

# 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<sub>OUT</sub>=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

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## ■Features

### Maximum Output Current

: 250mA

(within max. power dissipation, V<sub>OUT</sub> = 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<sub>OUT</sub>=5.0V

### Output Voltage Temperature Characteristics

: Typ. ±100ppm/°C

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

### Small Input-Output Differential

: I<sub>OUT</sub> = 100mA @ V<sub>OUT</sub> = 5.0V with a 0.12V differential.

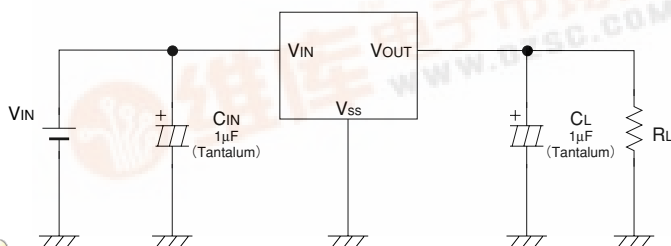
### Ultra Small Packages

: SOT-23 (150mW) mini-mold,

SOT-89 (500mW) mini-power mold

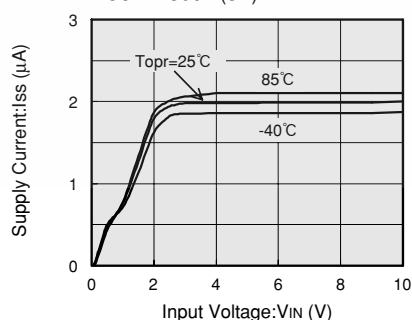
TO-92 (300mW)

## ■Typical Application Circuit



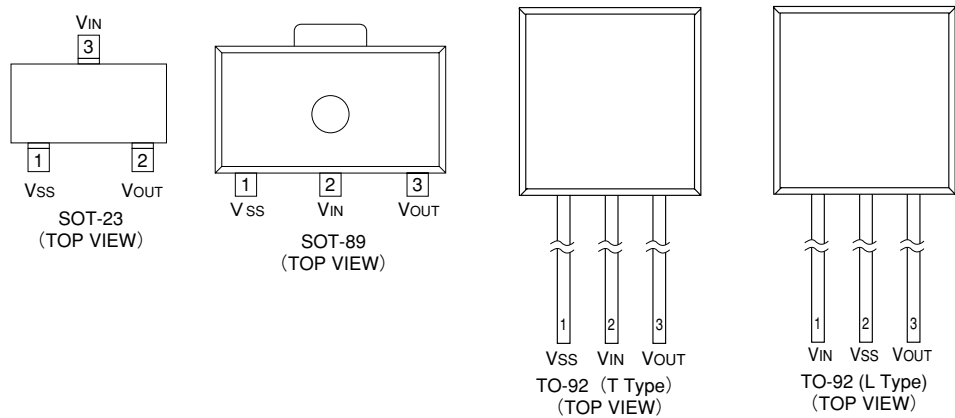
## ■Typical Performance Characteristic

XC62FP3002 (3V)



# XC62FP Series

## Pin Configuration



## Pin Assignment

PIN NUMBER				PIN NAME	FUNCTION
SOT-23	SOT-89	TO-92 (T)	TO-92 (L)		
1	1	1	2	V <sub>SS</sub>	Ground
3	2	2	1	V <sub>IN</sub>	Supply voltage input
2	3	3	3	V <sub>OUT</sub>	Regulated voltage output

## Product Classification

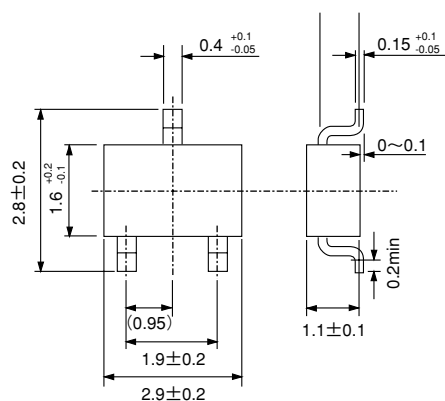
### Ordering Information

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

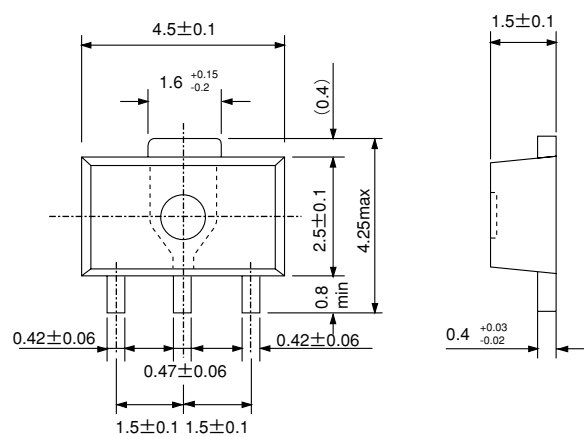
DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	Polarity of Output Voltage: P: + (Positive)	e	Package Type M=SOT-23 P=SOT-89 T=TO-92 (Standard) L=TO-92 (Custom pin configuration)
b	Output Voltage 30=3.0V 50=5.0V		
c	Temperature Coefficients: 0=±100ppm (typical)	f	Device Orientation R=Embossed Tape (Standard 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

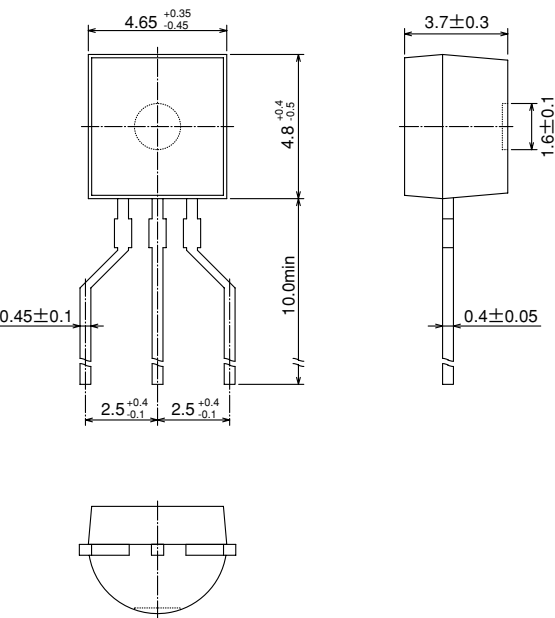


### ● SOT-89



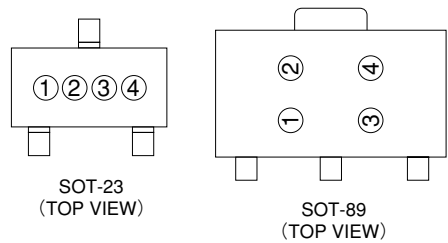
# XC62FP Series

## ●TO-92



## ■Marking

### ●SOT-23, SOT-89



#### 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

#### ① Represents the integer of the Output Voltage

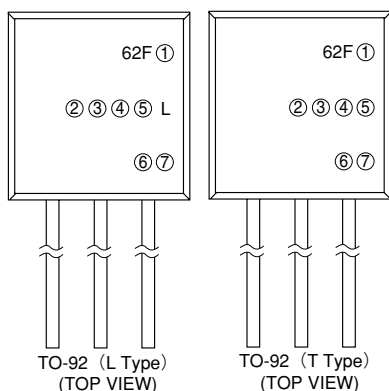
SYMBOL	VOLTAGE(V)	SYMBOL	VOLTAGE(V)
1	1.②	5	5.②
2	2.②	6	6.②
3	3.②		
4	4.②		

#### 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)

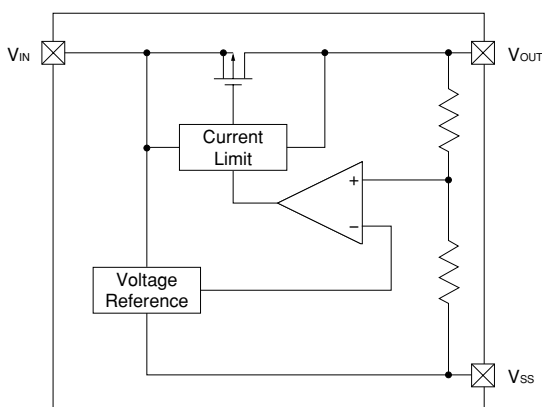
- ②③ Represents the Detect Voltage

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	mW
	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)	$I_{OUT}=40mA$ $V_{IN}=6.0V$	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	$\Delta V_{OUT}$	$V_{IN}=6.0V$ $1mA \leq I_{OUT} \leq 100mA$		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	$\mu A$	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	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$		$\pm 100$		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)	$I_{OUT}=40mA$ $V_{IN}=5.0V$	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	$\Delta V_{OUT}$	$V_{IN}=5.0V$ $1mA \leq I_{OUT} \leq 100mA$		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	$\mu A$	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	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$		$\pm 100$		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)	$I_{OUT}=40mA$ $V_{IN}=4.0V$	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	$\Delta V_{OUT}$	$V_{IN}=4.0V$ $1mA \leq I_{OUT} \leq 80mA$		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	$\mu A$	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	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$		$\pm 100$		ppm/ $^{\circ}C$	1

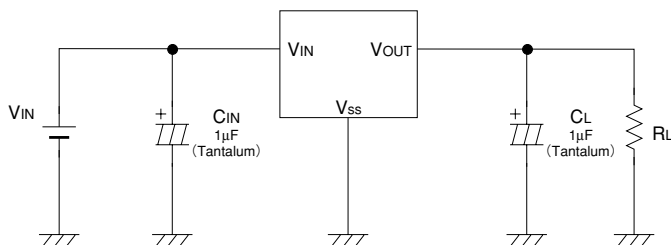
XC62FP2002  $V_{OUT}(T)=2.0V$  (Note1) $T_a=25^{\circ}C$ 

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (Note2)	$I_{OUT}=40mA$ $V_{IN}=3.0V$	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	$\Delta V_{OUT}$	$V_{IN}=3.0V$ $1mA \leq I_{OUT} \leq 60mA$		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	$\mu A$	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	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $-40^{\circ}C \leq T_{opr} \leq 85^{\circ}C$		$\pm 100$		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.

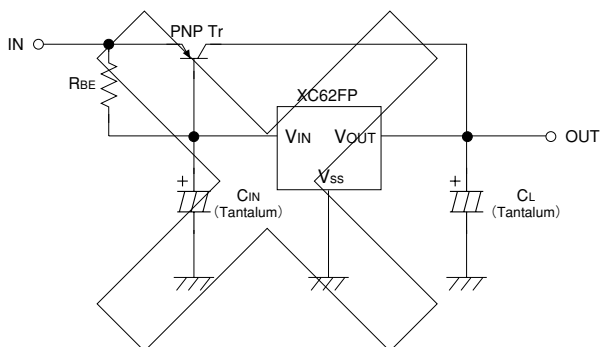
With a large output current, operations can be stabilised by increasing capacitor size (C<sub>IN</sub>). If C<sub>IN</sub> is small and capacitor size (C<sub>L</sub>) is increased, there is a possibility of oscillation due to input impedance.

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.

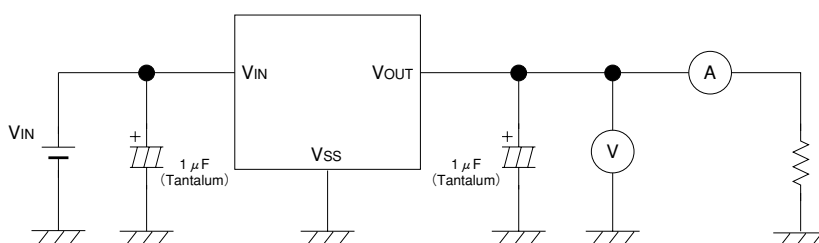
### Current Boost Circuit : Poor Example





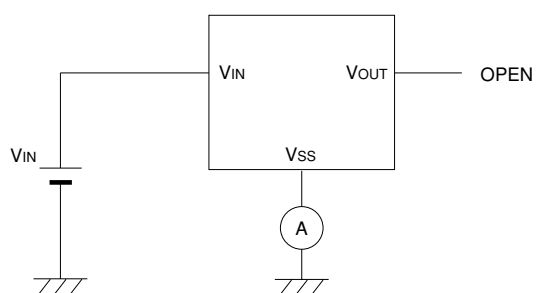
## ■ Test Circuits

Circuit 1



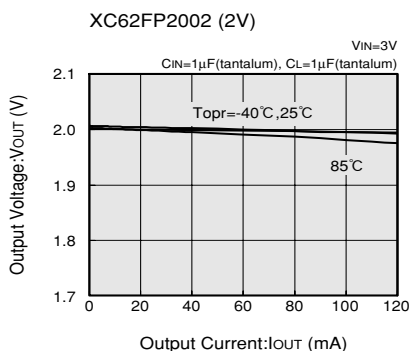
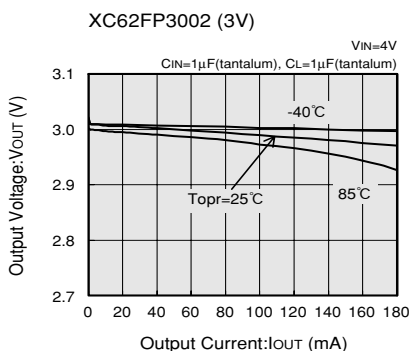
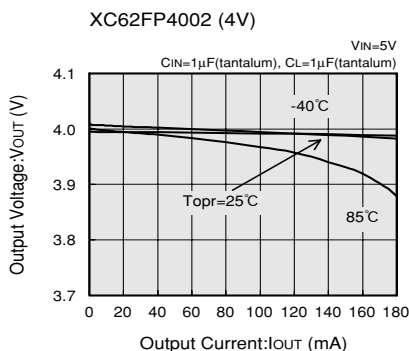
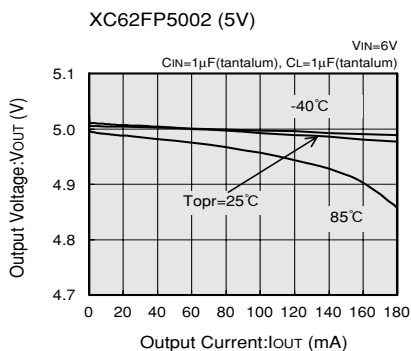
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Circuit 2

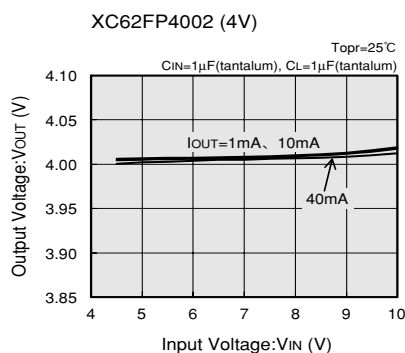
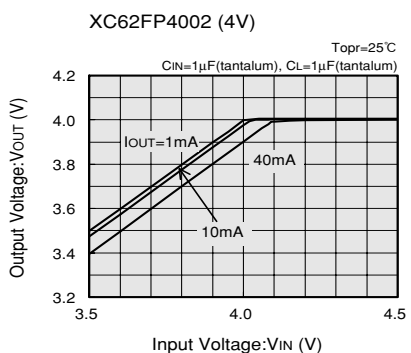
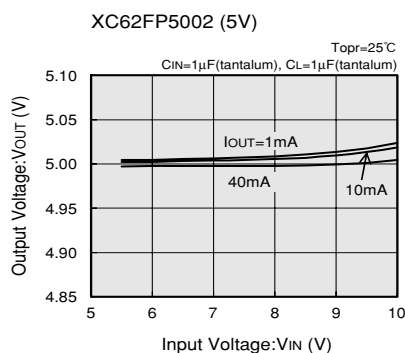
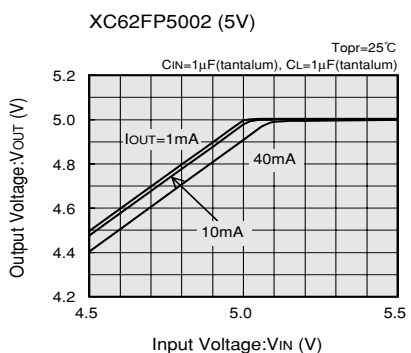


## Typical Performance Characteristics

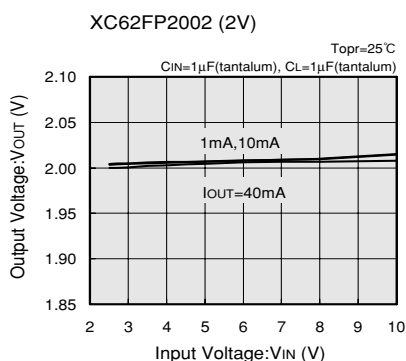
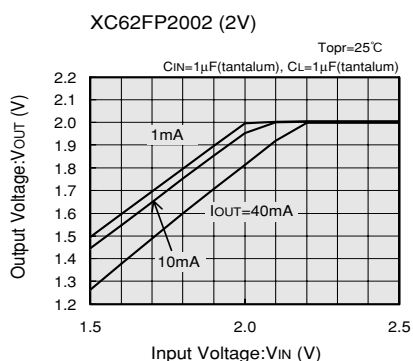
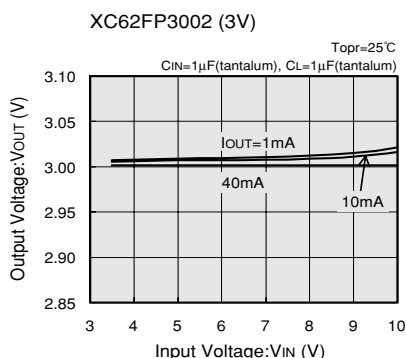
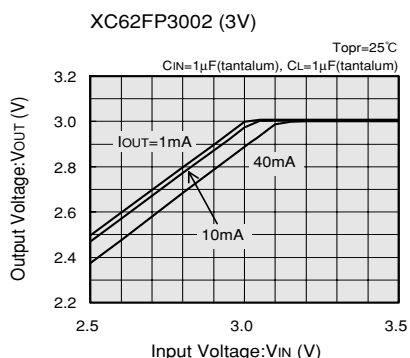
### (1) OUTPUT VOLTAGE vs. OUTPUT CURRENT



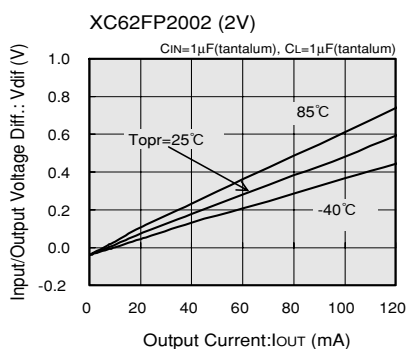
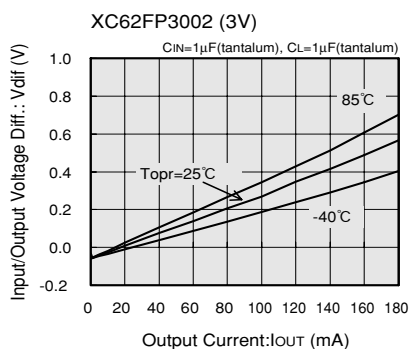
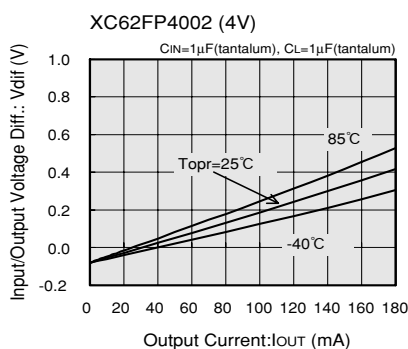
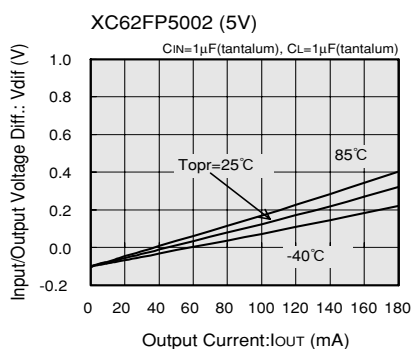
### (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE



## (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

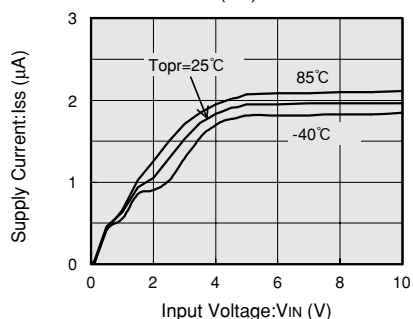


## (3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT

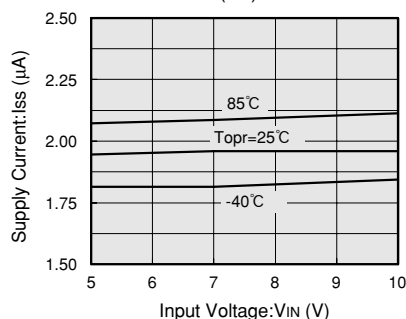


## (4) SUPPLY CURRENT vs. INPUT VOLTAGE

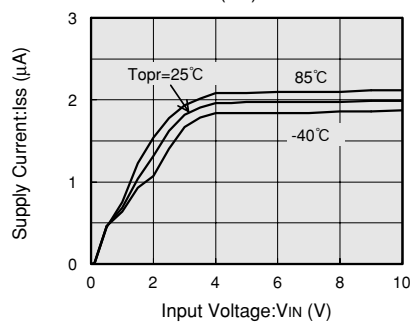
XC62FP5002 (5V)



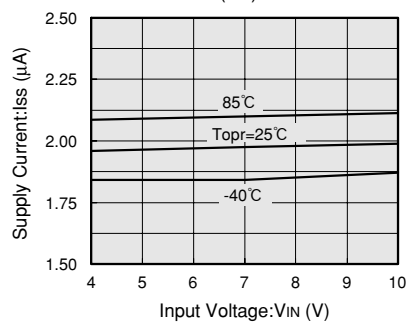
XC62FP5002 (5V)



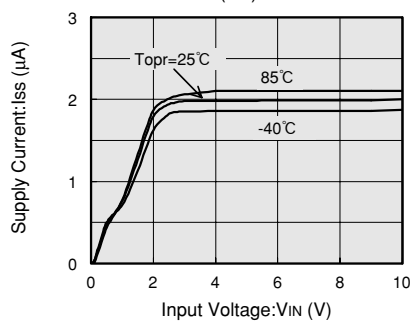
XC62FP4002 (4V)



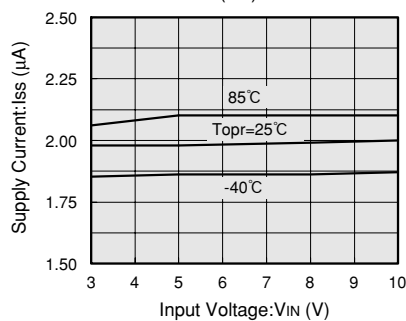
XC62FP4002 (4V)



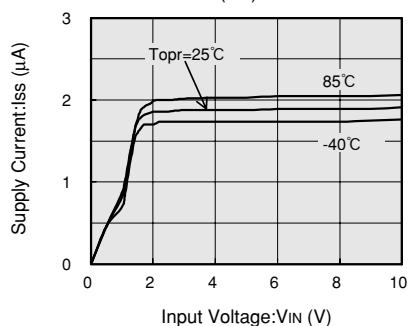
XC62FP3002 (3V)



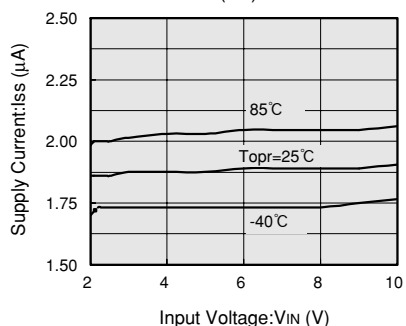
XC62FP3002 (3V)



XC62FP2002 (2V)

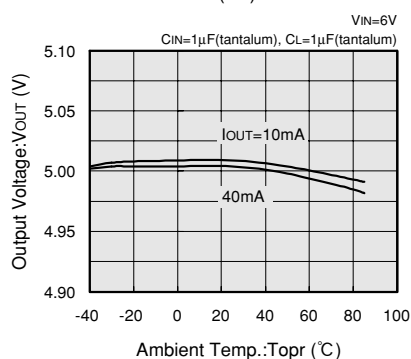


XC62FP2002 (2V)

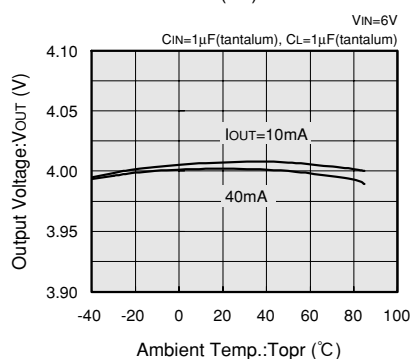


## (5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

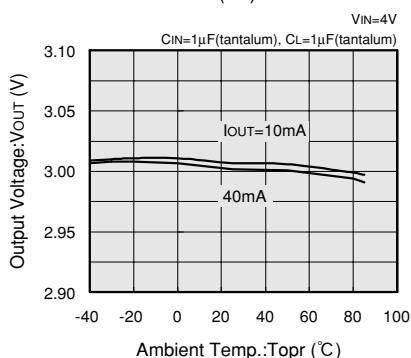
XC62FP5002 (5V)



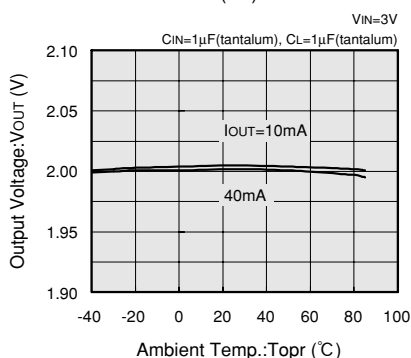
XC62FP4002 (4V)



XC62FP3002 (3V)

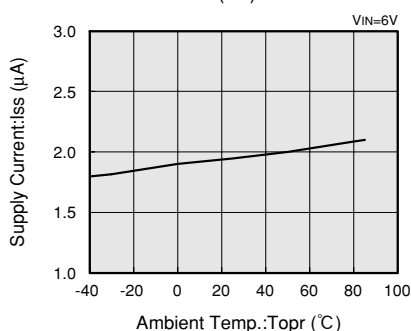


XC62FP2002 (2V)

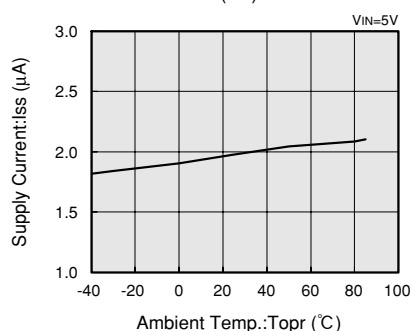


## (6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

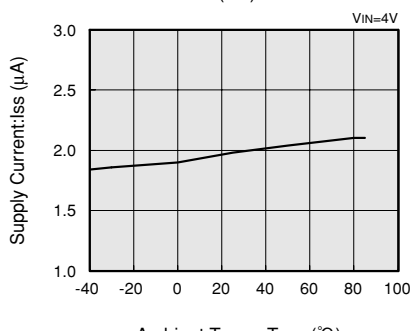
XC62FP5002 (5V)



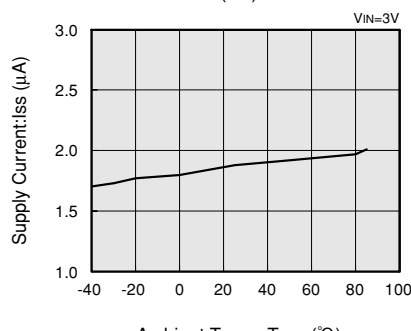
XC62FP4002 (4V)



XC62FP3002 (3V)



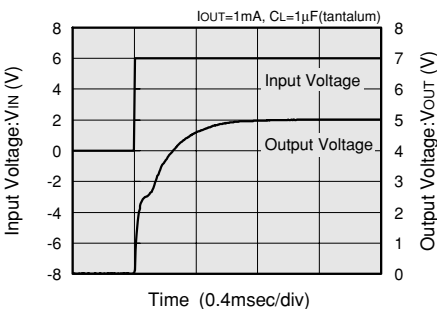
XC62FP2002 (2V)



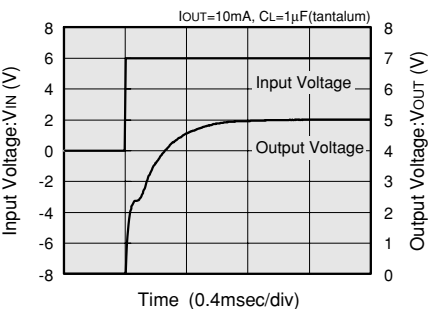
(7) INPUT TRANSIENT RESPONSE 1

3

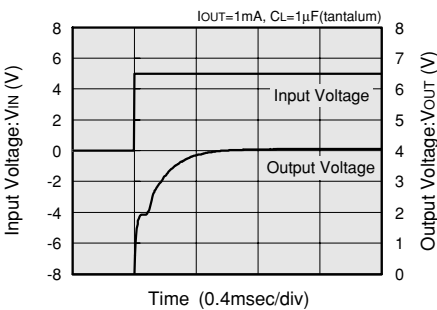
XC62FP5002 (5V)



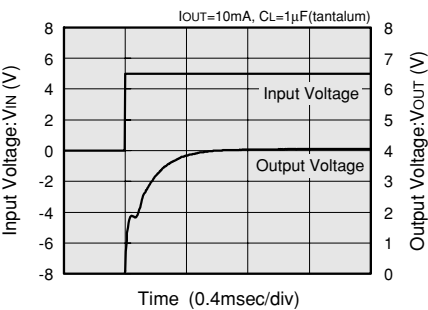
XC62FP5002 (5V)



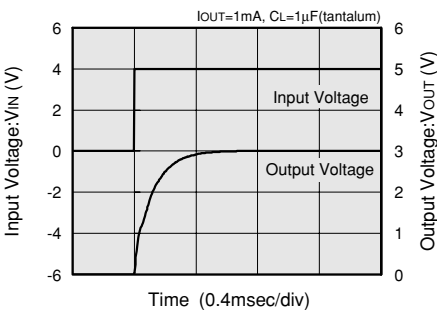
XC62FP4002 (4V)



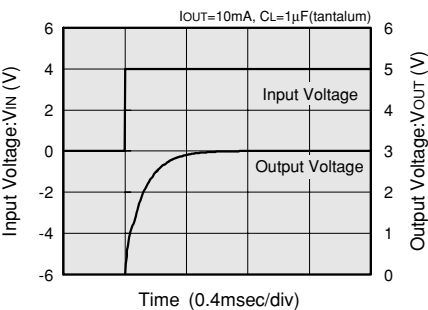
XC62FP4002 (4V)



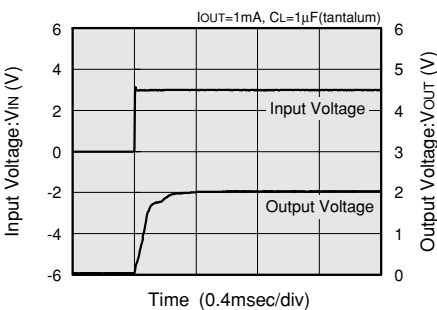
XC62FP3002 (3V)



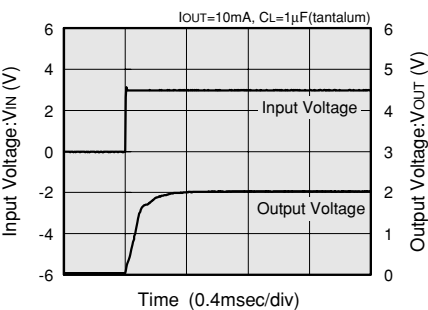
XC62FP3002 (3V)



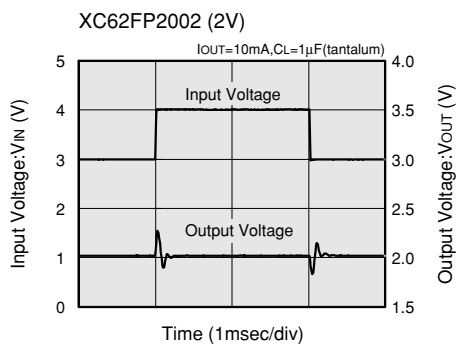
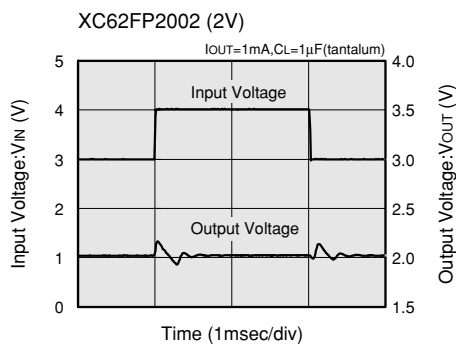
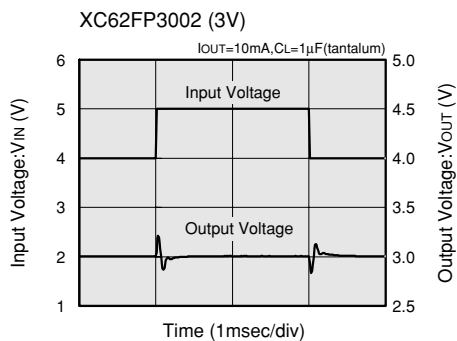
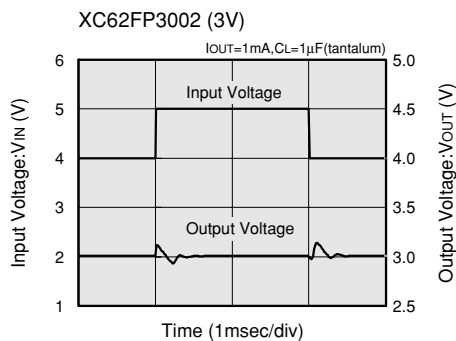
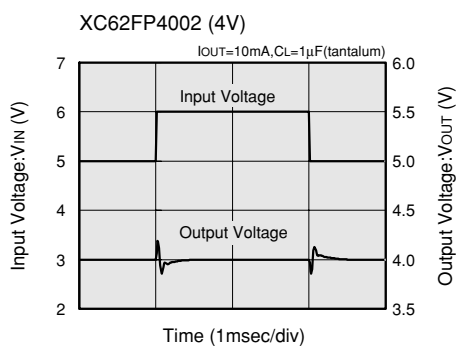
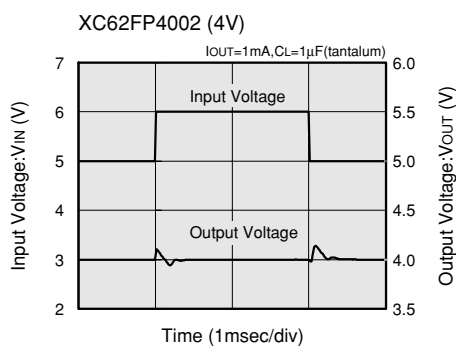
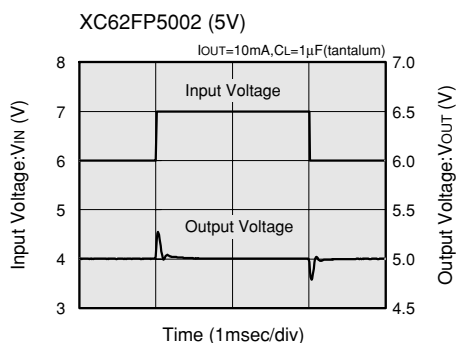
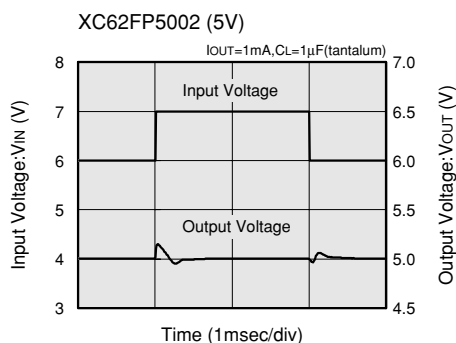
XC62FP2002 (2V)



XC62FP2002 (2V)

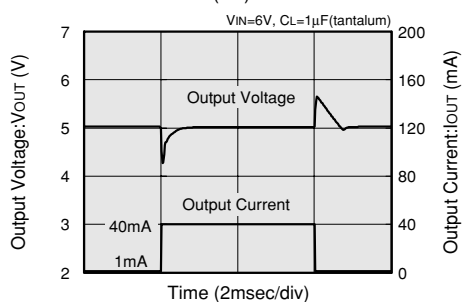


## (8) INPUT TRANSIENT RESPONSE 2

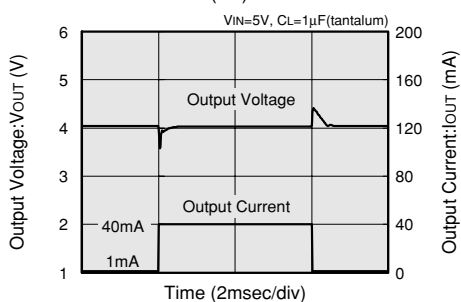


## (9) LOAD TRANSIENT RESPONSE

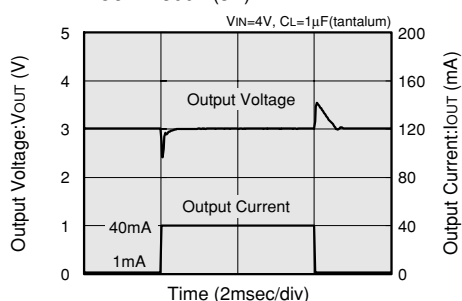
XC62FP5002 (5V)



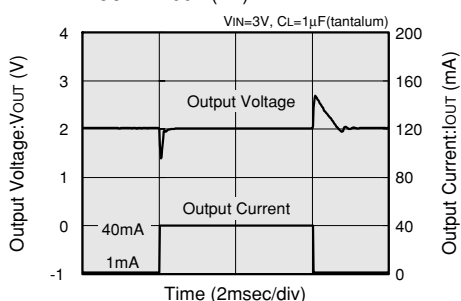
XC62FP4002 (4V)



XC62FP3002 (3V)

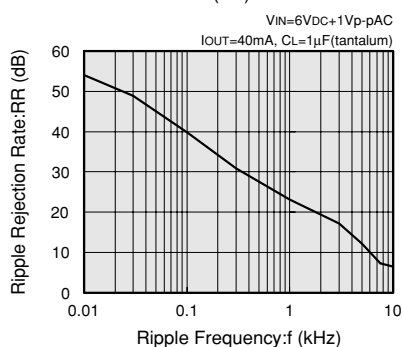


XC62FP2002 (2V)

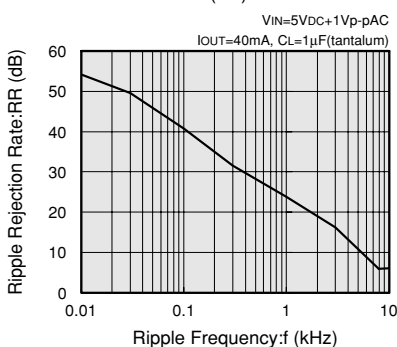


## (10) RIPPLE REJECTION RATE

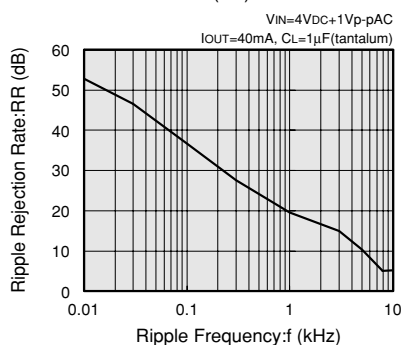
XC62FP5002 (5V)



XC62FP4002 (4V)



XC62FP3002 (3V)



XC62FP2002 (2V)

