

## High Speed "Green Operation" LDO Voltage Regulators

☆GreenOperation Compatible

### ■ GENERAL DESCRIPTION

The XC6217 series are precise, low noise, high speed, low dropout regulators with green operation (GO) function. They are fabricated using Torex's CMOS process. Performance features of the series include high ripple rejection and low dropout voltage, and the series include a reference voltage source, an error amplifier, a current limiter, and a phase compensation circuit.

GO provides high speed operation, low power consumption and high efficiencies by automatically switching between a high speed mode (HS) and a power save mode (PS) depending upon the load current level. The switching point of the GO to the output current is being fixed inside the IC. When only high-speed operation is required, it can be fixed by inputting a high level signal to the GO pin, thus providing operating conditions with the most suitable level of supply current for the application.

The CE function enables the output to be turned off resulting in greatly reduced power consumption. In this state, with the XC6217B/D series, the IC turns on the internal switch located between the  $V_{OUT}$  and  $V_{SS}$  pins. This short enables the electric charge at the output capacitor ( $C_L$ ) to be discharged via the internal auto-discharge resistance, and as a result the  $V_{OUT}$  pin quickly returns to the  $V_{SS}$  level. The series' output stabilization capacitor ( $C_L$ ) is also compatible with low ESR ceramic capacitors.

Output voltage is selectable in 0.05V increments within a range of 0.80V~4.00V, using laser trimming technologies.

The current limiter's foldback circuit also operates as a short circuit protection for the output current limiter and the output pin.

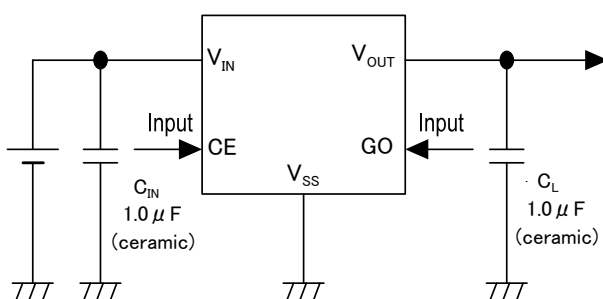
### ■ APPLICATIONS

- Cellular phones
- Cordless phones
- Wireless communication equipment
- Portable games
- Cameras, VCRs
- Portable AV equipment
- PDAs

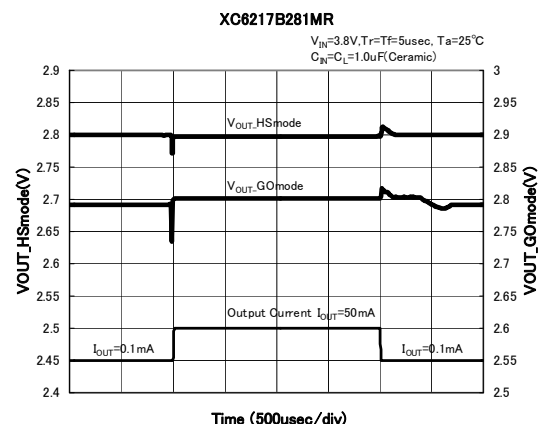
### ■ FEATURES

<b>Output Current</b>	: 200mA <Limit: 250mA (TYP.)>
<b>Dropout Voltage</b>	: 80mV @ $I_{OUT}=100mA$ , $V_{OUT}=3.0V$
<b>Operating Voltage Range</b>	: 1.6V ~ 6.0V ( $0.8V \leq V_{OUT} \leq 1.55V$ ) : 1.8V ~ 6.0V ( $1.6V \leq V_{OUT} \leq 4.0V$ )
<b>Output Voltage Range</b>	: 0.80V~4.00V (0.05V increments)
<b>Accuracy</b>	: $\pm 2\%$ (HS: $V_{OUT} \geq 2.00V$ ) (Standard) : $\pm 30mV$ (HS: $V_{OUT} \leq 1.95V$ ) (Standard) : +2.5%, -3.5% (PS: $V_{OUT} \geq 2.60V$ ) (Standard) : +3.5%, -4.5% (PS: $1.60 \leq V_{OUT} \leq 2.55V$ ) (Standard) : +70mV, -90mV (PS: $0.80 \leq V_{OUT} \leq 1.55V$ ) (Standard) : $\pm 1\%$ (HS: $V_{OUT} \geq 2.00V$ ) (High Accuracy) : $\pm 20mV$ (HS: $V_{OUT} \leq 1.95V$ ) (High Accuracy) : +1.5%, -2.5% (PS: $V_{OUT} \geq 2.60V$ ) (High Accuracy) : +2.5%, -3.5% (PS: $1.60 \leq V_{OUT} \leq 2.55V$ ) (High Accuracy) : +50mV, -70mV (PS: $0.80 \leq V_{OUT} \leq 1.55V$ ) (High Accuracy)
<b>Low Power Consumption</b>	: 4.5 $\mu A$ (TYP.) when PS mode : 25 $\mu A$ (TYP.) when HS mode
<b>Standby Current</b>	: Less than 0.1 $\mu A$
<b>High Ripple Rejection</b>	: 70dB @ 1kHz (When HS mode)
<b>Operating Temperature</b>	: -40°C~85°C
<b>Low ESR Capacitor</b>	: 1.0 $\mu F$ Ceramic capacitor
<b>Regulators with Green Operation (GO) Function</b>	
<b><math>C_L</math> High-Speed-Discharge (XC6217B/D)</b>	
<b>Packages</b>	: USP-4D, SOT-25(XC6217A/B Type) : SSOT-24,USPN-4(XC6217C/D Type)
<b>Environmentally Friendly</b>	: EU RoHS Compliant, Pb Free

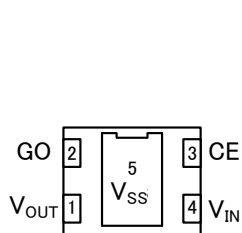
### ■ TYPICAL APPLICATION CIRCUIT



### ■ TYPICAL PERFORMANCE CHARACTERISTICS

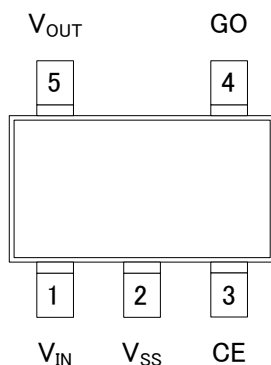


## PIN CONFIGURATION

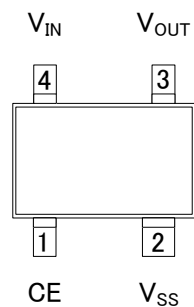


The USP-4D heat dissipation pad is recommended to solder in use of the reference mount pattern and metal mask pattern for the mounting strength and heat dissipation.

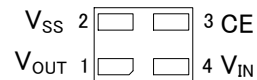
USP-4D  
(BOTTOM VIEW)



SOT-25  
(TOP VIEW)



SSOT-24  
(TOP VIEW)



USPN-4  
(BOTTOM VIEW)

The USPN-4 is recommended to solder in use of the reference mount pattern and metal mask pattern for the mounting strength.

## PIN ASSIGNMENT

PIN NUMBER				PIN NAME	FUNCTION
USP-4D	SOT-25	SSOT-24	USPN-4		
4	1	4	4	$V_{IN}$	Power Input
1	5	3	1	$V_{OUT}$	Output
2	4	–	–	GO	Green Operation Mode Switch
5	2	2	2	$V_{SS}$	Ground
3	3	1	3	CE	ON/OFF Control

\* XC6217A/B type: USP-4D package  
 XC6217A/B type: SOT-25 package  
 XC6217C/D type: SSOT-24 package  
 XC6217C/D type: USPN-4 package

## ■ PRODUCT CLASSIFICATION

● Ordering Information

XC6217①②③④⑤⑥-⑦<sup>(\*)</sup>

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION															
①	Type of Regulator	A	CE High Active, no C <sub>L</sub> discharge resistor															
		B	CE High Active, with C <sub>L</sub> discharge resistor															
		C	CE High Active, no C <sub>L</sub> discharge resistor, no GO pin															
		D	CE High Active, with C <sub>L</sub> discharge resistor, no GO pin															
② ③	Output Voltage	08 ~ 40	ex.) V <sub>OUT(T)</sub> = 3.00V → ② = 3, ③ = 0															
④	Output Accuracy	2	0.1V increments (Standard)															
			<table border="1"> <thead> <tr> <th>V<sub>OUT(T)</sub></th> <th>HS mode</th> <th>PS mode</th> </tr> </thead> <tbody> <tr> <td>0.80V ~ 1.50V</td> <td>V<sub>OUT(T)</sub> ± 30mV</td> <td>V<sub>OUT(T)</sub> +70mV, V<sub>OUT(T)</sub> -90mV</td> </tr> <tr> <td>1.60V ~ 1.90V</td> <td>V<sub>OUT(T)</sub> ± 30mV</td> <td>V<sub>OUT(T)</sub> +3.5%, V<sub>OUT(T)</sub> -4.5%</td> </tr> <tr> <td>2.00V ~ 2.50V</td> <td>V<sub>OUT(T)</sub> ± 2%</td> <td>V<sub>OUT(T)</sub> +3.5%, V<sub>OUT(T)</sub> -4.5%</td> </tr> <tr> <td>2.60V ~ 4.00V</td> <td>V<sub>OUT(T)</sub> ± 2%</td> <td>V<sub>OUT(T)</sub> +2.5%, V<sub>OUT(T)</sub> -3.5%</td> </tr> </tbody> </table>	V <sub>OUT(T)</sub>	HS mode	PS mode	0.80V ~ 1.50V	V <sub>OUT(T)</sub> ± 30mV	V <sub>OUT(T)</sub> +70mV, V <sub>OUT(T)</sub> -90mV	1.60V ~ 1.90V	V <sub>OUT(T)</sub> ± 30mV	V <sub>OUT(T)</sub> +3.5%, V <sub>OUT(T)</sub> -4.5%	2.00V ~ 2.50V	V <sub>OUT(T)</sub> ± 2%	V <sub>OUT(T)</sub> +3.5%, V <sub>OUT(T)</sub> -4.5%	2.60V ~ 4.00V	V <sub>OUT(T)</sub> ± 2%	V <sub>OUT(T)</sub> +2.5%, V <sub>OUT(T)</sub> -3.5%
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⑤⑥-⑦	Packages Taping Type <sup>(*)</sup>	GR	USP-4D (XC6217A/B type)															
		GR-G	USP-4D (XC6217A/B type)															
		MR	SOT-25 (XC6217A/B type)															
		MR-G	SOT-25 (XC6217A/B type)															
		NR	SSOT-24 (XC6217C/D type)															
		NR-G	SSOT-24 (XC6217C/D type)															
		7R-G	USPN-4 (XC6217C/Dtype)															

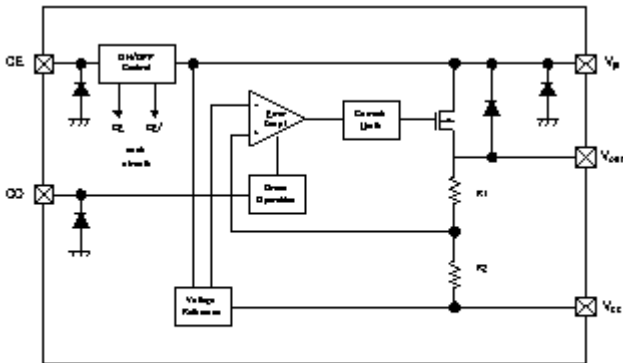
\*USPN-4 0.80V ≤ V<sub>OUT(T)</sub> ≤ 1.55V under development.

<sup>(\*)</sup> The "-G" suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

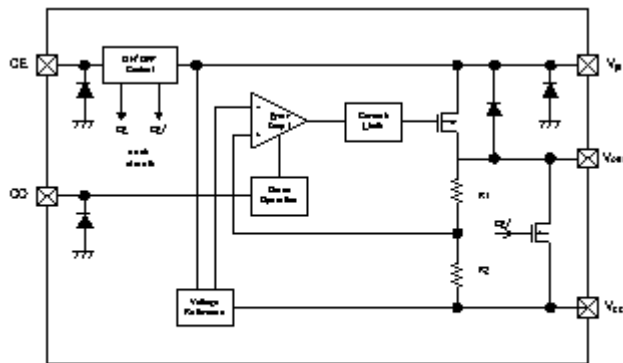
<sup>(\*)</sup> The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ⑤R-⑦, Reverse orientation: ⑤L-⑦)

## ■ BLOCK DIAGRAMS

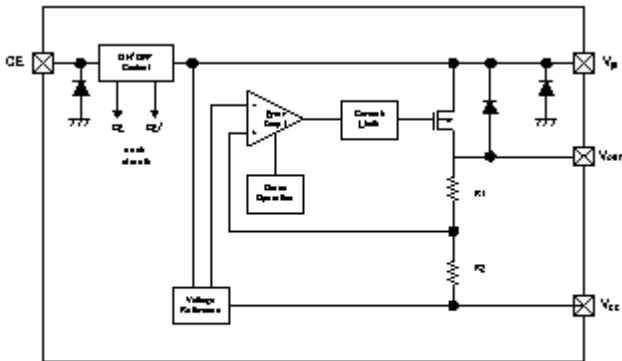
● XC6217A Series



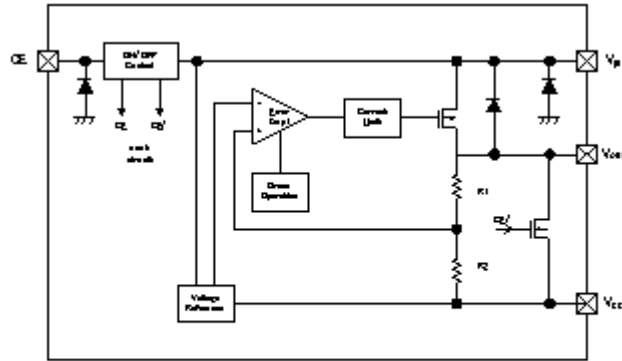
● XC6217B Series



● XC6217C Series



● XC6217D Series



\*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>	V <sub>SS</sub> -0.3 ~ +6.5	V	
Output Current	I <sub>OUT</sub>	400 *1	mA	
Output Voltage	V <sub>OUT</sub>	V <sub>SS</sub> - 0.3 ~ V <sub>IN</sub> + 0.3	V	
CE/GO Input Voltage	V <sub>CE</sub> /V <sub>GO</sub>	V <sub>SS</sub> - 0.3 ~ +6.5	V	
Power Dissipation	USP-4D SOT-25 SSOT-24 USPN-4	Pd	120	mW
			650 (PCB mounted)*2	
			250	
			150	
			100	
			600 (PCB mounted)*2	
Operational Temperature Range	Topr	- 40 ~ + 85	°C	
Storage Temperature Range	Tstg	- 55 ~ +125	°C	

\*1: I<sub>OUT</sub> ≤ Pd / (V<sub>IN</sub> - V<sub>OUT</sub>)

\*2: This power dissipation figure shown is PCB mounted and is for reference only. Please refer to page 27-28 for details.

## ■ ELECTRICAL CHARACTERISTICS

● XC6217A/B series

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage (Standard)	V <sub>OUT(E)</sub> (*2)	High Speed Mode (HS) V <sub>OUT(T)</sub> ≥ 2.00V V <sub>GO</sub> = V <sub>IN</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	x 0.98		x 1.02	V	1
		High Speed Mode (HS) V <sub>OUT(T)</sub> ≤ 1.95V V <sub>GO</sub> = V <sub>IN</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-0.03		+0.03		
		Power Save Mode (PS) V <sub>OUT(T)</sub> ≥ 2.60V V <sub>GO</sub> = V <sub>SS</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x0.965	V <sub>OUT(T)</sub> (*3)	x1.025		
		Power Save Mode (PS) 1.60V ≤ V <sub>OUT(T)</sub> ≤ 2.55V V <sub>GO</sub> = V <sub>SS</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x 0.955		x 1.035		
		Power Save Mode (PS) 0.80V ≤ V <sub>OUT(T)</sub> ≤ 1.55V V <sub>GO</sub> = V <sub>SS</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	-0.09		+0.07		
Output Voltage (High Accuracy)	V <sub>OUT(E)</sub> (*2)	High Speed Mode (HS) V <sub>OUT(T)</sub> ≥ 2.00V V <sub>GO</sub> = V <sub>IN</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	x 0.99		x 1.01	V	1
		High Speed Mode(HS) V <sub>OUT(T)</sub> ≤ 1.95V V <sub>GO</sub> = V <sub>IN</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-0.02		+0.02		
		Power Save Mode (PS) V <sub>OUT(T)</sub> ≥ 2.60V V <sub>GO</sub> = V <sub>SS</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x0.975	V <sub>OUT(T)</sub> (*3)	x1.015		
		Power Save Mode (PS), 1.60V ≤ V <sub>OUT(T)</sub> ≤ 2.55V V <sub>GO</sub> = V <sub>SS</sub> , V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x 0.965		x 1.025		
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Output Current	I <sub>OUTMAX</sub>	V <sub>GO</sub> = V <sub>IN</sub> (HS), V <sub>CE</sub> = V <sub>IN</sub> V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V 0.80V ≤ V <sub>OUT(T)</sub> ≤ 4.00V	200	250		mA	1
Load Regulation	ΔV <sub>OUT</sub>	V <sub>GO</sub> = V <sub>IN</sub> (HS), V <sub>CE</sub> = V <sub>IN</sub> 0.1mA ≤ I <sub>OUT</sub> ≤ 100mA	-	10	40	mV	1
Dropout Voltage (*4)	V <sub>dif</sub>	V <sub>GO</sub> = V <sub>IN</sub> (HS), V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 100mA		E-4		mV	1
Supply Current 1	I <sub>SS1</sub>	V <sub>CE</sub> = V <sub>IN</sub> , V <sub>GO</sub> = V <sub>IN</sub> (HS), I <sub>OUT</sub> = 0mA	-	25	50	μA	2
Supply Current 2	I <sub>SS2</sub>	V <sub>CE</sub> = V <sub>IN</sub> , V <sub>GO</sub> = V <sub>SS</sub> (PS), I <sub>OUT</sub> = 0mA	-	4.5	8.0	μA	2
Standby Current	I <sub>STB</sub>	V <sub>IN</sub> = 6.0V, V <sub>CE</sub> = V <sub>SS</sub>	-	0.01	0.10	μA	2
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	V <sub>OUT(T)</sub> + 0.5V ≤ V <sub>IN</sub> ≤ 6.0V V <sub>OUT(T)</sub> ≥ 1.10V V <sub>GO</sub> = V <sub>IN</sub> (HS), V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-	0.01	0.20	%V	1
		1.6V ≤ V <sub>IN</sub> ≤ 6.0V V <sub>OUT(T)</sub> ≤ 1.05V V <sub>GO</sub> = V <sub>IN</sub> (HS), V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA					
Input Voltage	V <sub>IN</sub>	0.80V ≤ V <sub>OUT(T)</sub> ≤ 1.55V	1.6	-	6.0	V	1
		1.60V ≤ V <sub>OUT(T)</sub> ≤ 4.00V	1.8	-	6.0		

## ■ ELECTRICAL CHARACTERISTICS (Continued)

### ● XC6217A/B series (Continued)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_a \cdot V_{OUT}}$	$V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ $I_{OUT}=30mA$ $-40^{\circ}C \leq T_a \leq 85^{\circ}C$	-	$\pm 100$	-	ppm/ $^{\circ}C$	1
Ripple Rejection Rate	PSRR	$V_{IN}=\{V_{OUT(T)}+1.0\}V_{DC}+0.5V_{p-pAC}$ $0.85V \leq V_{OUT(T)} \leq 4.00V$ $V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ $I_{OUT}=30mA$ , $f=1kHz$ $V_{IN}=1.85V_{DC}+0.5V_{p-pAC}$ $V_{OUT(T)}=0.80V$ $V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ $I_{OUT}=30mA$ , $f=1kHz$	-	70	-	dB	3
Limit Current	$I_{LIM}$	$V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$	200	250	-	mA	1
Short Current	$I_{SHORT}$	$V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ $V_{OUT}$ is short-circuited to the $V_{SS}$ level.	-	30	-	mA	1
PS Switching Current	$I_{GOR}$	$V_{CE}=V_{IN}$ $V_{GO}=V_{SS}$ (GO mode), $I_{OUT}$ : heavy to light load	0.5	-	-	mA	4
HS Switching Current	$I_{GO}$	$V_{CE}=V_{IN}$ , $V_{GO}=V_{SS}$ (GO mode), $I_{OUT}$ : light to heavy load	-	-	8.0	mA	4
Switch Current Hysteresis Range	$I_{GOhys}$	$I_{GOhys}=I_{GO}-I_{GOR}$	-	3.5	-	mA	4
PS Switching Delay Time (*7)	$t_{DPS}$	$V_{CE}=V_{IN}$ , $V_{GO}=V_{SS}$ (GO mode)	E-5			$\mu s$	4
CE High Level Voltage	$V_{CEH}$		1.2	-	6.0	V	4
GO High Level Voltage	$V_{GOH}$	$V_{CE}=V_{IN}$ , $I_{SS}$ Search, $I_{OUT}=0mA$	1.2	-	6.0	V	4
CE Low Level Voltage	$V_{CEL}$		-	-	0.3	V	4
GO Low Level Voltage	$V_{GOL}$	$V_{CE}=V_{IN}$ , $I_{SS}$ Search, $I_{OUT}=0mA$	-	-	0.3	V	4
CE High Level Current	$I_{CEH}$	$V_{GO}=V_{IN}$ , $V_{CE}=V_{IN}$	-0.1	-	0.1	$\mu A$	4
GO High Level Current	$I_{GOH}$	$V_{GO}=V_{IN}$ , $V_{CE}=V_{IN}$	-0.1	-	0.1	$\mu A$	4
CE Low Level Current	$I_{CEL}$	$V_{CE}=V_{SS}$ , $V_{GO}=V_{SS}$	-0.1	-	0.1	$\mu A$	4
GO Low Level Current	$I_{GOL}$	$V_{CE}=V_{SS}$ , $V_{GO}=V_{SS}$	-0.1	-	0.1	$\mu A$	4
CL Auto-Discharge Resistance (* 8)	$R_{DCHG}$	$V_{IN}=6.0V$ , $V_{OUT}=4.00V$ , $V_{CE}=V_{GO}=V_{SS}$	-	780	-	$\Omega$	1

#### NOTE:

- \* 1: Unless otherwise stated regarding input voltage conditions,  $V_{IN}=V_{OUT(T)}+1.0V$ .
- \* 2:  $V_{OUT(E)}$  = Effective output voltage (Refer to the voltage chart E-0 to E-3)  
(I.e. the output voltage when an amply stabilized " $V_{OUT(T)}+1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value.)
- \* 3:  $V_{OUT(T)}$  = Nominal output voltage
- \* 4:  $V_{dif}=\{V_{IN1}(*6)-V_{OUT1}(*5)\}$
- \* 5:  $V_{OUT1}$ =A voltage equal to 98% of the output voltage whenever an amply stabilized  $I_{OUT}$   $\{V_{OUT(T)}+1.0V\}$  is input in the HS mode.
- \* 6:  $V_{IN1}$ =The input voltage when  $V_{OUT1}$  appears as input voltage is gradually decreased.
- \* 7: Time until HS mode is changed to PS mode by  $I_{GOR}$
- \* 8: For the XC6217B series only. The XC6217A series discharges by resistors R1 and R2 only as shown in the block diagrams.

## ■ ELECTRICAL CHARACTERISTICS (Continued)

● XC6217C/D series

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage (Standard)	V <sub>OUT(E)</sub> (* 2)	High Speed Mode (HS) V <sub>OUT(T)</sub> ≥ 2.00V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	x 0.98 (*3)		x 1.02	V	1
		High Speed Mode(HS) V <sub>OUT(T)</sub> ≤ 1.95V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-0.03 (*3)		+0.03		
		Power Save Mode (PS) V <sub>OUT(T)</sub> ≥ 2.60V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x0.965 (*3)	V <sub>OUT(T)</sub> (*3)	x1.025		
		Power Save Mode (PS) 1.60V ≤ V <sub>OUT(T)</sub> ≤ 2.55V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x 0.955 (*3)		x 1.035		
		Power Save Mode(PS) 0.80V ≤ V <sub>OUT(T)</sub> ≤ 1.55V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	-0.09 (*3)		+0.07		
Output Voltage (High Accuracy)	V <sub>OUT(E)</sub> (* 2)	High Speed Mode (HS) V <sub>OUT(T)</sub> ≥ 2.00V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	x 0.99		x 1.01	V	1
		High Speed Mode(HS) V <sub>OUT(T)</sub> ≤ 1.95V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-0.02		+0.02		
		Power Save Mode (PS) V <sub>OUT(T)</sub> ≥ 2.60V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x0.975	V <sub>OUT(T)</sub> (*3)	x1.015		
		Power Save Mode (PS) 1.60V ≤ V <sub>OUT(T)</sub> ≤ 2.55V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	x 0.965		x 1.025		
		Power Save Mode(PS) 0.80V ≤ V <sub>OUT(T)</sub> ≤ 1.55V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0.1mA	-0.07		+0.05		
Output Current	I <sub>OUTMAX</sub>	V <sub>CE</sub> = V <sub>IN</sub> , V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, 0.80V ≤ V <sub>OUT(T)</sub> ≤ 4.00V	200	250	-	mA	1
Load Regulation	ΔV <sub>OUT</sub>	V <sub>CE</sub> = V <sub>IN</sub> , 8mA ≤ I <sub>OUT</sub> ≤ 100mA	-	10	40	mV	1
Dropout Voltage (*4)	V <sub>dif</sub>	V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 100mA	E-4			mV	1
Supply Current 1	I <sub>SS1</sub>	V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 8mA	-	25	50	μA	4
Supply Current 2	I <sub>SS2</sub>	V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 0mA	-	4.5	8.0	μA	2
Standby Current	I <sub>STBY</sub>	V <sub>IN</sub> = 6.0V, V <sub>CE</sub> = V <sub>SS</sub>	-	0.01	0.10	μA	2
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	V <sub>OUT(T)</sub> + 0.5V ≤ V <sub>IN</sub> ≤ 6.0V V <sub>OUT(T)</sub> ≥ 1.10V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA	-	0.01	0.20	% / V	1
		1.6V ≤ V <sub>IN</sub> ≤ 6.0V V <sub>OUT(T)</sub> ≤ 1.05V V <sub>CE</sub> = V <sub>IN</sub> , I <sub>OUT</sub> = 10mA					
Input Voltage	V <sub>IN</sub>	0.80V ≤ V <sub>OUT(T)</sub> ≤ 1.55V	1.6	-	6.0	V	1
		1.60V ≤ V <sub>OUT(T)</sub> ≤ 4.00V	1.8	-	6.0		

## ELECTRICAL CHARACTERISTICS (Continued)

### XC6217C/D series (Continued)

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_a \cdot V_{OUT}}$	$V_{CE}=V_{IN}, I_{OUT}=30mA$ $-40^\circ C \leq T_a \leq 85^\circ C$	-	$\pm 100$	-	ppm/°C	1
Ripple Rejection Rate	PSRR	$V_{IN}=(V_{OUT(T)}+1.0)V_{DC}+0.5V_{P-PAC}$ $0.85V \leq V_{OUT(T)} \leq 4.00V$ $V_{CE}=V_{IN}, I_{OUT}=30mA, f=1kHz$ $V_{IN}=1.85V_{DC}+0.5V_{P-PAC}$ $V_{OUT(T)}=0.80V$ $V_{CE}=V_{IN}, I_{OUT}=30mA, f=1kHz$	-	70	-	dB	3
Limit Current	$I_{LIM}$	$V_{CE}=V_{IN}$	200	250	-	mA	1
Short Current	$I_{SHORT}$	$V_{CE}=V_{IN}$ $V_{OUT}$ is short-circuited at the $V_{SS}$ level.	-	30	-	mA	1
PS Switching Current	$I_{GOR}$	$V_{CE}=V_{IN}, I_{OUT}$ : heavy to light load	0.5	-	-	mA	4
HS Switching Current	$I_{GO}$	$V_{CE}=V_{IN}, I_{OUT}$ : light to heavy load	-	-	8.0	mA	4
Switch Current Hysteresis Range	$I_{GOhys}$	$I_{GOhys}=I_{GO} - I_{GOR}$	-	3.5	-	mA	4
PS Switching Delay Time (*7)	$t_{DPS}$	$V_{CE}=V_{IN}$	E-5			$\mu s$	4
CE High Level Voltage	$V_{CEH}$		1.2	-	6.0	V	4
CE Low Level Voltage	$V_{CEL}$		-	-	0.3	V	4
CE High Level Current	$I_{CEH}$	$V_{CE}=V_{IN}$	-0.1	-	0.1	$\mu A$	4
CE Low Level Current	$I_{CEL}$	$V_{CE}=V_{SS}$	-0.1	-	0.1	$\mu A$	4
CL Auto-Discharge Resistance (*8)	$R_{DCHG}$	$V_{IN}=6.0V, V_{OUT}=4.00V, V_{CE}=V_{SS}$	-	780	-	$\Omega$	1

#### NOTE:

- \* 1: Unless otherwise stated regarding input voltage conditions,  $V_{IN}=V_{OUT(T)}+1.0V$ .
- \* 2:  $V_{OUT(E)}$  = Effective output voltage (Refer to the voltage chart E-0 to E-3 chart)  
(I.e. the output voltage when an amply stabilized " $V_{OUT(T)}+1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value.)
- \* 3:  $V_{OUT(T)}$  = Nominal output voltage
- \* 4:  $V_{dif}=(V_{IN1}(*6)-V_{OUT1}(*5))$
- \* 5:  $V_{OUT1}$ =A voltage equal to 98% of the output voltage whenever an amply stabilized  $I_{OUT}$  ( $V_{OUT(T)}+1.0V$ ) is input in the HS mode.
- \* 6:  $V_{IN1}$ =The input voltage when  $V_{OUT1}$  appears as input voltage is gradually decreased.
- \* 7: Time until HS mode is changed to PS mode by  $I_{GOR}$
- \* 8: For the XC6217D series only. The XC6217C series discharges by resistors R1 and R2 only as shown in the block diagrams.

## ■ OUTPUT VOLTAGE CHART

SYMBOL	E-0		E-1		E-2		E-3	
NOMINAL OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE (HS MODE) Standard (V)		OUTPUT VOLTAGE (PS MODE) Standard (V)		OUTPUT VOLTAGE (HS MODE) High Accuracy (V)		OUTPUT VOLTAGE (PS MODE) High Accuracy (V)	
V <sub>OUT(T)</sub>	V <sub>OUT(E)</sub>		V <sub>OUT(E)</sub>		V <sub>OUT(E)</sub>		V <sub>OUT(E)</sub>	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
0.80	0.7700	0.8300	0.7100	0.8700	0.7800	0.8200	0.7300	0.8500
0.85	0.8200	0.8800	0.7600	0.9200	0.8300	0.8700	0.7800	0.9000
0.90	0.8700	0.9300	0.8100	0.9700	0.8800	0.9200	0.8300	0.9500
0.95	0.9200	0.9800	0.8600	1.0200	0.9300	0.9700	0.8800	1.0000
1.00	0.9700	1.0300	0.9100	1.0700	0.9800	1.0200	0.9300	1.0500
1.05	1.0200	1.0800	0.9600	1.1200	1.0300	1.0700	0.9800	1.1000
1.10	1.0700	1.1300	1.0100	1.1700	1.0800	1.1200	1.0300	1.1500
1.15	1.1200	1.1800	1.0600	1.2200	1.1300	1.1700	1.0800	1.2000
1.20	1.1700	1.2300	1.1100	1.2700	1.1800	1.2200	1.1300	1.2500
1.25	1.2200	1.2800	1.1600	1.3200	1.2300	1.2700	1.1800	1.3000
1.30	1.2700	1.3300	1.2100	1.3700	1.2800	1.3200	1.2300	1.3500
1.35	1.3200	1.3800	1.2600	1.4200	1.3300	1.3700	1.2800	1.4000
1.40	1.3700	1.4300	1.3100	1.4700	1.3800	1.4200	1.3300	1.4500
1.45	1.4200	1.4800	1.3600	1.5200	1.4300	1.4700	1.3800	1.5000
1.50	1.4700	1.5300	1.4100	1.5700	1.4800	1.5200	1.4300	1.5500
1.55	1.5200	1.5800	1.4600	1.6200	1.5300	1.5700	1.4800	1.6000
1.60	1.5700	1.6300	1.5280	1.6560	1.5800	1.6200	1.5440	1.6400
1.65	1.6200	1.6800	1.5758	1.7078	1.6300	1.6700	1.5923	1.6913
1.70	1.6700	1.7300	1.6235	1.7595	1.6800	1.7200	1.6405	1.7425
1.75	1.7200	1.7800	1.6713	1.8113	1.7300	1.7700	1.6888	1.7938
1.80	1.7700	1.8300	1.7190	1.8630	1.7800	1.8200	1.7370	1.8450
1.85	1.8200	1.8800	1.7668	1.9148	1.8300	1.8700	1.7853	1.8963
1.90	1.8700	1.9300	1.8145	1.9665	1.8800	1.9200	1.8335	1.9475
1.95	1.9200	1.9800	1.8623	2.0183	1.9300	1.9700	1.8818	1.9998
2.00	1.9600	2.0400	1.9100	2.0700	1.9800	2.0200	1.9300	2.0500
2.05	2.0090	2.0910	1.9578	2.1218	2.0295	2.0705	1.9783	2.1013
2.10	2.0850	2.1420	2.0055	2.1735	2.0790	2.1210	2.0265	2.1525
2.15	2.1070	2.1930	2.0533	2.2253	2.1285	2.1715	2.0748	2.2038
2.20	2.1560	2.2440	2.1010	2.2770	2.1780	2.2220	2.1230	2.2550
2.25	2.2050	2.2950	2.1488	2.3288	2.2275	2.2725	2.1713	2.3063
2.30	2.2540	2.3460	2.1965	2.3805	2.2770	2.3230	2.2195	2.3575
2.35	2.3030	2.3970	2.2443	2.4323	2.3265	2.3735	2.2678	2.4088
2.40	2.3520	2.4480	2.2920	2.4840	2.3760	2.4240	2.3160	2.4600
2.45	2.4010	2.4990	2.3398	2.5358	2.4255	2.4745	2.3646	2.5113
2.50	2.4500	2.5500	2.3875	2.5875	2.4750	2.5250	2.4125	2.5625
2.55	2.4990	2.6010	2.4353	2.6393	2.5245	2.5755	2.4608	2.6138
2.60	2.5480	2.6520	2.5090	2.6650	2.5740	2.6260	2.5350	2.6390
2.65	2.5970	2.7030	2.5573	2.7163	2.6235	2.6765	2.5838	2.6898
2.70	2.6460	2.7540	2.6055	2.7675	2.6730	2.7270	2.6325	2.7405
2.75	2.6950	2.8050	2.6538	2.8188	2.7225	2.7775	2.6813	2.7913
2.80	2.7440	2.8560	2.7020	2.8700	2.7720	2.8280	2.7300	2.8420
2.85	2.7930	2.9070	2.7503	2.9213	2.8215	2.8785	2.7788	2.8928
2.90	2.8420	2.9580	2.7985	2.9725	2.8710	2.9290	2.8275	2.9435
2.95	2.8910	3.0090	2.8468	3.0238	2.9205	2.9795	2.8763	2.9943

\*USPN-4 0.80V ≤ V<sub>OUT(T)</sub> ≤ 1.55V underdevelopment.

## ■ OUTPUT VOLTAGE CHART (Continued)

SYMBOL	E-0		E-1		E-2		E-3	
NOMINAL OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE (HS MODE) Standard (V)		OUTPUT VOLTAGE (PS MODE) Standard (V)		OUTPUT VOLTAGE (HS MODE) High Accuracy (V)		OUTPUT VOLTAGE (PS MODE) High Accuracy (V)	
$V_{OUT(T)}$	$V_{OUT(E)}$		$V_{OUT(E)}$		$V_{OUT(E)}$		$V_{OUT(E)}$	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
3.00	2.9400	3.0600	2.8950	3.0750	2.9700	3.0300	2.9250	3.0450
3.05	2.8990	3.1100	2.9433	3.1263	3.0195	3.0805	2.9738	3.0958
3.10	3.0380	3.1620	2.9915	3.1775	3.0690	3.1310	3.0225	3.1465
3.15	3.0870	3.2130	3.0398	3.2288	3.1185	3.1815	3.0713	3.1973
3.20	3.1360	3.2640	3.0880	3.2800	3.1680	3.2320	3.1200	3.2480
3.25	3.1850	3.3150	3.1363	3.3313	3.2175	3.2825	3.1688	3.2988
3.30	3.2340	3.3660	3.1845	3.3825	3.2670	3.3330	3.2175	3.3495
3.35	3.2830	3.4170	3.2328	3.4338	3.3165	3.3835	3.2663	3.4003
3.40	3.3320	3.4680	3.2810	3.4850	3.3660	3.4340	3.3150	3.4510
3.45	3.3810	3.5190	3.3293	3.5363	3.4155	3.4845	3.3638	3.5018
3.50	3.4300	3.570	3.3775	3.5875	3.4650	3.5350	3.4125	3.5525
3.55	3.4790	3.6210	3.4258	3.6388	3.5145	3.5855	3.4613	3.6033
3.60	3.5280	3.6720	3.4740	3.6900	3.5640	3.6360	3.5100	3.6540
3.65	3.5770	3.7230	3.5223	3.7413	3.6135	3.6855	3.5588	3.7048
3.70	3.6260	3.7740	3.5705	3.7925	3.6630	3.7370	3.6075	3.7555
3.75	3.6750	3.8250	3.6188	3.8438	3.7125	3.7875	3.6563	3.8063
3.80	3.7240	3.8760	3.6670	3.8950	3.7620	3.8380	3.7050	3.8570
3.85	3.7730	3.9270	3.7153	3.9463	3.8115	3.8885	3.7538	3.9078
3.90	3.8220	3.9780	3.7635	3.9975	3.8610	3.9390	3.8025	3.9585
3.95	3.8710	4.0290	3.8118	4.0488	3.9105	3.9895	3.8513	4.0093
4.00	3.9200	4.0800	3.8600	4.1000	3.9600	4.0400	3.9000	4.0600

## ■ DROPOUT VOLTAGE CHART

SYMBOL	E-4		E-5					
NOMINAL OUTPUT VOLTAGE (V)	DROPOUT VOLTAGE V <sub>dif</sub> (mV)		PS SWITCHING DELAY TIME (GO MODE) ( $\mu$ s)					
V <sub>OUT(T)</sub>	V <sub>dif</sub>		t <sub>DPS</sub>					
	TYP.	MAX.	MAX					
0.80	500	850	850					
0.85								
0.90	410	720		850				
0.95								
1.00	330	650			850			
1.05								
1.10								
1.15								
1.20	230	410				850		
1.30								
1.35								
1.40	200	360					850	
1.45								
1.50	160	290						850
1.55								
1.60	160	250	850					
1.65								
1.70								
1.75								
1.80	125	210		850				
1.85								
1.90								
1.95								
2.00	115	195			850			
2.05								
2.10								
2.15								
2.20								
2.25								
2.30								
2.35								
2.40	95	170	1200					
2.45								
2.50								
2.55								
2.60								
2.65								
2.70								
2.75								
2.80								
2.85								
2.90								
2.95								

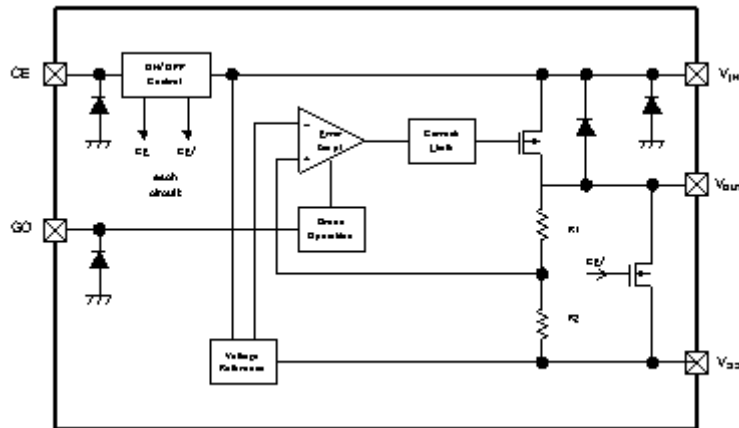
\*USPN-4 0.80V  $\leq$  V<sub>OUT(T)</sub>  $\leq$  1.55V underdevelopment.

SYMBOL	E-4		E-5
NOMINAL OUTPUT VOLTAGE (V)	DROPOUT VOLTAGE V <sub>dif</sub> (mV)		PS SWITCHING DELAY TIME (GO MODE) ( $\mu$ s)
V <sub>OUT(T)</sub>	V <sub>dif</sub>		t <sub>DPS</sub>
	TYP.	MAX.	MAX
3.00	80	140	1200
3.05			
3.10			
3.15			
3.20			
3.25			
3.30			
3.35			
3.40			
3.45			
3.50			
3.55			
3.60			
3.65			
3.70			
3.75			
3.80			
3.85			
3.90			
3.95			
4.00			

## OPERATIONAL EXPLANATION

### <Output Voltage Control>

The voltage divided by resistors R1 & R2 is compared with the internal reference voltage by the error amplifier. The P-channel MOSFET, which is connected to the V<sub>OUT</sub> pin, is then driven by the subsequent output signal. The output voltage at the V<sub>OUT</sub> pin is controlled & stabilized by a system of negative feedback. The current limit circuit and short protect circuit operate in relation to the level of output current. The GO function monitors the output current and switches a supply current to two values according to the level of output current. Further, the IC's internal circuitry can be shutdown via the CE pin's signal.



### <Green Operation>

XC6217A and B series can be set as a fixed high-speed mode or a green operation (GO) mode via a signal to the green operation (GO) pin. Under the condition that the GO pin becomes low level, the IC operates in the GO mode and the IC operates in the fixed high-speed mode when the GO pin is at high level. The GO mode enables the IC to switch automatically the supply current to the high speed (HS) mode or the power save (PS) mode according to the level of output current. While having both high-speed operation and low supply current state, the series can acquire high efficiency. At the HS/PS automatic switching mode (GO mode), the switching point of the HS mode and the PS mode is being fixed inside the IC. When the output current becomes I<sub>GOR</sub> 0.5mA (MIN.) or below, the mode changes automatically to the PS mode after the delay time of hundreds μsec(s), and it can reduce supply current in light load. Also when the output current becomes I<sub>GO</sub> 8mA (MAX.) or more, the mode changes automatically to the HS mode and the IC becomes high speed operation. When the XC6217 is used in the GO mode, stable operation range is over 8.0mA in HS mode and below 0.5mA in PS mode.

### <Low ESR capacitor>

With the XC6217 series, a stable output voltage is achievable even if used with low ESR capacitors, as a phase compensation circuit is built-in. Values required for the phase compensation are as the chart below. In order to ensure the stable phase compensation while avoiding run-out of values, please use the capacitor which does not depend on bias or temperature too much. For a stable power input, please connect an input capacitor (C<sub>IN</sub>) of 1.0 μF between the V<sub>IN</sub> pin and the V<sub>SS</sub> pin.

• Excluding USPN-4

OUTPUT VOLTAGE (V)	OUTPUT CAPACITOR VALUE
0.8 ~ 1.15	More than C <sub>L</sub> =4.7 μF
1.2 ~ 1.35	More than C <sub>L</sub> =2.2 μF
1.4 ~ 4.0	More than C <sub>L</sub> =1.0 μF

• USPN-4

OUTPUT VOLTAGE (V)	OUTPUT CAPACITOR VALUE
1.6 ~ 4.0	More than C <sub>L</sub> =2.2 μF

#### <C<sub>L</sub> Auto-Discharge Function>

XC6217B/D series can quickly discharge the electric charge at the output capacitor (C<sub>L</sub>), when a low signal to the CE pin, which enables a whole IC circuit put into OFF state, is inputted via the N-channel transistor located between the V<sub>OUT</sub> pin and the V<sub>SS</sub> pin (cf. BLOCK DIAGRAM). The C<sub>L</sub> auto-discharge resistance value is fixed to 780 Ω (V<sub>IN</sub>=6.0V, V<sub>OUT</sub>=4.0V at typical). The discharge time of the output capacitor (C<sub>L</sub>) is set by the C<sub>L</sub> auto-discharge resistance (R) and the output capacitor (C<sub>L</sub>). By setting time constant of a CL auto-discharge resistance value [R<sub>DCHG</sub>] and an output capacitor value (C<sub>L</sub>) as  $\tau$  ( $\tau = C \times R_{DCHG}$ ), the output voltage after discharge via the N channel transistor is calculated by the following formulas.

$$V = V_{OUT(E)} \times e^{-t/\tau}, \quad \text{or} \quad t = \tau \ln ( V / V_{OUT(E)} )$$

( V : Output voltage after discharge, V<sub>OUT(E)</sub> : Output voltage, t: Discharge time,  
 $\tau$  : C<sub>L</sub> auto-discharge resistance R<sub>DCHG</sub> × Output capacitor (C<sub>L</sub>) value C)

#### <Current Limiter, Short-Circuit Protection>

The XC6217 series' foldback circuit operates as an output current limiter and a short protection of the output pin. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, output voltage drops further and output current decreases. When the output pin is shorted to the V<sub>SS</sub> level, a current of about 30mA flows.

#### <CE Pin>

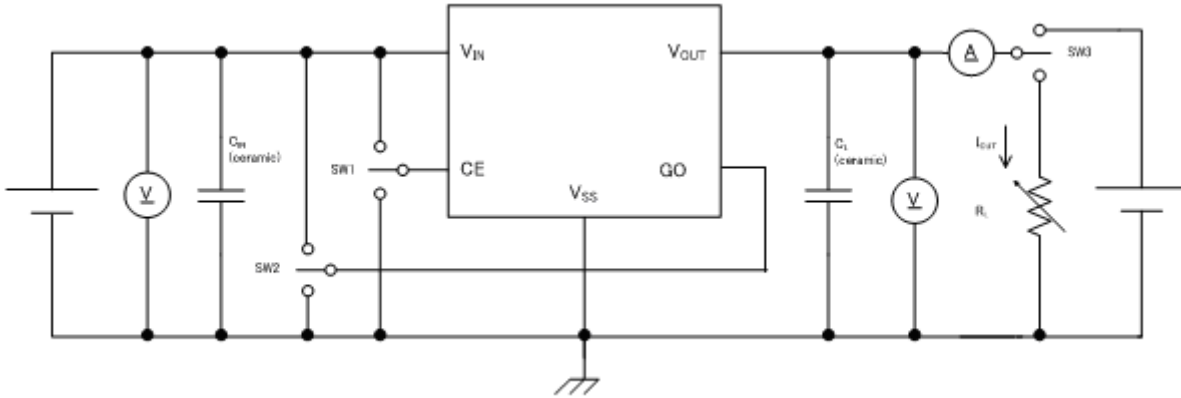
The IC's internal circuitry can be shutdown via the signal from the CE pin with the XC6217 series. In shutdown mode, output at the V<sub>OUT</sub> pin will be pulled down to the V<sub>SS</sub> level via R1 & R2. However, as for the XC6217B/D series, the C<sub>L</sub> auto-discharge resistor is connected in parallel to R1 and R2 while the power supply is applied to the V<sub>IN</sub> pin. Therefore, time until the V<sub>OUT</sub> pin reaches the V<sub>SS</sub> level becomes short. The output voltage becomes unstable, when the CE pin is open. If this IC is used with the correct output voltage for the CE pin, the logic is fixed and the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry when medium voltage is input.

## ■ NOTES ON USE

1. Please use this IC within the stated absolute maximum ratings. The IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen V<sub>IN</sub> and V<sub>SS</sub> wiring in particular.
3. Please wire the input capacitor (C<sub>IN</sub>) and the output capacitor (C<sub>L</sub>) as close to the IC as possible.

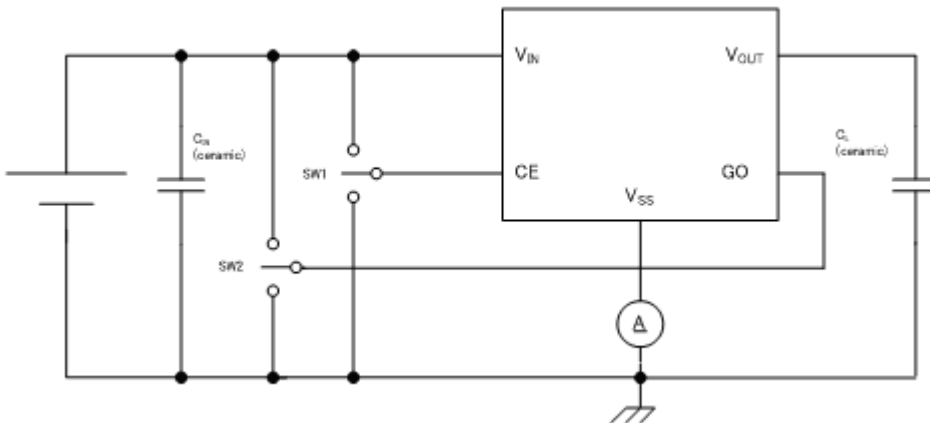
## TEST CIRCUITS

Circuit 1: Output Voltage, Output Current, Dropout Voltage, Input/Operating Voltage, Line Regulation, Load Regulation, Current Limit, Short Current,  $C_L$  Discharge Resistance



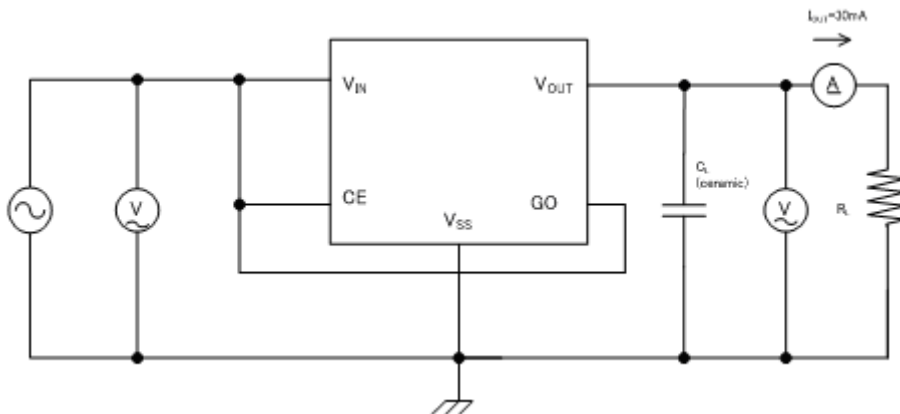
\*No GO pin with the XC6217C/D types.

Circuit 2: Supply Current, Standby Current



\*No GO pin with the XC6217C/D types.

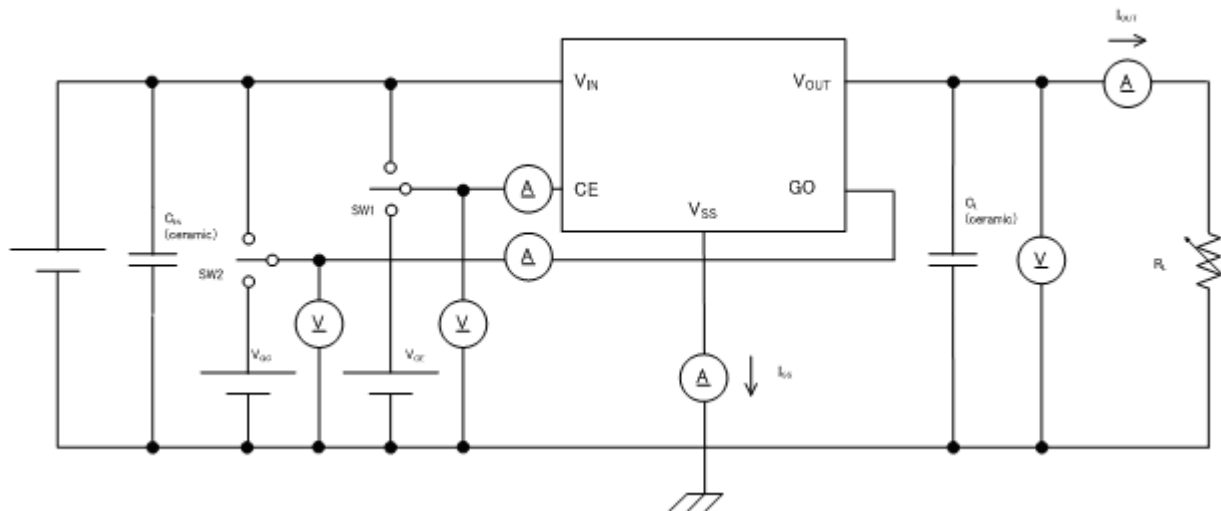
Circuit 3: Ripple Rejection Rate



\*No GO pin with the XC6217C/D types.

## ■ TEST CIRCUITS (Continued)

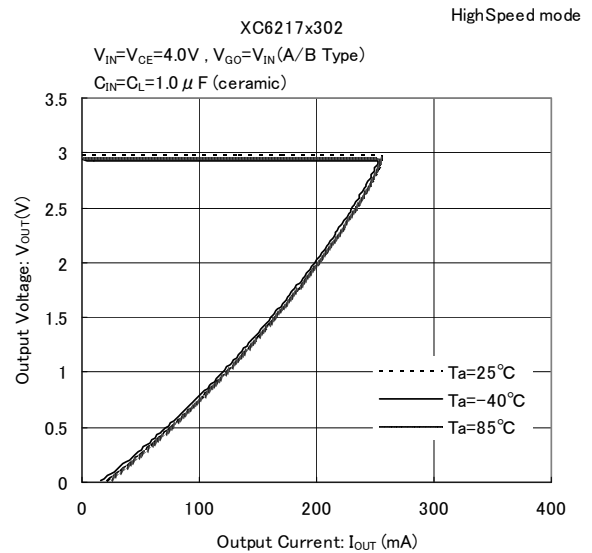
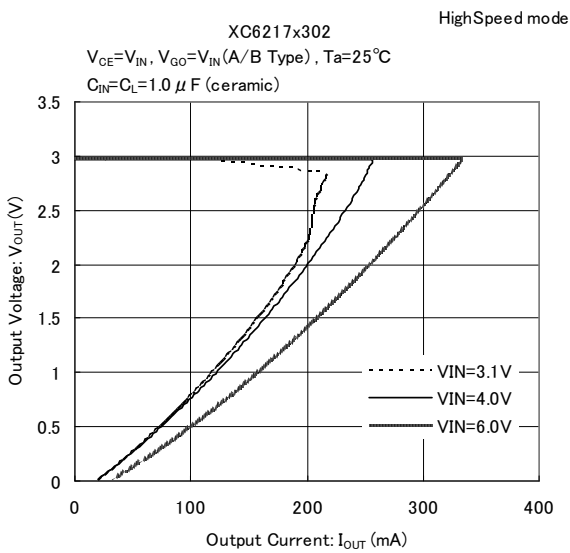
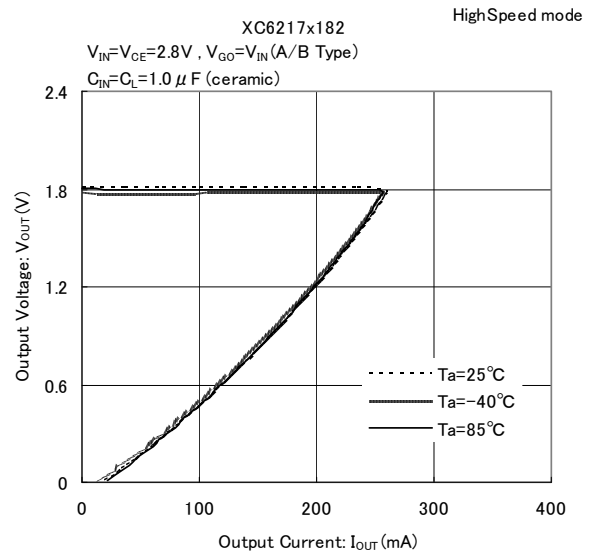
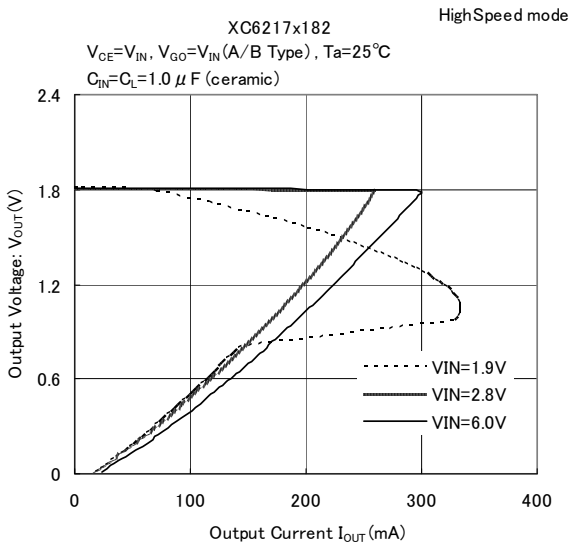
Circuit 4: Supply Current, HS/PS Switching Current, PS Switching Delay Time, CE/GO "H" "L" Level Voltage, CE/GO "H" "L" Level Current



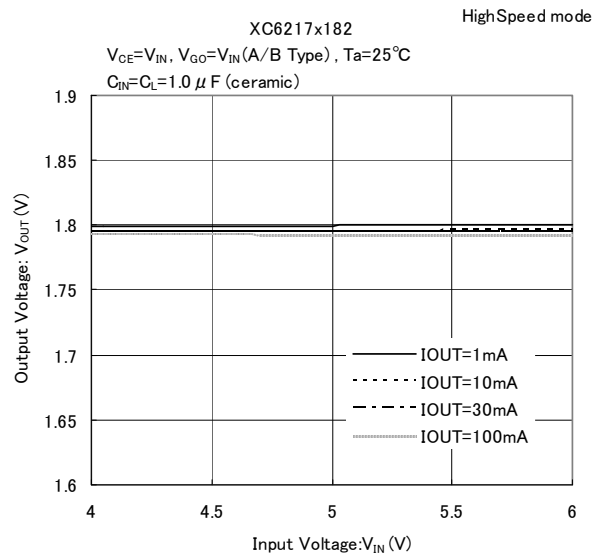
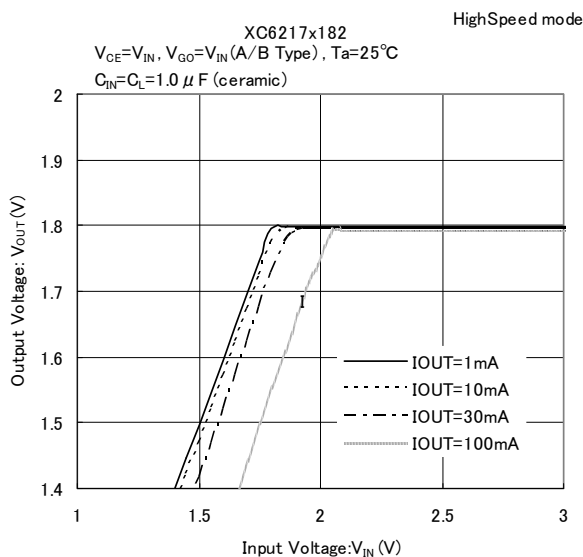
\*No GO pin with the XC6217C/D types.

## TYPICAL PERFORMANCE CHARACTERISTICS

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

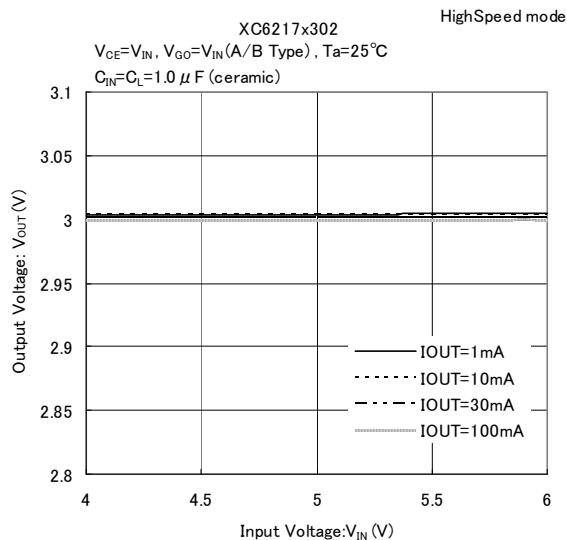
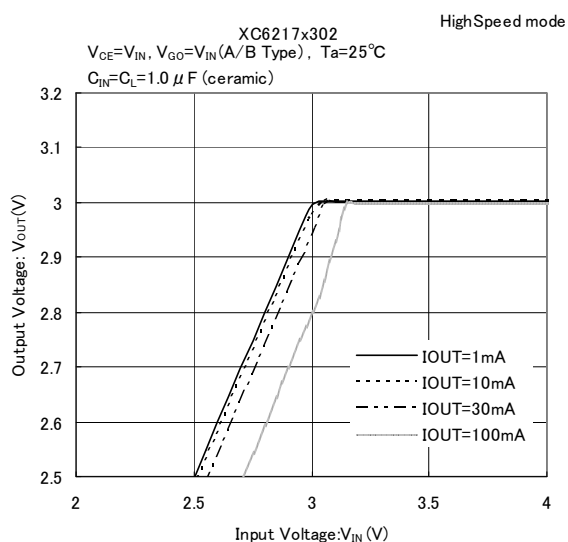


### (2) Output Voltage vs. Input Voltage

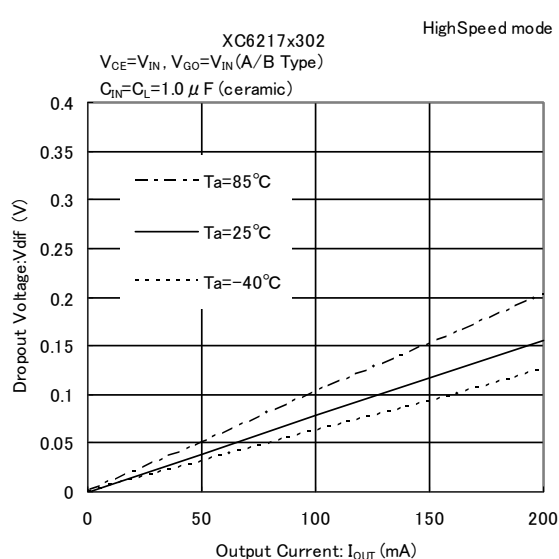
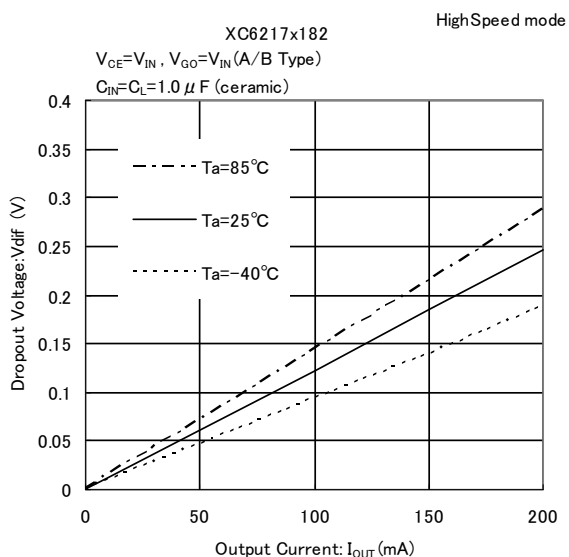


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

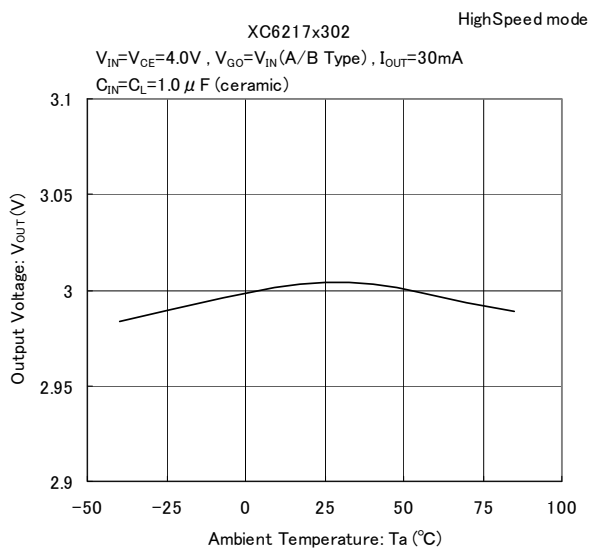
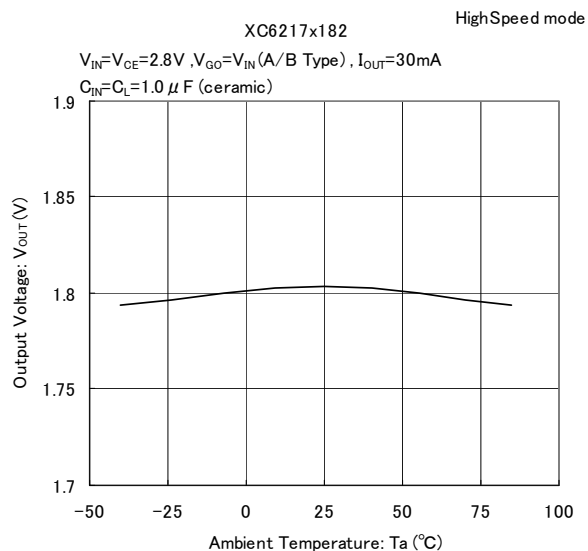
### (2) Output Voltage vs. Input Voltage (Continued)



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

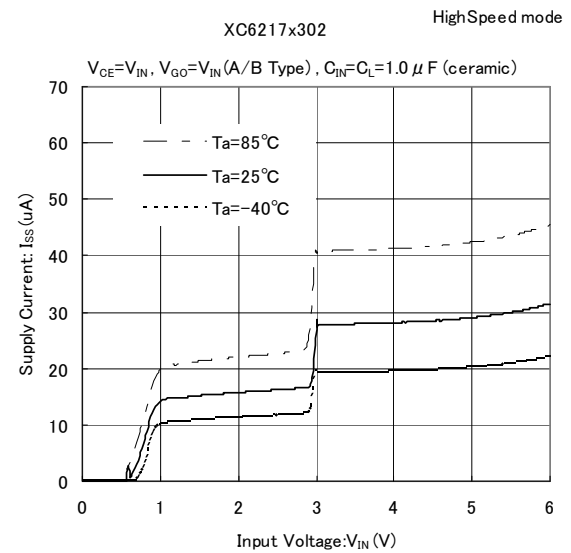
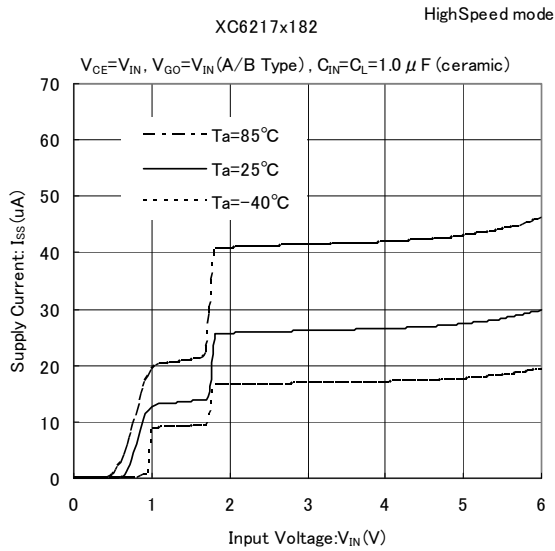
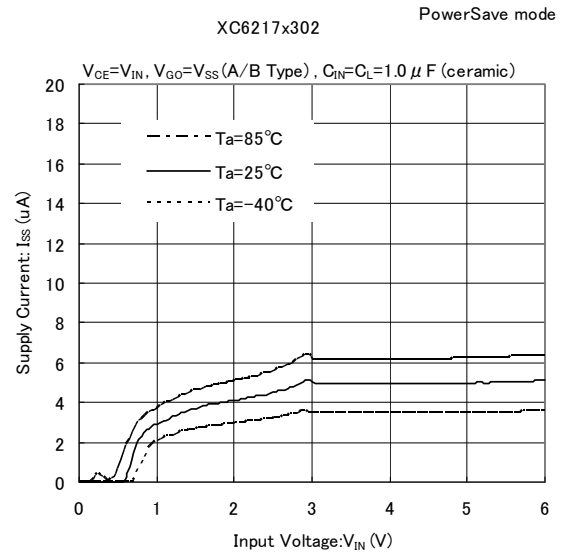
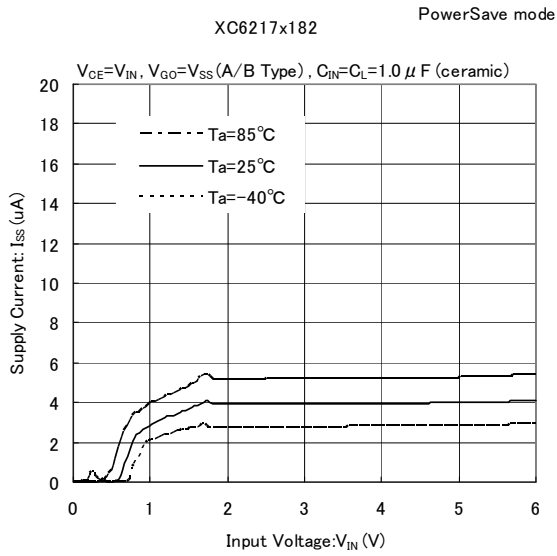


### (4) Output Voltage vs. Ambient Temperature

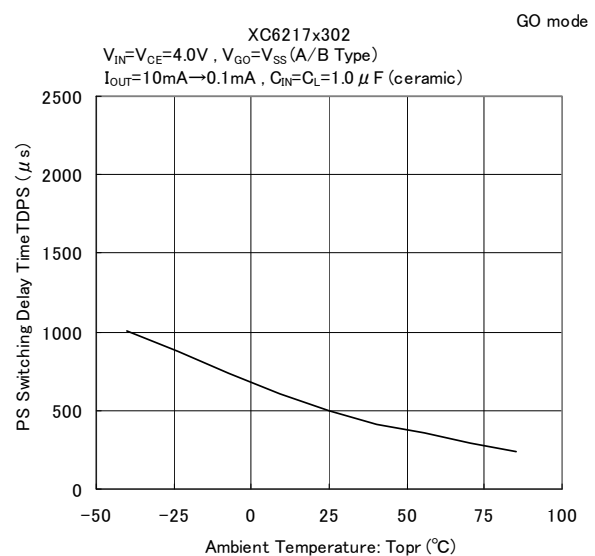
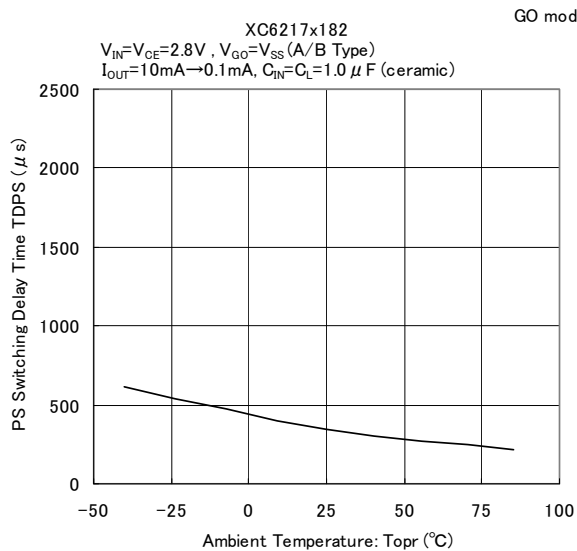


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

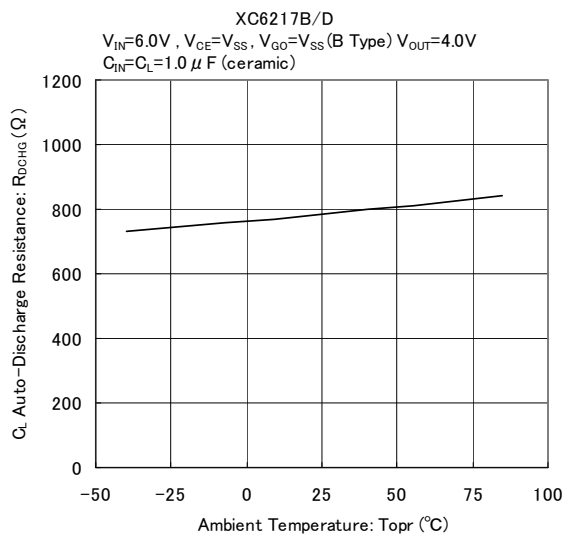


### (6) PS Switching Delay Time vs. Ambient Temperature

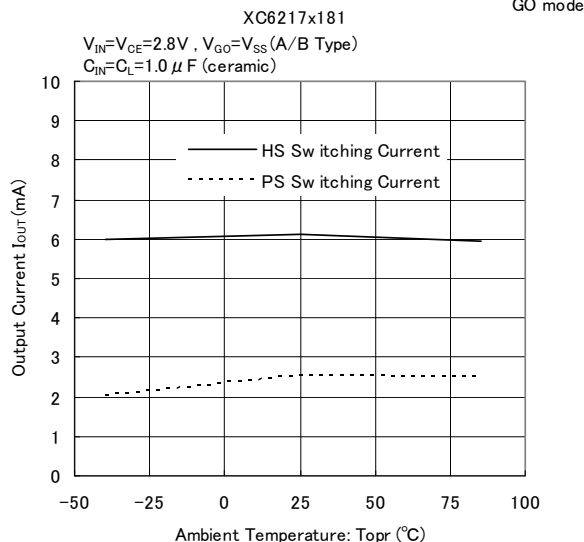


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

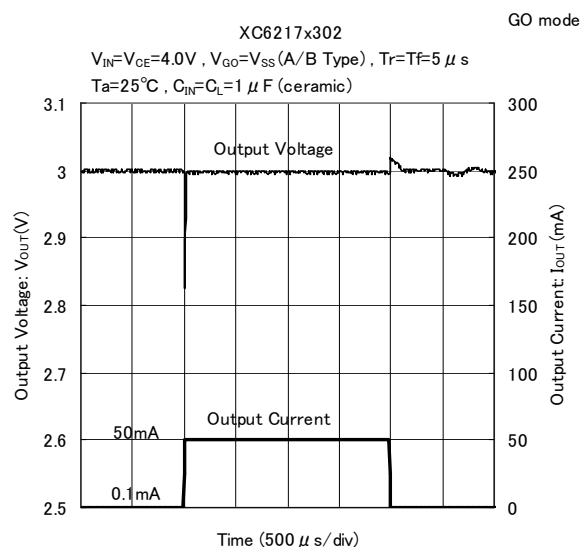
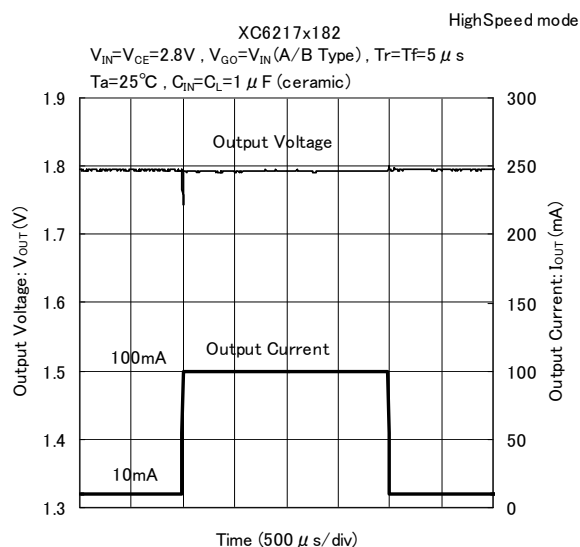
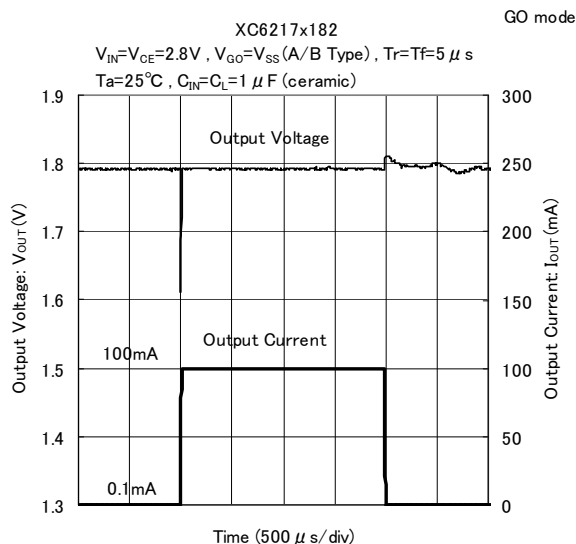
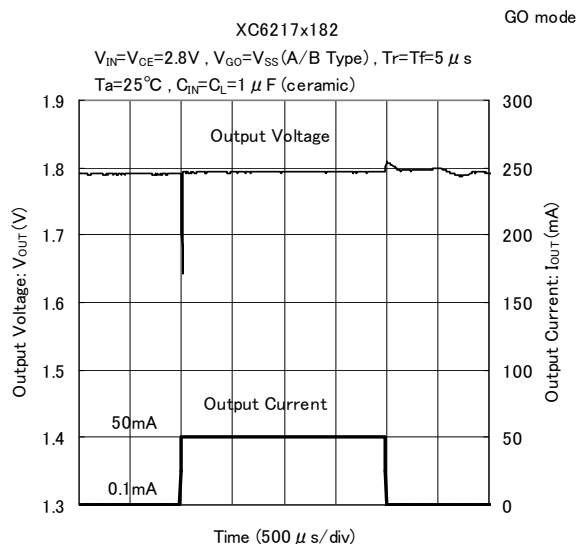
(7) CL Auto-Discharge Resistance vs. Ambient Temperature



(8) PS/HS Switching Current vs. Ambient Temperature

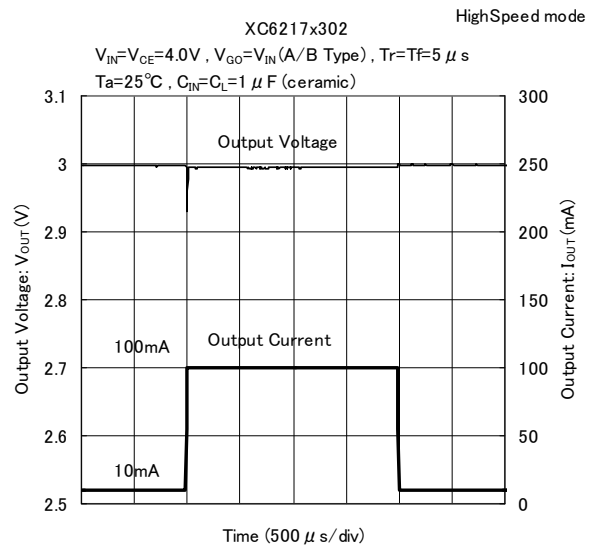
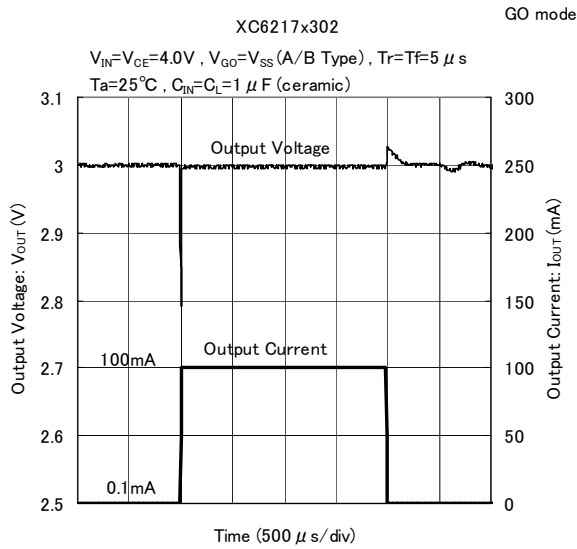


(9) Load Transient Response

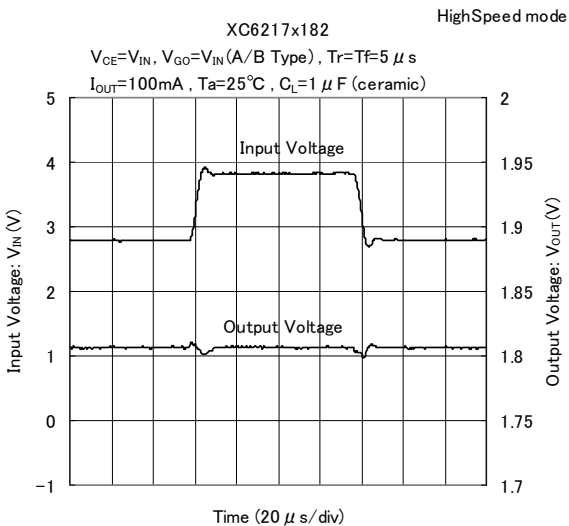
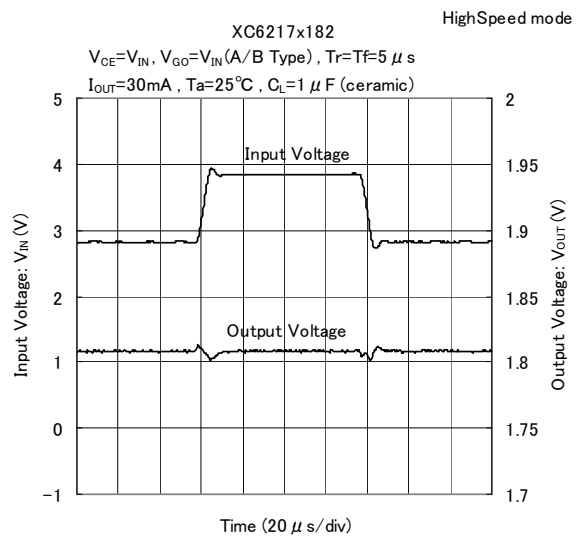
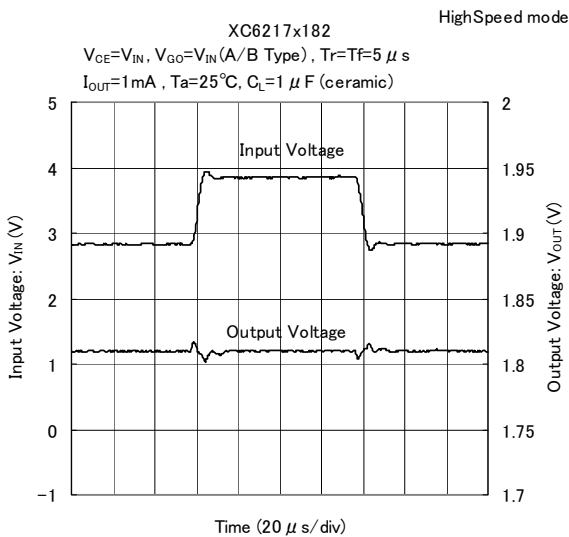


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Load Transient Response

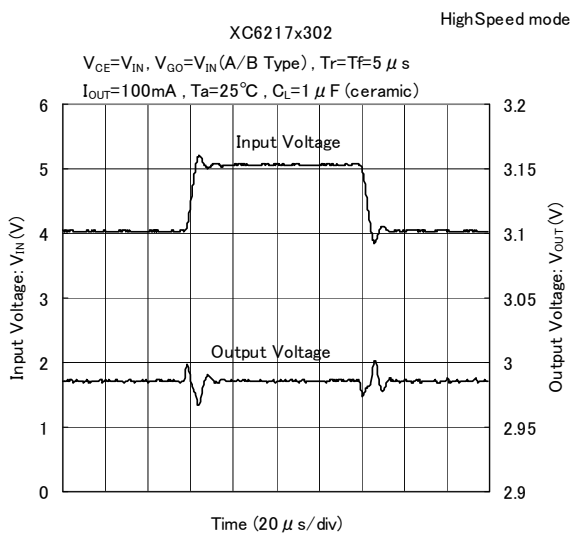
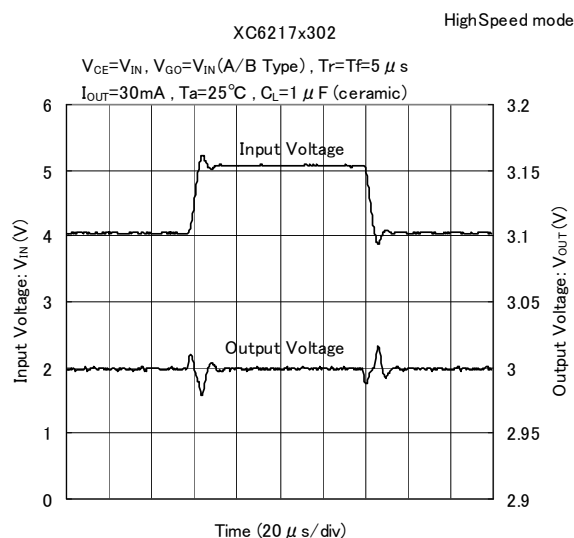
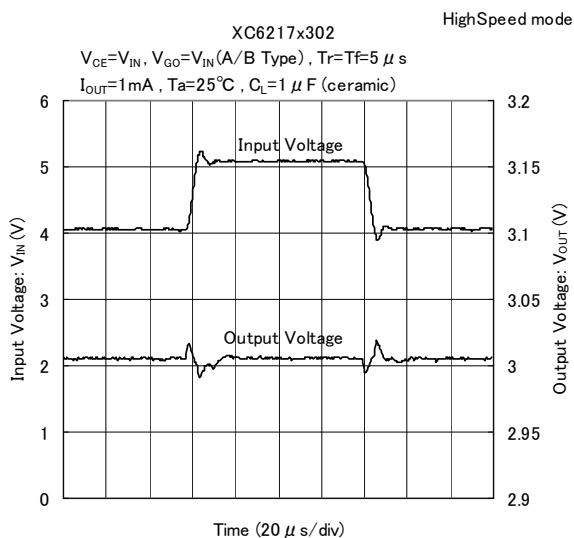


### (10) Line Transient Response

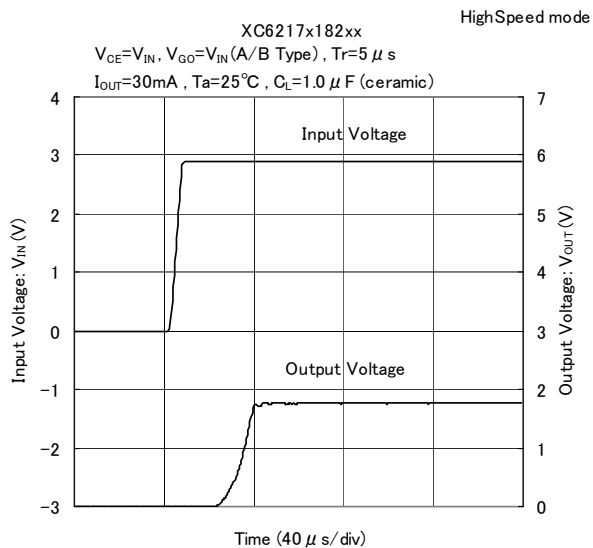
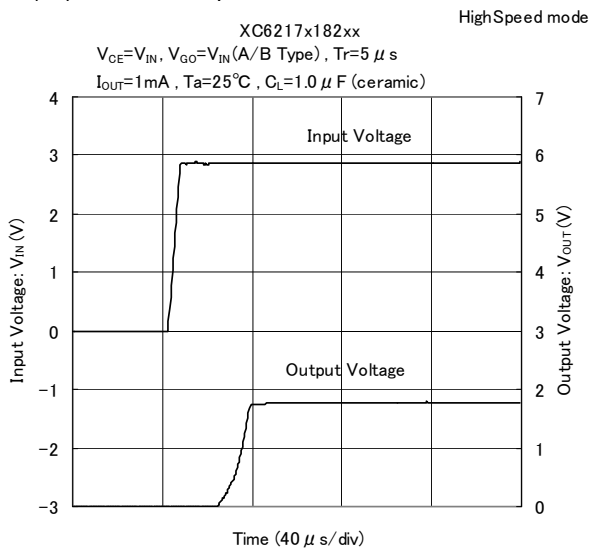


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (10) Line Transient Response

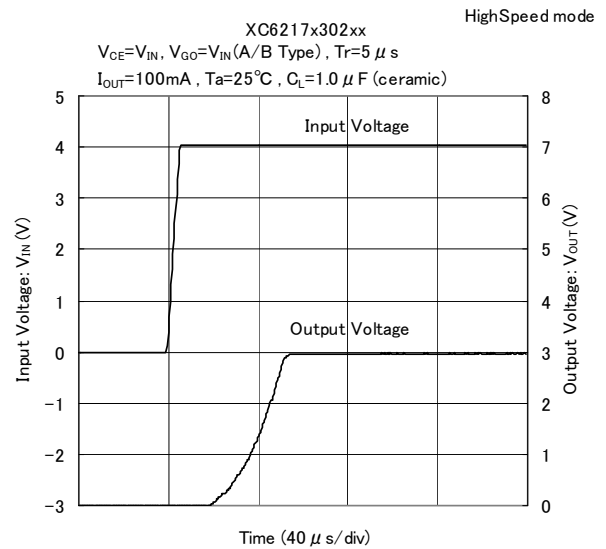
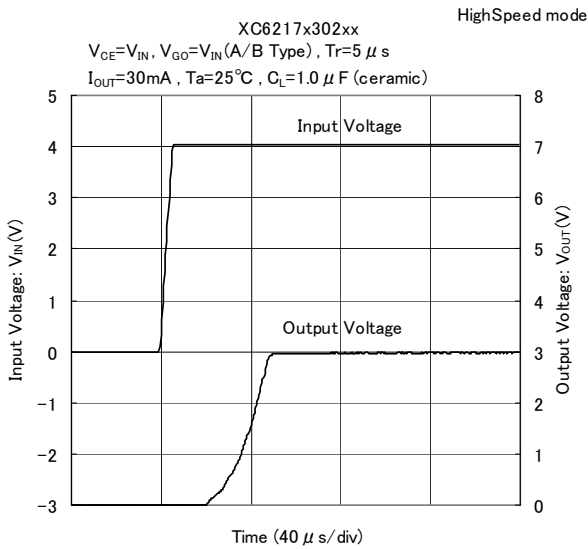
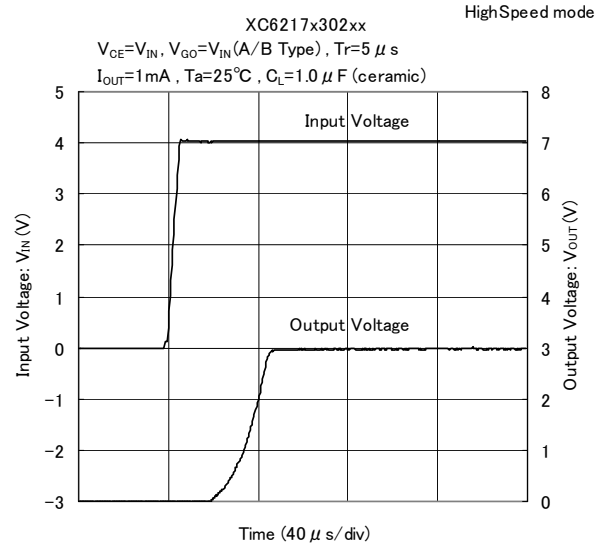
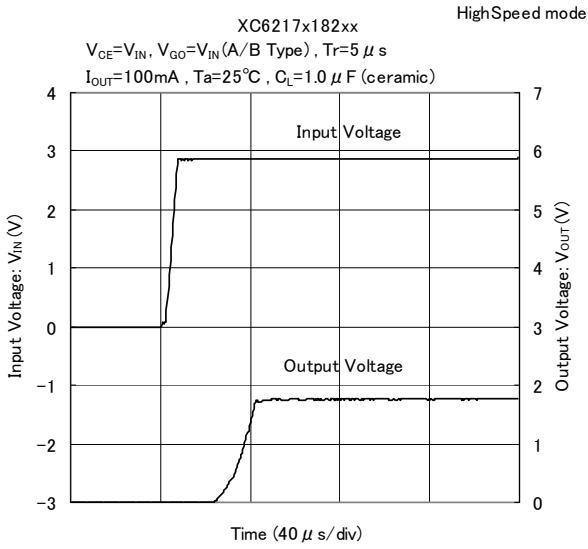


### (11) Turn-On Response

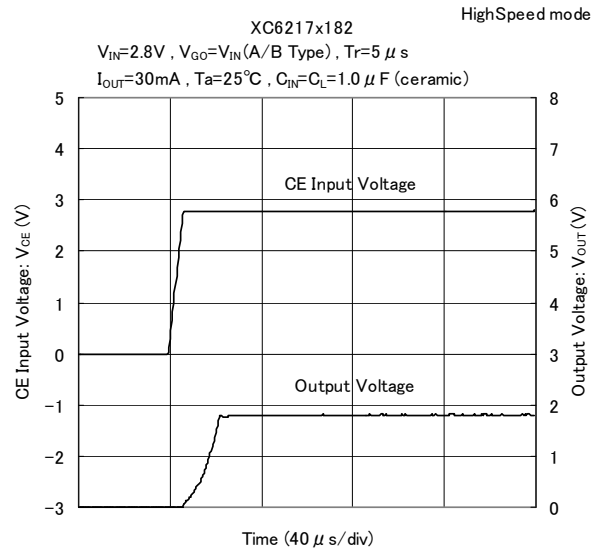
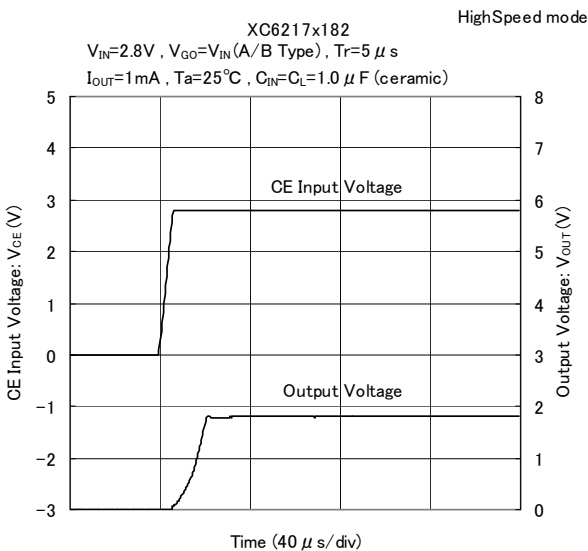


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) Turn-On Response (Continued)

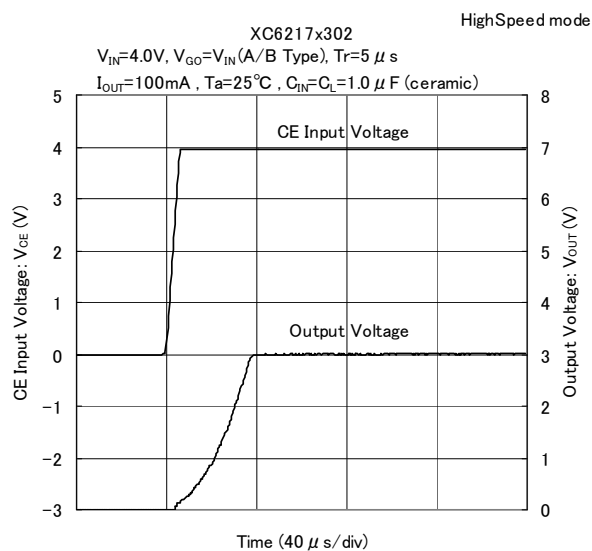
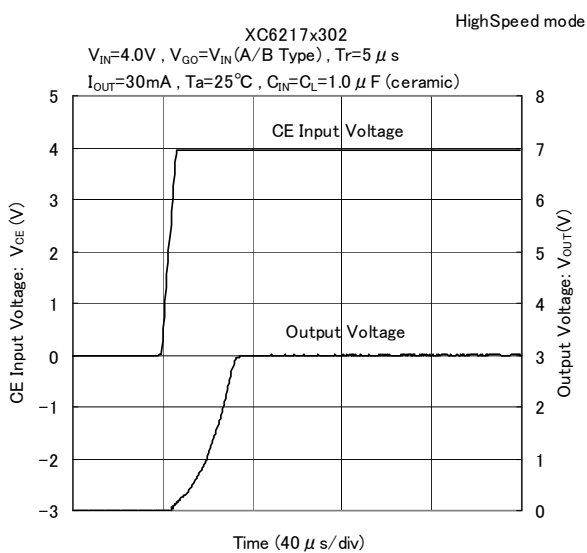
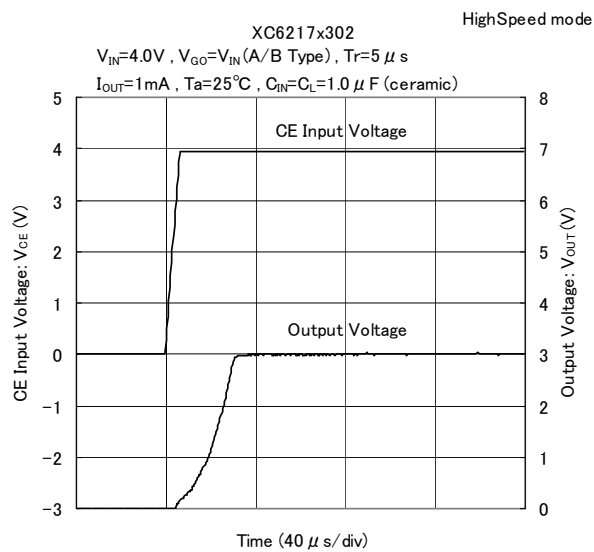
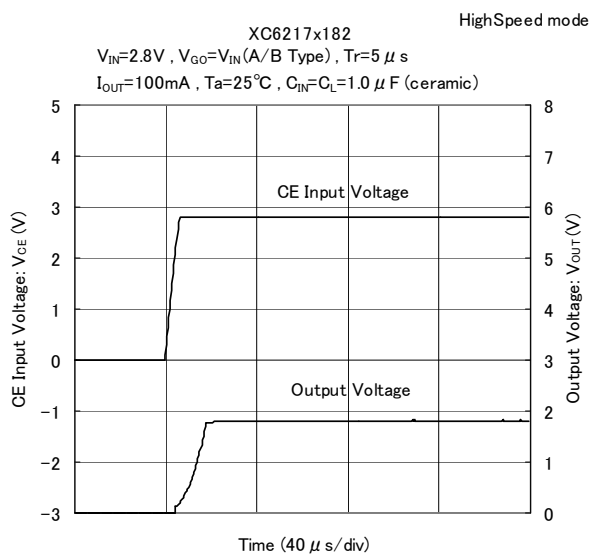


### (12) CE Turn-On Response



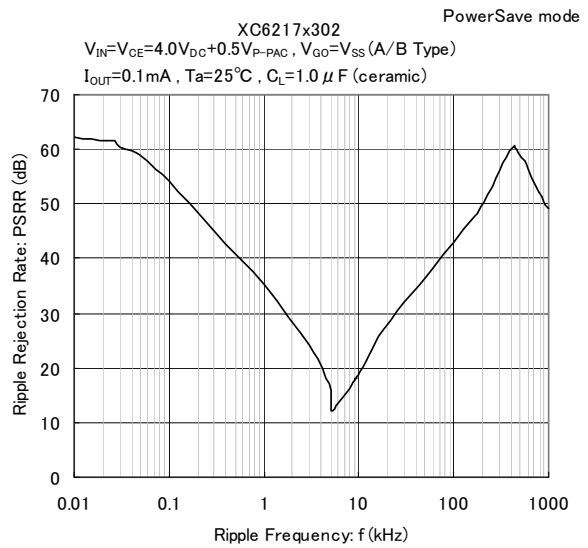
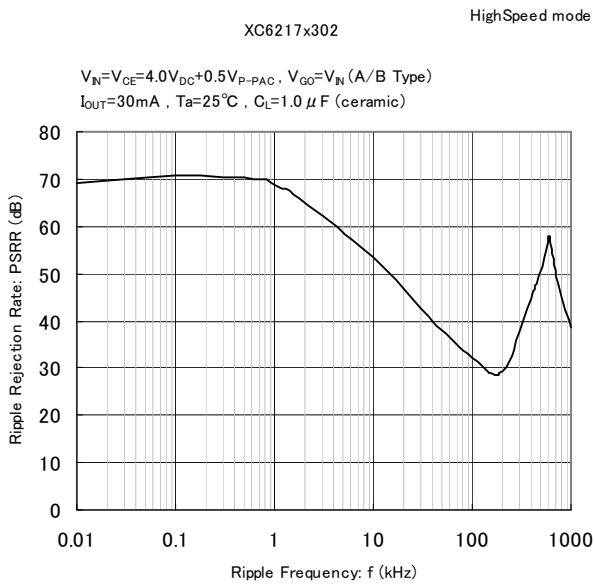
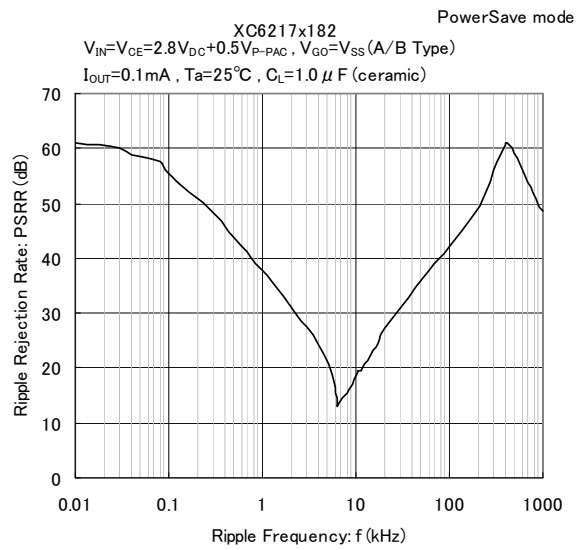
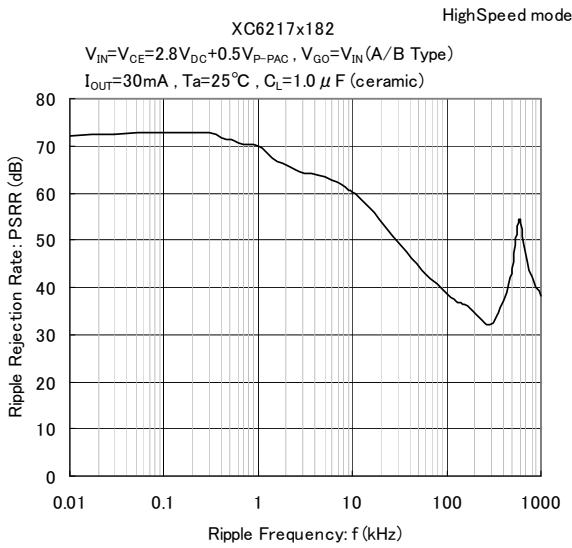
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (12) CE Turn-On Response (Continued)



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

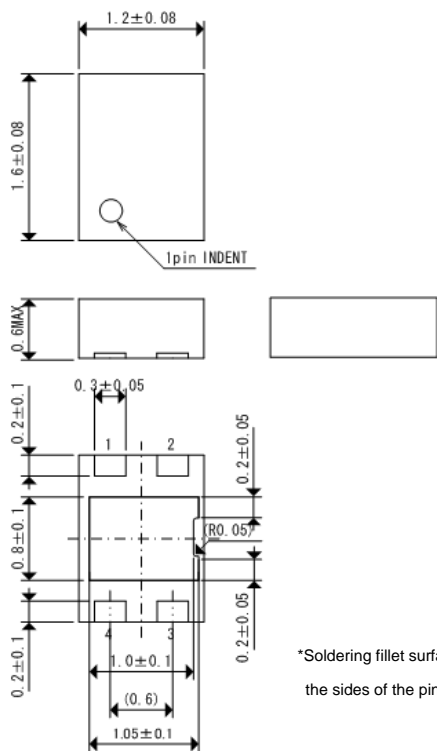
### (13) Ripple Rejection Rate



**PACKAGING INFORMATION**

● **USP-4D**

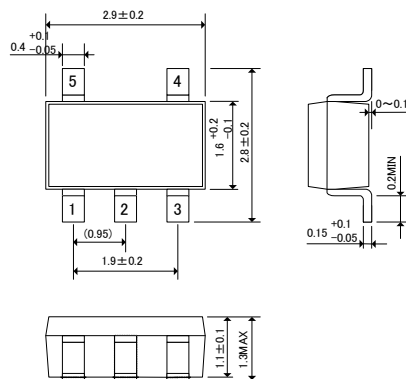
(unit : mm)



\*Soldering fillet surface is not formed because the sides of the pins are plated.

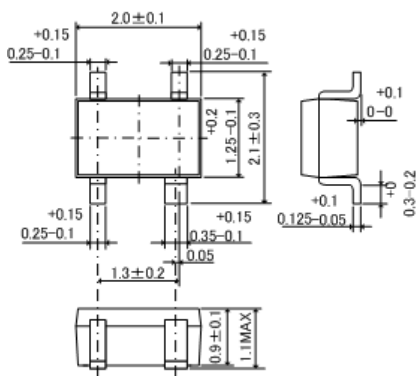
● **SOT-25**

(unit : mm)



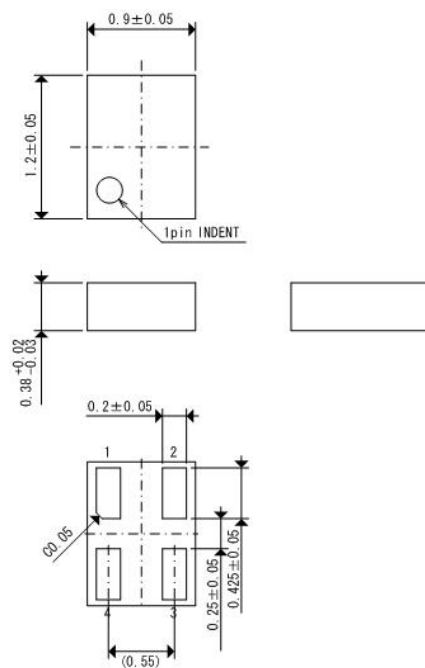
● **SSOT-24**

(unit : mm)



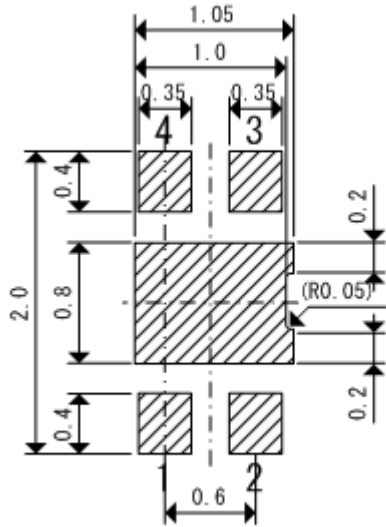
● **USPN-4**

(unit : mm)

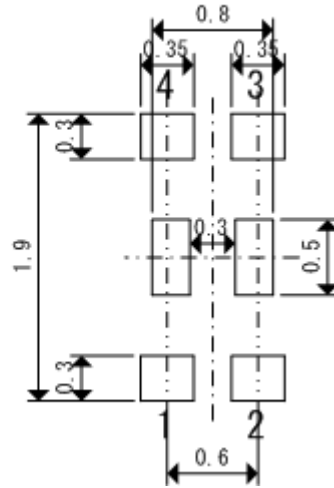


## PACKAGING INFORMATION (Continued)

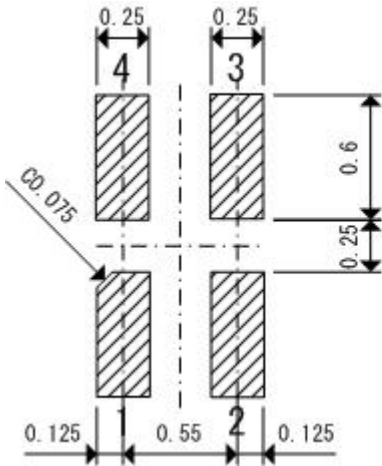
● USP-4D Reference Pattern Layout Dimension



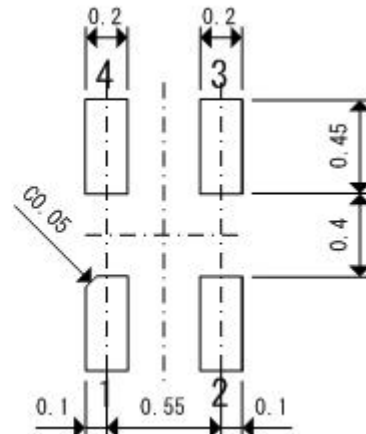
● USP-4D Reference metal mask design



● USPN-4 Reference Pattern Layout Dimension



● USPN-4 Reference metal mask design

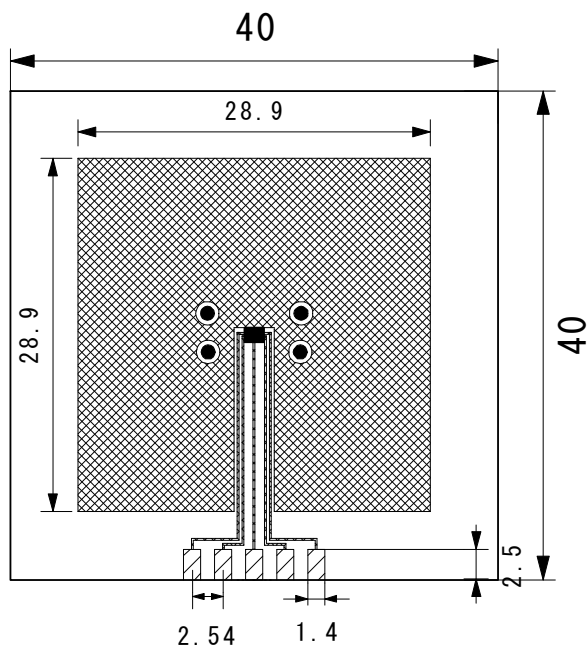


● USP-4D Power Dissipation

Power dissipation data for the USP-4D is shown in this page.  
The value of power dissipation varies with the mount board conditions.  
Please use this data as one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

- Condition: Mount on a board
- Ambient: Natural convection
- Soldering: Lead (Pb) free
- Board: Dimensions 40 x 40 mm (1600 mm<sup>2</sup> in one side)  
Copper (Cu) traces occupy 50% of the board area  
In top and back faces  
Package heat-sink is tied to the copper traces
- Material: Glass Epoxy (FR-4)
- Thickness: 1.6 mm
- Through-hole: 4 x 0.8 Diameter

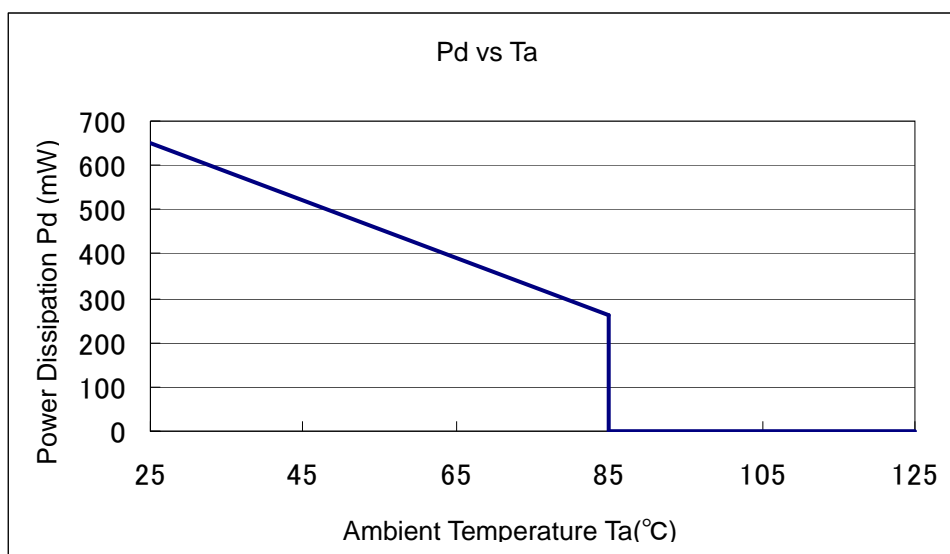


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (T<sub>j</sub> max = 125°C)

Ambient Temperature(°C)	Power Dissipation Pd (mW)	Thermal Resistance(°C/W)
25	650	153.8
85	260	



## ● USPN-4 Power Dissipation

Power dissipation data for the USPN-4 is shown in this page.  
 The value of power dissipation varies with the mount board conditions.  
 Please use this data as one of reference data taken in the described condition.

### 1. Measurement Condition (Reference data)

Condition: Mount on a board

Ambient: Natural convection

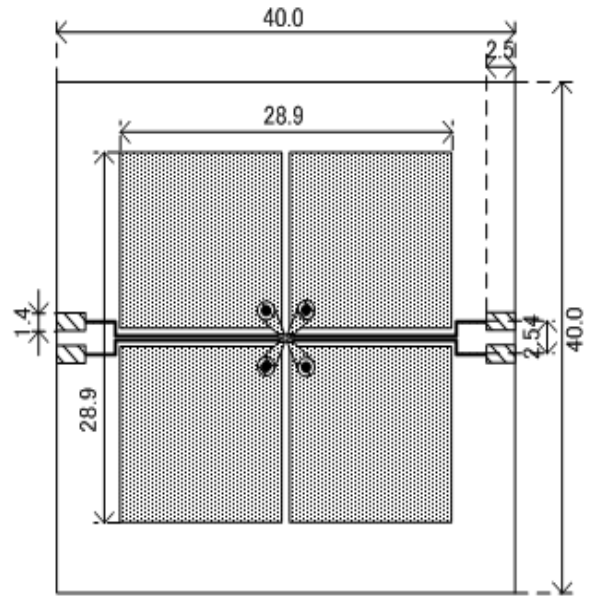
Soldering: Lead (Pb) free

Board: Dimensions 40 x 40 mm (1600 mm<sup>2</sup> in one side)  
 Copper (Cu) traces occupy 50% of the front and 50% of the back.  
 The copper area is divided into four block, one block is 12.5% of total.  
 The USPN-4 package has for terminals.  
 Each terminal connects one copper block in the front and one in the back.

Material: Glass Epoxy (FR-4)

Thickness: 1.6 mm

Through-hole: 4 x 0.8 Diameter

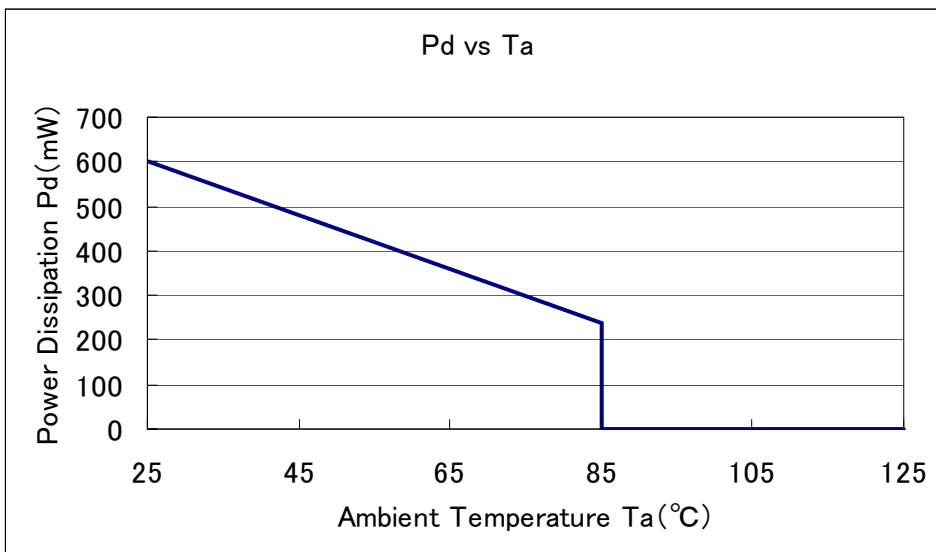


Evaluation Board (Unit: mm)

### 2. Power Dissipation vs. Ambient Temperature

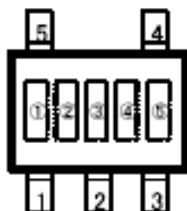
Board Mount ( $T_j$  max = 125°C)

Ambient Temperature(°C)	Power Dissipation Pd (mW)	Thermal Resistance(°C/W)
25	600	166.67
85	240	



## MARKING RULE

### ● SOT-25



SOT-25  
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
1	XC6217xxxxx

② represents type of regulators

MARK				PRODUCT SERIES
OUTPUT VOLTAGE 0.1V INCREMENTS		OUTPUT VOLTAGE 0.05V INCREMENTS		
0.80V~3.00V	3.10V~4.00V	0.85V~3.05V	3.15V~3.95V	
V	A	E	L	XC6217Axxxxx
X	B	F	M	XC6217Bxxxxx

③ represents output voltage

MARK	OUTPUT VOLTAGE (V)				MARK	OUTPUT VOLTAGE (V)			
0	-	3.10	-	3.15	F	1.60	-	1.65	-
1	-	3.20	-	3.25	H	1.70	-	1.75	-
2	-	3.30	-	3.35	K	1.80	-	1.85	-
3	-	3.40	-	3.45	L	1.90	-	1.95	-
4	-	3.50	-	3.55	M	2.00	-	2.05	-
5	-	3.60	-	3.65	N	2.10	-	2.15	-
6	-	3.70	-	3.75	P	2.20	-	2.25	-
7	0.80	3.80	0.85	3.85	R	2.30	-	2.35	-
8	0.90	3.90	0.95	3.95	S	2.40	-	2.45	-
9	1.00	4.00	1.05	-	T	2.50	-	2.55	-
A	1.10	-	1.15	-	U	2.60	-	2.65	-
B	1.20	-	1.25	-	V	2.70	-	2.75	-
C	1.30	-	1.35	-	X	2.80	-	2.85	-
D	1.40	-	1.45	-	Y	2.90	-	2.95	-
E	1.50	-	1.55	-	Z	3.00	-	3.05	-

④⑤ represents production lot number

01 to 09, 10 to 99, 0A~ 0Z, 1A in order. (G, I, J, O, Q, W excluded)

Note: No character inversion used.

## MARKING RULE (Continued)

### SSOT-24



SSOT-4  
(TOP VIEW)

① represents type of regulators and output voltage range

MARK				PRODUCT SERIES
OUTPUT VOLTAGE 0.10V INCREMENTS		OUTPUT VOLTAGE 0.05V INCREMENTS		
0.80V~3.0V	3.10V~4.00V	0.85V~3.05V	3.15V~3.95V	
1	5	2	6	XC6217Cxxxxx
3	7	4	8	XC6217Dxxxxx

② represents output voltage numbers after the decimal point.

MARK	OUTPUT VOLTAGE (V)				MARK	OUTPUT VOLTAGE (V)			
0	-	3.10	-	3.15	F	1.60	-	1.65	-
1	-	3.20	-	3.25	H	1.70	-	1.75	-
2	-	3.30	-	3.35	K	1.80	-	1.85	-
3	-	3.40	-	3.45	L	1.90	-	1.95	-
4	-	3.50	-	3.55	M	2.00	-	2.05	-
5	-	3.60	-	3.65	N	2.10	-	2.15	-
6	-	3.70	-	3.75	P	2.20	-	2.25	-
7	0.80	3.80	0.85	3.85	R	2.30	-	2.35	-
8	0.90	3.90	0.95	3.95	S	2.40	-	2.45	-
9	1.00	4.00	1.05	-	T	2.50	-	2.55	-
A	1.10	-	1.15	-	U	2.60	-	2.65	-
B	1.20	-	1.25	-	V	2.70	-	2.75	-
C	1.30	-	1.35	-	X	2.80	-	2.85	-
D	1.40	-	1.45	-	Y	2.90	-	2.95	-
E	1.50	-	1.55	-	Z	3.00	-	3.05	-

③④ represents production lot number

01 to 09, 10 to 99, 0A~ 0Z, 1A in order. (G, I, J, O, Q, W excluded)

Note: No character inversion used.

## MARKING RULE (Continued)

● USP-4D



USP-4D  
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
1	XC6217xxxxxx

② represents type of regulators

MARK	TYPE OF REGULATORS	PRODUCT SERIES
A	CE High Active, without CL-Discharge	XC6217Axxxxx
B	CE High Active, with CL-Discharge	XC6217Bxxxxx

③ represents integer number of output voltage  
ex.)

MARK	VOLTAGE (V)	PRODUCT SERIES
3	3.xx	XC6217x3xxGx
5	5.xx	XC6217x5xxGx

④ represents output voltage numbers after the decimal point.

MARK	VOLTAGE(V)	PRODUCT SEIRES	MARK	VOLTAGE (V)	PRODUCT SEIRES
0	x.00	XC6217xx02/1Gx	A	x.05	XC6217xx0A/1Gx
1	x.10	XC6217xx12/1Gx	B	x.15	XC6217xx1A/1Gx
2	x.20	XC6217xx22/1Gx	C	x.25	XC6217xx2A/1Gx
3	x.30	XC6217xx32/1Gx	D	x.35	XC6217xx3A/1Gx
4	x.40	XC6217xx42/1Gx	E	x.45	XC6217xx4A/1Gx
5	x.50	XC6217xx52/1Gx	F	x.55	XC6217xx5A/1Gx
6	x.60	XC6217xx62/1Gx	H	x.65	XC6217xx6A/1Gx
7	x.70	XC6217xx72/1Gx	K	x.75	XC6217xx7A/1Gx
8	x.80	XC6217xx82/1Gx	L	x.85	XC6217xx8A/1Gx
9	x.90	XC6217xx92/1Gx	M	x.95	XC6217xx9A/1Gx

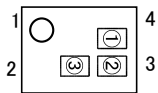
⑤⑥ represents production lot number

01 to 09, 10 to 99, 0A~ 0Z, 1A in order. (G, I, J, O, Q, W excluded)

Note: No character inversion used.

## MARKING RULE (Continued)

### ●USPN-4



USPN-4  
(TOP VIEW)

① represents type of regulators and output voltage range

MARK				PRODUCT SERIES
OUTPUT VOLTAGE 0.10V INCREMENTS		OUTPUT VOLTAGE 0.05V INCREMENTS		
0.80V~3.00V	3.10V~4.00V	0.85V~3.05V	3.15V~3.95V	
1	5	2	6	XC6217Cxxxxx
3	7	4	8	XC6217Dxxxxx

② represents output voltage numbers after the decimal point.

MARK	OUTPUT VOLTAGE (V)				MARK	OUTPUT VOLTAGE (V)			
0	-	3.10	-	3.15	F	1.60	-	1.65	-
1	-	3.20	-	3.25	H	1.70	-	1.75	-
2	-	3.30	-	3.35	K	1.80	-	1.85	-
3	-	3.40	-	3.45	L	1.90	-	1.95	-
4	-	3.50	-	3.55	M	2.00	-	2.05	-
5	-	3.60	-	3.65	N	2.10	-	2.15	-
6	-	3.70	-	3.75	P	2.20	-	2.25	-
7	0.80	3.80	0.85	3.85	R	2.30	-	2.35	-
8	0.90	3.90	0.95	3.95	S	2.40	-	2.45	-
9	1.00	4.00	1.05	-	T	2.50	-	2.55	-
A	1.10	-	1.15	-	U	2.60	-	2.65	-
B	1.20	-	1.25	-	V	2.70	-	2.75	-
C	1.30	-	1.35	-	X	2.80	-	2.85	-
D	1.40	-	1.45	-	Y	2.90	-	2.95	-
E	1.50	-	1.55	-	Z	3.00	-	3.05	-

\*USPN-4  $0.80V \leq V_{OUT(T)} \leq 1.55V$  underdevelopment.

③ represents production lot number

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

Note: No character inversion used.

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