# XC6506 Series

ETR03126-001a

Ultra-Low Supply Current Voltage Regulator (with Stand-by Function)

## ■GENERAL DESCRIPTION

The XC6506 series are positive voltage LDO regulators manufactured using CMOS processes. The series achieves Ultra low supply current, 0.8μA and consists of a reference voltage source, an error amplifier, a current fold-back circuit, and a phase compensation circuit plus a driver transistor.

The series is also compatible with low ESR ceramic capacitors, which give added output stability.

The current limiter's fold-back circuit also operates as a short protect for the output current limiter and the output pin.

Furthermore, the CE function allows the output of the regulator to be turned off, resulting in greatly reduced power consumption.

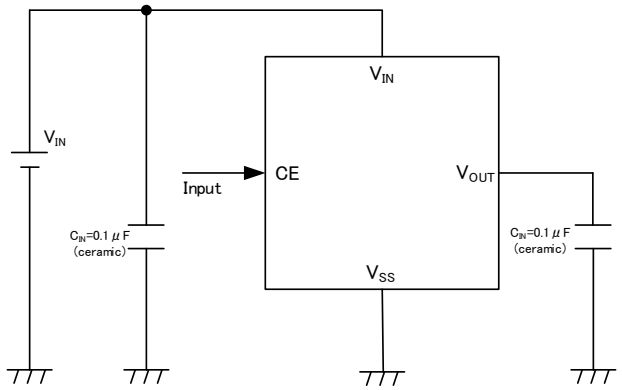
## ■APPLICATIONS

- IoT devices
- Smart cards

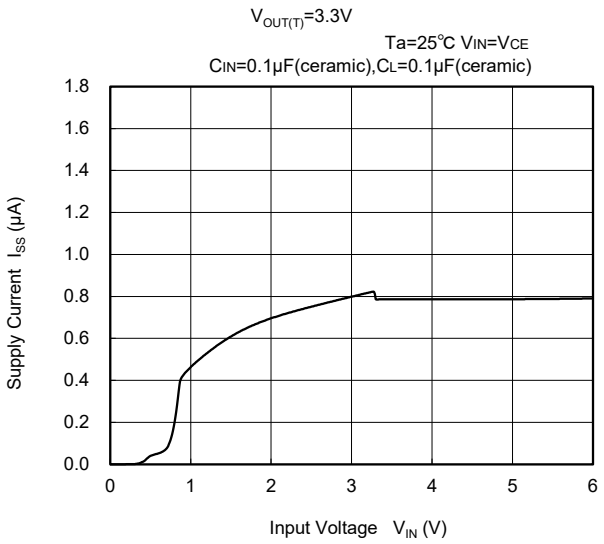
## ■FEATURES

| | |
|---|---|
| Operating Voltage Range | : 1.5V ~ 6.0V |
| Output Voltage | : 1.2V ~ 5.0V (0.1V increments) |
| Output Accuracy | : ±30mV ($V_{OUT}$≦1.5V)<br>±2.0% (1.5V＜$V_{OUT}$) |
| Maximum Output Current | : 150mA (300mA Limit) |
| Dropout Voltage | : 360mV@ $I_{OUT}$=100mA<br>($V_{OUT}$=3.3V) |
| Low Power Consumption | : 0.8μA |
| Stand-by Current | : 0.01μA |
| Protection function | : Current Limit |
| Low ESR Capacitor Compatible | : Ceramic capacitor |
| Operating Temperature Range | : -40℃ ~ 105℃ |
| Packages | : USPN-4 (0.90 x 1.20 x 0.40mm) |
| Environmentally Friendly | : EU RoHS Compliant, Pb Free |

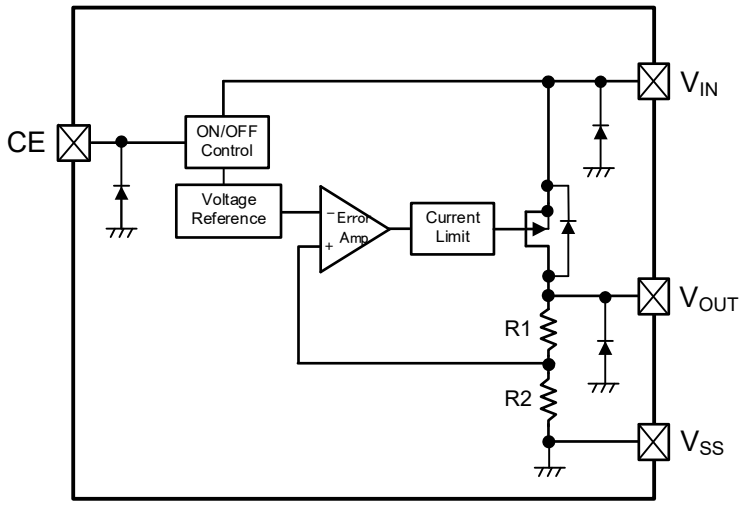
## ■TYPICAL APPLICATION CIRCUIT




## ■TYPICAL PERFORMANCE CHARACTERISTICS



## ■BLOCK DIAGRAMS




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

## ■PRODUCT CLASSIFICATION

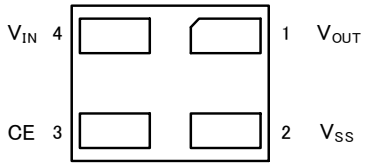
●Ordering Information

XC6506①②③④⑤⑥-⑦

| DESIGNATOR | ITEM | SYMBOL | DESCRIPTION |
|---|---|---|---|
| ① | Type | B | CE “H” Active |
| ②③ | Output Voltage | 12 ~ 50 | e.g. 3.3V → 33, 5.0V → 50 (0.1V increments) |
| ④ | Output Voltage Accuracy | 2 | ±2.0% (1.5V＜$V_{OUT}$≦5.0V)<br>±30mV (1.2V≦$V_{OUT}$≦1.5V ) |
| 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.

## ■PIN CONFIGURATION




USPN-4
(BOTTOM VIEW)

## ■PIN ASSIGNMENT

| PIN NUMBER | PIN NAME | FUNCTIONS |
|---|---|---|
| USPN-4 | | |
| 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 | $V_{OUT(E)}$(*2) | $I_{OUT}$=1mA | | | E-0 | | V | ① |
| Maximum Output Current | $I_{OUTMAX}$ | $V_{OUT(T)}$≦2.4V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+2.0V | | 150 | - | - | mA | ① |
| | | $V_{OUT(T)}$≧2.5V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+1.0V | | | | | | |
| Load Regulation | $\Delta V_{OUT}$ | $V_{OUT(T)}$≦1.3V<br>1mA≦$I_{OUT}$≦80mA | | - | 15 | 70 | mV | ① |
| | | $V_{OUT(T)}$≧1.4V<br>1mA≦$I_{OUT}$≦100mA | | | | | | |
| Dropout Voltage | Vdif (*3) | $V_{OUT(T)}$≦1.3V<br>$V_{CE}$=$V_{IN}$ , $I_{OUT}$=80mA | | | E-1 | | mV | ① |
| | | $V_{OUT(T)}$≧1.4V<br>$V_{CE}$=$V_{IN}$ , $I_{OUT}$=100mA | | | | | | |
| Supply Current | $I_{SS}$ | $V_{OUT(T)}$≦3.9V | | - | 0.8 | 1.5 | μA | ② |
| | | $V_{OUT(T)}$≧4.0V | | - | 1.0 | 2.1 | | |
| Stand-by Current | $I_{STB}$ | $V_{IN}$=6.0V , $V_{CE}$=$V_{SS}$ | | - | 0.01 | 0.10 | μA | ② |
| Line Regulation | $\Delta V_{OUT}$/ ($\Delta V_{IN}$・$V_{OUT}$) | $V_{OUT(T)}$=1.2V , $V_{CE}$=$V_{IN}$<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=1mA | | - | 0.05 | 0.15 | %/V | ① |
| | | $V_{OUT(T)}$≧1.3V , $V_{CE}$=$V_{IN}$<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=30mA | | - | 0.05 | 0.15 | %/V | ① |
| Output Voltage Temperature Characteristics | $\Delta V_{OUT}$/ ($\Delta$Topr・$V_{OUT}$) | $V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+1.0V<br>$I_{OUT}$=30mA<br>-40℃≦Topr≦105℃ | | - | ±100 | - | ppm/℃ | ① |
| Limit Current | $I_{LIM}$ | $V_{OUT(T)}$≦2.4V<br>$V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+2.0V | | 150 | 260 | - | mA | ① |
| | | $V_{OUT(T)}$≧2.5V<br>$V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+1.0V | | 150 | 260 | - | | |
| Short Circuit Current | $I_{SHORT}$ | $V_{OUT}$=0V | | - | 30 | - | mA | ① |
| CE "H" Voltage | $V_{CEH}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V | Ta=25℃ | 1.0 | - | 6.0 | V | ③ |
| | | | -40℃≦Ta≦105℃(*4) | | | | | |
| CE "L" Voltage | $V_{CEL}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V | Ta=25℃ | $V_{SS}$ | - | 0.3 | V | ③ |
| | | | -40℃≦Ta≦105℃(*4) | | | | | |
| CE "H" Current | $I_{CEH}$ | $V_{IN}$=$V_{CE}$=6.0V | | - | 0.0 | 0.1 | μA | ② |
| CE "L" Current | $I_{CEL}$ | $V_{IN}$=6.0V<br>$V_{CE}$=$V_{SS}$ | | - | 0.0 | 0.1 | μA | ② |

Unless otherwise stated, $V_{IN}$=$V_{CE}$=$V_{OUT}$+1.0V,

(*1) $V_{OUT(T)}$: Fixed output voltage

(*2) $V_{OUT(E)}$: Effective output voltage

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

(*3) Vdif = { $V_{IN1}$ – $V_{OUT1}$ }

$V_{IN1}$ : The input voltage when $V_{OUT1}$ appears as input voltage is gradually decreased.

$V_{OUT1}$ : 98% of the output voltage when $V_{IN}$ is input after stabilizing sufficiently at $I_{OUT}$ {$V_{OUT(T)}$+1.0V}.

(*4) The ambient temperature range (-40℃≦Ta≦105℃) is design Value.

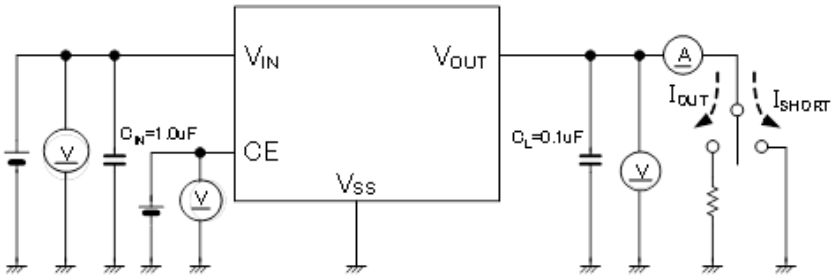
## ■ELECTRICAL CHARACTERISTICS

Voltage Chart

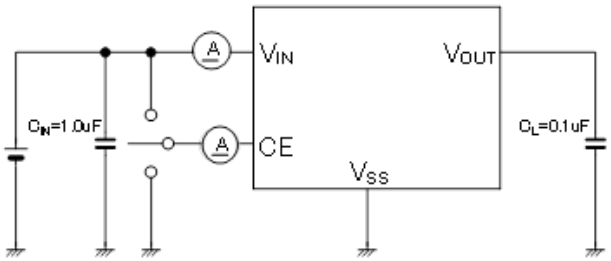
| NOMINAL OUTPUT VOLTAGE(V) | E-0 | | E-1 | |
|---|---|---|---|---|
| | OUTPUT VOLTAGE $V_{OUT(E)}$ (V) | | DROPOUT VOLTAGE Vdif (mV) | |
| $V_{OUT(T)}$ | MIN. | MAX. | TYP. | MAX. |
| 1.2 | 1.170 | 1.230 | 910 | 1130 |
| 1.3 | 1.270 | 1.330 | | |
| 1.4 | 1.370 | 1.430 | | |
| 1.5 | 1.470 | 1.530 | 800 | 1010 |
| 1.6 | 1.568 | 1.632 | | |
| 1.7 | 1.666 | 1.734 | | |
| 1.8 | 1.764 | 1.836 | 710 | 910 |
| 1.9 | 1.862 | 1.938 | | |
| 2.0 | 1.960 | 2.040 | | |
| 2.1 | 2.058 | 2.142 | | |
| 2.2 | 2.156 | 2.244 | | |
| 2.3 | 2.254 | 2.346 | | |
| 2.4 | 2.352 | 2.448 | | |
| 2.5 | 2.450 | 2.550 | 510 | 660 |
| 2.6 | 2.548 | 2.652 | | |
| 2.7 | 2.646 | 2.754 | | |
| 2.8 | 2.744 | 2.856 | | |
| 2.9 | 2.842 | 2.958 | | |
| 3.0 | 2.940 | 3.060 | 360 | 480 |
| 3.1 | 3.038 | 3.162 | | |
| 3.2 | 3.136 | 3.264 | | |
| 3.3 | 3.234 | 3.366 | | |
| 3.4 | 3.332 | 3.468 | | |
| 3.5 | 3.430 | 3.570 | | |
| 3.6 | 3.528 | 3.672 | | |
| 3.7 | 3.626 | 3.774 | | |
| 3.8 | 3.724 | 3.876 | | |
| 3.9 | 3.822 | 3.978 | | |
| 4.0 | 3.920 | 4.080 | | |
| 4.1 | 4.018 | 4.182 | | |
| 4.2 | 4.116 | 4.284 | | |
| 4.3 | 4.214 | 4.386 | | |
| 4.4 | 4.312 | 4.488 | | |
| 4.5 | 4.410 | 4.590 | | |
| 4.6 | 4.508 | 4.692 | | |
| 4.7 | 4.606 | 4.794 | | |
| 4.8 | 4.704 | 4.896 | | |
| 4.9 | 4.802 | 4.998 | | |
| 5.0 | 4.900 | 5.100 | 260 | 350 |

■TEST CIRCUITS

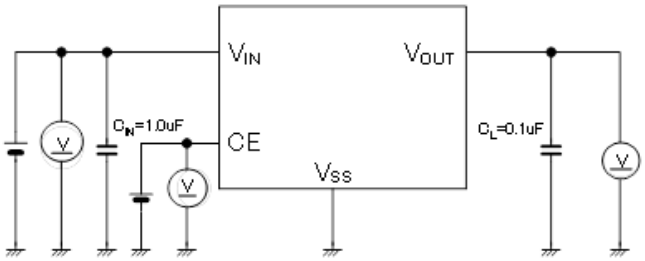
TEST CIRCUITS ①



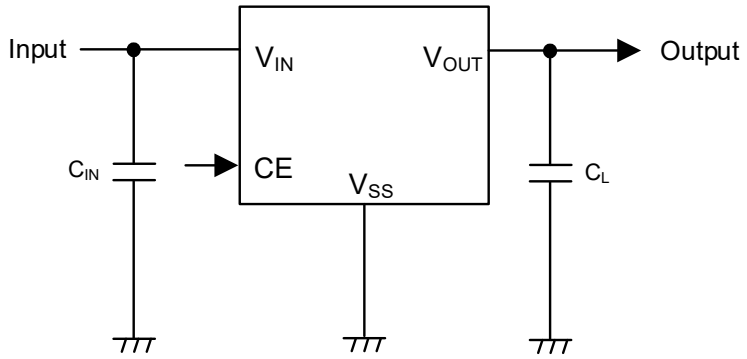

TEST CIRCUITS ②




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 |

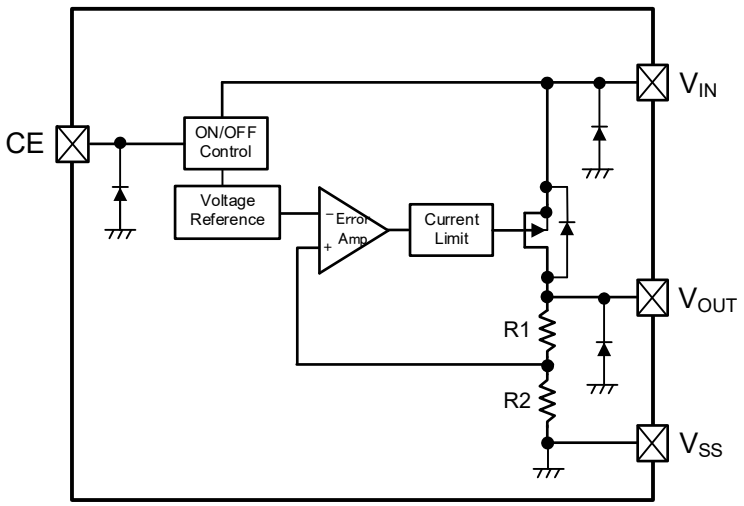
(*1) Some ceramic capacitors have an effective capacitance that is significantly lower than the nominal value due to the applied DC bias and ambient temperature.
For the input capacitance of this IC, use an appropriate ceramic capacitor according to the DC bias usage conditions (ambient temperature, 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 0.1μF 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 XC6506 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 IC's internal circuitry can be active or stand-by via the signal from the CE pin. In stand-by mode, output at the $V_{OUT}$ pin will be pulled down to the $V_{SS}$ level via R1 & 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.

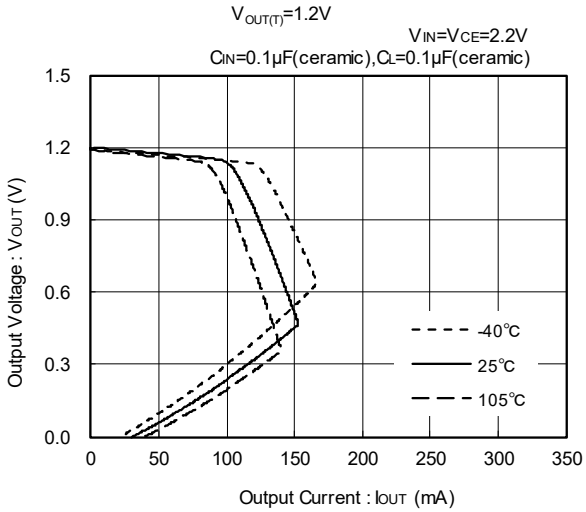
2) Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen $V_{IN}$ and $V_{SS}$ wiring in particular.

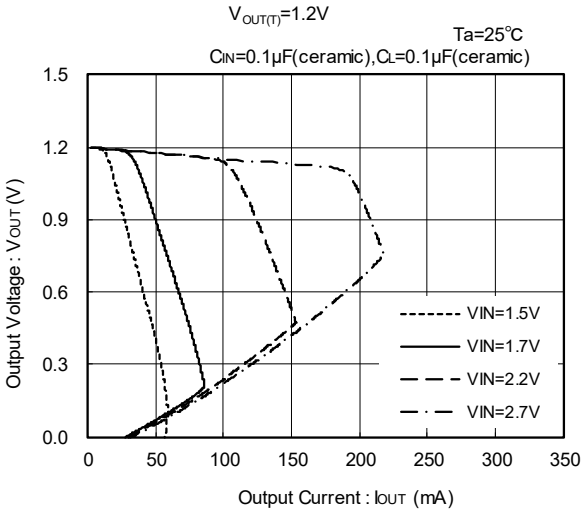
3) The input capacitor ($C_{IN}$) and the output capacitor ($C_L$) should be placed to the IC as close as possible. Capacitances of these capacitors ($C_{IN}$, $C_L$) are decreased by the influences of bias voltage and ambient temperature. Care shall be taken for capacitor selection to ensure stability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

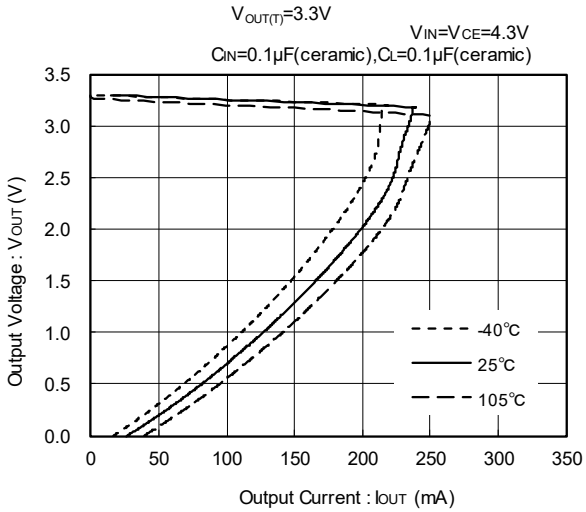
4) Torex places an importance on improving our products and its reliability. However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

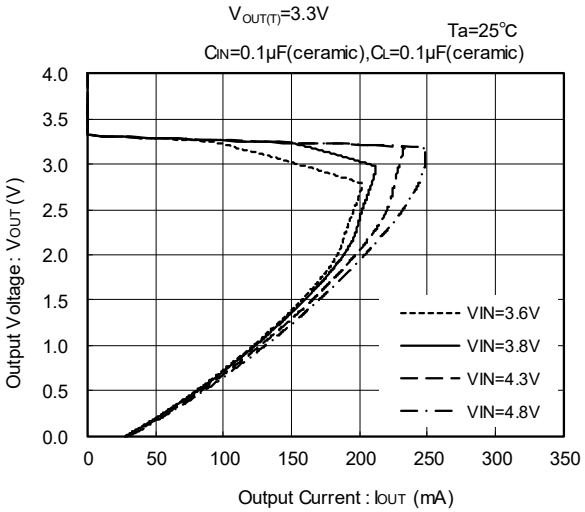
# ■ TYPICAL PERFORMANCE CHARACTERISTICS

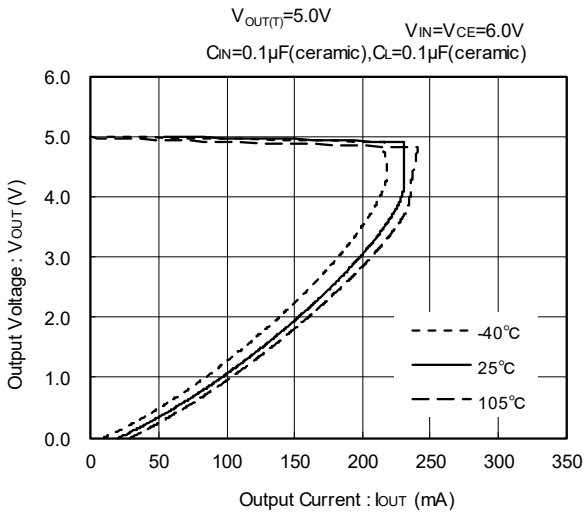
(1) Output Voltage vs. Output Current

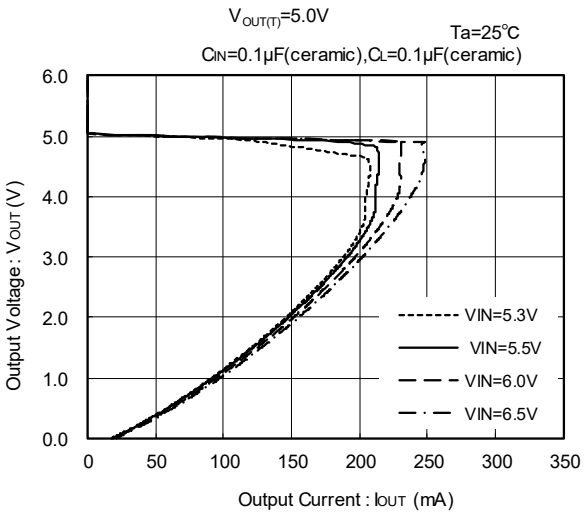


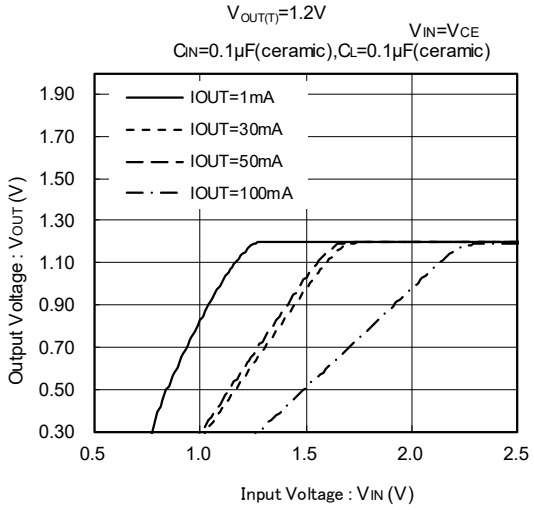



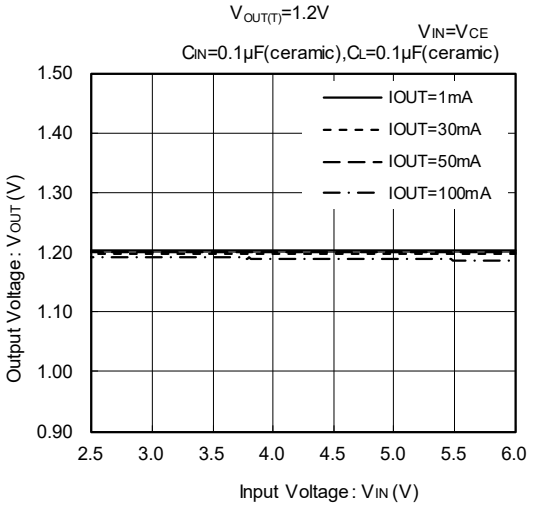



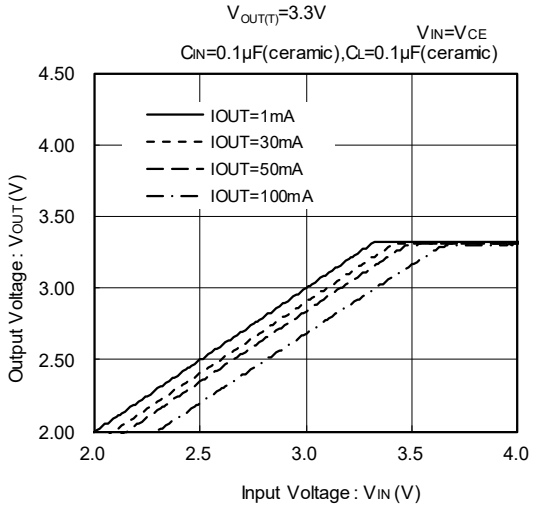



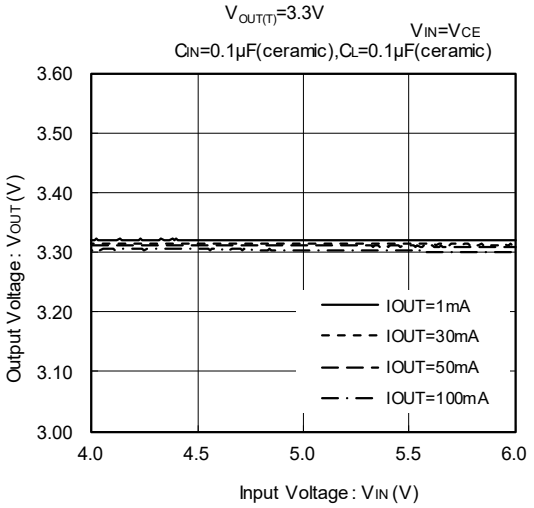
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

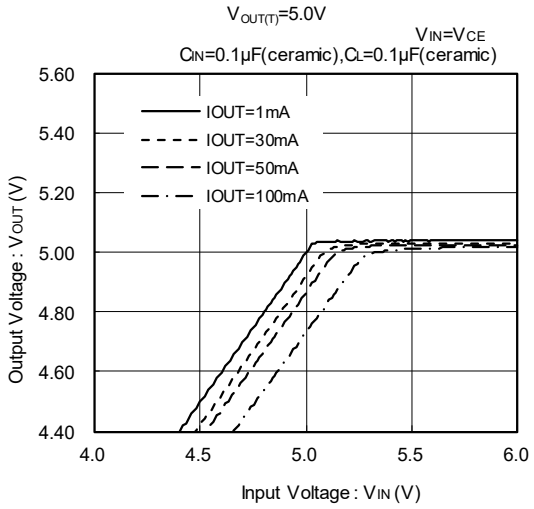
(2) Output Voltage vs. Input Voltage

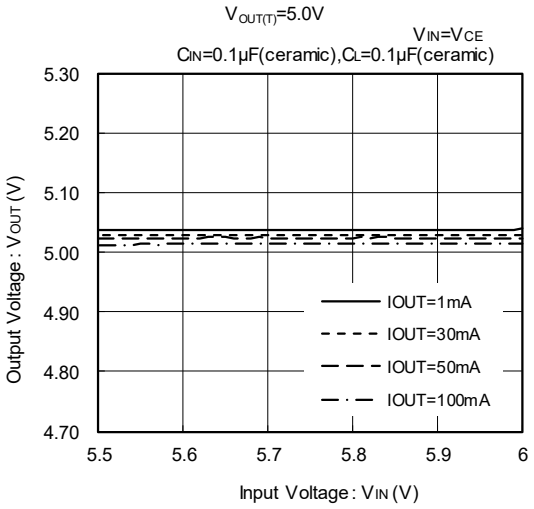


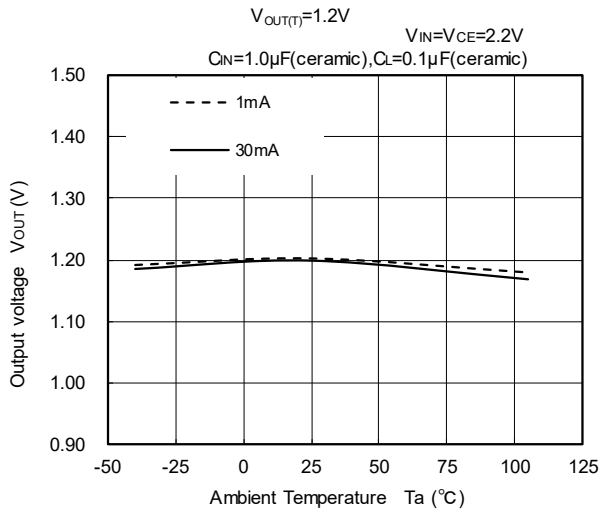



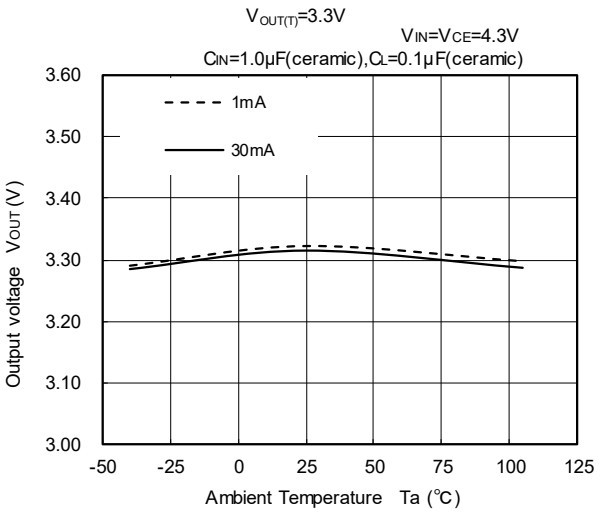



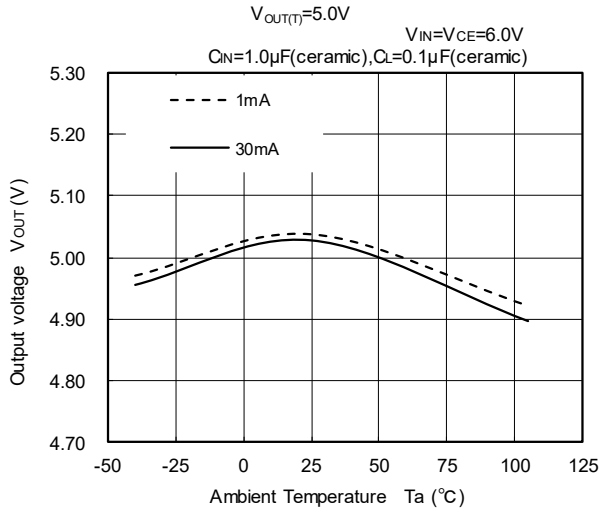



# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Output Voltage vs. Ambient Temperature

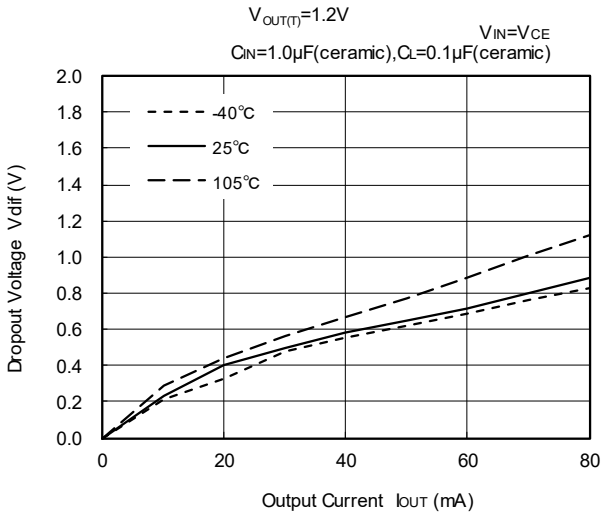


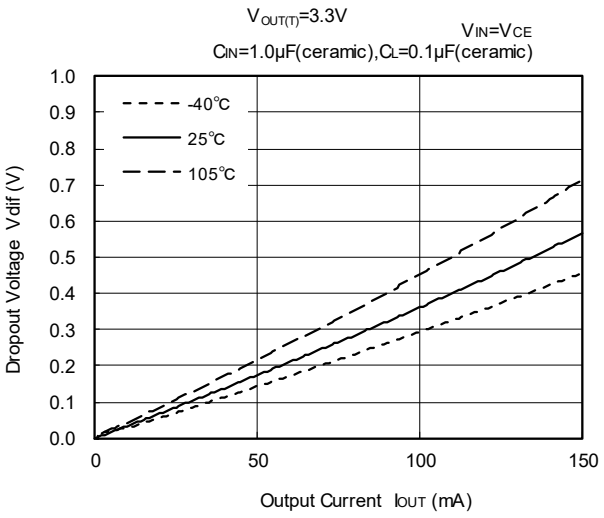



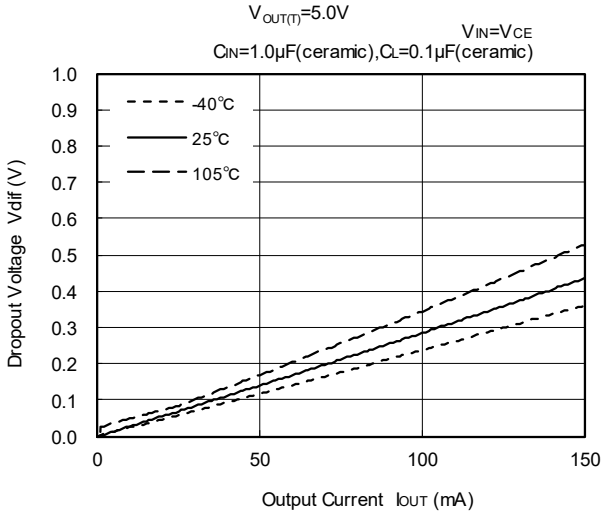



## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(4) Dropout Voltage vs. Output Current

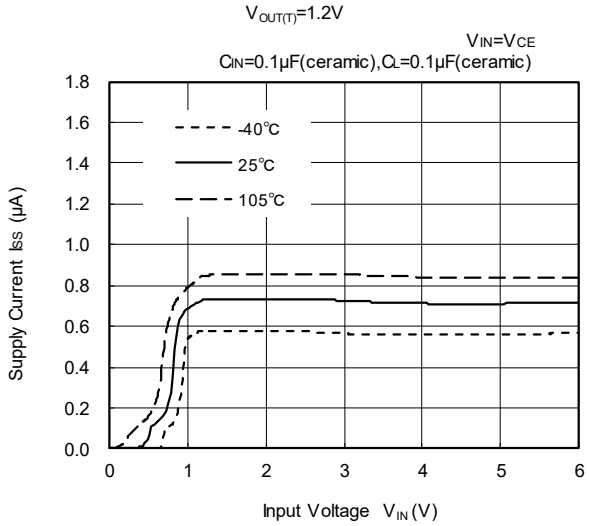


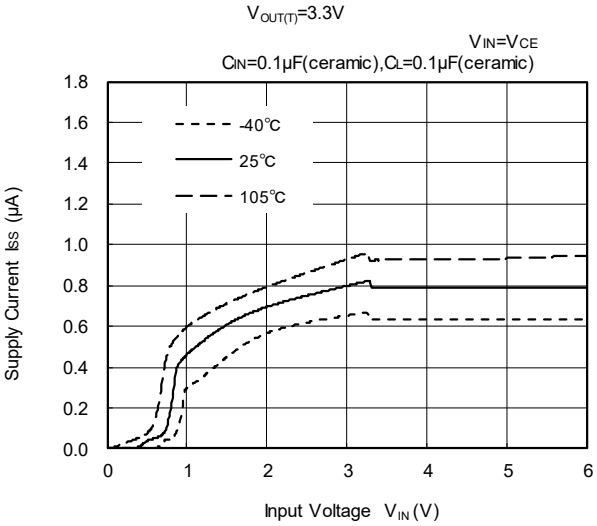



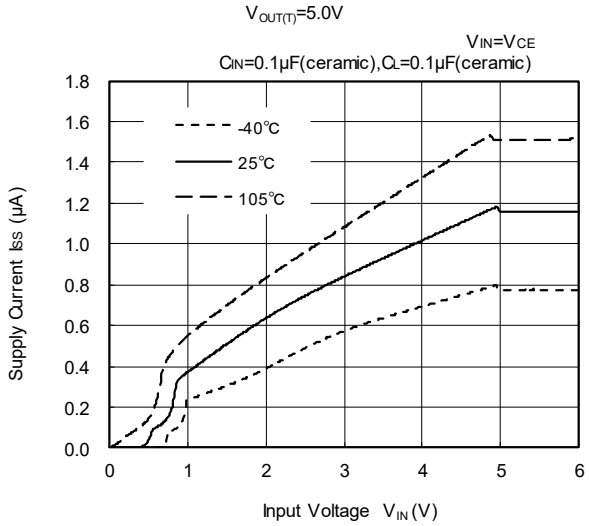



# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Supply Current vs. Input Voltage

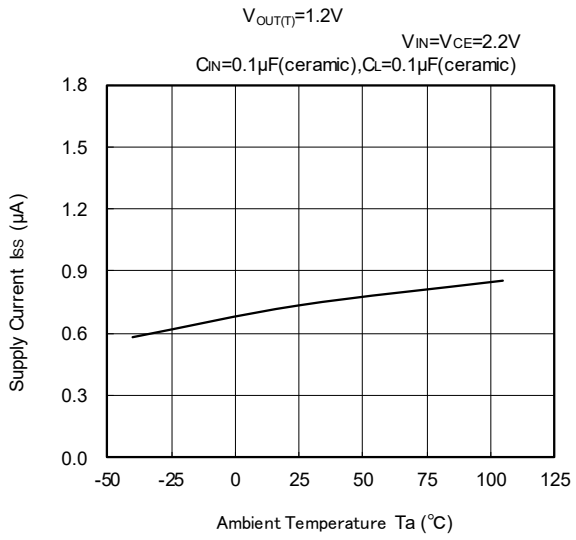


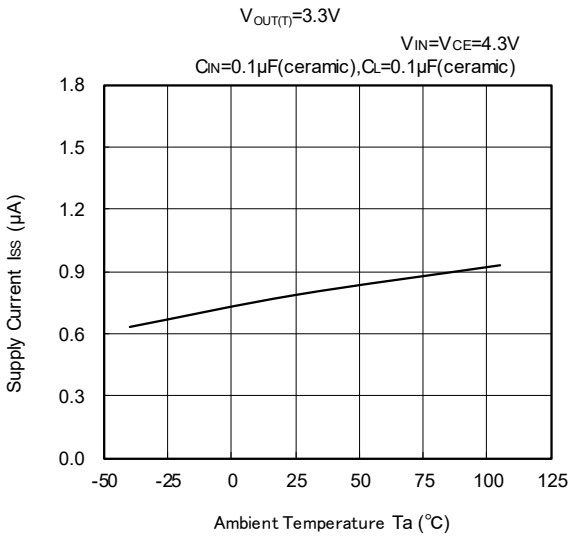



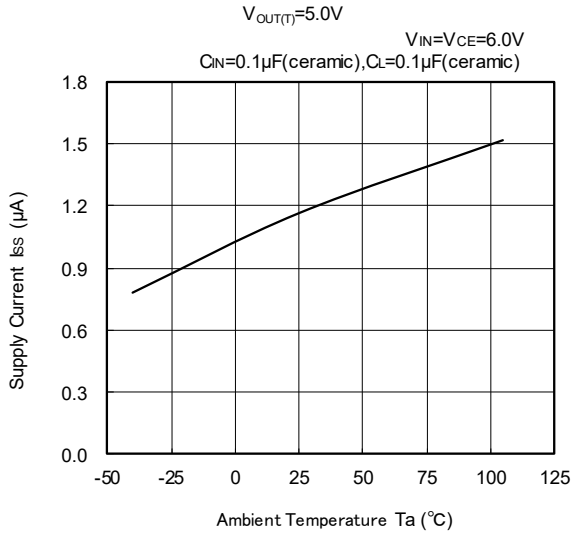



## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(6) Supply Current vs. Ambient Temperature

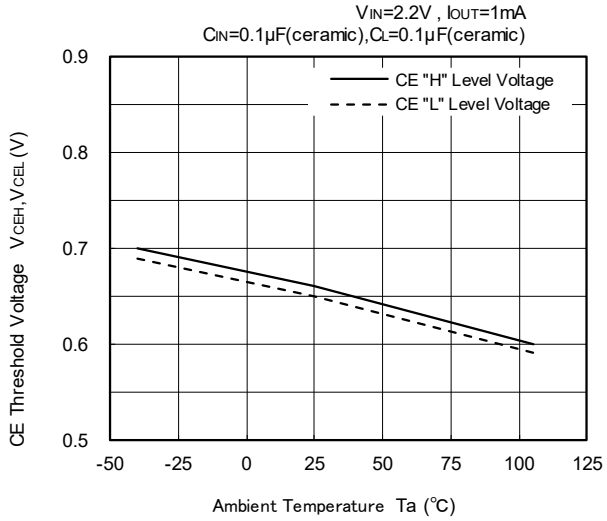


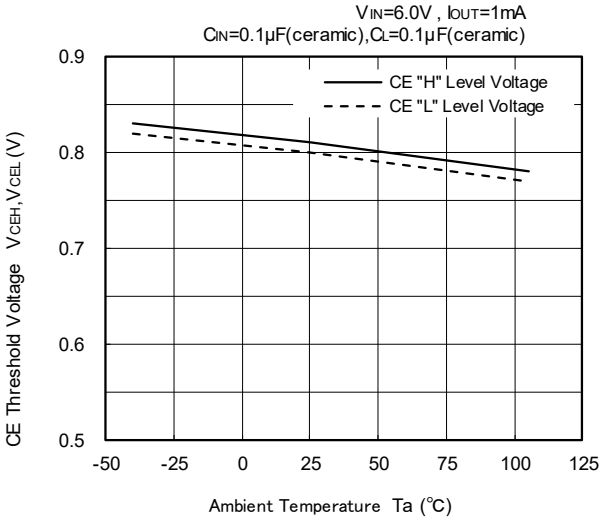



# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

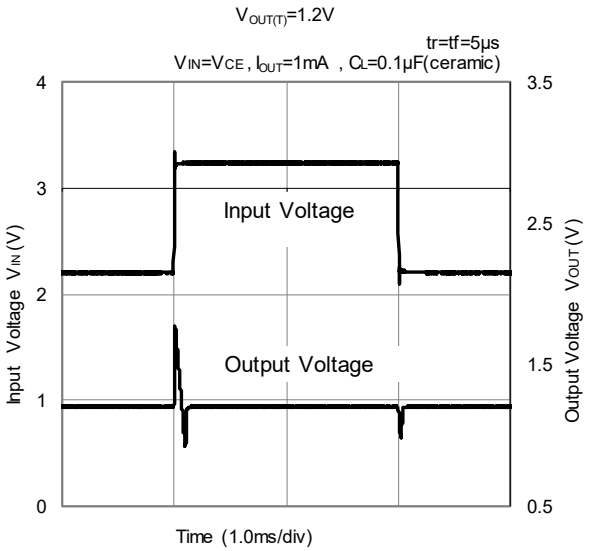
(7) CE Threshold Voltage vs. Ambient Temperature

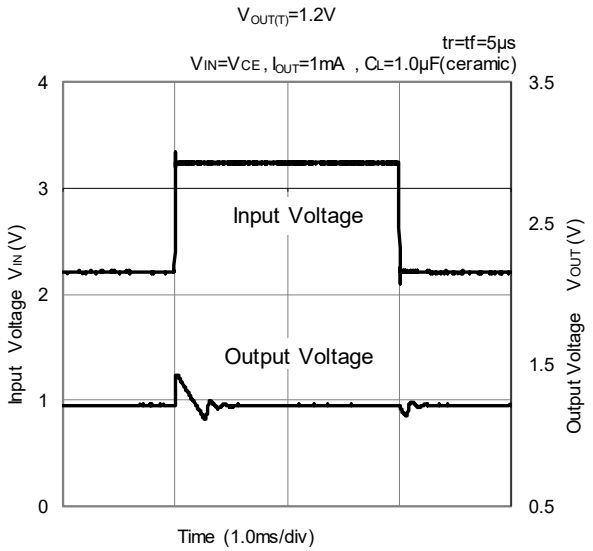


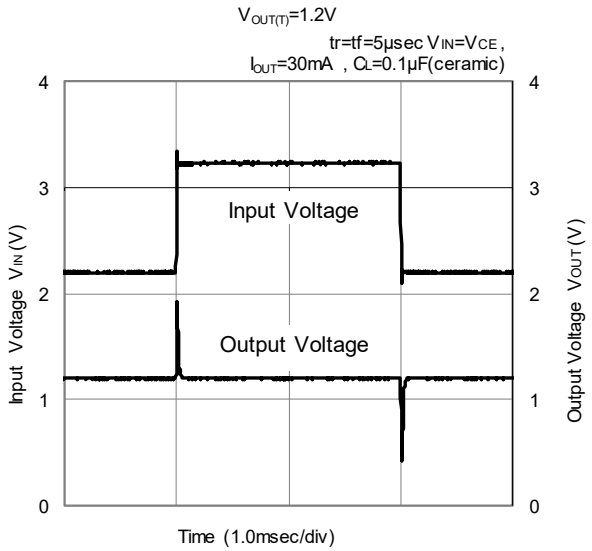



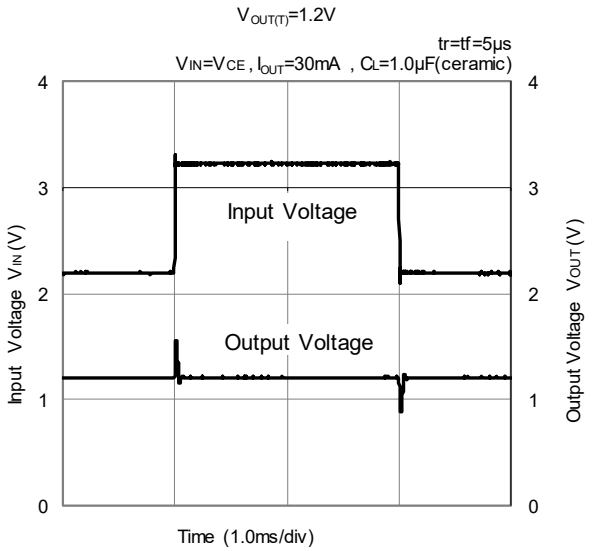
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

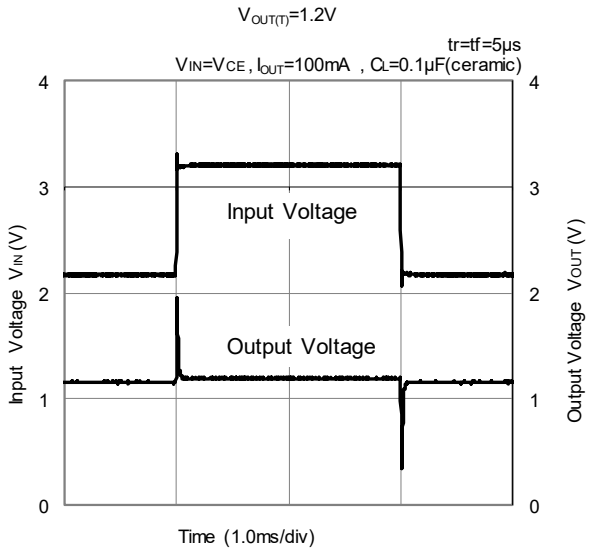
(8) Input Transient Response

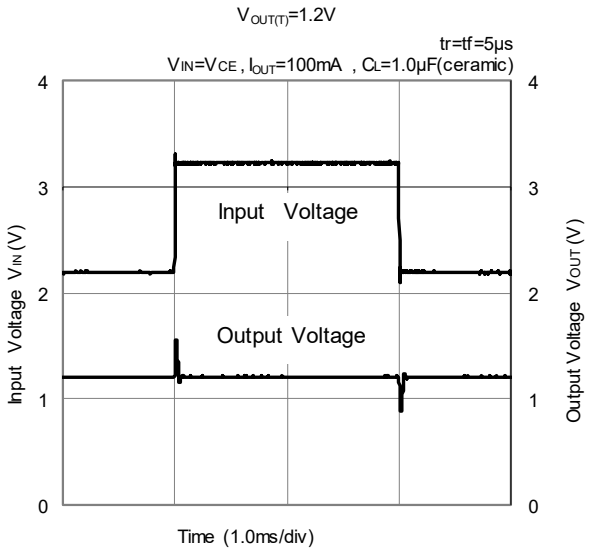


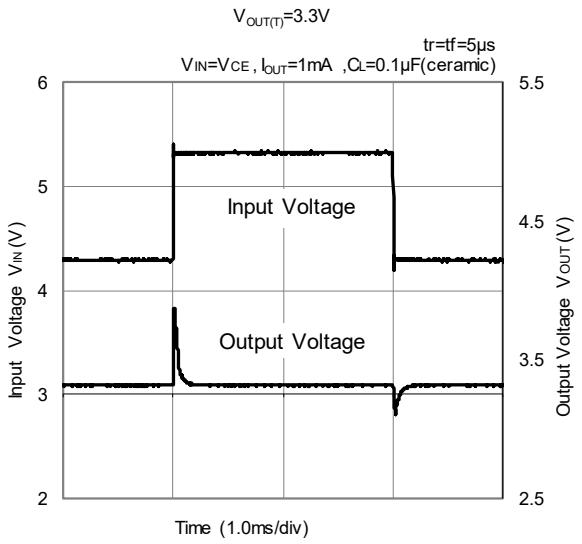



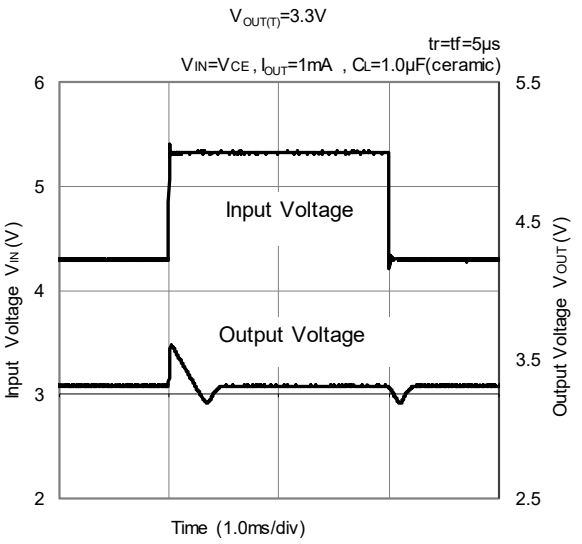



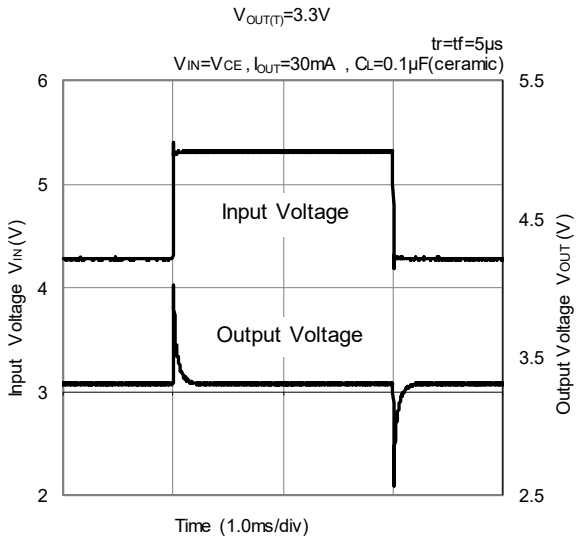



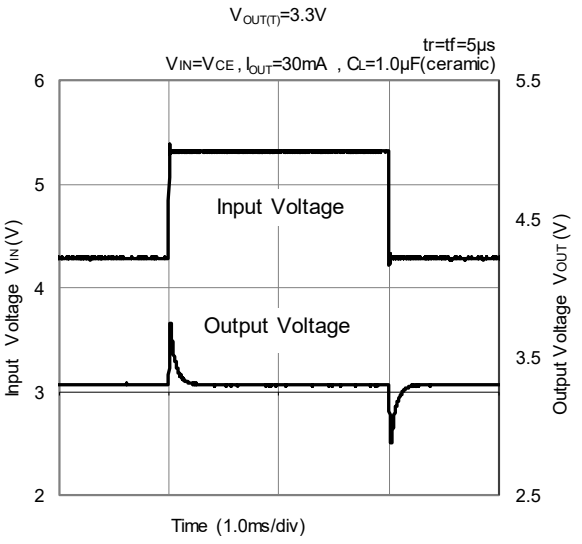
# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

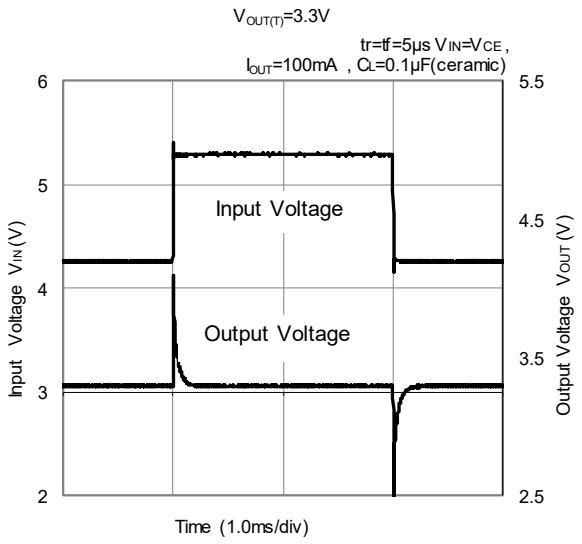
(8) Input Transient Response

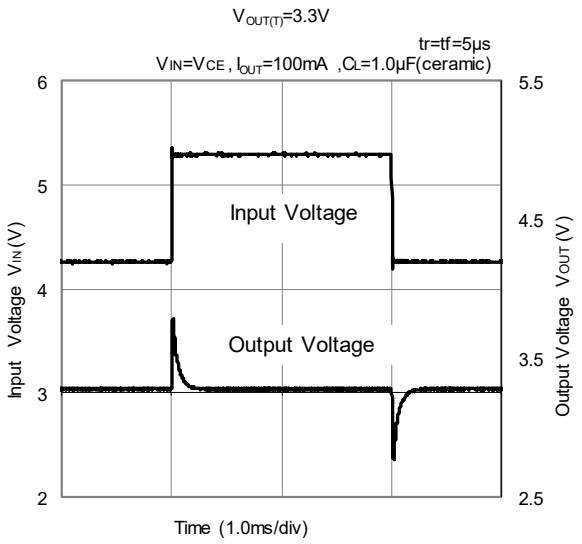


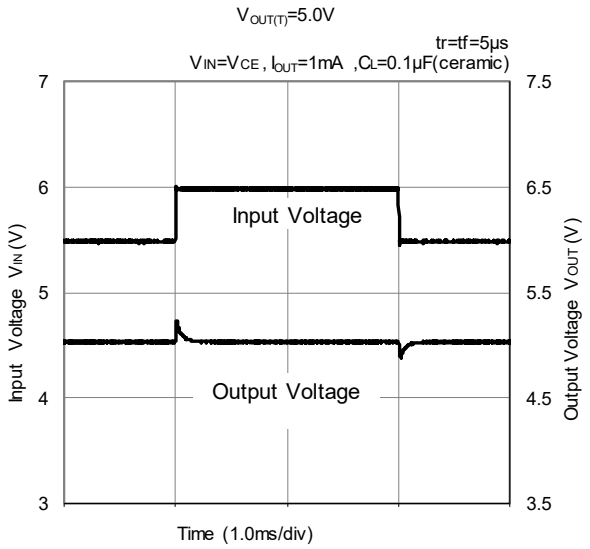



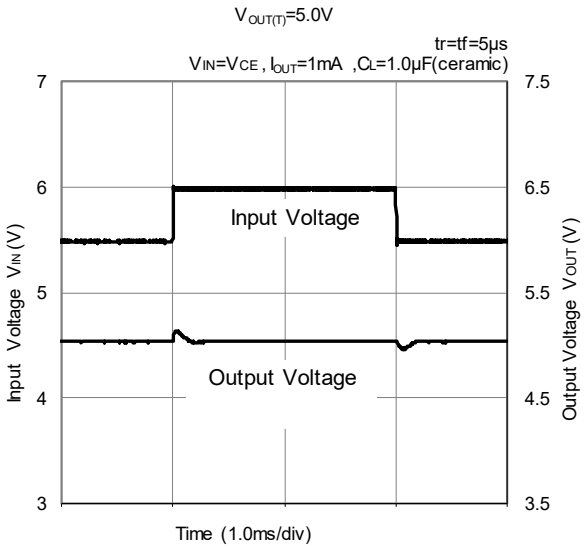



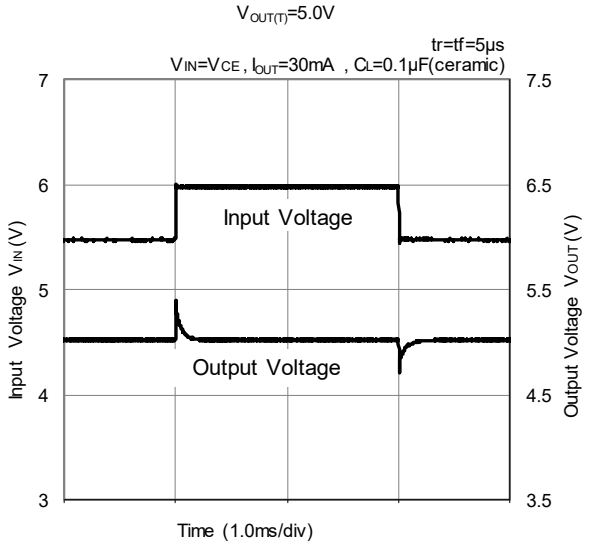



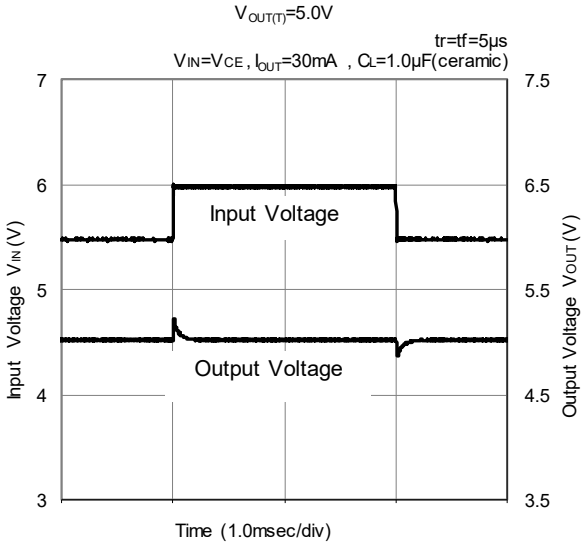
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

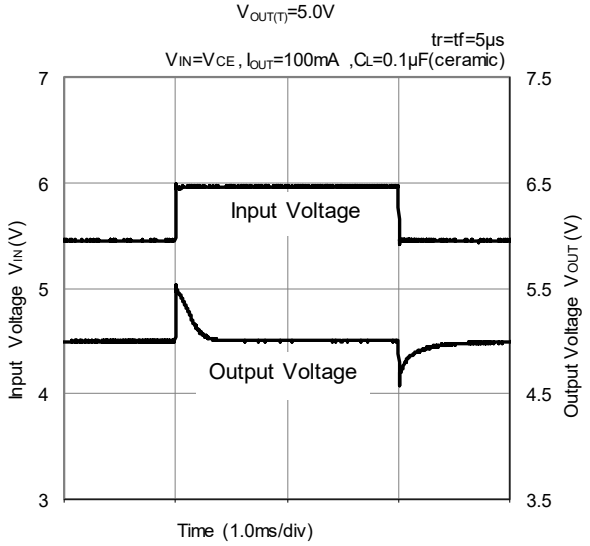
(8) Input Transient Response

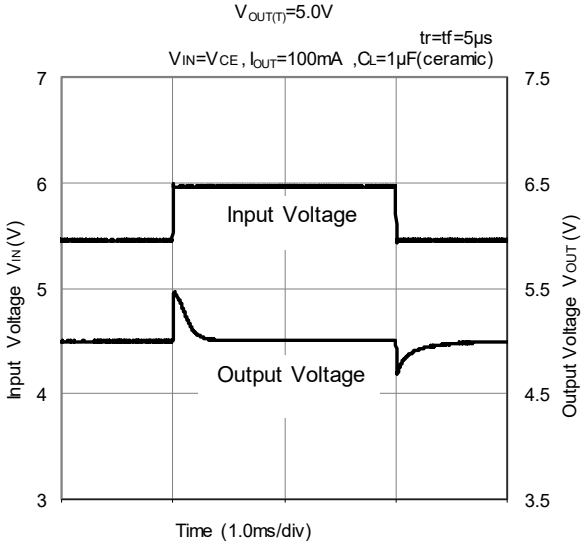


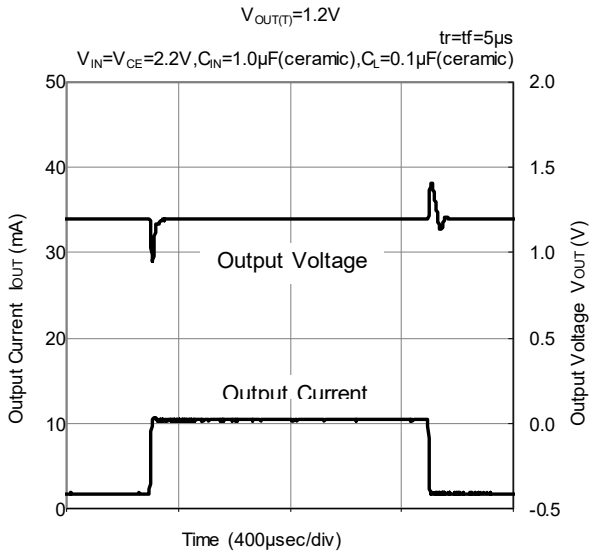



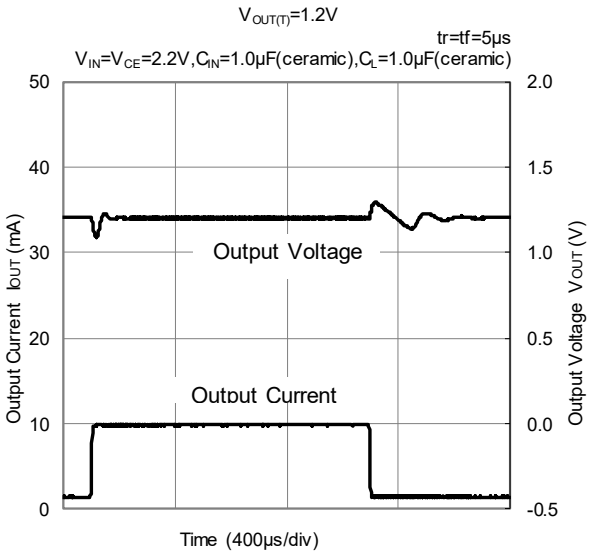



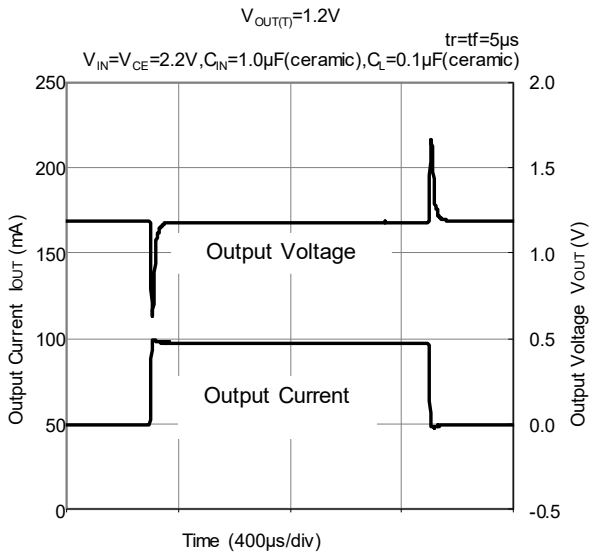



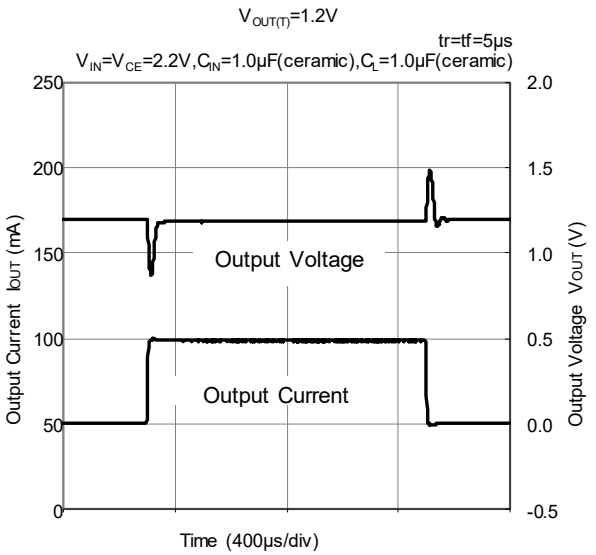
# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response



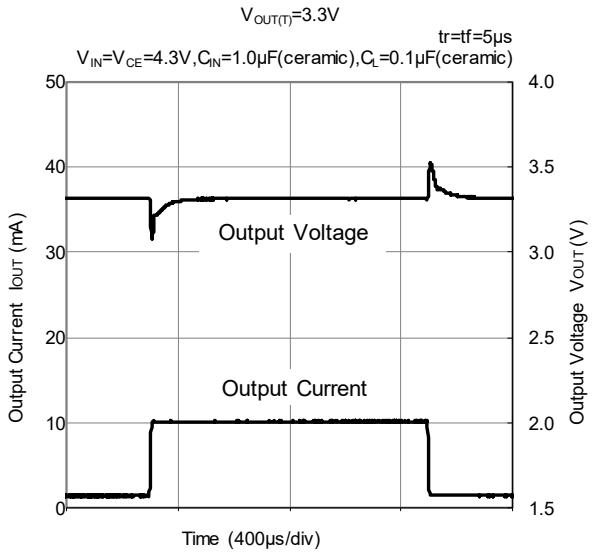



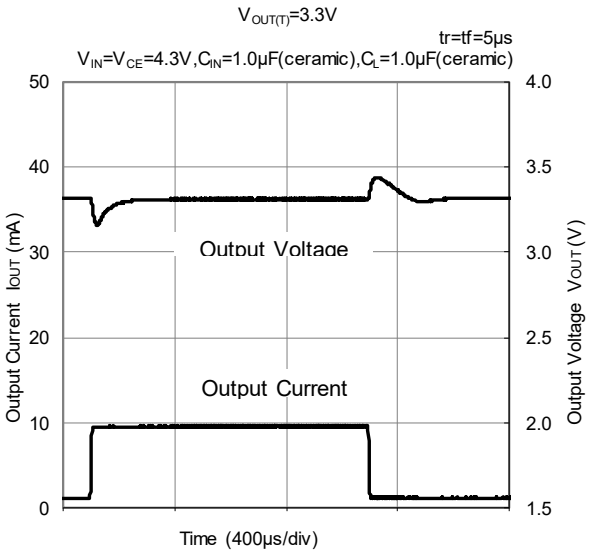



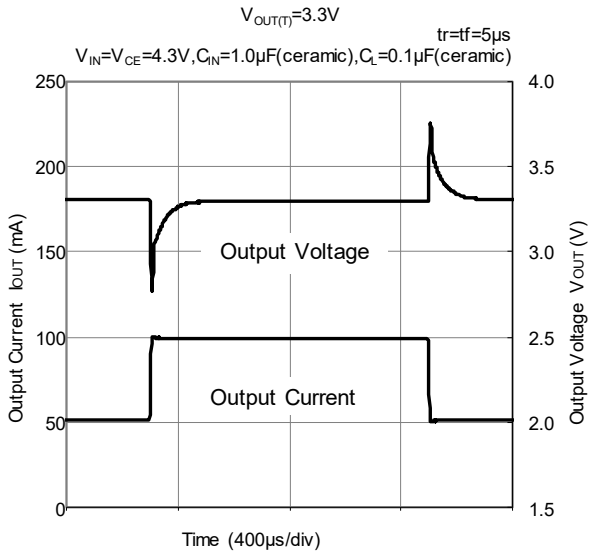



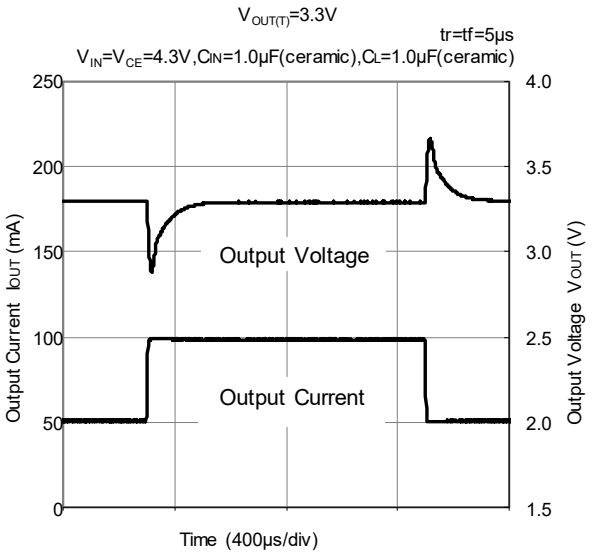
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response



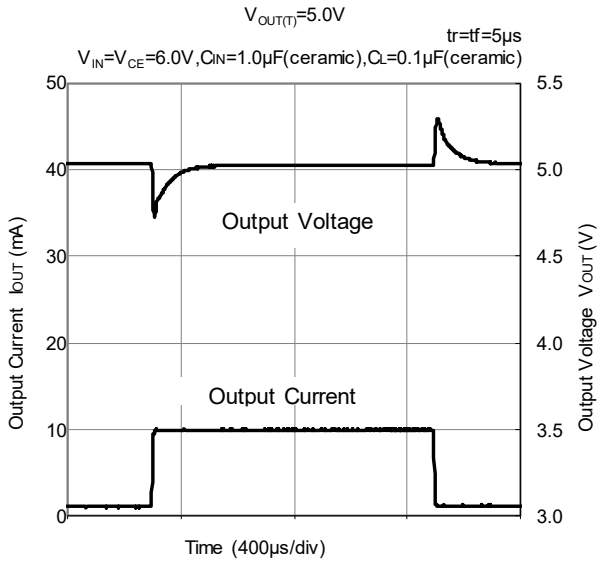



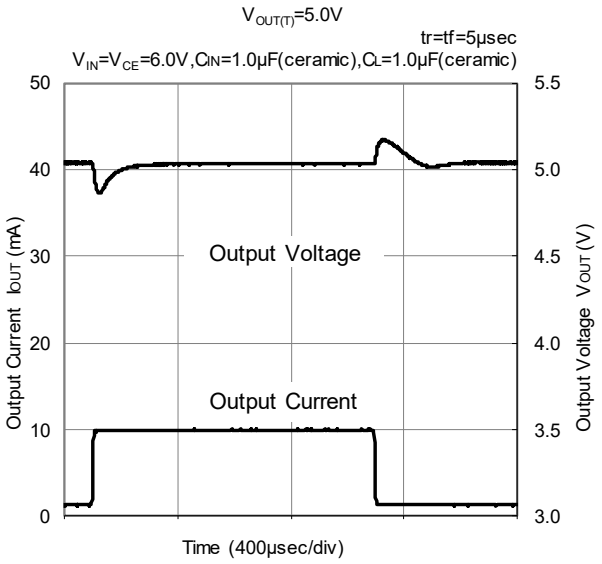



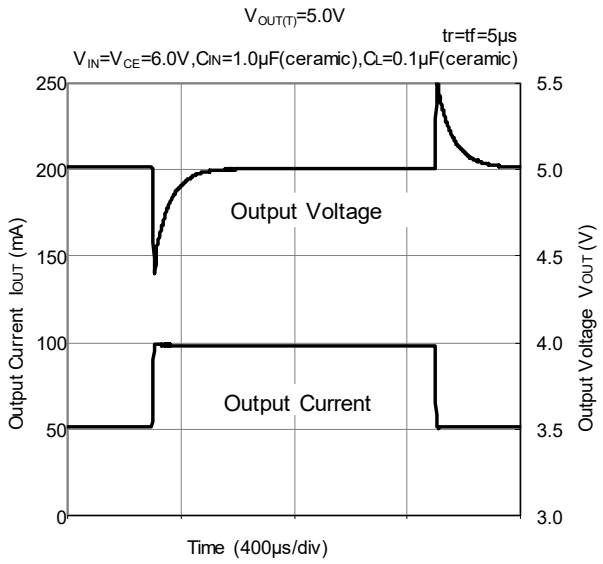



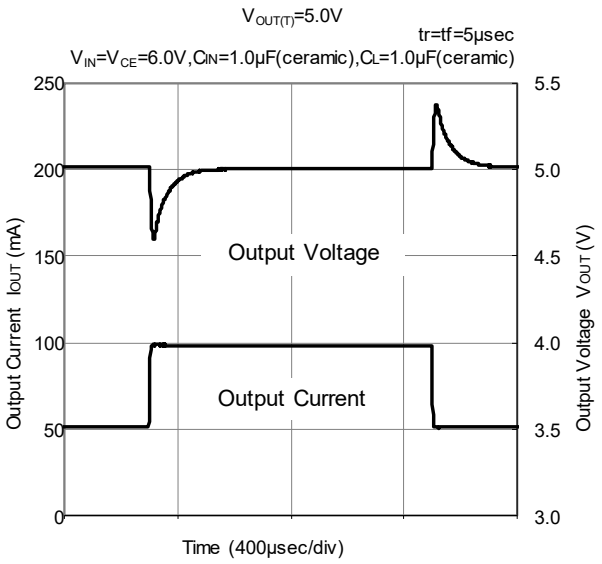
# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response



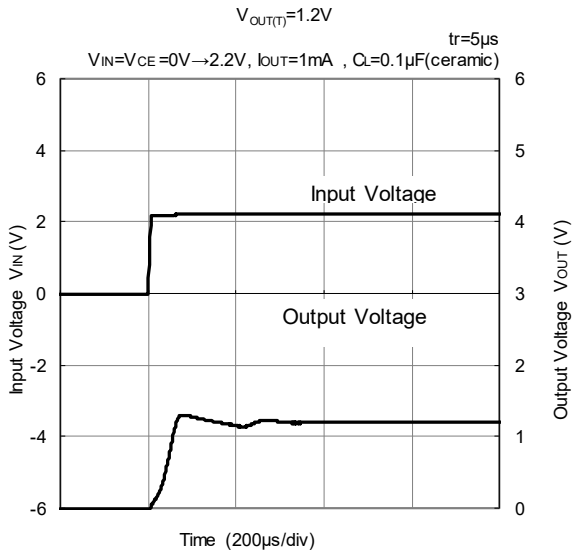



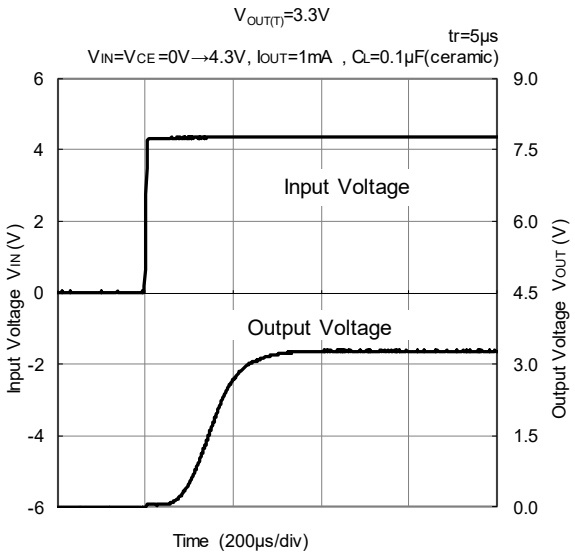



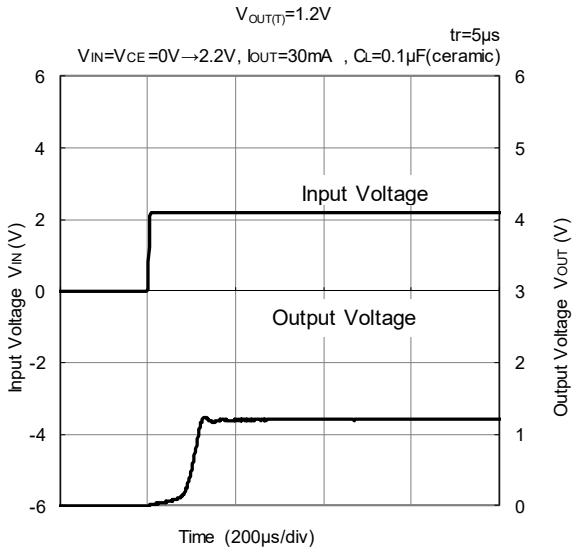



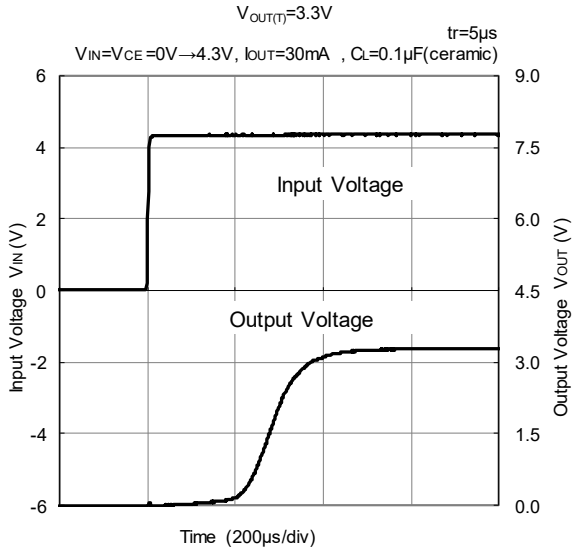
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

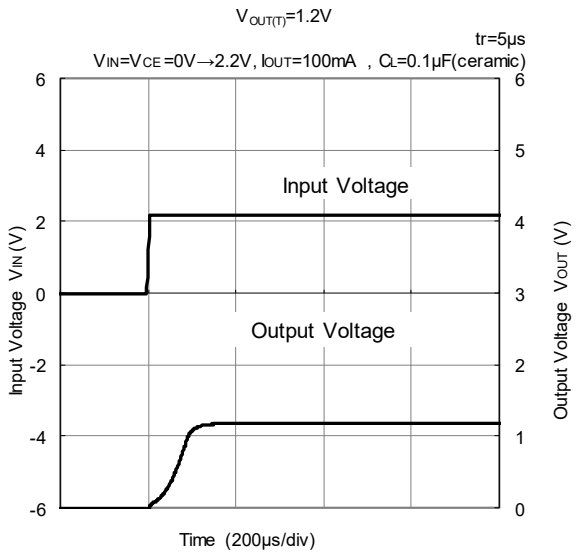
(10) Rising Response Time

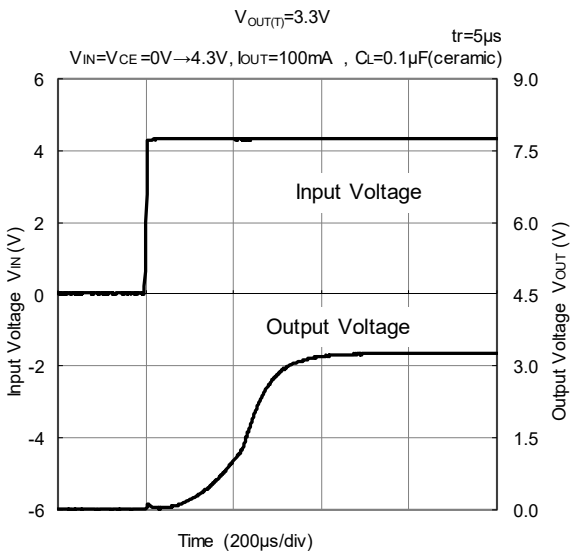


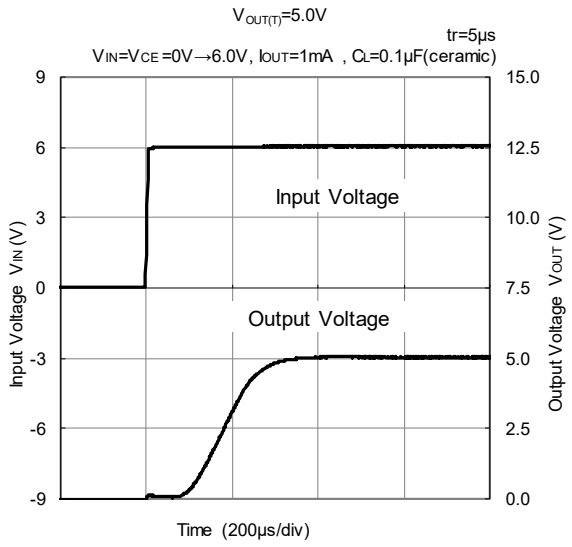



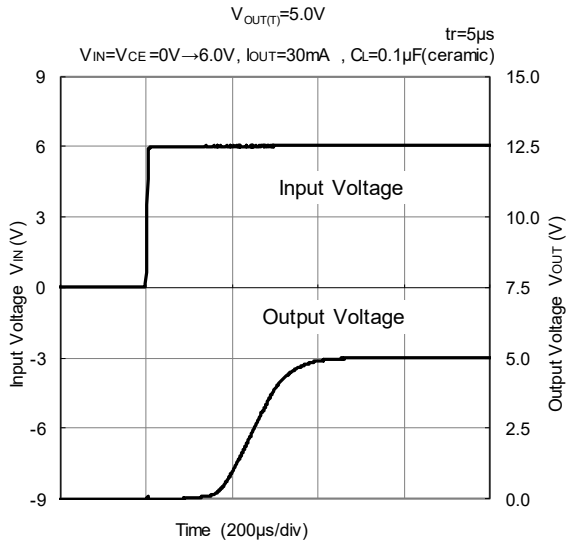



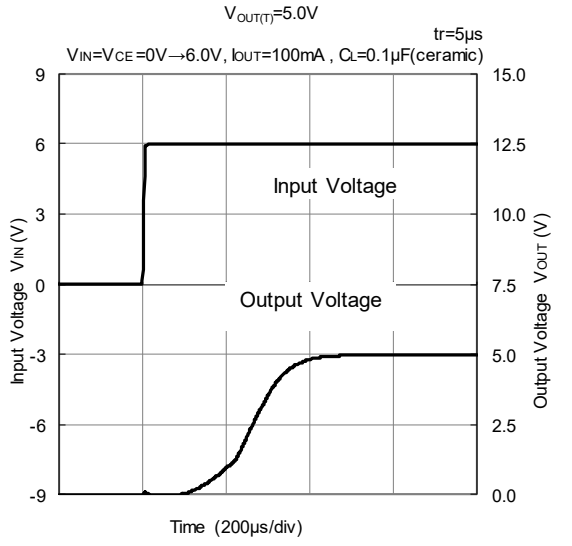



# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Rising Response Time

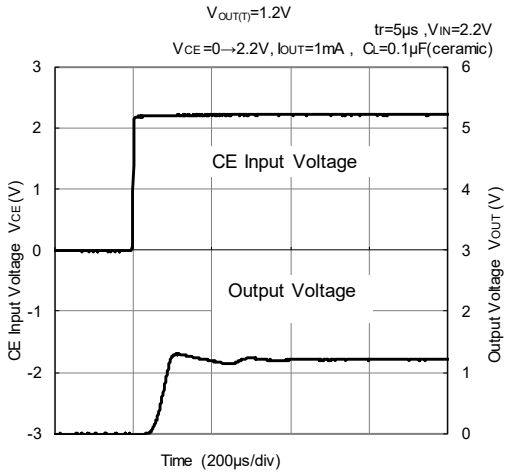


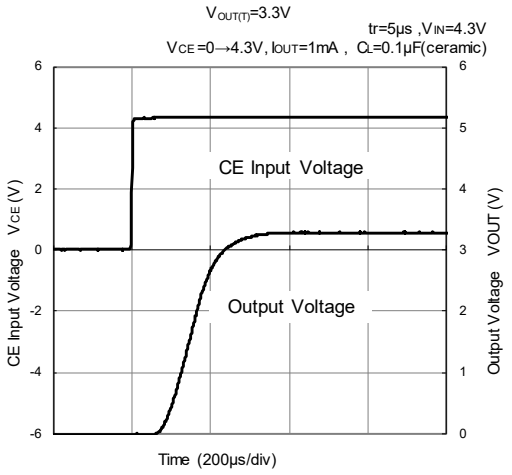



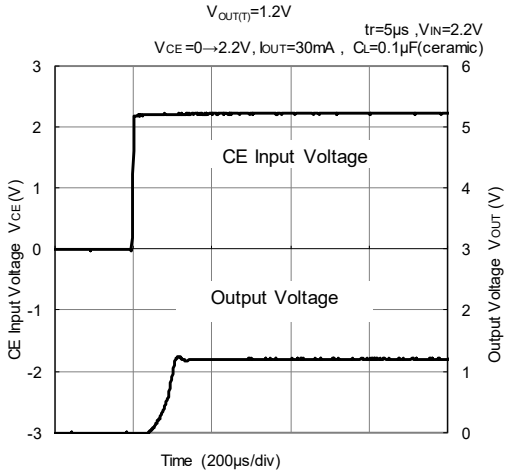



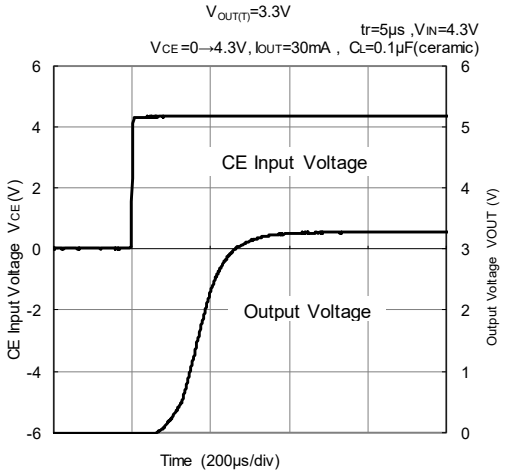
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

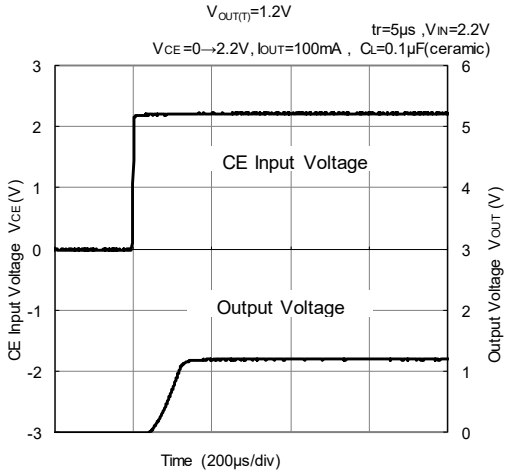
(11) CE Rising Response Time

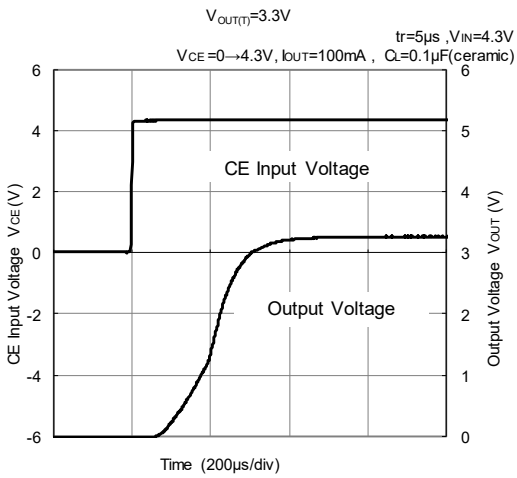


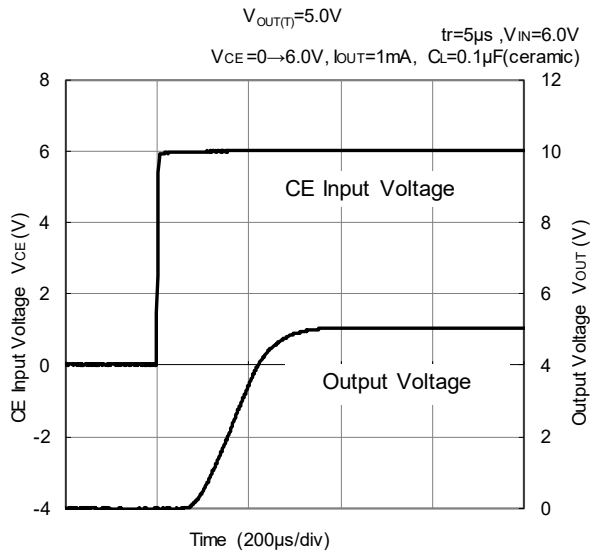



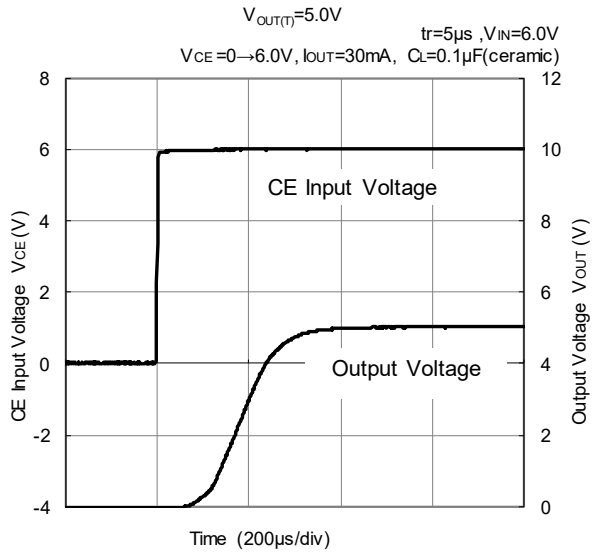



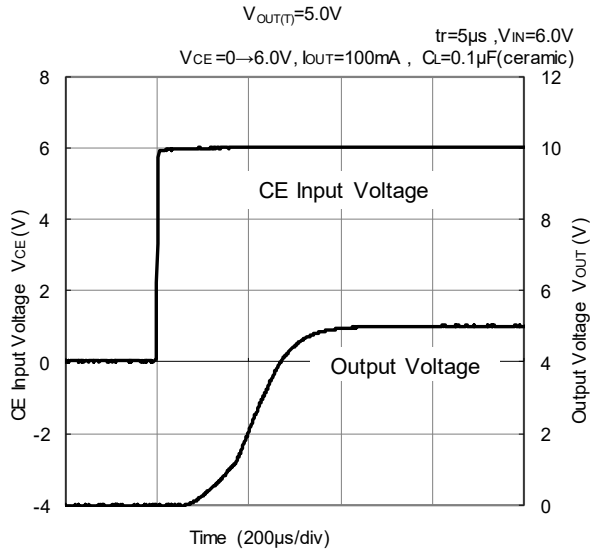



# ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) CE Rising Response Time



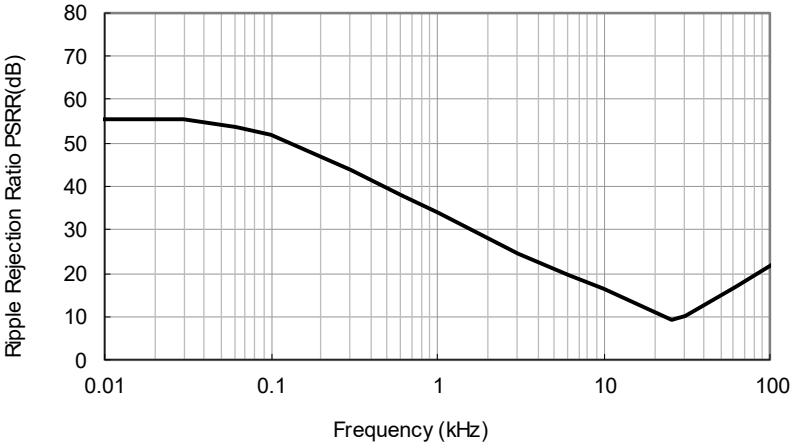



## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(12) Ripple Rejection Rate

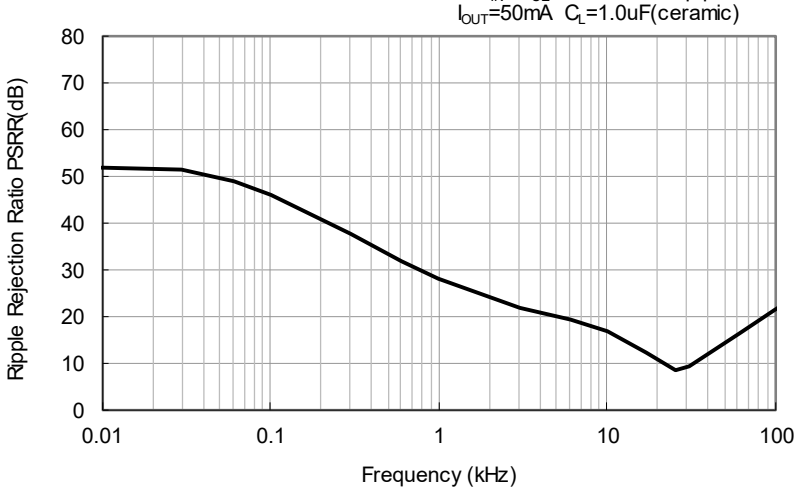
$V_{OUT(T)}$=1.2V

$V_{IN}=V_{CE}$=2.2Vdc+0.5Vp-pAC
$I_{OUT}$=50mA $C_L$=1.0uF(ceramic)



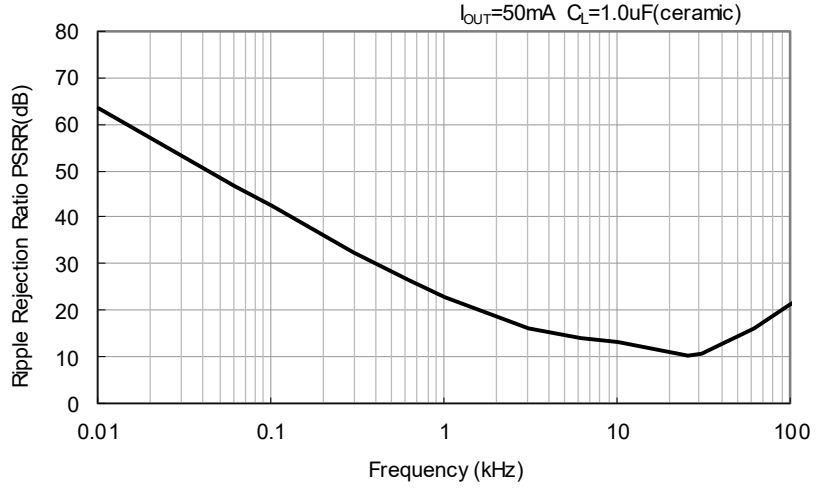

$V_{OUT(T)}$=3.3V

$V_{IN}=V_{CE}$=4.3Vdc+0.5Vp-pAC
$I_{OUT}$=50mA $C_L$=1.0uF(ceramic)




$V_{OUT(T)}$=5.0V

$V_{IN}=V_{CE}$=5.75Vdc+0.5Vp-pAC
$I_{OUT}$=50mA $C_L$=1.0uF(ceramic)



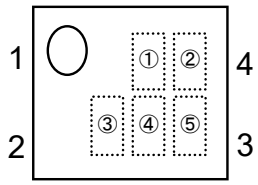
# ■PACKAGING INFORMATION

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 | XC6506******-G |

②represents type of regulator and output voltage range

| MARK | Regulator type | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|---|---|---|---|
| T | CE High active with no pull-down resistor | 1.2V ~ 3.0V | XC6506B*****-G |
| U | | 3.1V ~ 5.0V | |

③represents output voltage

| MARK | OUTPUT VOLTAGE (V) | | MARK | OUTPUT VOLTAGE (V) | | MARK | OUTPUT VOLTAGE (V) | |
|---|---|---|---|---|---|---|---|---|
| 0 | - | 3.1 | A | - | 4.1 | N | 2.1 | - |
| 1 | - | 3.2 | B | 1.2 | 4.2 | P | 2.2 | - |
| 2 | - | 3.3 | C | 1.3 | 4.3 | R | 2.3 | - |
| 3 | - | 3.4 | D | 1.4 | 4.4 | S | 2.4 | - |
| 4 | - | 3.5 | E | 1.5 | 4.5 | T | 2.5 | - |
| 5 | - | 3.6 | F | 1.6 | 4.6 | U | 2.6 | - |
| 6 | - | 3.7 | H | 1.7 | 4.7 | V | 2.7 | - |
| 7 | - | 3.8 | K | 1.8 | 4.8 | X | 2.8 | - |
| 8 | - | 3.9 | L | 1.9 | 4.9 | Y | 2.9 | - |
| 9 | - | 4.0 | M | 2.0 | 5.0 | Z | 3.0 | - |

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.