- **CMOS Low Power Consumption**
- **Small Input-Output Voltage Differential: 0.1V at 100mA**
- **Maximum Output Current: 1000mA**
- **Output Voltage Range: 2V~6V**
- **Output Voltage Accuracy: ±2%**

Applications

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

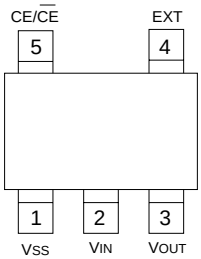
General Description

The XC62E series are a group of positive output voltage regulators that can supply up to 1A of output current using an external transistor. Low power and high accuracy are achieved through CMOS process and laser trimming technologies.
The series consists of a high precision voltage reference, an error correction circuit and a short-circuit protected output driver.
In stand-by mode, supply current can be dramatically cut. Since the input-output voltage differential is small, loss control efficiency is good.
The XC62E is particularly suited for use with battery operated portable products, and products where supply current regulation is required.
The series comes in an ultra small SOT-25 package.
In connection with the CE function, apart from the negative logic XC62EP series, a positive logic XC62ER series (custom) is also available.

Features

Ultra small input-output voltage differential: 100mA of output current is available with a differential of 0.1V. (Performance depends on the external transistor characteristics.)
Maximum output current: 1000mA
Output voltage: 2V to 6V in 0.1V increments
Highly accurate: Set-up voltage ±2%
Low power consumption: Typ.50μA (V_{OUT}=5.0V)
Typ.0.2μA (Stand-by)
Output voltage temperature coefficient: Typ.±100ppm/℃
Input stability: Typ.0.1%/V
Ultra small package: SOT-25 mini-mold

Pin Configuration



SOT-25
(TOP VIEW)

Pin Assignment

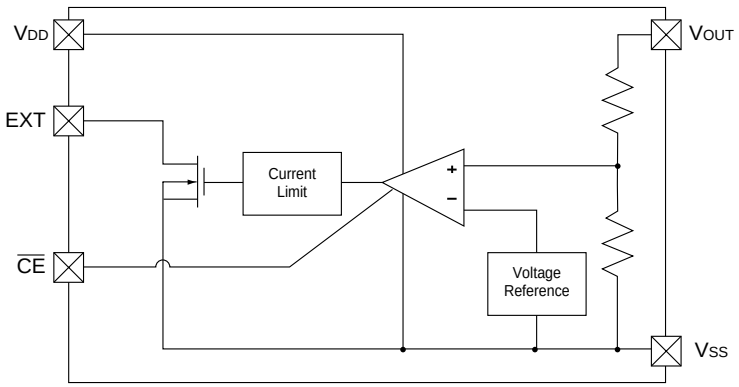
PIN NUMBER	PIN NAME	FUNCTION
1	V_{SS}	Ground
2	V_{IN}	Supply voltage input
3	V_{OUT}	Regulated voltage output
4	EXT	Base current control
5	CE/$\overline{CE}$	Chip enable

Function

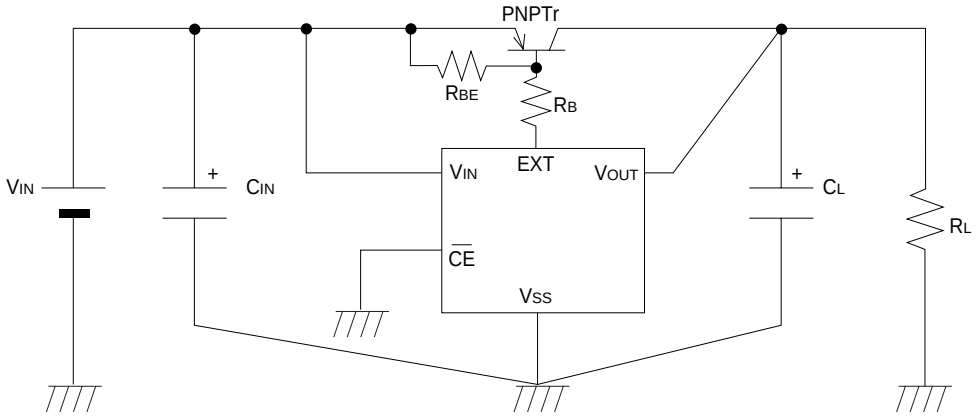
SERIES	CE	OUTPUT VOLTAGE
XC62ER	H	ON
	L	OFF
XC62EP	H	OFF
	L	ON

H=High Level
L=Low Level

Block Diagram



Standard Circuit



Peripherals :
- PNP Tr : 2SA1213
- RBE : 20kΩ ~ 47kΩ
- RB : Please refer to Note 2 on the following page.
- CIN : 10µF (Tantalum)
- CL : 47µF (Tantalum) 10µF minimum

Functional Description

Output voltage (V_{OUT}) can be fixed by revising the external transistor's base current. This can be done by comparing the detected voltage level and the set voltage power supply level.
With the XC62EP (CE negative voltage), if a voltage above the $\overline{CE}$ pin's "H" level is applied, the IC will enter stand-by mode where the base and differential amplifier's currents are regulated.

Suggestions for External Components

1. PNP Transistor

The selection of a transistor should take into account output current, input voltage and power dissipation for each specific application. It is recommended that a transistor that has a low output saturated voltage (V_{CE}) and high h_{FE} characteristics be used.

2. R_B Resistor

Although the IC unit is protected by a base current remitter circuit, it is recommended that a resistor (R_B) be connected between the transistor's base and the IC's EXT pin to protect the transistor.
Required output current can be calculated using the following equation although characteristic variations and conditions of use should be carefully checked before use. The following equation also indicates the conditions needed to obtain I_{OUT} (max.) at V_{IN} (min.). However, the larger the input current, the larger the output current (I_{OUT}) that can be obtained.

$$\frac{V_{IN}(min.) - 1.2(V)}{R_B} - \frac{0.7(V)}{R_{BE}} > \frac{I_{OUT}(max.)}{h_{FE}}$$

3. R_{BE} Resistor, C_L Capacitor

To prevent oscillation due to output load variation, use of a phase compensation capacitor C_L is recommended. Please use a Tantalum capacitor of at least 10µF. Please also use an R_{BE} resistor of less than 47kΩ.
An R_{BE} resistor of between 20kΩ and 47kΩ is recommended for less power consumption.

4. Input Impedance

In order to control oscillation brought about as a result of impedance at the power supply line, connect a capacitor of 10µF or more (Tantalum) between the external transistor's emitter and the ground pin.

Special Note

1. Protection Circuit

The built-in protect circuit is to protect the IC only. Therefore to prevent output shorts and overshoot current through the transistor, use of a resistor R_B or an overshoot current protection circuit is recommended.
Care should also be taken with the transistor's power dissipation.

■ Absolute Maximum Ratings

Ta=25℃

PARAMETER	SYMBOL	RATINGS	UNITS
VIN Input Voltage	VIN	12	V
VOUT Output Voltage	VOUT	VSS-0.3~VIN+0.3	V
CE/$\overline{CE}$ Input Voltage	VCE	VSS-0.3~VIN+0.3	V
EXT Output Voltage	VEXT	12	V
EXT Output Current	IEXT	50	mA
Continuous Total Power Dissipation	Pd	150	Mw
Operating Ambient Temperature	Topr	-30~+80	℃
Storage Temperature	Tstg	-40~+125	℃

■ Electrical Characteristics

XC62EP3002 VOUT(T)=3.0V(Note1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT(E) (Note2)	IOUT=50mA VIN=4.0V	2.940	3.000	3.060	V
Maximum Output Current*	IOUT max.	VIN=4.0V		1000		mA
Load Stability*	ΔVOUT	VIN=4.0V 1mA ≦ IOUT ≦ 100mA	-60		60	mV
Input-OutputVoltage Differential (Note3)	Vdif	IOUT=100mA		100		mV
Supply Current1	ISS1	VIN=4.0V, VCE=VSS		50	80	μA
Supply Current2	ISS2	VIN=8.0V,VCE=VIN			0.6	μA
Input Stability*	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	IOUT=50mA 4.0V ≦ VIN ≦ 8.0V		0.1	0.3	%/V
Input Voltage	VIN				8	V
Output Voltage Temperature Characteristics*	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	IOUT=10mA –30℃ ≦ Topr ≦ 80℃		±100		ppm/℃
EXT Output Voltage	VEXT				8	V
EXT Leak Current	ILEAK				0.5	μA
$\overline{CE}$ "High" Level Voltage	VCEH		1.5			V
$\overline{CE}$ "Low" Level Voltage	VCEL				0.25	V
$\overline{CE}$ "High" Level Current	ICEH	VCE=VIN			0.1	μA
$\overline{CE}$ "Low" Level Current	ICEL	VCE=VSS	–0.2	–0.05	0	μA

The characteristics for the XC62ER series are the same as above except for the CE operating logic which is the opposite.

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 (Note5)-VOUT1 (Note4)}
4. VOUT1= A voltage equal to 98% of the Output Voltage whenever an amply stabilised IOUT {VOUT(T)+1.0V} is input.
5. VIN1= The Input Voltage when VOUT1 appears as Input Voltage is gradually decreased.
6. The characteristics for those parameters marked with an asterisk* are liable to vary depending on which transistor is used. Please use a transistor with a low saturation voltage level and hFE equal to 100 or more.
7. The maximum output current value is not a value representing continuous output due to the limitations of the 2AS1213 transistor's power dissipation.

■ Electrical Characteristics

XC62EP4002 $V_{OUT}(T)$=4.0V(Note1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$ (Note2)	I_{OUT}=50mA V_{IN}=5.0V	3.920	4.000	4.080	V
Maximum Output Current*	I_{OUT} max.	V_{IN}=5.0V		1000		mA
Load Stability*	ΔV_{OUT}	V_{IN}=5.0V 1mA ≦ I_{OUT} ≦ 100mA	-60		60	mV
Input-OutputVoltage Differential (Note3)	Vdif	I_{OUT}=100mA		100		mV
Supply Current1	$I_{SS}1$	V_{IN}=5.0V, V_{CE}=V_{SS}		50	80	μA
Supply Current2	$I_{SS}2$	V_{IN}=8.0V,V_{CE}=V_{IN}			0.6	μA
Input Stability*	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	I_{OUT}=50mA 5.0V ≦ V_{IN} ≦ 8.0V		0.1	0.3	%/V
Input Voltage	V_{IN}				8	V
Output Voltage Temperature Characteristics*	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	I_{OUT}=10mA –30℃ ≦ Topr ≦ 80℃		±100		ppm/℃
EXT Output Voltage	V_{EXT}				8	V
EXT Leak Current	I_{LEAK}				0.5	μA
$\overline{CE}$ "High" Level Voltage	V_{CEH}		1.5			V
$\overline{CE}$ "Low" Level Voltage	V_{CEL}				0.25	V
$\overline{CE}$ "High" Level Current	I_{CEH}	V_{CE}=V_{IN}			0.1	μA
$\overline{CE}$ "Low" Level Current	I_{CEL}	V_{CE}=V_{SS}	–0.2	–0.05	0	μA

XC62EP5002 $V_{OUT}(T)$=5.0V(Note1) Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$ (Note2)	I_{OUT}=50mA V_{IN}=6.0V	4.900	5.000	5.100	V
Maximum Output Current*	I_{OUT} max.	V_{IN}=6.0V		1000		mA
Load Stability*	ΔV_{OUT}	V_{IN}=6.0V 1mA ≦ I_{OUT} ≦ 100mA	-60		60	mV
Input-OutputVoltage Differential (Note3)	Vdif	I_{OUT}=100mA		100		mV
Supply Current1	$I_{SS}1$	V_{IN}=6.0V, V_{CE}=V_{SS}		50	80	μA
Supply Current2	$I_{SS}2$	V_{IN}=8.0V,V_{CE}=V_{IN}			0.6	μA
Input Stability*	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	I_{OUT}=50mA 6.0V ≦ V_{IN} ≦ 8.0V		0.1	0.3	%/V
Input Voltage	V_{IN}				8	V
Output Voltage Temperature Characteristics*	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	I_{OUT}=10mA –30℃ ≦ Topr ≦ 80℃		±100		ppm/℃
EXT Output Voltage	V_{EXT}				8	V
EXT Leak Current	I_{LEAK}				0.5	μA
$\overline{CE}$ "High" Level Voltage	V_{CEH}		1.5			V
$\overline{CE}$ "Low" Level Voltage	V_{CEL}				0.25	V
$\overline{CE}$ "High" Level Current	I_{CEH}	V_{CE}=V_{IN}			0.1	μA
$\overline{CE}$ "Low" Level Current	I_{CEL}	V_{CE}=V_{SS}	–0.2	–0.05	0	μA

The characteristics for the XC62ER series are the same as above except for the CE operating logic which is the opposite.

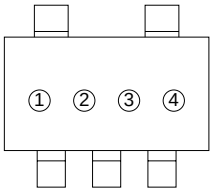
Note:
1. $V_{OUT}(T)$=Specified Output Voltage .
2. $V_{OUT}(E)$=Effective Output Voltage (i.e. the output voltage when "$V_{OUT}(T)$+1.0V" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value).
3. Vdif= {$V_{IN}1$ (Note5)-$V_{OUT}1$ (Note4)}
4. $V_{OUT}1$= A voltage equal to 98% of the Output Voltage whenever an amply stabilised I_{OUT} {$V_{OUT}(T)$+1.0V} is input.
5. $V_{IN}1$= The Input Voltage when $V_{OUT}1$ appears as Input Voltage is gradually decreased.
6. The characteristics for those parameters marked with an asterisk* are liable to vary depending on which transistor is used. Please use a transistor with a low saturation voltage level and h_{FE} equal to 100 or more.
7. The maximum output current value is not a value representing continuous output due to the limitations of the 2AS1213 transistor's power dissipation.

■ Ordering Information

XC62Exxxxxxx
a b c d e f

DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	CE pin Logic: R=Positive P=Negative	e	Package Type M=SOT-25
b	Output Voltage 30=3.0V 50=5.0V		
c	Temperature Coefficients: 0=±100ppm (typical)	f	Device Orientation R=Embossed Tape (Orientation of Device:Right) L=Embossed Tape (Orientation of Device:Left)
d	Output Voltage Accuracy: 1=±1.0%(Semi-custom) 2=±2.0%		

■ Marking



SOT-25
(TOP VIEW)

①Not Used

② Represents the integer of the Output Voltage

R TYPE POSITIVE VOLTAGE LOGIC SYMBOL	VOLTAGE(V)	P TYPE NEGATIVE VOLTAGE LOGIC SYMBOL	VOLTAGE(V)
2	2.③	2	2.③
3	3.③	3	3.③
4	4.③	4	4.③
5	5.③	5	5.③
6	6.③	6	6.③

③ Represents the decimal point of the Output Voltage

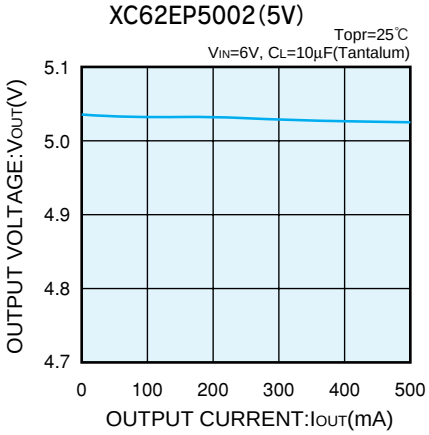
R TYPE POSITIVE VOLTAGE LOGIC SYMBOL	VOLTAGE(V)	P TYPE NEGATIVE VOLTAGE LOGIC SYMBOL	VOLTAGE(V)
0	②.0	0	②.0
1	②.1	1	②.1
2	②.2	2	②.2
3	②.3	3	②.3
4	②.4	4	②.4
5	②.5	5	②.5
6	②.6	6	②.6
7	②.7	7	②.7
8	②.8	8	②.8
9	②.9	9	②.9

④ Based on internal standards

■ Electrical Characteristics

(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

XC62EP5002(5V)



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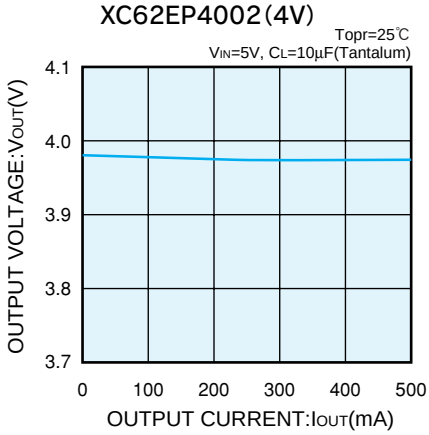
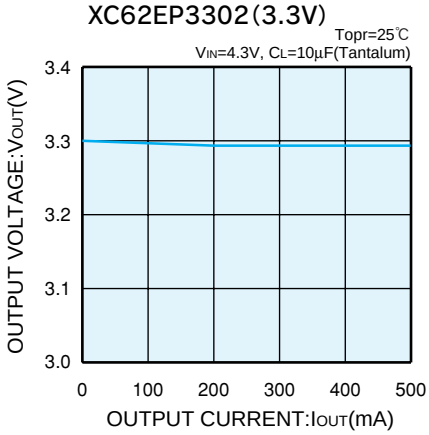
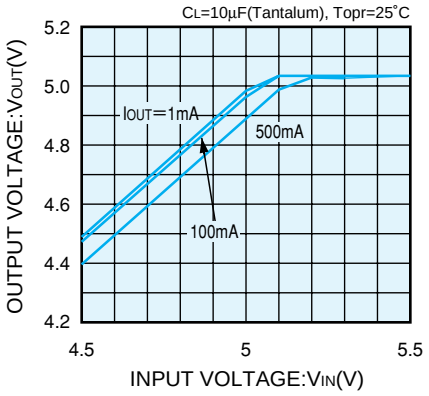


XC62EP3302(3.3V)



(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

XC62EP5002(5V)



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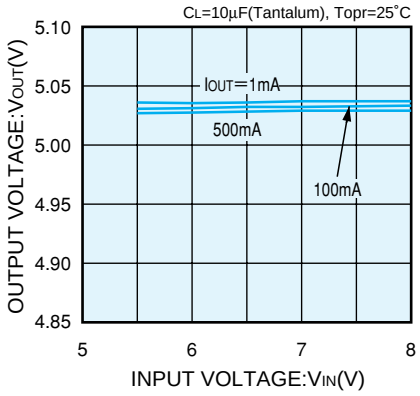

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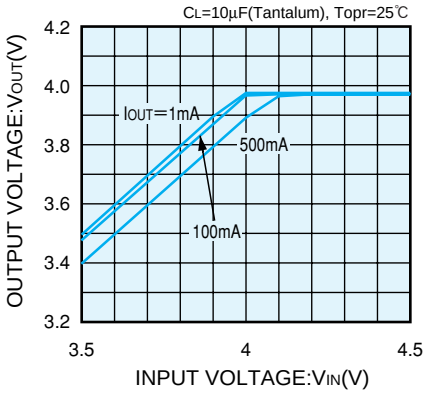

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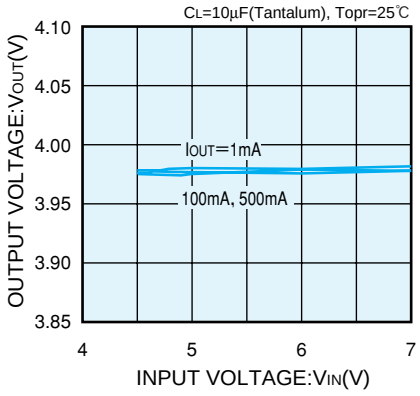

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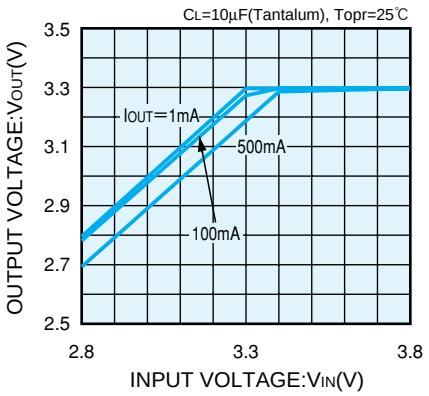

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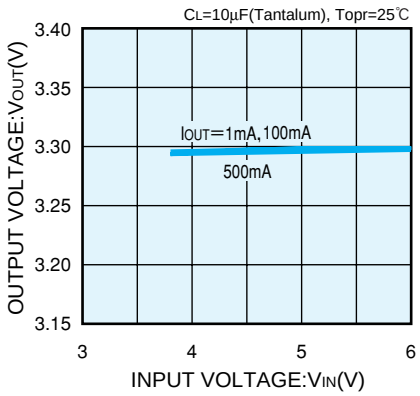
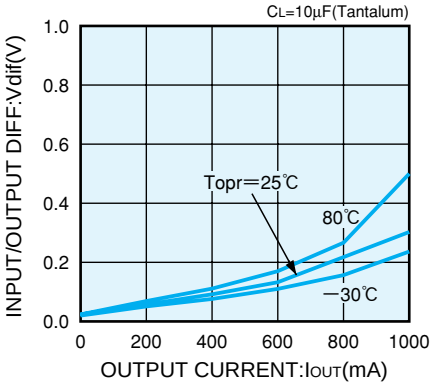


(3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT

XC62EP5002(5V)



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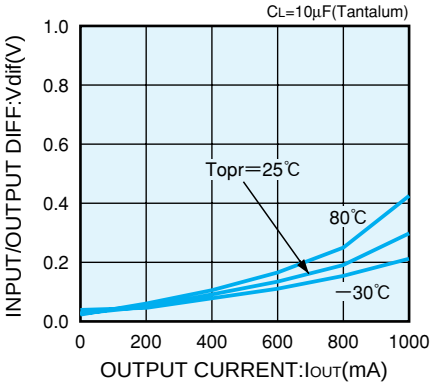

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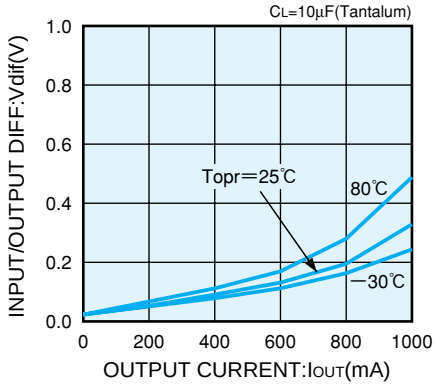
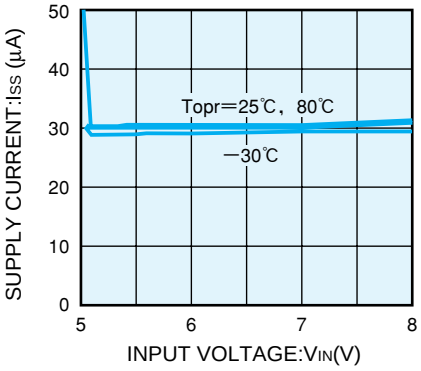


(4) SUPPLY CURRENT vs. INPUT VOLTAGE

XC62EP5002(5V)



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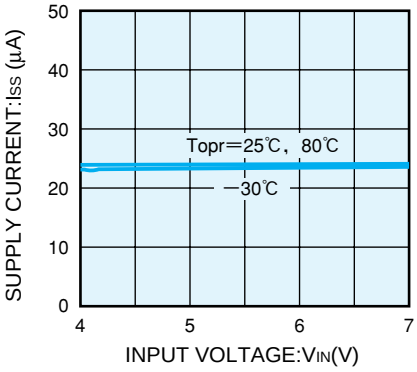
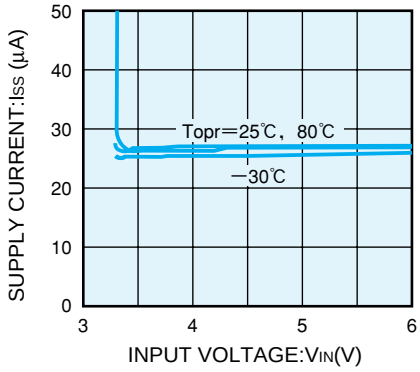
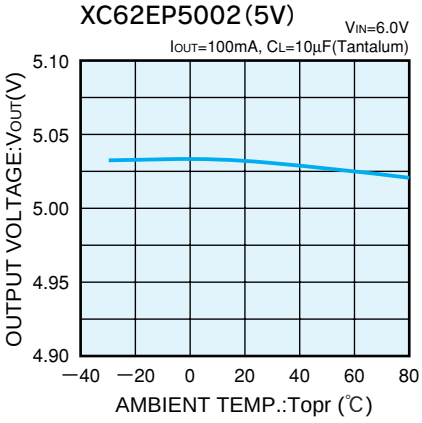


XC62EP3302(3.3V)

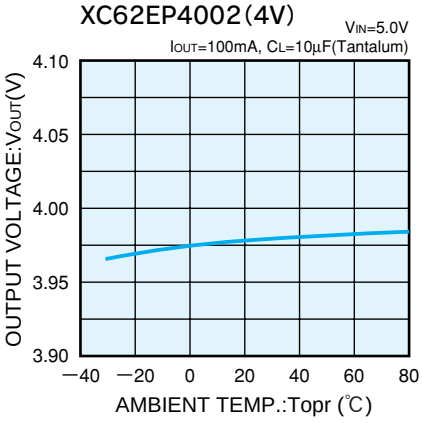


(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

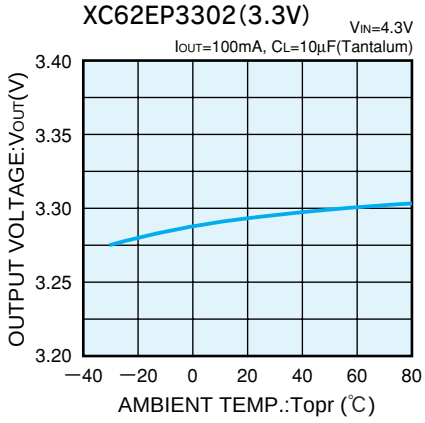
XC62EP5002(5V)



XC62EP4002(4V)

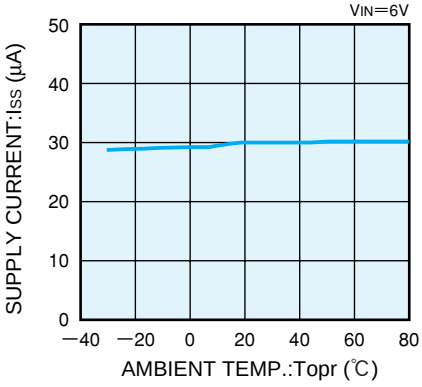


XC62EP3302(3.3V)



(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

XC62EP5002(5V)



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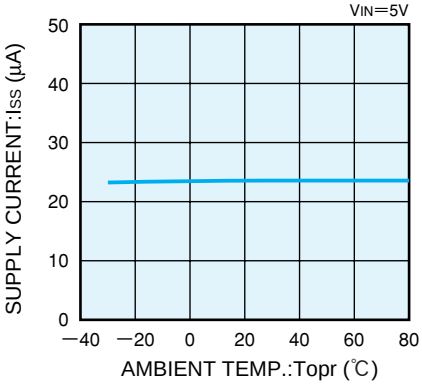
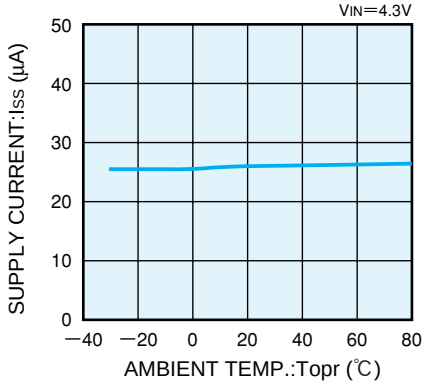
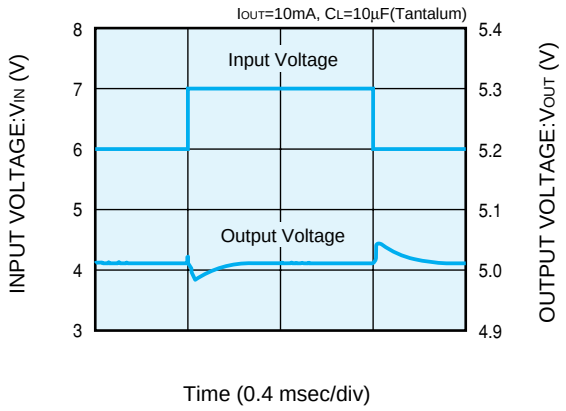


XC62EP3302(3.3V)



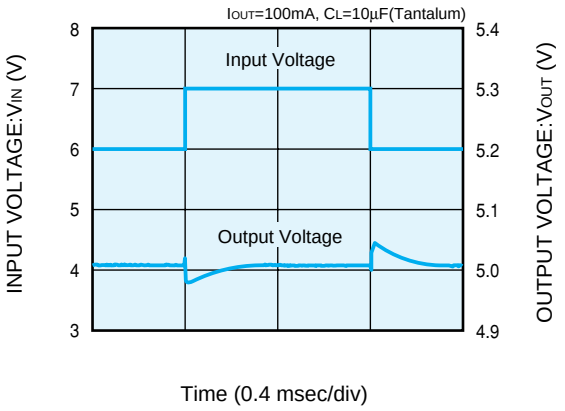
(7) INPUT TRANSIENT RESPONSE

XC62EP5002(5V)



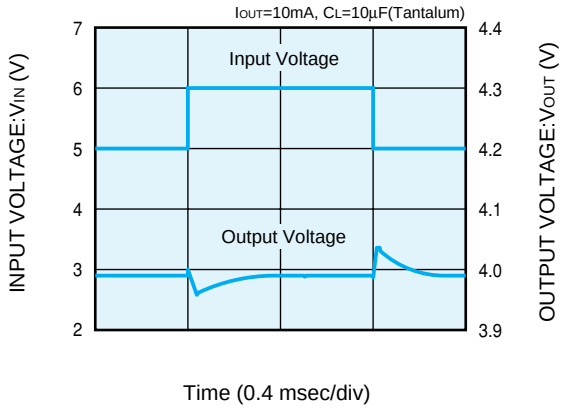
Time (0.4 msec/div)

XC62EP5002(5V)



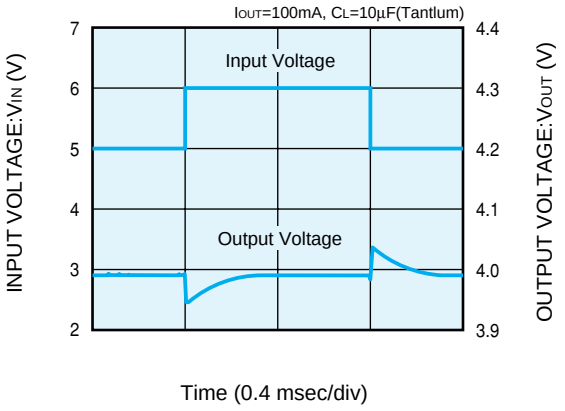
Time (0.4 msec/div)

XC62EP4002(4V)



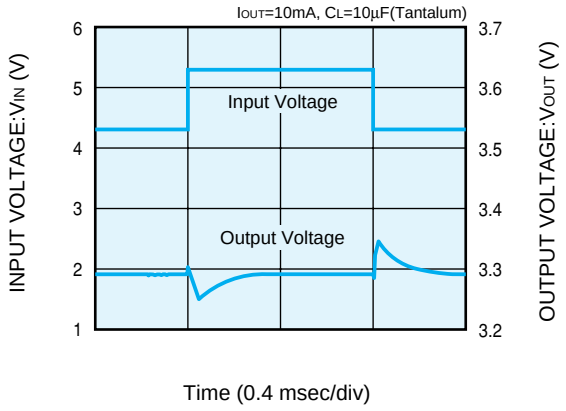
Time (0.4 msec/div)

XC62EP4002(4V)



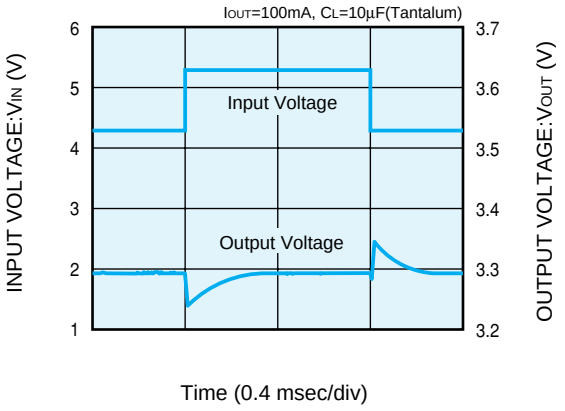
Time (0.4 msec/div)

XC62EP3302(3.3V)



Time (0.4 msec/div)

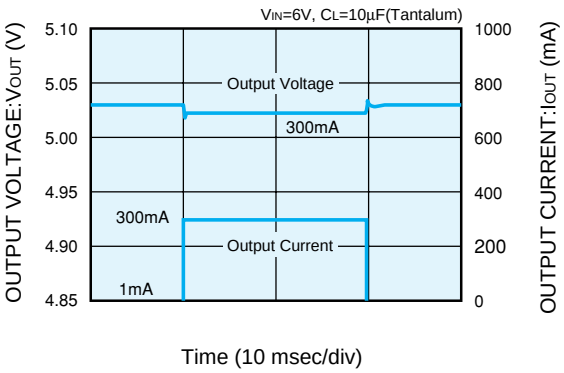
XC62EP3302(3.3V)



Time (0.4 msec/div)

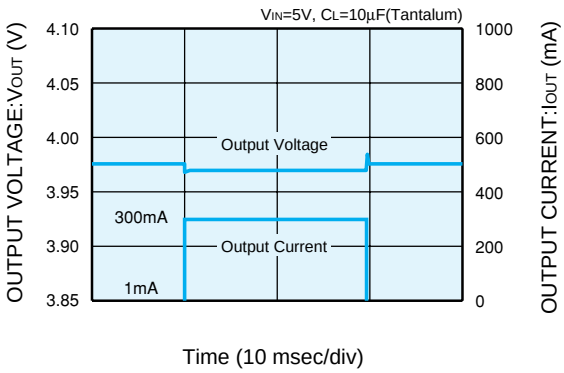
(8) LOAD TRANSIENT RESPONSE

XC62EP5002(5V)



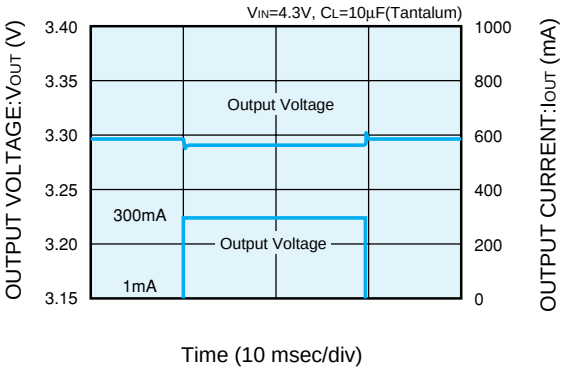
Time (10 msec/div)

XC62EP4002(4V)



Time (10 msec/div)

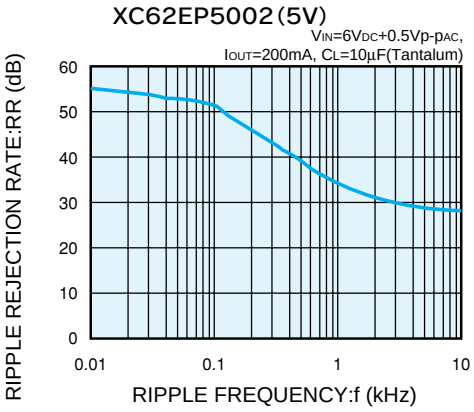
XC62EP3302(3.3V)



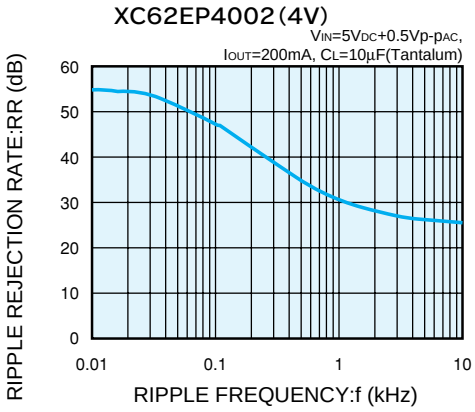
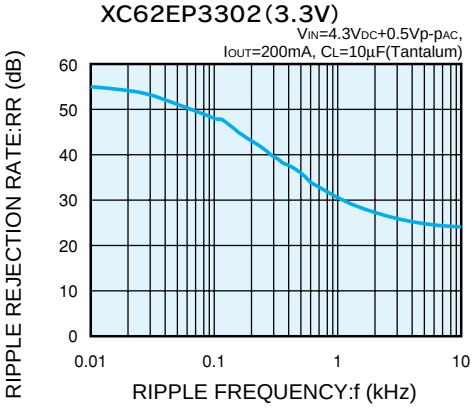
Time (10 msec/div)

(9) RIPPLE REJECTION RATE

XC62EP5002(5V)



XC62EP4002(4V)



XC62EP3302(3.3V)