XC6217 Series

ETR0322_013a

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.

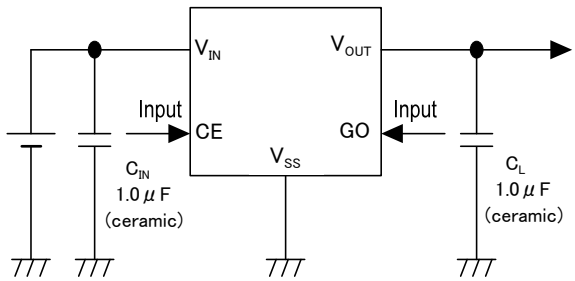
■APPLICATIONS

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

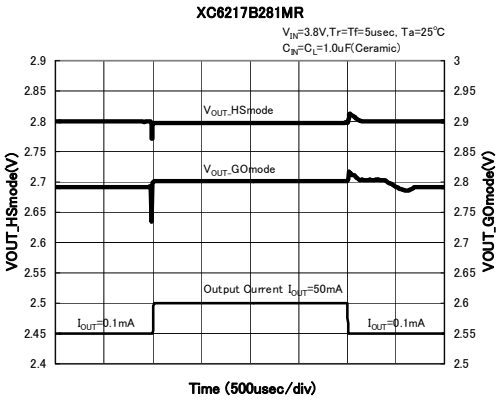
■FEATURES

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

■TYPICAL APPLICATION CIRCUIT



■ TYPICAL PERFORMANCE CHARACTERISTICS



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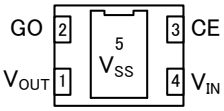
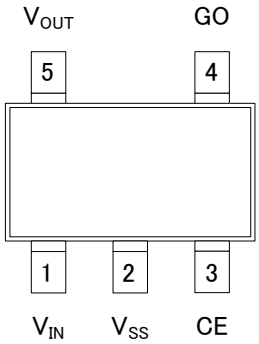
■PIN CONFIGURATION

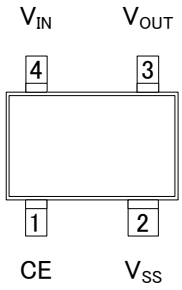


The USP-4D heat dissipation pad is recommended to solder in use of the reference mount pattern and metal mask pattern for the mounting strength and heat dissipation.

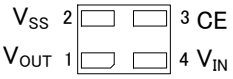
USP-4D
(BOTTOM VIEW)



SOT-25
(TOP VIEW)



SSOT-24
(TOP VIEW)



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

USPN-4
(BOTTOM VIEW)

■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

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■PRODUCT CLASSIFICATION

●Ordering Information

XC6217①②③④⑤⑥−⑦(*1)

<table>
<tr><th>DESIGNATOR</th><th>DESCRIPTION</th><th>SYMBOL</th><th>DESCRIPTION</th></tr>
<tr><td rowspan="4">①</td><td rowspan="4">Type of Regulator</td><td>A</td><td>CE High Active, no C_L discharge resistor</td></tr>
<tr><td>B</td><td>CE High Active, with C_L discharge resistor</td></tr>
<tr><td>C</td><td>CE High Active, no C_L discharge resistor, no GO pin</td></tr>
<tr><td>D</td><td>CE High Active, with C_L discharge resistor, no GO pin</td></tr>
<tr><td>② ③</td><td>Output Voltage</td><td>08 ~ 40</td><td>ex.) $V_{OUT(T)}$ = 3.00V → ② = 3, ③ = 0</td></tr>
<tr><td rowspan="4">④</td><td rowspan="4">Output Accuracy</td><td>2</td><td>0.1V increments (Standard)
<table>
<tr><th>$V_{OUT(T)}$</th><th>HS mode</th><th>PS mode</th></tr>
<tr><td>0.80V ～ 1.50V</td><td>$V_{OUT(T)}$±30mV</td><td>$V_{OUT(T)}$+70mV, $V_{OUT(T)}$−90mV</td></tr>
<tr><td>1.60V ～ 1.90V</td><td>$V_{OUT(T)}$±30mV</td><td>$V_{OUT(T)}$+3.5%, $V_{OUT(T)}$−4.5%</td></tr>
<tr><td>2.00V ～ 2.50V</td><td>$V_{OUT(T)}$±2%</td><td>$V_{OUT(T)}$+3.5%, $V_{OUT(T)}$−4.5%</td></tr>
<tr><td>2.60V ～ 4.00V</td><td>$V_{OUT(T)}$ ±2%</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
</table>
ex.) 2.00V Standard → ②=2, ③=0, ④=2</td></tr>
<tr><td>A</td><td>0.05V increments (Standard)
<table>
<tr><th>$V_{OUT(T)}$</th><th>HS mode</th><th>PS mode</th></tr>
<tr><td>0.85V ～ 1.55V</td><td>$V_{OUT(T)}$±30mV</td><td>$V_{OUT(T)}$+70mV, $V_{OUT(T)}$−90mV</td></tr>
<tr><td>1.65V ～ 1.95V</td><td>$V_{OUT(T)}$±30mV</td><td>$V_{OUT(T)}$+3.5%, $V_{OUT(T)}$−4.5%</td></tr>
<tr><td>2.05V ～ 2.55V</td><td>$V_{OUT(T)}$±2%</td><td>$V_{OUT(T)}$+3.5%, $V_{OUT(T)}$−4.5%</td></tr>
<tr><td>2.65V ～ 3.95V</td><td>$V_{OUT(T)}$ ±2%</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
</table>
ex.) 2.05V Standard → ②=2, ③=0, ④=A</td></tr>
<tr><td>1</td><td>0.1V increments (High Accuracy)
<table>
<tr><th>$V_{OUT(T)}$</th><th>HS mode</th><th>PS mode</th></tr>
<tr><td>0.80V ～ 1.50V</td><td>$V_{OUT(T)}$±20mV</td><td>$V_{OUT(T)}$+50mV, $V_{OUT(T)}$−70mV</td></tr>
<tr><td>1.60V ～ 1.90V</td><td>$V_{OUT(T)}$±20mV</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
<tr><td>2.00V ～ 2.50V</td><td>$V_{OUT(T)}$±1%</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
<tr><td>2.60V ～ 4.00V</td><td>$V_{OUT(T)}$ ±1%</td><td>$V_{OUT(T)}$+1.5%, $V_{OUT(T)}$−2.5%</td></tr>
</table>
ex.) 2.00V High Accuracy → ②=2, ③=0, ④=1</td></tr>
<tr><td>B</td><td>0.05V increments (High Accuracy)
<table>
<tr><th>$V_{OUT(T)}$</th><th>HS mode</th><th>PS mode</th></tr>
<tr><td>0.85V ～ 1.55V</td><td>$V_{OUT(T)}$±20mV</td><td>$V_{OUT(T)}$+50mV, $V_{OUT(T)}$−70mV</td></tr>
<tr><td>1.65V ～ 1.95V</td><td>$V_{OUT(T)}$±20mV</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
<tr><td>2.05V ～ 2.55V</td><td>$V_{OUT(T)}$±1%</td><td>$V_{OUT(T)}$+2.5%, $V_{OUT(T)}$−3.5%</td></tr>
<tr><td>2.65V ～ 3.95V</td><td>$V_{OUT(T)}$ ±1%</td><td>$V_{OUT(T)}$+1.5%, $V_{OUT(T)}$−2.5%</td></tr>
</table>
ex.) 2.05V High Accuracy → ②=2, ③=0, ④=B</td></tr>
<tr><td rowspan="8">⑤⑥−⑦</td><td rowspan="8">Packages
Taping Type (*2)</td><td>GR</td><td>USP-4D (XC6217A/B type)</td></tr>
<tr><td>GR-G</td><td>USP-4D (XC6217A/B type)</td></tr>
<tr><td>MR</td><td>SOT-25 (XC6217A/B type)</td></tr>
<tr><td>MR-G</td><td>SOT-25 (XC6217A/B type)</td></tr>
<tr><td>NR</td><td>SSOT-24 (XC6217C/D type)</td></tr>
<tr><td>NR-G</td><td>SSOT-24 (XC6217C/D type)</td></tr>
<tr><td>7R-G</td><td>USPN-4 (XC6217C/Dtype)</td></tr>
</table>

*USPN-4 0.80V≦$V_{OUT(T)}$≦1.55V under development.

(*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: ⑤R-⑦, Reverse orientation: ⑤L-⑦)

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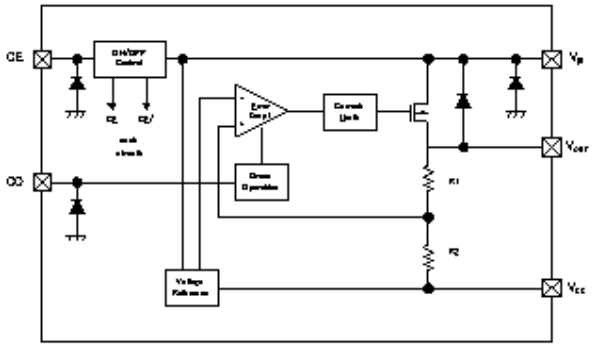
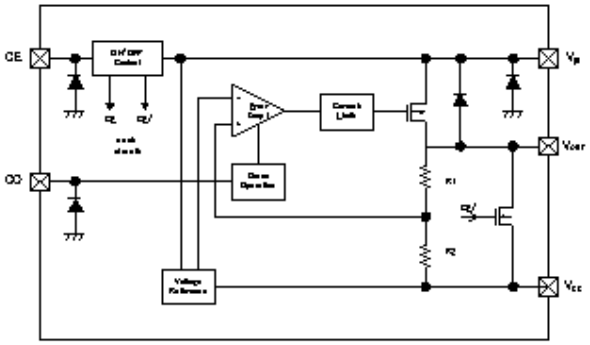
■BLOCK DIAGRAMS

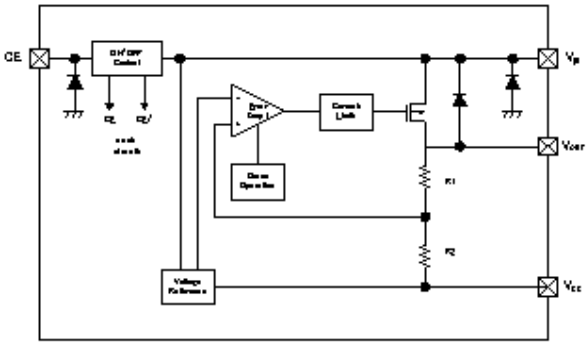
●XC6217A Series



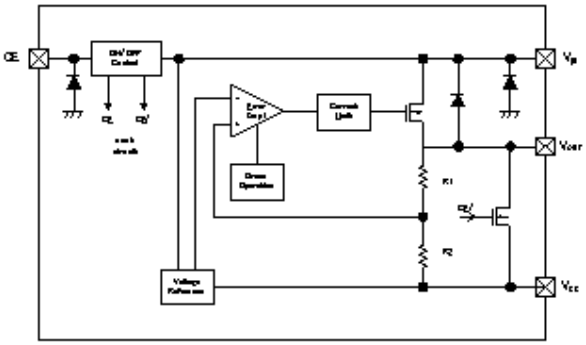
●XC6217B Series



●XC6217C Series



●XC6217D Series



*Diodes inside the circuit are an ESD protection diode and a parasitic diode.

■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	V_{SS} -0.3 ~ +6.5	V
Output Current		I_{OUT}	400 *1	mA
Output Voltage		V_{OUT}	V_{SS} – 0.3 ~ V_{IN} + 0.3	V
CE/GO Input Voltage		V_{CE}/V_{GO}	V_{SS} – 0.3 ~ +6.5	V
Power Dissipation	USP-4D	Pd	120	mW
			650 (PCB mounted)*2	
	SOT-25		250	
	SSOT-24		150	
	USPN-4		100	
			600 (PCB mounted)*2	
Operational Temperature Range		Topr	- 40 ~ + 85	℃
Storage Temperature Range		Tstg	- 55 ~ +125	℃

*1: $I_{OUT} \leqq$ Pd / (V_{IN}-V_{OUT})

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

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■ELECTRICAL CHARACTERISTICS

●XC6217A/B series

Ta=25℃

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

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■ELECTRICAL CHARACTERISTICS (Continued)

●XC6217A/B series (Continued)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{\triangle Ta \cdot V_{OUT}}$	$V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	1
Ripple Rejection Rate	PSRR	$V_{IN}=\{V_{OUT(T)}+1.0\}V_{DC}+0.5V_{p-pAC}$ $0.85V \leqq V_{OUT(T)} \leqq 4.00V$ $V_{GO}=V_{IN}$ (HS), $V_{CE}=V_{IN}$ I_{OUT}=30mA, f=1kHz	-	70	-	dB	3
		$V_{IN}=1.85V_{DC}+0.5V_{p-pAC}$ $V_{OUT(T)}$=0.80V $V_{GO}=V_{IN}$ (HS),$V_{CE}=V_{IN}$ I_{OUT}=30mA, f=1kHz					
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		μs	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	μA	4
GO High Level Current	I_{GOH}	$V_{GO}=V_{IN}$, $V_{CE}=V_{IN}$	-0.1	-	0.1	μA	4
CE Low Level Current	I_{CEL}	$V_{CE}=V_{SS}$, $V_{GO}=V_{SS}$	-0.1	-	0.1	μA	4
GO Low Level Current	I_{GOL}	$V_{CE}=V_{SS}$, $V_{GO}=V_{SS}$	-0.1	-	0.1	μA	4
CL Auto-Discharge Resistance (* 8)	R_{DCHG}	V_{IN}=6.0V, V_{OUT}=4.00V, $V_{CE}=V_{GO}=V_{SS}$	-	780	-	Ω	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: Vdif={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.

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■ELECTRICAL CHARACTERISTICS (Continued)

●XC6217C/D series

Ta=25℃

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

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■ELECTRICAL CHARACTERISTICS (Continued)

●XC6217C/D series (Continued)

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{\triangle Ta \cdot V_{OUT}}$	$V_{CE}=V_{IN}$, I_{OUT}=30mA -40℃≦Ta≦85℃	-	±100	-	ppm/℃	1
Ripple Rejection Rate	PSRR	$V_{IN}=\{V_{OUT(T)}+1.0\}V_{DC}+0.5V_{P-PAC}$ 0.85V≦$V_{OUT(T)}$≦4.00V $V_{CE}=V_{IN}$, I_{OUT}=30mA, f=1kHz	-	70	-	dB	3
		$V_{IN}=1.85V_{DC}+0.5V_{P-PAC}$ $V_{OUT(T)}$=0.80V $V_{CE}=V_{IN}$, I_{OUT}=30mA, f=1kHz					
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		μs	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	μA	4
CE Low Level Current	I_{CEL}	$V_{CE}=V_{SS}$	-0.1	-	0.1	μA	4
CL Auto-Discharge Resistance (*8)	R_{DCHG}	V_{IN}=6.0V, V_{OUT}=4.00V, $V_{CE}=V_{SS}$	-	780	-	Ω	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: Vdif={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.

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■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)	
$V_{OUT(T)}$	$V_{OUT(E)}$		$V_{OUT(E)}$		$V_{OUT(E)}$		$V_{OUT(E)}$	
	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	1.460	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	1.770	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 $0.80V \leqq V_{OUT(T)} \leqq 1.55V$ underdevelopment.

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■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

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■DROPOUT VOLTAGE CHART

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

SYMBOL	E-4		E-5
NOMINAL OUTPUT VOLTAGE (V)	DROPOUT VOLTAGE Vdif (mV)		PS SWITCHING DELAY TIME (GO MODE) (μs)
$V_{OUT(T)}$	Vdif		t_{DPS}
	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			

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

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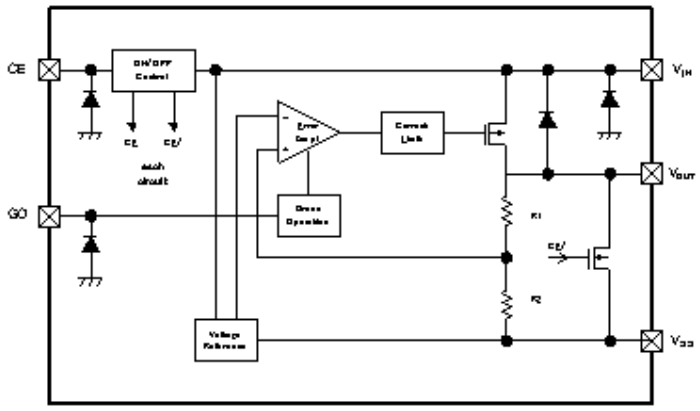
■OPERATIONAL EXPLANATION

<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_{OUT} pin, is then driven by the subsequent output signal. The output voltage at the V_{OUT} 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_{GOR} 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_{GO} 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 is 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_{IN}) of 1.0 μF between the V_{IN} pin and the V_{SS} pin.

・Excluding USPN-4

OUTPUT VOLTAGE (V)	OUTPUT CAPACITOR VALUE
0.8 ~ 1.15	More than C_L=4.7 μF
1.2 ~ 1.35	More than C_L=2.2 μF
1.4 ~ 4.0	More than C_L=1.0 μF

・USPN-4

OUTPUT VOLTAGE (V)	OUTPUT CAPACITOR VALUE
1.6 ~ 4.0	More than C_L=2.2 μF

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<C_L Auto-Discharge Function>

XC6217B/D series can quickly discharge the electric charge at the output capacitor (C_L), 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_{OUT} pin and the V_{SS} pin (cf. BLOCK DIAGRAM). The C_L auto-discharge resistance value is fixed to 780Ω (V_{IN}=6.0V, V_{OUT}=4.0V at typical). The discharge time of the output capacitor (C_L) is set by the C_L auto-discharge resistance (R) and the output capacitor (C_L). By setting time constant of a CL auto-discharge resistance value [R_{DCHG}] and an output capacitor value (C_L) as τ (τ =C x R_{DCHG}), the output voltage after discharge via the N channel transistor is calculated by the following formulas.

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

(V : Output voltage after discharge, $V_{OUT(E)}$: Output voltage, t: Discharge time,
τ : C_L auto-discharge resistance R_{DCHG} × Output capacitor (C_L) 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_{SS} 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_{OUT} pin will be pulled down to the VSS level via R1 & R2. However, as for the XC6217B/D series, the C_L auto-discharge resistor is connected in parallel to R1 and R2 while the power supply is applied to the VIN pin. Therefore, time until the V_{OUT} pin reaches the V_{SS} 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_{IN} and V_{SS} wiring in particular.
3. Please wire the input capacitor (C_{IN}) and the output capacitor (C_L) as close to the IC as possible.

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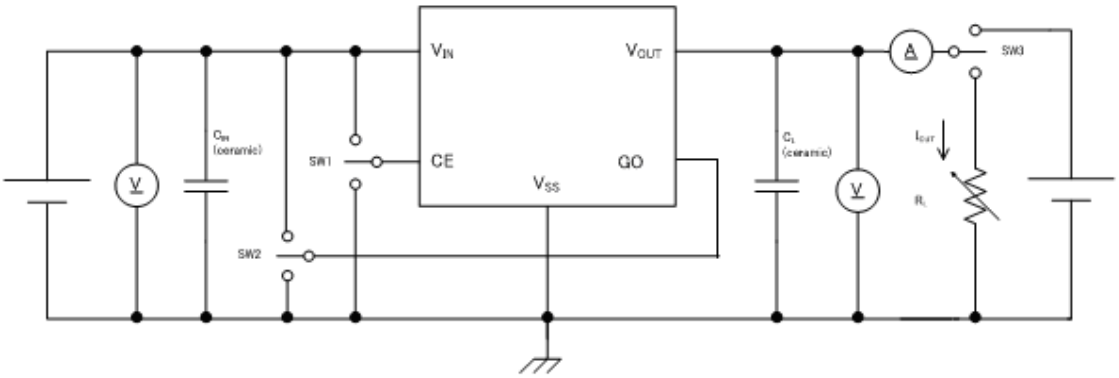
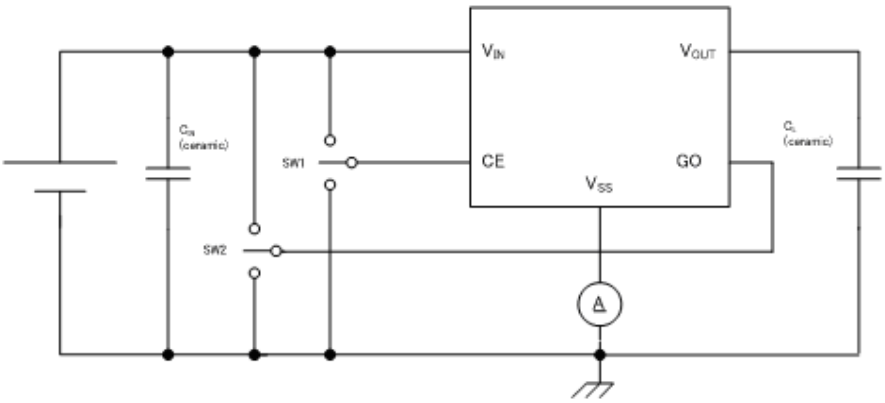
■TEST CIRCUITS

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



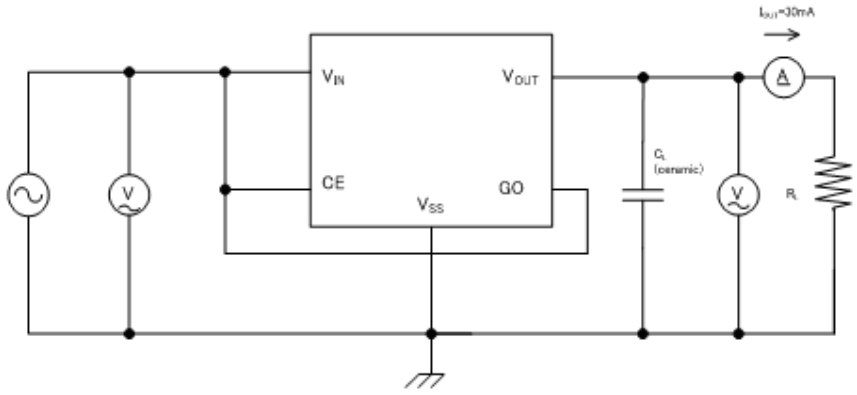
*No GO pin with the XC6217C/D types.

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.

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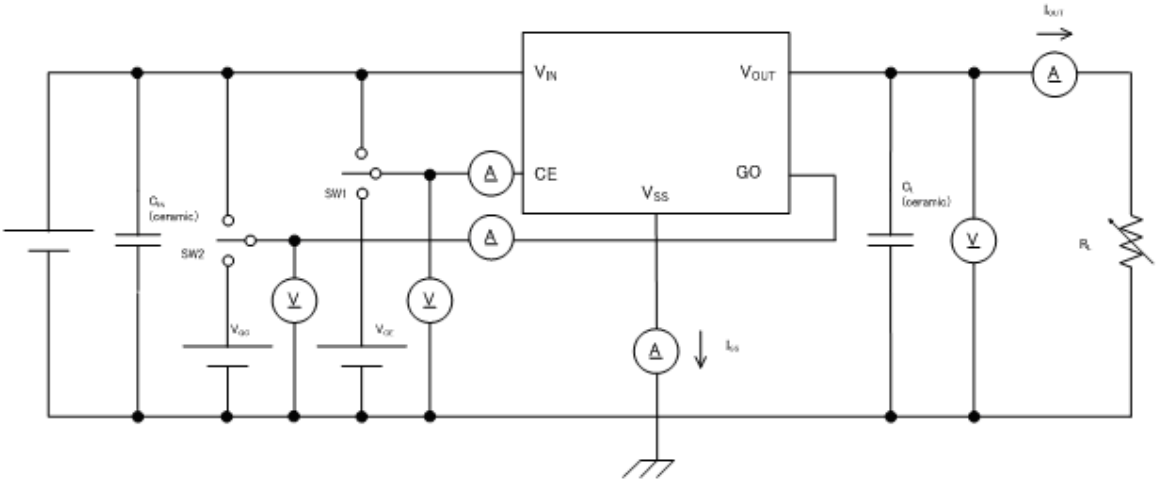
■TEST CIRCUITS (Continued)

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.

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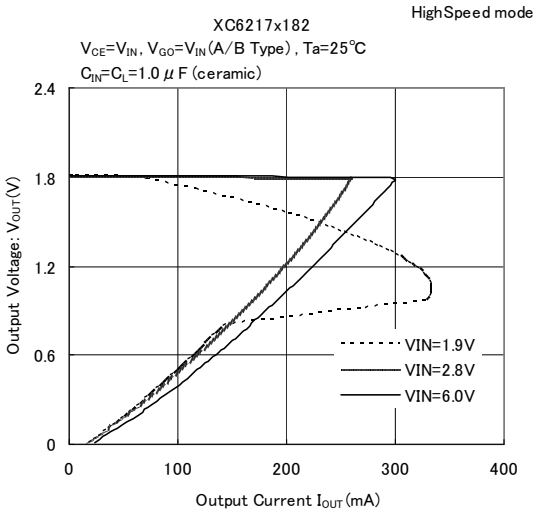
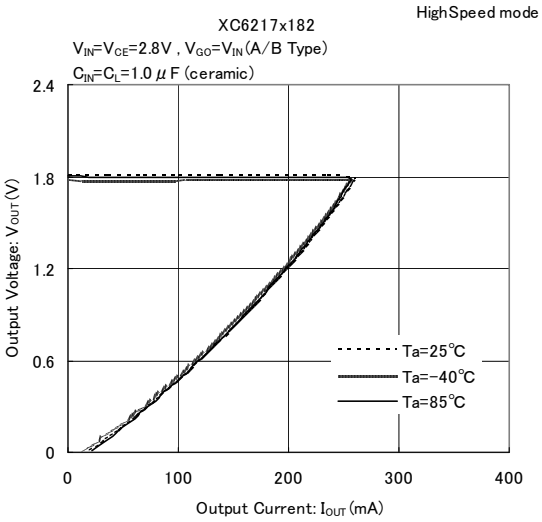
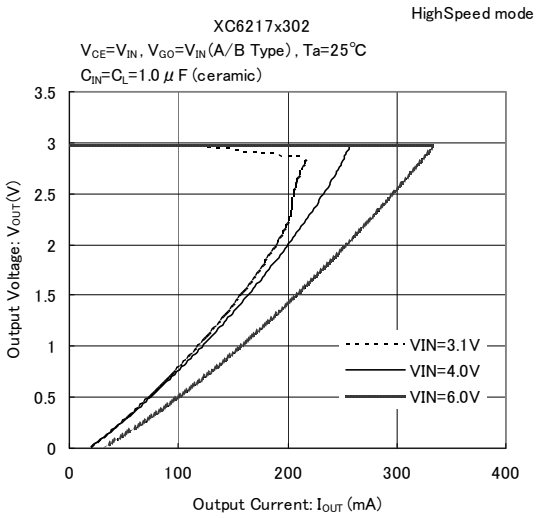
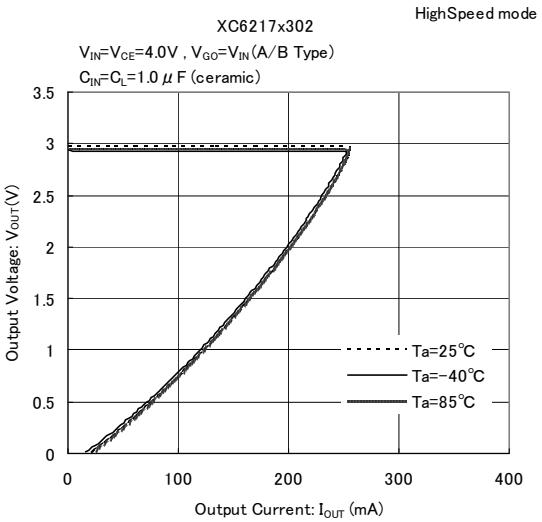
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

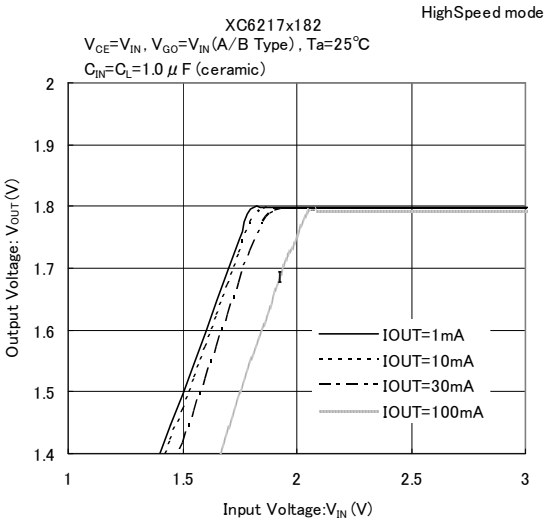


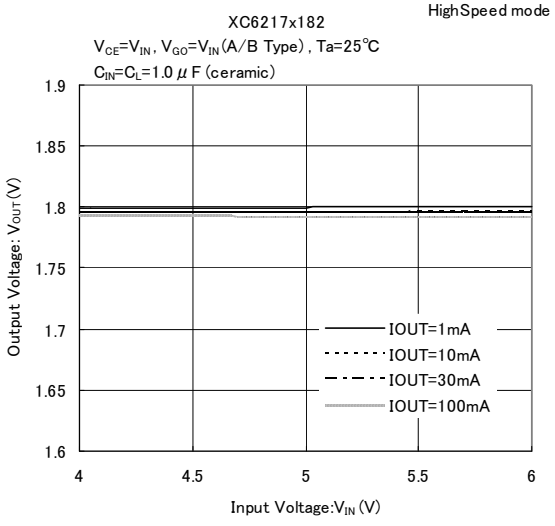






(2) Output Voltage vs. Input Voltage





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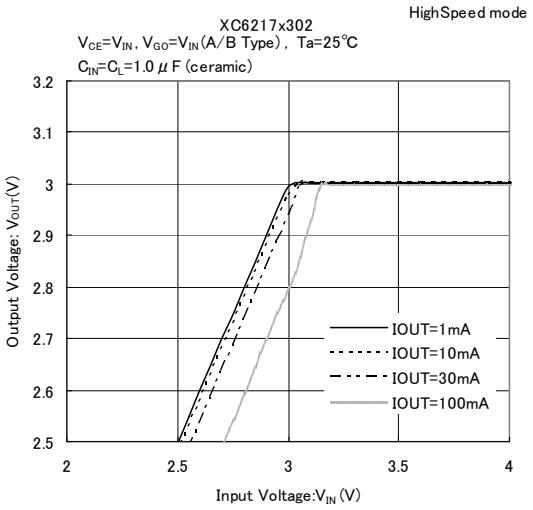
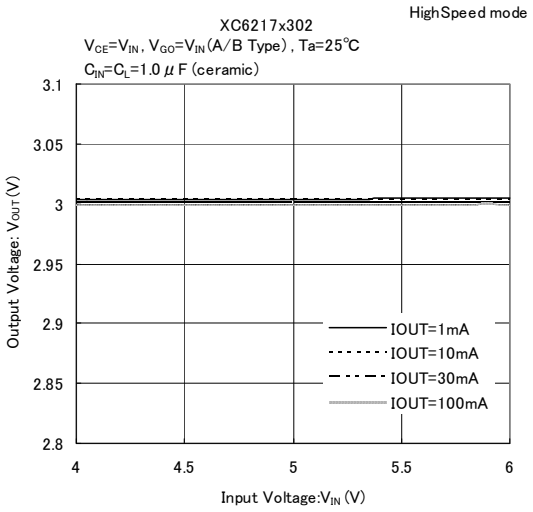
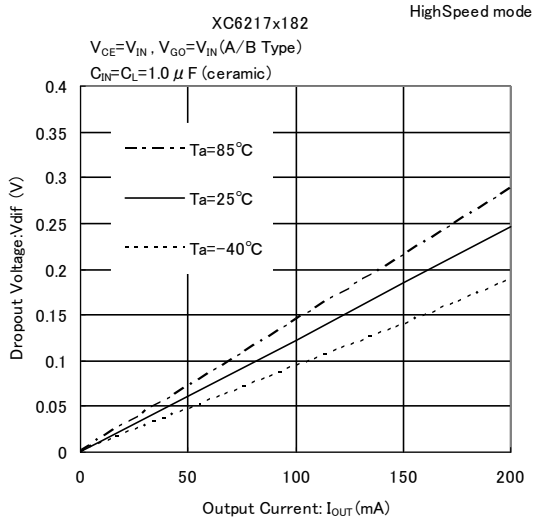
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

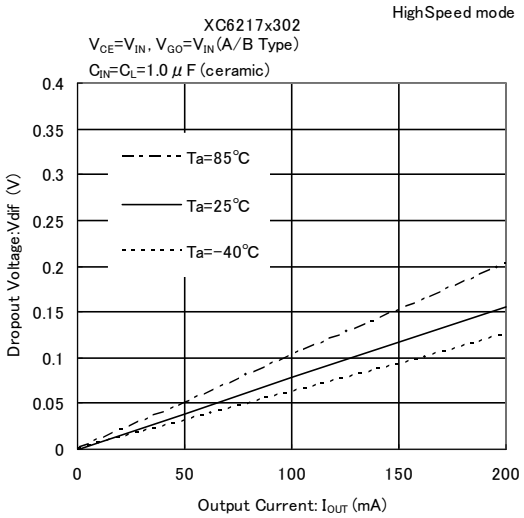
(2) Output Voltage vs. Input Voltage (Continued)



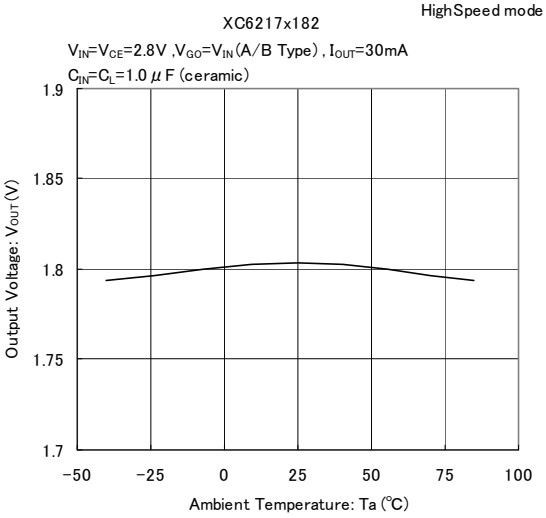


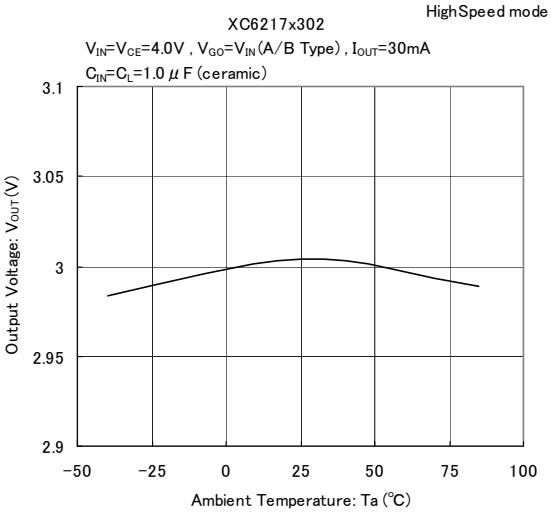
(3) Dropout Voltage vs. Output Current





(4) Output Voltage vs. Ambient Temperature





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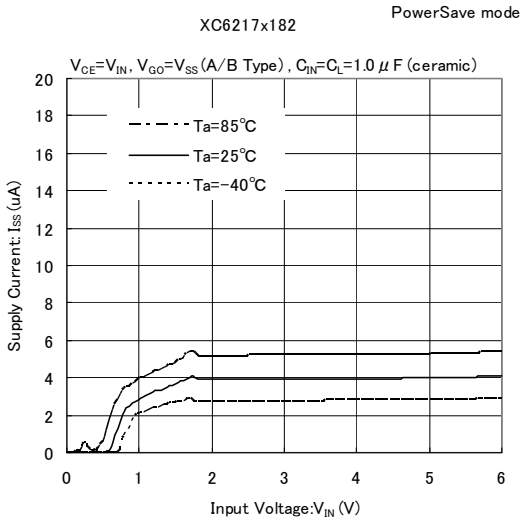
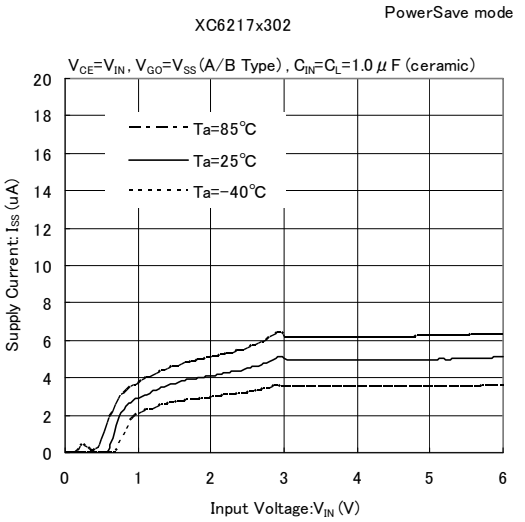
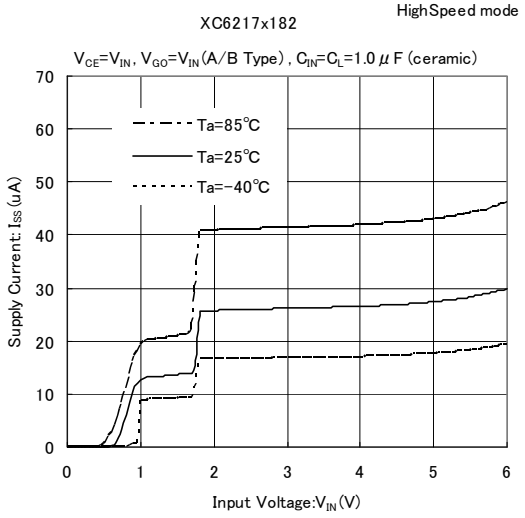
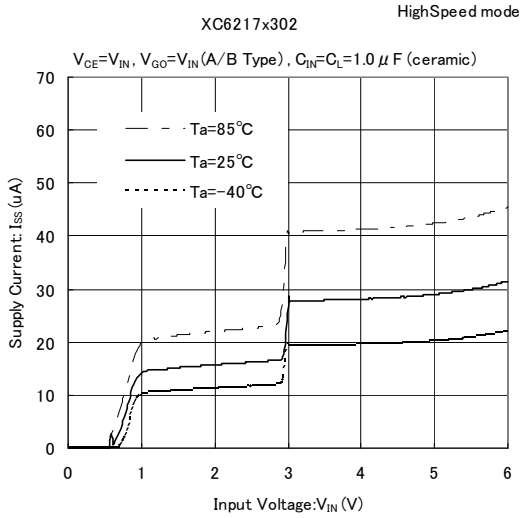
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Supply Current vs. Input Voltage

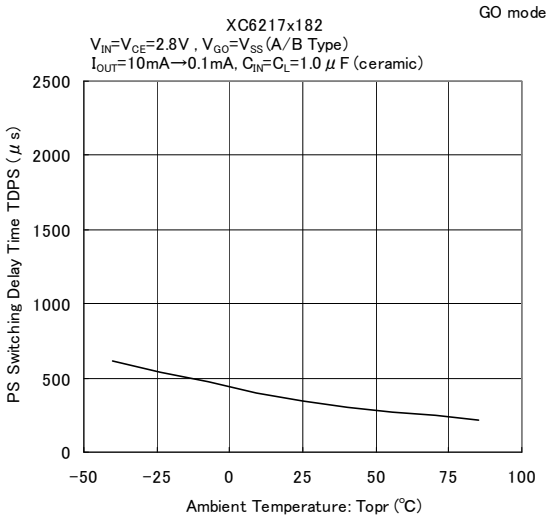


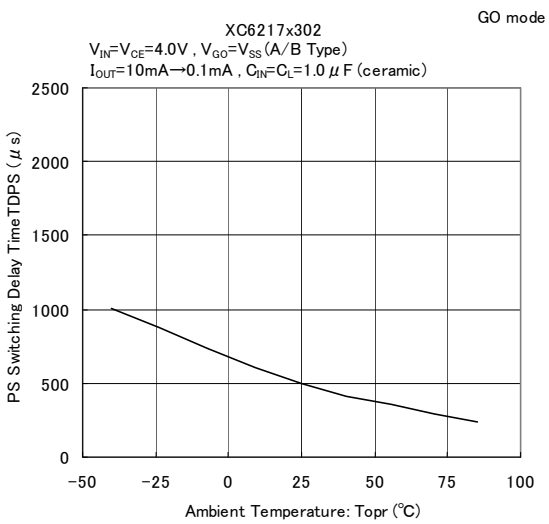






(6) PS Switching Delay Time vs. Ambient Temperature





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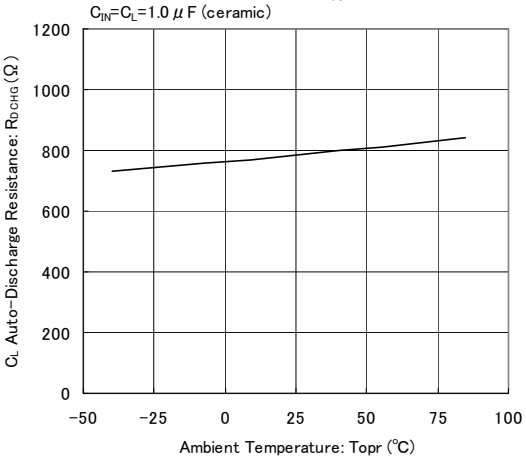
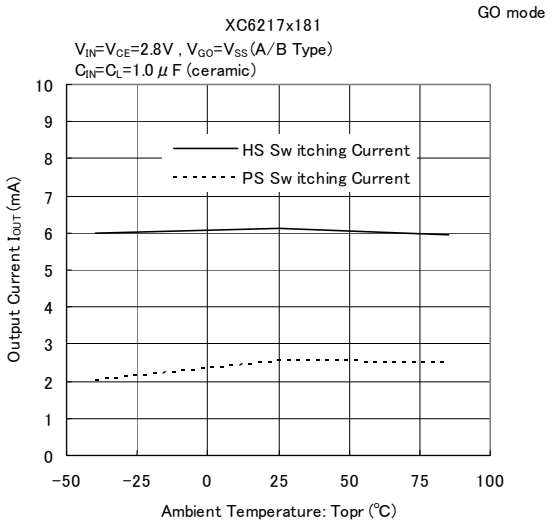
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

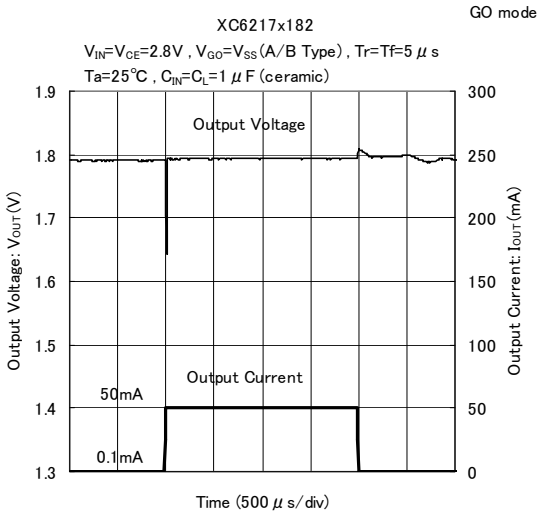
(7) CL Auto-Discharge Resistance vs. Ambient Temperature

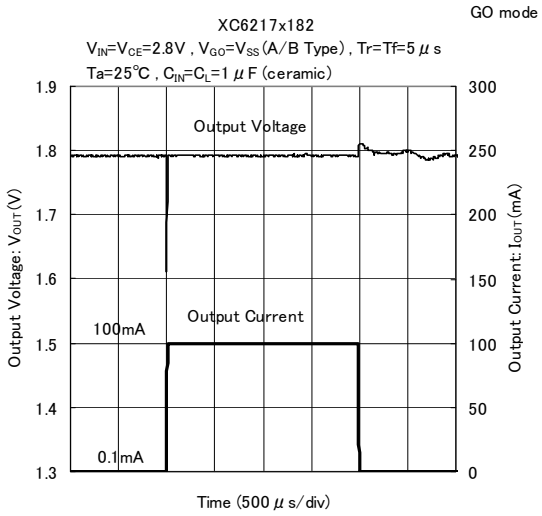


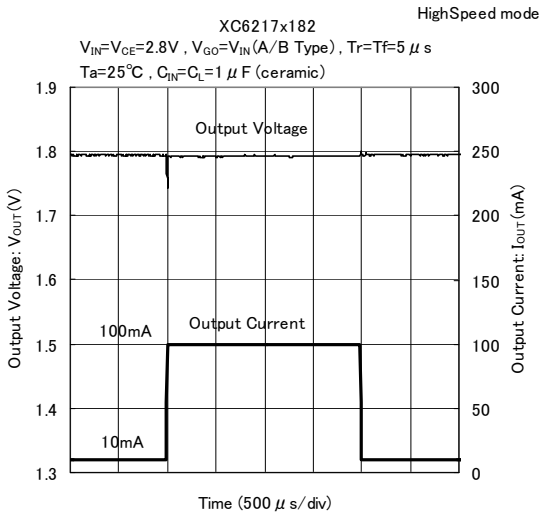
(8) PS/HS Switching Current vs. Ambient Temperature

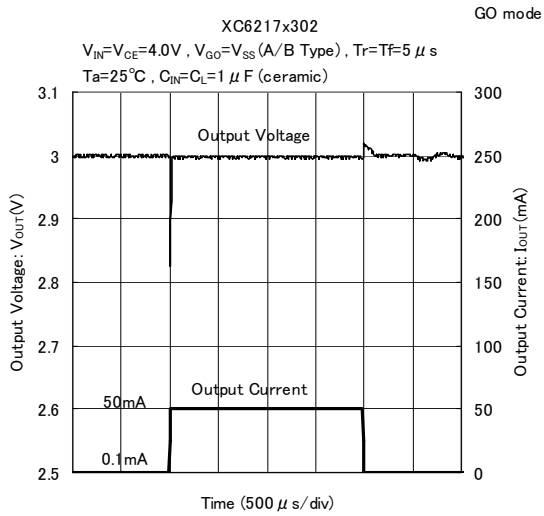


(9) Load Transient Response









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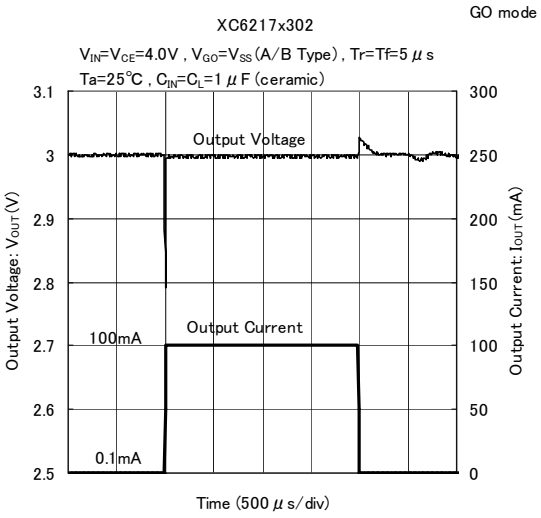
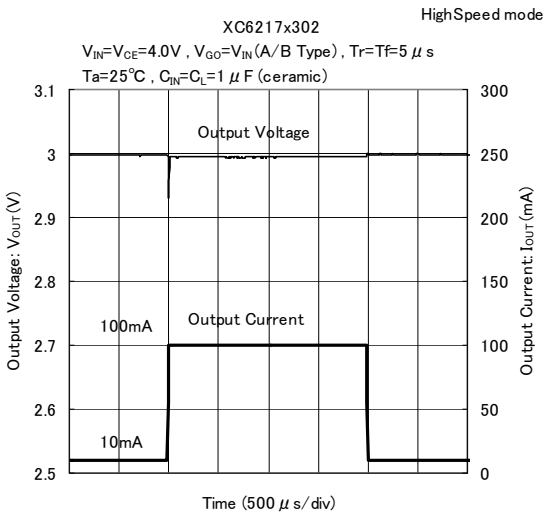
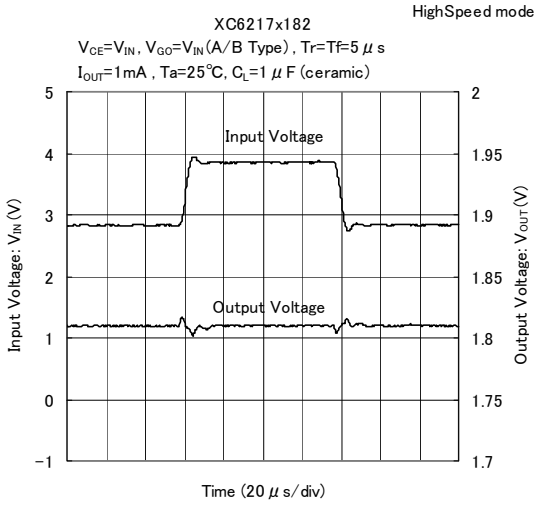
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

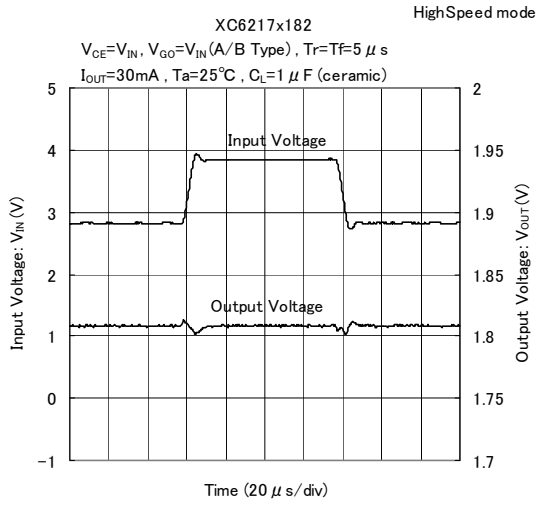
(9) Load Transient Response

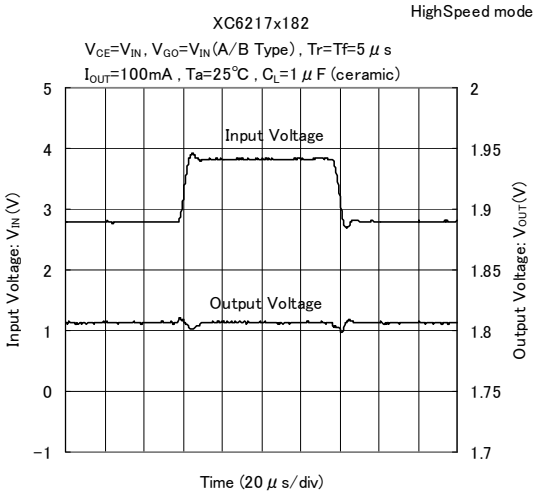




(10) Line Transient Response







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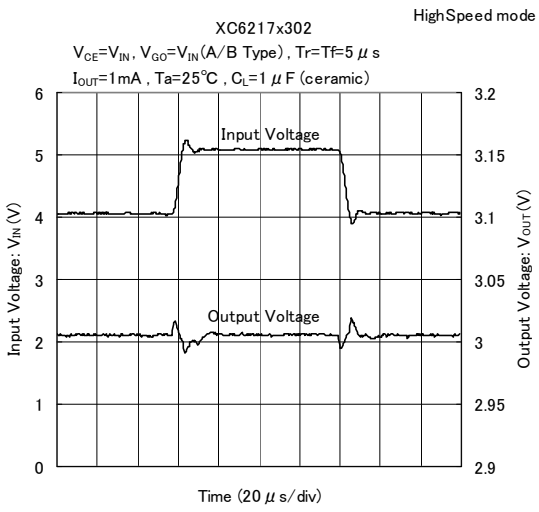
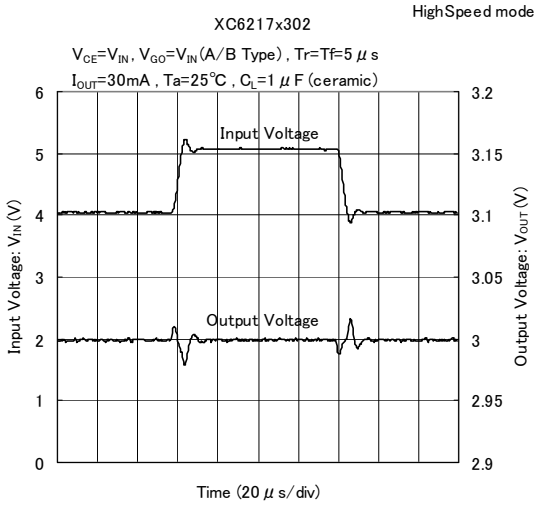
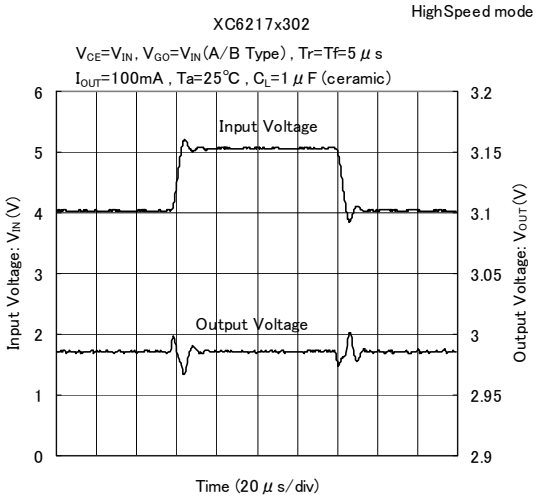
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

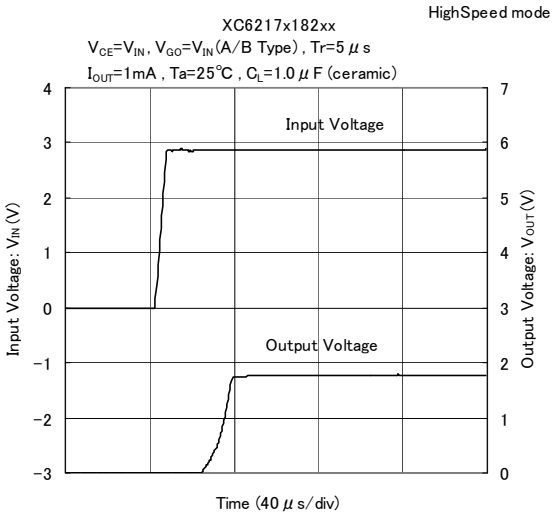
(10) Line Transient Response

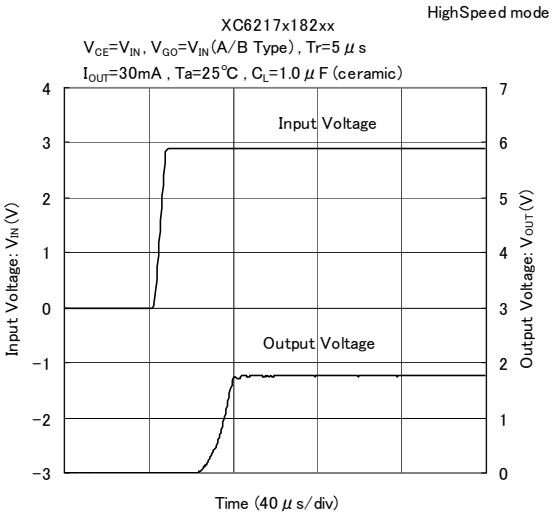






(11) Turn-On Response





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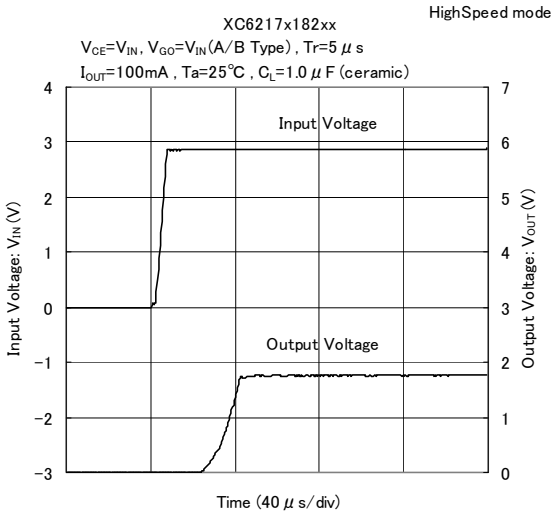
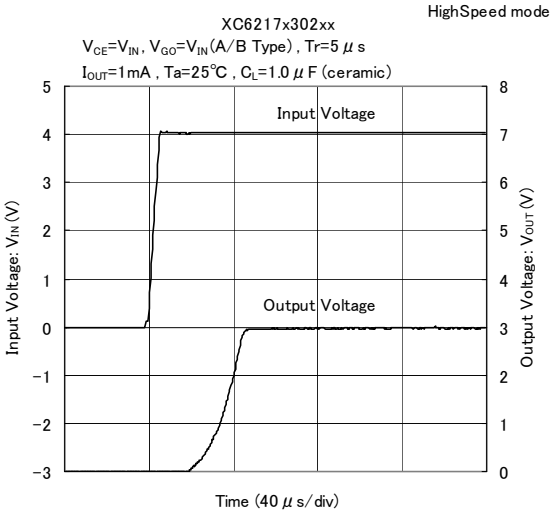
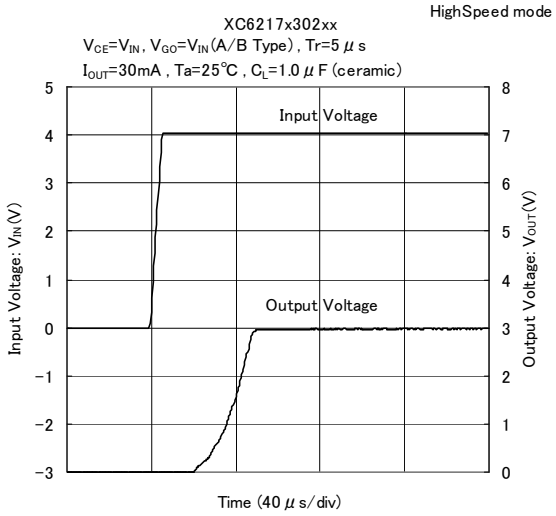
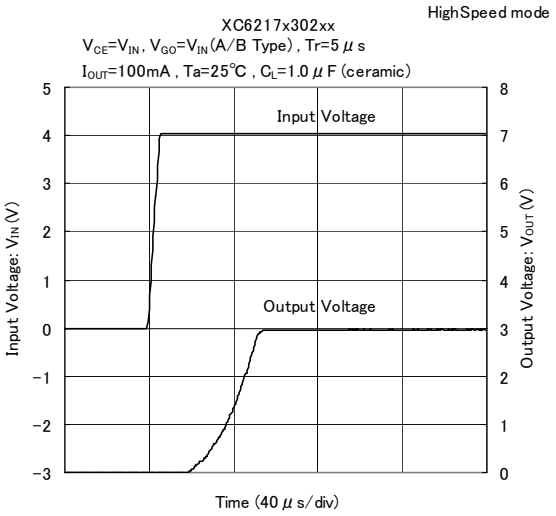
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) Turn-On Response (Continued)

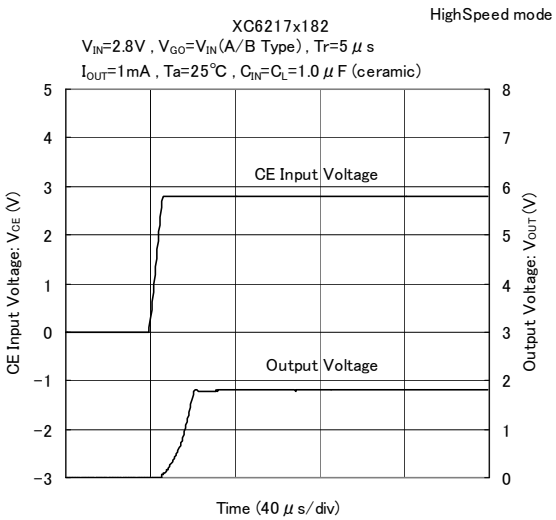


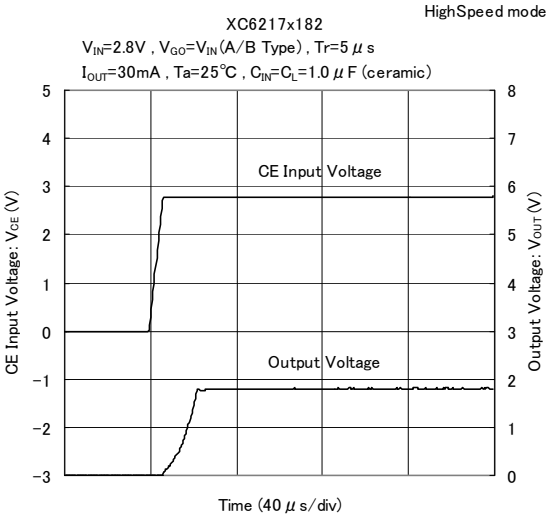






(12) CE Turn-On Response





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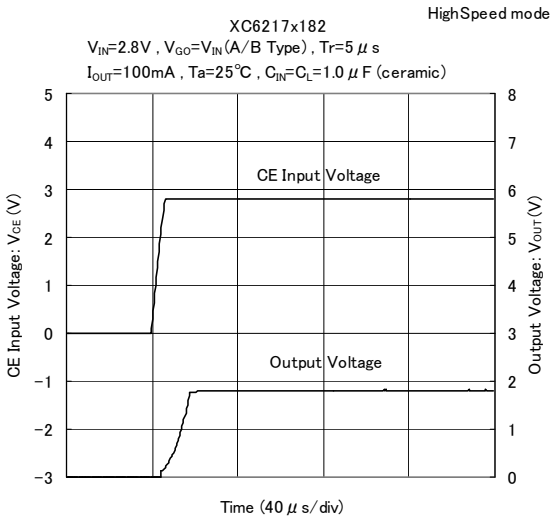
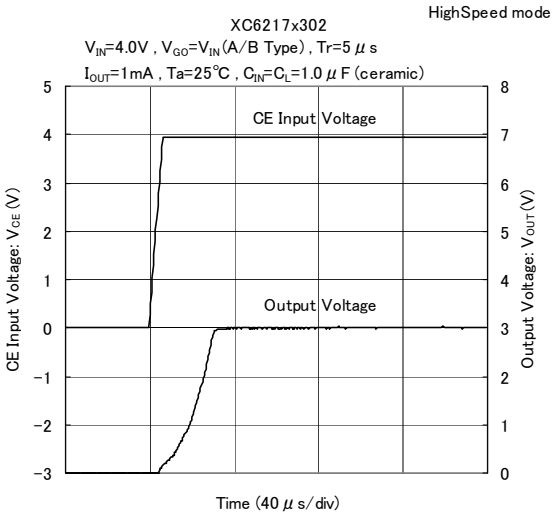
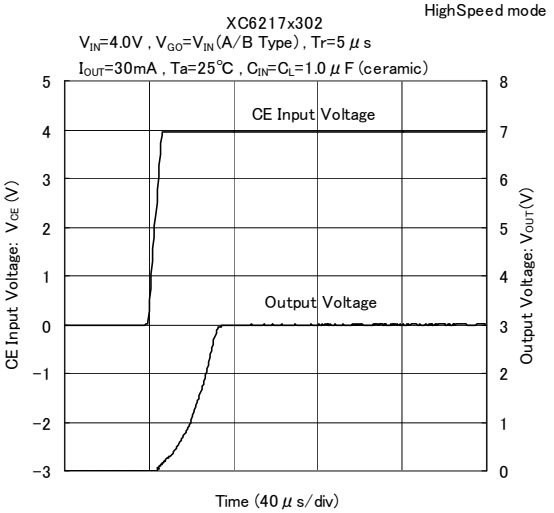
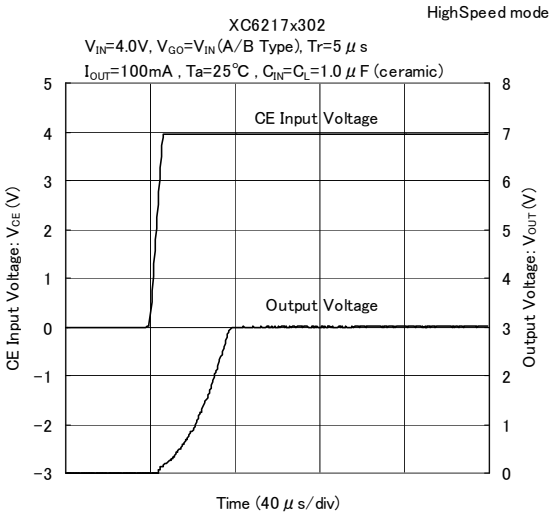
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(12) CE Turn-On Response (Continued)









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■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

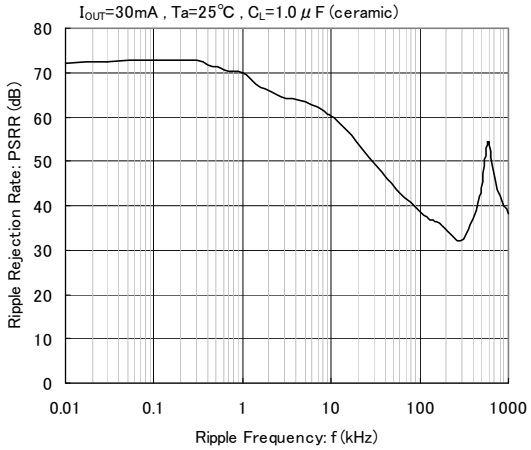
(13) Ripple Rejection Rate

HighSpeed mode

XC6217x182

$V_{IN}=V_{CE}=2.8V_{DC}+0.5V_{P-PAC}$, $V_{GO}=V_{IN}$ (A/B Type)

I_{OUT}=30mA , Ta=25℃ , C_L=1.0μF (ceramic)

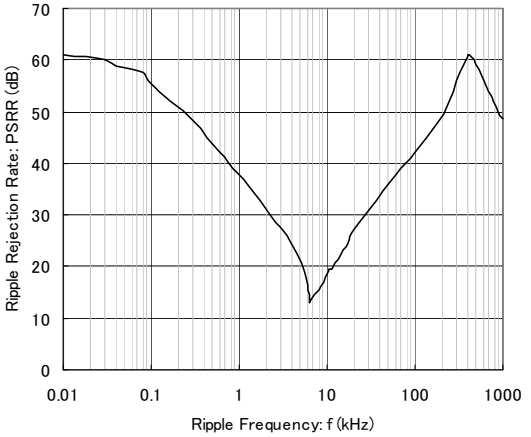


PowerSave mode

XC6217x182

$V_{IN}=V_{CE}=2.8V_{DC}+0.5V_{P-PAC}$, $V_{GO}=V_{SS}$ (A/B Type)

I_{OUT}=0.1mA , Ta=25℃ , C_L=1.0μF (ceramic)

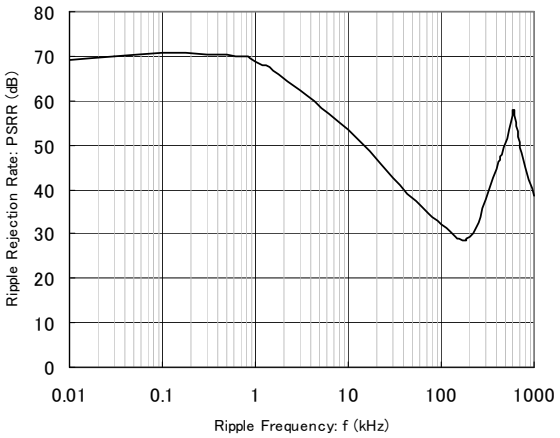


HighSpeed mode

XC6217x302

$V_{IN}=V_{CE}=4.0V_{DC}+0.5V_{P-PAC}$, $V_{GO}=V_{IN}$ (A/B Type)

I_{OUT}=30mA , Ta=25℃ , C_L=1.0μF (ceramic)

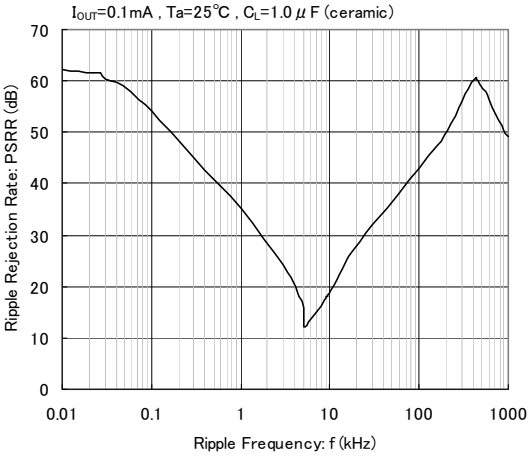


PowerSave mode

XC6217x302

$V_{IN}=V_{CE}=4.0V_{DC}+0.5V_{P-PAC}$, $V_{GO}=V_{SS}$ (A/B Type)

I_{OUT}=0.1mA , Ta=25℃ , C_L=1.0μF (ceramic)



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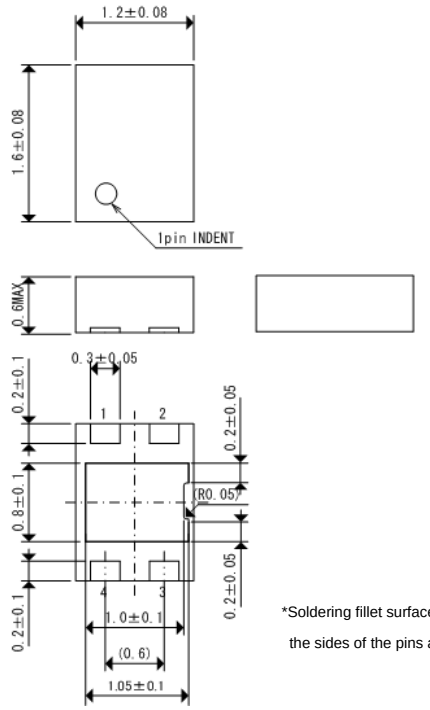
■PACKAGING INFORMATION

●USP-4D

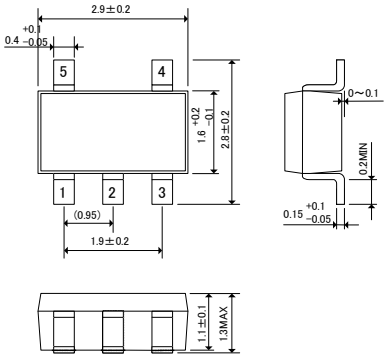
(unit : mm)



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

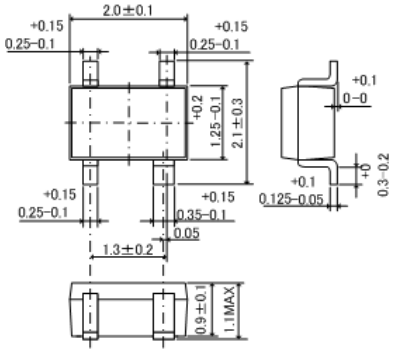
●SOT-25

(unit : mm)



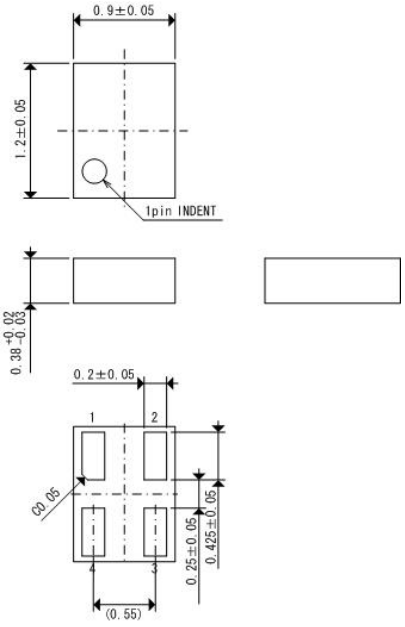
●SSOT-24

(unit : mm)



●USPN-4

(unit : mm)



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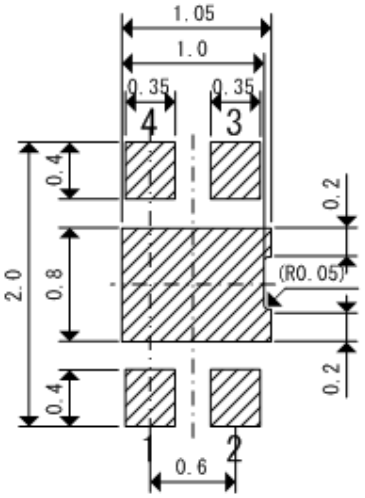
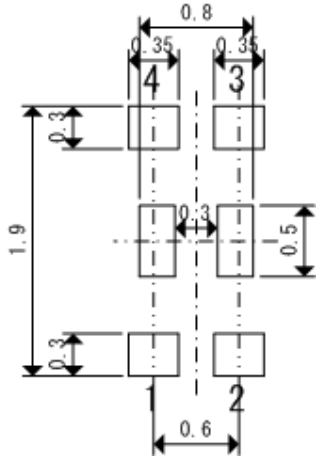
■PACKAGING INFORMATION (Continued)

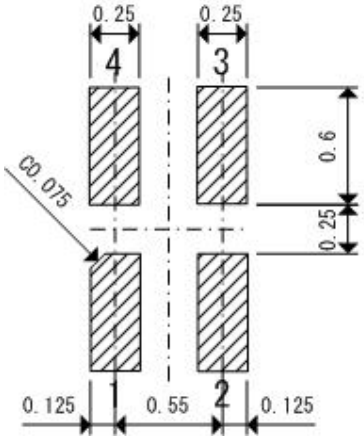
●USP-4D Reference Pattern Layout Dimension



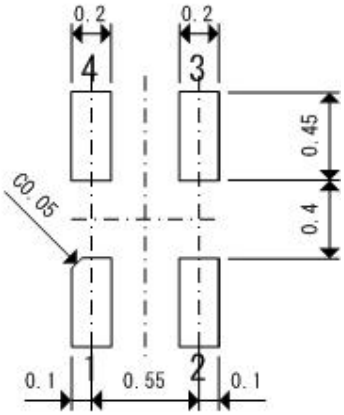
●USP-4D Reference metal mask design



●USPN-4 Reference Pattern Layout Dimension



●USPN-4 Reference metal mask design



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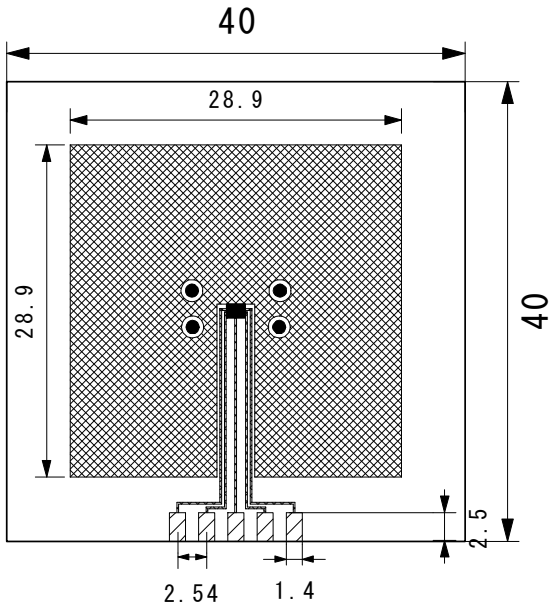
● USP-4D Power Dissipation

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^2 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

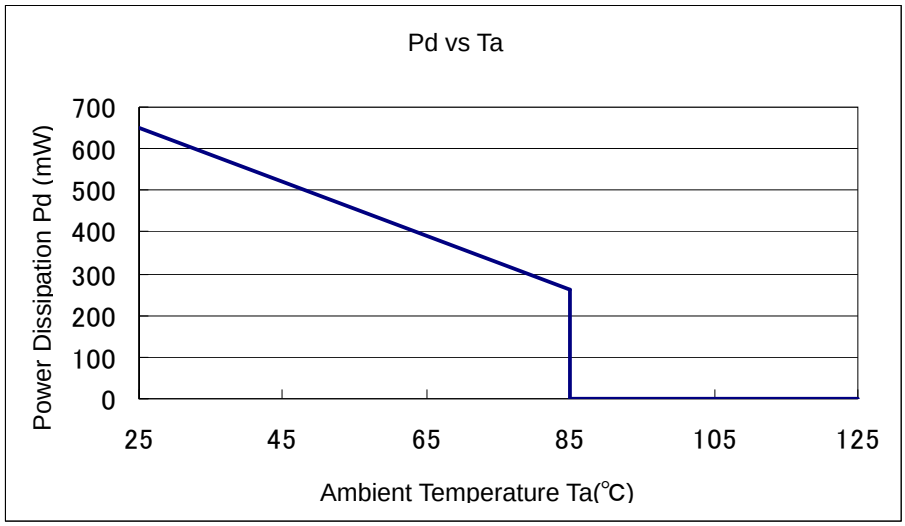


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

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



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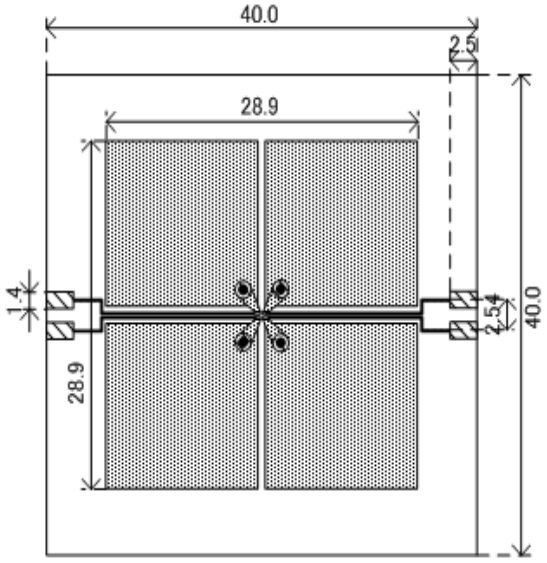
● USPN-4 Power Dissipation

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^2 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

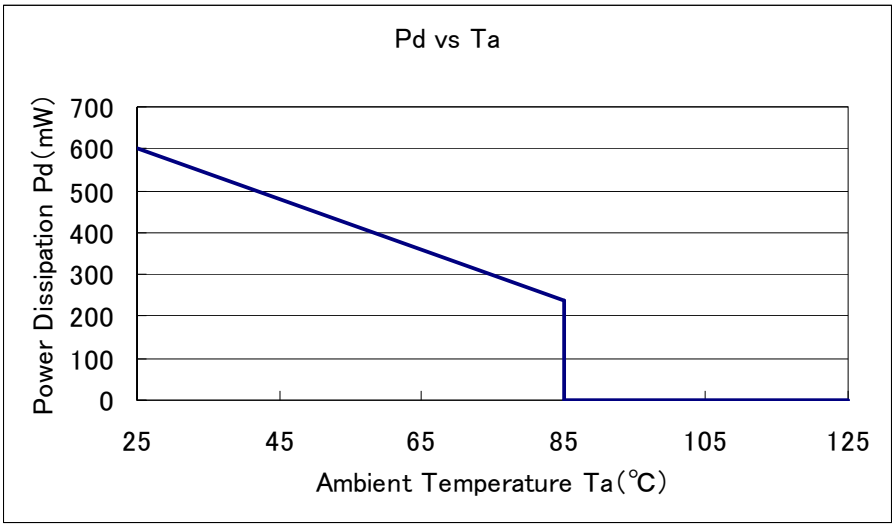


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

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



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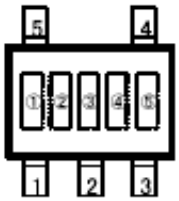
■MARKING RULE

●SOT-25



SOT-25
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
1	XC6217xxxxxx

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.

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■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.

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■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.

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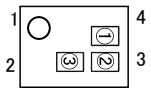
■MARKING RULE (Continued)

●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 $0.80V \leqq V_{OUT(T)} \leqq 1.55V$ 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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