XC6403/XC6404 Series

ETR10002-005

High Current, High Speed LDO Regulators, Voltage Detector Function

■GENERAL DESCRIPTION

The XC6403/XC6404 series are highly precise, low noise, high current, positive voltage low dropout regulators with built-in voltage detector. They are fabricated using Torex's CMOS process. Performance features of the series includes high ripple rejection and low dropout voltage, and the series features a voltage reference, an error amplifier, a current limiter and a phase compensation circuit plus a driver transistor.

Detect voltage is selectable in 100mV increments within the range of 0.9V to 5.6V and the LDO output voltage is selectable within a range of 0.9V to 5.6V (XC6403) 0.9V to 5.1V (XC6404), also in 100mV increments. The series is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series. The current limiter's foldback circuit also operates as a short circuit protection for the output current limiter and the output pin. The series provides options to the user to select from a variety of circuit features, such as detector monitoring, detector output logic, CE and EN pin input logic, internal pull-up / down resistance, and power ready. The IC's internal regulator circuit can be placed in stand-by mode via the EN function (XC6403/XC6404 A, C series). The whole IC can be put in to stand-by mode via the CE function with the XC6403/04D series (semi-custom). In the stand-by mode, power consumption is greatly reduced the XC6403/ XC6404A series features the toggle operation function. The regulator output can be OFF when the XC6403/04B series detects voltage (semi-custom).

The XC6403/XC6404E series can monitor another power source by using the VSEN pin (semi-custom). The XC6403/ XC6404F series can delay the detector output: the delay time can be controlled by the use of an external capacitor (semi-custom).

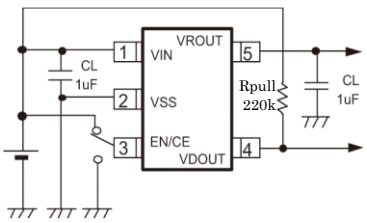
■APPLICATIONS

- ●Smart phones / Mobile phones
- ●Portable games
- ●Digital still cameras / Camcorders
- ●Digital audio equipments
- ●Reference voltage sources
- ●Multi-function power supplies

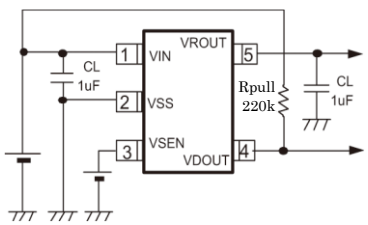
■FEATURES

Maximum Output Current	: More than 300mA (380mA limit) ($1.8 \leqq VR_{OUT} \leqq 5.3V$) [XC6403] More than 500mA (600mA limit) ($2.5V \leqq VR_{OUT} \leqq 4.9V$) [XC6404]
Dropout Voltage	: 200mV @ 100mA 400mV @ 200mA
Operating Voltage Range	: 2.0V ~ 6.0V
VR Output Voltage	: 0.9V ~ 5.6V [XC6403] 0.9V ~ 5.1V [XC6404]
VD Detect Voltage	: 0.9V ~ 5.5V More than 2.0V (V_{IN} sensing)
VR.VD Temp. Coefficient	: ±100ppm/℃
Low Power Consumption	: 35μA
High Ripple Rejection	: 65dB @10kHz
Highly Accurate	: ±2%
Operating Temperature	: -40℃ ~ 85℃
Low ESR Capacitor Compatible	: Ceramic capacitor compatible
Ultra Small Packages	: SOT-25, SOT-89-5, USP-6B
Environmentally Friendly	: EU RoHS Compliant, Pb Free

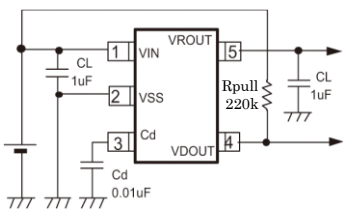
■TYPICAL APPLICATION CIRCUITS



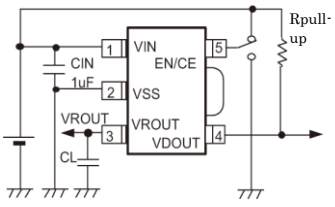
XC6403 A、C、D Series



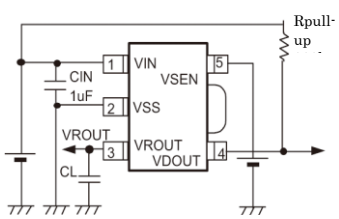
XC6403E Series



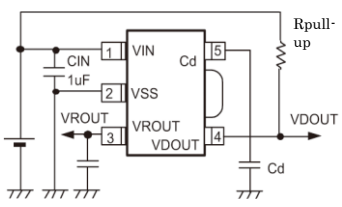
XC6403F Series



XC6404 A、C、D Series



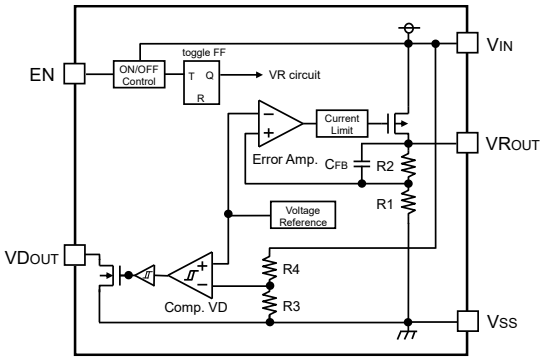
XC6404E Series



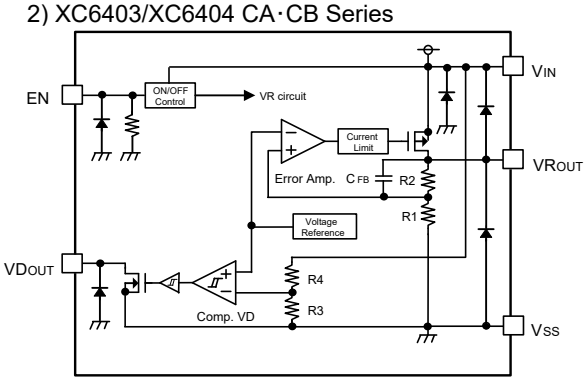
XC6404F Series

■BLOCK DIAGRAM

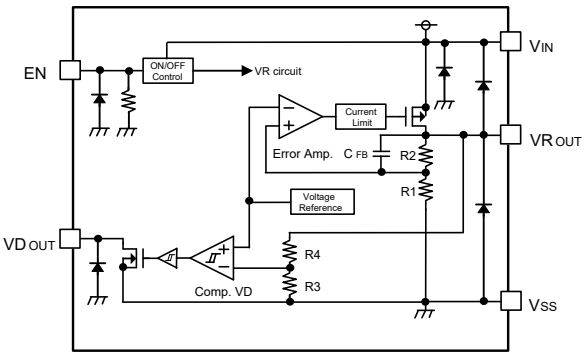
1) XC6403/XC6404 AA･AE･AL･AR Series



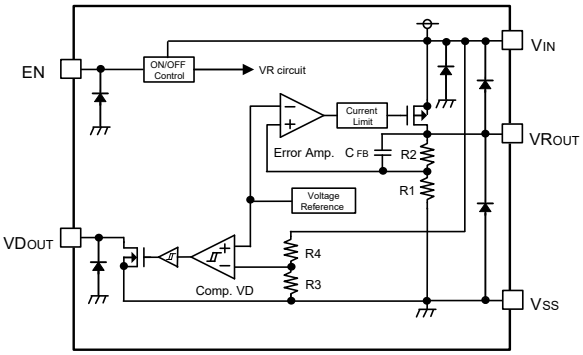
2) XC6403/XC6404 CA･CB Series



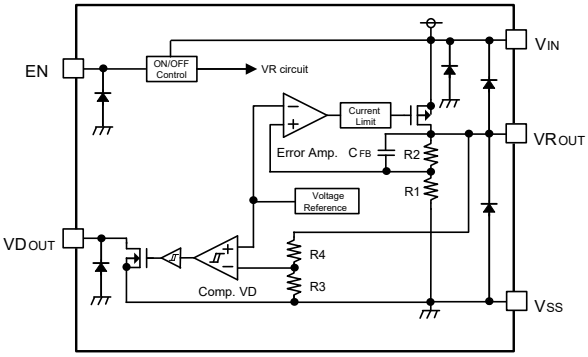
3) XC6403/XC6404 CC･CD Series



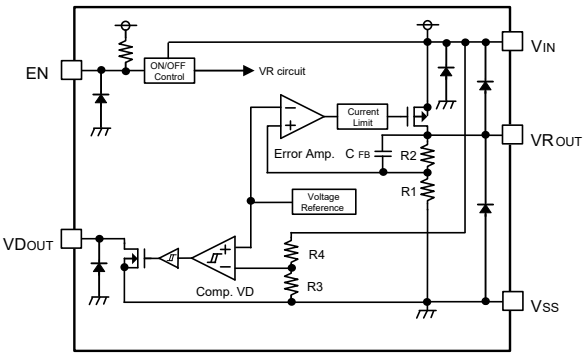
4) XC6403/XC6404 CE･CF･CR･CS Series



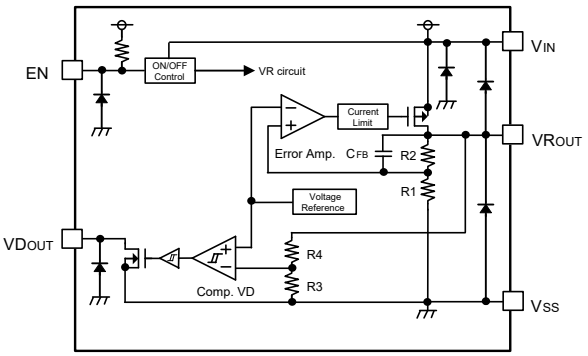
5) XC6403/XC6404 CH･CK･CT･CU Series



6) XC6403/XC6404 CL･CM Series



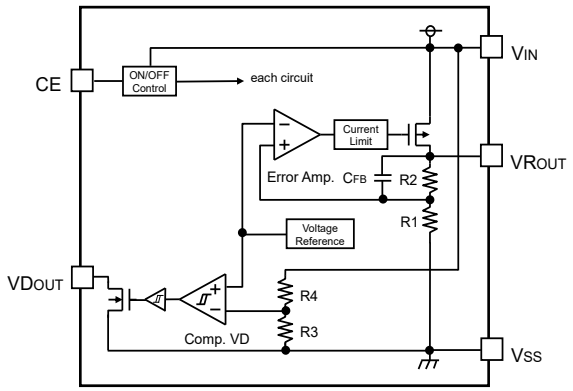
7) XC6403/XC6404 CN･CP Series



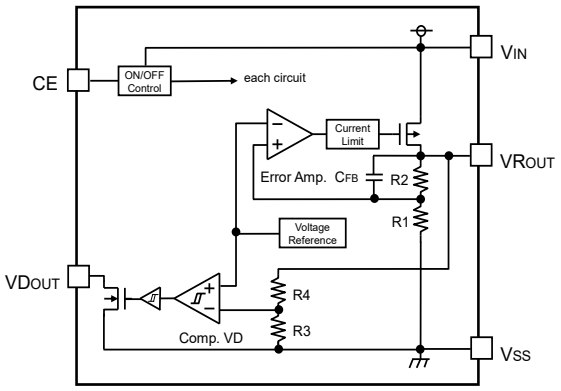
*Diodes inside the circuit are an ESD protection diode and a parasitic diode.

■BLOCK DIAGRAM (Continued)

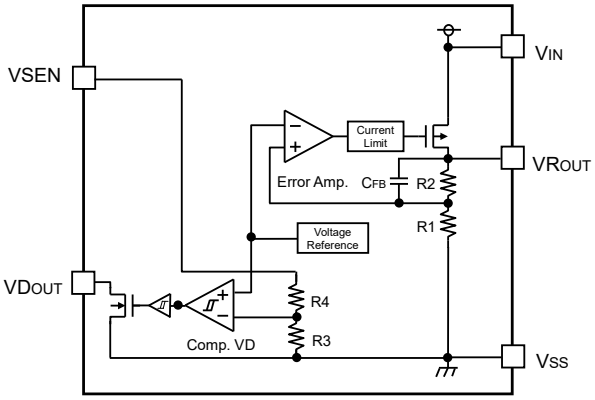
8) XC6403/XC6404 DA･DB･DE･DF･DL･DM･DR･DS Series



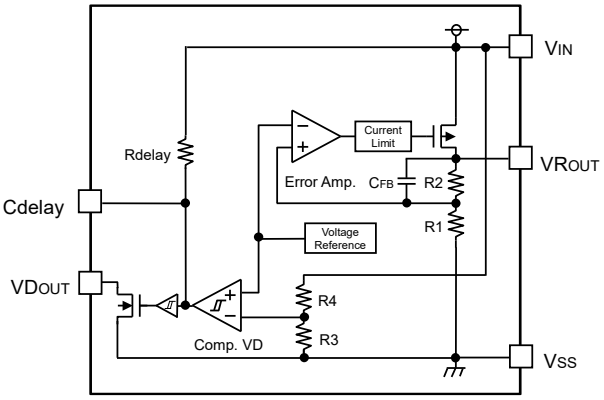
9) XC6403/XC6404 DC･DD･DH･DK･DN･DP･DT･DU Series



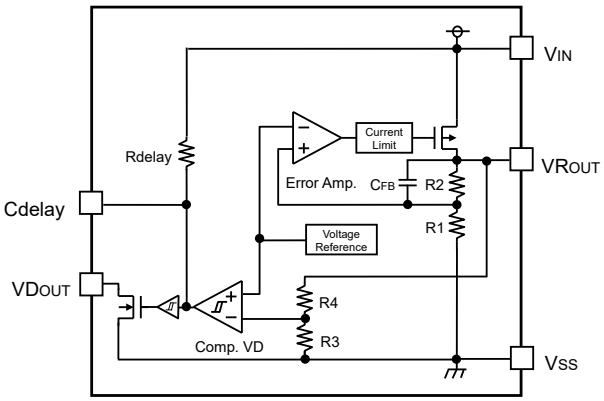
10) XC6403/XC6404 EV･EX Series



11) XC6403/XC6404 FV･FX Series



12) XC6403/XC6404 FY･FZ Series



■PRODUCT CLASSIFICATION

● Ordering Information

XC6403/XC6404 ①②③④⑤⑥-⑦(*1)

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
①	Operational Function	A	Toggle ,EN function
		C	EN function
		D	CE function
		E	V_{SEN} Pin
		F	Cd pin
②	Type of Regulator	-	As in the chart below.
③④	Output Voltage & Detect Voltage	-	Internally set sequential number relating to output voltage and detect voltage (refer to the chart below) VR setting output voltage range: 0.9V ~ 5.6V [XC6403] 0.9V ~ 5.1V [XC6404] Detect voltage setting range: 0.9V ~ 5.5V 100mV increments are available
⑤⑥-⑦(*1)	Packages (Order Unit)	MR-G	SOT-25 (3,000pcs/Reel)
		PR-G	SOT-89-5 (1,000pcs/Reel)
		DR-G	USP-6B (3,000pcs/Reel)

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

PIN NUMBER : ② Types

②	EN / CE FUNCTION	EN / CE LOGIC	PULL UP/DOWN RESISTANCE	VD SENSE PIN	VD OUTPUT LOGIC	PIN NUMBER①
A	Function	High Active	Pull-Down Function	V_{IN}	Detect L	A,C,D
B	Function	High Active	Pull-Down Function	V_{IN}	Detect H	C,D
C	Function	High Active	Pull-Down Function	VR_{OUT}	Detect L	
D	Function	High Active	Pull-Down Function	VR_{OUT}	Detect H	
E	Function	High Active	No functional	V_{IN}	Detect L	A,C,D
F	Function	High Active	No functional	V_{IN}	Detect H	C,D
H	Function	High Active	No functional	VR_{OUT}	Detect L	
K	Function	High Active	No functional	VR_{OUT}	Detect H	
L	Function	Low Active	Pull-Up Function	V_{IN}	Detect L	A,C,D
M	Function	Low Active	Pull-Up Function	V_{IN}	Detect H	C,D
N	Function	Low Active	Pull-Up Function	VR_{OUT}	Detect L	
P	Function	Low Active	Pull-Up Function	VR_{OUT}	Detect H	
R	Function	Low Active	No functional	V_{IN}	Detect L	A,C,D
S	Function	Low Active	No functional	V_{IN}	Detect H	C,D
T	Function	Low Active	No functional	VR_{OUT}	Detect L	
U	Function	Low Active	No functional	VR_{OUT}	Detect H	
V	No functional	-	-	V_{IN} / V_{SEN}	Detect L	E,F
X	No functional	-	-	V_{IN} / V_{SEN}	Detect H	
Y	No functional	-	-	VR_{OUT}	Detect L	F
Z	No functional	-	-	VR_{OUT}	Detect H	

* For the XC6403/XC6404 AB/AC/AD/AF/AH/AK/AM/AN/AP/AS/AT/AU series. For further detail, please ask your sales contacts.

■PRODUCT CLASSIFICATION (Continued)

●Ordering Information (Continued)

●Pin Number ③, ④ : Type (80 ~ 99 : Standard voltage products)

●XC6403 Series

③④	VROUT	VDOUT	③④	VROUT	VDOUT	③④	VROUT	VDOUT	③④	VROUT	VDOUT
01	1.80	2.40	21	3.30	3.10	-	-	-	80	1.80	1.60
02	1.80	2.90	22	-	-	-	-	-	81	2.80	3.10
03	1.80	1.60	23	-	-	-	-	-	82	1.80	2.00
04	-	-	24	-	-	-	-	-	83	2.50	2.80
05	-	-	25	3.20	2.80	-	-	-	84	2.85	3.20
06	-	-	26	-	-	-	-	-	85	3.00	3.30
07	-	-	27	-	-	-	-	-	86	3.50	3.80
08	-	-	28	-	-	-	-	-	87	3.00	4.20
09	-	-	29	-	-	-	-	-	88	3.30	4.00
10	-	-	30	4.00	4.30	-	-	-	89	3.50	3.90
11	1.80	1.70	31	2.85	2.70	-	-	-	90	1.40	1.20
12	-	-	32	2.60	2.40	-	-	-	91	3.00	2.80
13	1.80	3.00	33	2.70	2.90	-	-	-	92	1.50	2.70
14	-	-	34	2.85	2.55	-	-	-	93	3.30	3.30
15	-	-	35	-	-	-	-	-	94	3.30	3.20
16	2.50	2.90	36	-	-	-	-	-	95	3.30	3.40
17	1.80	2.30	37	-	-	-	-	-	96	1.50	2.95
18	2.80	3.40	38	-	-	-	-	-	97	3.30	2.20
19	-	-	39	-	-	-	-	-	98	3.00	2.20
20	3.30	3.00	40	-	--	-	-	-	99	2.20	1.90

34 : Hysteresis Range 3.0% (TYP.) for an error flag

For the other voltages, please ask your sales contacts.

●XC6404 Series

③④	VROUT	VDOUT	③④	VROUT	VDOUT	③④	VROUT	VDOUT	③④	VROUT	VDOUT
01	2.70	4.20	21	1.80	3.60	-	-	-	80	1.80	1.60
02	-	--	22	1.80	4.20	-	-	-	81	2.80	3.10
03	2.50	2.60	23	2.50	2.90	-	-	-	82	1.80	2.00
04	3.30	4.30	24	2.50	3.60	-	-	-	83	2.50	2.80
05	3.30	4.40	25	2.50	4.20	-	-	-	84	2.85	3.20
06	-	--	26	4.30	4.00	-	-	-	85	3.00	3.30
07	3.30	5.20	27	2.50	3.90	-	-	-	86	3.50	3.80
08	2.80	4.30	28	3.30	3.70	-	-	-	87	3.00	4.20
09	4.30	2.80	29	2.60	3.90	-	-	-	88	3.30	4.00
10	3.30	3.60	30	3.30	4.20	-	-	-	89	3.50	3.90
11	2.80	2.10	31	3.30	4.50	-	-	-	90	1.40	1.20
12	2.80	2.80	32	2.85	2.60	-	-	-	91	3.00	2.80
13	-	--	33	3.30	2.80	-	-	-	92	1.50	2.70
14	-	--	34	3.40	4.20	-	-	-	93	3.30	3.30
15	-	--	35	-	-	-	-	-	94	3.30	3.20
16	3.00	2.70	36	-	-	-	-	-	95	3.30	3.40
17	2.80	2.50	37	-	-	-	-	-	96	1.50	2.95
18	-	--	38	-	-	-	-	-	97	3.30	2.20
19	-	--	39	-	-	-	-	-	98	3.00	2.20
20	1.80	2.90	40	-	-	-	-	-	99	2.20	1.90

For the other voltages, please ask your sales contacts.

■PRODUCT CLASSIFICATION (Continued)

●Ordering Example (Standard Products)

PRODUCT NAME	PRODUCT DESCRIPTION	VOLTAGE	
		VROUT	VDOUT
XC6403/04CH80MR-G	EN Function, High Active, VROUT Sense, Detect L	1.80	1.60
XC6403/04CE81MR-G	EN Function, High Active, VIN Sense, Detect L	2.80	3.10
XC6403/04DE82MR-G	CE Function, High Active, VIN Sense, Detect L	1.80	2.00
XC6403/04DE83MR-G	CE Function, High Active, VIN Sense, Detect L	2.50	2.80
XC6403/04DE84MR-G	CE Function, High Active, VIN Sense, Detect L	2.85	3.20
XC6403/04DE85MR-G	CE Function, High Active, VIN Sense, Detect L	3.00	3.30
XC6403/04DE86MR-G	CE Function, High Active, VIN Sense, Detect L	3.50	3.80
XC6403/04FV87MR-G	Cd Function, VIN Sense, Detect L	3.00	4.20
XC6403/04FV88MR-G	Cd Function, VIN Sense, Detect L	3.30	4.00
XC6404DE89MR-G	CE Function, High Active, VIN Sense, Detect L	3.50	3.90
XC6404DE90MR-G	CE Function, High Active, VIN Sense, Detect L	1.40	1.20
XC6404DE91MR-G	CE Function, High Active, VIN Sense, Detect L	3.00	2.80

■PRODUCT CLASSIFICATION

●Selection Guide

1. TOGGLE FUNCTION, VD SELF-SATURATION AS OPTION

SERIES	TOGGLE FUNCTION (BUILT-IN)
XC6403/XC6404A	VD with Toggle Function
XC6403/XC6404C ~ F	VD with No Toggle Function

2. STAND-BY MODE FUNCTION AS OPTION

SERIES	STAND-BY MODE FUNCTION
XC6403/XC6404A , C	VR with Stand-By Mode Function
XC6403/XC6404D	Chip Stand-By Mode Function
XC6403/XC6404E, F	No Stand-By Mode Function

3. CE / EN INPUT LOGIC, INTERNAL PULL-UP/DOWN AS OPTION (*A,C,D Series)

SERIES	CE INPUT LOGIC
XC6403/XC6404 * A ~ D	High Active with Pull Down
XC6403/XC6404 * E ~ K	High Active with No Pull Down
XC6403/XC6404 * L ~ P	Low Active with Pull Up
XC6403/XC6404 * R ~ U	Low Active with No Pull Up

4. VD SENSE AS OPTION (*A,C,D,F and F Series) (*1)

SERIES	VD SENSE PIN
XC6403/XC6404 * A, B, E, F, L, M, R, S, V, X	V_{IN}
XC6403/XC6404 * C, D, H, K, N, P, T, U, Y, Z	V_{OUT}
XC6403/XC6404 E, V ~ Z	V_{SEN}

5. VD OUTPUT LOGIC AS OPTION (*A,C,D,E,F and F Series) (*1)

SERIES	VD OUTPUT LOGIC FUNCTION
XC6403/XC6404 * A, C, E, H, L, N, R, T, V, Y	Detect L
XC6403/XC6404 * B, D, F, K, M, P, S, U, X, Z	Detect H

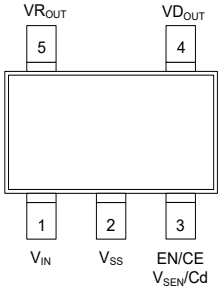
6. VD DELAY FUNCTION AS OPTION

SERIES	DELAY FUNCTION
XC6403/XC6404A ~ E	No Delay
XC6403/XC6404F	Delay Time Adjustable by Connecting Cd

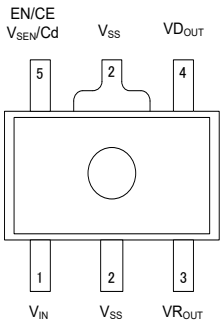
(*1)

XC6403 / XC6404 A series supports the AA / AE / AL / AR series.
XC6403 / XC6404 E series supports the EV/EX series.
XC6403 / XC6404 F series supports the FV/FX/FY/FZ series.

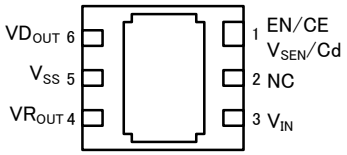
■PIN CONFIGURATION



SOT-25 (TOP VIEW)



SOT-89-5 (TOP VIEW)



USP-6B (BOTTOM VIEW)

* The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking 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. 5) pin.

■PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTION
SOT-25	SOT-89-5	USP-6B		
1	1	3	V_{IN}	Power Input
2	2	5	V_{SS}	Ground
3	5	1	EN	VR ON / OFF Control
3	5	1	CE	ON / OFF Control
3	5	1	V_{SEN}	VD Monitoring
3	5	1	Cd	Delay Capacitor Connection
4	4	6	VD_{OUT}	VD Output
5	3	4	VR_{OUT}	VR Output
-	-	2	NC	No connection

■PIN FUNCTIOS ASSIGNMENT

XC6403/XC6404A～D/A,B,C,D,E,F,H,K Series

EN/CE	STATUS
H	ON
L	OFF

XC6403/XC6404A～D/L,M,N,P,R,S,T,U Series

EN/CE	STATUS
H	OFF
L	ON

H=High Level

L=Low Level

■ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	7.0	V
VR Output Current		VRI_{OUT}	700(*1)	mA
VR Output Voltage		VR_{OUT}	V_{SS} -0.3 ~ VIN + 0.3	V
VD Output Current		VDI_{OUT}	50	mA
VD Output Voltage		VD_{OUT}	V_{SS} -0.3 ~ 7.0	V
V_{CE} / V_{EN} / VC_d Pin Voltage		V_{CE} / V_{EN} / VC_d	V_{SS} -0.3 ~ VIN + 0.3	V
V_{SEN} Output Voltage		V_{SEN}	V_{SS} -0.3 ~ 7.0	V
Power Dissipation	SOT-25	Pd	250	mW
			600 (40mm x 40mm Standard board) (*2)	
	SOT-89-5		500	
			1300 (40mm x 40mm Standard board) (*2)	
	USP-6B		100	
			1000 (40mm x 40mm Standard board) (*2)	
Operating Temperature Range		Topr	- 40 ~ + 85	℃
Storage Temperature Range		Tstg	- 55 ~ + 125	℃

(*1) VRI_{OUT} Pd/ (V_{IN}-VR_{OUT})

(*2) The power dissipation figure shown is PCB mounted and is for reference only.
Please see the power dissipation page for the mounting condition.

■ELECTRICAL CHARACTERISTICS

Ta=25℃

XC6403/XC6404 AA･AE･AL･AR Series

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current (XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V, V_{IN}=3.1V V_{EN}=ON(V_{IN} or V_{SS})	300	-	-	mA	①
VR_{OUT}=5.4V			286	-	-		
VR_{OUT}=5.5V			239	-	-		
VR_{OUT}=5.6V			191	-	-		
VR Maximum Output Current (XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	V_{IN}=$V_{ROUT(T)}$+2.0V $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V V_{EN}=ON(V_{IN} or V_{SS})	500	-	-	mA	①
VR_{OUT}=5.0V			477	-	-		
VR_{OUT}=5.1V			429	-	-		
VR_{OUT}<2.5V			400	-	-		
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100mA	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA	-	E-2			
Supply Current (AA Series)	I_{DD}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V, V_{IN}=2.0V	-	40	75	μA	②
Supply Current (AL Series)		V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS} VR_{OUT}≦0.90V, V_{IN}=2.0V	-				
Supply Current (AE Series)		V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V, V_{IN}=2.0V	-	35	70		
Supply Current (AR Series)		V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS} VR_{OUT}≦0.90V , V_{IN}=2.0V	-				
VR Line Regulation	ΔVR_{OUT}/(ΔV_{IN}･VR_{OUT})	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V, 2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V, 5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V, IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristics	ΔVR_{OUT}/(ΔTopr･VR_{OUT})	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V, $_{IN}$=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more,V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V, V_{IN}=3.1V, V_{EN}=ON(V_{IN} or V_{SS})	300	380	-	mA	①
VR_{OUT}<1.8V			-	380			
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V V_{EN}=ON(V_{IN} or V_{SS})	500	600	-	mA	①
VR_{OUT}<2.5V			-	600			
VR Short-Circuit Current (XC6403 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V, V_{IN}=3.1V, V_{EN}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
VR Short-Circuit Current (XC6404 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V, V_{IN}=3.5V, V_{EN}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
EN "High" Level Current	V_{ENH}	-	1.6	-	V_{IN}	V	①
EN "Low" Level Current	V_{ENL}	-	-	-	0.25	V	①
EN "High" Level Current (AA Series *)	I_{ENH}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V	-0.1	-	5.0	μA	②
EN "High" Level Current (AE･AL･AR Series)	I_{ENH}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V	-0.1	-	0.1	μA	②
EN "Low" Level Current (AL Series)	I_{ENL}	V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS}	-5.0	-	0.1	μA	②
EN "Low" Level Current (AA･AE･AR Series)	I_{ENL}	V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS}	-0.1	-	0.1	μA	②

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 AA･AE･AL･AR Series (Continued) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DDVD}	V_{EN}=OFF(V_{IN} or V_{SS})	-			μA	②
		V_{IN}=2.0V		6.5	14.5		
		V_{IN}=3.0V		7.0	15.0		
		V_{IN}=4.0V		7.5	15.5		
		V_{IN}=5.0V		8.0	16.0		
		V_{IN}=6.0V		9.0	17.0		
VD Output Current	I_{DOUT}	VD_{OUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④

NOTE:

*1: Unless otherwise stated, V_{IN}=$V_{OUT(T)}$+1.0V, However VR_{OUT}≦0.9V, V_{IN}=2.0V

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized VR_{OUT1}=IR_{OUT}{$VR_{OUT(T)}$+1.0V} is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

*10: About EN condition
XC6403/XC6404AA, AE Series : ON=V_{IN}, OFF=V_{SS}
XC6403/XC6404AL, AR Series : ON=V_{SS}, OFF=V_{IN}

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 CA·CB·CC·CD·CE·CF·CH·CK·CL·CM·CN·CP·CR·CS·CT·CU Series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current (XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V V_{EN}=ON(V_{IN} or V_{SS})	300	-	-	mA	①
VR_{OUT}=5.4V			286				
VR_{OUT}=5.5V			239				
VR_{OUT}=5.6V			191				
VR Maximum Output Current (XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	$V_{IN}=V_{ROUT(T)}+2.0V$ $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V V_{EN}=ON(V_{IN} or V_{SS})	500	-	-	mA	①
VR_{OUT}=5.0V			477				
VR_{OUT}=5.1V			429				
VR_{OUT}<2.5V			400				
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100mA	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA		E-2			
Supply Current (CA·CB·CC·CD Series)	I_{DD}	$V_{IN}=V_{EN}=VR_{OUT(T)}+1.0V$ VR_{OUT}≦0.90V,V_{IN}=2.0V	-	40	75	μA	②
Supply Current (CL·CM·CN·CP Series)		$V_{IN}=VR_{OUT(T)}+1.0V$, $V_{EN}=V_{SS}$ VR_{OUT}≦0.90V or more, V_{IN}=2.0V					
Supply Current (CE·CF·CH·CK Series)		$V_{IN}=V_{EN}=VR_{OUT(T)}+1.0V$ VR_{OUT}≦0.90V,V_{IN}=2.0V		35	70		
Supply Current (CR·CS·CT·CU Series)		$V_{IN}=VR_{OUT(T)}+1.0V$, $V_{EN}=V_{SS}$ VR_{OUT}≦0.90V,V_{IN}=2.0V					
VR Line Regulation	ΔVR_{OUT}/ (ΔV_{IN}・VR_{OUT})	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V,2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V,5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V,IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristics	ΔVR_{OUT}/ (ΔTopr・VR_{OUT})	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V,V_{IN}=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more, V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V, V_{EN}=ON(V_{IN} or V_{SS})	300	380	-	mA	①
VR_{OUT}<1.8V			-	380	-		
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	$V_{IN}=VR_{OUT(T)}+2.0V$ $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V V_{EN}=ON（V_{IN} or V_{SS})	500	600	-	mA	①
VR_{OUT}<2.5V			-	600	-		
VR Current Limiter (XC6403 Series)	IRshort	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V, V_{EN}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
VR Current Limiter (XC6404 Series)	IRshort	$V_{IN}=VR_{OUT(T)}+2.0V$ $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V,V_{IN}=3.5V, V_{EN}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
EN "High" Level Voltage	V_{ENH}	-	1.6	-	V_{IN}	V	①
EN "Low" Level Voltage	V_{ENL}	-	-	-	0.25	V	①
EN "High" Level Current (CA·CB·CC·CD Series)	I_{ENH}	$V_{IN}=V_{EN}=VR_{OUT(T)}+1.0V$	-0.1	-	5.0	μA	②
EN "High" Level Current (CE·CF·CH·CK·CL·CM·CN·CP·CR·CS·CT·CU Series)	I_{ENH}	$V_{IN}=V_{EN}=VR_{OUT(T)}+1.0V$	-0.1	-	0.1	μA	②
EN "Low" Level Voltage (CL·CM·CN·CP Series)	I_{ENL}	$V_{IN}=VR_{OUT(T)}+1.0V$, $V_{EN}=V_{SS}$	-5.0	-	0.1	μA	②
EN "Low" Level Voltage (CA·CB·CC·CD·CE·CF·CH·CK·CR·CS·CT·CU Series)	I_{ENL}	$V_{IN}=VR_{OUT(T)}+1.0V$, $V_{EN}=V_{SS}$	-0.1	-	0.1	μA	②

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 CA･CB･CC･CD･CE･CF･CH･CK･CL･CM･CN･CP･CR･CS･CT･CU Series (Continued) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Detect Voltage	$V_{DF(E)}$	-	×0.98	$V_{DF(T)}$	×1.02	V	④
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DDVD}	V_{EN}=OFF(V_{IN} or V_{SS})	-	-	-	μA	②
		V_{IN}=2.0V		6.5	14.5		
		V_{IN}=3.0V		7.0	15.0		
		V_{IN}=4.0V		7.5	15.5		
		V_{IN}=5.0V		8.0	16.0		
		V_{IN}=6.0V		9.0	17.0		
VD Output Current	I_{DOUT}	V_{DOUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④

NOTE:

*1: Unless otherwise stated, V_{IN}=$V_{OUT(T)}$+1.0V, However VR_{OUT}≦0.9V, V_{IN}=2.0V

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized VR_{OUT1}=IR_{OUT}{$VR_{OUT(T)}$+1.0V} is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

*10: About EN condition
XC6403/XC6404 CA, CB, CC, CD, CE, CF, CH, CK Series : ON=V_{IN}, OFF=V_{SS}
XC6403/XC6404 CL, CM, CN, CP, CR, CS, CT, CU Series : ON=V_{SS}, OFF=V_{IN}

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 DA·DB·DC·DD·DE·DF·DH·DK·DL·DM·DN·DP·DR·DS·DT·DU Series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current (XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0Vor more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V V_{EN}=ON(V_{IN} or V_{SS})	300	-	-	mA	①
VR_{OUT}=5.4V			286				
VR_{OUT}=5.5V			239				
VR_{OUT}=5.6V			191				
VR Maximum Output Current (XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	V_{IN}=$V_{ROUT(T)}$+2.0V $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V V_{EN}=ON(V_{IN} or V_{SS})	500	-	-	mA	①
VR_{OUT}=5.0V			477				
VR_{OUT}=5.1V			429				
VR_{OUT}<2.5V			400				
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100Ma	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA		E-2			
Supply Current (DA·DB·DC·DD Series)	I_{DD}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V,V_{IN}=2.0V	-	40	75	μA	②
Supply Current (DL·DM·DN·DP Series)		V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS} VR_{OUT}≦0.90V,V_{IN}=2.0V					
Supply Current (DE·DF·DH·DK Series)		V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V,V_{IN}=2.0V		35	70		
Supply Current (DR·DS·DT·DU Series)		V_{IN}=$VR_{OUT(T)}$+1.0V, V_{EN}=V_{SS} VR_{OUT}≦0.90V,V_{IN}=2.0V					
Stand-by Current	I_{STB}	V_{IN}=VR_{OUT}+1.0V, CE=OFF (V_{IN} or V_{SS}), VDVOUT:OPEN	-0.1	0	0.1	μA	②
VR Line Regulation	ΔVR_{OUT}/ (ΔV_{IN}・VR_{OUT})	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V,2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V,5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V,IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristics	ΔVR_{OUT}/ (ΔTopr・VR_{OUT})	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V,V_{IN}=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more, V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V, V_{CE}=ON(V_{IN} or V_{SS})	300	380	-	mA	①
VR_{OUT}<1.8V			-	380	-		
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V V_{CE}=ON(V_{IN} or V_{SS})	500	600	-	mA	①
VR_{OUT}<2.5V			-	600	-		
VR Current Limiter (XC6403 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V, V_{CE}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
VR Current Limiter (XC6404 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V,V_{IN}=3.5V, V_{CE}=ON(V_{IN} or V_{SS})	-	50	-	mA	①
CE “High” Level Voltage	V_{CEH}	-	1.6	-	V_{IN}	V	①
CE "Low" Level Voltage	V_{CEL}	-	-	-	0.25	V	①
CE "High" Level Current (DA·DB·DC·DD Series)	I_{CEH}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V	-0.1	-	5.0	μA	②
CE "High" Level Current (DE·DF·DH·DK·DL·DM·DN·DP·DR·DS·DT·DU Series)	I_{CEH}	V_{IN}=V_{EN}=$VR_{OUT(T)}$+1.0V	-0.1	-	0.1	μA	②
CE "Low" Level Voltage (DL·DM·DN·DP Series)	I_{CEL}	V_{IN}=$VR_{OUT(T)}$+1.0V, V_{CE}=V_{SS}	-5.0	-	0.1	μA	②
CE "Low" Level Voltage (DA·DB·DC·DD·DE·DF·DH·DK·DR·DS·DT·DU Series)	I_{CEL}	V_{IN}=$VR_{OUT(T)}$+1.0V, V_{CE}=V_{SS}	-0.1	-	0.1	μA	②

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 DA･DB･DC･DD･DE･DF･DH･DK･DL･DM･DN･DP･DR･DS･DT･DU Series (Continued) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Detect Voltage	$V_{DF(E)}$	-	×0.98	$V_{DF(T)}$	×1.02	V	④
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DOUT}	V_{DOUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④

NOTE:

*1: Unless otherwise stated, $V_{IN}=V_{OUT(T)}+1.0V$, However VR_{OUT}≦0.9V, V_{IN}=2.0V

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized $VR_{OUT1}=IR_{OUT}\{VR_{OUT(T)}+1.0V\}$ is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

*10: About EN condition
XC6403/XC6404 DA, DB, DC, DD, DE, DF, DH, DK Series : ON=V_{IN}, OFF=V_{SS}
XC6403/XC6404 DL, DM, DN, DP, DR, DS, DT, DU Series : ON=V_{SS}, OFF=V_{IN}

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 EV･EX Series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current(XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	-	-	mA	①
VR_{OUT}=5.4V			286				
VR_{OUT}=5.5V			239				
VR_{OUT}=5.6V			191				
VR Maximum Output Current(XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	V_{IN}=$V_{ROUT(T)}$+2.0V $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V	500	-	-	mA	①
VR_{OUT}=5.0V			477				
VR_{OUT}=5.1V			429				
VR_{OUT}<2.5V			400				
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100mA	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA		E-2			
Supply Current (EV･EX Series)	I_{DD}	V_{IN}=V_{SEN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V,V_{IN}=2.0V	-	35	70	μA	②
VR Line Regulation	ΔVR_{OUT}/ (ΔV_{IN}･VR_{OUT})	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V,2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V,5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V,IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristic	ΔVR_{OUT}/ (ΔTopr･VR_{OUT})	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V,V_{IN}=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more, V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	380	-	mA	①
VR_{OUT}<1.8V			-	380	-		
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V	500	600	-	mA	①
VR_{OUT}<2.5V			-	600	-		
VR Short-Circuit Current (XC6403 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	-	50	-	mA	①
VR Short-Circuit Current (XC6404 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V,V_{IN}=3.5V	-	50	-	mA	①

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 EV･EX Series (Continued)

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Detect Voltage	$V_{DF(E)}$	-	×0.98	$V_{DF(T)}$	×1.02	V	④
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DOUT}	V_{DOUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④

NOTE:

*1: Unless otherwise stated, $V_{IN}=V_{OUT(T)}+1.0V$, However $VR_{OUT}\leqq 0.9V$, $V_{IN}=2.0V$

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized $VR_{OUT1}=IR_{OUT}\{VR_{OUT(T)}+1.0V\}$ is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 FV･FX Series Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current(XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	-	-	mA	①
VR_{OUT}=5.4V			286				
VR_{OUT}=5.5V			239				
VR_{OUT}=5.6V			191				
VR Maximum Output Current(XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	V_{IN}=$V_{ROUT(T)}$+2.0V $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V	500	-	-	mA	①
VR_{OUT}=5.0V			477				
VR_{OUT}=5.1V			429				
VR_{OUT}<2.5V			400				
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100mA	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA		E-2			
Supply Current	I_{DD}	V_{IN}=V_{SEN}=$VR_{OUT(T)}$+1.0V VR_{OUT}≦0.90V,V_{IN}=2.0V	-	35	70	μA	②
VR Line Regulation	ΔVR_{OUT}/(ΔV_{IN}･VR_{OUT})	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V,2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V,5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V,IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristics	ΔVR_{OUT}/(ΔTopr･VR_{OUT})	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V,V_{IN}=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more, V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	380	-	mA	①
VR_{OUT}<1.8V			-	380	-		
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V	500	600	-	mA	①
VR_{OUT}<2.5V			-	600	-		
VR Short-Circuit Current (XC6403 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+1.0V $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	-	50	-	mA	①
VR Short-Circuit Current (XC6404 Series)	IRshort	V_{IN}=$VR_{OUT(T)}$+2.0V $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V,V_{IN}=3.5V	-	50	-	mA	①

■ELECTRICAL CHARACTERISTICS

XC6403/XC6404 FV･FX Series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Detect Voltage	$V_{DF(E)}$	-	×0.98	$V_{DF(T)}$	×1.02	V	④
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DOUT}	V_{DOUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④
Delay Resistance	Delay	V_{IN}=6.0V Delay Resistance =6.0V/Delay Current	1.0	2.0	3.5	MΩ	⑥

NOTE:

*1: Unless otherwise stated, V_{IN}=$V_{OUT(T)}$+1.0V, However VR_{OUT}≦0.9V, V_{IN}=2.0V

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized VR_{OUT1}=IR_{OUT}{$VR_{OUT(T)}$+1.0V} is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 FY･FZ Series

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VR Output Voltage	$VR_{OUT(E)}$	IR_{OUT}=30mA	×0.98	$VR_{OUT(T)}$	×1.02	V	①
VR Maximum Output Current(XC6403 Series) VR_{OUT}≦5.3V	IR_{OUTMAX}	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	-	-	mA	①
VR_{OUT}=5.4V			286				
VR_{OUT}=5.5V			239				
VR_{OUT}=5.6V			191				
VR Maximum Output Current(XC6404 Series) 2.5≦VR_{OUT}≦4.9V	IR_{OUTMAX}	$V_{IN}=V_{ROUT(T)}+2.0V$ $V_{ROUT(T)}$=4.0V or more, V_{IN}=6.0V	500	-	-	mA	①
VR_{OUT}=5.0V			477				
VR_{OUT}=5.1V			429				
VR_{OUT}<2.5V			400				
VR Load Regulation	ΔVR_{OUT}	1mA≦IR_{OUT}≦100mA	-	15	50	mV	①
VR Dropout Voltage	Vdif1	IR_{OUT}=30mA	-	E-1		mV	①
	Vdif2	IR_{OUT}=100mA		E-2			
Supply Current	I_{DD}	$V_{IN}=V_{SEN}=VR_{OUT(T)}+1.0V$ VR_{OUT}≦0.90V,V_{IN}=2.0V	-	35	70	μA	②
VR Line Regulation	$\Delta VR_{OUT}/(\Delta V_{IN}･VR_{OUT})$	$VR_{OUT(T)}$+1.0V≦V_{IN}≦6.0V VR_{OUT}≦0.90V,2.0≦V_{IN}≦6.0V VR_{OUT}≧4.5V,5.5≦V_{IN}≦6.0V IR_{OUT}=30mA, VR_{OUT}≦1.75V,IR_{OUT}=10mA	-	0.01	0.20	%/V	①
Input Voltage	V_{IN}	-	2.0	-	6.0	V	-
VR Output Voltage Temperature Characteristics	$\Delta VR_{OUT}/(\Delta Topr･VR_{OUT})$	IR_{OUT}=30mA, -40℃≦Topr≦85℃	-	±100	-	ppm/℃	①
VR Ripple Rejection Rate	PSRR	V_{IN}=[$VR_{OUT(T)}$+1.0]V+0.5Vp-pAC VR_{OUT}≦1.25V,V_{IN}=2.25V+0.5Vp-pAC IR_{OUT}=50mA, f=10kHz VR_{OUT}≧4.75 or more, V_{IN}=5.75V+0.5Vp-pAC	-	65	-	dB	③
VR Current Limiter (XC6403 Series) 1.8V≦VR_{OUT}	IRlim	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	300	380	-	mA	①
VR_{OUT}<1.8V			-	380	-		
VR Current Limiter (XC6404 Series) 2.5V≦VR_{OUT}	IRlim	$V_{IN}=VR_{OUT(T)}+2.0V$ $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V	500	600	-	mA	①
VR_{OUT}<2.5V			-	600	-		
VR Short-Circuit Current (XC6403 Series)	IRshort	$V_{IN}=VR_{OUT(T)}+1.0V$ $VR_{OUT(T)}$=5.0V or more, V_{IN}=6.0V VR_{OUT}≦2.1V,V_{IN}=3.1V	-	50	-	mA	①
VR Short-Circuit Current (XC6404 Series)	IRshort	$V_{IN}=VR_{OUT(T)}+2.0V$ $VR_{OUT(T)}$=4.0V or more, V_{IN}=6.0V VR_{OUT}≦1.5V,V_{IN}=3.5V	-	50	-	mA	①

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/XC6404 FY･FZ Series

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
VD Detect Voltage	$V_{DF(E)}$	-	×0.98	$V_{DF(T)}$	×1.02	V	④
VD Hysteresis Range	V_{HYS}	-	$V_{DF(E)}$ ×0.02	$V_{DF(E)}$ ×0.05	$V_{DF(E)}$ ×0.08	V	④
VD Supply Current	I_{DOUT}	VD_{OUT}=0.5V	-	-	-	mA	⑤
		V_{IN}=2.0V	3.0	6.0			
		V_{IN}=3.0V	4.0	8.0			
		V_{IN}=4.0V	5.0	10.0			
		V_{IN}=5.0V	7.0	12.0			
		V_{IN}=6.0V	10.0	15.0			
VD Detect Voltage Temperature Characteristics	ΔV_{DF}/ (ΔTopr･V_{DF})	-40℃≦Topr≦85℃	-	±100	-	ppm/℃	④
Delay Resistance	Delay	V_{IN}=6.0V Delay Resistance =6.0V/Delay Current	1.0	2.0	3.5	MΩ	⑥

NOTE:

*1: Unless otherwise stated, V_{IN}=$V_{OUT(T)}$+1.0V, However VR_{OUT}≦0.9V, V_{IN}=2.0V

*2: $VR_{OUT(T)}$=Specified VR output voltage

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

*4: Vdif={V_{IN1}(*6)-VR_{OUT1}(*5)}

*5: A voltage equal to 98% of the VR output voltage whenever a stabilized VR_{OUT1}=IR_{OUT}{$VR_{OUT(T)}$+1.0V} is input.

*6: V_{IN1}=The input voltage when V_{OUT1}, which appears as input voltage is gradually decreased.

*7: $V_{DF(T)}$: Specified detect voltage value

*8: $V_{DF(E)}$: Effective detect voltage value. Refer to the E-0 chart for $V_{DF(T)}$ values less than 1.5V.

*9: VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

■ELECTRICAL CHARACTERISTICS (Continued)

XC6403/6404 Series

●VR Dropout Voltage 1

SYMBOL	E-0		E-1		E-2	
PARAMETER / SPECIFIED DETECT VOLTAGE / OUTPUT VOLTAGE	VR OUTPUT VOLTAGE DETECT VOLTAGE (V)		DROPOUT VOLTAGE 1 (mV) (IOUT=30mA)		DROPOUT VOLTAGE 2 (mV) (IOUT=100mA)	
			Ta=25℃		Ta=25℃	
$VR_{OUT(T)}$ $V_{DF(T)}$	VR_{OUT}, V_{DF}		Vdif1		Vdif2	
	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.
0.90	0.870	0.930	1100	1110	1150	1200
1.00	0.970	1.030	1000	1010	1050	1100
1.10	1.070	1.130	900	910	950	1000
1.20	1.170	1.230	800	810	850	900
1.30	1.270	1.330	700	710	750	800
1.40	1.370	1.430	600	610	650	700
1.50	1.470	1.530	500	510	550	600
1.60	1.568	1.632	400	410	500	550
1.70	1.666	1.734	300	310	400	450
1.80	1.764	1.836	200	300	300	400
1.90	1.862	1.938	120	150	280	380
2.00	1.960	2.040	80	120	240	350
2.10	2.058	2.142	80	120	240	330
2.20	2.156	2.244	80	120	240	330
2.30	2.254	2.346	80	120	240	310
2.40	2.352	2.448	80	120	240	310
2.50	2.450	2.550	70	100	220	290
2.60	2.548	2.652	70	100	220	290
2.70	2.646	2.754	70	100	220	290
2.80	2.744	2.856	70	100	220	270
2.90	2.842	2.958	70	100	220	270
3.00	2.940	3.060	60	90	200	270
3.10	3.038	3.162	60	90	200	250
3.20	3.136	3.264	60	90	200	250
3.30	3.234	3.366	60	90	200	250
3.40	3.332	3.468	60	90	200	250
3.50	3.430	3.570	60	90	200	250
3.60	3.528	3.672	60	90	200	250
3.70	3.626	3.774	60	90	200	250
3.80	3.724	3.876	60	90	200	250
3.90	3.822	3.978	60	90	200	250
4.00	3.920	4.080	60	80	180	230
4.10	4.018	4.182	60	80	180	230
4.20	4.116	4.284	60	80	180	230
4.30	4.214	4.386	60	80	180	230
4.40	4.312	4.488	60	80	180	230
4.50	4.410	4.590	60	80	180	230
4.60	4.508	4.692	60	80	180	230
4.70	4.606	4.794	60	80	180	230
4.80	4.704	4.896	60	80	180	230
4.90	4.802	4.998	60	80	180	230
5.00	4.900	5.100	50	70	160	210
5.10	4.998	5.202	50	70	160	210
5.20	5.096	5.304	50	70	160	210
5.25	5.145	5.355	50	70	160	210
5.30	5.194	5.406	50	70	160	210
5.35	5.243	5.457	50	70	160	210
5.40	5.292	5.508	50	70	160	210
5.45	5.341	5.559	50	70	160	210
5.50	5.390	5.610	50	70	160	210
5.55	5.439	5.661	50	70	160	210
5.60	5.488	5.712	50	70	160	210

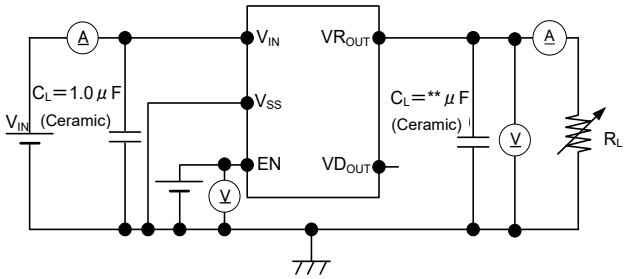
●VR Dropout Voltage 2

SYMBOL	E-0	
SPECIFIED DETECT VOLTAGE	DETECT VOLTAGE (V)	
$V_{DF(T)}$	V_{DF}	
	MIN	MAX
5.70	5.586	5.814
5.80	5.684	5.916
5.90	5.782	6.018
6.00	5.880	6.120

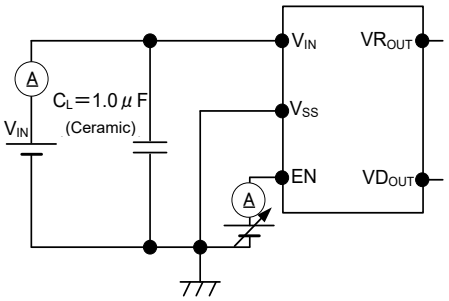
■TEST CIRCUITS

XC6403/XC6404 A・C Series

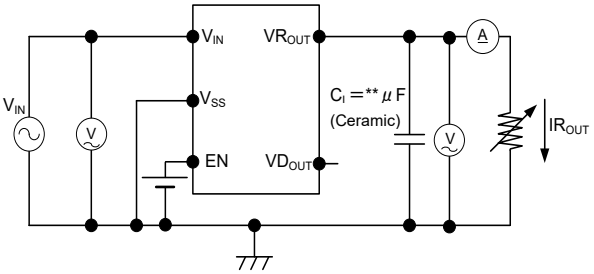
●Circuit ①



●Circuit ②

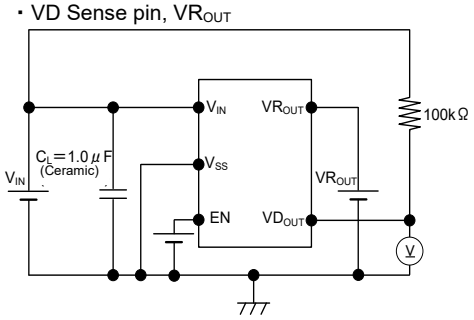


●Circuit ③

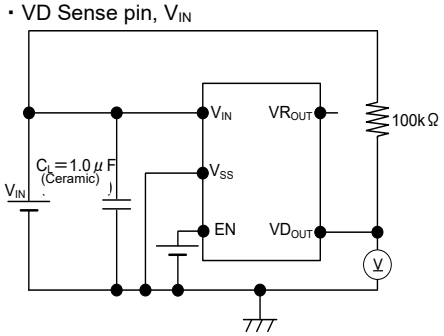


●Circuit ④

・VD Sense pin, VR_{OUT}

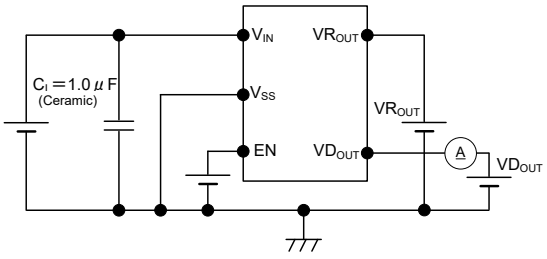


・VD Sense pin, V_{IN}

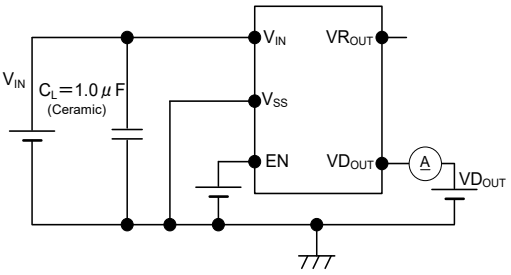


●Circuit ⑤

・VD Sense pin, VR_{OUT}



・VD Sense pin, V_{IN}



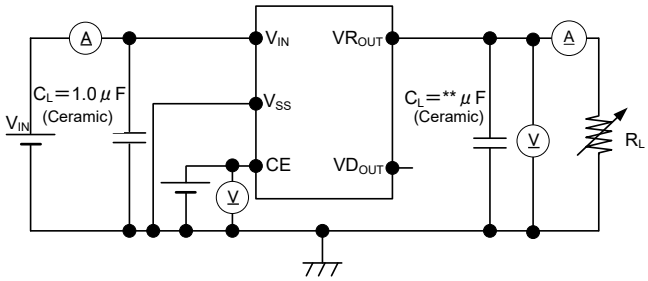
Output Capacitor Corresponding Chart

VR_{OUT}	C_L
0.9 ~ 1.2V	4.7μF
1.3 ~ 1.7V	2.2μF
1.8 ~ 5.5V	1.0μF

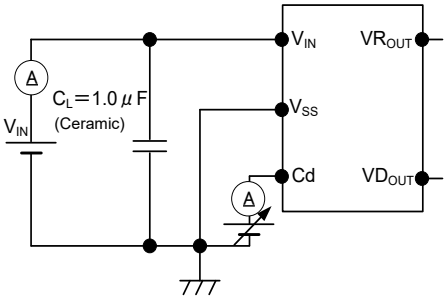
■TEST CIRCUITS (Continued)

XC6403/XC6404D Series

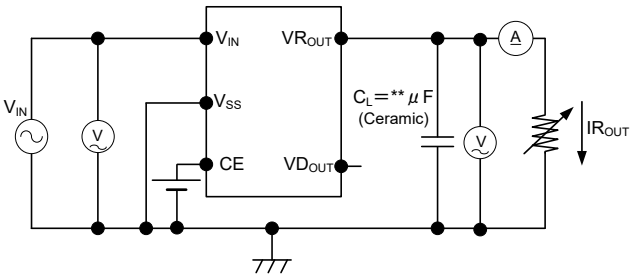
●Circuit ①



●Circuit ②

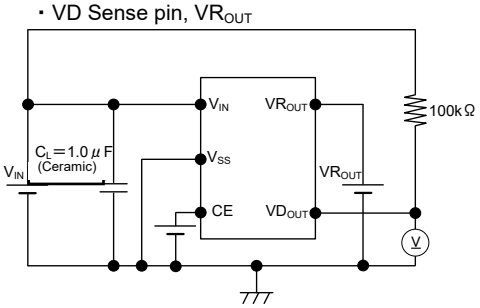


●Circuit ③

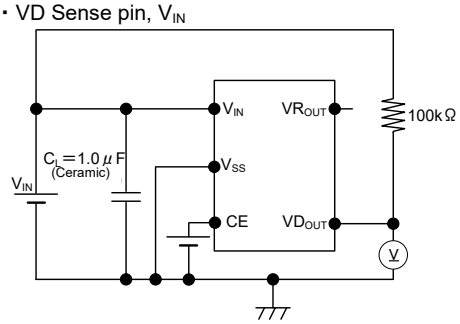


●Circuit ④

・VD Sense pin, VR_{OUT}

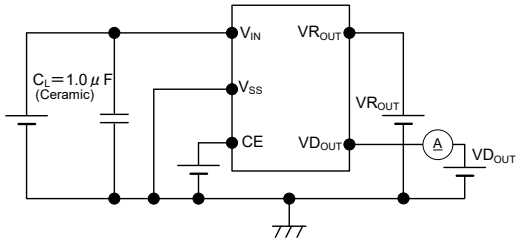


・VD Sense pin, V_{IN}

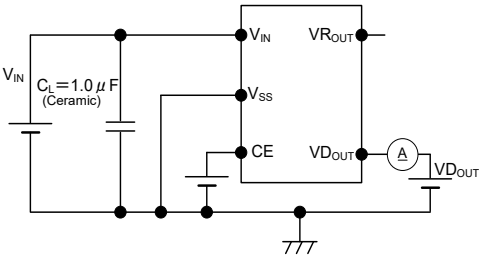


●Circuit ⑤

・VD Sense pin, VR_{OUT}



・VD Sense pin, V_{IN}



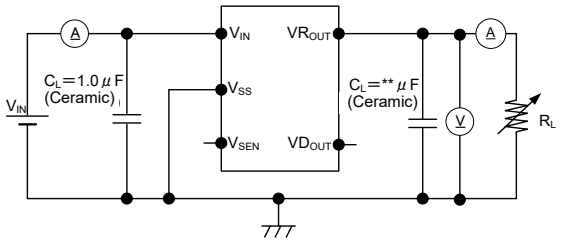
Output Capacitor Corresponding Chart

VR_{OUT}	C_L
0.9 ~ 1.2V	4.7μF
1.3 ~ 1.7V	2.2μF
1.8 ~ 5.5V	1.0μF

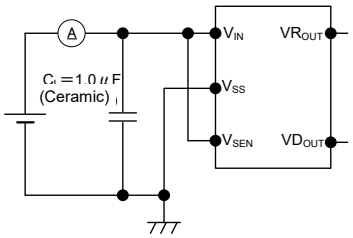
■TEST CIRCUITS (Continued)

XC6403/XC6404 EV・EX Series

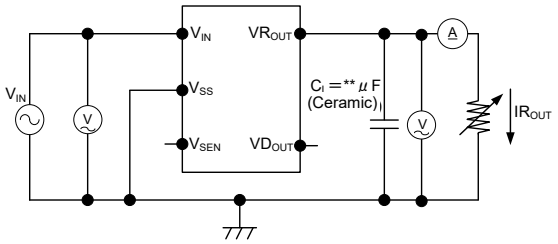
●Circuit ①



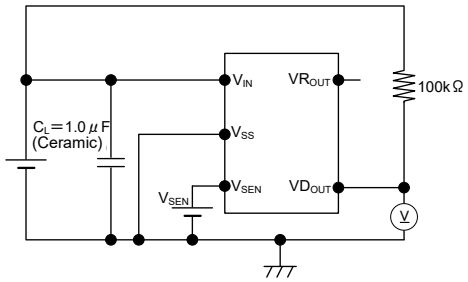
●Circuit ②



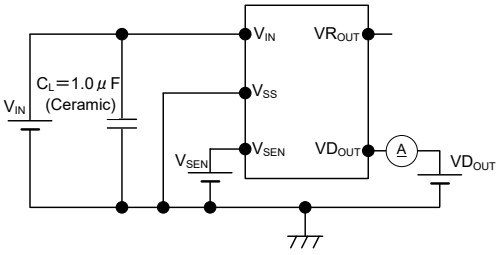
●Circuit ③



●Circuit ④



●Circuit ⑤



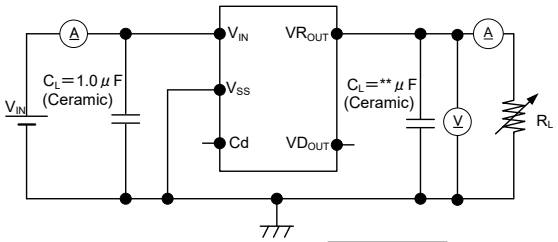
Output Capacitor Corresponding Chart

VR_{OUT}	C_L
0.9 ~ 1.2V	4.7μF
1.3 ~ 1.7V	2.2μF
1.8 ~ 5.5V	1.0μF

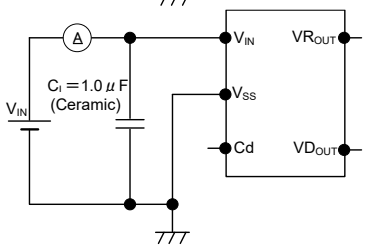
■TEST CIRCUITS (Continued)

XC6403/XC6404 FV・FX Series

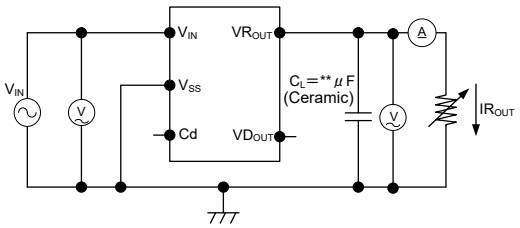
●Circuit ①



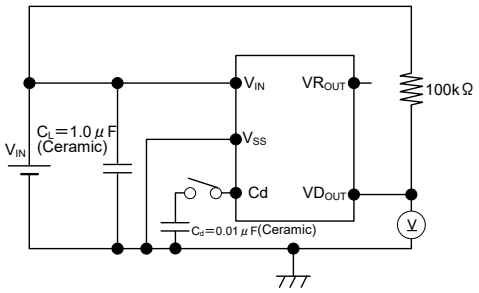
●Circuit ②



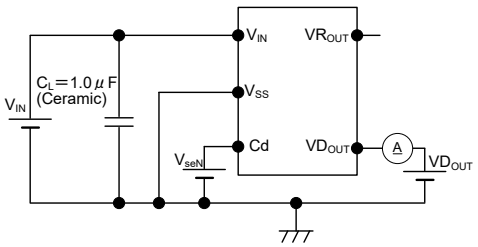
●Circuit ③



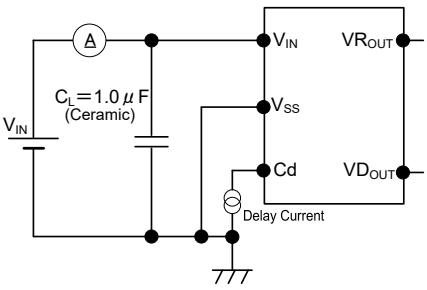
●Circuit ④



●Circuit ⑤



●Circuit ⑥



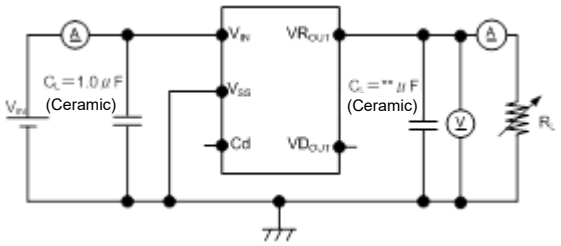
Output Capacitor Corresponding Chart

VR_{OUT}	C_L
0.9 ~ 1.2V	4.7μF
1.3 ~ 1.7V	2.2μF
1.8 ~ 5.5V	1.0μF

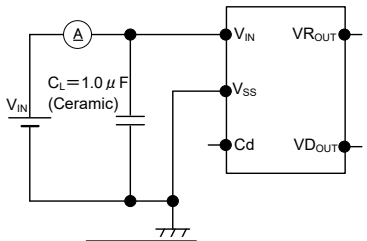
■TEST CIRCUITS (Continued)

XC6403/XC6404 FY・FZ Series

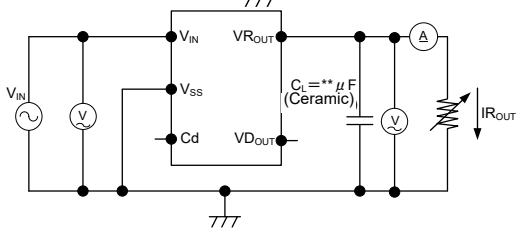
●Circuit ①



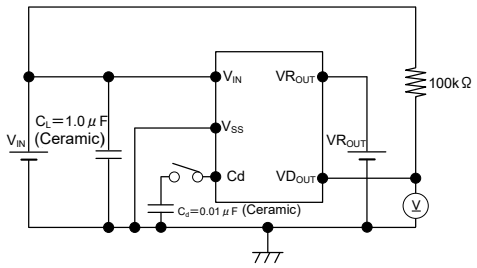
●Circuit ②



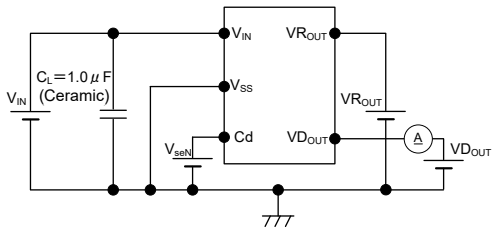
●Circuit ③



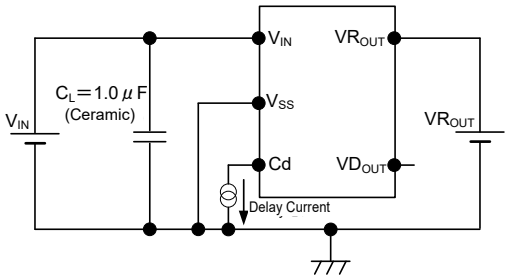
●Circuit ④



●Circuit ⑤



●Circuit ⑥



Output Capacitor Corresponding Chart

VR_{OUT}	C_L
0.9 ~ 1.2V	4.7μF
1.3 ~ 1.7V	2.2μF
1.8 ~ 5.5V	1.0μF

■OPERATIONAL EXPLANATION

<Output Voltage Regulator Control>

The voltage, divided by resistors R1 & R2 which are connected to the VR_{OUT} pin is compared with the internal reference voltage by the error amplifier. The P-channel MOSFET, which is connected to the VR_{OUT} pin, is then driven by the subsequent output signal. The output voltage at the VR_{OUT} pin is controlled & stabilized by negative feedback.

The current limit circuit and short circuit protection operate in relation to the level of output current. Further, the voltage regulator's internal circuitry can be shutdown via the EN or CE pin's signal.

<Detector Function with the XC6403/XC6404 Series>

The series' detector function monitors the voltage divided by resistors R3 & R4 which are connected to the VR_{OUT} pin or the V_{IN} pin or the V_{SEN} pin, as well as monitoring the voltage of the internal reference voltage source via the comparator.
The VD_{SEN} pin has options (please refer to the Selection Guide, item 4). A 'High' or 'Low' signal level can be output from the VD_{OUT} pin when the VD pin voltage level goes below the detect voltage.

The VD output logic has options (please refer to the Selection Guide, item 5). As VD_{OUT} is an open-drain N-channel output, a pull-up resistor of about 220kΩ is needed to achieve a voltage output. Because of hysteresis at the detector function, output at the VD_{OUT} pin will invert when the detect voltage level increases above the release voltage (105% of the detect voltage). Even when the XC6403/04A, C, series are in stand-by mode, the voltage detector function operates and the output voltage at VD_{OUT} will output according to the voltage level at VDSENSE voltage.

For the XC6403/XC6404A,C types, in stand-by, if a voltage of the recovery voltage is present at the VR_{OUT} pin (from another power source), the VD_{OUT} pin will be high impedance mode, and the pull up voltage will be output at VD_{OUT}. By connecting the Cdelay pin to a capacitor (Cd), the XC6403/XC6404F series can apply a delay time to VD_{OUT} voltage when releasing voltage. The delay time can be calculated from the internal resistance, Rdelay (2MΩ fixed) and the value of Cd as per the following equation.

Delay Time = Cdelay x Rdelay x 0.7

Delay Time Rdelay standard : 1.0 ~ 3.5MΩ TYP : 2.0MΩ

Cdelay	DELAY TIME (TYP.)	DELAY TIME (TYP.)
0.01μF	14.0 ms	7.0 ms ~ 24.5 ms
0.022μF	30.8 ms	15.4 ms ~ 53.9 ms
0.047μF	65.8 ms	32.9 ms ~ 115.15 ms
0.1μF	140 ms	70 ms ~ 245 ms
0.22μmF	308 ms	154 ms ~ 539 ms
0.47μF	658 ms	329 ms ~ 1151.5 ms
1μF	1400 ms	700 ms ~ 2450 ms

<Low ESR Capacitors>

With the XC6403/XC6404 series regulator, a stable output voltage is achievable even if low ESR capacitors are used, as a phase compensation circuit is built-in to the regulator. In order to ensure the effectiveness of the phase compensation, we suggest that an output capacitor (C_L) be connected as close as possible, between the output pin (VR_{OUT}) and the V_{SS} pin. Please use an output capacitor (C_L) with a capacitance, based on the chart below. We also suggest an input capacitor (C_{IN}) of 1μF : this should be connected between V_{IN} and V_{SS} in order to stabilize input power source.

Output Capacitor

VR_{OUT}	0.9V ~ 1.2V	1.3V ~ 1.7V	1.8V ~
C_L	More Than 4.7μF	More Than 2.2μF	More Than 1.0μF

<Current Limiter, Short-Circuit Protection>

The XC6403/XC6404 series regulator offers a combination of current limit and circuit protection by means of a built-in fixed current limiter circuit and a foldback circuit. 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, the output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

■OPERATIONAL EXPLANATION (Continued)

<EN / CE Pin>

The IC's internal regulator circuitry can be shut down via the signal from the EN pin with the XC6403/XC6404A,C series. In shutdown mode, output at the VR_{OUT} pin will be pulled down to the V_{SS} level via R1 & R2. The whole IC's circuitry can be shut down via CE pin with the XC6403/XC6404D series and power consumption can be reduced to around 0 μA (TYP.).

While the voltage detector is in shutdown mode, the voltage detector output is in a post-detection state.

When choosing Detect L, input current can be set by using the following formula.

Input Current = V_{IN} voltage / Pull-Up Resistance

In stand-by mode, the above input current can be reduced by connecting a Pull-Up resistor between VR_{OUT} and VD_{OUT}.

Note that as the XC6403/XC6404*E to K types of the XC6404 A ,C, D series are ' High Active / No Pull-Down' and XC6403/XC6404*R to U types of the XC6404A ,C, D series are ' Low Active / No Pull-Up', operations will become unstable with the CE pin open (See the chart below).

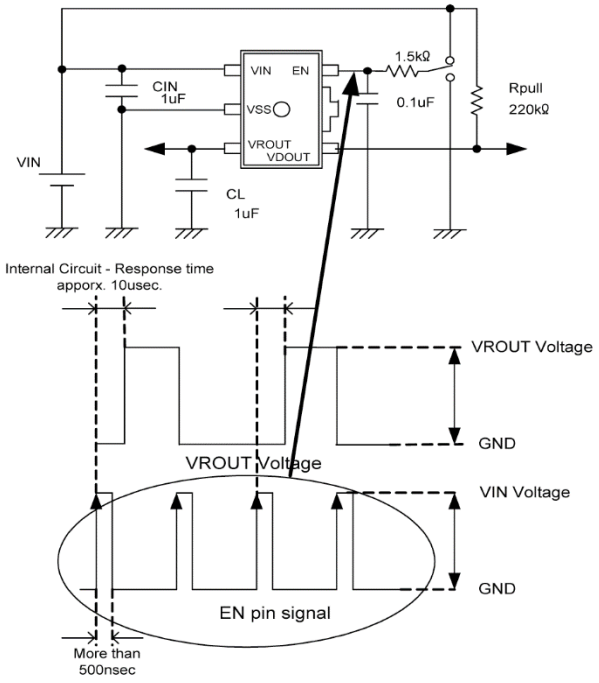
SERIES	EN/CE INPUT LOGIC
XC6403/04 * A ,C, D	High Active with Pull-Down
XC6403/04 * E ~ K	High Active with No Pull-Down
XC6403/04 * L ~ P	Low Active with Pull-Up
XC6403/04 * R ~ U	Low Active with No Pull-Up

(*A , C , D Series)

We suggest that you use this IC with either a V_{IN} voltage or a V_{SS} voltage input at the EN or CE pin. If this IC is used with the correct specifications for the EN or CE pin, the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry if a voltage other than V_{IN} or V_{SS} is applied.

<Toggle Operation>

The XC6403/XC6404 A series have a built-in toggle ON/OFF switch which repeats an on/off operation via the EN pin's leading edge signal when the EN logic is Active HIGH, and via the EN pin's falling edge signal when the EN logic is Active LOW (Please also refer the figure below). The EN input signal duration should be over 500ns. If the EN input signal is less than 500ns, it is possible that the circuit fails to respond and the toggle function does not operate. To operate the toggle function properly when the EN pin voltage noise is large, a RC filter should be used to reduce the noise in the signal to the EN pin. In the case where input delay time is required, it is possible to set the time constant by connecting an RC network to the EN pin.



EN Logic Active "HIGH"

■NOTES ON USE

1. For the phenomenon of temporal and transitional voltage decrease or voltage increase, the IC may be damaged or deteriorated if IC is used beyond the absolute MAX. specifications.

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.
   Should rapid input fluctuation or load fluctuation occur, please increase the capacitor value such as C_{IN} or C_L to stabilize the operation.

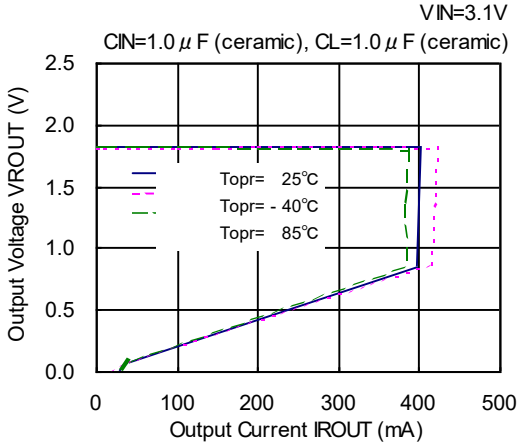
4. Torex places an importance on improving our products and their reliability. We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

■TYPICAL PERFORMANCE CHARACTERISTICS

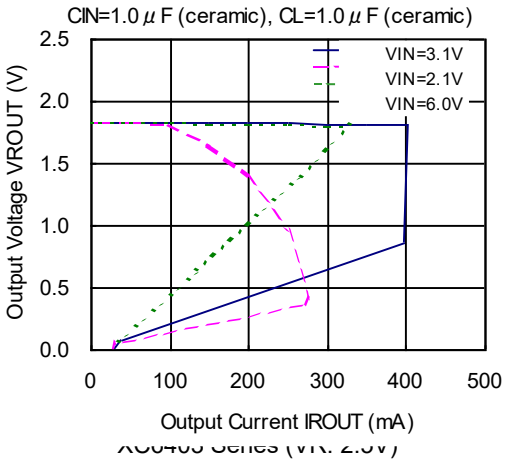
●XC6403 Series

(1) VR Output Voltage vs. VR Output Current

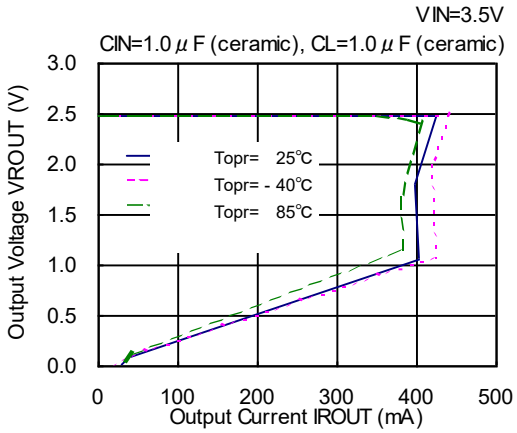
XC6403 Series (VR: 1.8V)

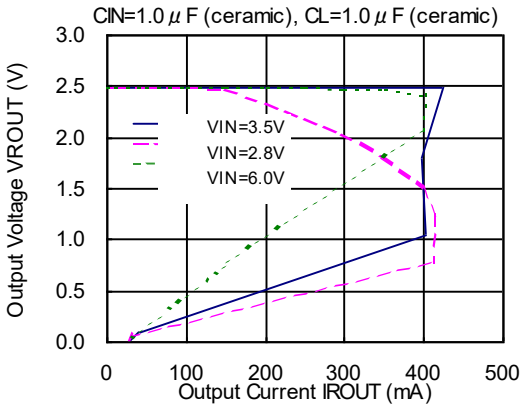


XC6403 Series (VR: 1.8V)

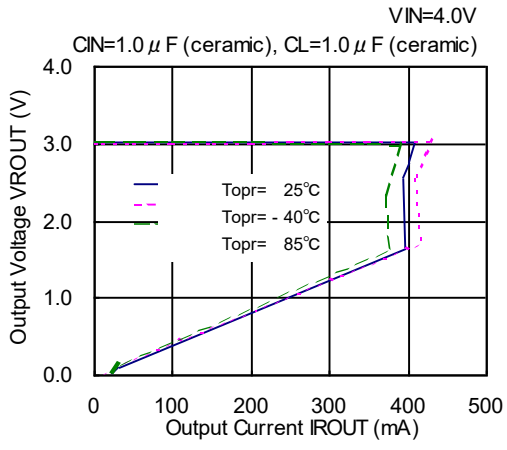


XC6403 Series (VR: 2.5V)

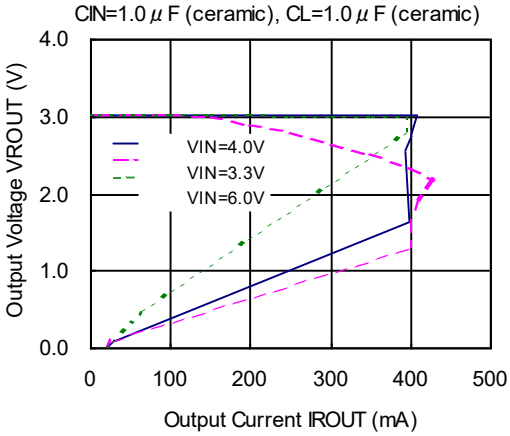




XC6403 Series (VR: 3.0V)



XC6403 Series (VR: 3.0V)

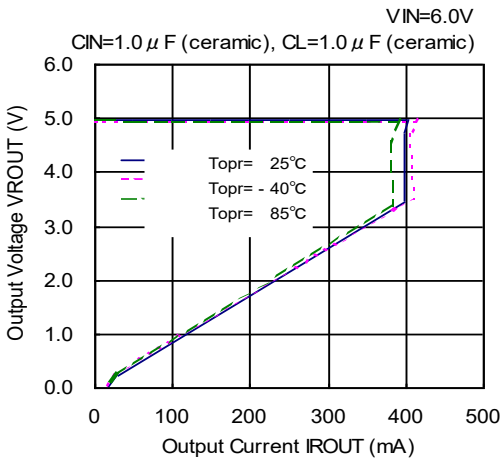


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

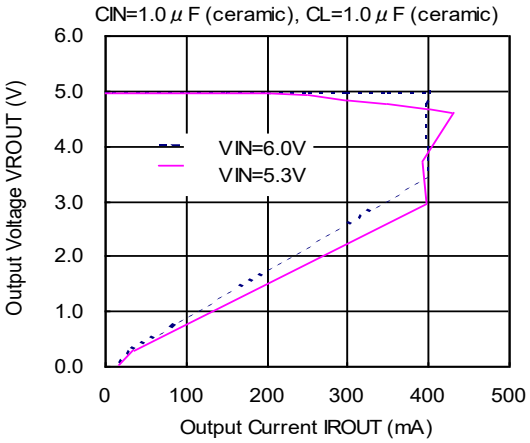
●XC6403 Series (Continued)

(1) VR Output Voltage vs. VR Output Current (Continued)

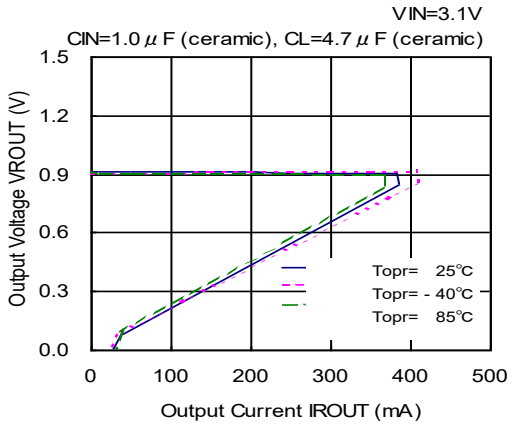
XC6403 Series (VR: 5.0V)



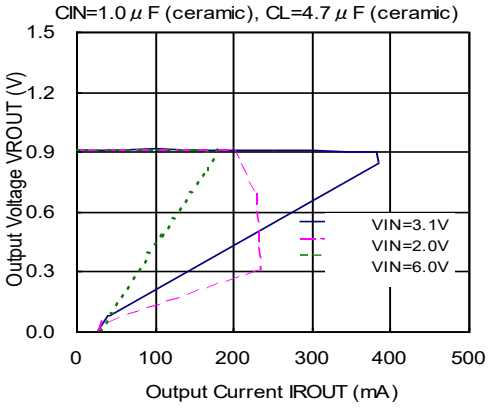
XC6403 Series (VR: 5.0V)



XC6403 Series (VR: 0.9V)



XC6403 Series (VR: 0.9V)

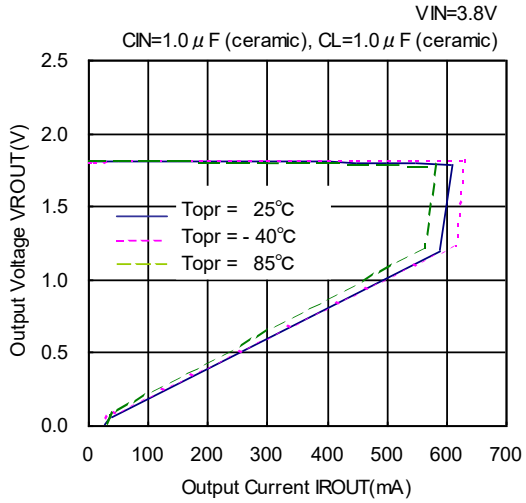


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

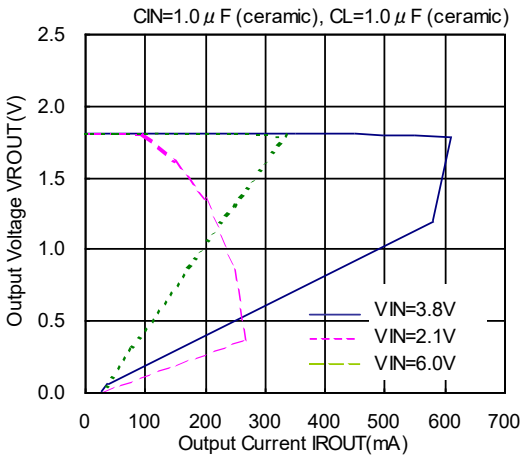
●XC6404 Series

(1) VR Output Voltage vs. VR Output Current

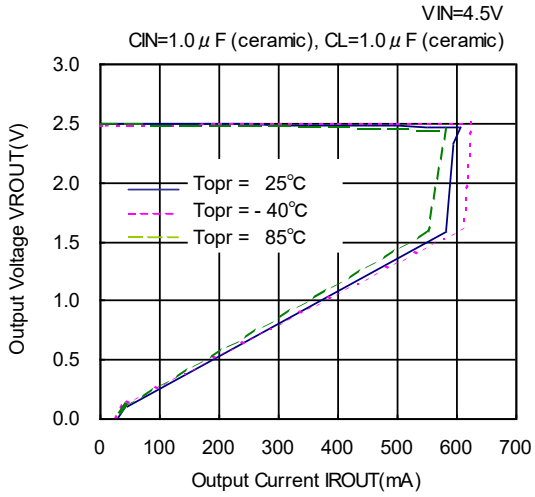
XC6404 Series (VR: 1.8V)



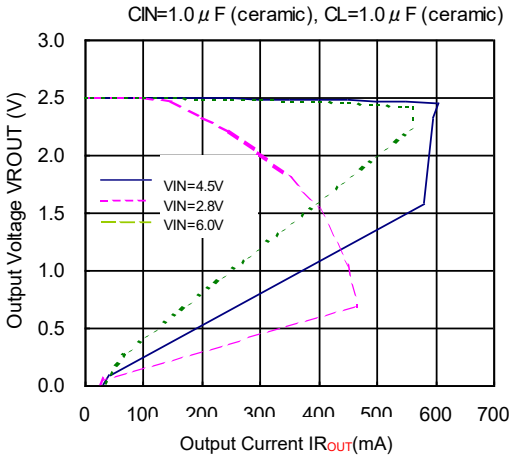
XC6404 Series (VR: 1.8V)



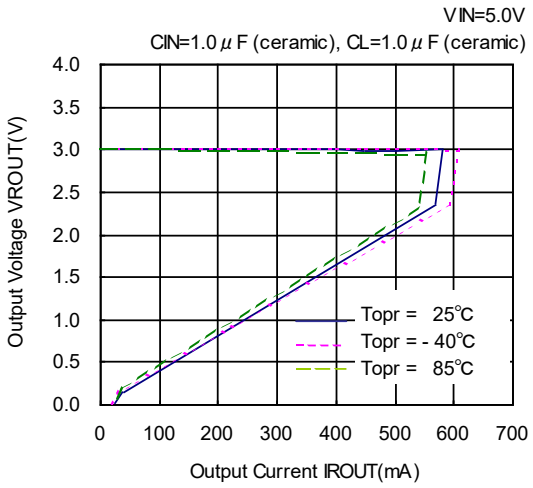
XC6404 Series (VR: 2.5V)



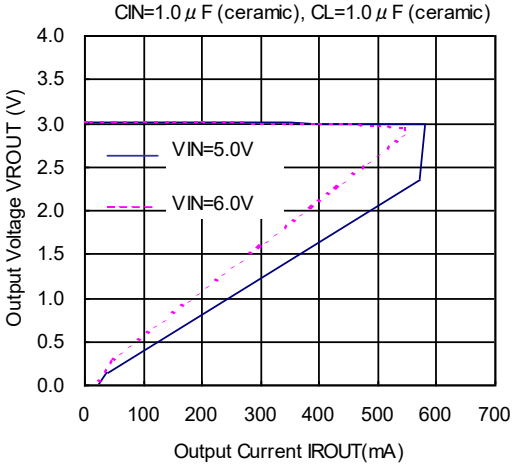
XC6404 Series (VR: 2.5V)



XC6404 Series (VR: 3.0V)



XC6404 Series (VR: 3.0V)

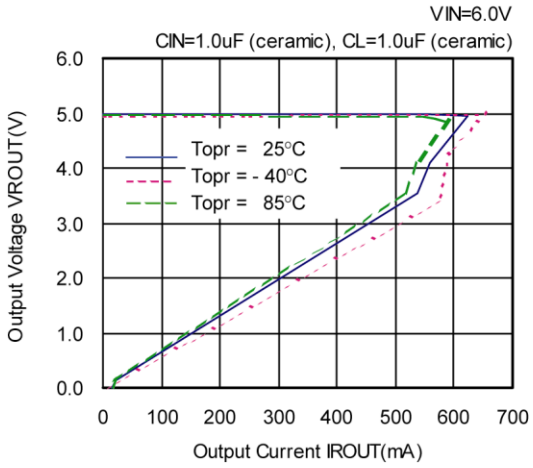


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

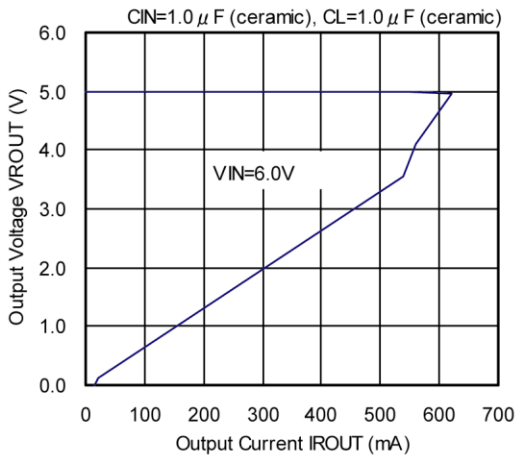
●XC6404 Series (Continued)

(1) VR Output Voltage vs. VR Output Current (Continued)

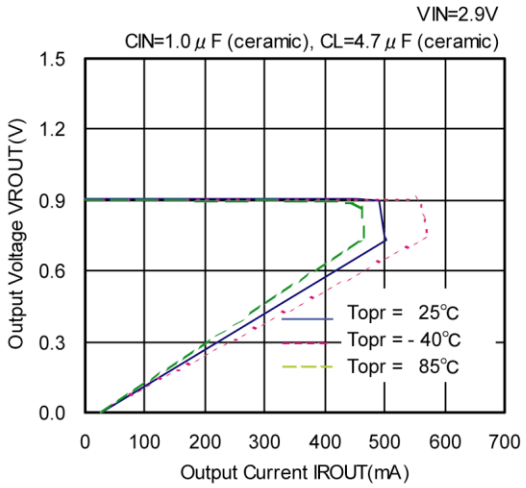
XC6404 Series (VR : 5.0V)



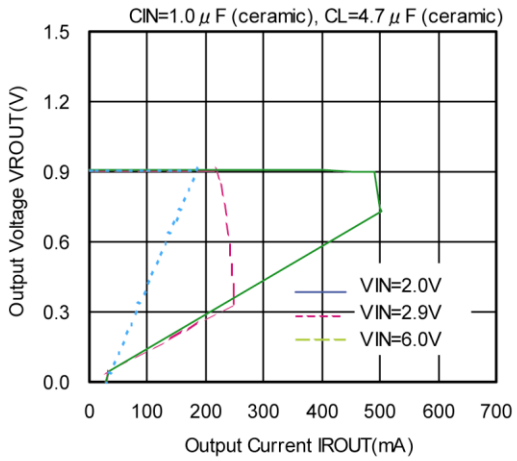
XC6404 Series (VR : 5.0V)



XC6404 Series (VR : 0.9V)



XC6404 Series (VR : 0.9V)

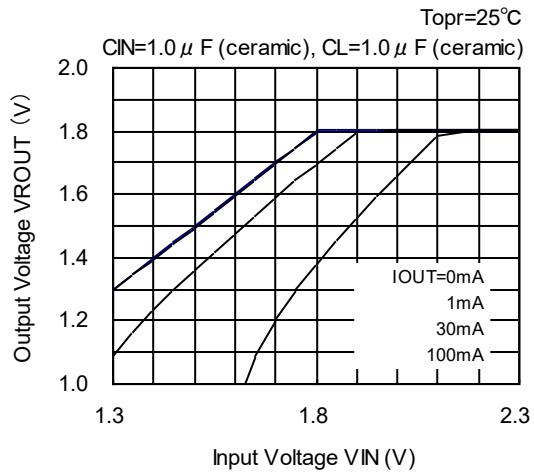


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

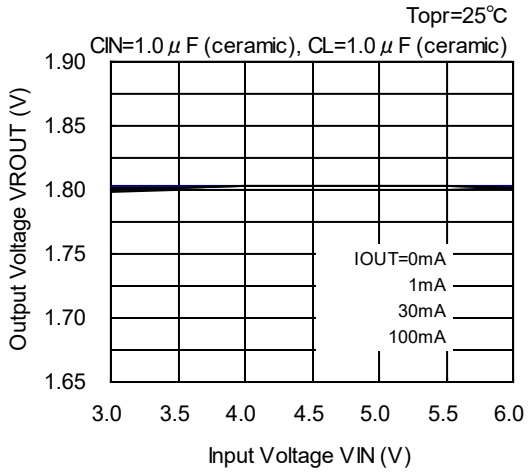
●XC6403/04 Series

(2) VR Output Voltage vs. Input Voltage

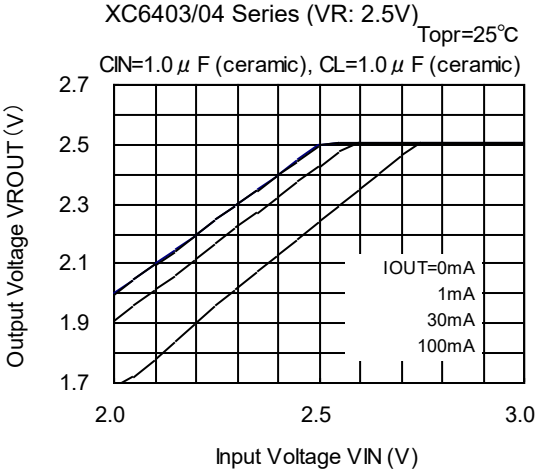
XC6403/04 Series (VR: 1.8V)



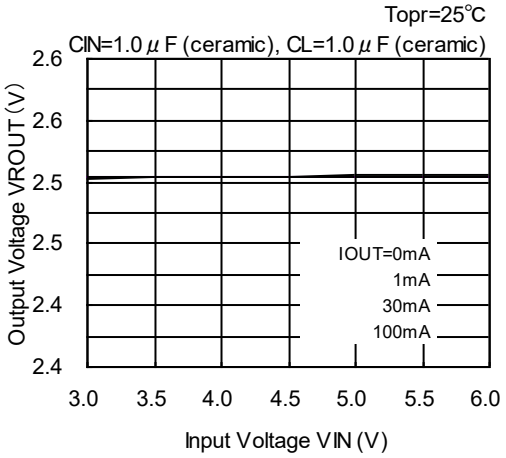
XC6403/04 Series (VR: 1.8V)



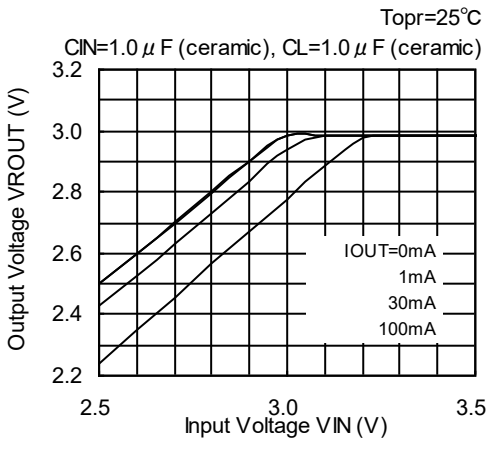
XC6403/04 Series (VR: 2.5V)



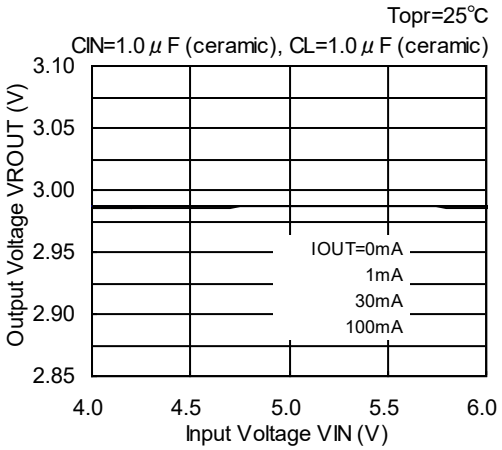
XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 3.0V)

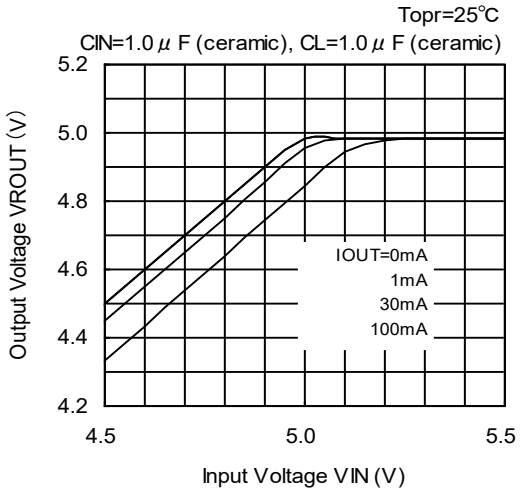


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

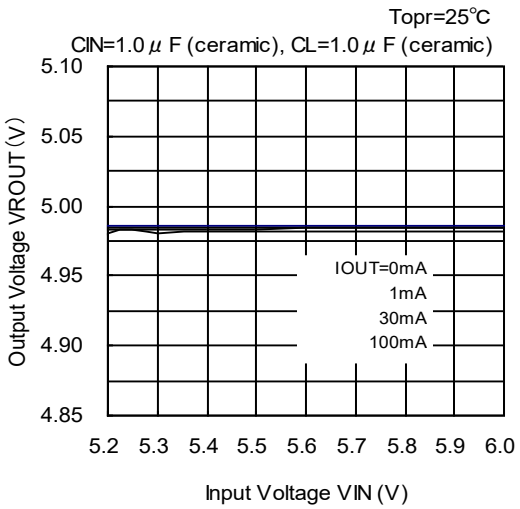
●XC6403/04 Series (Continued)

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

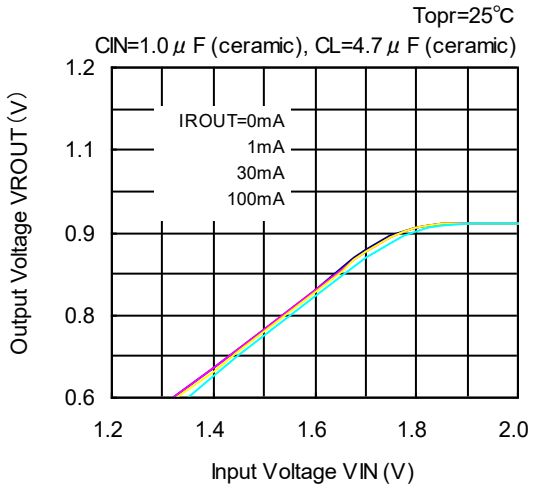
XC6403/04 Series (VR: 5.0V)



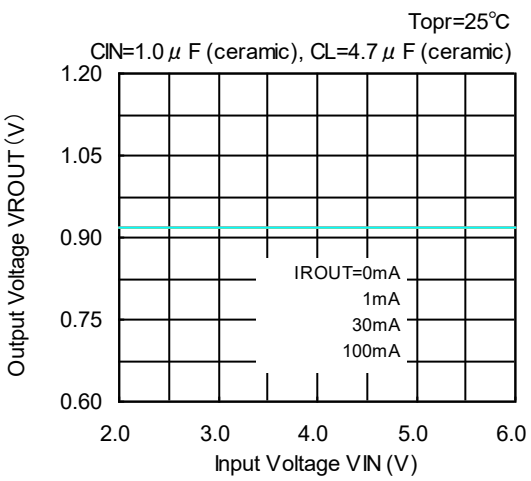
XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)

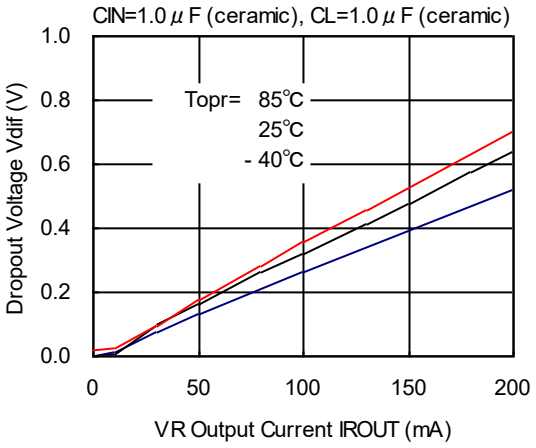


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

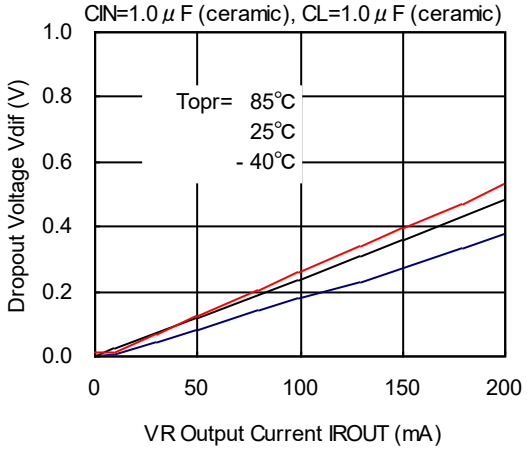
●XC6403/04 Series (Continued)

(3) Dropout Voltage vs. VR Output Current

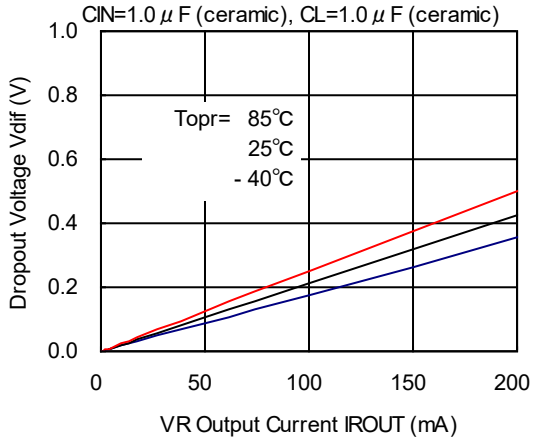
XC6403/04 Series (VR: 1.8V)



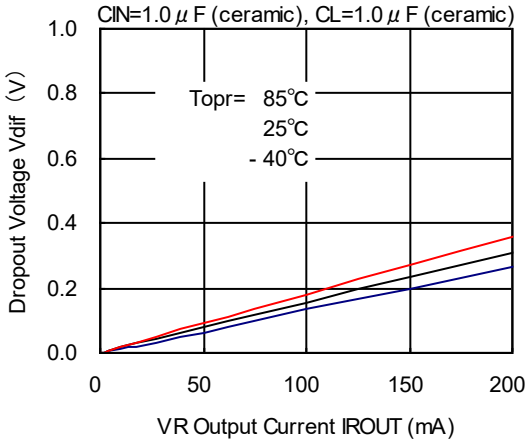
XC6403/04 Series (VR: 2.5V)



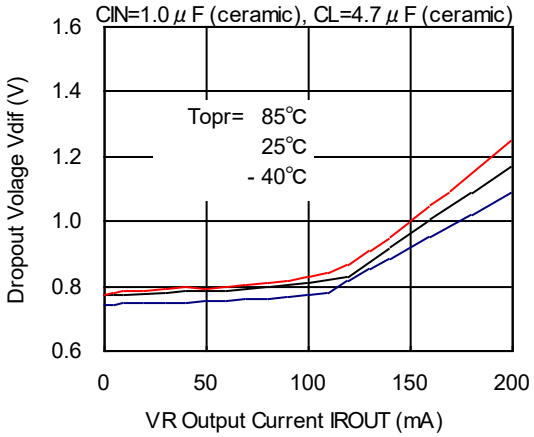
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

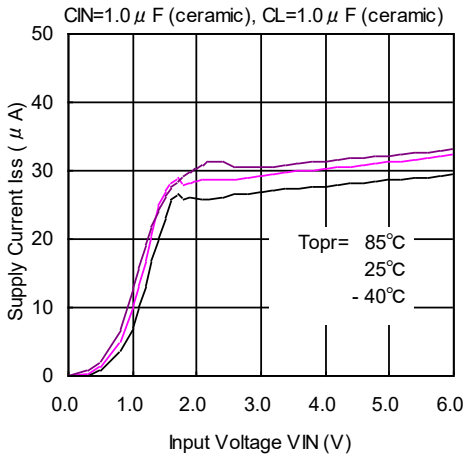


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

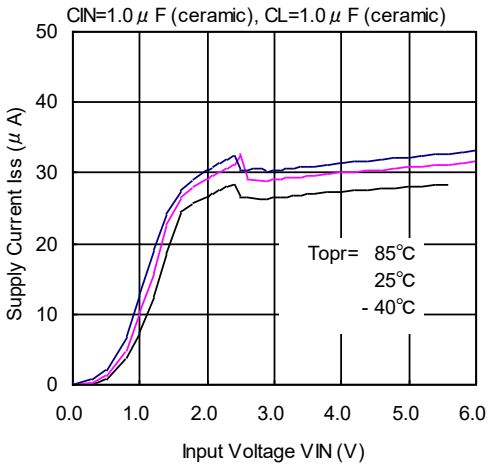
●XC6403/04 Series (Continued)

(4) Supply Current vs. Input Voltage

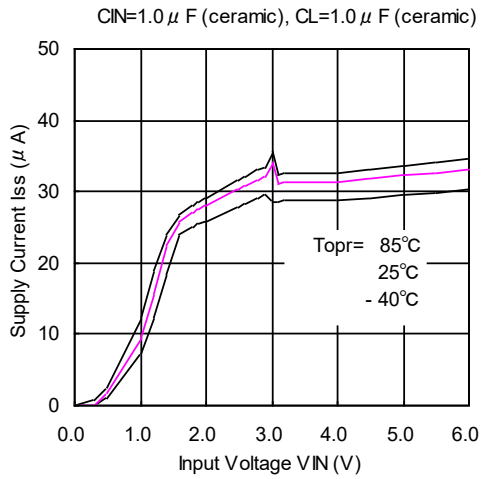
XC6403/04 Series (VR: 1.8V)



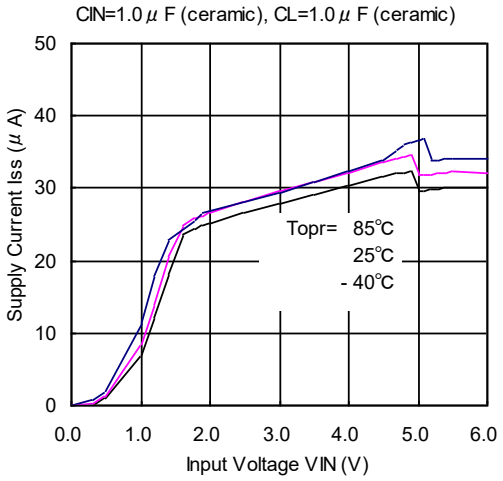
XC6403/04 Series (VR: 2.5V)



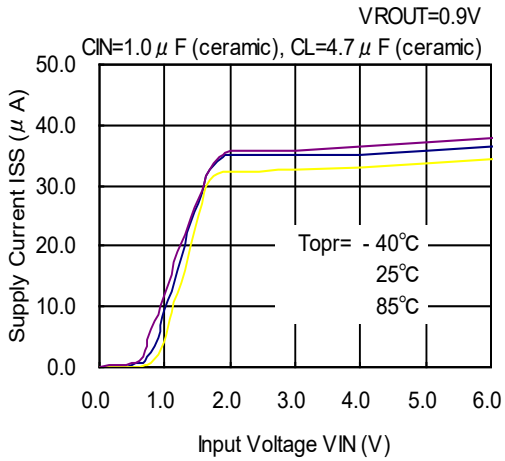
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

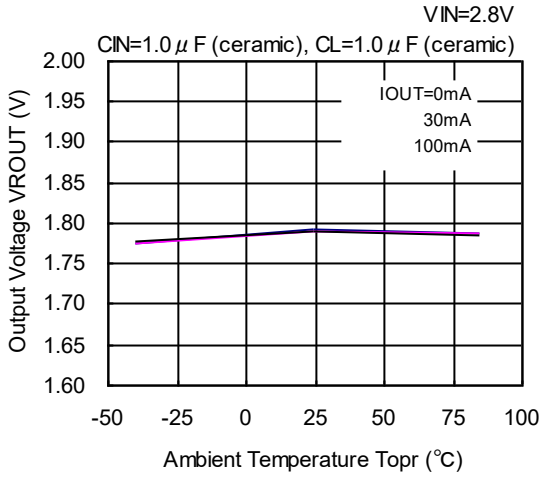


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

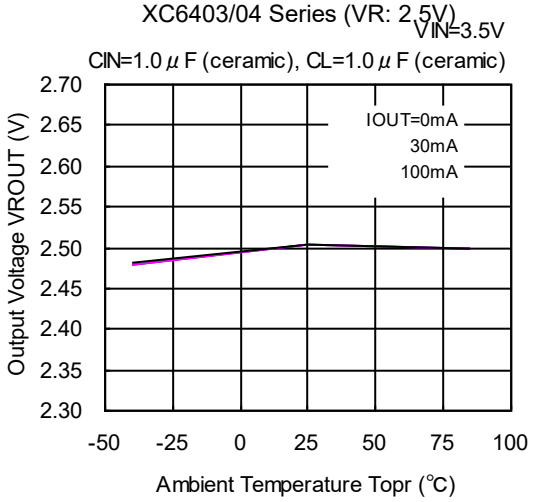
●XC6403/04 Series (Continued)

(5) VR Output Voltage vs. Ambient Temperature

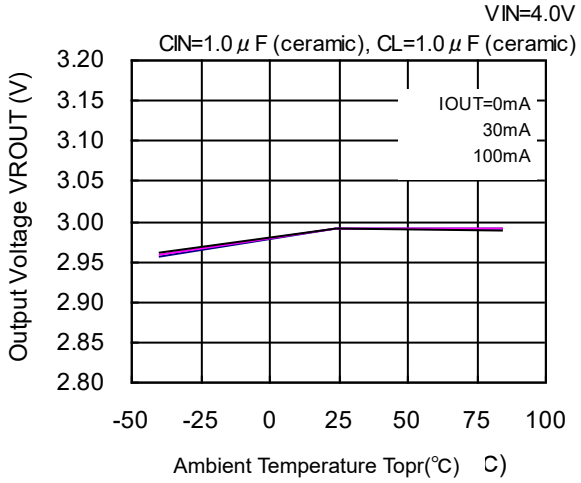
XC6403/04 Series (VR: 1.8V)



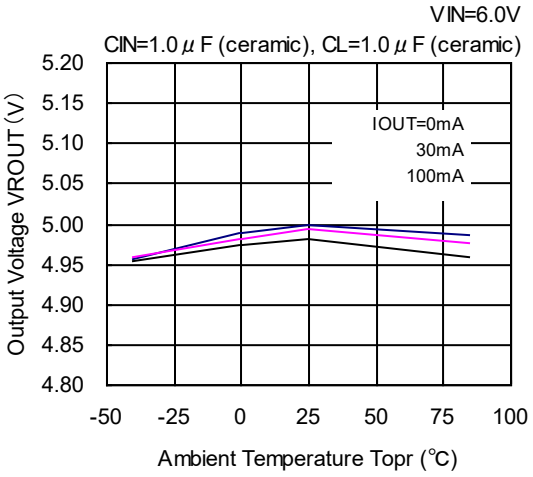
XC6403/04 Series (VR: 2.5V)



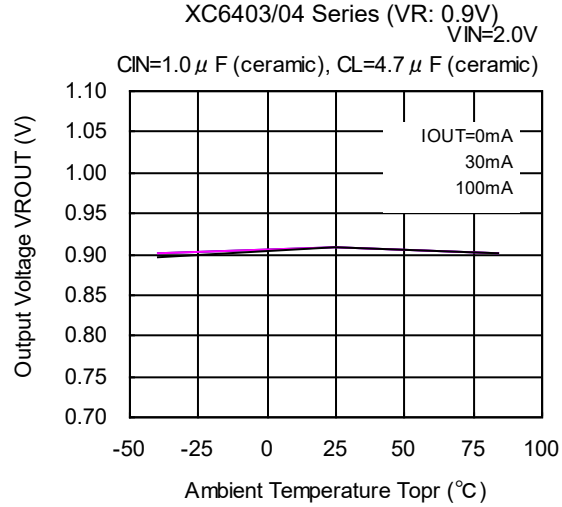
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

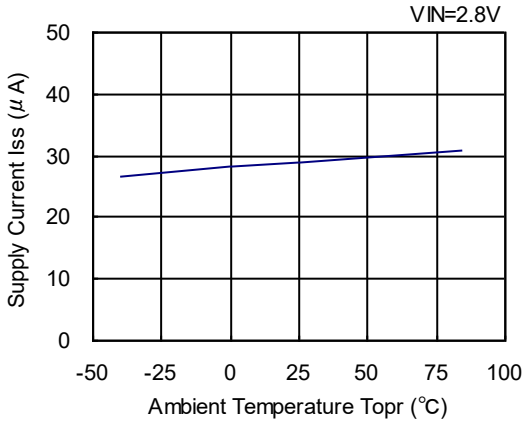


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

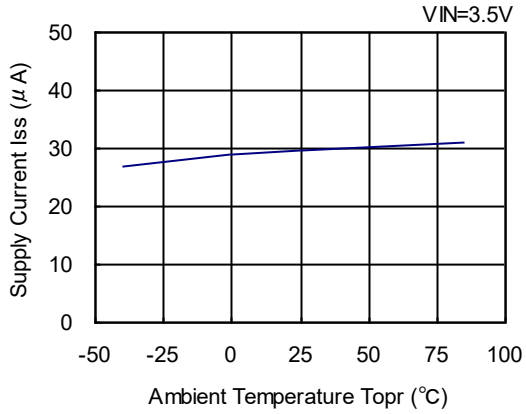
●XC6403/04 Series (Continued)

(6) Supply Current vs. Ambient Temperature

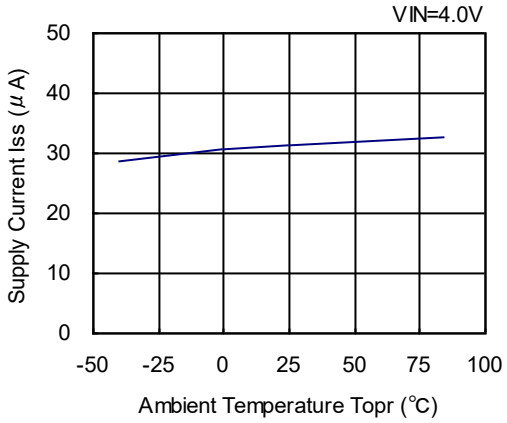
XC6403/04 Series (VR: 1.8V)



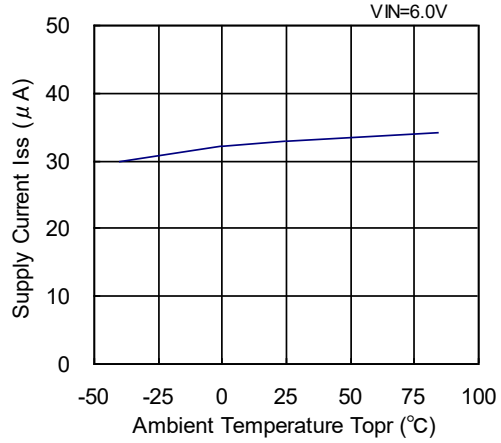
XC6403/04 Series (VR: 2.5V)



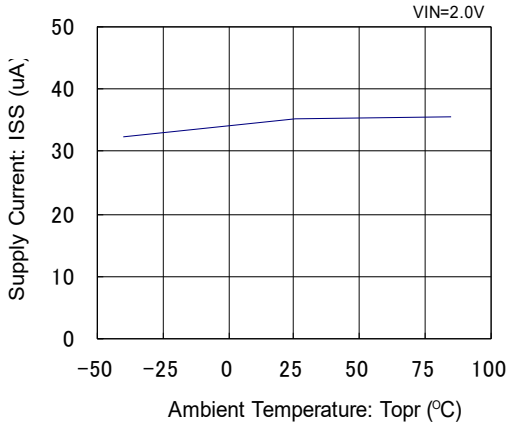
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



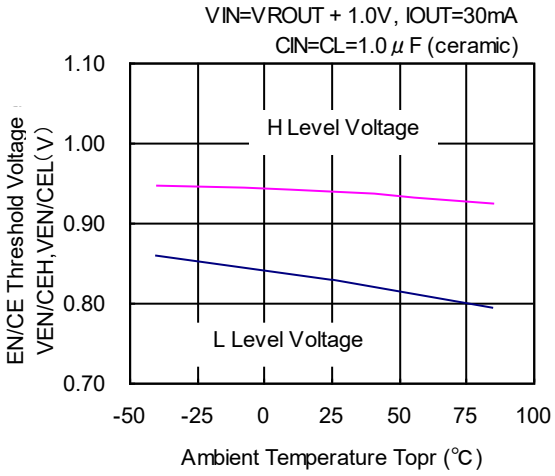
XC6403/04 Series (VR: 0.9V)



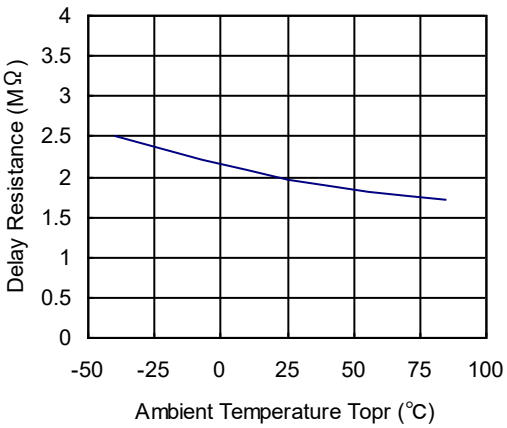
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6403/04 Series (Continued)

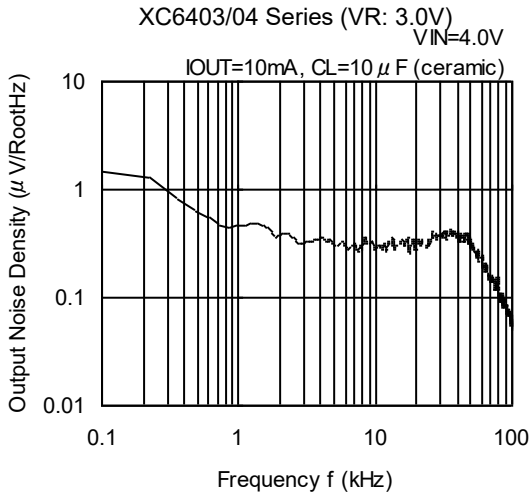
(7) EN/CE Threshold Voltage vs. Ambient Temperature



(8) Rdelay vs. Ambient Temperature



(9) Output Noise Density

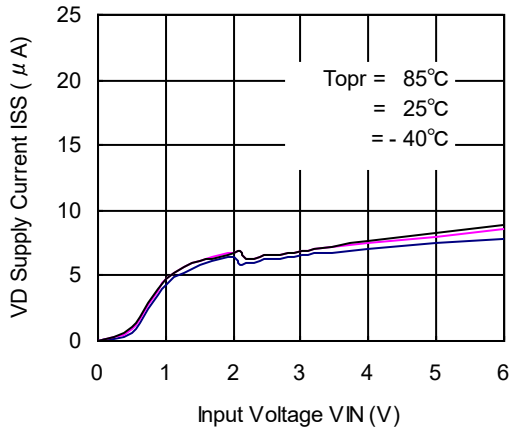


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

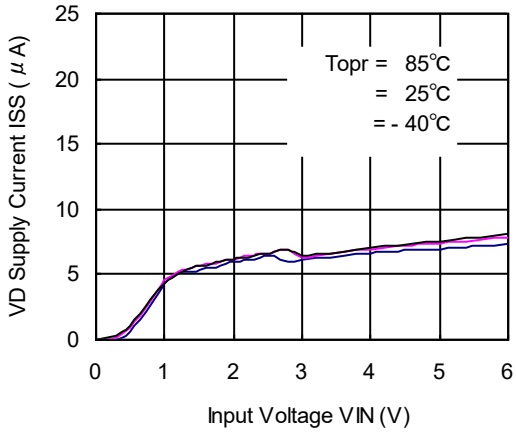
●XC6403/04 Series (Continued)

(10) VD Supply Current vs. Input Voltage (Only A ~ C Types)

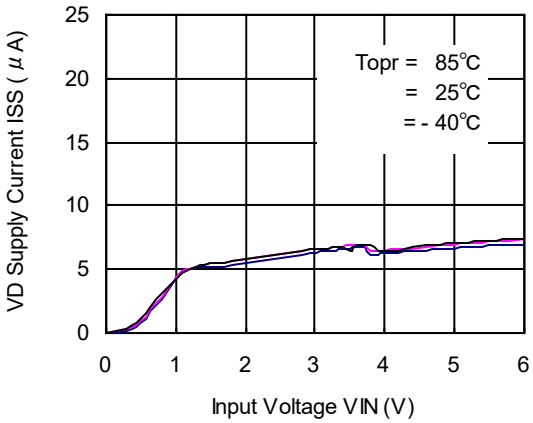
XC6403/04 Series (VD: 2.0V)



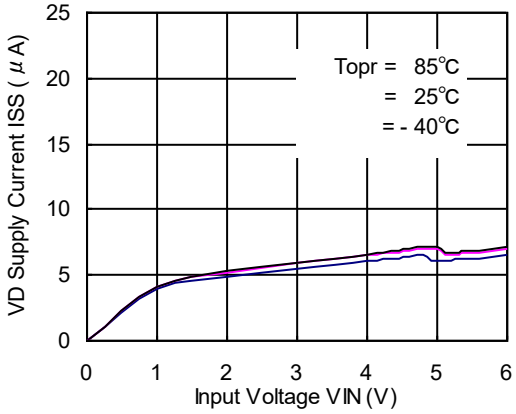
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD:5.0V)

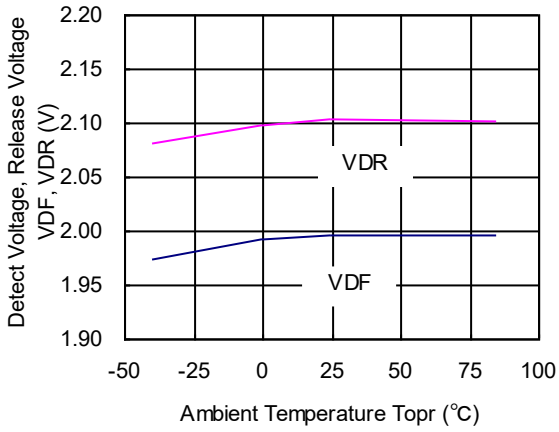


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

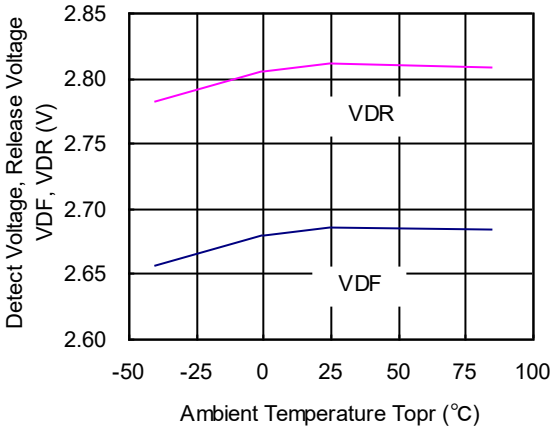
●XC6403/04 Series (Continued)

(11) vs. Ambient Temperature

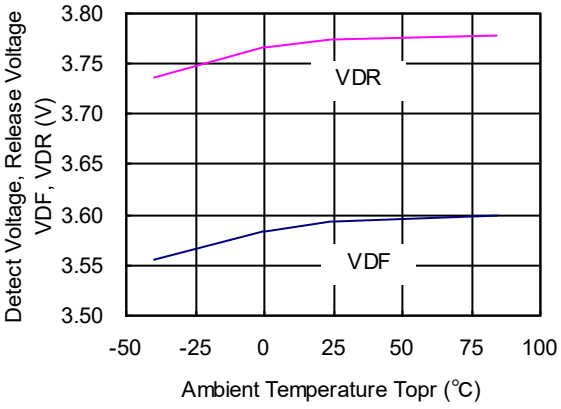
XC6403/04 Series (VD: 2.0V)



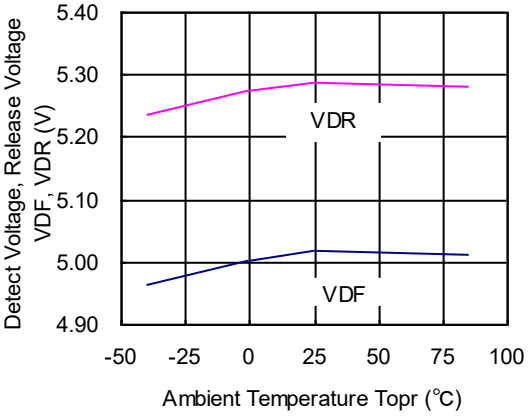
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

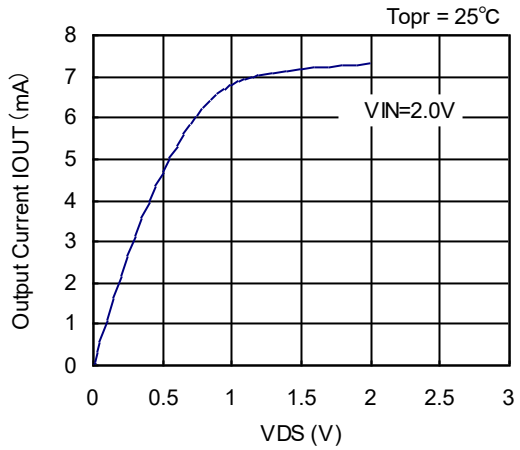


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

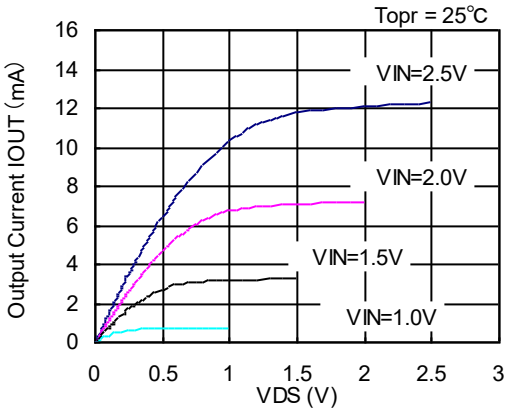
●XC6403/04 Series (Continued)

(12) VD N-ch Driver Output Current vs. VDS

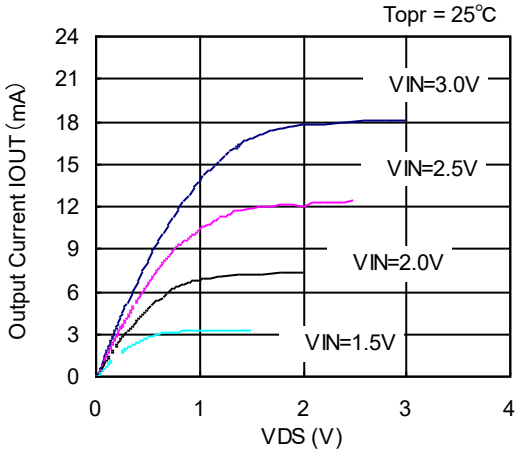
XC6403/04 Series (VD: 2.4V)



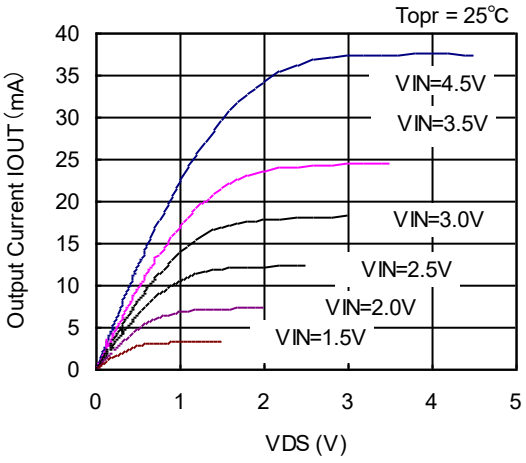
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

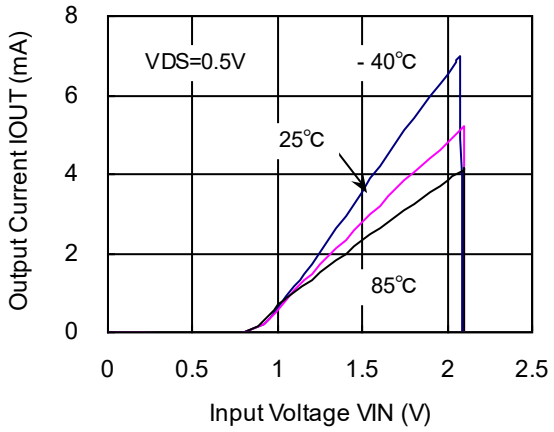


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

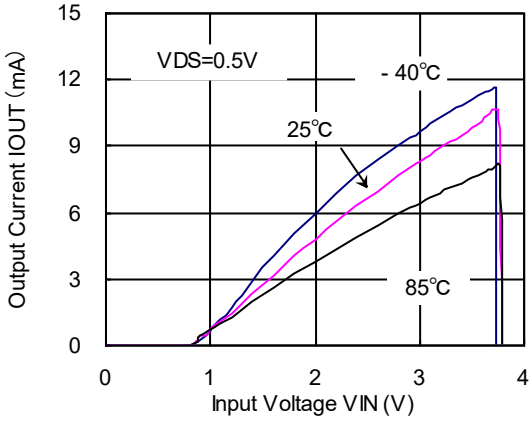
●XC6403/04 Series (Continued)

(13) VDN N-ch Driver Output Current vs. Input Voltage

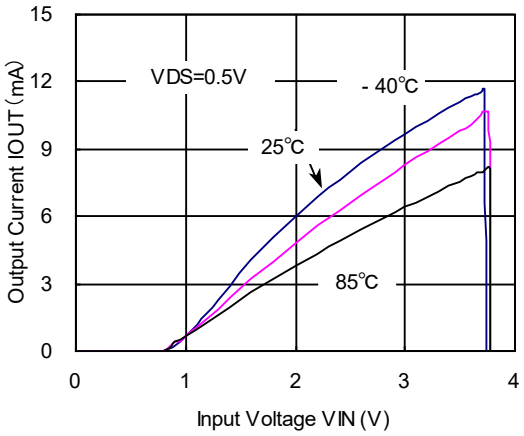
XC6403/04 Series (VD: 2.0V)



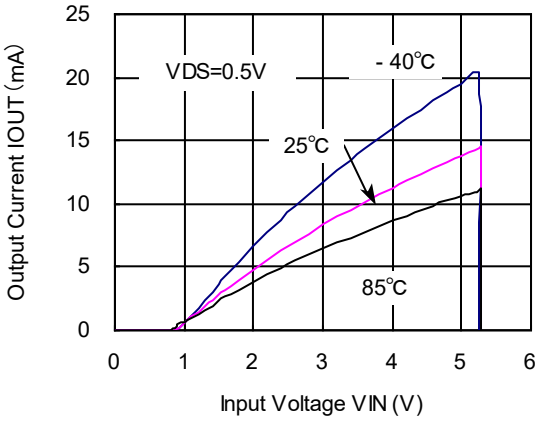
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

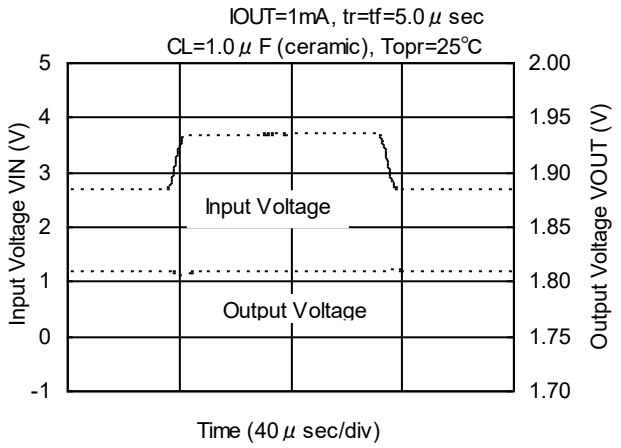


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

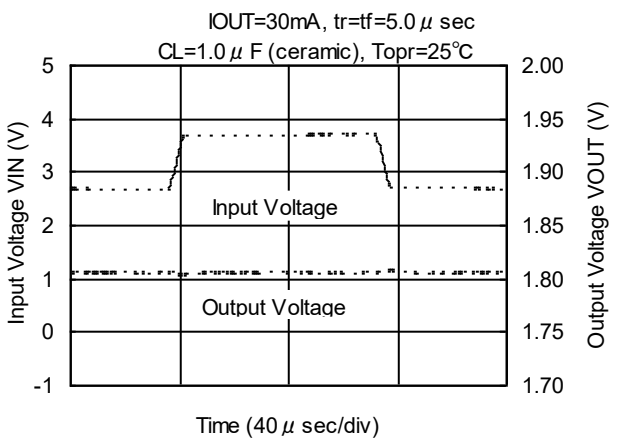
●XC6403/04 Series (Continued)

(14) Input Transient Response

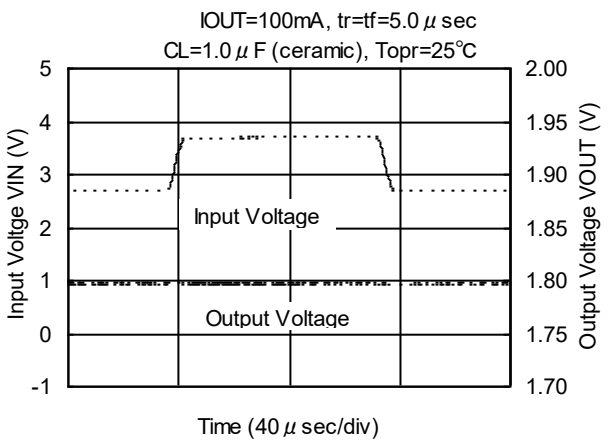
XC6403/04 Series (VR: 1.8V)



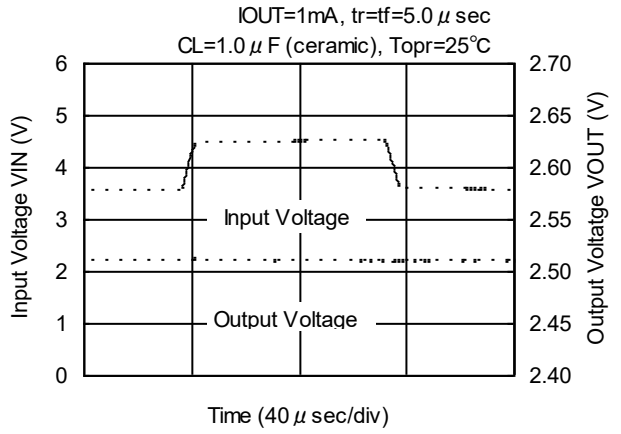
XC6403/04 Series (VR: 1.8V)



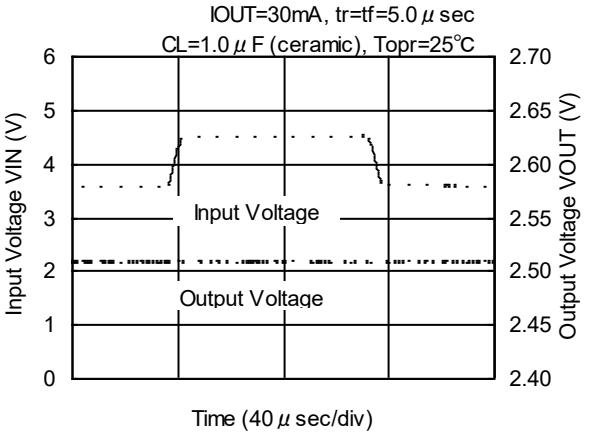
XC6403/04 Series (VR: 1.8V)



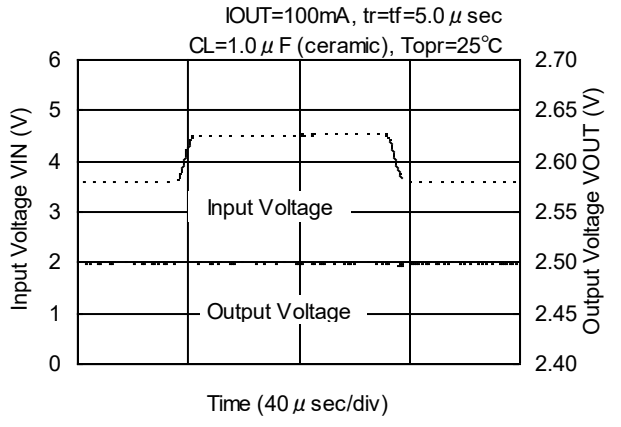
XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 2.5V)

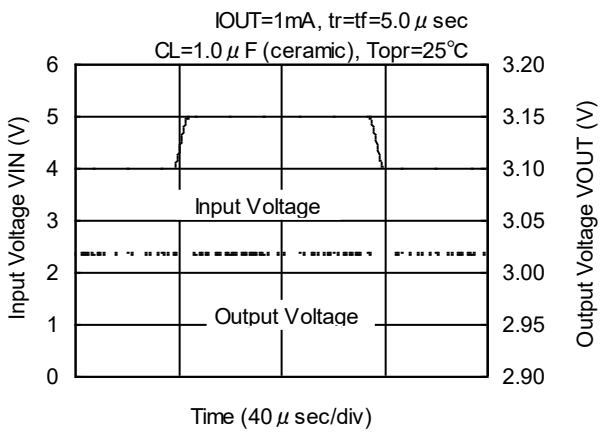


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

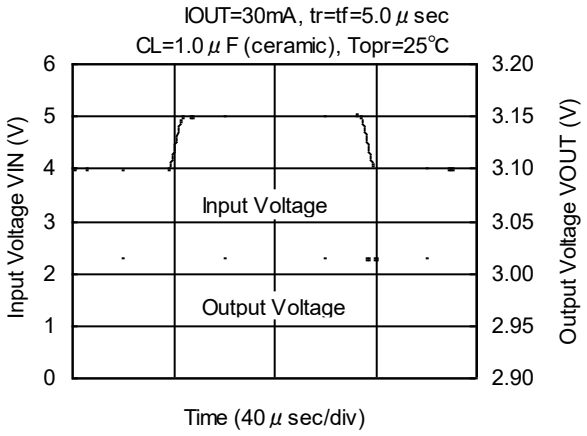
●XC6403/04 Series (Continued)

(14) Input Transient Response (Continued)

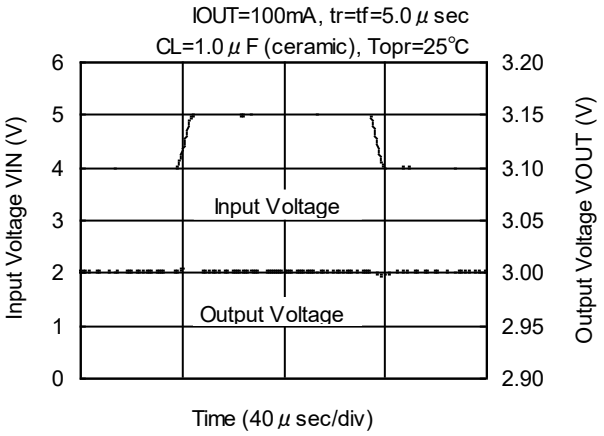
XC6403/04 Series (VR: 3.0V)



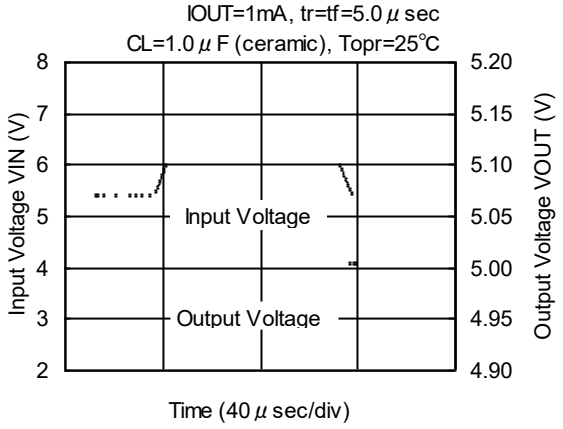
XC6403/04 Series (VR: 3.0V)



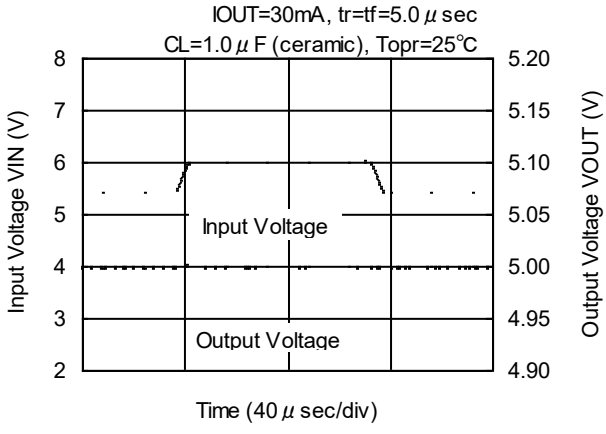
XC6403/04 Series (VR: 3.0V)



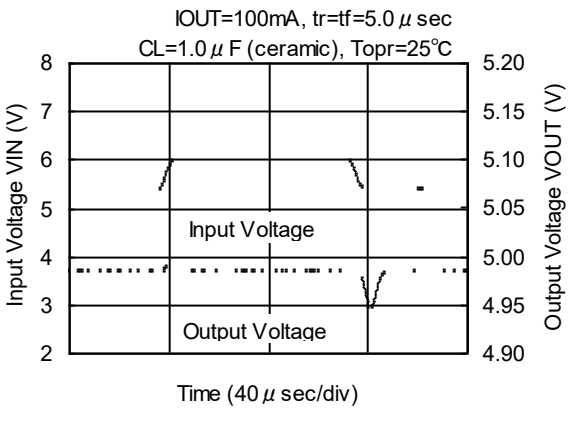
XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 5.0V)

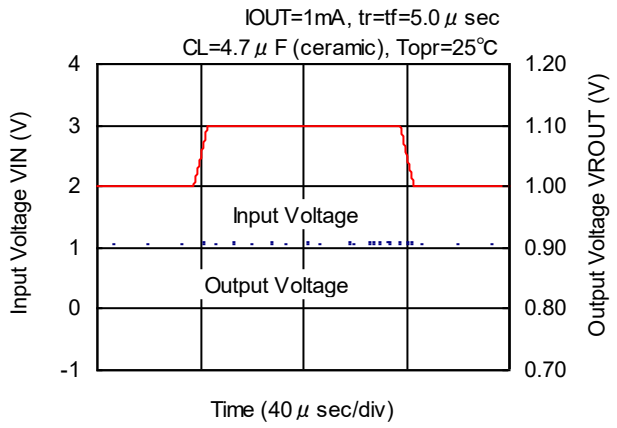


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

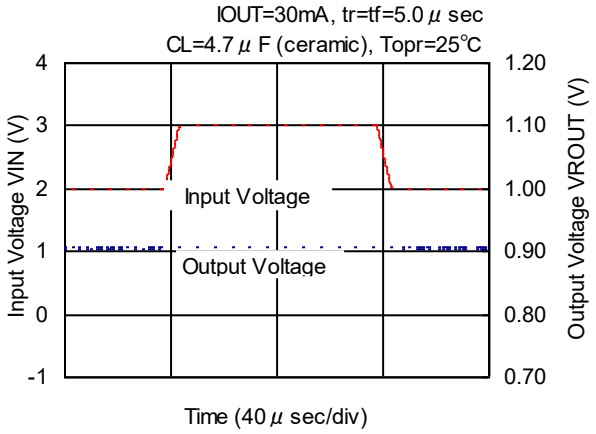
●XC6403/04 Series (Continued)

(14) Input Transient Response (Continued)

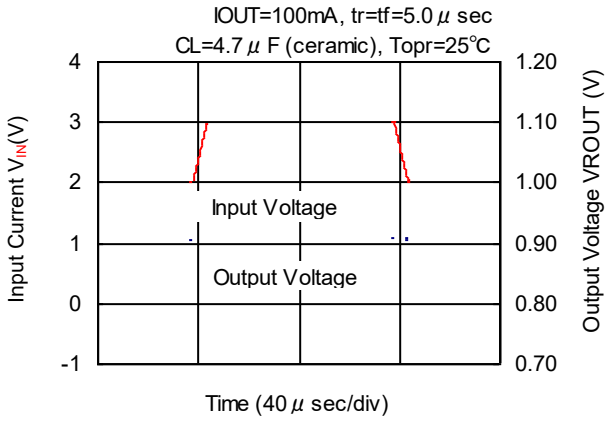
XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)



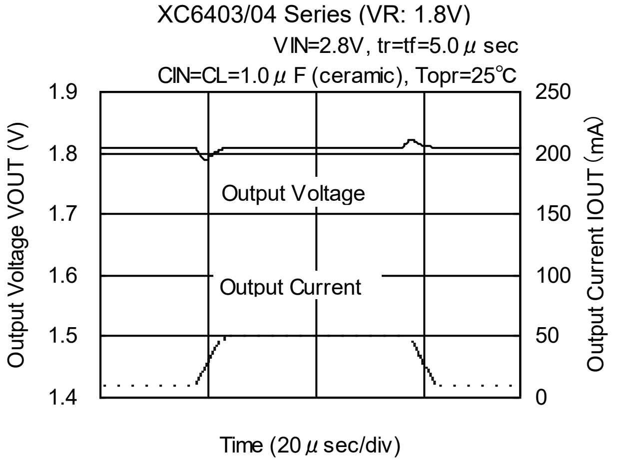
XC6403/04 Series (VR: 0.9V)

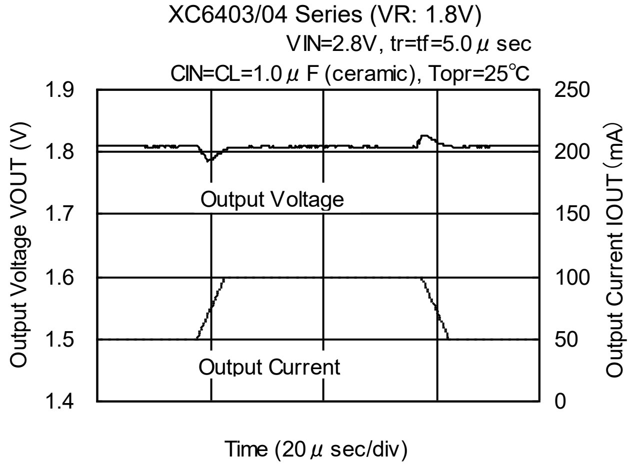


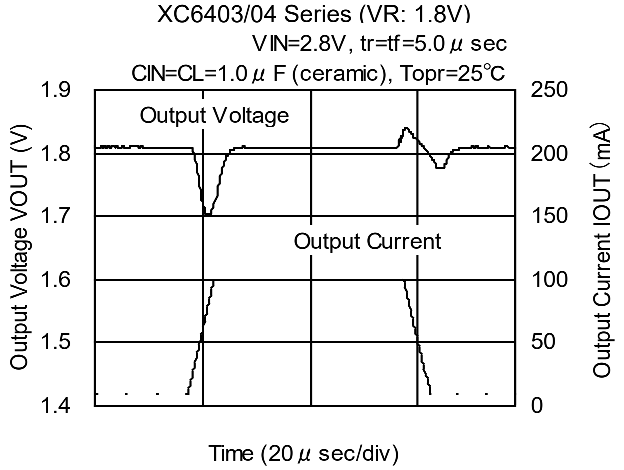
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

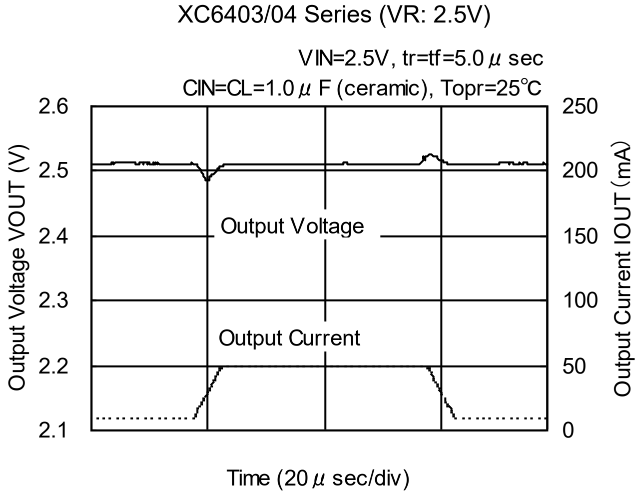
●XC6403/04 Series (Continued)

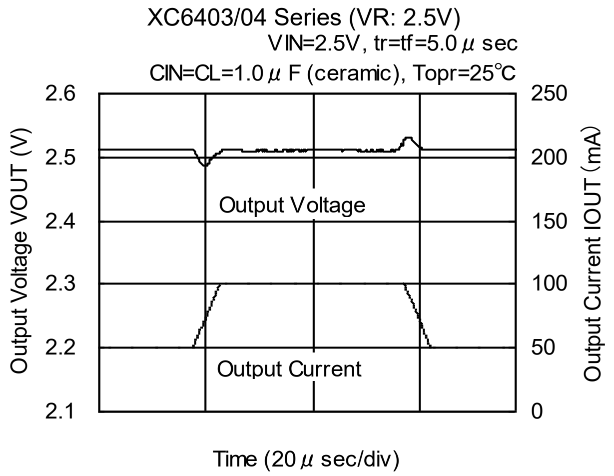
(15) Load Transient Response

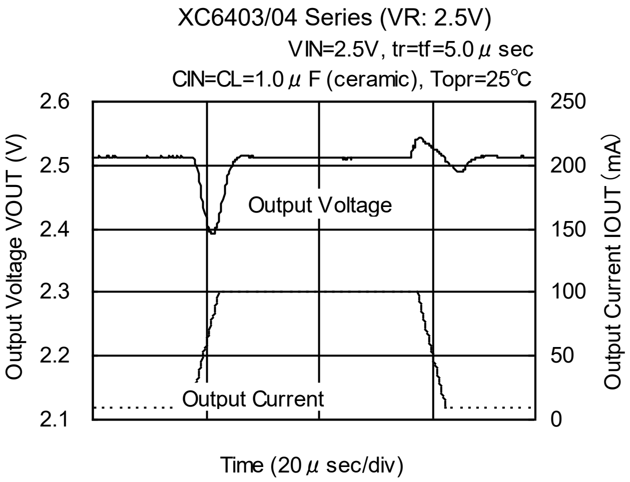










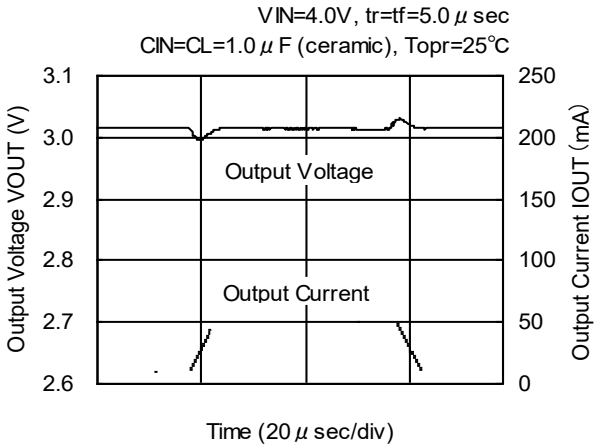


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

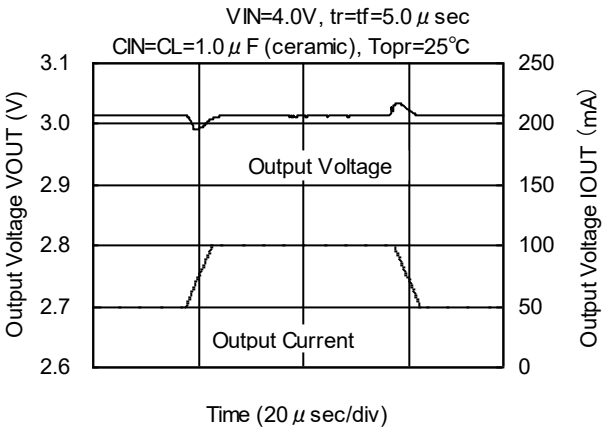
●XC6403/04 Series (Continued)

(15) Load Transient Response (Continued)

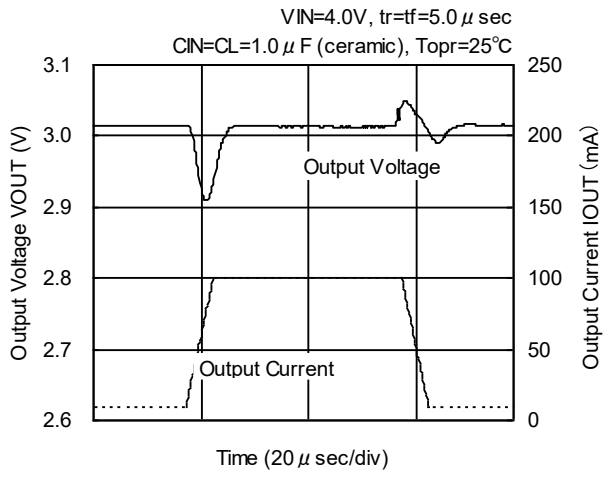
XC6403/04 Series (VR: 3.0V)



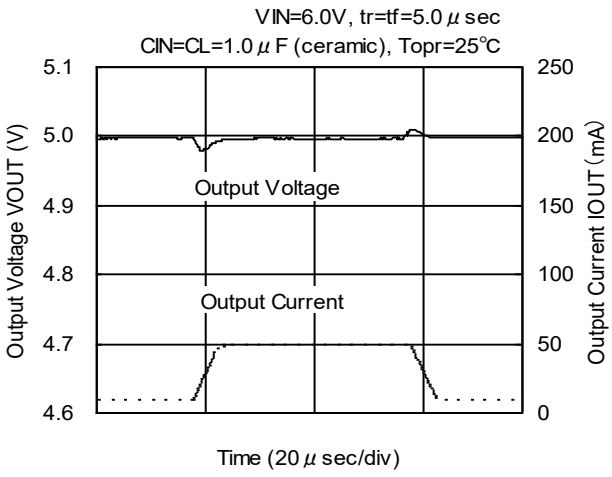
XC6403/04 Series (VR: 3.0V)



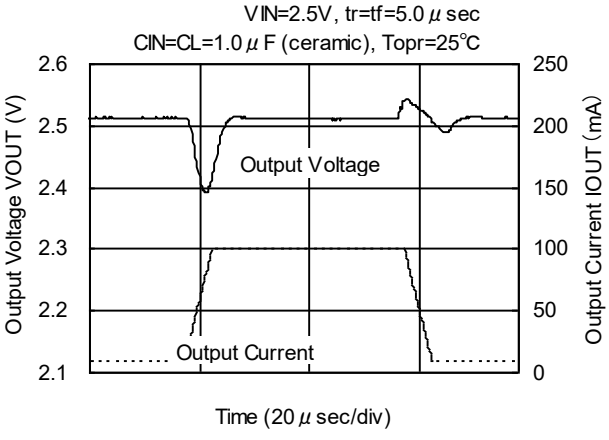
XC6403/04 Series (VR: 3.0V)



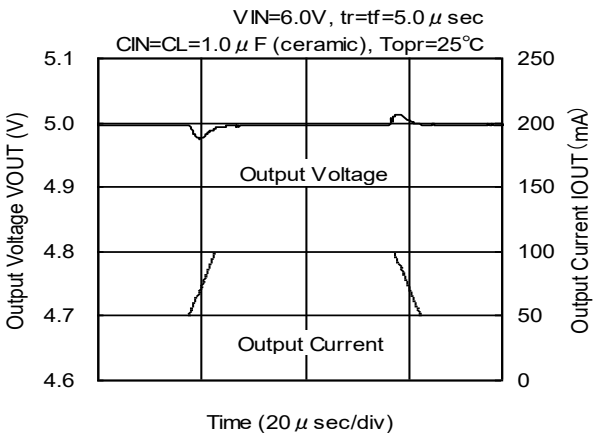
XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 5.0V)



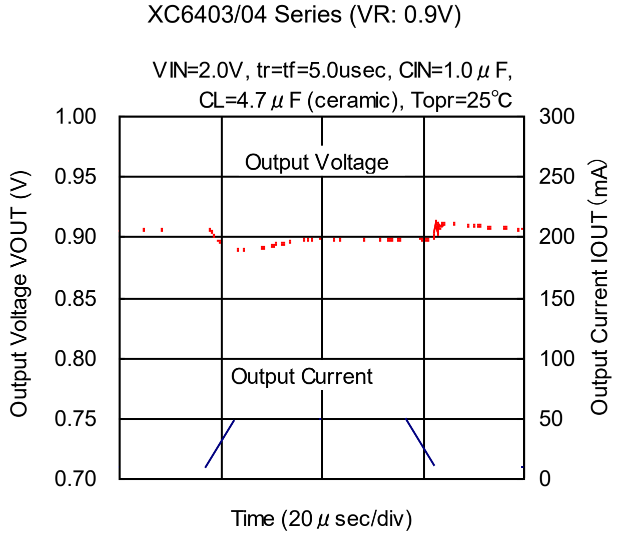
XC6403/04 Series (VR: 5.0V)

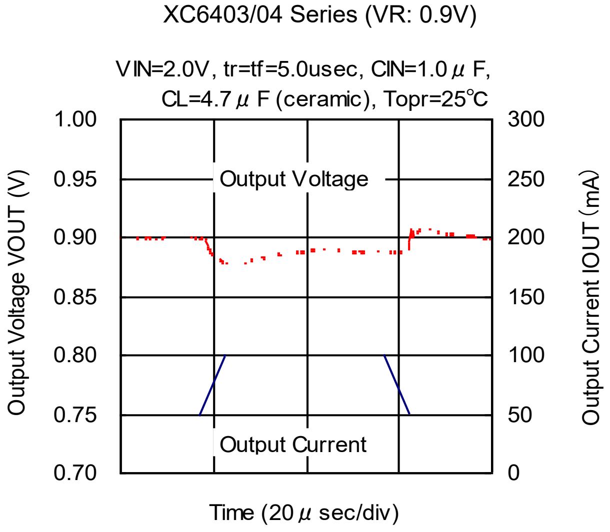


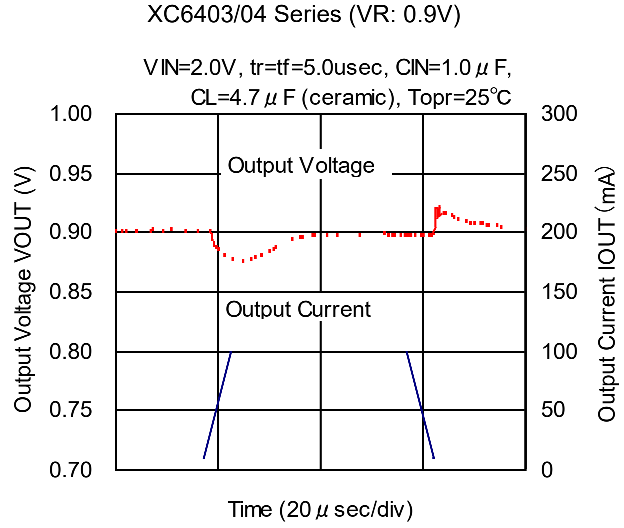
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

●XC6403/04 Series (Continued)

(15) Load Transient Response (Continued)



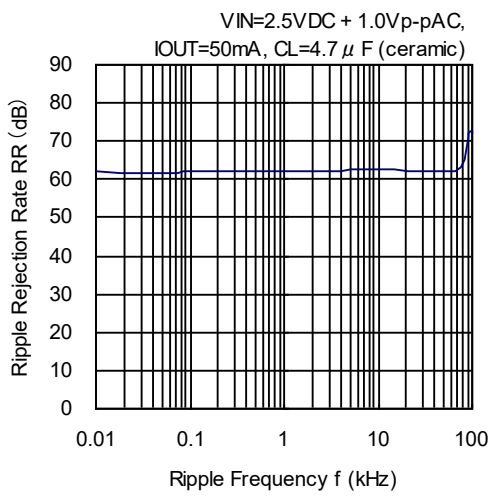




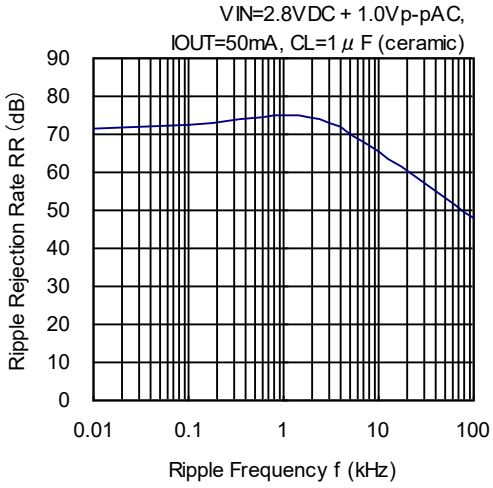
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(16) Ripple Rejection Rate

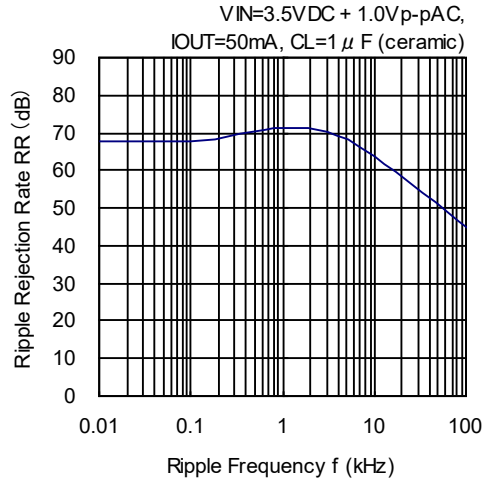
XC6403/04 Series (VR: 0.9V)



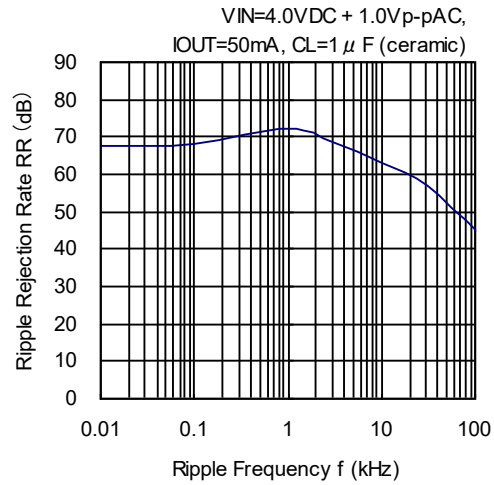
XC6403/04 Series (VR: 1.8V)



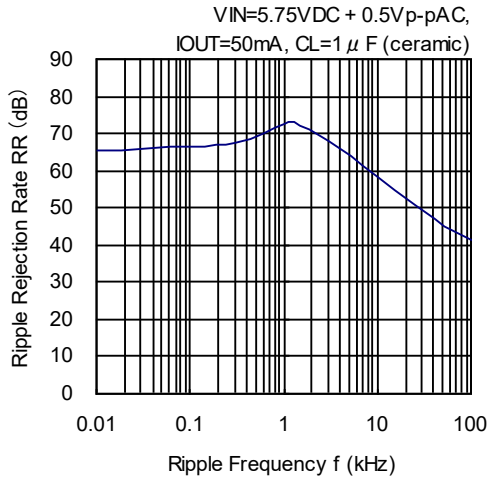
XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



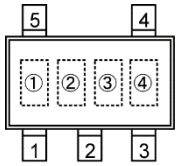
■PACKAGING INFORMATION

For the latest package information go to, www.torexsemi.com/technical-support/packages

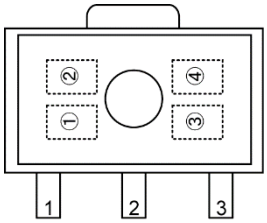
PACKAGE	OUTLINE / LAND PATTERN	THERMAL CHARACTERISTICS
SOT-25	SOT-25 PKG	SOT-25 Power Dissipation
SOT-89-5	SOT-89-5 PKG	SOT-89-5 Power Dissipation
USP-6B	USP-6B PKG	USP-6B Power Dissipation

■MARKING RULE

●SOT-25 / SOT-89-5



SOT-25
(TOP VIEW)



SOT-89-5
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
3	XC6403xxxxxx
4	XC6404xxxxxx

②③ represents internal sequential number
Sequential numbering rule

1) Order

MARK	NUMBERING RULE
1	01~09
2	10~99
3	A0~A9
4	B0~B9
5	~Z9

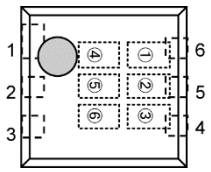
*G, I, J, O, Q, W excluded

2) The same marking is printed on the product with same optional functions, product type, detect voltage, and output voltage although packages are different.

④ represents production lot number
0 to 9,A to Z reverse character 0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

■MARKING RULE (Continued)

●USP-6B



USP-6B
(TOP VIEW)

① represents product series

MARK	PRODUCT SERIES
2	XC6403xxxxDx
3	XC6404xxxxDx

② represents optional functions

MARK	OPTIONAL FUNCTIONS	PRODUCT SERIES
A	Toggle and EN Function	XC6403/04AxxDx
C	EN Function	XC6403/04CxxDx
D	CE Function	XC6403/04DxxDx
E	VSEN Pin	XC6403/04ExxDx
F	Cd Pin	XC6403/04FxxDx

③ represents product type

MARK	CE/EN FUNCTION	EN / CE LOGIC	PULL-UP/DOWN RESISTANCE	VD SENSE PIN	VD OUTPUT LOGIC	PRODUCT SERIES
A	Function	High Active	Pull-Down Function	V_{IN}	Detect L	XC6403/04xAxxDx
C	Function	High Active	Pull-Down Function	VR_{OUT}	Detect L	XC6403/04xCxxDx
D	Function	High Active	Pull-Down Function	V_{IN}	Detect H	XC6403/04xDxxDx
E	Function	High Active	Nonfunctional	V_{IN}	Detect L	XC6403/04xExxDx
F	Function	High Active	Nonfunctional	VR_{OUT}	Detect H	XC6403/04xFxxDx
H	Function	High Active	Nonfunctional	VR_{OUT}	Detect L	XC6403/04xHxxDx
K	Function	High Active	Nonfunctional	V_{IN}	Detect H	XC6403/04xKxxDx
L	Function	Low Active	Pull-Up Function	V_{IN}	Detect L	XC6403/04xLxxDx
M	Function	Low Active	Pull-Up Function	VR_{OUT}	Detect H	XC6403/04xMxxDx
N	Function	Low Active	Pull-Up Function	VR_{OUT}	Detect L	XC6403/04xNxxDx
P	Function	Low Active	Pull-Up Function	V_{IN}	Detect H	XC6403/04xPxxDx
R	Function	Low Active	Nonfunctional	V_{IN}	Detect L	XC6403/04xRxxDx
S	Function	Low Active	Nonfunctional	VR_{OUT}	Detect H	XC6403/04xSxxDx
T	Function	Low Active	Nonfunctional	VR_{OUT}	Detect L	XC6403/04xTxxDx
U	Function	Low Active	Nonfunctional	V_{IN} / V_{SEN}	Detect H	XC6403/04xUxxDx
V	Nonfunctional	-	-	V_{IN}	Detect L	XC6403/04xVxxDx
X	Nonfunctional	-	-	VR_{OUT}/V_{SEN}	Detect H	XC6403/04xXxxDx
Y	Nonfunctional	-	-	VR_{OUT}/V_{SEN}	Detect L	XC6403/04xYxxDx
Z	Nonfunctional	-	-	VR_{OUT}/V_{SEN}	Detect H	XC6403/04xZxxDx

④,⑤ represents output voltage and detect voltage
ex.)

MARK		OUTPUT VOLTAGE		PRODUCT SERIES
④	⑤	VROUT (V)	VDOUT (V)	
3	0	4.0	4.3	XC6403/04**30D*

⑥ represents production lot number
0 to 9,A to Z repeated (G, I, J, O, Q, W excluded)
Note: 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.

9.

TOREX SEMICONDUCTOR LTD.