

- ◆ CMOS Low Power Consumption
- ◆ Operating Voltage Range : up to 20V
- ◆ Dropout Voltage : 200mV @ 30mA, 670mV @ 100mA
- ◆ Maximum Output Current : more than 150mA
- ◆ Highly Accurate :  $\pm 2\%$
- ◆ Output Voltage Range : 1.8V to 18.0V
- ◆ Current Limiter Circuit Built-In
- ◆ SOT-23 / SOT-89 Package
- ◆ Low ESR Capacitor can be used

- Applications
  - Battery Powered Equipment
  - Reference Voltage Sources
  - Cameras, Video Cameras
  - Palmtops

### ■ General Description

The XC6202 series are highly precise, low power consumption, high voltage, positive voltage regulators manufactured using CMOS and laser trimming technologies. The XC6202 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit.

Output voltage is selectable in 0.1V steps from 1.8V ~ 18V.

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

Since the current limiter circuit is built-in, the IC is protected against overshoot currents at such times of output shorts etc.

SOT-23(150mW) and SOT-89(500mW) packages are available.

### ■ Features

**Maximum Output Current** : 150mA

**Dropout Voltage** : 200mV @ 30mA

**Operating Voltage Range** : up to 20V

**Output Voltage Range** : 1.8V to 18V (selectable in 0.1V steps)

**Highly Accurate** :  $\pm 2\%$

**Low Power Consumption** : TYP 10  $\mu$ A ( $V_{OUT}=3.3V$ )

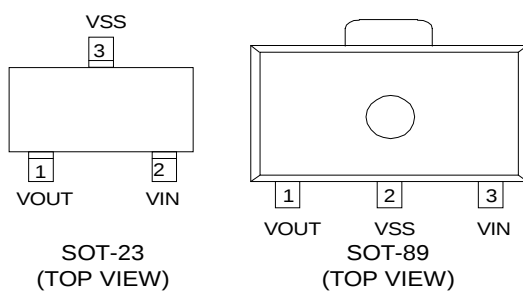
**Operating Ambient Temp.** :  $-40^{\circ}C \sim 85^{\circ}C$

**Line Regulation** : TYP 0.01% / V

**Ultra Small Packages** : SOT-23 (150mW), SOT-89 (500mW)

**Low ESR Capacitor Compatible** : ceramic capacitor

### ■ Pin Configuration



### ■ Pin Assignment

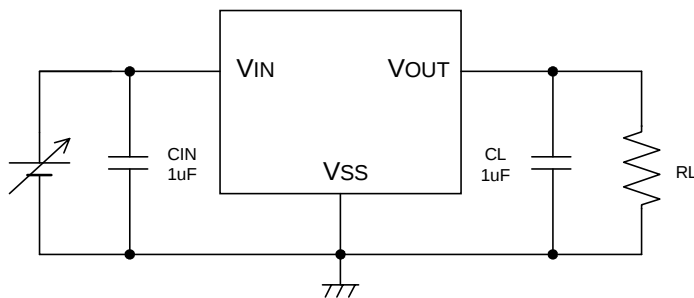
| PIN NAME |        | PIN NAME | FUNCTION    |
|----------|--------|----------|-------------|
| SOT-23   | SOT-89 |          |             |
| 1        | 1      | VOUT     | Output      |
| 3        | 2      | VSS      | Ground      |
| 2        | 3      | VIN      | Power Input |

### ■ Ordering Information

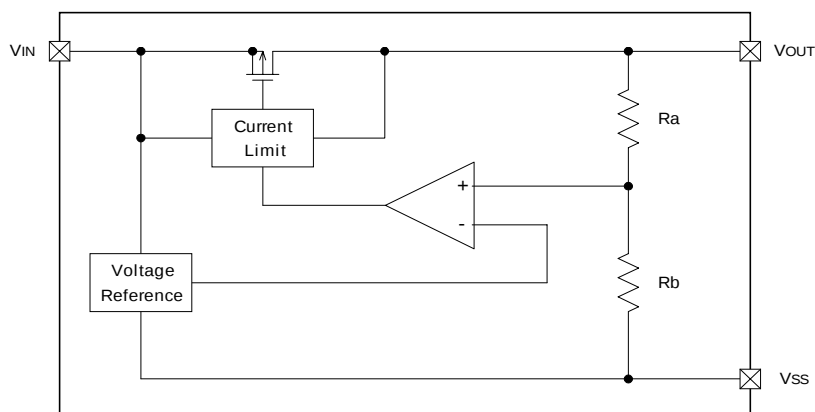
XC6202P①②③④⑤

| DESIGNATOR | SYMBOL  | DESCRIPTION                                                                                                                                                                            |
|------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①②         | 18 ~ J0 | Output Voltage<br>For the voltage above 10V, see the example<br>10=A, 11=B, 12=C, 13=D, 14=E, 15=F, 16=G, 17=H, 18=J<br>e.g. VOUT=3.0V→①:3, ②:0 VOUT=12V→①:C, ②:0<br>VOUT=15V→①:F, ②:0 |
| ③          | 2       | Accuracy : ±2%                                                                                                                                                                         |
| ④          | M       | Package : SOT-23                                                                                                                                                                       |
|            | P       | SOT-89                                                                                                                                                                                 |
| ⑤          | R       | Embossed Tape : Standard Feed                                                                                                                                                          |
|            | L       | Embossed Tape : Reverse Feed                                                                                                                                                           |

### ■ Typical Application



### ■ Block Diagram



### Absolute Maximum Ratings

Ta = 25°C

| PARAMETER                     | SYMBOL | RATINGS                | UNITS |
|-------------------------------|--------|------------------------|-------|
| Input Voltage                 | VIN    | 22                     | V     |
| Output Current                | IOUT   | 500                    | mA    |
| Output Voltage                | VOUT   | VSS ~ 0.3 to VIN + 0.3 | V     |
| Continuous Total              | SOT-23 | Pd                     | 150   |
| Power Dissipation             | SOT-89 | Pd                     | 500   |
| Operating Ambient Temperature | Topr   | -40 to +85             | °C    |
| Storage Temperature           | Tstg   | -40 to +125            | °C    |

### Electrical Characteristics

XC6202P182 VOUT(T) = 1.8V (Note 1)

Ta=25°C

| PARAMETER                                     | SYMBOL                                       | CONDITIONS                       | MIN   | TYP         | MAX         | UNITS    | CIRCUIT |
|-----------------------------------------------|----------------------------------------------|----------------------------------|-------|-------------|-------------|----------|---------|
| Output Voltage                                | VOUT(E)<br>(Note2)                           | VIN=2.8V<br>IOUT=30mA            | 1.764 | 1.800       | 1.836       | V        | 2       |
| Maximum Output Current                        | IOUT max                                     | VIN=2.8V<br>VOUT ≥ VOUT(E) × 0.9 | 60    |             |             | mA       | 2       |
| Load Regulation                               | Δ VOUT                                       | VIN=2.8V<br>1mA ≤ IOUT ≤ 100mA   |       | 10          | 80          | mV       | 2       |
| Dropout Voltage (Note 3)                      | Vdif 1<br>Vdif 2                             | IOUT=30mA<br>IOUT=100mA          |       | 340<br>1000 | 470<br>1500 | mV       | 2       |
| Supply Current                                | ISS                                          | VIN=2.8V                         |       | 10.0        | 24.0        | μA       | 1       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$  | IOUT=1mA<br>2.8V ≤ VIN ≤ 20.0V   |       | 0.01        | 0.2         | % / V    | 2       |
| Input Voltage                                 | VIN                                          |                                  |       |             | 20          | V        | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C |       | ±100        |             | ppm / °C | 2       |
| Short-circuit Current                         | Ishort                                       | VIN=3.8V                         |       | 40          |             | mA       | 2       |

- Note :
1. VOUT(T) = Specified Output Voltage.
  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).
  3. Vdif = VIN1 - VOUT1
  4. VOUT1 = A voltage equal to 98% of the output voltage when "VOUT(T)+1.0V" is input.e
  5. VIN1 = The input voltage when VOUT1 is output following a gradual decrease in the input voltage.

# XC6202 Series

## (High Voltage) Positive Voltage Regulators

Preliminary

XC6202P332 VOUT(T) = 3.3V (Note 1)

Ta=25°C

| PARAMETER                                     | SYMBOL                                          | CONDITIONS                       | MIN   | TYP   | MAX   | UNITS    | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------|----------------------------------|-------|-------|-------|----------|---------|
| Output Voltage                                | VOUT(E)<br>(Note2)                              | VIN=4.3V                         | 3.234 | 3.300 | 3.366 | V        | 2       |
|                                               |                                                 | IOUT=30mA                        |       |       |       |          |         |
| Maximum Output Current                        | IOUT max                                        | VIN=4.3V<br>VOUT ≥ VOUT(E) × 0.9 | 150   |       |       | mA       | 2       |
| Load Regulation                               | Δ VOUT                                          | VIN=4.3V<br>1mA ≤ IOUT ≤ 100mA   |       | 25    | 90    | mV       | 2       |
| Dropout Voltage (Note 3)                      | Vdif 1                                          | IOUT=30mA                        |       | 200   | 280   | mV       | 2       |
|                                               | Vdif 2                                          | IOUT=100mA                       |       | 670   | 900   |          |         |
| Supply Current                                | ISS                                             | VIN=4.3V                         |       | 10.0  | 24.0  | μA       | 1       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$     | IOUT=1mA<br>4.3V ≤ VIN ≤ 20.0V   |       | 0.01  | 0.2   | % / V    | 2       |
| Input Voltage                                 | VIN                                             |                                  |       |       | 20    | V        | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta T_{opr} \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C |       | ±100  |       | ppm / °C | 2       |
| Short-circuit Current                         | Ishort                                          | VIN=5.3V                         |       | 40    |       | mA       | 2       |

XC6202P502 VOUT(T) = 5.0V (Note 1)

Ta=25°C

| PARAMETER                                     | SYMBOL                                          | CONDITIONS                       | MIN   | TYP   | MAX   | UNITS    | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------|----------------------------------|-------|-------|-------|----------|---------|
| Output Voltage                                | VOUT(E)<br>(Note2)                              | VIN=6V                           | 4.900 | 5.000 | 5.100 | V        | 2       |
|                                               |                                                 | IOUT=30mA                        |       |       |       |          |         |
| Maximum Output Current                        | IOUT max                                        | VIN=6V<br>VOUT ≥ VOUT(E) × 0.9   | 200   |       |       | mA       | 2       |
| Load Regulation                               | Δ VOUT                                          | VIN=6V<br>1mA ≤ IOUT ≤ 100mA     |       | 30    | 100   | mV       | 2       |
| Dropout Voltage (Note 3)                      | Vdif 1                                          | IOUT=30mA                        |       | 130   | 190   | mV       | 2       |
|                                               | Vdif 2                                          | IOUT=100mA                       |       | 440   | 550   |          |         |
| Supply Current                                | ISS                                             | VIN=6V                           |       | 10.0  | 24.0  | μA       | 1       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$     | IOUT=1mA<br>6V ≤ VIN ≤ 20.0V     |       | 0.01  | 0.2   | % / V    | 2       |
| Input Voltage                                 | VIN                                             |                                  |       |       | 20    | V        | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta T_{opr} \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C |       | ±100  |       | ppm / °C | 2       |
| Short-circuit Current                         | Ishort                                          | VIN=7V                           |       | 40    |       | mA       | 2       |

- Note :
1. VOUT(T) = Specified Output Voltage.
  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).
  3. Vdif = VIN1 - VOUT1
  4. VOUT1 = A voltage equal to 98% of the output voltage when "VOUT(T)+1.0V" is input.e
  5. VIN1 = The input voltage when VOUT1 is output following a gradual decrease in the input voltage.

# XC6202 Series

## (High Voltage) Positive Voltage Regulators

Preliminary

XC6202PC02 VOUT(T) = 12V (Note 1)

Ta=25°C

| PARAMETER                                     | SYMBOL                                          | CONDITIONS                       | MIN    | TYP    | MAX    | UNITS    | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------|----------------------------------|--------|--------|--------|----------|---------|
| Output Voltage                                | VOUT(E)<br>(Note2)                              | VIN=13V                          | 11.760 | 12.000 | 12.240 | V        | 2       |
|                                               |                                                 | IOUT=30mA                        |        |        |        |          |         |
| Maximum Output Current                        | IOUT max                                        | VIN=13V<br>VOUT ≥ VOUT(E) × 0.9  | 200    |        |        | mA       | 2       |
| Load Regulation                               | Δ VOUT                                          | VIN=13V<br>1mA ≤ IOUT ≤ 100mA    |        | 60     | 230    | mV       | 2       |
| Dropout Voltage (Note 3)                      | Vdif 1                                          | IOUT=30mA                        |        | 90     | 150    | mV       | 2       |
|                                               | Vdif 2                                          | IOUT=100mA                       |        | 290    | 380    |          |         |
| Supply Current                                | ISS                                             | VIN=13V                          |        | 12.0   | 28.0   | μA       | 1       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$     | IOUT=1mA<br>13V ≤ VIN ≤ 20.0V    |        | 0.01   | 0.2    | % / V    | 2       |
| Input Voltage                                 | VIN                                             |                                  |        |        | 20     | V        | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta T_{opr} \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C |        | ±100   |        | ppm / °C | 2       |
| Short-circuit Current                         | Ishort                                          | VIN=14V                          |        | 40     |        | mA       | 2       |

XC6202PJ02 VOUT(T) = 18V (Note 1)

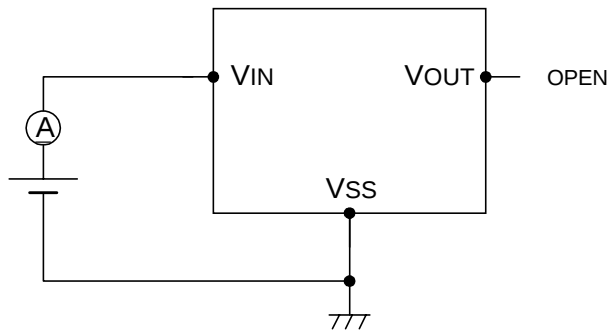
Ta=25°C

| PARAMETER                                     | SYMBOL                                          | CONDITIONS                       | MIN    | TYP    | MAX    | UNITS    | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------|----------------------------------|--------|--------|--------|----------|---------|
| Output Voltage                                | VOUT(E)<br>(Note2)                              | VIN=19V                          | 17.640 | 18.000 | 18.360 | V        | 2       |
|                                               |                                                 | IOUT=30mA                        |        |        |        |          |         |
| Maximum Output Current                        | IOUT max                                        | VIN=19V<br>VOUT ≥ VOUT(E) × 0.9  | 200    |        |        | mA       | 2       |
| Load Regulation                               | Δ VOUT                                          | VIN=19V<br>1mA ≤ IOUT ≤ 100mA    |        | 120    | 380    | mV       | 2       |
| Dropout Voltage (Note 3)                      | Vdif 1                                          | IOUT=30mA                        |        | 80     | 150    | mV       | 2       |
|                                               | Vdif 2                                          | IOUT=100mA                       |        | 280    | 380    |          |         |
| Supply Current                                | ISS                                             | VIN=19V                          |        | 15.0   | 30.0   | μA       | 1       |
| Line Regulation                               | $\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$     | IOUT=1mA<br>19V ≤ VIN ≤ 20.0V    |        | 0.01   | 0.2    | % / V    | 2       |
| Input Voltage                                 | VIN                                             |                                  |        |        | 20     | V        | -       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta VOUT}{\Delta T_{opr} \cdot VOUT}$ | IOUT=30mA<br>-40°C ≤ Topr ≤ 85°C |        | ±100   |        | ppm / °C | 2       |
| Short-circuit Current                         | Ishort                                          | VIN=20V                          |        | 40     |        | mA       | 2       |

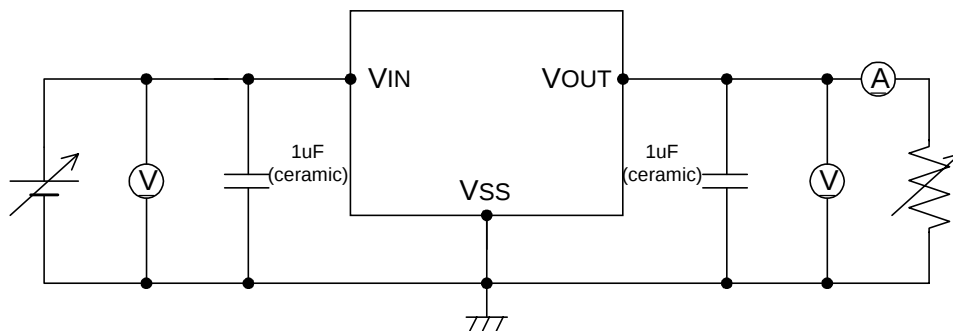
- Note :
1. VOUT(T) = Specified Output Voltage.
  2. VOUT(E) = Effective Output Voltage (i.e. the output voltage when "VOUT(T)+1.0V" is provided at the VIN pin while maintaining a certain IOUT value).
  3. Vdif = VIN1 - VOUT1
  4. VOUT1 = A voltage equal to 98% of the output voltage when "Vout(T)+1.0V" is input.e
  5. VIN1 = The input voltage when VOUT1 is output following a gradual decrease in the input voltage.

## ■ Test Circuits

CIRCUIT 1

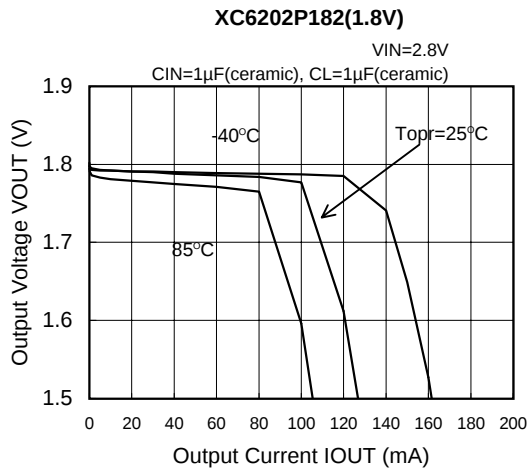


CIRCUIT 2

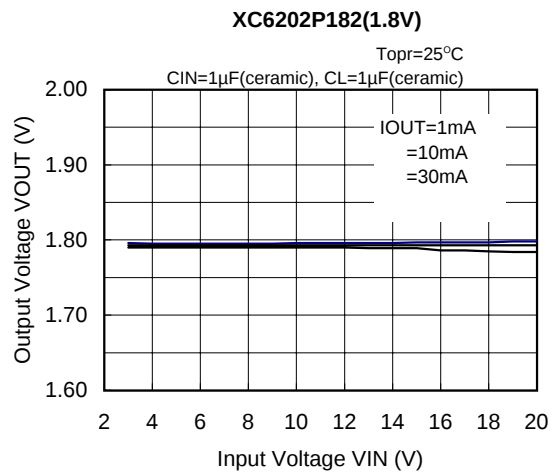
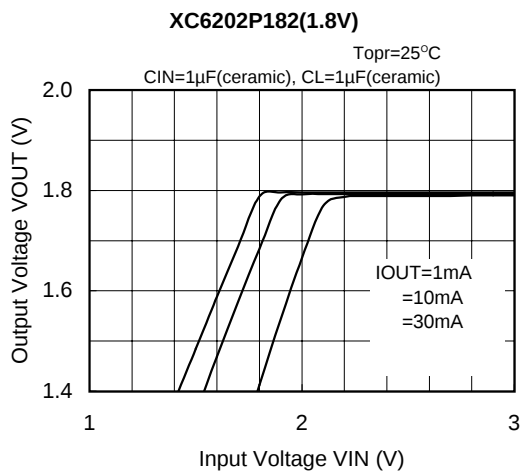


### ■ XC6202

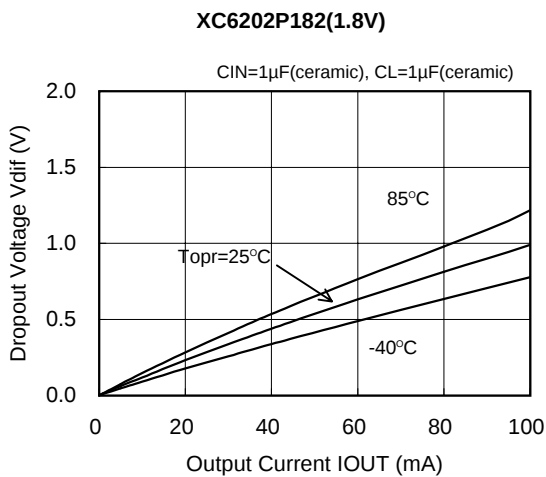
#### (1) Output Voltage vs. Output Current



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

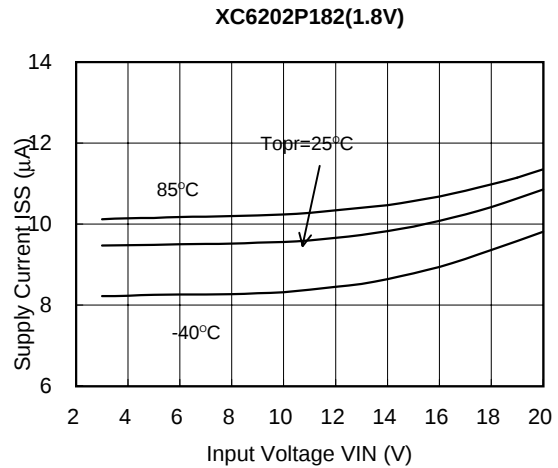
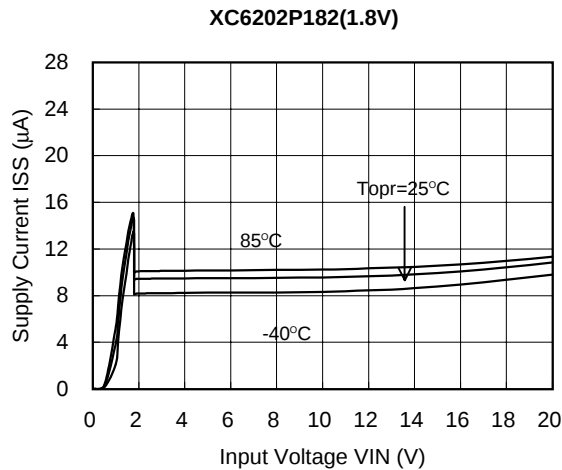


#### (3) Dropout Voltage vs. Output Current

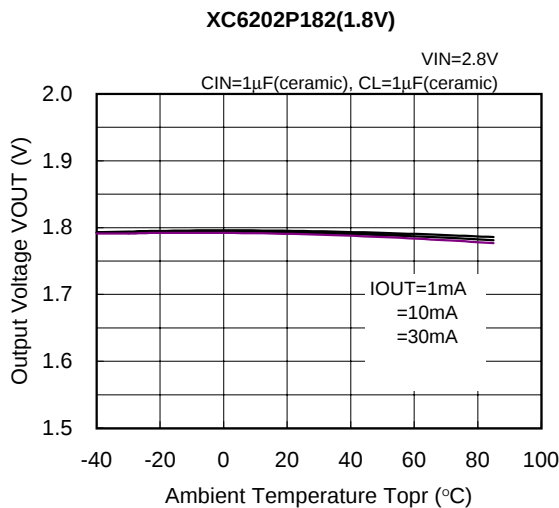


### ■ XC6202

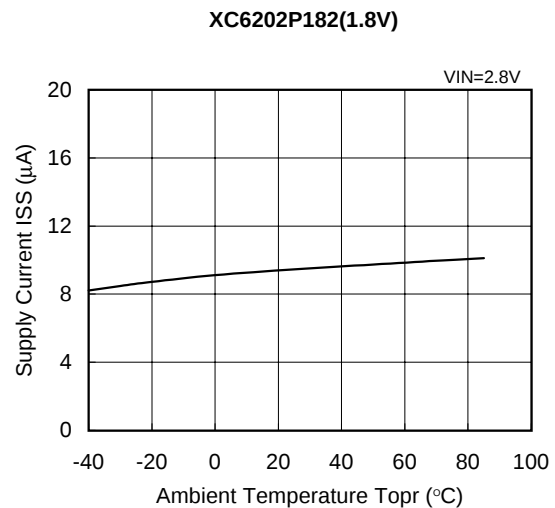
#### (4) Supply Current vs. Input Voltage



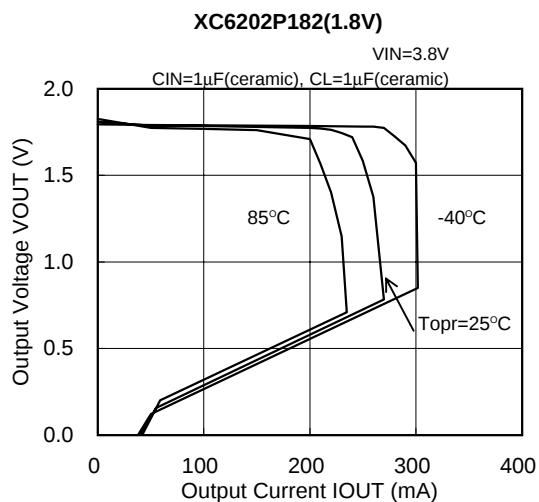
#### (5) Output Voltage vs. Ambient Temperature



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



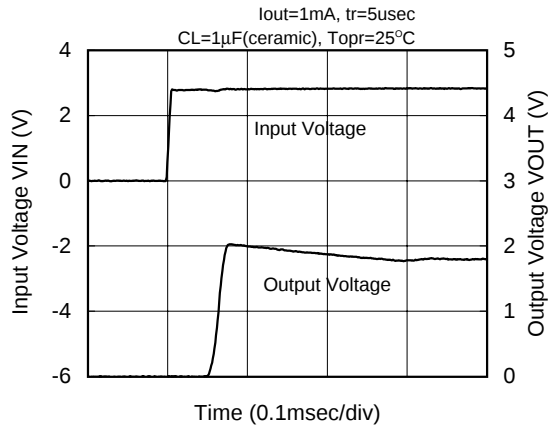
#### (7) Current Limiter Circuit



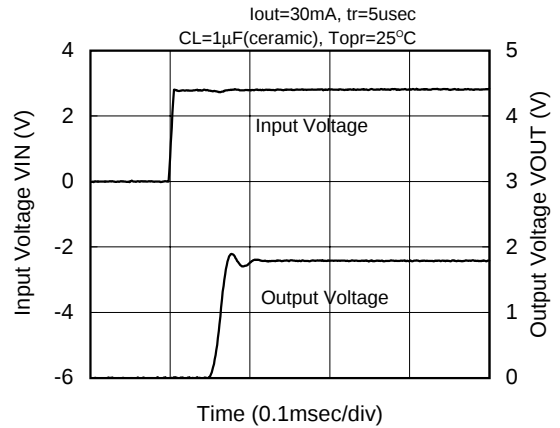
### ■ XC6202

#### (8) Input Transient Response 1

##### XC6202P182(1.8V)

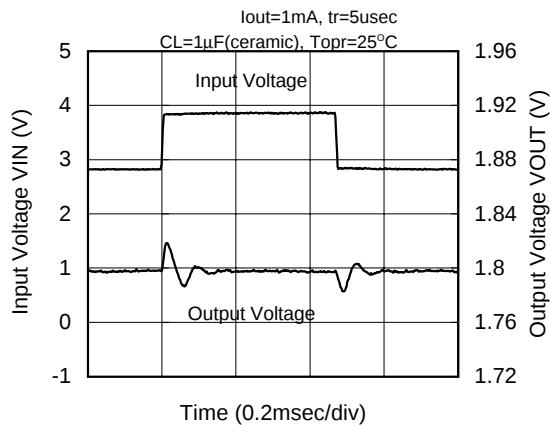


##### XC6202P182(1.8V)

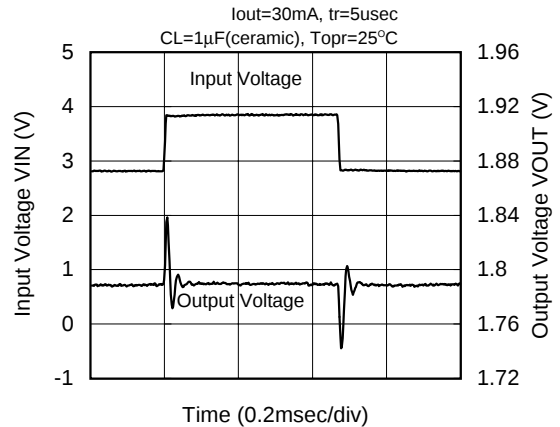


#### (9) Input Transient Response 2

##### XC6202P182(1.8V)

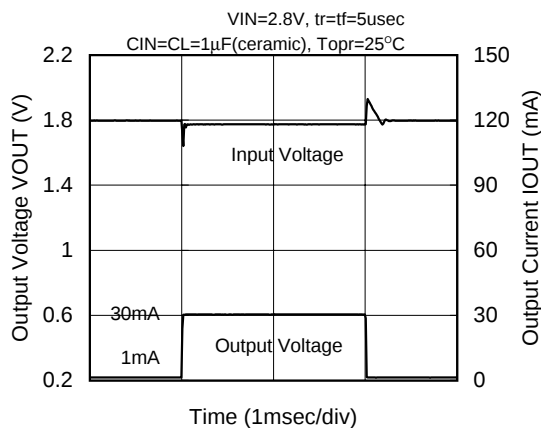


##### XC6202P182(1.8V)



#### (10) Load Transient Response

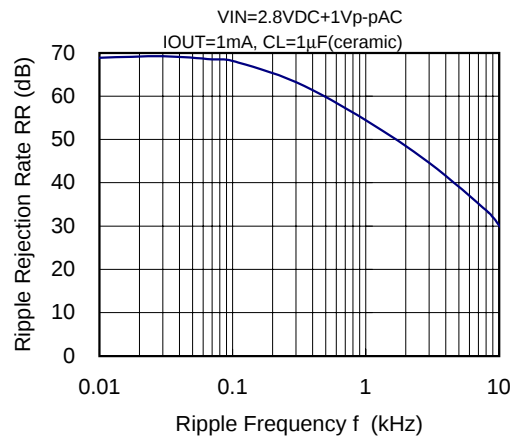
##### XC6202P182(1.8V)



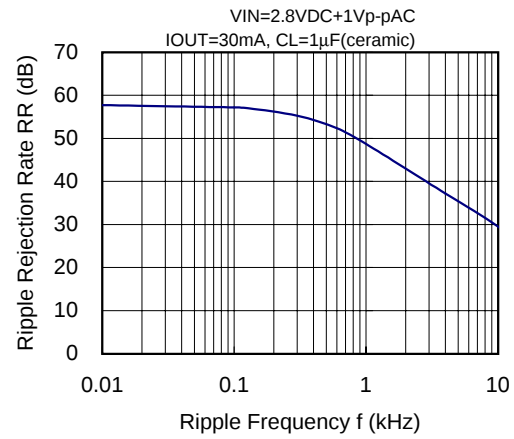
### ■ XC6202

#### (11) Ripple Rejection Rate

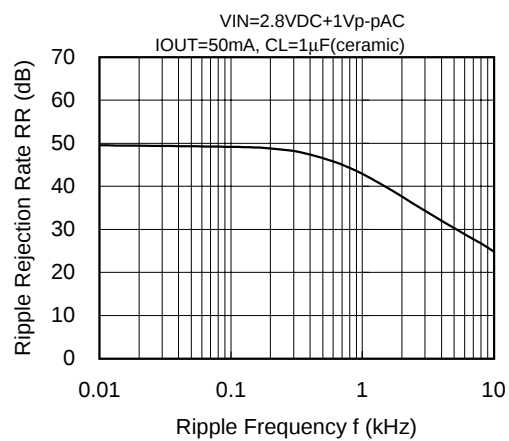
##### XC6202P182(1.8V)



##### XC6202P182(1.8V)

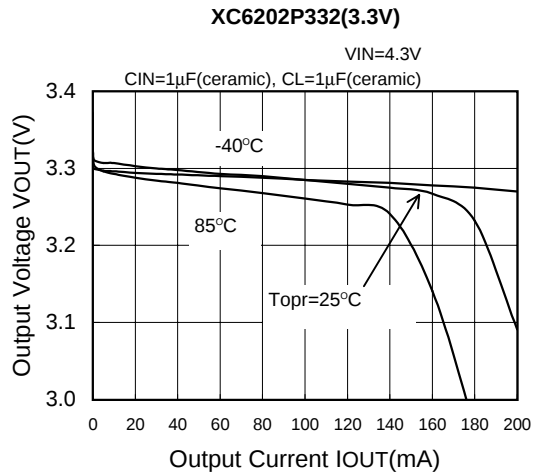


##### XC6202P182(1.8V)

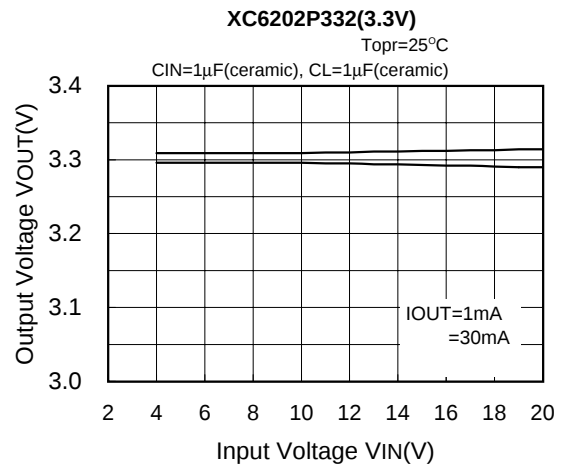
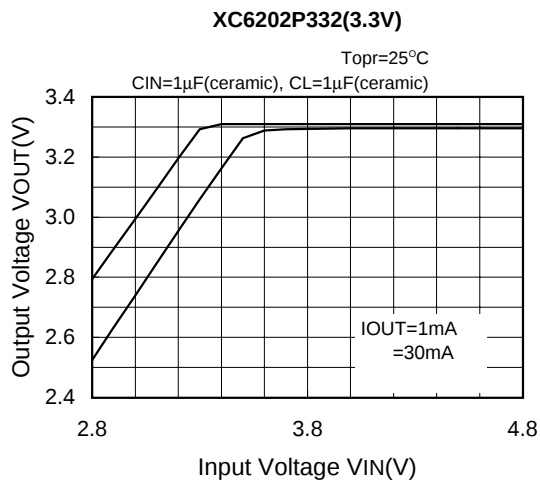


### ■ XC6202

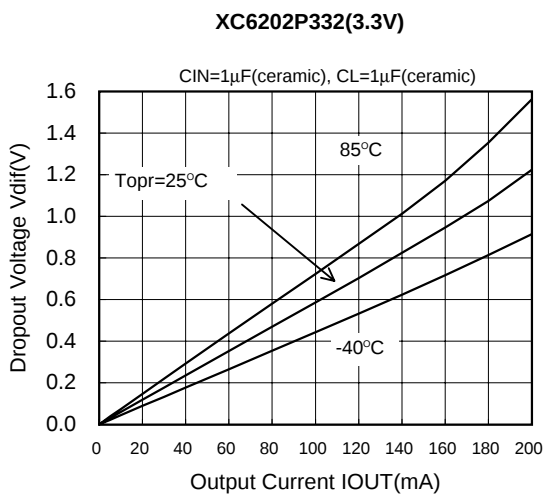
#### (1) Output Voltage vs. Output Current



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



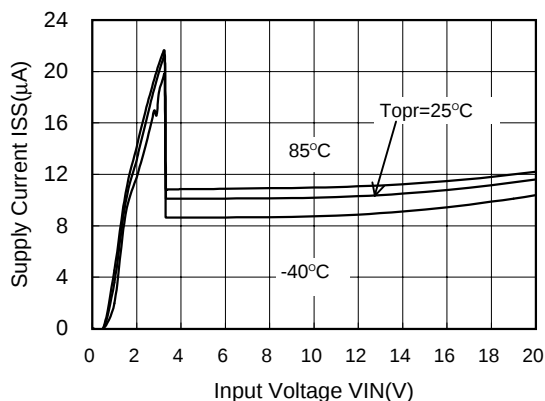
#### (3) Dropout Voltage vs. Output Current



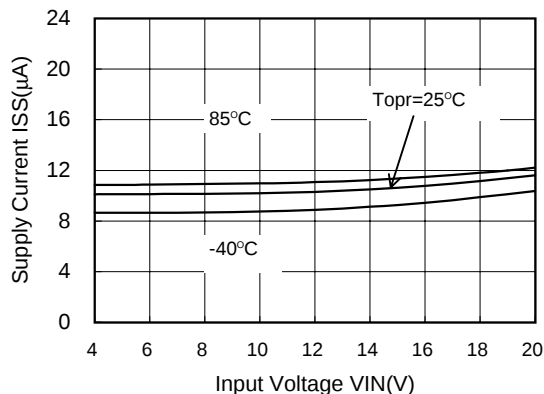
### ■ XC6202

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

XC6202P332(3.3V)

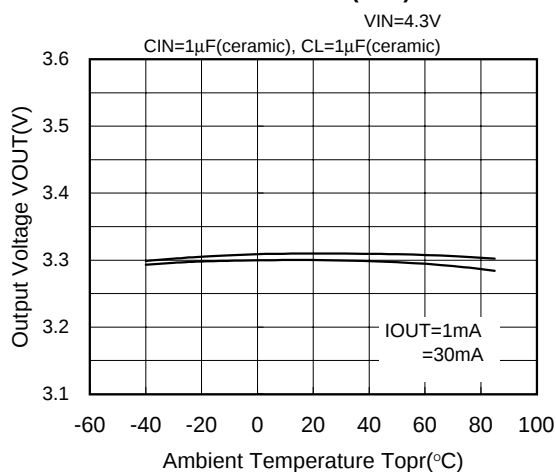


XC6202P332(3.3V)



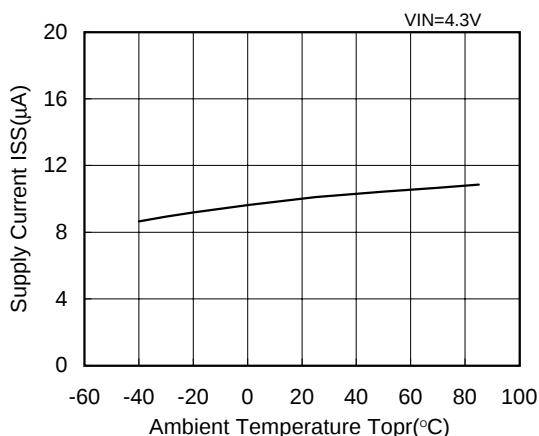
#### (5) Output Voltage vs. Ambient Temperature

XC6202P332(3.3V)



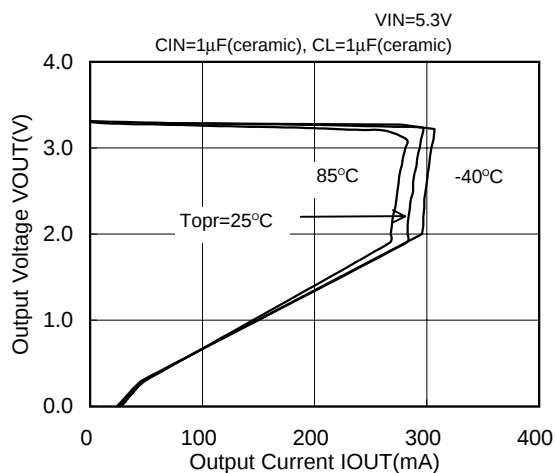
#### (6) Supply Current vs. Ambient Temperature

XC6202P332(3.3V)



#### (7) Current Limiter Circuit

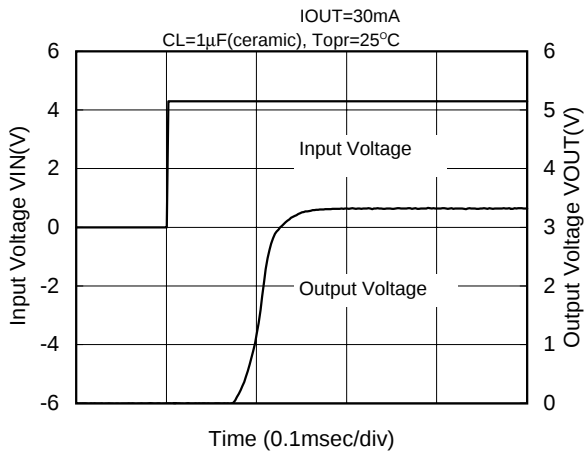
XC6202P332(3.3V)



### ■ XC6202

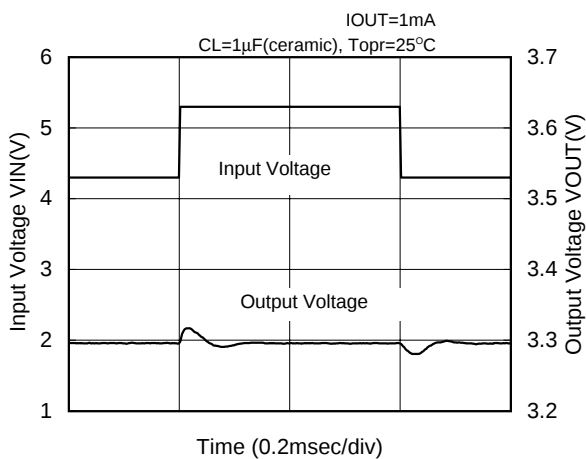
#### (8) Input Transient Response 1

##### XC6202P332(3.3V)

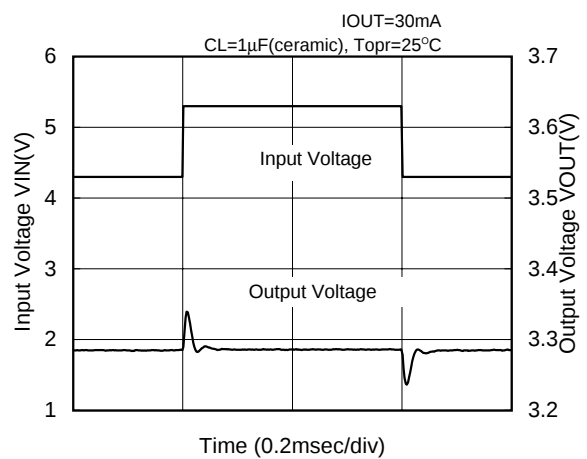


#### (9) Input Transient Response 2

##### XC6202P332(3.3V)

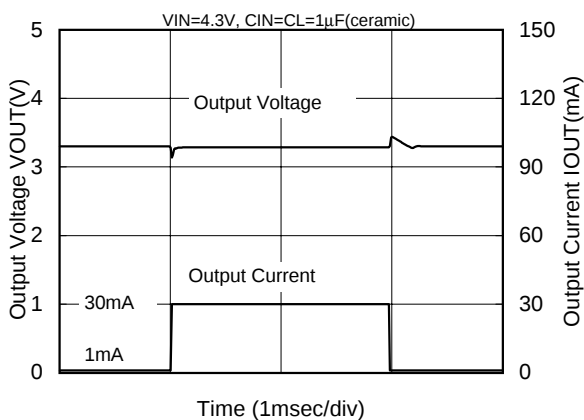


##### XC6202P332(3.3V)



#### (10) Load Transient Response

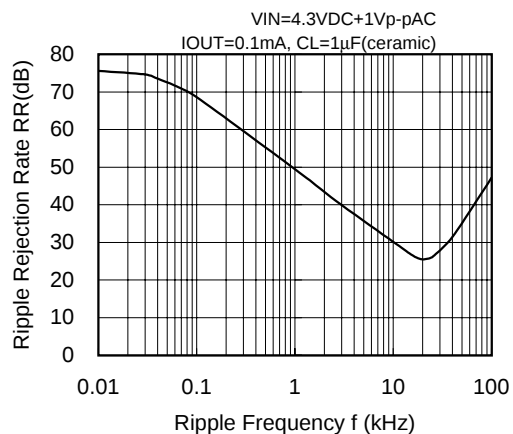
##### XC6202P332(3.3V)



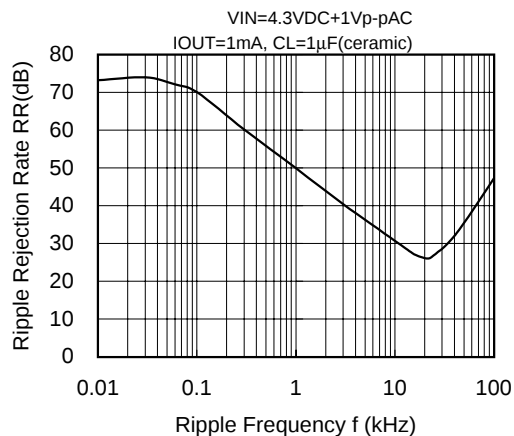
### ■ XC6202

#### (11) Ripple Rejection Rate

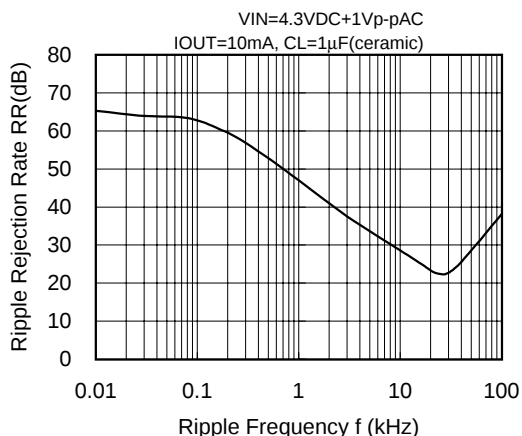
**XC6202P332(3.3V)**



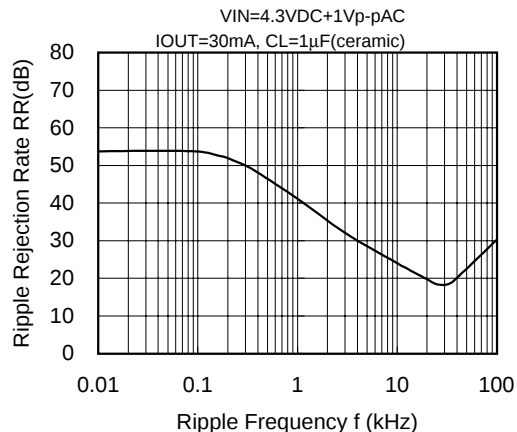
**XC6202P332(3.3V)**



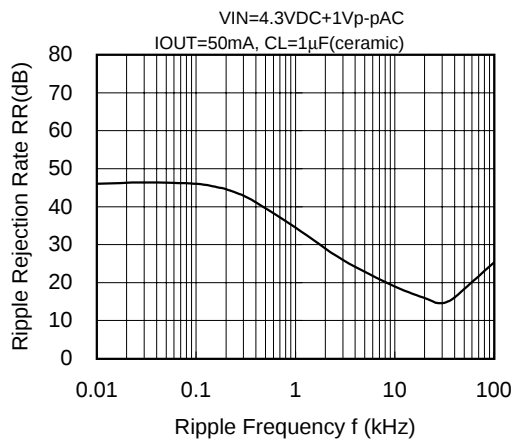
**XC6202P332(3.3V)**



**XC6202P332(3.3V)**

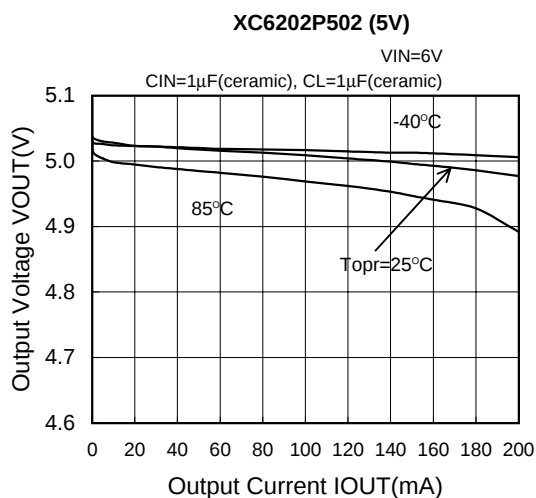


**XC6202P332(3.3V)**

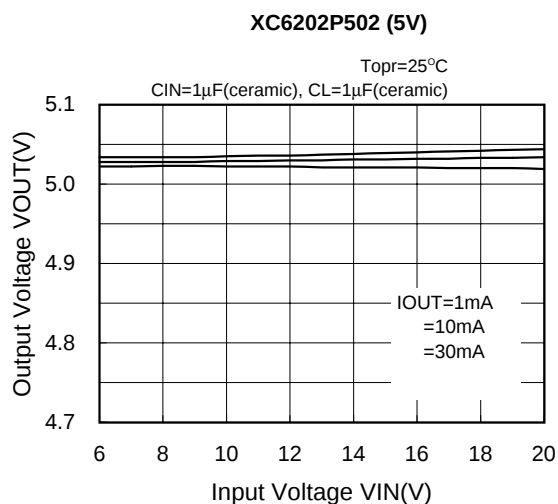
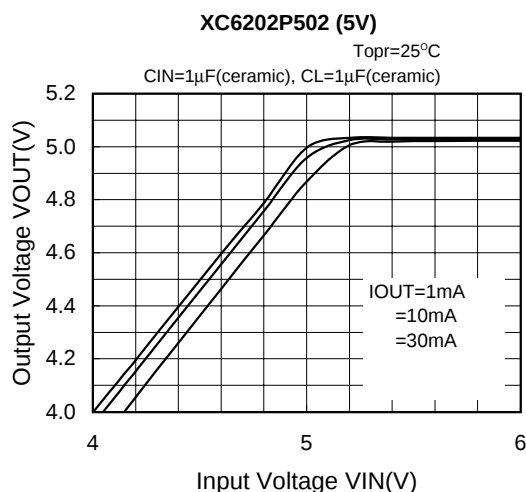


### ■ XC6202P502

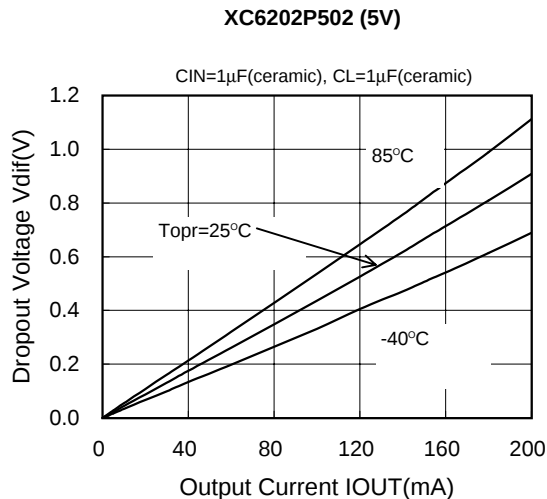
#### (1) Output Voltage vs. Output Current



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



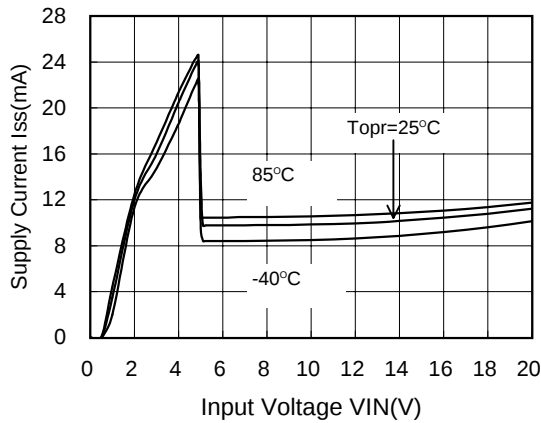
#### (3) Dropout Voltage vs. Output Current



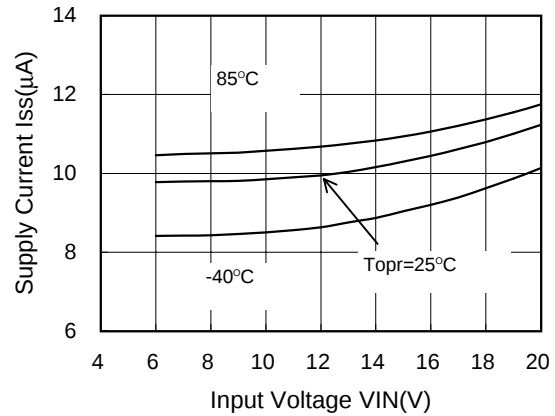
### ■ XC6202P502

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

XC6202P502 (5V)

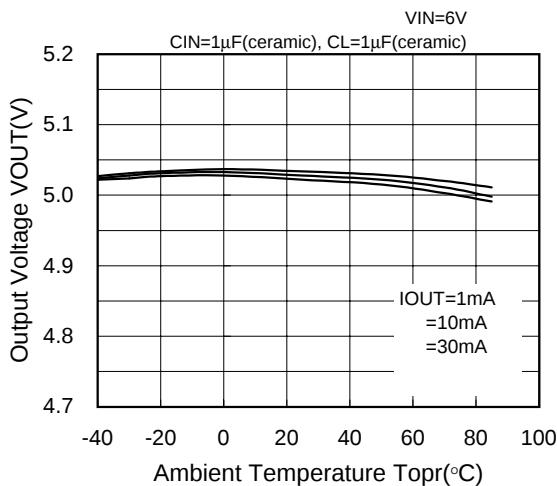


XC6202P502 (5V)



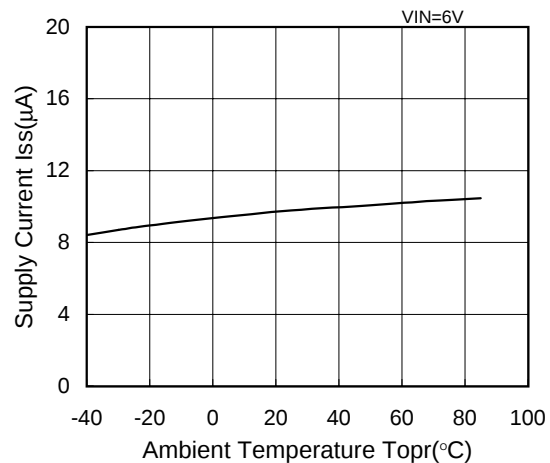
#### (5) Output Voltage vs. Ambient Temperature

XC6202P502 (5V)



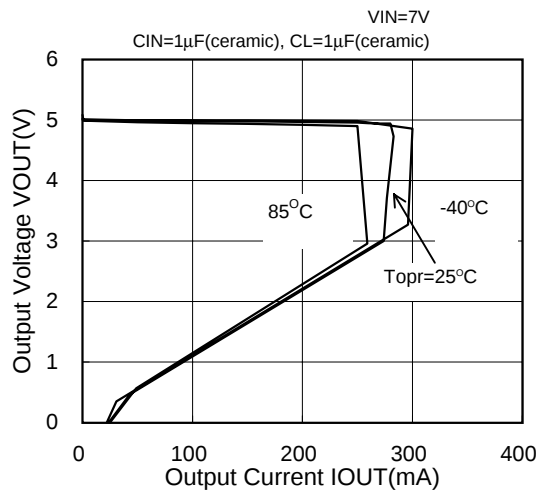
#### (6) Supply Current vs. Ambient Temperature

XC6202P502 (5V)



#### (7) Current Limiter Circuit

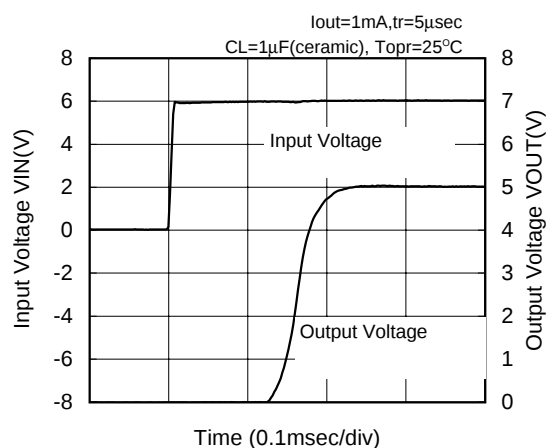
XC6202P502 (5V)



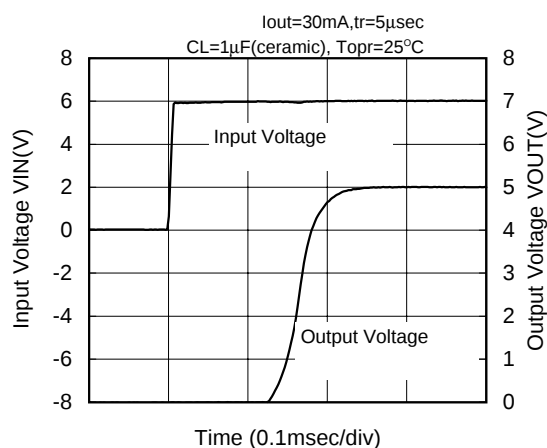
### ■ XC6202P502

#### (8) Input Transient Response 1

XC6202P502 (5V)

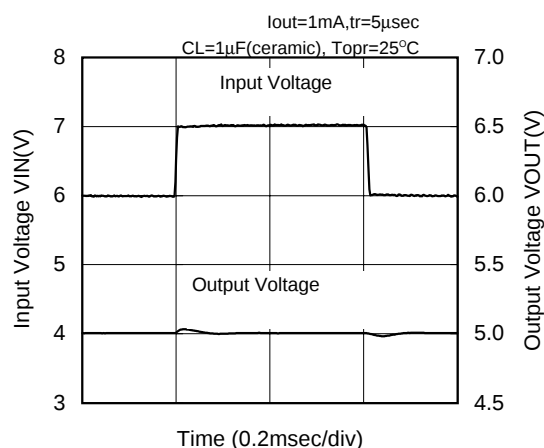


XC6202P502 (5V)

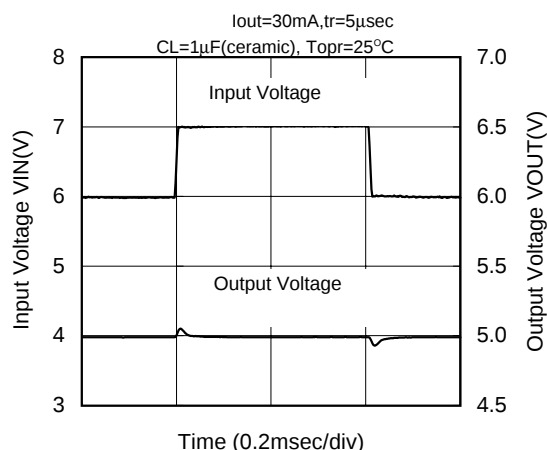


#### (9) Input Transient Response 2

XC6202P502 (5V)

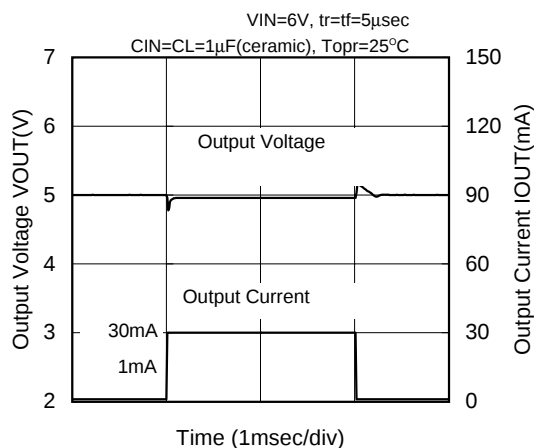


XC6202P502 (5V)



#### (10) Load Transient Response

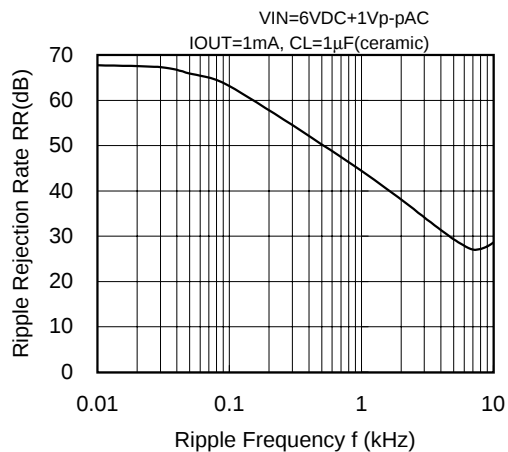
XC6202P502 (5V)



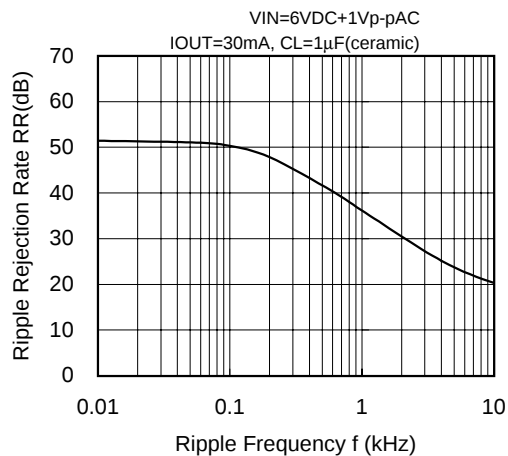
### ■ XC6202P502

#### (11) Ripple Rejection Rate

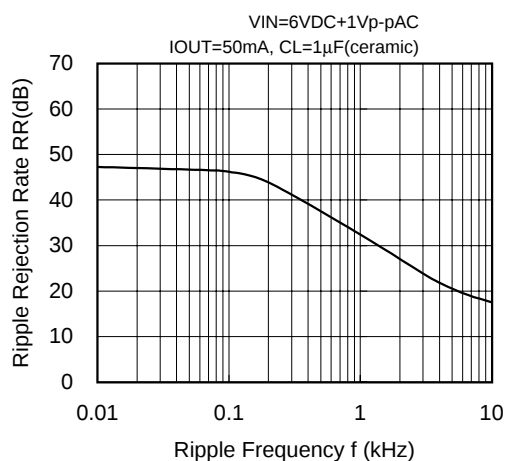
**XC6202P502 (5V)**



**XC6202P502 (5V)**



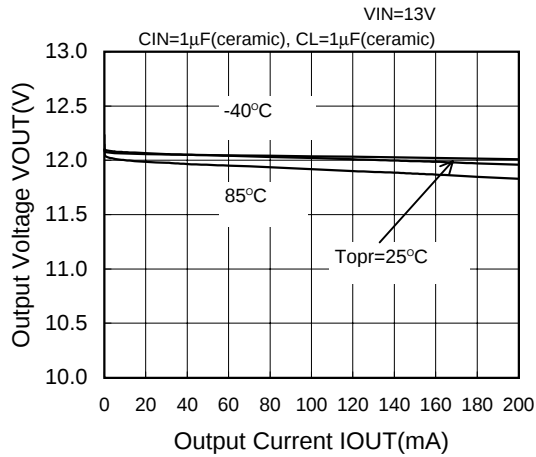
**XC6202P502 (5V)**



### ■ XC6202PC02

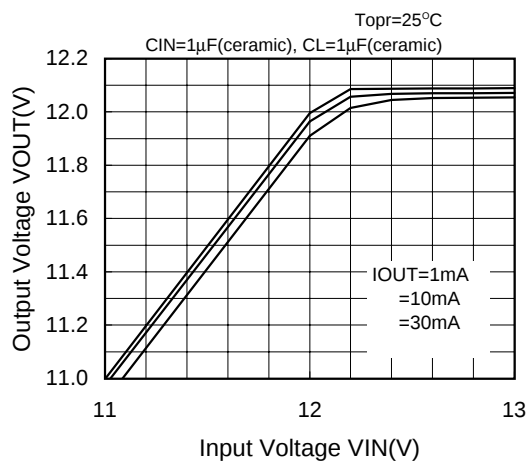
#### (1) Output Voltage vs. Output Current

##### XC6202PC02 (12V)

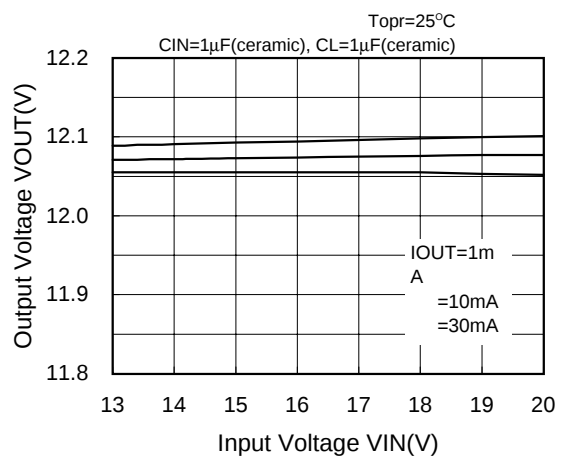


#### (2) Output Voltage vs. Input Voltage

##### XC6202PC02 (12V)

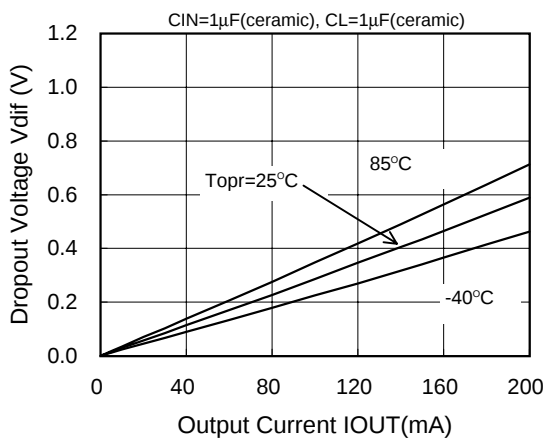


##### XC6202PC02 (12V)



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

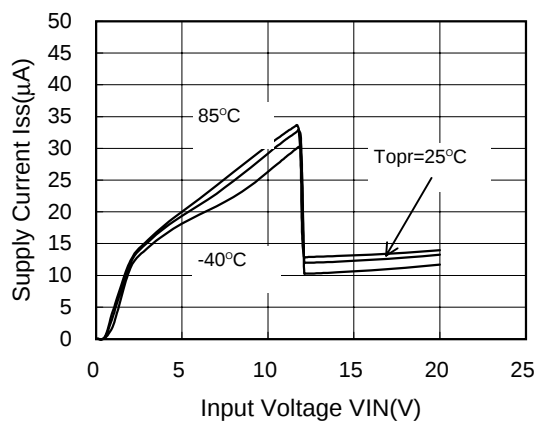
##### XC6202PC02 (12V)



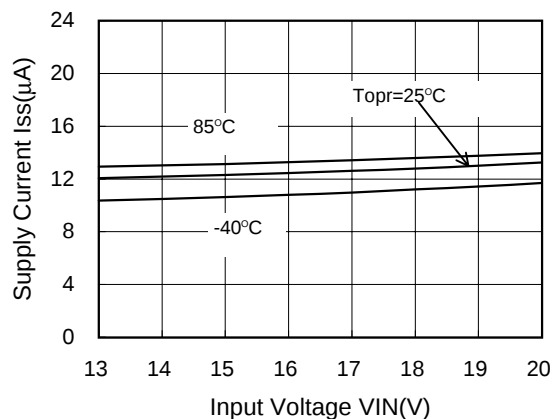
### ■ XC6202PC02

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

XC6202PC02 (12V)

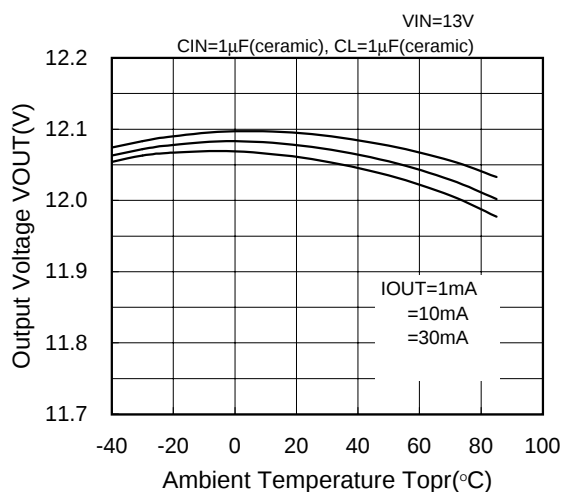


XC6202PC02 (12V)



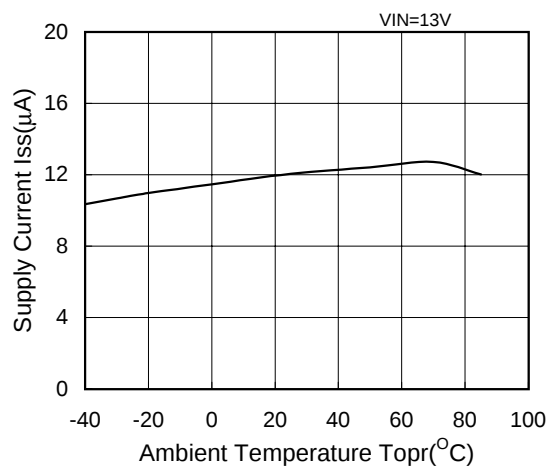
#### (5) Output Voltage vs. Ambient Temperature

XC6202PC02 (12V)



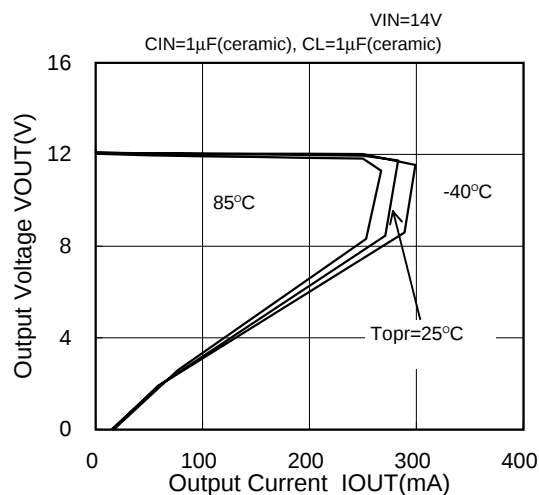
#### (6) Supply Current vs. Ambient Temperature

XC6202PC02 (12V)



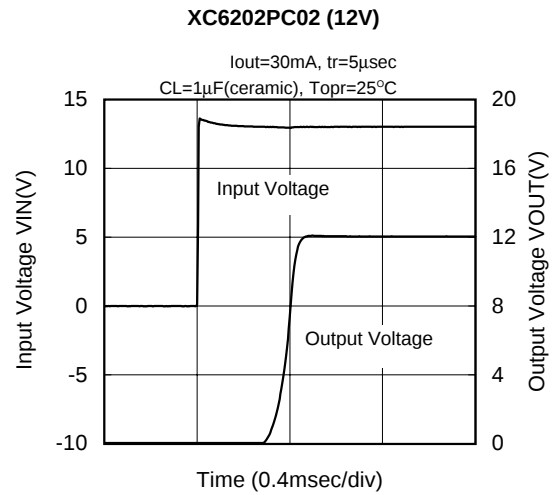
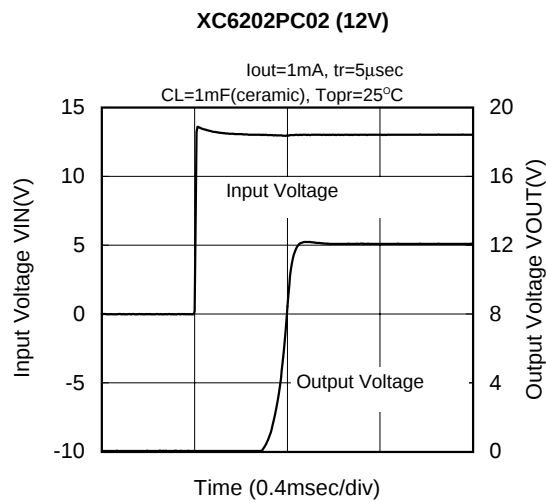
#### (7) Current Limiter Circuit

XC6202PC02 (12V)

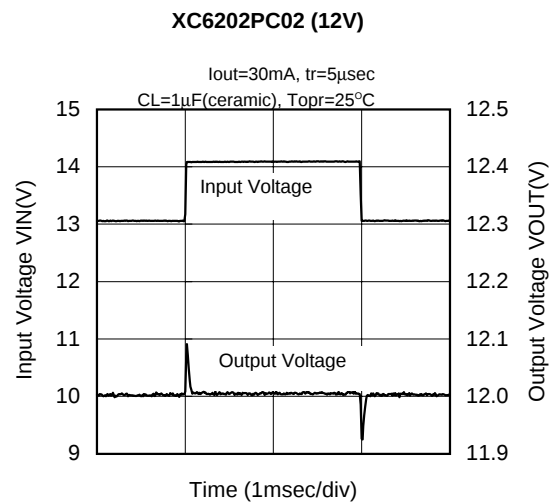
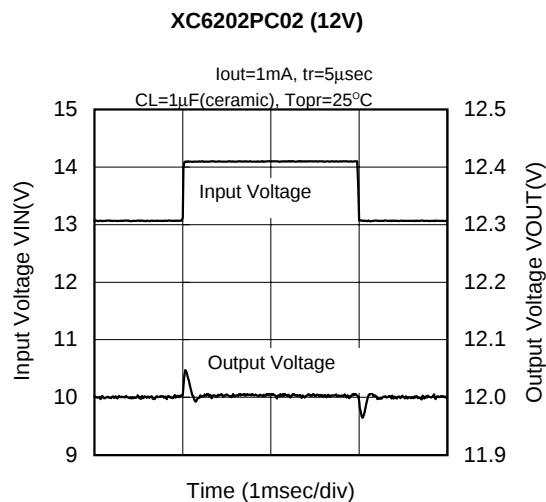


### ■ XC6202PC02

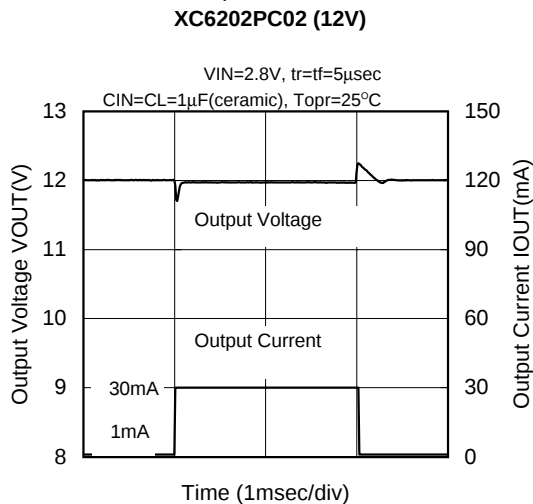
#### (8) Input Transient Response 1



#### (9) Input Transient Response 2



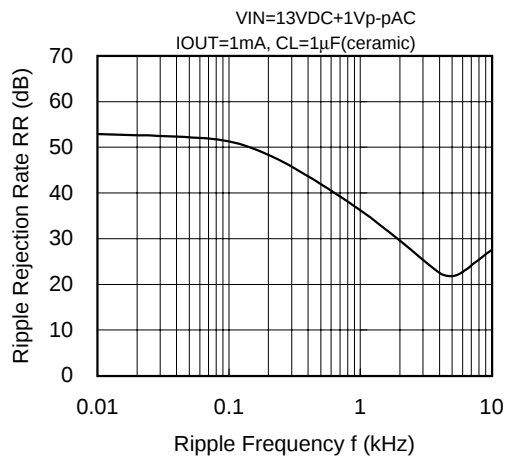
#### (10) Load Transient Response



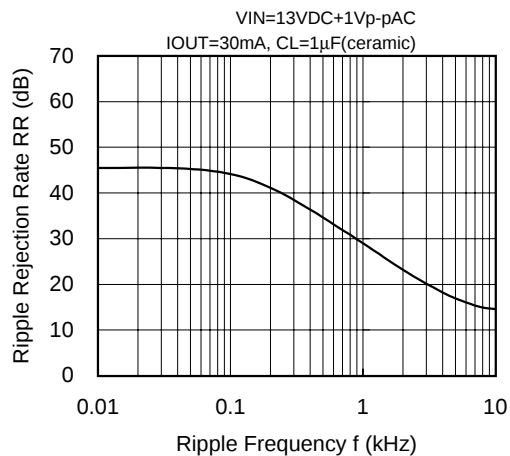
### ■ XC6202PC02

#### (11) Ripple Rejection Rate

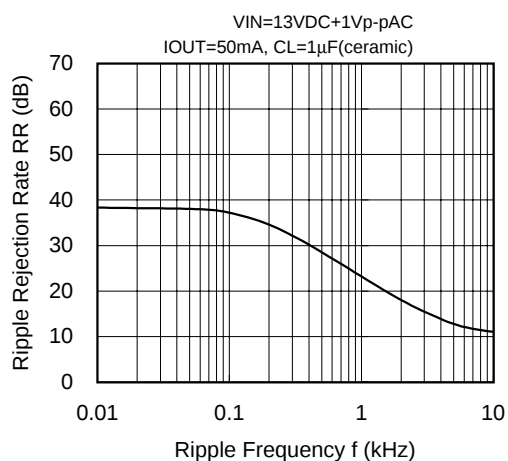
**XC6202PC02 (12V)**



**XC6202PC02 (12V)**



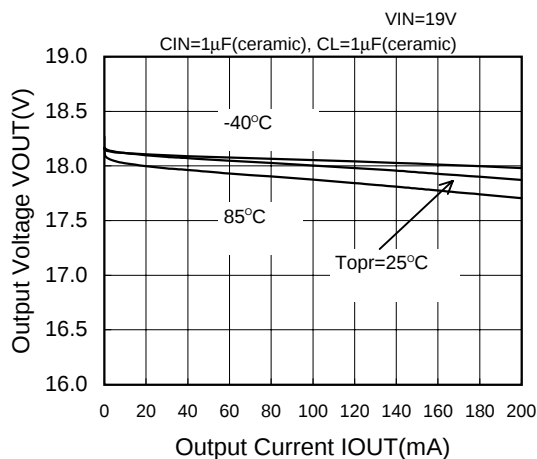
**XC6202PC02 (12V)**



### ■ XC6202PJ02

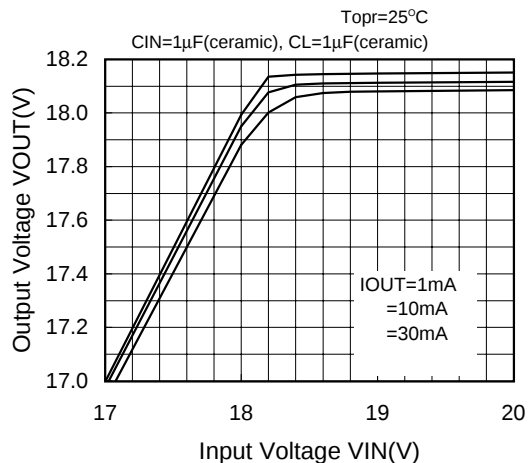
(1) Output Voltage vs. Output Current

XC6202JC02 (18V)



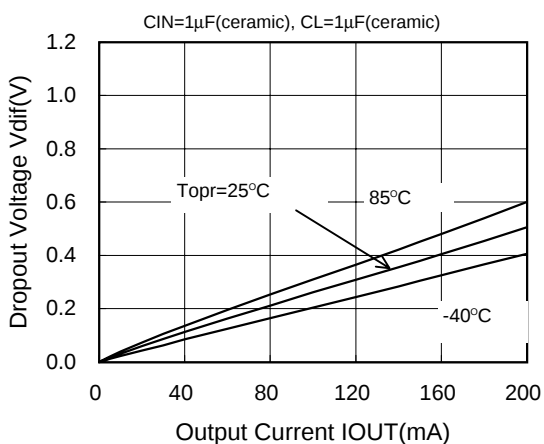
(2) Output Voltage vs. Input Voltage

XC6202JC02 (18V)



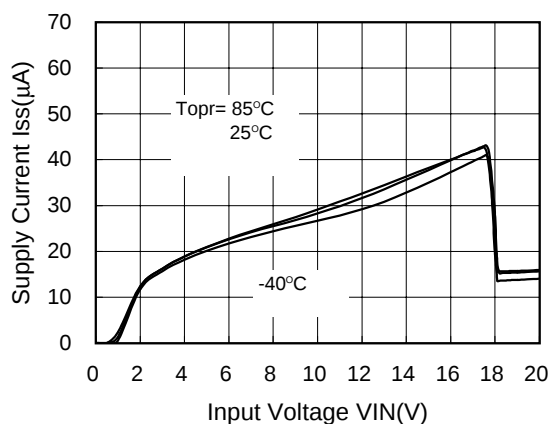
(3) Dropout Voltage vs. Output Current

XC6202JC02 (18V)



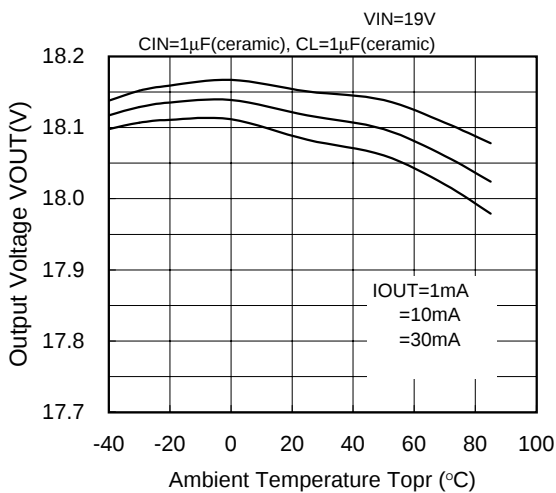
(4) Supply Current vs. Input Voltage

XC6202JC02 (18V)



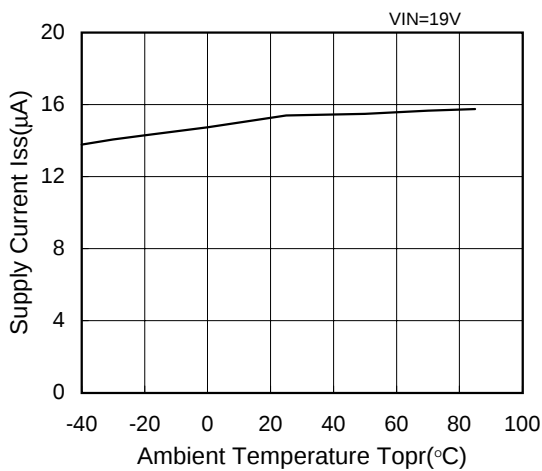
(5) Output Voltage vs. Ambient Temperature

XC6202JC02 (18V)



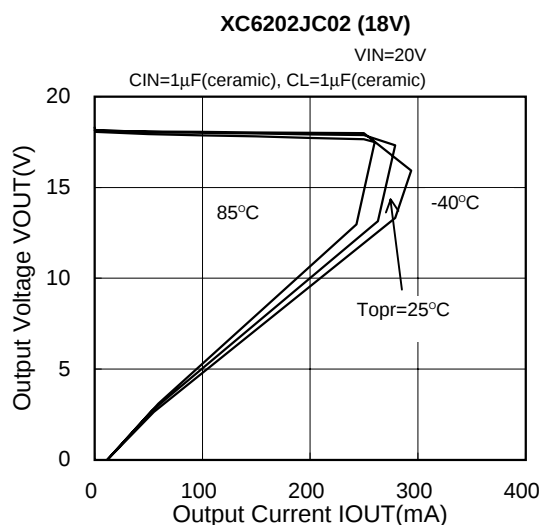
(6) Supply Current vs. Ambient Temperature

XC6202JC02 (18V)

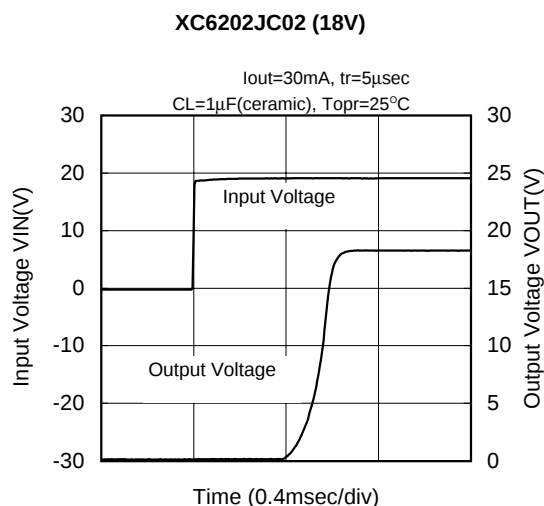
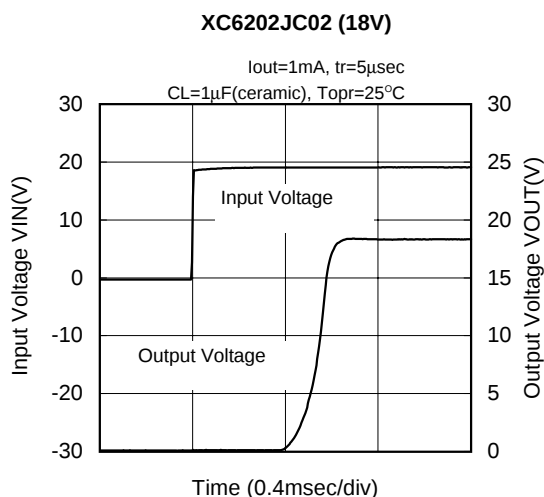


#### ■ XC6202PJ02

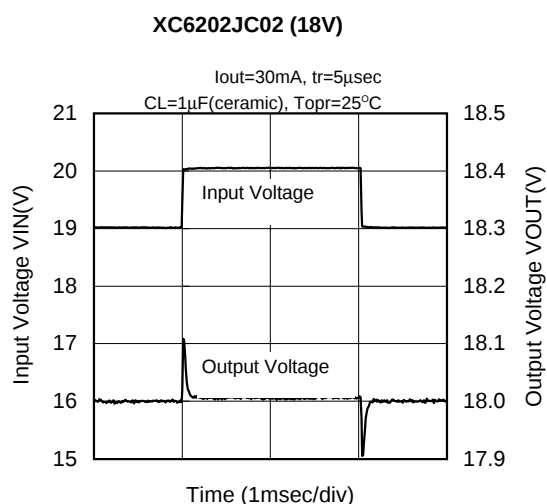
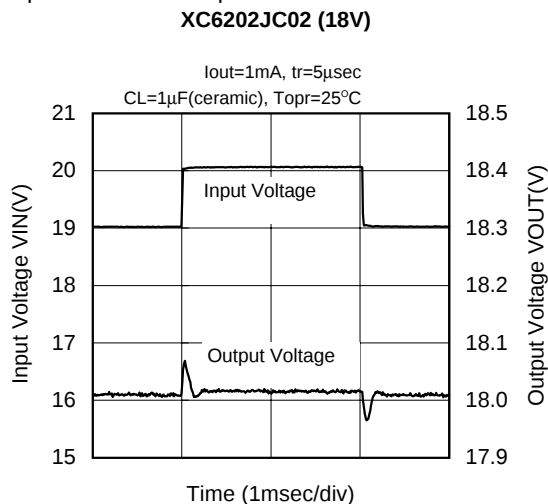
##### (7) Current Limiter Circuit



##### (8) Input Transient Response 1



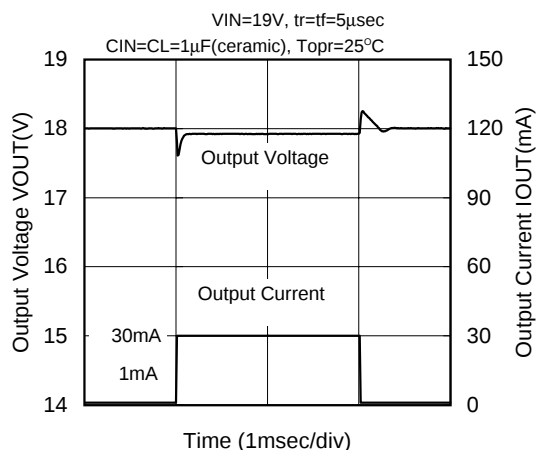
##### (9) Input Transient Response 2



### ■ XC6202PJ02

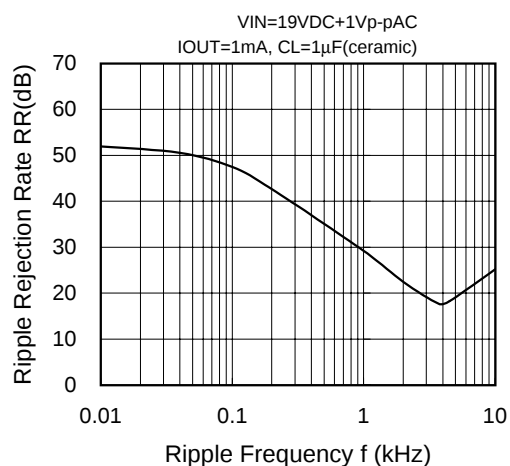
#### (10) Load Transient Response

##### XC6202JC02 (18V)

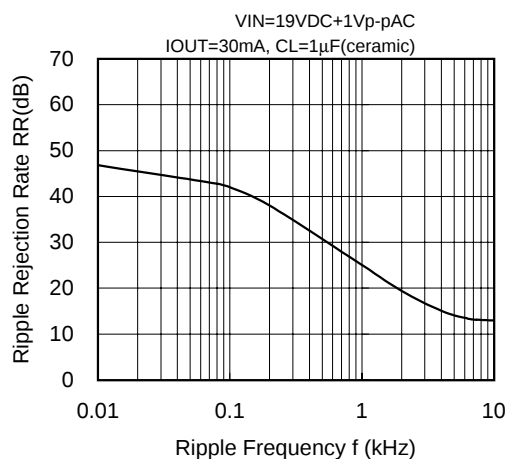


#### (11) Ripple Rejection Rate

##### XC6202JC02 (18V)



##### XC6202JC02 (18V)



##### XC6202JC02 (18V)

