XC6242 Series

ETR03125-001

Charging ICs for Rechargeable Batteries Compatible with CV Charging
(0.8μA Low Power Consumption Voltage Regulator)

■GENERAL DESCRIPTION

The XC6242 series of products consists of regulators which have achieved an ultra-low supply current of 0.8μA, and can be used for charging rechargeable batteries compatible with CV (Constant Voltage) charging.

The output voltage of these products is internally fixed to be compatible with the CV voltages of rechargeable batteries.

Even if fluctuations are taken into account, the CV voltages of rechargeable batteries will not be exceeded, so charging can be performed without concern.

The addition of a diode on the input side also allows the sink current flowing from a rechargeable battery to the regulator to be suppressed to 0.24μA, which can greatly contribute to extending the battery-driven time while charging is not being performed.

The CE function can turn the regulator output off and put the IC into a shutdown state where the supply current can be substantially reduced.

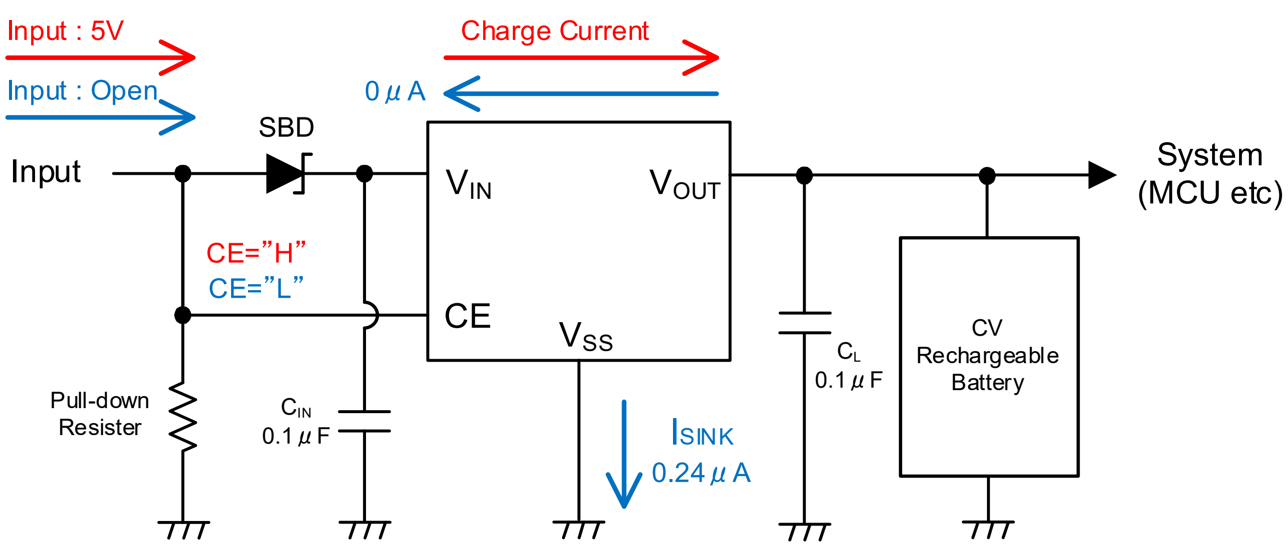
■APPLICATIONS

- Rechargeable Batteries Compatible with CV Charging
- IoT devices
- Smart cards

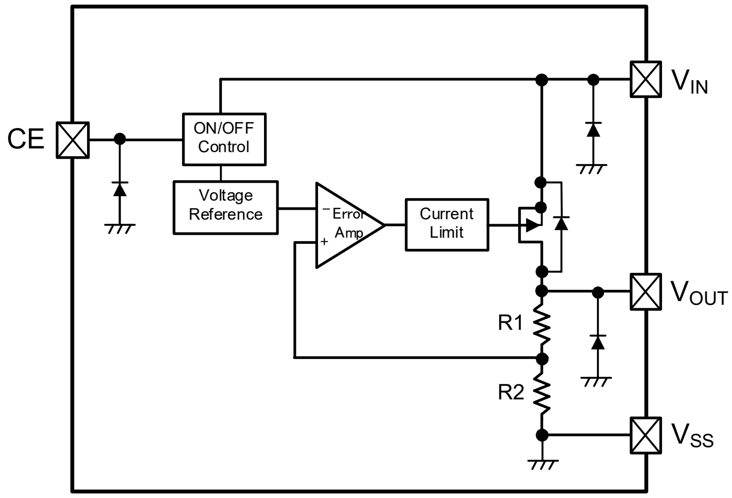
■FEATURES

Operating Voltage Range	: 1.5V ~ 6.0V
Output Voltage	: 2.63V ± 1.5%
Maximum Output Current	: 150mA (300mA Limit)
Dropout Voltage	: 510mV@I_{OUT}=100mA
Low Supply Current	: 0.8μA
V_{OUT} Pin Sink Current	: 0.24μA
Stand-by Current	: 0.01μA
Operating Temperature Range	: -40℃ ~ 105℃
Protective Function	: Current Limit
Output Capacitor	: Ceramic capacitor
Packages	: USPN-4 (0.90 x 1.20 x 0.40mm)
Environmentally Friendly	: EU RoHS Compliant, Pb Free

■TYPICALAPPLICATION CIRCUIT



■BLOCK DIAGRAMS



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

■PRODUCT CLASSIFICATION

●Ordering Information

XC6242①②③④⑤⑥-⑦

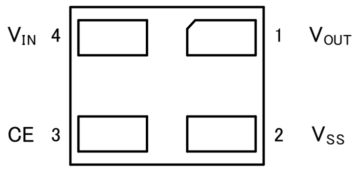
DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Type	A	CE "H" Active
②③④	Output Voltage	263	2.63V (±1.5% Accuracy)
⑤⑥-⑦ (*1)	Packages (Order Unit)	7R-G(*1)	USPN-4 (5,000pcs/Reel)

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

●Selection Guide

TYPE	RECHARGEABLE BATTERY CV VOLTAGE	OUTPUT VOLTAGE MIN.	OUTPUT VOLTAGE TYP.	OUTPUT VOLTAGE MAX.
XC6242A263	2.7V	2.500V	2.630V	2.700V

■PIN CONFIGURATION



USPN-4
(BOTTOM VIEW)

■PIN ASSIGNMENT

PIN NUMBER USPN-4	PIN NAME	FUNCTIONS
1	V_{OUT}	Output
2	V_{SS}	Ground
3	CE	ON/OFF Control
4	V_{IN}	Power Input

■FUNCTION CHART

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

* Please do not leave the CE pin open. Each should have a certain voltage.

■ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	-0.3 ~ 7.0	V
Output Voltage		V_{OUT}	-0.3 ~ V_{IN} + 0.3 or 7.0 (*1)	V
CE Input Voltage		V_{CE}	-0.3 ~ 7.0	V
Power Dissipation (Ta=25℃)	USPN-4	Pd	600(40mm x 40mm Standard Board)(*2)	mW
Junction Temperature		Tj	-40 ~ 125	℃
Storage Temperature		Tstg	-55 ~ 125	℃

All voltages are described based on the V_{SS}.
(*1) The maximum rating corresponds to the lowest value between V_{IN}+0.3V or 7.0V.
(*2) The power dissipation figure shown is PCB mounted and is for reference only.
Please refer to PACKAGING INFORMATION for the mounting condition.

■RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Input Voltage	V_{IN}	1.5	-	6.0	V
Output Current(*1)	I_{OUT}	0.0	-	150	mA
CE Input Voltage	V_{CE}	0.0	-	6.0	V
Operating Ambient Temperature	Topr	-40	-	105	℃
Input Capacitor (Effective Value)	C_{IN}	0.1(*2,3)	-	1000	μF

All voltages are described based on the V_{SS}.

(*1) Please use the IC within the range where the junction temperature does not exceed the maximum junction temperature.

(*2) Some ceramic capacitors have an effective capacitance that is significantly lower than the nominal value due to the applied DC bias and ambient temperature.
For the input capacitance of this IC, use an appropriate ceramic capacitor according to the DC bias usage conditions (ambient temperature, input voltage) so that the effective capacitance value is equal to or higher than the recommended component.

(*3) When using a capacitor with large-capacity such as an electrolytic capacitor or tantalum capacitor as the input capacity, place a low ESR ceramic capacitor in parallel.
If a ceramic capacitor is not used, high-frequency voltage fluctuations will increase and there is a possibility that the IC may malfunction.

■ELECTRICAL CHARACTERISTICS

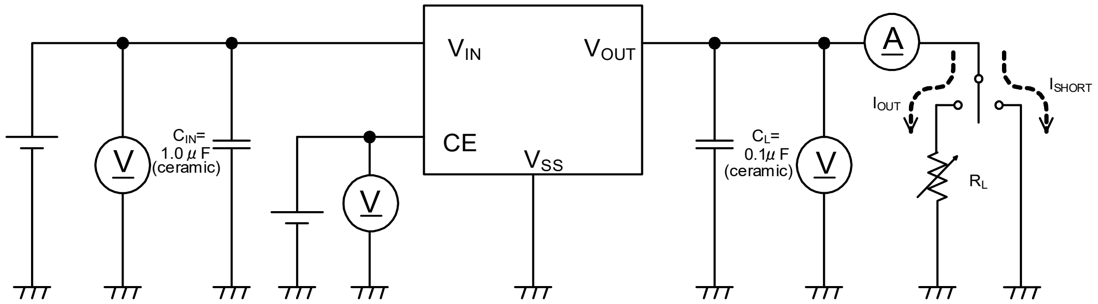
Ta=25℃

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUIT
Input Voltage	V_{IN}			1.5	-	6.0	V	-
Output Voltage	$V_{OUT(E)}$ (*1)	$V_{IN}=V_{CE}$=3.63V I_{OUT}=1mA	Ta=25℃	2.591	2.630	2.669	V	①
			-40℃≦Ta≦105℃(*3)	2.500	2.630	2.700		
Maximum Output Current	I_{OUTMAX}	$V_{IN}=V_{CE}$=3.63V		150	-	-	mA	①
Load Regulation	ΔV_{OUT}	$V_{IN}=V_{CE}$=3.63V 1mA≦I_{OUT}≦100mA		-	15	70	mV	①
Dropout Voltage	Vdif (*2)	$V_{CE}=V_{IN}$ I_{OUT}=100mA		-	510	660	mV	①
Supply Current	I_{SS}	$V_{IN}=V_{CE}$=3.63V		-	0.8	1.5	μA	②
Stand-by Current	I_{STB}	V_{IN}=3.63V $V_{CE}=V_{SS}$		-	0.01	0.10	μA	②
V_{OUT} Pin Sink Current	I_{SINK}	$V_{IN}=V_{OUT}$=2.7V $V_{CE}=V_{SS}$		-	0.24	0.60	μA	③
Line Regulation	$\Delta V_{OUT}/(\Delta V_{IN} \cdot V_{OUT})$	3.13V≦V_{IN}≦6.0V I_{OUT}=30mA $V_{CE}=V_{IN}$		-	0.05	0.15	%/V	①
Output Voltage Temperature Characteristics	$\Delta V_{OUT}/(\Delta Topr \cdot V_{OUT})$	$V_{IN}=V_{CE}$=3.63V I_{OUT}=30mA -40℃≦Topr≦105℃		-	±100	-	ppm/℃	①
Limit Current	I_{LIM}	$V_{IN}=V_{CE}$=4.63V V_{OUT}=2.50V		150	260	-	mA	①
Short Circuit Current	I_{SHORT}	$V_{IN}=V_{CE}$=3.63V V_{OUT}=0V		-	30	-	mA	①
CE "H" Voltage	V_{CEH}	V_{IN}=3.63V	Ta=25℃ -40℃≦Ta≦105℃(*3)	1.0	-	6.0	V	①
CE "L" Voltage	V_{CEL}	V_{IN}=3.63V	Ta=25℃ -40℃≦Ta≦105℃(*3)	V_{SS}	-	0.3	V	①
CE "H" Current	I_{CEH}	$V_{IN}=V_{CE}$=3.63V		-	0.0	0.1	μA	②
CE "L" Current	I_{CEL}	V_{IN}=3.63V $V_{CE}=V_{SS}$		-	0.0	0.1	μA	②

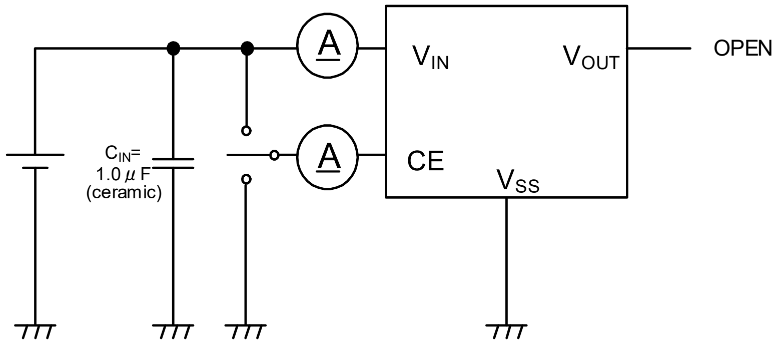
(*1) $V_{OUT(E)}$: Effective output voltage. Unless otherwise stated regarding input voltage conditions,(V_{IN}=3.63V).
(*2) Vdif = { V_{IN1} – V_{OUT1} }
V_{IN1} : The input voltage when V_{OUT1} appears as input voltage is gradually decreased.
V_{OUT1} : A voltage equal to 98% of the output voltage whenever an amply stabilized I_{OUT} { V_{IN}=3.63V } is input.
(*3) The ambient temperature range (-40℃≦Ta≦105℃) is design Value.

■TEST CIRCUITS

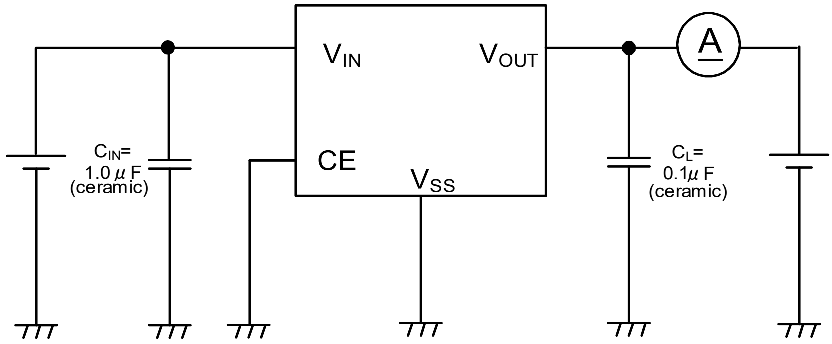
TEST CIRCUITS ①



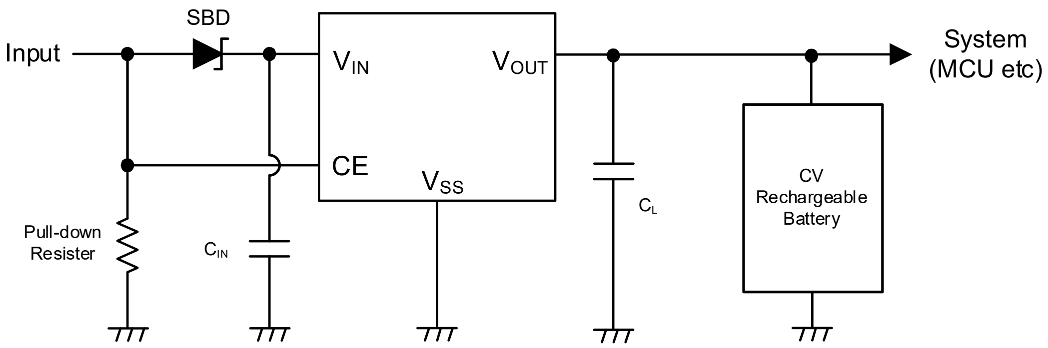
TEST CIRCUITS ②



TEST CIRCUITS ③



■TYPICAL APPLICATION CIRCUIT



【Typical Examples】

	VALUE
C_{IN} (*1,2)	Effective Value 0.1μF or more / 10V or more
C_L (*3)	Effective Value 0.1μF or more / 6.3V or more

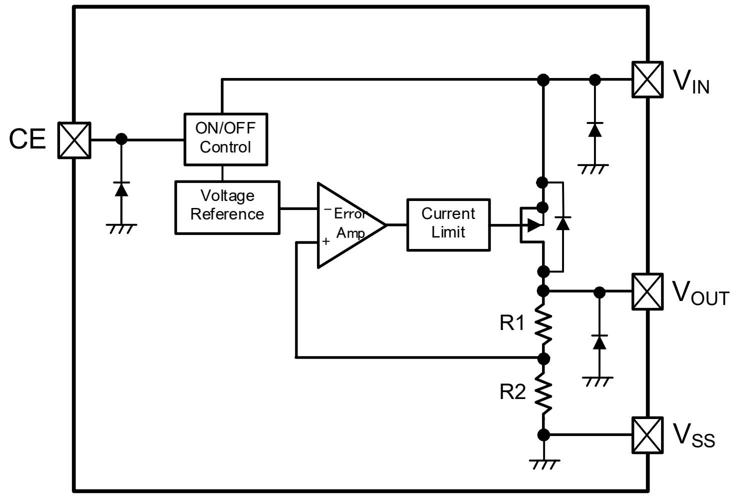
(*1) Some ceramic capacitors have an effective capacitance that is significantly lower than the nominal value due to the applied DC bias and ambient temperature.
For the input capacitance of this IC, use an appropriate ceramic capacitor according to the DC bias usage conditions (ambient temperature, input voltage) so that the effective capacitance value is equal to or higher than the recommended component.

(*2) When using a capacitor with large-capacity such as an electrolytic capacitor or tantalum capacitor as the input capacity, place a low ESR ceramic capacitor in parallel.
If a ceramic capacitor is not used, high-frequency voltage fluctuations will increase and there is a possibility that the IC may malfunction.

(*3) The phase compensation of this IC is realized by an output capacitor (C_L). Use an output capacitor (C_L) with an effective capacitance of 0.1 μF or more.

■OPERATIONAL EXPLANATION

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



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

< Current Limit, Short-Circuit Protection>

The XC6242 series limit output current by current fold-back circuit. When the output current reaches the current limit level (TYP. 260mA), the current fold-back circuit operates and the output current also drops as the output voltage drops. The output voltage drops further and output current decreases. When the output pin is shorted, the output current is I_{SHORT} (TYP. 30mA).

< CE Function>

The circuit of the IC can be stopped by the signal from the CE pin. In the stopped state, I_{SINK} (0.24μA TYP.) current flows from the V_{OUT} pin to the V_{SS} pin via R1 and R2.

The output voltage becomes unstable when the CE pin is open. Please input a certain voltage within an electrical characteristic into CE pin.

If this IC is used with the correct output voltage for the CE pin, the logic is fixed and the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry when medium voltage is input.

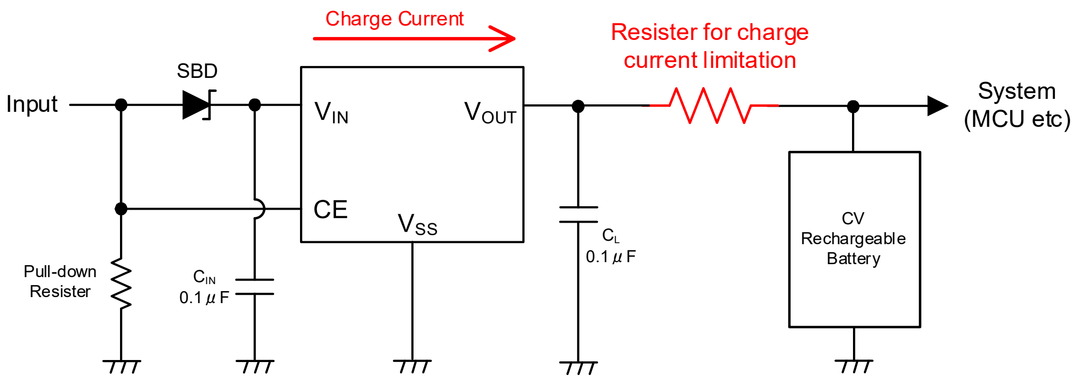
■NOTES ON USE

1) For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded. Also, if the IC used under conditions outside the recommended operating range, the IC may not operate normally or may cause deterioration.

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) The input capacitor (C_{IN}) and the output capacitor (C_L) should be placed to the IC as close as possible. Capacitances of these capacitors (C_{IN}, C_L) are decreased by the influences of bias voltage and ambient temperature. Care shall be taken for capacitor selection to ensure stability of phase compensation from the point of Capacitance and ESR influence.

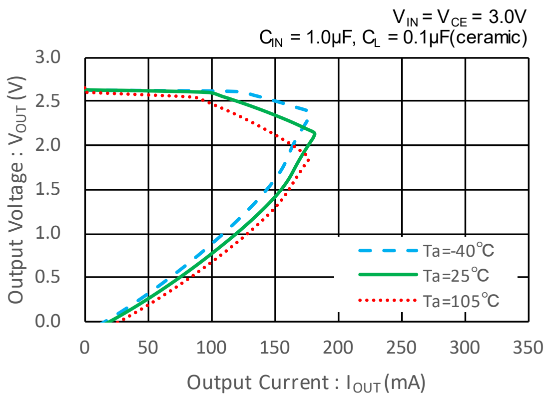
4) This IC supports a secondary battery that is compliant to CV charging .
When charging a battery with an internal resistance of several Ω or less as well as a large battery capacity, the charging current may increase and the junction temperature may exceed the absolute maximum rating.
By inserting a limiting resistor between the V_{OUT} and the secondary battery, it is possible to reduce the charging current and suppress the rise in junction temperature.
Adjust the charging current with a limiting resistor, etc. so that the junction temperature does not exceed the absolute maximum rating.

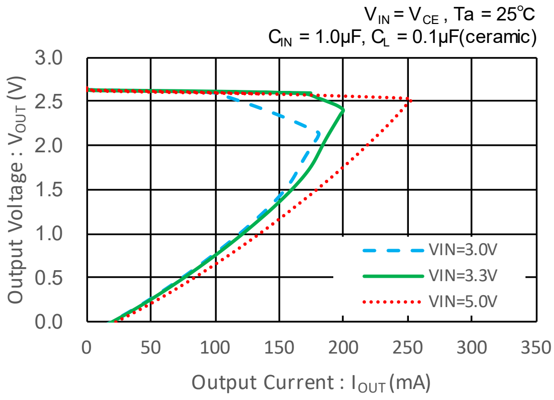


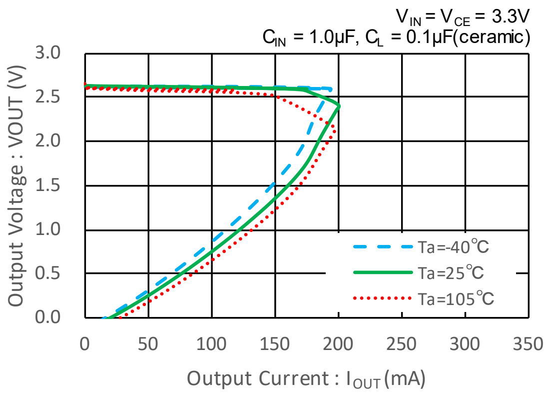
5) Torex places an importance on improving our products and its reliability. However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

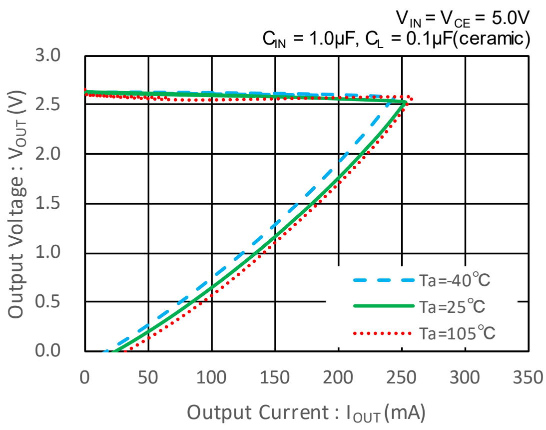
■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current



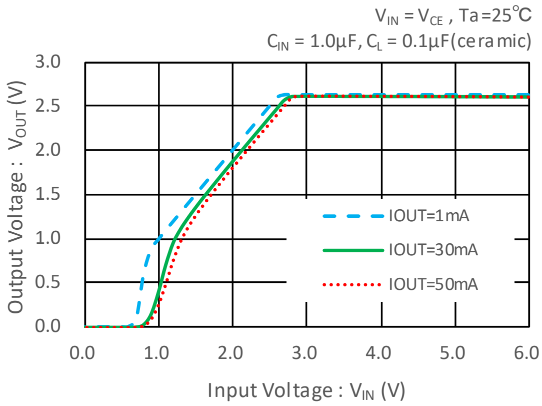


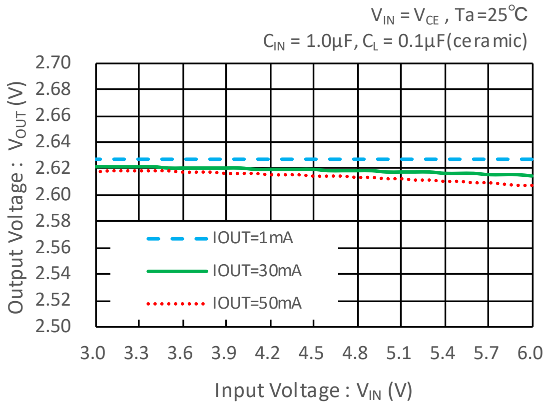




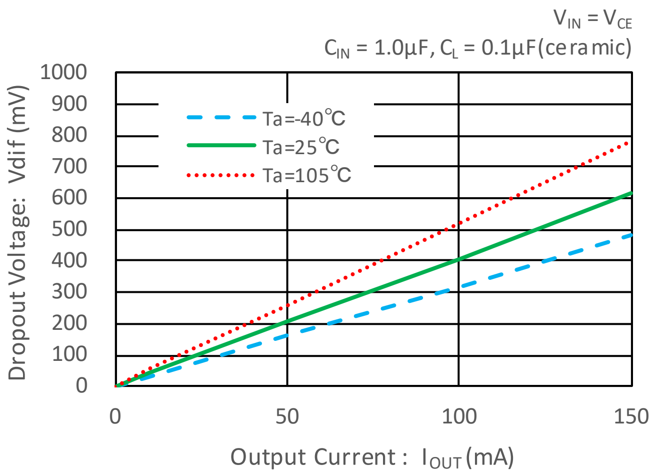
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(2) Output Voltage vs. Input Voltage

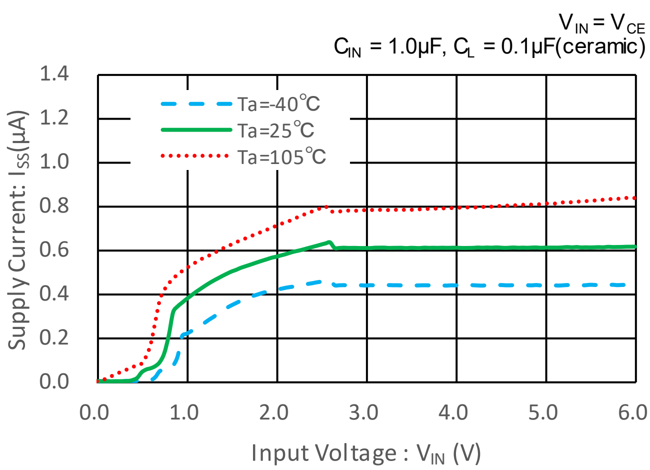




(3) Dropout Voltage vs. Output Current

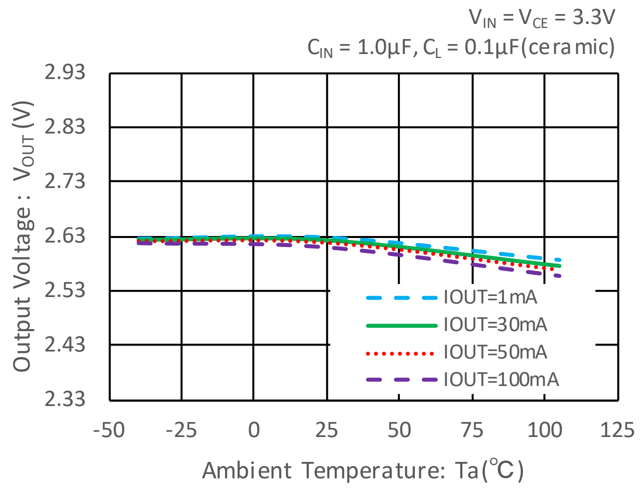


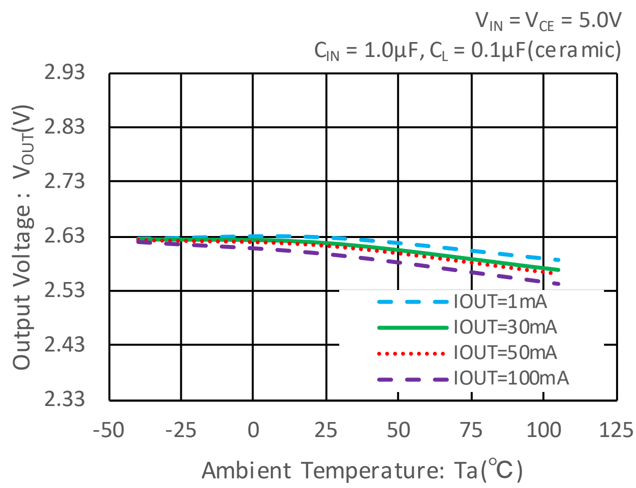
(4) Supply Current vs. Input Voltage



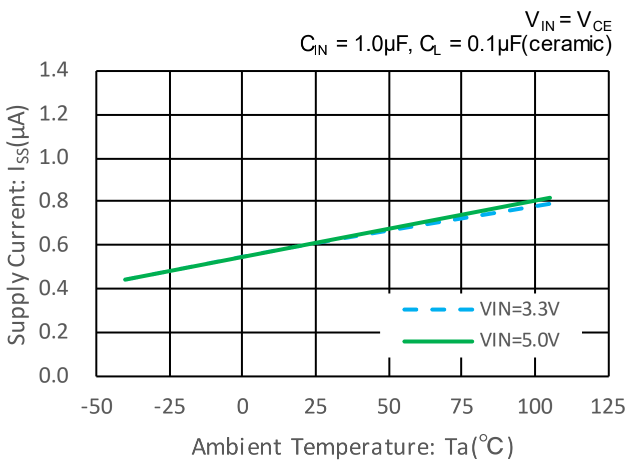
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Output Voltage vs. Ambient Temperature

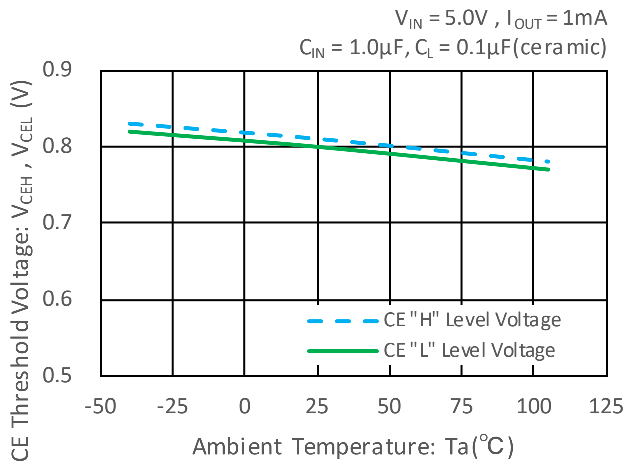




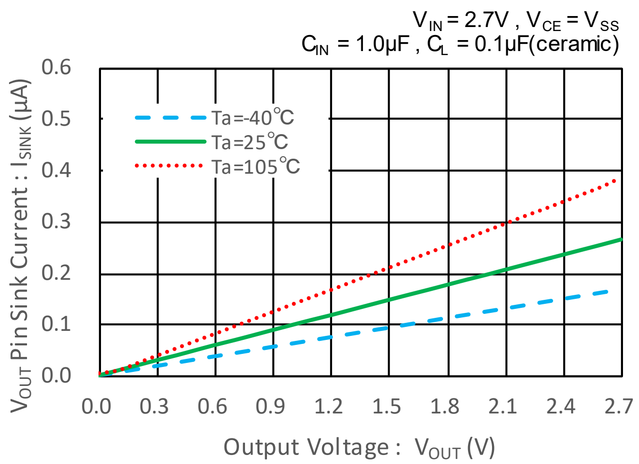
(6) Supply Current vs. Ambient Temperature



(7) CE Threshold Voltage vs. Ambient Temperature

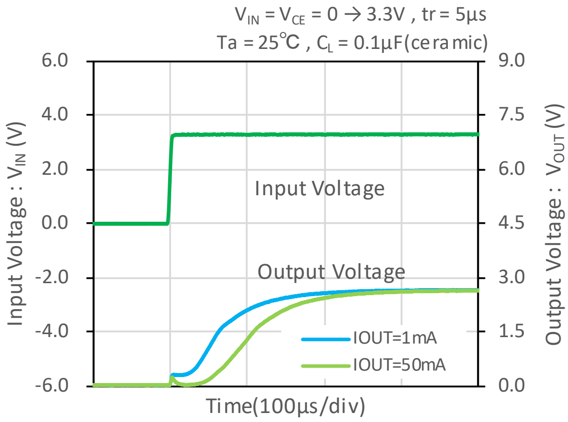


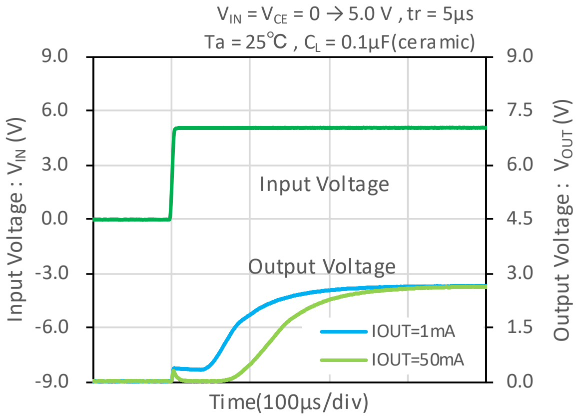
(8) VOUT Pin Sink Current vs. Output Voltage



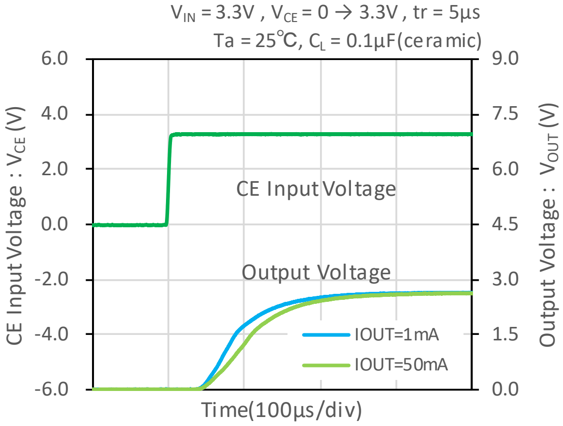
■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

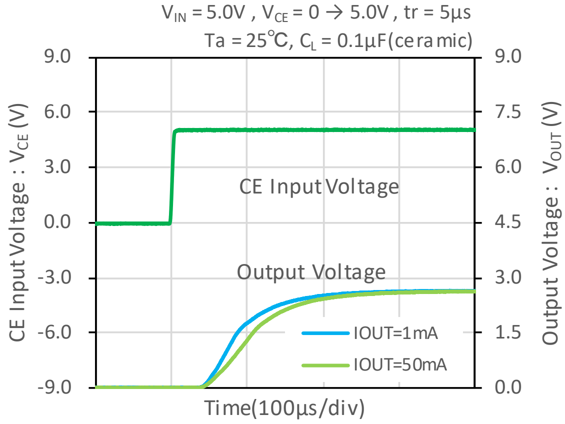
(9) Turn-On Response





(10) CE Transient Response





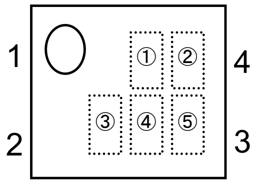
■PACKAGING INFORMATION

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

PACKAGE	OUTLINE / LAND PATTERN	THERMAL CHARACTERISTICS
USPN-4	USPN-4 PKG	USPN-4 Power Dissipation

■MARKING RULE

USPN-4



①represents product number

MARK	PRODUCT SERIES
P	XC6242*******-G

②represents type of regulator and output voltage range

MARK	Regulator type	OUTPUT VOLTAGE RANGE	PRODUCT SERIES
A	CE High active with no pull-down resistor	2.63V	XC6242A263**-G

③represents output voltage

MARK	OUTPUT VOLTAGE(V)
U	2.63

④,⑤ represents production lot number. 01～09、0A～0Z、11･･･9Z、A1～A9、AA･･･Z9、ZA～ZZ in order.
(G, I, J, O, Q, W excepted) *No character inversion used.

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

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

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

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

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

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

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

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

9.

TOREX SEMICONDUCTOR LTD.