

# XC62FP

## Series

### Positive Voltage Regulators



#### ◆CMOS Low Power Consumption

#### ◆Small Input-Output Voltage Differential

: 0.12V @ 100mA,

0.38V @ 200mA

#### ◆Maximum Output Current : 250mA ( $V_{OUT}=5.0V$ )

#### ◆Output Voltage Range : 2.0V~6.0V

#### ◆Highly Accurate : $\pm 2\%$ ( $\pm 1\%$ )

### ■General Description

The XC62FP series is a group of positive voltage output, three-pin regulators, that provide a high current even when the input/output voltage differential is small. Low power consumption and high accuracy is achieved through CMOS and laser trimming technologies.

The XC62FP consists of a high-precision voltage reference, an error amplification circuit, and a current limited output driver. Transient response to load variations have improved in comparison to the existing series.

SOT-23 (150mW), SOT-89 (500mW) and TO-92 (300mW) packages are available.

### ■Applications

- Battery Powered Equipment
- Palmtops
- Portable Cameras and Video Recorders
- Reference Voltage Sources

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### ■Features

#### Maximum Output Current

: 250mA

(within max. power dissipation,  $V_{OUT} = 5.0V$ )

#### Output Voltage Range

: 2.0V ~ 6.0V in 0.1V increments

(1.5V ~ 1.9V for custom products)

#### Highly Accurate: Output voltage $\pm 2\%$

( $\pm 1\%$  for semi-custom products)

#### Low Power Consumption

: Typ. 2.0 $\mu A$  @  $V_{OUT}=5.0V$

#### Output Voltage Temperature Characteristics

: Typ.  $\pm 100ppm/^{\circ}C$

#### Input Stability : Typ. 0.2%/V

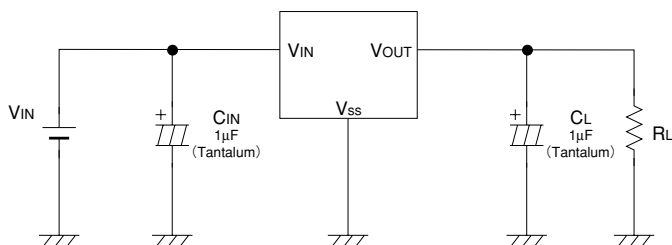
#### Small Input-Output Differential

:  $I_{OUT} = 100mA$  @  $V_{OUT} = 5.0V$  with a  
0.12V differential.

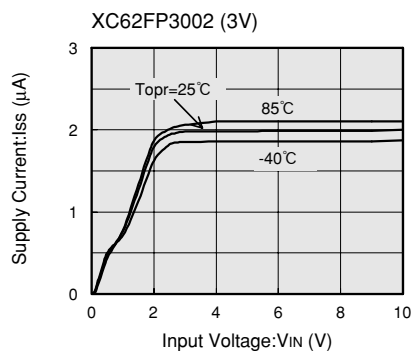
#### Ultra Small Packages

: SOT-23 (150mW) mini-mold,  
SOT-89 (500mW) mini-power mold  
TO-92 (300mW)

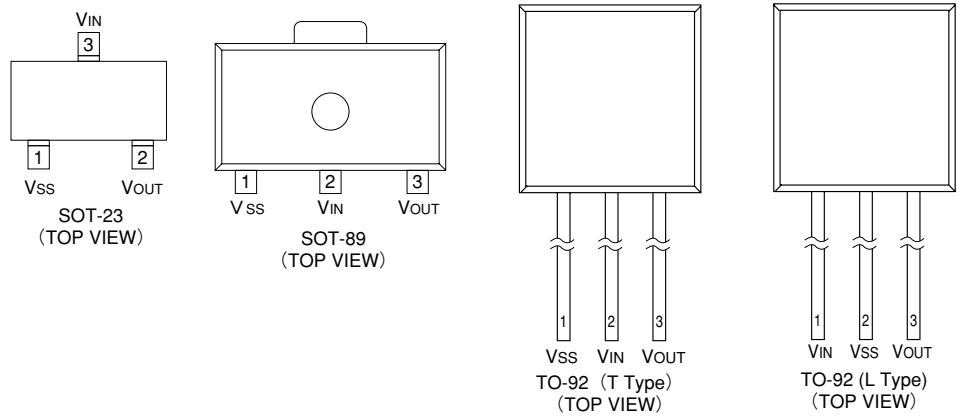
### ■Typical Application Circuit



### ■Typical Performance Characteristic



Pin Configuration



Pin Assignment

| PIN NUMBER |        |           |           | PIN NAME | FUNCTION                 |
|------------|--------|-----------|-----------|----------|--------------------------|
| SOT-23     | SOT-89 | TO-92 (T) | TO-92 (L) |          |                          |
| 1          | 1      | 1         | 2         | VSS      | Ground                   |
| 3          | 2      | 2         | 1         | VIN      | Supply voltage input     |
| 2          | 3      | 3         | 3         | VOUT     | Regulated voltage output |

Product Classification

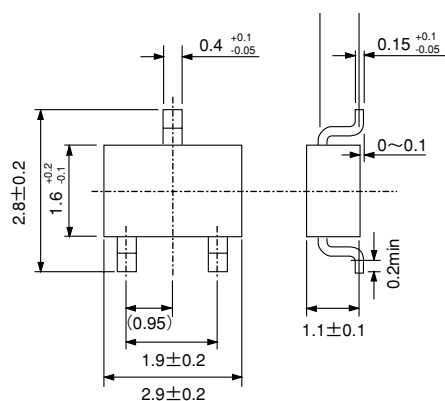
Ordering Information

X C 6 2 F X X X X X X X  
          ↑    ↑    ↑    ↑    ↑  
          a   b   c   d   e   f

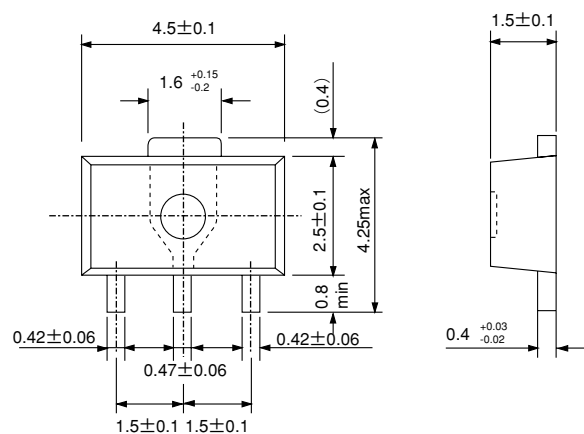
| DESIGNATOR | DESCRIPTION                                                  | DESIGNATOR | DESCRIPTION                                                                                                                            |
|------------|--------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------|
| a          | Polarity of Output Voltage:<br>P: + (Positive)               | e          | Package Type<br>M=SOT-23<br>P=SOT-89<br>T=TO-92 (Standard)<br>L=TO-92 (Custom pin configuration)                                       |
| b          | Output Voltage<br>30=3.0V<br>50=5.0V                         |            |                                                                                                                                        |
| c          | Temperature Coefficients:<br>0=±100ppm (typical)             | f          | Device Orientation<br>R=Embossed Tape<br>(Standard Feed)<br>L=Embossed Tape<br>(Reverse Feed)<br>H=Paper Tape (TO-92)<br>B=Bag (TO-92) |
| d          | Output Voltage Accuracy:<br>1=±1.0% (Semi-custom)<br>2=±2.0% |            |                                                                                                                                        |

## ■ Packaging Information

### ● SOT-23

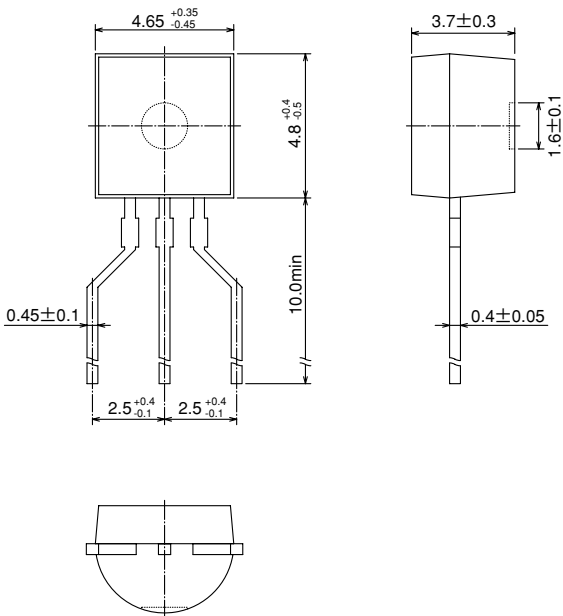


### ● SOT-89



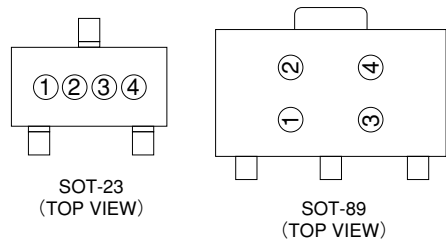
●TO-92

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■Marking

●SOT-23, SOT-89



① Represents the integer of the Output Voltage

| SYMBOL | VOLTAGE(V) | SYMBOL | VOLTAGE(V) |
|--------|------------|--------|------------|
| 1      | 1.②        | 5      | 5.②        |
| 2      | 2.②        | 6      | 6.②        |
| 3      | 3.②        |        |            |
| 4      | 4.②        |        |            |

② Represents the decimal number of the Output Voltage

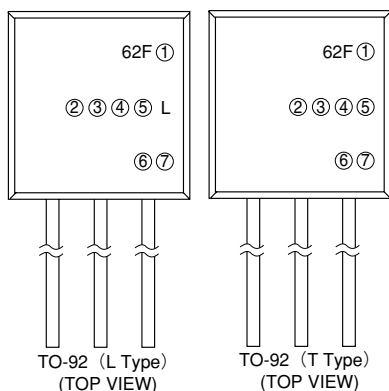
| SYMBOL | VOLTAGE(V) | SYMBOL | VOLTAGE(V) |
|--------|------------|--------|------------|
| A      | ①.0        | F      | ①.5        |
| B      | ①.1        | H      | ①.6        |
| C      | ①.2        | K      | ①.7        |
| D      | ①.3        | L      | ①.8        |
| E      | ①.4        | M      | ①.9        |

③ Based on internal standards

| SYMBOL |
|--------|
| 0      |

④ Represents the assembly lot no.  
Based on internal standards

●TO-92



- ① Represents the polarity of Output Voltage

| DESIGNATOR | CONFIGURATION |
|------------|---------------|
| P          | CMOS          |

- ④ Represents the temperature characteristics

| DESIGNATOR | TEMPERATURE CHARACTERISTICS |
|------------|-----------------------------|
| 0          | TPY $\pm$ 100ppm            |

- ⑥ Represents a least significant digit of the produced year

| DESIGNATOR | PRODUCED YEAR |
|------------|---------------|
| 0          | 2000          |
| 1          | 2001          |

- ⑦ Denotes the production lot number  
0 to 9, A to Z repeated (G.I.J.O.Q.W excepted)

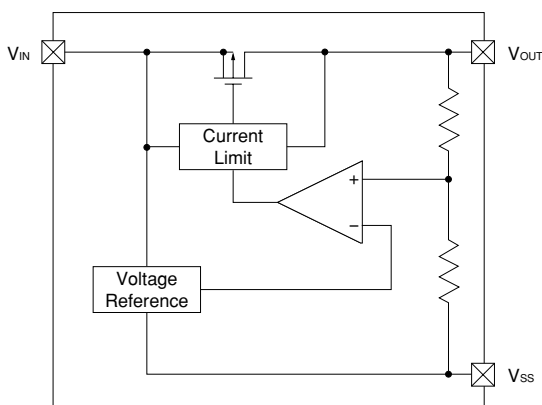
- ②③ Represents the Detect Voltage

| DESIGNATOR |   | VOLTAGE (V) |
|------------|---|-------------|
| ②          | ③ |             |
| 3          | 3 | 3.3         |
| 5          | 0 | 5.0         |

- ⑤ Represents the Detect Voltage Accuracy

| DESIGNATOR | DETECT VOLTAGE ACCURACY        |
|------------|--------------------------------|
| 1          | within $\pm 1\%$ (semi-custom) |
| 2          | within $\pm 2\%$               |

## ■Block Diagram



## ■Absolute Maximum Ratings

Ta=25°C

| PARAMETER                          | SYMBOL           | RATINGS                                     | UNITS |
|------------------------------------|------------------|---------------------------------------------|-------|
| Input Voltage                      | V <sub>IN</sub>  | 12                                          | V     |
| Output Current                     | I <sub>OUT</sub> | 500                                         | mA    |
| Output Voltage                     | V <sub>OUT</sub> | V <sub>SS</sub> -0.3 ~ V <sub>IN</sub> +0.3 | V     |
| Continuous Total Power Dissipation | SOT-23           | P <sub>d</sub>                              | 150   |
|                                    | SOT-89           |                                             | 500   |
|                                    | TO-92            |                                             | 300   |
| Operating Ambient Temperature      | T <sub>opr</sub> | -40 ~ +85                                   | °C    |
| Storage Temperature                | T <sub>stg</sub> | -40 ~ +125                                  | °C    |

## ■Electrical Characteristics

XC62FP5002  $V_{OUT}(T)=5.0V$  (Note1)

$T_a=25^{\circ}C$

| PARAMETER                                     | SYMBOL                                                | CONDITIONS                                                     | MIN   | TYP       | MAX   | UNITS            | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|-------|-----------|-------|------------------|---------|
| Output Voltage                                | $V_{OUT}(E)$ (Note2)                                  | $I_{OUT}=40mA$<br>$V_{IN}=6.0V$                                | 4.900 | 5.000     | 5.100 | V                | 1       |
| Maximum Output Current                        | $I_{OUT\ max}$                                        | $V_{IN}=6.0V$ , $V_{OUT}(E) \geq 4.5V$                         | 250   |           |       | mA               | 1       |
| Load Stability                                | $\Delta V_{OUT}$                                      | $V_{IN}=6.0V$<br>$1mA \leq I_{OUT} \leq 100mA$                 |       | 40        | 80    | mV               | 1       |
| Input -Output<br>Voltage Differential (Note3) | $V_{dif1}$                                            | $I_{OUT}=100mA$                                                |       | 120       | 300   | mV               | 1       |
|                                               | $V_{dif2}$                                            | $I_{OUT}=200mA$                                                |       | 380       | 600   | mV               | 1       |
| Supply Current                                | $I_{SS}$                                              | $V_{IN}=6.0V$                                                  |       | 2.0       | 4.5   | $\mu A$          | 2       |
| Input Stability                               | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$  | $I_{OUT}=40mA$<br>$6.0V \leq V_{IN} \leq 10.0V$                |       | 0.2       | 0.3   | %/V              | 1       |
| Input Voltage                                 | $V_{IN}$                                              |                                                                |       |           | 10    | V                | —       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$<br>$-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ |       | $\pm 100$ |       | ppm/ $^{\circ}C$ | 1       |

XC62FP4002  $V_{OUT}(T)=4.0V$  (Note1)

$T_a=25^{\circ}C$

| PARAMETER                                     | SYMBOL                                                | CONDITIONS                                                     | MIN   | TYP       | MAX   | UNITS            | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|-------|-----------|-------|------------------|---------|
| Output Voltage                                | $V_{OUT}(E)$ (Note2)                                  | $I_{OUT}=40mA$<br>$V_{IN}=5.0V$                                | 3.920 | 4.000     | 4.080 | V                | 1       |
| Maximum Output Current                        | $I_{OUT\ max}$                                        | $V_{IN}=5.0V$ , $V_{OUT}(E) \geq 3.6V$                         | 200   |           |       | mA               | 1       |
| Load Stability                                | $\Delta V_{OUT}$                                      | $V_{IN}=5.0V$<br>$1mA \leq I_{OUT} \leq 100mA$                 |       | 45        | 90    | mV               | 1       |
| Input -Output<br>Voltage Differential (Note3) | $V_{dif1}$                                            | $I_{OUT}=100mA$                                                |       | 170       | 330   | mV               | 1       |
|                                               | $V_{dif2}$                                            | $I_{OUT}=200mA$                                                |       | 400       | 630   | mV               | 1       |
| Supply Current                                | $I_{SS}$                                              | $V_{IN}=5.0V$                                                  |       | 2.0       | 4.5   | $\mu A$          | 2       |
| Input Stability                               | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$  | $I_{OUT}=40mA$<br>$5.0V \leq V_{IN} \leq 10.0V$                |       | 0.2       | 0.3   | %/V              | 1       |
| Input Voltage                                 | $V_{IN}$                                              |                                                                |       |           | 10    | V                | —       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$<br>$-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ |       | $\pm 100$ |       | ppm/ $^{\circ}C$ | 1       |

XC62FP3002  $V_{OUT}(T)=3.0V$  (Note1) $T_a=25^{\circ}C$ 

| PARAMETER                                     | SYMBOL                                                | CONDITIONS                                                     | MIN   | TYP       | MAX   | UNITS            | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|-------|-----------|-------|------------------|---------|
| Output Voltage                                | $V_{OUT}(E)$ (Note2)                                  | $I_{OUT}=40mA$<br>$V_{IN}=4.0V$                                | 2.940 | 3.000     | 3.060 | V                | 1       |
| Maximum Output Current                        | $I_{OUT\ max}$                                        | $V_{IN}=4.0V$ , $V_{OUT}(E) \geq 2.7V$                         | 150   |           |       | mA               | 1       |
| Load Stability                                | $\Delta V_{OUT}$                                      | $V_{IN}=4.0V$<br>$1mA \leq I_{OUT} \leq 80mA$                  |       | 45        | 90    | mV               | 1       |
| Input -Output<br>Voltage Differential (Note3) | $V_{dif1}$                                            | $I_{OUT}=80mA$                                                 |       | 180       | 360   | mV               | 1       |
|                                               | $V_{dif2}$                                            | $I_{OUT}=160mA$                                                |       | 400       | 700   | mV               | 1       |
| Supply Current                                | $I_{SS}$                                              | $V_{IN}=4.0V$                                                  |       | 2.0       | 4.5   | $\mu A$          | 2       |
| Input Stability                               | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$  | $I_{OUT}=40mA$<br>$4.0V \leq V_{IN} \leq 10.0V$                |       | 0.2       | 0.3   | %/V              | 1       |
| Input Voltage                                 | $V_{IN}$                                              |                                                                |       |           | 10    | V                | —       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$<br>$-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ |       | $\pm 100$ |       | ppm/ $^{\circ}C$ | 1       |

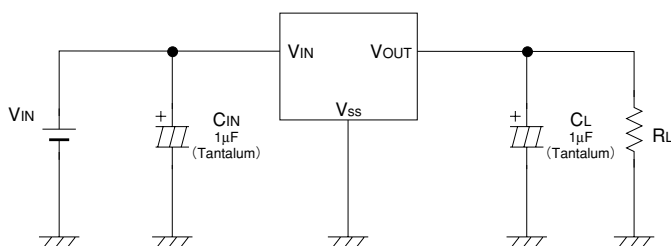
XC62FP2002  $V_{OUT}(T)=2.0V$  (Note1) $T_a=25^{\circ}C$ 

| PARAMETER                                     | SYMBOL                                                | CONDITIONS                                                     | MIN   | TYP       | MAX   | UNITS            | CIRCUIT |
|-----------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|-------|-----------|-------|------------------|---------|
| Output Voltage                                | $V_{OUT}(E)$ (Note2)                                  | $I_{OUT}=40mA$<br>$V_{IN}=3.0V$                                | 1.960 | 2.000     | 2.040 | V                | 1       |
| Maximum Output Current                        | $I_{OUT\ max}$                                        | $V_{IN}=3.0V$ , $V_{OUT}(E) \geq 1.8V$                         | 100   |           |       | mA               | 1       |
| Load Stability                                | $\Delta V_{OUT}$                                      | $V_{IN}=3.0V$<br>$1mA \leq I_{OUT} \leq 60mA$                  |       | 45        | 90    | mV               | 1       |
| Input -Output<br>Voltage Differential (Note3) | $V_{dif1}$                                            | $I_{OUT}=60mA$                                                 |       | 180       | 360   | mV               | 1       |
|                                               | $V_{dif2}$                                            | $I_{OUT}=120mA$                                                |       | 400       | 700   | mV               | 1       |
| Supply Current                                | $I_{SS}$                                              | $V_{IN}=3.0V$                                                  |       | 2.0       | 4.5   | $\mu A$          | 2       |
| Input Stability                               | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$  | $I_{OUT}=40mA$<br>$3.0V \leq V_{IN} \leq 10.0V$                |       | 0.2       | 0.3   | %/V              | 1       |
| Input Voltage                                 | $V_{IN}$                                              |                                                                |       |           | 10    | V                | —       |
| Output Voltage<br>Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$<br>$-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ |       | $\pm 100$ |       | ppm/ $^{\circ}C$ | 1       |

Note: 1.  $V_{OUT}(T)$ =Specified Output Voltage .  
 2.  $V_{OUT}(E)$ =Effective Output Voltage (i.e. the output voltage when " $V_{OUT}(T)+1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value).  
 3.  $V_{dif} = \{V_{IN1}^{(Note4)} - V_{OUT}(E)\}$   
 4.  $V_{IN1}$ = The input voltage at the time 98% of  $V_{OUT}(E)$  is output (input voltage has been gradually reduced).

## ■ Typical Application Circuit

### ● Standard Circuit



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## ■ Directions for use

### ● Notes on Use

1. Please use this IC within the stipulated absolute maximum ratings as the IC is liable to malfunction outside of such parameters.
2. There is a possibility that oscillation may occur as a result of the impedance present between the power supply and the IC's input. Where impedance is 10Ω or more, please use a capacitor (C<sub>IN</sub>) of at least 1µF.

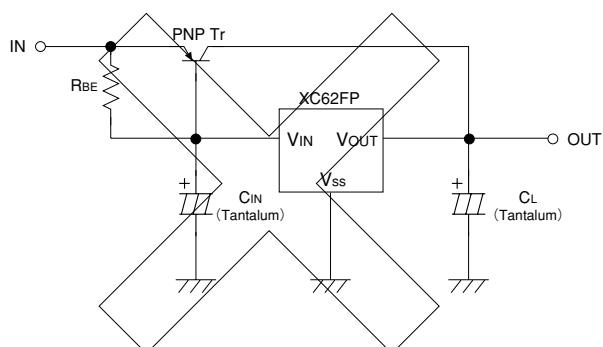
With a large output current, operations can be stabilised by increasing capacitor size (C<sub>IN</sub>). If C<sub>IN</sub> is small and capacitor size (C<sub>L</sub>) is increased, there is a possibility of oscillation due to input impedance.

In such cases, operations can be stabilised by either increasing the size of C<sub>IN</sub> or decreasing the size of C<sub>L</sub>.

3. Please ensure that output current (I<sub>OUT</sub>) is less than  $P_d \div (V_{IN} - V_{OUT})$  and does not exceed the stipulated Continuous Total Power Dissipation value (P<sub>d</sub>) for the package.
4. Should you wish to increase output current (I<sub>OUT</sub>) and/or have the capability to exceed the stipulated P<sub>d</sub> value, using a current boost circuit (similar to the one shown below) is likely to lead to oscillation.

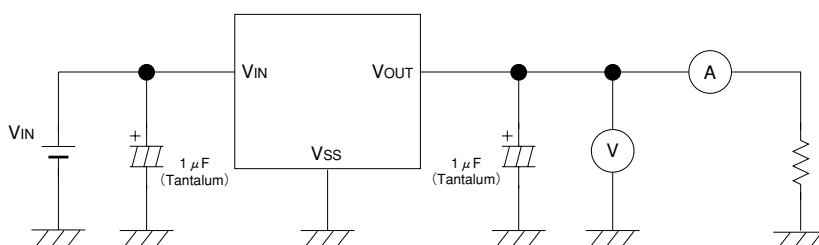
With such applications, we recommend use of a boost type voltage regulator, such as the Torex XC62EP series.

### Current Boost Circuit : Poor Example

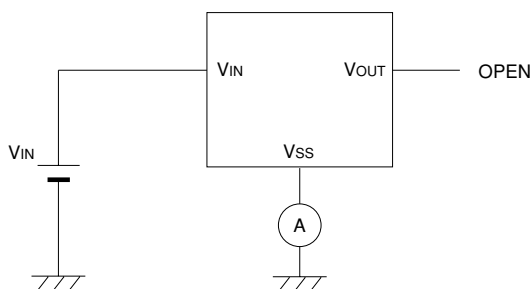


## ■ Test Circuits

Circuit 1

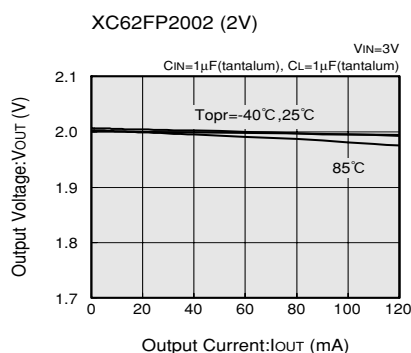
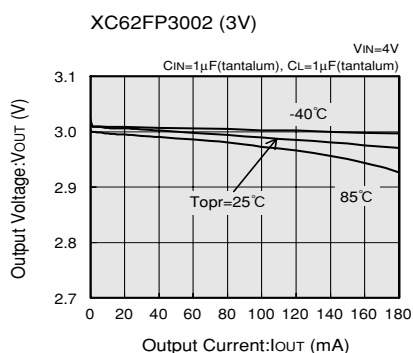
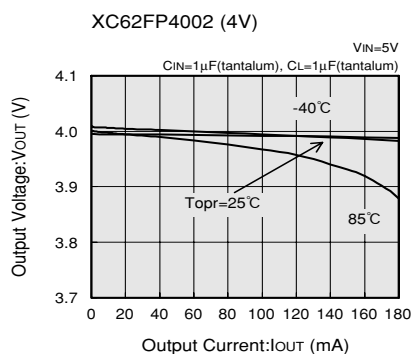
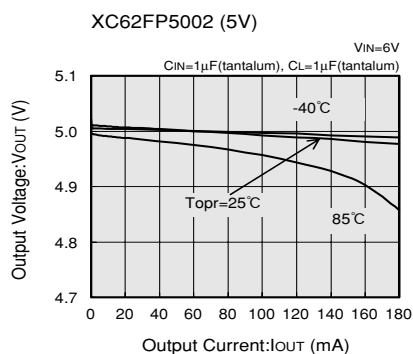


Circuit 2

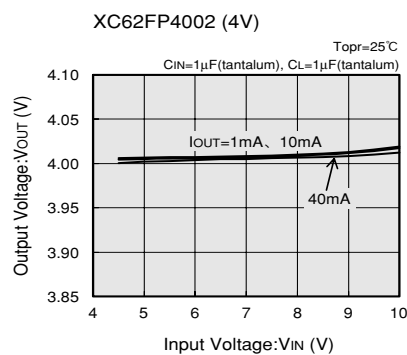
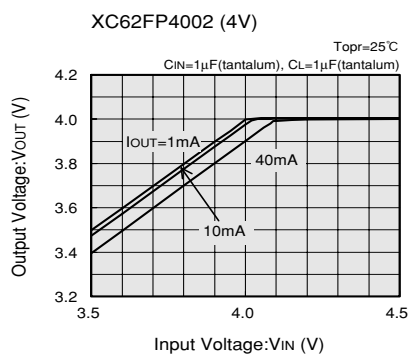
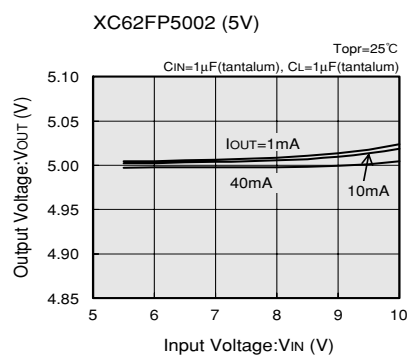
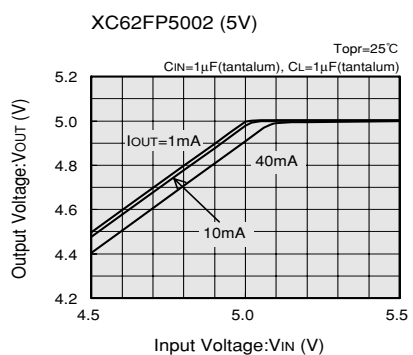


## ■ Typical Performance Characteristics

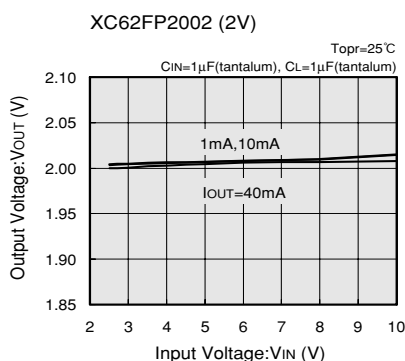
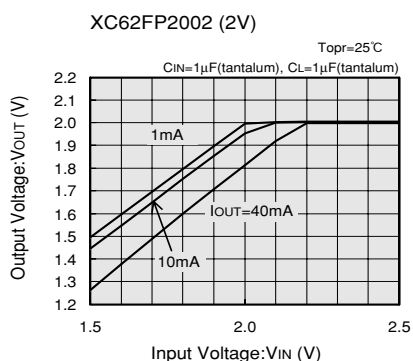
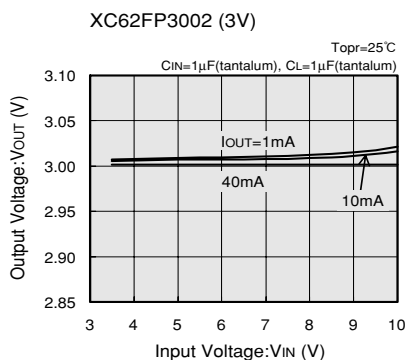
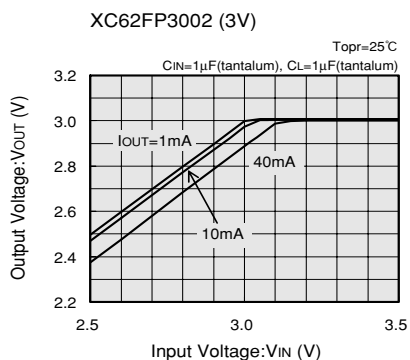
### (1) OUTPUT VOLTAGE vs. OUTPUT CURRENT



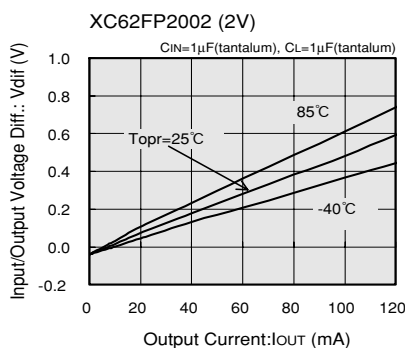
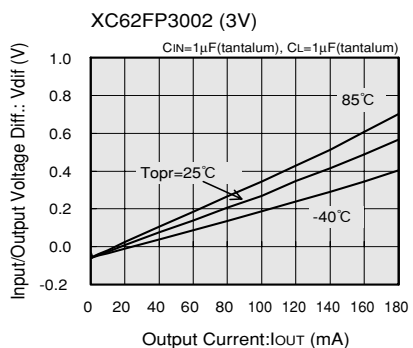
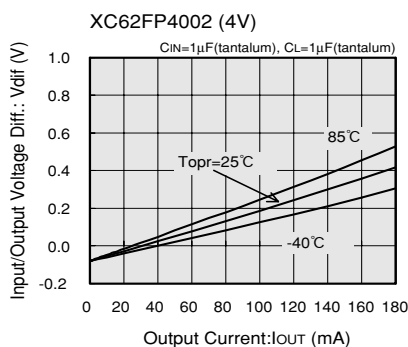
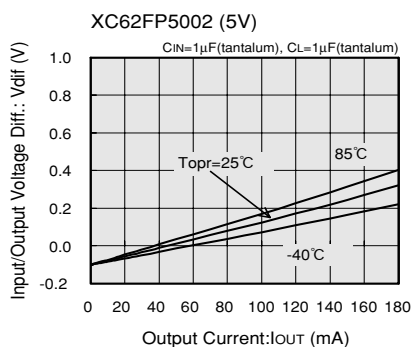
### (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE



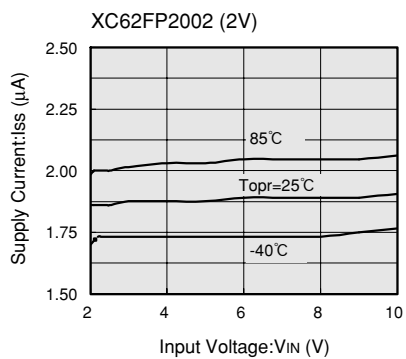
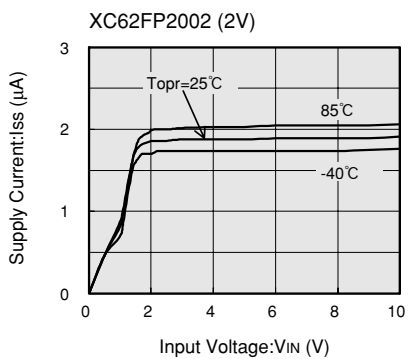
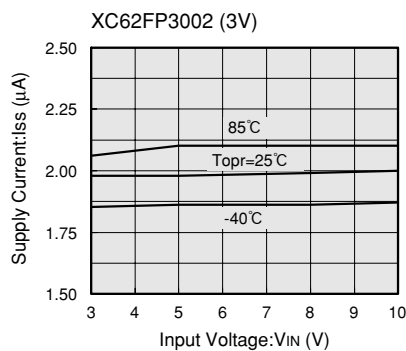
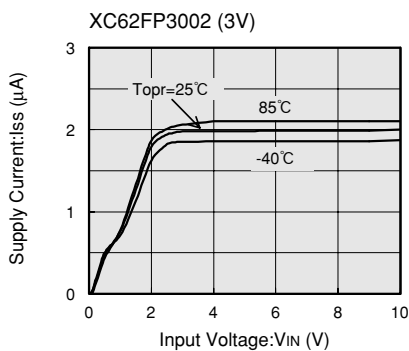
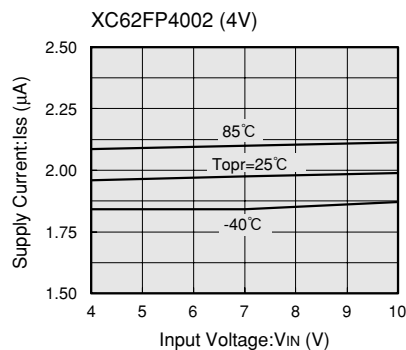
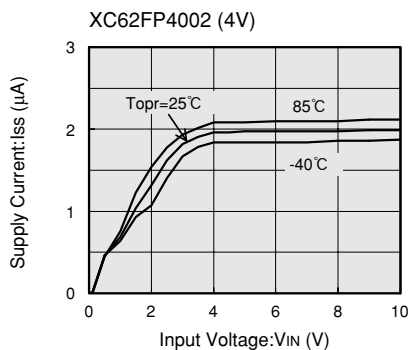
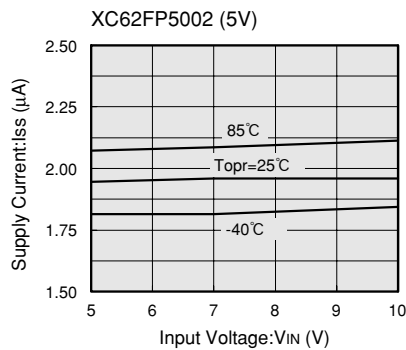
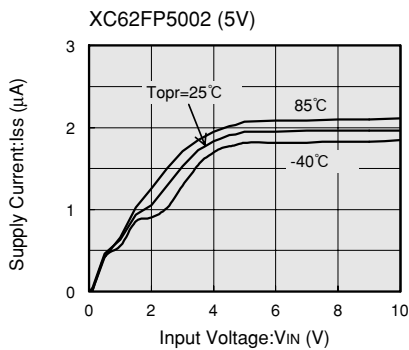
## (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE



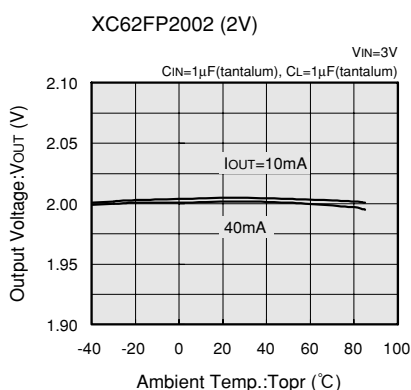
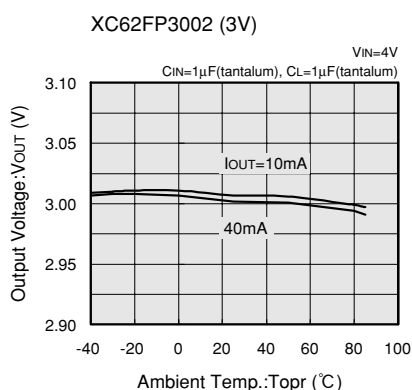
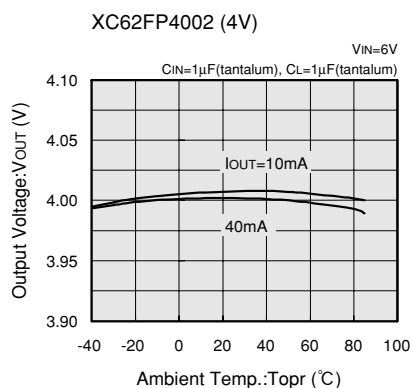
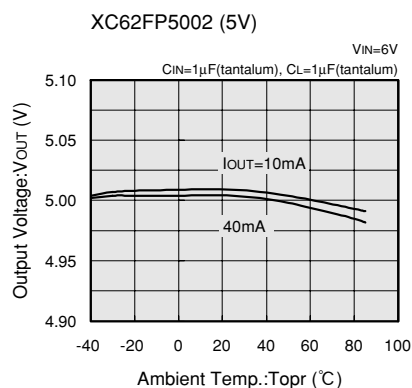
## (3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT



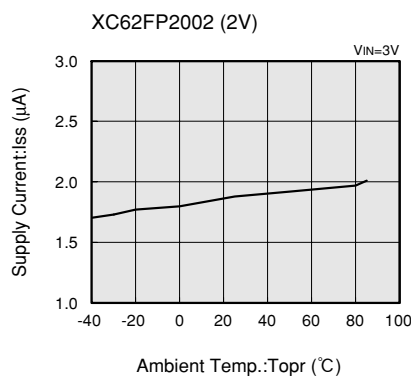
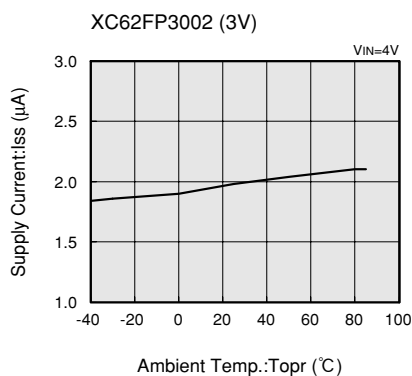
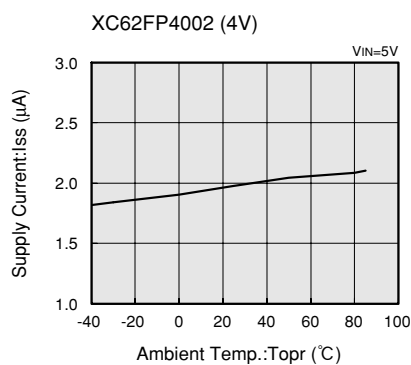
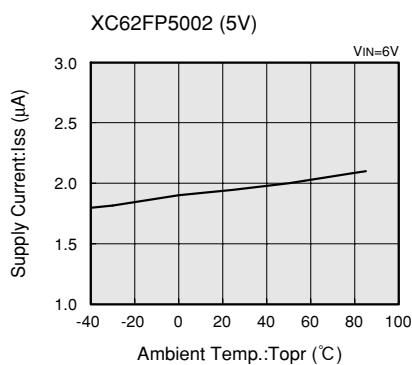
(4) SUPPLY CURRENT vs. INPUT VOLTAGE



## (5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



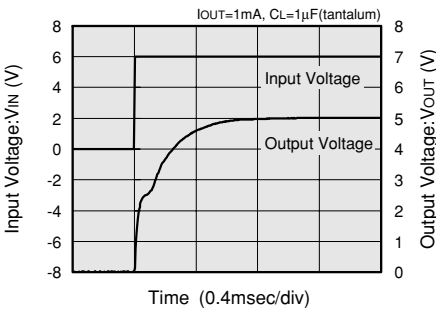
## (6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE



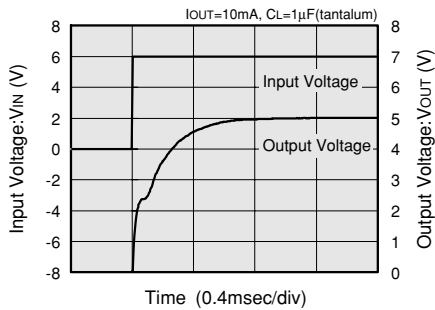
(7) INPUT TRANSIENT RESPONSE 1

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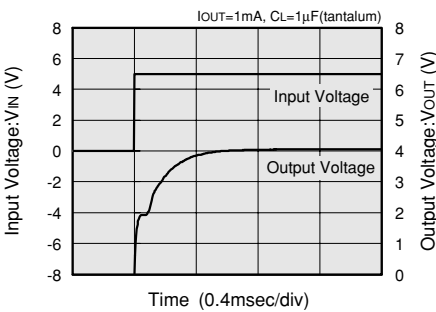
XC62FP5002 (5V)



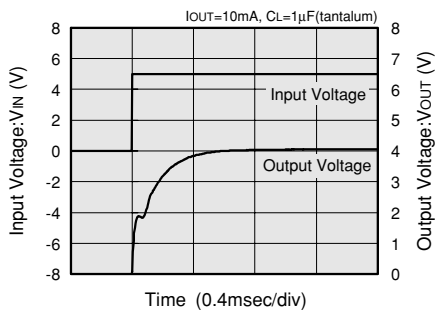
XC62FP5002 (5V)



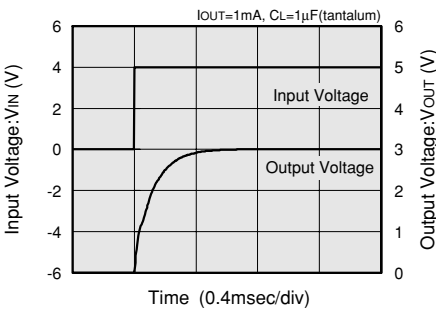
XC62FP4002 (4V)



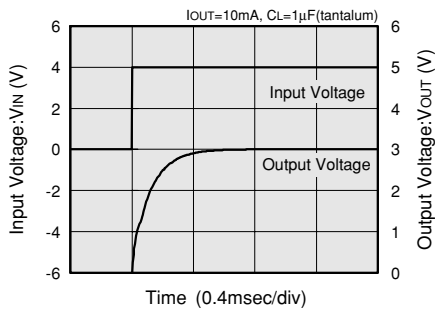
XC62FP4002 (4V)



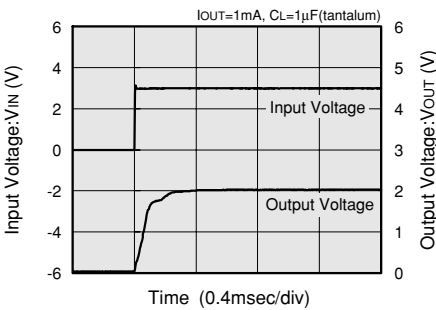
XC62FP3002 (3V)



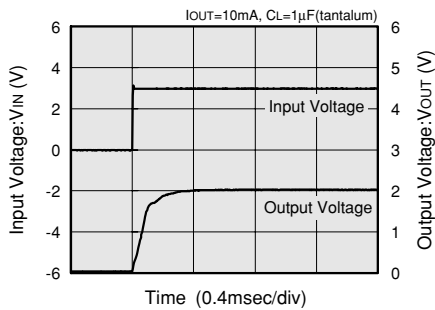
XC62FP3002 (3V)



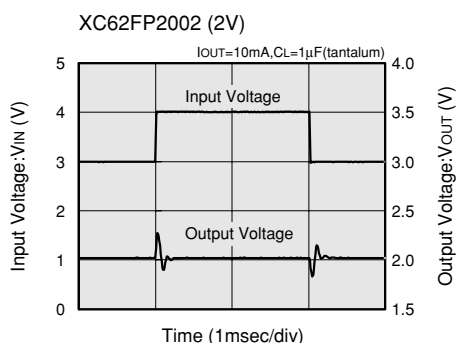
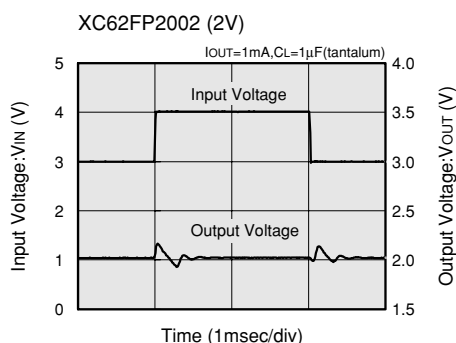
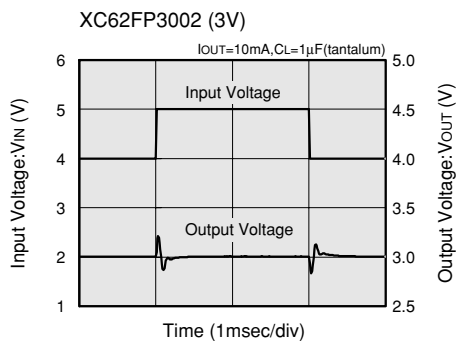
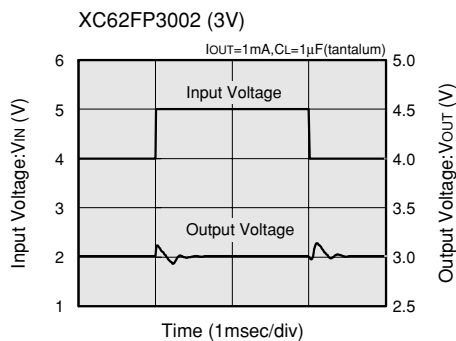
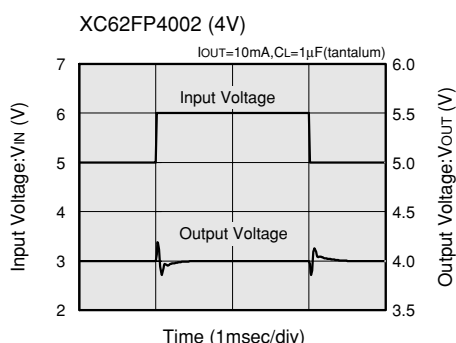
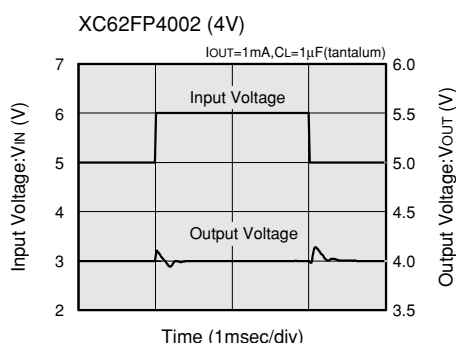
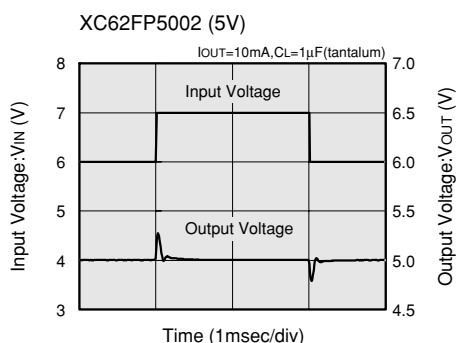
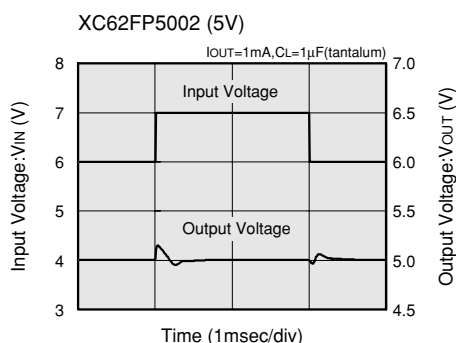
XC62FP2002 (2V)



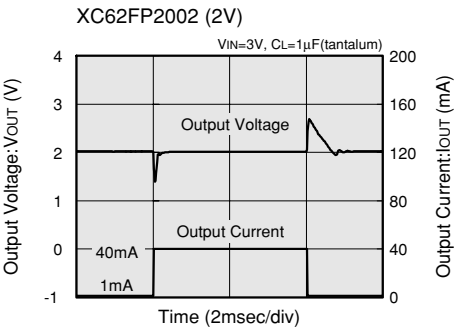
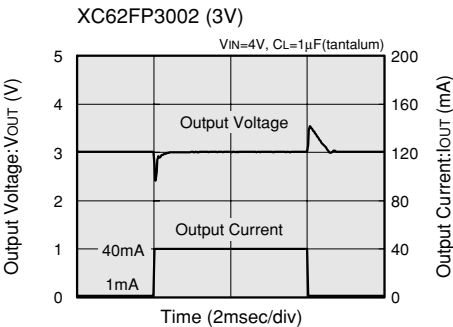
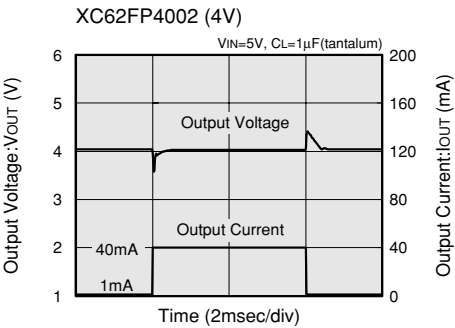
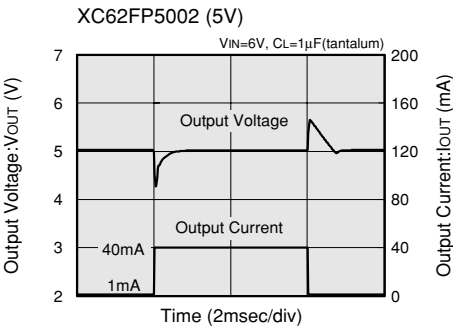
XC62FP2002 (2V)



## (8) INPUT TRANSIENT RESPONSE 2



(9) LOAD TRANSIENT RESPONSE



(10) RIPPLE REJECTION RATE

