

## LOW NOISE 150mA LDO REGULATOR

NO.EA-204-170425

### OUTLINE

The RP109x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, extremely low supply current, low ON-resistance, and high ripple rejection. Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, a current limit circuit and a chip enable circuit.

These ICs perform with low dropout voltage and a chip enable function which prolong the battery life.

The line transient response and load transient response of the RP109x Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment. RP109x Series contributes to the downsizing of the hand-held equipment because it can use the 0.1 $\mu$ F ceramic capacitor.

In addition to SOT-23-5, SC-88A and DFN1010-4 packages, a 0.8mm square ultra compact DFN(PLP)0808-4 package is also available.

### FEATURES

- Supply Current ..... Typ. 50 $\mu$ A
- Standby Mode ..... Typ. 0.1 $\mu$ A
- Dropout Voltage..... Typ. 0.25V ( $I_{OUT}=150\text{mA}$ ,  $V_{OUT}=2.5\text{V}$ )
- Ripple Rejection ..... Typ. 75dB ( $f=1\text{kHz}$ ,  $V_{OUT}=2.5\text{V}$ )
- Temperature-Drift Coefficient of Output Voltage ..... Typ.  $\pm 100\text{ppm}/^\circ\text{C}$  ( $V_{OUT}<1.8\text{V}$ )  
Typ.  $\pm 30\text{ppm}/^\circ\text{C}$  ( $V_{OUT}\geq 1.8\text{V}$ )
- Line Regulation ..... Typ. 0.02%/V
- Output Voltage Accuracy .....  $\pm 1.0\%$
- Packages ..... DFN(PLP)0808-4, DFN1010-4, SC-88A, SOT-23-5
- Input Voltage Range..... 1.4V to 5.25V
- Output Voltage Range..... 0.8V 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 or more

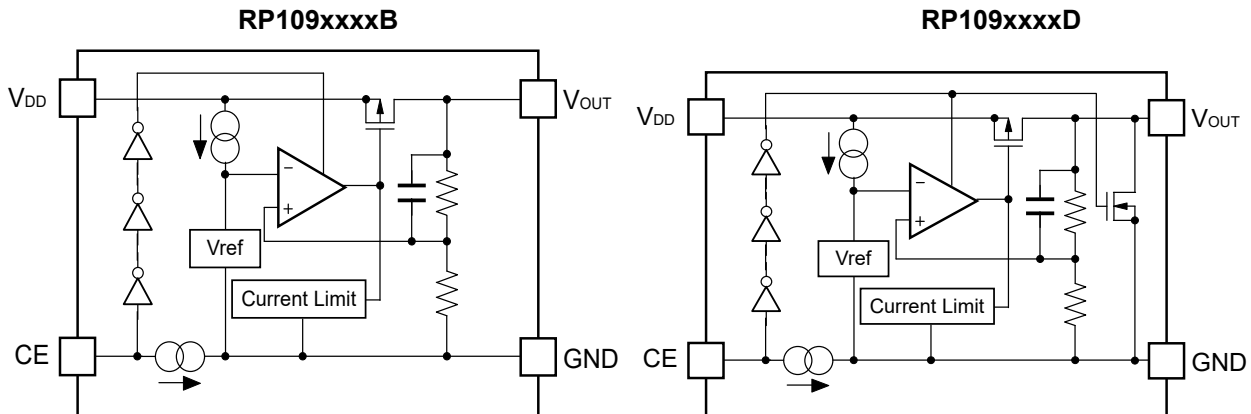
### APPLICATIONS

- Power source for portable communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
- Power source for home appliances.

## RP109x

NO.EA-204-170425

## 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
RP109Kxx1*-TR	DFN(PLP)0808-4	10,000 pcs	Yes	Yes
RP109Lxx1*-TR	DFN1010-4	10,000 pcs	Yes	Yes
RP109Qxx2*-TR-FE	SC-88A	3,000 pcs	Yes	Yes
RP109Nxx1*-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

xx: Specify the set output voltage ( $V_{SET}$ ) within the range of 0.8V to 3.6 in 0.1V steps.

The second decimal point of  $V_{SET}$  is described as below.

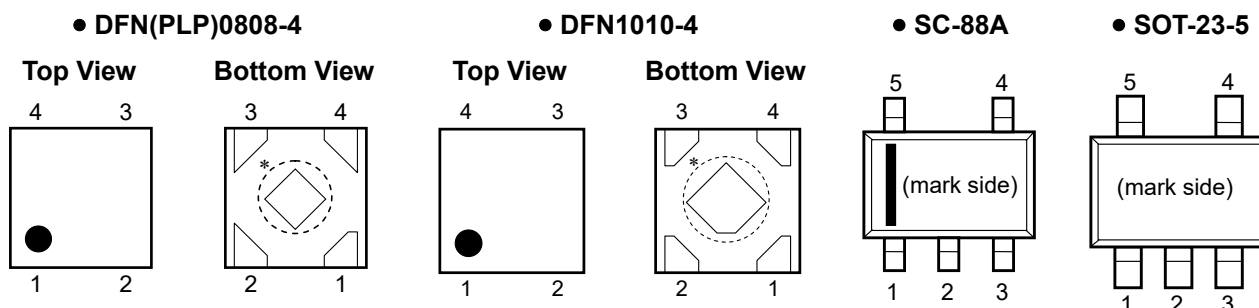
1.25V: RP109x12x\*5

1.85V: RP109x18x\*5

2.85V: RP109x28x\*5

\*: Select the polarity of the CE pin from (B) "H" active without auto-discharge function or (D) "H" active with auto-discharge function.

## PIN CONFIGURATIONS



## PIN DESCRIPTIONS

### • DFN(PLP)0808-4 / DFN1010-4

Pin No	Symbol	Pin Description
1	$V_{OUT}$	Output Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	$V_{DD}$	Input Pin

\* Tab is GND level. (They are connected to the reverse side of this IC.)

The tab is better to be connected to the GND, but leaving it open is also acceptable.

### • SC-88A

Pin No	Symbol	Pin Description
1	CE	Chip Enable Pin ("H" Active)
2 *	NC	No Connection
3	GND	Ground Pin
4	$V_{OUT}$	Output Pin
5	$V_{DD}$	Input Pin

\* Pin No. 2 is connected to the bottom of the IC. It is recommended that the pin be connected to the ground plane on the board, or otherwise be left floating so that there is no contact with other potentials.

### • SOT-23-5

Pin No	Symbol	Pin Description
1	$V_{DD}$	Input Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
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	180	mA
$P_D$	Power Dissipation* (DFN(PLP)0808-4)	286	mW
	Power Dissipation* (DFN1010-4)	400	
	Power Dissipation* (SC-88A)	380	
	Power Dissipation* (SOT-23-5)	420	
$T_a$	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.

## ELECTRICAL CHARACTERISTICS

● RP109xxxxB/D

$V_{IN}=V_{SET}+1.0V$  ( $V_{OUT}>1.5$ ),  $V_{IN}=2.5V$  ( $V_{OUT}\leq 1.5V$ ),  $I_{OUT}=1mA$ ,  $C_{IN}=C_{OUT}=0.1\mu F$ , unless otherwise noted.

The specifications surrounded by   are guaranteed by Design Engineering at  $-40^{\circ}C \leq T_a \leq 85^{\circ}C$ .

RP109x Series

( $T_a=25^{\circ}C$ )

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
$V_{OUT}$	Output Voltage	$T_a = 25^{\circ}C$	$V_{SET} \geq 1.8V$	x 0.99	x 1.01	V
			$V_{SET} < 1.8V$	-18	+18	mV
		$-40^{\circ}C \leq T_a \leq 85^{\circ}C$	$V_{SET} \geq 1.8V$	<span style="border: 1px solid black; padding: 0 2px;">x 0.985</span>	<span style="border: 1px solid black; padding: 0 2px;">x 1.015</span>	V
			$V_{SET} < 1.8V$	<span style="border: 1px solid black; padding: 0 2px;">-50</span>	<span style="border: 1px solid black; padding: 0 2px;">+50</span>	mV
$I_{OUT}$	Output Current		<span style="border: 1px solid black; padding: 0 2px;">150</span>			mA
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$1mA \leq I_{OUT} \leq 150mA$		5	<span style="border: 1px solid black; padding: 0 2px;">30</span>	mV
$V_{DIF}$	Dropout Voltage	Please see <i>Dropout Voltage</i> on the next page.				
$I_{SS}$	Supply Current	$I_{OUT} = 0mA$		50	<span style="border: 1px solid black; padding: 0 2px;">70</span>	$\mu A$
$I_{standby}$	Supply Current (Standby Mode)	$V_{CE} = 0V$		0.1	1.0	$\mu A$
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$V_{SET}+0.5V \leq V_{IN} \leq 5.25V$ $V_{IN} \geq 1.4V$		0.02	<span style="border: 1px solid black; padding: 0 2px;">0.10</span>	%/V
RR	Ripple Rejection	f = 1kHz Ripple 0.2Vp-p $V_{IN} = V_{SET} + 1.0V$ $I_{OUT} = 30mA$		75		dB
$V_{IN}$	Input Voltage*1		<span style="border: 1px solid black; padding: 0 2px;">1.4</span>		<span style="border: 1px solid black; padding: 0 2px;">5.25</span>	V
$\frac{\Delta V_{OUT}}{\Delta T_a}$	Output Voltage Temperature Coefficient	$-40^{\circ}C \leq T_a \leq 85^{\circ}C$	$V_{SET} \geq 1.8V$		$\pm 30$	ppm / $^{\circ}C$
			$V_{SET} < 1.8V$		$\pm 100$	
$I_{SC}$	Short Current Limit	$V_{OUT} = 0V$		40		mA
$I_{PD}$	CE Pull-down Current			0.3	<span style="border: 1px solid black; padding: 0 2px;">0.6</span>	$\mu A$
$V_{CEH}$	CE Input Voltage "H"		<span style="border: 1px solid black; padding: 0 2px;">1.0</span>			V
$V_{CEL}$	CE Input Voltage "L"				<span style="border: 1px solid black; padding: 0 2px;">0.4</span>	V
en	Output Noise	BW = 10Hz to 100kHz	$V_{SET} \geq 1.8V$		20 x $V_{SET}$	$\mu V_{rms}$
			$V_{SET} < 1.8V$		40 x $V_{SET}$	
$R_{LOW}$	Nch On Resistance for Auto-discharge (D Version Only)	$V_{IN} = 4.0V$ $V_{CE} = 0V$		60		$\Omega$

All test items listed under *Electrical Characteristics* are done under the pulse load condition ( $T_j \approx T_a = 25^{\circ}C$ ) except Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

\*1 Maximum input voltage is 5.25V. If, for any reason the input voltage exceeds 5.25V, it has to be no more than 5.5V, and total operating time should be within 500 hours.

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**RP109x**

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The specifications surrounded by   are guaranteed by Design Engineering at  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$ .

**Dropout Voltage**

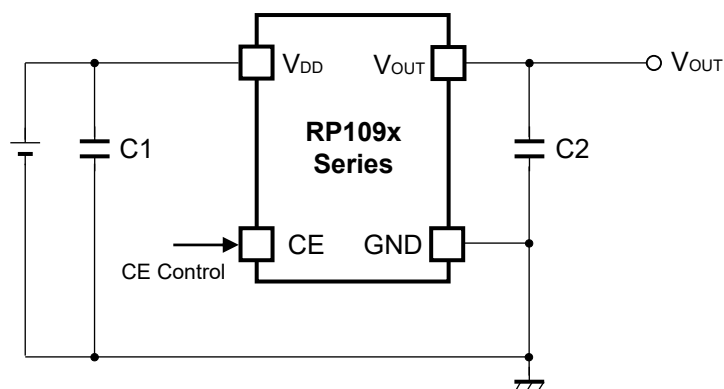
(Ta=25°C)

Set Output Voltage $V_{\text{SET}}$ (V)	Dropout Voltage $V_{\text{DIF}}$ (V)		
	Condition	Typ.	Max.
$V_{\text{SET}} = 0.8$	$I_{\text{OUT}} = 150\text{mA}$	0.700	1.000
$V_{\text{SET}} = 0.9$		0.620	0.910
$1.0 \leq V_{\text{SET}} < 1.2$		0.560	0.820
$1.2 \leq V_{\text{SET}} < 1.4$		0.470	0.670
$1.4 \leq V_{\text{SET}} < 1.8$		0.390	0.540
$1.8 \leq V_{\text{SET}} < 2.1$		0.330	0.480
$2.1 \leq V_{\text{SET}} < 2.5$		0.280	0.400
$2.5 \leq V_{\text{SET}} < 3.0$		0.250	0.350
$3.0 \leq V_{\text{SET}} \leq 3.6$		0.230	0.320

**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.

## TYPICAL APPLICATION



(External Components)

C2 0.1 $\mu$ F MURATA: GRM155B31C104KA87B

## 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 0.1 $\mu$ F or more and good 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.

## PACKAGE INFORMATION

### • Power Dissipation (DFN (PLP) 0808-4)

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

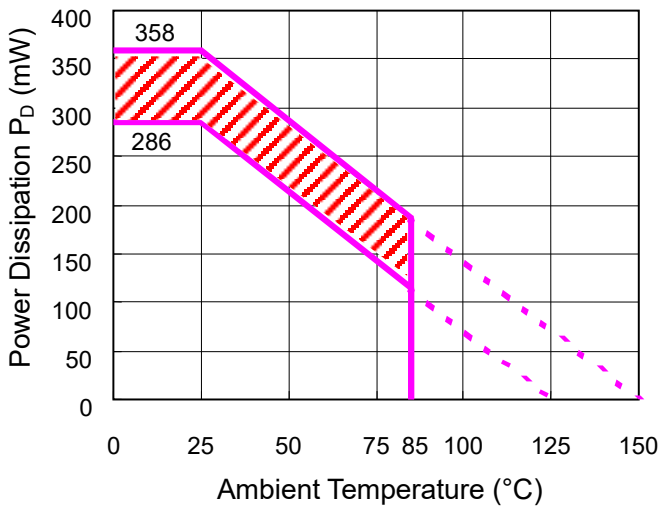
#### Measurement Conditions:

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double-sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	φ 0.5mm × 24pcs

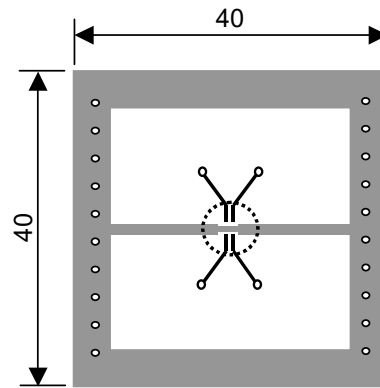
#### Measurement Results:

( $T_a=25^\circ\text{C}$ )

	Standard Land Pattern
Power Dissipation	286mW ( $T_{j\max}=125^\circ\text{C}$ ) 358mW ( $T_{j\max}=150^\circ\text{C}$ )
Thermal Resistance	$\theta_{ja} = (125-25^\circ\text{C})/0.286\text{W} = 350^\circ\text{C/W}$
	$\theta_{jc} = 90^\circ\text{C/W}$



Power Dissipation



Measurement Board Pattern

○ IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of  $T_{j\max}=125^\circ\text{C}$  and  $T_{j\max}=150^\circ\text{C}$ .

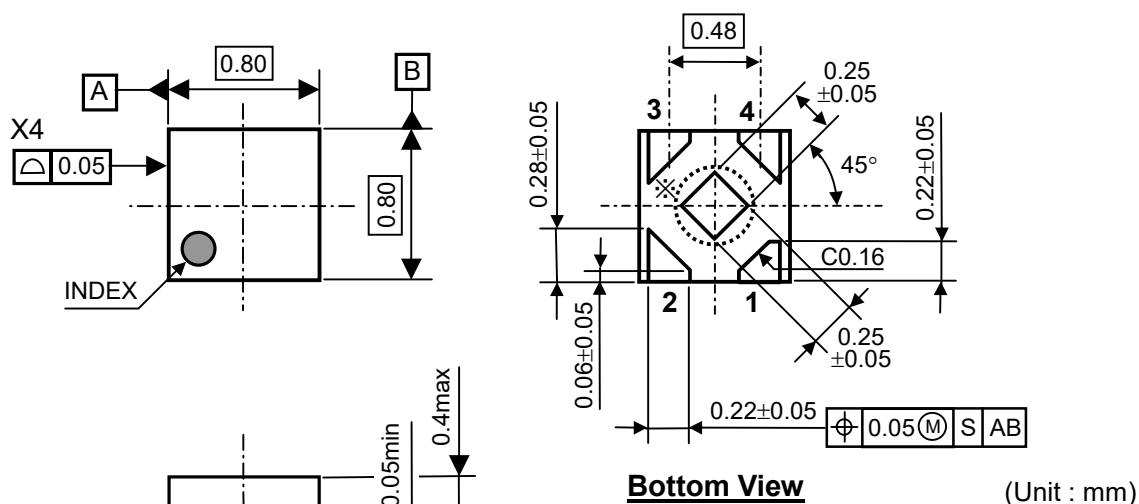
The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime.

The operation time of the IC must be remained within the time limit described in the table below.

Operating Time	Estimated Years (Operating 4 hours/day)
13,000 hours	9 years



• Package Dimensions (DFN (PLP) 0808-4)

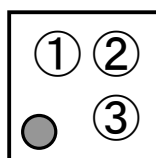


※) Tab is GND level. (They are connected to the reverse side of this IC.)  
The tab is better to be connected to the GND, but leaving it open is also acceptable.

• Mark Specification (DFN (PLP) 0808-4)

①: Product Code ... Refer to “RP109K Series Mark Specification Table”.

②③: Lot Number ... Alphanumeric Serial Number



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**RP109x**

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● **RP109K Series Mark Specification Table (DFN(PLP)0808-4)****RP109Kxx1B**

Product Name	①	V <sub>SET</sub>
RP109K081B	A	0.8V
RP109K091B	A	0.9V
RP109K101B	A	1.0V
RP109K111B	A	1.1V
RP109K121B	A	1.2V
RP109K131B	A	1.3V
RP109K141B	A	1.4V
RP109K151B	A	1.5V
RP109K161B	A	1.6V
RP109K171B	A	1.7V
RP109K181B	A	1.8V
RP109K191B	A	1.9V
RP109K201B	A	2.0V
RP109K211B	A	2.1V
RP109K221B	A	2.2V
RP109K231B	A	2.3V
RP109K241B	A	2.4V
RP109K251B	A	2.5V
RP109K261B	A	2.6V
RP109K271B	A	2.7V
RP109K281B	A	2.8V
RP109K291B	A	2.9V
RP109K301B	A	3.0V
RP109K311B	A	3.1V
RP109K321B	A	3.2V
RP109K331B	A	3.3V
RP109K341B	A	3.4V
RP109K351B	A	3.5V
RP109K361B	A	3.6V
RP109K121B5	A	1.25V
RP109K181B5	A	1.85V
RP109K281B5	A	2.85V

**RP109Kxx1D**

Product Name	①	V <sub>SET</sub>
RP109K081D	A	0.8V
RP109K091D	A	0.9V
RP109K101D	A	1.0V
RP109K111D	A	1.1V
RP109K121D	A	1.2V
RP109K131D	A	1.3V
RP109K141D	A	1.4V
RP109K151D	A	1.5V
RP109K161D	A	1.6V
RP109K171D	A	1.7V
RP109K181D	A	1.8V
RP109K191D	A	1.9V
RP109K201D	A	2.0V
RP109K211D	A	2.1V
RP109K221D	A	2.2V
RP109K231D	A	2.3V
RP109K241D	A	2.4V
RP109K251D	A	2.5V
RP109K261D	A	2.6V
RP109K271D	A	2.7V
RP109K281D	A	2.8V
RP109K291D	A	2.9V
RP109K301D	A	3.0V
RP109K311D	A	3.1V
RP109K321D	A	3.2V
RP109K331D	A	3.3V
RP109K341D	A	3.4V
RP109K351D	A	3.5V
RP109K361D	A	3.6V
RP109K121D5	A	1.25V
RP109K181D5	A	1.85V
RP109K281D5	A	2.85V

● **Power Dissipation (DFN1010-4)**

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

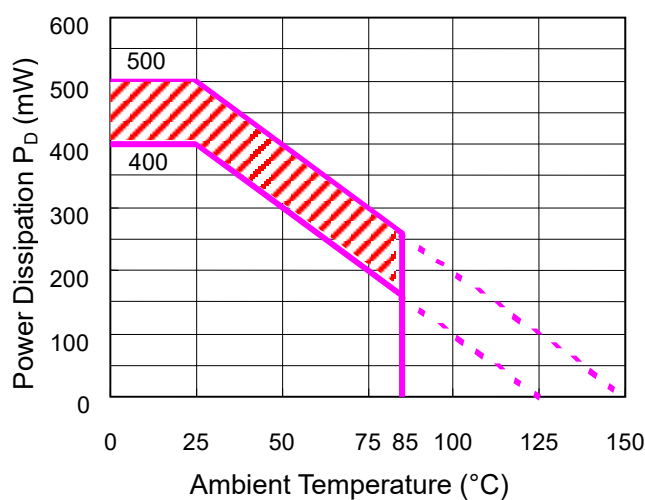
**Measurement Conditions:**

	<b>Standard Land Pattern</b>
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	φ 0.54mm × 24pcs

**Measurement Results:**

( $T_a=25^{\circ}\text{C}$ )

	<b>Standard Land Pattern</b>
Power Dissipation	400mW ( $T_{jmax}=125^{\circ}\text{C}$ ) 500mW ( $T_{jmax}=150^{\circ}\text{C}$ )
Thermal Resistance	$\theta_{ja} = (125-25^{\circ}\text{C})/0.4\text{W} = 250^{\circ}\text{C/W}$ $\theta_{jc} = 67^{\circ}\text{C/W}$



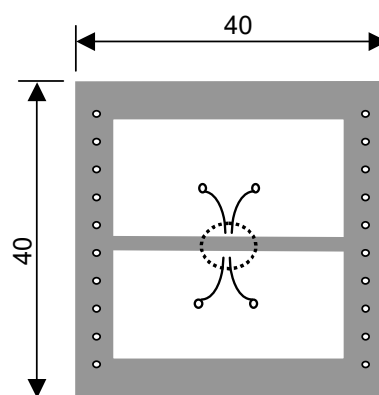
**Power Dissipation**

The above graph shows the Power Dissipation of the package under the conditions of  $T_{jmax}=125^{\circ}\text{C}$  and  $T_{jmax}=150^{\circ}\text{C}$ .

The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime.

The operation time of the IC must be remained within the time limit described in the table below.

<b>Operating Time</b>	<b>Estimated Years (Operating 4 hours/day)</b>
13,000 hours	9 years



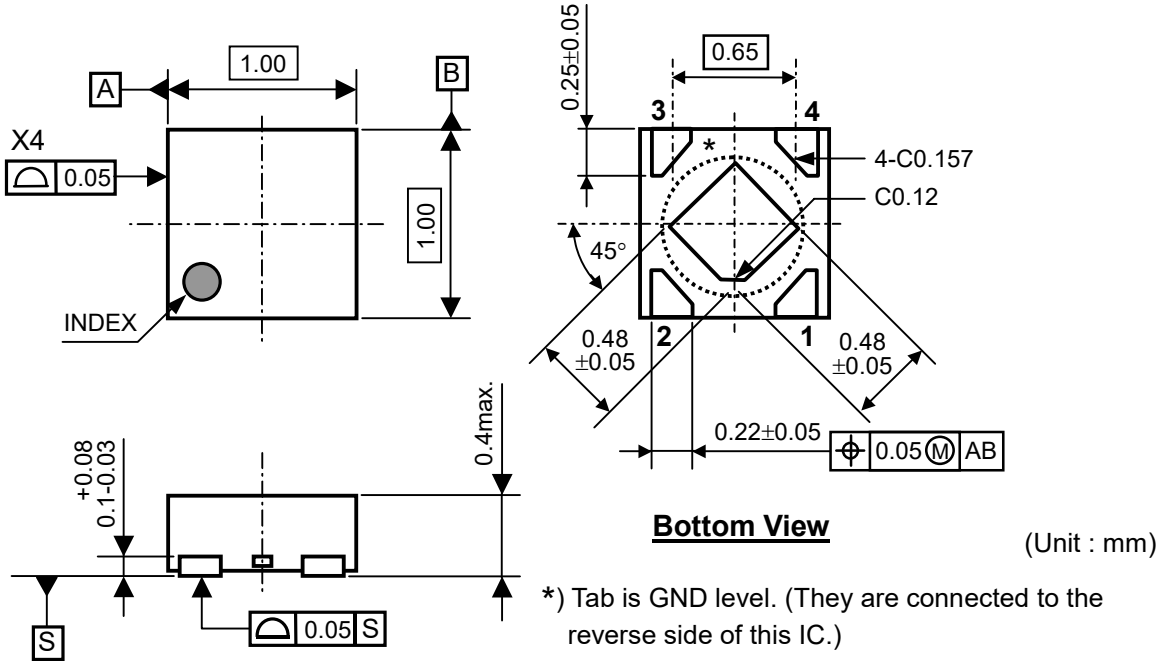
**Measurement Board Pattern**

○ IC Mount Area (Unit: mm)

**RP109x**

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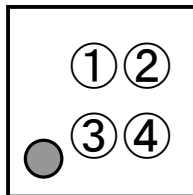
• **Package Dimensions (DFN1010-4)**



\*) Tab is GND level. (They are connected to the reverse side of this IC.)  
The tab is better to be connected to the GND, but leaving it open is also acceptable.

• **Mark Specification (DFN1010-4)**

- ①②: Product Code ... Refer to "RP109L Series Mark Specification Table".
- ③④: Lot Number ... Alphanumeric Serial Number



● RP109L Series Mark Specification Table (DFN1010-4)

**RP109Lxx1B**

Product Name	①②	V <sub>SET</sub>
RP109L081B	C0	0.8V
RP109L091B	C1	0.9V
RP109L101B	C2	1.0V
RP109L111B	C3	1.1V
RP109L121B	C4	1.2V
RP109L131B	C5	1.3V
RP109L141B	C6	1.4V
RP109L151B	C7	1.5V
RP109L161B	C8	1.6V
RP109L171B	C9	1.7V
RP109L181B	D0	1.8V
RP109L191B	D1	1.9V
RP109L201B	D2	2.0V
RP109L211B	D3	2.1V
RP109L221B	D4	2.2V
RP109L231B	D5	2.3V
RP109L241B	D6	2.4V
RP109L251B	D7	2.5V
RP109L261B	D8	2.6V
RP109L271B	D9	2.7V
RP109L281B	E0	2.8V
RP109L291B	E1	2.9V
RP109L301B	E2	3.0V
RP109L311B	E3	3.1V
RP109L321B	E4	3.2V
RP109L331B	E5	3.3V
RP109L341B	E6	3.4V
RP109L351B	E7	3.5V
RP109L361B	E8	3.6V
RP109L121B5	E9	1.25V
RP109L181B5	J0	1.85V
RP109L281B5	J1	2.85V

**RP109Lxx1D**

Product Name	①②	V <sub>SET</sub>
RP109L081D	F0	0.8V
RP109L091D	F1	0.9V
RP109L101D	F2	1.0V
RP109L111D	F3	1.1V
RP109L121D	F4	1.2V
RP109L131D	F5	1.3V
RP109L141D	F6	1.4V
RP109L151D	F7	1.5V
RP109L161D	F8	1.6V
RP109L171D	F9	1.7V
RP109L181D	G0	1.8V
RP109L191D	G1	1.9V
RP109L201D	G2	2.0V
RP109L211D	G3	2.1V
RP109L221D	G4	2.2V
RP109L231D	G5	2.3V
RP109L241D	G6	2.4V
RP109L251D	G7	2.5V
RP109L261D	G8	2.6V
RP109L271D	G9	2.7V
RP109L281D	H0	2.8V
RP109L291D	H1	2.9V
RP109L301D	H2	3.0V
RP109L311D	H3	3.1V
RP109L321D	H4	3.2V
RP109L331D	H5	3.3V
RP109L341D	H6	3.4V
RP109L351D	H7	3.5V
RP109L361D	H8	3.6V
RP109L121D5	H9	1.25V
RP109L181D5	K0	1.85V
RP109L281D5	K1	2.85V

# RP109x

NO.EA-204-170425

## • Power Dissipation (SC-88A)

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

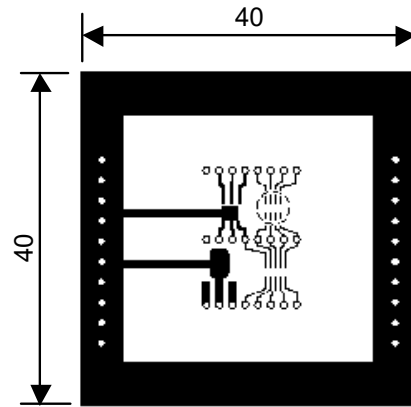
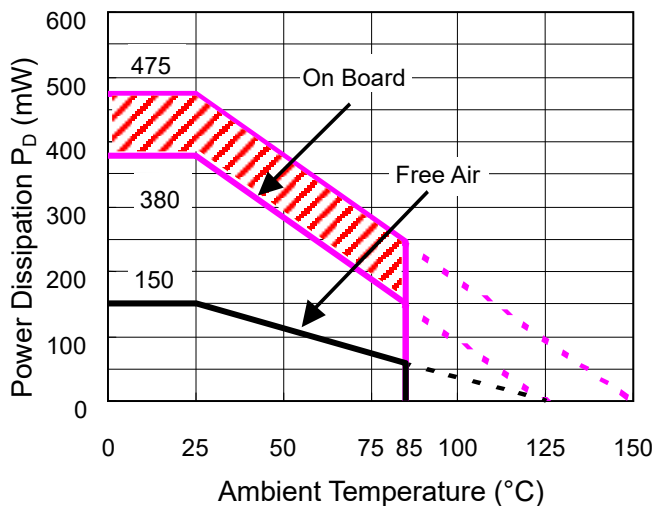
### Measurement Conditions:

	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double Layers)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-hole	φ0.5mm × 44pcs

### Measurement Results:

( $T_a=25^\circ\text{C}$ )

	Standard Land Pattern	Free Air
Power Dissipation	380mW ( $T_{jmax}=125^\circ\text{C}$ ) 475mW ( $T_{jmax}=150^\circ\text{C}$ )	150mW
Thermal Resistance	$\theta_{ja}=(125-25^\circ\text{C})/0.38\text{W}=263^\circ\text{C/W}$ $\theta_{jc}=75^\circ\text{C/W}$	$\theta_{ja}=(125-25^\circ\text{C})/0.15\text{W}=667^\circ\text{C/W}$ -



Measurement Board Pattern

⊙ IC Mount Area (Unit: mm)

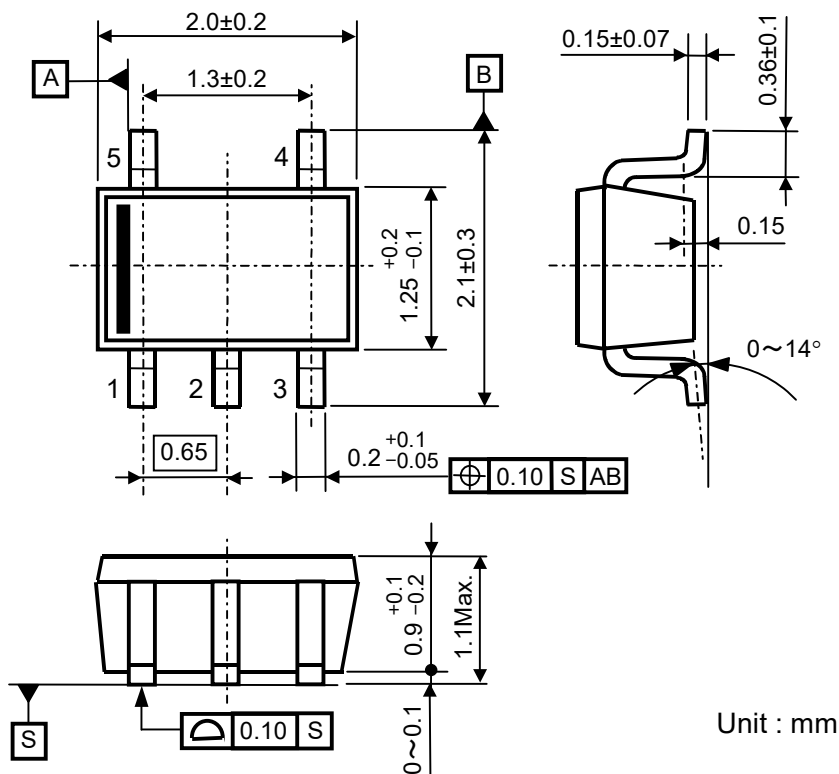
### Power Dissipation

The above graph shows the Power Dissipation of the package under the conditions of  $T_{jmax}=125^\circ\text{C}$  and  $T_{jmax}=150^\circ\text{C}$ .

The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime. The operation time of the IC must be remained within the time limit described in the table below.

Operating Time	Estimated Years (Operating 4 hours/day)
13,000 hours	9 years

● Package Dimensions (SC-88A)

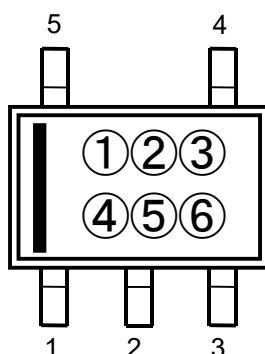


Unit : mm

● Mark Specification (SC-88A)

①②③④: Product Code ... Refer to "RP109Q Series Mark Specification Table".

⑤⑥: Lot Number ... Alphanumeric Serial Number



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**RP109x**

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NO.EA-204-170425

● **RP109Q Series Mark Specification Table (SC-88A)****RP109Qxx2B**

<b>Product Name</b>	<b>①②③④</b>	<b>V<sub>SET</sub></b>
RP109Q082B	<b>AE08</b>	0.8V
RP109Q092B	<b>AE09</b>	0.9V
RP109Q102B	<b>AE10</b>	1.0V
RP109Q112B	<b>AE11</b>	1.1V
RP109Q122B	<b>AE12</b>	1.2V
RP109Q132B	<b>AE13</b>	1.3V
RP109Q142B	<b>AE14</b>	1.4V
RP109Q152B	<b>AE15</b>	1.5V
RP109Q162B	<b>AE16</b>	1.6V
RP109Q172B	<b>AE17</b>	1.7V
RP109Q182B	<b>AE18</b>	1.8V
RP109Q192B	<b>AE19</b>	1.9V
RP109Q201B	<b>AE20</b>	2.0V
RP109Q212B	<b>AE21</b>	2.1V
RP109Q222B	<b>AE22</b>	2.2V
RP109Q232B	<b>AE23</b>	2.3V
RP109Q242B	<b>AE24</b>	2.4V
RP109Q252B	<b>AE25</b>	2.5V
RP109Q262B	<b>AE26</b>	2.6V
RP109Q272B	<b>AE27</b>	2.7V
RP109Q282B	<b>AE28</b>	2.8V
RP109Q292B	<b>AE29</b>	2.9V
RP109Q302B	<b>AE30</b>	3.0V
RP109Q312B	<b>AE31</b>	3.1V
RP109Q322B	<b>AE32</b>	3.2V
RP109Q332B	<b>AE33</b>	3.3V
RP109Q342B	<b>AE34</b>	3.4V
RP109Q352B	<b>AE35</b>	3.5V
RP109Q362B	<b>AE36</b>	3.6V
RP109Q122B5	<b>AE37</b>	1.25V
RP109Q182B5	<b>AE38</b>	1.85V
RP109Q282B5	<b>AE39</b>	2.85V

**RP109Qxx2D**

<b>Product Name</b>	<b>①②③④</b>	<b>V<sub>SET</sub></b>
RP109Q082D	<b>AF08</b>	0.8V
RP109Q092D	<b>AF09</b>	0.9V
RP109Q102D	<b>AF10</b>	1.0V
RP109Q112D	<b>AF11</b>	1.1V
RP109Q122D	<b>AF12</b>	1.2V
RP109Q132D	<b>AF13</b>	1.3V
RP109Q142D	<b>AF14</b>	1.4V
RP109Q152D	<b>AF15</b>	1.5V
RP109Q162D	<b>AF16</b>	1.6V
RP109Q172D	<b>AF17</b>	1.7V
RP109Q182D	<b>AF18</b>	1.8V
RP109Q192D	<b>AF19</b>	1.9V
RP109Q202D	<b>AF20</b>	2.0V
RP109Q212D	<b>AF21</b>	2.1V
RP109Q222D	<b>AF22</b>	2.2V
RP109Q232D	<b>AF23</b>	2.3V
RP109Q242D	<b>AF24</b>	2.4V
RP109Q252D	<b>AF25</b>	2.5V
RP109Q262D	<b>AF26</b>	2.6V
RP109Q272D	<b>AF27</b>	2.7V
RP109Q282D	<b>AF28</b>	2.8V
RP109Q292D	<b>AF29</b>	2.9V
RP109Q302D	<b>AF30</b>	3.0V
RP109Q312D	<b>AF31</b>	3.1V
RP109Q322D	<b>AF32</b>	3.2V
RP109Q332D	<b>AF33</b>	3.3V
RP109Q342D	<b>AF34</b>	3.4V
RP109Q352D	<b>AF35</b>	3.5V
RP109Q362D	<b>AF36</b>	3.6V
RP109Q122D5	<b>AF37</b>	1.25V
RP109Q182D5	<b>AF38</b>	1.85V
RP109Q282D5	<b>AF39</b>	2.85V



● **Power Dissipation (SOT-23-5)**

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

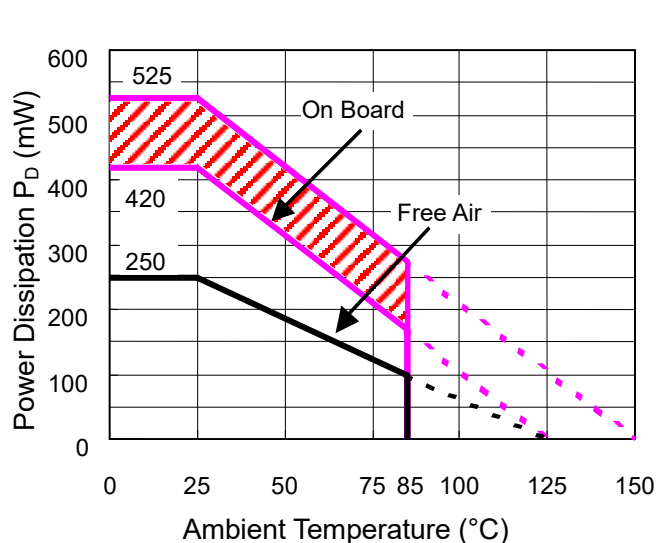
**Measurement Conditions:**

	<b>Standard Land Pattern</b>
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	φ 0.5mm × 44pcs

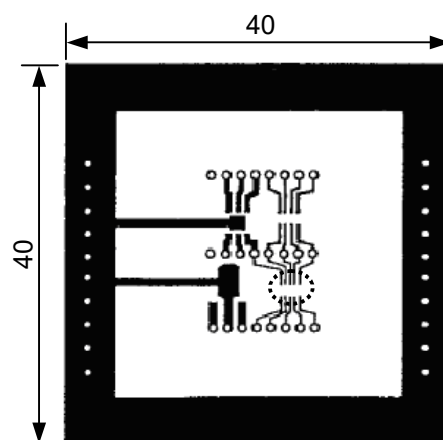
**Measurement Results:**

( $T_a=25^\circ\text{C}$ )

	<b>Standard Land Pattern</b>	<b>Free Air</b>
Power Dissipation	420mW ( $T_{jmax}=125^\circ\text{C}$ ) 525mW ( $T_{jmax}=150^\circ\text{C}$ )	250mW
Thermal Resistance	$\theta_{ja} = (125-25^\circ\text{C})/0.42\text{W} = 238^\circ\text{C/W}$	400 $^\circ\text{C/W}$



**Power Dissipation**



**Measurement Board Pattern**

○ IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of  $T_{jmax}=125^\circ\text{C}$  and  $T_{jmax}=150^\circ\text{C}$ .

The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime.

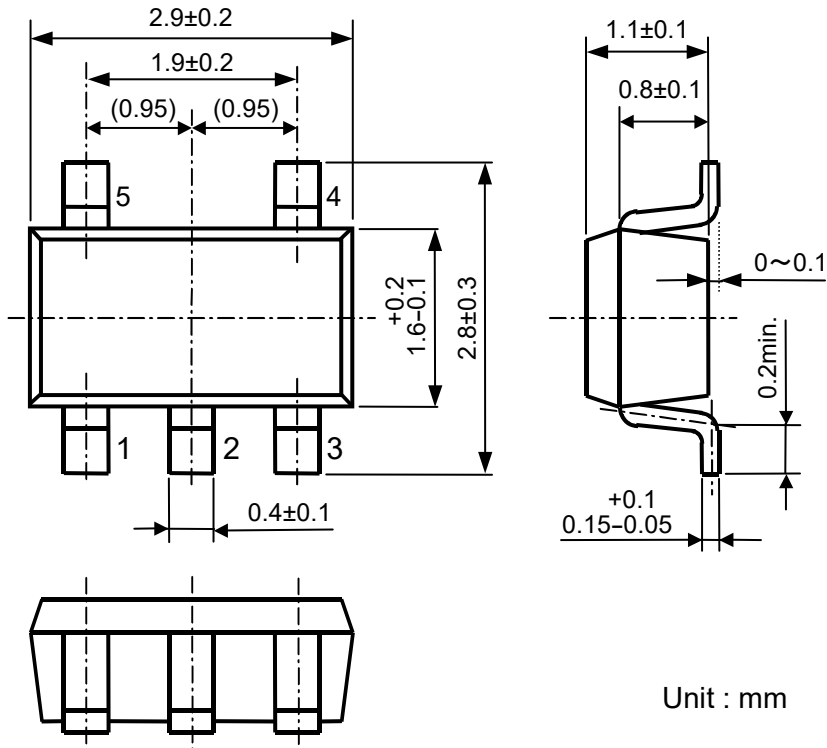
The operation time of the IC must be remained within the time limit described in the table below.

<b>Operating Time</b>	<b>Estimated Years (Operating 4 hours/day)</b>
13,000 hours	9 years

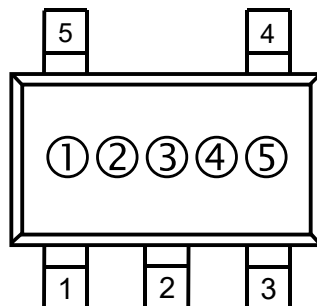
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**RP109x**NO.EA-204-170425

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**• Package Dimensions (SOT-23-5)****• Mark Specification (SOT-23-5)**①②③: Product Code ... Refer to "RP109N Mark Specification Table".

④⑤: Lot Number ... Alphanumeric Serial Number



● RP109N Series Mark Specification Table (SOT-23-5)

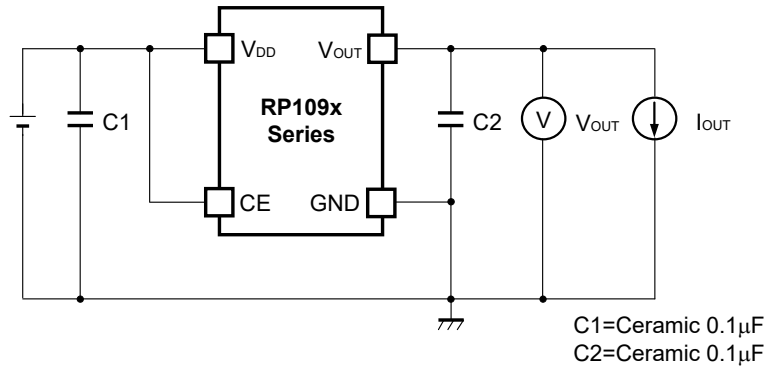
**RP109Nxx1B**

Product Name	①②③	V <sub>SET</sub>
RP109N081B	<b>NAA</b>	0.8V
RP109N091B	<b>NAB</b>	0.9V
RP109N101B	<b>NAC</b>	1.0V
RP109N111B	<b>NAD</b>	1.1V
RP109N121B	<b>NAE</b>	1.2V
RP109N131B	<b>NAF</b>	1.3V
RP109N141B	<b>NAG</b>	1.4V
RP109N151B	<b>NAH</b>	1.5V
RP109N161B	<b>NAJ</b>	1.6V
RP109N171B	<b>NAK</b>	1.7V
RP109N181B	<b>NAL</b>	1.8V
RP109N191B	<b>NAM</b>	1.9V
RP109N201B	<b>NAN</b>	2.0V
RP109N211B	<b>NAP</b>	2.1V
RP109N221B	<b>NAQ</b>	2.2V
RP109N231B	<b>NAR</b>	2.3V
RP109N241B	<b>NAS</b>	2.4V
RP109N251B	<b>NAT</b>	2.5V
RP109N261B	<b>NAU</b>	2.6V
RP109N271B	<b>NAV</b>	2.7V
RP109N281B	<b>NAW</b>	2.8V
RP109N291B	<b>NAX</b>	2.9V
RP109N301B	<b>NAY</b>	3.0V
RP109N311B	<b>NAZ</b>	3.1V
RP109N321B	<b>PAA</b>	3.2V
RP109N331B	<b>PAB</b>	3.3V
RP109N341B	<b>PAC</b>	3.4V
RP109N351B	<b>PAD</b>	3.5V
RP109N361B	<b>PAE</b>	3.6V
RP109N121B5	<b>PAF</b>	1.25V
RP109N181B5	<b>PAG</b>	1.85V
RP109N281B5	<b>PAH</b>	2.85V

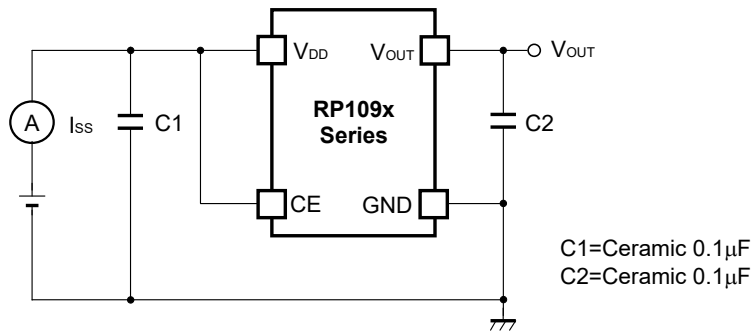
**RP109Nxx1D**

Product Name	①②③	V <sub>SET</sub>
RP109N081D	<b>NBA</b>	0.8V
RP109N091D	<b>NBB</b>	0.9V
RP109N101D	<b>NBC</b>	1.0V
RP109N111D	<b>NBD</b>	1.1V
RP109N121D	<b>NBE</b>	1.2V
RP109N131D	<b>NBF</b>	1.3V
RP109N141D	<b>NBG</b>	1.4V
RP109N151D	<b>NBH</b>	1.5V
RP109N161D	<b>NBJ</b>	1.6V
RP109N171D	<b>NBK</b>	1.7V
RP109N181D	<b>NBL</b>	1.8V
RP109N191D	<b>NBM</b>	1.9V
RP109N201D	<b>NBN</b>	2.0V
RP109N211D	<b>NBP</b>	2.1V
RP109N221D	<b>NBQ</b>	2.2V
RP109N231D	<b>NBR</b>	2.3V
RP109N241D	<b>NBS</b>	2.4V
RP109N251D	<b>NBT</b>	2.5V
RP109N261D	<b>NBU</b>	2.6V
RP109N271D	<b>NBV</b>	2.7V
RP109N281D	<b>NBW</b>	2.8V
RP109N291D	<b>NBX</b>	2.9V
RP109N301D	<b>NBY</b>	3.0V
RP109N311D	<b>NBZ</b>	3.1V
RP109N321D	<b>PBA</b>	3.2V
RP109N331D	<b>PBB</b>	3.3V
RP109N341D	<b>PBC</b>	3.4V
RP109N351D	<b>PBD</b>	3.5V
RP109N361D	<b>PBE</b>	3.6V
RP109N121D5	<b>PBF</b>	1.25V
RP109N181D5	<b>PBG</b>	1.85V
RP109N281D5	<b>PBH</b>	2.85V

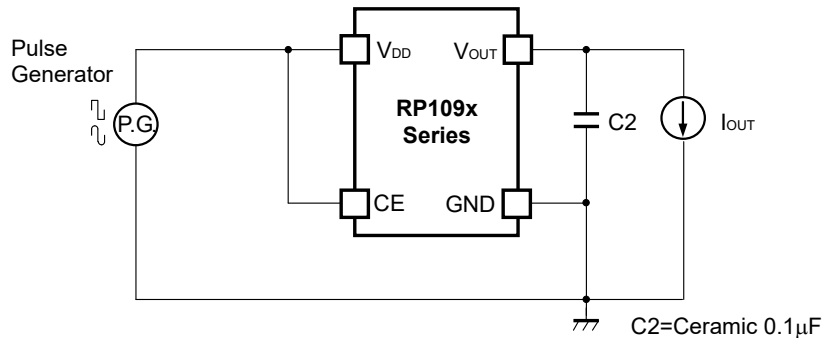
TEST CIRCUITS



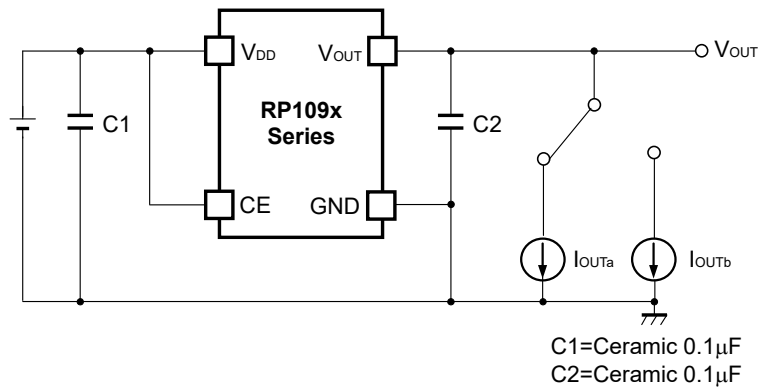
Basic Test Circuit



Test Circuit for Supply Current



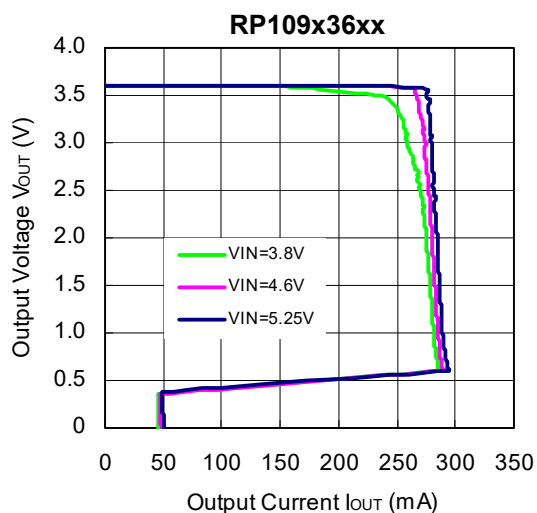
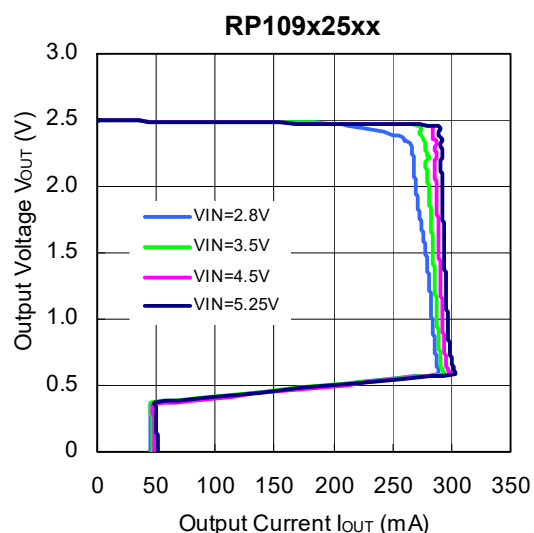
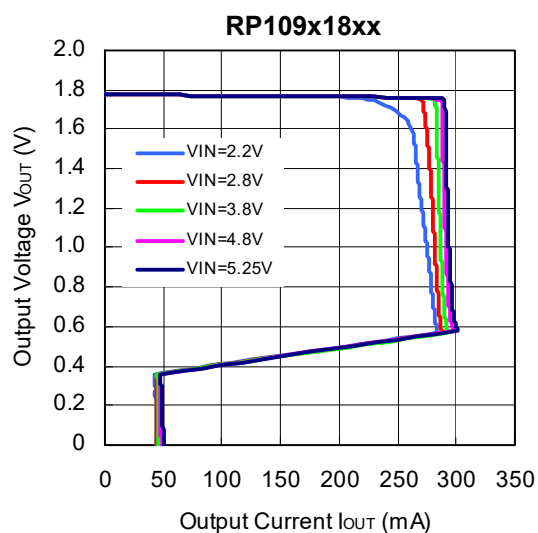
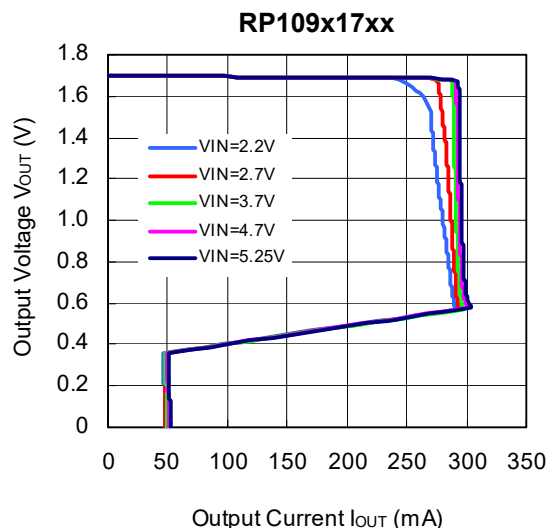
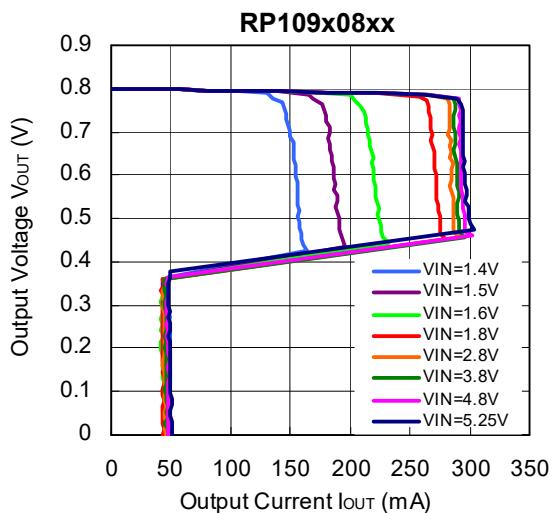
Test Circuit for Ripple Rejection



Test Circuit for Load Transient Response

## TYPICAL CHARACTERISTICS

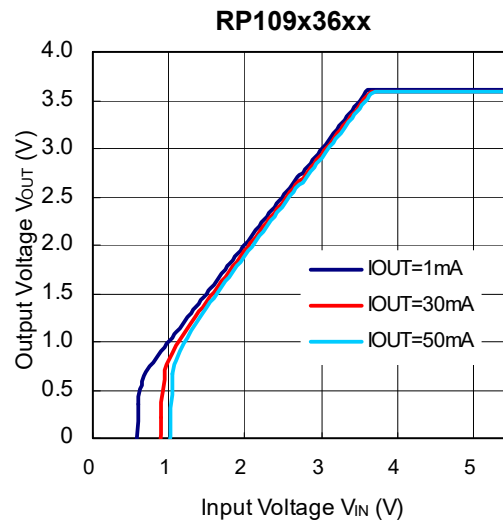
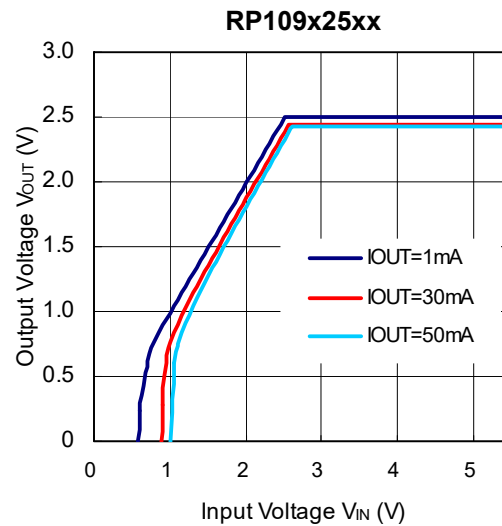
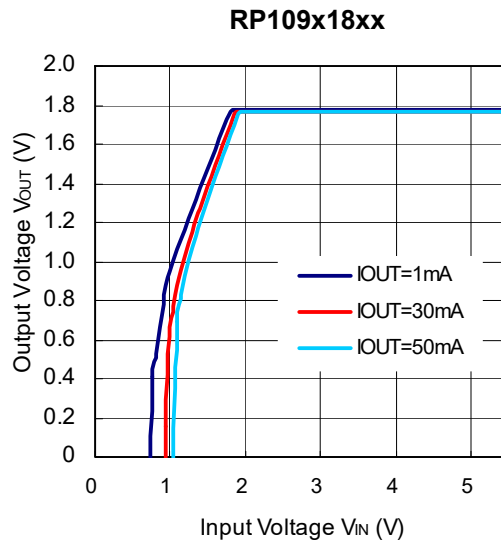
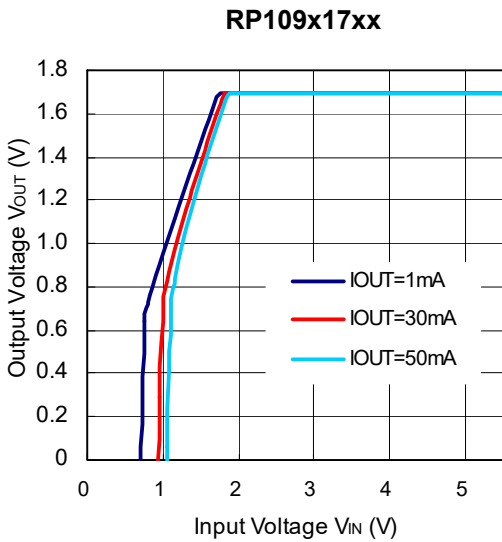
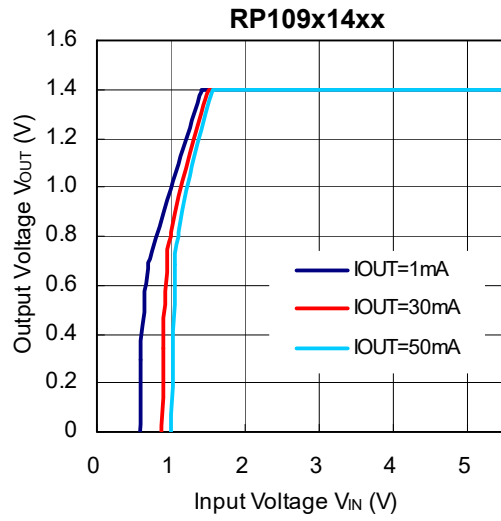
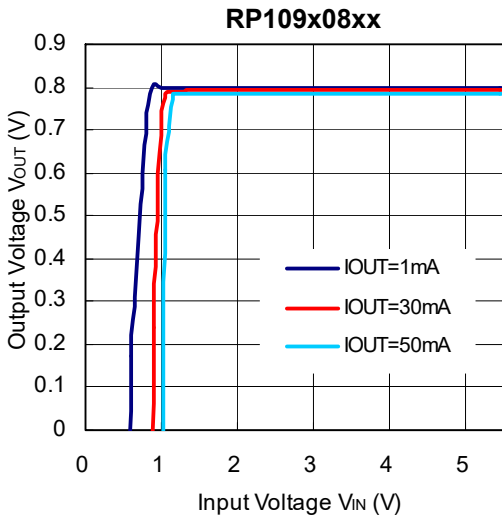
### 1) Output Voltage vs. Output Current (C1=0.1μF, C2=0.1μF, T<sub>opt</sub>=25°C)



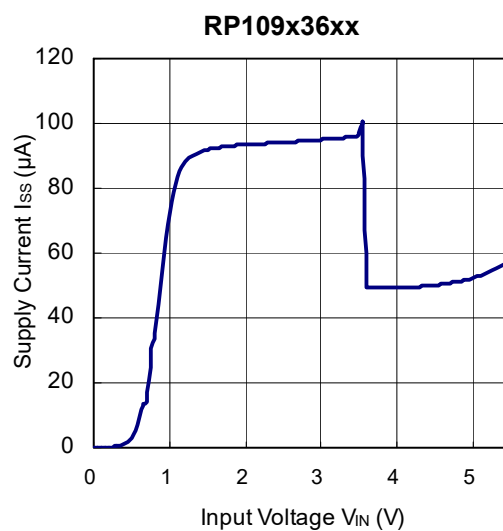
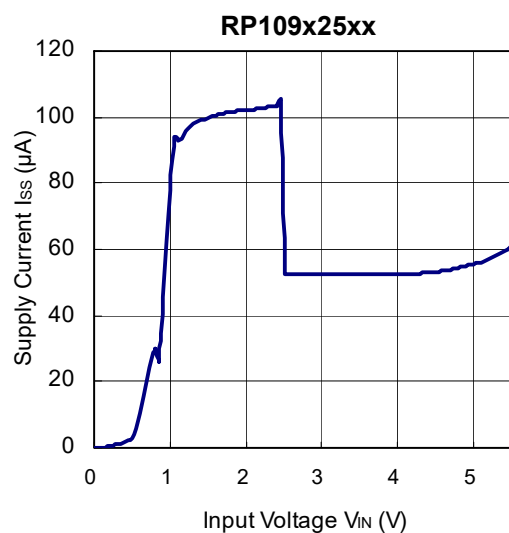
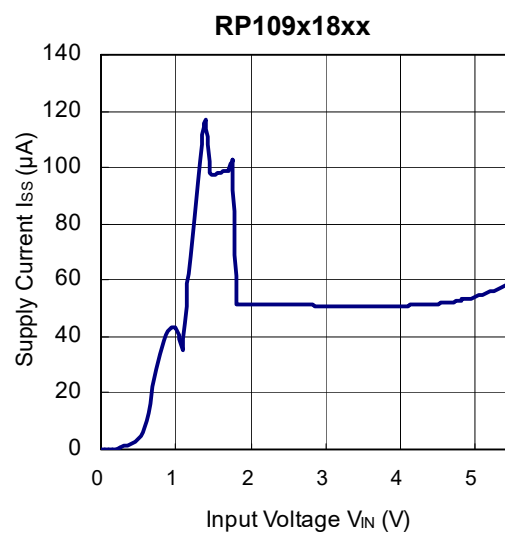
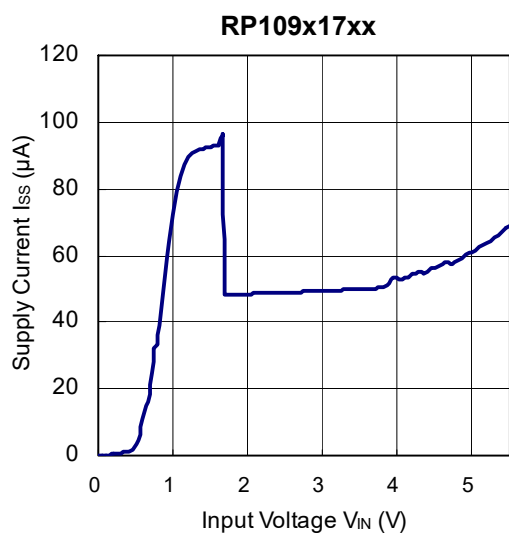
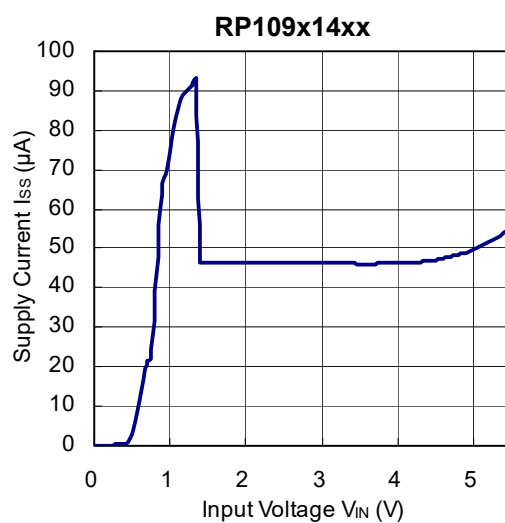
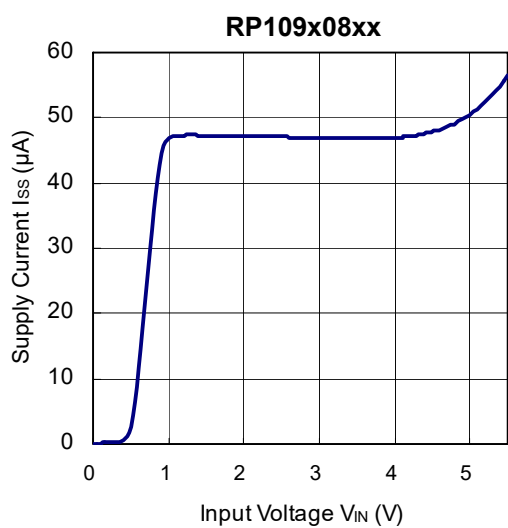
# RP109x

NO.EA-204-170425

## 2) Output Voltage vs. Input Voltage (C1=0.1μF, C2=0.1μF, T<sub>opt</sub>=25°C)



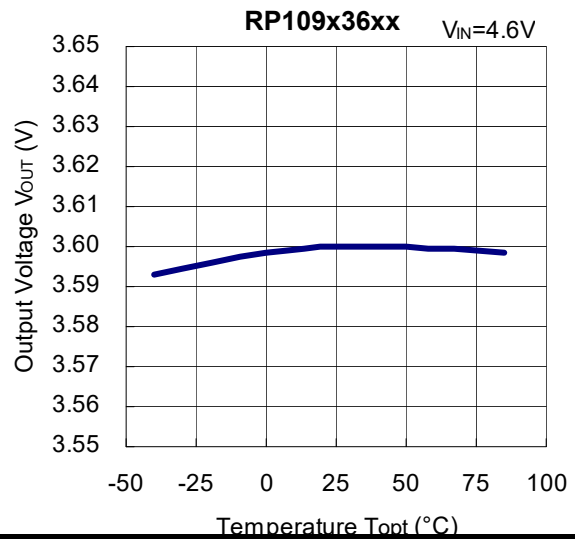
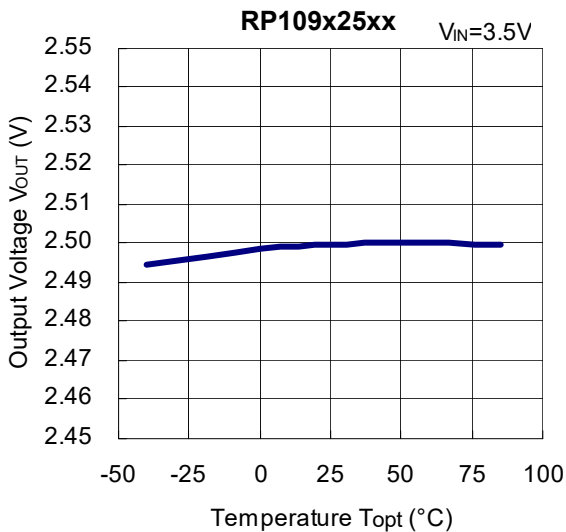
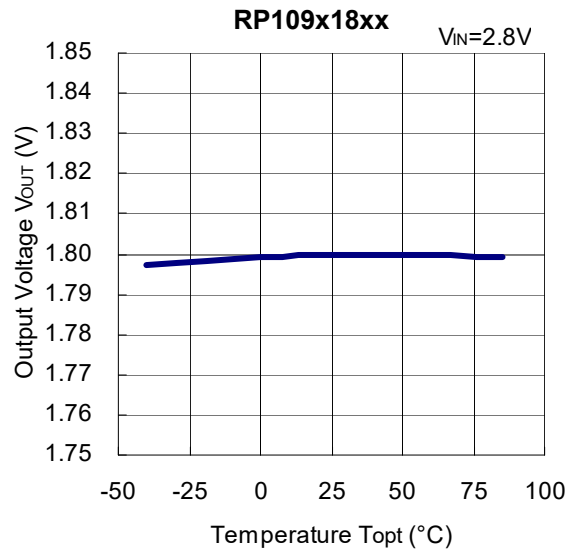
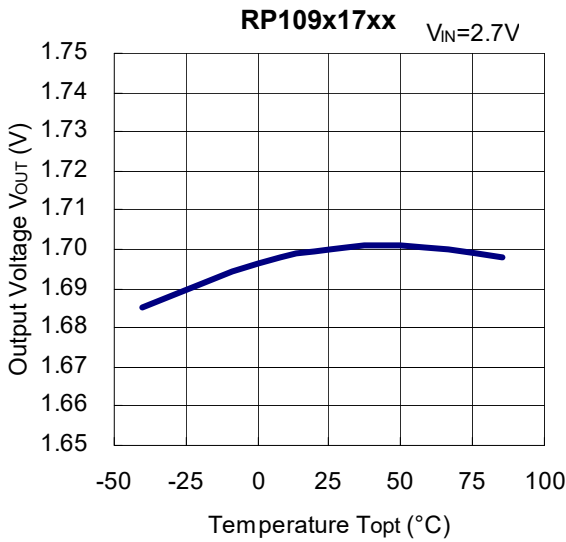
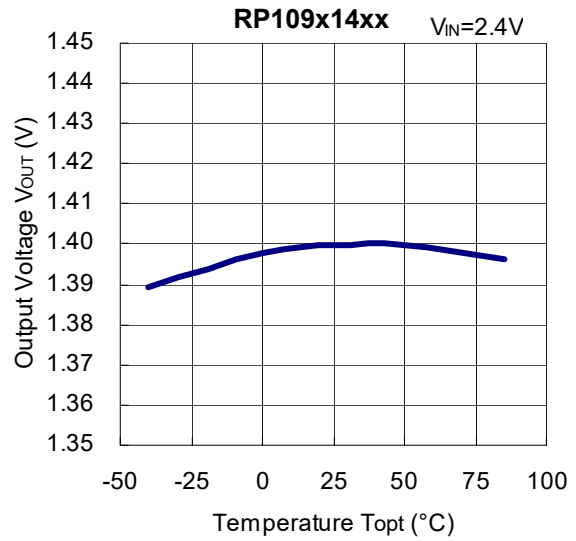
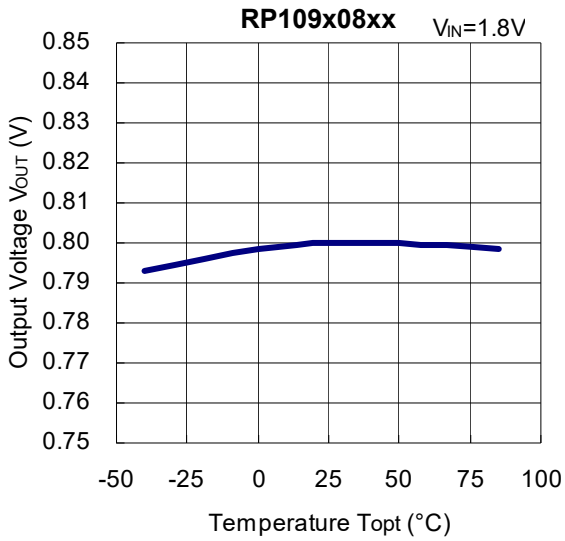
3) Supply Current vs. Input Voltage (C1=0.1μF, C2=0.1μF, T<sub>opt</sub>=25°C)



# RP109x

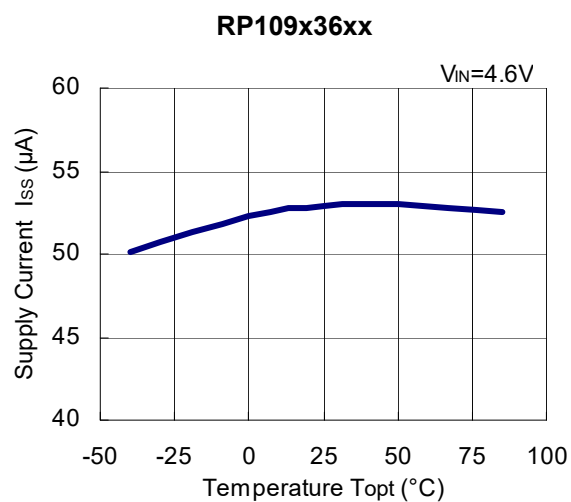
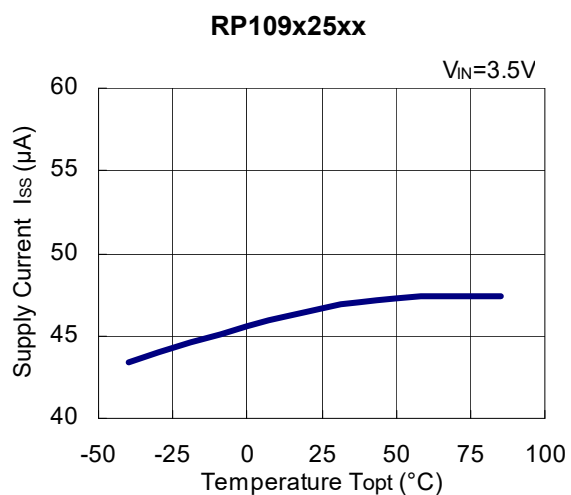
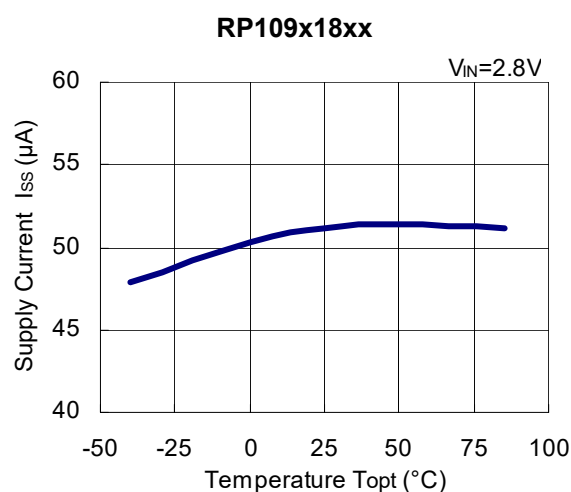
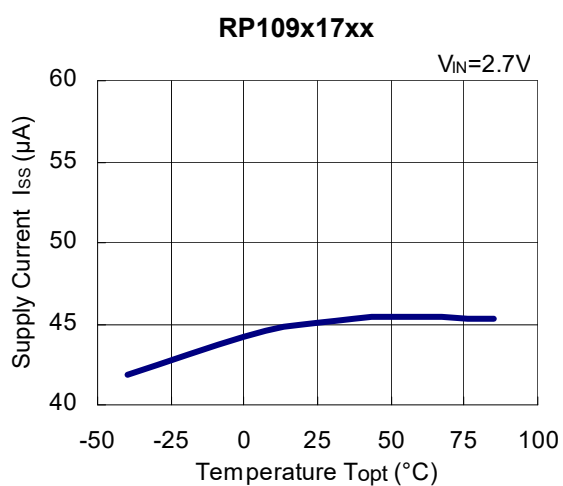
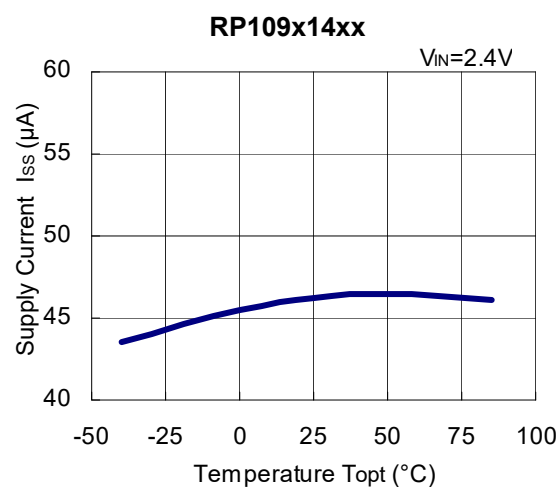
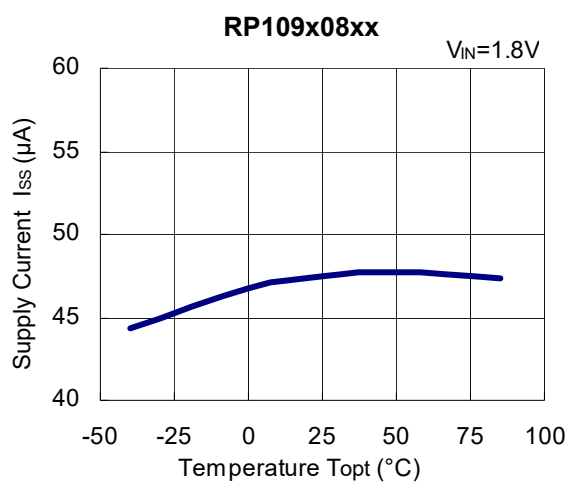
NO.EA-204-170425

## 4) Output Voltage vs. Temperature (C1=0.1μF, C2=0.1μF, I<sub>OUT</sub>=1mA)





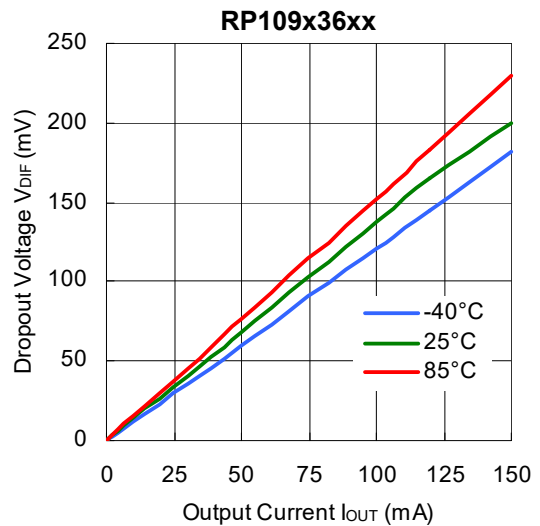
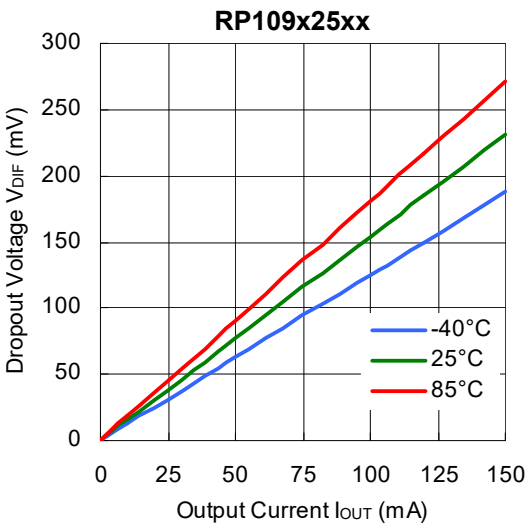
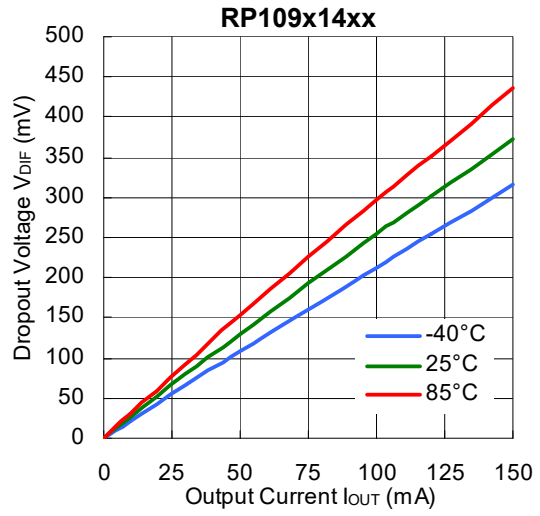
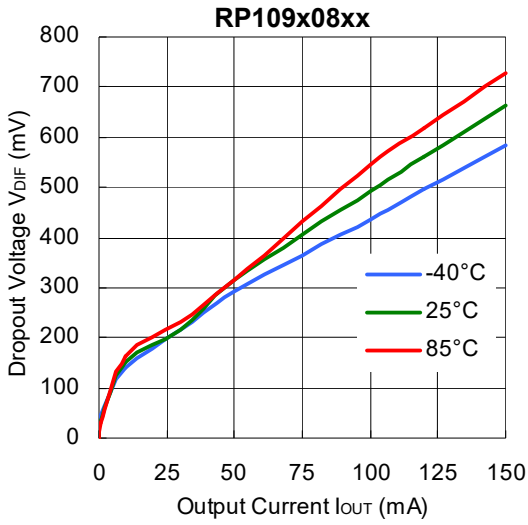
5) Supply Current vs. Temperature (C1=0.1μF, C2=0.1μF, I<sub>OUT</sub>=0mA)



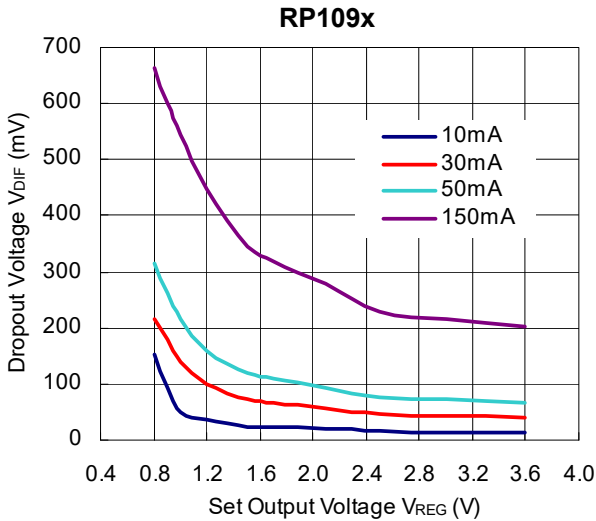
# RP109x

NO.EA-204-170425

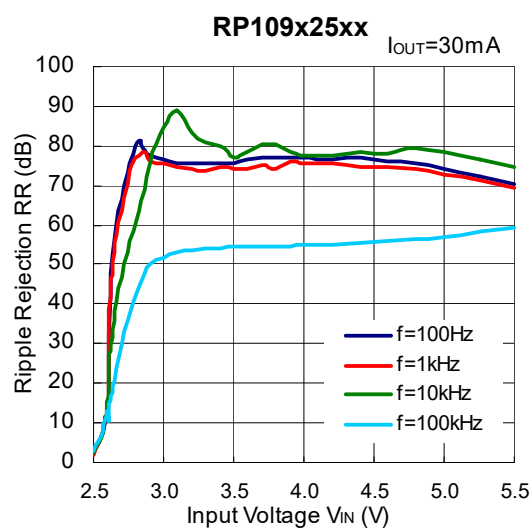
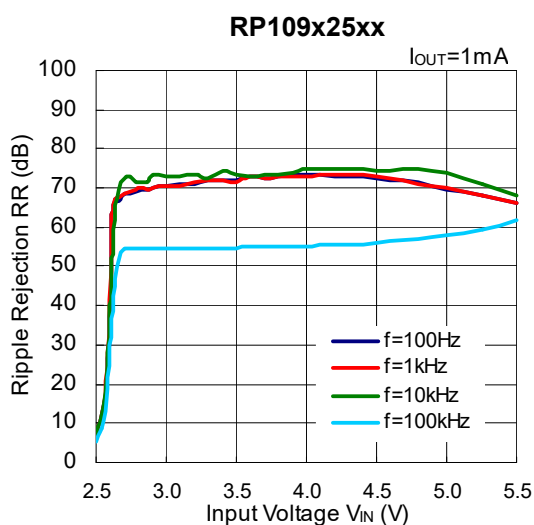
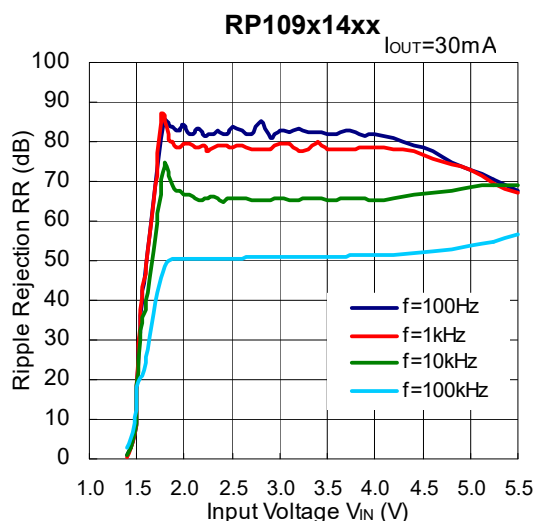
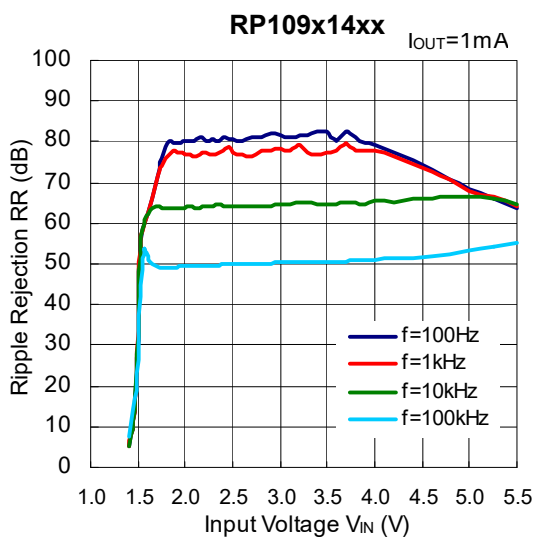
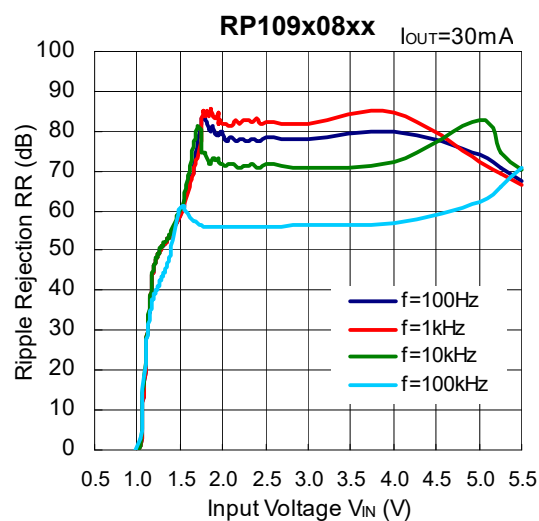
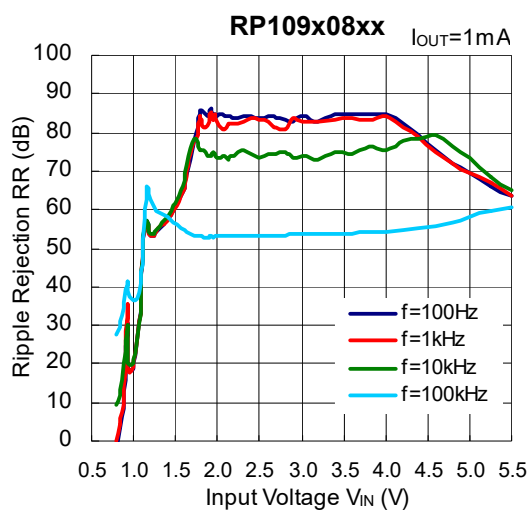
## 6) Dropout Voltage vs. Output Current (C1=0.1μF, C2=0.1μF)



## 7) Dropout Voltage vs. Set Output Voltage (C1=0.1μF, C2=0.1μF, T<sub>opt</sub>=25°C)

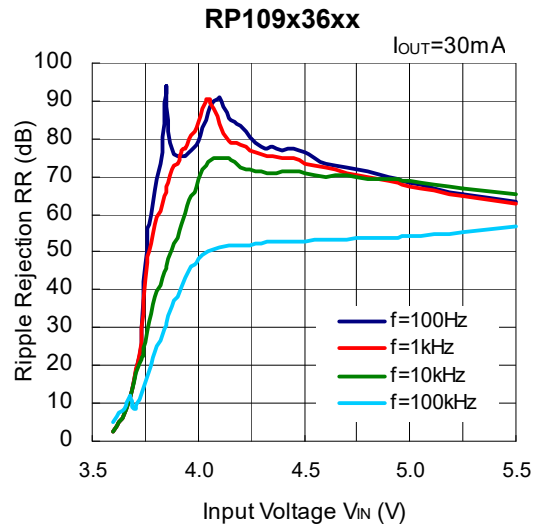
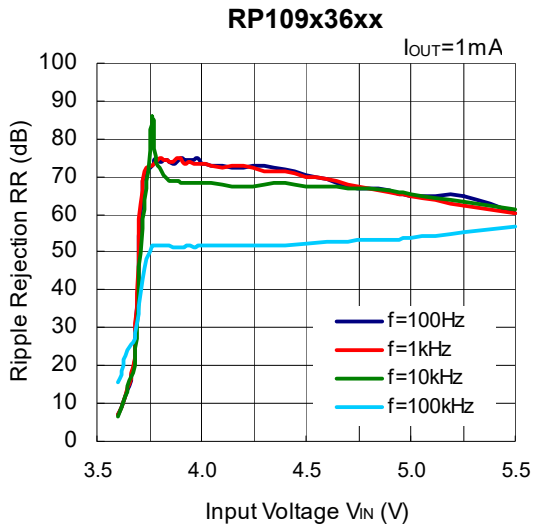


8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=0.1μF, Ripple=0.2Vp-p, T<sub>opt</sub>=25°C)

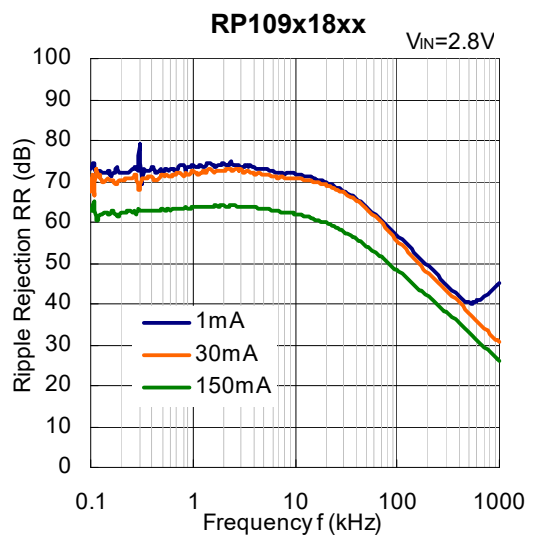
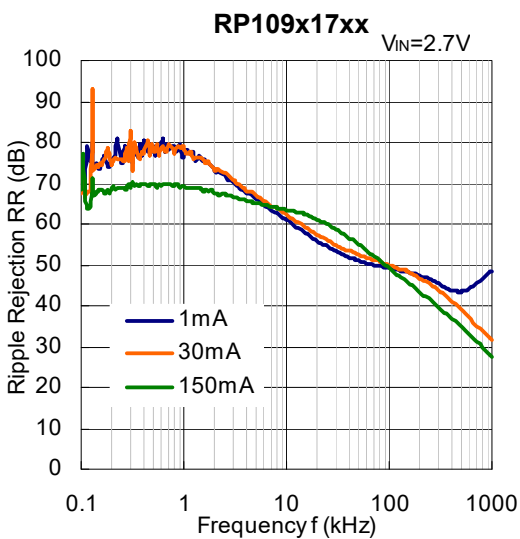
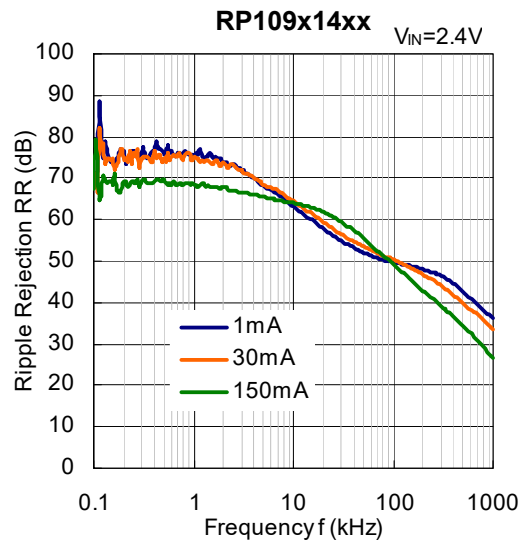
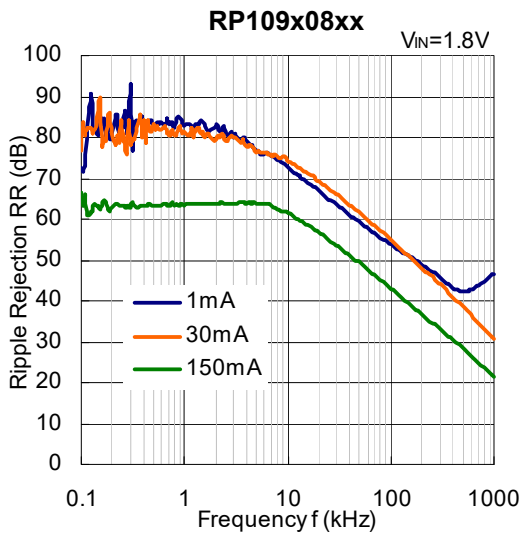


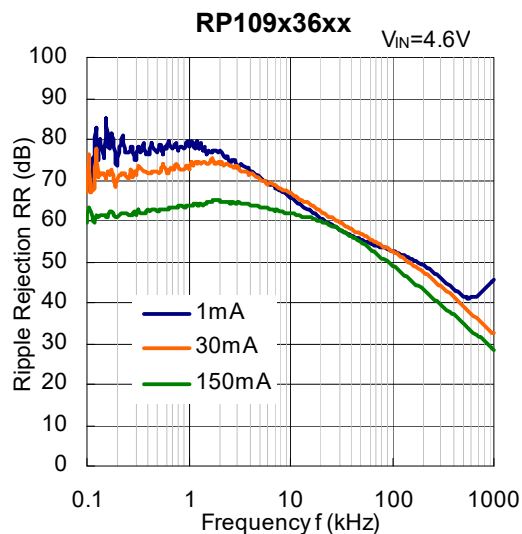
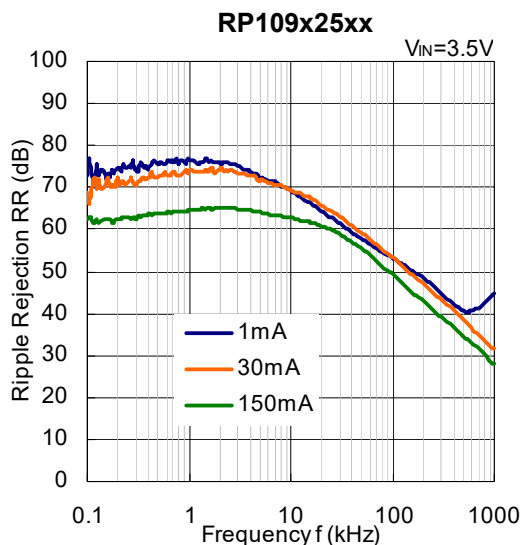
# RP109x

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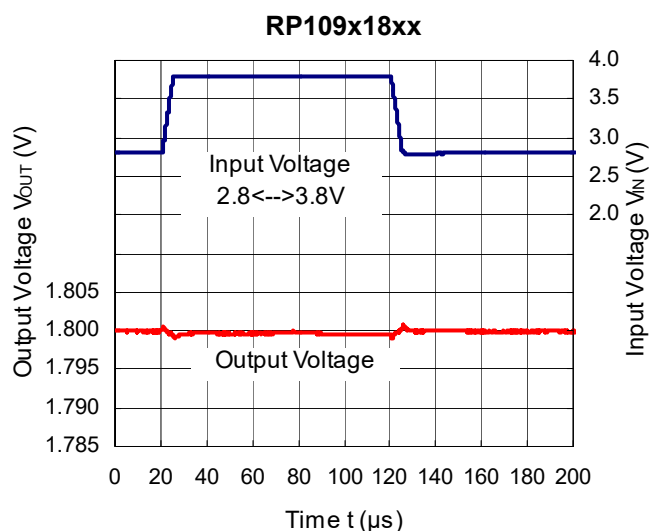
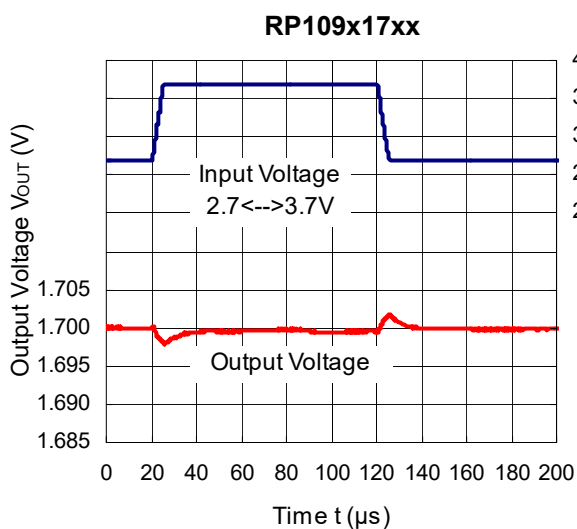
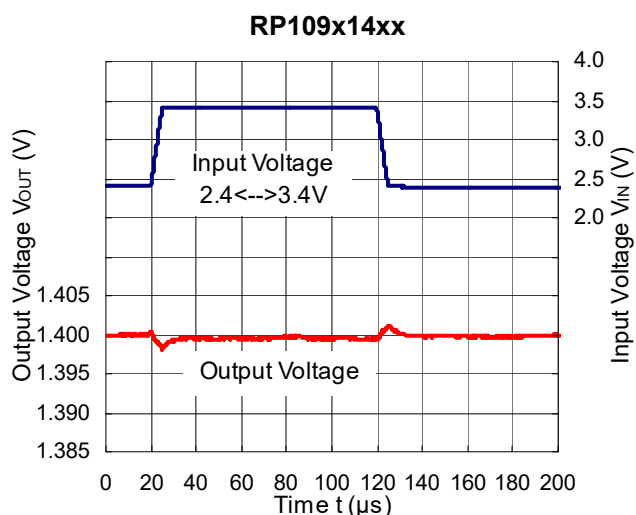
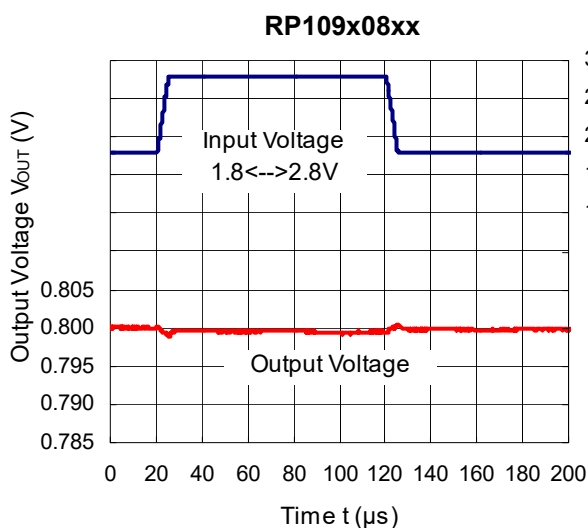


## 9) Ripple Rejection vs. Frequency ( $C1=none$ , $C2=0.1\mu F$ , Ripple=0.2Vp-p)



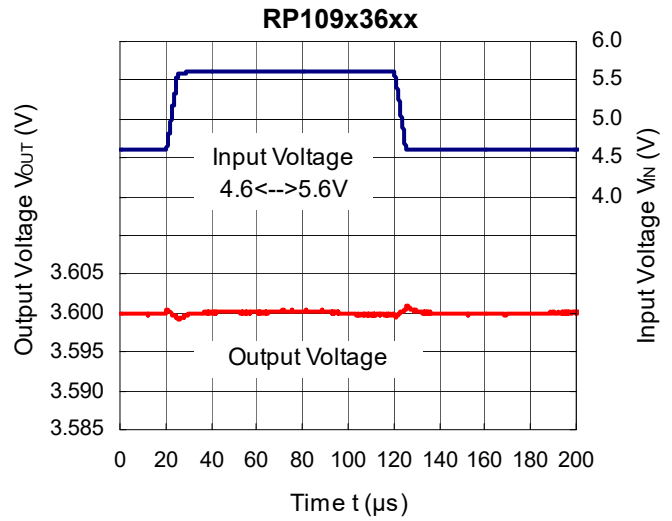
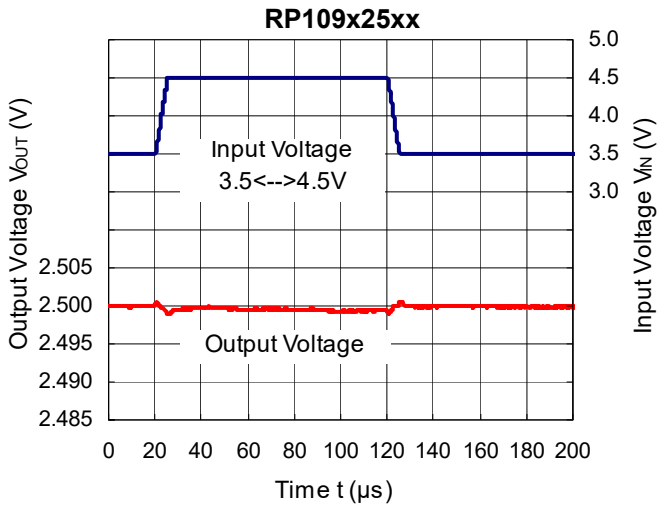


**10) Input Transient Response ( $C1=none$ ,  $C2=0.1\mu F$ ,  $I_{OUT}=30mA$ ,  $t_r=t_f=5\mu s$ ,  $T_{opt}=25^\circ C$ )**

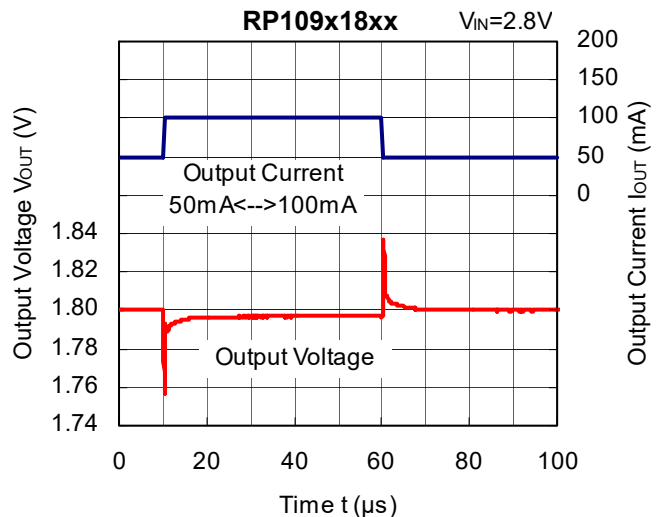
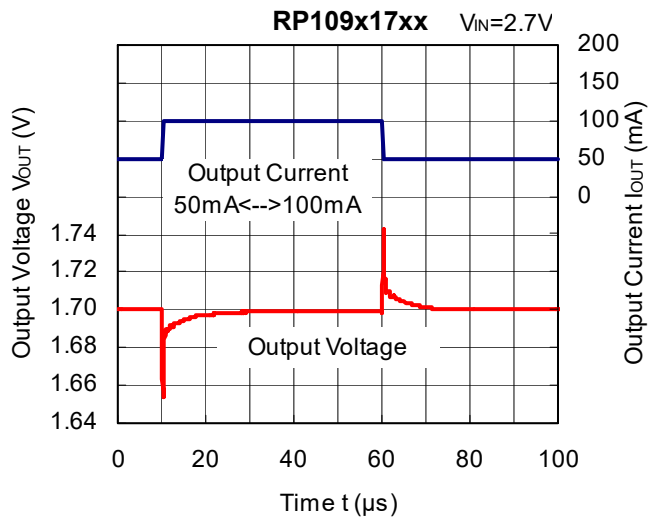
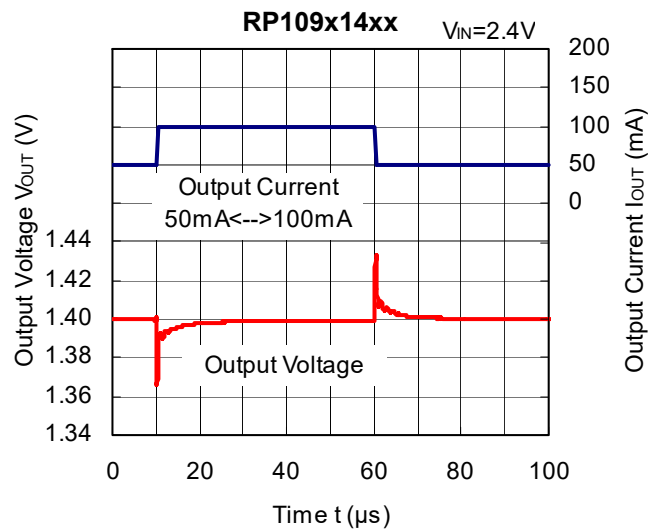
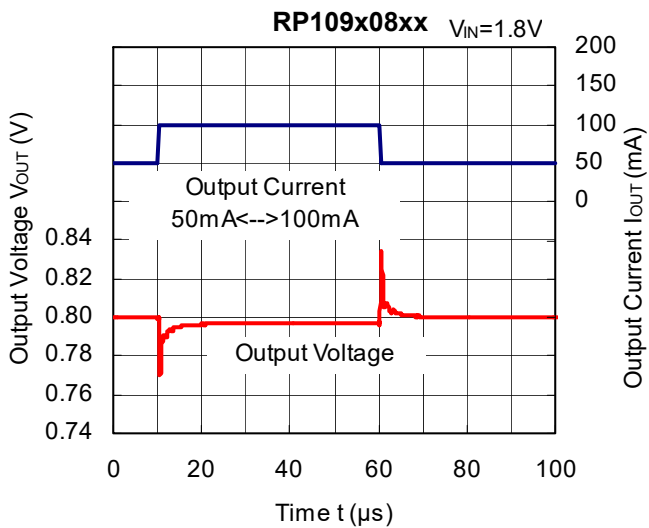


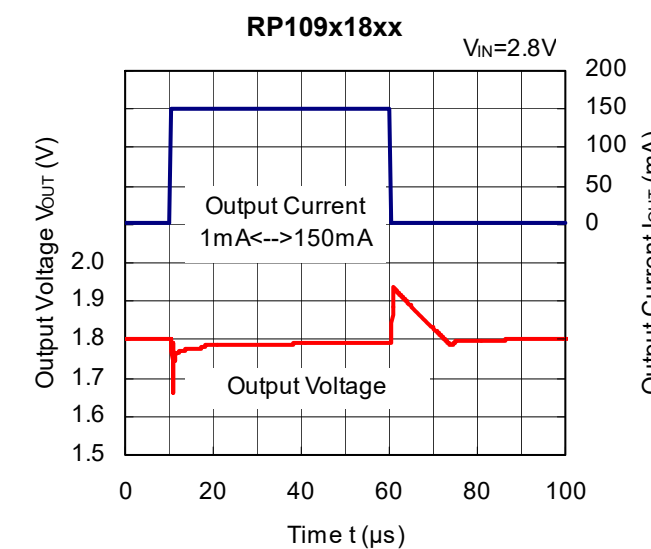
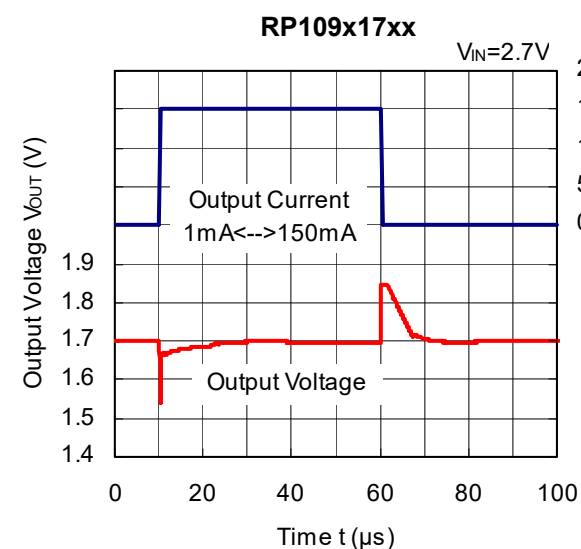
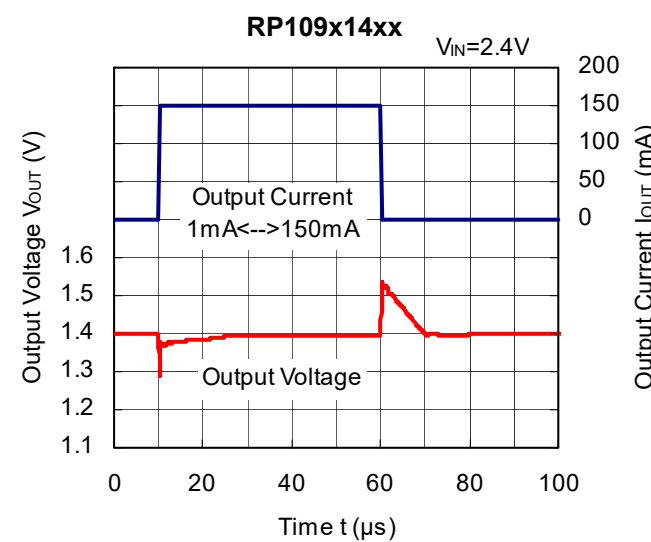
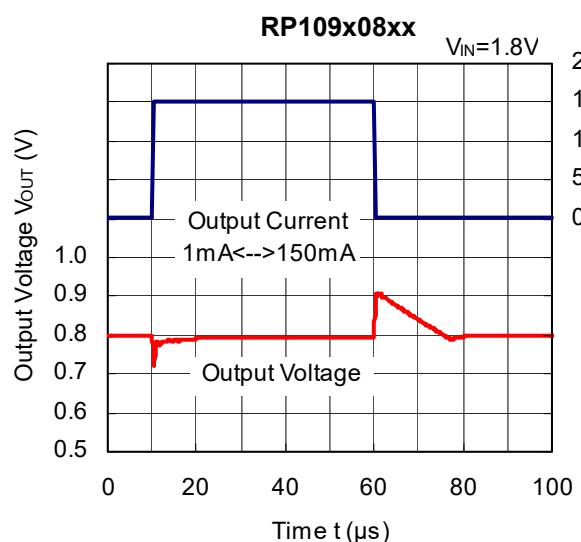
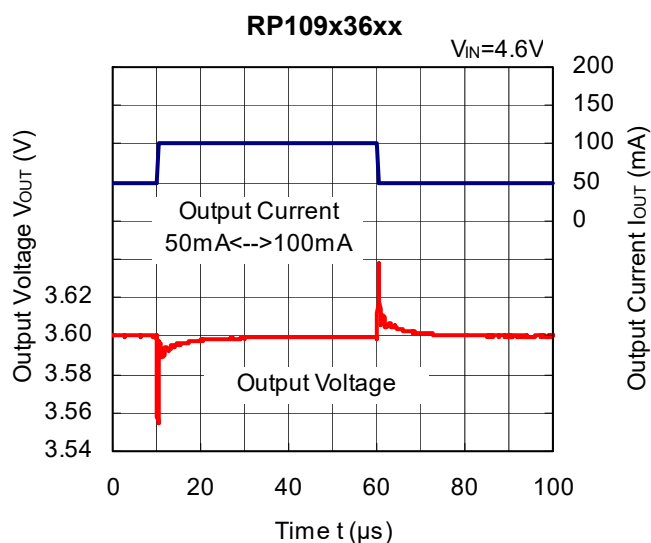
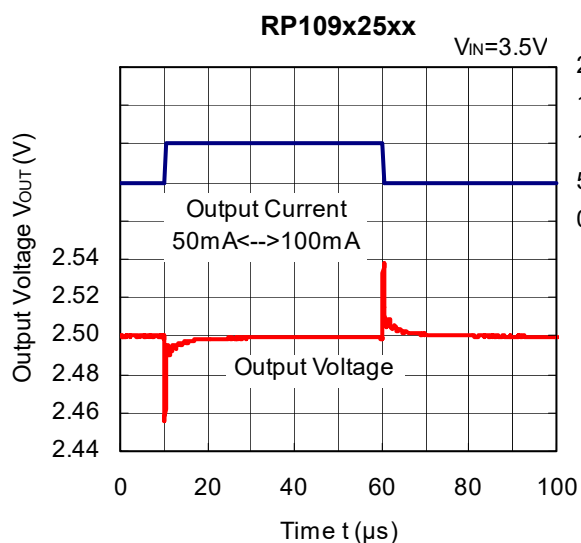
# RP109x

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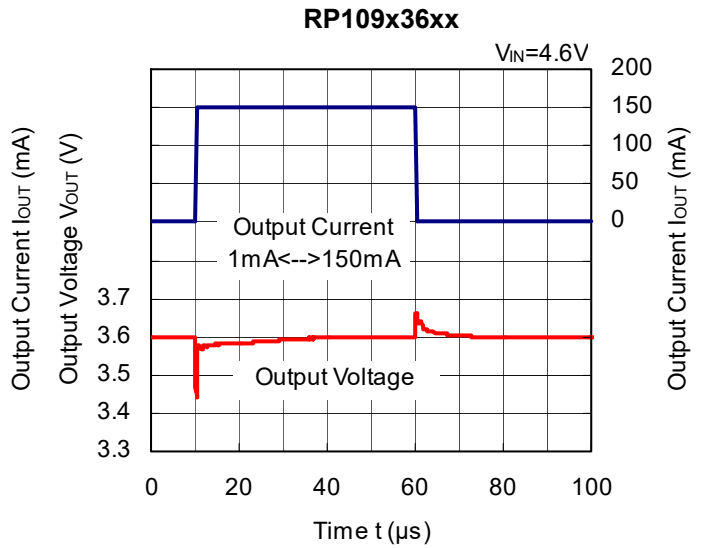
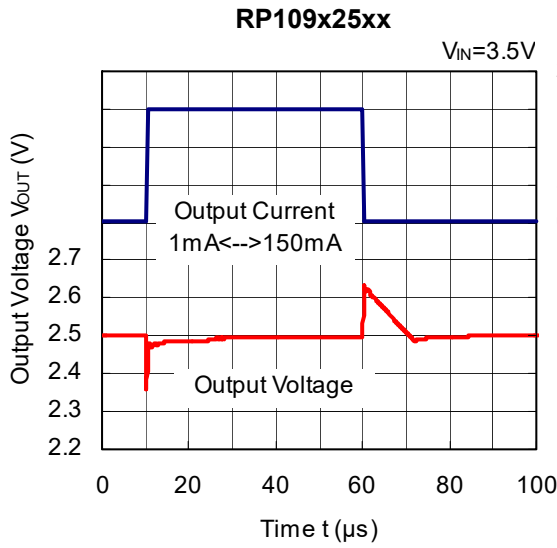
## 11) Load Transient Response ( $C_1=0.1\mu\text{F}$ , $C_2=0.1\mu\text{F}$ , $t_r=t_f=5\mu\text{s}$ , $T_{opt}=25^\circ\text{C}$ )



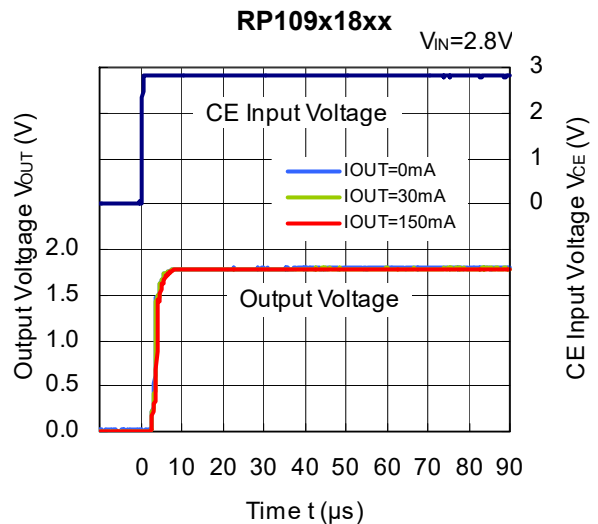
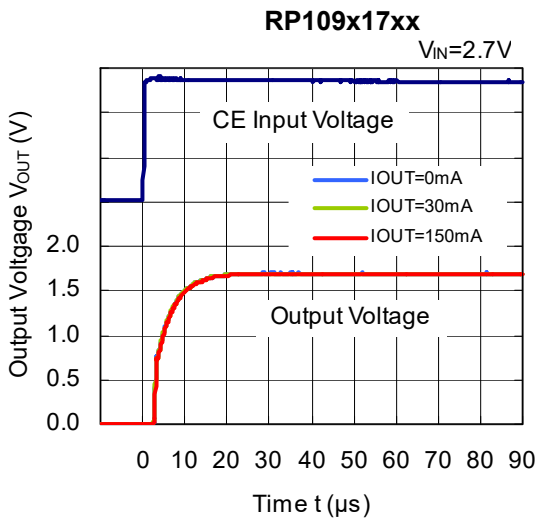
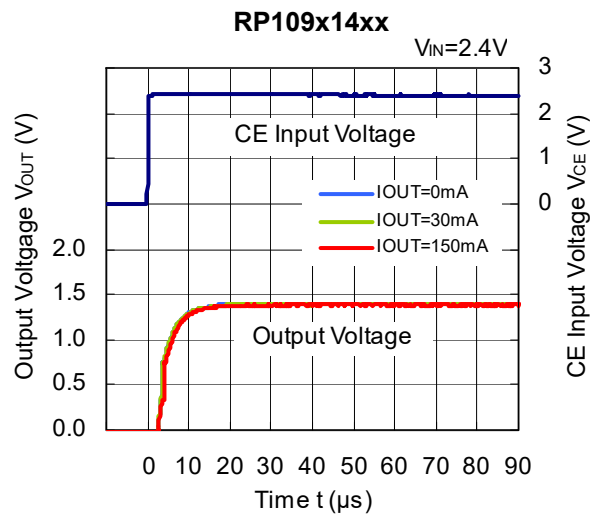
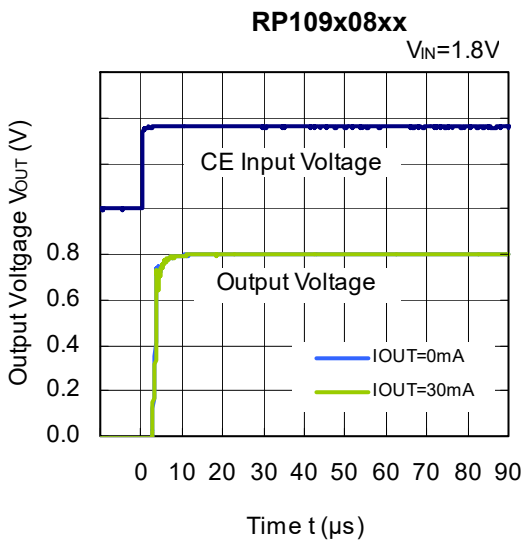


# RP109x

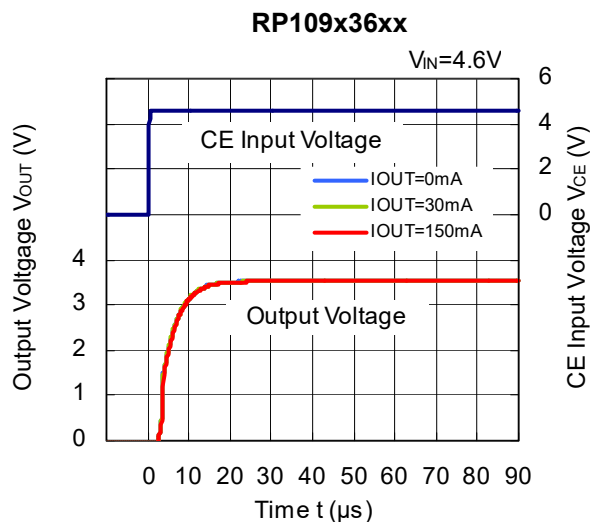
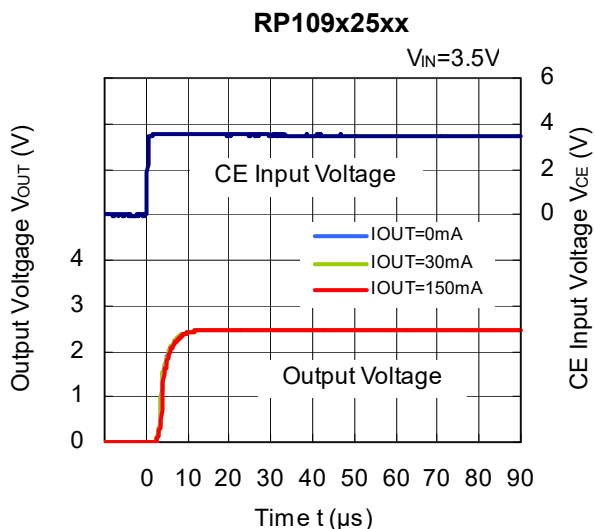
NO.EA-204-170425



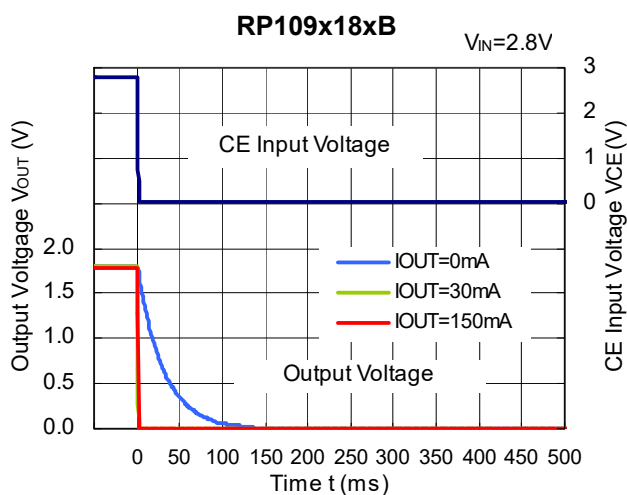
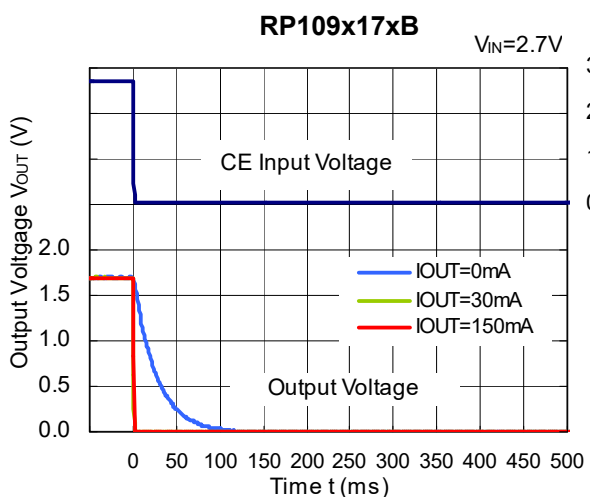
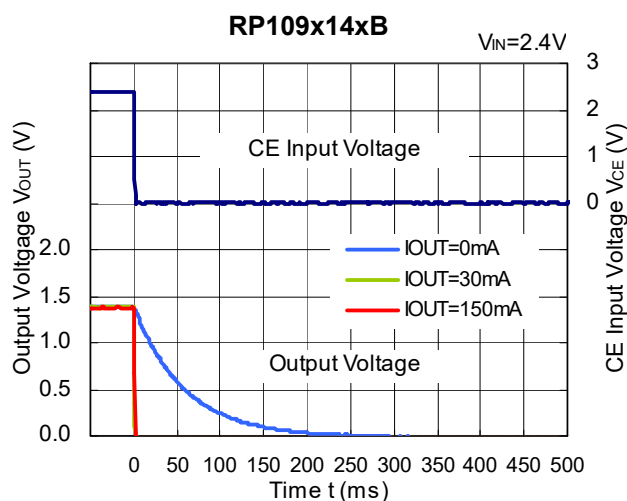
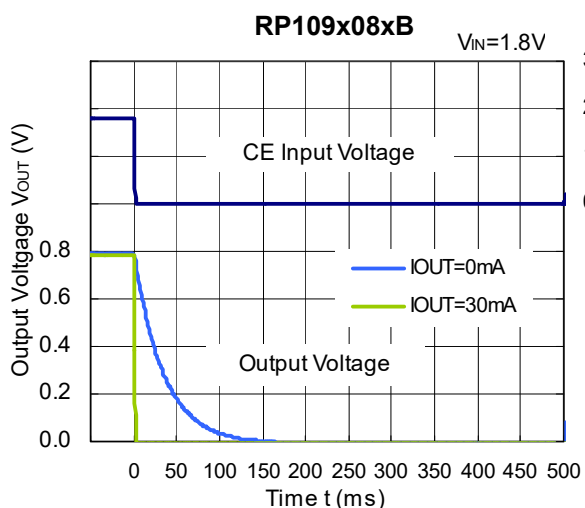
## 12) Turn On Speed with CE pin ( $C1=0.1\mu F$ , $C2=0.1\mu F$ , $T_{opt}=25^{\circ}C$ )





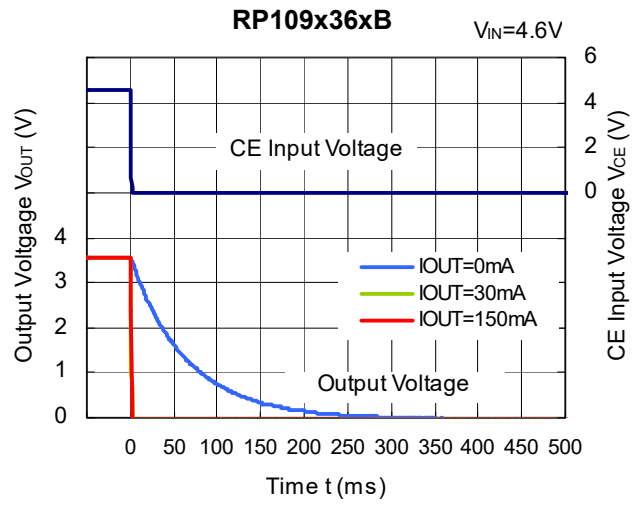
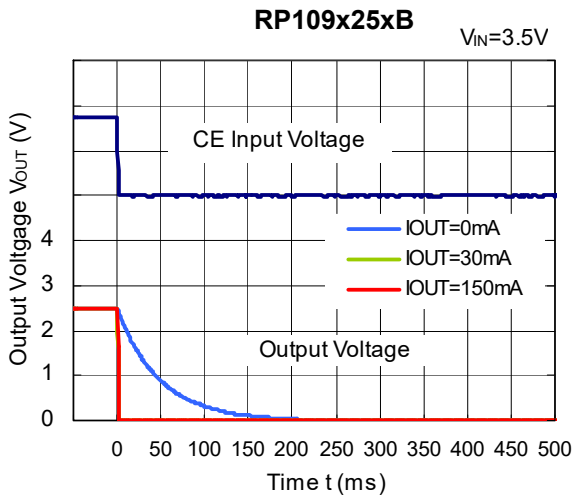


**13) Turn Off Speed with CE pin (B Version) (C1=0.1µF, C2=0.1µF, T<sub>opt</sub>=25°C)**

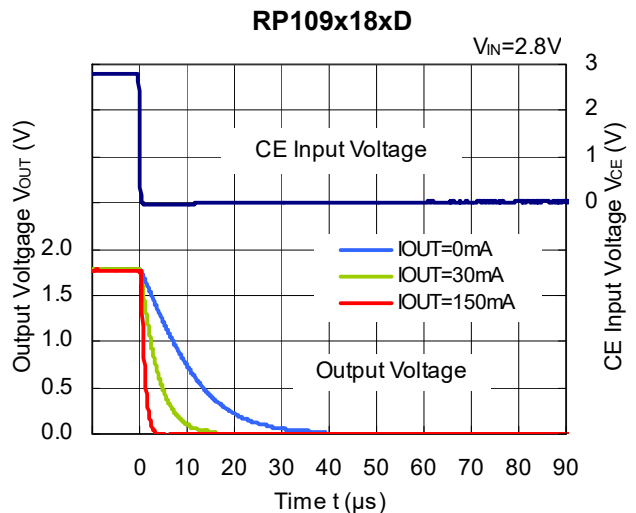
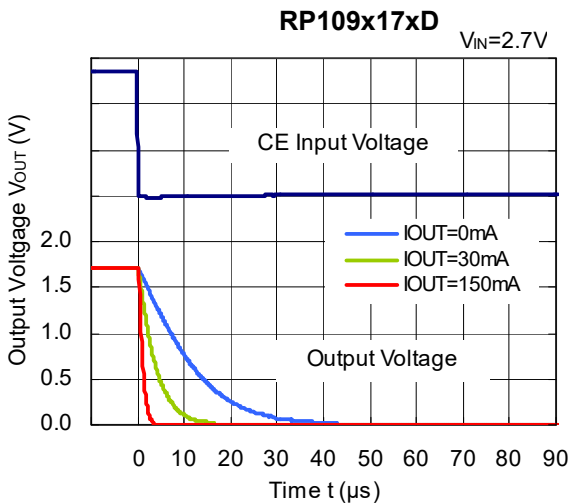
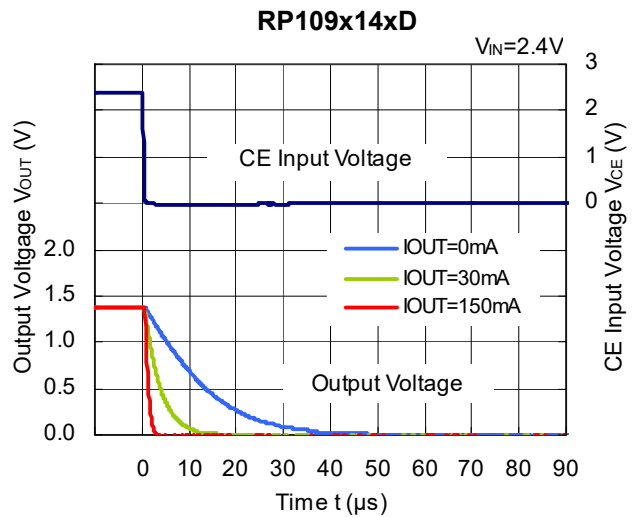
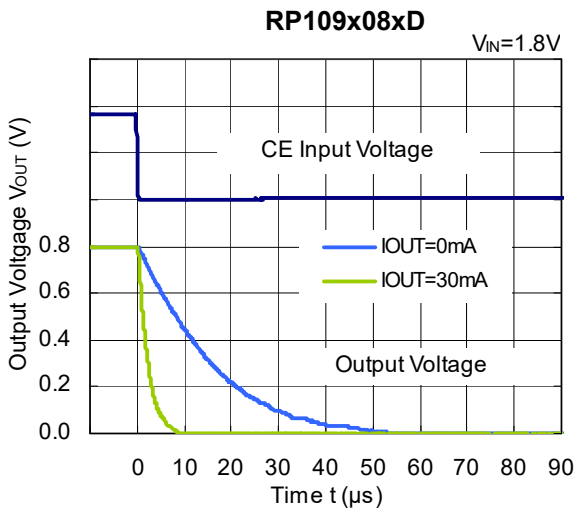


# RP109x

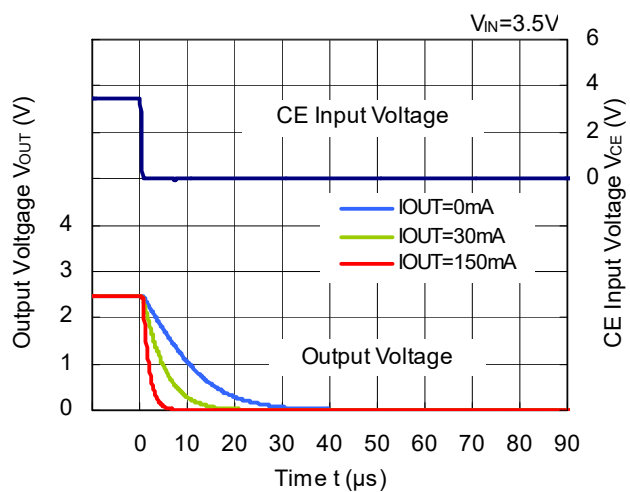
NO.EA-204-170425



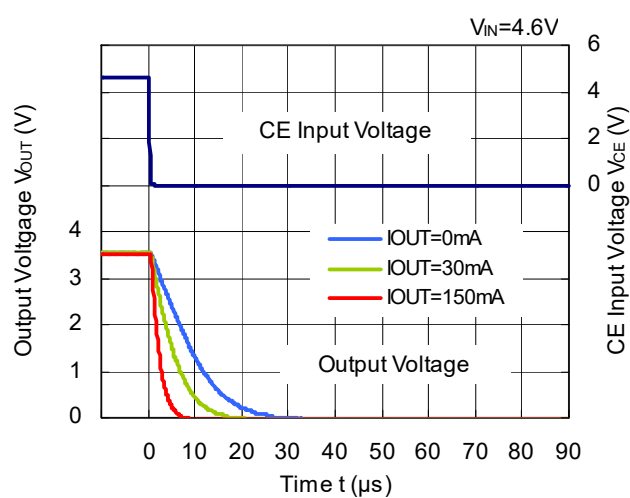
## 14) Turn Off Speed with CE pin (D Version) ( $C1=0.1\mu F$ , $C2=0.1\mu F$ , $T_{opt}=25^{\circ}C$ )



RP109x25xD



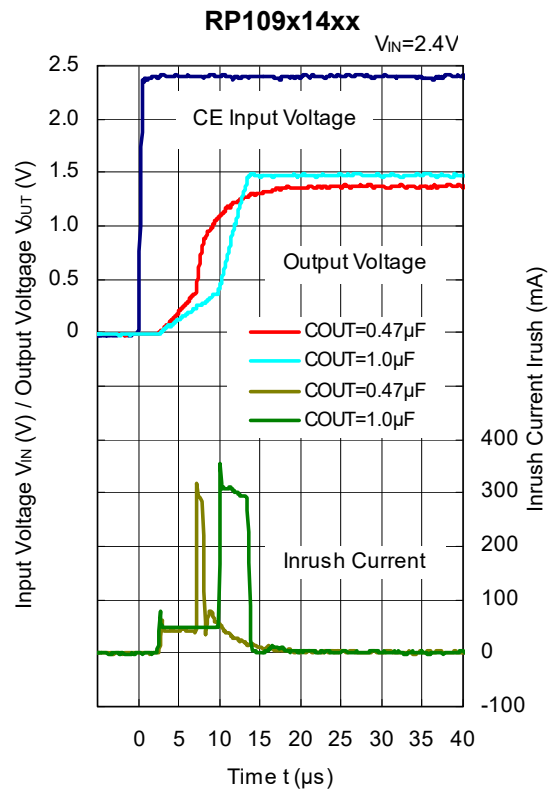
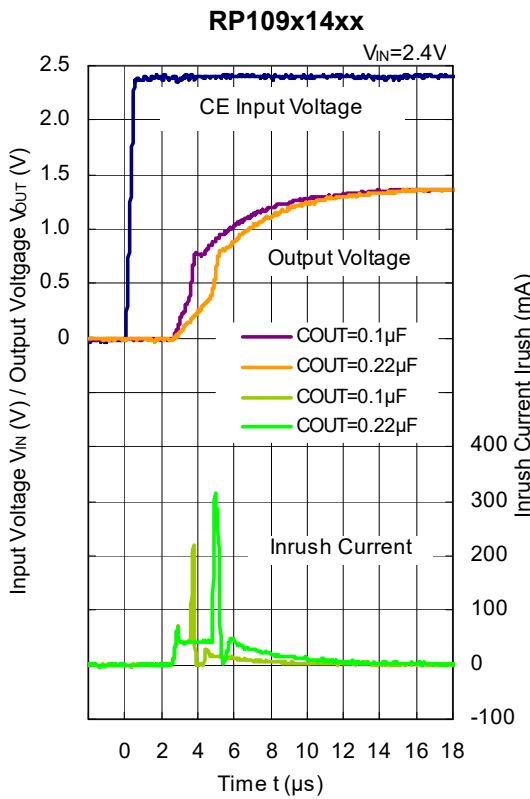
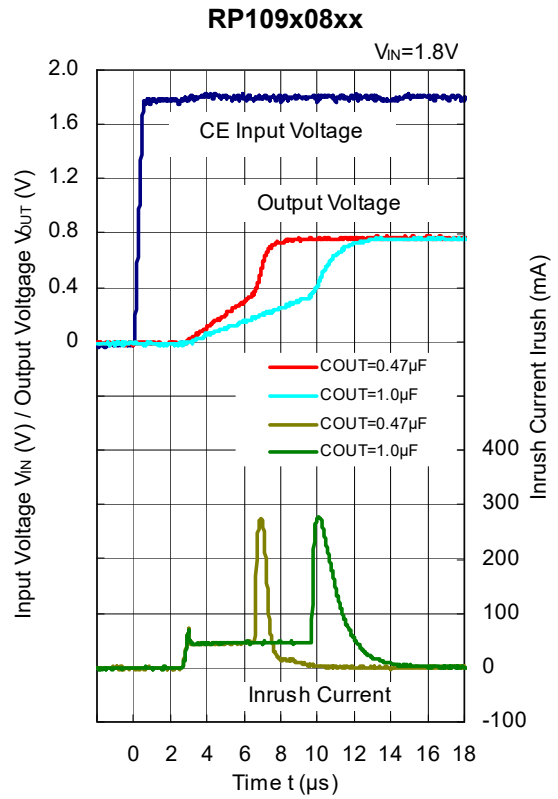
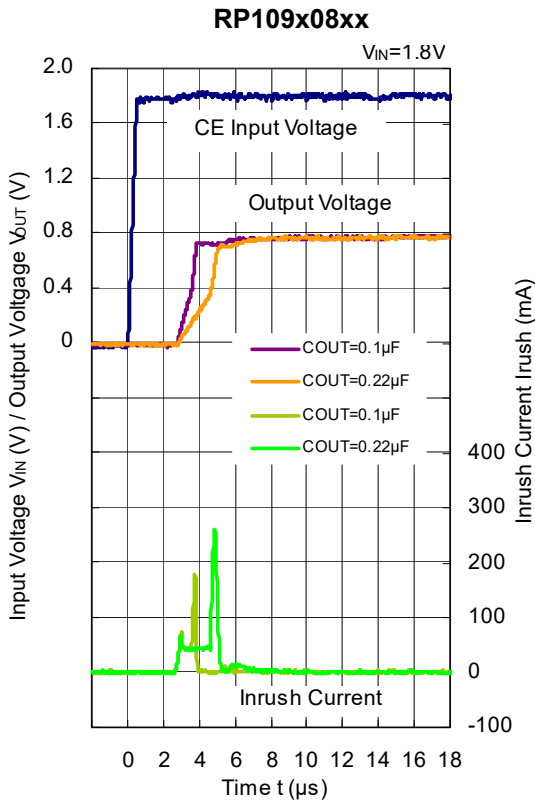
RP109x36xD

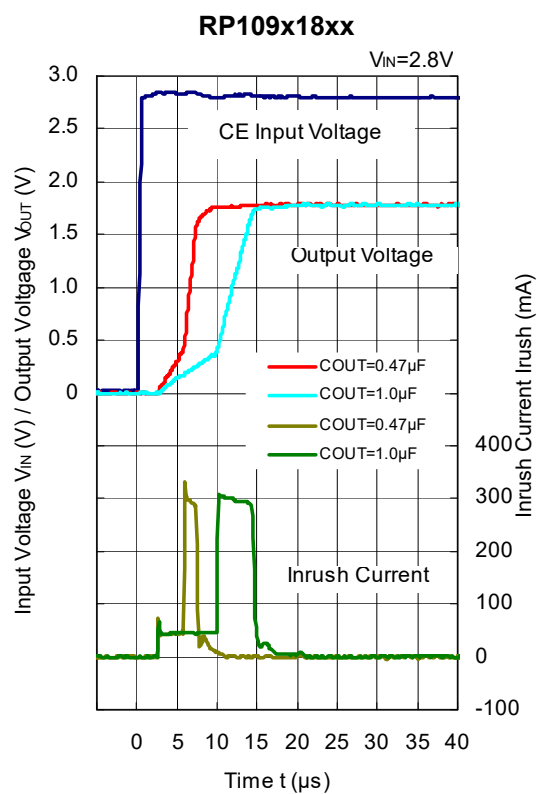
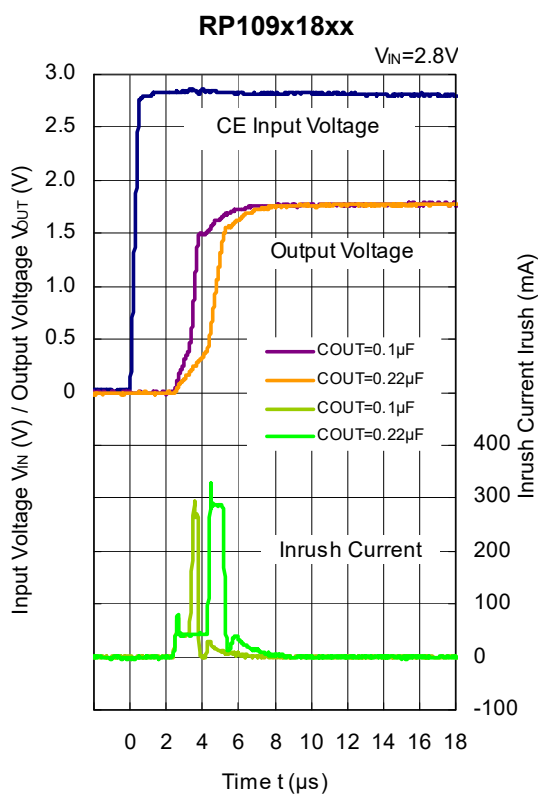
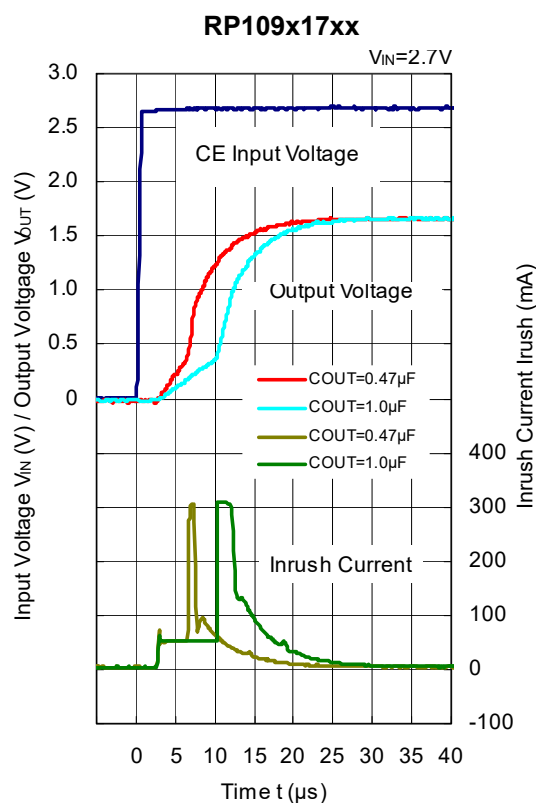
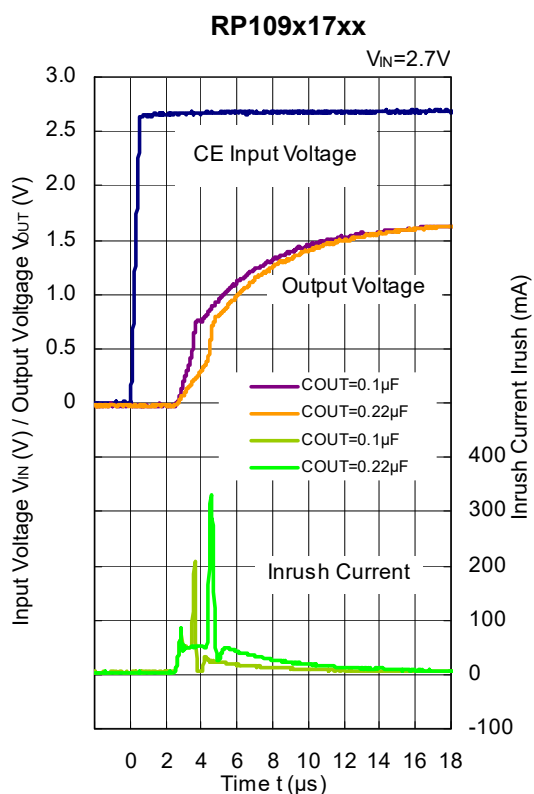


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**15) Inrush Current (C1=4.7μF, I<sub>OUT</sub>=0mA, T<sub>opt</sub>=25°C)**

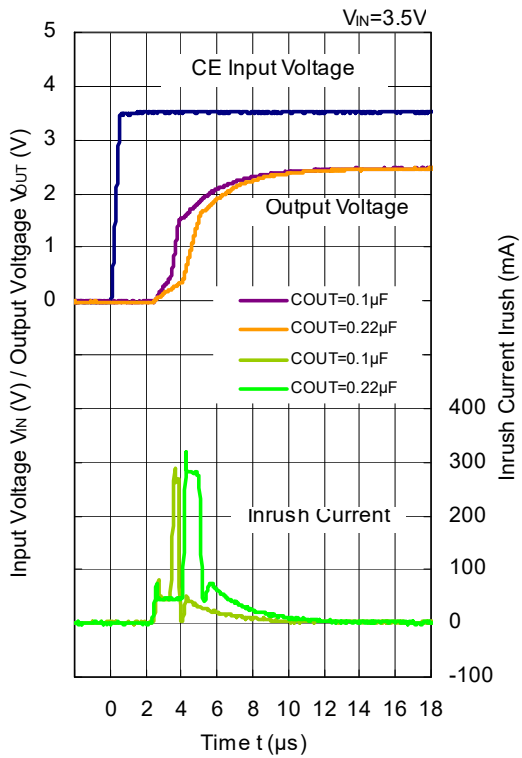




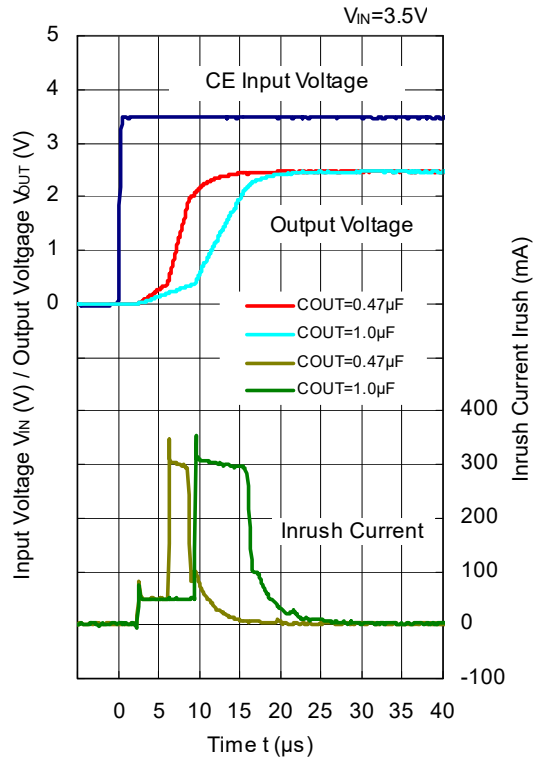
**RP109x**

NO.EA-204-170425

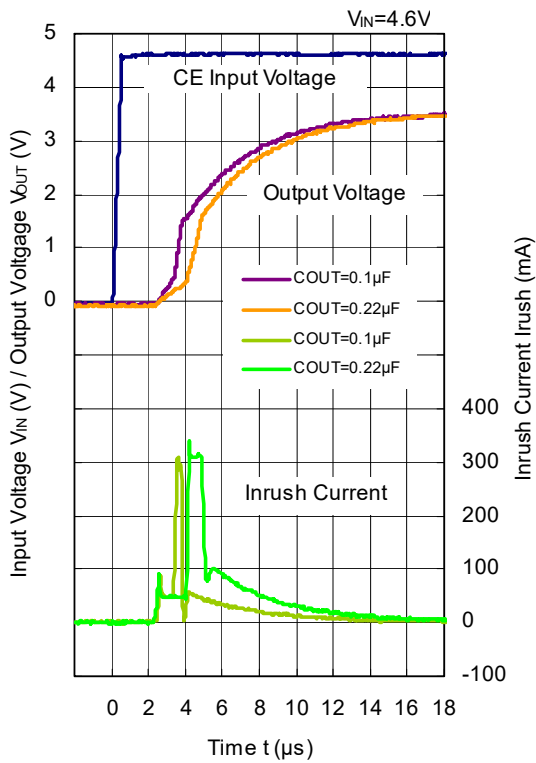
**RP109x25xx**



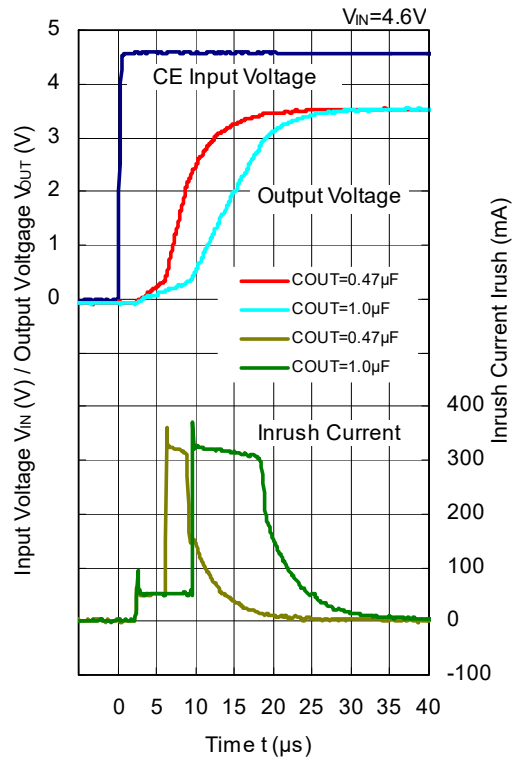
**RP109x25xx**



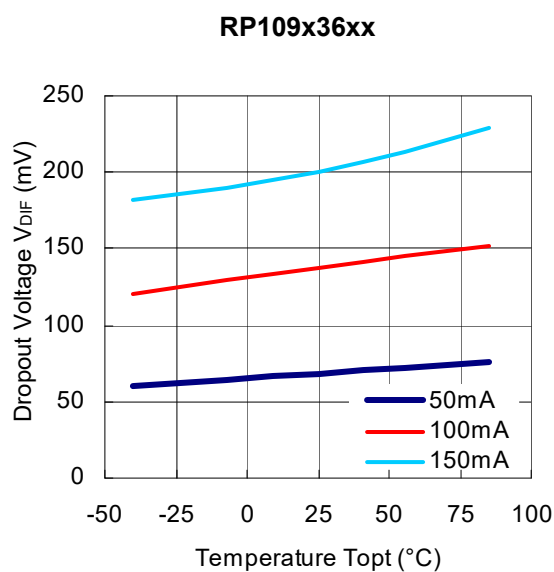
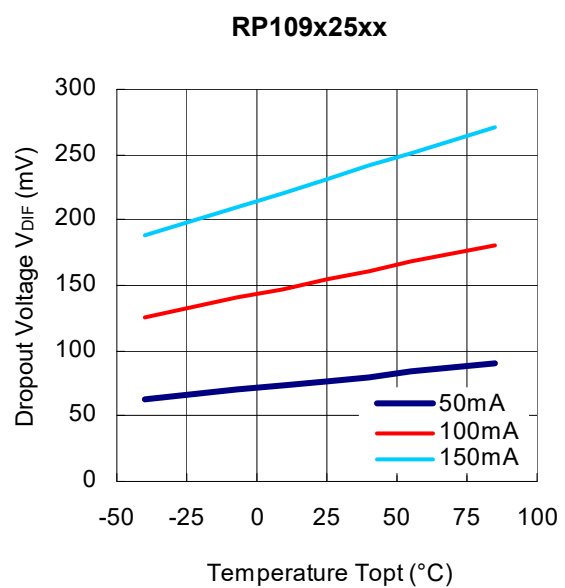
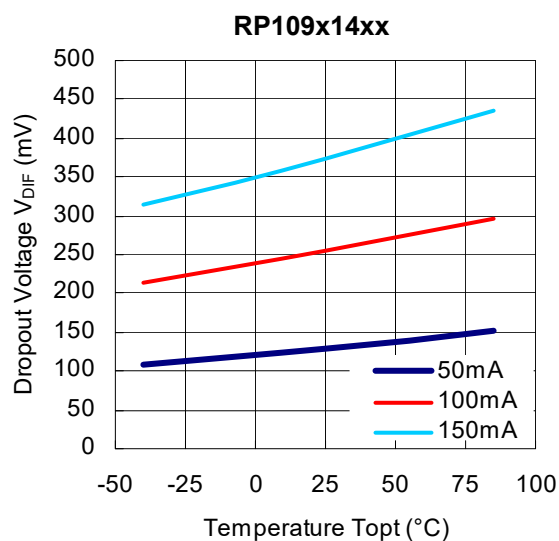
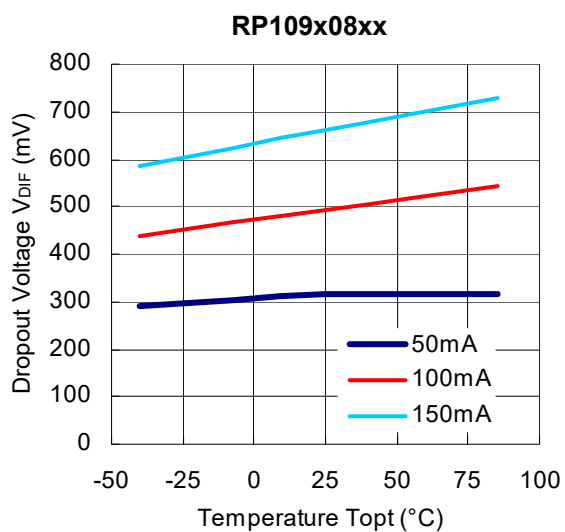
**RP109x36xx**



**RP109x36xx**



16) Dropout Voltage vs. Temperature (C1=0.1μF, C2=0.1μF)



## 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.

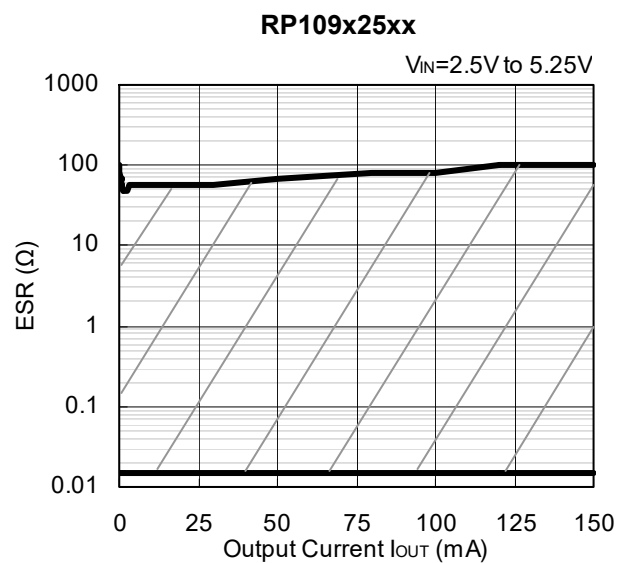
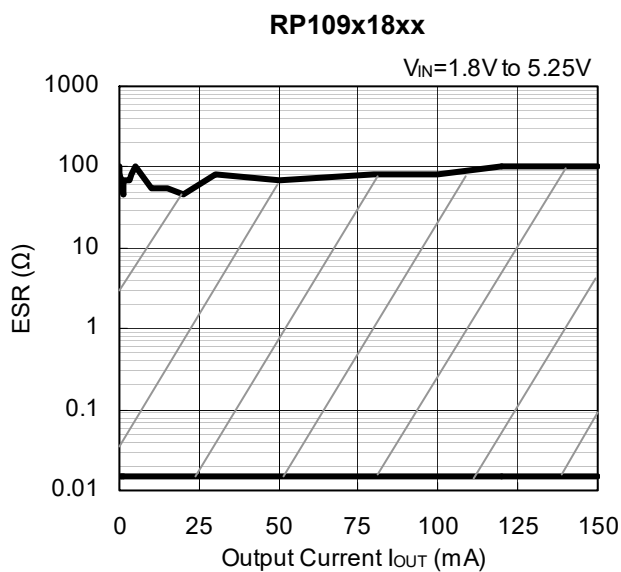
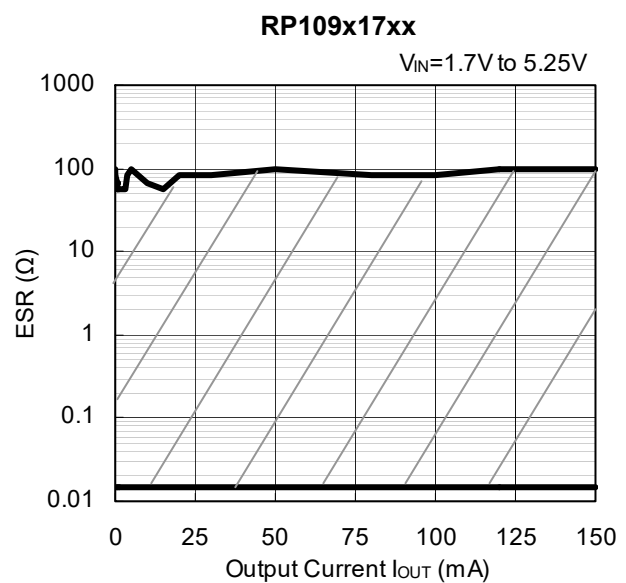
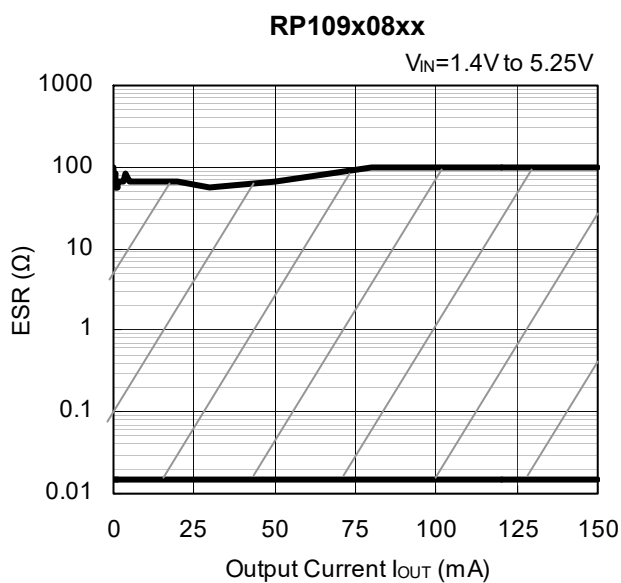
The conditions when the white noise level is under  $40\mu\text{V}$  (Avg.) are marked as the hatched area in the graph.

### Measurement conditions

Frequency Band : 10Hz to 2MHz

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

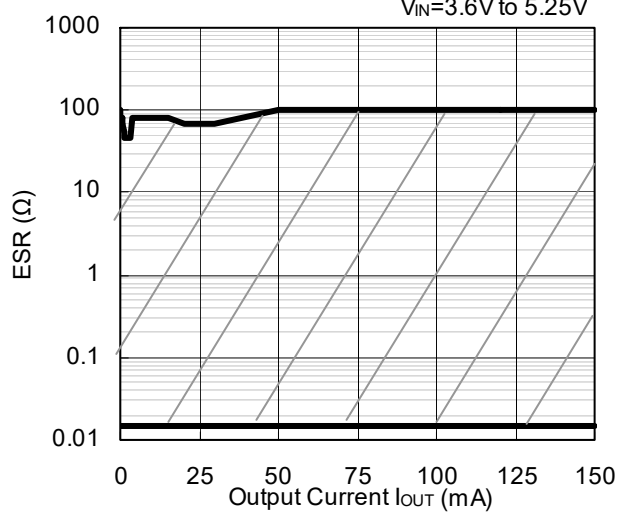
C1, C2 : Ceramic  $0.1\mu\text{F}$





RP109x36xx

$V_{IN}=3.6V$  to  $5.25V$





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