XC62K Series

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 (150mW), SOT-89 (500mW), USP-6B (100mW) and TO-92 (300mW) packages are available.

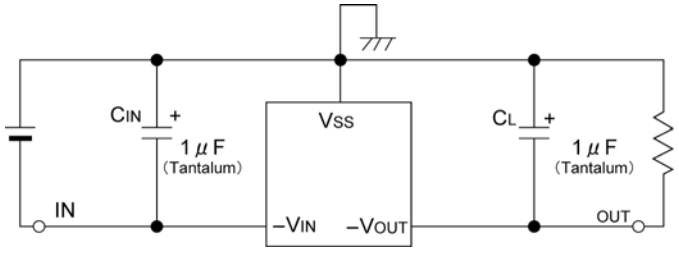
■APPLICATIONS

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

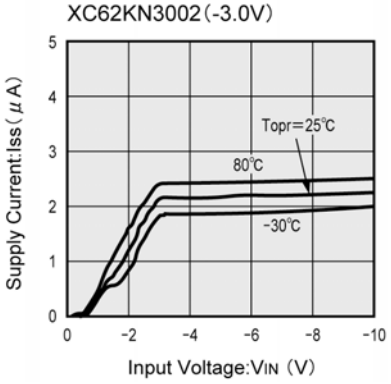
■FEATURES

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 ±2%
(±1% for semi-custom products)
Low Power Consumption : 3.0μA @ V_{OUT}= -5.0V (TYP.)
Output Voltage Temperature Characteristics
: ±100ppm/℃ (TYP.)
Line Regulation : 0.1%/V (TYP.)
CMOS Low Power Consumption
Packages : SOT-23
SOT-89
TO-92
USP-6B
Environmentally Friendly : EU RoHS Compliant, Pb Free

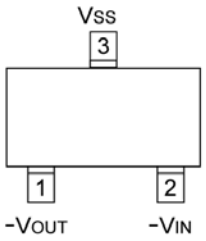
■TYPICAL APPLICATION CIRCUIT



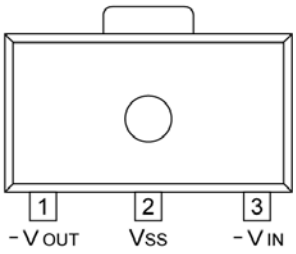
■ TYPICAL PERFORMANCE CHARACTERISTICS



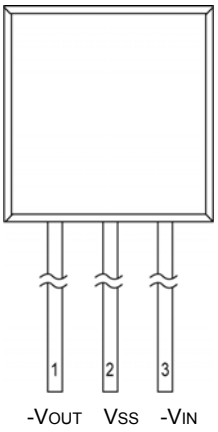
■PIN CONFIGURATION



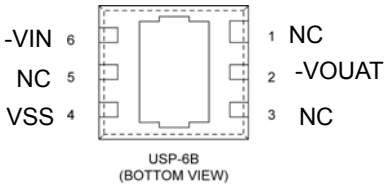
SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)



TO-92
(SIDE 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 VSS pin.

■PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTIONS
SOT-23	SOT-89/TO-92	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

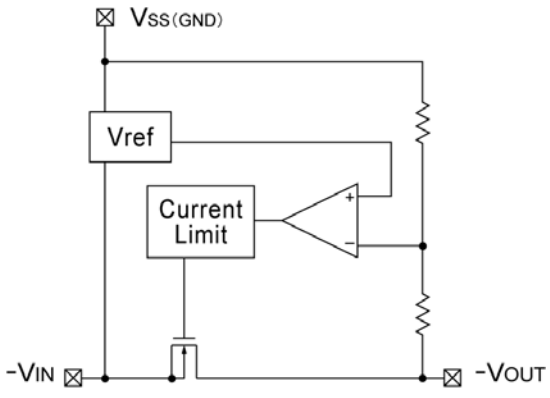
●Ordering Information

XC62K①②③④⑤⑥⑦-⑧(*1)

MARK	ITEM	SYMBOL	DESCRIPTION
①	Polarity of Output Voltage	N	Negative
②③	Output Voltage	21 ~ 60	e.g. VOUT – 2.1V → ②=2, ③=1 VOUT – 6.0V → ②=6, ③=0
④	Temperature Characteristics	0	± 100ppm (TYP.)
⑤	Output Voltage Accuracy	1	± 1% (Semi-custom)
		2	± 2%
⑥⑦-⑧	Packages (Order Unit)	MR	SOT-23
		MR-G	SOT-23
		PR	SOT-89
		PR-G	SOT-89
		TH	TO-92:Paper type
		TH-G	TO-92:Paper type
		TB	TO-92:Bag type
		TB-G	TO-92:Bag type
		DR	USP-6B
		DR-G	USP-6B

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

■BLOCK DIAGRAM



■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	-12.0	V
Output Current		I_{OUT}	200	mA
Output Voltage		V_{OUT}	$-V_{DD}$-0.3~V_{IN}+0.3	V
Power Dissipation	SOT-23	Pd	150	mW
	SOT-89		500	
	TO-92		300	
	USP-6B		100	
Operating Ambient Temperature		Topr	-40 ~ +85	℃
Storage Temperature		Tstg	-40 ~ +125	℃

Note: Please ensure that I_{OUT} is less than Pd/(V_{OUT}-V_{IN}).

■ELECTRICAL CHARACTERISTICS

XC62KN Series

Ta=25℃

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(*4)	$V_{OUT(T)}$	E1-2(*4)	V	2
Maximum Output Current	I_{OUTmax}	V_{IN}=$V_{OUT(T)}$-1.0V $V_{OUT(E)}$≧$V_{OUT(T)}$×0.9	E2(*4)			mA	4
Load Regulation	ΔV_{OUT}	V_{IN}=$V_{OUT(T)}$－1.0V 1mA≦I_{OUT}≦{E3}mA	-	40	80	mV	4
Dropout Voltage	Vdif1(*3)	I_{OUT}={E4-1}(*4)mA	-	120	300	mV	3
	Vdif2(*3)	I_{OUT}={E4-2}(*4)mA	-	380	600		
Supply Current	I_{SS}	V_{IN}=$V_{OUT(T)}$-1.0V	-	E5-1(*4)	E5-2(*4)	μA	1
Line Regulation	ΔV_{OUT}/ (ΔV_{IN}・V_{OUT})	I_{OUT}=20mA V_{IN}≧$V_{OUT(T)}$-1.0V V_{IN}≦-10.0V	-	0.1	0.3	%V	3
Input Voltage	V_{IN}		-	-	-10.0	V	-
Output Voltage Temperature Characteristics	ΔV_{OUT}/ (ΔV_{IN}・V_{OUT})	I_{OUT}=20mA －40℃≦Topr≦85℃	-	±100	-	ppm/ ℃	-

*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: Vdif1,Vdif2 =Vdif={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 / SETTING OUTPUT VOLTAGE(V)	OUTPUT VOLTAGE (V) (2% products)		OUTPUT VOLTAGE (V) (1% products)		MAXIMUM OUTPUT CURRENT (mA)	SUPPLY CURRENT1 (μ A)	
$V_{OUT(T)}$	$V_{OUT(E)}$				I_{OUTmax}	I_{SS}	
	MIN	MAX	MIN	MAX	MIN	TYP	MAX
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	↑	↑	↑

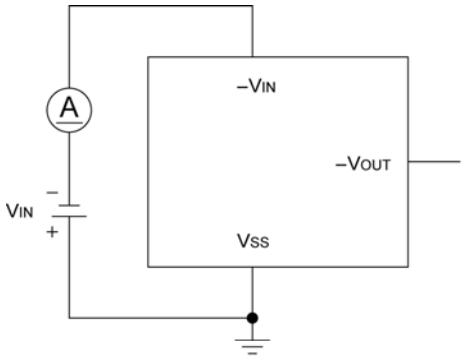
●Conditions Chart

E3	E4-1	E4-2
LOAD REGULATION (mV)	DROPOUT VOLTAGE (mV)	
I_{OUT}	Vdif1	Vdif2
CONDITIONS	CONDITIONS	CONDITIONS
30	30	60
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
40	40	80
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
45	45	90
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
50	50	100
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑
↑	↑	↑

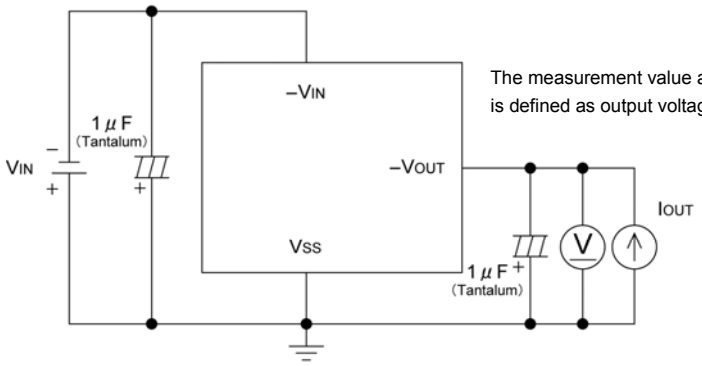
Note) The symbol is as same as that in the chart of electrical characteristics.

■TEST CIRCUITS

Circuit 1. Supply Current

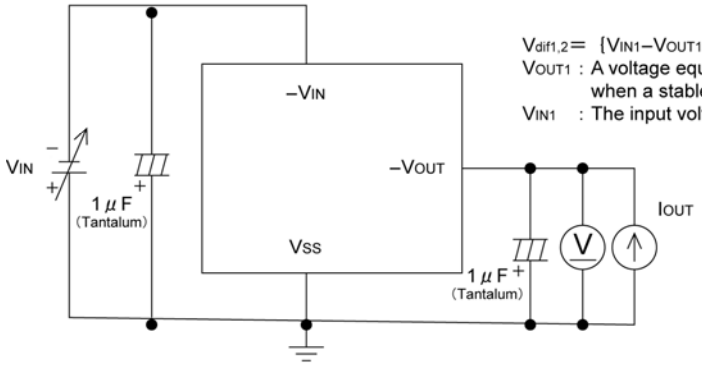


Circuit 2. Output Voltage



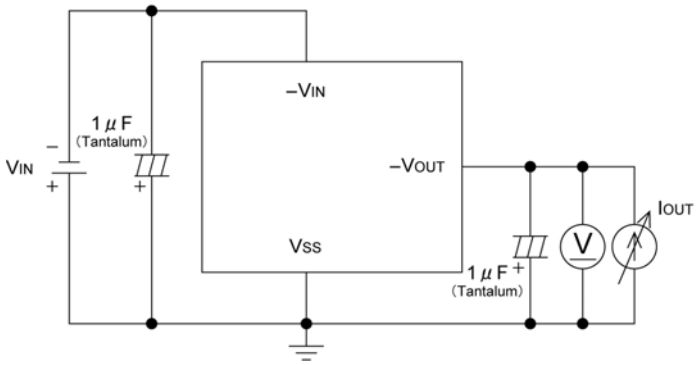
The measurement value at the time V_{IN}=$V_{OUT(T)}$(TYP.) -1V is defined as output voltage.

Circuit 3. Line Regulation Dropout Voltage



$V_{dif1,2}$= {V_{IN1}–V_{OUT1}}
V_{OUT1} : A voltage equal to 98% of output voltage when a stable 'set-up voltage - 1.0V ' is input.
V_{IN1} : The input voltage when V_{OUT1} is output.

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.

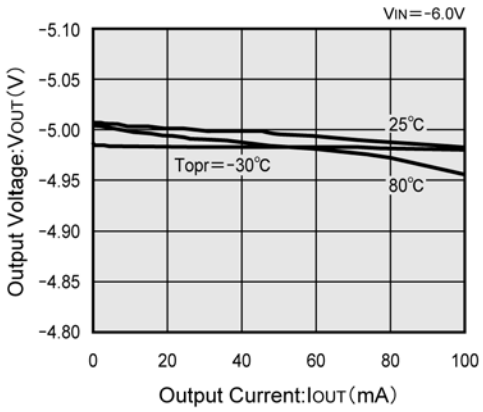
2) Please ensure that values for input capacitance, C_{IN} and out capacitance, C_L, are more than 1 μF (Tantalum).

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.

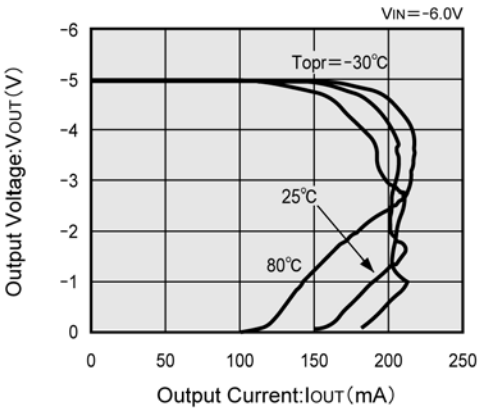
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

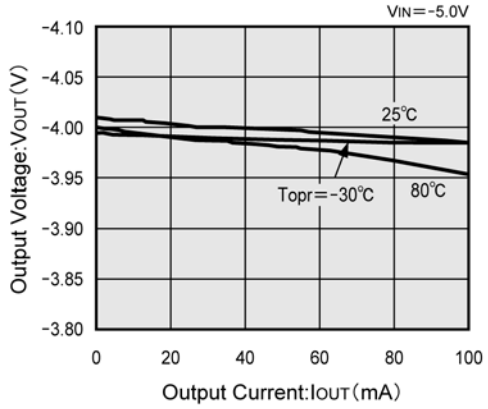
XC62KN5002(-5.0V)



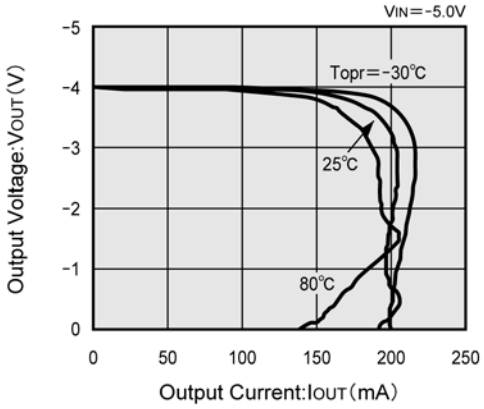
XC62KN5002(-5.0V)



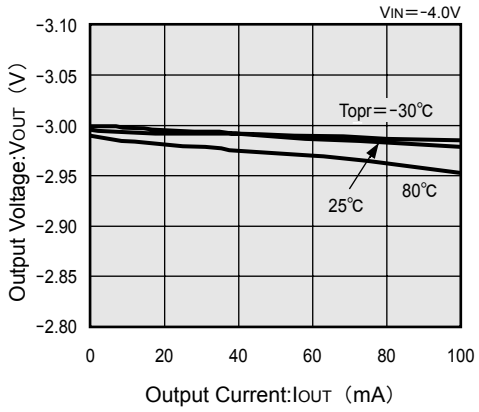
XC62KN4002(-4.0V)



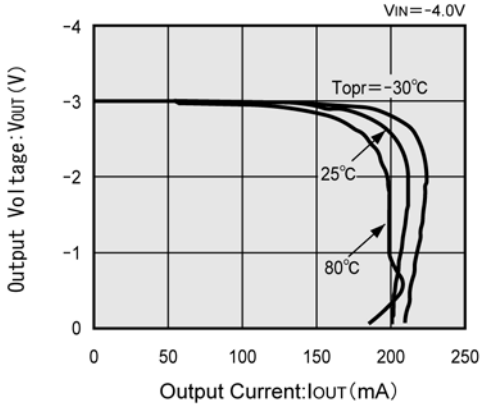
XC62KN4002(-4.0V)



XC62KN3002（-3.0V）



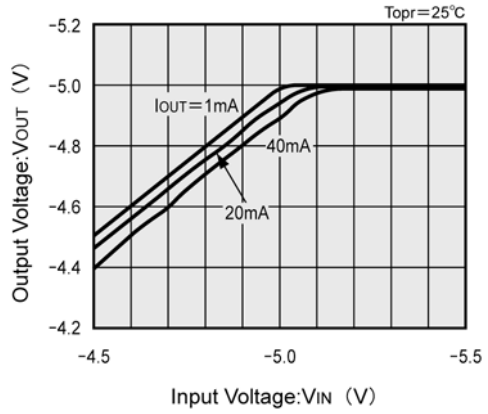
XC62KN3002(-3.0V)



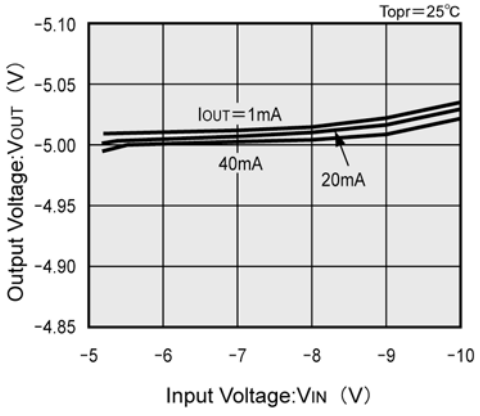
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Input Voltage

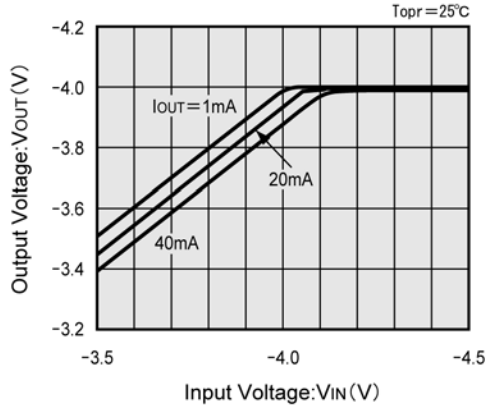
XC62KN5002 (-5.0V)



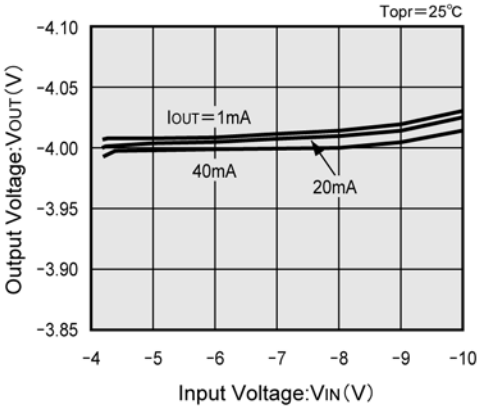
XC62KN5002 (-5.0V)



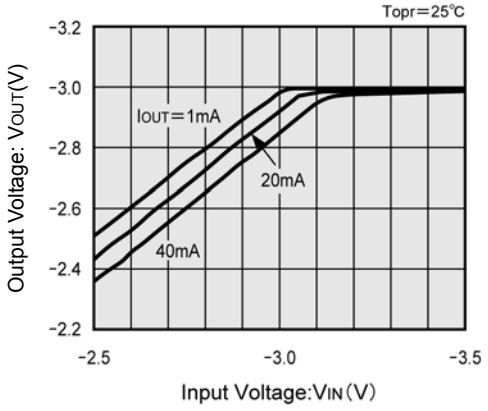
XC62KN4002(-4.0V)



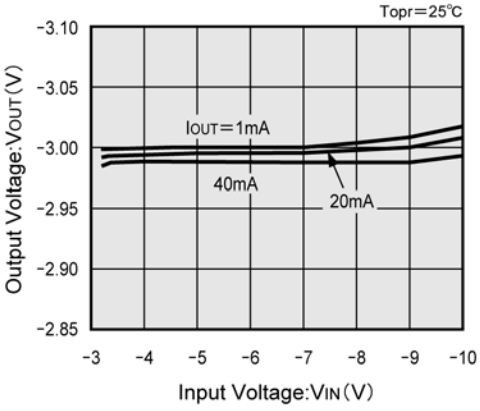
XC62KN4002(-4.0V)



XC62KN3002(-3.0V)

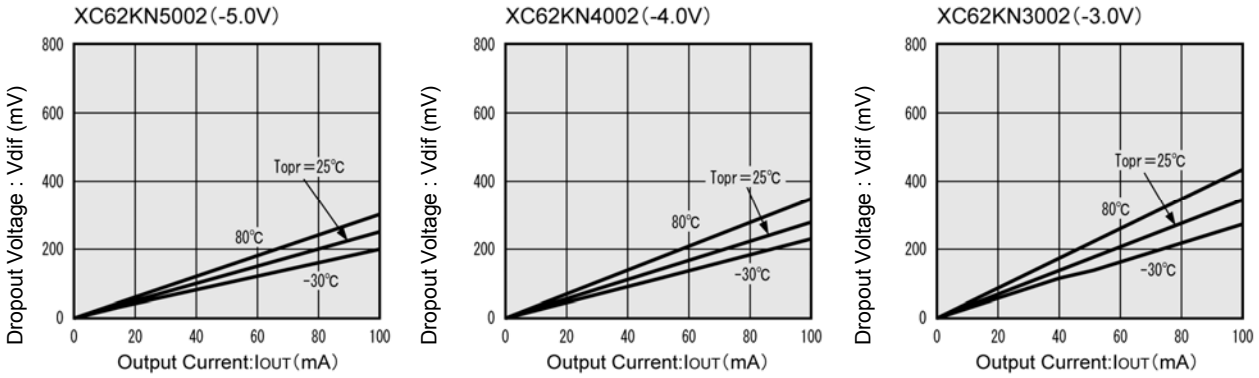


XC62KN3002(-3.0V)

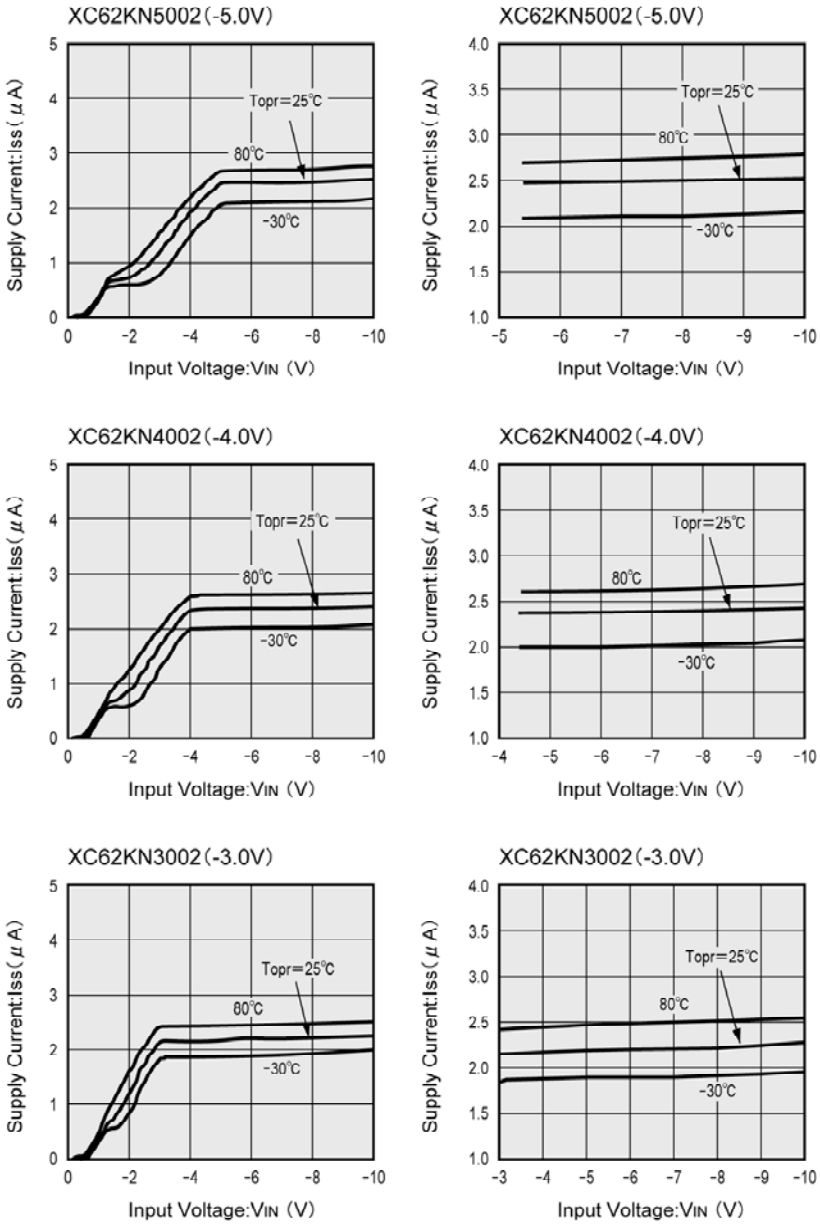


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Dropout Voltage vs. Output Current

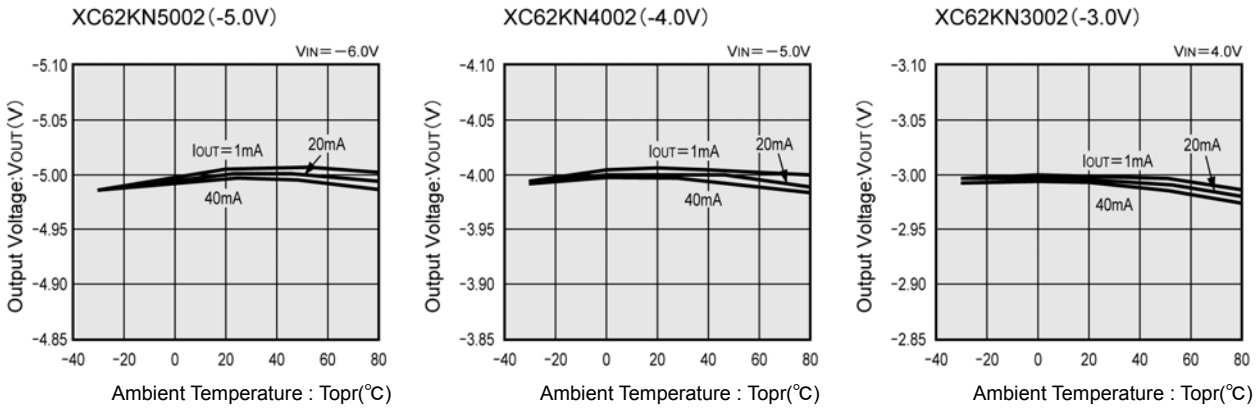


(4) Supply Current vs. Input Voltage

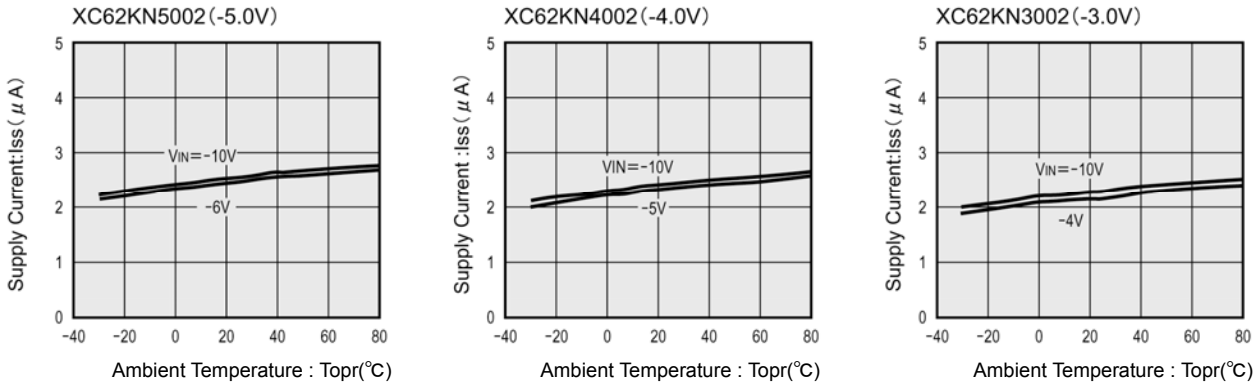


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

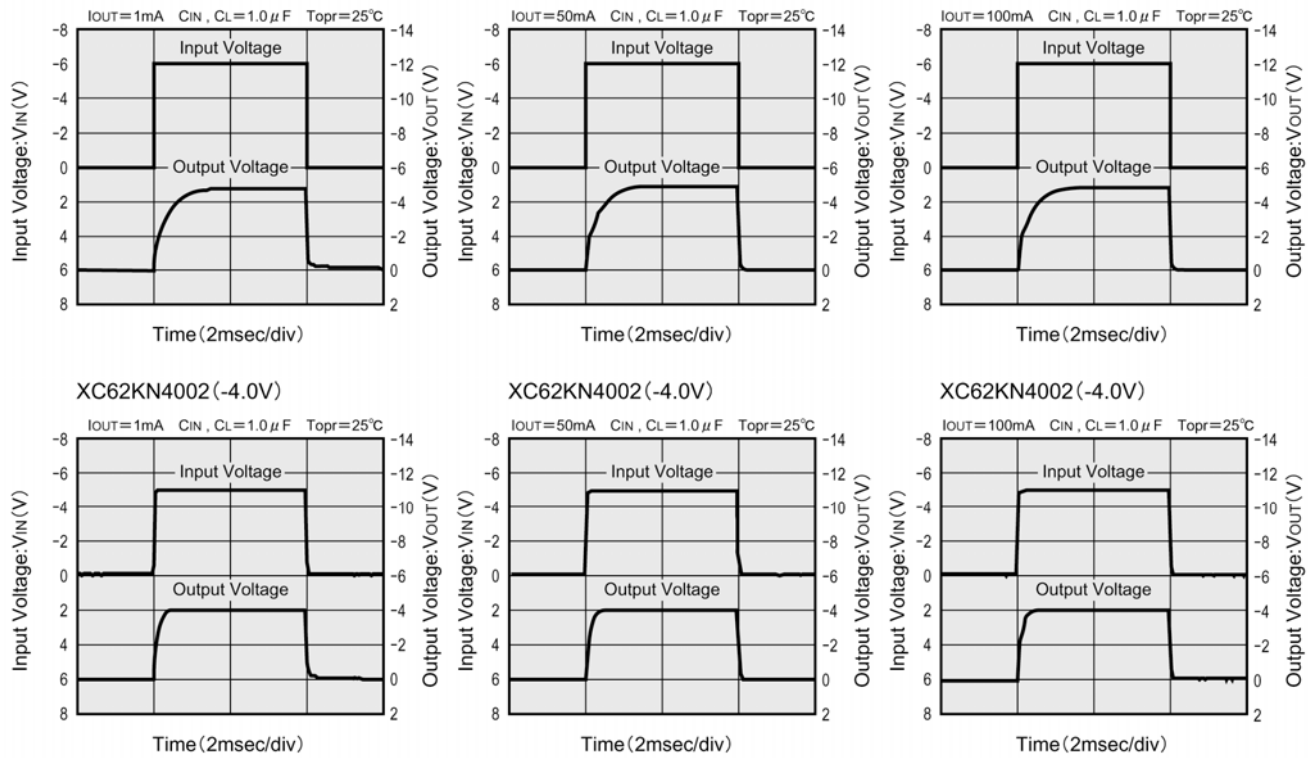
(5) Output Voltage vs. Ambient Temperature



(6) Supply Current vs. Ambient Temperature

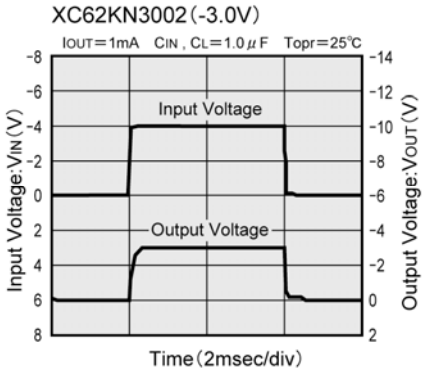


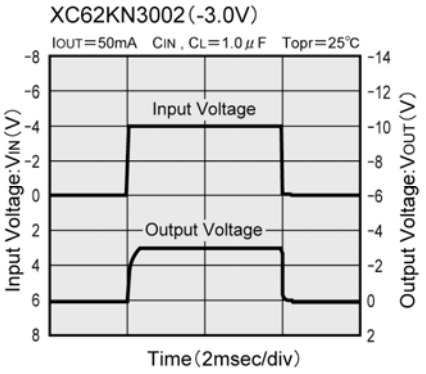
(7) Input Transient Response 1

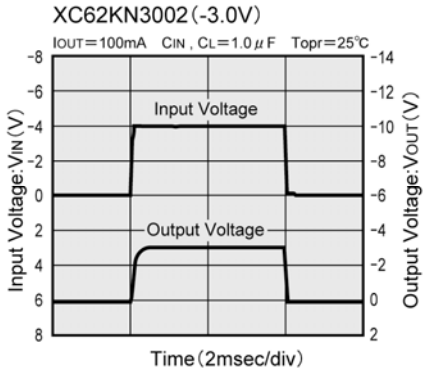


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

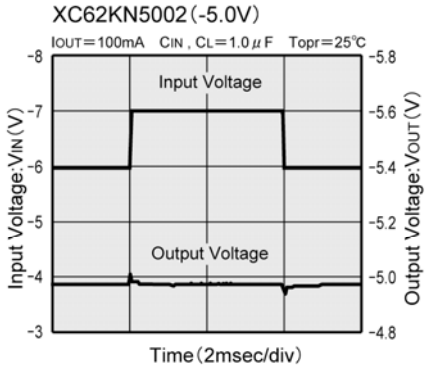
(7) Input Transient Response 1

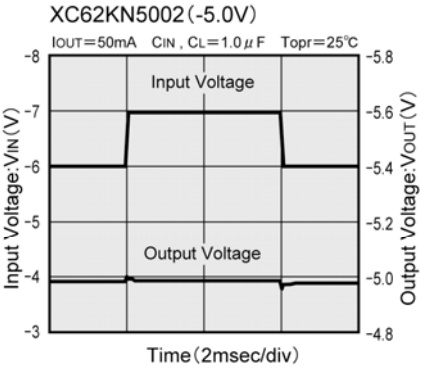


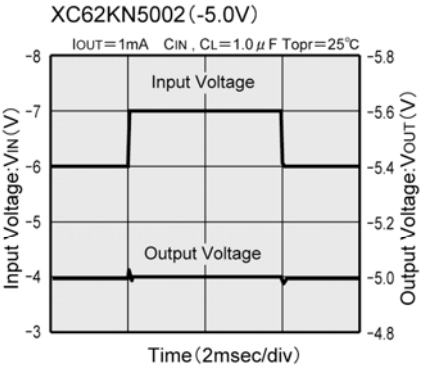


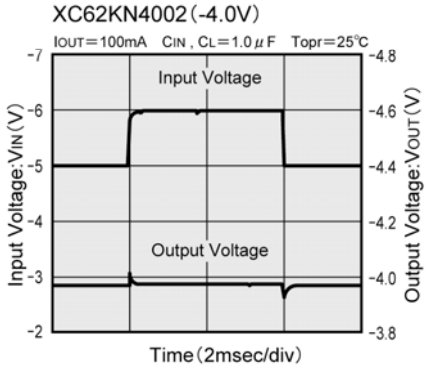


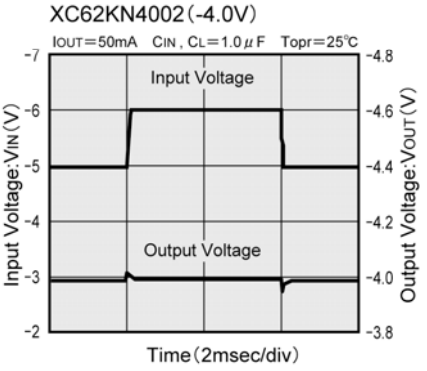
(8) Input Transient Response 2

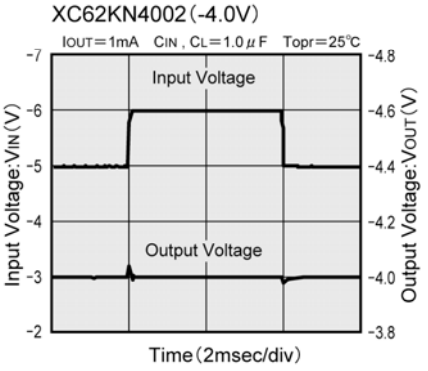


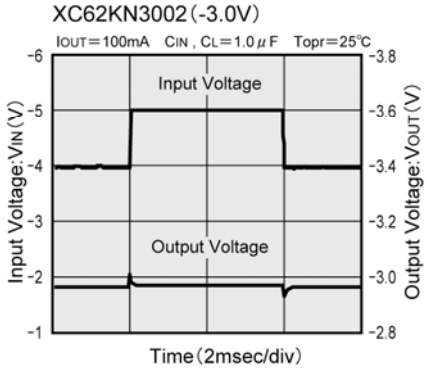


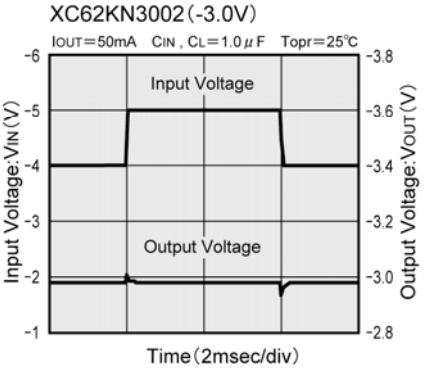


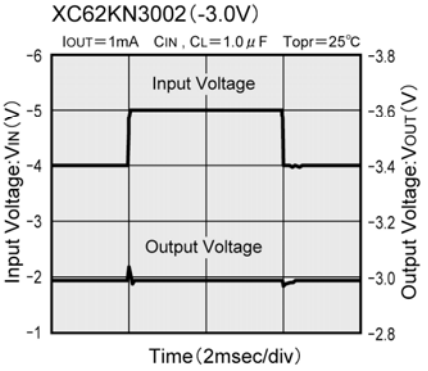






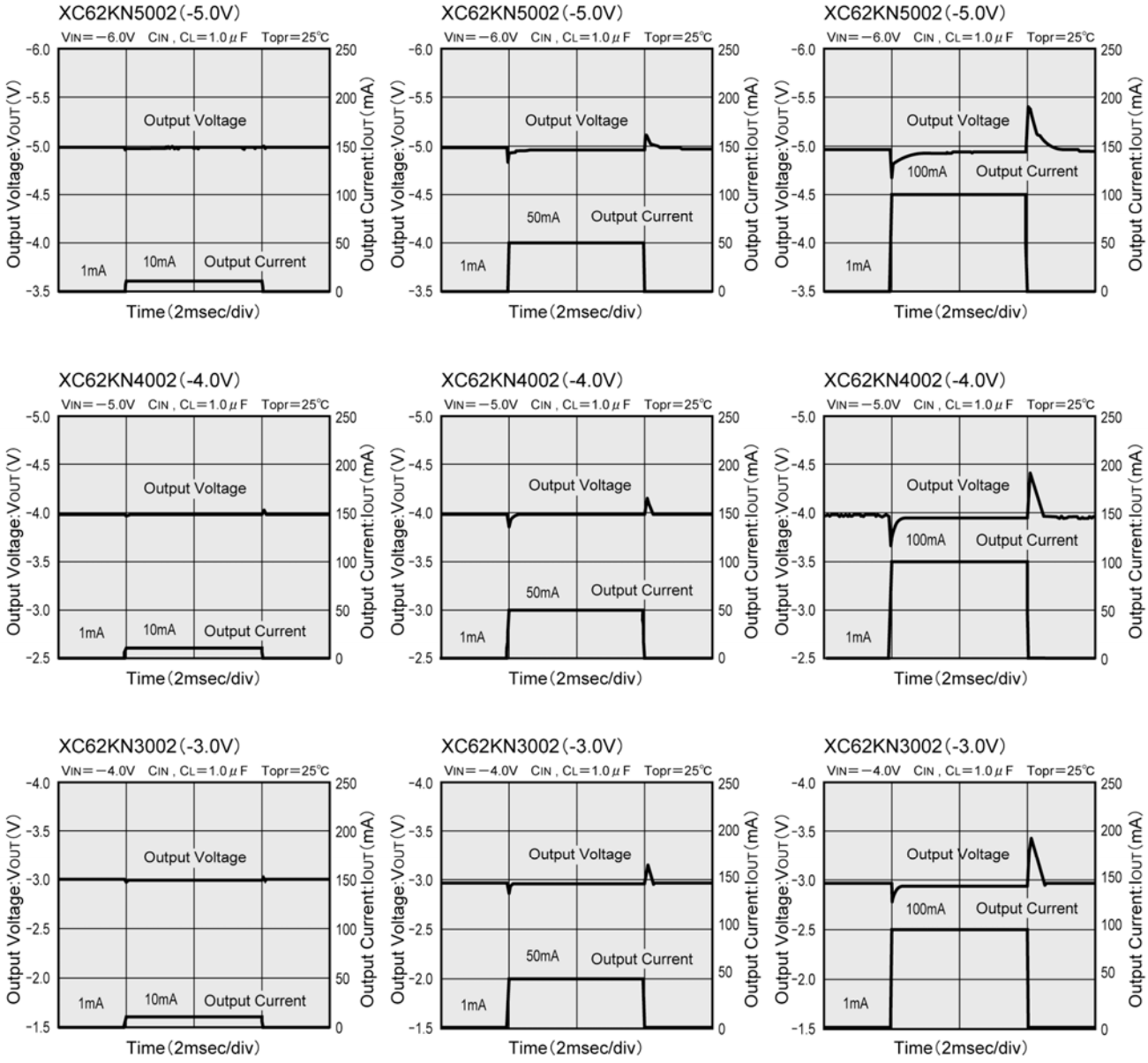




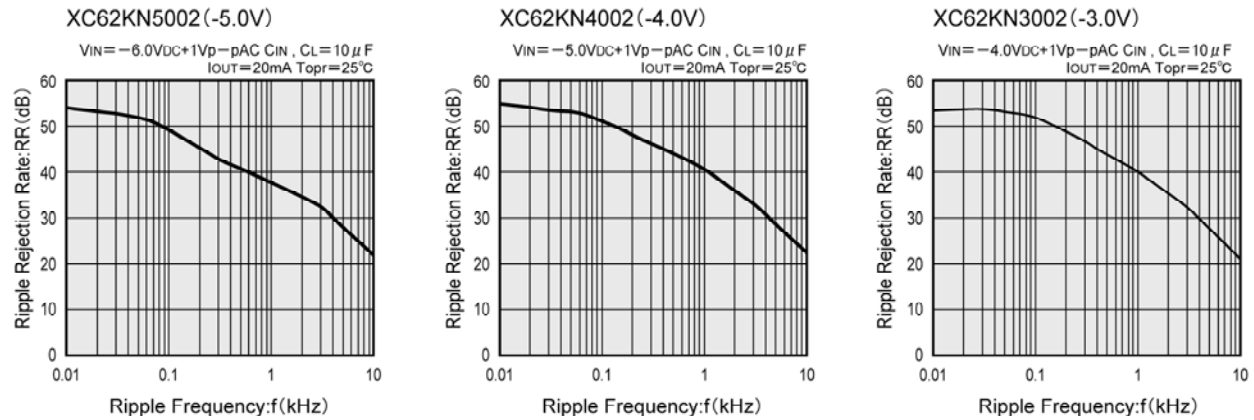


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response



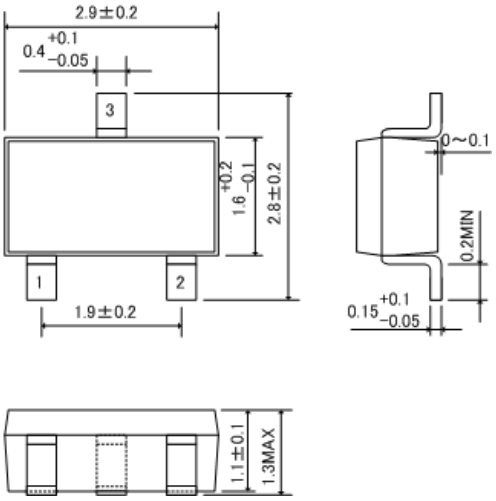
(10) Ripple Rejection Rate



■PACKAGING INFORMATION

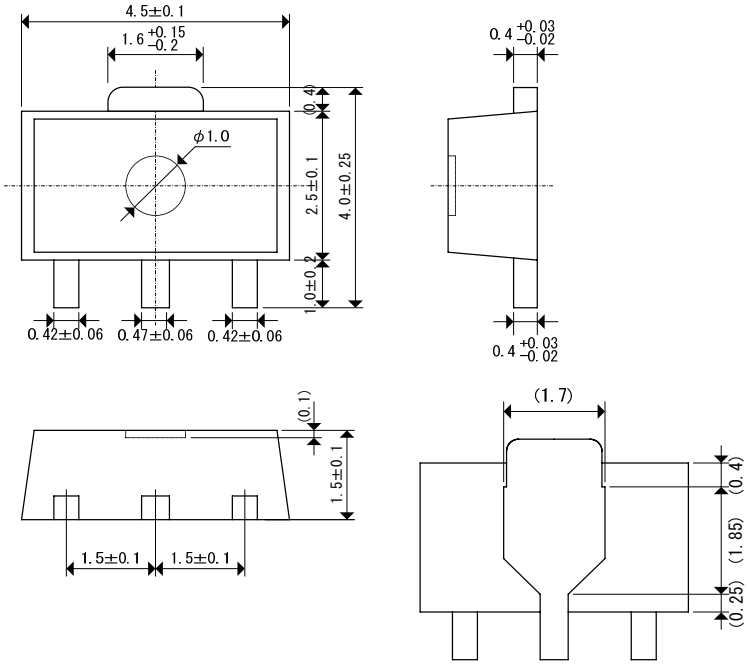
●SOT-23

Unit : mm



●SOT-89

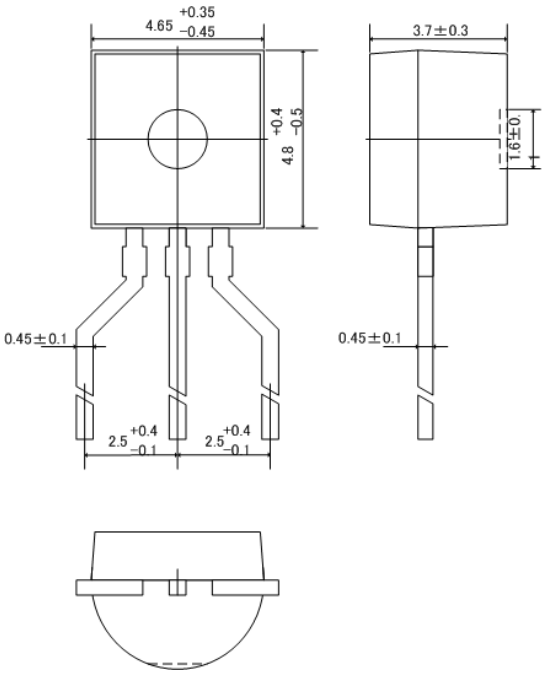
Unit : mm



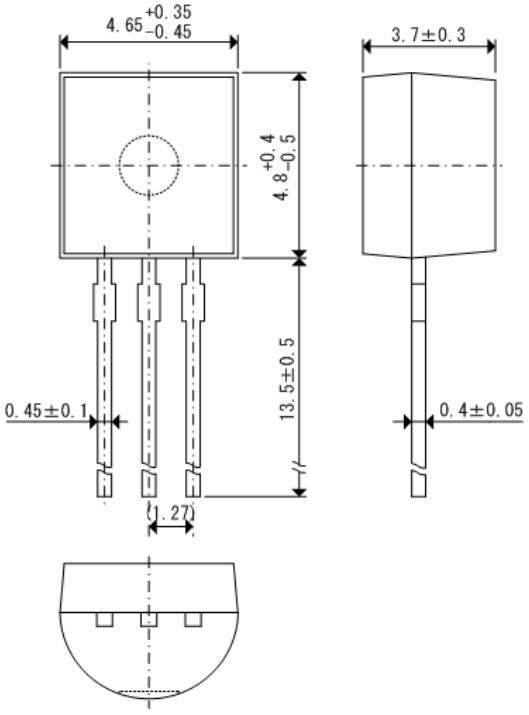
●TO-92

Unit : mm

Paper type



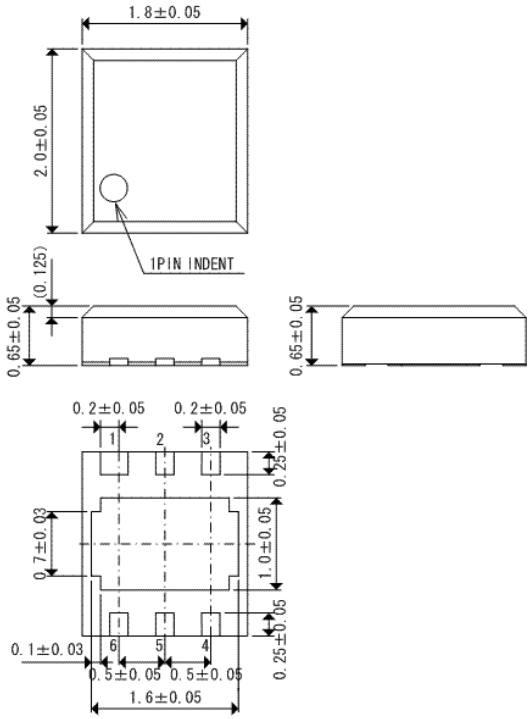
Bag



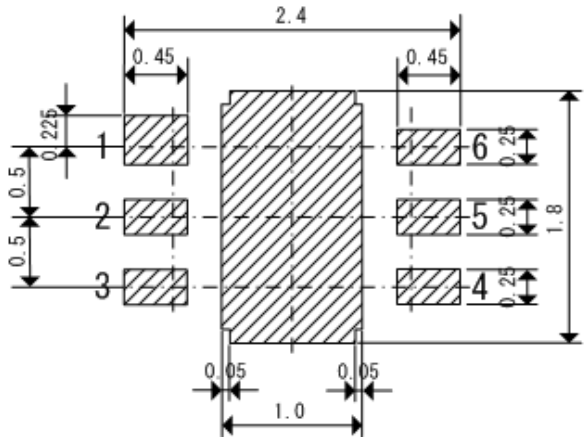
■PACKAGING INFORMATION (Continued)

●USP-6B

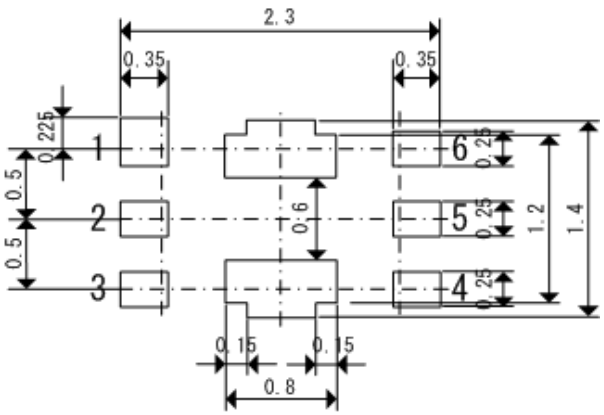
Unit : mm



●USP-6B Reference Pattern Layout

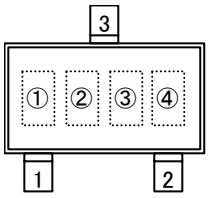


●USP-6B Reference Metal Mask Design

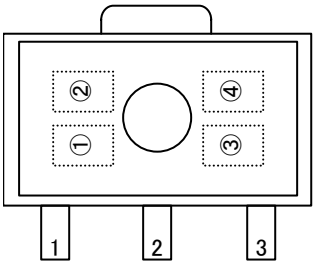


■ MARKING RULE

●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

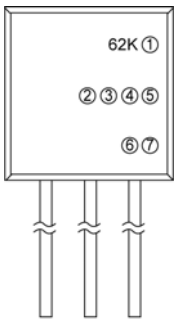
MARK	VOLTAGE (V)	MARK	VOLTAGE (V)
A	x.0	F	x.5
B	x.1	H	x.6
C	x.2	K	x7
D	x.3	L	x.8
E	x.4	M	x.9

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)

●TO-92



TO-92
(SIDE VIEW)

① represents polarity of output voltage

MARK	OUTPUT CONFIGURATION
N	− (Negative)

②③ represents output voltage (ex.)

MARK		VOLTAGE (V)
②	③	
3	3	3.3
5	0	5.0

④ represents temperature characteristics

MARK	TEMPERATURE CHARACTERISTICS
0	±100 ppm (TYP.)

⑤ represents output voltage accuracy

MARK	OUTPUT VOLTAGE ACCURACY
1	Within ±1% (semi-custom)
2	Within ±2%

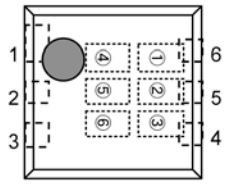
⑥ represents least significant digit of production year (ex.)

MARK	PRODUCTION YEAR
3	2003
4	2004

⑦ represents production lot number
0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

■ MARKING RULE (Continued)

●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.

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