

## Negative Voltage Regulators

### ■ GENERAL DESCRIPTION

The XC62K series are highly precise, low power consumption, negative voltage regulators, manufactured using CMOS and laser trimming technologies. The series achieves high output currents with small input-output voltage differentials, and consists of a high precision voltage reference, an error correction circuit, and an output driver with current limitation. SOT-23, SOT-8, USP-6B packages are available.

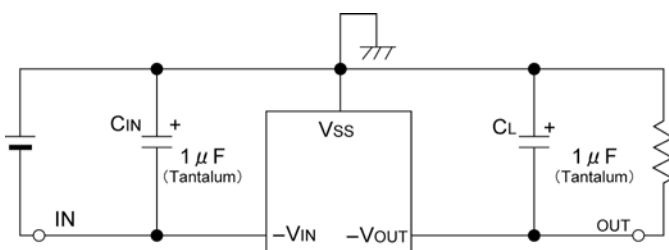
### ■ APPLICATIONS

- Multi-function power supplies.
- Smart phones / Mobile phones.
- Mobile devices / terminals.

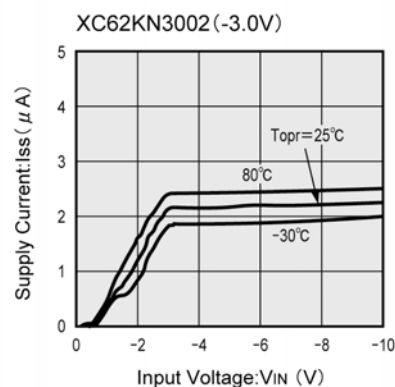
### ■ FEATURES

- Dropout Voltage** : 0.12V@50mA ( $V_{OUT}=-5.0V$ )  
: 0.38V@100mA
- Maximum Output Current** : 100mA (within MAX. power dissipation,  $V_{OUT}=-5.0V$ )
- Output Voltage Range** : -2.1V ~ -6.0V (0.1V increments)  
-5.0, -4.0, -3.0V, -2.5V standard  
(All other voltages are semi-custom)
- Highly Accurate** : Setting output voltage  $\pm 2\%$   
( $\pm 1\%$  for semi-custom products)
- Low Power Consumption** : 3.0  $\mu A$  @  $V_{OUT}=-5.0V$  (TYP.)
- Output Voltage Temperature Characteristics**  
:  $\pm 100ppm/^{\circ}C$  (TYP.)
- Line Regulation** : 0.1%/V (TYP.)
- CMOS Low Power Consumption**
- Packages** : SOT-23  
SOT-89  
USP-6B
- Environmentally Friendly** : EU RoHS Compliant, Pb Free

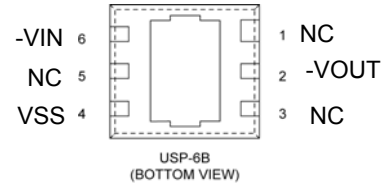
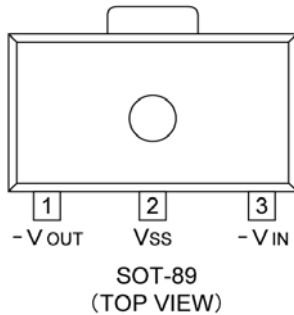
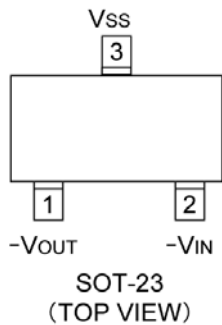
### ■ TYPICAL APPLICATION CIRCUIT



### ■ TYPICAL PERFORMANCE CHARACTERISTICS



## 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 VSS pin.

## PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTIONS
SOT-23	SOT-89	USP-6B		
2	3	6	-VIN	Power Supply Input
3	2	4	Vss	Ground
1	1	2	-VOUT	Output
-	-	1.3.5	NC	No Connection

## PRODUCT CLASSIFICATION

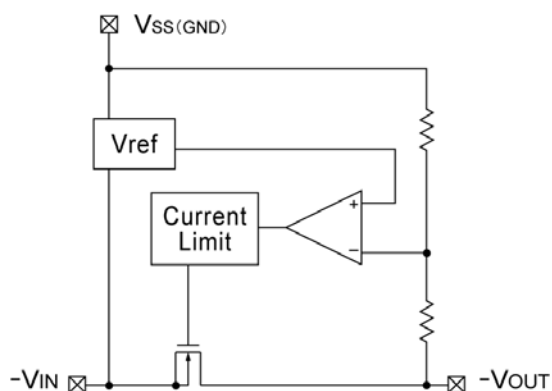
### Ordering Information

XC62K①②③④⑤⑥⑦-⑧<sup>(\*)</sup>

MARK	ITEM	SYMBOL	DESCRIPTION
①	Polarity of Output Voltage	N	Negative
②③	Output Voltage	21 ~ 60	e.g. $V_{OUT} = 2.1V \rightarrow$ ②=2, ③=1 $V_{OUT} = 6.0V \rightarrow$ ②=6, ③=0
④	Temperature Characteristics	0	$\pm 100\text{ppm}$ (TYP.)
⑤	Output Voltage Accuracy	1	$\pm 1\%$ (Semi-custom)
		2	$\pm 2\%$
⑥⑦-⑧	Packages (Order Unit)	MR	SOT-23
		MR-G	SOT-23
		PR	SOT-89
		PR-G	SOT-89
		DR	USP-6B
		DR-G	USP-6B

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

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

Ta=25°C

PARAMETER	SYMBOL	RATINGS	UNITS
Input Voltage	V <sub>IN</sub>	-12.0	V
Output Current	I <sub>OUT</sub>	200	mA
Output Voltage	V <sub>OUT</sub>	-V <sub>SS</sub> -0.3~V <sub>IN</sub> +0.3	V
Power Dissipation	SOT-23	150	mW
	SOT-89	500	
	USP-6B	100	
Operating Ambient Temperature	T <sub>opr</sub>	-40 ~ +85	°C
Storage Temperature	T <sub>stg</sub>	-40 ~ +125	°C

Note: Please ensure that I<sub>OUT</sub> is less than Pd/(V<sub>OUT</sub>-V<sub>IN</sub>).

## ELECTRICAL CHARACTERISTICS

XC62KN Series

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}^{(*2)}$	$I_{OUT}=20mA$ $V_{IN}=V_{OUT(T)}^{(*1)}-1.0V$	E1-1 <sup>(*4)</sup>	$V_{OUT(T)}$	E1-2 <sup>(*4)</sup>	V	2
Maximum Output Current	$I_{OUTmax}$	$V_{IN}=V_{OUT(T)}-1.0V$ $V_{OUT(E)} \geq V_{OUT(T)} \times 0.9$	E2 <sup>(*4)</sup>			mA	4
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=V_{OUT(T)}-1.0V$ $1mA \leq I_{OUT} \leq \{E3\}mA$	-	40	80	mV	4
Dropout Voltage	$V_{dif1}^{(*3)}$	$I_{OUT}=\{E4-1\}^{(*4)}mA$	-	120	300	mV	3
	$V_{dif2}^{(*3)}$	$I_{OUT}=\{E4-2\}^{(*4)}mA$	-	380	600		
Supply Current	$I_{SS}$	$V_{IN}=V_{OUT(T)}-1.0V$	-	E5-1 <sup>(*4)</sup>	E5-2 <sup>(*4)</sup>	$\mu A$	1
Line Regulation	$\frac{\Delta V_{OUT}}{(\Delta V_{IN} \cdot V_{OUT})}$	$I_{OUT}=20mA$ $V_{IN} \geq V_{OUT(T)}-1.0V$ $V_{IN} \leq -10.0V$	-	0.1	0.3	%V	3
Input Voltage	$V_{IN}$		-	-	-10.0	V	-
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{(\Delta V_{IN} \cdot V_{OUT})}$	$I_{OUT}=20mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$	-	$\pm 100$	-	ppm/ °C	-

\*1:  $V_{OUT(T)}$ =Specified output voltage

\*2:  $V_{OUT(E)}$ =Effective output voltage

i.e. the output voltage when " $V_{OUT(T)}-1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value).

\*3:  $V_{dif1}, V_{dif2} = V_{dif} = \{V_{IN1}^{(*5)} - V_{OUT1}^{(*4)}\}$

$V_{OUT1}$  = A voltage equal to 98% of the output voltage whenever an amply stabilized  $I_{OUT}$  ( $V_{OUT(T)}-1.0V$ ) is input.

$V_{IN1}$  = The input voltage when a voltage equal to 98% of  $V_{OUT(E)}$  appears.

\*4: Refer to the "Voltage chart".

## ■ ELECTRICAL CHARACTERISTICS (Continued)

● Voltage Chart

SYMBOL	E1-1	E1-2	E1-1	E1-2	E2	E5-1	E5-2
PARAMETER	OUTPUT VOLTAGE (V) (2% products)		OUTPUT VOLTAGE (V) (1% products)		MAXIMUM OUTPUT CURRENT (mA)	SUPPLY CURRENT1 (μA)	
SETTING	V <sub>OUT(E)</sub>					I <sub>OUTmax</sub>	I <sub>SS</sub>
OUTPUT VOLTAGE(V)	MIN	MAX	MIN	MAX	MIN	TYP	MAX
V <sub>OUT(T)</sub>							
2.1	2.058	2.142	-	-	40	2.5	6.0
2.2	2.156	2.244	-	-	↑	↑	↑
2.3	2.254	2.346	-	-	↑	↑	↑
2.4	2.352	2.448	-	-	↑	↑	↑
2.5	2.450	2.550	2.475	2.525	↑	↑	↑
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	60	↑	↑
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	↑	↑	↑
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	↑	↑	↑
3.9	3.822	3.978	3.861	3.939	↑	↑	↑
4.0	3.920	4.080	3.960	4.040	80	3.0	6.5
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	↑	↑	↑
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	100	↑	7.0
5.1	4.998	5.202	5.049	5.151	↑	↑	↑
5.2	5.096	5.304	5.148	5.252	↑	↑	↑
5.3	5.194	5.406	5.247	5.353	↑	↑	↑
5.4	5.292	5.508	5.346	5.454	↑	↑	↑
5.5	5.390	5.610	5.445	5.555	↑	↑	↑
5.6	5.488	5.712	5.544	5.656	↑	↑	↑
5.7	5.586	5.814	5.643	5.757	↑	↑	↑
5.8	5.684	5.916	5.742	5.858	↑	↑	↑
5.9	5.782	6.018	5.841	5.959	↑	↑	↑
6.0	5.880	6.120	5.940	6.060	↑	↑	↑

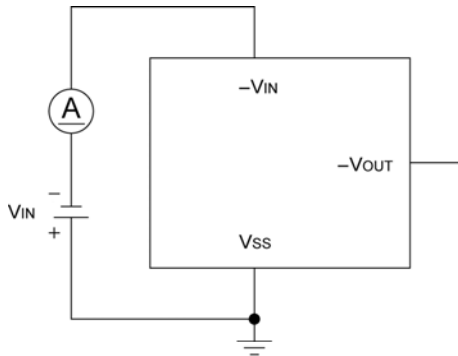
● Conditions Chart

E3	E4-1	E4-2
LOAD REGULATION (mV)	DROPOUT VOLTAGE (mV)	
I <sub>OUT</sub>	Vd <sub>if1</sub>	Vd <sub>if2</sub>
CONDITIONS	CONDITIONS	CONDITIONS
30	30	60
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
40	40	80
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
45	45	90
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
50	50	100
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑

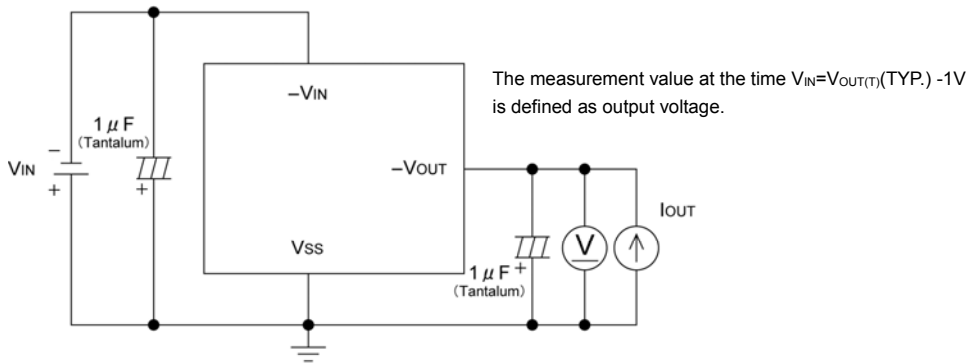
Note) The symbol is as same as that in the chart of electrical characteristics.

## TEST CIRCUITS

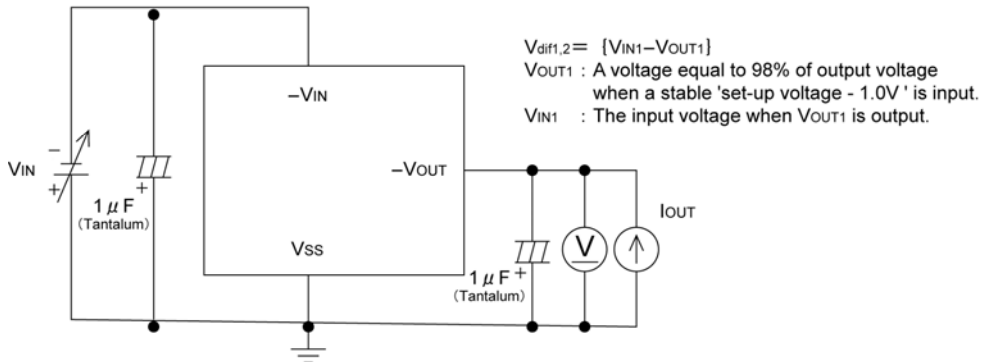
Circuit 1. Supply Current



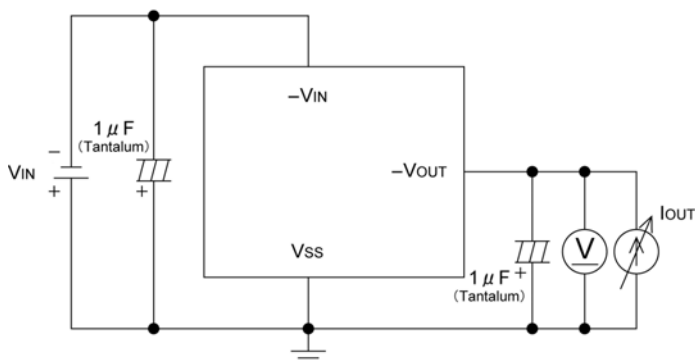
Circuit 2. Output Voltage



Circuit 3. Line Regulation Dropout Voltage



Circuit 4. Load Regulation, Maximum Output Current

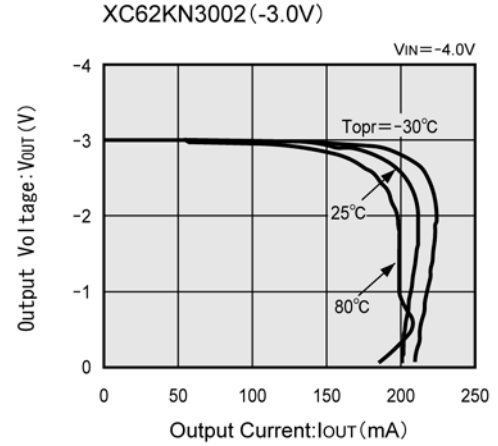
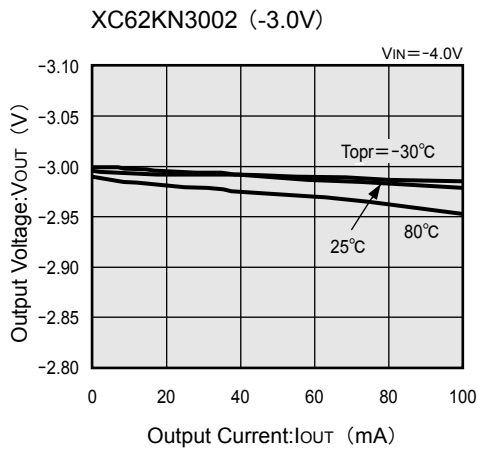
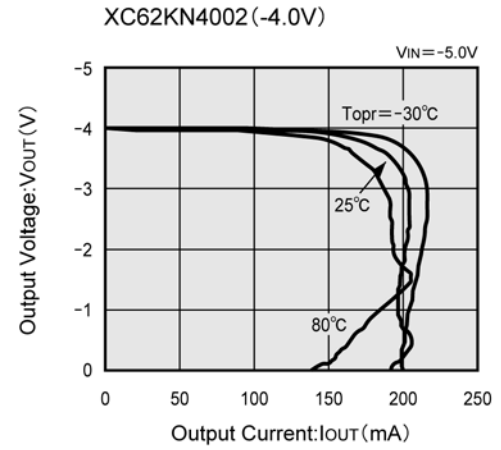
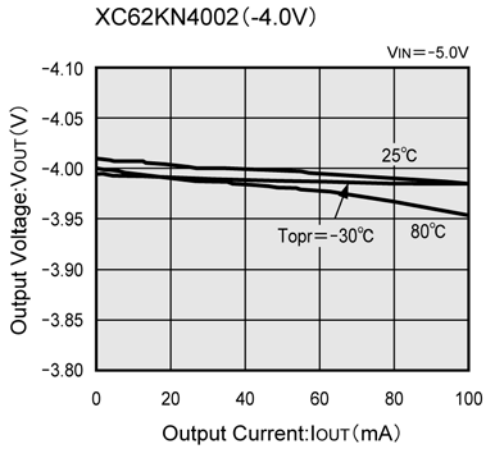
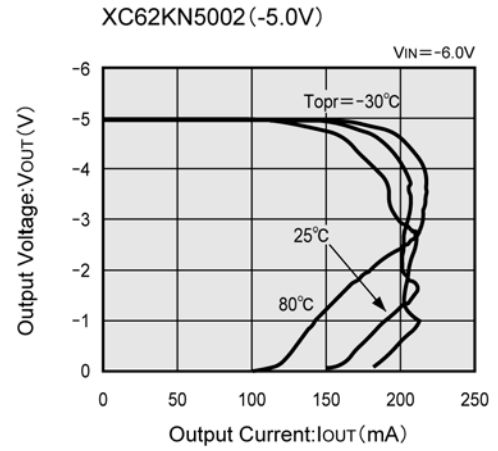
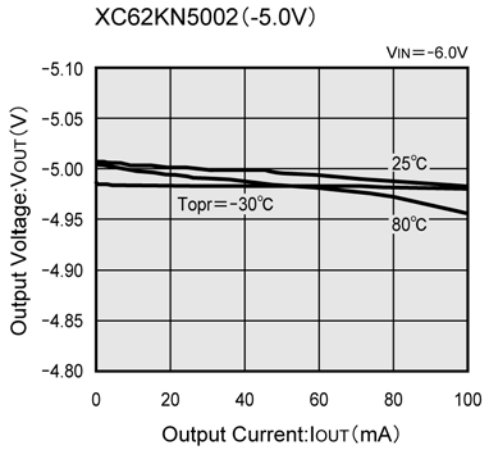


## ■ NOTES ON USE

- 1) For the phenomenon of temporal and transitional voltage decrease or voltage increase, the IC may be damaged or deteriorated if IC is used beyond the absolute MAX. specifications.
- 2) Please ensure that values for input capacitance,  $C_{IN}$  and out capacitance,  $C_L$ , are more than  $1 \mu F$  (Tantalum).
- 3) 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

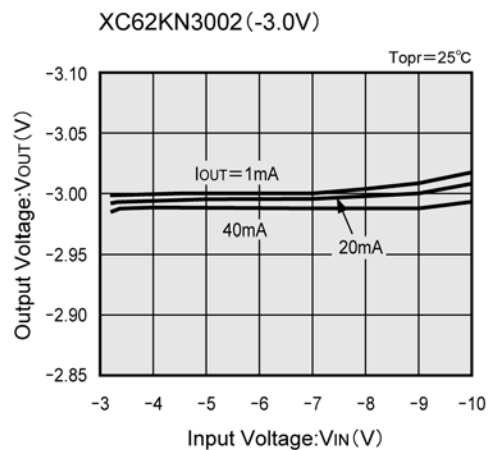
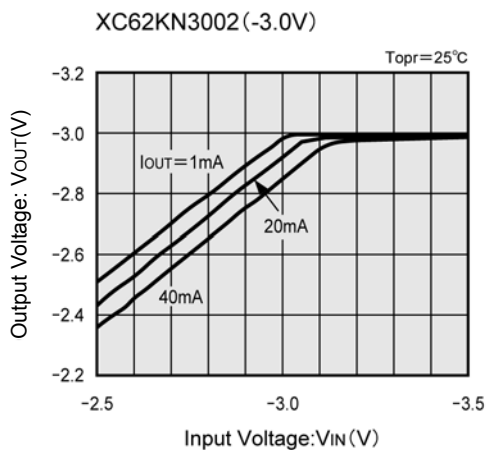
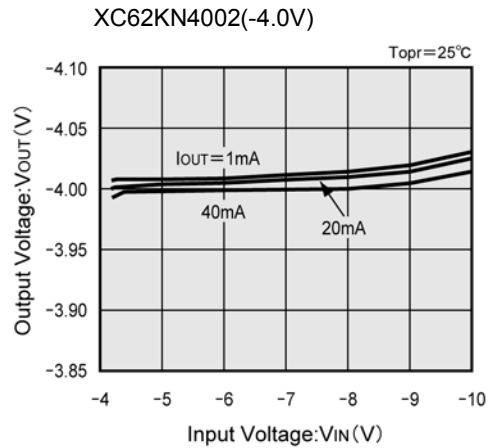
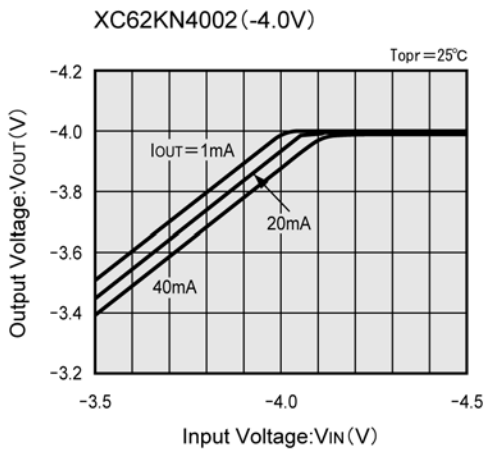
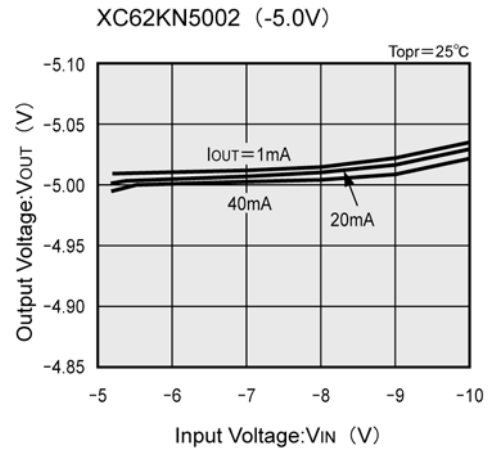
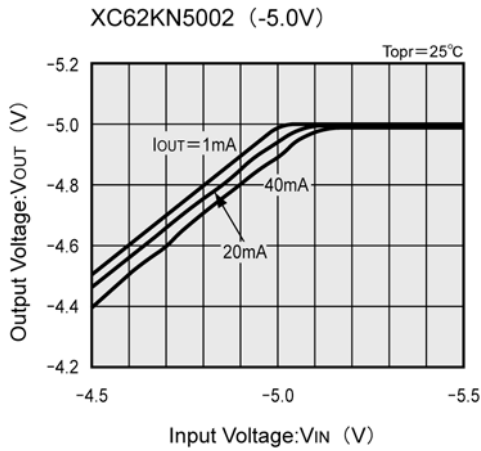
### (1) Output Voltage vs. Output Current





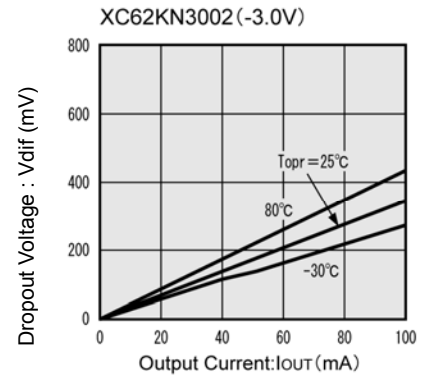
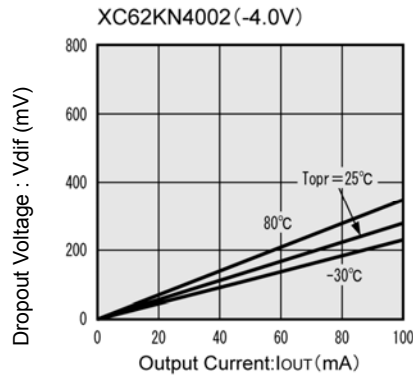
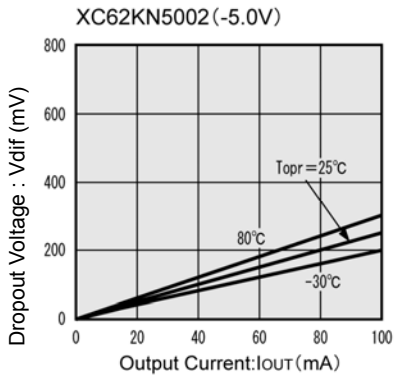
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

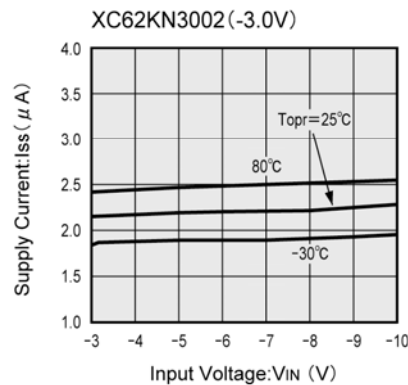
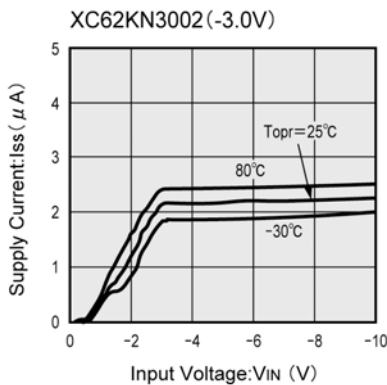
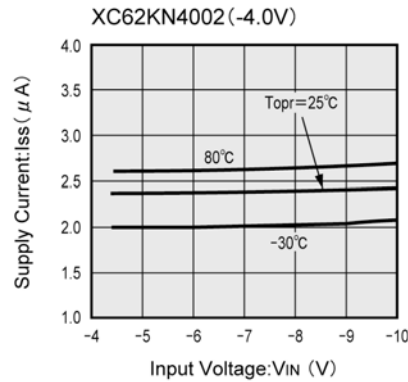
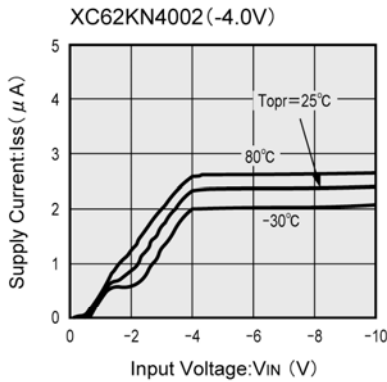
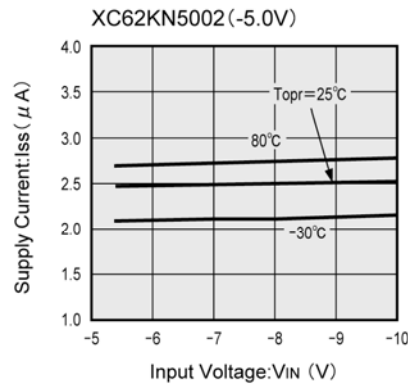
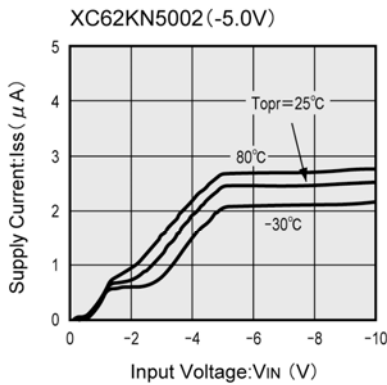


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

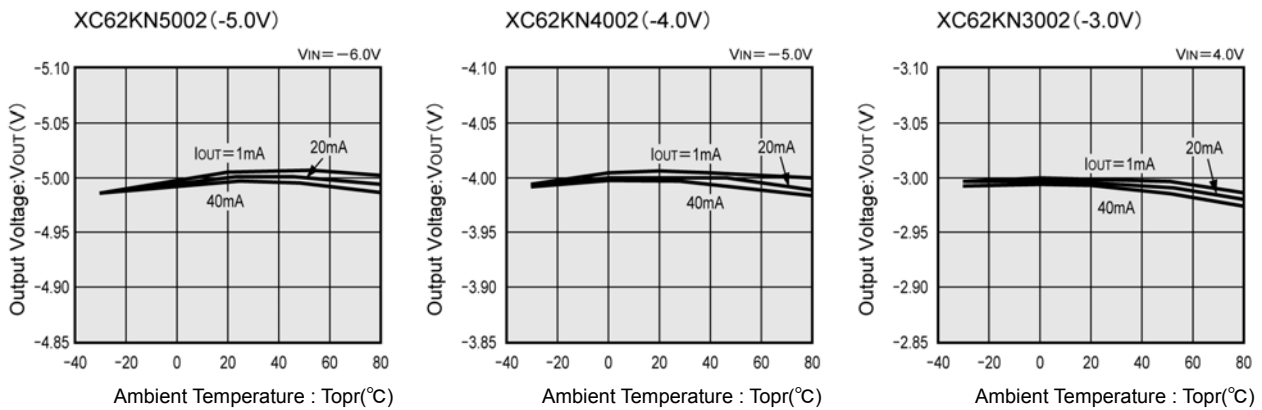


### (4) Supply Current vs. Input Voltage

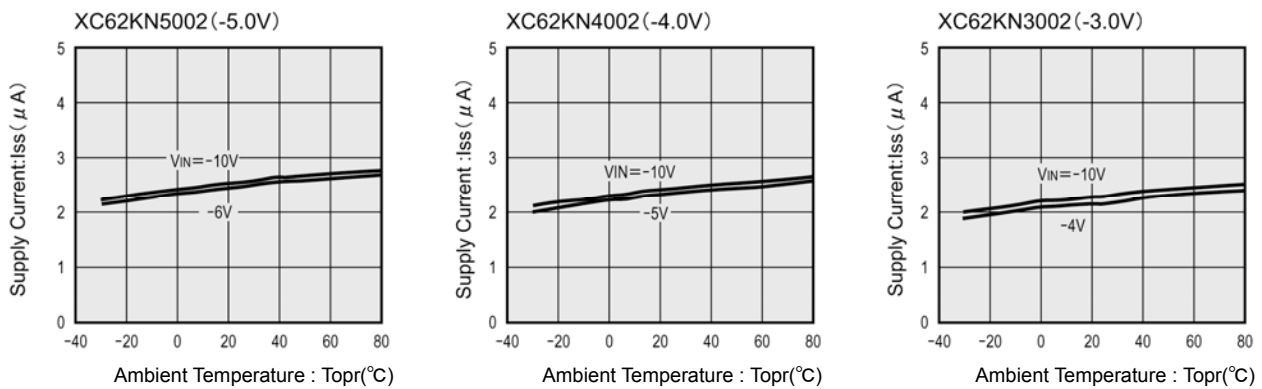


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

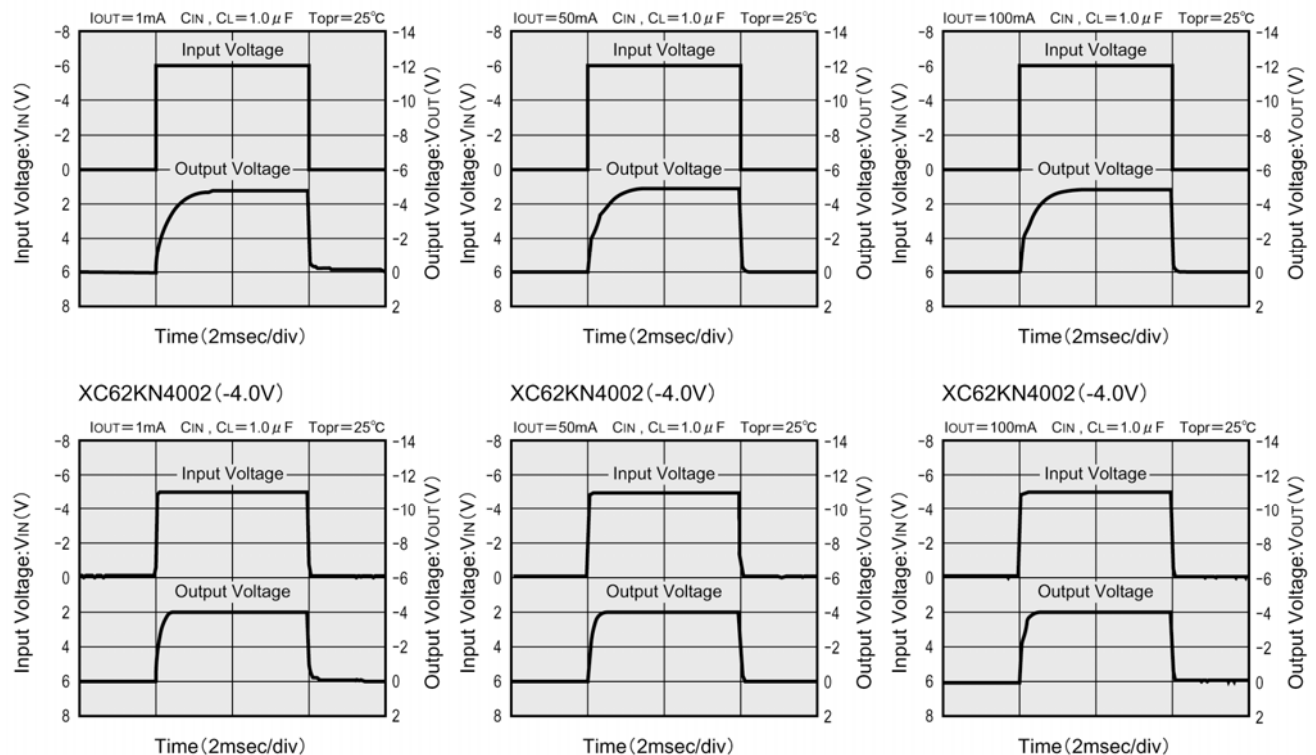
### (5) Output Voltage vs. Ambient Temperature



### (6) Supply Current vs. Ambient Temperature

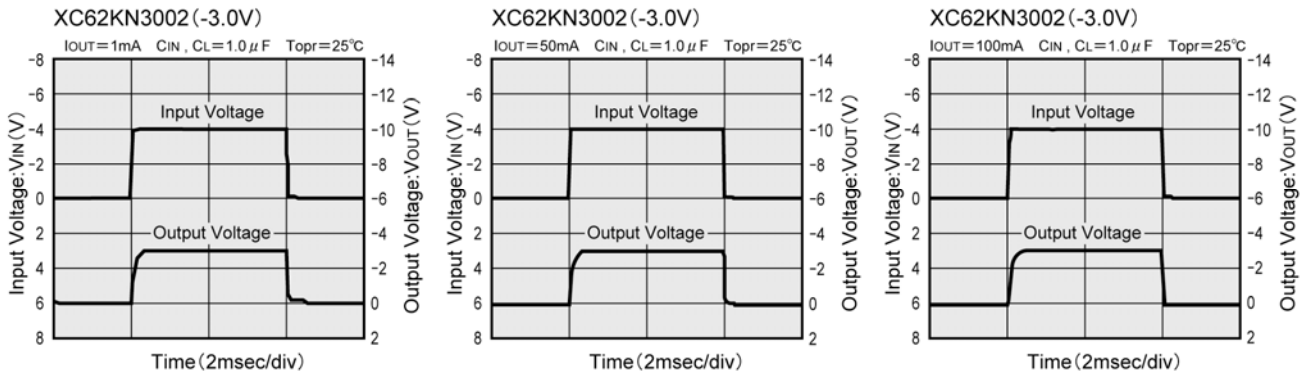


### (7) Input Transient Response 1

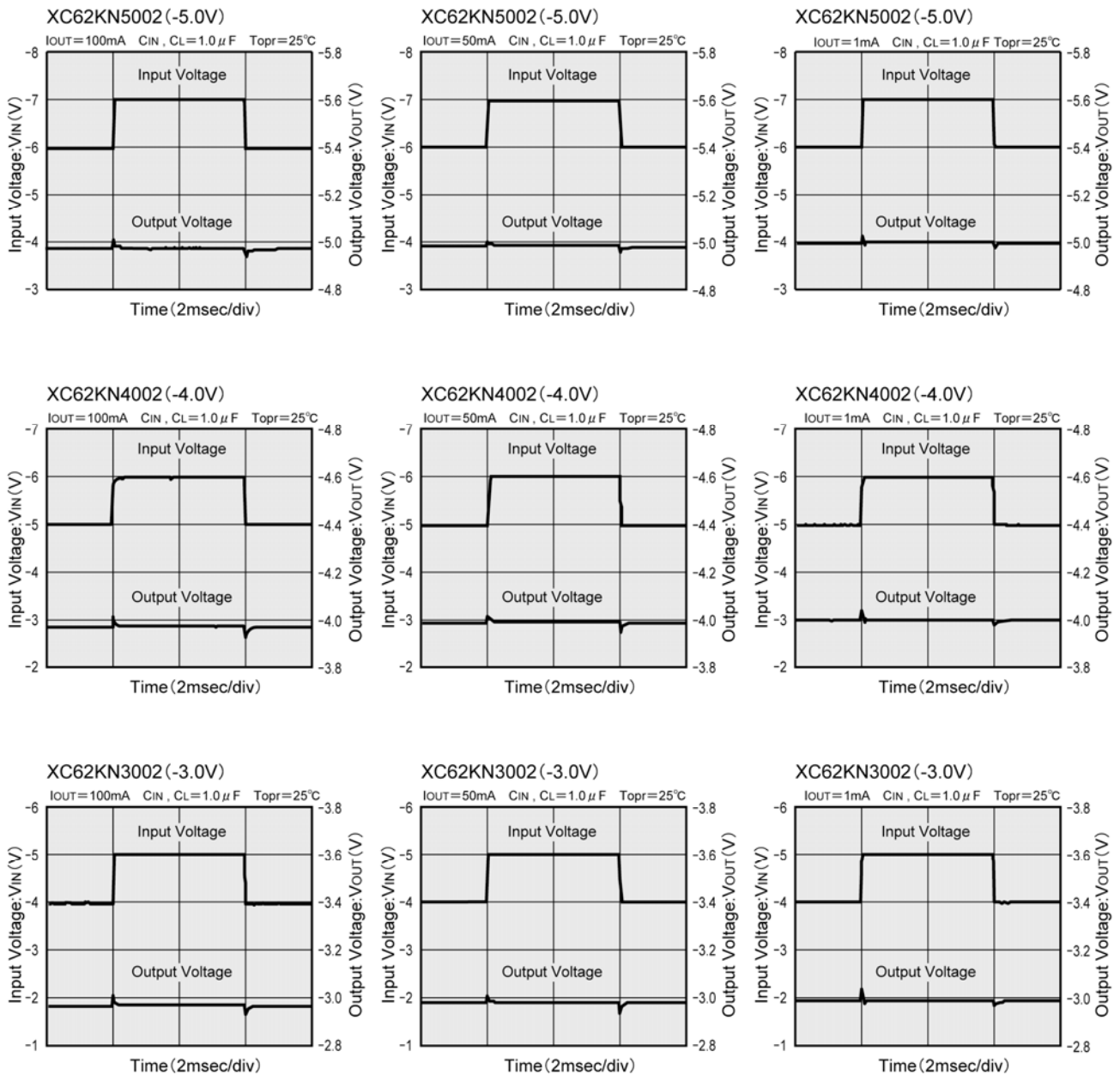


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (7) Input Transient Response 1

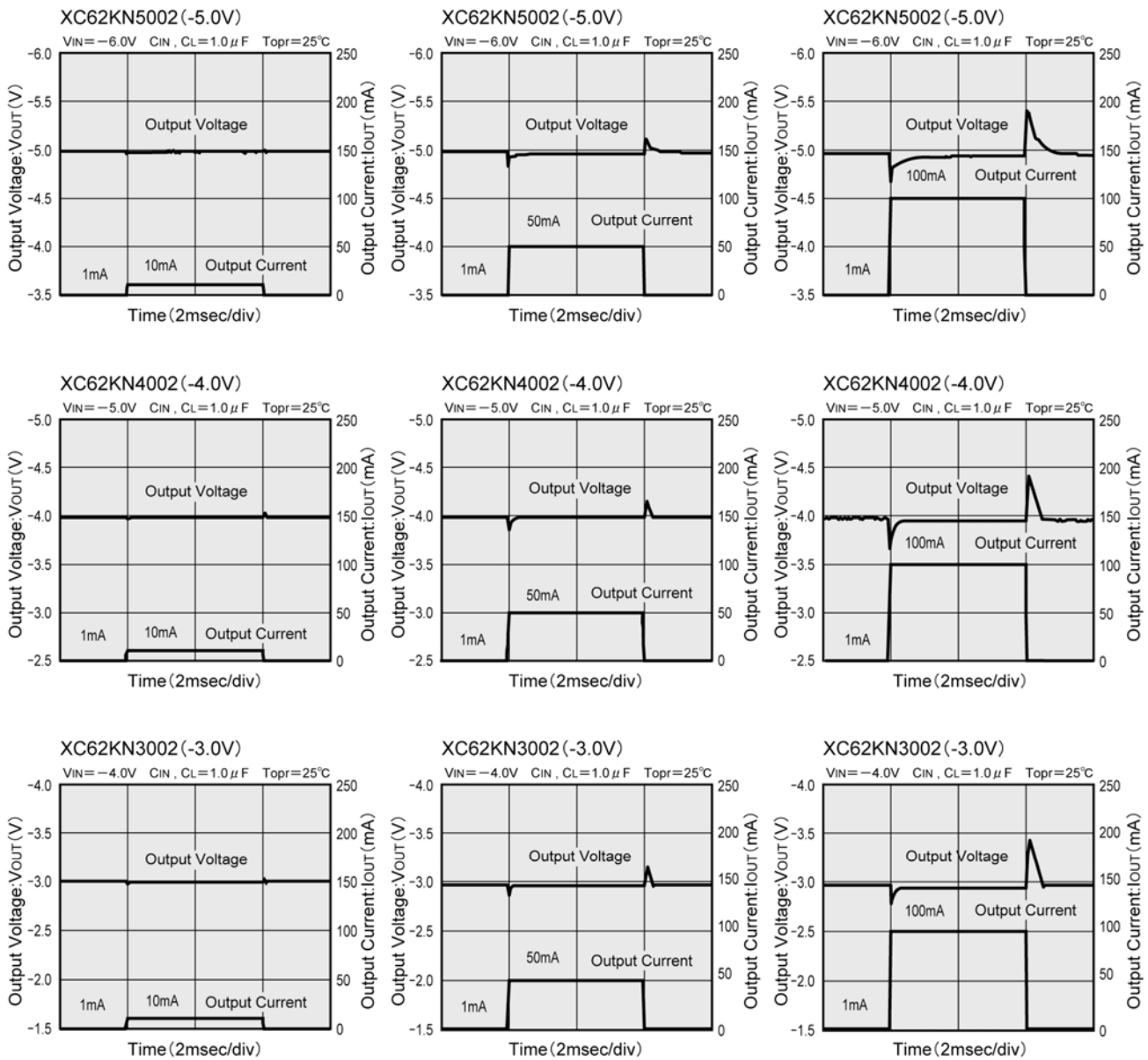


### (8) Input Transient Response 2

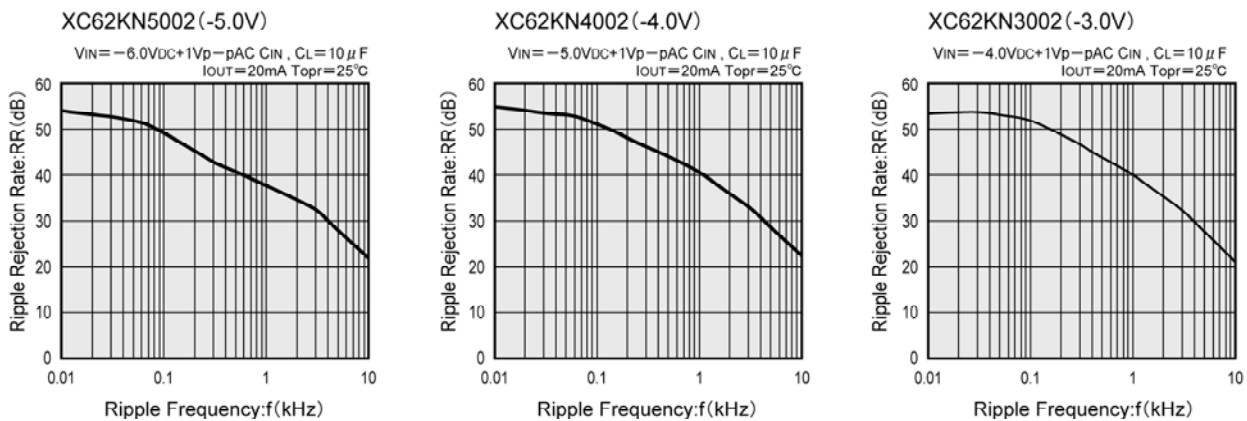


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Load Transient Response



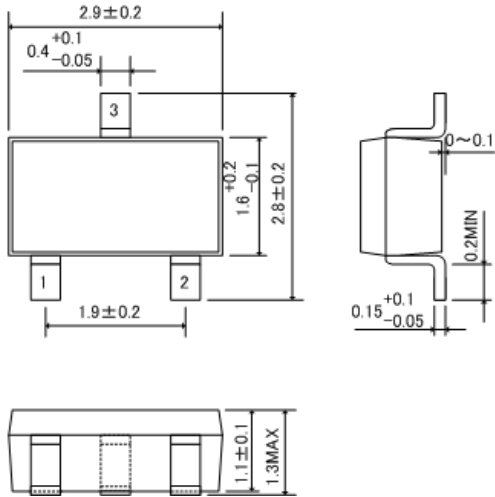
### (10) Ripple Rejection Rate



## PACKAGING INFORMATION

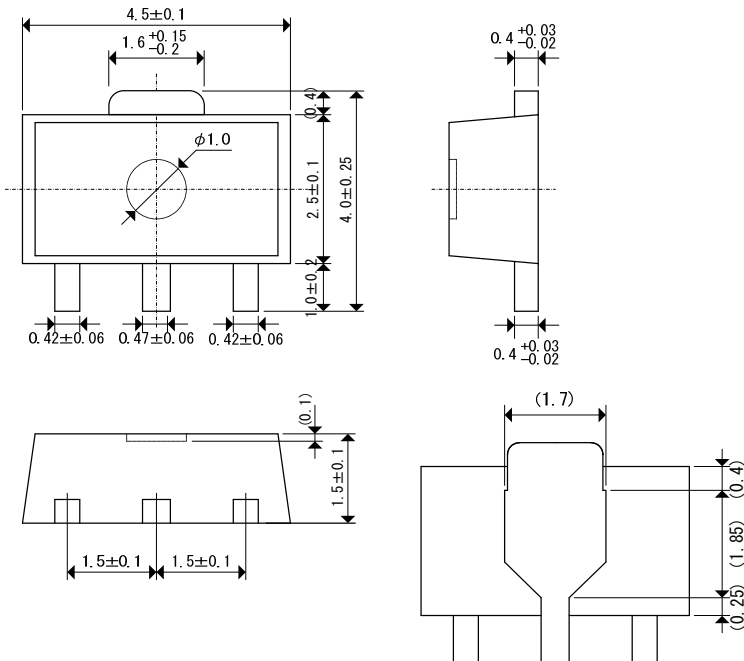
### ● SOT-23

Unit : mm



### ● SOT-89

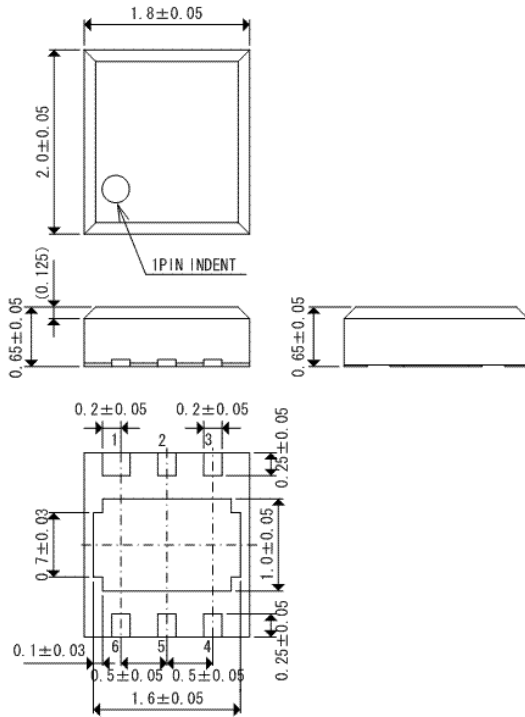
Unit : mm



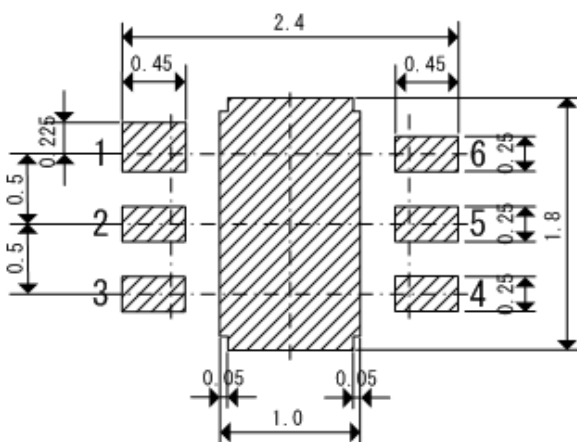
■ PACKAGING INFORMATION (Continued)

● USP-6B

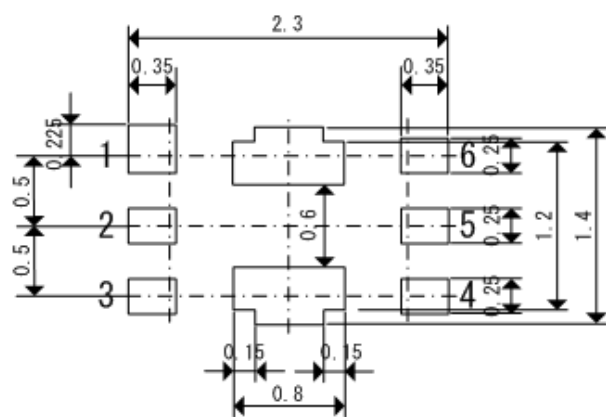
Unit : mm



● USP-6B Reference Pattern Layout

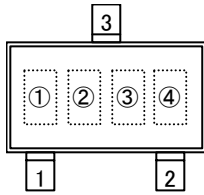


● USP-6B Reference Metal Mask Design

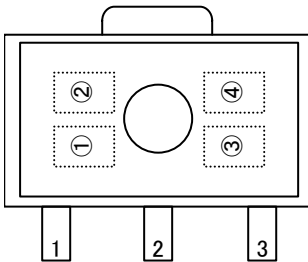


## MARKING RULE

### ●SOT-23, SOT-89



SOT-23  
(TOP VIEW)



SOT-89  
(TOP VIEW)

① represents integral number of output voltage

MARK	VOLTAGE (V)	MARK	VOLTAGE (V)
2	2.X	5	5.X
3	3.X	6	6.X
4	4.X		

② represents decimal number of output voltage

MARK	VOLTAGE (V)	MARK	VOLTAGE (V)
A	x.0	F	x.5
B	x.1	H	x.6
C	x.2	K	x.7
D	x.3	L	x.8
E	x.4	M	x.9

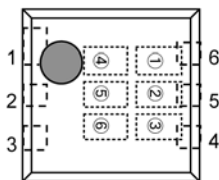
③ represents polarity of output voltage

MARK	POLARITY
5	Negative

④ represents production lot number

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

### ●USP-6B



USP-6B  
(TOP VIEW)

① represents production series

MARK	PRODUCT SERIES
K	XC62KNxx0xDx

② represents polarity of output voltage

MARK	POLARITY	PRODUCT SERIES
N	-(Negative)	XC62KNxx0xDx

③④ represents output voltage (ex.)

MARK		VOLTAGE (V)	PRODUCT SERIES
③	④		
3	3	3.3	XC62KN330xDx
5	0	5.0	XC62KN500xDx

⑤ represents temperature characteristics

MARK	TEMPERATURE CHARACTERISTICS	PRODUCT SERIES
0	± 100 ppm (TYP.)	XC62KNxx0xDx

⑥ represents production lot number

0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)  
Note: No character inversion used.