XC6238 Series

300mA High Speed LDO Regulator with ON/OFF Switch

■GENERAL DESCRIPTION

The XC6238 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 V_{OUT} 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 in 0.05V increments within the range of 1.2V to 4.0V 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.

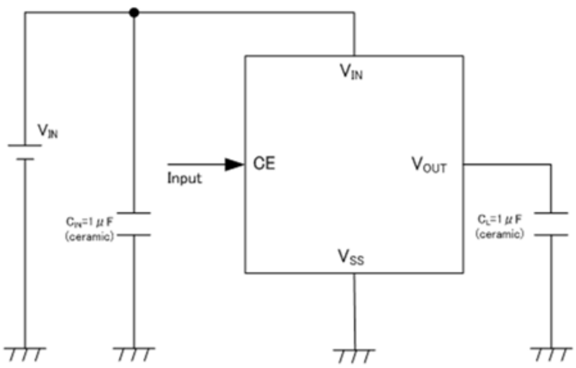
■APPLICATIONS

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

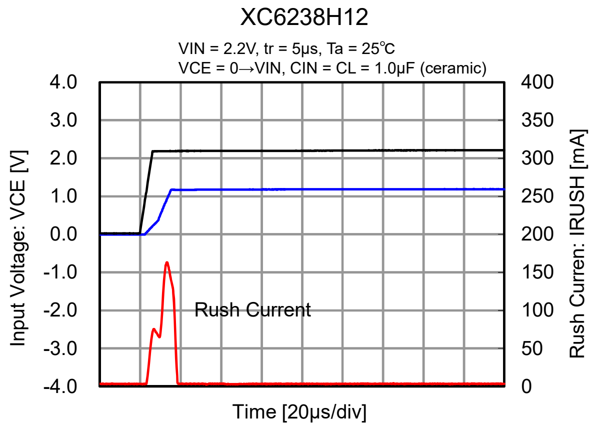
■FEATURES

Maximum Output Current : 300mA
Input Voltage Range : 1.6～5.5V
Output Voltages : 2.0～4.0V (Accuracy ±1%)
1.2～1.95V (Accuracy ±20mV)
0.05V increments
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
Inrush Current Protection (Type H)
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 : UFN-4A01
Environmentally Friendly : EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT

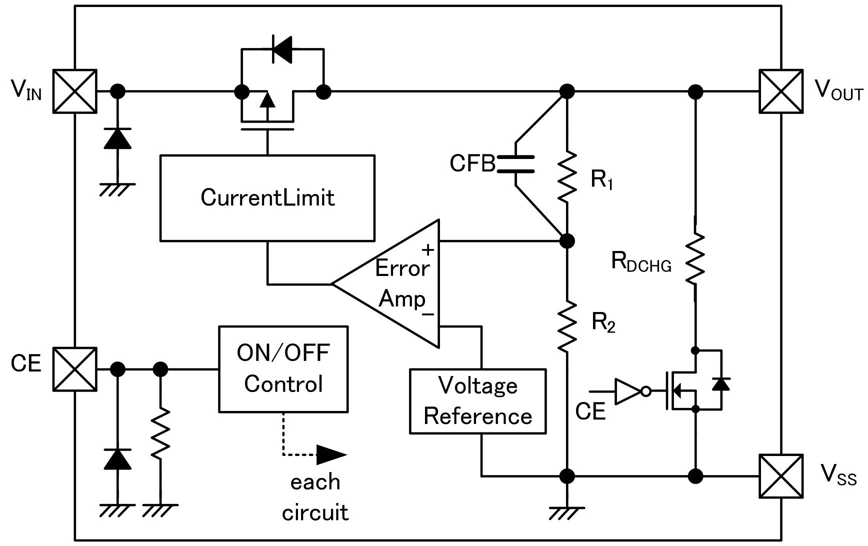


■ TYPICAL PERFORMANCE CHARACTERISTICS

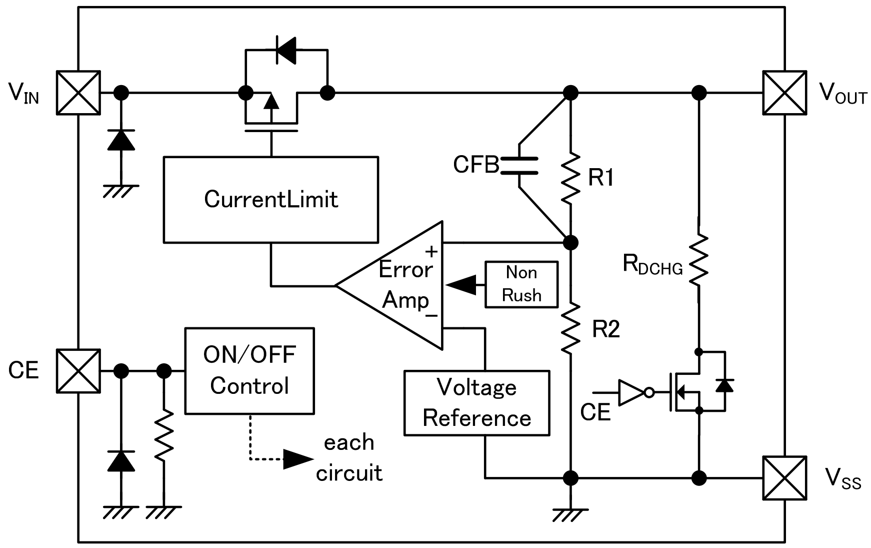


■BLOCK DIAGRAMS

XC6238D



XC6238H



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

■PRODUCT CLASSIFICATION

●Ordering Information

XC6238①②③④⑤⑥-⑦ (*1)

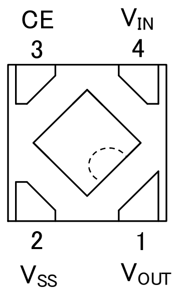
DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Regulator Type	D	No Inrush Current Control
		H	Inrush Current Prevention Circuit Built-in
②③	Output Voltage	12～40	ex.) 2.80V → ②=2, ③=8, ④=please see down below.
④	Output Voltage Accuracy	1	±1% (V_{OUT}≧2.0V) ±0.02V (V_{OUT}<2.0V) In case of 2nd decimal place 0 (ex.2.80V → ④=1)
		B	±1% (V_{OUT}≧2.0V) ±0.02V (V_{OUT}<2.0V) In case of 2nd decimal place 5 (ex.2.85V → ④=B)
⑤⑥-⑦ (*1)	Packages (Order Unit)	6R-G	UFN-4A01 (3,000pcs/Reel)

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

●Selection Guide

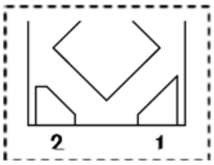
TYPE	CURRENT LIMITTER	CE PULL-DOWN RESISTOR	C_L DISCHARGE	INRUSH CURRENT PROTECTION
D	Yes	Yes	Yes	No
H	Yes	Yes	Yes	Yes

■PIN CONFIGURATION

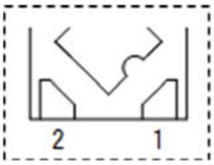


UFN-4A01
(BOTTOM VIEW)

*Please not there are 2 types of metal plating of UFN-4A01 package; Au plating and Sn plating.



Au plating



Sn plating

Reference picture: Identifying the types of pin plating

* The dissipation pad for the UFN-4A01 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
UFN-4A01		
1	V_{OUT}	Output
2	V_{SS}	Ground
3	CE	ON/OFF Control
4	V_{IN}	Power Supply Input

■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
V_{IN} Pin Voltage		V_{IN}	V_{SS}-0.3～V_{SS}+7.0	V
V_{OUT} Pin Current		I_{OUT}	500 (*1)	mA
V_{OUT} Pin Voltage		V_{OUT}	V_{SS}-0.3～V_{IN}+0.3	V
CE Pin Voltage		V_{CE}	V_{SS}-0.3～V_{SS}+7.0	V
Power Dissipation	UFN-4A01	Pd	100	mW
			550 (PCB mounted)	
Operating Ambient Temperature		Topr	-40～+85	℃
Storage Temperature		Tstg	-55～+125	℃

* All voltages are described based on the V_{SS}.
(*1) $I_{OUT} \leqq Pd / (V_{IN}-V_{OUT})$

■ELECTRICAL CHARACTERISTICS

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT(E)}$ (*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	$V_{OUT(T)}$-20mV(*2)	$V_{OUT(T)}$ (*2)	$V_{OUT(T)}$+20mV(*2)		
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

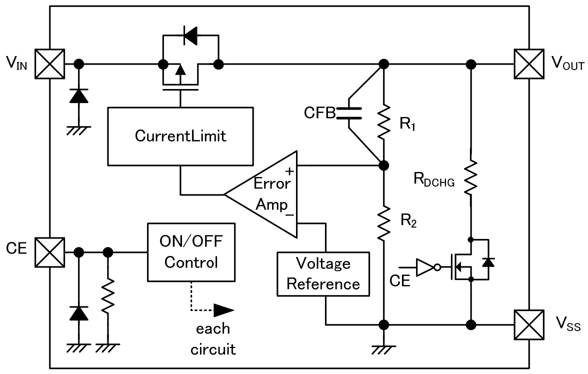
NOMINAL OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE(±1%) (V)		DROPOUT VOLTAGE (mV) E-1	
$V_{OUT(T)}$	$V_{OUT(E)}$		Vdif	
	MIN.	MAX.	TYP.	MAX.
1.20	1.1800	1.2200	480	630
1.25	1.2300	1.2700		
1.30	1.2800	1.3200	440	580
1.35	1.3300	1.3700		
1.40	1.3800	1.4200	420	520
1.45	1.4300	1.4700		
1.50	1.4800	1.5200	420	460
1.55	1.5300	1.5700		
1.60	1.5800	1.6200	400	440
1.65	1.6300	1.6700		
1.70	1.6800	1.7200		
1.75	1.7300	1.7700		
1.80	1.7800	1.8200	300	410
1.85	1.8300	1.8700		
1.90	1.8800	1.9200		
1.95	1.9300	1.9700		
2.00	1.9800	2.0200	270	380
2.05	2.0295	2.0705		
2.10	2.0790	2.1210		
2.15	2.1285	2.1715		
2.20	2.1780	2.2220		
2.25	2.2275	2.2725		
2.30	2.2770	2.3230		
2.35	2.3265	2.3735		
2.40	2.3760	2.4240		
2.45	2.4255	2.4745		
2.50	2.4750	2.5250	240	350
2.55	2.5245	2.5755		
2.60	2.5740	2.6260		
2.65	2.6235	2.6765		
2.70	2.6730	2.7270		
2.75	2.7225	2.7775		

■OUTPUT VOLTAGE CHART

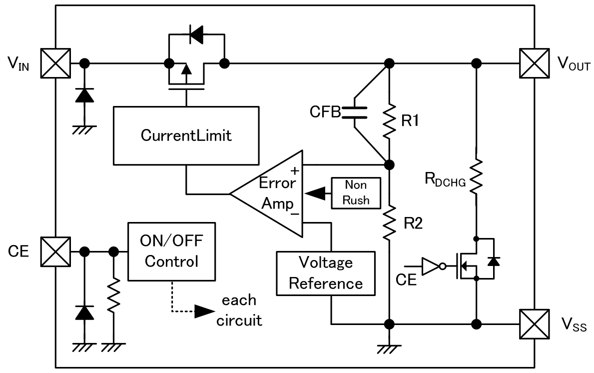
●Voltage Chart 1

NOMINAL OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE(±1%) (V)		DROPOUT VOLTAGE (mV) E-1	
$V_{OUT(T)}$	$V_{OUT(E)}$		Vdif	
	MIN.	MAX.	TYP.	MAX.
2.80	2.7720	2.8280	240	350
2.85	2.8215	2.8785		
2.90	2.8710	2.9290		
2.95	2.9205	2.9795		
3.00	2.9700	3.0300	200	305
3.05	3.0195	3.0805		
3.10	3.0690	3.1310		
3.15	3.1185	3.1815		
3.20	3.1680	3.2320		
3.25	3.2175	3.2825		
3.30	3.2670	3.3330		
3.35	3.3165	3.3835		
3.40	3.3660	3.4340		
3.45	3.4155	3.4845		
3.50	3.4650	3.5350		
3.55	3.5145	3.5855		
3.60	3.5640	3.6360		
3.65	3.6135	3.6865		
3.70	3.6630	3.7370		
3.75	3.7125	3.7875		
3.80	3.7620	3.8380		
3.85	3.8115	3.8885		
3.90	3.8610	3.9390		
3.95	3.9105	3.9895		
4.00	3.9600	4.0400		

■ OPERATIONAL EXPLANATION



XC6238D



XC6238H

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

<Low ESR Capacitor>
The XC6238 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 XC6238 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 XC6238 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 XC6238 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 XC6238H.

■ 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.

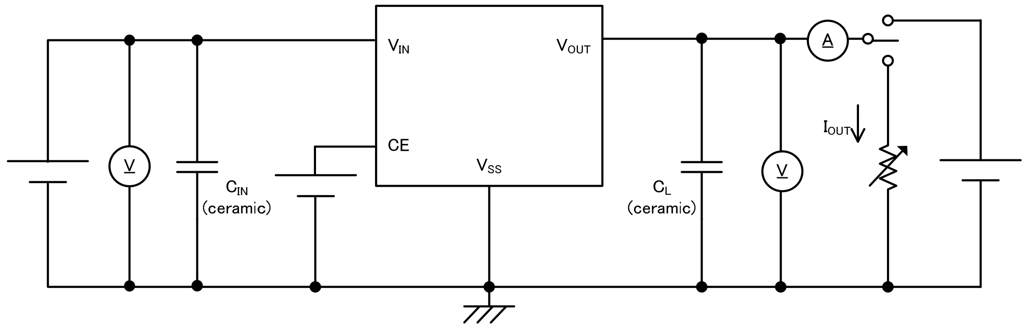
3. The input capacitor C_{IN} and the output capacitor C_L should be placed to the as close as possible with a shorter wiring.

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.

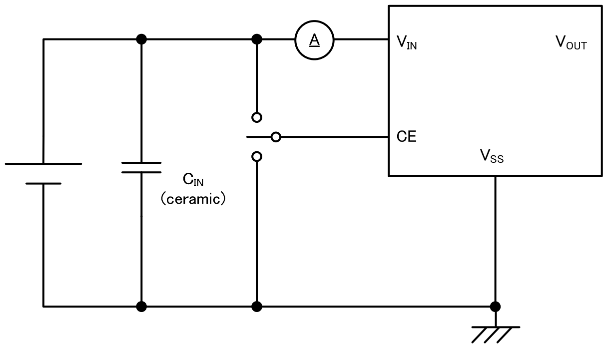
5. Torex places an importance on improving our products and its reliability.
   However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

TEST CIRCUITS

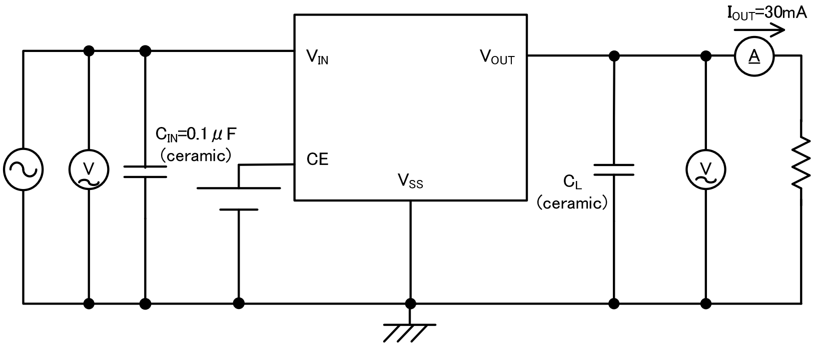
●Circuit ①



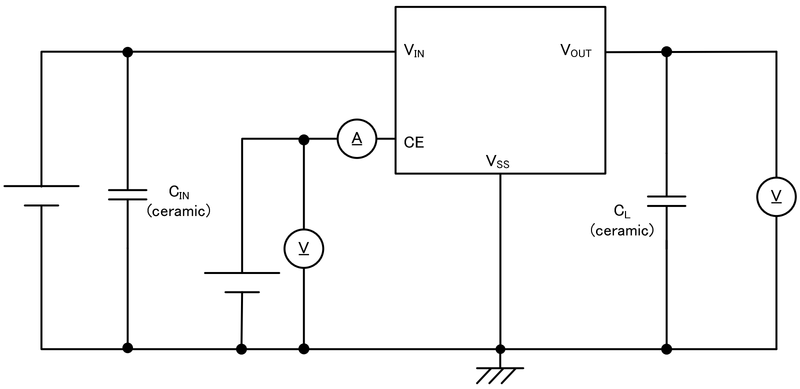
●Circuit ②



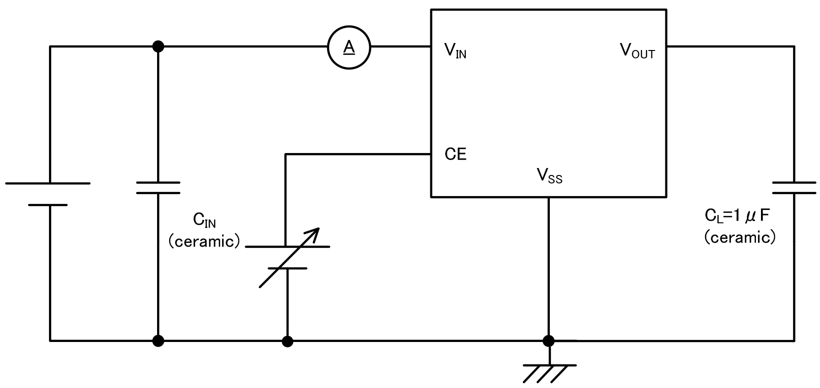
●Circuit ③



●Circuit ④

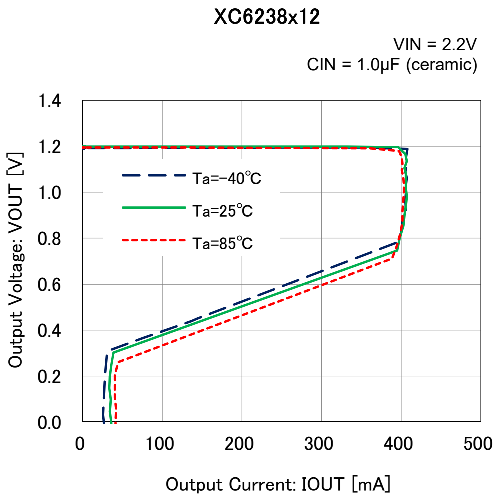


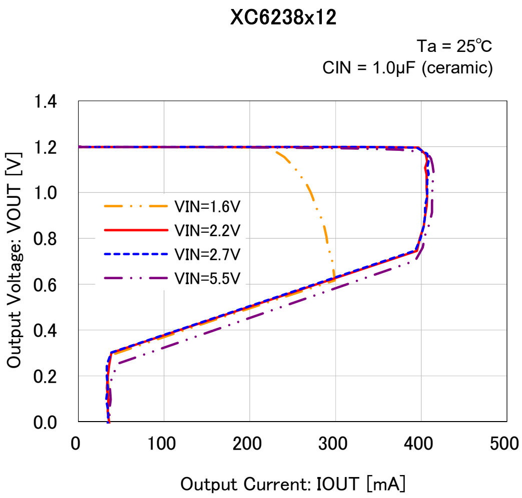
●Circuit ⑤

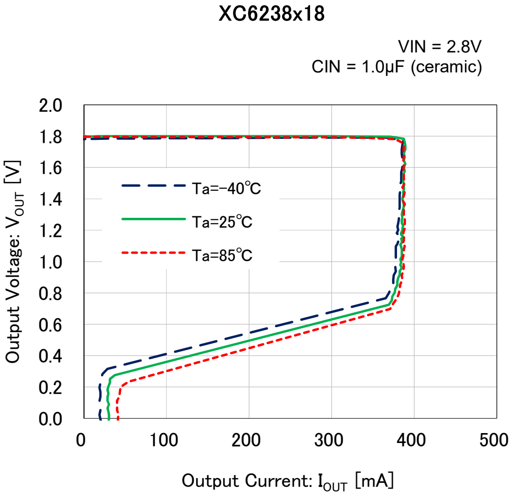


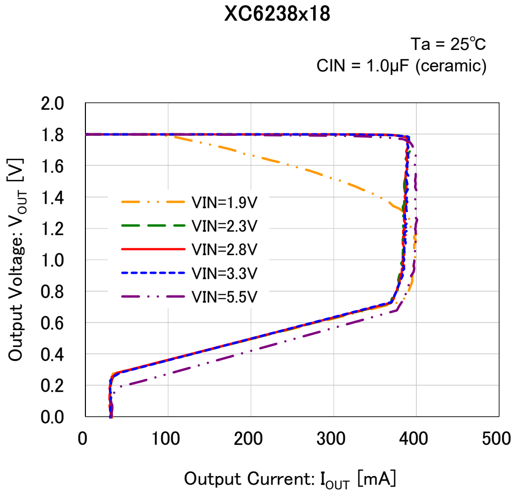
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current



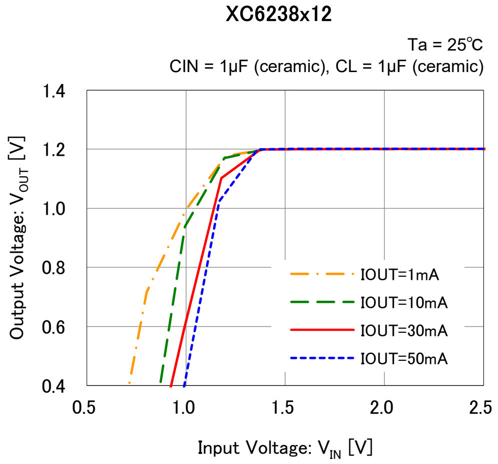


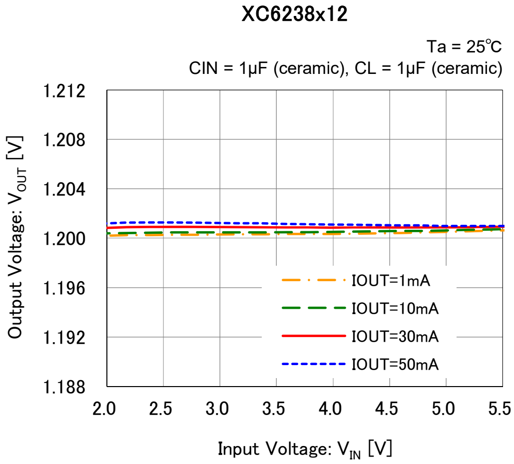


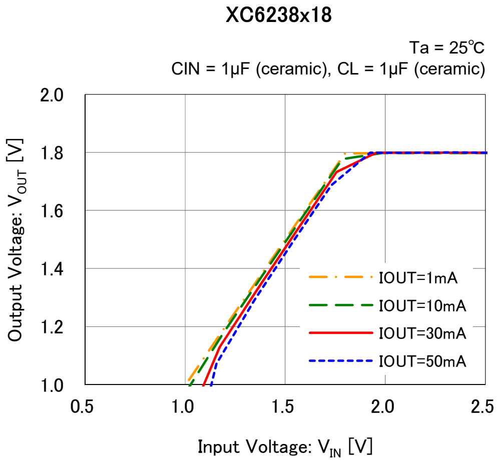


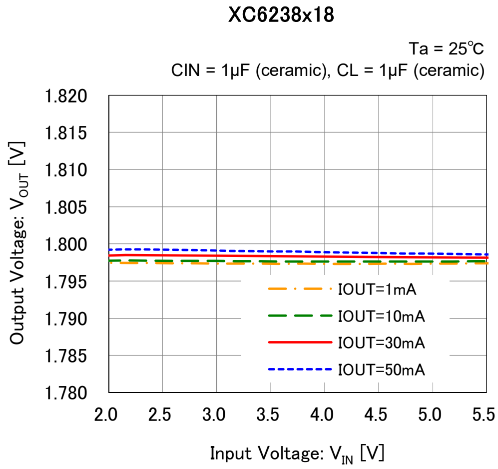
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Input Voltage





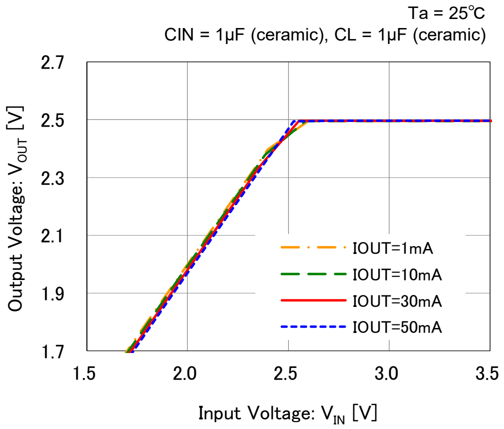




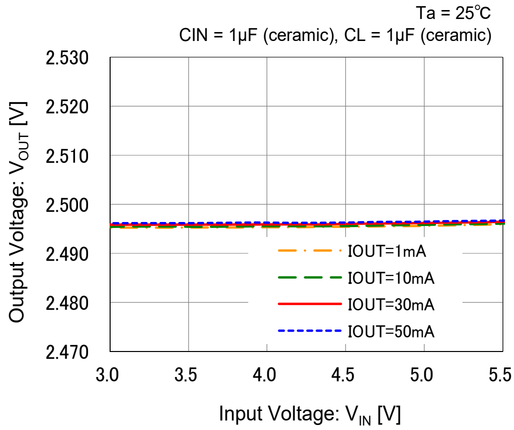
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Input Voltage

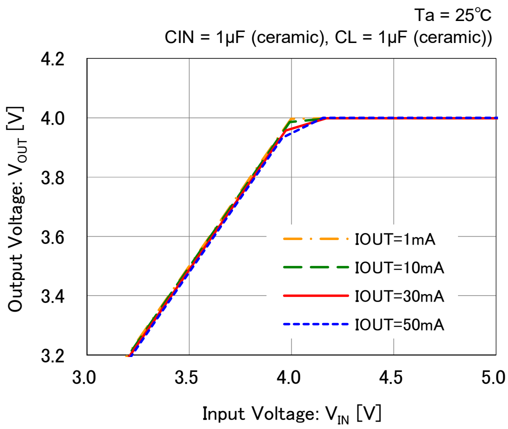
XC6238x25



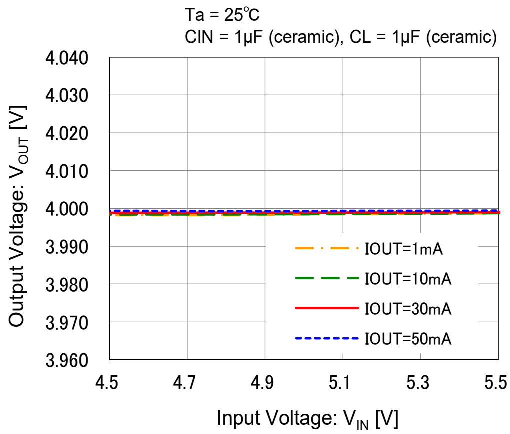
XC6238x25



XC6238x40

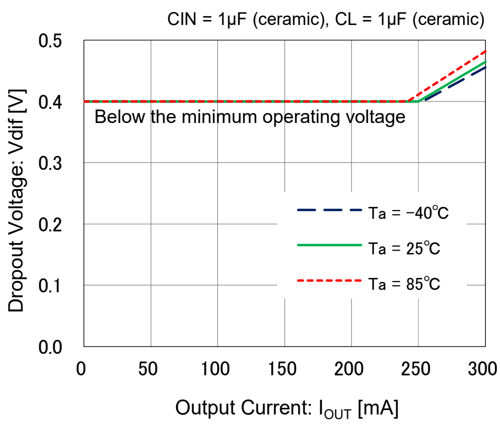


XC6238x40

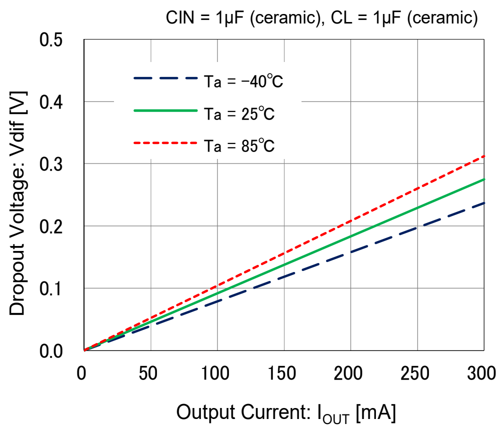


(3) Dropout Voltage vs. Output Current

XC6238x12



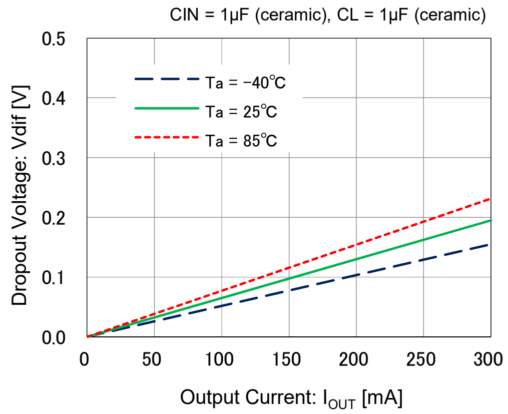
XC6238x18



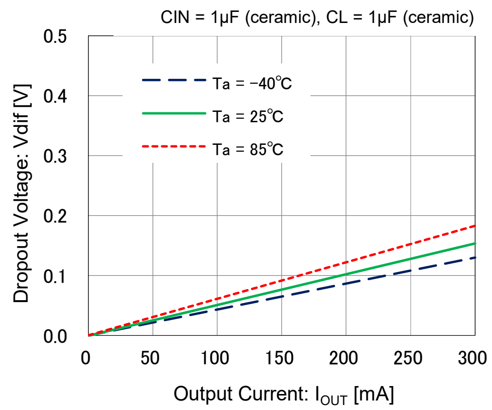
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Dropout Voltage vs. Output Current

XC6238x25

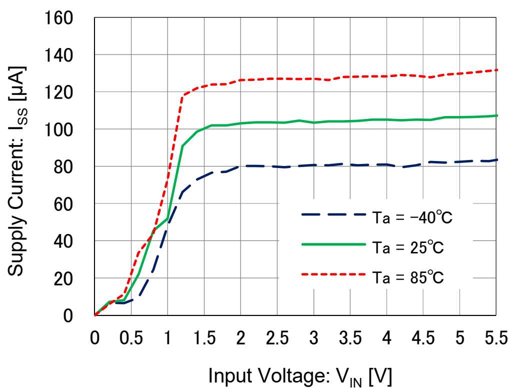


XC6238x40

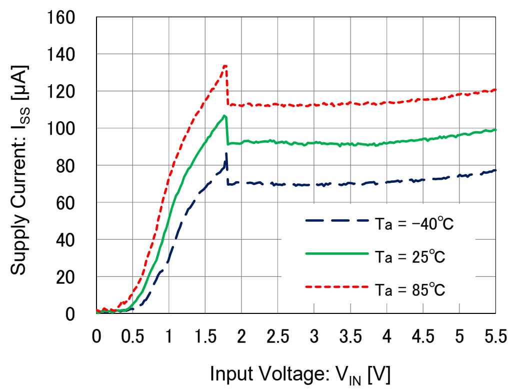


(4) Supply Current vs. Input Voltage

XC6238x12



XC6238x18



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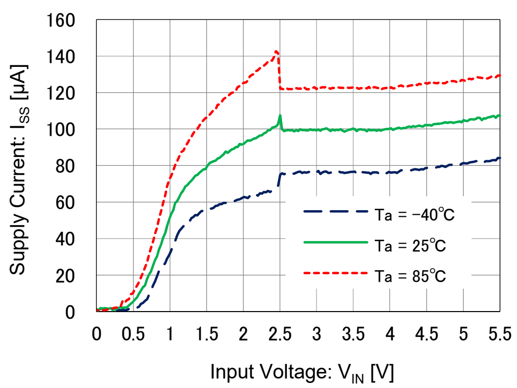

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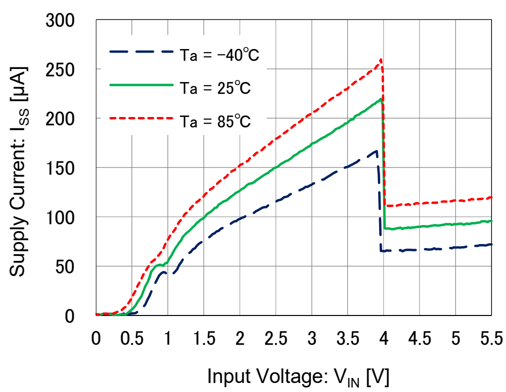
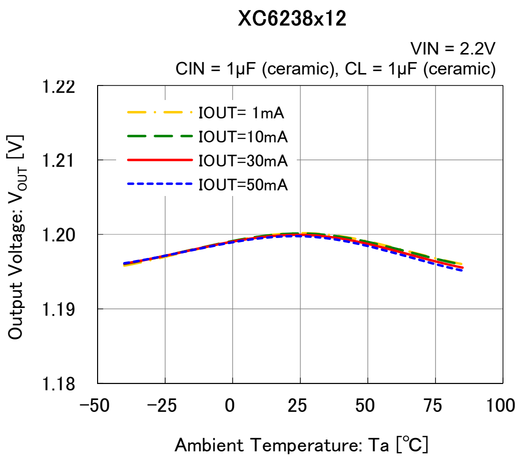
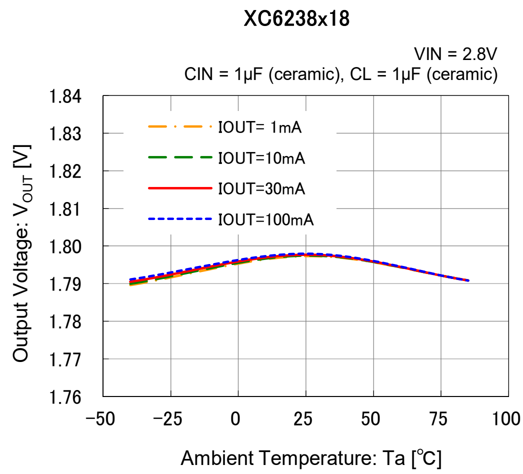
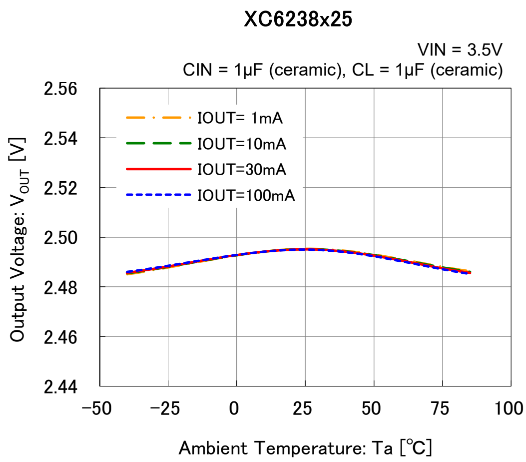


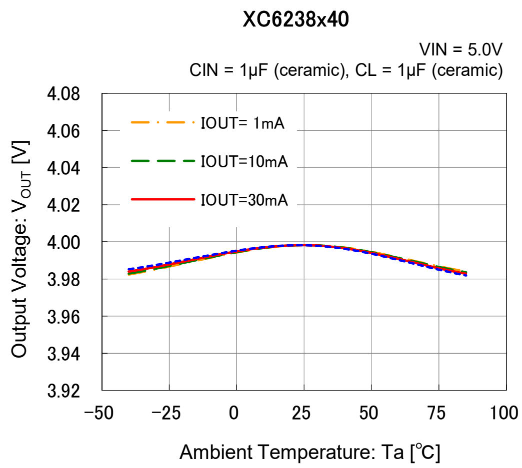
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Output Voltage vs. Ambient Temperature

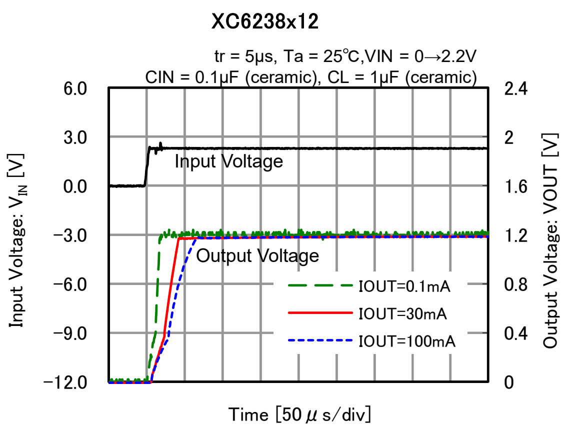


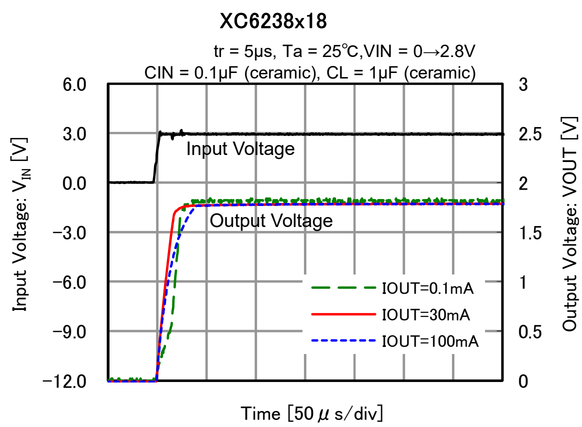






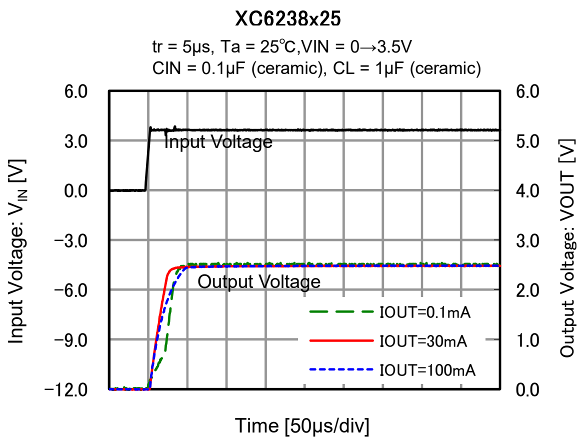
(6) Rising Response Time

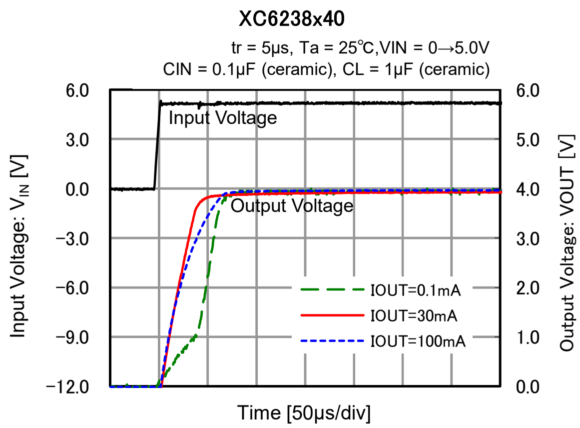




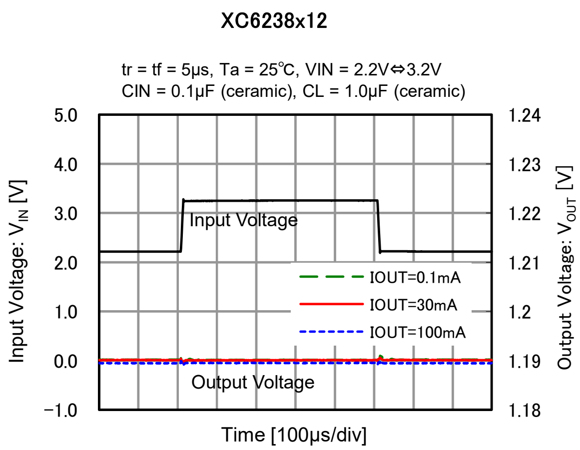
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

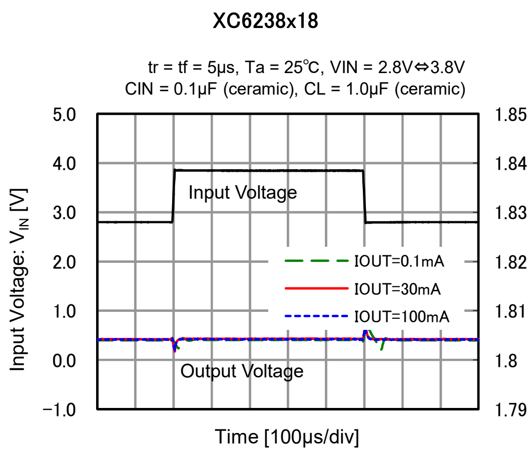
(6) Rising Response Time

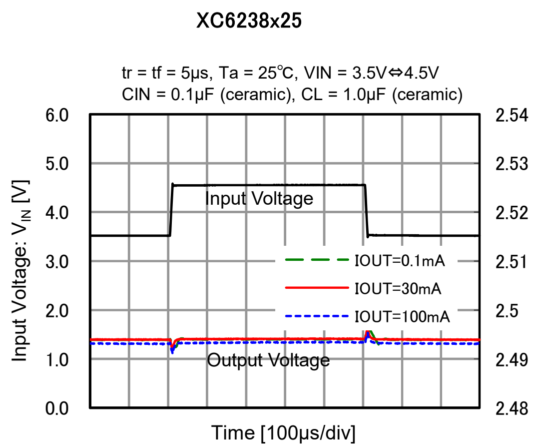


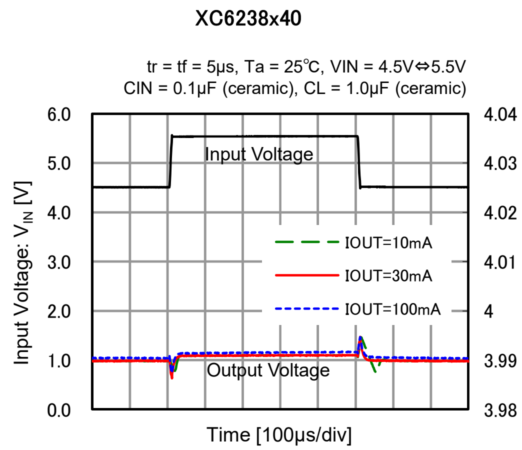


(7) Input Transient Response







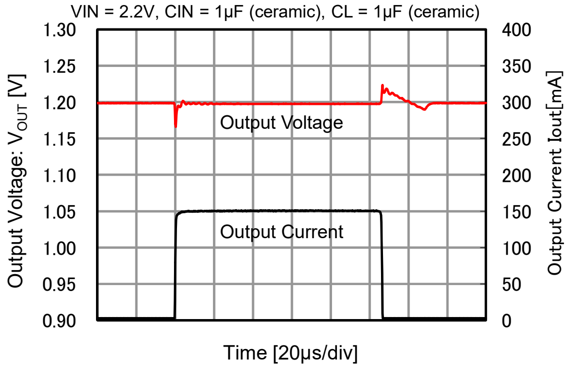


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

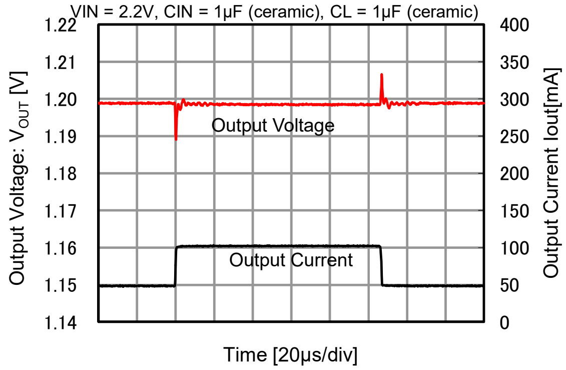
XC6238x12

tr = tf = 0.5μs, Ta = 25℃, IOUT = 1⇔150mA
VIN = 2.2V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



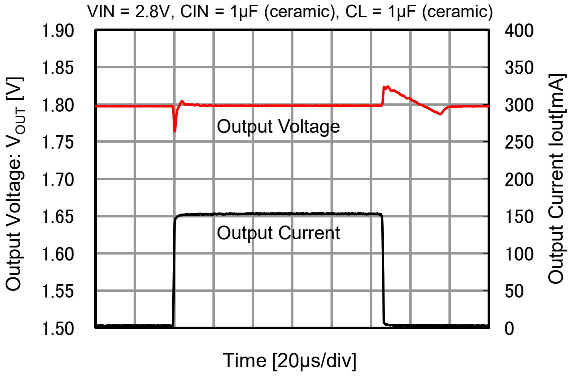
XC6238x12

tr = tf = 0.5μs, Ta = 25℃, IOUT = 50⇔100mA
VIN = 2.2V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



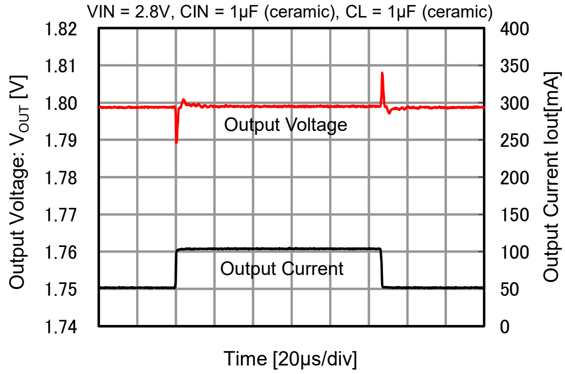
XC6238x18

tr = tf = 0.5μs, Ta = 25℃, IOUT = 1⇔150mA
VIN = 2.8V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



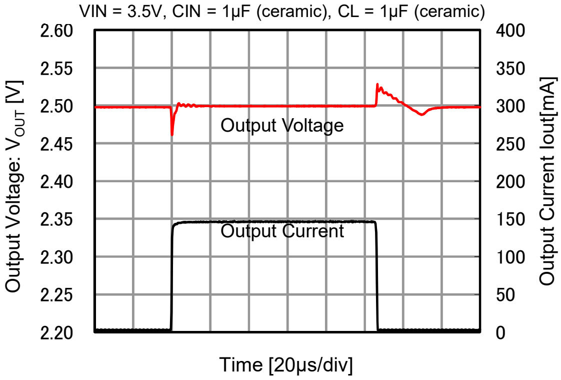
XC6238x18

tr = tf = 0.5μs, Ta = 25℃, IOUT = 50⇔100mA
VIN = 2.8V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



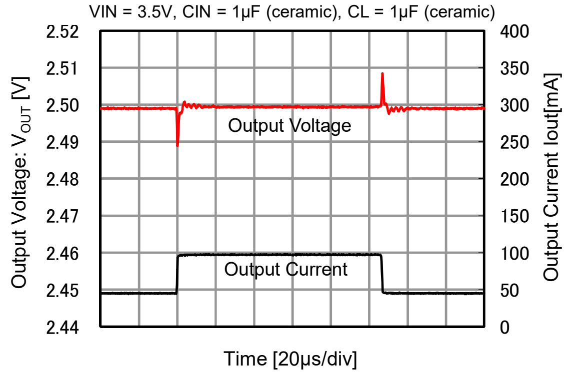
XC6238x25

tr = tf = 0.5μs, Ta = 25℃, IOUT = 1⇔150mA
VIN = 3.5V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



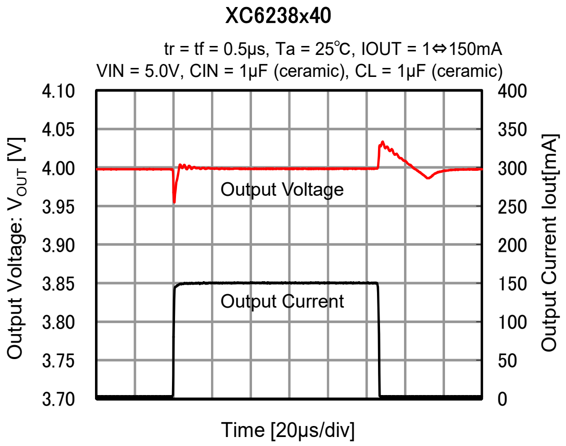
XC6238x25

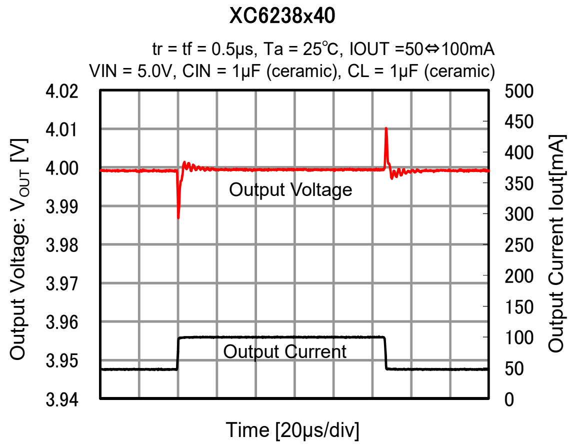
tr = tf = 0.5μs, Ta = 25℃, IOUT = 50⇔100mA
VIN = 3.5V, CIN = 1μF (ceramic), CL = 1μF (ceramic)



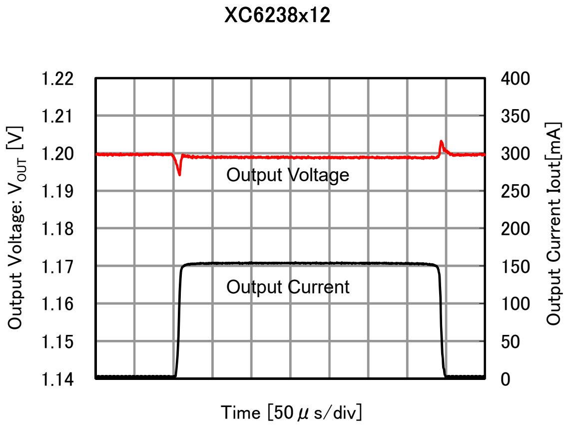
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

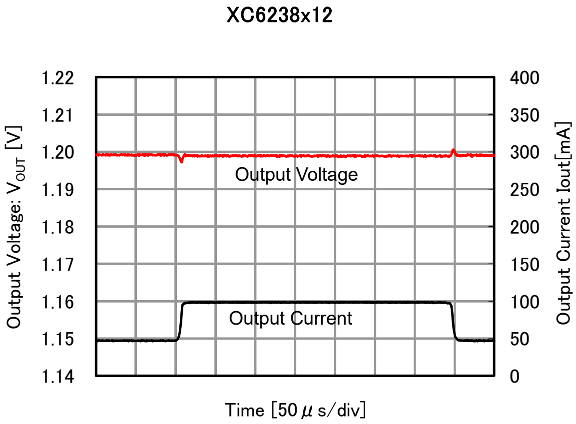
(8) Load Transient Response (tr=tf=0.5μs)

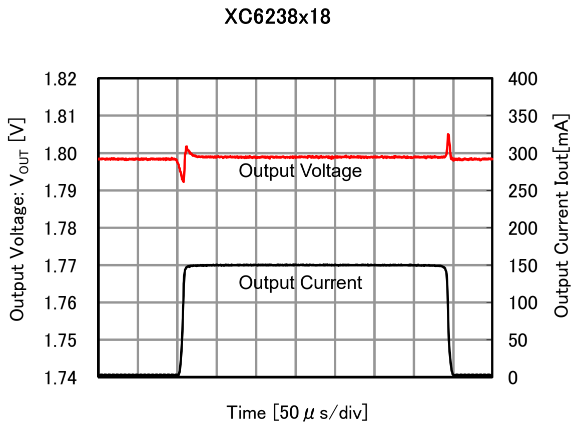


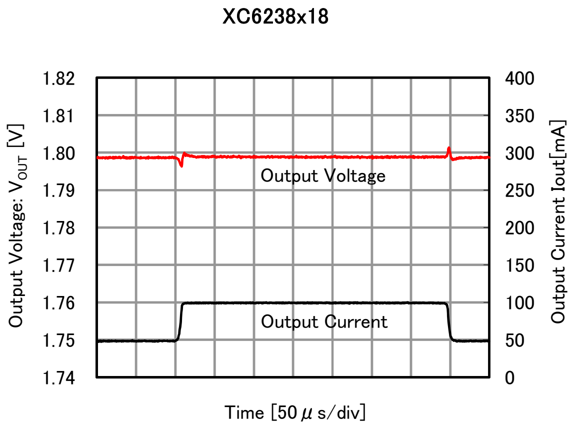


(8) Load Transient Response (tr=tf=5μs)





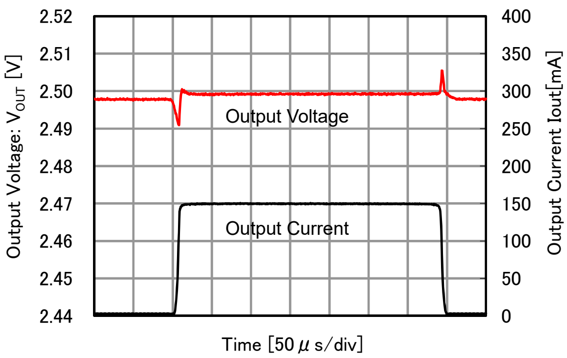




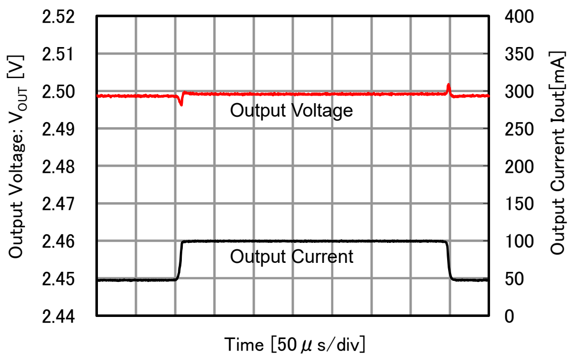
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

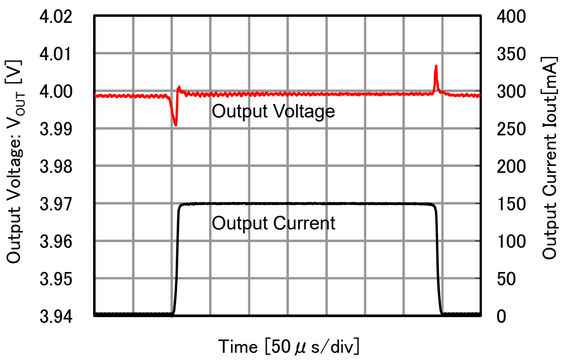
XC6238x25



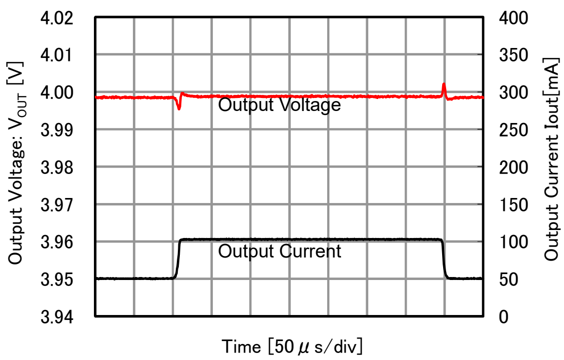
XC6238x25



XC6238x40

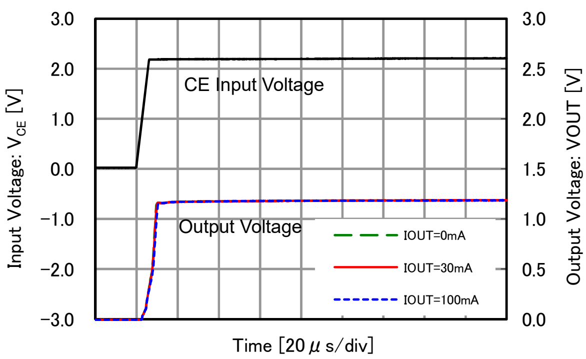


XC6238x40

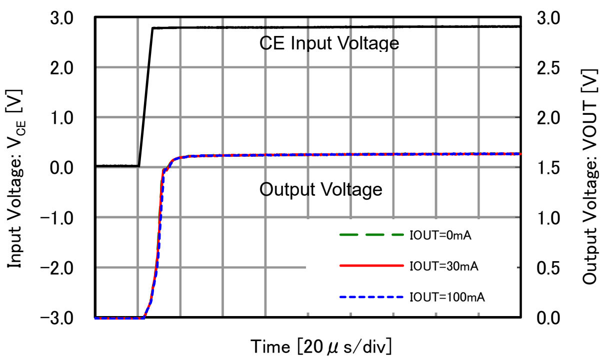


(9) CE Rising Response Time (Type D)

XC6238D12



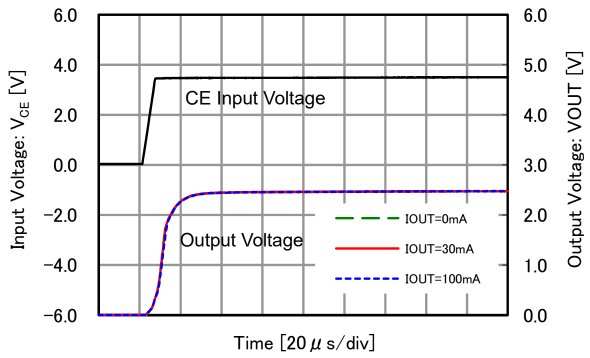
XC6238D18



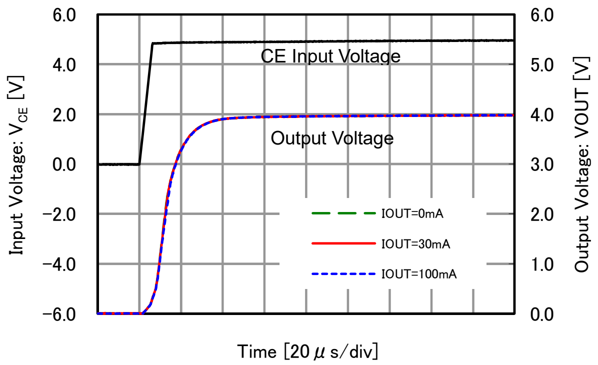
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) CE Rising Response Time (Type D)

XC6238D25

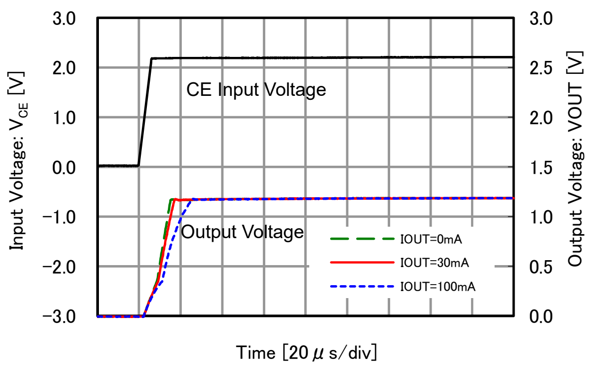


XC6238D40

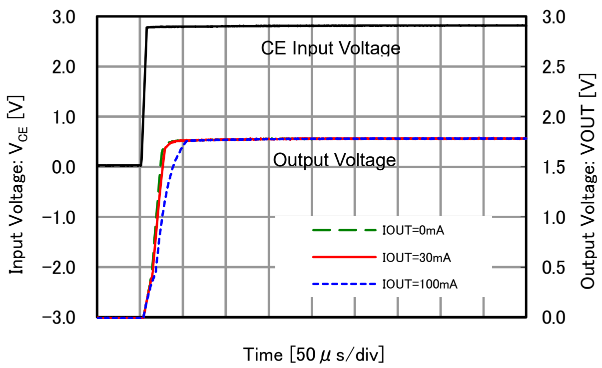


(9) CE Rising Response Time (Type H)

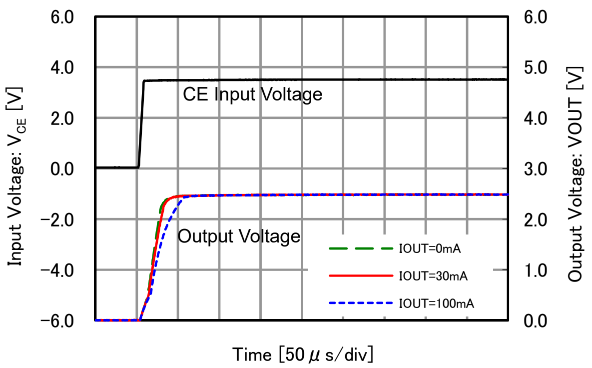
XC6238H12



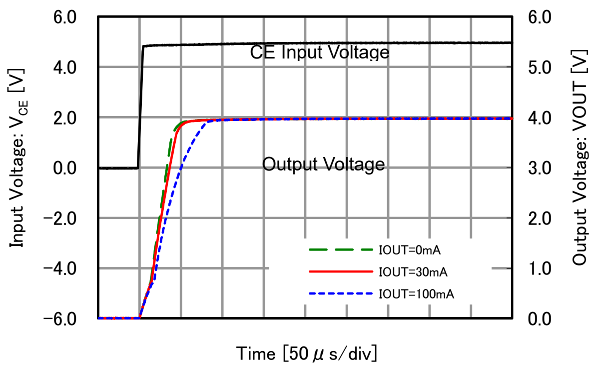
XC6238H18



XC6238H251



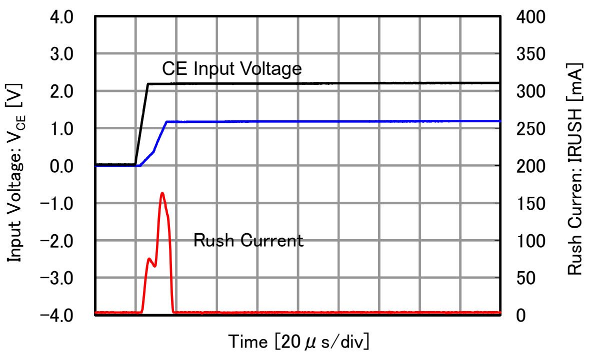
XC6238H40



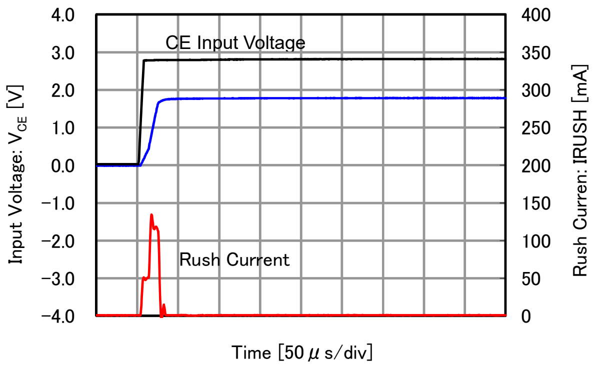
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Inrush Current Response Time (Type H)

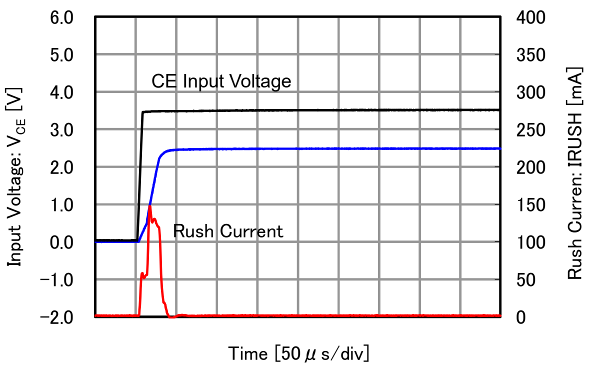
XC6238H12



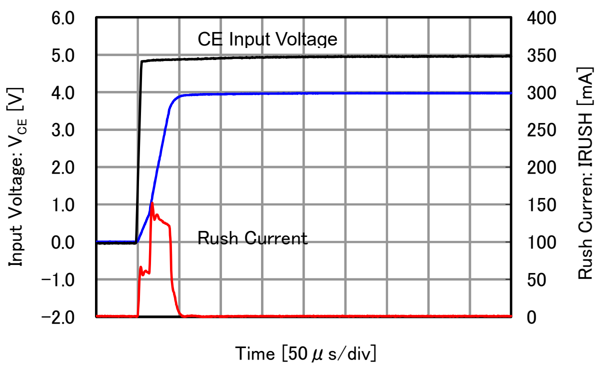
XC6238H18



XC6238H25

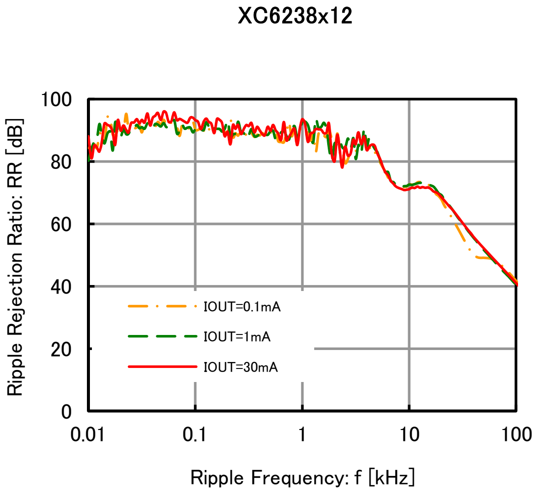


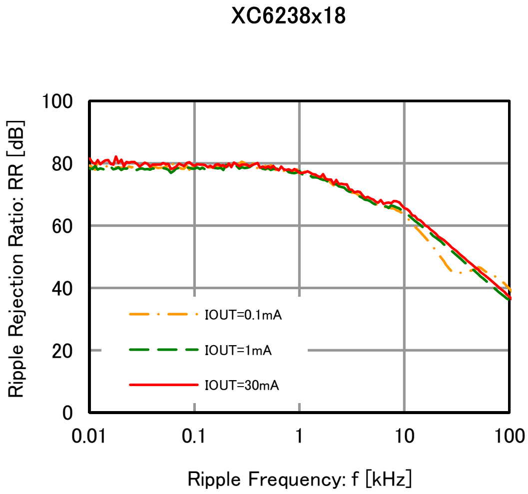
XC6238H40

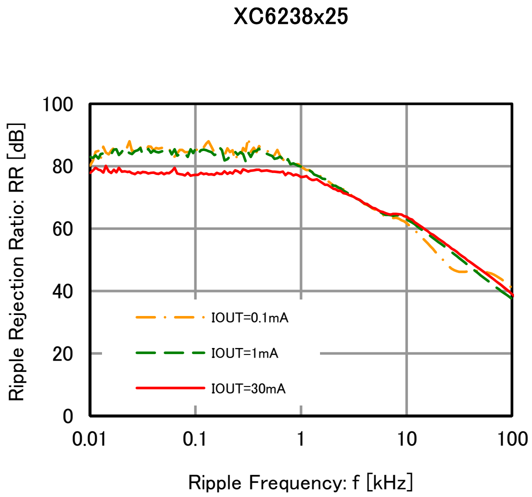


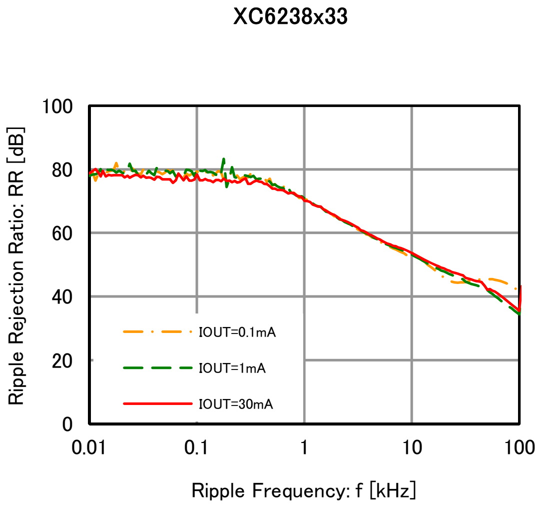
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) Ripple Rejection Rate



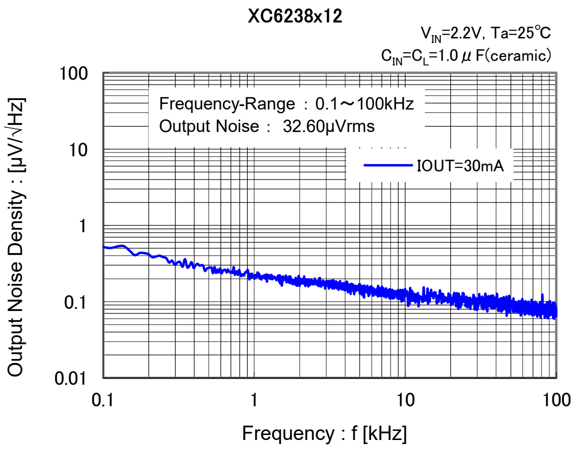


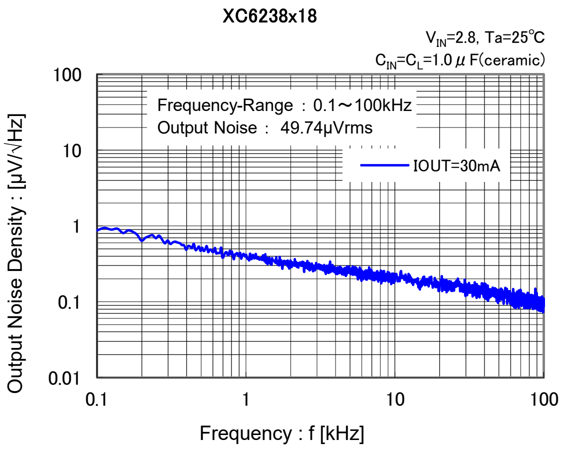


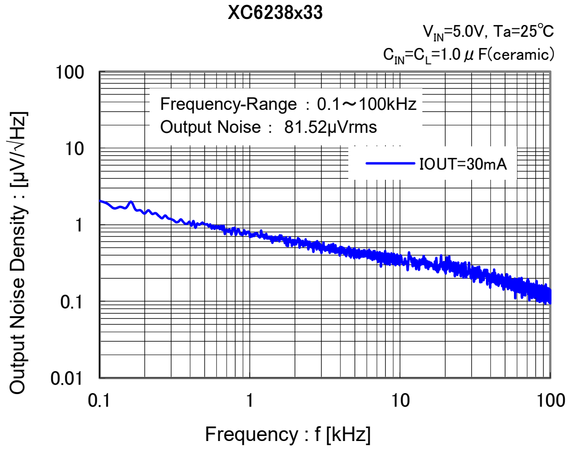


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(12) Output Noise Density

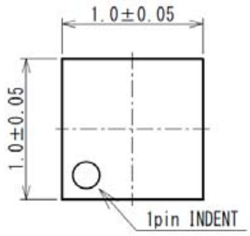


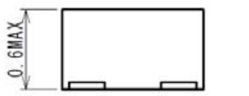


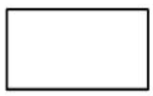


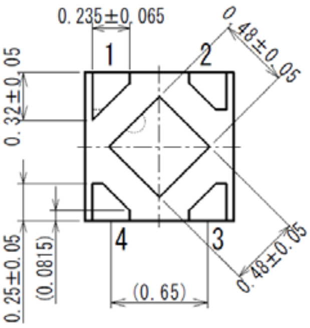
■PACKAGING INFORMATION

UFN-4A01
(unit : mm)



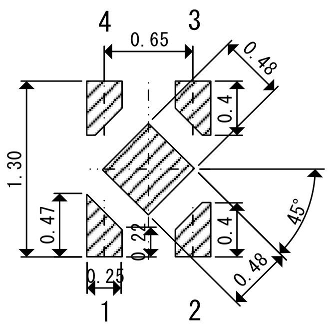




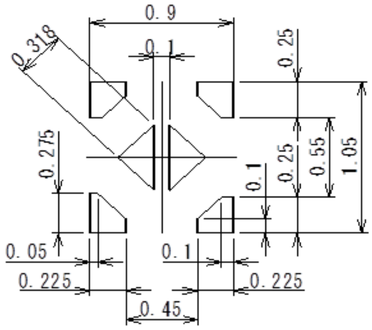


*The package don't have filet because
side of lead is no plating.

●Reference Pattern Layout
(unit : mm)



●Reference Metal Mask Design
(unit : mm)

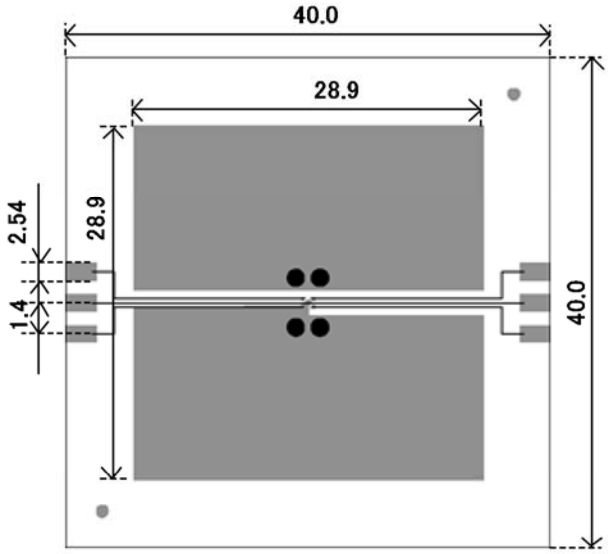


● UFN-4A01 Power Dissipation

Power dissipation data for theUFN-4A01 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 mm2 in one side)
4 Copper Layers
Each layer is connected to the package heat-sink and terminal pin No.1.
Each layer has approximately 800mm2 copper area
Material: Glass Epoxy (FR-4)
Thickness: 1.6mm
Through-hole: 4 x 0.8 Diameter

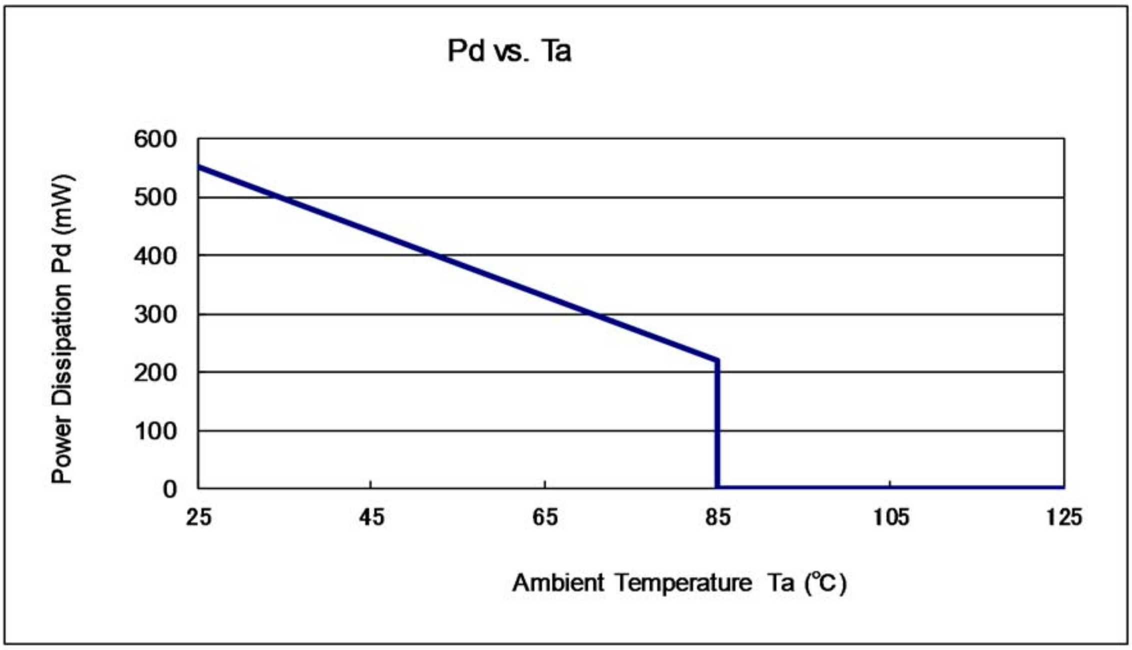


Evaluation Board (Unit: mm)

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	

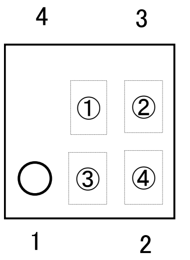


■MARKING RULE

●UFN-4A01

① represents product number

MARK	PRODUCT SERIES
H	XC6238D**1/26R-G
K	XC6238H**1/26R-G
L	XC6238D**A/B6R-G
M	XC6238H**A/B6R-G



UFN-4A01
(BOTTOM VIEW)

② represents output voltage

MARK	OUTPUT VOLTAGE (V)		MARK	OUTPUT VOLTAGE (V)	
0	1.2	1.25	F	2.7	2.75
1	1.3	1.35	H	2.8	2.85
2	1.4	1.45	K	2.9	2.95
3	1.5	1.55	L	3.0	3.05
4	1.6	1.65	M	3.1	3.15
5	1.7	1.75	N	3.2	3.25
6	1.8	1.85	P	3.3	3.35
7	1.9	1.95	R	3.4	3.45
8	2.0	2.05	S	3.5	3.55
9	2.1	2.15	T	3.6	3.65
A	2.2	2.25	U	3.7	3.75
B	2.3	2.35	V	3.8	3.85
C	2.4	2.45	X	3.9	3.95
D	2.5	2.55	Y	4.0	
E	2.6	2.65			

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.

1. The product and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date.

2. The information in this datasheet is intended to illustrate the operation and characteristics of our products. We neither make warranties or representations with respect to the accuracy or completeness of the information contained in this datasheet nor grant any license to any intellectual property rights of ours or any third party concerning with the information in this datasheet.

3. Applicable export control laws and regulations should be complied and the procedures required by such laws and regulations should also be followed, when the product or any information contained in this datasheet is exported.

4. The product is neither intended nor warranted for use in equipment of systems which require extremely high levels of quality and/or reliability and/or a malfunction or failure which may cause loss of human life, bodily injury, serious property damage including but not limited to devices or equipment used in 1) nuclear facilities, 2) aerospace industry, 3) medical facilities, 4) automobile industry and other transportation industry and 5) safety devices and safety equipment to control combustions and explosions. Do not use the product for the above use unless agreed by us in writing in advance.

5. Although we make continuous efforts to improve the quality and reliability of our products; nevertheless Semiconductors are likely to fail with a certain probability. So in order to prevent personal injury and/or property damage resulting from such failure, customers are required to incorporate adequate safety measures in their designs, such as system fail safes, redundancy and fire prevention features.

6. Our products are not designed to be Radiation-resistant.

7. Please use the product listed in this datasheet within the specified ranges.

8. We assume no responsibility for damage or loss due to abnormal use.

TOREX SEMICONDUCTOR LTD.