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## 150mA LDO REGULATOR

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NO.EA-105-111027

### OUTLINE

The R1180x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, extremely low supply current, and low ON-resistance. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit which prevents the destruction by excess current, and so on. The output voltage of these ICs is fixed with high accuracy. B version has a chip enable pin, therefore ultra-low consumption current standby mode can be realized with the pin.

Since the packages for these ICs are SOT-23-5 (R1180N Series), SC-82AB (R1180Q Series), and SON1612-6 (R1180D Series), therefore high density mounting of the ICs on boards is possible.

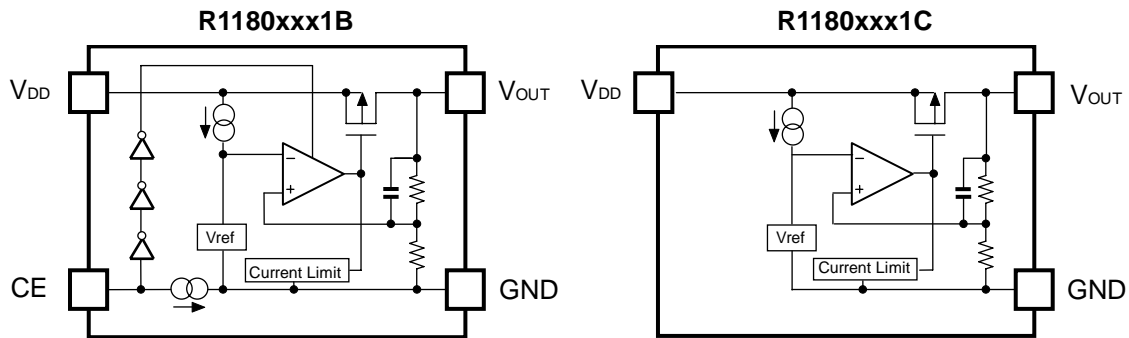
### FEATURES

- Supply Current ..... Typ. 1 $\mu$ A  
(Except the current through CE pull-down circuit)
- Standby Mode ..... Typ. 0.1 $\mu$ A
- Dropout Voltage ..... Typ. 0.25V ( $I_{OUT}=150\text{mA}$  3.0V Output type)
- Temperature-Drift Coefficient of Output Voltage ..... Typ.  $\pm 100\text{ppm}/^{\circ}\text{C}$
- Line Regulation ..... Typ. 0.05%/V
- Output Voltage Accuracy .....  $\pm 2.0\%$
- Packages ..... SON1612-6, SC-82AB, SOT-23-5
- Output Voltage Range ..... 1.2V to 3.6V (0.1V steps)  
(For other voltages, please refer to MARK INFORMATION.)
- Built-in Fold Back Protection Circuit ..... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC ..... 0.1 $\mu$ F

### APPLICATIONS

- Stable voltage reference.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.

## BLOCK DIAGRAMS



## SELECTION GUIDE

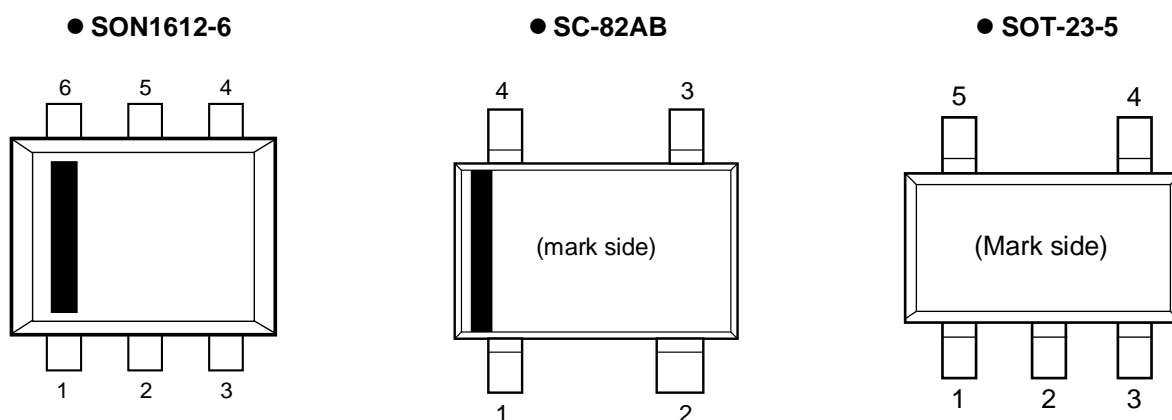
The output voltage, CE pin polarity, package, etc. for the ICs can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1180Dxx1*-TR-FE	SON1612-6	4,000 pcs	Yes	Yes
R1180Qxx1*-TR-FE	SC-82AB	3,000 pcs	Yes	Yes
R1180Nxx1*-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

xx: The output voltage can be designated in the range from 1.2V(12) to 3.6V(36) in 0.1V steps.  
(For other voltages, please refer to MARK INFORMATIONS.)

\* : CE pin polarity are options as follows.  
(B) "H" Active  
(C) without CE pin

## PIN CONFIGURATION



## PIN DESCRIPTIONS

### • SON1612-6

Pin No	Symbol	Pin Description
1	$V_{DD}$	Input Pin
2	GND	Ground Pin
3	$V_{OUT}$	Output pin
4	NC	No Connection
5	GND	Ground Pin
6	CE or NC	Chip Enable Pin or No Connection

### • SC-82AB

Pin No	Symbol	Pin Description
1	CE or NC	Chip Enable Pin or No Connection
2	GND	Ground Pin
3	$V_{OUT}$	Output pin
4	$V_{DD}$	Input Pin

### • SOT-23-5

Pin No	Symbol	Pin Description
1	$V_{DD}$	Input Pin
2	GND	Ground Pin
3	CE or NC	Chip Enable Pin or No Connection
4	NC	No Connection
5	$V_{OUT}$	Output pin

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
$V_{IN}$	Input Voltage	6.5	V
$V_{CE}$	Input Voltage (CE Pin)	6.5	V
$V_{OUT}$	Output Voltage	-0.3 to $V_{IN}+0.3$	V
$I_{OUT}$	Output Current	180	mA
$P_D$	Power Dissipation (SON1612-6)*	500	mW
	Power Dissipation (SC-82AB)*	380	
	Power Dissipation (SOT-23-5)*	420	
$T_{opt}$	Operating Temperature Range	-40 to 85	°C
$T_{stg}$	Storage Temperature Range	-55 to 125	°C

\*) For Power Dissipation, please refer to PACKAGE INFORMATION.

### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.

The functional operation at or over these absolute maximum ratings is not assured.

### RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

## ELECTRICAL CHARACTERISTICS

### • R1180xxx1B/C

T<sub>opt</sub>=25°C

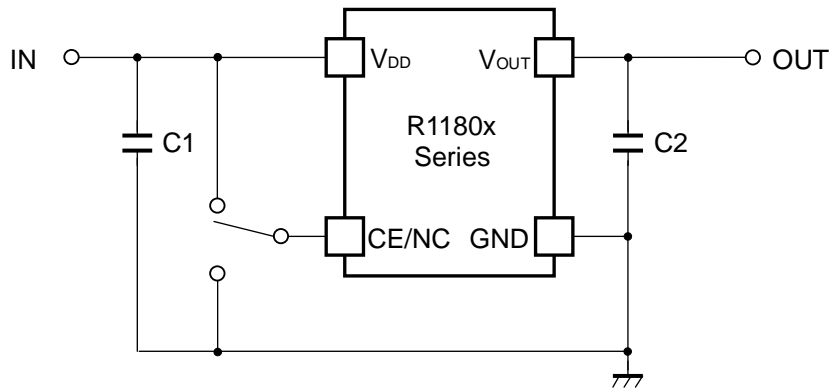
Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V <sub>OUT</sub>	Output Voltage	V <sub>IN</sub> =Set V <sub>OUT</sub> +1V 1μA ≤ I <sub>OUT</sub> ≤ 30mA	×0.980		×1.020	V
I <sub>OUT</sub>	Output Current	V <sub>IN</sub> -V <sub>OUT</sub> =1.0V(V <sub>OUT</sub> ≥ 1.5V) V <sub>IN</sub> =2.4V(V <sub>OUT</sub> <1.5V)	150			mA
ΔV <sub>OUT</sub> /ΔI <sub>OUT</sub>	Load Regulation	V <sub>IN</sub> -V <sub>OUT</sub> =1.0V(V <sub>OUT</sub> ≥ 1.5V) V <sub>IN</sub> =2.4V(V <sub>OUT</sub> <1.5V) 1μA ≤ I <sub>OUT</sub> ≤ 150mA		20	40	mV
V <sub>DIF</sub>	Dropout Voltage	Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE				
I <sub>SS</sub>	Supply Current	V <sub>IN</sub> -V <sub>OUT</sub> =1.0V, I <sub>OUT</sub> =0mA		1.0	1.5	μA
I <sub>standby</sub>	Supply Current (Standby)	V <sub>IN</sub> -V <sub>OUT</sub> =1.0V, V <sub>CE</sub> =GND		0.1	1.0	μA
ΔV <sub>OUT</sub> /ΔV <sub>IN</sub>	Line Regulation	I <sub>OUT</sub> =30mA V <sub>OUT</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V (V <sub>OUT</sub> ≥ 1.5V) 2.0V ≤ V <sub>IN</sub> ≤ 6.0V (1.2V ≤ V <sub>OUT</sub> ≤ 1.4V)		0.05	0.20	%/V
V <sub>IN</sub>	Input Voltage		1.7		6.0	V
ΔV <sub>OUT</sub> /ΔT <sub>opt</sub>	Output Voltage Temperature Coefficient	I <sub>OUT</sub> =30mA -40°C ≤ T <sub>opt</sub> ≤ 85°C		±100		ppm/°C
I <sub>SC</sub>	Short Current Limit	V <sub>OUT</sub> =0V		40		mA
I <sub>PD</sub>	CE Pull-down Constant Current	(R1180xxx1B)		0.35		μA
V <sub>CEH</sub>	CE Input Voltage "H"	(R1180xxx1B)	1.2		6.0	V
V <sub>CEL</sub>	CE Input Voltage "L"	(R1180xxx1B)	0.0		0.3	V

### • ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

T<sub>opt</sub> = 25°C

Output Voltage V <sub>OUT</sub> (V)	Dropout Voltage V <sub>DIF</sub> (V)		
	Condition	Typ.	Max.
1.2 ≤ V <sub>OUT</sub> < 1.3	I <sub>OUT</sub> =150mA	0.85	1.20
1.3 ≤ V <sub>OUT</sub> < 1.4		0.75	1.10
1.4 ≤ V <sub>OUT</sub> < 1.5		0.65	1.00
1.5 ≤ V <sub>OUT</sub> < 1.7		0.60	0.90
1.7 ≤ V <sub>OUT</sub> < 1.9		0.50	0.75
1.9 ≤ V <sub>OUT</sub> < 2.1		0.40	0.65
2.1 ≤ V <sub>OUT</sub> < 2.8		0.35	0.55
2.8 ≤ V <sub>OUT</sub> ≤ 3.6		0.25	0.40

## TYPICAL APPLICATION



(External Components)

Output Capacitor

Ceramic Capacitor      0.1 $\mu$ F

## TECHNICAL NOTES

When using these ICs, consider the following points:

### Phase Compensation

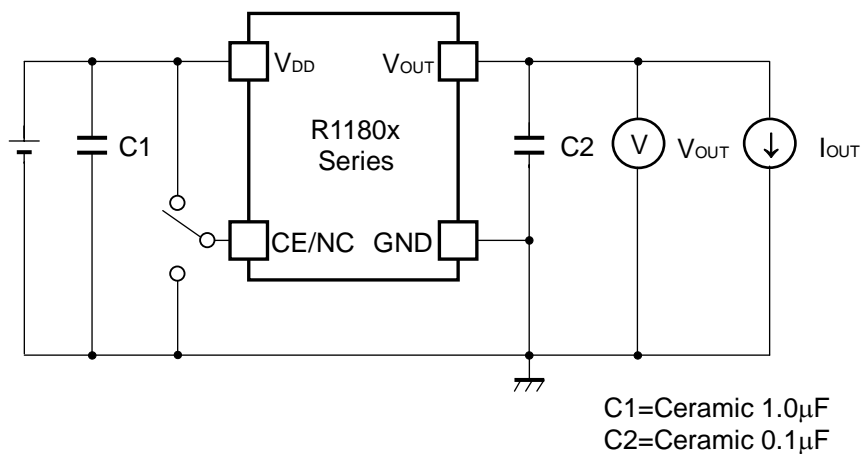
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

### PCB Layout

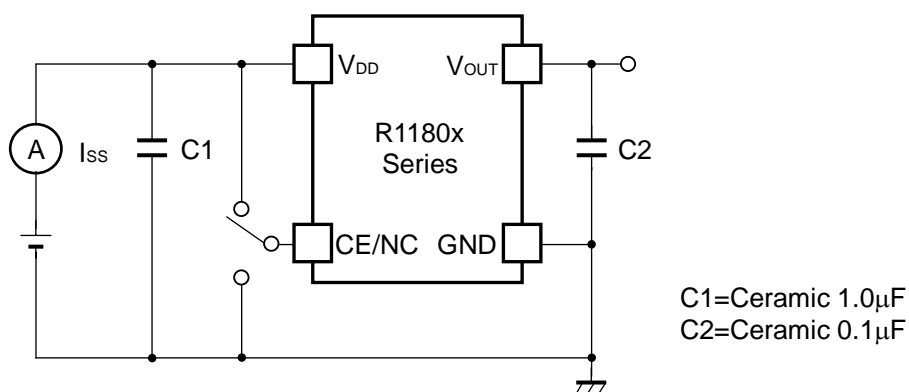
Make V<sub>DD</sub> and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.1 $\mu$ F or more between V<sub>DD</sub> and GND pin, and as close as possible to the pins.

Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

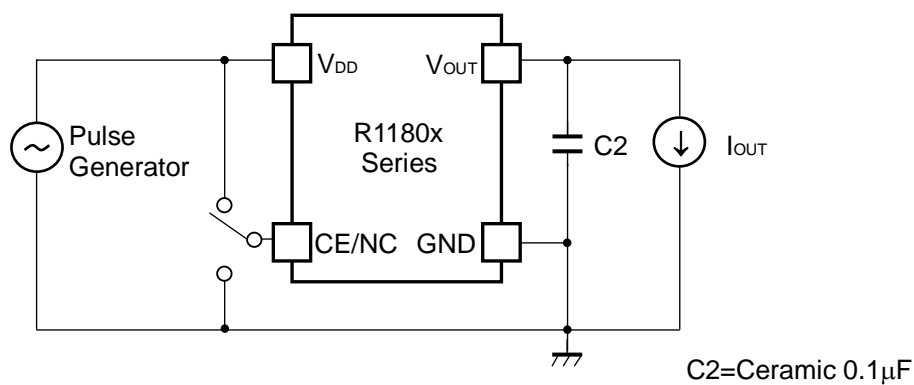
## TEST CIRCUITS



Standard test Circuit



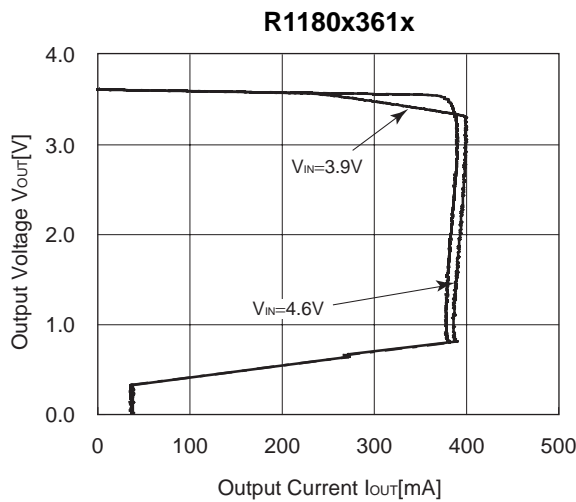
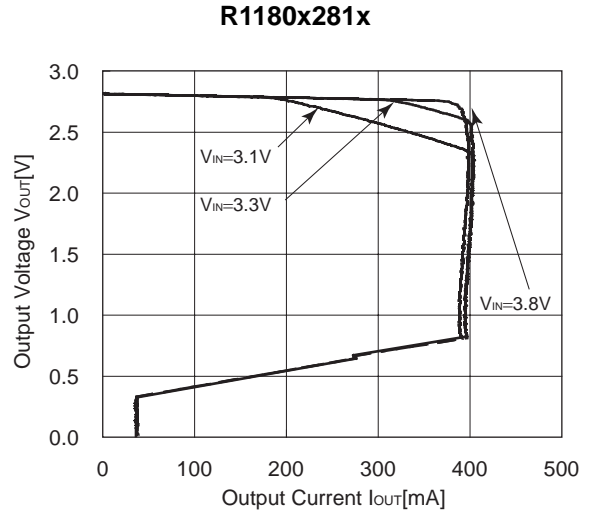
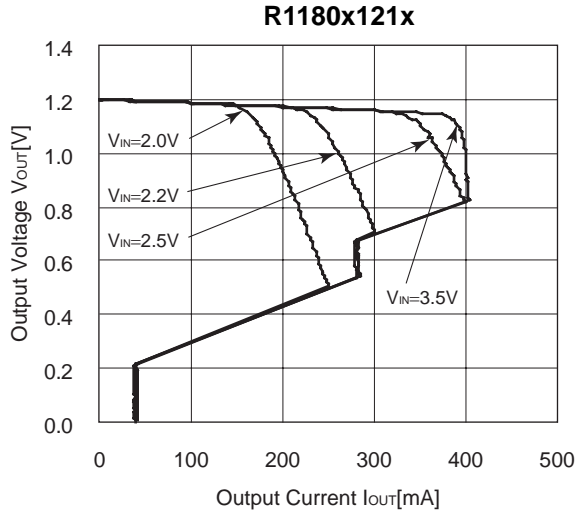
Supply Current Test Circuit



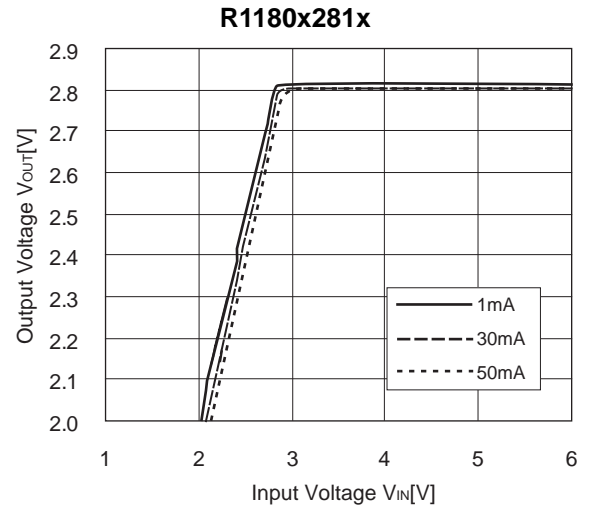
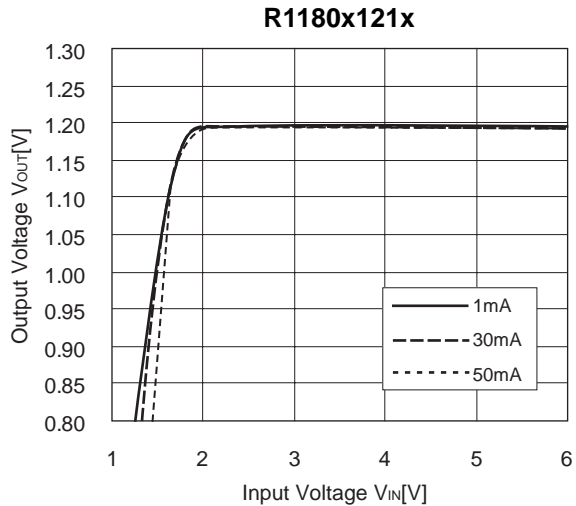
Ripple Rejection, Line Transient Response Test Circuit

## TYPICAL CHARACTERISTICS

### 1) Output Voltage vs. Output Current (T<sub>opt</sub>=25°C)

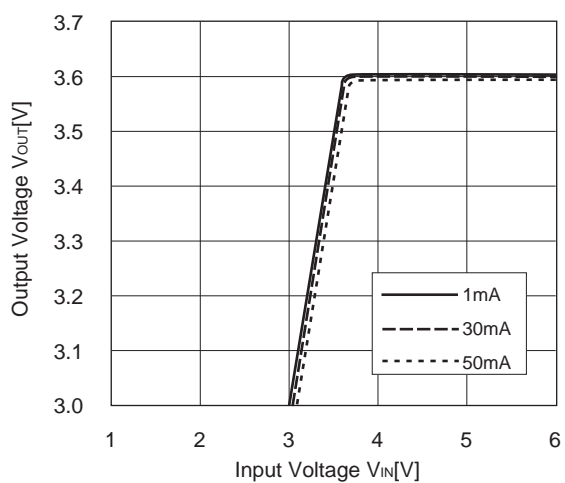


### 2) Output Voltage vs. Input Voltage (T<sub>opt</sub>=25°C)



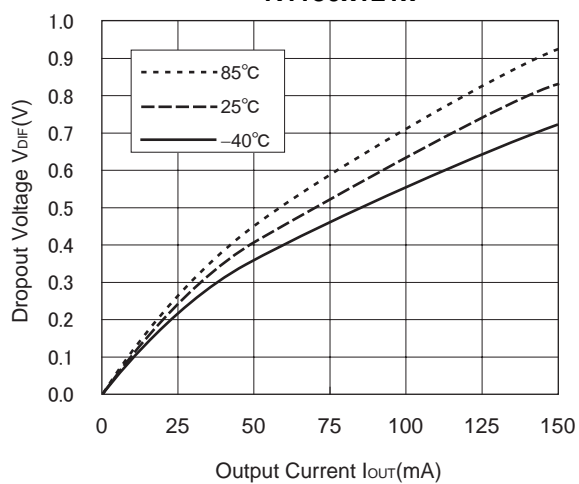


**R1180x361x**

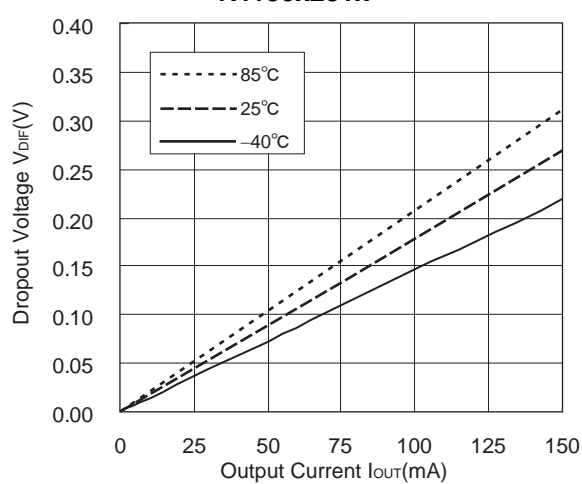


3) Dropout Voltage vs. Output Current

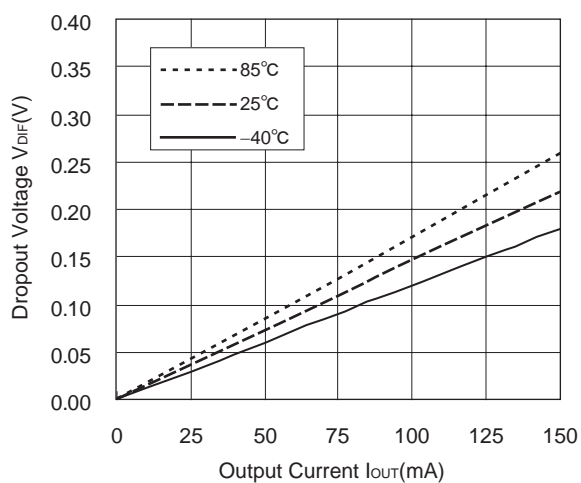
**R1180x121x**



**R1180x281x**



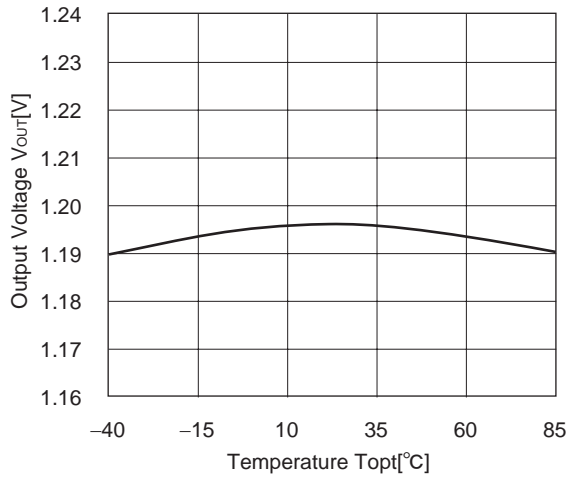
**R1180x361x**



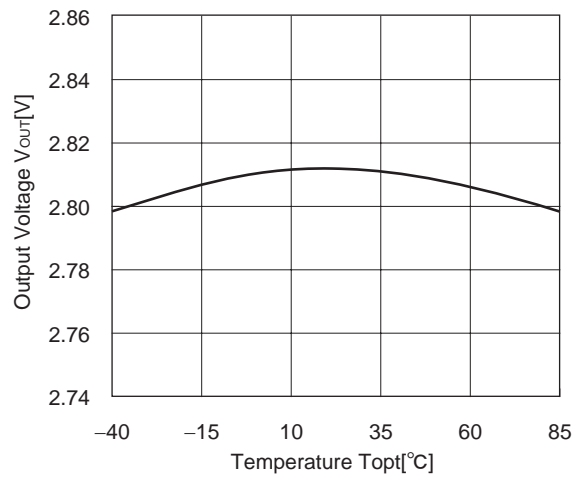
# R1180x

## 4) Output Voltage vs. Temperature ( $I_{OUT}=30mA$ )

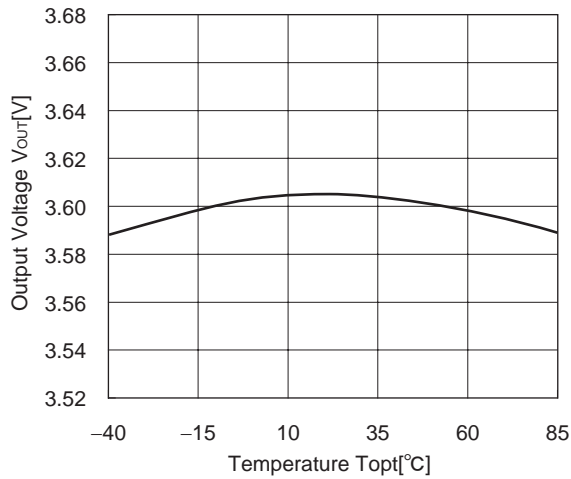
### R1180x121x ( $V_{IN}=2.2V$ )



### R1180x281x ( $V_{IN}=3.8V$ )

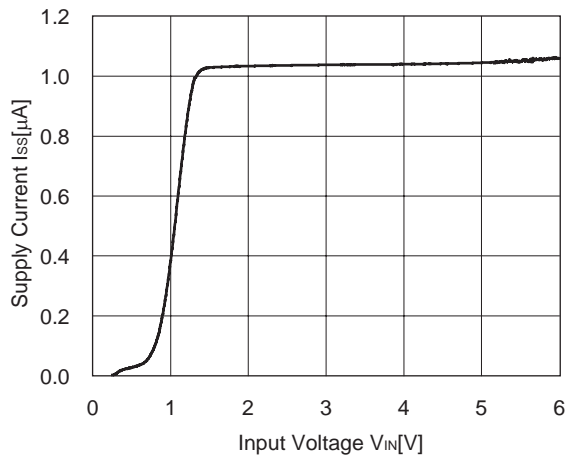


### R1180x361x ( $V_{IN}=4.6V$ )

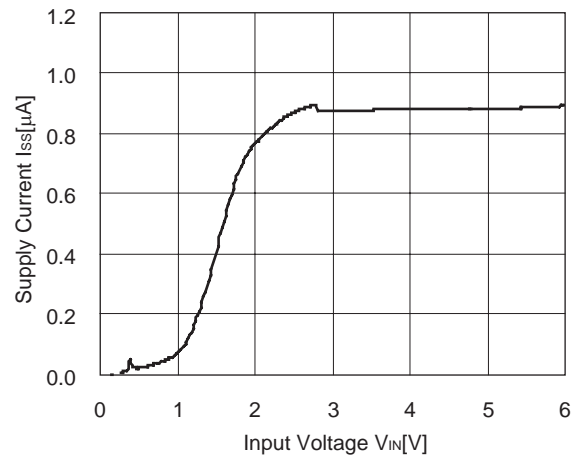


## 5) Supply Current vs. Input Voltage ( $T_{opt}=25^{\circ}C$ )

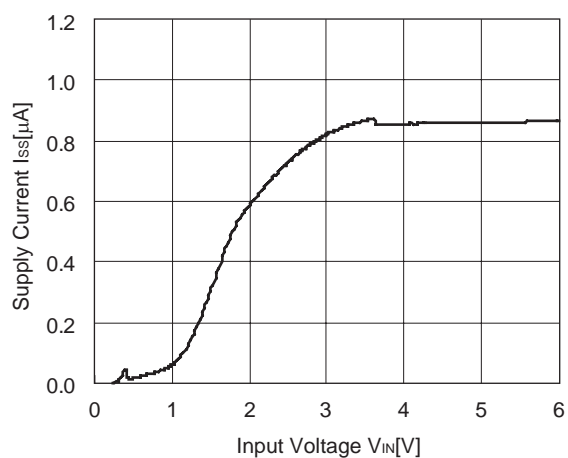
### R1180x121x



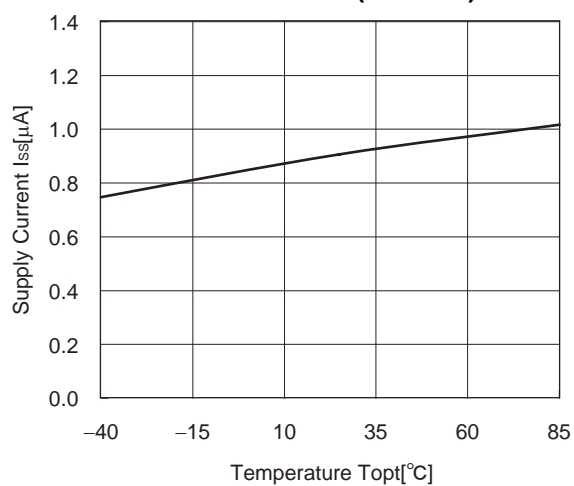
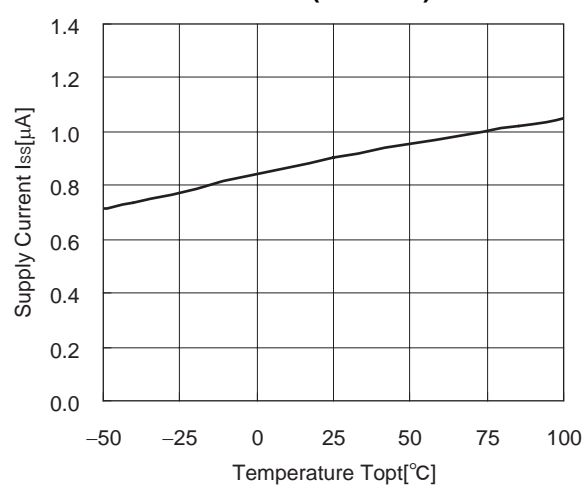
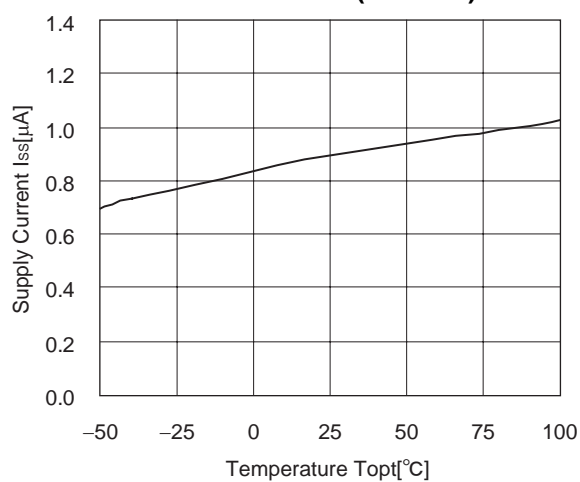
### R1180x281x



R1180x361x

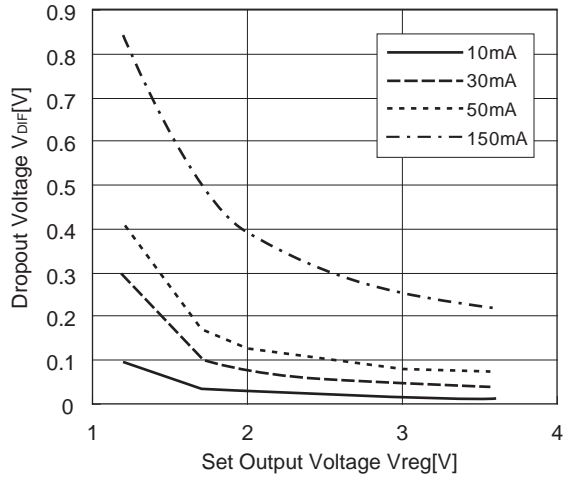


## 6) Supply Current vs. Temperature

R1180x121x( $V_{IN}=2.2V$ )R1180x281x( $V_{IN}=3.8V$ )R1180x361x( $V_{IN}=4.6V$ )

# R1180x

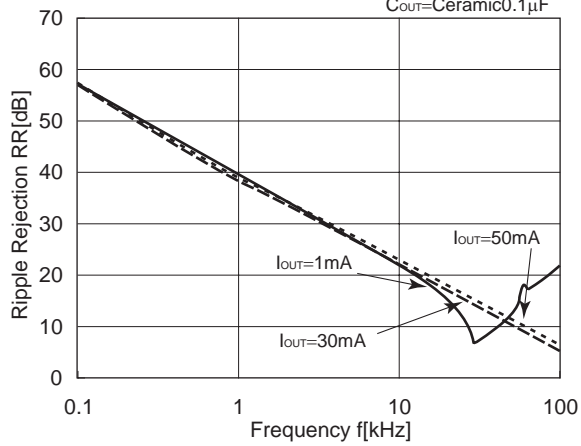
## 7) Dropout Voltage vs. Set Output Voltage (T<sub>opt</sub>=25°C)



## 8) Ripple Rejection vs. Frequency (C<sub>IN</sub>=none)

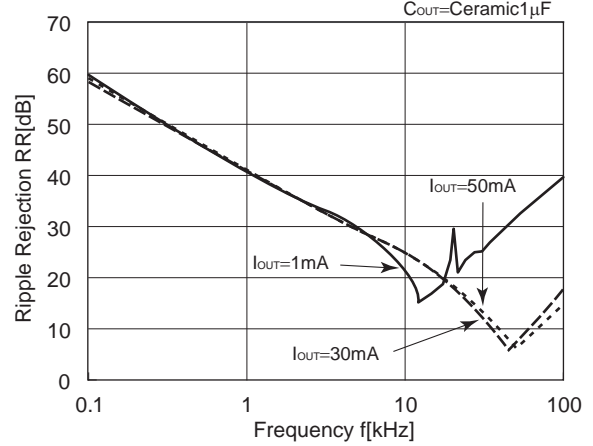
### R1180x121x

$V_{IN}=2.4V_{DC}+0.5p-p$   
 $C_{OUT}=\text{Ceramic}0.1\mu F$



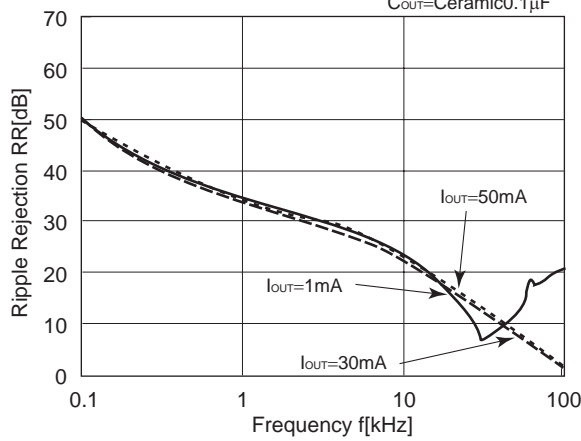
### R1180x121x

$V_{IN}=2.4V_{DC}+0.5p-p$   
 $C_{OUT}=\text{Ceramic}1\mu F$



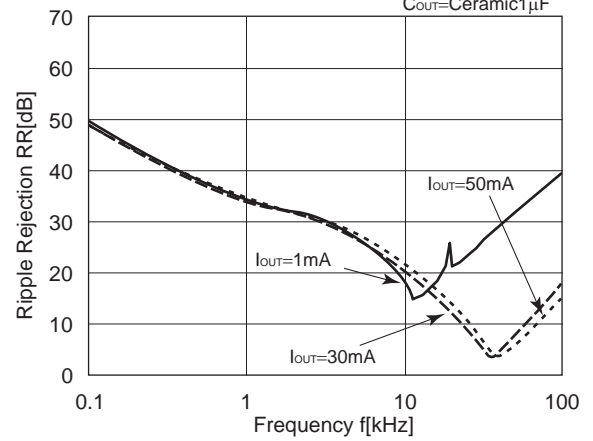
### R1180x281x

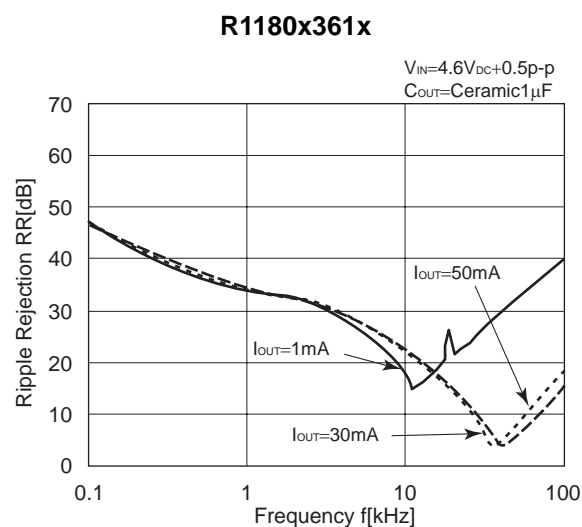
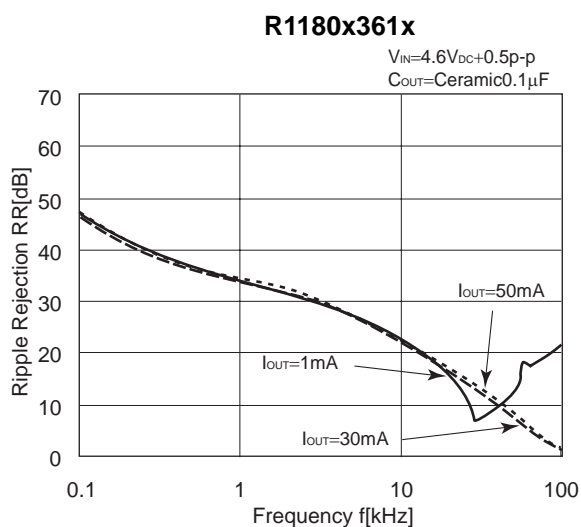
$V_{IN}=3.8V_{DC}+0.5p-p$   
 $C_{OUT}=\text{Ceramic}0.1\mu F$



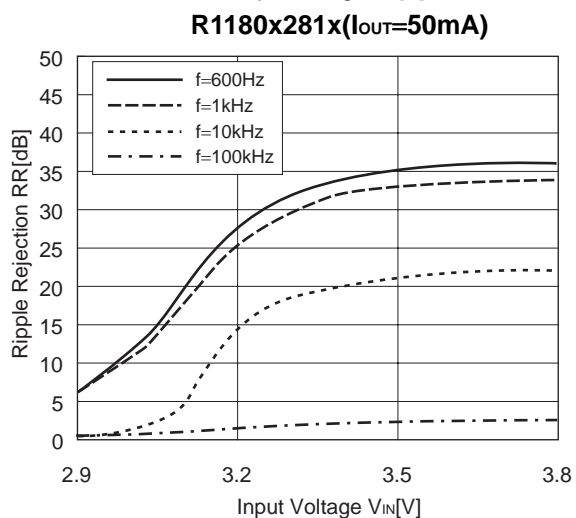
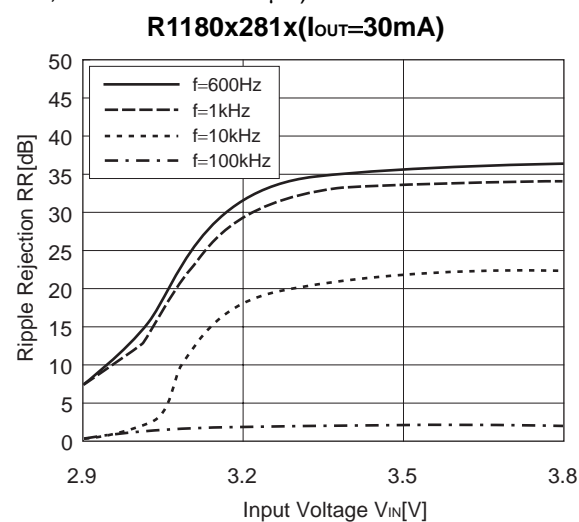
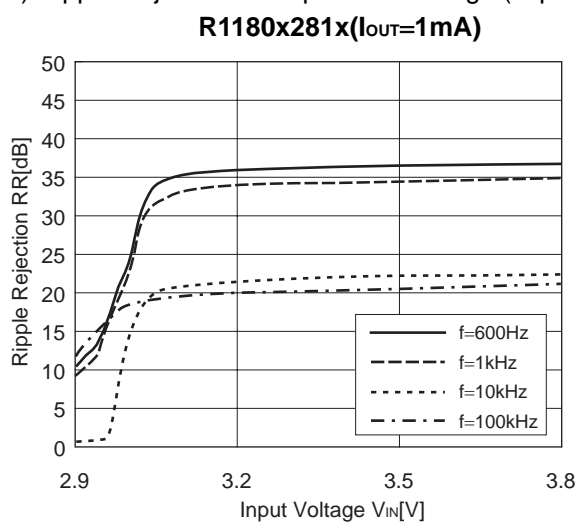
### R1180x281x

$V_{IN}=3.8V_{DC}+0.5p-p$   
 $C_{OUT}=\text{Ceramic}1\mu F$



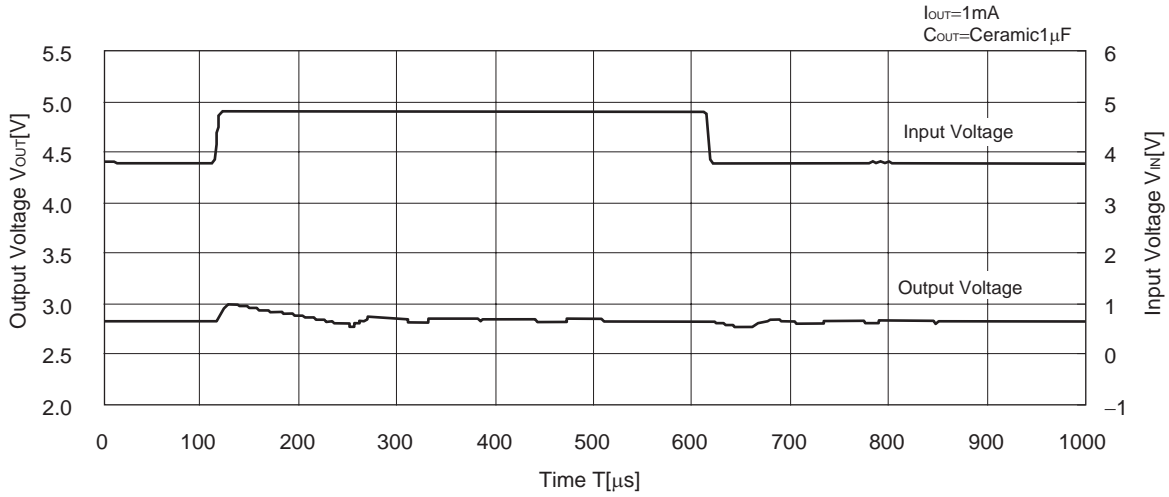


9) Ripple Rejection vs. Input Bias Voltage ( $T_{opt}=25^{\circ}C$ ,  $C_{IN}=\text{none}$ ,  $C_{OUT}=\text{Ceramic}0.1\mu F$ )

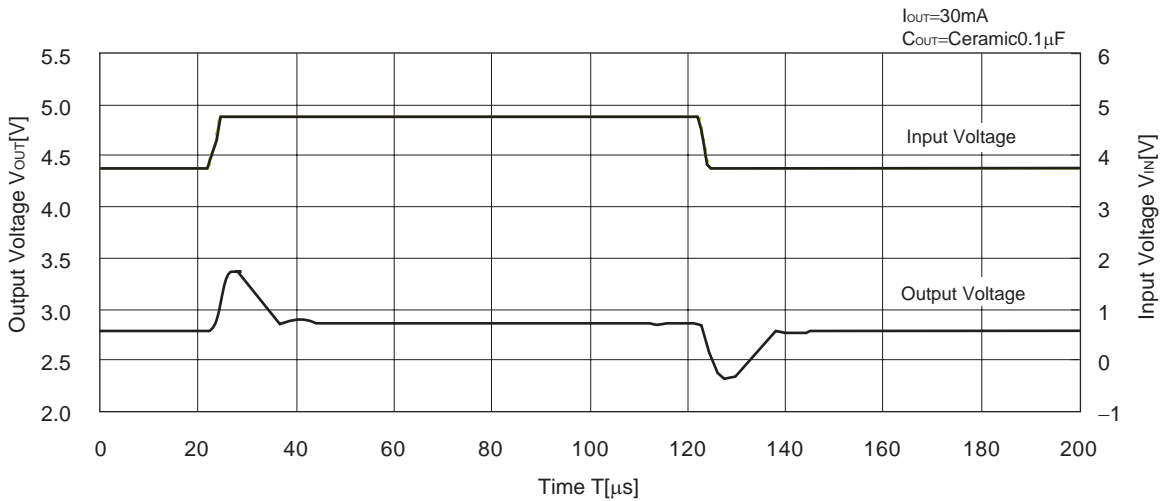


10) Input Transient Response ( $C_{IN}=none, tr=tf=5\mu s$ )

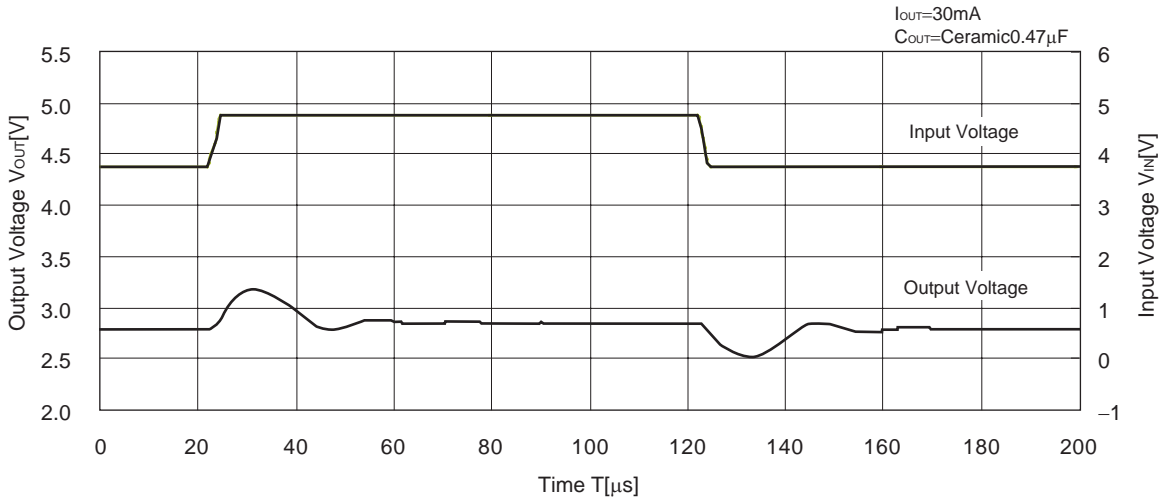
R1180x281x



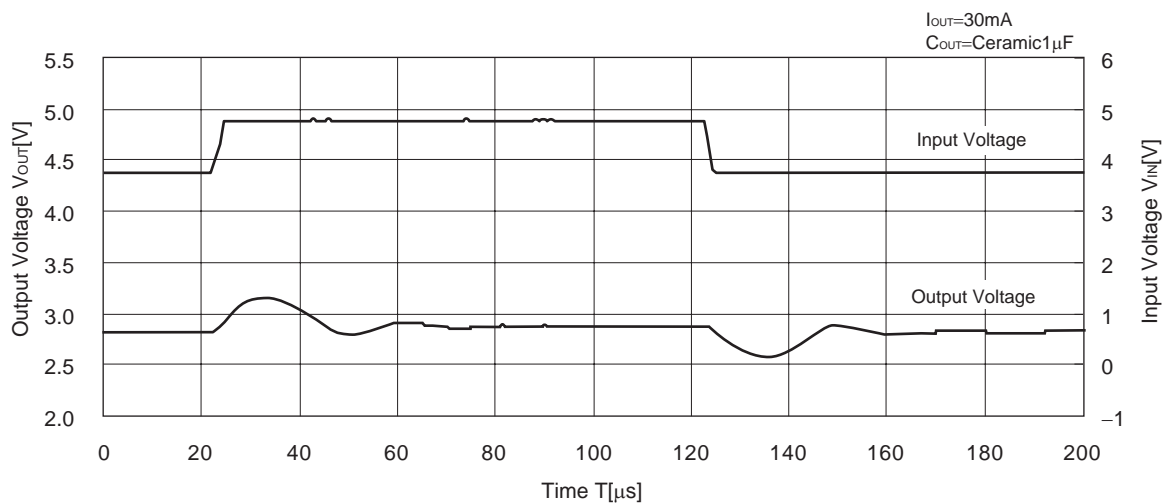
R1180x281x



R1180x281x

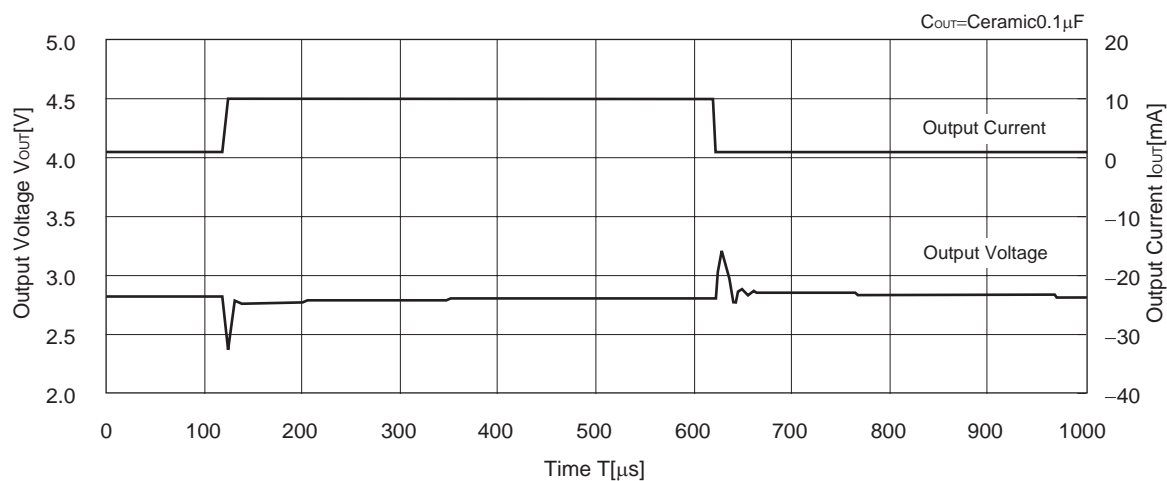


R1180x281x

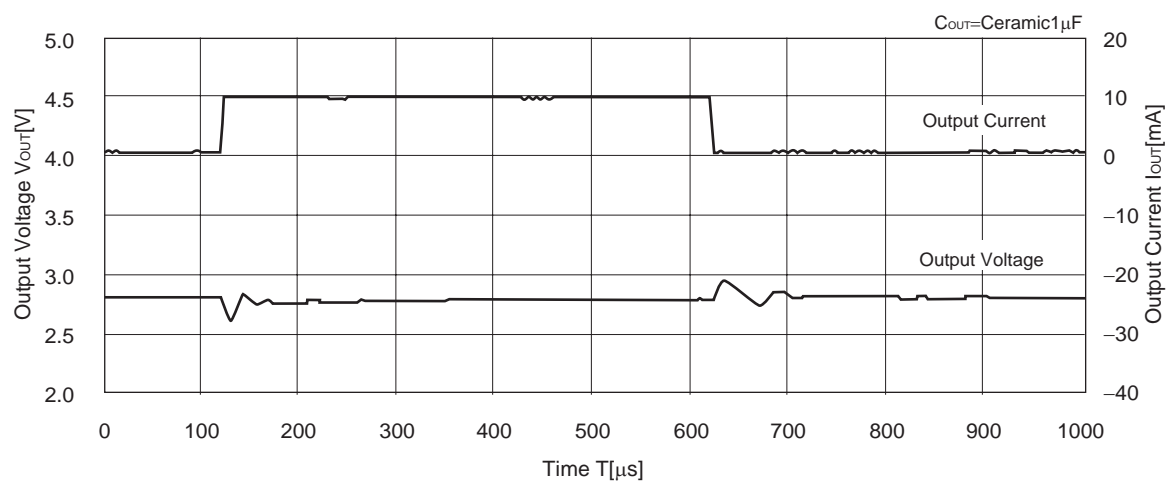


11) Load Transient Response ( $t_r=t_f=0.5\mu\text{s}$   $V_{IN}=3.8\text{V}$ )

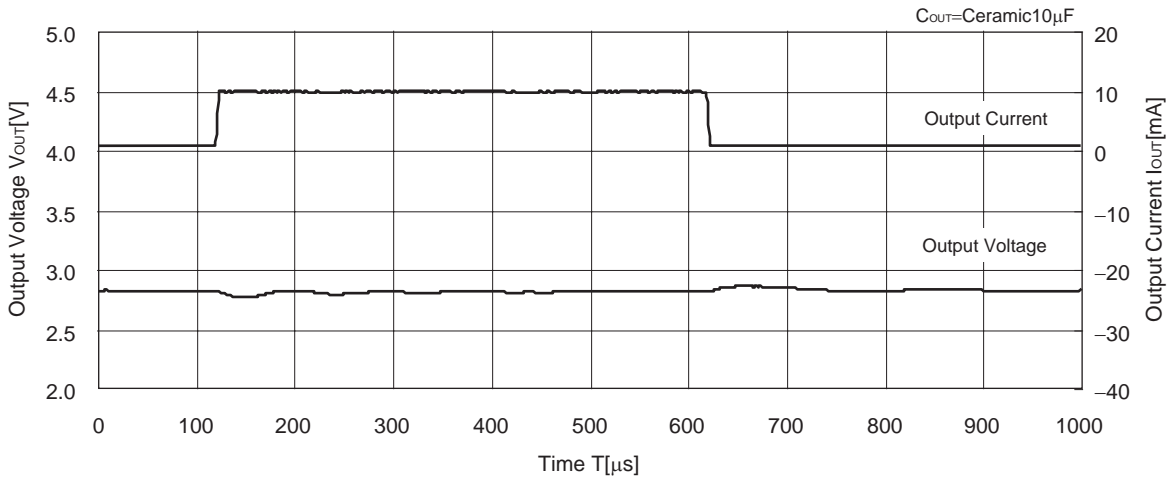
R1180x281x



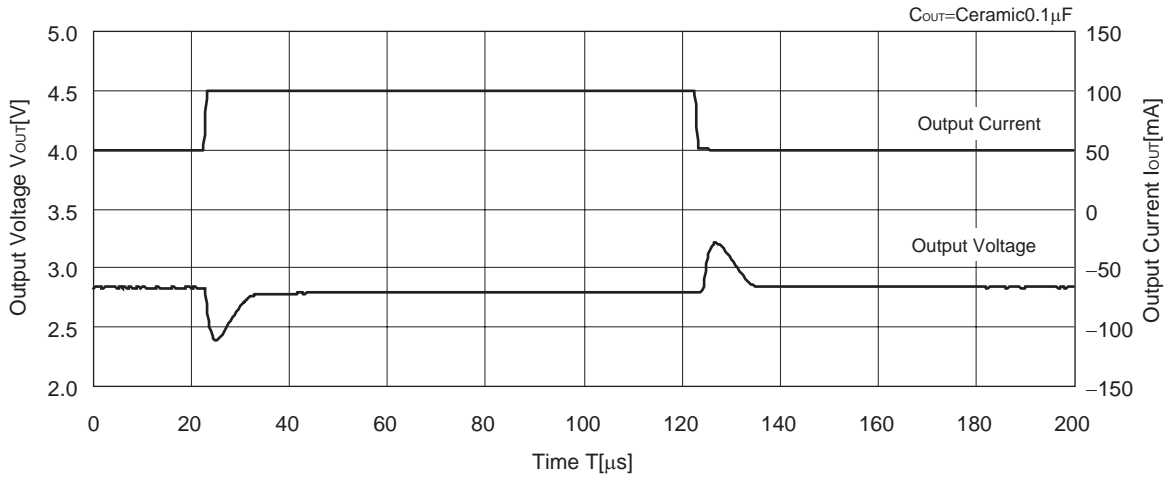
R1180x281x



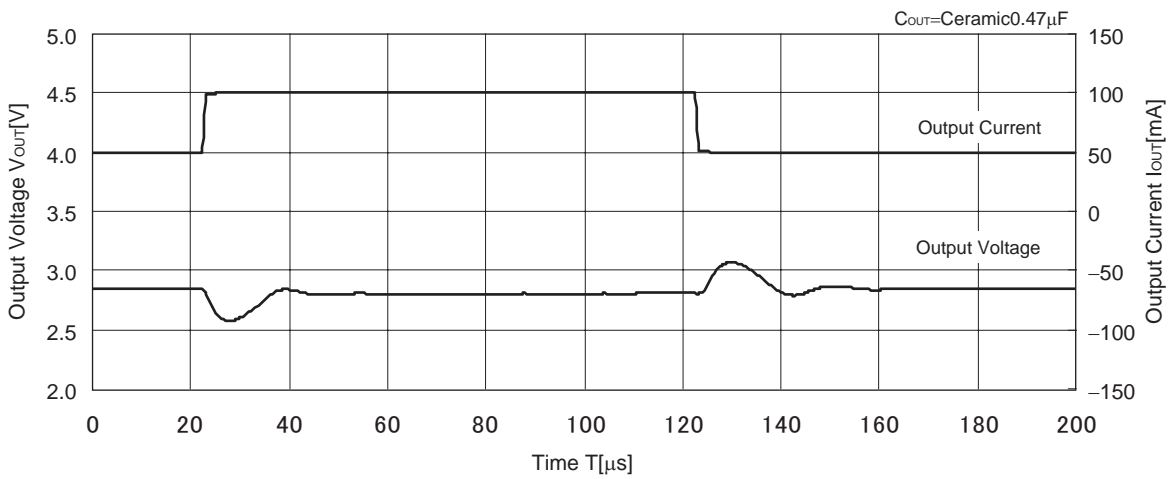
R1180x281x



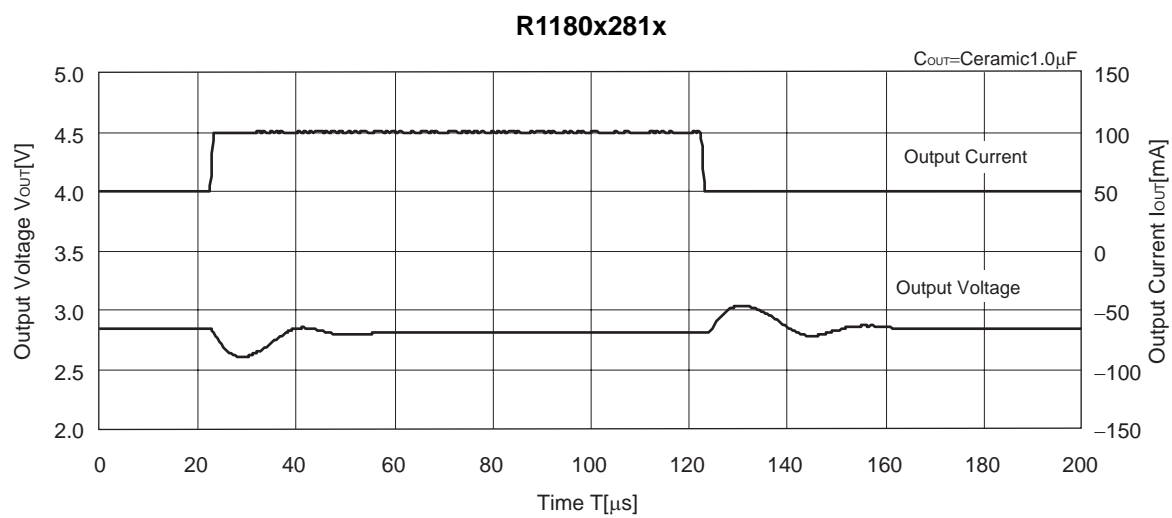
R1180x281x



R1180x281x





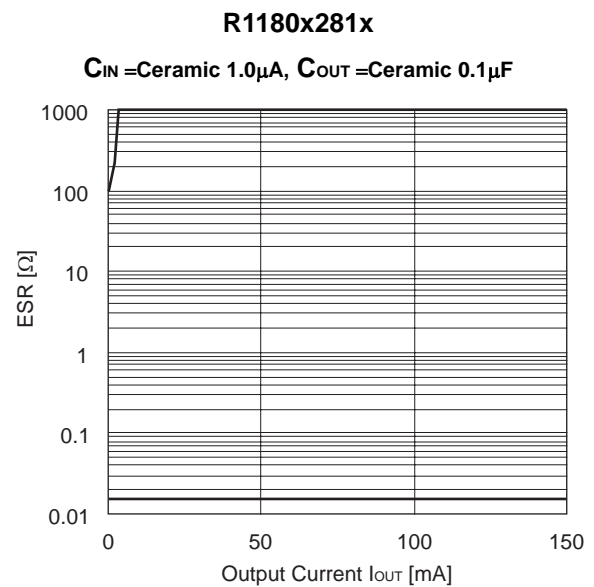
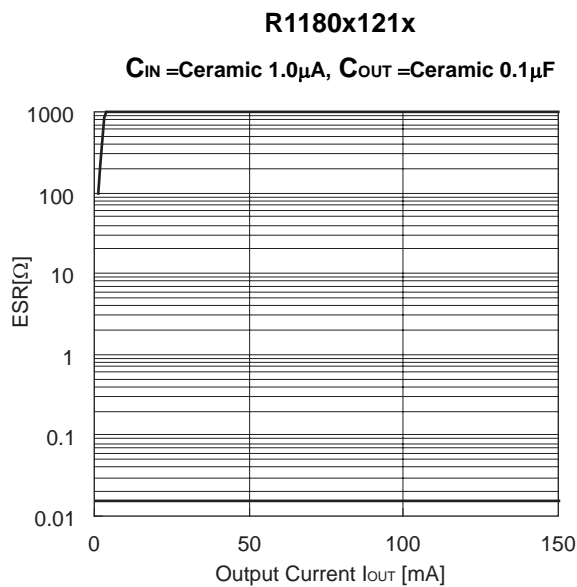


## ESR vs. Output Current

The relations between  $I_{OUT}$  (Output Current) and ESR of an output capacitor are shown above. The conditions when the white noise level is under  $40\mu V$  (Avg.) are marked as the hatched area in the graph.

<Measurement conditions>

- (1)  $V_{IN}=V_{OUT}+1V$
- (2) Frequency Band: 10Hz to 2MHz (BW=30Hz)
- (3) Temperature:  $-40^{\circ}C$  to  $85^{\circ}C$





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8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
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11. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.



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