

## Low ESR Cap.Compatible Positive Voltage Regulators

### GENERAL DESCRIPTION

The XC6206 series are highly precise, low power consumption, high voltage, 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 current limiter's foldback circuit also operates as a short protect for the output current limiter and the output pin.

Output voltage can be set 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

Battery powered equipment  
Reference voltage sources  
Cameras, video cameras  
Portable AV systems  
Mobile phones  
Portable games  
Cordless phones,  
wireless communication equipment

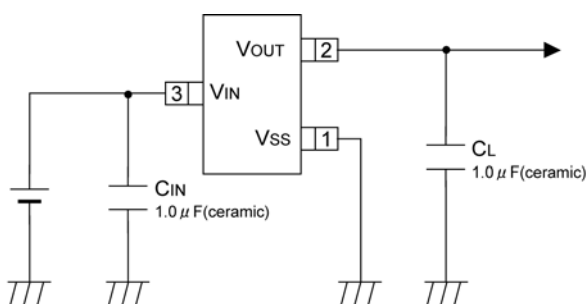
### FEATURES

#### CMOS

<b>Maximum Output Current</b>	: 250mA (5.0V type)
<b>Dropout Voltage</b>	: 250mV @ 100mA (3.0V type)
<b>Maximum Operating Voltage</b>	: 6.0V
<b>Output Voltage Range</b>	: 1.2V ~ 5.0V (0.1V increments)
<b>Highly Accurate</b>	: Fixed voltage accuracy $\pm 2\%$ ( $\pm 30\text{mV}$ @ $V_{\text{OUT}} < 1.5\text{V}$ ) ( $\pm 1\%$ @ $V_{\text{OUT}} \geq 2.0\text{V}$ )

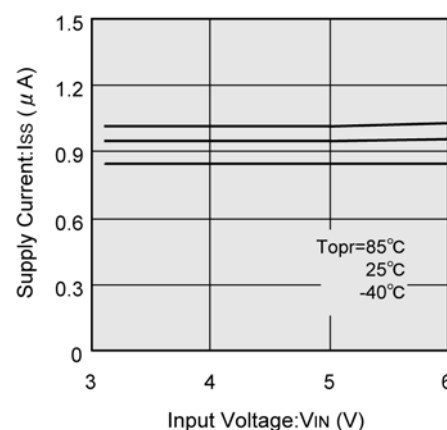
<b>Low Power Consumption</b>	: 1.0 $\mu\text{A}$ (TYP.)
<b>Operating Temperature Range</b>	: $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$
<b>Low ESR Capacitor</b>	: Ceramic capacitor compatible
<b>Current Limit Circuit Built-in</b>	
<b>Ultra Small Package</b>	: SOT-23 (250mW) SOT-89 (500mW) TO-92 (300mW) USP-6B (100mW)

### TYPICAL APPLICATION CIRCUIT

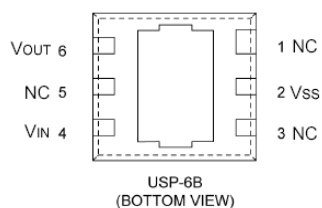
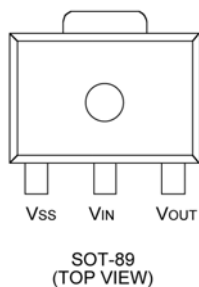
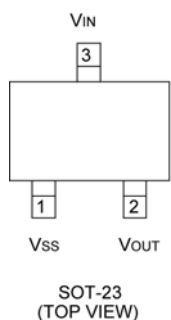


### TYPICAL PERFORMANCE CHARACTERISTICS

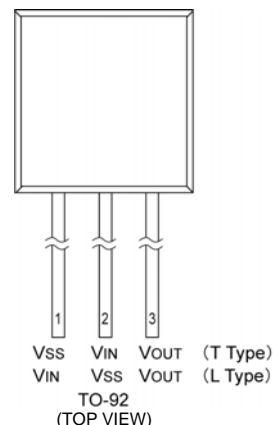
XC6206P302



## PIN CONFIGURATION



\*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 ( $V_{IN}$ ).



## PIN ASSIGNMENT

PIN NUMBER				PIN NAME	FUNCTIONS
SOT-23	SOT-89/TO-92 (T)	USP-6B	TO-92 (L)		
1	1	2	2	VSS	Ground
3	2	4	1	VIN	Power Input
2	3	6	3	VOUT	Output
-	-	1, 3, 5	-	NC	No Connection

## PRODUCT CLASSIFICATION

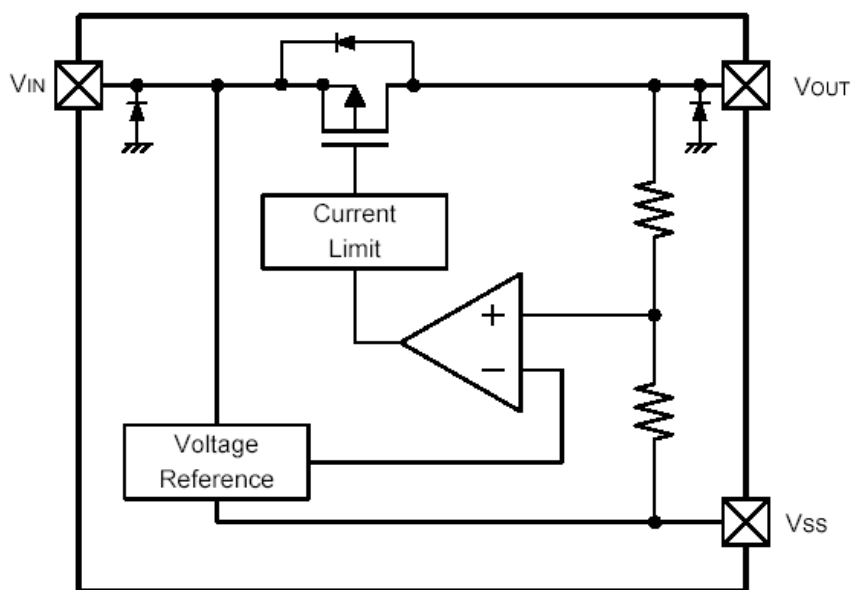
Ordering Information

XC6206P

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
	Output Voltage	12~50	: e.g. VOUT: 3.0V    =3,    =0
	Accuracy	2	: Within $\pm 2\%$ (within $\pm 30\text{mV}$ when $V_{OUT} < 1.5\text{V}$ )
		1 *	: Within $\pm 1\%$
	Packages	M	: SOT-23
		P	: SOT-89
		D	: USP-6B
		T	: TO-92 (T type)
		L	: TO-92 (L type) (Discontinued Product)
	Device Orientation	R	: Embossed tape, standard feed
		L	: Embossed tape, reverse feed
		H	: Page type (TO-92)
		B	: Bag (TO-92)

\*  $\pm 1\%$  accuracy can be set at  $V_{OUT(T)} \geq 2.0\text{V}$ .

## 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 <sub>IN</sub>	7.0	V
Output Current		I <sub>OUT</sub>	500 *	mA
Output Voltage		V <sub>OUT</sub>	V <sub>SS</sub> - 0.3 ~ V <sub>IN</sub> + 0.3	V
Power Dissipation	SOT-23	P <sub>d</sub>	250	mW
	SOT-89		500	
	USP-6B		100	
	TO-92		300	
Operating Temperature Range		T <sub>opr</sub>	- 40 ~ + 85	°C
Storage Temperature Range		T <sub>stg</sub>	- 55 ~ + 125	°C

\* I<sub>OUT</sub>=P<sub>d</sub> / (V<sub>IN</sub>-V<sub>OUT</sub>)

## ELECTRICAL CHARACTERISTICS

XC6206P series

Ta=25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage <sup>(*)</sup>	V <sub>OUT(E)</sub> <sup>(*)</sup>	I <sub>OUT</sub> =30mA	x 0.98	V <sub>OUT(T)</sub>	x 1.02	V	
				E-1			
Maximum Output Current	I <sub>OUTMAX</sub>	-	E-2	-	-	mA	
Load Regulation	V <sub>OUT</sub>	V <sub>OUT(T)</sub> >1.8V: 1mA I <sub>OUT</sub> 100mA V <sub>OUT(T)</sub> ≤1.8V: 1mA I <sub>OUT</sub> 50mA	-	-	E-3	mV	
Dropout Voltage	V <sub>dif1</sub>	I <sub>OUT</sub> =30mA	-	E-4		mV	
	V <sub>dif2</sub>	V <sub>OUT(T)</sub> >1.8V: I <sub>OUT</sub> =100mA V <sub>OUT(T)</sub> ≤1.8V: I <sub>OUT</sub> =60mA	-	E-5		mV	
Supply Current	I <sub>DD</sub>	V <sub>CE</sub> =V <sub>IN</sub>	-	1.0	3.0	μA	
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	V <sub>OUT(T)</sub> <4.5V: V <sub>OUT(T)</sub> +1.0V V <sub>IN</sub> 6.0V V <sub>OUT(T)</sub> ≥4.5V: 5.5V V <sub>IN</sub> 6.0V I <sub>OUT</sub> =30mA	-	0.05	0.25	%/V	
Input Voltage	V <sub>IN</sub>	-	1.8	-	6.0	V	-
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{T_{opr} \cdot V_{OUT}}$	I <sub>OUT</sub> =30mA -40 °C T <sub>opr</sub> 85 °C	-	±100	-	ppm/°C	
Short Circuit Current	I <sub>short</sub>	V <sub>IN</sub> =V <sub>OUT</sub> +1.5V, V <sub>OUT</sub> =V <sub>SS</sub>	-	E-6	-	mA	

### NOTE:

- \* 1 : V<sub>OUT(T)</sub> = Specified output voltage
- \* 2 : V<sub>OUT(E)</sub> = Effective output voltage (I.e. The output voltage when "V<sub>OUT(T)</sub>+1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>OUT</sub> value.)
- \* 3 : V<sub>dif</sub> = {V<sub>IN</sub> 1<sup>(\*)</sup> - V<sub>OUT</sub> 1<sup>(\*)</sup>}
- \* 4 : V<sub>OUT1</sub> = A voltage equal to 98% of the output voltage whenever an amply stabilized I<sub>OUT</sub> {V<sub>OUT(T)</sub> + 1.0V} is input.
- \* 5 : V<sub>IN1</sub> = The input voltage when V<sub>OUT1</sub> appears as input voltage is gradually decreased.
- \* 6 : Unless otherwise stated, V<sub>IN</sub> = V<sub>OUT(T)</sub> + 1.0V
- \* 7 : When V<sub>OUT(T)</sub>≥1.5V, accuracy is ±2%.  
When V<sub>OUT(T)</sub><1.5V, accuracy is MIN.:V<sub>OUT(T)</sub> -30mV / MAX.:V<sub>OUT(T)</sub> +30mV  
±1% accuracy (MIN.: V<sub>OUT(T)</sub> x 0.99 / MAX.:V<sub>OUT(T)</sub> x 1.01) is set at V<sub>OUT(T)</sub>≥2.0V

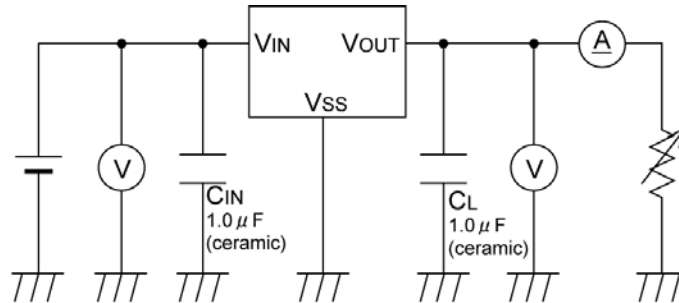
## ELECTRICAL CHARACTERISTICS (Continued)

Electrical Characteristics Chart

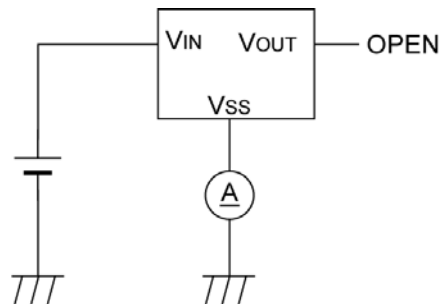
	E-1				E-2	E-3	E-4		E-5		E-6					
PARAMETER  SETTING VOLTAGE	OUTPUT VOLTAGE				MAX. OUTPUT CURRENT	LOAD REGULATION	DROPOUT VOLTAGE 1		DROPOUT VOLTAGE 2		SHORT CURRENT					
	2% ACCURACY		1% ACCURACY													
VOUT(T)	VOUT(E) (V)		VOUT(E) (V)		IOUTMAX (mA)	ΔVout (mV)	Vdif1 (mV)		Vdif2 (mV)		Ishort (mA)					
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.	TYP.					
1.2	1.170	1.230	Not Available		60	40	460	760	700	960	180					
1.3	1.270	1.330					400	650								
1.4	1.370	1.430					350	590								
1.5	1.470	1.530			80	45	300	510	580	860	155					
1.6	1.568	1.632					250	450								
1.7	1.666	1.734					200	410	450	810						
1.8	1.764	1.836					150	390								
1.9	1.862	1.938					100	370	350	710	100					
2.0	1.960	2.040	1.980	2.020	120	50										
2.1	2.058	2.042	2.079	2.121												
2.2	2.156	2.244	2.178	2.222												
2.3	2.254	2.346	2.277	2.323												
2.4	2.352	2.448	2.376	2.424												
2.5	2.450	2.550	2.475	2.525	150	55										
2.6	2.548	2.652	2.574	2.626												
2.7	2.646	2.754	2.673	2.727												
2.8	2.744	2.856	2.772	2.828												
2.9	2.842	2.958	2.871	2.929												
3.0	2.940	3.060	2.970	3.030	200	60	75	350	250	680	100					
3.1	3.038	3.162	3.069	3.131												
3.2	3.136	3.264	3.168	3.232												
3.3	3.234	3.366	3.267	3.333												
3.4	3.332	3.468	3.366	3.434		65										
3.5	3.430	3.570	3.465	3.535												
3.6	3.528	3.672	3.564	3.636												
3.7	3.626	3.774	3.663	3.737												
3.8	3.724	3.876	3.762	3.838	250	70										
3.9	3.822	3.978	3.861	3.939												
4.0	3.920	4.080	3.960	4.040												
4.1	4.018	4.182	4.059	4.141												
4.2	4.116	4.284	4.158	4.242												
4.3	4.214	4.386	4.257	4.343		75	60	320	200	630						
4.4	4.312	4.488	4.356	4.444												
4.5	4.410	4.590	4.455	4.545												
4.6	4.508	4.692	4.554	4.646												
4.7	4.606	4.794	4.653	4.747												
4.8	4.704	4.896	4.752	4.848												
4.9	4.802	4.998	4.851	4.949												
5.0	4.900	5.100	4.950	5.050		80						50	290	175	600	

## TEST CIRCUITS

Circuit

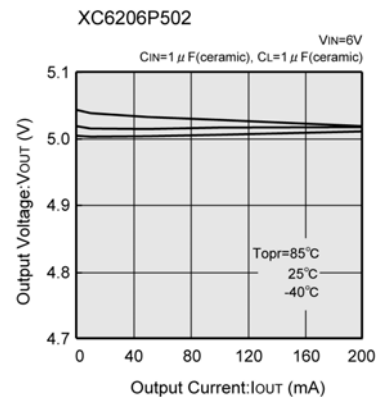
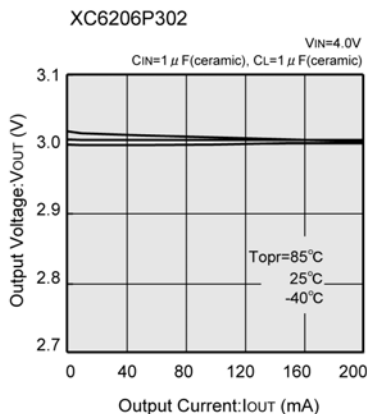
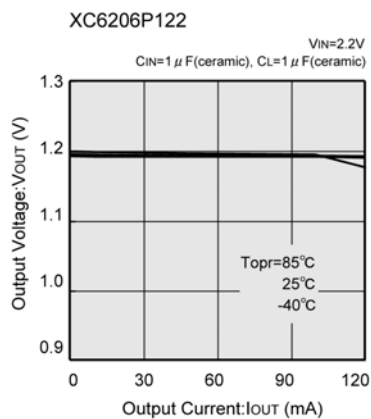


Circuit

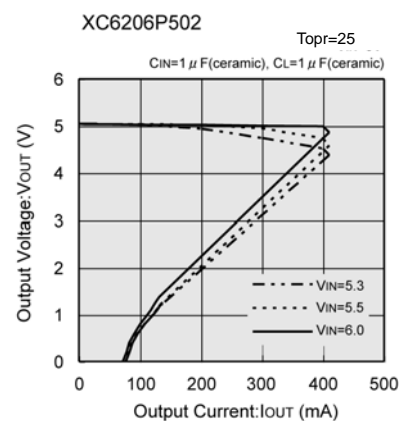
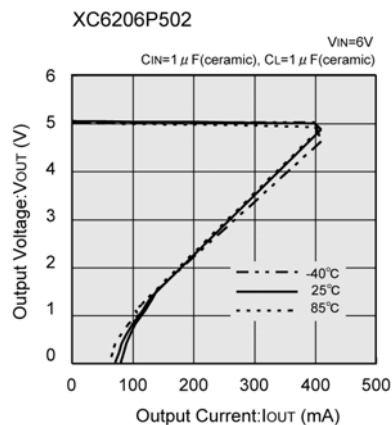
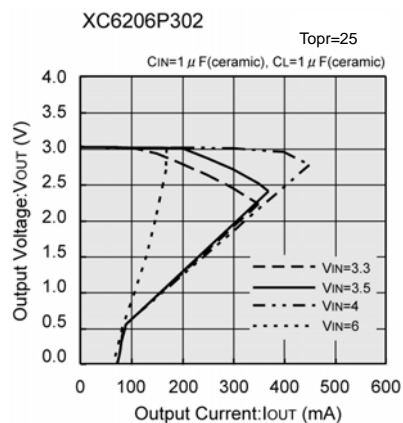
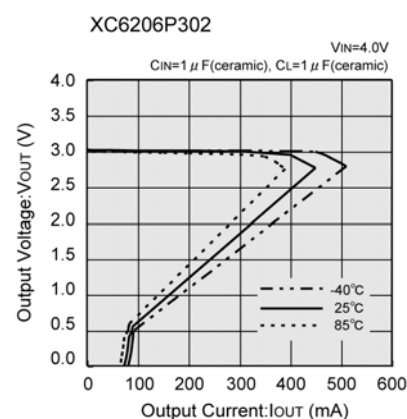
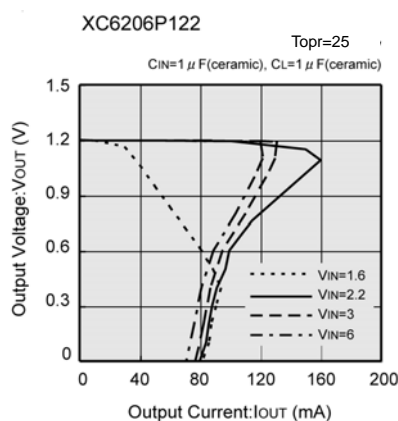
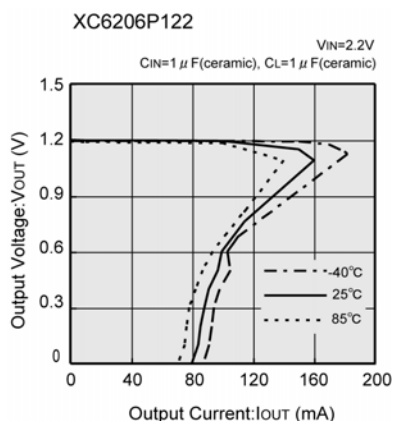


## TYPICAL PERFORMANCE CHARACTERISTICS

### (1) Output Voltage vs. Output Current

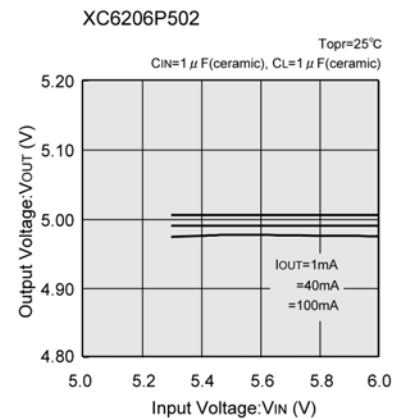
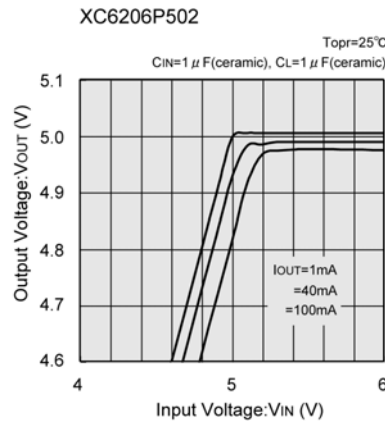
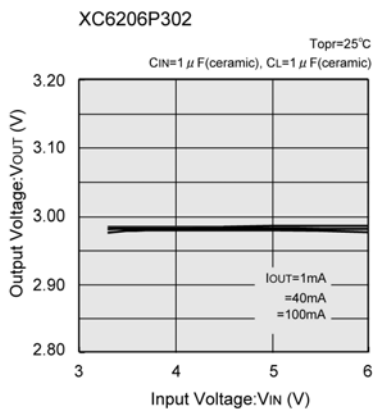
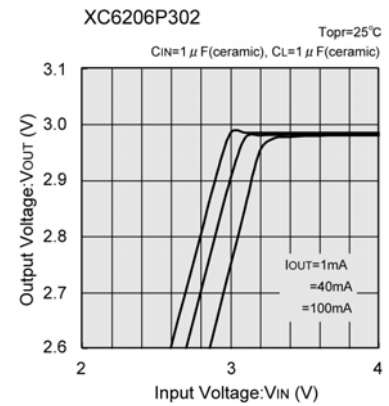
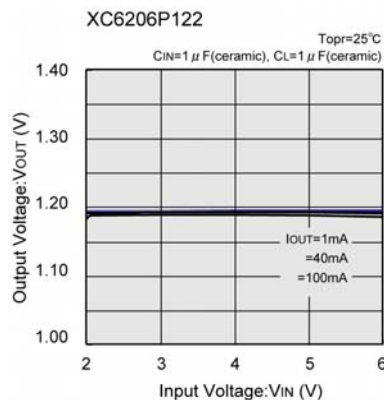
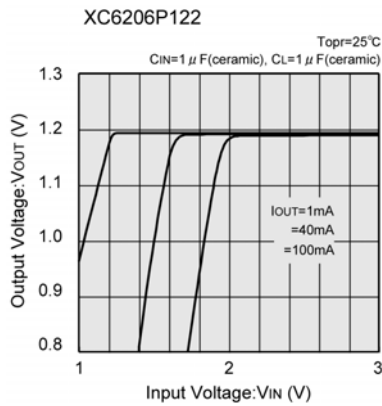


### (2) Current Limit

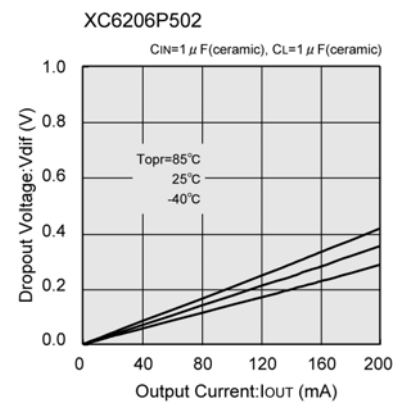
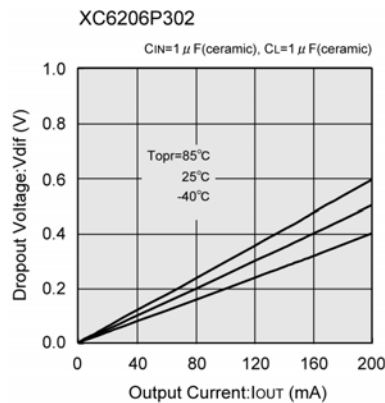
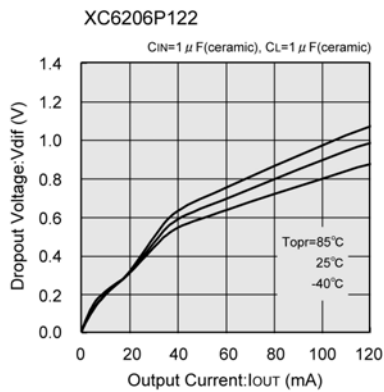


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (3) Output Voltage vs. Input Voltage



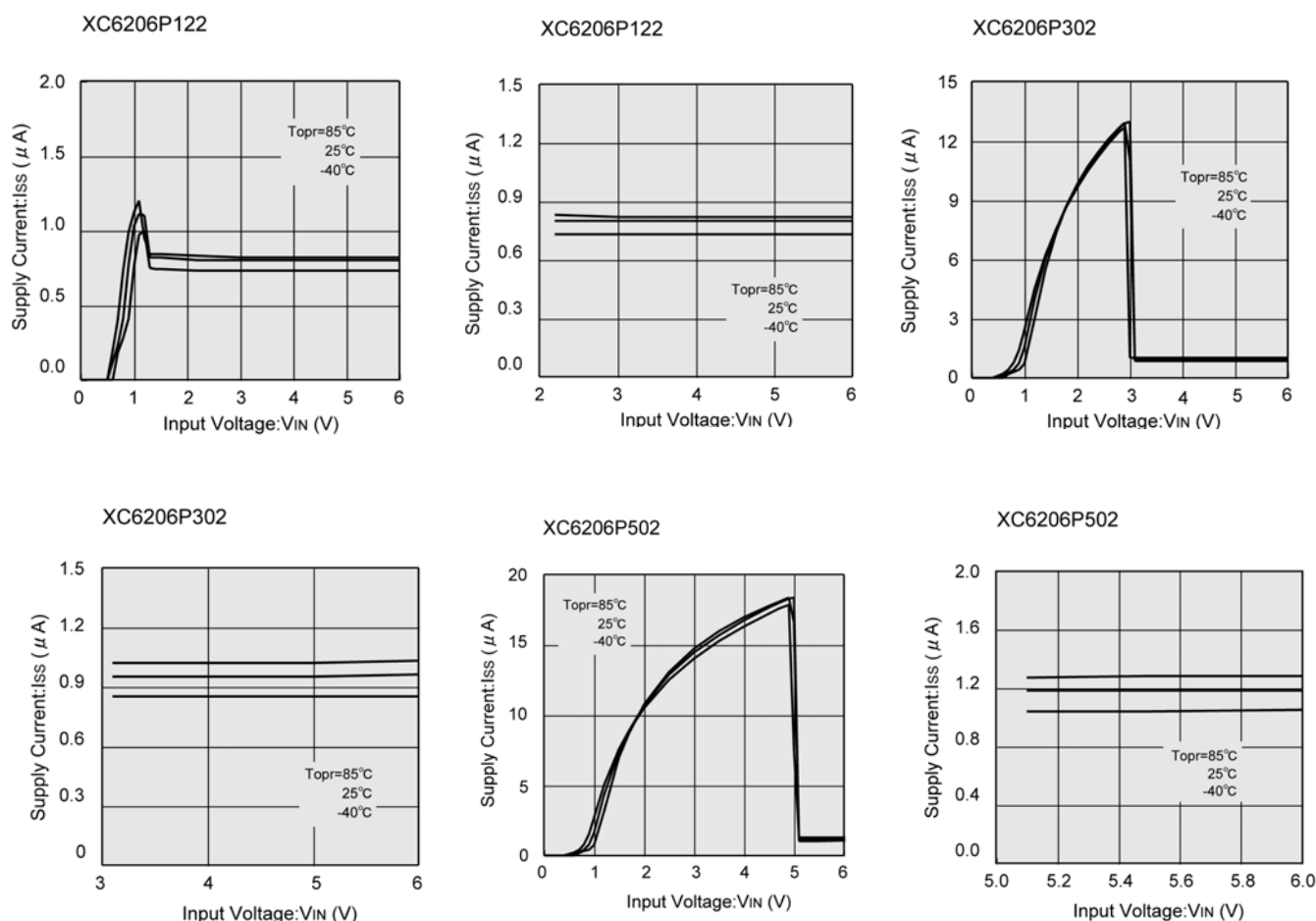
### (4) Dropout Voltage vs. Output Current



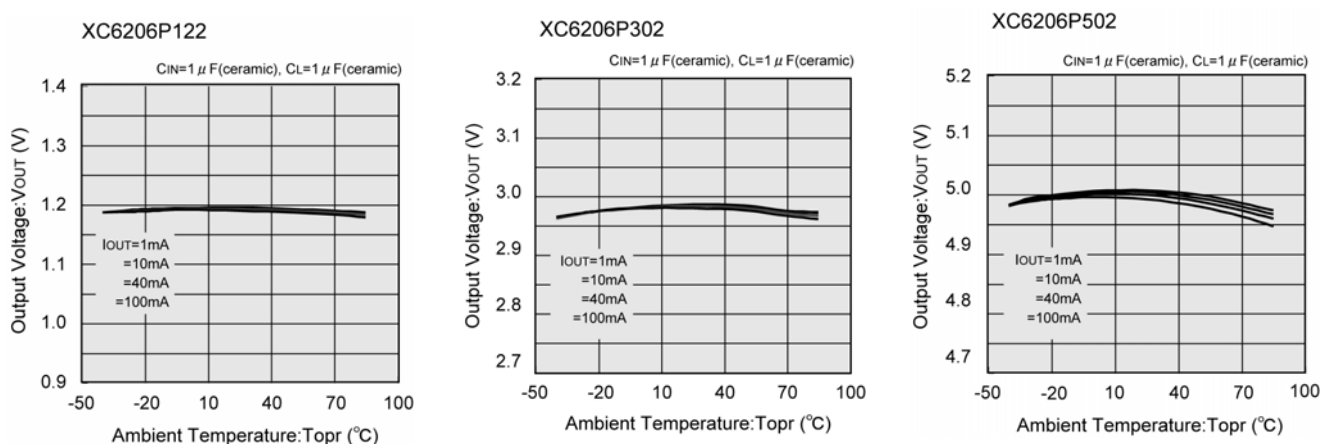


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (5) Supply Current vs. Input Voltage

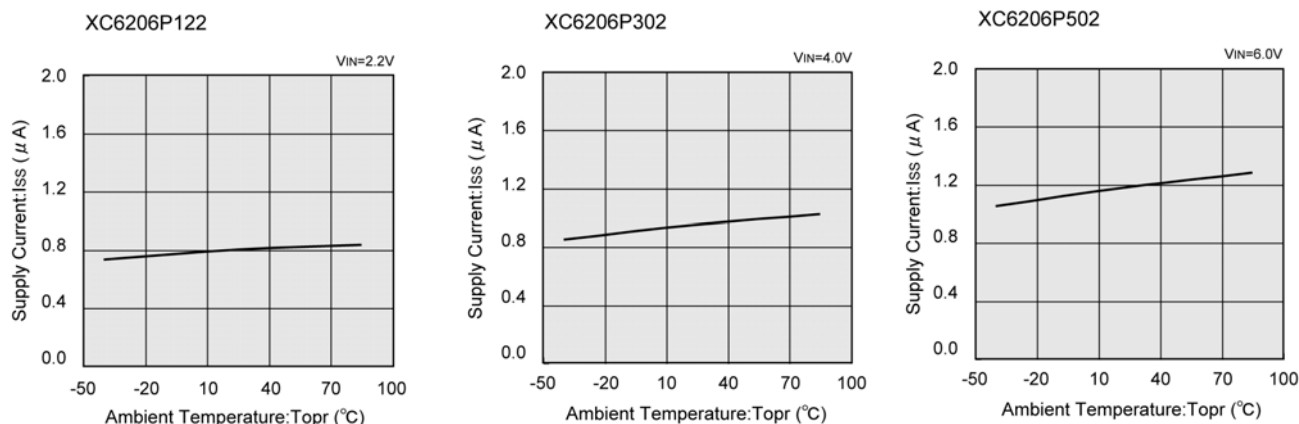


### (6) Output Voltage vs. Ambient Temperature

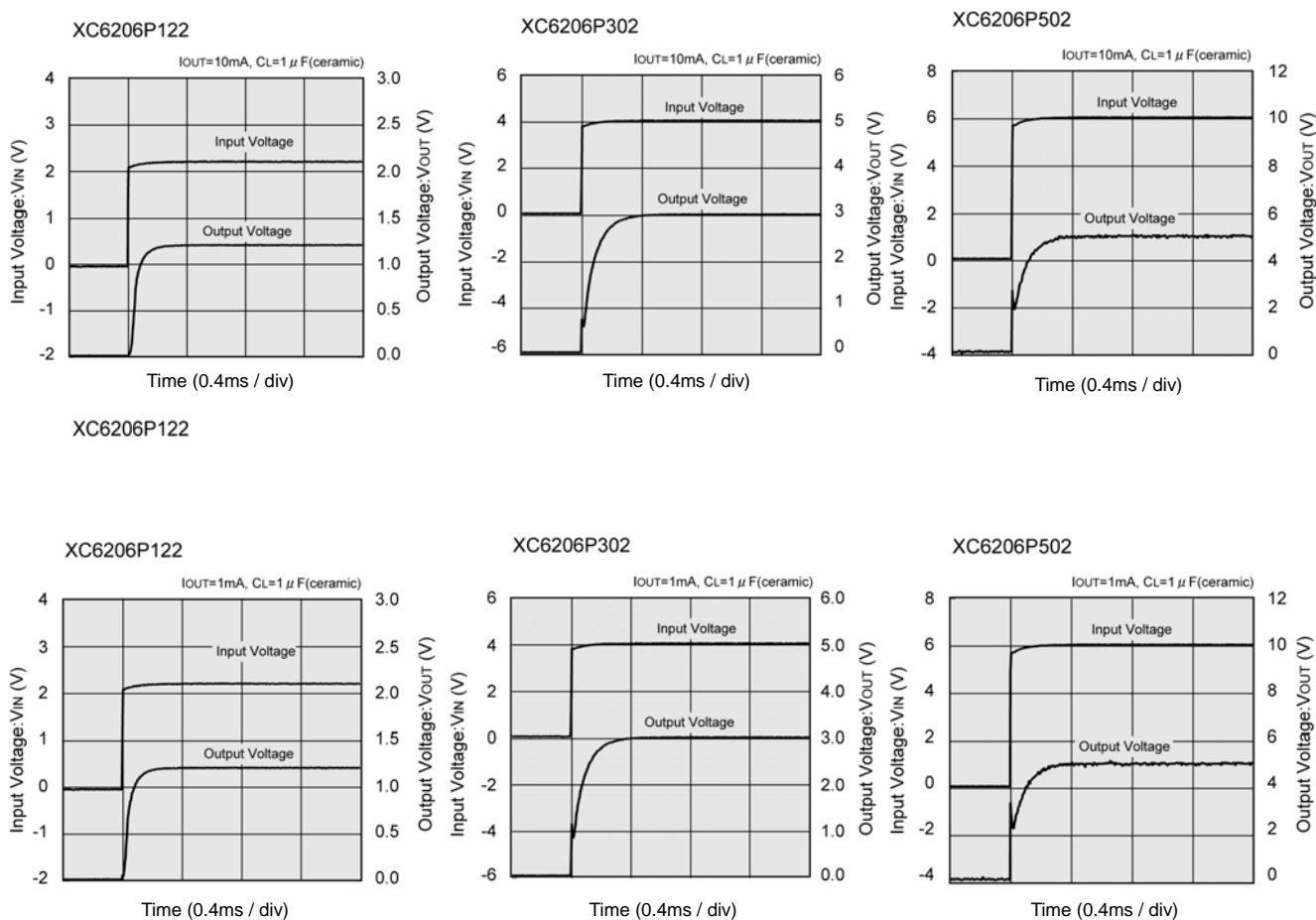


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (7) Output Voltage vs. Ambient Temperature

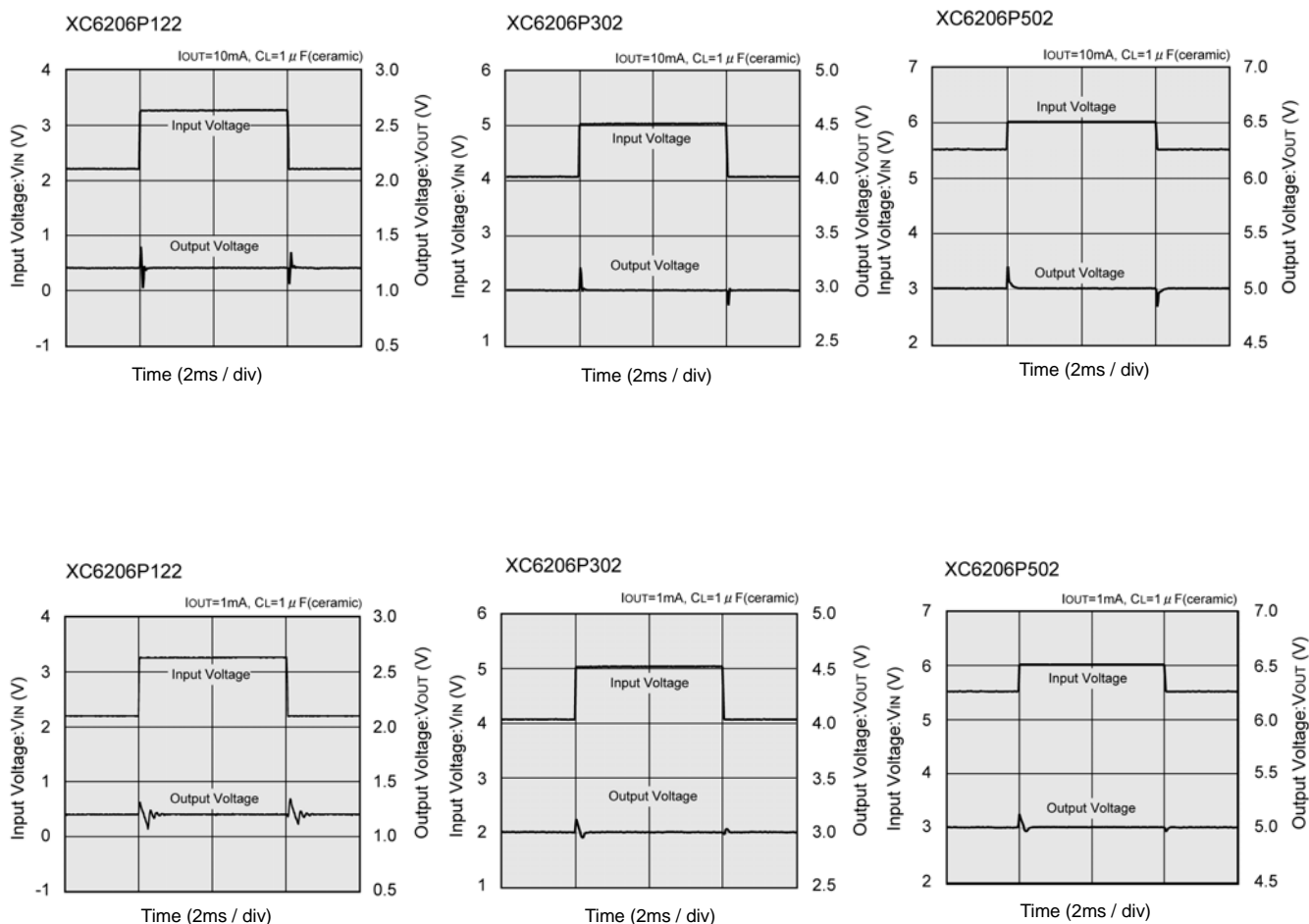


### (8) Input Transient Response 1

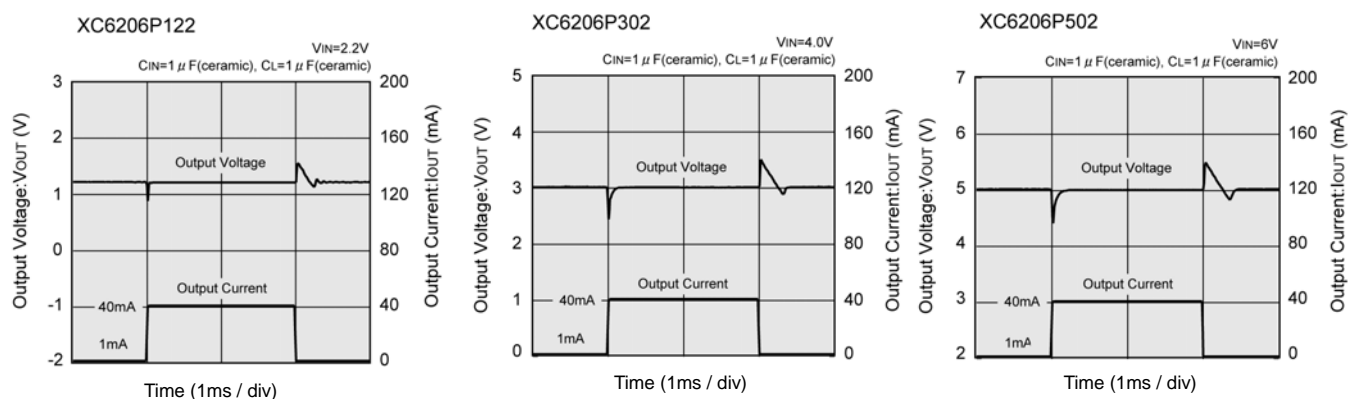


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Input Transient Response 2

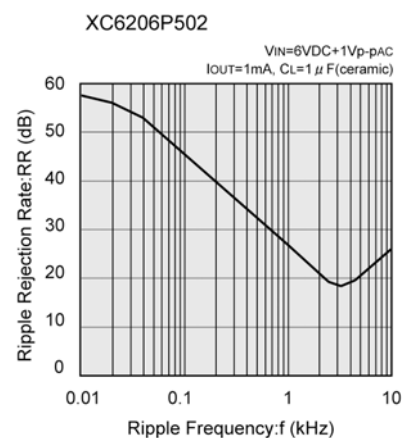
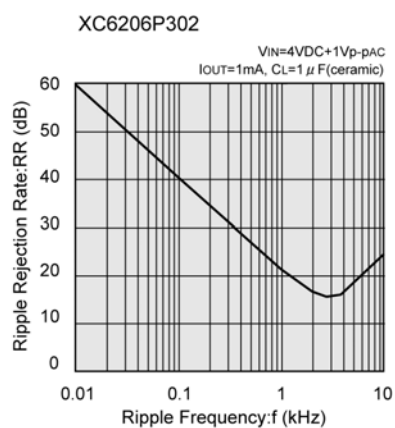
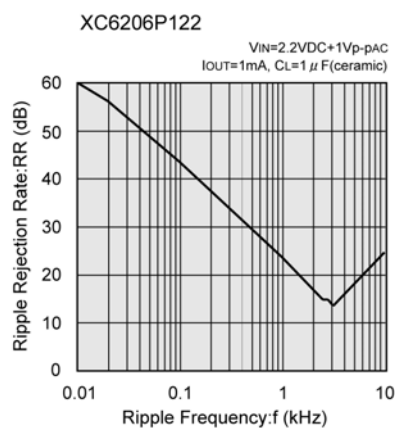
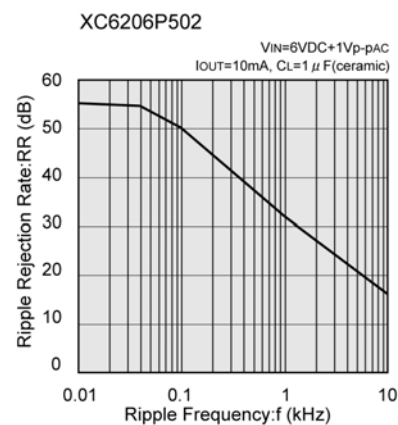
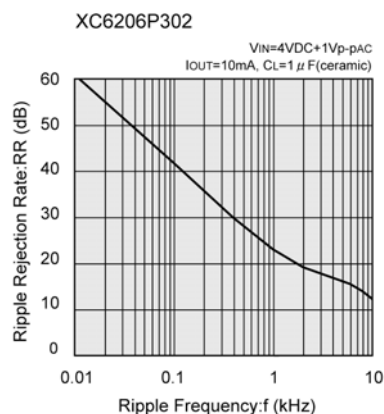
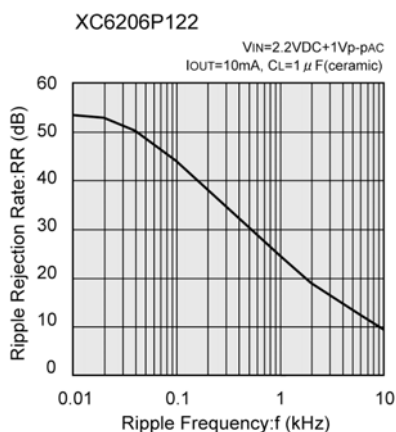


### (10) Load Transient Response



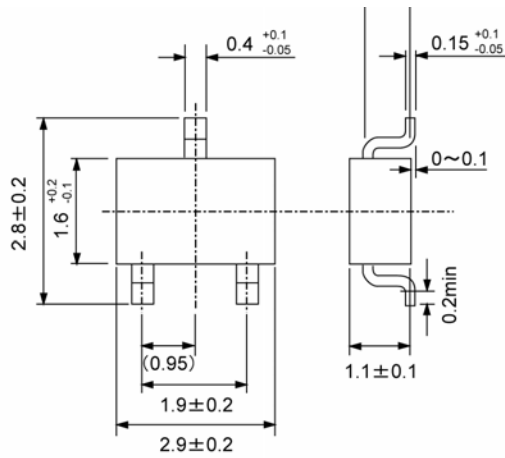
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) Ripple Rejection Rate

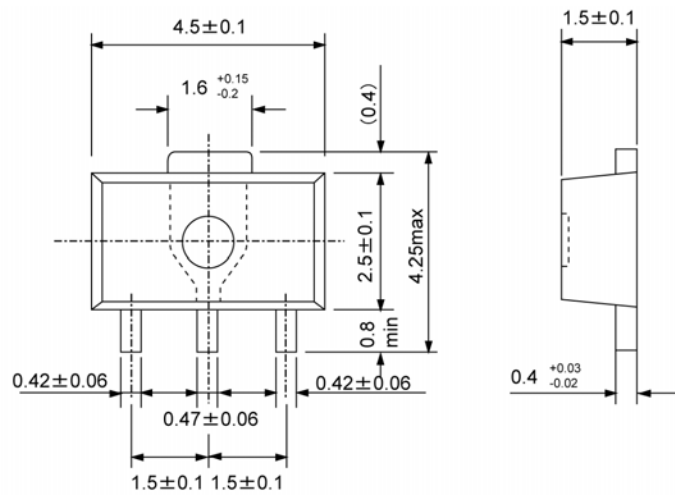


## PACKAGING INFORMATION

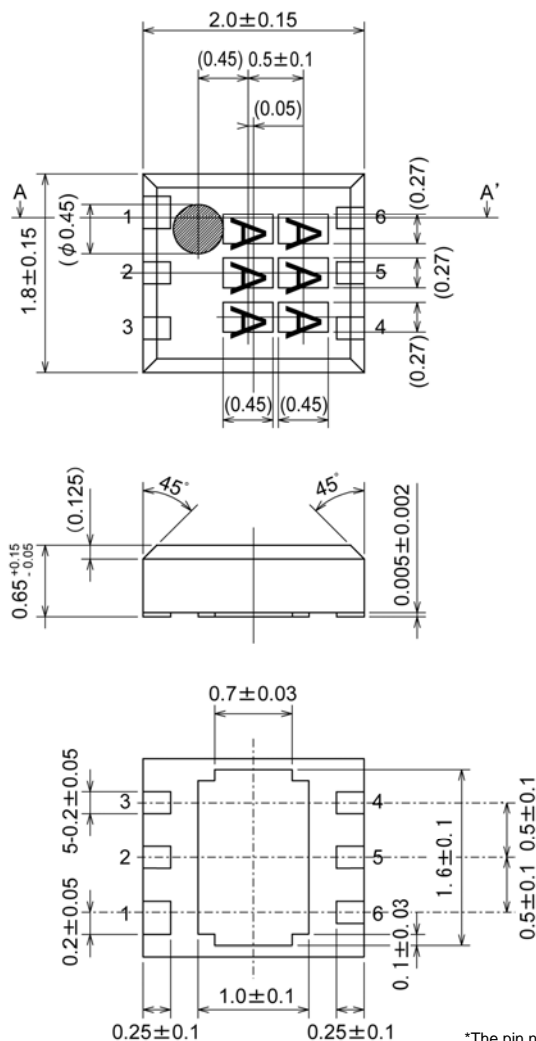
SOT-23



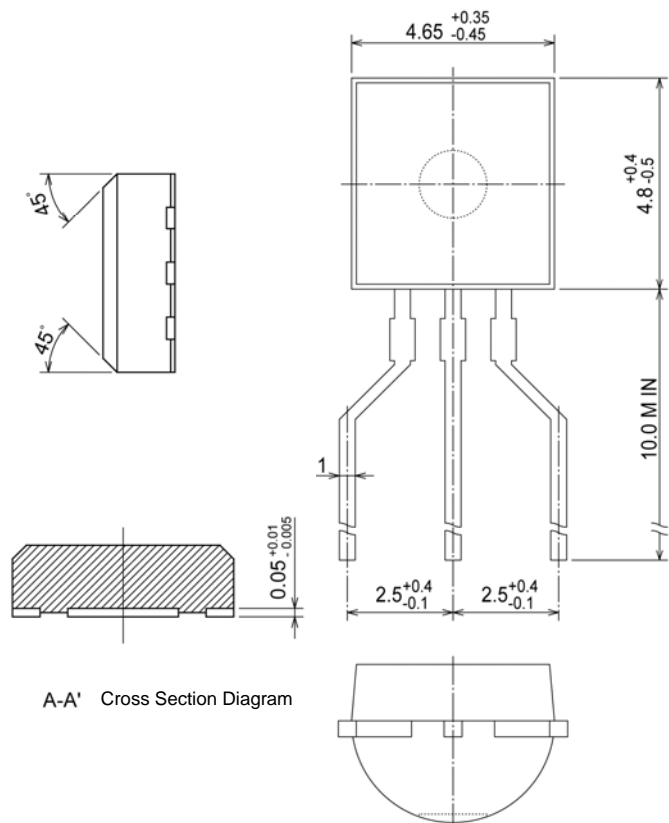
SOT-89



USP-6B



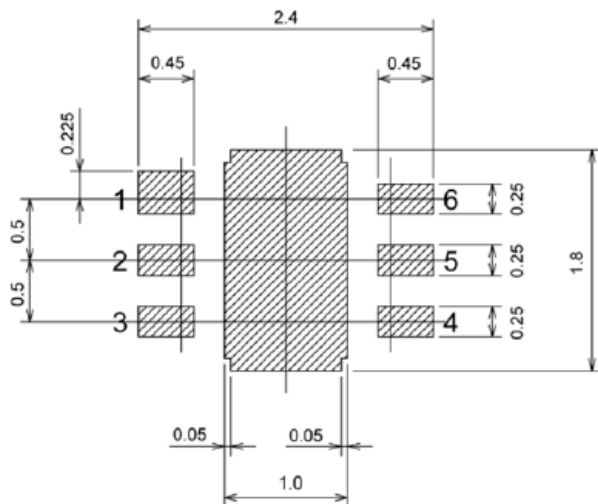
TO-92



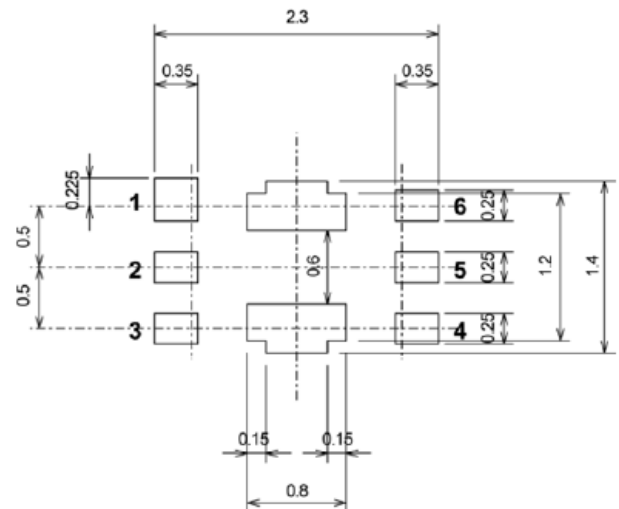
\*The pin number 1 is larger than the other pins

## PACKAGING INFORMATION (Continued)

USP-6B Reference Pattern Layout

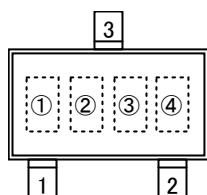


USP-6B Reference Metal Mask Design

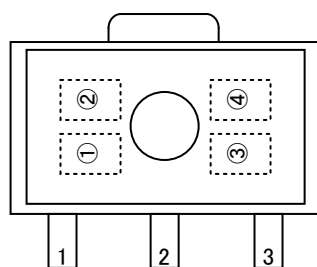


## MARKING RULE

SOT-23, SOT-89



SOT-23  
(TOP VIEW)



SOT-89  
(TOP VIEW)

Represents product number

MARK	PRODUCT SERIES
6	XC6206P*****

Represents 3 pins regulator

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

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	-	-

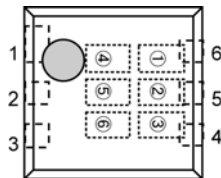
Represents production lot number

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

\*No character inversion used.

## MARKING RULE (Continued)

USP-6B



USP-6B  
(TOP VIEW)

Represents product number

MARK		PRODUCT SERIES
0	6	XC6206P***D*

Represents 3 pins regulator

MARK	PRODUCT SERIES
P	XC6206P***D*

Represents output voltage

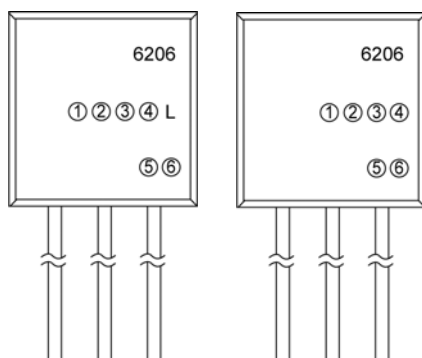
MARK		OUTPUT VOLTAGE(V)	PRODUCT SERIES
3	3	3.3	XC6206P33*D*
5	0	5.0	XC6206P50*D*

Represents production lot number

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

\*No character inversion used.

TO-92



TO-92 (L Type)  
(TOP VIEW)

TO-92 (T Type)  
(TOP VIEW)

Represents type of regulator

MARK	PRODUCT SERIES
P	XC6206P*****

Represents output voltage

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

Represents detect voltage accuracy

MARK	DETECT VOLTAGE ACCURACY	PRODUCT SERIES
1	Within $\pm 1\%$	XC6206P**1**
2	Within $\pm 2\%$	XC6206P**2**

Represents least significant digit of the production year

MARK	PRODUCTION YEAR
3	2003
4	2004

Represents production lot number

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

\*No character inversion used.



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