

# XC6201 Series

Positive Voltage Regulators



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- ◆ CMOS Low Power Consumption
- ◆ Dropout Voltage : 0.16V @ 100mA,  
0.40V @ 200mA
- ◆ Maximum Output Current : 250mA (V<sub>OUT</sub>=5.0V, TYP)
- ◆ Highly Accurate : ± 2%
- ◆ Output Voltage Range : 1.3V ~ 6.0V
- ◆ SOT-25 / SOT-89 / TO-92 Package
- ◆ Capacitors can be Tantalum or Ceramic

## General Description

The XC6201 series are highly precise, low power consumption, positive voltage regulators manufactured using CMOS and laser trimming technologies.

The series provides large currents with a significantly small dropout voltage.

The XC6201 consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error amplifier. Output voltage is selectable in 0.1V steps between 1.3V ~ 6.0V.

SOT-25 (250mW), SOT-89 (500mW) and TO-92 (300mW) packages are available.

## Applications

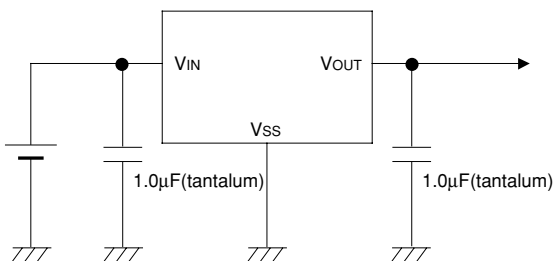
- Mobile phones
- Cordless phones
- Cameras, video recorders
- Portable games
- Portable AV equipment
- Reference voltage
- Battery powered equipment

## Features

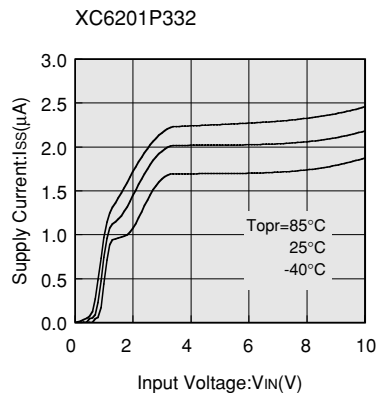
<b>Maximum Output Current</b>	: 250mA (TYP.)
<b>Dropout Voltage</b>	: 0.16V @ 100mA
<b>Maximum Operating Voltage</b>	: 10V
<b>Output Voltage Range</b>	: 1.3V ~ 6.0V (selectable in 0.1V steps)
<b>Highly Accurate</b>	: ± 2%
<b>Low Power Consumption</b>	: TYP 2.0 μA
<b>Operational Temperature Range</b>	: -40°C ~ 85°C
<b>Ultra Small Packages</b>	: SOT-25 (250mW), SOT-89 (500mW), TO-92 (300mW)

Capacitors can be Tantalum or Ceramic

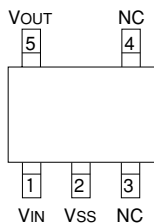
## Typical Application Circuit



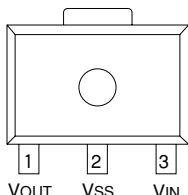
## Typical Performance Characteristic



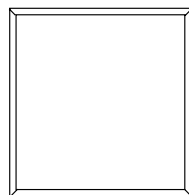
## Pin Configuration



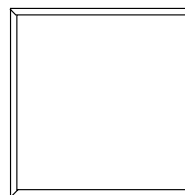
SOT-25  
(TOP VIEW)



SOT-89  
(TOP VIEW)



V<sub>OUT</sub> V<sub>SS</sub> V<sub>IN</sub>  
TO-92 (T Type)  
(TOP VIEW)



V<sub>SS</sub> V<sub>OUT</sub> V<sub>IN</sub>  
TO-92 (L Type)  
(TOP VIEW)

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## Pin Assignment

PIN NUMBER			PIN NAME	FUNCTION
SOT-25	SOT-89/TO-92 (T)	TO-92 (L)		
5	1	2	V<sub>OUT</sub>	Output
2	2	1	V<sub>SS</sub>	Ground
1	3	3	V<sub>IN</sub>	Power Input
3	—	—	(NC)	No Connection
4	—	—	(NC)	No Connection

## Product Classification

### Ordering Information

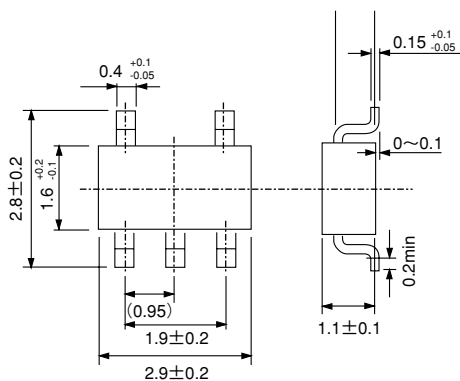
X C 6 2 0 1 P ③④⑤⑥

↑ ↑  
① ②

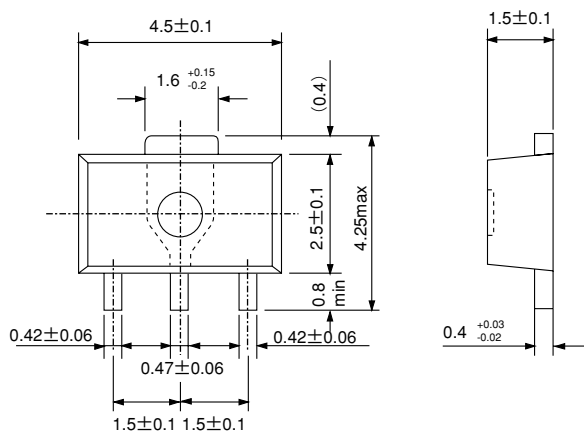
DESIGNATOR	SYMBOL	DESCRIPTION	DESIGNATOR	SYMBOL	DESCRIPTION
①	01	Indicates the product number	④	1/2	Output Voltage Accuracy e.g.1 : ±1.0% 2 : ±2.0%
②	P	Type of regulator 3-pin		M	
③	13~60	Output Voltage e.g. 30 : 3.0V 50 : 5.0V	⑤	P	: SOT-89
				T	: TO-92 (Standard)
				L	: TO-92 (Custom pin configuration)
			⑥	R	Embossed Tape:Standard Feed
L	Embossed Tape:Reverse Feed				
H	Paper Type (TO-92)				
			B	Bag (TO-92)	

## ■ Packaging Information

### ● SOT-25

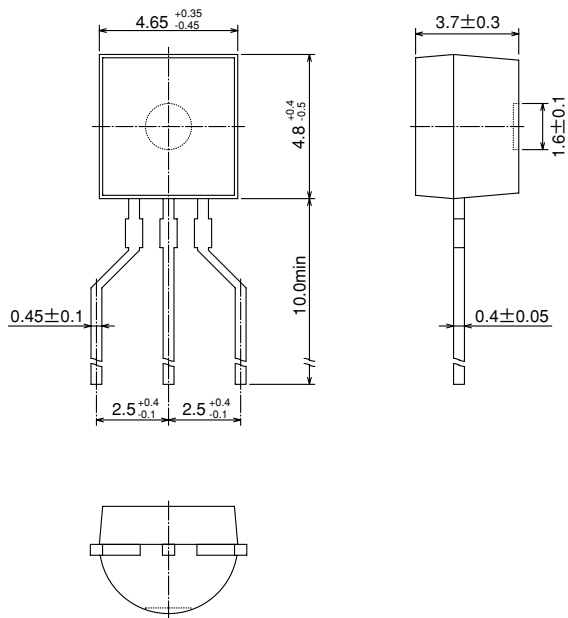


### ● SOT-89



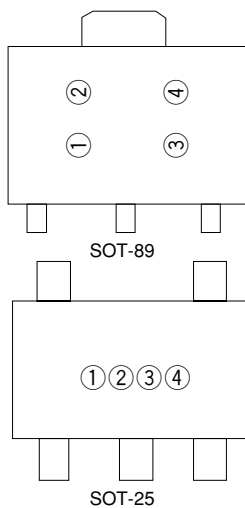
## ●TO-92

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## ■ Marking

● SOT-89, SOT-25



① Represents the product name

SYMBOL	PRODUCT NAME
1	XC6201PXXXXX

② Represents the type of regulator

VOLTAGE (V)	0.1~3.0	3.1~6.0	6.1~9.0
SYMBOL	5	6	7

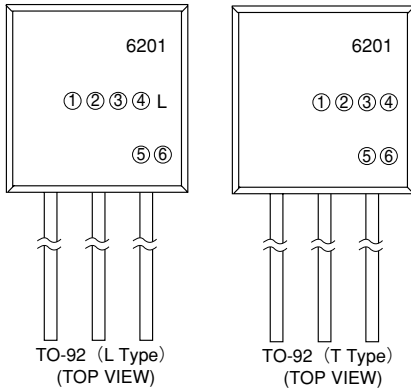
③ Represents the Output Voltage

SYMBOL	OUTPUT VOLTAGE (V)			SYMBOL	OUTPUT VOLTAGE (V)		
0	—	3.1	—	F	1.6	4.6	—
1	—	3.2	—	H	1.7	4.7	—
2	—	3.3	—	K	1.8	4.8	—
3	—	3.4	—	L	1.9	4.9	—
4	—	3.5	—	M	2.0	5.0	—
5	—	3.6	—	N	2.1	5.1	—
6	—	3.7	—	P	2.2	5.2	—
7	—	3.8	—	R	2.3	5.3	—
8	—	3.9	—	S	2.4	5.4	—
9	—	4.0	—	T	2.5	5.5	—
A	—	4.1	—	U	2.6	5.6	—
B	—	4.2	—	V	2.7	5.7	—
C	1.3	4.3	—	X	2.8	5.8	—
D	1.4	4.4	—	Y	2.9	5.9	—
E	1.5	4.5	—	Z	3.0	6.0	—

④ Represents the assembly lot no.

0~9, A~Z repeated (G, I, J, O, Q, W excepted)

## ●TO-92



① Represents the type of regulator

DESIGNATOR	PRODUCT NAME
P	XC6201P*****
T	XC6201T*****

②③ Represents the Output Voltage

DESIGNATOR		VOLTAGE (V)	PRODUCT NAME
②	③		
3	3	3.3	XC6201*33***
5	0	5.0	XC6201*50***

④ Represents the Detect Voltage Accuracy

DESIGNATOR	DETECT VOLTAGE ACCURACY	PRODUCT NAME
1	within $\pm 1\%$	XC6201P**1**
2	within $\pm 2\%$	XC6201P**2**

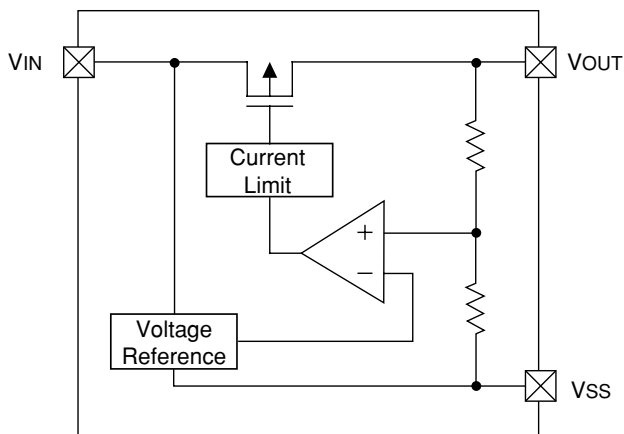
⑤ Represents a least significant digit of the produced year

DESIGNATOR	Produced year
0	2000
1	2001

⑥ Denotes the production lot number  
0 to 9, A to Z repeated (G.I.J.O.Q.W excepted)

Note : Character inversion is not used

## ■Block Diagram



## Absolute Maximum Ratings

Ta=25°C

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		VIN	12	V
Output Current		IOUT	500	mA
Output Voltage		VOUT	VSS-0.3~VIN+0.3	V
Power Dissipation	SOT-25	Pd	250	mW
	SOT-89		500	
	TO-92		300	
Operating Temp.		To <sub>pr</sub>	-40~+85	°C
Storage Temp.		T <sub>stg</sub>	-55~+125	°C

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## Electrical Characteristics

XC6201P132 VOUT(T)=1.3V (Note 1)

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	VOUT(E) (Note2)	VIN=2.3V IOUT=10mA	1.274	1.300	1.326	V	2
Maximum Output Current	IOUTmax	VIN=2.3V VOUT(E)≥1.17V	60			mA	2
Load Regulation	ΔVOUT	VIN=2.3V 1mA≤IOUT≤30mA		10	30	mV	2
Dropout Voltage (Note 3)	Vdif1	IOUT=30mA		200	600	mV	2
	Vdif2	IOUT=60mA		500	810		
Supply Current	ISS	VIN=2.3V		3.0	5.0	μA	1
Line Regulation	$\frac{\Delta VOUT}{\Delta VIN \cdot VOUT}$	IOUT=10mA 2.3V≤VIN≤10.0V		0.2	0.3	%/V	2
Input Voltage	VIN		1.8		10	V	—
Output Voltage Temperature Characteristics	$\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$	IOUT=40mA -40°C≤Topr≤85°C		±100		ppm/°C	2

XC6201P182  $V_{OUT}(T)=1.8V$  (Note 1)

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (Note 2)	$V_{IN}=2.8V$ $I_{OUT}=40mA$	1.764	1.800	1.836	V	2
Maximum Output Current	$I_{OUTmax}$	$V_{IN}=2.8V$ $V_{OUT}(E) \geq 1.62V$	80			mA	2
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=2.8V$ $1mA \leq I_{OUT} \leq 40mA$		10	30	mV	2
Dropout Voltage (Note 3)	$V_{dif1}$	$I_{OUT}=40mA$		200	370	mV	2
	$V_{dif2}$	$I_{OUT}=80mA$		450	710		
Supply Current	$I_{SS}$	$V_{IN}=2.8V$		3.0	5.0	$\mu A$	1
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $2.8V \leq V_{IN} \leq 10.0V$		0.2	0.3	%/V	2
Input Voltage	$V_{IN}$		1.8		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 / $^{\circ}C$	2

XC6201P272  $V_{OUT}(T)=2.7V$  (Note 1)

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (Note 2)	$V_{IN}=3.7V$ $I_{OUT}=40mA$	2.646	2.700	2.754	V	2
Maximum Output Current	$I_{OUTmax}$	$V_{IN}=3.7V$ $V_{OUT}(E) \geq 2.43V$	100			mA	2
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=3.7V$ $1mA \leq I_{OUT} \leq 60mA$		15	40	mV	2
Dropout Voltage (Note 3)	$V_{dif1}$	$I_{OUT}=60mA$		200	370	mV	2
	$V_{dif2}$	$I_{OUT}=120mA$		450	710		
Supply Current	$I_{SS}$	$V_{IN}=3.7V$		2.0	5.0	$\mu A$	1
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $3.7V \leq V_{IN} \leq 10.0V$		0.2	0.3	%/V	2
Input Voltage	$V_{IN}$		1.8		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 / $^{\circ}C$	2



**XC6201P332**  $V_{OUT}(T)=3.3V$  (Note 1)

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (Note 2)	$V_{IN}=4.3V$ $I_{OUT}=40mA$	3.234	3.300	3.366	V	2
Maximum Output Current	$I_{OUTmax}$	$V_{IN}=4.3V$ $V_{OUT}(E) \geq 2.97V$	150			mA	2
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=4.3V$ $1mA \leq I_{OUT} \leq 80mA$		20	50	mV	2
Dropout Voltage (Note 3)	$V_{dif1}$	$I_{OUT}=80mA$		200	360	mV	2
	$V_{dif2}$	$I_{OUT}=160mA$		450	700		
Supply Current	$I_{SS}$	$V_{IN}=4.3V$		2.0	5.0	$\mu A$	1
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $4.3V \leq V_{IN} \leq 10.0V$		0.2	0.3	%/V	2
Input Voltage	$V_{IN}$		1.8		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 / $^{\circ}C$	2

**XC6201P502**  $V_{OUT}(T)=5.0V$  (Note 1)

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	CIRCUIT
Output Voltage	$V_{OUT}(E)$ (Note 2)	$V_{IN}=6.0V$ $I_{OUT}=40mA$	4.900	5.000	5.100	V	2
Maximum Output Current	$I_{OUTmax}$	$V_{IN}=6.0V$ $V_{OUT}(E) \geq 4.5V$	200			mA	2
Load Regulation	$\Delta V_{OUT}$	$V_{IN}=6.0V$ $1mA \leq I_{OUT} \leq 100mA$		30	70	mV	2
Dropout Voltage (Note 3)	$V_{dif1}$	$I_{OUT}=100mA$		160	340	mV	2
	$V_{dif2}$	$I_{OUT}=200mA$		400	600		
Supply Current	$I_{SS}$	$V_{IN}=6.0V$		2.0	6.0	$\mu A$	1
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ $6.0V \leq V_{IN} \leq 10.0V$		0.2	0.3	%/V	2
Input Voltage	$V_{IN}$		1.8		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 / $^{\circ}C$	2

Note : 1.  $V_{OUT}(T)$  = Specified Output Voltage.

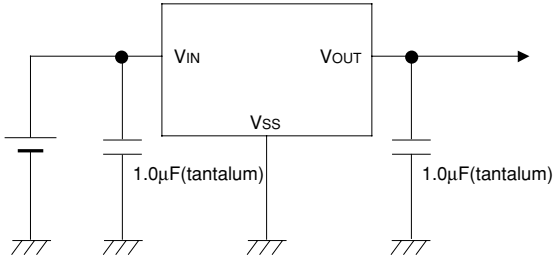
2.  $V_{OUT}(E)$  = Effective Output Voltage (i.e. the output voltage when " $V_{OUT}(T)+1.0V$ " is provided while maintaining a certain  $I_{OUT}$  value).

3.  $V_{dif} = \{ V_{IN1}^{(Note5)} - V_{OUT1}^{(Note4)} \}$

4.  $V_{OUT1}$  = A voltage equal to 98% of the output voltage when a stabilised ( $V_{OUT}(T) + 1.0V$ ) is input.

5.  $V_{IN1}$  = The input voltage at the time  $V_{OUT1}$  is output (input voltage has been gradually reduced).

## Typical Application Circuit

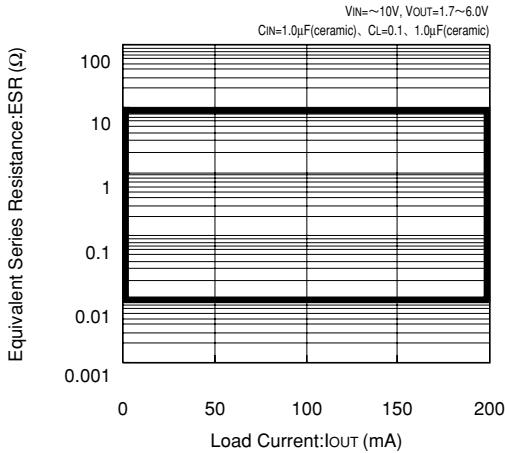


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#### < External Capacitors >

The XC6201 requires an output capacitor between the V<sub>OUT</sub> pin and the V<sub>SS</sub> pin in order to obtain stable output voltages. Where output voltage is greater than 1.7V, the output capacitor (C<sub>L</sub>) used should be more than 0.1µF whether using tantalum or low ESR (ceramic, for example) capacitors. Where output voltage is between 1.3V ~ 1.6V, it is recommended that only a tantalum capacitor of more than 2.2µF be used on the output in order to stabilize operations.

Output Voltage	C <sub>IN</sub>	C <sub>L</sub> (tantalum)	C <sub>L</sub> (low ESR)
1.3V~1.6V	greater than 0.1µF	greater than 2.2µF	–
1.7V~6.0V	greater than 0.1µF	greater than 0.1µF	greater than 0.1µF



## ■ Directions for use

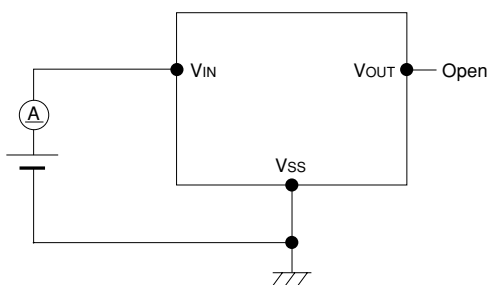
### ● Notes on Use

1. Please use this IC within the stipulated absolute maximum ratings as the IC is liable to malfunction outside of such parameters. When the voltage on  $V_{OUT}$  is larger than that of  $V_{IN}$ , for example, when there are two power supply, please insert schottky diode between  $V_{OUT}$  and  $V_{IN}$  not to exceed the rating of  $V_{OUT}$ .
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  $10\Omega$  or more, please use a capacitor ( $C_{IN}$ ) of at least  $1\mu F$ .  
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.

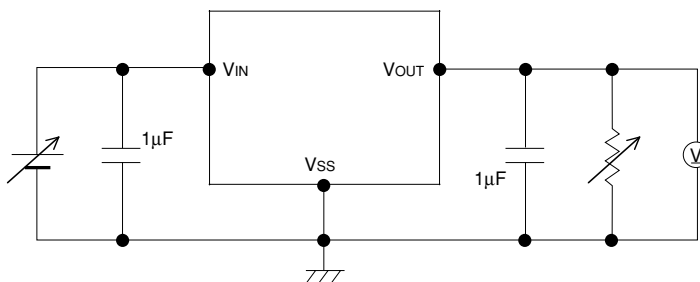
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## ■ Test Circuits

### Measuring Circuit 1 : Supply Current



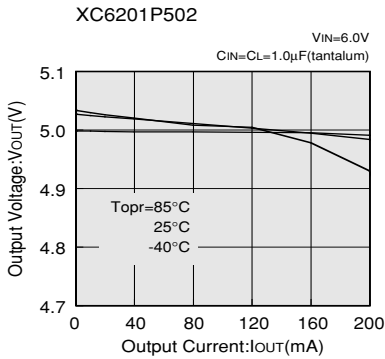
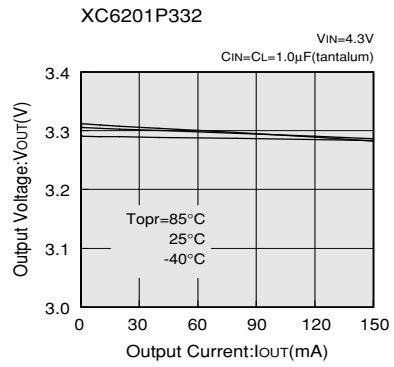
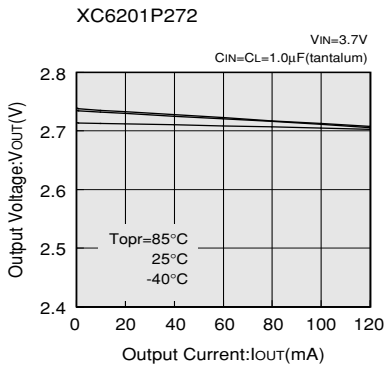
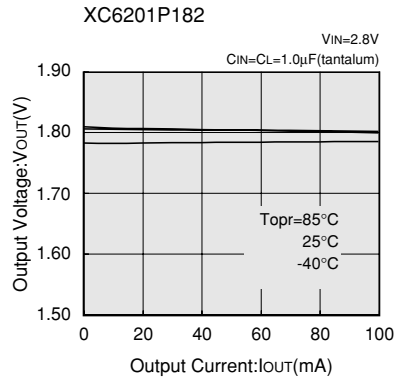
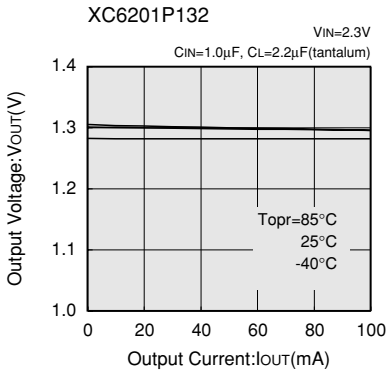
### Measuring Circuit 2 : Output Voltage, Oscillation Check, Line Regulation, Dropout Voltage, Load Regulation



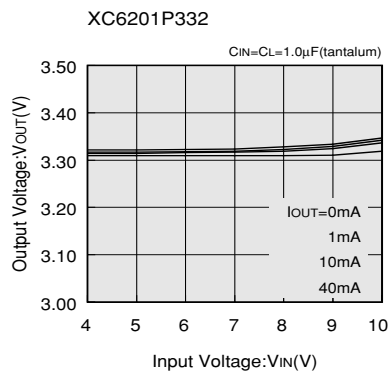
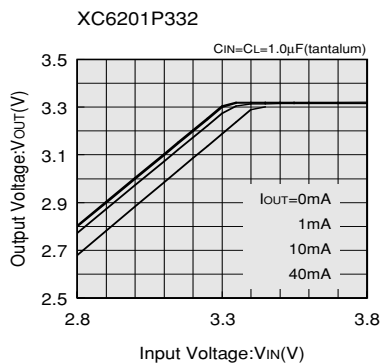
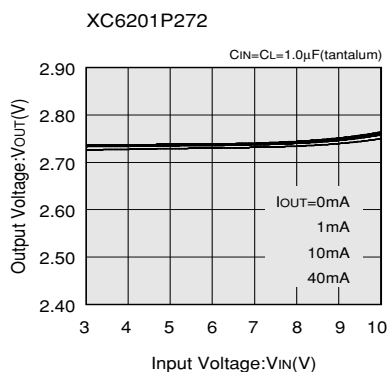
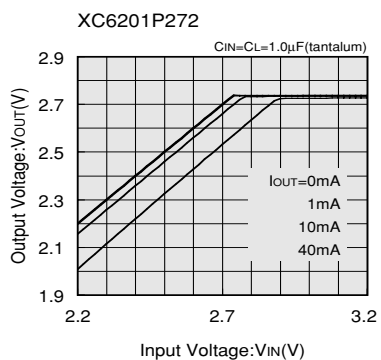
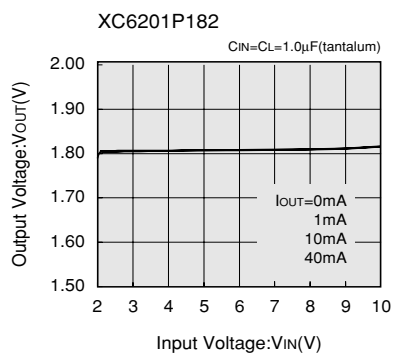
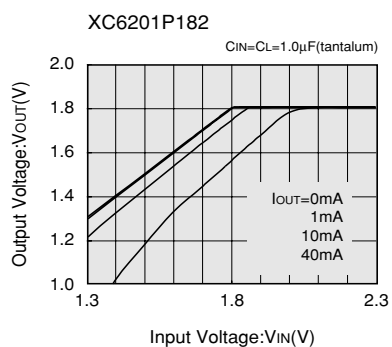
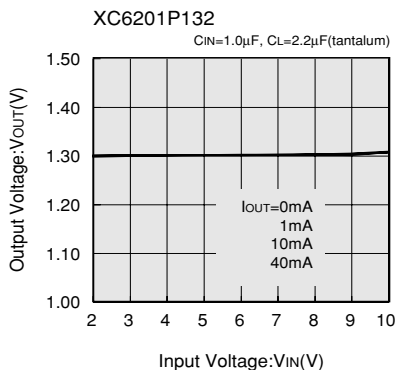
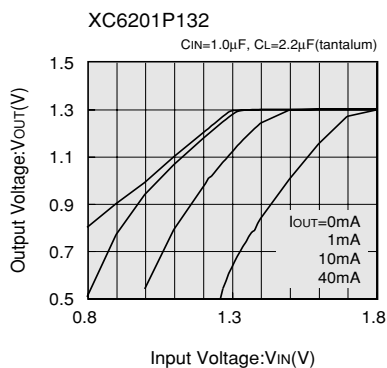
## Typical Performance Characteristics

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

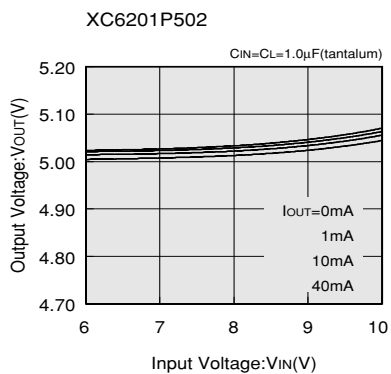
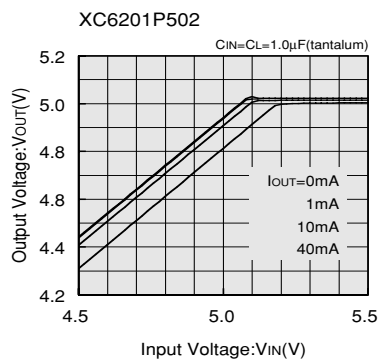
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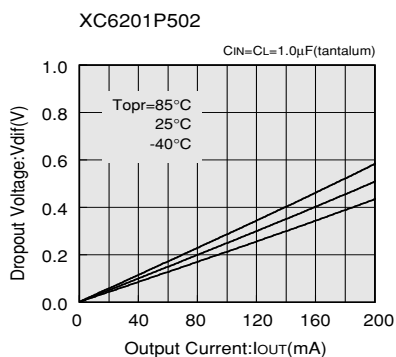
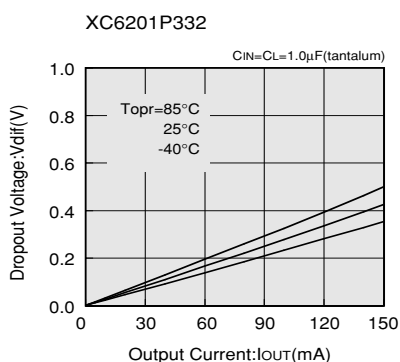
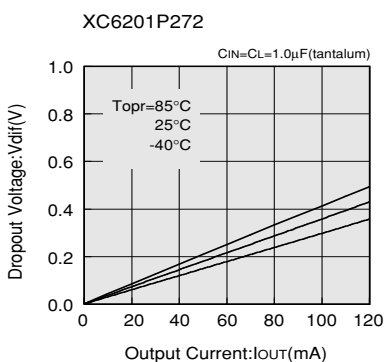
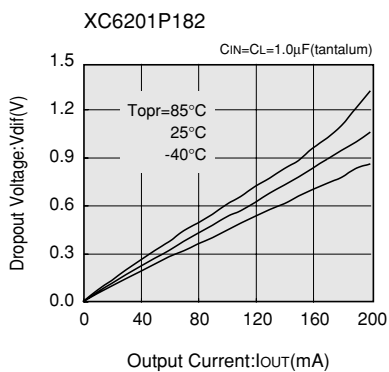
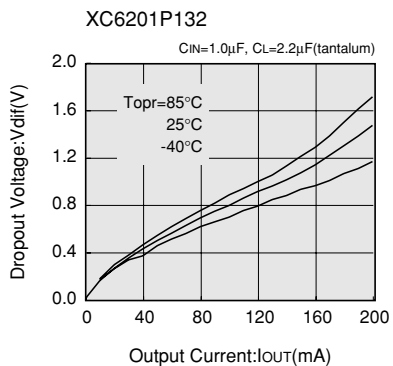
(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE



## (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE



**(3) DROPOUT VOLTAGE vs. OUTPUT CURRENT**

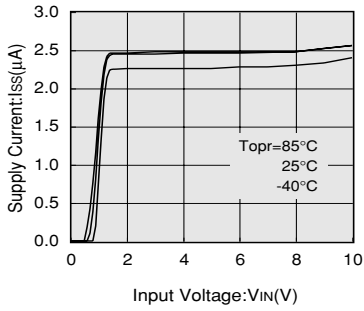


**3**

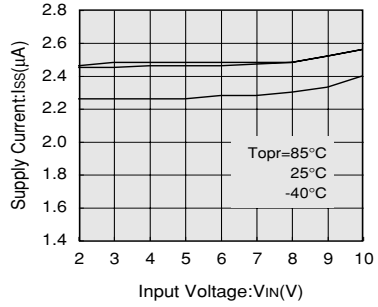
## (4) SUPPLY CURRENT vs. INPUT VOLTAGE

3

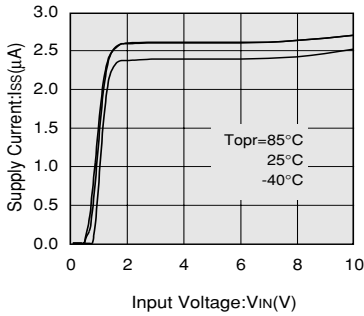
XC6201P132



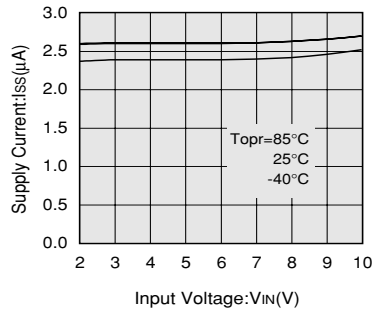
XC6201P132



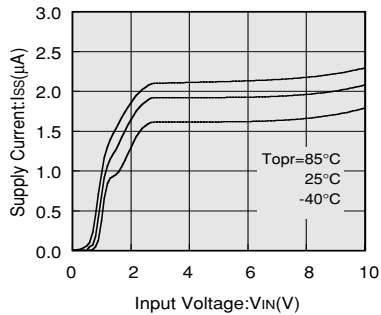
XC6201P182



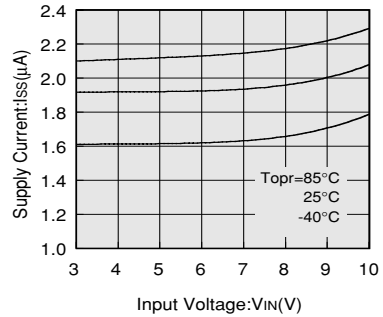
XC6201P182



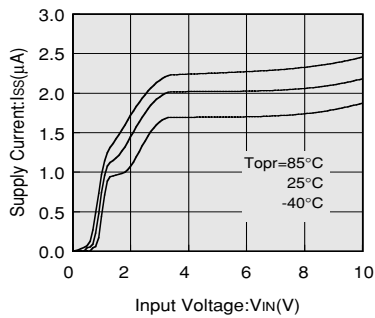
XC6201P272



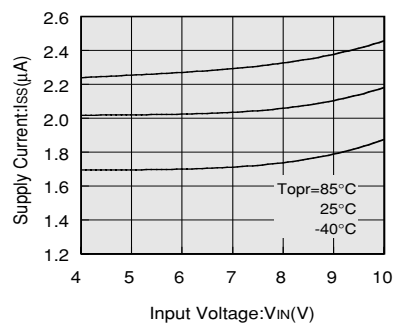
XC6201P272



XC6201P332

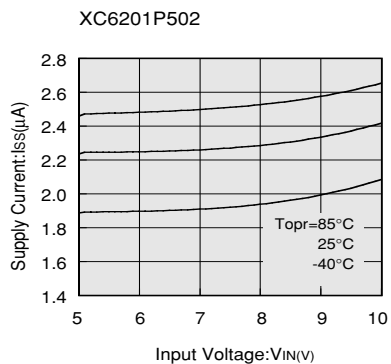
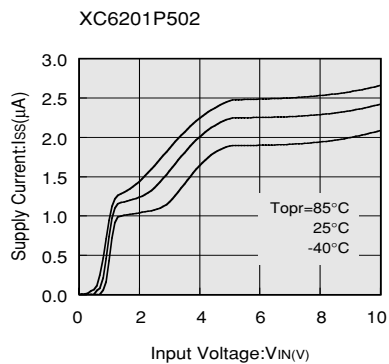


XC6201P332



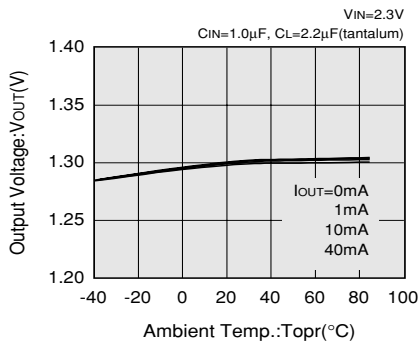


(4) SUPPLY CURRENT vs. INPUT VOLTAGE

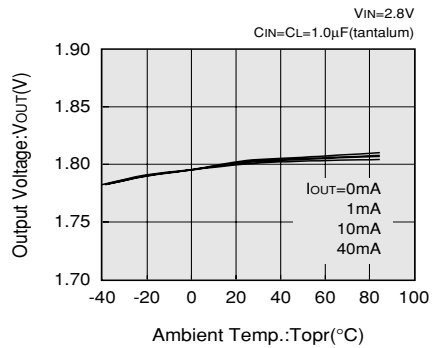


## (5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

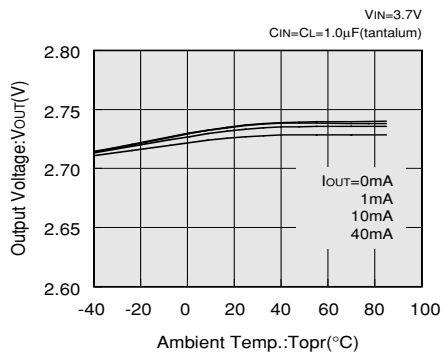
XC6201P132



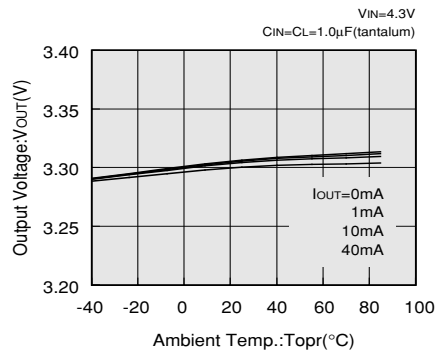
XC6201P182



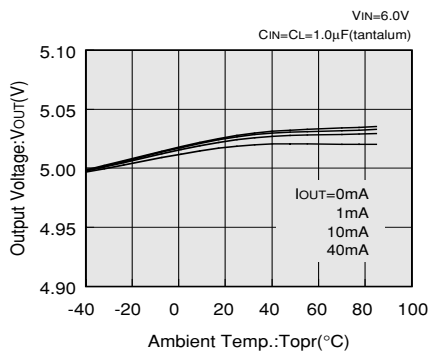
XC6201P272



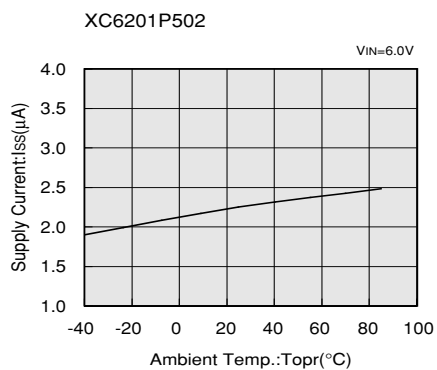
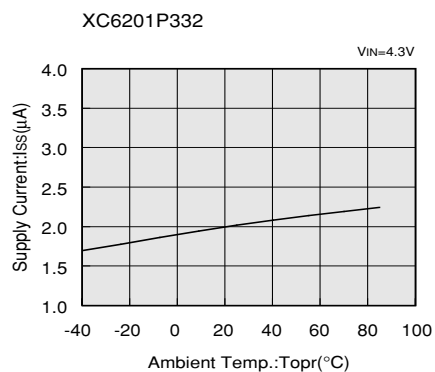
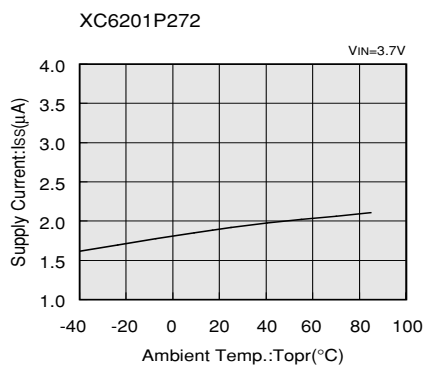
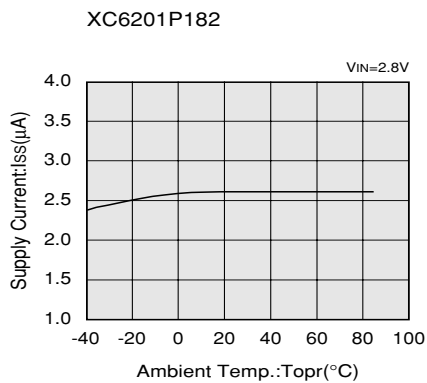
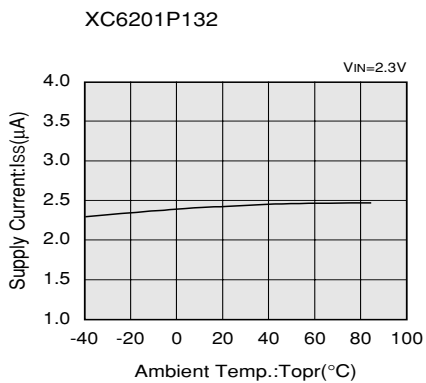
XC6201P332



XC6201P502



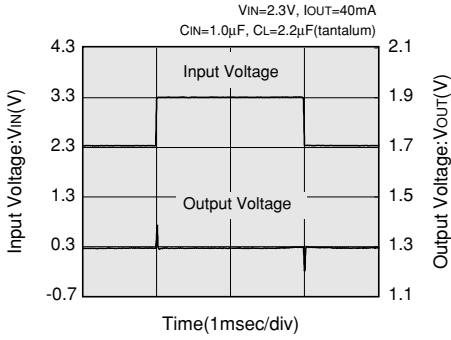
(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE



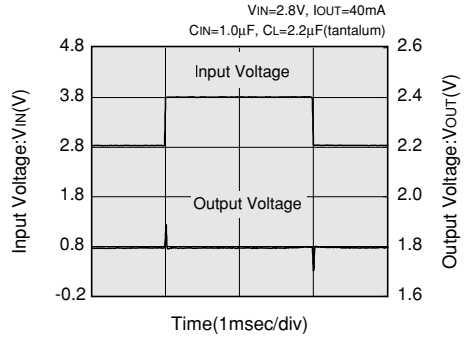
3

## (7) INPUT TRANSIENT RESPONSE

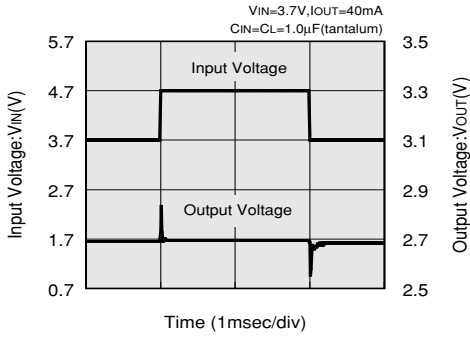
XC6201P132



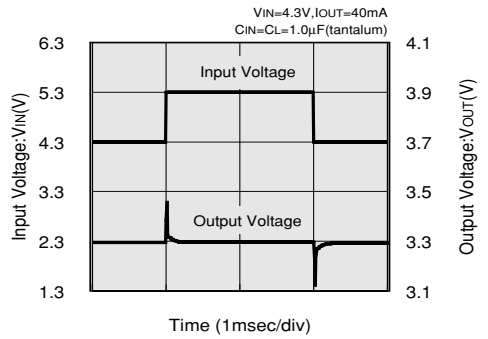
XC6201P182



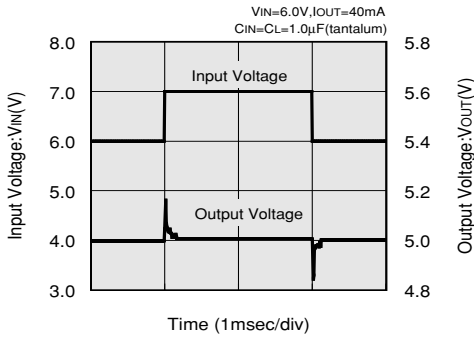
XC6201P272



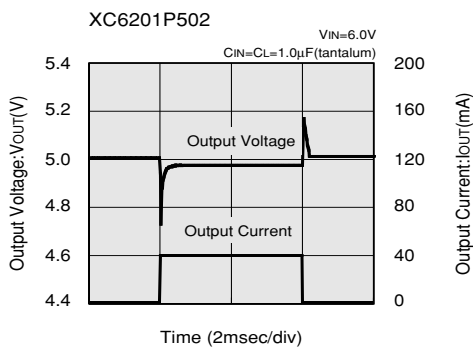
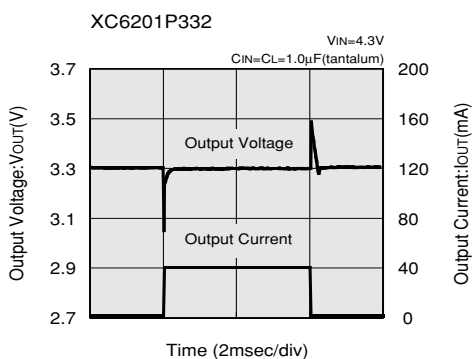
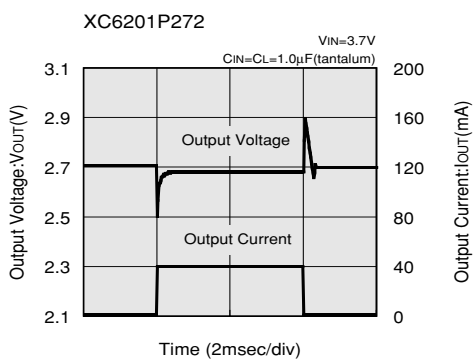
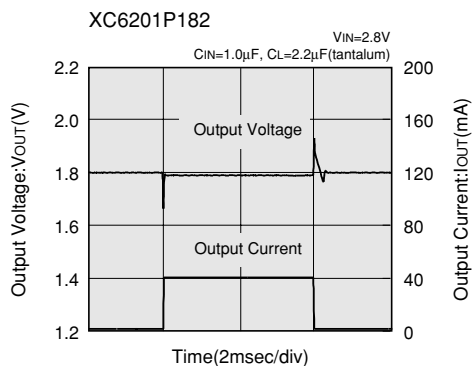
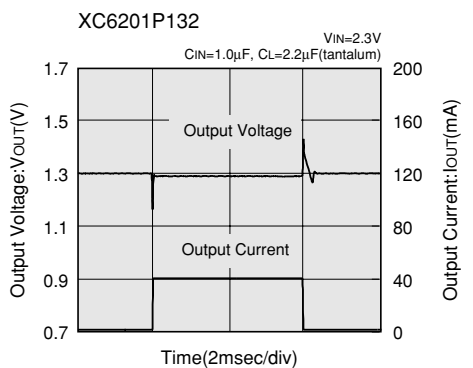
XC6201P332



XC6201P502

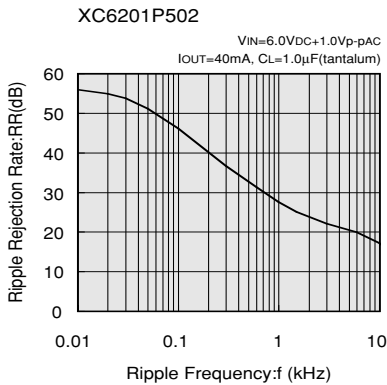
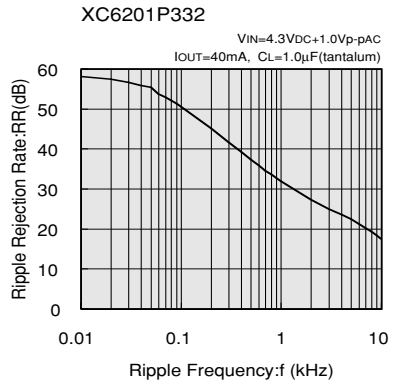
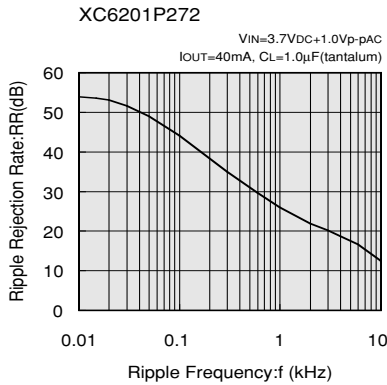
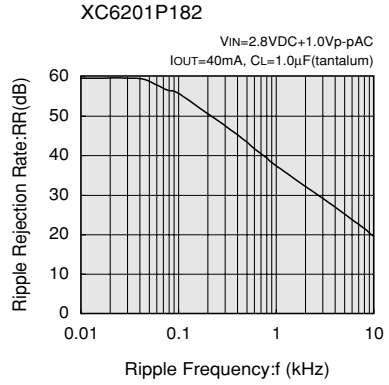
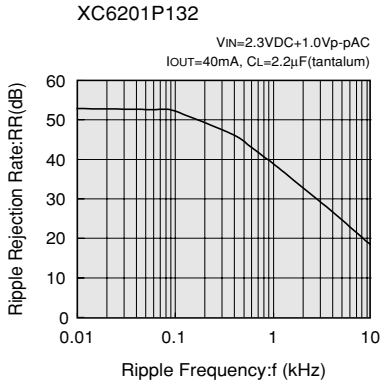


**(8) LOAD TRANSIENT RESPONSE**



**3**

### (9) RIPPLE REJECTION RATE



### (10) OUTPUT NOISE DENSITY

