

XC62FP

Series

Positive Voltage Regulators



3

- ◆ 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 : ±2% (±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.

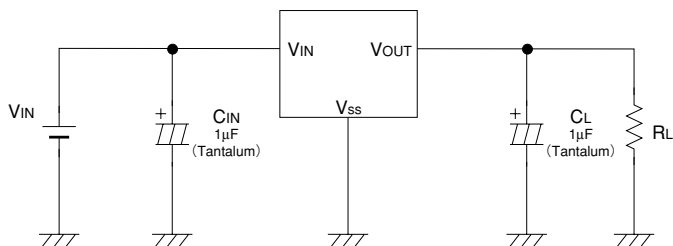
Applications

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

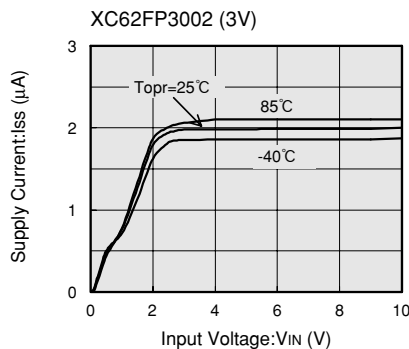
Features

- 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 ±2%
(±1% for semi-custom products)
- Low Power Consumption**
 - : Typ. 2.0µA @ V_{OUT}=5.0V
- Output Voltage Temperature Characteristics**
 - : Typ. ±100ppm/°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)

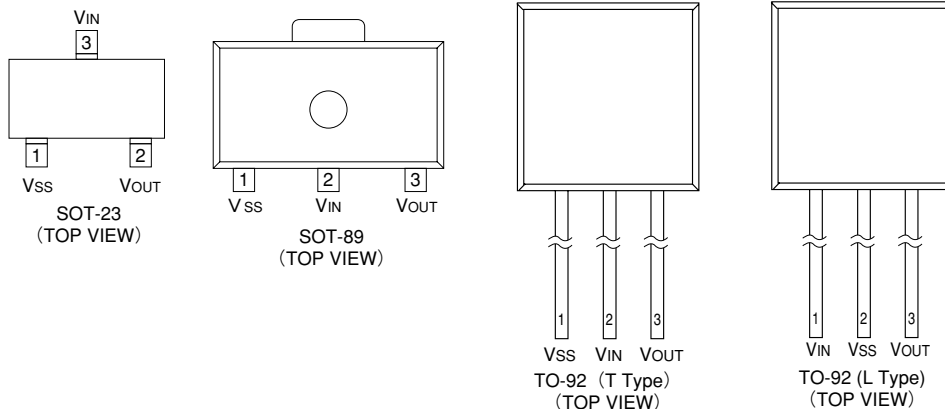
Typical Application Circuit



Typical Performance Characteristic



Pin Configuration



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Pin Assignment

| PIN NUMBER | | | | PIN NAME | FUNCTION |
|------------|--------|-----------|-----------|------------------|--------------------------|
| SOT-23 | SOT-89 | TO-92 (T) | TO-92 (L) | | |
| 1 | 1 | 1 | 2 | V _{SS} | Ground |
| 3 | 2 | 2 | 1 | V _{IN} | Supply voltage input |
| 2 | 3 | 3 | 3 | V _{OUT} | Regulated voltage output |

Product Classification

Ordering Information

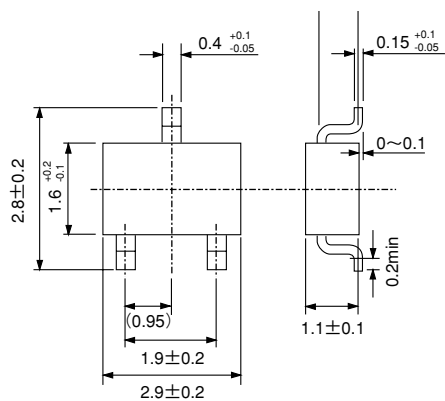
XC62FX^aX^bX^cX^dX^eX^f

↑ ↑ ↑ ↑ ↑ ↑
 a b c d e f

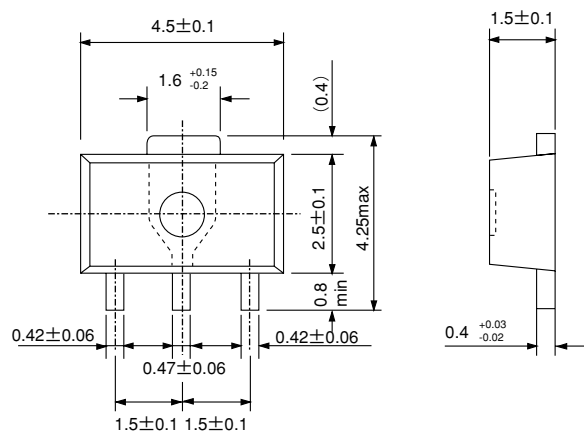
| DESIGNATOR | DESCRIPTION | DESIGNATOR | DESCRIPTION |
|------------|--|------------|--|
| a | Polarity of Output Voltage: P: + (Positive) | e | Package Type M=SOT-23 P=SOT-89 T=TO-92 (Standard) L=TO-92 (Custom pin configuration) |
| b | Output Voltage 30=3.0V 50=5.0V | | |
| c | Temperature Coefficients: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

■ Packaging Information

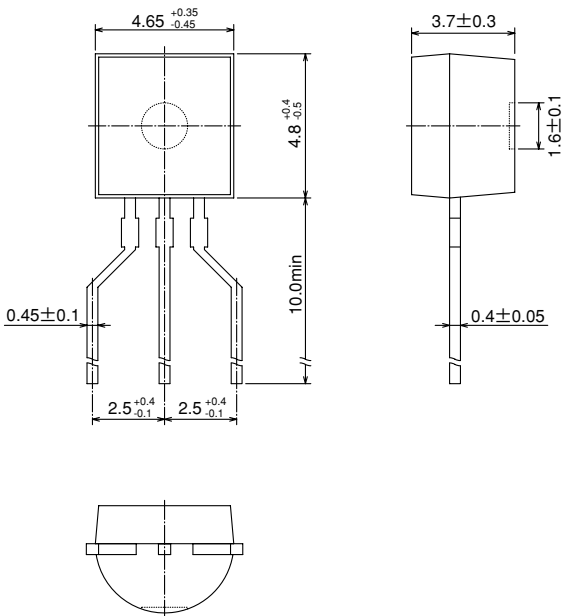
● SOT-23



● SOT-89



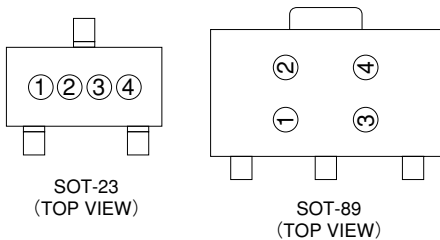
●TO-92



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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

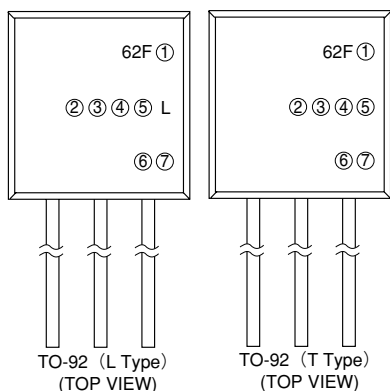
| SYMBOL | VOLTAGE(V) | SYMBOL | VOLTAGE(V) |
|--------|------------|--------|------------|
| A | ①.0 | F | ①.5 |
| B | ①.1 | H | ①.6 |
| C | ①.2 | K | ①.7 |
| D | ①.3 | L | ①.8 |
| E | ①.4 | M | ①.9 |

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±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.I.J.O.Q.W excepted)

②③ Represents the Detect Voltage

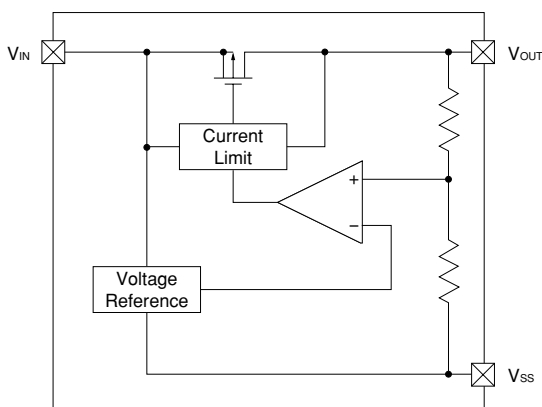
| DESIGNATOR | | VOLTAGE (V) |
|------------|---|-------------|
| ② | ③ | |
| 3 | 3 | 3.3 |
| 5 | 0 | 5.0 |

⑤ Represents the Detect Voltage Accuracy

| DESIGNATOR | DETECT VOLTAGE ACCURACY |
|------------|--------------------------|
| 1 | within ±1% (semi-custom) |
| 2 | within ±2% |

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■Block Diagram



■Absolute Maximum Ratings

Ta=25°C

| PARAMETER | SYMBOL | RATINGS | UNITS |
|------------------------------------|------------------|---|-------|
| Input Voltage | V _{IN} | 12 | V |
| Output Current | I _{OUT} | 500 | mA |
| Output Voltage | V _{OUT} | V _{SS} -0.3 ~ V _{IN} +0.3 | V |
| Continuous Total Power Dissipation | SOT-23 | P _d | 150 |
| | SOT-89 | | 500 |
| | TO-92 | | 300 |
| Operating Ambient Temperature | T _{opr} | -40 ~ +85 | °C |
| Storage Temperature | T _{stg} | -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) | $I_{OUT}=40mA$ $V_{IN}=6.0V$ | 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 | ΔV_{OUT} | $V_{IN}=6.0V$ $1mA \leq I_{OUT} \leq 100mA$ | | 40 | 80 | mV | 1 |
| Input -Output 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 | μA | 2 |
| Input Stability | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $6.0V \leq V_{IN} \leq 10.0V$ | | 0.2 | 0.3 | %/V | 1 |
| Input Voltage | V_{IN} | | | | 10 | V | — |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $-40^\circ C \leq T_{opr} \leq 85^\circ C$ | | ± 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) | $I_{OUT}=40mA$ $V_{IN}=5.0V$ | 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 | ΔV_{OUT} | $V_{IN}=5.0V$ $1mA \leq I_{OUT} \leq 100mA$ | | 45 | 90 | mV | 1 |
| Input -Output 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 | μA | 2 |
| Input Stability | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $5.0V \leq V_{IN} \leq 10.0V$ | | 0.2 | 0.3 | %/V | 1 |
| Input Voltage | V_{IN} | | | | 10 | V | — |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $-40^\circ C \leq T_{opr} \leq 85^\circ C$ | | ± 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) | $I_{OUT}=40mA$ $V_{IN}=4.0V$ | 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 | ΔV_{OUT} | $V_{IN}=4.0V$ $1mA \leq I_{OUT} \leq 80mA$ | | 45 | 90 | mV | 1 |
| Input -Output 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 | μA | 2 |
| Input Stability | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $4.0V \leq V_{IN} \leq 10.0V$ | | 0.2 | 0.3 | %/V | 1 |
| Input Voltage | V_{IN} | | | | 10 | V | — |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ | | ± 100 | | ppm/ $^{\circ}C$ | 1 |

XC62FP2002 $V_{OUT}(T)=2.0V$ (Note1)

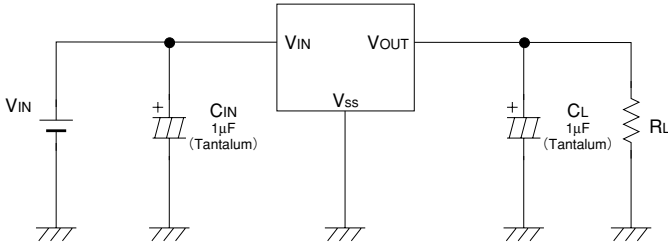
$T_a=25^{\circ}C$

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS | CIRCUIT |
|--|---|--|-------|-----------|-------|------------------|---------|
| Output Voltage | $V_{OUT}(E)$ (Note2) | $I_{OUT}=40mA$ $V_{IN}=3.0V$ | 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 | ΔV_{OUT} | $V_{IN}=3.0V$ $1mA \leq I_{OUT} \leq 60mA$ | | 45 | 90 | mV | 1 |
| Input -Output 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 | μA | 2 |
| Input Stability | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $3.0V \leq V_{IN} \leq 10.0V$ | | 0.2 | 0.3 | %/V | 1 |
| Input Voltage | V_{IN} | | | | 10 | V | — |
| Output Voltage Temperature Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$ | $I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$ | | ± 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_{IN}) of at least 1µF.

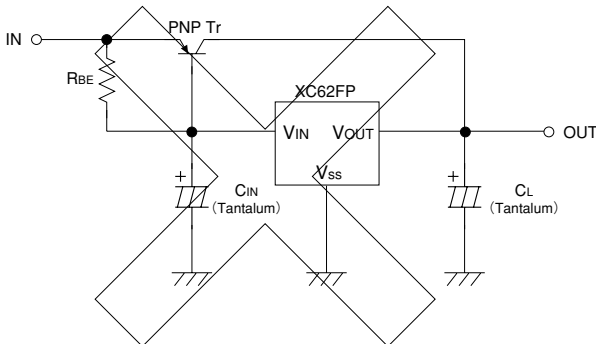
With a large output current, operations can be stabilised by increasing capacitor size (C_{IN}). If C_{IN} is small and capacitor size (C_L) is increased, there is a possibility of oscillation due to input impedance.

In such cases, operations can be stabilised by either increasing the size of C_{IN} or decreasing the size of C_L.

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

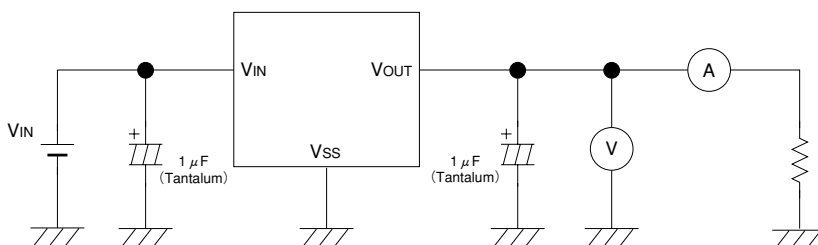
With such applications, we recommend use of a boost type voltage regulator, such as the Torex XC62EP series.

Current Boost Circuit : Poor Example



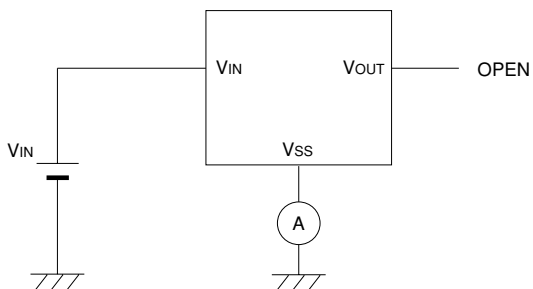
■ Test Circuits

Circuit 1



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Circuit 2

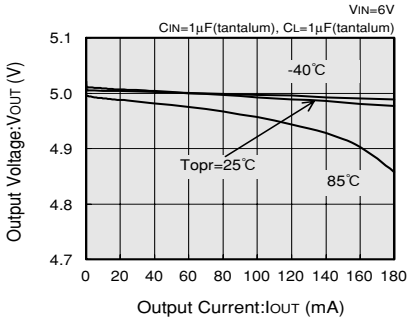


Typical Performance Characteristics

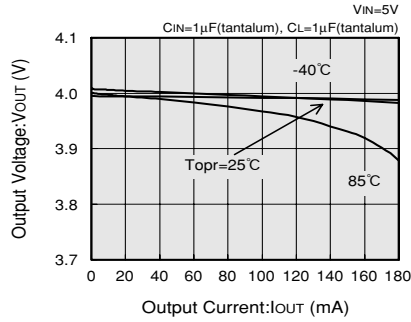
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

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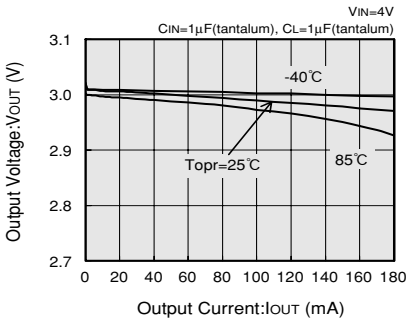
XC62FP5002 (5V)



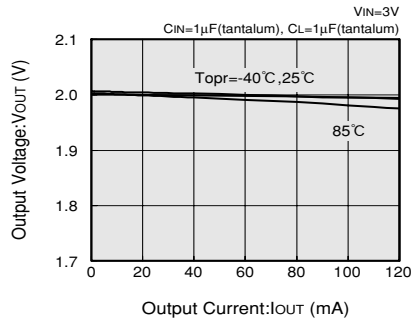
XC62FP4002 (4V)



XC62FP3002 (3V)

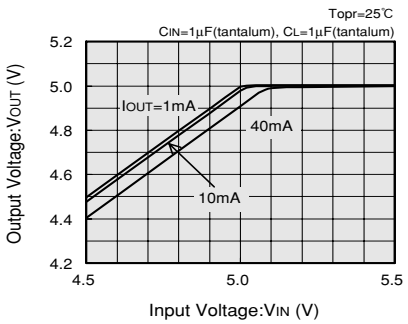


XC62FP2002 (2V)

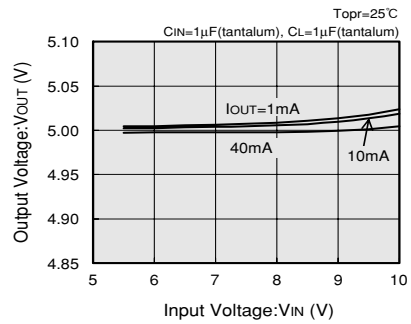


(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

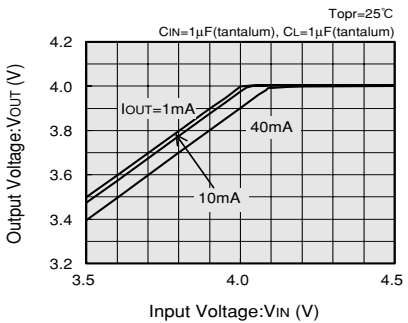
XC62FP5002 (5V)



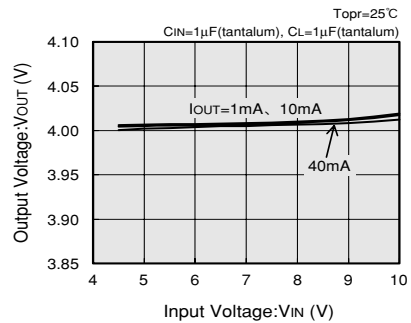
XC62FP5002 (5V)



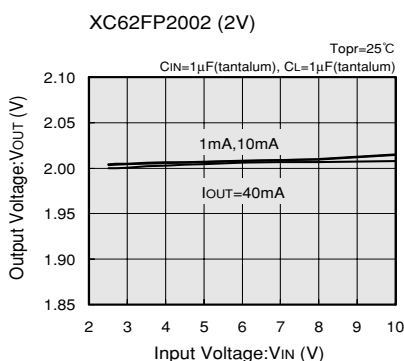
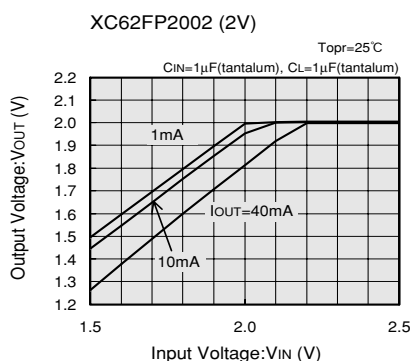
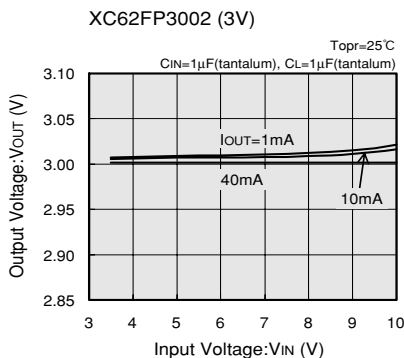
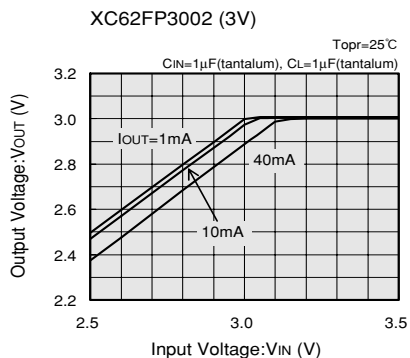
XC62FP4002 (4V)



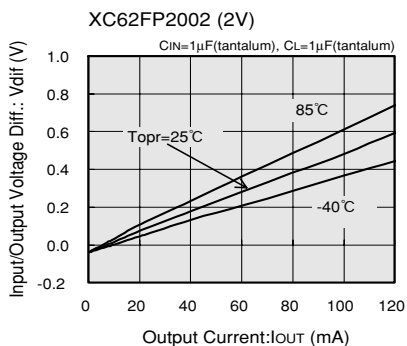
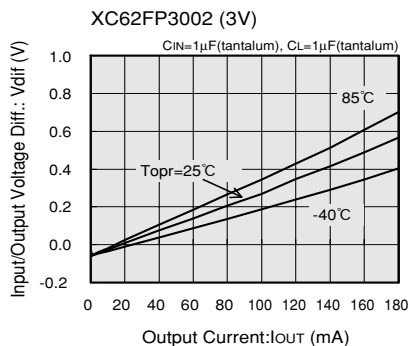
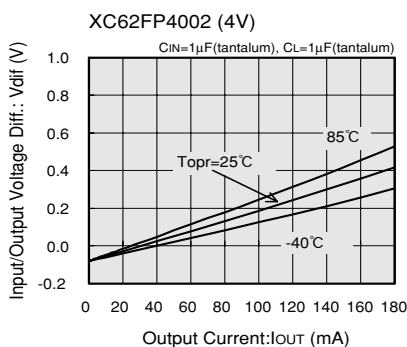
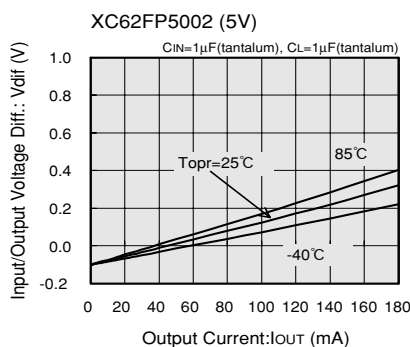
XC62FP4002 (4V)



(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

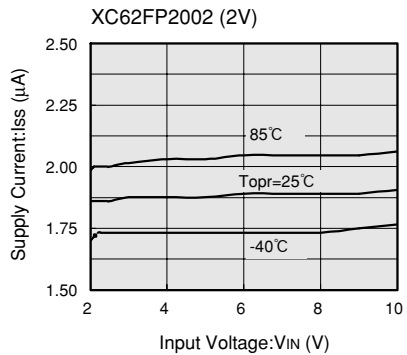
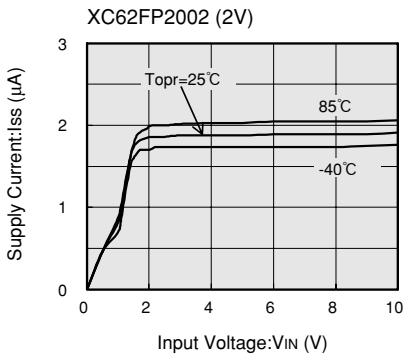
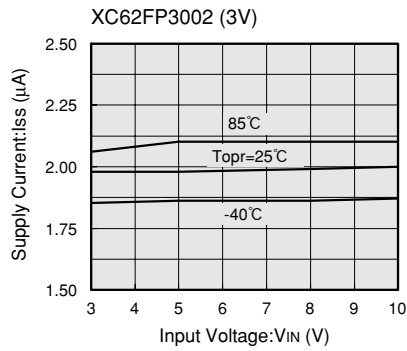
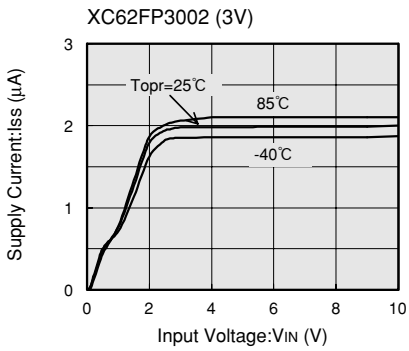
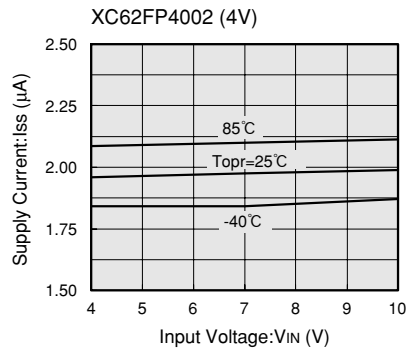
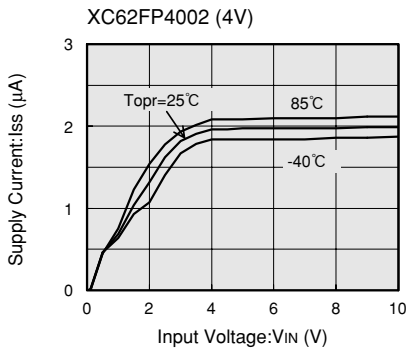
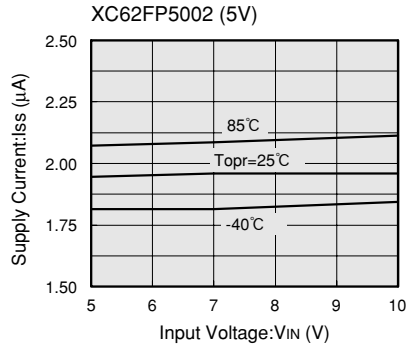
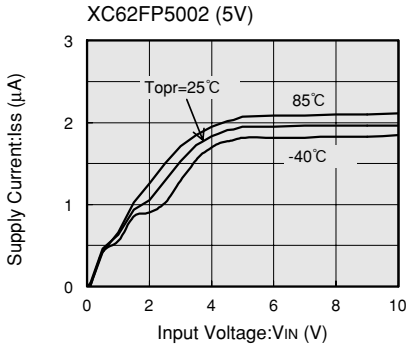


(3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT

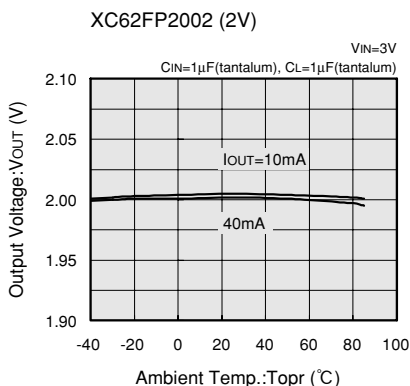
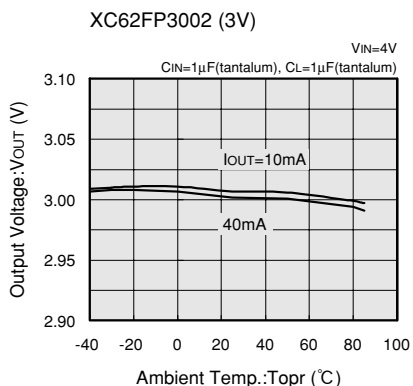
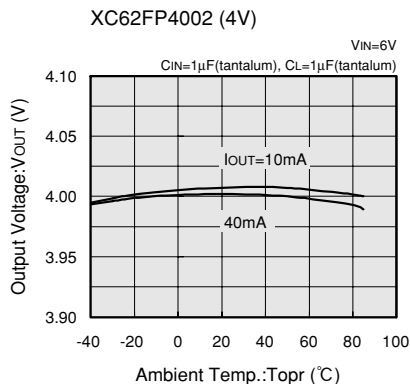
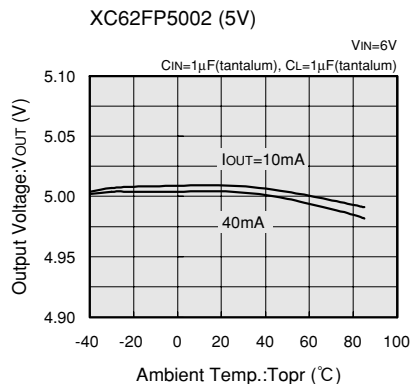


(4) SUPPLY CURRENT vs. INPUT VOLTAGE

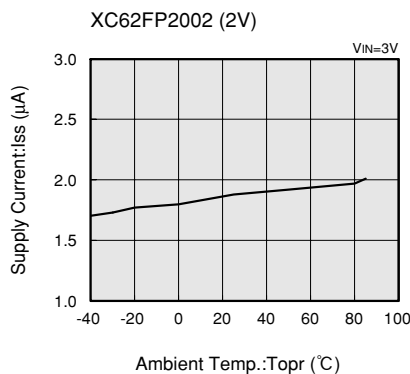
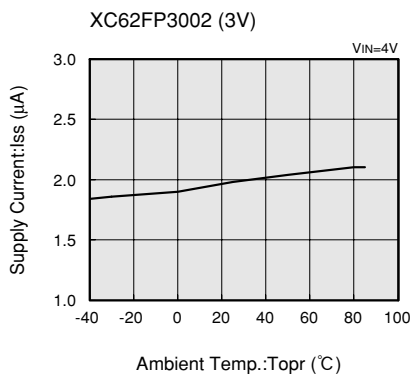
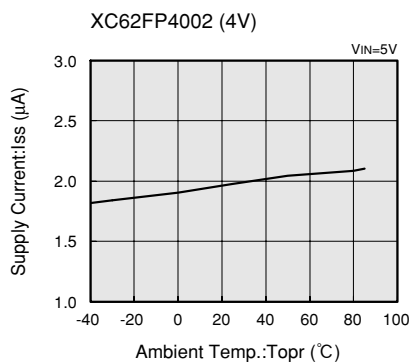
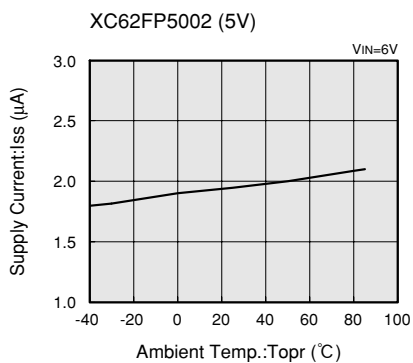
3



(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

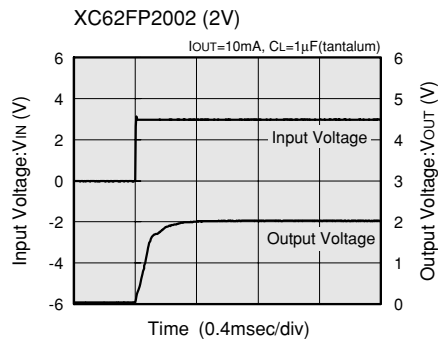
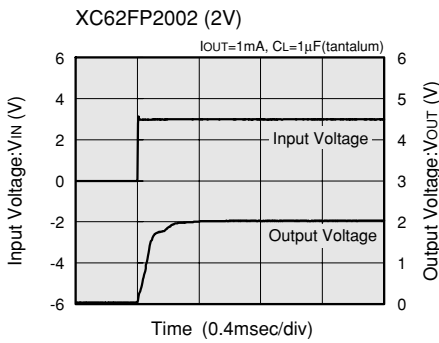
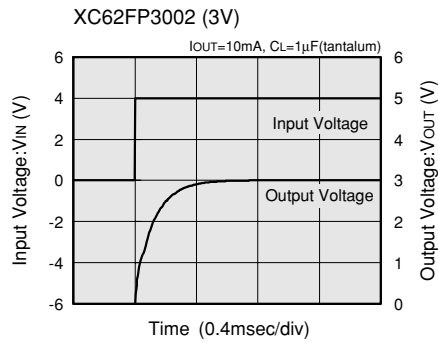
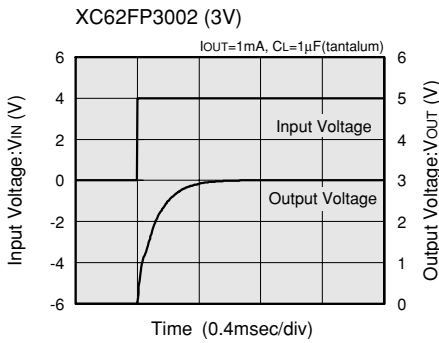
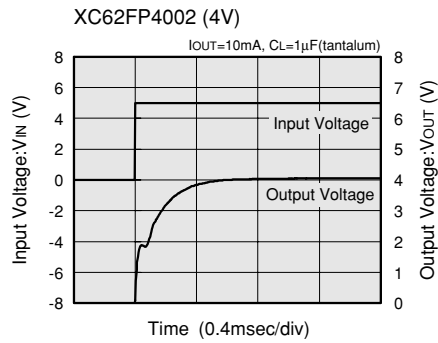
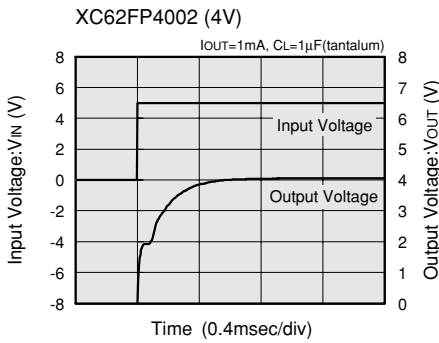
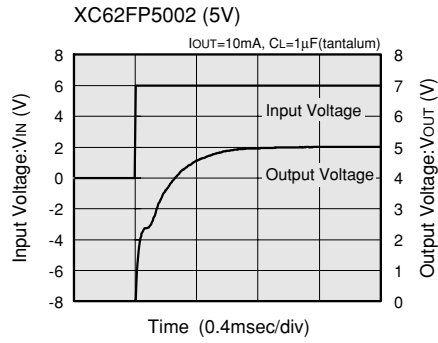
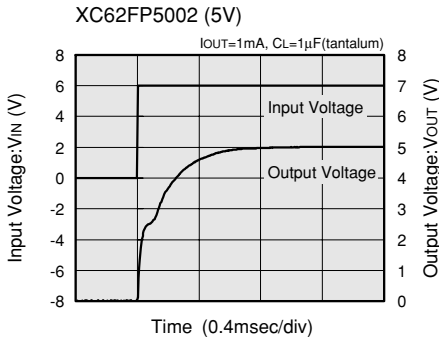


(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

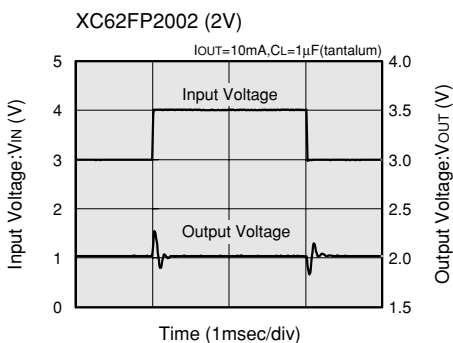
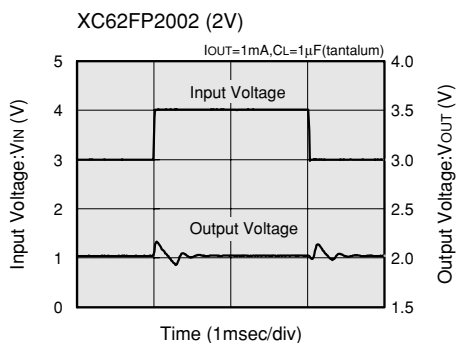
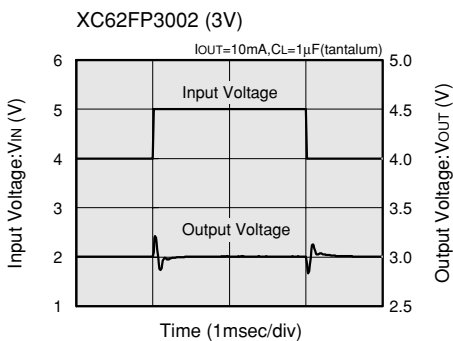
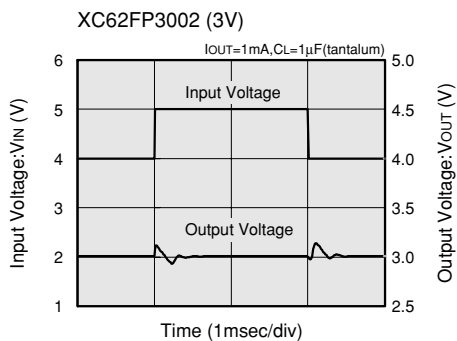
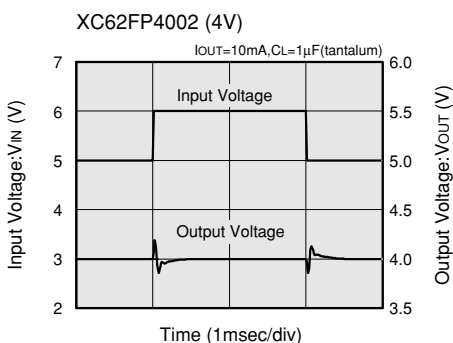
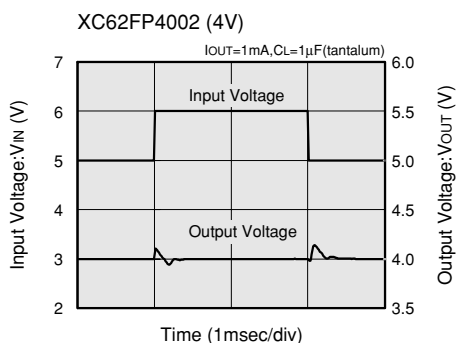
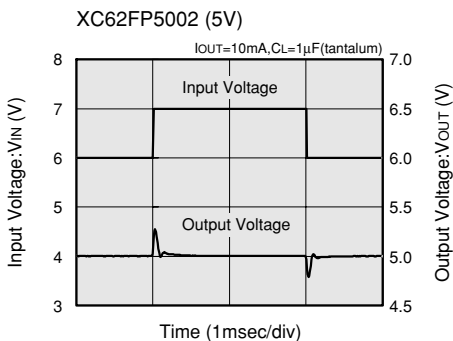
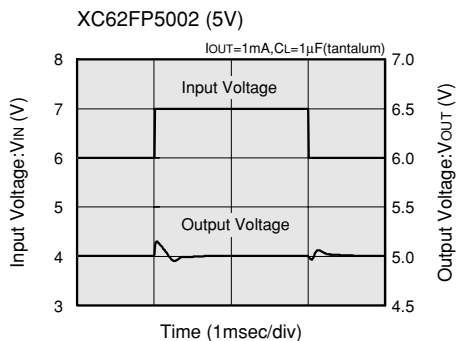


(7) INPUT TRANSIENT RESPONSE 1

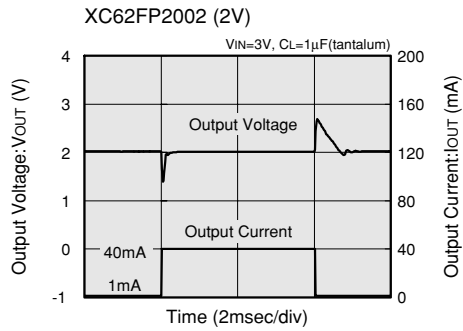
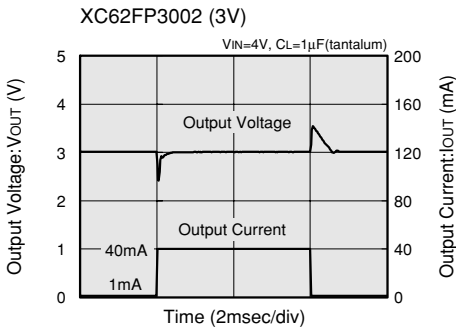
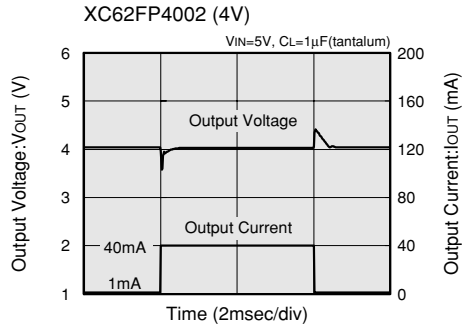
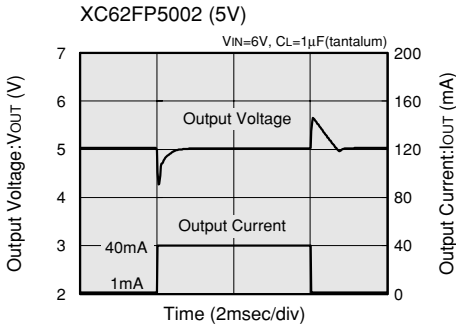
3



(8) INPUT TRANSIENT RESPONSE 2



(9) LOAD TRANSIENT RESPONSE



(10) RIPPLE REJECTION RATE

