

- Low Power Consumption : 25 $\mu$ A (TYP.)
- Dropout Voltage : 30mA @ 60mV  
: 100mA @ 200mV
- Output Current : 150mA (XC6209A ~D series)  
: 300mA (XC6209E ~H series)
- Highly Accurate :  $\pm$  2% ( $\pm$  30mV less than 1.5V)
- Output Voltage Range : 0.9V ~ 6.0V (50mV Step)
- Low ESR capacitor compatible

### ■ GENERAL DESCRIPTION

The XC6209 series are precise, low noise, positive voltage LDO regulators manufactured using CMOS processes. The series achieves high ripple rejection and low dropout and consists of a voltage reference, an error amplifier, a current limiter and a phase compensation circuit plus a driver transistor.

Output voltage is selectable in 50mV increments within a range of 0.9V ~ 6.0V.

The series is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series.

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

The CE function enables the output to be turned off, resulting in greatly reduced power consumption.

### ■ APPLICATIONS

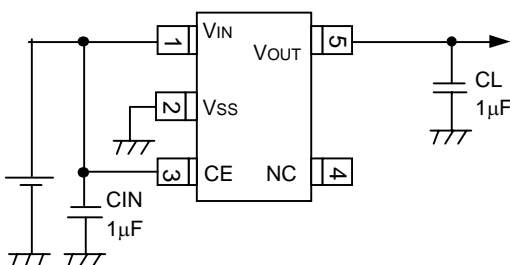
- Mobile phones, Cordless phones
- Wireless communication equipment
- Portable games
- Cameras, Video recorders
- Portable AV equipment
- Reference voltage
- Battery powered equipment

### ■ FEATURES

|                              |  |
|------------------------------|--|
| Maximum Output Current (*)   | : 150mA (XC6209A ~ D series)<br>: 300mA (XC6209E ~ H series) |
| Dropout Voltage              | : 200mV @ IOUT=100mA   |
| Operating Voltage Range      | : 2.0V ~ 10V   |
| Output Voltage Range         | : 0.9V ~ 6.0V (50mV Step)                                    |
| Highly Accurate              | : $\pm$ 2% (VOUT>1.5V)<br>: $\pm$ 30mV (VOUT $\leq$ 1.5V)    |
| Low Power Consumption        | : 25 $\mu$ A (TYP.)  |
| Standby Current              | : Less than 0.1 $\mu$ A (TYP.)                               |
| High Ripple Rejection        | : 70dB (10kHz)   |
| Operating Temperature Range  | : - 40°C ~ + 85°C  |
| Low ESR Capacitor Compatible | : Ceramic capacitor  |
| Ultra Small Packages         | : SOT-25<br>SOT-89-5<br>USP-6B                               |

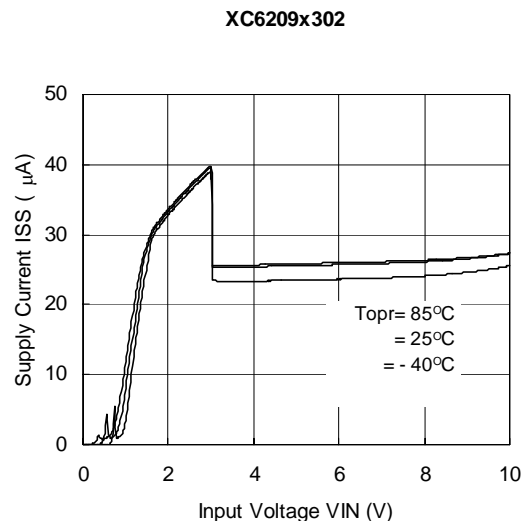
\* Maximum output current of the XC6209E ~ H series depends on the setting voltage.

### ■ TYPICAL APPLICATION CIRCUIT



### ■ TYPICAL PERFORMANCE CHARACTERISTICS

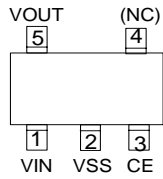
- Supply Current vs. Input Voltage



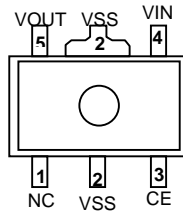
# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

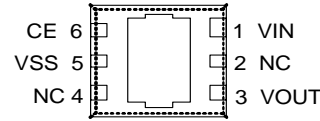
## PIN CONFIGURATION



SOT-25 (TOP VIEW)



SOT-89 (TOP VIEW)



USP-6B (BOTTOM VIEW)

\*Please do not connect a heat dissipation pad to the circuitry. If the pad needs to be connected to the circuitry, it should be connected to the VSS pin.

## PIN ASSIGNMENT

| PIN NUMBER |          |        | PIN NAME | FUNCTION       |
|------------|----------|--------|----------|----------------|
| SOT-25     | SOT-89-5 | USP-6B |          |                |
| 1          | 4        | 1      | VIN      | Input          |
| 2          | 2        | 5      | VSS      | Ground         |
| 3          | 3        | 6      | CE       | ON/OFF Control |
| 4          | 1        | 2, 4   | NC       | No Connection  |
| 5          | 5        | 3      | VOUT     | Output         |

## SELECTION GUIDE

The following options for the CE pin logic and internal pull-up/down are available:

- High Active + no pull-down resistor built-in (standard)
- High Active + 2.0M $\Omega$  pull-down resistor built-in <between CE-VSS> (semi-custom)
- Low Active + no pull-up resistor built-in (semi-custom)
- Low Active + 2.0M $\Omega$  pull-up resistor built-in <between VIN-CE> (semi-custom)

Note: \*With the pull-up resistor or pull-down resistor built-in types, the supply current during operation will increase by VIN / 2.0M $\Omega$  (TYP.).

## ORDERING INFORMATION

XC6209①②③④⑤⑥

| DESIGNATOR    | SYMBOL  | DESCRIPTION   | DESIGNATOR | SYMBOL | DESCRIPTION   |
|---------------|---------|---|------------|--------|---|
| ①<br>(*Note1) | A / E   | High Active<br>(pull-down resistor built in, semi-custom) | ④          | 2      | Output Voltage : 100mV Step<br>Accuracy : within $\pm 2\%$ (*Note2)<br>e.g. ②=2, ③=8, ④=2 $\Rightarrow$ 2.80V |
|               | B / F   | High Active<br>(no pull-down resistor built in, standard) |            | A      | Output Voltage : 50mV Step<br>Accuracy : within $\pm 2\%$ (*Note 2)<br>e.g. ②=2, ③=8, ④=A $\Rightarrow$ 2.85V |
|               | C / G   | Low Active<br>(pull-up resistor built in, semi-custom)    | ⑤          | M      | Package Type : SOT-25<br>SOT-89<br>USP - 6B   |
|               | D / H   | Active 'Low'<br>(no pull-up resistor built in, stanard)   |            | P      |   |
|               |         |   | D          |        |   |
| ② ③           | Integer | Output Voltage :<br>e.g. 3.0V = ② : 3, ③ : 0              | ⑥          |        | Device Orientation :  |
|               |         |   |            | R      | Embossed Tape : Standard Feed   |
|               |         |   |            | L      | Embossed Tape : Reverse Feed  |

(Note 1) Maximum output current of the XC6209E ~ H series depend on the setting voltage.

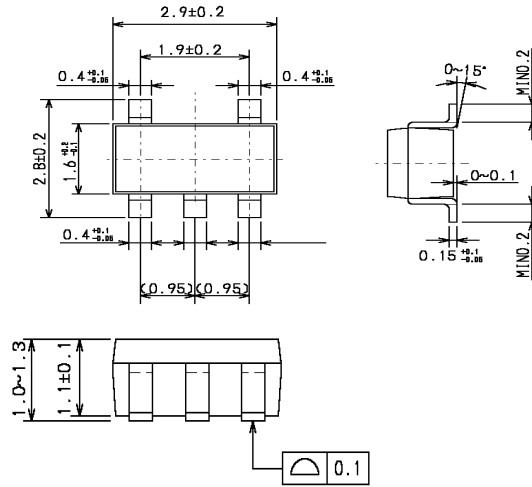
(Note 2) Within  $\pm 30\text{mV}$  ( $V_{\text{OUT}} \leq 1.5\text{V}$ )

# XC6209 Series

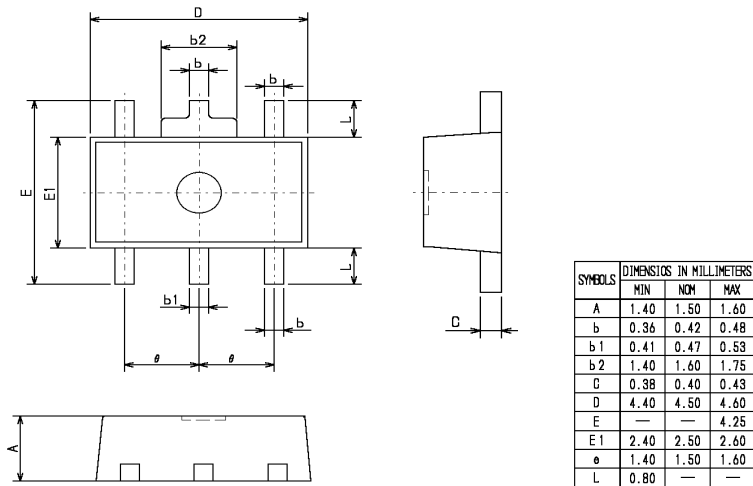
High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## PACKAGING INFORMATION

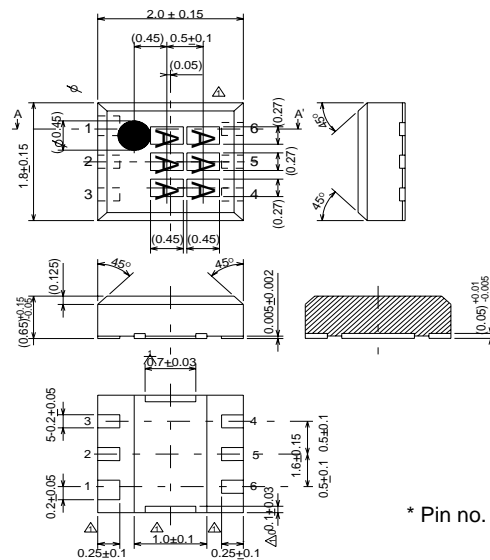
### SOT-25



### SOT-89-5



### USP-6B



\* Pin no. 1 is thicker than other pins.

# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

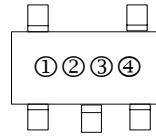
## MARKING RULE

### ○ SOT-25 & SOT-89-5

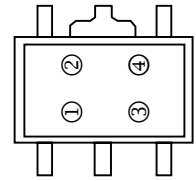
#### ① Represents product series

| SYMBOL | PRODUCT SERIES |
|--------|----------------|
| 9      | XC6209xxxxx    |

\* Sequential number for custom products (0 to 9 or A to Z)



SOT-25  
(TOP VIEW)



SOT-89-5  
(TOP VIEW)

#### ② Represents the type of voltage regulator

| SYMBOL            |                   |                     |                     | PRODUCT SERIES |
|-------------------|-------------------|---------------------|---------------------|----------------|
| VOUT 100mV STEPS  |                   | VOUT 50mV STEPS     |                     |                |
| VOUT=<br>0.1~3.0V | VOUT=<br>3.1~6.0V | VOUT=<br>0.15~3.05V | VOUT=<br>3.15~6.05V |                |
| V                 | A                 | E                   | L                   | XC6209Axxxxx   |
| X                 | B                 | F                   | M                   | XC6209Bxxxxx   |
| Y                 | C                 | H                   | N                   | XC6209Cxxxxx   |
| Z                 | D                 | K                   | P                   | XC6209Dxxxxx   |
| <u>V</u>          | <u>A</u>          | <u>E</u>            | <u>L</u>            | XC6209Exxxxx   |
| <u>X</u>          | <u>B</u>          | <u>F</u>            | <u>M</u>            | XC6209Fxxxxx   |
| <u>Y</u>          | <u>C</u>          | <u>H</u>            | <u>N</u>            | XC6209Gxxxxx   |
| <u>Z</u>          | <u>D</u>          | <u>K</u>            | <u>P</u>            | XC6209Hxxxxx   |

#### ③ Represents output voltage

| SYMBOL | OUTPUT VOLTAGE (V) |      |      |      | SYMBOL | OUTPUT VOLTAGE (V) |      |      |      |
|--------|--------------------|------|------|------|--------|--------------------|------|------|------|
| 0      | -                  | 3.10 | -    | 3.15 | F      | 1.60               | 4.60 | 1.65 | 4.65 |
| 1      | -                  | 3.20 | -    | 3.25 | H      | 1.70               | 4.70 | 1.75 | 4.75 |
| 2      | -                  | 3.30 | -    | 3.35 | K      | 1.80               | 4.80 | 1.85 | 4.85 |
| 3      | -                  | 3.40 | -    | 3.45 | L      | 1.90               | 4.90 | 1.95 | 4.95 |
| 4      | -                  | 3.50 | -    | 3.55 | M      | 2.00               | 5.00 | 2.05 | 5.05 |
| 5      | -                  | 3.60 | -    | 3.65 | N      | 2.10               | 5.10 | 2.15 | 5.15 |
| 6      | -                  | 3.70 | -    | 3.75 | P      | 2.20               | 5.20 | 2.25 | 5.25 |
| 7      | -                  | 3.80 | -    | 3.85 | R      | 2.30               | 5.30 | 2.35 | 5.35 |
| 8      | 0.90               | 3.90 | 0.95 | 3.95 | S      | 2.40               | 5.40 | 2.45 | 5.45 |
| 9      | 1.00               | 4.00 | 1.05 | 4.05 | T      | 2.50               | 5.50 | 2.55 | 5.55 |
| A      | 1.10               | 4.10 | 1.15 | 4.15 | U      | 2.60               | 5.60 | 2.65 | 5.65 |
| B      | 1.20               | 4.20 | 1.25 | 4.25 | V      | 2.70               | 5.70 | 2.75 | 5.75 |
| C      | 1.30               | 4.30 | 1.35 | 4.35 | X      | 2.80               | 5.80 | 2.85 | 5.85 |
| D      | 1.40               | 4.40 | 1.45 | 4.45 | Y      | 2.90               | 5.90 | 2.95 | 5.95 |
| E      | 1.50               | 4.50 | 1.55 | 4.55 | Z      | 3.00               | 6.00 | 3.05 | -    |

#### ④ Represents production lot number

0 to 9, A to Z, reversed character of 0 to 9 and A to Z repeated (G,I,J,O,Q excepted)

# XC6209 Series

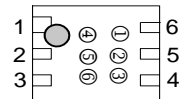
High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## MARKING RULE (Continued)

### ○ USP-6B

① ② Represents product series

| SYMBOL |   | PRODUCT SERIES |
|--------|---|----------------|
| ①      | ② |                |
| 0      | 9 | XC6209AxxxDx   |



USP-6B  
(TOP VIEW)

③ Represents the type of voltage regulator

| SYMBOL | TYPE   | PRODUCT SERIES |
|--------|--|----------------|
| A      | CE Pin, High Active with pull-down resistor    | XC6209AxxxDx   |
| B      | CE Pin, High Active with no pull-down resistor | XC6209BxxxDx   |
| C      | CE Pin, High Active with pull-up resistor      | XC6209CxxxDx   |
| D      | CE Pin, High Active with no pull-up resistor   | XC6209DxxxDx   |

④ Represents the integer of output voltage

| SYMBOL | TYPE | PRODUCT SERIES |
|--------|------|----------------|
| 3      | 3.X  | XC6209x3xxDx   |
| 5      | 5.X  | XC6209x5xxDx   |

⑤ Represents the decimal point of output voltage

| SYMBOL | OUTPUT VOLTAGE (V) |              | SYMBOL | OUTPUT VOLTAGE (V) |              |
|--------|--------------------|--------------|--------|--------------------|--------------|
| 0      | X.0                | XC6209xx0xDx | A      | X.05               | XC6209xx0ADx |
| 1      | X.1                | XC6209xx1xDx | B      | X.15               | XC6209xx1ADx |
| 2      | X.2                | XC6209xx2xDx | C      | X.25               | XC6209xx2ADx |
| 3      | X.3                | XC6209xx3xDx | D      | X.35               | XC6209xx3ADx |
| 4      | X.4                | XC6209xx4xDx | E      | X.45               | XC6209xx4ADx |
| 5      | X.5                | XC6209xx5xDx | F      | X.55               | XC6209xx5ADx |
| 6      | X.6                | XC6209xx6xDx | H      | X.65               | XC6209xx6ADx |
| 7      | X.7                | XC6209xx7xDx | K      | X.75               | XC6209xx7ADx |
| 8      | X.8                | XC6209xx8xDx | L      | X.85               | XC6209xx8ADx |
| 9      | X.9                | XC6209xx9xDx | M      | X.95               | XC6209xx9ADx |

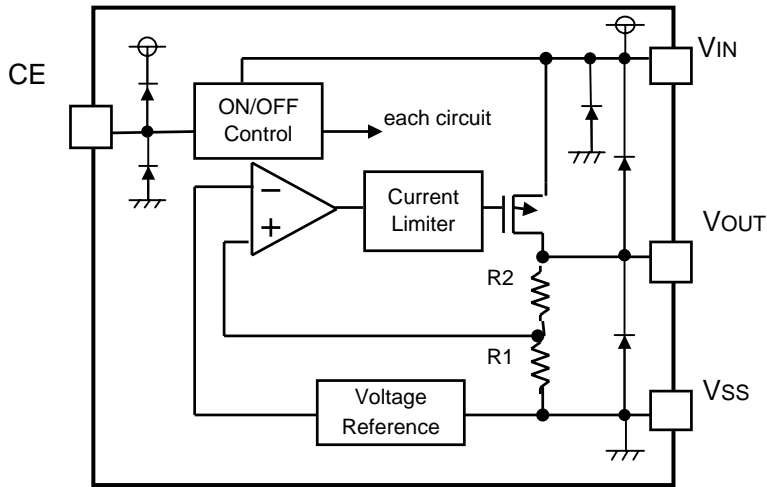
④ Represents production lot number

0 to 9, A to Z, reversed character of 0 to 9 and A to Z repeated (G,I,J,O,Q excepted)

# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

|                             |          |                     | Ta=25°C |  |
|-----------------------------|----------|---------------------|---------|--|
| PARAMETER                   | SYMBOL   | RATINGS             | UNITS   |  |
| Input Voltage               | VIN      | 12                  | V       |  |
| Output Current              | IOUT     | 500                 | mA      |  |
| Output Voltage              | VOUT     | VSS -0.3 ~ VIN +0.3 | V       |  |
| CE Input Voltage            | VCE      | VSS -0.3 ~ VIN +0.3 | V       |  |
| Power Dissipation           | SOT-25   | Pd                  | 250     |  |
|                             | SOT-89-5 |                     | 500     |  |
|                             | USP-6B   |                     | 100     |  |
| Operating Temperature Range | Topr     | - 40 ~ + 85         | °C      |  |
| Storage Temperature Range   | Tstg     | - 55 ~ + 125        | °C      |  |

\* IOUT should be less than Pd / (VIN - VOUT)

# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## ELECTRICAL CHARACTERISTICS

XC6209B Series

Ta=25°C

| PARAMETER                                     | SYMBOL                                       | CONDITIONS  | MIN          | TYP     | MAX    | UNITS  | CIRCUIT |
|---|--|---|--------------|---------|--------|--------|---------|
| Output Voltage                                | VOUT (E)                                     | IOUT=30mA (1.55V~)                                  | × 0.98       | VOUT(T) | × 1.02 | V      | ①       |
|   |  | IOUT=30mA (0.9 ~ 1.5V)                              | - 0.03       |         | + 0.03 |        |         |
| Maximum Output Current                        | IOUTMAX                                      |   | 150          | -       | -      | mA     | ①       |
| Load Regulation                               | ΔVOUT  | 1mA ≤ IOUT ≤ 100mA                                  | -            | 15      | 50     | mV     | ①       |
| Dropout Voltage                               | Vdif1  | IOUT=30mA   | E-2 (page 9) |         |        | mV     | ①       |
|   | Vdif2  | IOUT=100mA  | E-3 (page 9) |         |        | mV     |         |
| Supply Current                                | IDD  | VCE=VIN   | -            | 25      | 50     | μA     | ②       |
| Standby Current                               | Istby  | VCE=VSS   | -            | 0.01    | 0.10   | μA     | ②       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$  | VOUT(T)+1.0V ≤ VIN ≤ 10V<br>IOUT=30mA (VOUT > 1.0V) | -            | 0.01    | 0.20   | % / V  | ①       |
|   |  | 2.0V ≤ VIN ≤ 10V<br>IOUT=30mA (VOUT ≤ 1.0V)         |              |         |        |        |         |
| Input Voltage                                 | VIN  |   | 2            | -       | 10     | V      | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C                    | -            | 100     | -      | ppm/°C | ①       |
| Ripple Rejection Rate                         | PSRR   | IOUT=50mA, f=10kHz                                  | -            | 70      | -      | dB     | ④       |
| Current Limiter                               | Ilim   |   | -            | 300     | -      | mA     | ①       |
| Short-circuit Current                         | Ishort                                       |   | -            | 50      | -      | mA     | ①       |
| CE "High" Voltage                             | VCEH   |   | 1.60         | -       | VIN    | V      | ①       |
| CE "Low" Voltage                              | VCEL   |   | -            | -       | 0.25   | V      | ②       |
| CE "High" Current                             | ICEH   | VCE=VIN   | -0.10        | -       | 0.10   | μA     | ②       |
| CE "Low" Current                              | ICEL   | VCE=VSS   | -0.10        | -       | 0.10   | μA     | ②       |

(NOTE 1) VOUT(T)=Specified Output Voltage

(NOTE 2) VOUT(E)=Effective Output Voltage

(I.e. the output voltage when "VOUT(T)+1.0V" is provided at the VIN pin while maintaining a certain IOUT value).

(NOTE 3)  $Vdif = \{VIN1^{(NOTE5)} - VOUT1^{(NOTE4)}\}$

(NOTE 4) VOUT1=A voltage equal to 98% of the Output Voltage whenever an amply stabilized IOUT {VOUT(T)+1.0V} is input.

(NOTE 5) VIN1=The Input Voltage when VOUT1 appears as Input Voltage is gradually decreased.

(NOTE 6) Unless otherwise stated, VIN=VOUT(T)+1.0V. If VOUT is less than 1.0V, VIN=2.0V.

# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## ELECTRICAL CHARACTERISTICS

XC6209F Series

Ta=25°C

| PARAMETER                                     | SYMBOL                                       | CONDITIONS  | MIN          | TYP     | MAX    | UNITS  | CIRCUIT |
|---|--|---|--------------|---------|--------|--------|---------|
| Output Voltage                                | VOUT (E)                                     | IOUT=30mA (1.55V~)                                  | × 0.98       | VOUT(T) | × 1.02 | V      | ①       |
|   |  | IOUT=30mA (0.9 ~ 1.5V)                              | - 0.03       |         | + 0.03 |        |         |
| Maximum Output Current                        | IOUTMAX                                      |   | E-1 (page 9) |         |        | mA     | ①       |
| Load Regulation                               | ΔVOUT  | 1mA ≤ IOUT ≤ 100mA                                  | -            | 15      | 50     | mV     | ①       |
| Dropout Voltage                               | Vdif1  | IOUT=30mA   | E-2 (page 9) |         |        | mV     | ①       |
|   | Vdif2  | IOUT=100mA  | E-3 (page 9) |         |        | mV     |         |
| Supply Current                                | IDD  | VCE=VIN   | -            | 25      | 50     | μA     | ②       |
| Standby Current                               | Istby  | VCE=VSS   | -            | 0.01    | 0.10   | μA     | ②       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$  | VOUT(T)+1.0V ≤ VIN ≤ 10V<br>IOUT=30mA (VOUT > 1.0V) | -            | 0.01    | 0.20   | % / V  | ①       |
|   |  | 2.0V ≤ VIN ≤ 10V<br>IOUT=30mA (VOUT ≤ 1.0V)         |              |         |        |        |         |
| Input Voltage                                 | VIN  |   | 2            | -       | 10     | V      | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C                    | -            | 100     | -      | ppm/°C | ①       |
| Ripple Rejection Rate                         | PSRR   | IOUT=50mA, f=10kHz                                  | -            | 70      | -      | dB     | ④       |
| Current Limiter                               | Ilim   |   | -            | 380     | -      | mA     | ①       |
| Short-circuit Current                         | Ishort                                       |   | -            | 50      | -      | mA     | ①       |
| CE "High" Voltage                             | VCEH   |   | 1.60         | -       | VIN    | V      | ①       |
| CE "Low" Voltage                              | VCEL   |   | -            | -       | 0.25   | V      | ②       |
| CE "High" Current                             | ICEH   | VCE=VIN   | -0.10        | -       | 0.10   | μA     | ②       |
| CE "Low" Current                              | ICEL   | VCE=VSS   | -0.10        | -       | 0.10   | μA     | ②       |

(NOTE 1) VOUT(T)=Specified Output Voltage

(NOTE 2) VOUT(E)=Effective Output Voltage

(I.e. the output voltage when "VOUT(T)+1.0V" is provided at the VIN pin while maintaining a certain IOUT value).

(NOTE 3)  $Vdif = \{VIN1^{(NOTE5)} - VOUT1^{(NOTE4)}\}$

(NOTE 4) VOUT1=A voltage equal to 98% of the Output Voltage whenever an amply stabilized IOUT {VOUT(T)+1.0V} is input.

(NOTE 5) VIN1=The Input Voltage when VOUT1 appears as Input Voltage is gradually decreased.

(NOTE 6) Unless otherwise stated, VIN=VOUT(T)+1.0V. If VOUT is less than 1.0V, VIN=2.0V.



# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

## ■ MAXIMUM OUTPUT CURRENT, OUTPUT VOLTAGE

XC6209E ~ H series

| E-1                |                   |              |
|--------------------|-------------------|--------------|
| OUTPUT VOLTAGE (V) | CONDITION         | IOUTMAX (mA) |
|                    |                   | MIN          |
| 0.90 ~ 0.95        | VIN = 2.5V        | 260          |
| 1.00 ~ 1.05        | VIN = 2.5V        | 260          |
| 1.10 ~ 1.15        | VIN = 2.6V        | 270          |
| 1.20 ~ 1.25        | VIN = 2.7V        | 290          |
| 1.30 ~ 1.35        | VIN = 2.8V        | 300          |
| 1.40 ~ 1.45        | VIN = 2.9V        |              |
| 1.50 ~ 1.95        | VIN = 3.0V        |              |
| 2.00 ~ 6.00        | VIN = VOUT + 1.0V |              |

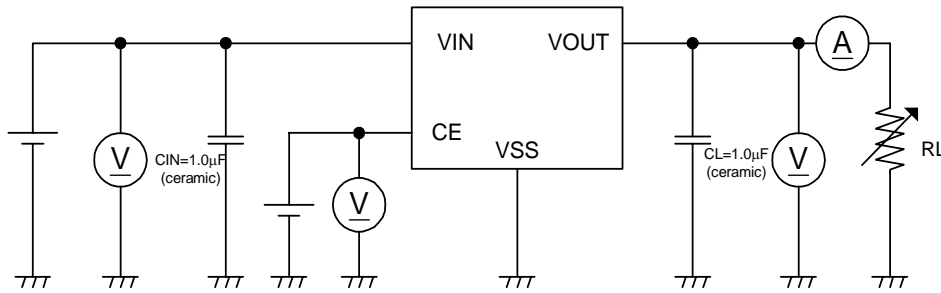
## ■ DROPOUT VOLTAGE

| SYMBOL<br>PARAMETER | E-2                    |      |      | E-3                    |      |      |
|---------------------|------------------------|------|------|------------------------|------|------|
|                     | Dropout Voltage 1 (mV) |      |      | Dropout Voltage 2 (mV) |      |      |
|                     | MIN                    | TYP  | MAX  | MIN                    | TYP  | MAX  |
| OUTPUT VOLTAGE      |                        |      |      |                        |      |      |
| 0.90 ~ 0.95         | 1100                   | 1100 | 1110 | 1100                   | 1150 | 1200 |
| 1.00 ~ 1.05         | 1000                   | 1000 | 1010 | 1000                   | 1050 | 1100 |
| 1.10 ~ 1.15         | 900                    | 900  | 910  | 900                    | 950  | 1000 |
| 1.20 ~ 1.25         | 800                    | 800  | 810  | 800                    | 850  | 900  |
| 1.30 ~ 1.35         | 700                    | 700  | 710  | 700                    | 750  | 800  |
| 1.40 ~ 1.45         | 600                    | 600  | 610  | 600                    | 650  | 700  |
| 1.50 ~ 1.55         | 500                    | 500  | 510  | 500                    | 550  | 600  |
| 1.60 ~ 1.65         | 400                    | 400  | 410  | 400                    | 500  | 550  |
| 1.70 ~ 1.75         | 300                    | 300  | 310  | 300                    | 400  | 450  |
| 1.80 ~ 1.85         | 200                    | 200  | 210  | 200                    | 300  | 400  |
| 1.90 ~ 1.95         | 100                    | 120  | 150  | 100                    | 280  | 380  |
| 2.00 ~ 2.05         | -                      | 80   | 120  | -                      | 240  | 350  |
| 2.10 ~ 2.25         | -                      | 80   | 120  | -                      | 240  | 330  |
| 2.30 ~ 2.45         | -                      | 80   | 120  | -                      | 240  | 310  |
| 2.50 ~ 2.75         | -                      | 70   | 100  | -                      | 220  | 290  |
| 2.80 ~ 2.95         | -                      | 70   | 100  | -                      | 220  | 270  |
| 3.00 ~ 3.05         | -                      | 60   | 90   | -                      | 200  | 270  |
| 3.10 ~ 3.95         | -                      | 60   | 90   | -                      | 200  | 250  |
| 4.00 ~ 4.95         | -                      | 60   | 80   | -                      | 180  | 230  |
| 5.00 ~ 6.00         | -                      | 50   | 70   | -                      | 160  | 210  |

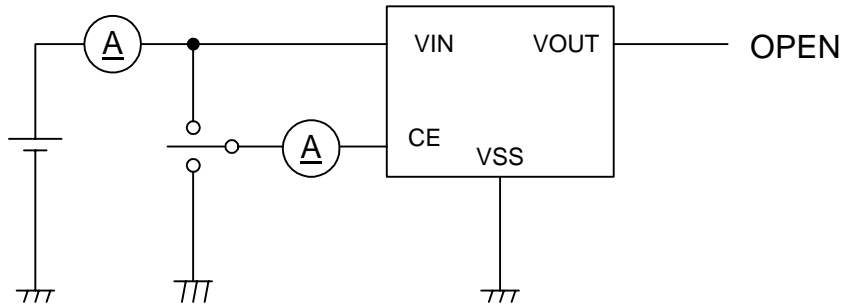
\* The input voltage 2.0V (MIN.) is needed to operate the series. When the output voltage is less than 2.0V, 2.0V-VOUT(T) of dropout voltage is needed at minimum.

### TEST CIRCUITS

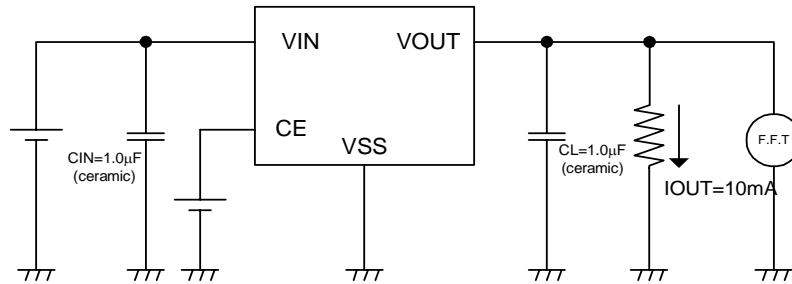
Circuit ①



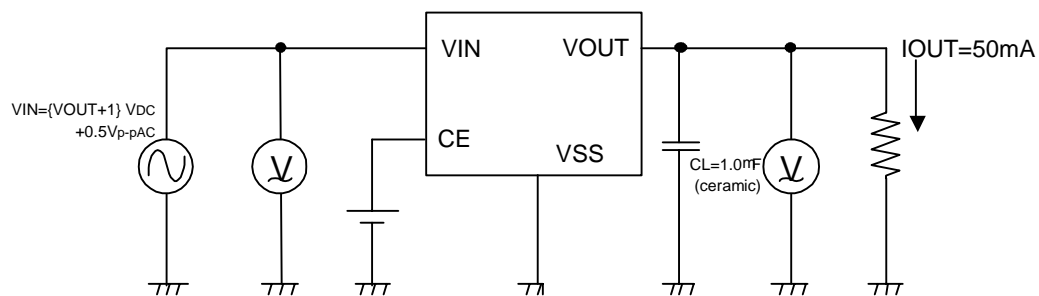
Circuit ②



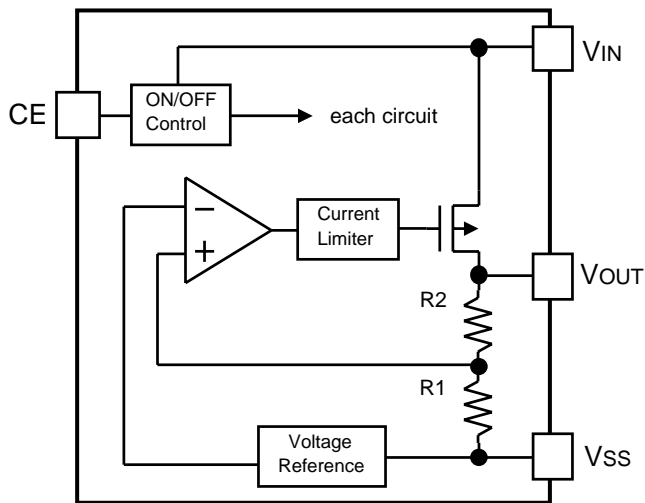
Circuit ③



Circuit ④



### ■ OPERATIONAL EXPLANATION



Output voltage control with the XC6209 series :

The voltage divided by resistors R1 & R2 is compared with the internal reference voltage by the error amplifier.

The P-Channel MOSFET, which is connected to the VOUT pin, is then driven by the subsequent output signal. The output voltage at the VOUT pin is controlled & stabilized by a system of negative feedback.

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

#### Low ESR Capacitors

With the XC6209 series, a stable output voltage is achievable even if used with low ESR capacitors as a phase compensation circuit is built-in. In order to ensure the effectiveness of the phase compensation, we suggest that an output capacitor (CL) is connected as close as possible to the output pin (VOUT) and the VSS pin. Please use an output capacitor with a capacitance value of at least 1  $\mu\text{F}$ . Also, please connect an input capacitor (CIN) of 0.1  $\mu\text{F}$  between the VIN pin and the VSS pin in order to ensure a stable power input.

#### Current Limiter, Short-Circuit Protection

The XC6209 series includes a combination of a fixed current limiter circuit & a foldback circuit which aid the operations of the current limiter and circuit protection. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

#### CE Pin

The IC's internal circuitry can be shutdown via the signal from the CE pin with the XC6209 series. In shutdown mode, output at the VOUT pin will be pulled down to the VSS level via R1 & R2. The operational logic of the IC's CE pin is selectable (please refer to the selection guide on page 3). Note that as the standard XC6209B/F type is 'High Active/No Pull Down', operations will become unstable with the CE pin open. Although the CE pin is equal to an inverter input with CMOS hysteresis, with either the pull-up or pull-down options, the CE pin input current will increase when the IC is in operation. We suggest that you use this IC with either a VIN voltage or a VSS voltage input at the CE pin. If this IC is used with the correct specifications for the CE pin, the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry.

### ■ NOTES ON USE

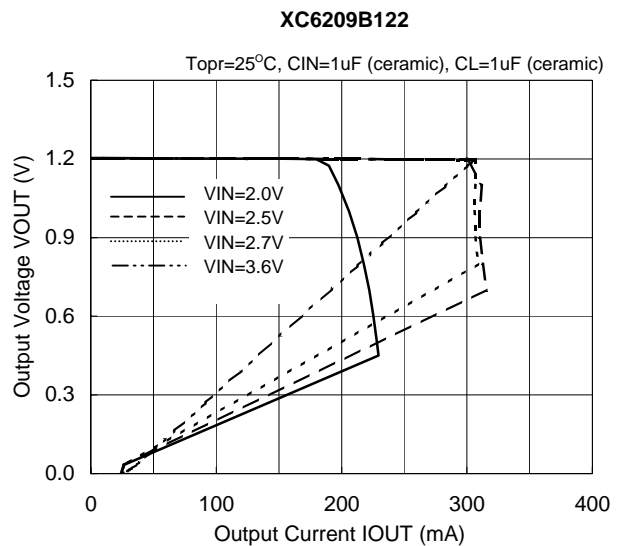
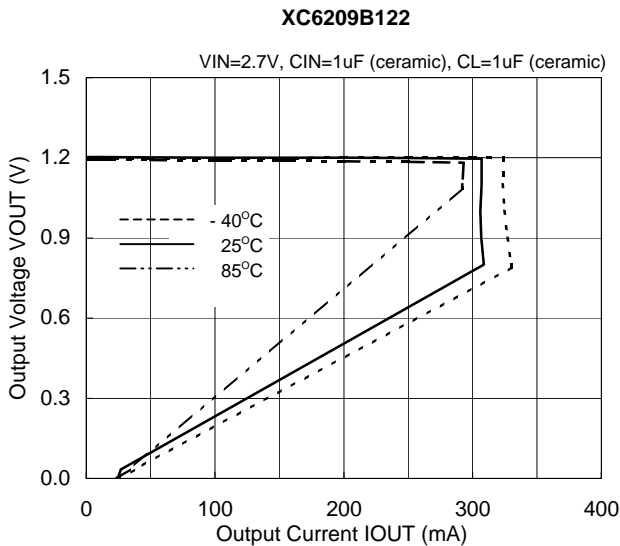
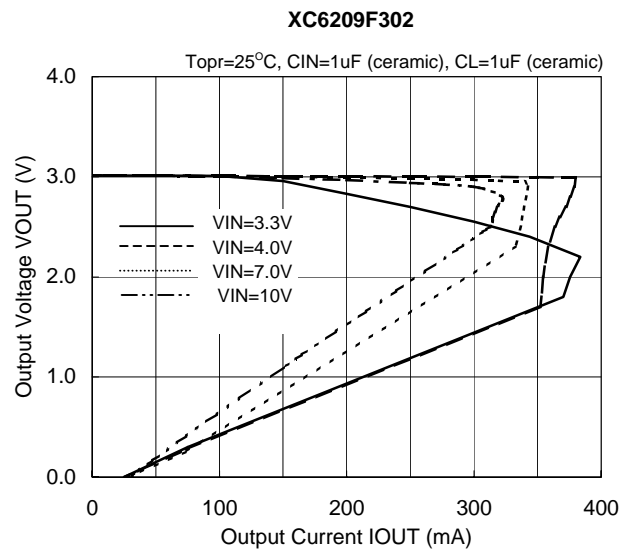
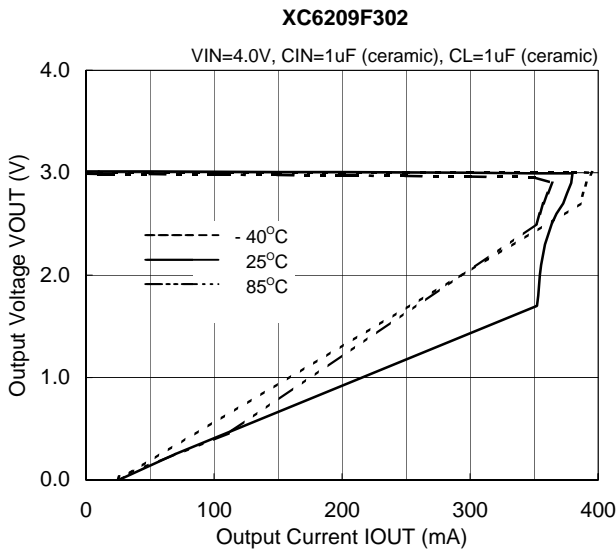
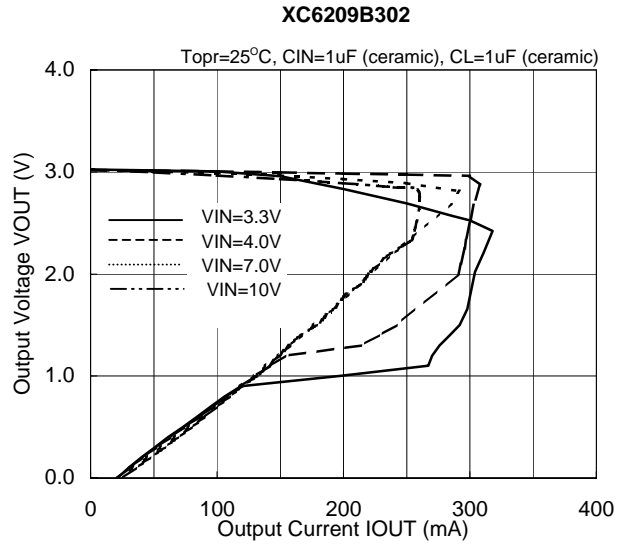
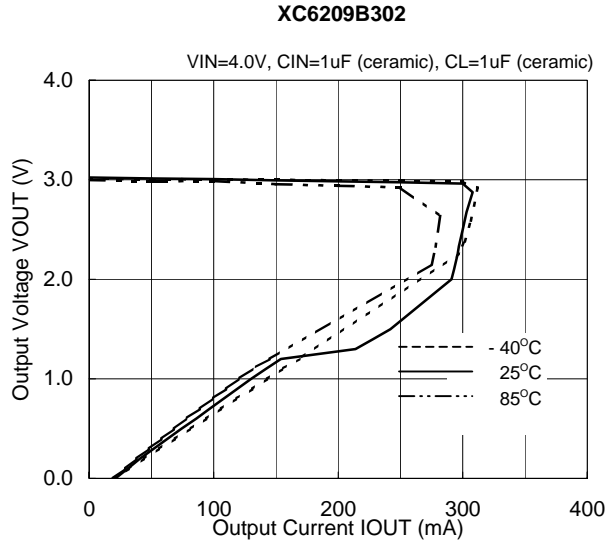
- 1 Please use this IC within the stated absolute maximum ratings.  
The IC is liable to malfunction should the ratings be exceeded.
- 2 Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen VIN and VSS wiring in particular.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

# XC6209 Series

High Speed LDO Regulators, Low ESR Cap. Compatible, Output On/Off Control

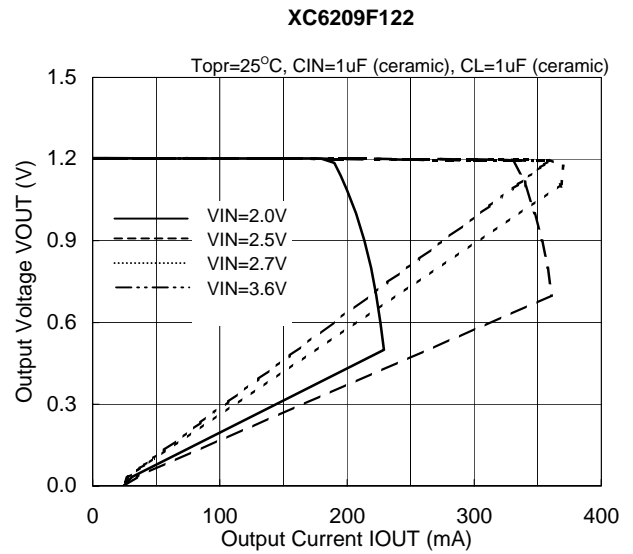
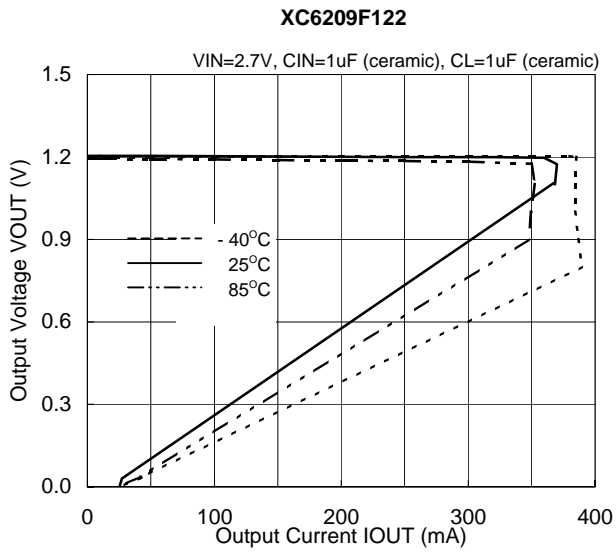
## TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

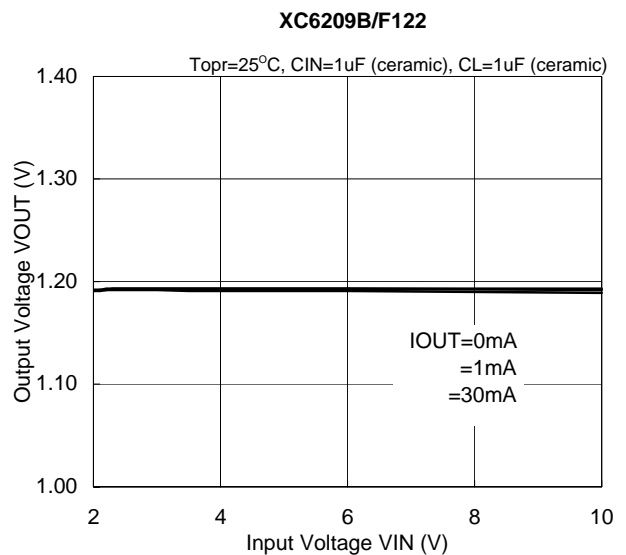
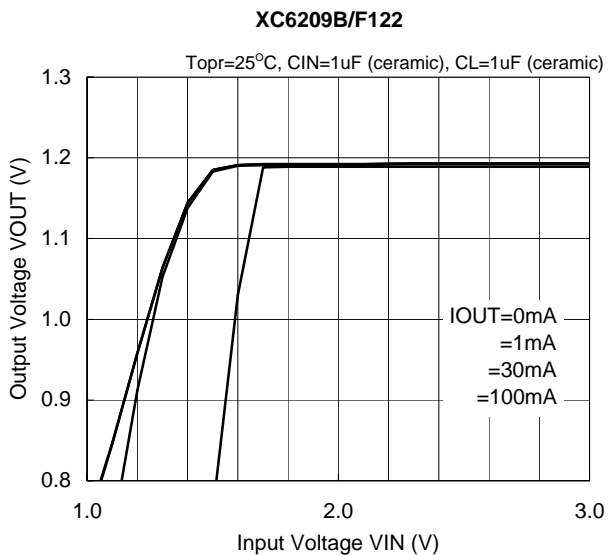
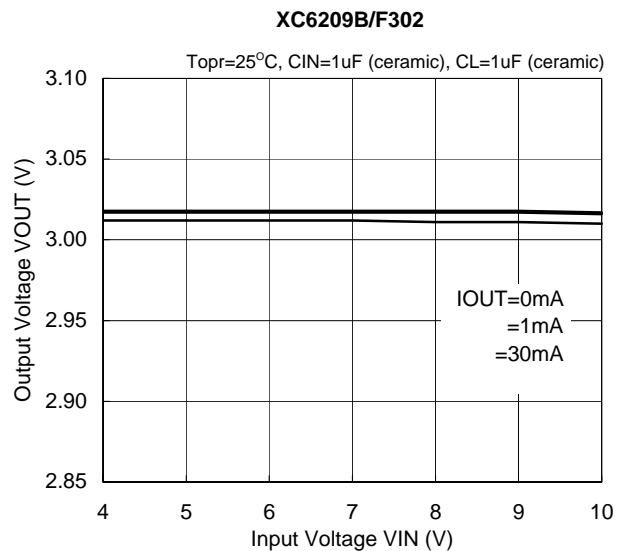
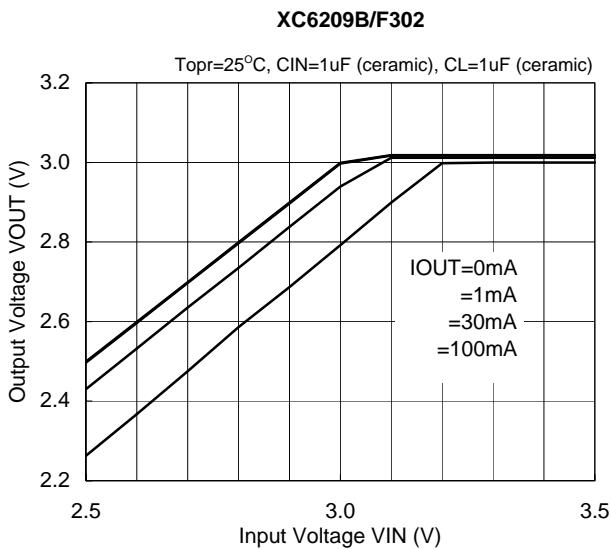


### ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

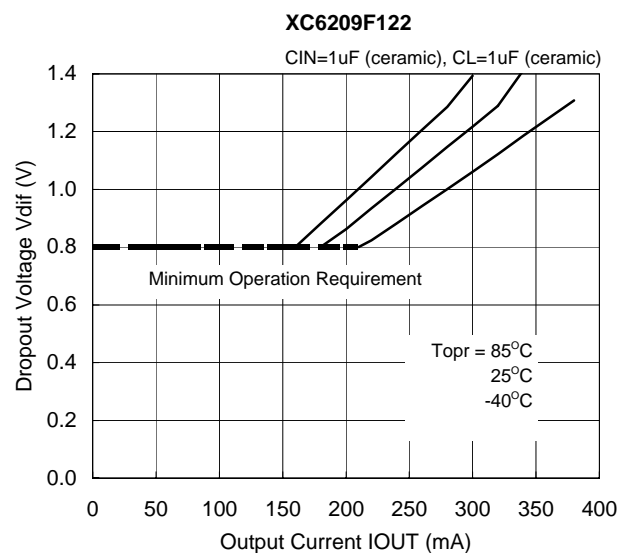
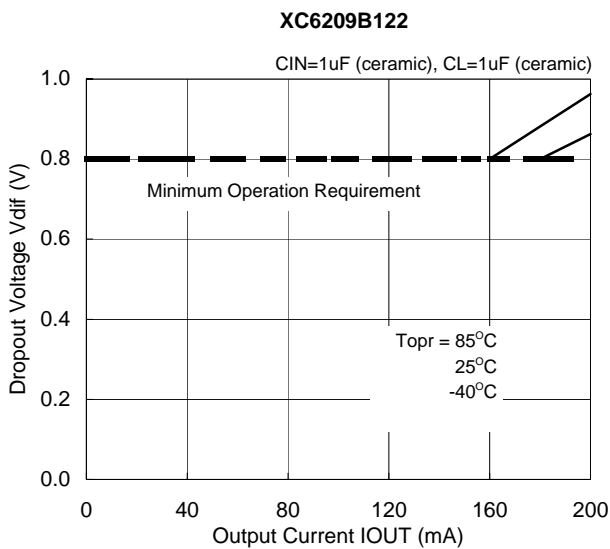
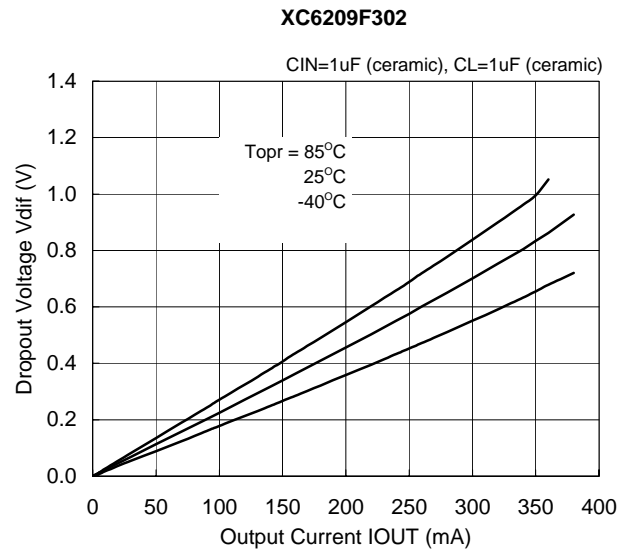
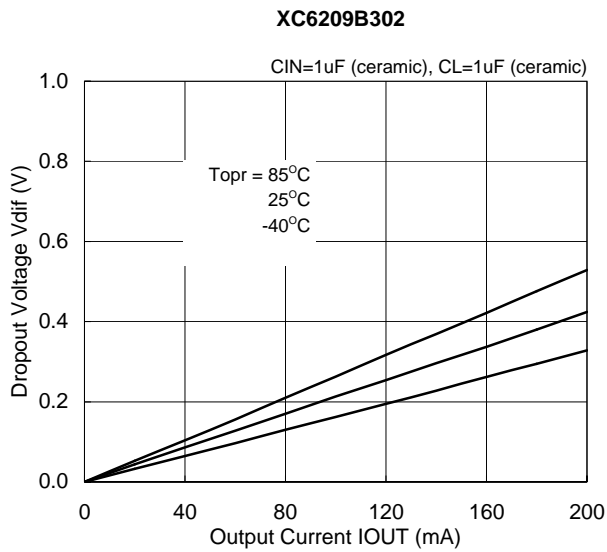


(2) Output Voltage vs. Input Voltage

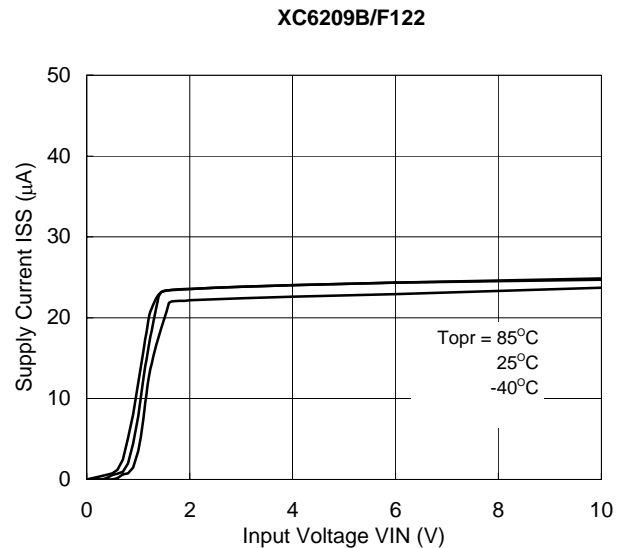
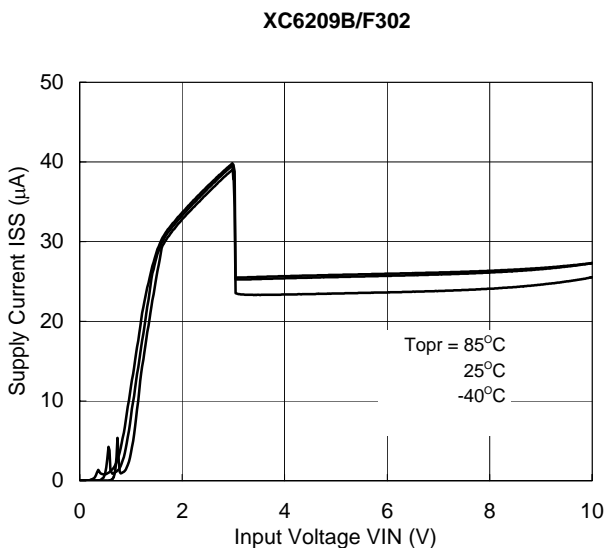


### ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

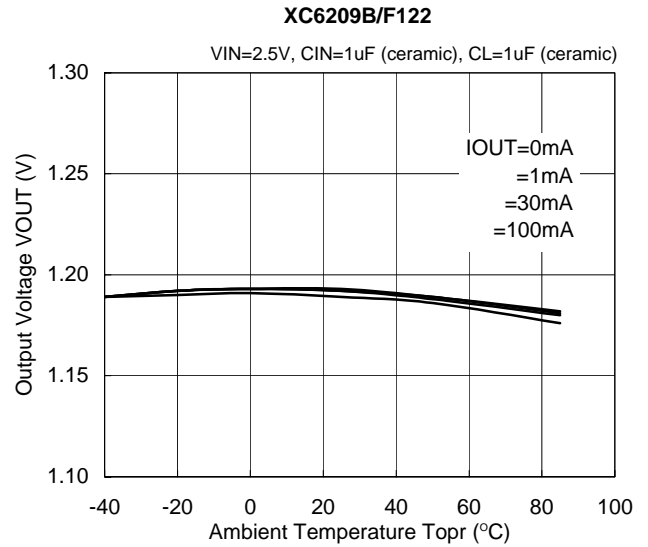
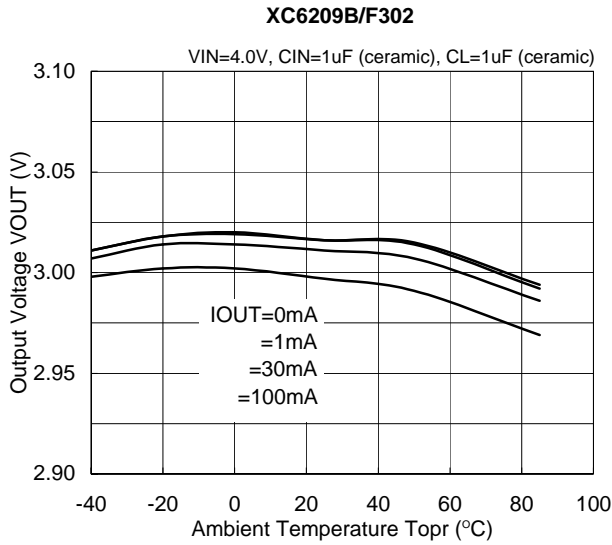


#### (4) Supply Current vs. Input Voltage

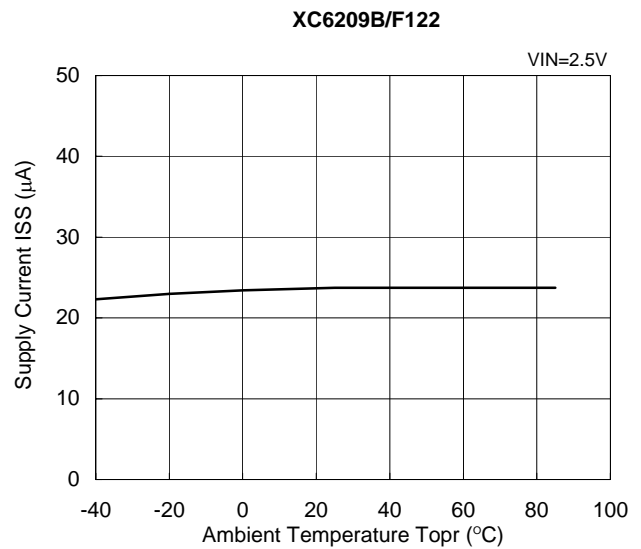
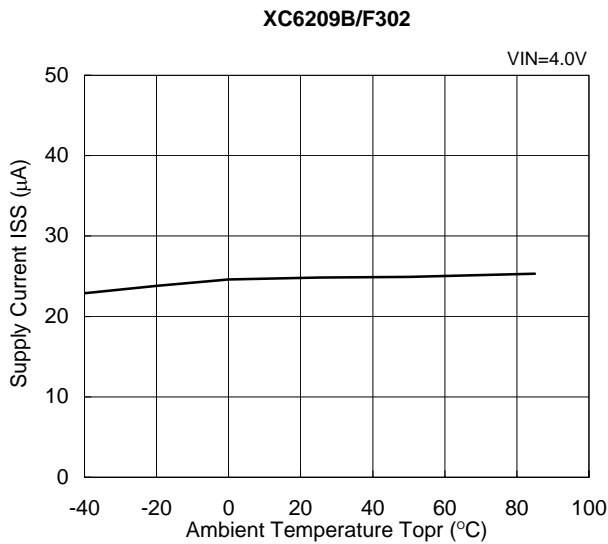


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

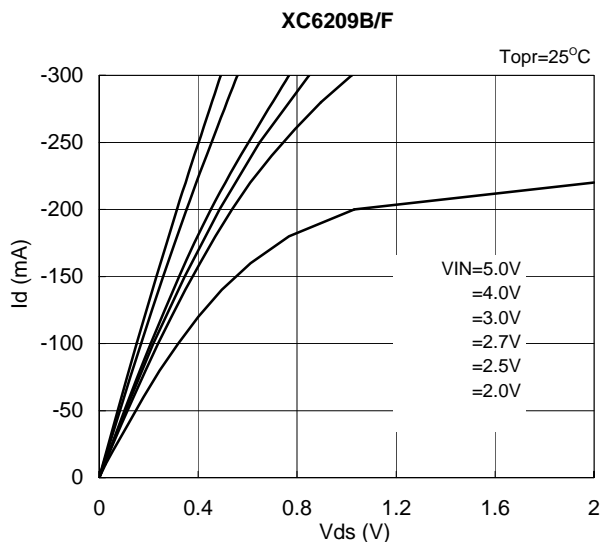
(5) Output Voltage vs. Ambient Temperature



(6) Supply Current vs. Ambient Temperature

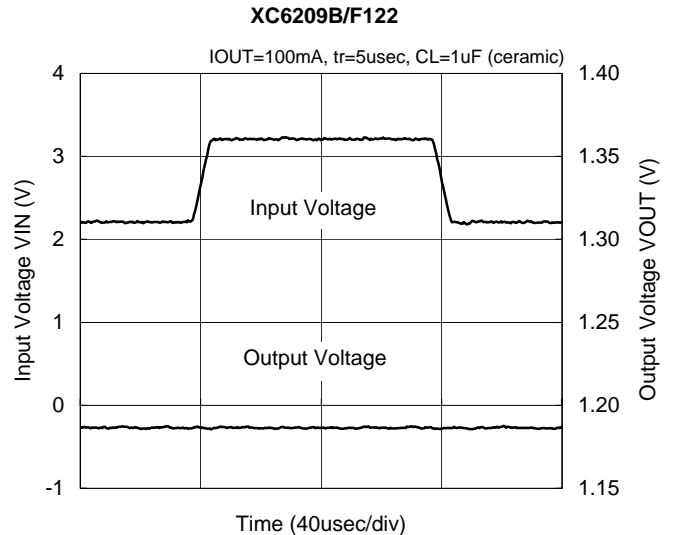
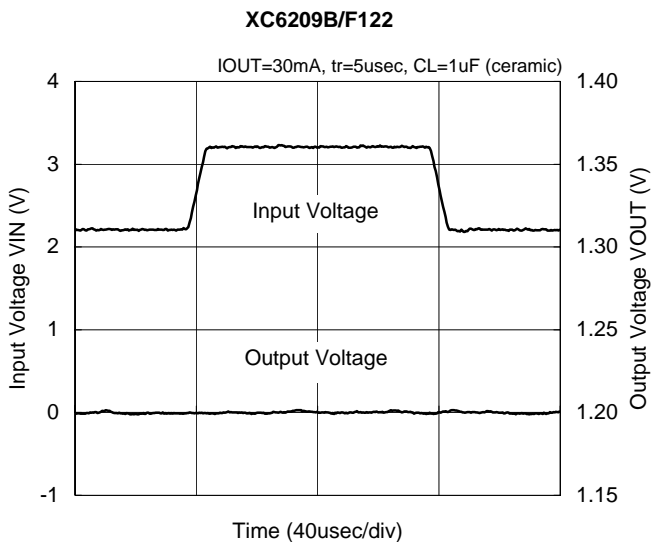
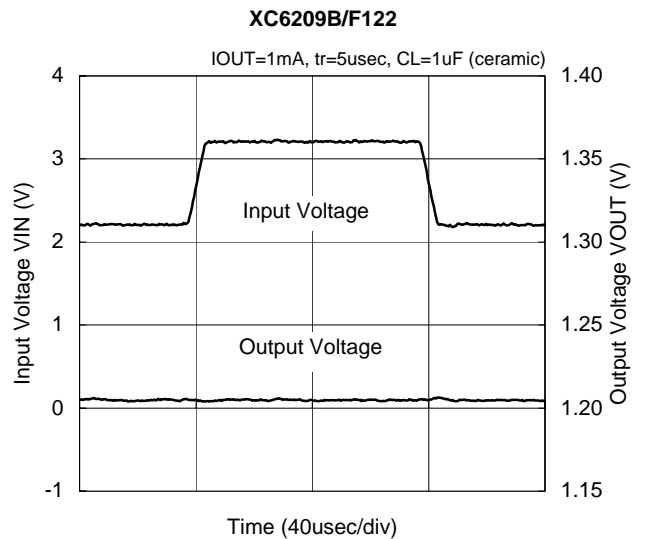
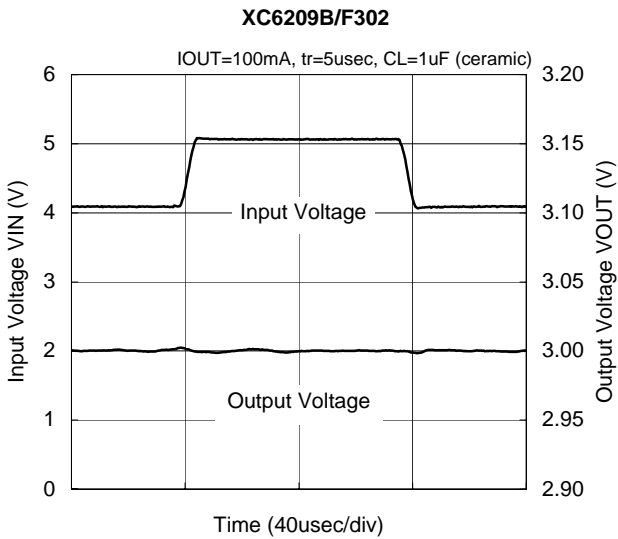
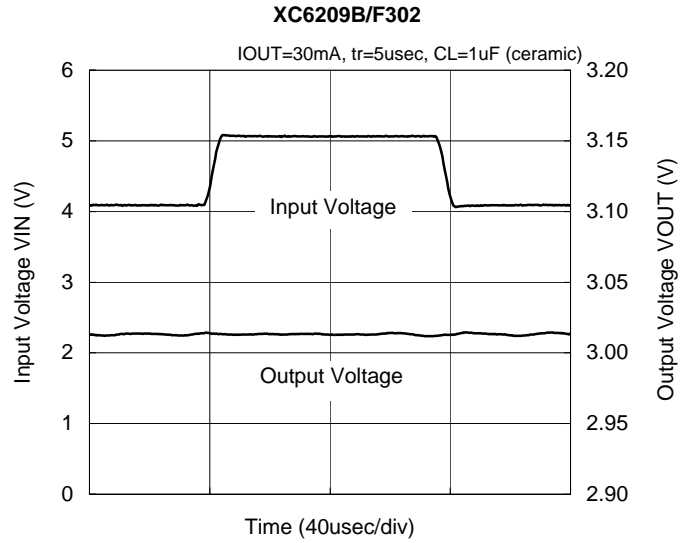
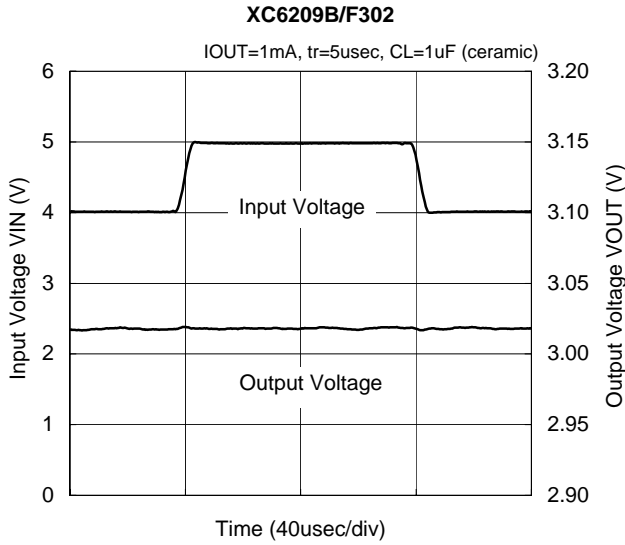


(7) P-ch Driver Transistor Characteristics



### ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

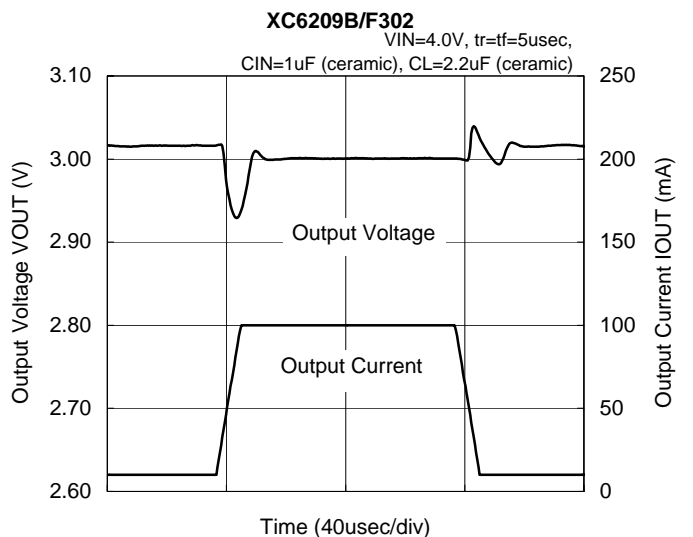
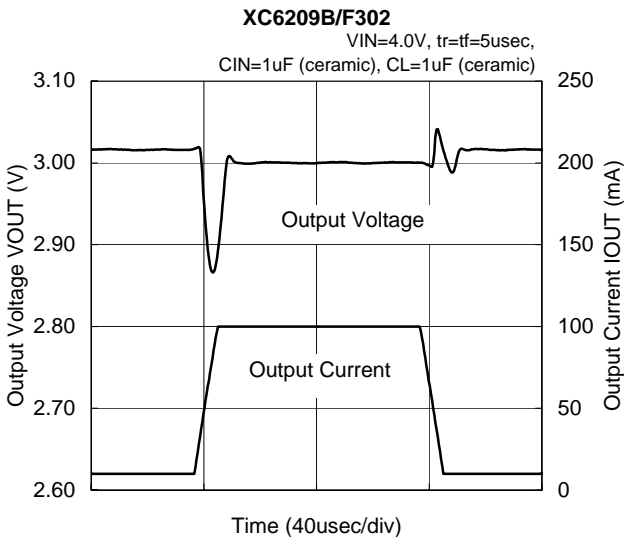
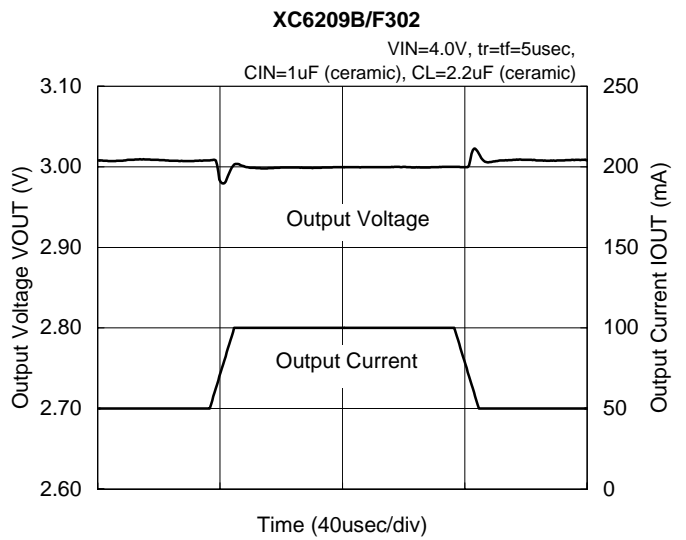
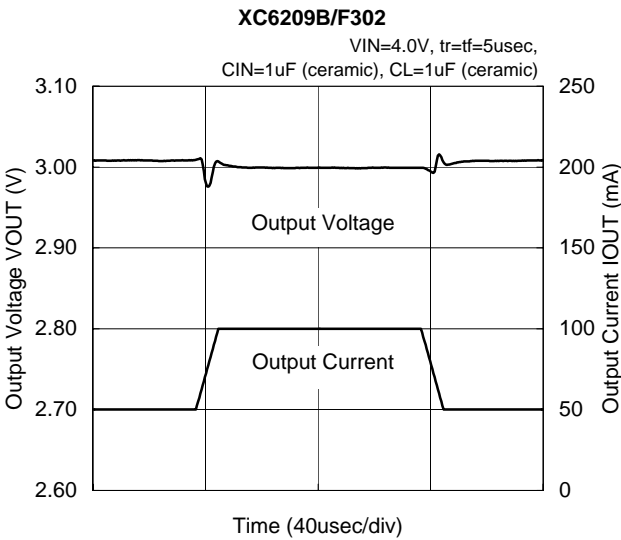
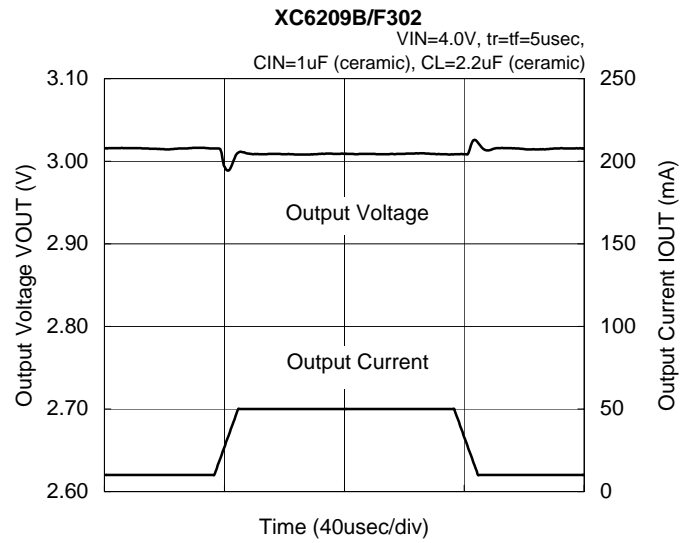
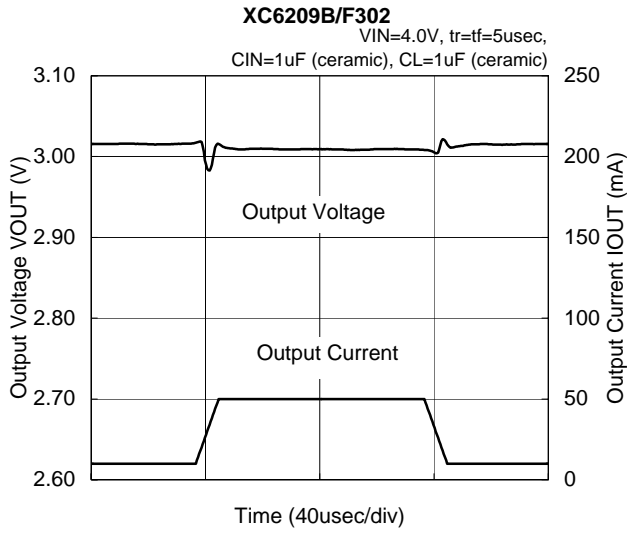
#### (8) Input Transient Response





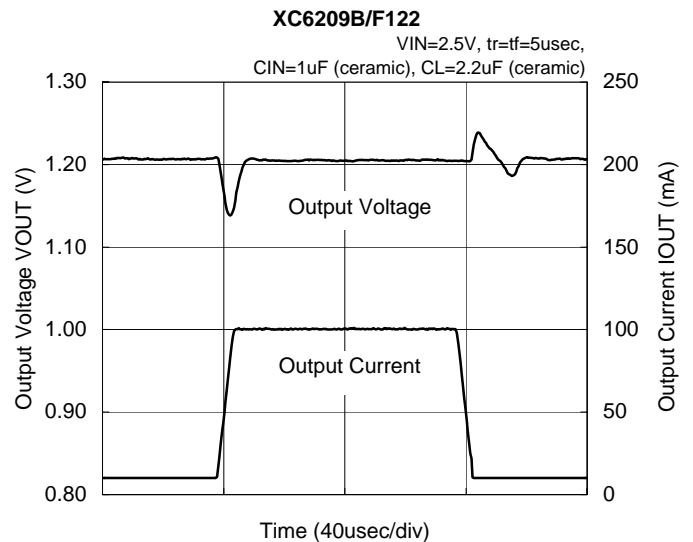
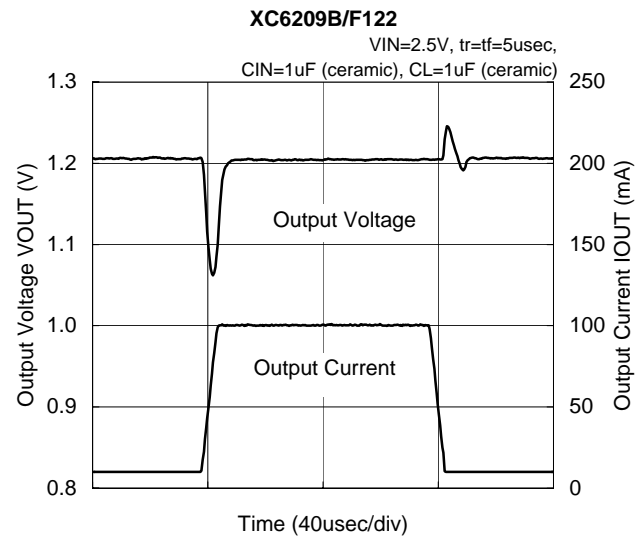
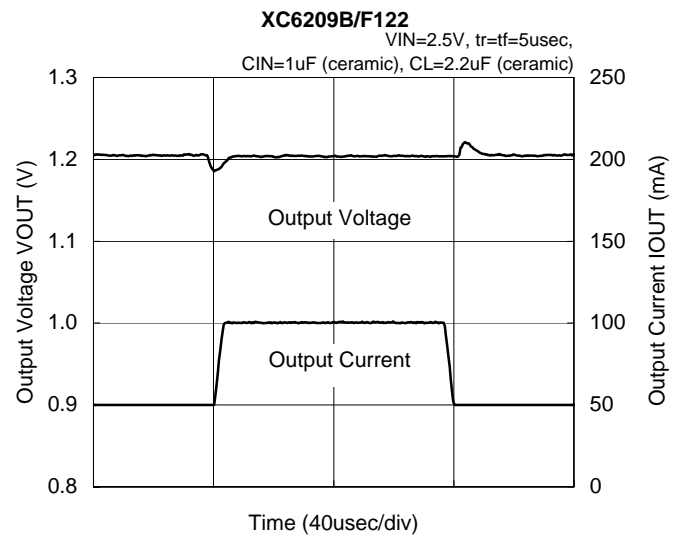
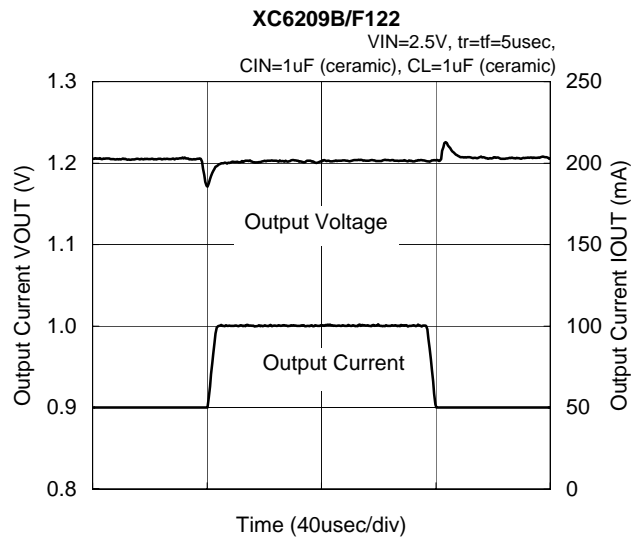
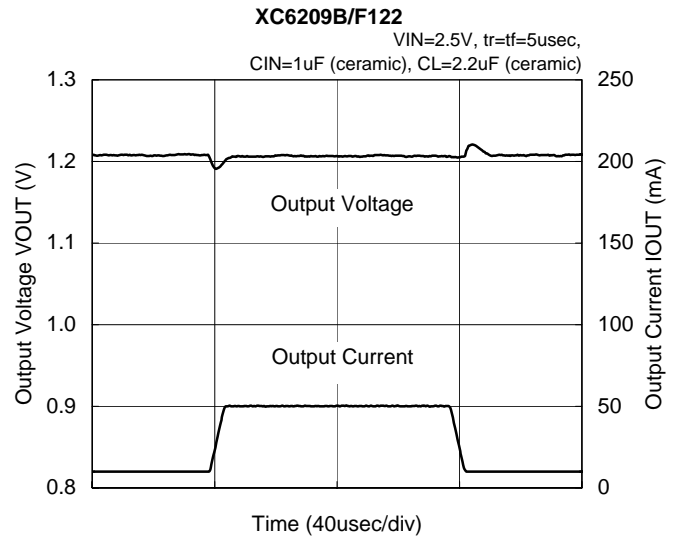
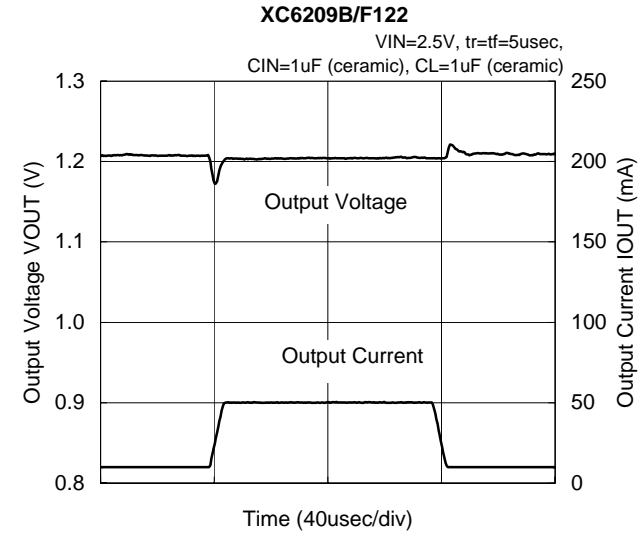
### TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

#### (9) Load Transient Response



### ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

#### (9) Load Transient Response



## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Ripple Rejection Rate

