

Large Current Positive Voltage Regulators

GENERAL DESCRIPTION

The XC6203 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 XC6203P consists of a driver transistor, a current limiter, a precision reference voltage and an error amplifier. The XC6203E is also available but without the current limiter function. Output voltage is selectable in 100mV increments between a voltage of 1.8V and 6.0V.

SOT-23 (150mW), SOT-89 (500mW), SOT-223 (1200mW) and TO-92 (300mW) package are available.

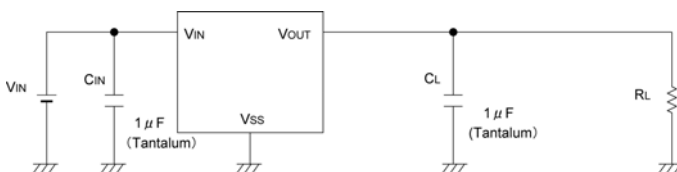
APPLICATIONS

- Battery powered equipment
- Reference voltage sources
- Cameras, video cameras
- CD-ROMs, DVDs
- Palmtops
- Portable audio video equipment

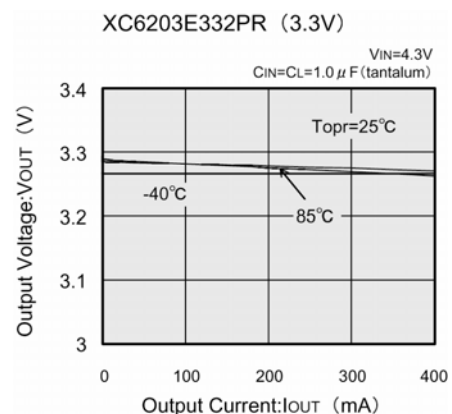
FEATURES

- Maximum Output Current** : More than 400mA (3.3V)
- Maximum Operating Voltage** : 8.0V
- Output Voltage Range** : 1.8V ~ 6.0V (selectable in 100mV increments)
- Highly Accurate** : $\pm 2\%$
- Low Power Consumption** : 8.0 μ A (TYP.)
- Line Regulation** : 0.2% / V (TYP.)
- Output Voltage Temperature Characteristics** : ± 100 ppm/ (TYP.)
- Operational Temperature Range** : -40 ~ 85
- Dropout Voltage** : 150mV @ 100mA,
300mV @ 200mA
- Ultra Small Packages** : SOT-23, SOT-89,
SOT-223, TO-92

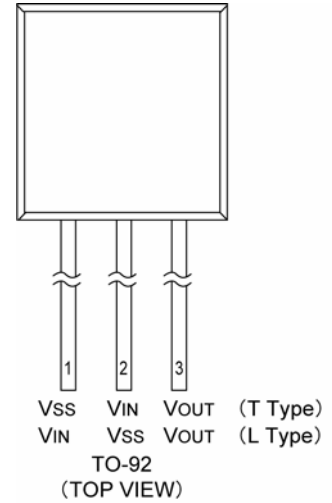
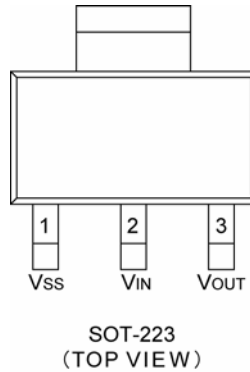
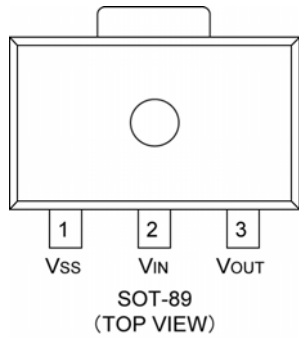
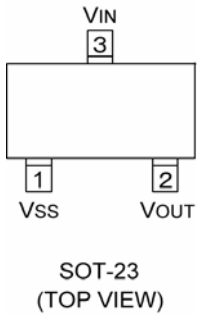
TYPICAL APPLICATION CIRCUIT



TYPICAL PERFORMANCE CHARACTERISTICS



PIN CONFIGURATION



PIN ASSIGNMENT

PIN NUMBER			PIN NAME	FUNCTION
SOT-23	SOT-89/SOT-223/TO-92 (T)	TO-92(L)		
1	1	2	VSS	Ground
3	2	1	VIN	Power Input
2	3	3	VOUT	Output

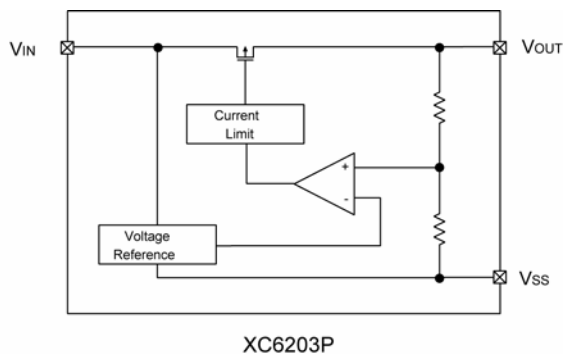
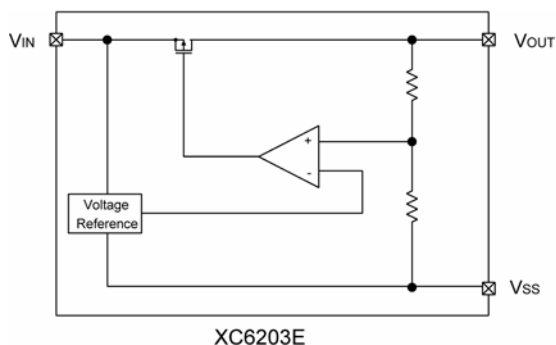
PRODUCT CLASSIFICATION

Ordering Information

XC6203 _____

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
	Type of Regulator	P	: Current limiter circuit built-in
		E	: No current limiter circuit built-in
	Output Voltage	18~60, A	: e.g. 252:2.5V, Accuracy $\pm 2\%$ 28A:2.85V, Accuracy $\pm 2\%*$ * "A" indicates voltage of 50mV increments
	Package	M	: SOT-23
		P	: SOT-89
		F	: SOT-223
		T	: TO-92 (Standard)
		L	: TO-92 (Custom pin configuration)
	Device Orientation	R	: Embossed tape, standard feed
		L	: Embossed tape, reverse feed
		H	: Paper type (TO-92)
		B	: Bag (TO-92)

BLOCK DIAGRAMS



ABSOLUTE MAXIMUM RATINGS

Ta = 25

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
Power Dissipation	SOT-23	150	mW
	SOT-89	500	
	SOT-223	1,200 ^(*)	
	TO-92	300	
Operating Temperature Range	T _{opr}	-40 ~ +85	
Storage Temperature Range	T _{stg}	-55 ~ +125	

*: Circuits board mounting: Double-sided board

ELECTRICAL CHARACTERISTICS

XC6203X182

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

$T_a = 25$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	$V_{OUT(E)}$ (*2)	$V_{IN} = 2.8V$ $I_{OUT} = 40mA$	1.764	1.800	1.836	V
Maximum Output Current	I_{OUTmax}	$V_{IN} = 2.8V$ $V_{OUT} = V_{OUT(E)} \times 0.90$	400	-	-	mA
Load Regulation	V_{OUT}	$V_{IN} = 2.8V$ $1mA \leq I_{OUT} \leq 200mA$	-	40	100	mV
Dropout Voltage (*3)	V_{dif1}	$I_{OUT} = 100mA$	-	200	300	mV
	V_{dif2}	$I_{OUT} = 200mA$	-	400	600	
Supply Current	I_{SS}	$V_{IN} = 2.8V$	-	8.0	16.0	μA
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $2.8V \leq V_{IN} \leq 8.0V$	-	0.2	0.3	%/V
Input Voltage	V_{IN}		-	-	8	V
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $-40 \leq T_{opr} \leq 85$	-	± 100	-	ppm /
Short-Circuit Current (XC6203P Series Only)	I_{lim}	$V_{IN} = 2.8V$ $V_{OUT} = 0V$	-	60	-	mA

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: $V_{dif} = V_{IN1} - V_{OUT1}$

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

*5: V_{IN1} = The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

XC6203X252

$V_{OUT(T)} = 2.5V$ (*1)

$T_a = 25$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	$V_{OUT(E)}$ (*2)	$V_{IN} = 3.5V$ $I_{OUT} = 40mA$	2.450	2.500	2.550	V
Maximum Output Current	I_{OUTmax}	$V_{IN} = 3.5V$ $V_{OUT} = V_{OUT(E)} \times 0.93$	400	-	-	mA
Load Regulation	V_{OUT}	$V_{IN} = 3.5V$ $1mA \leq I_{OUT} \leq 200mA$	-	40	100	mV
Dropout Voltage (*3)	V_{dif1}	$I_{OUT} = 100mA$	-	170	250	mV
	V_{dif2}	$I_{OUT} = 200mA$	-	320	500	
Supply Current	I_{SS}	$V_{IN} = 3.5V$	-	8.0	16.0	μA
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $3.5V \leq V_{IN} \leq 8.0V$	-	0.2	0.3	%/V
Input Voltage	V_{IN}		-	-	8	V
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $-40 \leq T_{opr} \leq 85$	-	± 100	-	ppm /
Short-Circuit Current (XC6203P Series Only)	I_{lim}	$V_{IN} = 3.5V$ $V_{OUT} = 0V$	-	60	-	mA

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: $V_{dif} = V_{IN1} - V_{OUT1}$

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

*5: V_{IN1} = The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

ELECTRICAL CHARACTERISTICS (Continued)

XC6203X302

$V_{OUT(T)} = 3.0V$ (*1)

$T_a=25$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	$V_{OUT(E)}$ (*2)	$V_{IN}=4V$ $I_{OUT}=40mA$	2.940	3.000	3.060	V
Maximum Output Current	I_{OUTmax}	$V_{IN}=4V$ $V_{OUT} = V_{OUT(E)} \times 0.96$	400	-	-	mA
Load Regulation	V_{OUT}	$V_{IN}=4V$ 1mA I_{OUT} 200mA	-	40	100	mV
Dropout Voltage (*3)	Vdif1	$I_{OUT}=100mA$	-	150	220	mV
	Vdif2	$I_{OUT}=200mA$	-	300	420	
Supply Current	I_{SS}	$V_{IN}=4V$	-	8.0	16.0	μA
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ 4V V_{IN} 8.0V	-	0.2	0.3	%/V
Input Voltage	V_{IN}		-	-	8.0	V
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{Topr \cdot V_{OUT}}$	$I_{OUT}=40mA$ -40 $Topr$ 85	-	± 100	-	ppm /
Short-Circuit Current (XC6203P Series Only)	I_{lim}	$V_{IN}=4V$ $V_{OUT}=0V$	-	60	-	mA

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: $V_{dif} = V_{IN1} - V_{OUT1}$
- *4: V_{OUT1} = A voltage equal to 98% of the output voltage when " $V_{OUT(T)} + 1.0V$ " is input.
- *5: V_{IN1} = The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

XC6203X332

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

$T_a=25$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	$V_{OUT(E)}$ (*2)	$V_{IN}=4.3V$ $I_{OUT}=40mA$	2.940	3.300	3.366	V
Maximum Output Current	I_{OUTmax}	$V_{IN}=4.3V$ $V_{OUT} = V_{OUT(E)} \times 0.96$	400	-	-	mA
Load Regulation	V_{OUT}	$V_{IN}=4.3V$ 1mA I_{OUT} 200mA	-	40	100	mV
Dropout Voltage (*3)	Vdif1	$I_{OUT}=100mA$	-	150	220	mV
	Vdif2	$I_{OUT}=200mA$	-	300	420	
Supply Current	I_{SS}	$V_{IN}=4.3V$	-	8.0	16.0	μA
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT}=40mA$ 4.3V V_{IN} 8.0V	-	0.2	0.3	%/V
Input Voltage	V_{IN}		-	-	8	V
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{Topr \cdot V_{OUT}}$	$I_{OUT}=40mA$ -40 $Topr$ 85	-	± 100	-	ppm /
Short-Circuit Current (XC6203P Series Only)	I_{lim}	$V_{IN}=4.3V$ $V_{OUT}=0V$	-	60	-	mA

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: $V_{dif} = V_{IN1} - V_{OUT1}$
- *4: V_{OUT1} = A voltage equal to 98% of the output voltage when " $V_{OUT(T)} + 1.0V$ " is input.
- *5: V_{IN1} = The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

ELECTRICAL CHARACTERISTICS (Continued)

XC6203X502

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

$T_a = 25$

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Voltage	$V_{OUT(E)}$ (*2)	$V_{IN} = 6.0V$ $I_{OUT} = 40mA$	4.900	5.000	5.100	V
Maximum Output Current	I_{OUTmax}	$V_{IN} = 6.0V$ $V_{OUT} = V_{OUT(E)} \times 0.96$	400	-	-	mA
Load Regulation	V_{OUT}	$V_{IN} = 6.0V$ $1mA \leq I_{OUT} \leq 200mA$	-	40	100	mV
Dropout Voltage (*3)	V_{dif1}	$I_{OUT} = 100mA$	-	100	180	mV
	V_{dif2}	$I_{OUT} = 200mA$	-	200	320	
Supply Current	I_{SS}	$V_{IN} = 6.0V$	-	10.0	20.0	μA
Line Regulation	$\frac{V_{OUT}}{V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $6.0V \leq V_{IN} \leq 8.0V$	-	0.2	0.3	%/V
Input Voltage	V_{IN}		-	-	8.0	V
Output Voltage Temperature Characteristics	$\frac{V_{OUT}}{T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 40mA$ $-40 \leq T_{opr} \leq 85$	-	± 100	-	ppm /
Short-Circuit Current (XC6203P Series Only)	I_{lim}	$V_{IN} = 6.0V$ $V_{OUT} = 0V$	-	60	-	mA

NOTE:

*1: $V_{OUT(T)}$ = Specified output voltage.

*2: $V_{OUT(E)}$ = Effective output voltage

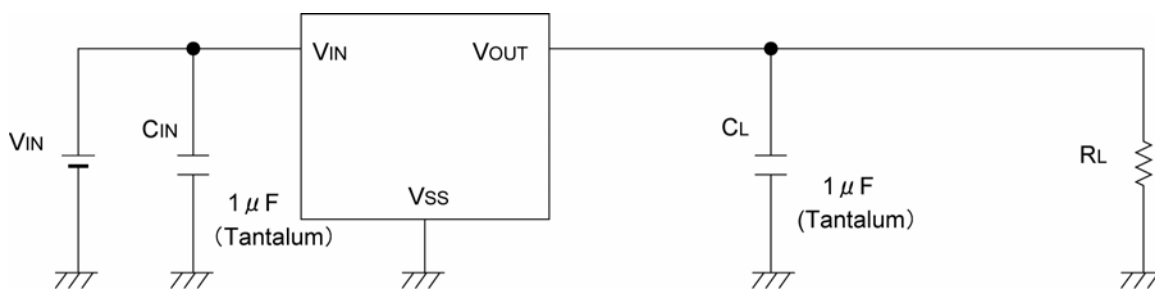
(i.e. the output voltage when " $V_{OUT(T)} + 1.0V$ " is provided at the V_{IN} pin while maintaining a certain I_{OUT} value).

*3: $V_{dif} = V_{IN1} - V_{OUT1}$

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

*5: V_{IN1} = The input voltage when V_{OUT1} appears as input voltage is gradually decreased.

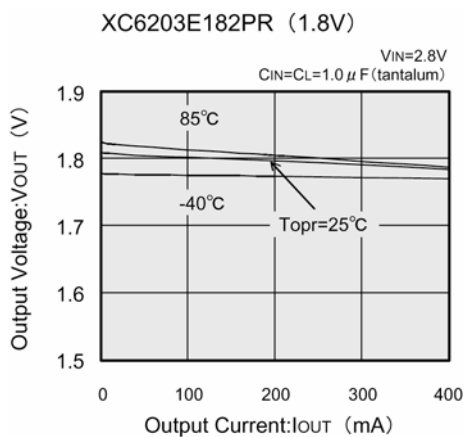
TYPICAL APPLICATION CIRCUIT



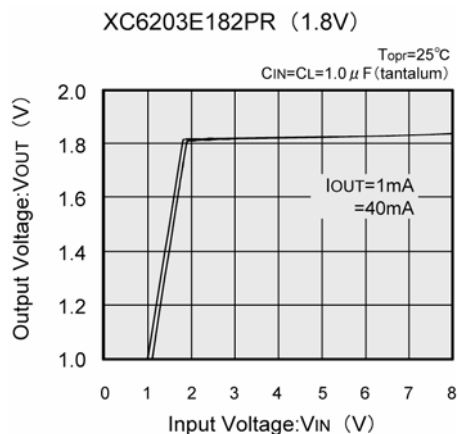
TYPICAL PERFORMANCE CHARACTERISTICS

XC6203P182

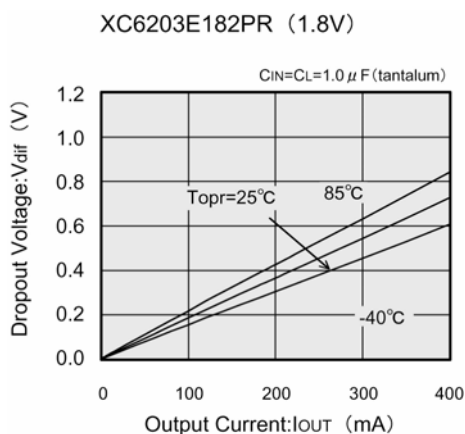
(1) Output Voltage vs. Output Current



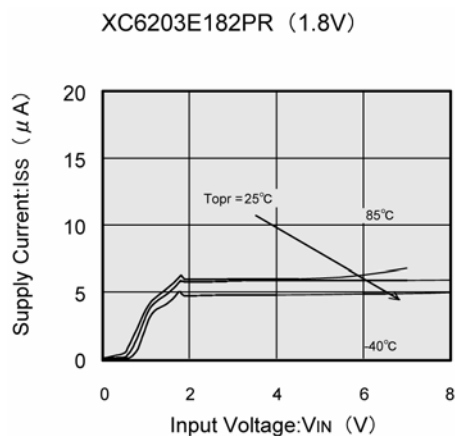
(2) Output Voltage vs. Input Voltage



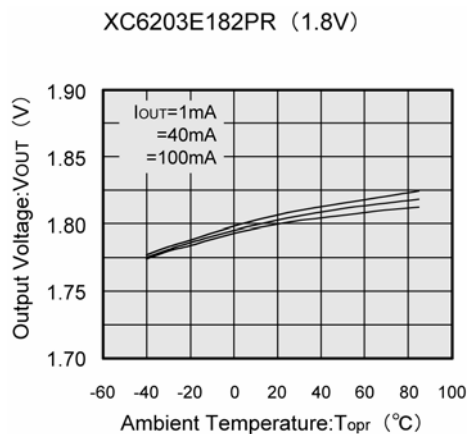
(3) Dropout Voltage vs. Output Current



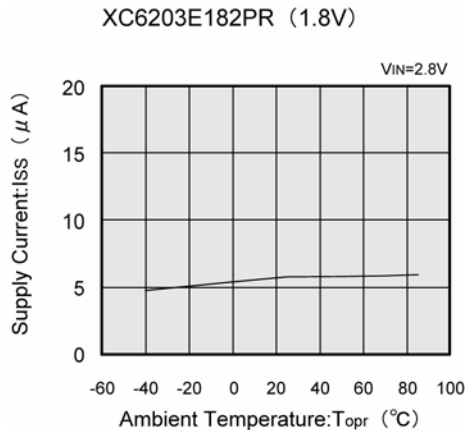
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



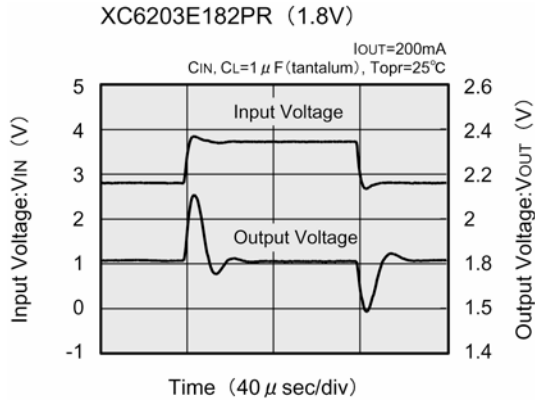
(6) Supply Current vs. Ambient Temperature



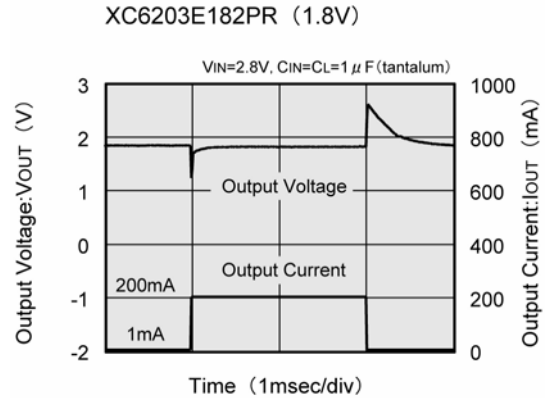
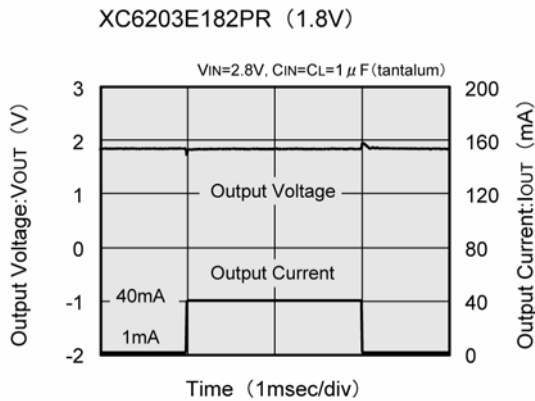
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203P182 (Continued)

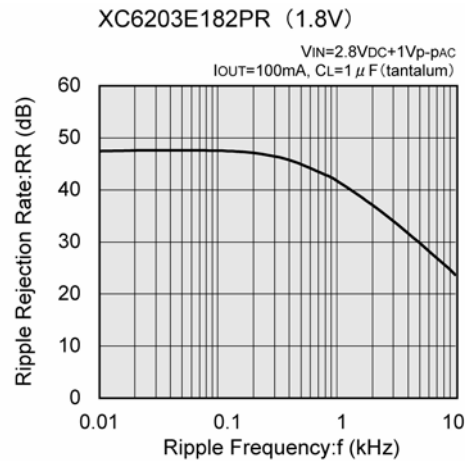
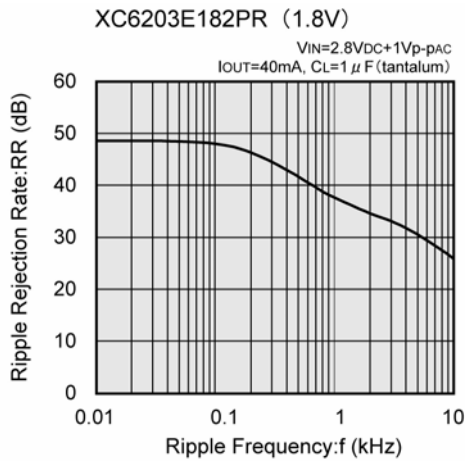
(7) Input Transient Response



(8) Load Transient Response



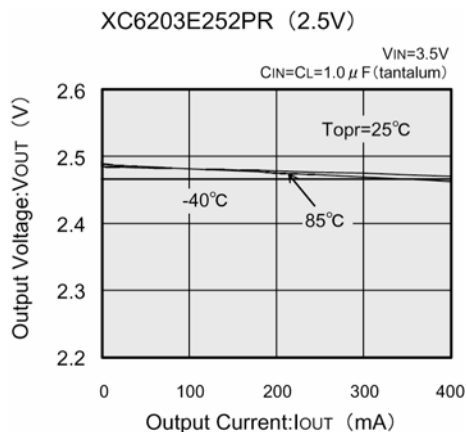
(9) Ripple Rejection Rate



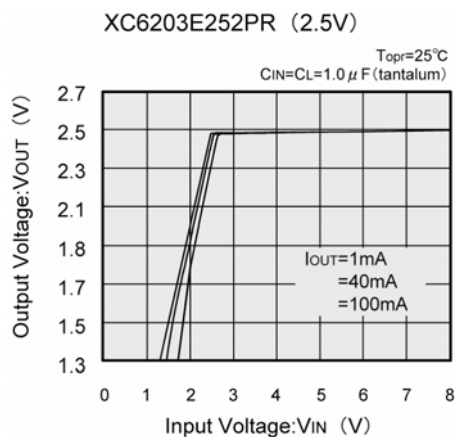
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E252PR

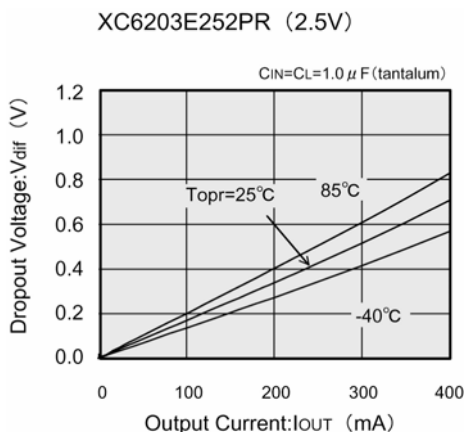
(1) Output Voltage vs. Output Current



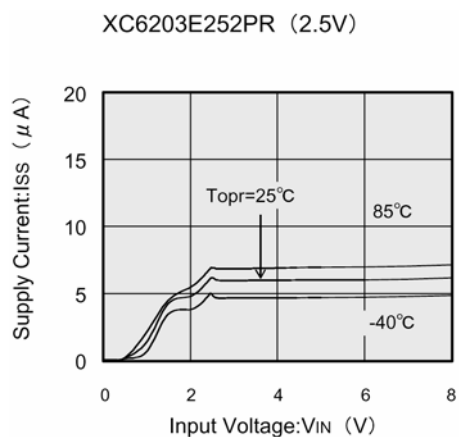
(2) Output Voltage vs. Input Voltage



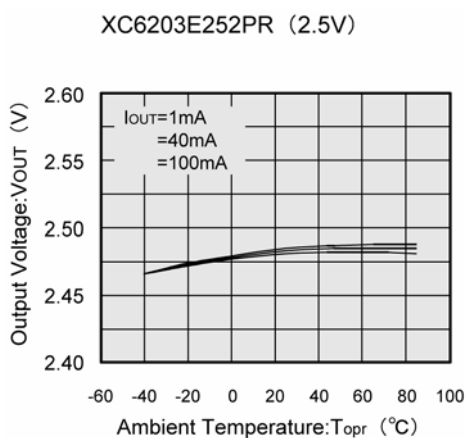
(3) Dropout Voltage vs. Output Current



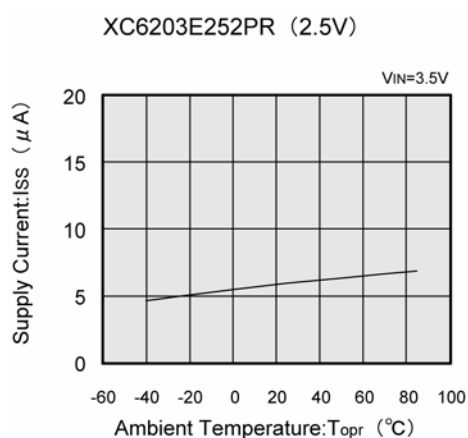
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



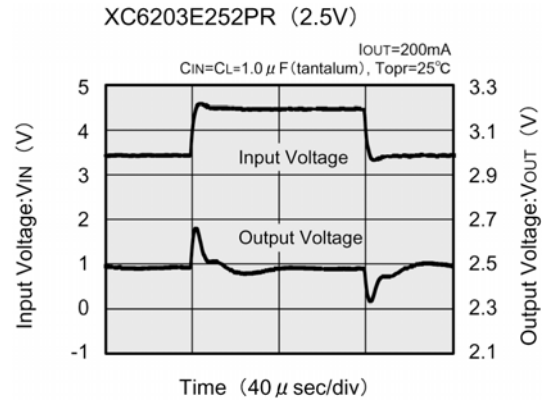
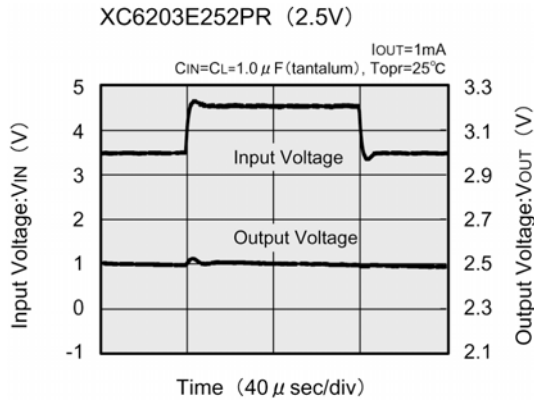
(6) Supply Current vs. Ambient Temperature



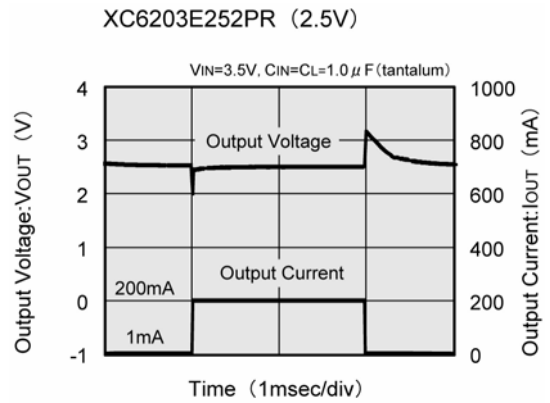
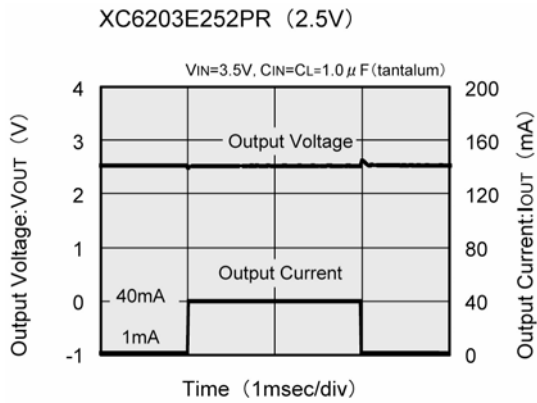
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E252PR (Continued)

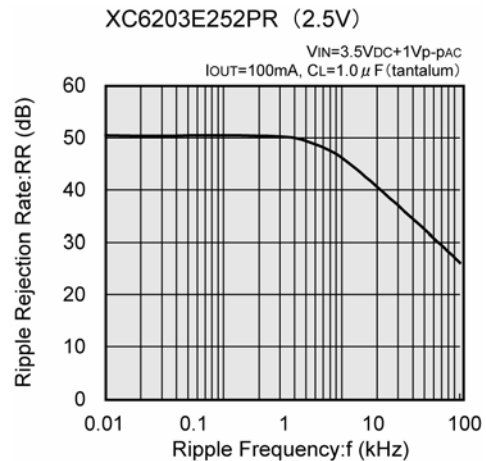
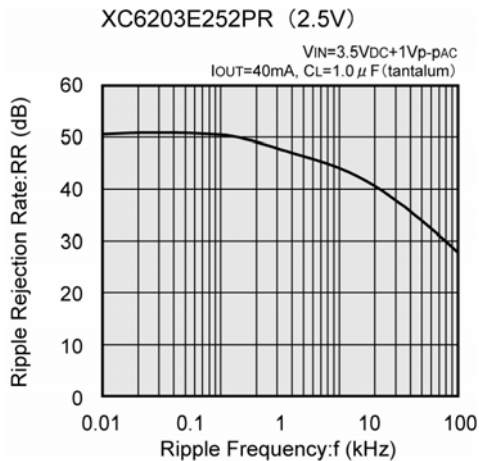
(7) Input Transient Response



(8) Load Transient Response



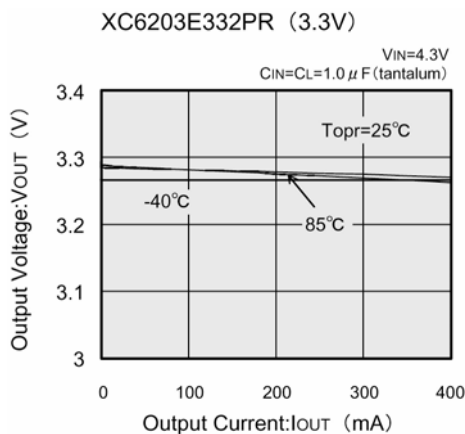
(9) Ripple Rejection Rate



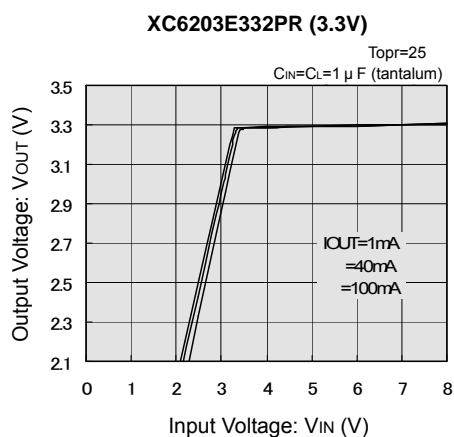
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E332PR

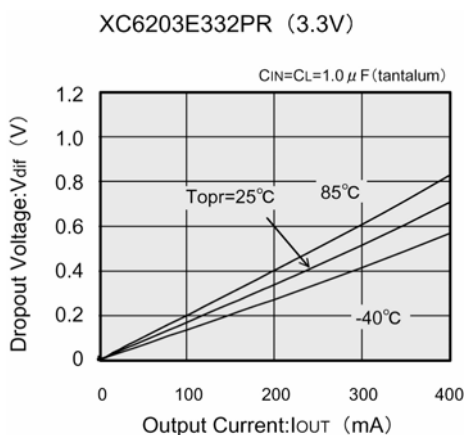
(1) Output Voltage vs. Output Current



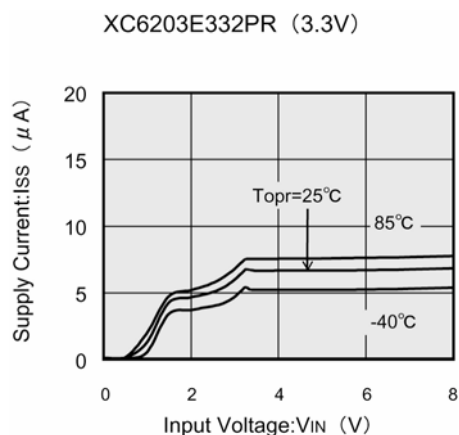
(2) Output Voltage vs. Input Voltage



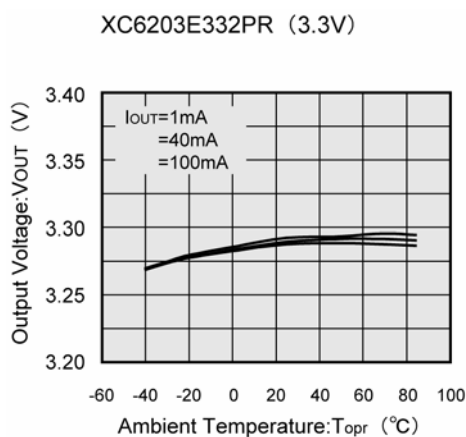
(3) Dropout Voltage vs. Output Current



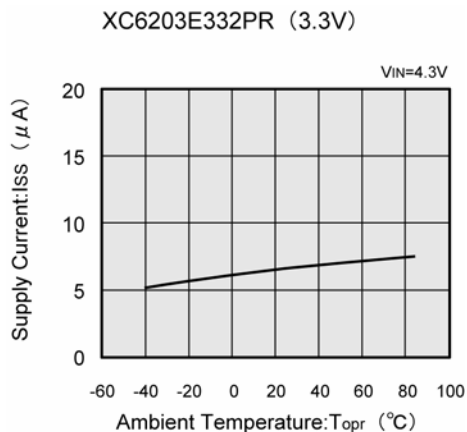
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



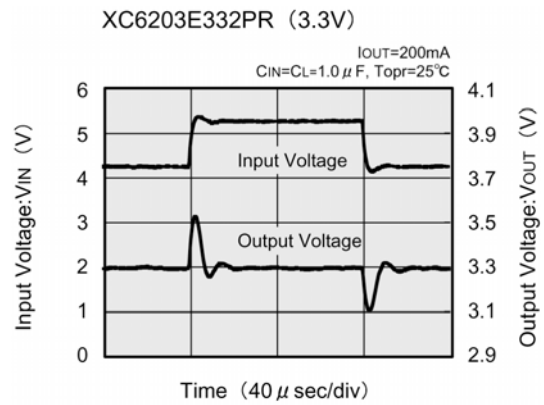
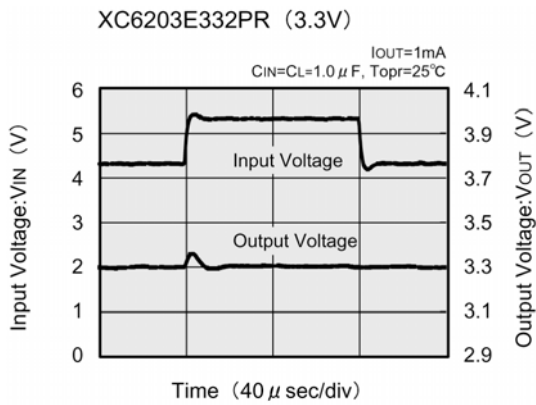
(6) Supply Current vs. Ambient Temperature



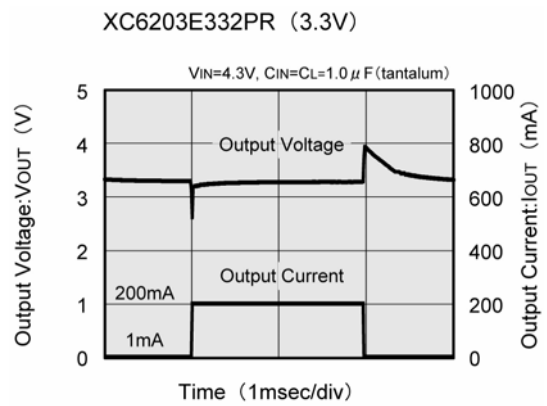
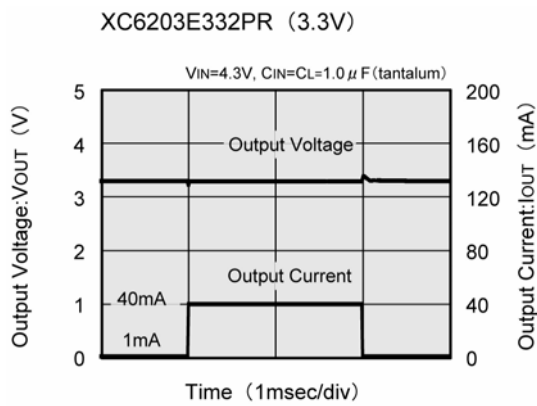
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E332PR (Continued)

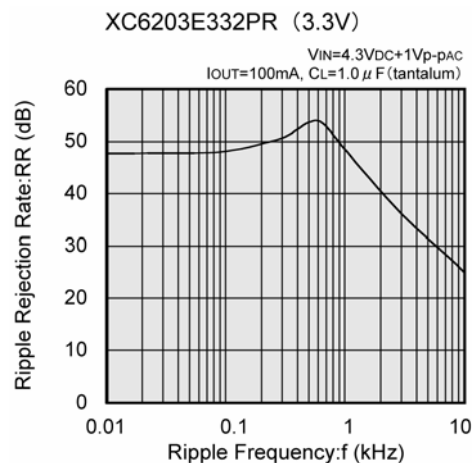
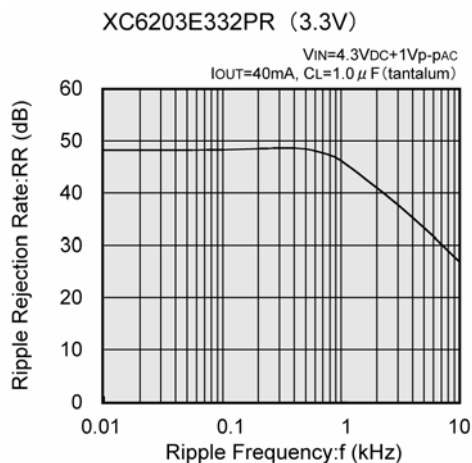
(7) Input Transient Response



(8) Load Transient Response



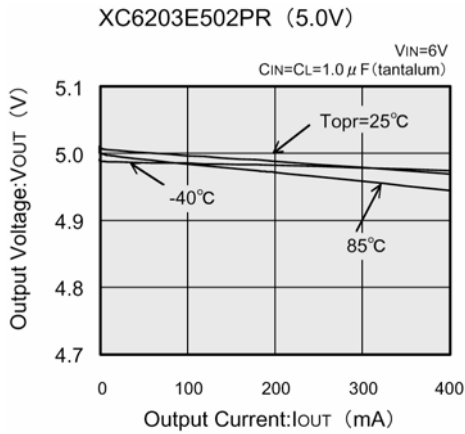
(9) Ripple Rejection Rate



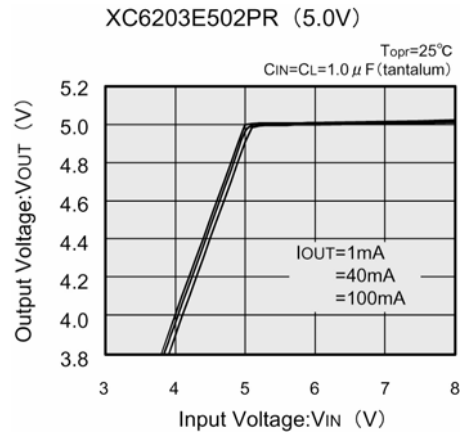
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E502PR

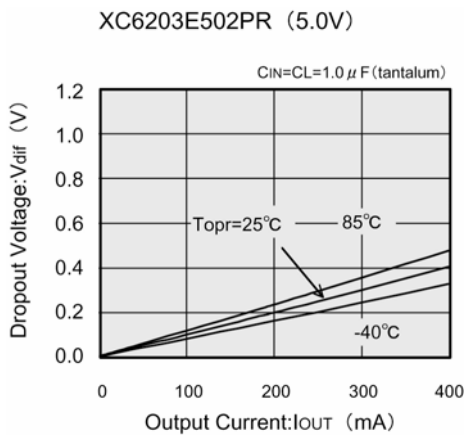
(1) Output Voltage vs. Output Current



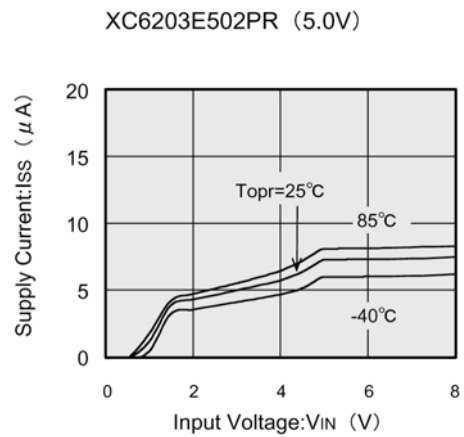
(2) Output Voltage vs. Input Voltage



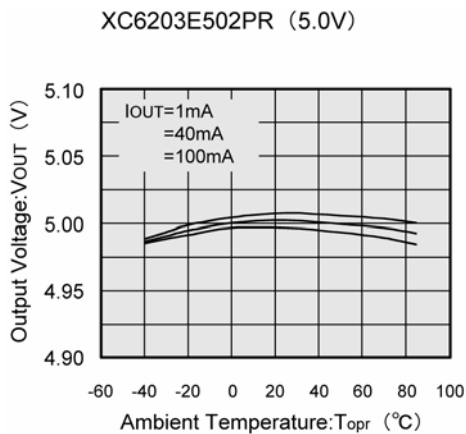
(3) Dropout Voltage vs. Output Current



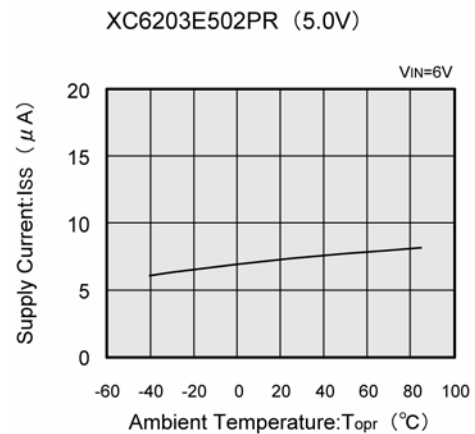
(4) Supply Current vs. Input Voltage



(5) Output Voltage vs. Ambient Temperature



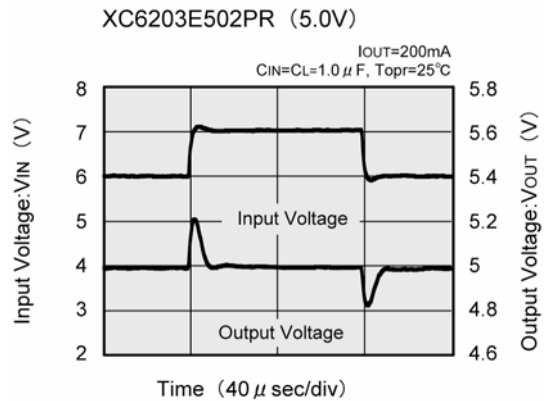
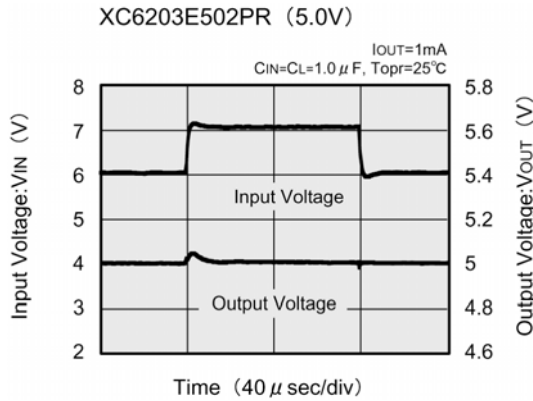
(6) Supply Current vs. Ambient Temperature



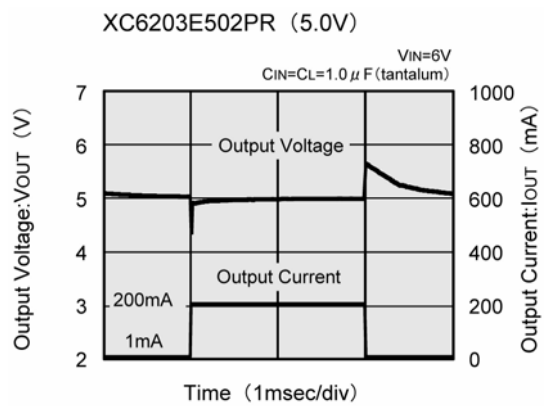
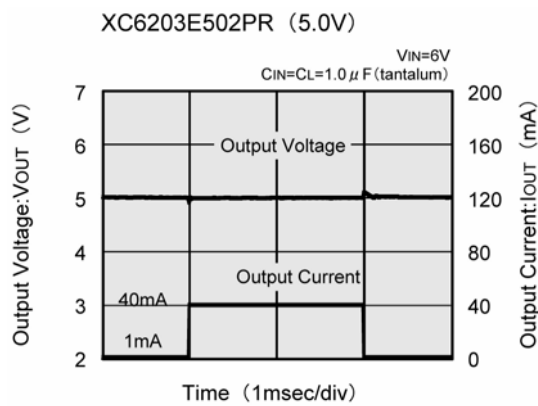
TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

XC6203E502PR (Continued)

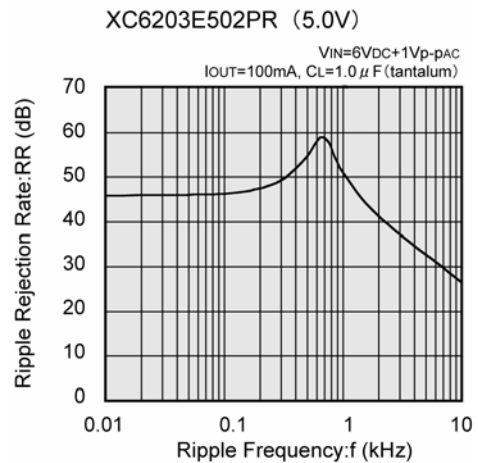
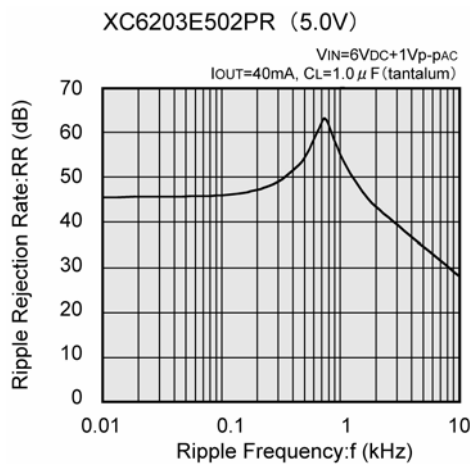
(7) Input Transient Response



(8) Load Transient Response



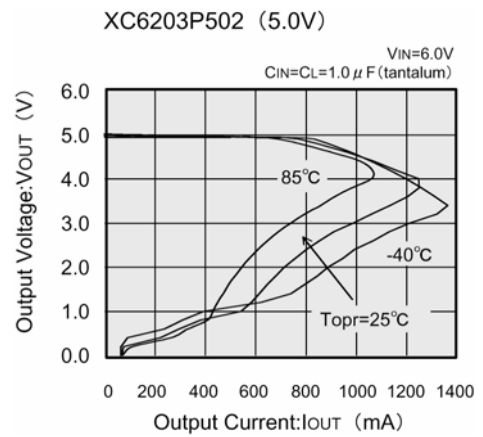
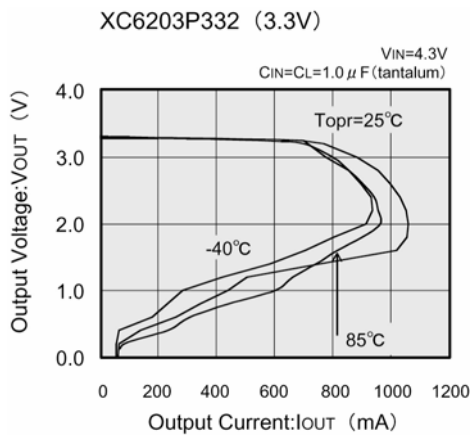
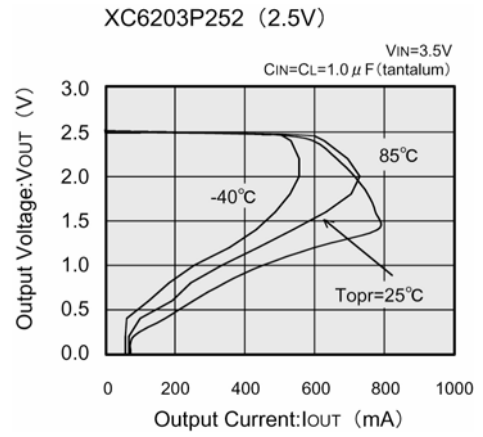
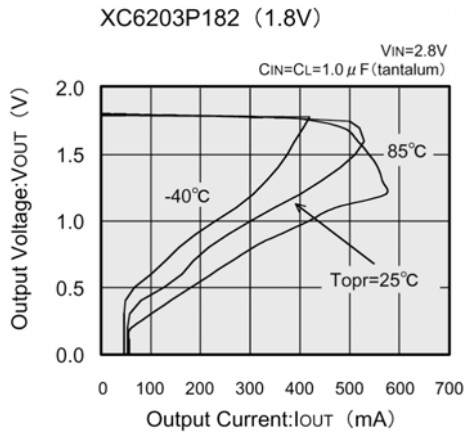
(9) Ripple Rejection Rate



TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

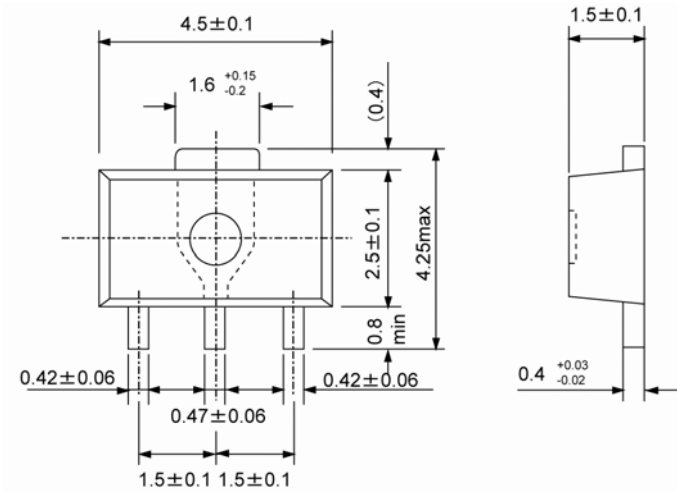
XC6203E502PR (Continued)

(10) Output Voltage vs. Output Current

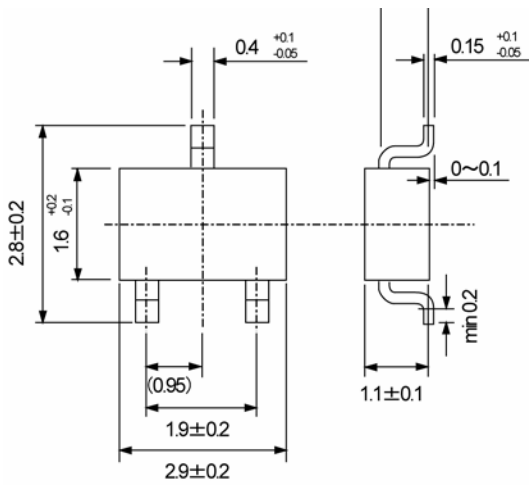


PACKAGING INFORMATION

SOT-89

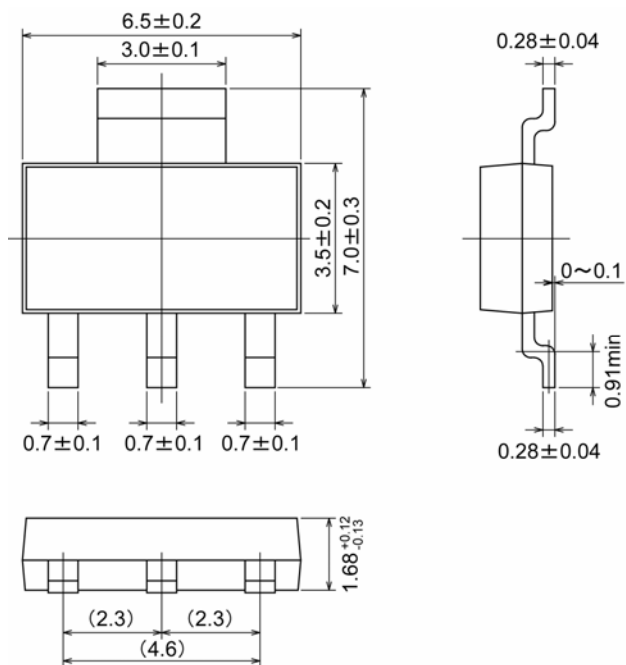


SOT-23

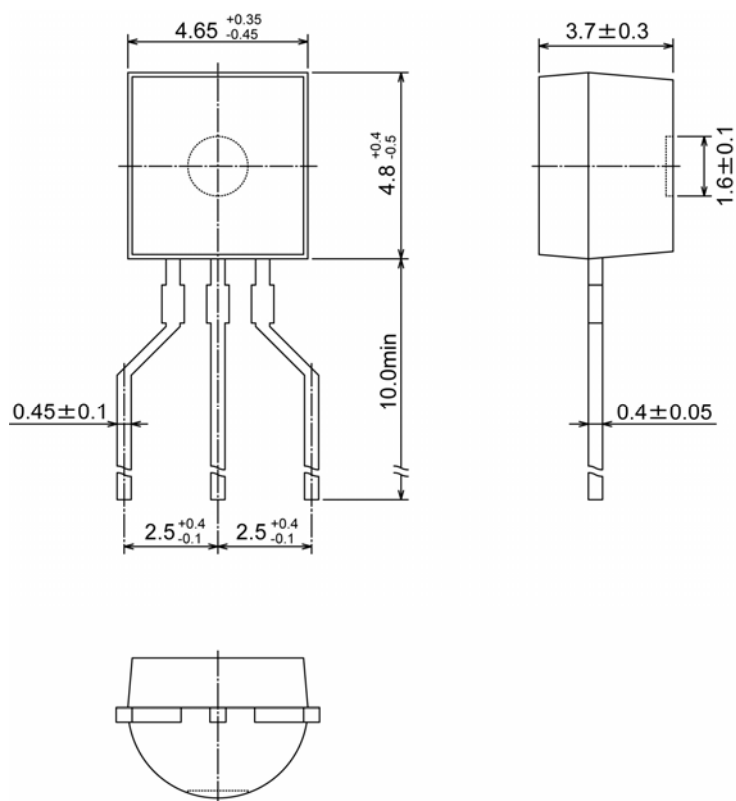


PACKAGING INFORMATION (Continued)

SOT-223

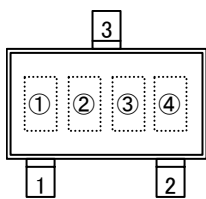


TO-92

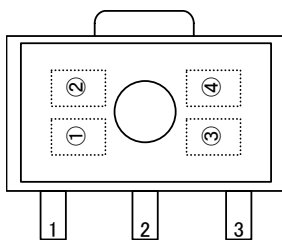


MARKING RULE

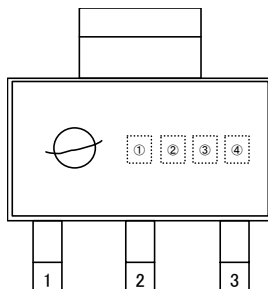
SOT-23, SOT-89, SOT-223



SOT-23
(TOP VIEW)



SOT-89
(TOP VIEW)



SOT-223
(TOP VIEW)

Represents product series

MARK	PRODUCT SERIES
3	XC6203xxxx

Represents type of regulator

MARK			PRODUCT SERIES
VOLTAGE=0.1 ~ 3.0V	VOLTAGE=3.1 ~ 6.0V	VOLTAGE=2.85V	
5	6	7	XC6203Pxxxx
2	3	4	XC6203Exxxxx

Represents output voltage

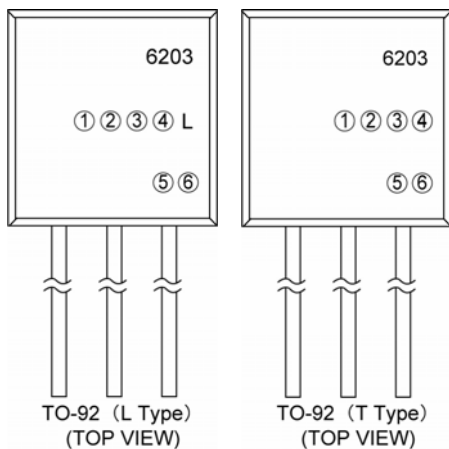
MARK	OUTPUT VOLTAGE (V)			MARK	OUTPUT VOLTAGE (V)		
0	-	3.1	-	F	-	4.6	-
1	-	3.2	-	H	-	4.7	-
2	-	3.3	-	K	1.8	4.8	-
3	-	3.4	-	L	1.9	4.9	-
4	-	3.5	-	M	2.0	5.0	-
5	-	3.6	-	N	2.1	5.1	-
6	-	3.7	-	P	2.2	5.2	-
7	-	3.8	-	R	2.3	5.3	-
8	-	3.9	-	S	2.4	5.4	-
9	-	4.0	-	T	2.5	5.5	-
A	-	4.1	-	U	2.6	5.6	-
B	-	4.2	-	V	2.7	5.7	-
C	-	4.3	-	X	2.8	5.8	2.85
D	-	4.4	-	Y	2.9	5.9	-
E	-	4.5	-	Z	3.0	6.0	-

Represents production lot number

0 ~ 9, A to Z or inverted characters of 0 to 9 and A to Z repeated (G, I, J, O, Q, W excepted)

MARKING RULE (Continued)

TO-92



Represents type of regulator

MARK	PRODUCT SERIES
P	XC6203Pxxxxx
E	XC6203Exxxxx

Represents output voltage and voltage accuracy

MARK			VOLTAGE (V)	VOLTAGE ACCURACY (%)	PRODUCT SERIES
3	3	2	3.3	± 2	XC6203x332xx
5	0	1	5.0	± 1	XC6203x501xx
2	8	A	2.85	± 2	XC6203x28Axx

Represents least significant digit of the production year

MARK	PRODUCTION SERIES
3	2003
4	2004

Represents production lot number

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

Note: No character inversion used

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