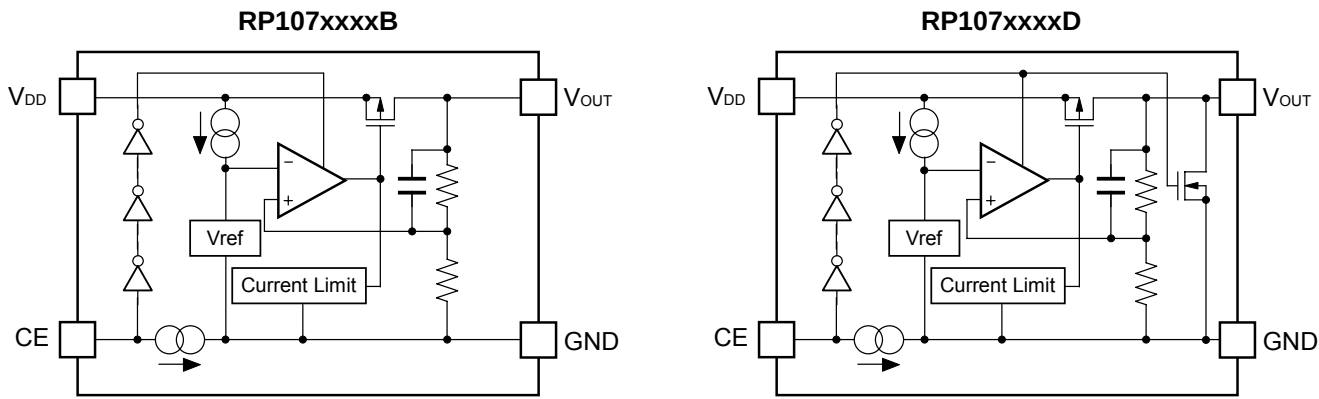


BLOCK DIAGRAMS

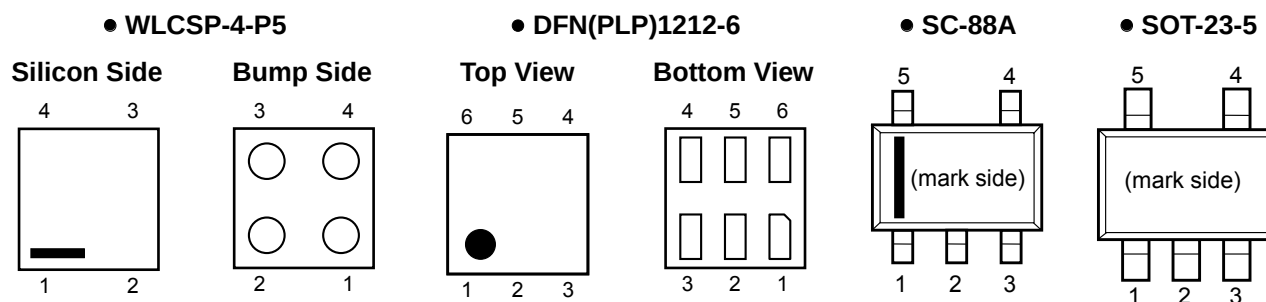


SELECTION GUIDE

The output voltage, auto discharge function, package, and the taping type, etc. for the ICs can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP107Zxx1*-TR-F	WLCSP-4-P5	5,000 pcs	Yes	Yes
RP107Kxx1*-TR	DFN(PLP)1212-6	5,000 pcs	Yes	Yes
RP107Qxx2*-TR-FE	SC-88A	3,000 pcs	Yes	Yes
RP107Nxx1*-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes
xx: The output voltage can be designated in the range from 1.0V(10) to 4.2V(42) in 0.1V steps. (For other voltages, please refer to MARK INFORMATION.)				
* : CE pin polarity and auto discharge function at off state are options as follows. (B) "H" active, without auto discharge function at off state (D) "H" active, with auto discharge function at off state				

PIN CONFIGURATIONS



PIN DESCRIPTIONS

• WLCSP-4-P5

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

• DFN(PLP)1212-6

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

• SC-88A

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

• SOT-23-5

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

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.0	V
V_{CE}	Input Voltage (CE Pin)	-0.3 to 6.0	V
V_{OUT}	Output Voltage	-0.3 to $V_{IN}+0.3$	V
I_{OUT}	Output Current	400	mA
P_D	Power Dissipation* (WLCSP-4-P5)	278	mW
	Power Dissipation* (DFN(PLP)1212-6)	400	
	Power Dissipation* (SC-88A)	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

• RP107xxxxB/D

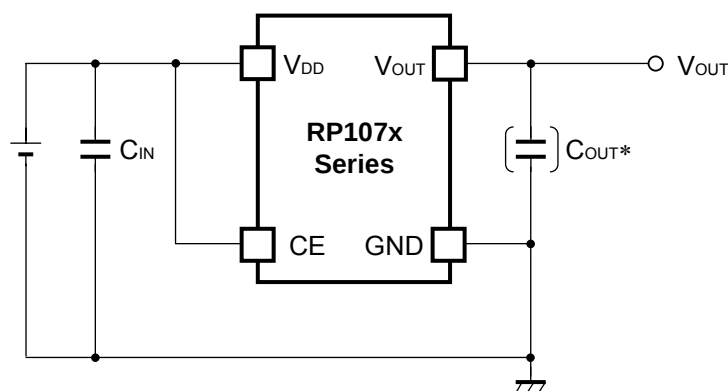
V_{IN} =Set $V_{OUT}+1.0V$, $I_{OUT}=1mA$, $C_{IN}=C_{OUT}=0.1\mu F$, unless otherwise noted.

The specification in is checked and guaranteed by design engineering at $-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$. $T_{opt}=25^{\circ}C$

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	$T_{opt}=25^{\circ}C$	$V_{OUT} > 2.0V$	$\times 0.99$	$\times 1.01$	V
			$V_{OUT} \leq 2.0V$	-20	+20	mV
		$-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$	$V_{OUT} > 2.0V$	×0.980	×1.015	V
			$V_{OUT} \leq 2.0V$	-40	+30	mV
I_{OUT}	Output Current		200			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	$1mA \leq I_{OUT} \leq 200mA$		25	50	mV
V_{DIF}	Dropout Voltage	$I_{OUT}=200mA$	$1.0V \leq V_{OUT} < 1.1V$	0.64	0.92	V
			$1.1V \leq V_{OUT} < 1.2V$	0.59	0.84	
			$1.2V \leq V_{OUT} < 1.5V$	0.55	0.76	
			$1.5V \leq V_{OUT} < 2.0V$	0.44	0.60	
			$2.0V \leq V_{OUT} < 2.6V$	0.35	0.49	
			$2.6V \leq V_{OUT}$	0.27	0.36	
I_{SS}	Supply Current	$I_{OUT}=0mA$		9.5	25	μA
$I_{standby}$	Standby Current	$V_{CE}=GND$		0.1	3.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set $V_{OUT}+0.5V \leq V_{IN} \leq 5.0V$		± 0.02	±0.20	%/V
RR	Ripple Rejection	$f=1kHz$ ($V_{OUT} \leq 1.2V$) $f=1kHz$ ($1.2V < V_{OUT} \leq 2.2V$) $f=1kHz$ ($V_{OUT} \leq 1.2V$) Ripple 0.2Vp-p, $V_{IN}=\text{Set } V_{OUT}+1V$, $I_{OUT}=30mA$ (In case that $V_{OUT} \leq 1.2V$, $V_{IN}=2.2V$)		70 65 60		dB
V_{IN}	Input Voltage		1.4		5.25	V
$\Delta V_{OUT}/\Delta T_{opt}$	Output Voltage Temperature Coefficient	$-40^{\circ}C \leq T_{opt} \leq 85^{\circ}C$		± 100		ppm/ $^{\circ}C$
I_{SC}	Short Current Limit	$V_{OUT}=0V$		50		mA
I_{PD}	CE Pull-down Current			0.1		μA
V_{CEH}	CE Input Voltage "H"		1.0			V
V_{CEL}	CE Input Voltage "L"				0.4	V
R_{LOW}	Low Output Nch Tr. ON Resistance (of D version)	$V_{IN}=4.0V$ $V_{CE}=0V$		30		Ω

All of units are tested and specified under load conditions such that $T_j \approx T_{opt}=25^{\circ}C$ except for Ripple Rejection, Output Voltage Temperature Coefficient.

TYPICAL APPLICATION



TECHNICAL NOTES

When using these ICs, consider the following points:

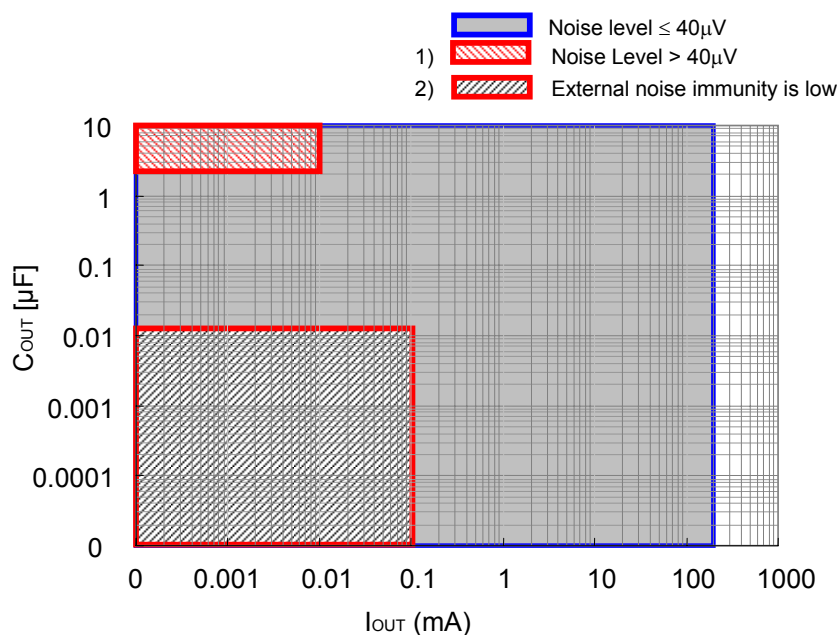
Phase Compensation ^{*)}

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. If load variation is very large, it is better to attach the output capacitor in the range from 0.1 μ F to 10 μ F. If the tantalum capacitor is selected and the ESR (Equivalent Series Resistance) is high, the output may be unstable.

Notes: 1) If the output capacitor is set as equal or more than 2.2 μ F, output current is 0.01mA or lower than 0.01mA, noise level might be equal or more than 40 μ V. Considering frequency characteristics, fully evaluation is necessary.

Notes: 2) If the output capacitor is set as equal or less than 0.01 μ F, and the output current is 0.1mA or less, external noise caused by other circuits may affect on the device. Enforce the GND or fully countermeasure is necessary.

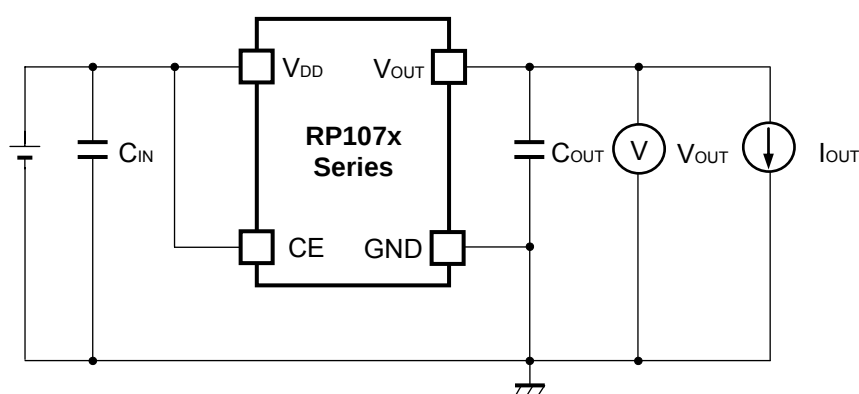
Please refer to the characteristics graph: external capacitor vs. output voltage.



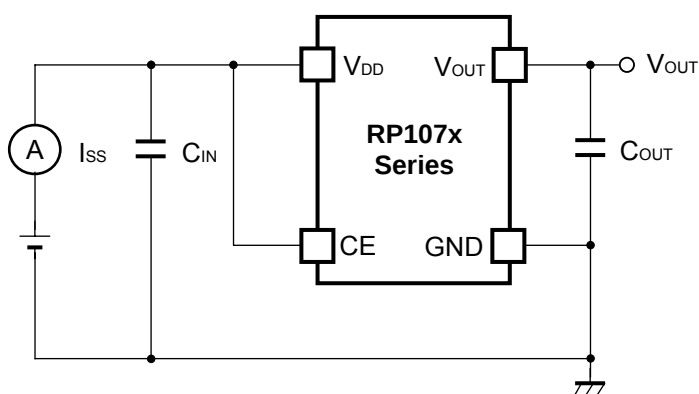
PCB Layout

Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C_{IN} with a capacitance value as much as $0.1\mu\text{F}$ or more between V_{DD} and GND pin, and as close as possible to the pins.

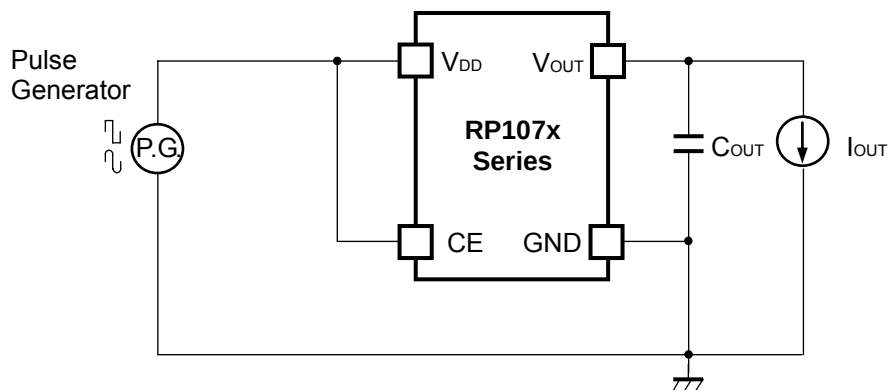
TEST CIRCUITS



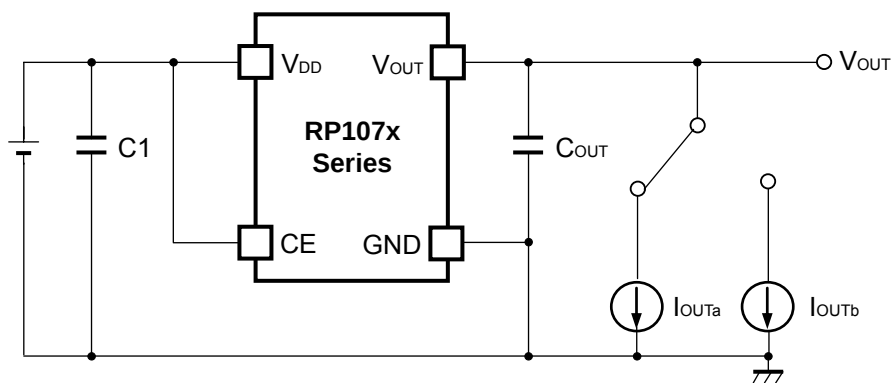
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection



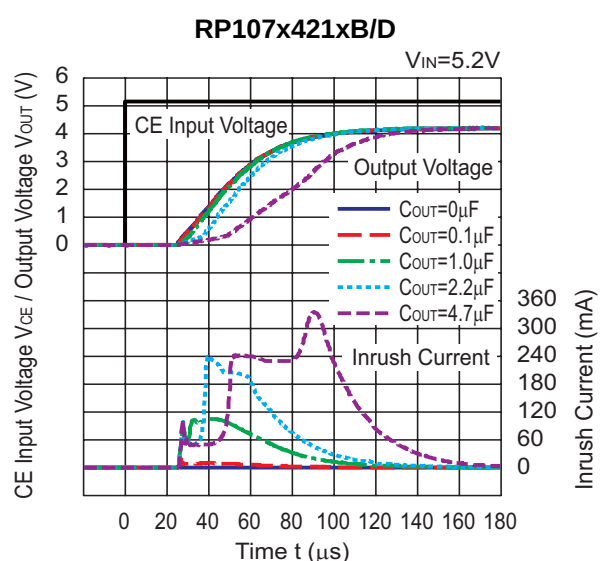
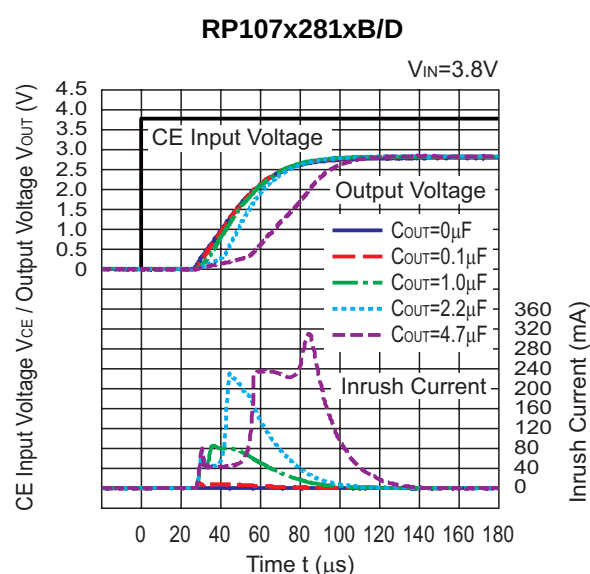
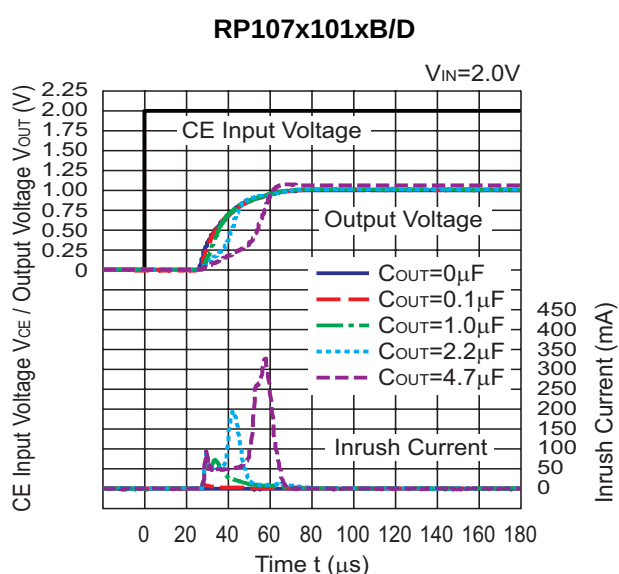
Test Circuit for Load Transient Response

■ Constant Slope Circuits

The RP107x Series is equipped with a constant slope circuit as a soft-start circuit, which allows the output voltage to start up gradually when the CE is turned on. The constant slope circuit minimizes the inrush current at the start-up and also prevents the overshoot of the output voltage. The capacitor to create the start-up slope is built in the IC that does not require any external components. The start-up time and the start-up slope angle are fixed inside the IC.

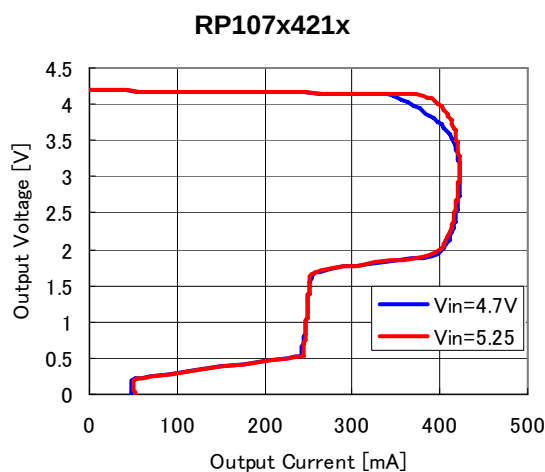
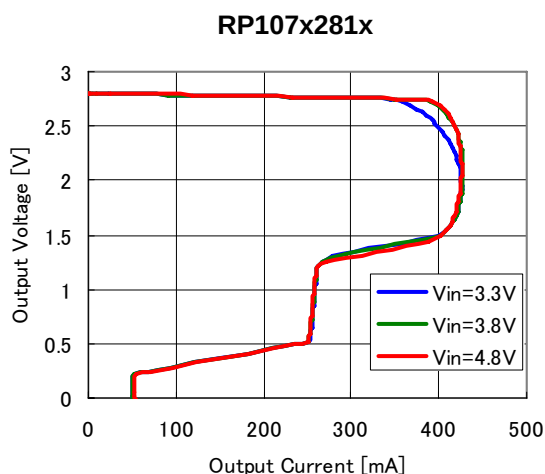
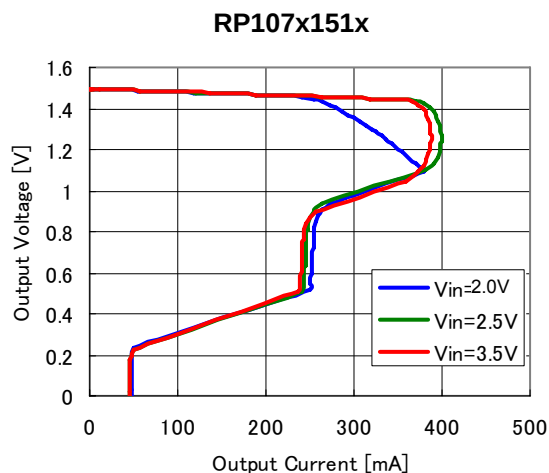
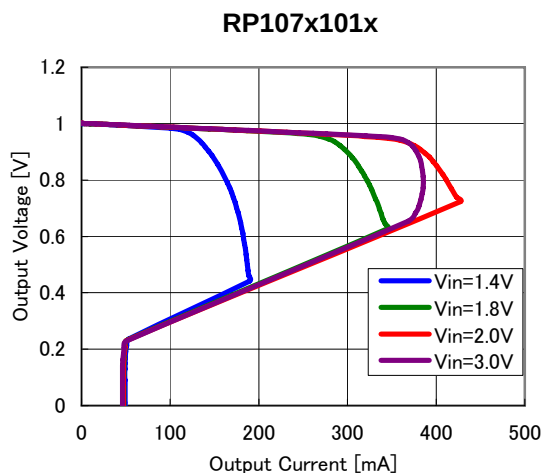
If the capacitance of the external output capacitor (C_{OUT}) becomes more than the certain capacitance, the output current limit circuit minimizes the incoming current of the output capacitor at the start-up. As a result, the start-up time becomes longer and the start-up slope angle becomes more gentle. As “Inrush Current Characteristics Example” below shows, if the C_{OUT} is less than $2.2\mu\text{F}$, the constant slope circuit easily starts to function at the start-up, likewise, if the C_{OUT} is over $4.7\mu\text{F}$, the output current limit circuit easily starts to function at the start-up. The boundary point of using these two circuits is inversely proportional to the output voltage. If the output voltage is higher, the output current limit circuit easily starts to function even if the C_{OUT} capacitance is small. For more details, please refer to the graph 15 of “Inrush Current Characteristics Example”.

Inrush Current Characteristics Example ($C_1=0.1\mu\text{F}$, $T_{opt}=25^\circ\text{C}$)

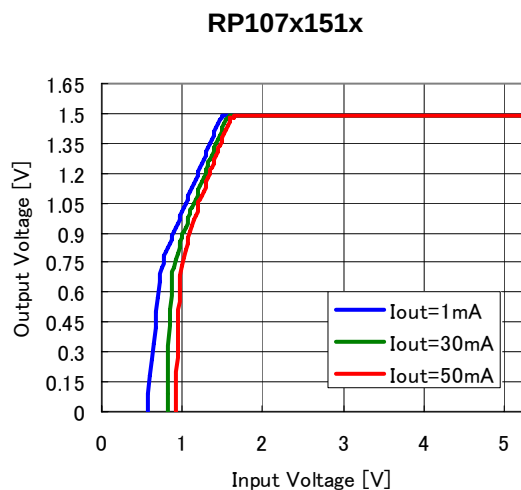
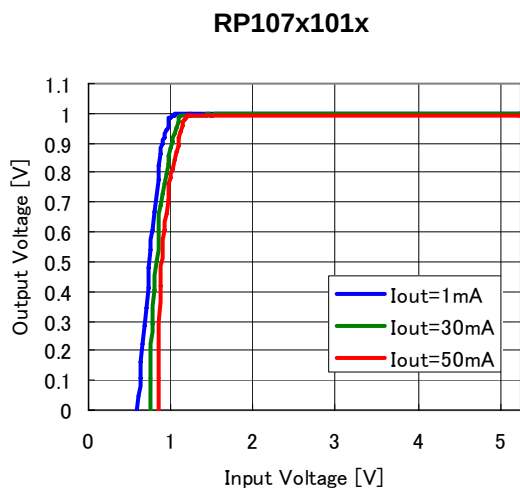


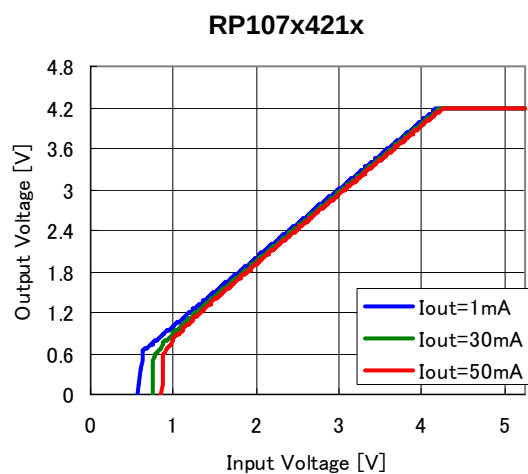
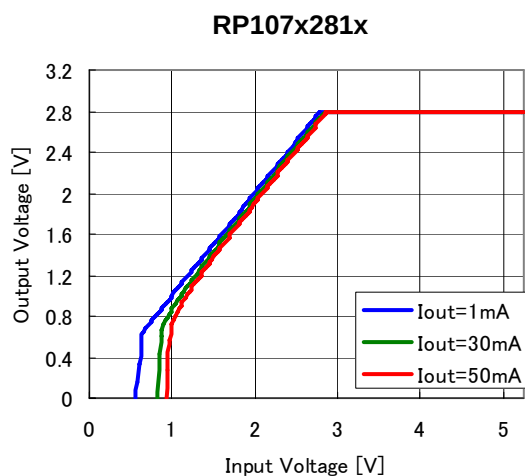
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)

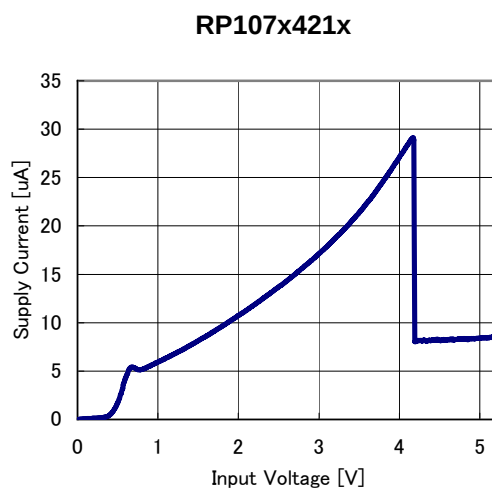
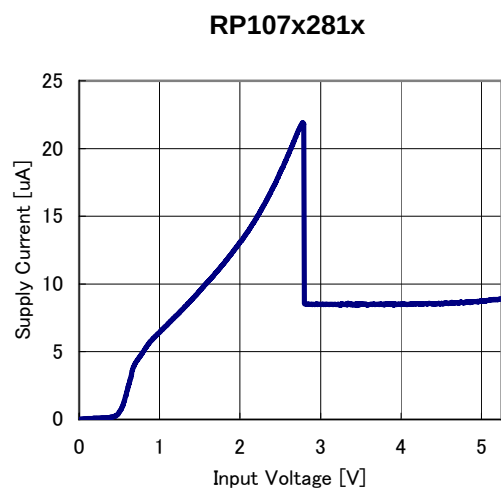
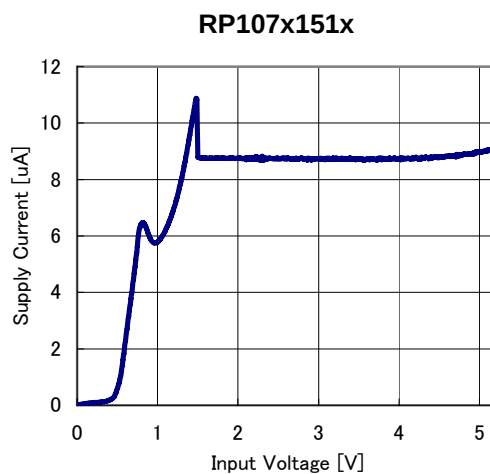
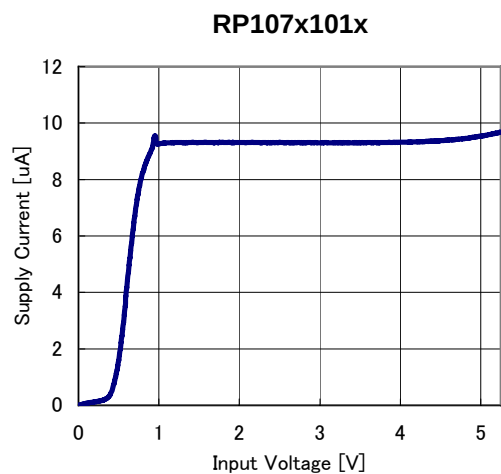


2) Output Voltage vs. Input Voltage ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)

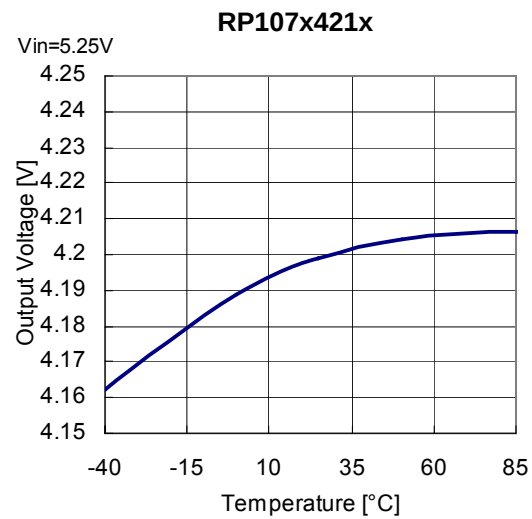
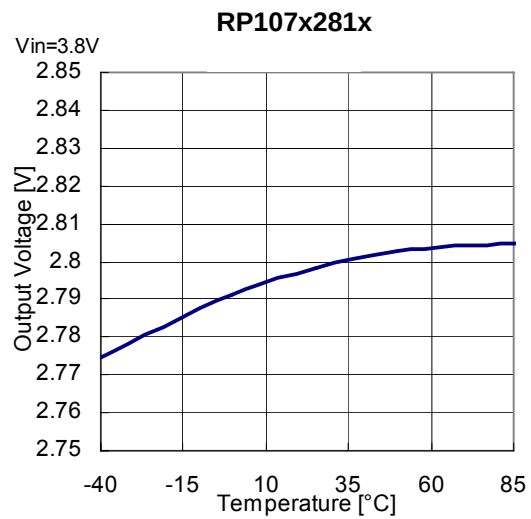
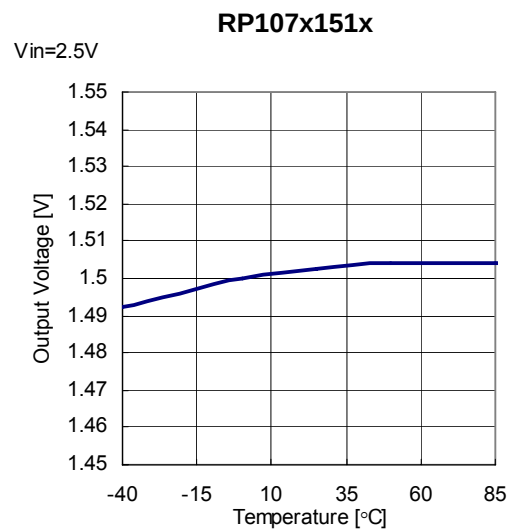
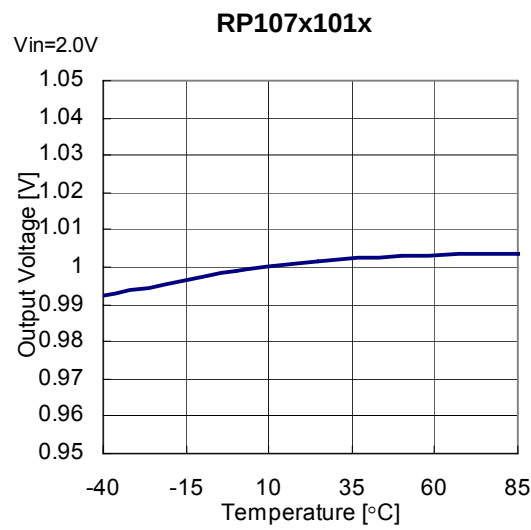




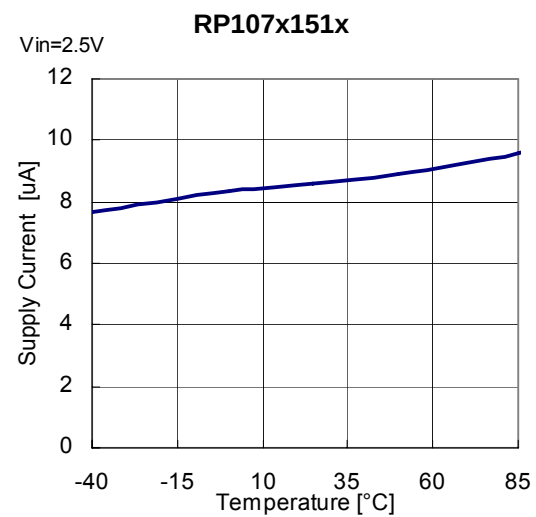
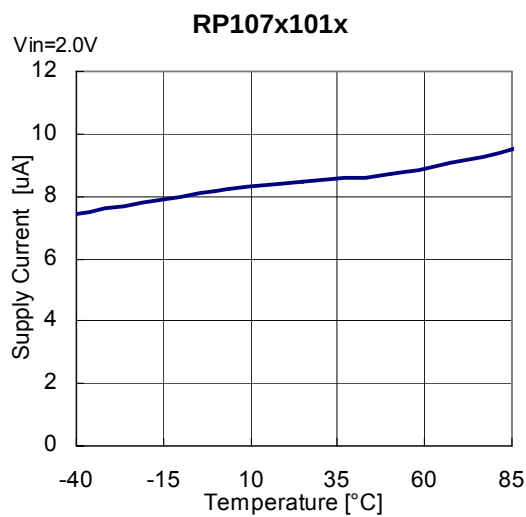
3) Supply Current vs. Input Voltage ($C_{IN}=0.1\mu\text{F}$, $T_{opt}=25^\circ\text{C}$)

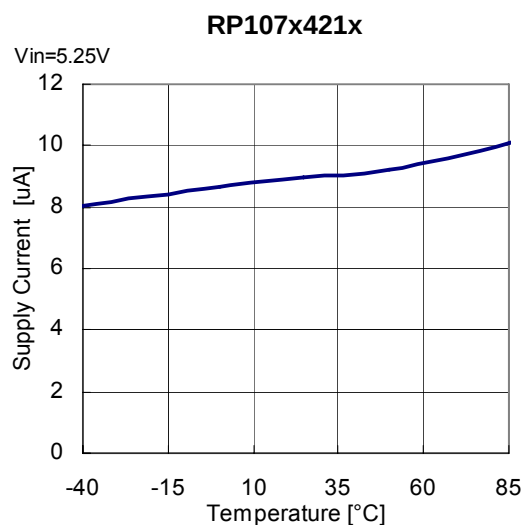
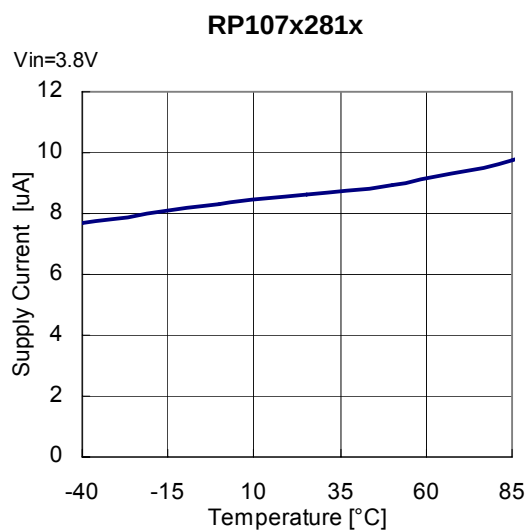


4) Output Voltage vs. Temperature ($C_{IN}=0.1\mu F$, $I_{OUT}=1mA$)

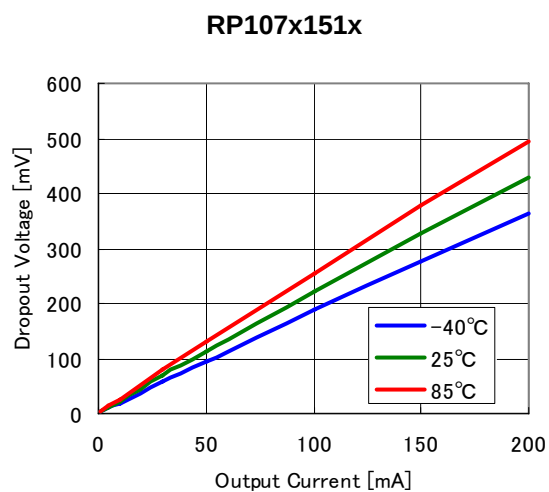
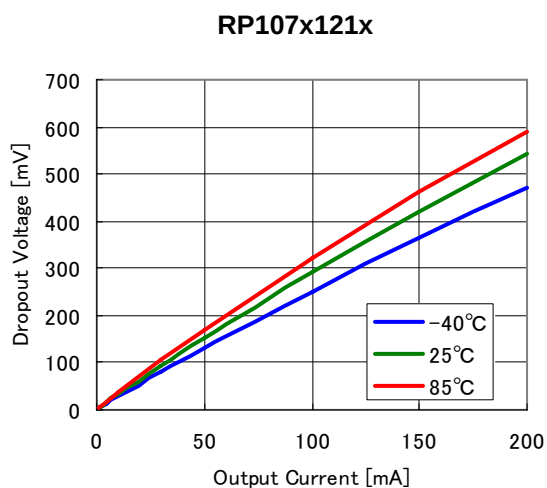
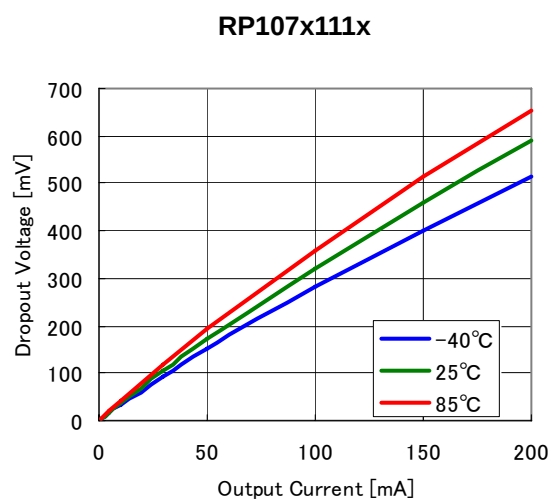
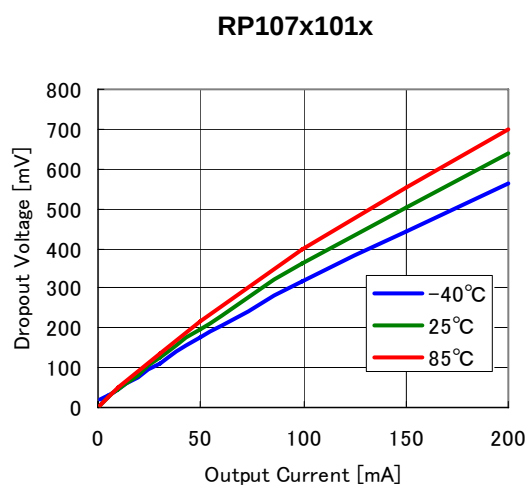


5) Supply Current vs. Temperature ($C_{IN}=0.1\mu F$, $I_{OUT}=0mA$)

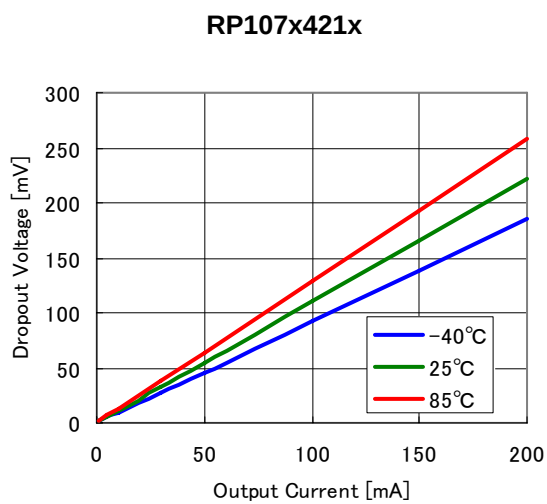
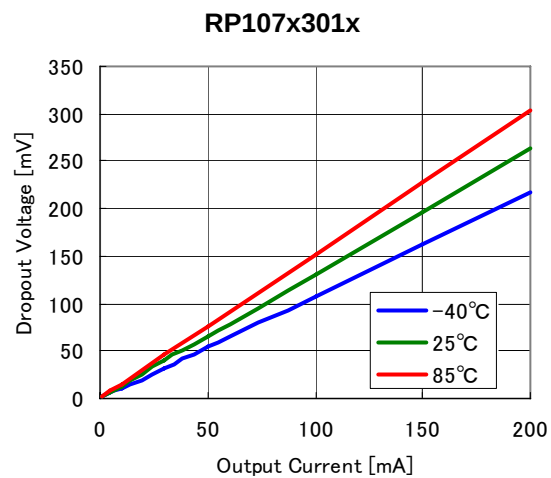
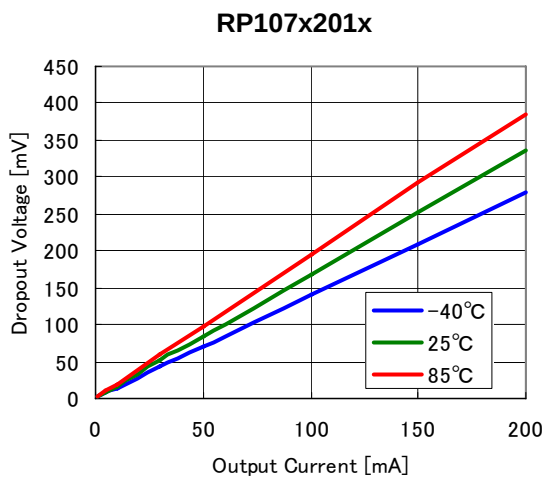




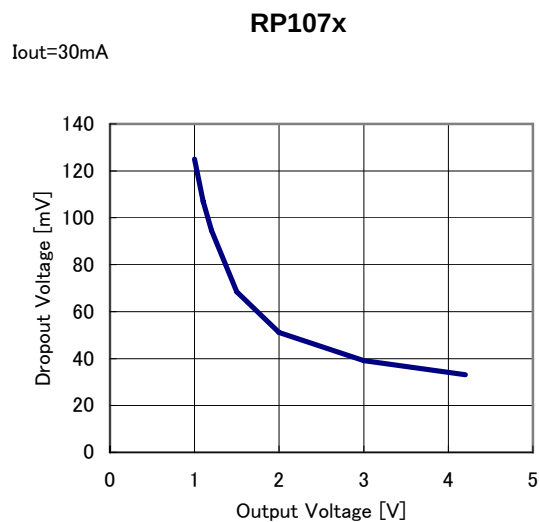
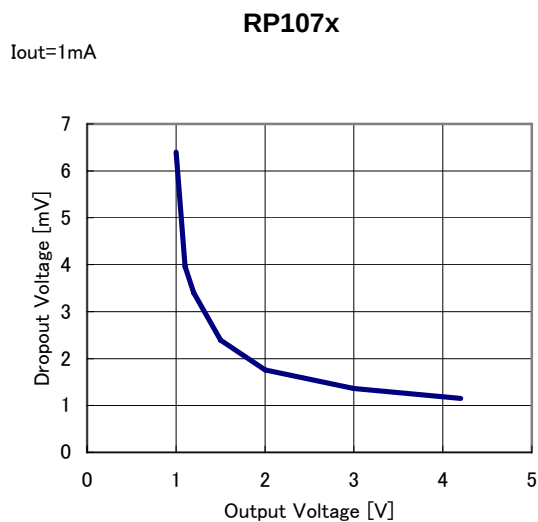
6) Dropout Voltage vs. Output Current ($C_{IN}=0.1\mu F$)



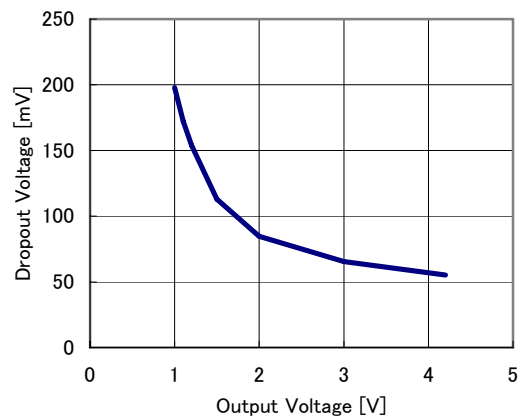
RP107x



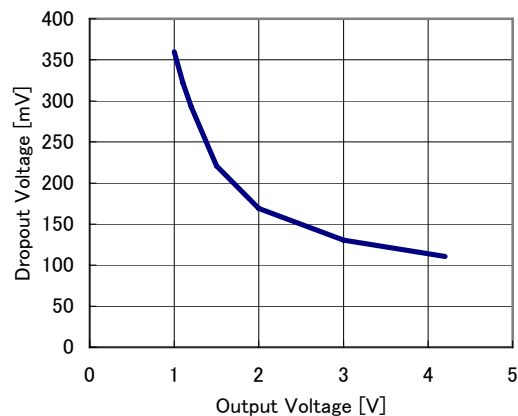
7) Dropout Voltage vs. Set Output Voltage ($C_{IN}=0.1\mu F$)



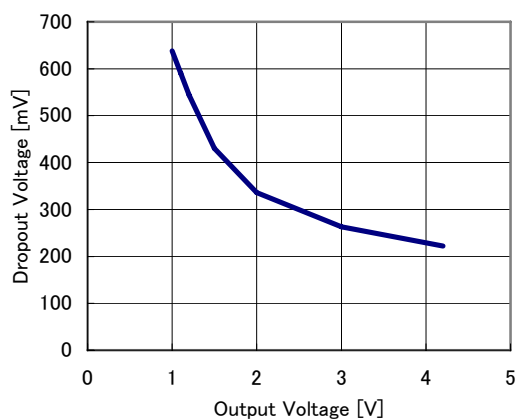
RP107x
I_{out}=50mA



RP107x
I_{out}=100mA

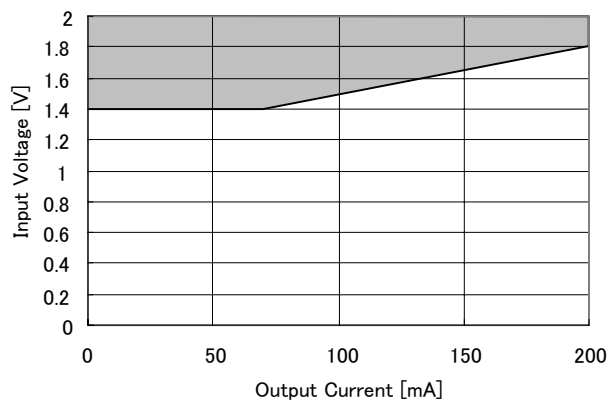


RP107x
I_{out}=200mA



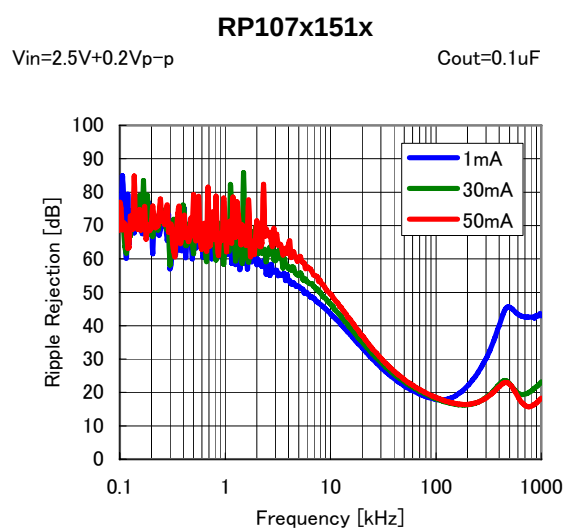
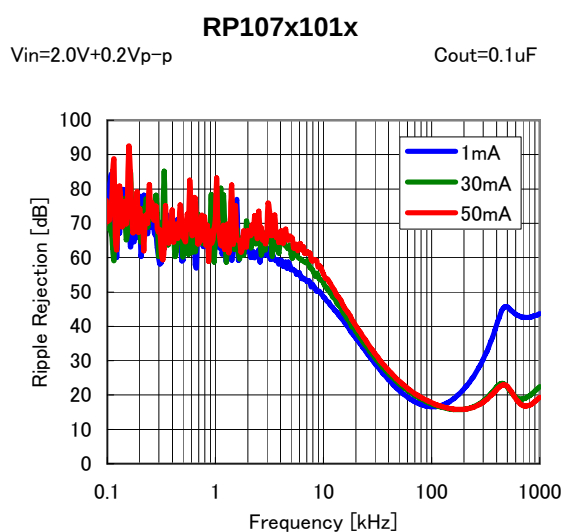
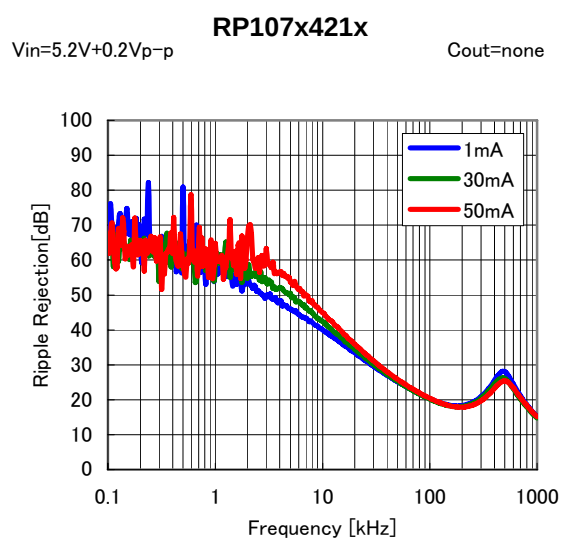
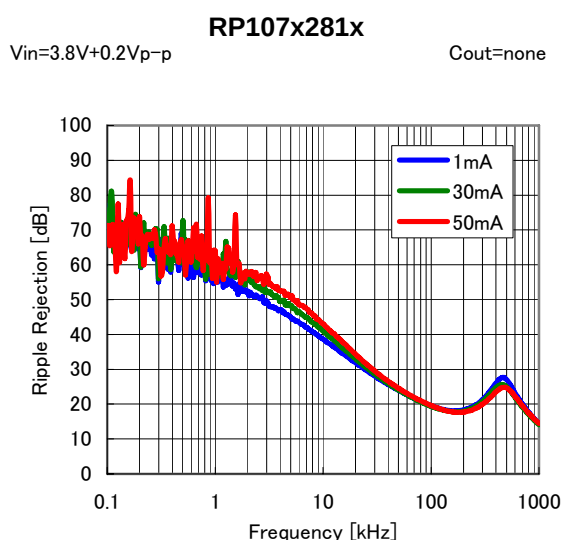
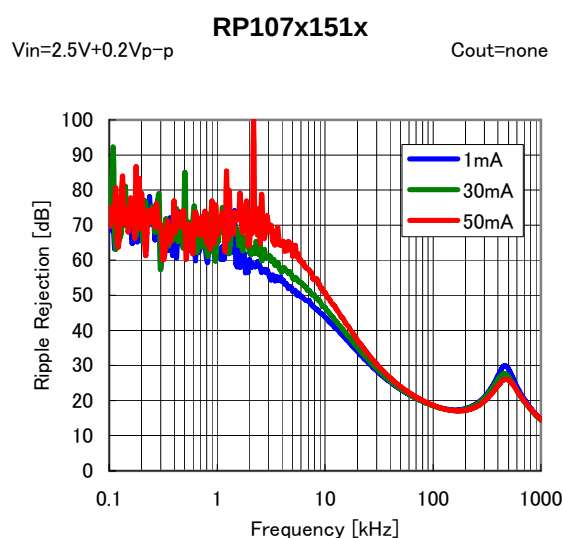
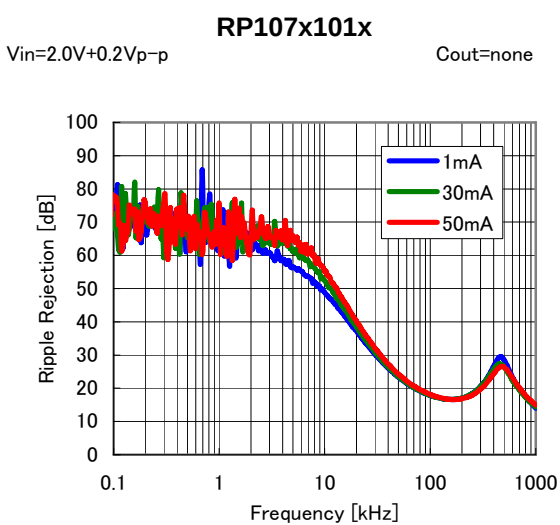
8) Minimum Operating Voltage (C_{IN}=0.1μF)

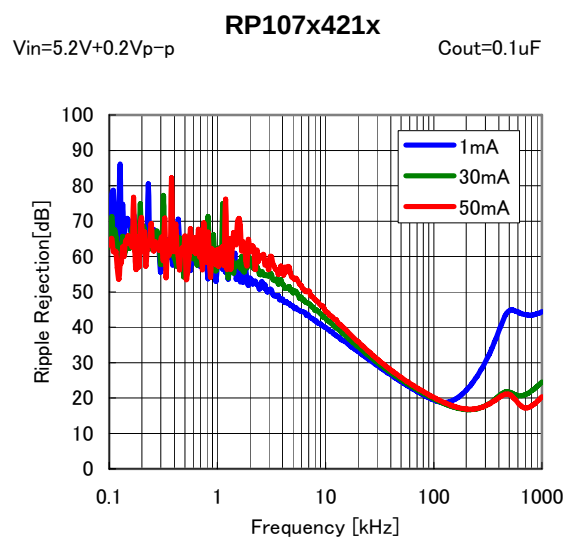
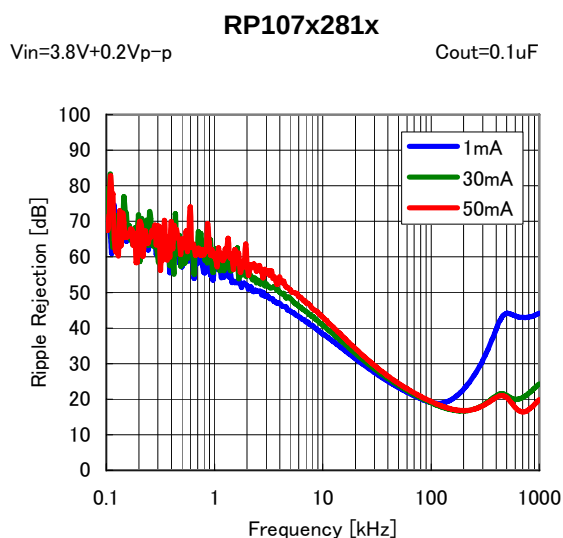
RP107x101x



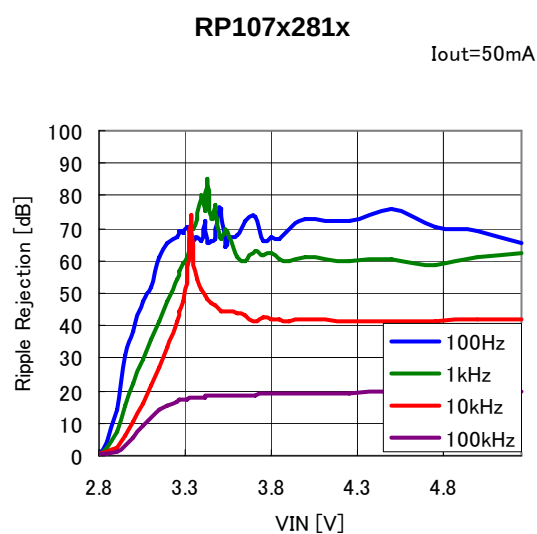
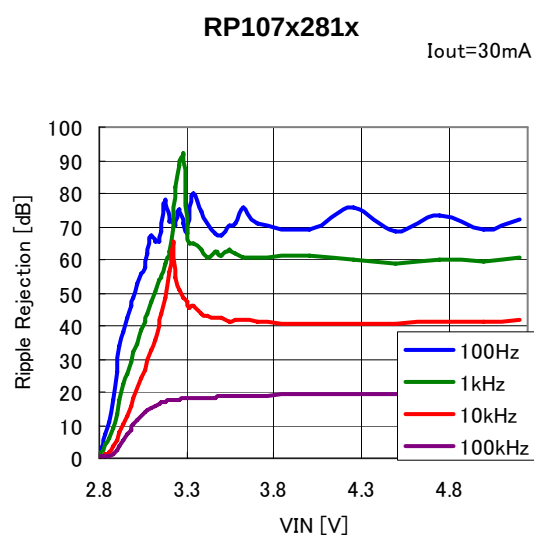
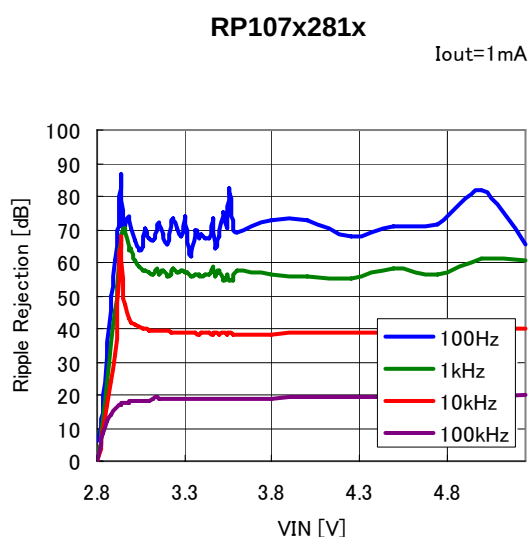
Hatched area is available
for 1.0V output

9) Ripple Rejection vs. Frequency ($C_{IN}=none$, $T_{opt}=25^{\circ}C$)





10) Ripple Rejection vs. Input Bias Voltage ($C_{out}=0.1\mu F$, $Ripple=0.2V_{p-p}$, $T_{opt}=25^{\circ}C$)

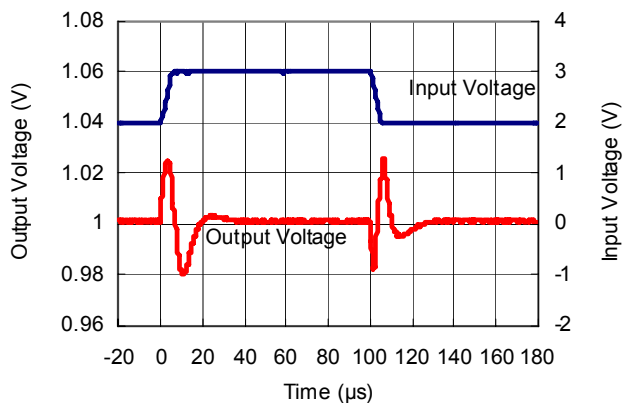


11) Input Transient Response ($C_{IN}=none$, $I_{OUT}=30mA$, $t_r=t_f=5\mu s$, $T_{opt}=25^{\circ}C$)

RP107x101x

Vin: 2V $\leftrightarrow$ 3V

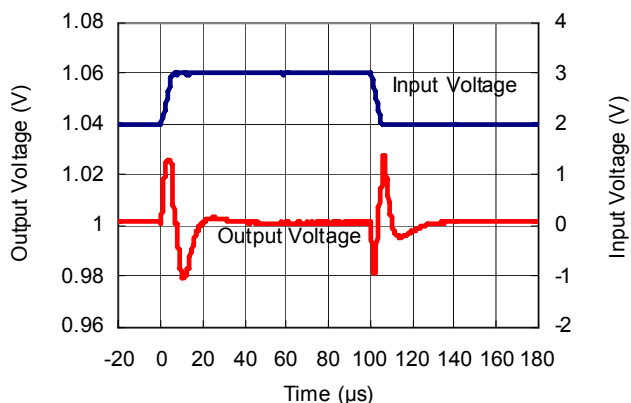
Cout=none



RP107x101x

Vin: 2V $\leftrightarrow$ 3V

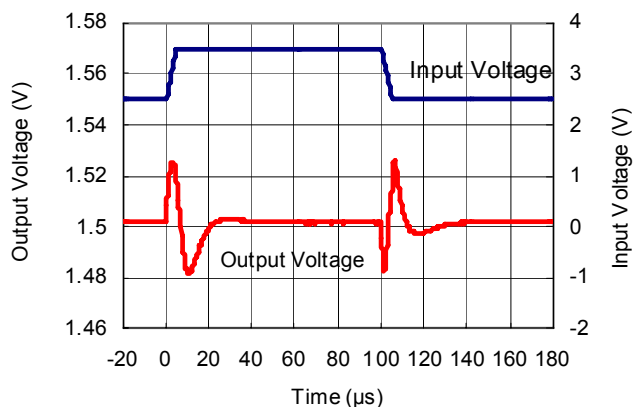
Cout=Ceramic 0.1 μF



RP107x151x

Vin: 2.5V $\leftrightarrow$ 3.5V

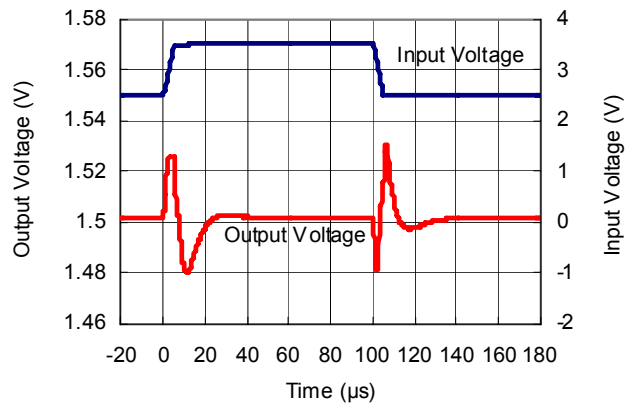
Cout=none



RP107x151x

Vin: 2.5V $\leftrightarrow$ 3.5V

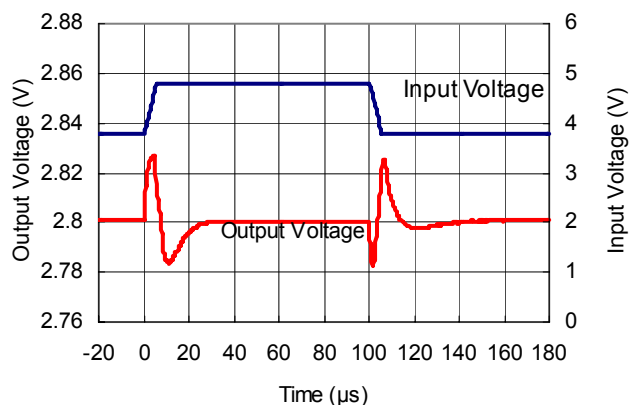
Cout=Ceramic 0.1 μF



RP107x281x

Vin: 3.8V $\leftrightarrow$ 4.8V

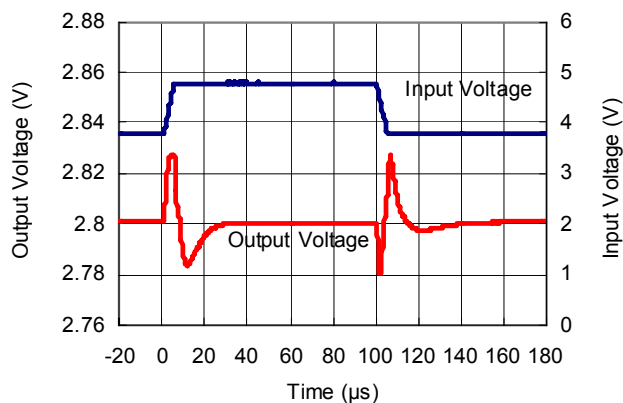
Cout=none



RP107x281x

Vin: 3.8V $\leftrightarrow$ 4.8V

Cout=Ceramic 0.1 μF



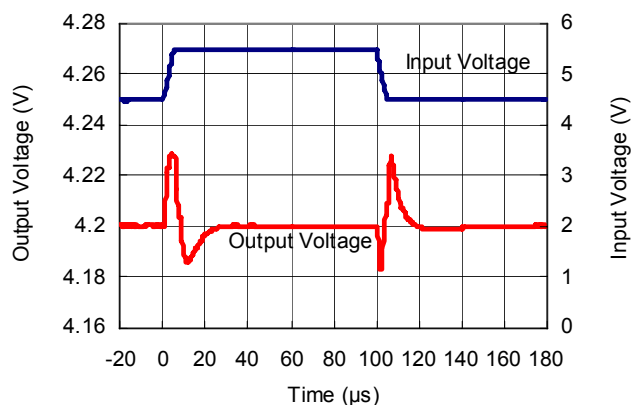
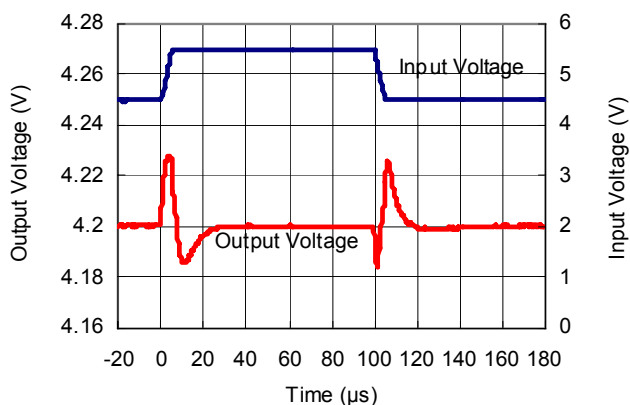
RP107x421x

Vin: 4.5V $\leftrightarrow$ 5.5V

Cout=none

Vin: 4.5V $\leftrightarrow$ 5.5V

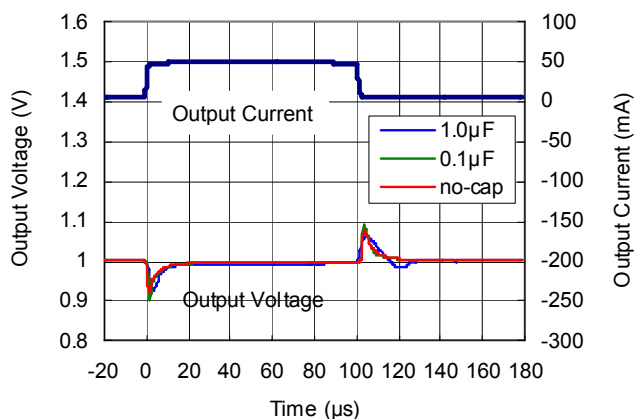
Cout=Ceramic 0.1 μ F



12) Load Transient Response ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)

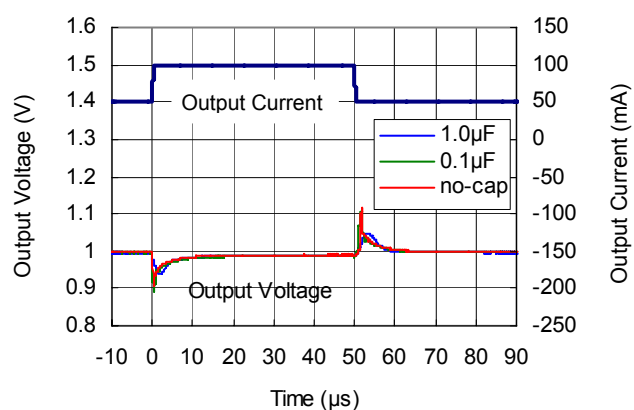
RP107x101x

Tr=Tf: 2 μ s
Iout: 5mA $\leftrightarrow$ 50mA



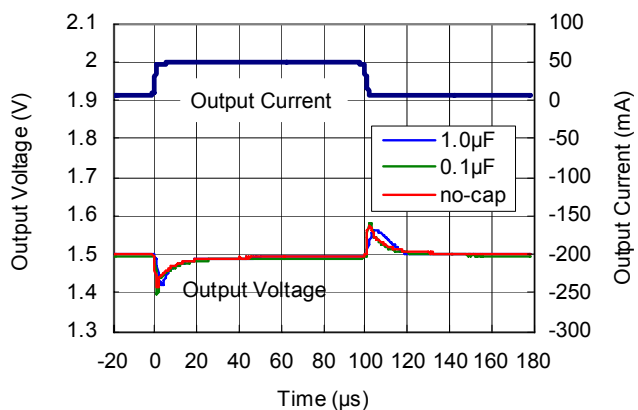
RP107x101x

Tr=Tf: 0.5 μ s
Iout: 50mA $\leftrightarrow$ 100mA



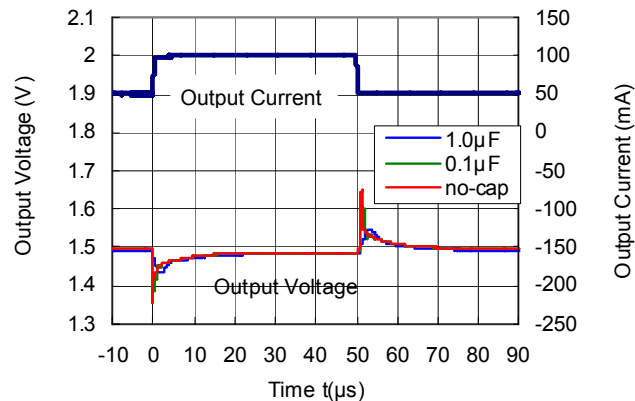
RP107x151x

Tr=Tf: 2 μ s
Iout: 5mA $\leftrightarrow$ 50mA

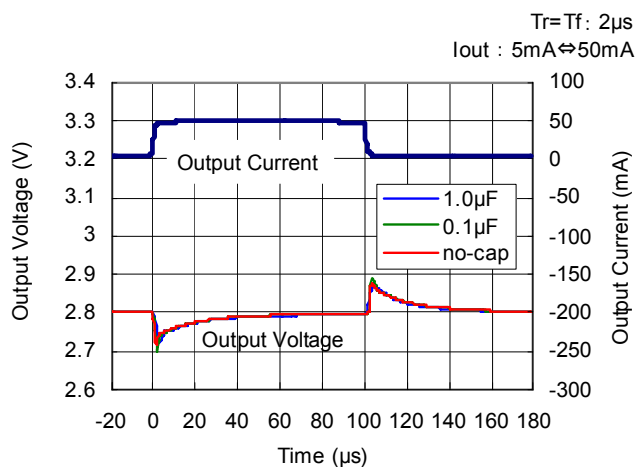


RP107x151x

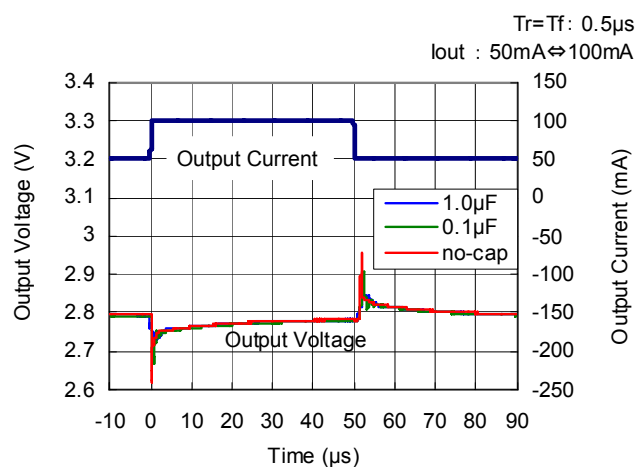
Tr=Tf: 0.5 μ s
Iout: 50mA $\leftrightarrow$ 100mA



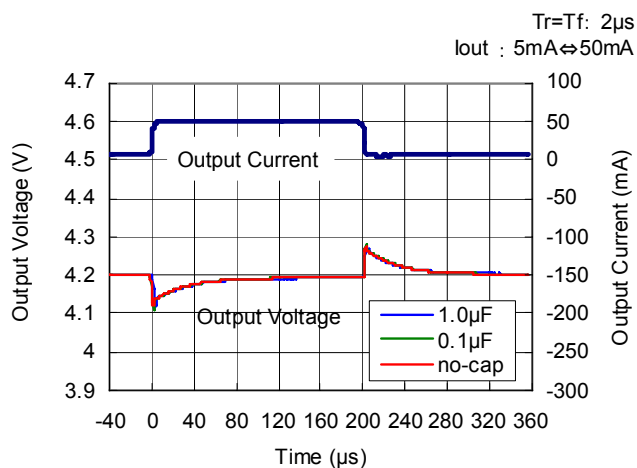
RP107x281x



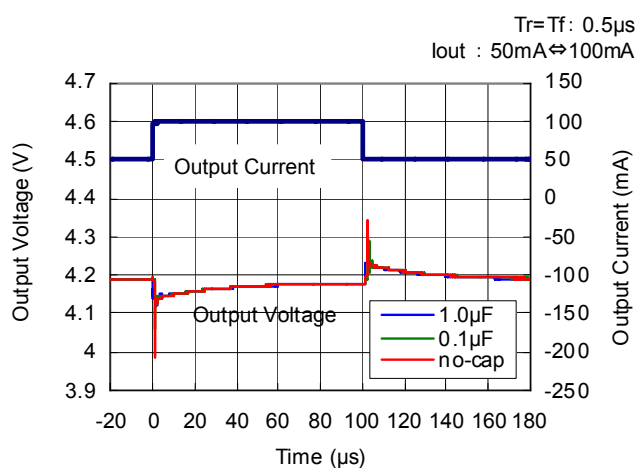
RP107x281x



RP107x421x



RP107x421x

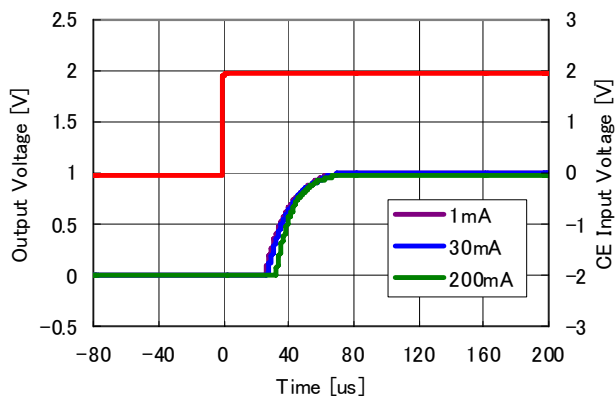


13) Turn On Speed with CE pin ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)

RP107x101x

Vin=2.0V

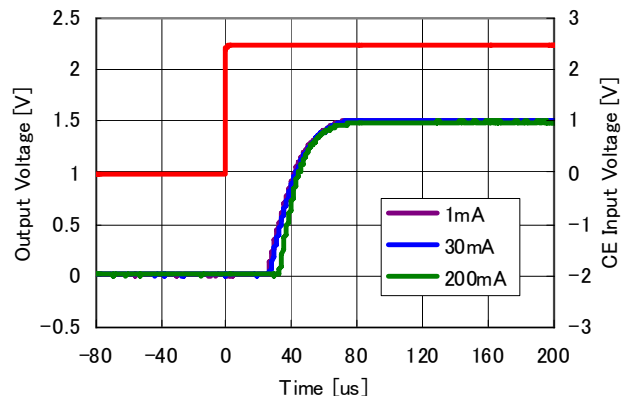
Cout=none

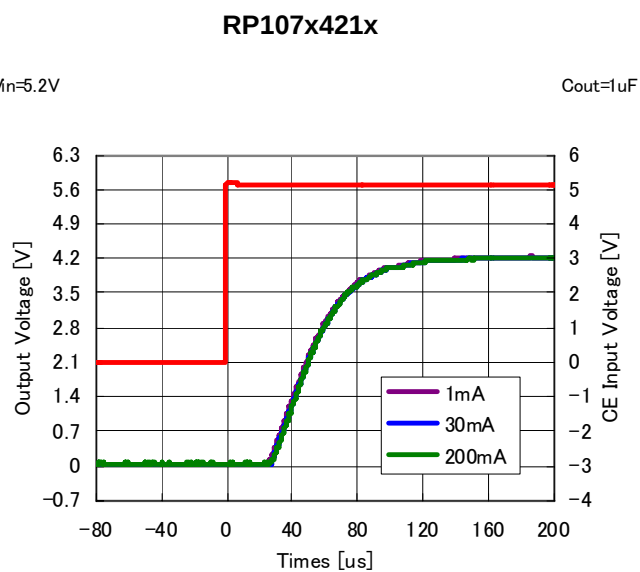
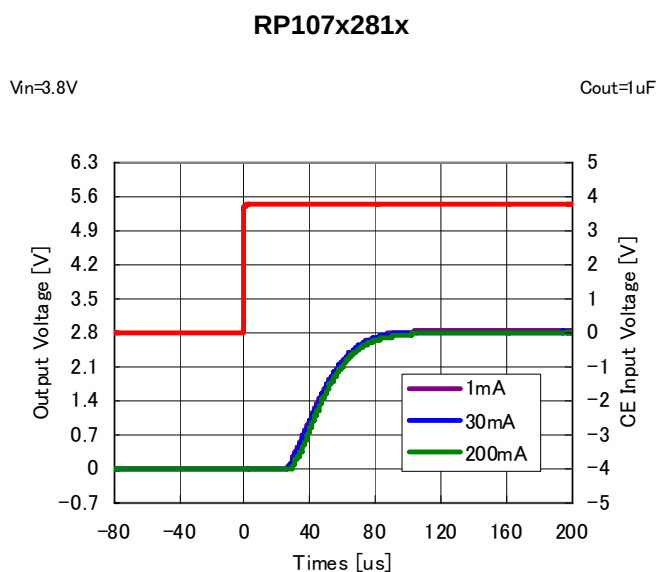
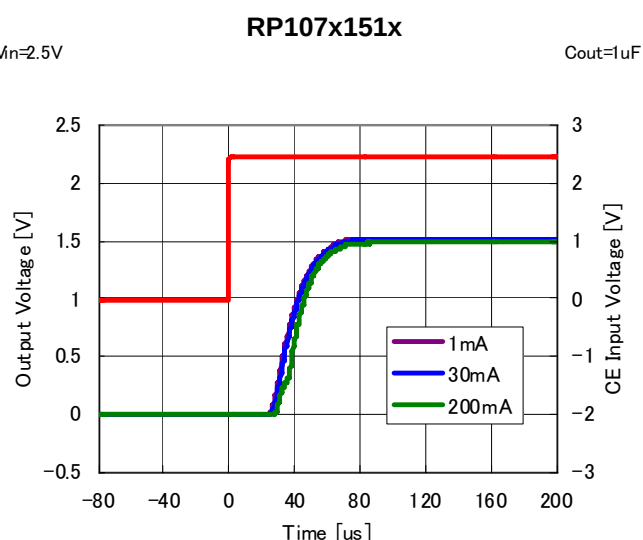
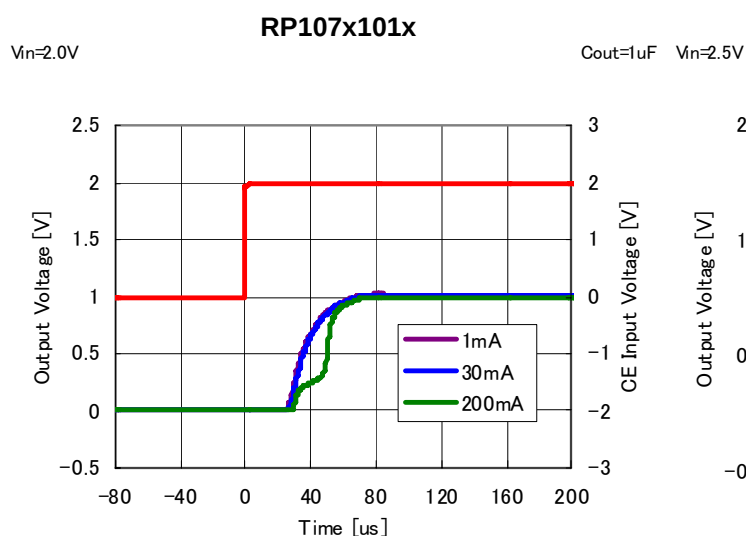
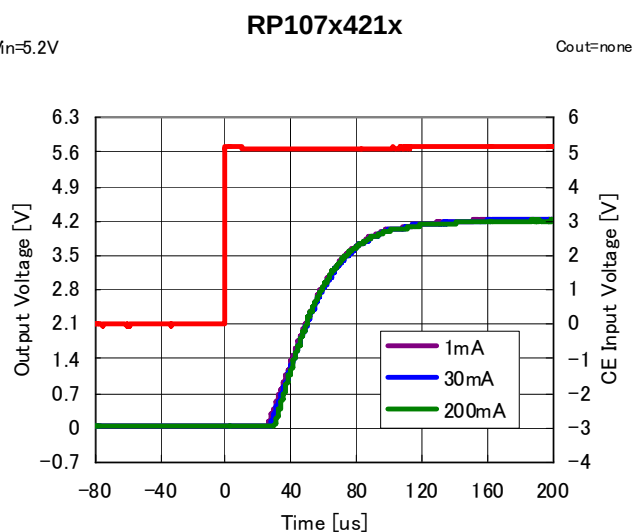
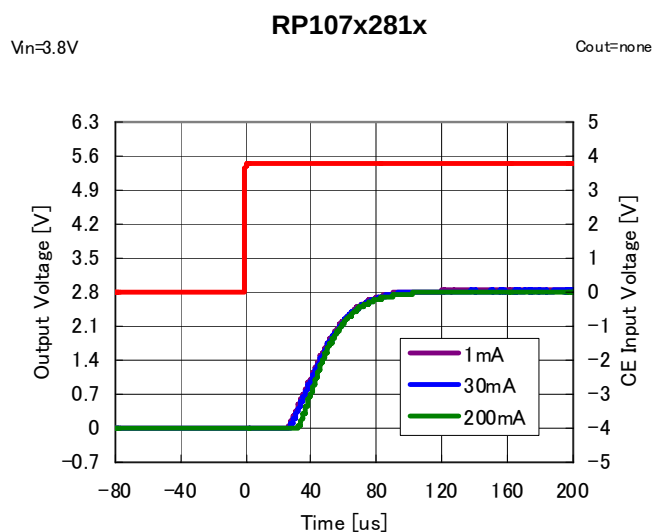


RP107x151x

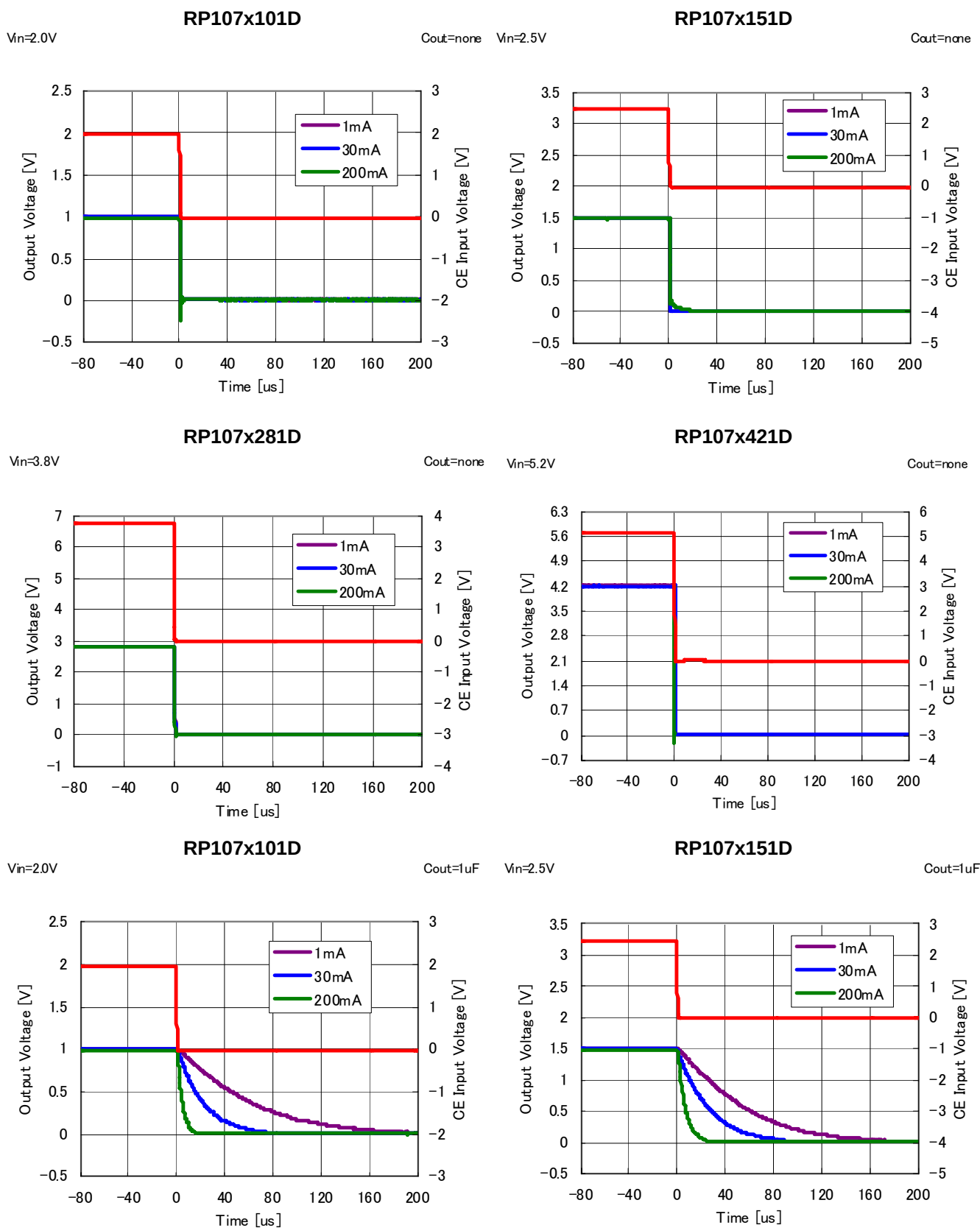
Vin=2.5V

Cout=none





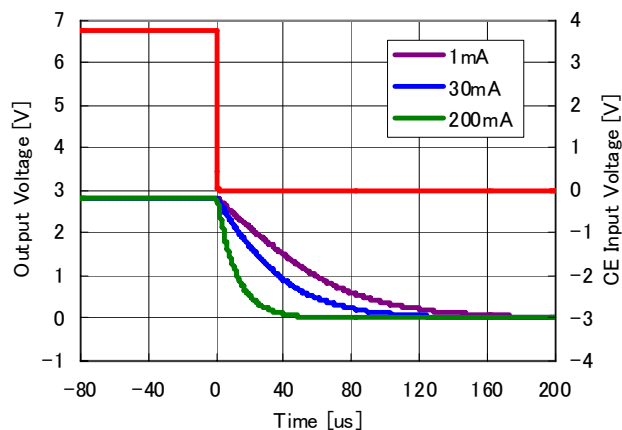
14) Turn Off Speed with CE pin (D Version) ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)



RP107x281D

$V_{IN}=3.8V$

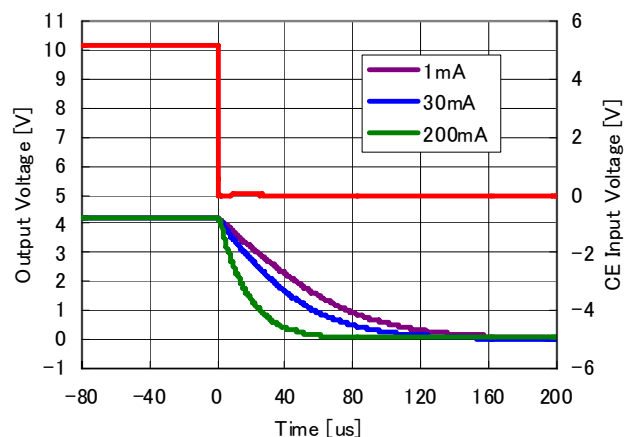
$C_{OUT}=1\mu F$



RP107x421D

$V_{IN}=5.2V$

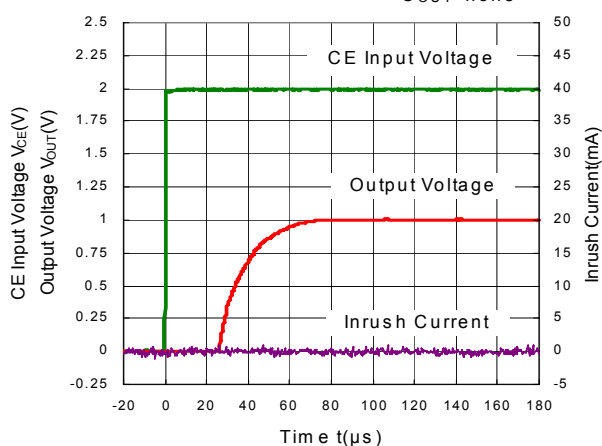
$C_{OUT}=1\mu F$



15) Inrush Current ($C_{IN}=0.1\mu F$, $T_{opt}=25^{\circ}C$)

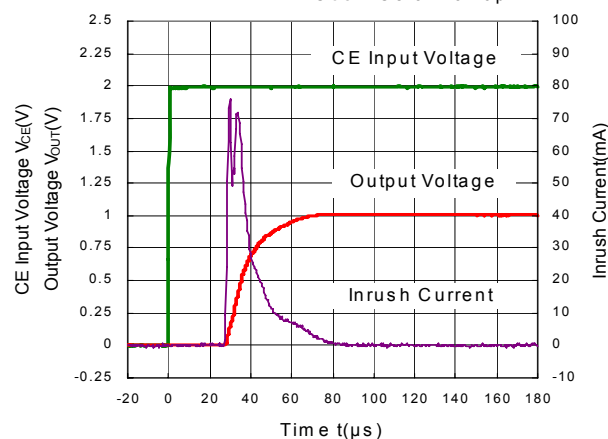
RP107x101x

$V_{IN}=2.0V$
 $C_{OUT}=none$



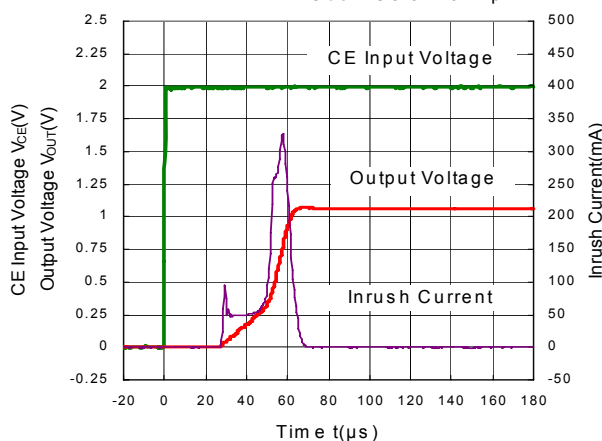
RP107x101x

$V_{IN}=2.0V$
 $C_{OUT}=Ceramic1.0\mu F$



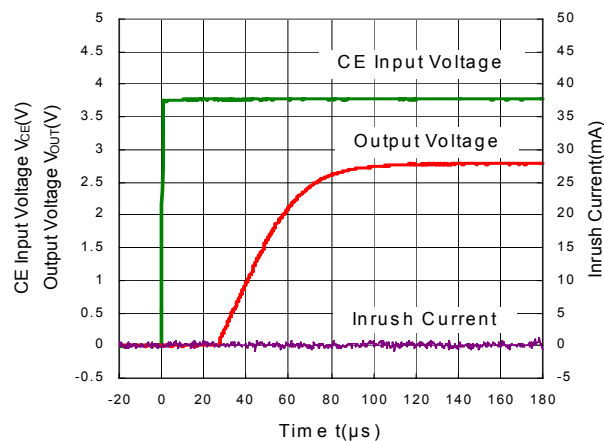
RP107x101x

$V_{IN}=2.0V$
 $C_{OUT}=Ceramic4.7\mu F$



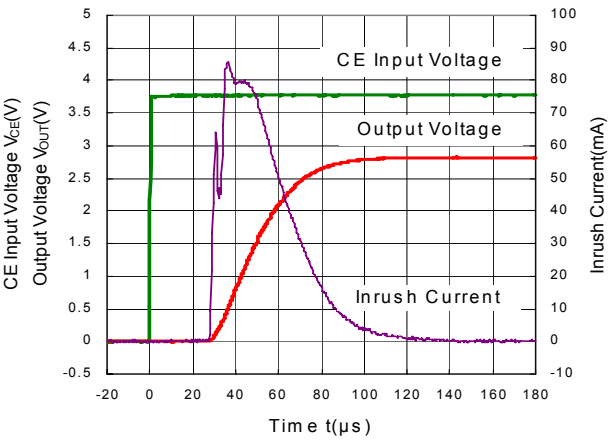
RP107x281x

$V_{IN}=3.8V$
 $C_{OUT}=none$



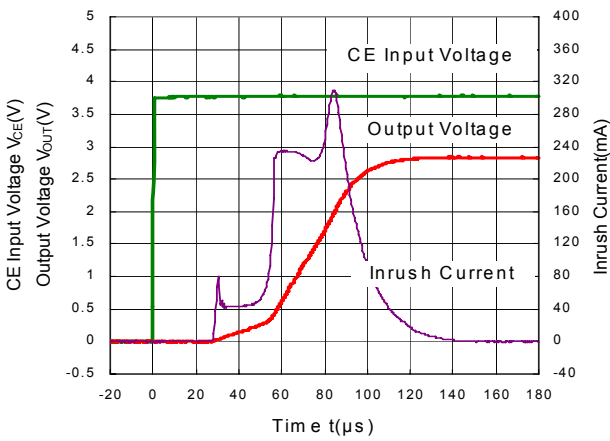
RP107x281x

V_{IN}=3.8V
C_{OUT}=Ceramic1.0μF



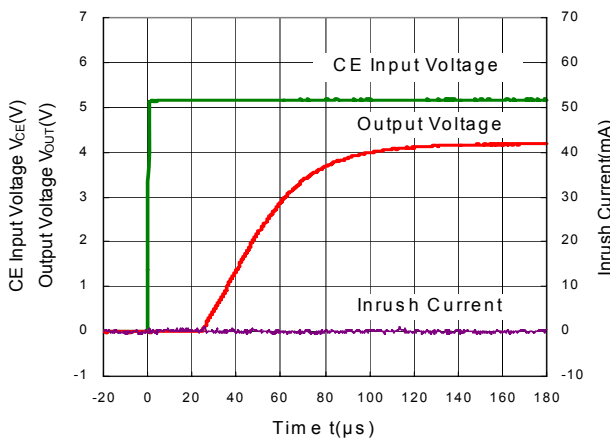
RP107x281x

V_{IN}=3.8V
C_{OUT}=Ceramic4.7μF



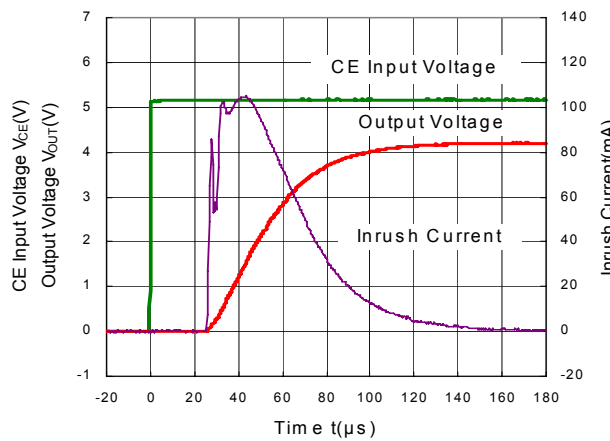
RP107x421x

V_{IN}=5.2V
C_{OUT}=none



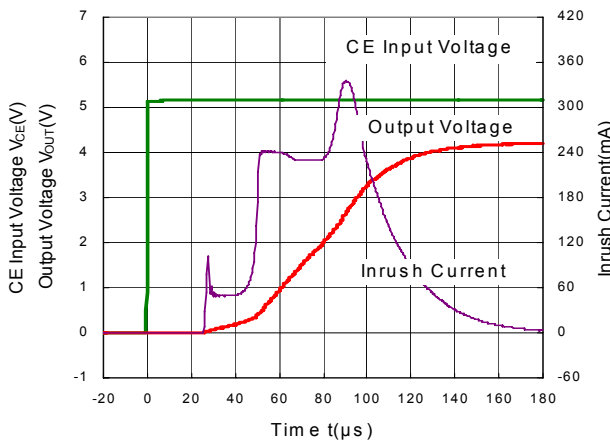
RP107x421x

V_{IN}=5.2V
C_{OUT}=Ceramic1.0μF



RP107x421x

V_{IN}=5.2V
C_{OUT}=Ceramic4.7μF



ESR vs. Output Current

When using these ICs, consider the following points:

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below.

The conditions when the white noise level is under $40\mu V$ (Avg.) are marked as the hatched area in the graph.

Measurement conditions

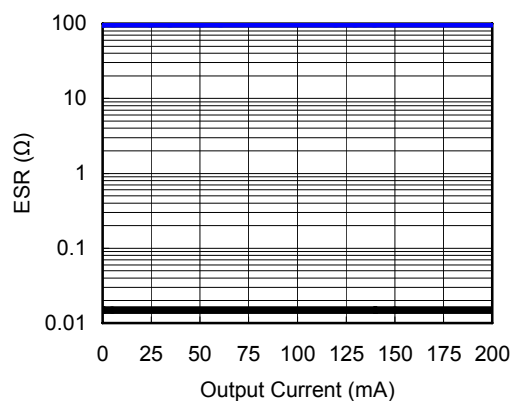
Frequency Band : 10Hz to 2MHz

Temperature : $-40^{\circ}C$ to $85^{\circ}C$

C_{IN} , C_{OUT} : Ceramic $0.1\mu F$

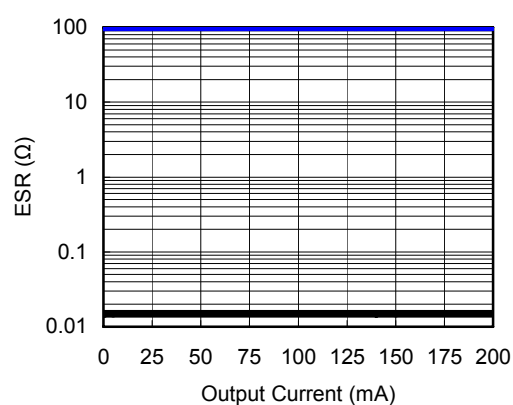
RP107x101x

$V_{in}=1.0V\sim 5.25V$



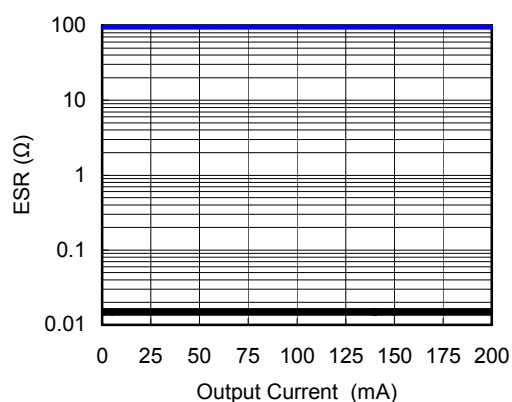
RP107x281x

$V_{in}=1.0V\sim 5.25V$



RP107x421x

$V_{in}=1.0V\sim 5.25V$





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■ Ricoh awarded ISO 14001 certification.

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