XC6203 Series

Large Current Positive Voltage Regulators

■GENERAL DESCRIPTION

The XC6203 series are highly precise, low power consumption, 3 terminal positive voltage regulators manufactured using CMOS and laser trimming technologies.

The series provides large currents with a significantly small dropout voltage.

The XC6203P consists of a driver transistor, a current limiter, a precision reference voltage and an error amplifier. The XC6203E is also available but without the current limiter function. Output voltage is selectable in 0.1V increments between a voltage of 1.8V and 6.0V.

SOT-23, SOT-89, SOT-223 and TO-92 package are available.

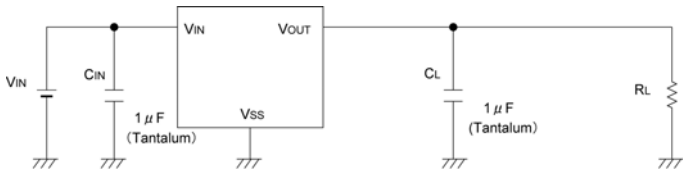
■APPLICATIONS

- ●Magnetic disk drive
- ●Note PCs / Tabet PCs
- ●Digital still cameras /Camcorders
- ●Digital audio equipments
- ●Reference voltage souces
- ●Multi-function power supplies

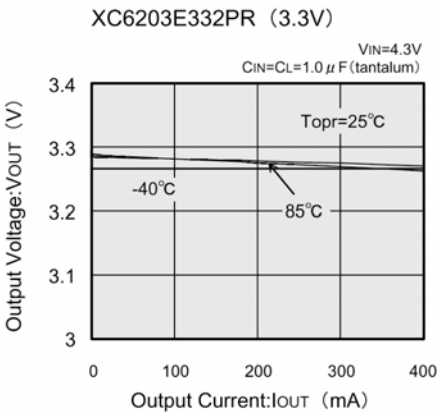
■FEATURES

Maximum Output Current : 400mA (3.3V)
Maximum Operating Voltage : 8.0V
Output Voltage Range : 1.8V ~ 6.0V
(selectable in 0.1V increments)
Highly Accurate : ±2%
Low Power Consumption : 8.0μA (TYP.)
Line Regulation : 0.2% / V (TYP.)
Output Voltage Temperature Characteristics
: ±100ppm/℃ (TYP.)
Dropout Voltage : 150mV @ 100mA,
300mV @ 200mA
Operating Ambient Temperature : -40℃ ~ 85℃
Packages : SOT-23, SOT-89,
SOT-223, TO-92
Environmentally Friendly : EU RoHS Compliant, Pb Free

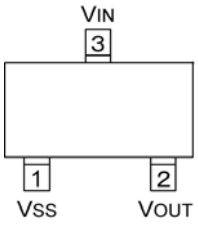
■TYPICAL APPLICATION CIRCUIT



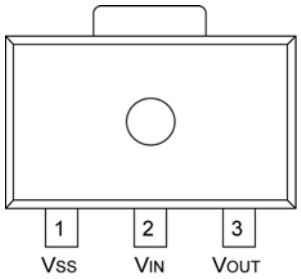
■TYPICAL PERFORMANCE CHARACTERISTICS



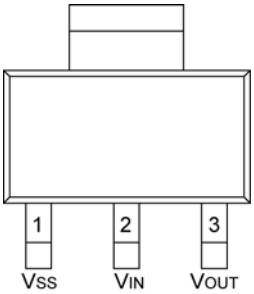
■PIN CONFIGURATION



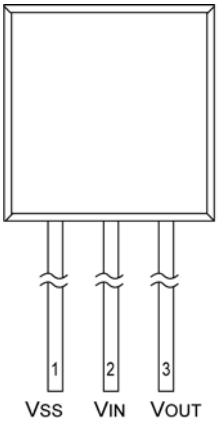
SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)



SOT-223
(TOP VIEW)



TO-92
(SIDE VIEW)

■PIN ASSIGNMENT

PIN NUMBER		PIN NAME	FUNCTIONS
SOT-23	SOT-89/SOT-223/TO-92		
1	1	VSS	Ground
3	2	VIN	Power Input
2	3	VOUT	Output

■PRODUCT CLASSIFICATION

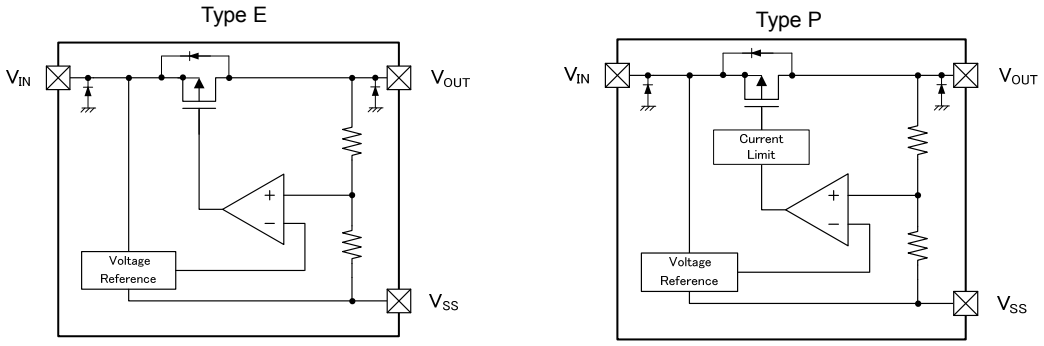
●Ordering Information

XC6203 ①②③④⑤⑥-⑦(*1)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Type of Regulator	P	Current limiter circuit built-in
		E	No current limiter circuit built-in
②③	Output Voltage	18~	e.g. 1.8V → ③=1, ④=8
④	Output Accuracy	2	±2% Output voltage is {x.x0V} (the 2nd decimal place is “0”)
		A	±2% Output voltage is {x.x5V} (the 2nd decimal place is “5)
⑤⑥-⑦(*1)	Packages (Order Unit)	MR	SOT-23 (3,000/Reel)
		MR-G	SOT-23 (3,000/Reel)
		PR	SOT-89 (1,000/Reel)
		PR-G	SOT-89 (1,000/Reel)
		FR	SOT-223 (1,000/Reel)
		FR-G	SOT-223 (1,000/Reel)
		TH	TO-92, Paper type (2,000/Tape)
		TH-G	TO-92, Paper type (2,000/Tape)
		TB	TO-92, Bag type (500/Bag)
		TB-G	TO-92, Bag type (500/Bag)

(*1) The “-G” suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

■BLOCK DIAGRAMS



* Diodes inside the circuits are ESD protection diodes and parasitic diodes.

■ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		VIN	-0.3～+12.0	V
Output Current		IOUT	600(*1)	mA
Output Voltage		VOUT	-0.3～VIN+0.3	V
Power Dissipation	SOT-23	Pd	250	mW
			500(PCB mounted)(*2)	
	SOT-89		500	
			1000(PCB mounted)(*2)	
	SOT-223		300	
			1500(PCB mounted)(*2)	
	TO-92		300	
Operating Ambient Temperature		Topr	-40～+85	℃
Storage Temperature		Tstg	-55～+125	℃

*1: $I_{OUT} \leqq Pd / (V_{IN}-V_{OUT})$

*2 These values are example data which is taken with the PCB mounted. Please refer to pages 20 to 22 for details.

■ELECTRICAL CHARACTERISTICS

XC6203 Series Type E

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$(*2)	I_{OUT}=40mA 1.8V≦$V_{OUT(T)}$	×0.98	$V_{OUT(T)}$(*3)	×1.02	V	②
Maximum Output Current	I_{OUTMAX}	V_{OUT}≧E-1(*4)	E-2(*4)	-	-	mA	②
Load Regulation	ΔV_{OUT}	1.8V≦$V_{OUT(T)}$ 1mA≦I_{OUT}≦150mA	-	40	100	mV	②
Dropout Voltage 1	Vdif1(*5)	I_{OUT}=100mA	-	E-3(*4)		mV	②
Dropout Voltage 2	Vdif2(*5)	I_{OUT}=200mA	-	E-4(*4)		mV	
Supply Current	I_{DD}		-	E-5(*4)		μA	①
Line Regulation	ΔV_{OUT}/(ΔV_{IN}・V_{OUT})	1.8V≦$V_{OUT(T)}$, $V_{OUT(T)}$+1.0V≦V_{IN}≦8.0V, I_{OUT}=40mA	-	0.2	0.3	%/V	②
Input Voltage	V_{IN}		-	-	8.0	V	②
Output Voltage Temperature Characteristics	ΔV_{OUT}/(ΔTopr・V_{OUT})	I_{OUT}=40mA -40℃≦Topr≦85℃	-	±100	-	ppm/℃	②

*1: Unless overwise stated, V_{IN}=$V_{OUT(T)}$+1.0V
*2: $V_{OUT(E)}$: Effective output voltage
*3: $V_{OUT(T)}$: Nominal output voltage.
*4: Please refer to the table E-1, E-2, E-3, E-4, E-5.
*5: Vdif = {V_{IN1} - V_{OUT1}}
V_{IN1} : The input voltage when V_{OUT1} appears as input voltage is gradually decreased.
V_{OUT1} : A voltage equal to 98% of the output voltage when "$V_{OUT(T)}$ + 1.0V" is input.

■ELECTRICAL CHARACTERISTICS (Continued)

XC6203 Series Type P

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$(*2)	I_{OUT}=40mA 1.8V≦$V_{OUT(T)}$	×0.98	$V_{OUT(T)}$(*3)	×1.02	V	②
Maximum Output Current	I_{OUTMAX}	V_{OUT}≧E-1(*4)	E-2(*4)	-	-	mA	②
Load Regulation	ΔV_{OUT}	1.8V≦$V_{OUT(T)}$ 1mA≦I_{OUT}≦200mA	-	40	100	mV	②
Dropout Voltage 1	Vdif1(*5)	I_{OUT}=100mA	-	E-3(*4)		mV	②
Dropout Voltage 2	Vdif2(*5)	I_{OUT}=200mA	-	E-4(*4)		mV	
Supply Current	I_{DD}		-	E-5(*4)		μA	①
Line Regulation	ΔV_{OUT}/ (ΔV_{IN}・V_{OUT})	1.8V≦$V_{OUT(T)}$ $V_{OUT(T)}$+1.0V≦V_{IN}≦8.0V I_{OUT}=40mA	-	0.2	0.3	%/V	②
Input Voltage	V_{IN}		-	-	8.0	V	②
Output Voltage Temperature Characteristics	ΔV_{OUT}/ (ΔTopr・V_{OUT})	I_{OUT}=40mA -40℃≦Topr≦85℃	-	±100	-	ppm/℃	②
Short-Circuit Current	I_{SHORT}	V_{OUT}=V_{SS}	-	60	-	mA	②

*1: Unless overwise stated, V_{IN}=$V_{OUT(T)}$+1.0V
*2: $V_{OUT(E)}$: Effective output voltage
*3: $V_{OUT(T)}$: Nominal output voltage.
*4: Please refer to the table E-1, E-2, E-3, E-4, E-5.
*5: Vdif = {V_{IN1} - V_{OUT1}}
V_{IN1} : The input voltage when V_{OUT1} appears as input voltage is gradually decreased.
V_{OUT1} : A voltage equal to 98% of the output voltage when "$V_{OUT(T)}$ + 1.0V" is input.

■ELECTRICAL CHARACTERISTICS (Continued)

NOMINAL OUTPUT VOLTAGE	E-1	E-2	E-3		E-4		E-5	
	MAXIMUM OUTPUT VOLTAGE		DROPOUT VOLTAGE1		DROPOUT VOLTAGE2		SUPPLY CURRENT	
	V_{OUT2} (V)	I_{OUTMAX} (mA)	V_{dif1} (mV)		V_{dif2} (mV)		I_{SS} (μA)	
$V_{OUT(T)}$	-	MIN.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.
1.8	$V_{OUT(E)} \times 0.9$	400	200	300	400	600	8.0	16.0
1.9								
2.0	$V_{OUT(E)} \times 0.93$							
2.1								
2.2								
2.3								
2.4								
2.5			170	250	320	500		
2.6								
2.7								
2.8								
2.85								
2.9								
3.0	$V_{OUT(E)} \times 0.96$		150	220	300	420		
3.1								
3.2								
3.3								
3.4								
3.5							10.0	20.0
3.6								
3.7								
3.8								
3.9								
4.0			130	200	250	380		
4.1								
4.2								
4.3								
4.4								
4.5								
4.6								
4.7								
4.8								
4.9								
5.0			100	180	200	320		
5.1								
5.2								
5.3								
5.4								
5.5								

*) The symbol is as same as that in the chart of electrical characteristics.

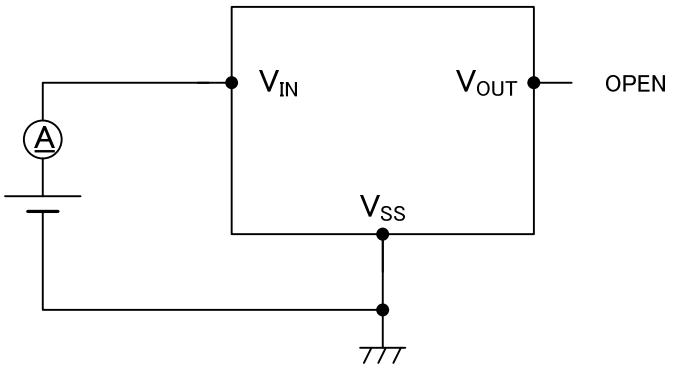
■ELECTRICAL CHARACTERISTICS (Continued)

NOMINAL OUTPUT VOLTAGE	E-1	E-2	E-3		E-4		E-5	
	MAXIMUM OUTPUT VOLTAGE		DROPOUT VOLTAGE1		DROPOUT VOLTAGE2		SUPPLY CURRENT	
	V_{OUT2} (V)	I_{OUTMAX} (mA)	V_{dif1} (mV)		V_{dif2} (mV)		I_{SS} (μA)	
$V_{OUT(T)}$	-	MIN.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.
5.6	$V_{OUT(E)}$×0.96	400	100	180	200	320	10.0	20.0
5.7								
5.8								
5.9								
6.0								

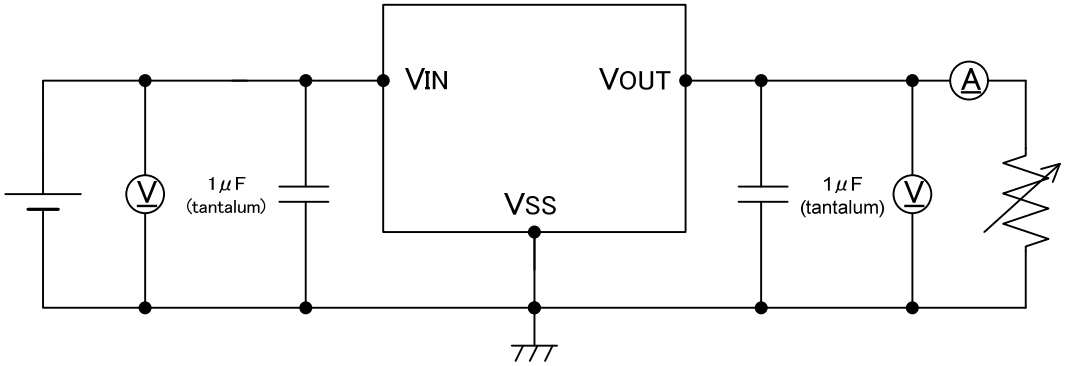
*) The symbol is as same as that in the chart of electrical characteristics.

■TYPICAL APPLICATION CIRCUIT

1) CIRCUIT①



2) CIRCUIT②



■NOTES ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.

2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please keep the resistance low for the V_{BIAS}, V_{IN} and V_{SS} wiring in particular.

3. Please wire the C_{IN} and C_L as close to the IC as possible.

4. Capacitances of these capacitors (C_{IN}, C_L) are decreased by the influences of bias voltage and ambient temperature. Care shall be taken for capacitor selection to ensure stability of phase compensation from the point of ESR influence.

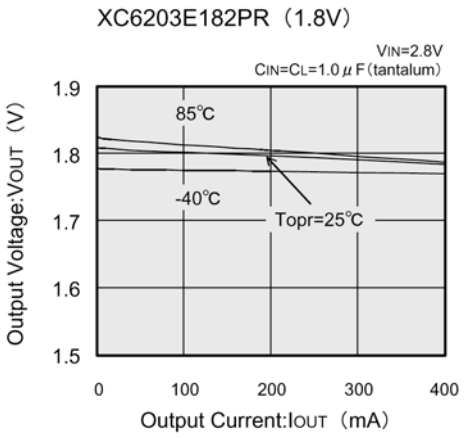
5. When it is used in a quite small input / output dropout voltage, output may go into unstable operation. Please test it thoroughly before using it in production.

6. Torex places an importance on improving our products and their reliability. We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

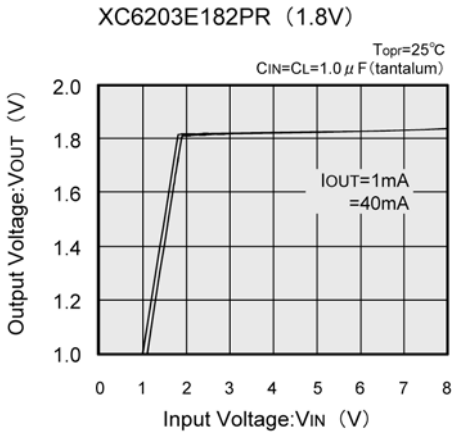
■TYPICAL PERFORMANCE CHARACTERISTICS

●XC6203E182PR

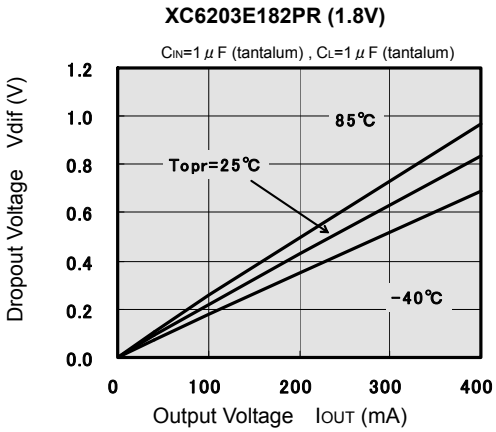
(1) Output Voltage vs. Output Current



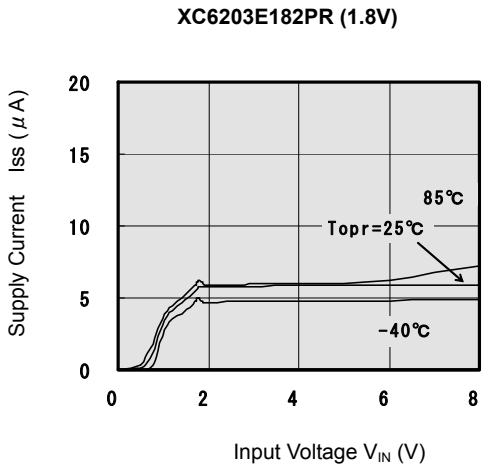
(2) Output Voltage vs. Input Voltage



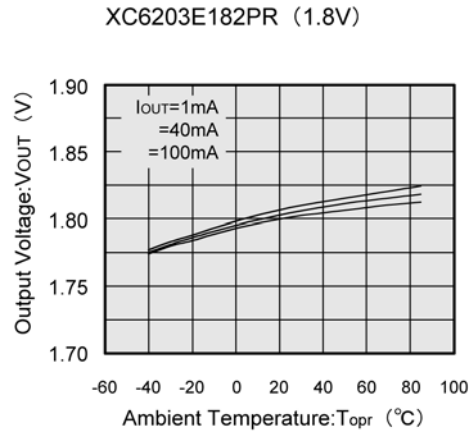
(3) Dropout Voltage vs. Output Current



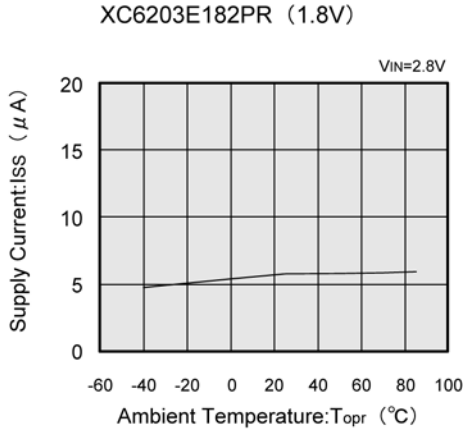
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



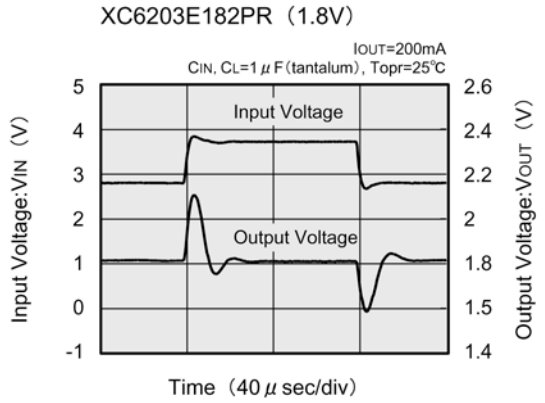
(6) Supply Current vs. Ambient Temperature



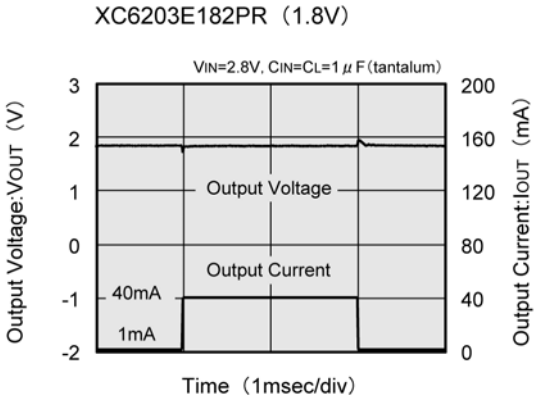
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

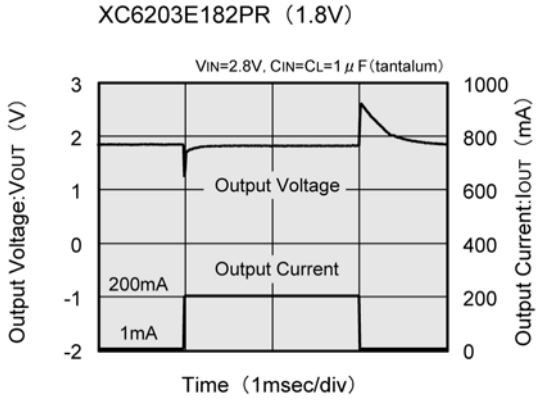
●XC6203E182PR (Continued)

(7) Input Transient Response

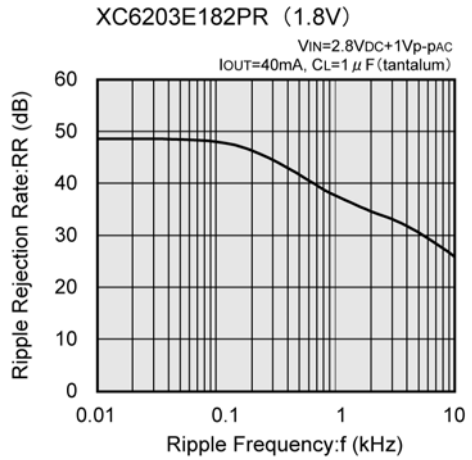


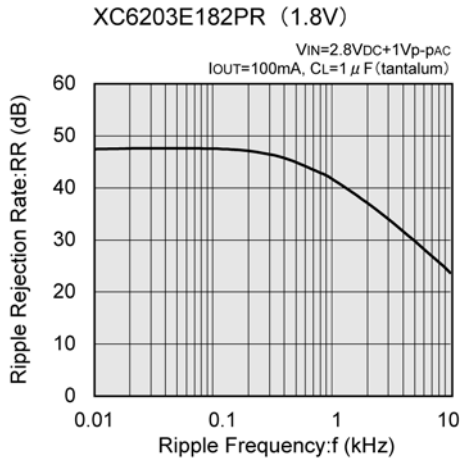
(8) Load Transient Response





(9) Ripple Rejection Rate

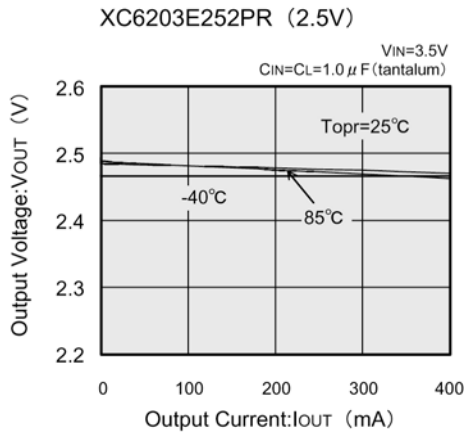




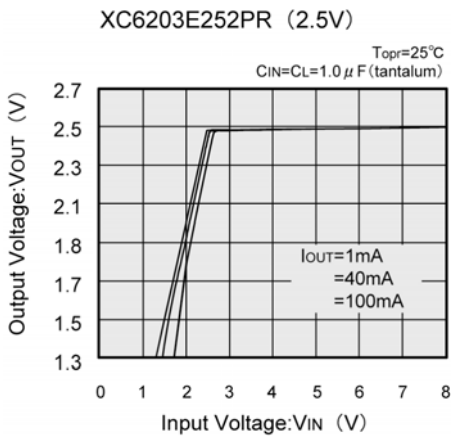
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6203E252PR

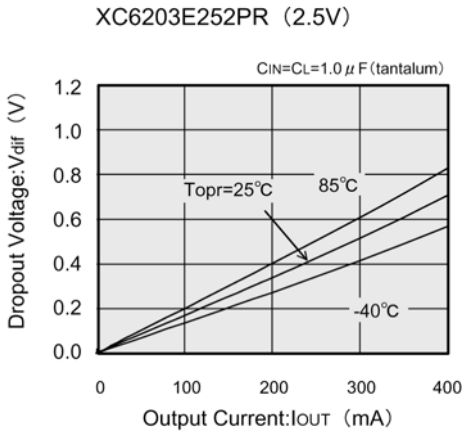
(1) Output Voltage vs. Output Current



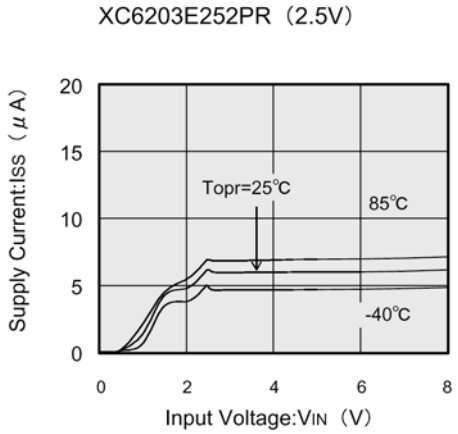
(2) Output Voltage vs. Input Voltage



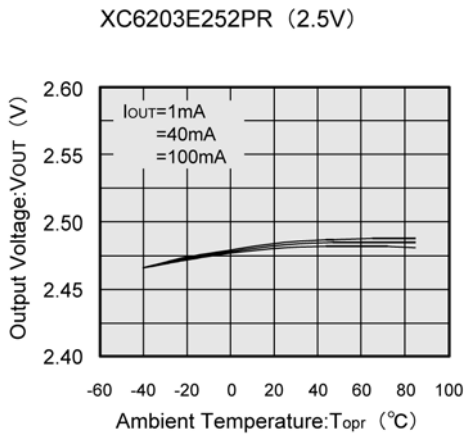
(3) Dropout Voltage vs. Output Current



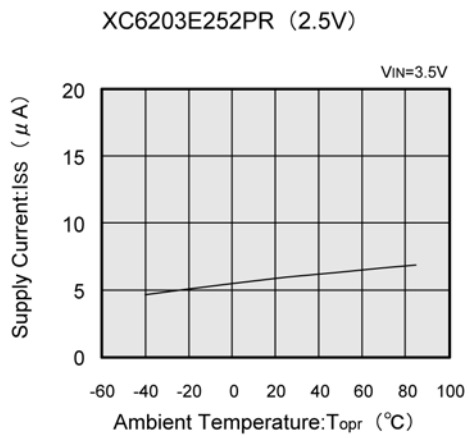
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



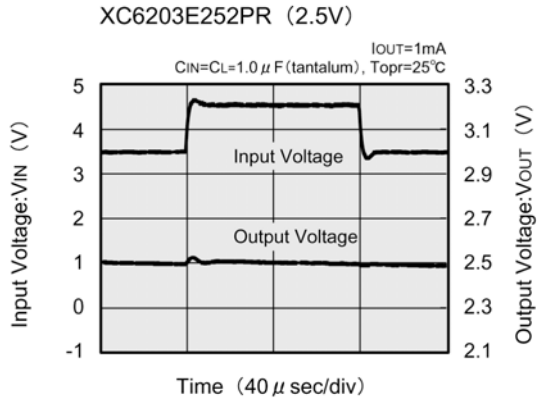
(6) Supply Current vs. Ambient Temperature

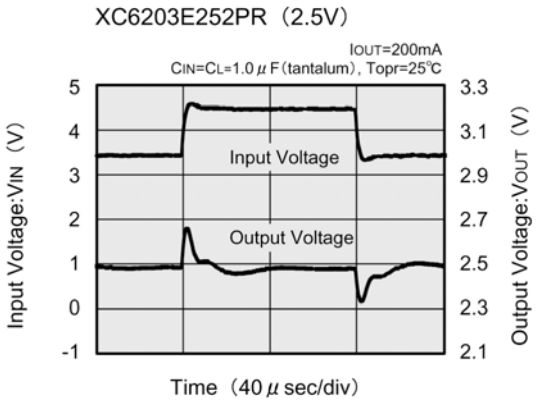


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

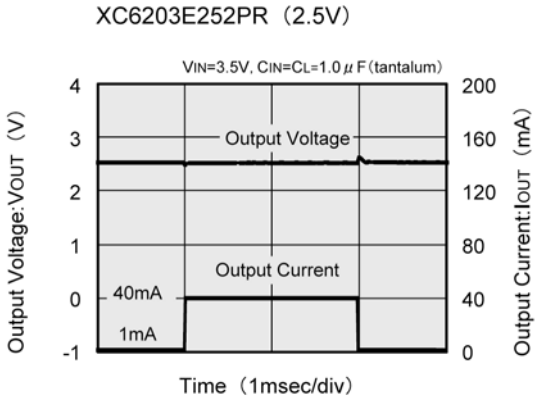
●XC6203E252PR (Continued)

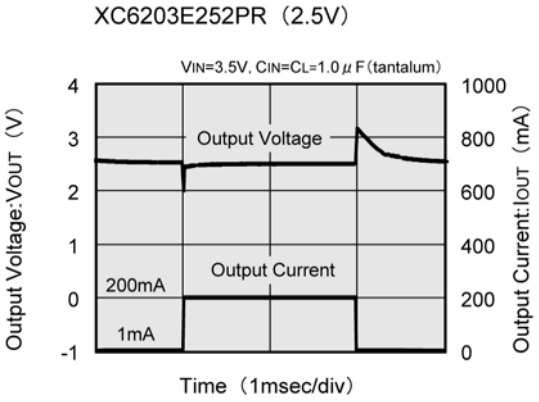
(7) Input Transient Response



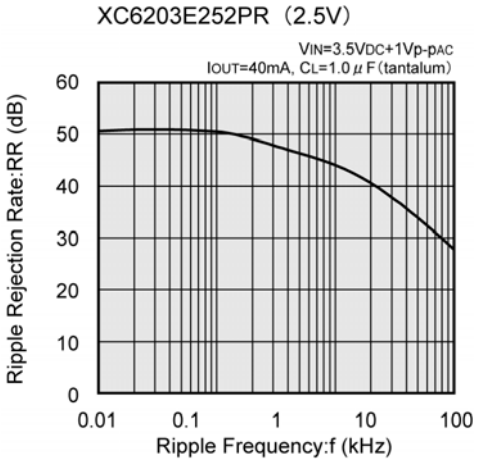


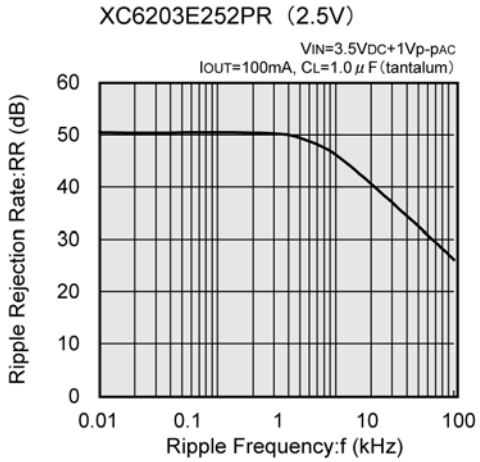
(8) Load Transient Response





(9) Ripple Rejection Rate

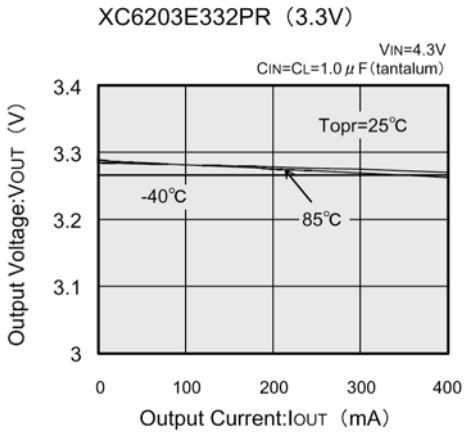




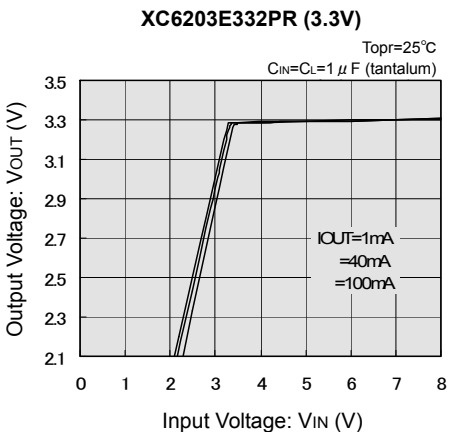
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6203E332PR

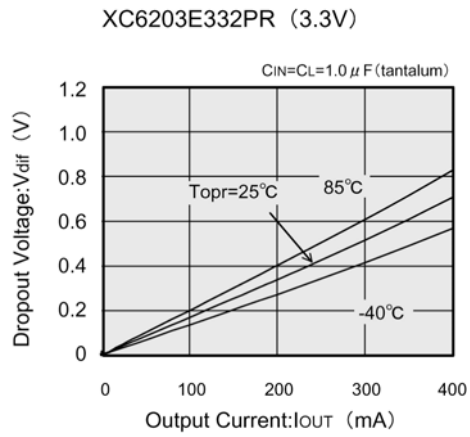
(1) Output Voltage vs. Output Current



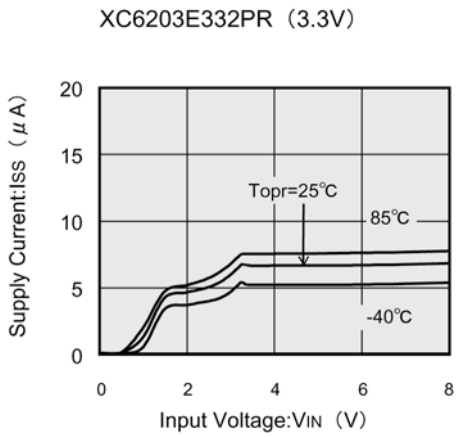
(2) Output Voltage vs. Input Voltage



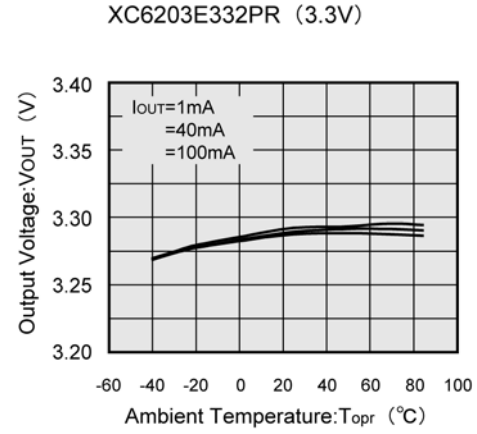
(3) Dropout Voltage vs. Output Current



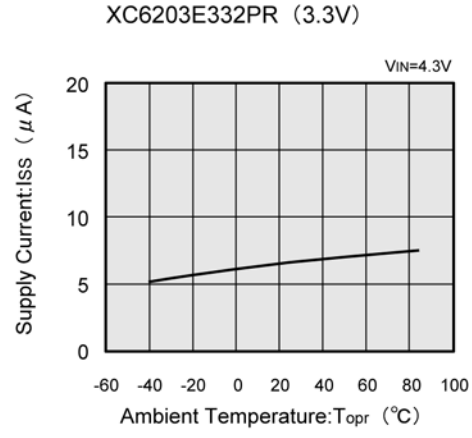
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



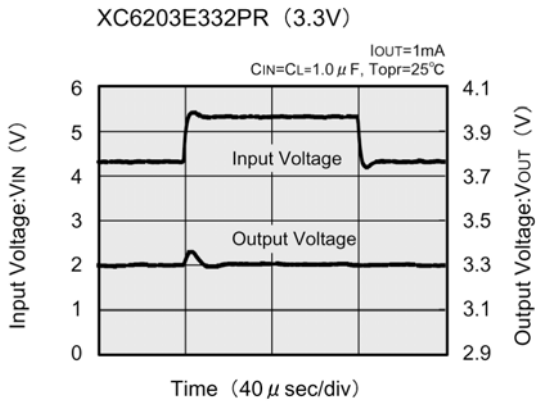
(6) Supply Current vs. Ambient Temperature

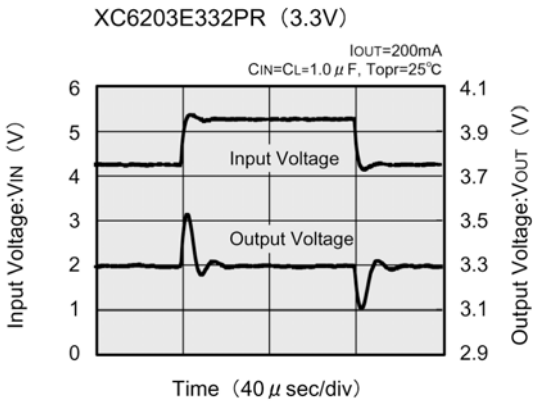


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

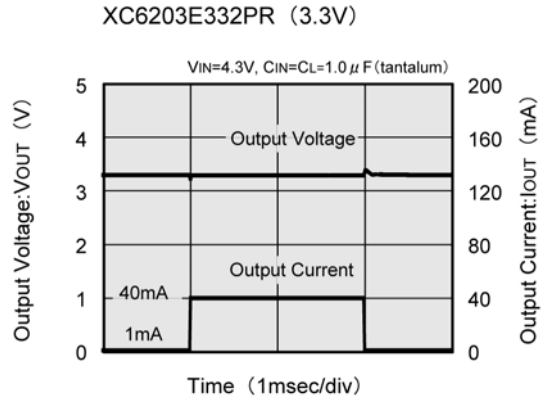
●XC6203E332PR (Continued)

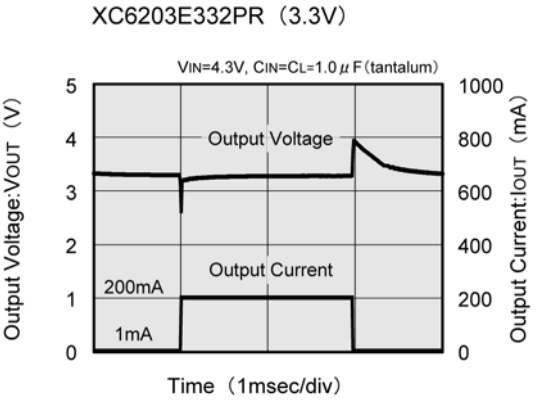
(7) Input Transient Response



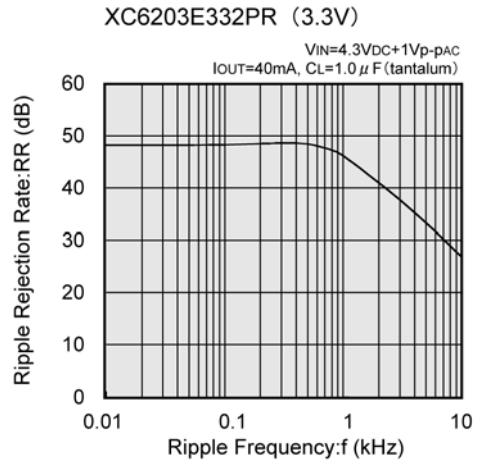


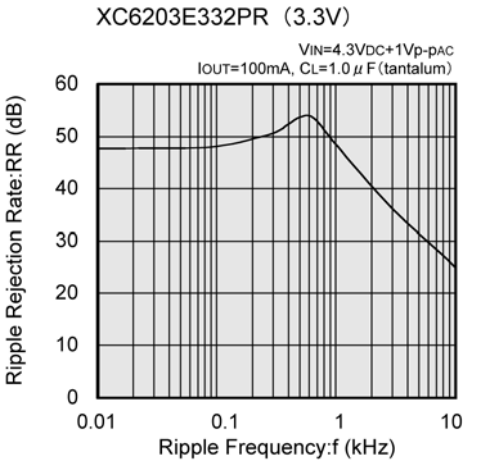
(8) Load Transient Response





(9) Ripple Rejection Rate

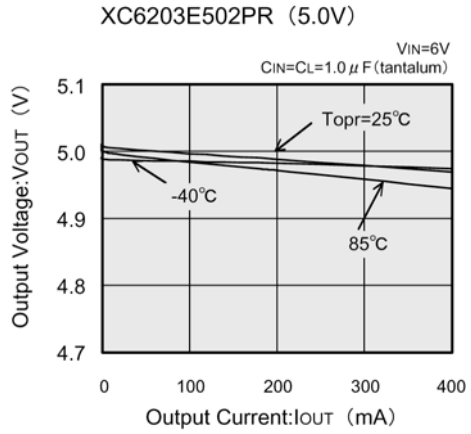




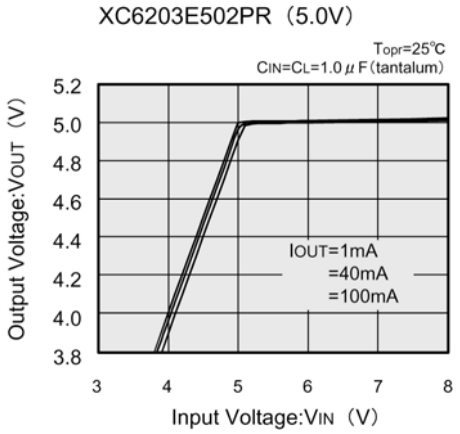
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6203E502PR

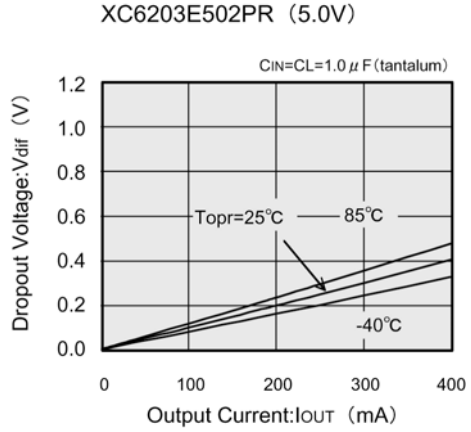
(1) Output Voltage vs. Output Current



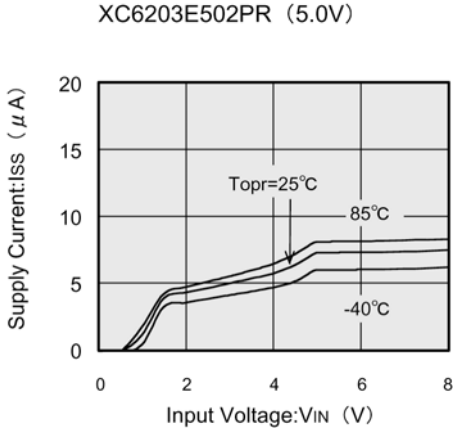
(2) Output Voltage vs. Input Voltage



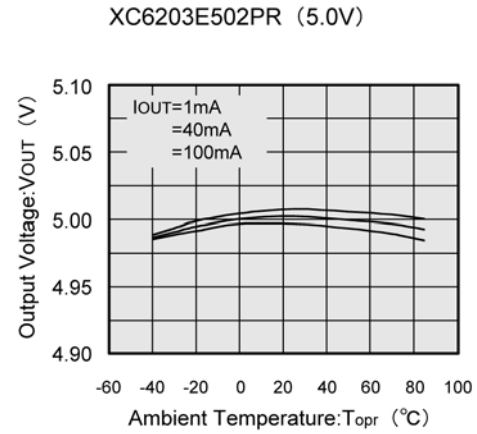
(3) Dropout Voltage vs. Output Current



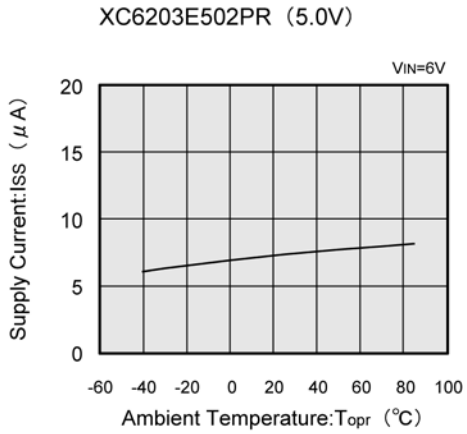
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



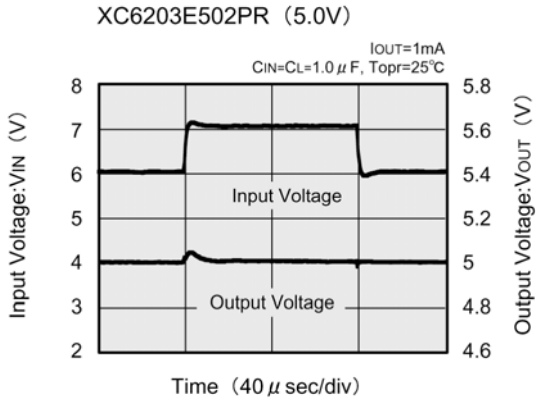
(6) Supply Current vs. Ambient Temperature

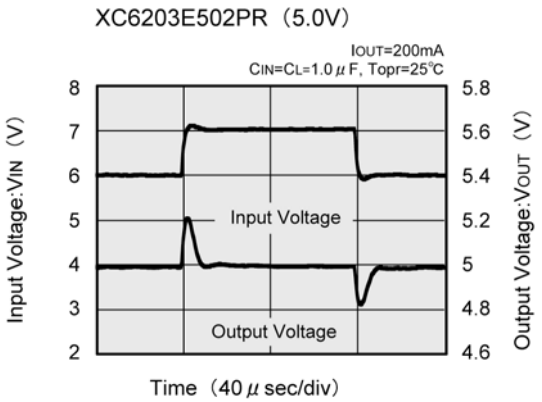


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

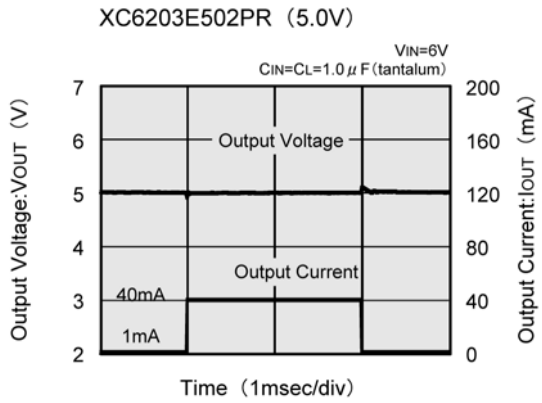
●XC6203E502PR (Continued)

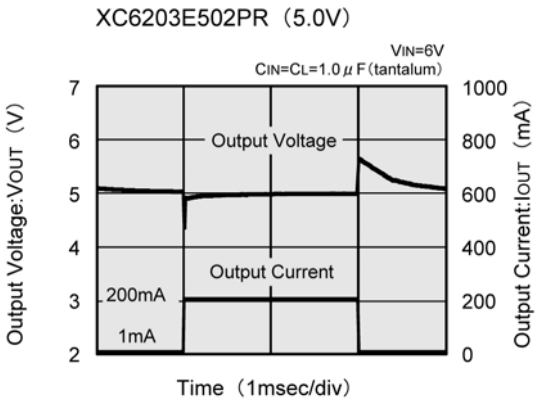
(7) Input Transient Response



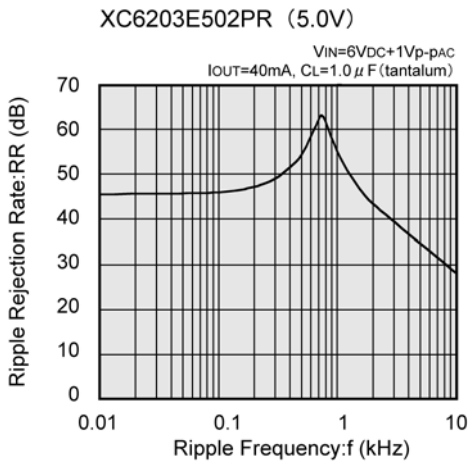


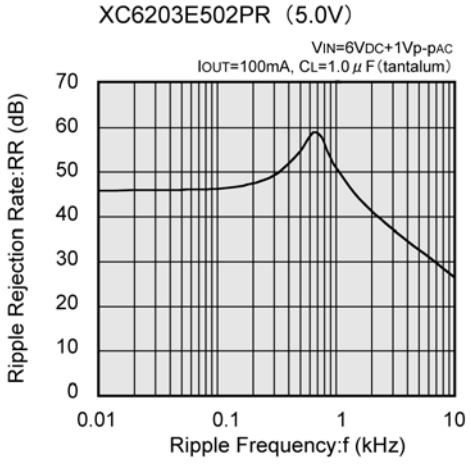
(8) Load Transient Response





(9) Ripple Rejection Rate

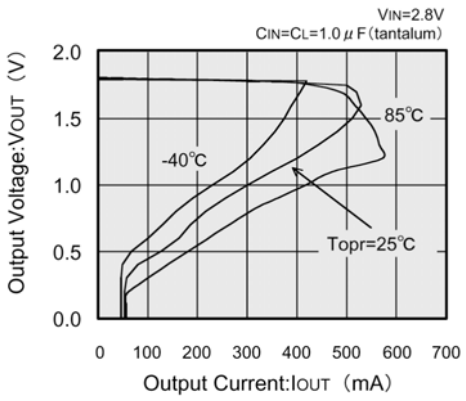




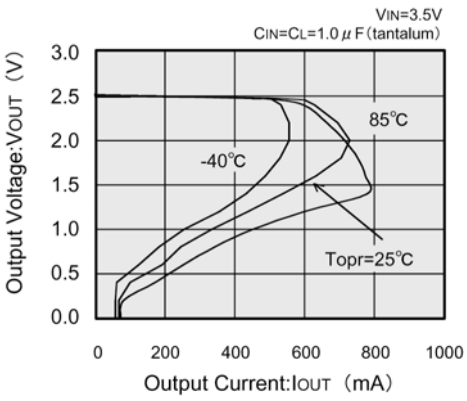
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Output Voltage vs. Output Current

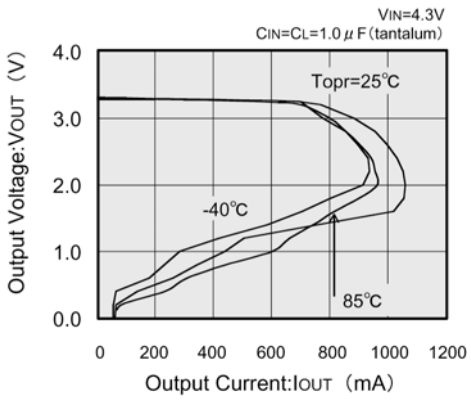
XC6203P182（1.8V）



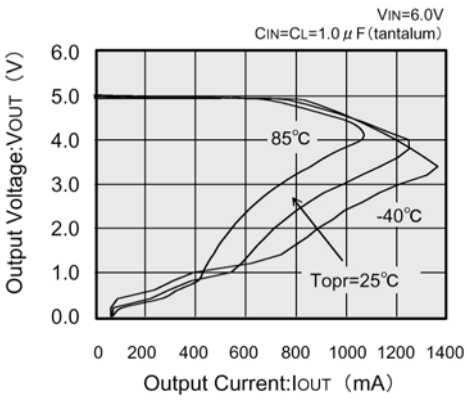
XC6203P252（2.5V）



XC6203P332（3.3V）

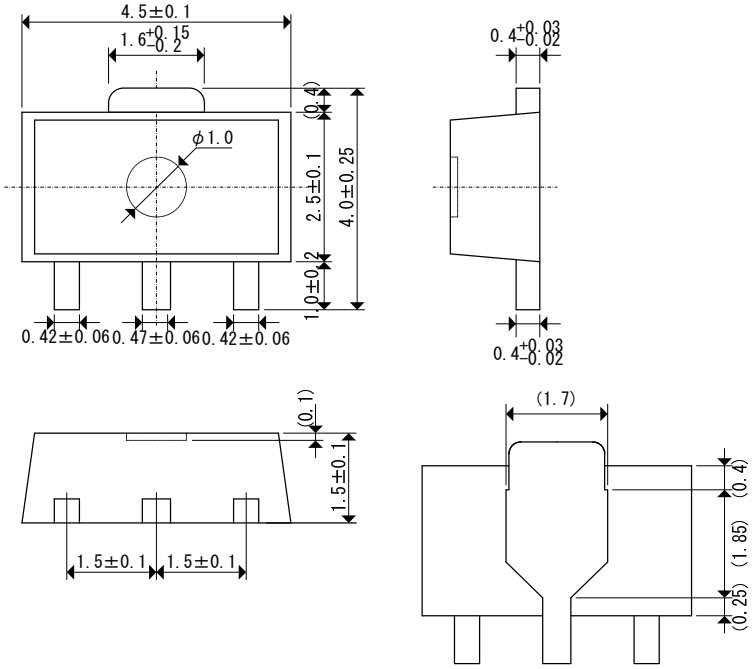


XC6203P502（5.0V）

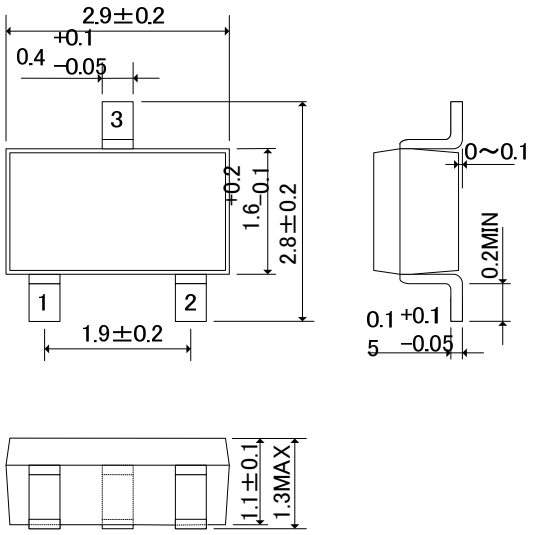


■PACKAGING INFORMATION

●SOT-89 (unit : mm)



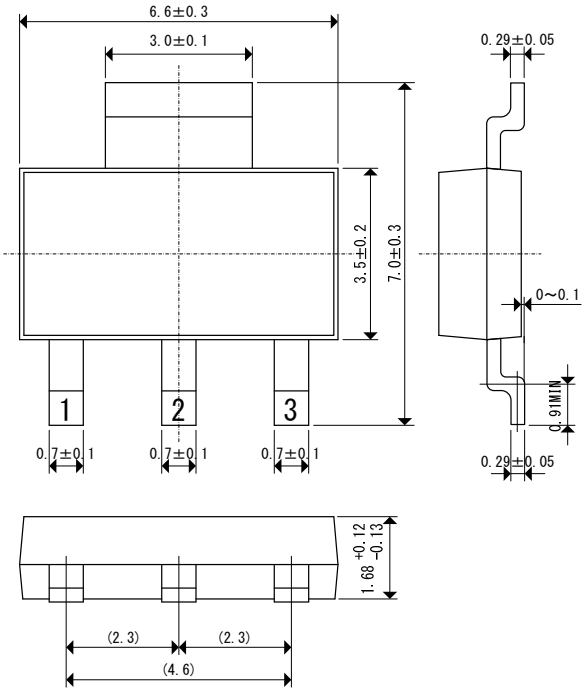
●SOT-23 (unit : mm)



■PACKAGING INFORMATION (Continued)

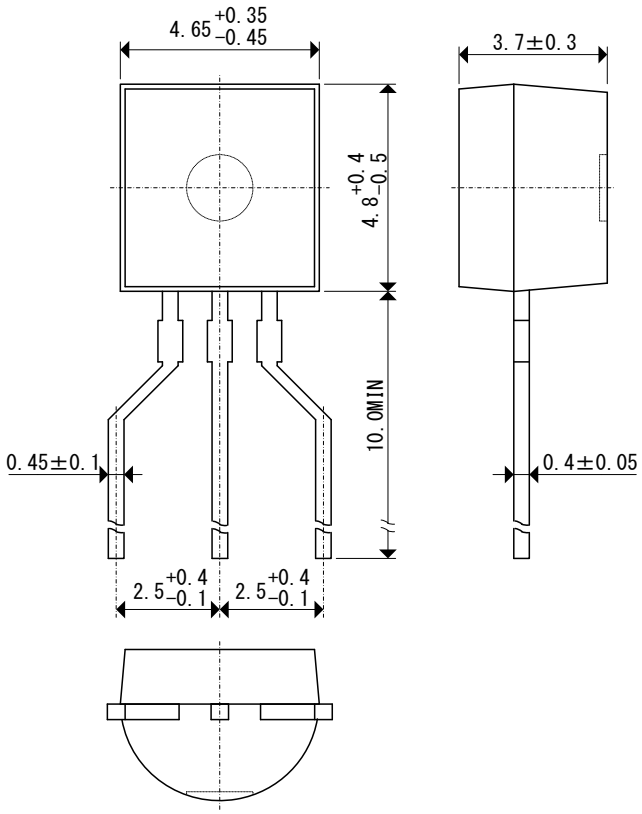
●SOT-223

(unit : mm)



●TO-92

(unit : mm)

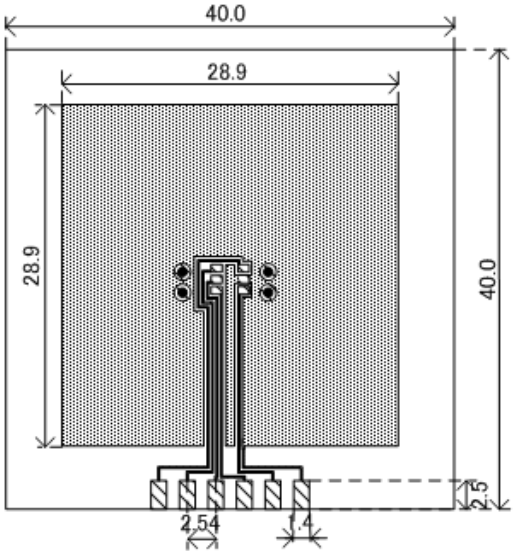


■PACKAGING INFORMATION (Continued)

●SOT-23 Power Dissipation

Power dissipation data for the SOT-23 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following.

1. Measurement Condition
   Condition : Mount on a board
   Ambient : Natural convection
   Soldering : Lead (Pb) free
   Board : Dimensions 40×40mm（1600mm^2 in one side）
   Copper (Cu) traces occupy 50% of the board area
   In top and back faces
   Package heat-sink is tied to the copper traces
   (Board of SOT-26 is used)
   Material : Glass Epoxy（FR-4）
   Thickness : 1.6mm
   Through-hole : 4 x 0.8 Diameter

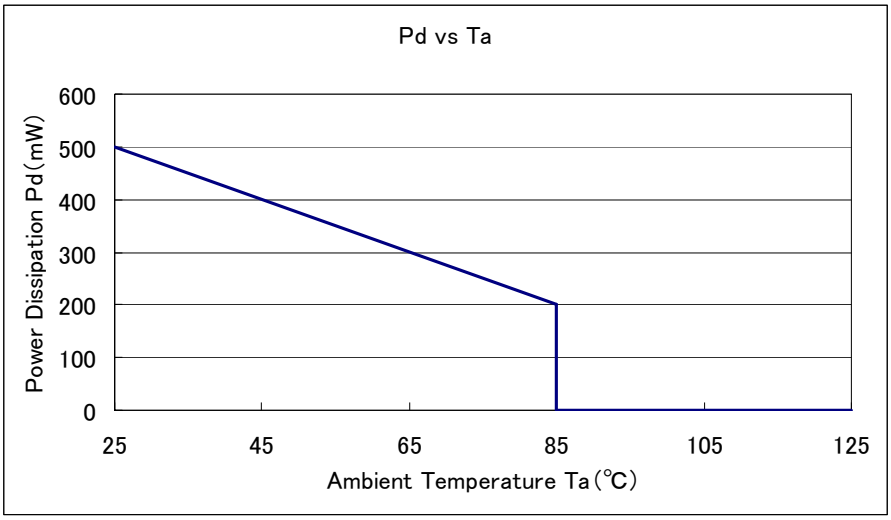


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tjmax=125℃)

Ambient Temperature (℃)	Power Dissipation Pd (mW)	Thermal Resistance (℃/W)
25	500	200.00
85	200	

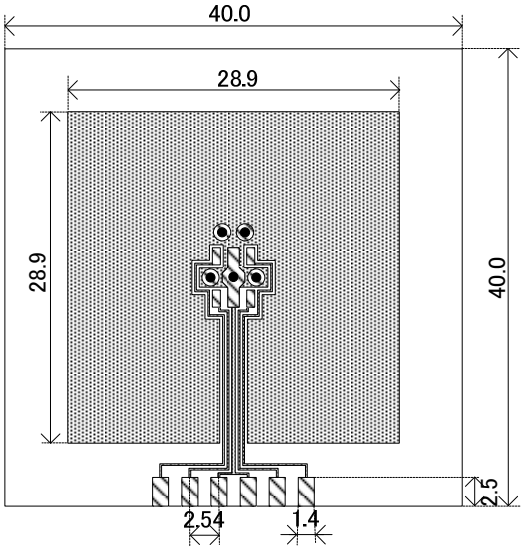


■PACKAGING INFORMATION (Continued)

●SOT-89 Power Dissipation

Power dissipation data for the SOT-89 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following.

1. Measurement Condition
Condition : Mount on a board
Ambient : Natural convection
Soldering : Lead (Pb) free
Board : Dimensions 40×40mm（1600mm^2 in one side）
Copper (Cu) traces occupy 50% of the board area
In top and back faces
Package heat-sink is tied to the copper traces
Material : Glass Epoxy（FR-4）
Thickness : 1.6mm
Through-hole : 5 x 0.8 Diameter

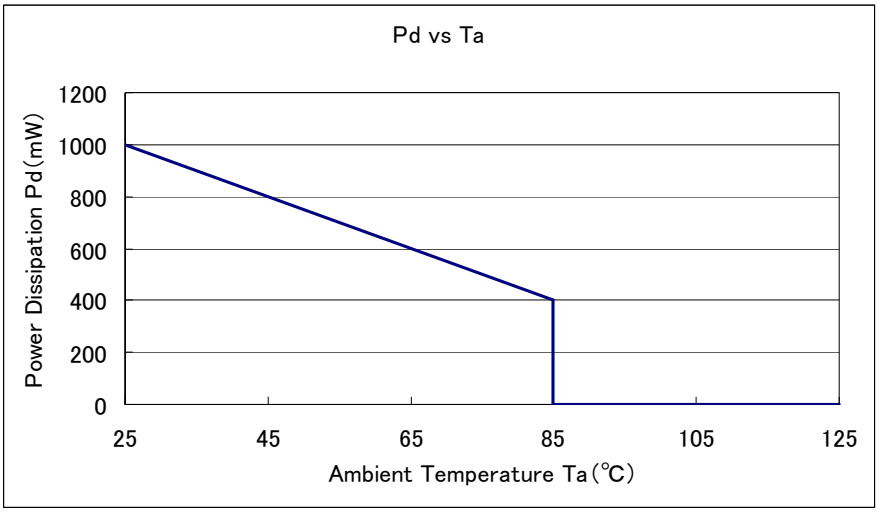


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tjmax=125℃)

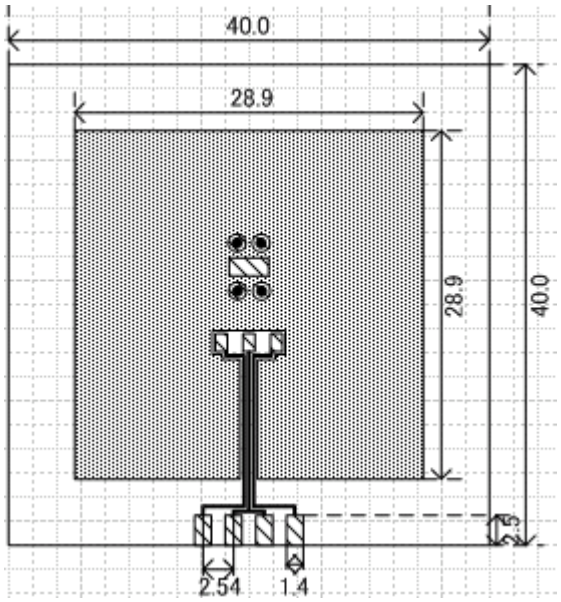
Ambient Temperature (℃)	Power Dissipation Pd (mW)	Thermal Resistance (℃/W)
25	1000	100.00
85	400	



■PACKAGING INFORMATION (Continued)

●SOT-223 Power Dissipation

Power dissipation data for the SOT-223 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.



Evaluation Board (Unit: mm)

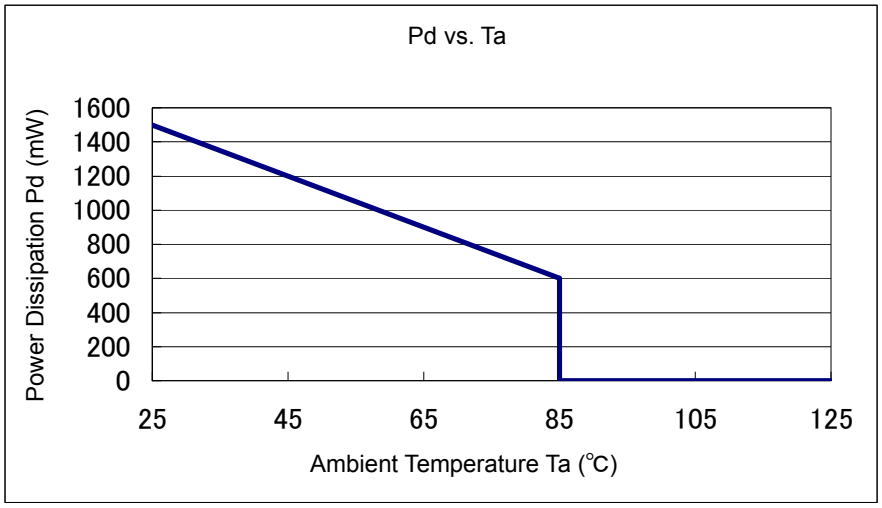
1. Measurement Condition

Condition:	Mount on a board
Ambient:	Natural convection
Soldering:	Lead (Pb) free
Board:	Dimensions 40 x 40 mm (1600 mm^2 in one side)
	Copper (Cu) traces occupy 50% of the board area
	In top and back faces
	Package heat-sink is tied to the copper traces
Material:	Glass Epoxy (FR-4)
Thickness:	1.6 mm
Through-hole:	4 x 0.8 Diameter

2. Power Dissipation vs. Ambient Temperature

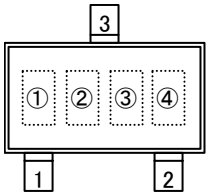
Board Mount (Tj max = 125℃)

Ambient Temperature (℃)	Power Dissipation Pd (mW)	Thermal Resistance (℃/W)
25	1500	66.67
85	600	

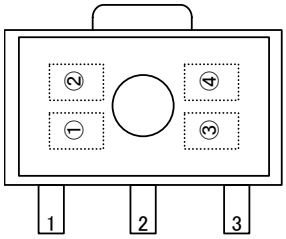


■MARKING RULE

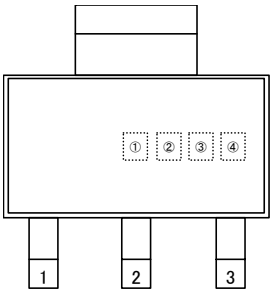
●SOT-23, SOT-89, SOT-223



SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)



SOT-223
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
3	XC6203xxxxx

② represents type of regulator

MARK			PRODUCT SERIES
VOLTAGE=0.1～3.0V	VOLTAGE=3.1～6.0V	VOLTAGE=2.85V	
5	6	7	XC6203Pxxxxx
2	3	4	XC6203Exxxxx

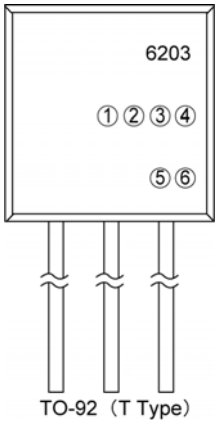
③ represents output voltage

MARK	OUTPUT VOLTAGE（V）			MARK	OUTPUT VOLTAGE（V）		
0	－	3.1	－	F	－	4.6	－
1	－	3.2	－	H	－	4.7	－
2	－	3.3	－	K	1.8	4.8	－
3	－	3.4	－	L	1.9	4.9	－
4	－	3.5	－	M	2.0	5.0	－
5	－	3.6	－	N	2.1	5.1	－
6	－	3.7	－	P	2.2	5.2	－
7	－	3.8	－	R	2.3	5.3	－
8	－	3.9	－	S	2.4	5.4	－
9	－	4.0	－	T	2.5	5.5	－
A	－	4.1	－	U	2.6	5.6	－
B	－	4.2	－	V	2.7	5.7	－
C	－	4.3	－	X	2.8	5.8	2.85
D	－	4.4	－	Y	2.9	5.9	－
E	－	4.5	－	Z	3.0	6.0	－

④ represents production lot number
0～9, A to Z or inverted characters of 0 to 9 and A to Z repeated (G, I, J, O, Q, W excluded)

■MARKING RULE (Continued)

●TO-92



(SIDE VIEW)

① represents type of regulator

MARK	PRODUCT SERIES
P	XC6203Pxxxxx
E	XC6203Exxxxx

②③④ represents output voltage and voltage accuracy

MARK			VOLTAGE (V)	VOLTAGE ACCURACY (%)	PRODUCT SERIES
②	③	④			
3	3	2	3.3	±2	XC6203x332xx
5	0	1	5.0	±1	XC6203x501xx
2	8	A	2.85	±2	XC6203x28Axx

⑤ represents least significant digit of the production year

MARK	PRODUCTION SERIES
3	2003
4	2004

⑥ represents production lot number
0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)
Note: No character inversion used

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2. We assume no responsibility for any infringement of patents, patent rights, or other rights arising from the use of any information and circuitry in this datasheet.
3. Please ensure suitable shipping controls (including fail-safe designs and aging protection) are in force for equipment employing products listed in this datasheet.
4. The products in this datasheet are not developed, designed, or approved for use with such equipment whose failure of malfunction can be reasonably expected to directly endanger the life of, or cause significant injury to, the user.
   (e.g. Atomic energy; aerospace; transport; combustion and associated safety equipment thereof.)
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