XC6207 Series

High Speed "Green Operation" LDO Voltage Regulators

☆GO-Compatible

May 17, 2005 V4

◆CMOS Low Power Consumption
◆Dropout Voltage : 40mV@30mA
120mV@100mA
◆Output Voltage Range : 1.2V ~ 5.0V
◆Output Current : 300mA <Up to 380mA (TYP.)>
◆Low ESR Capacitor Compatible
◆High Ripple Rejection, Low Output Noise
◆Regulators with Green Operation (GO) Function
◆CL High-Speed Auto-Discharge (XC6207B)

■APPLICATIONS

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

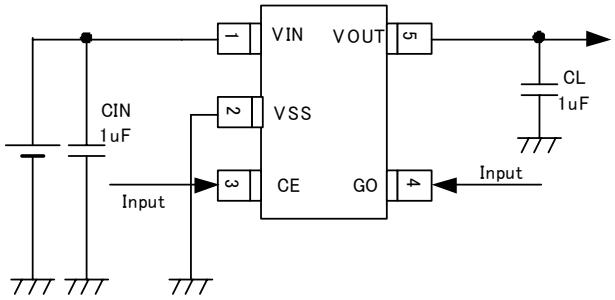
■GENERAL DESCRIPTION

The XC6207 series are precise, low noise, high speed, low dropout regulators with green operation (GO) function. They are fabricated using Torex's CMOS process. Performance features of the series include high ripple rejection and low dropout voltage, and the series include a reference voltage source, an error amplifier, a current limiter, and a phase compensation circuit.
Output voltage is selectable in 50mV increments within a range of 1.2V~5.0V, using laser trimming technologies.
The series' output stabilization capacitor (CL) is also compatible with low ESR ceramic capacitors.
GO provides high speed operation, low power consumption and high efficiencies by automatically switching between a high speed mode (HS) and a power save mode (PS) depending upon the load current level. The switching point of the GO to the output current is being fixed inside the IC. The IC operates when the GO pin is low-level. When only high-speed operation is required, it can be fixed by inputting a high level signal to the GO pin, thus providing operating conditions with the most suitable level of supply current for the application.
The CE function enables the output to be turned off resulting in greatly reduced power consumption. In this state, with the XC6207B series, the IC turns on the internal switch located between the VOUT and VSS pins. This short enables the electric charge at the output capacitor (CL) to be discharged via the internal auto-discharge resistance, and as a result the VOUT pin quickly returns to the VSS level.
The constant current limit circuit and the current limiter's foldback circuit also operate as a short circuit protection for the output current limiter and the output pin.

■FEATURES

Maximum Output Current : 300mA <Up to 380mA (TYP.)>
Dropout Voltage : 120mV@ IOUT=100mA
Operating Voltage Range: 2.0V ~ 6.0V
Output Voltage Setting Range: 1.2V ~ 5.0V (50mV increments)
Accuracy : ±2% (HS Mode:VOUT >1.5V)
±2%,-3% (PS Mode:VOUT >1.5V)
±30mV (HS Mode:VOUT≦1.5V)
+30mV, -45mV (PS Mode:VOUT≦1.5V)
Low Power Consumption : 5.5μA (TYP.)(PS mode)
50μA (TYP.)(HS mode)
Standby Current : Less than 0.1μA
High Ripple Rejection : 70dB @ 1kHz
Operating Temperature Range: -40℃ ~ 85℃
Low ESR Capacitor : Ceramic capacitor compatible
Ultra Small Packages : SOT-89-5
SOT-25
USP-6C

■TYPICAL APPLICATION CIRCUIT

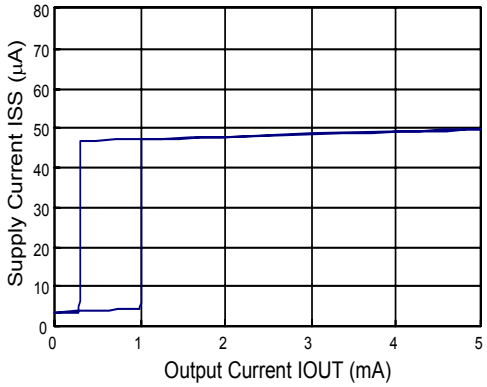


■TYPICAL PERFORMANCE CHARACTERISTICS

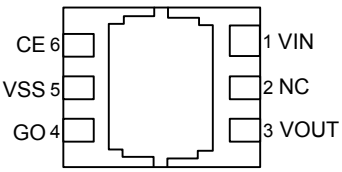
●Supply Current vs. Output Current

XC6207A182xx

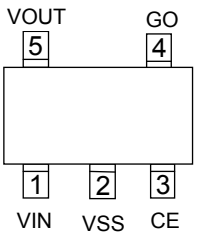
VIN=CE, VSS=GO=0V
VIN=2.8V, CIN=CL=1.0μF, Ta=25°C



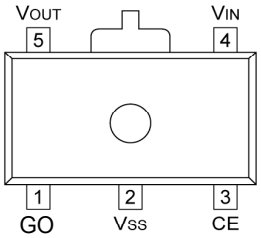
■PIN CONFIGURATION



USP-6C
(BOTTOM VIEW)



SOT-25
(TOP VIEW)



SOT-89-5
(TOP VIEW)

*The dissipation pad for the USP-6C package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release.
If the pad needs to be connected to other pins, it should be connected to the VSS pin, No. 5.

■PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTIONS
USP-6C	SOT-25	SOT-89-5		
1	1	4	VIN	Power Input
2	-	-	NC	No Connection
3	5	5	VOUT	Output
4	4	1	GO	Green Operation Mode Switch
5	2	2	VSS	Ground
6	3	3	CE	ON/OFF Control

■FUNCTIONS CHART

●CE pin

CE	FUNCTION
H	Operation
L	Stand by

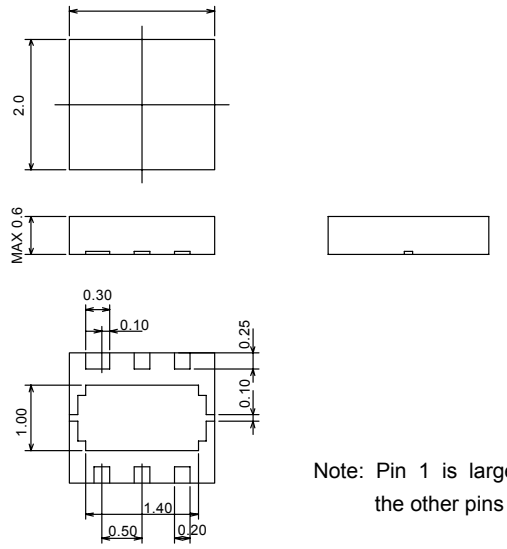
*For the XC6207B series, the output capacitor (CL) is discharged via the internal auto-discharge resistance when the CE is at low level.

●CE pin

GO	FUNCTION
H	High Speed Mode
L	Green Operation (HS/PS Mode Automatic Switching) IGO ≦ IOUT High Speed Mode IGOR ≧ IOUT Power Save Mode

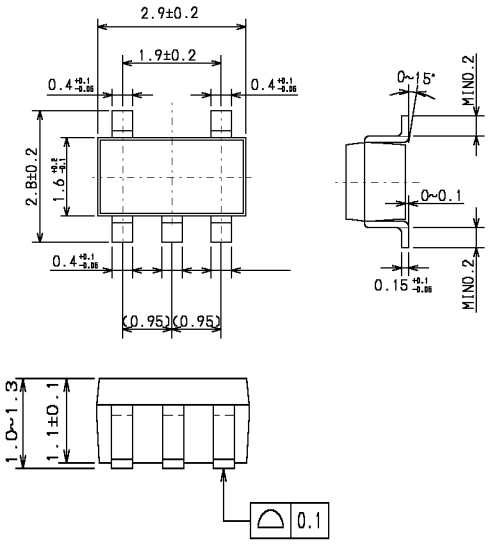
■PACKAGING INFORMATION

●USP-6C

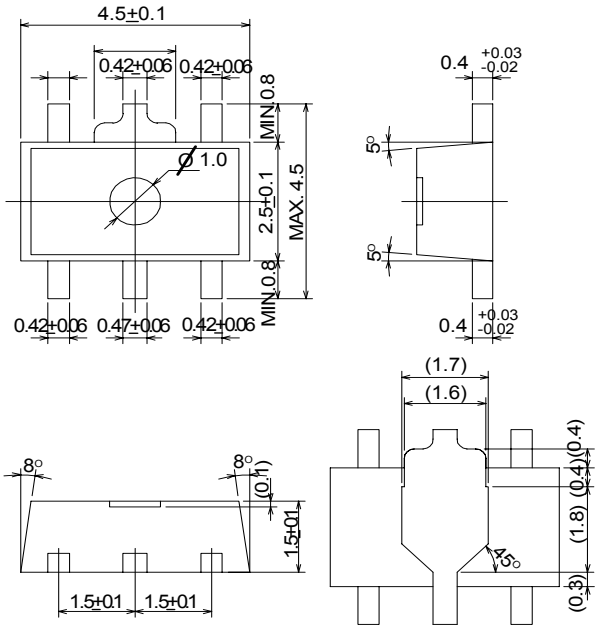


Note: Pin 1 is larger than the other pins

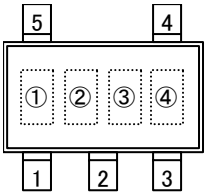
●SOT-25 (SOT-23-5)



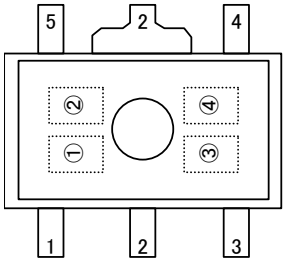
●SOT-89-5



■MARKING RULE



SOT-25
(TOP VIEW)



SOT-89-5
(TOP VIEW)

①Represents product series

MARK	PRODUCT SERIES
7	XC6207xxxxxx

②Represents type of regulator

MARK		PRODUCT SERIES
OUTPUT VOLTAGE 100mV step	OUTPUT VOLTAGE 50mV step	
A	N	XC6207Axxxxx
B	P	XC6207Bxxxxx

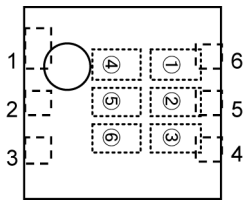
③Represents output voltage

MARK	OUTPUT VOLTAGE(V)				MARK	OUTPUT VOLTAGE(V)			
0	-	3.1	-	3.15	F	1.6	4.6	1.65	4.65
1	-	3.2	-	3.25	H	1.7	4.7	1.75	4.75
2	-	3.3	-	3.35	K	1.8	4.8	1.85	4.85
3	-	3.4	-	3.45	L	1.9	4.9	1.95	4.95
4	-	3.5	-	3.55	M	2.0	5.0	2.05	-
5	-	3.6	-	3.65	N	2.1	-	2.15	-
6	-	3.7	-	3.75	P	2.2	-	2.25	-
7	0.8	3.8	0.85	3.85	R	2.3	-	2.35	-
8	0.9	3.9	0.95	3.95	S	2.4	-	2.45	-
9	1.0	4.0	1.05	4.05	T	2.5	-	2.55	-
A	1.1	4.1	1.15	4.15	U	2.6	-	2.65	-
B	1.2	4.2	1.25	4.25	V	2.7	-	2.75	-
C	1.3	4.3	1.35	4.35	X	2.8	-	2.85	-
D	1.4	4.4	1.45	4.45	Y	2.9	-	2.95	-
E	1.5	4.5	1.55	4.55	Z	3.0	-	3.05	-

④Represents production lot number

0 to 9, A to Z reverse character 0 to 9, A to Z repeated
(G, I, J, O, Q, W excepted)

■MARKING RULE (Continued)



USP-6C
(TOP VIEW)

①②Represents product series

MARK		PRODUCT SERIES
①	②	
0	7	XC6207xxxxxx

③Represents type of regulator

MARK	TYPE	PRODUCT SERIES
A	High Active with No Pull-Down Resistor, No CL Discharge Resistor	XC6207AxxxDx
B	High Active with No Pull-Down Resistor, with CL Discharge Resistor	XC6207BxxxDx

④Represents integer of the output voltage
ex)

MARK	VOLTAGE (V)	PRODUCT SERIES
3	3.X	XC6207x3xxDx
5	5.X	XC6207x5xxDx

⑤Represents decimal number of the output voltage

MARK	VOLTAGE(V)	PRODUCT SERIES	MARK	VOLTAGE(V)	PRODUCT SERIES
0	X.0	XC6207xx02/1Dx	A	X.05	XC6207xx0A/BDx
1	X.1	XC6207xx12/1Dx	B	X.15	XC6207xx1A/BDx
2	X.2	XC6207xx22/1Dx	C	X.25	XC6207xx2A/BDx
3	X.3	XC6207xx32/1Dx	D	X.35	XC6207xx3A/BDx
4	X.4	XC6207xx42/1Dx	E	X.45	XC6207xx4A/BDx
5	X.5	XC6207xx52/1Dx	F	X.55	XC6207xx5A/BDx
6	X.6	XC6207xx62/1Dx	H	X.65	XC6207xx6A/BDx
7	X.7	XC6207xx72/1Dx	K	X.75	XC6207xx7A/BDx
8	X.8	XC6207xx82/1Dx	L	X.85	XC6207xx8A/BDx
9	X.9	XC6207xx92/1Dx	M	X.95	XC6207xx9A/BDx

⑥Represents production lot number
0 to 9, A to Z repeated (G, I, J, O, Q, W excepted)
Note: No character inversion used.

■PRODUCT CLASSIFICATION

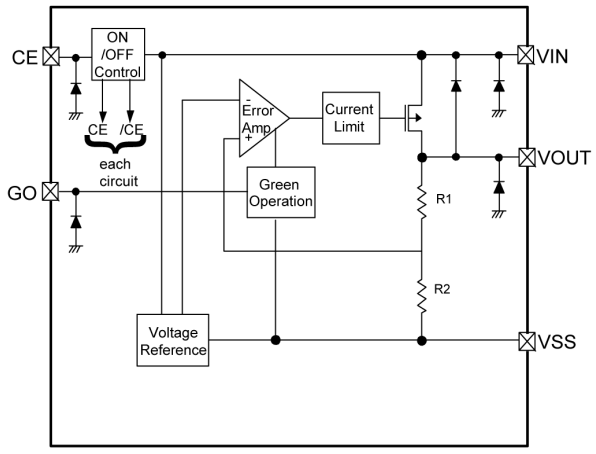
●Ordering Information

XC6207 ①②③④⑤⑥

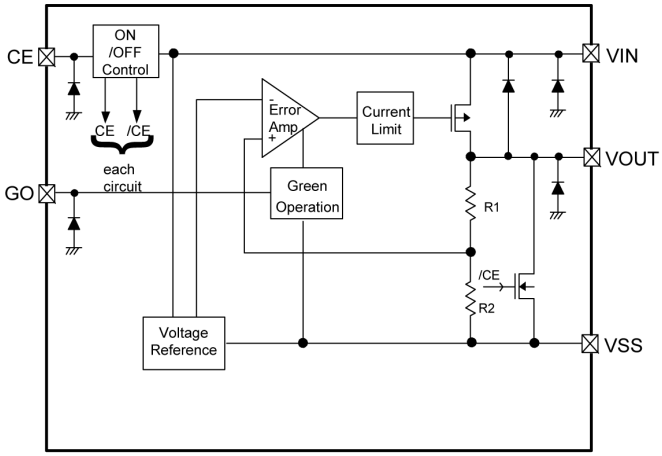
DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
①	Type of Regulator	A	: CE High Active, no resistor for fixing pin's electrical potential, no CL discharge resistor
		B	: CE High Active, no resistor for fixing pin's electrical potential, with CL discharge resistor
② ③	Output Voltage	12 ~ 50	: ex.) VOUT(T) = 3.0V → ② = 3, ③ = 0
④	Output Accuracy	2	: Output voltage 100mV step setting When 1.2V≦VOUT(T)≦1.5V, HS mode : Accuracy±30mV PS mode : Accuracy+30mV or −45mV When 1.5V＜VOUT(T)≦5.0V, HS mode : Accuracy±2% PS mode : Accuracy+2% or −3%
		A	: Output voltage 50mV step setting When 1.2V≦VOUT(T)≦1.5V, HS mode : Accuracy±30mV PS mode : Accuracy+30mV or −45mV When 1.5V＜VOUT(T)≦5.0V, HS mode : Accuracy±2% PS mode : Accuracy+2% or −3%
⑤	Package	E	: USP-6C
		M	: SOT-25
		P	: SOT-89-5
⑥	Device Orientation	R	: Embossed tape, standard feed
		L	: Embossed tape, reverse feed

■BLOCK DIAGRAMS

●XC6207A Series



●XC6207B Series



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

■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		VIN	-0.3 ~ 7.0	V
Output Current		IOUT	500*	mA
Output Voltage		VOUT	VSS – 0.3 ~ VIN + 0.3	V
CE Input Voltage		VCE	VSS – 0.3 ~ 7.0	V
GO Input Voltage		VGO	VSS – 0.3 ~ 7.0	V
Power Dissipation	SOT-89-5	Pd	500	mW
	SOT-25		250	
	USP-6C		100	
Operational Temperature Range		Topr	- 40 ~ + 85	℃
Storage Temperature Range		Tstg	- 55 ~ +125	℃

* IOUT=Pd / (VIN-VOUT)

■ELECTRICAL CHARACTERISTICS

●XC6207A/B series

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (* 3)	V_{GO}= V_{IN}, V_{CE}=V_{IN} I_{OUT}=10mA: High Speed (HS) mode	(*9)	E-0	(*9)	V	1
		V_{GO}=V_{SS}, V_{CE}=V_{IN} I_{OUT}=0.1mA: Power Save (PS) mode	(*9)	E-1	(*9)		
Maximum Output Current	I_{OUT}MAX	V_{CE}=V_{IN}	300	-	-	mA	1
Load Regulation	△V_{OUT}	VGO=VIN (HS mode), VCE=VIN 1mA ≦I_{OUT}≦100mA	-	15	60	mV	1
Dropout Voltage (* 4)	Vdif1	V_{GO}= V_{IN}, (HS mode), VCE=VIN, I_{OUT}=30mA	E-2			mV	1
	Vdif2	V_{GO}= V_{IN} (HS mode), VCE=VIN, I_{OUT}=100mA	E-3				
Supply Current 1	I_{SS}1	V_{GO}=V_{IN} (HS mode), V_{IN}=V_{CE}=6.0V, No load	35	50	80	μA	2
Supply Current 2	I_{SS}2	V_{GO}=V_{SS} (PS mode), V_{IN}=V_{CE}=6.0V, No load	-	5.5	8.0	μA	2
Standby Current	ISTBY	V_{IN}=6.0V, V_{CE}=V_{SS}	-	0	0.1	μA	2
Line Regulation 1.2V≦V_{OUT}(T)＜4.5V	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	VGO=VIN (HS mode), V_{OUT}(T)+1.0V≦VIN≦6.0V V_{CE}=V_{IN}, I_{OUT}=30mA	-	0.01	0.20	%/V	1
Line Regulation 4.5V≦V_{OUT}(T)≦5.0V		VGO=VIN (HS mode) 5.5V≦VIN≦6.0V V_{CE}=V_{IN}, I_{OUT}=30mA					
Input Voltage	V_{IN}	-	2.0	-	6.0	V	1
Output Voltage Temperature Characteristics	$\frac{\triangle V_{OUT}}{\triangle Ta \cdot V_{OUT}}$	VGO=VIN (HS mode) -40℃≦Ta≦85℃, VCE=VIN, I_{OUT}=30mA	-	±100	-	ppm/℃	1
Ripple Rejection Rate 1.2V≦V_{OUT}(T)≦1.25V	PSRR	V_{GO}= V_{IN} (HS mode), V_{CE}=V_{IN}, I_{OUT}=30mA, V_{IN}=2.25V_{DC}+0.5Vp-pAC f=1kHz	-	70	-	dB	3
Ripple Rejection Rate 1.25V＜V_{OUT}(T)＜4.75V		V_{GO}= V_{IN} (HS mode), V_{CE}=V_{IN}, I_{OUT}=30mA , V_{IN}={V_{OUT}(T)+1.0V}V_{DC}+0.5Vp-pAC, f=1kHz					
Ripple Rejection Rate 4.75V≦V_{OUT}(T)≦5.0V		V_{GO}= V_{IN} (HS mode), V_{CE}=V_{IN}, I_{OUT}=30mA, V_{IN}=5.75V_{DC}+0.5Vp-pAC f=1kHz					
Limit Current	Ilim	V_{GO}= V_{IN} (HS mode), V_{CE}=V_{IN}	300	380	-	mA	1
Short Current	Ishort	V_{GO}= V_{IN} (HS mode), V_{CE}=V_{IN} V_{OUT} is short-circuited at the V_{SS} level.	-	50	-	mA	1
PS Switching Current	IGOR	V_{CE}=V_{IN}, V_{GO}=V_{SS}, (HS/PS automatic switching) I_{OUT} : heavy to light load	0.3	-	-	mA	6
HS Switching Current	IGO	V_{CE}=V_{IN}, V_{GO}=V_{SS} (HS/PS automatic switching) I_{OUT} : light to heavy load	-	-	2.0	mA	6

■ELECTRICAL CHARACTERISTICS (Continued)

●XC6207A/B series (Continued)

Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Switch Current Hysteresis Range	IGOhys	IGOhys=IGO- IGOR	-	1.0	-	mA	6
PS Switching Delay Time	TDPS	V_{CE}=V_{IN}, V_{GO}=V_{SS} (HS/PS automatic switching) Time until HS mode is changed-over to PS mode by IGOR	-	-	900	μsec	6
CE High Level Voltage	V_{CEH}	V_{GO}=V_{IN}, no load Voltage which enters into the state of operation when the CE is applied voltage	1.6	-	-	V	4
CE Low Level Voltage	V_{CEL}	V_{GO}=V_{IN}, no load Voltage which enters into the state of standby when the CE is applied voltage	-	-	0.25	V	4
GO High Level Voltage (* 7)	V_{GOH}	V_{CE}=V_{IN}, no load Voltage which changes into high speed mode when the GO is applied voltage.	1.6	-	-	V	4
GO Low Level Voltage (* 7)	V_{GOL}	V_{CE}=V_{IN}, no load Voltage which changes into HS/PS automatic switching mode when the GO is applied voltage.	-	-	0.25	V	4
CE High Level Current	I_{CEH}	V_{CE}=V_{IN}, V_{GO}=V_{IN}	-0.1	-	0.1	μA	5
CE Low Level Current	I_{CEL}	V_{CE}=V_{SS}, V_{GO}=V_{IN}	-0.1	-	0.1	μA	5
GO High Level Current	I_{GOH}	V_{GO} =V_{IN}, V_{CE}=V_{IN}	-0.1	-	0.1	μA	5
GO Low Level Current	I_{GOL}	V_{GO}=V_{SS}, V_{CE}=V_{IN},	-0.1	-	0.1	μA	5
CL Auto-Discharge Resistance (* 8)	Rdischg	V_{IN}=6.0V, V_{OUT}=6.0V, V_{CE}=V_{GO}=V_{SS}	-	470	-	Ω	7

NOTE:

* 1: Unless otherwise stated, V_{IN}=V_{OUT}(T)＋1.0V.
* 2: V_{OUT} (T) = Specified output voltage
* 3: V_{OUT} (E) = Effective output voltage
  (I.e. the output voltage when an amply stabilized "V_{OUT} (T)＋1.0V" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value.)
  High Speed (HS) mode: The voltage of VGOH or more is input to the GO pin, or the voltage of VGOL or less is input to the GO pin when the output current is IGO or more.
  Power Save (PS) mode: The voltage of VGOL or less is input to the GO pin when the output current is IGOR or less.
* 4: Vdif={V_{IN}1(*6)-V_{OUT}1(*5)}
* 5: V_{OUT}1=A voltage equal to 98% of the output voltage whenever an amply stabilized I_{OUT} {V_{OUT}(T)+1.0V} is input in the HS mode.
* 6: V_{IN}1=The input voltage when V_{OUT}1 appears as Input Voltage is gradually decreased.
* 7: With the GO pin input voltage, the fixed HS mode or Green Operation (GO) is selectable.
* 8: For the XC6207B series only. The XC6207A series discharges by resistors R1 and R2 only as shown in the block diagrams.
* 9: The rated value of the output voltage when V_{OUT}(T)≦1.5V is shown below.
  HS mode : V_{OUT} (T)-30mV≦V_{OUT} (E)≦V_{OUT} (T)+30mV
  PS mode : V_{OUT} (T)-45mV≦V_{OUT} (E)≦V_{OUT} (T)+30mV
* 10: Recommended conditions for C_{IN} and CL
  1.2V≦V_{OUT} (T)＜1.8V : C_{IN}=1.0μF, CL=4.7μF (ceramic cap.)
  1.8V≦V_{OUT} (T)＜2.5V : C_{IN}=1.0μF, CL=1.0μF (ceramic cap.)
  2.5V≦V_{OUT} (T)≦5.0V : C_{IN}=2.2μF, CL=1.0μF (ceramic cap.)

■DROPOUT VOLTAGE CHART

SYMBOL	E-0			E-1			E-2		E-3	
SETTING OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE (HS MODE) (V)			OUTPUT VOLTAGE (PS MODE) (V)			DROPOUT VOLTAGE 1 IOUT=30mA (mV)		DROPOUT VOLTAGE 2 IOUT=100mA (mV)	
VOUT (T)	VOUT(E)			VOUT(E)			Vdif1		Vdif2	
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.
1.20	1.170	1.20	1.230	1.1550	1.20	1.230	800	850	810	860
1.25	1.220	1.25	1.280	1.2050	1.25	1.280				
1.30	1.270	1.30	1.330	1.2550	1.30	1.330	700	750	710	760
1.35	1.320	1.35	1.380	1.3050	1.35	1.380				
1.40	1.370	1.40	1.430	1.3550	1.40	1.430	600	650	610	660
1.45	1.420	1.45	1.480	1.4050	1.45	1.480				
1.50	1.470	1.50	1.530	1.4550	1.50	1.530	500	550	510	560
1.55	1.519	1.55	1.581	1.5035	1.55	1.581				
1.60	1.568	1.60	1.632	1.5520	1.60	1.632	400	450	410	460
1.65	1.617	1.65	1.683	1.6005	1.65	1.683				
1.70	1.666	1.70	1.734	1.6490	1.70	1.734	300	350	310	360
1.75	1.715	1.75	1.785	1.6975	1.75	1.785				
1.80	1.764	1.80	1.836	1.7460	1.80	1.836	200	250	210	260
1.85	1.813	1.85	1.887	1.7945	1.85	1.887				
1.90	1.862	1.90	1.938	1.8430	1.90	1.938	100	150	200	250
1.95	1.911	1.95	1.989	1.8915	1.95	1.989				
2.00	1.960	2.00	2.040	1.9400	2.00	2.040	60	90	180	245
2.05	2.009	2.05	2.091	1.9885	2.05	2.091				
2.10	2.058	2.10	2.142	2.0370	2.10	2.142				
2.15	2.107	2.15	2.193	2.0855	2.15	2.193				
2.20	2.156	2.20	2.244	2.1340	2.20	2.244		80		240
2.25	2.205	2.25	2.295	2.1825	2.25	2.295				
2.30	2.254	2.30	2.346	2.2310	2.30	2.346				
2.35	2.303	2.35	2.397	2.2795	2.35	2.397				
2.40	2.352	2.40	2.448	2.3280	2.40	2.448				
2.45	2.401	2.45	2.499	2.3765	2.45	2.499				
2.50	2.450	2.50	2.550	2.4250	2.50	2.550	50	70	150	220
2.55	2.499	2.55	2.601	2.4735	2.55	2.601				
2.60	2.548	2.60	2.652	2.5220	2.60	2.652				
2.65	2.597	2.65	2.703	2.5705	2.65	2.703				
2.70	2.646	2.70	2.754	2.6190	2.70	2.754				
2.75	2.695	2.75	2.805	2.6675	2.75	2.805				
2.80	2.744	2.80	2.856	2.7160	2.80	2.856				
2.85	2.793	2.85	2.907	2.7645	2.85	2.907				
2.90	2.842	2.90	2.958	2.8130	2.90	2.958				
2.95	2.891	2.95	3.009	2.8615	2.95	3.009				
3.00	2.940	3.00	3.060	2.9100	3.00	3.060	40	65	120	190
3.05	2.989	3.05	3.111	2.9585	3.05	3.111				
3.10	3.038	3.10	3.162	3.0070	3.10	3.162				
3.15	3.087	3.15	3.213	3.0555	3.15	3.213				
3.20	3.136	3.20	3.264	3.1040	3.20	3.264				
3.25	3.185	3.25	3.315	3.1525	3.25	3.315				
3.30	3.234	3.30	3.366	3.2010	3.30	3.366				
3.35	3.283	3.35	3.417	3.2495	3.35	3.417				
3.40	3.332	3.40	3.468	3.2980	3.40	3.468				

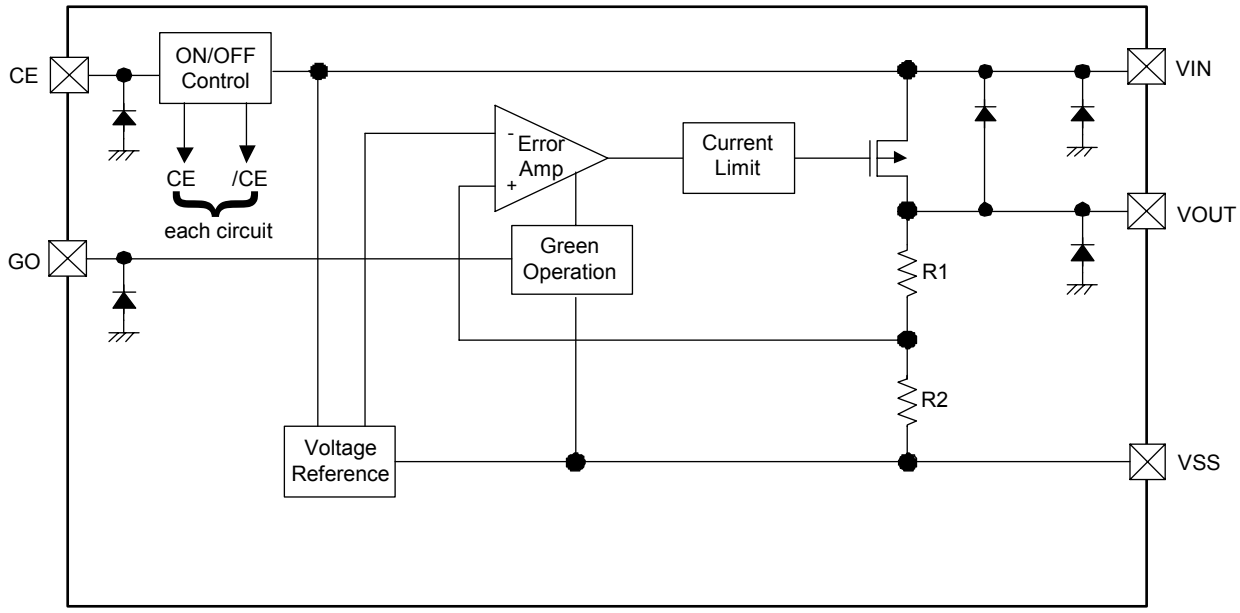
■DROPOUT VOLTAGE CHART (Continued)

SYMBOL	E-0			E-1			E-2		E-3	
SETTING OUTPUT VOLTAGE (V)	OUTPUT VOLTAGE (HS MODE) (V)			OUTPUT VOLTAGE (PS MODE) (V)			DROPOUT VOLTAGE 1 IOUT=30mA (mV)		DROPOUT VOLTAGE 2 IOUT=100mA (mV)	
VOUT (T)	VOUT(E)			VOUT(E)			Vdif1		Vdif2	
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	TYP.	MAX.	TYP.	MAX.
3.45	3.381	3.45	3.519	3.3465	3.45	3.519				
3.50	3.430	3.50	3.570	3.3950	3.50	3.570				
3.55	3.479	3.55	3.621	3.4435	3.55	3.621				
3.60	3.528	3.60	3.672	3.4920	3.60	3.672				
3.65	3.577	3.65	3.723	3.5405	3.65	3.723				
3.70	3.626	3.70	3.774	3.5890	3.70	3.774				
3.75	3.675	3.75	3.825	3.6375	3.75	3.825				
3.80	3.724	3.80	3.876	3.6860	3.80	3.876				
3.85	3.773	3.85	3.927	3.7345	3.85	3.927				
3.90	3.822	3.90	3.978	3.7830	3.90	3.978				
3.95	3.871	3.95	4.029	3.8315	3.95	4.029				
4.00	3.920	4.00	4.080	3.8800	4.00	4.080				
4.05	3.969	4.05	4.131	3.9285	4.05	4.131				
4.10	4.018	4.10	4.182	3.9770	4.10	4.182				
4.15	4.067	4.15	4.233	4.0255	4.15	4.233				
4.20	4.116	4.20	4.284	4.0740	4.20	4.284				
4.25	4.165	4.25	4.335	4.1225	4.25	4.335	40	65	120	190
4.30	4.214	4.30	4.386	4.1710	4.30	4.386				
4.35	4.263	4.35	4.437	4.2195	4.35	4.437				
4.40	4.312	4.40	4.488	4.2680	4.40	4.488				
4.45	4.361	4.45	4.539	4.3165	4.45	4.539				
4.50	4.410	4.50	4.590	4.3650	4.50	4.590				
4.55	4.459	4.55	4.641	4.4135	4.55	4.641				
4.60	4.508	4.60	4.692	4.4620	4.60	4.692				
4.65	4.557	4.65	4.743	4.5105	4.65	4.743				
4.70	4.606	4.70	4.794	4.5590	4.70	4.794				
4.75	4.655	4.75	4.845	4.6075	4.75	4.845				
4.80	4.704	4.80	4.896	4.6560	4.80	4.896				
4.85	4.753	4.85	4.947	4.7045	4.85	4.947				
4.90	4.802	4.90	4.998	4.7530	4.90	4.998				
4.95	4.851	4.95	5.049	4.8015	4.95	5.049				
5.00	4.900	5.00	5.100	4.8500	5.00	5.100				

■OPERATIONAL EXPLANATION

<Output Voltage Control>

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



<Green Operation>

XC6207 series can be set as a fixed high-speed mode or a green operation (GO) mode via a signal to the green operation (GO) pin. Under the condition that the output current becomes IGOR or less, the IC operates in the fixed high-speed mode when the GO pin is at high level and the IC operates in the power save (PS) mode when the GO pin is at low level. The GO mode enables the IC to switch automatically the supply current to the high speed (HS) mode or the power save (PS) mode according to the level of output current. While having both high-speed operation and low supply current state, the XC6207 series can acquire high efficiency. At the HS/PS automatic switching mode (GO mode), the switching point of the HS mode and the PS mode is being fixed inside the IC. When the output current becomes IGOR 0.3mA (TYP.) or below, the mode changes automatically to the PS mode after the delay time of hundreds μsec(s), and it can reduce supply current in light load. For applications, most of portable equipment control the system current, which is the output current to the IC, and control the supply current according to the system condition. Furthermore, the high-speed operation might be required. In such a case, at the automatic switching mode (GO mode), when the output current becomes IGO or more, the mode will automatically switch to the HS mode. In the HS mode, the response of the output voltage during the output current fluctuation is better than the PS mode. Automatic switching PS mode to HS mode causes the switching delay time of tens of μsec(s), the output voltage drops more than in the fixed HS mode. If the GO pin voltage is at high level {tens of μsec(s) before the output current fluctuation occurs} and the IC is used in the HS mode, the output current fluctuation will be suppressed to as low as the fixed HS mode. (cf. the following item: Load Transient Response by Switching Mode with GO pin.)

The output current at the HS/PS mode should be adjusted to 2.0mA or more / 0.3mA or less respectively when you use the IC in the HS/PS automatic switching mode (GO mode).

It is suggested that you use this IC with either a VIN voltage or a VSS voltage input at the GO pin. If this IC is used with the correct specifications for the GO pin, the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry when medium voltage is input.

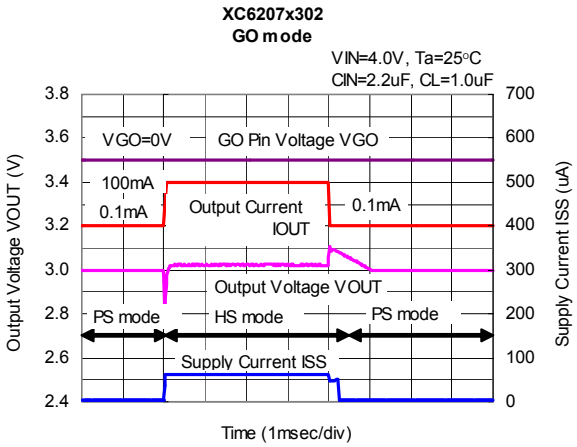
■OPERATIONAL EXPLANATION (Continued)

<Green Operation> (Continued)

● Load Transient Response by Switching Mode

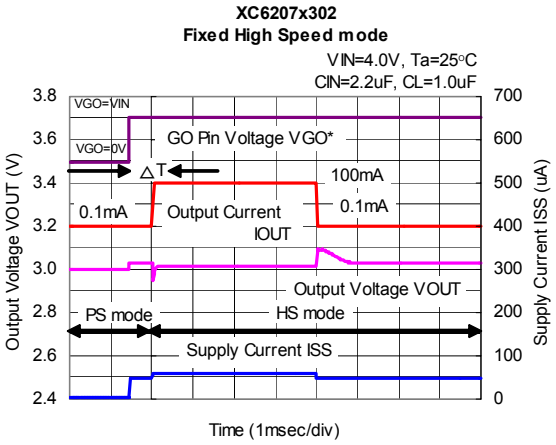
○ GO mode (GO pin voltage: Low)

Output Current: IOUT=0.1mA⇔100mA



○ Fixed high speed mode via GO pin signal (GO pin voltage: Low to High)

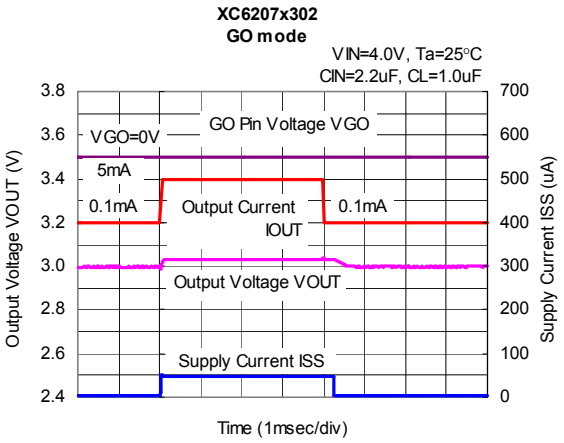
Output Current: IOUT=0.1mA⇔100mA



*Note: Input a “H” level signal to the GO pin before the output current fluctuation (ΔT) occurs.

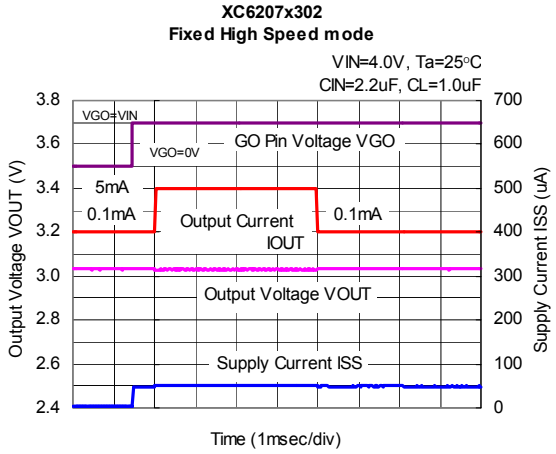
○ GO mode (GO pin voltage: Low)

Output Current: IOUT=0.1mA⇔5mA



○ Fixed high speed mode via GO pin signal (GO pin voltage: Low to High)

Output Current: IOUT=0.1mA⇔5mA



<Low ESR capacitor>

With the XC6207 series, a stable output voltage is achievable even if used with low ESR capacitors, as a phase compensation circuit is built-in. In order to ensure the effectiveness of the phase compensation, we suggest that an output capacitor (CL) is connected as close as possible to the output pin (VOUT) and the VSS pin. Please use an output capacitor with a capacitance value of at least 1μF when the setting output voltage (VOUT(T)) is less than or equal to 1.8V. Also, when the setting output voltage (VOUT(T)) is less than or equal to 2.5V, please connect an input capacitor (CIN) of 2.2μF between the VIN pin and the VSS pin in order to ensure a stable power input.

<Recommended conditions of CIN and CL>

SETTING VOLTAGE	CIN (μF)	CL (μF)
1.2V ~ 1.7V	1.0	4.7
1.8V ~ 2.4V	1.0	1.0
2.5V ~ 5.0V	2.2	1.0

■OPERATIONAL EXPLANATION (Continued)

<CL Auto-Discharge Function>

XC6207B series can quickly discharge the electric charge at the output capacitor (CL), when a low signal to the CE pin, which enables a whole IC circuit put into OFF state, is inputted via the N-channel transistor located between the VOUT pin and the VSS pin (cf. BLOCK DIAGRAM). In this state, the application is protected from a glitch operation caused by the electric charge at the output capacitor (CL). The CL auto- discharge resistance at this time depends on the input voltage. Moreover, discharge time of the output capacitor (CL) is set by the CL auto-discharge resistance (R) and the output capacitor (CL). By setting time constant of a CL auto-discharge resistance value [R] and an output capacitor value (CL) as τ (τ =C x R), the output voltage after discharge via the N channel transistor is calculated by the following formulas.

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

(V : Output voltage after discharge, VOUT(E) : Output voltage, t: Discharge time,
τ : CL auto-discharge resistance R × Output capacitor (CL) value C)

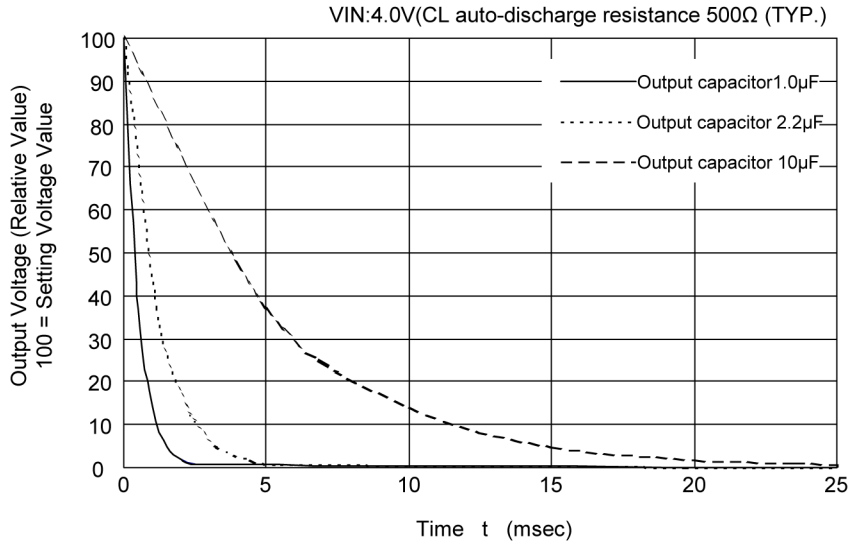
Ta=25°C

INPUT VOLTAGE	CL AUTO-DISCHARGE RESISTANCE
2.0V	750Ω (TYP.)
3.0V	550Ω (TYP.)
4.0V	500Ω (TYP.)
5.0V	480Ω (TYP.)
6.0V	470Ω (TYP.)

(ex.) When input voltage: 4.0V, CL auto-discharge resistance: 500Ω (TYP.); output capacitor (CL): 10μF, VOUT:3.0V,
CE voltage=Changing from 4.0V to 0V (CE pin L level signal)

1 τ (500μsec) after CE OFF signal is inputted, VOUT(E) becomes: 3.0V × 0.368 = approx. 1.104V
2 τ (1000μsec) after CE OFF signal is inputted, VOUT(E) becomes: 3.0V × 0.135 = approx. 0.405V
3 τ (1500μsec) after CE OFF signal is inputted, VOUT(E) becomes: 3.0V × 0.050 = approx. 0.150V
4 τ (2000μsec) after CE OFF signal is inputted, VOUT(E) becomes: 3.0V × 0.018 = approx. 0.055V

OUTPUT VOLTAGE DISCHARGE CHARACTERISTICS



■OPERATIONAL EXPLANATION (Continued)

<Current Limiter, Short-Circuit Protection>

The XC6207 series includes a combination of a fixed current limiter circuit & a foldback circuit, which aid the operations of the current limiter and circuit protection. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

<CE Pin>

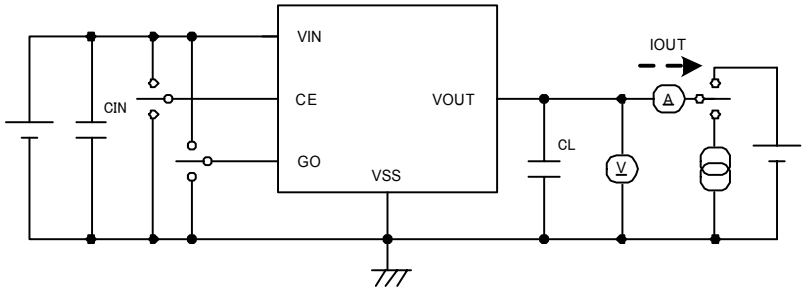
The IC's internal circuitry can be shutdown via the signal from the CE pin with the XC6207 series. In shutdown mode, output at the V_{OUT} pin will be pulled down to the V_{SS} level via R1 & R2. However, as for the XC6207B series, the CL auto-discharge resistor is connected in parallel to R1 and R2 while the power supply is applied to the V_{IN} pin. Therefore, time until the V_{OUT} pin reaches the V_{SS} level becomes short. Although the CE pin is equal to an inverter input with CMOS hysteresis, with either the pull-up or pull-down options, the CE pin input current will increase when the IC is in operation. We suggest that you use this IC with either a V_{IN} voltage or a V_{SS} voltage input at the CE pin. If this IC is used with the correct specifications for the CE pin, the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry when medium voltage is input.

■NOTES ON USE

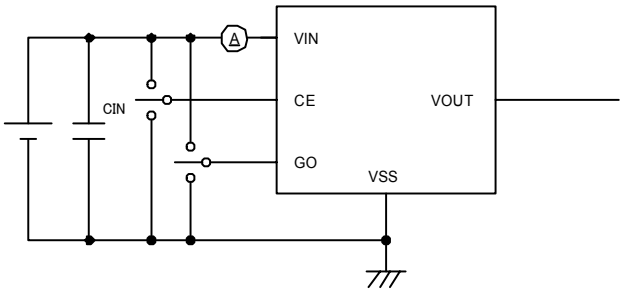
1. Please use this IC within the stated absolute maximum ratings. The IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen V_{IN} and V_{SS} wiring in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

■TEST CIRCUITS

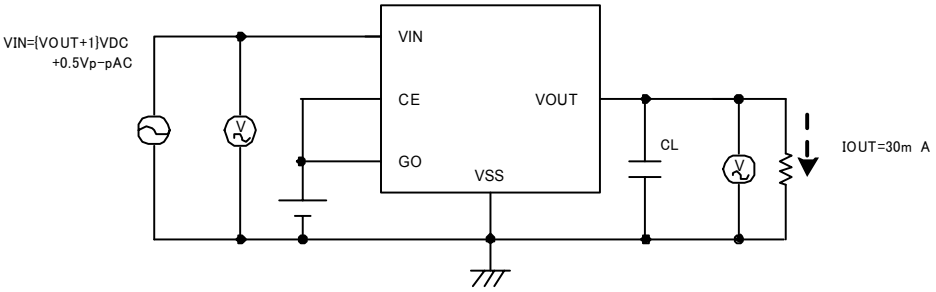
Circuit 1 Output Voltage, Input Operating Voltage, Dropout Voltage, Line Regulation, Load Regulation, Limit Current, Short Current



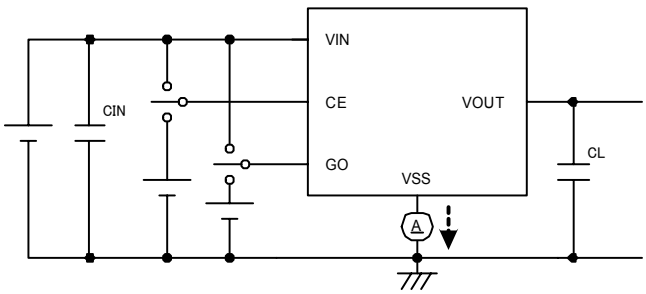
Circuit 2 Supply Current, Standby Current



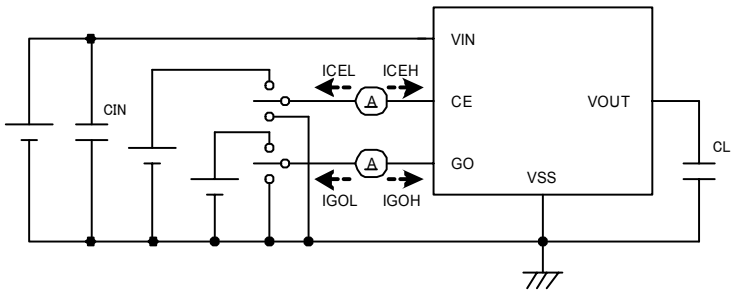
Circuit 3 Ripple Rejection Rate



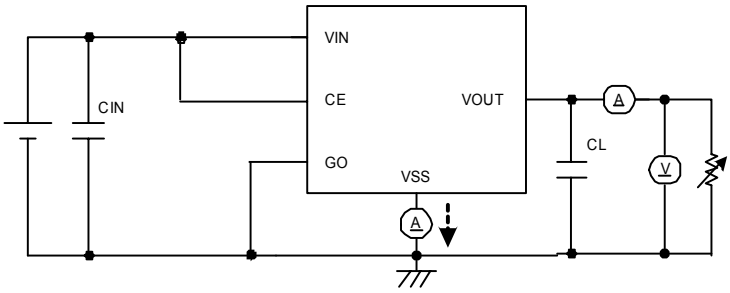
Circuit 4 CE/GO, High & Low Level Voltage



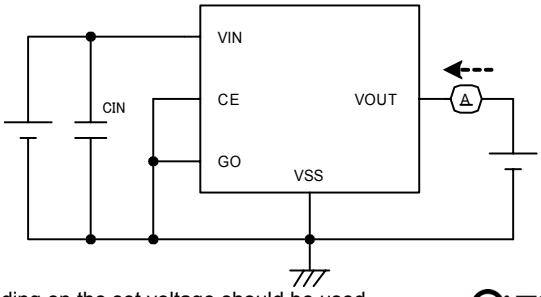
Circuit 5 CE/GO, High & Low Level Current



Circuit 6 HS/PS Switching Current, PS Switching Delay Time



Circuit 7 CL Auto-Discharge Resistance Current

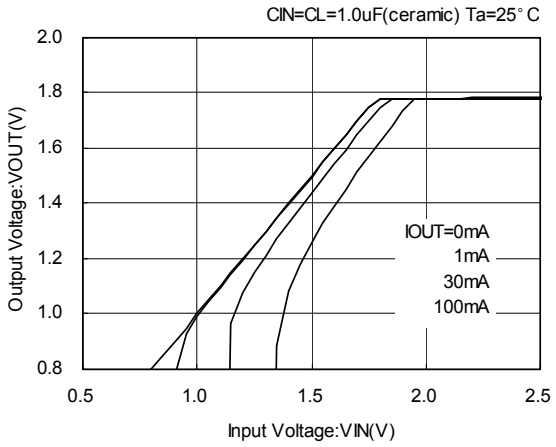


Note : For the capacity of the CIN and the CL, the recommended capacity depending on the set voltage should be used.

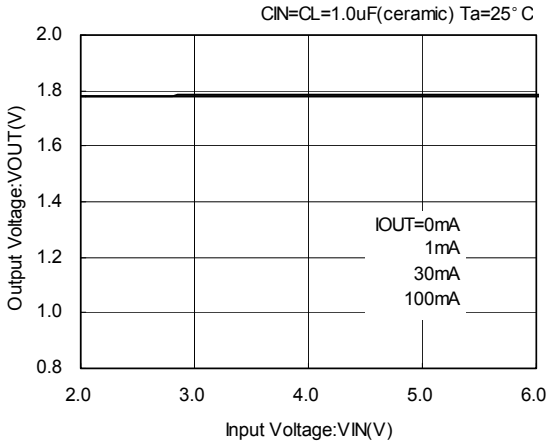
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Input Voltage

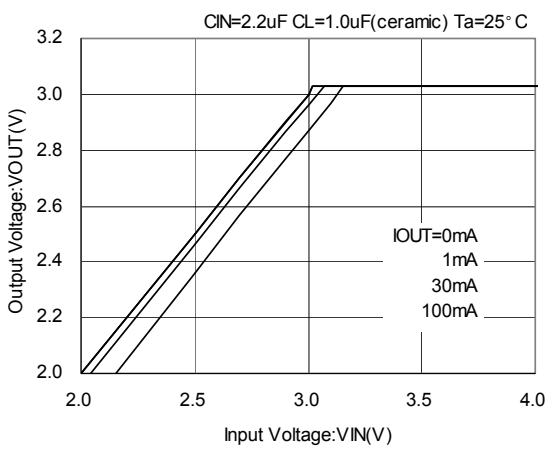
XC6207A/B182xx



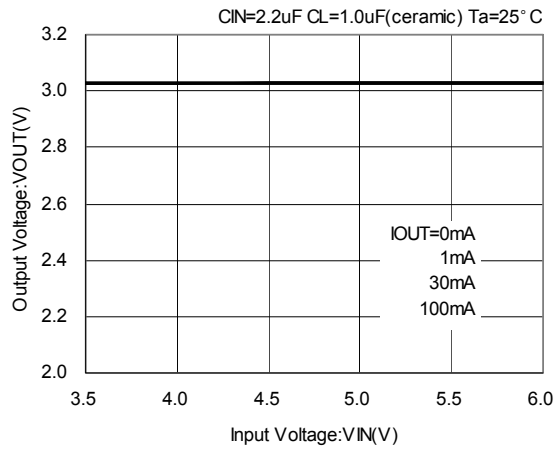
XC6207A/B182xx



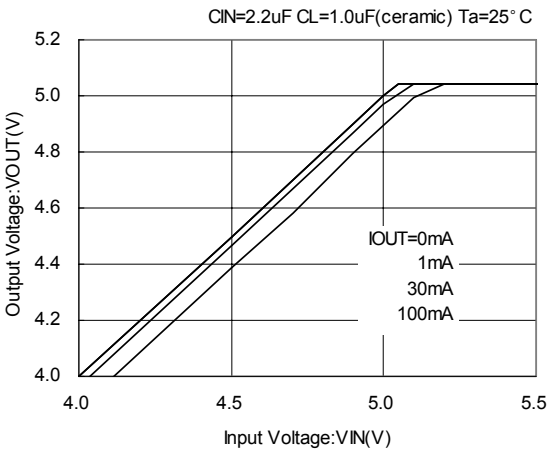
XC6207A/B302xx



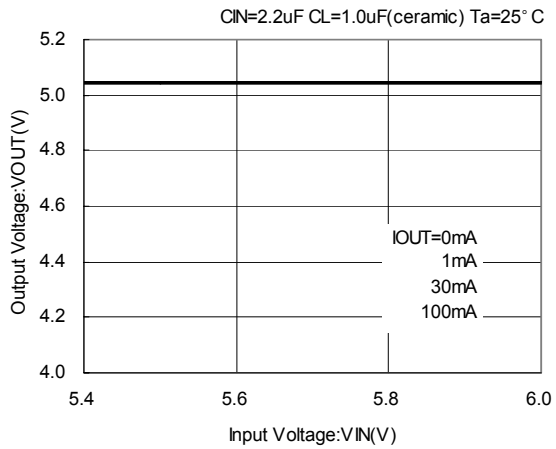
XC6207A/B302xx



XC6207A/B502xx



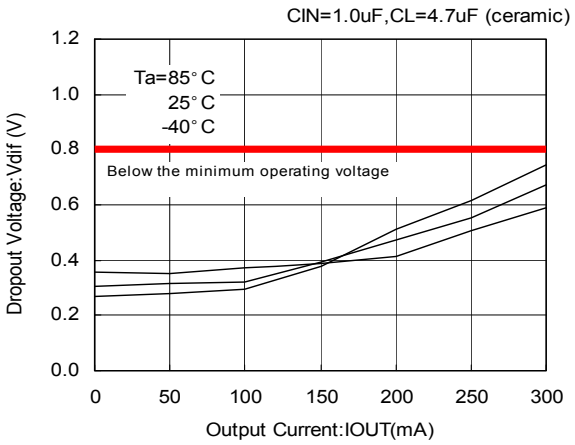
XC6207A/B502xx



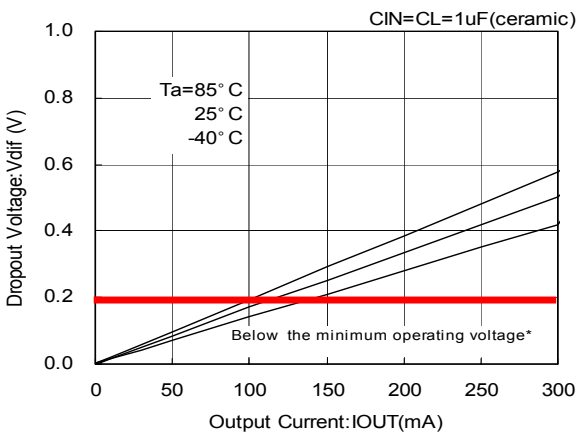
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Dropout Voltage vs. Output Current

XC6207A/B122xx

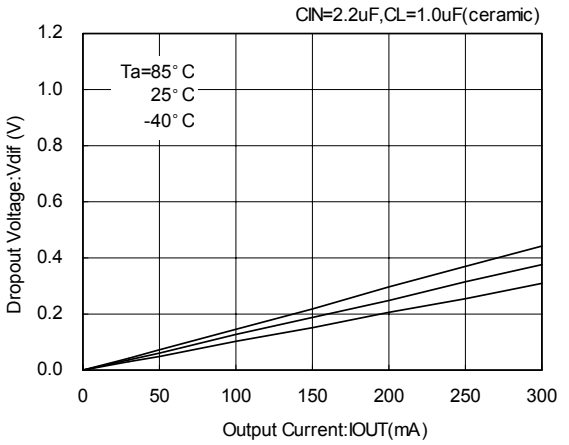


XC6207A/B182xx

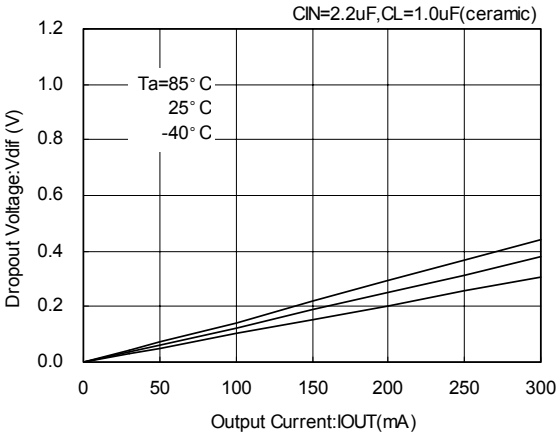


*The characteristic when Vdif is lower than 0.2V is the reference characteristic below the minimum operating voltage.

XC6207A/B302xx

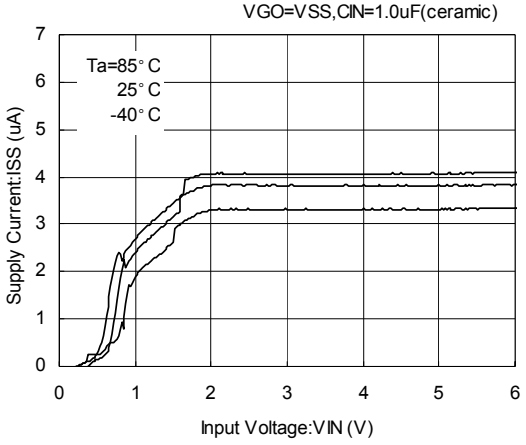


XC6207A/B502xx

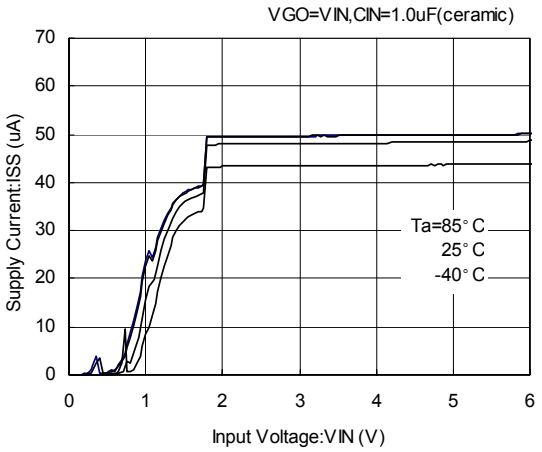


(3) Supply Current vs. Input Voltage

XC6207A/B182xx



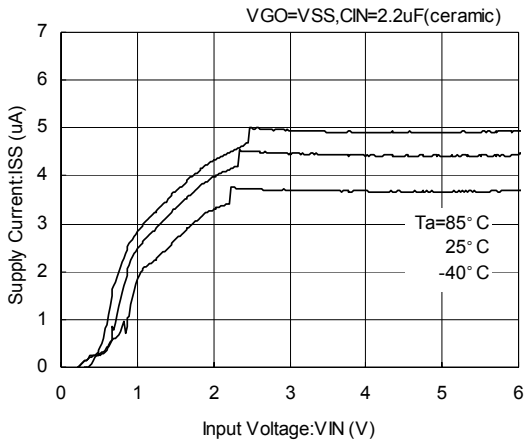
XC6207A/B182xx



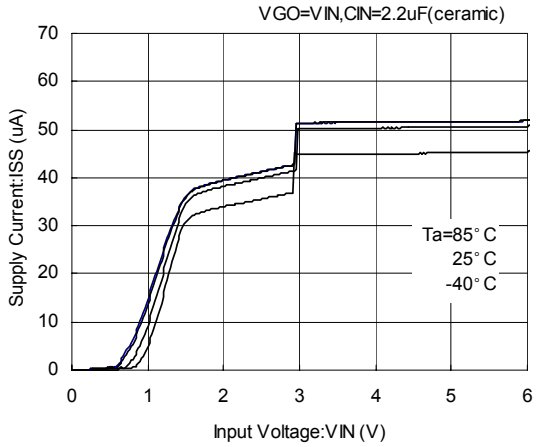
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

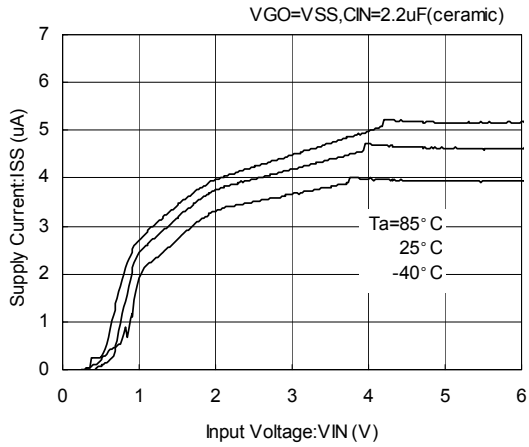
XC6207A/B302xx



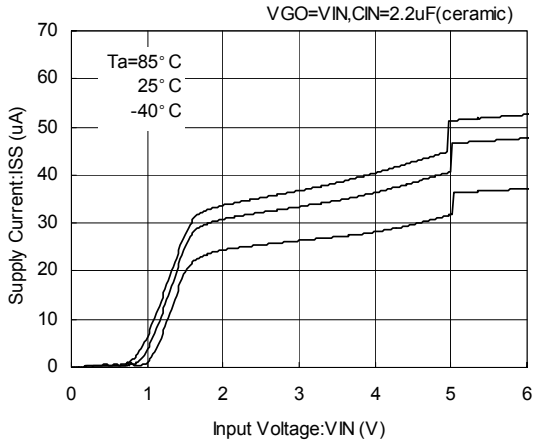
XC6207A/B302xx



XC6207A/B502xx

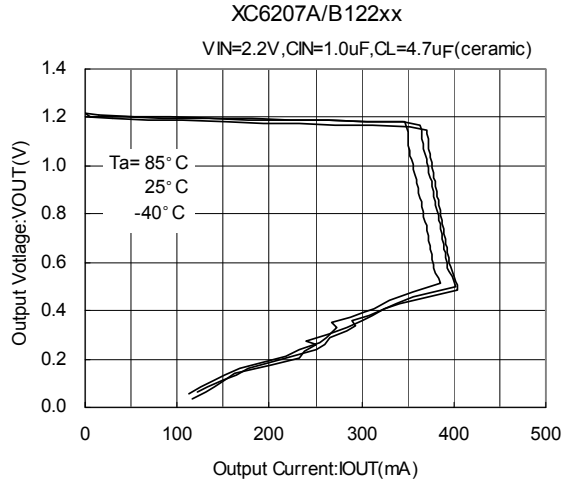


XC6207A/B502xx

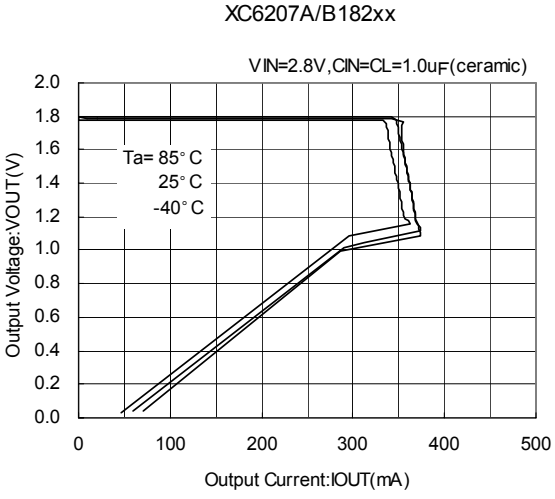


(4) Current Limiter Circuit

XC6207A/B122xx



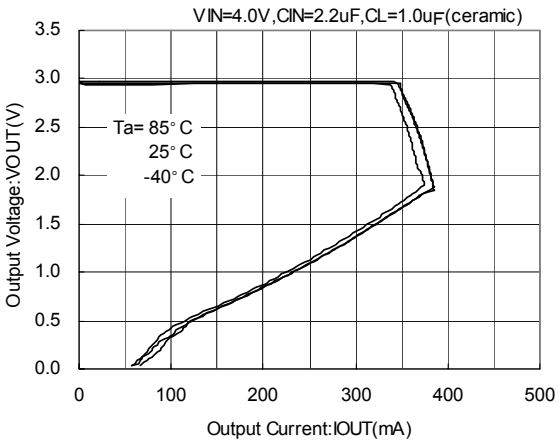
XC6207A/B182xx



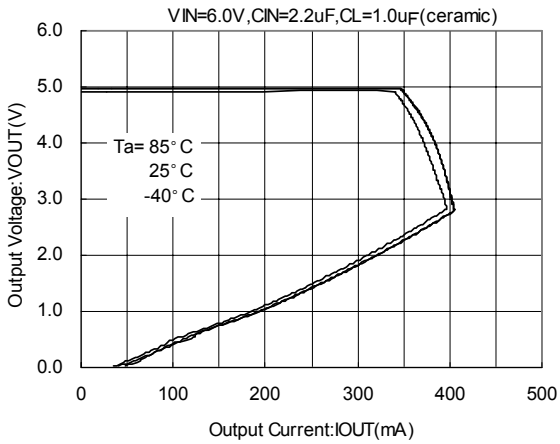
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(4) Current Limiter Circuit (Continued)

XC6207A/B302xx

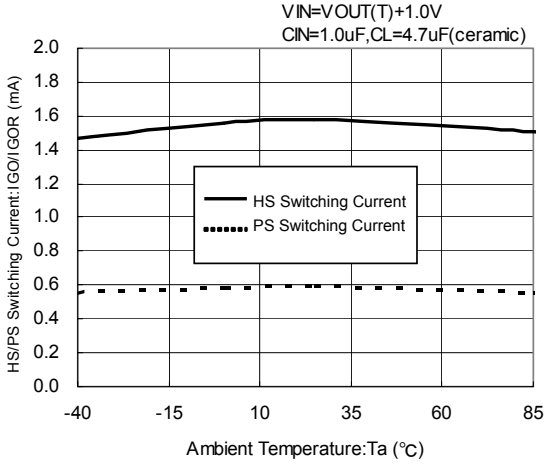


XC6207A/B502xx

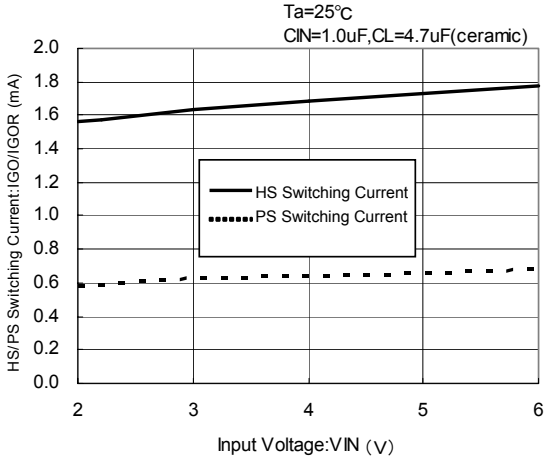


(5) High speed / Power Save Switching Current

XC6207A/B122xx

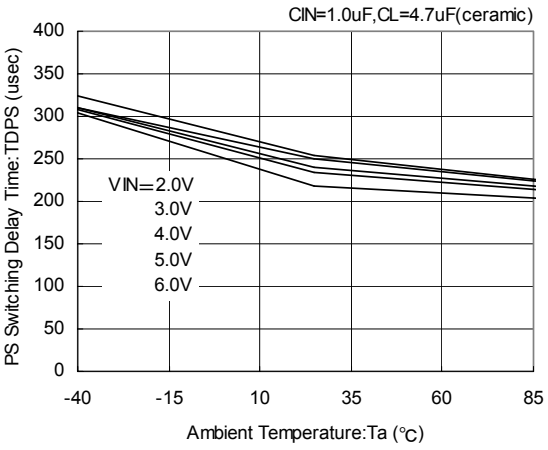


XC6207A/B122xx



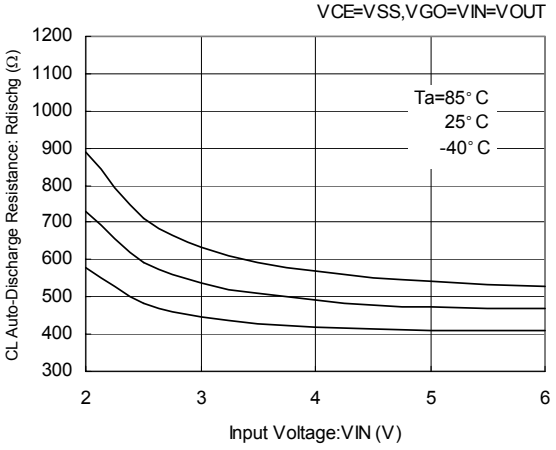
(6) Power Save Switching Delay Time

XC6207A/B122xx



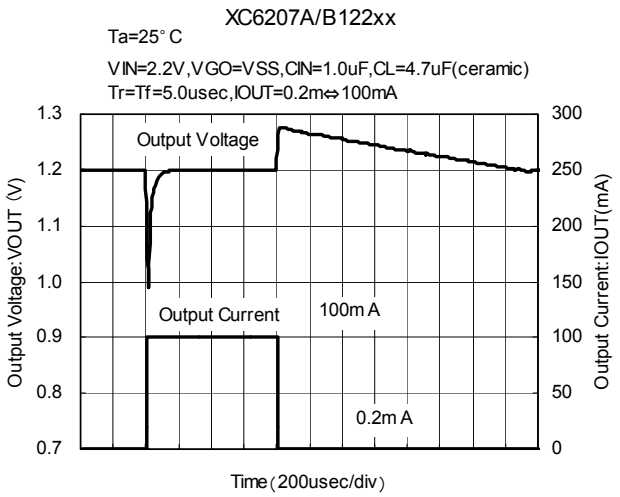
(7) CL Discharge Resistance

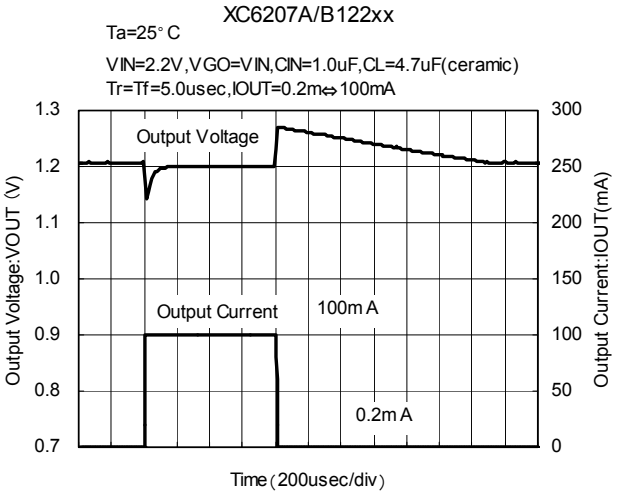
XC6207B122xx

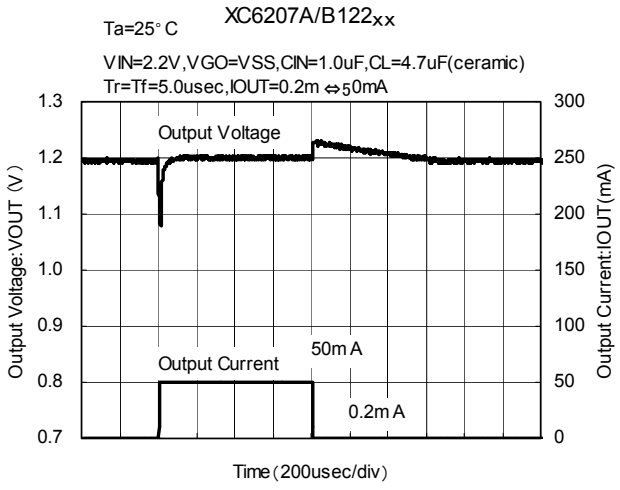


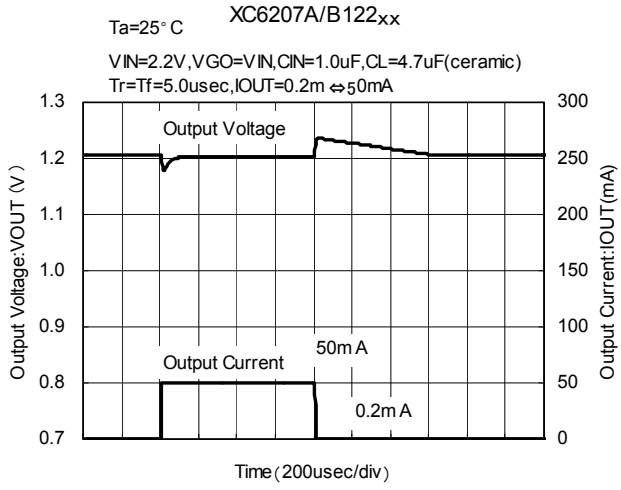
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

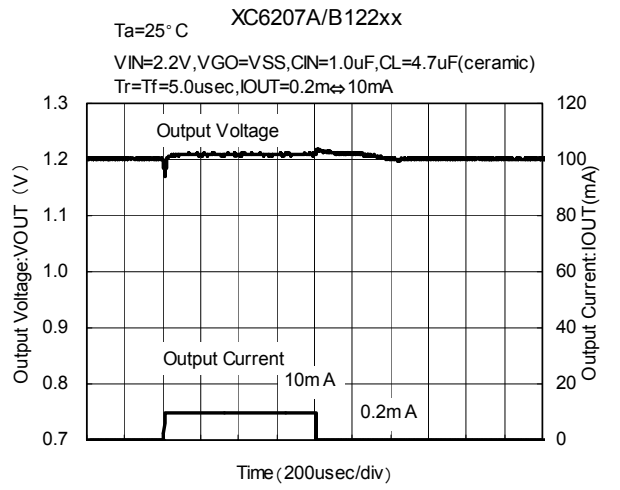
(8) Load Transient Response

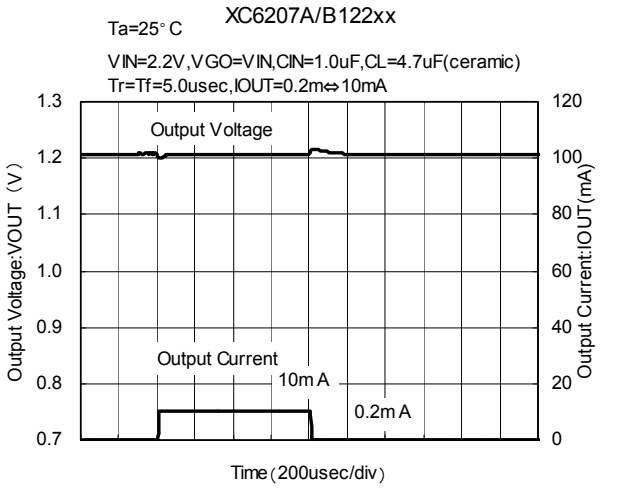






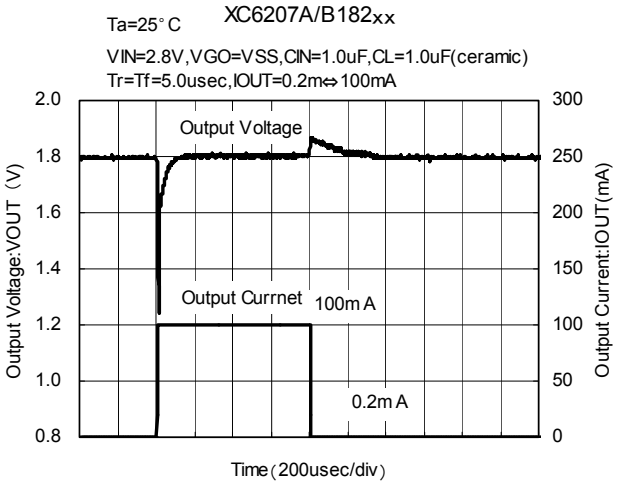


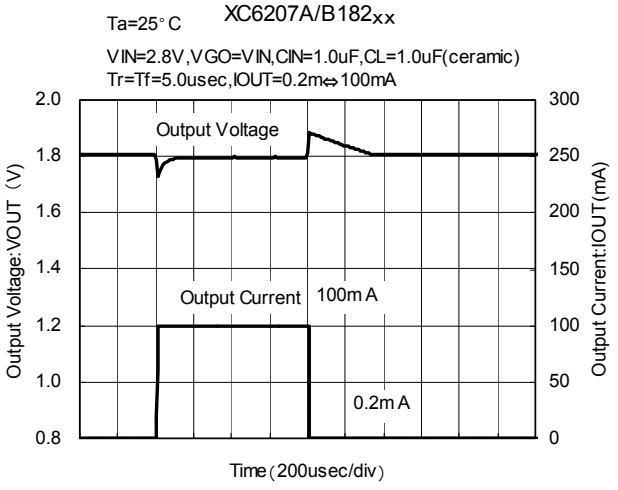


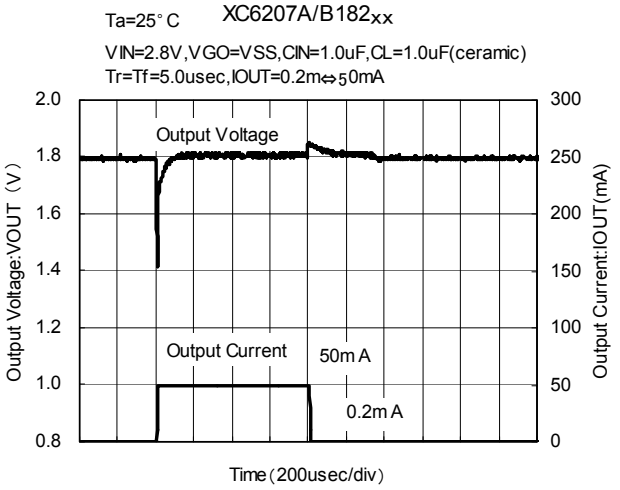


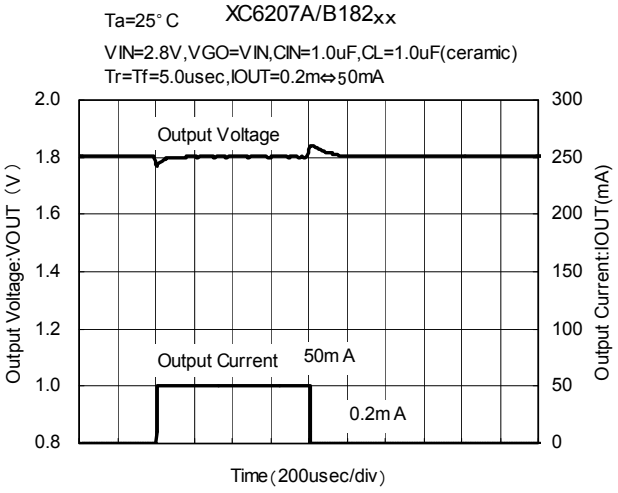
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

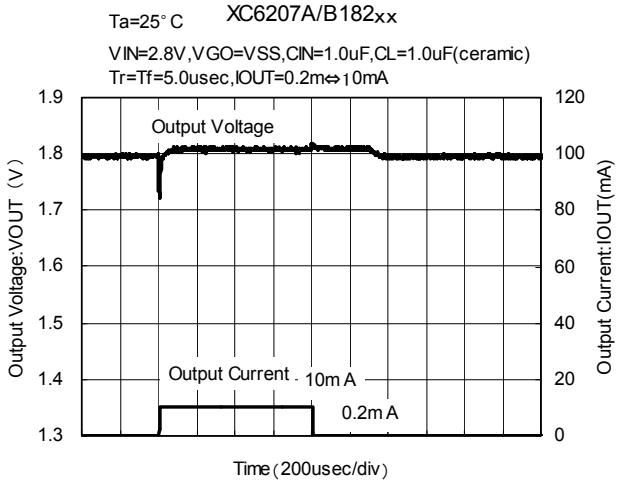
(8) Load Transient Response (Continued)

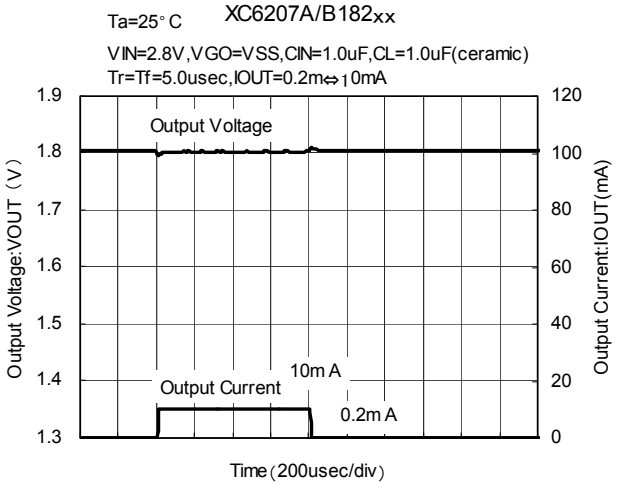






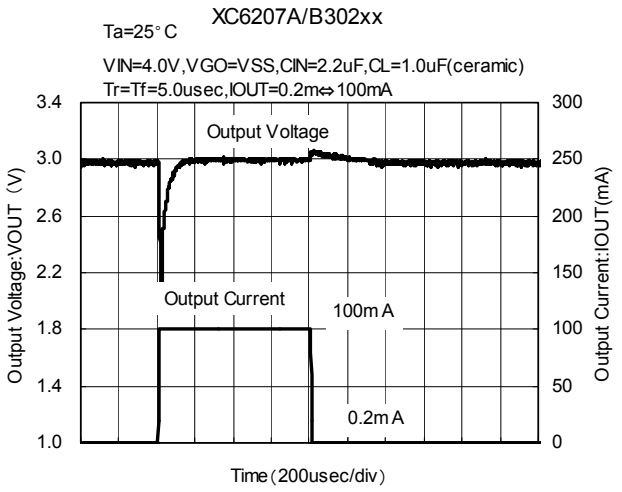


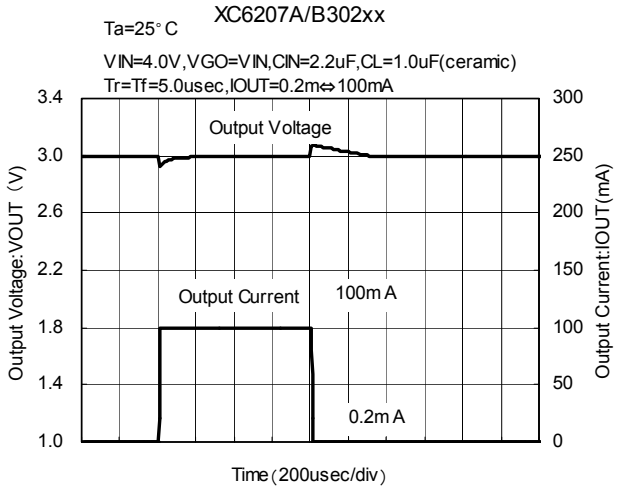


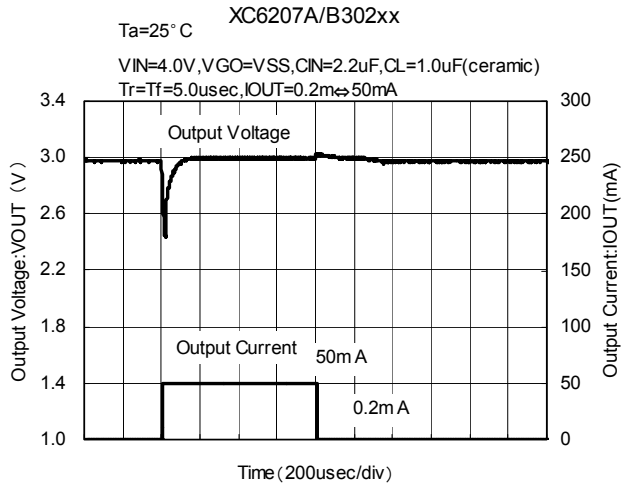


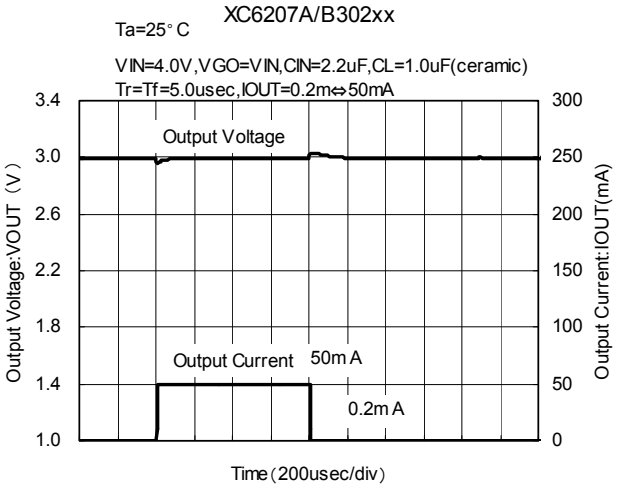
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

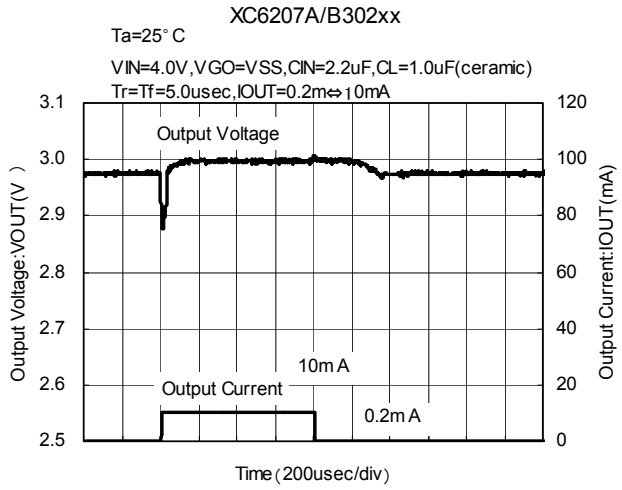
(8) Load Transient Response (Continued)

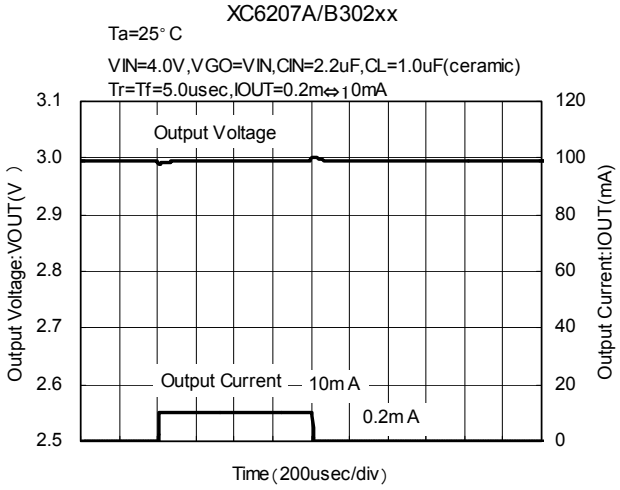






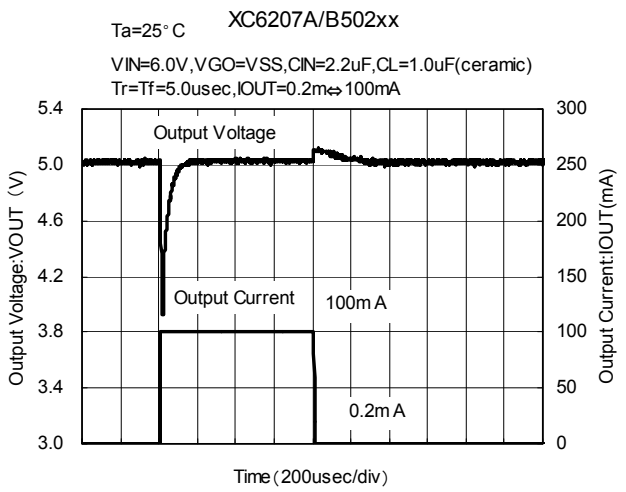


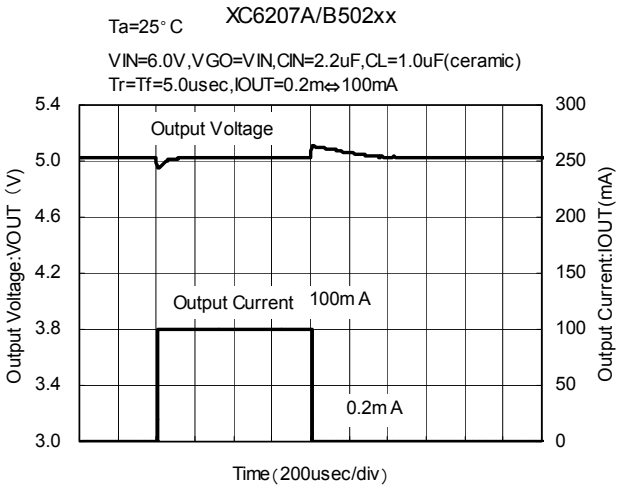


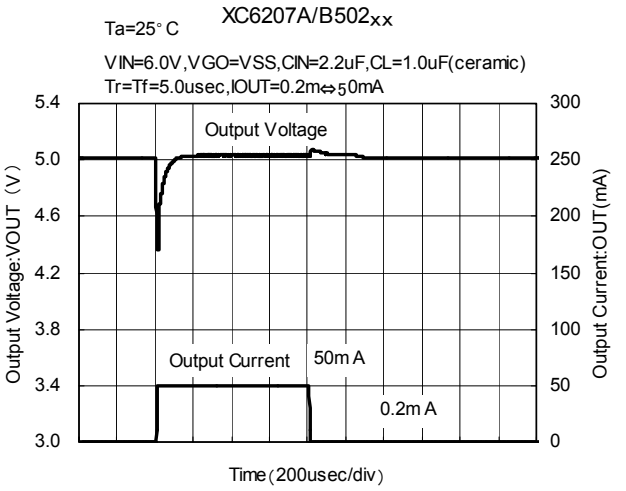


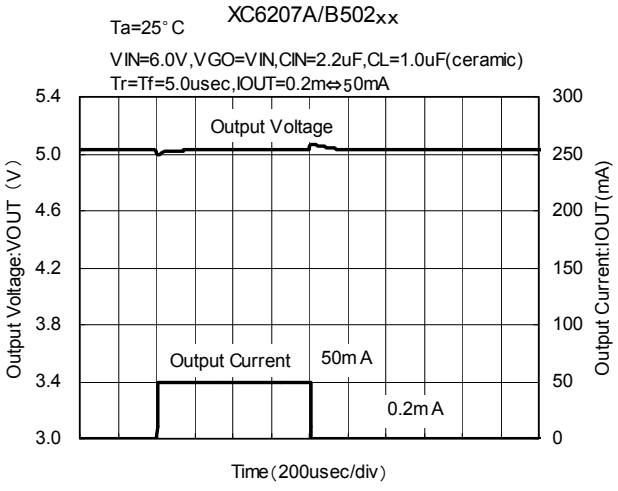
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

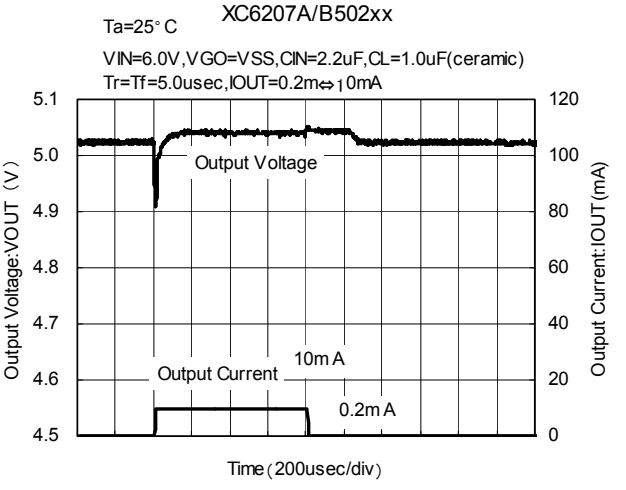
(8) Load Transient Response (Continued)

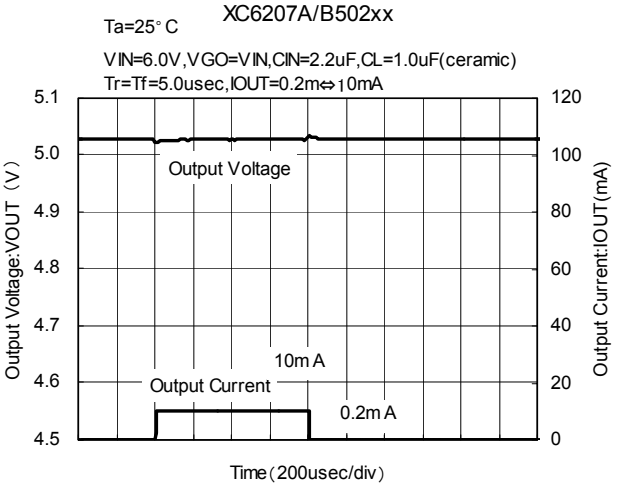






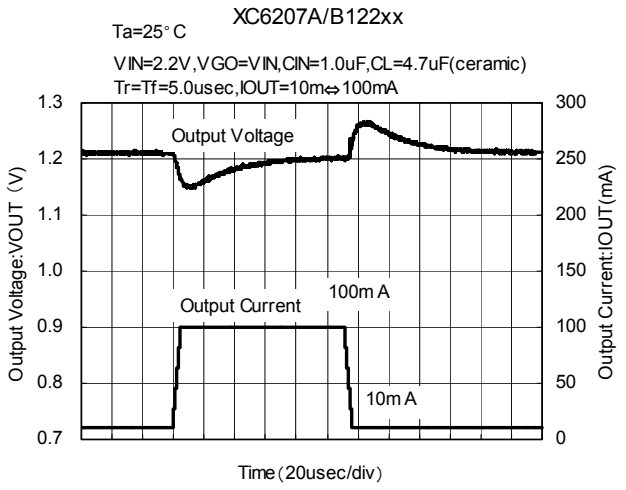


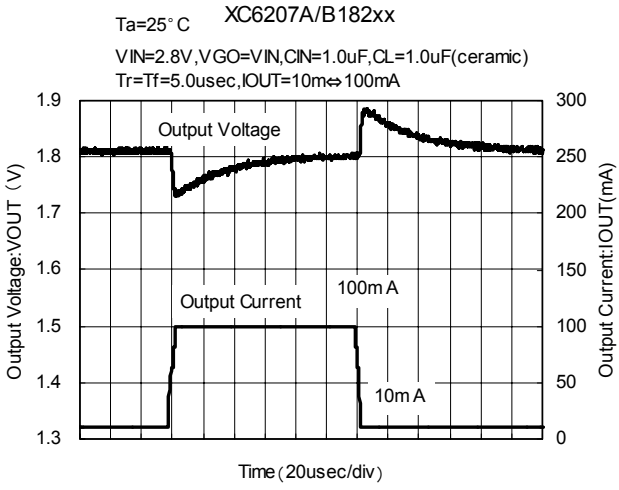


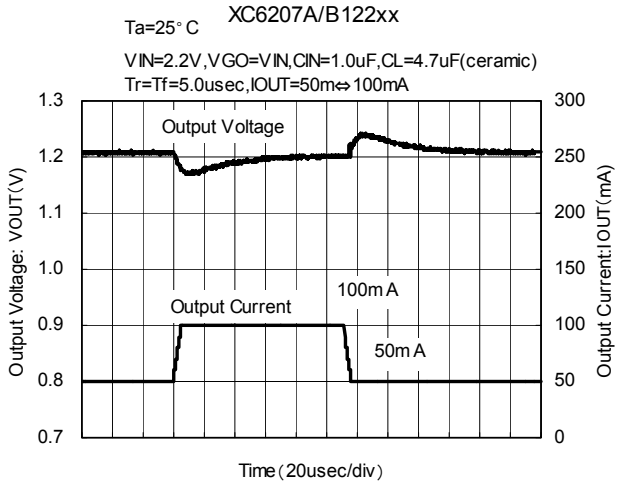


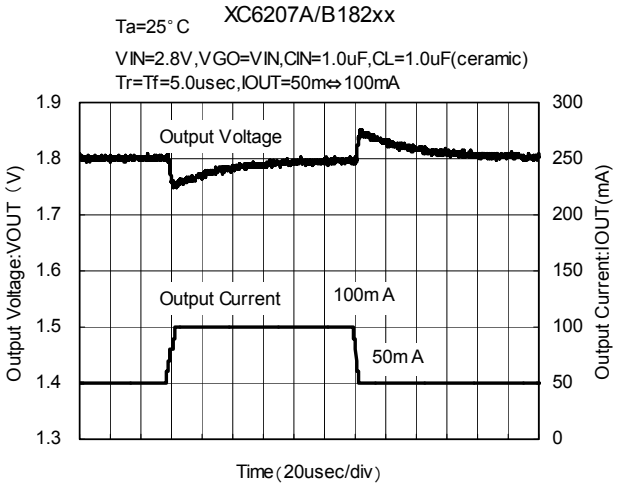
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

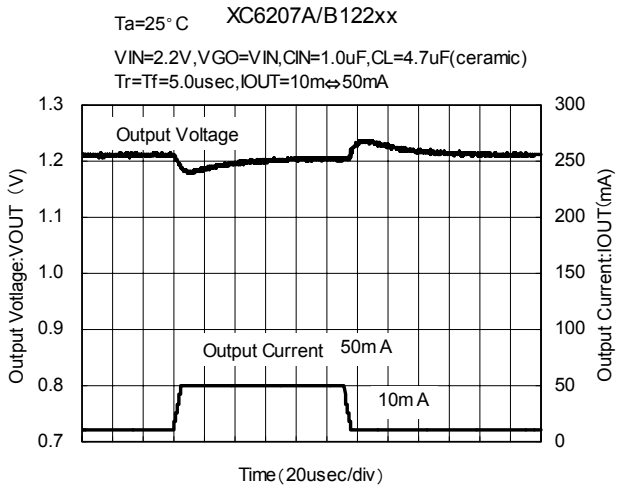
(8) Load Transient Response (Continued)

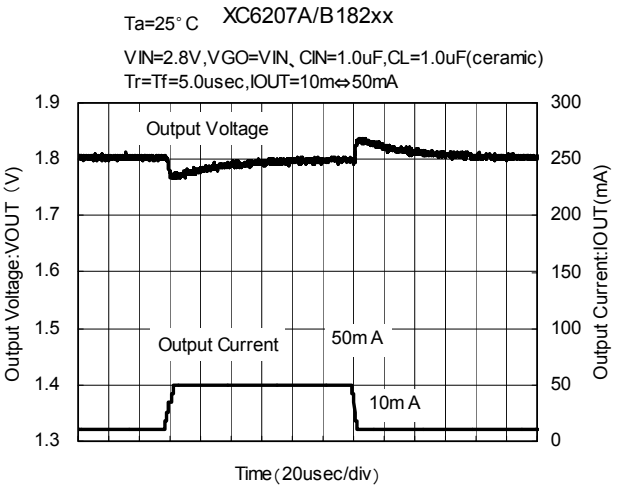










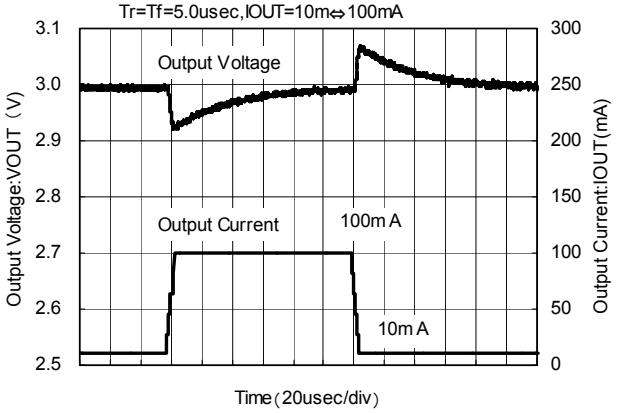


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8) Load Transient Response (Continued)

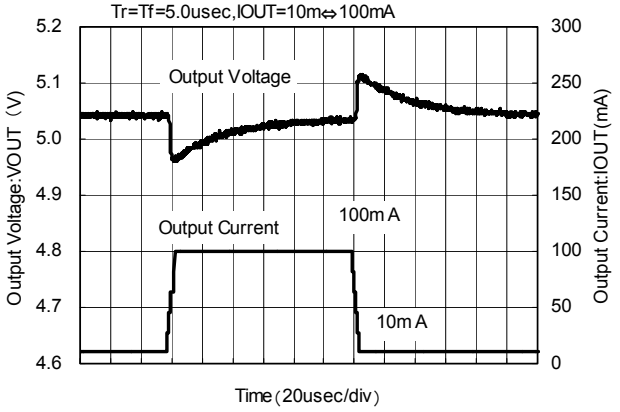
XC6207A/B302xx

Ta=25°C
VIN=4.0V,VGO=VIN,CIN=2.2uF,CL=1.0uF(ceramic)
Tr=Tf=5.0usec,IOUT=10m⇔100mA



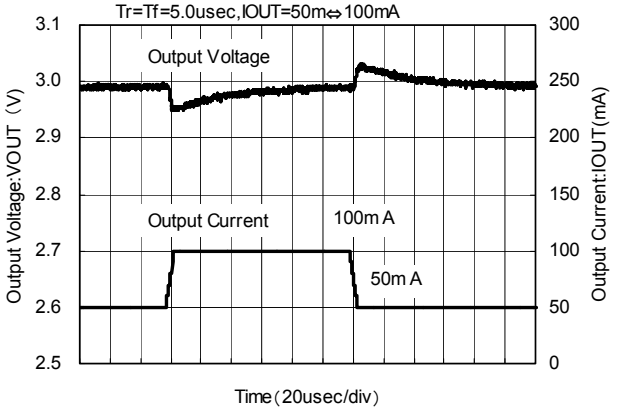
XC6207A/B502xx

Ta=25°C
VIN=6.0V,VGO=VIN、CIN=2.2uF,CL=1.0uF(ceramic)
Tr=Tf=5.0usec,IOUT=10m⇔100mA



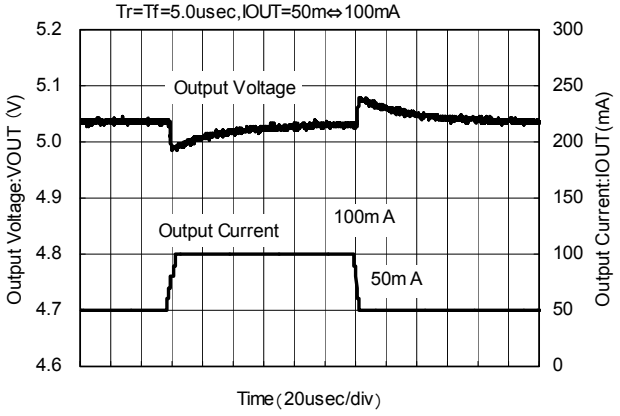
XC6207A/B302xx

Ta=25°C
VIN=4.0V,VGO=VIN,CIN=2.2uF,CL=1.0uF(ceramic)
Tr=Tf=5.0usec,IOUT=50m⇔100mA



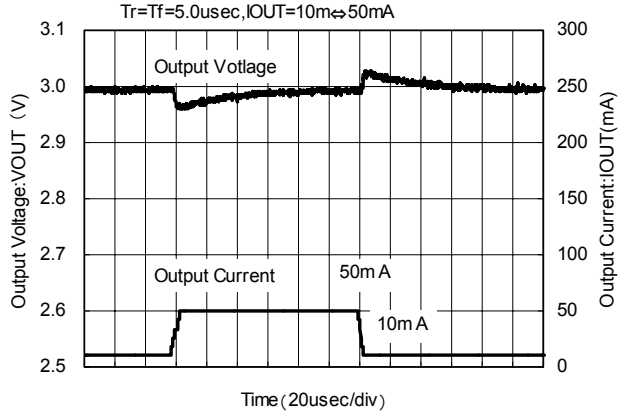
XC6207A/B502xx

Ta=25°C
VIN=6.0V,VGO=VIN,CIN=1.0uF,CL=4.7uF(ceramic)
Tr=Tf=5.0usec,IOUT=50m⇔100mA



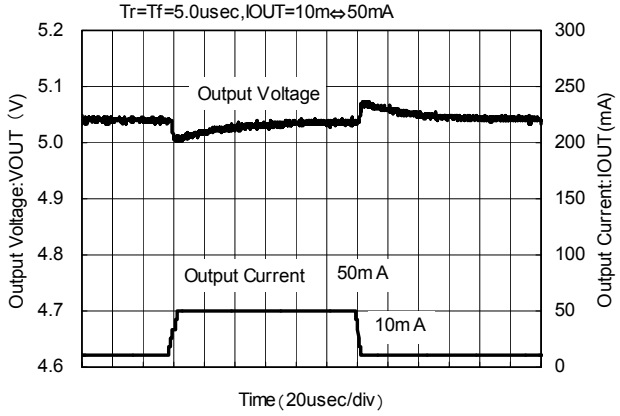
XC6207A/B302xx

Ta=25°C
VIN=4.0V,VGO=VIN,CIN=2.2uF,CL=1.0uF(ceramic)
Tr=Tf=5.0usec,IOUT=10m⇔50mA



XC6207A/B502xx

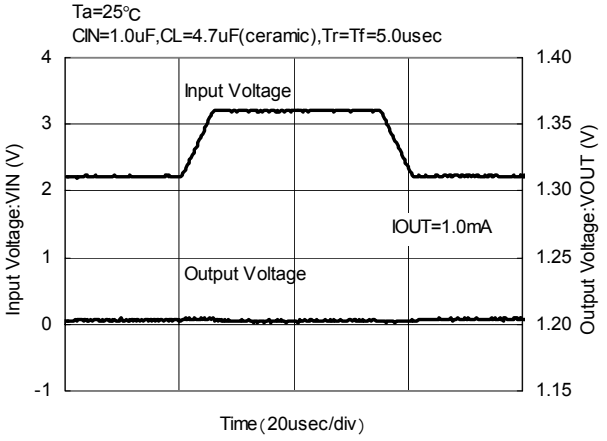
Ta=25°C
VIN=6.0V,VGO=VIN,CIN=2.2uF,CL=1.0uF(ceramic)
Tr=Tf=5.0usec,IOUT=10m⇔50mA



■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Input Transient Response

XC6207A/B122××



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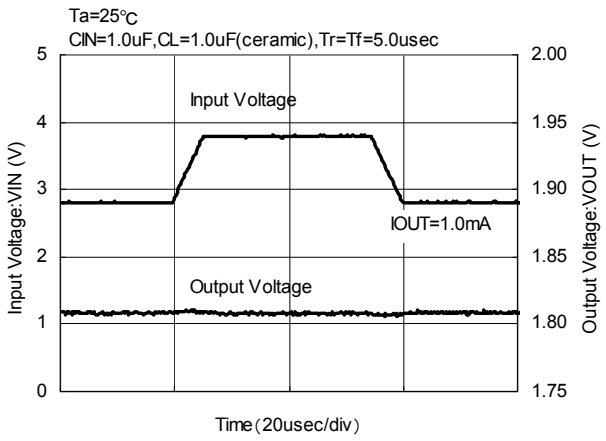

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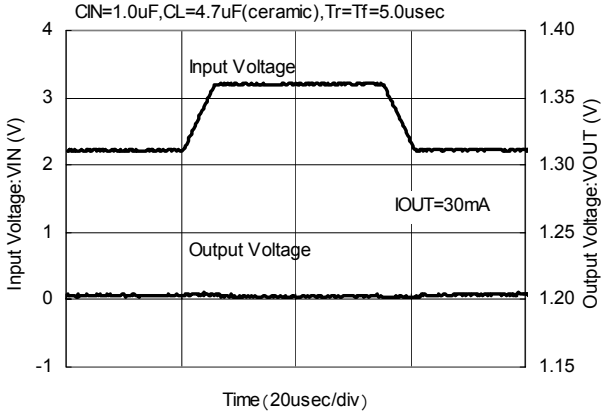

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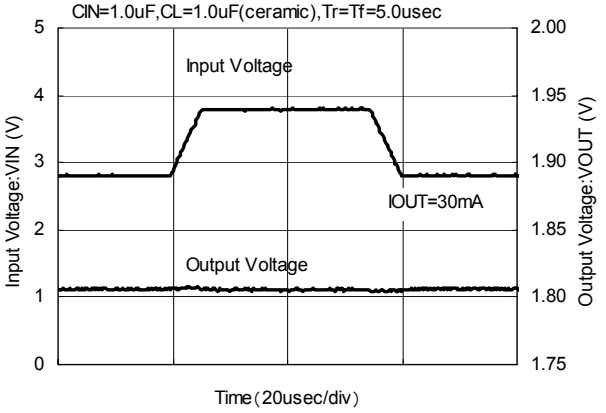

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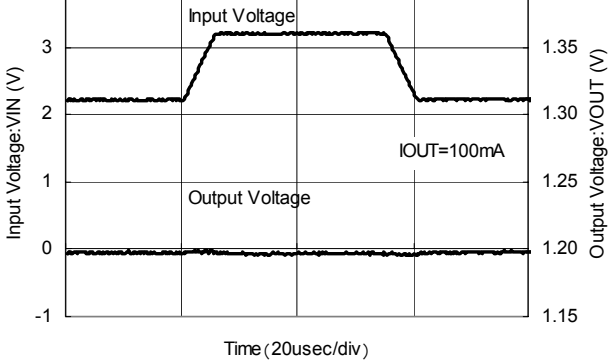

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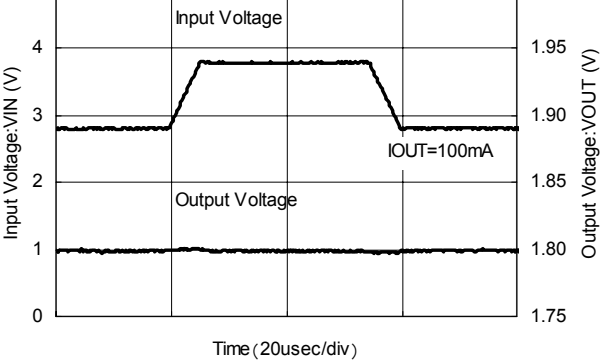
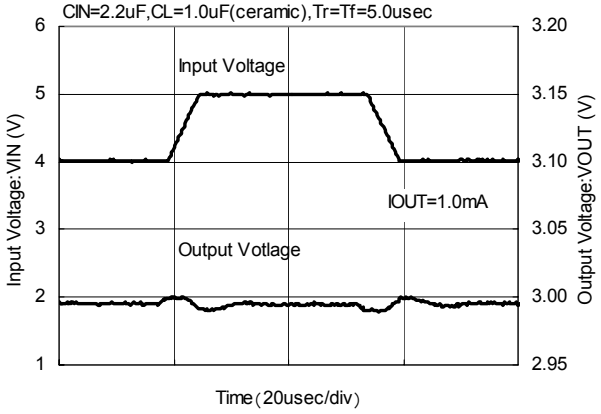


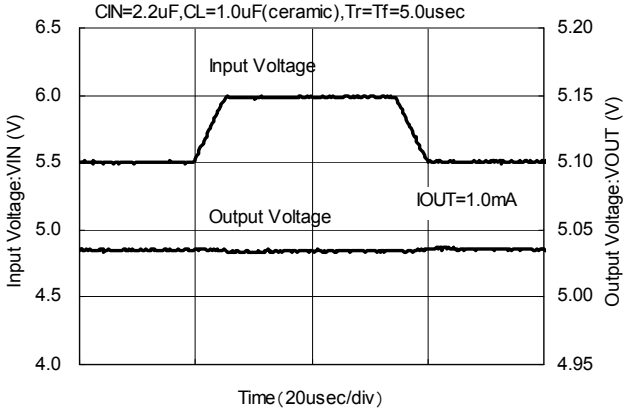
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Input Transient Response (Continued)

XC6207A/B302××



XC6207A/B502××



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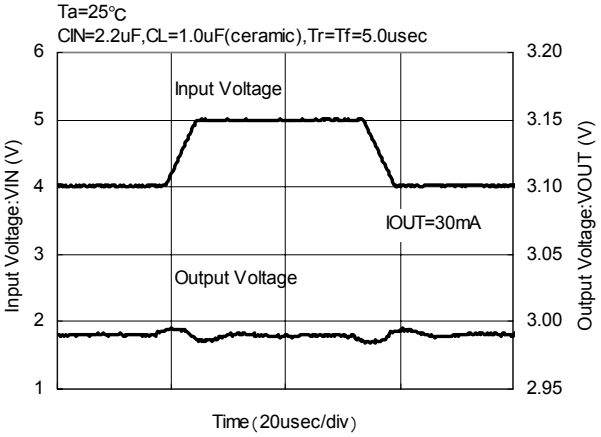

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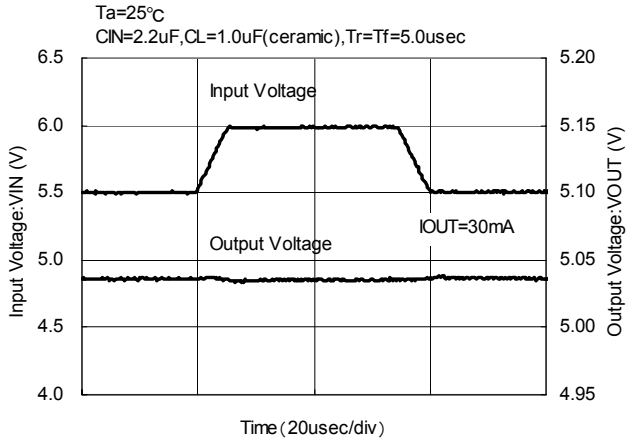

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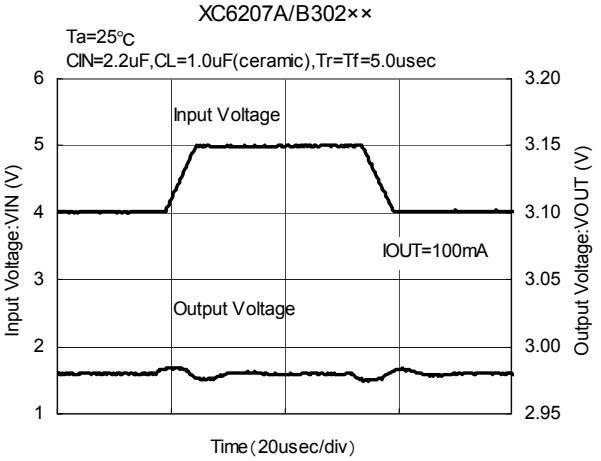

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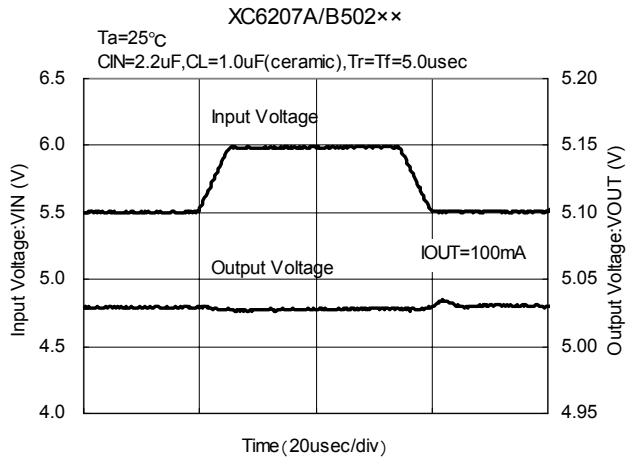
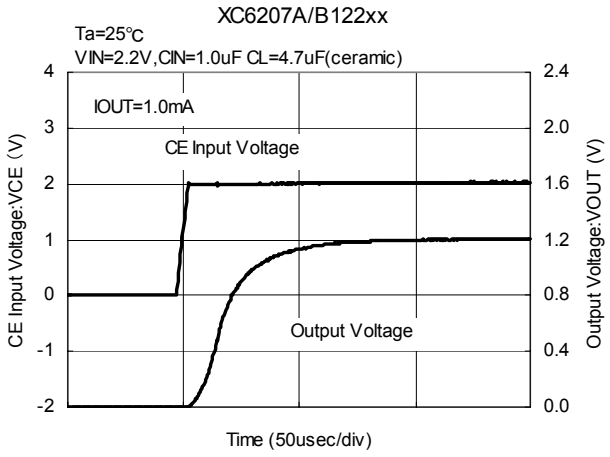
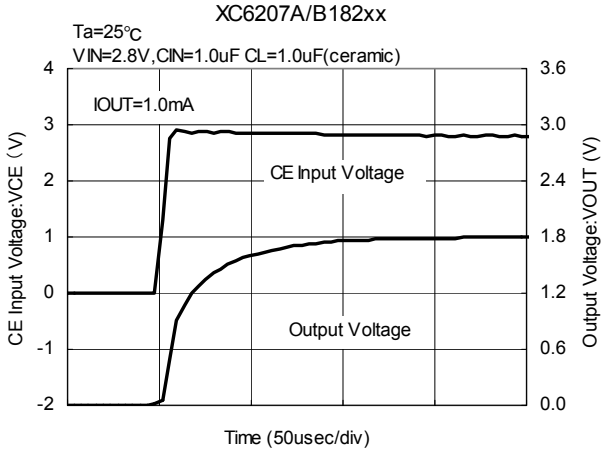
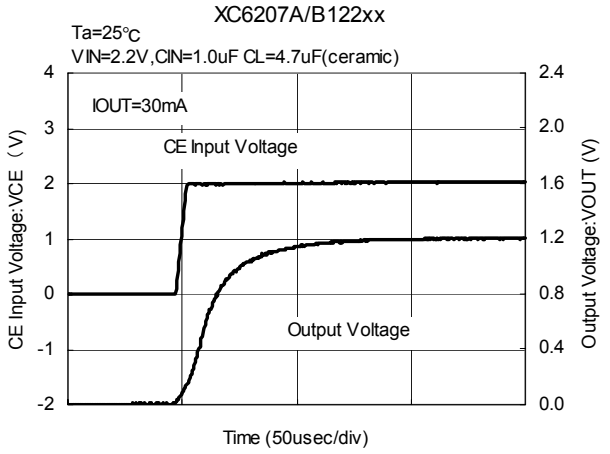


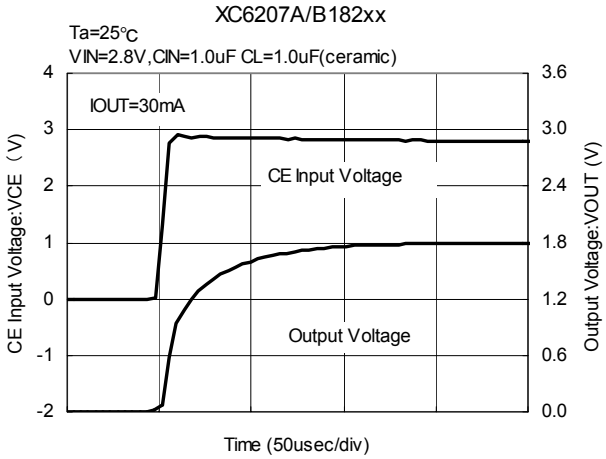
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

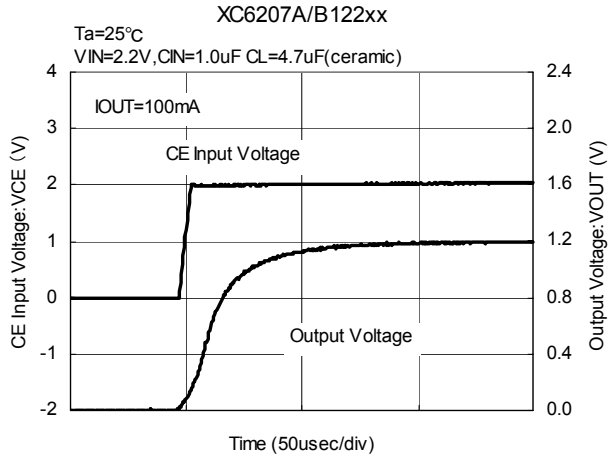
(10) Enable Response Time

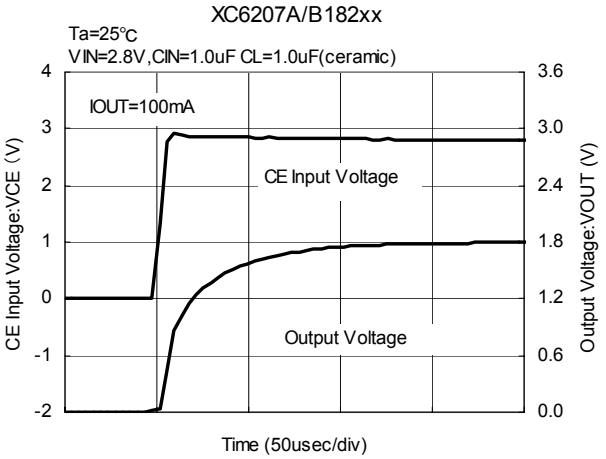








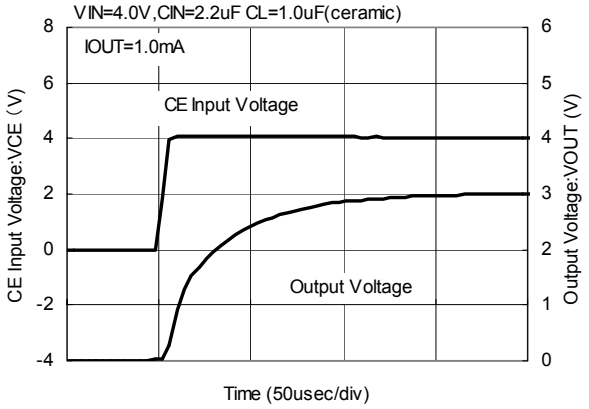




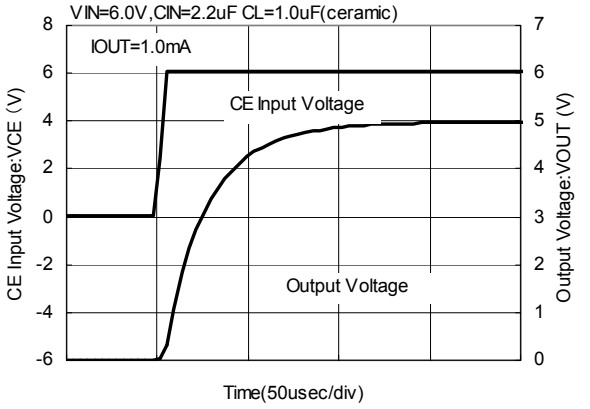
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Enable Response Time (Continued)

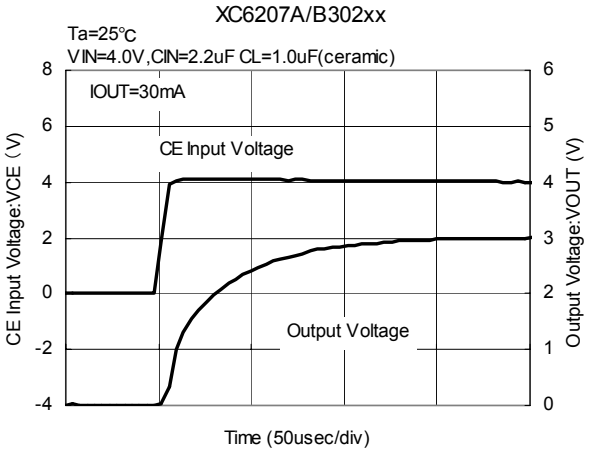
XC6207A/B302xx



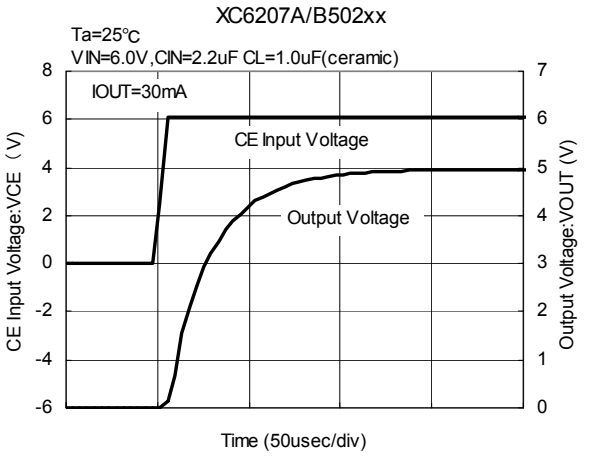
XC6207A/B502xx



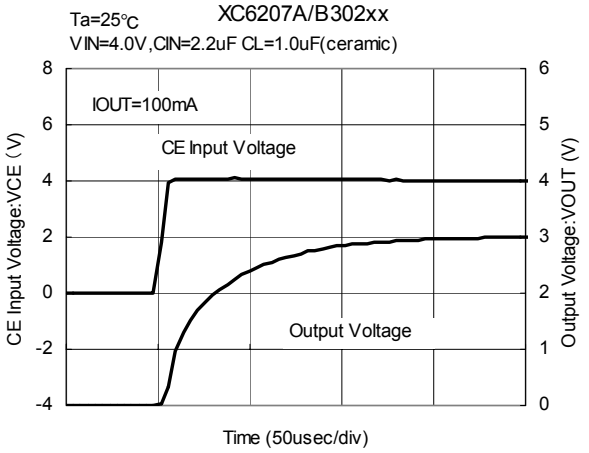
XC6207A/B302xx



XC6207A/B502xx



XC6207A/B302xx



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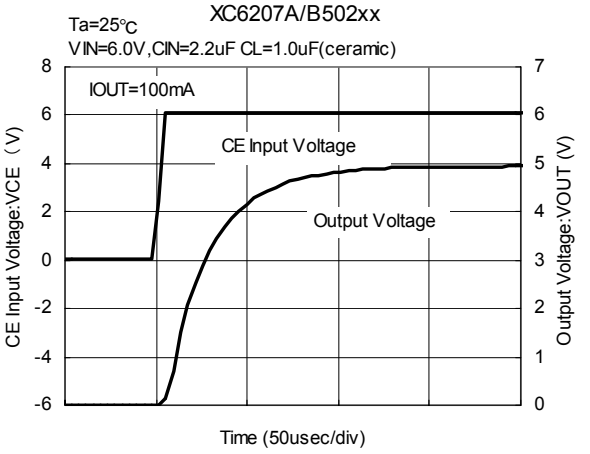
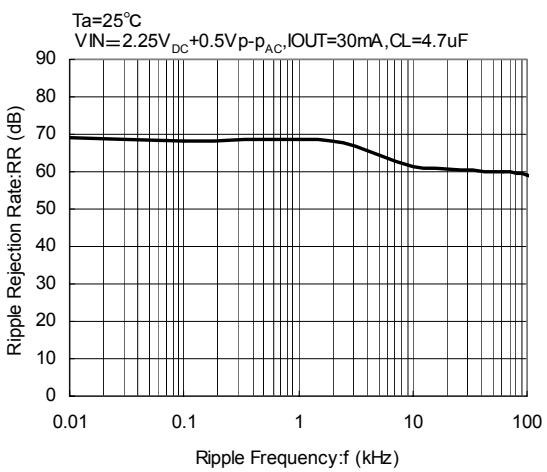


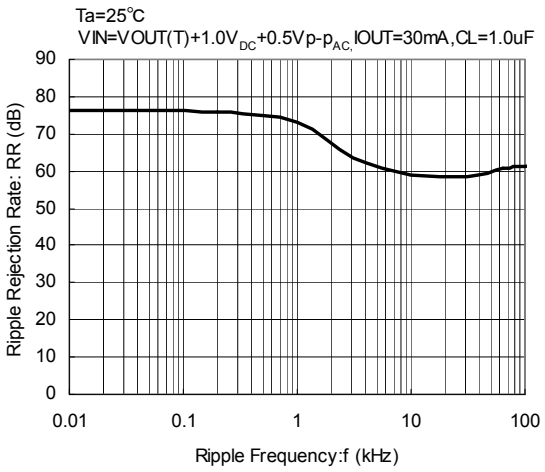
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) Ripple Rejection Rate

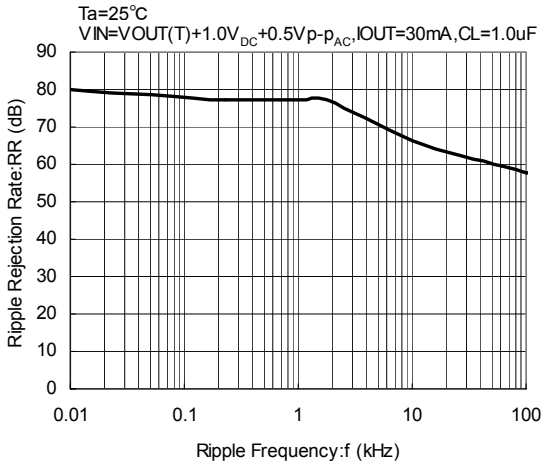
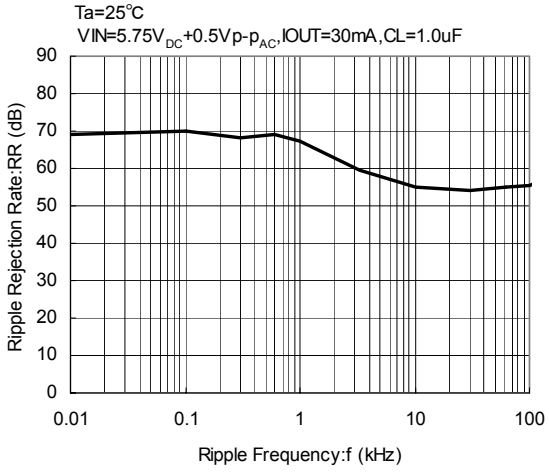
XC6207A/B122xx



XC6207A/B182xx



XC6207A/B302xx



XC6207A/B502xx