

## 0.8 $\mu$ A Low Power Consumption Voltage Regulator with ON/OFF Switch

### ■ GENERAL DESCRIPTION

The XC6215 series are highly precise, low noise, positive voltage LDO regulators manufactured using CMOS processes. The series achieves very low supply current, 0.8  $\mu$  A and consists of a reference voltage source, an error amplifier, a current foldback circuit, and a phase compensation circuit plus a driver transistor.

Ultra small packages USP-3, USP-4, USPN-4, USP-6B06 and SSOT-24, and small package SOT-25 packages make high density mounting possible. Therefore, the series is ideal for applications where high density mounting is required such as in mobile phones.

Output voltage is selectable in 0.1V increments within a range of 0.9V ~ 5.0V by laser trimming

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

The current limiter's foldback 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

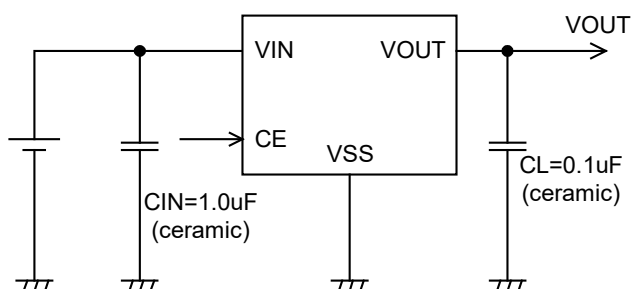
- Smart phones / Mobile phones
- Portable game consoles
- Digital still cameras / Camcorders
- Digital audio equipments
- Mobile devices / terminals

### ■ FEATURES

- Maximum Output Current** : 200mA (300mA Limit, TYP.)  
@  $V_{OUT}=3.0V$ ,  $V_{IN}=4.0V$
- Dropout Voltage** : 320mV @  $I_{OUT} = 100mA$   
@  $V_{OUT} = 3.0V$
- Operating Input Voltage** : 1.5V ~ 6.0V
- Output Voltage Range** : 0.9V ~ 5.0V (0.1V Increments)
- Highly Accurate** : Set voltage accuracy  $\pm 2\%$   
( $1.5V < V_{OUT} (\tau) \leq 5.0V$ )  
Set voltage accuracy  $\pm 30mV$   
( $0.9V \leq V_{OUT} (\tau) \leq 1.5V$ )
- Low Power Consumption** : 0.8  $\mu$  A
- Stand-by Current** : 0.01  $\mu$  A
- Operating Temperature Range** :  $-40^{\circ}C \sim 85^{\circ}C$
- Low ESR Capacitor Compatible** : Ceramic capacitor
- Current Limiter Circuit Built-In**
- Packages** : USP-4  
SSOT-24  
USP-3 (XC6215P only)  
SOT-25  
USPN-4  
USP-6B06
- Environmentally Friendly** : EU RoHS Compliant, Pb Free

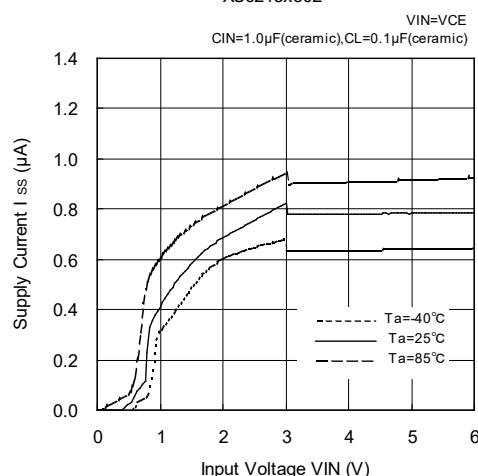
### ■ TYPICAL APPLICATION CIRCUIT

- USP-4, SSOT-24, SOT-25, USPN-4, USP-6B06 packages  
(For the USP-3 package, with no CE pin)



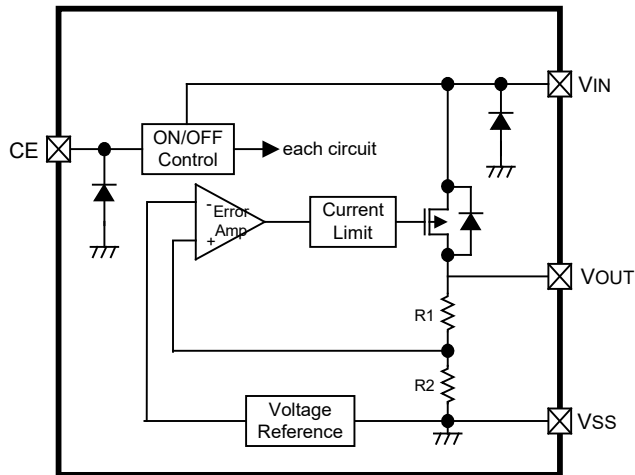
### ■ TYPICAL PERFORMANCE CHARACTERISTICS

- Supply Current vs. Input Voltage  
XC6215x302

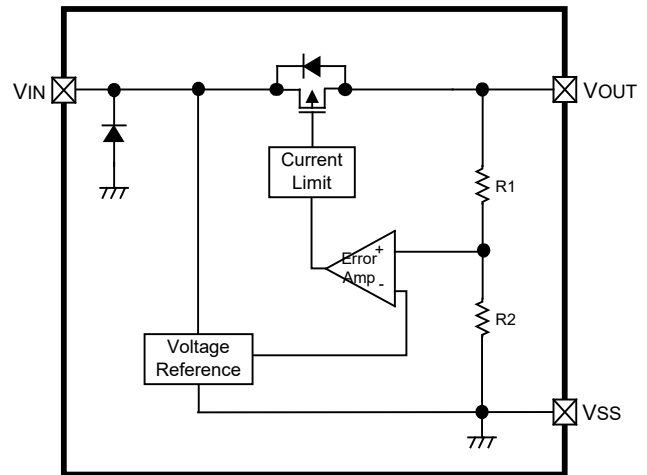


## BLOCK DIAGRAMS

### XC6215B Type



### XC6215P Type



\* Diodes shown in the above circuit are ESD protection diodes and parasitic diodes

## PRODUCT CLASSIFICATION

### Ordering Information

XC6215①②③④⑤⑥-⑦<sup>(\*)</sup> : With CE function

| DESIGNATOR | ITEM                    | SYMBOL  | DESCRIPTION                                                  |
|------------|-------------------------|---------|--------------------------------------------------------------|
| ①          | Type of Regulator       | B       | CE logic = High active with no pull-down resistor            |
| ②③         | Output Voltage          | 09 ~ 50 | 0.9 V ~ 5.0V, 0.1V step                                      |
| ④          | Output Voltage Accuracy | 2       | ±2% accuracy (e.g. $V_{OUT}=3.0V \Rightarrow$ ②=3, ③=0, ④=2) |
| ⑤⑥-⑦       | Packages (Order Unit)   | GR-G    | USP-4 (3,000pcs/Reel)                                        |
|            |                         | NR-G    | SSOT-24 (3,000pcs/Reel)                                      |
|            |                         | MR-G    | SOT-25 (3,000pcs/Reel)                                       |
|            |                         | 7R-G    | USPN-4 (5,000pcs/Reel)                                       |
|            |                         | 8R-G    | USP-6B06 (5,000pcs/Reel)                                     |

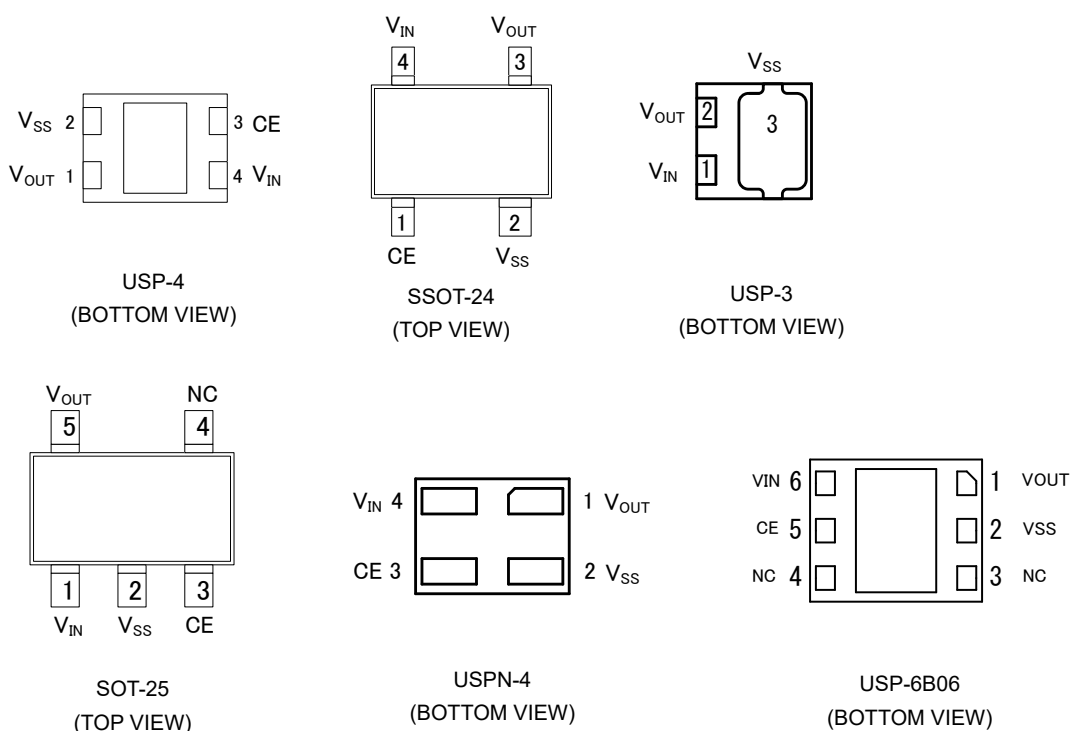
<sup>(\*)</sup> The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

XC6215①②③④⑤⑥-⑦<sup>(\*)</sup> : 3 pin regulator with no CE pin

| DESIGNATOR | ITEM                    | SYMBOL  | DESCRIPTION                                                  |
|------------|-------------------------|---------|--------------------------------------------------------------|
| ①          | Type of Regulator       | P       | 3 pin regulator with no CE pin                               |
| ②③         | Output Voltage          | 09 ~ 50 | 0.9 V ~ 5.0V, 0.1V step                                      |
| ④          | Output Voltage Accuracy | 2       | ±2% accuracy (e.g. $V_{OUT}=3.0V \Rightarrow$ ②=3, ③=0, ④=2) |
| ⑤⑥-⑦       | Packages (Order Unit)   | HR-G    | USP-3 (3,000pcs/Reel)                                        |

<sup>(\*)</sup> The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

## PIN CONFIGURATION



\* For mounting intensity and heat dissipation, please refer to recommended mounting pattern and recommended metal mask when soldering the pad of USP-4 and USP-6B06.  
Mounting should be electrically isolated or connected to the V<sub>SS</sub> (No.2) pin.

## PIN ASSIGNMENT

| PIN NUMBER |         |       |        |        |          | PIN NAME         | FUNCTIONS       |
|------------|---------|-------|--------|--------|----------|------------------|-----------------|
| USP-4      | SSOT-24 | USP-3 | SOT-25 | USPN-4 | USP-6B06 |                  |                 |
| 3          | 1       | -     | 3      | 3      | 5        | CE               | ON / OFF Switch |
| 2          | 2       | 3     | 2      | 2      | 2        | V <sub>SS</sub>  | Ground          |
| 1          | 3       | 2     | 5      | 1      | 1        | V <sub>OUT</sub> | Output          |
| 4          | 4       | 1     | 1      | 4      | 6        | V <sub>IN</sub>  | Power Supply    |
| -          | -       | -     | 4      | -      | 3,4      | NC               | No Connection   |

## PIN FUNCTION ASSIGNMENT

XC6215B Type

| CE | IC OPERATION  |
|----|---------------|
| H  | Operation ON  |
| L  | Operation OFF |

\* CE pin should not be left open.

## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                        |                                                   | SYMBOL           | RATINGS                                            | UNITS |
|----------------------------------|---------------------------------------------------|------------------|----------------------------------------------------|-------|
| Input Voltage                    |                                                   | V <sub>IN</sub>  | -0.3 ~ 7.0                                         | V     |
| Output Voltage                   |                                                   | V <sub>OUT</sub> | V <sub>SS</sub> - 0.3 ~ V <sub>IN</sub> + 0.3      | V     |
| CE Input Voltage <sup>(*1)</sup> |                                                   | V <sub>CE</sub>  | V <sub>SS</sub> - 0.3 ~ 7.0                        | V     |
| Power Dissipation<br>(Ta=25°C)   | SOT-25                                            | Pd               | 250 (IC only)                                      | mW    |
|                                  |                                                   |                  | 600 (40mm x 40mm Standard board) <sup>(*2)</sup>   |       |
|                                  |                                                   |                  | 760 (JESD51-7 board) <sup>(*2)</sup>               |       |
|                                  | SSOT-24                                           |                  | 150 (IC only)                                      |       |
|                                  |                                                   |                  | 500 (40mm x 40mm Standard board ) <sup>(*2)</sup>  |       |
|                                  |                                                   |                  | 680 (JESD51-7 board) <sup>(*2)</sup>               |       |
|                                  | USP-4                                             |                  | 120 (IC only)                                      |       |
|                                  |                                                   |                  | 1000 (40mm x 40mm Standard board ) <sup>(*2)</sup> |       |
|                                  | USP-3                                             |                  | 120 (IC only)                                      |       |
|                                  |                                                   |                  | 1000 (40mm x 40mm Standard board ) <sup>(*2)</sup> |       |
|                                  | USPN-4                                            |                  | 100 (IC only)                                      |       |
| USP-6B06                         | 600 (40mm x 40mm Standard board ) <sup>(*2)</sup> |                  |                                                    |       |
|                                  | 900 (40mm x 40mm Standard board ) <sup>(*2)</sup> |                  |                                                    |       |
| Operating Ambient Temperature    |                                                   | Topr             | -40 ~ 85                                           | °C    |
| Storage Temperature              |                                                   | Tstg             | -55 ~ 125                                          | °C    |

Note:

<sup>(\*)1</sup> Except for the XC6215P Type

<sup>(\*)2</sup> This power dissipation figure shown is PCB mounted and is for reference only.

Please refer to PACKAGING INFORMATION for the mounting condition.

## ■ ELECTRICAL CHARACTERISTICS

● XC6215B Type

Ta = 25°C

| PARAMETER                       | SYMBOL              | CONDITIONS                                                                                                                      | MIN.                | TYP. | MAX. | UNIT. | CIRCUIT |
|---------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------|------|------|-------|---------|
| Output Voltage <sup>(*2)</sup>  | V <sub>OUT(E)</sub> | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> <sup>(*1)</sup> + 1.0V,<br>I <sub>OUT</sub> =1mA                          | E-0 <sup>(*6)</sup> |      |      | V     | ①       |
| Maximum Output Current          | I <sub>OUTMAX</sub> | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =0.9V                                       | 50                  | 70   | -    | mA    | ①       |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.0V ~ 1.1V                                | 60                  | 80   | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.2V ~ 1.3V                                | 80                  | 110  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.4V ~ 1.6V                                | 100                 | 140  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.7V ~ 2.2V                                | 120                 | 150  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =2.3V ~ 2.9V                                | 150                 | 195  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≥3.0V                                       | 200                 | 300  | -    |       |         |
| Load Regulation                 | △V <sub>OUT</sub>   | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =0.9V<br>1mA≤I <sub>OUT</sub> ≤50mA         | -                   | 15   | 70   | mV    | ①       |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> = 1.0V ~ 1.1V<br>1mA≤I <sub>OUT</sub> ≤60mA |                     |      |      |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.2V~1.3V<br>1mA≤I <sub>OUT</sub> ≤80mA    |                     |      |      |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≥1.4V<br>1mA≤I <sub>OUT</sub> ≤100mA        |                     |      |      |       |         |
| Dropout Voltage <sup>(*3)</sup> | V <sub>dif</sub>    | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>OUT(T)</sub> =0.9V<br>I <sub>OUT</sub> =50mA                                          | E-1 <sup>(*6)</sup> |      |      | mV    | ①       |
|                                 |                     | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>OUT(T)</sub> =1.0V ~ 1.1V<br>I <sub>OUT</sub> =60mA                                   |                     |      |      |       |         |
|                                 |                     | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>OUT(T)</sub> =1.2V ~ 1.3V<br>I <sub>OUT</sub> =80mA                                   |                     |      |      |       |         |
|                                 |                     | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>OUT(T)</sub> ≥1.4V<br>I <sub>OUT</sub> =100mA                                         |                     |      |      |       |         |
| Supply Current                  | I <sub>DD</sub>     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≤3.9V                                       | -                   | 0.8  | 1.5  | μ A   | ②       |
|                                 |                     | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≥4.0V                                       | -                   | 1.0  | 1.8  |       |         |
| Stand-by Current                | I <sub>stby</sub>   | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V,<br>V <sub>CE</sub> =V <sub>SS</sub>                                                | -                   | 0.01 | 0.10 | μ A   | ②       |

## ELECTRICAL CHARACTERISTICS (Continued)

●XC6215B Type

Ta = 25°C

| PARAMETER                                  | SYMBOL                                                  | CONDITIONS                                                                                             | MIN.  | TYP. | MAX. | UNIT.    | CIRCUIT |
|--------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------|------|------|----------|---------|
| Line Regulation                            | $\frac{\Delta V_{OUT}}{(\Delta V_{IN} \cdot V_{OUT})}$  | $V_{OUT(T)}=0.9V, V_{CE}=V_{IN}$<br>$1.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=1mA$                      | -     | 0.05 | 0.15 | % / V    | ①       |
|                                            |                                                         | $V_{OUT(T)}=1.0V \sim 1.2V, V_{CE}=V_{IN}$<br>$V_{OUT(T)}+0.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=1mA$ |       |      |      |          |         |
|                                            |                                                         | $V_{OUT(T)} \geq 1.3V, V_{CE}=V_{IN}$<br>$V_{OUT(T)}+0.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=30mA$     |       |      |      |          |         |
| Input Voltage                              | $V_{IN}$                                                | -                                                                                                      | 1.5   | -    | 6.0  | V        | -       |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{(\Delta T_{opr} \cdot V_{OUT})}$ | $V_{IN}=V_{CE}=V_{OUT(T)}+1.0V, I_{OUT}=30mA$<br>- 40°C ≤ Topr ≤ 85°C                                  | -     | ±100 | -    | ppm / °C | ①       |
| Current Limit                              | $I_{lim}$                                               | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=0.9V$<br>$V_{IN}=V_{CE}=V_{OUT(T)}+2.0V$               | 100   | 300  | -    | mA       | ①       |
|                                            |                                                         | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.0V \sim 1.1V$<br>$V_{IN}=V_{CE}=V_{OUT(T)}+2.0V$     | 120   | 300  | -    |          |         |
|                                            |                                                         | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.2V \sim 1.3V$<br>$V_{IN}=V_{CE}=V_{OUT(T)}+2.0V$     | 160   | 300  | -    |          |         |
|                                            |                                                         | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.4V \sim 2.9V$<br>$V_{IN}=V_{CE}=V_{OUT(T)}+2.0V$     | 200   | 300  | -    |          |         |
|                                            |                                                         | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)} \geq 3.0V$<br>$V_{IN}=V_{CE}=V_{OUT(T)}+1.0V$          | 200   | 300  | -    |          |         |
| Short Circuit Current                      | $I_{short}$                                             | $V_{IN}=V_{CE}=V_{OUT(T)}+1.0V,$<br>$V_{OUT}=0V$                                                       | -     | 50   | -    | mA       | ①       |
| CE 'H' Level Voltage                       | $V_{CEH}$                                               | $V_{IN}=V_{OUT(T)}+1.0V$                                                                               | 1.0   | -    | 6.0  | V        | ①       |
| CE 'L' Level Voltage                       | $V_{CEL}$                                               | $V_{IN}=V_{OUT(T)}+1.0V$                                                                               | -     | -    | 0.3  |          |         |
| CE 'H' Level Current                       | $I_{CEH}$                                               | $V_{IN}=V_{CE}=V_{OUT(T)}+1.0V$                                                                        | - 0.1 | -    | 0.1  | μA       | ②       |
| CE 'L' Level Current                       | $I_{CEL}$                                               | $V_{IN}=V_{OUT(T)}+1.0V, V_{CE}=V_{SS}$                                                                | - 0.1 | -    | 0.1  |          |         |

NOTE:

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

(\*) $V_{OUT(E)}$  = Effective output voltage

(i.e. the output voltage when "V<sub>OUT(T)</sub> + 1.0V" is provided at the VIN pin while maintaining a certain I<sub>OUT</sub> value).

(\*) $V_{dif} = \{ V_{IN1}^{(*)} - V_{OUT1}^{(*)} \}$

(\*) $V_{IN1}$  = The input voltage when V<sub>OUT1</sub> appears as input voltage is gradually decreased.

(\*) $V_{OUT1}$  = A voltage equal to 98% of the output voltage whenever an amply stabilized I<sub>OUT</sub> { V<sub>OUT(T)</sub> + 1.0V } is input.

(\*)Refer to "VOLTAGE CHART".

## ■ ELECTRICAL CHARACTERISTICS (Continued)

●XC6215P Type

Ta = 25°C

| PARAMETER                       | SYMBOL              | CONDITIONS                                                                                                   | MIN.                | TYP. | MAX. | UNIT. | CIRCUIT |
|---------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------|---------------------|------|------|-------|---------|
| Output Voltage <sup>(*2)</sup>  | V <sub>OUT(E)</sub> | V <sub>IN</sub> =V <sub>OUT(T)</sub> <sup>(*1)</sup> + 1.0V,<br>I <sub>OUT</sub> =1mA                        | E-0 <sup>(*6)</sup> |      |      | V     | ①       |
| Maximum Output Current          | I <sub>OUTMAX</sub> | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =0.9V                                     | 50                  | 70   | -    | mA    | ①       |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.0V ~ 1.1V                              | 60                  | 80   | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.2V ~ 1.3V                              | 80                  | 110  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.4V ~ 1.6V                              | 100                 | 140  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.7V ~ 2.2V                              | 120                 | 150  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =2.3V ~ 2.9V                              | 150                 | 195  | -    |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≥3.0V                                     | 200                 | 300  | -    |       |         |
| Load Regulation                 | ΔV <sub>OUT</sub>   | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =0.9V<br>1mA≤I <sub>OUT</sub> ≤50mA       | -                   | 15   | 70   | mV    | ①       |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> = 1.0V~1.1V<br>1mA≤I <sub>OUT</sub> ≤60mA |                     |      |      |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> =1.2V~1.3V<br>1mA≤I <sub>OUT</sub> ≤80mA  |                     |      |      |       |         |
|                                 |                     | V <sub>IN</sub> =V <sub>OUT(T)</sub> + 1.0V<br>V <sub>OUT(T)</sub> ≥1.4V<br>1mA≤I <sub>OUT</sub> ≤100mA      |                     |      |      |       |         |
| Dropout Voltage <sup>(*3)</sup> | V <sub>dif</sub>    | V <sub>OUT(T)</sub> =0.9V<br>I <sub>OUT</sub> =50mA                                                          | E-1 <sup>(*6)</sup> |      |      | mV    | ①       |
|                                 |                     | V <sub>OUT(T)</sub> =1.0V ~ 1.1V<br>I <sub>OUT</sub> =60mA                                                   |                     |      |      |       |         |
|                                 |                     | V <sub>OUT(T)</sub> =1.2V ~ 1.3V<br>I <sub>OUT</sub> =80mA                                                   |                     |      |      |       |         |
|                                 |                     | V <sub>OUT(T)</sub> ≥1.4V<br>I <sub>OUT</sub> =100mA                                                         |                     |      |      |       |         |
| Supply Current                  | I <sub>DD</sub>     | V <sub>IN</sub> =V <sub>OUT(T)</sub> =1.0V<br>V <sub>OUT(T)</sub> ≤3.9V                                      | -                   | 0.8  | 1.5  | μA    | ②       |
|                                 |                     | V <sub>IN</sub> = V <sub>OUT(T)</sub> +1.0V<br>V <sub>OUT(T)</sub> ≥4.0V                                     | -                   | 1.0  | 1.8  |       |         |

## ELECTRICAL CHARACTERISTICS (Continued)

●XC6215P Type

Ta = 25°C

| PARAMETER                                  | SYMBOL                                                | CONDITIONS                                                                                  | MIN. | TYP.      | MAX. | UNIT.      | CIRCUIT |
|--------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------|------|-----------|------|------------|---------|
| Line Regulation                            | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$  | $V_{OUT(T)}=0.9V$<br>$1.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=1mA$                          | -    | 0.05      | 0.15 | %V         | ①       |
|                                            |                                                       | $V_{OUT(T)}=1.0V \sim 1.2V$<br>$V_{OUT(T)}+0.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=1mA$     |      |           |      |            |         |
|                                            |                                                       | $V_{OUT(T)} \geq 1.3V$<br>$V_{OUT(T)}+0.5V \leq V_{IN} \leq 6.0V$<br>$I_{OUT}=30mA$         |      |           |      |            |         |
| Input Voltage                              | $V_{IN}$                                              | -                                                                                           | 1.5  | -         | 6.0  | V          | -       |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $V_{IN}=V_{OUT(T)}+1.0V, I_{OUT}=30mA$<br>$-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$      | -    | $\pm 100$ | -    | ppm/<br>°C | ①       |
| Current Limit                              | $I_{lim}$                                             | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=0.9V$<br>$V_{IN}=V_{OUT(T)}+2.0V$           | 100  | 300       | -    | mA         | ①       |
|                                            |                                                       | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.0V \sim 1.1V$<br>$V_{IN}=V_{OUT(T)}+2.0V$ | 120  | 300       | -    |            |         |
|                                            |                                                       | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.2V \sim 1.3V$<br>$V_{IN}=V_{OUT(T)}+2.0V$ | 160  | 300       | -    |            |         |
|                                            |                                                       | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)}=1.4V \sim 2.9V$<br>$V_{IN}=V_{OUT(T)}+2.0V$ | 200  | 300       | -    |            |         |
|                                            |                                                       | $V_{OUT}=V_{OUT(E)} \times 0.95$<br>$V_{OUT(T)} \geq 3.0V$<br>$V_{IN}=V_{OUT(T)}+1.0V$      | 200  | 300       | -    |            |         |
| Short Circuit Current                      | $I_{short}$                                           | $V_{IN}=V_{OUT(T)}+1.0V, V_{OUT}=0V$                                                        | -    | 50        | -    | mA         | ①       |

### NOTE:

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

(\*) $V_{OUT(E)}$ : 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).

(\*)  $V_{dif} = \{ V_{IN1} (*) - V_{OUT1} (*) \}$

(\*)  $V_{IN1}$ : 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  $I_{OUT} \{ V_{OUT(T)} + 1.0V \}$  is input.

(\*) Refer to "VOLTAGE CHART".

## ■ VOLTAGE CHART

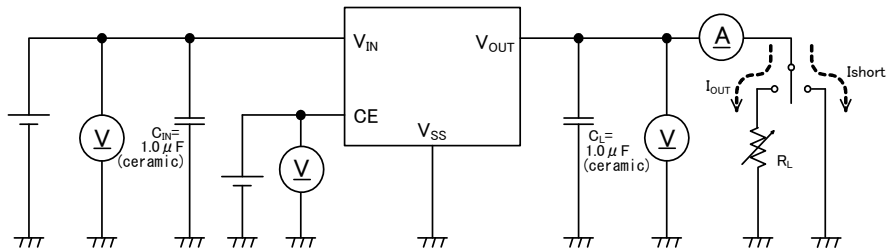
### ● Dropout Voltage Chart

| SETTING OUTPUT<br>VOLTAGE | E-0                   |       | E-1                     |      |
|---------------------------|-----------------------|-------|-------------------------|------|
|                           | OUTPUT VOLTAGE<br>(V) |       | DROPOUT VOLTAGE<br>(mV) |      |
| V <sub>OUT(T)</sub>       | V <sub>OUT</sub>      |       | V <sub>dif</sub>        |      |
|                           | MIN.                  | MAX.  | TYP.                    | MAX. |
| 0.9                       | 0.870                 | 0.930 | 870                     | 1000 |
| 1.0                       | 0.970                 | 1.030 | 860                     | 1000 |
| 1.1                       | 1.070                 | 1.130 | 780                     | 950  |
| 1.2                       | 1.170                 | 1.230 | 800                     | 1000 |
| 1.3                       | 1.270                 | 1.330 | 720                     | 900  |
| 1.4                       | 1.370                 | 1.430 | 750                     | 960  |
| 1.5                       | 1.470                 | 1.530 | 700                     | 890  |
| 1.6                       | 1.568                 | 1.632 | 680                     | 860  |
| 1.7                       | 1.666                 | 1.734 | 650                     | 830  |
| 1.8                       | 1.764                 | 1.836 | 630                     | 800  |
| 1.9                       | 1.862                 | 1.938 | 610                     | 780  |
| 2.0                       | 1.960                 | 2.040 | 580                     | 740  |
| 2.1                       | 2.058                 | 2.142 | 580                     | 740  |
| 2.2                       | 2.156                 | 2.244 | 580                     | 740  |
| 2.3                       | 2.254                 | 2.346 | 510                     | 650  |
| 2.4                       | 2.352                 | 2.448 | 510                     | 650  |
| 2.5                       | 2.450                 | 2.550 | 450                     | 580  |
| 2.6                       | 2.548                 | 2.652 | 450                     | 580  |
| 2.7                       | 2.646                 | 2.754 | 450                     | 580  |
| 2.8                       | 2.744                 | 2.856 | 450                     | 580  |
| 2.9                       | 2.842                 | 2.958 | 450                     | 580  |
| 3.0                       | 2.940                 | 3.060 | 320                     | 420  |
| 3.1                       | 3.038                 | 3.162 | 320                     | 420  |
| 3.2                       | 3.136                 | 3.264 | 320                     | 420  |
| 3.3                       | 3.234                 | 3.366 | 320                     | 420  |
| 3.4                       | 3.332                 | 3.468 | 320                     | 420  |
| 3.5                       | 3.430                 | 3.570 | 320                     | 420  |
| 3.6                       | 3.528                 | 3.672 | 320                     | 420  |
| 3.7                       | 3.626                 | 3.774 | 320                     | 420  |
| 3.8                       | 3.724                 | 3.876 | 320                     | 420  |
| 3.9                       | 3.822                 | 3.978 | 320                     | 420  |
| 4.0                       | 3.920                 | 4.080 | 290                     | 380  |
| 4.1                       | 4.018                 | 4.182 | 290                     | 380  |
| 4.2                       | 4.116                 | 4.284 | 290                     | 380  |
| 4.3                       | 4.214                 | 4.386 | 290                     | 380  |
| 4.4                       | 4.312                 | 4.488 | 290                     | 380  |
| 4.5                       | 4.410                 | 4.590 | 290                     | 380  |
| 4.6                       | 4.508                 | 4.692 | 290                     | 380  |
| 4.7                       | 4.606                 | 4.794 | 290                     | 380  |
| 4.8                       | 4.704                 | 4.896 | 290                     | 380  |
| 4.9                       | 4.802                 | 4.998 | 290                     | 380  |
| 5.0                       | 4.900                 | 5.100 | 230                     | 310  |

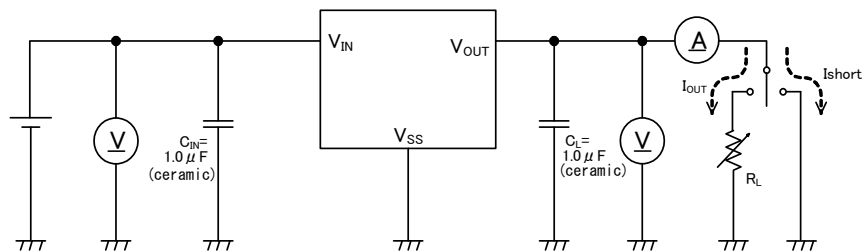
## TEST CIRCUITS

### ● Circuit ①

XC6215 B Type

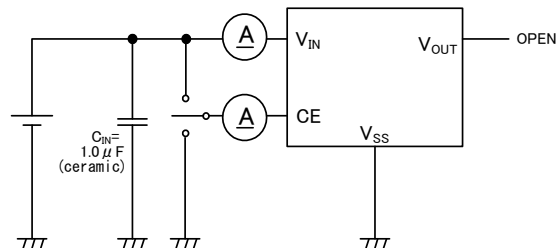


XC6215 P Type

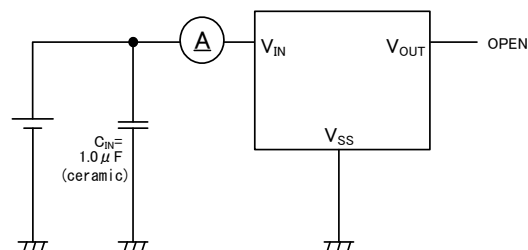


### ● Circuit ②

XC6215 B Type



XC6215 P Type

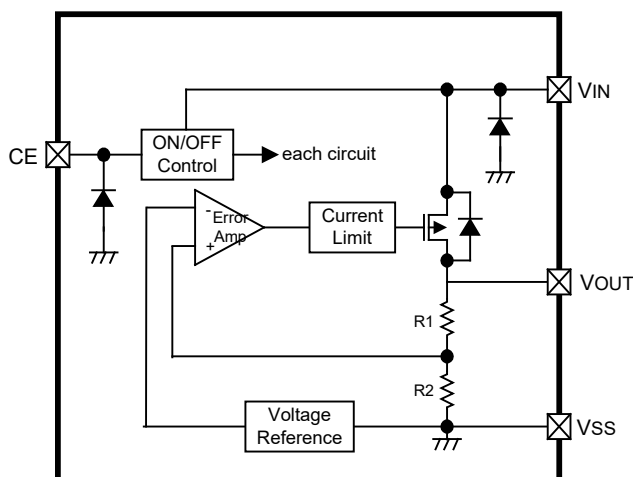


## ■ OPERATIONAL EXPLANATION

● XC6215B (As for the XC6215P, with no CE pin)

### <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 V<sub>OUT</sub> pin, is then driven by the subsequent output signal. The output voltage at the V<sub>OUT</sub> pin is controlled and stabilized by a system of negative feedback. The current limit circuit and short protect circuit operate in relation to the level of output current. Further, the IC's internal circuitry can be operated or shutdown via the CE pin's signal.



### <Short Protection Circuit>

The XC6215 series' regulator offers circuit protection by means of a built-in foldback circuit. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, the output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

### <CE Pin>

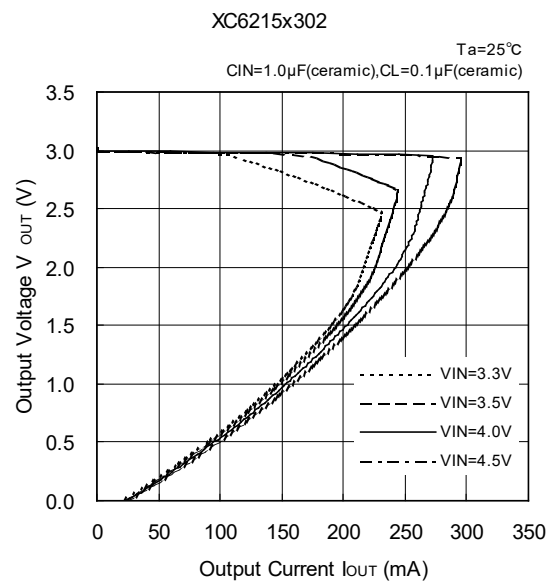
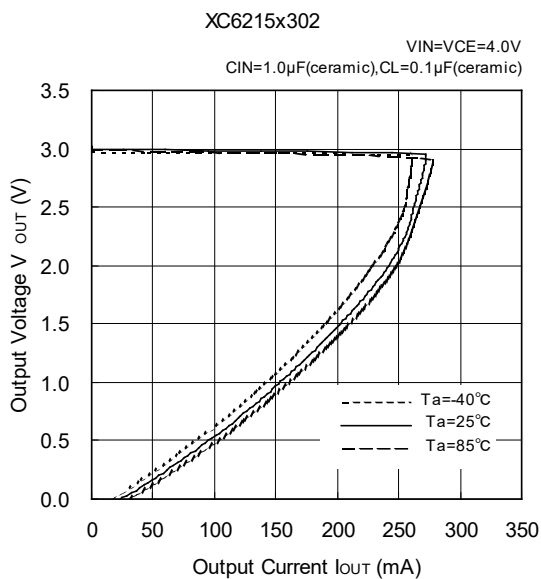
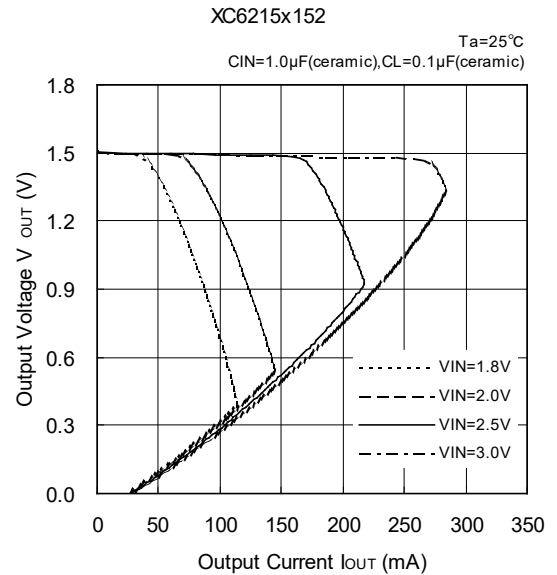
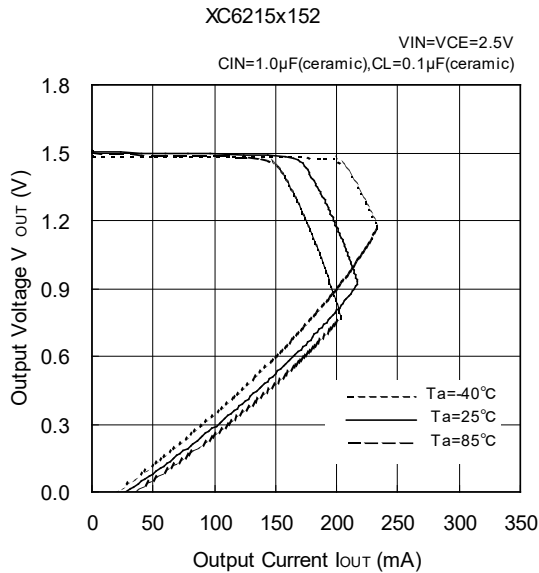
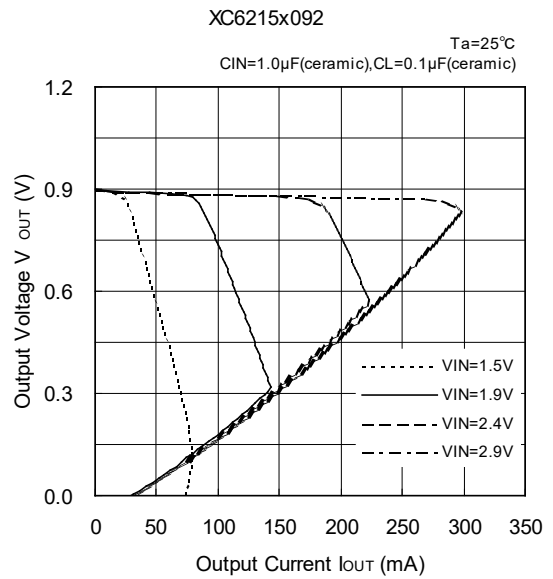
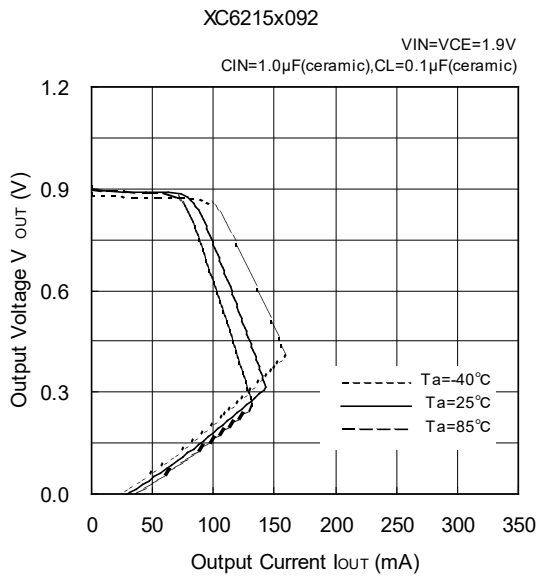
The IC's internal circuitry can be operated or shutdown via the signal from the CE pin with the XC6215B series. In shutdown mode, output at the V<sub>OUT</sub> pin will be pulled down to the V<sub>SS</sub> level via R1 & R2. Note that the XC6215 series' regulator is "High Active/No Pull-Down", operations will become unstable with the CE pin open. We suggest that you use this IC with either a V<sub>IN</sub> voltage or a V<sub>SS</sub> voltage input at the CE pin. If this IC is used with the correct specifications for the CE pin, the operational 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.

## ■ NOTES ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current.
3. As for the XC6215 series, internally achieved phase compensation makes a stable operation of the IC possible even when there is no output capacitor (C<sub>L</sub>). In order to stabilize the V<sub>IN</sub>'s voltage level, we recommend that an input capacitor (C<sub>IN</sub>) of about 0.1 to 1.0  $\mu$ F be connected between the V<sub>IN</sub> pin and the V<sub>SS</sub> pin. Moreover, during transient response, so as to prevent an undershoot or overshoot, we recommend that the output capacitor (C<sub>L</sub>) of about 0.1 to 1.0  $\mu$ F be connected between the V<sub>OUT</sub> pin and the V<sub>SS</sub> pin. However, please wire the input capacitor (C<sub>IN</sub>) and the output capacitor (C<sub>L</sub>) as close to the IC as possible.
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.

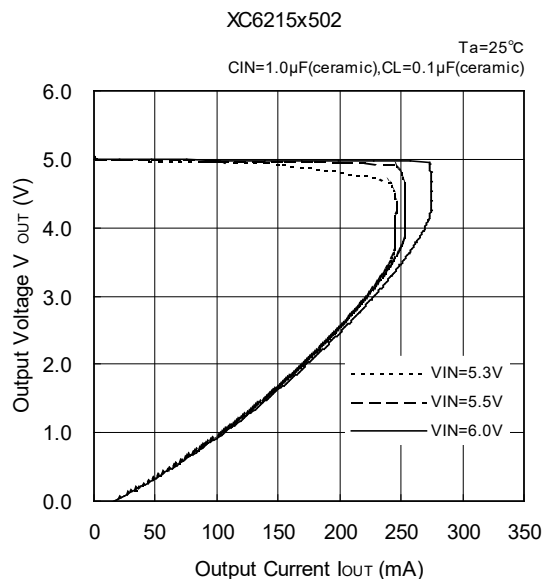
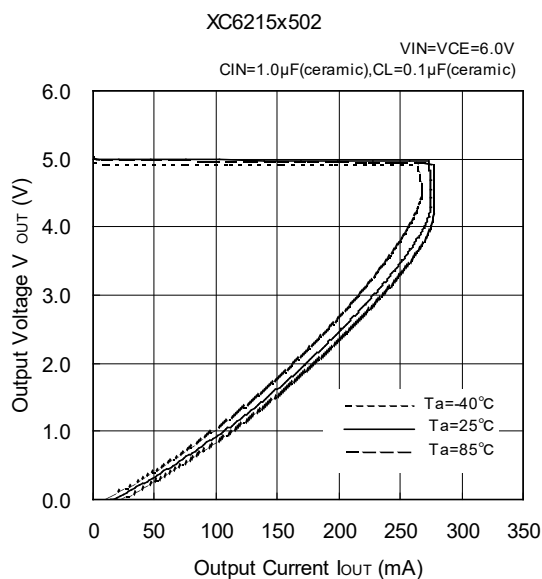
## TYPICAL PERFORMANCE CHARACTERISTICS

### (1) Output Voltage vs. Output Current

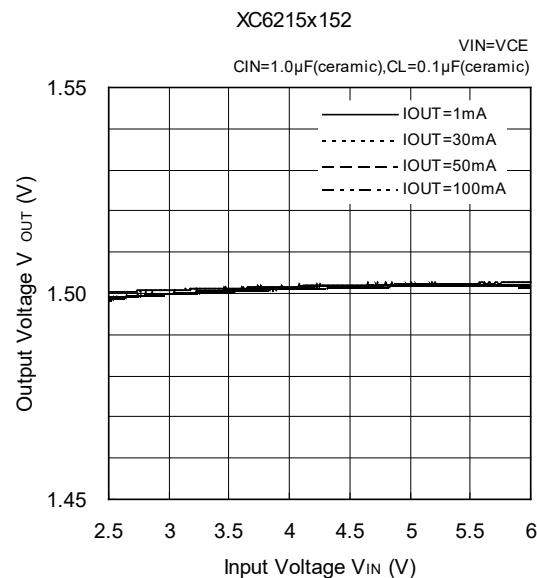
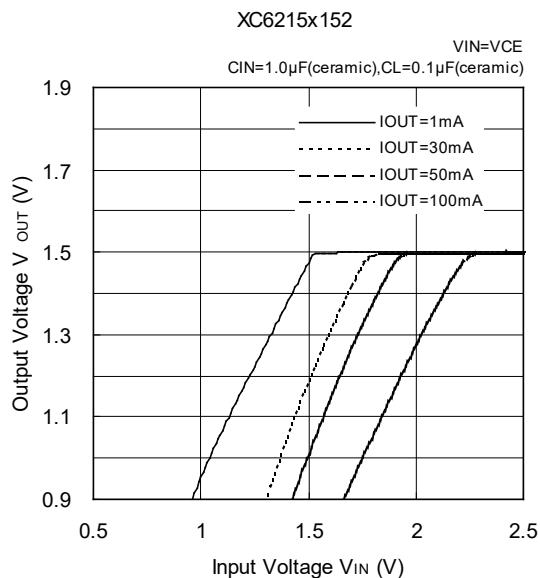
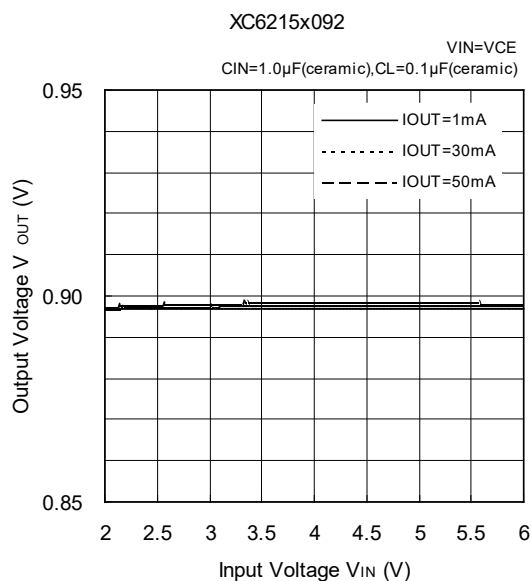
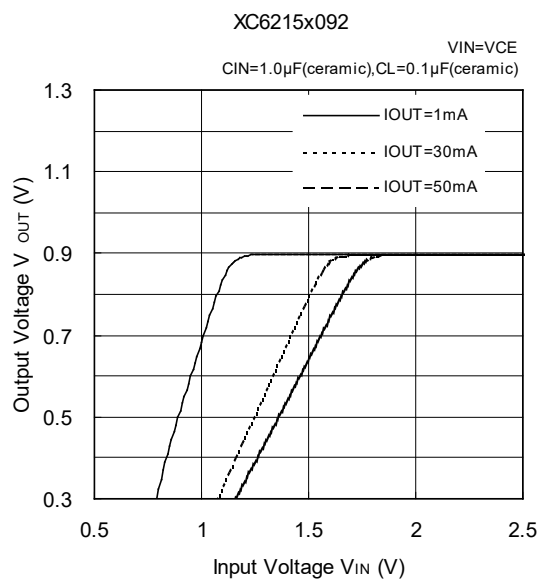


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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



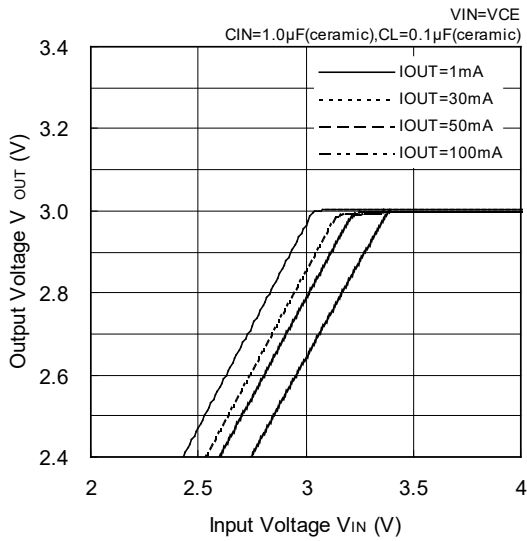
### (2) Output Voltage vs. Input Voltage



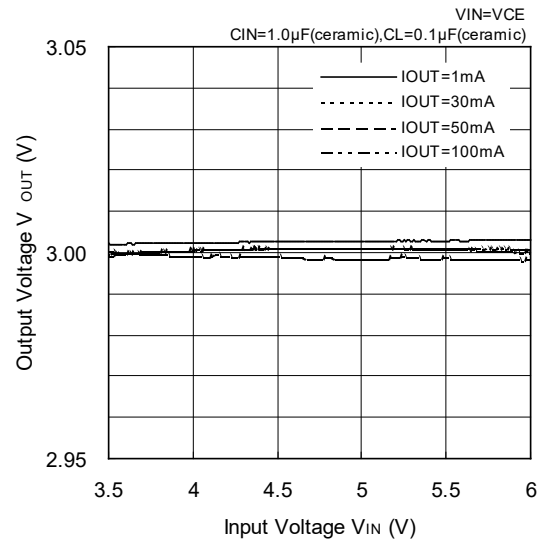
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

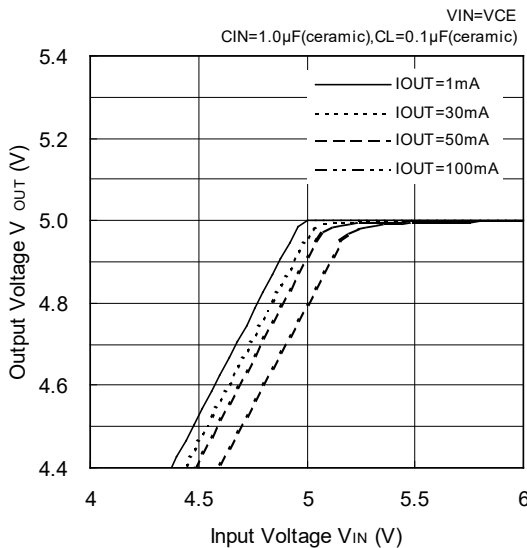
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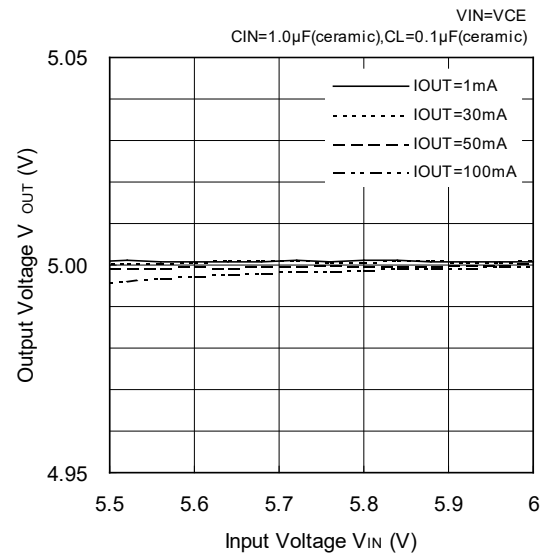
XC6215x302



XC6215x502

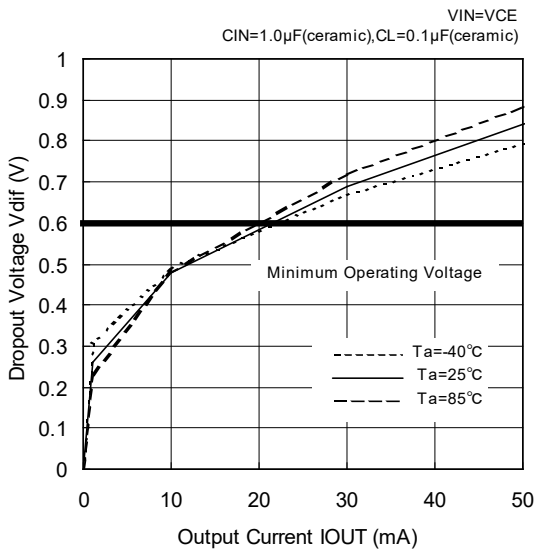


XC6215x502

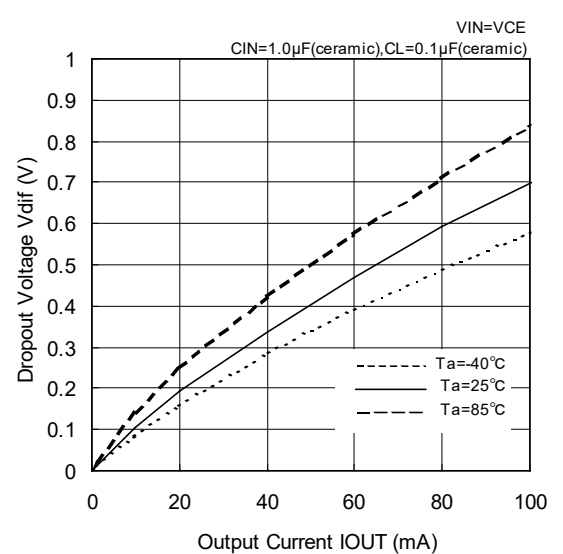


### (3) Dropout Voltage vs. Output Current

XC6215x092



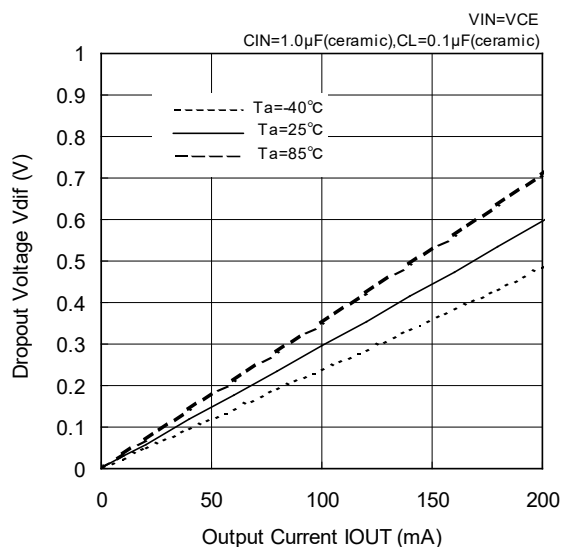
XC6215x152



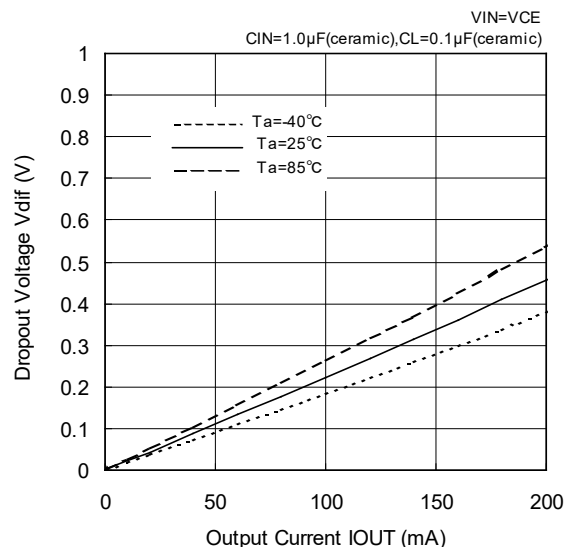
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (3) Dropout Voltage vs. Output Current (Continued)

XC6215x302

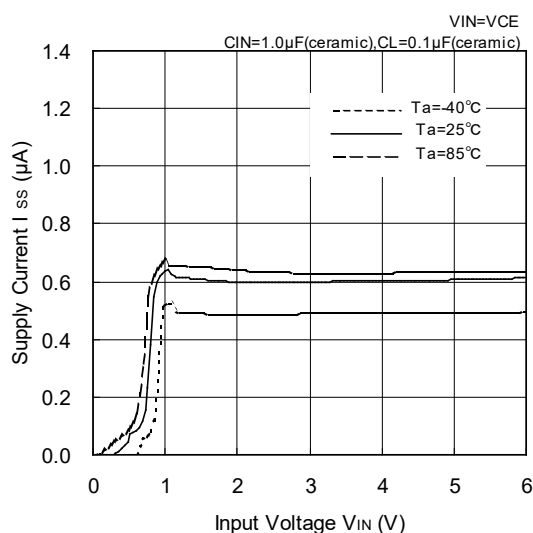


XC6215x502

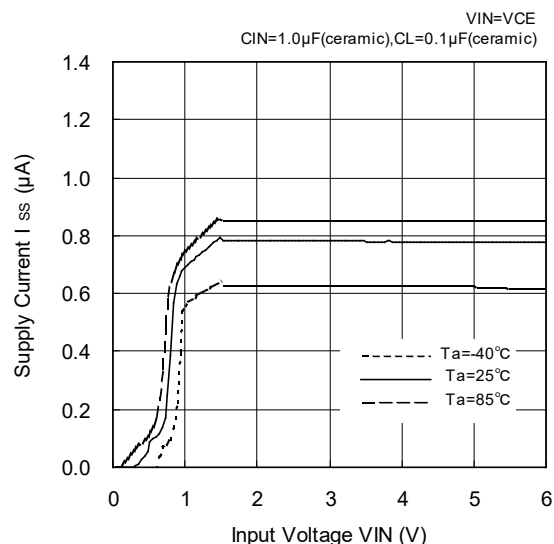


### (4) Supply Current vs. Input Voltage

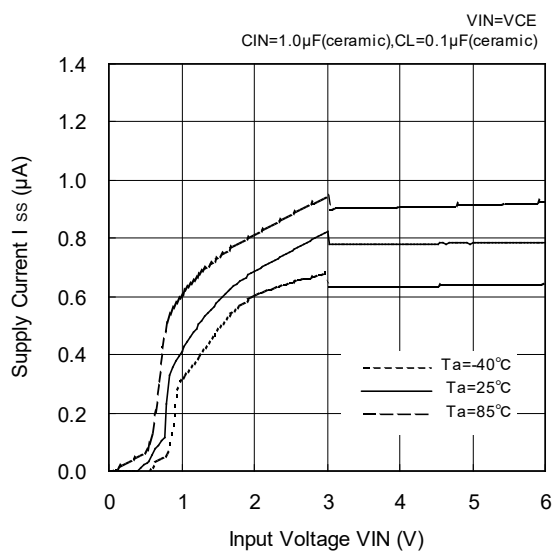
XC6215x092



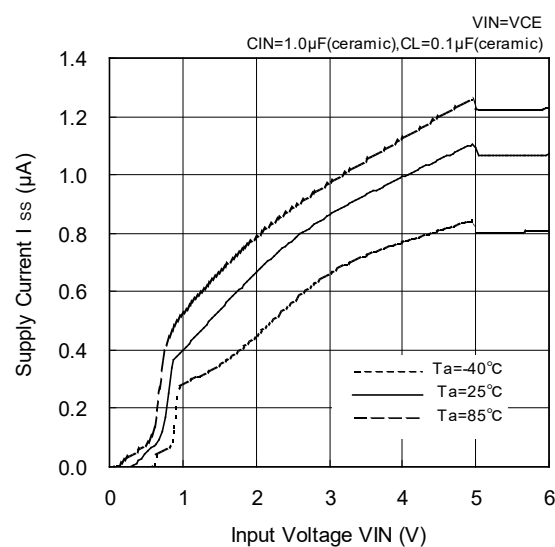
XC6215x152



XC6215x302

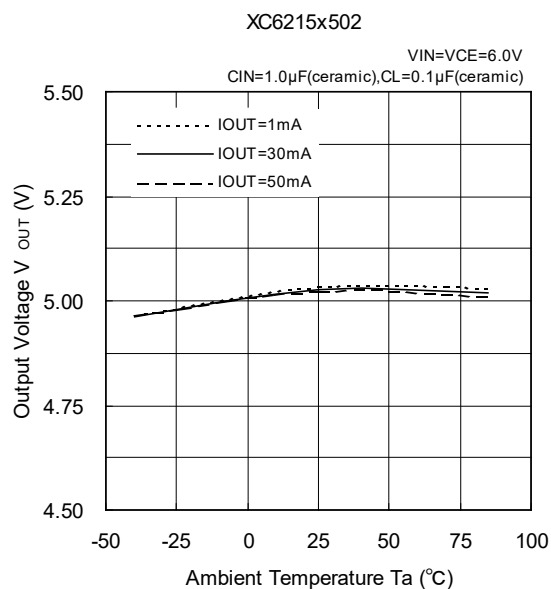
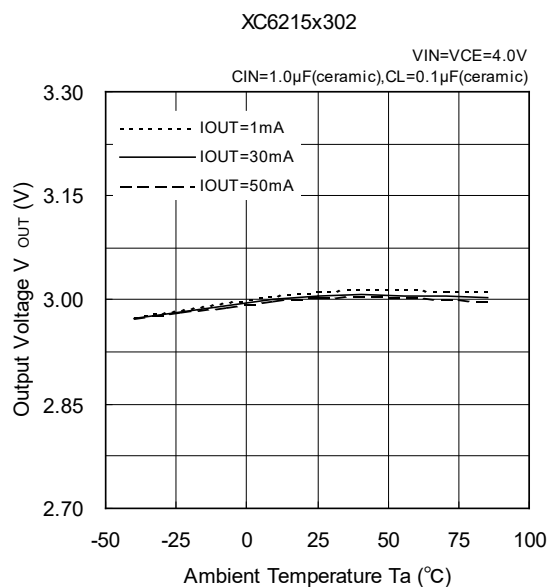
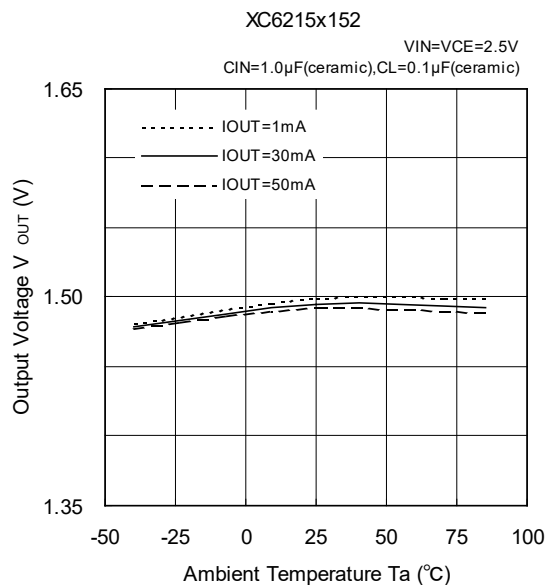
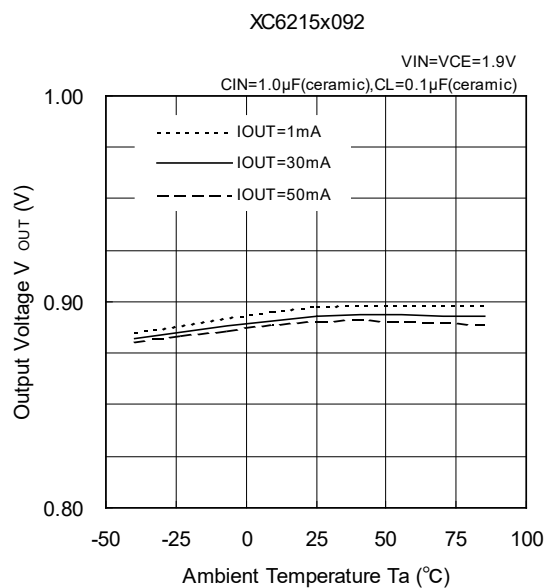


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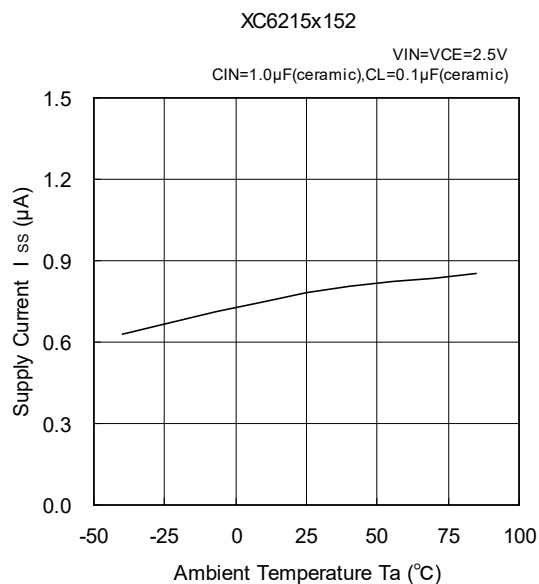
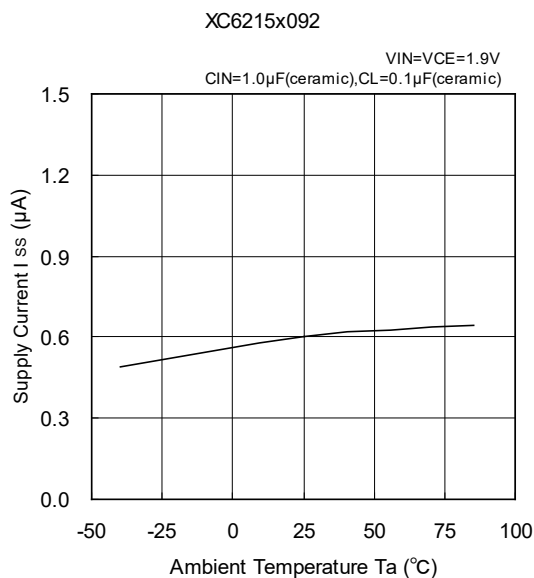


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (5) Output Voltage vs. Ambient Temperature



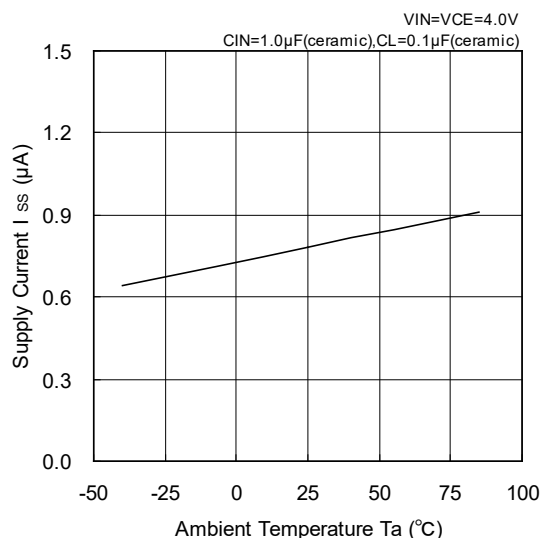
### (6) Supply Current vs. Ambient Temperature



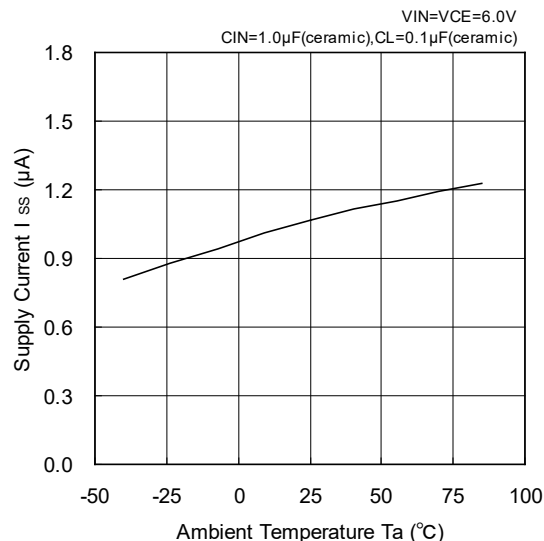
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (6) Supply Current vs. Ambient Temperature (Continued)

XC6215x302

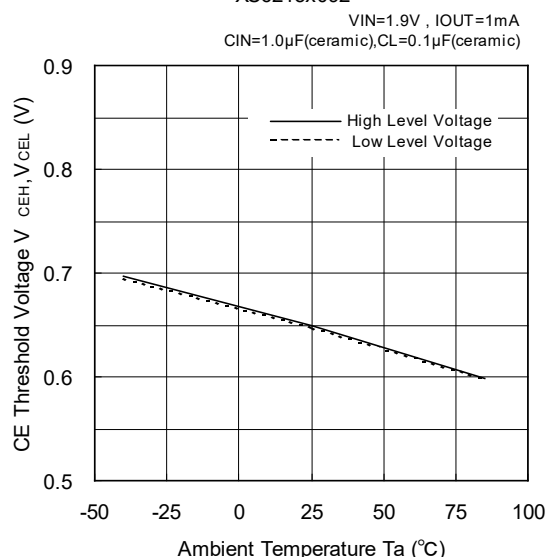


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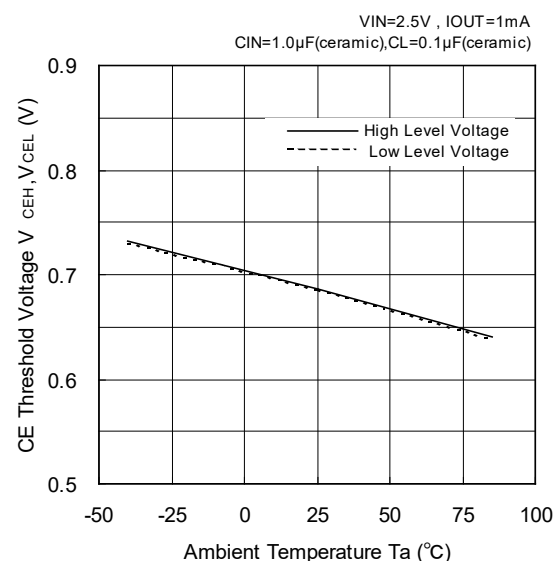


### (7) CE Threshold Voltage vs. Ambient Temperature

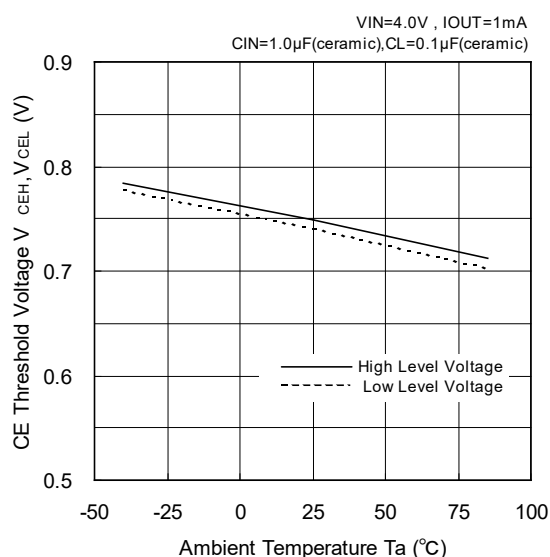
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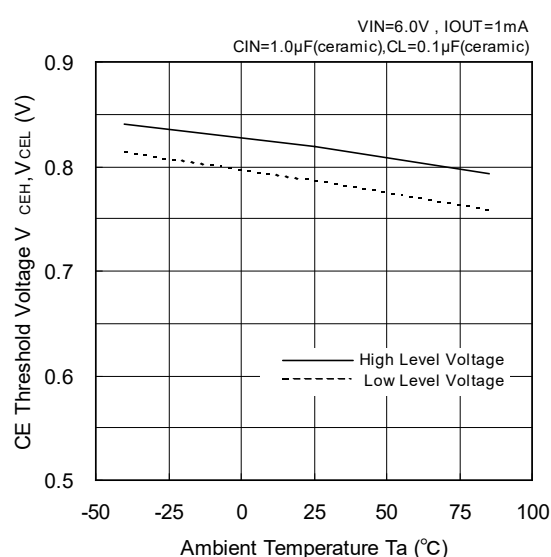
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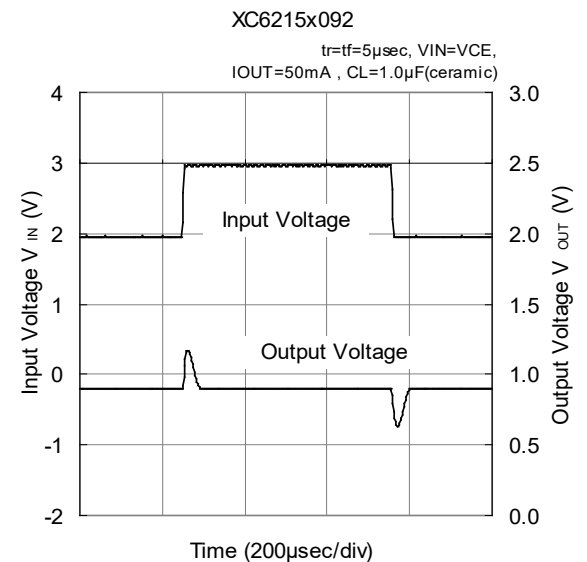
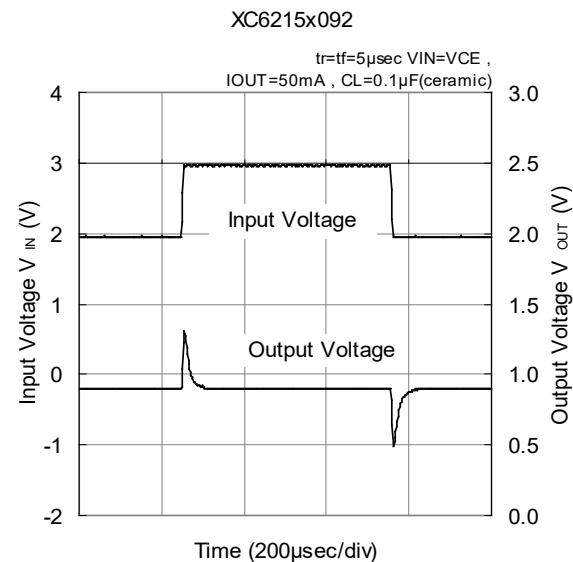
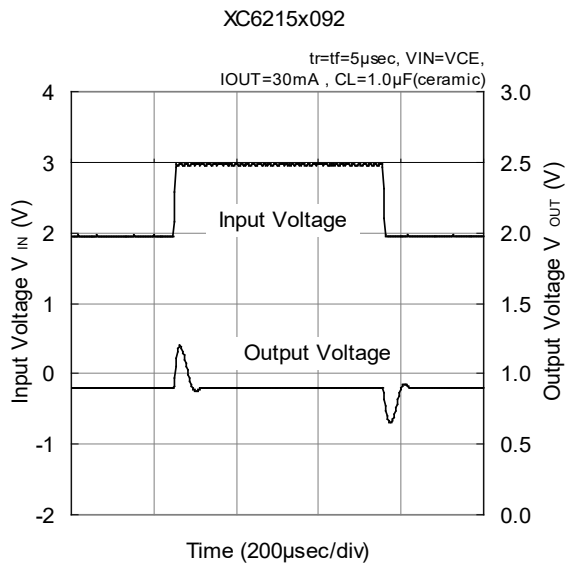
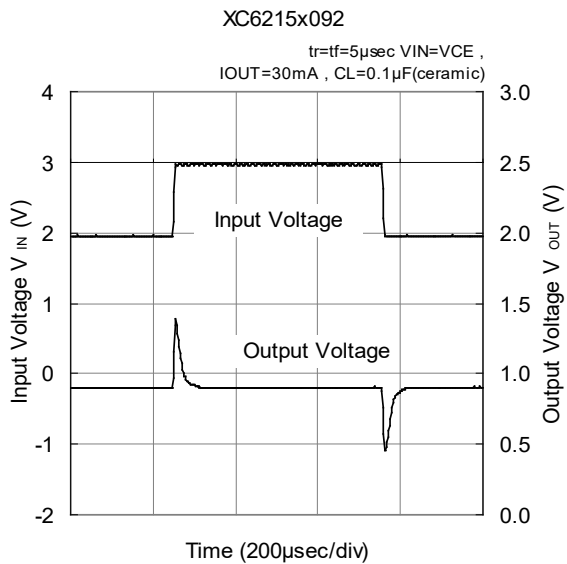
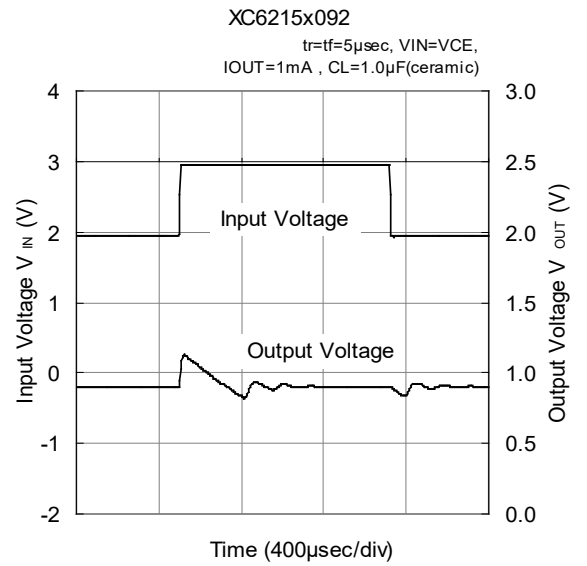
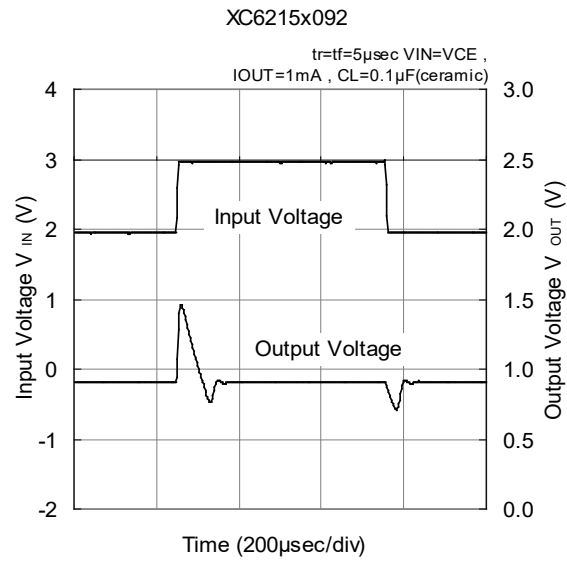


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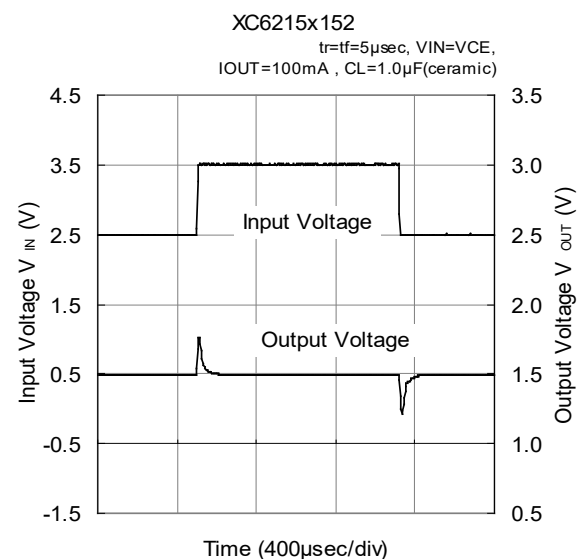
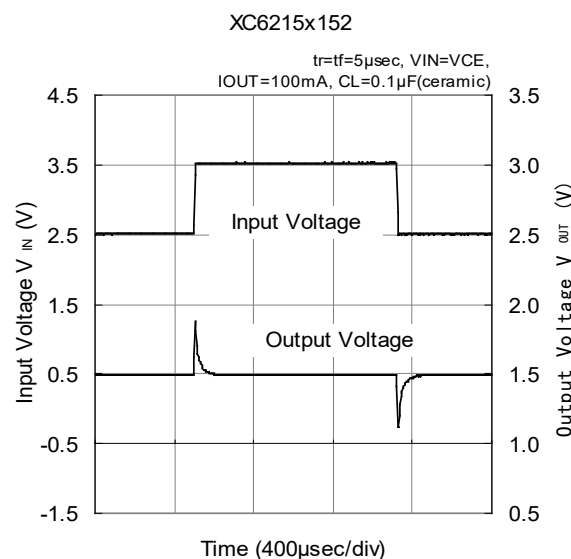
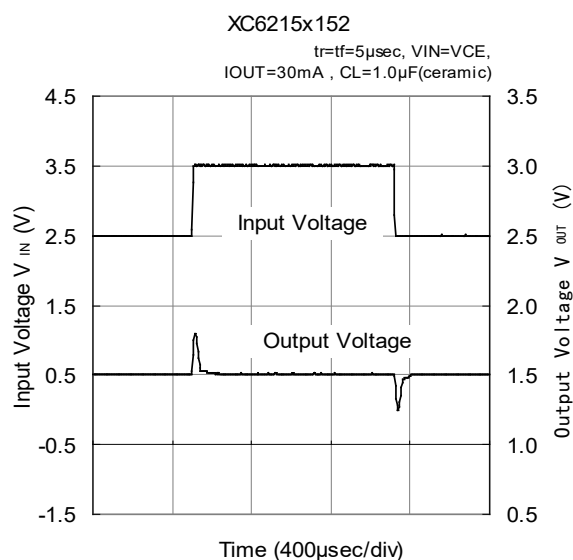
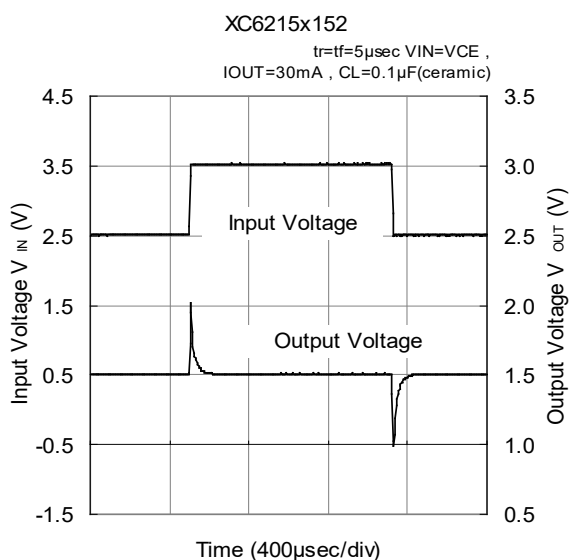
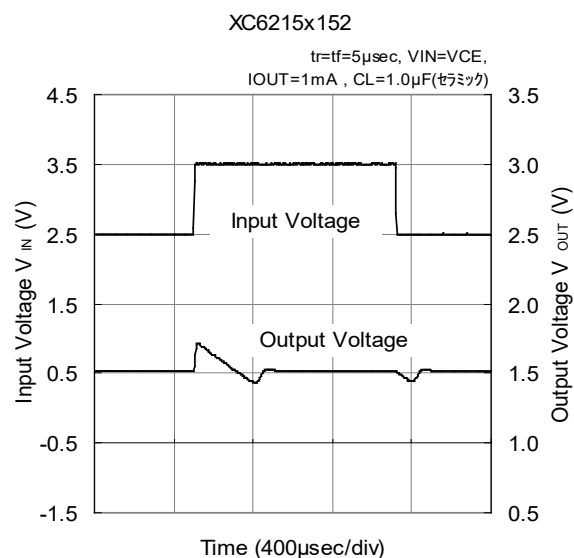
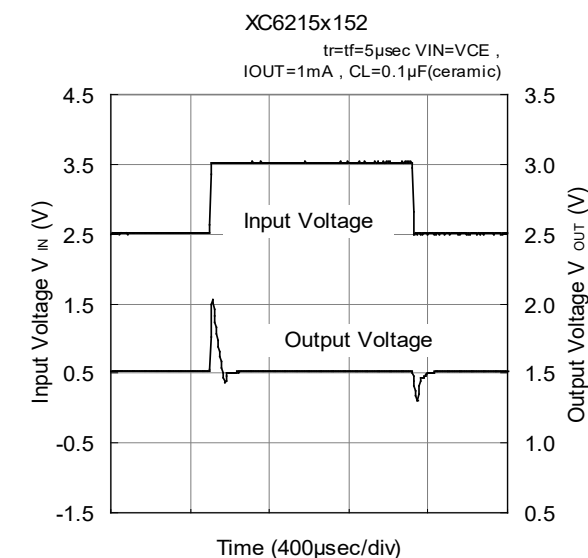
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (8) Input Transient Response



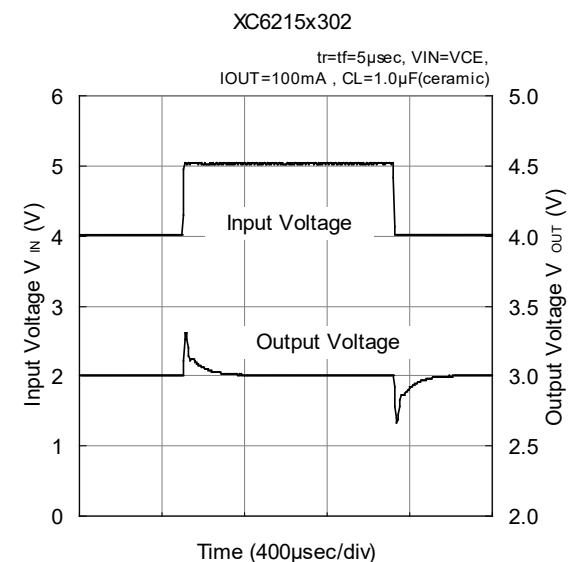
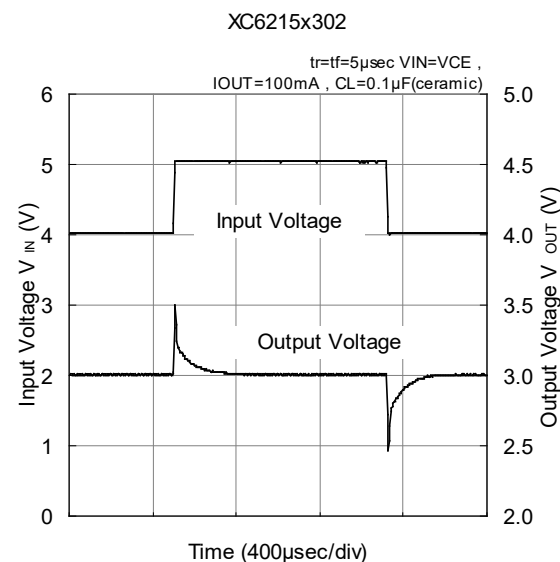
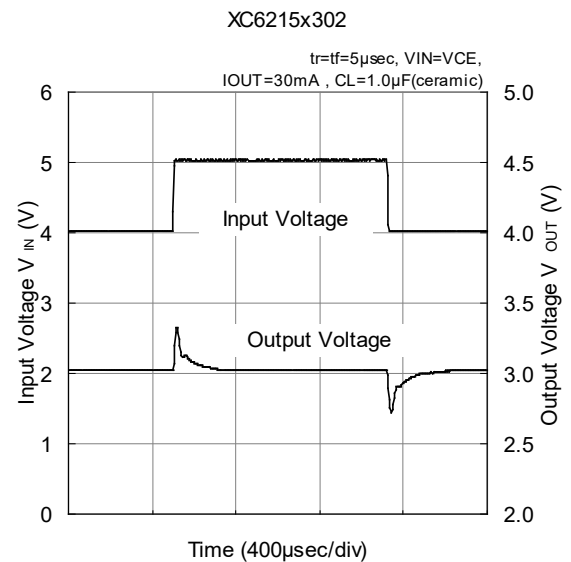
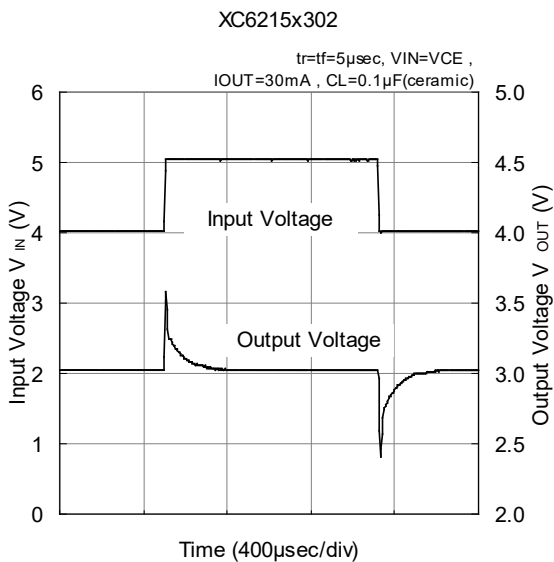
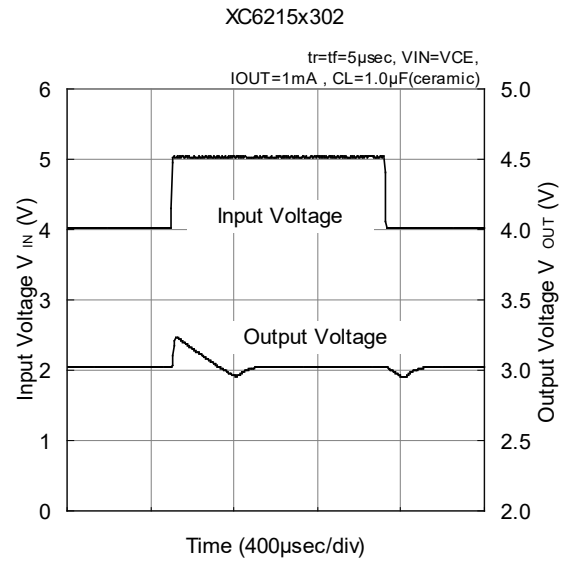
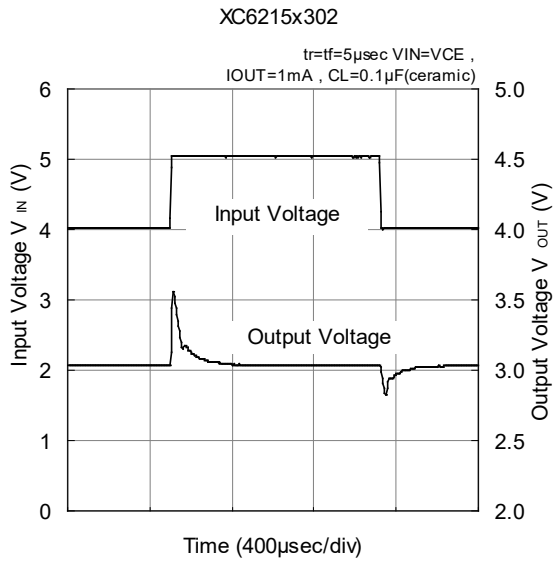
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (8) Input Transient Response (Continued)



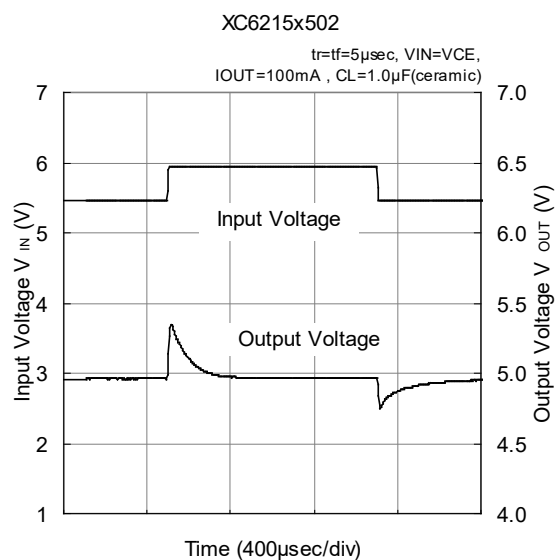
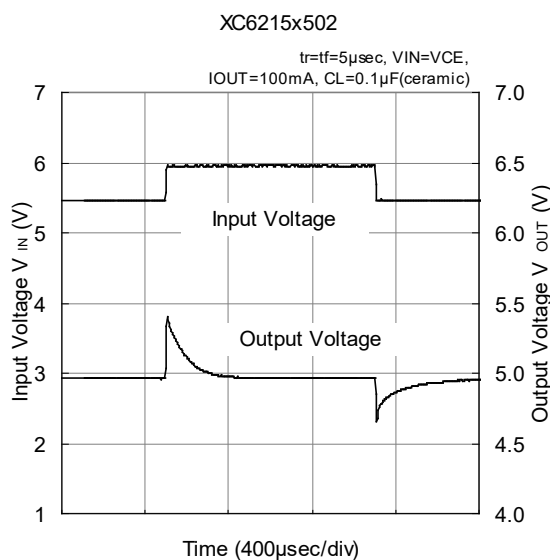
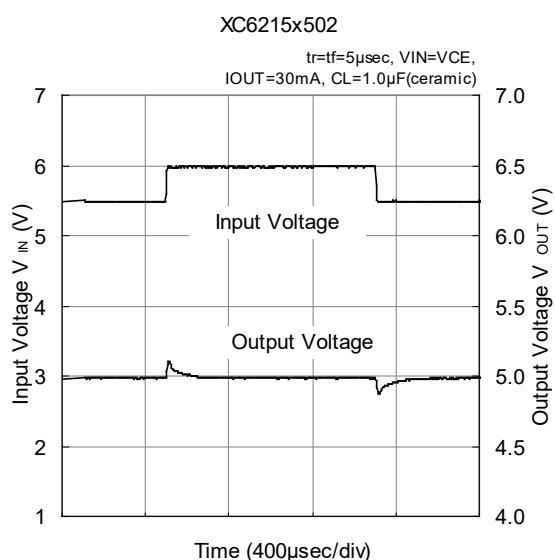
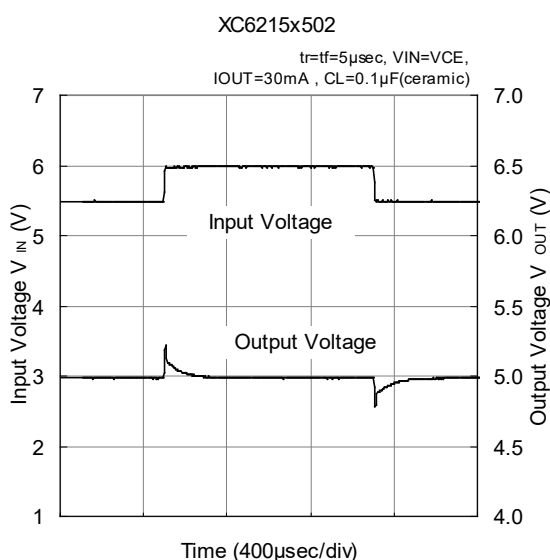
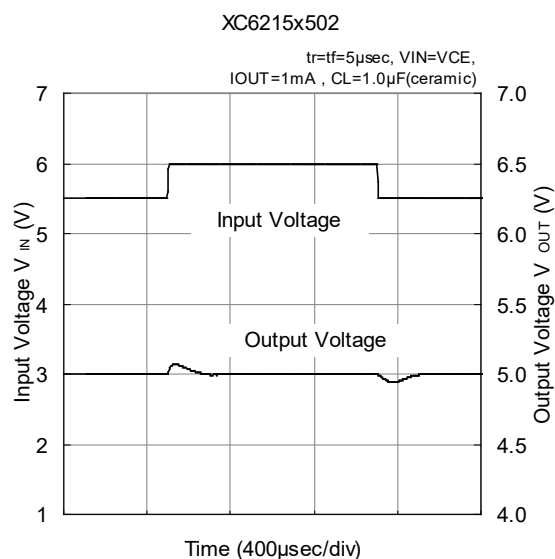
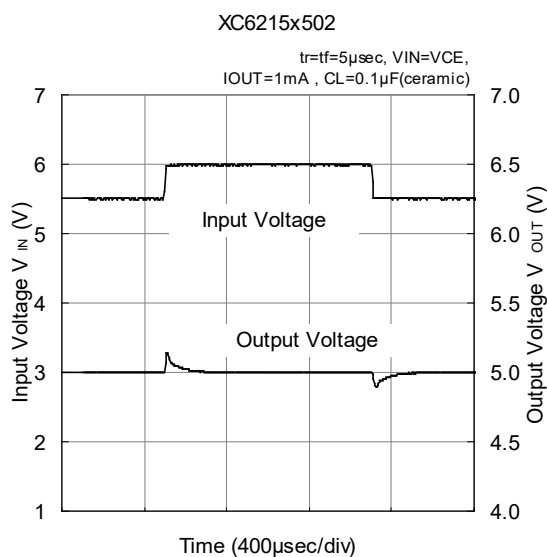
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (8) Input Transient Response (Continued)



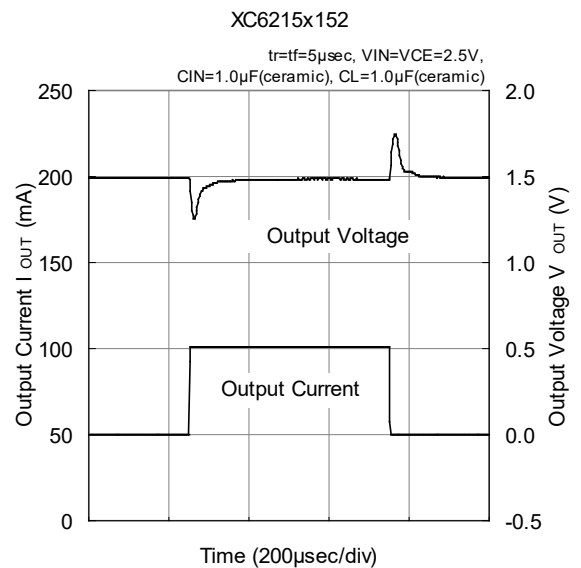
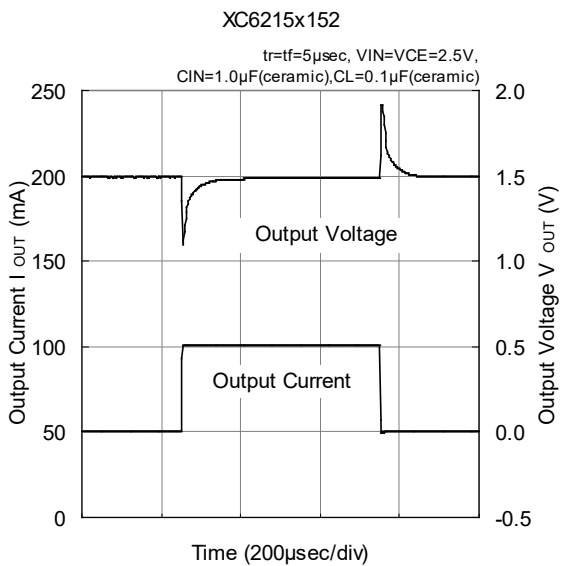
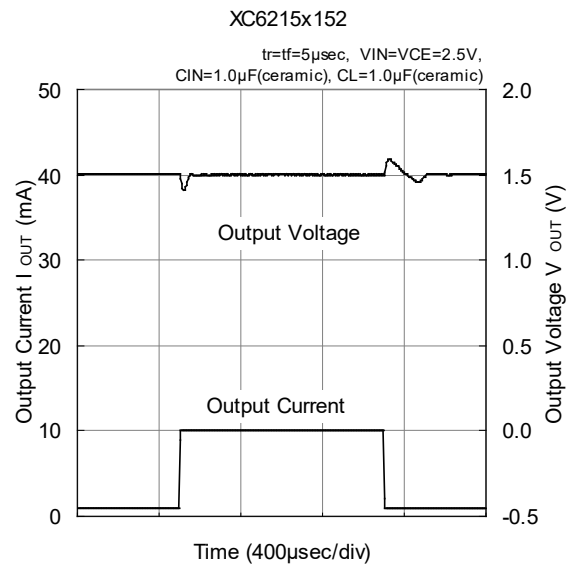
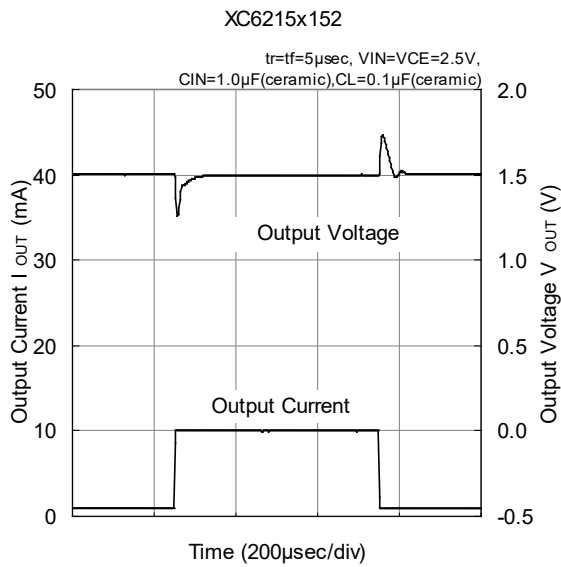
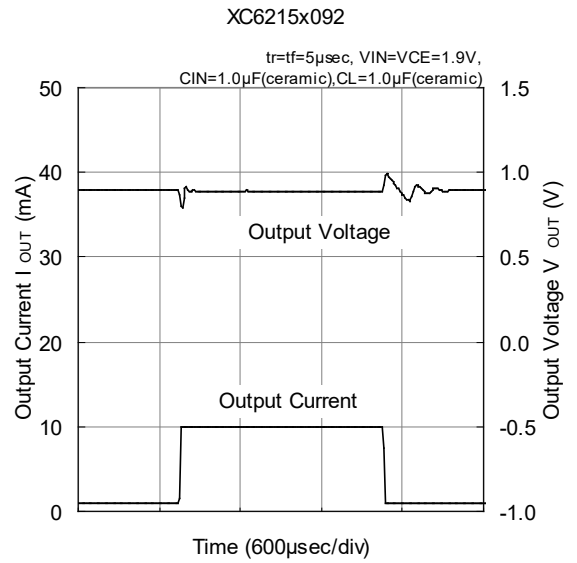
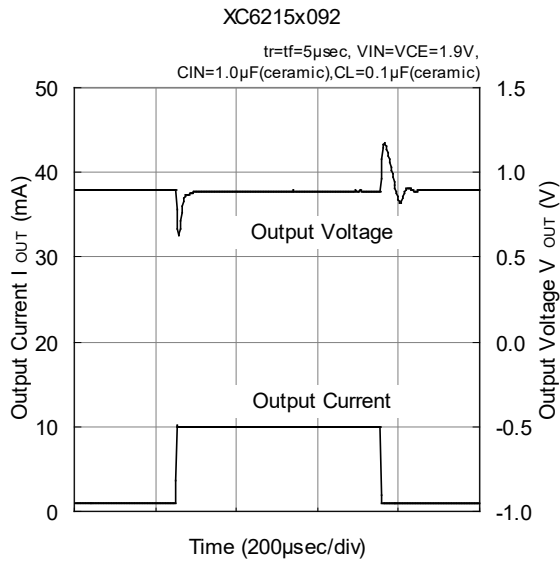
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (8) Input Transient Response (Continued)



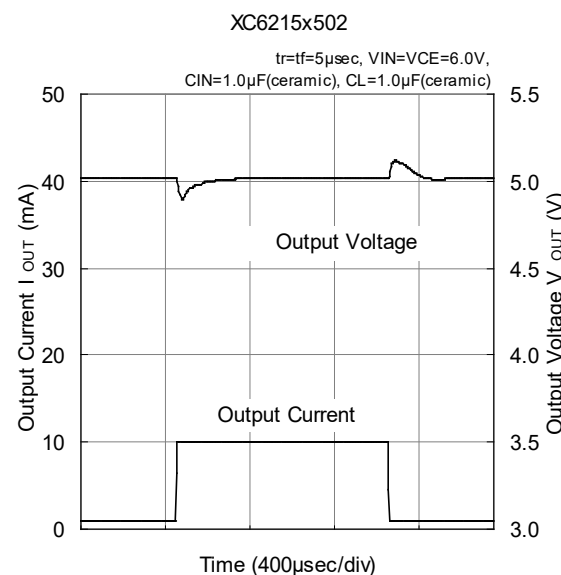
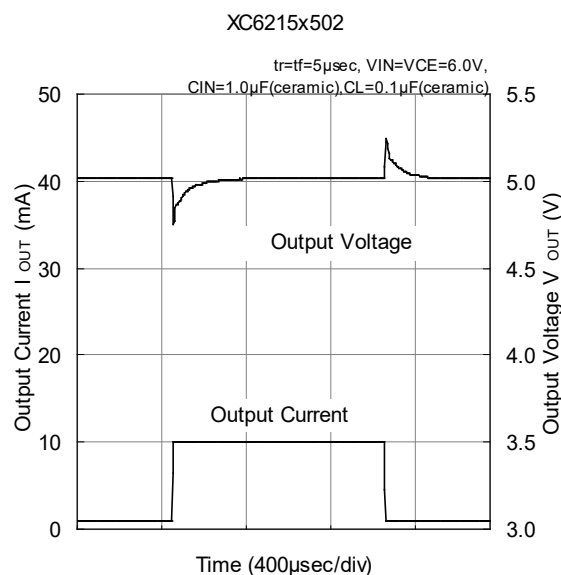
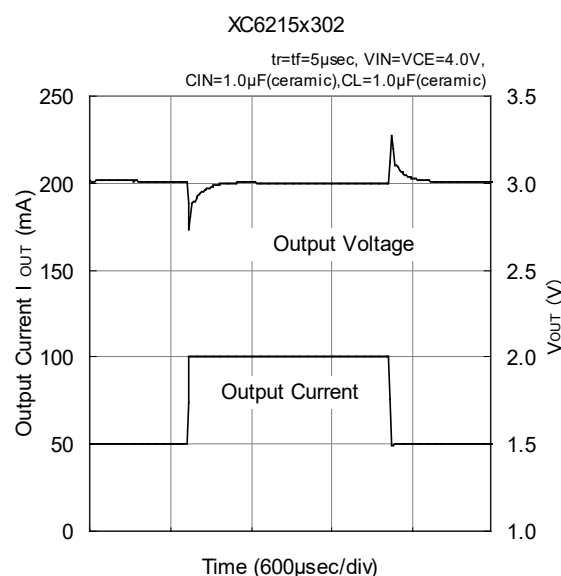
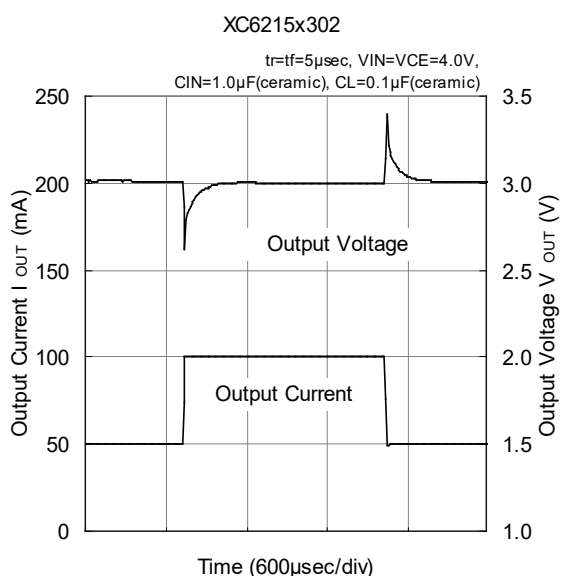
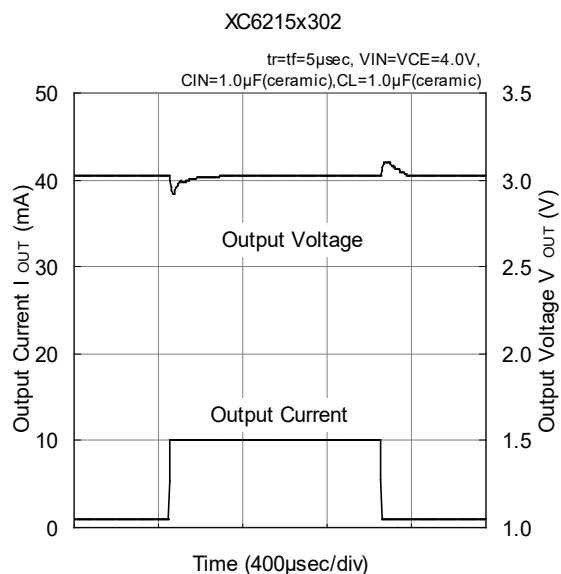
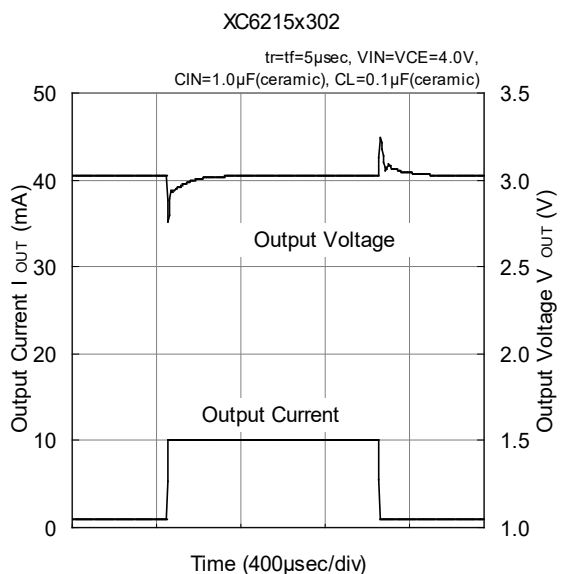
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Load Transient Response



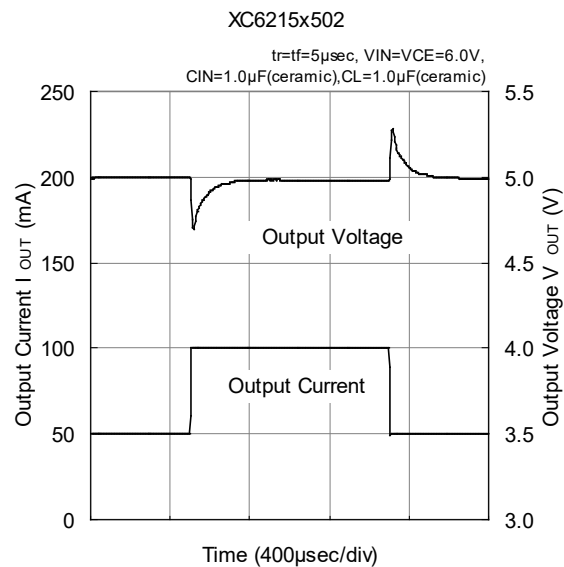
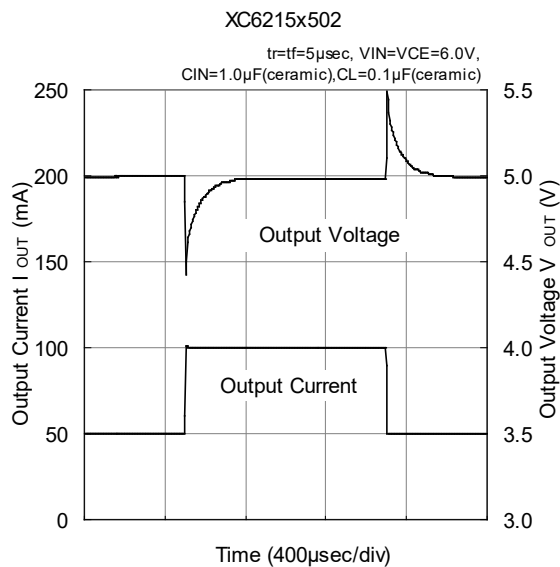
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Load Transient Response (Continued)

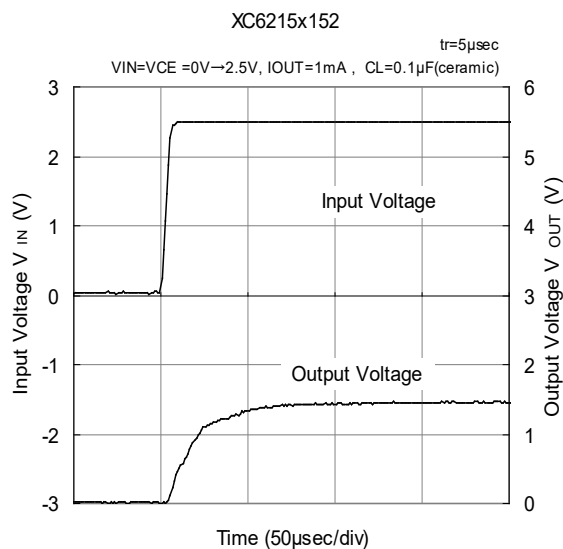
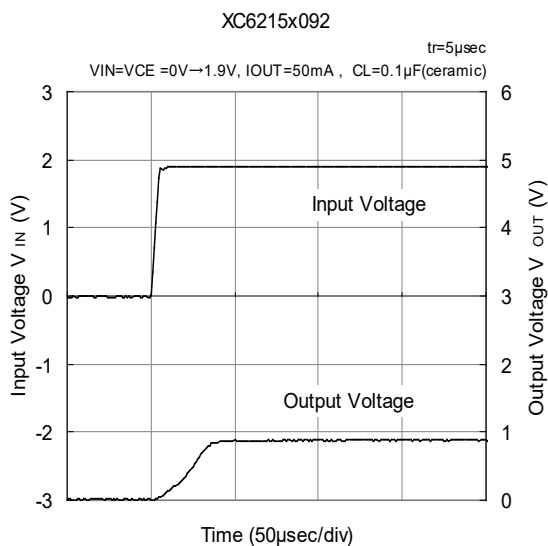
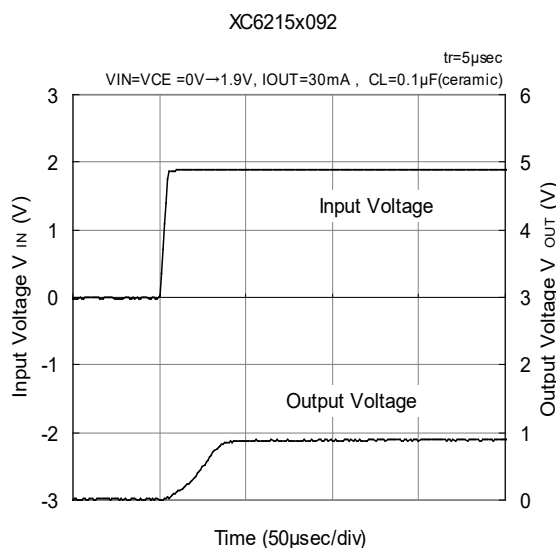
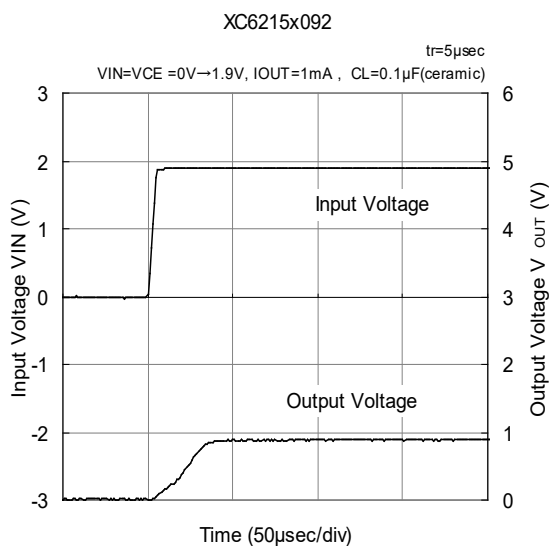


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (9) Load Transient Response (Continued)

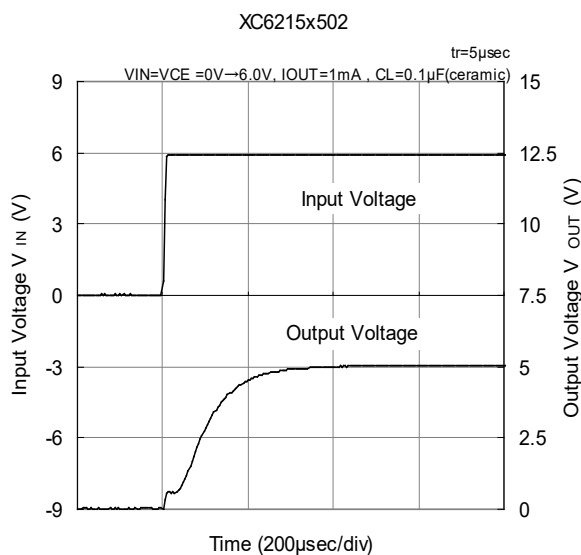
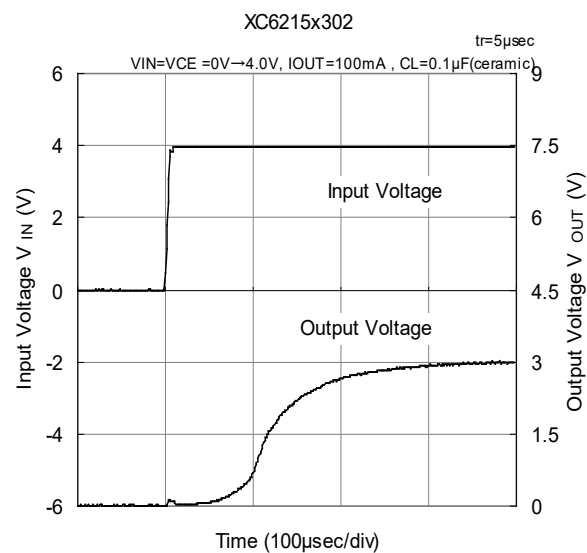
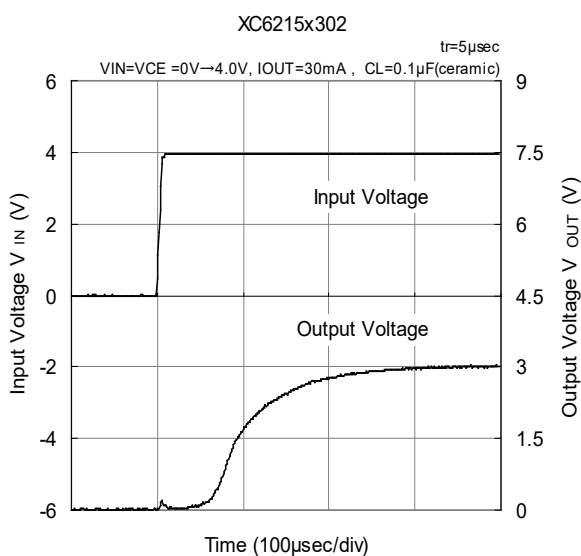
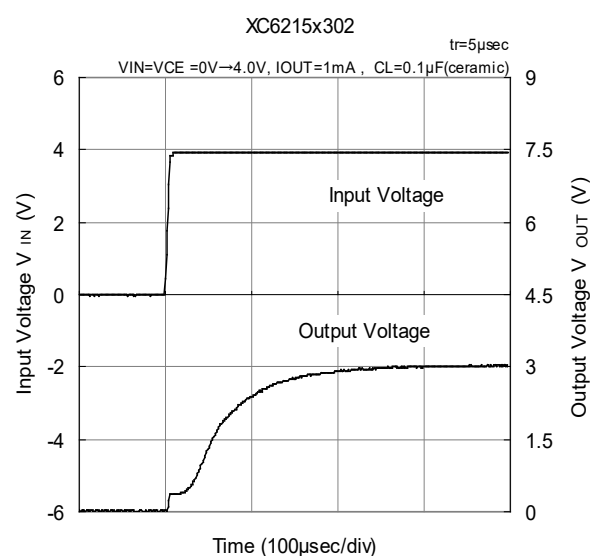
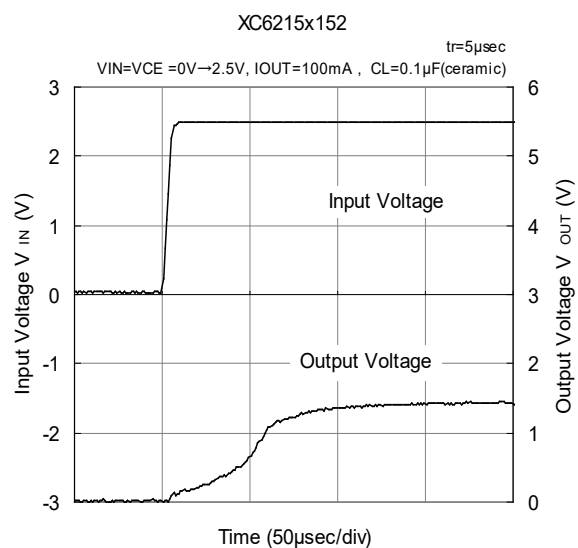
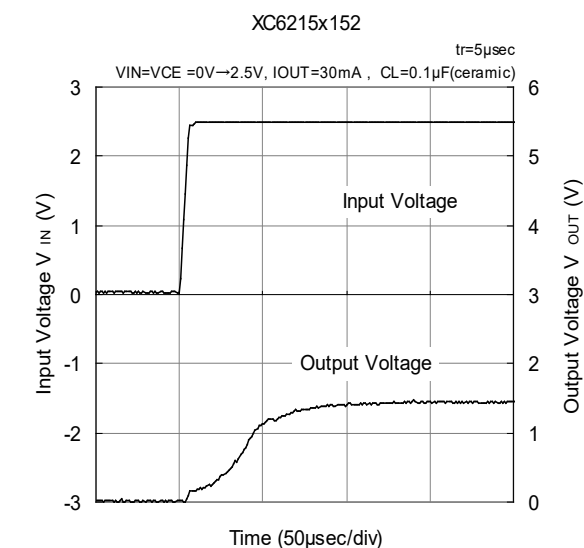


### (10) Rising Response Time



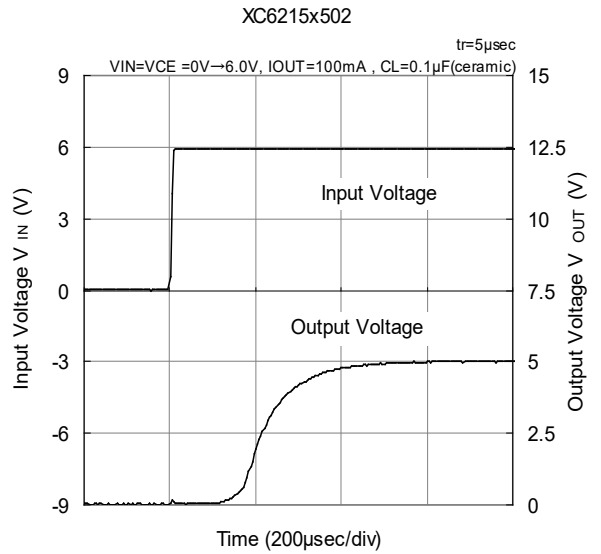
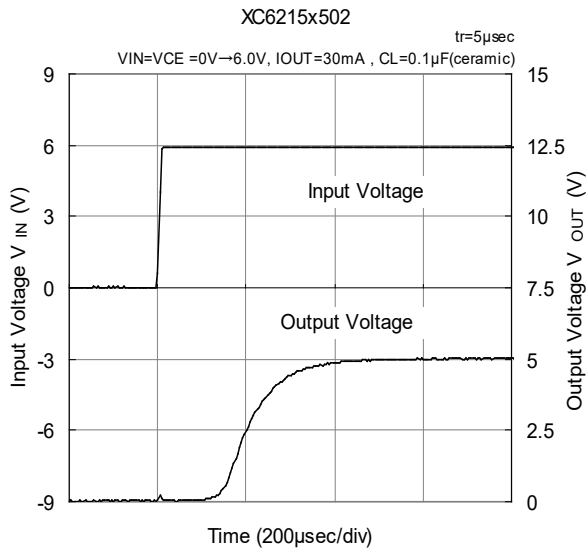
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (10) Rising Response Time (Continued)

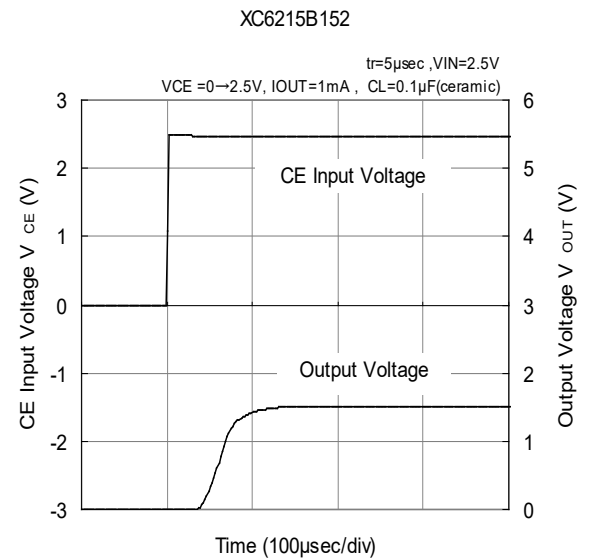
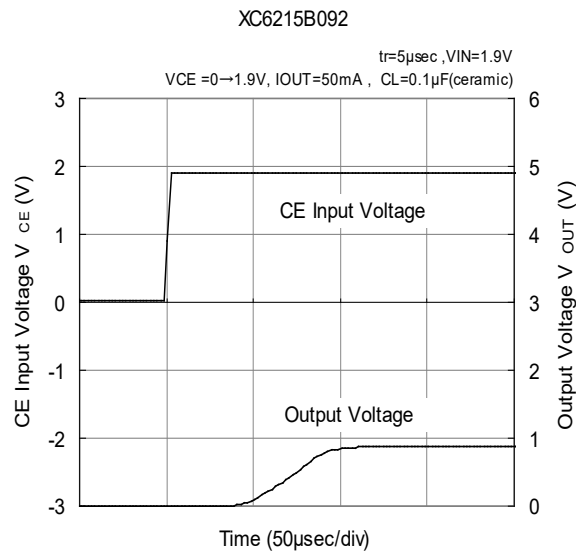
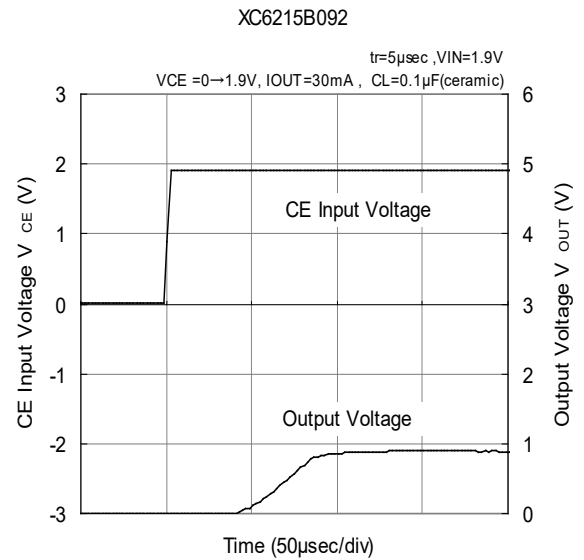
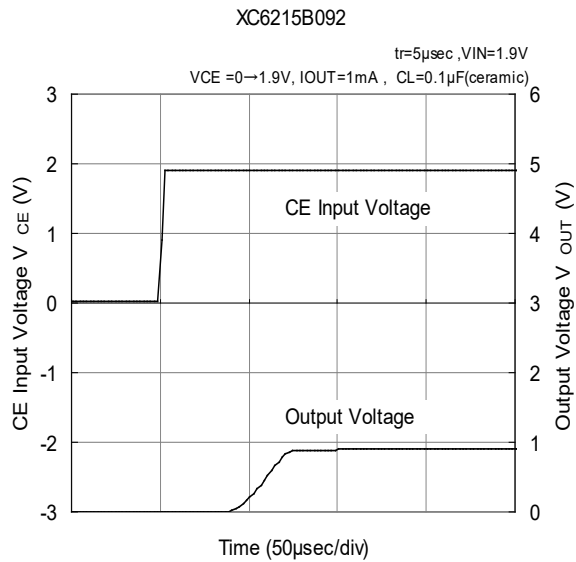


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (10) Rising Response Time (Continued)



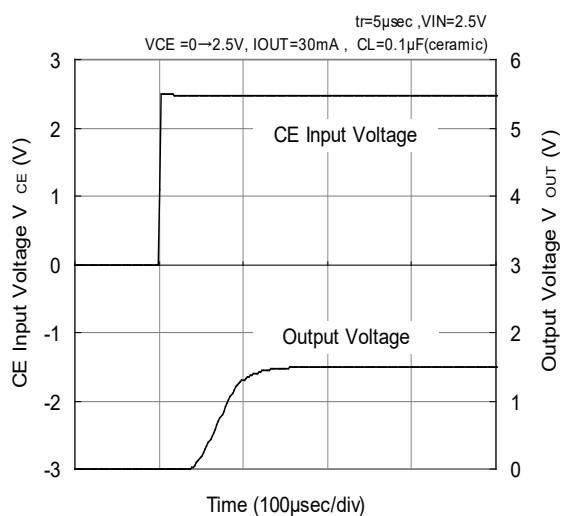
### (11) CE Rising Response Time (For XC6215B Type)



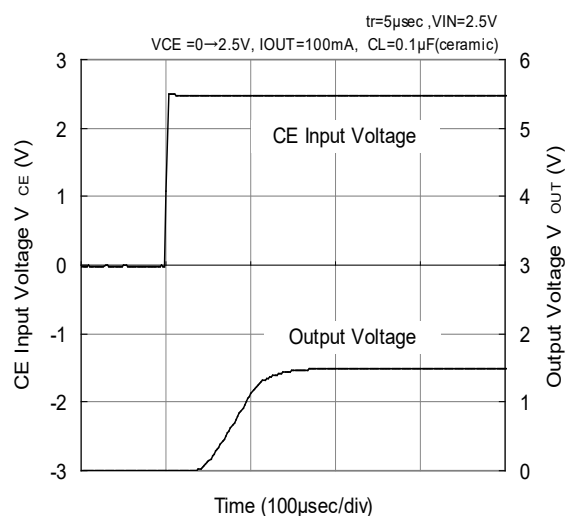
## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) CE Rising Response Time (Continued)

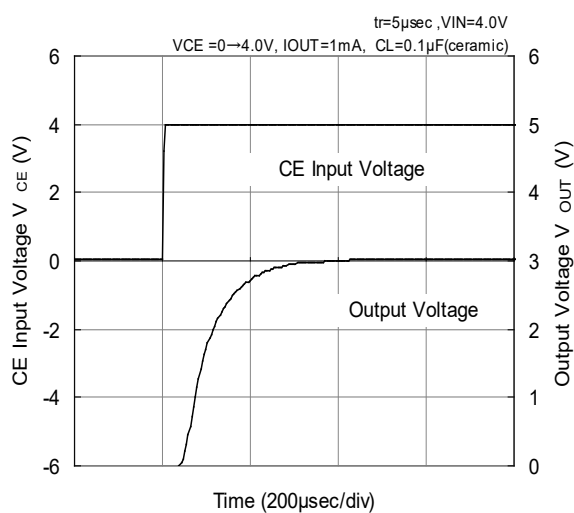
XC6215B152



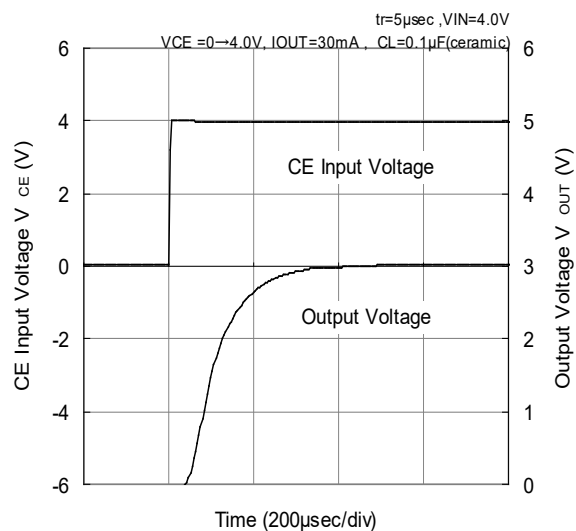
XC6215B152



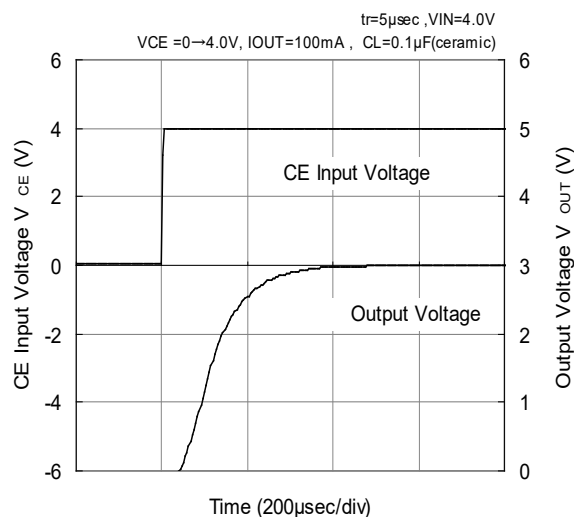
XC6215B302



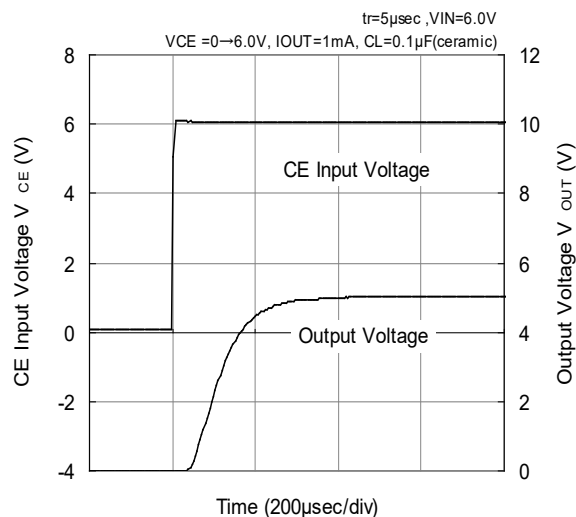
XC6215B302



XC6215B302



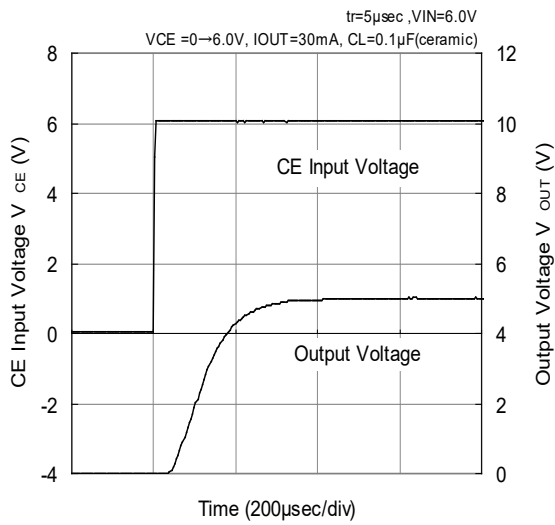
XC6215B502



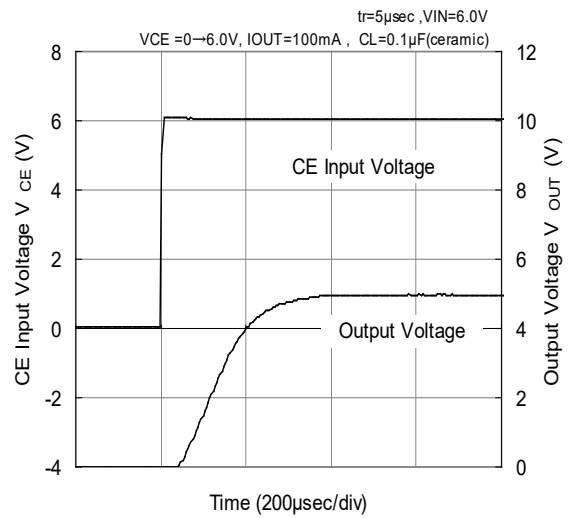
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) CE Rising Response Time (For XC6215 Type)

XC6215B502

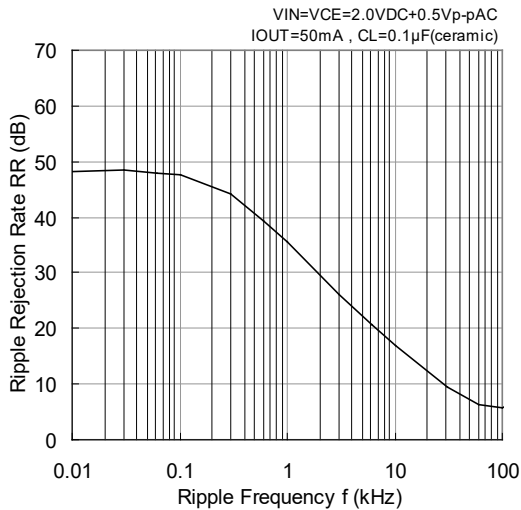


XC6215B502

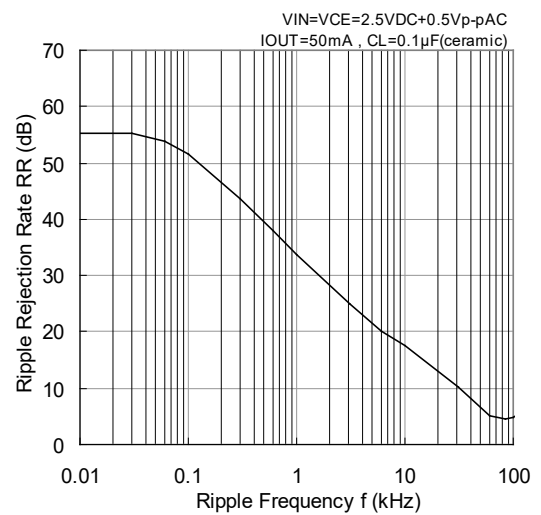


### (12) Ripple Rejection Rate

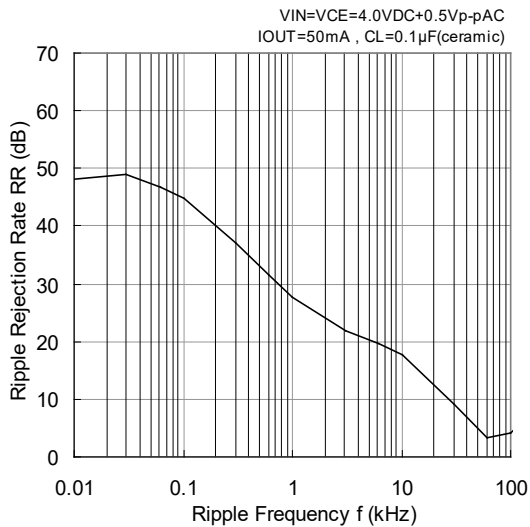
XC6215x092



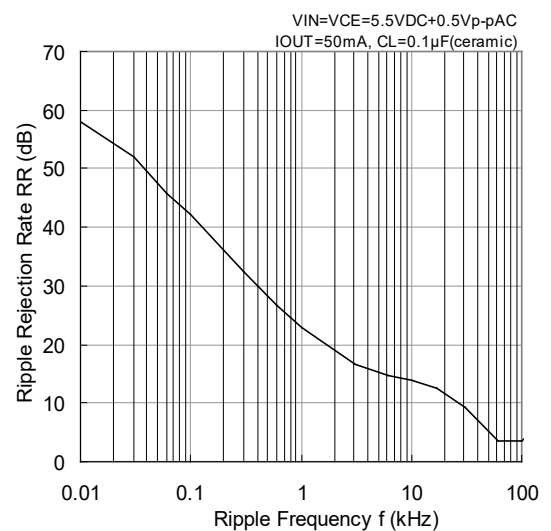
XC6215x152



XC6215x302



XC6215x502



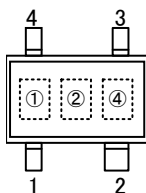
## ■ PACKAGING INFORMATION

For the latest package information go to, [www.torexsemi.com/technical-support/packages](http://www.torexsemi.com/technical-support/packages)

| PACKAGE  | OUTLINE / LAND PATTERN       | THERMAL CHARACTERISTICS                    |
|----------|------------------------------|--------------------------------------------|
| USP-3    | <a href="#">USP-3 PKG</a>    | <a href="#">USP-3 Power Dissipation</a>    |
| USP-4    | <a href="#">USP-4 PKG</a>    | <a href="#">USP-4 Power Dissipation</a>    |
| SOT-25   | <a href="#">SOT-25 PKG</a>   | <a href="#">SOT-25 Power Dissipation</a>   |
| SSOT-24  | <a href="#">SSOT-24 PKG</a>  | <a href="#">SSOT-24 Power Dissipation</a>  |
| USPN-4   | <a href="#">USPN-4 PKG</a>   | <a href="#">USPN-4 Power Dissipation</a>   |
| USP-6B06 | <a href="#">USP-6B06 PKG</a> | <a href="#">USP-6B06 Power Dissipation</a> |

## MARKING RULE

### ●SSOT-24



SSOT-24  
(TOP VIEW)

① represents type of regulator and output voltage range

| MARK | TYPE                                                    | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|------|---------------------------------------------------------|----------------------|----------------|
| T    | CE pin, High Active with no pull-down resistor built in | 0.9V ~ 3.0V          | XC6215Bxxxxx   |
| U    |                                                         | 3.1V ~ 5.0V          |                |

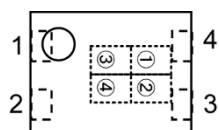
② represents decimal point of output voltage

| MARK | OUTPUT VOLTAGE (V) |     |   | MARK | OUTPUT VOLTAGE (V) |     |   |
|------|--------------------|-----|---|------|--------------------|-----|---|
| 0    | -                  | 3.1 | - | F    | 1.6                | 4.6 | - |
| 1    | -                  | 3.2 | - | H    | 1.7                | 4.7 | - |
| 2    | -                  | 3.3 | - | K    | 1.8                | 4.8 | - |
| 3    | -                  | 3.4 | - | L    | 1.9                | 4.9 | - |
| 4    | -                  | 3.5 | - | M    | 2.0                | 5.0 | - |
| 5    | -                  | 3.6 | - | N    | 2.1                | -   | - |
| 6    | -                  | 3.7 | - | P    | 2.2                | -   | - |
| 7    | -                  | 3.8 | - | R    | 2.3                | -   | - |
| 8    | 0.9                | 3.9 | - | S    | 2.4                | -   | - |
| 9    | 1.0                | 4.0 | - | T    | 2.5                | -   | - |
| A    | 1.1                | 4.1 | - | U    | 2.6                | -   | - |
| B    | 1.2                | 4.2 | - | V    | 2.7                | -   | - |
| C    | 1.3                | 4.3 | - | X    | 2.8                | -   | - |
| D    | 1.4                | 4.4 | - | Y    | 2.9                | -   | - |
| E    | 1.5                | 4.5 | - | Z    | 3.0                | -   | - |

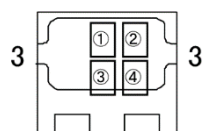
③ represents production lot number  
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)  
NOTE: No character inversion used.

## ■ MARKING RULE (Continued)

### ● USP-4, USP-3



USP-4  
(TOP VIEW)



USP-3  
(TOP VIEW)

① represents product series

| MARK | PRODUCT SERIES |
|------|----------------|
| E    | XC6215xxxxxx   |

② represents type of regulator and output voltage range

| MARK | TYPE                                                    | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|------|---------------------------------------------------------|----------------------|----------------|
| T    | CE pin, High Active with no pull-down resistor built in | 0.9V ~ 3.0V          | XC6215xxxxxx   |
| U    |                                                         | 3.1V ~ 5.0V          |                |

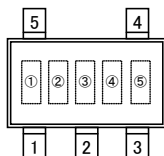
③ represents output voltage

| MARK | OUTPUT VOLTAGE (V) |     |   | MARK | OUTPUT VOLTAGE (V) |     |   |
|------|--------------------|-----|---|------|--------------------|-----|---|
| 0    | -                  | 3.1 | - | F    | 1.6                | 4.6 | - |
| 1    | -                  | 3.2 | - | H    | 1.7                | 4.7 | - |
| 2    | -                  | 3.3 | - | K    | 1.8                | 4.8 | - |
| 3    | -                  | 3.4 | - | L    | 1.9                | 4.9 | - |
| 4    | -                  | 3.5 | - | M    | 2.0                | 5.0 | - |
| 5    | -                  | 3.6 | - | N    | 2.1                | -   | - |
| 6    | -                  | 3.7 | - | P    | 2.2                | -   | - |
| 7    | -                  | 3.8 | - | R    | 2.3                | -   | - |
| 8    | 0.9                | 3.9 | - | S    | 2.4                | -   | - |
| 9    | 1.0                | 4.0 | - | T    | 2.5                | -   | - |
| A    | 1.1                | 4.1 | - | U    | 2.6                | -   | - |
| B    | 1.2                | 4.2 | - | V    | 2.7                | -   | - |
| C    | 1.3                | 4.3 | - | X    | 2.8                | -   | - |
| D    | 1.4                | 4.4 | - | Y    | 2.9                | -   | - |
| E    | 1.5                | 4.5 | - | Z    | 3.0                | -   | - |

④ represents production lot number  
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)  
NOTE: No character inversion used.

## MARKING RULE (Continued)

### ● SOT-25



SOT-25  
(TOP VIEW)

① represents product series

| MARK | PRODUCT SERIES |
|------|----------------|
| E    | XC6215xxxxxx   |

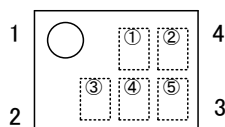
② represents type of regulators and output voltage range

| MARK | TYPE                                                    | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|------|---------------------------------------------------------|----------------------|----------------|
| T    | CE pin, High Active with no pull-down resistor built in | 0.9V~3.0V            | XC6215xxxxxx   |
| U    |                                                         | 3.1V~5.0V            |                |

③ represents output voltage

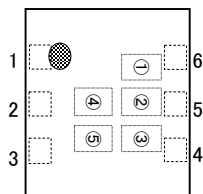
| MARK | OUTPUT VOLTAGE (V) |     |   | MARK | OUTPUT VOLTAGE (V) |     |   |
|------|--------------------|-----|---|------|--------------------|-----|---|
| 0    | -                  | 3.1 | - | F    | 1.6                | 4.6 | - |
| 1    | -                  | 3.2 | - | H    | 1.7                | 4.7 | - |
| 2    | -                  | 3.3 | - | K    | 1.8                | 4.8 | - |
| 3    | -                  | 3.4 | - | L    | 1.9                | 4.9 | - |
| 4    | -                  | 3.5 | - | M    | 2.0                | 5.0 | - |
| 5    | -                  | 3.6 | - | N    | 2.1                | -   | - |
| 6    | -                  | 3.7 | - | P    | 2.2                | -   | - |
| 7    | -                  | 3.8 | - | R    | 2.3                | -   | - |
| 8    | 0.9                | 3.9 | - | S    | 2.4                | -   | - |
| 9    | 1.0                | 4.0 | - | T    | 2.5                | -   | - |
| A    | 1.1                | 4.1 | - | U    | 2.6                | -   | - |
| B    | 1.2                | 4.2 | - | V    | 2.7                | -   | - |
| C    | 1.3                | 4.3 | - | X    | 2.8                | -   | - |
| D    | 1.4                | 4.4 | - | Y    | 2.9                | -   | - |
| E    | 1.5                | 4.5 | - | Z    | 3.0                | -   | - |

### ● USPN-4



USPN-4  
(TOP VIEW)

### ● USP-6B06



USP-6B06  
(TOP VIEW)

④⑤ represents production lot number  
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)  
NOTE: No character inversion used.

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