XC6203 Series

(Large Current) Positive Voltage Regulators

TOREX

- ◆CMOS Low Power Consumption (16μA max)
- ◆Dropout Voltage : 150mV @ 100mA,
  300mV @ 200mA
- ◆Maximum Output Current
  : more than 400mA (3.3V)
- ◆Highly Accurate : ± 2%
- ◆SOT-89 / SOT-223 / TO-92 Package

■General Description

The XC6203E 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 XC6203E consists of a driver transistor, a precision reference voltage and an error amplifier. Output voltage is selectable in 0.1V steps between a voltage of 1.8V and 6.0V.

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

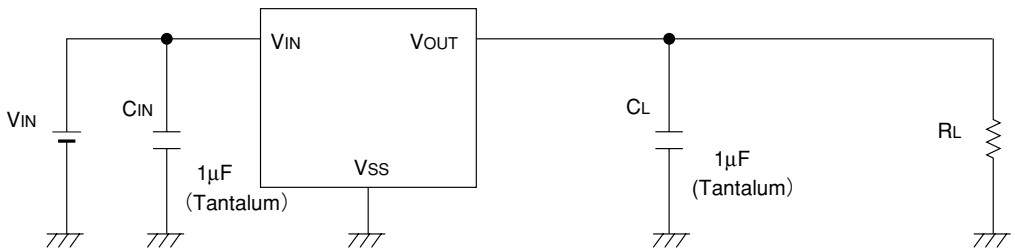
■Applications

- ●Battery Powered Equipment
- ●Reference Voltage Sources
- ●Cameras, Video Cameras
- ●CD-ROMs, DVDs
- ●Palmtops
- ●Portable Audio Video Equipment

■Features

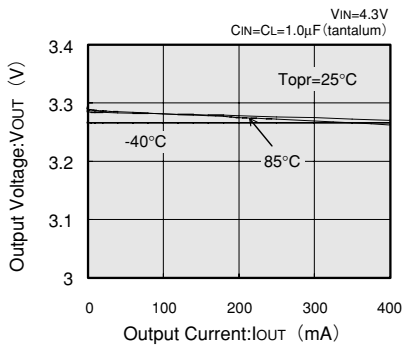
Maximum Output Current	: 400mA
Maximum Operating Voltage	: 8V
Output Voltage Range	: 1.8V ~ 6.0V (selectable in 0.1V steps)
Highly Accurate	: ± 2%
Low Power Consumption	: TYP 8.0 μA
Output Voltage Temperature Characteristics	: TYP ±100ppm/°C
Operational Temperature Range	: -40°C ~ 85°C
Ultra Small Packages	: SOT-89, SOT223, TO-92

■Typical Application Circuit

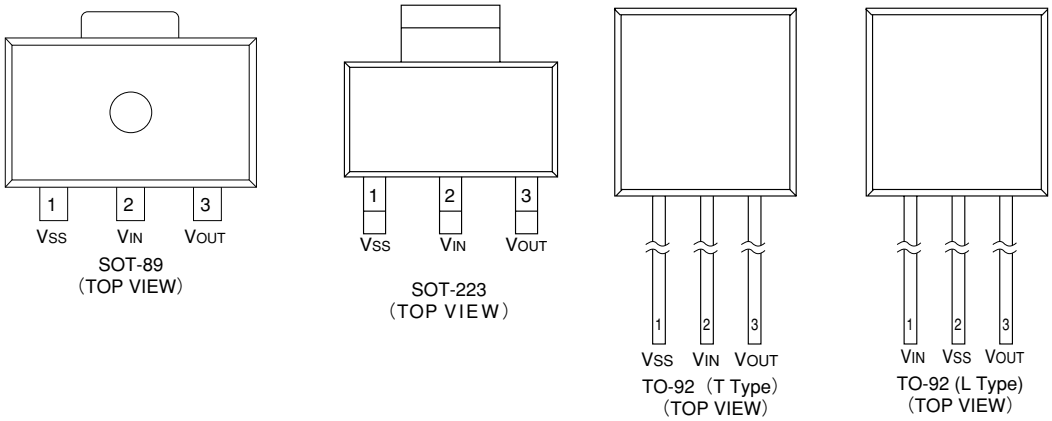


■Typical Performance Characteristic

XC6203E332PR (3.3V)



■Pin Configuration



■Pin Assignment

PIN NUMBER		PIN NAME	FUNCTION
SOT-89/SOT223/TO-92 (T)	TO-92 (L)		
1	2	VSS	Ground
2	1	VIN	Power Input
3	3	VOUT	Output

■Product Classification

●Ordering Information

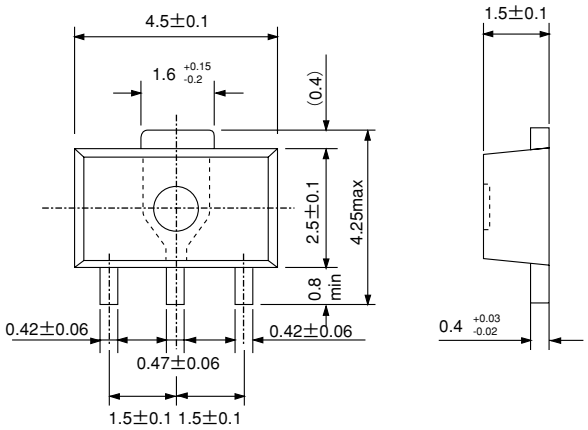
XC6203 ①②③④⑤⑥

DESIGNATOR	SYMBOL	DESCRIPTION	DESIGNATOR	SYMBOL	DESCRIPTION
①	Type of Regulator		⑤	Package Type	
	P	Current limiter circuit built-in		P	SOT-89
				F	SOT-223
	E	No current limiter circuit built-in		T	TO-92 (Standard)
				L	TO-92 (Custom pin configuration)
②③④	18～60 & A	e.g. 252 : 2.5V, Accuracy ±2% 28A : 2.85V, Accuracy ±2%* "A" indicates voltage of 50mV steps	⑥	Device Orientation	
				R	Embossed Tape (Standard Feed)
				L	Embossed Tape (Reverse Feed)
				H	Paper Type (TO-92)
				B	Bag (TO-92)

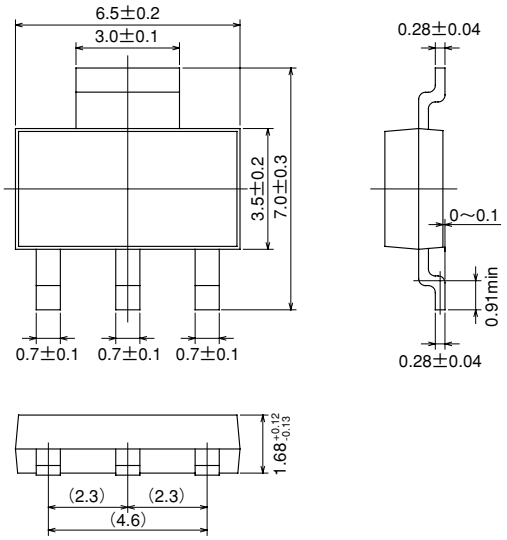
Note*: Output Voltage in 50mV steps is applied only for 2.85V type.
Accuracy of ±1% is available as custom-designed products.

■Packaging Information

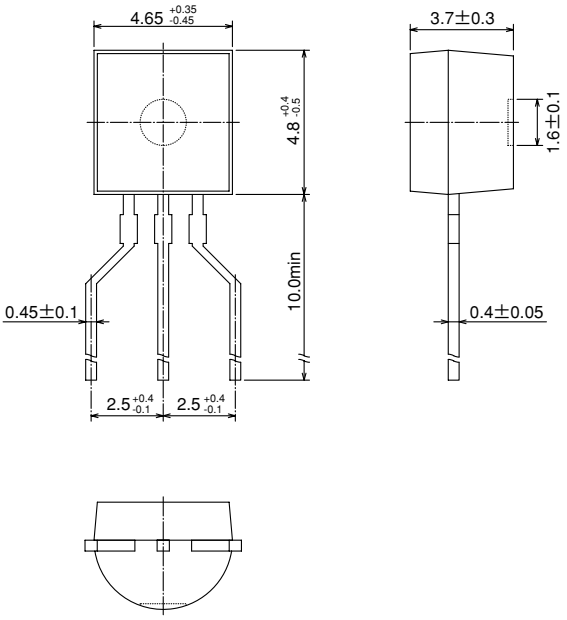
●SOT-89



●SOT-223

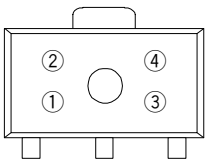


●TO-92

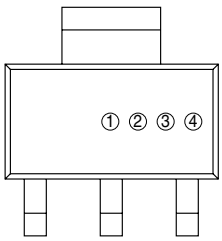

4.65 +0.35 -0.45
3.7±0.3
4.8 +0.4 -0.5
1.6±0.1
10.0min
0.45±0.1
0.4±0.05
2.5 +0.4 -0.1
2.5 +0.4 -0.1

■Marking

●SOT-89, SOT-223



SOT-89
(TOP VIEW)



SOT-223
(TOP VIEW)

① Represents the product name

DESIGNATOR	PRODUCT NAME
3	XC6203＊＊＊＊＊

② Represents the type of regulator

DESIGNATOR			PRODUCT NAME
VOLTAGE=0.1～3.0V	VOLTAGE=3.1～6.0V	VOLTAGE=2.85V	
5	6	7	XC6203P＊＊＊＊＊
2	3	4	XC6203E＊＊＊＊＊

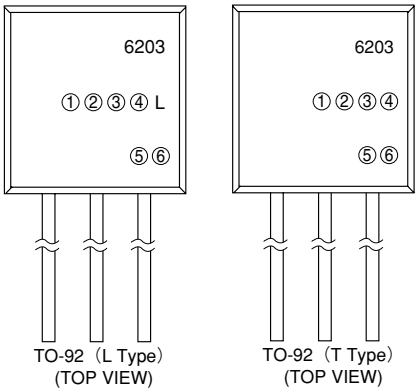
③ Represents the output voltage

DESIGNATOR	OUTPUT VOLTAGE（V）			DESIGNATOR	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	—

④ Denotes the production lot number

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

●TO-92



TO-92 (L Type)
(TOP VIEW)

TO-92 (T Type)
(TOP VIEW)

① Represents the type of regulator

DESIGNATOR	PRODUCT NAME
P	XC6203P*****
E	XC6203E*****

②③④ Represents the output voltage

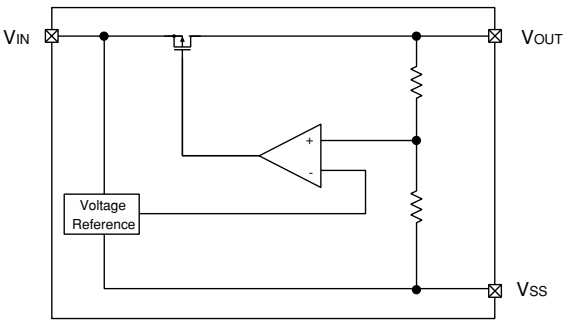
DESIGNATOR			VOLTAGE (V)	VOLTAGE ACCURACY(%)	PRODUCT NAME
②	③	④			
3	3	2	3.3	±2	XC6203*33***
5	0	2	5.0	±2	XC6203*50***
2	8	A	2.85	±2	XC6203*28A**

⑤ Represents a least significant digit of the produced year

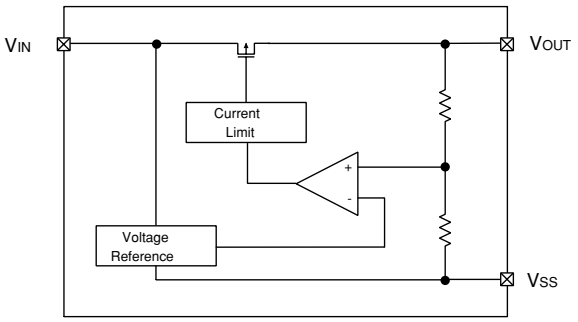
DESIGNATOR	PRODUCED YEAR
0	2000
1	2001

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



XC6203E



XC6203P

■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-89	Pd	500	mW
	SOT-223		1,200 (NOTE)	
	TO-92		300	
Operating Ambient Temperature		Topr	−40～+85	°C
Storage Temperature		Tstg	−40～+125	°C

Note: Circuits board mounting : Double-sided board

■Electrical Characteristics

XC6203X182 VOUT(T)=1.8V (Note 1) Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT(E) (Note2)	VIN=2.8V IOUT=40mA	1.764	1.800	1.836	V
Maximum Output Current	IOUTmax	VIN=2.8V VOUT≥VOUT(E)×0.90	400			mA
Load Regulation	ΔVOUT	VIN=2.8V 1mA≤IOUT≤200mA		40	100	mV
Dropout Voltage (Note3)	Vdif1	IOUT=100mA		200	300	mV
	Vdif2	IOUT=200mA		400	600	
Supply Current	ISS	VIN=2.8V		8.0	16.0	μA
Line Regulation	$\frac{\Delta VOUT}{\Delta VIN \cdot \Delta VOUT}$	IOUT=40mA 2.8V≤VIN≤8.0V		0.2	0.3	%/V
Input Voltage	VIN				8	V
Output Voltage Temperature Characteristics	$\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$	IOUT=40mA -40°C≤Topr≤85°C		±100		ppm/°C
Short Circuit Current (XC6203P Series Only)	Ilim	VIN=2.8V VOUT=0V		60		mA

XC6203X252 VOUT(T)=2.5V (Note 1) Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT(E) (Note2)	VIN=3.5V IOUT=40mA	2.450	2.500	2.550	V
Maximum Output Current	IOUTmax	VIN=3.5V VOUT>VOUT(E)×0.93	400			mA
Load Regulation	ΔVOUT	VIN=3.5V 1mA≤IOUT≤200mA		40	100	mV
Dropout Voltage (Note3)	Vdif1	IOUT=100mA		170	250	mV
	Vdif2	IOUT=200mA		320	500	
Supply Current	ISS	VIN=3.5V		8.0	16.0	μA
Line Regulation	$\frac{\Delta VOUT}{\Delta VIN \cdot \Delta VOUT}$	IOUT=40mA 3.5V≤VIN≤8.0V		0.2	0.3	%/V
Input Voltage	VIN				8	V
Output Voltage Temperature Characteristics	$\frac{\Delta VOUT}{\Delta Topr \cdot VOUT}$	IOUT=40mA -40°C≤Topr≤85°C		±100		ppm/°C
Short Circuit Current (XC6203P Series Only)	Ilim	VIN=3.5V VOUT=0V		60		mA

XC6203X302 VOUT(T)=3.0V (Note 1) Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT(E) (Note2)	VIN=4V IOUT=40mA	2.940	3.000	3.060	V
Maximum Output Current	IOUTmax	VIN=4V VOUT≥VOUT(E)×0.96	400			mA
Load Regulation	ΔVOUT	VIN=4V 1mA≤IOUT≤200mA		40	100	mV
Dropout Voltage (Note3)	Vdif1	IOUT=100mA		150	220	mV
	Vdif2	IOUT=200mA		300	420	
Supply Current	ISS	VIN=4V		8.0	16.0	μA
Line Regulation	ΔVOUT / ΔVIN・ΔVOUT	IOUT=40mA 4V≤VIN≤8.0V		0.2	0.3	%/V
Input Voltage	VIN				8	V
Output Voltage Temperature Characteristics	ΔVOUT / ΔTopr・VOUT	IOUT=40mA -40°C≤Topr≤85°C		±100		ppm /°C
Short Circuit Current (XC6203P Series Only)	Ilim	VIN=4V VOUT=0V		60		mA

XC6203X332 VOUT(T)=3.3V (Note 1) Ta=25°C

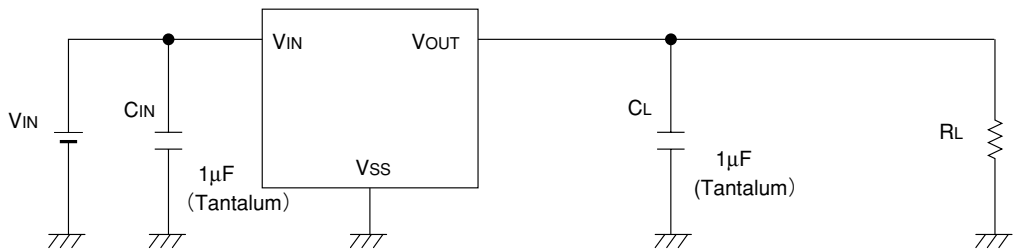
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT(E) (Note2)	VIN=4.3V IOUT=40mA	3.234	3.300	3.366	V
Maximum Output Current	IOUTmax	VIN=4.3V VOUT≥VOUT(E)×0.96	400			mA
Load Regulation	ΔVOUT	VIN=4.3V 1mA≤IOUT≤200mA		40	100	mV
Dropout Voltage (Note3)	Vdif1	IOUT=100mA		150	220	mV
	Vdif2	IOUT=200mA		300	420	
Supply Current	ISS	VIN=4.3V		8.0	16.0	μA
Line Regulation	ΔVOUT / ΔVIN・ΔVOUT	IOUT=40mA 4.3V≤VIN≤8.0V		0.2	0.3	%/V
Input Voltage	VIN				8	V
Output Voltage Temperature Characteristics	ΔVOUT / ΔTopr・VOUT	IOUT=40mA -40°C≤Topr≤85°C		±100		ppm /°C
Short Circuit Current (XC6203P Series Only)	Ilim	VIN=4.3V VOUT=0V		60		mA

XC6203X502 $V_{OUT}(T)$=5.0V (Note 1) Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$ (Note2)	V_{IN}=6.0V I_{OUT}=40mA	4.900	5.000	5.100	V
Maximum Output Current	I_{OUT}max	V_{IN}=6.0V $V_{OUT} \geq V_{OUT}(E) \times 0.96$	400			mA
Load Regulation	ΔV_{OUT}	V_{IN}=6.0V 1mA≤I_{OUT}≤200mA		40	100	mV
Dropout Voltage (Note3)	Vdif1	I_{OUT}=100mA		100	180	mV
	Vdif2	I_{OUT}=200mA		200	320	
Supply Current	I_{SS}	V_{IN}=6.0V		10.0	20.0	μA
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot \Delta V_{OUT}}$	I_{OUT}=40mA 6.0V≤V_{IN}≤8.0V		0.2	0.3	%/V
Input Voltage	V_{IN}				8	V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta Topr \cdot V_{OUT}}$	I_{OUT}=40mA -40°C≤Topr≤85°C		±100		ppm /°C
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. Vdif = V_{IN1} - V_{OUT1}
4. V_{OUT1} = A voltage equal to 98% of the output voltage when "$V_{OUT}(T)$+1.0V" is input.e
5. V_{IN1} = The input voltage when V_{OUT1} is output following a gradual decrease in the input voltage.

■Typical Application Circuit

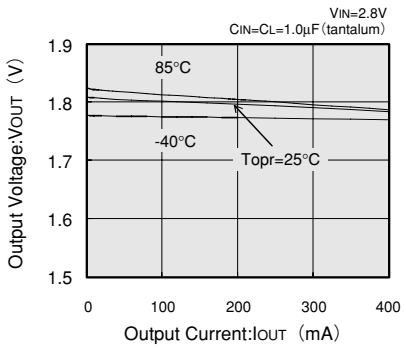


■Typical Performance Characteristics

●XC6203E182PR

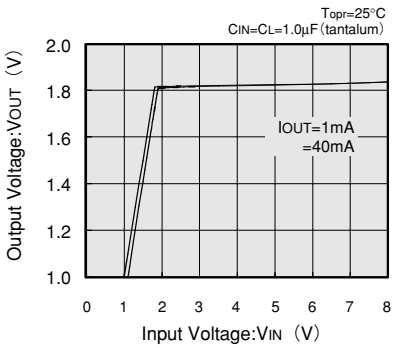
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

XC6203E182PR（1.8V）



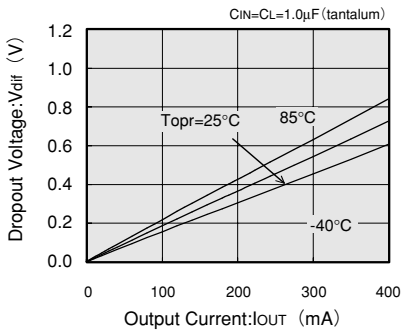
(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

XC6203E182PR（1.8V）



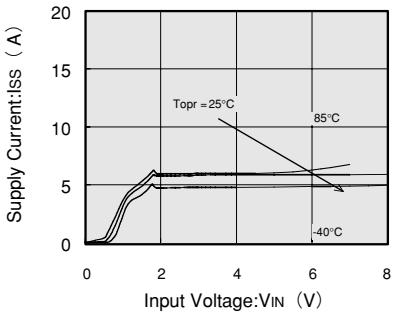
(3) DROPOUT VOLTAGE vs. OUTPUT CURRENT

XC6203E182PR（1.8V）



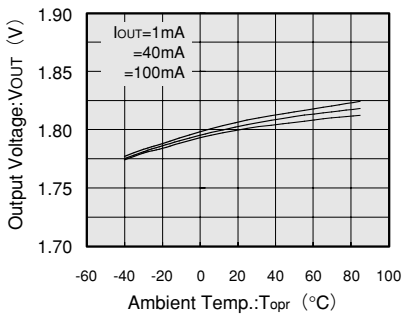
(4) SUPPLY CURRENT vs. INPUT VOLTAGE

XC6203E182PR（1.8V）



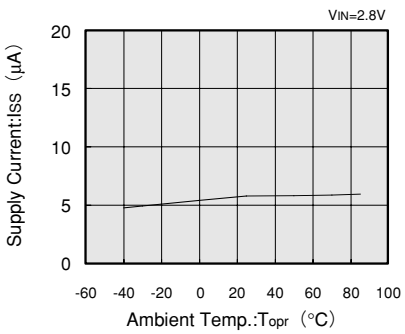
(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

XC6203E182PR（1.8V）



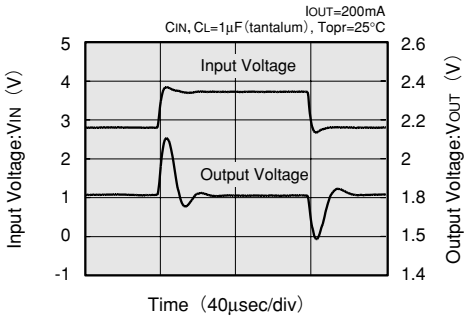
(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

XC6203E182PR（1.8V）



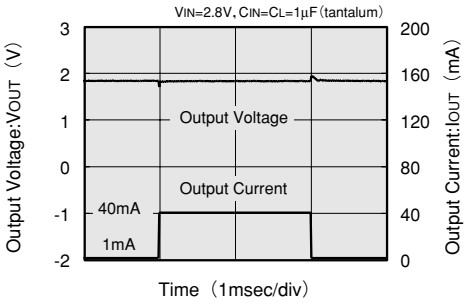
(7) INPUT TRANSIENT RESPONSE

XC6203E182PR（1.8V）

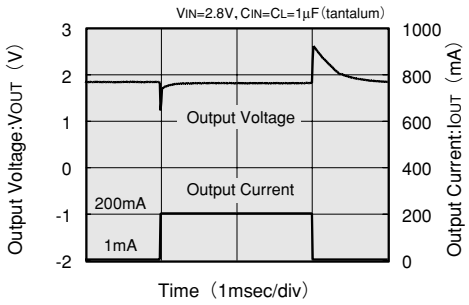


(8) LOAD TRANSIENT RESPONSE

XC6203E182PR（1.8V）

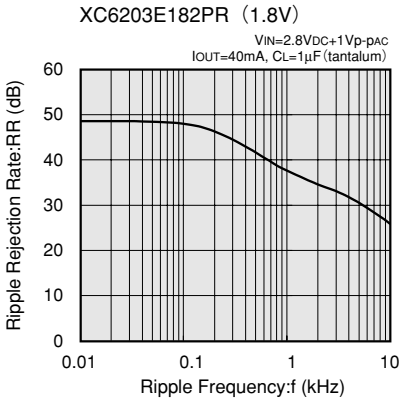


XC6203E182PR（1.8V）

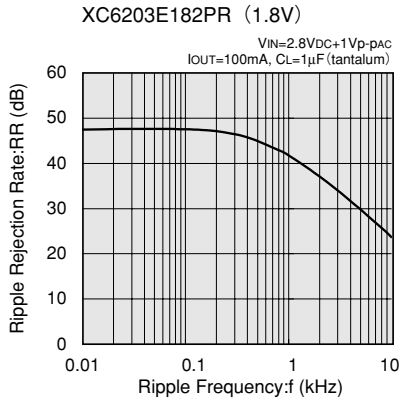


(9) RIPPLE REJECTION RATE

XC6203E182PR（1.8V）



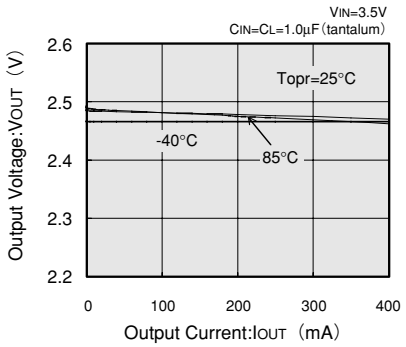
XC6203E182PR（1.8V）



●XC6203E252PR

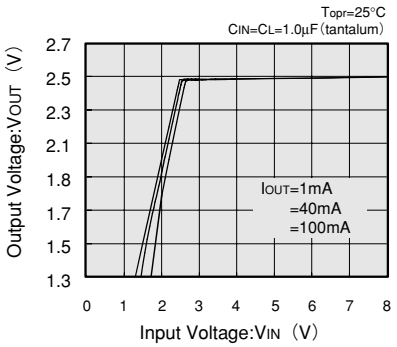
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

XC6203E252PR（2.5V）



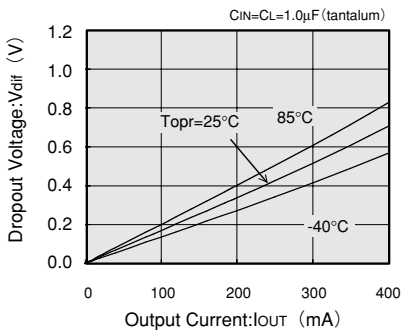
(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

XC6203E252PR（2.5V）



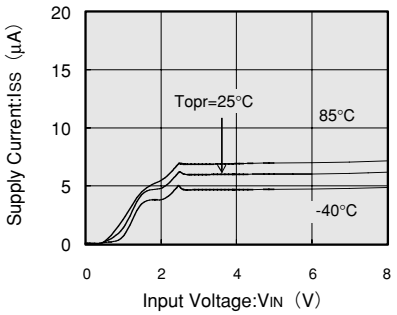
(3) DROPOUT VOLTAGE vs. OUTPUT CURRENT

XC6203E252PR（2.5V）



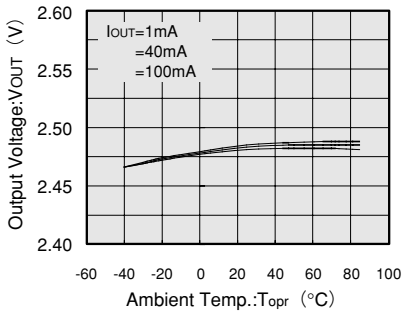
(4) SUPPLY CURRENT vs. INPUT VOLTAGE

XC6203E252PR（2.5V）



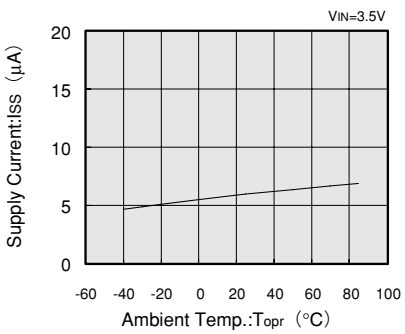
(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

XC6203E252PR（2.5V）



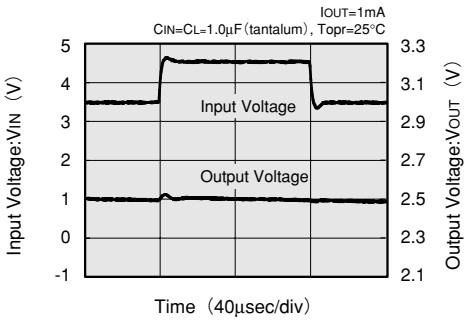
(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

XC6203E252PR（2.5V）

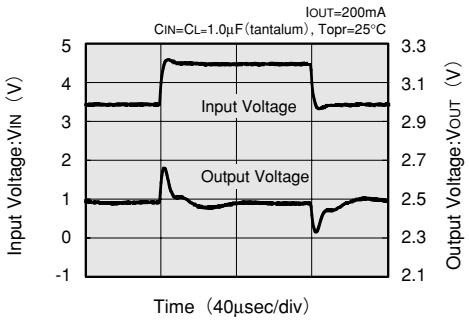


(7) INPUT TRANSIENT RESPONSE

XC6203E252PR（2.5V）



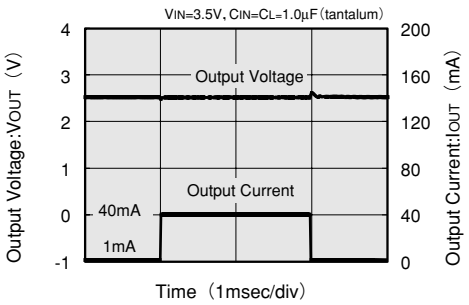
XC6203E252PR（2.5V）



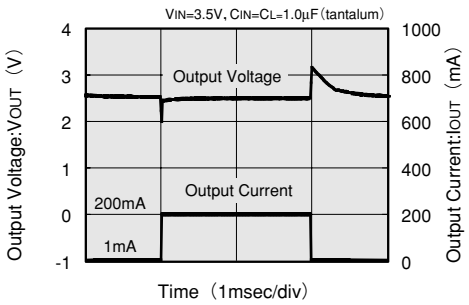
3

(8) LOAD TRANSIENT RESPONSE

XC6203E252PR（2.5V）

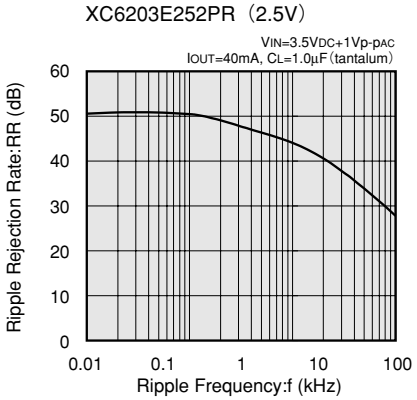


XC6203E252PR（2.5V）

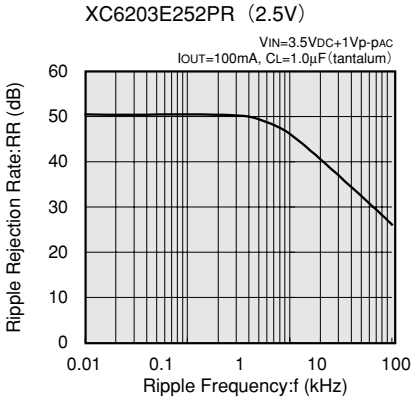


(9) RIPPLE REJECTION RATE

XC6203E252PR（2.5V）



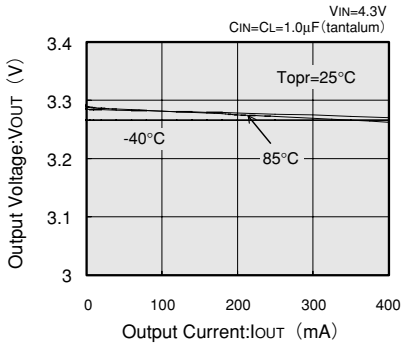
XC6203E252PR（2.5V）



●XC6203E332PR

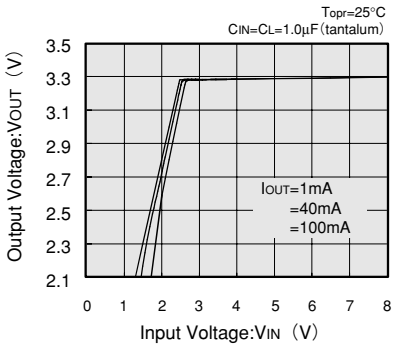
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

XC6203E332PR（3.3V）



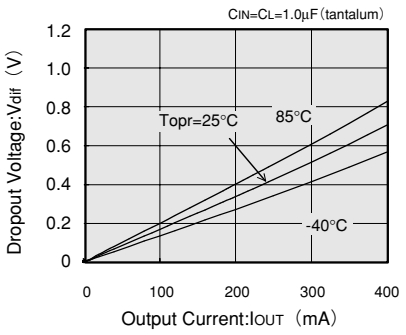
(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

XC6203E332PR（3.3V）



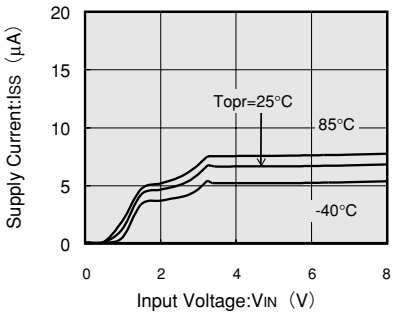
(3) DROPOUT VOLTAGE vs. OUTPUT CURRENT

XC6203E332PR（3.3V）



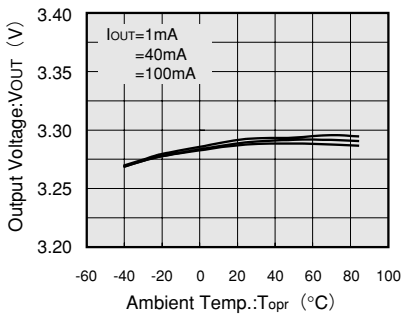
(4) SUPPLY CURRENT vs. INPUT VOLTAGE

XC6203E332PR（3.3V）



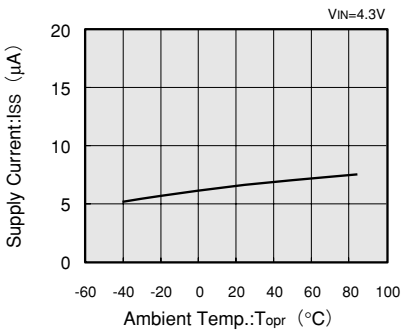
(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

XC6203E332PR（3.3V）



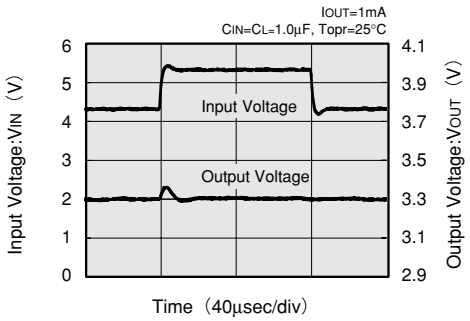
(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

XC6203E332PR（3.3V）

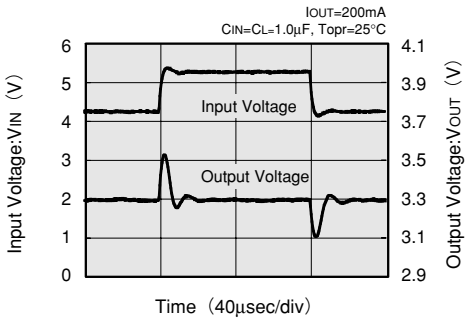


(7) INPUT TRANSIENT RESPONSE

XC6203E332PR（3.3V）

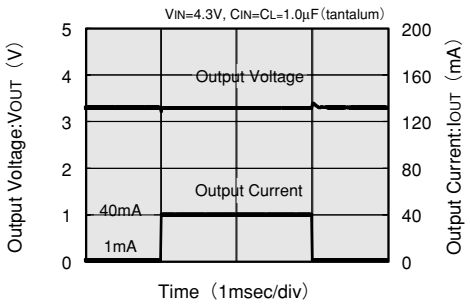


XC6203E332PR（3.3V）

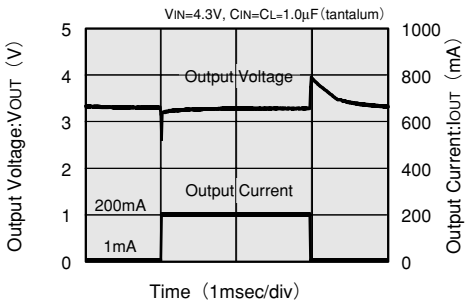


(8) LOAD TRANSIENT RESPONSE

XC6203E332PR（3.3V）

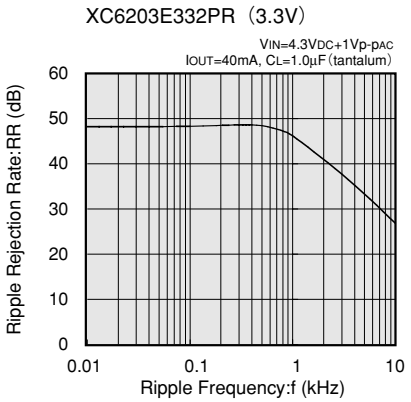


XC6203E332PR（3.3V）

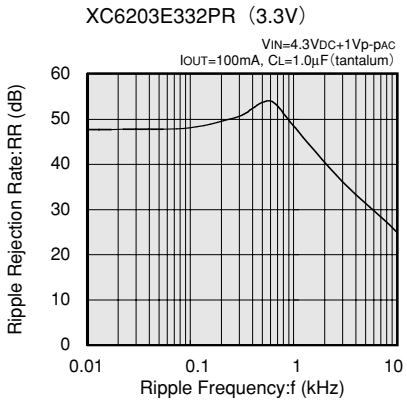


(9) RIPPLE REJECTION RATE

XC6203E332PR（3.3V）



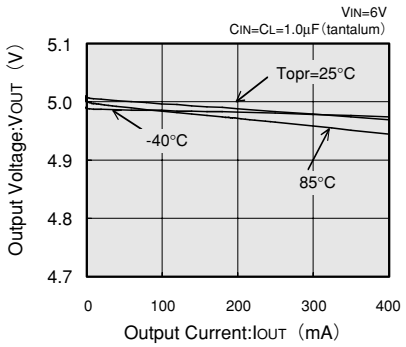
XC6203E332PR（3.3V）



●XC6203E502PR

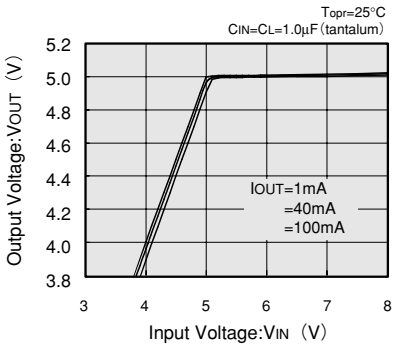
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

XC6203E502PR（5.0V）



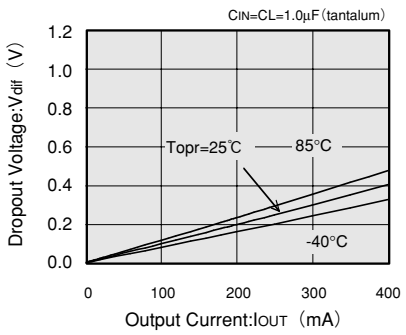
(2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

XC6203E502PR（5.0V）



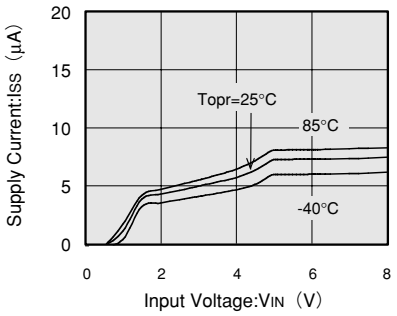
(3) DROPOUT VOLTAGE vs. OUTPUT CURRENT

XC6203E502PR（5.0V）



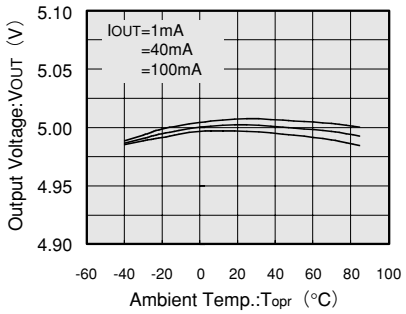
(4) SUPPLY CURRENT vs. INPUT VOLTAGE

XC6203E502PR（5.0V）



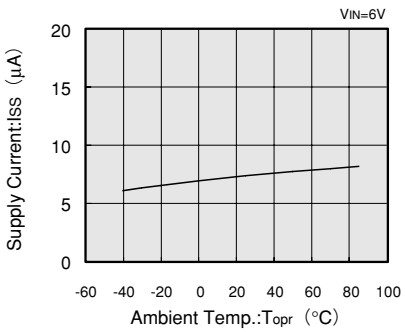
(5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

XC6203E502PR（5.0V）



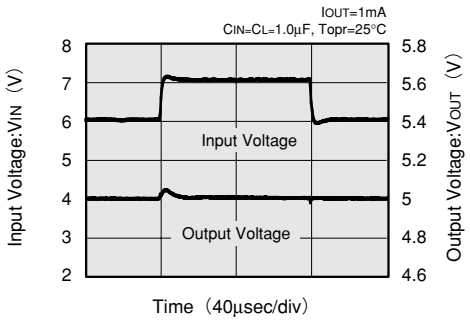
(6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE

XC6203E502PR（5.0V）

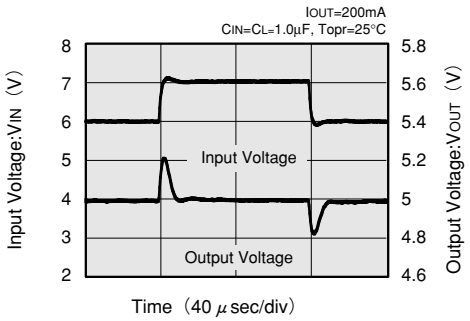


(7) INPUT TRANSIENT RESPONSE

XC6203E502PR（5.0V）

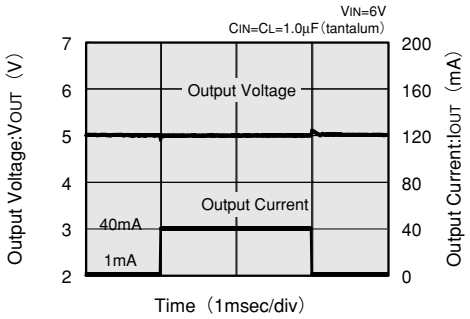


XC6203E502PR（5.0V）

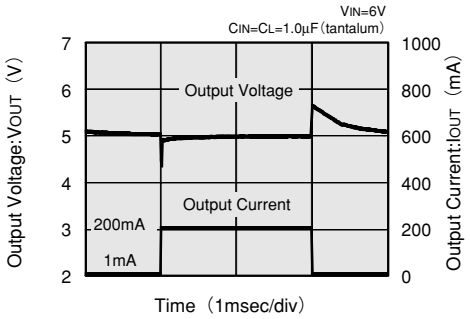


(8) LOAD TRANSIENT RESPONSE

XC6203E502PR（5.0V）

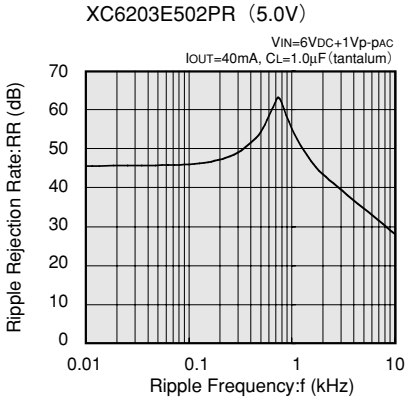


XC6203E502PR（5.0V）

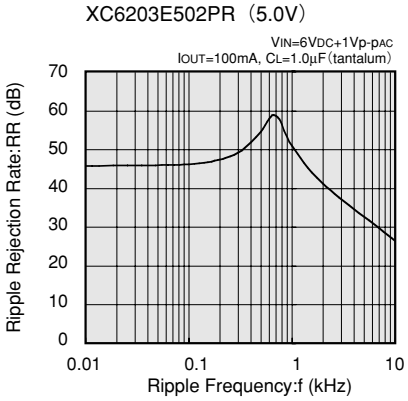


(9) RIPPLE REJECTION RATE

XC6203E502PR（5.0V）

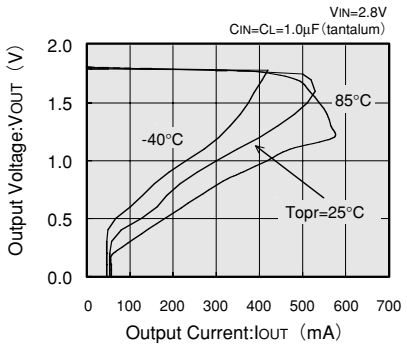


XC6203E502PR（5.0V）

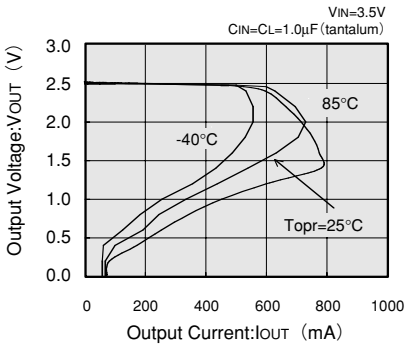


(10) OUTPUT VOLTAGE vs. OUTPUT CURRENT

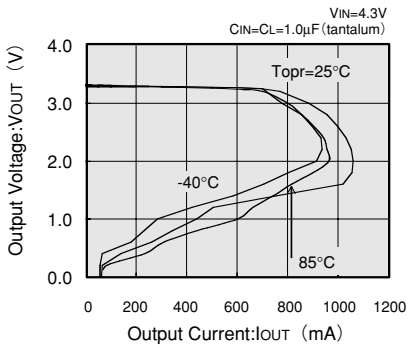
XC6203P182（1.8V）



XC6203P252（2.5V）



XC6203P332（3.3V）



XC6203P502（5.0V）