High Voltage Positive Voltage Regulators

■GENERAL DESCRIPTION

The XC6202 series are highly precise, low power consumption, high voltage input, positive voltage regulators manufactured using CMOS and laser trimming technologies. The XC6202 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit.

Output voltage is selectable in 0.1V steps from 1.8V ~ 18V. The series are also compatible with low ESR ceramic capacitors which give added output stability.

Since the current limiter circuit is built-in, the IC is protected against overshoot currents at such times of output shorts etc.

SOT-23, SOT-89, TO-92, SOT-223 and USP-6B packages are available.

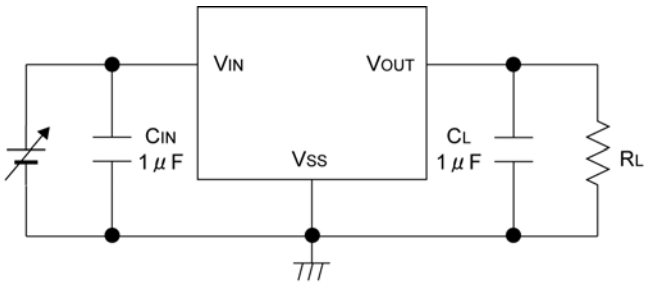
■APPLICATIONS

- ●Battery powered equipment
- ●Reference voltage
- ●Cameras, video cameras
- ●Palmtops

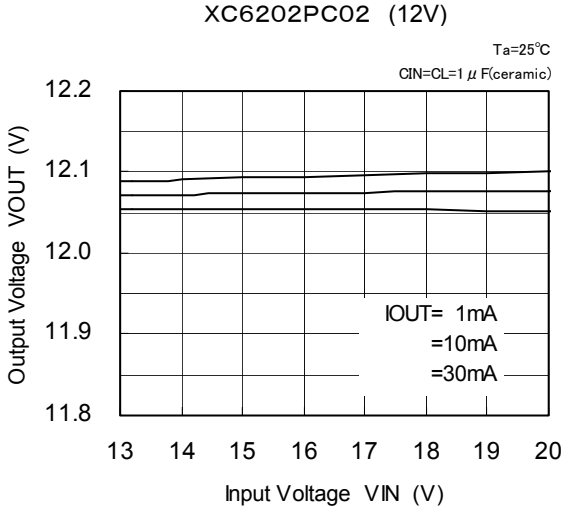
■FEATURES

Maximum Output Current	: 150mA (within Pd)
Maximum Operational Voltage	: 20V
Output Voltage Range	: 1.8V ~ 18V (0.1V increments)
Highly Accurate	: ±2%
Low Power Consumption	: 10μA (TYP.)
Line Regulation	: 0.01% / V (TYP.)
Dropout Voltage	: 200mV @ 30mA 670mV@100mA
Operational Temperature Range	: -40℃ ~ 85℃
Low ESR Capacitor Compatible	: Ceramic capacitor
Current Limiter Circuit Built-In	
Small Packages	: SOT-23 SOT-89 TO-92 SOT-223 USP-6B

■TYPICAL APPLICATION CIRCUIT



■TYPICAL PERFORMANCE CHARACTERISTICS



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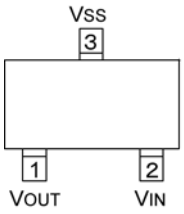
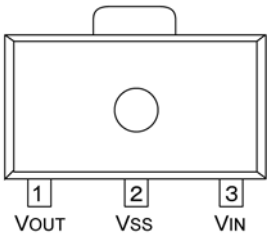
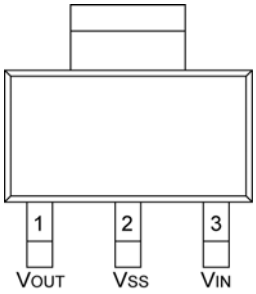
■PIN CONFIGURATION



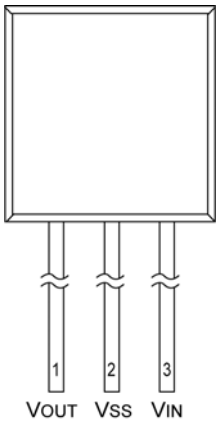
SOT-23
(TOP VIEW)



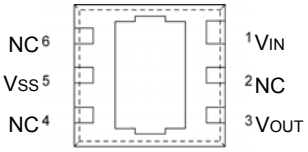
SOT-89
(TOP VIEW)



SOT-223
(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 (No.5) pin.

■PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTION
SOT-23	SOT-89/TO-92/ SOT-223	USP-6B		
1	1	3	VOUT	Output
3	2	5	VSS	Ground
2	3	1	VIN	Power Input
—	—	2, 4, 6	NC	No connection

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■PRODUCT CLASSIFICATION

●Ordering Information

XC6202P①②③④⑤-⑥(*1)

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
①②	Output Voltage	18 ～ J0	: For the voltage above 10V, see the example 10=A, 11=B 12=C, 13=D, 14=E, 15=F, 16=G, 17=H, 18=J e.g. VOUT= 3.0V → ①:3, ②:0 VOUT= 12V → ①:C, ②:0 VOUT= 15V → ①:F, ②:0
③	Accuracy	2	: ±2%
④⑤-⑥	Packages Taping Type (*2)	MR	: SOT-23
		MR-G	: SOT-23 (Halogen & Antimony free)
		PR	: SOT-89
		PR-G	: SOT-89 (Halogen & Antimony free)
		TH	: TO-92
		TH-G	: TO-92 (Halogen & Antimony free)
		TB	: TO-92
		TB-G	: TO-92 (Halogen & Antimony free)
		FR	: SOT-223
		FR-G	: SOT-223 (Halogen & Antimony free)
		DR	: USP-6B

(*1) The “-G” suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.
(*2) The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ④R-⑥, Reverse orientation: ④L-⑥)

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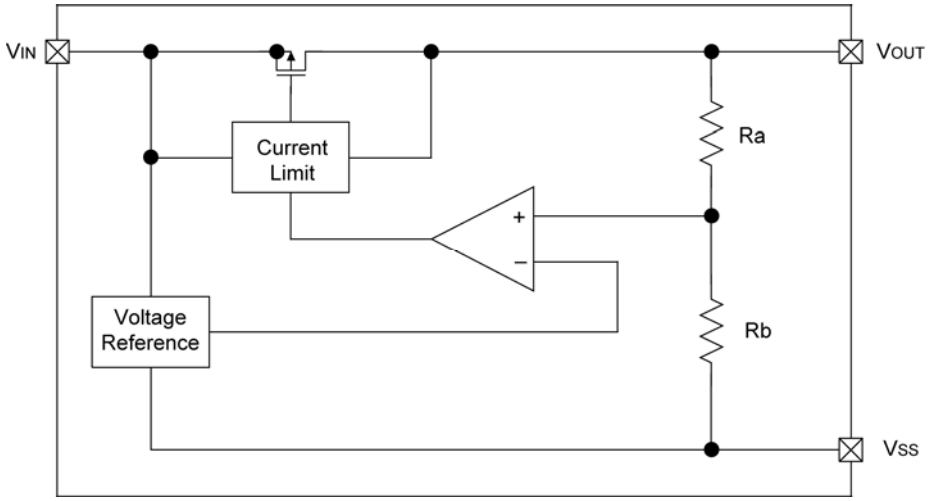
■BLOCK DIAGRAM



■ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		VIN	22.0	V
Output Current		IOUT	500	mA
Output Voltage		VOUT	VSS-0.3 ~ VIN+0.3	V
Power Dissipation	SOT-23	Pd	250	mW
	SOT-89		500	
	TO-92		300	
	USP-6B		120	
	SOT-223		1,200 *	
Operating Temperature Range		Topr	-40～+85	℃
Storage Temperature Range		Tstg	-55～+125	℃

* Circuits board mounting: Double-sided board

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■ELECTRICAL CHARACTERISTICS

XC6202P182 $V_{OUT(T)}$=1.8V (*1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*2)	V_{IN}=2.8V I_{OUT}=30mA	1.764	1.800	1.836	V	②
Maximum Output Current	I_{OUTmax}	V_{IN}=2.8V $V_{OUT} \geqq V_{OUT(E)} \times 0.9$	60	-	-	mA	②
Load Regulation	ΔV_{OUT}	V_{IN}=2.8V 1mA≦I_{OUT}≦60mA	-	10	80	mV	②
Dropout Voltage(*3)	Vdif1	I_{OUT}=30mA	-	340	470	mV	②
	Vdif2	I_{OUT}=100mA	-	1000	1500		
Supply Current	I_{SS}	V_{IN}=2.8V	-	10	24	μA	①
Line Regulation	$\frac{\Delta V_{OUT}}{(\Delta V_{IN} \cdot \Delta V_{OUT})}$	I_{OUT}=1mA 2.8V≦V_{IN}≦20V	-	0.01	0.20	%/V	②
Input Voltage	V_{IN}		-	-	20	V	-
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{(\Delta Ta \cdot \Delta V_{OUT})}$	I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	②
Short-circuit Current	Ishort	V_{IN}=3.8V	-	40	-	mA	②

XC6202P332 $V_{OUT(T)}$=3.3V (*1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*2)	V_{IN}=4.3V I_{OUT}=30mA	3.234	3.300	3.366	V	②
Maximum Output Current	I_{OUTmax}	V_{IN}=4.3V $V_{OUT} \geqq V_{OUT(E)} \times 0.9$	150	-	-	mA	②
Load Regulation	ΔV_{OUT}	V_{IN}=4.3V 1mA≦I_{OUT}≦100mA	-	25	90	mV	②
Dropout Voltage(*3)	Vdif1	I_{OUT}=30mA	-	200	280	mV	②
	Vdif2	I_{OUT}=100mA	-	670	900		
Supply Current	I_{SS}	V_{IN}=4.3V	-	10	24	μA	①
Line Regulation	$\frac{\Delta V_{OUT}}{(\Delta V_{IN} \cdot \Delta V_{OUT})}$	I_{OUT}=1mA 4.3V≦V_{IN}≦20V	-	0.01	0.20	%/V	②
Input Voltage	V_{IN}		-	-	20	V	-
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{(\Delta Ta \cdot \Delta V_{OUT})}$	I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	②
Short-circuit Current	Ishort	V_{IN}=5.3V	-	40	-	mA	②

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■ELECTRICAL CHARACTERISTICS (Continued)

XC6202P502 $V_{OUT(T)}$=5.0V (*1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*2)	V_{IN}=6V I_{OUT}=30mA	4.900	5.000	5100	V	②
Maximum Output Current	I_{OUTmax}	V_{IN}=6V $V_{OUT} \geqq V_{OUT(E)} \times 0.9$	200	-	-	mA	②
Load Regulation	$\triangle V_{OUT}$	V_{IN}=6V 1mA≦I_{OUT}≦100mA	-	30	100	mV	②
Dropout Voltage(*3)	Vdif1	I_{OUT}=30mA	-	130	190	mV	②
	Vdif2	I_{OUT}=100mA	-	440	550		
Supply Current	I_{SS}	V_{IN}=6V	-	10	24	μA	①
Line Regulation	$\frac{\triangle V_{OUT}}{(\triangle V_{IN} \cdot \triangle V_{OUT})}$	I_{OUT}=1mA 6V≦V_{IN}≦20V	-	0.01	0.20	%/V	②
Input Voltage	V_{IN}		-	-	20	V	-
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{(\triangle Ta \cdot \triangle V_{OUT})}$	I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	②
Short-circuit Current	Ishort	V_{IN}=7V	-	40	-	mA	②

XC6202PC02 $V_{OUT(T)}$=12V (*1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*2)	V_{IN}=13V I_{OUT}=30mA	11.760	12.000	12.240	V	②
Maximum Output Current	I_{OUTmax}	V_{IN}=13V $V_{OUT} \geqq V_{OUT(E)} \times 0.9$	200	-	-	mA	②
Load Regulation	$\triangle V_{OUT}$	V_{IN}=13V 1mA≦I_{OUT}≦100mA	-	60	230	mV	②
Dropout Voltage(*3)	Vdif1	I_{OUT}=30mA	-	90	150	mV	②
	Vdif2	I_{OUT}=100mA	-	290	380		
Supply Current	I_{SS}	V_{IN}=13V	-	12	28	μA	①
Line Regulation	$\frac{\triangle V_{OUT}}{(\triangle V_{IN} \cdot \triangle V_{OUT})}$	I_{OUT}=1mA 13V≦V_{IN}≦20V	-	0.01	0.20	%/V	②
Input Voltage	V_{IN}		-	-	20	V	-
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{(\triangle Ta \cdot \triangle V_{OUT})}$	I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	②
Short-circuit Current	Ishort	V_{IN}=14V	-	40	-	mA	②

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■ELECTRICAL CHARACTERISTICS (Continued)

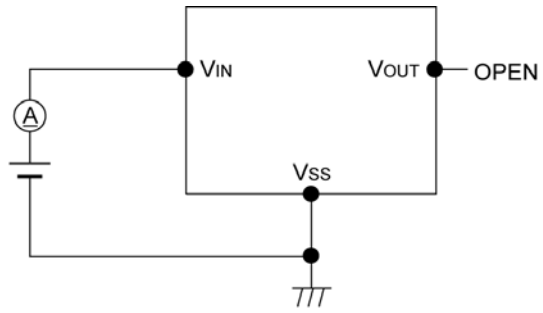
XC6202PJ02 $V_{OUT(T)}$=18V (*1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*2)	V_{IN}=19V I_{OUT}=30mA	17.640	18.000	18.360	V	②
Maximum Output Current	I_{OUTmax}	V_{IN}=19V $V_{OUT} \geqq V_{OUT(E)} \times 0.9$	200	-	-	mA	②
Load Regulation	$\triangle V_{OUT}$	V_{IN}=19V 1mA≦I_{OUT}≦100mA	-	120	380	mV	②
Dropout Voltage(*3)	Vdif1	I_{OUT}=30mA	-	80	150	mV	②
	Vdif2	I_{OUT}=100mA	-	280	380		
Supply Current	I_{SS}	V_{IN}=19V	-	15	30	μA	①
Line Regulation	$\frac{\triangle V_{OUT}}{(\triangle V_{IN} \cdot \triangle V_{OUT})}$	I_{OUT}=1mA 19V≦V_{IN}≦20V	-	0.01	0.20	%/V	②
Input Voltage	V_{IN}		-	-	20	V	-
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{(\triangle Ta \cdot \triangle V_{OUT})}$	I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	②
Short-circuit Current	Ishort	V_{IN}=20V	-	40	-	mA	②

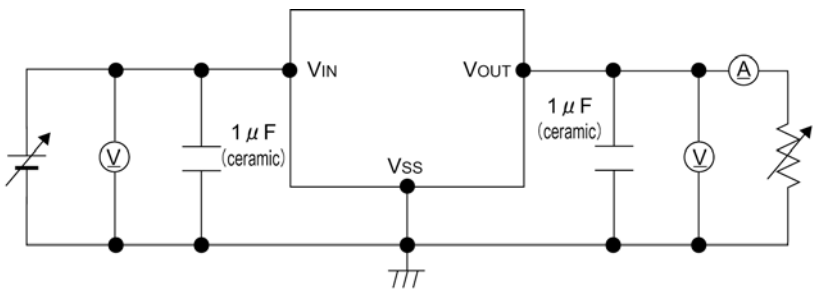
*1. $V_{OUT(T)}$ = Specified output voltage.
*2. $V_{OUT(E)}$ = Effective output voltage (i.e. the output voltage when "$V_{OUT(T)}$+1.0V" is provided at the V_{IN} pin while maintaining certain I_{OUT} value).
*3. Vdif = {V_{IN1}(*5)-V_{OUT1}(*4)}
*4. V_{OUT1} = A voltage equal to 98% of the output voltage when "$V_{OUT(T)}$ + 1.0V" is input.
*5. V_{IN1} = The input voltage when V_{OUT1} is output following a gradual decrease in the input voltage.

■TEST CIRCUITS

CIRCUIT ①



CIRCUIT ②



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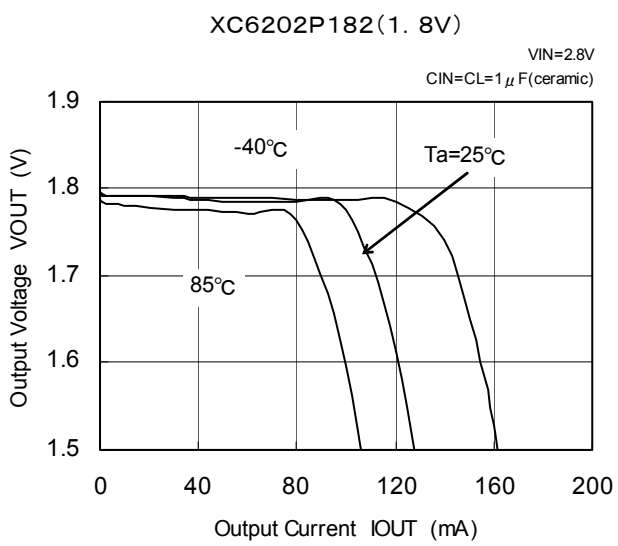
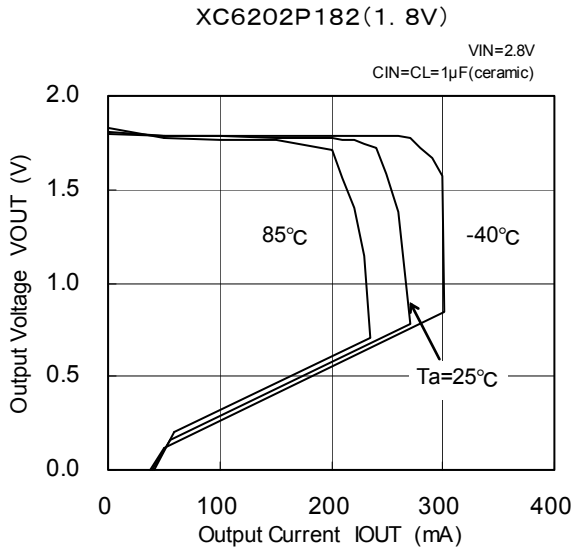
■TYPICAL PERFORMANCE CHARACTERISTICS

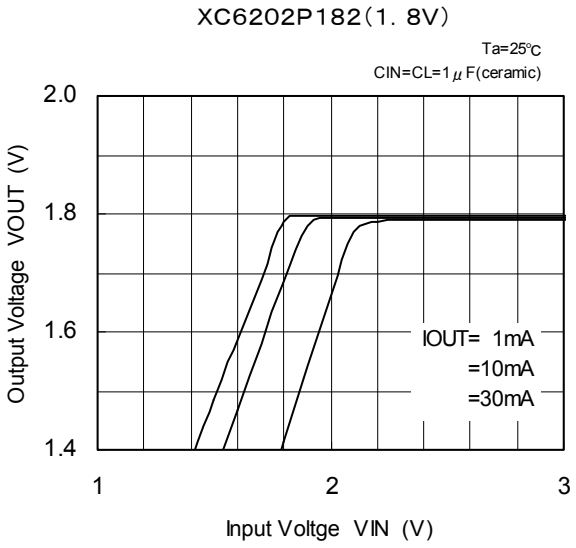
●XC6202P182

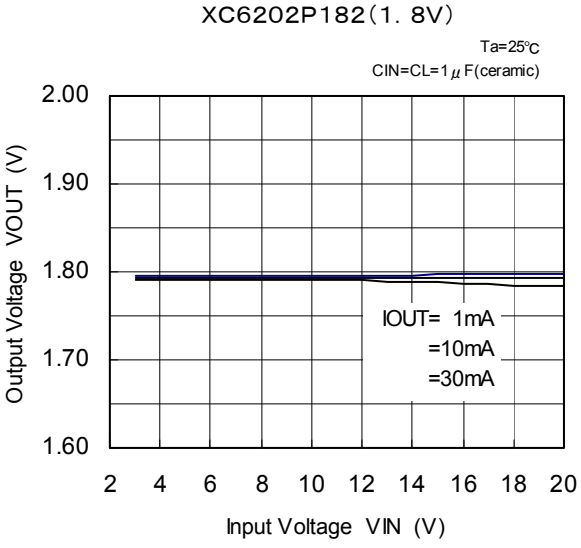
(1) Output Voltage vs. Output Current



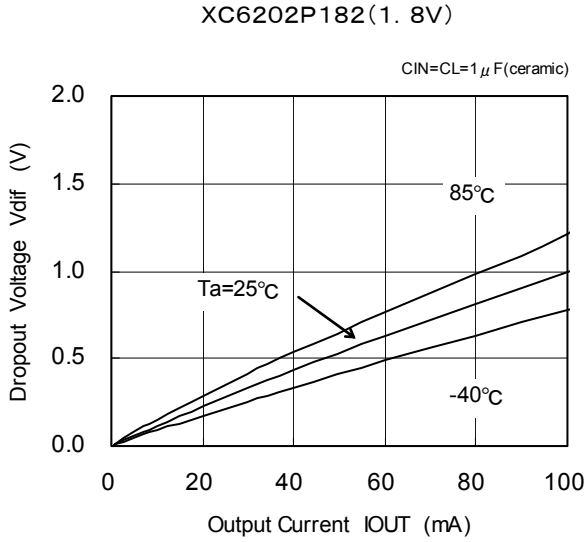


(2) Output Voltage vs. Input Voltage





(3) Dropout Voltage vs. Output Current



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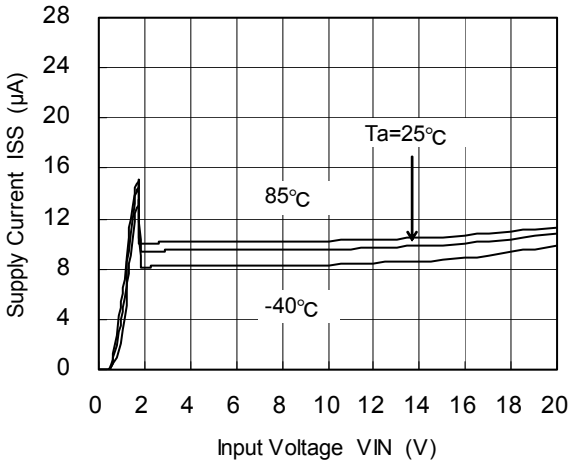
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

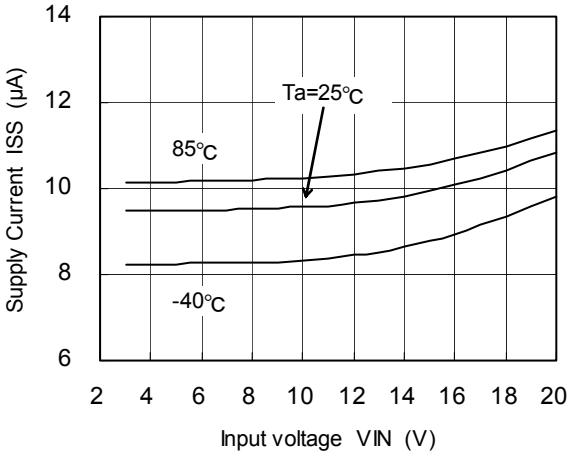
●XC6202P182 (Continued)

(4) Supply Current vs. Input Voltage

XC6202P182(1.8V)

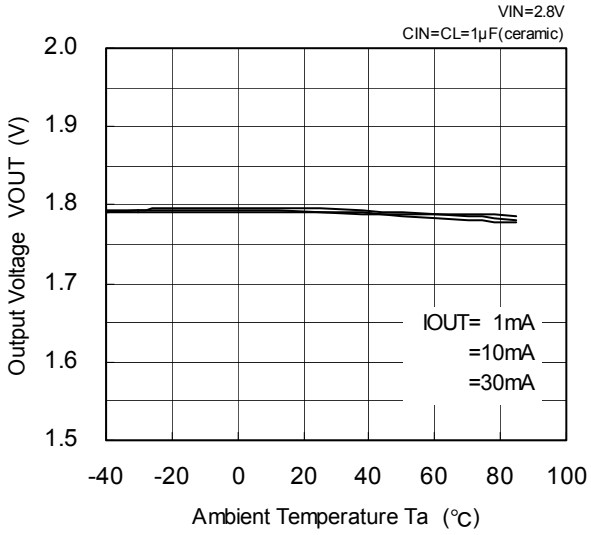


XC6202P182(1.8V)



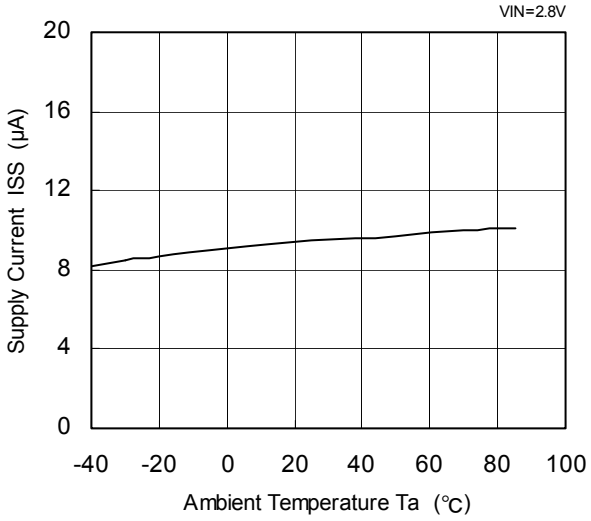
(5) Output Voltage vs. Ambient Temperature

XC6202P182(1.8V)



(6) Supply Current vs. Ambient Temperature

XC6202P182(1.8V)



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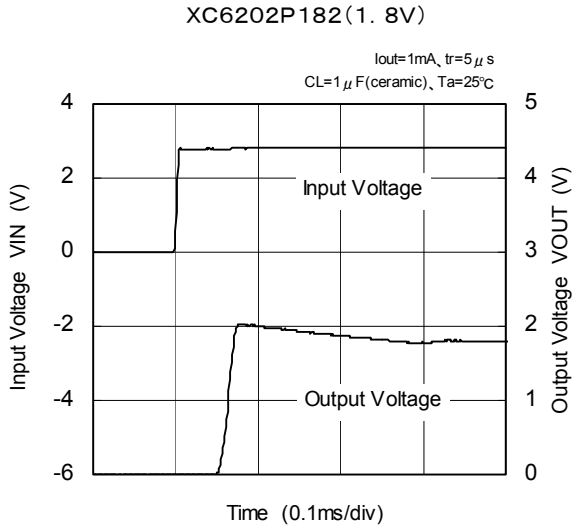
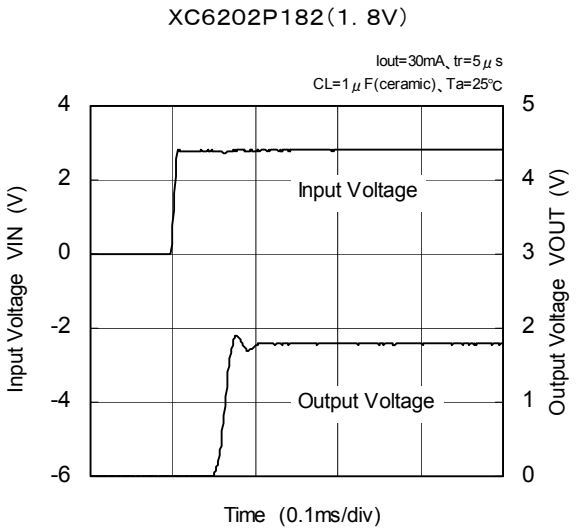
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

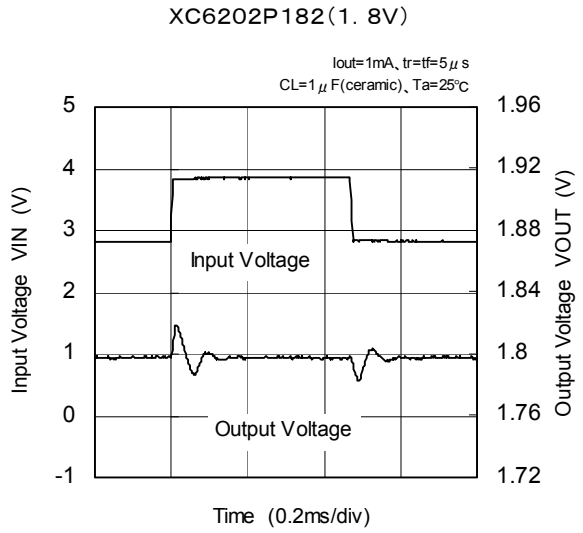
●XC6202P182 (Continued)

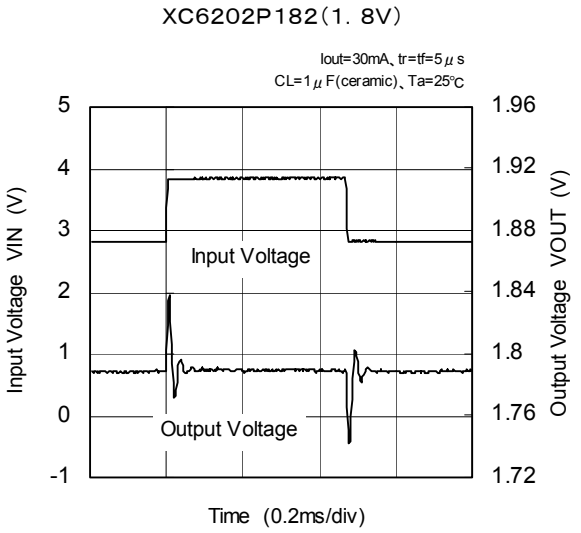
(7) Input Transient Response 1



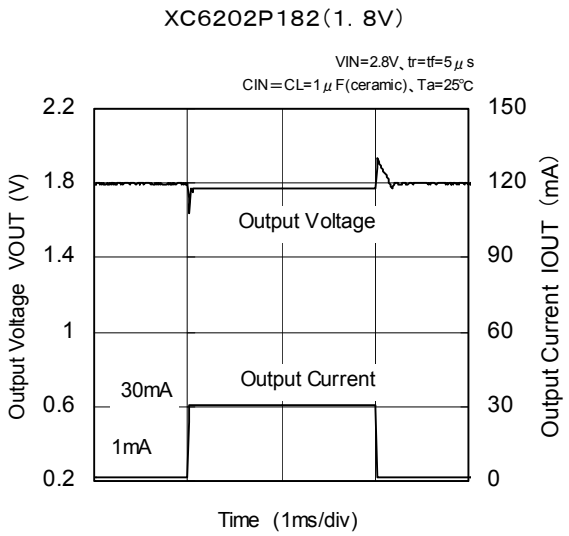


(8) Input Transient Response 2





(9) Load Transient Response



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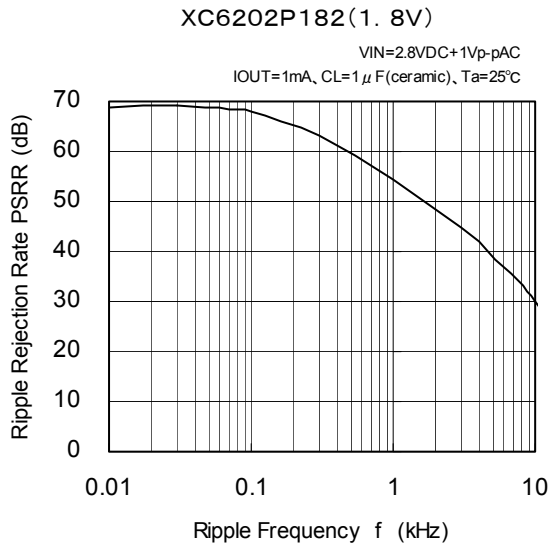
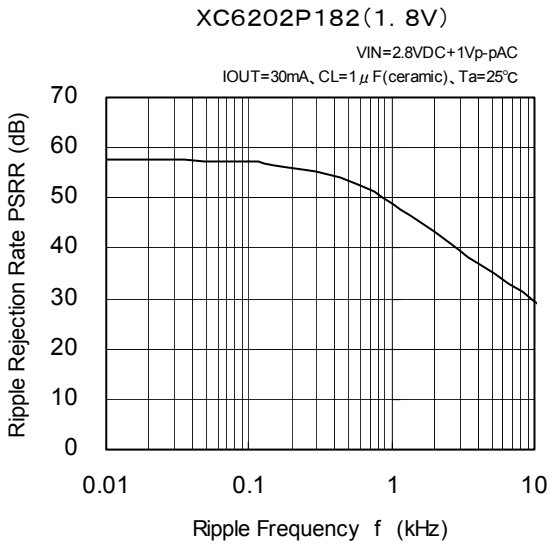
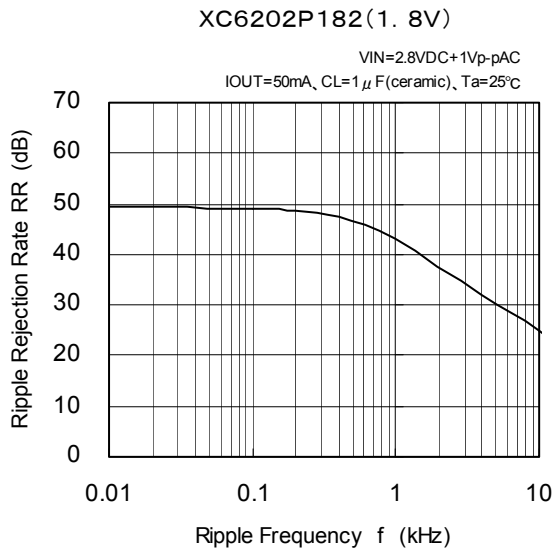
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6202P182 (Continued)

(10) Ripple Rejection Rate







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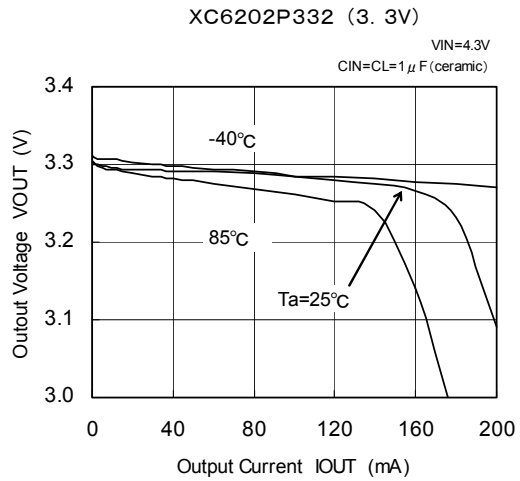
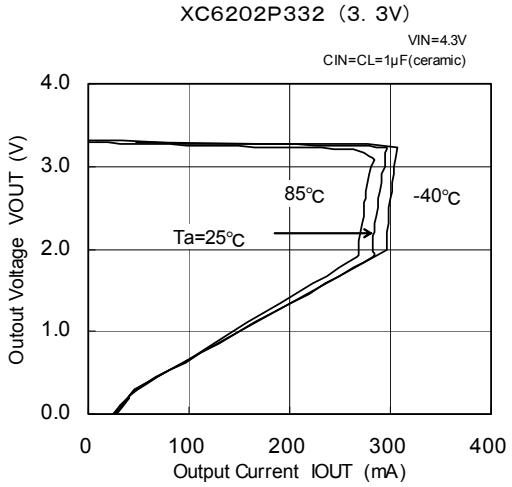
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

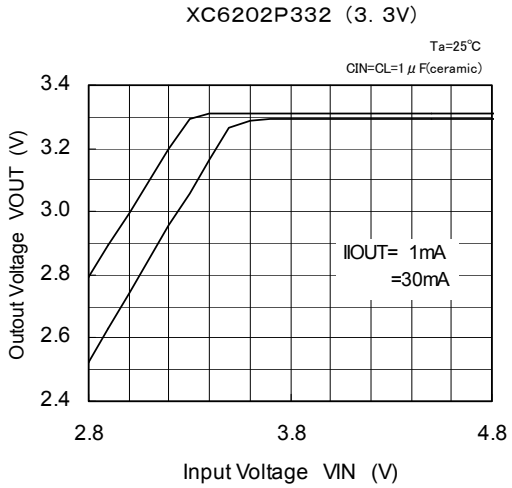
●XC6202P332

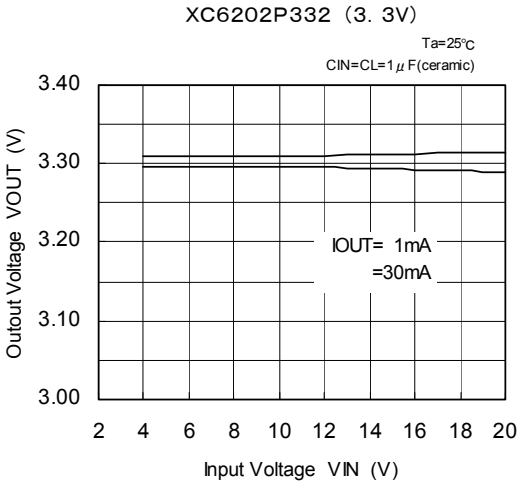
(1) Output Voltage vs. Output Current



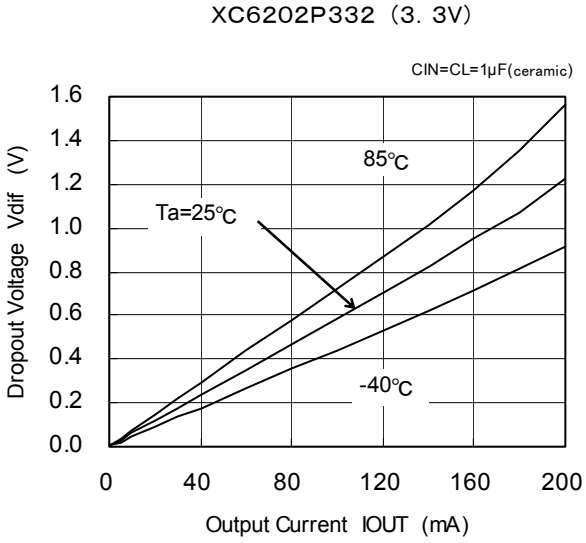


(2) Output Voltage vs. Input Voltage





(3) Dropout Voltage vs. Output Current



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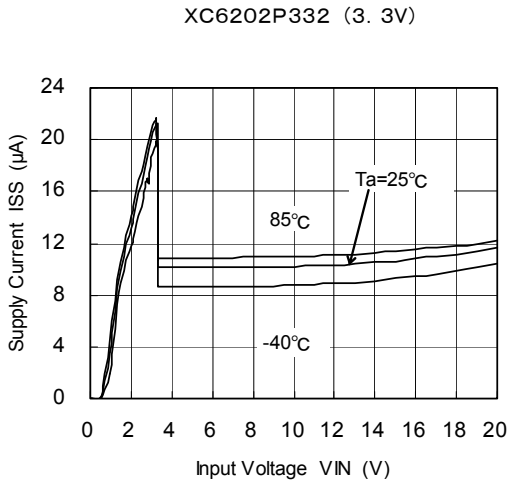
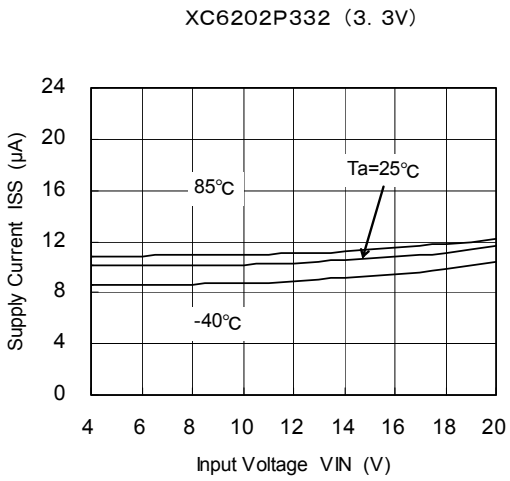
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

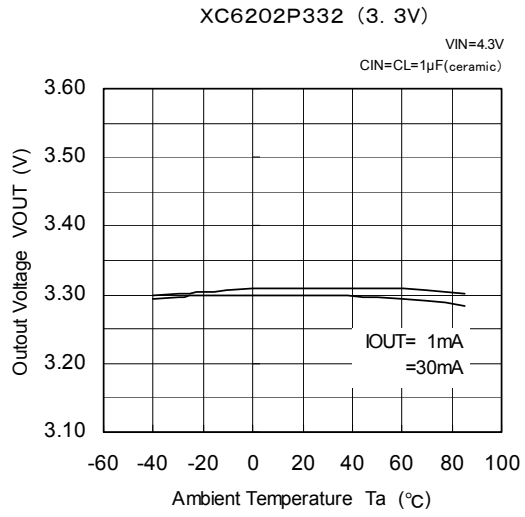
●XC6202P332 (Continued)

(4) Supply Current vs. Input Voltage

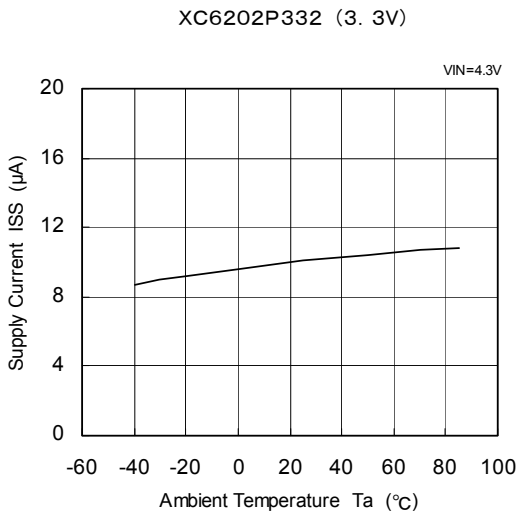




(5) Output Voltage vs. Ambient Temperature



(6) Supply Current vs. Ambient Temperature



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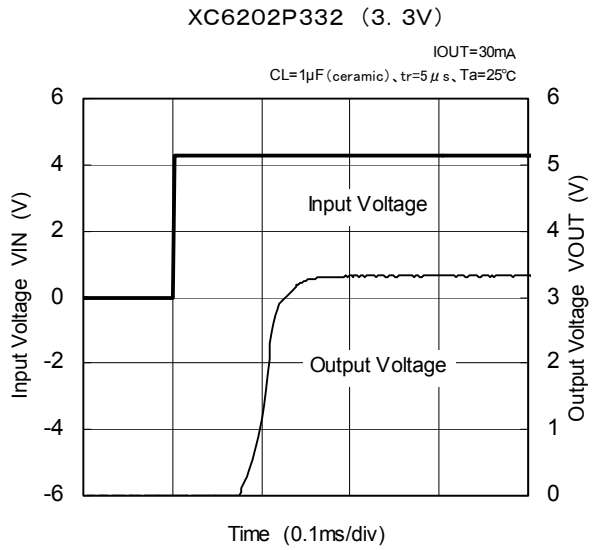
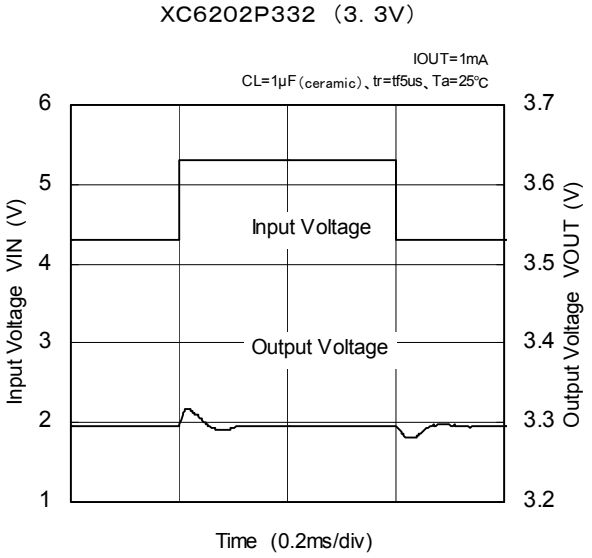
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

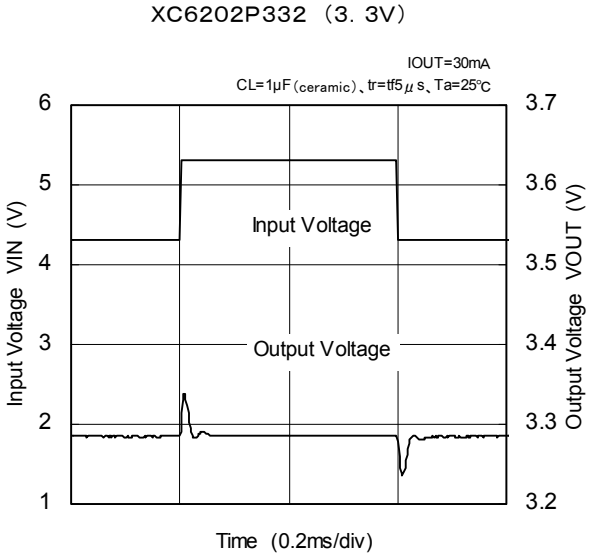
●XC6202P332 (Continued)

(7) Input Transient Response 1

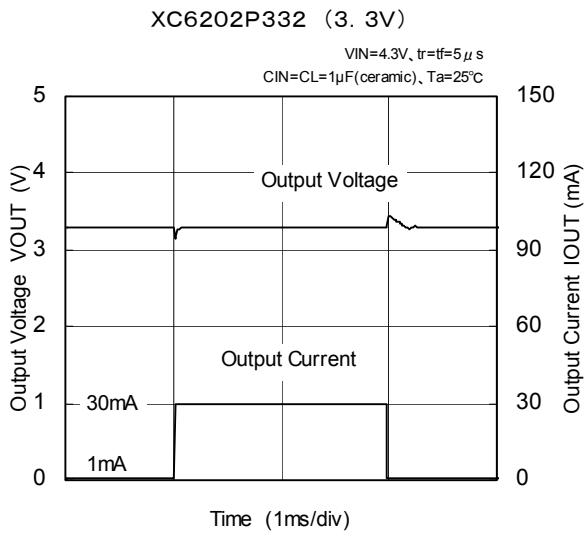


(8) Input Transient Response 2





(9) Load Transient Response



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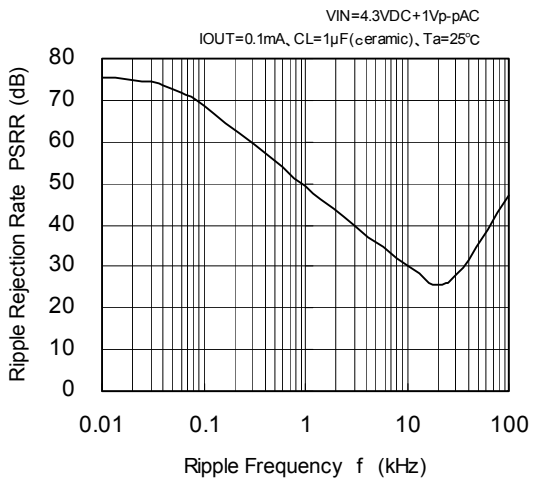
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

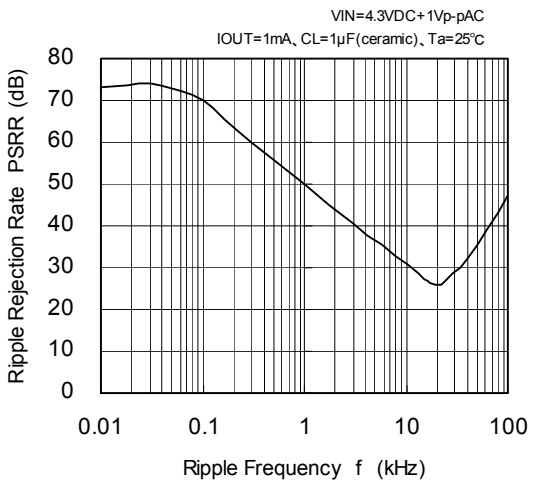
●XC6202P332 (Continued)

(10) Ripple Rejection Rate

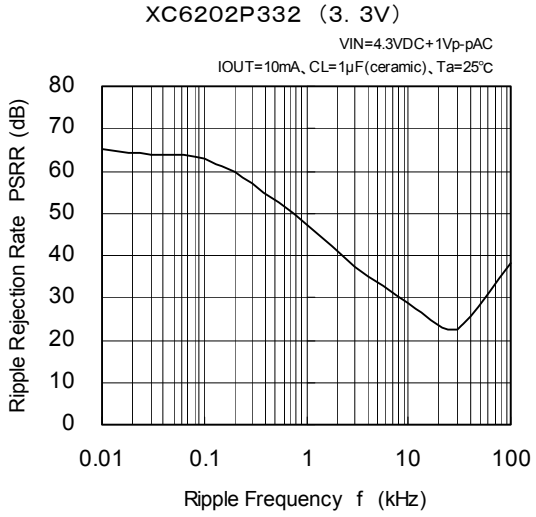
XC6202P332 (3.3V)



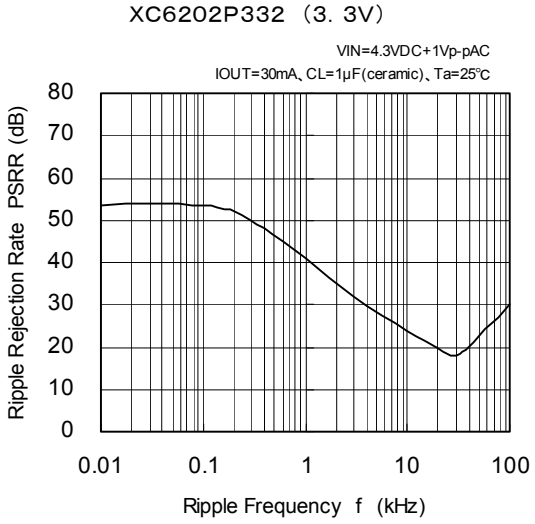
XC6202P332 (3.3V)



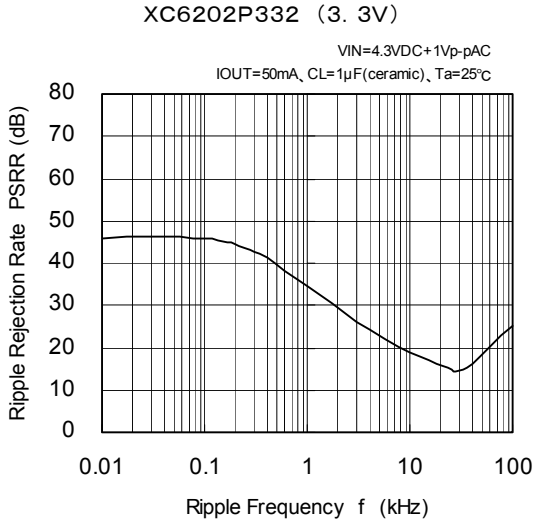
XC6202P332 (3.3V)



XC6202P332 (3.3V)



XC6202P332 (3.3V)



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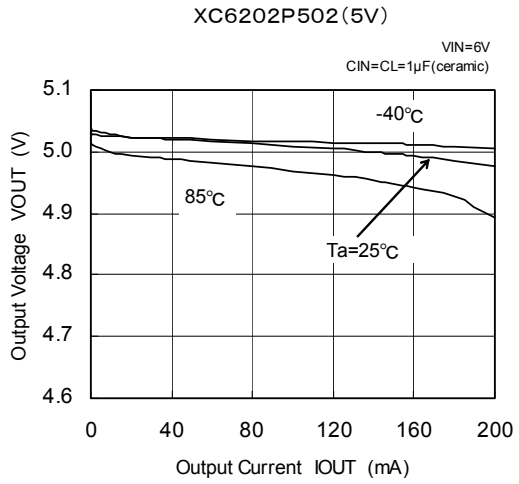
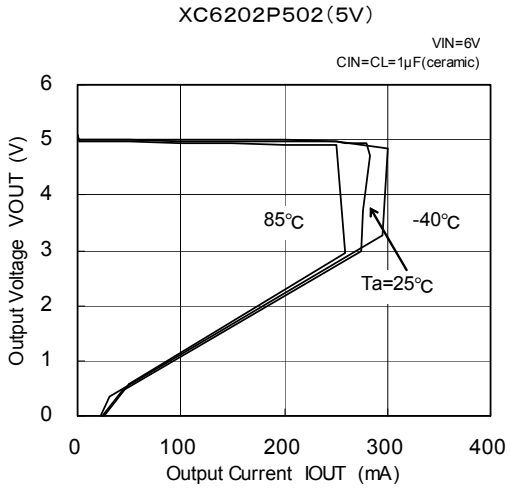
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

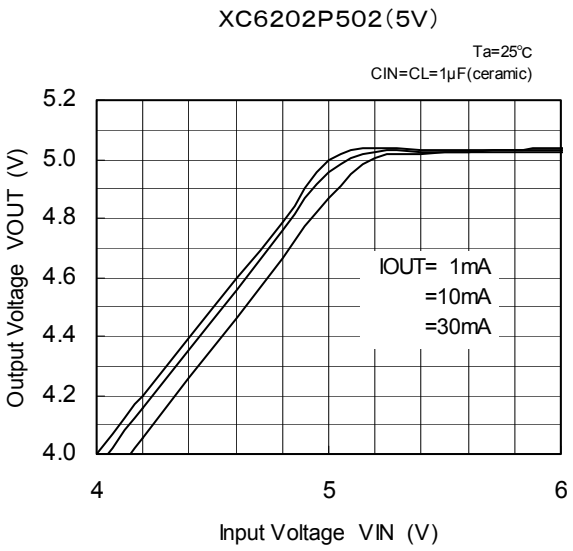
●XC6202P502

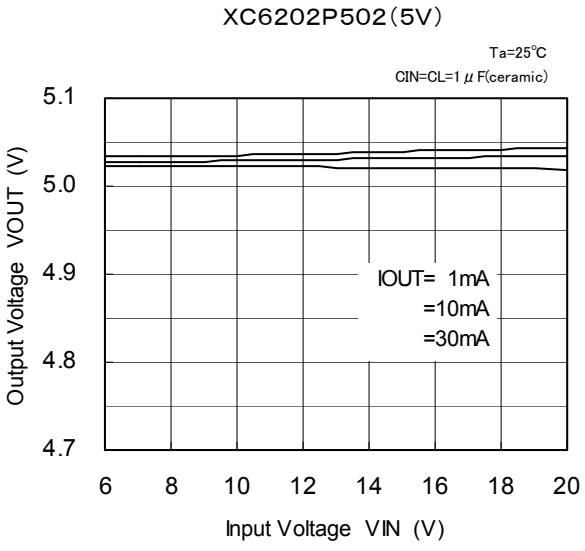
(1) Output Voltage vs. Output Current



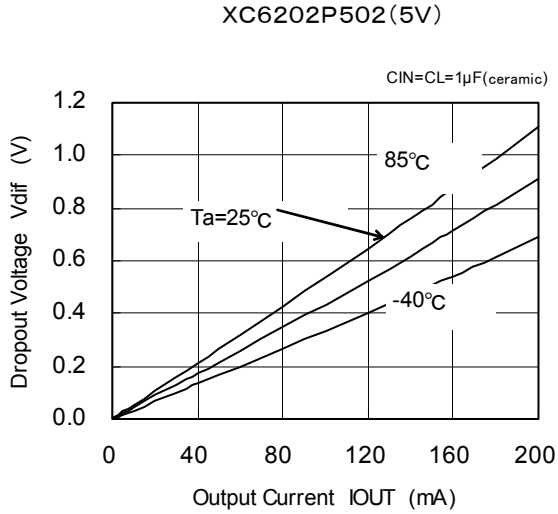


(2) Output Voltage vs. Input Voltage





(3) Dropout Voltage vs. Output Current



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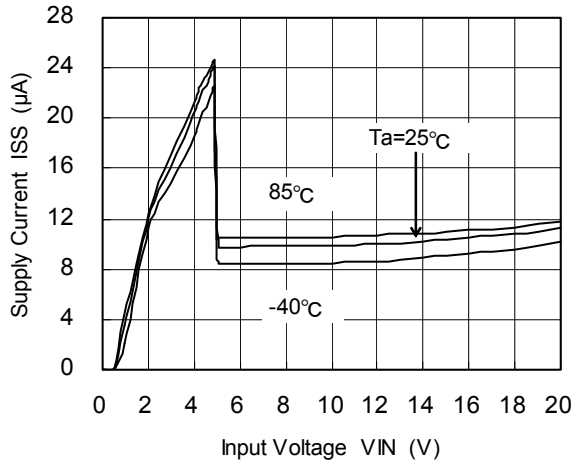
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

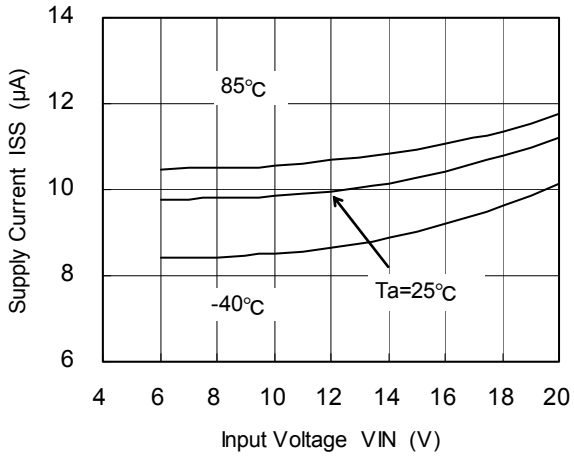
●XC6202P502 (Continued)

(4) Supply Current vs. Input Voltage

XC6202P502(5V)



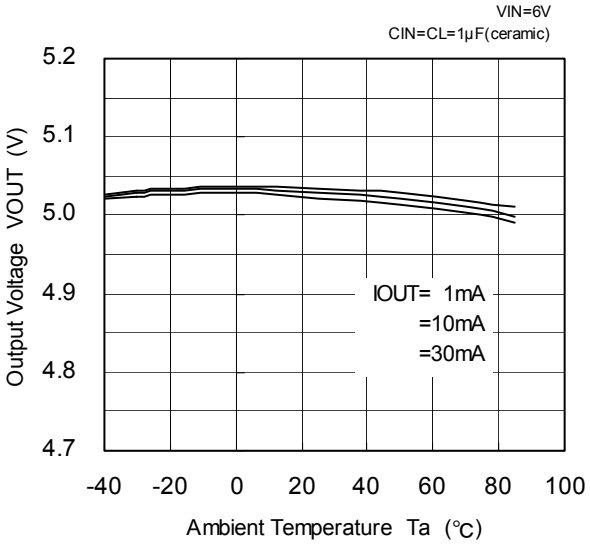
XC6202P502(5V)



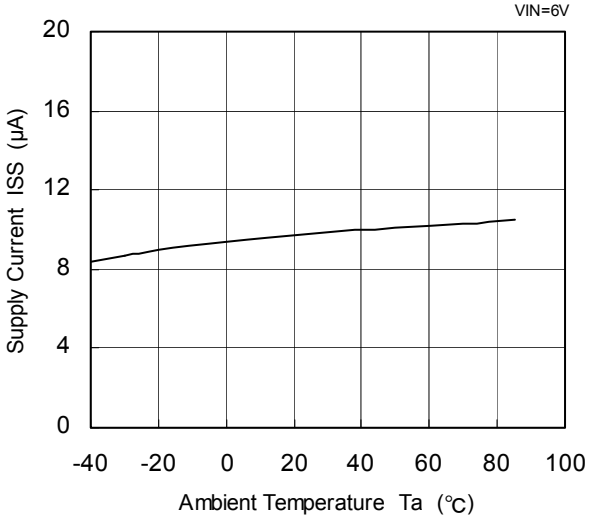
(5) Output Voltage vs. Ambient Temperature

(6) Supply Current vs. Ambient Temperature

XC6202P502(5V)



XC6202P502(5V)



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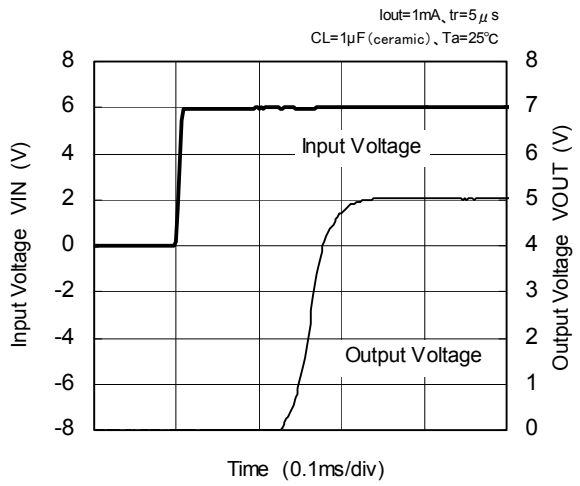
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

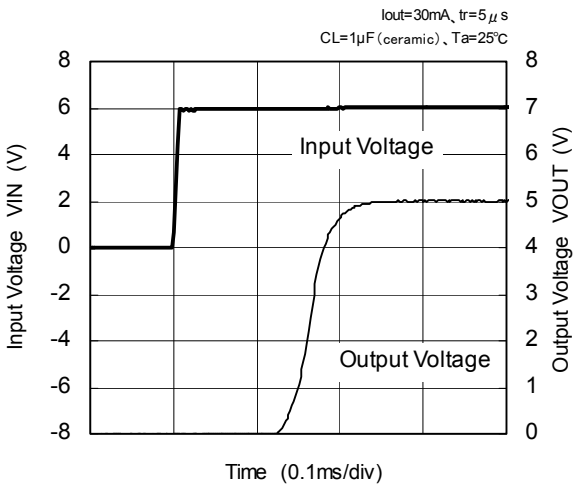
●XC6202P502 (Continued)

(7) Input Transient Response 1

XC6202P502(5V)

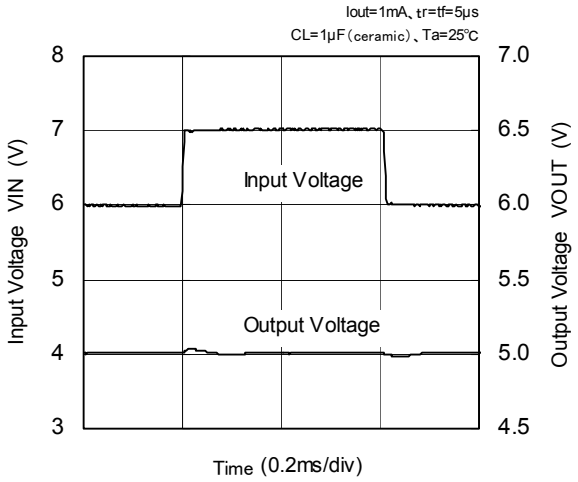


XC6202P502(5V)

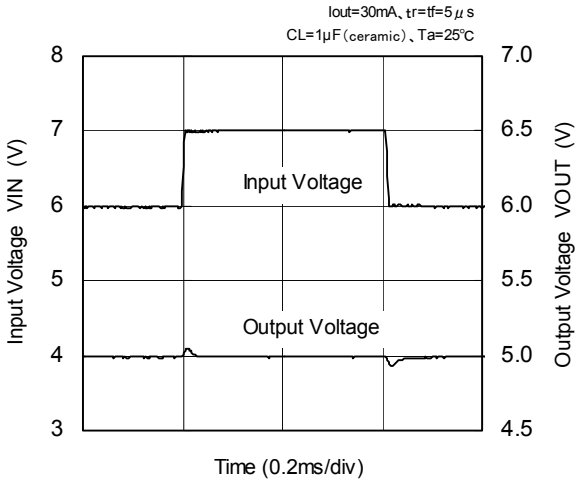


(8) Input Transient Response 2

XC6202P502(5V)

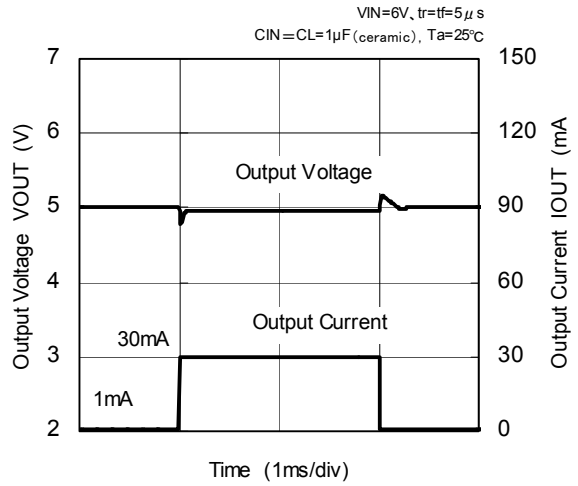


XC6202P502(5V)



(9) Load Transient Response

XC6202P502(5V)



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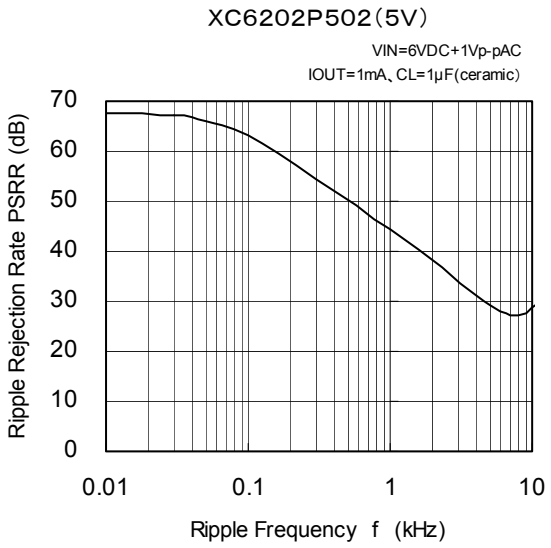
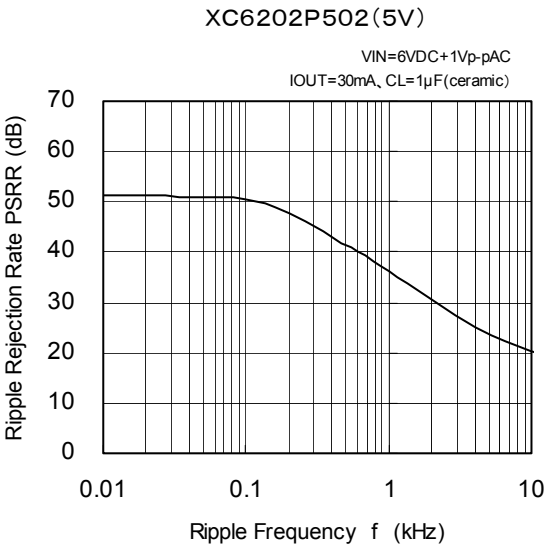
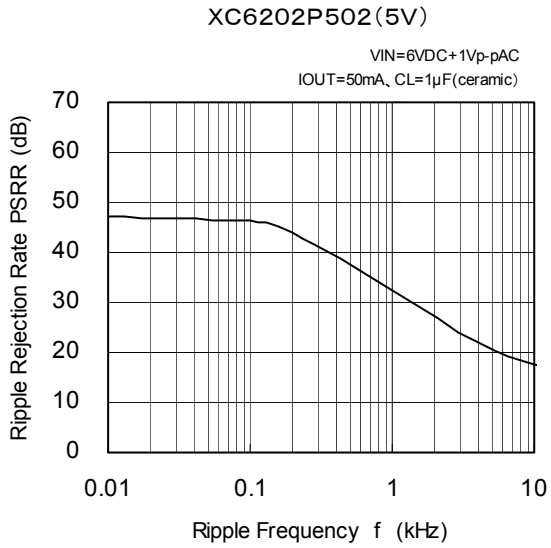
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6202P502 (Continued)

(10) Ripple Rejection Rate







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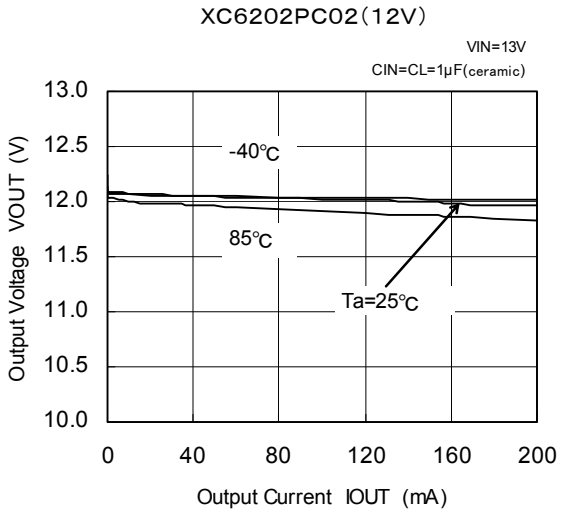
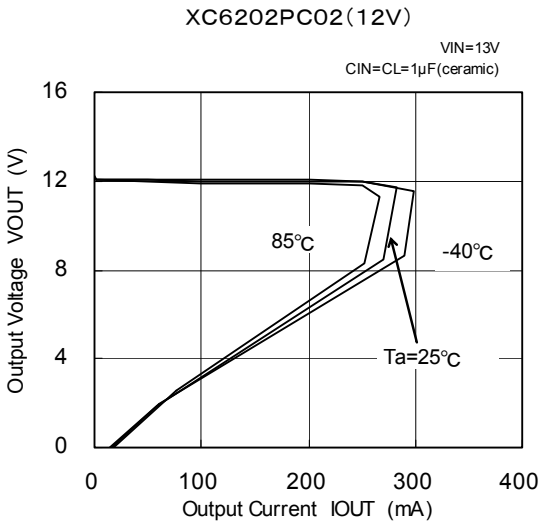
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

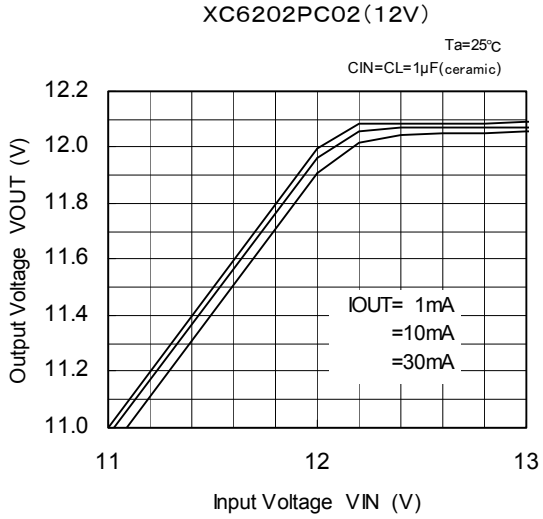
●XC6202PC02

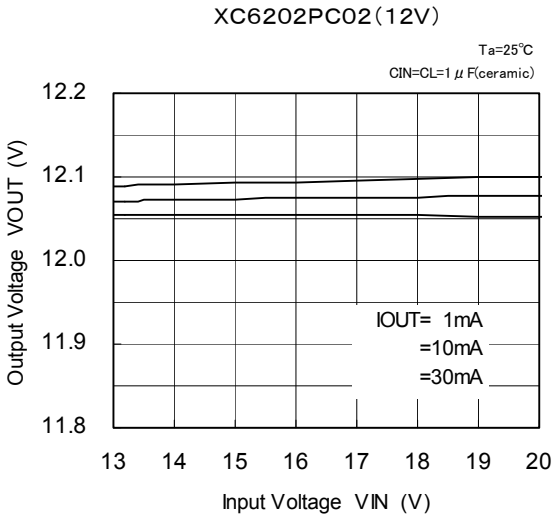
(1) Output Voltage vs. Output Current



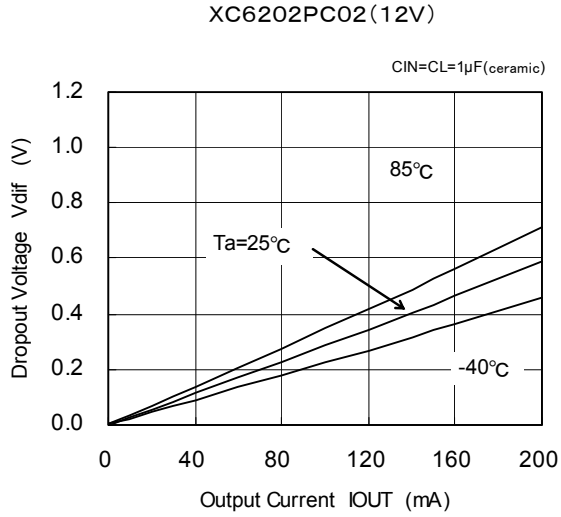


(2) Output Voltage vs. Input Voltage





(3) Dropout Voltage vs. Output Current



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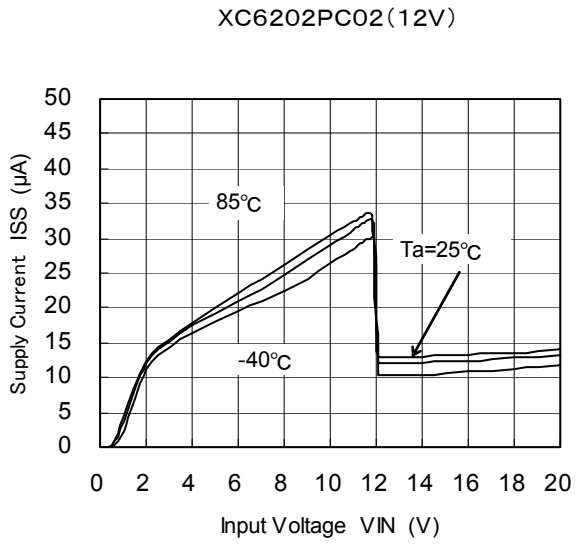
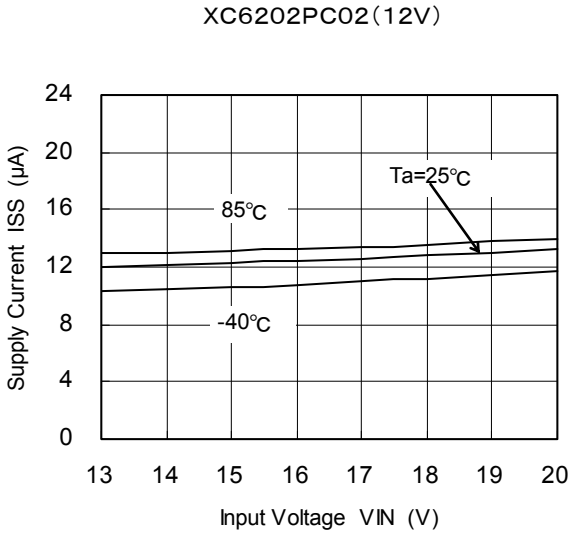
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

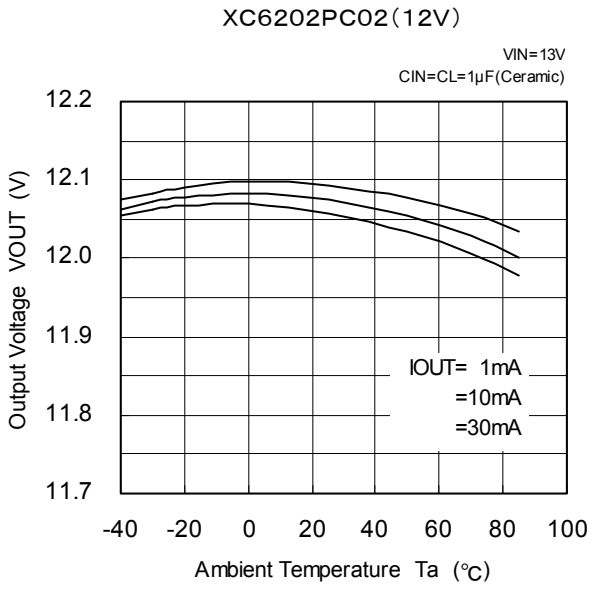
●XC6202PC02 (Continued)

(4) Supply Current vs. Input Voltage

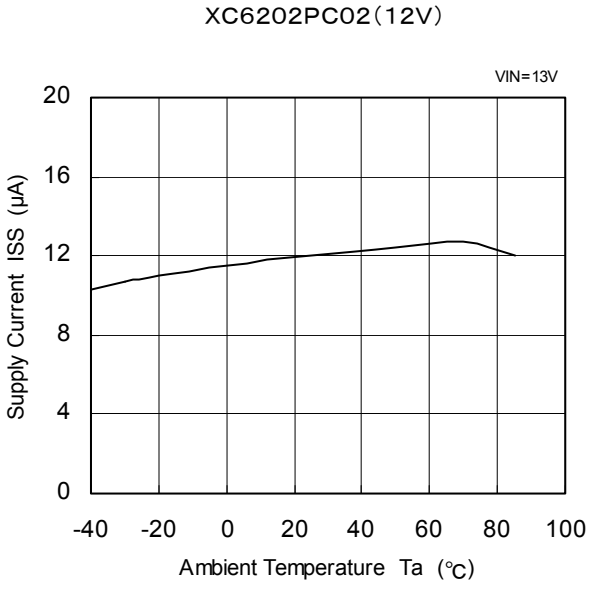




(5) Output Voltage vs. Ambient Temperature



(6) Supply Current vs. Ambient Temperature



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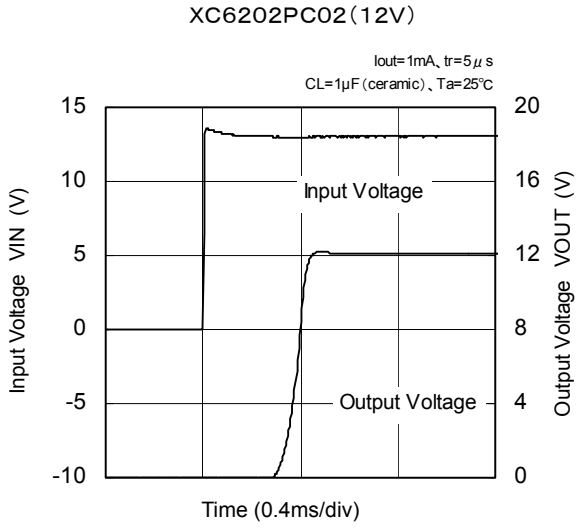
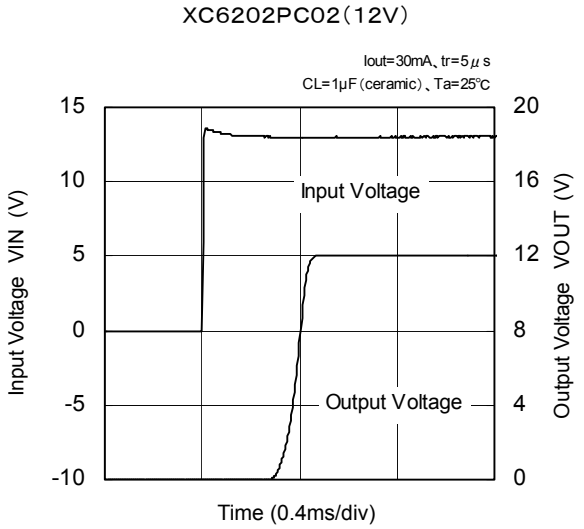
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

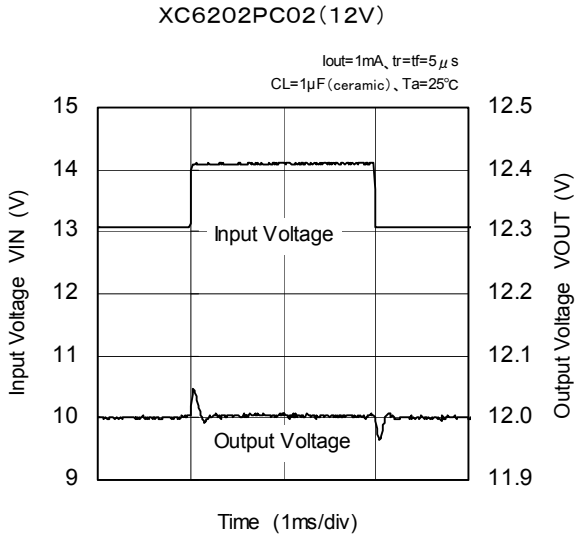
●XC6202PC02 (Continued)

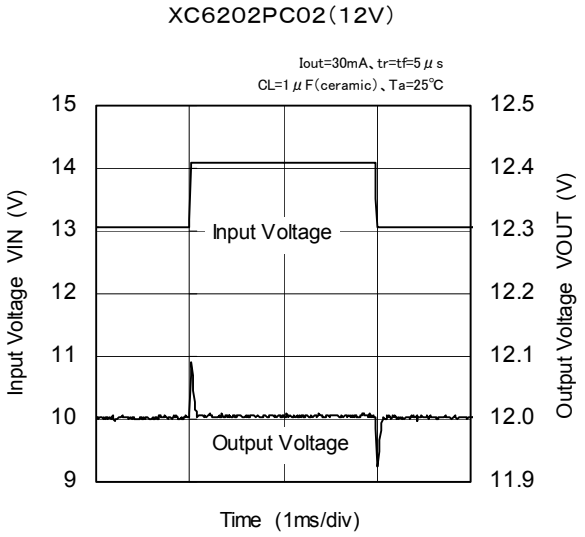
(7) Input Transient Response 1



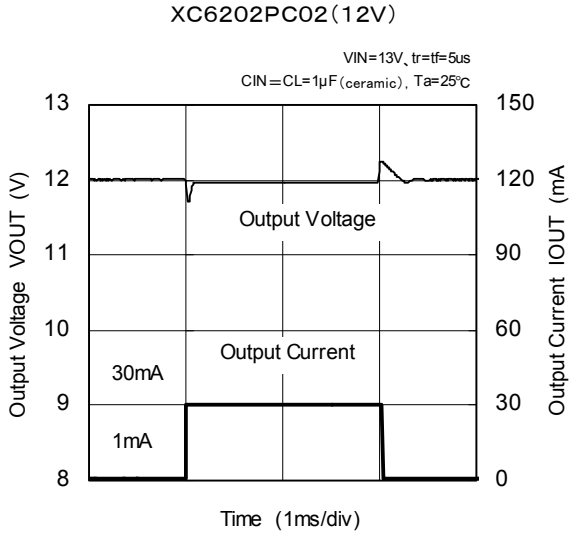


(8) Input Transient Response 2





(9) Load Transient Response



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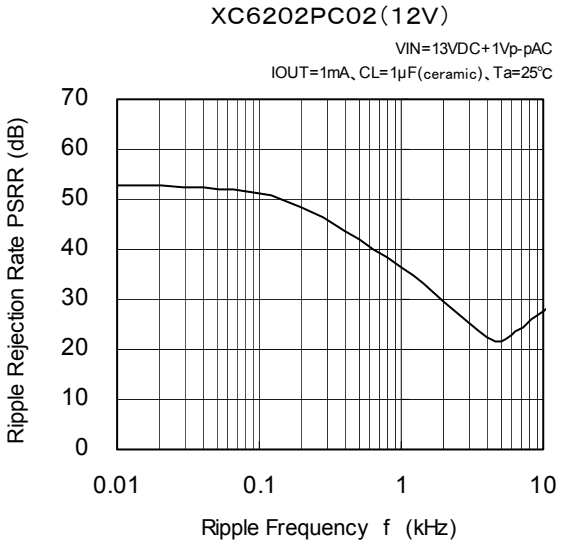
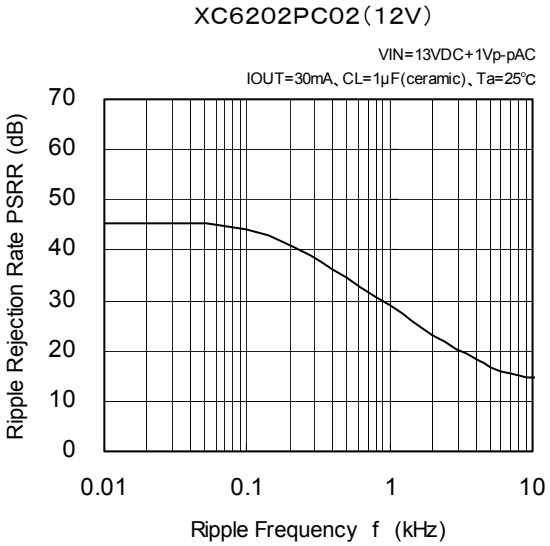
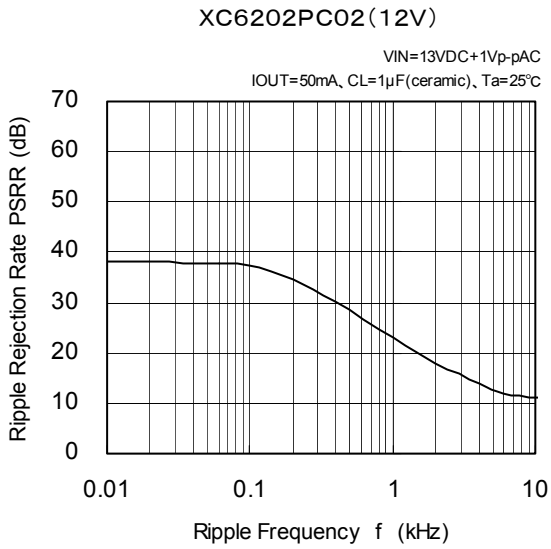
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6202PC02 (Continued)

(10) Ripple Rejection Rate







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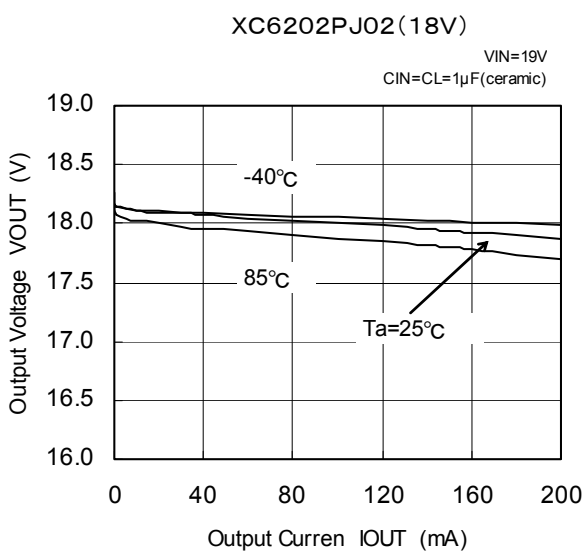
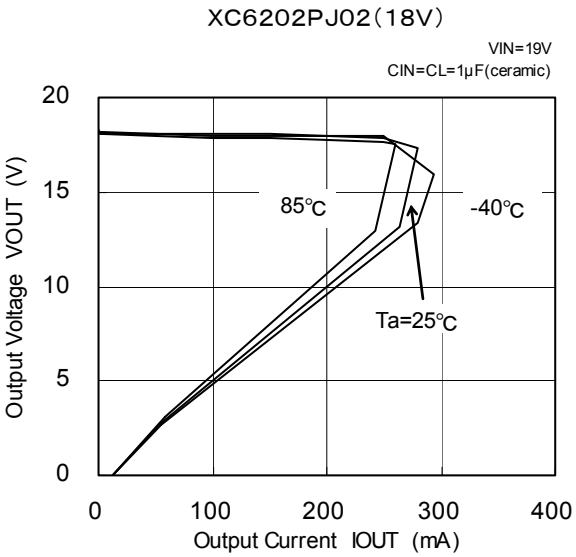
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

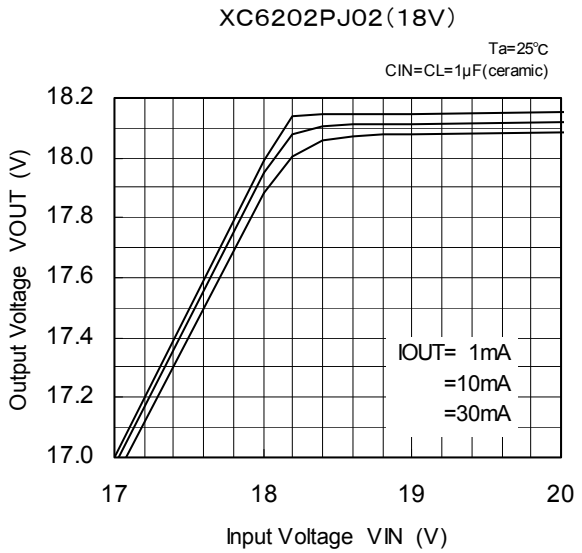
●XC6202PJ02

(1) Output Voltage vs. Output Current

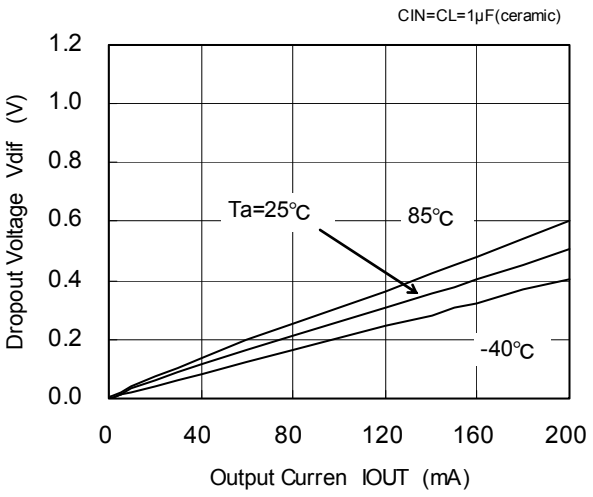




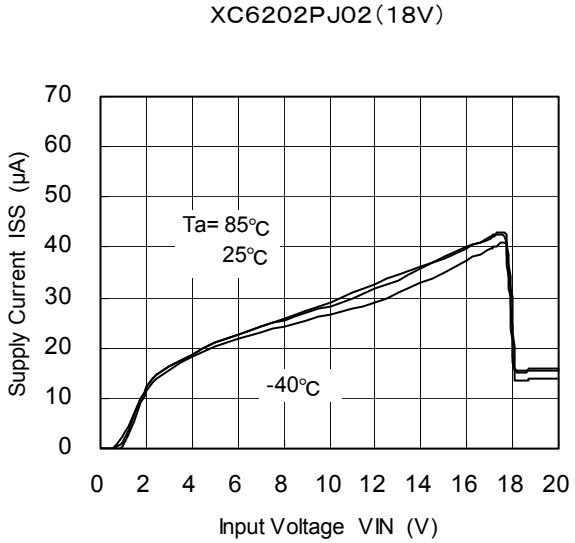
(2) Output Voltage vs. Input Voltage



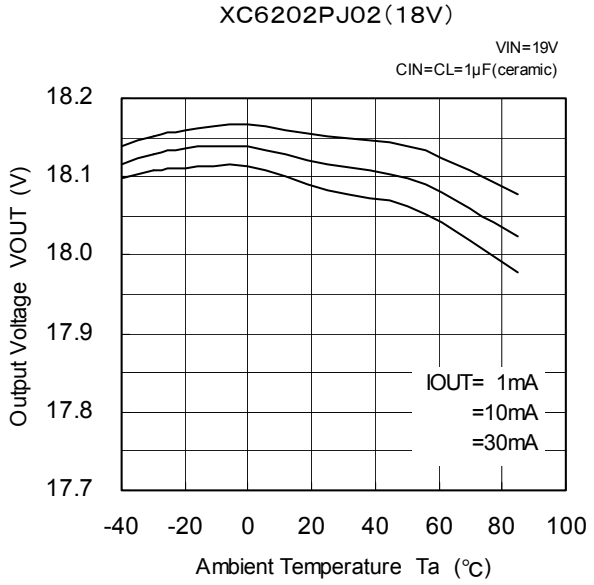
(3) Dropout Voltage vs. Output Current



(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



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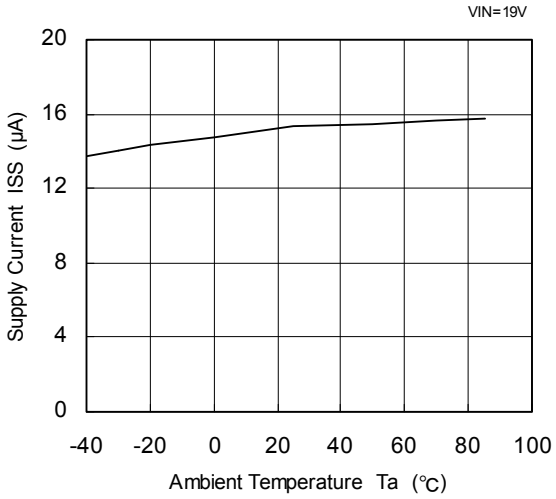
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6202PJ02 (Continued)

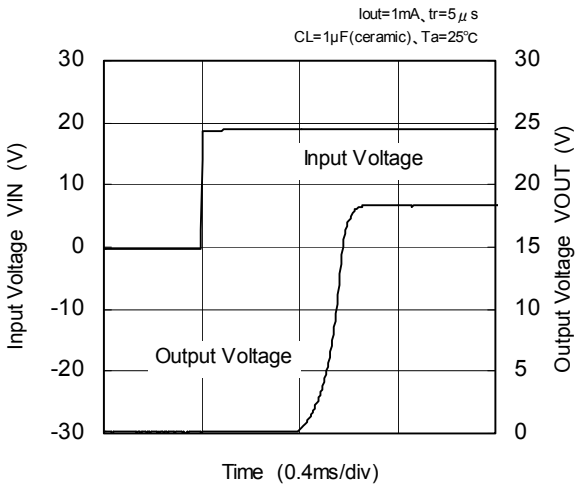
(6) Supply Current vs. Ambient Temperature

XC6202PJ02（18V）

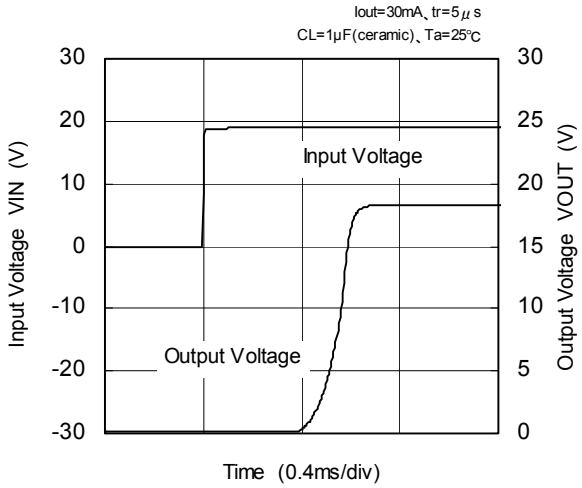


(7) Input Transient Response 1

XC6202PJ02（18V）

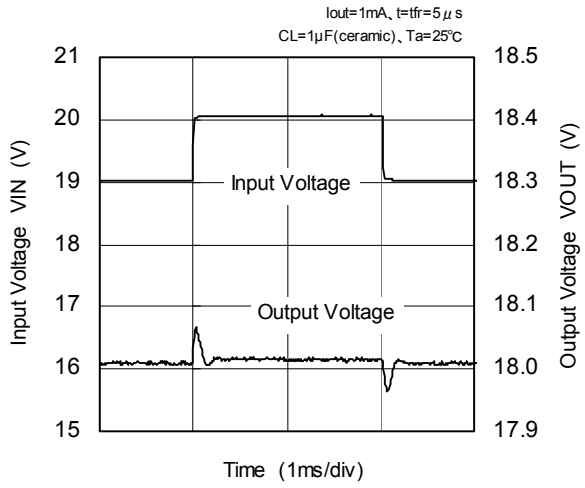


XC6202PJ02（18V）

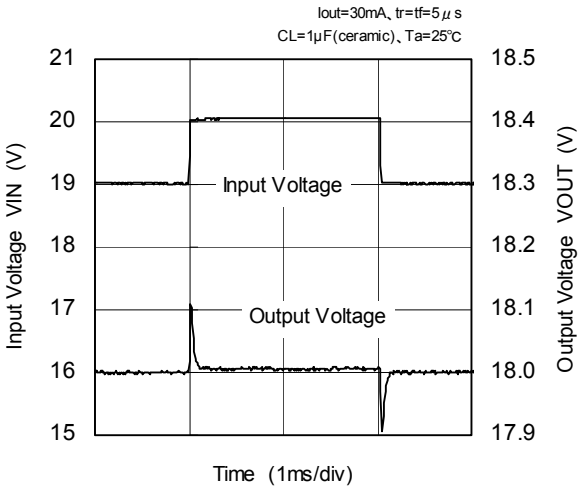


(8) Input Transient Response 2

XC6202PJ02（18V）



XC6202PJ02（18V）



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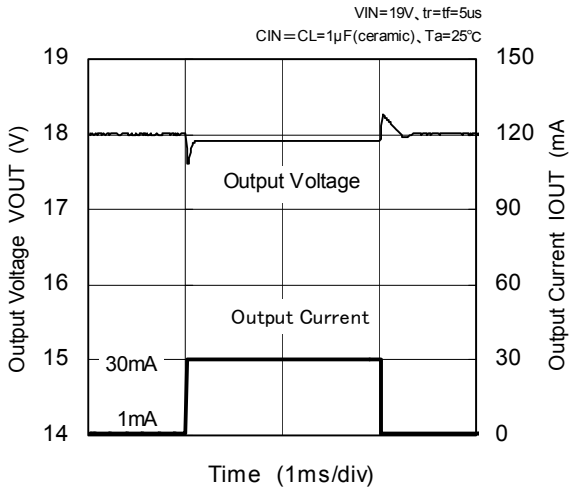
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6202PJ02 (Continued)

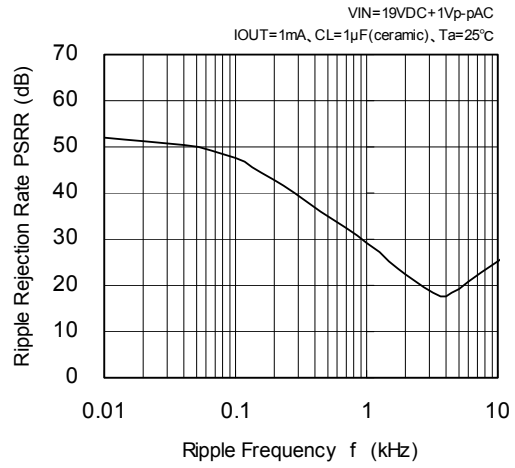
(9) Load Transient Response

XC6202PJ02（18V）

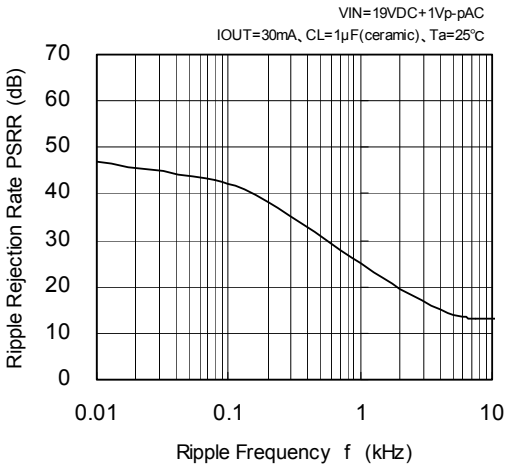


(10) Ripple Rejection Rate

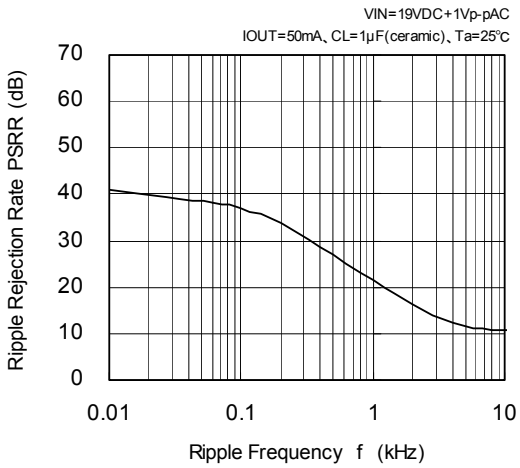
XC6202PJ02（18V）



XC6202PJ02（18V）



XC6202PJ02（18V）



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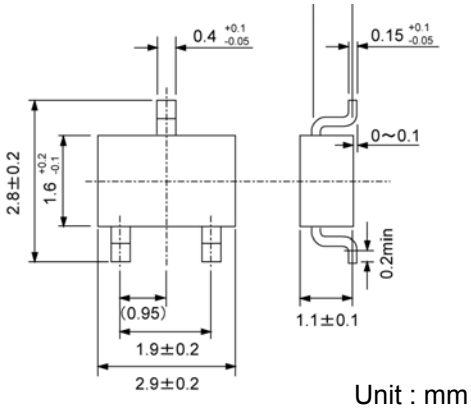
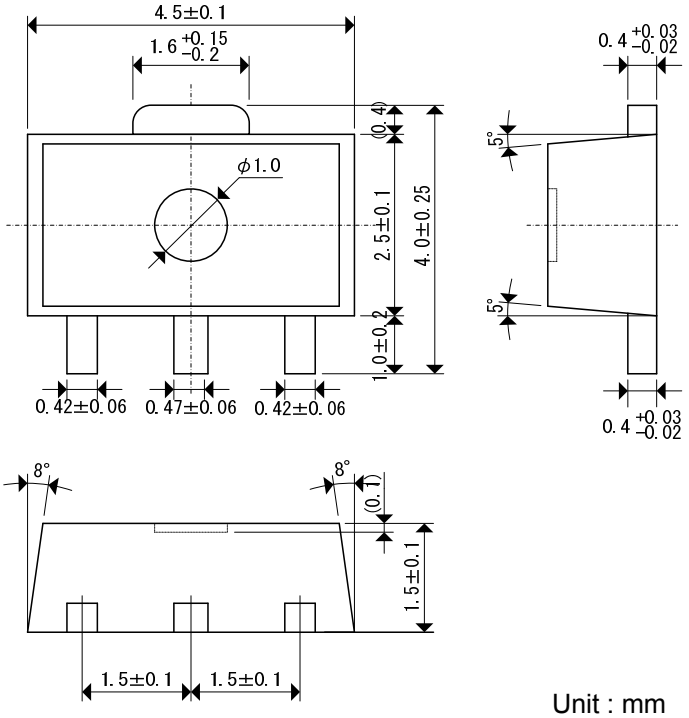
■PACKAGING INFORMATION

●SOT-23



Unit : mm

●SOT-89



Unit : mm

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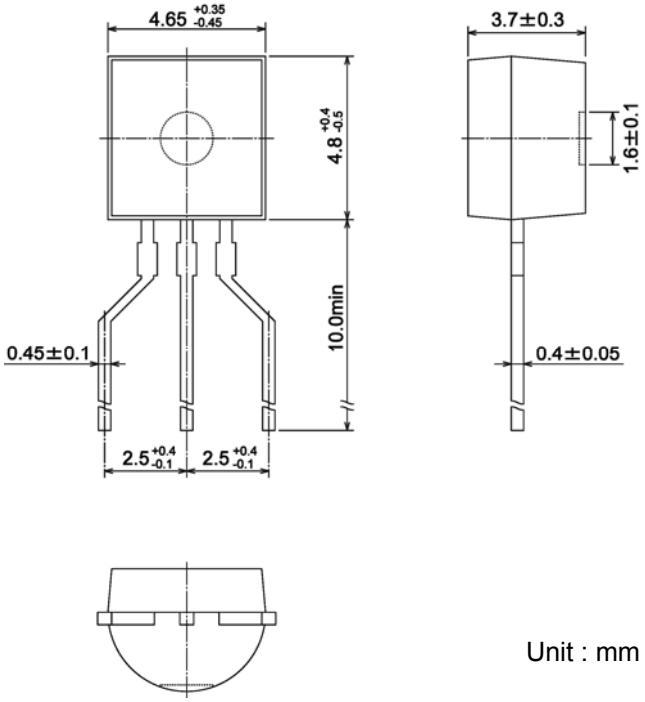
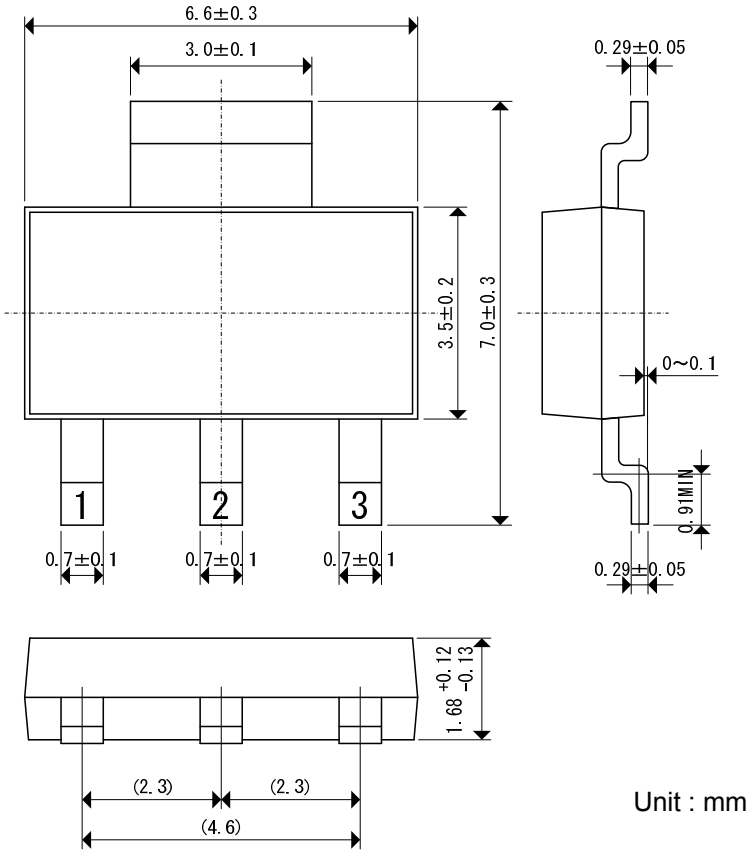
■PACKAGING INFORMATION (Continued)

●TO-92



Unit : mm

●SOT-223



Unit : mm

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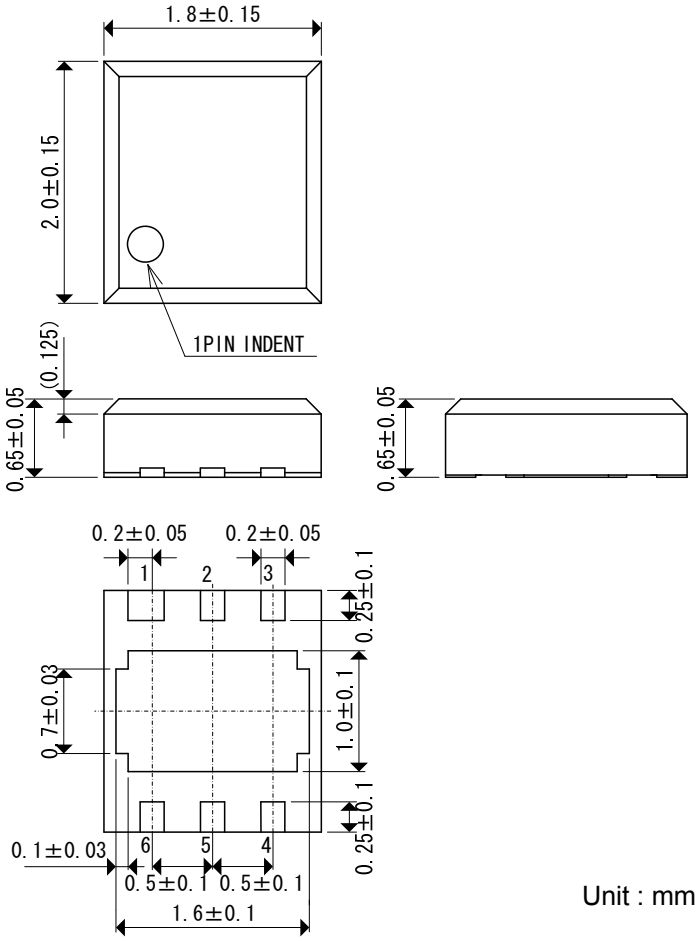
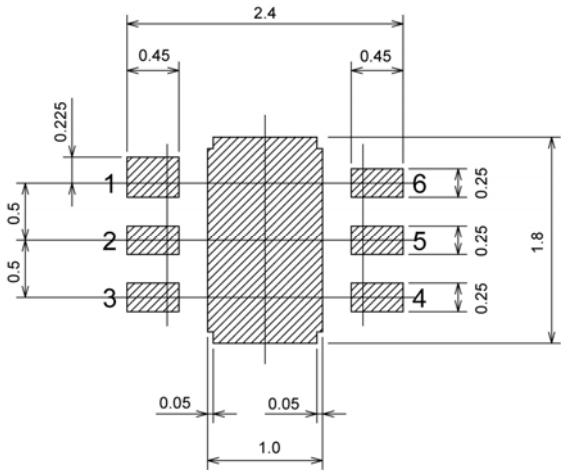
■PACKAGING INFORMATION (Continued)

●USP-6B

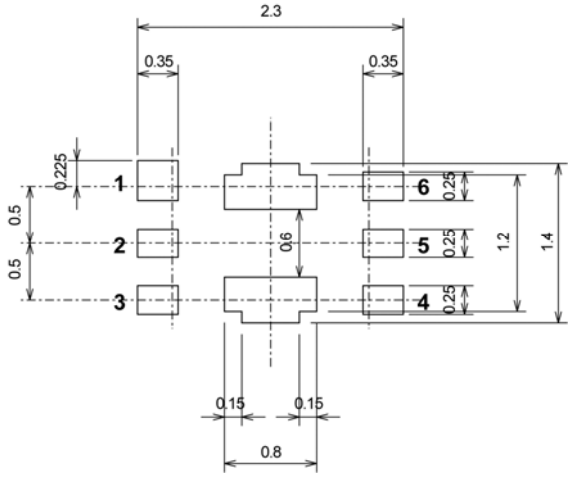


Unit : mm

●USP-6B Recommended Pattern Layout



●USP-6B Recommended Metal Mask Design



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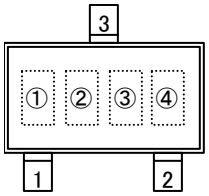
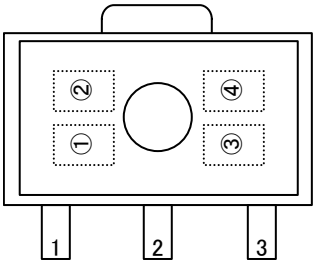
■MARKING RULE

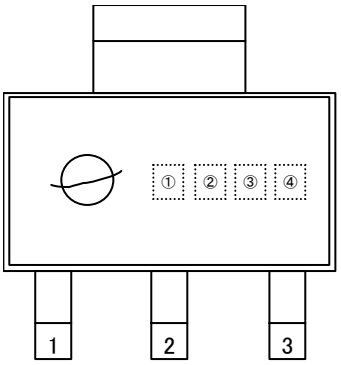
●SOT-23, SOT-89, SOT-223



SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)



SOT-223
(TOP VIEW)

①Represents product series

MARK	PRODUCT SERIES
2	XC6202Pxxxxx

②Represents output voltage range

MARK	VOLTAGE (V)	PRODUCT SERIES
4	0.1 ~ 3.0	XC6202Pxxxxx
5	3.1 ~ 6.0	
6	6.1 ~ 9.0	
7	9.1 ~ 12.0	
8	12.1 ~ 15.0	
9	15.1 ~ 18.0	

③Represents output voltage

MARK	VOLTAGE (V)						MARK	VOLTAGE (V)					
0	—	3.1	6.1	9.1	12.1	15.1	F	—	4.6	7.6	10.6	13.6	16.6
1	—	3.2	6.2	9.2	12.2	15.2	H	—	4.7	7.7	10.7	13.7	16.7
2	—	3.3	6.3	9.3	12.3	15.3	K	1.8	4.8	7.8	10.8	13.8	16.8
3	—	3.4	6.4	9.4	12.4	15.4	L	1.9	4.9	7.9	10.9	13.9	16.9
4	—	3.5	6.5	9.5	12.5	15.5	M	2.0	5.0	8.0	11.0	14.0	17.0
5	—	3.6	6.6	9.6	12.6	15.6	N	2.1	5.1	8.1	11.1	14.1	17.1
6	—	3.7	6.7	9.7	12.7	15.7	P	2.2	5.2	8.2	11.2	14.2	17.2
7	—	3.8	6.8	9.8	12.8	15.8	R	2.3	5.3	8.3	11.3	14.3	17.3
8	—	3.9	6.9	9.9	12.9	15.9	S	2.4	5.4	8.4	11.4	14.4	17.4
9	—	4.0	7.0	10.0	13.0	16.0	T	2.5	5.5	8.5	11.5	14.5	17.5
A	—	4.1	7.1	10.1	13.1	16.1	U	2.6	5.6	8.6	11.6	14.6	17.6
B	—	4.2	7.2	10.2	13.2	16.2	V	2.7	5.7	8.7	11.7	14.7	17.7
C	—	4.3	7.3	10.3	13.3	16.3	X	2.8	5.8	8.8	11.8	14.8	17.8
D	—	4.4	7.4	10.4	13.4	16.4	Y	2.9	5.9	8.9	11.9	14.9	17.9
E	—	4.5	7.5	10.5	13.5	16.5	Z	3.0	6.0	9.0	12.0	15.0	18.0

④Represents production lot number

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

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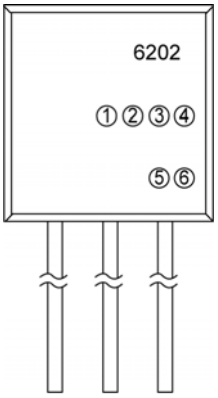
■MARKING RULE(Continued)

●TO-92



TO-92
(SIDE VIEW)

①Represents type of regulator

MARK	PRODUCT SERIES
P	XC6202Pxxxxx

②Represents integer of the output voltage

MARK	VOLTAGE (V)	PRODUCT SERIES	MARK	VOLTAGE (V)	PRODUCT SERIES
1	1.x	XC6202P1xxxx	A	10.x	XC6202PAxxxx
2	2.x	XC6202P2xxxx	B	11.x	XC6202PBxxxx
3	3.x	XC6202P3xxxx	C	12.x	XC6202PCxxxx
4	4.x	XC6202P4xxxx	D	13.x	XC6202PDxxxx
5	5.x	XC6202P5xxxx	E	14.x	XC6202PExxxx
6	6.x	XC6202P6xxxx	F	15.x	XC6202PFxxxx
7	7.x	XC6202P7xxxx	G	16.x	XC6202PGxxxx
8	8.x	XC6202P8xxxx	H	17.x	XC6202PHxxxx
9	9.x	XC6202P9xxxx	J	18.x	XC6202PJxxxx

③Represents decimal number of output voltage

MARK	VOLTAGE (V)	PRODUCT SERIES
3	x.3	XC6202Px3xxx
0	x.0	XC6202Px0xxx

④Represents detect voltage accuracy

MARK	DETECT VOLTAGE ACCURACY	PRODUCT SERIES
2	Within ±2%	XC6202Pxx2xx
1	Within ±1%	XC6202Pxx1xx

⑤Represents a least significant digit of production year

MARK	PRODUCTION YEAR
3	2003
4	2004

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

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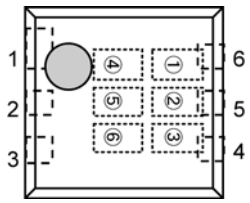
■MARKING RULE (Continued)

●USP-6B



USP-6B
(TOP VIEW)

①②Represents product series

MARK		PRODUCT SERIES
①	②	
0	2	XC6202PxxxDx

③Represents type of regulator

MARK	PRODUCT SERIES
P	XC6202Pxxxxx

④Represents integer of the output voltage

MARK	VOLTAGE (V)	PRODUCT SERIES	MARK	VOLTAGE (V)	PRODUCT SERIES
1	1.x	XC6202P1xxDx	A	10.x	XC6202PAxxDx
2	2.x	XC6202P2xxDx	B	11.x	XC6202PBxxDx
3	3.x	XC6202P3xxDx	C	12.x	XC6202PCxxDx
4	4.x	XC6202P4xxDx	D	13.x	XC6202PDxxDx
5	5.x	XC6202P5xxDx	E	14.x	XC6202PExxDx
6	6.x	XC6202P6xxDx	F	15.x	XC6202PFxxDx
7	7.x	XC6202P7xxDx	G	16.x	XC6202PGxxDx
8	8.x	XC6202P8xxDx	H	17.x	XC6202PHxxDx
9	9.x	XC6202P9xxDx	J	18.x	XC6202PJxxDx

⑤Represents decimal number of output voltage

MARK	VOLTAGE (V)	PRODUCT SERIES
3	X.3	XC6202Px3xDx
0	X.0	XC6202Px0xDx

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

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