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FAIRCHILD™

April 2015

4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M 6-Pin General Purpose Phototransistor Optocouplers

Features

- Minimum Current Transfer Ratio at I_F = 10 mA, V_{CE} = 10 V:
  - 10% for 4N27M and 4N28M
  - 20% for 4N25M and 4N26M
  - 100% for 4N35M, 4N36M and 4N37M
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

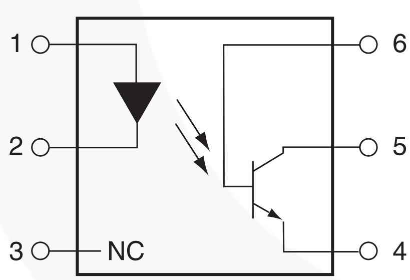
Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a standard plastic six-pin dual-in-line package.

Schematic



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

Figure 1. Schematic

Package Outlines

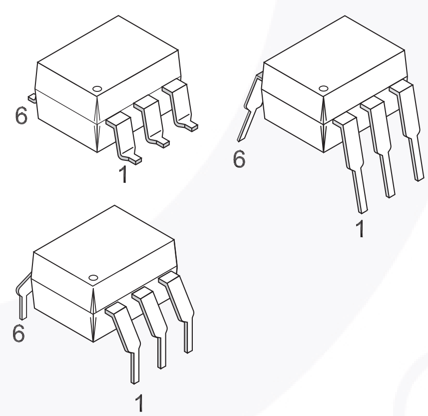


Figure 2. Package Outlines

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for "safe electrical insulation" only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V_{RMS}	I–IV
	< 300 V_{RMS}	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V_{PR}	Input-to-Output Test Voltage, Method A, V_{IORM} x 1.6 = V_{PR}, Type and Sample Test with t_m = 10 s, Partial Discharge < 5 pC	1360	V_{peak}
	Input-to-Output Test Voltage, Method B, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with t_m = 1 s, Partial Discharge < 5 pC	1594	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	850	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	6000	V_{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T_S	Case Temperature(1)	175	°C
$I_{S,INPUT}$	Input Current(1)	350	mA
$P_{S,OUTPUT}$	Output Power(1)	800	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V(1)	> 10^9	Ω

Note:
1. Safety limit values – maximum values allowed in the event of a failure.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. T_A = 25°C unless otherwise specified.

Symbol	Parameter	Value	Unit
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	270	mW
	Derate Above 25°C	2.94	mW/°C
EMITTER			
I_F	DC/Average Forward Input Current	60	mA
V_R	Reverse Input Voltage	6	V
I_F(pk)	Forward Current – Peak (300 µs, 2% Duty Cycle)	3	A
P_D	LED Power Dissipation @ T_A = 25°C	120	mW
	Derate Above 25°C	1.41	mW/°C
DETECTOR			
V_{CEO}	Collector-to-Emitter Voltage	30	V
V_{CBO}	Collector-to-Base Voltage	70	V
V_{ECO}	Emitter-to-Collector Voltage	7	V
P_D	Detector Power Dissipation @ T_A = 25°C	150	mW
	Derate Above 25°C	1.76	mW/°C

Electrical Characteristics

TA = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
EMITTER						
V_F	Input Forward Voltage	I_F = 10 mA		1.18	1.50	V
I_R	Reverse Leakage Current	V_R = 6.0 V		0.001	10	µA
DETECTOR						
BV_{CEO}	Collector-to-Emitter Breakdown Voltage	I_C = 1.0 mA, I_F = 0	30	100		V
BV_{CBO}	Collector-to-Base Breakdown Voltage	I_C = 100 µA, I_F = 0	70	120		V
BV_{ECO}	Emitter-to-Collector Breakdown Voltage	I_E = 100 µA, I_F = 0	7	10		V
I_{CEO}	Collector-to-Emitter Dark Current	V_{CE} = 10 V, I_F = 0		1	50	nA
I_{CBO}	Collector-to-Base Dark Current	V_{CB} = 10 V			20	nA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz		8		pF

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS							
CTR	Current Transfer Ratio, Collector-to-Emitter	I_F = 10 mA, V_{CE} = 10 V	4N35M, 4N36M, 4N37M	100			%
			4N25M, 4N26M	20			%
			4N27M, 4N28M	10			%
		I_F = 10 mA, V_{CE} = 10 V, T_A = -55°C	4N35M, 4N36M, 4N37M	40			%
		I_F = 10 mA, V_{CE} = 10 V, T_A = +100°C	4N35M, 4N36M, 4N37M	40			%
$V_{CE\ (SAT)}$	Collector-to-Emitter Saturation Voltage	I_C = 2 mA, I_F = 50 mA	4N25M, 4N26M, 4N27M, 4N28M			0.5	V
		I_C = 0.5 mA, I_F = 10 mA	4N35M, 4N36M, 4N37M			0.3	V
AC CHARACTERISTICS							
T_{ON}	Non-Saturated Turn-on Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	4N25M, 4N26M, 4N27M, 4N28M		2		µs
		I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	4N35M, 4N36M, 4N37M		2	10	µs
T_{OFF}	Turn-off Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	4N25M, 4N26M, 4N27M, 4N28M		2		µs
		I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	4N35M, 4N36M, 4N37M		2	10	µs

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	t = 1 Minute	4170			VAC_{RMS}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, f = 1 MHz		0.2		pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}			Ω

Typical Performance Curves

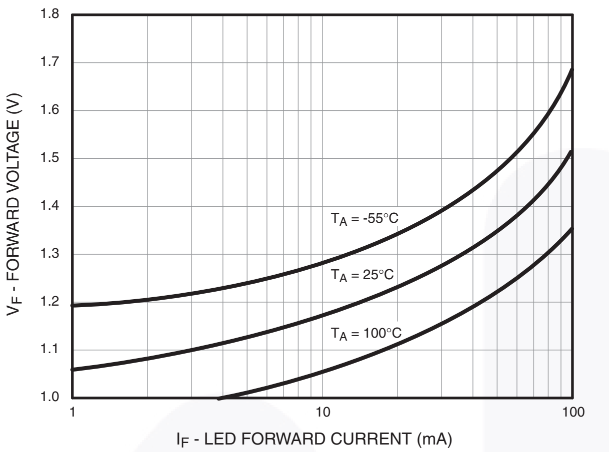


Figure 3. LED Forward Voltage vs. Forward Current

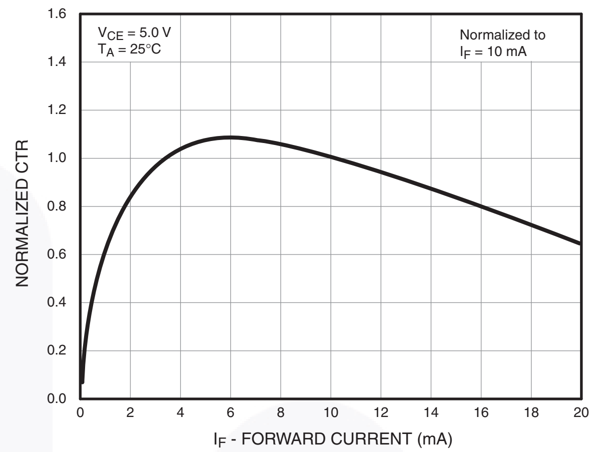


Figure 4. Normalized CTR vs. Forward Current

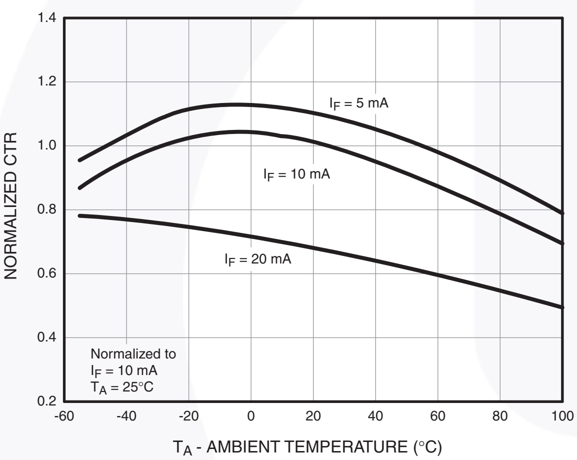


Figure 5. Normalized CTR vs. Ambient Temperature

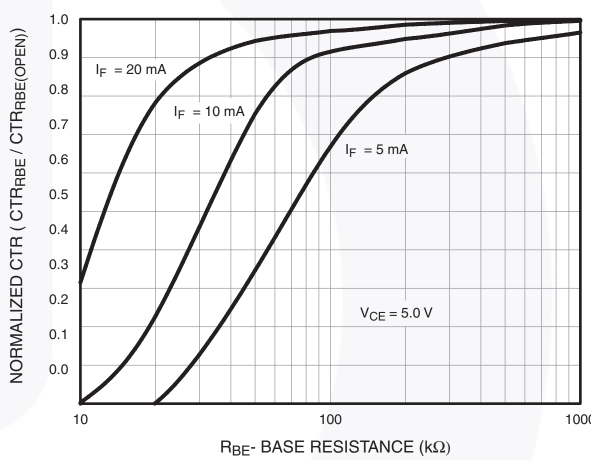


Figure 6. CTR vs. RBE (Unsaturated)

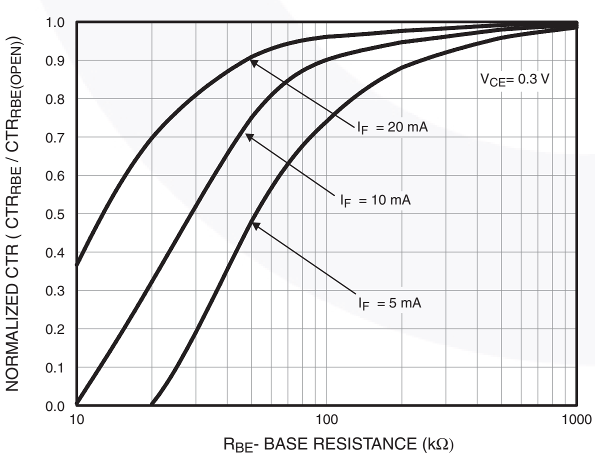


Figure 7. CTR vs. RBE (Saturated)

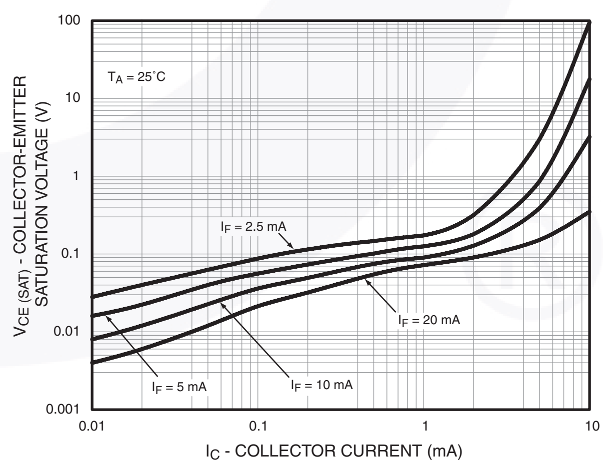


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)

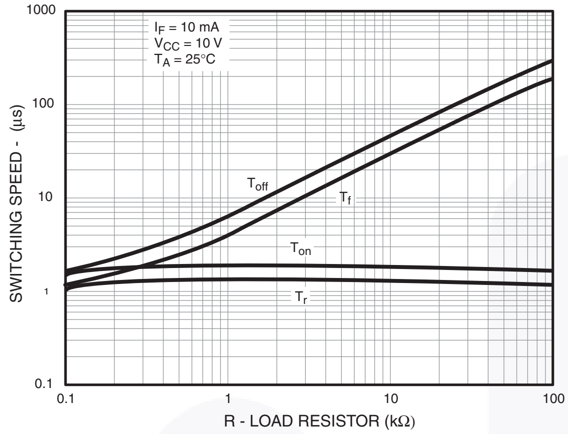


Figure 9. Switching Speed vs. Load Resistor

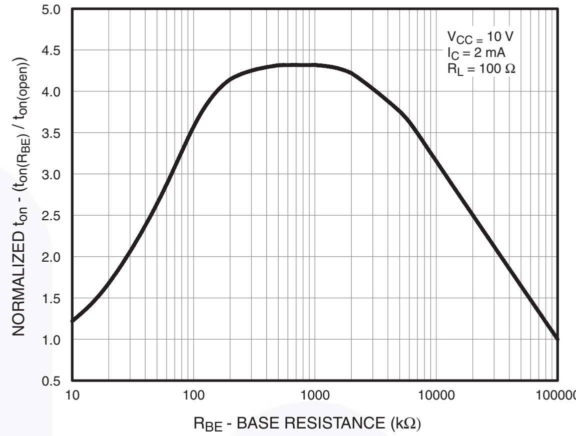


Figure 10. Normalized t_{on} vs. R_{BE}

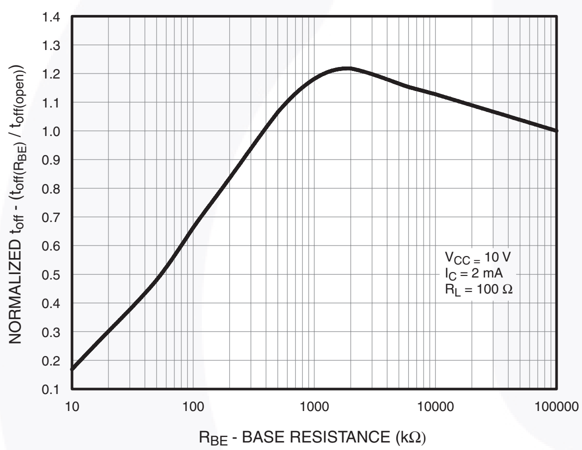


Figure 11. Normalized t_{off} vs. R_{BE}

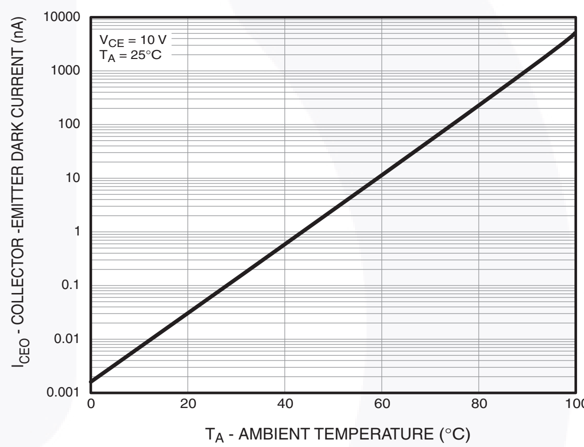


Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveforms

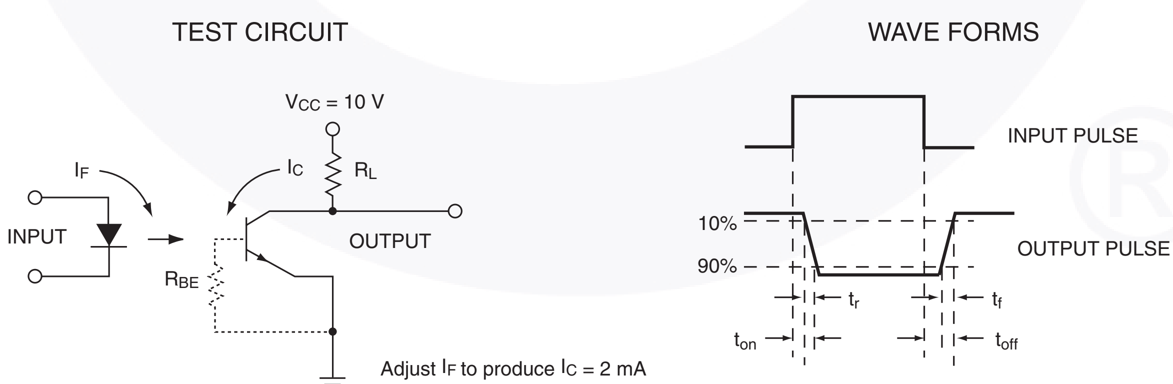


Figure 13. Switching Time Test Circuit and Waveforms

Reflow Profile

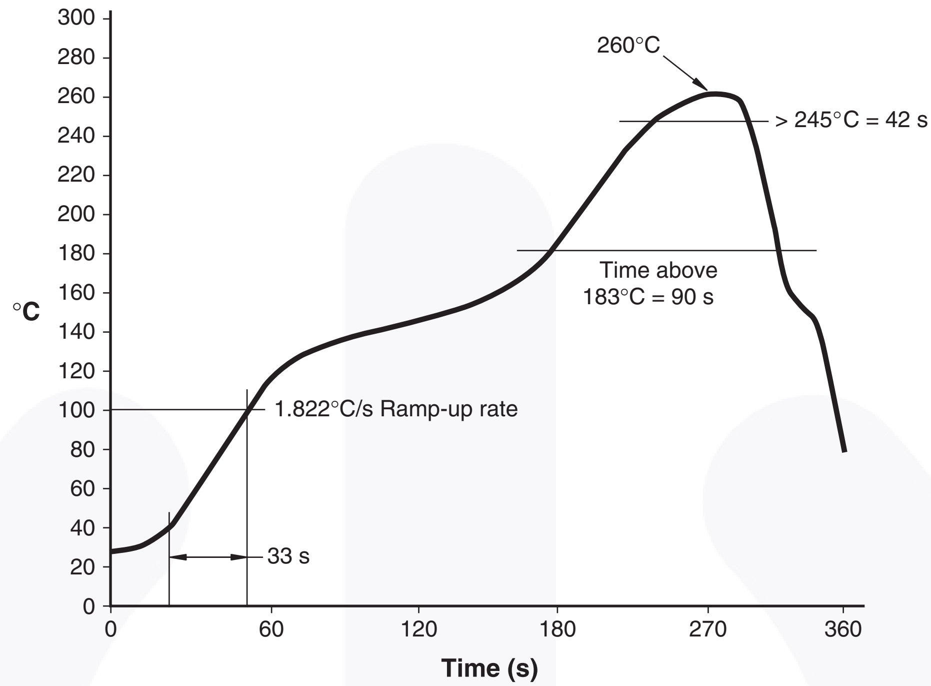


Figure 14. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
4N25M	DIP 6-Pin	Tube (50 Units)
4N25SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
4N25SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
4N25VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N25SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
4N25SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
4N25TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

2. The product orderable part number system listed in this table also applies to the 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, and 4N37M devices.

Marking Information

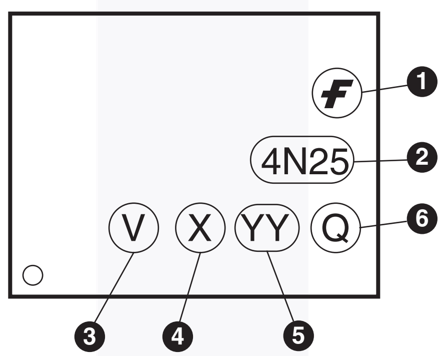
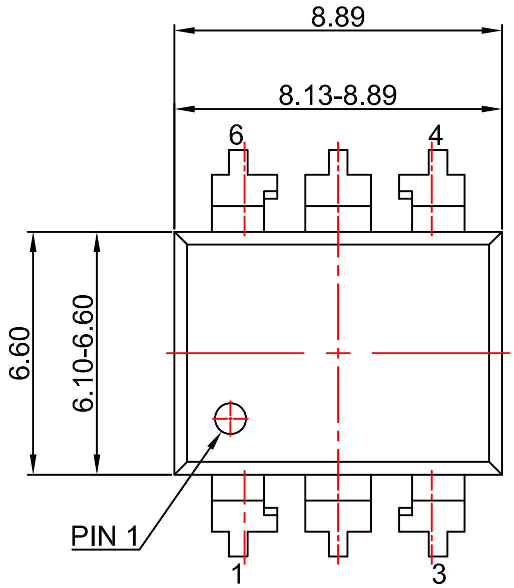
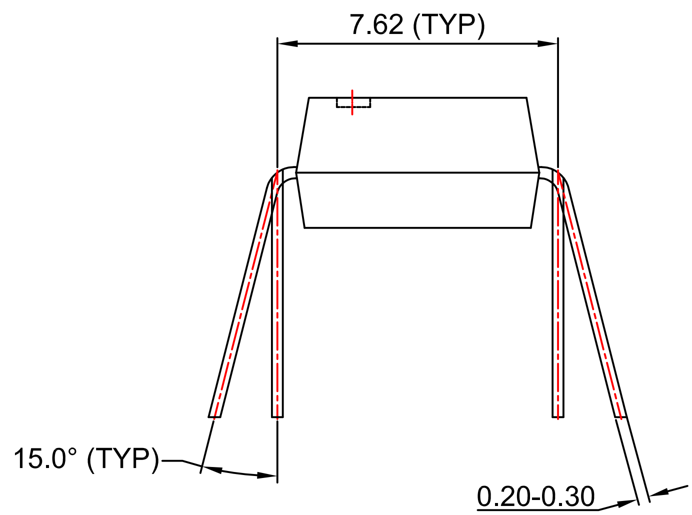


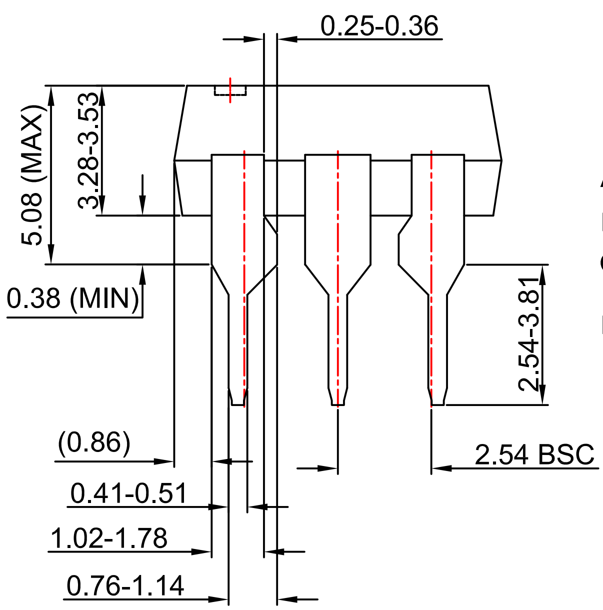
Figure 15. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code







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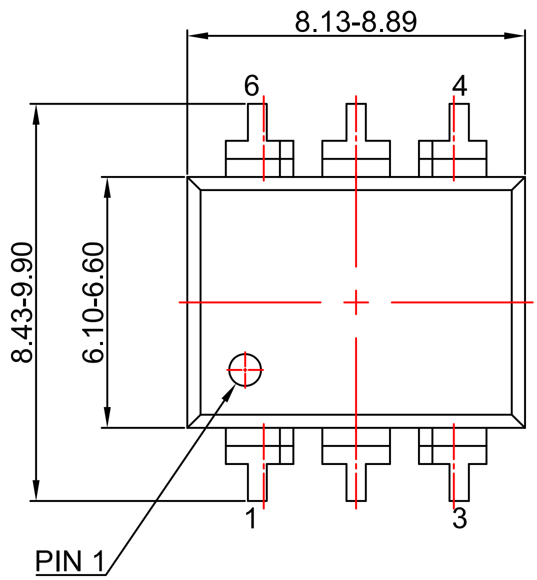
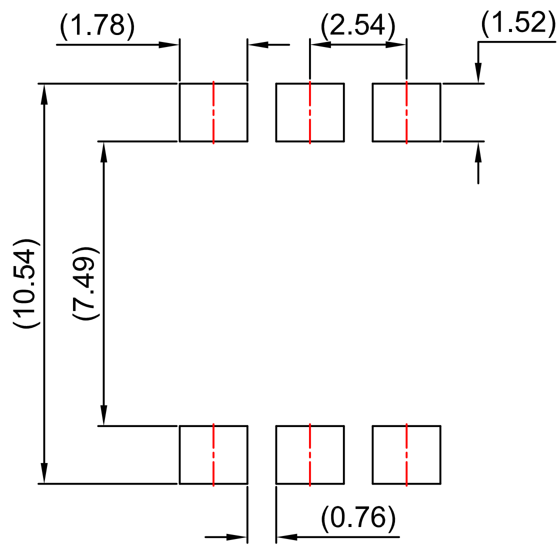
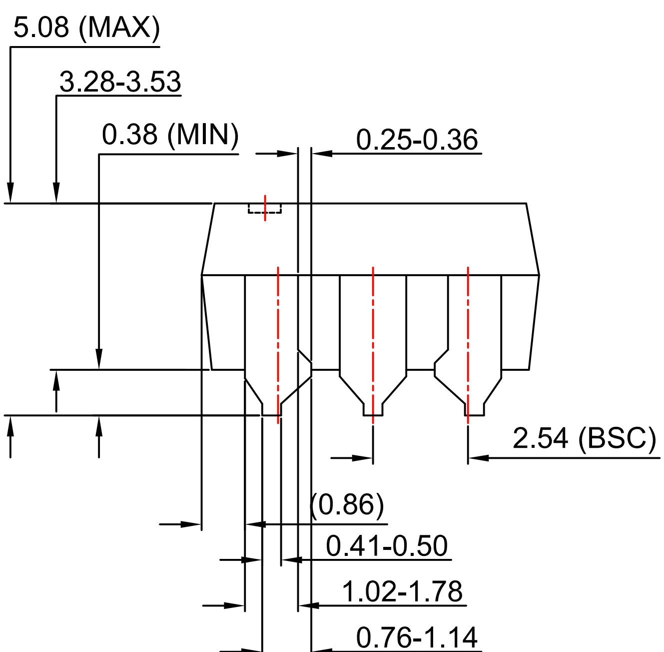
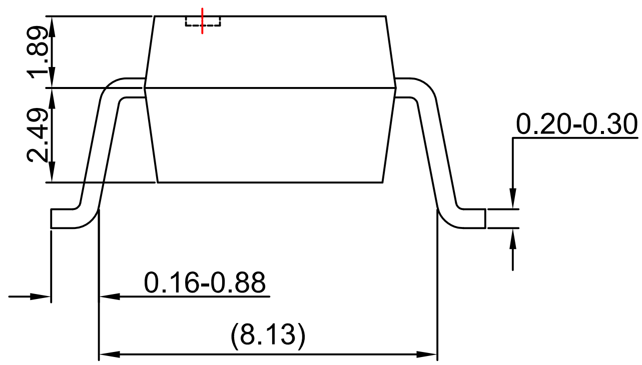




LAND PATTERN RECOMMENDATION





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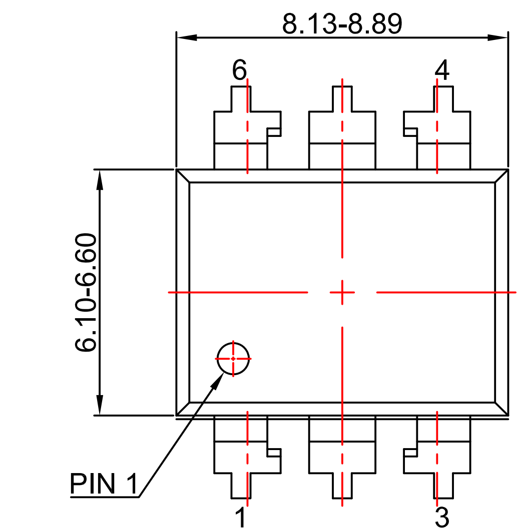

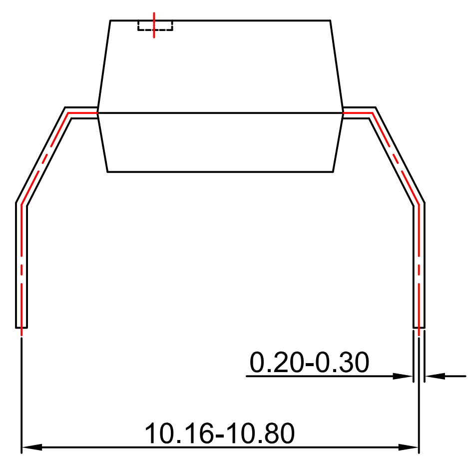

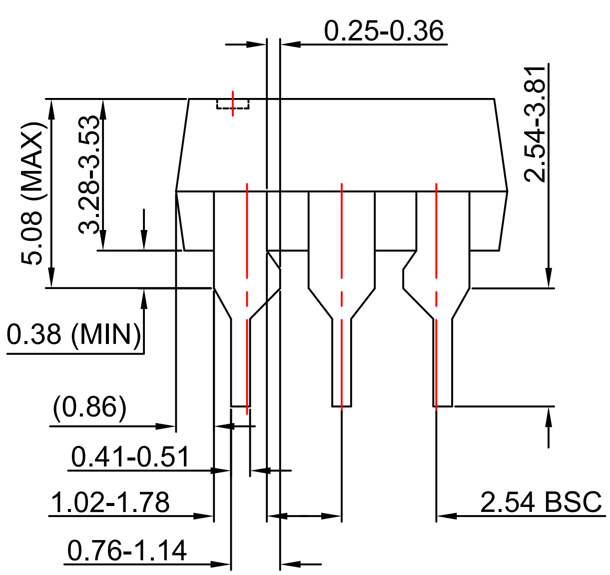

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