XC6206 Series

Low ESR Cap.Compatible Positive Voltage Regulators

■GENERAL DESCRIPTION

The XC6206 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 XC6206 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit. The series is compatible with low ESR ceramic capacitors. The currrent limiter's foldback circuit operates as a short circuit protection as well as the output current limiter for the output pin.

Output voltages are internally by laser trimming technologies. It is selectable in 0.1V increments within a range of 1.2V to 5.0V.

SOT-23, SOT-89, TO-92 and USP-6B packages are available.

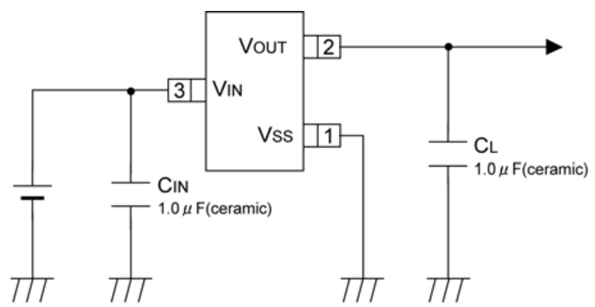
■APPLICATIONS

- ●Smart phones / Mobile phones
- ●Portable game consoles
- ●Digital still cameras / Camcorders
- ●Digital audio equipments
- ●Reference voltage sources
- ●Multi-function power supplies

■FEATURES

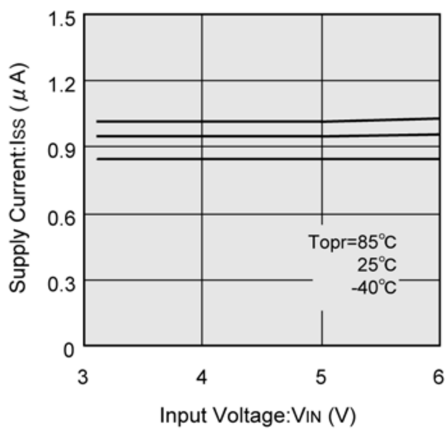
Maximum Output Current	: 200mA (3.0V type)
Dropout Voltage	: 250mV @ 100mA (3.0V type)
Maximum Operating Voltage	: 6.0V
Output Voltage Range	: 1.2V ~ 5.0V (0.1V increments)
Highly Accurate	: $\pm$2%@$V_{OUT}\geqq$1.5V $\pm$30mV@V_{OUT}<1.5V ($\pm$1% @$V_{OUT}\geq$2.0V)
Low Power Consumption	: 1.0μA (TYP.)
Low ESR Capacitor	: Ceramic capacitor compatible
Protection	: Current Limit Circuit Built-in
Operating Ambient Temperature	: -40℃~ +85℃
Packages	: SOT-23 SOT-89 TO-92 USP-6B
Environmentally Friendly	: EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT

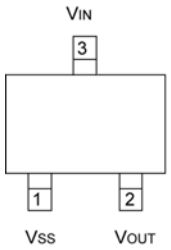


■TYPICAL PERFORMANCE CHARACTERISTICS

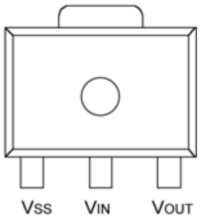
XC6206P302



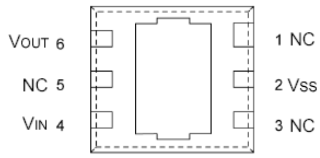
■PIN CONFIGURATION



SOT-23
(TOP VIEW)

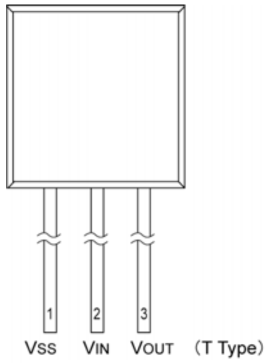


SOT-89
(TOP VIEW)



USP-6B
(BOTTOM VIEW)

*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release. If the pad needs to be connected to other pins, it should be connected to the pin number 4 (V_{IN}).



TO-92
(SIDE VIEW)

■PIN ASSIGNMENT

PIN NUMBER				PIN NAME	FUNCTIONS
SOT-23	SOT-89	USP-6B	TO-92		
1	1	2	1	V_{SS}	Ground
3	2	4	2	V_{IN}	Power Input
2	3	6	3	V_{OUT}	Output
-	-	1, 3, 5	-	NC	No Connection

■PRODUCT CLASSIFICATION

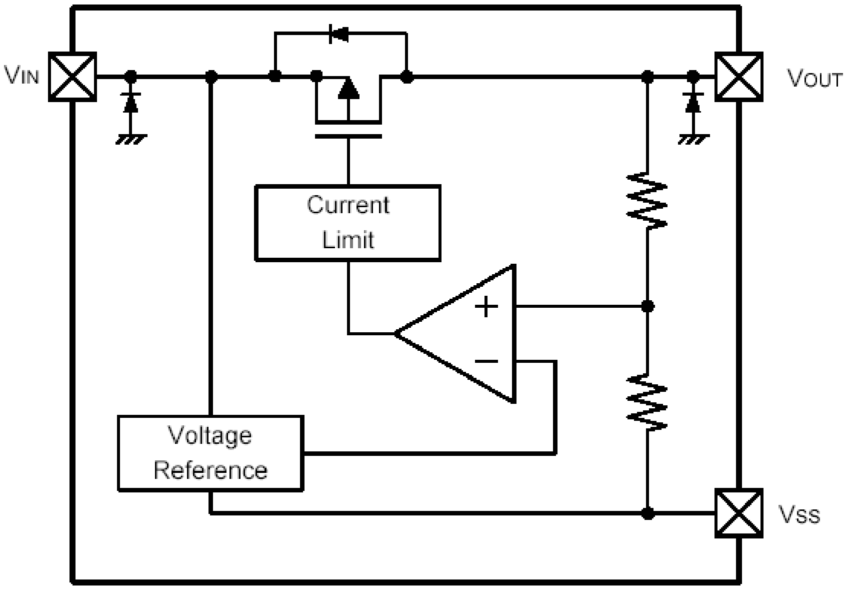
●Ordering Information

XC6206P ①②③④⑤-⑥[*1]

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①②	Output Voltage	12~50	e.g. V_{OUT}: 3.0V→①=3, ②=0
③	Accuracy	2	± 2% (V_{OUT}≧1.5V), ±30mV (V_{OUT}<1.5V)
		1	±1% (V_{OUT}≧2.0V)
④⑤-⑥	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)
		DR	USP-6B (3,000/Reel)
		DR-G	USP-6B (3,000/Reel)
		TH	TO-92 (T type), Paper type (2,000/Tape)
		TH-G	TO-92 (T type), Paper type (2,000/Tape)
		TB	TO-92 (T type), Bag type (500/Bag)
		TB-G	TO-92 (T type), Bag type (500/Bag)

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

■BLOCK DIAGRAM



*Diodes inside the circuit are an ESD protection diode and a parasitic diode.

■ABSOLUTE MAXIMUM RATINGS

Ta=25°C

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	-0.3～+7.0	V
Output Current		I_{OUT}	500 (*1)	mA
Output Voltage		V_{OUT}	-0.3 ~ V_{IN} + 0.3	V
Power Dissipation	SOT-23	Pd	250	mW
			500(PCB mounted) (*2)	
	SOT-89		500	
			1000(PCB mounted) (*2)	
	USP-6B		120	
			1000(PCB mounted) (*2)	
	TO-92		300	
Operating Ambient Temperature		Topr	- 40 ~ + 85	°C
Storage Temperature		Tstg	- 55 ~ + 125	°C

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

(*2) This power dissipation figure shown is PCB mounted and is for reference only. Please refer to page 15~17 for details.

■ELECTRICAL CHARACTERISTICS

Ta=25 °C

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage (Standard)(*2)	$V_{OUT(E)}$(*3)	I_{OUT}=30mA	$V_{OUT(T)}$<1.5V	-0.03	$V_{OUT(T)}$(*4)	+0.03	V	②
			$V_{OUT(T)}$≧1.5V	×0.98		×1.02		
Output Voltage (High Accuracy)(*2)		I_{OUT}=30mA	$V_{OUT(T)}$≧2.0V	×0.99		×1.01		
Supply Current	I_{DD}			-	1.0	3.0	μA	①
Load Regulation	ΔV_{OUT}	$V_{OUT(T)}$≦1.8V, 1mA≦I_{OUT}≦50mA		-	-	E-1(*5)	mV	②
		$V_{OUT(T)}$>1.8V, 1mA≦I_{OUT}≦100mA						
Dropout Voltage 1	Vdif1(*6)	I_{OUT}=30mA		-	E-2(*5)		mV	②
Dropout Voltage 2	Vdif2(*6)	$V_{OUT(T)}$≦1.8V, I_{OUT}=60mA		-	E-3(*5)			
		$V_{OUT(T)}$>1.8V, I_{OUT}=100mA						
Line Regulation	ΔV_{OUT}/ (ΔV_{IN}・V_{OUT})	$V_{OUT(T)}$<4.5V, $V_{OUT(T)}$+1.0V≦V_{IN}≦6.0V, I_{OUT}=30mA		-	0.05	0.25	%/V	②
		$V_{OUT(T)}$≧4.5V, 5.5V≦V_{IN}≦6.0V, I_{OUT}=30mA						
Maximum Output Current	I_{OUTMAX}	V_{OUT}≧$V_{OUT(E)}$× 0.9		E-4(*5)	-	-	mA	②
Short Circuit Current	I_{SHORT}	V_{OUT}=V_{SS}		-	E-5(*5)	-	mA	②
Input Voltage	V_{IN}			1.8	-	6.0	V	②
Output Voltage Temperature Characteristics	ΔV_{OUT}/ (ΔTopr・V_{OUT})	I_{OUT}=30mA, -40℃≦Topr≦85℃		-	±100	-	ppm/℃	②

*1: Unless otherwise stated, V_{IN} = $V_{OUT(T)}$ + 1.0V
*2: (Standard):±2% (1.5V≦$V_{OUT(T)}$) , ±0.03V (1.5V>$V_{OUT(T)}$)
(High Accuracy):±1% (2.0V≦$V_{OUT(T)}$)
*3: $V_{OUT(E)}$:Effective output voltage.
*4: $V_{OUT(T)}$:Nominal voltage
*5: For E-1,E-2,E-3,E-4,E-5, Please refer to Electrical Characteristics Chart.
*6: Vdif =V_{IN1} -V_{OUT1}
V_{OUT1} :A voltage equal to 98% of the output voltage whenever an amply stabilized {$V_{OUT(T)}$ + 1.0V} is input with each I_{OUT}.
V_{IN1} :The input voltage when V_{OUT1} appears as input voltage is gradually decreased.
*7: The low ESR capacitors use that is more than 1.0μF as C_L is possible.

■ELECTRICAL CHARACTERISTICS (Continued)

●Electrical Characteristics Chart

<table>
<tr><th rowspan="3">NOMINAL VOLTAGE</th><th>E-1</th><th colspan="2">E-2</th><th colspan="2">E-3</th><th>E-4</th><th>E-5</th></tr>
<tr><th>LOAD REGULATION</th><th colspan="2">DROPOUT VOLTAGE1</th><th colspan="2">DROPOUT VOLTAGE2</th><th>MAX. OUTPUT CURRENT</th><th rowspan="2">SHORT CURRENT</th></tr>
<tr><th>⊿V_{OUT} (mV)</th><th colspan="2">V_{dif1} (mV)</th><th colspan="2">V_{dif2} (mV)</th><th>I_{OUTMAX} (mA)</th></tr>
<tr><th>$V_{OUT(T)}$</th><th>MAX.</th><th>TYP.</th><th>MAX.</th><th>TYP.</th><th>MAX.</th><th>MIN.</th><th>TYP.</th></tr>
<tr><td>1.2</td><td rowspan="3">40</td><td>460</td><td>760</td><td rowspan="2">700</td><td rowspan="2">960</td><td rowspan="4">60</td><td rowspan="3">180</td></tr>
<tr><td>1.3</td><td>400</td><td>650</td></tr>
<tr><td>1.4</td><td>350</td><td>590</td><td rowspan="2">580</td><td rowspan="2">860</td></tr>
<tr><td>1.5</td><td rowspan="5">45</td><td>300</td><td>510</td><td rowspan="3">155</td></tr>
<tr><td>1.6</td><td>250</td><td>450</td><td rowspan="2">450</td><td rowspan="2">810</td><td rowspan="4">80</td></tr>
<tr><td>1.7</td><td>200</td><td>410</td></tr>
<tr><td>1.8</td><td>150</td><td>390</td><td rowspan="12">350</td><td rowspan="3">780</td><td rowspan="5">130</td></tr>
<tr><td>1.9</td><td rowspan="11">100</td><td rowspan="11">370</td></tr>
<tr><td>2.0</td><td rowspan="5">50</td><td rowspan="5">120</td></tr>
<tr><td>2.1</td><td rowspan="9">710</td></tr>
<tr><td>2.2</td></tr>
<tr><td>2.3</td><td rowspan="28">100</td></tr>
<tr><td>2.4</td></tr>
<tr><td>2.5</td><td rowspan="5">55</td><td rowspan="5">150</td></tr>
<tr><td>2.6</td></tr>
<tr><td>2.7</td></tr>
<tr><td>2.8</td></tr>
<tr><td>2.9</td></tr>
<tr><td>3.0</td><td rowspan="5">60</td><td rowspan="10">75</td><td rowspan="10">350</td><td rowspan="10">250</td><td rowspan="10">680</td><td rowspan="10">200</td></tr>
<tr><td>3.1</td></tr>
<tr><td>3.2</td></tr>
<tr><td>3.3</td></tr>
<tr><td>3.4</td></tr>
<tr><td>3.5</td><td rowspan="5">65</td></tr>
<tr><td>3.6</td></tr>
<tr><td>3.7</td></tr>
<tr><td>3.8</td></tr>
<tr><td>3.9</td></tr>
<tr><td>4.0</td><td rowspan="5">70</td><td rowspan="10">60</td><td rowspan="10">320</td><td rowspan="10">200</td><td rowspan="10">630</td><td rowspan="11">250</td></tr>
<tr><td>4.1</td></tr>
<tr><td>4.2</td></tr>
<tr><td>4.3</td></tr>
<tr><td>4.4</td></tr>
<tr><td>4.5</td><td rowspan="5">75</td></tr>
<tr><td>4.6</td></tr>
<tr><td>4.7</td></tr>
<tr><td>4.8</td></tr>
<tr><td>4.9</td></tr>
<tr><td>5.0</td><td>80</td><td>50</td><td>290</td><td>175</td><td>600</td></tr>
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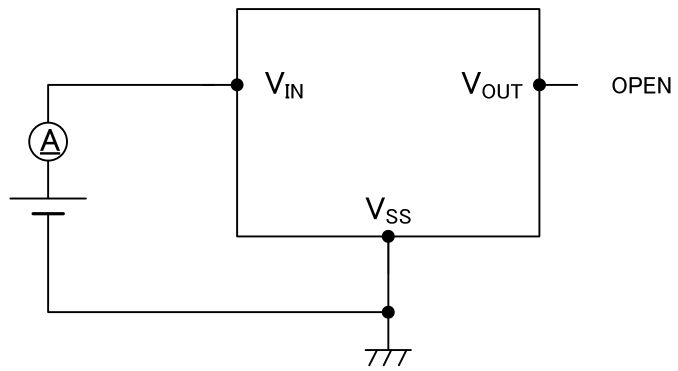
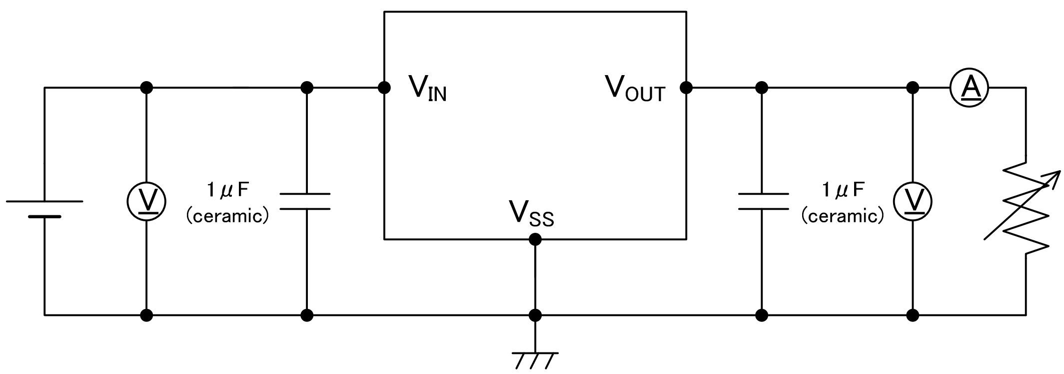
■TEST CIRCUITS

Circuit ①



Circuit ②



■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 strengthen V_{BIAS}, V_{IN} and V_{SS} wiring in particular

3. Please wire the input capacitor (C_{IN}) and the output capacitor (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.

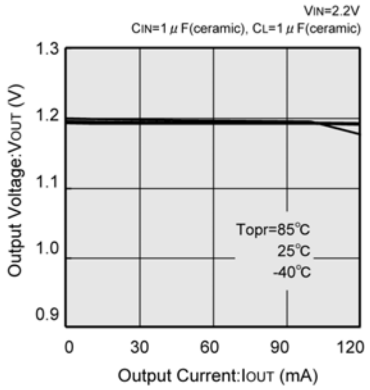
5. When it is used in a quite small input / output dropout voltage, output may go into unstable operation. Please test it thoroughly before using it in production.

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.

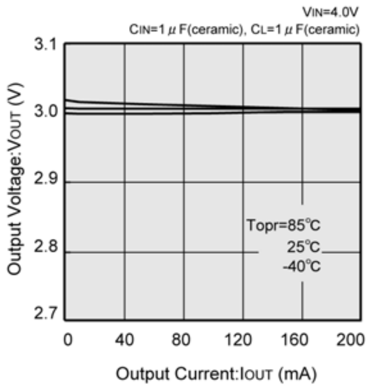
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

XC6206P122



XC6206P302



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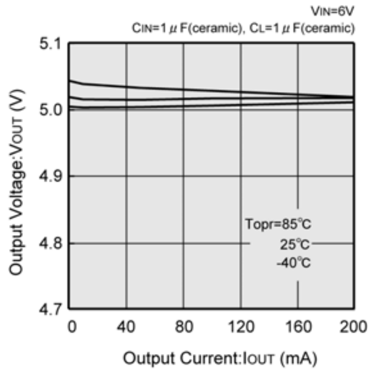
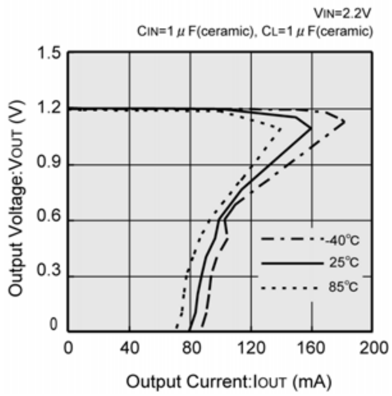


(2) Current Limit

XC6206P122



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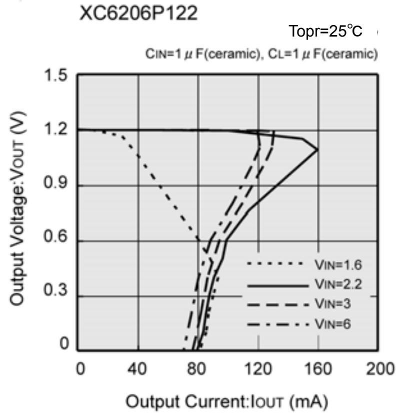

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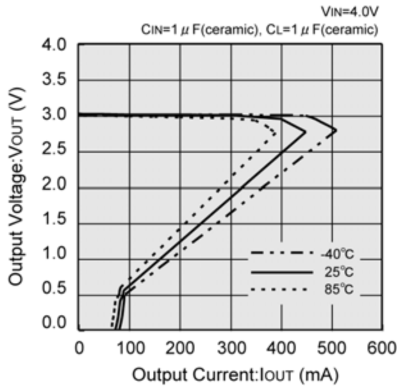

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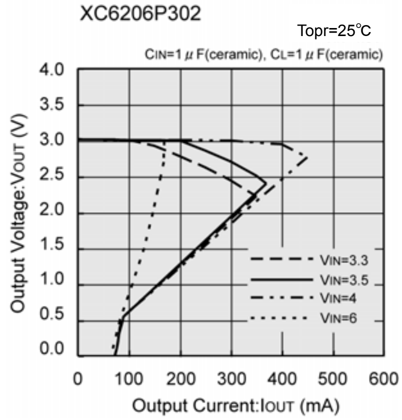

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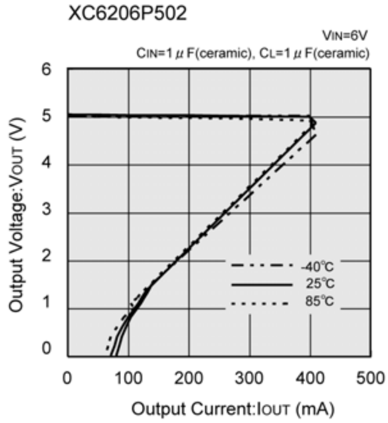

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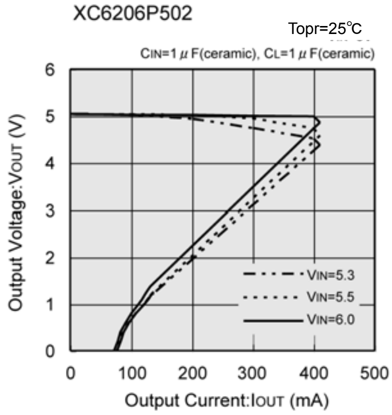
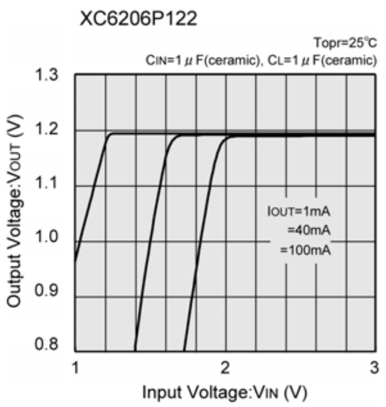
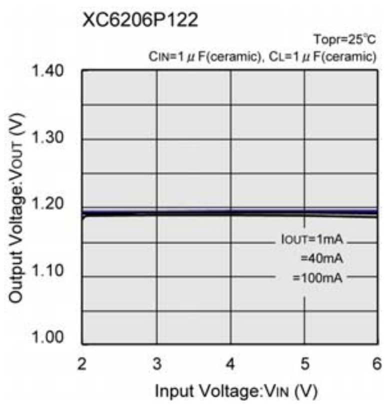
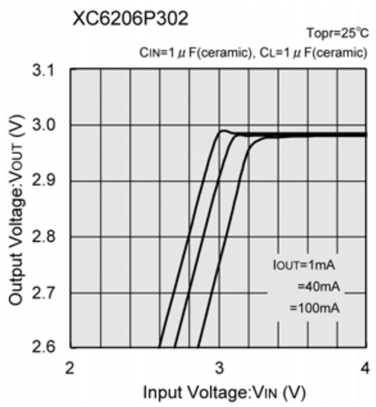


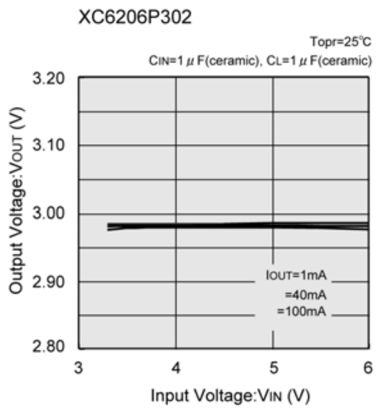
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

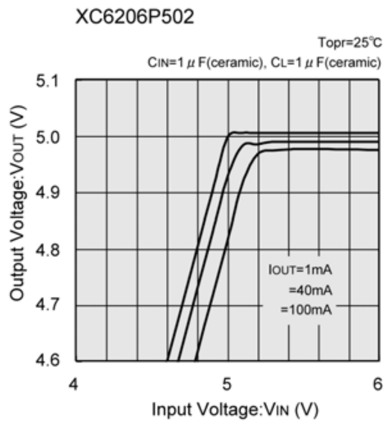
(3) Output Voltage vs. Input Voltage

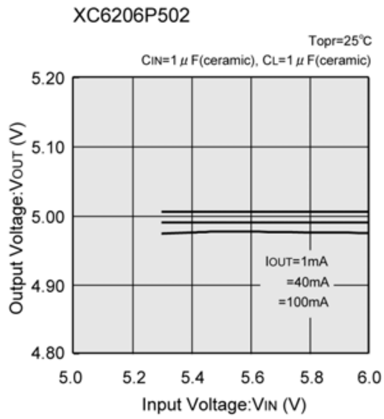




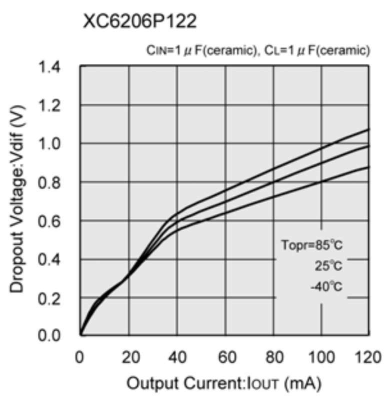


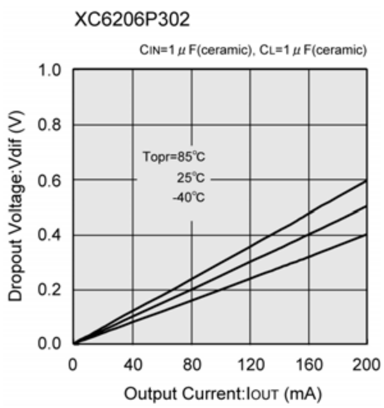


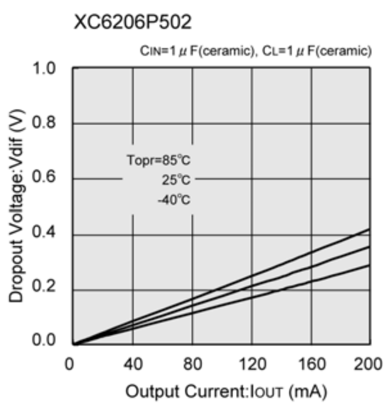




(4) Dropout Voltage vs. Output Current







■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Supply Current vs. Input Voltage

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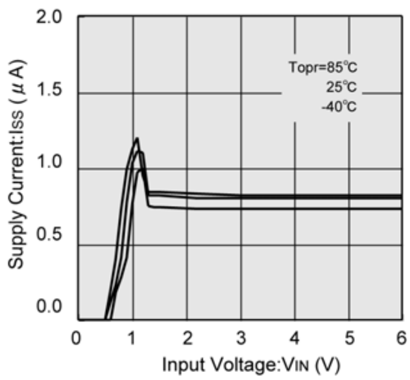

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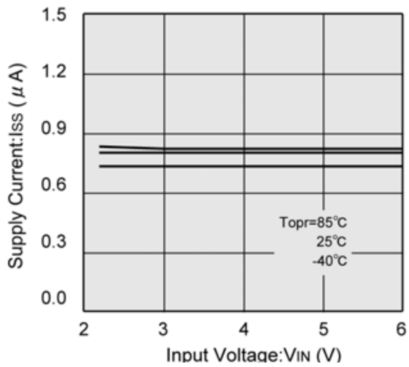

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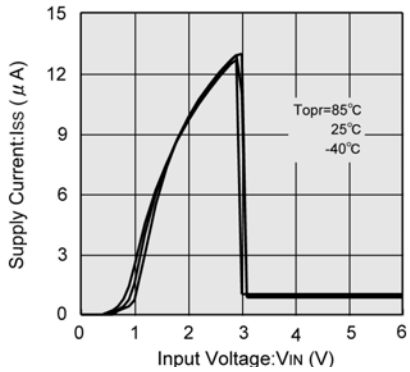

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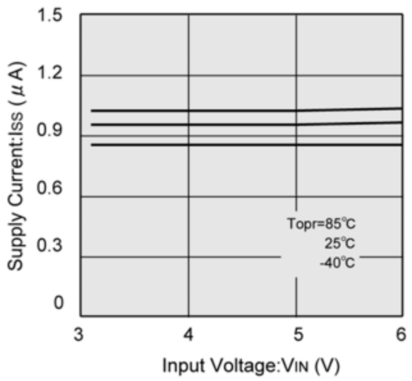

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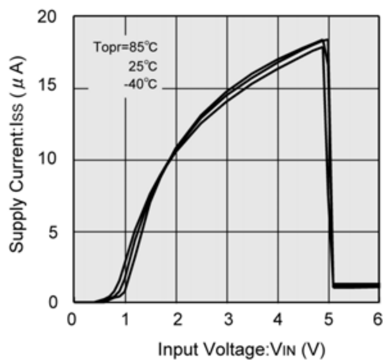

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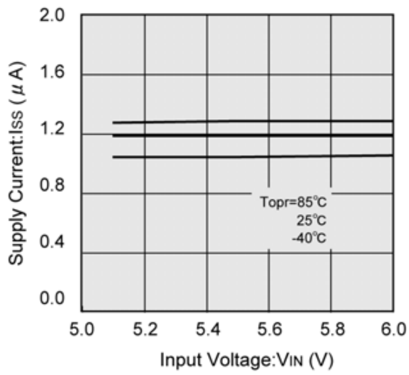
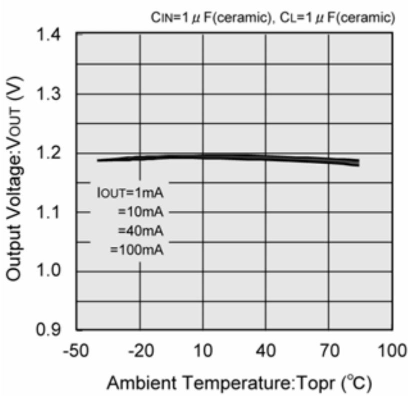


(6) Output Voltage vs. Ambient Temperature

XC6206P122



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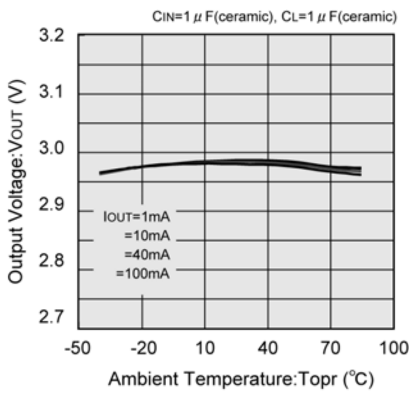

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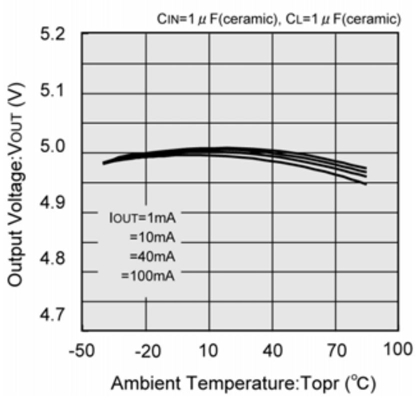
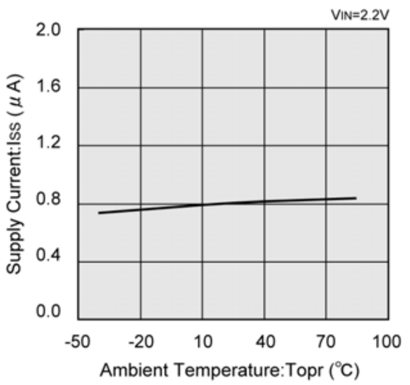


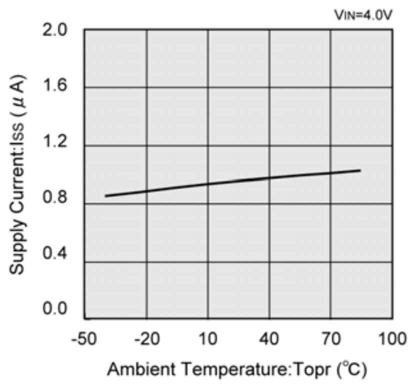
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(7) Output Voltage vs. Ambient Temperature

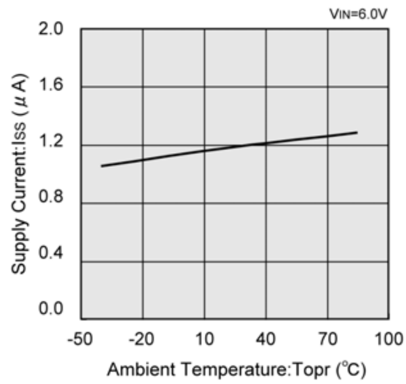
XC6206P122



XC6206P302

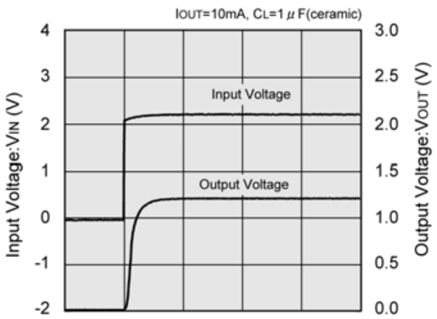


XC6206P502



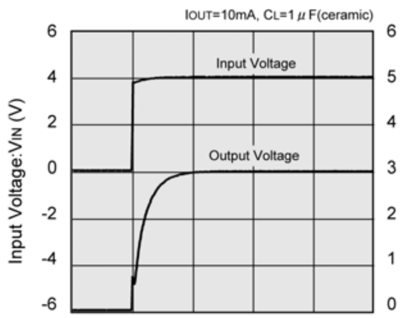
(8) Input Transient Response 1

XC6206P122



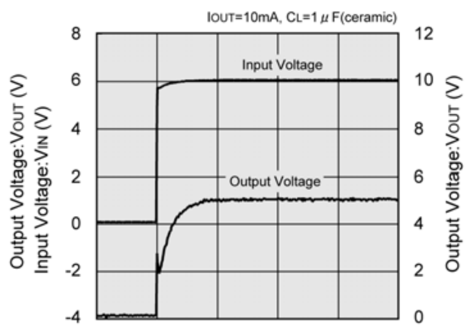
Time (0.4ms / div)

XC6206P302



Time (0.4ms / div)

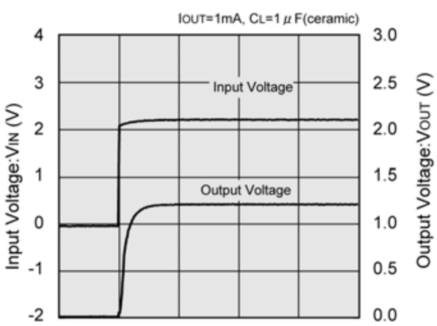
XC6206P502



Time (0.4ms / div)

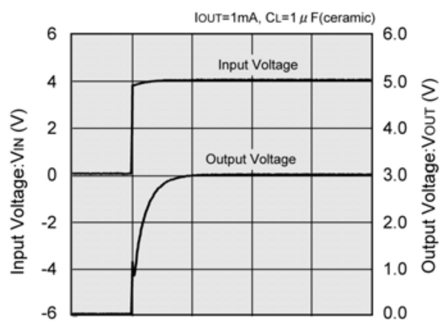
XC6206P122

XC6206P122



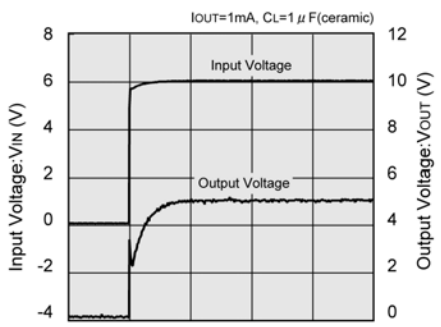
Time (0.4ms / div)

XC6206P302



Time (0.4ms / div)

XC6206P502

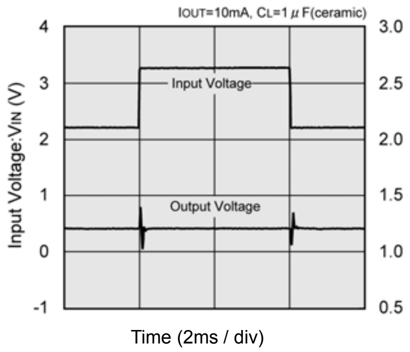


Time (0.4ms / div)

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Input Transient Response 2

XC6206P122



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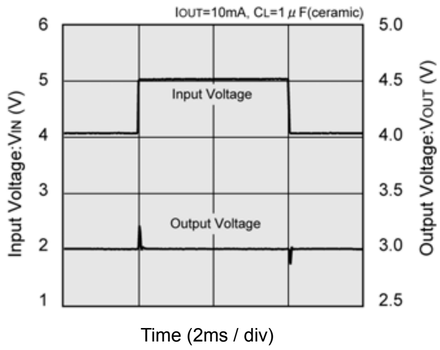

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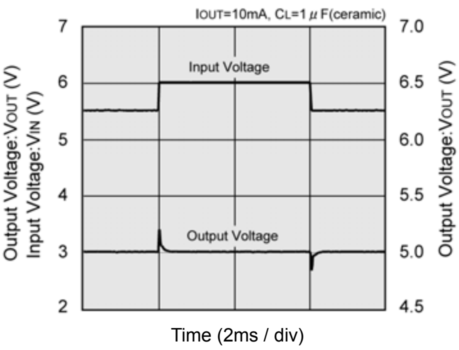

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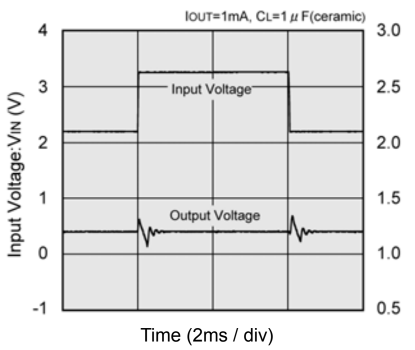

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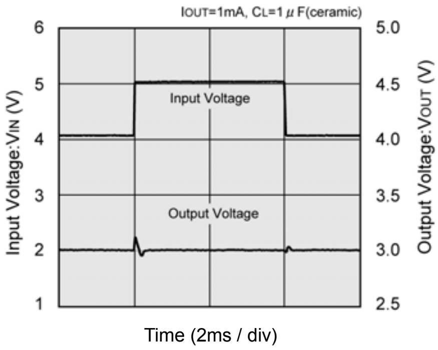

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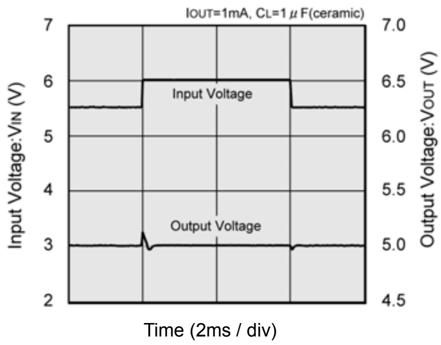
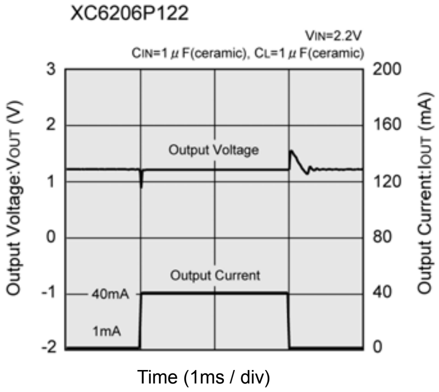


(10) Load Transient Response

XC6206P122



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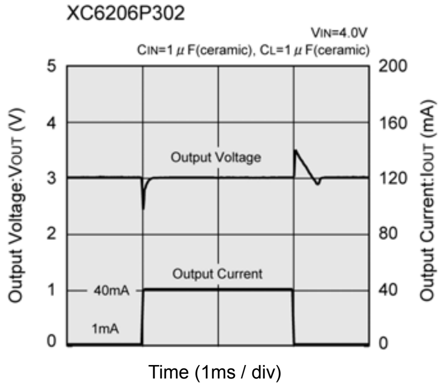
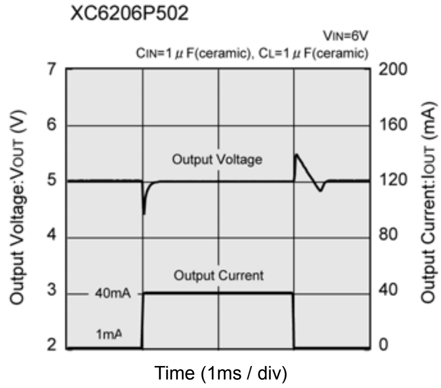
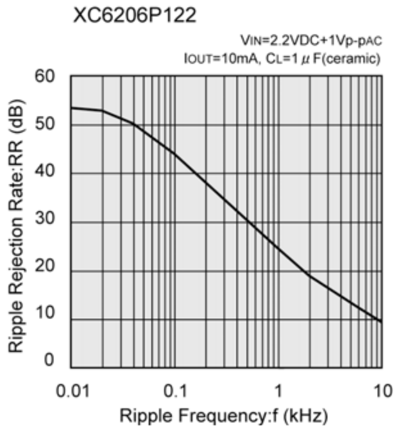


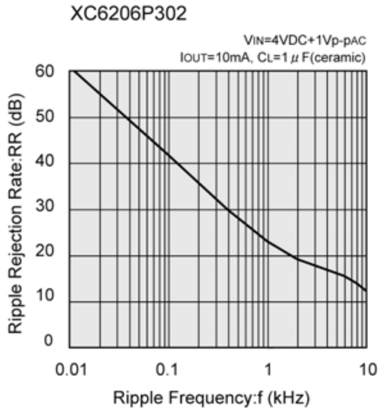
XC6206P502

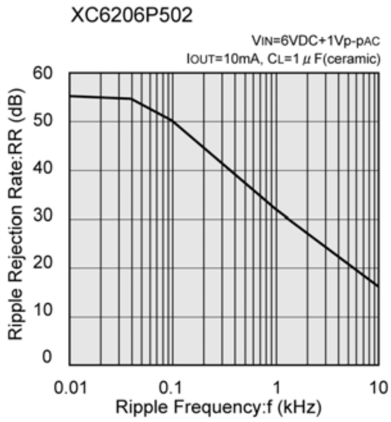


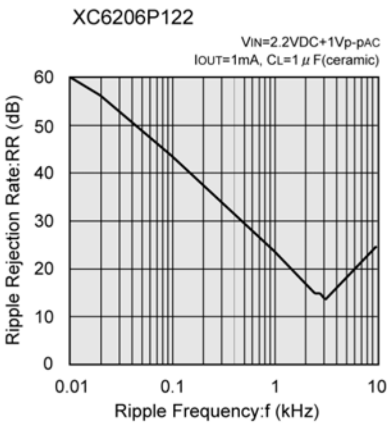
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

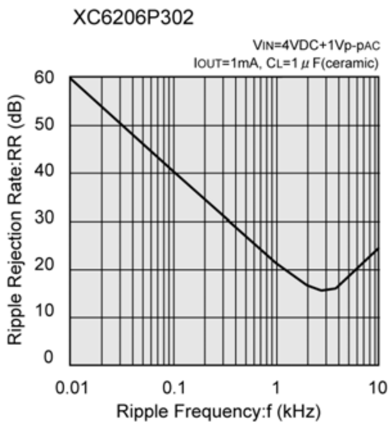
(11) Ripple Rejection Rate

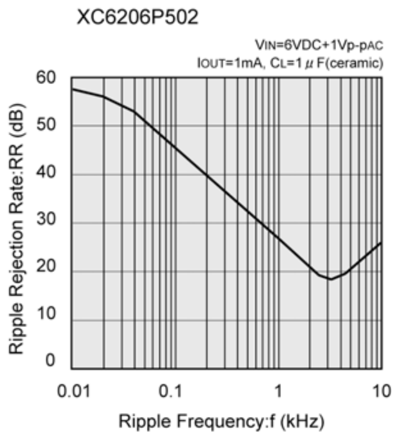








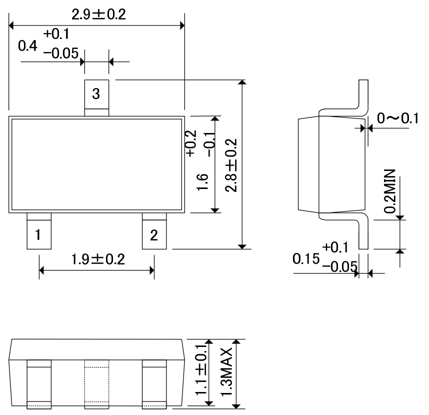




■PACKAGING INFORMATION

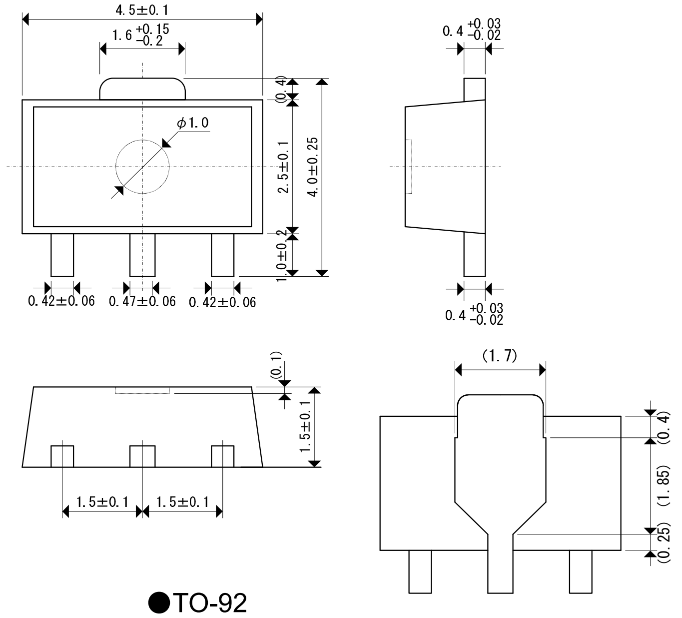
●SOT-23

Unit : mm



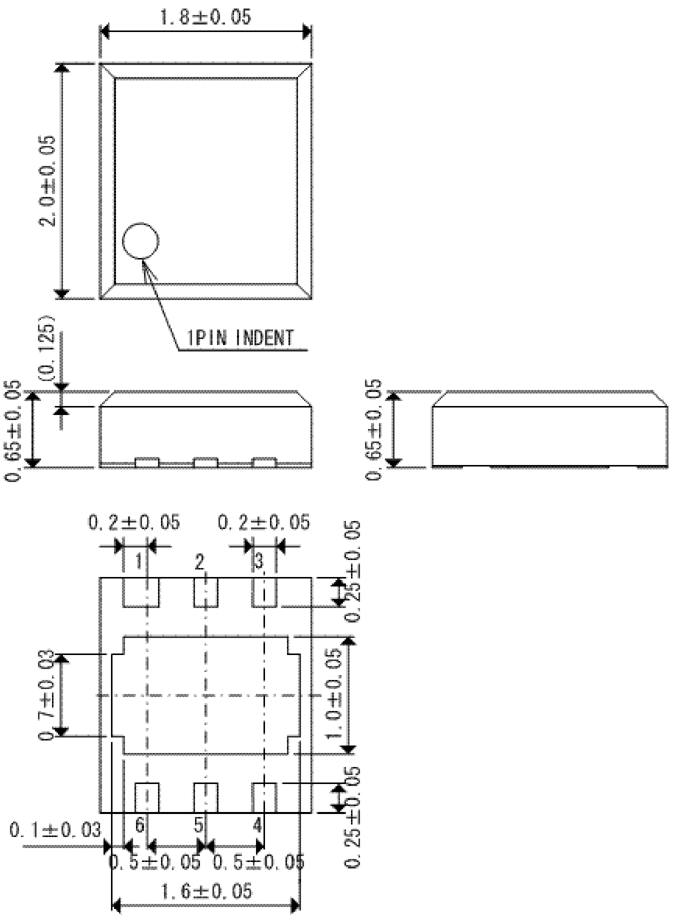
●SOT-89

Unit : mm



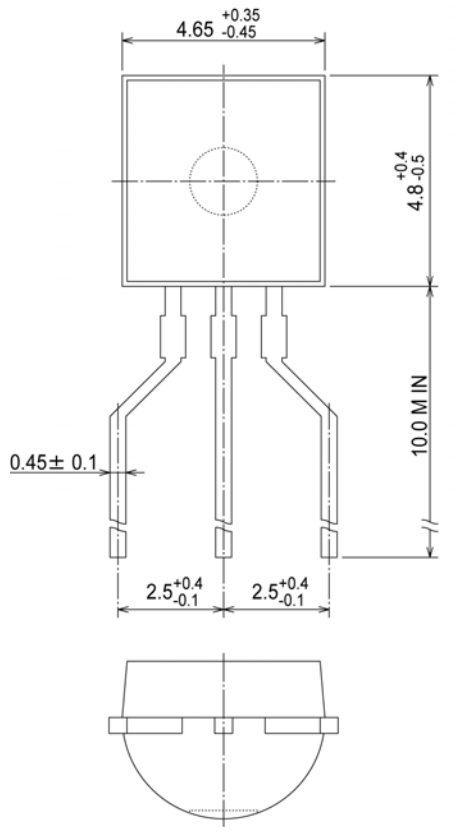
●USP-6B

Unit : mm



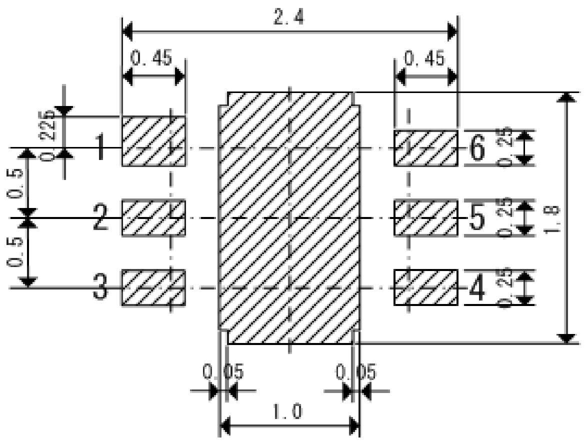
●TO-92

Unit : mm

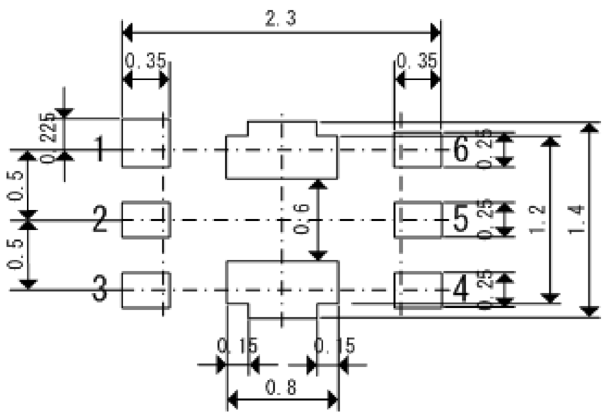


■PACKAGING INFORMATION (Continued)

●USP-6B Reference Pattern Layout



●USP-6B Reference Metal Mask Design



■PACKAGING INFORMATION (Continued)

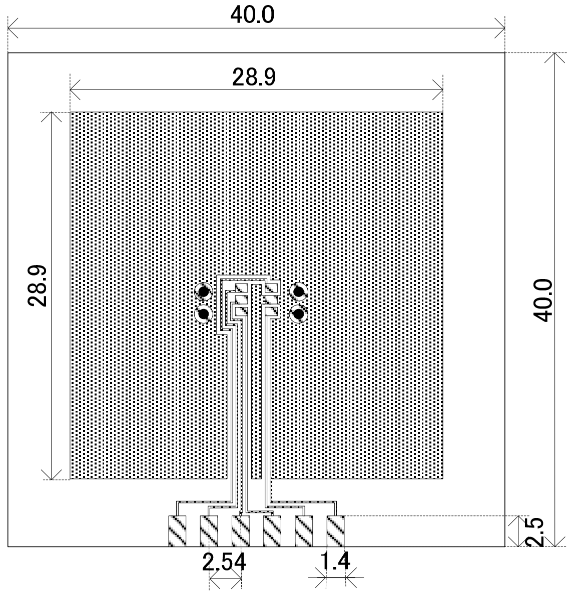
● SOT-23 Power Dissipation

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 one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

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 (Board of SOT-26 is used.)
Material:	Glass Epoxy (FR-4)
Thickness:	1.6 mm

Through-hole: 4 x 0.8 Diameter

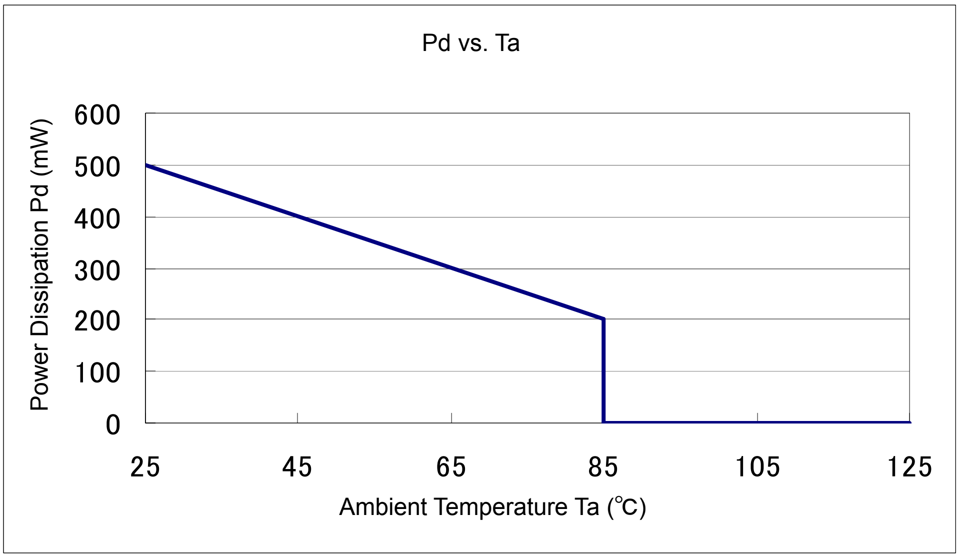


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

Board Mount (Tj max = 125℃)

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



■PACKAGING INFORMATION (Continued)

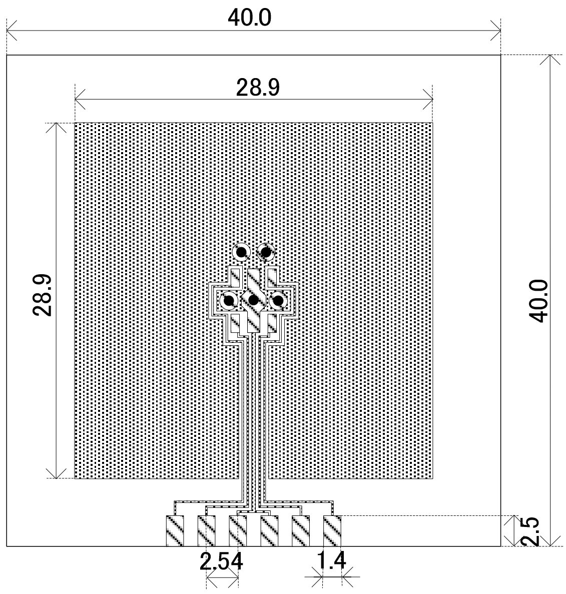
● SOT-89 Power Dissipation

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 one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

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: 5 x 0.8 Diameter

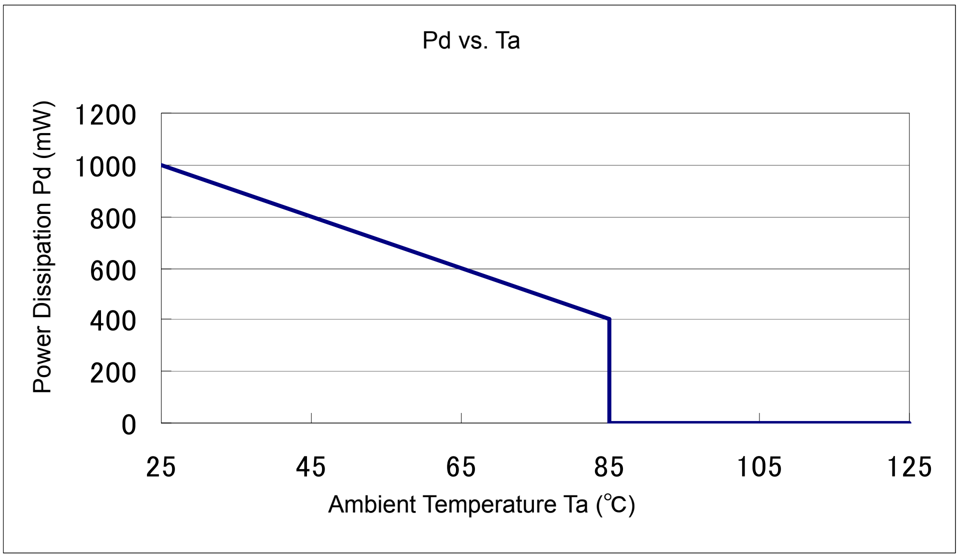


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

Board Mount (Tj max = 125℃)

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



■PACKAGING INFORMATION (Continued)

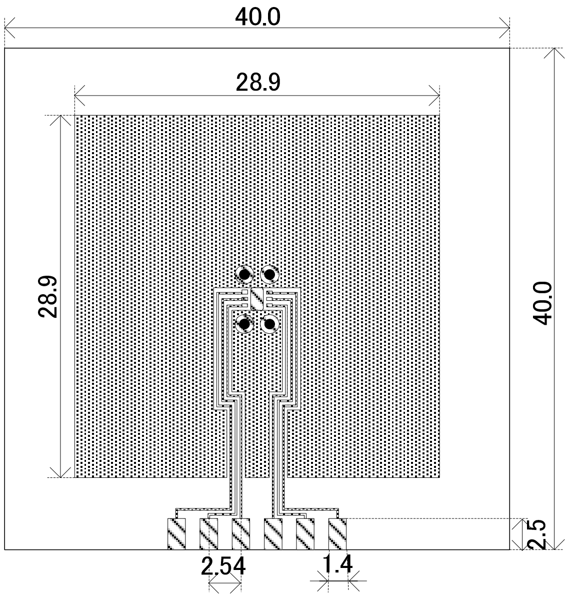
● USP-6B Power Dissipation

Power dissipation data for the USP-6B is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

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

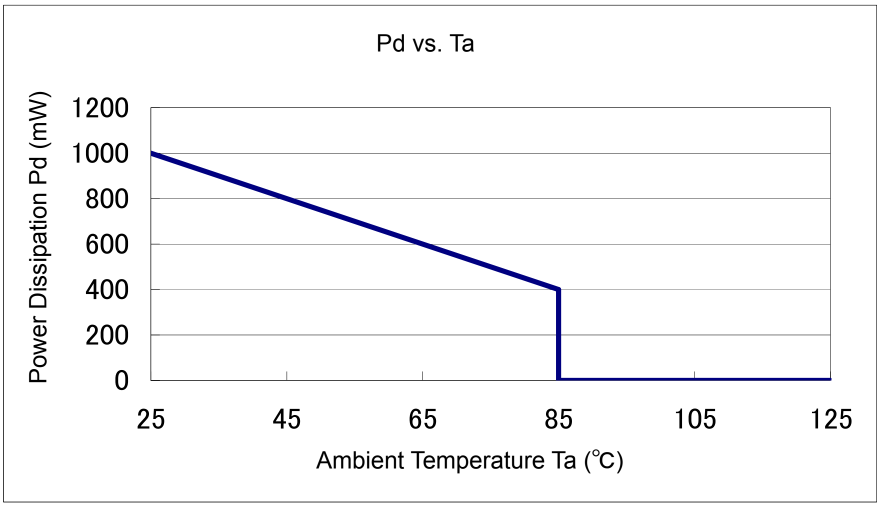


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

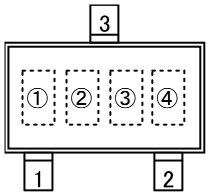
Board Mount (Tj max = 125℃)

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

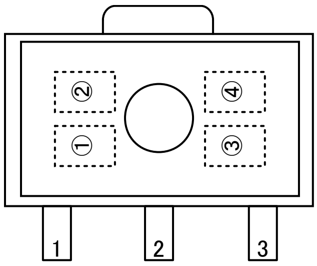


■MARKING RULE

●SOT-23, SOT-89



SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)

① represents product number

MARK	PRODUCT SERIES
6	XC6206P*****

② represents 3 pins regulator

MARK		PRODUCT SERIES
VOLTAGE＝0.1 ~ 3.0V	VOLTAGE＝3.1 ~ 6.0V	
5	6	XC6206P*****

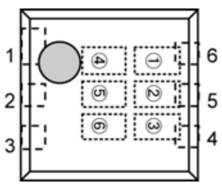
③ represents output voltage

MARK	VOLTAGE (V)			MARK	OUTPUT VOLTAGE (V)		
0	-	3.1	-	F	1.6	4.6	-
1	-	3.2	-	H	1.7	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	-	-
6	-	3.7	-	P	2.2	-	-
7	-	3.8	-	R	2.3	-	-
8	-	3.9	-	S	2.4	-	-
9	-	4.0	-	T	2.5	-	-
A		4.1	-	U	2.6	-	-
B	1.2	4.2	-	V	2.7	-	-
C	1.3	4.3	-	X	2.8	-	-
D	1.4	4.4	-	Y	2.9	-	-
E	1.5	4.5	-	Z	3.0	-	-

④ represents production lot number
0 to 9, A to Z, and inverted 0 to 9, A to Z repeated. (G, I, J, O, Q, W excepted.)

■MARKING RULE (Continued)

●USP-6B



USP-6B
(TOP VIEW)

①② represents product number

MARK		PRODUCT SERIES
①	②	
0	6	XC6206P***D*

③ represents 3 pins regulator

MARK	PRODUCT SERIES
P	XC6206P***D*

④⑤ represents output voltage

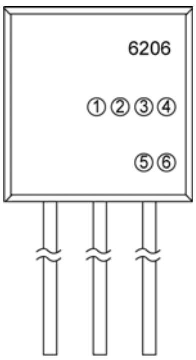
MARK		OUTPUT VOLTAGE(V)	PRODUCT SERIES
④	⑤		
3	3	3.3	XC6206P33*D*
5	0	5.0	XC6206P50*D*

⑥ represents production lot number

0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)

*No character inversion used.

● TO-92



TO-92 (T Type)
(SIDE VIEW)

① represents type of regulator

MARK	PRODUCT SERIES
P	XC6206P*****

②③ represents output voltage

MARK		VOLTAGE (V)	PRODUCT SERIES
②	③		
3	3	3.3	XC6206P33***
5	0	5	XC6206P50***

④ represents output voltage accuracy

MARK	OUTPUT VOLTAGE ACCURACY	PRODUCT SERIES
1	±1%	XC6206P**1**
2	±2%	XC6206P**2**

⑤ represents least significant digit of the production year

MARK	PRODUCTION YEAR
3	2003
4	2004

⑥ represents production lot number

0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)

*No character inversion used.

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