XC6228 Series

300mA High Speed LDO Regulator with ON/OFF Switch

■GENERAL DESCRIPTION

The XC6228 series is a high speed LDO regulator that features high accurate, low noise, high ripple rejection, low dropout and low power consumption. The series consists of a voltage reference, an error amplifier, a driver transistor, a current limiter, a phase compensation circuit.

The CE function enables the circuit to be in stand-by mode by inputting low level signal. In the stand-by mode, the series enables the electric charge at the output capacitor C_L to be discharged via the internal switch, and as a result the VOUT pin quickly returns to the V_{SS} level. The output stabilization capacitor C_L is also compatible with low ESR ceramic capacitors.

The output voltage is selectable from 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.1V, 3.3V which fixed by laser trimming technologies. The over current protection circuit is built-in. This protection circuit will operate when the output current reaches current limit level.

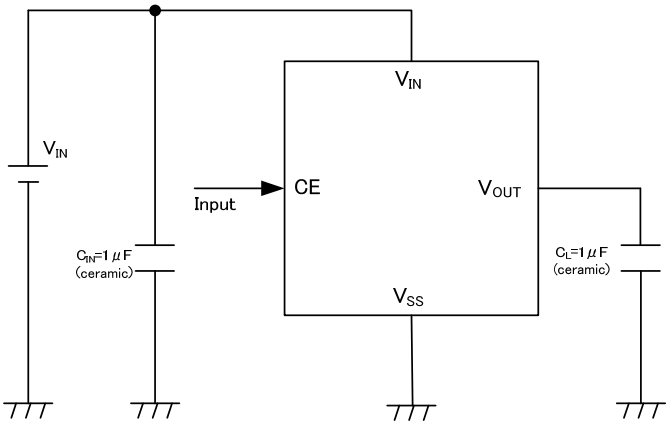
■APPLICATIONS

- ●Mobile devices
- ●Wireless communications
- ●Modules
- ●Mobile phones

■FEATURES

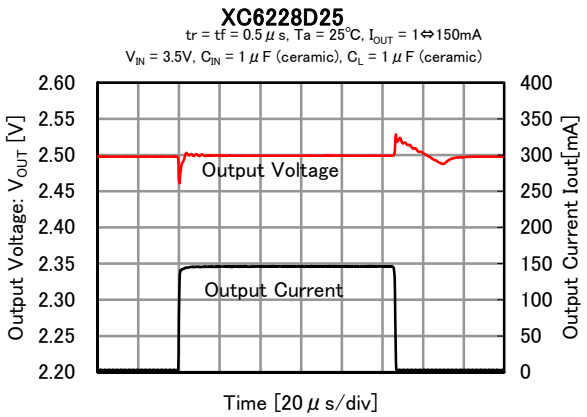
Maximum Output Current	: 300mA
Input Voltage Range	: 1.6～5.5V
Output Voltages	: 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.1V, 3.3V (±1%,±2%)
Dropout Voltage	: 200mV@I_{OUT}=300mA (V_{OUT}=3.0V)
Low Power Consumption	: 100μA
Stand-by Current	: 0.1μA
High Ripple Rejection	: 80dB@f=1kHz
Protection Circuits	: Current Limit（400mA） Short Circuit Protection
Low ESR Capacitors	: C_{IN}=1μF, C_L=1μF
CE Function	: Active High, C_L High Speed Discharge
Operating Ambient Temperature	: -40℃～+85℃
Small Package	: SOT-25J USPQ-4B04
Environmentally Friendly	: EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT



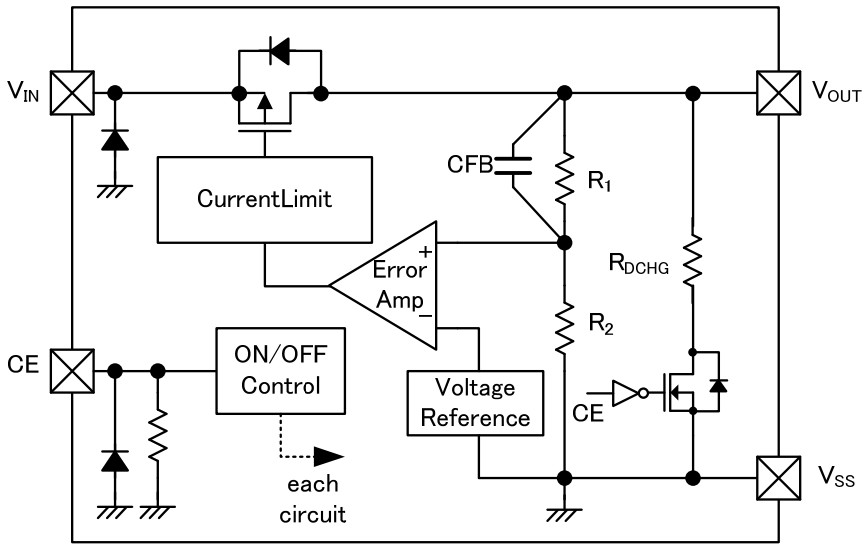
■ TYPICAL PERFORMANCE CHARACTERISTICS

●Load Transient Response

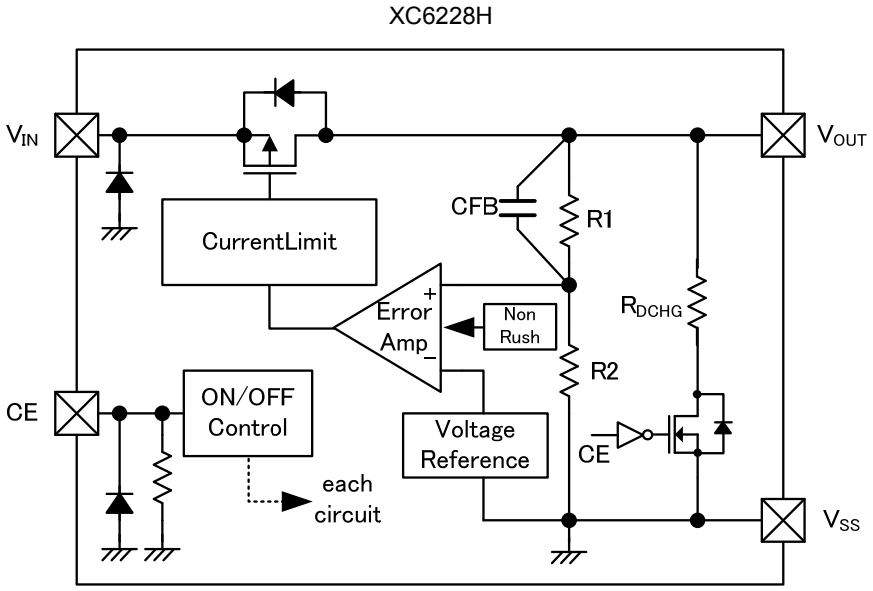


■BLOCK DIAGRAMS

XC6228D



XC6228H



* Diodes inside the circuits are ESD protection diodes and parasitic diodes.

■PRODUCT CLASSIFICATION

●Ordering Information

XC6228①②③④⑤⑥-⑦ (*1)

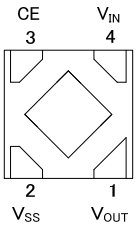
DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Regulator Type	D	No Inrush Current Control
		H	Inrush Current Prevention Circuit Built-in
②③	Output Voltage	12	1.2V
		15	1.5V
		18	1.8V
		25	2.5V
		28	2.8V
		30	3.0V
		31	3.1V
		33	3.3V
④	Output Voltage Accuracy	1	±1%(*2)
		2	±2%
⑤⑥-⑦ (*1)	Packages (Order Unit)	9R-G	USPQ-4B04 (3,000/Reel)
		VR-G	SOT-25J (3,000/Reel)

(*1) The “-G” suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.
(*2) $V_{OUT(T)}$<2.0V, $V_{OUT(T)}$±20mV

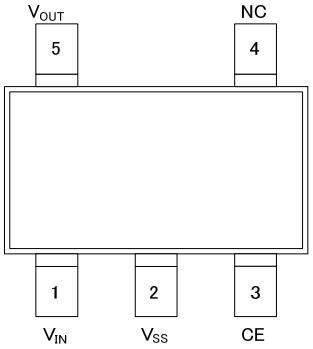
●Selection Guide

TYPE	CURRENT LIMITTER	CE PULL-DOWN RESISTOR	C_L DISCHARGE	INRUSH CURRENT PROTECTION
D	Yes	Yes	Yes	No
H	Yes	Yes	Yes	Yes

■PIN CONFIGURATION



USPQ-4B04
(BOTTOM VIEW)



SOT-25J
(TOP VIEW)

* The dissipation pad for the USPQ-4B04 package should be solder-plated in reference mount pattern and metal masking so as to enhance mounting strength and heat release. If the pad needs to be connected to other pins, it should be connected to the V_{SS} (No. 2) pin.

■PIN ASSIGNMENT

PIN NUMBER		PIN NAME	FUNCTIONS
USPQ-4B04	SOT-25J		
1	5	V_{OUT}	Output
2	2	V_{SS}	Ground
3	3	CE	ON/OFF Control
4	1	V_{IN}	Power Input
-	4	NC	No Connection

■PIN FUNCTION ASSIGNMENT

PIN NAME	SIGNAL	STATUS
CE	L	Stand-by
	H	Active
	OPEN	Stand-by*

* An internal pull-down resister maintains the CE pin voltage to be low.

■ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	V_{SS}-0.3～V_{SS}+7.0	V
Output Current		I_{OUT}	500 (*1)	mA
Output Voltage		V_{OUT}	V_{SS}-0.3～V_{IN}+0.3	V
CE Input Voltage		V_{CE}	V_{SS}-0.3～V_{SS}+7.0	V
Power Dissipation	SOT-25J	Pd	200	mW
			500 (PCB mounted) (*2)	
	USPQ-4B04		100	
			550 (PCB mounted) (*2)	
Operating Ambient Temperature		Topr	-40～+85	℃
Storage Temperature		Tstg	-55～+125	℃

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

(*2) This is a reference data taken by using the test board. Please refer to page 21 to 22 for details.

■ELECTRICAL CHARACTERISTICS

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUITS
Output Voltage (±1%)	$V_{OUT(E)}$ (*1)	$V_{OUT(T)}$≧2.0V, V_{CE}=V_{IN}, I_{OUT}=10mA	$V_{OUT(T)}$×0.99 (*2)	$V_{OUT(T)}$ (*2)	$V_{OUT(T)}$×1.01 (*2)	V	①
		$V_{OUT(T)}$<2.0V, V_{CE}=V_{IN}, I_{OUT} =10mA (*3)	$V_{OUT(T)}$-20mV (*2)	$V_{OUT(T)}$ (*2)	$V_{OUT(T)}$+20mV (*2)	V	
Output Voltage (±2%)	$V_{OUT(E)}$ (*1)	V_{CE}=V_{IN}, I_{OUT}=10mA	$V_{OUT(T)}$×0.98 (*2)	$V_{OUT(T)}$ (*2)	$V_{OUT(T)}$×1.02 (*2)	V	①
Maximum Output Current	I_{OUTMAX}	V_{CE}=V_{IN}	300	-	-	mA	①
Load Regulation	ΔV_{OUT}	V_{CE}=V_{IN}, 0.1mA≦I_{OUT}≦300mA	-	25	45	mV	①
Dropout Voltage	Vdif (*3)	V_{CE}=V_{IN}, I_{OUT}=300mA	-	E-1		mV	①
Supply Current	I_{SS}	V_{CE}=V_{IN}	-	100	220	μA	②
Stand-by Current	I_{STB}	V_{CE}=V_{SS}	-	0.01	0.4	μA	②
Line Regulation	ΔV_{OUT}/(ΔV_{IN}・V_{OUT})	$V_{OUT(T)}$+0.5V≦V_{IN}≦5.5V, V_{CE}=V_{IN}, I_{OUT}=50mA	-	0.01	0.1	%/V	①
Input Voltage	V_{IN}	-	1.6	-	5.5	V	①
Output Voltage Temperature Characteristics	ΔV_{OUT}/(ΔTopr・V_{OUT})	V_{CE}=V_{IN}, I_{OUT}=10mA, -40℃≦Ta≦85℃	-	±100	-	ppm/℃	①
Power Supply Rejection Ratio	PSRR	$V_{OUT(T)}$＜2.5V, V_{IN}=3.0V_{DC}+0.5Vp-p_{AC}, V_{CE}=$V_{OUT(T)}$+1.0V, I_{OUT}=30mA, f=1kHz	-	80	-	dB	③
		$V_{OUT(T)}$≧2.5V, V_{IN}={$V_{OUT(T)}$+1.0}V_{DC}+0.5Vp-p_{AC}, V_{CE}=$V_{OUT(T)}$+1.0V, I_{OUT}=30mA, f=1kHz					
Current Limit	I_{LIM}	V_{CE}=V_{IN}	310	400	-	mA	①
Short Current	I_{SHORT}	V_{CE}=V_{IN}, V_{OUT}=V_{SS}	-	50	-	mA	①
CE High Level Voltage	V_{CEH}	-	1.0	-	5.5	V	④
CE Low Level Voltage	V_{CEL}	-	0	-	0.3	V	④
CE High Level Current	I_{CEH}	V_{CE}=V_{IN}=5.5V	3.0	5.5	9.0	μA	④
CE High Level Current	I_{CEL}	V_{CE}=V_{SS}	-0.1	-	0.1	μA	④
C_L Discharge Resistance	R_{DCHG}	V_{IN}=5.5V, V_{OUT}=2.0V, V_{CE}=V_{SS}	-	300	-	Ω	①
Inrush Current (Type H)	I_{RUSH}	V_{IN}=5.5V, V_{CE}=0→5.5V	-	150	-	mA	⑤

NOTE:

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

(*2)$V_{OUT(T)}$: Nominal output voltage

(*3)Vdif＝V_{IN1}(*4)-V_{OUT1}(*5) (V_{IN1}≧1.6V)

(*4)V_{IN1}=The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

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

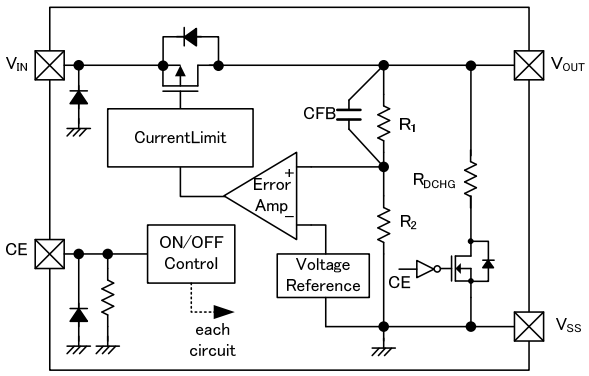
(*6)Unless otherwise stated regarding input voltage conditions, V_{IN}=$V_{OUT(T)}$＋1.0V.

■OUTPUT VOLTAGE CHART

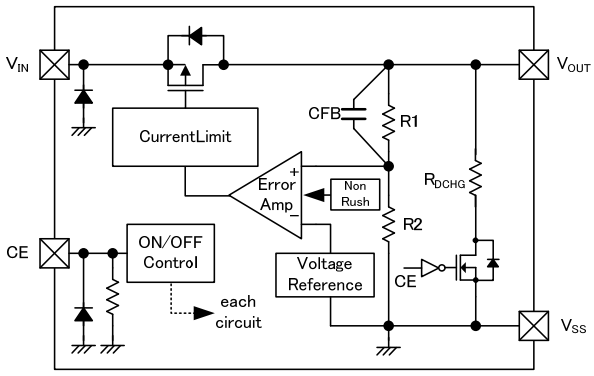
●Voltage Chart 1

NOMINAL OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE(±1%) (V)		OUTPUT VOLTAGE(±2%) (V)		DROPOUT VOLTAGE (mV) E-1	
$V_{OUT(T)}$	$V_{OUT(E)}$		$V_{OUT(E)}$		Vdif	
	MIN.	MAX.	MIN.	MAX.	TYP.	MAX.
1.20	1.180	1.220	1.176	1.224	480	630
1.50	1.480	1.520	1.470	1.530	420	460
1.80	1.780	1.820	1.764	1.836	300	410
2.50	2.475	2.525	2.450	2.550	240	350
2.80	2.772	2.828	2.744	2.856		
3.00	2.970	3.030	2.940	3.060	200	305
3.10	3.069	3.131	3.038	3.162		
3.30	3.267	3.333	3.234	3.366		

■ OPERATIONAL EXPLANATION



XC6228D



XC6228H

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 and stabilized by a system of negative feedback. The current limit circuit and short circuit protection operate in relation to the level of output current and heat dissipation. Further, the IC's internal circuitry can be shutdown via the CE pin signal.

<Low ESR Capacitor>

The XC6228 series needs an output capacitor C_L for phase compensation. Please place an output capacitor (C_L) at the output pin (V_{OUT}) and the ground pin (V_{SS}) as close as possible. Please use the output capacitor (C_L) is 1.0μF or larger. For a stable power input, please connect an input capacitor (C_{IN}) of 1.0μF between the V_{IN} pin and the V_{SS} pin.

<Current Limiter, Short-Circuit Protection>

The XC6228 has current limiter and droop shape of fold-back circuit. When the load current reaches the current limit, the droop current limiter circuit operates and the output voltage drops. When the output voltage dropped, the fold-back circuit operates and the output current goes to decrease. The output current finally falls at the level of 50mA when the output pin is short-circuited.

<CE Pin>

The IC's internal circuitry can be shutdown via the signal from the CE pin. In shutdown mode, the XC6228 series enables the electric charge at the output capacitor (C_L) to be discharged via the internal switch located between the V_{OUT} and V_{SS} pins, and as a result the V_{OUT} pin quickly returns to the V_{SS} level. The XC6228 series has a pull-down resistor at the CE pin inside, so that the CE pin input current flows.

<Inrush Current Protection>

The inrush current protection circuit is built in the XC6228H.

When the IC starts to operate, the protection circuit limits the inrush current from input pin (V_{IN}) to output pin (V_{OUT}) to charge C_L capacitor.

■ NOTES ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.

2. Where wiring impedance is high, operations may become unstable due to the noise and/or phase lag depending on output current. Please strengthen V_{IN} and V_{SS} wiring in particular.

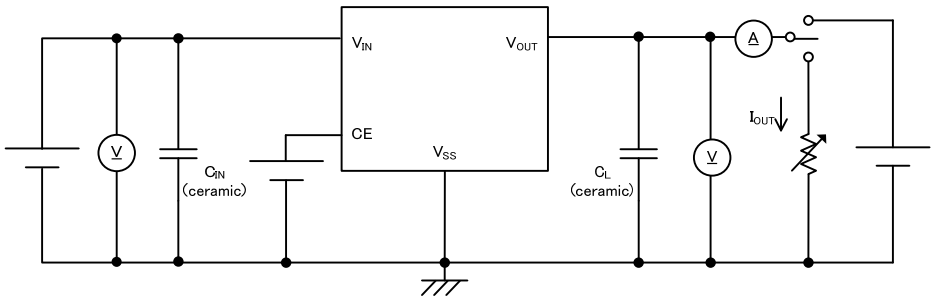
3. The input capacitor C_{IN} and the output capacitor C_L should be placed to the as close as possible with a shorter wiring.

4. The IC is controlled with constant current start-up. Start-up sequence control is requested to draw a load current after even nominal output voltage rising up the output voltage.

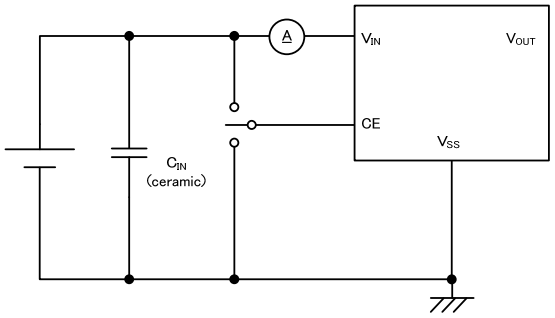
5. Torex places an importance on improving our products and its reliability.
   However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

■TEST CIRCUITS

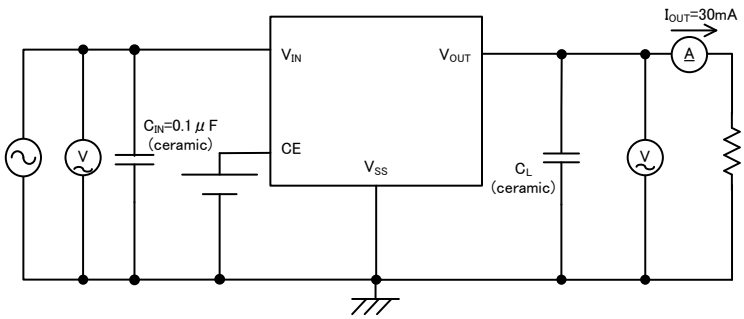
●Circuit ①



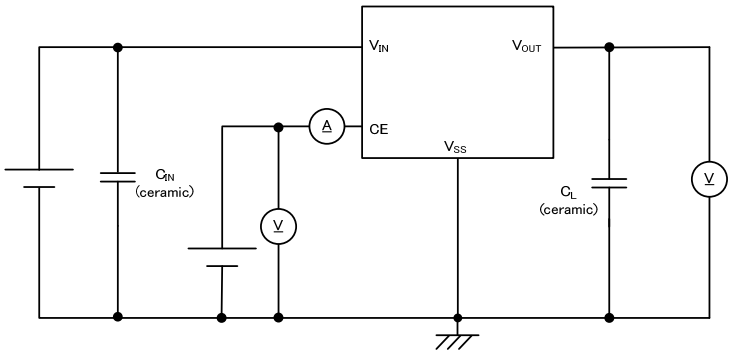
●Circuit ②



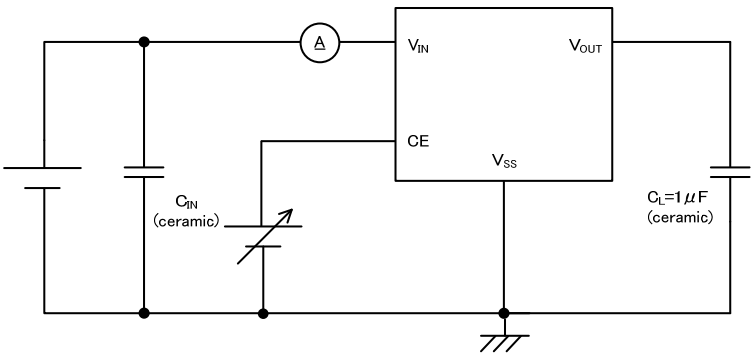
●Circuit ③



●Circuit ④



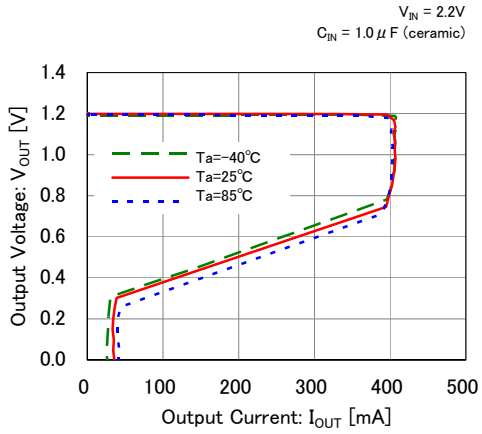
●Circuit ⑤



■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

XC6228x12



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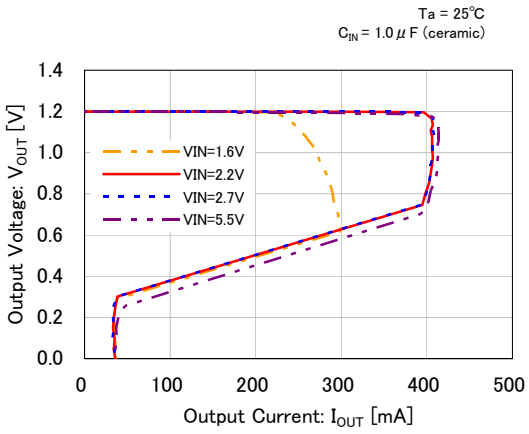
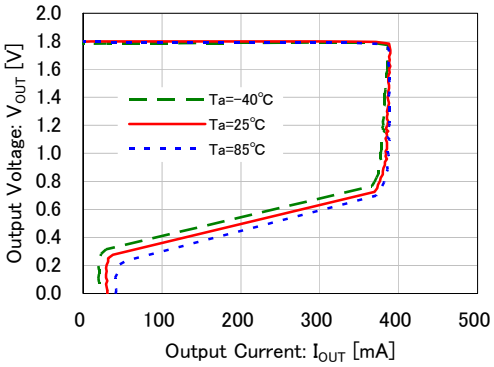


XC6228x18



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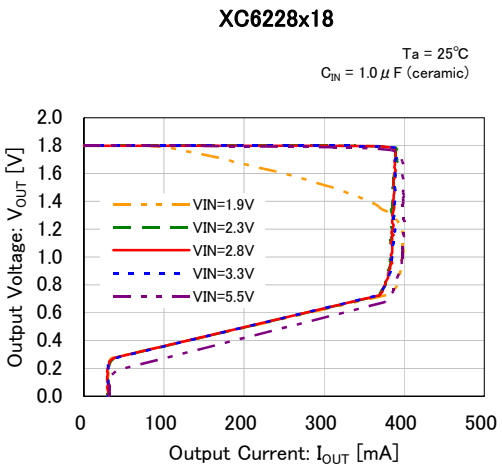
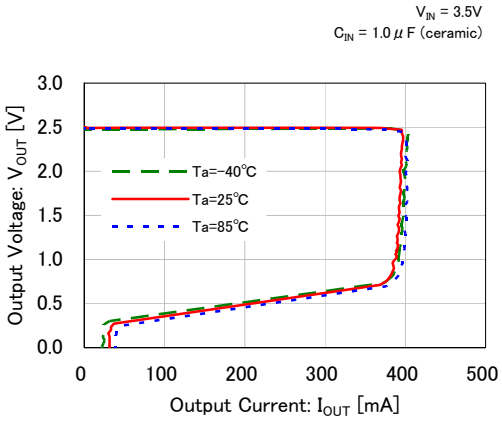


XC6228x25



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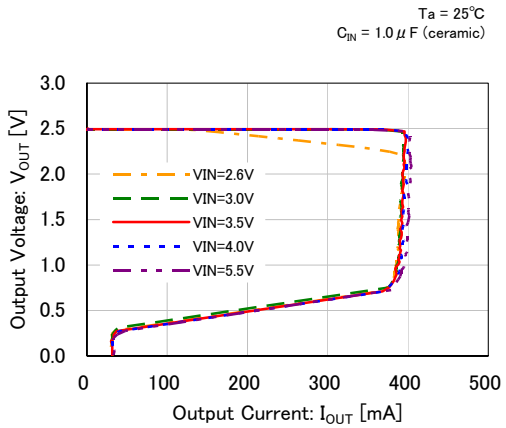
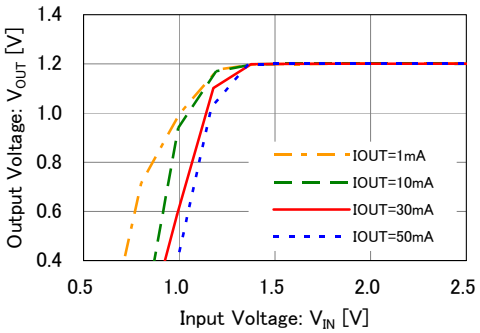


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Input Voltage

XC6228x12

Ta = 25℃
C_{IN} = 1μF (ceramic), C_L = 1μF (ceramic)



XC6228x12

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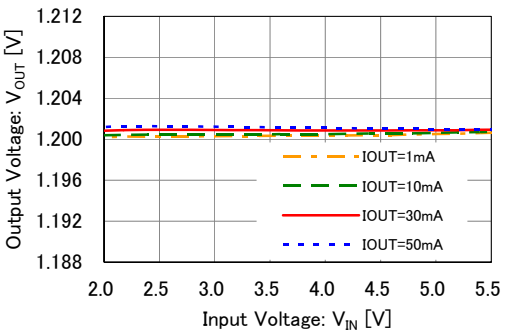

XC6228x18

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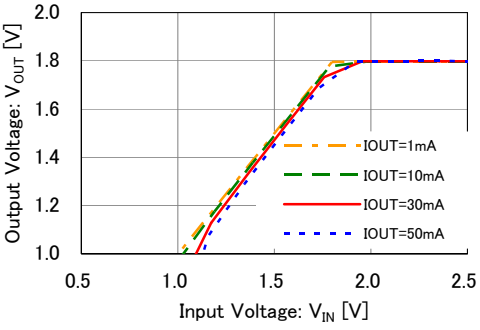

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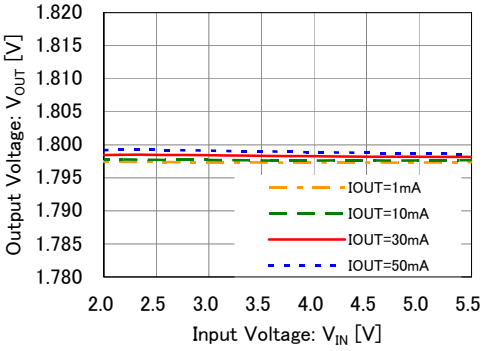

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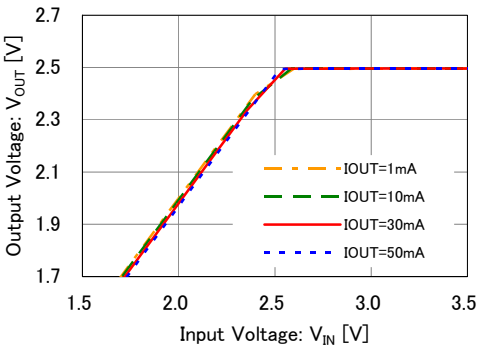

XC6228x25

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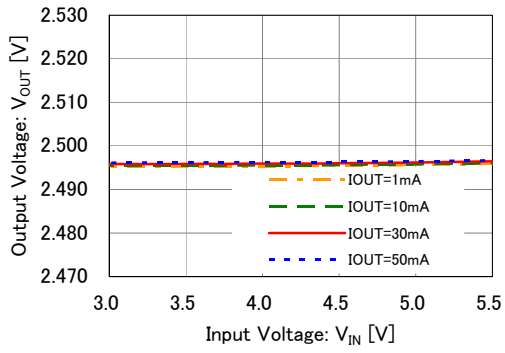
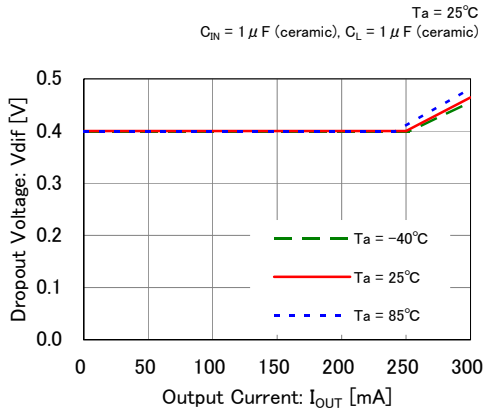


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Dropout Voltage vs. Output Current

XC6228x12



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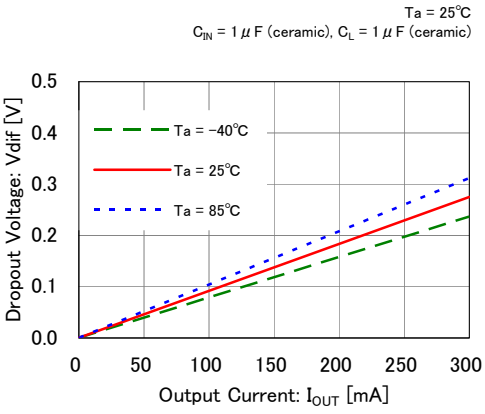
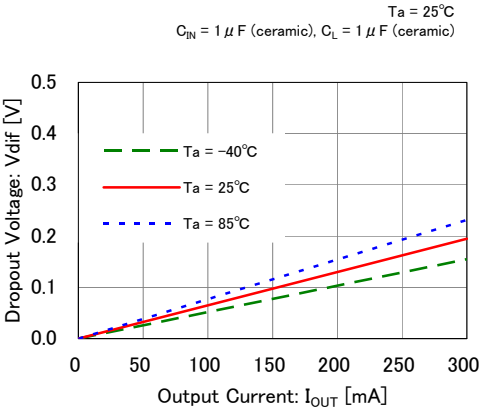
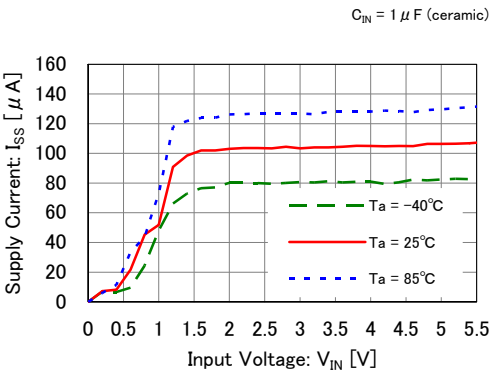


XC6228x25

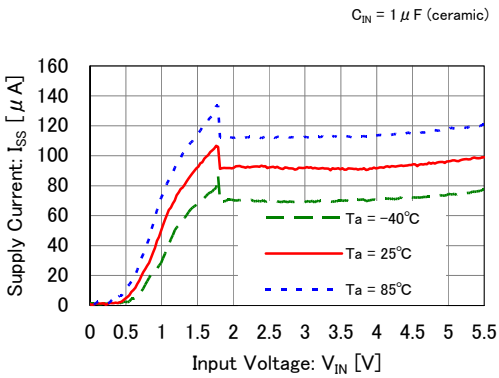


(4) Supply Current vs. Input Voltage

XC6228x12



XC6228x18

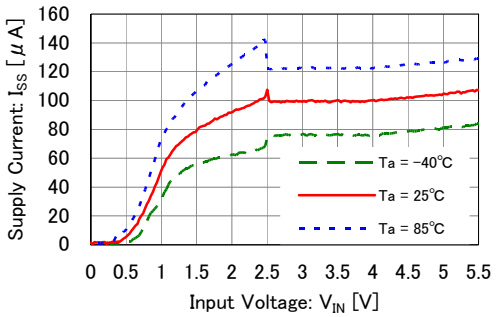


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

XC6228x25

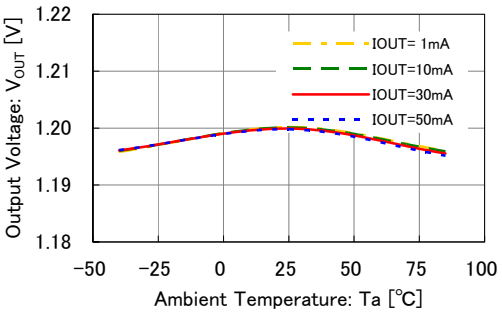
C_{IN} = 1 μF (ceramic)



(5) Output Voltage vs. Ambient Temperature

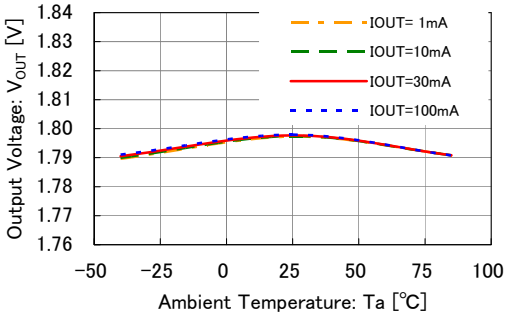
XC6228x12

V_{IN} = 2.2V
C_{IN} = 1 μF (ceramic), C_L = 1 μF (ceramic)



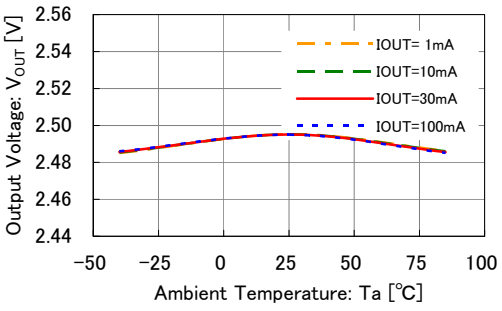
XC6228x18

V_{IN} = 2.8V
C_{IN} = 1 μF (ceramic), C_L = 1 μF (ceramic)



XC6228x25

V_{IN} = 3.5V
C_{IN} = 1 μF (ceramic), C_L = 1 μF (ceramic)

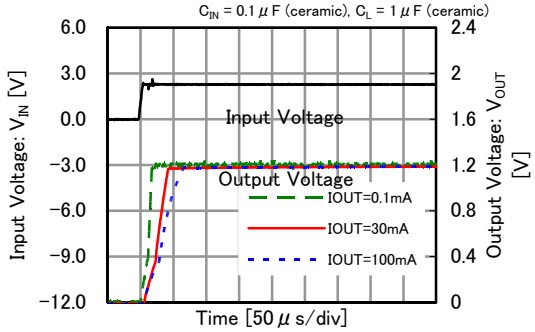


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(6) Rising Response Time

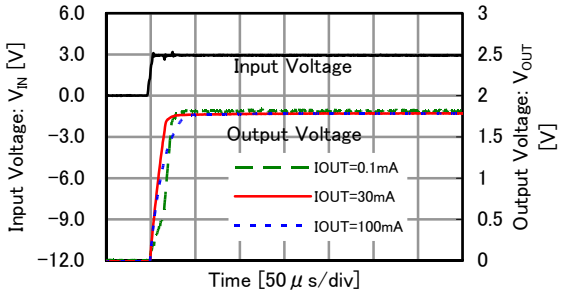
XC6228x12

tr = 5μs, Ta = 25℃,V_{IN} = 0→2.2V
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



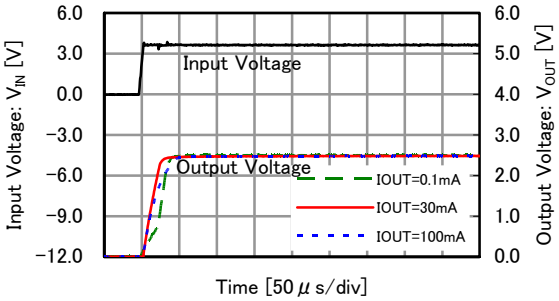
XC6228x18

tr = 5μs, Ta = 25℃,V_{IN} = 0→2.8V
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



XC6228x25

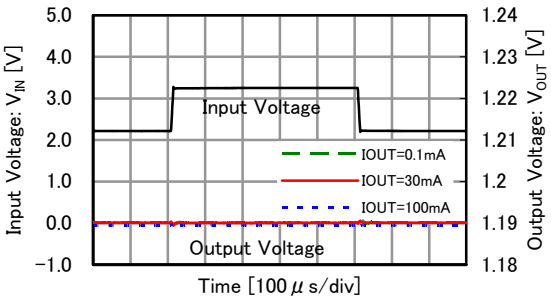
tr = 5μs, Ta = 25℃,V_{IN} = 0→3.5V
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



(7) Input Transient Response

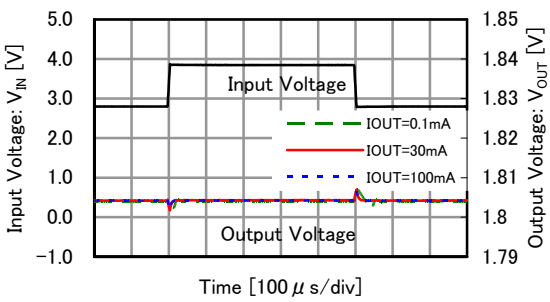
XC6228x12

tr = tf = 5μs, Ta = 25℃, V_{IN} = 2.2V⇔3.2V
C_{IN} = 0.1μF (ceramic), C_L = 1.0μF (ceramic)



XC6228x18

tr = tf = 5μs, Ta = 25℃, V_{IN} = 2.8V⇔3.8V
C_{IN} = 0.1μF (ceramic), C_L = 1.0μF (ceramic)

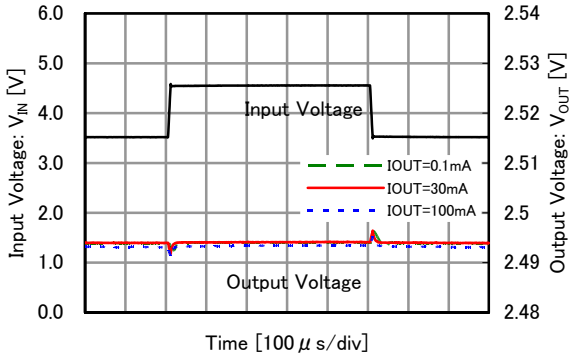


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(7) Input Transient Response (Continued)

XC6228x25

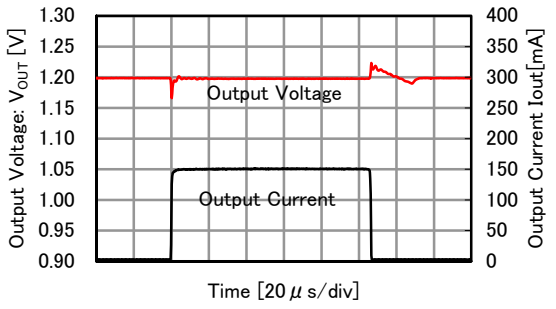
tr = tf = 5μs, Ta = 25℃, V_{IN} = 3.5V⇔4.5V
C_{IN} = 0.1μF (ceramic), C_L = 1.0μF (ceramic)



(8) Load Transient Response (tr=tf=0.5μs)

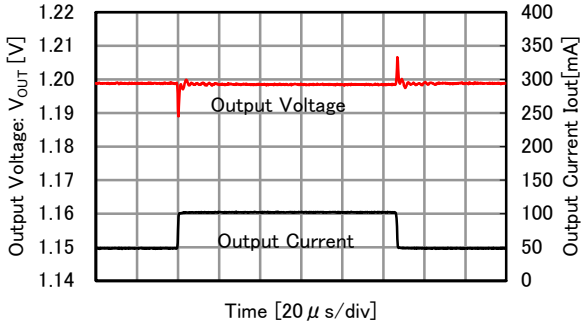
XC6228x12

tr = tf = 0.5μs, Ta = 25℃, I_{OUT} = 1⇔150mA
V_{IN} = 2.2V, C_{IN} = 1μF (ceramic), C_L = 1μF (ceramic)



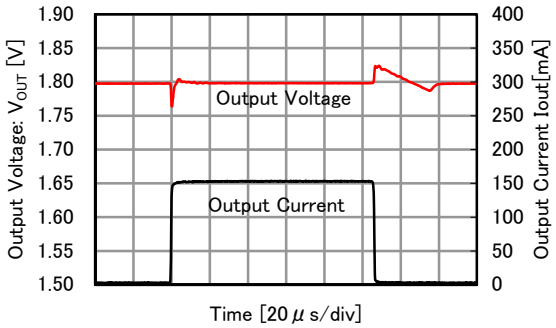
XC6228x12

tr = tf = 0.5μs, Ta = 25℃, I_{OUT} = 50⇔100mA
V_{IN} = 2.2V, C_{IN} = 1μF (ceramic), C_L = 1μF (ceramic)



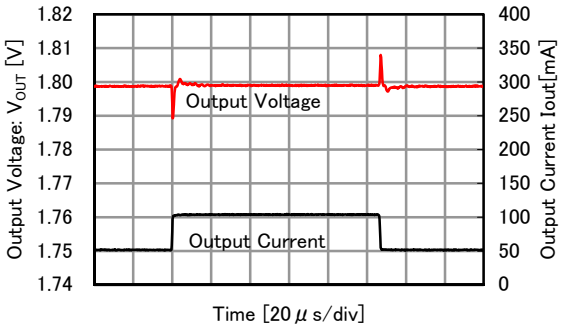
XC6228x18

tr = tf = 0.5μs, Ta = 25℃, I_{OUT} = 1⇔150mA
V_{IN} = 2.8V, C_{IN} = 1μF (ceramic), C_L = 1μF (ceramic)



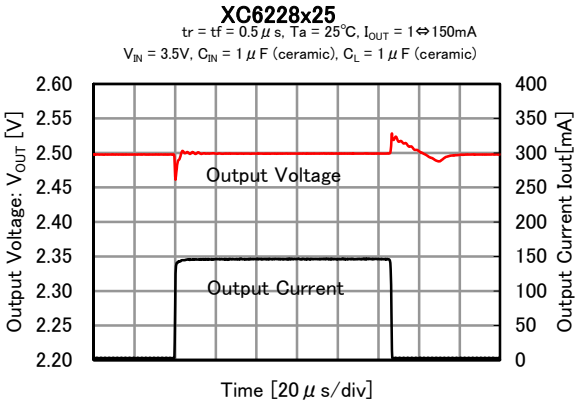
XC6228x18

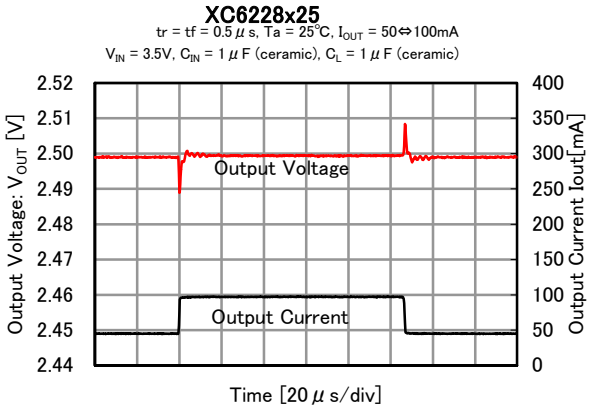
tr = tf = 0.5μs, Ta = 25℃, I_{OUT} = 50⇔100mA
V_{IN} = 2.8V, C_{IN} = 1μF (ceramic), C_L = 1μF (ceramic)



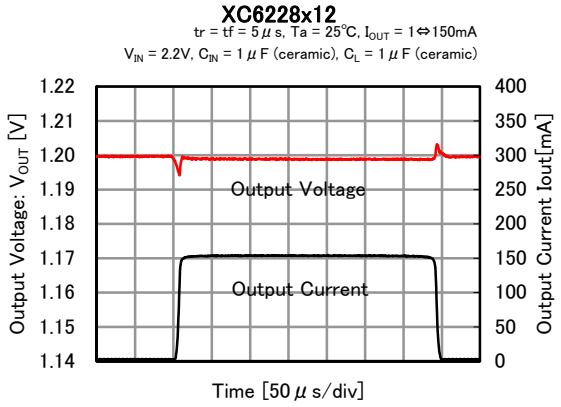
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

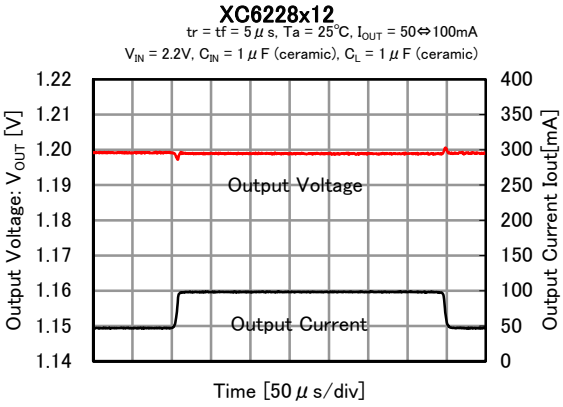
(8) Load Transient Response (tr=tf=0.5μs) (Continued)

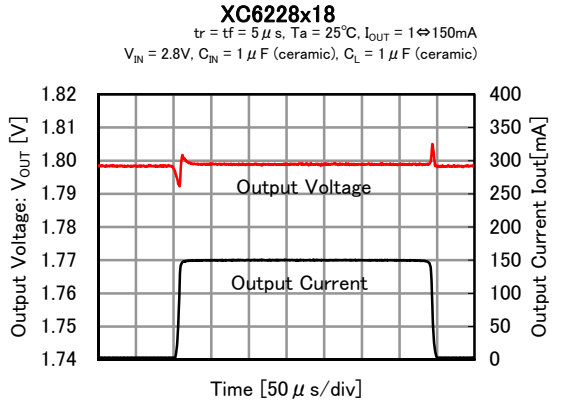


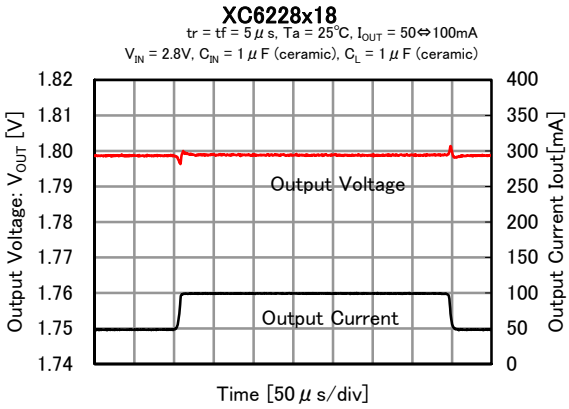


(9) Load Transient Response (tr=tf=5μs)



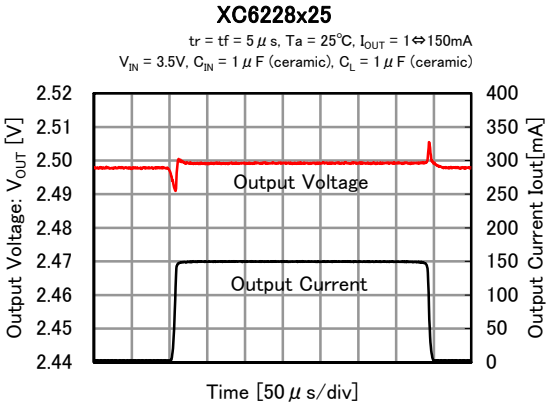


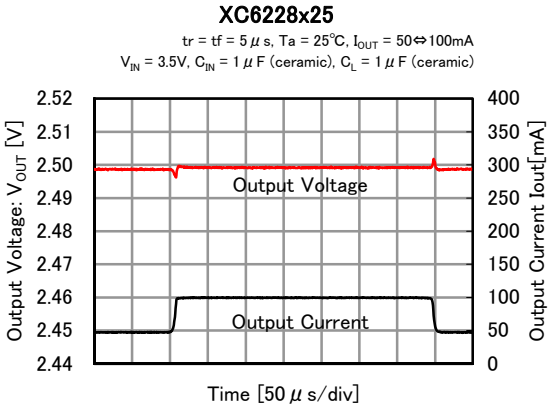




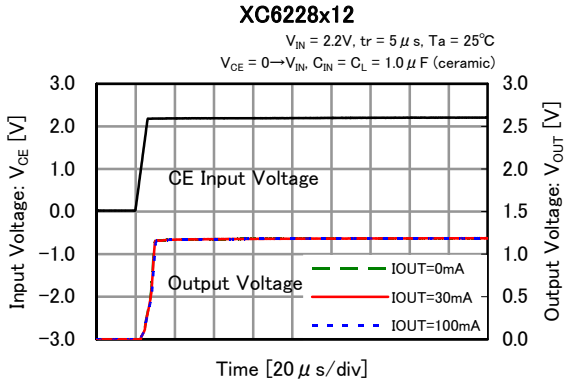
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

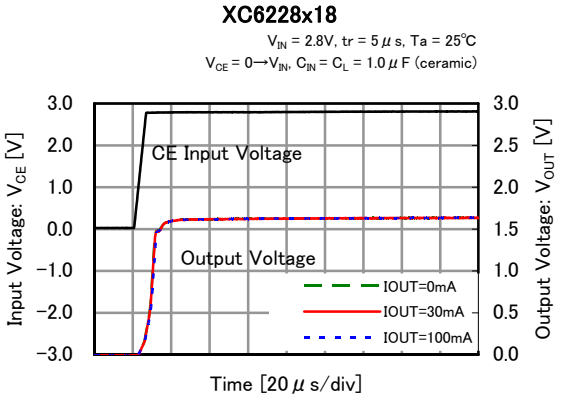
(9) Load Transient Response (tr=tf=5μs) (Continued)

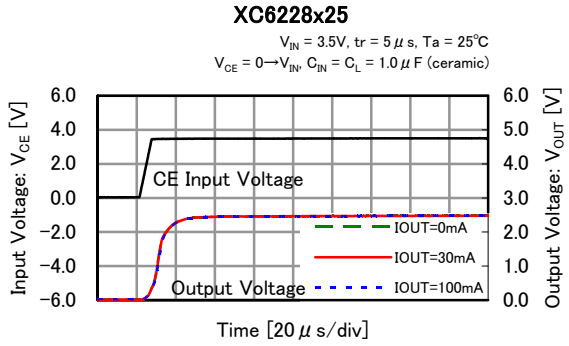




(10) CE Rising Response Time (Type D)





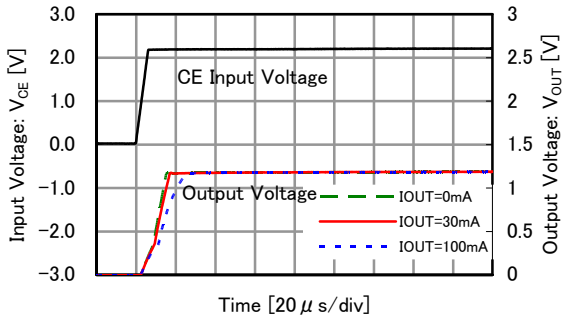


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) CE Rising Response Time (Type H)

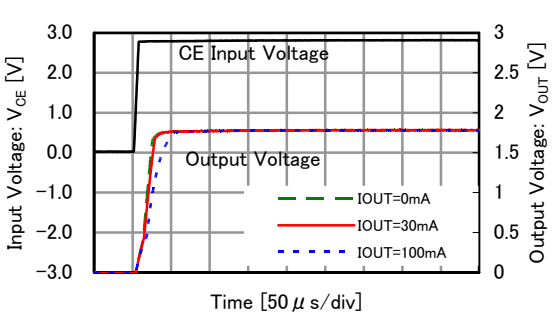
XC6228x12

V_{IN} = 2.2V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)



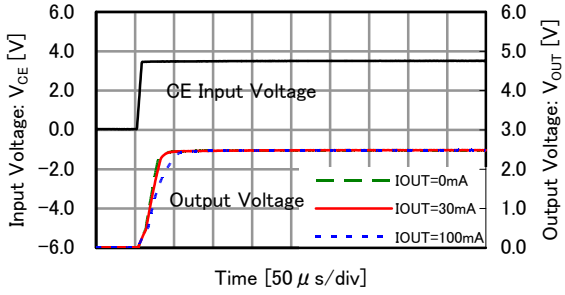
XC6228x18

V_{IN} = 2.8V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)



XC6228x25

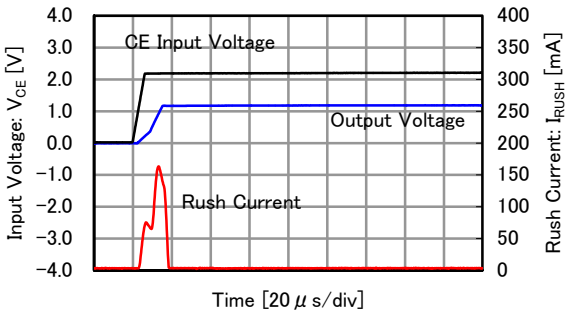
V_{IN} = 3.5V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)



(12) Inrush Current Response Time (Type H)

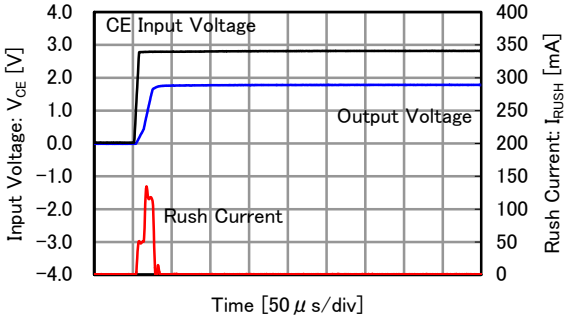
XC6228x12

V_{IN} = 2.2V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)



XC6228x18

V_{IN} = 2.8V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)

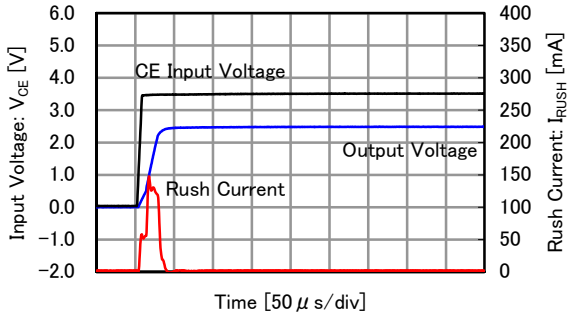


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(12) Inrush Current Response Time (Type H) (Continued)

XC6228x25

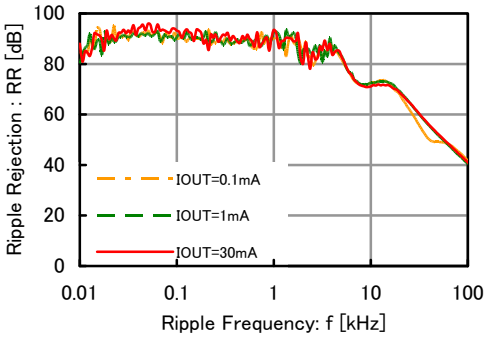
V_{IN} = 3.5V, tr = 5μs, Ta = 25℃
V_{CE} = 0→V_{IN}, C_{IN} = C_L = 1.0μF (ceramic)



(13) Ripple Rejection Rate

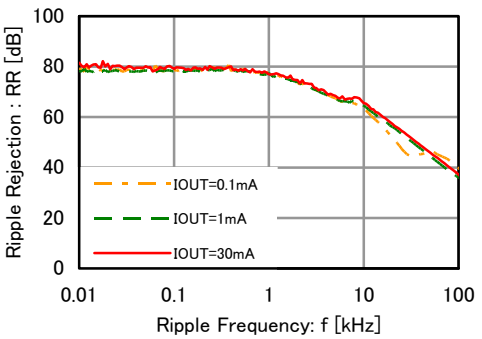
XC6228x12

Ta = 25℃, V_{IN} = 3.0VDC+0.5Vp-pAC
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



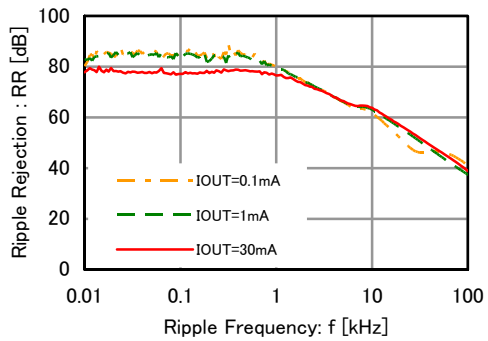
XC6228x18

Ta = 25℃, V_{IN} = 3.0VDC+0.5Vp-pAC
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



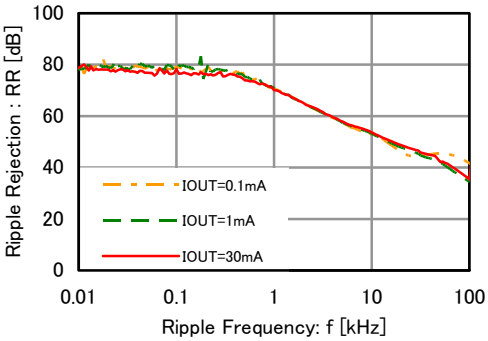
XC6228x25

Ta = 25℃, V_{IN} = 3.5VDC+0.5Vp-pAC
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)



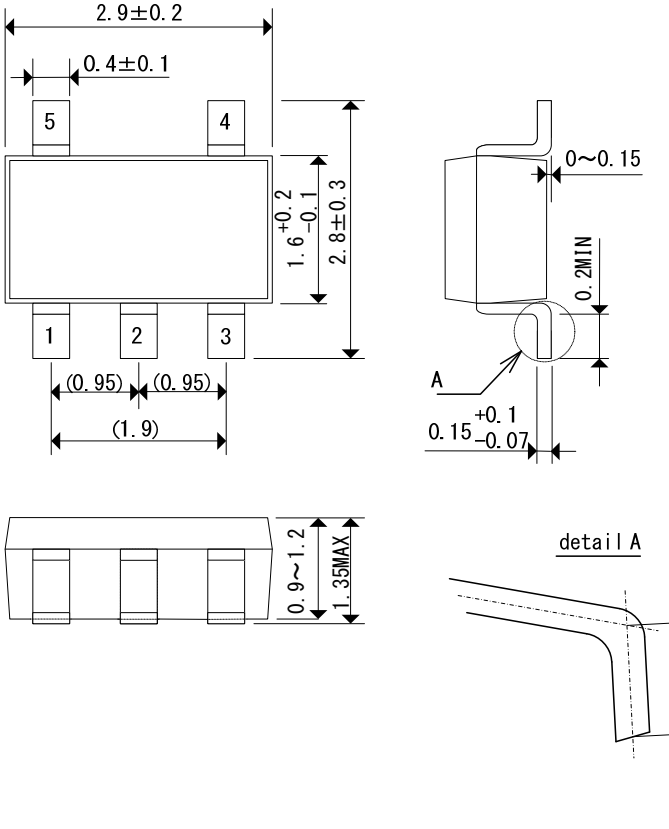
XC6228x33

Ta = 25℃, V_{IN} = 4.3VDC+0.5Vp-pAC
C_{IN} = 0.1μF (ceramic), C_L = 1μF (ceramic)

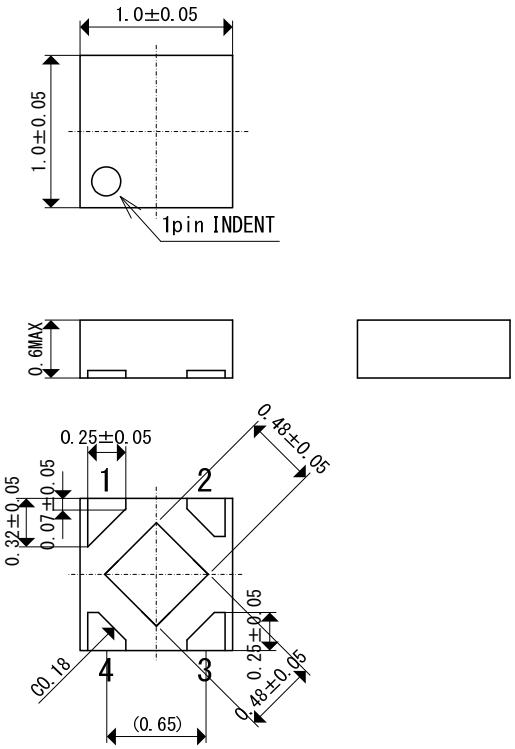


■PACKAGING INFORMATION

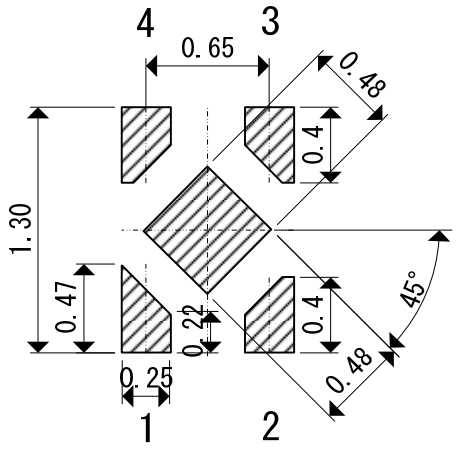
●SOT-25J



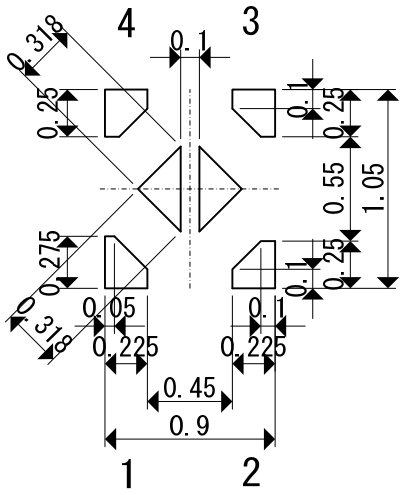
●USPQ-4B04 (unit:mm)



●USPQ-4B04 Reference Pattern Layout (unit: mm)



●USPQ-4B04 Reference Metal Mask Design (unit: mm)



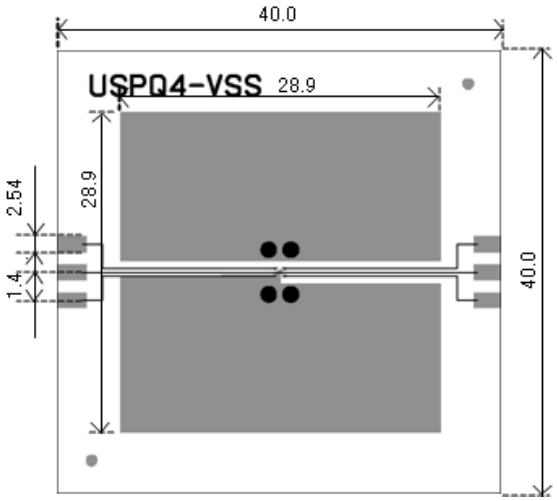
■PACKAGING INFORMATION (Continued)

● USPQ-4B04 Power Dissipation

Power dissipation data for the USPQ-4B04 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.

1. Measurement Condition

Condition	: Mount on a board
Ambient	: Natural convection
Soldering	: Lead (Pb) free
Board Dimensions	: 40 x 40 mm (1600mm^2)
Board Structure	: 4 Copper Layers Each layer is connected to the package heat-sink and terminal pin No.1. Each layer has approximately 800mm^2 copper area.
Material	: Glass Epoxy (FR-4)
Thickness	: 1.6 mm
Through-hole	: 4 x 0.8 Diameter

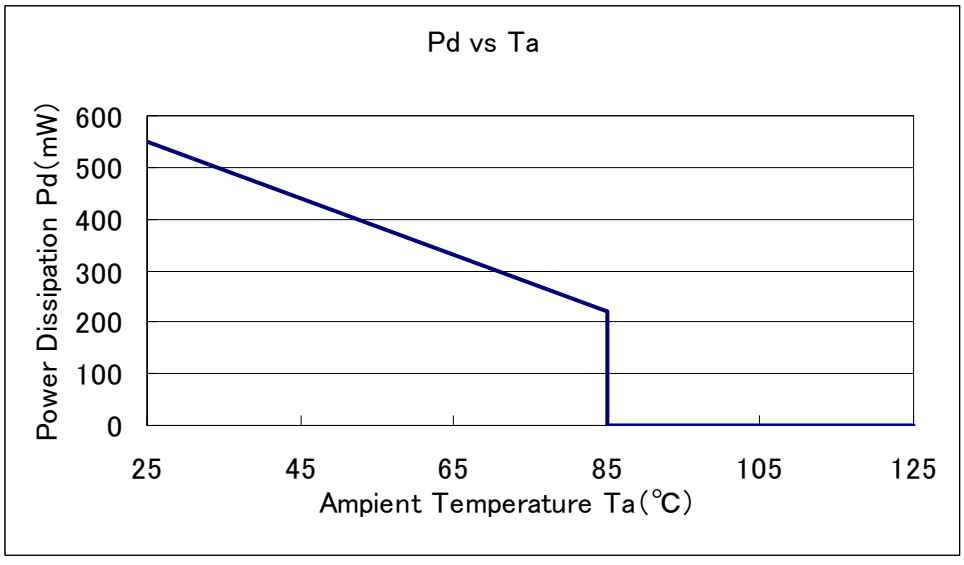


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

Ambient Temperature(℃)	Power Dissipation Pd(mW)	Thermal Resistance (℃/W)
25	550	181.82
85	220	

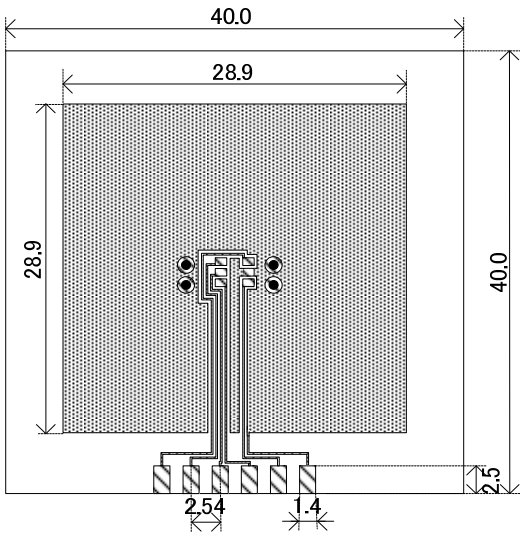


■PACKAGING INFORMATION (Continued)

●SOT-25J Power Dissipation

Power dissipation data for the SOT-25J is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.

1. Measurement Condition
   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
   (Board of SOT-26 is used.)
   Material: Glass Epoxy (FR-4)
   Thickness: 1.6 mm
   Through-hole: 4 x 0.8 Diameter

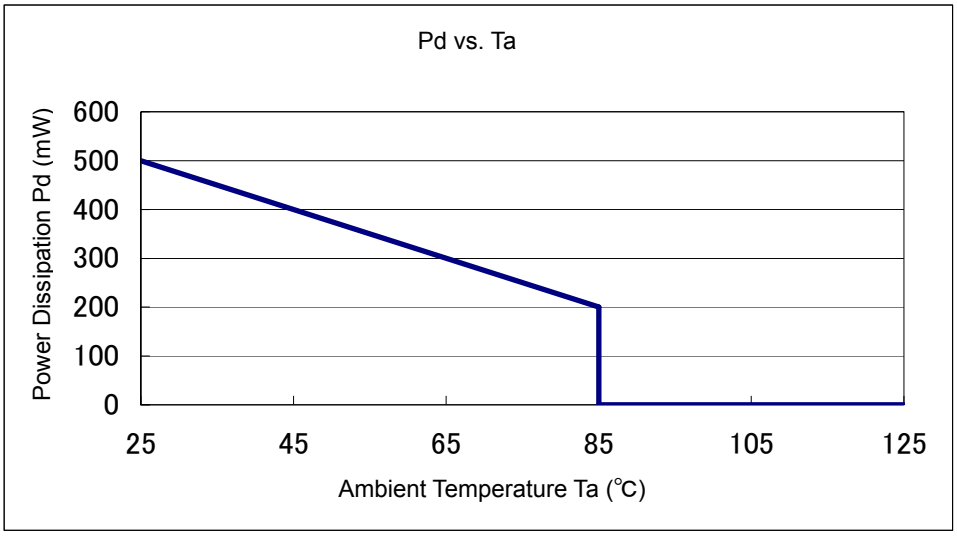


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

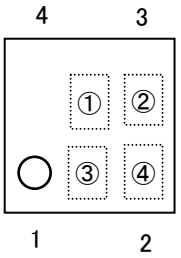
Ambient Temperature (℃)	Power Dissipation Pd (mW)	Thermal Resistance (℃/W)
25	500	200.00
85	200	



■MARKING RULE

●USPQ-4B04

USPQ-4B04



① represents product series.

MARK	PRODUCT SERIES
1	XC6228******-G

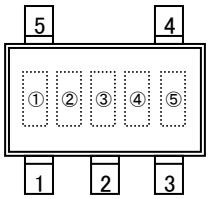
② represents products series, type of regulator and output voltage.

MARK	OUTPUT VOLTAGE (V)	PRODUCT SERIES
A	1.2	XC6228D12***-G
B	1.5	XC6228D15***-G
C	1.8	XC6228D18***-G
D	2.5	XC6228D25***-G
E	2.8	XC6228D28***-G
F	3.0	XC6228D30***-G
H	3.1	XC6228D31***-G
K	3.3	XC6228D33***-G
L	1.2	XC6228H12***-G
M	1.5	XC6228H15***-G
N	1.8	XC6228H18***-G
P	2.5	XC6228H25***-G
R	2.8	XC6228H28***-G
S	3.0	XC6228H30***-G
T	3.1	XC6228H31***-G
U	3.3	XC6228H33***-G

③④ represents production lot number.
01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to AZ, B1 to ZZ in order.
(G, I, J, O, Q, W excepted)
*No character inversion used.

■MARKING RULE (Continued)

●SOT-25J



SOT-25J
(TOP VIEW)

① represents product series.

MARK	PRODUCT SERIES
9	XC6228******-G

② represents type of regulator and combination of output voltage.

MARK	PRODUCT SERIES
P	XC6228D*****-G
3	XC6228H*****-G

③ represents output voltage.

MARK	OUTPUT VOLTAGE (V)	PRODUCT SERIES
2	1.2	XC6228*12***-G
5	1.5	XC6228*15***-G
8	1.8	XC6228*18***-G
F	2.5	XC6228*25***-G
L	2.8	XC6228*28***-G
N	3.0	XC6228*30***-G
P	3.1	XC6228*31***-G
S	3.3	XC6228*33***-G

④⑤ represents production lot number.
01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to AZ, B1 to ZZ in order.
(G, I, J, O, Q, W excepted)
*No character inversion used.

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2. We assume no responsibility for any infringement of patents, patent rights, or other rights arising from the use of any information and circuitry in this datasheet.
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4. The products in this datasheet are not developed, designed, or approved for use with such equipment whose failure of malfunction can be reasonably expected to directly endanger the life of, or cause significant injury to, the user.
   (e.g. Atomic energy; aerospace; transport; combustion and associated safety equipment thereof.)
5. Please use the products listed in this datasheet within the specified ranges.
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7.

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