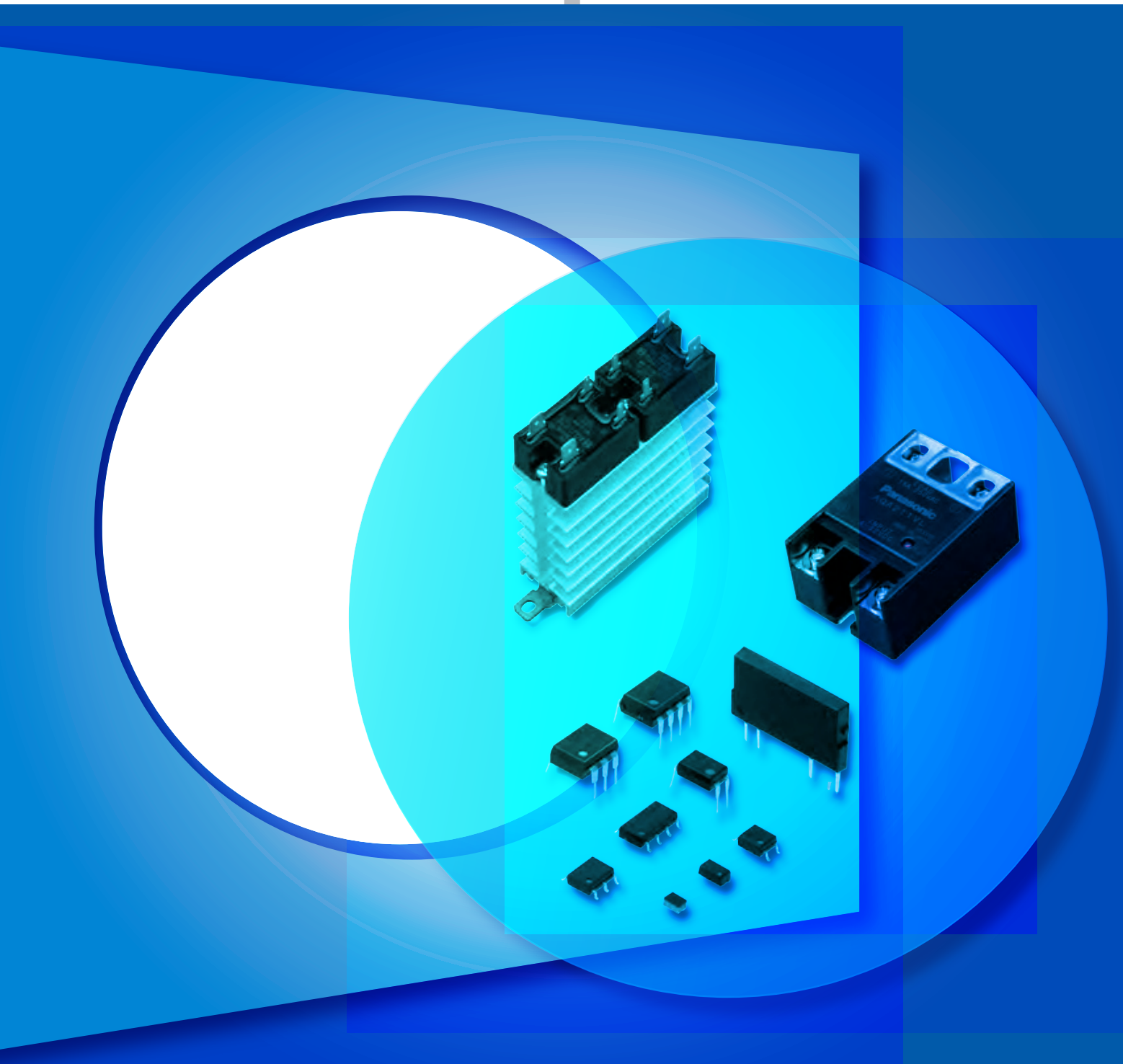
Panasonic
ideas for life

PART 1: ELECTROMECHANICAL RELAYS

RELAY CATALOG PART 2

PHOTOMOS & SOLID STATE RELAYS



Notes and Guidelines

Panasonic is part of a large worldwide group selling relays and associated switching products under different brand names in different territories. The conditions of use in some territories may differ from those customary in Europe. In particular there are often major differences in regard to national and international specifications, such as UL, CSA, VDE, SEV, EVE, SEMKO, etc. Thus, when considering contact loads as stated in this catalogue (e.g. 10 A, 30 VDC for the SP relay) it should be understood that these values are not necessarily an absolute maximum but tested ratings. Mostly the stated value has been tested for a certain life expectancy as stated by the manufacturer or the respective test house. Thus, under different conditions, the stated “maximum” may, in practice, be safely exceeded.

Therefore consideration should be given to each specific application for:

- rating and type of load
- switching frequency - cycles per second (or minute)
- environmental conditions

A general statement of compliance on data sheets, publicity, etc. concerning industrial standards, approvals or certification may imply compliance to a certain standard is available. However, because of the multiplicity of types available, in general not all types within the product family are covered to the same extent by the standard. Thus, in the event of a specific query regarding a particular product and its compliance with the standard, users are asked to refer to Panasonic for detailed information.

In case of uncertainty, contact should be made with Panasonic locally to ascertain the likelihood of the relay meeting the required life expectancy in the specific planned operational circumstances. It is also pointed out that in this book, and in deviation from EN / IEC 61810-1, operational life data is given under a normal ambient temperature of about 25°C.

The features and specifications quoted have been carefully tested using modern methods and represent the values which are to be expected with a product in new condition at room temperature. They are not guaranteed values and may change during operational life or due to ambient influences. Statistical test information covering major operating features is available on request. Panasonic reserves the right to make alterations and changes to specifications without notice from time to time as may be deemed necessary.

Application of the EC Directives to All-or-Nothing Relays

1 EMC Directive

The EMC Directive concerns primarily the finished products. In applying the Directive to components, the Guidelines[1] should be consulted to determine whether the component in question has a “direct function”. Electric motors, power supply units or temperature controls represent examples of such components with “direct function”. These types of components must be provided with a CE marking.

Components which are integrated into a device, such as relays, do not have an independent function of their own. A given relay may perform differing functions in different devices. Consequently, all-or-nothing relays must be considered components without “direct function” which are not subject to the EMC Directive.

All-or-nothing - be they electro-mechanical relays or solid state relays - shall not be labeled with a CE marking nor shall a declaration of conformity be issued within the scope of the EMC Directive.

2 Low Voltage Directive

Relays with terminals for printed boards/plug-and-socket connections do not come within the purview of the Low Voltage Directive.

The Low Voltage Directive concerns electrical equipment intended for incorporation into a device as well as equipment intended for direct use. In the case of electrical equipment which is considered a basic component intended for incorporation into other electrical equipment, the properties and safety of the final product will be largely dependent on how it is integrated: as such, these components do not fall within the Low Voltage Directive and shall not be CE marked. The Guidelines[2] specifically cite electro-mechanical basic components such as connectors, relays with terminals for printed circuit boards and micro switches. They are therefore not subject to the scope of the Low Voltage Directive.

Except for larger relays which may, for example, find application in switching cabinets, the same considerations apply to common-place relays with plug-in connections available also with printed board terminals. Here again, safety is a function of the individual application. In evaluating these relays’ performance from the perspective of the Low Voltage Directive, the same conclusion is reached as with the printed board relay. As such, CE marking is not mandatory for this type of relay.

3 Machinery Directive

The Machinery Directive differentiates between machines, machine parts and safety components. Relays are not part of any of these categories. The listing of safety components in Appendix IV is conclusive and does not include relays.

Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer’s declaration be issued under the Machinery Directive.

As of this moment, none of the aforementioned directives require CE marking for all-or-nothing relays[3].

4 RoHS Directive

The substances prohibited by the RoHS Directive (Pb, Hg, Cd, Cr^{+6}, PBB, PBDE) concern 10 categories of devices that are mostly, but not entirely, intended for private use. Components such as relays are not listed in these categories. Therefore they do not directly fall within the scope of this directive. However, if the user employs relays in devices that fall within the scope of this directive, the user must also acknowledge the substances prevented. In order to adapt to this situation in good time, all Panasonic relays are generally RoHS compliant.

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1. Guidelines (version dated March 22, 2007) for the Application of the Council Directive 2004/108/EC.
2. Guidelines (version dated August 2007) for the Application of the Council Directive 2006/95/EC.
3. This writing deals exclusively with “non-specified-time all-or-nothing relays”. The abbreviated term “all-or-nothing relay” has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.

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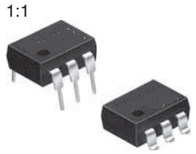
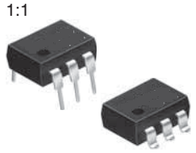
Alphabetical List of Semiconductor Relays

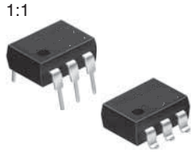
Selector Chart

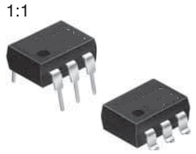
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQY212GS**	1:1 4.3 x 4.4 x 2.1mm	High capacity type	60V	• 1.0A / 3.0A 1A	0.34/0.7Ω	220pF	3.0mA	0.3mA	5.0ms	0.5ms	1,500V AC	81 UL, C-UL, TÜV, VDE
AQY212G2S		High capacity type	60V	• 1.25A / 3.0A 1.25A	0.2/0.5Ω	220pF	3.0mA	0.3mA	5.0ms	0.5ms	1,500V AC	81 -
★**AQY212S**			60V	• 0.5A / 1.0A 0.5A	0.83/2.5Ω	80pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	85 UL, C-UL, BSI, CSA, TÜV
AQY210LS		Current limiting	350V	• 0.12A / - 0.18A (Output limit current [typ.]) 0.12A	20/25Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	1,500V AC	137 UL, C-UL, BSI, CSA, TÜV
★**AQY210S**		PSpice	350V	• 0.12A / 0.3A 0.12A	17/25Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	85 UL, C-UL, BSI, CSA, TÜV
★**AQY210KS**		Short circuit protected	350V	• 0.12A / - 0.2A (Cut off current [typ.]) 0.12A	23.5/35Ω	42pF	3.0mA	0.3mA	2.0ms	1.0ms	1,500V AC	128 UL, C-UL, BSI, CSA, TÜV
★**AQY214S**		PSpice	400V	• 0.1A / 0.24A 0.1A	25/35Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	85 UL, C-UL, BSI, CSA, TÜV
★**AQY232S**		Sensitive type	60V	• 0.5A / 1.5A 0.5A	0.85/2.5Ω	0.8pF	0.5mA	0.1mA	5.0ms	2.0ms	1,500V AC	273 -
★**AQY230S**		Sensitive type	350V	• 0.12A / 0.3A 0.12A	19/25Ω	0.8pF	0.5mA	0.1mA	5.0ms	2.0ms	1,500V AC	273 -
★**AQY234S**		Sensitive type	400V	• 0.1A / 0.24A 0.1A	27/35Ω	0.8pF	0.5mA	0.1mA	5.0ms	2.0ms	1,500V AC	273 -

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output	
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)
★**AQY211EH**	1:1  DIP : 4.78 x 6.4 x 3.2mm SMD: 4.78 x 6.4 x 2.9mm		30V	• 1.0A / 3.0A 
★**AQY212EH**			60V	• 0.55A / 1.5A 
★**AQY212GH**		High capacity type	60V	• 1.1A / 3.0A 
★**AQY214EH**			400V	• 0.12A / 0.3A 
★**AQY210EH**			350V	• 0.13A / 0.4A 
AQY210HL		Current limiting	350V	• 0.12A / - 0.18A (Output limit current [typ.]) 
★**AQY216EH**			600V	• 0.05A / 0.15A 

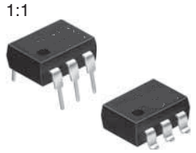
Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
0.25/0.5Ω	240pF	3.0mA	0.4mA	5.0ms	1.0ms	5,000V AC	146 UL, C-UL, CSA, TÜV, BSI, VDE
0.85/2.5Ω	80pF	3.0mA	0.4mA	4.0ms	1.0ms	5,000V AC	146 UL, C-UL, BSI, CSA, TÜV
0.34/0.7Ω	220pF	3.0mA	0.3mA	5.0ms	0.5ms	5,000V AC	96 UL, C-UL, VDE
26/35Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	146 UL, C-UL, CSA, TÜV, BSI, VDE
18/25Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	146 UL, C-UL, CSA, TÜV, BSI, VDE
20/25Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	140 UL, BSI, C-UL, CSA, TÜV
52/120Ω	35pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	146 UL, C-UL, CSA, TÜV, BSI, VDE

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQV212S**	1:1  6.3 x 4.4 x 2.1mm	PSpice	60V	• 0.5A / 1.0A 0.5A	0.83/2.5Ω	150pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
AQV215S		PSpice	100V	• 0.3A / 0.9A 0.3A	2.3/4.0Ω	110pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
AQV217S		PSpice	200V	• 0.16A / 0.48A 0.16A	11/15Ω	70pF	3.0mA	0.4mA	1.0ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
AQV210S		PSpice	350V	• 0.12A / 0.3A 0.12A	23/35Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
AQV214S		PSpice	400V	• 0.1A / 0.3A 0.1A	30/50Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
AQV216S		PSpice	600V	• 0.04A / 0.12A 0.04A	70/120Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	88 UL, C-UL, CSA, TÜV
★**AQV212**	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm	PSpice	60V	• 0.55A / 1.2A 0.55A	0.83/2.5Ω	150pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV
★**AQV252G**		High capacity type	60V	• 2.5A / 6.0A 2.5A	0.08/0.12Ω	240pF	3.0mA	0.2mA	5.0ms	0.5ms	1,500V AC	250 UL, C-UL, CSA, TÜV, VDE
★**AQV251G**		High capacity type	30V	• 3.5A / 6.0A 3.5A	0.035/0.08Ω	350pF	3.0mA	0.2mA	5.0ms	0.5ms	1,500V AC	247 -
AQV255GS	1:1  6.3 x 4.4 x 2.0mm	High capacity type	80V	• 1.25A / 2.5A 1.25A	0.09/0.15Ω	300pF	3.0mA	0.2mA	5.0ms	0.5ms	1,500V AC	247 -
AQV215	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm	PSpice	100V	• 0.32A / 0.96A 0.32A	2.3/4.0Ω	110pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV
AQV217		PSpice	200V	• 0.18A / 0.54A 0.18A	11/15Ω	70pF	3.0mA	0.4mA	1.0ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV
AQV210		PSpice	350V	• 0.13A / 0.4A 0.13A	23/35Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
AQV210E	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm		350V	• 0.13A / 0.4A 0.13A	23/35Ω	45pF	3.0mA	1.0mA	2.0ms	1.0ms	1,500V AC	150 UL, C-UL, CSA, TÜV
★**AQV210EH**			350V	• 0.13A / 0.4A 0.13A	23/35Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	150 UL, C-UL, CSA, TÜV, BSI, VDE
AQV214		PSpice	400V	• 0.12A / 0.3A 0.12A	30/50Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV
AQV214E			400V	• 0.12A / 0.3A 0.12A	30/50Ω	45pF	3.0mA	0.3mA	2.0ms	1.0ms	1,500V AC	150 UL, C-UL, CSA, TÜV
★**AQV214EH**			400V	• 0.12A / 0.3A 0.12A	30/50Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	150 UL, C-UL, CSA, TÜV, BSI, VDE
AQV214H			400V	• 0.12A / 0.3A 0.12A	30/50Ω	45pF	3.0mA	0.4mA	0.8ms	0.2ms	5,000V AC	99 UL, C-UL, CSA, TÜV, BSI, VDE
AQV216		PSpice	600V	• 0.05A / 0.15A 0.05A	70/120Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	99 UL, C-UL, CSA, TÜV
AQV101			40V DC	• 0.7A / 1.8A 0.7A	0.3/0.5Ω	600pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
AQV201			40V	• 0.5A / 1.8A 0.5A	0.6/1Ω	350pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
AQV251			40V	• 0.5A / 1.8A 0.5A	0.6/1.0Ω	350pF	3.0mA	0.4mA	3.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
AQV102			60V DC	• 0.6A / 1.5A 0.6A	0.37/0.7Ω	600pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
AQV202			60V	• 0.4A / 1.5A 0.4A	0.74/1.4Ω	350pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV

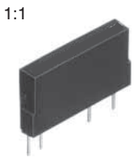
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output	
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)
AQV252	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm		60V	• 0.4A / 1.5A 
★**AQV112KL**		Short circuit protected	60V DC	• 0.5A / - 
AQV255			100V	• 0.35A / 1.0A 
AQV257			200V	• 0.25A / 0.75A 
AQV103			250V DC	• 0.3A / 0.6A 
AQV203			250V	• 0.2A / 0.6A 
AQV253			250V	• 0.2A / 0.6A 

Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
0.74/1.4Ω	350pF	3.0mA	0.4mA	1.4ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
0.55/2Ω	300pF	10mA	0.3mA	2.0ms	1.0ms	1,500V AC	133 UL, C-UL, CSA, TÜV, VDE
1.8/2.5Ω	350pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
2.6/4.0Ω	170pF	3.0mA	0.4mA	3.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
2.7/4Ω	300pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
5.5/8Ω	170pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
5.5/8.0Ω	170pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current(max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
AQV253H	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm		250V	• 0.2A / 0.6A 0.2A	5.5/8Ω	170pF	3.0mA	0.4mA	4.0ms	0.2ms	5,000V AC	243 UL, C-UL, CSA, TÜV, BSI, VDE
AQV104			400V DC	• 0.18A / 0.5A 0.18A	6.3/8Ω	300pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
AQV204			400V	• 0.15A / 0.5A 0.15A	12.4/16Ω	170pF	5.0mA	0.8mA	1.0ms	1.0ms	1,500V AC	265 UL, C-UL, TÜV
AQV234		Sensitive type	400V	• 0.12A / 0.3A 0.12A	30/50Ω	45pF	0.31mA	0.1mA	2.0ms	1.0ms	1,500V AC	270 UL, C-UL, CSA, TÜV
AQV254			400V	• 0.15A / 0.5A 0.15A	12.4/16Ω	170pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
AQV254H			400V	• 0.15A / 0.5A 0.15A	12.4/16Ω	170pF	3.0mA	0.4mA	3.0ms	0.2ms	5,000V AC	243 UL, C-UL, CSA, TÜV, BSI, VDE
AQV259			1,000V	• 0.03A / 0.09A 0.03A	80/200Ω	80pF	3.0mA	0.4mA	1.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV
AQV258			1,500V	• 0.02A / 0.06A 0.03A	345/500Ω	80pF	3.0mA	0.4mA	1.0ms	0.2ms	1,500V AC	243 UL, C-UL, CSA, TÜV

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQZ102**	1:1  21 x 3.5 x 12.5mm		60V DC	• 4.0A / 9.0A 4.0A	0.05/0.09Ω	1700pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQZ105			100V DC	• 2.6A / 6.0A 2.6A	0.081/0.17Ω	1700pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQZ107			200V DC	• 1.3A / 3.0A 1.3A	0.34/0.55Ω	900pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQZ104			400V DC	• 0.7A / 1.5A 0.7A	1.06/1.6Ω	900pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQZ262	1:1  43 x 9 x 32mm		60V	• 6.0A / 10.0A 6.0A	0.036/0.05Ω	1400pF	3.0mA	0.4mA	10.0ms	3.0ms	1,500V AC	300 UL, CSA
★**AQZ202**	1:1  21 x 3.5 x 12.5mm		60V	• 3.0A / 9.0A 3.0A	0.11/0.18Ω	1400pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
★**AQZ205**			100V	• 2.0A / 6.0A 2.0A	0.23/0.34Ω	1400pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQZ207			200V	• 1.0A / 3.0A 1.0A	07/11Ω	600pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
★**AQZ204**			400V	• 0.5A / 1.5A 0.5A	2.1/3.2Ω	600pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	283 UL, C-UL, CSA, TÜV
AQY212FG2S	1:1  4.30 x 4.40 x 2.10mm	Built-in resistor	60V	• 1.25A / 3.0A 1.25A	0.2/0.5Ω	-	Operate voltage V_{Fon} (max.) 4.0V	Turn off voltage V_{Foff} (min.) 0.8V	5.0ms	0.5ms	500V AC	92 -

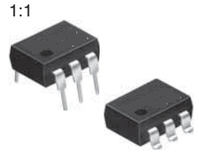
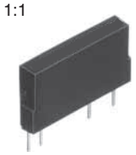
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
AQZ264	1:1  43 x 9 x 32mm		400V	• 1.0A / 3.0A 1.0A	1.0/1.4Ω	600pF	3.0mA	0.4mA	10.0ms	3.0ms	1,500V AC	300 UL, CSA
AQY272	1:1  DIP : 9.3 x 8.8 x 3.9mm SMD: 9.3 x 8.8 x 3.7mm		60V	• 2.0A / 6.0A 2.0A	0.11/0.18Ω	1400pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	279 UL, C-UL, CSA
AQY275			100V	• 1.3A / 4.0A 1.3A	0.23/0.34Ω	1400pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	279 UL, C-UL, CSA
AQY277			200V	• 0.65A / 2.0A 0.65A	0.7/1.1Ω	600pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	279 UL, C-UL, CSA
AQY274			400V	• 0.35A / 1.0A 0.35A	2.1/3.2Ω	600pF	3.0mA	0.4mA	5.0ms	3.0ms	2,500V AC	279 UL, C-UL, CSA

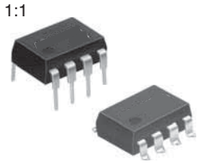
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Operate voltage (max.)	Turn-off voltage (min.)	Turn-on time (max.)	Turn-off time (max.)		
AQZ102D	1:1  21 x 3.5 x 12.5mm	Input voltage sensitive	60V DC	• 3.6A / 9.0A 3.6A	0.033/0.09Ω	1700pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ105D		Input voltage sensitive	100V DC	• 2.3A / 6.0A 2.3A	0.090/ 0.17Ω	1700pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ107D		Input voltage sensitive	200V DC	• 1.1A / 3.0A 1.1A	0.33/0.55Ω	900pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ104D		Input voltage sensitive	400V DC	• 0.6A / 1.5A 0.6A	1.23/1.6Ω	900pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ202D		Input voltage sensitive	60V	• 2.7A / 9.0A 2.7A	0.066/0.18Ω	1400pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ205D		Input voltage sensitive	100V	• 1.8A / 6.0A 1.8A	0.18/0.34Ω	1400pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ207D		Input voltage sensitive	200V	• 0.9A / 3.0A 0.9A	0.64/1.1Ω	600pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV
AQZ204D		Input voltage sensitive	400V	• 0.45A / 1.5A 0.45A	2.4/3.2Ω	600pF	4V	0.8V	10.0ms	3.0ms	2,500V AC	294 UL, CSA, TÜV

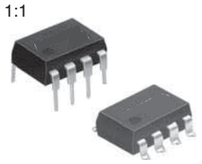
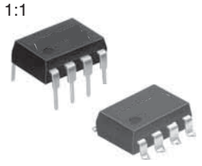
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQY221R2T**	1:1  2.2 x 2.1 x 2.9mm	Low CxR	40V	• 0.25A 	0.8/1.25Ω	14pF	3.0mA	0.2mA	0.5ms	0.2ms	200V AC	176 -
★**AQY221N3M**	1:1  2.2 x 2.95 x 1.4mm	Low CxR	25V	• 0.15A / - 	5.5/7.5Ω	1.1pF	3.0mA	0.2mA	0.2ms	0.2ms	200V AC	182 -
★**AQY221R2M**		Low CxR	40V	• 0.25A / 0.75A 	0.8/1.25Ω	14pF	3.0mA	0.2mA	0.5ms	0.2ms	200V AC	190 -
★**AQY221N2M**		Low CxR	40V	• 0.12A / - 	9.5/12.5Ω	1.1pF	3.0mA	0.2mA	0.2ms	0.2ms	200V AC	190 -
★**AQY221N3V**		Low CxR	25V	• 0.15A / 0.4A 	5.5/7.5Ω	1.pF	3.0mA	0.2mA	0.2ms	0.2ms	1,500V AC	186 -
★**AQY221R4V**		Low CxR	40V	• 0.5A / 1.0A 	0.55/1.0Ω	24pF	3.0mA	0.1mA	0.75ms	0.2ms	1,500V AC	195 -
★**AQY221N2V**		Low CxR PSpice	40V	• 0.12A / 0.3A 	9.5/12.5Ω	1.0pF	3.0mA	0.2mA	0.5ms	0.2ms	1,500V AC	195 -
★**AQY221R2V**	1:1  2.65 x 4.45 x 1.8mm	Low CxR PSpice	40V	• 0.25A / 0.75A 	0.75/1.25Ω	12.5pF	3.0mA	0.1mA	0.5ms	0.2ms	1,500V AC	195 -
AQY221FR2V		Built-in resistor	40V	• 0.25A / 0.75A 	0.75/1.25Ω	12.5pF	Operate voltage V_{Fon} (max.) 4.0V	Turn off voltage V_{Foff} (min.) 0.8V	0.5ms	0.2ms	500V AC	199 -
AQY221FN2V		Built-in resistor	40V	• 0.12A / 0.2A 	9.5/12.5Ω	1pF	Operate voltage V_{Fon} (max.) 4.0V	Turn off voltage V_{Foff} (min.) 0.8V	0.5ms	0.2ms	500V AC	199 -
AQY225R2V		Low CxR	80V	• 0.12A / 0.3A 	10.5/15Ω	4.5pF	3.0mA	0.1mA	0.5ms	0.2ms	1,500V AC	216 -

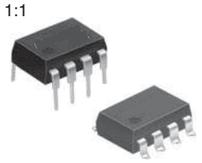
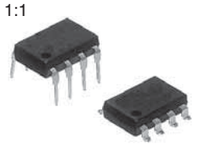
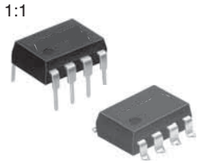
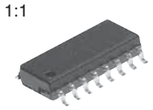
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQY221N2S**	1:1 4.3 x 4.4 x 2.1mm	Low CxR	40V	• 0.12A / 0.3A 0.12A	9.5/12.5Ω	1.0pF	3.0mA	0.2mA	0.5ms	0.2ms	1,500V AC	208 UL, CSA, TÜV
★**AQY221R2S**		Low CxR	40V	• 0.25A / 0.75A 0.25A	0.8/1.25Ω	13pF	3.0mA	0.1mA	0.5ms	0.2ms	500V AC	203 UL, CSA, TÜV
AQY222R1S		Low CxR	60V	• 0.5A / 1.0A 0.5A	0.8/1.2Ω	24.5pF	3.0mA	0.1mA	0.5ms	0.2ms	1,500V AC	219 -
AQY225R1S		Low CxR	80V	• 0.35A / 0.7A 0.35A	0.8/1.2Ω	37.5pF	3.0mA	0.1mA	0.75ms	0.2ms	1,500V AC	219 -
AQY225R2S		Low CxR	80V	• 0.15A / 0.45A 0.15A	10.5/15Ω	4.5pF	3.0mA	0.1mA	0.5ms	0.2ms	1,500V AC	219 -
AQV227NS	1:1 6.3 x 4.4 x 2.1mm		200V	• 0.05A / 0.15A 0.05A	30/50Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	226 UL, CSA, TÜV
AQV224NS			400V	• 0.04A / 0.12A 0.04A	70/100Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	226 UL, CSA, TÜV
AQV221	1:1 DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm		40V	• 0.08A / 0.18A 0.8A	22/35Ω	5.6pF	3.0mA	0.4mA	0.3ms	0.1ms	1,500V AC	172 UL, CSA, TÜV
AQV225			80V	• 0.05A / 0.15A 0.05A	36/50Ω	4.8pF	3.0mA	0.4mA	0.3ms	0.1ms	1,500V AC	172 UL, CSA, TÜV
AQV227N			200V	• 0.07A / 0.21A 0.07A	30/50Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	230 UL, CSA, TÜV
AQV224N			400V	• 0.05A / 0.15A 0.05A	70/100Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	230 UL, CSA, TÜV

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
1 Form B Signal Relays												
AQY412S	1:1  4.3 x 4.4 x 2.1mm		60V	• 0.5A / 1.5A 0.5A	1/2.5Ω	450pF	3.0mA	0.4mA	3.0ms	1.0ms	1,500V AC	109 UL, CSA, VDE
★**AQY410S**			350V	• 0.12A / 0.3A 0.12A	18/25Ω	110pF	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	109 UL, CSA, TÜV, BSI
AQY414S			400V	• 0.1A / 0.24A 0.1A	26/35Ω	100pF	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	109 UL, CSA, TÜV, BSI
AQY412EH	1:1  DIP : 4.78 x 6.4 x 3.2mm SMD: 4.78 x 6.4 x 2.9mm		60V	• 0.55A / 1.5A 0.55A	1/2.5Ω	480pF	3.0mA	0.4mA	10.0ms	1.0ms	5,000V AC	158 UL, CSA, VDE
★**AQY410EH**			350V	• 0.13A / 0.4A 0.13A	18/25Ω	110pF	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	158 UL, CSA, BSI
AQY414EH			400V	• 0.12A / 0.3A 0.12A	26/35Ω	100pF	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	158 UL, CSA, BSI
AQV414S	1:1  6.3 x 4.4 x 2.1mm		400V	• 0.1A / 0.3A 0.1A	26/50Ω	100pF	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	112 UL, CSA, TÜV

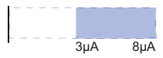
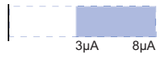
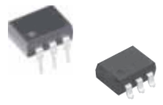
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
AQV410EH	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm		350V	• 0.13A / 0.4A 0.13A	18/35Ω	110pF	3.0mA	0.4mA	3.0ms	1.5ms	5,000V AC	161 UL, CSA, TÜV, BSI, VDE
AQV412EH			60V	• 0.55A / 1.5A 0.55A	1/2.5Ω	480pF	3.0mA	0.4mA	10.0ms	1.5ms	5,000V AC	161 UL, CSA, TÜV, VDE
AQV414E			400V	• 0.12A / 0.3A 0.12A	26/50Ω	100pF	3.0mA	0.3mA	2.0ms	1.0ms	1,500V AC	161 UL, CSA, TÜV
AQV414EH			400V	• 0.12A / 0.3A 0.12A	26/50Ω	100pF	3.0mA	0.4mA	3.0ms	1.5ms	5,000V AC	161 UL, CSA, TÜV, BSI, VDE
AQV453			250V	• 0.2A / 0.6A 0.2A	5.5/8.0Ω	350pF	3.0mA	0.4mA	3.0ms	1.0ms	1,500V AC	256 UL, CSA
AQV414			400V	• 0.12A / 0.3A 0.12A	26/50Ω	100pF	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	116 UL, CSA, TÜV
AQV454			400V	• 0.15A / 0.5A 0.15A	10.5/16Ω	170pF	3.0mA	0.4mA	2.0ms	1.0ms	1,500V AC	256 UL, CSA, TÜV
AQV454H			400V	• 0.15A / 0.5A 0.15A	10.5/16Ω	170pF	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	256 UL, CSA, TÜV
1 Form B Power Relays												
AQZ404	1:1  21 x 3.5 x 12.5mm		400V	• 0.5A / 1.5A 0.5A	2.8/4.0Ω	2000pF	3.0mA	0.4mA	7.5ms	3.0ms	2,500V AC	290 UL, CSA

Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
★**AQW210S**	1:1  9.37 x 4.4 x 2.1mm		350V	• 0.1A / 0.3A 0.1A	16/35Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	103 UL, CSA, TÜV
AQW212S			60V	• 0.4A / 1.5A 0.4A	0.83/2.5Ω	-	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	103 UL, CSA, TÜV
★**AQW214S**			400V	• 0.08A / 0.24A 0.8A	30/50Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	103 UL, CSA, TÜV
★**AQW212EH**	1:1  DIP : 9.86 x 6.4 x 3.2mm SMD: 9.86 x 6.4 x 2.9mm		60V	• 0.5A / 1.5A 0.5A	0.83/2.5Ω	80pF	3.0mA	0.4mA	4.0ms	1.0ms	5,000V AC	154 UL, CSA, TÜV
★**AQW210EH**			350V	• 0.12A / 0.36A 0.12A	18/25Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	154 UL, CSA, TÜV
AQW210HL		Current limiting	350V	• 0.1A / - 0.18A (Output limit current [typ.]) 0.1A	20/25Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	143 UL, CSA, TÜV
AQW214EH			400V	• 0.1A / 0.3A 0.1A	26/35Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	154 UL, CSA, TÜV
★**AQW216EH**			600V	• 0.04A / 0.12A 0.04A	52/120Ω	45pF	3.0mA	0.4mA	2.0ms	1.0ms	5,000V AC	154 UL, CSA, TÜV
AQW212	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm		60V	• 0.6A / 1.0A 0.6A	0.83/2.5Ω	150pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	106 UL, CSA, TÜV
AQW215			100V	• 0.3A / 0.9A 0.3A	2.3/4.0Ω	110pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	106 UL, CSA, TÜV
AQW217			200V	• 0.16A / 0.48A 0.16A	11/15Ω	70pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	106 UL, CSA, TÜV
AQW210			350V	• 0.12A / 0.36A 0.12A	23/35Ω	45pF	3.0mA	0.4mA	0.5ms	0.05ms	1,500V AC	106 UL, CSA, TÜV
AQW214			400V	• 0.1A / 0.3A 0.1A	30/50Ω	45pF	3.0mA	0.4mA	0.5ms	0.05ms	1,500V AC	106 UL, CSA, TÜV
AQW254			400V	• 0.12A / 0.36A 0.12A	12.4/16Ω	170pF	3.0mA	0.4mA	2.0ms	0.2ms	1,500V AC	253 UL, CSA, TÜV
AQW216			600V	• 0.04A / 0.12A 0.04A	70/120Ω	45pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	106 UL, CSA, TÜV

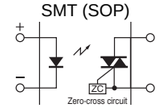
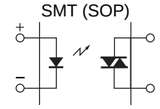
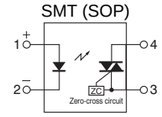
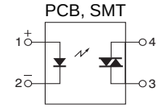
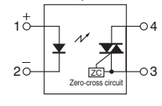
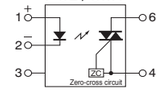
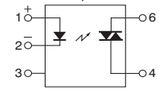
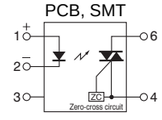
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output		Output		Input		Switching speed		I/O isolation voltage	Page Approvals
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
2 Form A Low CxR												
AQW227NS	1:1  9.37 x 4.4 x 2.1mm		200V	• 0.04A / 0.15A 0.04A	30/50Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	234 UL, C-UL, TÜV
AQW223R2S		Low CxR	250V	• 0.14A / 0.42A 0.14A	10/15Ω	33pF	3.0mA	0.1mA	0.5ms	0.2ms	1,500V AC	223 C-UL
AQW227N	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm		200V	• 0.05A / 0.15A 0.05A	30/50Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	237 UL, CSA, TÜV
AQW224N			400V	• 0.04A / 0.12A 0.04A	70/100Ω	10pF	3.0mA	0.4mA	0.5ms	0.2ms	1,500V AC	237 UL, CSA, TÜV
2 Form B												
★**AQW414EH**	1:1  DIP : 9.86 x 6.4 x 3.2mm SMD: 9.86 x 6.4 x 2.9mm		400V	• 0.1A / 0.3A 0.1A	26/35Ω	100pF	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	165 UL, CSA, TÜV, BSI
AQW414	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm		400V	• 0.1A / 0.3A 0.1A	26/50Ω	100pF	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	119 UL, CSA, TÜV
AQW454			400V	• 0.12A / 0.36A 0.12A	11/16Ω	170pF	3.0mA	0.4mA	2.0ms	1.0ms	1,500V AC	259 UL, CSA, TÜV
1 Form A / 1 Form B												
AQW612S	1:1  9.4 x 4.4 x 2.1mm		60V	• 0.45A / 1.5A 0.45A	1/2.5Ω	80pF (N.O.) 450pF (N.C.)	3.0mA	0.4mA	3.0ms	1.0m	1,500V AC	122 UL, CSA, TÜV, VDE
★**AQW610S**	1:1  9.37 x 4.4 x 2.1mm		350V	• 0.1A / 0.3A 0.1A	18/25Ω	45pF (N.O) 100pF (N.C.)	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	122 UL, CSA, TÜV, BSI

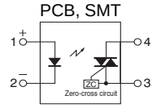
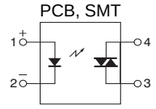
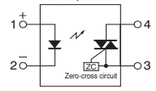
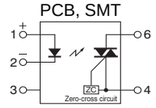
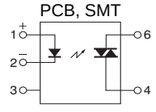
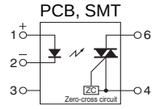
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output	
			Peak load V DC/AC	Continuous load current/ Peak load current (100ms)
AQW612EH	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm		60V	• 0.5A / 1.5A 0.5A
★**AQW610EH**	1:1  DIP : 9.86 x 6.4 x 3.2mm SMD: 9.86 x 6.4 x 2.9mm		350V	• 0.12A / 0.36A 0.12A
★**AQW614EH**			400V	• 0.1A / 0.3A 0.1A
AQW614	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm		400V	• 0.1A / 0.3A 0.1A
AQW654			400V	• 0.12A / 0.36A 0.12A
Multichannel				
AQS221N2S	1:1  10.37 x 4.4 x 2.1mm	Low CxR	40V	• 0.06A / 0.12A 0.06A
AQS225R2S		Low CxR	80V	• 0.07A / 0.2A 0.07A
AQS221FR2S		Built-in resistor	40V	• 0.16A / 0.2A 0.16A
AQS221FN2S		Built-in resistor	40V	• 0.06A / 0.12A 0.06A

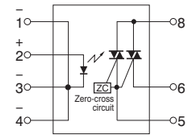
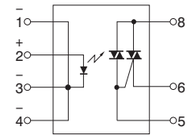
Output		Input		Switching speed		I/O isolation voltage	Page Approvals
ON resistance (typical/max.)	Output capacitance (typical)	LED operate current (max.)	LED turn-off current (min.)	Turn-on time (max.)	Turn-off time (max.)		
1/2.5Ω	80pF (N.O.) 480pF (N.C.)	3.0mA	0.4mA	4.0ms (N.O.) 10.0ms (N.C.)	1.0ms	5,000V AC	168 UL, CSA, TÜV, VDE
18/25Ω	45pF (N.O.) 100pF (N.C.)	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	168 UL, CSA, TÜV, BSI
26/35Ω	45pF (N.O.) 100pF (N.C.)	3.0mA	0.4mA	3.0ms	1.0ms	5,000V AC	168 UL, CSA, TÜV, BSI
27/50Ω	45pF (N.O.) 100pF (N.C.)	3.0mA	0.4mA	1.0ms	1.0ms	1,500V AC	125 UL, CSA, TÜV
• N.O.: 10/16Ω • N.C.: 11/16Ω	170pF	3.0mA	0.4mA	3.0ms	1.0ms	1,500V AC	262 UL, CSA, TÜV
9.5/12.5Ω	1pF	3.0mA	0.1mA	0.2ms	0.2ms	500V AC	208 -
10.5/15.0Ω	4.5pF	3.0mA	0.3mA	0.3ms	0.2ms	1,500V AC	240 UL, CSA, TÜV
0.5/1.5Ω	12.5pF	Operate voltage V_{Fon} (max.) 4.0V	Turn off voltage V_{Foff} (min.) 0.8V	0.5ms	0.2ms	500V AC	212 -
9.5/12.5Ω	1pF	Operate voltage V_{Fon} (max.) 4.0V	Turn off voltage V_{Foff} (min.) 0.8V	0.5ms	0.2ms	500V AC	212 -

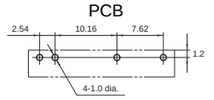
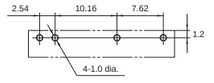
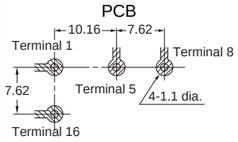
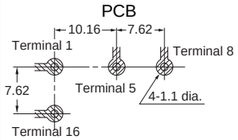
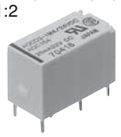
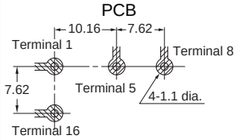
Type ★ = Popular Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output	
			Drop-out voltage (typical/min.)	Short circuit current (typical/min.)
★**APV2111V**	1:1  2.65 x 4.45 x 1.8mm	• Ultra small SSOP housing	8.2/5.0V	• 8 / 3μA 
★**APV1121S**	1:1  4.3 x 4.4 x 2mm	• Ultra small SMD (SOP) housing	8.7/6.0V	• 14 / 5μA 
APV2121S		• Ultra small SMD (SOP) housing	8.2/5.0V	• 8 / 3μA 
APV1122	1:1  DIP : 8.8 x 6.4 x 3.4mm SMD: 8.8 x 6.4 x 3.4mm	• 5000V breakdown voltage	8.7/6.0V	• 14 / 5μA 

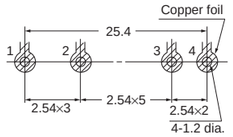
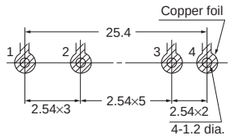
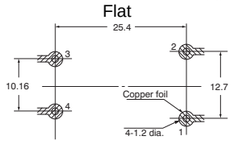
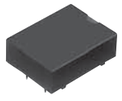
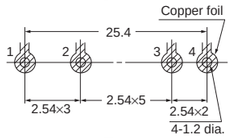
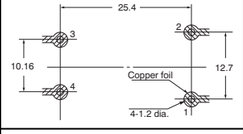
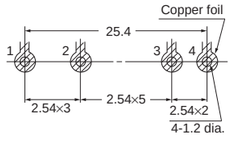
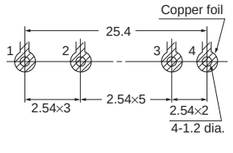
Input		Switching speed		I/O isolation voltage	Page Approvals
LED operate current (max.)	LED turn-off current (min.)	Turn-on time (typical)	Turn-off time (typical)		
3.0mA	0.2mA	0.8ms	0.1ms	1,500V AC	305 C-UL
3.0mA	0.2mA	0.4ms	0.1ms	2,500V AC	305 C-UL
3.0mA	0.2mA	0.8ms	0.1ms	2,500V AC	305 C-UL
3.0mA	0.2mA	0.4ms	0.1ms	5,000V AC	305 C-UL

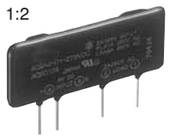
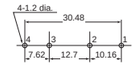
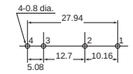
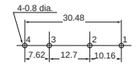
Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output				Input			Zero-cross voltage (max.)	I/O isolation voltage	Connection type Switching diagram	Page Approvals
			Repetitive peak OFF-state voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	PeakON-state voltage (max.)	Peak OFF-state current (max.)	LED trigger current (max.)	LED drop-out voltage (max.)	Turn-on time (max.)				
APT1211S	1:1  4.3 x 4.4 x 2.1mm	• Zero-cross • SOP 4 pin	• 600V	• 0.05A / 0.6A 	2.5V	1μA	10mA	1.3V	0.1ms	50V	3,750V AC	SMT (SOP) 	327 UL, C-UL, VDE
APT1221S		• Random • SOP 4 pin								-		SMT (SOP) 	
APT1231S		• Low zero-cross • SOP 4 pin			2.0V					15V		SMT (SOP) 	
APT1211	1:1 DIP : 4.78 x 6.4 x 3.2mm SMD: 4.78 x 6.4 x 2.9mm	• Zero-cross • DIP 4 pin	• 600V	• 0.1A / 1.2A	2.5V	1μA	10mA	1.3V	0.1ms	50V	5,000V AC	PCB, SMT	327 UL, C-UL, VDE
APT1221		• Random • DIP 4 pin								-		PCB, SMT 	
APT1231		• Low zero-cross • DIP 4 pin			2.0V					15V		PCB, SMT 	
APT1212	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm	• Zero-cross • DIP 6 pin	• 600V	• 0.1A / 1.2A 	2.5V	1μA	10mA	1.3V	0.1ms	50V	5,000V AC	PCB, SMT 	327 UL, C-UL, VDE
APT1222		• Random • DIP 6 pin								-		PCB, SMT 	
APT1232		• Low zero-cross • DIP 6 pin			2.0V					15V		PCB, SMT 	

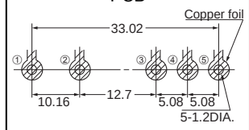
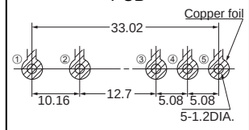
Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output				Input			Zero-cross voltage (max.)	I/O isolation voltage	Connection type Switching diagram	Page Approvals
			Repetitive peak OFF-state voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	PeakON-state voltage (max.)	Peak OFF-state current (max.)	LED trigger current (max.)	LED drop-out voltage (max.)	Turn-on time (max.)				
APT1211W	1:1  DIP : 4.78 x 6.4 x 3.0mm SMD: 4.78 x 6.4 x 2.7mm	• Zero-cross • DIP 4 pin wide terminal	• 600V	• 0.1A / 1.2A 	2.5V	1μA	10mA	1.3V	0.1ms	50V	5,000V AC	PCB, SMT 	327 UL, C-UL, VDE
APT1221W		• Random • DIP 4 pin wide terminal								-		PCB, SMT 	
APT1231W		• Low zero-cross • DIP 4 pin wide terminal			2.0V					15V		PCB, SMT 	
APT1212W	1:1  DIP : 8.8 x 6.4 x 3.9mm SMD: 8.8 x 6.4 x 3.6mm	• Zero-cross • DIP 6 pin wide terminal	• 600V	• 0.1A / 1.2A 	2.5V	1μA	10mA	1.3V	0.1ms	50V	5,000V AC	PCB, SMT 	327 UL, C-UL, VDE
APT1222W		• Random • DIP 6 pin wide terminal								-		PCB, SMT 	
APT1232W		• Low zero-cross • DIP 6 pin wide terminal			2.0V					15V		PCB, SMT 	

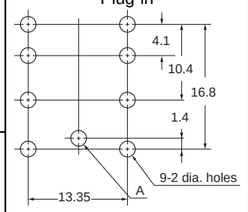
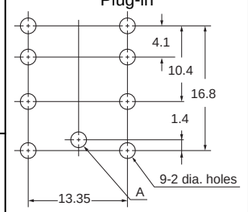
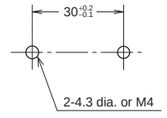
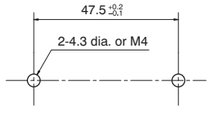
Type	Photo with Dimensions (Picture scale: DIN A4)	Features	Output				Input			Zero-cross voltage (max.)	I/O isolation voltage	Connection type Switching diagram	Page Approvals
			Repetitive peak OFF-state voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	PeakON-state voltage (max.)	Peak OFF-state current (max.)	LED trigger current (max.)	LED drop-out voltage (max.)	Turn-on time (max.)				
AQH0213	1:1  DIP : 9.78 x 6.4 x 3.9mm SMD: 9.78 x 6.4 x 3.6mm	• Photo-Triac • Zero-cross	• 600V	• 0.3A / 3A 	2.5V	100μA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT With zero-cross switch: 	335 UL, C-UL, VDE
AQH0223		• Photo-Triac • Random								-			
AQH1213		• Photo-Triac • Zero-cross	• 600V	• 0.6A / 6A 	2.5V	100μA	10mA	1.3V	0.1ms	50V	5,000V		
AQH1223		• Photo-Triac • Random								-			
AQH2213		• Photo-Triac • Zero-cross	• 600V	• 0.9A / 9A 	2.5V	100μA	10mA	1.3V	0.1ms	50V	5,000V	Without zero-cross switch: 	
AQH2223		• Photo-Triac • Random								-			
AQH3213		• Photo-Triac • Zero-cross	• 600V	• 1.2A / 12A 	2.5V	100μA	10mA	1.3V	0.1ms	50V	5,000V		
AQH3223		• Photo-Triac • Random								-			

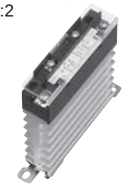
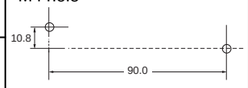
Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQG 1A 1:1  24.5 x 4.5 x 13.5mm	• Photo-Triac • Zero-cross • Integrated snubber circuit	• 75 - 264V AC	• 1A / 8A 	1.5mA	4 - 6V DC	0.3kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB 	338 UL, C-UL, VDE
					9.6 - 14.4V DC	0.8kΩ						
					19.2 - 28.8V DC	1.6kΩ						
	• Photo-Triac • Random • Integrated snubber circuit	• 75 - 264V AC	• 1A / 8A 	1.5mA	4 - 6V DC	0.3kΩ	1V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
					9.6 - 14.4V DC	0.8kΩ						
					19.2 - 28.8V DC	1.6kΩ						
AQG 2A 1:1  24.5 x 4.5 x 20.5mm	• Photo-Triac • Zero-cross • Integrated snubber circuit	• 75 - 264V AC	• 2A / 30A 	1.5mA	4 - 6V DC	0.3kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB 	
					9.6 - 14.4V DC	0.8kΩ						
					19.2 - 28.8V DC	1.6kΩ						
	• Photo-Triac • Random • Integrated snubber circuit	• 75 - 264V AC	• 2A / 30A 	1.5mA	4 - 6V DC	0.3kΩ	1V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
					9.6 - 14.4V DC	0.8kΩ						
					19.2 - 28.8V DC	1.6kΩ						
AQ-C AC input, DC input 1:2  20 x 10 x 12.8mm	• Photo-Transistor • AC input type	• 4 - 32V DC	• 25mA / - 	5μA	80 - 250V AC	-	10V AC	20ms	20ms	2,500V AC	PCB 	371 UL, CSA, TÜV
	• Photo-Transistor • DC input type	• 4 - 32V DC	• 25mA / - 	5μA	3 - 32V DC	-	1V DC	5ms	5ms	2,500V AC		
AQ-C 1A (AC output) 1:2  20 x 10 x 12.8mm	• Photo-Triac • Zero-cross	• 75 -125V AC • 75 - 250V AC	• 1A / 20A 	1.1mA	4 - 6V DC	0.3kΩ	0.5V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC	PCB 	371 UL, CSA, TÜV
					9.6 - 14.4V DC	0.8kΩ	1.2V					
					21.6 - 26.4V DC	1.8kΩ	2.4V					
	• Photo-Triac • Random	• 75 -125V AC • 75 - 250V AC	• 1A / 20A 	1.1mA	4.- 6V DC	0.3kΩ	0.5V	1ms	½ cycle of voltage sine wave + 1ms	2,500V AC		
					9.6 - 14.4V DC	0.8kΩ	1.2V					
					21.6 - 26.4V DC	1.8kΩ	2.4V					
AQ-C 1A (DC output) 1:2  20 x 10 x 12.8mm	• Photo-Transistor	• 3 - 60V DC	• 1A / 1.5A (1s) 	0.1mA	4 - 6V DC	430Ω	4V	0.5ms	1ms	2,500V AC	PCB 	371 UL, CSA, TÜV
					9.6 - 14.4V DC	1.2kΩ	9.6V					
					21.6 - 26.4V DC	2.8kΩ	21.6V					

Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQ1 1A (DC output) 1:2  33 x 10 x 25.1mm	• Photo-Transistor	• 10 - 200V DC	• 1A / 5A (1s) 	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	3,000V AC	PCB Slim 	341 UL, CSA, TÜV
AQ1 2A (DC output) 1:2  33 x 10 x 25.1mm	• Photo-Transistor	• 3 - 60V DC	• 2A / 5A (1s) 	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	3,000V AC		
AQ1 2A (AC output) 1:2  33 x 10 x 25.1mm  33 x 25 x 12mm	• Photo-Transistor • Zero-cross	• 75 - 250V AC	• 2A / 80A 	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Slim  Flat 	341 UL, CSA, TÜV
AQ1 3A (AC output) 1:2  33 x 10 x 25.1mm  33 x 25 x 12mm	• Photo-Triac • Zero-cross and random type available	• 75 - 250V AC	• 3A / 100A 	5mA	4 - 32V DC	- (Input current, max. 20mA)	1.0V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 4,000V AC (between input and output) • 2,500V AC (between input, output and case)	PCB Slim  Flat 	341 VDE
AQ1 5A (AC output) 1:2  54 x 26mm	• Photo-Transistor • Zero-cross	• 75 - 250V AC	• 5A (3A without heat sink) / 100A 	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 3,000V AC (between input and output) • 1,500V AC (between input, output and case)	PCB 	341 UL, CSA, TÜV
AQ1 10A (AC output) 1:2  54 x 26mm	• Photo-Triac • Zero-cross and random type available	• 75 - 250V AC	• 10A (5A without heat sink) / 100A 	5mA	4 - 32V DC	- (Input current, max. 20mA)	1.0V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 4,000V AC (between input and output) • 2,500V AC (between input, output and case)	PCB 	341 VDE

Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQ8 2A 1:2  45 x 9 x 24mm	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	• 2A / 30A 	5mA	4 - 6V DC	0.18kΩ	0.5V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Between input terminal 5.08mm  Between input terminal 7.65mm 	347 UL, CSA, TÜV, VDE
					9.6 - 14.4V DC	0.55kΩ	1.2V					
					21.6 - 26.4V DC	1.4kΩ	2.4V					
	• Photo-Triac • Random	• 75 - 125V AC • 75 - 250V AC	• 2A / 30A 	5mA	4 - 6V DC	0.3kΩ	0.5V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
					9.6 - 14.4V DC	0.8kΩ	1.2V					
					21.6 - 26.4V DC	1.8kΩ	2.4V					
AQ8 3A 1:2  43 x 9 x 32mm	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	• 3A / 80A 	5mA	4 - 6V DC	0.18kΩ	0.5V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Between input terminal 5.08mm  Between input terminal 7.65mm 	347 UL, CSA, TÜV, VDE
					9.6 - 14.4V DC	0.55kΩ	1.2V					
					21.6 - 26.4V DC	1.4kΩ	2.4V					
	• Photo-Triac • Random	• 75 - 125V AC • 75 - 250V AC	• 3A / 80A 	5mA	4 - 6V DC	0.3kΩ	0.5V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
					9.6 - 14.4V DC	0.8kΩ	1.2V					
					21.6 - 26.4V DC	1.8kΩ	2.4V					

Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
I/O RELAY AC input modules 1:2  43 x 10 x 20.5mm	• Photo-Transistor	• 4 - 15V DC • 10 - 32V DC	• 15mA / - 	100μA	80 - 140V AC	-	10V AC	20ms	20ms	4,000V AC	PCB 	376 UL, CSA
					160 - 280V AC	-	20V AC					
I/O RELAY DC input modules 1:2  43 x 10 x 20.5mm	• Photo-Transistor	• 4 - 15V DC • 10 - 32V DC	• 15mA / - 	100μA	3 - 32V DC	-	0.8V	5ms	5ms	4,000V AC		
I/O RELAY AC output modules 1:2  43 x 10 x 20.5mm	• Photo-Transistor • Zero-cross	• 75 - 125V AC • 75 - 250V AC	• 2A / 30A 	5mA	3 - 15V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	4,000V AC	PCB 	376 UL, CSA
					4 - 15V DC	1.7kΩ						
					10 - 32V DC	5.6kΩ						
I/O RELAY DC output modules 1:2  43 x 10 x 20.5mm	• Photo-Transistor • Zero-cross	• 3 - 60V DC • 10 - 200V DC	• 2A / 5A (1s)  • 1A 	1mA	3 - 15V DC	1.6kΩ	0.8V	0.5ms	2ms	4,000V AC		
					4 - 15V DC	1.7kΩ						
					10 - 32V DC	5.6kΩ						

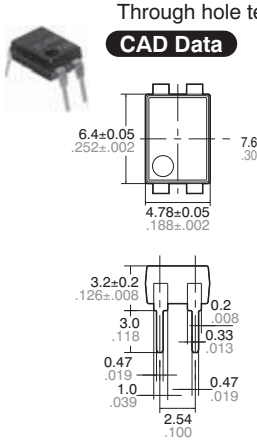
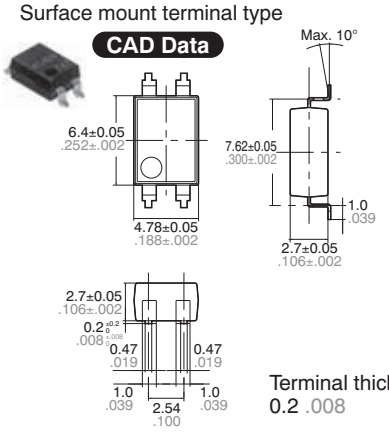
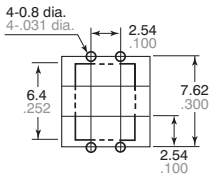
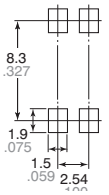
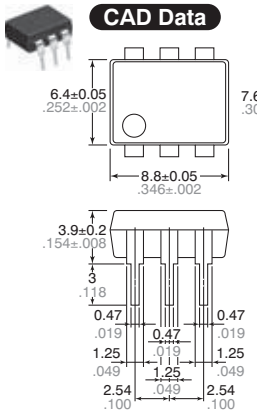
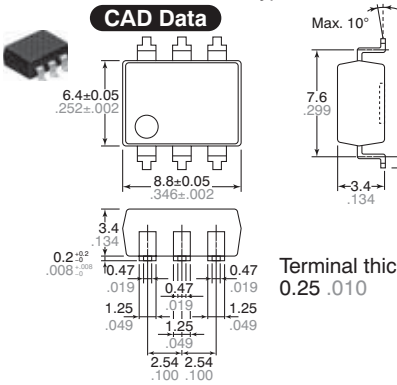
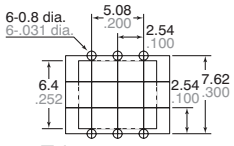
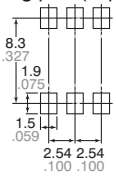
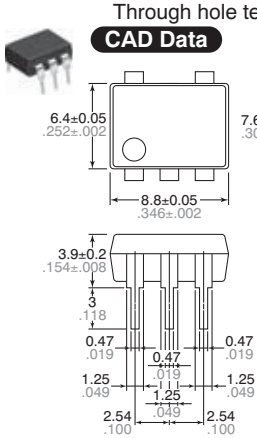
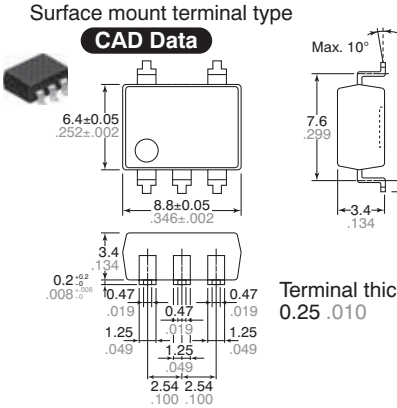
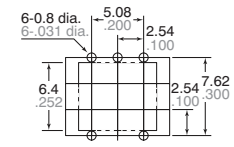
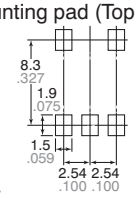
Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
Solid State Plug-in Terminals												
AQ-F 2A/3A (AC output) 1:2  27 x 21 x 35.2mm	• Photo-Triac • Zero-cross	• 75 - 250V AC	• 2A / 80A 	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,000V AC	Plug-in 	353 UL, CSA
	• Photo-Triac • Zero-cross	• 75 - 250V AC	• 3A / 80A 	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,000V AC		
AQ-F 2A/3A (DC output) 1:2  27 x 21 x 35.2mm	• Photo-Transistor	• 3 - 60V DC	• 2A / 5A 	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	2,000V AC	Plug-in 	
	• Photo-Transistor	• 3 - 60V DC	• 3A / 6A 	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	2,000V AC		
Solid State Hockey Puck Types												
AQ-J 1:2  38 x 28 x 17mm	• Photo-Triac • Zero-cross • Ultra-compact size • Built-in varistor	• 75 - 264V AC	• 10A / 100A 	5mA	4 - 6V DC	260Ω	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 3,000V AC (between input and output) • 2,500V AC (between input, output and case)	- 	357 C-UL, TÜV
			• 15A / 150A 		10 - 18V DC	800Ω						
			• 25A / 250A 		18 - 28V DC	1.6kΩ						
					4 - 6V DC	260Ω						
					10 - 18V DC	800Ω						
					18 - 28V DC	1.6kΩ						
AQ-A 1:2  58 x 40 x 25.5mm	• Photo-Triac • Zero-cross and random type available • Built-in varistor and LED indication	• 75 - 250V AC	• 15A / 150A 	10mA	4 - 32V DC	- (Input current, max. 20mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 4,000V AC (between input and output) • 2,500V AC (between input, output and case)	- 	364
			• 25A / 250A 									
			• 40A / 400A 									

Type	Features	Output			Input					Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current/ Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
Solid State DIN Rail Types												
AQ-K 1:2  102 x 22.5 x 100mm	• Photo-Triac • Zero-cross	• 75 - 250V AC	• 15A / 150A 	9mA	4.5 - 30V DC	- (Input current, max. 10mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC/ 4,000V AC	- 35mm DIN rail mounting hole or 2-4.6mm dia. hole or M4 hole 	369 UL, C-UL, TÜV
	• Photo-Triac • Zero-cross	• 75 - 250V AC	• 25A / 250A 	9mA	4.5 - 30V DC	- (Input current, max. 10mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC/ 4,000V AC		

PhotoMOS Relays

PhotoMOS Relay Dimensions

mm inch

Type	Dimensions
AQY21(DIP) AQY41(DIP) Series	Through hole terminal type  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQV10(DIP) AQV11(DIP) AQV20(DIP) AQV21(DIP) AQV22(DIP) AQV23(DIP) AQV25(DIP) AQV41(DIP) AQV45(DIP) Series	Through hole terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Recommended mounting pad (Top view) 
APV1122(DIP) Series	Through hole terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Recommended mounting pad (Top view) 

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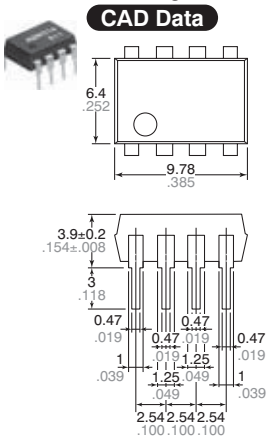
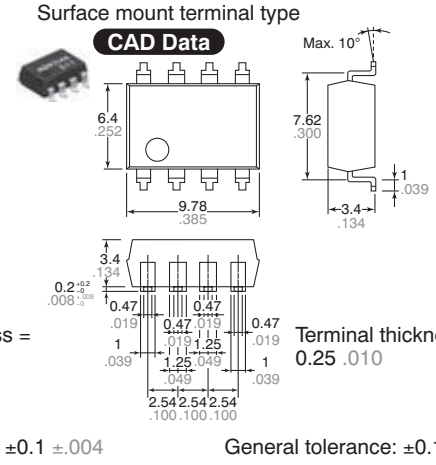
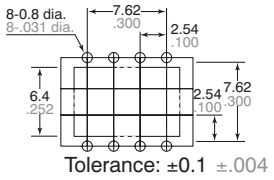
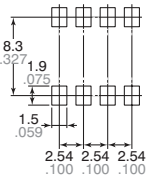
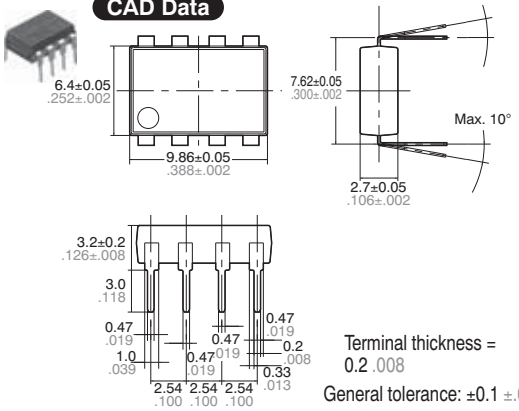
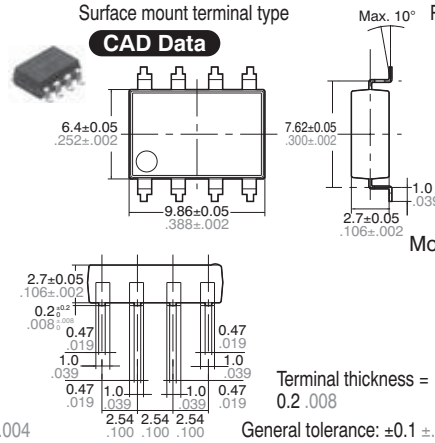
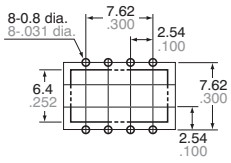
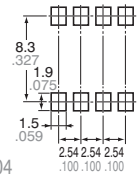
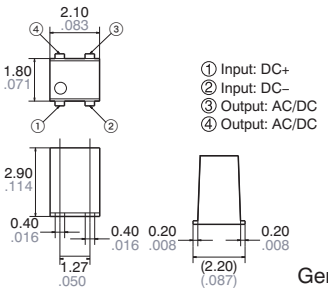
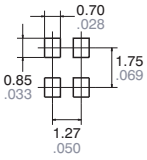
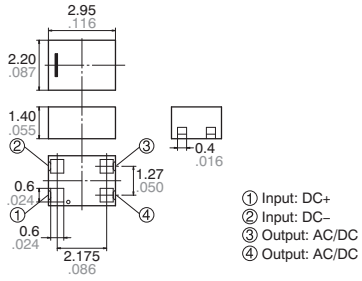
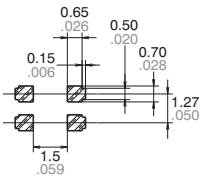
mm inch

Type	Dimensions
AQW21(DIP) AQW22(DIP) AQW25(DIP) AQW41(DIP) AQW45(DIP) AQW61(DIP) AQW65(DIP) Series	Through hole terminal type CAD Data  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type CAD Data  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Recommended mounting pad (Top view) 
AQW21❍EH (DIP) AQW21❍HL (DIP) AQW41❍EH (DIP) AQW61❍EH (DIP) Series	Through hole terminal type CAD Data  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 Surface mount terminal type CAD Data  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQY22 (VSSOP) Series	CAD Data  ① Input: DC+ ② Input: DC– ③ Output: AC/DC ④ Output: AC/DC General tolerance: ±0.2 Recommended mounting pad (Top view)  Tolerance : ±0.1
AQY22(SON) Series	CAD Data  ① Input: DC+ ② Input: DC– ③ Output: AC/DC ④ Output: AC/DC General tolerance: ±0.2 ±.008 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004

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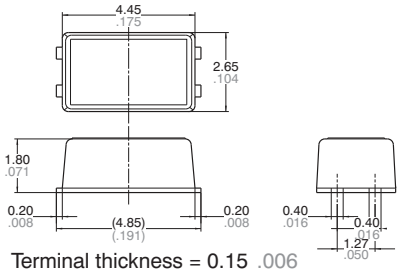
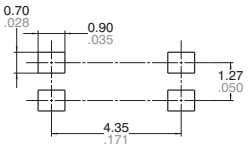
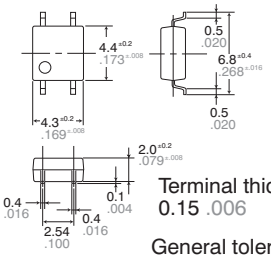
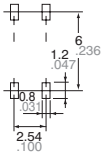
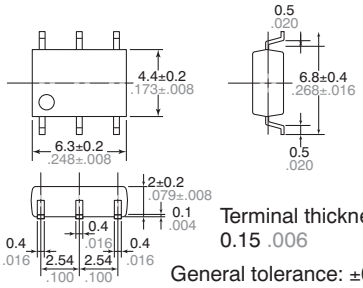
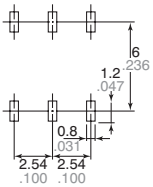
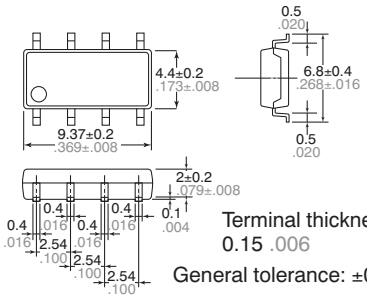
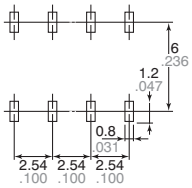
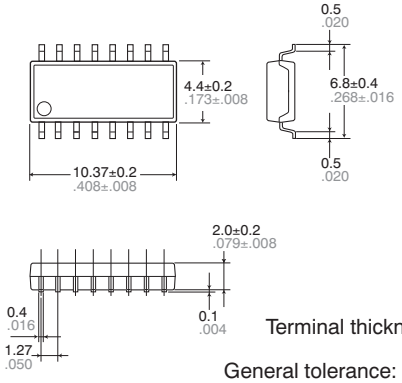
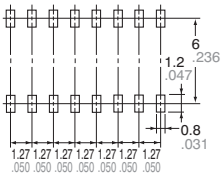
mm inch

Type	Dimensions
APV21(SSOP) AQY22(SSOP) Series	 CAD Data  Terminal thickness = 0.15 .006 General tolerance: ±0.5 ±.020 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
APV11(SOP) APV21(SOP) AQY2 (SOP) AQY21(SOP) AQY22(SOP) AQY41(SOP) Series	 CAD Data  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQV21(SOP) AQV22(SOP) AQV25(SOP) AQV41(SOP) Series	 CAD Data  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQW21(SOP) AQW22(SOP) AQW61(SOP) Series	 CAD Data  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQS22(SOP) Series	 CAD Data  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004

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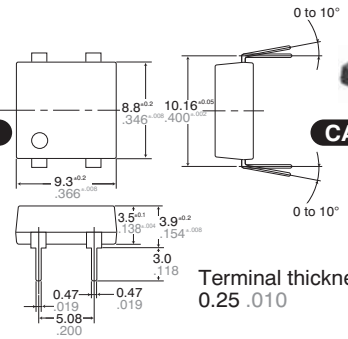
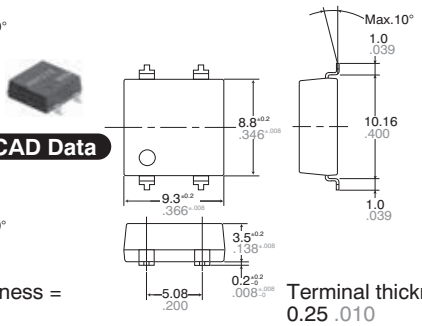
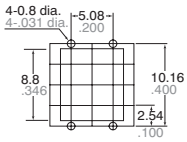
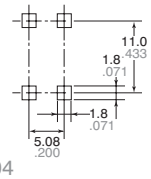
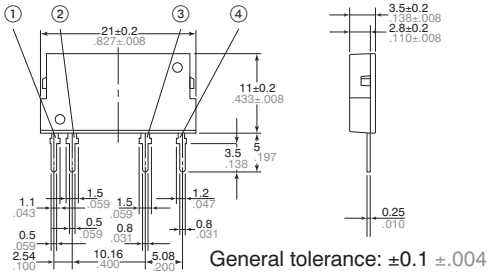
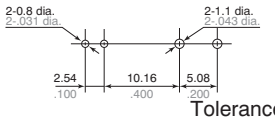
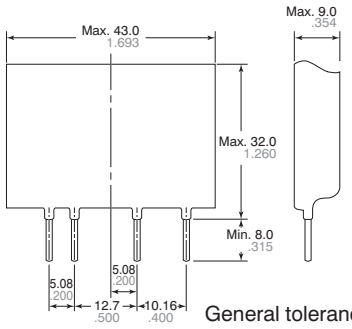
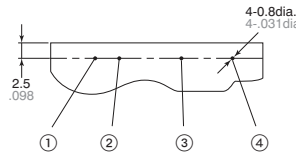
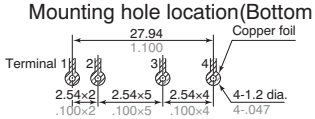
mm inch

Type	Dimensions
AQY27 Power DIP) Series	Through hole terminal type CAD Data  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type CAD Data  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQZ10(SIL) AQZ20(SIL) AQZ40(SIL) Series	 CAD Data  General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 AC/DC type ① Input: DC- ② Input: DC+ ③ Output: DC or AC ④ Output: DC or AC DC type ① Input: DC- ② Input: DC+ ③ Output: DC- ④ Output: DC+
AQZ26(SIL) Series	 CAD Data  General tolerance: ±0.5 ±.020  ① Input: DC - ② Input: DC + ③ Output : AC or DC ④ Output : AC or DC Mounting hole location(Bottom view)  Pitch tolerance: ±0.1 ±.004

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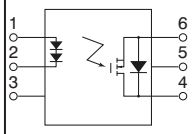
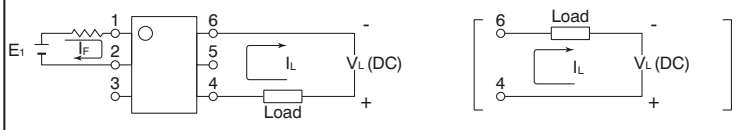
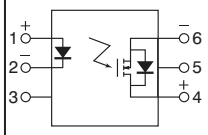
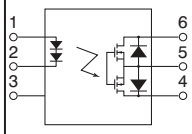
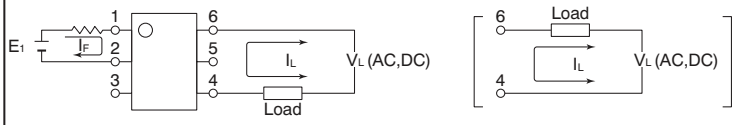
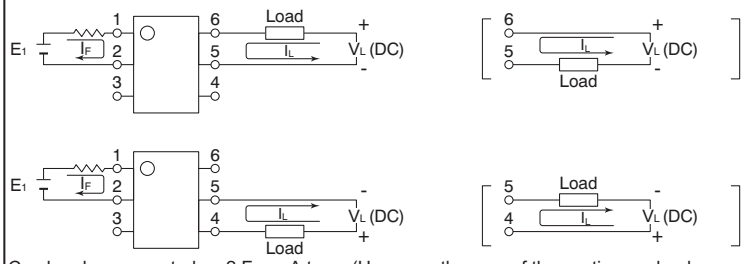
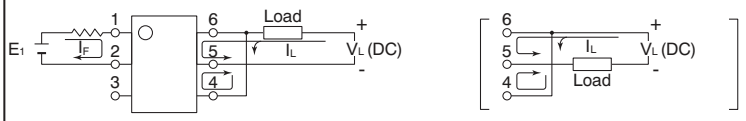
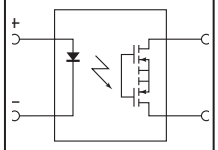
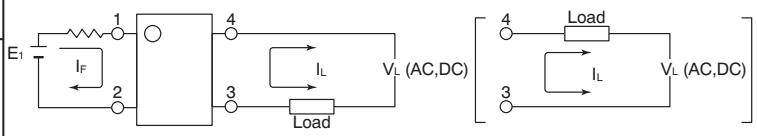
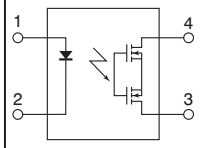
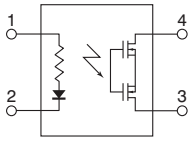
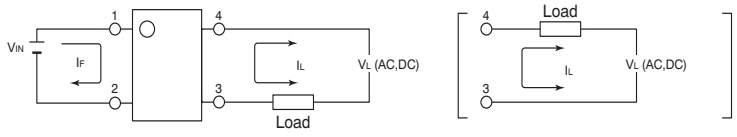
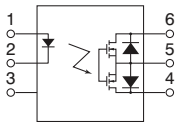
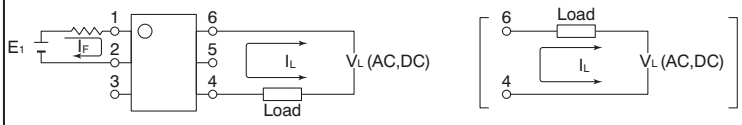
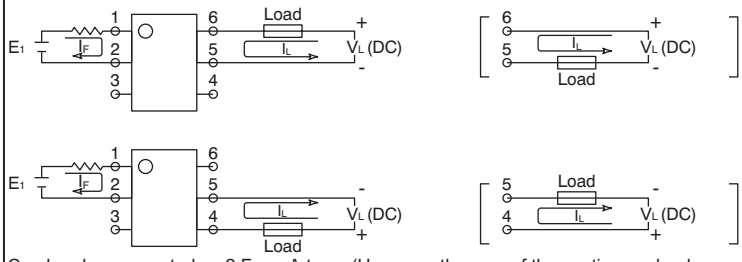
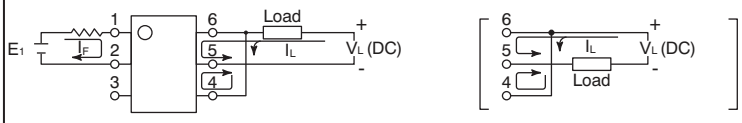
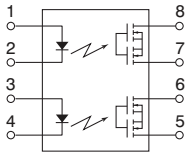
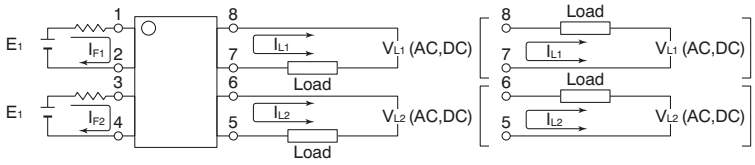
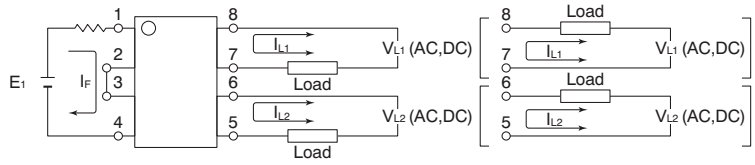
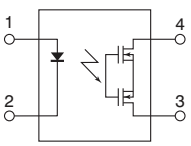
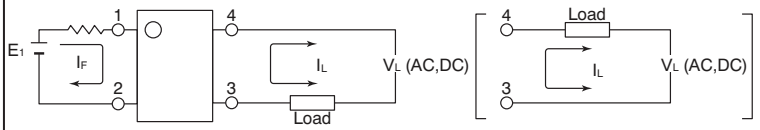
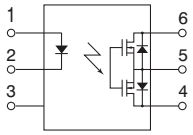
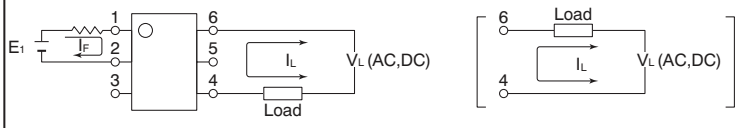
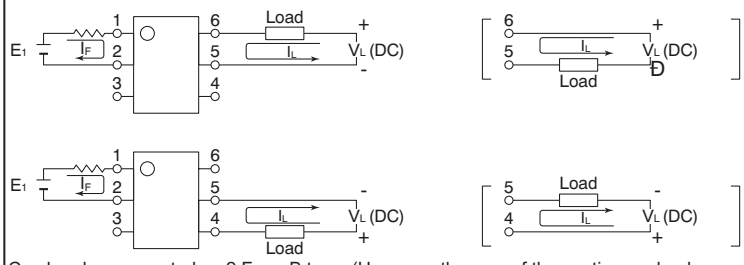
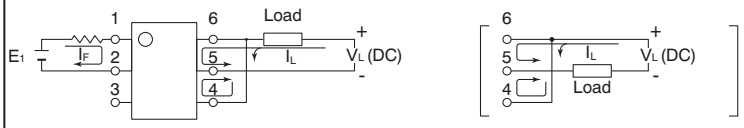
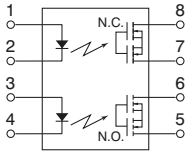
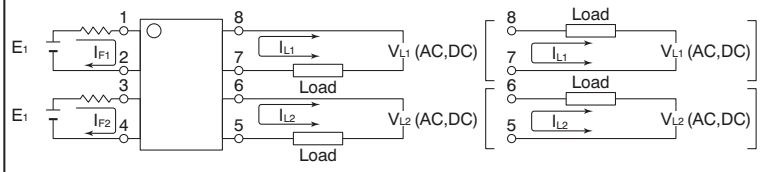
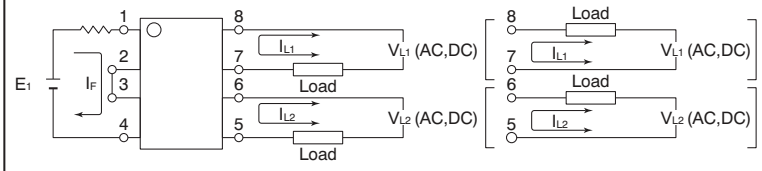
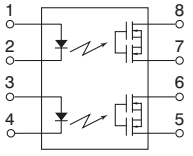
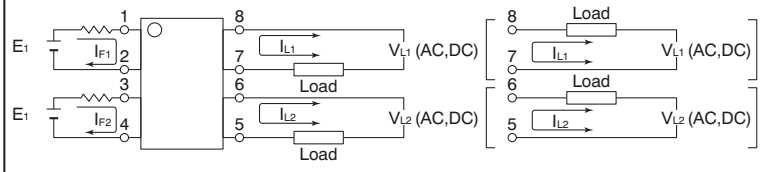
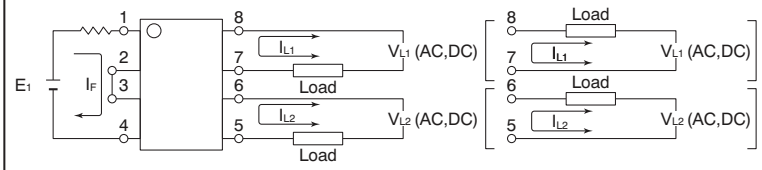
PhotoMOS Relay Schematic and Wiring Diagrams

	Schematic	Output configuration	Load type	Connection	Wiring diagram
AQV10(DIP) Series		1a	DC	A	
AQV11(DIP) Series					
AQV20(DIP) Series		1a	AC/DC	A	
			DC	B	 Can be also connected as 2 Form A type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	
AQY22 (VSSOP)		1a	AC/DC	—	
AQY2 (SOP) AQY21 (DIP, SOP) AQY22(SOP, SSOP, SON) AQY27 (Power-DIP) Series		1a	AC/DC	—	

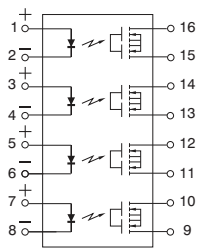
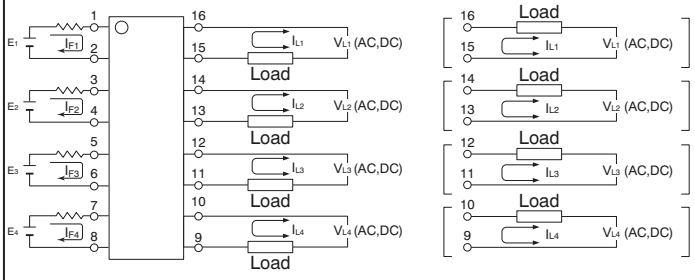
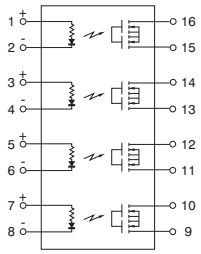
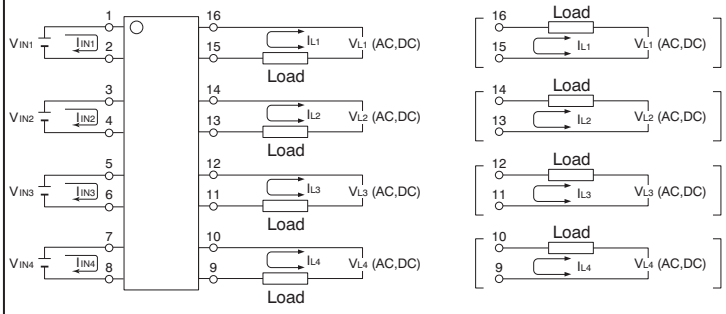
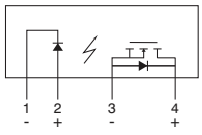
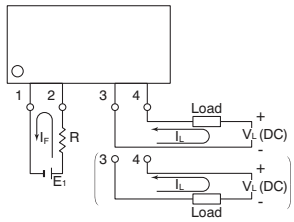
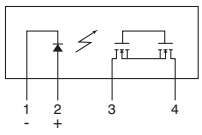
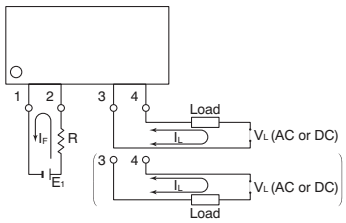
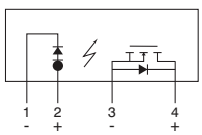
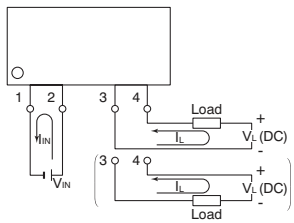
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.
*Terminal 3 cannot be used, since it is in the internal circuit of the relay.

	Schematic	Output configuration	Load type	Connection	Wiring diagram
AQY22○F AQY21○F Series		1a	AC/DC	—	
AQV21 (DIP, SOP) AQV22 (DIP, SOP) AQV23(DIP)* AQV25 (DIP, SOP) Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay.	1a	AC/DC	A	
			DC	B	 Can be also connected as 2 Form A type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	
AQW21 (DIP, SOP) AQW22 (DIP, SOP) AQW25 Series		2a	AC/DC	—	(1) Two independent 1 Form A use  (2) 2 Form A use 
AQY41 (DIP, SOP) Series		1b	AC/DC	—	

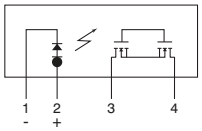
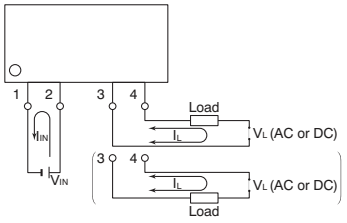
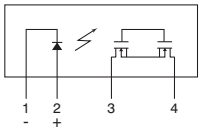
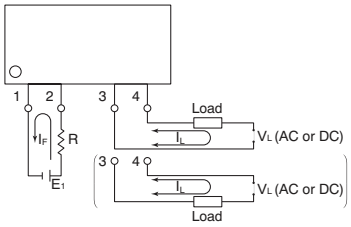
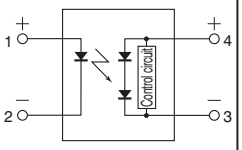
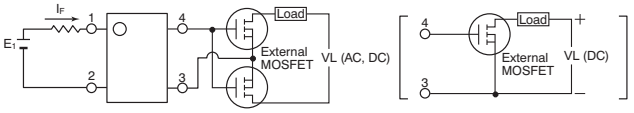
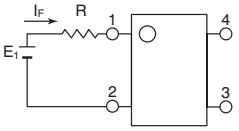
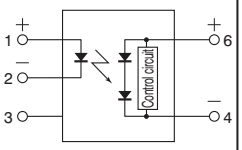
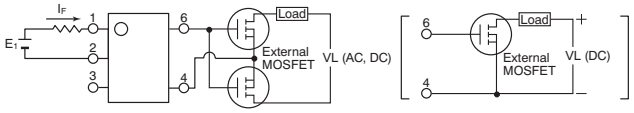
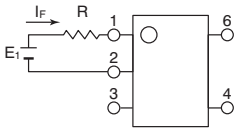
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.
* AQV23 series in SOP is also possible. Please inquire.

	Schematic	Output configuration	Load type	Connection	Wiring diagram
AQV41 (DIP, SOP) AQV45 (DIP) Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay.	1b	AC/DC	A	
			DC	B	 Can be also connected as 2 Form B type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	
AQW61 (DIP, SOP) AQW65 (DIP) Series		1a1b	AC/DC	—	(1) Two independent 1 Form A & 1 Form B use  (2) 1 Form A 1 Form B use 
AQW41 (DIP) AQW45 (DIP) Series		2b	AC/DC	—	(1) Two independent 1 Form B use  (2) 2 Form B use 

Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

	Schematic	Output configu-ration	Load type	Con-nection	Wiring diagram
AQS22(SOP) Series		4a	AC/DC	—	
AQS22❍F (SOP) Series		4a	AC/DC	—	
AQZ10(SIL) Series		1a	DC	—	
AQZ20(SIL) AQZ26(SIL) Series		1a	AC/DC	—	
AQZ10❍D (SIL) Series		1a	DC	—	

Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

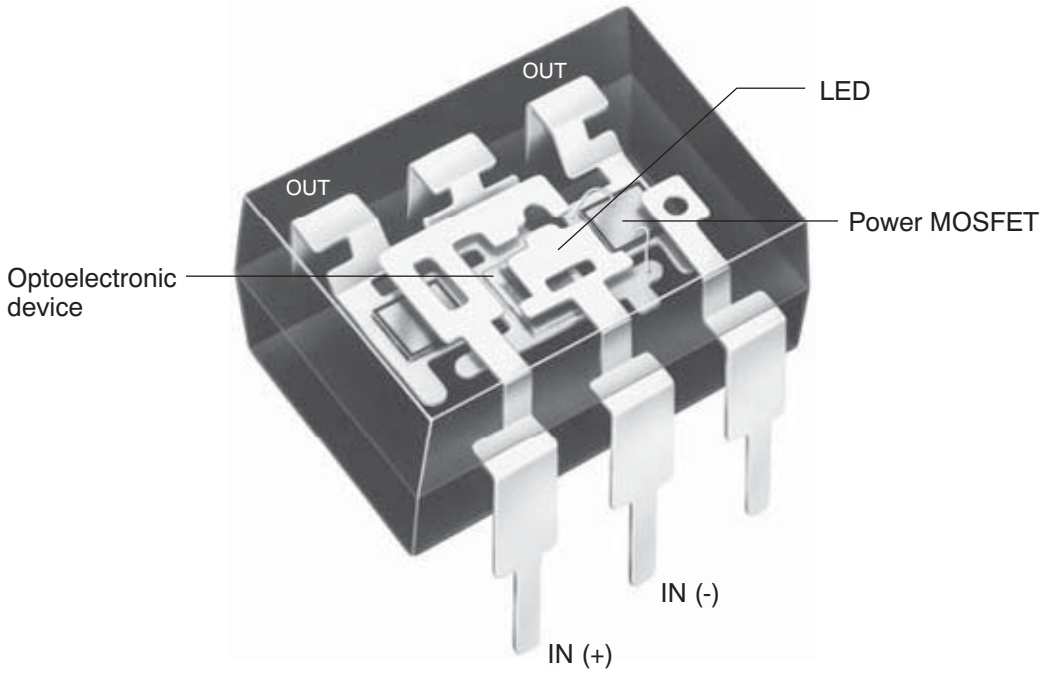
	Schematic	Output configu-ration	Load type	Con-nection	Wiring diagram
AQZ20❍D (SIL) Series		1a	AC/DC	—	
AQZ40(SIL) Series		1b	AC/DC	—	
APV1121S (SOP) APV2121S (SOP) APV2111V (SSOP)		1a	DC	—	Power MOSFET drive wiring diagram  Example of each input power supply and current limit resistors (I_F = 10mA) 
APV1122(DIP)		1a	AC/DC	—	Power MOSFET drive wiring diagram  Example of each input power supply and current limit resistors (I_F = 10mA) 

E_1	R
5V	Approx. 380Ω
15V	Approx. 1.4kΩ
24V	Approx. 2.3kΩ

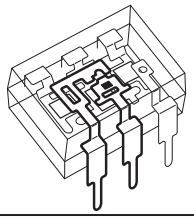
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

PhotoMOS Relay Technical Information

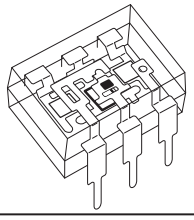
How PhotoMOS Relays Operate



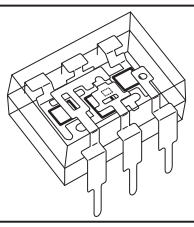
When operated



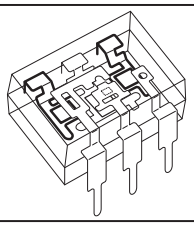
When a signal current flows to the input terminals the LED on the input side emits light.



The emitted light passes through transparent silicon and reaches the photoelectric element (solar cell) which is mounted opposite the LED.

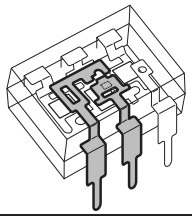


The photoelectric element converts the received light to a voltage corresponding to the quantity of light. This voltage passes through a control circuit and charges the MOSFET gate on the output side.

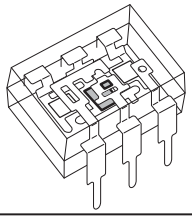


When the MOSFET gate voltage supplied from the photoelectric element reaches a preset voltage value, the MOSFET begins to conduct and turns on the load.

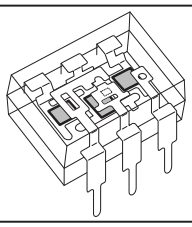
When turned off



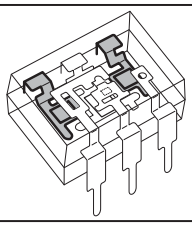
When the signal current at the input terminal is cut off, the LED stops emitting light.



When the emitted light from the LED stops, the voltage of the photoelectric element decreases.



When the voltage supplied from photoelectric element decrease, the control circuit rapidly discharges the gate charge of MOSFET.



This control circuit makes MOSFET stop conducting and immediately turns off the load.

Note: The explanation above applies to the current driving method. Products using the voltage driving method employ a different internal structure and operating principle.

Terminology

Term		Symbol	Description
Input	LED forward current	I_F	Current that flows between the input terminals when the input diode is forward biased.
	LED reverse voltage	V_R	Reverse breakdown voltage between the input terminals.
	Peak forward current	I_{FP}	Maximum instantaneous value of the forward current.
	LED operate current	I_{FON}	Current when the output switches on (by increasing the LED current) with a designated supply voltage and load connected between the output terminals.
	LED turn off current	I_{Foff}	Current when the output switches off (by decreasing the LED current) after operating the relay with a designated supply voltage and load connected between the output terminals.
	LED dropout voltage	V_F	Dropout voltage between the input terminals due to forward current.
	Power dissipation	P_{in}	Allowable power dissipation between the input terminals.
Output	Load voltage	V_L	Supply voltage range at the output used to normally operate the PhotoMOS relay. Represents the peak value for AC voltages.
	Continuous load current	I_L	Maximum current value that flows continuously between the output terminals of the PhotoMOS relay under designated ambient temperature conditions. Represents the peak value for AC current.
	On resistance	R_{on}	Obtained using the equation below from dropout voltage VDS (on) between the output terminals (when a designated LED current is made to flow through the input terminals and the designated load current through the output terminals.) $R_{on} = V_{DS}$ (on)/I_L
	Off state leakage current	I_{leak}	Current flowing to the output when a designated supply voltage is applied between the output terminals with no LED current flow.
	Power dissipation	P_{out}	Allowable power dissipation between the output terminals.
Electrical characteristics	Turn on time	T_{on}	Delay time until the output switches on after a designated LED current is made to flow through the input terminals.
	Turn off time	T_{off}	Delay time until the output switches off after the designated LED current flowing through the input terminals is cut off.
	I/O capacitance	C_{iso}	Capacitance between the input and output terminals.
	Output capacitance	C_{out}	Capacitance between output terminals when LED current does not flow.
	I/O isolation resistance	R_{iso}	Resistance between terminals (input and output) when a specified voltage is applied between the input and output terminals.
	Total power dissipation	P_T	Allowable power dissipation in the entire circuit between the input and output terminals.
	I/O isolation voltage	V_{iso}	Critical value before dielectric breakdown occurs, when a high voltage is applied for 1 minute between the same terminals where the I/O isolation resistance is measured.
	Operating temperature	T_{opr}	Ambient temperature range in which the PhotoMOS relay can operate normally with a designated load current conditions.
	Storage temperature	T_{stg}	Ambient temperature range in which the PhotoMOS relay can be stored without applying voltage.

Reliability tests

Classification	Item	Condition	Purpose
Life tests	High temperature storage test	T_{stg} (Max.)	Determines resistance to long term storage at high temperature.
	Low temperature storage test	T_{stg} (Min.)	Determines resistance to long term storage at low temperature.
	High temperature and high humidity storage test	85°C 185°F, R.H. 85%	Determines resistance to long term storage at high temperature and high humidity.
	Continuous operation life test	V_L = Max., I_L = Max., I_F = LED operate current (Max.)	Determines resistance to electrical stress (voltage and current).
Thermal environment tests	Temperature cycling test	Low storage temperature (T_{stg} Min.) High storage temperature (T_{stg} Max.)	Determines resistance to exposure to both low temperatures and high temperatures.
	Thermal shock test	Low temperature (0°C) (32°F), High temperature (100°C) (212°F)	Determines resistance to exposure to sudden changes in temperature.
	Solder burning resistance	260±5°C 500±41°F, 10 s	Determines resistance to thermal stress occurring while soldering.
Mechanical environment tests	Vibration test	196 m/s² {20 G}, 20 to 2,000 Hz*1	Determines the resistance to vibration sustained during shipment or operation.
	Shock test	9,800 m/s² {1,000 G} 0.5 ms*2; 4,900 m/s² {500 G} 1 ms	Determines the mechanical and structural resistance to shock.
	Drop test	Dropped at a height of 80 cm on oak board	Determines the mechanical resistance to drops sustained during shipment or operation.
	Terminal strength test	Determined from terminal shape and cross section	Determines the resistance to external force on the terminals of the PhotoMOS relay mounted on the PC board while wiring or operating.
	Solderability	230°C 446°F 5 s (with soldering flux)	Evaluates the solderability of the terminals.

*1 10 to 55 Hz at double amplitude of 3 mm for Power PhotoMOS relays.
*2 4,900 m/s², 1 ms for Power PhotoMOS relays.

PhotoMOS Relays Cautions for Use

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

1. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the overvoltage or overcurrent. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

Therefore, the circuit should be designed in such a way that the load never exceed the absolute maximum ratings, even momentarily.

2. Derating design

Derating is essential in any reliable design and a significant factor in consideration of product life. Sufficient derating is needed against maximum rating when designing a system.

And also, relays should be examined using a measurement equipment.

Derated voltages must be considered according to operating and environmental conditions the relay will be subjected to.

3. Unused terminals

The No. 3 terminal is used with the circuit inside the relay. Therefore, do not connect it to the external circuitry with either connection method A, B or C.

(1 Form A 6-pin type)

4. Short across terminals

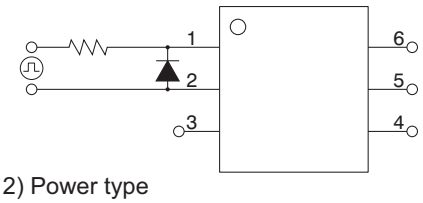
Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

5. Surge voltages at the input

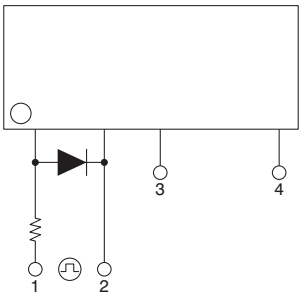
If reverse surge voltages are present at the input terminals, connect a diode in reverse parallel across the input terminals and keep the reverse voltages below the reverse breakdown voltage.

Typical circuits are below shown.

1) 6-pin



2) Power type



6. Recommended LED forward current (I_F) or recommended input voltage (V_{IN})

It is recommended that the LED forward current (I_F) or the input voltage (V_{IN}) of each PhotoMOS Relay should be set according to the following table.

	Product name	Recommended LED forward current (I_F)
DIP SOP SSOP SON VSSOP	AQV10, 11, 20 Series APV11, 21 Series (MOSFET drivers)	10 mA
	AQY21, 41 Series AQY22 Series AQV21, 41 Series AQV22 Series AQV25, 45 Series AQW21 Series AQW41, 61 Series AQW22 Series AQW25, 45, 65 Series AQS22 Series	5mA
	AQY212GS, AQY212G2S AQY21✳H, 41✳H Series AQY210KS AQY210HL AQY27 Series AQV21✳H Series AQV25✳H, 45✳H Series AQV252G AQV255GS AQW21✳H, 41✳H, 61✳H Series AQW210HL	5 to 10mA
	AQV234	2 mA
SIL	AQZ10, 20, 40 Series AQZ26 Series	5 to 10 mA

	Product name	Recommended input voltage (V_{IN})
SOP • SSOP	AQY2❍❍F Series, AQS221F Series	5 V
SIL	AQZ10❍D, AQZ20❍D	

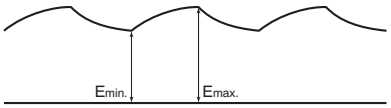
Notes: "✳" indicates two or more characters of number or alphabet.
"❍" indicates a single-digit figure.

7. Ripple in the input power supply

If ripple is present in the input power supply, observe the following:

1) For LED operate current at E_{min}, please maintain the value mentioned in the table of "6. Recommended LED forward current (I_F)."

2) Please make sure for $E_{max.}$ is no higher the LED operate current at than 50 mA.



3) Please maintain the input voltage at least 4V for $E_{min.}$ (GU, RF and Power voltage-sensitive type).

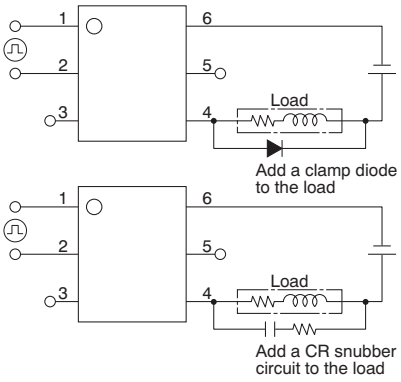
4) Please make sure the input voltage for $E_{max.}$ is no higher than 6V (GU and RF voltage-sensitive type).

5) Please make sure the input voltage for $E_{max.}$ is no higher than 30V (Power voltage-sensitive type).

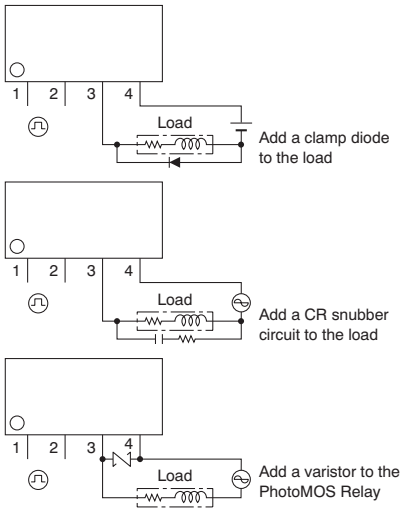
8. Output spike voltages

1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits of AC/DC dual use type are shown below. It is the same with DC only type.

1) 6-pin



2) Power type



2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

9. Cleaning solvents compatibility

The PhotoMOS relay forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

- Frequency: 27 to 29 kHz
- Ultrasonic output:
  No greater than 0.25W/cm^2
- Cleaning time:
  No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other:
  Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

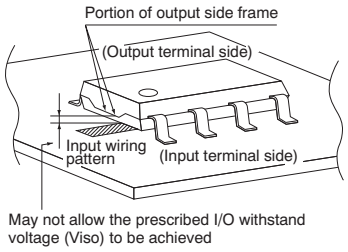
10. Notes for mounting

1) If many different packages are combined on a single substrate, then lead temperature rise is highly dependent on package size. For this reason, please make sure that the temperature of the terminal solder area of the PhotoMOS relay falls within the temperature conditions of item 9 before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 12, resin strength will fall and the nonconformity of the heat expansion coefficient of each constituent material will increase markedly, possibly causing cracks in the package, severed bonding wires, and the like. For this reason, please inquire with us about whether this use is possible.

11. Input wiring pattern

With AQY* or AQW*, AQS series avoid installing the input (LED side) wiring pattern to the bottom side of the package if you require the specified I/O isolation voltage (V_{iso}) after mounting the PC board. Since part of the frame on the output side is exposed, it may cause fluctuations in the I/O isolation voltage.



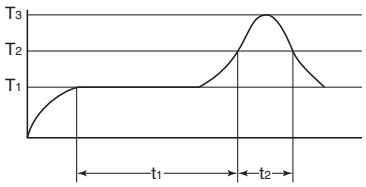
*except for GU-E (Reinforced 5,000V) type

12. Soldering

1) When soldering PC board terminals, keep soldering time to within 10 s at 260°C 500°F.

2) When soldering surface-mount terminals, SOP, SSOP and SON package, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T_1 = 150 to 180°C 302 to 356°F
T_2 = 230°C 446°F
T_3 = 250°C 482°F or less*
t_1 = 60 to 120 s or less
t_2 = 30 s or less

*245°C 473°F or less for SON package

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F
Wattage: 30 to 60 W
Soldering time: within 3 s

• When using lead-free solder, we recommend a type with an alloy composition of Sn 3.0 Ag 0.5 Cu. Please inquire about soldering conditions and other details.

(3) Others

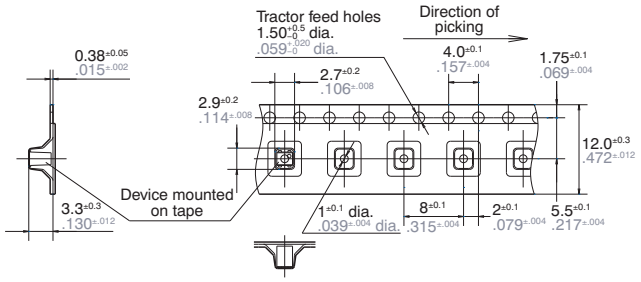
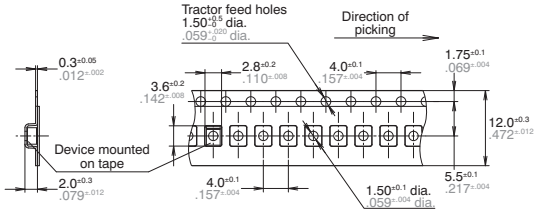
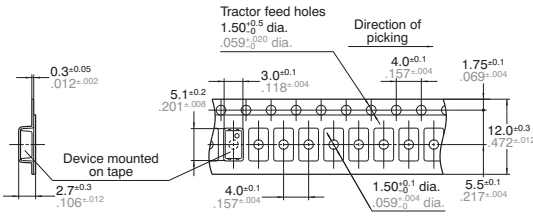
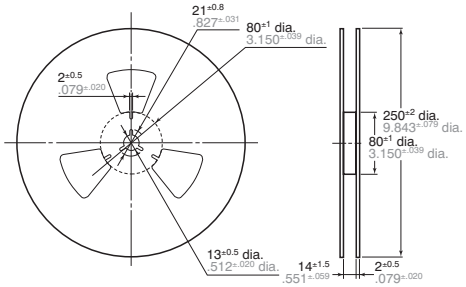
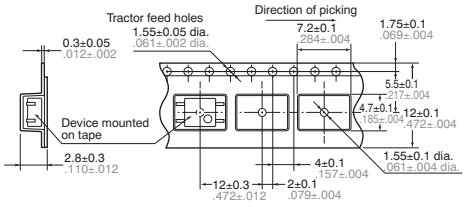
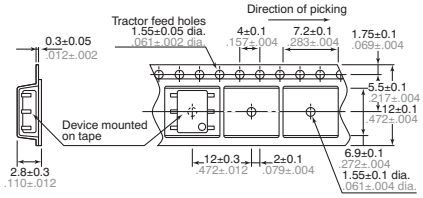
Check mounting conditions before using other soldering methods (DWS, VPS, hot-air, hot plate, laser, pulse heater, etc.)

• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

13. The following shows the packing format

1) Tape and reel

mm inch

	Tape dimensions	Dimensions of paper tape reel
VSSOP 4-pin		
SON 4-pin		
SSOP 4-pin		
SOP 4-pin		
SOP 6-pin		

(1) When picked from 1 and 4-pin side: Part No. AQY❍❍❍TY (Shown above)
(2) When picked from 2 and 3-pin side: Part No. AQY❍❍❍TW

(1) When picked from 1 and 4-pin side: Part No. AQY✳MY (Shown above)
(2) When picked from 2 and 3-pin side: Part No. AQY✳MW

(1) When picked from 1 and 4-pin side: Part No. AQY✳VY,
APV2111VY (Shown above)
(2) When picked from 2 and 3-pin side: Part No. AQY✳VW, APV2111VW

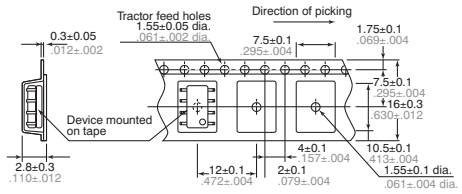
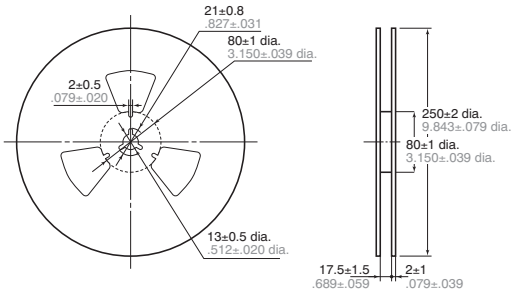
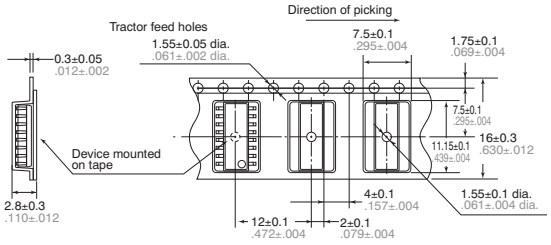
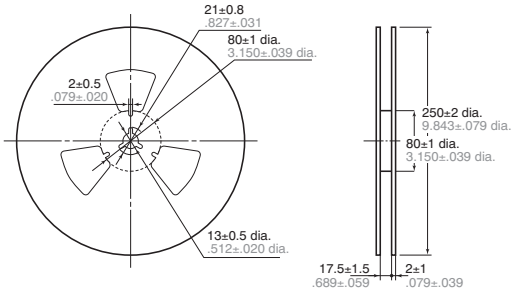
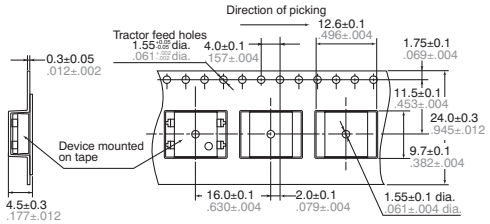
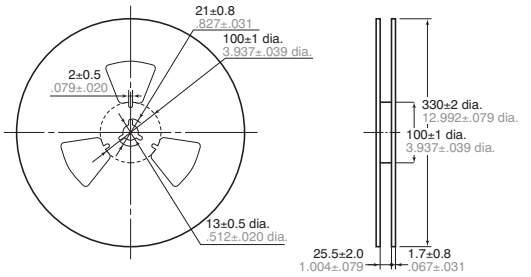
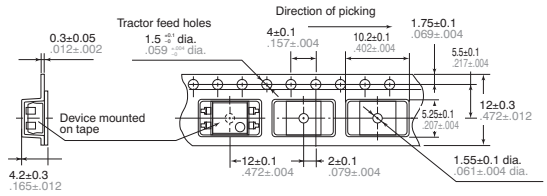
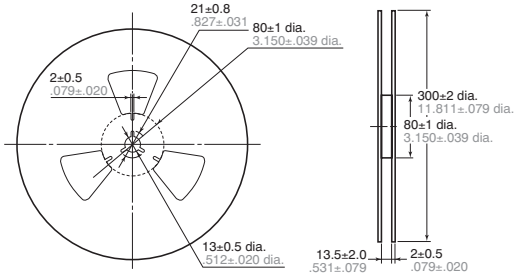
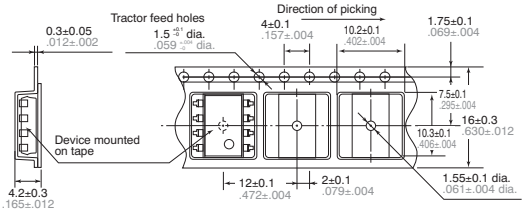
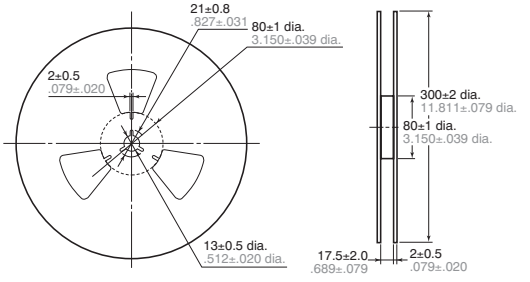
(1) When picked from 1/2-pin side: Part No. AQY✳SX,
APV❍❍21SX (Shown above)
(2) When picked from 3/4-pin side: Part No. AQY✳SZ, APV❍❍21SZ

(1) When picked from 1/2/3-pin side: Part No. AQV✳SX (Shown above)
(2) When picked from 4/5/6-pin side: Part No. AQV✳SZ

Notes: "✳" indicates two or more characters of number or alphabet.
"❍" indicates a single-digit figure.

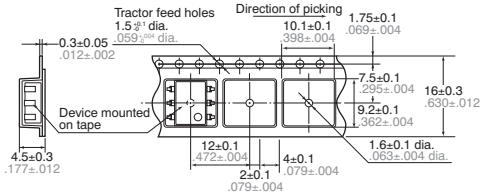
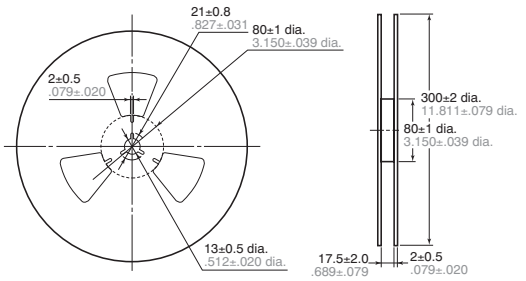
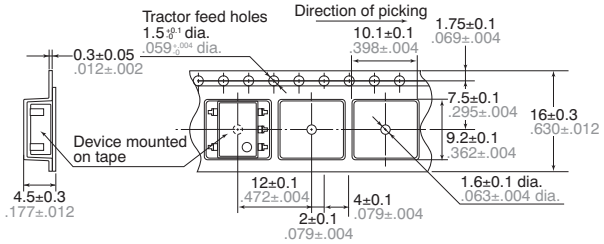
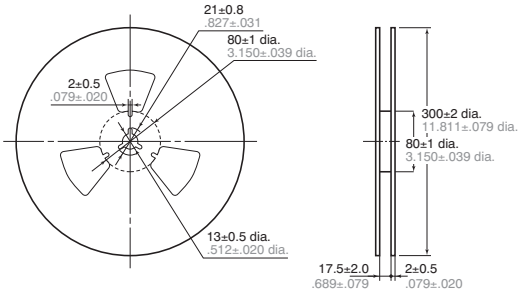
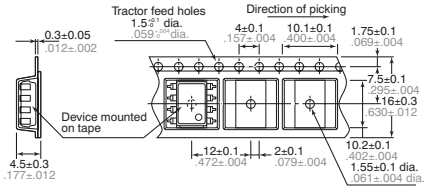
PhotoMOS

mm inch

	Tape dimensions	Dimensions of paper tape reel
SOP 8-pin		
	(1) When picked from 1/2/3/4-pin side: Part No. AQW✳SX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW✳SZ	
SOP 16-pin		
	(1) When picked from 1/2/3/4/5/6/7/8-pin side: Part No. AQS✳SX (Shown above) (2) When picked from 9/10/11/12/13/14/15/16-pin side: Part No. AQS✳SZ	
Power-DIP 4-pin SMD		
	(1) When picked from 1/2-pin side: Part No. AQY○7○AX (Shown above) (2) When picked from 3/4-pin side: Part No. AQY○7○AZ	
DIP 4-pin Surface mount terminal		
	(1) When picked from 1/2-pin side: Part No. AQY✳HAX, AQY210HLAX (Shown above) (2) When picked from 3/4-pin side: Part No. AQY✳HAZ, AQY210HLAZ	
DIP 8-pin Surface mount terminal (Reinforced insulation type)		
	(1) When picked from 1/2/3/4-pin side: Part No. AQW○○○EHAX, AQW210HLAX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW○○○EHAZ, AQW210HLAZ	

Notes: "✳" indicates two or more characters of number or alphabet.
"○" indicates a single-digit figure.

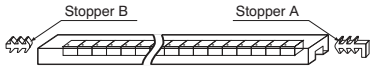
mm inch

	Tape dimensions	Dimensions of paper tape reel
DIP 6-pin Surface mount terminal	 (1) When picked from 1/2/3-pin side: Part No. AQV✳AX (Shown above) (2) When picked from 4/5/6-pin side: Part No. AQV✳AZ	
DIP 6-pin Surface mount terminal (Photovoltaic MOSFET driver)	 (1) When picked from 1/2/3-pin side: Part No. APV1122AX (Shown above) (2) When picked from 4/6-pin side: Part No. APV1122AZ	
DIP 8-pin Surface mount terminal (Basic insulation type)	 (1) When picked from 1/2/3/4-pin side: Part No. AQW✳AX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW✳AZ	

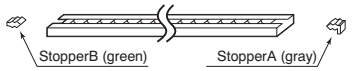
Note: "✳" indicates two or more characters of number or alphabet.

2) Tube
Devices are packaged in a tube so that pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.

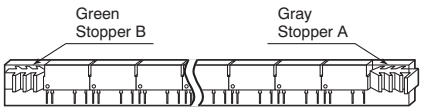
(PD type, GU-E type [AQY❍EH, AQW❍EH], GU Current Limit Function type [AQY❍HL, AQW❍HL])



(SOP type)



(Power type)



The power photoMOS relays are stick packed so that the number 1 terminal is in the direction of stopper B.
One stick contains 25 power photoMOS relays.

14. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

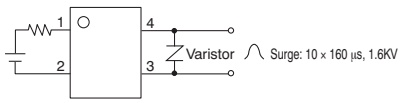
• Temperature: 0 to 45°C 32 to 113°F
• Humidity: Less than 70% R.H.
• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

3) PhotoMOS relays implemented in SON, SSOP, SOP are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month ≦ 45°C/70% R.H.).
• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

15. Current limit function (output current control)

1) Current limit function aims to increase resistance to surges when the switch is turned on. Before using this function, connect the varistor to the output as shown in the figure below.



* Set the varistor voltage to 150 V or less.

2) The current limit function capability can be lost if used longer than the specified time. Be sure to set the output loss to the max. rate.

16. Deterioration and destruction caused by discharge of static electricity (RF C×R5, 10)

This phenomenon is generally called static electricity destruction, and occurs when static electricity generated by various factors is discharged while the relay terminals are in contact, producing internal destruction of the element.
To prevent problems from static electricity, the following precautions and measures should be taken when using your device.

1) Employees handling relays should wear anti-static clothing and should be grounded through protective resistance of 500 kΩ to 1 MΩ.
2) A conductive metal sheet should be placed over the work table. Measuring instruments and jigs should be grounded.
3) When using soldering irons, either use irons with low leakage current, or ground the tip of the soldering iron. (Use of low-voltage soldering irons is also recommended.)
4) Devices and equipment used in assembly should also be grounded.
5) When packing printed circuit boards and equipment, avoid using high-polymer materials such as foam styrene, plastic, and other materials which carry an electrostatic charge.
6) When storing or transporting relays, the environment should not be conducive to generating static electricity (for instance, the humidity should be between 45 and 60%), and relays should be protected using conductive packing materials.

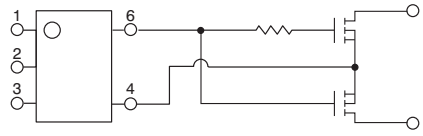
17. Short circuit protection circuit

The short circuit protection circuit is designed to protect circuits from excess current. Therefore, surge current may be detected as current overload in which case the output current will be cut and the off state maintained. For this reason, please include the inrush current in the load current and keep it below the maximum load current. Also, in order to maintain stability of internal IC operation, maintain an input current of at least 5 mA (Latch type), 10 mA (Non Latch type).

18. Photovoltaic MOSFET driver cautions for use

When two external MOSFETs are connected with a common source terminal, oscillation may occur when operation is restored. Therefore, please insert a 100 to 1,000 ohms resistor between the gate terminal of the first MOSFET and the gate terminal of the second MOSFET.

A typical example of this is given in the circuit below.



19. Power PhotoMOS Relays cautions for use

(1) Input LED current (Standard type)

For rising and dropping ratio of input LED current (di/dt), maintain min. 100 μA/s.

(2) Input voltage (Voltage sensitive type)

For rising and dropping ratio of input voltage (dv/dt), maintain min. 100 mV/s.

(3) Adjacent mounting

1) When relays are mounted close together with the heat-generated devices, ambient temperature may rise abnormally. Mounting layout and ventilation should be considered.

2) When many relays are mounted close together, load current should be reduced. (Refer to the date of “Load current vs. ambient temperature characteristics in adjacent mounting.”)

(4) Recommended load voltage

As a guide in selecting PhotoMOS Relays, please refer to the following table.

1) Power photoMOS relays (1 Form A)

		Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
DC type	AQZ102	60 V DC	4.0 A DC	5,12,24 V DC
	AQZ105	100 V DC	2.6 A DC	48 V DC
	AQZ107	200 V DC	1.3 A DC	100 V DC
	AQZ104	400 V DC	0.7 A DC	200 V DC
AC/DC type	AQZ202	Peak AC 60 V	Peak AC 3.0 A	12 V AC; 5,12,24 V DC
	AQZ205	Peak AC 100 V	Peak AC 2.0 A	24 V AC 48 V DC
	AQZ207	Peak AC 200 V	Peak AC 1.0 A	48 V AC 100 V DC
	AQZ204	Peak AC 400 V	Peak AC 0.5 A	100 V AC 200 V DC

2) Power PhotoMOS relays (1 Form B)

		Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ404	Peak AC 400 V	Peak AC 0.5 A	100 V AC 200 V DC

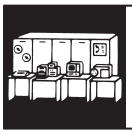
3) Power PhotoMOS relays Voltage-sensitive type (1 Form A)

		Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
DC type	AQZ102D	60 V DC	3.6 A DC	5.12,24 V DC
	AQZ105D	100 V DC	2.3 A DC	48 V DC
	AQZ107D	200 V DC	1.1 A DC	100 V DC
	AQZ104D	400 V DC	0.6 A DC	200 V DC
AC/DC type	AQZ202D	Peak AC 60 V	Peak AC 2.7 A	12 V AC; 5,12,24 V DC
	AQZ205D	Peak AC 100 V	Peak AC 1.8 A	24 V AC 48 V DC
	AQZ207D	Peak AC 200 V	Peak AC 0.9 A	48 V AC 100 V DC
	AQZ204D	Peak AC 400 V	Peak AC 0.45 A	100 V AC 200 V DC

4) Power PhotoMOS relay High Capacity type (1 Form A)

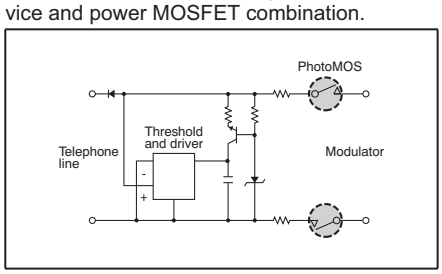
		Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ262	Peak AC, DC 60V	Peak AC, DC 6A	12V AC 5,12,24V DC
	AQZ264	Peak AC, DC 400V	Peak AC, DC 1A	100V AC 200V DC

PhotoMOS Relays for Various Applications



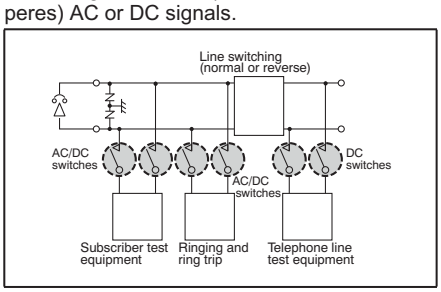
Automatic meter reading

The needs of centralized remote meter reading systems for water, gas and electricity in medium and high rise apartments and new subdivisions are now increasing. PhotoMOS relays are capable of controlling from low level signals up to power signals and feature low leakage current and noise from the optoelectronic device and power MOSFET combination.



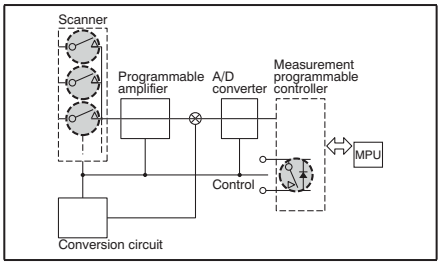
Telecommunications

A variety of signals, with levels from millivolts (at microamperes) to tens of volts (at several hundred milliamperes), AC or DC, and even high bit-rate signals, can be superimposed on telephone lines, the heart of telecommunication networks. The switches in telecommunication circuits, which normally carry DC signals, also carry AC signals on top of the DC level when an intermittent signal (e.g. ringer signal) is being sent. PhotoMOS relays are capable of controlling small level (millivolts at microamperes) AC or DC signals.



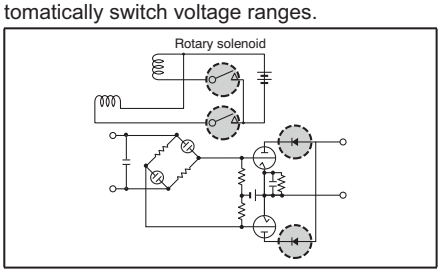
Instrumentation

With the spread of microcomputer chips, the latest instruments are required to measure a variety of signals at high speeds under various conditions. PhotoMOS relays are recommended for measurement scanning functions, automatic zero-point compensation to eliminate zero-point error, and measurement sequence interfaces (e.g. alarm interface.)



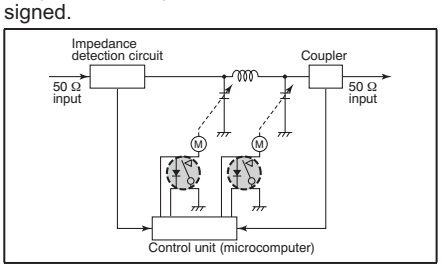
Medical equipment

Medical equipment which processes low level signals includes electrocardiographs, electroencephalographs, and X-ray CT scanners. PhotoMOS relays accurately transfer low level signals (less than several hundred millivolts). Furthermore, they are also convenient in driving rotary solenoids such as those used to automatically switch voltage ranges.



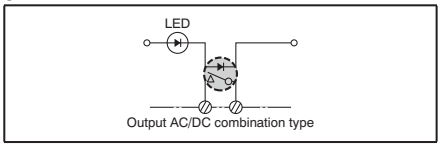
Communications equipment

The future of communications is in satellite communications. Satellite-communications feature many advantages such as indifference to terrestrial disasters, wide service areas, simple circuit modification and simultaneous conversations. An important control operation in communications equipment is fast automatic tuning.
PhotoMOS relays can easily be connected in parallel, difficult with conventional transistor type. As a result, a variety of circuit connection are possible and power circuits can also be designed.



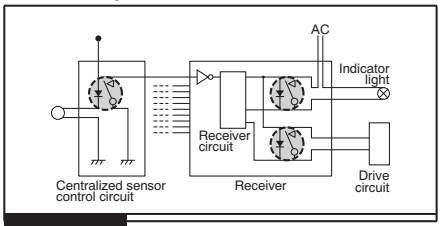
Programmable controller

The output circuit of a programmable controller requires various interfaces to match the load type. Recently, as the computing speed and data processing speed increase, problems may arise from noise at the input interface as well as at the output interface.
PhotoMOS relays are resistant to inrush current (due to phase shift) and eliminate the need for snubber circuits as long as they are operated within the ratings. Furthermore, use of PhotoMOS relays decreases the mounting area requirements, resulting in more compact programmable controllers.



Security Equipment

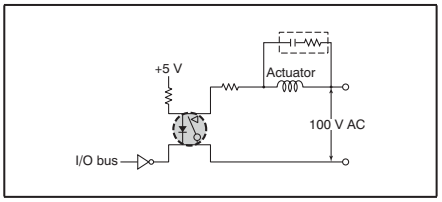
There are many types of security systems from home and office security to building security. PhotoMOS relays are ideal for use as input interfaces for system sensors and output interfaces for alarms.
Input interface: Low leakage current makes use possible for low level voltage and current input.
Output interface: Outputs either AC or DC up to a load voltage of 400 V.



OA equipment

OA equipment usually contains a sensor control unit (for temperature, speed, torque, etc.), drive unit, power supply unit, and a processing unit which controls the overall system. It is organized similarly to compact factory automation machinery. PhotoMOS relays have wide application in the interfaces for signals which connect the functions of these units.

- Operates on a 24 mW input to enable direct control of C-MOS devices.
- Signal transfer through optical coupling achieves high resistance to noise and transients, eliminating the need for adding a snubber circuit to the output to control the load voltage.
- Advantages in the total cost and reliability in the control system result from the absence of AC leakage current related to the snubber circuit.

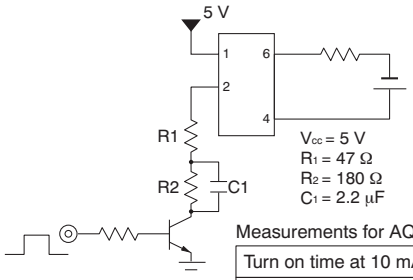


If you are a user experiencing difficulty with solid-state relays and triacs:

If you would like to control small analog signals with a photocoupler and solid-state relays.	➤	PhotoMOS relays feature low offset voltages and on resistances of 0.25 Ω or less. (AQV251 Connection)
If you require a device with a small leakage current (as opposed to bipolar devices having large internal leakage currents).	➤	PhotoMOS relays have leakage currents in the order of microamperes and can control up to 1500 V (peak). (AQV258)
If you would like to directly control analog signals and you would like a device integrating a photocoupler, driver and analog IC to simplify the circuit as much as possible.	➤	PhotoMOS relays contain all of these functions in a single package. Furthermore, circuit design is simplified as a power supply is unnecessary since the internal optoelectronic device directly drives the power MOSFET.
If you require a snubber circuit with a triac or solid-state relay, but are concerned about the snubber circuit's AC leakage current.	➤	PhotoMOS relays are resistant to transients and as long as they are operated within the maximum ratings, eliminate the need for adding a snubber circuit to the output to control the rise in load voltage. Leakage current ceases to be a problem, with cost and reliability being other advantages.
If you require a device for AC control that is resistant to ambient temperature changes and input signal noise.	➤	PhotoMOS relays do not employ the self-trigger mechanism used in SCRs and triacs. Therefore, they do not switch on accidentally. Furthermore, the noise suppression characteristics of optoelectronic devices make them highly resistant to ambient noise for operation at temperatures up to 80°C 176°F.

PhotoMOS Relay Application Examples

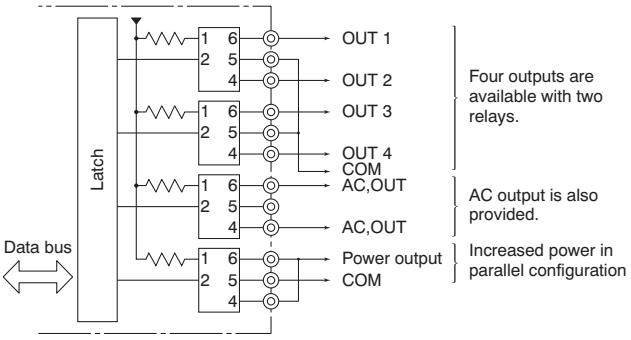
High Response Speed



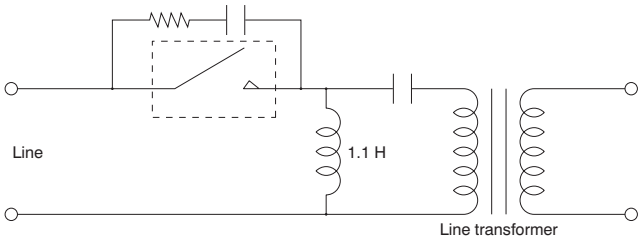
Measurements for AQV204(400V) AC/DC type

Turn on time at 10 mA LED current	0.18 ms
Turn on time with speed-increase capacitor (LED current 45 mA)	0.03 ms

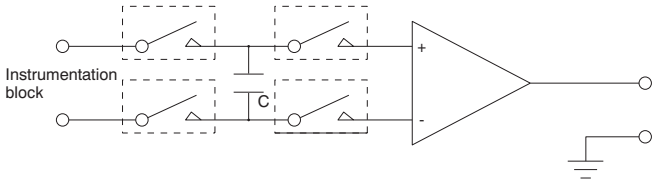
Microprocessor system I/O board



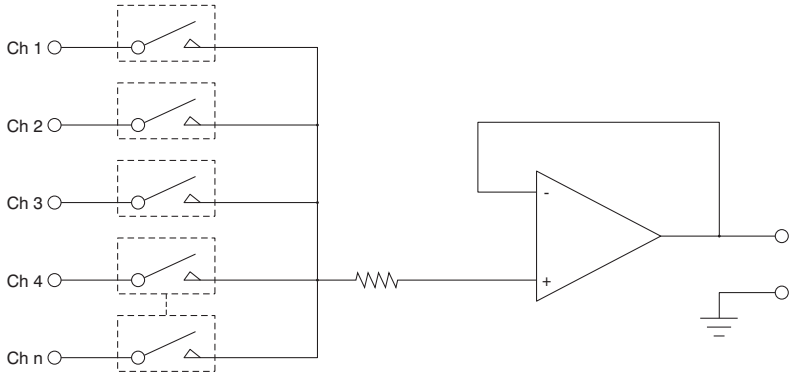
Dial Pulse Generator



Capacitor Switch Circuit



Scanner



PhotoMOS Relays for Automotive Applications

Before Selecting PhotoMOS Relays for Automotive Applications

Some changes in specification parameters are needed when PhotoMOS relays are used in certain automotive applications. Automotive grade PhotoMOS relays are generally used in automotive environment since stricter enhanced quality controls are needed. The user is cautioned and asked to inquire with a Panasonic Electric Works local sales representative before designing the products in such environments.

About Specification Reviews

Automotive applications require specification reviews. This is important and necessary in order to prevent performance, quality and reliability problems. The following parameters should be reviewed with a Panasonic Electric Works local sales representative:

- Targeted application
- Targeted levels of quality and reliability
- Circuits description of load level, driving methods, etc.
- Service conditions
- Influence at failure and failsafe concepts, etc.

About Derating Design

Derating is essential in any reliable design and a significant factor in consideration of product life. Sufficient derating is needed against maximum rating when designing a system. Please contact your Panasonic Electric Works representative to determine derated percentages of the maximum load voltage and maximum load current ratings.
Relays should be examined using measurement equipment.
Derated voltages must be considered according to the operating and environmental conditions the relay will be subjected to.
In case of automotive applications, more allowance should be given to maximum ratings and installation of safety measures (i.e. use of double circuits). Misuse of the products listed in this document shall be made at the users' own risk.

Typical Products for Automotive Applications

Types and absolute maximum ratings (Ambient temperature: 25°C 77°F)

Part number	Type	Package	Contact configuration	Load voltage (V_L)*1	Continuous load current (I_L)*1	Temperature limits	
						Operating (T_{opr})	Storage (T_{stg})
AQW216HAX❍❍❍	GU	DIP8pin (SMD)	2 Form A	600V	40mA (50mA)*2	–40°C to +85°C –40°F to +185°F	–40°C to +100°C –40°F to +212°F
AQW212HAX❍❍❍	GU	DIP8pin (SMD)	2 Form A	60V	500mA (600mA)*2		
AQV258HAX❍❍❍	HE	DIP6pin (SMD)	1 Form A	1500V	20mA		

*1 Indicate the peak AC and DC values.
*2 In case of using only 1 channel

Electric characteristics (Ambient temperature: 25°C 77°F)

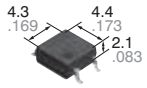
Item			Symbol	Part number			Test conditions
				AQW216HAX❍❍❍	AQW212HAX❍❍❍	AQV258HAX❍❍❍	
Input	LED operate current	Typ.	I_{Fon}	1mA	1mA	0.8mA	I_L = Max.
		Max.		3mA	3mA	3mA	
	LED turn off current	Typ.	I_{Foff}	0.2mA	0.2mA	0.2mA	
		Max.		0.8mA	0.8mA	0.7mA	
	LED dropout voltage	Typ.	V_F	1.25V	1.25V	1.25V	I_F = 50mA
		Max.		1.5V	1.5V	1.5V	
Output	On resistance	Typ.	R_{on}	70Ω	0.83Ω	305Ω	I_F = 10mA (AQW216HAX❍❍❍, AQW212HAX❍❍❍) I_F = 7.5mA (AQV258HAX❍❍❍) I_L = Max.
		Max.		150Ω	2.5Ω	500Ω	
	Off state leakage current	Max.	I_{Leak}	1μA	1μA	10μA	I_F = 0mA, VL = Max.
Transfer characteristics	Turn on time	Typ.	T_{on}	0.2ms	0.5ms	0.28ms	I_F = 10mA (AQW216HAX❍❍❍, AQW212HAX❍❍❍) I_F = 7.5mA (AQV258HAX❍❍❍) I_L = Max.
		Max.		0.5ms	2ms	1ms	
	Turn off time	Typ.	T_{off}	0.04ms	0.08ms	0.1ms	
		Max.		0.5ms	0.5ms	0.5ms	

For further particulars on automotive grade PhotoMOS relays, please inquire with a Panasonic Electric Works sales representive.

Panasonic
ideas for life

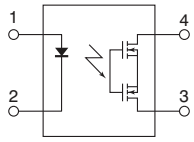
Miniature SOP4-pin type with high capacity up to 1.25A

PhotoMOS Relays
GU SOP 1 Form A High Capacity
(AQY212GS, AQY212G2S)



CAD Data

mm inch



FEATURES

1. Greatly increased load current in miniature SOP4-pin package (1.25A high capacity type added).
2. Greatly improved specifications allow you to use this in place of mercury and mechanical relays.

TYPICAL APPLICATIONS

• Measuring instruments
• Security and disaster-preventing system: use in I/O for alarm and security devices, etc.

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2-pin side	Tape and reel packing style: Picked from the 3/4-pin side	Tube	Tape and reel
AC/DC dual use	60V	1.0A	SOP4-pin	AQY212GS	AQY212GSX	AQY212GSZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
		1.25A		AQY212G2S	AQY212G2SX	AQY212G2SZ		

* Indicate the peak AC and DC values.

Note: 1. For space reasons, the three initial letters of the part number “AQY”, the surface mount terminal shape indicator “S” and the packing style indicator “X” or “Z” are not marked on the relay. (Ex. the label for product number AQY212G2SX is 212G2.)
2. For types with a built-in resistor, see page 92.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

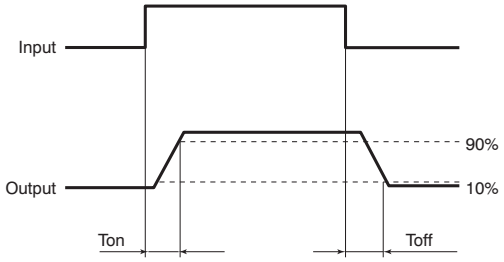
Item		Symbol	AQY212GS	AQY212G2S	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	60 V		
	Continuous load current	I_L	1.0 A	1.25 A	Peak AC, DC
	Peak load current	I_{peak}	3 A		100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW		
Total power dissipation		P_T	350 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

GU SOP 1 Form A High Capacity (AQY212GS, AQY212G2S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212GS	AQY212G2S	Condition
Input	LED operate current	Typical	I_{Fon}	1.1 mA		I_L = 100mA
		Maximum		3 mA		
	LED turn off current	Minimum	I_{Foff}	0.3 mA		I_L = 100mA
		Typical		1.0 mA		
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	0.34 Ω	0.2 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		0.7 Ω	0.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA		I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.3 ms		I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms		
	Turn off time*	Typical	T_{off}	0.1 ms		I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		0.5 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC
	Max. switching frequency	Maximum	—	—	5 times/s	I_F = 5 mA duty = 50% $V_L \times I_L$ = 75 V·A

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

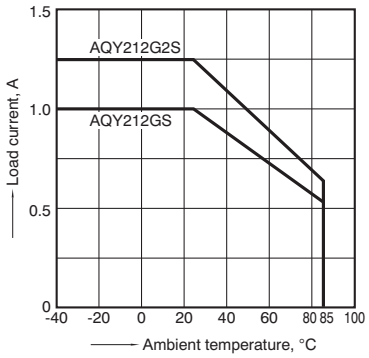
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

For more information, see page 80.

REFERENCE DATA

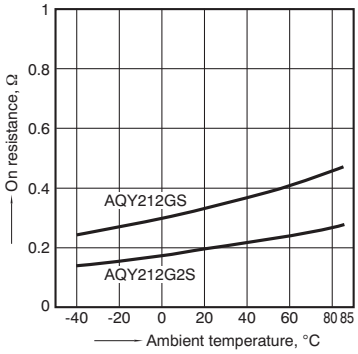
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



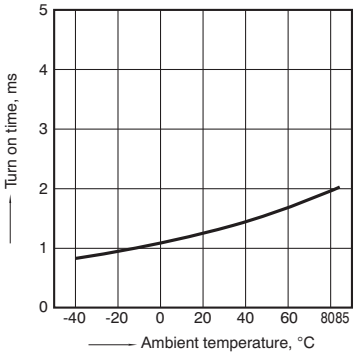
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



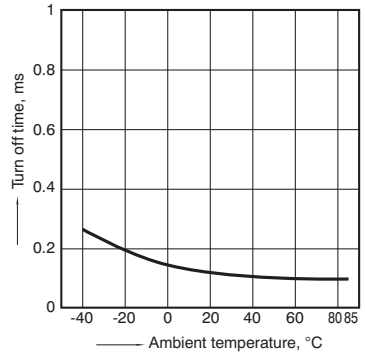
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



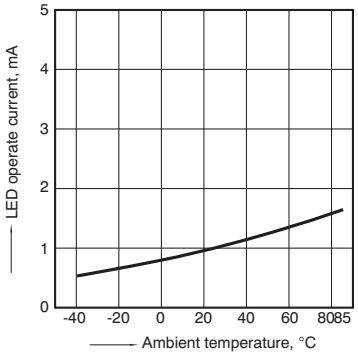
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



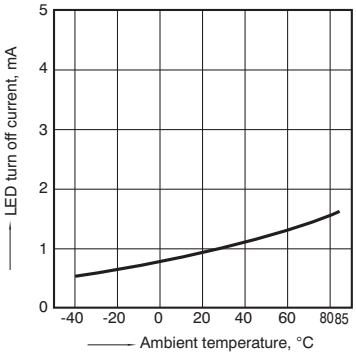
5. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



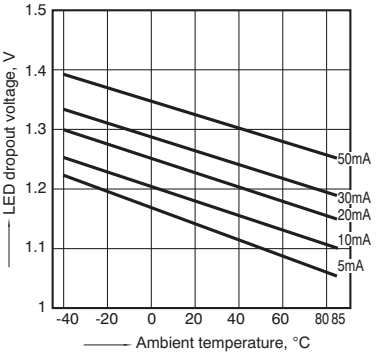
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



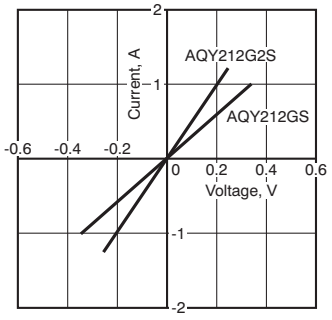
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



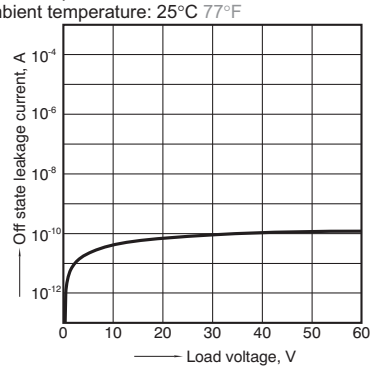
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



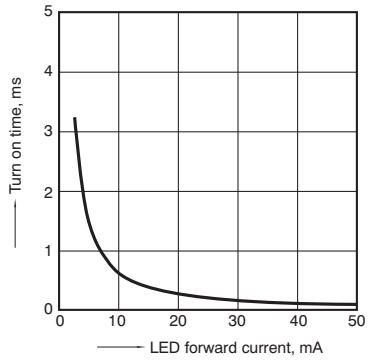
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



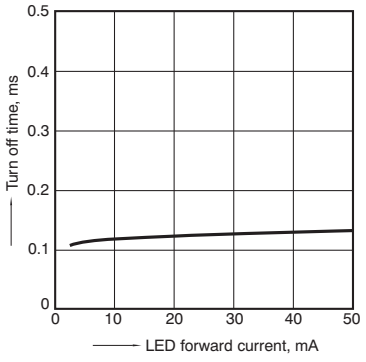
10.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



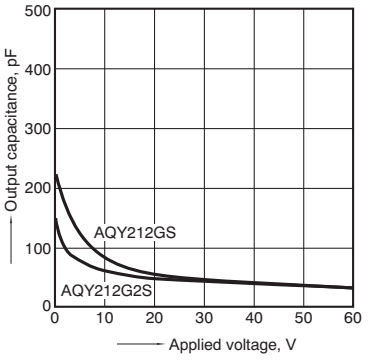
11.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



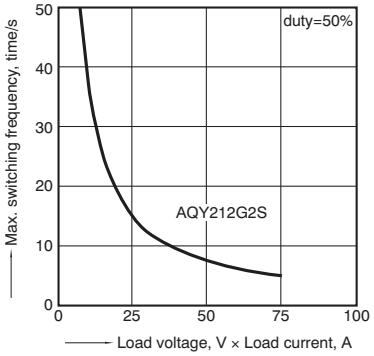
12.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



13.Max. switching frequency vs. load voltage and load current

LED current: 5 mA
Ambient temperature: 25°C 77°F



Panasonic
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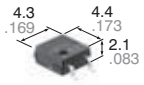
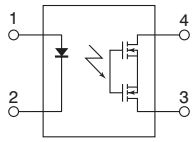
Miniature SOP4-pin type of 60V/350V/400V load voltage

PhotoMOS Relays
GU SOP 1 Form A
(AQY21❍S)



CAD Data

mm inch



FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

2. Small SOP4-Pin package
The device comes in a miniature SOP4-pin type measuring (W)4.3 × (L)4.4 × (H)2.1 mm (W).169 × (L).173 × (H).083 inch

3. Low-level off state leakage current of max. 1 μA

4. Load voltage 60V, 350V and 400V types available

TYPICAL APPLICATIONS

- Telecommunication (PC, electronic notepad)
- Measuring and testing equipment
- Factory automation equipment
- Security equipment
- High speed inspection machines

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60V	500mA	SOP4-pin	AQY212S	AQY212SX	AQY212SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
	350V	120mA		AQY210S	AQY210SX	AQY210SZ		
	400V	100mA		AQY214S	AQY214SX	AQY214SZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the three initial letters of the part number "AQY", the surface mount terminal indicator "S" and the packing style indicator "X" or "Z" are not marked on the relay. (Ex. the label for product number AQY210SX is 210.)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

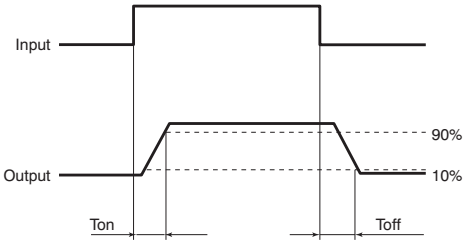
Item		Symbol	AQY212S	AQY210S	AQY214S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.5 A	0.12 A	0.1 A	Peak AC, DC
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW			
Total power dissipation		P_T	350 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

GU SOP 1 Form A (AQY21❍S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212S	AQY210S	AQY214S	Remarks
Input	LED operate current	Typical	I_{Fon}	0.9 mA			I_L = Max.
		Maximum		3 mA			
	LED turn off current	Minimum	I_{Foff}	0.4 mA			I_L = Max.
		Typical		0.85 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.83 Ω	17 Ω	25 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	35 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.65 ms	0.23 ms	0.21 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	0.5 ms	0.5 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	0.04 ms		I_F = 5 mA I_L = Max.
		Maximum		0.2 ms			
	I/O capacitance	Maximum	C_{iso}	1.5 pF			f = 1 MHz V_B = 0 V
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

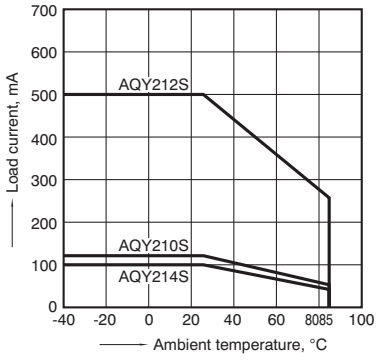
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

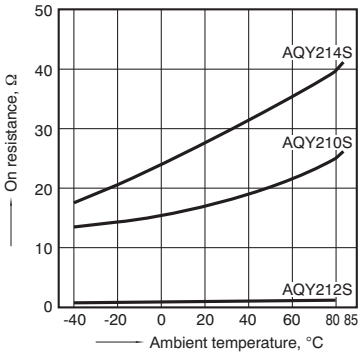
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



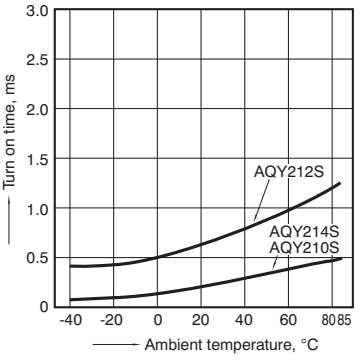
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



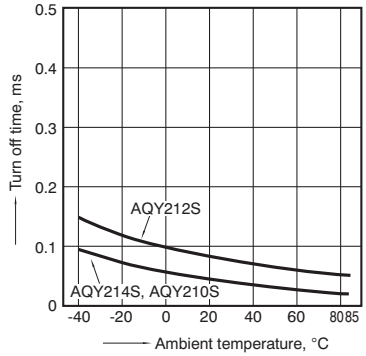
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



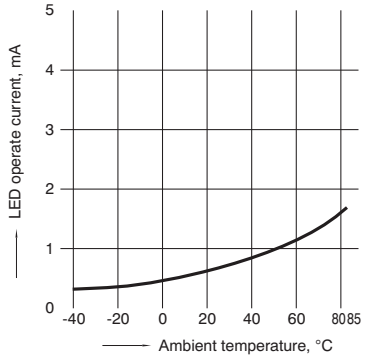
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



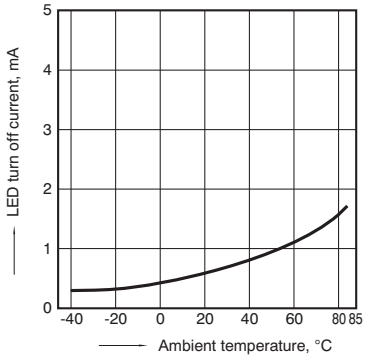
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



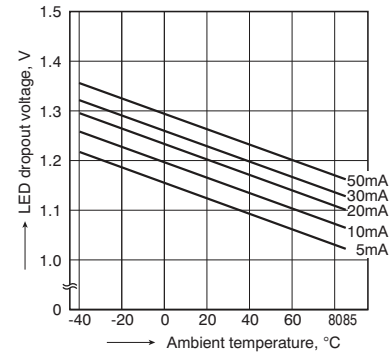
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



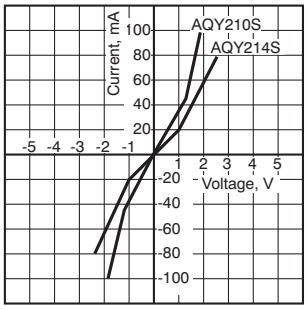
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types; LED current: 5 to 50 mA



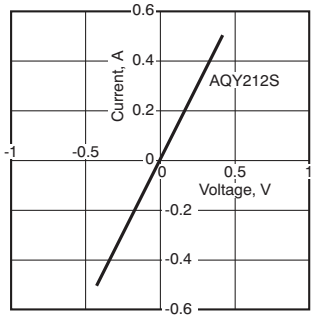
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



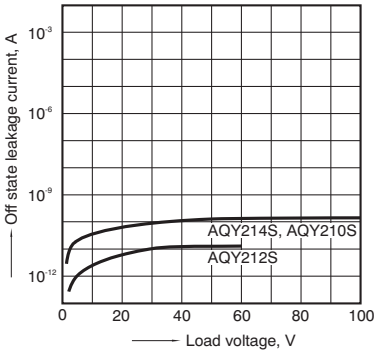
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



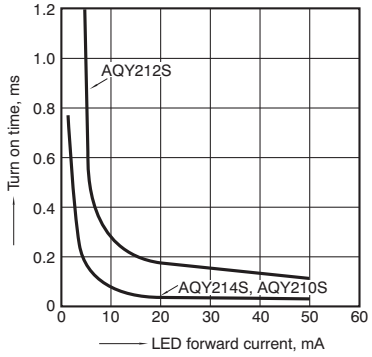
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



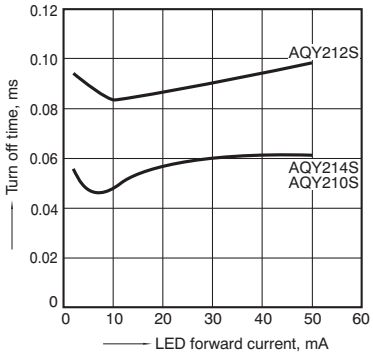
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



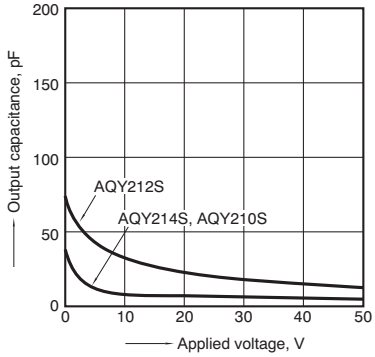
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

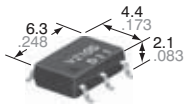
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

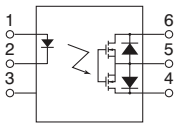
Miniature SOP6-pin type of 60 to 400V load voltage

PhotoMOS Relays
GU SOP 1 Form A
(AQV21○S)



CAD Data

mm inch



FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

2. Small SOP6-Pin package
The device comes in a miniature SOP measuring (W) 4.4 × (L) 6.3 ×(H) 2.1 mm (W) .173× (L) .248×(H) .083 inch approx. 25% of the volume and 50% of the footprint size of DIP type

3. Low-level off state leakage current of max. 1 μA

4. Wide variation of load voltage 60V to 600V

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computers
- Industrial robots
- High-speed inspection machines

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3-pin side	Tape and reel packing style: Picked from the 4/5/6-pin side	Tube	Tape and reel
AC/DC dual use	60V	500mA	SOP6-pin	AQV212S	AQV212SX	AQV212SZ	1 tube contains: 75 pcs. 1 batch contains: 1,500 pcs.	1,000 pcs.
	100V	300mA		AQV215S	AQV215SX	AQV215SZ		
	200V	160mA		AQV217S	AQV217SX	AQV217SZ		
	350V	120mA		AQV210S	AQV210SX	AQV210SZ		
	400V	100mA		AQV214S	AQV214SX	AQV214SZ		
	600V	40mA		AQV216S	AQV216SX	AQV216SZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the two initial letters of the part number "AQ" and the packing style indicator "X" or "Z" are not marked on the relay.
(Ex. the label for product number AQV212SX is V212S.)

RATING

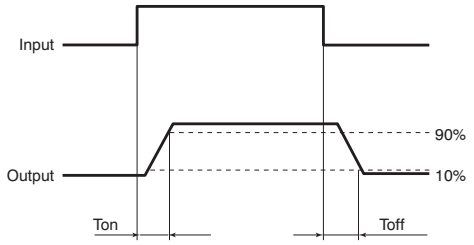
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV212S	AQV215S	AQV217S	AQV210S	AQV214S	AQV216S	Remarks
Input	LED forward current	I_F		50 mA						
	LED reverse voltage	V_R		5 V						
	Peak forward current	I_{FP}		1 A						f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW						
Output	Load voltage (peak AC)	V_L		60 V	100 V	200 V	350 V	400 V	600 V	
	Continuous load current	I_L	A	0.50 A	0.30 A	0.16 A	0.12 A	0.10 A	0.04 A	A connection: Peak AC, DC B, C connection: DC
			B	0.65 A	0.40 A	0.20 A	0.13 A	0.11 A	0.05 A	
			C	0.80 A	0.56 A	0.28 A	0.15 A	0.12 A	0.06 A	
	Peak load current	I_{peak}		1.0A	0.90A	0.48A	0.3 A	0.3 A	0.12 A	A connection: 100 ms (1 shot) V_L= DC
	Power dissipation	P_{out}		450 mW						
Total power dissipation		P_T		500 mW						
I/O isolation voltage		V_{iso}		1,500 V AC						
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F						Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F						

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV212S	AQV215S	AQV217S	AQV210S	AQV214S	AQV216S	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.7 mA						I_L = Max.
		Maximum			3 mA						
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA						I_L = Max.
		Typical			0.65 mA						
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)						I_F = 50 mA
		Maximum			1.5 V						
Output	On resistance	Typical	R_{on}	A	0.83 Ω	2.3 Ω	11 Ω	23 Ω	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			2.5 Ω	4.0 Ω	15 Ω	35 Ω	50 Ω	120 Ω	
		Typical	R_{on}	B	0.44 Ω	1.15 Ω	5.5 Ω	11.5 Ω	22.5 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			1.25 Ω	2.0 Ω	7.5 Ω	17.5 Ω	25 Ω	100 Ω	
		Typical	R_{on}	C	0.25 Ω	0.6 Ω	2.8 Ω	6.0 Ω	11.3 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.63 Ω	1.0 Ω	3.8 Ω	8.8 Ω	12.5 Ω	50 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA						I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.65 ms	0.60 ms	0.25 ms	0.25 ms	0.25 ms	0.25 ms	I_F = 5 mA V_L = Max.
		Maximum			2.0 ms	2.0 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	
	Turn off time	Typical	T_{off}	—	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.05 ms	I_F = 5 mA V_L = Max.
		Maximum			0.2 ms						
	I/O capacitance	Typical	C_{iso}	—	0.8 pF						f = 1 MHz V_B = 0 V
		Maximum			1.5 pF						
	Initial I/C isolation resistance	Minimum	R_{iso}	—	1,000 MΩ						500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

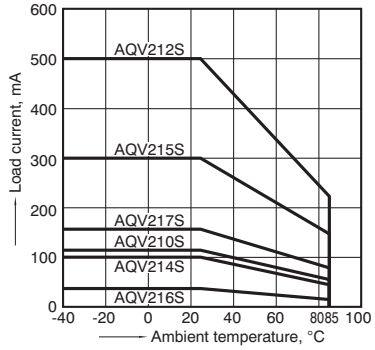
■ **For Dimensions, see Page 62.**
■ **For Schematic and Wiring Diagrams, see Page 65.**
■ **For Cautions for Use, see Page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

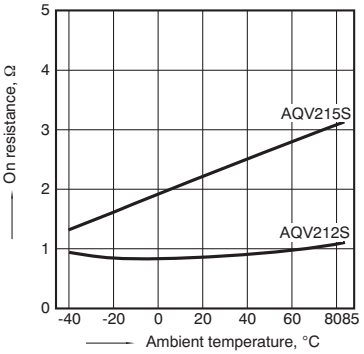
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



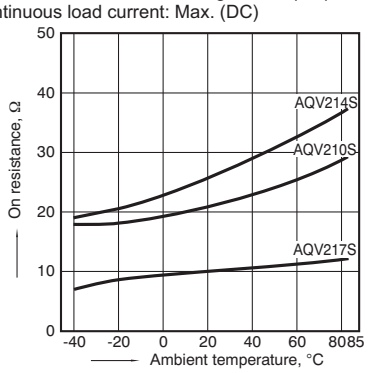
2. -(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



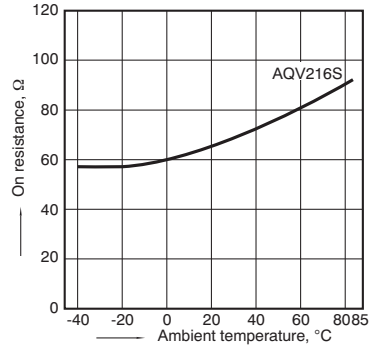
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



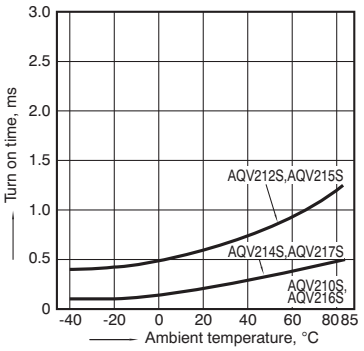
2.-(3) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



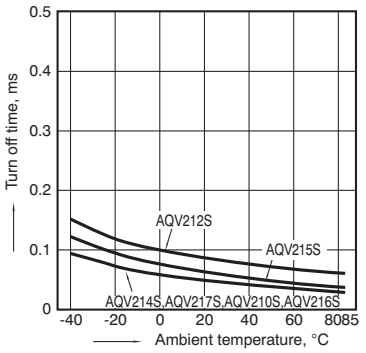
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



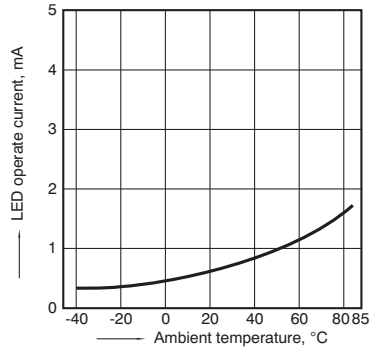
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



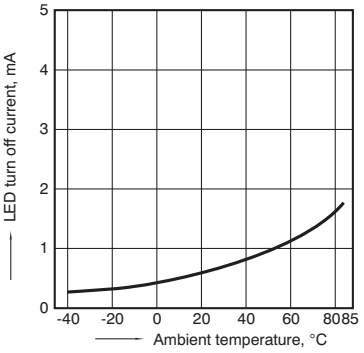
5. LED operate current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



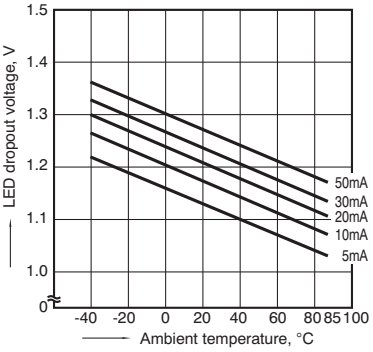
6. LED turn off current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



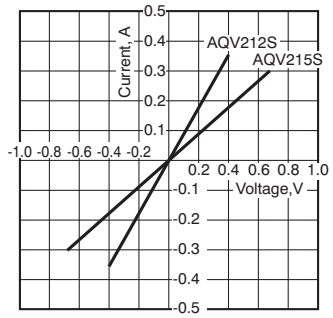
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



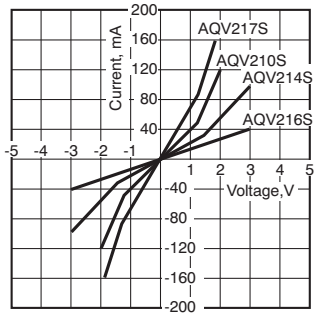
8. -(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



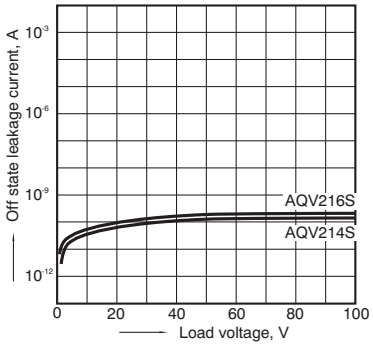
8.-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



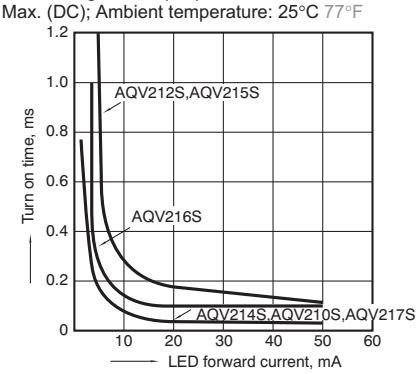
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



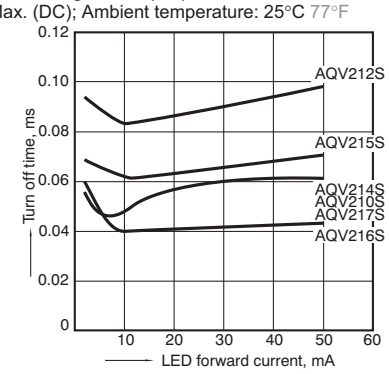
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



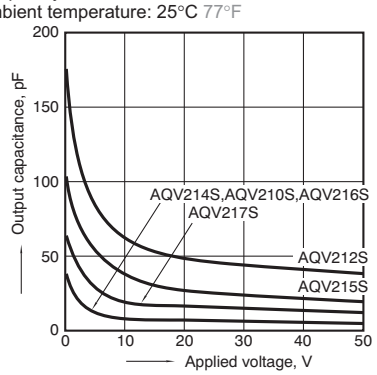
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

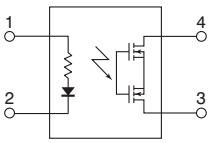


Panasonic
ideas for life

Space-saving SOP4-pin high capacity type with built-in input registor

PhotoMOS Relays
GU SOP 1 Form A High Capacity
Voltage-sensitive (AQY212FG2S)

L 4.30mm .169inch
W 4.40mm .173inch
H 2.10mm .083inch

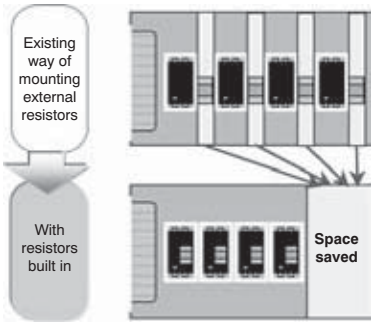


CAD Data

FEATURES

1. Built-in input resistor means less man-hours when mounting
The voltage-sensitive type, which eliminates the need to mount an external input resistor, is now available in a small package (recommended input voltage is 5 V). Man-hours spent mounting external input resistors are cut and board designing is simplified.

2. Saves space on PC board
Since the small package size remains the same while including a built-in input resistor, space on the PC board is saved. This makes it easier to incorporate space savings when designing miniature devices.



<Artistic impression of PC board space savings due to built-in resistor>
*Above is in case of SSOP.

3. Continuous load current of 1.25A
This miniature SOP type controls 1.25A/ 60V load.

TYPICAL APPLICATIONS

1. Measuring and testing equipment
Semiconductor testing equipment, Probe cards, Datalogger, Board tester and other testing equipment.

2. Telecommunication, Broadcasting, and Medical equipment

TYPES

	Output rating*1		Package	Part No.*2			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60V	1.25A	SOP4-pin	AQY212FG2S	AQY212FG2SX	AQY212FG2SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.

Notes:
*1 Indicate the peak AC and DC values.
*2 For space reasons, only “212FG2” is marked on the product. The three initial letters of the part number “AQY”, the package (SOP) indicator “S”, and the packing style indicator “X” or “Z” have been omitted.

RATING

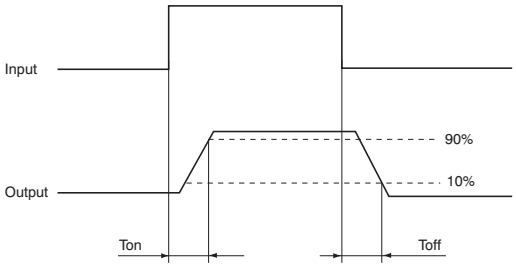
1. Absolute maximum ratings (Condition: ambient temperature 25°C 77°F)

Item		Symbol	AQY212FG2S	Remarks
Input	Input voltage	V_{IN}	6V	
	Input reverse voltage	V_{RIN}	5V	
	Power dissipation	P_{in}	65mW	*65mW for 1a
Output	Load voltage (peak AC)	V_L	60V	
	Load current	I_L	1.25A	Peak AC, DC
	Peak load current	I_{peak}	3A	100ms (1shot), V_L=DC
	Power dissipation	P_{out}	300mW	
Total power dissipation		P_T	350mW	
I/O isolation voltage		V_{iso}	500V AC	
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Condition: ambient temperature 25°C 77°F)

Item			Symbol	AQY212FG2S	Condition
Input	Operate voltage	Typ.	V_{Fon}	1.4V	I_L = 100mA
		Max.		4V	
	Turn off voltage	Min.	V_{Foff}	0.8V	
		Typ.		1.4V	
	Input current	Typ.	I_{IN}	8.5mA	V_{IN} = 5V
Output	On resistance	Typ.	R_{on}	0.2Ω	V_{IN} = 5V, I_L = Max. Within 1 s on time
		Max.		0.5Ω	
	Output capacitance	Typ.	C_{out}	–	V_{IN} = 0V, V_B = 0V, f = 1MHz
		Max.		–	
	Off state leakage current	Typ.	I_{Leak}	–	V_{IN} = 0V, V_L = Max.
		Max.		1μA	
Transfer characteristics	Turn on time*	Typ.	T_{on}	0.7ms	V_{IN} = 5V, I_L = 100mA, V_L = 10V
		Max.		5ms	
	Turn off time*	Typ.	T_{off}	0.1ms	
		Max.		0.5ms	
	I/O capacitance	Typ.	C_{iso}	0.8pF	f = 1MHz, V_B = 0V
		Max.		1.5pF	f = 1MHz, V_B = 0V
	Initial I/O isolation resistance	Min.	R_{iso}	1,000MΩ	500V DC
	Maximum operating frequency	Max.	–	5 cps	V_{IN} = 5V, duty = 50% $V_I \times I_I$ = 75V·A

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Minimum	Typical	Maximum	Unit
Input voltage	V_{IN}	4.5	5	5.5	V

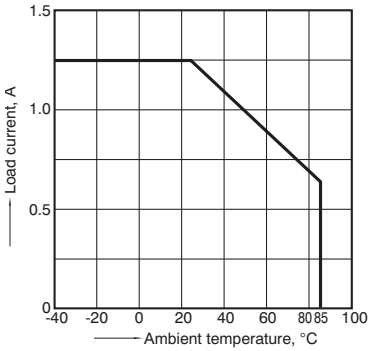
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

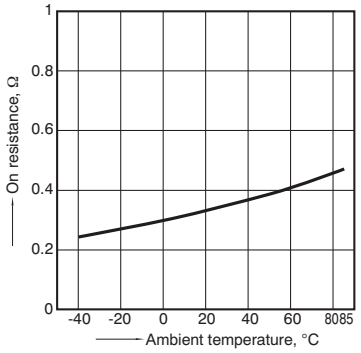
13.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



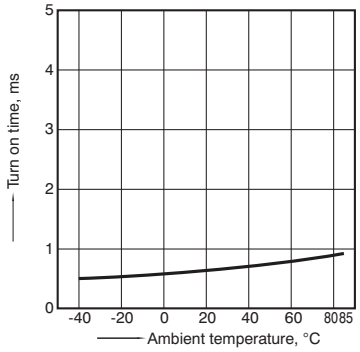
14.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Input voltage: 5V; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



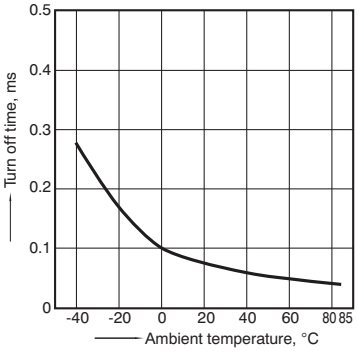
15.Turn on time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 100mA (DC)



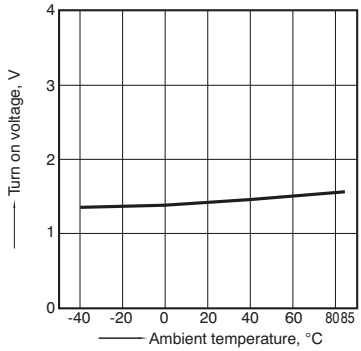
16.Turn off time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 100mA (DC)



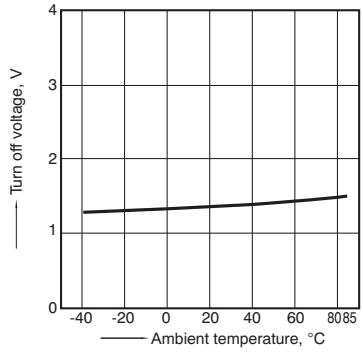
17.Turn on voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 100mA (DC)



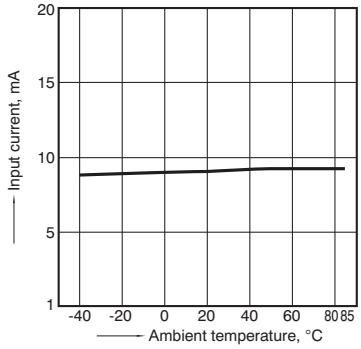
18.Turn off voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 100mA (DC)



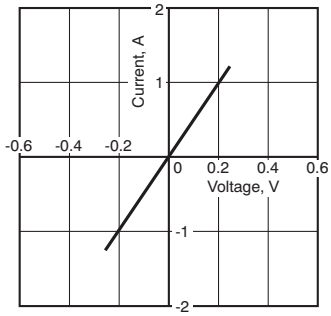
19.Input current vs. ambient temperature characteristics

Input voltage: 5V



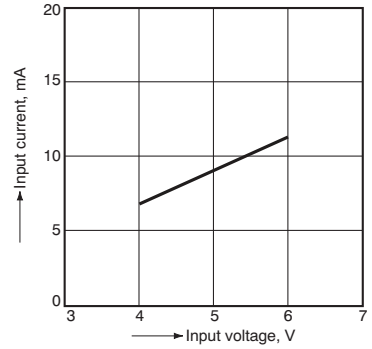
20.Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



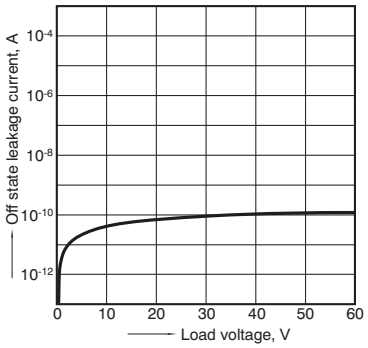
21.Input current vs. input voltage characteristics

Ambient temperature: 25°C 77°F
(Recommended input voltage: 5±0.5V)



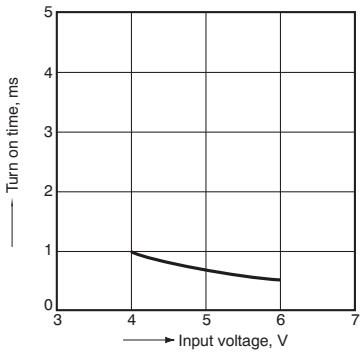
22.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



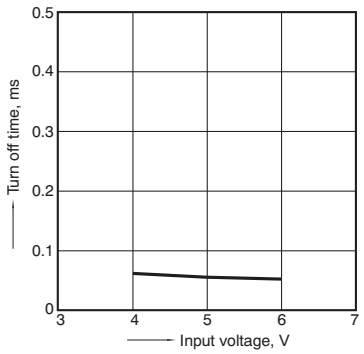
23.Turn on time vs. input voltage characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 100mA (DC); Ambient temperature: 25°C 77°F



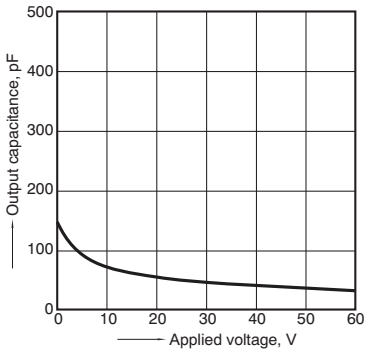
24.Turn off time vs. input voltage characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 100mA (DC); Ambient temperature: 25°C 77°F



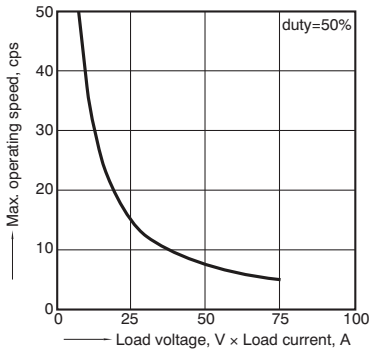
25.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms;
Ambient temperature: 25°C 77°F



26.Max. operating speed vs. load voltage-load current characteristics

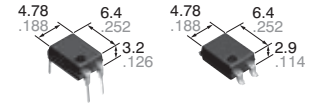
Input voltage: 5V
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

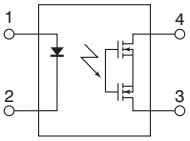
4-pin high capacity of 1.1A, I/O isolation voltage of 5,000V

PhotoMOS Relays
GU 1 Form A High Capacity
(AQY212GH)



(Height includes standoff) mm inch

CAD Data



FEATURES

1. Greatly increased capacity
Continuous load current: 1.1A
2. Reinforced insulation
I/O isolation voltage: 5,000 V AC
3. Compact 4-pin DIP type
4. The improved performance relative to mercury or mechanical relays

TYPICAL APPLICATIONS

• Measuring instruments
• Security and disaster-preventing system: use in I/O for alarm and security devices, etc.

TYPES

	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60 V	1.1 A	AQY212GH	AQY212GHA	AQY212GHAX	AQY212GHAZ	1 tube contains 100 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the three initial letters of the part number “AQY”, the surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

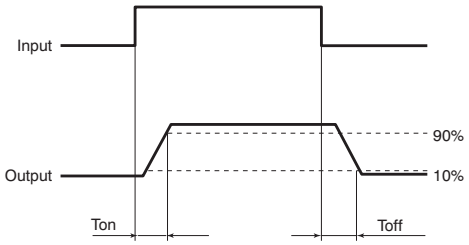
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY212GH(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	60 V	
	Continuous load current	I_L	1.1 A	Peak AC, DC
	Peak load current	I_{peak}	3.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212GH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.1 mA	I_L = 100mA
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = 100mA
		Typical		1.0 mA	
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.34 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		0.7 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.3 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms	
	Turn off time*	Typical	T_{off}	0.1 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		0.5 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

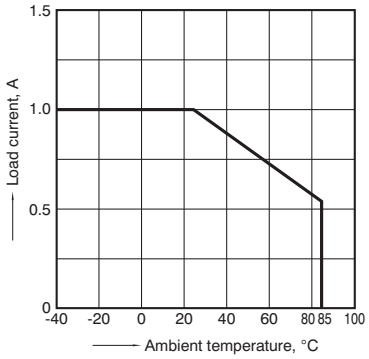
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

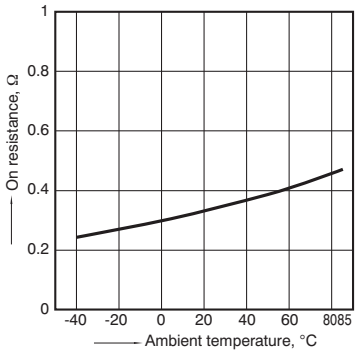
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



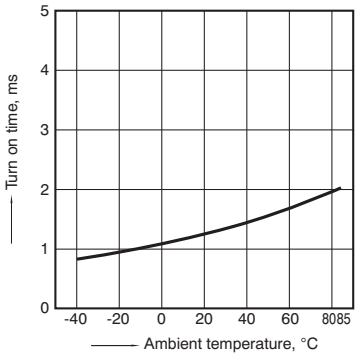
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



3. Turn on time vs. ambient temperature characteristics

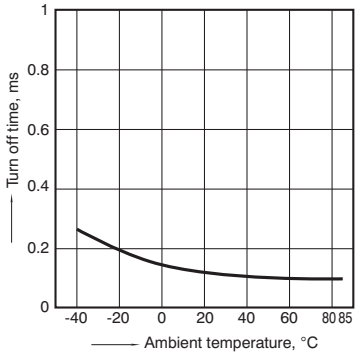
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



GU 1 Form A High Capacity (AQY212GH)

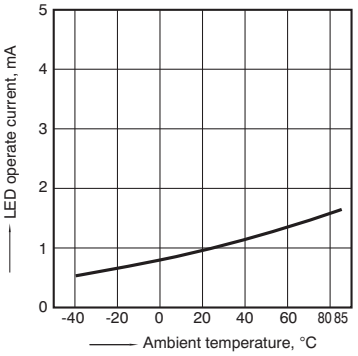
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



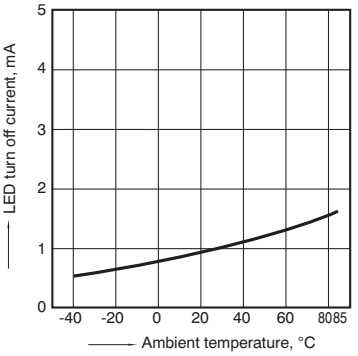
5. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



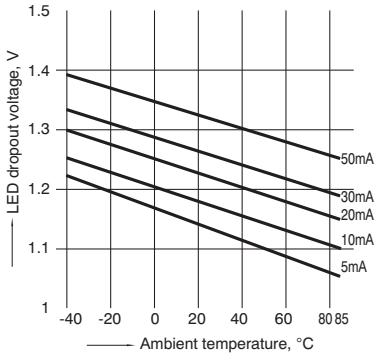
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



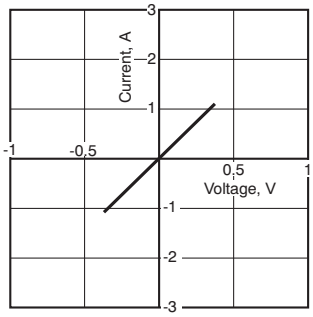
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



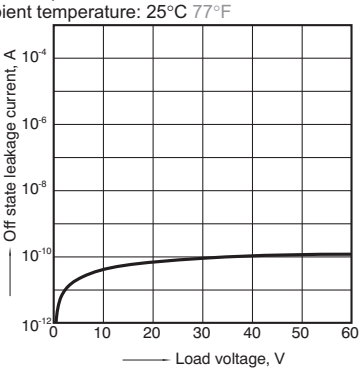
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



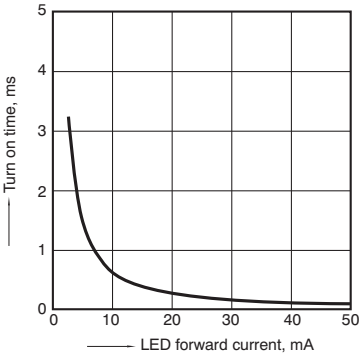
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



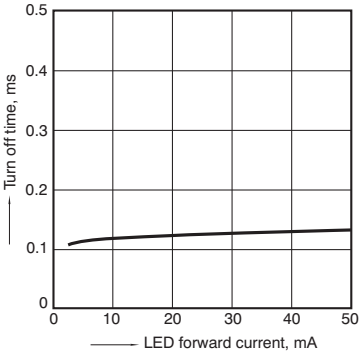
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



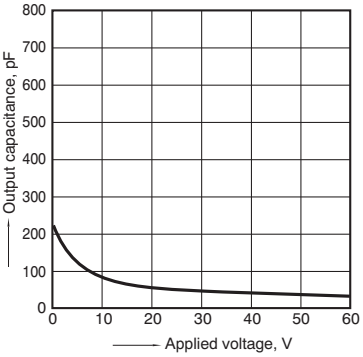
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

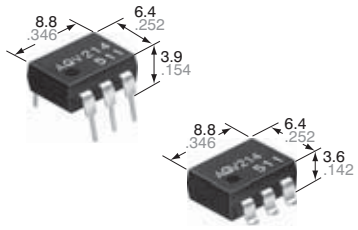
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

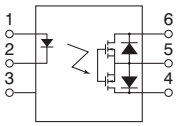
6-pin type for switching low-level analog signal

PhotoMOS Relays
GU 1 Form A
(AQV21❍, AQV214H)



CAD Data

mm inch



FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
2. Controls various types of loads such as relays, motors, lamps and solenoids
3. Optical coupling for extremely high isolation
Unlike mechanical relays, the PhotoMOS relay combines LED and optoelectronic device to transfer signals using light for extremely high isolation.
4. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side
5. Stable on-resistance
6. Low-level off state leakage current of max. 1 μA
7. Reinforced insulation type of I/O voltage 5,000V also available

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computers

TYPES

	I/O isolation	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
		Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
							Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	Standard 1,500 V AC	60V	550 mA	DIP6-pin	AQV212	AQV212A	AQV212AX	AQV212AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		100 V	320 mA		AQV215	AQV215A	AQV215AX	AQV215AZ		
		200 V	180 mA		AQV217	AQV217A	AQV217AX	AQV217AZ		
		350 V	130 mA		AQV210	AQV210A	AQV210AX	AQV210AZ		
		400 V	120 mA		AQV214	AQV214A	AQV214AX	AQV214AZ		
		600 V	50 mA		AQV216	AQV216A	AQV216AX	AQV216AZ		
	Reinforced 5,000 V	400 V	120 mA		AQV214H	AQV214HA	AQV214HAX	AQV214HAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

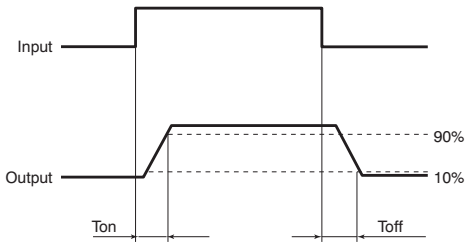
	Item		Symbol	Type of connection	AQV212(A)	AQV215(A)	AQV217(A)	AQV210(A)	AQV214(A)	AQV216(A)	AQV214H(A)	Remarks
Input	LED forward current		I_F		50 mA							
	LED reverse voltage		V_R		5 V							
	Peak forward current		I_{FP}		1 A							f = 100 Hz, Duty factor = 0.1%
	Power dissipation		P_{in}		75 mW							
Output	Load voltage (peak AC)		V_L		60 V	100 V	200 V	350 V	400 V	600 V	400 V	
	Continuous load current		I_L	A	0.55 A	0.32 A	0.18 A	0.13 A	0.12 A	0.05 A	0.12 A	A connection: Peak AC, DC B, C connection: DC
				B	0.65 A	0.42 A	0.22 A	0.15 A	0.13 A	0.06 A	0.13 A	
				C	0.80 A	0.60 A	0.30 A	0.17 A	0.15 A	0.08 A	0.15 A	
	Peak load current		I_{peak}		1.2 A	0.96 A	0.54 A	0.4 A	0.3 A	0.15 A	0.3 A	A connection: 100 ms (1 shot), V_L=DC
	Power dissipation		P_{out}		500 mW							
Total power dissipation			P_T		550 mW							
I/O isolation voltage			V_{iso}		1,500 V AC						5,000 V AC	
Temperature limits		Operating	T_{opr}		–40°C to +85°C –40°F to +185°F							Non-condensing at low temp.
		Storage	T_{stg}		–40°C to +100°C –40°F to +212°F							

GU 1 Form A (AQV21❍, AQV214H)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

	Item		Symbol	Type of connection**	AQV212(A)	AQV215(A)	AQV217(A)	AQV210(A)	AQV214(A)	AQV216(A)	AQV214H(A)	Condition
Input	LED operate current	Typical	I_{Fon}	—	1 mA	1 mA	1 mA	1 mA	1 mA	1 mA	1.3 mA	I_L = Max.
		Maximum			3 mA	3 mA	3 mA	3 mA	3 mA	3 mA	3 mA	
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA	0.4 mA	0.4 mA	0.4 mA	0.4 mA	0.4 mA	1.2 mA	I_L = Max.
		Typical			0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)							I_F = 50 mA
		Maximum			1.5 V							
Output	On resistance	Typical	R_{on}	A	0.83 Ω	2.3 Ω	11.0 Ω	23 Ω	30 Ω	70 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			2.5 Ω	4.0 Ω	15.0 Ω	35 Ω	50 Ω	120 Ω	50 Ω	
		Typical	R_{on}	B	0.44 Ω	1.15 Ω	5.5 Ω	11.5 Ω	22.5 Ω	55 Ω	22.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			1.25 Ω	2.0 Ω	7.5 Ω	17.5 Ω	25 Ω	100 Ω	25 Ω	
		Typical	R_{on}	C	0.25 Ω	0.6 Ω	2.8 Ω	6.0 Ω	11.3 Ω	28 Ω	11.3 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.63 Ω	1.0 Ω	3.8 Ω	8.8 Ω	12.5 Ω	50 Ω	12.5 Ω	
	Output capacitance	Typical	C_{out}	A	150 pF	110 pF	70 pF	45 pF	45 pF	45 pF	45 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
	Off state leakage current	Maximum	I_{Leak}	—	1 μA							I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.65 ms	0.6 ms	0.25 ms	0.25 ms	0.21 ms	0.28 ms	0.6 ms	I_F= 5 mA** I_L=Max.
		Maximum			2 ms	2 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	0.8 ms	
	Turn off time*	Typical	T_{off}	—	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.04 ms	0.05 ms	I_F = 5 mA I_L = Max.
		Maximum			0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF							f = 1 MHz V_B = 0 V
		Maximum			1.5 pF							
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ							500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	Standard type: 5 Reinforced type: 5 to 10	mA

■ For Dimensions, see page 60.
■ For Schematic and Wiring Diagrams, see page 65.
■ For Cautions for Use, see page 71.

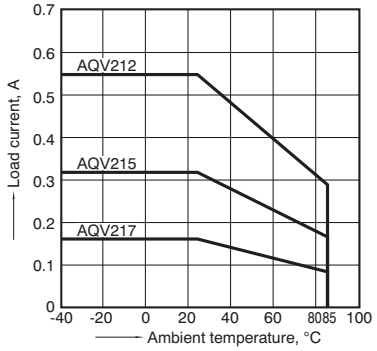
■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

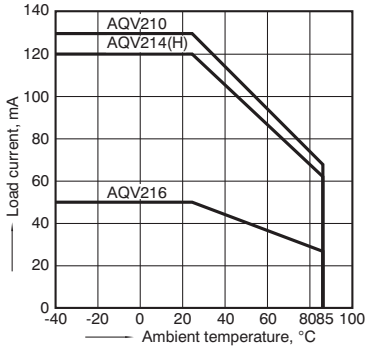
Type of connection: A



1-(2). Load current vs. ambient temperature characteristics

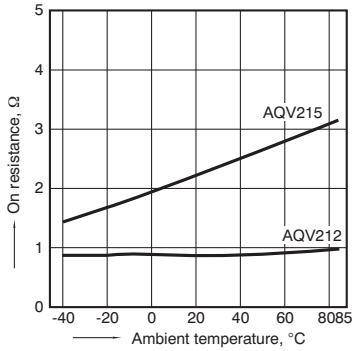
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



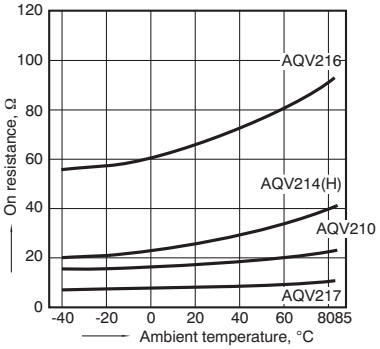
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



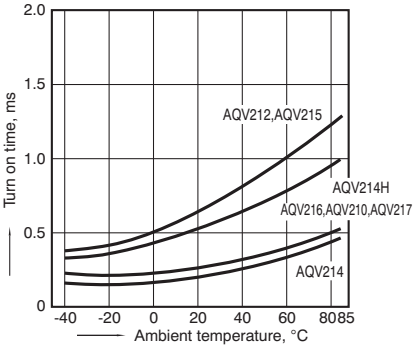
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



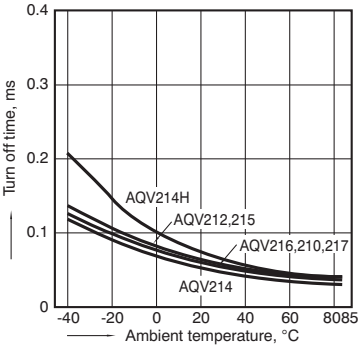
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



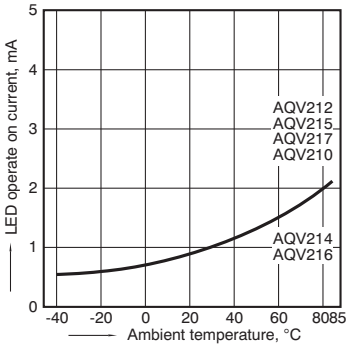
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



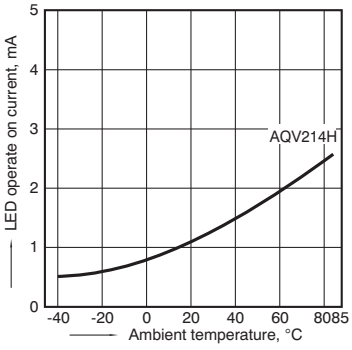
5-(1). LED operate current vs.ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



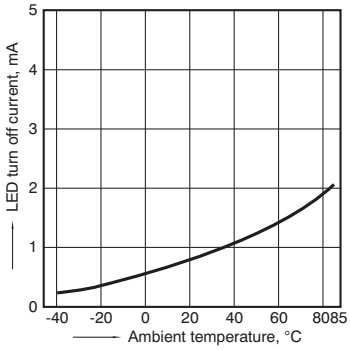
5-(2). LED operate current vs.ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



6-(1). LED turn off current vs. ambient temperature characteristics

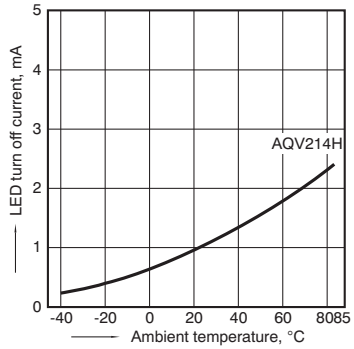
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



GU 1 Form A (AQV21❍, AQV214H)

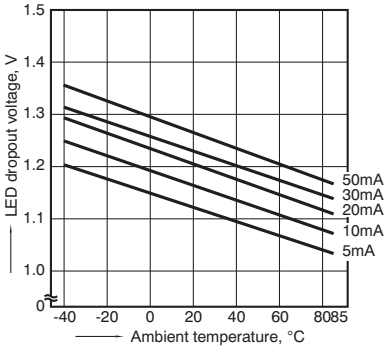
6-(2). LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



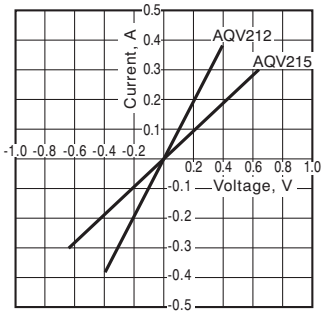
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types
LED current: 5 to 50 mA



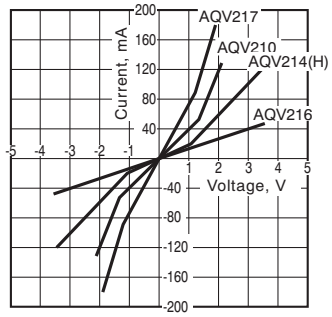
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



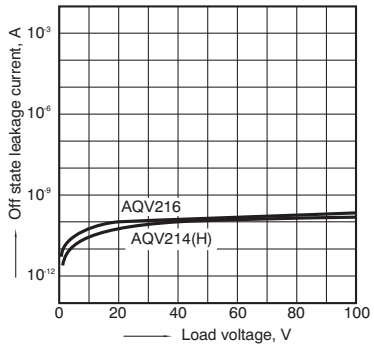
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



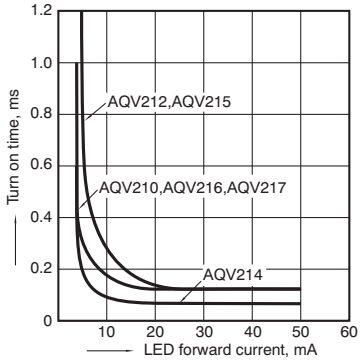
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



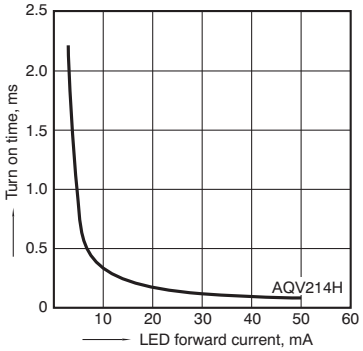
10-(1). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



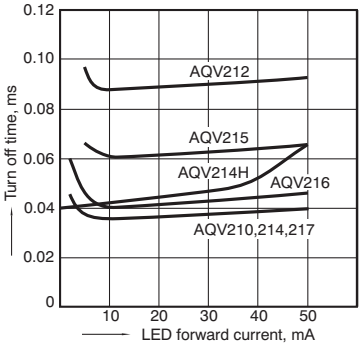
10-(2). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



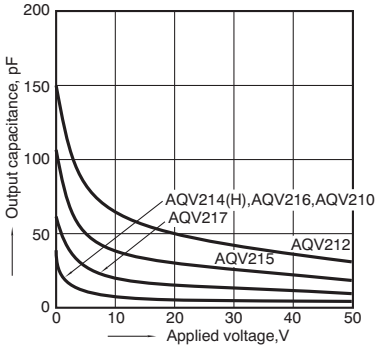
11.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12.Output capacitance vs. applied voltage characteristics

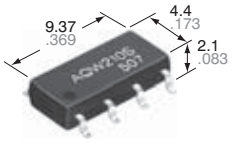
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

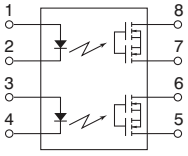
Miniature SOP8-pin type of 60V/350V/400V load voltage

PhotoMOS Relays
GU SOP 2 Form A
(AQW21○S)



CAD Data

mm inch



FEATURES

1. 2 channels in miniature SOP8-pin design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 9.37 × (H) 2.1 mm (W) .173× (L) .369× (H) .083 inch —approx. 38% of the volume and 66% of the footprint size of DIP8-pin type.

2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Measuring instruments
- Data communications
- Computers
- Industrial robots
- High-speed inspection machines.

PhotoMOS

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3/4-pin side	Tape and reel packing style: Picked from the 5/6/7/8-pin side	Tube	Tape and reel
AC/DC dual use	60V	400mA	SOP8-pin	AQW212S	AQW212SX	AQW212SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	350V	100mA		AQW210S	AQW210SX	AQW210SZ		
	400V	80mA		AQW214S	AQW214SX	AQW214SZ		

* Indicate the peak AC and DC values.
Note: The packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

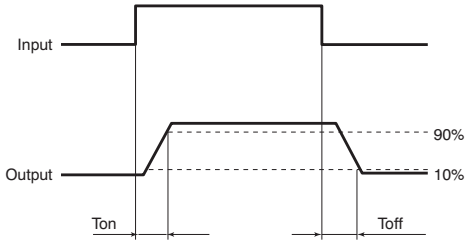
Item		Symbol	AQW212S	AQW210S	AQW214S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.4 A (0.5 A)	0.1 A (0.13 A)	0.08 A (0.1 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW			
Total power dissipation		P_T	650 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

GU SOP 2 Form A (AQW21❍S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW212S	AQW210S	AQW214S	Remarks
Input	LED operate current	Typical	I_{Fon}	0.9 mA			I_L = Max.
		Maximum		3 mA			
	LED turn off current	Minimum	I_{Foff}	0.4 mA			I_L = Max.
		Typical		0.8 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.83 Ω	16 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	35 Ω	50 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.65 ms	0.23 ms	0.21 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	0.5 ms		
	Turn off time*	Typical	T_{off}	0.08 ms	0.04 ms		I_F = 5 mA I_L = Max.
		Maximum		0.2 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

*Turn on/ Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

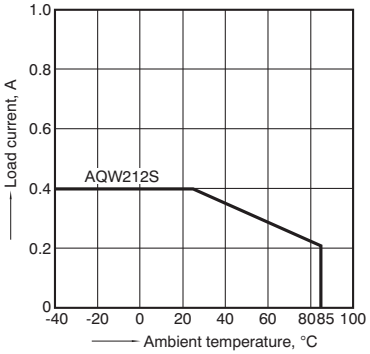
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

1-(1) Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

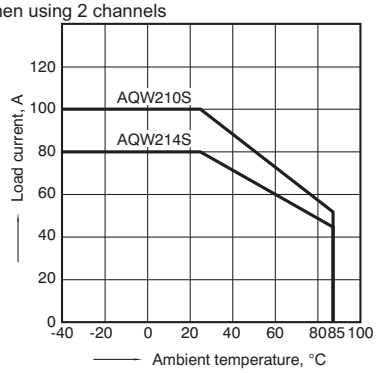
When using 2 channels



1.-(2) Load current vs. ambient temperature characteristics

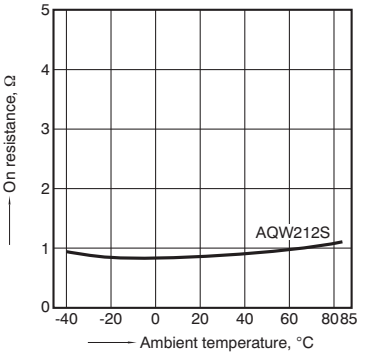
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

When using 2 channels



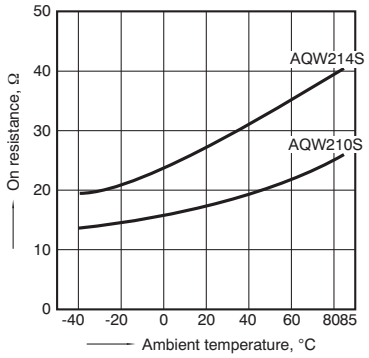
2-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



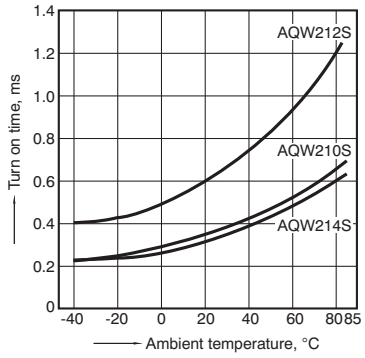
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



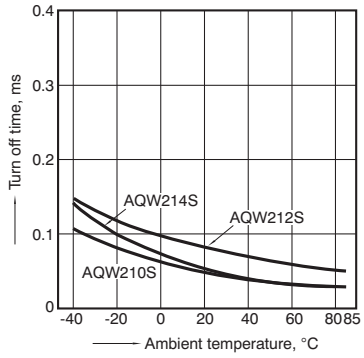
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



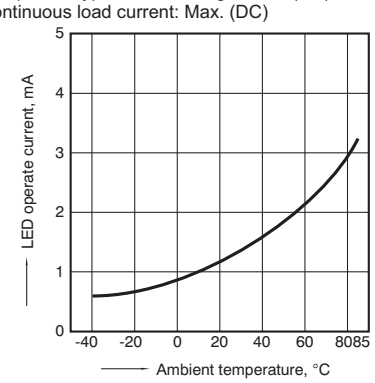
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



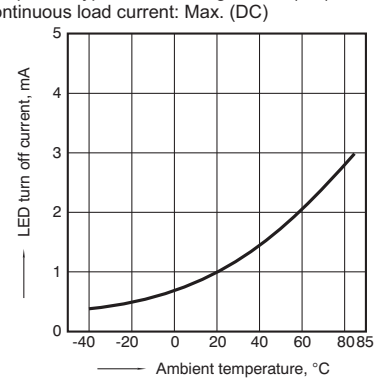
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



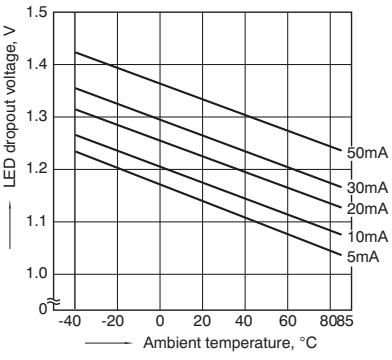
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



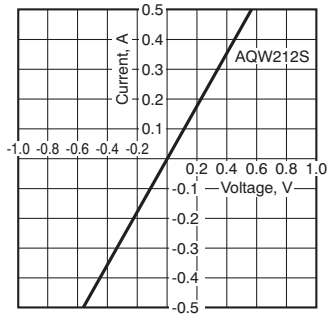
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



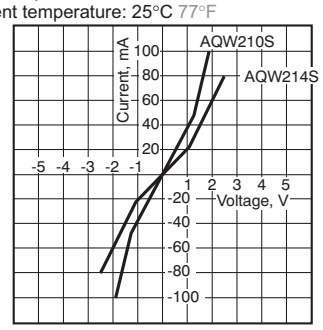
8-(1) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



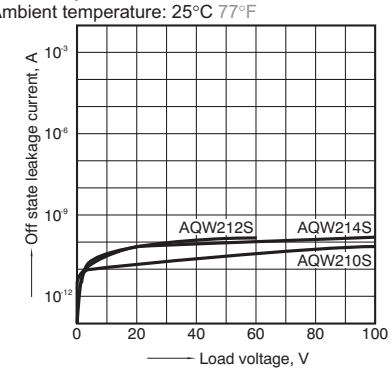
8.-(2) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



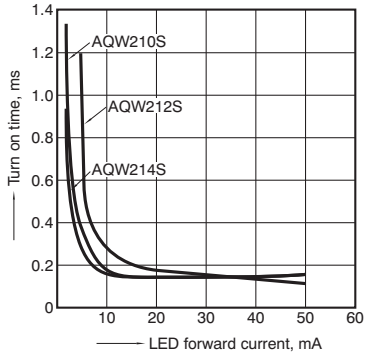
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



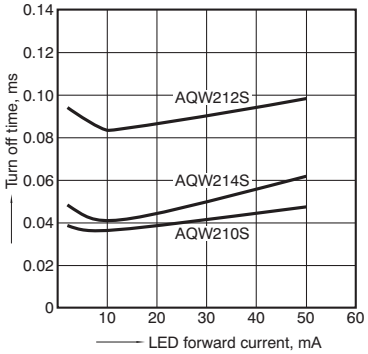
10.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



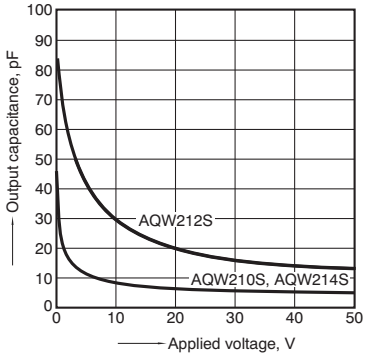
11.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12.Output capacitance vs. applied voltage characteristics

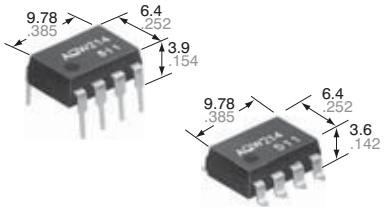
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

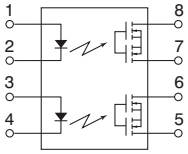
Compact DIP8-pin type of 60V to 600V load voltage

PhotoMOS Relays
GU 2 Form A
(AQW21❍)



CAD Data

mm inch



FEATURES

1. Compact 8-pin DIP size
The device comes in a compact (W) 6.4 × (L) 9.78 ×(H) 3.9 mm (W) .252×(L) .385×(H) .154 inch, 8-pin DIP size (through hole terminal type).
2. Applicable for 2 Form A use as well as two independent 1 Form A use
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. High sensitivity and high speed response
Can control max. 0.6 A load current with 5 mA input current. Fast operation speed of typ. 0.65 ms (AQW212).
5. Low-level off state leakage current of max. 1 μA
6. Wide variation of load voltage 60V to 600V

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephones equipment
- Computer

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	60V	500 mA	DIP8-pin	AQW212	AQW212A	AQW212AX	AQW212AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
	100 V	300 mA		AQW215	AQW215A	AQW215AX	AQW215AZ		
	200 V	160 mA		AQW217	AQW217A	AQW217AX	AQW217AZ		
	350 V	120 mA		AQW210	AQW210A	AQW210AX	AQW210AZ		
	400 V	100 mA		AQW214	AQW214A	AQW214AX	AQW214AZ		
	600 V	40 mA		AQW216	AQW216A	AQW216AX	AQW216AZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

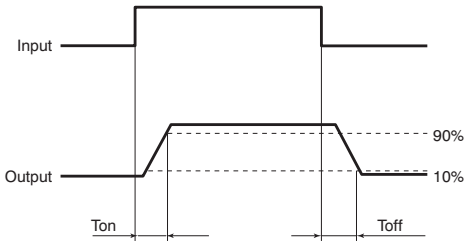
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW212(A)	AQW215(A)	AQW217(A)	AQW210(A)	AQW214(A)	AQW216(A)	Remarks
Input	LED forward current	I_F	50 mA						
	LED reverse voltage	V_R	5 V						
	Peak forward current	I_{FP}	1 A						f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW						
Output	Load voltage (peak AC)	V_L	60 V	100 V	200 V	350 V	400 V	600 V	
	Continuous load current	I_L	0.50 A (0.60A)	0.30 A (0.35 A)	0.16 A (0.2 A)	0.12 A (0.14 A)	0.10 A (0.13 A)	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	1.0 A	0.9 A	0.48 A	0.36 A	0.3 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW						
Total power dissipation		P_T	850 mW						
I/O isolation voltage		V_{iso}	1,500 V AC						Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F						Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F						

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW212(A)	AQW215(A)	AQW217(A)	AQW210(A)	AQW214(A)	AQW216(A)	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA						I_L = Max.
		Maximum		3 mA						
	LED turn off current	Minimum	I_{Foff}	0.4 mA						I_L = Max.
		Typical		0.8 mA						
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)						I_F = 50 mA
		Maximum		1.5 V						
Output	On resistance	Typical	R_{on}	0.83 Ω	2.3 Ω	11 Ω	23 Ω	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 son time
		Maximum		2.5 Ω	4.0 Ω	15 Ω	35 Ω	50 Ω	120 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA						I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.65 ms	0.60 ms	0.25 ms	0.25 ms	0.31 ms	0.28 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	2 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 ms						
	I/O capacitance	Typical	C_{iso}	0.8 pF						f = 1 MHz V_B = 0 V
		Maximum		1.5 pF						
	Initial I/C isolation resistance	Minimum	R_{iso}	1,000 MΩ						500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

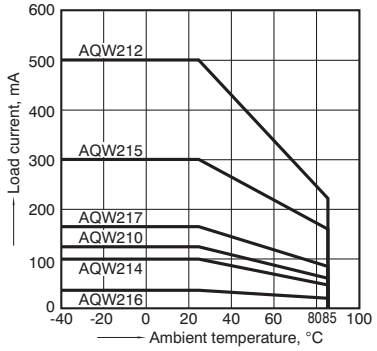
■ **For Dimensions, see Page 61.**
■ **For Schematic and Wiring Diagrams, see Page 65.**
■ **For Cautions for Use, see Page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

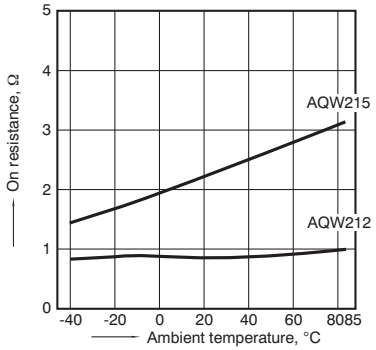
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



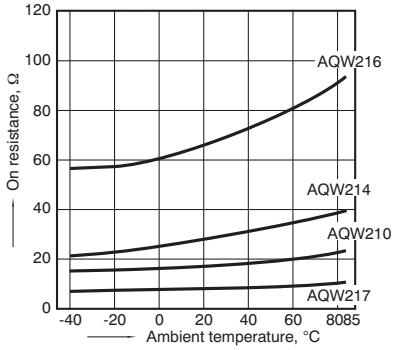
2-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



2.-(2) On resistance vs. ambient temperature characteristics

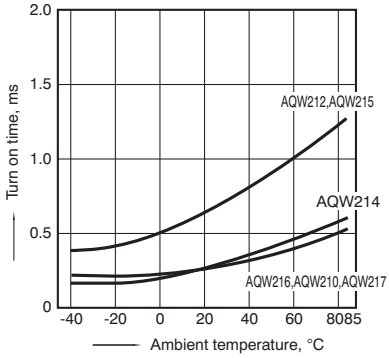
Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



GU 2 Form A (AQW21❍)

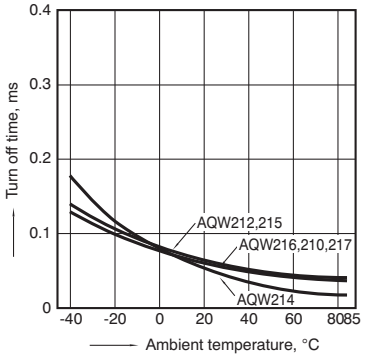
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



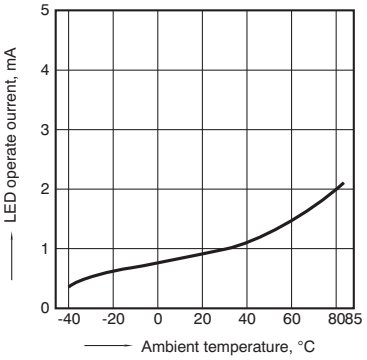
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



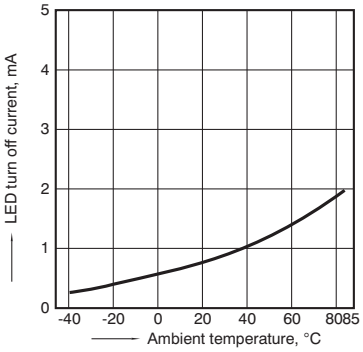
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



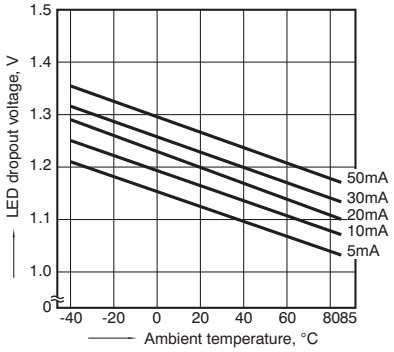
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



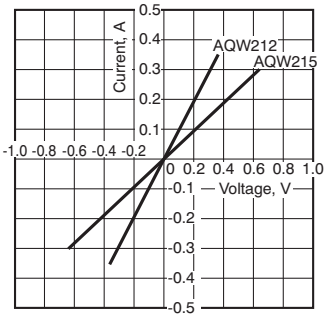
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



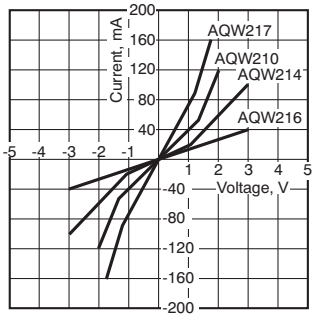
8-(1) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



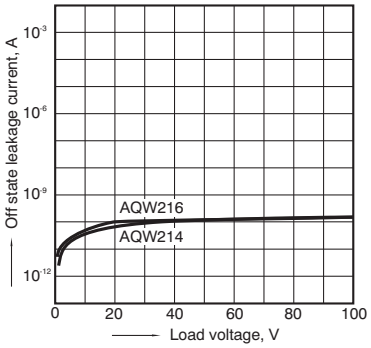
8.-(2) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



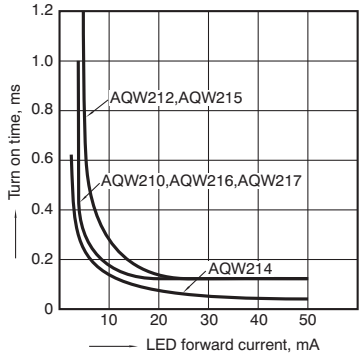
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



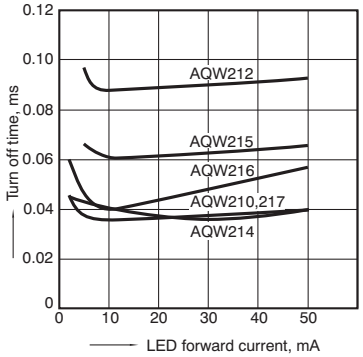
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



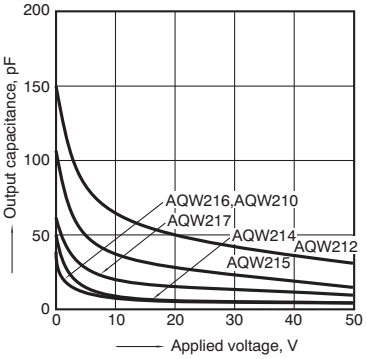
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



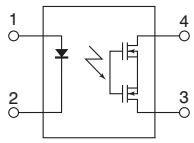
Panasonic
ideas for life

Normally closed SOP4-pin type of 60V/350V/400V load voltage

PhotoMOS Relays
GU SOP 1 Form B
(AQY41❍S)

CAD Data

mm inch

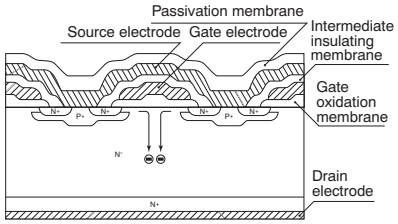


FEATURES

1. Small SOP4-pin package
The device comes in a super-miniature SO package 4-pin type measuring (W) 4.3×(L) 4.4×(H) 2.1 mm (W) .169×(L) .173×(H) .083 inch

2. Low on-resistance
The AQ❍4 series (normally closed type) has a low on-resistance.
This has been achieved thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off-state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Power supply
- Measuring instruments
- Security equipment
- Telephone equipment
- Sensing equipment

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60V	500mA	SOP4-pin	AQY412S	AQY412SX	AQY412SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
	350V	120mA		AQY410S	AQY410SX	AQY410SZ		
	400V	100mA		AQY414S	AQY414SX	AQY414SZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the three initial letters of the part number “AQY”, the surface mount terminal shape indicator “S” and the packing style indicator “X” or “Z” are not marked on the relay. (Ex. the label for product number AQY412SX is 412)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

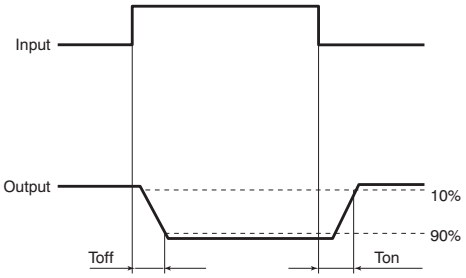
Item		Symbol	AQY412S	AQY410S	AQY414S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.5 A	0.12 A	0.1 A	Peak AC, DC
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW			
Total power dissipation		P_T	350 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Temperture limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

GU SOP 1 Form B (AQY41❍S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY412S	AQY410S	AQY414S	Remarks
Input	LED operate (OFF) current	Typical	I_{Foff}	0.9 mA			I_L = Max.
		Maximum		3 mA			
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA			I_L = Max.
		Typical		0.85 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1 Ω	18 Ω	26 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	35 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	0.9 ms	0.52 ms	0.47 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		3 ms	1 ms		
	Reverse (ON) time*	Typical	T_{on}	0.21 ms	0.23 ms	0.28 ms	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1 ms	1 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

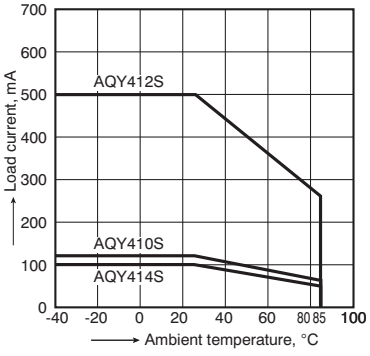
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

For more information, see page 80.

REFERENCE DATA

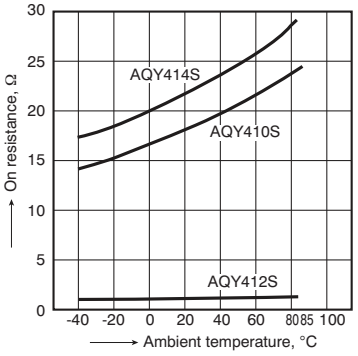
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature:
–40°C to +85°C
–40°F to +185°F



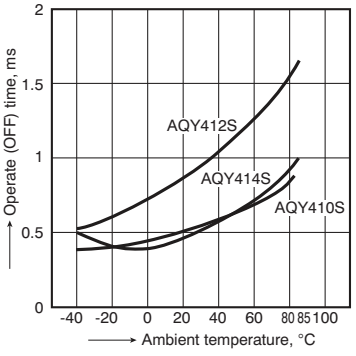
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 0 mA;
Continuous load current: Max.(DC)



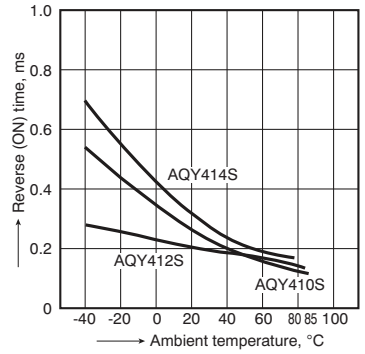
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



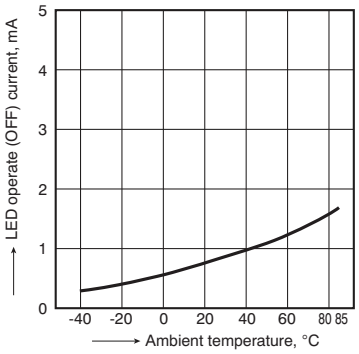
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



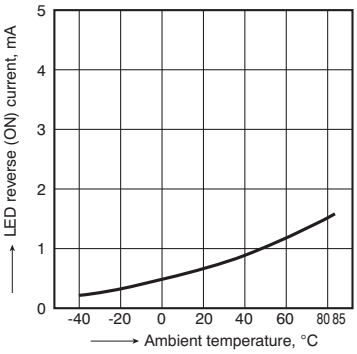
5. LED operate (OFF) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



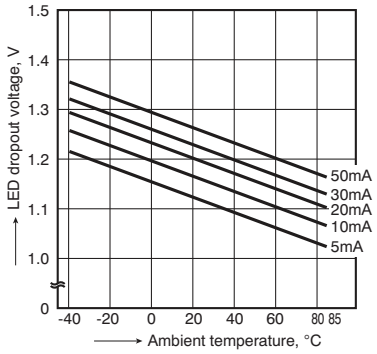
6. LED reverse (ON) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



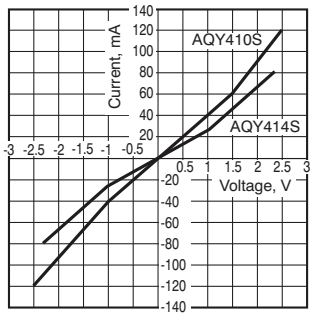
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



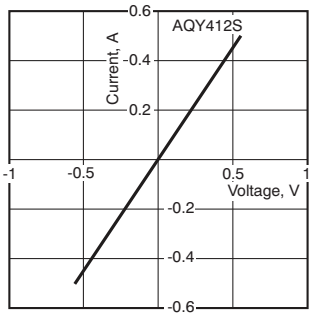
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



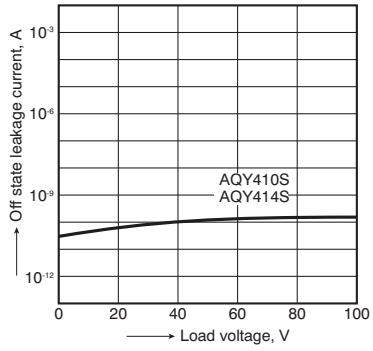
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



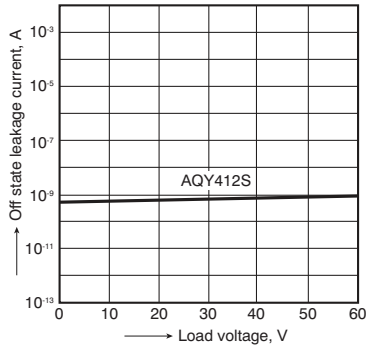
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Ambient temperature: 25°C 77°F



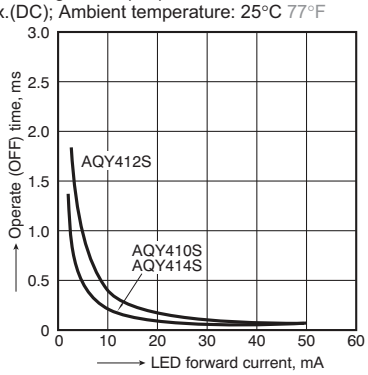
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Ambient temperature: 25°C 77°F



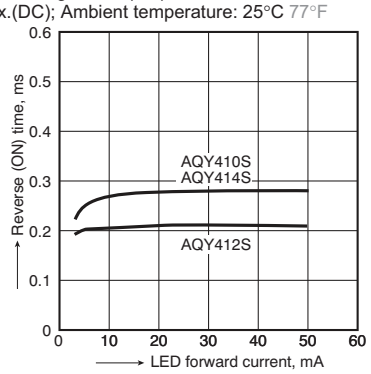
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



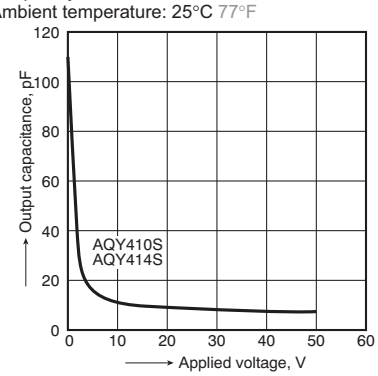
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



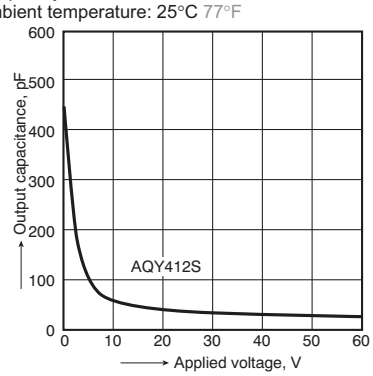
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

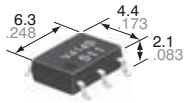
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

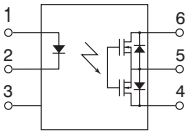
Normally closed SOP6-pin type of 400V load voltage

PhotoMOS Relays
GU SOP 1 Form B
(AQV414S)



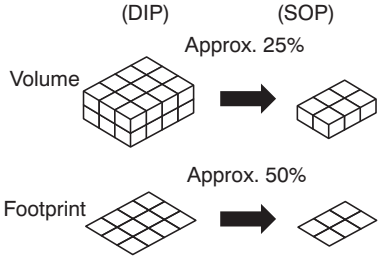
CAD Data

mm inch



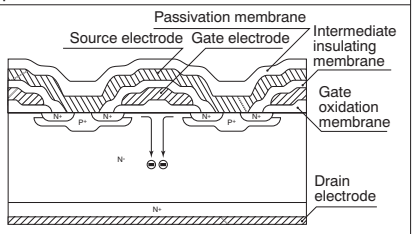
FEATURES

1. Miniature SOP6-pin package
The device comes in a small SOP measuring (W) 4.4 × (L) 6.3 ×(H) 2.1 mm (W) .173× (L) .248×(H) .083 inch approx. 25% of the volume and 50% of the footprint size of DIP type.



2. Low on-resistance (typ. 26 Ω) for normally-closed type
This has been achieved thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-Diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computers
- Industrial robots
- High-speed inspection machines

TYPES

	Output rating*		Package	Part No.			Packing quantity	
					Tape and reel packing style			
	Load voltage	Load current		Tube packing style	Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side	Tube	Tape and reel
AC/DC dual use	400V	100mA	SOP6-pin	AQV414S	AQV414SX	AQV414SZ	1 tube contains: 75 pcs. 1 batch contains: 1,500 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: For space reasons, only “V41S” is marked on the product. The two initial letters of the part number “AQ” and the packing style indicator “X” or “Z” have been omitted.

RATING

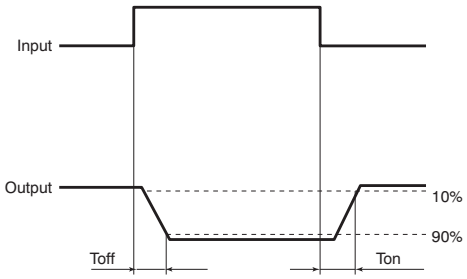
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV414S	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.10 A	A connection: Peak AC, DC B, C connection: DC
			B	0.11 A	
			C	0.12 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot) V_L= DC
	Power dissipation	P_{out}		450 mW	
Total power dissipation		P_T		500 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV414S	Remarks
Input	LED operate (OFF) current	Typical	I_{Foff}	—	0.6 mA	I_L= Max.
		Maximum			3 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	—	0.4 mA	I_L= Max.
		Typical			0.55 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)	I_F= 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	26 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
		Maximum			50 Ω	
		Typical	R_{on}	B	20 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	
		Typical	R_{on}	C	10 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 5 mA, V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	—	0.47 ms	I_F= 0 mA → 5 mA V_L = Max.
		Maximum			1.0 ms	
	Reverse (ON) time*	Typical	T_{on}	—	0.28 ms	I_F= 5 mA → 0 mA V_L = Max.
		Maximum			1.0 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/C isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

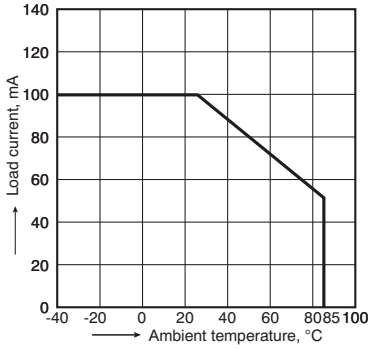
■ For Dimensions, see page 62.
■ For Schematic and Wiring Diagrams, see page 66.
■ For Cautions for Use, see page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

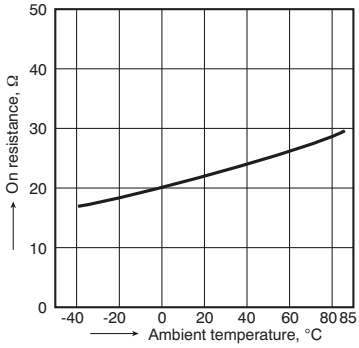
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



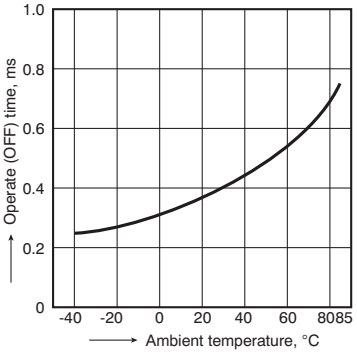
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA;
Continuous load current: 100 mA (DC)



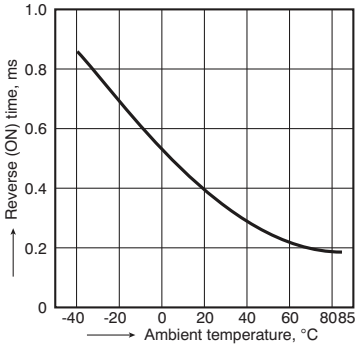
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



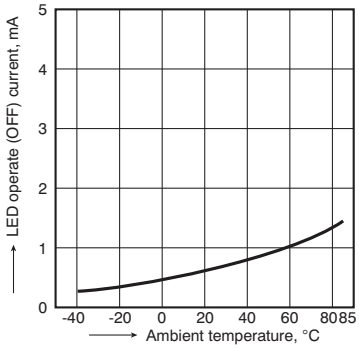
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 50 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



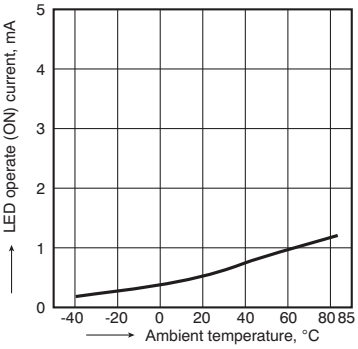
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



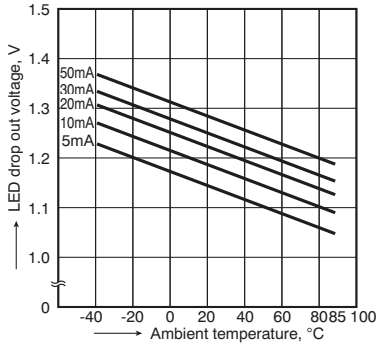
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



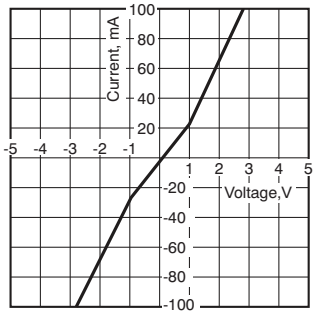
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



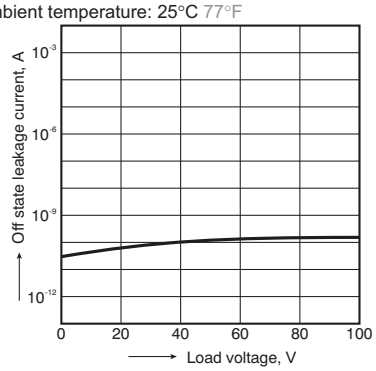
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



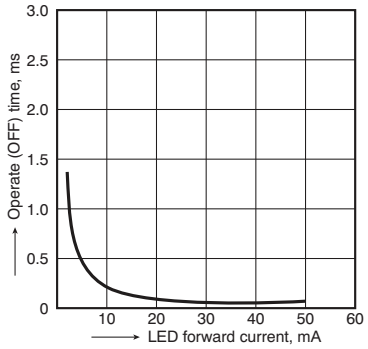
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Ambient temperature: 25°C 77°F



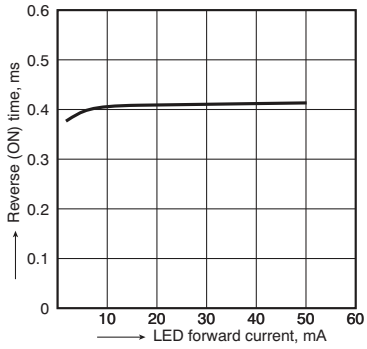
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



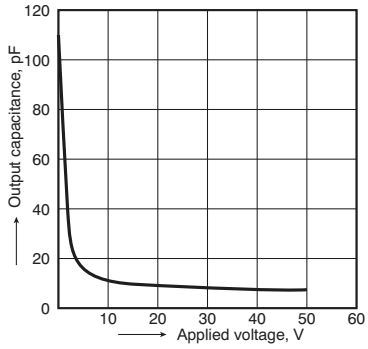
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

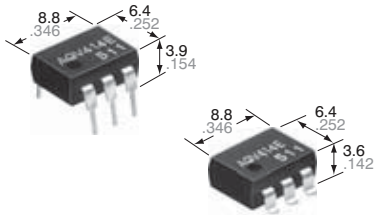
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

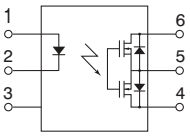
Normally closed 6-pin type of 400V load voltage

PhotoMOS Relays
GU 1 Form B
(AQV414)



CAD Data

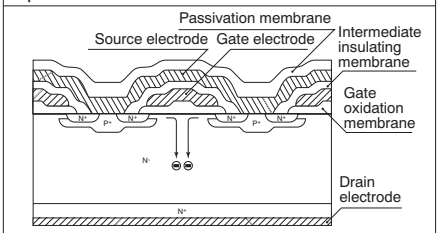
mm inch



FEATURES

1. Low on-resistance (typ. 26Ω) for normally-closed type
This has been achieved thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. High sensitivity and low on-resistance
Can control max. 0.15 A load current with 5 mA input current.

4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Security equipment
- Telephone equipment (Dial pulse)
- Measuring instruments

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	1,500 V AC	400 V	120 mA	DIP6-pin	AQV414	AQV414A	AQV414AX	AQV414AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

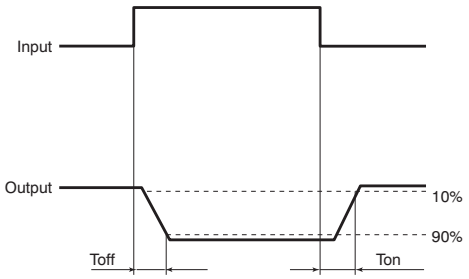
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV414(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forwrd current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.12 A	A connection: Peak AC, DC B, C connection: DC
			B	0.13 A	
			C	0.15 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV414(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	—	1.0 mA	I_L= 120 mA
		Maximum			3.0 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	—	0.4 mA	I_L= 120 mA
		Typical			0.95 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F= 5 mA)	I_F= 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	26 Ω	I_F = 0 mA I_L= Max. Within 1 s on time
		Maximum			50 Ω	
		Typical	R_{on}	B	20 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
		Maximum			25 Ω	
		Typical	R_{on}	C	10 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
		Maximum			12.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F= 5 mA V_L = 400 V
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	—	0.47 ms	I_F = 0 mA → 5 mA I_L = 120 mA
		Maximum			1.0 ms	
	Reverse (ON) time*	Typical	T_{on}	—	0.28 ms	I_F= 5 mA → 0 mA I_L = 120 mA
		Maximum			1.0 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

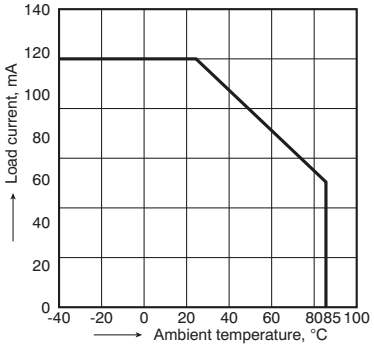
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

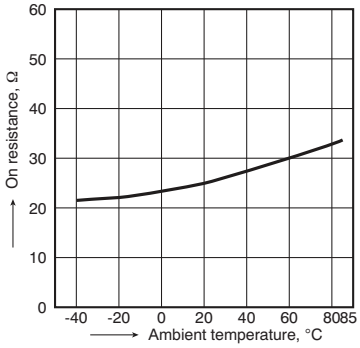
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



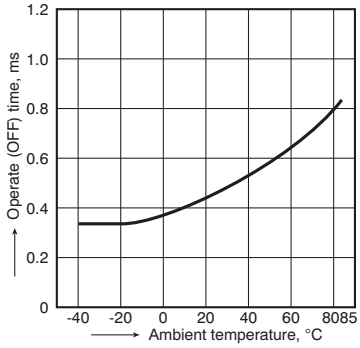
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA;
Continuous load current: 120 mA (DC)



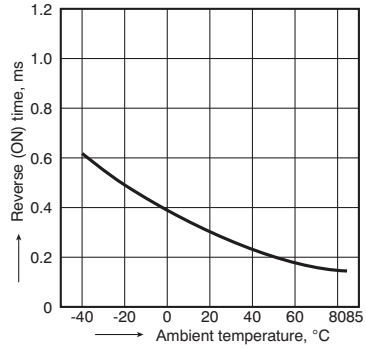
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



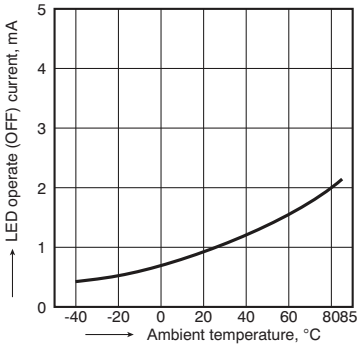
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



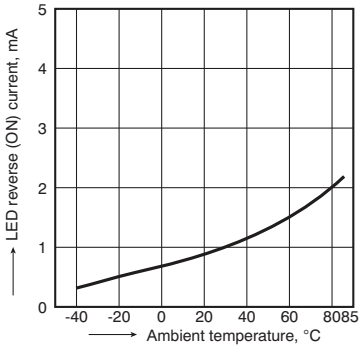
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



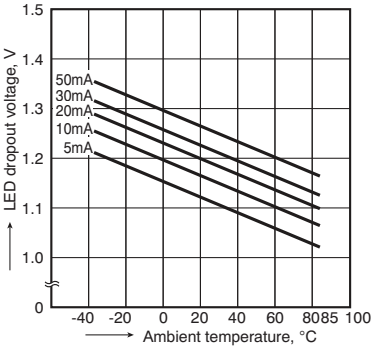
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



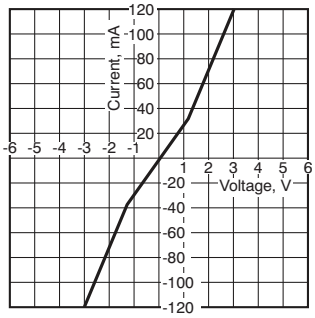
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



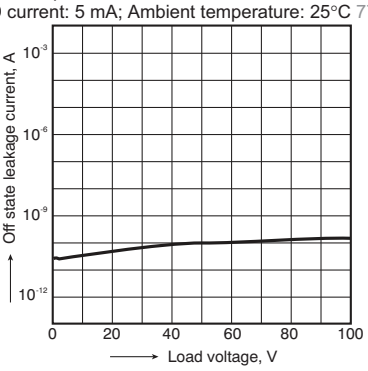
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



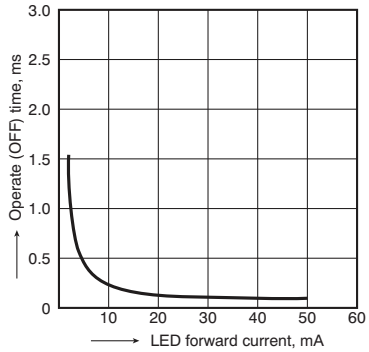
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Ambient temperature: 25°C 77°F



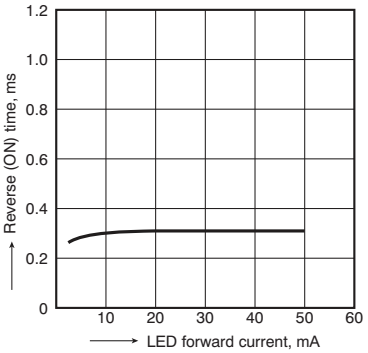
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



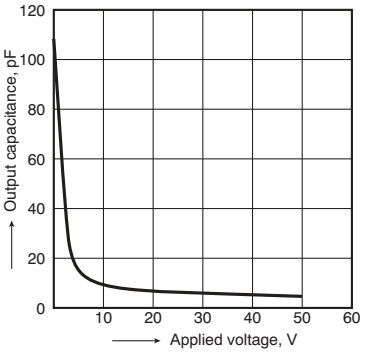
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

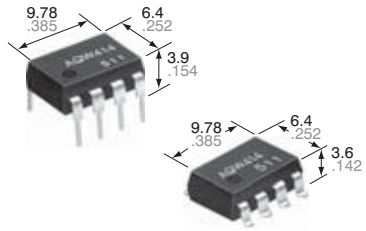
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

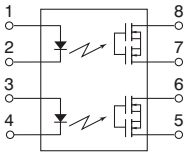
Normally closed DIP8-pin type of 400V load voltage

PhotoMOS Relays
GU 2 Form B
(AQW414)



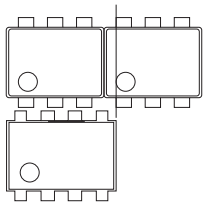
CAD Data

mm inch



FEATURES

1. Approx. 1/2 the space compared with the mounting of Two 1 Form B PhotoMOS units



Two 1 Form B units

2 Form B type

2. Applicable for 2 Form B use as well as two independent 1 Form B use
3. Controls load currents up to 0.13 A with an input current of 5 mA
4. High speed switching: operate time typ. 0.46 ms
5. Extremely low closed-circuit offset voltages to enable control of small analog signals without distortion

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Computers

TYPES

	Output rating*		Package	Part No.				Packing quantity	
	Load voltage	Load current		Through hole terminal	Surface-mount terminal				
				Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	400 V	100 mA	DIP8-pin	AQW414	AQW414A	AQW414AX	AQW414AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

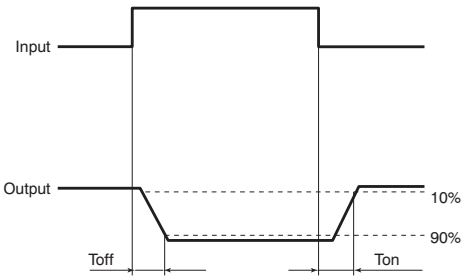
Item		Symbol	AQW414(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stag}	–40°C to +100°C –40°F to +212°F	

GU 2 Form B (AQW414)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW414(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	0.7 mA	I_L = Max.
		Maximum		3 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA	I_L = Max.
		Typical		0.64 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	26 Ω	I_F = 0 mA I_L= Max. Within 1 s on time
		Maximum		50 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	0.46 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		1 ms	
	Reverse (ON) time*	Typical	T_{on}	0.40 ms	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

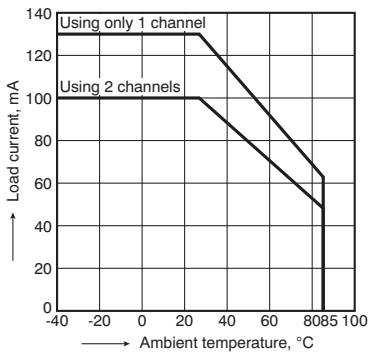
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

For more information, see page 80.

REFERENCE DATA

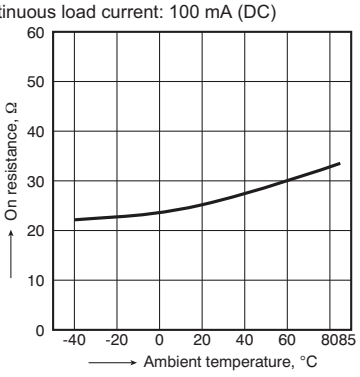
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



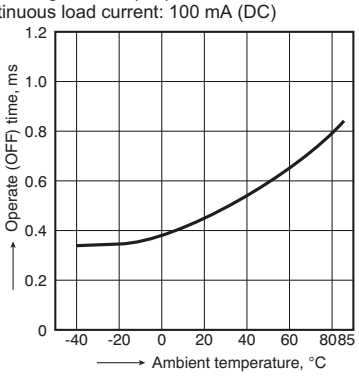
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 0 mA;
Continuous load current: 100 mA (DC)



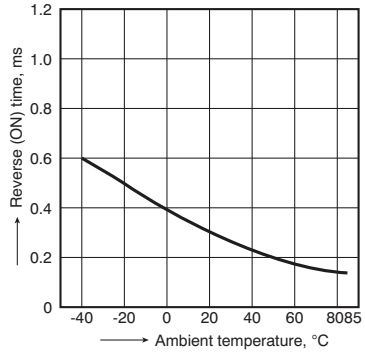
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



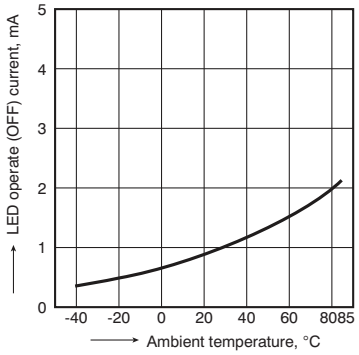
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



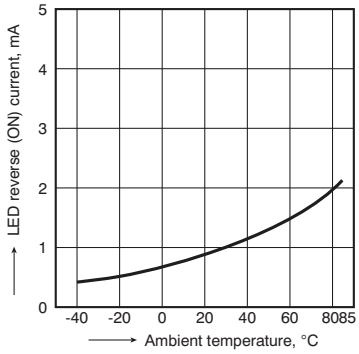
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



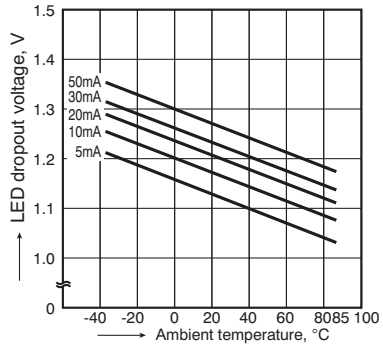
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



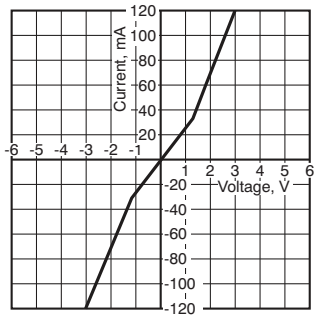
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



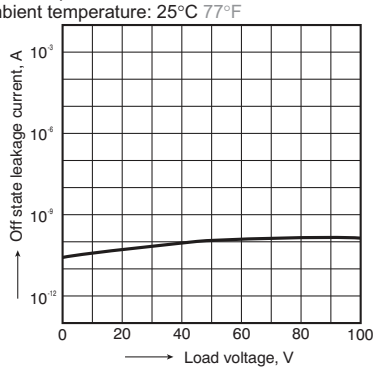
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



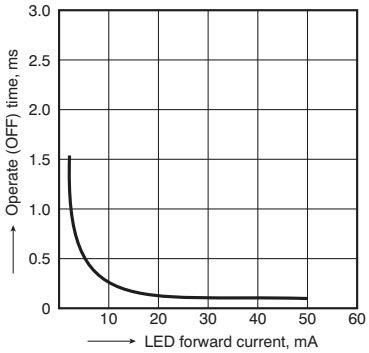
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



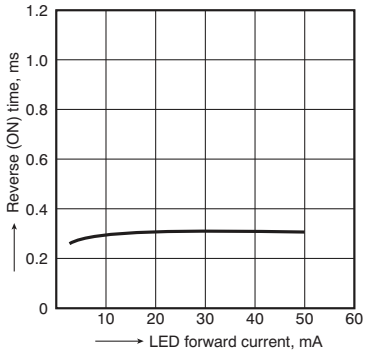
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



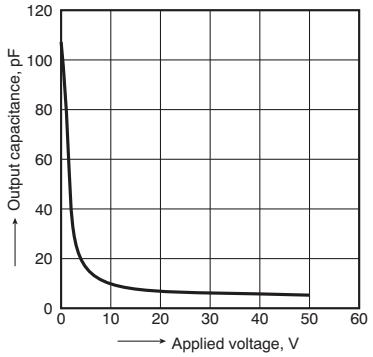
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

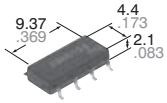
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

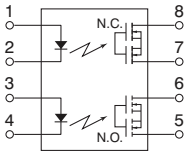
Both NO and NC contacts incorporated in a small SOP8-pin package

PhotoMOS Relays
GU SOP Form A & B
(AQW61❍S)



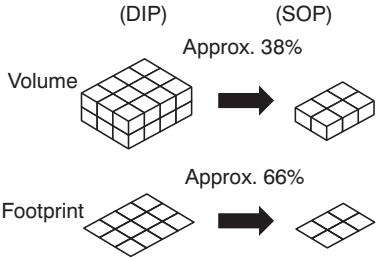
CAD Data

mm inch



FEATURES

1. Normally open and normally closed contacts in a SOP package
The device comes in a miniature SOP measuring (W) 4.4 × (L) 9.37 × (H) 2.1 mm (W) .173× (L) .369× (H) .083 inch — approx. 38% of the volume and 66% of the footprint size of DIP type.



2. 60V type couples high capacity (0.45A) with low on-resistance (typ. 1Ω) (AQW612S).
3. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use
4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion
5. Low-level off-state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Telephone equipment
- Computer input machines
- Industrial robots
- High-speed inspection machines

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3/4-pin side	Tape and reel packing style: Picked from the 5/6/7/8-pin side	Tube	Tape and reel
AC/DC dual use	60V	450mA	SOP8-pin	AQW612S	AQW612SX	AQW612SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	350V	100mA		AQW610S	AQW610SX	AQW610SZ		

* Indicate the peak AC and DC values.
Note: The packing style indicator “X” or “Z” are not marked on the relay.

RATING

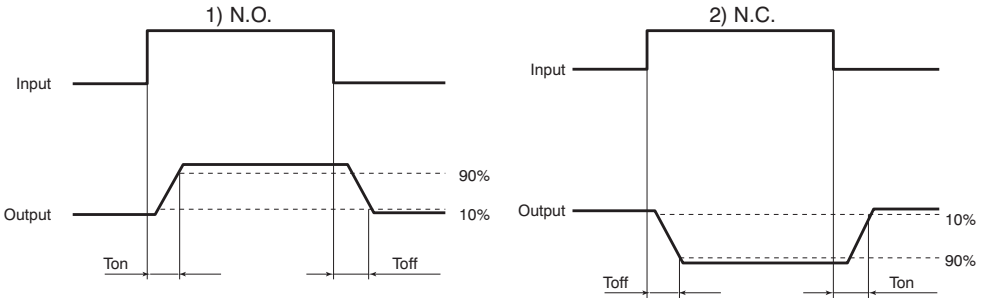
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW612S	AQW610S	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	60 V	350 V	
	Continuous load current	I_L	0.45 A (0.55 A)	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	1.5 A	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW		
Total power dissipation		P_T	650 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW612S	AQW610S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA		I_L = Max.
		Maximum		3 mA		
	LED reverse current	Minimum	I_{Foff}	0.4 mA		I_L = Max.
		Typical		0.8 mA		
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	1 Ω	18 Ω	I_F = 5 mA (N.O.) I_F= 0 mA (N.C.) I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA		I_F = 0 mA (N.O.) I_F= 5 mA (N.C.) V_L = Max.
Transfer characteristics	Operate time*	Typical	T_{on} (N.O.) T_{off} (N.C.)	0.65 ms (N.O.), 0.9 ms (N.C.)	0.28 ms (N.O.), 0.52 ms (N.C.)	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		3.0 ms	1.0 ms	
	Reverse time*	Typical	T_{off} (N.O.) T_{on} (N.C.)	0.08 ms (N.O.), 0.2 ms (N.C.)	0.04 ms (N.O.), 0.23 ms (N.C.)	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1.0 ms	1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

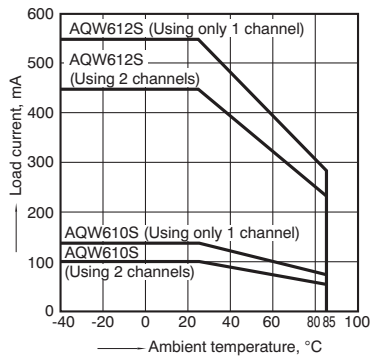
■ For Dimensions, see page 62.
■ For Schematic and Wiring Diagrams, see page 66.
■ For Cautions for Use, see page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

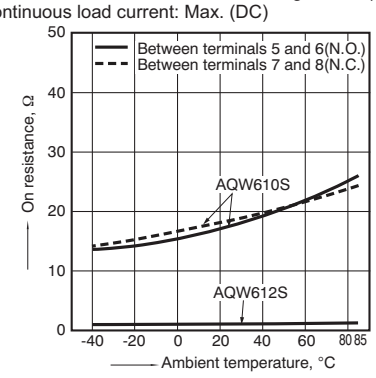
13.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



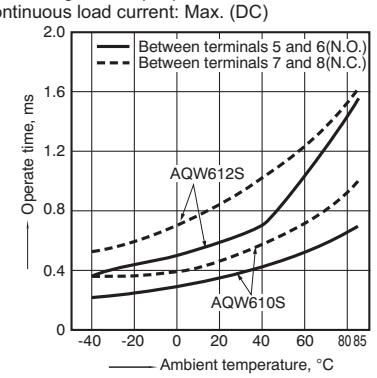
14.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



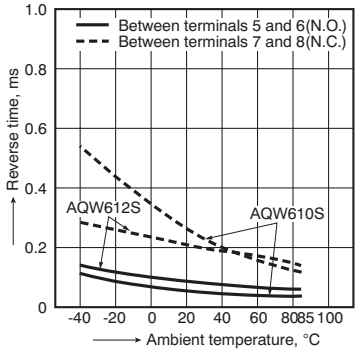
15.Operate time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



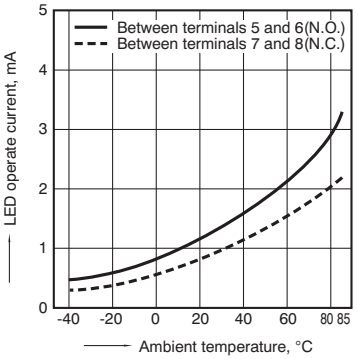
16.Reverse time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



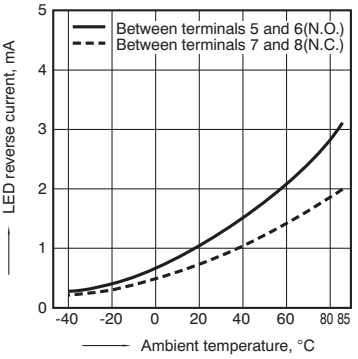
17.LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



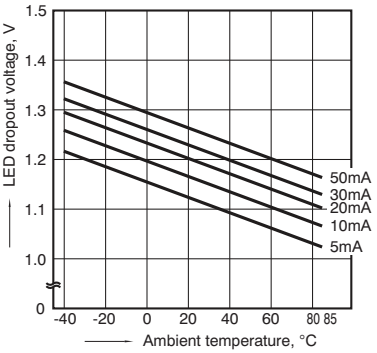
18.LED reverse current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



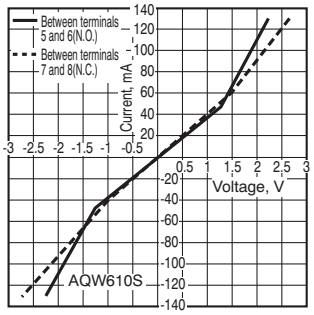
19.LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



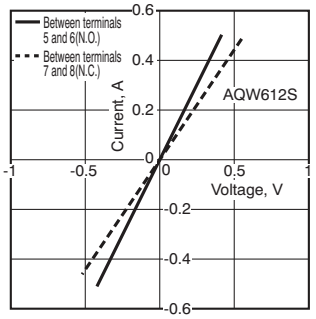
20-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



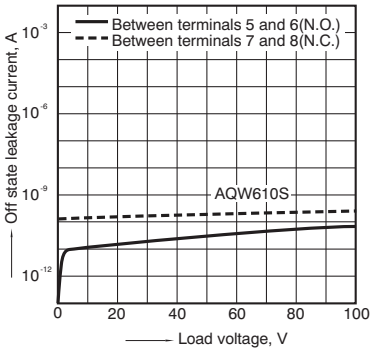
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



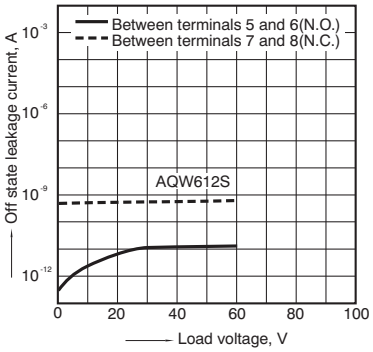
21-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



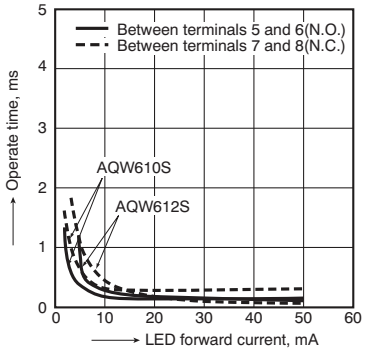
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



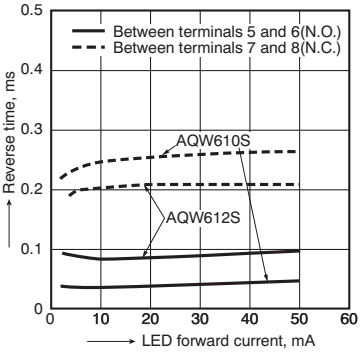
22.Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



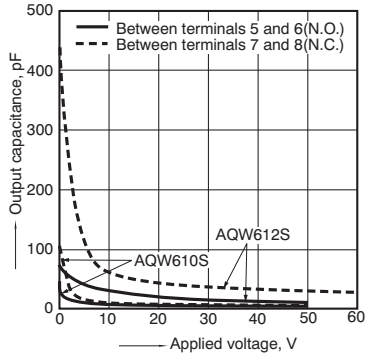
23.Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



24.Output capacitance vs. applied voltage characteristics

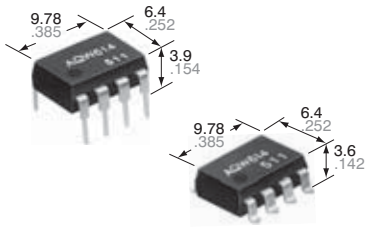
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

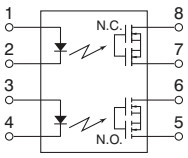
Both NO and NC contacts incorporated in a DIP8-pin package

PhotoMOS Relays
GU Form A & B
(AQW614)



CAD Data

mm inch



FEATURES

1. **Approx. 1/2 the space compared with the mounting of a set of 1 Form A and 1 Form B PhotoMOS relays**
2. **Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use**
3. **Controls load currents up to 0.13 A with 5 mA input current**
4. **Extremely low closed-circuit offset voltages to enable control of small analog signals without distortion**
5. **Stable on-resistance**

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Computers
- Sensing equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
	Load voltage	Load current		Through hole terminal	Surface-mount terminal				
				Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	400 V	100 mA	DIP8-pin	AQW614	AQW614A	AQW614AX	AQW614AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

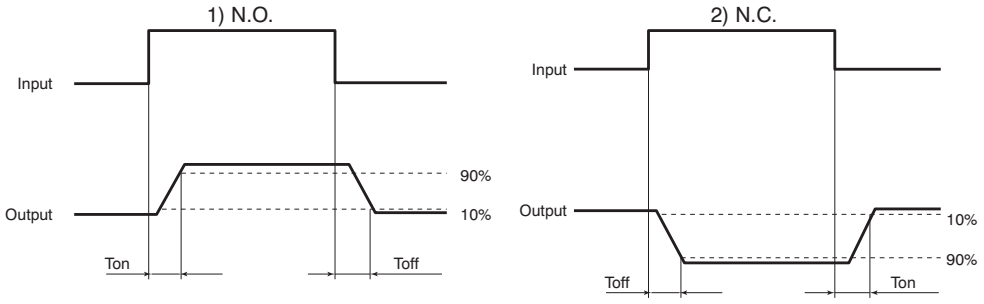
Item		Symbol	AQW614(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

GU Form A & B (AQW614)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW614(A)	Condition
Input	LED operate current	Typical	I_{Fon} (N.O.) I_{Foff} (N.C.)	0.9 mA	I_L = 100 mA
		Maximum		3 mA	
	LED reverse current	Minimum	I_{Foff} (N.O.) I_{Fon} (N.C.)	0.4 mA	I_L = 100 mA
		Typical		0.8 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	27 Ω	I_F = 5 mA (N.O.) I_F = 0 mA (N.C.) I_L = 100 mA within 1 s on time
		Maximum		50 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA (N.O.) I_F = 5 mA (N.C.) V_L = 400 V
Transfer characteristics	Operate time*	Typical	T_{on} (N.O.) T_{off} (N.C.)	0.28 ms (N.O.) 0.43 ms (N.C.)	I_F = 0 mA → 5 mA I_L = 100 mA
		Maximum		1 ms	
	Reverse time*	Typical	T_{off} (N.O.) T_{on} (N.C.)	0.04 ms (N.O.) 0.3 ms (N.C.)	I_F = 5 mA → 0 mA I_L = 100 mA
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

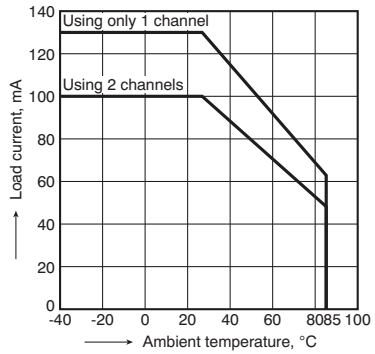
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

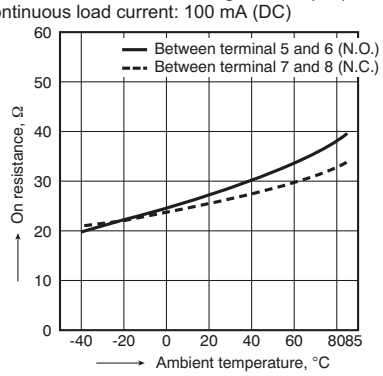
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



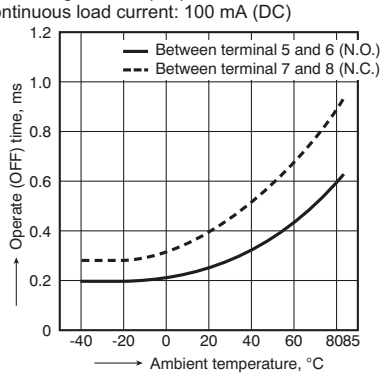
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



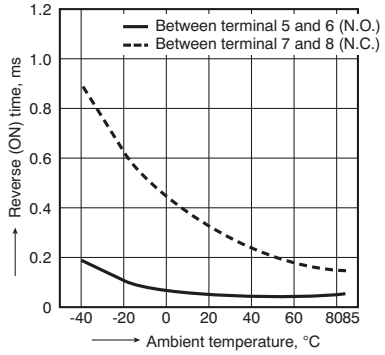
3. Operate time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



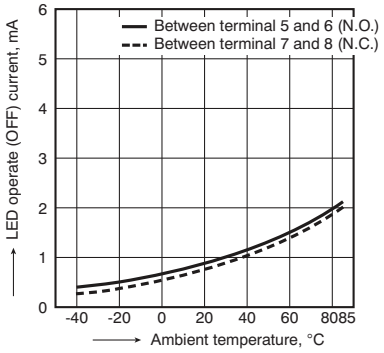
4. Reverse time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



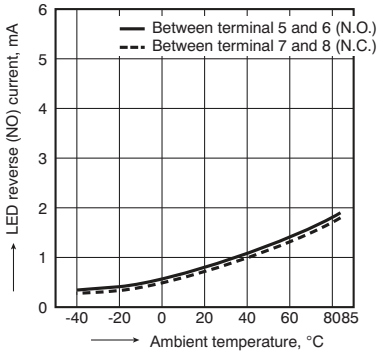
5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



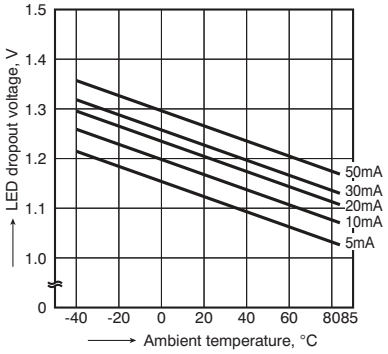
6. LED reverse current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



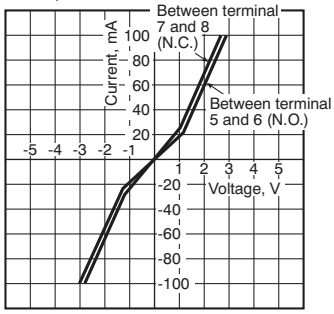
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



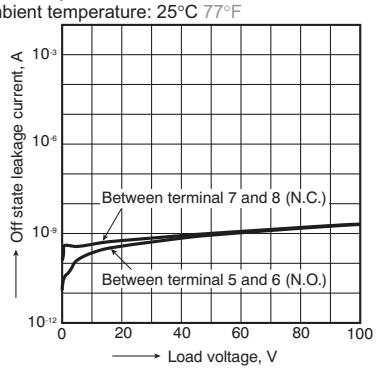
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



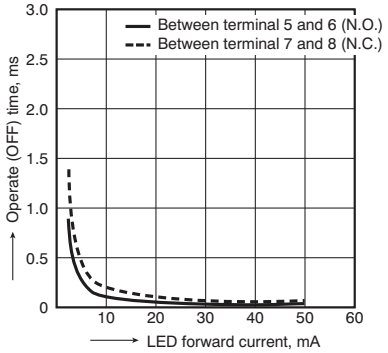
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



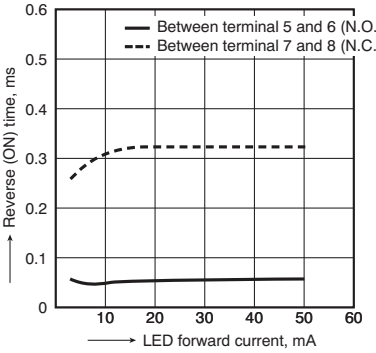
10. Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



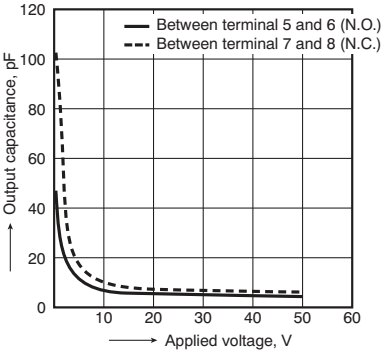
11. Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

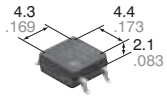
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

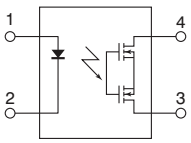
Small SOP4-pin type with short circuit protecting (Latch type)

PhotoMOS Relays
GU SOP 1 Form A
Short Circuit Protection (AQY210KS)



CAD Data

mm inch



FEATURES

1. Short circuit protection (Latch type)
When the output current exceeds a fixed amount, it is cut and the off state is maintained. The relay can be restored by turning off the input current and then turning it back on.
2. Miniature SOP4-pin package
3. Controls low-level analog signals
4. Low-level off state leakage current

TYPICAL APPLICATIONS

- Modem and telephone equipment
- Measuring and testing equipment
- Security equipment
- Industrial equipment
- Traffic signal control

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side)	Picked from the 3/4-pin side		
AC/DC dual use	350V	120mA	SOP4-pin	AQY210KS	AQY210KSX	AQY210KSZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: For space reasons, only “210K” is marked on the product. The three initial letters of the part number “AQY”, the surface mount terminal shape indicator “S” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

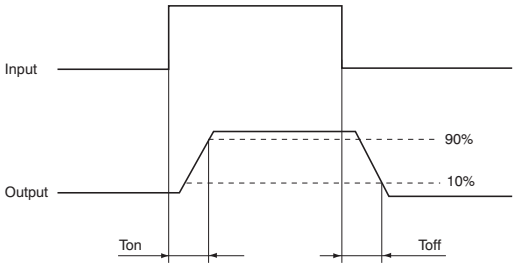
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY210KS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.12 A	Peak AC, DC
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY210KS	Condition
Input	LED operate current		Typical	I_{Fon}	1.1 mA	I_L = Max.
			Maximum		3.0 mA	
	LED turn off current		Minimum	I_{Foff}	0.3 mA	I_L = Max.
			Typical		1.0 mA	
	LED dropout voltage		Typical	V_F	1.32 V (1.13 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	23.5Ω	I_F = 5 mA I_L = 120 mA Within 1 s on time
			Maximum		35Ω	
	Off state leakage current		Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = 350 V
	Over current protection	Cut off current	Minimum	I_{shut}	160 mA	I_F = 5 mA Within 20ms on time
			Typical		200 mA	
			Maximum		240 mA	
		Detection time	Typical	T_{shut}	50μs	I_F = 5 mA V_L = 350 V DC short circuit
Transfer characteristics	Turn on time*		Typical	T_{on}	0.7 ms	I_F = 5 mA I_L = Max.
			Maximum		2 ms	
	Turn off time*		Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = Max.
			Maximum		1 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

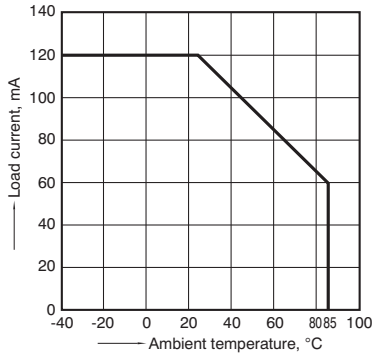
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

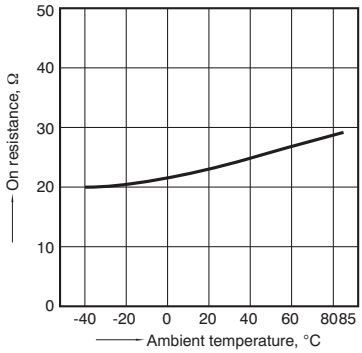
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



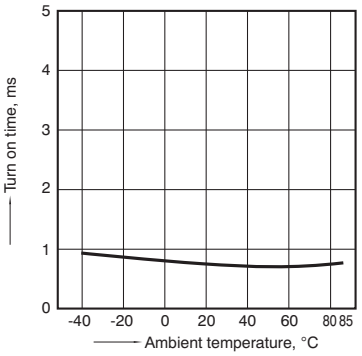
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load current: Max.(DC)



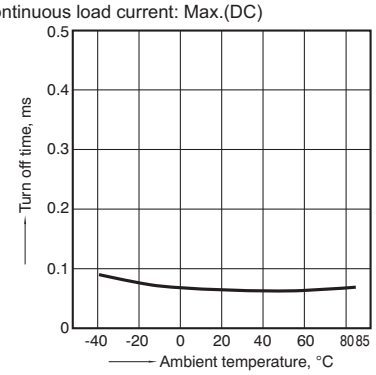
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Continuous load current: Max.(DC)



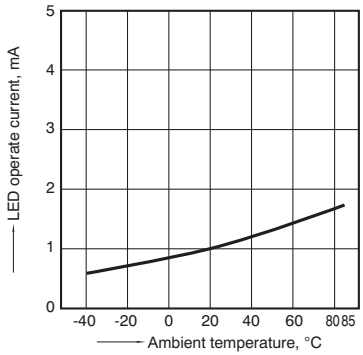
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA;
Continuous load current: Max.(DC)



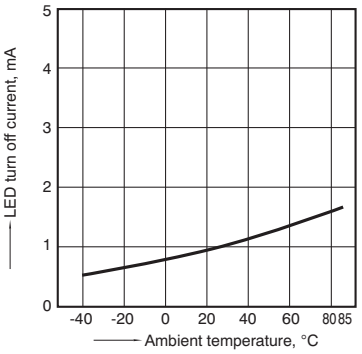
5. LED operate current vs. ambient temperature characteristics

Continuous load current: Max.(DC)



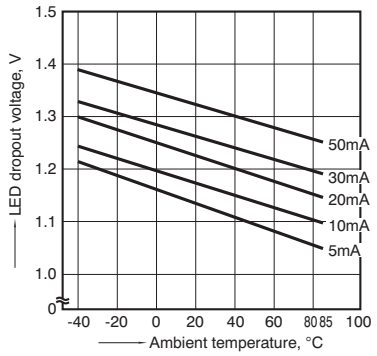
6. LED turn off current vs. ambient temperature characteristics

Continuous load current: Max.(DC)



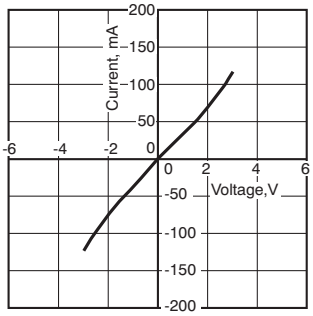
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



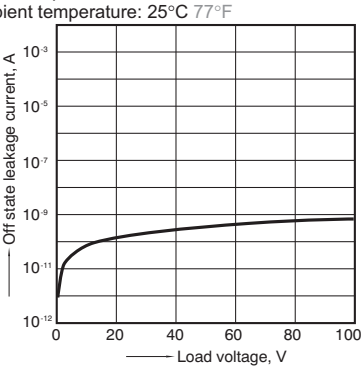
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



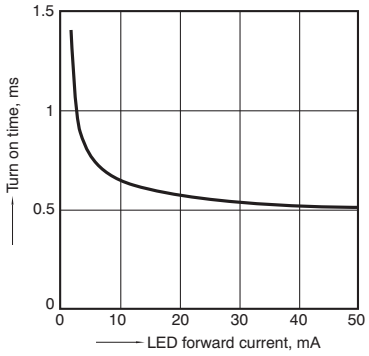
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



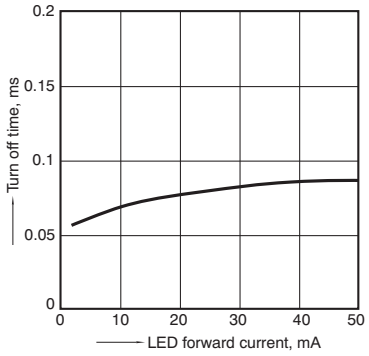
10.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC); Ambient temperature: 25°C 77°F



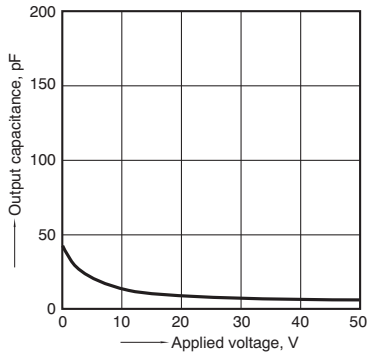
11.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC); Ambient temperature: 25°C 77°F



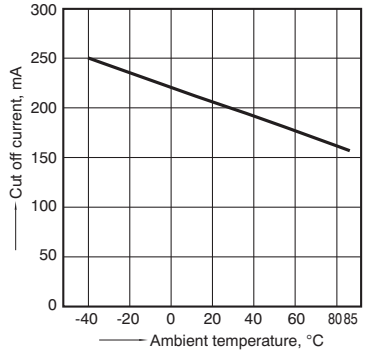
12.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4; Frequency: 1 MHz; Ambient temperature: 25°C 77°F



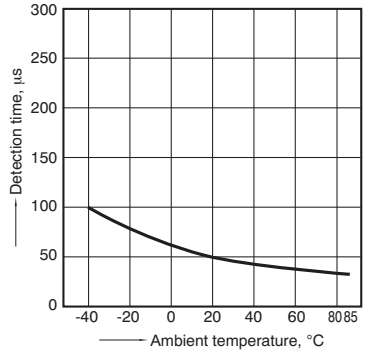
13.Cut off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4; LED current: 5 mA, within 20ms on time



14.Detection time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4; LED current: 5 mA; Load voltage: Max.(DC);

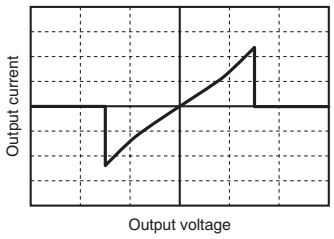


What is short circuit protection latch type?

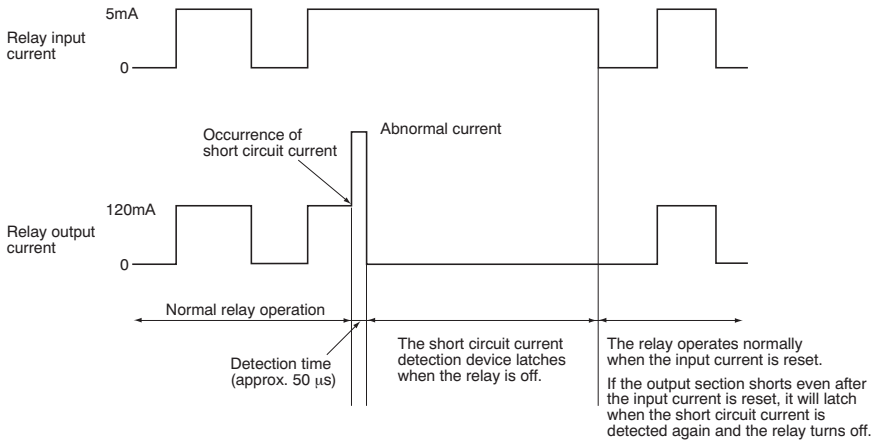
When the load current exceeds specifications, the short circuit protection function kicks in and completely cuts off the load current, thus turning off the relay. The short circuit protection inside the PhotoMOS relay instantaneously (typ. 50 μs) and completely cuts of the load current.
This protects any circuits that follow the PhotoMOS relay from excess current. There is almost no heating of the PhotoMOS relay, which prevents it from becoming damaged. To restore the function of the relay turn off the input current and then turn it back on.
In order to operate the short circuit protection function, ensure that the input current is at least I_F = 5 mA.

Output voltage and output current characteristics

V-I characteristics of PhotoMOS relay with short circuit protection circuit



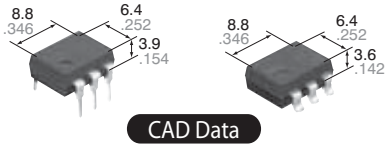
Operation chart



Panasonic
ideas for life

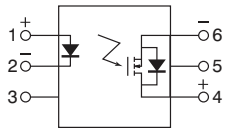
Short circuit protection (Non-latch type) only for DC load

PhotoMOS Relays
GU 1 Form A
Short Circuit Protection (AQV112KL)



CAD Data

mm inch



FEATURES

1. Protects Circuit from excess current
The short circuit protection function prevents the continued flow of short current. After short current is detected, load current is monitored, and if the load returns to normal, the relay returns to normal operation.

2. No need for fuses, polyswitches, or other protectors
The built-in short circuit protection function eliminates the need for overcurrent protectors, reducing mounting costs and space requirements.

3. High capacity
Can control up to 0.5A (60V DC) load current.

TYPICAL APPLICATIONS

- Industrial equipment
- Traffic signal control
- Security equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
DC only	60 V	500 mA	DIP6-pin	AQV112KL	AQV112KLA	AQV112KLAX	AQV112KLAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

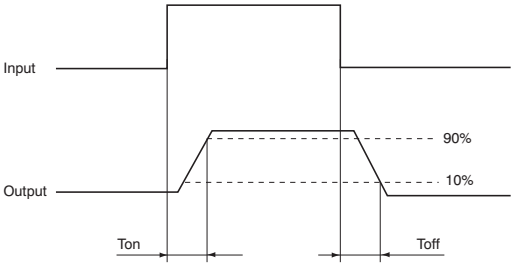
Item		Symbol	AQV112KL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	7 to 60V	
	Continuous load current	I_L	0.5 A	Peak AC, DC
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

GU 1 Form A Short Circuit Protection (AQV112KL)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQV112KL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	0.8 mA	I_L = 100mA
		Maximum		10 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = 100mA
		Typical		0.7 mA	
	LED dropout voltage	Typical	V_F	1.35 V (1.17 V at I_F = 10 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.55 Ω	I_F = 10 mA I_L = Max.
		Maximum		2.0 Ω	
	Load short circuit detection voltage	Typical	V_{LSHT}	5 V	I_F = 10 mA
		Maximum		7 V	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	2.0 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms	
	Turn off time*	Typical	T_{off}	0.1 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	10	mA

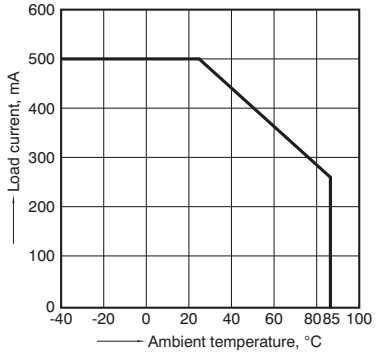
■ For Dimensions, see page 60.
■ For Schematic and Wiring Diagrams, see page 64.
■ For Cautions for Use, see page 71.

■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

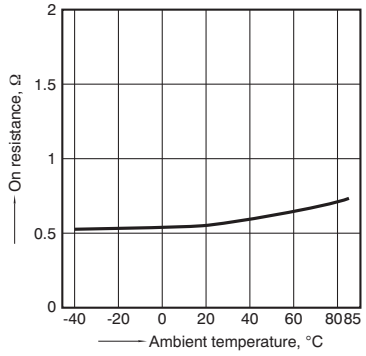
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



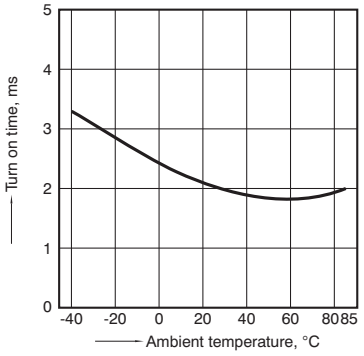
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load current: Max.(DC)



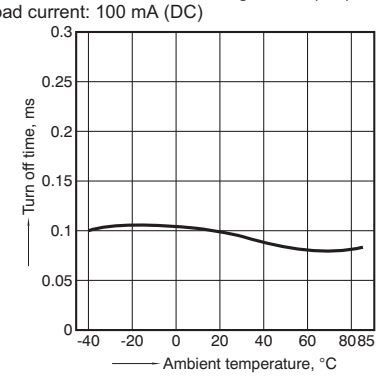
3. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load voltage: 10V (DC);
Load current: 100 mA



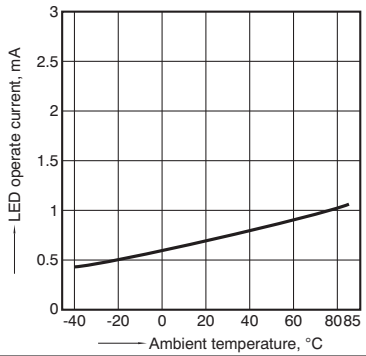
4. Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load voltage: 10 V (DC);
Load current: 100 mA (DC)



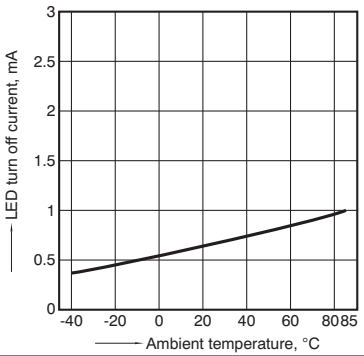
5. LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
Load current: 100 mA



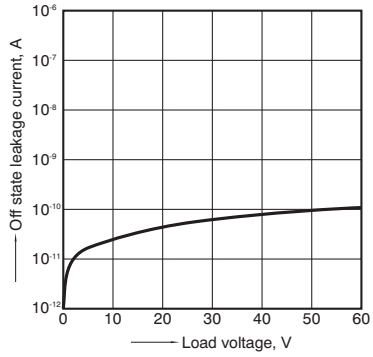
6. LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
Load current: 100 mA



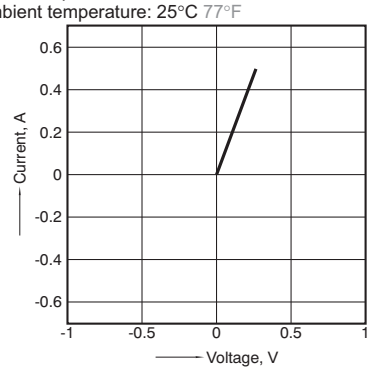
7. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



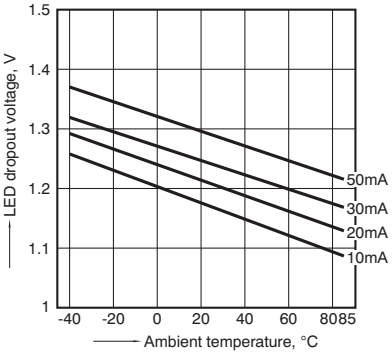
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



9. LED dropout voltage vs. ambient temperature characteristics

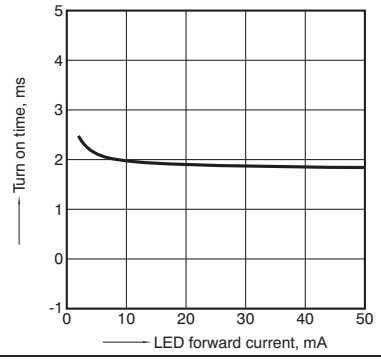
Measured portion: between terminals 1 and 2;
LED current: 10 to 50 mA



GU 1 Form A Short Circuit Protection (AQV112KL)

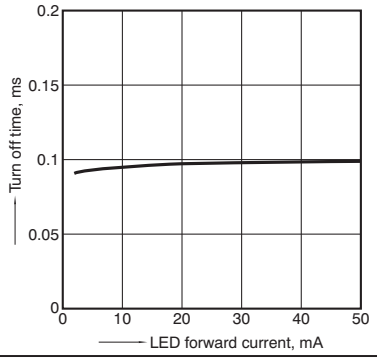
10.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC); Load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



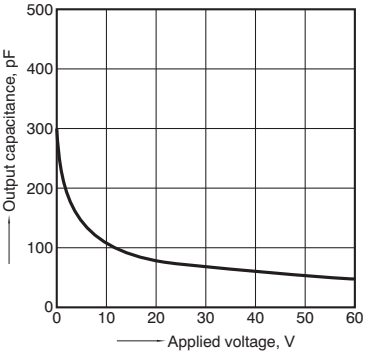
11.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC); Load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



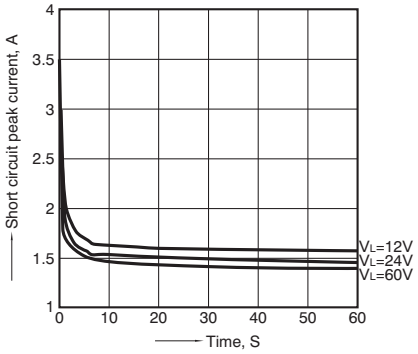
12.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



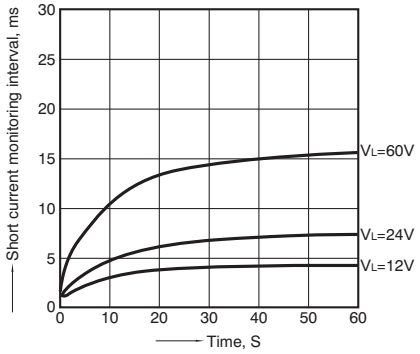
13.Short circuit peak current vs. time characteristics

Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load resistance: 0;
Ambient temperature: 25°C 77°F



14.Short current monitoring interval vs. time characteristics

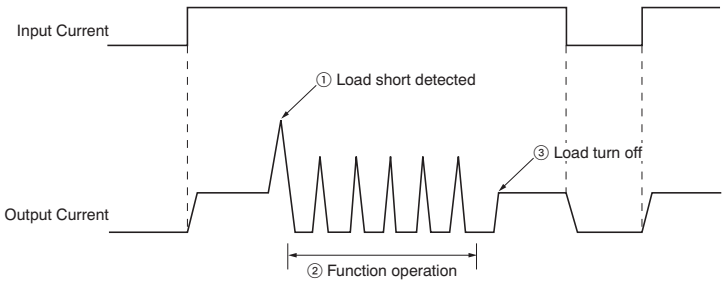
Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load resistance: 0;
Ambient temperature: 25°C 77°F



What is short circuit protection Non-latch type?

If the load current reaches a predetermined overcurrent level, the output-side short circuit protection function cuts off the load current. It then monitors the load current, and if it returns to normal, automatically recovers to normal relay operation.
In order to operate the short circuit protection function, ensure that the input current is at least I_F = 10 mA.

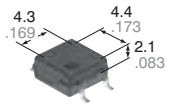
Operation chart (Non-latch type)



Panasonic
ideas for life

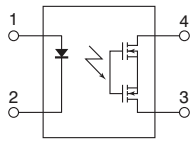
Miniature SOP4-pin type with current limiting

PhotoMOS Relays
GU SOP 1 Form A
Current Limiting (AQY210LS)



CAD Data

mm inch



FEATURES

1. Current limiting function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhances the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. Small SOP4-Pin package
The device comes in a super-miniature SO package 4-Pin type measuring (W) 4.3×(L) 4.4×(H) 2.1 mm (W) .169×(L) .173×(H) .083 inch

4. Controls low-level analog signals

5. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem
- Measuring equipment

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	350V	120mA	SOP4-pin	AQY210LS	AQY210LSX	AQY210LSZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: For space reasons, only “210L” is marked on the product. The three initial letters of the part number “AQY”, the surface mount terminal shape indicator “S” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

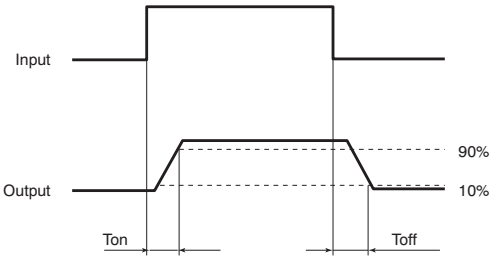
Item		Symbol	AQY210LS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.12 A	Peak AC, DC
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

GU SOP 1 Form A Current Limiting (AQY210LS)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY210LS	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

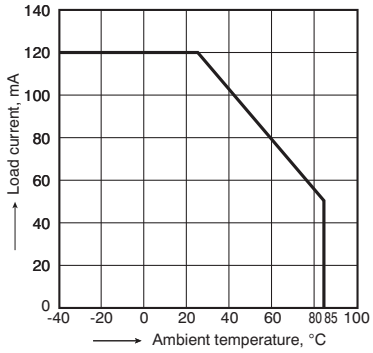
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

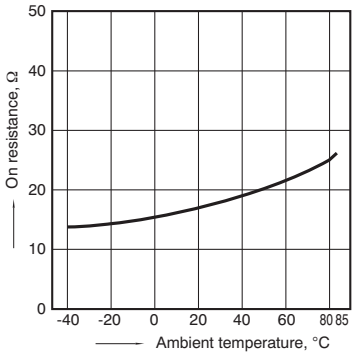
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature:
–40°C to +85°C
–40°F to +185°F



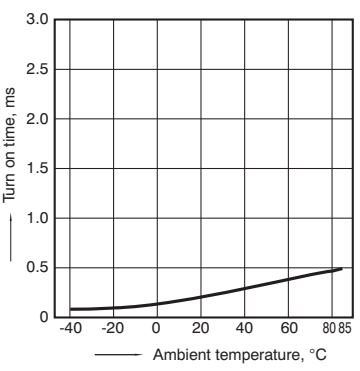
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



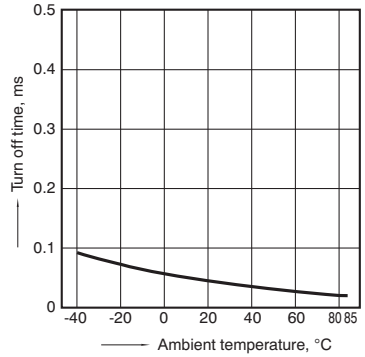
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



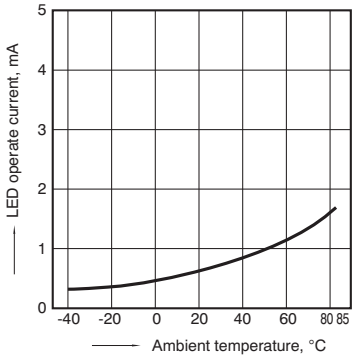
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



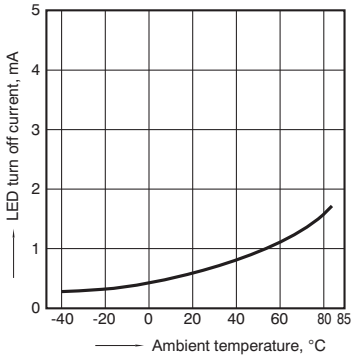
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



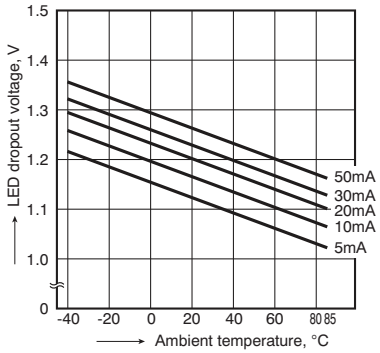
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



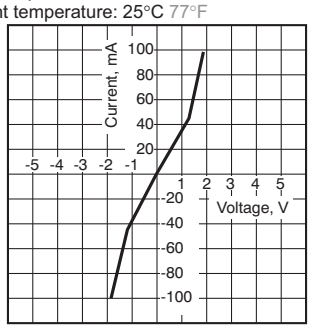
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



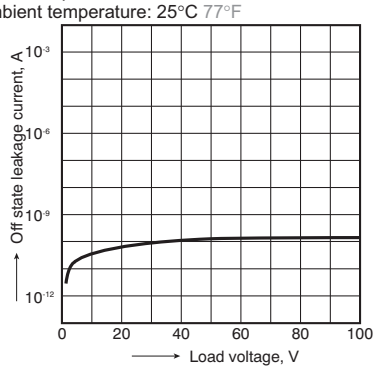
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



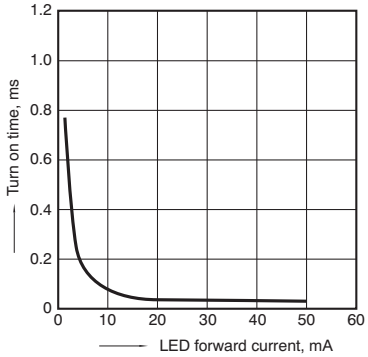
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



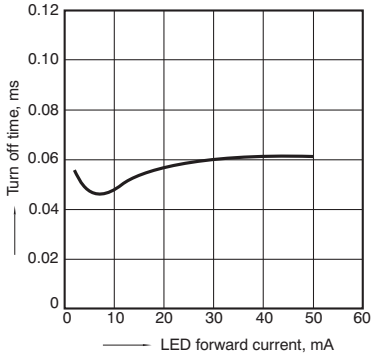
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



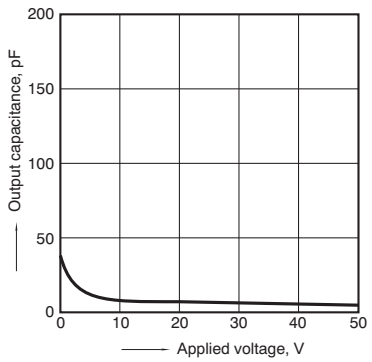
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



What is current limit?

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.

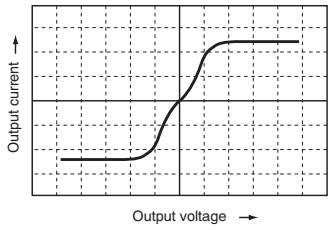
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.

But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.

• Comparison of output voltage and output current characteristics

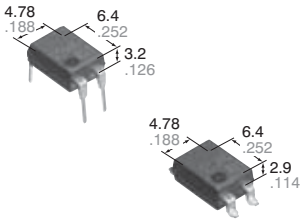
V-I Characteristics



Panasonic
ideas for life

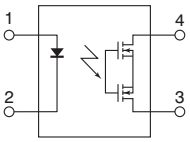
DIP4-pin type with current limiting and reinforced insulation

PhotoMOS Relays
GU 1 Form A
Current Limiting (AQY210HL)



CAD Data

mm inch



FEATURES

1. Current Limiting Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhances the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. Reinforced insulation of 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity and low on-resistance

6. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	Reinforced 5,000 V	350 V	120 mA	DIP4-pin	AQY210HL	AQY210HLA	AQY210HLAX	AQY210HLAZ	1 tube contains: 100 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, only “210HL” is marked on the product. The three initial letters of the part number “AQY”, the surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

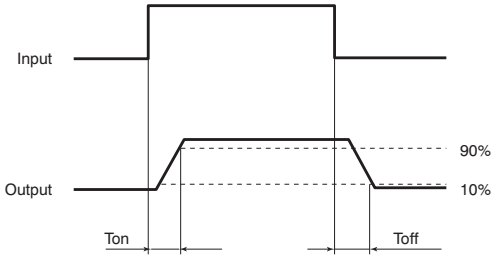
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY210HL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.12 A	Peak AC, DC
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY210HL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

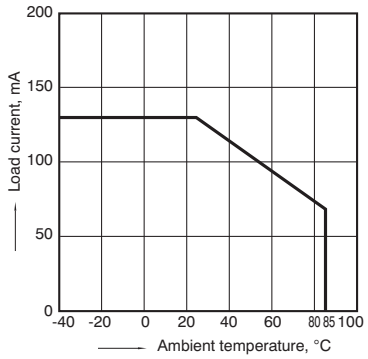
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

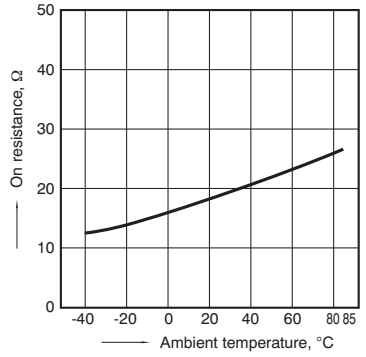
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



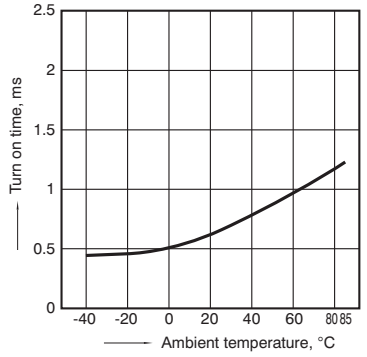
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



3. Turn on time vs. ambient temperature characteristics

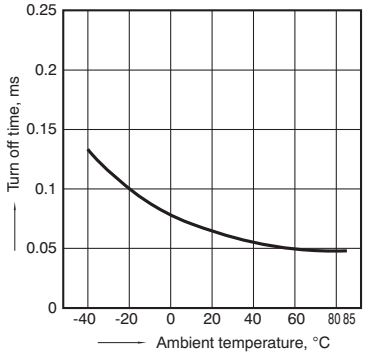
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



GU 1 Form A Current Limiting (AQY210HL)

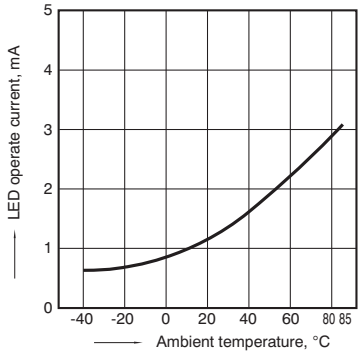
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



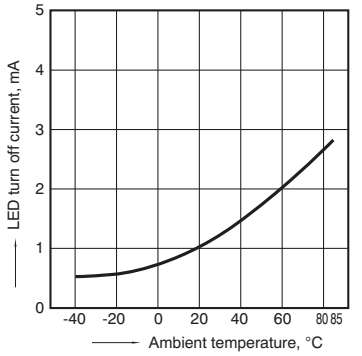
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



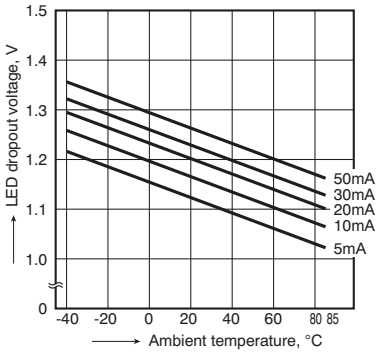
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



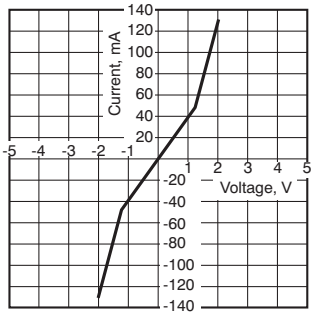
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



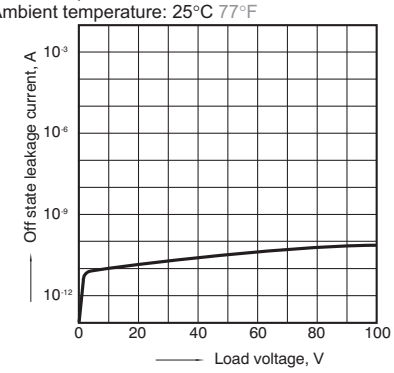
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



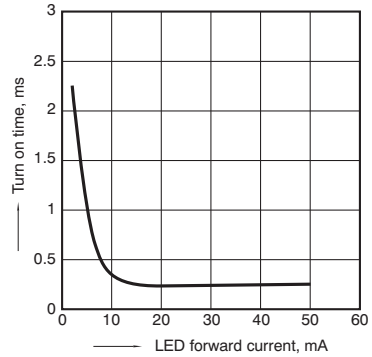
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



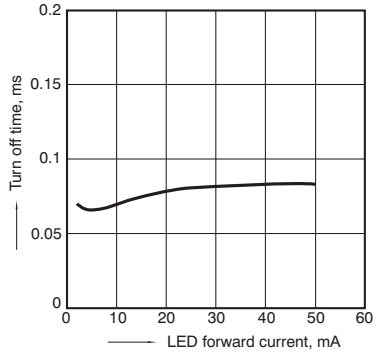
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



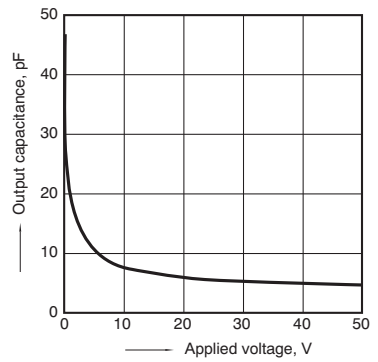
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



What is current limit?

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.

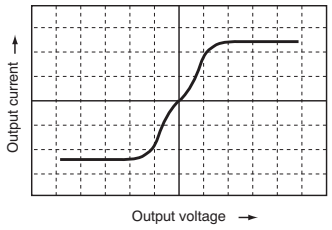
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.

But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.

• Comparison of output voltage and output current characteristics

V-I Characteristics



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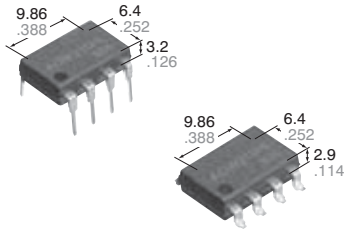
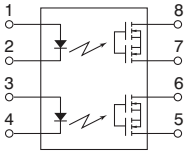
Two output type with current limiting and reinforced insulation

PhotoMOS Relays
GU 2 Form A
Current Limiting (AQW210HL)



CAD Data

mm inch



FEATURES

1. Current Limiting Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.
2. Enhances the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.
3. Reinforced insulation of 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).
4. Applicable for 2 Form A use as well as two independent 1 Form A use.
5. Controls low-level analog signals
6. High sensitivity and high speed response.
Can control max. 0.12 A load current with 5 mA input current. This enables fast operation speed of typ. 0.5 ms
7. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	Reinforced 5,000 V AC	350 V	100 mA	DIP8-pin	AQW210HL	AQW210HLA	AQW210HLAX	AQW210HLAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

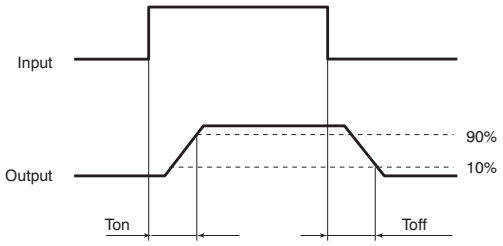
Item		Symbol	AQW210HL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.1 A (0.12 A)	Peak AC, DC ( ): in case of using only 1 channel
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

GU 2 Form A Current Limiting (AQW210HL)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW210HL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

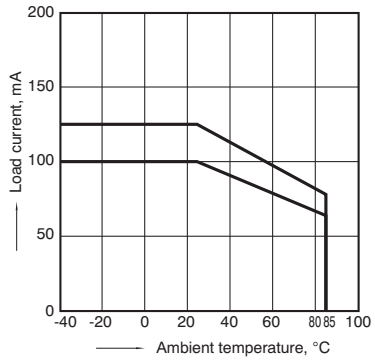
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

For more information, see page 80.

REFERENCE DATA

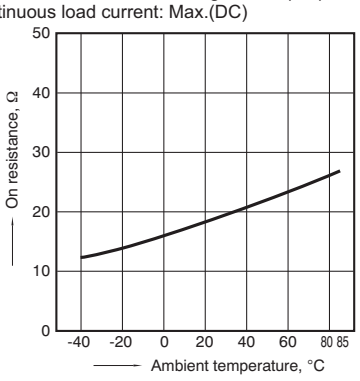
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



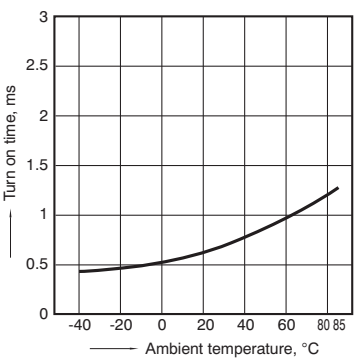
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



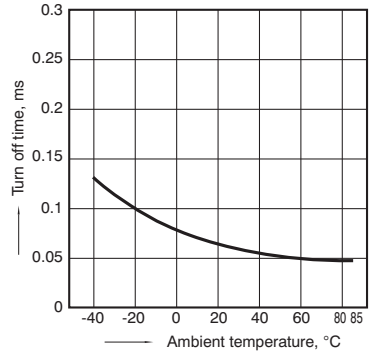
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



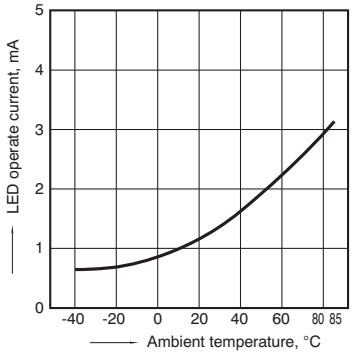
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



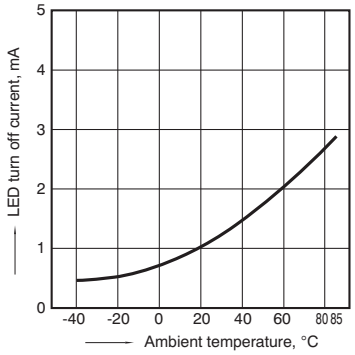
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



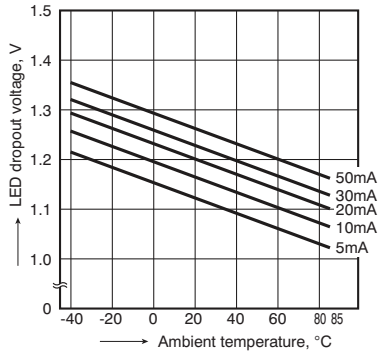
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



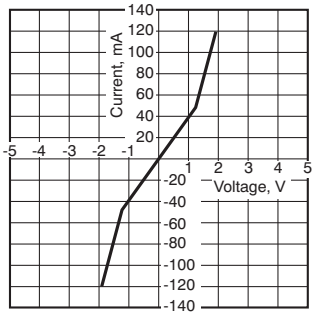
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



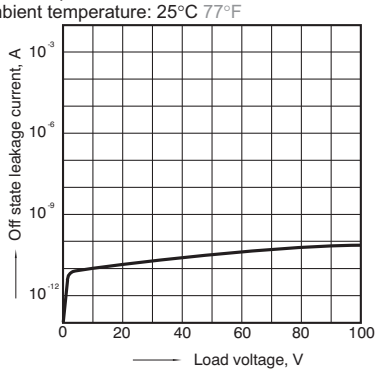
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



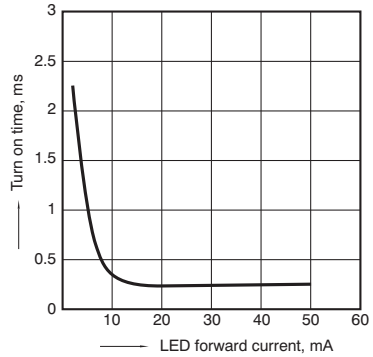
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



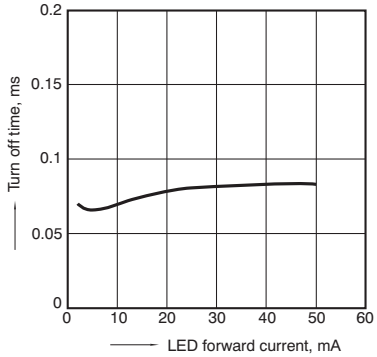
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



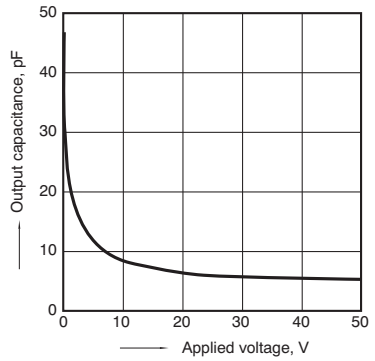
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



What is current limit?

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.

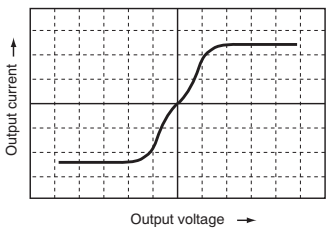
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.

But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.

• Comparison of output voltage and output current characteristics

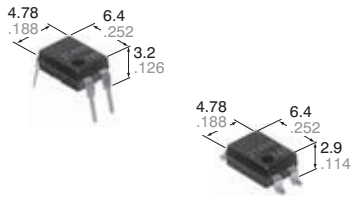
V-I Characteristics



Panasonic
ideas for life

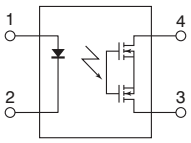
High cost-performance DIP4-pin type with reinforced insulation

PhotoMOS Relays
GU-E 1 Form A
(AQY21○EH)



CAD Data

mm inch



FEATURES

1. Reinforced insulation of 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).
2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
3. High sensitivity and low on-resistance
Can control max. 0.13 A load current with 5 mA input current.
Low on-resistance of typ. 25Ω (AQY211EH).
4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensing equipment

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	Reinforced 5,000 V	30 V	1,000 mA	DIP4-pin	AQY211EH	AQY211EHA	AQY211EHAX	AQY211EHAZ	1 tube contains: 100 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
		60 V	550 mA		AQY212EH	AQY212EHA	AQY212EHAX	AQY212EHAZ		
		350 V	130 mA		AQY210EH	AQY210EHA	AQY210EHAX	AQY210EHAZ		
		400 V	120 mA		AQY214EH	AQY214EHA	AQY214EHAX	AQY214EHAZ		
		600 V	50 mA		AQY216EH	AQY216EHA	AQY216EHAX	AQY216EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the initial letters of the part number "AQY", the surface mount terminal shape indicator "A" and the packing style indicator "X" or "Z" are not marked on the relay. (Ex. the label for product number AQY211EHAX is 211EH)

RATING

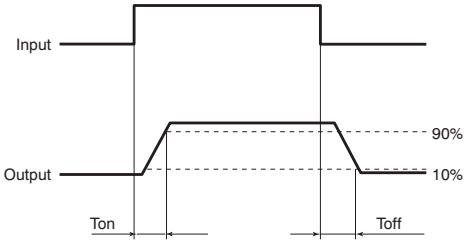
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY211EH(A)	AQY212EH(A)	AQY210EH(A)	AQY214EH(A)	AQY216EH(A)	Remarks
Input	LED forward current	I_F	50mA					
	LED reverse voltage	V_R	5 V					
	Peak forward current	I_{FP}	1 A					f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW					
Output	Load voltage (peak AC)	V_L	30 V	60 V	350 V	400 V	600 V	
	Continuous load current	I_L	1 A	0.55 A	0.13 A	0.12 A	0.05 A	Peak AC, DC
	Peak load current	I_{peak}	3 A	1.5 A	0.4 A	0.3 A	0.15 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	500mW					
Total power dissipation		P_T	550mW					
I/O isolation voltage		V_{iso}	5,000 V AC					
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F					Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F					

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY211EH(A)	AQY212EH(A)	AQY210EH(A)	AQY214EH(A)	AQY216EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2mA					I_L=Max.
		Maximum		3.0mA					
	LED turn off current	Minimum	I_{Foff}	0.4mA					I_L=Max.
		Typical		1.1mA					
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F=5mA)					I_F=50mA
		Maximum		1.5V					
Output	On resistance	Typical	R_{on}	0.25Ω	0.85Ω	18Ω	26Ω	52Ω	I_F=5mA I_L=Max. Within 1 s on time
		Maximum		0.5Ω	2.5Ω	25Ω	35Ω	120Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA					I_F=0mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.5ms	1ms	0.5ms			I_F=5mA I_L=Max.
		Maximum		5ms	4ms	2.0ms			
	Turn off time*	Typical	T_{off}	0.1ms	0.05ms	0.08ms		0.04ms	I_F=5mA I_L=Max.
		Maximum		1.0ms					
	I/O capacitance	Typical	C_{iso}	0.8pF					f =1MHz V_B =0V
		Maximum		1.5pF					
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ					500V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

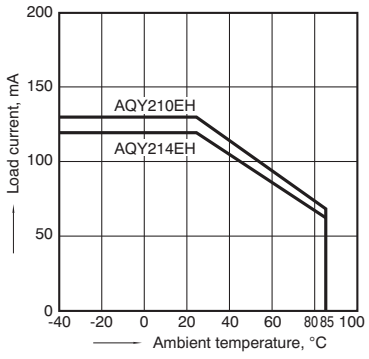
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

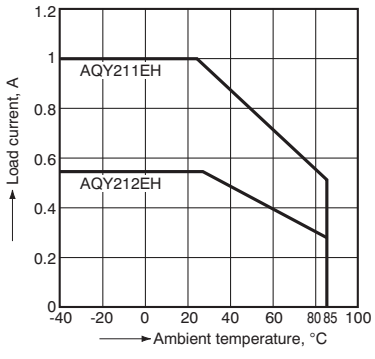
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



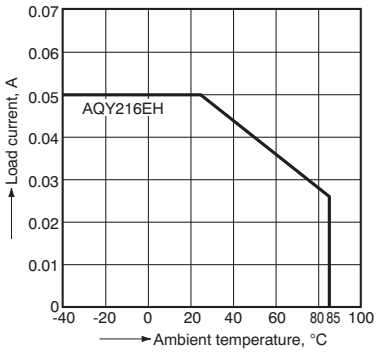
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



1-(3). Load current vs. ambient temperature characteristics

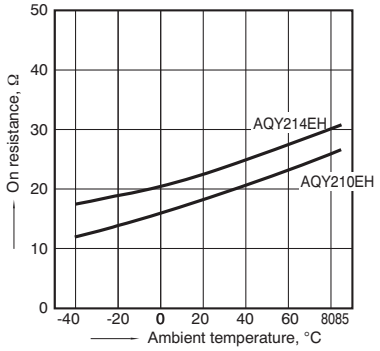
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



GU-E 1 Form A (AQY21❍EH)

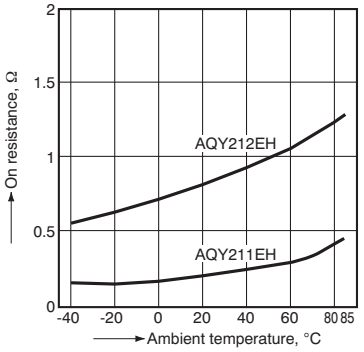
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



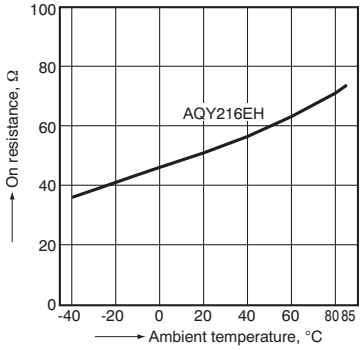
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



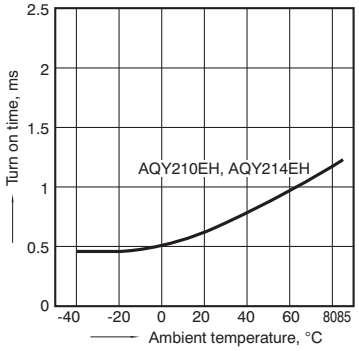
2-(3). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



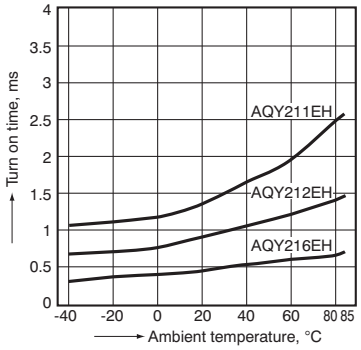
3-(1). Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



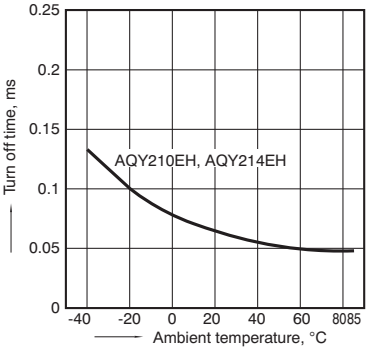
3-(2). Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



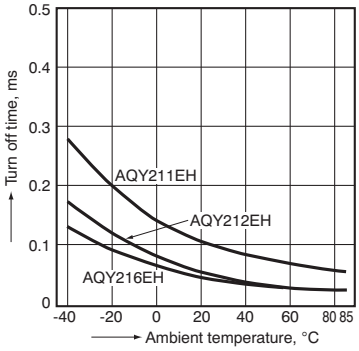
4-(1). Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



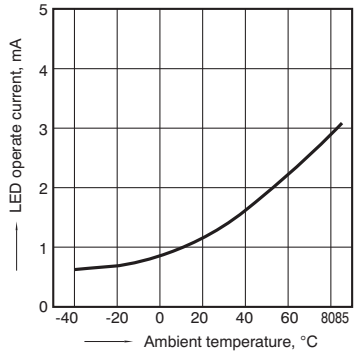
4-(2). Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



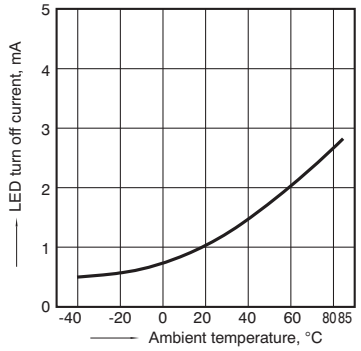
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



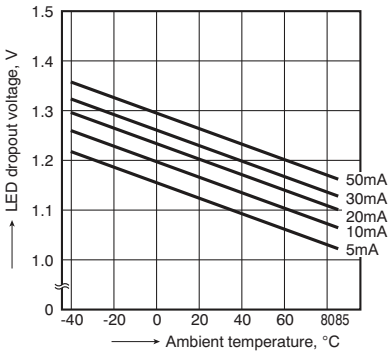
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



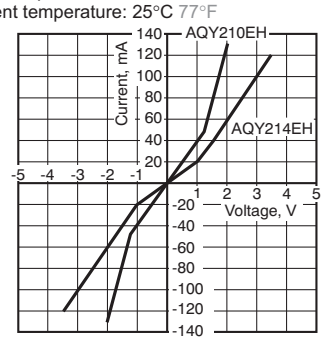
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types; LED current: 5 to 50 mA



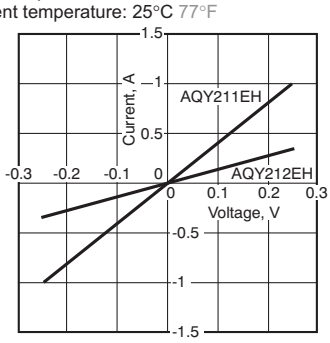
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



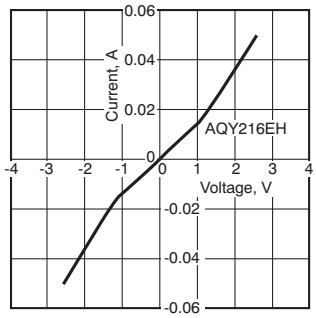
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



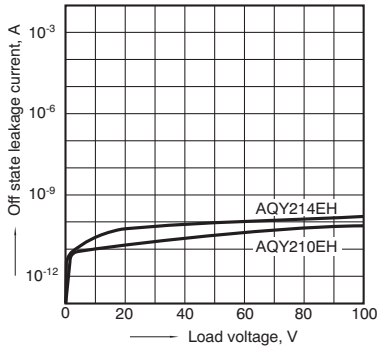
8-(3). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



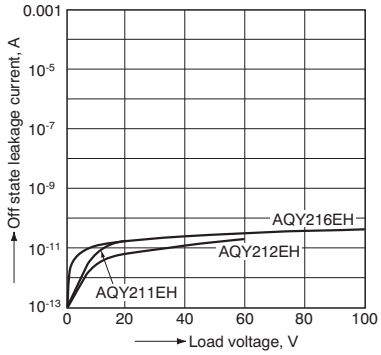
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



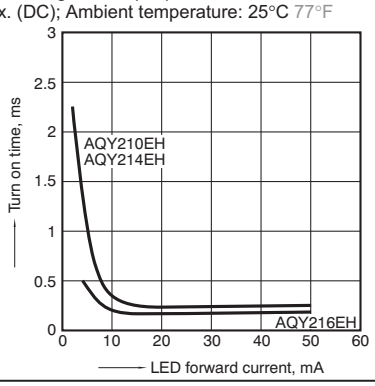
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



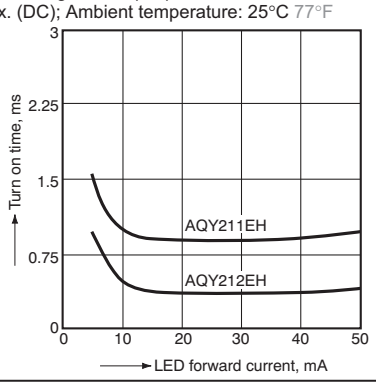
10-(1). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



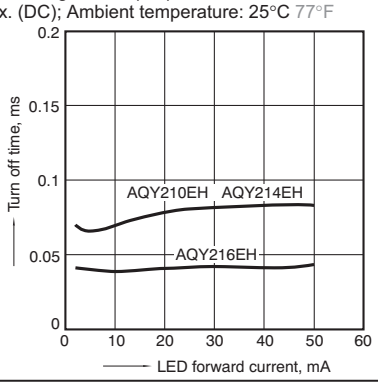
10-(2). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



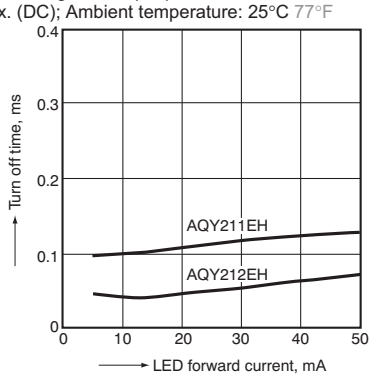
11-(1). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



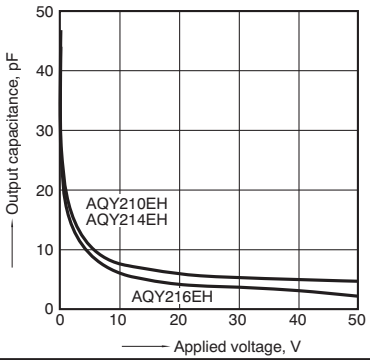
11-(2). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



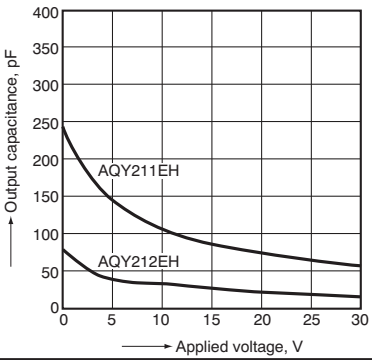
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F

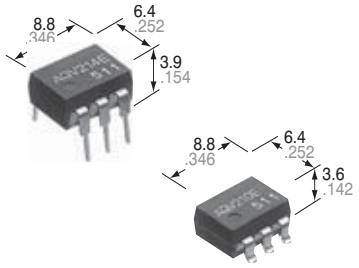


(Standard type) (Reinforced type)

Panasonic
ideas for life

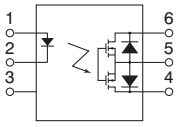
High cost-performance DIP6-pin type, reinforced insulation available

PhotoMOS Relays
GU-E 1 Form A
(AQV21❍E, AQV21❍EH)



CAD Data

mm inch



FEATURES

1. Reinforced insulation of I/O isolation voltage 5,000V (Reinforced insulation type)
2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
3. Stable on-resistance
4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computers

TYPES

	I/O isolation	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	Standard 1,500 V AC	350 V	130 mA	DIP6-pin	AQV210E	AQV210EA	AQV210EAX	AQV210EAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
		400 V	120 mA		AQV214E	AQV214EA	AQV214EAX	AQV214EAZ		
	Reinforced 5,000 V	350 V	130 mA		AQV210EH	AQV210EHA	AQV210EHAX	AQV210EHAZ		
		400 V	120 mA		AQV214EH	AQV214EHA	AQV214EHAX	AQV214EHAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

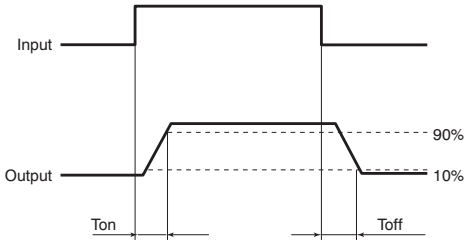
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Sym-bol	Type of connec-tion	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		5 V				
	Peak forward current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW				
Output	Load voltage (peak AC)	V_L		350 V	400 V	350 V	400 V	
	Continuous load current	I_L	A	0.13 A	0.12 A	0.13 A	0.12 A	A connection: Peak AC, DC B, C connection: DC
			B	0.15 A	0.13 A	0.15 A	0.13 A	
			C	0.17 A	0.15 A	0.17 A	0.15 A	
	Peak load current	I_{peak}		0.4 A	0.3 A	0.4 A	0.3 A	A connection: 100 ms (1 shot), V_L=DC
	Power dissipation	P_{out}		500 mW				
Total power dissipation		P_T		550 mW				
I/O isolation voltage		V_{iso}		1,500 V AC		5,000 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temp.
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	—	1.1 mA		1.6 mA		I_L = Max.
		Maximum			3 mA				
	LED turn off current	Minimum	I_{Foff}	—	0.3 mA		0.4 mA		I_L = Max.
		Typical			1.0 mA		1.5 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)				I_F = 50 mA
		Maximum			1.5 V				
Output	On resistance	Typical	R_{on}	A	23 Ω	30 Ω	23 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			35 Ω	50 Ω	35 Ω	50 Ω	
		Typical	R_{on}	B	11.5 Ω	22.5 Ω	11.5 Ω	22.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			17.5 Ω	25 Ω	17.5 Ω	25 Ω	
		Typical	R_{on}	C	6.0 Ω	11.3 Ω	6.0 Ω	11.3 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			8.8 Ω	12.5 Ω	8.8 Ω	12.5 Ω	
	Output capacitance	Typical	C_{out}	A	45 pF				I_F = 0 mA V_B = 0 V f = 1 MHz
	Off state leakage current	Maximum	I_{Leak}	—	1 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.5 ms		0.7 ms		I_F = 0 mA → 5 mA** I_L = Max.
		Maximum			2.0 ms				
	Turn off time*	Typical	T_{off}	—	0.05 ms				I_F = 0 mA → 5 mA I_L = Max.
		Maximum			1.0 ms				
	I/O capacitance	Typical	C_{iso}	—	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum			1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ				500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	Standard type: 5 Reinforced type: 5 to 10	mA

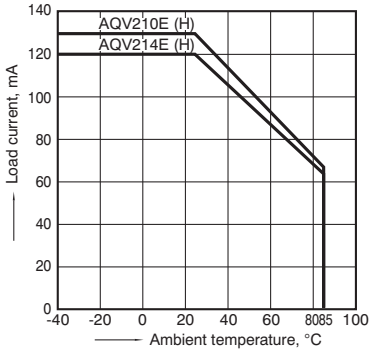
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

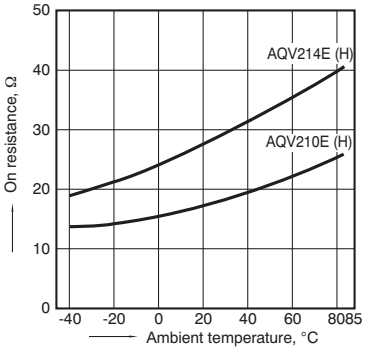
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection:A



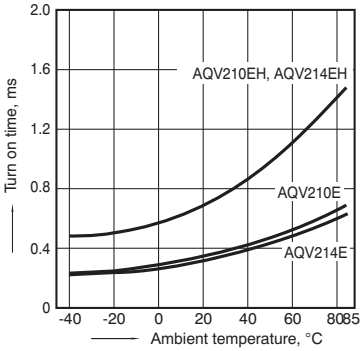
2. On-resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



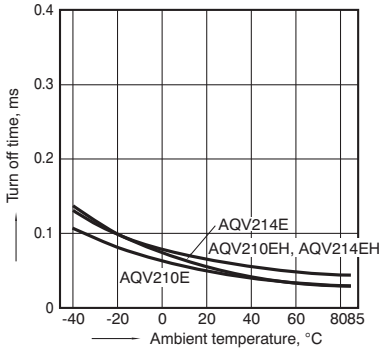
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



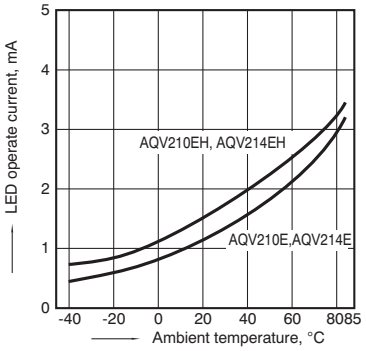
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



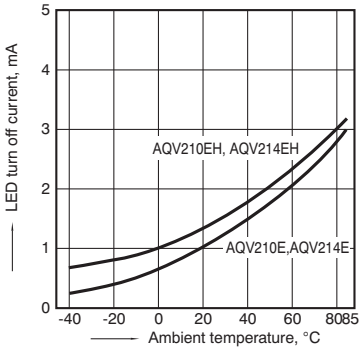
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



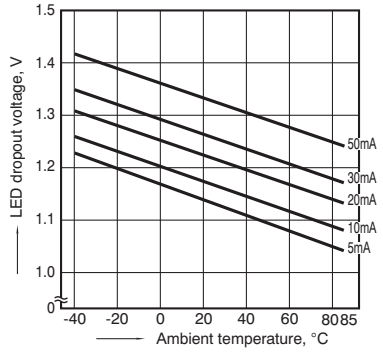
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



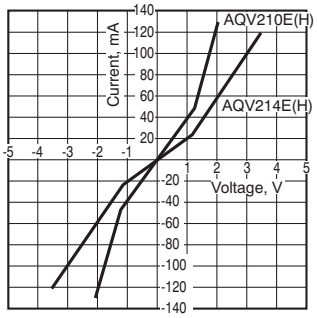
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types
LED current: 5 to 50 mA



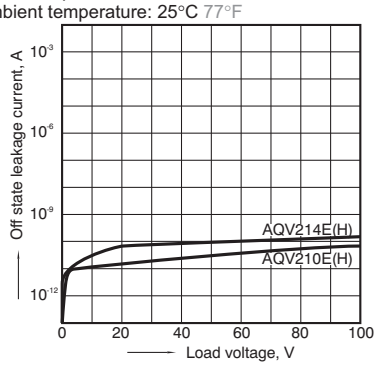
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



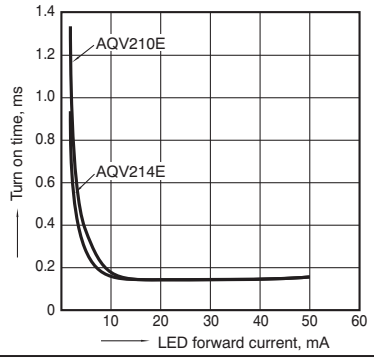
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



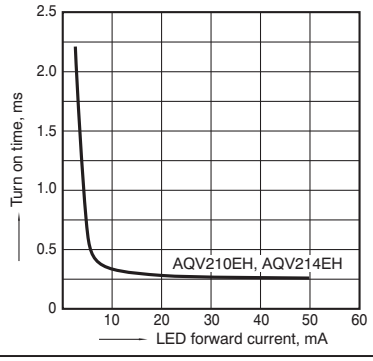
10-(1). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



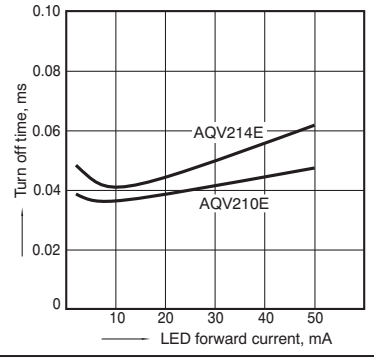
10-(2). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



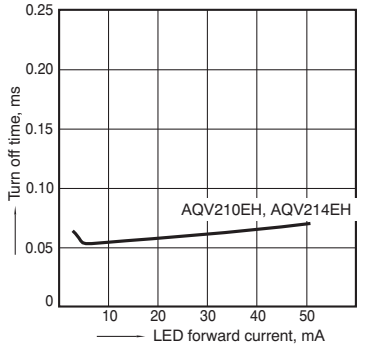
11-(1). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



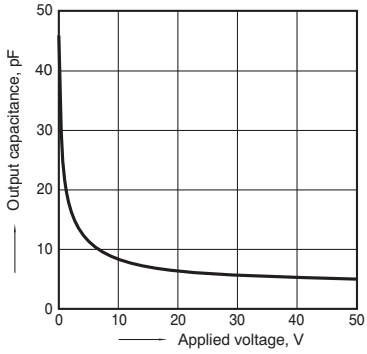
11-(2). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12.Output capacitance vs. applied voltage characteristics

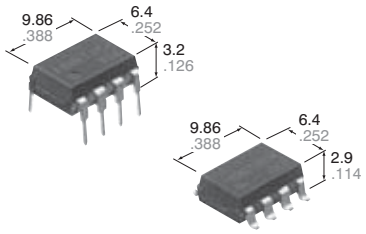
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

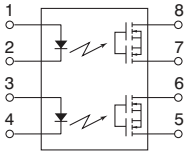
High cost-performance DIP8-pin type with reinforced insulation

PhotoMOS Relays
GU-E 2 Form A
(AQW21❍EH)



CAD Data

mm inch



FEATURES

1. Reinforced insulation of 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).
2. Applicable for 2 Form A use as well as two independent 1 Form A use
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. High sensitivity and high speed response
Can control max. 0.14 A load current with 5 mA input current. Fast operation speed of typ. 0.5 ms (AQW210EH).
5. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensing equipment

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
		Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
							Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	Reinforced 5,000 V	60 V	500 mA	DIP8-pin	AQW212EH	AQW212EHA	AQW212EHAX	AQW212EHAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
		350 V	120 mA		AQW210EH	AQW210EHA	AQW210EHAX	AQW210EHAZ		
		400 V	100 mA		AQW214EH	AQW214EHA	AQW214EHAX	AQW214EHAZ		
		600 V	40 mA		AQW216EH	AQW216EHA	AQW216EHAX	AQW216EHAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

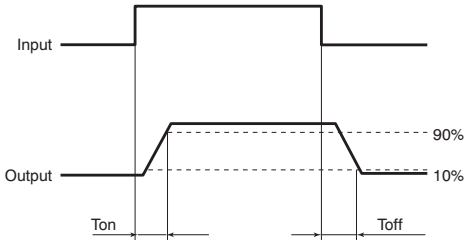
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW212EH(A)	AQW210EH(A)	AQW214EH(A)	AQW216EH(A)	Remarks
Input	LED forward current	I_F	50mA				
	LED reverse voltage	V_R	5V				
	Peak forward current	I_{FP}	1A				f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW				
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	600 V	
	Continuous load current	I_L	0.5 A (0.6 A)	0.12 A (0.14 A)	0.1 A (0.13 A)	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	1.5 A	0.36 A	0.3 A	0.15 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800mW				
Total power dissipation		P_T	850mW				
I/O isolation voltage		V_{iso}	5,000 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW212EH(A)	AQW210EH(A)	AQW214EH(A)	AQW216EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2mA				I_L=Max.
		Maximum		3.0mA				
	LED turn off current	Minimum	I_{Foff}	0.4mA				I_L=Max.
		Typical		1.1mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F=5mA)				I_F=50mA
		Maximum		1.5V				
Output	On resistance	Typical	R_{on}	0.83Ω	18Ω	26Ω	52Ω	I_F=5mA I_L=Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	120Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA				I_F=0mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1ms	0.5ms			I_F=5mA I_L=Max.
		Maximum		4ms	2.0ms			
	Turn off time*	Typical	T_{off}	0.08ms			0.04ms	I_F=5mA I_L=Max.
		Maximum		1.0ms				
	I/O capacitance	Typical	C_{iso}	0.8pF				f =1MHz V_B =0V
		Maximum		1.5pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ				500V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

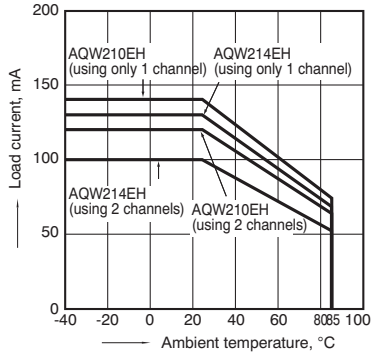
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

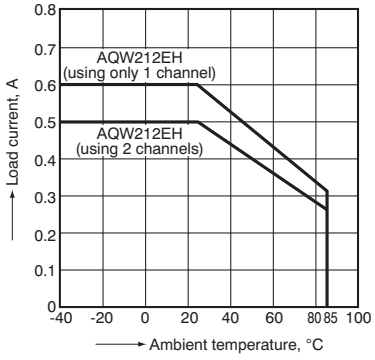
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –20°C to +85°C
–4°F to +185°F



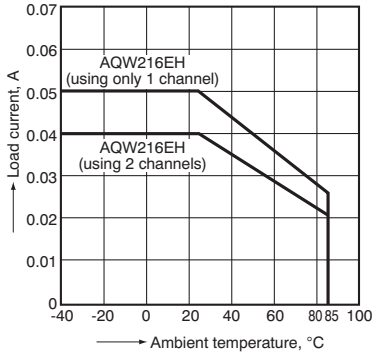
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



1-(3). Load current vs. ambient temperature characteristics

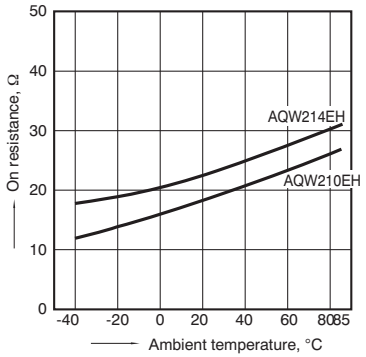
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



GU-E 2 Form A (AQW21❍EH)

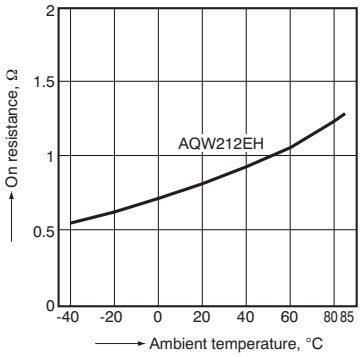
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



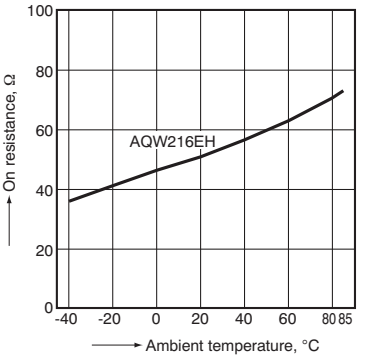
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



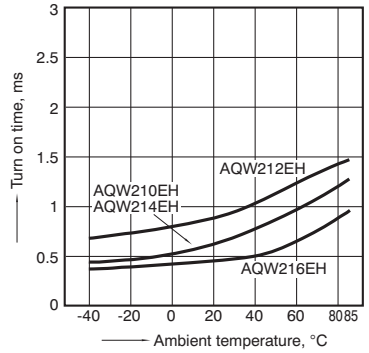
2-(3). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



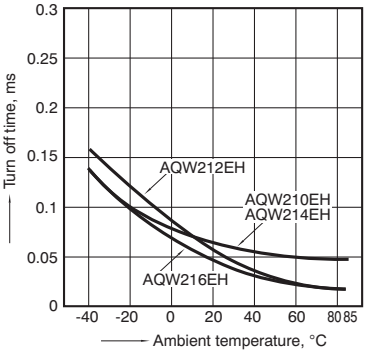
3. Turn on time vs. ambient temperature characteristics

Sample: All types
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



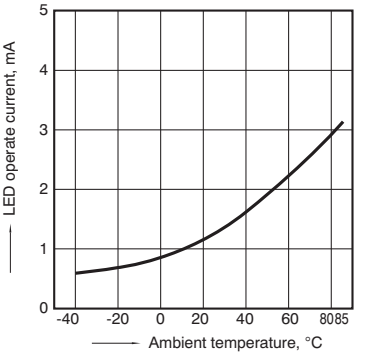
4. Turn off time vs. ambient temperature characteristics

Sample: All types
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



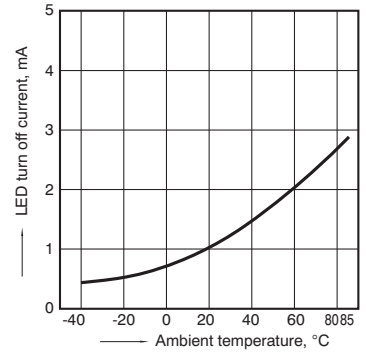
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



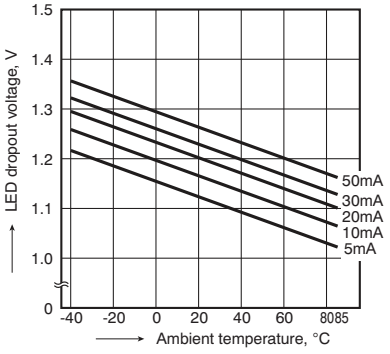
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



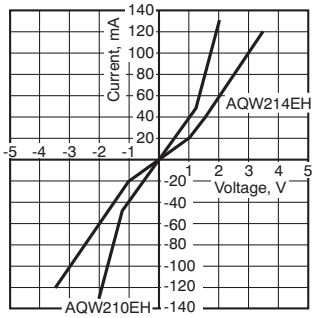
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types; LED current: 5 to 50 mA



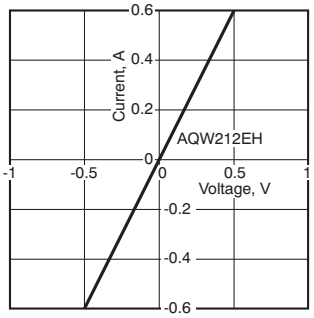
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



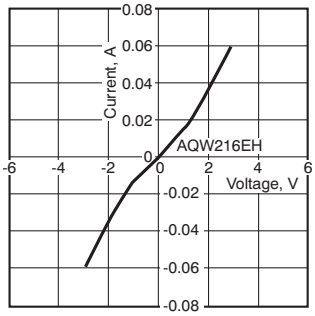
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



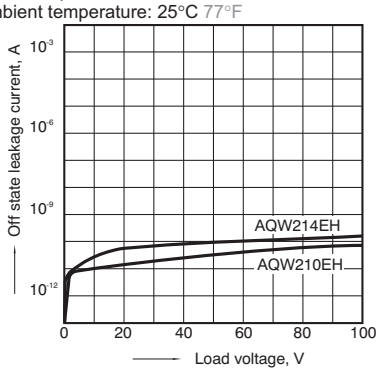
8-(3). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



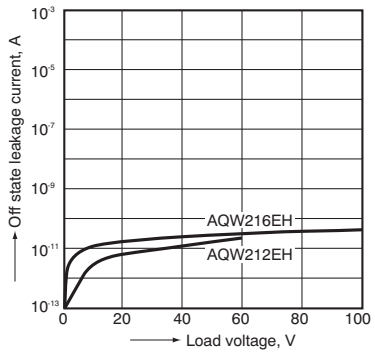
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



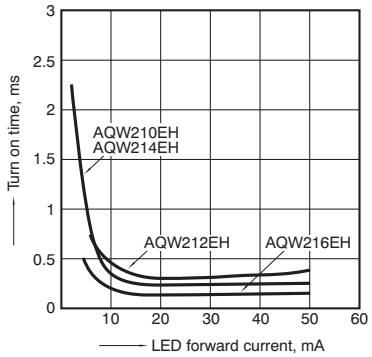
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



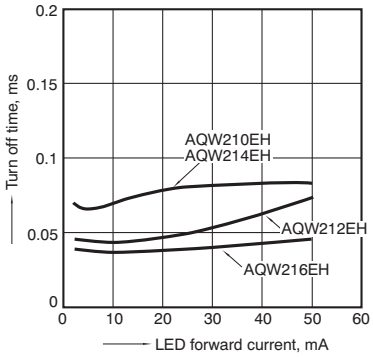
10. Turn on time vs. LED forward current characteristics

Sample: All types
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



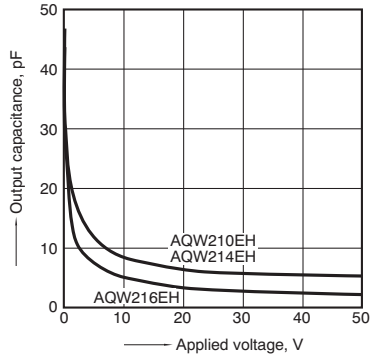
11. Turn off time vs. LED forward current characteristics

Sample: All types
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



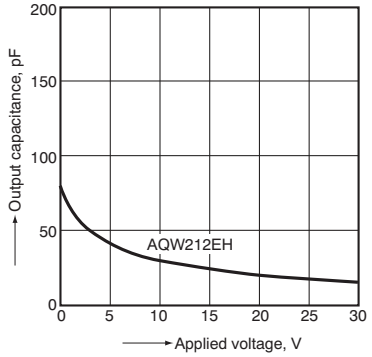
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

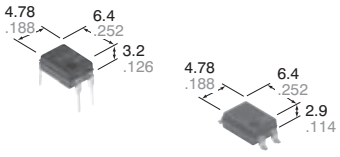
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

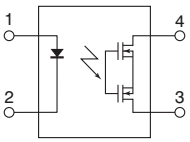
Normally closed DIP4-pin economic type with reinforced insulation

PhotoMOS Relays
GU-E 1 Form B
(AQY41○EH)



CAD Data

mm inch



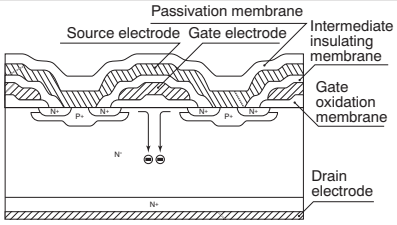
FEATURES

1. High cost-performance type of PhotoMOS relay 1 Form B output

2. Low on-resistance

This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Reinforced insulation of 5,000 V

More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).

4. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity and low on-resistance

Can control max. 0.55 A load current with 5 mA input current.
Low on-resistance of typ.1Ω (AQY412EH).

6. Low-level off-state leakage current

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Modem
- Telephone equipment
- Electricity, plant equipment
- Sensing equipment

TYPES

Type	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
		Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
							Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	Reinforced 5,000 V	60 V	550 mA	DIP4-pin	AQY412EH	AQY412EHA	AQY412EHAX	AQY412EHAZ	1 tube contains: 100 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
		350 V	130 mA		AQY410EH	AQY410EHA	AQY410EHAX	AQY410EHAZ		
		400 V	120 mA		AQY414EH	AQY414EHA	AQY414EHAX	AQY414EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the initial letters of the part number "AQY", the surface mount terminal shape indicator "A" and the packing style indicator "X" or "Z" are not marked on the relay. (Ex. the label for product number AQY412EHAX is 412EH.)

RATING

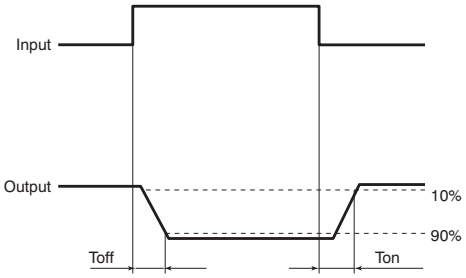
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY412EH(A)	AQY410EH(A)	AQY414EH(A)	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.55 A	0.13 A	0.12 A	Peak AC, DC
	Peak load current	I_{peak}	1.5 A	0.4 A	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	500 mW			
Total power dissipation		P_T	550 mW			
I/O isolation voltage		V_{iso}	5,000 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY412EH(A)	AQY410EH(A)	AQY414EH(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	1.4 mA			I_L=Max.
		Maximum		3.0 mA			
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA			I_L=Max.
		Typical		1.3 mA			
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1Ω	18Ω	26Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	
	Off state leakage current	Maximum	I_{Leak}	10μA			I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	3.0 ms	1.0 ms	0.8 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		10.0 ms	3.0 ms		
	Reverse (ON) time*	Typical	T_{on}	0.2 ms	0.3 ms	0.2 ms	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1.0 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f =1MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ			500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

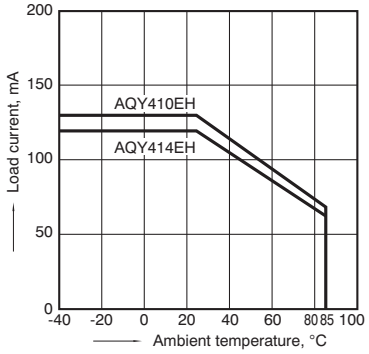
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

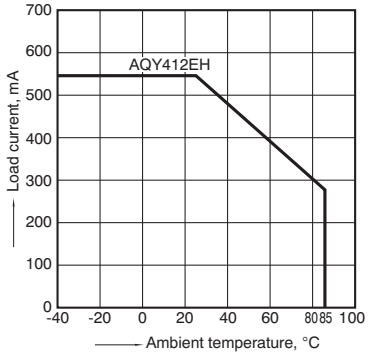
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



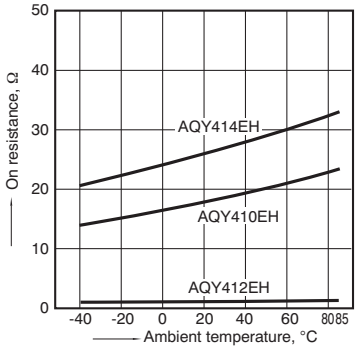
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



2. On resistance vs. ambient temperature characteristics

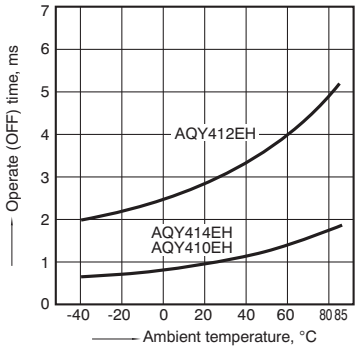
Measured portion: between terminals 3 and 4;
LED current: 0 mA; Load voltage: Max.(DC);
Continuous load current: Max. (DC)



GU-E 1 Form B (AQY41❍EH)

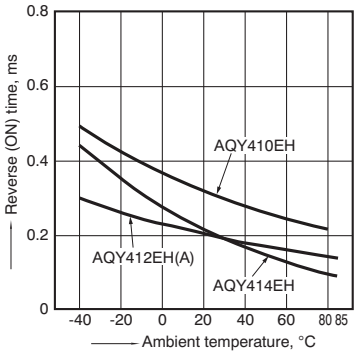
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



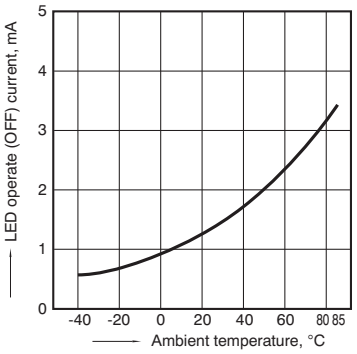
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



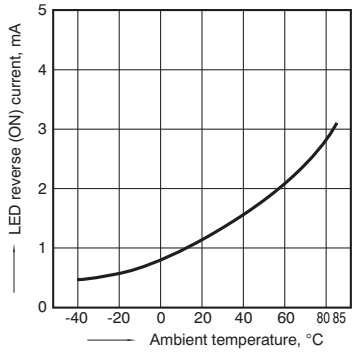
5. LED operate (OFF) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



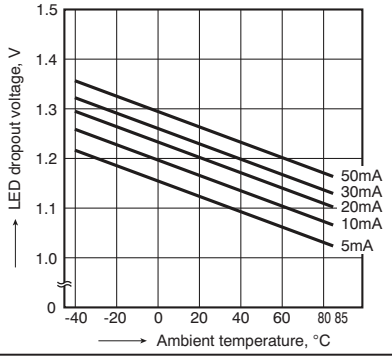
6. LED reverse (ON) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



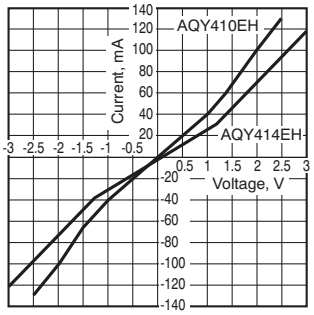
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



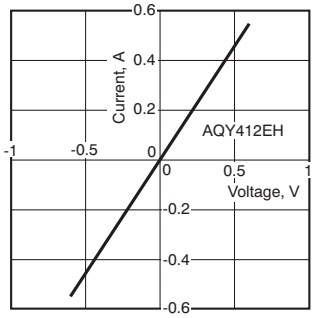
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



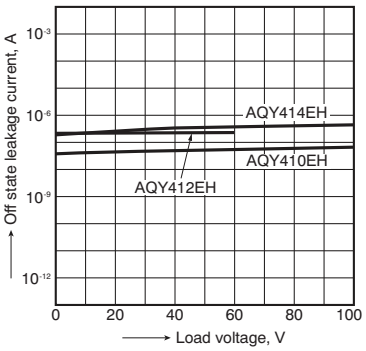
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



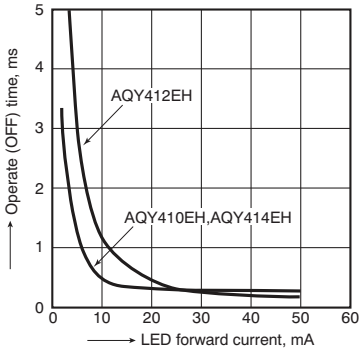
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



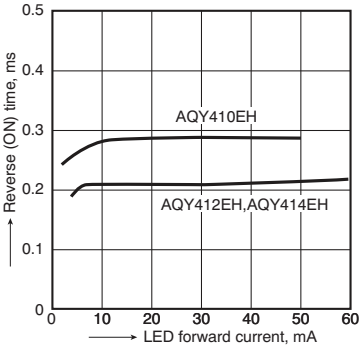
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



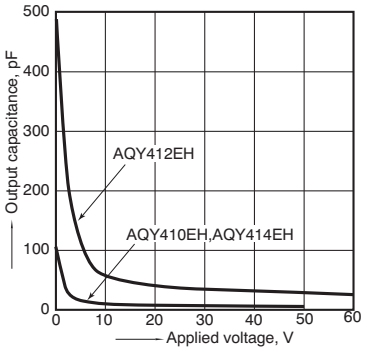
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



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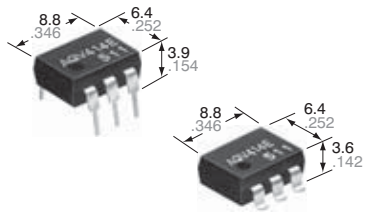
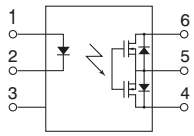
Normally closed DIP6-pin economic type with reinforced insulation

PhotoMOS Relays
GU-E 1 Form B
(AQV414E, AQV41❍EH)



CAD Data

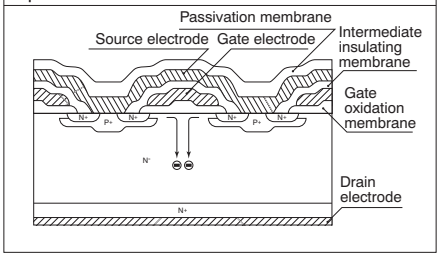
mm inch



FEATURES

1. High cost-performance type of PhotoMOS relay 1 Form B output
2. 60V type couples high capacity (0.55A) with low on-resistance (typ. 1Ω).
3. Low on-resistance
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity and low on-resistance
Can control max. 0.55 A load current with 5 mA input current.
Low on-resistance of typ. 1Ω (AQV412EH).
6. Low-level off-state leakage current of max. 1 μA (AQV414E)
7. Reinforced insulation 5,000 V type also available
More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Telephone equipment
- Sensing equipment

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	1,500 V AC (Standard)	400 V	120 mA	DIP6-pin	AQV414E	AQV414EA	AQV414EAX	AQV414EAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
	5,000 V AC (Reinforced)	60 V	550 mA		AQV412EH	AQV412EHA	AQV412EHAX	AQV412EHAZ		
		350 V	130 mA		AQV410EH	AQV410EHA	AQV410EHAX	AQV410EHAZ		
		400 V	120 mA		AQV414EH	AQV414EHA	AQV414EHAX	AQV414EHAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator "A" and the packing style indicator "X" or "Z" are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

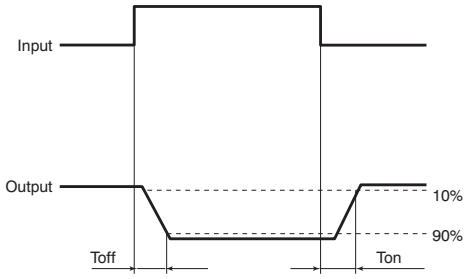
Item		Symbol	Type of connection	AQV414E(A)	AQV412EH(A)	AQV410EH(A)	AQV414EH(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		5 V				
	Peak forwrd current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW				
Output	Load voltage (peak AC)	V_L		400 V	60 V	350 V	400 V	
	Continuous load current	I_L	A	0.12 A	0.55 A	0.13 A	0.12 A	A connection: Peak AC, DC B,C connection: DC
			B	0.13 A	0.65 A	0.15 A	0.13 A	
			C	0.15 A	0.8 A	0.17 A	0.15 A	
	Peak load current	I_{peak}		0.3 A	1.5 A	0.4 A	0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW				
Total power dissipation		P_T		550 mW				
I/O isolation voltage		V_{iso}		1,500 V AC	5,000 V AC			
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

GU-E 1 Form B (AQV414E, AQV41❍EH)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV414E(A)	AQV412EH(A)	AQV410EH(A)	AQV414EH(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	—	1.45 mA	1.9 mA			I_L= Max.
		Maximum			3.0 mA				
	LED reverse (ON) current	Minimum	I_{Fon}	—	0.3 mA	0.4 mA			I_L = Max.
		Typical			1.40 mA	1.8 mA			
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F= 5 mA)				I_F = 50 mA
		Maximum			1.5 V				
Output	On resistance	Typical	R_{on}	A	26 Ω	1 Ω	18 Ω	25.2 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			50 Ω	2.5 Ω	35 Ω	50 Ω	
		Typical	R_{on}	B	20 Ω	0.55 Ω	13 Ω	19 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	1.3 Ω	17.5 Ω	25 Ω	
		Typical	R_{on}	C	10 Ω	0.3 Ω	6.5 Ω	10 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	0.7 Ω	8.8 Ω	12.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	10 μA			I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	—	0.7 ms	3 ms	1.5 ms	1.3 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum			2.0 ms	8 ms	3.0 ms		
	Reverse (ON) time*	Typical	T_{on}	—	0.1 ms	0.3 ms			I_F = 5 mA → 0 mA I_L = Max.
		Maximum			1.0 ms	1.5 ms			
	I/O capacitance	Typical	C_{iso}	—	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum			1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ				500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	Standard type: 5 Reinforced type: 5 to 10	mA

■ For Dimensions, see page 60.
■ For Schematic and Wiring Diagrams, see page 66.
■ For Cautions for Use, see page 71.

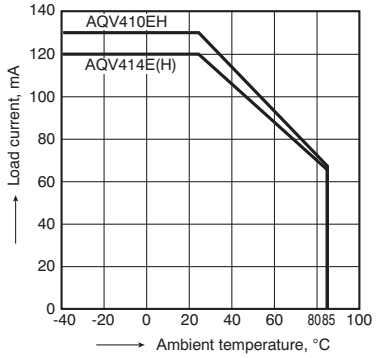
■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

13-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

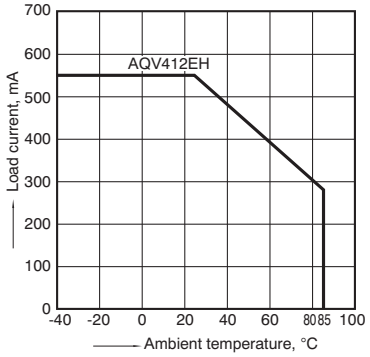
Type of connection: A



1-(2). Load current vs. ambient temperature characteristics

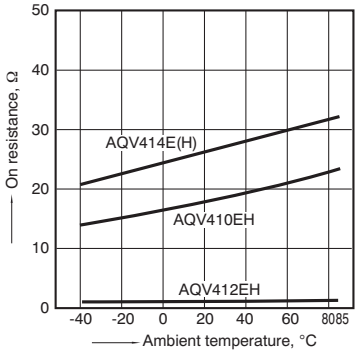
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



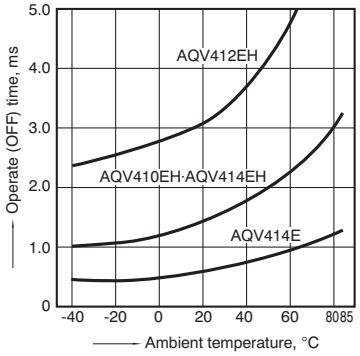
14.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



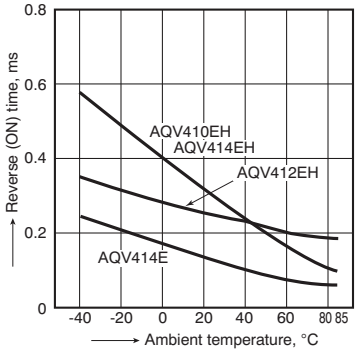
15.Operate (OFF) time vs. ambient temperature characteristics

LED current: 5mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



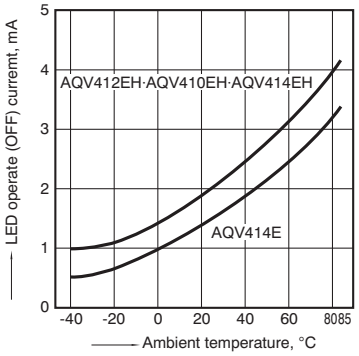
16.Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



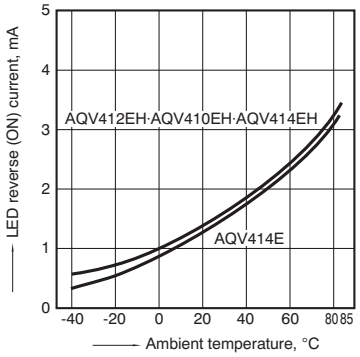
17.LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



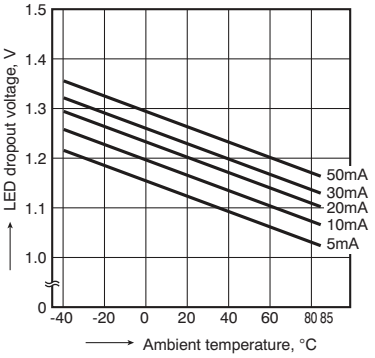
18.LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



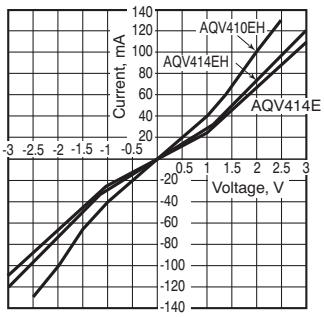
19.LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



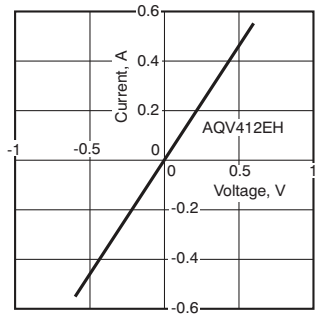
20-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



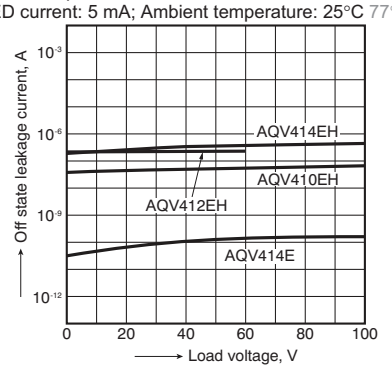
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



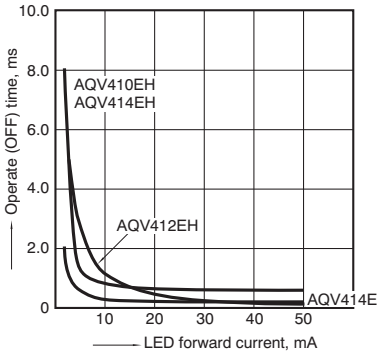
21.Off state leakage current vs. load voltage characteristics

Sample: All types;
Measured portion: between terminals 4 and 6;
LED current: 5 mA; Ambient temperature: 25°C 77°F



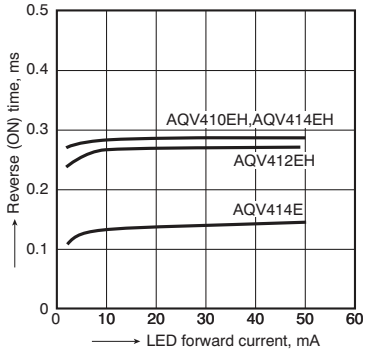
22.Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



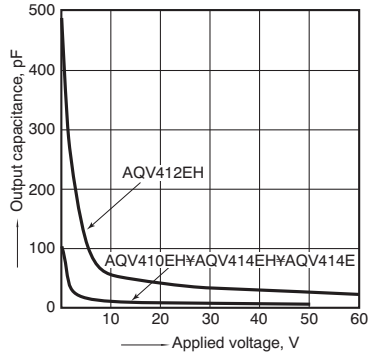
23.Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



24.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



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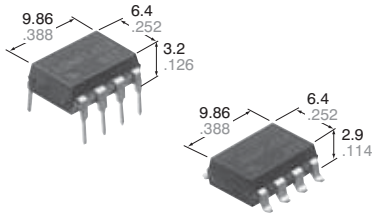
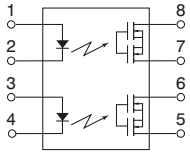
Normally closed DIP8-pin economic type with reinforced insulation

PhotoMOS Relays
GU-E 2 Form B
(AQW414EH)



CAD Data

mm inch



FEATURES

1. Reinforced insulation of 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).
2. Applicable for 2 Form B use as well as two independent 1 Form B use
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. High sensitivity and high speed response
Can control max. 0.13 A load current with 5 mA input current. Fast operation speed of typ. 0.8 ms.
5. Low-level off state leakage current

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensing equipment

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	Reinforced 5,000 V	400 V	100 mA	DIP8-pin	AQW414EH	AQW414EHA	AQW414EHAX	AQW414EHAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

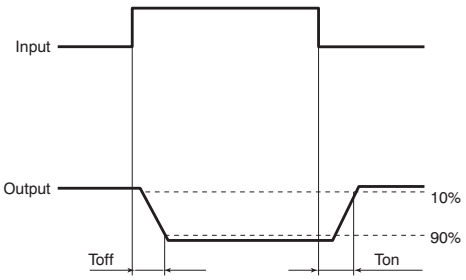
Item		Symbol	AQW414EH(A)	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1 channel.
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800mW	
Total power dissipation		P_T	850mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

GU-E 2 Form B (AQW414EH)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW414EH(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	1.3mA	I_L=Max.
		Maximum		3.0mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4mA	I_L=Max.
		Typical		1.2mA	
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F=5mA)	I_F=50mA
		Maximum		1.5V	
Output	On resistance	Typical	R_{on}	26Ω	I_F=0mA I_L=Max. Within 1 s on time
		Maximum		35Ω	
	Off state leakage current	Maximum	I_{Leak}	10μA	I_F=5mA V_L=Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	0.8ms	I_F=0mA→5mA I_L=Max.
		Maximum		3.0ms	
	Reverse (ON) time*	Typical	T_{on}	0.2ms	I_F=5mA→0mA I_L=Max.
		Maximum		1.0ms	
	I/O capacitance	Typical	C_{iso}	0.8pF	f =1MHz V_B =0V
		Maximum		1.5pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

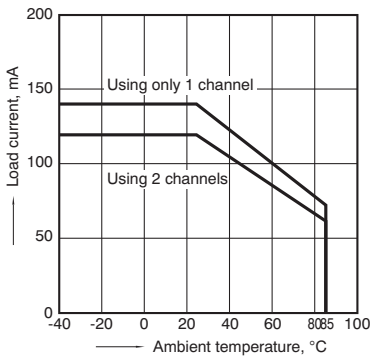
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

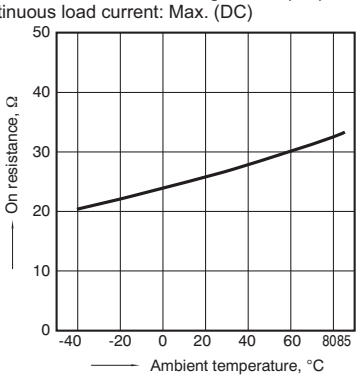
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



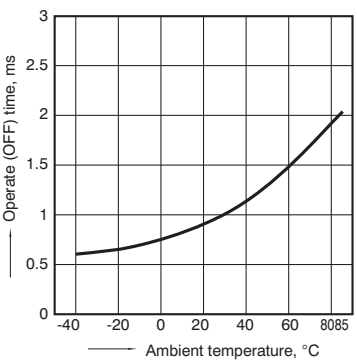
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



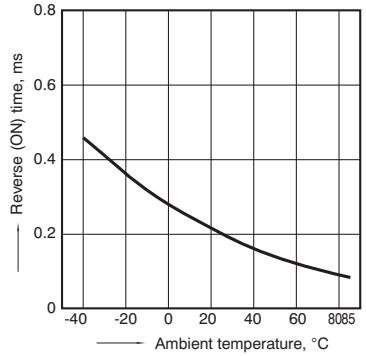
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



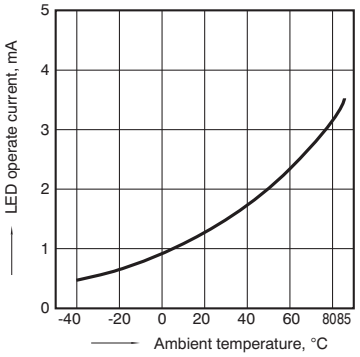
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



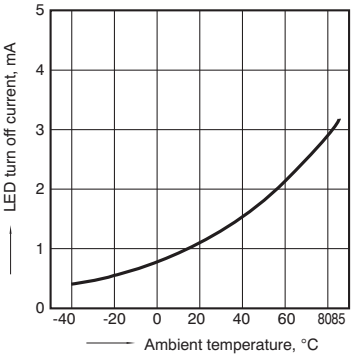
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



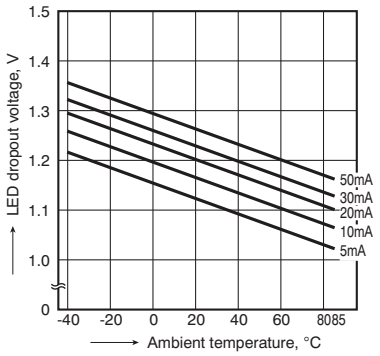
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



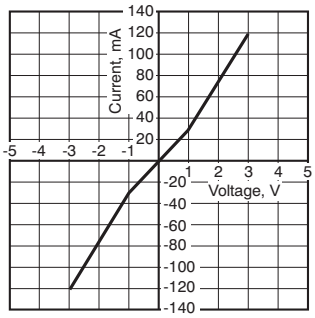
7. LED dropout voltage vs. ambient temperature characteristics;

LED current: 5 to 50 mA



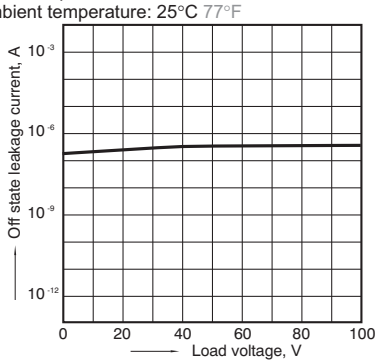
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



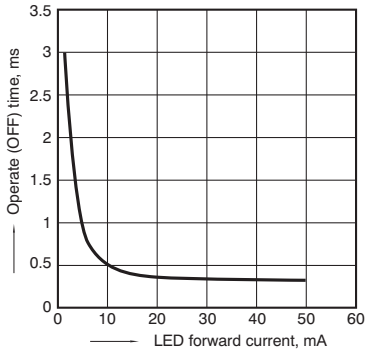
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



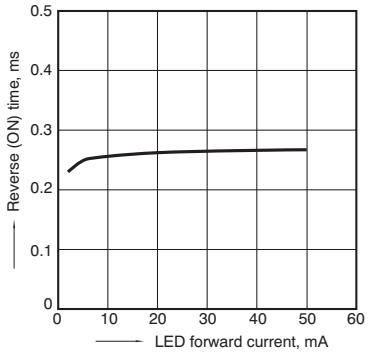
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



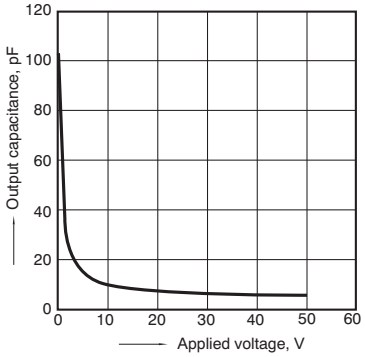
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



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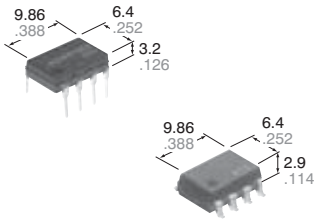
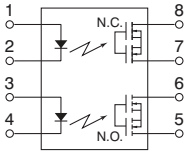
Both NO and NC contacts incorporated in a compact DIP8-pin Reinforced insulation

PhotoMOS Relays
GU-E Form A & B
(AQW61❍EH)



CAD Data

mm inch



FEATURES

1. 60V type couples high capacity (0.5A) with low on-resistance (typ. 1Ω).
2. Reinforced insulation 5,000 V
More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).
3. Aprrox. 1/2 the space compared with the mounting area of a set of 1 Form A and 1 Form B PhotoMOS relays
4. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use
5. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
6. High sensitivity and high speed response
Can control max. 0.14 A load current with 5 mA input current. Fast operation speed of typ. 0.5 ms [N.O.] (AQW610EH).
7. Low-level off-state leakage current

TYPICAL APPLICATIONS

- Power supply
- Measuring instruments
- Security equipment
- Modem
- Telephone equipment
- Electricity, plant equipment
- Sensing equipment

TYPES

	I/O isolation voltage	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	Reinforced 5,000 V	60 V	500 mA	DIP8-pin	AQW612EH	AQW612EHA	AQW612EHAX	AQW612EHAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
		350 V	120 mA		AQW610EH	AQW610EHA	AQW610EHAX	AQW610EHAZ		
		400 V	100 mA		AQW614EH	AQW614EHA	AQW614EHAX	AQW614EHAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

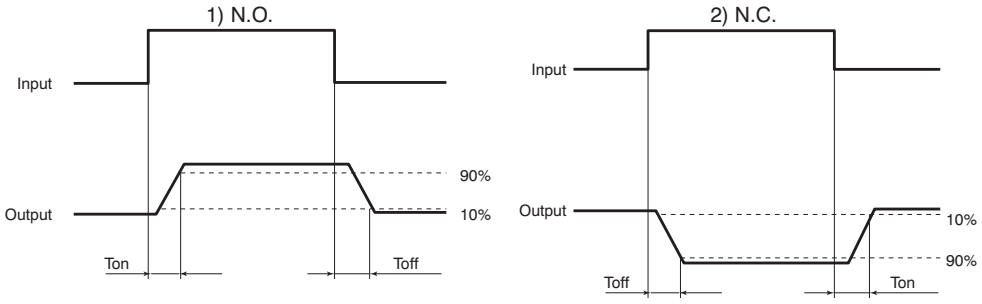
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW612EH(A)	AQW610EH(A)	AQW614EH(A)	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.5 A (0.6 A)	0.12 A (0.14 A)	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	1.5 A	0.36 A	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800 mW			
Total power dissipation		P_T	850 mW			
I/O isolation voltage		V_{iso}	5,000 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW612EH(A)	AQW610EH(A)	AQW614EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}(N.O.) I_{Foff}(N.C.)	1.3 mA			I_L=Max.
		Maximum		3.0 mA			
	LED reverse current	Minimum	I_{Foff}(N.O.) I_{Fon}(N.C.)	0.4 mA			I_L=Max.
		Typical		1.3 mA			
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F = 5 mA)			I_F=50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1Ω	18Ω	26Ω	I_F=5mA (N.O.) I_F = 0mA (N.C.) I_L = Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA (N.O.), 10μA (N.C.)			I_F=0 mA (N.O.) I_F = 5 mA (N.C.) V_L = Max.
Transfer characteristics	Operate time*	Typical	T_{on}(N.O.) T_{off}(N.C.)	1.0 ms (N.O.) 3.0 ms (N.C.)	0.5 ms (N.O.) 1.0 ms (N.C.)	0.5 ms (N.O.) 0.8 ms (N.C.)	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		4.0 ms (N.O.) 10.0 ms (N.C.)	3.0 ms		
	Reverse time*	Typical	T_{off}(N.O.) T_{on}(N.C.)	0.05ms (N.O.), 0.2ms (N.C.)	0.08ms (N.O.), 0.3ms (N.C.)	0.08ms (N.O.), 0.2ms (N.C.)	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1.0ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ			500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

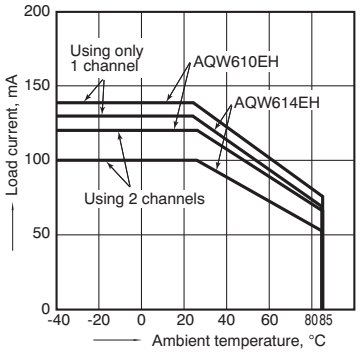
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

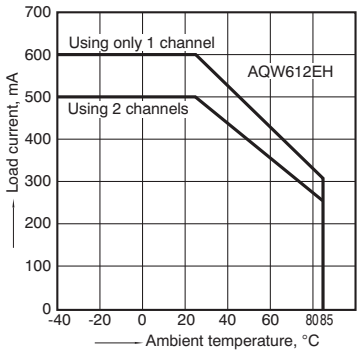
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



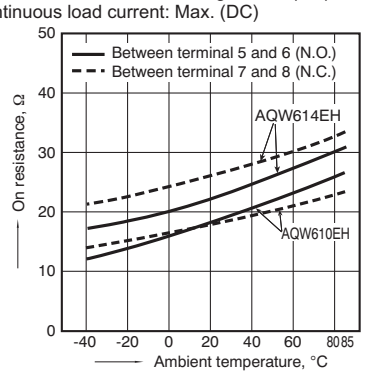
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



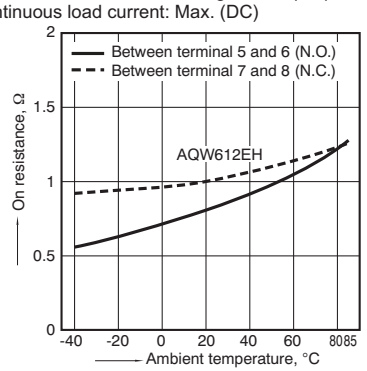
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage; Max. (DC)
Continuous load current: Max. (DC)



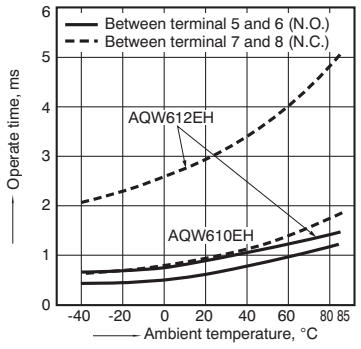
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage; Max. (DC)
Continuous load current: Max. (DC)



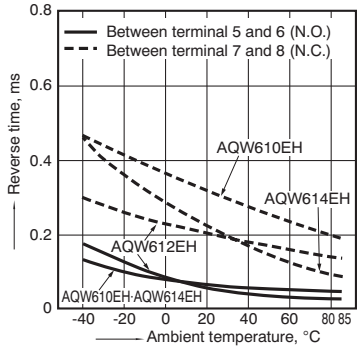
3. Operate time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



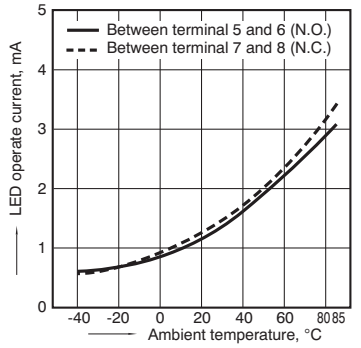
4. Reverse time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



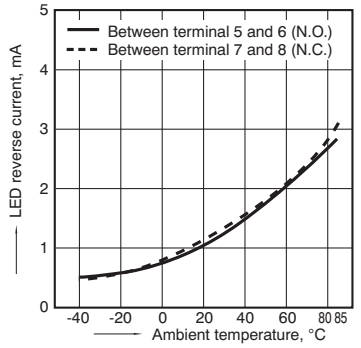
5. LED operate current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



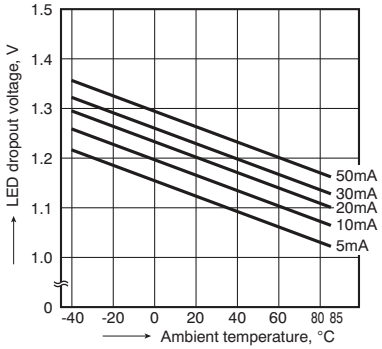
6. LED reverse current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



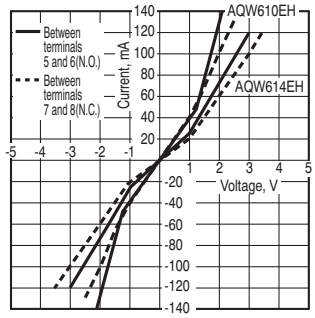
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



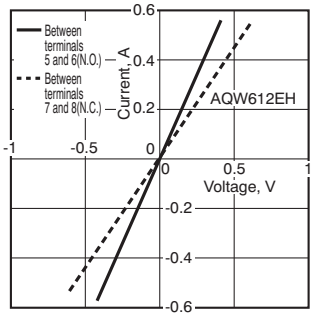
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



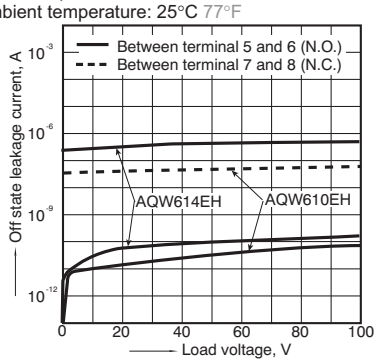
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



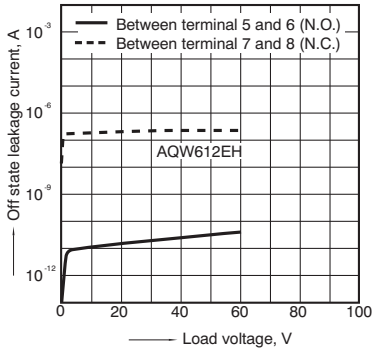
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



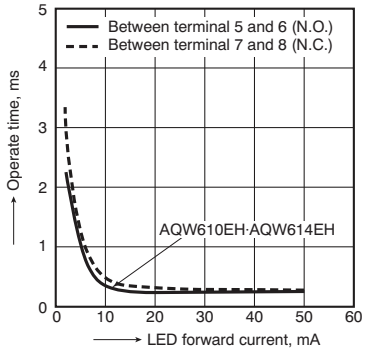
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



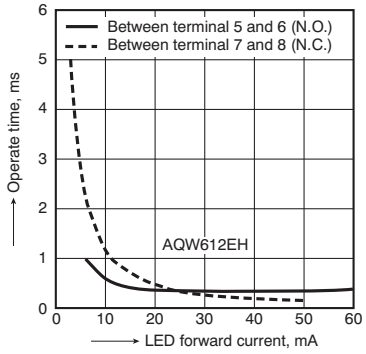
10-(1). Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



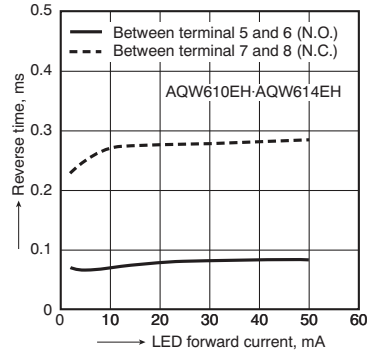
10-(2). Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



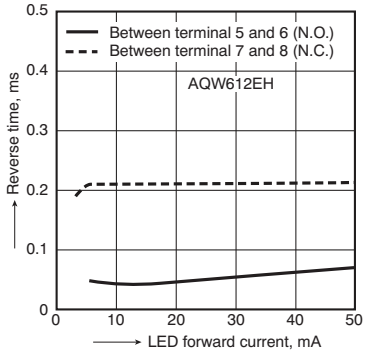
11-(1). Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



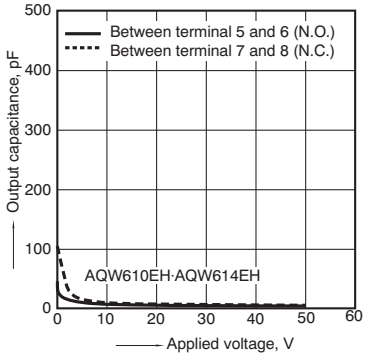
11-(2). Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



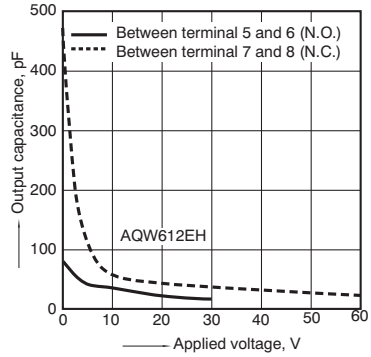
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

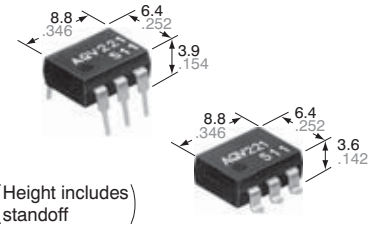
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

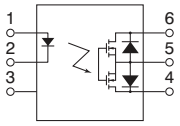
DIP6-pin type suited for radio frequent switching

PhotoMOS Relays
RF 1 Form A
(AQV22❍)



CAD Data

mm inch



FEATURES

1. High frequency characteristics with low capacitance between output terminals
Low output capacitance: typ. 4.8 pF
Isolation loss: 40 dB or more (at 1 MHz) (AQV225)
2. High speed switching
Turn on time: typ. 0.1 ms
Turn off time: typ. 0.03 ms
3. Low-level off state leakage current of typ. 0.03 nA
4. Controls low-level analog signals
PhotoMOS relay features extremely low closed-circuit offset voltages to enable control of small analog signals without distortion.

TYPICAL APPLICATIONS

1. Measuring instruments
Scanner, IC checker, Board tester, etc.
2. Audio visual equipment
CD, VCR
3. Security equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
	Load voltage	Load current		Through hole terminal	Surface-mount terminal			Tube	Tape and reel
				Tube packing style		Tape and reel packing style			
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	40 V	80 mA	DIP6-pin	AQV221	AQV221A	AQV221AX	AQV221AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs
	80 V	50 mA		AQV225	AQV225A	AQV225AX	AQV225AZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal shape indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

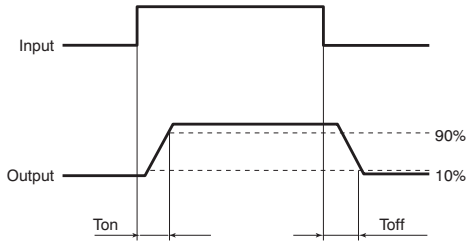
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV221(A)	AQV225(A)	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (peak AC)	V_L		40 V	80 V	
	Continuous load current	I_L	A	0.08 A	0.05 A	A connection: Peak AC, DC B, C connection: DC
			B	0.09 A	0.06 A	
			C	0.12 A	0.075 A	
	Peak load current	I_{peak}		0.18 A	0.15 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		230 mW		
Total power dissipation		P_T		280 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV221(A)	AQV225(A)	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.9 mA		I_L= Max.
		Maximum			3 mA		
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA		I_L= Max.
		Typical			0.85 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum			1.5 V		
Output	On resistance	Typical	R_{on}	A	22 Ω	36 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			35 Ω	50 Ω	
		Typical	R_{on}	B	13 Ω	21 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			18 Ω	25 Ω	
		Typical	R_{on}	C	6.5 Ω	10.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			9 Ω	12.5 Ω	
	Output capacitance	Typical	C_{out}	—	5.6 pF	4.8 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum			8 pF		
	Off state leakage current	Typical	I_{Leak}	—	0.03 nA		I_F = 0 mA V_L = Max.
		Maximum			10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.1 ms		I_F = 5 mA I_L = Max.
		Maximum			0.3 ms		
	Turn off time*	Typical	T_{off}	—	0.03 ms		I_F = 5 mA I_L = Max.
		Maximum			0.1 ms		
	I/O capacitance	Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum			1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

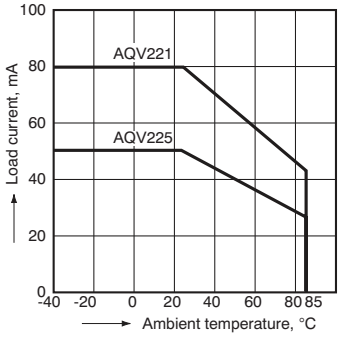
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

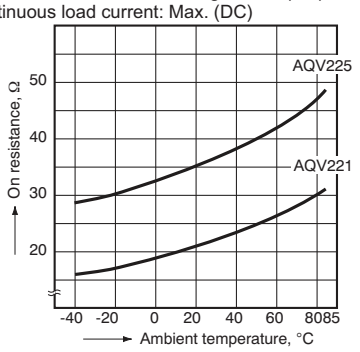
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



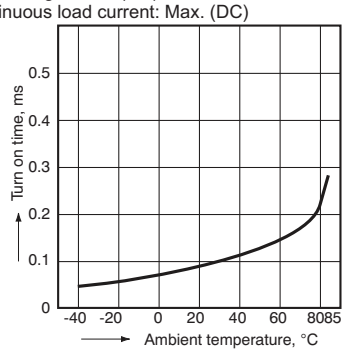
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



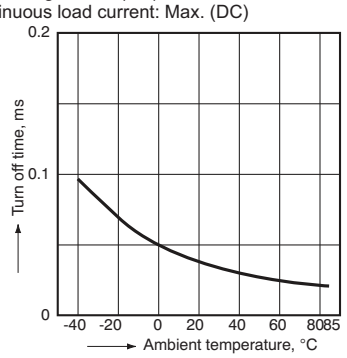
3. Turn on time vs. ambient temperature characteristics

Sample: AQV221, AQV225; LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



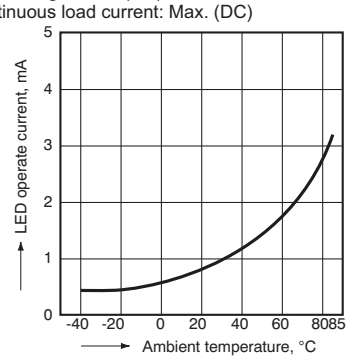
4. Turn off time vs. ambient temperature characteristics

Sample: AQV221, AQV225; LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



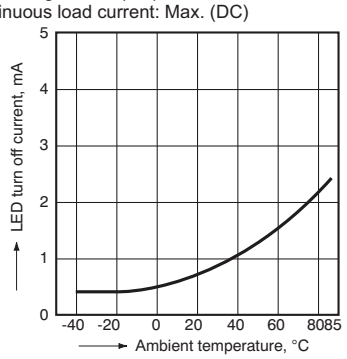
5. LED operate current vs. ambient temperature characteristics

Sample: AQV221, AQV225;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



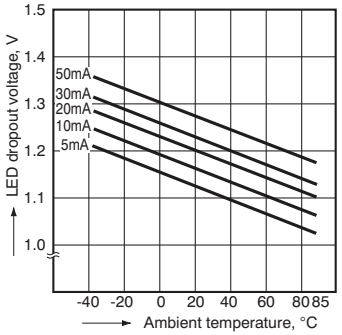
6. LED turn off current vs. ambient temperature characteristics

Sample: AQV221, AQV225;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



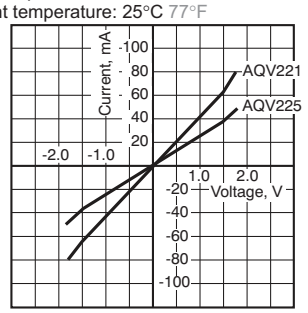
7. LED dropout voltage vs. ambient temperature characteristics

Sample: AQV221, AQV225;
LED current: 5 to 50 mA



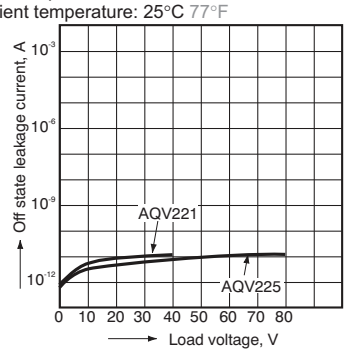
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



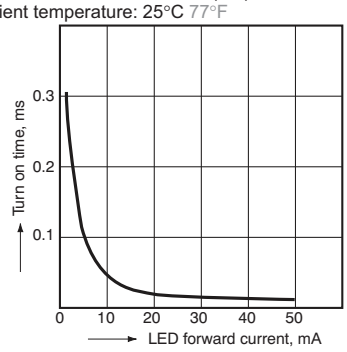
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



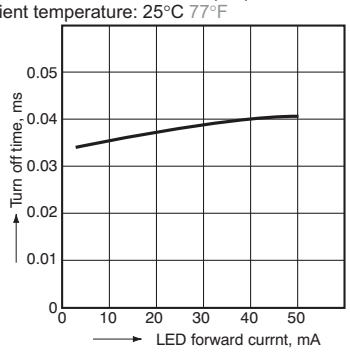
10.Turn on time vs. LED forward current characteristics

Sample: AQV221, AQV225;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



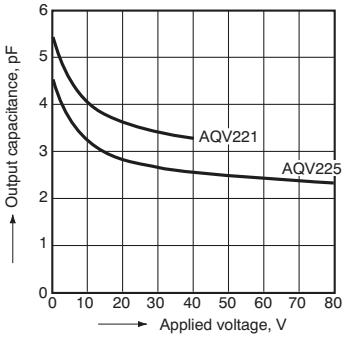
11.Turn off time vs. LED forward current characteristics

Sample: AQV221, AQV225;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



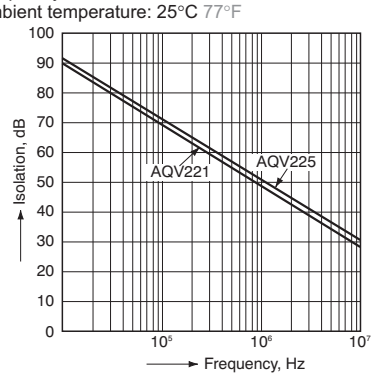
12.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



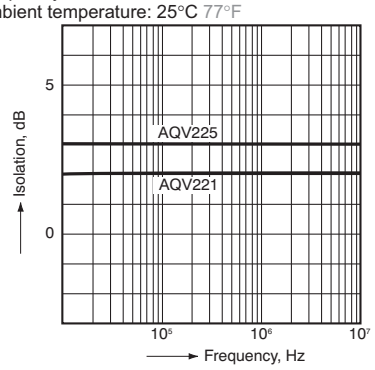
13.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



14.Insertion loss vs. frequency characteristics (50Ω impedance)

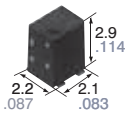
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

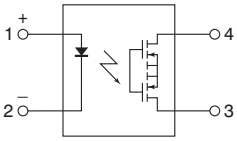
Smallest VSSOP package in its class
4.6 mm² mounting area/ 40 V load voltage

PhotoMOS
RF VSSOP 1 Form A C×R10 (AQY221R2T)



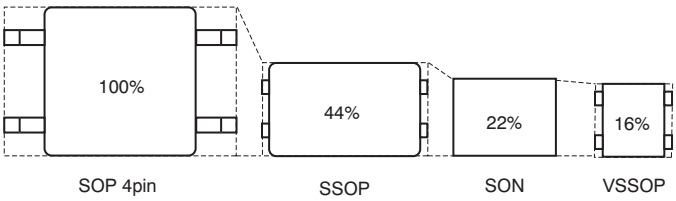
CAD Data

mm inch



FEATURES

1. VSSOP type with further reduction in mounting area
4.6 mm² mounting area achieved. Approx 29% less than previous product (SON type).
Contributes to the miniaturization of instruments and higher density mounting.



2. Low on resistance (R type) available
Variation possible through combinations of output capacitance and On resistance. For more information, please contact our sales office in your area.

3. Low on resistance and low output capacitance available at C×R10
[Output capacitance: 14 pF (typical), On resistance: 0.8Ω (typical)]

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Probe card, Board tester and other testing equipment

2. Telecommunication equipment
*Does not support automotive applications.

TYPES

Type		Output rating*1		Part No. (Tape and reel packing style)*2		Packing quantity in the tape and reel
		Load voltage	Load current	Picked from the 1 and 4-pin side	Picked from the 2 and 3-pin side	
AC/DC type	Low on resistance (R type)	40 V	250 mA	AQY221R2TY	AQY221R2TW	1,000 pcs.

Notes: *1 Indicate the peak AC and DC values.
*2 Only tape and reel package is available.
For space reasons, only "1R2" is marked on the product as the part number.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

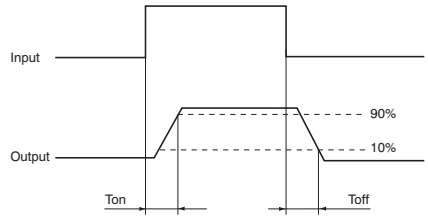
Item		Symbol	AQY221R2T	Remarks
Input side	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output side	Load voltage (peak AC)	V_L	40 V	
	Continuous load current	I_L	0.25 A	Peak AC, DC
	Peak load current	I_{peak}	0.75 A	100 ms (1shot), V_L = DC
	Power dissipation	P_{out}	250 mW	
Total power dissipation		P_T	300 mW	
I/O isolation voltage		V_{iso}	200 V AC	
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY221R2T	Condition
Input	LED operate current	Typical	I_{Fon}	0.5 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.1 mA	I_L = Max.
		Typical		0.4 mA	
	LED dropout voltage	Typical	V_F	1.14 V	I_F = 5 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.8 Ω	I_F = 5 mA, I_L = Max.
		Maximum		1.25 Ω	
	Output capacitance	Typical	C_{out}	14 pF	I_F = 0 mA, f = 1 MHz, V_B = 0 V
		Maximum		18 pF	
	Off state leakage current	Typical	I_{Leak}	0.02 nA	I_F = 0 mA, V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.1 ms	I_F = 5 mA, V_L = 10 V, R_L = 40 Ω
		Maximum		0.5 ms	
	Turn off time*	Typical	T_{off}	0.06 ms	I_F = 5 mA, V_L = 10 V, R_L = 40 Ω
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.4 pF	f = 1 MHz, V_B = 0 V
		Maximum		1.5 pF	

Note: Please refer to the “Schematic and Wiring Diagrams” for connection method.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper this device operation and resetting.

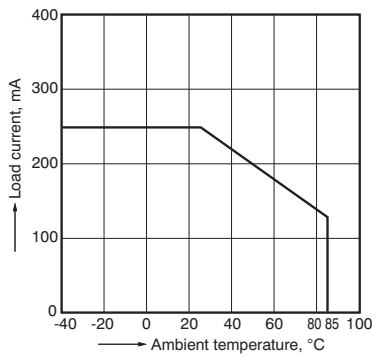
Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

For Cautions for Use, see page 71.

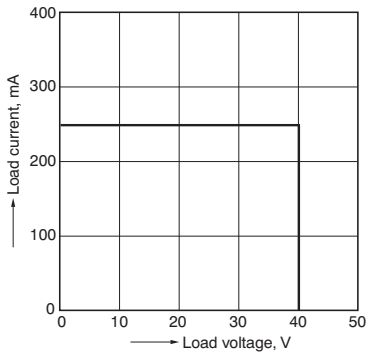
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

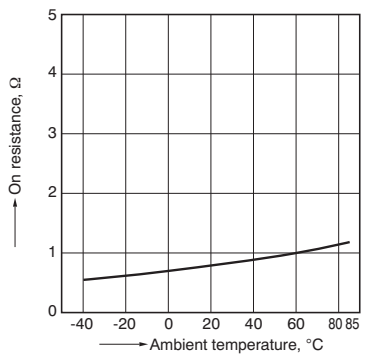
1. Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



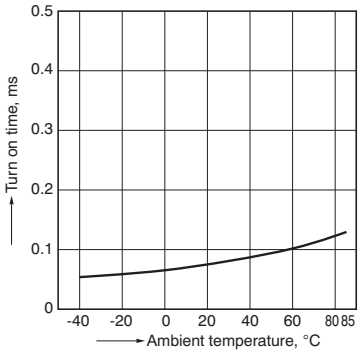
2. Load current vs. Load voltage characteristics
Ambient temperature: 25°C 77°F



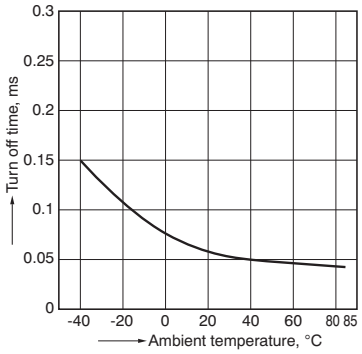
3. On resistance vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250 mA (DC)



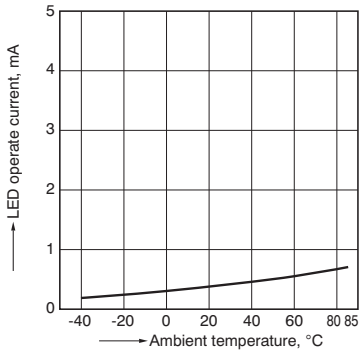
4. Turn on time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250 mA (DC)



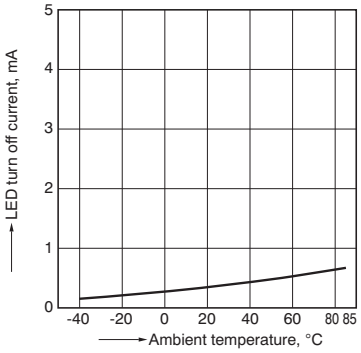
5. Turn off time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250 mA (DC)



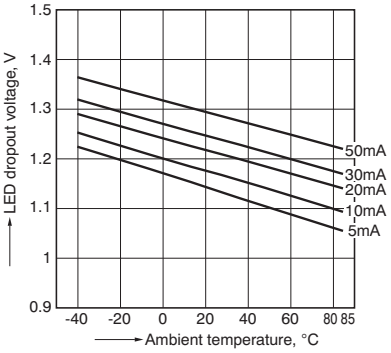
6. LED operate current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250 mA (DC)



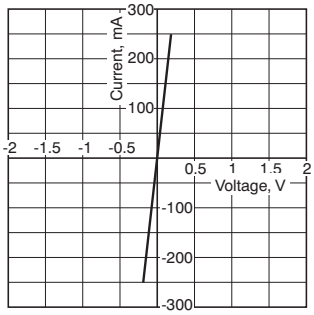
7. LED turn off current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250 mA (DC)



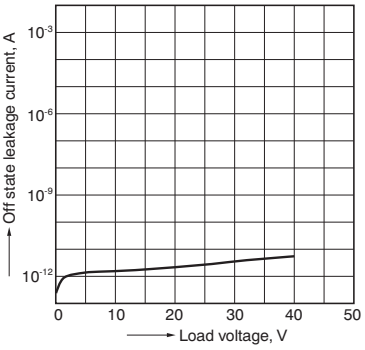
8. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



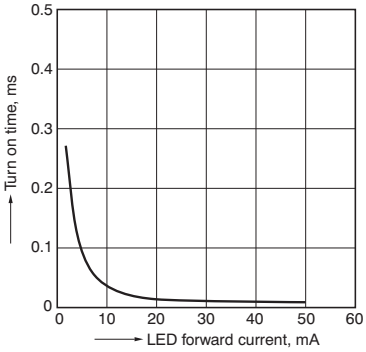
9. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



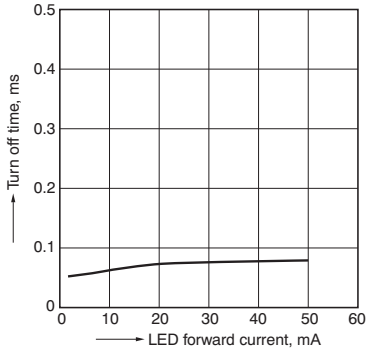
10. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



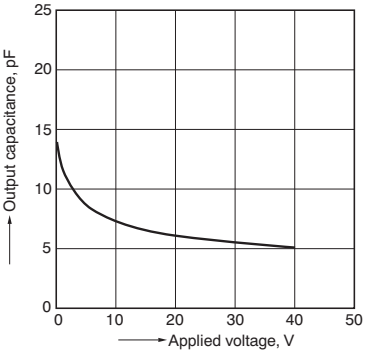
11. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250 mA (DC); Ambient temperature: 25°C 77°F



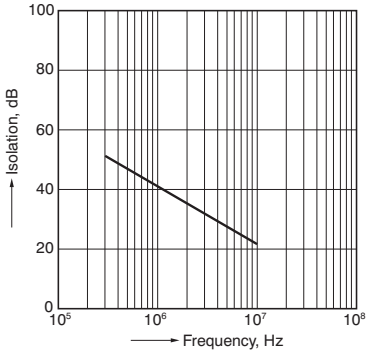
12. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250 mA (DC); Ambient temperature: 25°C 77°F



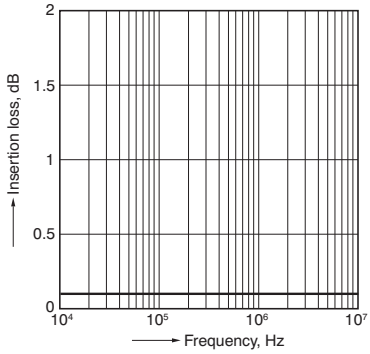
13. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



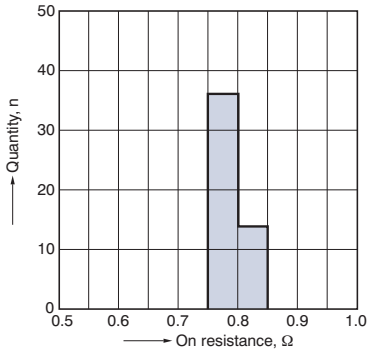
14. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



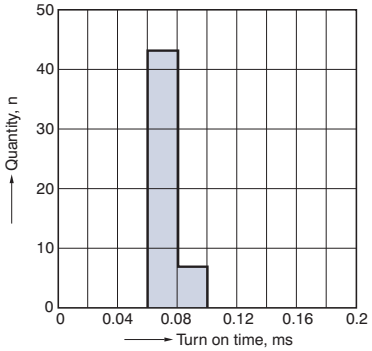
15. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



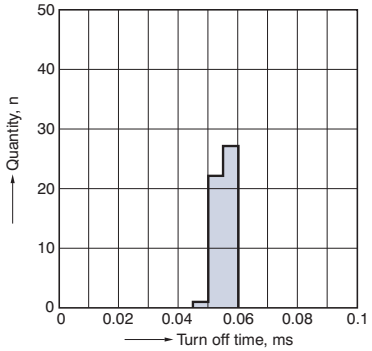
16. On resistance distribution
Measured portion: between terminals 3 and 4
Continuous load current: 250 mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



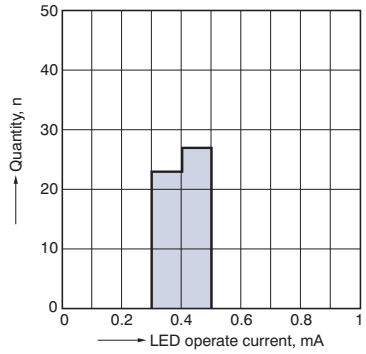
17. Turn on time distribution
Load voltage: 10V (DC)
Continuous load current: 250 mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



18. Turn off time distribution
Load voltage: 10V (DC)
Continuous load current: 250 mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



19. LED operate current distribution
Load voltage: 10V (DC)
Continuous load current: 250 mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F

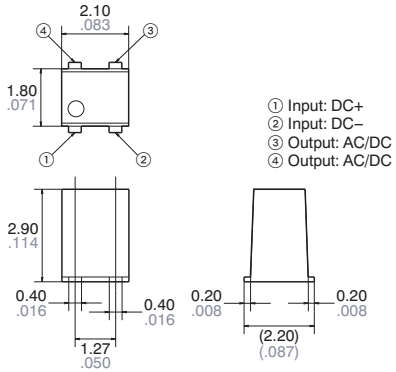


DIMENSIONS (mm inch)

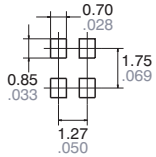
Download CAD Data from our Web site.

CAD Data

External dimensions



Recommended mounting pad (Top view)

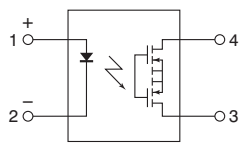
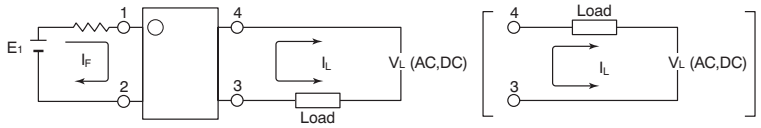


Tolerance: ±0.1 ±.004

General tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

E_1: Power source at input side, I_F: LED forward current, V_L: Load voltage, I_L: Load current

Schematic	Output configuration	Load	Connection	Wiring diagram
	1 Form A	AC/DC	—	

PhotoMOS CAUTIONS FOR USE

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the device (including connecting parts such as the terminal board and socket).

• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

1. Please refer to "PhotoMOS®" catalog (latest version) for cautions for use and explanations of terminology.

2. Derated designs

Consideration of reliability is absolutely imperative for derated designs because of its importance to the working lifetime of the product.

Please be sure to derate sufficiently from the maximum rating of the device when designing a system. Be sure to conduct real-life testing of the product; and, if necessary, provide extra leeway against the maximum rating by taking sufficiently safety measures.

3. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage or current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

Therefore, the circuit should be designed in such a way that the load never exceed the absolute maximum ratings, even momentarily.

4. Deterioration and destruction caused by discharge of static electricity

This phenomenon is generally called static electricity destruction, and occurs when static electricity generated by various factors is discharged while the device terminals are in contact, producing internal destruction of the element.

To prevent problems from static electricity, the following precautions and measures should be taken when using your device.

1) Employees handling devices should wear anti-static clothing and should be grounded through protective resistance of 500 kΩ to 1 MΩ.

2) A conductive metal sheet should be placed over the work table. Measuring instruments and jigs should be grounded.

3) When using soldering irons, either use irons with low leakage current, or ground the tip of the soldering iron. (Use of low-voltage soldering irons is also recommended.)

4) Devices and equipment used in assembly should also be grounded.

5) When packing printed circuit boards and equipment, avoid using high-polymer materials such as foam styrene, plastic, and other materials which carry an electrostatic charge.

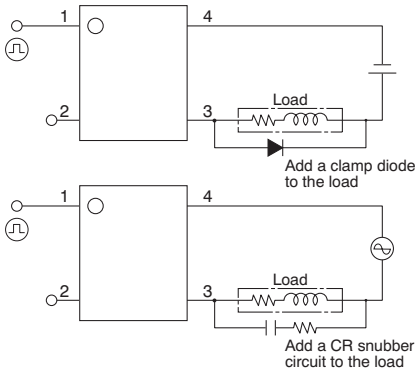
6) When storing or transporting devices, the environment should not be conducive to generating static electricity (for instance, the humidity should be between 45 and 60%), and devices should be protected using conductive packing materials.

5. Short across terminals

Do not short circuit between terminals when device is energized, since there is possibility of breaking of the internal IC.

6. Output spike voltages

1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits are shown below.



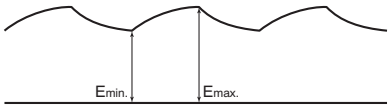
2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

7. Ripple in the input power supply

If ripple is present in the input power supply, observe the following:

1) For LED operate current at E_{min}, maintain the value mentioned in the table of "Recommended LED forward current (I_F)."

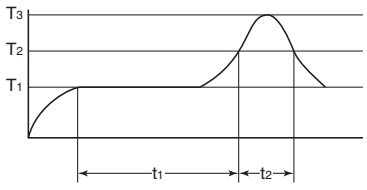
2) Keep the LED operate current at 50 mA or less at E_{max}.



8. Soldering

• Example of recommended soldering conditions

(1) IR (Infrared reflow) soldering method



T1 = 150 to 180°C 302 to 356°F
T2 = 230°C 446°F
T3 = 245°C 473°F or less
t1 = 60 to 120 s or less
t2 = 30 s or less

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F

Wattage: 30 to 60 W

Soldering time: within 3 s

(3) Others

Check mounting conditions before using other soldering methods (VPS, hot-air, hot plate, laser, pulse heater, etc.)

9. Notes for mounting

1) If many different packages are combined on a single substrate, then lead temperature rise is highly dependent on package size. For this reason, please make sure that the temperature of the terminal solder area of the PhotoMOS falls within the temperature conditions of item “8. Soldering” before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 8, resin strength will fall and the nonconformity of the heat expansion coefficient of each constituent material will increase markedly, possibly causing cracks in the package, severed bonding wires, and the like. For this reason, please inquire with us about whether this use is possible.

10. Cleaning

This product creates a light path by coupling with resin the LED of the emitting element and the solar cell of the receiving element. For this reason, ultrasonic cleaning should be avoided as much as possible, because the product differs from other molded resin products that contain discrete elements (MOS transistors and bipolar transistors, etc.). We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

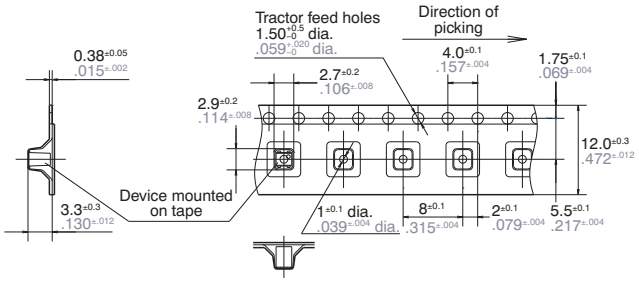
- Frequency: 27 to 29 kHz
- Ultrasonic output:
  No greater than 0.25W/cm^2
- Cleaning time: No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other:
  Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

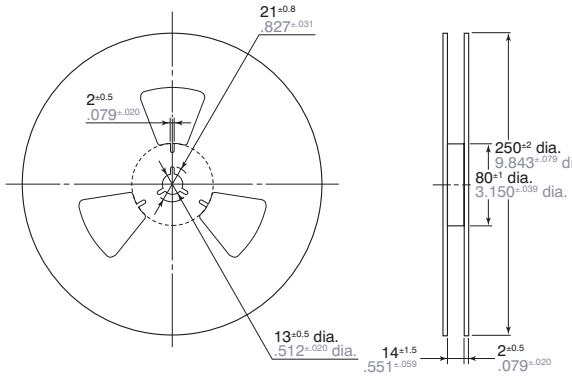
11. Device packaging format

Tape and reel (Unit: mm inch)

Tape dimensions



Dimensions of paper tape reel



(1) When picked from 1 and 4-pin side: Part No. AQY❍❍❍TY (Shown above)
(2) When picked from 2 and 3-pin side: Part No. AQY❍❍❍TW

12. Transportation and storage

1) Extreme vibration during transport will damage the device. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

- Temperature: 0 to 45°C 32 to 113°F
- Humidity: Less than 70% R.H.
- Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

3) PhotoMOS implemented in VSSOP type are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

- After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month, less than 45°C 113°F/70% R.H.).
- If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

*When thermal stress is applied when mounting with solder after the product has absorbed moisture, the water will evaporate, swelling will occur, and the inside of the package will become stressed. Since this can lead to bulging and cracking of the package surface, please be sure to be careful and follow the correct soldering conditions.

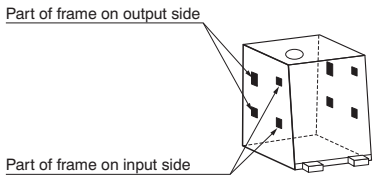
13. About the exposed terminals on the sides of the package

As shown in the following figure, part of the input and output frames are exposed on the sides of the package. Due to this, please be keep in mind the cautions listed below.

1) Shorting the exposed terminals may cause deterioration of the insulation between the inputs and outputs, and may damage the internal IC.

2) Since the exposed terminals are connected electrically to the internal element, please refer to the section “4. Deterioration and destruction caused by discharge of static electricity”, and implement sufficient measures to control static electricity.

3) When installing the devices in the vicinity, please keep in mind that if the exposed frames of adjacent devices get too close, a short between devices may occur.



14. Regarding close installations

When this product is installed close to other parts, the ambient temperature may rise due to heating of the internal element when power is applied. Be sure to use with a reduced load current after testing under actual conditions, because the degree of temperature rise depends on the placement of the devices and conditions of use.

Panasonic
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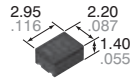
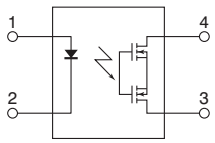
Micro-miniature SON package
Lower output capacitance and on resistance (C×R5)
25V load voltage

PhotoMOS Relays
RF SON 1 Form A C×R5
(AQY221N3M)



CAD Data

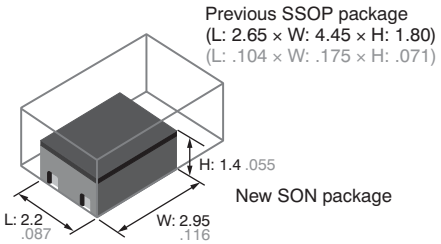
mm inch



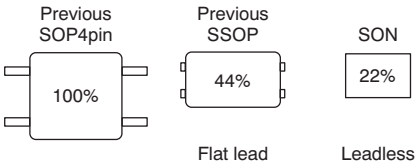
FEATURES

1. Super miniature SON* package contributes to space savings and high density mounting.
The SON type is a new PhotoMOS relay with approximately 43% the volume ratio of existing SSOP type. The super miniature leadless construction reduces the mounting area and enables high density mounting.

***Small Outline No-lead package**
Reduced to approximately 43% volume ratio



Area comparison (including leads)



2. Lower output capacitance and on-resistance
Output capacitance (Cout): 1.1pF (typ.)
On resistance (Ron): 5.5Ω (typ.)

3. High speed switching
Turn on time: 0.02ms (typ.)
Turn off time: 0.02ms (typ.)

TYPICAL APPLICATIONS

Measuring and testing equipment

1. Testing equipment
IC tester, Semiconductor performance tester, Probe cards, etc.

2. Board tester
Bare board tester, In-circuit tester, Function tester, etc.

TYPES

	Output rating*1		Package	Tape and reel packing style*2		Packing quantity in tape and reel
	Load voltage	Load current		Picked from the 1 and 4-pin side	Picked from the 2 and 3-pin side	
AC/DC dual use	25 V	150 mA	SON	AQY221N3MY	AQY221N3MW	3,500 pcs.

Notes: *1 Indicate the peak AC and DC values.
*2 Only tape and reel package is available.
For space reasons, only "1N3" is marked on the product as the part number.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

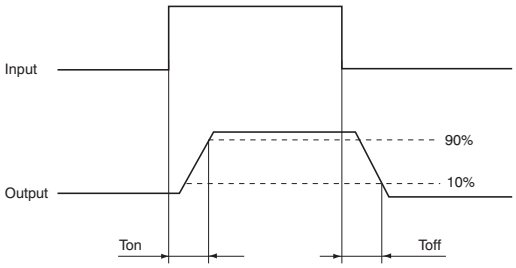
Item		Symbol	AQY221N3M	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	25V	
	Continuous load current	I_L	0.15A	Peak AC, DC
	Power dissipation	P_{out}	250mW	
Total power dissipation		P_T	300mW	
I/O isolation voltage		V_{iso}	200V AC	
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY221N3M	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA	I_L = 80 mA
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.2 mA	I_L = 80 mA
		Typical		0.9 mA	
	LED dropout voltage	Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	5.5Ω	I_F = 5 mA I_L = 80 mA Within 1 s on time
		Maximum		7.5Ω	
	Output capacitance	Typical	C_{out}	1.1 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.02 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
		Maximum		0.2 ms	
	Turn off time*	Typical	T_{off}	0.02 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	

Note: Variation possible through combinations of output capacitance and on resistance. For more information, please contact our sales office in your area.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

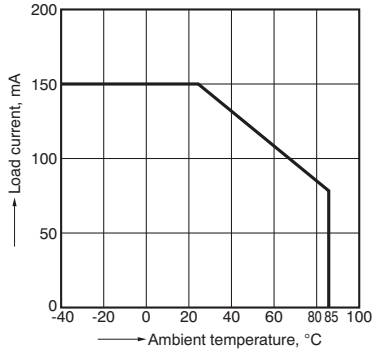
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

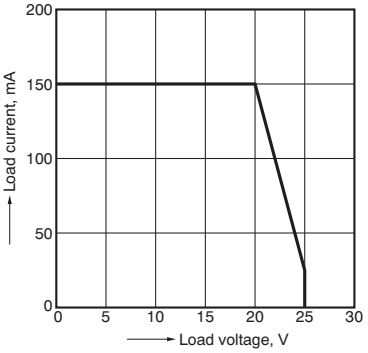
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



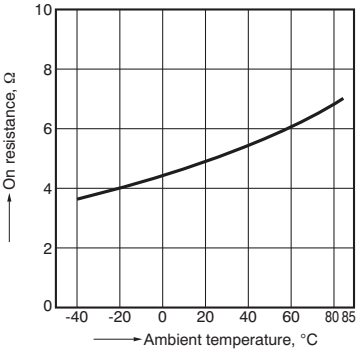
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



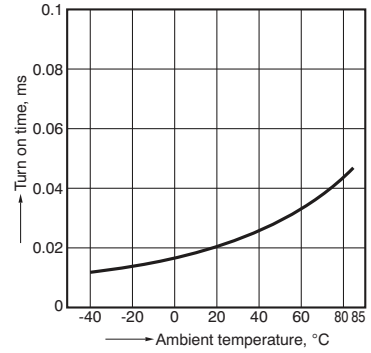
3. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Load current: 80mA (DC)



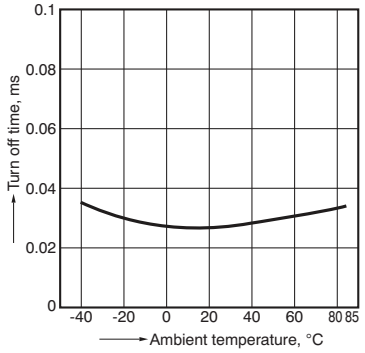
4. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



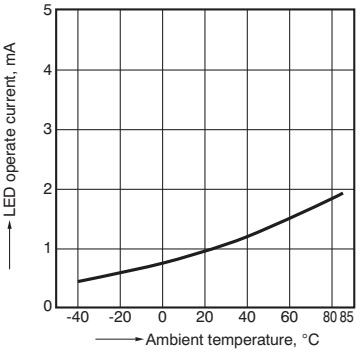
5. Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



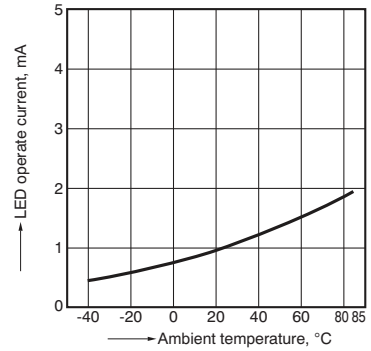
6. LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



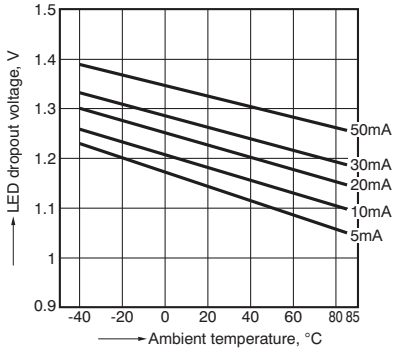
7. LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



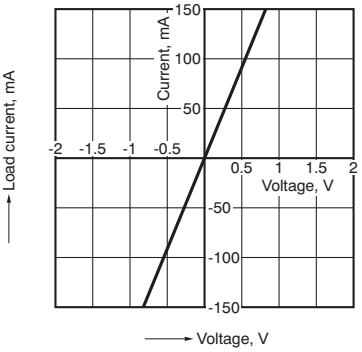
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



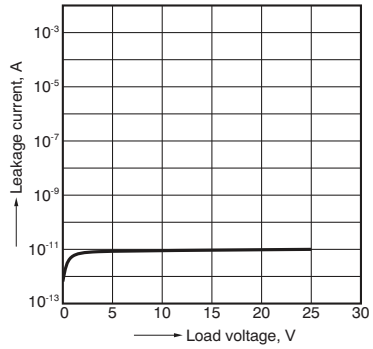
9. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



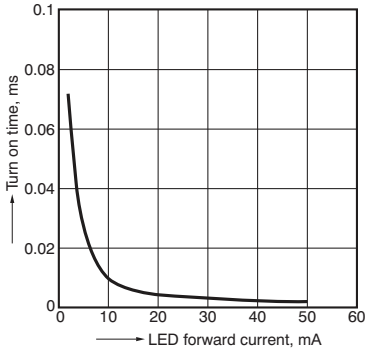
10.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



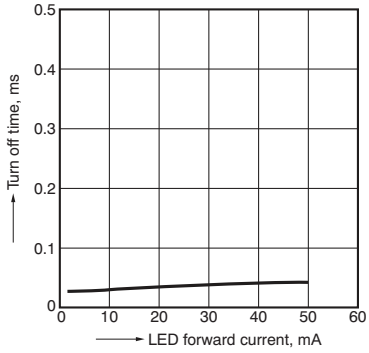
11.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



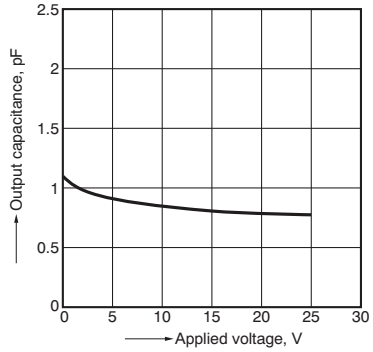
12.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



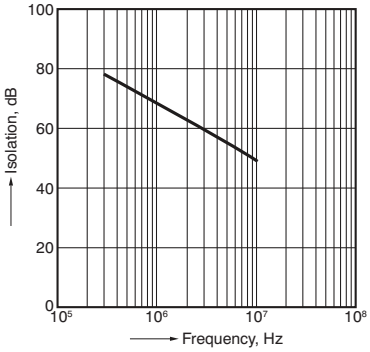
13.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



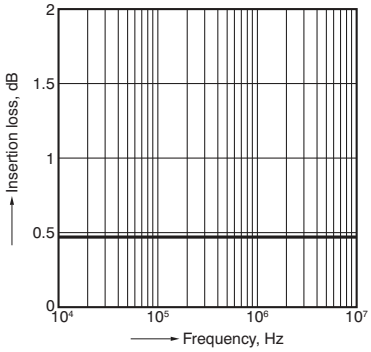
14.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



15.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F

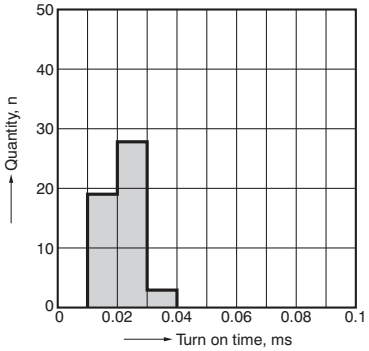


16.On resistance distribution

Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F

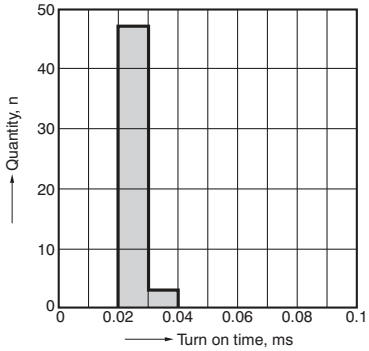
17.Turn on time distribution

Load voltage: 10V (DC)
Continuous load current: 80mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



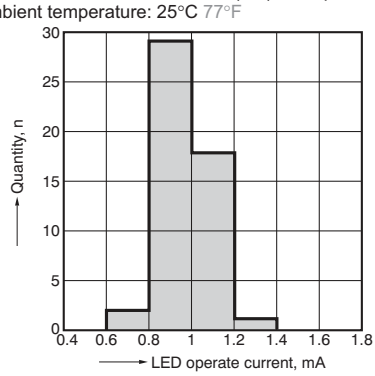
18.Turn off time distribution

Load voltage: 10V (DC)
Continuous load current: 80mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



19.LED operate current distribution

Load voltage: 10V (DC)
Continuous load current: 80mA (DC), n: 50pcs.
Ambient temperature: 25°C 77°F



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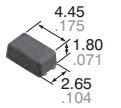
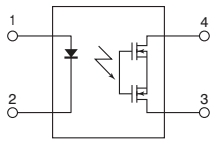
Super miniature SSOP
Lower output capacitance and on resistance (C×R5)
Load voltage 25V

PhotoMOS Relays
RF SSOP 1 Form A C×R5
(AQY221N3V)



CAD Data

mm inch

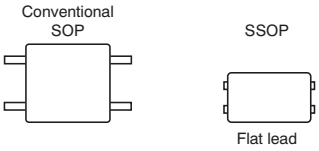


FEATURES

1. Reduced package size
Lower surface has been reduced 60% and mounting space 40% compared to conventional SOP4-pin type.

2. Lower output capacitance and on-resistance
Output capacitance (Cout): 1.0pF (typ.)
ON resistance (Ron): 5.5Ω (typ.)

3. Mounting space has been reduced and output signals have been improved by using new flat lead terminals.



4. High speed switching
Turn on time: 0.02ms (typ.)
Turn off time: 0.02ms (typ.)

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Board tester, etc.

2. Medical equipment
Ultrasonic wave diagnostic machine

3. Multi-point recorder
Warping, Thermo couple, etc.

4. Telecommunication and broadcasting equipment

TYPES

	Output rating*1		Package	Tape and reel packing style		Packing quantity in tape and reel*2
	Load voltage	Load current		Picked from the 1/4-pin side	Picked from the 2/3-pin side	
AC/DC dual use	25 V	150 mA	SSOP	AQY221N3VY	AQY221N3VW	3,500 pcs.

Notes: *1 Indicate the peak AC and DC values.
*2 Tape and reel is the standard packing style for SSOP.
For space reasons, only "N3V" is marked on the product as the part number. The three initial letters of the part number "AQY", and the package (SSOP) indicator "V" and the packing style indicator "Y" or "W" are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

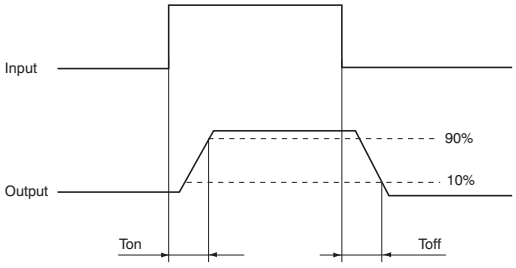
Item		Symbol	AQY221N3V	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	25V	
	Continuous load current	I_L	0.15A	Peak AC, DC
	Peak load current	I_{peak}	0.4A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	250mW	
Total power dissipation		P_T	300mW	
I/O isolation voltage		V_{iso}	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY221N3V	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA	I_L = 80 mA
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.2 mA	I_L = 80 mA
		Typical		0.9 mA	
	LED dropout voltage	Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	5.5Ω	I_F = 5 mA, I_L = 80 mA Within 1 s on time
		Maximum		7.5Ω	
	Output capacitance	Typical	C_{out}	1.0 pF	I_F = 0 mA, V_B = 0 V f = 1 MHz
		Maximum		1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.02 ms	I_F = 5 mA, V_L = 10 V R_L = 125Ω
		Maximum		0.2 ms	
	Turn off time*	Typical	T_{off}	0.02 ms	I_F = 5 mA, V_L = 10 V R_L = 125Ω
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

Note: Variation possible through combinations of output capacitance and on resistance. For more information, please contact our sales office in your area.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

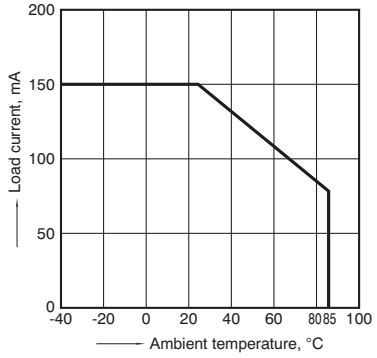
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

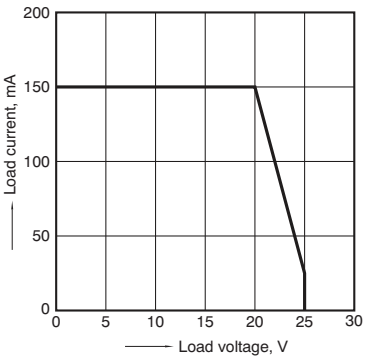
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



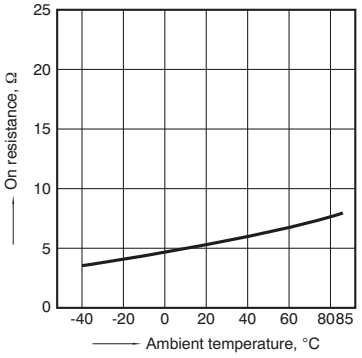
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



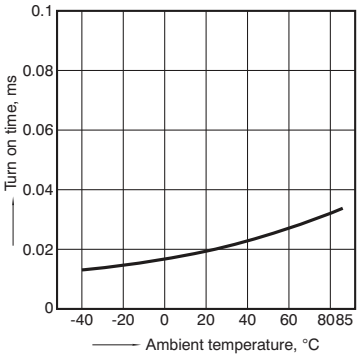
3. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Load current: 80mA (DC)



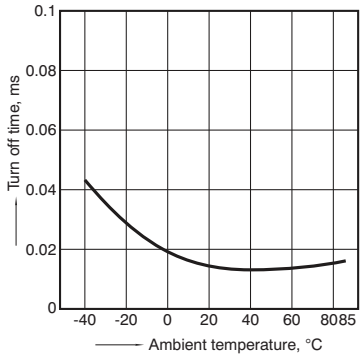
4. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



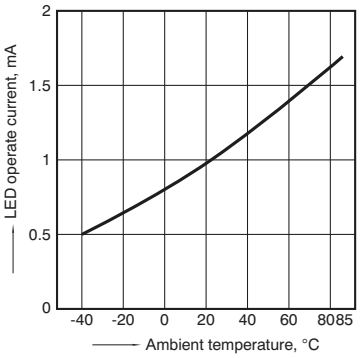
5. Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



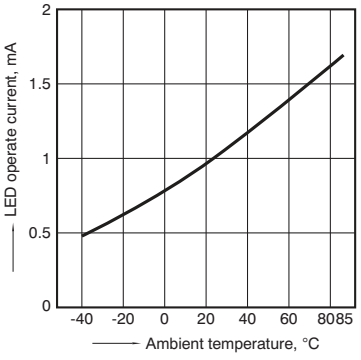
6. LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



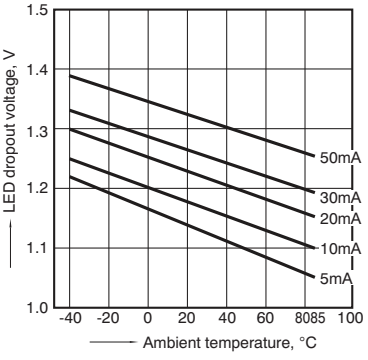
7. LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



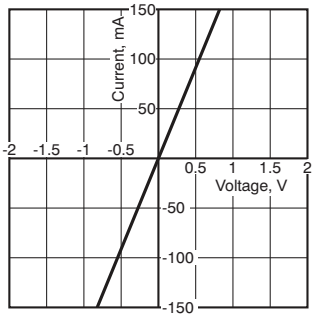
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



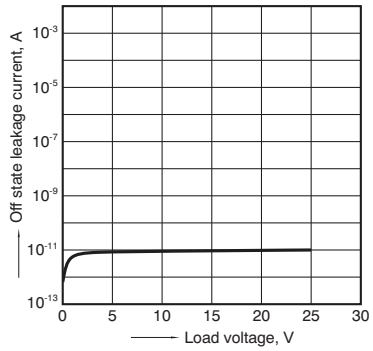
9. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



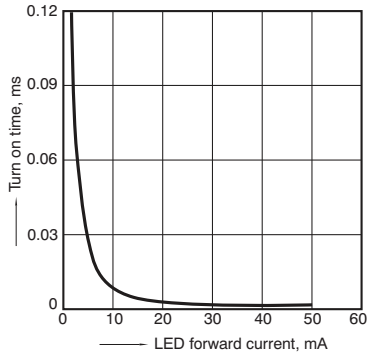
10.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



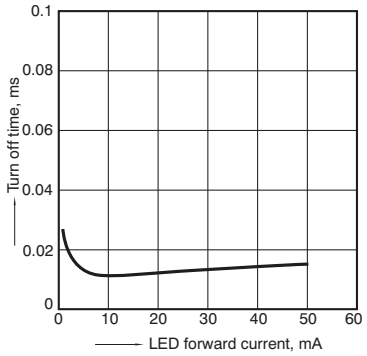
11.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



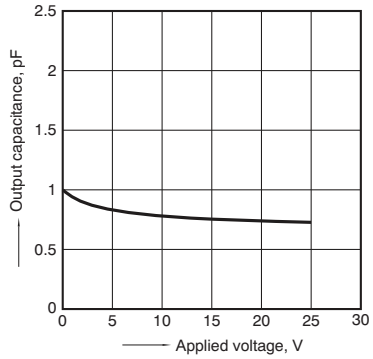
12.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



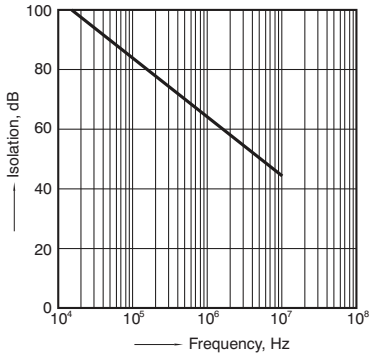
13.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



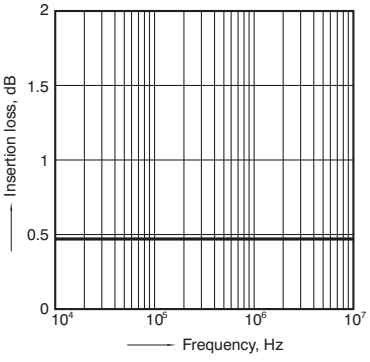
14.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



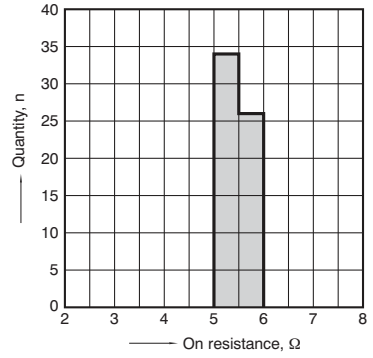
15.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



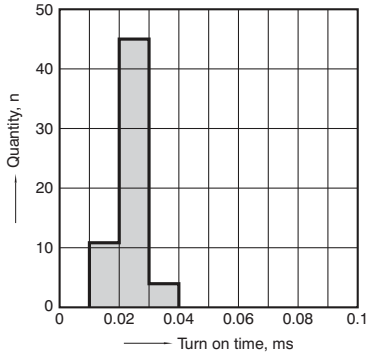
16.On resistance distribution

Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



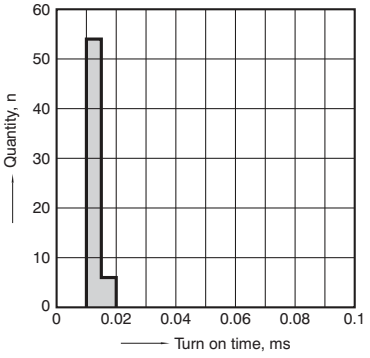
17.Turn on time distribution

Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



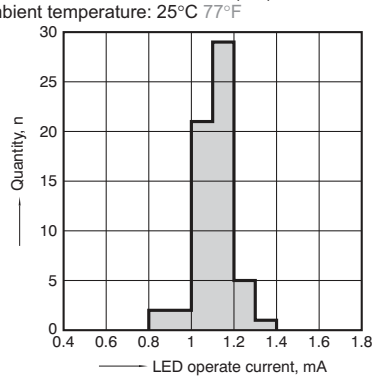
18.Turn off time distribution

Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



19.LED operate current distribution

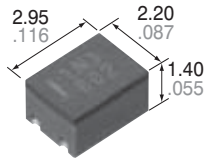
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

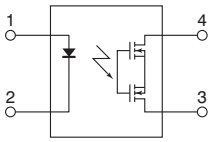
Micro-miniature SON package
Lower output capacitance and on resistance (C×R10)
40V load voltage

PhotoMOS Relays
RF SON 1 Form A C×R10
(AQY221○2M)



CAD Data

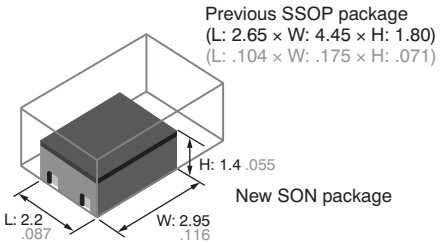
mm inch



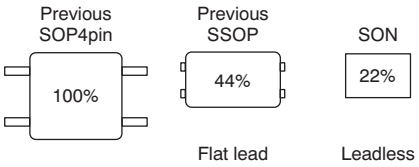
FEATURES

1. Super miniature SON* package contributes to space savings and high density mounting.
The SON type is a new PhotoMOS relay with approximately 43% the volume ratio of existing SSOP type. The super miniature leadless construction reduces the mounting area and enables high density mounting.

***Small Outline No-lead package**
Reduced to approximately 43% volume ratio



Area comparison (including leads)



2. Both low on-resistance (R type) and low capacitance (C type) available at C×R10
- R type: On resistance 0.8Ω (typ.)
  Output capacitance 14pF (typ.)
- C type: On resistance 9.5Ω (typ.)
  Output capacitance 1.1pF (typ.)

TYPICAL APPLICATIONS

1. Measuring equipment
IC tester, Probe cards, board tester and other testing equipment
2. Telecommunication or broadcasting equipment
3. Medical equipment

TYPES

	Type	Output rating*1		Package	Tape and reel packing style*2		Packing quantity in tape and reel
		Load voltage	Load current		Picked from the 1 and 4-pin side	Picked from the 2 and 3-pin side	
AC/DC dual use	Low on-resistance (R type)	40 V	250 mA	SON	AQY221R2MY	AQY221R2MW	3,500 pcs.
	Low capacitance (C type)	40 V	120 mA		AQY221N2MY	AQY221N2MW	

Notes: *1 Indicate the peak AC and DC values.
*2 Only tape and reel package is available.
For space reasons, only "1R2" or "1N2" is marked on the product as the part number.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

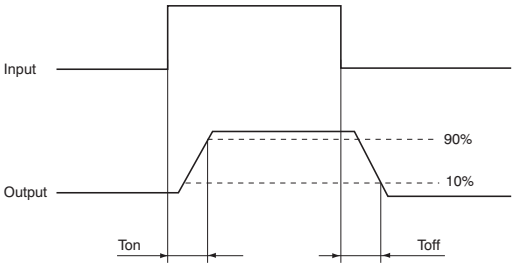
Item		Symbol	AQY221R2M	AQY221N2M	Remarks
Input	LED forward current	I_F	50mA		
	LED reverse voltage	V_R	5V		
	Peak forward current	I_{FP}	1A		f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW		
Output	Load voltage (peak AC)	V_L	40V	40V	
	Continuous load current	I_L	0.25A	0.12A	Peak AC, DC
	Peak load current	I_{peak}	0.75A	–	100ms (1shot), V_L=DC
	Power dissipation	P_{out}	250mW		
Total power dissipation		P_T	300mW		
I/O isolation voltage		V_{iso}	200V AC		
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	R type	C type	Condition
				AQY221R2M	AQY221N2M	
Input	LED operate current	Typical	I_{Fon}	0.8 mA	1.0 mA	R type: I_L = 250 mA C type: I_L = 80 mA
		Maximum		3.0 mA		
	LED turn off current	Minimum	I_{Foff}	0.2 mA		
		Typical		0.7 mA	0.9 mA	
	LED dropout voltage	Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	0.8Ω	9.5Ω	R type: I_F = 5 mA, I_L = 250 mA C type: I_F = 5 mA, I_L = 80 mA Within 1 s on time
		Maximum		1.25Ω	12.5Ω	
	Output capacitance	Typical	C_{out}	14 pF	1.1 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		18 pF	1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA		I_F = 0 mA V_L = Max.
		Maximum		10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	0.2 ms	0.02 ms	R type: I_F = 5 mA, V_L = 10 V, R_L = 40Ω C type: I_F = 5 mA, V_L = 10 V, R_L = 125Ω
		Maximum		0.5 ms	0.2 ms	
	Turn off time*	Typical	T_{off}	0.04 ms	0.02 ms	
		Maximum		0.2 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		

Note: Variation possible through combinations of output capacitance and on resistance. For more information, please contact our sales office in your area.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

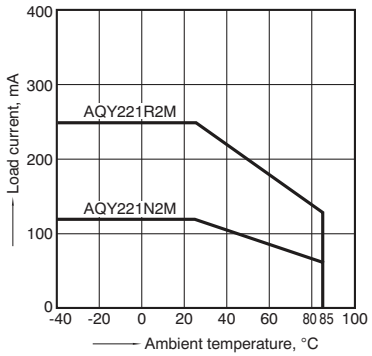
■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

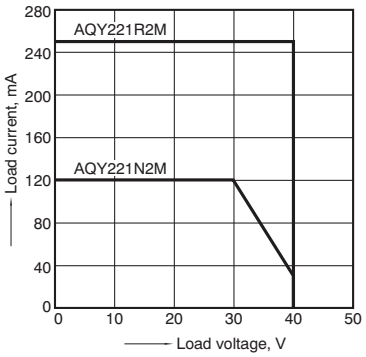
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



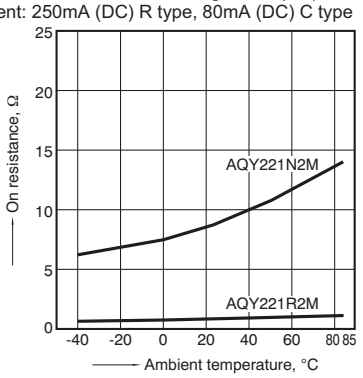
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



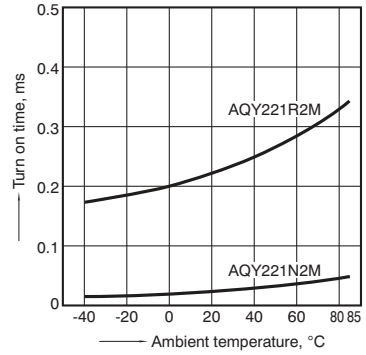
3. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: 10V (DC); Load current: 250mA (DC) R type, 80mA (DC) C type



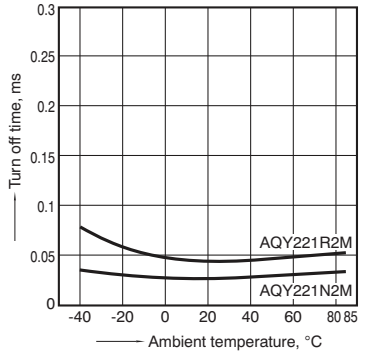
4. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4; LED current: 5 mA; Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type



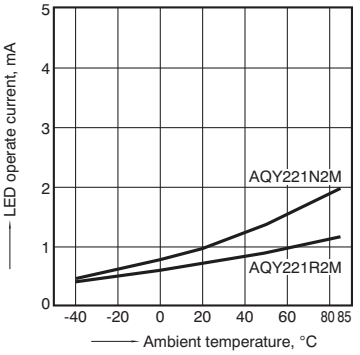
5. Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4; LED current: 5 mA; Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type



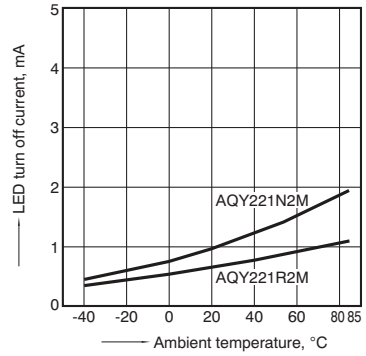
6. LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type



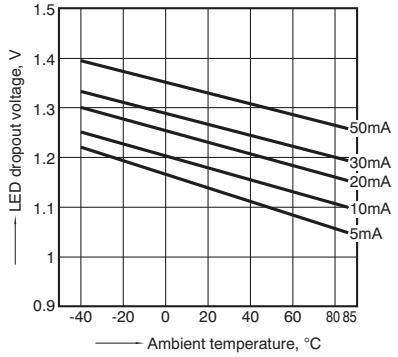
7. LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type



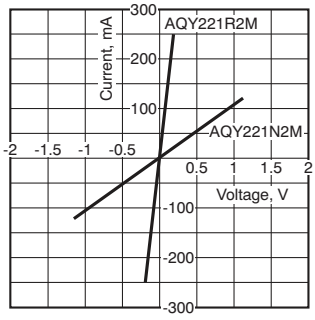
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



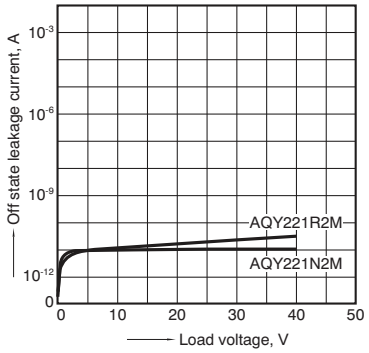
9. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



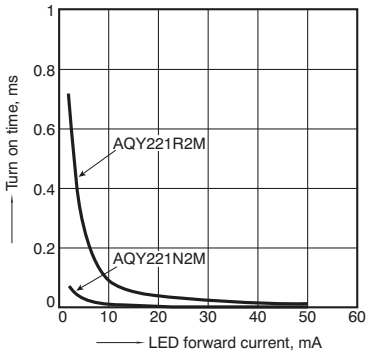
10.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



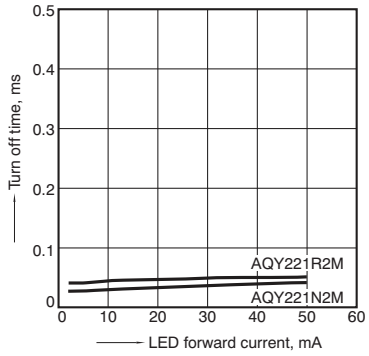
11.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type; Ambient temperature: 25°C 77°F



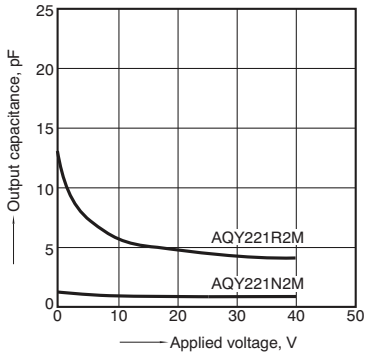
12.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: 10V (DC); Continuous load current: 250mA (DC) R type, 80mA (DC) C type; Ambient temperature: 25°C 77°F



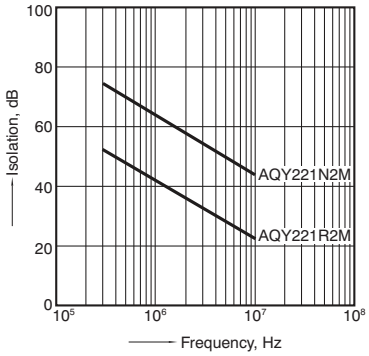
13.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



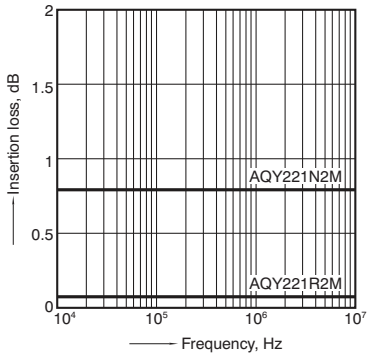
14.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



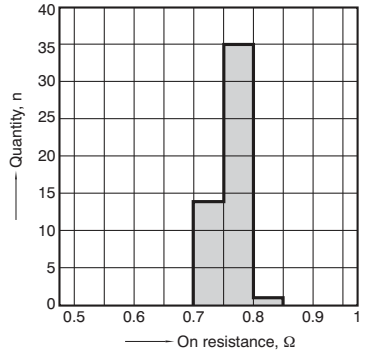
15.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



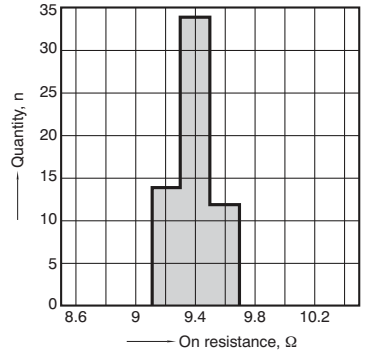
16-(1) On resistance distribution

Sample: AQY221R2M; Measured portion: between terminals 3 and 4; Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



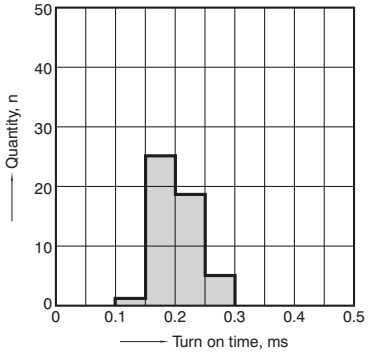
16.-(2) On resistance distribution

Sample: AQY221N2M; Measured portion: between terminals 3 and 4; Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



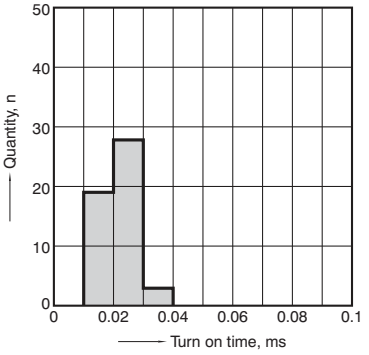
17-(1) Turn on time distribution

Sample: AQY221R2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



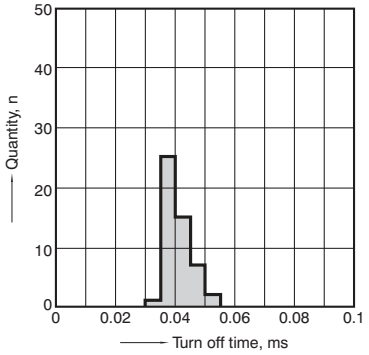
17.-(2) Turn on time distribution

Sample: AQY221N2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



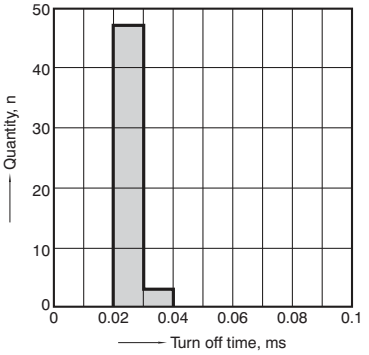
18-(1) Turn off time distribution

Sample: AQY221R2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



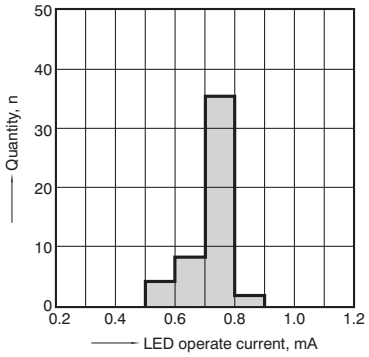
18.-(2) Turn off time distribution

Sample: AQY221N2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



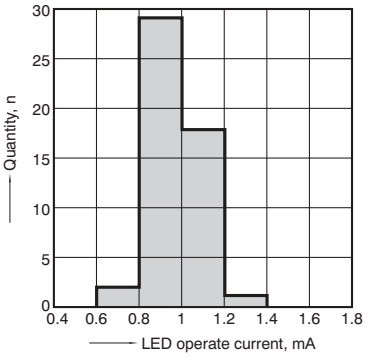
19-(1) LED operate current distribution

Sample: AQY221R2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



19.-(2) LED operate current distribution

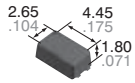
Sample: AQY221N2M; Load voltage: 10V (DC)
Continuous load current: 250mA (DC) R type, 80mA (DC) C type, n: 50pcs.
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

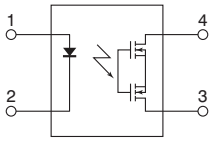
Micro-miniature SSOP
Lower output capacitance and on resistance (C×R10)
40 V load voltage

PhotoMOS Relays
RF SSOP 1 Form A C×R10
(AQY221○○V)



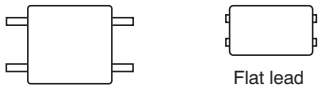
CAD Data

mm inch



FEATURES

1. Micro-miniature package (SSOP) using a new flat lead terminal shape
Compared to previous models (SOP 4-pin), mounting area can be reduced by approximately 56%*. This contributes to improved output signal transit characteristics.



*Comparison of area of SSOP and SOP 4-pin (including leads).

2. Full lineup with C×R10
Lineup includes three types with superior electrical performance of C×R10. R type and C type, respectively, feature greatly reduced on resistance and output capacitance.

		On resistance (Typical)	Output capacitance (Typical)
R type	AQY221R4V	0.55Ω	24pF
	AQY221R2V	0.75Ω	12.5pF
C type	AQY221N2V	9.5Ω	1.0pF

TYPICAL APPLICATIONS

1. Measuring and testing equipment
Semiconductor testing equipment, Probe cards, Datalogger, Board tester and other testing equipment
2. Telecommunication and broadcasting equipment
3. Medical equipment

TYPES

	Type	Output rating*1		Package	Tape and reel packing style*2		Packing quantity in tape and reel
		Load voltage	Load current		Picked from the 1 and 4-pin side	Picked from the 2 and 3-pin side	
AC/DC dual use	Low on-resistance (R type)	40 V	500 mA	SSOP	AQY221R4VY	AQY221R4VW	3,500 pcs.
		40 V	250 mA		AQY221R2VY	AQY221R2VW	
	Low capacitance (C type)	40 V	120 mA		AQY221N2VY	AQY221N2VW	

Notes: *1 Indicate the peak AC and DC values.
*2 Tape and reel is the standard packing style for SSOP.
For space reasons, the three initial letters of the part number "AQY", the package (SSOP) indication "V", and the packaging style "Y" or "W" are not marked on the relay. (Ex. the label for product number AQY221R4VY is 221R4)
*3 For types with a built-in resistor, see page 199.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	R type		C type	Remarks
			AQY221R4V	AQY221R2V	AQY221N2V	
Input	LED forward current	I_F	50mA			
	LED reverse voltage	V_R	5V			
	Peak forward current	I_{FP}	1A			f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW			
Output	Load voltage (peak AC)	V_L	40V			
	Continuous load current	I_L	0.5A	0.25A	0.12A	Peak AC, DC
	Peak load current	I_{peak}	1A	0.75A	0.3A	100ms (1shot), V_L=DC
	Power dissipation	P_{out}	250mW			
Total power dissipation		P_T	300mW			
I/O isolation voltage		V_{iso}	1,500V AC			
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F			

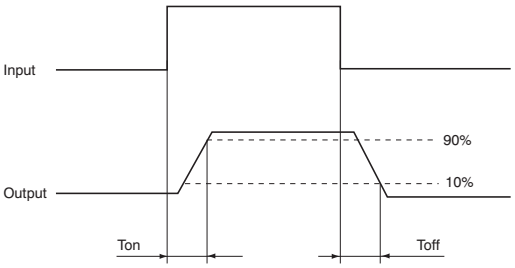
RF SSOP 1 Form A CxR10 (AQY221❍❍V)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	R type		C type	Condition
				AQY221R4V	AQY221R2V	AQY221N2V	
Input	LED operate current	Typical	I_{Fon}	0.9 mA		1.0 mA	AQY221R4V: I_L = 500 mA AQY221R2V: I_L = 250 mA AQY221N2V: I_L = 80 mA
		Maximum		3.0 mA			
	LED turn off current	Minimum	I_{Foff}	0.1 mA		0.2 mA	
		Typical		0.8 mA		0.9 mA	
	LED dropout voltage*1	Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.55Ω	0.75Ω	9.5Ω	AQY221R4V: I_F = 5 mA, I_L = 500 mA AQY221R2V: I_F = 5 mA, I_L = 250 mA AQY221N2V: I_F = 5 mA, I_L = 80 mA Within 1 s on time
		Maximum		1Ω	1.25Ω	12.5Ω	
	Output capacitance	Typical	C_{out}	24 pF	12.5 pF	1.0 pF	I_F = 0 mA, V_B = 0 V, f = 1 MHz
		Maximum		30 pF	18 pF	1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.02 nA		0.01 nA	I_F = 0 mA, V_L = Max.
		Maximum		10 nA			
Transfer characteristics	Turn on time*2	Typical	T_{on}	0.25 ms	0.10 ms	0.20 ms	AQY221R4V: I_F = 5 mA, V_L = 10 V, R_L = 20Ω AQY221R2V: I_F = 5 mA, V_L = 10 V, R_L = 40Ω AQY221N2V: I_F = 5 mA, V_L = 10 V, R_L = 125Ω
		Maximum		0.75 ms	0.5 ms		
	Turn off time*2	Typical	T_{off}	0.08 ms		0.02 ms	
		Maximum		0.2 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz, V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

Note: Variation possible through combinations of output capacitance and on resistance. For more information, please contact our sales office in your area.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

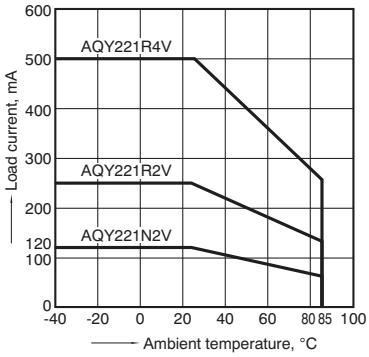
■ **For Dimensions, see Page 62.**
■ **For Schematic and Wiring Diagrams, see Page 64.**
■ **For Cautions for Use, see Page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

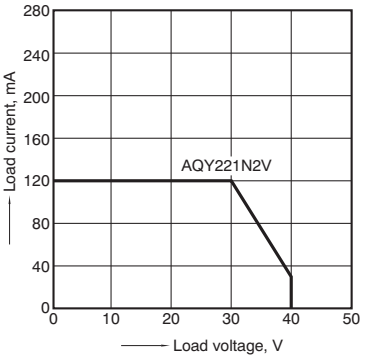
20.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



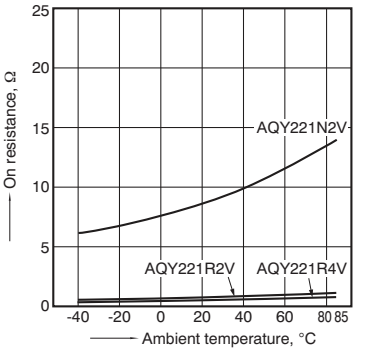
21.Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



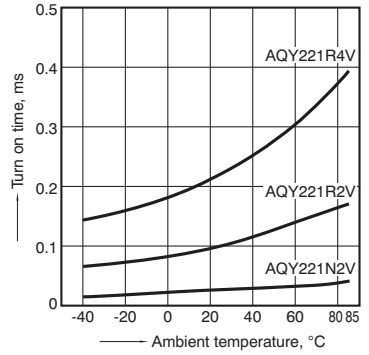
22.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)



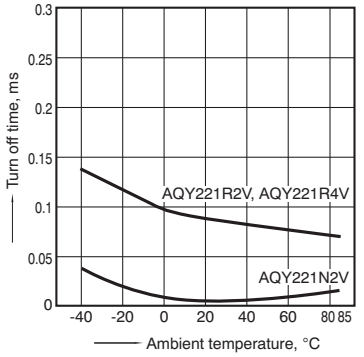
23.Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)



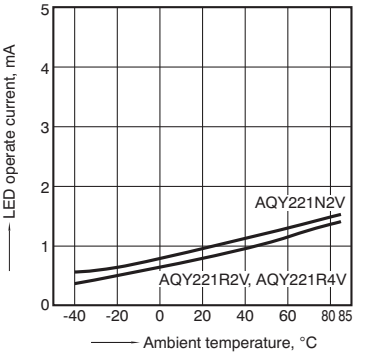
24.Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)



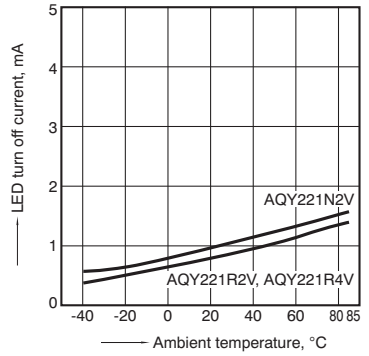
25.LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)



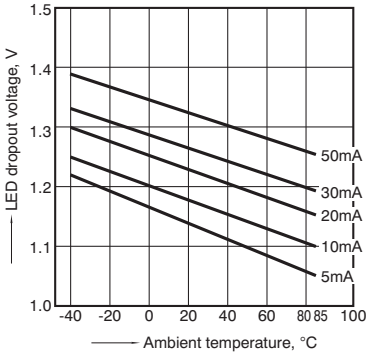
26.LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)



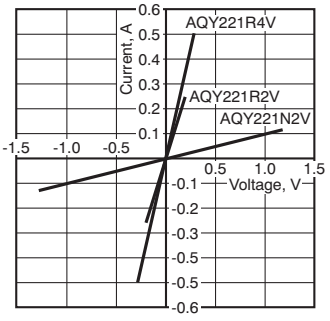
27.LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



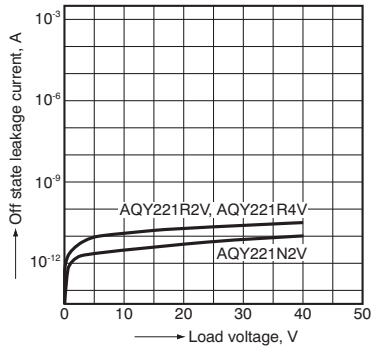
28.Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



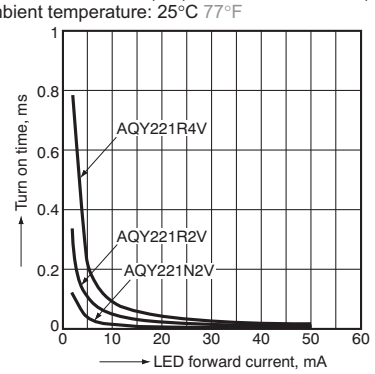
29.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



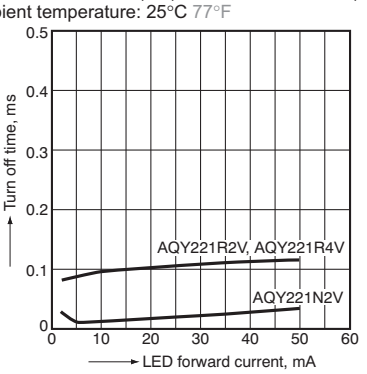
30.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)
Ambient temperature: 25°C 77°F



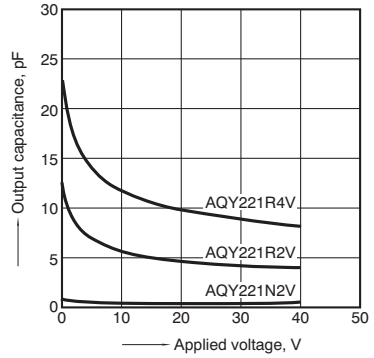
31.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: AQY221R4V 500mA (DC), AQY221R2V 250mA (DC), AQY221N2V 80mA (DC)
Ambient temperature: 25°C 77°F



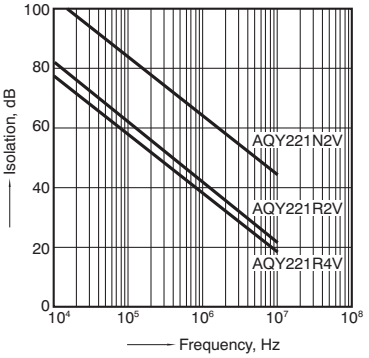
32.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms
Ambient temperature: 25°C 77°F



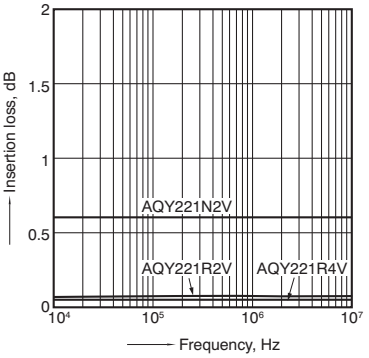
33.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



34.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



Panasonic
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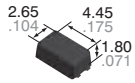
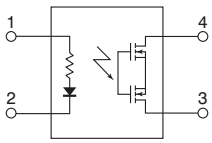
Space-saving SSOP 1 Form A type with built-in registor 40V load voltage

PhotoMOS Relays
RF SSOP C×R10
Voltage-sensitive (AQY221F○2V)



CAD Data

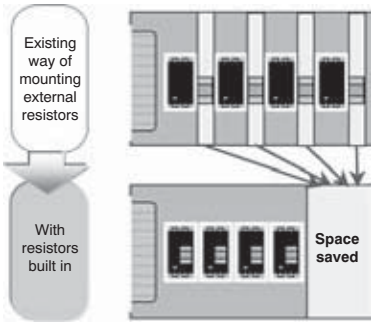
mm inch



FEATURES

1. Built-in input resistor means less man-hours when mounting
The voltage-sensitive type, which eliminates the need to mount an external input resistor, is now available in a small package. Man-hours spent mounting external input resistors are cut and board designing is simplified.

2. Save space on PC board
Since the small package size remains the same while including a built-in input resistor, space on the PC board is saved. This makes it easier to incorporate space savings when designing miniature devices.



<Artistic impression of PC board space savings due to built-in resistor>

3. Both low on-resistance (R type) and low capacitance (C type) available at excellent electrical characteristics of C×R10
- R type: On resistance 0.75Ω (typ.) Output resistance 12.5pF (typ.)
- C type: On resistance 9.5Ω (typ.) Output capacitance 1pF (typ.)

TYPICAL APPLICATIONS

1. Measuring and testing equipment
Semiconductor testing equipment, Probe cards, Datalogger, Board tester and other testing equipment.

2. Telecommunication and broadcasting equipment

3. Medical equipment

TYPES

	Type	Output rating*1		Package	Part No.*2		Packing quantity in tape and reel
		Load voltage	Load current		Tape and reel packing style (Picked from the 1 and 4-pin side)	Tape and reel packing style (Picked from the 2 and 3-pin side)	
AC/DC dual use	Low on-resistance (R type)	40 V	0.25A	SSOP	AQY221FR2VY	AQY221FR2VW	3,500 pcs.
	Low capacitance (C type)	40 V	0.12A		AQY221FN2VY	AQY221FN2VW	

Notes: *1 Indicate the peak AC and DC values.
*2 Tape and reel is the standard packing style for SSOP.
For space reasons, the three initial letters of the part number "AQY", and the package (SSOP) indicator "V" and the packing style indicator "Y" or "W" are not marked on the relay. (Ex. the label for product number AQY221FR2VY is 221FR2)

RATING

1. Absolute maximum ratings (Condition: ambient temperature 25°C 77°F)

Item		Symbol	AQY221FR2V	AQY221FN2V	Remarks
Input	Input voltage	V_{IN}	6V		
	Input reverse voltage	V_{RIN}	5V		
	Power dissipation	P_{in}	65mW		
Output	Load voltage (peak AC)	V_L	40V		
	Load current	I_L	0.25A	0.12A	Peak AC, DC
	Peak load current	I_{peak}	0.75A	0.2A	100ms (1shot), V_L=DC
	Power dissipation	P_{out}	250mW		
Total power dissipation		P_T	300mW		
I/O isolation voltage		V_{iso}	500V AC		
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F		

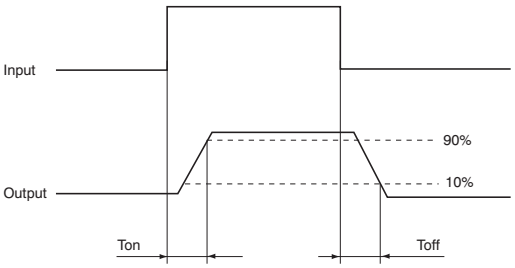
RF SSOP CxR10 Voltage-sensitive (AQY221F❍2V)

2. Electrical characteristics (Condition: ambient temperature 25°C 77°F)

Item			Symbol	AQY221FR2V	AQY221FN2V	Condition
Input	Operate voltage	Typ.	V_{Fon}	1.3V		AQY221FR2V: I_L = Max. AQY221FN2V: I_L = 80mA
		Max.		4V		
	Turn off voltage	Min.	V_{Foff}	0.8V		
		Typ.		1.3V		
	Input current	Typ.	I_{IN}	8.5mA		V_{IN} = 5V
Output	On resistance	Typ.	R_{on}	0.75Ω	9.5Ω	AQY221FR2V: V_{IN} = 5V, I_L = Max. AQY221FN2V: V_{IN} = 5V, I_L = 80mA Within 1 s on time
		Max.		1.25Ω	12.5Ω	
	Output capacitance	Typ.	C_{out}	12.5pF	1pF	V_{IN} = 0V, V_B = 0V, f = 1MHz
		Max.		18pF	1.5pF	
	Off state leakage current	Typ.	I_{Leak}	0.02nA	0.01nA	V_{IN} = 0V, V_L = Max.
		Max.		10nA		
Transfer characteristics	Turn on time*	Typ.	T_{on}	0.05ms	0.01ms	AQY221FR2V: V_{IN} = 5V, V_L = 10V, R_L = 40¾ AQY221FN2V: V_{IN} = 5V, V_L = 10V, R_L = 125¾
		Max.		0.5ms		
	Turn off time*	Typ.	T_{off}	0.06ms	0.03ms	
		Max.		0.2ms		
	I/O capacitance	Typ.	C_{iso}	0.8pF		f = 1MHz, V_B = 0V
		Max.		1.5pF		f = 1MHz, V_B = 0V
	Initial I/O isolation resistance	Min.	R_{iso}	1,000MΩ		500V DC

Note: If you wish to change the input voltage, rating or performance, please inquire with our sales.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Minimum	Typical	Maximum	Unit
Input voltage	V_{IN}	4.5	5	5.5	V

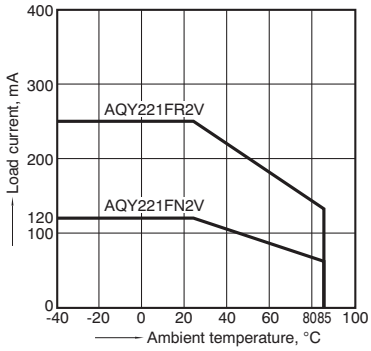
■ For Dimensions, see Page 62.
■ For Schematic and Wiring Diagrams, see Page 64.
■ For Cautions for Use, see Page 71.

■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

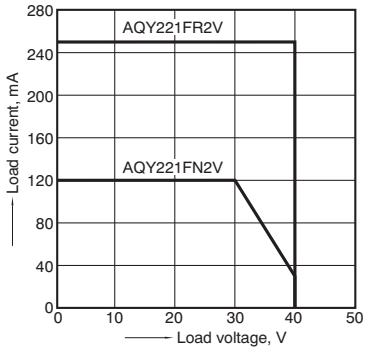
35.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



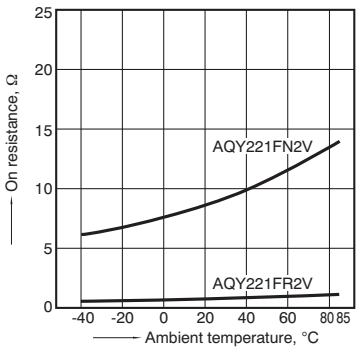
36.Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



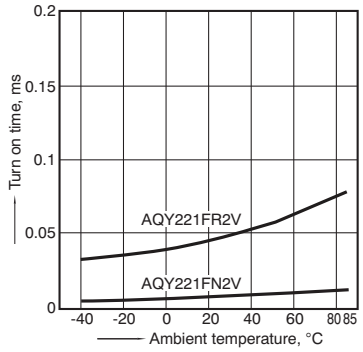
37.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



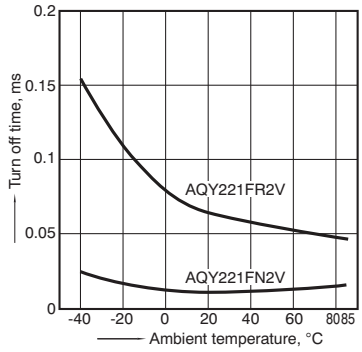
38.Turn on time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type



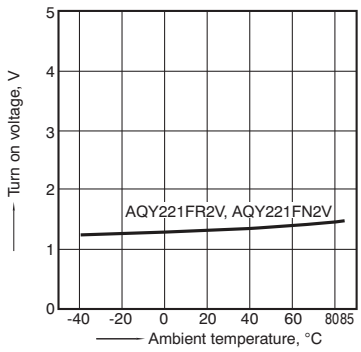
39.Turn off time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type



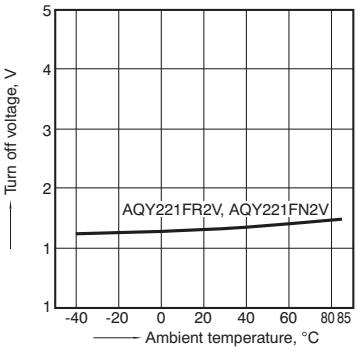
40.Turn on voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type



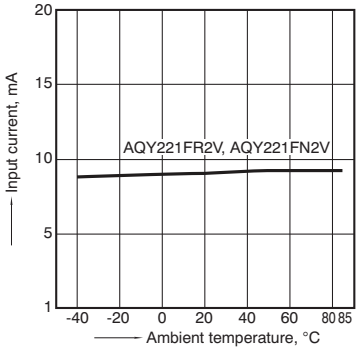
41.Turn off voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type



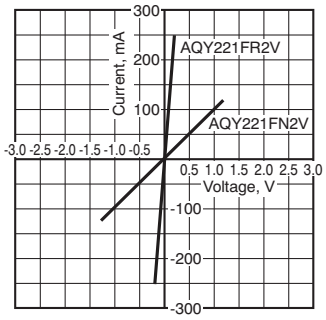
42.Input current vs. ambient temperature characteristics

Input voltage: 5V



43.Current vs. voltage characteristics of output at MOS portion

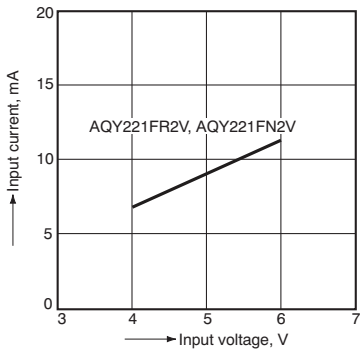
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



RF SSOP CxR10 Voltage-sensitive (AQY221F❍2V)

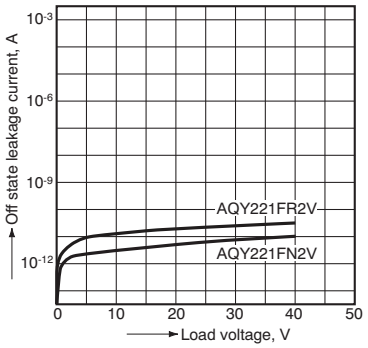
44.Input current vs. input voltage characteristics

Ambient temperature: 25°C 77°F
(Recommended input voltage: 5±0.5V)



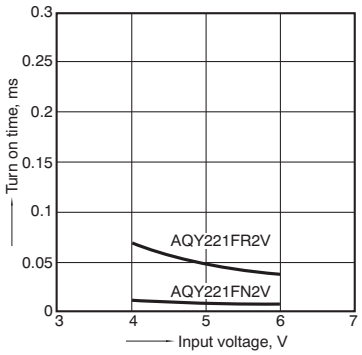
45.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



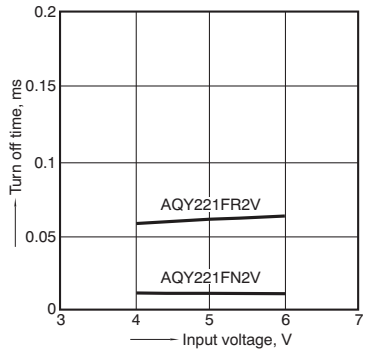
46.Turn on time vs. input voltage characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type; Ambient temperature: 25°C 77°F



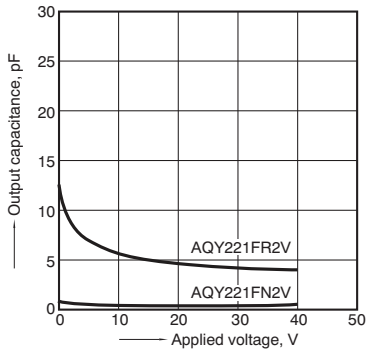
47.Turn off time vs. input voltage characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type,
80mA (DC) C type; Ambient temperature: 25°C 77°F



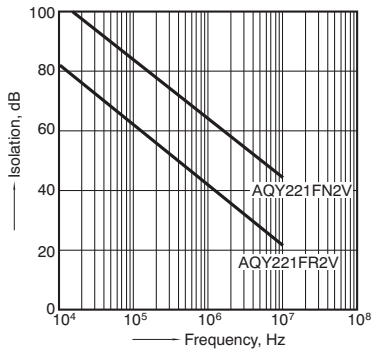
48.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms;
Ambient temperature: 25°C 77°F



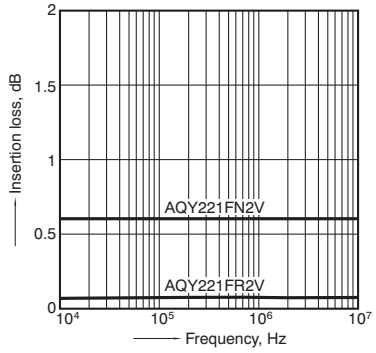
49.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



50.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



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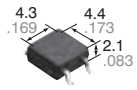
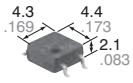
Miniature SOP4-pin with C×R10 40V load voltage

PhotoMOS Relays
RF SOP 1 Form A C×R10
(AQY221❍2S)



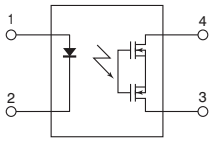
<R type>



<C type>

CAD Data

mm inch



FEATURES

1. Both low on-resistance (R type) and low capacitance (C type) available at excellent characteristics of C×R10

	AQY221R2S (R type)	AQY221N2S (C type)
Low on resistance: R	0.8Ω	9.5Ω
Low output capacitance: C	13pF	1pF

2. High speed switching
Turn on time: 0.03ms (typ.)
Turn off time: 0.03ms (typ.)
(AQY221N2S)
3. Small profile of miniature SOP4-pin
4. Low-level off state leakage current of typ. 0.01nA (AQY221N2S)

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Bare board tester, In-circuit tester, Function tester, etc.
2. Telecommunication and broadcasting equipment
3. Medical equipment
Ultrasonic wave diagnostic machine
4. Multi-point recorder
Warping, Thermo couple, etc.

TYPES

	Type	Output rating*		Package	Part No.			Packing quantity	
		Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	Low on resistance (R type)	40V	250mA	SOP4-pin	AQY221R2S	AQY221R2SX	AQY221R2SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
	Low capacitance (C type)	40V	120mA		AQY221N2S	AQY221N2SX	AQY221N2SZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the initial letters of the part number "AQY", the package (SOP) indicator "S" and the packing style indicator "X" or "Z" are not marked on the relay.
(Ex. the label for product number AQY221R2SX is 221R2)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

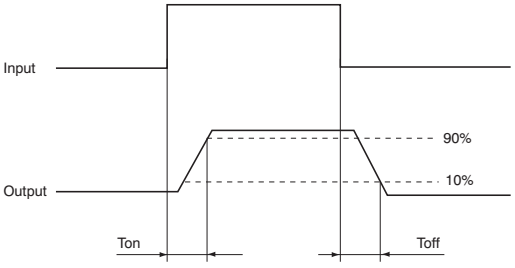
Item		Symbol	AQY221R2S (R type)	AQY221N2S (C type)	Remarks
Input	LED forward current	I_F	50mA		
	LED reverse voltage	V_R	5V		
	Peak forward current	I_{FP}	1A		f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW		
Output	Load voltage (peak AC)	V_L	40V		
	Continuous load current	I_L	0.25A	0.12A	Peak AC, DC
	Peak load current	I_{peak}	0.75A	0.30A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	300mW		
Total power dissipation		P_T	350mW		
I/O isolation voltage		V_{iso}	500V AC	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

RF SOP 1 Form A CxR10 (AQY221○2S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY221R2S (R type)	AQY221N2S (C type)	Condition
Input	LED operate current	Typical	I_{Fon}	0.5 mA	0.9 mA	I_L = 250 mA (R type) I_L = 80 mA (C type)
		Maximum		3.0 mA		
	LED turn off current	Minimum	I_{Foff}	0.1 mA	0.2 mA	I_L = 250 mA (R type) I_L = 80 mA (C type)
		Typical		0.4 mA	0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	0.8Ω	9.5Ω	I_F = 5 mA I_L = 250 mA (R type), I_L = 80 mA (C type) Within 1 s on time
		Maximum		1.25Ω	12.5Ω	
	Output capacitance	Typical	C_{out}	13 pF	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		18 pF	1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.03 nA	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	0.1 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 40Ω (R type), 125Ω (C type)
		Maximum		0.5ms		
	Turn off time*	Typical	T_{off}	0.06 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 40Ω (R type), 125Ω (C type)
		Maximum		0.2 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

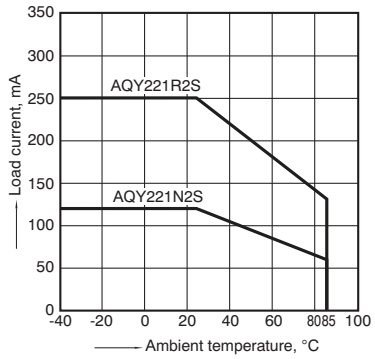
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

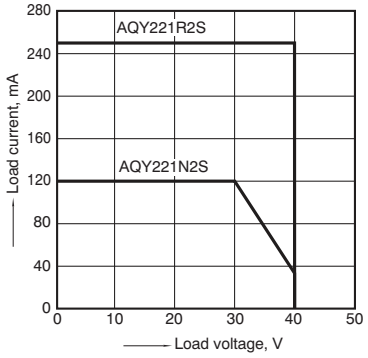
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



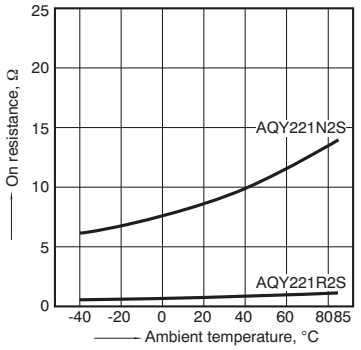
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



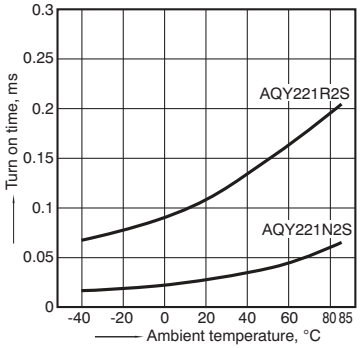
3. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC);
Load current: 250mA (DC) [R type], 80mA (DC) [C type]



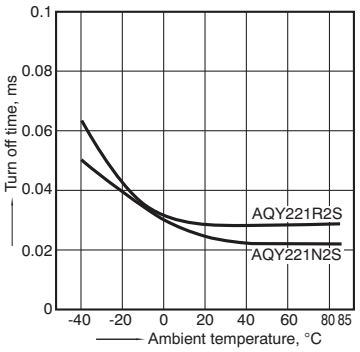
4. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type]



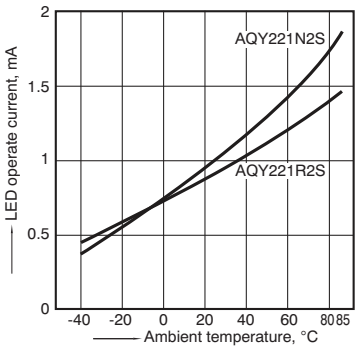
5. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type]



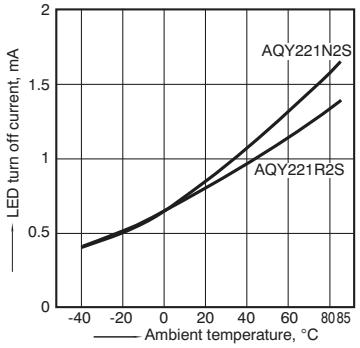
6. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type]



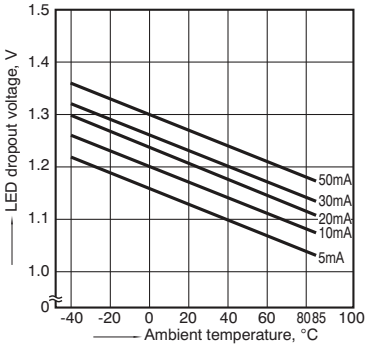
7. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];



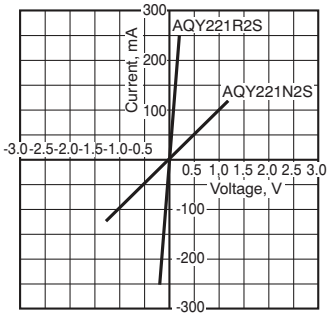
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



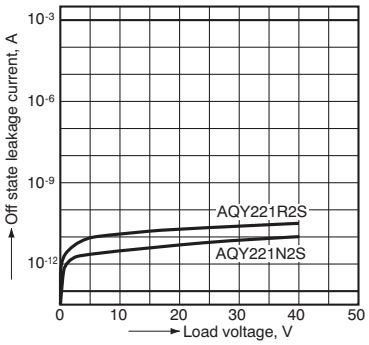
9. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



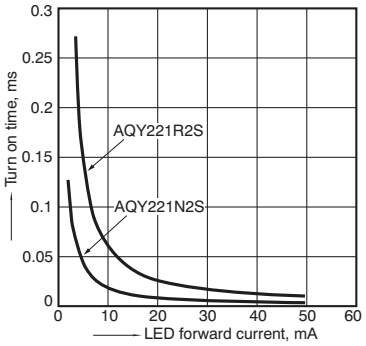
10.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



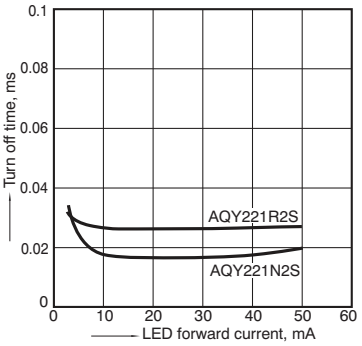
11.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];
Ambient temperature: 25°C 77°F



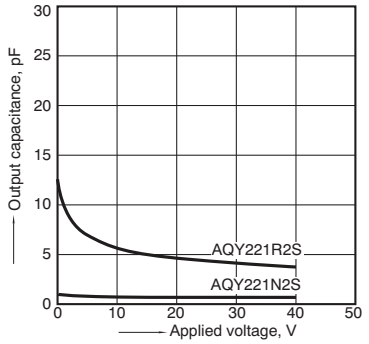
12.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];
Ambient temperature: 25°C 77°F



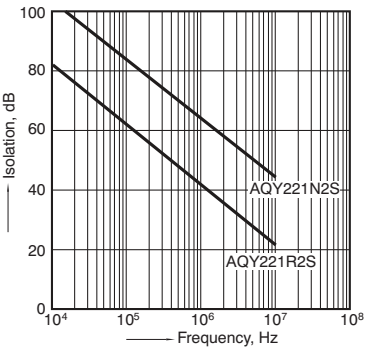
13.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



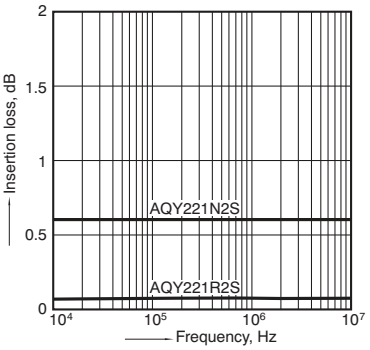
14.Isolation vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



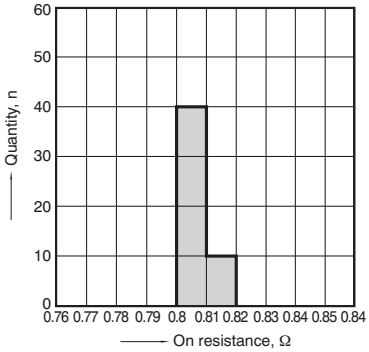
15.Insertion loss vs. frequency characteristics (50Ω impedance)

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



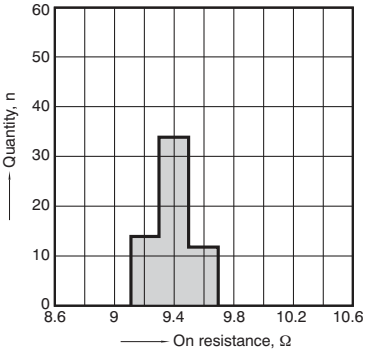
16-(1). On resistance distribution (R type)

Measured portion: between terminals 3 and 4
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



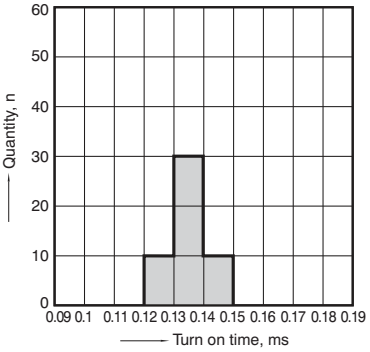
16-(2). On resistance distribution (C type)

Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F

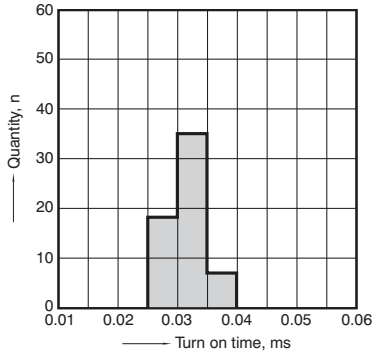


17-(1). Turn on time distribution (R type)

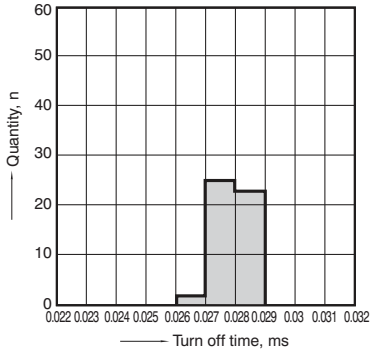
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



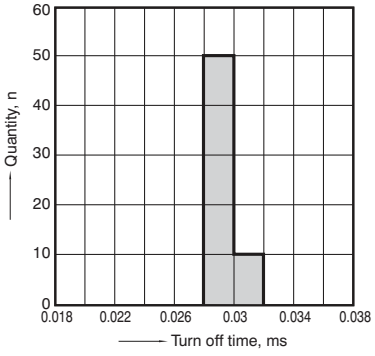
17-(2). Turn on time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



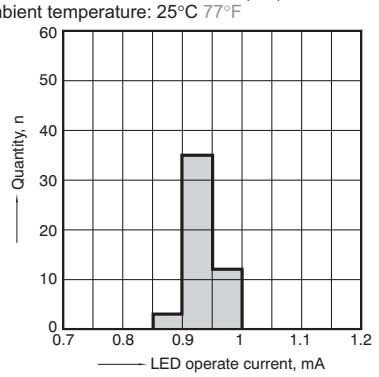
18-(1). Turn off time distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



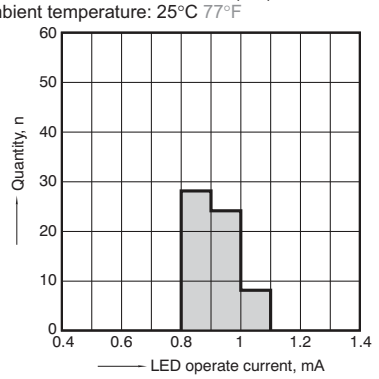
18-(2). Turn off time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



19-(1). LED operate current distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



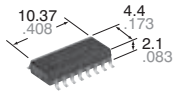
19-(2). LED operate current distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

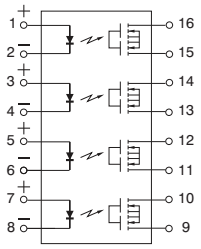
Space-saving low C×R type with 4 channels in a SOP16-pin package

PhotoMOS Relays
RF SOP 4 Form A C×R10
(AQS221○2S)



CAD Data

mm inch



FEATURES

1. 4-channel (4 Form A) in a small SOP16-pin package
The device comes in a miniature SOP measuring (W)10.37 × (L)4.4 × (H)2.1mm (W).408×(L).173×(H).083inch
This contributes to space-saving of PC board.
2. Both low on-resistance (R type) and low capacitance (C type) available at excellent characteristics of C×R10
• R type: On resistance 0.8Ω (typ.)
Output capacitance 13pF (typ.)
• C type: On resistance 9.7Ω (typ.)
Output capacitance 1.0pF (typ.)
3. High-speed switching of 0.03ms (C type, typical turn on time)
4. Applicable for 4 Form A use, as well as 4 independent 1 Form A

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Bare board tester, In-circuit tester, Function tester, etc.
2. Telecommunication and broadcasting equipment
3. Medical equipment
Ultrasonic wave diagnostic machine
4. Multi-point recorder
Warping, Thermo couple, etc.

TYPES

	Type	Output rating*1		Package	Part No.*2			Packing quantity	
		Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4/5/6/7/8-pin side	Picked from the 9/10/11/12/13/14/15/16-pin side		
AC/DC dual use	Low on-resistance (R type)	40V	0.16A	SOP16-pin	AQS221R2S	AQS221R2SX	AQS221R2SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	Low capacitance (C type)	40V	0.06A		AQS221N2S	AQS221N2SX	AQS221N2SZ		

Notes:
*1 Indicate the peak AC and DC values.
*2 The packing style indicator "X" or "Z" is not marked on the relay.

RATING

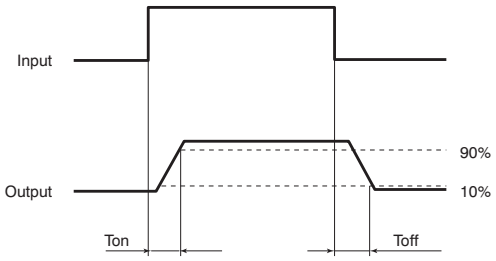
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQS221R2S (R type)	AQS221N2S (C type)	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	40 V		
	Continuous load current	I_L	0.16 A	0.06 A	Peak AC, DC
	Peak load current	I_{peak}	0.2 A	0.12 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW		
Total power dissipation		P_T	650 mW		
I/O isolation voltage		V_{iso}	500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQS221R2S (R type)	AQS221N2S (C type)	Condition
Input	LED operate current	Typical	I_{Fon}	0.5 mA	0.9 mA	I_L = Max.
		Maximum		3.0 mA		
	LED turn off current	Minimum	I_{Foff}	0.1 mA		I_L = Max.
		Typical		0.4 mA	0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	0.8Ω	9.5Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		1.25Ω	12.5Ω	
	Output capacitance	Typical	C_{out}	13.0 pF	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		18.0 pF	1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.03 nA	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	0.1 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 62.5Ω (R type), R_L = 500Ω (C type)
		Maximum		0.5 ms	0.2 ms	
	Turn off time*	Typical	T_{off}	0.06 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 62.5Ω (R type), R_L = 500Ω (C type)
		Maximum		0.2 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

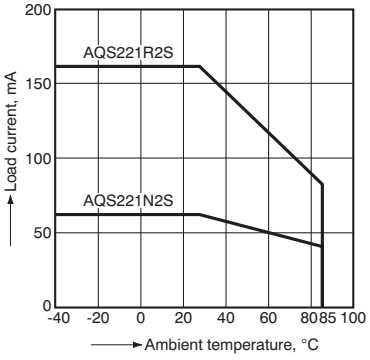
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 67.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

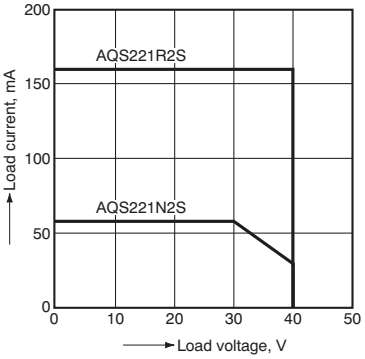
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



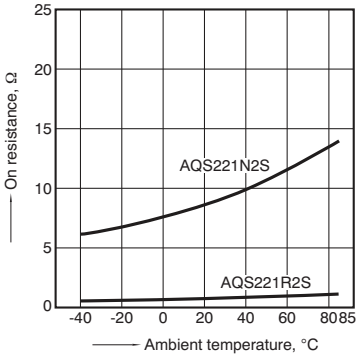
2. Load current vs. load voltage characteristics

Ambient temperature: 25°C 47°F



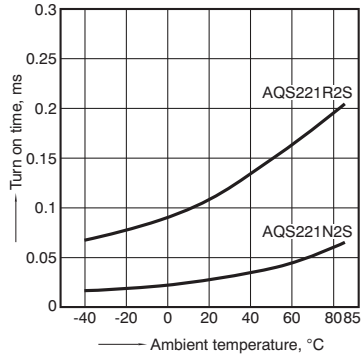
3. On resistance vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
60 mA (DC) C type



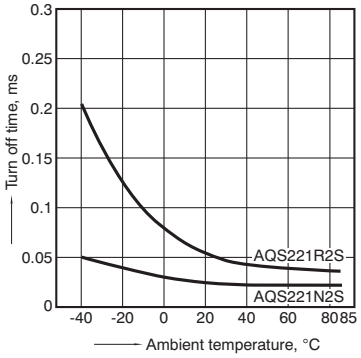
4. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
20 mA (DC) C type



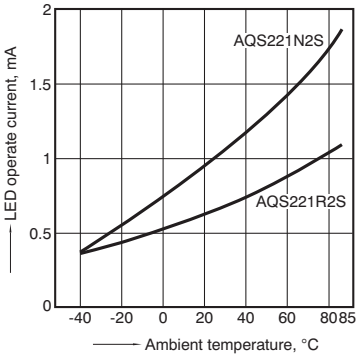
5. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
20 mA (DC) C type



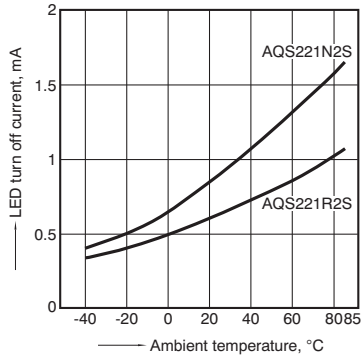
6. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
60 mA (DC) C type



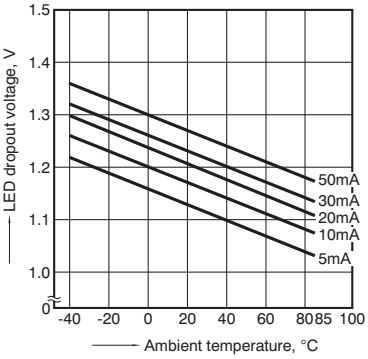
7. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
60 mA (DC) C type



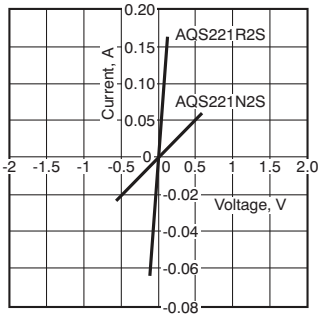
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



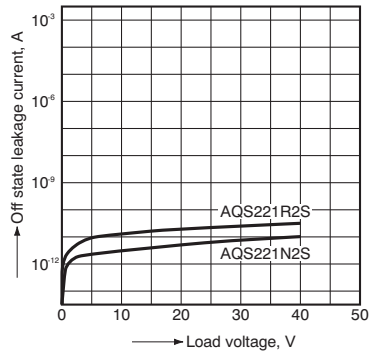
9. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



10.Off state leakage current vs. load voltage characteristics

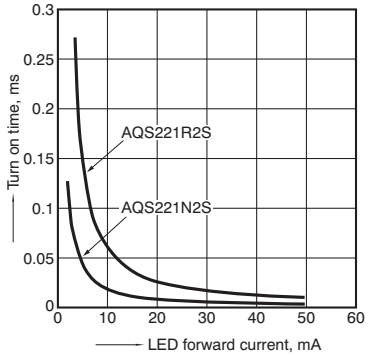
Ambient temperature: 25°C 77°F



11.Turn on time vs. LED forward current characteristics

Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
20 mA (DC) C type

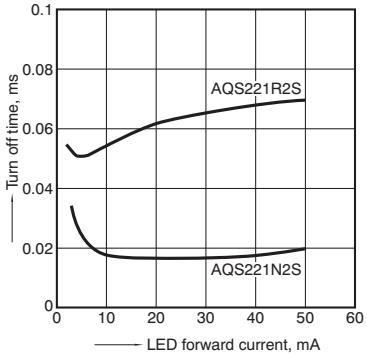
Ambient temperature: 25°C 77°F



12.Turn off time vs. LED forward current characteristics

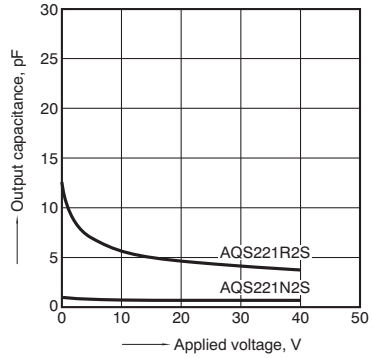
Load voltage: 10 V (DC);
Continuous load current: 160 mA (DC) R type/
20 mA (DC) C type

Ambient temperature: 25°C 77°F



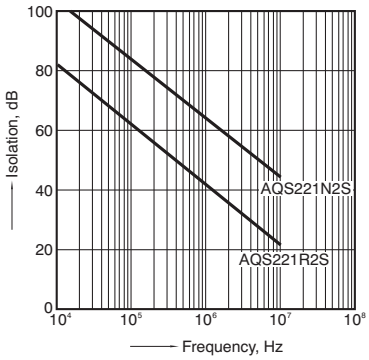
13.Output capacitance vs. applied voltage characteristics

Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



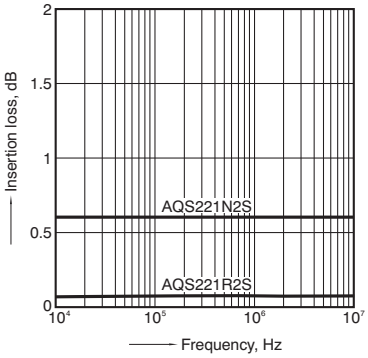
14.Isolation vs. frequency characteristics (50Ω impedance)

Ambient temperature: 25°C 77°F



15.Insertion loss vs. frequency characteristics (50Ω impedance)

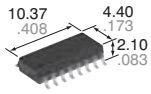
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

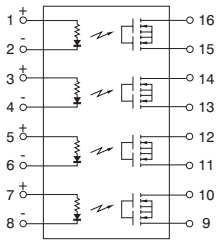
Space-saving 4-channel type with built-in input resistor

PhotoMOS Relays
RF SOP 4 Form A C×R10
Voltage-sensitive



CAD Data

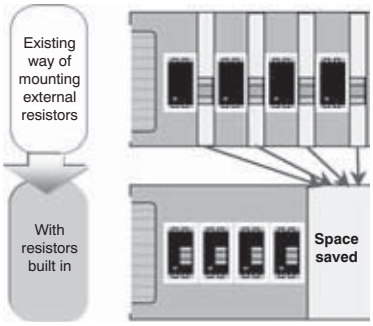
mm inch



FEATURES

1. Built-in input resistor means less man-hours when mounting
The voltage-sensitive type, which eliminates the need to mount an external input resistor, is now available in a small package. Man-hours spent mounting external input resistors are cut and board designing is simplified.

2. Saves space on PC board
Since the small package size remains the same while including a built-in input resistor, space on the PC board is saved. This makes it easier to incorporate space savings when designing miniature devices.



<Artistic impression of PC board space savings due to built-in resistor>
In case of SSOP.

3. Both low on-resistance (R type) and low capacitance (C type) available at excellent electrical characteristics of C×R10
- R type: On resistance 0.8Ω (typ.)
  Output capacitance 14pF (typ.)
- C type: On resistance 9.5Ω (typ.)
  Output capacitance 1.1pF (typ.)

TYPICAL APPLICATIONS

For multi-circuit switching;

1. Measuring and testing equipment
Semiconductor testing equipment, Probe cards, Datalogger, Board tester and other testing equipment

2. Telecommunication and broadcasting equipment

3. Medical equipment

TYPES

	Type	Output rating*1		Package	Part No.*2			Packing quantity	
		Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3/4/5/6/7/8-pin side	Tape and reel packing style: Picked from the 9/10/11/12/13/14/15/16-pin side	Tube	Tape and reel
AC/DC dual use	Low on resistance (R type)	40 V	0.16A	SOP16-pin	AQS221FR2S	AQS221FR2SX	AQS221FR2SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	Low capacitance (C type)	40 V	0.06A		AQS221FN2S	AQS221FN2SX	AQS221FN2SZ		

Notes: *1 Indicate the peak AC and DC values.
*2 The packing style indicator "X" or "Z" is not marked on the relay.

RATING

1. Absolute maximum ratings (Condition: ambient temperature 25°C 77°F)

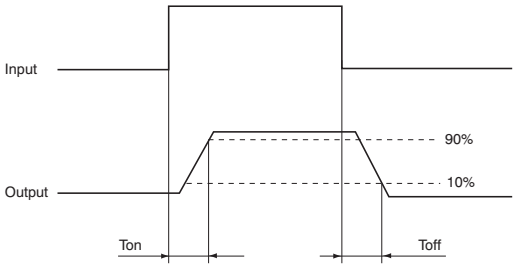
Item		Symbol	AQS221FR2S	AQS221FN2S	Remarks
Input	Input voltage	V_{IN}	6V		
	Input reverse voltage	V_{RIN}	5V		
	Power dissipation	P_{in}	260mW*		*65mW for 1a
Output	Load voltage (peak AC)	V_L	40V	40V	
	Load current	I_L	0.16A	0.06A	Peak AC, DC
	Peak load current	I_{peak}	0.2A	0.12A	100ms (1shot), V_L=DC
	Power dissipation	P_{out}	600mW		
Total power dissipation		P_T	650mW		
I/O isolation voltage		V_{iso}	500V AC		
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Condition: ambient temperature 25°C 77°F)

Item			Symbol	AQS221FR2S	AQS221FN2S	Condition
Input	Operate voltage	Typ.	V_{Fon}	1.3V		I_L = Max.
		Max.		4V		
	Turn off voltage	Min.	V_{Foff}	0.8V		
		Typ.		1.3V		
	Input current	Typ.	I_{IN}	8.5mA		V_{IN} = 5V
Output	On resistance	Typ.	R_{on}	0.75Ω	9.5Ω	V_{IN} = 5V I_L = Max. Within 1 s on time
		Max.		1.25Ω	12.5Ω	
	Output capacitance	Typ.	C_{out}	12.5pF	1pF	V_{IN} = 0V V_B = 0V f = 1MHz
		Max.		18pF	1.5pF	
	Off state leakage current	Typ.	I_{Leak}	0.02nA	0.01nA	V_{IN} = 0V V_L = Max.
		Max.		10nA		
Transfer characteristics	Turn on time*	Typ.	T_{on}	0.07ms	0.02ms	AQS221FR2S: V_{IN} = 5V, I_L = Max. AQS221FN2S: V_{IN} = 5V, V_L = 10V, R_L = 500¾
		Max.		0.5ms		
	Turn off time*	Typ.	T_{off}	0.07ms	0.02ms	
		Max.		0.2ms		
	I/O capacitance	Typ.	C_{iso}	0.8pF		f = 1MHz, V_B = 0V
		Max.		1.5pF		f = 1MHz, V_B = 0V
	Initial I/O isolation resistance	Min.	R_{iso}	1,000MΩ		500V DC

Note: If you wish to change the input voltage, rating or performance, please inquire with our sales.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Minimum	Typical	Maximum	Unit
Input voltage	V_{IN}	4.5	5	5.5	V

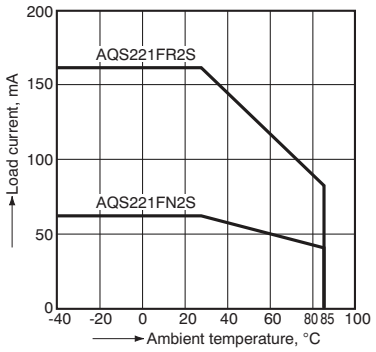
■ For Dimensions, see Page 62.
■ For Schematic and Wiring Diagrams, see Page 67.
■ For Cautions for Use, see Page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

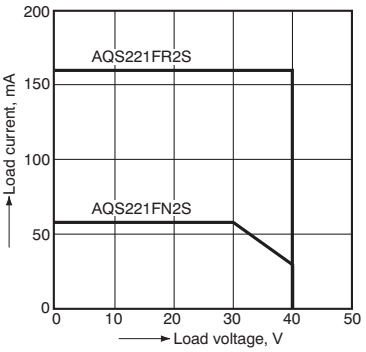
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



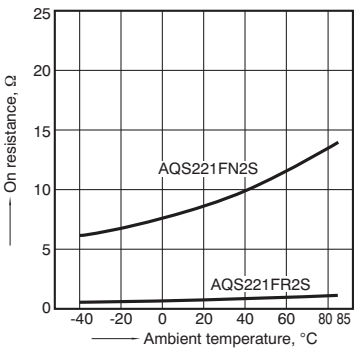
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



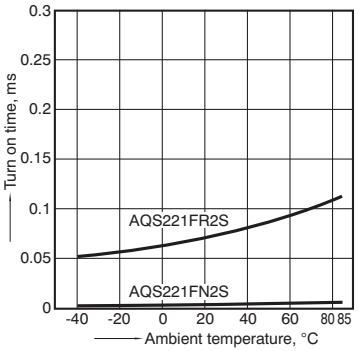
3. On resistance vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 160mA (DC) R type,
60mA (DC) C type



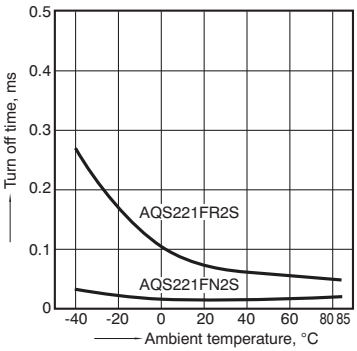
4. Turn on time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 125mA (DC) R type,
20mA (DC) C type



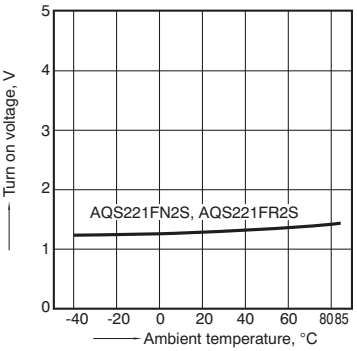
5. Turn off time vs. ambient temperature characteristics

Input voltage: 5V; Load voltage: 10V (DC);
Continuous load current: 125mA (DC) R type,
20mA (DC) C type



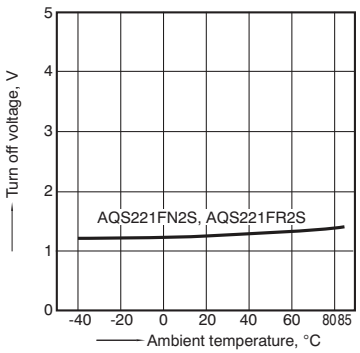
6. Turn on voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 160mA (DC) R type,
60mA (DC) C type



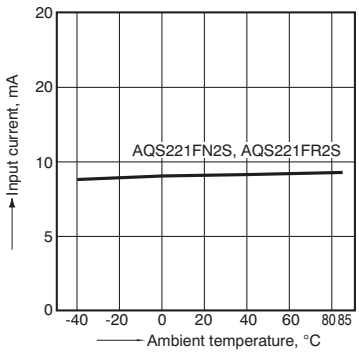
7. Turn off voltage vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 160mA (DC) R type,
60mA (DC) C type



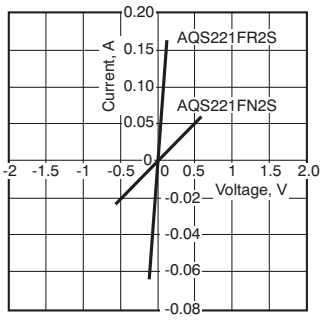
8. Input current vs. ambient temperature characteristics

Input voltage: 5V

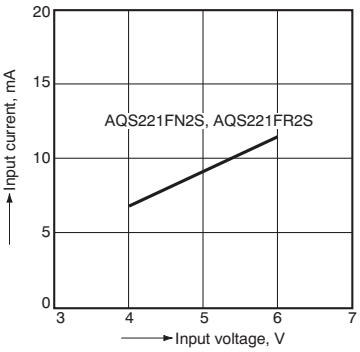


9. Current vs. voltage characteristics of output at MOS portion

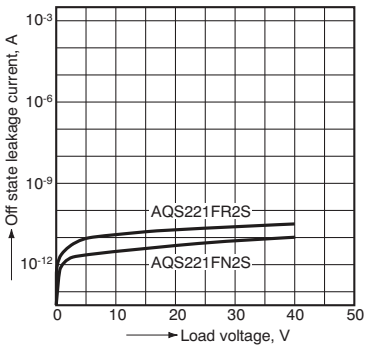
Ambient temperature: 25°C 77°F



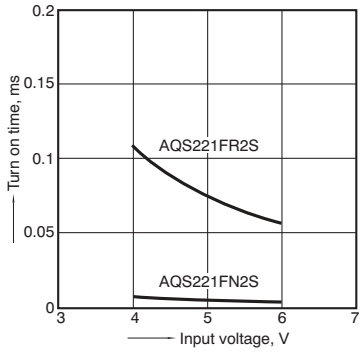
10. Input current vs. input voltage characteristics
Ambient temperature: 25°C 77°F
(Recommended input voltage: 5±0.5V)



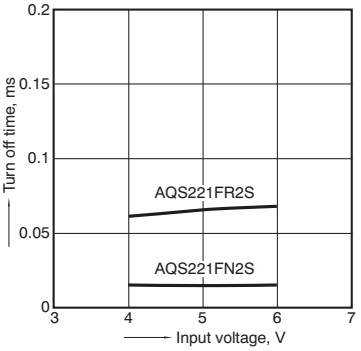
11. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



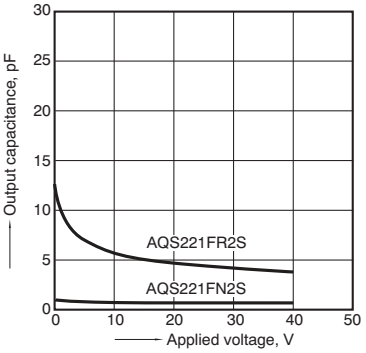
12. Turn on time vs. input voltage characteristics
Load voltage: 10V (DC);
Continuous load current: 125mA (DC) R type,
20mA (DC) C type; Ambient temperature: 25°C 77°F



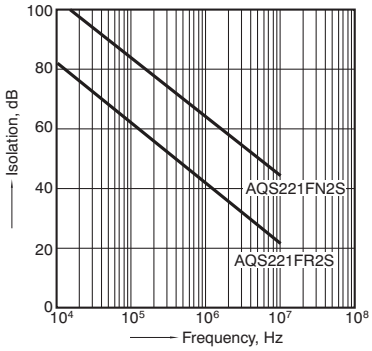
13. Turn off time vs. input voltage characteristics
Load voltage: 10V (DC);
Continuous load current: 125mA (DC) R type,
20mA (DC) C type; Ambient temperature: 25°C 77°F



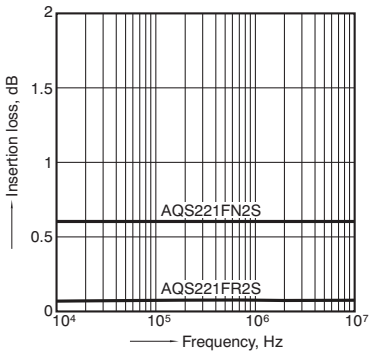
14. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms;
Ambient temperature: 25°C 77°F



15. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



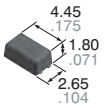
16. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

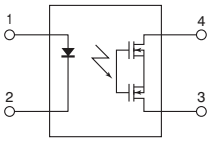
Super miniature SSOP type featuring low C×R 80V load voltage

PhotoMOS Relays
RF SSOP 1 Form A C×R
(AQY225R2V)



CAD Data

mm inch

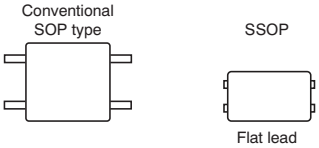


FEATURES

1. Low capacitance and on-resistance with 80V load voltage
Output capacitance (Cout): 4.5pF (typ.)
ON resistance (Ron): 10.5Ω (typ.)

2. Reduced package size
The bottom dimension has been reduced by 60% and mounting space by 40% compared to conventional SOP4-pin type.

3. Mounting space has been reduced and output signals have been improved by using new flat lead terminals.



4. High speed switching
Turn on time: 0.05ms (typ.)
Turn off time: 0.05ms (typ.)

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Bare board tester, In-circuit tester, function tester, etc.

2. Telecommunication and broadcasting equipment

3. Medical equipment

4. Multi-point recorder
Warping, Thermo couple, etc.

TYPES

	Output rating*1		Package	Tape and reel packing style*2		Packing quantity in tape and reel
	Load voltage	Load current		Picked from the 1/4-pin side	Picked from the 2/3-pin side	
AC/DC dual use	80 V	0.12 A	SSOP	AQY225R2VY	AQY225R2VW	3,500 pcs.

Notes: *1 Indicate the peak AC and DC values.
*2 Tape and reel is the standard packing style for SSOP.
For space reasons, the three initial letters of the part number “AQY” the package (SSOP) indicator “V” and the packing style indicator “Y” or “W” are not marked on the relay.

RATING

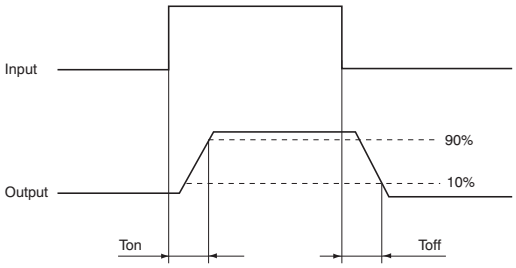
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY225R2V	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	80V	
	Continuous load current	I_L	0.12A	Peak AC, DC
	Peak load current	I_{peak}	0.3A	A connection: 100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	250mW	
Total power dissipation		P_T	300mW	
I/O isolation voltage		V_{iso}	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY225R2V	Condition
Input	LED operate current	Typical	I_{Fon}	0.5 mA	I_L = 80 mA
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.1 mA	I_L = 80 mA
		Typical		0.45 mA	
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	10.5Ω	I_F = 5 mA I_L = 80 mA
		Maximum		15Ω	
	Output capacitance	Typical	C_{out}	4.5 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		6 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.05 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
		Maximum		0.5 ms	
	Turn off time*	Typical	T_{off}	0.05 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

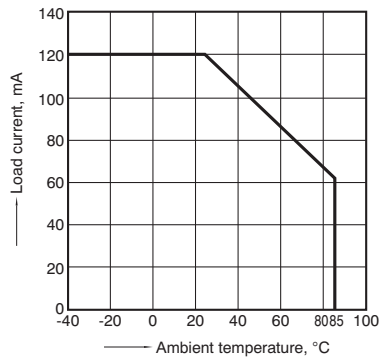
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

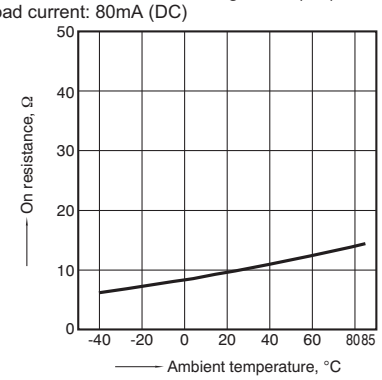
16.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



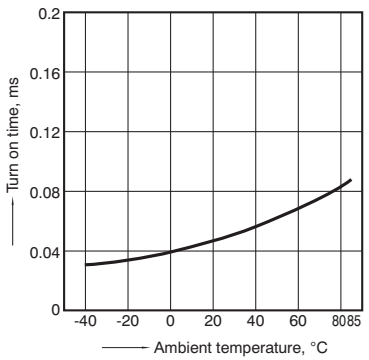
17.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Load current: 80mA (DC)



18.Turn on time vs. ambient temperature characteristics

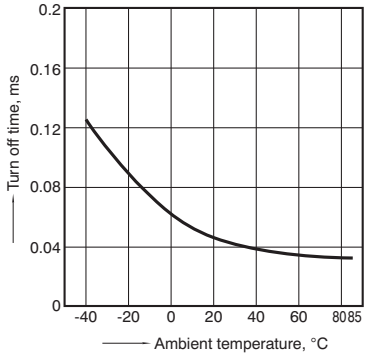
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



RF SSOP 1 Form A C×R (AQY225R2V)

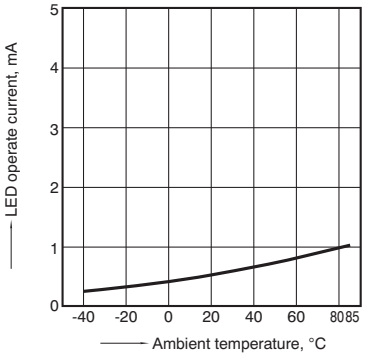
19.Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



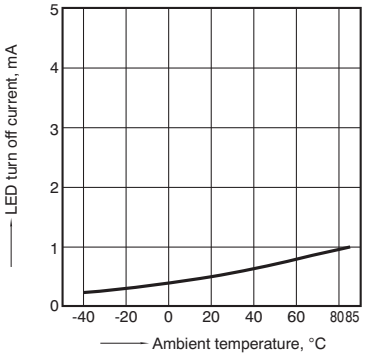
20.LED operate current vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



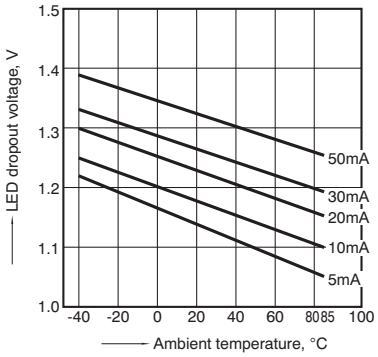
21.LED turn off current vs. ambient temperature characteristics

Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



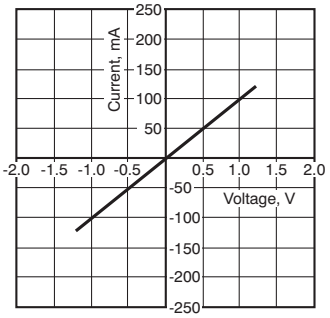
22.LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



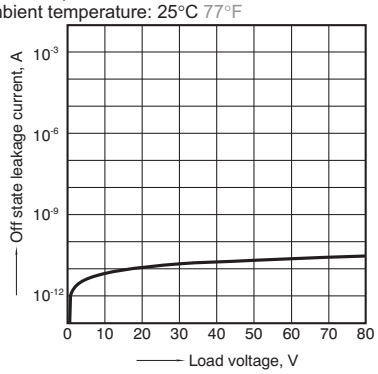
23.Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



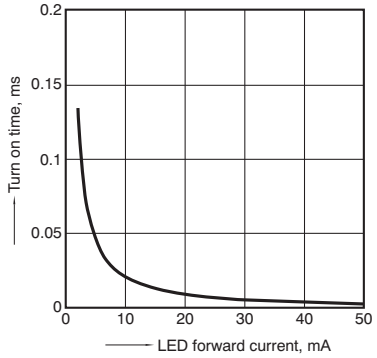
24.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



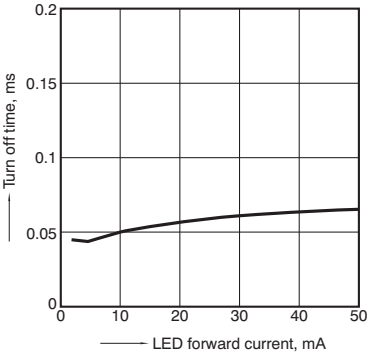
25.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



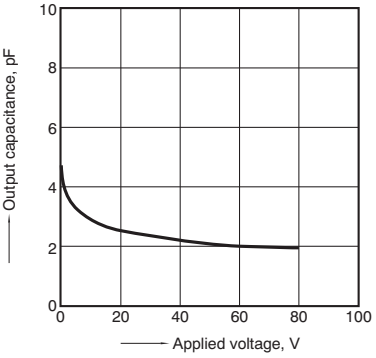
26.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



27.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



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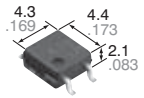
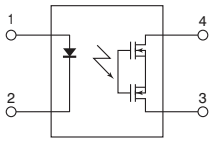
Miniature SOP4-pin type featuring low C×R 60V/80V load voltage

PhotoMOS Relays
RF SOP 1 Form A C×R
(AQY22○R○S)



CAD Data

mm inch



FEATURES

1. Low capacitance and low on resistance (Load voltage: 60 to 80V)

	AQY222R1S	AQY225R1S	AQY225R2S
Output capacitance (Cout)	24.5pF (typ.)	37.5pF (typ.)	**4.5pF** (typ.)
On resistance (Ron)	**0.8**Ω (typ.)	**0.8**Ω (typ.)	10.5Ω (typ.)

2. Miniature SOP4-pin package
(W)4.3 × (L)4.4 × (H)2.1 mm
(W).169 × (L).173 × (H).083 inch
3. Low-level off-state leakage current of typ. 0.01 nA (AQY225R2S)
4. Controls low-level analog signals

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Bare board tester, In-circuit tester, Function tester, etc.
2. Telecommunication and broadcasting equipment
3. Medical equipment
4. Multi-point recorder
Warping, Thermo couple

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2-pin side	Tape and reel packing style: Picked from the 3/4-pin side	Tube	Tape and reel
AC/DC dual use	60V	0.5A	SOP4-pin	AQY222R1S	AQY222R1SX	AQY222R1SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
	80V	0.35A		AQY225R1S	AQY225R1SX	AQY225R1SZ		
	80V	0.15A		AQY225R2S	AQY225R2SX	AQY225R2SZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the three initial letters of the part number “AQY”, the package (SOP) indicator “S” and the packing style indicator “X” or “Z” are not marked on the relay. (Ex. the label for product number AQY222R1SX is 222R1)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

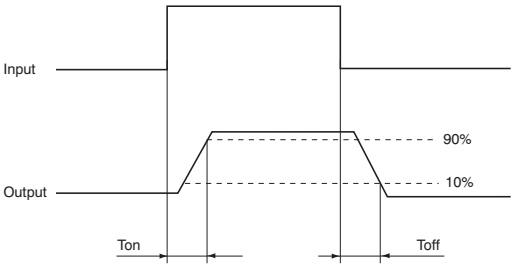
Item		Symbol	AQY222R1S	AQY225R1S	AQY225R2S	Remarks
Input	LED forward current	I_F	50mA			
	LED reverse voltage	V_R	5V			
	Peak forward current	I_{FP}	1A			f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW			
Output	Load voltage (peak AC)	V_L	60V	80V		
	Continuous load current	I_L	0.5A	0.35A	0.15A	Peak AC, DC
	Peak load current	I_{peak}	1A	0.7A	0.45A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	300mW			
Total power dissipation		P_T	350mW			
I/O isolation voltage		V_{iso}	1,500V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

RF SOP 1 Form A C×R (AQY22❍R❍S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY222R1S	AQY225R1S	AQY225R2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.5 mA			I_L = Max.
		Maximum		3.0 mA			
	LED turn off current	Minimum	I_{Foff}	0.1 mA			I_L = Max.
		Typical		0.45 mA			
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.8Ω		10.5Ω	I_F = 5 mA I_L = Max.
		Maximum		1.2Ω		15Ω	
	Output capacitance	Typical	C_{out}	24.5 pF	37.5 pF	4.5 pF	I_F = 0 mA, f = 1 MHz, V_B = 0 V (amplitude of 30mV) Measured from 10s onward after application
		Maximum		30 pF	45 pF	6.0 pF	
	Off state leakage current	Typical	I_{Leak}	0.05 nA	0.03 nA	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA			
Transfer characteristics	Turn on time*	Typical	T_{on}	0.15 ms	0.25 ms	0.05 ms	I_F = 5 mA V_L = 10V R_L = 100Ω
		Maximum		0.5ms	0.75ms	0.5ms	
	Turn off time*	Typical	T_{off}	0.06 ms	0.08 ms	0.05 ms	I_F = 5 mA V_L = 10V R_L = 100Ω
		Maximum		0.2 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ			500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

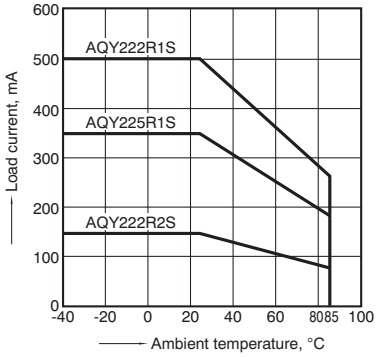
■ For Dimensions, see Page 62.
■ For Schematic and Wiring Diagrams, see Page 64.
■ For Cautions for Use, see Page 71.

■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

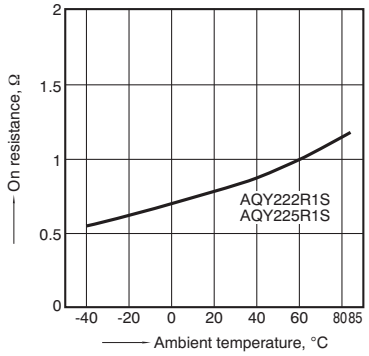
28.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



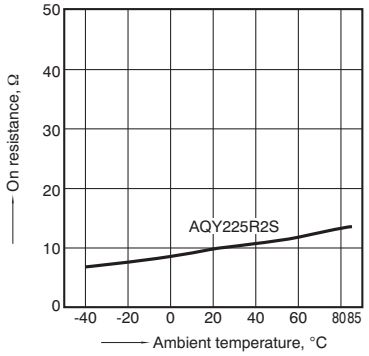
29-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



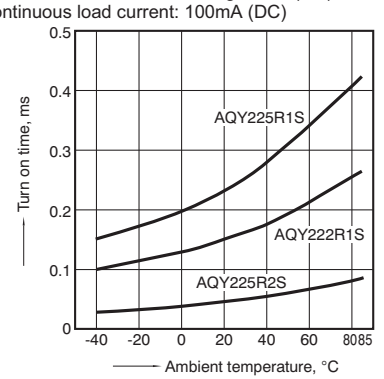
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



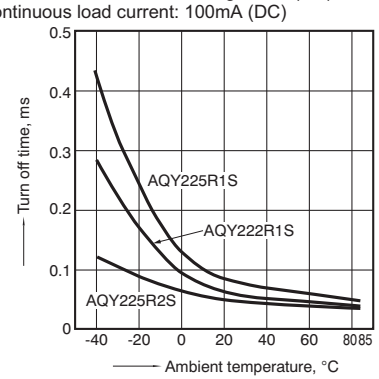
30.Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10V (DC)
Continuous load current: 100mA (DC)



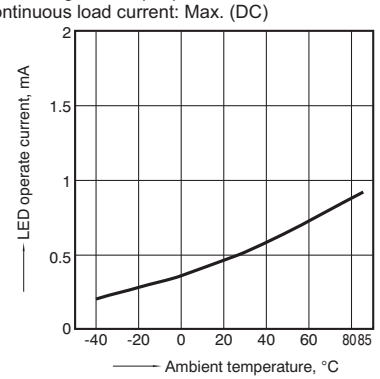
31.Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10V (DC)
Continuous load current: 100mA (DC)



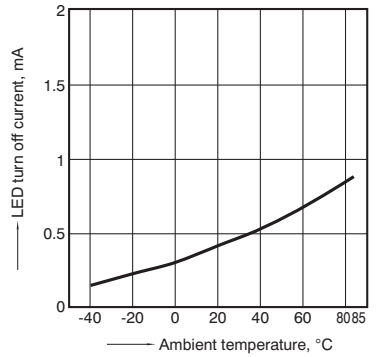
32.LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC)
Continuous load current: Max. (DC)



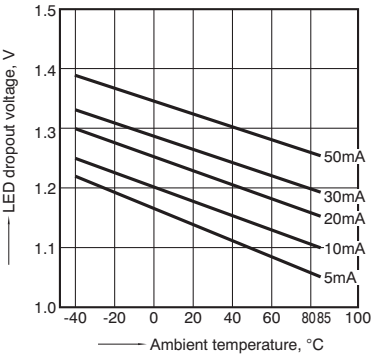
33.LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC)
Continuous load current: Max. (DC)



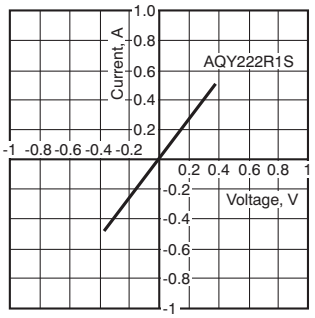
34.LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



35-(1) Current vs. voltage characteristics of output at MOS portion

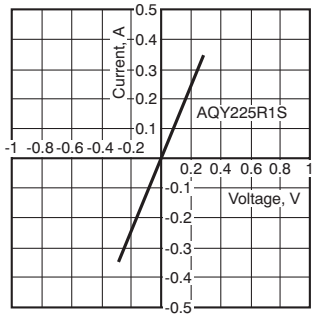
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



RF SOP 1 Form A C×R (AQY22❍R❍S)

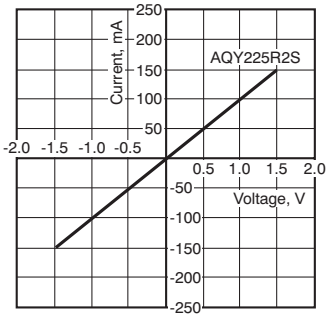
8.-(2) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



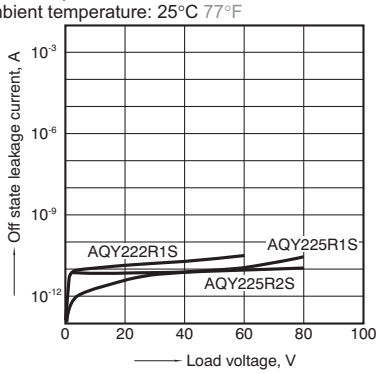
8.-(3) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



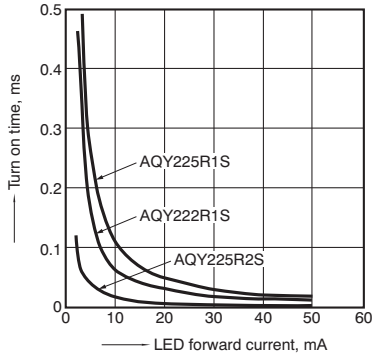
36.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



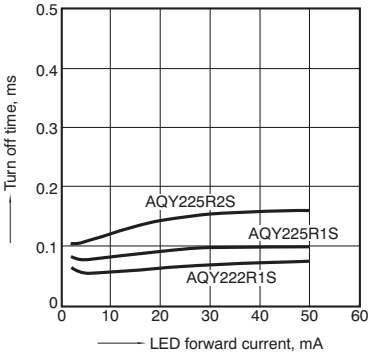
37.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: 100mA (DC)
Ambient temperature: 25°C 77°F



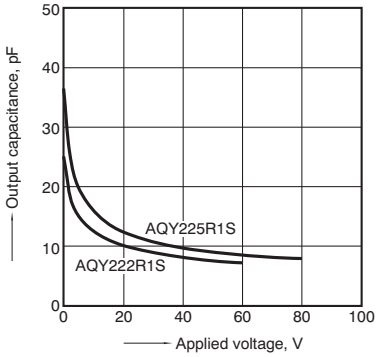
38.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC)
Continuous load current: 100mA (DC)
Ambient temperature: 25°C 77°F



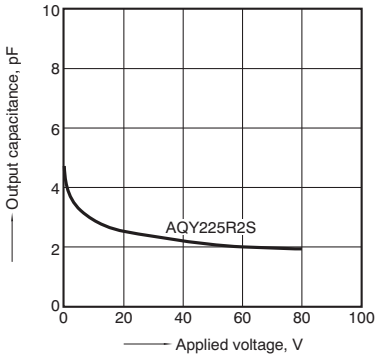
39-(1) Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms
Ambient temperature: 25°C 77°F



12.-(2) Output capacitance vs. applied voltage characteristics

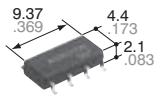
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

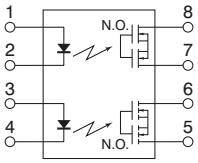
Miniature SOP8-pin type featuring low C×R with high load voltage of 250V

PhotoMOS Relays
RF SOP 2 Form A C×R
(AQW223R2S)



CAD Data

mm inch



FEATURES

1. With high load voltage of 250V, low output capacitance and low on-resistance.
Output capacitance (Cout): 33 pF (typ.)
On-resistance (Ron): 11Ω (typ.)
2. 2-channel (Form A) in miniature SOP8-pin package
(W) 4.4 × (L) 9.37 × (H) 2.1 mm
(W) .173× (L) .369 × (H) .083 inch
3. Low-level off-state leakage current of typ. 0.03 nA
4. Controls low-level analog signals

TYPICAL APPLICATIONS

1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Semiconductor performance tester, Bare board tester, In-circuit tester, Function tester, etc.
2. Telecommunication and broadcasting equipment
3. Medical equipment
4. Multi-point recorder
Warping, Thermo couple

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	250V	0.14A	SOP8-pin	AQW223R2S	AQW223R2SX	AQW223R2SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: The packing style indicator “X” or “Z” is not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

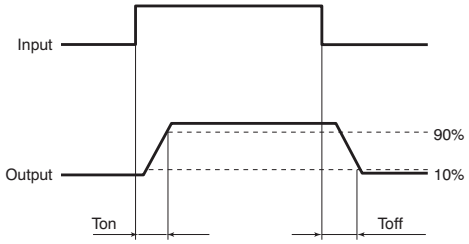
Item		Symbol	AQW223R2S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	250 V	
	Continuous load current	I_L	0.14 A (0.17 A)	Peak AC, DC ( ): in case of using only 1a (1 channel)
	Peak load current	I_{peak}	0.42 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

RF SOP 2 Form A C×R (AQW223R2S)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW223R2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.5mA	I_L=Max.
		Maximum		3.0mA	
	LED turn off current	Minimum	I_{Foff}	0.1mA	I_L=Max.
		Typical		0.45mA	
	LED dropout voltage	Typical	V_F	1.32V (1.14V at I_F=5mA)	I_F=50mA
		Maximum		1.5V	
Output	On resistance	Typical	R_{on}	11Ω	I_F=5mA I_L=Max.
		Maximum		15Ω	
	Output capacitance	Typical	C_{out}	33pF	I_F=0mA f=1 MHz V_B=0V
		Maximum		40pF	
	Off state leakage current	Typical	I_{Leak}	0.03nA	I_F=0mA V_L=Max.
		Maximum		10nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.15ms	I_F=5mA I_L=Max.
		Maximum		0.5ms	
	Turn off time*	Typical	T_{off}	0.05ms	I_F=5mA or 10mA I_L=Max.
		Maximum		0.2ms	
	I/O capacitance	Typical	C_{iso}	0.8pF	f=1MHz V_B=0V
		Maximum		1.5pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

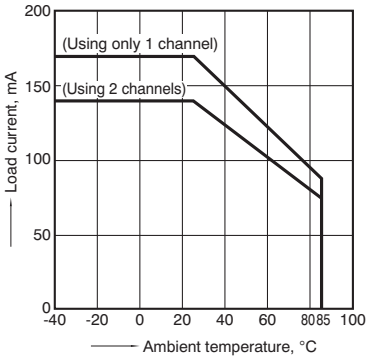
■ For Dimensions, see Page 62.
■ For Schematic and Wiring Diagrams, see Page 65.
■ For Cautions for Use, see Page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

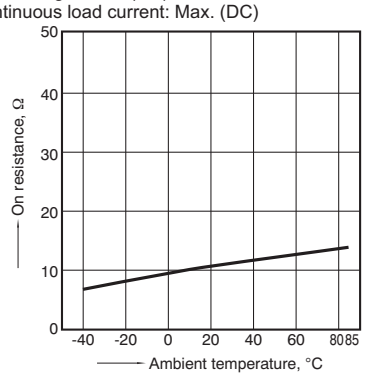
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



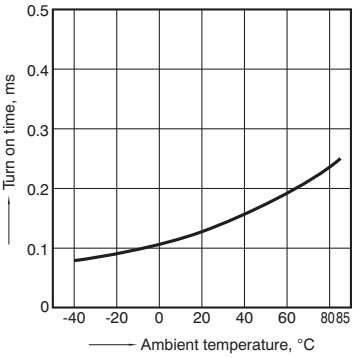
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8:
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



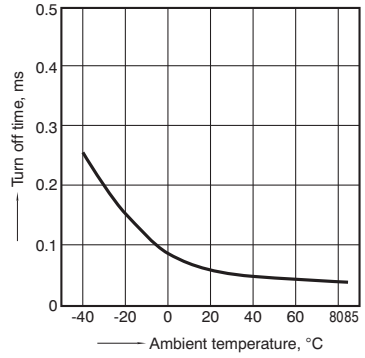
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



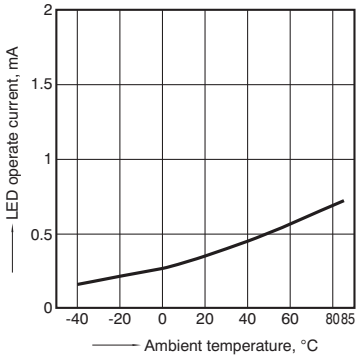
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



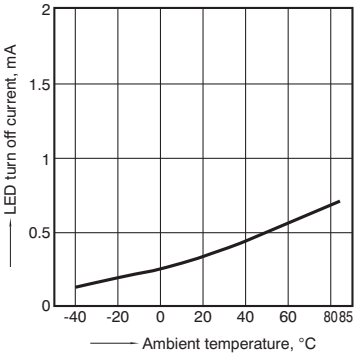
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



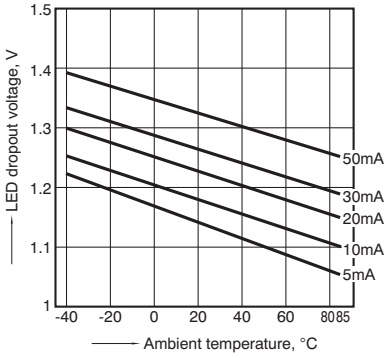
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



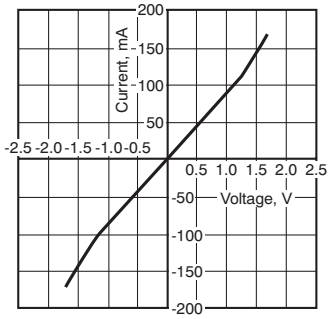
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



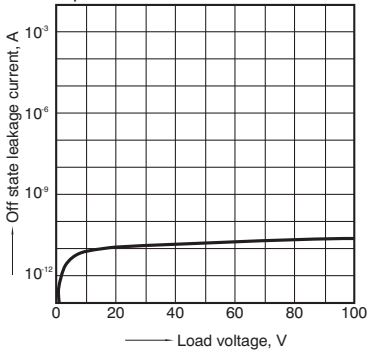
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



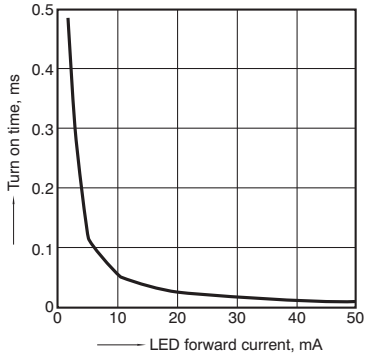
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



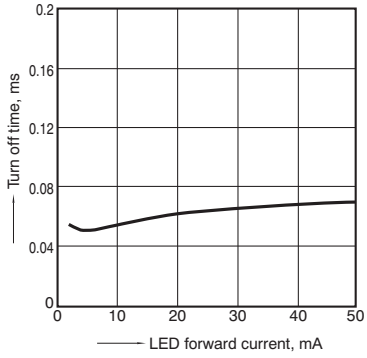
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



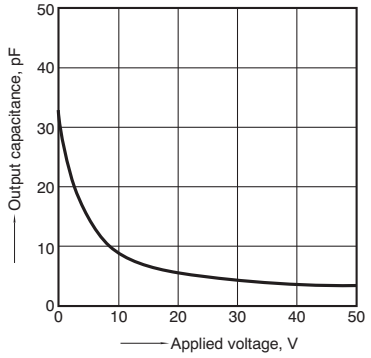
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

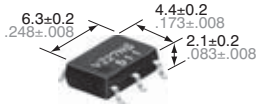
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

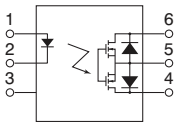
Miniature SOP6-pin type featuring low on-resistance with 200V/400V load voltage

PhotoMOS Relays
RF SOP 1 Form A
Low on-resistance (AQV22○NS)



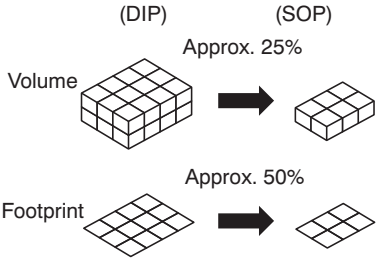
CAD Data

mm inch



FEATURES

1. Miniature SOP4-pin package
(W) 4.4 × (L) 6.3 × (H) 2.1 mm (W) .173× (L) .248× (H) .083 inch —approx. 25% of the volume and 50% of the footprint size of DIP type PhotoMOS Relays.



2. Low output capacitance and high response speed
The capacitance between output terminals is small; typ. 10pF. This enables a fast operation speed of typ. 0.1ms (AQY224NS).

3. Low-level off state leakage current

4. Controls low-level analog signals

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computers
- Industrial robots
- High-speed inspection machines

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3-pin side	Tape and reel packing style: Picked from the 4/5/6-pin side	Tube	Tape and reel
AC/DC dual use	200 V	50 mA	SOP6-pin	AQV227NS	AQV227NSX	AQV227NSZ	1 tube contains: 75 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	400 V	40 mA		AQV224NS	AQV224NSX	AQV224NSZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the two initial letters of the part number "AQ" and the packing style indicator "X" or "Z" are not marked on the relay.
(Ex. the label for product number AQV227NS is V227NS)

RATING

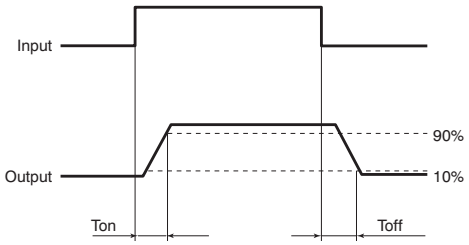
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV227NS	AQV224NS	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (peak AC)	V_L		200 V	400 V	
	Continuous load current	I_L	A	0.05 A	0.04 A	A connection: Peak AC, DC B, C connection: DC
			B	0.06 A	0.05 A	
			C	0.08 A	0.06 A	
	Peak load current	I_{peak}		0.15 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		450 mW		
Total power dissipation		P_T		500 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV227NS	AQV224NS	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.7 mA		I_L = Max.
		Maximum			3 mA		
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA		I_L = Max.
		Typical			0.65 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum			1.5 V		
Output	On resistance	Typical	R_{on}	A	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			50 Ω	100 Ω	
		Typical	R_{on}	B	16 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	70 Ω	
		Typical	R_{on}	C	8 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	35 Ω	
	Output capacitance	Typical	C_{out}		10 pF		I_F = 0 V_B = 0 f = 1 MHz
		Maximum			15 pF		
	Off state leakage current	Maximum	I_{leak}	—	10 nA		I_F = 0 V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.12 ms	0.1 ms	I_F = 5 mA I_L = Max.
		Maximum			0.5 ms		
	Turn off time*	Typical	T_{off}	—	0.05 ms		I_F = 5 mA I_L = Max.
		Maximum			0.2 ms		
	I/O capacitance	Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0
		Maximum			1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

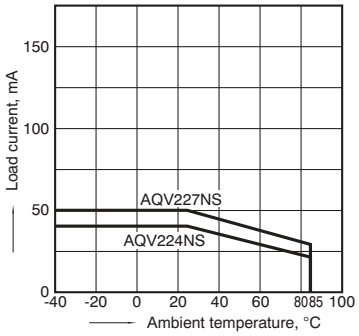
■ For Dimensions, see Page 62.
■ For Schematic and Wiring Diagrams, see Page 65.
■ For Cautions for Use, see Page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

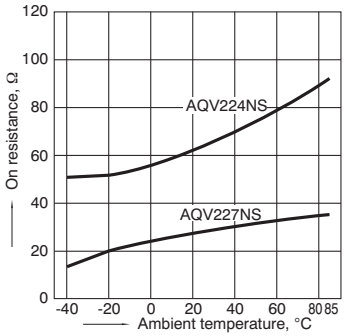
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



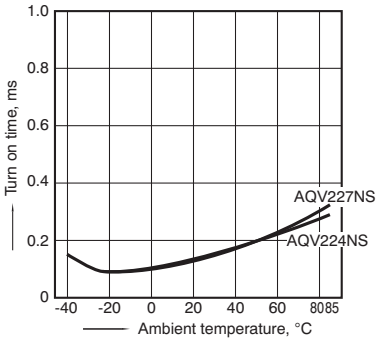
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



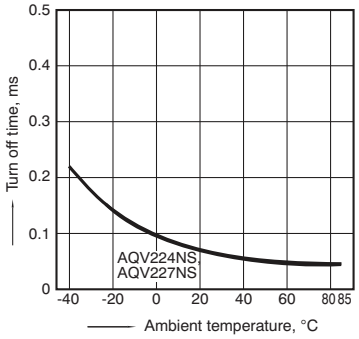
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



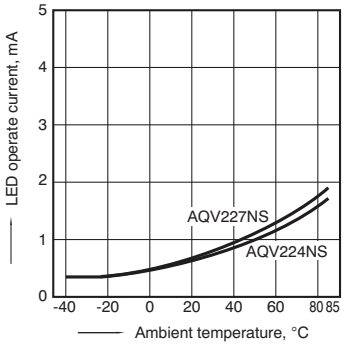
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



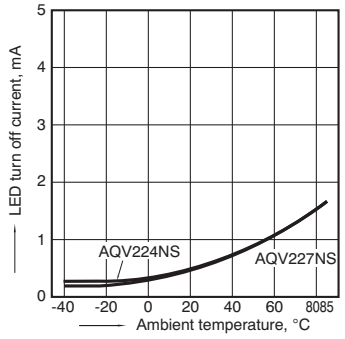
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



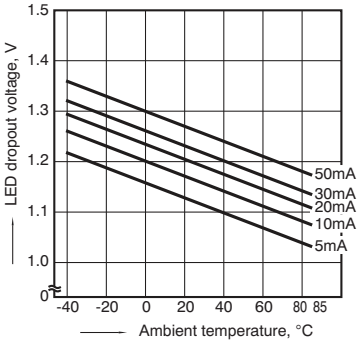
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



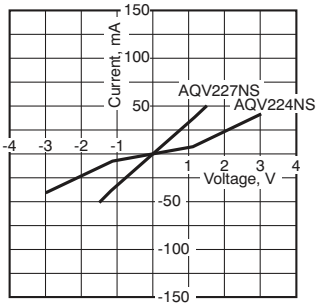
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



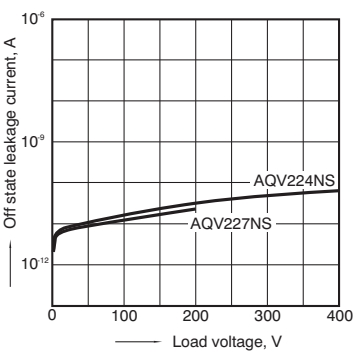
8. Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



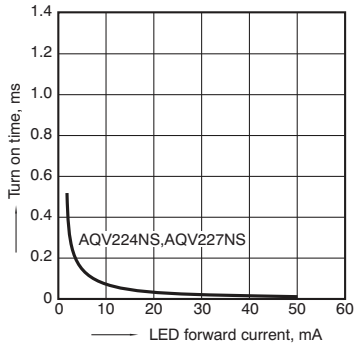
9. Off state leakage current

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



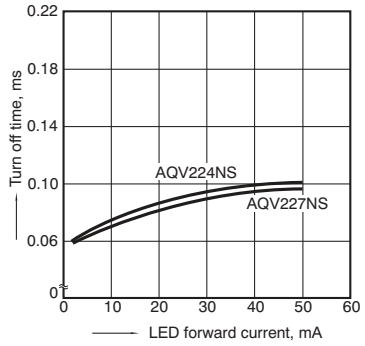
10.LED forward current vs. turn on time characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



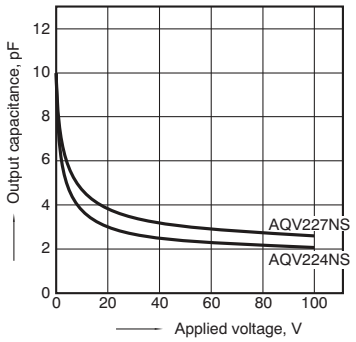
11.LED forward current vs. turn off time characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



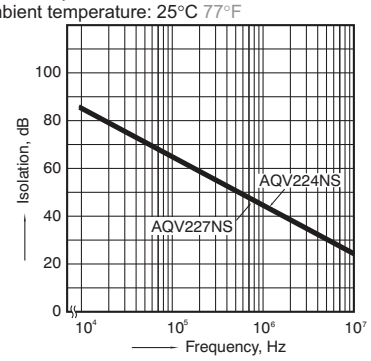
12.Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



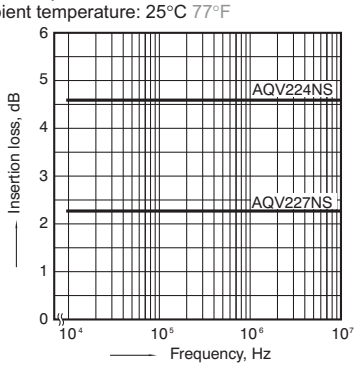
13.Isolation characteristics (50 Ω impedance)

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



14.Insertion loss characteristics (50 Ω impedance)

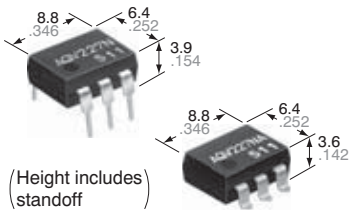
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

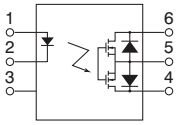
DIP6-pin type featuring low on-resistance with 200V/400V load voltage

PhotoMOS Relays
RF 1 Form A
Low on-resistance (AQV22○N)



CAD Data

mm inch



FEATURES

1. Low output capacitance and high response speed
The capacitance between output terminals is small; typ. 10pF.
This enables a fast operation speed of typ. 0.2ms.
2. High sensitivity and low on-resistance
Max. 0.1 A of load current can be controlled with input current of 5 mA.
The on resistance is less than our conventional models.
3. Low-level off state leakage current of typ. 0.03nA (AQV227N)
4. Controls low-level analog signals

TYPICAL APPLICATIONS

- Measuring instruments
- Communication equipment
- Computers
- Robots

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	200 V	70 mA	DIP6-pin	AQV227N	AQV227NA	AQV227NAX	AQV227NAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
	400 V	50 mA		AQV224N	AQV224NA	AQV224NAX	AQV224NAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

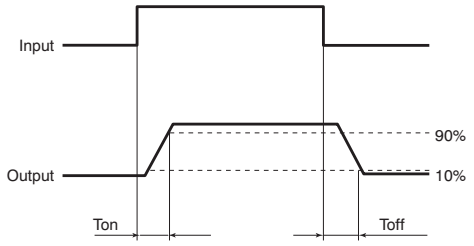
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV227N(A)	AQV224N(A)	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (peak AC)	V_L		200 V	400 V	
	Continuous load current	I_L	A	0.07 A	0.05 A	A connection: Peak AC, DC B, C connection: DC
			B	0.08 A	0.06 A	
			C	0.10 A	0.08 A	
	Peak load current	I_{peak}		0.21 A	0.15 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		360 mW		
Total power dissipation		P_T		410 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV227N(A)	AQV224N(A)	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.9 mA		I_L = Max.
		Maximum			3.0 mA		
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA		I_L = Max.
		Typical			0.85 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum			1.5 V		
Output	On resistance	Typical	R_{on}	A	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			50 Ω	100 Ω	
		Typical	R_{on}	B	16 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	70 Ω	
		Typical	R_{on}	C	8 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	35 Ω	
	Output capacitance	Typical	C_{out}	—	10 pF		I_F = 0 V_B = 0 f = 1 MHz
		Maximum			15 pF		
	Off state leakage current	Typical	I_{Leak}	—	0.03 nA	0.09 nA	I_F = 0 V_L = Max.
		Maximum			10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.2 ms		I_F = 5 mA I_L = Max.
		Maximum			0.5 ms		
	Turn off time*	Typical	T_{off}	—	0.08 ms		I_F = 5 mA I_L = Max.
		Maximum			0.2 ms		
	I/O capacitance	Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0
		Maximum			1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

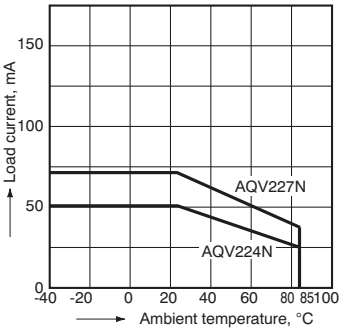
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

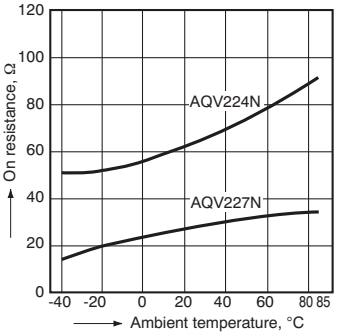
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



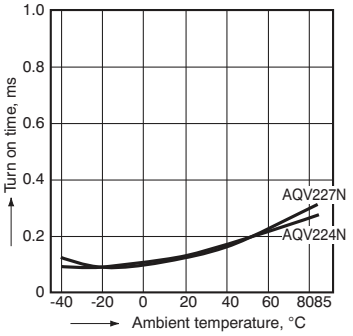
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



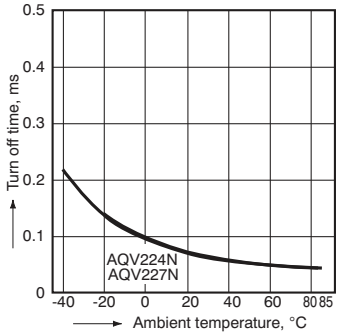
3. Turn on time vs. ambient temperature characteristics

Sample: AQV227N, AQV224N;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



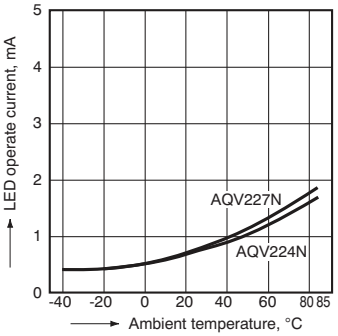
4. Turn off time vs. ambient temperature characteristics

Sample: AQV227N, AQV224N;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



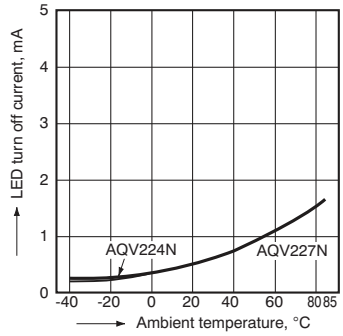
5. LED operate current vs. ambient temperature characteristics

Sample: AQV227N, AQV224N;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



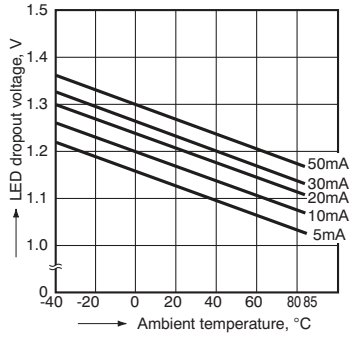
6. LED turn off current vs. ambient temperature characteristics

Sample: AQV227N, AQV224N;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



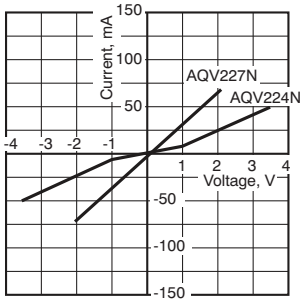
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



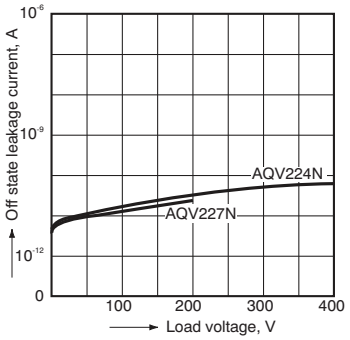
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



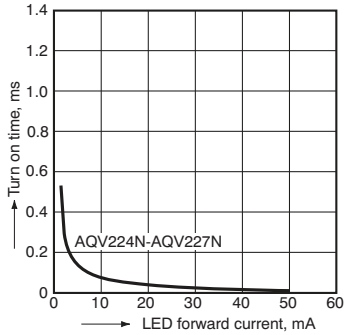
9. Off state leakage current

Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



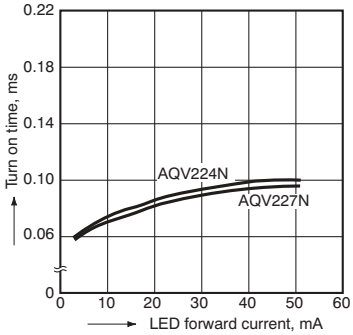
10.Turn on time vs. LED forward current characteristics

Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



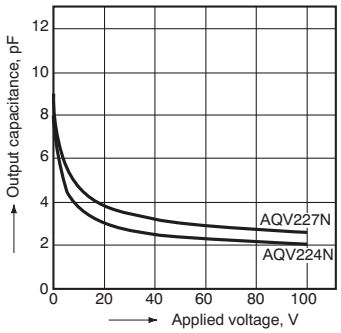
11.Turn off time vs. LED forward current characteristics

Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



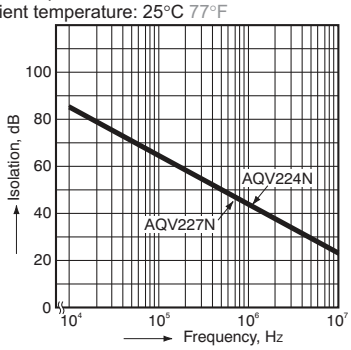
12.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



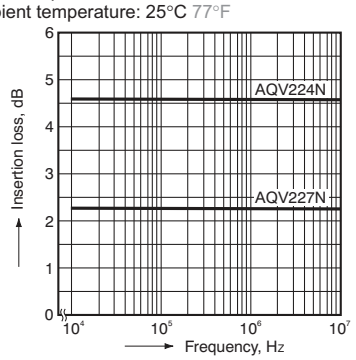
13.Isolation characteristics (50 Ω impedance)

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



14.Insertion loss characteristics (50 Ω impedance)

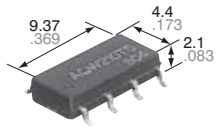
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

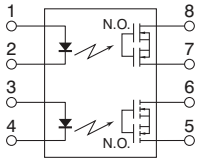
Miniature SOP8-pin type featuring low on-resistance with 200V load voltage

PhotoMOS Relays
RF SOP 2 Form A
Low on-resistance (AQW227NS)



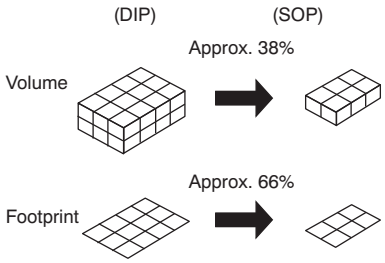
CAD Data

mm inch



FEATURES

1. 2-channel (Form A) in SOP8-pin package miniature
(W) 4.4 × (L) 9.37 × (H) 2.1 mm (W) .173 × (L) .369 × (H) .083 inch —approx. 38% of the volume and 66% of the footprint size of DIP8-pin.



2. Low output capacitance and high response speed
The capacitance between output terminals is small; typ. 10pF.
This enables a fast operation speed of typ. 0.25ms.
3. Low-level off state leakage current
4. Controls low-level analog signals

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computer input machines
- Industrial robots

TYPES

	Output rating*		Package	Part No.			Packing quantity	
					Tape and reel packing style			
	Load voltage	Load current		Tube packing style	Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side	Tube	Tape and reel
AC/DC dual use	200V	40mA	SOP8-pin	AQW227NS	AQW227NSX	AQW227NSZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Note: The packing style indicator “X” or “Z” is not marked on the relay.

RATING

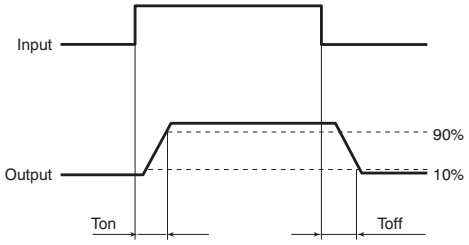
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW227NS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	200 V	
	Continuous load current	I_L	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.15 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW227NS	Condition
Input	LED operate current	Typical	I_{Fon}	0.7mA	I_L=Max.
		Maximum		3.0mA	
	LED turn off current	Minimum	I_{Foff}	0.4mA	I_L=Max.
		Typical		0.65mA	
	LED dropout voltage	Typical	V_F	1.25V (1.14V at I_F=5mA)	I_F=50mA
		Maximum		1.5V	
Output	On resistance	Typical	R_{on}	30Ω	I_F=5mA I_L=Max. Within 1 s on time
		Maximum		50Ω	
	Output capacitance	Typical	C_{out}	10pF	I_F=0mA V_B=0V f=1 MHz
		Maximum		15pF	
	Off state leakage current	Maximum	I_{Leak}	10nA	I_F=0mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.25ms	I_F=5mA I_L=Max.
		Maximum		0.5ms	
	Turn off time*	Typical	T_{off}	0.08ms	I_F=5mA I_L=Max.
		Maximum		0.2ms	
	I/O capacitance	Typical	C_{iso}	0.8pF	f=1MHz V_B=0V
		Maximum		1.5pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

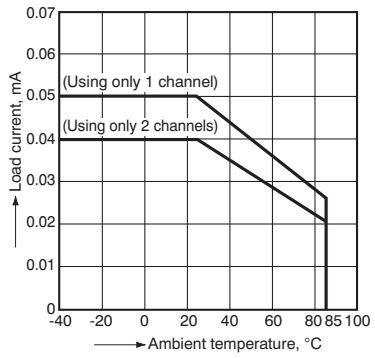
■ For Dimensions, see page 61.
■ For Schematic and Wiring Diagrams, see page 65.
■ For Cautions for Use, see page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

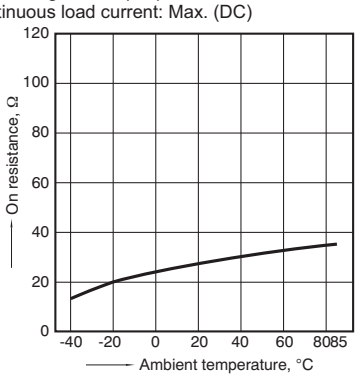
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



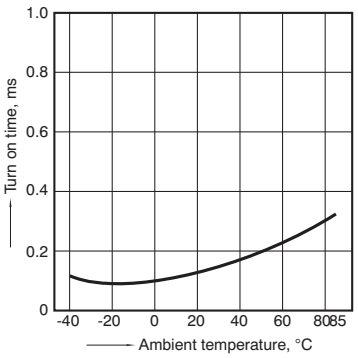
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8:
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



3. Turn on time vs. ambient temperature characteristics

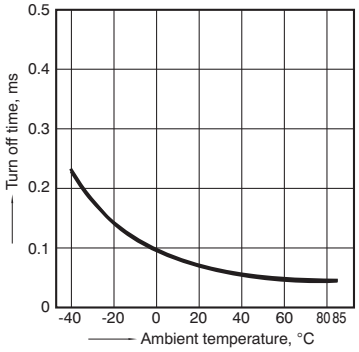
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



RF SOP 2 Form A Low on-resistance (AQW227NS)

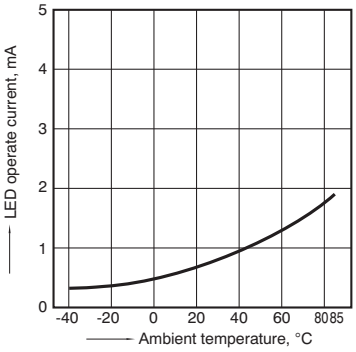
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



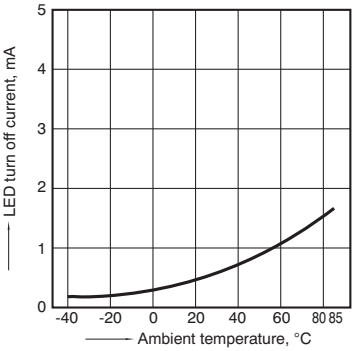
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



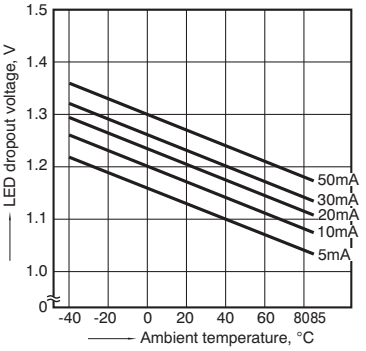
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



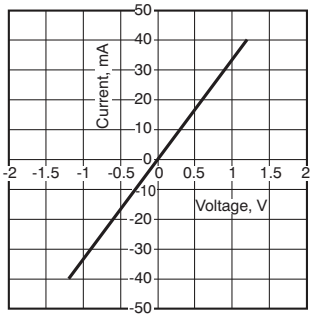
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



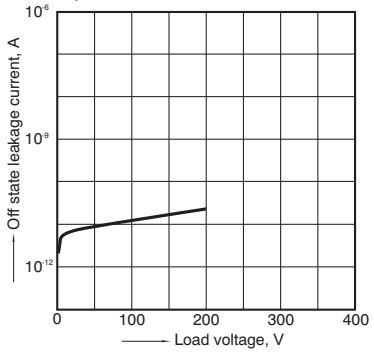
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



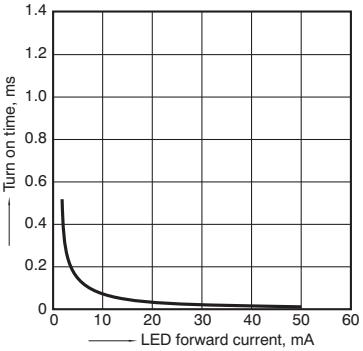
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



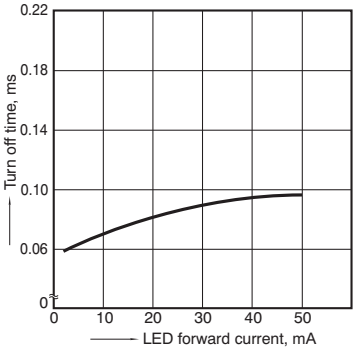
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



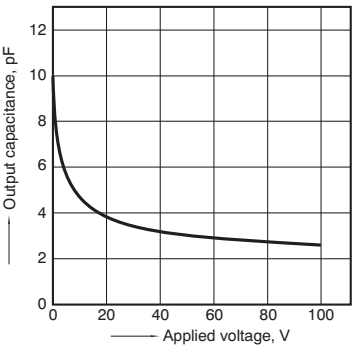
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



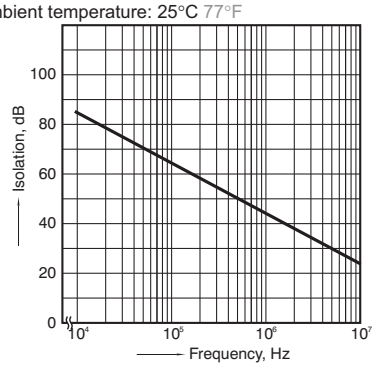
12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



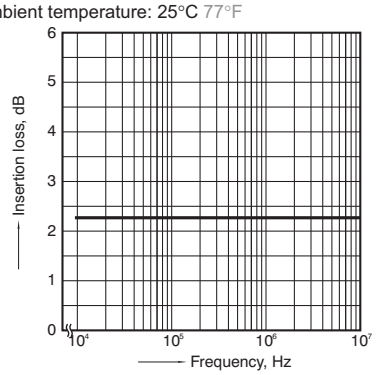
13. Isolation vs. frequency characteristics (50 Ω impedance)

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



14. Insertion loss vs. frequency characteristics (50 Ω impedance)

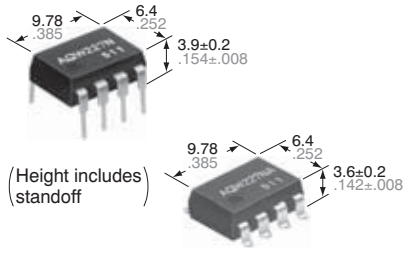
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

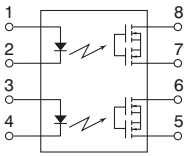
DIP8-pin type featuring low on-resistance with 200V/400V load voltage

PhotoMOS Relays
RF 2 Form A
Low on-resistance (AQW22○N)



CAD Data

mm inch



FEATURES

1. 2-channels (Form A) type with high response speed, low leakage current and low on-resistance.
2. Applicable for 2 Form A use as well as two independent 1 Form A use
3. Low capacitance between output terminals ensures high response speed:
The capacitance between output terminals is small; typ. 10 pF.
This enables for a fast operation speed of typ. 0.2 ms.
4. High sensitivity and low on-resistance:
Max. 0.07 A of load current can be controlled with input current of 5 mA.
The on-resistance is less than our conventional models.
5. Low-level off state leakage current
6. Controls low-level analog signals:
PhotoMOS relay features extremely low closed-circuit offset voltages to enable control of small analog signals without distortion.

TYPICAL APPLICATIONS

- **Measuring instruments**
  Scanner, IC checker, Board tester, etc.

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	200 V	50 mA	DIP8-pin	AQW227N	AQW227NA	AQW227NAX	AQW227NAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
	400 V	40 mA		AQW224N	AQW224NA	AQW224NAX	AQW224NAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

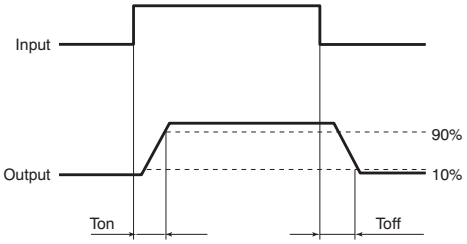
Item		Symbol	AQW227N(A)	AQW224N(A)	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	200 V	400 V	
	Continuous load current	I_L	0.05 A (0.07 A)	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.15 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW		
Total power dissipation		P_T	850 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

RF 2 Form A Low on-resistance (AQW22❍N)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW227N(A)	AQW224N(A)	Remarks
Input	LED operate current	Typical	I_{Fon}	0.9 mA		I_L = Max.
		Maximum		3.0 mA		
	LED turn off current	Minimum	I_{Foff}	0.4 mA		I_L = Max.
		Typical		0.8 mA		
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		50 Ω	100 Ω	
	Output capacitance	Typical	C_{out}	10 pF		I_F = 0 V_B = 0 f = 1 MHz
		Maximum		15 pF		
	Off state leakage current	Maximum	I_{Leak}	10 nA		I_F = 0 V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.2 ms		I_F = 5 mA I_L = Max.
		Maximum		0.5 ms		
	Turn off time*	Typical	T_{off}	0.08 ms		I_F = 5 mA I_L = Max.
		Maximum		0.2 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

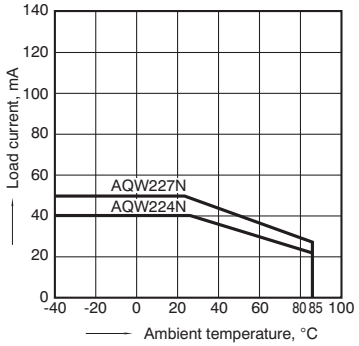
For more information, see page 80.

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

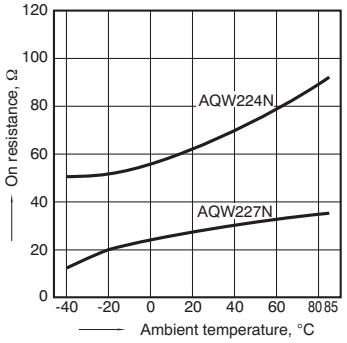
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

When using 2 channels



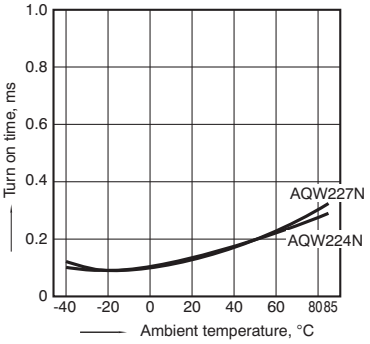
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



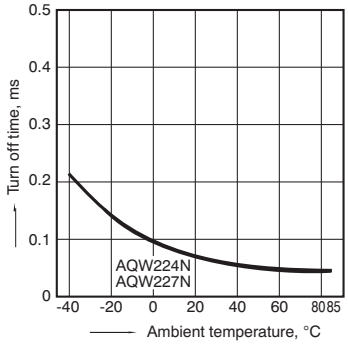
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



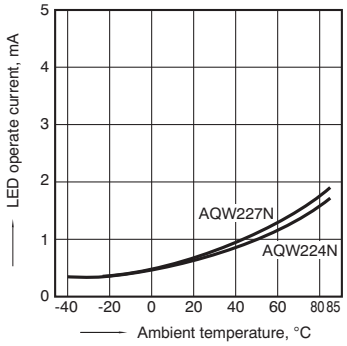
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



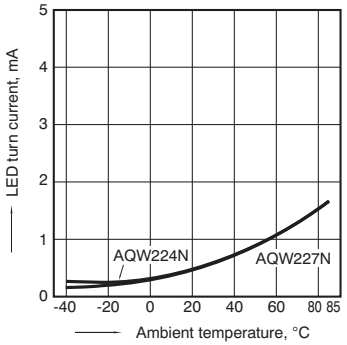
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



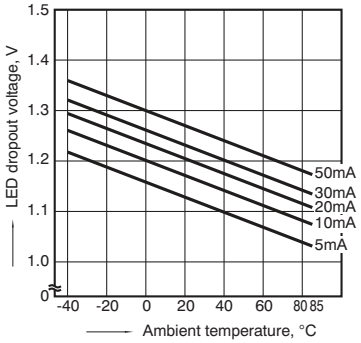
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



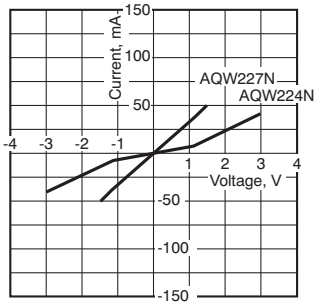
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



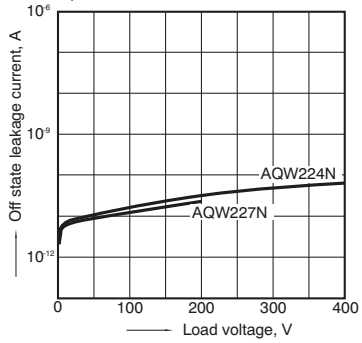
8. Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



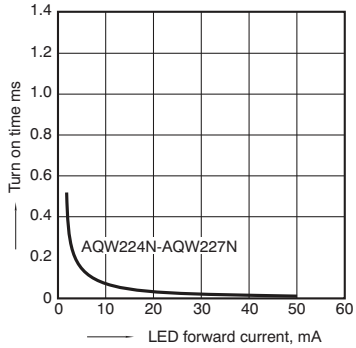
9. Off state leakage current

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



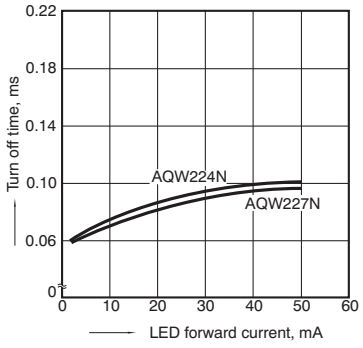
10. LED forward current vs. turn on time characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



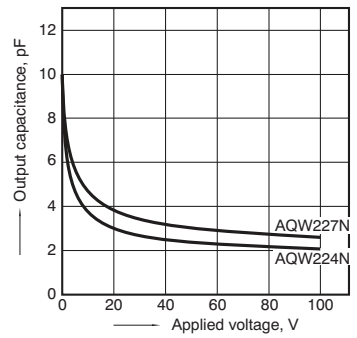
11. LED forward current vs. turn off time characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



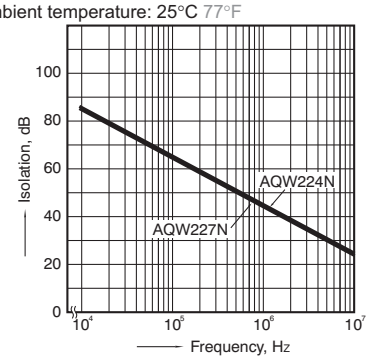
12. Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



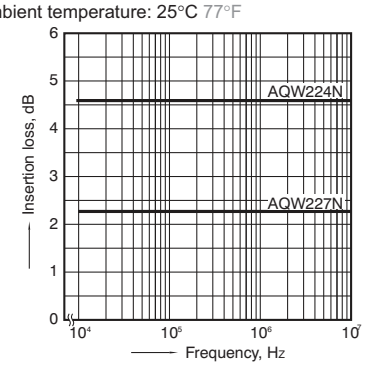
13. Isolation characteristics (50 Ω impedance)

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



14. Insertion loss characteristics (50 Ω impedance)

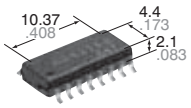
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

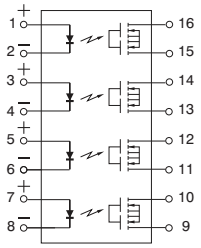
Space-saving SOP16-pin type featuring low on-resistance with 80V load voltage

PhotoMOS Relays
RF SOP 4 Form A
Low on-resistance (AQS225R2S)



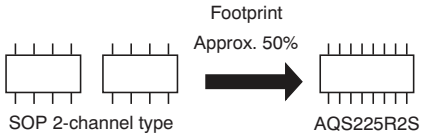
CAD Data

mm inch



FEATURES

1. 4-channel (4 Form A) in a small SOP16-pin package
The device comes in a miniature SOP measuring (W) 10.37 × (L) 4.4 × (H) 2.1mm (W) .408 × (L) .173 × (H) .083inch— approx. 50% of the footprint size of 8-pin (2-channel) type.



2. Low C×R and high response speed
- Output capacitance: 4.5pF (typ.)
- On resistance: 10.5Ω (typ.)
- Turn on time: 0.04ms (typ.)

3. Applicable for 4 Form A use, as well as 4 independent 1 Form A
4. Low-level off state leakage current of typ. 0.01nA
5. Controls low-level analog signals

TYPICAL APPLICATIONS

For multi-circuit switching;
1. Measuring and testing equipment
IC tester, Liquid crystal driver tester, Probe card, Bare board tester, In-circuit tester, Function tester, etc.
2. Communication and broadcasting equipment
3. Medical equipment
Ultrasonic wave diagnostic machine
4. Multi-point recorder
Warping, Thermo couple

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style: Picked from the 1/2/3/4/5/6/7/8-pin side	Tape and reel packing style: Picked from the 9/10/11/12/13/14/15/16-pin side	Tube	Tape and reel
AC/DC dual use	80V	70mA	SOP16-pin	AQS225R2S	AQS225R2SX	AQS225R2SZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.

* Indicate the peak AC and DC values.
Notes: 1. The packing style indicator “X” or “Z” is not marked on the relay.
2. For types with a built-in resistor, see page 212.

RATING

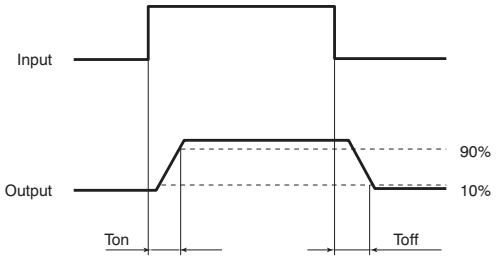
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQS225R2S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	80 V	
	Continuous load current	I_L	0.07 A	Peak AC, DC
	Peak load current	I_{peak}	0.2 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolatiom voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQS225R2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = Max.
		Typical		0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	10.5Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		15Ω	
	Output capacitance	Typical	C_{out}	4.5 pF	I_F = 0 V_B = 0 V f = 1 MHz
		Maximum		6 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.3 ms	
	Turn off time*	Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

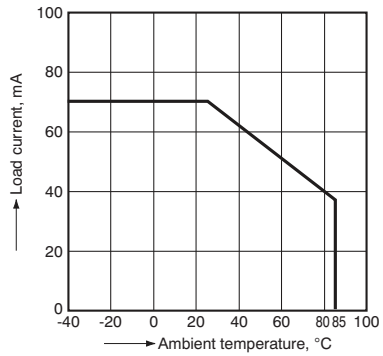
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 67.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

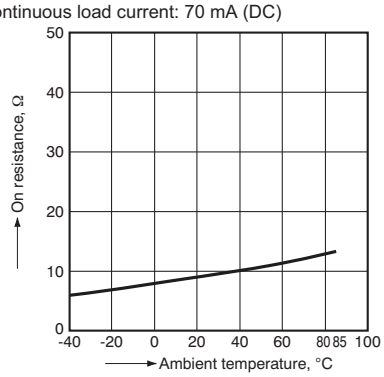
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



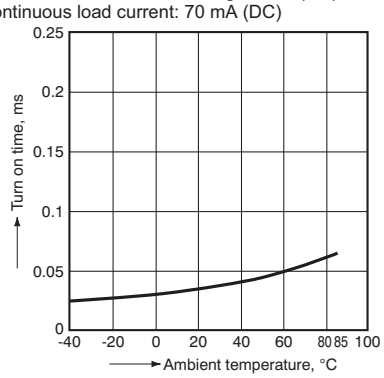
2. On resistance vs. ambient temperature characteristics

LED current: 5 mA;
Continuous load current: 70 mA (DC)



3. Turn on time vs. ambient temperature characteristics

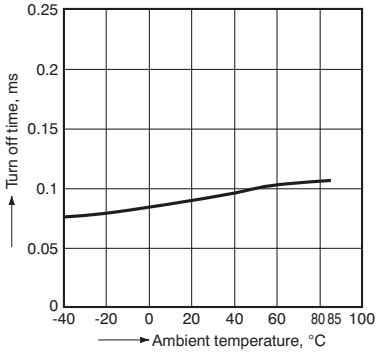
LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



RF SOP 4 Form A Low on-resistance (AQS225R2S)

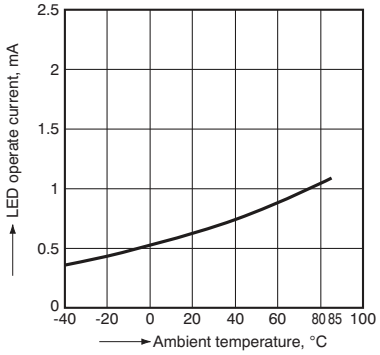
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



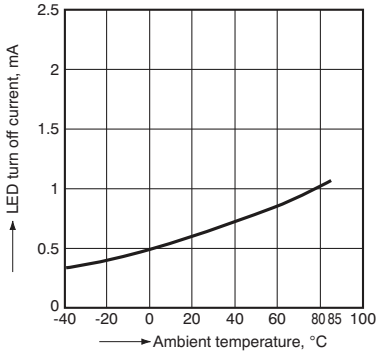
5. LED operate current vs. ambient temperature characteristics

Continuous load current: 70 mA (DC)



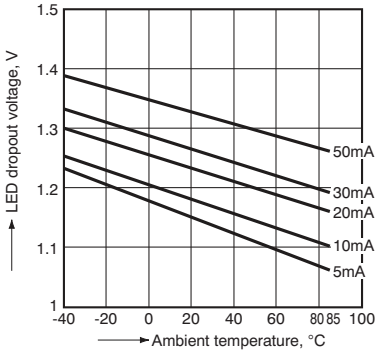
6. LED turn off current vs. ambient temperature characteristics

Continuous load current: 70 mA (DC)



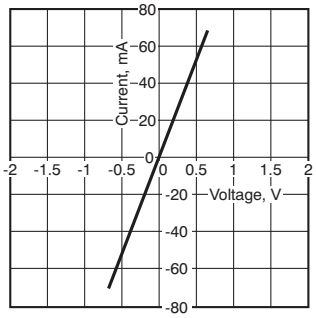
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



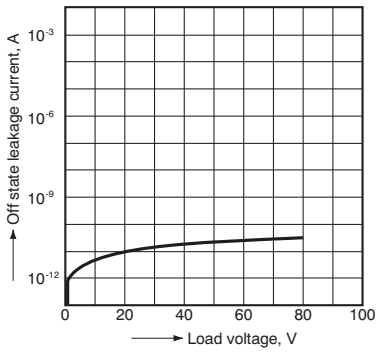
8. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



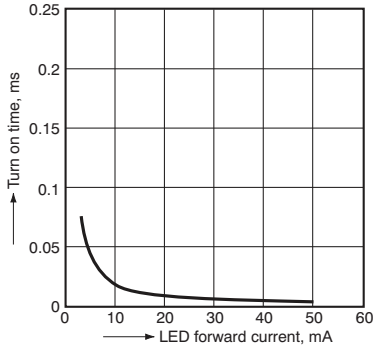
9. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



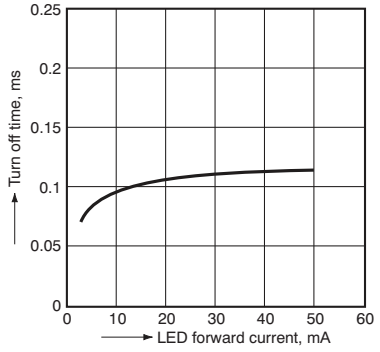
10. Turn on time vs. LED forward current characteristics

Load voltage: 80 V (DC); Continuous load current:
70 mA (DC); Ambient temperature: 25°C 77°F



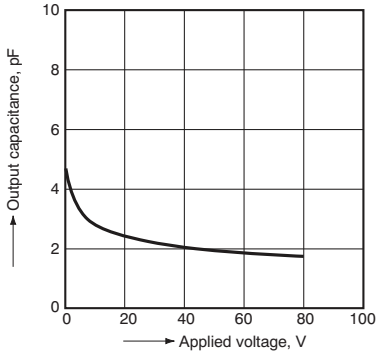
11. Turn off time vs. LED forward current characteristics

Load voltage: 80 V (DC); Continuous load current:
70 mA (DC); Ambient temperature: 25°C 77°F



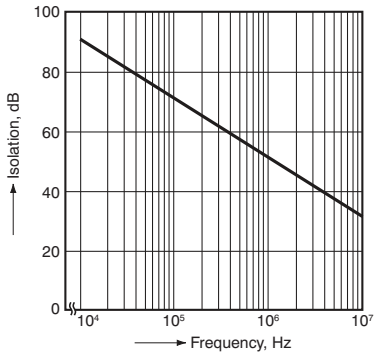
12. Output capacitance vs. applied voltage characteristics

Frequency: 1 MHz, 30 m Vrms;
Ambient temperature: 25°C 77°F



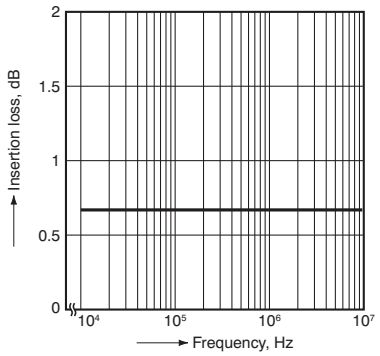
13. Isolation vs. frequency characteristics (50Ω impedance)

Ambient temperature: 25°C 77°F



14. Insertion loss vs. frequency characteristics (50Ω impedance)

Ambient temperature: 25°C 77°F



Panasonic
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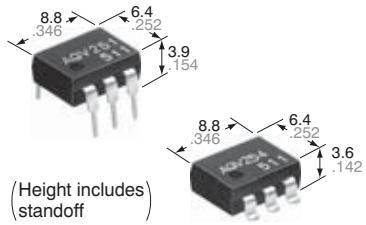
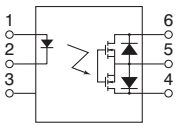
DIP6-pin type with low on-resistance and high cost-performance

PhotoMOS Relays
HE 1 Form A
(AQV25❍)



CAD Data

mm inch



FEATURES

1. Low on-resistance of typ. 0.6Ω (AQV251)
2. Reinforced insulation type of 5,000V I/O isolation available
3. Wide variation of 40V to 1,500V load voltage

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment

TYPES

	I/O isolation	Output rating*		Package	Part No.				Packing quantity	
					Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
		Load voltage	Load current				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	1,500V	40 V	500 mA	DIP6-pin	AQV251	AQV251A	AQV251AX	AQV251AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
		60 V	400 mA		AQV252	AQV252A	AQV252AX	AQV252AZ		
		100 V	350 mA		AQV255	AQV255A	AQV255AX	AQV255AZ		
		200 V	250 mA		AQV257	AQV257A	AQV257AX	AQV257AZ		
		250 V	200 mA		AQV253	AQV253A	AQV253AX	AQV253AZ		
		400 V	150 mA		AQV254	AQV254A	AQV254AX	AQV254AZ		
		1,000 V	30 mA		AQV259	AQV259A	AQV259AX	AQV259AZ		
		1,500 V	20 mA		AQV258	AQV258A	AQV258AX	AQV258AZ		
	Reinforced 5,000V	250 V	200 mA		AQV253H	AQV253HA	AQV253HAX	AQV253HAZ		
		400 V	150 mA		AQV254H	AQV254HA	AQV254HAX	AQV254HAZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator "A" and the packing style indicator "X" or "Z" are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

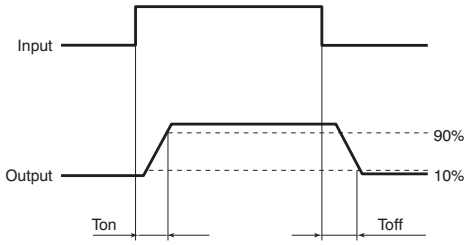
	Item		Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Remarks
Input	LED forward current		I_F		50 mA										
	LED reverse voltage		V_R		5 V										
	Peak forward current		I_{FP}		1 A										f = 100 Hz, Duty factor +0.1%
	Power dissipation		P_{in}		75 mW										
Output	Load voltage (peak AC)		V_L		40 V	60 V	100 V	200 V	250 V	400 V	1,000 V	1,500 V	250 V	400 V	
	Continuous load current		I_L	A	0.5 A	0.4 A	0.35 A	0.25 A	0.2 A	0.15 A	0.03 A	0.02 A	0.2 A	0.15 A	A connection: Peak AC, DC B, C connection: DC
				B	0.7 A	0.6 A	0.45 A	0.35 A	0.3 A	0.18 A	0.04 A	0.025 A	0.3 A	0.18 A	
				C	1.0 A	0.8 A	0.70 A	0.5 A	0.4 A	0.25 A	0.05 A	0.04 A	0.4 A	0.25 A	
	Peak load current		I_{peak}		1.8 A	1.5 A	1.0 A	0.75 A	0.6 A	0.5 A	0.09 A	0.06 A	0.6 A	0.5 A	A connection: 100 ms (1 shot) V_L = DC
	Power dissipation		P_{out}		360 mW										
Total power dissipation			P_T		410 mW										
I/O isolation voltage			V_{iso}		1,500 V AC								5,000 V AC		
Temperature limits		Operating	T_{opr}		–40°C to +85°C –40°F to +185°F										Non-condensing at low temperatures
		Storage	T_{stg}		–40°C to +100°C –40°F to +212°F										

HE 1 Form A (AQV25❍)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

	Item		Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Condition
Input	LED operate current	Typical	I_{Fon}	—	0.9 mA								1.4 mA		I_L = Max.
		Maximum			3 mA										
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA										I_L = Max.
		Typical			0.8 mA								1.3 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)										I_F = 50 mA
		Maximum			1.5 V										
Output	On resistance	Typical	R_{on}	A	0.6 Ω	0.74 Ω	1.8 Ω	2.6 Ω	5.5 Ω	12.4 Ω	85 Ω	345 Ω	5.5 Ω	12.4 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			1 Ω	1.4 Ω	2.5 Ω	4 Ω	8 Ω	16 Ω	200 Ω	500 Ω	8 Ω	16 Ω	
		Typical	R_{on}	B	0.3Ω	0.37 Ω	0.9 Ω	1.4 Ω	2.7 Ω	6.2 Ω	60 Ω	345 Ω	2.7 Ω	6.2 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.5 Ω	0.7 Ω	1.25 Ω	2 Ω	4 Ω	8 Ω	100 Ω	500 Ω	4 Ω	8 Ω	
		Typical	R_{on}	C	0.15 Ω	0.18 Ω	0.45 Ω	0.7 Ω	1.4 Ω	3.1 Ω	30 Ω	160 Ω	1.4 Ω	3.1 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.25 Ω	0.35 Ω	0.63 Ω	1 Ω	2 Ω	4 Ω	50 Ω	250 Ω	2 Ω	4 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA						10 μA		1 μA		I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	1.7 ms	1.4 ms	0.9 ms	1.5 ms	0.8ms	0.8ms	0.6ms	0.35 ms	2.4ms	1.8ms	I_F = 5 mA I_L = Max.
		Maximum			3 ms		2 ms	3 ms	2 ms		1 ms		4 ms	3 ms	
	Turn off time*	Typical	T_{off}	—	0.07 ms		0.09 ms	0.1 ms	0.06 ms	0.05 ms	0.04 ms		0.06 ms	0.05 ms	I_F = 5 mA I_L = Max.
		Maximum			0.2 ms										
	I/O capacitance	Typical	C_{iso}	—	1.3 pF										f = 1 MHz V_B = 0 V
		Maximum			3 pF										
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ										500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	Standard type: 5 Reinforced insulation type: 5 to 10	mA

■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

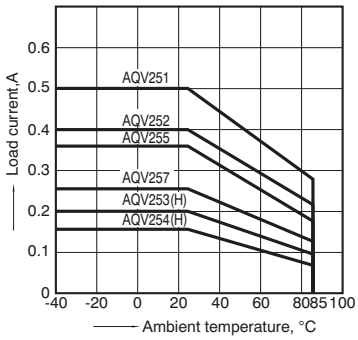
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

1-(1) Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F ;

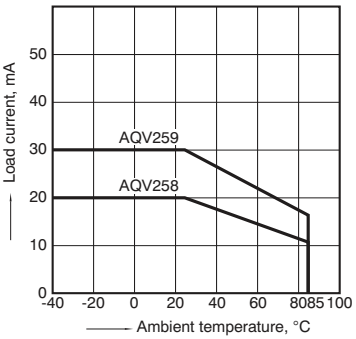
Type of connection: A



1.-(2) Load current vs. ambient temperature characteristics

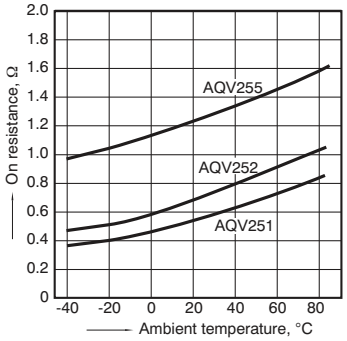
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F ;

Type of connection: A



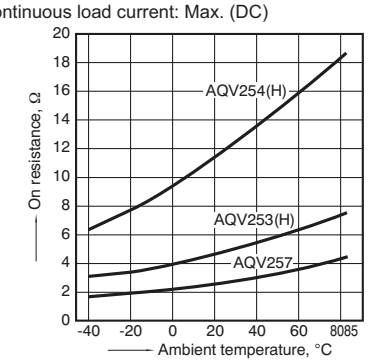
2-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: Max. (DC)



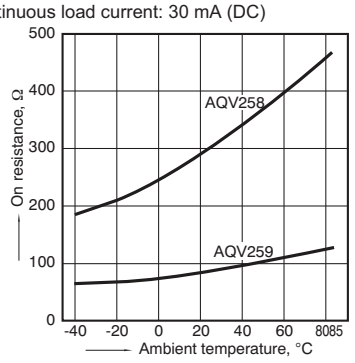
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: Max. (DC)



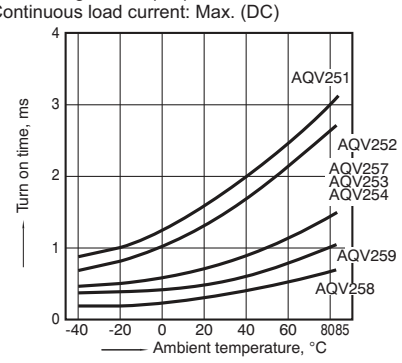
2.-(3) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: 30 mA (DC)



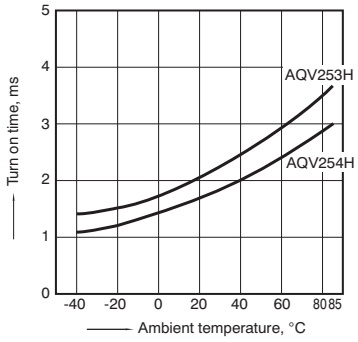
3-(1) Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



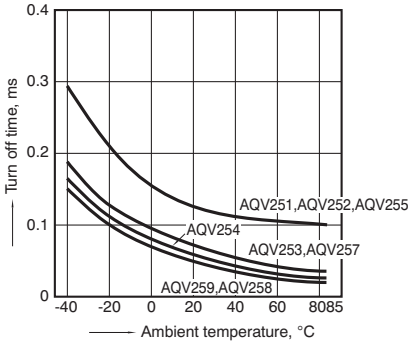
3.-(2) Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



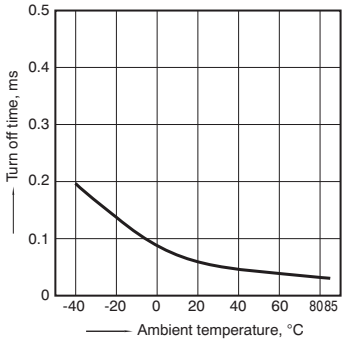
4-(1) Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



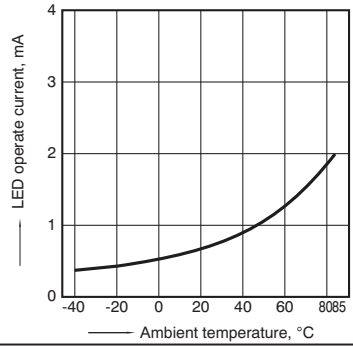
4.-(2) Turn off time vs. ambient temperature characteristics

Sample: AQV253H, AQV254H
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



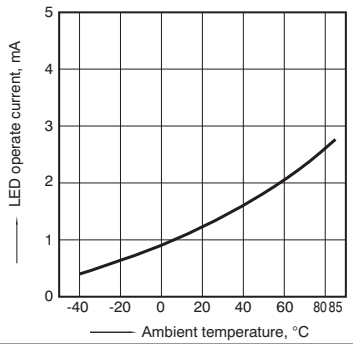
5-(1) LED operate current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



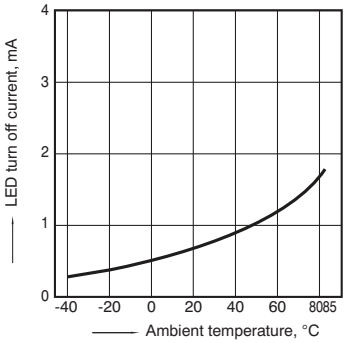
5.-(2) LED operate current vs. ambient temperature characteristics

Sample: AQV253H,AQV254H;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



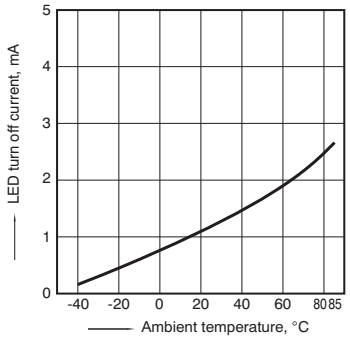
6-(1) LED turn off current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



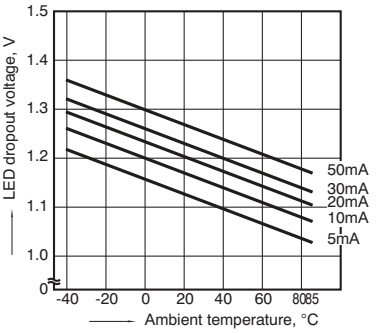
6.-(2) LED turn off current vs. ambient temperature characteristics

Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



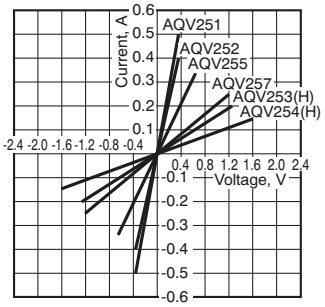
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



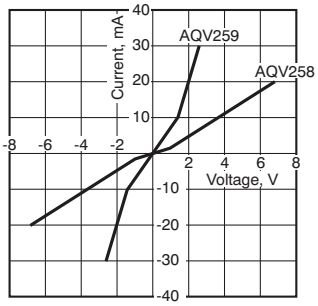
8-(1) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



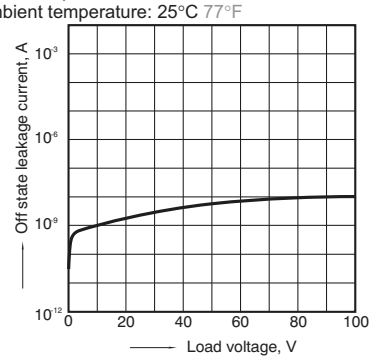
8.-(2) Current vs. voltage characteristics of output at MOS portion

Sample: AQV259
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



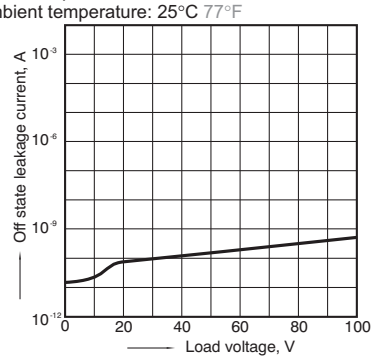
9-(1). Off state leakage current vs. load voltage characteristics

Sample: AQV259;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



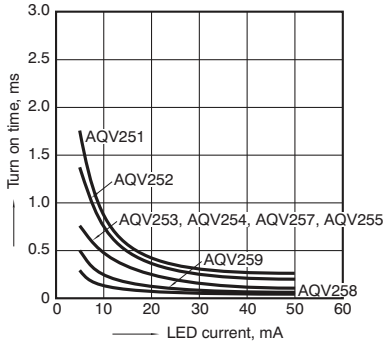
9-(2). Off state leakage current vs. load voltage characteristics

Sample: AQV254H;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



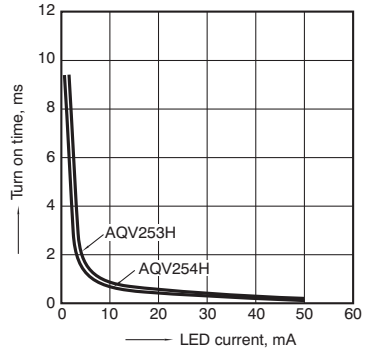
10-(1). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



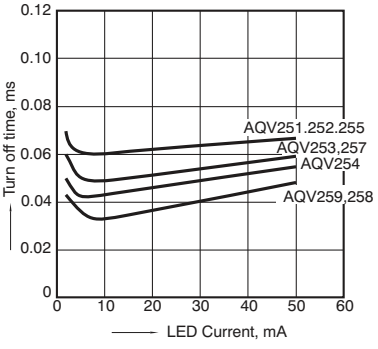
10-(2). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



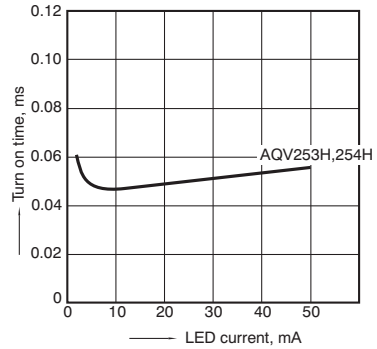
11-(1). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



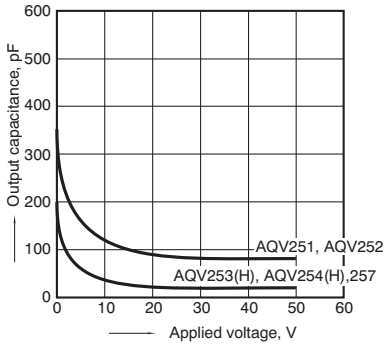
11-(2). Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



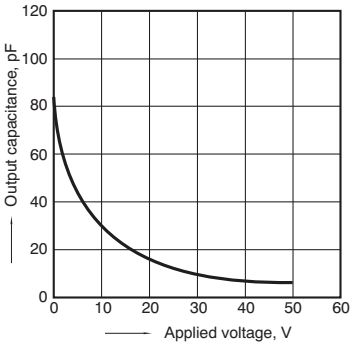
12-(1) Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



12.-(2) Output capacitance vs. applied voltage characteristics

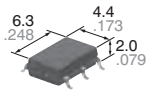
Sample: AQV259;
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

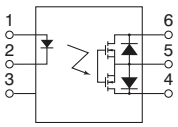
Miniature SOP6-pin type with high capacity of 1.25A load current

PhotoMOS Relays
HE SOP 1 Form A
High Capacity (AQV255GS)



CAD Data

mm inch



FEATURES

1. High capacity in a miniature SOP package
Continuous load current: 1.25A
Load voltage: 80V
2. Greatly improved specifications allow you to use this in place of mercury and mechanical relays.

TYPICAL APPLICATIONS

- Security equipment
- Fire-preventing system
- Measuring instruments

PhotoMOS

TYPES

	Output rating*		Package	Part No.			Packing quantity	
				Surface-mount terminal				
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	80 V	1.25 A	SOP6-pin	AQV255GS	AQV255GSX	AQV255GSZ	1 tube contains: 75 pcs. 1 batch contains: 1,500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the two initial letters of the part number “AQ” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

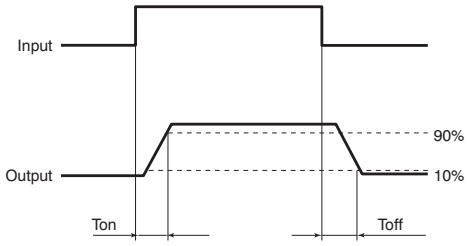
Item		Symbol	Type of connection	AQV255GS	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		80 V	
	Continuous load current	I_L	A	1.25 A	A connection: Peak AC, DC B, C connection: DC
			B	1.75 A	
			C	2.5 A	
	Peak load current	I_{peak}		3 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}		450 mW	
Total power dissipation		P_T		500 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

HE SOP 1 Form A High Capacity (AQV255GS)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV255GS	Condition
Input	LED operate current	Typical	I_{Fon}	—	0.5 mA	I_L = 100mA
		Maximum			3 mA	
	LED turn off current	Minimum	I_{Foff}	—	0.2 mA	I_L = 100mA
		Typical			0.4 mA	
	LED dropout voltage	Typical	V_F	—	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	0.09 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.15 Ω	
		Typical	R_{on}	B	0.05 Ω	
		Maximum			0.12 Ω	
		Typical	R_{on}	C	0.03 Ω	
		Maximum			0.1 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 0 mA, V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	1.3 ms	I_F = 5 mA, I_L = 100 mA V_L = 10 V
		Maximum			5 ms	
	Turn off time*	Typical	T_{off}	—	0.1 ms	I_F = 5 mA, I_L = 100 mA V_L = 10 V
		Maximum			0.5 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC
	Max. switching frequency	Maximum	—	—	5 times/s	I_F = 5 mA, duty = 50% $V_L \times I_L$ = 100 V·A

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

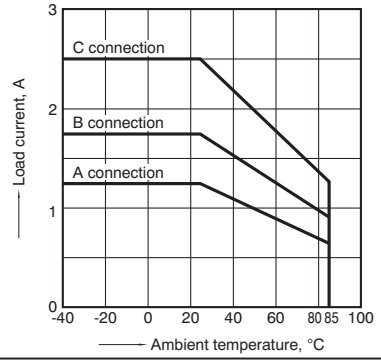
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

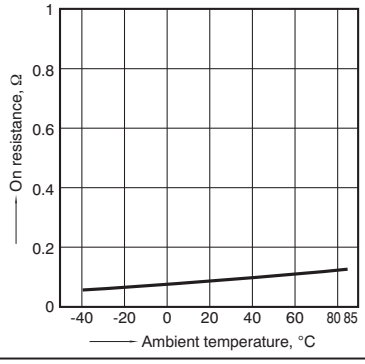
13.Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



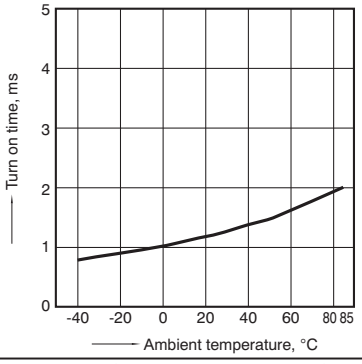
14.On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



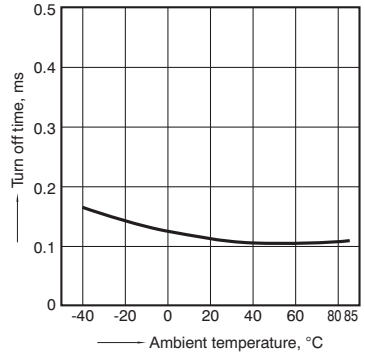
15.Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



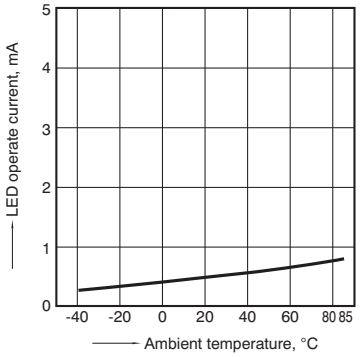
16.Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



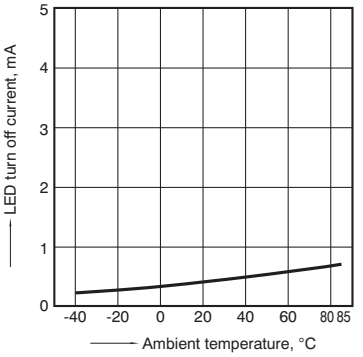
17.LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



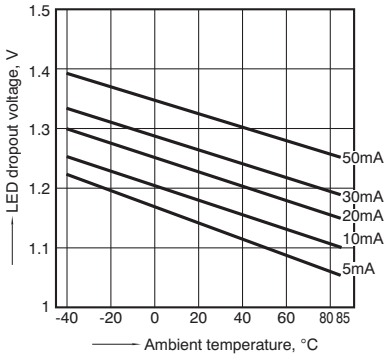
18.LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



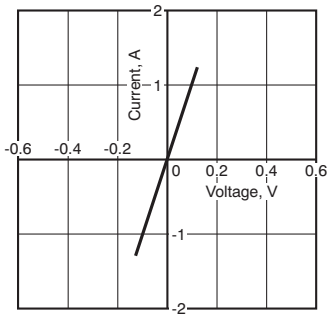
19.LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



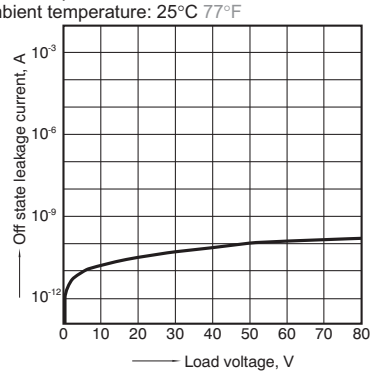
20.Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



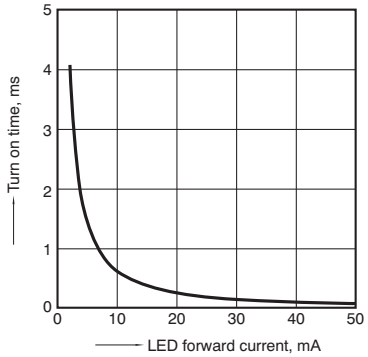
21.Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



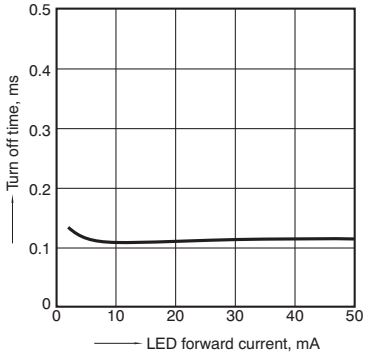
22.Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



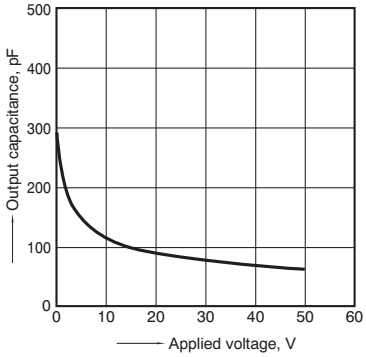
23.Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



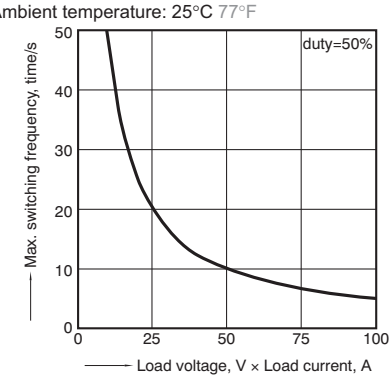
24.Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



25.Max. switching frequency vs. load voltage and load current

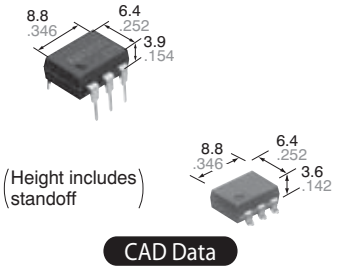
LED current: 5 mA
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

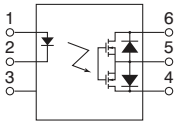
DIP6-pin type with high capacity of 2.5A load current

PhotoMOS Relays
HE 1 Form A
High Capacity (AQV252G)



CAD Data

mm inch



FEATURES

1. Greatly increased load current in a compact DIP package
Continuous load current: 2.5A
2. Greatly improved specifications allow you to use this in place of mercury and mechanical relays.

TYPICAL APPLICATIONS

- Security equipment
- Fire-preventing system
- Measuring instruments

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	60 V	2.5 A	DIP6-pin	AQV252G	AQV252GA	AQV252GAX	AQV252GAZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

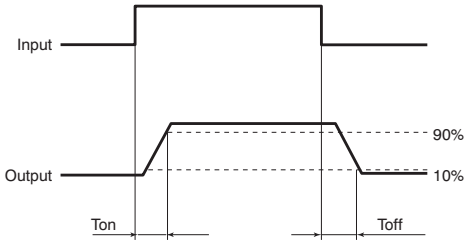
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV252G(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		60 V	
	Continuous load current	I_L	A	2.5 A	A connection: Peak AC, DC B, C connection: DC
			B	3.5 A	
			C	5.0 A	
	Peak load current	I_{peak}		6.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV252G(A)	Condition
Input	LED operate current	Typical	I_{Fon}	—	0.5 mA	I_L = 100mA
		Maximum			3 mA	
	LED turn off current	Minimum	I_{Foff}	—	0.2 mA	I_L = 100mA
		Typical			0.45 mA	
	LED dropout voltage	Typical	V_F	—	1.14 V (1.32 V at I_F = 50 mA)	I_F = 5 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	0.08 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.12 Ω	
		Typical	R_{on}	B	0.04 Ω	
		Maximum			0.06 Ω	
		Typical	R_{on}	C	0.02 Ω	
		Maximum			0.03 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 0 mA, V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	1.1 ms	I_F = 5 mA, I_L = 100 mA V_L = 10 V
		Maximum			5.0 ms	
	Turn off time*	Typical	T_{off}	—	0.25 ms	I_F = 5 mA, I_L = 100 mA V_L = 10 V
		Maximum			0.5 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

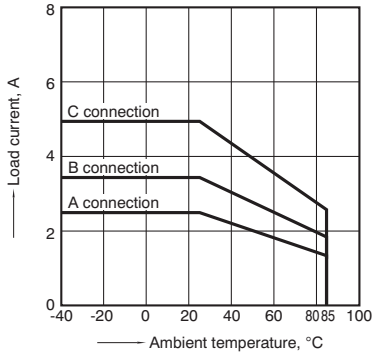
■ For Dimensions, see page 60.
■ For Schematic and Wiring Diagrams, see page 65.
■ For Cautions for Use, see page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

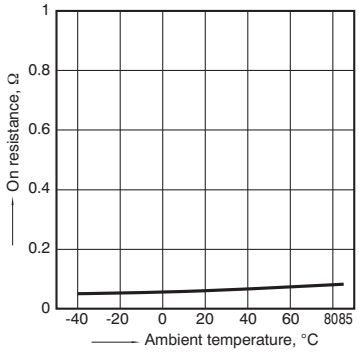
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



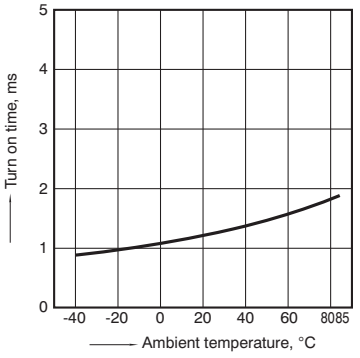
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



3. Turn on time vs. ambient temperature characteristics

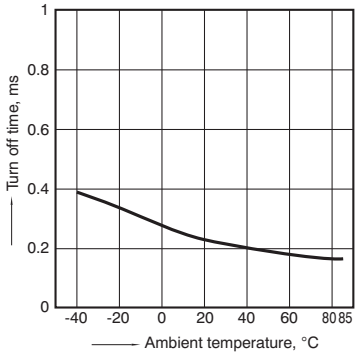
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



HE 1 Form A High Capacity (AQV252G)

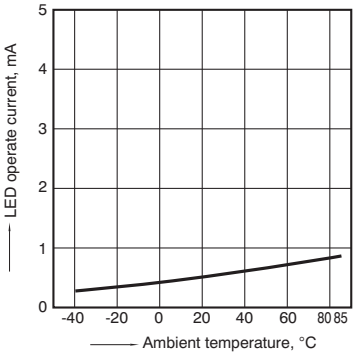
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



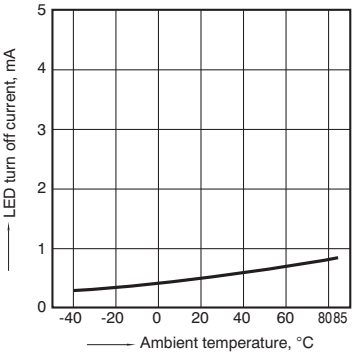
5. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



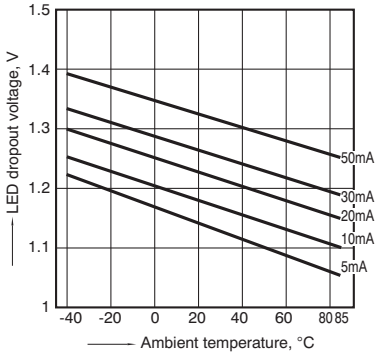
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



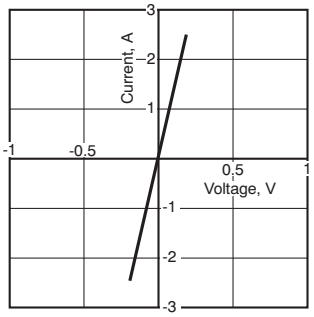
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



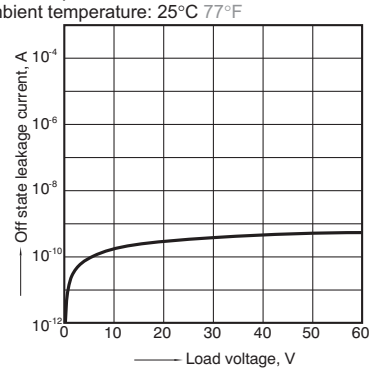
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



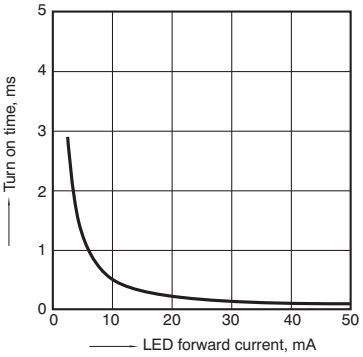
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



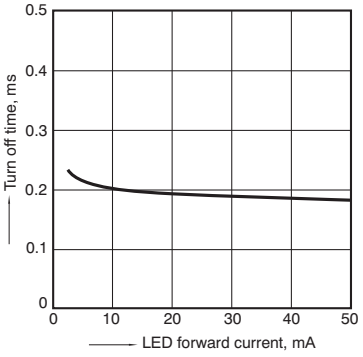
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



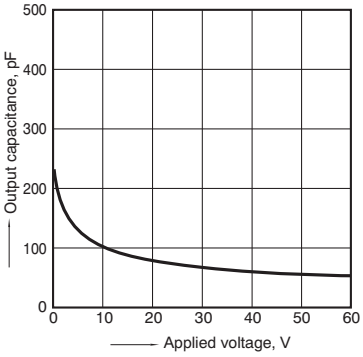
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

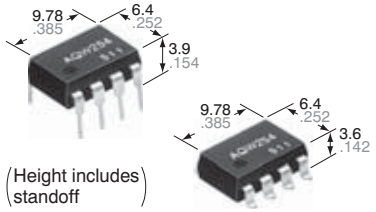
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

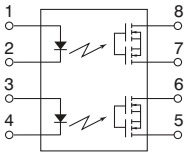
DIP8-pin type featuring low on-resistance with 400V load voltage

PhotoMOS Relays
HE 2 Form A
(AQW254)



CAD Data

mm inch



FEATURES

1. High sensitivity and low on-resistance
Can control max. 0.16 A load current with 5 mA input current. Low on-resistance of typ. 10.2Ω.
2. Applicable for 2 Form A use as well as two independent 1 Form A use
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- High-speed inspection machines
- Data communication equipment
- Telephone equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	400 V	120 mA	DIP8-pin	AQW254	AQW254A	AQW254AX	AQW254AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

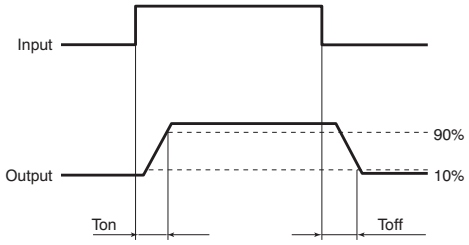
Item		Symbol	AQW254(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12 A (0.16 A)	A connection: Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

HE 2 Form A (AQW254)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW254(A)	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L= Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L= Max.
		Typical		0.8 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	10.2 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		16 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.8 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	
	Turn off time*	Typical	T_{off}	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 65.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

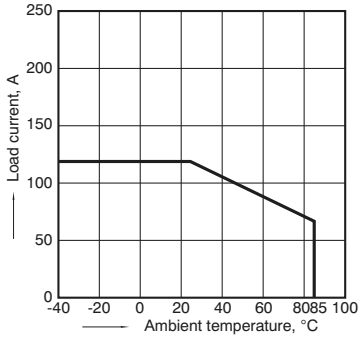
For more information, see page 80.

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

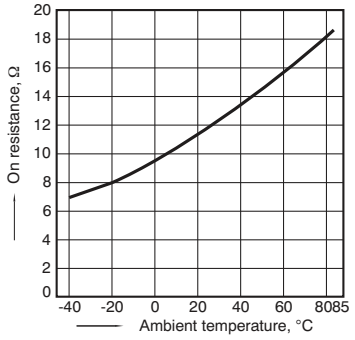
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

When using 2 channels



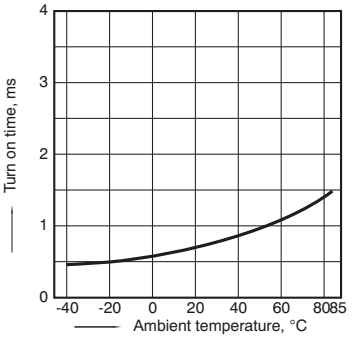
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



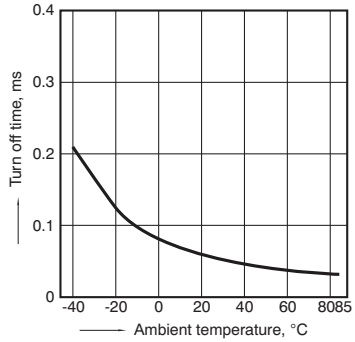
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



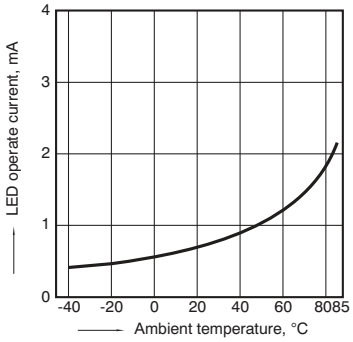
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



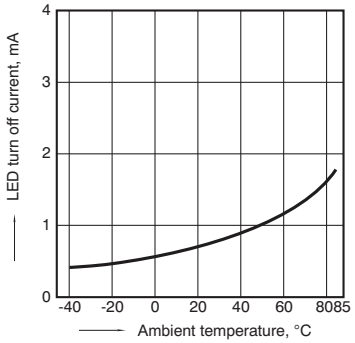
5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



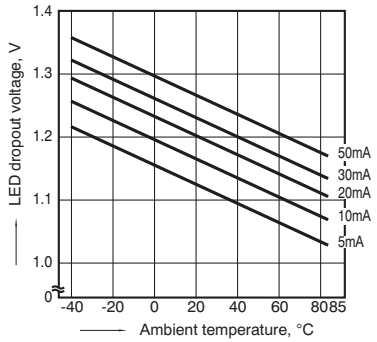
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



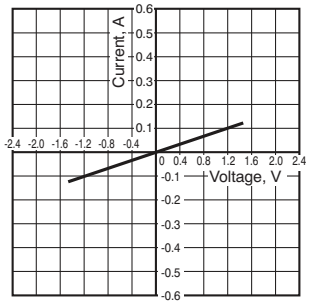
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



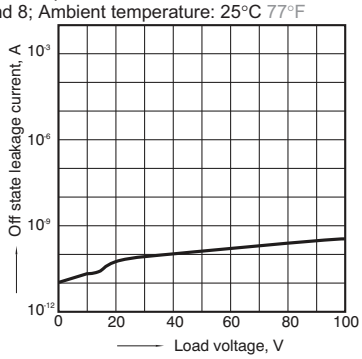
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



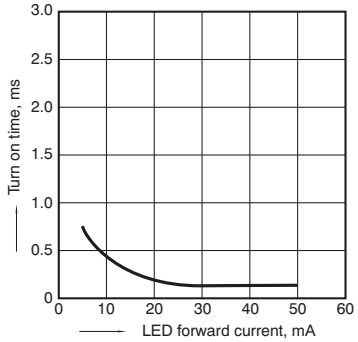
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



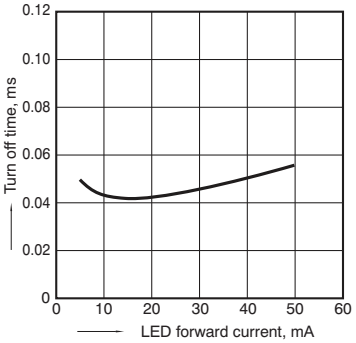
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



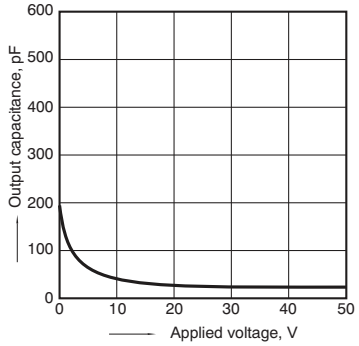
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

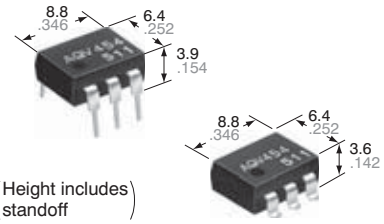


c UL us (Standard type) c UL us BSI (Standard type)

Panasonic
ideas for life

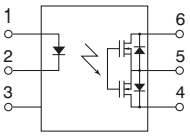
Normally closed DIP6-pin type Low on-resistance with 250V/400V load voltage

PhotoMOS Relays
HE 1 Form B
(AQV45❍, AQV454H)



CAD Data

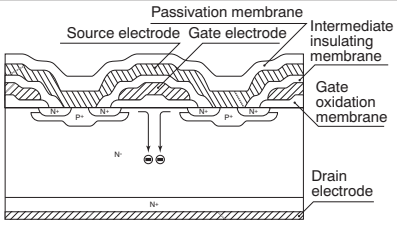
mm inch



FEATURES

1. 1 Form B (Normally-closed) type with low on-resistance
This has been achieved thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. High sensitivity and low on-resistance
Can control max. 0.2 A load current with 5 mA input current. Low on-resistance of typ. 5.5 Ω (AQV453).

4. Reinforced insulation 5,000 V type also available.
More than 0.4 mm .016 inch internal insulation distance between inputs and outputs. Conforms to IEC950 (reinforced insulation).

TYPICAL APPLICATIONS

- Security equipment
- High-speed inspection machines
- Measuring instruments
- Telephone equipment
- Sensing equipment

TYPES

	I/O isolation	Output rating*		Package	Part No.				Packing quantity	
		Load voltage	Load current		Through hole terminal	Surface-mount terminal			Tube	Tape and reel
					Tube packing style		Tape and reel packing style			
							Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	1,500 V AC	250 V	200 mA	DIP6-pin	AQV453	AQV453A	AQV453AX	AQV453AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.
		400 V	150 mA		AQV454	AQV454A	AQV454AX	AQV454AZ		
	Reinforced 5,000 V AC				AQV454H	AQV454HA	AQV454HAX	AQV454HAZ		

* Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

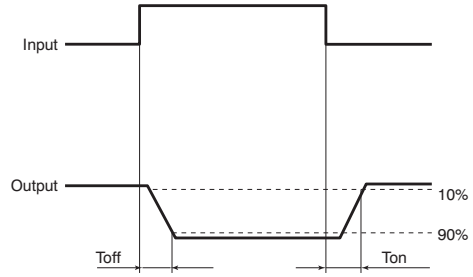
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV453(A)	AQV454(A)	AQV454H(A)	Remarks
Input	LED forward current	I_F		50 mA			
	LED reverse voltage	V_R		5 V			
	Peak forward current	I_{FP}		1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW			
Output	Load voltage (peak AC)	V_L		250 V	400 V		
	Continuous load current	I_L	A	0.2 A	0.15 A		A connection: Peak AC, DC B, C connection: DC
			B	0.3 A	0.18 A		
			C	0.4 A	0.25 A		
	Peak load current	I_{PEAK}		0.6 A	0.5 A		A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{OUT}		360 mW			
Total power dissipation		P_T		410 mW			
I/O isolation voltage		V_{iso}		1,500 V AC		5,000 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV453(A)	AQV454(A)	AQV454H(A)	Remarks
Input	LED operate (OFF) current	Typical	I_{Foff}	—	1 mA	0.9 mA	1.4 mA	I_L = Max.
		Maximum			3 mA			
	LED reverse (ON) current	Minimum	I_{Fon}	—	0.4 mA			I_L = Max.
		Typical			0.9 mA	0.8 mA	1.3 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F=5 mA)			I_F = 50 mA
		Maximum			1.5 V			
Output	On resistance	Typical	R_{on}	A	5.5 Ω	11 Ω		I_F = 0 mA I_L= Max. Within 1 s on time
		Maximum			8 Ω	16 Ω		
		Typical	R_{on}	B	2.7 Ω	6.3 Ω		I_F = 0 mA I_L= Max. Within 1 s on time
		Maximum			4 Ω	8 Ω		
		Typical	R_{on}	C	1.4 Ω	3.1 Ω		I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			2 Ω	4 Ω		
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	1 μA	10 μA	I_F= 5 mA V_L= Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	—	1.52 ms	1.2 ms	1.8 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum			3 ms	2.0 ms	3.0 ms	
	Reverse (ON) time*	Typical	T_{on}	—	0.4 ms	0.36 ms	0.4 ms	I_F = 5 mA → 0 mA I_L = Max.
		Maximum			1 ms			
	I/O capacitance	Typical	C_{iso}	—	1.3 pF			f = 1 MHz V_B = 0 V
		Maximum			3 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ			500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	Standard type: 5 Reinforced insulation type: 5 to 10	mA

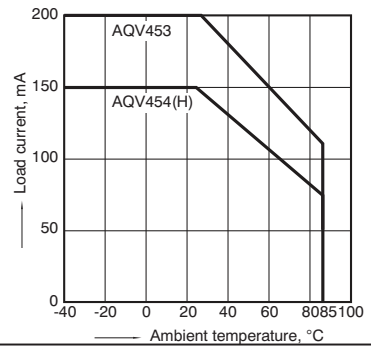
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

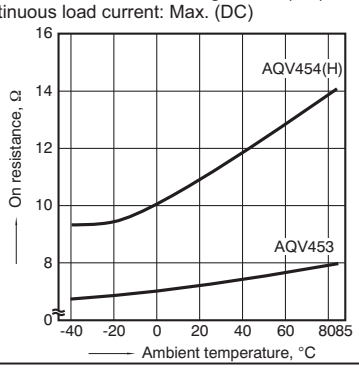
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



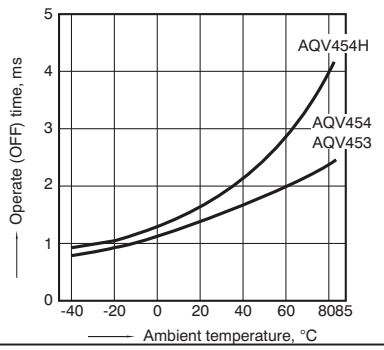
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



3. Operate (OFF) time vs. ambient temperature characteristics

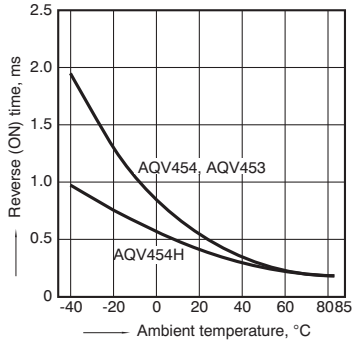
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



HE 1 Form B (AQV45❍, AQV454H)

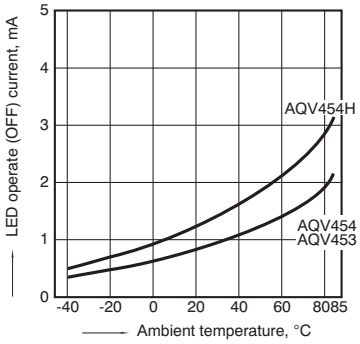
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



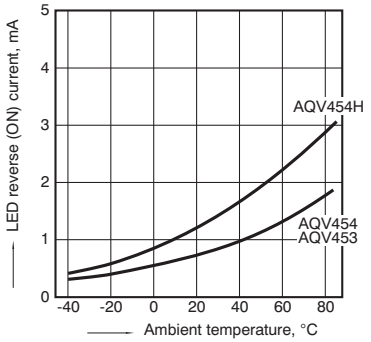
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



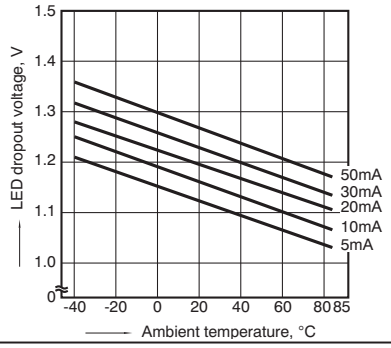
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



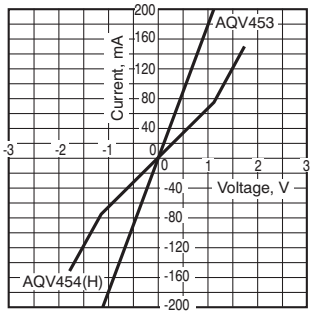
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



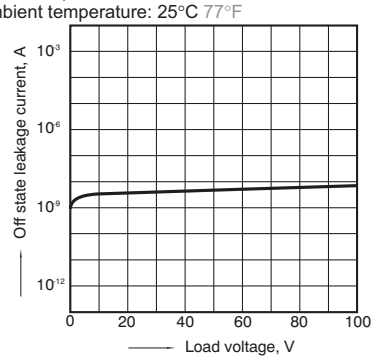
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



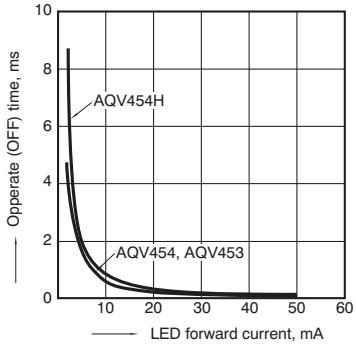
9. Off state leakage current vs. load voltage characteristics

Sample: AQV454;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



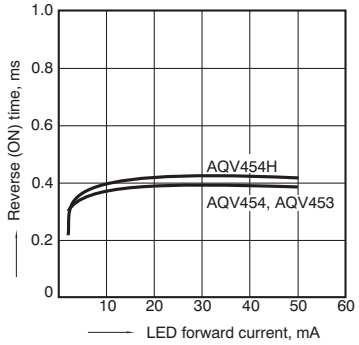
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



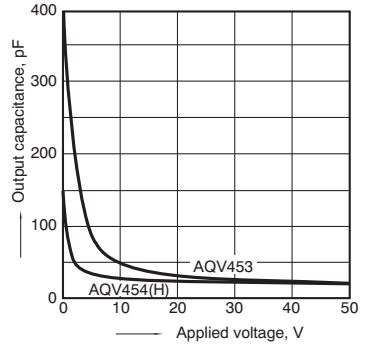
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

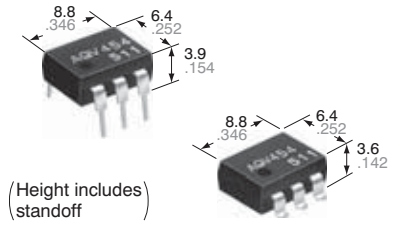
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



Panasonic
ideas for life

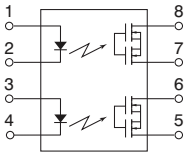
Normally closed (2 Form A)
DIP6-pin type
Low on-resistance with 400V load voltage

PhotoMOS Relays
HE 2 Form B
(AQW454)



CAD Data

mm inch



FEATURES

1. 2 Form B (Normally-closed) type
Has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.
2. Applicable for 2 Form B use as well as two independent 1 Form B use.
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. High sensitivity and low on-resistance
Can control max. 0.16 A load current with 5 mA input current. Low on-resistance of typ. 11 Ω.
5. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- Security equipment
- High-speed inspection machine
- Measuring instruments
- Telecommunication equipment
- Sensing equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	400 V	120 mA	DIP8-pin	AQW454	AQW454A	AQW454AX	AQW454AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

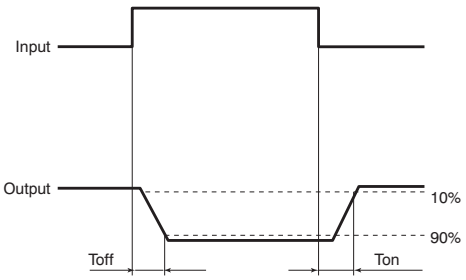
Item		Symbol	AQW454(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12 A (0.16 A)	A connection: Peak AC, DC ( ): for one 1b-circuit
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

HE 2 Form B (AQW454)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW454(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA	I_L = Max.
		Typical		0.8 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	11 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum		16 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	1.2 ms	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		2 ms	
	Reverse (ON) time*	Typical	T_{on}	0.36 ms	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

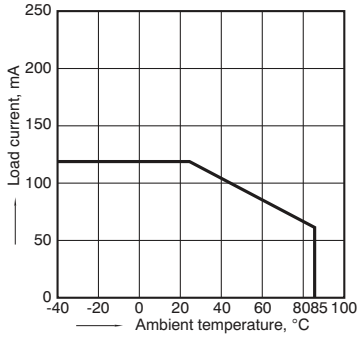
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

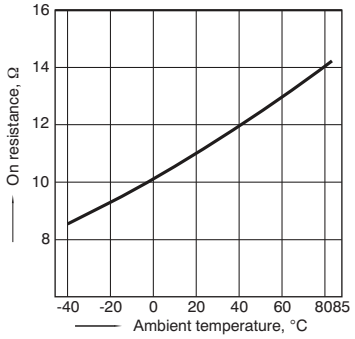
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

When using 2 channels



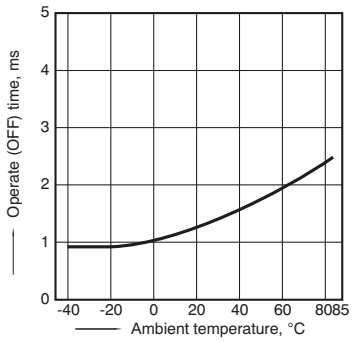
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 0 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



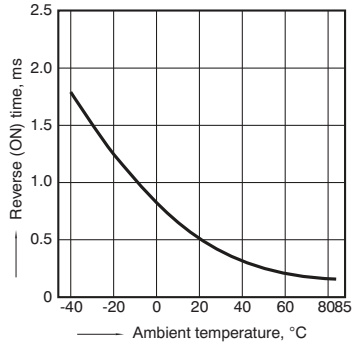
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



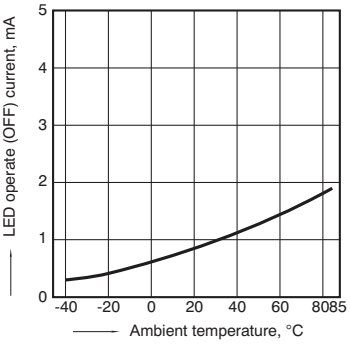
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



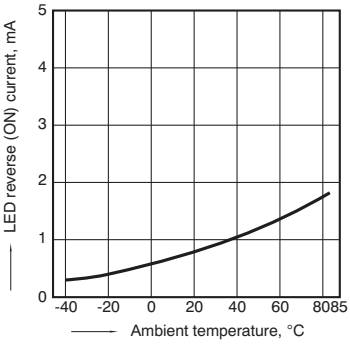
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



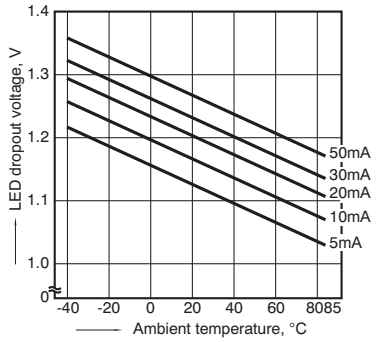
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



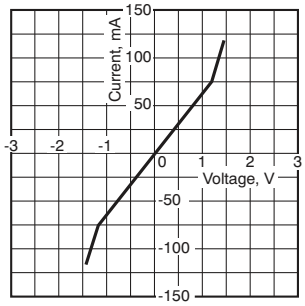
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



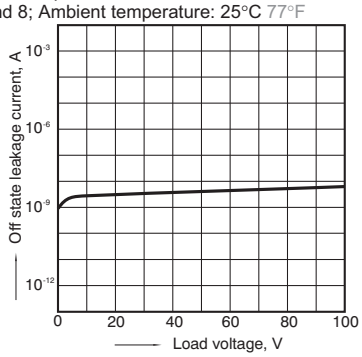
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



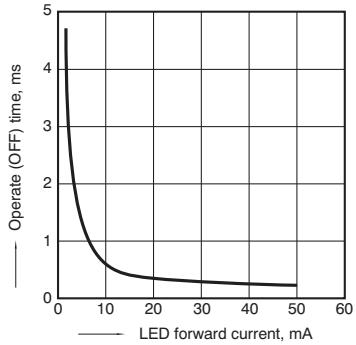
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



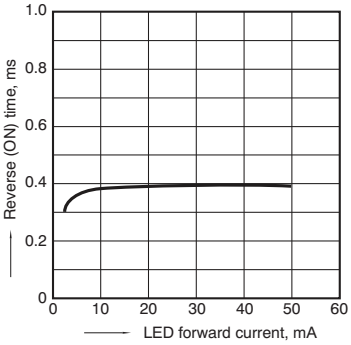
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



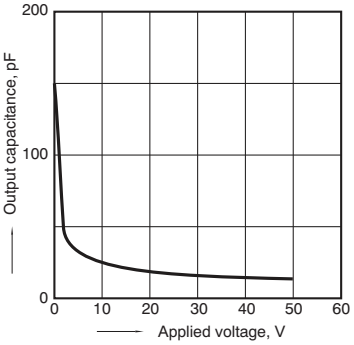
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

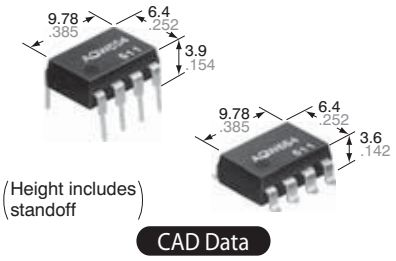
Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

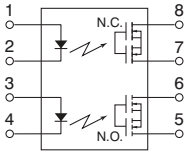
Both 1 Form A and 1 Form B contacts incorporated in a compact DIP8-pin with low on-resistance

PhotoMOS Relays
HE Form A & B
(AQW654)



CAD Data

mm inch



FEATURES

1. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use

2. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. High sensitivity and low on-resistance

Can control max. 0.16 A load current with 5 mA input current. Low on-resistance of max. 11 Ω.

4. Low-level off state leakage current of max. 1 μA

TYPICAL APPLICATIONS

- High-speed inspection machines
- Data communication equipment
- Telephone equipment
- Sensing equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC dual use	400 V	120 mA	DIP8-pin	AQW654	AQW654A	AQW654AX	AQW654AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

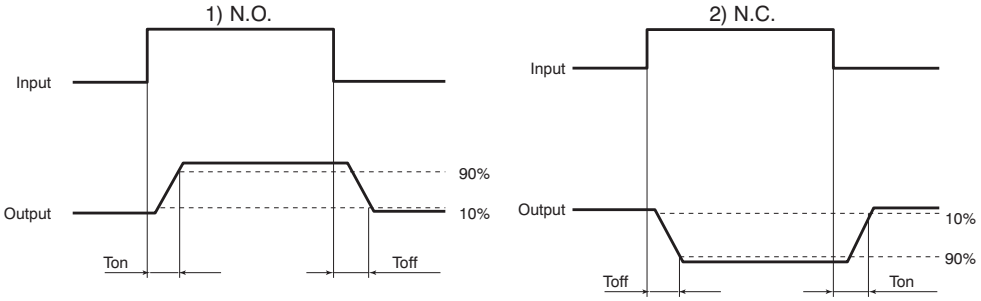
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW654(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12A (0.16 A)	Peak AC, DC ( ): in case of using only 1 channel)
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW654(A)	Remarks
Input	LED operate current	Typical	I_{Fon} (N.O.) I_{Foff} (N.C.)	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED reverse current	Minimum	I_{Foff} (N.O.) I_{Fon} (N.C.)	0.4 mA	I_L = Max.
		Typical		0.8 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	11 Ω	I_F = 5 mA (N.O.) I_F = 0 mA (N.C.) I_L = Max. Within 1 s on time
		Maximum		16 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA (N.O.) I_F = 5 mA (N.C.) V_L = Max.
Transfer characteristics	Operate time*	Typical	T_{on} (N.O.) T_{off} (N.C.)	0.8 ms (N.O.) 1.2 ms (N.C.)	I_F = 0 mA → 5 mA I_L = Max.
		Maximum		2 ms	
	Reverse time*	Typical	T_{off} (N.O.) T_{on} (N.C.)	0.04 ms (N.O.) 0.36 ms (N.C.)	I_F = 5 mA → 0 mA I_L = Max.
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5	mA

■ **For Dimensions, see page 61.**
■ **For Schematic and Wiring Diagrams, see page 66.**
■ **For Cautions for Use, see page 71.**

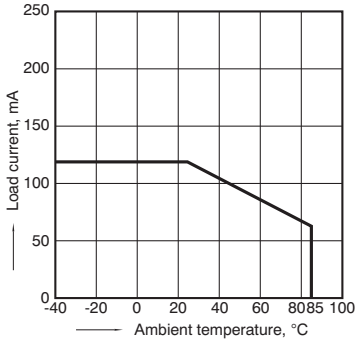
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

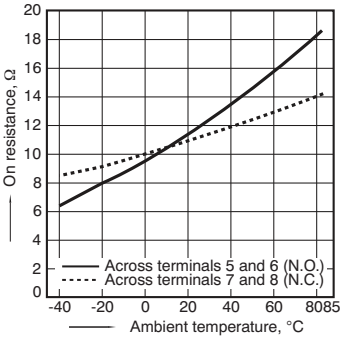
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

When using 2 channels



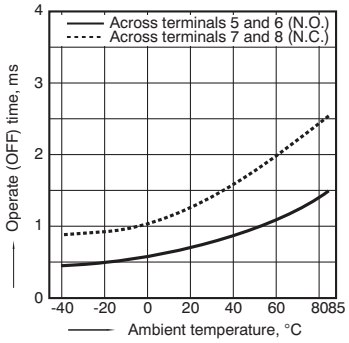
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



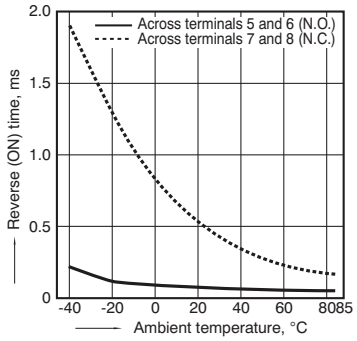
3. Operate time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



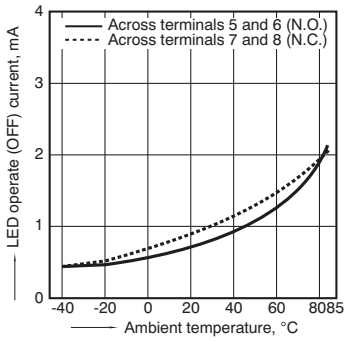
4. Reverse time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



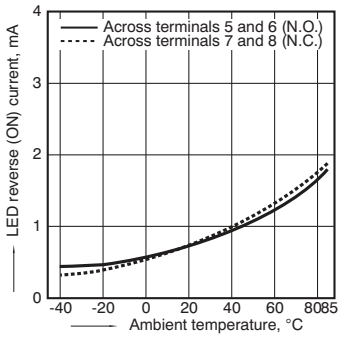
5. 5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



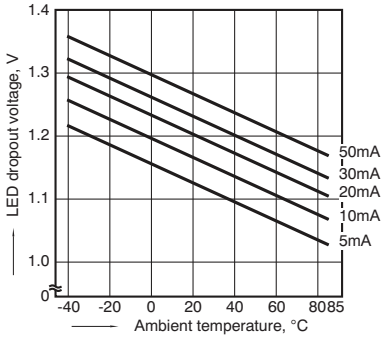
6. LED reverse current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



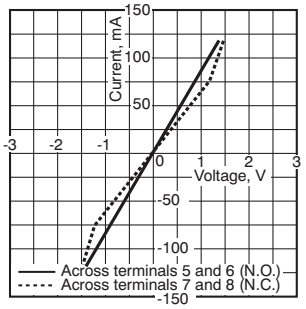
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



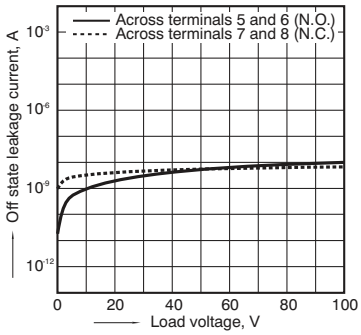
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



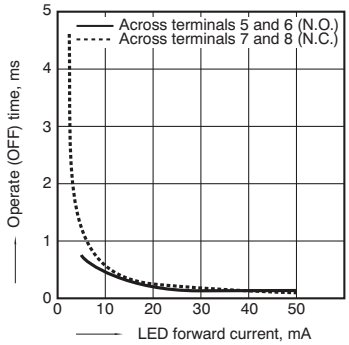
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



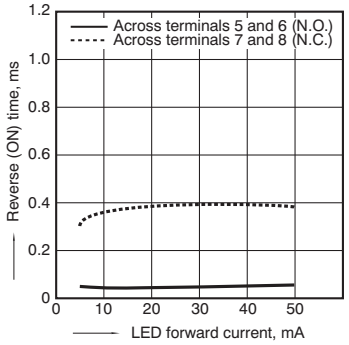
10. Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



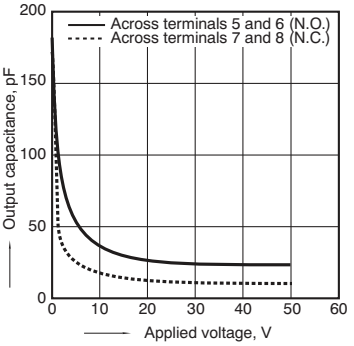
11. Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

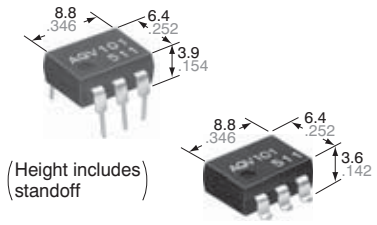
Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

DIP6-pin type with wide variation Low on-resistance

PhotoMOS Relays
HF 1 Form A
(AQV10❍, 20❍)



CAD Data

FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

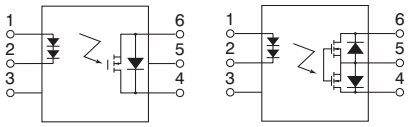
2. Controlled with low-level input signals

3. AC/DC dual use type and DC only type available.

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computers

mm inch



(AQV10 series) (AQV20 series)

TYPES

1. DC type (AQV10 series)

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
DC only	40 V	700 mA	DIP6-pin	AQV101	AQV101A	AQV101AX	AQV101AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs
	60 V	600 mA		AQV102	AQV102A	AQV102AX	AQV102AZ		
	250 V	300 mA		AQV103	AQV103A	AQV103AX	AQV103AZ		
	400 V	180 mA		AQV104	AQV104A	AQV104AX	AQV104AZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

2. AC/DC type (AQV20 series)

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	40 V	500 mA	DIP6-pin	AQV201	AQV201A	AQV201AX	AQV201AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs
	60 V	400 mA		AQV202	AQV202A	AQV202AX	AQV202AZ		
	250 V	200 mA		AQV203	AQV203A	AQV203AX	AQV203AZ		
	400 V	150 mA		AQV204	AQV204A	AQV204AX	AQV204AZ		

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQV101(A)	AQV102(A)	AQV103(A)	AQV104(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	10 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	150 mW				
Output	Load voltage (DC)	V_L	40 V	60 V	250 V	400 V	
	Continuous load current (DC)	I_L	0.7 A	0.6 A	0.3 A	0.18 A	
	Peak load current	I_{peak}	1.8 A	1.5 A	0.6 A	0.5 A	100 ms (1 shot)
	Power dissipation	P_{out}	360 mW				
Total power dissipation		P_T	410 mW				
I/O isolation voltage		V_{iso}	1,500 V (AC)				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQV101(A)	AQV102(A)	AQV103(A)	AQV104(A)	Condition
Input	LED operate current	Typical	I_{Fon}	2.3 mA				I_L = Max.
		Maximum		5 mA				
	LED turn off current	Minimum	I_{Foff}	0.8 mA				I_L = Max.
		Typical		2.2 mA				
	LED dropout voltage	Typical	V_F	2.3 V				I_F = 10 mA
		Maximum		3 V				
Output	On resistance	Typical	R_{on}	0.3 Ω	0.37 Ω	2.7 Ω	6.3 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
		Maximum		0.5 Ω	0.7 Ω	4 Ω	8 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA				I_F = 0 mA, V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.23 ms	0.22 ms	0.13 ms	0.09 ms	I_F = 10 mA I_L = Max.
		Maximum		1 ms				
	Turn off time*	Typical	T_{off}	0.07 ms			0.08 ms	I_F = 10 mA I_L = Max.
		Maximum		1 ms				
	I/O capacitance	Typical	C_{iso}	1.3 pF				f = 1 MHz V_B = 0 V
		Maximum		3 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC

2. AC/DC type

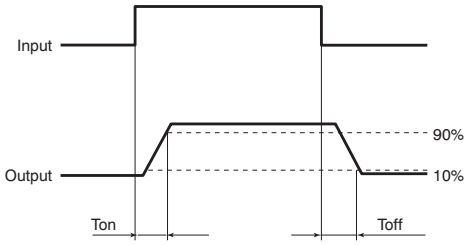
1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV201(A)	AQV202(A)	AQV203(A)	AQV204(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		10 V				
	Peak forward current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		150 mW				
Output	Load voltage (peak AC)	V_L		40 V	60 V	250 V	400 V	
	Continuous load current	I_L	A	0.5 A	0.4 A	0.2 A	0.15 A	A connection: Peak AC, DC B, C connection: DC
			B	0.7 A	0.6 A	0.3 A	0.18 A	
			C	1.0 A	0.8 A	0.4 A	0.25 A	
	Peak load current	I_{peak}		1.8 A	1.5 A	0.6 A	0.5 A	A connection 100 ms (1 shot) V_L = DC
	Power dissipation	P_{out}		360 mW				
Total power dissipation		P_T		410 mW				
I/O isolation voltage		V_{iso}		1,500 V AC				
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temperature
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV201(A)	AQV202(A)	AQV203(A)	AQV204(A)	Remarks
Input	LED operate current	Typical	I_{Fon}	—	2.4 mA				I_L = Max.
		Maximum			5 mA				
	LED turn off current	Minimum	I_{Foff}	—	0.8 mA				I_L = Max.
		Typical			2.2 mA				
	LED dropout voltage	Typical	V_F	—	2.3 V				I_F = 10 mA
		Maximum			3 V				
Output	On resistance	Typical	R_{on}	A	0.6 Ω	0.74 Ω	5.5 Ω	12.4 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
		Maximum			1 Ω	1.4 Ω	8 Ω	16 Ω	
		Typical	R_{on}	B	0.3 Ω	0.37 Ω	2.7 Ω	6.2 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
		Maximum			0.5 Ω	0.7 Ω	4 Ω	8 Ω	
		Typical	R_{on}	C	0.15 Ω	0.18 Ω	1.4 Ω	3.1 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
		Maximum			0.25 Ω	0.35 Ω	2 Ω	4 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA				I_F = 0 mA, V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.38 ms	0.41 ms	0.21 ms	0.18 ms	I_F = 10 mA I_L = Max.
		Maximum			1 ms				
	Turn off time*	Typical	T_{off}	—	0.08 ms		0.07 ms		I_F = 10 mA I_L = Max.
		Maximum			1 ms				
	I/O capacitance	Typical	C_{iso}	—	1.3 pF				f = 1 MHz V_B = 0 V
		Maximum			3 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ				500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	10	mA

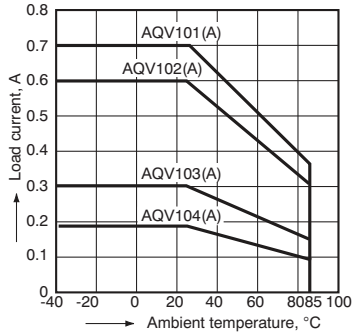
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

13-(1) Load current vs. ambient temperature characteristics (DC type)

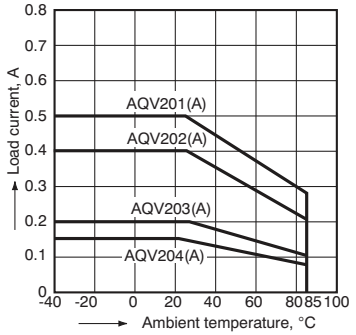
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



1.-(2) Load current vs. ambient temperature characteristics (AC/DC type)

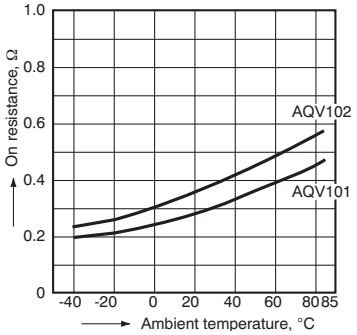
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



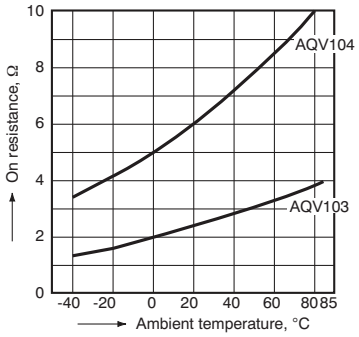
14-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)

LED current: 10 mA;
Continuous load current: Max. (DC)



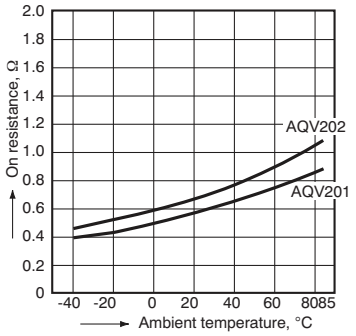
2.-(2) On resistance vs. ambient temperature characteristics (DC type: AQV103, AQV104)

LED current: 10 mA;
Continuous load current: Max. (DC)



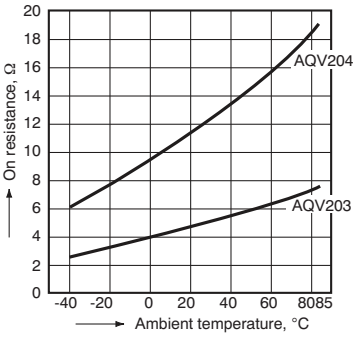
2.-(3) On resistance vs. ambient temperature characteristics (AC/DC type: AQV201, AQV202)

Measured portion: between terminals 4 and 6;
LED current: 10 mA;
Continuous load current: Max. (DC)



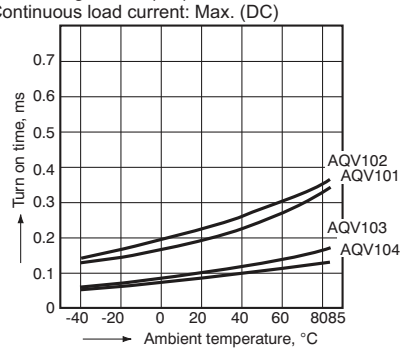
2.-(4) On resistance vs. ambient temperature characteristics (AC/DC type: AQV203, AQV204)

Measured portion: between terminals 4 and 6;
LED current: 10 mA;
Continuous load current: Max. (DC)



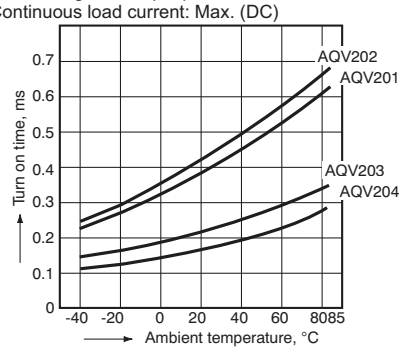
15-(1) Turn on time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



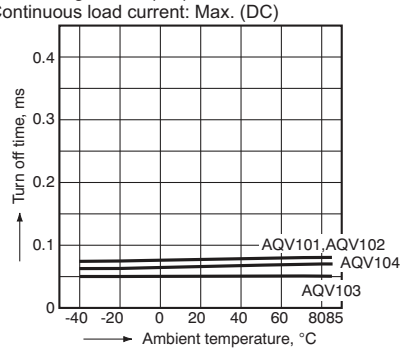
3.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



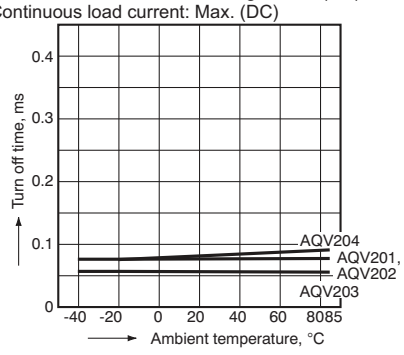
16-(1) Turn off time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



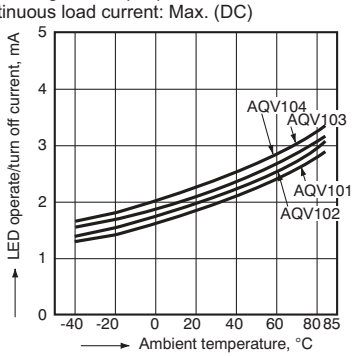
4.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



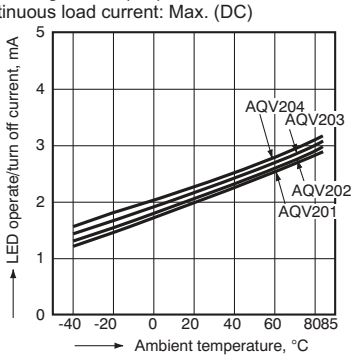
17-(1) LED operate/turn off current vs. ambient temperature characteristics (DC type)

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



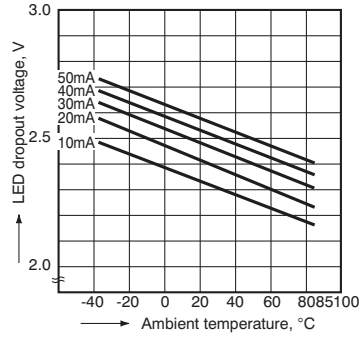
5.-(2) LED operate/turn off current vs. ambient temperature characteristics (AC/DC type)

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



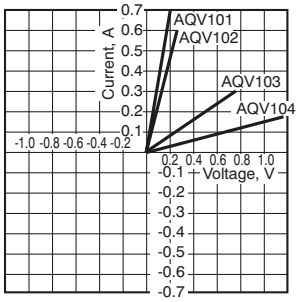
18.LED dropout voltage vs. ambient temperature characteristics

Sample: AQV202
LED current: 10 to 50 mA



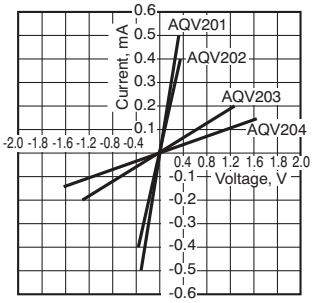
19-(1) Current vs. voltage characteristics of output at MOS portion (DC type)

Ambient temperature: 25°C 77°F



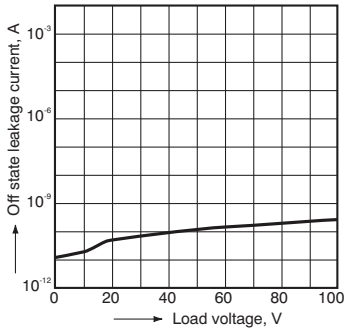
7.-(2) Current vs. voltage characteristics of output at MOS portion (AC/DC type)

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



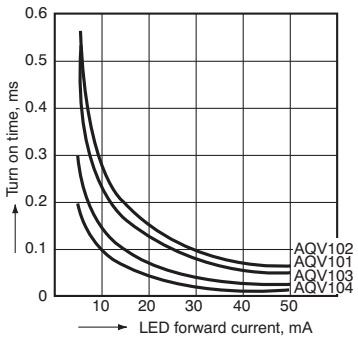
20.Off state leakage current vs. load voltage characteristics

Sample: AQV204;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



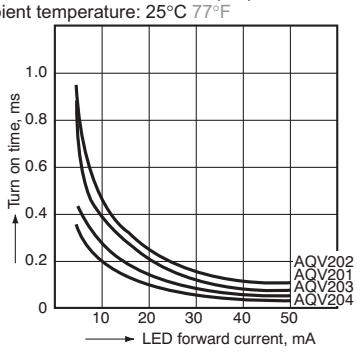
21-(1) Turn on time vs. LED forward current characteristics (DC type)

Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



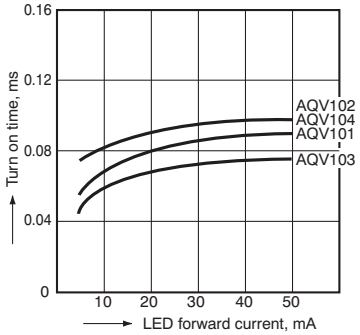
9.-(2) Turn on time vs. LED forward current characteristics (AC/DC type)

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



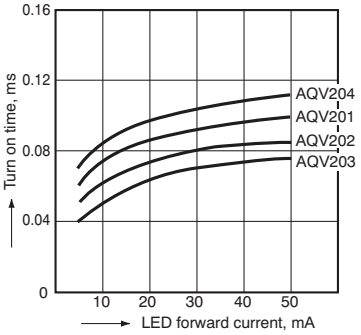
22-(1) Turn off time vs. LED forward current characteristics (DC type)

Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



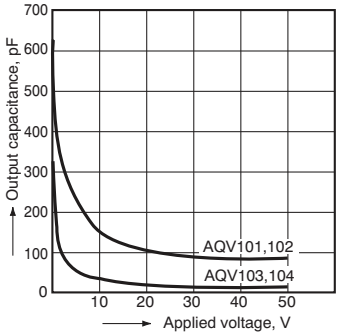
10.-(2) Turn off time vs. LED forward current characteristics (AC/DC type)

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



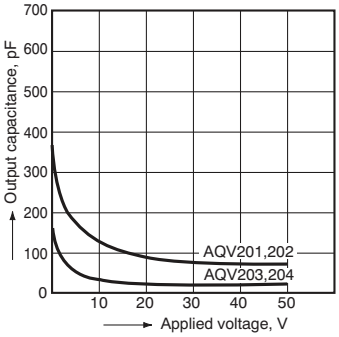
23-(1) Output capacitance vs. applied voltage characteristics (DC type)

Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



11.-(2) Output capacitance vs. applied voltage characteristics (AC/DC type)

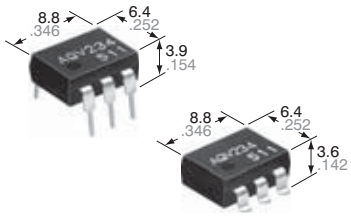
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

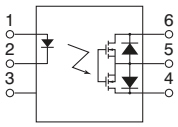
DIP6-pin type featuring high sensitivity

PhotoMOS Relays
HS 1 Form A
(AQV234)



CAD Data

mm inch



FEATURES

1. High sensitivity
LED operate current: 0.31mA (typ.)
Recommended LED input current: 2mA
2. Low-level off state leakage current of max. 1 μA
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

TYPICAL APPLICATIONS

1. High-speed inspection machines
Scanner, IC checker, Board tester, etc.
2. Telephone and data communication equipment

TYPES

	Output rating*		Package	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Load voltage	Load current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC dual use	400 V	120 mA	DIP6-pin	AQV234	AQV234A	AQV234AX	AQV234AZ	1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

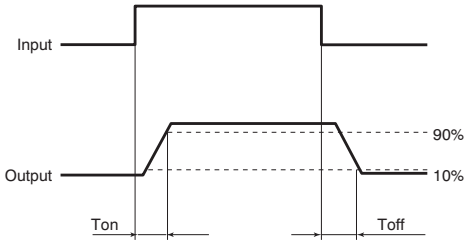
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV234(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (Peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.12 A	A connection: Peak AC, DC B, C connection: DC
			B	0.13 A	
			C	0.15 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperature
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV234(A)	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.31 mA	$\Delta I_F/\Delta t$ Q Min. 100 μA/s I_L = Max.
		Maximum			0.5 mA	
	LED turn off current	Minimum	I_{Foff}	—	0.1 mA	$\Delta I_F/\Delta t$ Q Min. 100 μA/s I_L = Max.
		Typical			0.29 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.1 V at I_F = 2 mA)	I_F = 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	30 Ω	I_F = 2 mA, I_L = Max. Within 1 s on time
		Maximum			50 Ω	
		Typical	R_{on}	B	22.5 Ω	I_F = 2 mA, I_L = Max. Within 1 s on time
		Maximum			25 Ω	
		Typical	R_{on}	C	11.3 Ω	I_F = 2 mA, I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 0 mA, V_L = Max.
Transistor characteristics	Turn on time*	Typical	T_{on}	—	0.89 ms	I_F = 2 mA I_L = Max.
		Maximum			2 ms	
	Turn off time*	Typical	T_{off}	—	0.22 ms	I_F = 2 mA I_L = Max.
		Maximum			1 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	2	mA

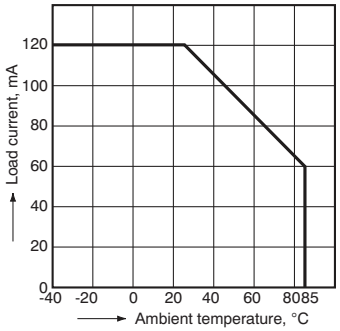
■ For Dimensions, see page 60.
■ For Schematic and Wiring Diagrams, see page 65.
■ For Cautions for Use, see page 71.

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

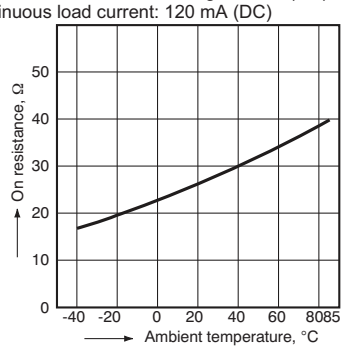
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



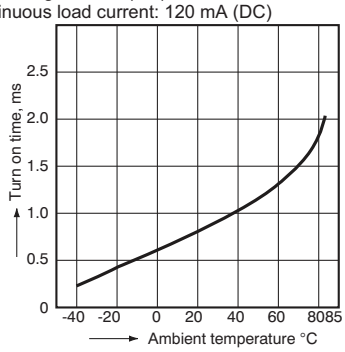
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 2 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



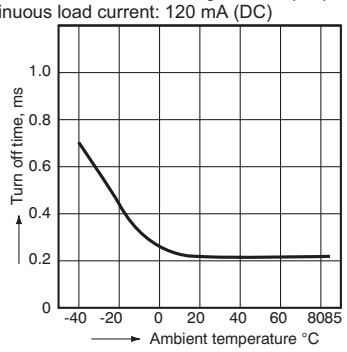
3. Turn on time vs. ambient temperature characteristics

LED current: 2 mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



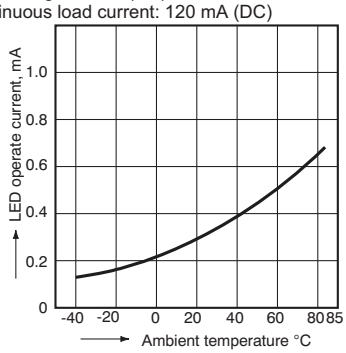
4. Turn off time vs. ambient temperature characteristics

LED current: 2 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



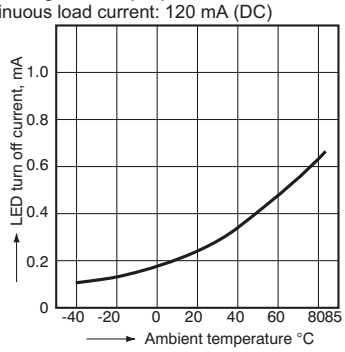
5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



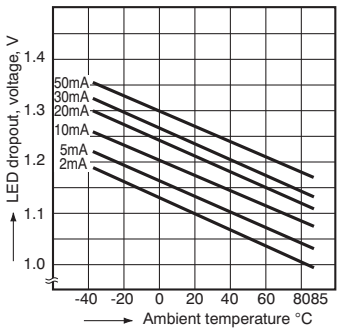
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



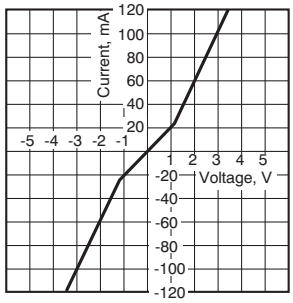
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 2 to 50 mA



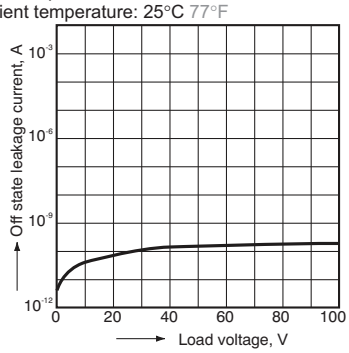
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



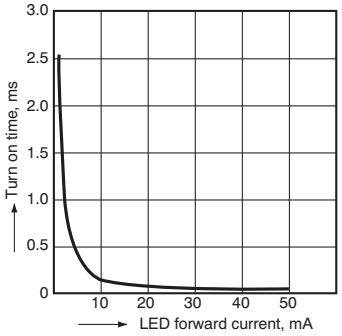
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



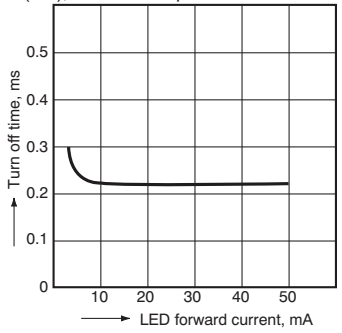
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current:
120 mA (DC); Ambient temperature: 25°C 77°F



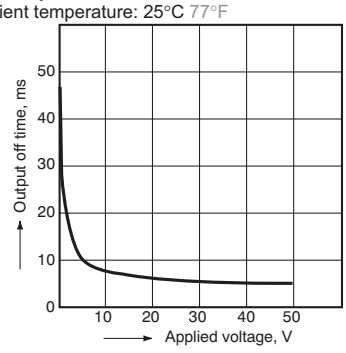
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current:
120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

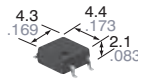
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
ideas for life

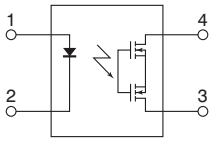
Recommended LED forward current 2 mA, High Sensitivity (Low current-consumption), Miniature SOP4-pin Type

PhotoMOS Relays
HS SOP 1 Form A
(AQY2)



CAD Data

mm inch



FEATURES

1. High sensitivity (Low current-consumption)
HS type PhotoMOS relays need less than half LED forward current of other types. This contributes to energy-saving working of equipment and longer operating life for battery.

Sensitivity comparison between HS type and GU type

In case of load voltage 60V type, SOP4-pin

		HS type (AQY232S)	GU type (AQY212S)
LED operate current	Typical	**0.35 mA**	0.9 mA
	Maximum	**0.5 mA**	3 mA
Recommended LED forward current		**2 mA**	5 mA

2. Small package (SOP4-pin)
3. 60 V, 350 V and 400 V load voltage types available

TYPICAL APPLICATIONS

Ideal for battery-powered devices that need to lengthen operating life. Also recommended for power-economizing of testing equipment that uses many relays.

1. Security equipment
• Crime-preventing system: Surveillance camera, burglar alarm
• Disaster-preventing system: Fire alarm, heat/smoke sensor
2. Measuring instruments
3. Meters (watt-hour, gas, etc.)
4. Telecommunication equipment
5. Industrial equipment

TYPES

	Output rating*		Package	Part No.			Packing quantity	
	Load voltage	Load current		Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60V	500mA	SOP4-pin	AQY232S	AQY232SX	AQY232SZ	1 tube contains: 100 pcs. 1 batch contains: 2,000 pcs.	1,000 pcs.
	350V	120mA		AQY230S	AQY230SX	AQY230SZ		
	400V	100mA		AQY234S	AQY234SX	AQY234SZ		

Note: For space reasons, the three initial letters of the part number "AQY", the surface mount terminal indicator "S" and the packing style indicator "X" or "Z" are not marked on the relay. (Ex. the label for product number AQY232SX is 232.)
* Indicate the peak AC and DC values.

Ratings and packages other than those given above are available by special order. Please contact our sales office in your area.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY232S	AQY230S	AQY234S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.5 A	0.12 A	0.1 A	Peak AC, DC
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW			
Total power dissipation		P_T	350 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Operating temperature		T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
Storage temperature		T_{stg}	–40°C to +100°C –40°F to +212°F			

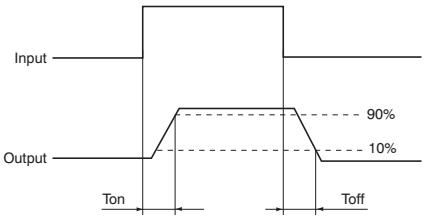
HS SOP 1 Form A (AQY2)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY232S	AQY230S	AQY234S	Remarks
Input	LED operate current	Typical	I_{Fon}	0.35 mA			$\Delta I_F/\Delta t \geqq$ Min. 100 μA/s I_L = Max.
		Maximum		0.5 mA			
	LED turn off current	Minimum	I_{Foff}	0.1 mA			$\Delta I_F/\Delta t \geqq$ Min. 100 μA/s I_L = Max.
		Typical		0.3 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.1 V at I_F = 2 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.85 Ω	19 Ω	27 Ω	I_F = 2 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	35 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.5 ms	1.2 ms	0.8 ms	I_F = 2 mA I_L = Max.
		Maximum		5 ms			
	Turn off time*	Typical	T_{off}	0.15 ms	0.1 ms	0.1 ms	I_F = 2 mA I_L = Max.
		Maximum		2 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

Note: Please refer to the schematic and wiring diagram for connection method.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation (turn on) and resetting (turn off).

Item	Symbol	Recommended value	Unit
Input LED current	I_F	2	mA

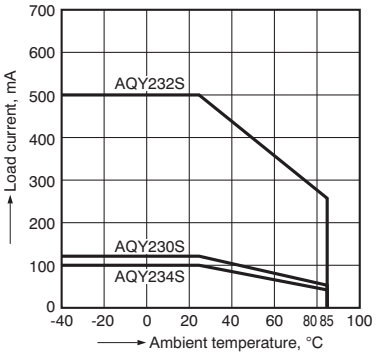
■ **For Dimensions, see page 62.**
■ **For Schematic and Wiring Diagrams, see page 64.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

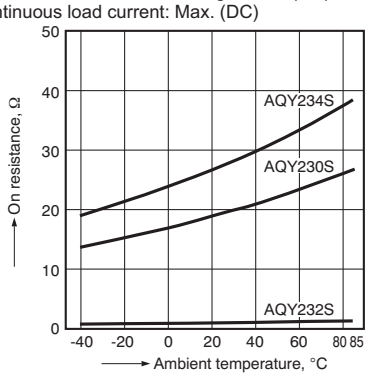
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



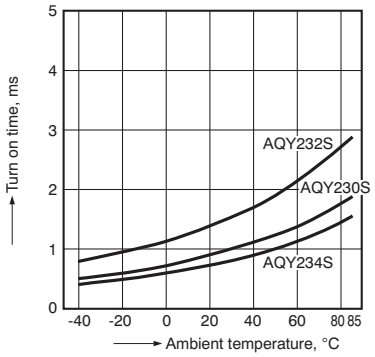
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 2 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



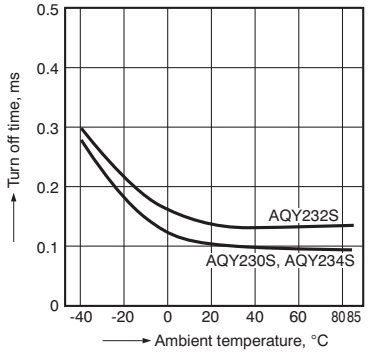
3. Turn on time vs. ambient temperature characteristics

LED current: 2 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



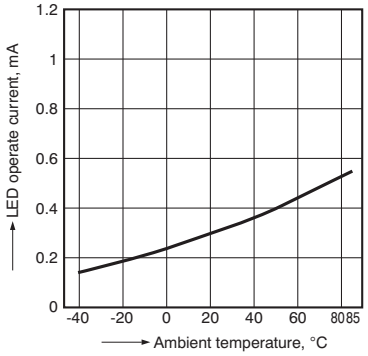
4. Turn off time vs. ambient temperature characteristics

LED current: 2 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



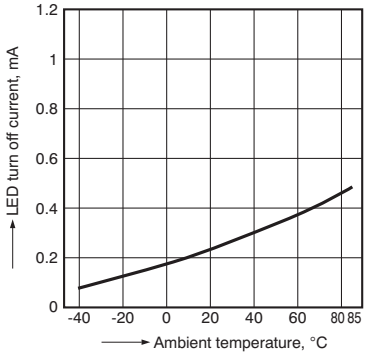
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



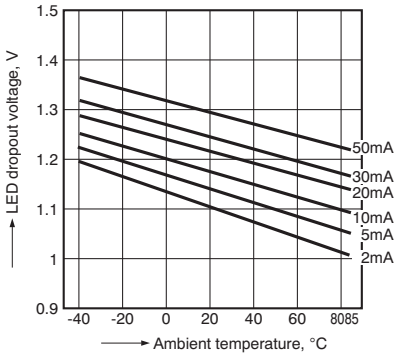
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



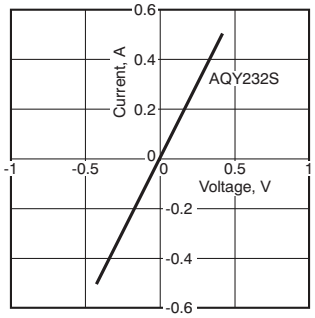
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types; LED current: 2 to 50 mA



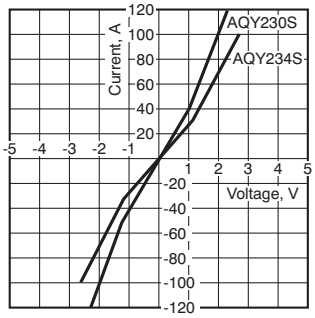
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



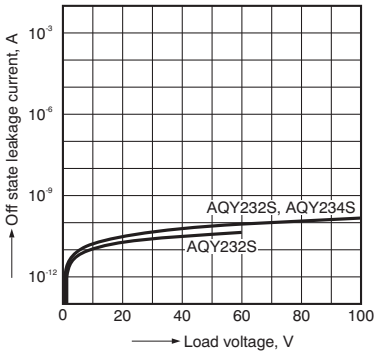
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



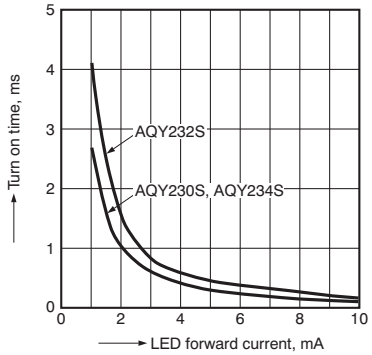
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



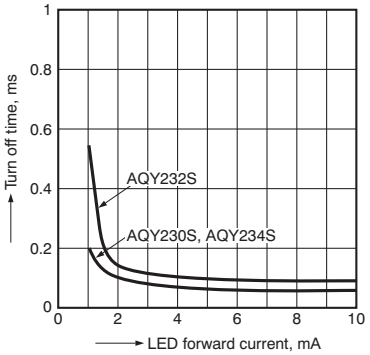
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



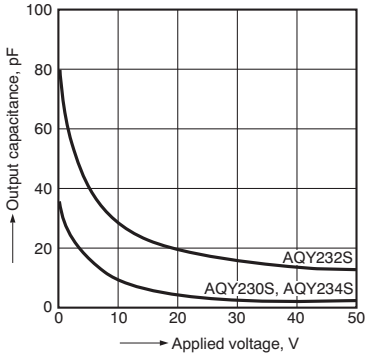
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



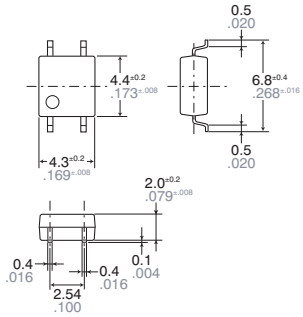
12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz (30 mVrms);
Ambient temperature: 25°C 77°F



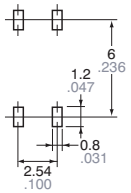
DIMENSIONS (Unit: mm inch)

External dimensions



Terminal thickness t = ±0.15 ±.006
General tolerance: ±0.1 ±.004

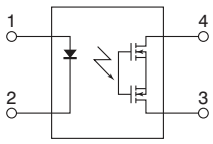
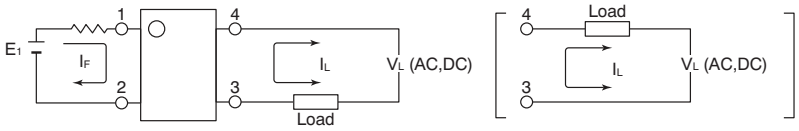
Recommended mounting pad (Top view)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

E_1: Power source at input side; I_F: LED forward current; V_L: Load voltage; I_L: Load current

Schematic	Output configuration	Load	Wiring diagram
	1a	AC/DC	

PhotoMOS RELAYS CAUTIONS FOR USE

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

1. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the overvoltage or overcurrent. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

Therefore, the circuit should be designed in such a way that the load never exceed the absolute maximum ratings, even momentarily.

2. Derating design

Derating is essential in any reliable design and a significant factor in consideration of product life. Sufficient derating is needed against maximum rating when designing a system.

And also, relays should be examined using a measurement equipment.

Derated voltages must be considered according to operating and environmental conditions the relay will be subjected to.

3. Short across terminals

Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

4. LED forward input current

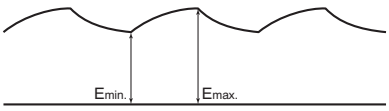
Use with an LED forward input current increase and decrease rate, $\Delta I_F/\Delta t$, of at least 100 μA/s.

5. Ripple in the input power supply

If ripple is present in the input power supply, observe the following:

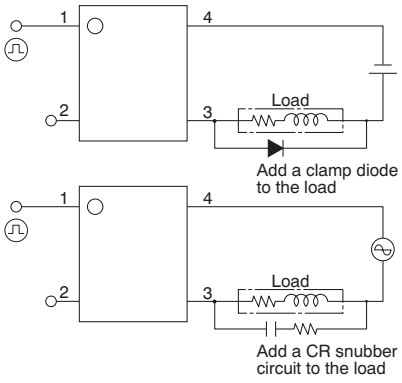
1) For LED operate current at E_{min}, please maintain 2 mA.

2) Please make sure for $E_{max.}$ is no higher the LED operate current at than 50 mA.



6. Output spike voltages

1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits are shown below.



2) Even if spike voltages generated at the load are limited with a clamp diode or snubber circuit if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

7. Cleaning

We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

- Frequency: 27 to 29 kHz
- Ultrasonic output:
  No greater than 0.25W/cm^2
- Cleaning time: No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other:
  Submerge in solvent in order to prevent the PC board and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

8. Notes for mounting

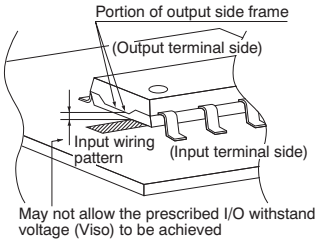
1) If many different packages are combined on a single substrate, then lead temperature rise is highly dependent on package size. For this reason, please make sure that the temperature of the terminal solder area of the PhotoMOS relay falls within the temperature conditions of item 10 before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 10, resin strength will fall and the nonconformity of the heat expansion coefficient of each constituent material will increase markedly, possibly causing cracks in the package, severed bonding wires, and the like. For this reason, please inquire with us about whether this use is possible.

3) We recommend cleaning with an organic solvent.
If you cannot avoid using ultrasonic cleaning, check beforehand for defects.

9. Input wiring pattern

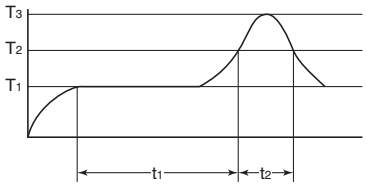
With AQY series avoid installing the input (LED side) wiring pattern to the bottom side of the package if you require the specified I/O isolation voltage (V_{iso}) after mounting the PC board. Since part of the frame on the output side is exposed, it may cause fluctuations in the I/O isolation voltage.



10. Soldering

Example of recommended soldering conditions

(1) IR (Infrared reflow) soldering method



T1 = 150 to 180°C 302 to 356°F
T2 = 230°C 446°F
T3 = 245°C 473°F or less
t1 = 60 to 120 s or less
t2 = 30 s or less

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F
Wattage: 30 to 60 W
Soldering time: within 3 s

(3) Others

Check mounting conditions before using other soldering methods (DWS, VPS, hot-air, hot plate, laser, pulse heater, etc.)

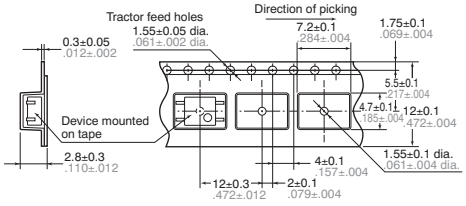
- When using lead-free solder, we recommend a type with an alloy composition of Sn 3.0 Ag 0.5 Cu. Please inquire about soldering conditions and other details.
- The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

11. Packing format

1) Tape and reel

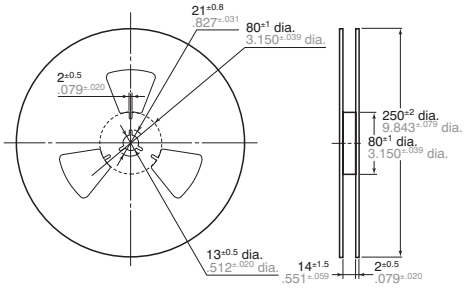
mm inch

Tape dimensions



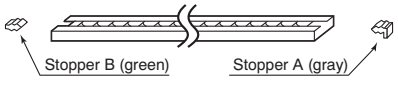
(1) When picked from 1/2-pin side: Part No. AQY23○SX (Shown above)
(2) When picked from 3/4-pin side: Part No. AQY23○SZ

Dimensions of paper tape reel



2) Tube

Devices are packaged in a tube so that pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.



12. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

• Temperature: 0 to 45°C 32 to 113°F
• Humidity: Less than 70% R.H.
• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

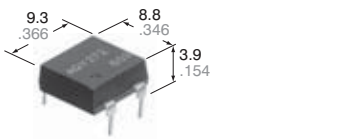
3) Storage method for SOP type PhotoMOS relays implemented in SOP type are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

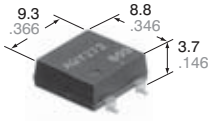
• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month, less than 45°C 113°F/70% R.H.).
• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

Panasonic
ideas for life

Flat Power-DIP4-pin type with high capacity up to 2A load current

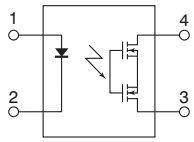
PhotoMOS Relays
PD 1 Form A
(AQY27❍)





CAD Data

mm inch



FEATURES

1. Flat-Packaged type
(W) 8.8 × (D) 9.3 × (H) 3.9 mm
(W) .346 × (D) .366 × (H) .154 inch
2. High capacity of continuous load current 2A (AQY272)
3. High sensitivity and low on-resistance
Max. 2A load can be controlled with 5mA input current. The on-resistance is low at typ. 0.11Ω (AQY272).

TYPICAL APPLICATIONS

- Measuring and Testing equipment
- IC Testers and Board Testers
- High speed inspection machines

TYPES

Type	Output rating*		Package	Part No.				Packing quantity	
	Load voltage	Load current		Through hole terminal	Surface-mount terminal				
				Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC dual use	60V	2.0A	Power-DIP4-pin	AQY272	AQY272A	AQY272AX	AQY272AZ	1 tube contains: 50 pcs. 1 batch contains: 1,000 pcs.	1,000 pcs.
	100V	1.3A		AQY275	AQY275A	AQY275AX	AQY275AZ		
	200V	0.65A		AQY277	AQY277A	AQY277AX	AQY277AZ		
	400V	0.35A		AQY274	AQY274A	AQY274AX	AQY274AZ		

* Indicate the peak AC and DC values.
Note: The surface mount terminal indicator “A” and the packing style indicator “X” or “Z” are not marked on the relay.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

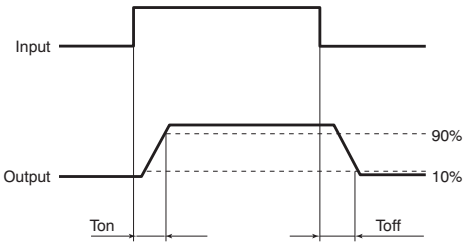
Item		Symbol	AQY272(A)	AQY275(A)	AQY277(A)	AQY274(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current	I_L	2.0 A	1.3 A	0.65 A	0.35 A	Peak AC, DC
	Peak load current	I_{peak}	6.0 A	4.0 A	2.0 A	1.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	700 mW				
Total power dissipation		P_T	750 mW				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperture limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	Tstg	–40°C to +100°C –40°F to +212°F				

PD 1 Form A (AQY27❍)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY272(A)	AQY275(A)	AQY277(A)	AQY274(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA				I_L = 100 mA V_L = 10 V
		Maximum		3.0 mA				
	LED turn off current	Minimum	I_{Foff}	0.4 mA				I_L = 100 mA V_L = 10 V
		Typical		0.9 mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
		Maximum		1.5 V				
Output	On resistance	Typical	R_{on}	0.11 Ω	0.23 Ω	0.7 Ω	2.1 Ω	I_F = 10 mA, I_L = Max. Within 1 s on time
		Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				I_F = 0 mA, V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	2.46 ms	2.40 ms	1.12 ms	1.65 ms	I_F = 10 mA, I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms				
		Typical		5.64 ms	5.65 ms	2.57 ms	3.88 ms	I_F = 5 mA, I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.22 ms	0.21 ms	0.10 ms	0.08 ms	I_F = 5 mA or 10 mA, I_L = 100 mA V_L = 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				I_F = 10 mA, Duty factor = 50% I_L = Max. , V_L = Max.

*Turn on/Turn off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

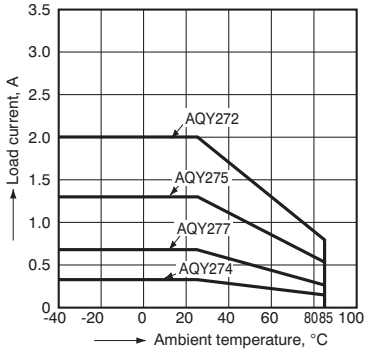
■ For Dimensions, see page 63.
■ For Schematic and Wiring Diagrams, see page 64.
■ For Cautions for Use, see page 71.

■ These products are not designed for automotive use.
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

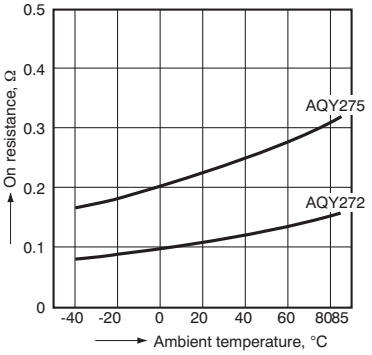
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



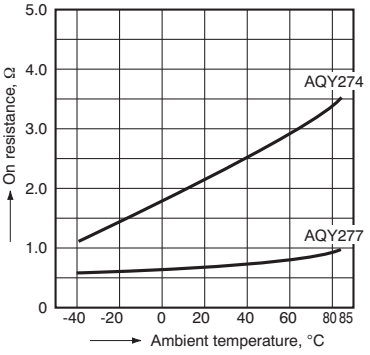
2-(1) On resistance vs. ambient temperature characteristics

LED current: 10 mA;
Continuous load current: 2.0 A (DC) (AQY272),
1.3 A (DC) (AQY275)



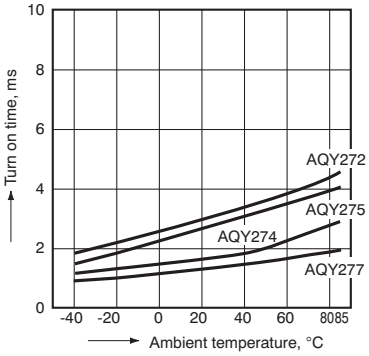
2.-(2) On resistance vs. ambient temperature characteristics

LED current: 10 mA;
Continuous load current: 0.65 A (DC) (AQY277),
0.35 A (DC) (AQY274)



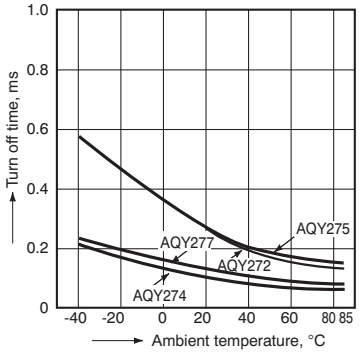
3. Turn on time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



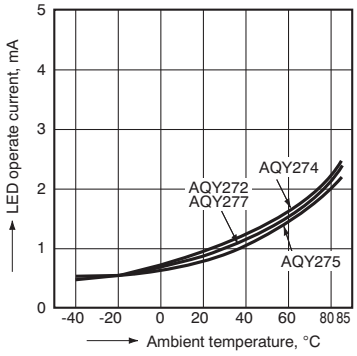
4. Turn off time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



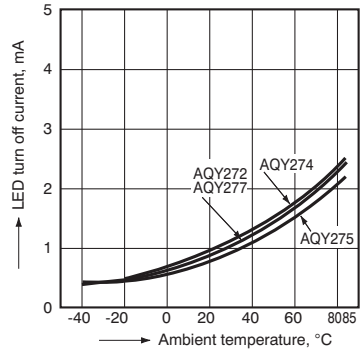
5. LED operate vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



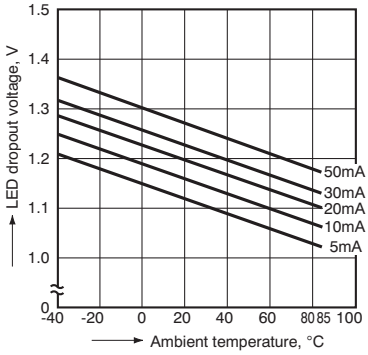
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



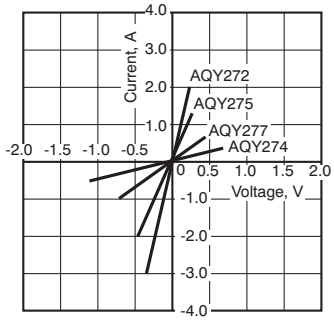
7. LED dropout voltage vs. ambient temperature characteristics

Sample: all types;
LED current: 5 to 50 mA



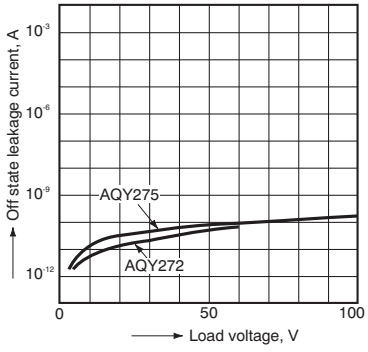
8. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



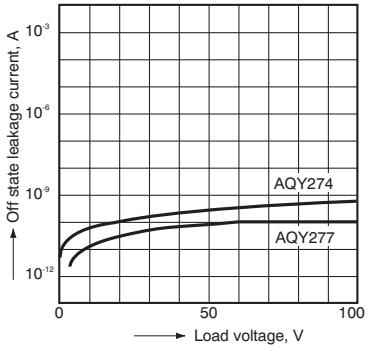
9-(1) Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



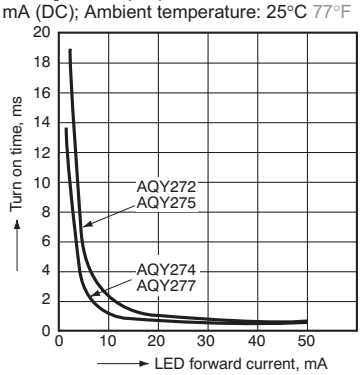
9.-(2) Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



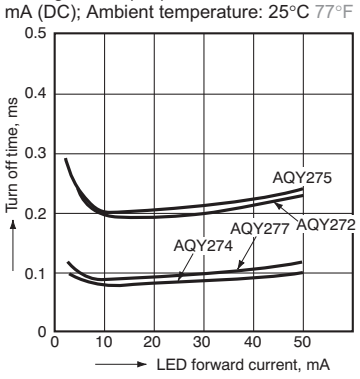
10. Turn on time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



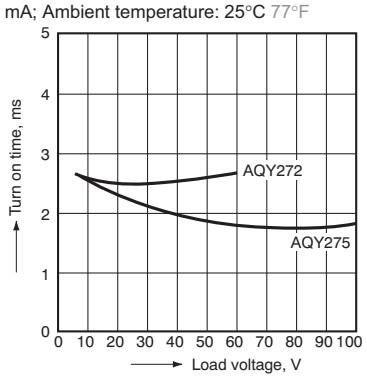
11. Turn off time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



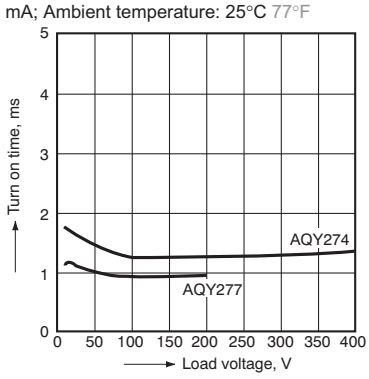
12-(1) Turn on time vs. load voltage characteristics

LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



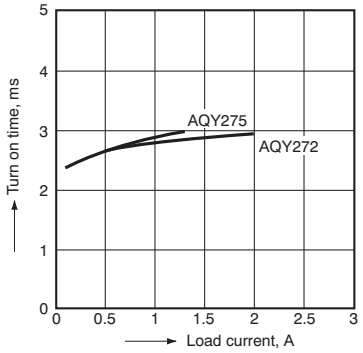
12.-(2) Turn on time vs. load voltage characteristics

LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



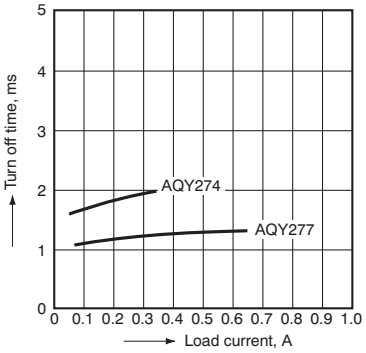
13-(1) Turn on time vs. load current characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



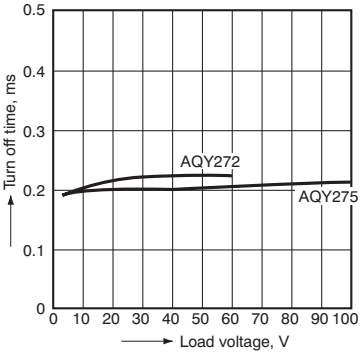
13.-(2) Turn on time vs. load current characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



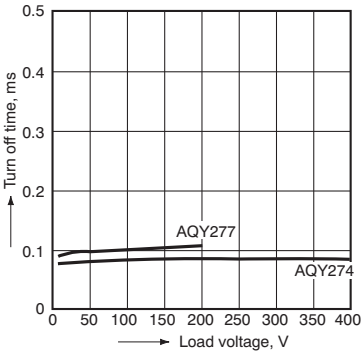
14-(1) Turn off time vs. load voltage characteristics

LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



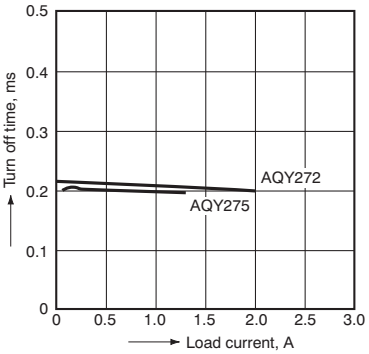
14.-(2) Turn off time vs. load voltage characteristics

LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



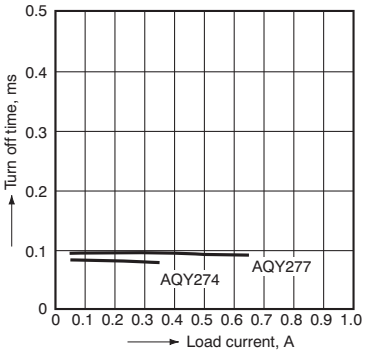
15-(1) Turn off time vs. load current characteristics

LED current: 10 mA; Load voltage 10 V (DC);
Ambient temperature: 25°C 77°F



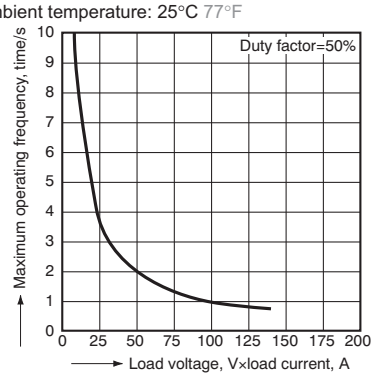
15.-(2) Turn off time vs. load current characteristics

LED current: 10 mA; Load voltage 10 V (DC);
Ambient temperature: 25°C 77°F



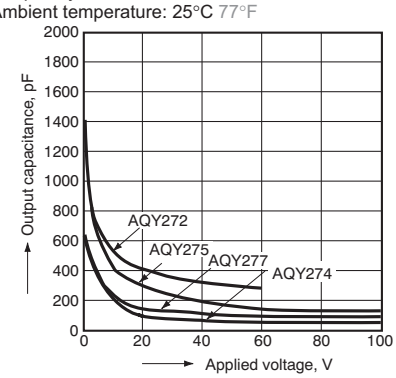
16.Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA;
Ambient temperature: 25°C 77°F



17.Output capacitance vs. applied voltage characteristics

Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



Panasonic
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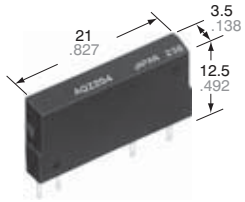
Slim type with high capacity up to 4A DC load type also available

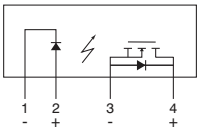
PhotoMOS Relays
Power 1 Form A
(AQZ10❍, 20❍)



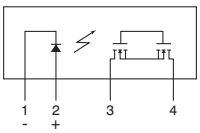
(Height includes standoff)

CAD Data

mm inch



DC type



AC/DC type

FEATURES

1. Slim SIL4-pin package
(W) 3.5 × (D) 21.0 × (H) 12.5 mm
(W) .138 × (D) .827 × (H) .492 inch
The compact size of the 4-pin SIL package allows high density mounting.
2. Extremely low on-resistance
3. Control low-level signal
Power Photo MOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. Low-level off state leakage current of max. 10 μA
5. High I/O isolation voltage of 2,500 V
6. Eliminates the need for a counter electromotive protection diode in the drive circuit on the input side
7. Eliminates the need for a power supply to drive the power MOSFET
8. No restriction on mounting direction
9. Low thermoelectromotive force
10. Neither noise nor arc at contact
11. Sockets are also available
(PA1a-PS, PA1a-PS-H)
12. Can be installed on the RT-3 relay terminal (Power PhotoMOS relay type)

TYPICAL APPLICATIONS

- Traffic signals
- Measuring instruments
- Industrial machines

TYPES

1. DC type

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
DC only	60 V	4.0 A	SIL4-pin	AQZ102	25 pcs.	500 pcs.
	100 V	2.6 A		AQZ105		
	200 V	1.3 A		AQZ107		
	400 V	0.7 A		AQZ104		

* Load voltage and current of DC type: DC

2. AC/DC type

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
AC/DC dual use	60 V	3.0 A	SIL4-pin	AQZ202	25 pcs.	500 pcs.
	100 V	2.0 A		AQZ205		
	200 V	1.0 A		AQZ207		
	400 V	0.5 A		AQZ204		

* Load voltage and current of AC/DC type: Peak AC/DC.

Power 1 Form A (AQZ10❍, 20❍)

RATING

1. DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ102	AQZ105	AQZ107	AQZ104	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (DC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (DC)	I_L	4.0 A	2.6 A	1.3 A	0.7 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.35 W				
Total power dissipation		P_T	1.35 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ102	AQZ105	AQZ107	AQZ104	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA				I_L= 100 mA V_L= 10 V
		Maximum		3.0 mA				
	LED turn off current	Minimum	I_{Foff}	0.4 mA				I_L= 100 mA V_L= 10 V
		Typical		0.9 mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
		Maximum		1.5 V				
Output	On resistance	Typical	R_{on}	0.05 Ω	0.081 Ω	0.34 Ω	1.06 Ω	I_F = 10 mA I_L =Max. Within 1 s on time
		Maximum		0.09 Ω	0.17 Ω	0.55 Ω	1.6 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.66 ms	1.89 ms	0.83 ms	1.01 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms				
		Typical		3.79 ms	4.50 ms	1.75 ms	2.34 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.15 ms	0.19 ms	0.08 ms	0.08 ms	I_F = 5 mA or 10 mA I_L = 100 mA V_L = 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				I_F = 10 mA Duty factor = 50% $I_L \times V_L$= 200 (VA)
Vibration resistance		Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance		Minimum	—	4,900 m/s² {500 G} 1 ms				3 times for 3 axes

2. AC/DC type

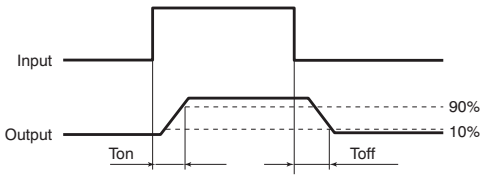
1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ202	AQZ205	AQZ207	AQZ204	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (Peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current	I_L	3.0 A	2.0 A	1.0 A	0.5 A	Peak AC, DC
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W				
Total power dissipation		P_T	1.6 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ202	AQZ205	AQZ207	AQZ204	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA				I_L= 100 mA V_L= 10 V
		Maximum		3.0 mA				
	LED turn off current	Minimum	I_{Foff}	0.4 mA				I_L= 100 mA V_L= 10 V
		Typical		0.9 mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
		Maximum		1.5 V				
Output	On resistance	Typical	R_{on}	0.11 Ω	0.23 Ω	0.7 Ω	2.1 Ω	I_F = 10 mA I_L =Max. Within 1 s on time
		Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	2.46 ms	2.40 ms	1.12 ms	1.65 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms				
		Typical		5.64 ms	5.65 ms	2.57 ms	3.88 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.22 ms	0.21 ms	0.10 ms	0.08 ms	I_F = 5 mA or 10 mA I_L = 100 mA V_L = 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				I_F = 10 mA Duty factor = 50% I_L = Max., V_L = Max.
Vibration resistance		Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance		Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

*Turn on/off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

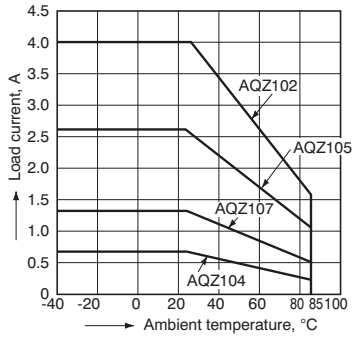
■ **For Dimensions, see page 63.**
■ **For Schematic and Wiring Diagrams, see page 67.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

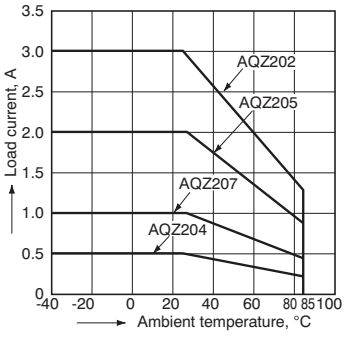
18-(1) Load current vs. ambient temperature characteristics (DC type)

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



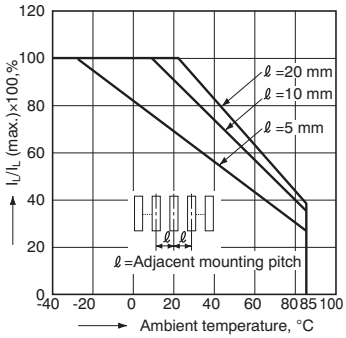
1.-(2) Load current vs. ambient temperature characteristics (AC/DC type)

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



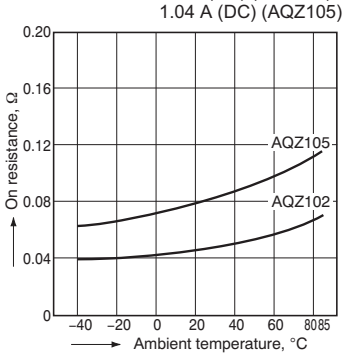
19.Load current vs. ambient temperature characteristics in adjacent mounting

I_L : Load current;
I_L (max.): Maximum continuous load current



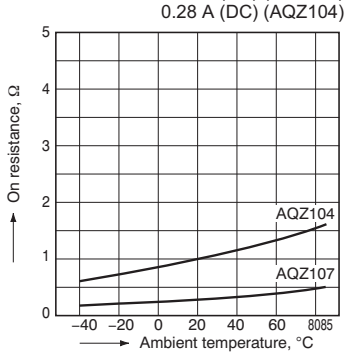
20-(1) On resistance vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Continuous load current: 1.6 A (DC) (AQZ102),
1.04 A (DC) (AQZ105)



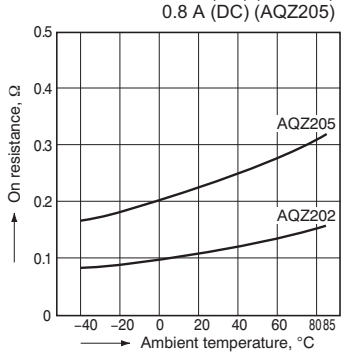
3.-(2) On resistance vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Continuous load current: 0.52 A (DC) (AQZ107),
0.28 A (DC) (AQZ104)



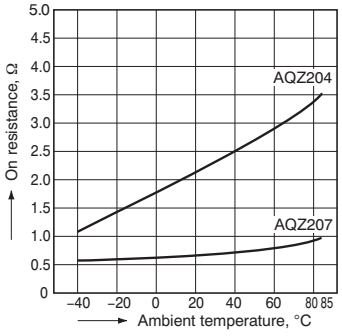
3.-(3) On resistance vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 1.2 A (DC) (AQZ202),
0.8 A (DC) (AQZ205)



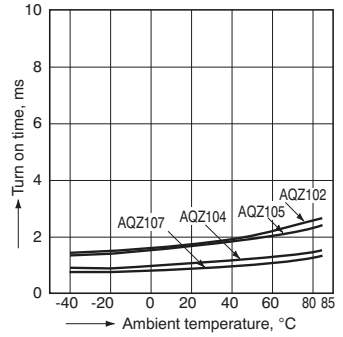
3.-(4) On resistance vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 0.4 A (DC) (AQZ207),
0.2 A (DC) (AQZ204)



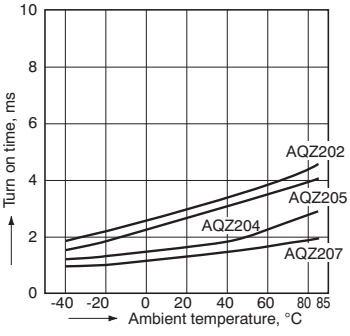
21-(1) Turn on time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



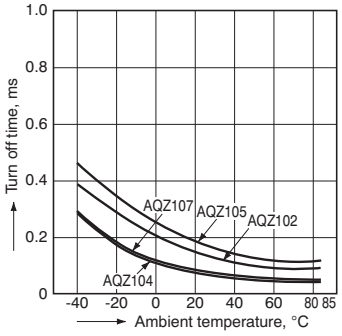
4.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



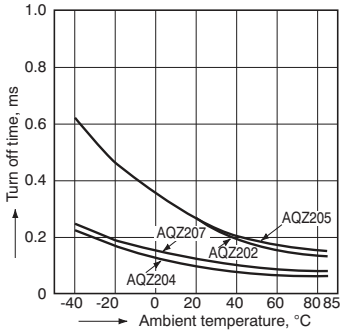
22-(1) Turn off time vs. ambient temperature characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



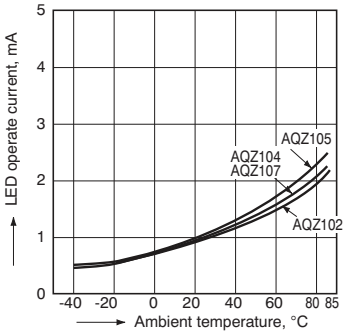
5.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)

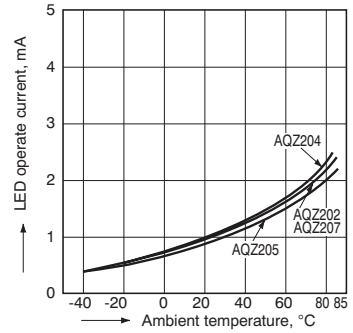


23-(1) LED operate vs. ambient temperature characteristics (DC type)

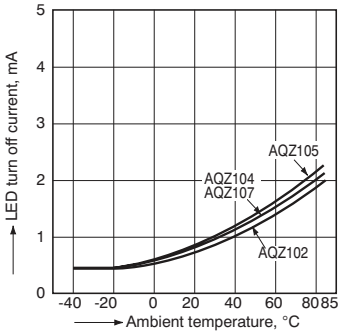
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



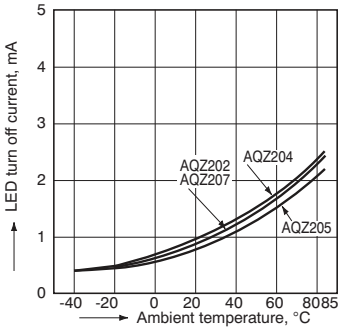
6.-(2) LED operate vs. ambient temperature characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



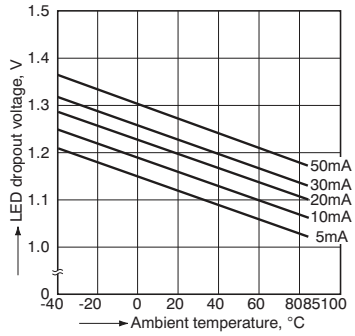
24-(1) LED turn off current vs. ambient temperature characteristics (DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



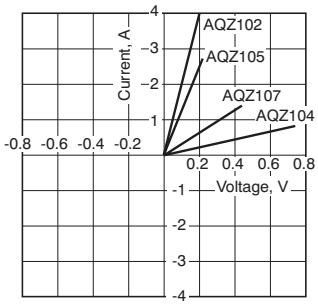
7.-(2) LED turn off current vs. ambient temperature characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



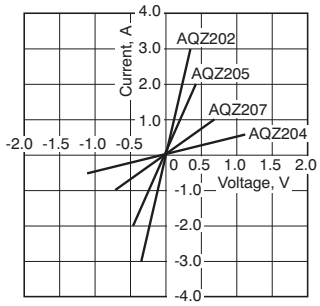
25.LED dropout voltage vs. ambient temperature characteristics
Sample: all types; LED current: 5 to 50 mA



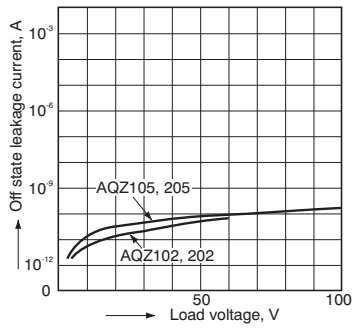
26-(1) Current vs. voltage characteristics of output at MOS portion (DC type)
Ambient temperature: 25°C 77°F



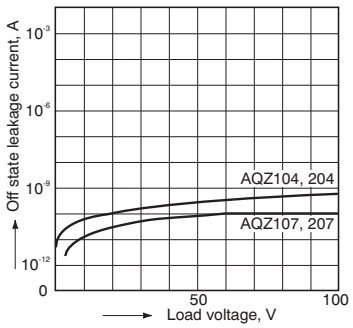
9.-(2) Current vs. voltage characteristics of output at MOS portion (AC/DC type)
Ambient temperature: 25°C 77°F



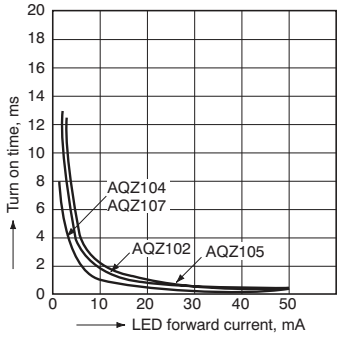
27-(1) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



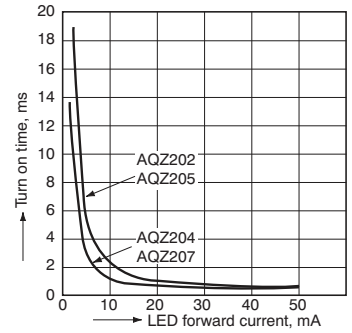
10.-(2) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



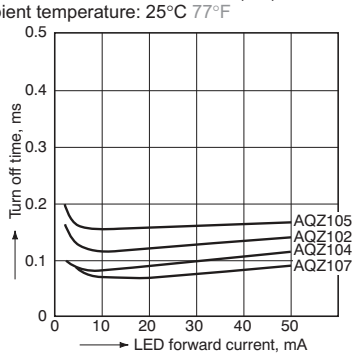
28-(1) Turn on time vs. LED forward current characteristics (DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



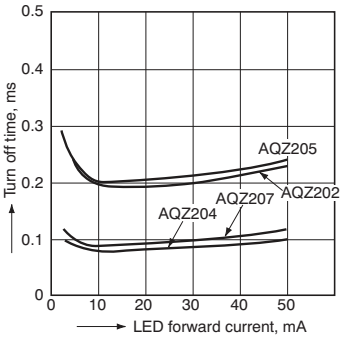
11.-(2) Turn on time vs. LED forward current characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



29-(1) Turn off time vs. LED forward current characteristics (DC type)
Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



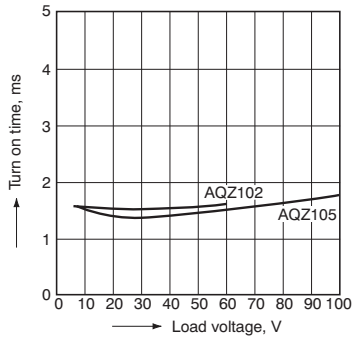
12.-(2) Turn off time vs. LED forward current characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



Power 1 Form A (AQZ10❍, 20❍)

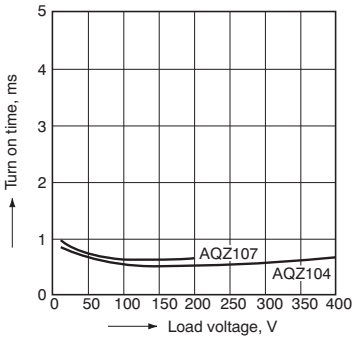
30-(1) Turn on time vs. load voltage characteristics (DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



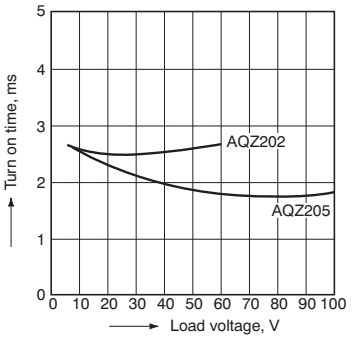
13.-(2) Turn on time vs. load voltage characteristics (DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



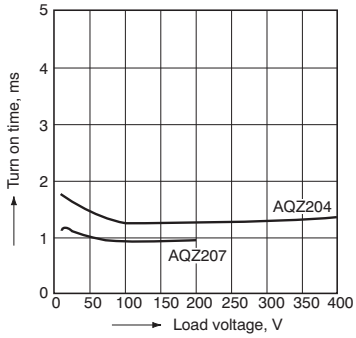
13.-(3) Turn on time vs. load voltage characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



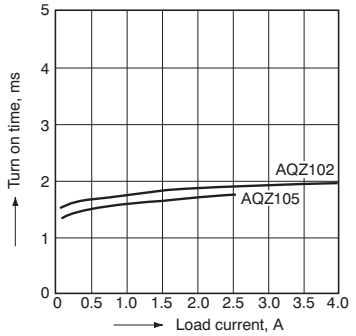
13.-(4) Turn on time vs. load voltage characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



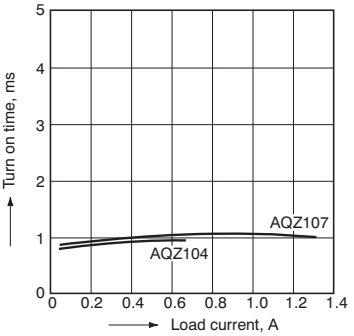
31-(1) Turn on time vs. load current characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



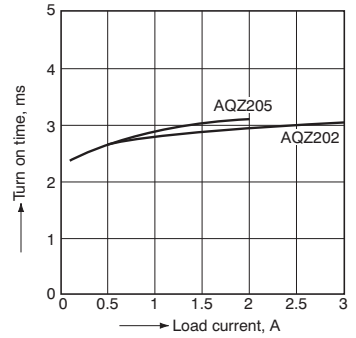
14.-(2) Turn on time vs. load current characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



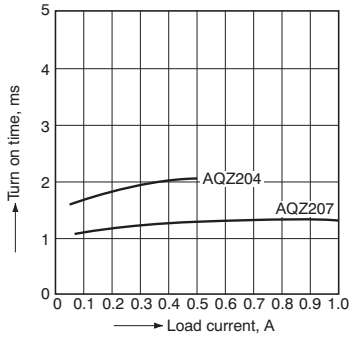
14.-(3) Turn on time vs. load current characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



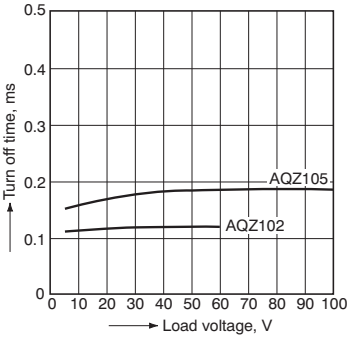
14.-(4) Turn on time vs. load current characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



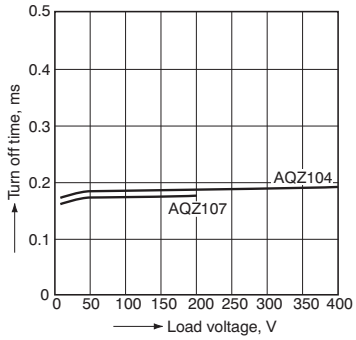
32-(1) Turn off time vs. load voltage characteristics (DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



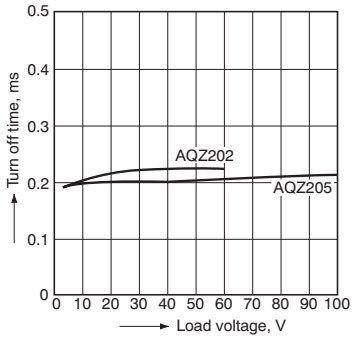
15.-(2) Turn off time vs. load voltage characteristics (DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



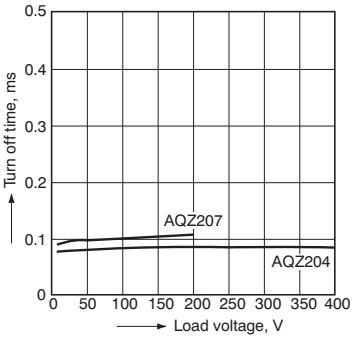
15.-(3) Turn off time vs. load voltage characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



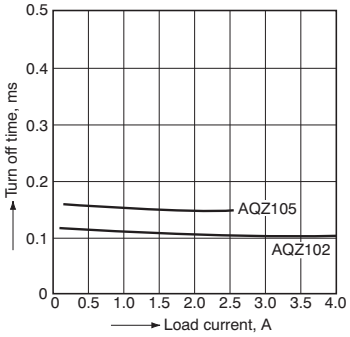
15.-(4) Turn off time vs. load voltage characteristics (AC/DC type)

LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



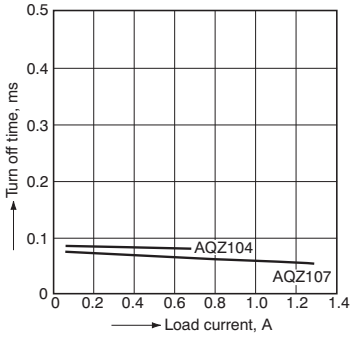
33-(1) Turn off time vs. load current characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



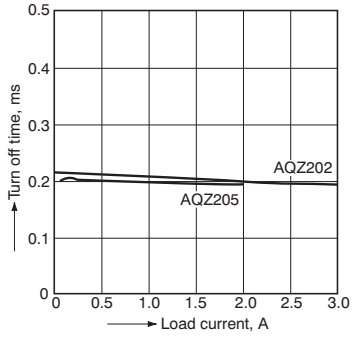
16.-(2) Turn off time vs. load current characteristics (DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



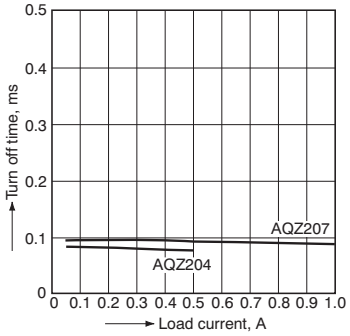
16.-(3) Turn off time vs. load current characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



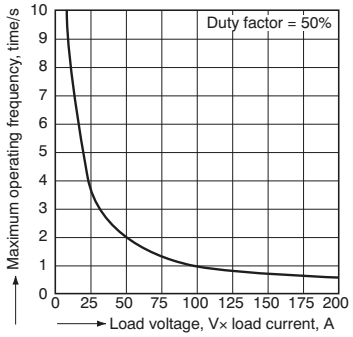
16.-(4) Turn off time vs. load current characteristics (AC/DC type)

LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



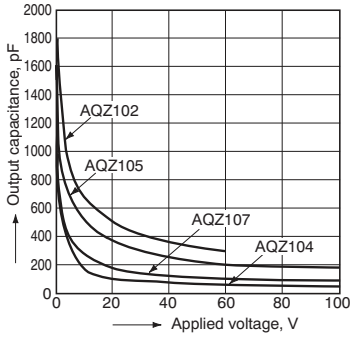
34.Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA;
Ambient temperature: 25°C 77°F



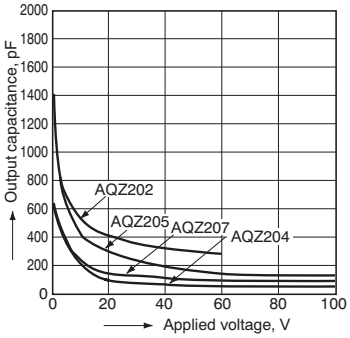
35-(1) Output capacitance vs. applied voltage characteristics (DC type)

Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



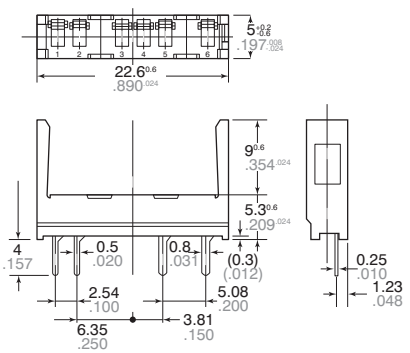
18.-(2) Output capacitance vs. applied voltage characteristics (AC/DC type)

Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

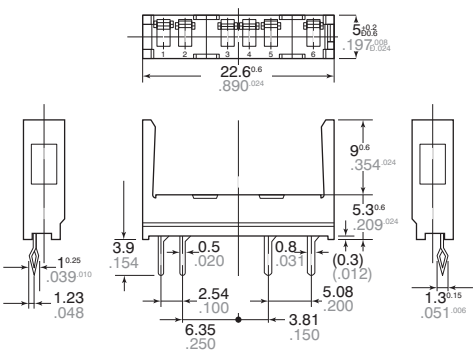


ACCESSORY (mm inch)

Socket



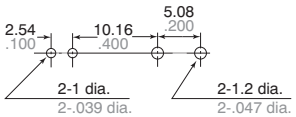
PA1a-PS



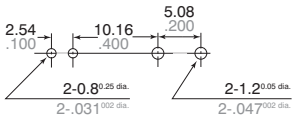
PA1a-PS-H

PC board pattern (BOTTOM VIEW)

Standard type



Self clinching type

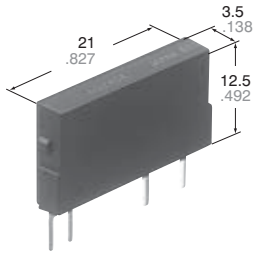


Tolerance: ±0.1 ±.004

Panasonic
ideas for life

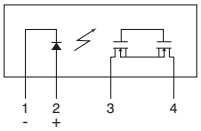
Normally closed type in a slim SIL package Load voltage 400V

PhotoMOS Relays
Power 1 Form B
(AQZ404)



CAD Data

mm inch

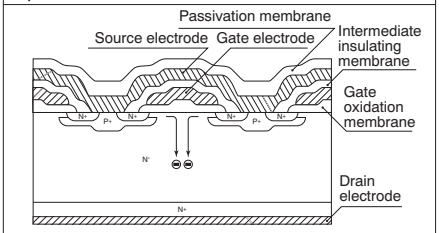


FEATURES

1. High sensitivity and low on-resistance
Max. 0.5A load can be controlled with 5 mA input current. The on-resistance is low at typ. 2.8Ω.

2. Normally closed (1 Form B) contact
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Slim SIL4-pin package
(W) 3.5 × (D) 21.0 × (H) 12.5 mm
(W) .138 × (D) .827 × (H) .492 inch
The compact size of the 4-pin SIL package allows high density mounting.

4. Sockets are also available
(PA1a-PS, PA1a-PS-H)

5. Can be installed on the RT-3 relay terminal (Power PhotoMOS relay type)

TYPICAL APPLICATIONS

- Railroad system, traffic signals
- Measuring instruments
- Industrial machines

TYPES

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
AC/DC dual use	400 V	0.5 A	SIL4-pin	AQZ404	25 pcs	500 pcs

*Indicate the peak AC and DC values.

RATING

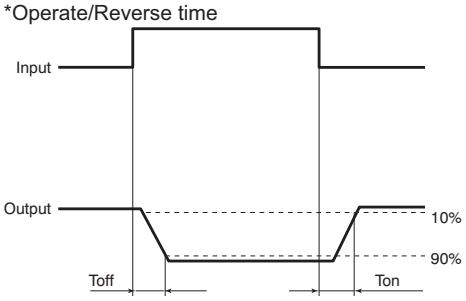
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ404	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.5 A	Peak AC, DC
	Peak load current	I_{peak}	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W	
Total power dissipation		P_T	1.6 W	
I/O isolation voltage		V_{iso}	2,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ404	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	1.0 mA	I_L= 100 mA V_L= 10 V
		Maximum		3.0 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA	I_L= 100 mA V_L= 10 V
		Typical		0.9 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	2.8 Ω	I_F = 0 mA, I_L = Max. Within 1 s on time
		Maximum		4.0 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA	I_F = 10mA, V_L = Max.
Transfer characteristics	Operating (OFF) time*	Typical	T_{off}	3.9 ms	I_F = 0 → 10 mA I_L = 100 mA, V_L = 10 V
		Maximum		7.5 ms	
		Typical		9.4 ms	I_F = 0 → 5 mA I_L = 100 mA, V_L = 10 V
		Maximum		15 ms	
	Reverse (ON) time*	Typical	T_{on}	0.8 ms	I_F = 5 mA → 0 or 10 mA → 0 I_L = 100 mA, V_L = 10 V
		Maximum		3.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC
	Maximum operating frequency	Maximum	—	0.5 cps	I_F = 10 mA, Duty factor = 50% I_L=Max., V_L=Max.

*Operate/Reverse time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

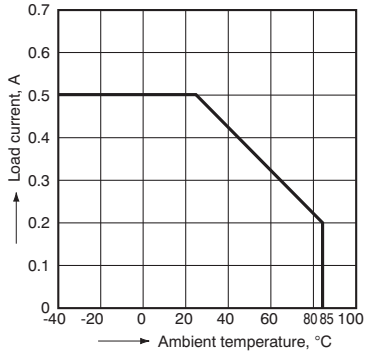
■ **For Dimensions, see page 63.**
■ **For Schematic and Wiring Diagrams, see page 68.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

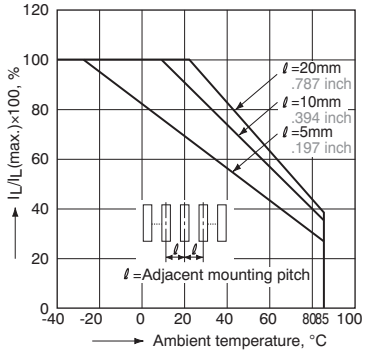
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



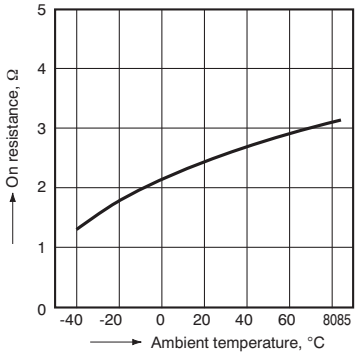
2. Load current vs. ambient temperature characteristics in adjacent mounting

I_L: Load current;
I_L (max.): Maximum continuous load current



3. On resistance vs. ambient temperature characteristics

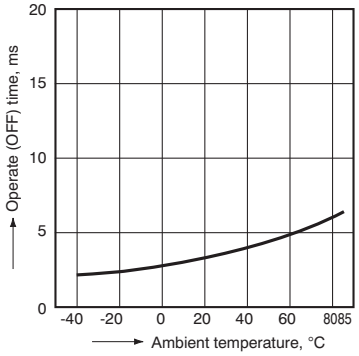
LED current: 0 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



Power 1 Form B (AQZ404)

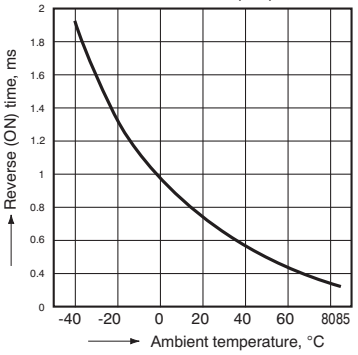
4. Operate (OFF) time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



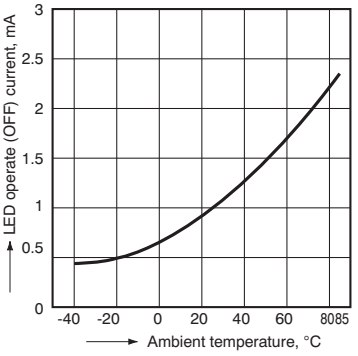
5. Reverse (ON) time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



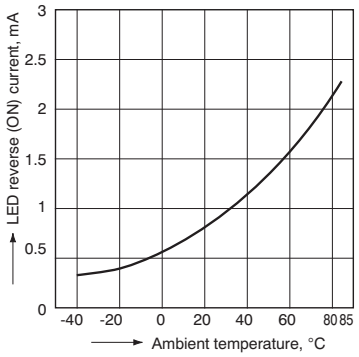
6. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



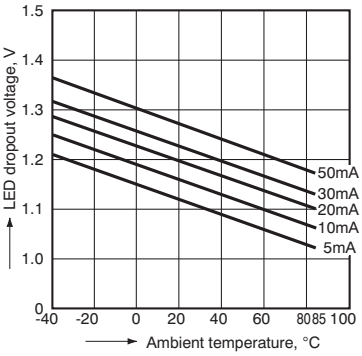
7. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



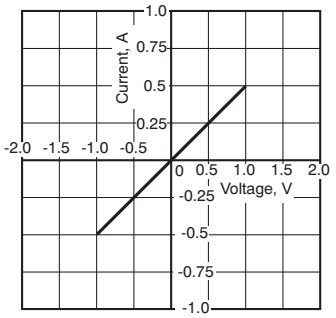
8. LED dropout voltage vs. ambient temperature characteristics

Sample: all types; LED current: 5 to 50 mA



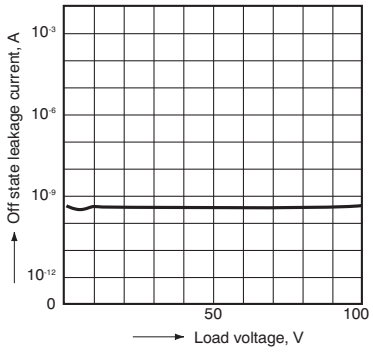
9. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



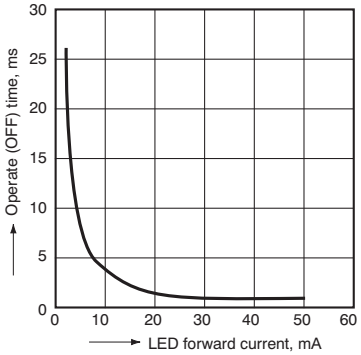
10. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



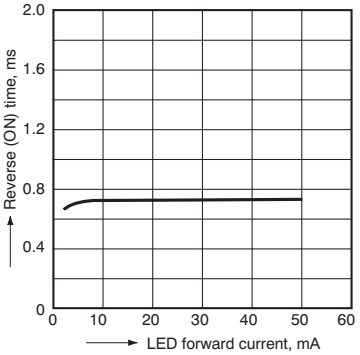
11. Operate (OFF) time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



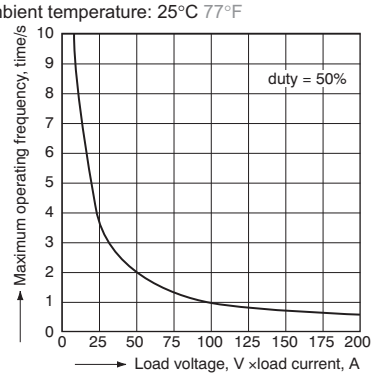
12. Reverse (ON) time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



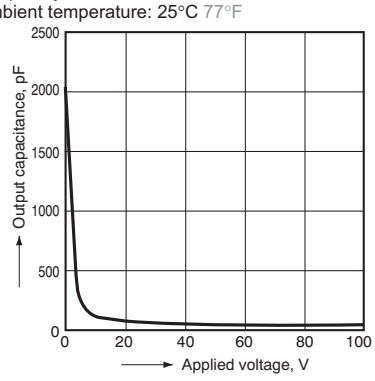
13. Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA;
Ambient temperature: 25°C 77°F



14. Output capacitance vs. applied voltage characteristics

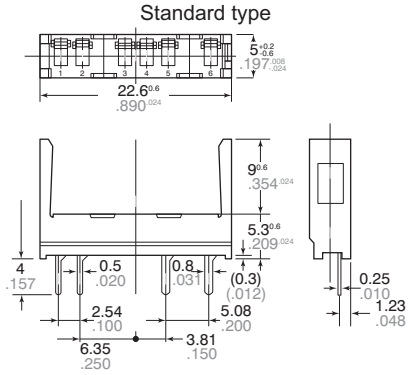
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



ACCESSORY (mm inch)

Socket

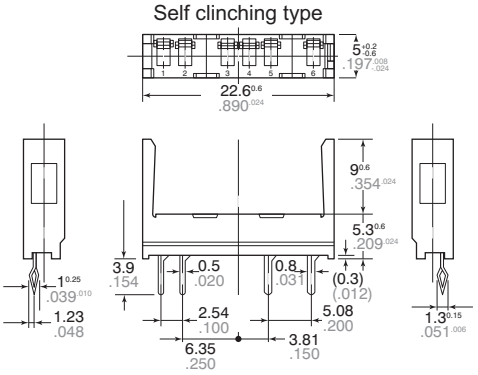
Standard type



PA1a-PS

General Tolerance: ±0.3 ±.012

Self clinching type

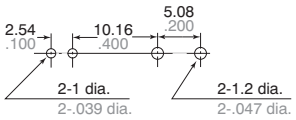


PA1a-PS-H

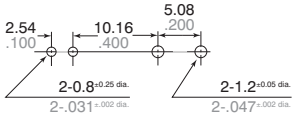
General Tolerance: ±0.3 ±.012

PC board pattern
(BOTTOM VIEW)

Standard type



Self clinching type

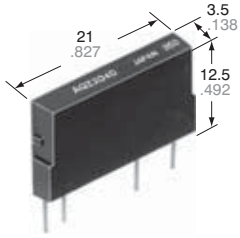


Tolerance: ±0.1 ±.004

Panasonic
ideas for life

Slim and high capacity up to 3.6A Voltage-driven type

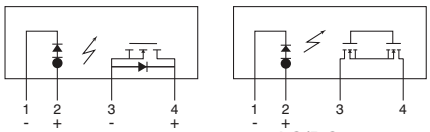
PhotoMOS Relays
1 Form A Voltage-sensitive (AQZ10❍D, 20❍D)



(Height includes standoff)

CAD Data

mm inch



FEATURES

1. A voltage-sensitive power PhotoMOS relay
Conventional power PhotoMOS relays are connected externally to an input limiting resistor in order to obtain the appropriate LED current. Adding an internal constant-current element renders the input limiting resistor unnecessary, making it possible for the PhotoMOS relay to be voltage-driven.

2. Wide range of input voltages
Allows a wide range of input voltages from 4 to 30 V DC. The relay can be used in 5 V, 12 V or 24 V DC systems.

3. Both AC/DC dual types and DC-only types available
The AC/DC dual type is capable of bi-directional control, and unlike conventional SSRs, does not have to be used differently depending on the load. The DC-only type is well suited for control of DC solenoids and DC motors.

4. High capacity
Supports the various types of load control, from very small loads to a max. 2.7 A for the AC/DC dual type, max. 3.6 A for the DC-only type.

5. High sensitivity and low on-resistance
Max. 3.6 A load can be controlled with the min. input voltage of 4 V DC. The on-resistance is also low at typ. 0.033 Ω (AQZ102D).

6. Slim SIL4-pin package
(W) 3.5 × (D) 21.0 × (H) 12.5 mm
(W) .138 × (D) .827 × (H) .492 inch
The compact size of the 4-pin SIL package allows high density mounting.

TYPES

1. DC type

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
DC only	60 V	3.6 A	SIL4-pin	AQZ102D	25 pcs.	500 pcs.
	100 V	2.3 A		AQZ105D		
	200 V	1.1 A		AQZ107D		
	400 V	0.6 A		AQZ104D		

* Load voltage and current of DC type: DC

2. AC/DC type

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
AC/DC dual use	60 V	2.7 A	SIL4-pin	AQZ202D	25 pcs.	500 pcs.
	100 V	1.8 A		AQZ205D		
	200 V	0.9 A		AQZ207D		
	400 V	0.45 A		AQZ204D		

* Load voltage and current of AC/DC type: Peak AC/DC

RATING

1. DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ102D	AQZ105D	AQZ107D	AQZ104D	Remarks
Input	Input voltage	V_{IN}	30 V				
	Input reverse voltage	V_{RIN}	5 V				
	Power dissipation	P_{in}	300 mW				
Output	Load voltage (DC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (DC)	I_L	3.6 A	2.3 A	1.1 A	0.6 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.35 W				
Total power dissipation		P_T	1.35 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F (4 V q V_{IN} q 6 V) –40°C to +75°C –40°F to +167°F (6 V < V_{IN} q 15 V) –40°C to +60°C –40°F to +140°F (15 V < V_{IN} q 30 V)				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ102D	AQZ105D	AQZ107D	AQZ104D	Remarks
Input	Operate voltage	Typical	V_{Fon}	1.4 V				I_L = 100 mA V_L = 10 V
		Maximum		4 V				
	Turn off voltage	Minimum	V_{Foff}	0.8 V				I_L = 100 mA V_L = 10 V
		Typical		1.3 V				
	Input current	Typical	I_{IN}	6.5 mA				V_{IN} = 5 V
Output	On resistance	Typical	R_{on}	0.033 Ω	0.090 Ω	0.33 Ω	1.23 Ω	V_{IN} = 5 V I_L = Max. Within 1 s on time
		Maximum		0.09 Ω	0.17 Ω	0.55 Ω	1.6 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				V_{IN} = 0 V V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	3.3 ms	2.2 ms	1.5 ms	1.2 ms	V_{IN} = 5 V I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.2 ms		0.1 ms		V_{IN} = 5 V I_L = 100 mA V_L= 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				V_{IN}= 5 V Duty factor = 50% $I_L \times V_L$ = 200 (VA)
Vibration resistance		Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance		Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

2. AC/DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

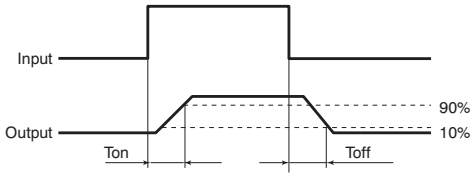
Item		Symbol	AQZ202D	AQZ205D	AQZ207D	AQZ204D	Remarks
Input	Input voltage	V_{IN}	30 V				
	Input reverse voltage	V_{RIN}	5 V				
	Power dissipation	P_{in}	300 mW				
Output	Load voltage (peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current	I_L	2.7 A	1.8 A	0.9 A	0.45 A	Peak AC, DC
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W				
Total power dissipation		P_T	1.6 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F (4 V q V_{IN} q 6 V) –40°C to +75°C –40°F to +167°F (6 V < V_{IN} q 15 V) –40°C to +60°C –40°F to +140°F (15 V < V_{IN} q 30 V)				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

1 Form A Voltage-sensitive (AQZ10❍D, 20❍D)

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ202D	AQZ205D	AQZ207D	AQZ204D	Remarks
Input	Operate voltage	Typical	V_{Fon}	1.4 V				I_L = 100 mA V_L = 10 V
		Maximum		4 V				
	Turn off voltage	Minimum	V_{Foff}	0.8 V				I_L = 100 mA V_L = 10 V
		Typical		1.3 V				
	Input current	Typical	I_{IN}	6.5 mA				V_{IN} = 5 V
Output	On resistance	Typical	R_{on}	0.066 Ω	0.180 Ω	0.64 Ω	2.4 Ω	V_{IN} = 5 V I_L = Max. Within 1 s on time
		Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				V_{IN} = 0 V V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	5.8 ms	4.2 ms	2.7 ms	2.3 ms	V_{IN} = 5 V I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.2 ms		0.1 ms		V_{IN} = 5 V I_L = 100 mA V_L= 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				V_{IN}= 5 V Duty factor = 50% $I_L \times V_L$ = 200 (VA)
Vibration resistance		Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance		Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

*Turn on/off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input voltage	V_{IN}	5	V

■ **For Dimensions, see page 63.**
■ **For Schematic and Wiring Diagrams, see page 67.**
■ **For Cautions for Use, see page 71.**

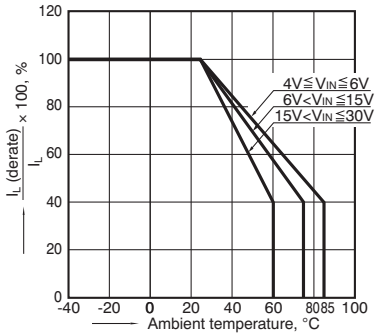
■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.

For more information, see page 80.

REFERENCE DATA

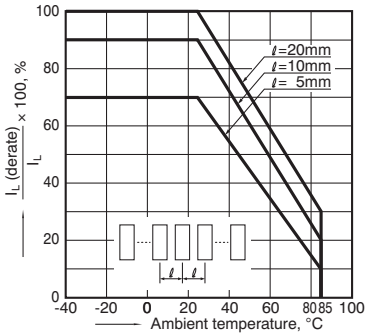
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F;
V_{IN}: Input voltage; I_L (derate):Load current (derate); I_L: Absolute maximum ratings of continuous load current



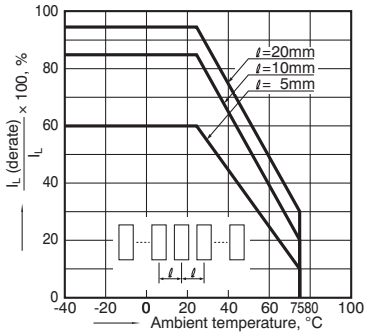
2.-(1) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 4V q V_{IN} q 6V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



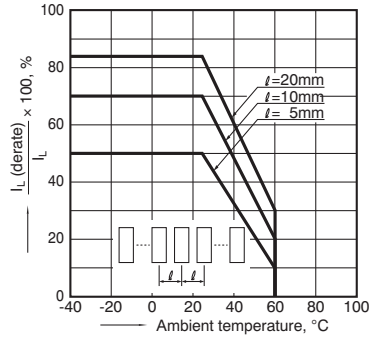
2.-(2) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 6V < V_{IN} q 15V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



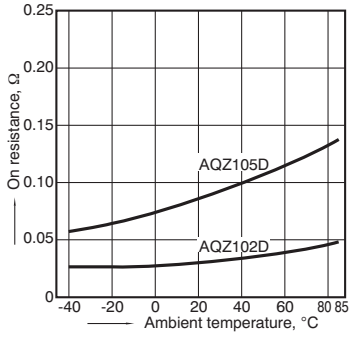
2.-(3) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 15V<V_{IN} q 30V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



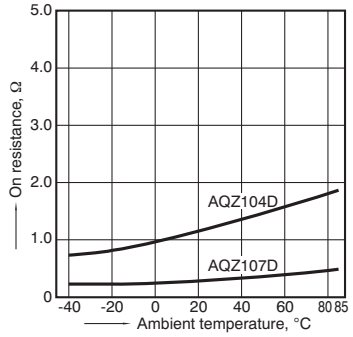
3.-(1) On resistance vs. ambient temperature characteristics (DC type)

Input voltage: 5 V;
Continuous load current: 3.6 A (DC) (AQZ102D)
2.3 A (DC) (AQZ105D)



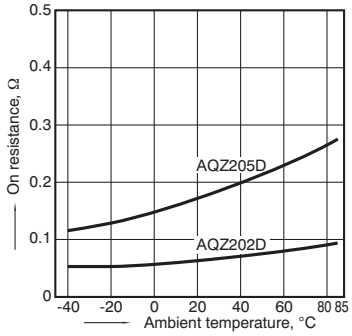
3.-(2) On resistance vs. ambient temperature characteristics (DC type)

Input voltage: 5 V;
Continuous load current: 1.1 A (DC) (AQZ107D)
0.6 A (DC) (AQZ104D)



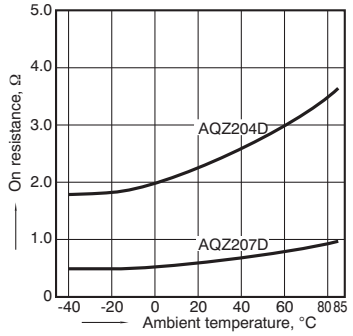
3.-(3) On resistance vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Continuous load current: 2.7 A (DC) (AQZ202D)
1.8 A (DC) (AQZ205D)



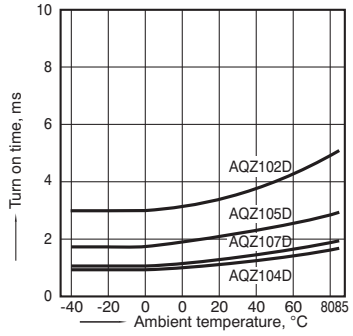
3.-(4) On resistance vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Continuous load current: 0.9 A (DC) (AQZ207D)
0.45 A (DC) (AQZ204D)



4-(1) Turn on time vs. ambient temperature characteristics (DC type)

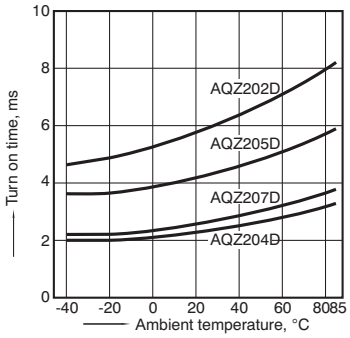
Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



1 Form A Voltage-sensitive (AQZ10❍D, 20❍D)

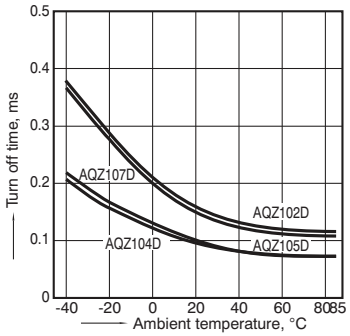
4.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



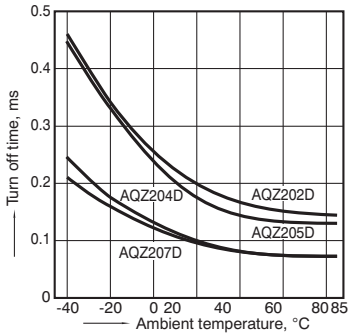
5-(1) Turn off time vs. ambient temperature characteristics (DC type)

Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



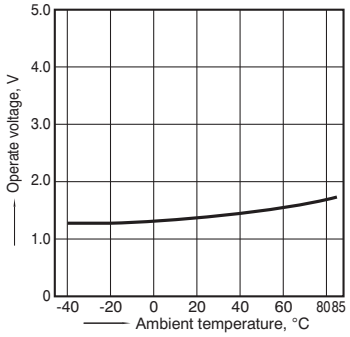
5.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



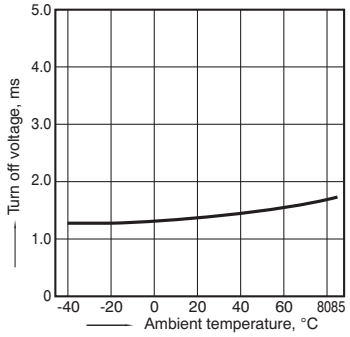
6. Operate voltage vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



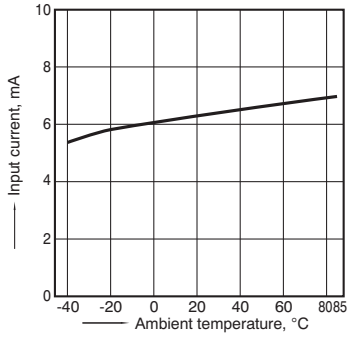
7. Turn off voltage vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



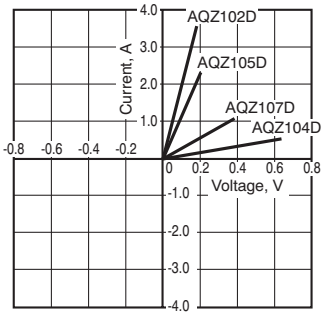
8. Input current vs. ambient temperature characteristics

Input voltage: 5 V



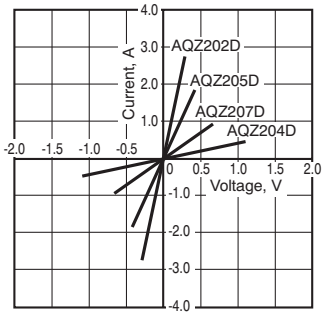
9-(1) Current vs. voltage characteristics of output at MOS portion (DC type)

Ambient temperature: 25°C 77°F



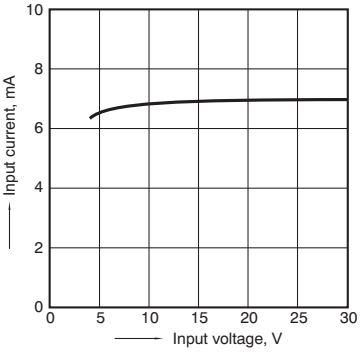
9.-(2) Current vs. voltage characteristics of output at MOS portion (AC/DC type)

Ambient temperature: 25°C 77°F



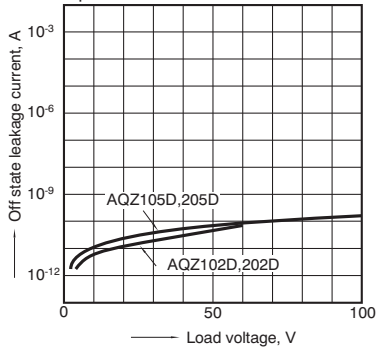
10.Input current vs. input voltage characteristics

Ambient temperature: 25°C 77°F



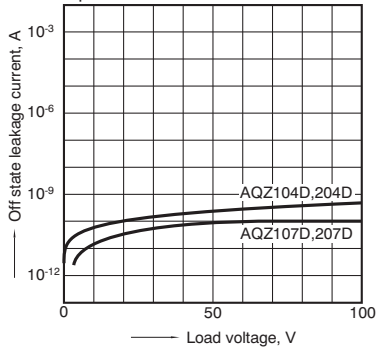
11-(1) Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



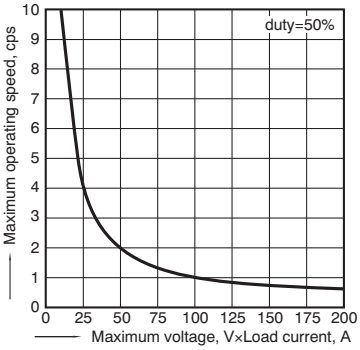
11.-(2) Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



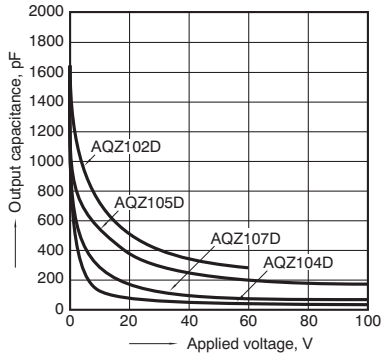
12.Maximum operating speed vs. load voltage × load current characteristics

Input voltage: 5V; Ambient temperature: 25°C 77°F



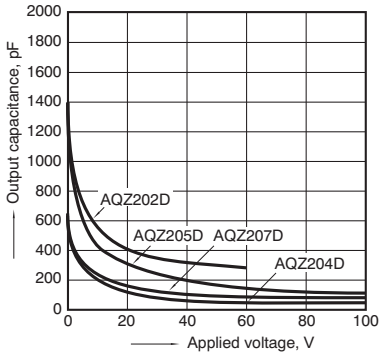
13-(1) Output capacitance vs. applied voltage characteristics (DC type)

Frequency: 1 MHz; Ambient temperature: 25°C 77°F



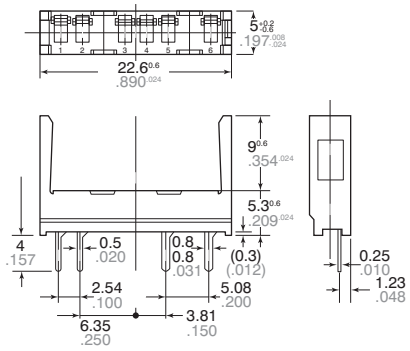
13.-(2) Output capacitance vs. applied voltage characteristics (AC/DC type)

Frequency: 1 MHz; Ambient temperature: 25°C 77°F

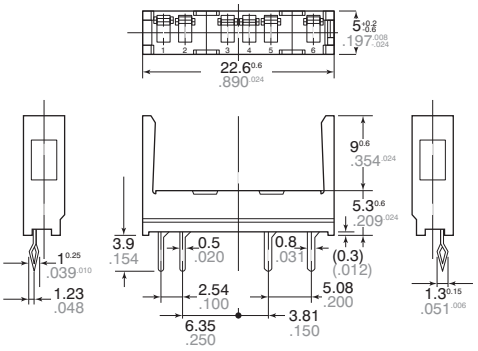


ACCESSORY (mm inch)

Socket

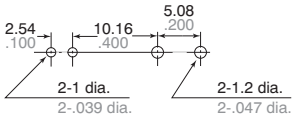


PA1a-PS

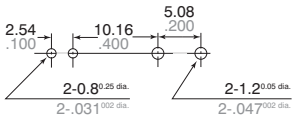


PA1a-PS-H

Standard type



Self clinching type

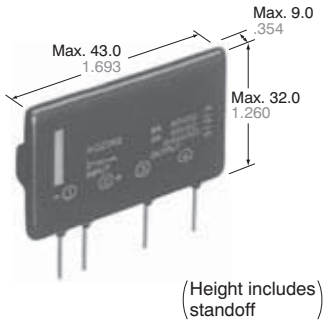


Tolerance: ±0.1 ±.004

Panasonic
ideas for life

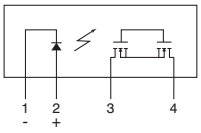
High capacity up to 6A in a slim SIL package

PhotoMOS Relays
Power 1 Form A
High Capacity (AQZ26❍)



CAD Data

mm inch



FEATURES

1. High capacity type power photoMOS relay.
Can switch a wide range of currents and voltages. Can control various types of loads, from very small loads to a max. 6A AC/DC current for sequencers, motors, and lamps.

2. Low on-resistance and high sensitivity.
Low on-resistance of less than typ. 0.036Ω (AQZ262). High sensitivity LED operate current of typ. 1 mA.

3. AC/DC dual use
Bi-directional control is possible. There is no need to differentiate depending on the load as was necessary with the conventional SSR.

4. 4-pin SIL type
(L) 43.0 mm × (W) 9.0 mm × (H) 32.0 mm
(L) 1.693 inch × (W) .354 inch × (H) 1.260 inch.

5. Low-level off state leakage current of max. 10 μA

6. Controls low-level analog signals
The triac, photocoupler, or SSR cannot be used to control signals of less than several hundred mV. The high capacity type power PhotoMOS relay feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

TYPICAL APPLICATIONS

- Mercury relay replacement
- Compact motors, lamps, heaters
- OA equipment

TYPES

	Output rating*		Package	Part No.	Packing quantity	
	Load voltage	Load current			Inner carton	Outer carton
AC/DC dual use	60 V	6.0 A	SIL4-pin	AQZ262	20 pcs	200 pcs
	400 V	1.0 A		AQZ264		

* Indicate the peak AC and DC values.

RATING

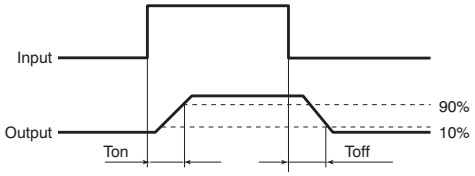
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ262	AQZ264	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mA		
Output	Load voltage (peak AC)	V_L	60 V	400 V	
	Continuous load current	I_L	6.0 A	1.0 A	Peak AC, DC
	Peak load current	I_{peak}	10.0 A	3.0 A	100 ms (1shot), V_L = DC
	Power dissipation	P_{out}	3.0 W		
Total power dissipation		P_T	3.0 W		
I/O isolation voltage		Viso	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to 185°F		Non-condensing at low temperatures
	Storage	Tstg	–40°C to +100°C –40°F to 212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQZ262	AQZ264	Remarks
Input	LED operate current	Typical	I_{Fon}	1.0 mA		I_L = 100 mA V_L = 10 V
		Maximum		3.0 mA		
	LED turn off current	Minimum	I_{Foff}	0.4 mA		I_L = 100 mA V_L = 10 V
		Typical		0.9 mA		
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	0.036 Ω	1.0 Ω	I_F = 10 mA I_L = max. Within 1 s on time
		Maximum		0.05 Ω	1.4 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA		I_F = 0 mA V_L = max.
Transfer characteristics	Turn on time*	Typical	T_{on}	5 ms	4 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		10 ms		
	Turn off time*	Typical	T_{off}	0.32 ms	0.14 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		3.0 ms		
	I/O capacitance	Typical	C_{iso}	2.0 pF		f = 1 MHz V_B = 0 V
		Maximum		4.0 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC
	Maximum operating frequency	Maximum	—	0.5 cps		I_F = 10 mA Duty factor = 50% I_L = Max., V_L = Max.

*Turn on/off time



RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	5 to 10	mA

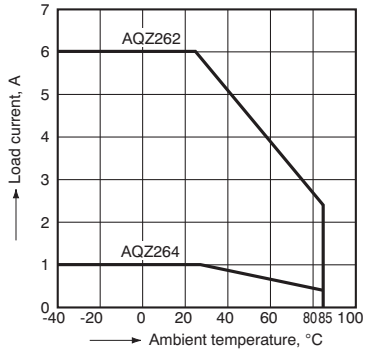
■ **For Dimensions, see page 63.**
■ **For Schematic and Wiring Diagrams, see page 67.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

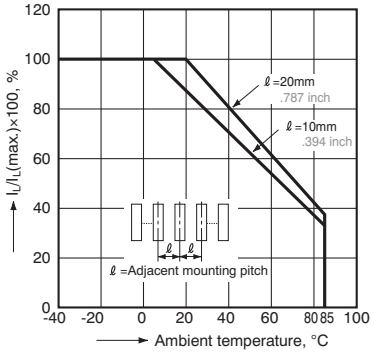
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



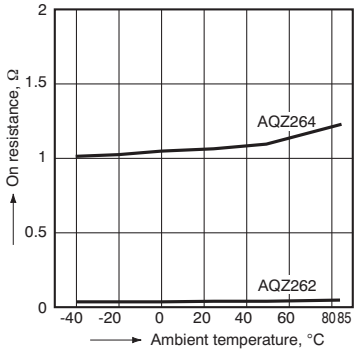
2. Load current vs. ambient temperature characteristics in adjacent mounting

I_L: Load current;
I_L (max.): Maximum continuous load current



3. On resistance vs. ambient temperature characteristics

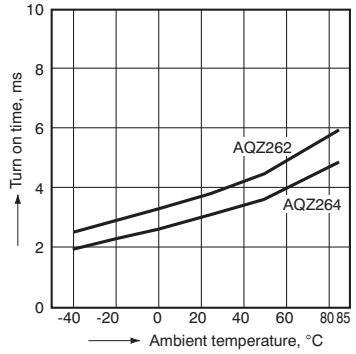
LED current: 10 mA;
Continuous load current: 6A (DC)(AQZ262)
1A (DC)(AQZ264)



Power 1 Form A High Capacity (AQZ26❍)

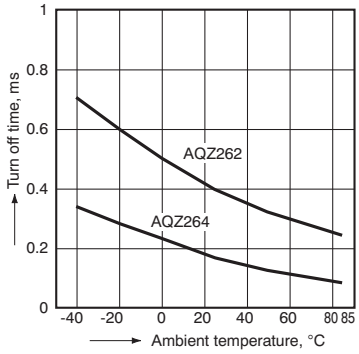
4. Turn on time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



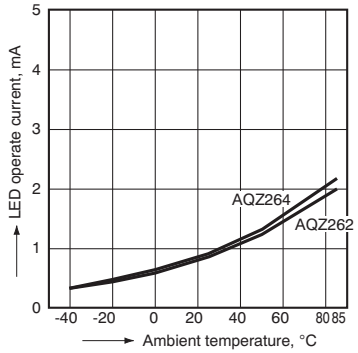
5. Turn off time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



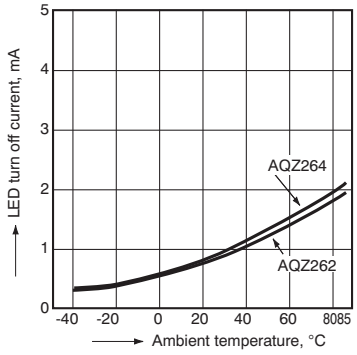
6. LED operate vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



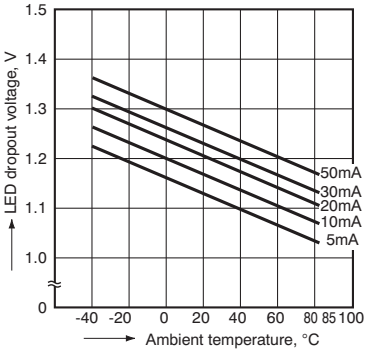
7. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



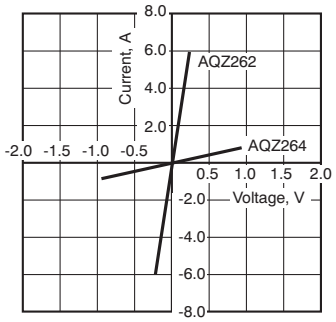
8. LED dropout voltage vs. ambient temperature characteristics

Sample: all types; LED current: 5 to 50 mA



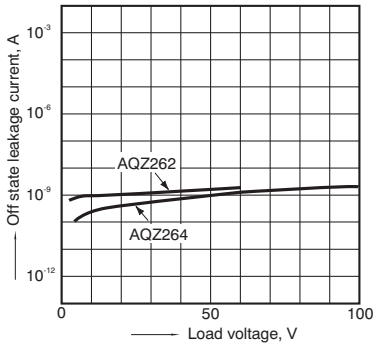
9. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



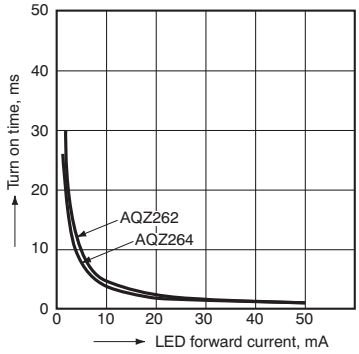
10. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



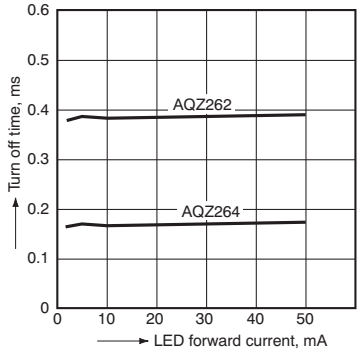
11. Turn on time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



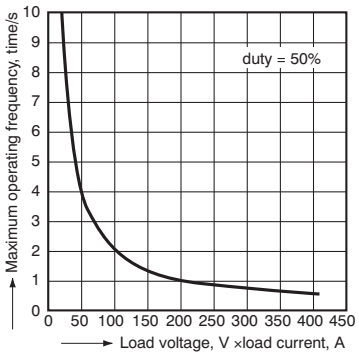
12. Turn off time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



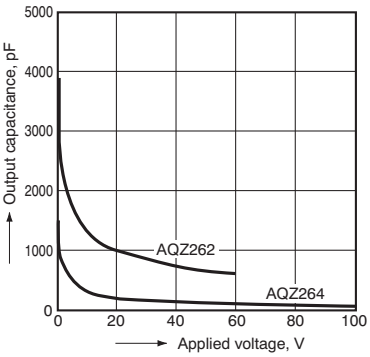
13. Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA; Ambient temperature: 25°C 77°F



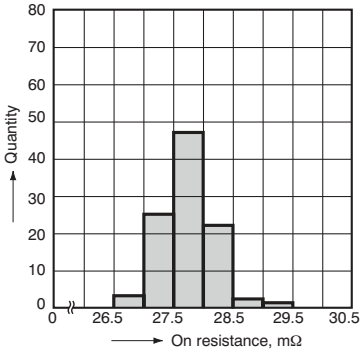
14. Output capacitance vs. applied voltage characteristics

Frequency: 10 KHz; Ambient temperature: 25°C 77°F

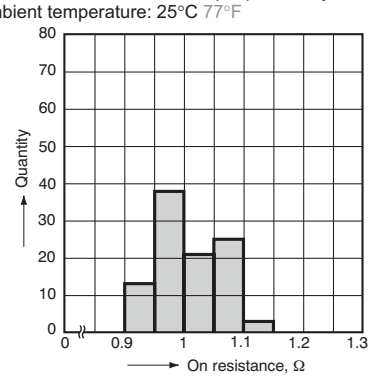


15-(1) On resistance distribution

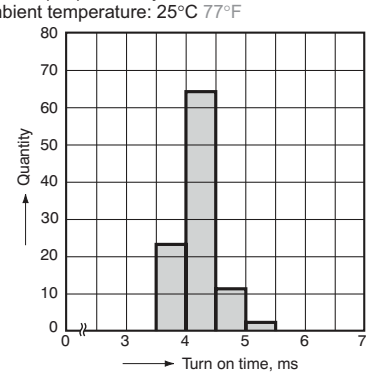
Sample: AQZ262
LED current: 10 mA; Continuous load current: 6 A (DC):
Quantity. n=100; Ambient temperature: 25°C 77°F



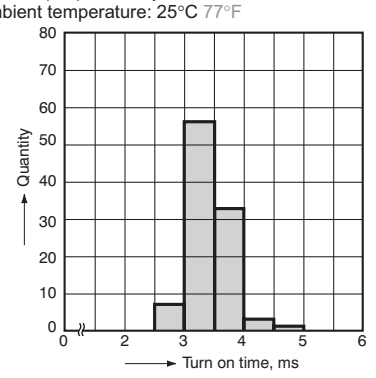
15.-(2) On resistance distribution
Sample: AQZ264
LED current: 10 mA;
Continuous load current: 1 A (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



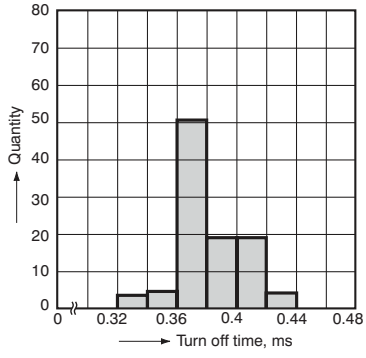
16-(1) Turn on time distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



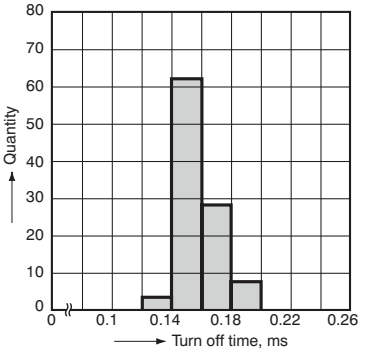
16.-(2) Turn on time distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



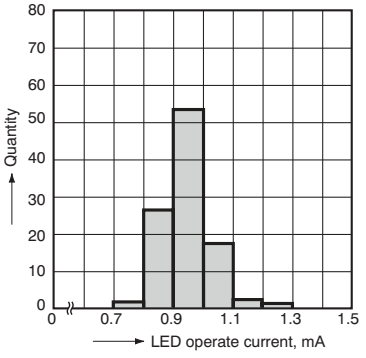
17-(1) Turn off time distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



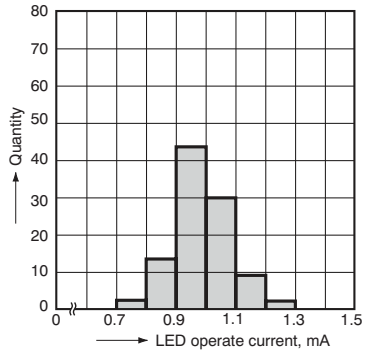
17.-(2) Turn off time distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



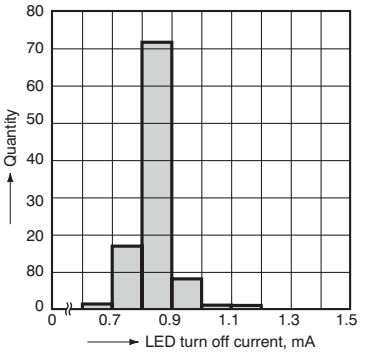
18-(1) LED operate current distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



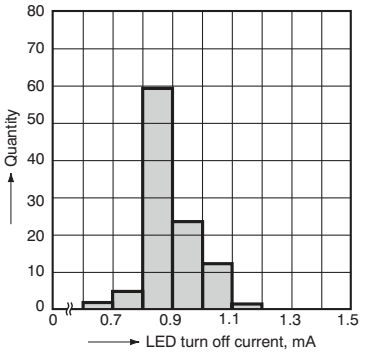
18.-(2) LED operate current distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



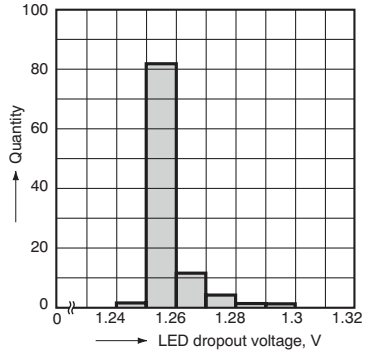
19-(1) LED turn off current distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



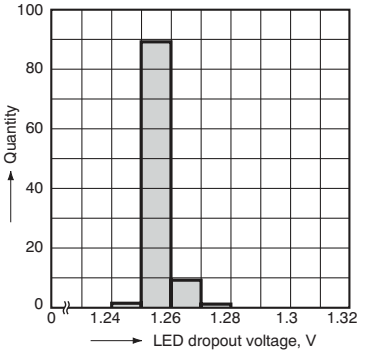
19.-(2) LED turn off current distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current:
100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



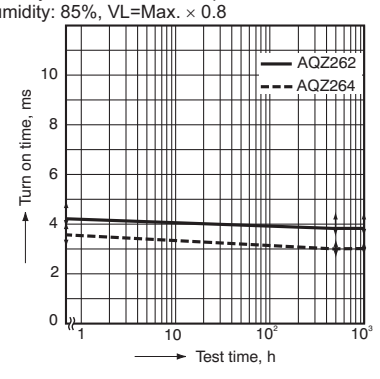
20-(1) LED dropout voltage distribution
Sample: AQZ262
LED current: 50 mA; Quantity, n=100;
Ambient temperature: 25°C 77°F



20.-(2) LED dropout voltage distribution
Sample: AQZ264
LED current: 50 mA; Quantity, n=100;
Ambient temperature: 25°C 77°F



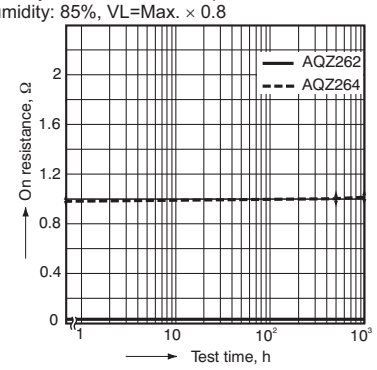
21-(1) Bias test at high temperature and high humidity (change of turn on time)
Quantity, n=10; Ambient temperature: 85°C 185°F
Humidity: 85%, VL=Max. × 0.8



Power 1 Form A High Capacity (AQZ26❍)

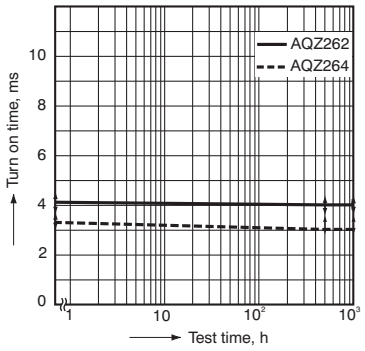
21.-(2) Bias test at high temperature and high humidity (change of on resistance)

Quantity, n=10; Ambient temperature: 85 °C 185°F
Humidity: 85%, VL=Max. × 0.8



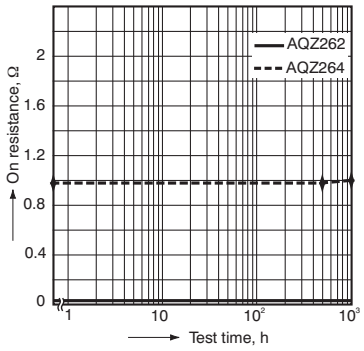
22-(1) Low temperature storage test (change of turn on time)

Quantity, n=10; Ambient temperature: –40°C –40°F



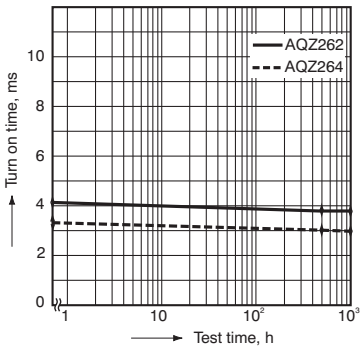
22.-(2) Low temperature storage test (change of on resistance)

Quantity, n=10; Ambient temperature: –40°C –40°F



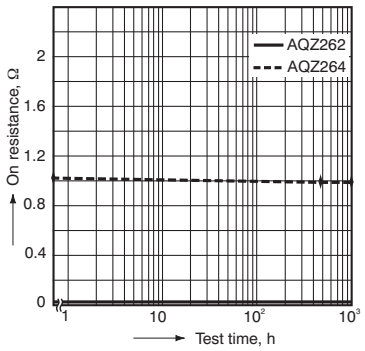
23-(1) High temperature storage test (change of turn on time)

Quantity, n=10; Ambient temperature: 100°C 212°F



23.-(2) High temperature storage test (change of on resistance)

Quantity, n=10; Ambient temperature: 100°C 212°F

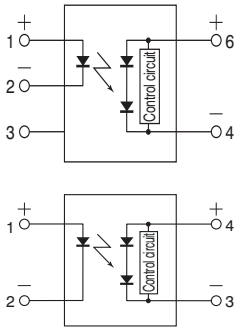


Panasonic
ideas for life

Photovoltaic MOSFET drivers of wide variation

Photovoltaic MOSFET Driver
(APV1, 2)

CAD Data



FEATURES

1. High-speed switching
Since release time is typ.0.1 ms, the MOSFET can be turned off quickly in urgent situations.

2. Space saving
With a built-in control circuit, an external resistor is not needed. This contributes to making substrates more compact.

3. High insulation
DIP type: 5,000 V
SOP type: 2,500 V
SSOP type: 1,500 V

4. Extensive product lineup
Products include SSOP, SOP4-pin and DIP6-pin.

TYPICAL APPLICATIONS

- Power supply (Vcc) for electronic circuits
- Driving MOSFET

TYPES

Output rating		Package	Part No.				Packing quantity	
Drop-out voltage (Typ.)	Short circuit current (Typ.)		Through hole terminal	Surface-mount terminal				
			Tube packing style	Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from 1/2/3-pin side*1	Picked from 4/5/6-pin side*2		
8.7V	14μA	DIP6-pin	APV1122	APV1122A	APV1122AX	APV1122AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
8.7V	14μA	SOP4-pin*3	—	APV1121S	APV1121SX	APV1121SZ	1 tube contains 100 pcs. 1 batch contains 2,000 pcs.	
8.2V	8μA		—	APV2121S	APV2121SX	APV2121SZ		
8.2V	8μA	SSOP*4	—	—	APV2111VY	APV2111VW	—	3,500 pcs.

Notes: *1 SOP type is picked from 1/2-pin side, SSOP type is picked from 1/4-pin side.
*2 SOP type is picked from 3/4-pin side, SSOP type is picked from 2/3-pin side.
*3 For space reasons, the two initial letters of the part number "AP", package (SOP) indicator "S" and the packing style indicator "X" or "Z" are not marked on the relay. (Ex. the label for product number APV1121SX is V1121).
*4 Tape and reel package is the standard packing style.
For space reasons, the two initial letters of the part number "AP", package (SSOP) indicator "V" and the packing style are not marked on the relay. (Ex. the label for product number APV2111VY is V2111).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	APV1122(A)	APV1121S	APV2121S	APV2111V	Remarks
Input	LED forward current	I_F	50mA				
	LED reverse voltage	V_R	5V				
	Peak forward current	I_{FP}	1A				f = 100 Hz, Duty Ratio = 0.1%
	Power dissipation	P_{in}	75mW				
I/O isolation voltage		V_{iso}	5,000V AC	2,500V AC	2,500V AC	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

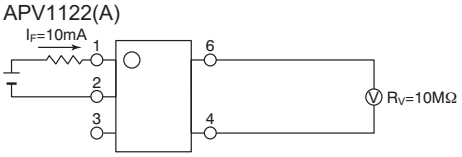
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	APV1122(A)	APV1121S	APV2121S	APV2111V	Condition
Input	LED operate current	Typical	I_{Fon}	0.6mA		0.85mA		V_{OC} = 5V
		Maximum		3mA				
	LED turn off current	Minimum	I_{Foff}	0.2mA				V_{OC} = 1V
		Typical		0.5mA		0.75mA		
	LED dropout voltage	Typical	V_F	1.15V				I_F = 10mA
		Maximum		1.5V				
Output	Drop-out voltage*	Minimum	V_{OC}	6V		5V		I_F = 10mA
		Typical		8.7V		8.2V		
	Short circuit current**	Minimum	I_{SC}	5μA		3μA		I_F = 10mA
		Typical		14μA		8μA		
Transfer characteristics	Turn on time***	Typical	T_{on}	0.4ms		0.8ms		I_F = 10mA, C_L = 1,000pF
	Turn off time***	Typical	T_{off}	0.1ms				I_F = 10mA, C_L = 1,000pF
	I/O capacitance	Typical	C_{iso}	0.8pF				V_B = 0V, f = 1MHz
		Maximum		1.5pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ				500V DC

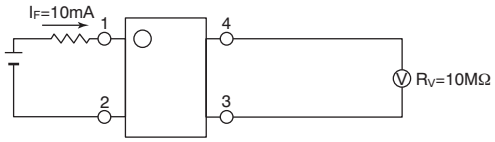
Note: Recommended LED forward current I_{FT}: 10mA.

*Drop-out voltage measurement circuit

APV1122(A)

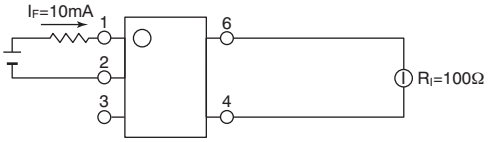


APV1121S, APV2121S, APV2111V

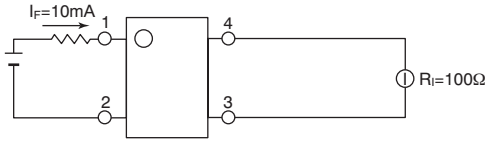


**Short circuit current measurement circuit

APV1122(A)

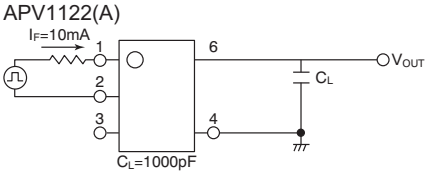


APV1121S, APV2121S, APV2111V

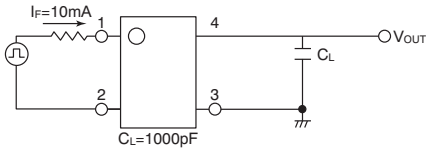


***Turn on/Turn off time measurement circuit

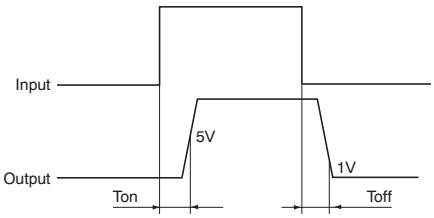
APV1122(A)



APV1121S, APV2121S, APV2111V



***Turn on time



■ RECOMMENDED OPERATING CONDITIONS

Please obey the following conditions to ensure proper relay operation and resetting.

Item	Symbol	Recommended value	Unit
Input LED current	I_F	10	mA

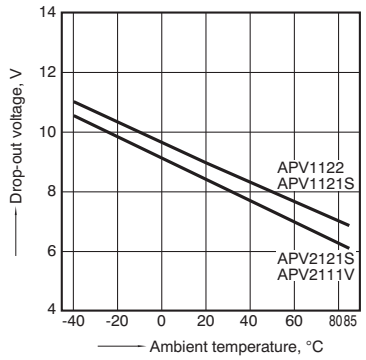
■ **For Dimensions, see page 60.**
■ **For Schematic and Wiring Diagrams, see page 68.**
■ **For Cautions for Use, see page 71.**

■ **These products are not designed for automotive use.**
If you are considering to use these products for automotive applications, please contact your local Panasonic Electric Works technical representative.
For more information, see page 80.

REFERENCE DATA

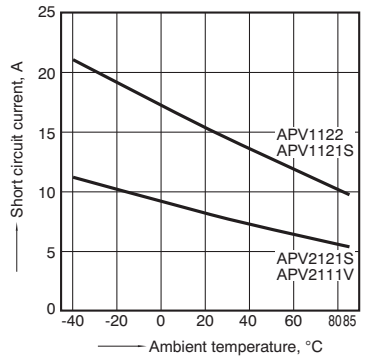
1. Drop-out voltage vs. ambient temperature characteristics

Input current: 10mA



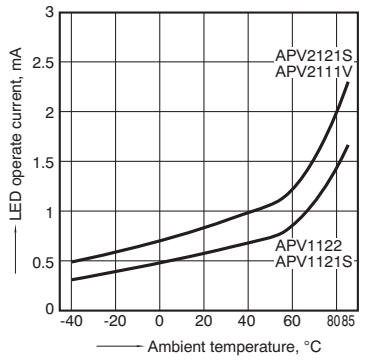
2. Short circuit current vs. ambient temperature characteristics

Input current: 10mA



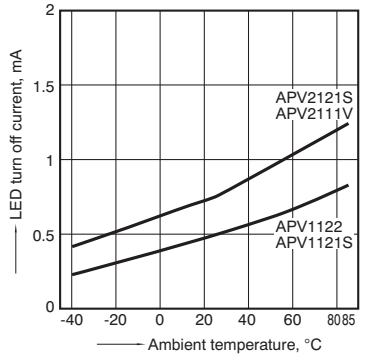
3. LED operate current vs. ambient temperature characteristics

Drop-out voltage: 5V



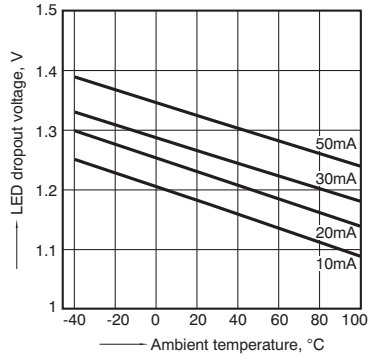
4. LED turn off current vs. ambient temperature characteristics

Drop-out voltage: 1V



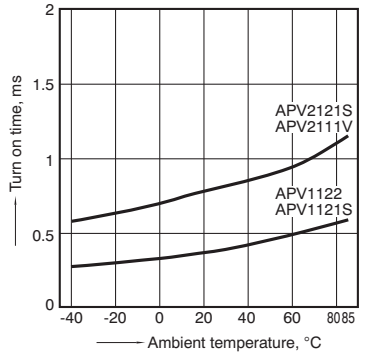
5. LED dropout voltage vs. ambient temperature characteristics

LED forward current: 5 to 50mA



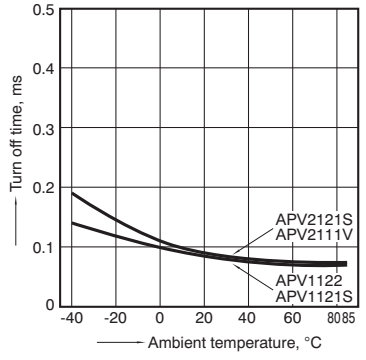
6. Turn on time vs. ambient temperature characteristics

LED forward current: 10mA
Load capacity: 1,000pF; output voltage: 5V



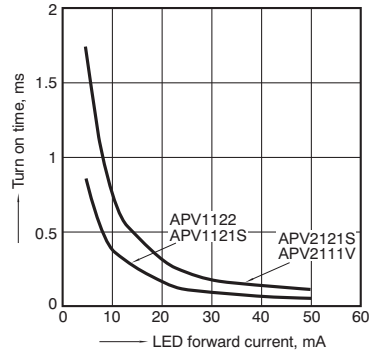
7. Turn off time vs. ambient temperature characteristics

LED forward current: 10mA
Load capacity: 1,000pF; output voltage: 1V



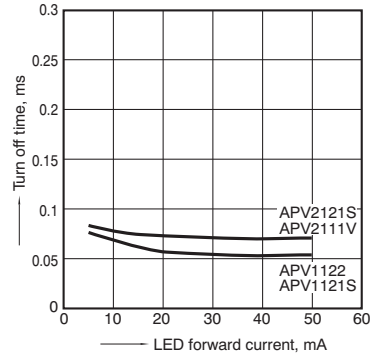
8. Turn on time vs. LED forward current characteristics

Load capacity: 1,000pF; output voltage: 5V

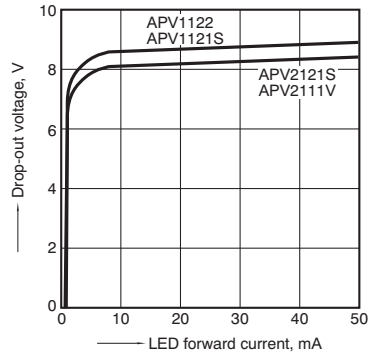


9. Turn off time vs. LED forward current characteristics

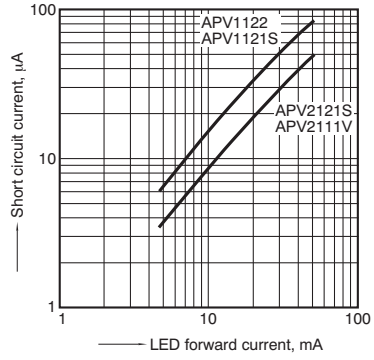
Load capacity: 1,000pF; output voltage: 1V



10. Drop-out voltage vs. LED forward current characteristics



11. Short circuit current vs. LED forward current characteristics

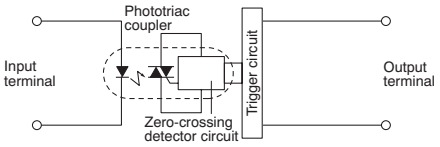
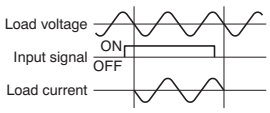
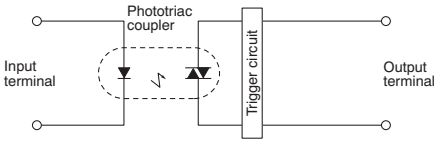
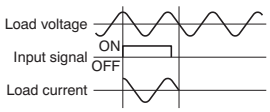


Photovoltaic MOSFET Driver (APV1, 2)

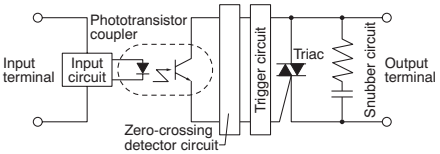
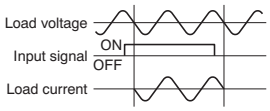
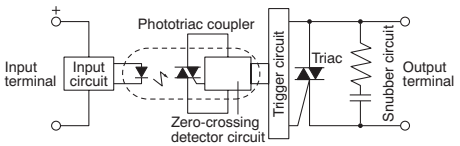
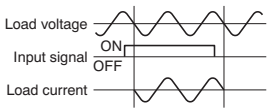
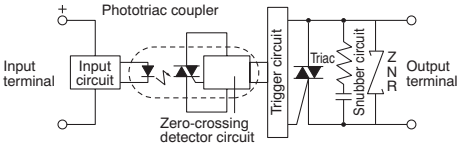
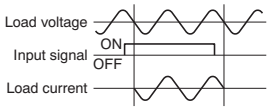
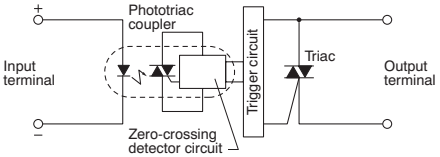
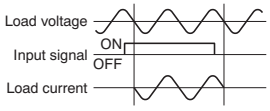
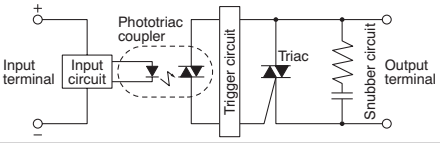
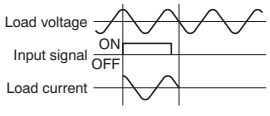
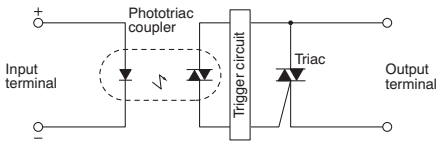
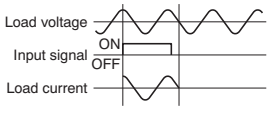
Solid State Relays

SSR Description and Circuit Configurations

Phototriac coupler

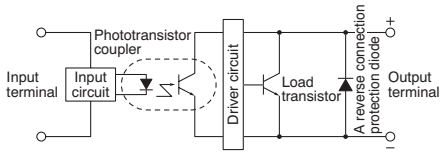
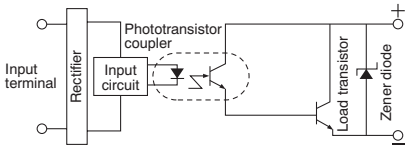
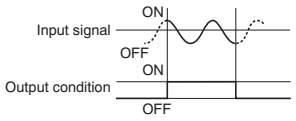
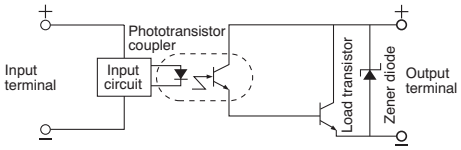
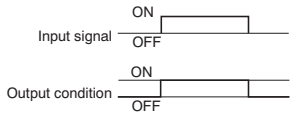
Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototriac	Yes	APT		
		No	APT		

SSR

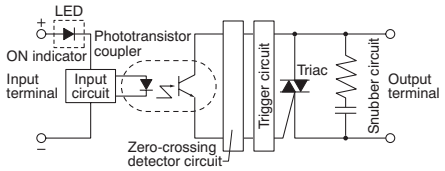
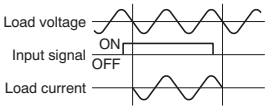
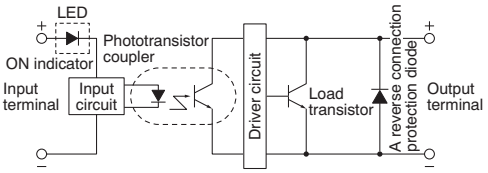
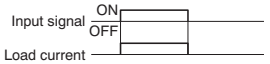
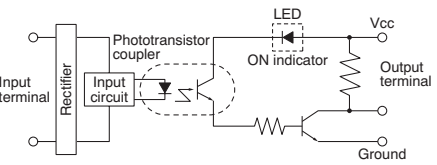
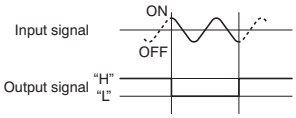
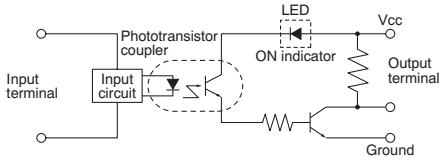
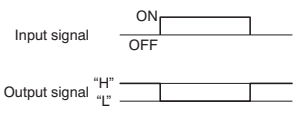
Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototransistor	Yes	AQ1 (2A, 5A) AQ-F		
	Phototriac	Yes	AQ-G AQ1 (3A, 10A) AQ-8 AQ-C		
			AQ-J AQ-A AQ-K		
			AQ-H		
		No	AQ-G (AQ1)* AQ8 (AQ-J)* AQ-A AQ-C		
			AQ-H		

* AQ1, AQ-J and AQ-A random types are available by special order.

SSR (continued)

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
DC	Phototransistor	—	AQ1 AQ-F AQ-C		
DC logic output	Phototransistor	—	AQ-C (IAC)		
		—	AQ-C (IDC)		

I/O relays

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototransistor	Yes	OAC		
DC		—	ODC		
DC logic output		—	IAC		
		—	IDC		

Principle of Operation

SSR Switching Characteristics

1.SSR for AC Loads

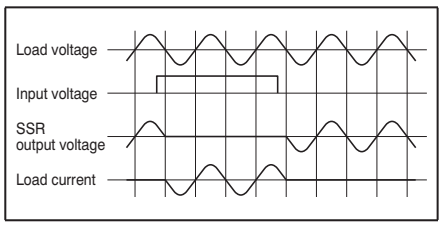
(1) Zero-crossing SSR

The zero-crossing SSR uses a phototransistor or phototriac coupler to isolate the input from the output (see the circuit configuration on the previous page). When the input signal is activated, the internal zero-crossing detector circuit triggers the triac to turn on as the AC load voltage crosses zero.

The load current is maintained by the triac's latching effect after the input signal is deactivated, until the triac is turned off when the load voltage crosses zero. The following describes voltage and current wave forms for different types of loads:

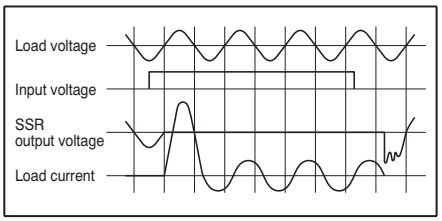
• Resistive loads

Since resistive loads cause no phase shift between the voltage and current, the triac turns on when the AC load voltage crosses zero after the input signal is activated. The SSR turns off when the AC load voltage crosses zero and the load current is turned off after the input signal is subsequently deactivated.



• Inductive loads

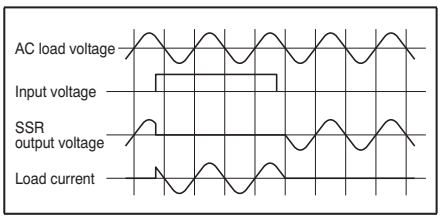
The SSR turns on when the load voltage crosses zero after the input signal is activated. It turns off when the load current subsequently crosses zero after the input signal is deactivated. A phase difference between the voltage and current may supply a transient spike to the SSR when it is turned off. While the snubber circuit absorbs this spike, an excessively large spike may result in a dv/dt error in the SSR's internal triac.



(2) Random type SSR

Random type SSR uses a phototriac coupler to isolate the input from the output. When the input signal is activated, the output immediately turns on, since there is no zero-crossing detector circuit. The load current is maintained by the triac's latching effect after the input signal is deactivated, until the AC load voltage crosses zero.

• Resistive loads



2. SSR for DC Loads

The SSR for DC loads uses a phototransistor coupler to isolate the input from the output. The output immediately responds to the input, since the phototransistor coupler directly turns the output transistor ON or OFF.

3. I/O Relays

(1) Input modules (Types IAC and IDC)

Interface SSRs have an input which is completely isolated from the output with a phototransistor coupler. This type of SSR outputs a logic signal that corresponds to the input signal. Two basic types are available: an IAC with an AC input, and an IDC with a DC input.

(2) Output modules (Types OAC and ODC)

The OAC type output module employs a circuit configuration identical to that of the zero-crossing SSR for AC loads; the ODC type output module employs a circuit configuration identical to that of the SSR for DC loads.

Terminology of Phototriac Coupler/AQ-H

Term		Symbol	Description
Input side	LED forward current	I_F	Current that flows between the input terminals when the input diode is forward biased.
	LED reverse voltage	V_R	Reverse breakdown voltage between the input terminals.
	Peak forward current	I_{FP}	Maximum instantaneous value of the forward current.
	LED dropout voltage	V_F	Dropout voltage between the input terminals due to forward current.
Output side	Repetitive peak OFF-state voltage	V_{DRM}	Maximum voltage with repeatability that can be applied continuously between the output terminals.
	ON-state RMS current	$I_{T(RSM)}$	Effective current value, based on designated conditions, that can flow continuously between output terminals.
	Non-repetitive surge current	I_{TSM}	Maximum current, without repeatability, that is based on designated conditions. Normally this is expressed as the wave height value of one power frequency current sinusoidal cycle.
	Peak ON-state voltage	V_{TM}	Effective value of the voltage drop when a regulated load current flows between the output terminals when device is on.
	Peak OFF-state current	I_{DRM}	Current that flows to output when a regulated load voltage is applied between the output terminals when device is off.
Electrical Characteristics	Trigger LED current	I_{FT}	Current flow when LED current is augmented and output is on, when regulated power supply voltage and load has been connected between the output terminals.
	Holding current	I_H	Load current to maintain on state after output terminals have been turned on based on designated conditions.
	Critical rate of rise of OFF-state voltage	dv/dt	Output terminals do not go to the on state from the off state based on designated conditions.
	Zero-cross voltage	V_{ZC}	In the zero-cross method, when input is turned on, the maximum voltage value when the output terminals turn on.
	Turn on time	Ton	Delay time until the output switches on after a designated LED current is made to flow through the input terminals.
	I/O capacitance	Ciso	Capacitance between the input and output terminals.
	I/O isolation resistance	Riso	Resistance between terminals (input and output) when a specified voltage is applied between the input and output terminals.

Terminology of SSR

Term		Description
Input side	Control voltage	Input voltage necessary for normal SSR operation under the specified temperature conditions.
	Activation voltage	Threshold at which the output turns on as the control voltage is gradually increased with the specified voltage applied to the loaded output.
	Recovery voltage	Threshold at which the output turns off as the control voltage is gradually decreased with the specified voltage applied to the loaded output.
	Input impedance	Resistance of the current limiting resistor used in the SSR input side.
	Input line voltage	Input voltage at which an input module SSR operates normally.
	Input current	Input current at which an input module SSR operates normally.
Load side	Max. load current	Maximum continuous current allowable across the SSR output terminals under the specified heat dissipation and ambient temperature conditions. AC current is specified in RMS units.
	Load voltage	Output supply voltage range in which the SSR operates normally. AC voltage is specified in RMS units.
	Logic supply voltage/current	Supply voltage/current range in which an input module SSR operates normally.
	Non-repetitive surge current	Maximum non-repetitive load current allowable under the specified heat dissipation and ambient temperature conditions. In general, it is given by the peak value of a single cycle of sinusoidal commercial AC current.
	“OFF-state” leakage current	Current that flows in the SSR output circuit when the specified supply voltage is applied to the output with no control voltage applied to the input.
	“ON-state” voltage drop	Output voltage drop caused by a specified load current supplied to the SSR output which is turned on by a specified input control voltage. AC voltage is specified in RMS units.
	Min. load current	Minimum load current at and above which the SSR operates normally under the specified temperature conditions. AC load current is specified in RMS units.
	Output stage breakdown voltage	Maximum voltage that can be applied across the output and ground of an input module SSR.
	Max. load current	Maximum current allowable for the output circuit of an input module SSR.
	Repetitive peak voltage, max.	Maximum repetitive voltage which can be continuously applied across the SSR output terminals. In general, a voltage of more than 400 V AC is used for 100 V AC applications, and more than 600 V AC for 200-250 V AC applications, to absorb supply voltage variations or on/off surges.
	Critical turn-off voltage rise ratio	SSRs may turn on if a turn-off voltage with a steep rising edge is applied. This phenomenon is called “dv/dt turn on.” Critical turn-off voltage rise ratio refers to the maximum turn-off voltage rise ratio at and below which the SSR remains turned off.
Electrical Characteristics	Operate time, max.	Time until the SSR output turns on after the specified control voltage is applied to the input.
	Release time, max.	Time until the SSR output turns off after the specified control voltage is removed from the input.
	Insulation resistance	Resistance measured with a specified voltage applied across the input and output, or across the input or output and frame ground.
	Breakdown voltage	Maximum voltage below which no dielectric breakdown occurs when applied for 1 minute across the same test points as those used for insulation resistance testing.
	Vibration resistance	Functional: The device sustains no damage and meets the specifications if it is exposed to vibration with its magnitude not exceeding this threshold during transit or installation. Destructive: Closed contacts of a relay remain closed for the specified time period if it is exposed to vibration with its magnitude not exceeding this threshold during operation.
	Shock resistance	Functional: The device sustains no damage and meets the specifications if it is exposed to physical impact with its magnitude not exceeding this threshold during transit or installation. Destructive: Closed contacts of a relay remain closed for the specified time period if it is exposed to physical impact with its magnitude not exceeding this threshold during operation.
	Ambient temperature	Ambient temperature range over which the SSR operates normally under the specified heat dissipation and load current conditions.
	Storage temperature	Ambient temperature range over which an SSR can be safely stored for extended periods without sustaining damage or performance degradation.

Cautions For Use of Phototriac Coupler/AQ-H

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

Cautions for Use

1. Applying stress that exceeds the absolute maximum rating

If the voltage and current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage and current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

As a result, the design should ensure that the absolute maximum ratings will never be exceeded, even momentarily.

2. Derating

Derating is absolutely imperative for reliable design and is an essential factor in determining product life. Therefore, be sure to amply derate the maximum rated values when designing a system. Since it is important to derate in accordance with the type of relay, conditions for use, and environment, please be sure to conduct tests using actual equipment. Also, if there is a possibility that, due to a quality problem, this product might have a great effect on human life or property, do take product liability into consideration by being sure to take even extra leeway against the maximum rated value and implement safety measures such as the construction of redundant circuits.

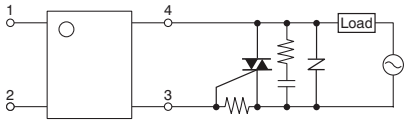
3. The phototriac coupler is designed solely to drive a triac. As a condition, the triac must be powered beforehand.

4. The internal IC could be damaged if a short forms between the I/O terminals while the phototriac coupler and AQ-H SSR are powered.

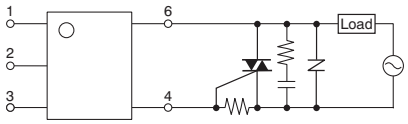
5. Output spike voltages

1) The figure below shows an ordinary triac drive circuit. Please add a snubber circuit or varistor, as noise/surge on the load side could damage the unit or cause malfunctions.

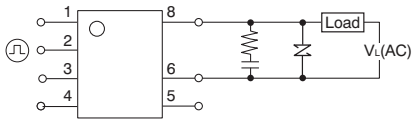
<Phototriac coupler SOP4, DIP4>



<Phototriac coupler DIP6>



<AQ-H>



Note: Connection of an external resister, etc., to terminal No. 5 (gate) is not necessary.

2) Clamp diode can limit spike voltages at the load side. However, long wires may cause spike voltages due to inductance. It is recommended to keep wires as short as possible to minimize inductance.

3) Output terminals may become conductive when a sudden voltage rise is applied, although the input power is not applied. This may occur even if voltage rise between terminals is less than the repetitive peak OFF-state voltage. Therefore, please perform sufficient tests with actual conditions.

4) When controlling loads using zero-cross voltage types in which the voltage and current phases differ, since the triac sometimes does not turn on regardless of the input state, please conduct sufficient tests using actual equipment.

6. Recommended input current value

I_F = 20 mA

7. Important Notes for Mounting

1) Temperature rise in the lead portion is highly dependent on package size. If multiple different packages are mounted on the same board, please check your board beforehand in an actual product, ensuring that the temperature conditions of the phototriac coupler fall within the parameters listed.

2) If the mounting conditions exceed the conditions recommended above, strength of the resin used will decrease and inconsistencies of the thermal expansion coefficients in the component materials will increase greatly. This can cause package cracking and breakage of the bonding wires. Please contact us for consultation.

8. Cleaning

The phototriac coupler and AQ-H SSR are forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleaning if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleaning, please ensure that the following conditions are met, and check beforehand for defects.

• Frequency: 27 to 29 kHz

• Ultrasonic output:
No greater than 0.25 W/cm^2

• Cleaning time:
No longer than 30 s

• Cleanser used: Asahiklin AK-225

• Other: Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

9. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the performance. The following storage conditions are recommended:

• Temperature: 0 to 45°C 32 to 113°F

• Humidity: Less than 70% R.H.

• Atmosphere: No harmful gases such as sulfurous acid gas, minimal dust.

3) Storage of SOP type

Phototriac couplers implemented in SO packages (SOP 4-pin type) are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, use the devices as soon as possible (use within 1 month ≦ 45°C 113°F/70% R.H.).

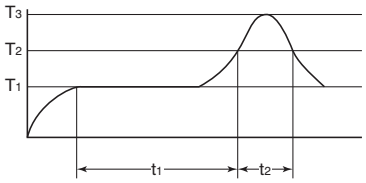
• If the devices are to be left in storage after the moisture-proof package has been unsealed, keep them in another moisture-proof bag containing silica gel and use within 3 months.

10. Soldering

1) When soldering PC board terminals, keep soldering time to within 10 s at 260°C 500°F.

2) When soldering surface-mount terminals or SO package, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T1 = 150 to 180°C 302 to 356°F
T2 = 230°C 446°F
T3 = 250°C 482°F or less
t1 = 60 to 120 s or less
t2 = 30 s or less

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F

Wattage: 30 to 60 W

Soldering time: within 3 s

(3) Others

Check mounting conditions before using other soldering methods (DWS, VPS, hot-air, hot plate, laser, pulse heater, etc.)

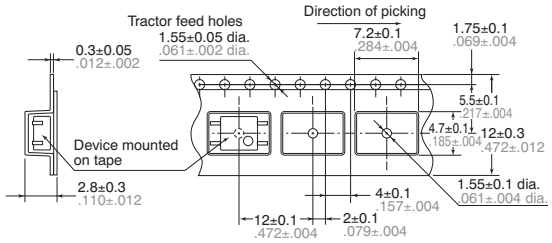
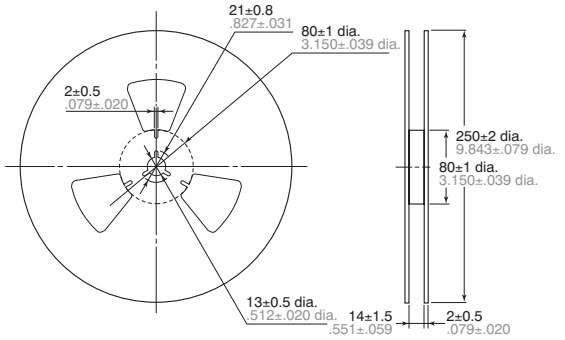
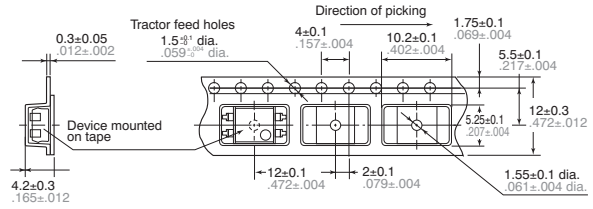
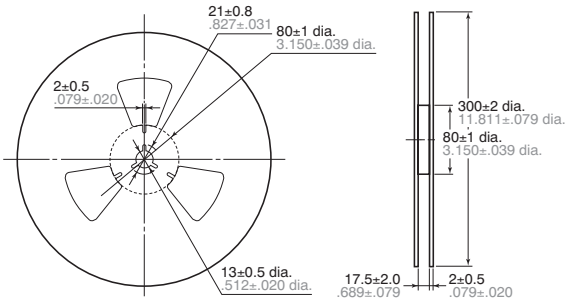
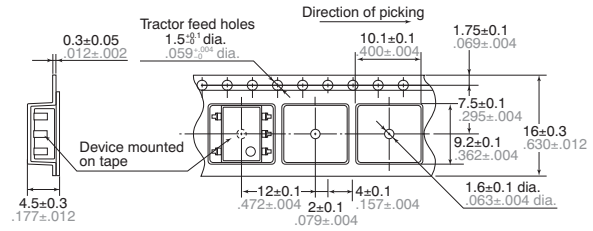
• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

• When using lead-free solder we recommend one with an alloy composition of Sn3.0Ag0.5Cu. Please consult us regarding details such as soldering conditions.

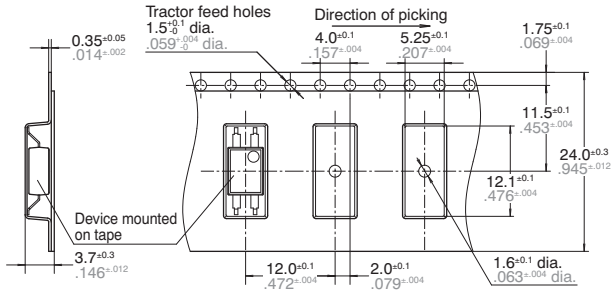
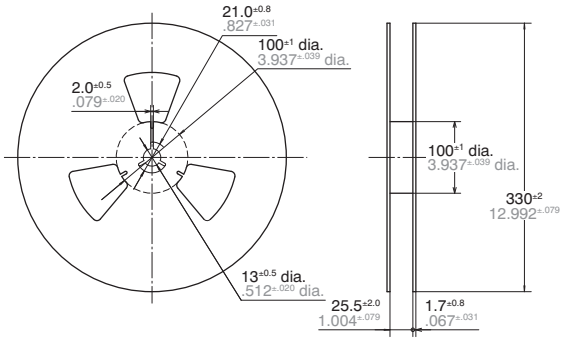
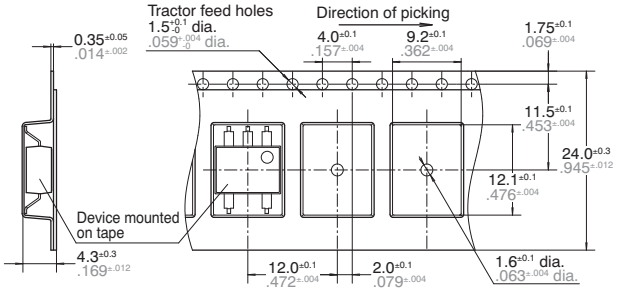
11. The following shows the packaging format

1) Tape and reel (Phototriac coupler)

mm inch

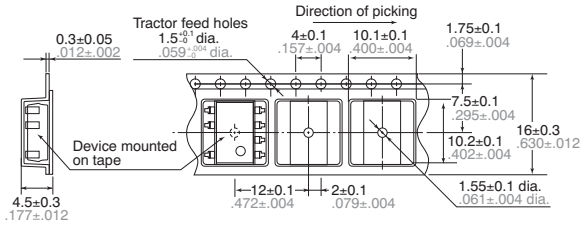
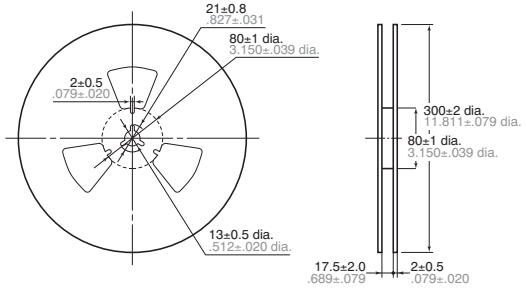
Type	Tape dimensions	Dimensions of paper tape reel
SO package 4-pin type	 (1) When picked from 1/2-pin side: Part No. APT○○○○SX (Shown above) (2) When picked from 3/4-pin side: Part No. APT○○○○SZ	
DIP 4-pin type	 (1) When picked from 1/2-pin side: Part No. APT○○○○AX (2) When picked from 3/4-pin side: Part No. APT○○○○AZ	
DIP 6-pin type	 (1) When picked from 1/2/3-pin side: Part No. APT○○○○AX (2) When picked from 4/5/6-pin side: Part No. APT○○○○AZ	

mm inch

Type	Tape dimensions	Dimensions of paper tape reel
DIP 4-pin wide terminal type	 (1) When picked from 1/4-pin side: Part No. APT○○○○WAY (2) When picked from 2/3-pin side: Part No. APT○○○○WAW	
DIP 6-pin wide terminal type	 (1) When picked from 1/6-pin side: Part No. APT○○○○WAY (2) When picked from 3/4-pin side: Part No. APT○○○○WAW	

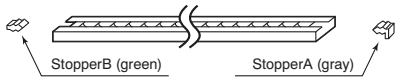
2) Tape and reel (AQ-H)

mm inch

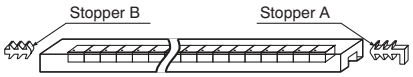
Type	Tape dimensions	Dimensions of paper tape reel
8-pin SMD type	 (1) When picked from 1/2/3/4-pin side: Part No. AQH○○○○AX (Shown above) (2) When picked from 5/6/8-pin side: Part No. AQH○○○○AZ	

Solid State

3) Tube
(1) Devices are packaged in a tube as pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.
(SOP type)



(DIP type)



13. Applying stress that exceeds the absolute maximum rating

If the voltage and current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage and current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.
As a result, the design should ensure that the absolute maximum ratings will never be exceeded, even momentarily.

14. Standard Chart

	c UL us	VDE	
File No. (Standard No.)	EU191218 (UL1577)	Nr.40011542 (EN60747-5-2)	Nr.40011542 (EN60950)
APT1211S	❍	❍	❍
APT1221S	❍	❍	❍
APT1231S	❍	❍	❍
APT1211(W)(A)	❍	❍	❍
APT1221(W)(A)	❍	❍	❍
APT1231(W)(A)	❍	❍	❍
APT1212(W)(A)	❍	❍	❍
APT1222(W)(A)	❍	❍	❍
APT1232(W)(A)	❍	❍	❍

Cautions for Use of SSR

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

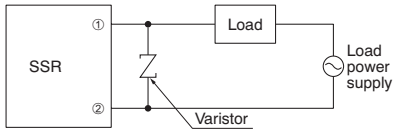
• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

Cautions for Use

1. Regarding output noise surge protection

(1) AC Output Type

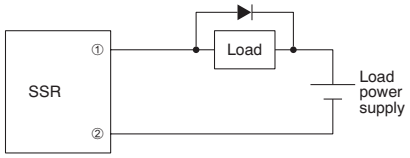
A high noise surge voltage applied to the SSR load circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use a varistor across the SSR output.



Note: AQ-F solid-state relay output terminals are numbered (8) and (12).

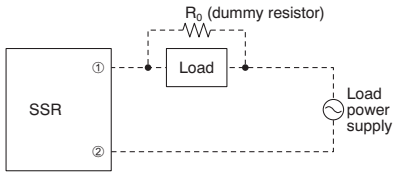
(2) DC Output Type

When the SSR is loaded with an inductive load, such as a solenoid contactor, motor, or solenoid valve, use a counter-EMF suppression diode across the load.



2. When used for the load less than rated

An SSR may malfunction if it is used below the specified load. In such an event, use a dummy resistor in parallel with the load.

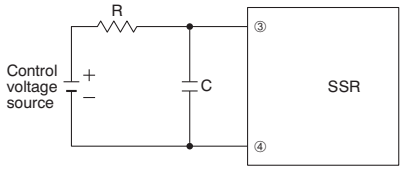


Load Specifications

Type		Load current
AQ-G	All models	20 mA
AQ-1	AC output type DC output type	50 mA 5 mA
AQ-8	100 V type 200V type	25 mA 50 mA
AQ-F	AC output type DC output type	50 mA 5 mA
AQ-J	All models	50 mA
AQ-A	All models	100 mA
AQ-K	All models	100 mA
AQ-C	100 V type with AC output 200 V type with AC output DC output type	10 mA 20 mA 1 mA
I/O relays	AC output module DC output module	50 mA 5 mA

3. Noise and surge protection at the input side

A high noise surge voltage applied to the SSR input circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use C or R noise absorber in the input circuit.

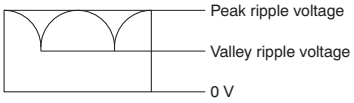


4. When the input terminals are connected with reverse polarity

Type	If the polarity of the input control voltage is reversed
AQ1, AQ-F, AQ-J, AQ-A, AQ-K AQ-J I/O relay	Reversing the polarity will not cause damage to the device, due to the presence of a protection diode, but the device will not operate.
AQ-H, AQ-G, AQ8, AQ-C	Reversing the polarity may cause permanent damage to the device. Take special care to avoid polarity reversal or use a protection diode in the input circuit.

5. In the case of operating voltage containing ripple

If the SSR control voltage contains ripple, the peak of the ripple should not exceed the maximum rated control voltage, and the bottom of the ripple should exceed the minimum rated control voltage.



6. Cleaning solvents compatibility

Dip cleaning with an organic solvent is recommended for removal of solder flux, dust, etc. If ultrasonic cleaning must be used, the severity of factors such as frequency, out power and cleaning solvent selected may cause loose wires and other troubles.

Please make sure these conditions before use.

7. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

• Temperature: 0 to 45°C 32 to 113°F

• Humidity: Less than 70% R.H.

• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

8. Others

(1) If an SSR is used in close proximity to another SSR or heat-generating device, its ambient temperature may exceed the allowable level. Carefully plan SSR layout and ventilation.

(2) Soldering to SSR terminals should be completed within 5 seconds at 260°C.

(3) Terminal connections should be made by referring to the associated wiring diagram.

(4) For higher reliability, check device quality under actual operating conditions.

Cautions for Use of SSR

Snubber Circuit

1. Reduce dv/dt

An SSR used with an inductive load can accidentally fire due to a high load voltage rise rate (dv/dt), even though the load voltage is below the allowable level (inductive load firing).

Our SSRs contain a snubber circuit designed to reduce dv/dt (except AQ-H).

2. Selecting the snubber constants

1) C selection

The charging coefficient tau for C of the SSR circuit is shown in formula ①

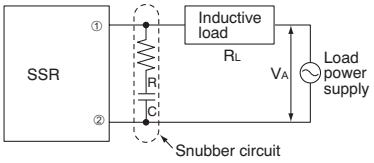
$\tau=(R_L+R) \times C$ ----------①

By setting formula ① so that it is below dv/dt value you have:

$C=0.632V_A/((dv/dt) \times (R_L+R))$ -----②

By setting C = 0.1 to 0.2 μF, dv/dt can be controlled to between nV/μs and n+V/μs or lower. For the condenser, use either an MP condenser metallized polyester film. For the 100 V line, use a voltage between 250 and 400 V, and for the 200 V line, use a voltage between 400 and 600 V.

2) R selection



If there is no resistance R (the resistance R controls the discharge current from condenser C), at turn-on of the SSR, there will be a sharp rise in dv/dt and the high peak value discharge current will begin to flow. This may cause damage to the internal elements of the SSR.

Therefore, it is always necessary to insert a resistance R. In normal applications, for the 100 V line, have R = 10 to 100 Ω and for the 200 V line, have R = 20 to 100 Ω. (The allowable discharge current at turn-on will differ depending on the internal elements of the SSR.) The power loss from R, written as P, caused by the discharge current and charging current from C, is shown in formula ③ below. For the 100 V line, use a power of 1/2 W, and for the 200 V line, use a power above 2 W.

$$P=\frac{C \times V_A^2 \times f}{2}\text{---------- ③}$$

f = Power supply frequency

Also, at turn-off of the SSR, a ringing circuit is formed with the capacitor C and the circuit inductance L, and a spike voltage is generated at both terminals of the SSR. The resistance R serves as a control resistance to prevent this ringing. Moreover, a good non-inductive resistance for R is required. Carbon film resistors or metal film resistors are often used. For general applications, the recommended values are C = 0.1 μF and R = 20 to 100 Ω. There are cases of resonance in the inductive load, so the appropriate care must be taken when making your selections.

Thermal Design

SSRs used in high-reliability equipment require careful thermal design. In particular, junction temperature control has a significant effect on device function and life time. The rated load current for board-mounting SSRs is defined as the maximum current allowable at an ambient temperature of 40°C (30°C) and under natural cooling. If the ambient temperature exceeds the SSRs derating temperature point (20°C to 40°C, depending on SSR), load current derating in accordance with the load current vs temperature diagram becomes nesessary. If adjacent devices act as heat sources, the SSR should be located more than 10 mm away from those devices. SSRs with a 5 A rating or more must be used with the dedicated heat sinks listed in Table 1 or equivalents. To ensure adequate thermal conduction, apply thermal conductive compound (Toshiba silicone YG6111, TSK5303 or alternate) to the SSR's mounting surface. For information on external heat sinks for our SSRs and their mounting method, refer to "Data and Cautions for Use for respective relay".

Table 1. Dedicated on-board heat sinks

Load current	Type	Heat sink
to 10 A	AQ10A2-ZT4/32V DC	AQ-HS-5A
10 A	AQ-J (10A)	AQP-HS-J10A AQP-HS-J10A (for AQ-J) AQP-HS-SJ10A (for AQ-J)* AQP-HS-SJ20A*
15 A	AQ-A (15A), AQ-J (15A)	AQP-HS-J10A AQP-HS-J10A (for AQ-J) AQP-HS-SJ10A (for AQ-J)* AQP-HS-SJ20A*
20 A	AQ-J (25A)	AQP-HS-J10A AQP-HS-SJ10A (for AQ-J)* AQP-HS-SJ20A*
25 to 40 A	AQ-A (25A)	AQP-HS-30/40A
25 A	AQ-J (25A)	AQP-HS-J25A
40 A	AQ-A (40A)	AQP-HS-J25A

*It is possible to mounting on the DIN rail.

Protection Circuit

High-reliability SSR circuits require an adequate protection circuit, as well as careful study of the characteristics and maximum ratings of the device.

1. Over-Voltage Protection

The SSR load power supply requires adequate protection against over-voltage errors from various causes. The methods of over-voltage protection include the following:

(1) Use devices with a guaranteed reverse surge withstand voltage (controlled avalanche devices, etc.)

(2) Suppress transient spikes

Use a switching device in the secondary circuit of a transformer or use a switch with a slow opening speed.

(3) Use a surge absorption circuit

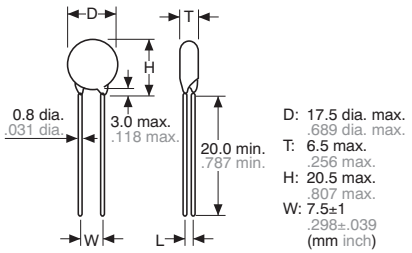
Use a CR surge absorber or varistor across the load power supply or SSR. Special care must be taken so power on/off surges or external surges do not exceed the device's rated load voltage. If a surge voltage exceeding the device's rated voltage is anticipated, use a surge absorption device and circuit (e.g. a ZNR from Panasonic Electronic Devices Co., Ltd.).

Choosing the Rated Voltage of the ZNR

(1) Peak supply voltage
(2) Supply voltage variation
(3) Degradation of ZNR characteristic (1 mA±10%)
(4) Tolerance of rated voltage (10%)

For application to 100 V AC lines, choose a ZNR with the following rated voltage:

(1) × (2) × (3) × (4) =
(100×2) ×1.1×1.1×1.1 = 188 (V)



Example of ZNR (Panasonic Electronic Components)

Types	Varistor voltage	Max. allowable circuit voltage		Max. control voltage	Max. average pulse electric power	Withstanding energy		Withstanding surge current		Electrostatic capacitance (Reference)
						(10/1000μs)	(2ms)	1time	(8/20μs) 2time	
	V1mA (V)	ACrms (V)	DC (V)	V50A (V)	(W)	(J)	(J)	(A)	(A)	@1KHz (pF)
ERZV14D201	200 (185 to 225)	130	170	340	0.6	70	50	6,000	5,000	770
ERZV14D221	220 (198 to 242)	140	180	360	0.6	78	55	6,000	5,000	740
ERZV14D241	240 (216 to 264)	150	200	395	0.6	84	60	6,000	5,000	700
ERZV14D271	270 (247 to 303)	175	225	455	0.6	99	70	6,000	5,000	640
ERZV14D361	360 (324 to 396)	230	300	595	0.6	130	90	6,000	4,500	540
ERZV14D391	390 (351 to 429)	250	320	650	0.6	140	100	6,000	4,500	500
ERZV14D431	430 (387 to 473)	275	350	710	0.6	155	110	6,000	4,500	450
ERZV14D471	470 (423 to 517)	300	385	775	0.6	175	125	6,000	4,500	400
ERZV14D621	620 (558 to 682)	385	505	1,025	0.6	190	136	6,000	4,500	330
ERZV14D681	680 (612 to 748)	420	560	1,120	0.6	190	136	5,000	4,500	320

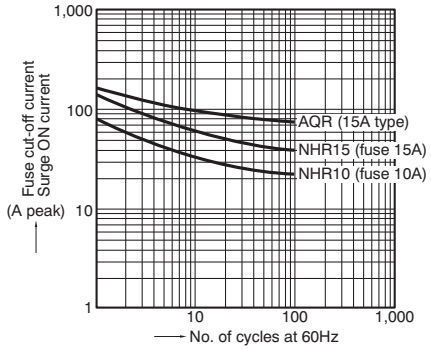
2. Over-Current Protection

An SSR circuit operated without over-current protection may result in damage to the device. Design the circuit so the device's rated junction temperature is not exceeded for a continuous overload current.
(e.g. Surge current into a motor or light bulb)
The surge-on current rating applies to over-current errors which occur less than several tens of times during the service life of a semiconductor device. A protection coordination device is required for this rating.

Methods of over-current protection include the following:

(1) Suppressing over-currents
Use a current limiting reactor in series with the load power supply.
(2) Use a current shut-off device
Use a current limiting fuse or circuit breaker in series with the load power supply.

Example of executing fuse selection of over-current protection cooperation



Load Type Description

1. Heaters (Resistive Load)

The SSR is best suited to resistive loads. Noise levels can be drastically lowered with zero-crossing switching.

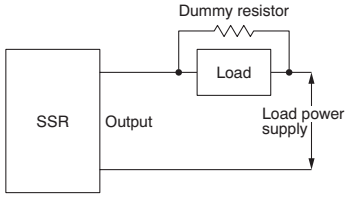
2. Lamps

Tungsten or halogen lamps draw a high inrush current when turned on (approximately 7 to 8 times the steady-state current for zero-crossing SSRs; approximately 9 to 12 times, in the worst case, for random type SSRs). Choose an SSR so the peak of the inrush current does not exceed 50% of the SSR surge-on current.

3. Solenoids

AC-driven solenoid contactors or solenoid valves also draw inrush current when they are activated. Choose an SSR such that the peak of the inrush current does not exceed 50% of the SSR surge-on current. For small solenoid valves and AC relays in particular, a leakage current may cause the load to malfunction after the SSR turns off. In such an event, use a dummy resistor in parallel with the load.

• Using an SSR below the Specified Load



Cautions for Use of SSR

4. Motors

When starting, an electric motor draws a symmetrical AC starting current some 5 to 10 times the steady-state load current, superimposed on a DC current. The starting time during which this high starting current is sustained depends on the capacities of the load and load power supply. Measure the starting current and time under the motor's actual operating conditions and choose an SSR so the peak of the starting current does not exceed 50% of the SSR surge-on current. When the motor load is deactivated, a voltage exceeding the load supply voltage is applied to the SSR due to counter-EMF. This voltage is approximately 1.3 times the load supply voltage for induction motors, and approximately 2 times that for synchronous motors.

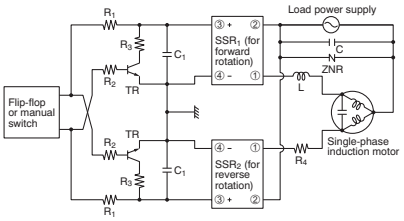
• Reversible Motor Control

When the direction of motor rotation is reversed, the transient current and time required for the reversal far exceed those required for simple starting. The reversing current and time should also be measured under actual operating conditions.

For a capacitor-starting, single-phase induction motor, a capacitive discharge current appears during the reversal process. Be sure to use a current limiting resistor or reactor in series with the SSR. Also, the SSR should have a high marginal voltage rating, since a voltage twice as high as the load supply voltage develops across the SSR in the reversal process. (For reversible control on a 100 V AC line, use SSRs with a 200 V rating; for use on a 200 V AC line, contact your nearest our representative for further information.)

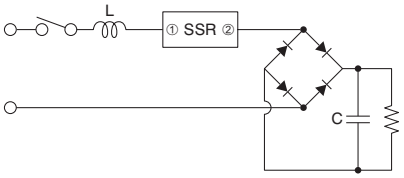
For reversible motor control, carefully design the driver circuit so the forward and reverse SSRs do not turn on at the same time.

Transistor-driven reversible motor control circuit



5. Capacitive Load

A capacitive load (switching regulator, etc.) draws an inrush current to charge the load capacitor when the SSR turns on. Choose an SSR so the peak of the inrush current does not exceed 50% of the SSR surge-on current. A timing error of up to one cycle can occur when a switch used in series with the SSR is opened or closed. If this is a problem, use an inductor (200 to 500 μH) in series to the SSR to suppress dv/dt error.

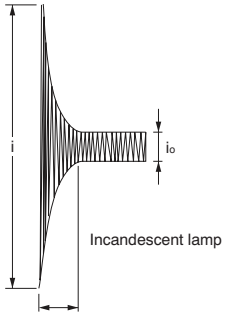


6. Other Electronic Equipment

In general, electronic equipment uses line filters in the primary supply circuit. The capacitors used in the line filters may cause the SSR to malfunction due to dv/dt turn on when the equipment is turned on or off. In such an event, use an inductor (200 to 500 μH) in series with the SSR to suppress dv/dt turn on.

Load Inrush Current Wave and Time

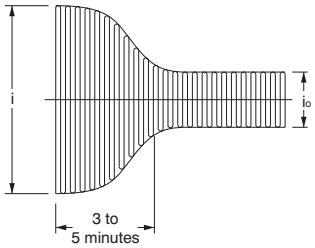
(1) Incandescent Lamp Load



Approx. 1/3 second

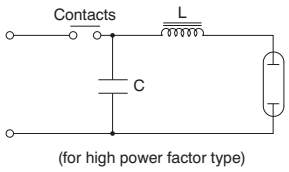
Inrush current/rated current: i/io]10 to 15 times

(2) Mercury Lamp Load i/io]3 times

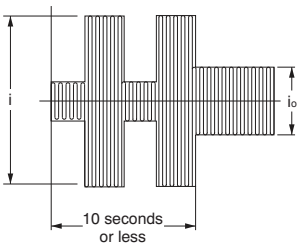


The discharge tube, transformer, choke coil, capacitor, etc., are combined in common discharge lamp circuits. Note that the inrush current may be 20 to 40 times, especially if the power supply impedance is low in the high power factor type.

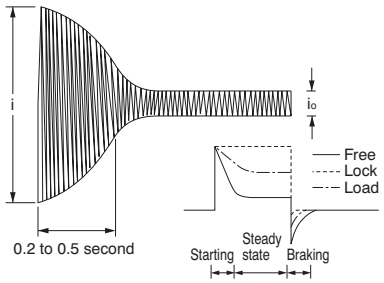
(3) Fluorescent Lamp Load i/io]5 to 10 times



(for high power factor type)

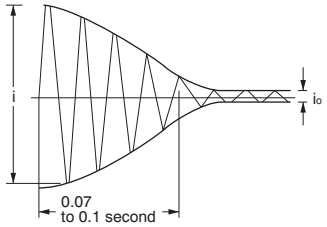


(4) Motor Load i/io]5 to 10 times



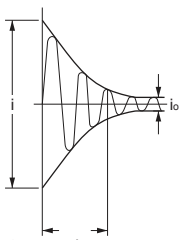
• Conditions become more harsh if plugging or inching is performed since state transitions are repeated.
• When using a relay to control a DC motor and brake, the on time inrush current, steady-state current and off time brake current differ depending on whether the load to the motor is free or locked. In particular, with non-polarized relays, when using from B contact of from contact for the DC motor brake, mechanical life might be affected by the brake current. Therefore, please verify current at the actual load.

(5) Solenoid Load i/io]10 to 20 times



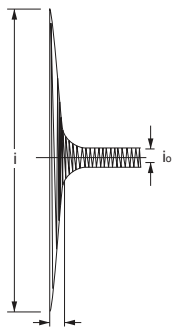
Note that since inductance is great, the arc lasts longer when power is cut. The contact may become easily worn.

(6) Electromagnetic Contact Load i/io]3 to 10 times



1 to 2 cycles (1/60 to 1/30 seconds)

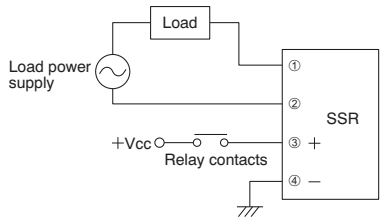
(7) Capacitive Load i/io]20 to 40 times



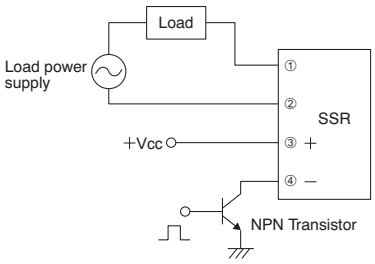
1/2 to 2 cycles (1/120 to 1/30 seconds)

SSR Driving Circuits

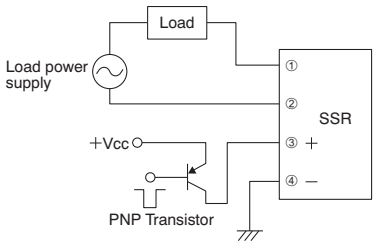
1. Relay Driver



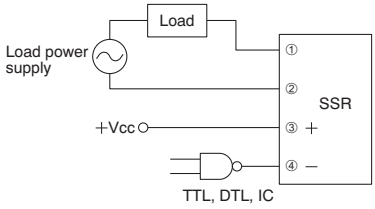
2. NPN Transistor Driver



3. PNP Transistor Driver

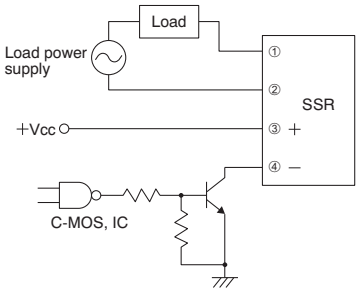


4. TTL/DTL/IC Driver

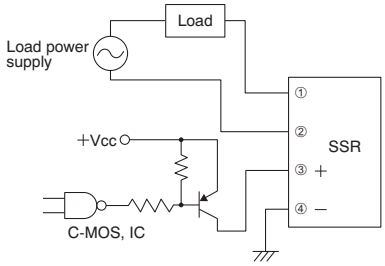


5. C-MOS/IC Driver

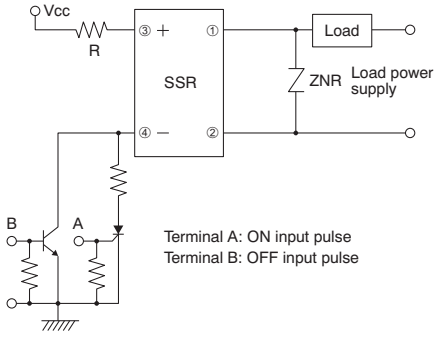
(1) SSR fires when IC output is HIGH:



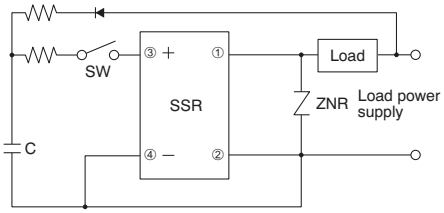
(2) SSR fires when IC output is LOW:



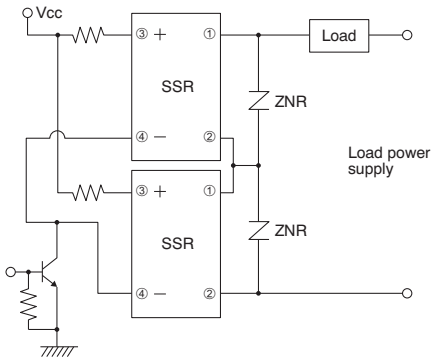
6. Self Sustaining Circuit Using SSR



7. Driving with a Shared Supply



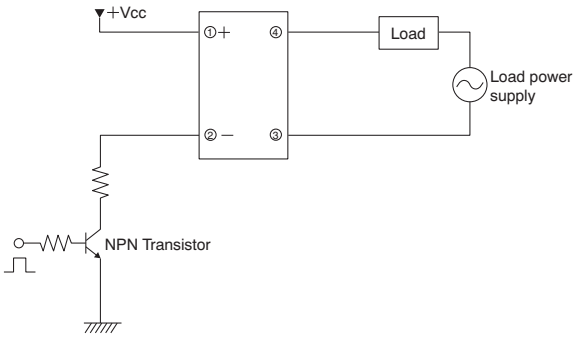
8. SSRs Used in Series



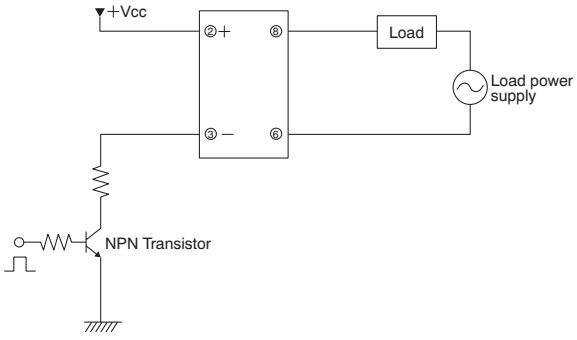
Phototriac Coupler, AQ-H Solid State Relay Driving Circuits

1. NPN Transistor Driver

1) Phototriac Coupler



2) AQ-H Solid State Relay

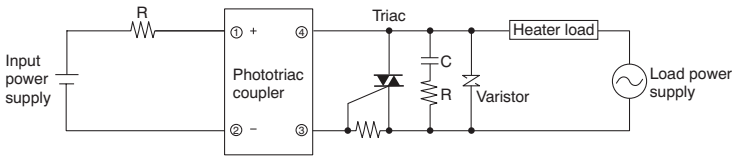


* Phototriac coupler and AQ-H is current driving type.

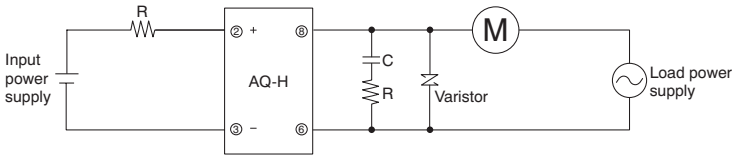
Phototriac Coupler/AQ-H Application Examples

Typical Applications

1. Temperature control for heater control



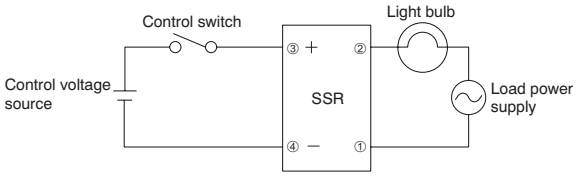
2. Airflow control for fan motors



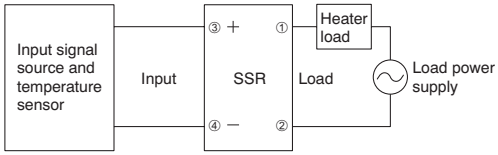
SSR Application Examples

Typical Applications

1. Light Bulb

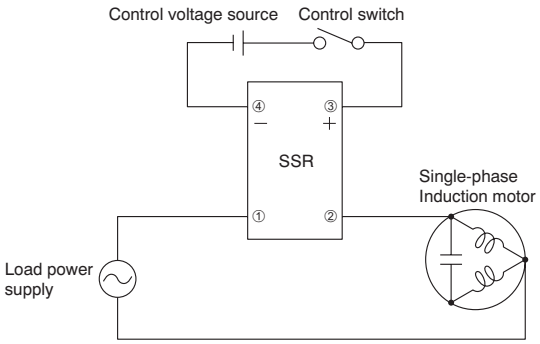


2. Electric Furnace Temperature Control

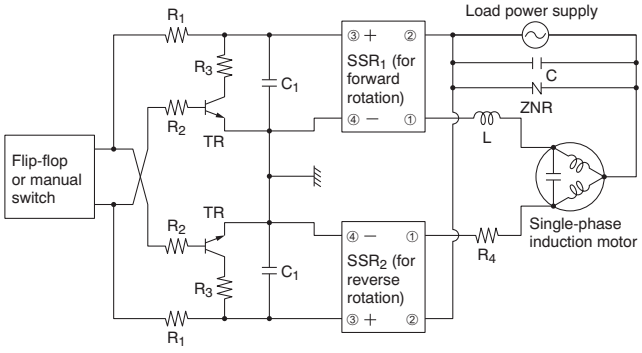


* KT Temperature Controller is available.

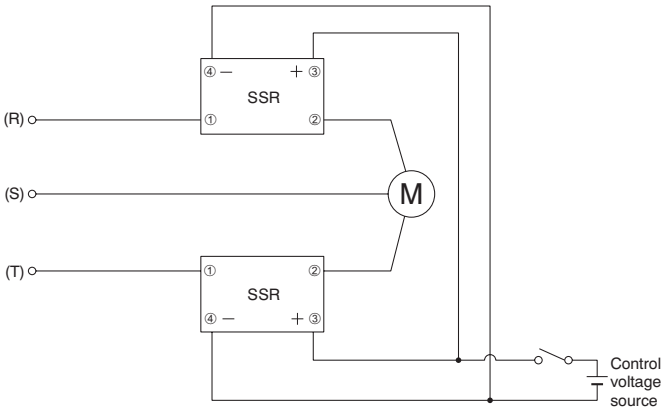
3. Single-Phase Induction Motor Control



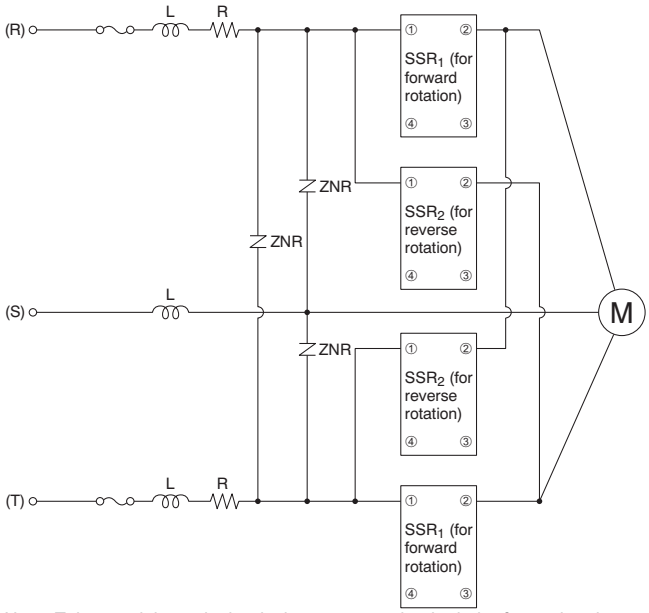
4. Reversible Control for a Single-Phase Induction Motor



5. Three-Phase Induction Motor Control

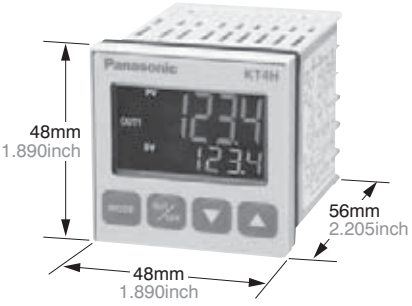


6. Reversible Control for a 3-Phase Induction Motor



Note: Take special care in the design to ensure that both the forward and reverse SSRs do not turn on at the same time.

Recommended Temperature Controllers



<KT4H Temperature Controller>

Our temperature controller is recommended for use with our Solid State Relays.

Features

- Data can be collected using the RS485 communications interface via a PLC.
- Improved visibility using a negative type LCD and backlight.
- Depth-wise length (chassis dimension) is 56 mm 2.205 inch.

Substitute part numbers

Power supply	Control output	Part No.
100 to 240 V AC	Relay contact	AKT4H111100

*For detailed product information about temperature controllers, please refer to our website: http://panasonic-denko.co.jp/ac/e/fasys/component/temperature_controller/

SSR Load Recommendation Chart

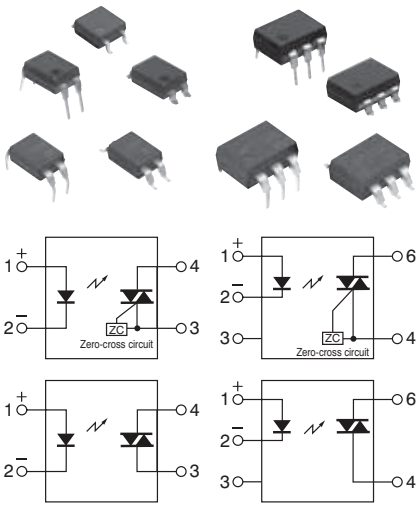
Please use this chart when selecting the SSR load. The values presented are for ambient temperatures of 40°C 104°F (30°C 86°F) and lower. When selected, please measure the load current waveform and use within the range of each surge current characteristic.

Load voltage	Product	Max. load current	Type of load						Remarks
			Heater	Solenoid bulb	Single-phase motor	Triple-phase motor	Lamp	Trans-former	
110 V AC	AQC (Output module) AQG (1A type)	1A	0.8A	0.5A	7W	—	0.5A	50W	
	AQ8 (2A type) I/O (Output module) AQG (2A type)	2A	1.6A	1A	15W	—	1A	100W	
	AQF (2A type)	2A	1.6A	1A	30W	—	1A	100W	
	AQF (3A type) AQ8 (3A type) AQ1 (3A type)	3A	2.4A	1.5A	60W	—	1.5A	150W	
	AQ1 (10A type) AQJ (10A type)	10A	8A	5A	200W	—	5A	500W	Heat sink AQP-HS-SJ10A (AQJ type) Heat sink AQP-HS-J10A, AQP-HS-SJ20A Heat sink AQ-HS-5A (AQ1 type)
	AQA (15A type) AQK (15A type) AQJ (15A type)	15A	12A	7.5A	300W	—	7.5A	750W	Heat sink AQP-HS-J10A, AQP-HS-SJ20A Heat sink AQP-HS-J10A (AQ-J type) (except AQ-K type)
	AQK (25A type) AQA (25A type) AQJ (25A type)	25A	20A	12.5A	500W	—	12.5A	1.25kW	Heat sink AQP-HS-30/40A (AQ-A type) Heat sink AQP-HS-J25A (AQ-J type)
	AQA (40A type)	40A	32A	20A	750W	—	20A	2kW	Heat sink AQP-HS-J25A (AQ-A type)
220 V AC	AQC (Output module) AQG (1A type)	1A	0.8A	0.5A	15W	50W	0.5A	100W	
	AQ8 (2A type) I/O (Output module) AQG (2A type)	2A	1.6A	1A	35W	100W	1A	200W	
	AQF (2A type)	2A	1.6A	1A	75W	200W	1A	200W	
	AQF (3A type) AQ8 (3A type) AQ1 (3A type)	3A	2.4A	1.5A	100W	300W	1.5A	300W	
	AQ1 (10A type) AQJ (10A type)	10A	8A	5A	400W	1kW	5A	1kW	Heat sink AQP-HS-SJ10A (AQJ type) Heat sink AQP-HS-J10A, AQP-HS-SJ20A Heat sink AQ-HS-5A (AQ1 type)
	AQK (15A type) AQA (15A type) AQJ (15A type)	15A	12A	7.5A	600W	1.5kW	7.5A	1.5kW	Heat sink AQP-HS-J10A, AQP-HS-SJ20A Heat sink AQP-HS-J10A (AQ-J type) (except AQ-K type)
	AQK (25A type) AQA (25A type) AQJ (25A type)	25A	20A	12.5A	1kW	2.5kW	12.5A	2.5kW	Heat sink AQP-HS-30/40A (AQ-A type) Heat sink AQP-HS-J25A (AQ-J type)
	AQA (40A type)	40A	32A	20A	1.5kW	3.7kW	20A	4kW	Heat sink AQP-HS-J25A (AQ-A type)
48 V DC	AQC (Output module)	1A	0.8A	0.5A	—	—	0.5A	—	
	AQ1 (2A type) I/O (Output module) AQF (2A type)	2A	1.6A	1.0A	—	—	1.0A	—	
	AQF (3A type)	3A	2.4A	1.5A	—	—	1.5A	—	
100 V DC	AQ1 (1A type) I/O (Output module)	1A	0.8A	0.5A	—	—	0.5A	—	

Panasonic
ideas for life

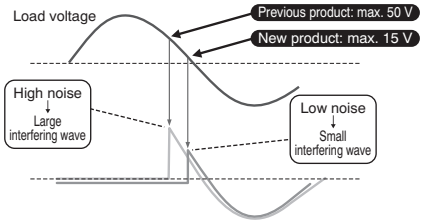
Phototriac Coupler with various options for external Triac control

Phototriac Coupler (APT1)



FEATURES

1. Low zero-cross voltage (max. 15 V) type added to lineup. Approximately 1/3 of previous product
Helps reduce device noises even further.



2. Two types available: Random type and zero-cross type
3. Many package sizes available. (Wide terminal type with 10.16 mm pitch between I/O terminals available.)
4. High dielectric strength. (Between input and output: SOP 3, 750 V; DIP 5,000 V)
5. Handles both 100 and 200 V AC loads
This relay handles both voltages in a single product it is not necessary for users that use both types to manage separate part numbers.
6. Terminal 5 of the DIP 6-pin type is completely molded.

TYPICAL APPLICATIONS

1. For triac driver in heater controls of products such as office equipment, home appliances, and industrial machines. (For 100V/200V, 50/60 Hz lines)
2. Triac driver for SSRs

Solid State

TYPES

1. SOP4 Type

Type	Output rating		Type	Package size	Part No.			Packing quantity	
	Repetitive peak OFF-state voltage	ON-state RMS current			Tube packing style	Tape and reel packing style		Tube	Tape and reel
AC type	600 V	50 mA	Zero-cross (max. 50 V)	SOP4pin	APT1211S	APT1211SX (Picked from the 1/2-pin side)	APT1211SZ (Picked from the 3/4-pin side)	1 tube contains: 100 pcs. 1 batch contains: 2, 000 pcs.	1, 000 pcs.
			Zero-cross (max. 15 V)		APT1231S	APT1231SX (Picked from the 1/2-pin side)	APT1231SZ (Picked from the 3/4-pin side)		
			Random		APT1221S	APT1221SX (Picked from the 1/2-pin side)	APT1221SZ (Picked from the 3/4-pin side)		

Note: For space reasons, the initial letters of the product number “APT” and “S” are omitted on the product seal.
The package type indicator “X” and “Z” are omitted from the seal. (Ex. the label for product number APT1221SZ is 1221).

2. DIP4/6 Type

Type	Output rating		Type	Package size	Part No.				Packing quantity	
	Repetitive peak OFF-state voltage	ON-state RMS current			Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
AC type	600 V	100 mA	Zero-cross (max. 50 V)	DIP4pin	APT1211	APT1211A	APT1211AX (Picked from the 1/2-pin side)	APT1211AZ (Picked from the 3/4-pin side)	[DIP4pin] 1 tube contains: 100 pcs. 1 batch contains: 1,000 pcs. [DIP6pin] 1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	[DIP4pin] [DIP6pin] 1,000 pcs.
			Zero-cross (max. 15 V)		APT1231	APT1231A	APT1231AX (Picked from the 1/2-pin side)	APT1231AZ (Picked from the 3/4-pin side)		
			Random		APT1221	APT1221A	APT1221AX (Picked from the 1/2-pin side)	APT1221AZ (Picked from the 3/4-pin side)		
			Zero-cross (max. 50 V)	DIP6pin	APT1212	APT1212A	APT1212AX (Picked from the 1/2/3-pin side)	APT1212AZ (Picked from the 4/6-pin side)		
			Zero-cross (max. 15 V)		APT1232	APT1232A	APT1232AX (Picked from the 1/2/3-pin side)	APT1232AZ (Picked from the 4/6-pin side)		
			Random		APT1222	APT1222A	APT1222AX (Picked from the 1/2/3-pin side)	APT1222AZ (Picked from the 4/6-pin side)		

Note: For space reasons the initial letters “APT” of the product number for the DIP 4-pin type, the letter “A”, which indicates the SMD terminal shape for the DIP 4-pin and 6-pin types, and the package type indications “X” and “Z” have been omitted from the product label. (Example: The label for product number APT1221AZ is 1221.)

3. DIP4/6 Wide Terminal Type

Type	Output rating*		Type	Package size	Part No.				Packing quantity	
	Repetitive peak OFF-state voltage	ON-state RMS current			Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
AC type	600 V	100 mA	Zero-cross (max. 50 V)	DIP4pin	APT1211W	APT1211WA	APT1211WAY (Picked from the 1/4-pin side)	APT1211WAW (Picked from the 2/3-pin side)	[DIP4pin] 1 tube contains: 100 pcs. 1 batch contains: 1,000 pcs. [DIP6pin] 1 tube contains: 50 pcs. 1 batch contains: 500 pcs.	[DIP4pin] [DIP6pin] 1,000 pcs.
			Zero-cross (max. 15 V)		APT1231W	APT1231WA	APT1231WAY (Picked from the 1/4-pin side)	APT1231WAW (Picked from the 2/3-pin side)		
			Random		APT1221W	APT1221WA	APT1221WAY (Picked from the 1/4-pin side)	APT1221WAW (Picked from the 2/3-pin side)		
			Zero-cross (max. 50 V)	DIP6pin	APT1212W	APT1212WA	APT1212WAY (Picked from the 1/6-pin side)	APT1212WAW (Picked from the 3/4-pin side)		
			Zero-cross (max. 15 V)		APT1232W	APT1232WA	APT1232WAY (Picked from the 1/6-pin side)	APT1232WAW (Picked from the 3/4-pin side)		
			Random		APT1222W	APT1222WA	APT1222WAY (Picked from the 1/6-pin side)	APT1222WAW (Picked from the 3/4-pin side)		

Note: For space reasons the initial letters “APT” of the product number for the DIP 4-pin type, the letter “WA”, which indicates the SMD terminal shape for the DIP 4-pin and 6-pin types, and the package type indications “Y” and “W” have been omitted from the product label. (Example: The label for product number APT1221WAY is 1221.)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

1) SOP4 types

Item			Symbol	APT1211S, APT1221S, APT1231S	Remarks
Input	LED forward current		I_F	50 mA	
	LED reverse voltage		V_R	6 V	
	Peak forward current		I_{FP}	1 A	f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage		V_{DRM}	600 V	
	ON-state RMS current*		$I_{T(RMS)}$	0.05 A	AC
	Non-repetitive surge current		I_{TSM}	0.6 A	In one cycle at 60Hz
Total power dissipation			P_T	350 mW	
I/O isolation voltage			V_{iso}	3,750 V AC	
Temperature limits		Operating	T_{opr}	–40°C to +100°C –40°F to +212°F	Non-condensing at low temperatures
		Storage	T_{stg}	–40°C to +125°C –40°F to +257°F	

Note: “X” and “Z” at the end of the part numbers have been omitted.

2) DIP4/6 type and DIP4/6 Wide terminal type

Item		Symbol	APT1211(W)	APT1221(W)	APT1231(W)	APT1212(W)	APT1222(W)	APT1232(W)	Remarks
Input	LED forward current	I_F	50 mA						
	LED reverse voltage	V_R	6 V						
	Peak forward current	I_{FP}	1 A						f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V						
	ON-state RMS current*	$I_{T(RMS)}$	0.1 A						AC
	Non-repetitive surge current	I_{TSM}	1.2 A						In one cycle at 60Hz
Total power dissipation		P_T	500 mW						
I/O isolation voltage		V_{iso}	5,000 V AC						
Temperature limits	Operating	T_{opr}	–40°C to +100°C –40°F to +212°F						Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +125°C –40°F to +257°F						

Note: “A”, “AX”, “AZ” “AY” and “AW” at the end of the part numbers have been omitted.
* Do not exceed 0.05 A of ON state RMS current in case of following load voltage condition.
DIP4pin (APT1211, APT1221, APT1231) and DIP4pin wide terminal type (APT1211W, APT1221W, APT1231W): more than 100 V AC;
DIP6pin (APT1212, APT1222, APT1232) and DIP6pin wide terminal type (APT1212W, APT1222W, APT1232W): more than 120 V AC.

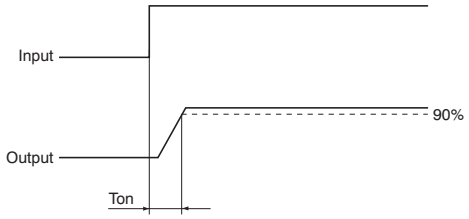
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

1) Zero-cross voltage type (max. 50V) and random type

Item			Symbol	APT1211S, APT1211(W), APT1212(W)	APT1221S, APT1221(W), APT1222(W)	Condition
Input	LED dropout voltage	Typical	V_F	1.21 V		I_F = 20 mA
		Maximum		1.3 V		
	LED reverse current	Typical	I_R	—		V_R = 6 V
		Maximum		10 μA		
Output	Repetitive peak OFF-state current	Typical	I_{DRM}	—		I_F = 0 mA, V_{DRM} = 600 V
		Maximum		1 μA		
	Repetitive peak On-state voltage	Typical	V_{TM}	1.3 V		I_F = 10 mA, I_{TM} = 0.05 A
		Maximum		2.5 V		
	Holding current	Typical	I_H	0.3 mA		
		Maximum		3.5 mA		
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	500 V/μs		V_{DRM} = 600 V ×1/√2
Transfer characteristics	Trigger LED current	Maximum	I_{FT}	10 mA		V_D = 6 V, R_L = 100 Ω
	Zero-cross voltage	Maximum	V_{ZC}	50 V	—	I_F = 10 mA
	Turn on time*	Maximum	T_{on}	100 μs		I_F = 20 mA, V_D = 6 V, R_L = 100 Ω
	I/O capacitance	Maximum	C_{iso}	1.5 pF		f = 1 MHz, V_B = 0 V
	I/O resistance	Minimum	R_{iso}	50 GΩ		500 V DC

Notes: 1. For type of connection, see page 334.
2. Terminals are either solder plated or solder dipped.

***Turn on time**

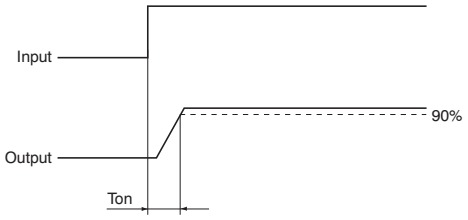


2) Zero-cross voltage type (max. 15V)

Item			Symbol	APT1231S, APT1231(W), APT1232(W)	Condition
Input	LED dropout voltage	Typical	V_F	1.21 V	I_F = 20 mA
		Maximum		1.3 V	
	LED reverse current	Typical	I_R	—	V_R = 6 V
		Maximum		10 μA	
Output	Repetitive peak OFF-state current	Typical	I_{DRM}	—	I_F = 0 mA, V_{DRM} = 600 V
		Maximum		1 μA	
	Repetitive peak On-state voltage	Typical	V_{TM}	1.2 V	I_F = 10 mA, I_{TM} = 0.03 A
		Maximum		2 V	
	Holding current	Typical	I_H	0.3 mA	
		Maximum		3.5 mA	
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	500 V/μs	V_{DRM} = 600 V ×1/√2
Transfer characteristics	Trigger LED current	Maximum	I_{FT}	10 mA	I_{DRM} = 30 mA
	Zero-cross voltage	Maximum	V_{ZC}	15 V	I_F = 10 mA
	Turn on time*	Maximum	T_{on}	100 μs	I_F = 20 mA, I_{DRM} = 30 mA
	I/O capacitance	Maximum	C_{iso}	1.5 pF	f = 1 MHz, V_B = 0 V
	I/O resistance	Minimum	R_{iso}	50 GΩ	500 V DC

Notes: 1. For type of connection, see page 334.
2. Terminals are either solder plated or solder dipped.

***Turn on time**



RECOMMENDED OPERATING CONDITIONS

Please follow the conditions below in order to ensure accurate operation and release of the phototriac coupler.

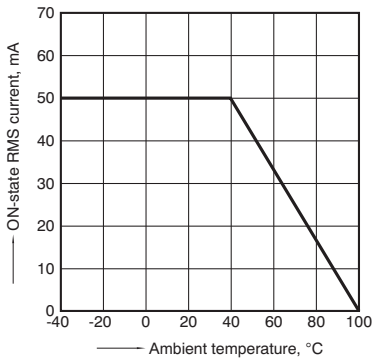
Item	Symbol	Value	Unit
Input LED current	I_F	20	mA

REFERENCE DATA

1-(1). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

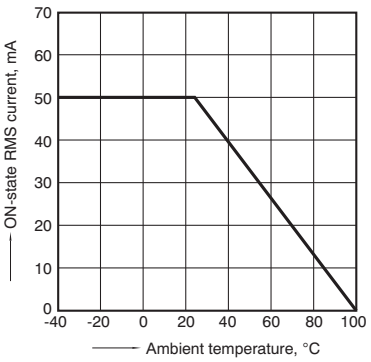
Tested sample: APT1211S, APT1221S



1-(2). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

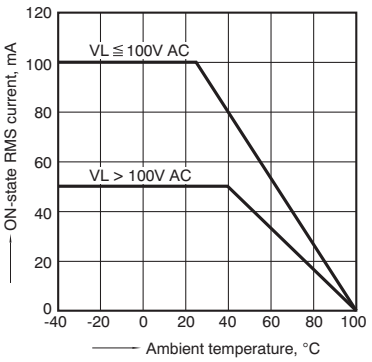
Tested sample: APT1231S



1-(3). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

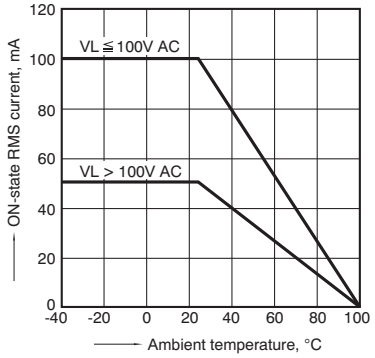
Tested sample: APT1211(A), APT1221(A), APT1211W(A), APT1221W(A)



1-(4). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

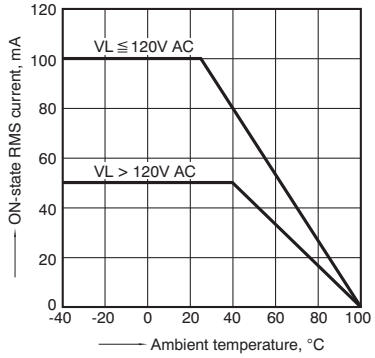
Tested sample: APT1231(A), APT1231W(A)



1-(5). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

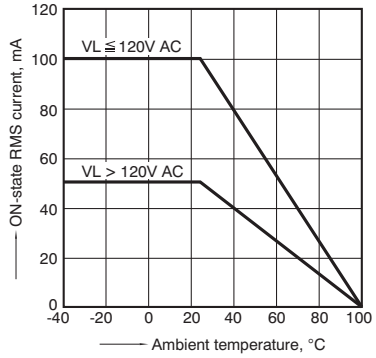
Tested sample: APT1212(A), APT1222(A), APT1212W(A), APT1222W(A)



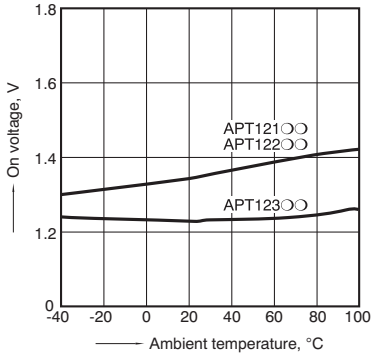
1-(6). ON-state RMS current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

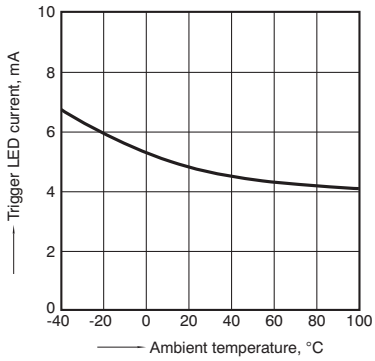
Tested sample: APT1232(A), APT1232W(A)



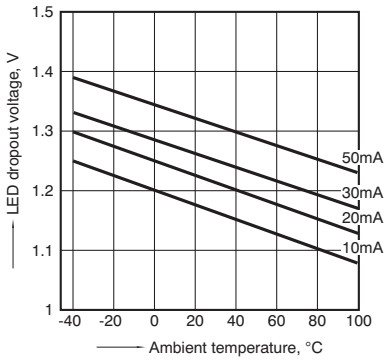
2. On voltage vs. ambient temperature characteristics



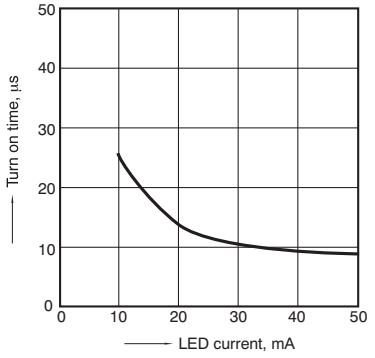
3. Trigger LED current vs. ambient temperature characteristics



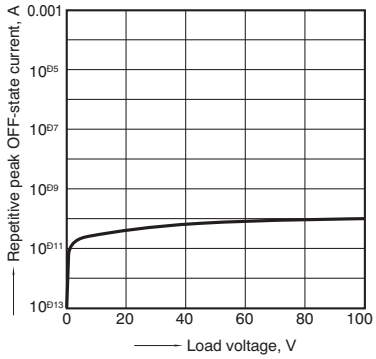
4. LED dropout voltage vs. ambient temperature characteristics



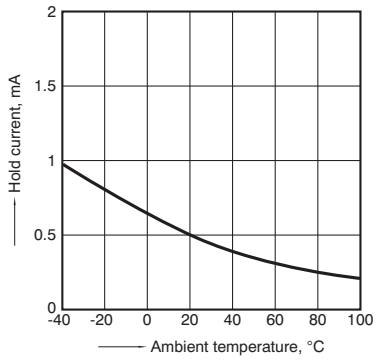
5. Turn on time vs. LED current



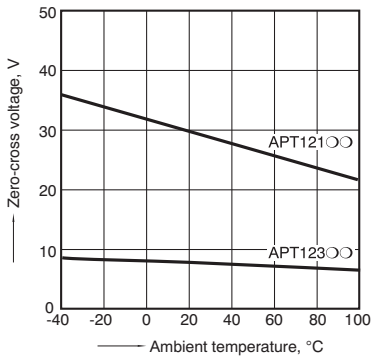
6. Repetitive peak OFF-state current vs. Load voltage characteristics



7. Hold current vs. ambient temperature characteristics



8. Zero-cross voltage vs. ambient temperature characteristics



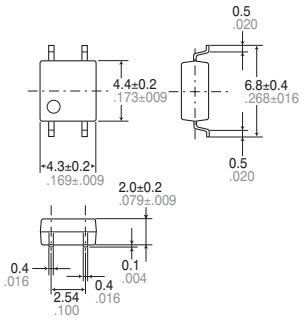
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. SOP Type

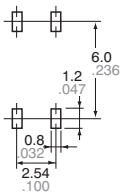
APT1211S, APT1221S, APT1231S

CAD Data



Terminal thickness = 0.15 .006
General tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)

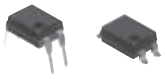


Tolerance: ±0.1 ±.004

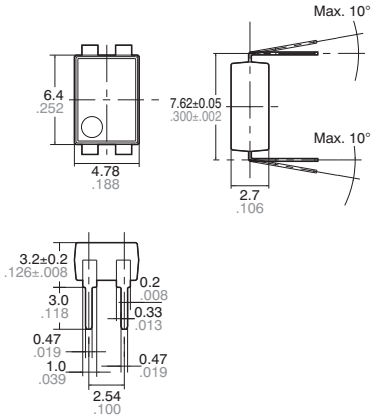
2. DIP4 Type

APT1211(A), APT1221(A), APT1231(A)

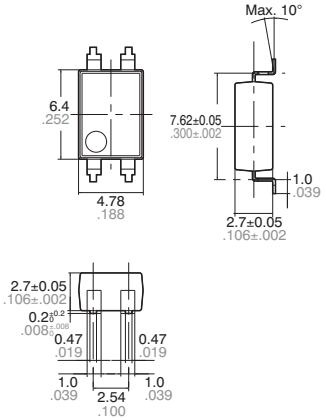
CAD Data



Through hole terminal type

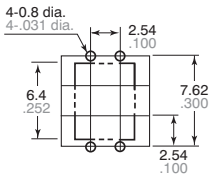


Surface mount terminal type



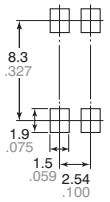
Terminal thickness = 0.2 .008
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)



Tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)



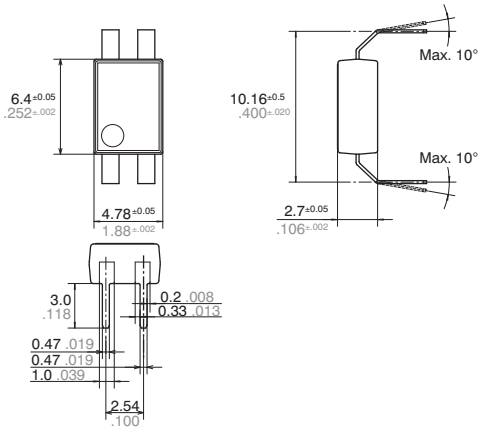
Tolerance: ±0.1 ±.004

3. DIP4 Wide Terminal Type

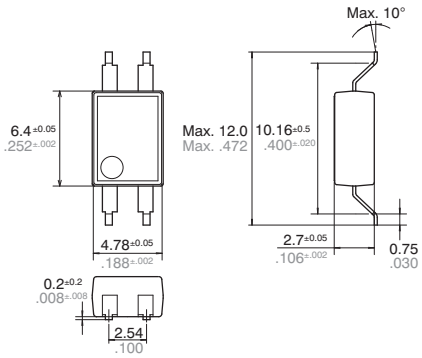
APT1211W(A), APT1221W(A), APT1231W(A)

CAD Data

Through hole terminal type

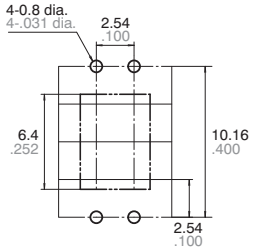


Surface mount terminal type



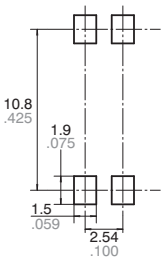
Terminal thickness = 0.20 .008
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)



Tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)

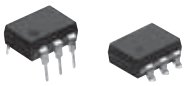


Tolerance: ±0.1 ±.004

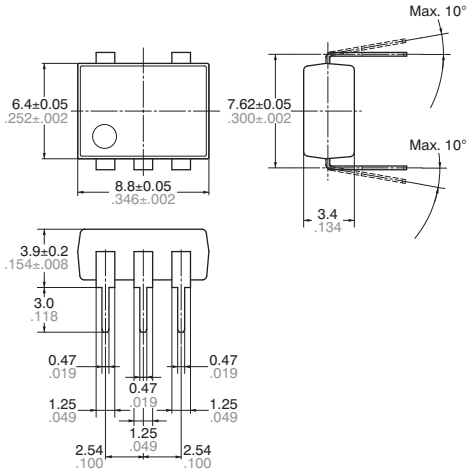
4. DIP6 Type

APT1212(A), APT1222(A), APT1232(A)

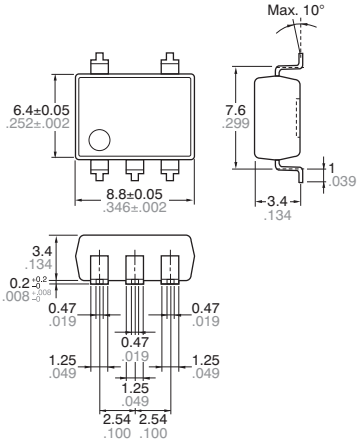
CAD Data



Through hole terminal type

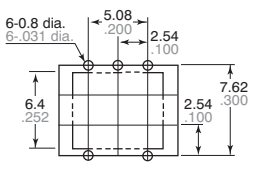


Surface mount terminal type



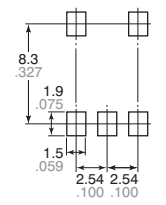
Terminal thickness = 0.25 .010
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)



Tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)

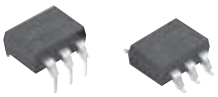


Tolerance: ±0.1 ±.004

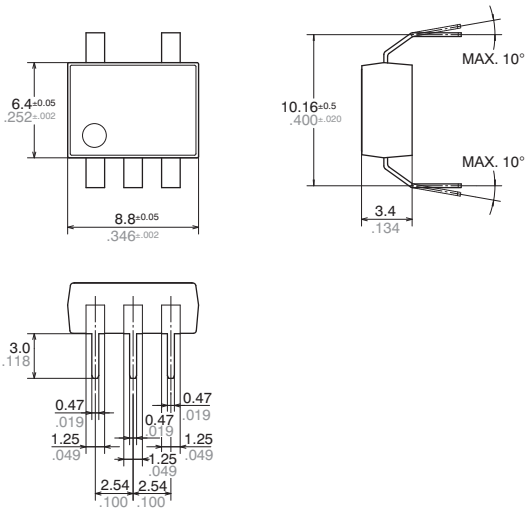
5. DIP6 Wide Terminal Type

APT1212W(A), APT1222W(A), APT1232W(A)

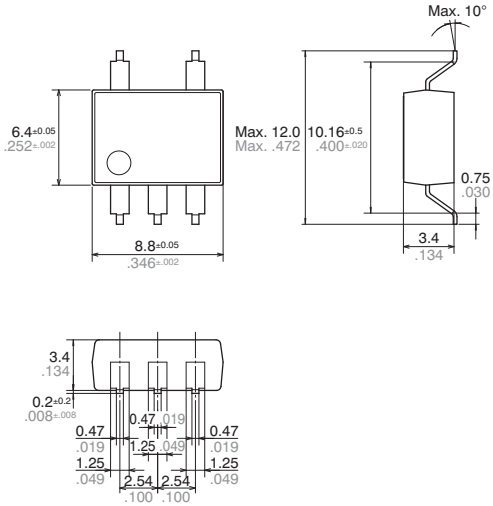
CAD Data



Through hole terminal type

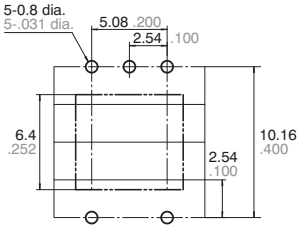


Surface mount terminal type



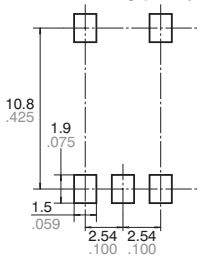
Terminal thickness = 0.25 .010
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)



Tolerance: ±0.1 ±.004

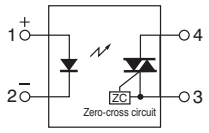
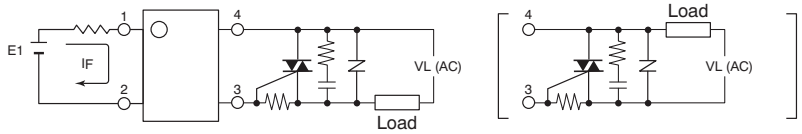
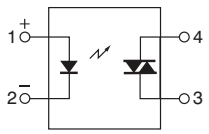
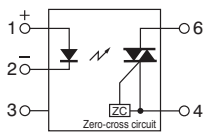
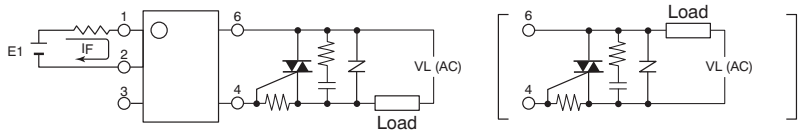
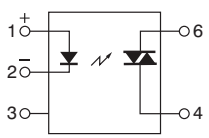
Recommended mounting pad (TOP VIEW)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

Notes: E_1: Power source at input side; I_F: LED forward current; V_L: Load voltage; I_L: Load current;

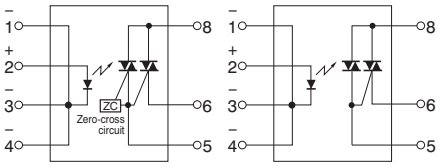
Schematic	Output configuration	Load	Wiring diagram
	1 Form A	AC	
			
			
			

For Cautions for Use, see Page 315.

Panasonic
ideas for life

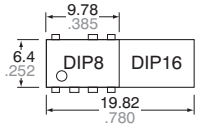
0.3A to 1.2A compact DIP type

AQ-H RELAYS



FEATURES

1. Compact DIP type SSR that's ideal for AC load control
2. Supports 0.3 A, 0.6 A, 0.9 A and 1.2 A ON-state RMS currents.
3. The 1.2 A type saves space with a DIP 8-pin package.



4. Handles both 100 and 200 V AC loads
This relay handles both voltages in a single product. It is not necessary for users that use both types to manage separate part numbers.
5. High dielectric strength: 5,000 V AC (between input and output)
6. Two types available: Zero-cross type and Random type

TYPICAL APPLICATIONS

1. Home appliances (air conditioner, microwave oven, washing machine, personal hygiene system, refrigerator, fan heater, inductive heating cooker, rice cooker and humidifier, etc.)
2. Industrial equipment

Solid State

TYPES

Type	Output rating*		Type	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Repetitive peak OFF-state voltage	ON-state RMS current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/8-pin side		
AC type	600 V	0.3 A	Zero-cross	AQH0213	AQH0213A	AQH0213AX	AQH0213AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		0.6 A		AQH1213	AQH1213A	AQH1213AX	AQH1213AZ		
		0.9 A		AQH2213	AQH2213A	AQH2213AX	AQH2213AZ		
		1.2 A		AQH3213	AQH3213A	AQH3213AX	AQH3213AZ		
		0.3 A	Random	AQH0223	AQH0223A	AQH0223AX	AQH0223AZ		
		0.6 A		AQH1223	AQH1223A	AQH1223AX	AQH1223AZ		
		0.9 A		AQH2223	AQH2223A	AQH2223AX	AQH2223AZ		
		1.2 A		AQH3223	AQH3223A	AQH3223AX	AQH3223AZ		

*Indicate the repetitive peak OFF-state voltage and ON-state RMS current: peak AC.
Note: For space reasons, the SMD terminal shape indicator "A" and the package type indicator "X" and "Z" are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQH0213, AQH0223	AQH1213, AQH1223	AQH2213, AQH2223	AQH3213, AQH3223	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	6 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V				
	ON-state RMS current	$I_{T(RMS)}$	0.3 A	0.6 A	0.9 A	1.2 A	
	Non-repetitive surge current	I_{TSM}	3 A	6 A	9 A	12 A	60Hz, 1 cycle
I/O isolation voltage		V_{iso}	5,000 V AC				
Temperature limits	Operating	T_{opr}	–30°C to +85°C –22°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +125°C –40°F to +257°F				

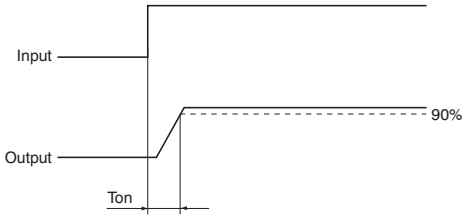
Note: "A", "AX" and "AZ" at the end of the part numbers have been omitted.

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQH0213, AQH1213, AQH2213, AQH3213	AQH0223, AQH1223, AQH2223, AQH3223	Condition
Input	LED dropout voltage	Typical	V_F	1.21 V		I_F = 20 mA
		Maximum		1.3 V		
	LED reverse current	Typical	I_R	—		V_R = 6 V
		Maximum		10 μA		
Output	Peak OFF-state current	Typical	I_{DRM}	—		I_F = 0 mA V_{DRM} = 600 V
		Maximum		100 μA		
	Peak ON-state voltage	Typical	V_{TM}	—		I_F = 10 mA I_{TM} = Max.
		Maximum		2.5 V		
	Holding current	Typical	I_H	—		
		Maximum		25 mA		
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	200 V/μs		V_{DRM} = 600 V ×1/M2
Transfer characteristics	Trigger LED current	Maximum	I_{FT}	10 mA		V_D = 6 V R_L = 100 Ω
	Zero-cross voltage	Maximum	V_{ZC}	50 V	—	I_F = 10 mA
	Turn on time*	Maximum	T_{ON}	100 μs		I_F = 20 mA V_D = 6 V R_L = 100 Ω
	I/O isolation resistance	Minimum	R_{iso}	50 GΩ		500 V DC

Notes: 1. For type of connection, see page 337.
2. "A", "AX" and "AZ" at the end of the part numbers have been omitted.

*Turn on time



RECOMMENDED OPERATING CONDITIONS

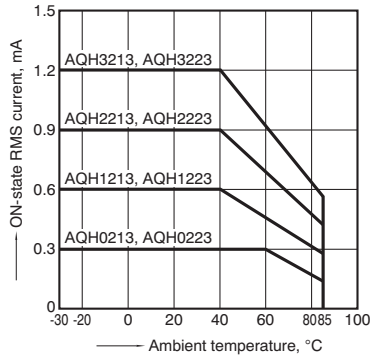
Please follow the conditions below in order to ensure accurate operation and release of the phototriac coupler.

Item	Symbol	Value	Unit
Input LED current	I_F	20	mA

REFERENCE DATA

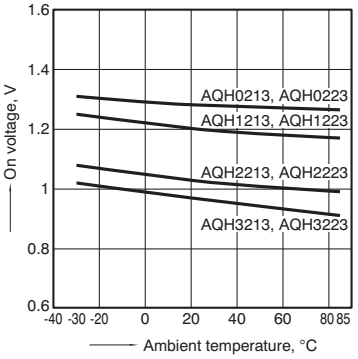
1. ON-state RMS current vs. Ambient temperature characteristics

Allowable ambient temperature:
–30°C to +85°C –22°F to +185°F



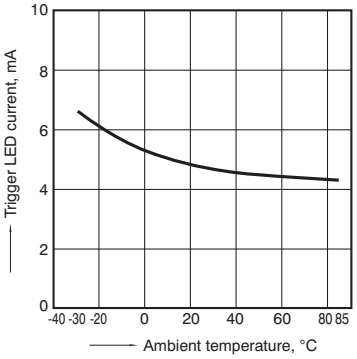
2. On voltage vs. Ambient temperature characteristics

LED current: 10 mA; ON current: Max.
Measured portion: between terminals 6 and 8



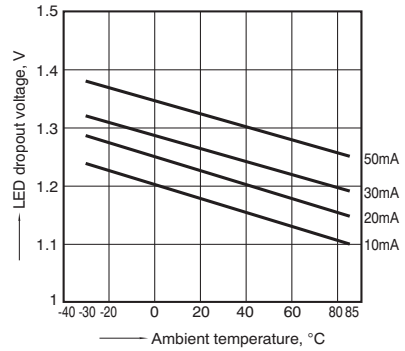
3. Trigger LED current vs. Ambient temperature characteristics

Load voltage: 6 V DC;
Load resistance: 100Ω



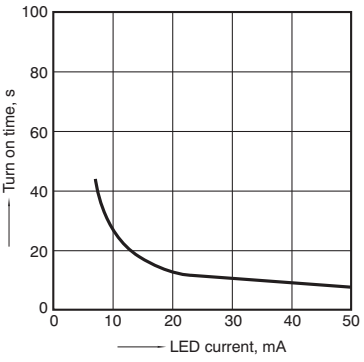
4. LED dropout voltage vs. Ambient temperature characteristics

LED current: 10 to 50 mA



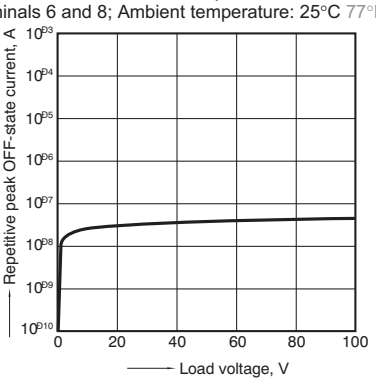
5. Turn on time vs. LED current characteristics

Load voltage: 6 V DC; Load resistance: 100Ω
Measured portion: between terminals 6 and 8

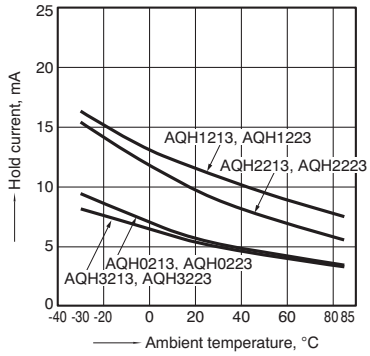


6. Repetitive peak OFF-state current vs. Load voltage characteristics

LED current: 0 mA; Measured portion: between terminals 6 and 8; Ambient temperature: 25°C 77°F

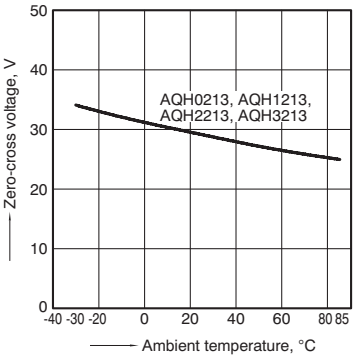


7. Hold current vs. Ambient temperature characteristics



8. Zero-cross voltage vs. Ambient temperature characteristics

LED current: 10 mA

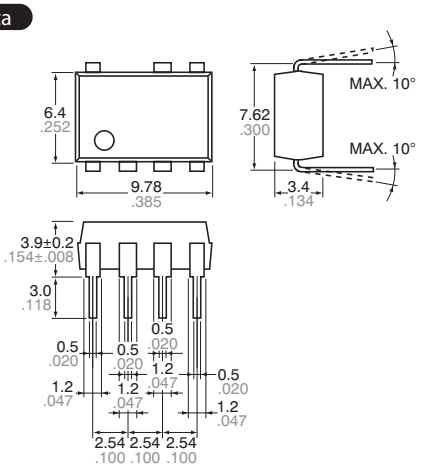


DIMENSIONS (mm inch)

Download CAD Data from our Web site.

Through hole terminal type

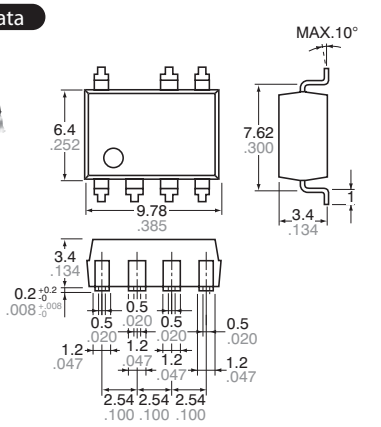
CAD Data



Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

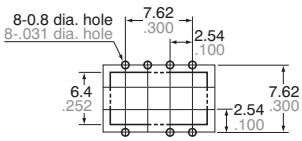
Surface mount terminal type

CAD Data



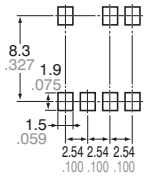
Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004
PC board pattern

(BOTTOM VIEW)



Tolerance: ±0.1 ±.004

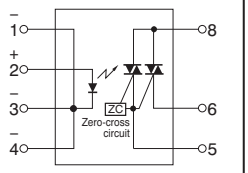
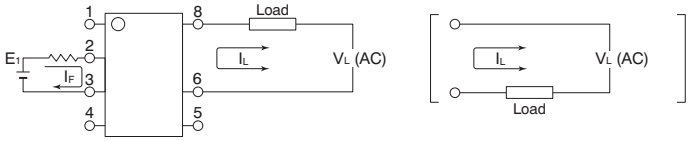
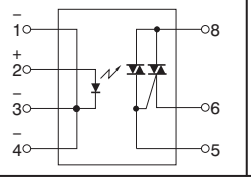
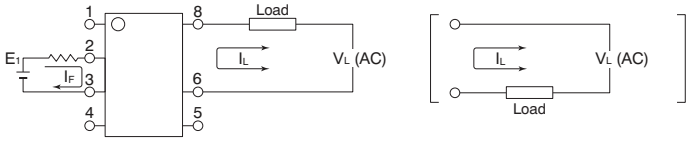
Recommended mounting pad
(TOP VIEW)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

Notes: E_1: Power source at input side; I_F: Trigger LED forward current; V_L: Load voltage; I_L: Load current;

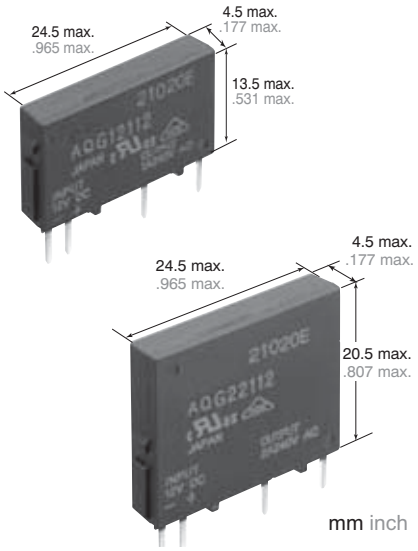
Schematic	Output configuration	Load	Wiring diagram
	1a	AC	
			

For Cautions for Use, see Page 315.

Panasonic
ideas for life

1A and 2A space saving PC board terminal type

AQ-G RELAYS



mm inch

FEATURES

1. Space saving, Vertical size with a maximum thickness of 4.5 mm.
Mounting space has been reduced to 30% (compared to conventional SSR's) while meeting high density PC board mounting requirements.

2. 1A and 2A load types available

3. Zero-cross type and Non zero-cross type available

4. High dielectric strength of 3,000V AC
(between input and output)

5. Snubber circuit integrated
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of voltage on the output side, such as inductive load and current.

TYPES

Type	Load current	Load voltage	Input voltage	Part No.
Zero-cross	1A	75 to 264 V AC	5 V DC	AQG12105
			12 V DC	AQG12112
			24 V DC	AQG12124
	2A	75 to 264 V AC	5 V DC	AQG22105
			12 V DC	AQG22112
			24 V DC	AQG22124
Non zero-cross	1A	75 to 264 V AC	5 V DC	AQG12205
			12 V DC	AQG12212
			24 V DC	AQG12224
	2A	75 to 264 V AC	5 V DC	AQG22205
			12 V DC	AQG22212
			24 V DC	AQG22224

TYPICAL APPLICATIONS

- **Manufacturing equipment**
  - NC machines
  - Injection molders
  - Robots
- **Air conditioners**
- **Computers**

ORDERING INFORMATION

Ex. AQG | 1 | 2 | 1 | 0 | 5 |

Load current	Load voltage	Type	Input voltage
1: 1 A 2: 2 A	2: 75 to 264 V AC	1: Zero-cross (3,000 V) 2: Non zero-cross (3,000 V)	05: 5 V DC 12: 12 V DC 24: 24 V DC

(Note) Standard packing: Carton 20 pcs., Case 500 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

1) Zero-cross type

Item	Type	Part No.						Remarks
		AQG12105	AQG12112	AQG12124	AQG22105	AQG22112	AQG22124	
Input side	Input voltage	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	
	Input impedance	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	
	Drop-out voltage, min.	1 V						
	Reverse voltage	3 V						
Load side	Max. load current	1 A AC			2 A AC			
	Load voltage	75 to 264 V AC						
	Frequency	45 to 65 Hz						
	Non-repetitive surge current	8 A			30 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current	1.5 mA (applied 200 V)						
	Max. “ON-state” voltage drop	1.6 V						at Max. carrying current
	Min. load current	20 mA						

2) Non zero-cross type

Item	Type	Part No.						Remarks
		AQG12205	AQG12212	AQG12224	AQG22205	AQG22212	AQG22224	
Input side	Input voltage	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	
	Input impedance	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	
	Drop-out voltage, min.	1 V						
	Reverse voltage	3 V						
Load side	Max. load current	1 A AC			2 A AC			
	Load voltage	75 to 264 V AC						
	Frequency	45 to 65 Hz						
	Non-repetitive surge current	8 A			30 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current	1.5 mA (applied 200 V)						
	Max. “ON-state” voltage drop	1.6 V						at Max. carrying current
	Min. load current	20 mA						

2. Characteristics (at 20°C 68°F, Input voltage ripple: 1% or less)

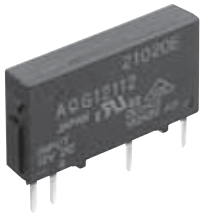
Item	Zero-cross type	Non zero-cross type	Remarks
Operate time max.	(1/2 cycle of voltage sine wave) + 1 ms	1 ms	
Release time, max.	(1/2 cycle of voltage sine wave) + 1 ms		
Insulation resistance, min.	10^9 Ω between input and output		Using 500 V DC megger
Breakdown voltage	3,000 Vrms between input and output		Initial for 1 min.
Vibration resistance	10 to 55 Hz double amplitude of 0.75 mm		X, Y, Z axes
Shock resistance	1,000 m/s^2		X, Y, Z axes
Ambient temperature	–30°C to +80°C –22°F to +176°F		Non-condensing at low temperatures
Storage temperature	–30°C to +100°C –22°F to +212°F		
Operational method	Zero-cross (Turn-ON and Turn-OFF)	Non zero-cross turn ON, Zero-cross turn OFF	

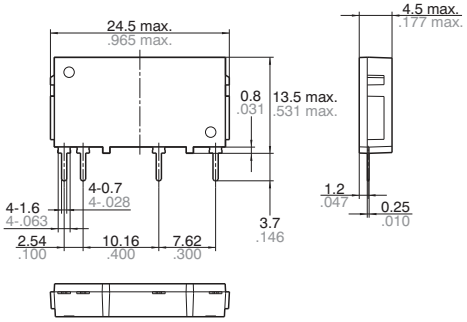
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. 1A type

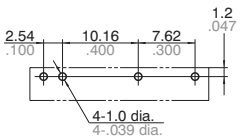
CAD Data





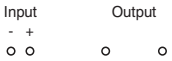
General tolerance: ±0.2 ±.008

PC board pattern (Bottom view)



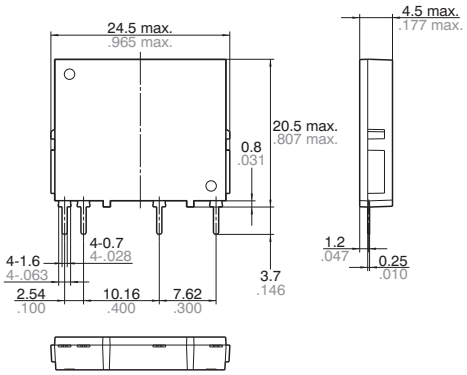
Tolerance: ±0.1 ±.004

Schematic
AC type



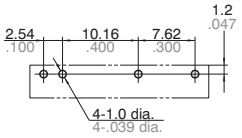
2. 2A type

CAD Data



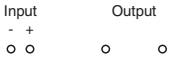
General tolerance: ±0.2 ±.008

PC board pattern (Bottom view)



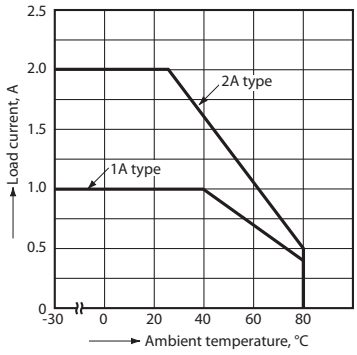
Tolerance: ±0.1 ±.004

Schematic
AC type

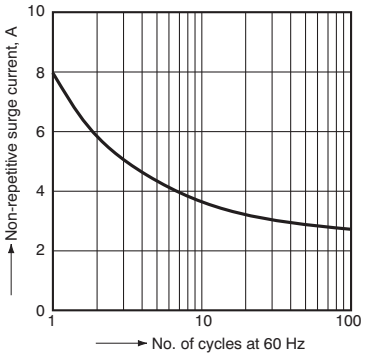


REFERENCE DATA

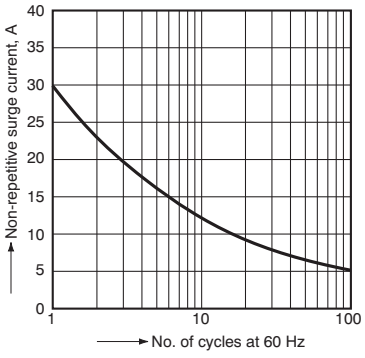
1. Load current vs. ambient temperature



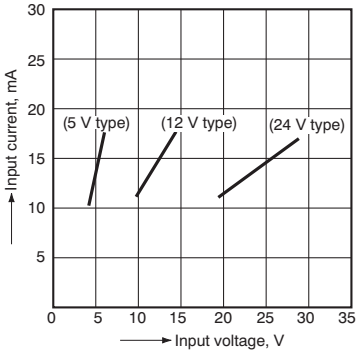
2-(1) Non-repetitive surge current vs. carrying time
(1A type)



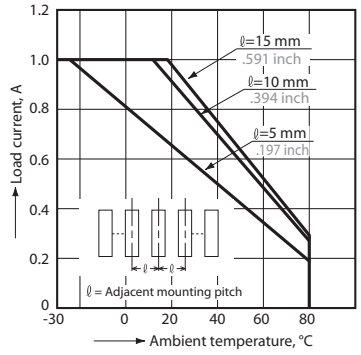
2.-(2) Non-repetitive surge current vs. carrying time
(2A type)



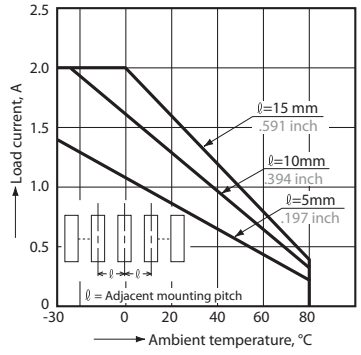
3. Input current vs. input voltage characteristics



4-(1) Load current vs. ambient temperature characteristics for adjacent mounting
(1A type)



4.-(2) Load current vs. ambient temperature characteristics for adjacent mounting
(2A type)

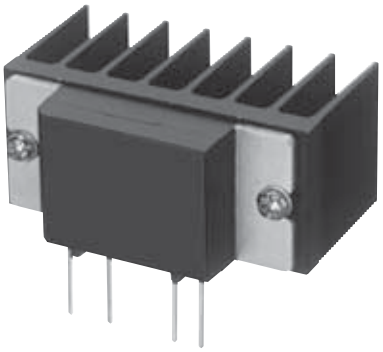


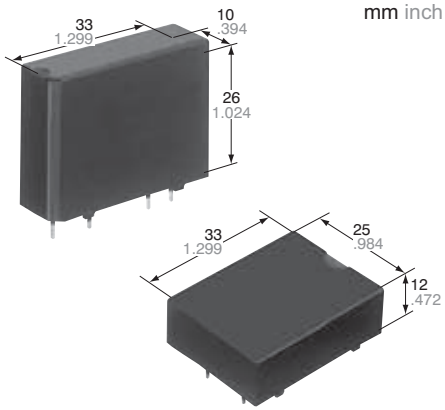
For Cautions for Use, see Page 319.

Panasonic
ideas for life

High capacity up to 10A PC board terminal type

AQ1 RELAYS





FEATURES

1. 10A high-capacity realized for PC board terminal (with heat sink)
SSR for compact PC boards with 10 A capacity that is two times greater than our previous model. It is suitable for long-life, highly frequent control.

2. VDE (EN60950-1) reinforced insulation compliant
Fully satisfies demand for safety by guaranteeing compliance with EN60950-1 safety standard and featuring 3,000 V reinforced insulation (AQ3A2-ZT4/32VDC, AQ3A2-J-ZT4/32VDC and AQ10A2-ZT4/32VDC).

3. Superior anti-vibration and anti-shock characteristics
The body is molded as a single unit with flame resistant resin which makes it highly resistant against vibration and shock, and gives it superior protection from environment. The body can also be washed.

4. Vertical types with SIL terminal arrangement and flat types are available.
1) The vertical type is available in thicknesses of 10 mm (2 A and 3 A types) and 12 mm (5 A and 10 A types). Terminal arrangement is SIL in integral multiples of 2.54 mm (0.1 inch).
2) The height of the flat type is 12 mm. The terminal arrangement is DIL in integral multiples of 2.54 mm.

5. Reduced noise generation
The load will operate at close to zero voltage even when the input signal is applied during a cycle. Also, even if an input signal is cancelled during a cycle, the load is cut off at close to zero current. For this reason, hardly any noise is produced and radio frequency interference (RFI) and electromagnetic interference (EMI) are kept to a minimum.

6. Built-in Snubber circuit prevents malfunction.

TYPICAL APPLICATIONS

- Printing machines
- Packing machines
- Traffic signal control
- Automatic ticket punchers
- Terminal equipment of data processing
- Computer peripherals
- NC machines

ORDERING INFORMATION

AQ ☐ ☐ - ☐ - ☐ ☐

Load current
1 A, 2 A, 3 A, 5 A, 10 A

Load voltage
2: 75 to 250 V AC
D1: 3 to 60 V DC
D2: 10 to 200 V DC

Shape
Nil: Vertical type
J: Flat type

Nil: DC output
ZT: Zero-cross AC output (Phototriac coupler)

Input voltage
3/28 V DC: 3 to 28 V DC
4/32 V DC: 4 to 32 V DC

* Random types are available upon request.

TYPES

1. AQ1 Solid State Relays

Load	Isolation	Zero-cross function	Type	Input voltage	Load current Load voltage	Part No.
AC	Phototriac coupler	Zero-cross*1	3 A (Vertical)	4 to 32 V DC	3 A, 75 to 250 V AC	AQ3A2-ZT4/32VDC
			3 A (flat)	4 to 32 V DC	3 A, 75 to 250 V AC	AQ3A2-J-ZT4/32VDC
			10 A	4 to 32 V DC	10 A, 75 to 250 V AC (5 A without heat sink)	AQ10A2-ZT4/32VDC
DC	Optically coupled isolation	–	1 A	3 to 28 V DC	1 A, 10 to 200 V DC	AQ1AD2-3/28VDC
			2 A	3 to 28 V DC	2 A, 3 to 60 V DC	AQ2AD1-3/28VDC

Standard packing: Carton 20 pcs., Case 200 pcs.
Note: *1 Non zero-cross type also available. Please inquire.

2. Heat sink for AQ1 solid state relay

Product name	Part No.
Heat sink for AQ10A2-ZT4/32VDC	AQ-HS-5A

Standard packing: Carton 20 pcs., Case 200 pcs.

SPECIFICATIONS

1. Rating (at 20°C 68°F, Ripple factor: less than 1%)

Item	Type	AC output type Zero-cross		DC output type		Remarks
		3 A type	10 A type	1 A type	2 A type	
Input side	Input voltage	4 to 32 V DC		3 to 28 V DC		
	Input impedance	—		Approx. 1.6 kΩ (3 to 28 V DC)		
	Input current, max.	20 mA		—		
	Drop-out voltage, min.	1.0 V		0.8 V		
Load side	Max. load current	3 A	10 A*1	1 A	2 A	Refer to “REFERENCE DATA 1. Load current vs. ambient temperature characteristics”.
	Load voltage	75 to 250 V AC		10 to 200 V DC	3 to 60 V DC	
	Non-repetitive surge current	100 A		5 A (1 s)		AC: In one cycle at 60 Hz, DC: 1s
	Max. “OFF-state” leakage current	5 mA		1 mA		AC: at 200 V, 60Hz DC: When maximum load voltage is applied.
	Max. “ON-state” voltage drop	1.6 V		1.6 V	2.3 V	At Max. carrying current
	Min. load current	50 mA*3		5 mA*3		

Notes: *1 When heat sink (AQ-HS-5A) is installed. The max. load current is 5 A when heat sink is not installed.
*2 When heat sink (AQ-HS-5A) is installed. The max. load current is 3 A when heat sink is not installed.
*3 When load current is below the rating, refer to “Cautions for Use” on page 346.

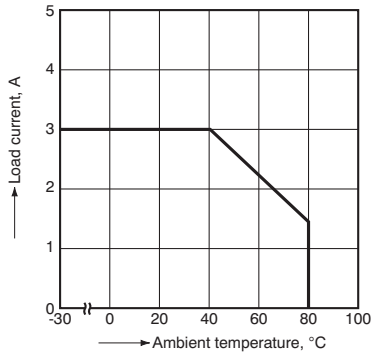
2. Characteristics (at 20°C 68°F, Ripple factor: less than 1%)

Item	Type	AC output Zero-cross		DC output	Remarks
		3 A type	10 A type		
Operate time, Max.		(1/2 cycle of voltage sine wave) + 1 ms		0.5 ms	
Release time, Max.		(1/2 cycle of voltage sine wave) + 1 ms		2 ms	
Insulation resistance, Min.		100 M Ω for input, output and case		100 M Ω for input, output	at 500 V DC
Breakdown voltage		4,000 Vrms between input and output 2,500 Vrms among input, output and case		3,000 Vrms between input-output	For 1 minute
Vibration resistance	Destructive	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm		117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm	1 hour for X, Y, Z axis
	Functional	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm		117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm	10 minutes for X, Y, Z axis
Shock resistance	Destructive	Min. 980 m/s² {100 G}		Min. 980 m/s² {100 G}	5 times each for X, Y, Z axis
	Functional	Min. 980 m/s² {100 G}		Min. 980 m/s² {100 G}	4 times each for X, Y, Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F			
Storage temperature		–30°C to +100°C –22°F to +212°F			
Operational method		Zero-cross (Turn-ON and Turn-OFF)		—	

REFERENCE DATA

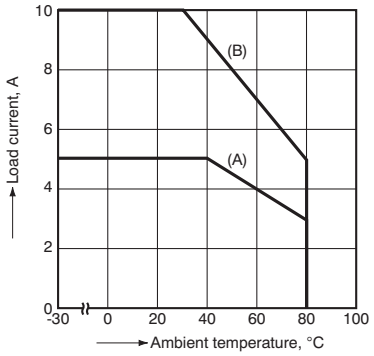
1-(1) Load current vs. ambient temperature

(AC output, 3 A type) Part No.: AQ3A2-ZT4/32VDC and AQ3A2-J-ZT4/32VDC
Allowable ambient temperature:
–30°C to +80°C –22°F to +176°F



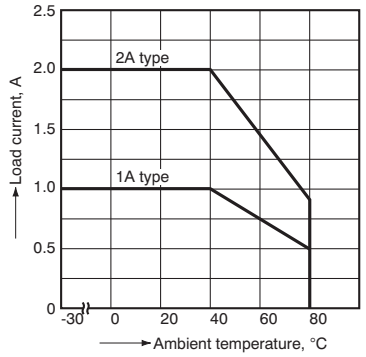
1.-(2) Load current vs. ambient temperature

(AC output, 10 A type) Part No.: AQ10A2-ZT4/32VDC
(A) When not using a heat sink
(B) When using a standard heat sink AQ-HS-5A
(When attached to a heat sink, use a heat conductive compound (Ex. Toshiba silicone YG6111 or TSK5303) of similar coating to improve cooling.)



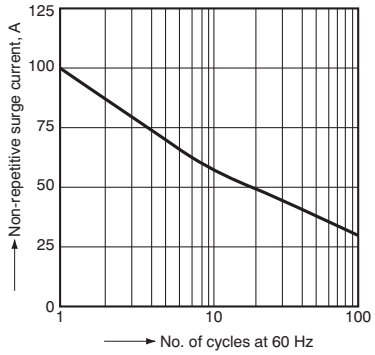
1.-(3) Load current vs. ambient temperature

(DC output, 1 A and 2 A types) Part No.: AQ1AD2-3/28VDC and AQ2AD1-3/28VDC
Allowable ambient temperature:
–30°C to +80°C –22°F to +176°F



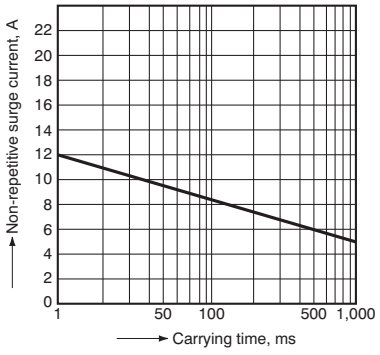
2-(1) Non-repetitive surge current vs. carrying time

(AC output, 3 A and 10 A types)
Part No.: AQ3A2-ZT4/32VDC, AQ3A2-J-ZT4/32VDC and AQ10A2-ZT4/32VDC



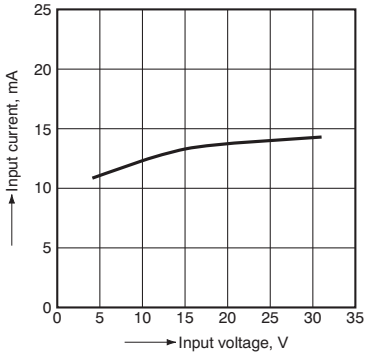
2.-(2) Non-repetitive surge current vs. carrying time

(DC output) Part No.: AQ1AD2-3/28VDC and AQ2AD1-3/28VDC



3-(1) Input current vs. input voltage characteristics

(AC output, 3 A and 10 A types)
Part No.: AQ3A2-ZT4/32VDC, AQ3A2-J-ZT4/32VDC and AQ10A2-ZT4/32VDC

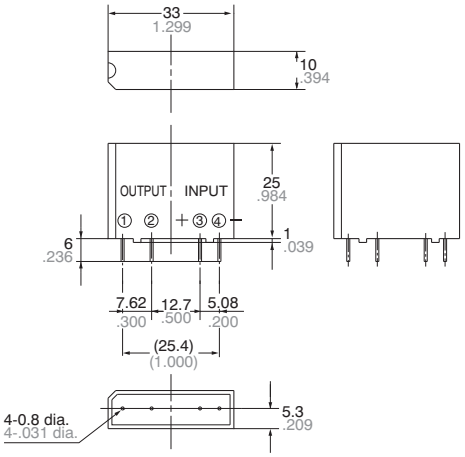


DIMENSIONS (mm inch)

Download CAD Data from our Web site.

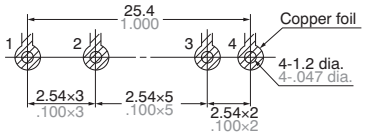
1. AC output, 3A types (Vertical)

CAD Data

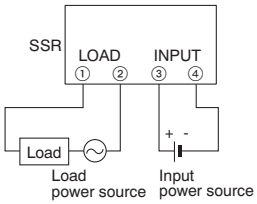


General tolerance: ±0.5 ±.020

Mounting hole location
(Copper-side view)



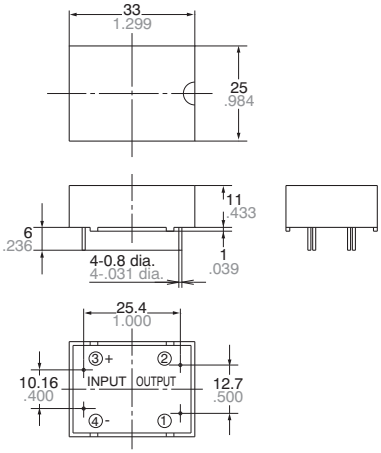
Schematic



Tolerance: ±0.1 ±.004

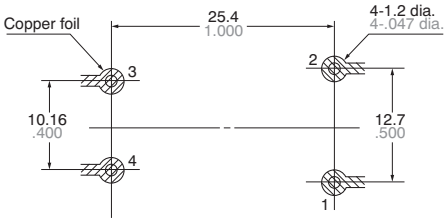
2. AC output, 3A types (Flat)

CAD Data

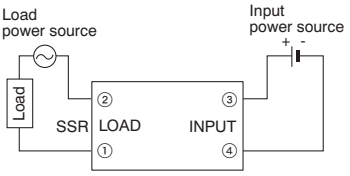


General tolerance: ±0.5 ±.020

Mounting hole location
(Copper-side view)



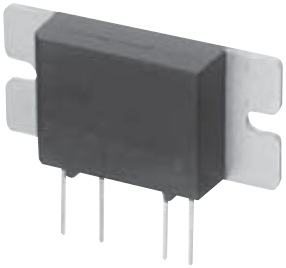
Schematic

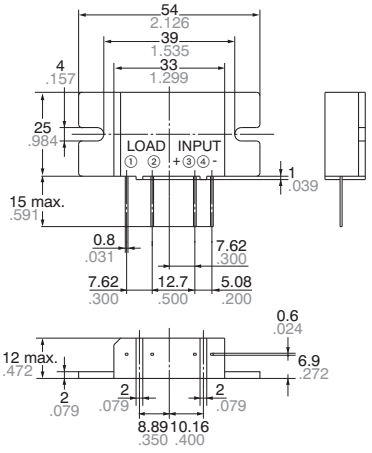


Tolerance: ±0.1 ±.004

3. AC output, 10A types

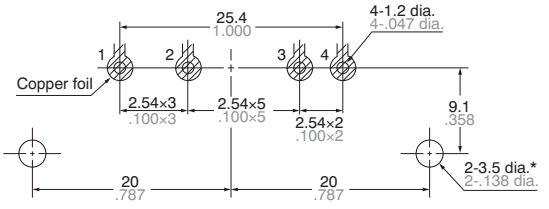
CAD Data





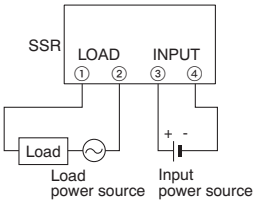
General tolerance: ±0.5 ±.020

Mounting hole location (Copper-side view)



* There 2 holes are not necessary when not using heat sink (AQ-HS-5A)

Schematic

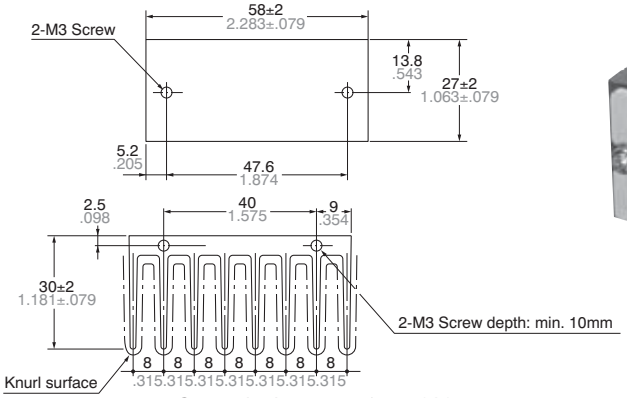


Tolerance: ±0.1 ±.004

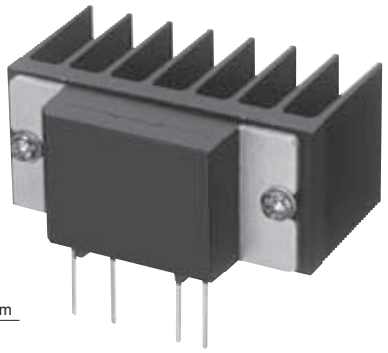
4. Heat sink (for AQ10A2-ZT4/32VDC)

mm inch

CAD Data



CAD Data

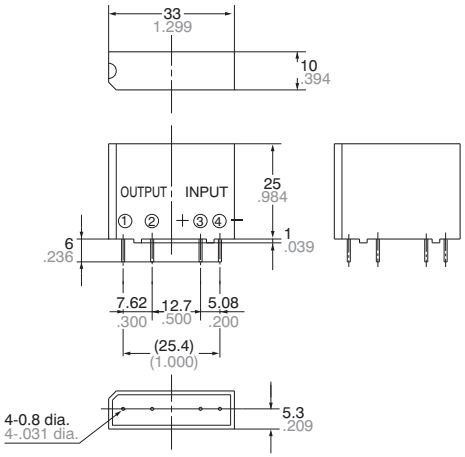


General tolerance: ±0.5 ±.020

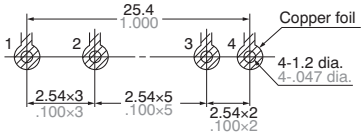
Heat sink attached to AQ1 relay

5. DC output, 1A and 2A types

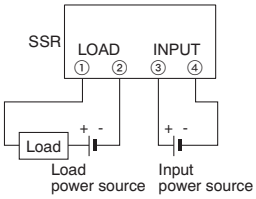
CAD Data



Mounting hole location
(Copper-side view)



Schematic



General tolerance: ±0.5 ±.020

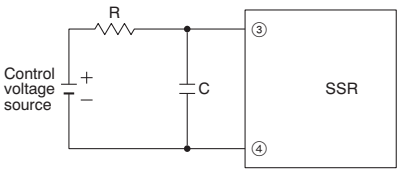
Tolerance: ±0.1 ±.004

CAUTIONS FOR USE

1. Input side

1) Noise and surge protection at the input side

A high noise surge voltage applied to the SSR input circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use C or R noise absorber in the input circuit.

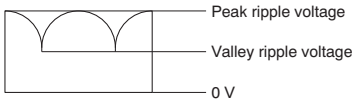


2) When the input terminals are connected with reverse polarity

Reversing the polarity will not cause damage to the device, due to the presence of a protection diode, but the device will not operate.

3) In the case of operating voltage containing ripple

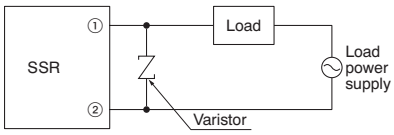
If the SSR control voltage contains ripple, the peak of the ripple should not exceed the maximum rated control voltage “32V”, and the bottom of the ripple should exceed the minimum rated control voltage “4V”.



2. Output side

1) Regarding output noise surge protection

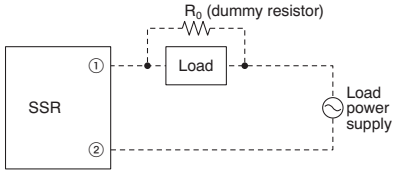
A high noise surge voltage applied to the SSR load circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use a varistor across the SSR output.



Keep the varistor voltage to no more than 500 V.

2) When used for the load less than rated

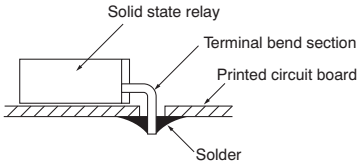
An SSR may malfunction if it is used below the specified load. In such an event, use a dummy resistor in parallel with the load.



Set a value of dummy resistor so that the load current becomes 50 mA or greater due to the dummy resister and load.

3. When using bent output terminals

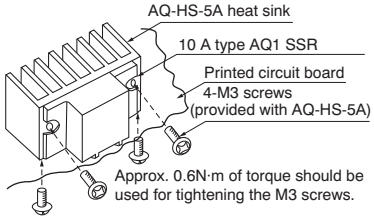
To avoid applying mechanical stress on the main unit and molded section of the solid state relay, radio pliers should be used to grasp the terminals between the point of bending and the molded case when making the bends.



4. When a heat sink is mounted on the 5 A or 10 A type

The heat sink (AQ-HS-5A) or a radiator which can make good contact should be used.

If a heat sink is used in which the contact condition is bad, a heat conducting compound should be used to improve the heat radiation. (Ex. Silicon compound Toshiba silicon YG6111 or TSK5303) The compound should be applied between the heat sink and the AQ1.



5. Others

1) If an SSR is used in close proximity to another SSR or heat-generating device, its ambient temperature may exceed the allowable level. Carefully plan SSR layout and ventilation.

2) Soldering to SSR terminals should be completed within 5 seconds at 260°C 500°F.

3) Terminal connections should be made by referring to the associated wiring diagram.

4) For higher reliability, check device quality under actual operating conditions.

6. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

• Temperature: 5 to 30°C 41 to 86°F
• Humidity: Less than 60% R.H.
• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

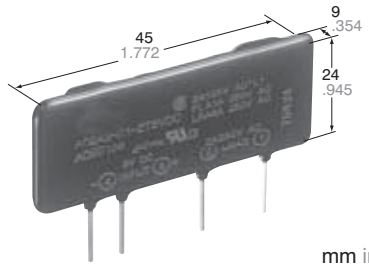
For Cautions for Use, see Page 319.

Please contact us about TÜV certified products.

Panasonic
ideas for life

2A and 3A space saving PC board terminal type

AQ8 RELAYS



mm inch

FEATURES

1. Slim with 9 mm .354 inch thickness
The thin type (45 mm long × 24 mm high × 9 mm wide) (1.772×.945×.354 inch) permits high density mounting.

2. Excellent in noise resistance
Since the input and output are insulated by the phototriac coupler, the noise on the output side is not fed back to the input side.

3. Snubber circuit integrated
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of the voltage on the output side, such as inductive load and noise.

4. Zero-cross and Non zero-cross types are available.
The zero-cross type generates minimal noise by suppressing occurrence of radio frequency interference (RFI) and electro-magnetic interference (EMI).
The non zero-cross type features a short operation time which permits phase control.

5. High dielectric strength: 3,000 V AC (between input and output)

6. Two kinds of terminals distance are available. (5.08 mm and 7.62 mm) (.200 and .300 inch)

7. High reliability, long life and maintenance-free

Solid State

TYPICAL APPLICATIONS

Most suitable as drivers for small size AC motors, solenoids, solenoid valves and so on.
1. Copying equipment
2. Air conditioners
3. Industrial equipment such as NC machines, sequencers, robots and so on

TYPES

1. Zero-cross type

Input terminals distance	Max. load current	Load voltage	Input voltage	Part No.
5.08 mm .200 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C1-ZT5VDC
			12 V DC	AQ2A1-C1-ZT12VDC
			24 V DC	AQ2A1-C1-ZT24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C1-ZT5VDC
			12 V DC	AQ2A2-C1-ZT12VDC
			24 V DC	AQ2A2-C1-ZT24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C1-ZT5VDC
			12 V DC	AQ3A1-C1-ZT12VDC
			24 V DC	AQ3A1-C1-ZT24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C1-ZT5VDC
			12 V DC	AQ3A2-C1-ZT12VDC
			24 V DC	AQ3A2-C1-ZT24VDC
7.62 mm .300 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C2-ZT5VDC
			12 V DC	AQ2A1-C2-ZT12VDC
			24 V DC	AQ2A1-C2-ZT24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C2-ZT5VDC
			12 V DC	AQ2A2-C2-ZT12VDC
			24 V DC	AQ2A2-C2-ZT24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C2-ZT5VDC
			12 V DC	AQ3A1-C2-ZT12VDC
			24 V DC	AQ3A1-C2-ZT24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C2-ZT5VDC
			12 V DC	AQ3A2-C2-ZT12VDC
			24 V DC	AQ3A2-C2-ZT24VDC

2. Non zero-cross type

Input terminals distance	Max. load current	Load voltage	Input voltage	Part No.
5.08 mm .200 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C1-T5VDC
			12 V DC	AQ2A1-C1-T12VDC
			24 V DC	AQ2A1-C1-T24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C1-T5VDC
			12 V DC	AQ2A2-C1-T12VDC
			24 V DC	AQ2A2-C1-T24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C1-T5VDC
			12 V DC	AQ3A1-C1-T12VDC
			24 V DC	AQ3A1-C1-T24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C1-T5VDC
			12 V DC	AQ3A2-C1-T12VDC
			24 V DC	AQ3A2-C1-T24VDC
7.62 mm .300 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C2-T5VDC
			12 V DC	AQ2A1-C2-T12VDC
			24 V DC	AQ2A1-C2-T24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C2-T5VDC
			12 V DC	AQ2A2-C2-T12VDC
			24 V DC	AQ2A2-C2-T24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C2-T5VDC
			12 V DC	AQ3A1-C2-T12VDC
			24 V DC	AQ3A1-C2-T24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C2-T5VDC
			12 V DC	AQ3A2-C2-T12VDC
			24 V DC	AQ3A2-C2-T24VDC

Remark: Standard packing Carton: 20 pcs.; Case: 200 pcs.

RATINGS

1. Rating (Ambient temperature: 20°C, 68°F; Voltage ripple on the input side: 1% or less)

1) Zero-cross type

• 2 A type

Item		Part No. AQ2A1-C1-ZT5VDC AQ2A1-C2-ZT5VDC	AQ2A1-C1-ZT12VDC AQ2A1-C2-ZT12VDC	AQ2A1-C1-ZT24VDC AQ2A1-C2-ZT24VDC	AQ2A2-C1-ZT5VDC AQ2A2-C2-ZT5VDC	AQ2A2-C1-ZT12VDC AQ2A2-C2-ZT12VDC	AQ2A2-C1-ZT24VDC AQ2A2-C2-ZT24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	2 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	30 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

• 3 A type

Item		Part No. AQ3A1-C1-ZT5VDC AQ3A1-C2-ZT5VDC	AQ3A1-C1-ZT12VDC AQ3A1-C2-ZT12VDC	AQ3A1-C1-ZT24VDC AQ3A1-C2-ZT24VDC	AQ3A2-C1-ZT5VDC AQ3A2-C2-ZT5VDC	AQ3A2-C1-ZT12VDC AQ3A2-C2-ZT12VDC	AQ3A2-C1-ZT24VDC AQ3A2-C2-ZT24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	3 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	80 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

Notes: *1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.

*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.

*3) When the load current is less than the min. load current, refer to “NOTES (page 352)”.

2) Non zero-cross type

• 2 A type

Item		Part No. AQ2A1-C1-T5VDC AQ2A1-C2-T5VDC	AQ2A1-C1-T12VDC AQ2A1-C2-T12VDC	AQ2A1-C1-T24VDC AQ2A1-C2-T24VDC	AQ2A2-C1-T5VDC AQ2A2-C2-T5VDC	AQ2A2-C1-T12VDC AQ2A2-C2-T12VDC	AQ2A2-C1-T24VDC AQ2A2-C2-T24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	2 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	30 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

• 3 A type

Item		Part No. AQ3A1-C1-T5VDC AQ3A1-C2-T5VDC	AQ3A1-C1-T12VDC AQ3A1-C2-T12VDC	AQ3A1-C1-T24VDC AQ3A1-C2-T24VDC	AQ3A2-C1-T5VDC AQ3A2-C2-T5VDC	AQ3A2-C1-T12VDC AQ3A2-C2-T12VDC	AQ3A2-C1-T24VDC AQ3A2-C2-T24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	3 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	80 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

Notes: *1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.
*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.
*3) When the load current is less than the min. load current, refer to “NOTES (page 352)”.

2. Characteristics (Ambient temperature: 20°C 68°F; Input voltage ripple: 1% or less)

Item \ Type		Zero-cross type	Non zero-cross type	Remarks
Operate time, max.		1/2 cycle of voltage sine wave + 1 ms	1 ms	
Release time, max.		1/2 cycle of voltage sine wave + 1 ms		
Insulation resistance, min.		$10^9\Omega$ between input and output		at 500 V DC
Breakdown voltage		3,000 V AC between input and output		For 1 minute
Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm		10 min. for X, Y, Z axis
	Destructive	10 to 55 Hz at double amplitude of 3 mm		1 hour for X, Y, Z axis
Shock resistance	Functional	Min. 980 m/s² {100 G}		4 times each for X, Y, Z axis
	Destructive	Min. 980 m/s² {100 G}		5 times each for X, Y, Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F		
Storage temperature		–30°C to +100°C –22°F to +212°F		
Operational method		Zero-cross (Turn ON and Turn OFF)	Non zero-cross turn ON, zero-cross turn OFF	

DIMENSIONS (mm inch)

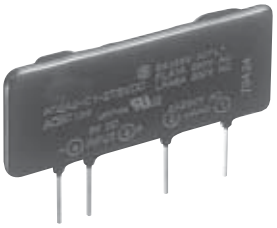
Download CAD Data from our Web site.

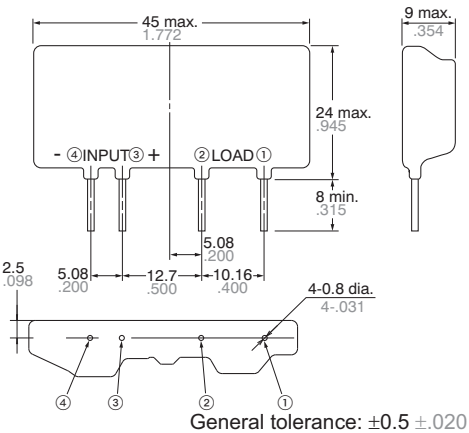
(Common for zero-cross and non zero-cross types)

1. Input terminals distance 5.08 mm .200 inch

1) 2 A type

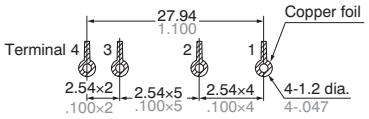
CAD Data





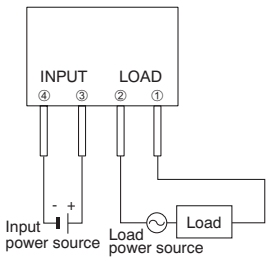
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



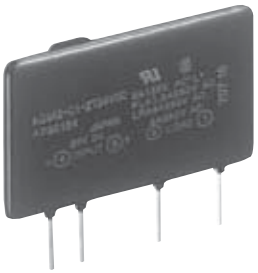
Tolerance: ±0.1 ±.004

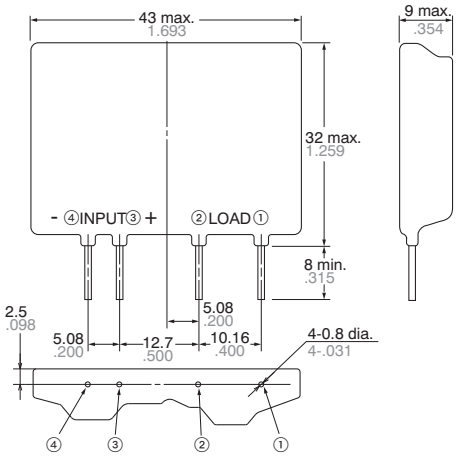
Schematic



2) 3 A type

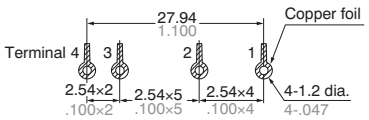
CAD Data





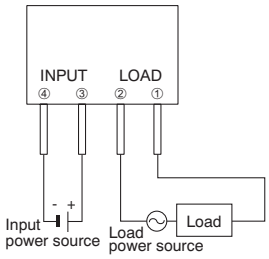
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



Tolerance: ±0.1 ±.004

Schematic

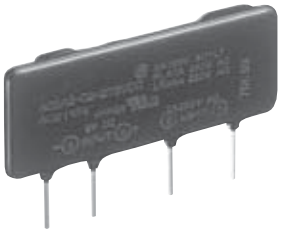


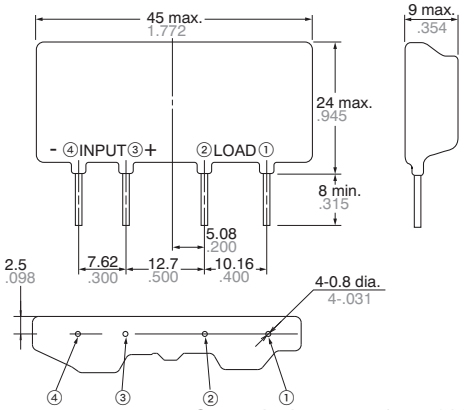
2. Input terminals distance 7.62 mm .300 inch

mm inch

1) 2A type

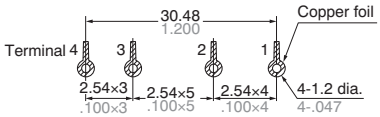
CAD Data





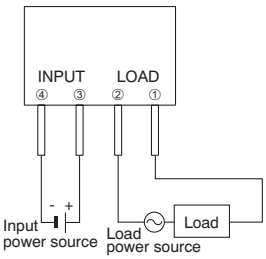
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



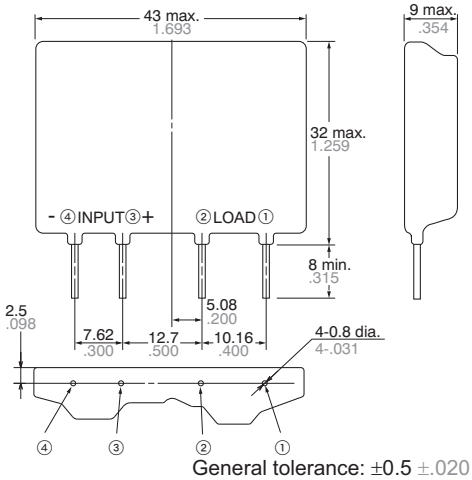
Tolerance: ±0.1 ±.004

Schematic



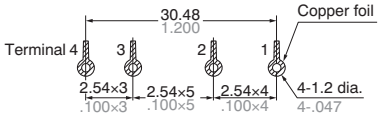
2) 3A type

CAD Data



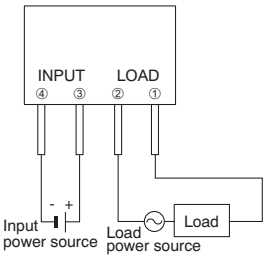
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



Tolerance: ±0.1 ±.004

Schematic

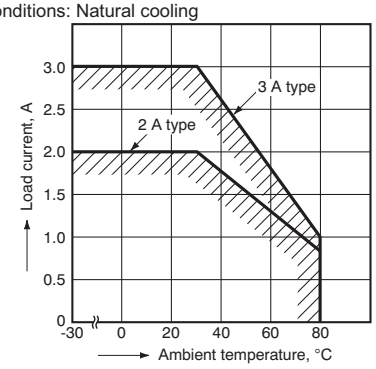


Solid State

REFERENCE DATA

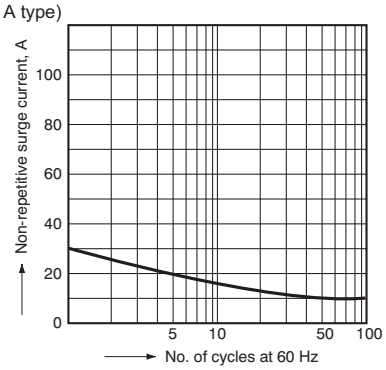
4. Characteristics of load current vs. ambient temperature

Conditions: Natural cooling

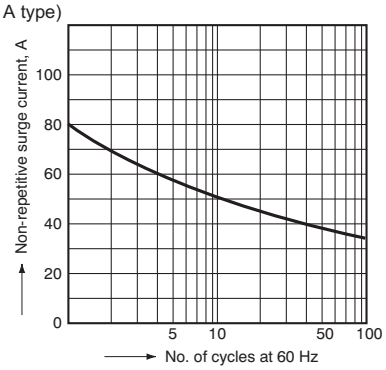


5. Characteristics of non-repetitive surge current vs. carrying time

(2 A type)

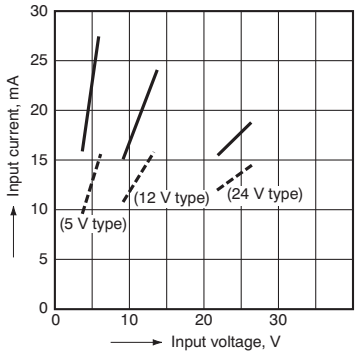


(3 A type)



6. Characteristics of input current vs. input voltage

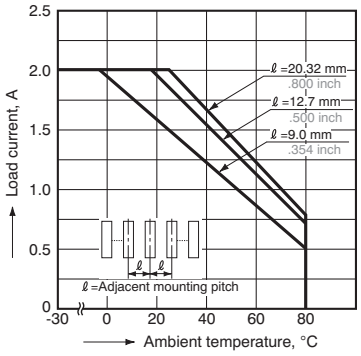
—zero-cross type ---non zero-cross type



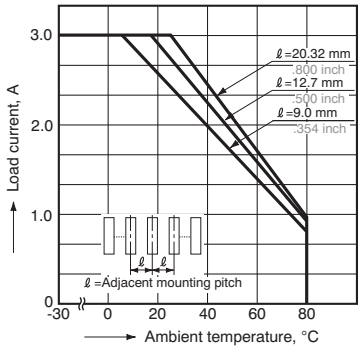
7. Characteristics of load current vs. ambient temperature for adjacent mounting

Conditions: Natural cooling

(2 A type)



(3 A type)



Approved standards list

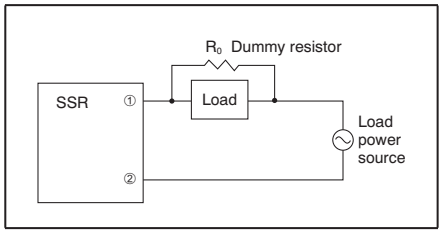
Product name	File No.	Qualified ratings
AQ8	UL E95895	2A type: 2 A 125, 250 V AC 2 A 125 V AC (Tungsten) FLA 1 A, LRA 6 A 125, 250 V AC 3A type: 3 A 125, 250 V AC 3 A 125 V AC (Tungsten) FLA 1.5 A, LRA 9 A 125, 250 V AC
	CSA LR26550	

NOTES

1. When used for the load less than rated

In case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off. Use a dummy resistor as a countermeasure.

The total of the current through the resistor and the load current must exceed the min. rated load current.

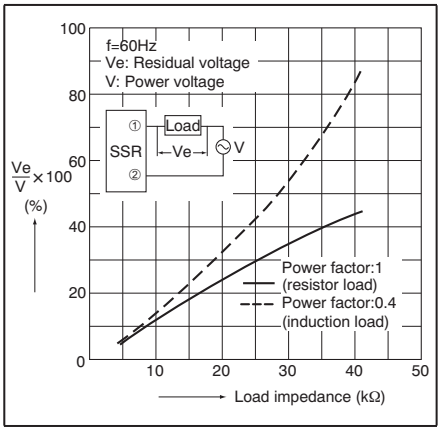


In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:

Example:

For the inductive load by the 20 mA load current and the 200 V AC load voltage, the load impedance becomes 10 k Ω and Ve/V = 14% is estimated from the right above graph. Accordingly, the 28 V voltage remains across the both ends of the load when the solid state relay is turned off.

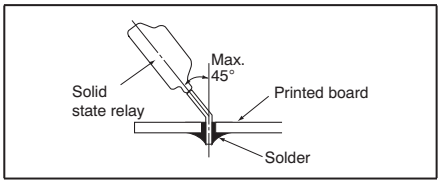
• Characteristics of residual voltage vs. load impedance



2. Solder the terminals within 5 seconds at 260°C 500°F.

3. When the terminal is bent

Care shall be taken neither to apply mechanical stresses to the mold area of the solid state relay nor to bend the terminal 45 degrees or more.

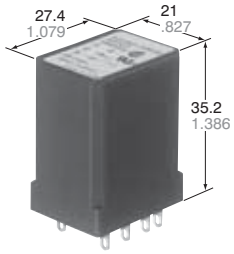


For Cautions for Use, see Page 319.

Panasonic
ideas for life

AC and DC Plug-in type

AQ-F RELAYS



mm inch

FEATURES

- **Suitable for high-capacity and high-frequency switching**
- **Same size, same terminal arrangement as HC relay**
  Sockets for HC relays are applicable
- **Two load types available: DC output type (2 A, 3 A)**
  AC output type (2 A, 3 A)
- **Wide range of input voltage: 3 V to 28 V**

Solid State

TYPICAL APPLICATIONS

Drive for small-sized motor, heater, solenoid and electromagnetic valves.

- NC machine
- Printing machine
- Machine tool
- Robot for industrial use
- Wrapping and packing machine

TYPES

Type		Part No.
AC output	Zero-cross 2 A	AQF2A2-ZT3/28VDC
	Zero-cross 3 A	AQF3A2-ZT3/28VDC
DC output	2 A	AQF2AD1-3/28VDC
	3 A	AQF3AD1-3/28VDC

SPECIFICATIONS

Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

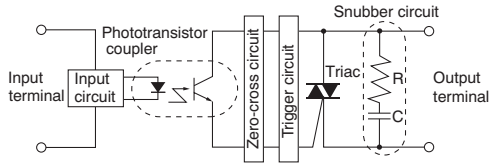
Item		Type: AC output AQF2A2-ZT3/28VDC	AC output AQF3A2-ZT3/28VDC	DC output AQF2AD1-3/28VDC	DC output AQF3AD1-3/28VDC	Remarks
Input side	Input voltage	3 to 28 V DC				
	Input impedance	Approx. 1.6 k Ω (3 to 28 V DC)				
	Drop-out voltage, min.	0.8 V DC				
Load side	Max. load current	2 A	3 A	2 A	3 A	See “REFERENCE DATA 1” on the following page
	Load voltage	75 to 250 V AC		3 to 60 V DC		
	Non-repetitive surge current	80 A		5 A	6 A	AC: In one cycle at 60 Hz DC: 1 s
	Max. “OFF-state” leakage current	5 mA		1 mA		AC: at 60 Hz 200 V DC: at 60 V
	Max. “ON-state” voltage drop	1.6 V				at max. carrying current
	Min. load current	50 mA		5 mA		

Characteristics (at 20°C 68°F, Input voltage ripple: 1% or less)

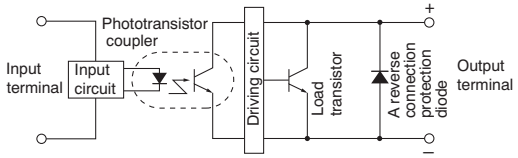
Item		Type: AC output AQF2A2-ZT3/28 VDC	AC output AQF3A2-ZT3/28 VDC	DC output AQF2AD1-3/28 VDC	DC output AQF3AD1-3/28 VDC	Remarks
Operate time max.		(1/2 cycle of voltage sine wave) + 1 ms		0.5 ms		
Release time, max.		(1/2 cycle of voltage sine wave) + 1 ms		2 ms		
Insulation resistance, min.		100 M Ω between input and output				Initial at 500 V DC
Breakdown voltage		2,000 Vrms between input and output				Initial for 1 min.
Vibration resistance	Functional	10 to 55 Hz double amplitude of 3 mm				10 min. for X, Y, Z axes
	Destructive	10 to 55 Hz double amplitude of 3 mm				1 hour for X, Y, Z axes
Shock resistance	Functional	Min. 980 m/s² {100 G}				4 times each for X, Y, Z axes
	Destructive	Min. 980 m/s² {100 G}				5 times each for X, Y, Z axes
Ambient temperature		–30°C to +80°C –22°F to +176°F				
Storage temperature		–30°C to +100°C –22°F to +212°F				
Operational method		Zero-cross (Turn-ON and Turn-OFF)		—		

OPERATING PRINCIPLE

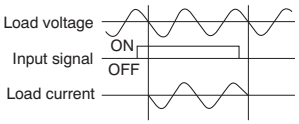
Internal circuit
AC output type

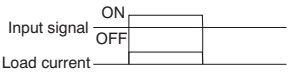


DC output type



Waveform of input and output (Resistive load)

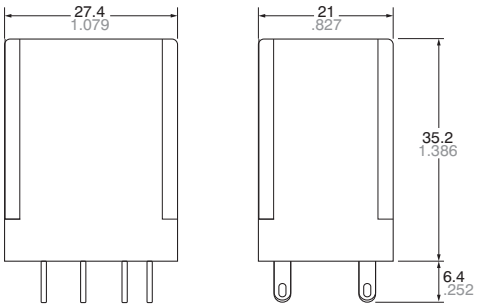




DIMENSIONS (mm inch)

Download CAD Data from our Web site.

CAD Data



AQ-F SOLID STATE RELAY ACCESSORIES

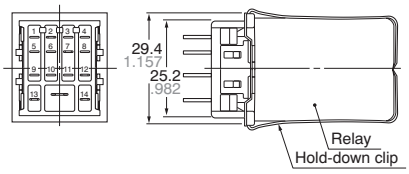
Socket of HC relay is available for AQ-F solid state relay.

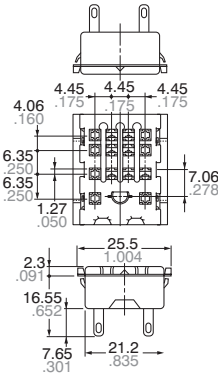
1. Socket for plug-in type

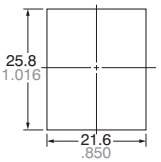
HC2 socket

CAD Data

HC2-SS-K







Note: HC3-SS-K and HC4-SS-K can be also used.

Tolerance: ±0.1 ±.004

HC2-PS-K

2. Socket for PC board

Tolerance: ±0.1 ±.004

HC2 socket for PC board

CAD Data

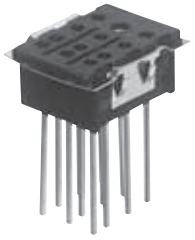
13.35

3. Wrapping socket

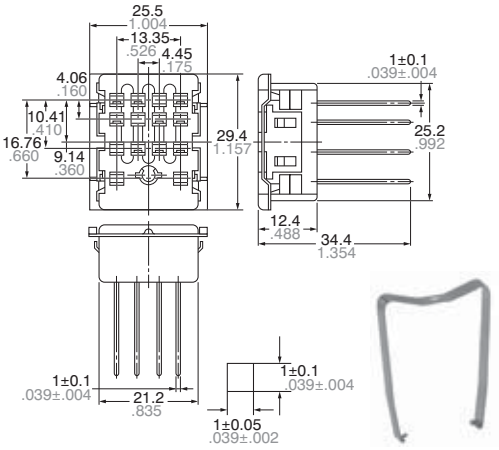
mm inch

Standard wrapping socket

CAD Data

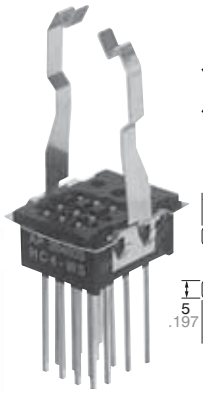


HC4-WS-K

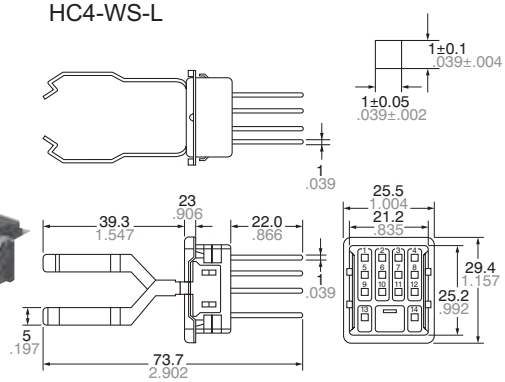


Wrapping socket with lock spring

CAD Data

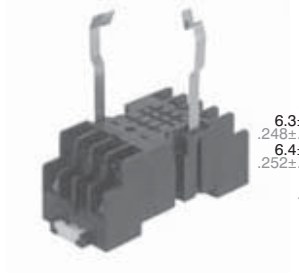


HC4-WS-L

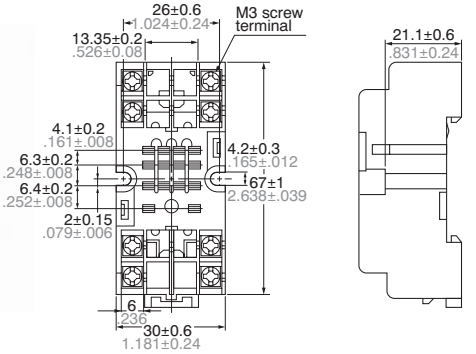


4. DIN rail mounting socket

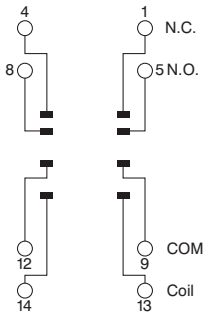
CAD Data



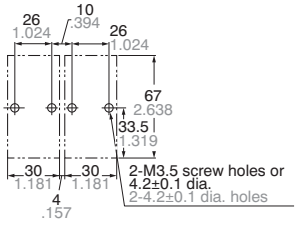
HC2-SFD-K



Schematic

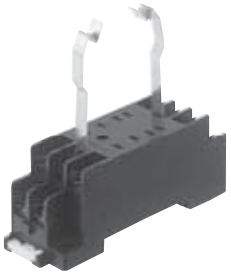


Mounting dimension (Bottom view)

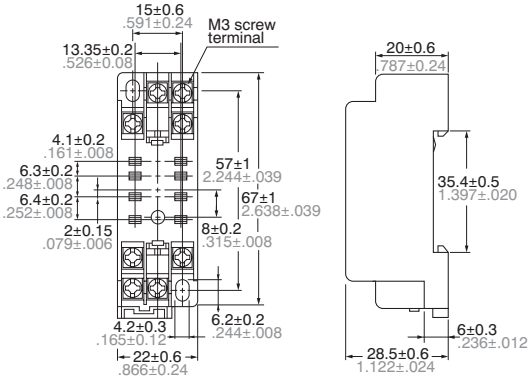


5. DIN socket for HC2-vertical type

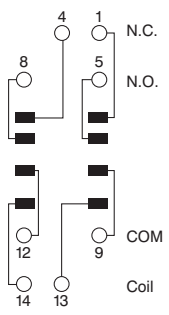
CAD Data



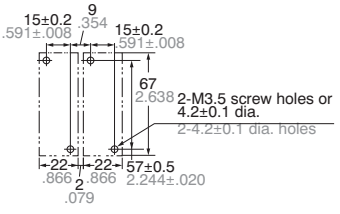
HC2-SFD-S



Schematic



Mounting dimension (Bottom view)

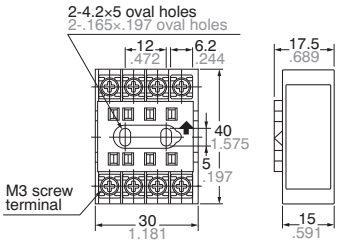


Solid State

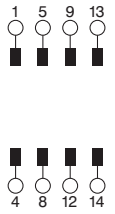
6. General socket

CAD Data

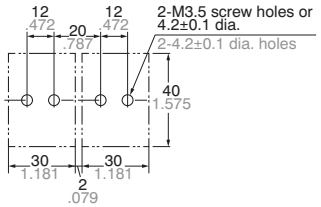
HC2-SF-K



Schematic



Mounting dimension (Bottom view)

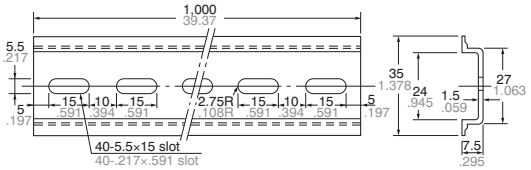


Minimum separation in tandem mounting

Mounting rail

CAD Data

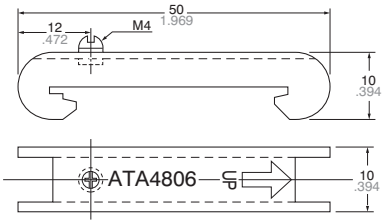
AT8-DLA1



Fastening plate

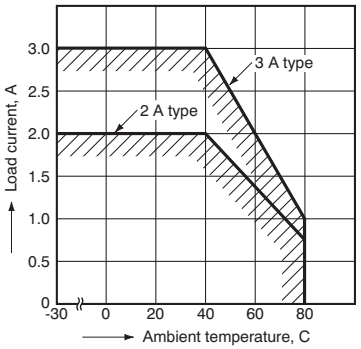
ATA4806

mm inch

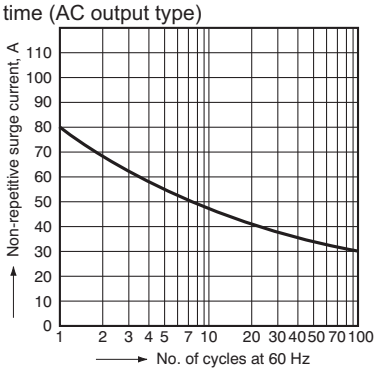


REFERENCE DATA

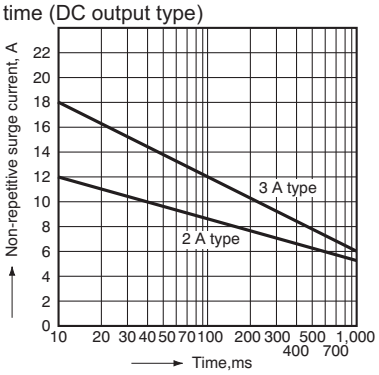
8. Load current vs. ambient temperature



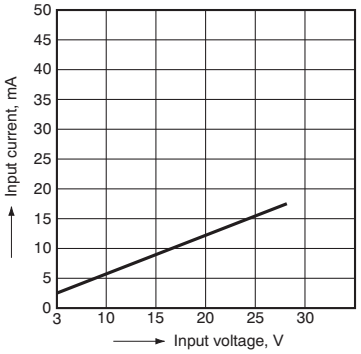
9-(1). Non-repetitive surge current vs. carrying time (AC output type)



2-(2). Non-repetitive surge current vs. carrying time (DC output type)



10.Input current vs. input voltage



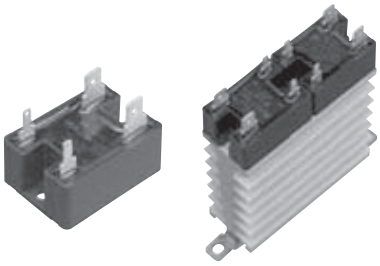
For Cautions for Use, see Page 319.

UL (60950-1) reinforced insulation compliant

Panasonic
ideas for life

Compact high capacity (25A max) Slim heat sink combined type joining the lineup

AQ-J RELAYS



Slim heat sink combined type

FEATURES

1. Compact Size
Approx 40% reduction in required space achieved in the footprint area compared with the previous model (AQ-R relay)
2. Built-in varistor
3. Reverse input connection prevention function
4. Labor Saving (tab terminal)
5. Output arrangement 1a and 1a × 2 available in the heat sink combined type

Note: * International standards are acquired for AQ-J SSR stand-alone, not applied to heat sink combined type.

TYPICAL APPLICATIONS

1. Kitchen appliances
2. Vending machine
3. Injection molding machine
4. Packing machine
5. Amusement machine

Solid State

ORDERING INFORMATION

AQJ □ □ □ □ □

AQ-J Solid State Relays

Output type
1: 10A, 75V to 264V AC
2: 15A, 75V to 264V AC
4: 25A, 75V to 264V AC

Terminal
1: Plug-in terminal, Zero-cross
2: Plug-in terminal, Random*

Input voltage
2: 4 to 6 V DC
6: 18 to 28 V DC
9: 10 to 18 V DC

Functions
V: Built-in varistor

Slim heat sink combined type
None: Without a heat sink
Y: 1a type
W: 1a × 2 type

Note: * Random type is available by custom order.

TYPES

1. AQ-J Solid State Relays

Type	Load current	Load voltage	Input voltage	Part No.
Zero-cross*	10A	75V to 264V AC	4 to 6V DC	AQJ112V
			10 to 18V DC	AQJ119V
			18 to 28V DC	AQJ116V
	15A		4 to 6V DC	AQJ212V
			10 to 18V DC	AQJ219V
			18 to 28V DC	AQJ216V
	25A		4 to 6V DC	AQJ412V
			10 to 18V DC	AQJ419V
			18 to 28V DC	AQJ416V

Standard Packing; carton: 10 pcs., case: 200 pcs.
Note: * Random type also available. Please inquire.

2. AQ-J SSR Slim Heat Sink Combined Type

Output configuration	Type	Load current	Load voltage	Input voltage	Part No.
1a	Zero-cross*	10A	75V to 264V AC	4 to 6V DC	AQJ112VY
				10 to 18V DC	AQJ119VY
				18 to 28V DC	AQJ116VY
		20A		4 to 6V DC	AQJ412VY
				10 to 18V DC	AQJ419VY
				18 to 28V DC	AQJ416VY
1a × 2		10A (per 1a)		4 to 6V DC	AQJ112VW
				10 to 18V DC	AQJ119VW
				18 to 28V DC	AQJ116VW
		15A (per 1a)		4 to 6V DC	AQJ412VW
				10 to 18V DC	AQJ419VW
				18 to 28V DC	AQJ416VW

Standard Packing; no carton, case: 10 pcs.
Note: * Random type also available. Please inquire.

3. Accessories

Type	Part No.	Packaged quantity
DIN rail mounting plate	AQP-DPJ	5 in a carton, 50 in a case
Slim heat sink (28mm wide) (Mountable on a DIN rail)	AQP-HS-SJ10A	No carton, 10 in a case
Slim heat sink (45mm wide) (Mountable on a DIN rail)	AQP-HS-SJ20A	No carton, 8 in a case
Standard heat sink (10A and 15A)	AQP-HS-J10A	5 in a carton, 20 in a case
Standard heat sink (25A only)	AQP-HS-J25A	No carton, 5 in a case

SPECIFICATIONS

1. Ratings (Test sample: AQ-J stand-alone, Measurement condition: at 20°C 68°F, input ripple: 1% or less)

1) Input side

Item \ Part No.	AQJ112V AQJ212V AQJ412V	AQJ119V AQJ219V AQJ419V	AQJ116V AQJ216V AQJ416V
Rated voltage	5V DC	12V DC	24V DC
Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC
Input impedance	Approx. 260Ω	Approx. 800Ω	Approx. 1.6kΩ
Drop-out voltage	Min. 1V DC		

2) Output side

Item \ Part No.	AQJ112V AQJ119V AQJ116V	AQJ212V AQJ219V AQJ216V	AQJ412V AQJ419V AQJ416V
Max. load current	10A	15A	25A
Load voltage	75 to 264V AC		
Frequency	45Hz to 65Hz		
Non-repetitive surge current	100A	150A	250A
Max. “OFF-state” leakage current	Max. 5mA		
Max. “ON-state” voltage drop	Max. 1.6V		
Min. load current*	50mA		

Note: * When the load current is less than the rated minimum load current, please refer to Cautions for Use, page 319.

2. Ratings (Test sample: AQ-J slim heat sink combined type, Measurement condition: at 20°C 68°F, input ripple: 1 % or less)

1) Input side

Item \ Part No.	AQJ112V(Y·W) AQJ412V(Y·W)	AQJ119V(Y·W) AQJ419V(Y·W)	AQJ116V(Y·W) AQJ416V(Y·W)
Rated voltage	5V DC	12V DC	24V DC
Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC
Input impedance	Approx. 260Ω	Approx. 800Ω	Approx. 1.6kΩ
Drop-out voltage	Min. 1V DC		

2) Output side

Item \ Part No.	AQJ112VY AQJ119VY AQJ116VY	AQJ412VY AQJ419VY AQJ416VY	AQJ112VW AQJ119VW AQJ116VW	AQJ412VW AQJ419VW AQJ416VW
Output arrangement	1a		1a × 2	
Max. load current*1	10A	20A	10A	15A
Load voltage	75 to 264V AC			
Frequency	45Hz to 65Hz			
Non-repetitive surge current	100A	250A	100A	250A
Max. “OFF-state” leakage current	Max. 5mA			
Max. “ON-state” voltage drop	Max. 1.6V			
Min. load current*2	50mA			

Notes: *1 Please refer to REFERENCE DATA, “1. Load current vs. ambient temperature” below.
*2 When the load current is less than the rated minimum load current, please refer to Cautions for Use, page 319.

3. Characteristics (Measurement condition: at 20°C 68°F, input ripple: 1% or less)

Item	Characteristics	Remarks
Operate time, max.	(1/2 cycle of voltage sine wave) + 1ms	
Release time, max.	(1/2 cycle of voltage sine wave) + 1ms	
Insulation resistance, min.	100MΩ between input to output to case	Using 500 V DC megger
Breakdown voltage	3,000 Vrms between input and output	for 1min.
	2,500 Vrms between input, output and case	
Vibration resistance	SSR stand-alone: 10 to 55Hz, double amplitude of 1.5mm Slim heat sink combined type: 10 to 55Hz, double amplitude of 0.75mm	X, Y, Z axes
Shock resistance	SSR stand-alone: Min. 980m/s² Slim heat sink combined type: Min. 197m/s²	X, Y, Z axes
Ambient temperature	–30 to +80°C –22 to +176°F	Non-condensing at low temperatures
Storage temperature	–30 to +100°C –22 to +212°F	
Operational method	Zero-cross (Turn ON and Turn OFF)	

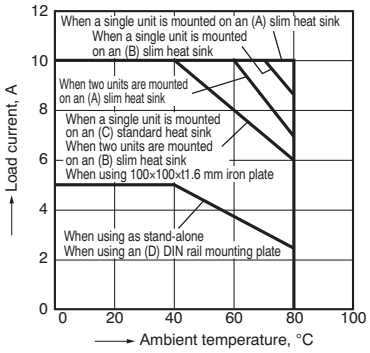
REFERENCE DATA

(1) AQ-J Solid State Relays

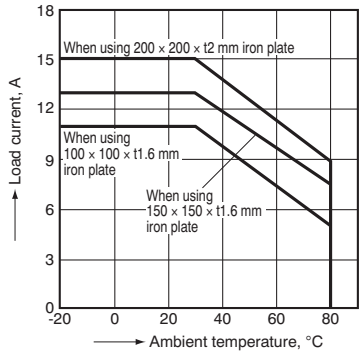
1. Load current vs. ambient temperature Use load current within range specified in the figure below

Tested condition:
1) If attached to a heat sink, use a heat conductive compound (Ex. Toshiba sillicone YG6111 or TSK5303) of similar coating to improve cooling
2) Without external heat sink
If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.
3) The current value is per 1a.

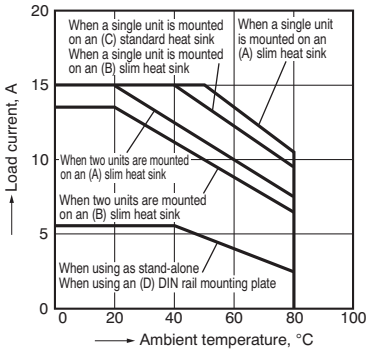
(1) 10 A type (when using heat sink or iron plate)



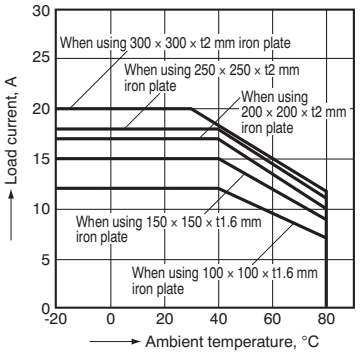
(2)-1. 15 A type (when using iron plate)



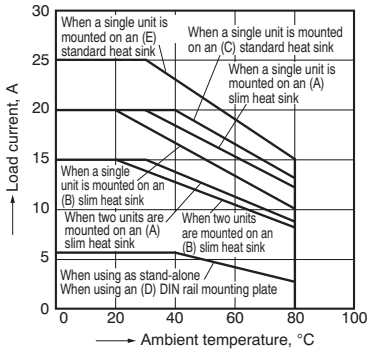
(2)-2. 15 A type (when using a heat sink)



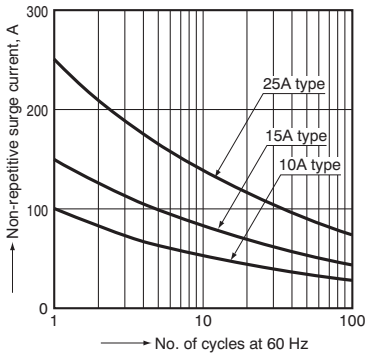
(3)-1. 25 A type (when using iron plate)



(3)-2. 25 A type (when using a heat sink)

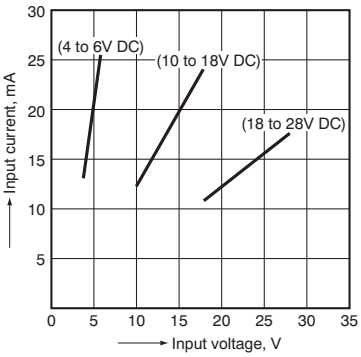


2. Non-repetitive surge current vs. carrying time



3. Input current vs. input voltage characteristics

(10A, 15A and 25A common)

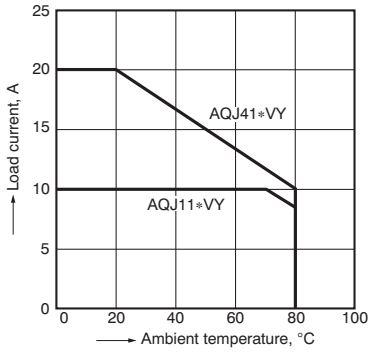


(A) slim heat sink	AQP-HS-SJ20A
(B) slim heat sink	AQP-HS-SJ10A
(C) standard heat sink	AQP-HS-J10A
(D) DIN rail mounting plate	AQP-DPJ
(E) standard heat sink	AQP-HS-J25A

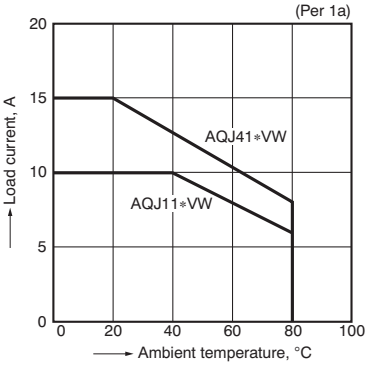
(2) AQ-J SSR Slim Heat Sink Combined Type

1. Load current vs. ambient temperature Use load current within range specified in the figure below

(1) Output arrangement: 1a

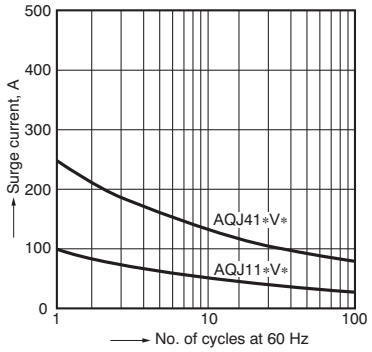


(2) Output arrangement: 1a × 2

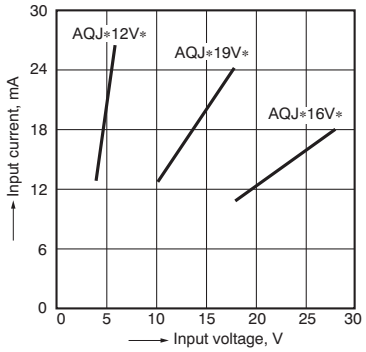


Note:
When two contacts are operated simultaneously.
In the case of a single-contact operation, the rating of (1) AQJ11∗VY, AQJ41∗VY applies.

2. Surge current vs. carrying time



3. Input current vs. input voltage characteristics

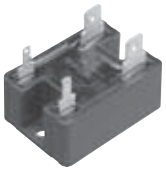


DIMENSIONS (mm inch)

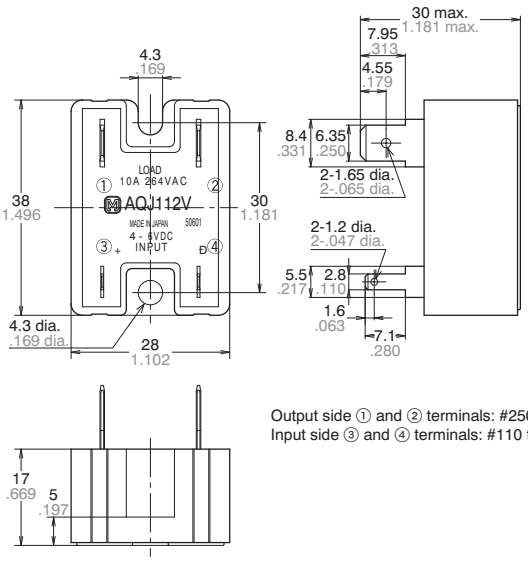
Download CAD Data from our Web site.

1. AQ-J Stand Alone

CAD Data

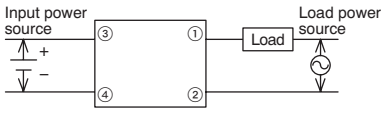


External dimensions

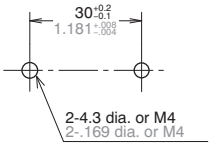


Output side ① and ② terminals: #250 type, t = 0.8 .031
Input side ③ and ④ terminals: #110 type, t = 0.5 .020

Schematic

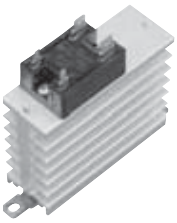


Mounting dimensions



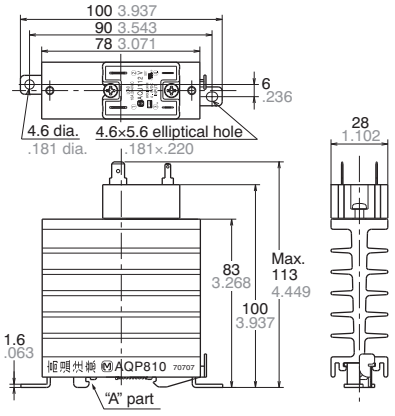
2.-(1) Slim Heat Sink Combined Type Output Arrangement: 1a

CAD Data

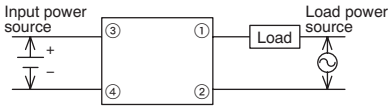


Note: When using on a DIN rail, please install so that the "A" part is on top.

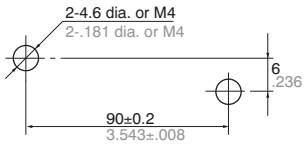
External dimensions



Schematic

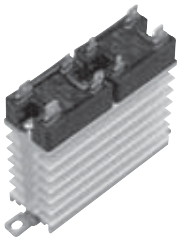


Mounting dimensions (Top view)



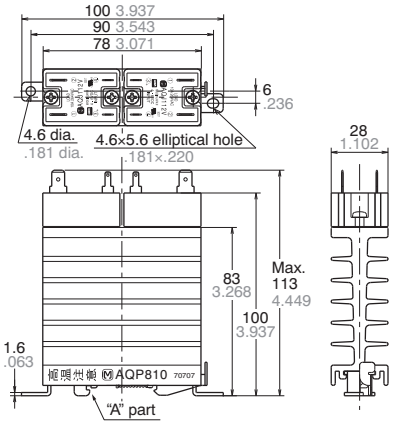
2.-(2) Slim Heat Sink Combined Type Output Arrangement: 1a × 2

CAD Data

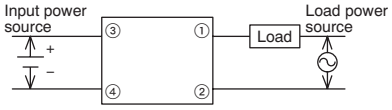


Note: When using on a DIN rail, please install so that the "A" part is on top.

External dimensions

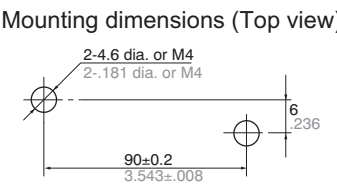


Schematic



Note: Use caution for AQ-J terminal numbers.

Mounting dimensions (Top view)

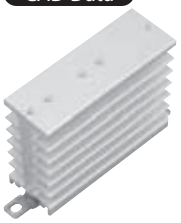


Solid State

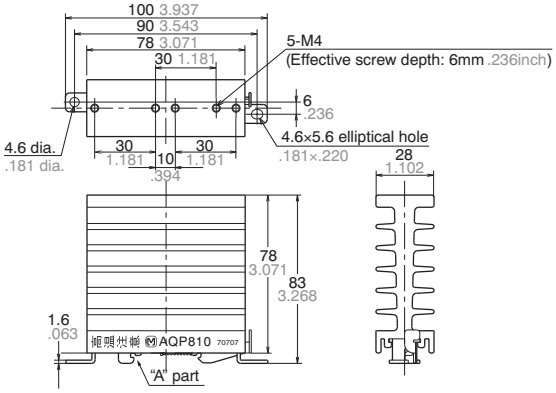
ACCESSORIES

AQP-HS-SJ10A Slim Heat Sink

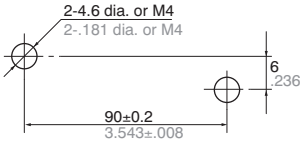
CAD Data



External dimensions



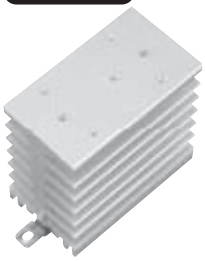
Mounting dimensions (Top view)



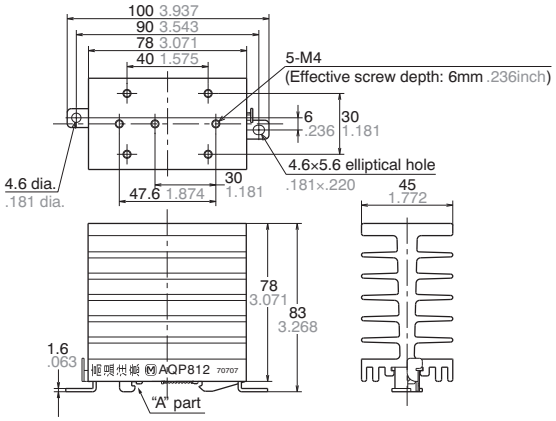
Note: When using on a DIN rail, please install so that the "A" part is on top.

AQP-HS-SJ20A Slim Heat Sink

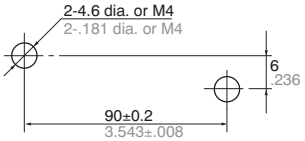
CAD Data



External dimensions



Mounting dimensions (Top view)

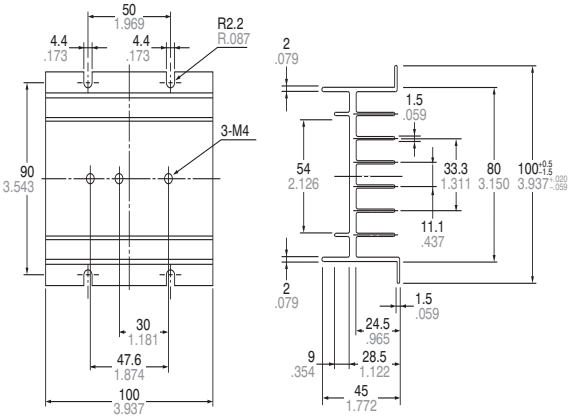


Note: When using on a DIN rail, please install so that the "A" part is on top.

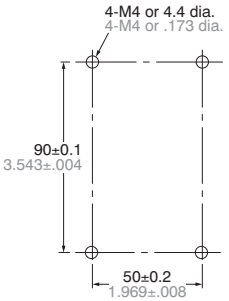
AQP-HS-J10A Standard Heat Sink (for 10A and 15A types)

CAD Data

External dimensions

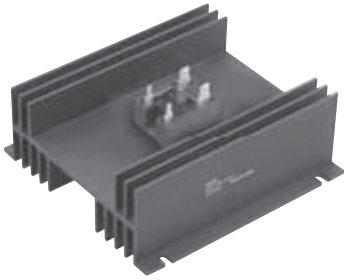


Mounting dimensions

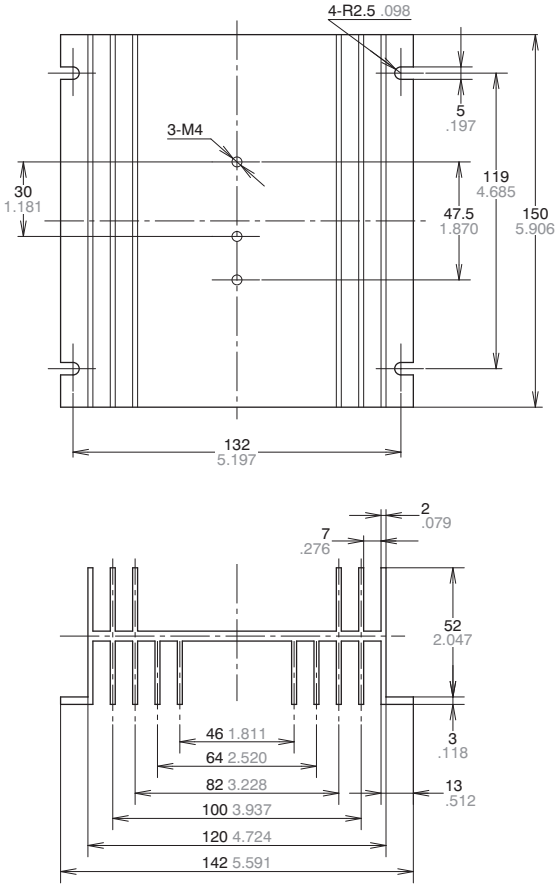


AQP-HS-J25A Standard Heat Sink (for 25A type)

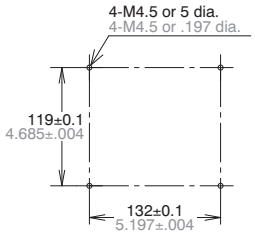
CAD Data



External dimensions



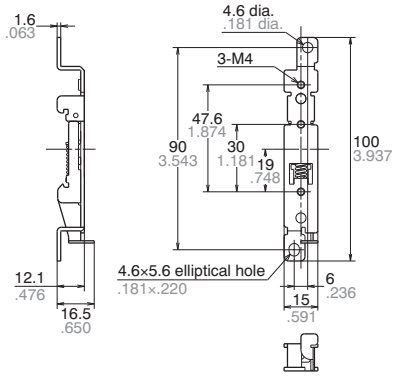
Mounting dimensions



AQP-DPJ DIN Rail Mounting Plate

CAD Data

External dimensions



For Cautions for Use, see page 319.

Panasonic
ideas for life

Load current 15 to 40A
Small Screw Terminal SSR

AQ-A RELAYS

FEATURES

1. Compact Size
W 40 × L 58 × H 25.5 mm
W 1.575 × L 2.283 × H 1.004 inch
2. With terminal cover for safety (output side only).
* Cover on input side available as option.
3. Mounting pitch 47.5 mm 1.870 inch
4. Built in varistor for excellent surge absorption
5. With LED indication for operation status verification

TYPICAL APPLICATIONS

Heater control
- **Business use:**
  Cooking machine
  Vending machine
  Freezer
  Refrigerator
- **Industrial use:**
  Molding machine
  Temperature controlled bath
  Printing machine
  Packing machine

ORDERING INFORMATION

AQA □ □ □ □

Output type
2: 15A, 75V to 250V AC
4: 25A, 75V to 250V AC
6: 40A, 75V to 250V AC

Terminal, Type
1: Screw terminal, Zero-cross
2: Screw terminal, Random*

Input voltage
1: 4 to 32 V DC

Functions
VL: Built-in varistor and LED indication

* Random type is available by custom order.

TYPES

1. AQ-A Solid State Relays

Type	Load current	Load voltage	Input voltage	Part No.
Zero-cross	15A	75V to 250V AC	4 to 32V DC	AQA211VL
	25A			AQA411VL
	40A			AQA611VL

Standard Packing; carton: 2 pcs., case: 60 pcs.
Note: Random type also available. Please inquire.

2. Accessories

Type	Part No.	Packaged quantity
Standard heat sink (15A)	AQP-HS-J10A	5 in a carton, 20 in a case
Standard heat sink (25A)	AQP-HS-30/40A	5 in a carton, 20 in a case
Standard heat sink (40A)	AQP-HS-J25A	No carton, 5 in a case
Slim heat sink (45mm wide) (Mountable on a DIN rail)	AQP-HS-SJ20A	No carton, 8 in a case
DIN rail mounting plate	AQP-DPJ	5 in a bag, 50 in a case
Terminal cover	AQA801	—

RATING

1. Ratings (Measurement condition: at 20°C 68°F, Input ripple: 1% or less)

Item	Part No.	AQA211VL	AQA411VL	AQA611VL	Remarks
Input side	Input voltage	4 to 32V DC			
	Input current	Max. 20mA			
	Drop-out voltage	Min. 1V			
Output side	Max. load current	15A	25A	40A	
	Load voltage	75 to 250V AC			
	Frequency	45 to 65Hz			
	Non-repetitive surge current	150A	250A	400A	In one cycle at 60Hz
	"OFF-state" leakage current	Max. 10mA			at 60Hz
	"ON-state" voltage drop	Min. 1.6V			at Max. carrying current
	Min. load current*	100mA			

Note: * When the load current is less than the rated minimum load current, please refer to Cautions for Use, page 319..

2. Characteristics (Measurement condition: at 20°C 68°F, Input ripple: 1% or less)

Item	AQA211VL	AQA411VL	AQA611VL	Remarks
Operate time	Max. 1/2 cycle of voltage sine wave + 1ms			
Release time	Max. 1/2 cycle of voltage sine wave + 1ms			
Insulation resistance	Min. 100MΩ between input and output			at 500 V DC
Breakdown voltage	4,000 Vrms between input and output 2,500 Vrms between input, output and case			for 1min.
Vibration resistance (Functional)	10 to 55Hz double amplitude of 1.5mm			X, Y, Z axes
Shock resistance (Functional)	Min. 980 m/s²			X, Y, Z axes
Ambient temperature	–20°C to +80°C –4°F to +176°F			Non-condensing at low temperatures
Storage temperature	–20°C to +85°C –4°F to +185°F			Non-condensing at low temperatures
Operational method	Zero-cross (Turn ON and Turn OFF)			

REFERENCE DATA

1. Load current vs. ambient temperature

Use load current within range specified in the figure below.

Tested condition

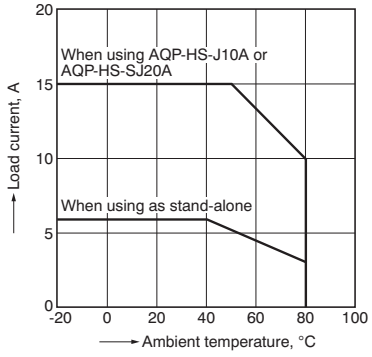
With external heat sink

1) (1) When using standard heat sink (AQP-HS-J25A)
   (2) When using standard heat sink (AQP-HS-30/40A)
   (3) When using standard heat sink (AQP-HS-J10A)
   (4) When using standard heat sink (AQP-HS-SJ20A)
2) If attached to a heat sink, use a heat conductive compound (Ex. Momentive Performance Materials Inc. YG6111 or TSK5303) of similar coating to improve cooling.

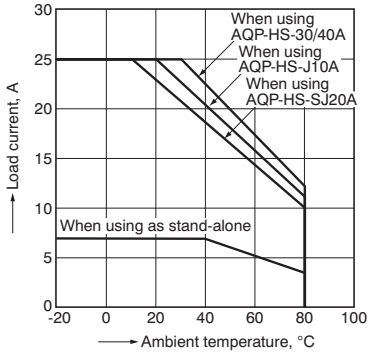
Without external heat sink

If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.

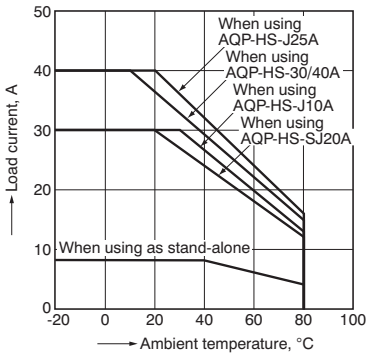
(1) 15A type (AQA211VL)



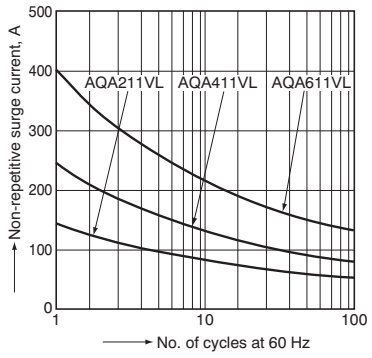
(2) 25A type (AQA411VL)



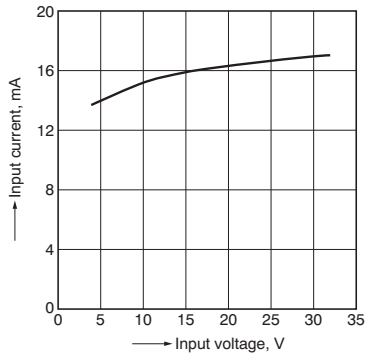
(3) 40A type (AQA611VL)



2. Non-repetitive surge current vs. carrying time characteristics



3. Input current vs. input voltage characteristics

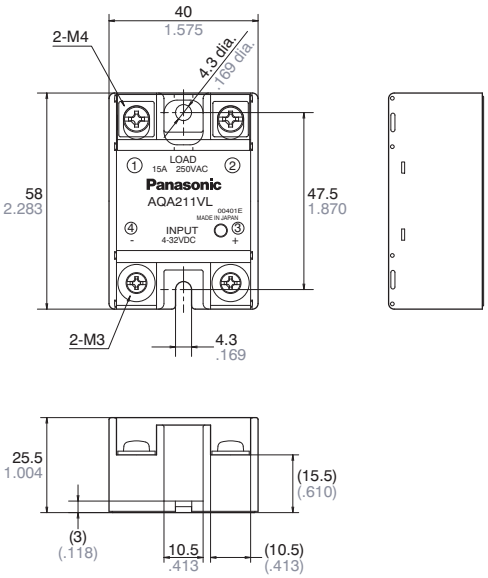


DIMENSIONS (mm inch)

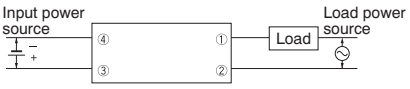
Download CAD Data from our Web site.

CAD Data

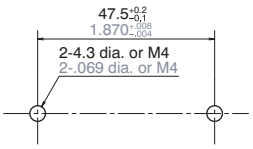
External dimensions



Schematic



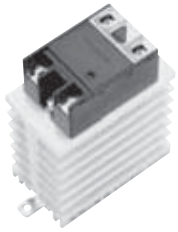
Mounting dimensions



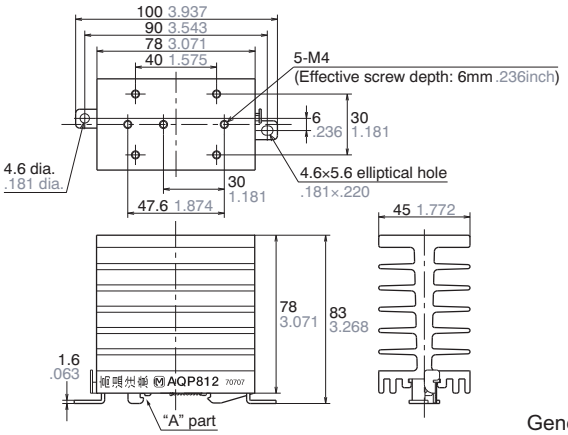
ACCESSORIES (mm inch)

AQP-HS-SJ20A Slim Heat Sink

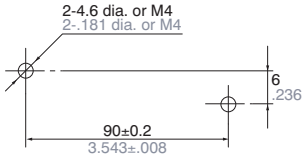
CAD Data



External dimensions



Mounting dimensions

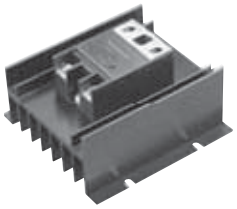


Note: When using on a DIN rail, please install so that the "A" part is on top.

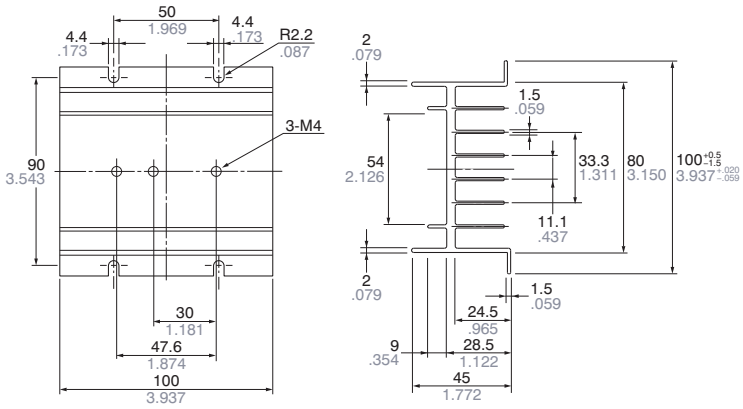
General tolerance: ±1.0 ±.039

AQP-HS-J10A Standard Heat Sink

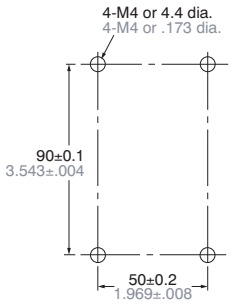
CAD Data



External dimensions



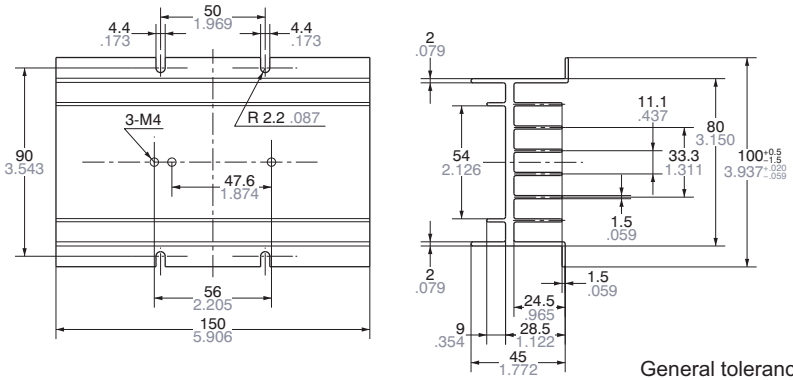
Mounting dimensions



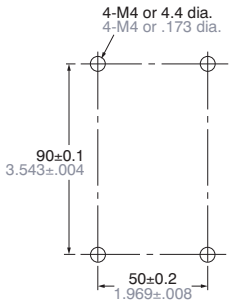
AQP-HS-30/40A Standard Heat Sink

CAD Data

External dimensions



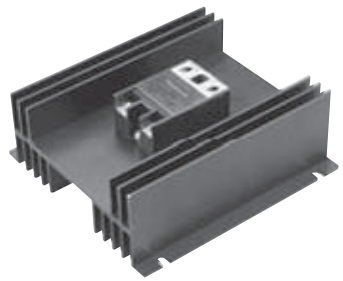
Mounting dimensions



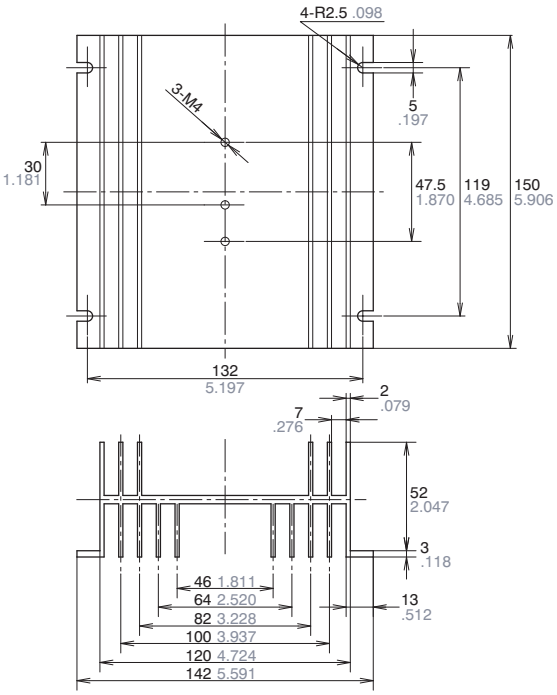
General tolerance: ±0.5 ±.020

AQP-HS-J25A Standard Heat Sink

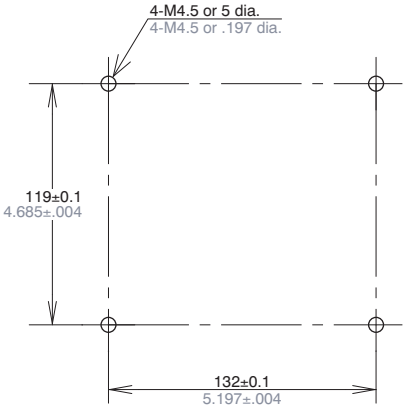
CAD Data



External dimensions

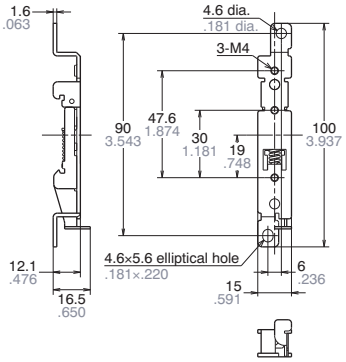


Mounting dimensions



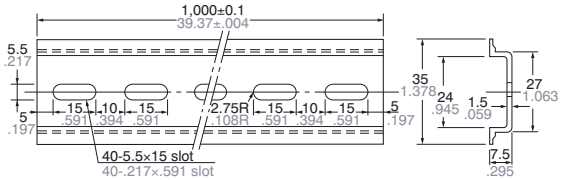
AQP-DPJ DIN Rail Mounting Plate

CAD Data



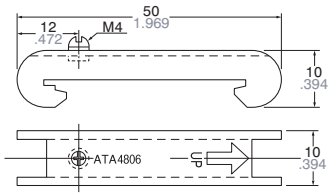
AT8-DLA1 Mounting Rail

CAD Data



ATA4806 Fastening plate

CAD Data



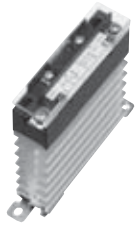
For Cautions for Use, see page 319.

(Breakdown voltage 2,500V) (Breakdown voltage 4,000V)

Panasonic
ideas for life

10A and 25A DIN rail type

AQ-K RELAYS



FEATURES

1. Combined with heat sink for vertical profile
Helps to save space on control panel

2. Dielectric voltage of 2,500V or 4,000V

3. Both screw-on installation or one-touch DIN rail installation available

4. Includes operation LED (red)

5. Built-in varistor

APPLICATIONS

1. Molding machine (heater control)
2. Temperature controlled bath (heater control)
3. Printing machine (heater control)
4. Machine tool (motor control)

Solid State

TYPES

Type	Load current	Load voltage	Breakdown voltage	Part No.
Zero-cross	15 A	75 to 250 V AC	2,500 V AC	AQK1211
			4,000 V AC	AQK1231
	25 A	75 to 250 V AC	2,500 V AC	AQK2211
			4,000 V AC	AQK2231

ORDERING INFORMATION

Ex. AQK □ □ □ □

Load current	Load voltage	Type	Input voltage
1: 15 A 2: 25 A	2: 75 to 250 V AC	1: Zero-cross type (2,500 V) 3: Zero-cross type (4,000 V)	1: 4.5 to 30 V DC

Note: Standard packing: Carton 10 pcs., Case: 60 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input ripple: 1% or less)
1) 10 A type

Items	Type	AQK1211	AQK1231	AQK2211	AQK2231	Remarks
Input side	Input voltage	4.5 to 30 V DC				
	Input current, max.	10 mA				
	Drop-out voltage, min.	1 V				
Load side	Max. load current	15 A		25 A		See “REFERENCE DATA 1”
	Load voltage	75 to 250 V AC				
	Frequency	45 to 65 Hz				
	Non-repetitive surge current	150 A		250 A		In one cycle at 60 Hz
	Max. “OFF-state” leakage current	9 mA (when 200 V applied)				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V				at max. carrying current
	Min. load current	100 mA				

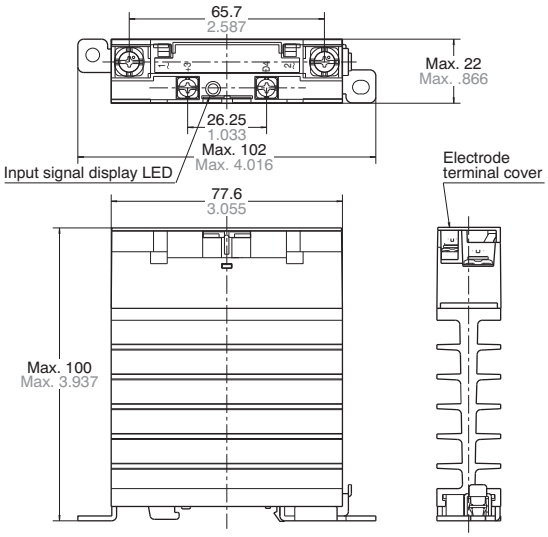
2. Characteristics (at 20°C 68°F, Input ripple: 1% or less)

Part No.	AQK1211	AQK1231	AQK2211	AQK2231	Remarks
Operate time, max.	(1/2 cycle of voltage sine wave) + 1 ms				
Release time, max.	(1/2 cycle of voltage sine wave) + 1 ms				
Breakdown voltage	2,500 V AC	4,000 V AC	2,500 V AC	4,000 V AC	
Ambient temperature	–30°C to +80°C –22°F to +176°F				Non-condensing at low temperatures
Insulation resistance, min., Initial	100 MΩ between input, output and case				by 500V DC megger
Vibration resistance	10 to 55 Hz at double amplitude of 0.75 mm				For 1 min.
Shock resistance	Min. 294 m/s²				
Storage temperature	–35°C to +100°C –31°F to +212°F				
Operational method	Zero-cross (Turn-ON and Turn-OFF)				

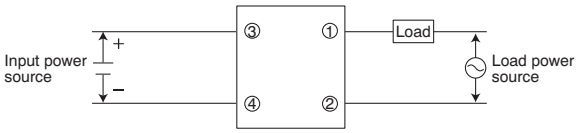
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

CAD Data

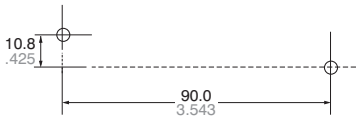


Schematic



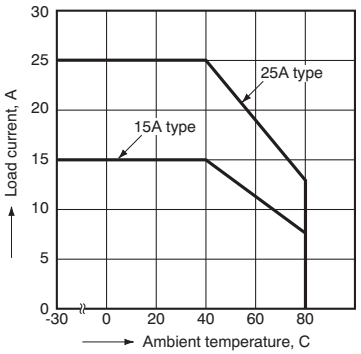
Mounting dimensions (Bottom view)

35-mm DIN rail installation, or 2-4.6/M4 dia. Screws

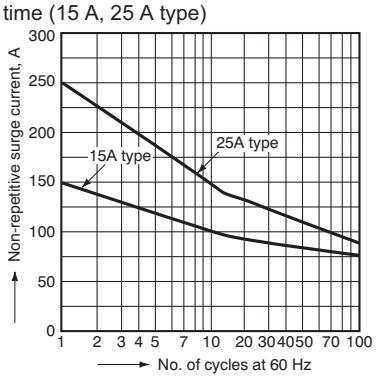


REFERENCE DATA

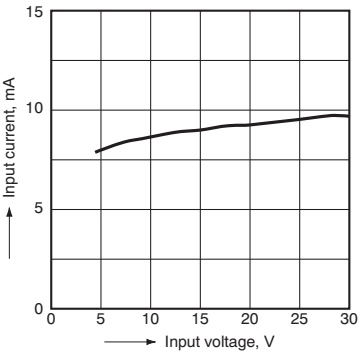
11.Load current vs. ambient temperature characteristics



12.Non-repetitive surge current vs. carrying time (15 A, 25 A type)

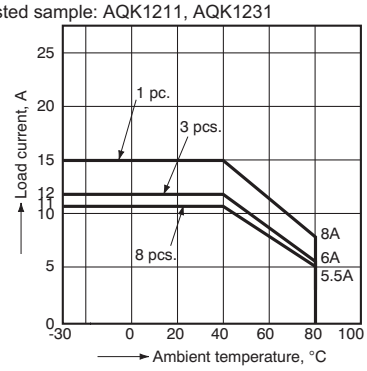


13.Input current vs. input voltage characteristics



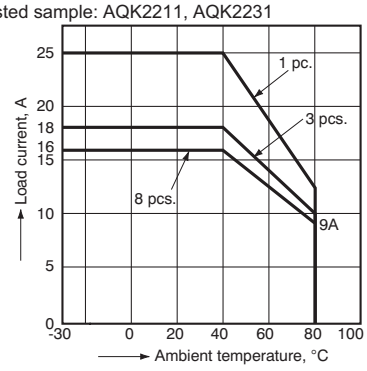
14-(1) Load current when contact mounted vs. ambient temperature characteristics

Tested sample: AQK1211, AQK1231



4-(2) Load current when contact mounted vs. ambient temperature characteristics

Tested sample: AQK2211, AQK2231



For Cautions for Use, see Page 319.

Please contact us about TÜV certified products.

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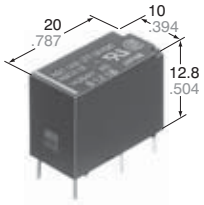
Input and output module compact DIL type

AQ-C RELAYS



mm inch

FEATURES

- **Compact DIL type: 20 mm (length) × 10 mm (width) × 12.8 mm (height) (.787×.394×.504 inch)**
- **Excellent in noise resistance**
- **Snubber circuit integrated**
- **High dielectric strength: 2,500 V between input and output**
- **Reverse polarity type available**

Solid State

TYPES

1. Input module

Type	Output voltage	Input voltage	Part No.
AC input	4 to 32 V DC	80 to 250 V AC	AQCD3-IM 100/240 V AC
DC input	4 to 32 V DC	3 to 32 V DC	AQCD3-IM 4/24 V DC

2. Output module

Type	Load voltage	Input voltage	Part No.
AC output Zero-cross	75 to 125 V AC	5 V DC	AQC1A1 - ZT5 V DC
		12 V DC	AQC1A1 - ZT12 V DC
		24 V DC	AQC1A1 - ZT24 V DC
	75 to 250 V AC	5 V DC	AQC1A2 - ZT5 V DC
		12 V DC	AQC1A2 - ZT12 V DC
		24 V DC	AQC1A2 - ZT24 V DC
AC output Non zero-cross	75 to 125 V AC	5 V DC	AQC1A1 - T 5 V DC
		12 V DC	AQC1A1 - T 12 V DC
		24 V DC	AQC1A1 - T 24 V DC
	75 to 250 V AC	5 V DC	AQC1A2 - T 5 V DC
		12 V DC	AQC1A2 - T 12 V DC
		24 V DC	AQC1A2 - T 24 V DC
DC output	3 to 60 V DC	5 V DC	AQC1AD1- 5 V DC
		12 V DC	AQC1AD1- 12 V DC
		24 V DC	AQC1AD1- 24 V DC

ORDERING INFORMATION

AQC [1A] [D1] — [ZT] [5VDC] — [R]

Load current	Load voltage	Type	Input voltage	Input polarity
Nil: Input module 1A: Output module	1: 75 to 125 V AC (Output module) 2: 75 to 250 V AC (Output module) D1: 3 to 60 V DC (Output module) D3: 4 to 32 V DC (Input module)	Nil: DC output IM: Input module T: AC output Non zero-cross ZT: AC output Zero-cross	Output module: 5, 12, 24 V DC Input module: 4/24 V DC, 100/240 V AC	Nil: Standard polarity R: Reverse polarity (Only for output module)

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

SPECIFICATIONS

Rating [at 20°C 68°F; Input voltage ripple (output module) and output voltage ripple (input module): max. 1%]

1. Input module

Item		Type: AC input AQCD3-IM 100/240 V AC	DC input AQCD3-IM 4/24 V DC	Remarks
Input side	Input voltage	80 to 250 V AC	3 to 32 V DC	
	Input current	Max. 5 mA	Max. 5 mA	
	Pick-up voltage	Max. 80 V AC	Max. 3 V DC	
	Drop-out voltage	Min. 10 V AC	Min. 1 V DC	
Output side	Load voltage	4 to 32 V DC	4 to 32 V DC	
	Load current	0.1 to 25 mA	0.1 to 25 mA	
	Max. “OFF-state” leakage current	Max. 5μA	Max. 5μA	When 32 V DC applied
	Max. “ON-state” voltage drop	Max. 1.6 V	Max. 1.6 V	at max. carrying current

2. Output module

(1) AC output type

Item		Type: AQC1A1-ZT5VDC / AQC1A1-T5VDC	AQC1A1-ZT12VDC / AQC1A1-T12VDC	AQC1A1-ZT24VDC / AQC1A1-T24VDC	AQC1A2-ZT5VDC / AQC1A2-T5VDC	AQC1A2-ZT12VDC / AQC1A2-T12VDC	AQC1A2-ZT24VDC / AQC1A2-T24VDC	Remarks
Input side	Input voltage	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	See “Data 3”.
	Input impedance (Approx.)	0.3 k Ω	0.8 k Ω	1.8 k Ω	0.3 k Ω	0.8 k Ω	1.8 k Ω	
	Drop-out voltage, min	0.5 V	1.2 V	2.4 V	0.5 V	1.2 V	2.4 V	
Load side	Max. load current	1 A						See “Data 1”. Ta = Min. 40°C
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Non-repetitive surge current	20 A						See “Data 2”. In one cycle at 60 Hz
	Max. “OFF-state” leakage current	0.6 m A (When 100 V AC applied)			1.1 m A (When 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop	1.6 A						at max. carrying current
	Min. load current	10 mA			20 mA			

(2) DC output type

Item		Type: AQC1AD1-5VDC	AQC1AD1-12VDC	AQC1AD1-24VDC	Remarks
Input side	Input voltage	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	See “Data 3”.
	Input impedance (Approx.)	430 Ω	1.2 k Ω	2.8 k Ω	
	Drop-out voltage, min	0.8 V			
Load side	Max. load current	1 A			See “Data 1”. Ta = Min. 40°C
	Load voltage	3 to 60 V DC			
	Non-repetitive surge current	1.5 A			See “Data 2”. at 1s
	Max. “OFF-state” leakage current	0.1 m A (When 60 V DC applied)			
	Max. “ON-state” voltage drop	1.6 V			at max. carrying current
	Min. load current	1 mA			

Characteristics [at 20°C 68°F; Input voltage ripple (output module) and output voltage ripple (input module): max. 1%]

Input module

Item		Type: AC Input	DC Input	Remarks
Operate time, max.		20 ms	0.5 ms	Input voltage: 24 V DC or 100V AC Output voltage: 24 V DC Output current: 25mA
Release time, max		20 ms	0.5 ms	
Insulation resistance, min.		10^9 Ω between input and output		at 500 V DC
Breakdown voltage		2,500 Vrms between input and output		For 1 minute
Vibration resistance	Functional	10 to 55Hz double amplitude of 3 mm		10 minutes for X,Y, Z, axis
	Destructive	10 to 55Hz double amplitude of 3 mm		1 hour for X,Y, Z, axis
Shock resistance	Functional	Min. 980 m/s² {100 G}		4 time each for X,Y,Z axis
	Destructive	Min. 980 m/s² {100 G}		5 time each for X,Y,Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F		
Storage temperature		–30°C to +100°C –22°F to +212°F		

Output module

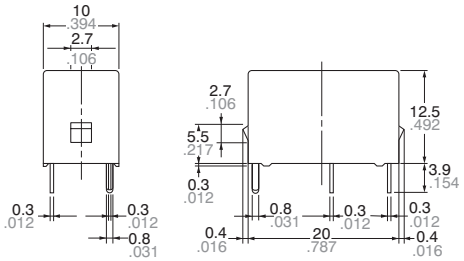
Item \ Type		AC output		DC output	Conditions
		Non zero-cross	Zero-cross		
Operate time, max.		1 ms	(1/2 cycle of voltage sine wave)+1ms	0.5 ms	
Release time, max.		(1/2 cycle of voltage sine wave)+1ms		1 ms	
Insulation resistance, min.		$10^9\Omega$ between input and output			at 500 V DC
Breakdown voltage		2,500 Vrms between input and output			For 1 minute
Vibration resistance	Functional	10 to 55Hz double amplitude of 3 mm			10 minutes for X,Y, Z, axis
	Destructive	10 to 55Hz double amplitude of 3 mm			1 hour for X,Y, Z, axis
Shock resistance	Functional	Min. 980 m/s² {100 G}			4 time each for X,Y,Z axis
	Destructive	Min. 980 m/s² {100 G}			5 time each for X,Y,Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F			
Storage temperature		–30°C to +100°C –22°F to +212°F			
Operational method		Non zero-cross Turn-ON, Zero-cross Turn-OFF	Zero-cross (Turn-ON and Turn-OFF)	—	

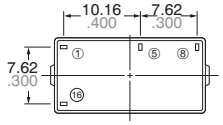
DIMENSIONS (mm inch)

Download CAD Data from our Web site.

1. Input module (AC, DC)

CAD Data



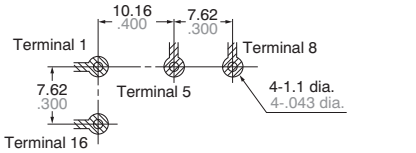


AC input
⑤ Output: DC-
⑧ Output: DC+
⑯ Input: AC
① Input: AC
Case color: Yellow

DC input
⑤ Output: DC-
⑧ Output: DC+
⑯ Input: DC+
① Input: DC-
Case color: White

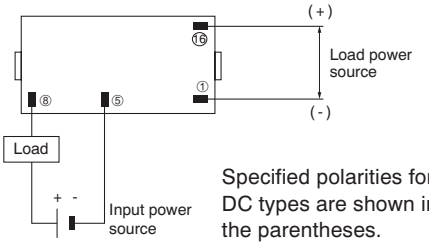
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

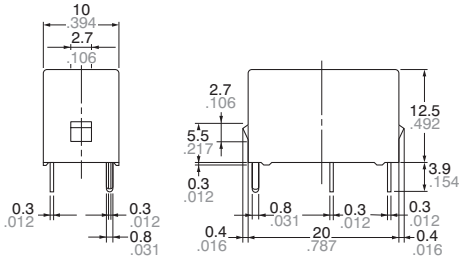
Schematic

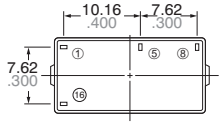


Specified polarities for DC types are shown in the parentheses.

2. Output module (AC, DC)

CAD Data



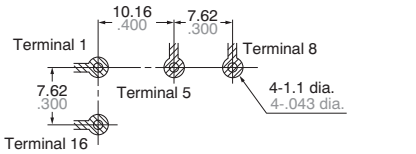


AC output
⑤ Output: AC
⑧ Output: AC
⑯ Input: DC+
① Input: DC -
Case color: Black

DC output
⑤ Output: DC -
⑧ Output: DC+
⑯ Input: DC+
① Input: DC -
Case color: Red

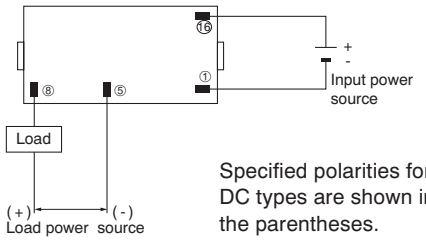
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



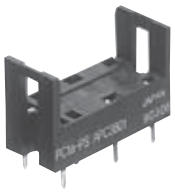
Tolerance: ±0.1 ±.004

Schematic



Specified polarities for DC types are shown in the parentheses.

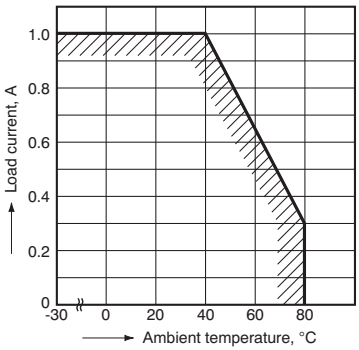
ACCESSORY



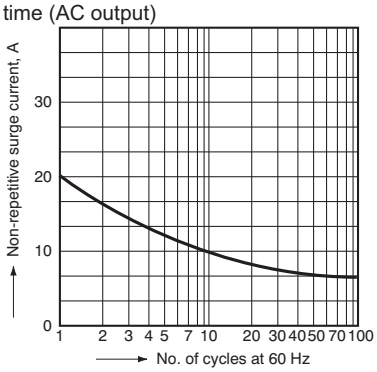
PC1A-PS

REFERENCE DATA

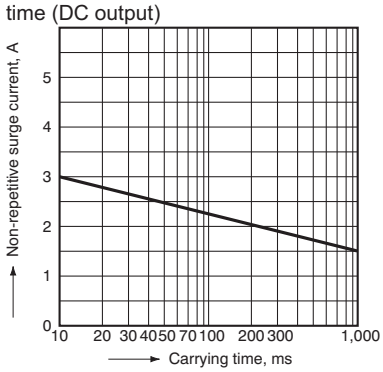
15.Load current vs. ambient temperature



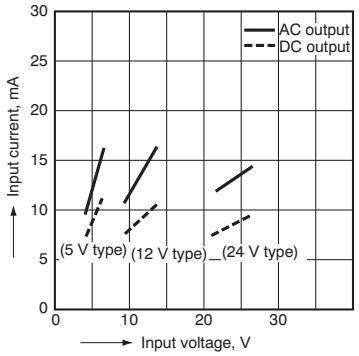
16-(1) Non-repetitive surge current vs. carrying time (AC output)



2.-(2) Non-repetitive surge current vs. carrying time (DC output)

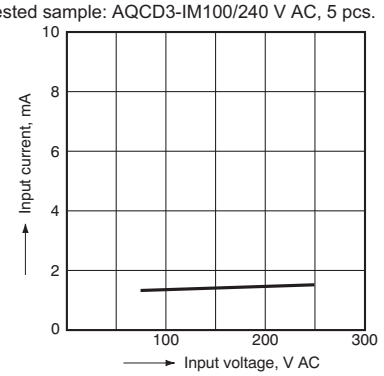


17.Input current vs. input voltage characteristics (AC/DC output)



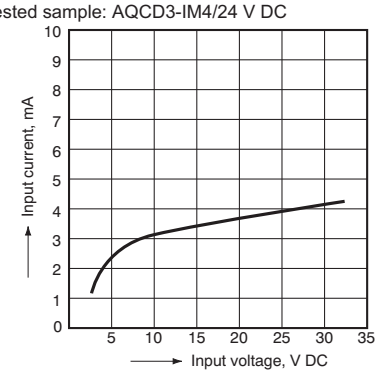
18-(1) Input current vs. input voltage characteristics (AC input)

Tested sample: AQCD3-IM100/240 V AC, 5 pcs.

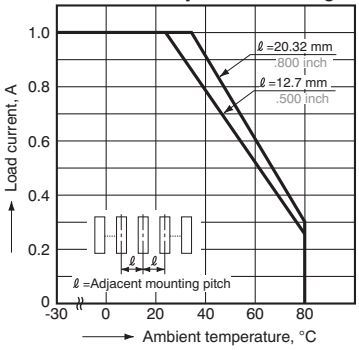


4.-(2) Input current vs. input voltage characteristics (DC input)

Tested sample: AQCD3-IM4/24 V DC

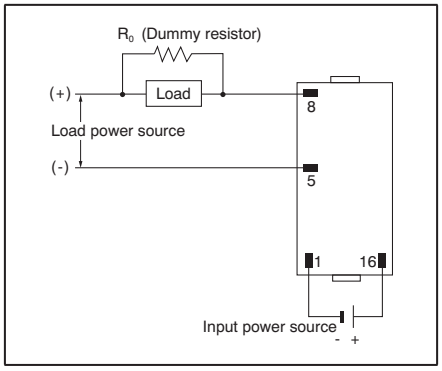


19.Load current vs. ambient temperature characteristics for adjacent mounting

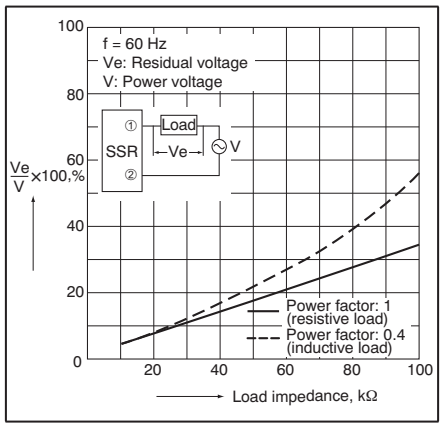


NOTE

When used for the load less than rated
In the case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off.
Use a dummy resistor as a countermeasure.
The total of the current through the resistor and the load current must exceed the min. rated load current.



In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:
Example:
For the inductive load by the 5 mA load current and the 200 V AC load voltage, the load impedance becomes 40 kW and Ve/V = 16% is estimated from the below graph.
Accordingly, the 32 V voltage remains across the both ends of the load when the solid state relay is turned off.
• Characteristics of residual voltage vs. load impedance



For Cautions for Use, see Page 319.

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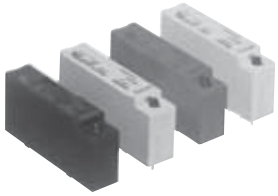
Input/Output relays for interface applications

I/O-RELAYS



FEATURES

- **Input and output modules for interfacing between CPU and external input devices or loads**
  - **IAC: AC input (yellow)**
  - **OAC: AC output (black)**
  - **IDC: DC input (white)**
  - **ODC: DC output (red)**
- **Excellent transient noise immunity**
- **Breakdown voltage: 4,000 V between input and output**
- **Zero-cross switching for reducing EMI**
- **LED operation indication types available**

TYPICAL APPLICATIONS

1. Optimum for minicomputer and microcomputer use, and for feed back control process control systems. Robot, NC machine, Automatic Assembling machine.
2. Programmable controllers controls for motors, solenoids and solenoid valves.

ORDERING INFORMATION

□ □ - □ □ - □

Input or Output
I: Input module
O: Output module

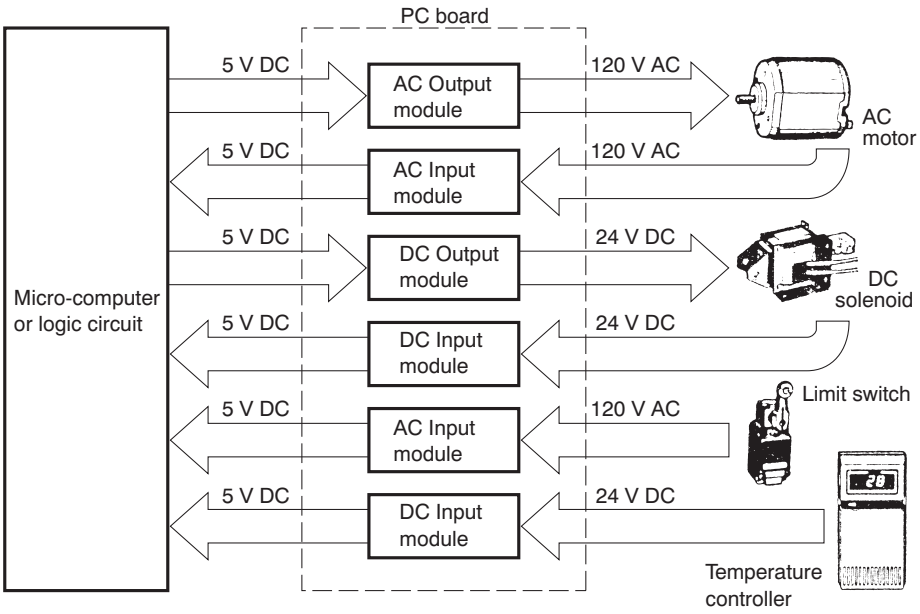
AC or DC
AC: AC input or AC output
DC: DC input or DC output

Logic supply or control voltage
3/15: 3 to 15 V DC
4/15: 4 to 15 V DC
10/32: 10 to 32 V DC

Input or Output Voltage
Input
Nil: 80 to 140 V AC
3 to 32 C DC
A: 160 to 280 V AC
Output
Nil: 75 to 125 V AC
3 to 60 V DC
A: 75 to 250 V AC
10 to 200 V DC

Operation indication
Nil: No operation indication
L: Operation indication

EXAMPLE OF I/O SYSTEM CONSTRUCTION



Recently, the microcomputer shown in the left has come into use, with a rapid increase in the use of feedback control for process controllers. As an input/output interface relay, it represents a fast responding interface with long life, noiseless, PC board mounting facility, making circuit design and manufacture simple, and providing amplification of maintenance with space saving. Our company's I/O relays have been grouped for use with either AC or DC devices as AC output type, AC input type, DC output type, and DC input. In addition, the I/O use relay is modularized identically, responding to the various load types for PC board mounting. Because combinations can be freely used, circuit design has been greatly facilitated. Accordingly, the above diagram of interface PC board mounting is a practical construction which can be used.

TYPES

Input modules

Type	Logic supply voltage	Input voltage	Part No.	
			No LED	With LED
AC	4 to 15 V DC	80 to 140 V AC	IAC4/15	IAC4/15-L
		160 to 280 V AC	IAC4/15-A	IAC4/15-AL
	10 to 32 V DC	80 to 140 V AC	IAC10/32	IAC10/32-L
		160 to 280 V AC	IAC 10/32-A	IAC10/32-AL
DC	4 to 15 V DC	3 to 32 V DC	IDC4/15	IDC4/15-L
	10 to 32 V DC	3 to 32 V DC	IDC10/32	IDC10/32-L

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

Output modules

Type	Logic supply voltage	Output voltage	Part No.	
			No LED	With LED
AC	3 to 15 V DC or 4 to 15 V DC	75 to 125 V AC	OAC3/15	OAC4/15-L
		75 to 250 V AC	OAC3/15-A	OAC4/15-AL
	10 to 32 V DC	75 to 125 V AC	OAC10/32	OAC10/32-L
		75 to 250 V AC	OAC10/32-A	OAC10/32-AL
DC	3 to 15 V DC or 4 to 15 V DC	3 to 60 V DC	ODC3/15	ODC4/15-L
		10 to 200 V DC	ODC3/15-A	ODC4/15-AL
	10 to 32 V DC	3 to 60 V DC	ODC10/32	ODC10/32-L
		10 to 200 V DC	ODC10/32-A	ODC10/32-AL

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

SPECIFICATIONS

Rating (at 20°C 68°F, Voltage ripple of logic side: less than 1%)

1. Input module

		IAC 4/15	IAC 4/15-L	IAC 10/32	IAC 10/32-L	IAC 4/15-A	IAC 4/15-AL	IAC 10/32-A	IAC 10/32-AL	IDC 4/15	IDC 4/15-L	IDC 10/32	IDC 10/32-L	Remarks
Input side	Input voltage	80 to 140 V AC				160 to 280 V AC				3 to 32 V DC				
	Input current, Max.	5 mA (100 V)				5 mA (200 V)				20 mA (32 V)				
	Operate voltage, Max.	80 V AC				160 V AC				3 V				
	Release voltage Min.	10 V AC				20 V AC				0.8 V				
Logic side	Logic supply voltage	4 to 15 V		10 to 32 V		4 to 15 V		10 to 32 V		4 to 15 V		10 to 32 V		
	Logic supply current, Max.	15 mA								15 mA				at max. logic supply voltage
	Breakdown voltage	30 V								30 V				
	Output current, Max.	25 mA								25 mA				
	Max. “OFF-side” leakage current	100 μA								100 μA				
	Max. “ON-side” voltage drop	0.4 V								0.4 V				at max. carrying current

2. Output module

		OAC 3/15	OAC 4/15-L	OAC 10/32	OAC 10/32-L	OAC 3/15-A	OAC 4/15-AL	OAC 10/32-A	OAC 10/32-AL	ODC 3/15	ODC 4/15-L	ODC 10/32	ODC 10/32-L	ODC 3/15-A	ODC 4/15-AL	ODC 10/32-A	ODC 10/32-AL	Remarks
Logic side	Logic voltage range	3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V		
	Input Impedance (Approx.)	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	*1
	Drop-out voltage, Min.	0.8V								0.8V								
Output side	Max. load current	2 A (Ambient temperature: Max. 30°C)*2								2 A (Ambient temperature: Max. 40°C)*2				1 A (Ambient temperature: Max. 40°C)*2				
	Output voltage	75 to 125 V AC				75 to 250 V AC				3 to 60 V DC				10 to 200 V DC				
	Non-repetitive surge current	30 A (in one cycle at 60 Hz)*3								5 A (for 1 s)*3								
	Max. “OFF-state” leakage current	5 mA (100 V)				5 mA (200 V)				1 mA (60 V)				1 mA (200 V)				at 60 Hz
	Max. “ON-state” voltage current	1.6 V								1.6 V				2.3 V				at max. carrying current
	Min. load current	50 mA*4								5 mA*4								

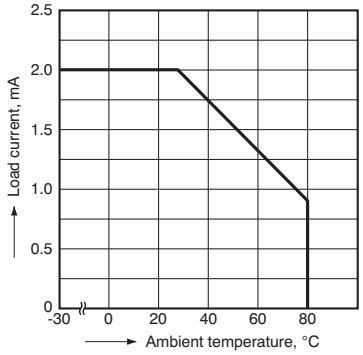
Notes: *1. Please refer to REFERENCE DATA, “3. Input current vs. input voltage”.
*2. Please refer to REFERENCE DATA, “1. Load current vs. ambient temperature”.
*3. Please refer to REFERENCE DATA, “2. Surge current vs. time”.
*4. When the load current is less than the rated minimum load current, please refer to the Cautions for Use, on Page 319.

Characteristics (at 20°C 68°F, Voltage ripple of logic side: less than 1%)

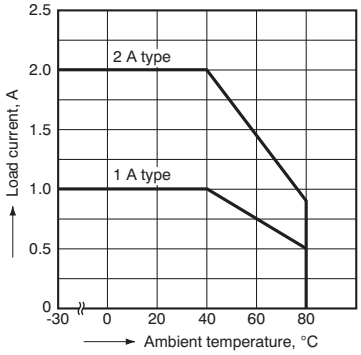
		Input modules		Output modules	
		IAC	IDC	OAC	ODC
Operate time, max.		20 ms	5 ms	1/2 cycle of voltage sine wave + 1 ms	0.5 ms
Release time, max.		20 ms	5 ms	1/2 cycle of voltage sine wave + 1 ms	2 ms
Insulation resistance		10^9 Ω between input and output (at 500 V DC)			
Breakdown voltage		4,000 V AC between input and output (for 1 min.)			
Vibration resistance	Destructive	10 to 55 Hz at double amplitude of 2 mm (1hour for X, Y, Z axis)			
	Functional	10 to 55 Hz at double amplitude of 2 mm (10 minutes for X, Y, Z axis)			
Shock resistance	Destructive	Min. 980 m/s² {100G} (5 times each for X, Y, Z axis)			
	Functional	Min. 980 m/s² {100G} (4 times each for X, Y, Z axis)			
Ambient temperature		–30°C to +80°C –22°F to +176°F		–30°C to +80°C –22°F to +176°F	
Storage temperature		–30°C to +100°C –22°F to +212°F		–30°C to +100°C –22°F to +212°F	
Operational method		–		Zero-cross (Turn-ON and Turn-OFF)	–

REFERENCE DATA

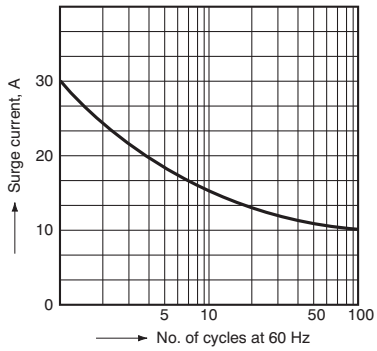
1-1. Load current vs. ambient temperature (OAC)



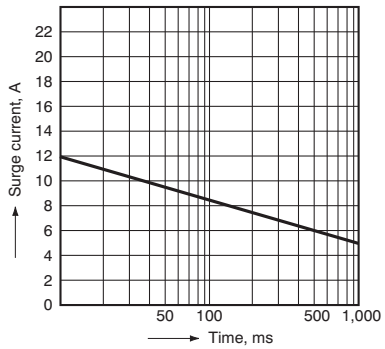
1-2. Load current vs. ambient temperature (ODC)



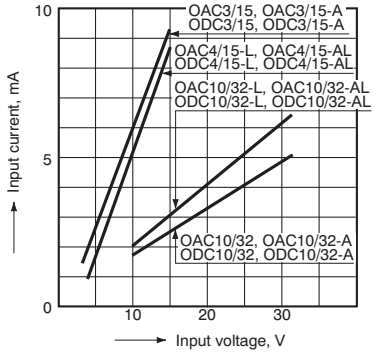
2-1. Surge current vs. time (OAC)



2-2. Surge current vs. time (ODC)



3. Input current vs. input voltage (OAC, ODC)

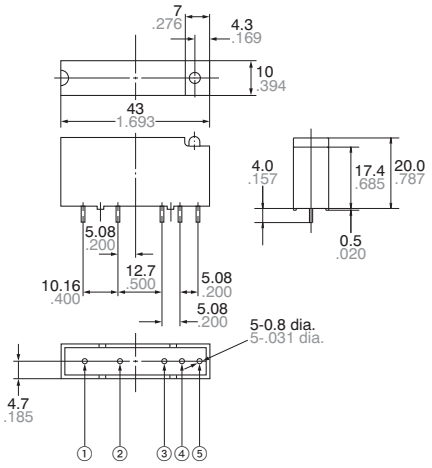


DIMENSIONS (mm inch)

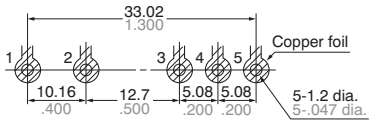
Download CAD Data from our Web site.

Input module (IAC, IDC)

CAD Data



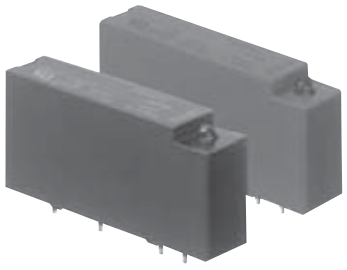
PC board pattern (Bottom view)

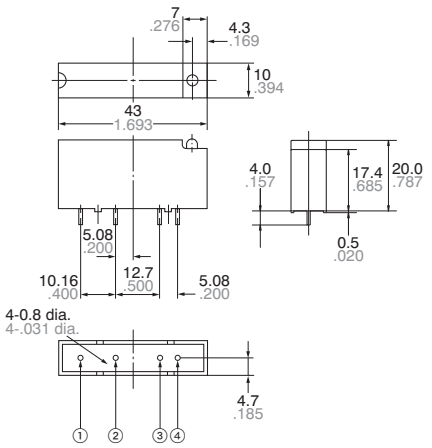


	IAC	IDC
1	Input: AC	Input: DC +
2	Input: AC	Input: DC –
3	Vcc	Vcc
4	Logic output	Logic output
5	Grounding	Grounding
Body color	Yellow	White

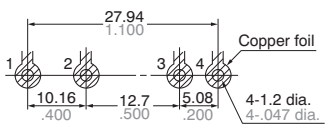
Output modules (OAC, ODC)

CAD Data





PC board pattern (Bottom view)

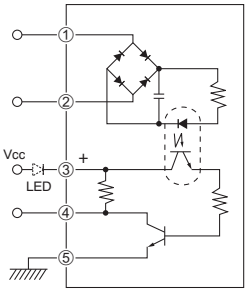


	OAC	ODC
1	Output: AC	Output: DC +
2	Output: AC	Output: DC –
3	Input: DC+	Input: DC+
4	Input: DC-	Input: DC-
Body color	Black	Red

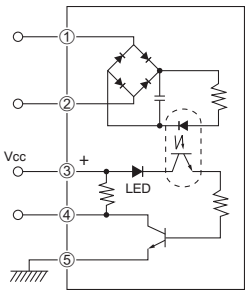
BLOCK DIAGRAM

1) AC input module

Without LED

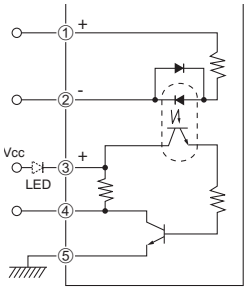


With LED

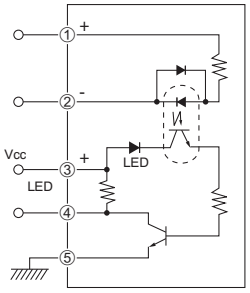


2) DC input module

Without LED

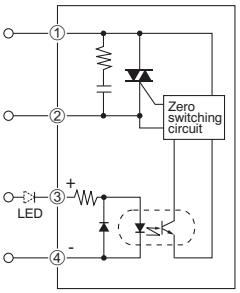


With LED

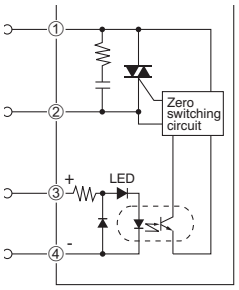


3) AC output module

Without LED

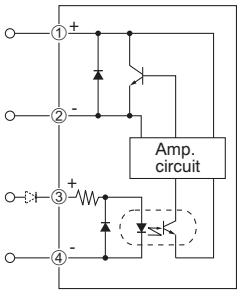


With LED

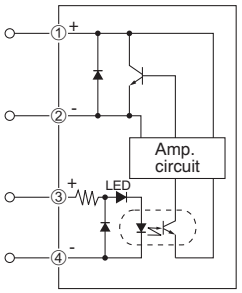


4) DC output module

Without LED



With LED

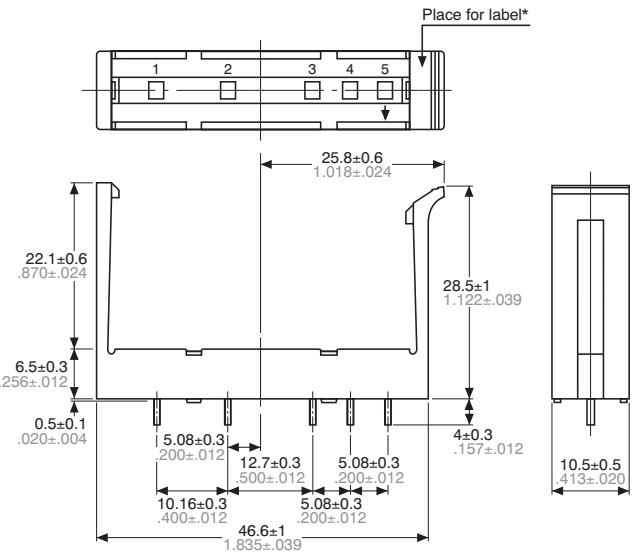


ACCESSORIES

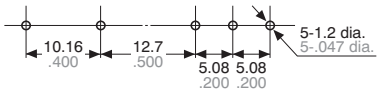
I/O Socket

CAD Data

I/O-PS



PC board pattern (Bottom view)



* Use the included label. Affixing it here on the socket will facilitate viewing of the circuit and other tasks.

For Cautions for Use, see Page 319.

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