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## 150mA Low Supply Current LDO REGULATOR

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NO.EA-239-140522

### OUTLINE

The RP110x Series is a voltage regulator (LDO) IC, which has been developed using the CMOS process technology, with high output voltage accuracy, ultra-low supply current, and low ON-resistance transistor. The IC contains the following components: a voltage reference unit, an error amplifier, a resistor-net for output voltage setting, a current limit circuit for preventing short-circuit, a soft-start circuit, and a chip enable circuit.

By minimizing the supply current to 1 $\mu$ A, the IC is able to prolong the battery life of each system. The external capacitor is 0.1 $\mu$ F with phase compensation. The IC also has a constant slope circuit as a soft-start circuit, which does not require any external capacitor. It minimizes the inrush current and prevents the output voltage overshoot at the start-up.

In addition to the small packaged SOT-23-5 and SC-88A, the RP110x Series offers the ultra-small DFN(PLP)0808-4 package and DFN1010-4, which enables the high density mounting of LDO regulator.

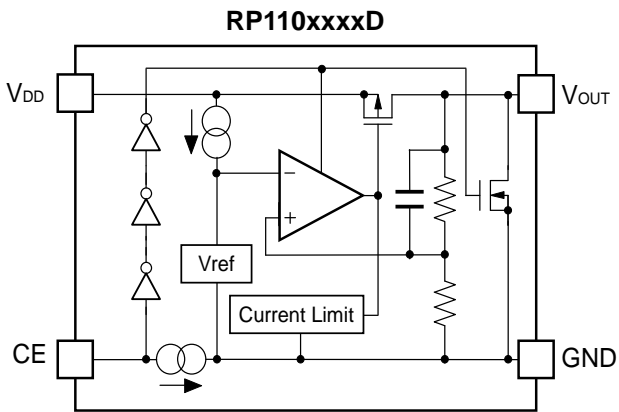
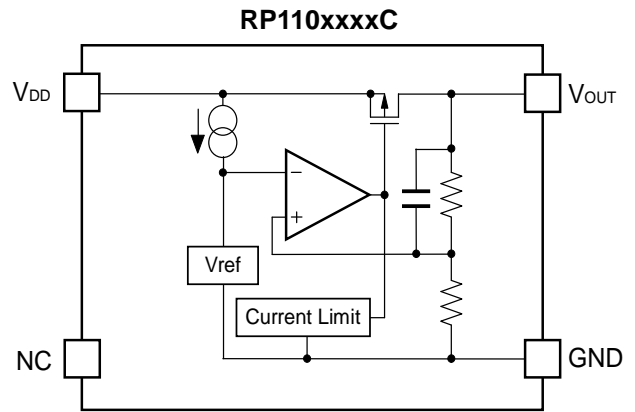
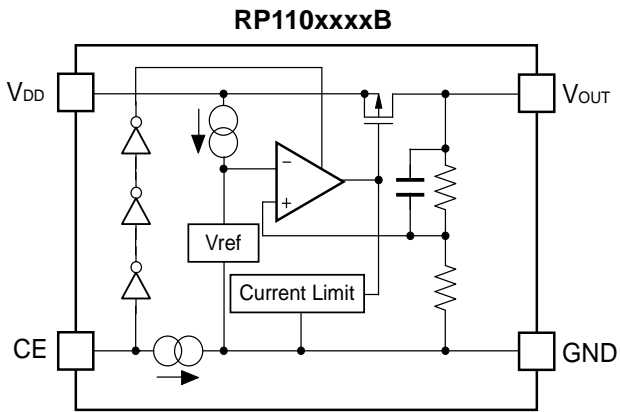
### FEATURES

- Supply Current .....Typ. 1.0 $\mu$ A  
(Except the current through CE pull down circuit)
- Standby Current .....Typ. 0.1 $\mu$ A
- Dropout Voltage .....Typ. 0.28V ( $I_{OUT}=150\text{mA}$ ,  $V_{OUT}=2.8\text{V}$ )
- Output Voltage Accuracy..... $\pm 1.0\%$
- Temperature-Drift Coefficient of Output Voltage ... Typ.  $\pm 100\text{ppm}/^\circ\text{C}$
- Line Regulation .....Typ. 0.02%/V
- 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. 50mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC .....0.1 $\mu$ F or more
- Built-in Constant Slope Circuit

### APPLICATIONS

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

**BLOCK DIAGRAMS**



## SELECTION GUIDE

The output voltage, chip enable circuit, auto discharge function, package for the ICs can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP110Kxx1*-TR	DFN(PLP)0808-4	10,000 pcs	Yes	Yes
RP110Lxx1*-TR	DFN1010-4	10,000 pcs	Yes	Yes
RP110Qxx2*-TR-FE	SC-88A	3,000 pcs	Yes	Yes
RP110Nxx1*-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

xx: Output voltage ( $V_{OUT}$ ) is selectable from 0.8V to 3.6V in 0.1V increments.

The second decimal point is described as below.

1.25V: RP110x12x\*5

1.85V: RP110x18x\*5

2.85V: RP110x28x\*5

\*: Selections of CE pin and Auto-discharge function are as shown below.

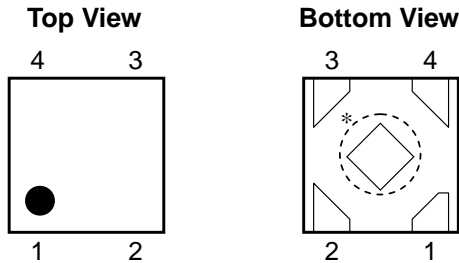
B: CE "H" active, Auto-discharge function: No

C: CE is unavailable, Auto-discharge function: No

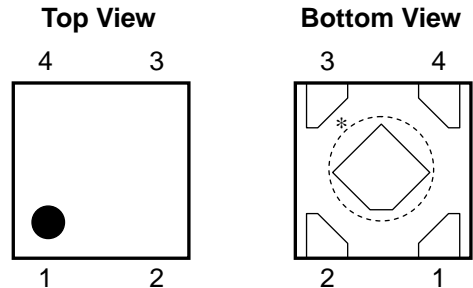
D: CE "H" active, Auto-discharge function: Yes

## PIN CONFIGURATIONS

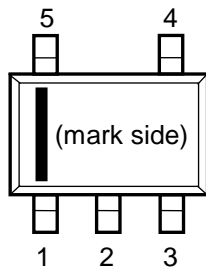
• DFN(PLP)0808-4



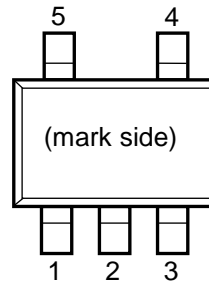
• DFN1010-4



• SC-88A



• SOT-23-5



## PIN DESCRIPTIONS

• DFN(PLP)0808-4

Pin No	Symbol	Pin Description
1	$V_{OUT}$	Output Pin
2	GND	Ground Pin
3	CE / NC	Chip Enable Pin ("H" Active) / No connection
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.

• DFN1010-4

Pin No.	Symbol	Description
1	$V_{OUT}$	Output Pin
2	GND	Ground Pin
3	CE / NC	Chip Enable Pin ("H" Active) / No connection
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	Description
1	CE / NC	Chip Enable Pin ("H" Active) / No connection
2	NC	No connection
3	GND	Ground Pin
4	V <sub>OUT</sub>	Output Pin
5	V <sub>DD</sub>	Input Pin

● SOT-23-5

Pin No	Symbol	Pin Description
1	V <sub>DD</sub>	Input Pin
2	GND	Ground Pin
3	CE / NC	Chip Enable Pin ("H" Active) / No connection
4	NC	No Connection
5	V <sub>OUT</sub>	Output Pin

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V <sub>IN</sub>	Input Voltage	6.0	V
V <sub>CE</sub>	Input Voltage (CE Pin)	6.0	V
V <sub>OUT</sub>	Output Voltage	-0.3 to V <sub>IN</sub> +0.3	V
I <sub>OUT</sub>	Output Current	180	mA
P <sub>D</sub>	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 <sub>opt</sub>	Operating Temperature Range	-40 to 85	°C
T <sub>stg</sub>	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.

## RP110x

NO.EA-239-140522

## ELECTRICAL CHARACTERISTICS

Unless otherwise noted,

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

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

RP110xxxxx

Ta=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
$V_{OUT}$	Output Voltage	Ta = 25°C	$V_{OUT} > 2.0V$	× 0.99	× 1.01	V
			$V_{OUT} \leq 2.0V$	-20	20	mV
		$-40^{\circ}C \leq Ta \leq 85^{\circ}C$	$V_{OUT} > 2.0V$	× 0.97	× 1.025	V
			$V_{OUT} \leq 2.0V$	-60	50	mV
$I_{OUT}$	Output Current		150		mA	
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$1mA \leq I_{OUT} \leq 150mA$	-20	0	20	mV
$V_{DIF}$	Dropout Voltage	Please refer to "Dropout Voltage".				
$I_{SS}$	Supply Current	$I_{OUT} = 0mA$		1	2.0	μA
Istandby	Standby Current	$V_{CE} = 0V$		0.1	1.0	μA
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	Set $V_{OUT} 0.5V \leq V_{IN} \leq 5.0V$		0.02	0.10	%/V
$V_{IN}$	Input Voltage *		1.4		5.25	V
$\frac{\Delta V_{OUT}}{\Delta Ta}$	Output Voltage Temperature Coefficient	$-40^{\circ}C \leq Ta \leq 85^{\circ}C$		±100		ppm/°C
$I_{SC}$	Short Current Limit	$V_{OUT} = 0V$		50		mA
$I_{CE}$	CE Pull-down Current (Only applied to D/ B versions)			0.3		μA
$V_{CEH}$	CE input Voltage "H" (Only for D/B versions)		1.0			V
$V_{CEL}$	CE Input Voltage "L" (Only applied to D/B versions)				0.4	V
$R_{LOW}$	LOW Output Nch ON Resistance (Only applied to D version)	$V_{IN} = 4.0V, V_{CE} = 0V$		60		Ω

All test categories were tested on the products under the pulse load condition ( $T_j \approx Ta = 25^{\circ}C$ ) except "Output Voltage Temperature Coefficient".

\*) The maximum input voltage (electrical characteristics) is 5.25V. In case of exceeding this value, the maximum input voltage cannot be over 5.5V and the total operating time has to be within 500hrs.

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

• Dropout Voltage

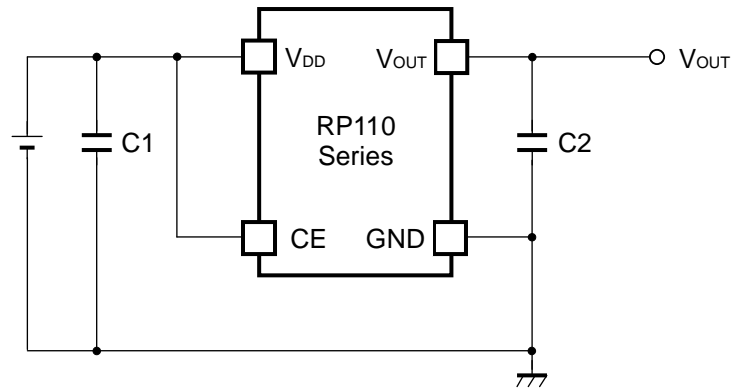
$T_a=25^{\circ}\text{C}$

Output Voltage $V_{\text{OUT}}$ (V)	Dropout Voltage $V_{\text{DIF}}$ (V)		
	Condition	Typ.	Max.
$0.8 \leq V_{\text{OUT}} < 0.9$	$I_{\text{OUT}}=150\text{mA}$	0.96	1.40
$0.9 \leq V_{\text{OUT}} < 1.0$		0.87	1.25
$1.0 \leq V_{\text{OUT}} < 1.2$		0.78	1.15
$1.2 \leq V_{\text{OUT}} < 1.4$		0.64	1.00
$1.4 \leq V_{\text{OUT}} < 1.7$		0.52	0.80
$1.7 \leq V_{\text{OUT}} < 2.0$		0.40	0.60
$2.0 \leq V_{\text{OUT}} < 2.5$		0.32	0.48
$2.5 \leq V_{\text{OUT}} < 3.0$		0.28	0.40
$3.0 \leq V_{\text{OUT}} \leq 3.6$		0.25	0.35

**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 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  $V_{DD}$  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  $V_{DD}$  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.



## CONSTANT SLOPE CIRCUITS

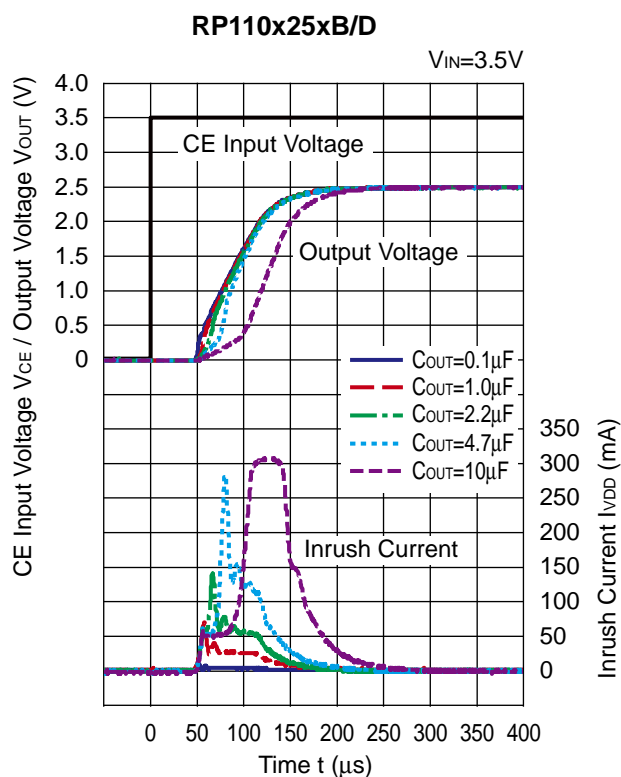
The RP110x Series is equipped with a constant slope circuit as a soft-start circuit, which allows the output voltage to start up gradually when the CE is turned on.

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  $4.7\mu\text{F}$ , the constant slope circuit easily starts to function at the start-up, likewise, if the  $C_{OUT}$  is over  $10\mu\text{F}$ , 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 14 of “Inrush Current Characteristics Example”.

### Inrush Current Characteristics Example ( $C_1=\text{none}$ , $I_{OUT}=0\text{mA}$ , $T_{opt}=25^\circ\text{C}$ )



## RP110x

NO.EA-239-140522

## 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:

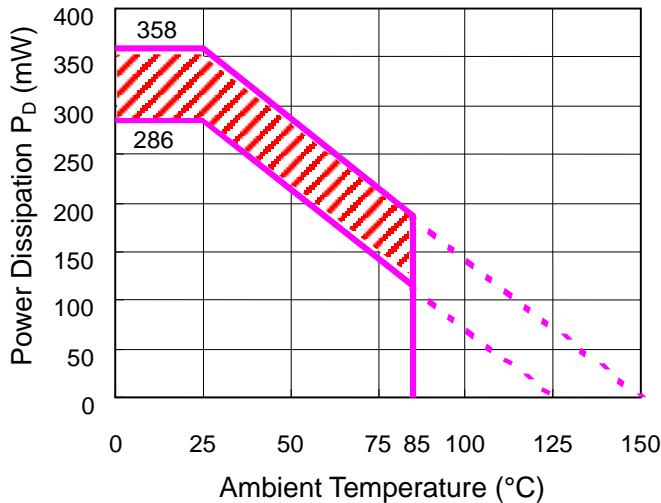
#### Measurement Conditions:

	Standard Test 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

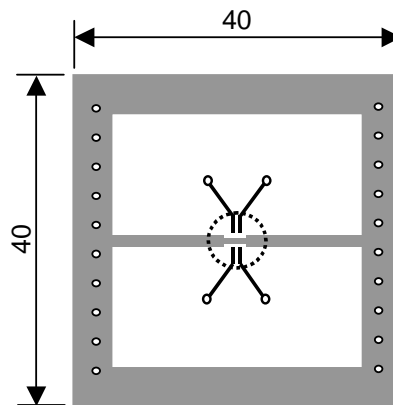
#### Measurement Results:

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

	Standard Test 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**

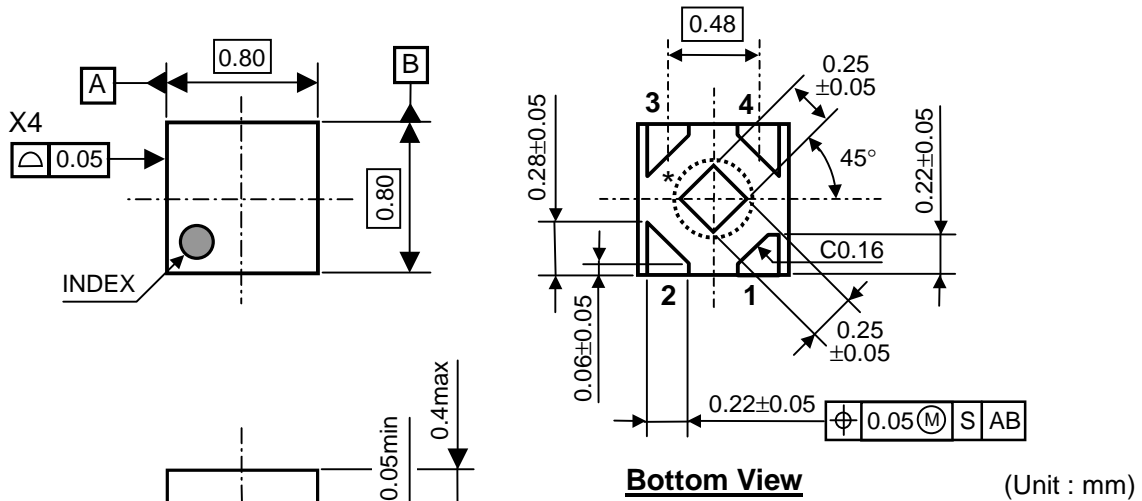
○ IC Mount Area (Unit: mm)

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 four hours/day)
13,000 hours	9 years

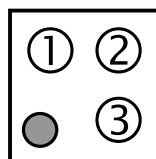
• Package Dimensions (DFN (PLP) 0808-4)



\* ) 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 "RP110K Series Mark Specification Table".
- ②③: Lot Number ... Alphanumeric Serial Number



**RP110x**

NO.EA-239-140522

● **RP110K Series Mark Specification Table (DFN(PLP)0808-4)****RP110Kxx1B**

Product Name	①	V <sub>SET</sub>
RP110K081B	B	0.8V
RP110K091B	B	0.9V
RP110K101B	B	1.0V
RP110K111B	B	1.1V
RP110K121B	B	1.2V
RP110K131B	B	1.3V
RP110K141B	B	1.4V
RP110K151B	B	1.5V
RP110K161B	B	1.6V
RP110K171B	B	1.7V
RP110K181B	B	1.8V
RP110K191B	B	1.9V
RP110K201B	B	2.0V
RP110K211B	B	2.1V
RP110K221B	B	2.2V
RP110K231B	B	2.3V
RP110K241B	B	2.4V
RP110K251B	B	2.5V
RP110K261B	B	2.6V
RP110K271B	B	2.7V
RP110K281B	B	2.8V
RP110K291B	B	2.9V
RP110K301B	B	3.0V
RP110K311B	B	3.1V
RP110K321B	B	3.2V
RP110K331B	B	3.3V
RP110K341B	B	3.4V
RP110K351B	B	3.5V
RP110K361B	B	3.6V
RP110K121B5	B	1.25V
RP110K181B5	B	1.85V
RP110K281B5	B	2.85V

**RP110Kxx1C**

Product Name	①	V <sub>SET</sub>
RP110K081C	B	0.8V
RP110K091C	B	0.9V
RP110K101C	B	1.0V
RP110K111C	B	1.1V
RP110K121C	B	1.2V
RP110K131C	B	1.3V
RP110K141C	B	1.4V
RP110K151C	B	1.5V
RP110K161C	B	1.6V
RP110K171C	B	1.7V
RP110K181C	B	1.8V
RP110K191C	B	1.9V
RP110K201C	B	2.0V
RP110K211C	B	2.1V
RP110K221C	B	2.2V
RP110K231C	B	2.3V
RP110K241C	B	2.4V
RP110K251C	B	2.5V
RP110K261C	B	2.6V
RP110K271C	B	2.7V
RP110K281C	B	2.8V
RP110K291C	B	2.9V
RP110K301C	B	3.0V
RP110K311C	B	3.1V
RP110K321C	B	3.2V
RP110K331C	B	3.3V
RP110K341C	B	3.4V
RP110K351C	B	3.5V
RP110K361C	B	3.6V
RP110K121C5	B	1.25V
RP110K181C5	B	1.85V
RP110K281C5	B	2.85V

**RP110Kxx1D**

Product Name	①	V <sub>SET</sub>
RP110K081D	B	0.8V
RP110K091D	B	0.9V
RP110K101D	B	1.0V
RP110K111D	B	1.1V
RP110K121D	B	1.2V
RP110K131D	B	1.3V
RP110K141D	B	1.4V
RP110K151D	B	1.5V
RP110K161D	B	1.6V
RP110K171D	B	1.7V
RP110K181D	B	1.8V
RP110K191D	B	1.9V
RP110K201D	B	2.0V
RP110K211D	B	2.1V
RP110K221D	B	2.2V
RP110K231D	B	2.3V
RP110K241D	B	2.4V
RP110K251D	B	2.5V
RP110K261D	B	2.6V
RP110K271D	B	2.7V
RP110K281D	B	2.8V
RP110K291D	B	2.9V
RP110K301D	B	3.0V
RP110K311D	B	3.1V
RP110K321D	B	3.2V
RP110K331D	B	3.3V
RP110K341D	B	3.4V
RP110K351D	B	3.5V
RP110K361D	B	3.6V
RP110K121D5	B	1.25V
RP110K181D5	B	1.85V
RP110K281D5	B	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:

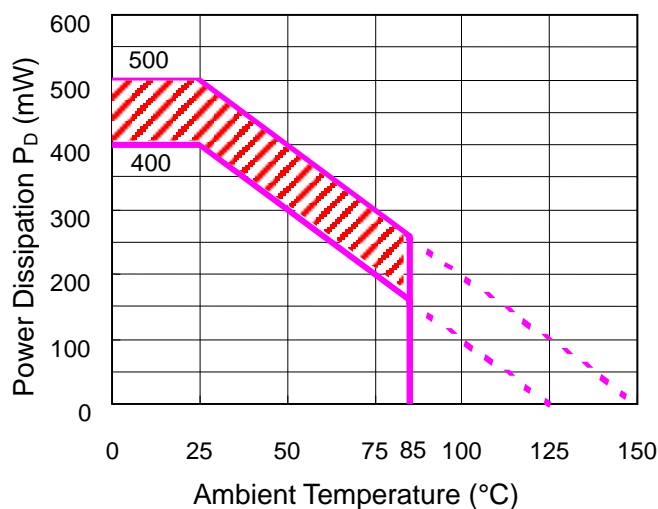
Measurement Conditions:

Standard Test 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 0.54mm × 24pcs

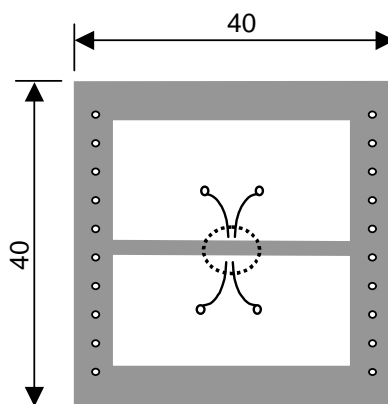
Measurement Results:

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

Standard Test Land Pattern	
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



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  $T_{jmax}=150^{\circ}\text{C}$ .

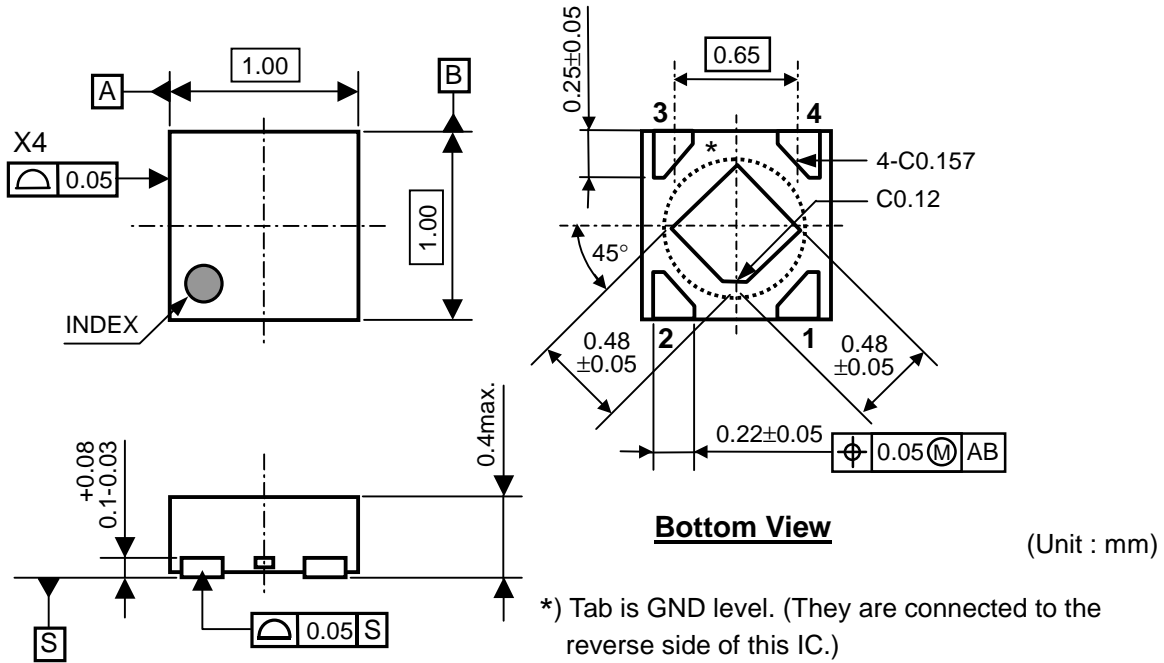
The operation of the IC within the shaded range in the graph might have an affect on the IC's lifetime. The operation time of the IC must be remained within the time limit described in the table below.

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

# RP110x

NO.EA-239-140522

## • Package Dimensions (DFN1010-4)



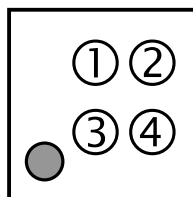
\*) Tab is GND level. (They are connected to the reverse side of this IC.)

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 "RP110L Series Mark Specification Table".

③④: Lot Number ... Alphanumeric Serial Number



● RP110L Series Mark Specification Table (DFN1010-4)

**RP110Lxx1B**

Product Name	①②	V <sub>SET</sub>
RP110L081B	00	0.8V
RP110L091B	01	0.9V
RP110L101B	02	1.0V
RP110L111B	03	1.1V
RP110L121B	04	1.2V
RP110L131B	06	1.3V
RP110L141B	07	1.4V
RP110L151B	08	1.5V
RP110L161B	09	1.6V
RP110L171B	10	1.7V
RP110L181B	11	1.8V
RP110L191B	13	1.9V
RP110L201B	14	2.0V
RP110L211B	15	2.1V
RP110L221B	16	2.2V
RP110L231B	17	2.3V
RP110L241B	18	2.4V
RP110L251B	19	2.5V
RP110L261B	20	2.6V
RP110L271B	21	2.7V
RP110L281B	22	2.8V
RP110L291B	24	2.9V
RP110L301B	25	3.0V
RP110L311B	26	3.1V
RP110L321B	27	3.2V
RP110L331B	28	3.3V
RP110L341B	29	3.4V
RP110L351B	30	3.5V
RP110L361B	31	3.6V
RP110L121B5	05	1.25V
RP110L181B5	12	1.85V
RP110L281B5	23	2.85V

**RP110Lxx1C**

Product Name	①②	V <sub>SET</sub>
RP110L081C	32	0.8V
RP110L091C	33	0.9V
RP110L101C	34	1.0V
RP110L111C	35	1.1V
RP110L121C	36	1.2V
RP110L131C	38	1.3V
RP110L141C	39	1.4V
RP110L151C	40	1.5V
RP110L161C	41	1.6V
RP110L171C	42	1.7V
RP110L181C	43	1.8V
RP110L191C	45	1.9V
RP110L201C	46	2.0V
RP110L211C	47	2.1V
RP110L221C	48	2.2V
RP110L231C	49	2.3V
RP110L241C	50	2.4V
RP110L251C	51	2.5V
RP110L261C	52	2.6V
RP110L271C	53	2.7V
RP110L281C	54	2.8V
RP110L291C	56	2.9V
RP110L301C	57	3.0V
RP110L311C	58	3.1V
RP110L321C	59	3.2V
RP110L331C	60	3.3V
RP110L341C	61	3.4V
RP110L351C	62	3.5V
RP110L361C	63	3.6V
RP110L121C5	37	1.25V
RP110L181C5	44	1.85V
RP110L281C5	55	2.85V

**RP110Lxx1D**

Product Name	①②	V <sub>SET</sub>
RP110L081D	64	0.8V
RP110L091D	65	0.9V
RP110L101D	66	1.0V
RP110L111D	67	1.1V
RP110L121D	68	1.2V
RP110L131D	70	1.3V
RP110L141D	71	1.4V
RP110L151D	72	1.5V
RP110L161D	73	1.6V
RP110L171D	74	1.7V
RP110L181D	75	1.8V
RP110L191D	77	1.9V
RP110L201D	78	2.0V
RP110L211D	79	2.1V
RP110L221D	80	2.2V
RP110L231D	81	2.3V
RP110L241D	82	2.4V
RP110L251D	83	2.5V
RP110L261D	84	2.6V
RP110L271D	85	2.7V
RP110L281D	86	2.8V
RP110L291D	88	2.9V
RP110L301D	89	3.0V
RP110L311D	90	3.1V
RP110L321D	91	3.2V
RP110L331D	92	3.3V
RP110L341D	93	3.4V
RP110L351D	94	3.5V
RP110L361D	95	3.6V
RP110L121D5	69	1.25V
RP110L181D5	76	1.85V
RP110L281D5	87	2.85V

# RP110x

NO.EA-239-140522

## • 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:

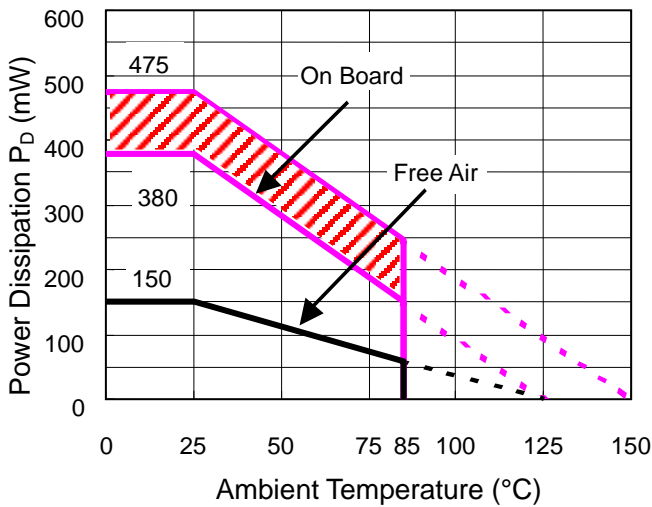
### Measurement Conditions:

	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

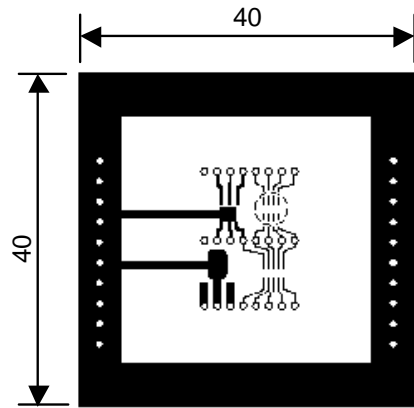
### Measurement Results:

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

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



**Power Dissipation**



**Measurement Board Pattern**

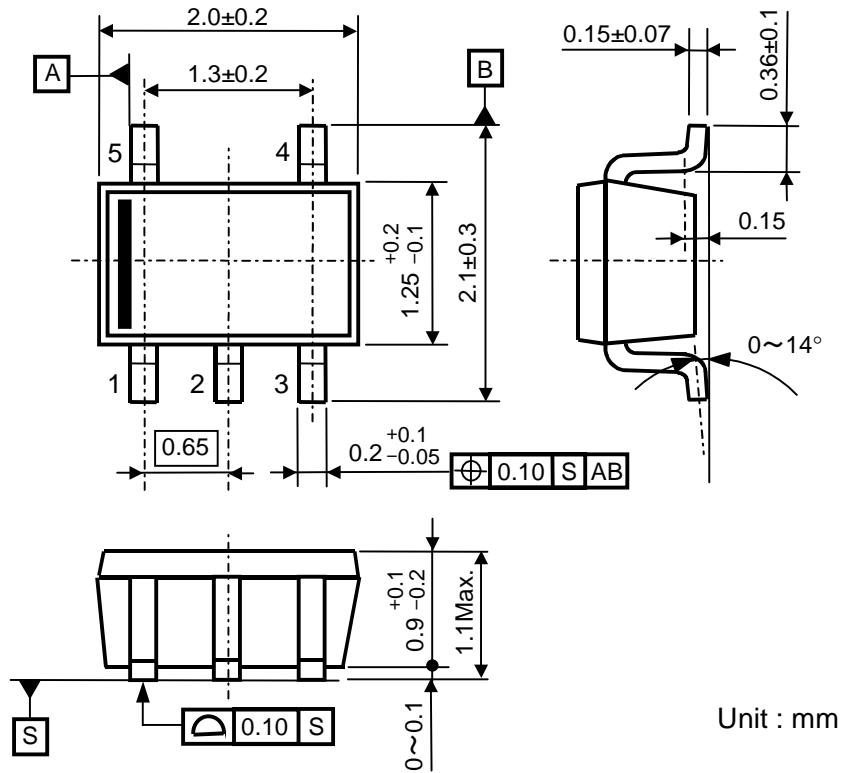
⊙ IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of  $T_{j\text{max}}=125^\circ\text{C}$  and  $T_{j\text{max}}=150^\circ\text{C}$ . 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 four hours/day)
13,000 hours	9 years

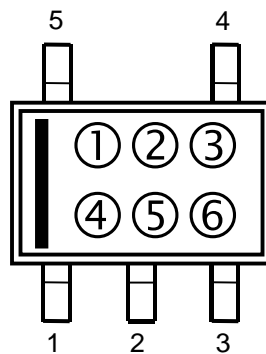


• Package Dimensions (SC-88A)



• Mark Specification (SC-88A)

- ①②③④: Product Code ... Refer to "RP110Q Series Mark Specification Table".
- ⑤⑥: Lot Number ... Alphanumeric Serial Number



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**RP110x**

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NO.EA-239-140522

**• RP110Q Series Mark Specification Table (SC-88A)**

## RP110Qxx2B

Product Name	①②③④	V <sub>SET</sub>
RP110Q082B	AN08	0.8V
RP110Q092B	AN09	0.9V
RP110Q102B	AN10	1.0V
RP110Q112B	AN11	1.1V
RP110Q122B	AN12	1.2V
RP110Q132B	AN13	1.3V
RP110Q142B	AN14	1.4V
RP110Q152B	AN15	1.5V
RP110Q162B	AN16	1.6V
RP110Q172B	AN17	1.7V
RP110Q182B	AN18	1.8V
RP110Q192B	AN19	1.9V
RP110Q202B	AN20	2.0V
RP110Q212B	AN21	2.1V
RP110Q222B	AN22	2.2V
RP110Q232B	AN23	2.3V
RP110Q242B	AN24	2.4V
RP110Q252B	AN25	2.5V
RP110Q262B	AN26	2.6V
RP110Q272B	AN27	2.7V
RP110Q282B	AN28	2.8V
RP110Q292B	AN29	2.9V
RP110Q302B	AN30	3.0V
RP110Q312B	AN31	3.1V
RP110Q322B	AN32	3.2V
RP110Q332B	AN33	3.3V
RP110Q342B	AN34	3.4V
RP110Q352B	AN35	3.5V
RP110Q362B	AN36	3.6V
RP110Q122B5	AN37	1.25V
RP110Q182B5	AN38	1.85V
RP110Q282B5	AN39	2.85V

## RP110Qxx2C

Product Name	①②③④	V <sub>SET</sub>
RP110Q082C	AP08	0.8V
RP110Q092C	AP09	0.9V
RP110Q102C	AP10	1.0V
RP110Q112C	AP11	1.1V
RP110Q122C	AP12	1.2V
RP110Q132C	AP13	1.3V
RP110Q142C	AP14	1.4V
RP110Q152C	AP15	1.5V
RP110Q162C	AP16	1.6V
RP110Q172C	AP17	1.7V
RP110Q182C	AP18	1.8V
RP110Q192C	AP19	1.9V
RP110Q202C	AP20	2.0V
RP110Q212C	AP21	2.1V
RP110Q222C	AP22	2.2V
RP110Q232C	AP23	2.3V
RP110Q242C	AP24	2.4V
RP110Q252C	AP25	2.5V
RP110Q262C	AP26	2.6V
RP110Q272C	AP27	2.7V
RP110Q282C	AP28	2.8V
RP110Q292C	AP29	2.9V
RP110Q302C	AP30	3.0V
RP110Q312C	AP31	3.1V
RP110Q322C	AP32	3.2V
RP110Q332C	AP33	3.3V
RP110Q342C	AP34	3.4V
RP110Q352C	AP35	3.5V
RP110Q362C	AP36	3.6V
RP110Q122C5	AP37	1.25V
RP110Q182C5	AP38	1.85V
RP110Q282C5	AP39	2.85V

## RP110Qxx2D

Product Name	①②③④	V <sub>SET</sub>
RP110Q082D	AQ08	0.8V
RP110Q092D	AQ09	0.9V
RP110Q102D	AQ10	1.0V
RP110Q112D	AQ11	1.1V
RP110Q122D	AQ12	1.2V
RP110Q132D	AQ13	1.3V
RP110Q142D	AQ14	1.4V
RP110Q152D	AQ15	1.5V
RP110Q162D	AQ16	1.6V
RP110Q172D	AQ17	1.7V
RP110Q182D	AQ18	1.8V
RP110Q192D	AQ19	1.9V
RP110Q202D	AQ20	2.0V
RP110Q212D	AQ21	2.1V
RP110Q222D	AQ22	2.2V
RP110Q232D	AQ23	2.3V
RP110Q242D	AQ24	2.4V
RP110Q252D	AQ25	2.5V
RP110Q262D	AQ26	2.6V
RP110Q272D	AQ27	2.7V
RP110Q282D	AQ28	2.8V
RP110Q292D	AQ29	2.9V
RP110Q302D	AQ30	3.0V
RP110Q312D	AQ31	3.1V
RP110Q322D	AQ32	3.2V
RP110Q332D	AQ33	3.3V
RP110Q342D	AQ34	3.4V
RP110Q352D	AQ35	3.5V
RP110Q362D	AQ36	3.6V
RP110Q122D5	AQ37	1.25V
RP110Q182D5	AQ38	1.85V
RP110Q282D5	AQ39	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.)

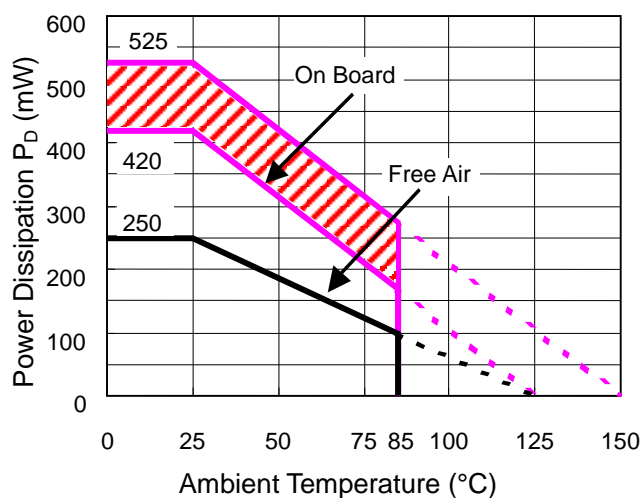
**Measurement Conditions:**

	<b>Standard Test 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

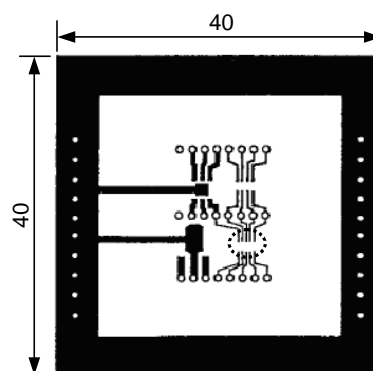
**Measurement Results:**

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

	<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.

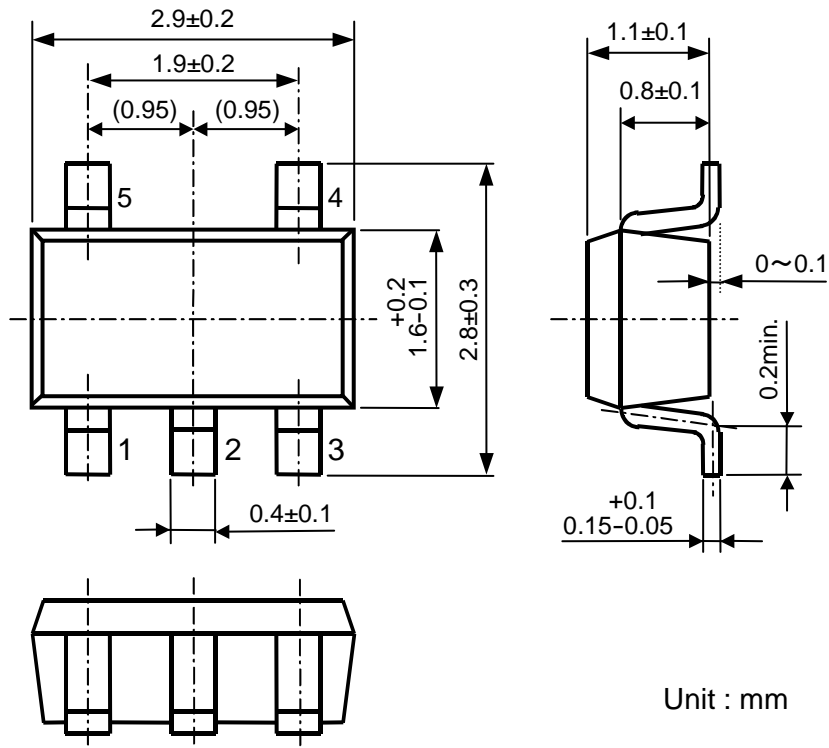
Operating Time	Estimated Years (Operating four hours/day)
13,000 hours	9 years

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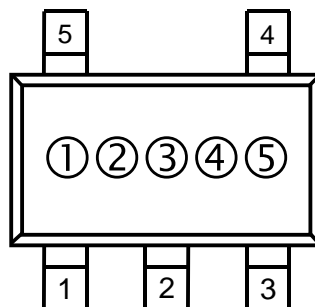
**RP110x**

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NO.EA-239-140522

**• Package Dimensions (SOT-23-5)****• Mark Specification (SOT-23-5)**

- ①②③: Product Code ... Refer to "RP110N Series Mark Specification Table".  
④⑤: Lot Number ... Alphanumeric Serial Number



● RP110N Series Mark Specification Table (SOT-23-5)

**RP110Nxx1B**

Product Name	①②③	V <sub>SET</sub>
RP110N081B	A08	0.8V
RP110N091B	A09	0.9V
RP110N101B	A10	1.0V
RP110N111B	A11	1.1V
RP110N121B	A12	1.2V
RP110N131B	A13	1.3V
RP110N141B	A14	1.4V
RP110N151B	A15	1.5V
RP110N161B	A16	1.6V
RP110N171B	A17	1.7V
RP110N181B	A18	1.8V
RP110N191B	A19	1.9V
RP110N201B	A20	2.0V
RP110N211B	A21	2.1V
RP110N221B	A22	2.2V
RP110N231B	A23	2.3V
RP110N241B	A24	2.4V
RP110N251B	A25	2.5V
RP110N261B	A26	2.6V
RP110N271B	A27	2.7V
RP110N281B	A28	2.8V
RP110N291B	A29	2.9V
RP110N301B	A30	3.0V
RP110N311B	A31	3.1V
RP110N321B	A32	3.2V
RP110N331B	A33	3.3V
RP110N341B	A34	3.4V
RP110N351B	A35	3.5V
RP110N361B	A36	3.6V
RP110N121B5	A37	1.25V
RP110N181B5	A38	1.85V
RP110N281B5	A39	2.85V

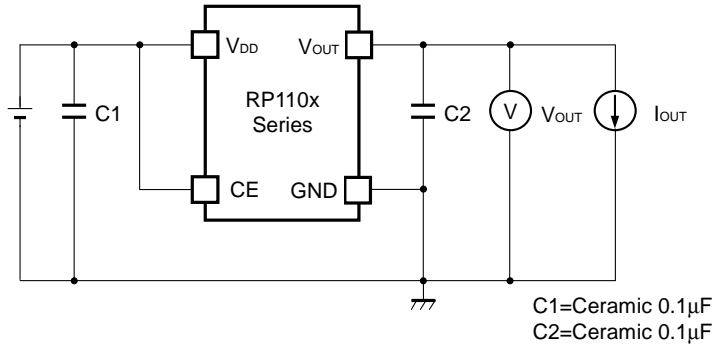
**RP110Nxx1C**

Product Name	①②③	V <sub>SET</sub>
RP110N081C	B08	0.8V
RP110N091C	B09	0.9V
RP110N101C	B10	1.0V
RP110N111C	B11	1.1V
RP110N121C	B12	1.2V
RP110N131C	B13	1.3V
RP110N141C	B14	1.4V
RP110N151C	B15	1.5V
RP110N161C	B16	1.6V
RP110N171C	B17	1.7V
RP110N181C	B18	1.8V
RP110N191C	B19	1.9V
RP110N201C	B20	2.0V
RP110N211C	B21	2.1V
RP110N221C	B22	2.2V
RP110N231C	B23	2.3V
RP110N241C	B24	2.4V
RP110N251C	B25	2.5V
RP110N261C	B26	2.6V
RP110N271C	B27	2.7V
RP110N281C	B28	2.8V
RP110N291C	B29	2.9V
RP110N301C	B30	3.0V
RP110N311C	B31	3.1V
RP110N321C	B32	3.2V
RP110N331C	B33	3.3V
RP110N341C	B34	3.4V
RP110N351C	B35	3.5V
RP110N361C	B36	3.6V
RP110N121C5	B37	1.25V
RP110N181C5	B38	1.85V
RP110N281C5	B39	2.85V

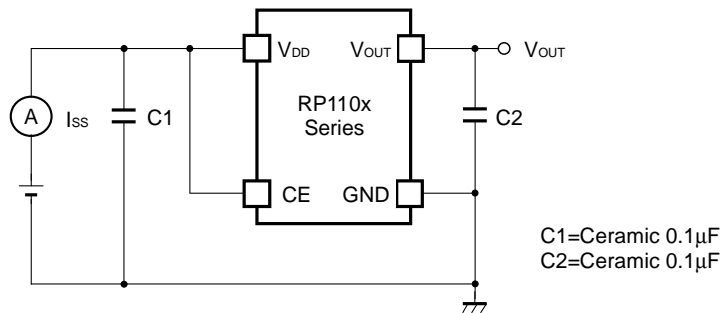
**RP110Nxx1D**

Product Name	①②③	V <sub>SET</sub>
RP110N081D	C08	0.8V
RP110N091D	C09	0.9V
RP110N101D	C10	1.0V
RP110N111D	C11	1.1V
RP110N121D	C12	1.2V
RP110N131D	C13	1.3V
RP110N141D	C14	1.4V
RP110N151D	C15	1.5V
RP110N161D	C16	1.6V
RP110N171D	C17	1.7V
RP110N181D	C18	1.8V
RP110N191D	C19	1.9V
RP110N201D	C20	2.0V
RP110N211D	C21	2.1V
RP110N221D	C22	2.2V
RP110N231D	C23	2.3V
RP110N241D	C24	2.4V
RP110N251D	C25	2.5V
RP110N261D	C26	2.6V
RP110N271D	C27	2.7V
RP110N281D	C28	2.8V
RP110N291D	C29	2.9V
RP110N301D	C30	3.0V
RP110N311D	C31	3.1V
RP110N321D	C32	3.2V
RP110N331D	C33	3.3V
RP110N341D	C34	3.4V
RP110N351D	C35	3.5V
RP110N361D	C36	3.6V
RP110N121D5	C37	1.25V
RP110N181D5	C38	1.85V
RP110N281D5	C39	2.85V

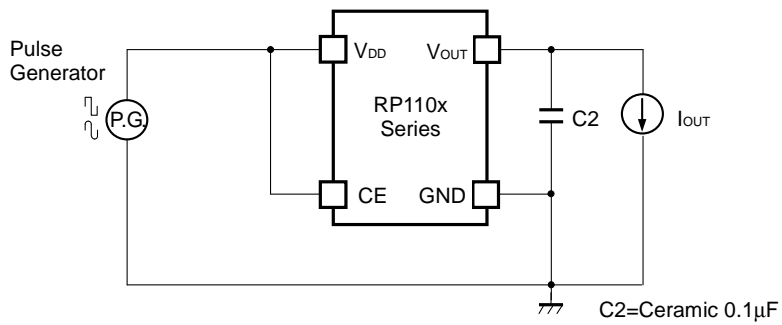
# TEST CIRCUITS



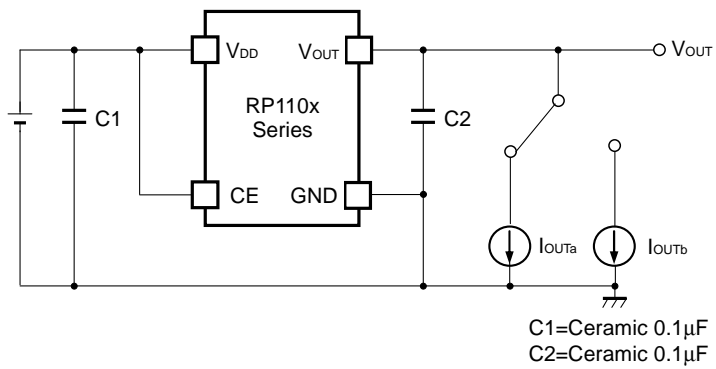
**Basic Test Circuit**



**Test Circuit for Supply Current**



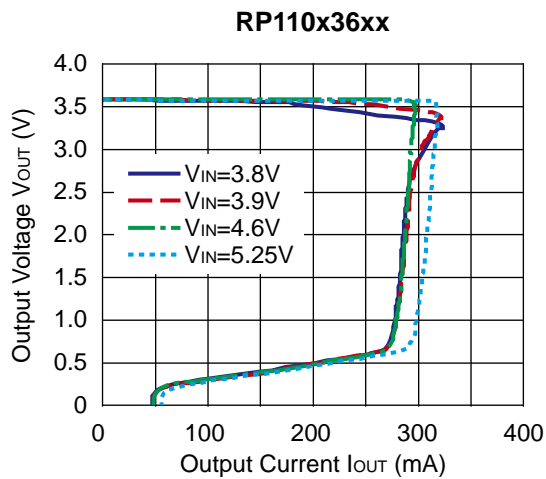
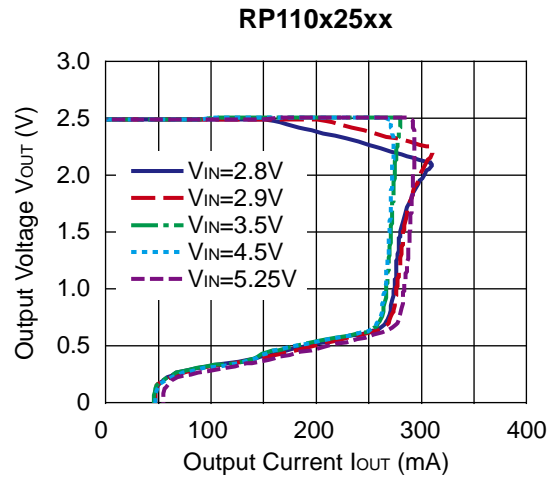
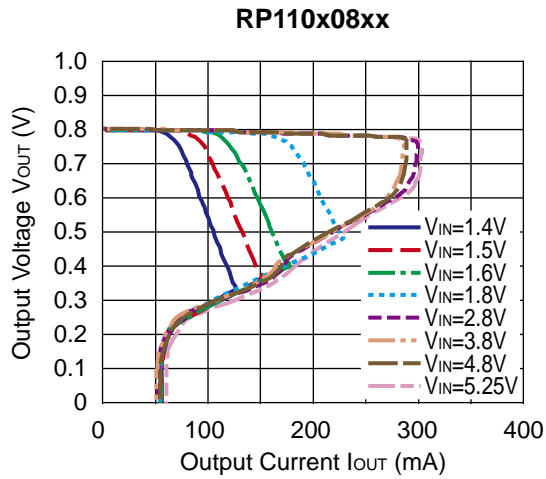
**Test Circuit for Ripple Rejection**



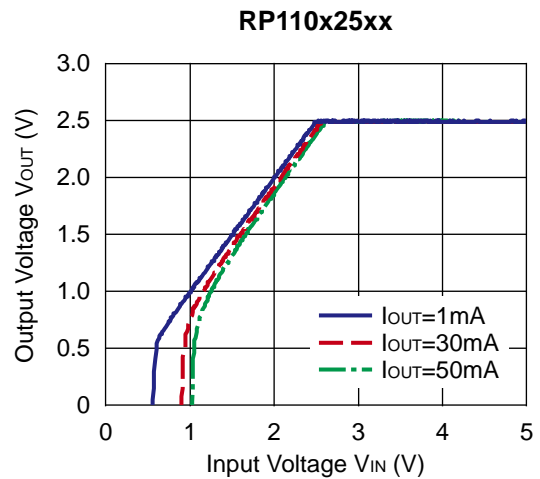
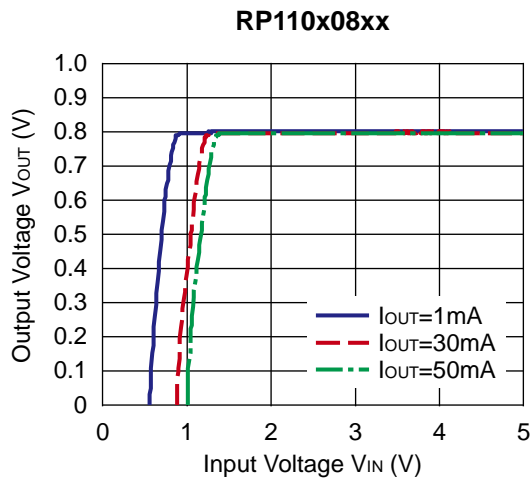
**Test Circuit for Load Transient Response**

## TYPICAL CHARACTERISTICS

### 1) Output Voltage vs. Output Current (C1=Ceramic 0.1 $\mu$ F, C2=Ceramic 0.1 $\mu$ F, T<sub>opt</sub>=25°C)



### 2) Output Voltage vs. Input Voltage (C1=Ceramic 0.1 $\mu$ F, C2=Ceramic 0.1 $\mu$ F, T<sub>opt</sub>=25°C)



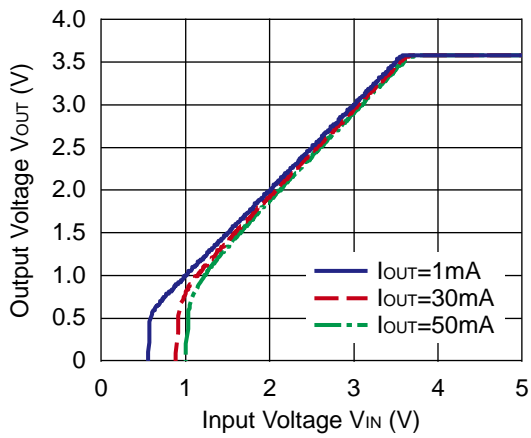
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## RP110x

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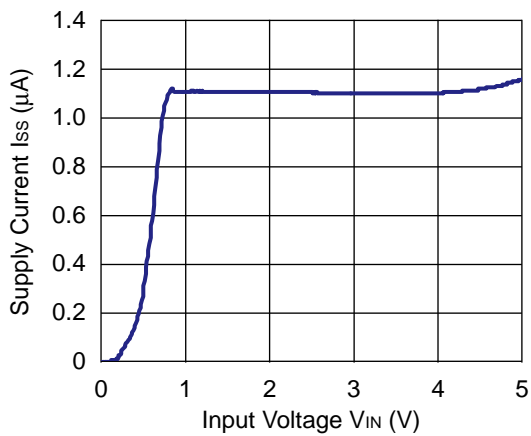
NO.EA-239-140522

### RP110x36xx

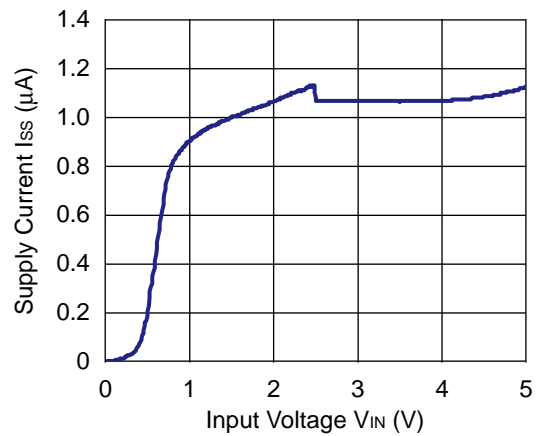


### 3) Supply Current vs. Input Voltage ( $C1$ =Ceramic $0.1\mu\text{F}$ , $C2$ =Ceramic $0.1\mu\text{F}$ , $T_{opt}=25^\circ\text{C}$ )

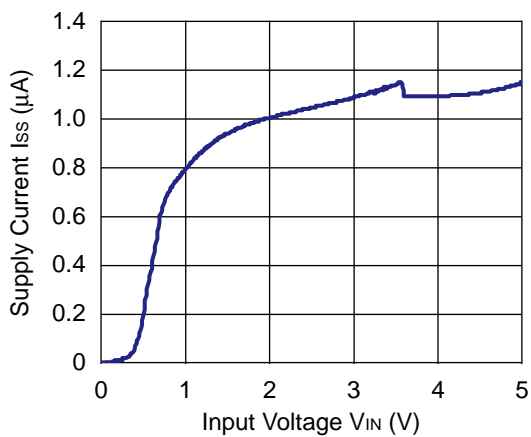
#### RP110x08xx



#### RP110x25xx

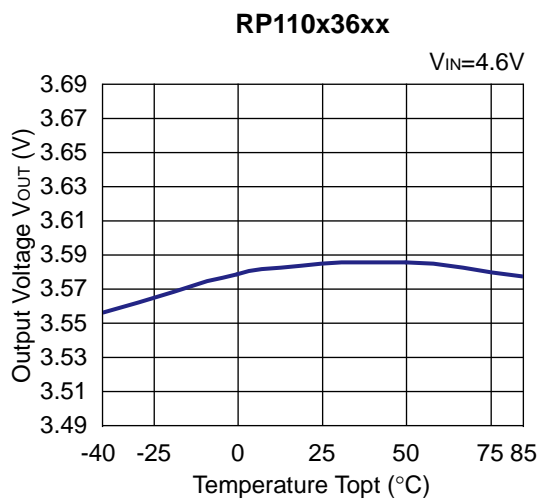
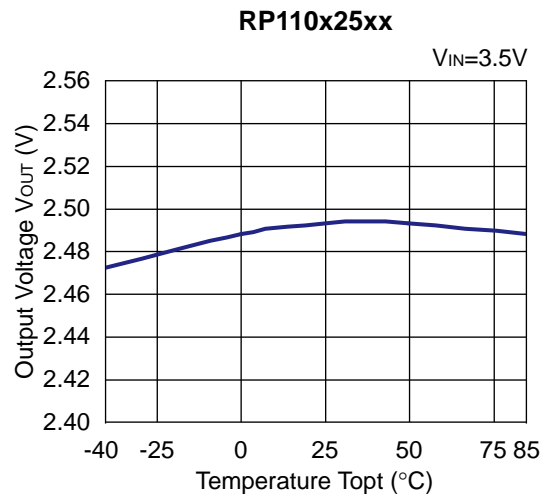
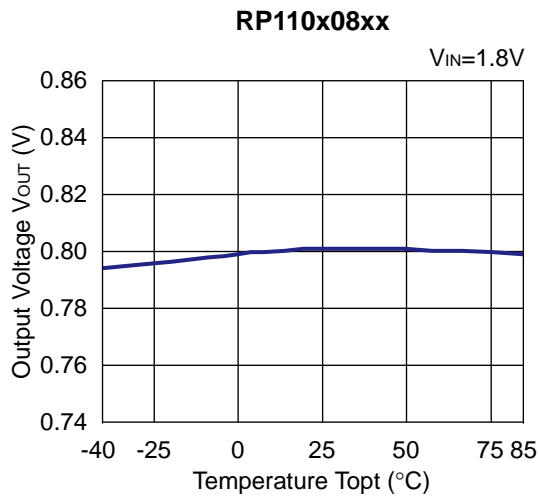


#### RP110x36xx

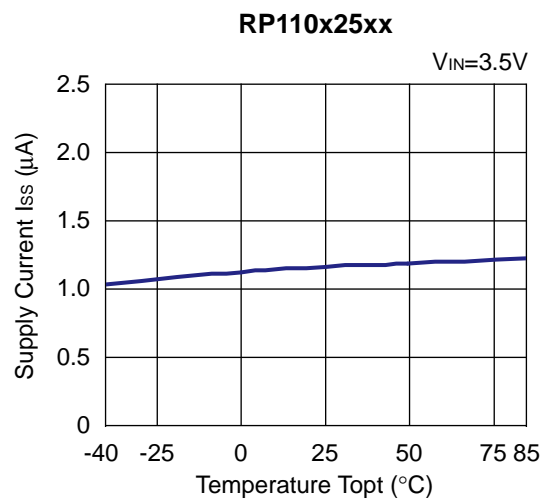
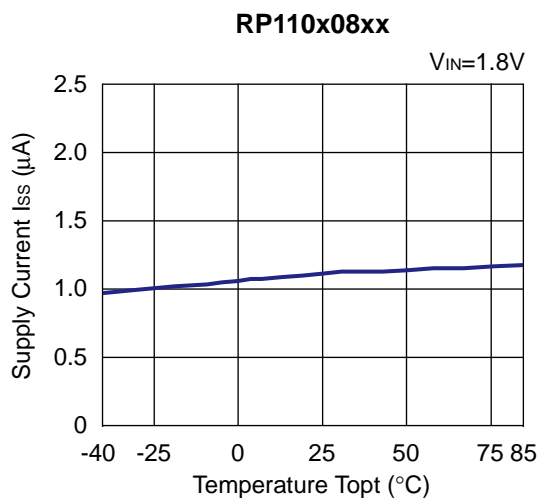




4) Output Voltage vs. Temperature (C1=Ceramic 0.1μF, C2=Ceramic 0.1μF, I<sub>OUT</sub>=1mA)



5) Supply Current vs. Temperature (C1=Ceramic 0.1μF, C2=Ceramic 0.1μF)

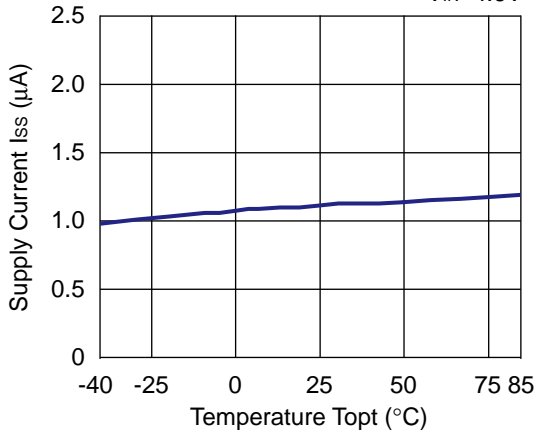
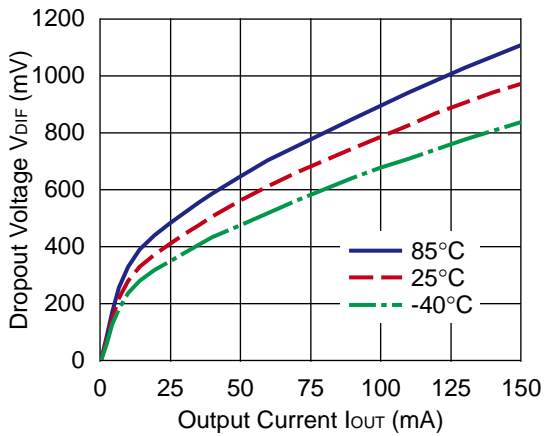
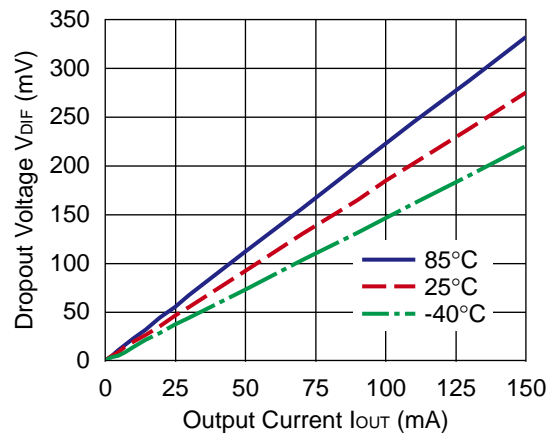
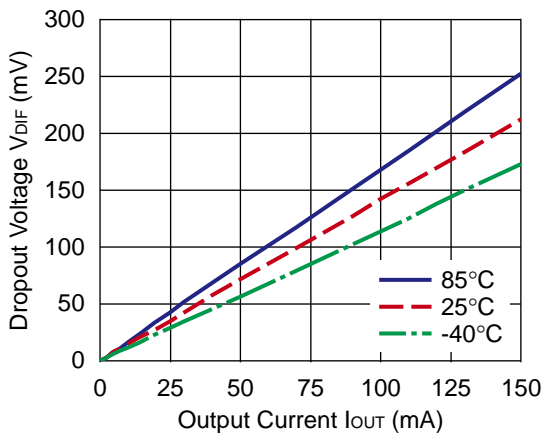


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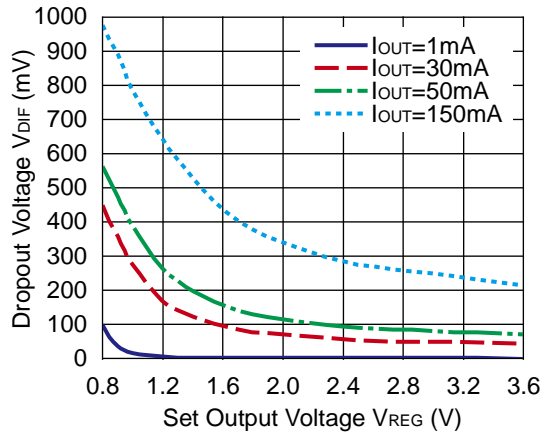
**RP110x**

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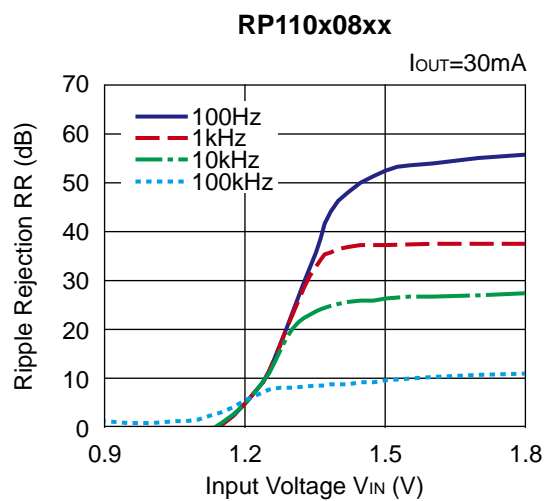
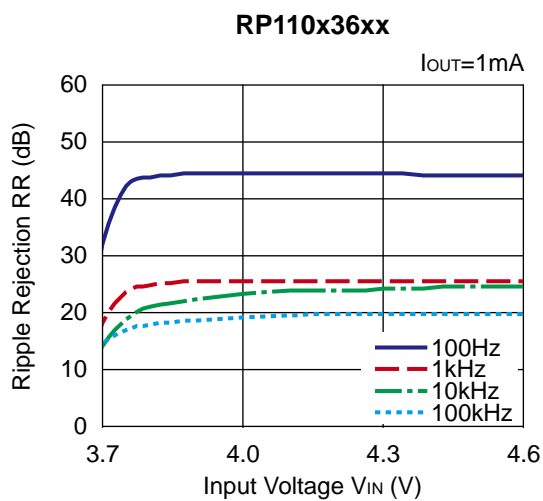
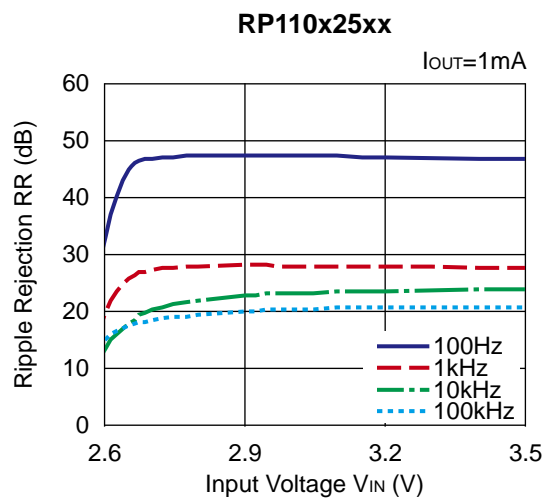
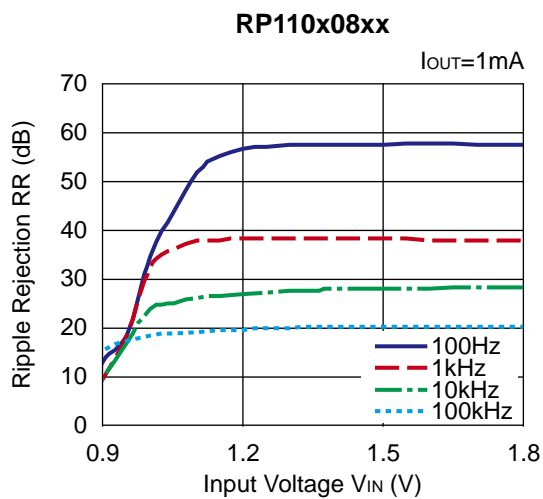
NO.EA-239-140522

**RP110x36xx** $V_{IN}=4.6V$ **6) Dropout Voltage vs. Output Current ( $C1=Ceramic\ 0.1\mu F$ ,  $C2=Ceramic\ 0.1\mu F$ ,  $T_{opt}=25^{\circ}C$ )****RP110x08xx****RP110x25xx****RP110x36xx**

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



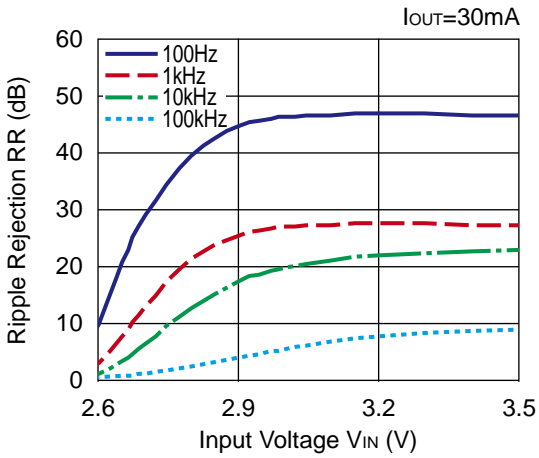
8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=Ceramic 0.1μF, Ripple=0.2Vp-p, T<sub>opt</sub>=25°C)



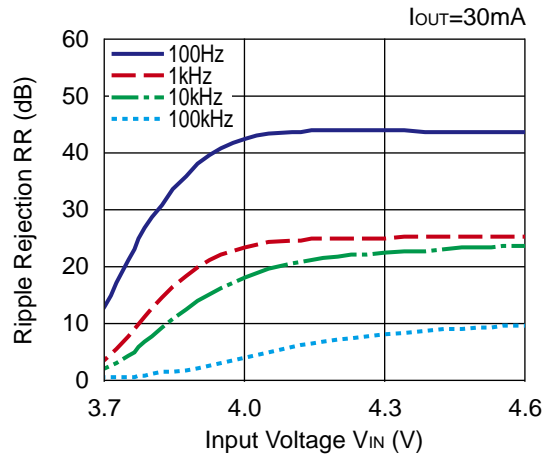
# RP110x

NO.EA-239-140522

### RP110x25xx

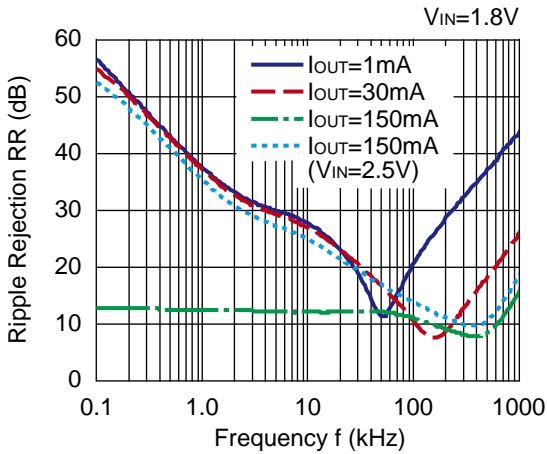


### RP110x36xx

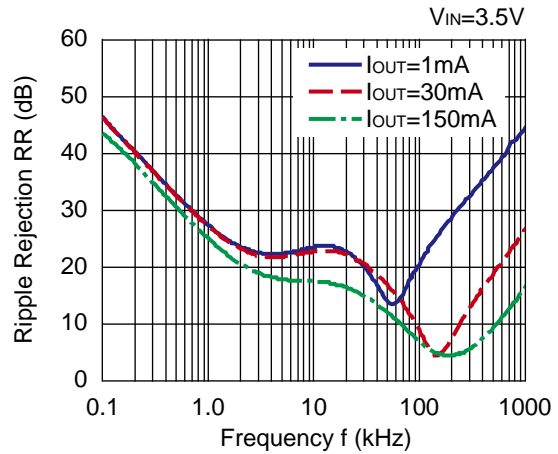


## 9) Ripple Rejection vs. Frequency ( $C1=none$ , $C2=Ceramic\ 0.1\mu F$ , $Ripple=0.2Vp-p$ , $T_{opt}=25^{\circ}C$ )

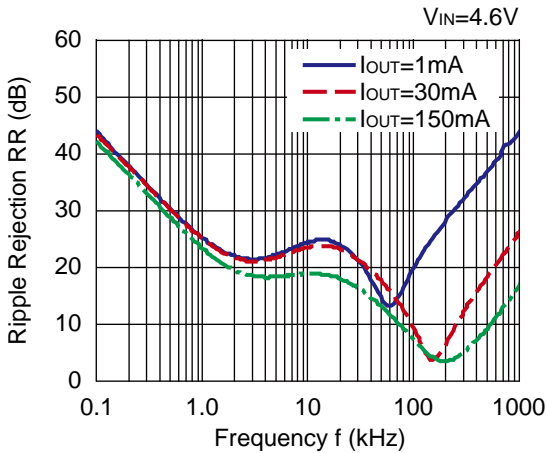
### RP110x08xx



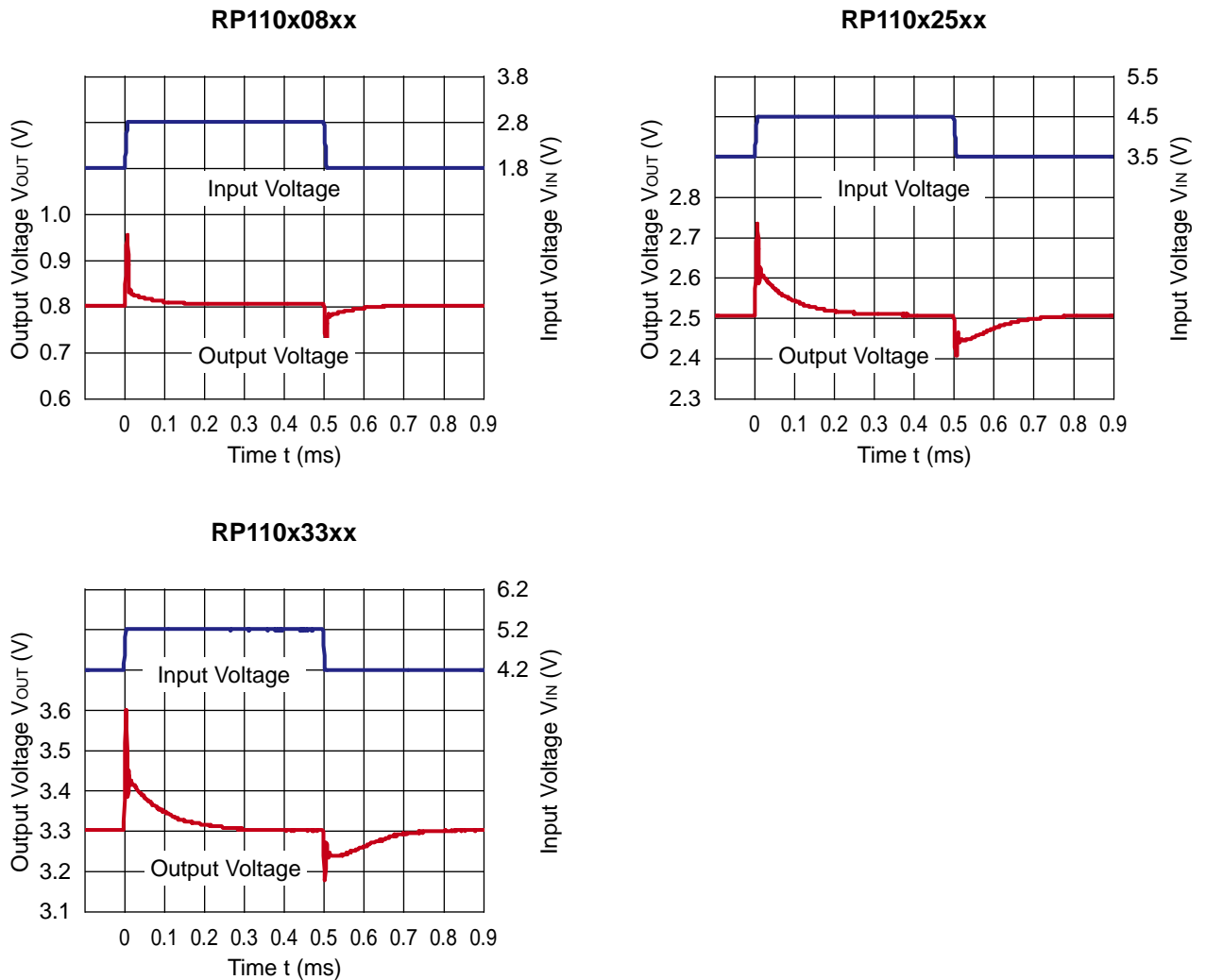
### RP110x25xx



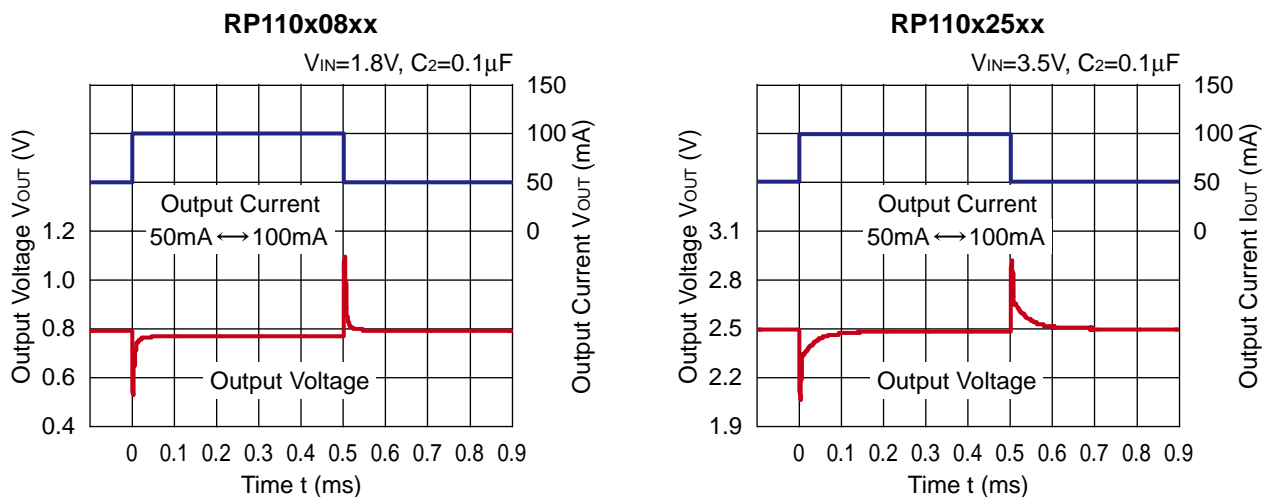
### RP110x36xx



10) Input Transient Response ( $C_1$ =none,  $C_2=0.1\mu\text{F}$ ,  $I_{OUT}=30\text{mA}$ ,  $t_r=t_f=5\mu\text{s}$ ,  $T_{opt}=25^\circ\text{C}$ )



11) Load Transient Response ( $C_1$ =none,  $t_r=t_f=5\mu\text{s}$ ,  $T_{opt}=25^\circ\text{C}$ )

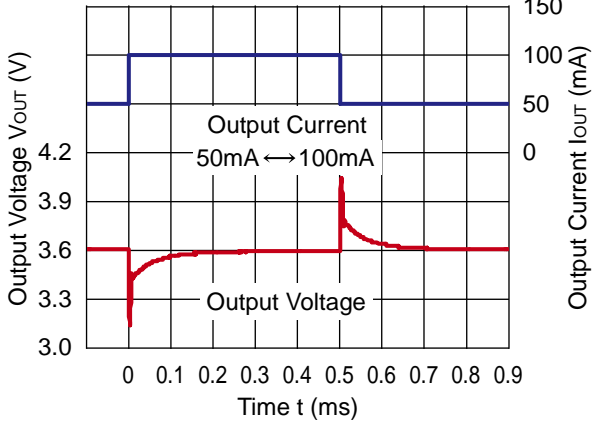


# RP110x

NO.EA-239-140522

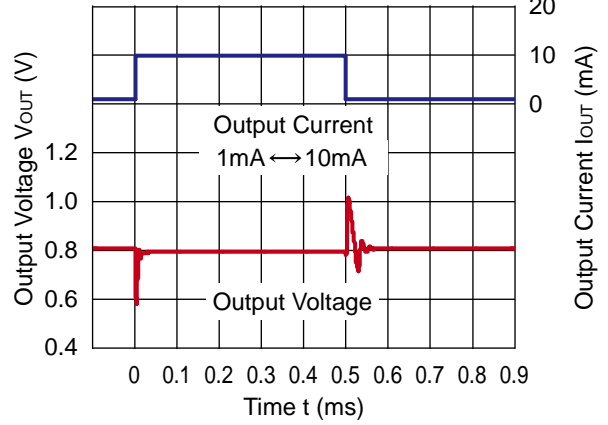
## RP110x36xx

$V_{IN}=4.6V, C_2=0.1\mu F$



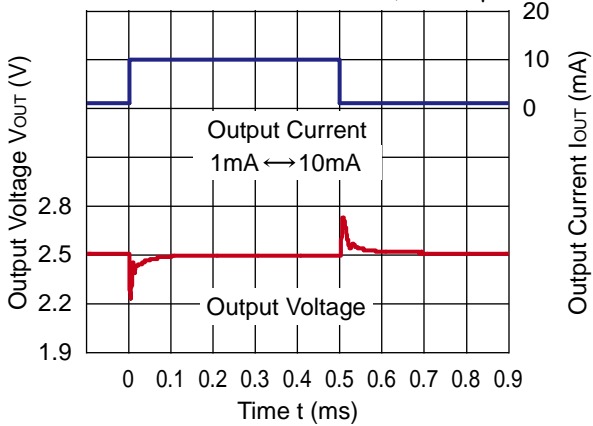
## RP110x08xx

$V_{IN}=1.8V, C_2=0.1\mu F$



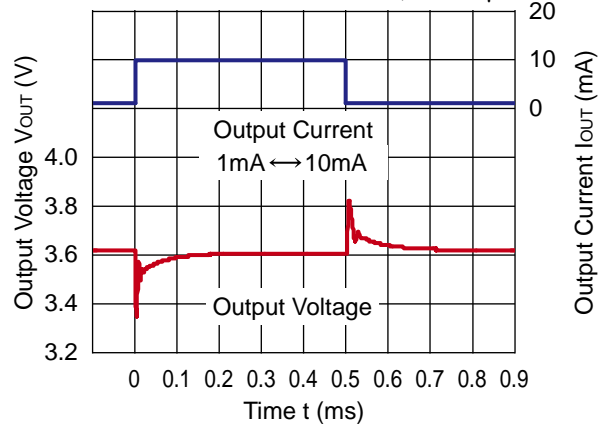
## RP110x25xx

$V_{IN}=3.5V, C_2=0.1\mu F$



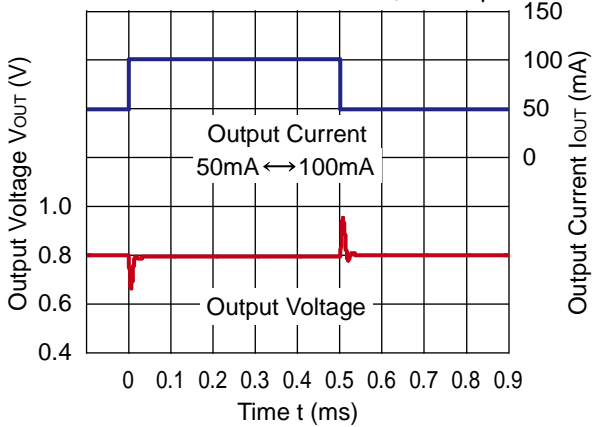
## RP110x36xx

$V_{IN}=4.6V, C_2=0.1\mu F$



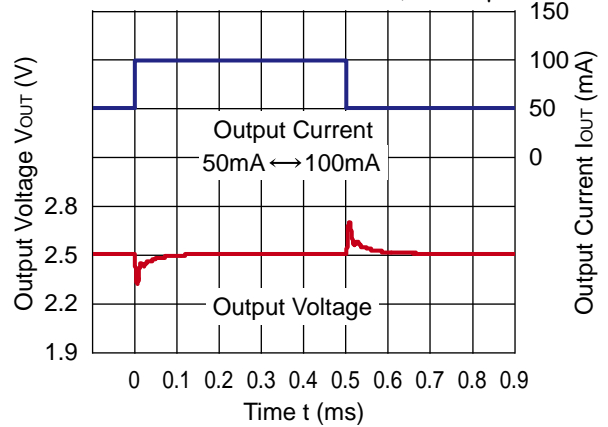
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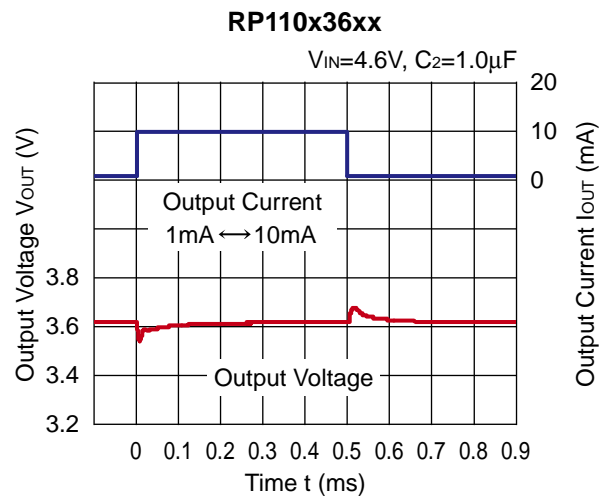
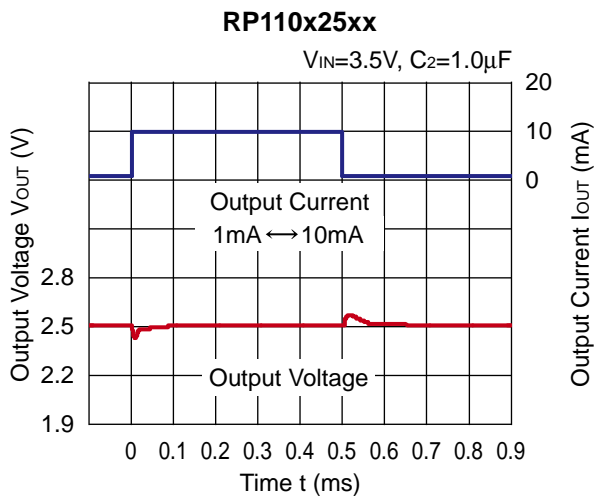
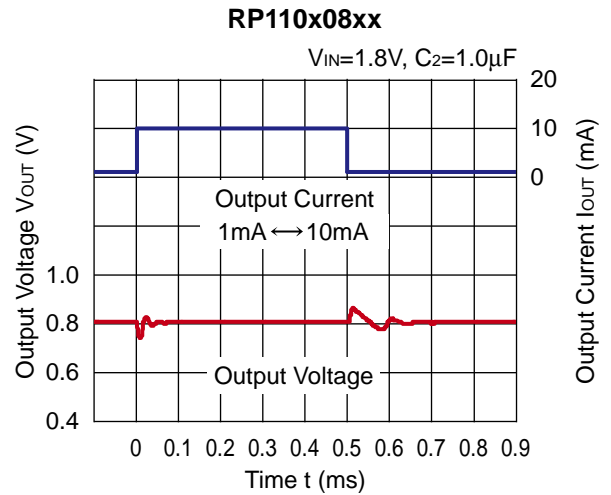
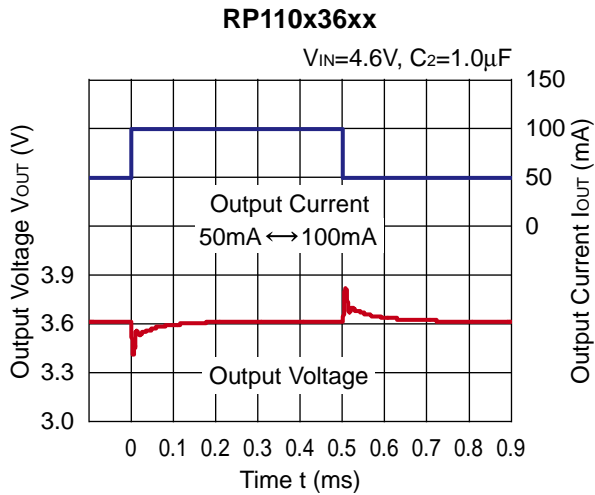
$V_{IN}=1.8V, C_2=1.0\mu F$



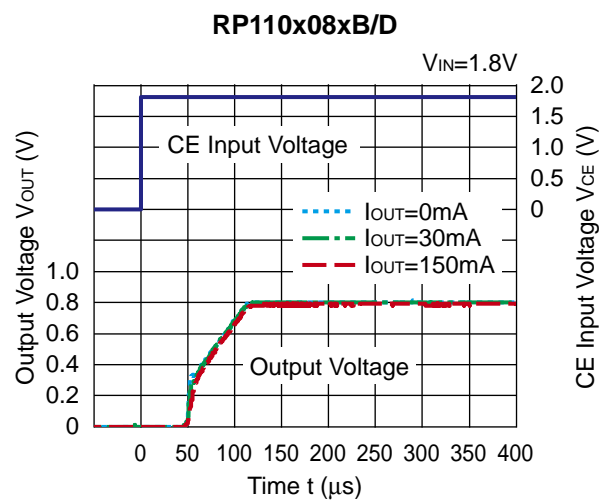
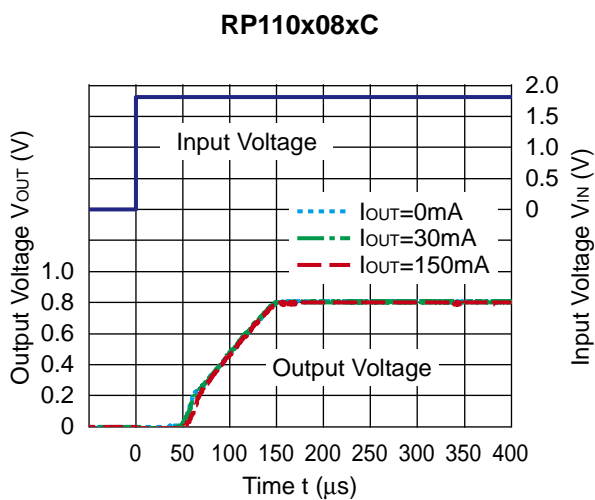
## RP110x25xx

$V_{IN}=3.5V, C_2=1.0\mu F$





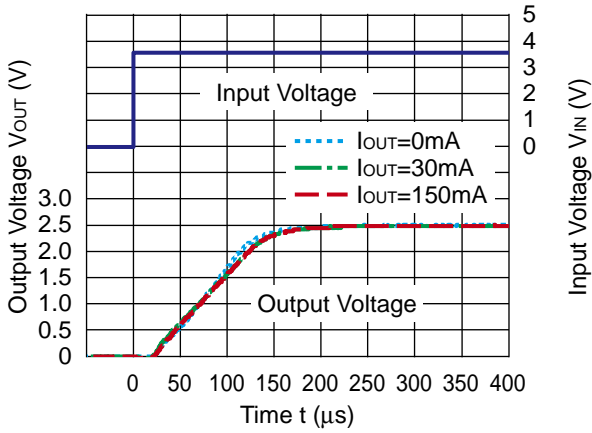
12) Turn On Speed ( $C_1$ =Ceramic  $0.1\mu F$ ,  $C_2$ =Ceramic  $0.1\mu F$ ,  $T_{opt}=25^\circ C$ )



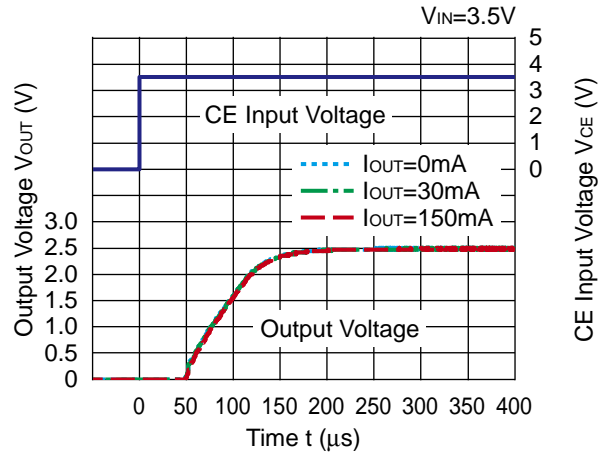
# RP110x

NO.EA-239-140522

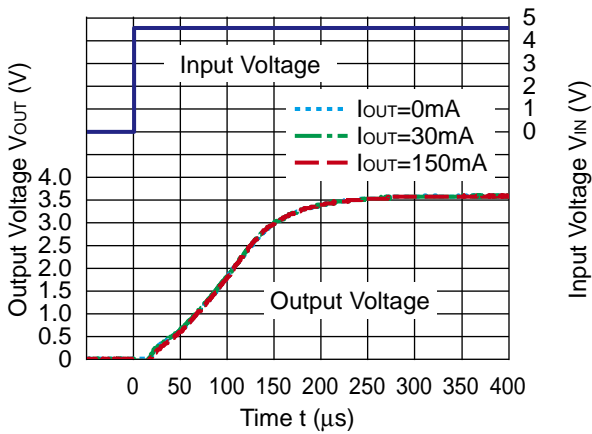
### RP110x25xC



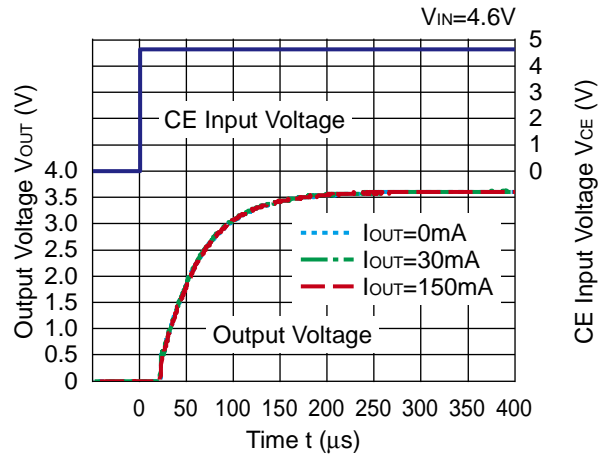
### RP110x25xB/D



### RP110x36xC

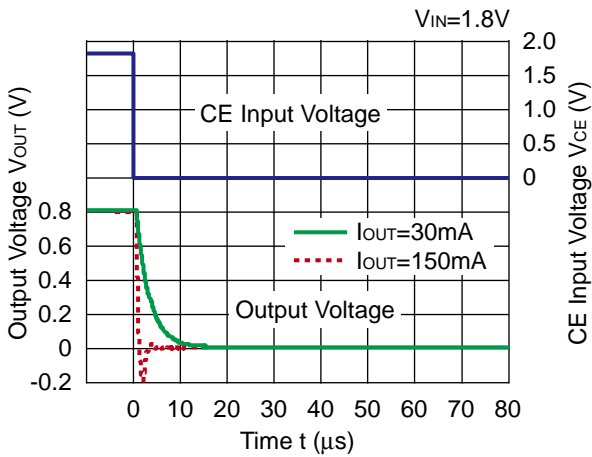


### RP110x36xB/D

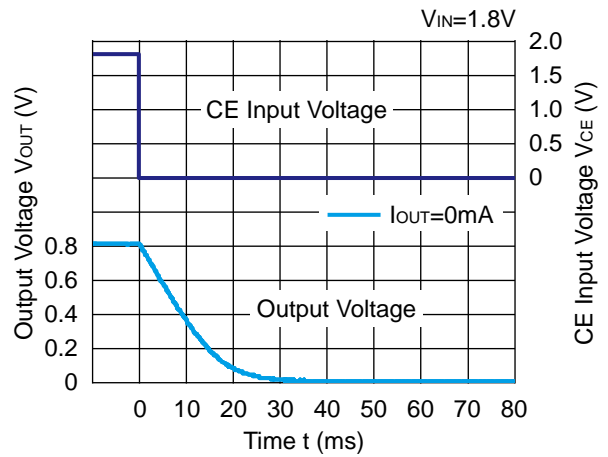


## 13) Turn Off Speed with CE pin ( $C1$ =Ceramic $0.1\mu$ F, $C2$ =Ceramic $0.1\mu$ F, $T_{opt}=25^{\circ}$ C)

### RP110x08xB

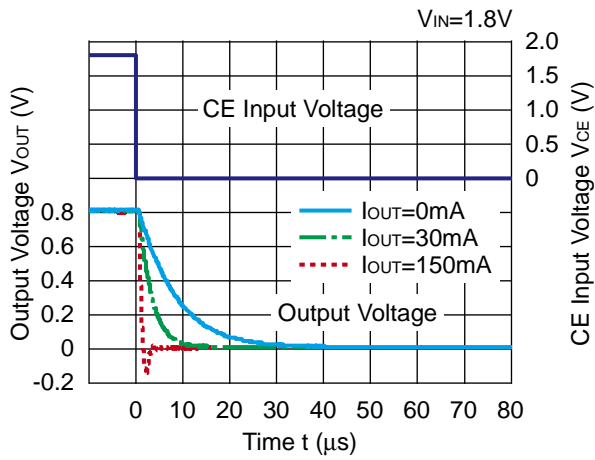


### RP110x08xB

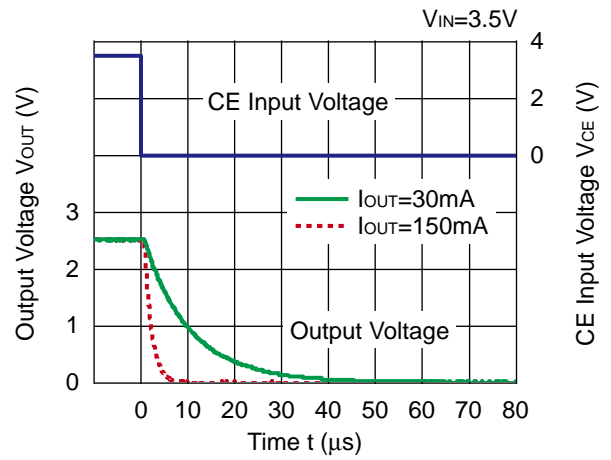




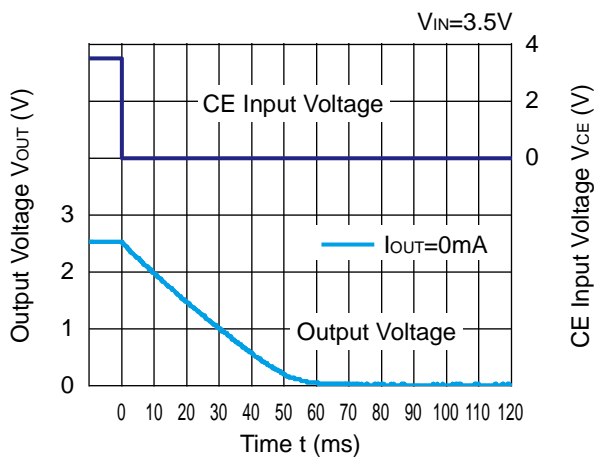
RP110x08xD



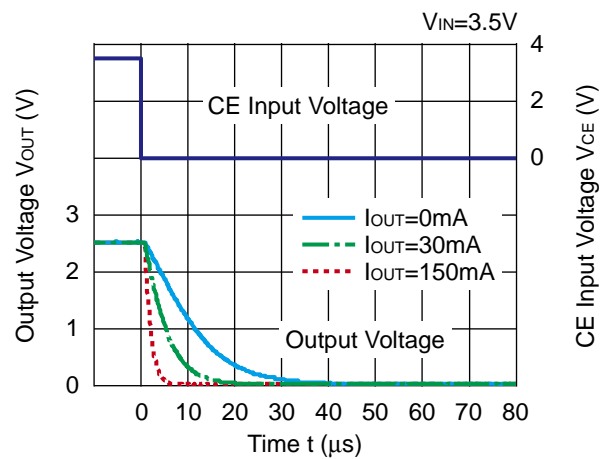
RP110x25xB



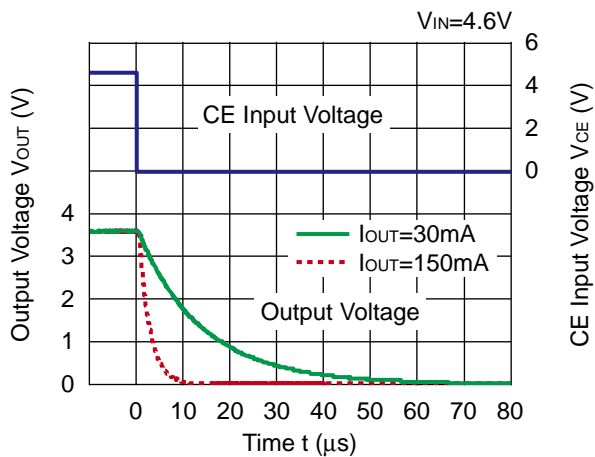
RP110x25xB



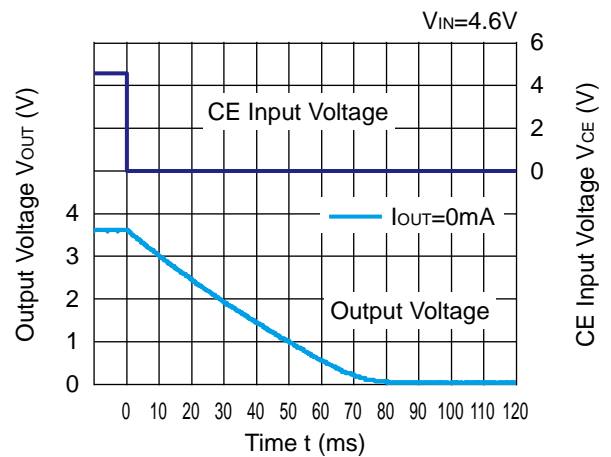
RP110x25xD



RP110x36xB



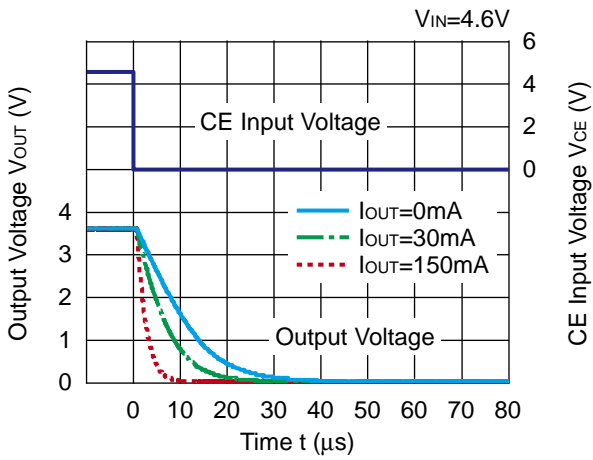
RP110x36xD



# RP110x

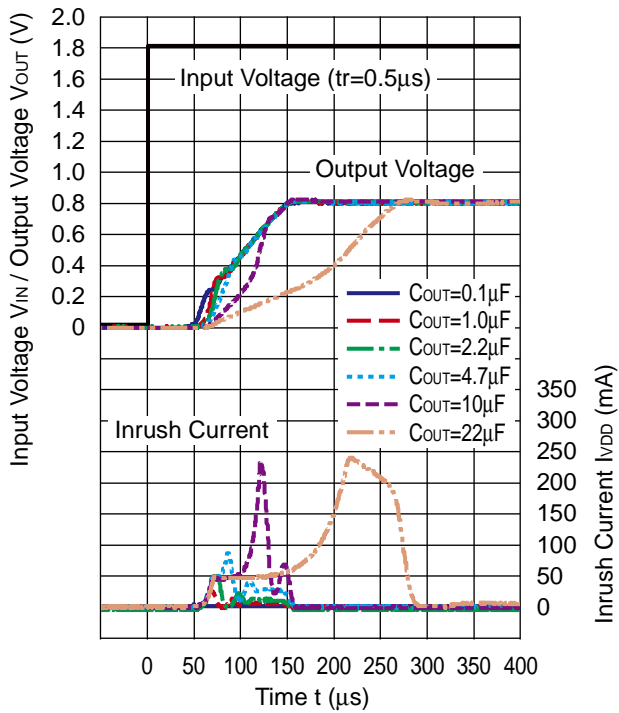
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## RP110x36xD

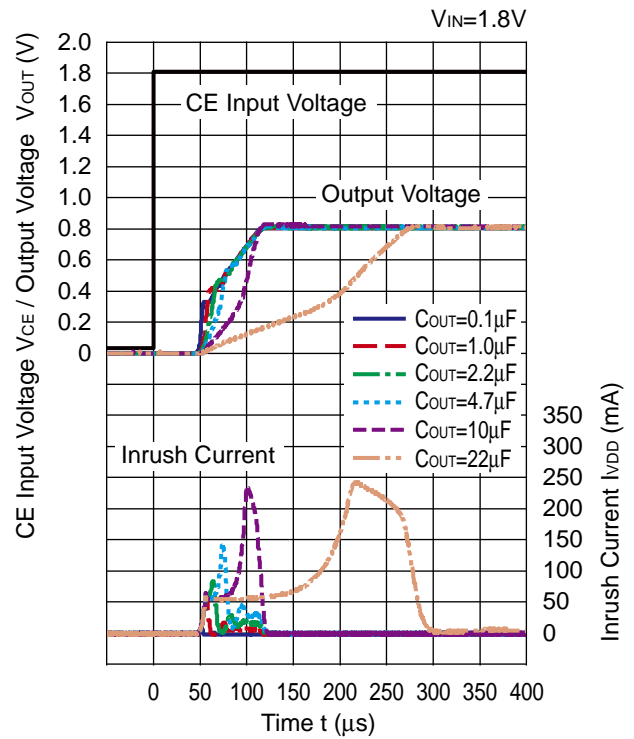


### 14) Inrush Current ( $C_1$ =none, $I_{OUT}=0mA$ , $T_{opt}=25^\circ C$ )

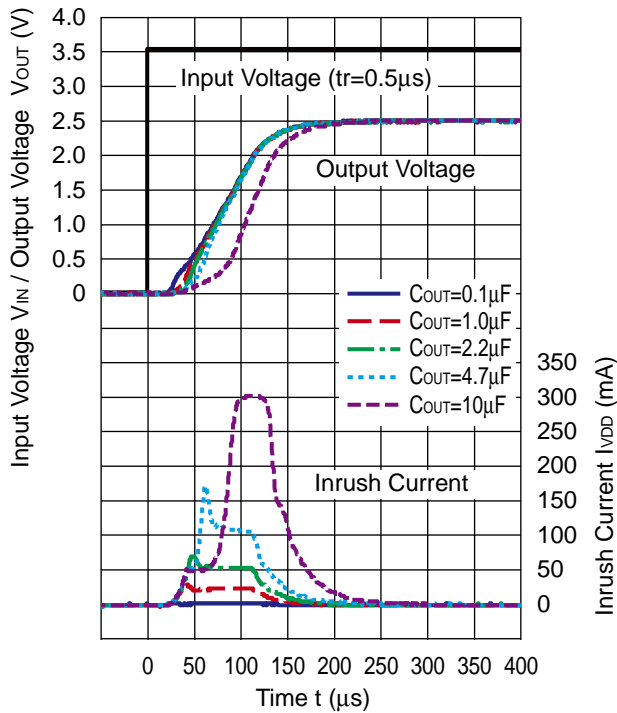
#### RP110x08xC



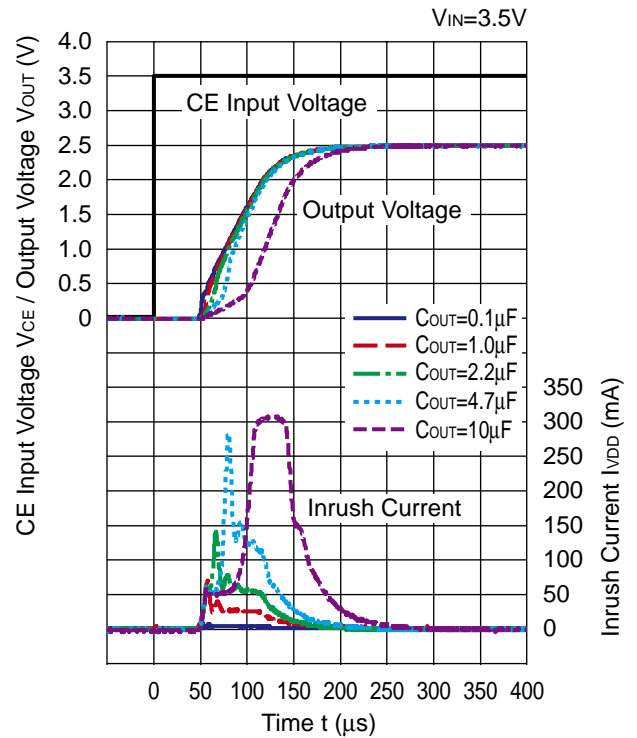
#### RP110x08xB/D



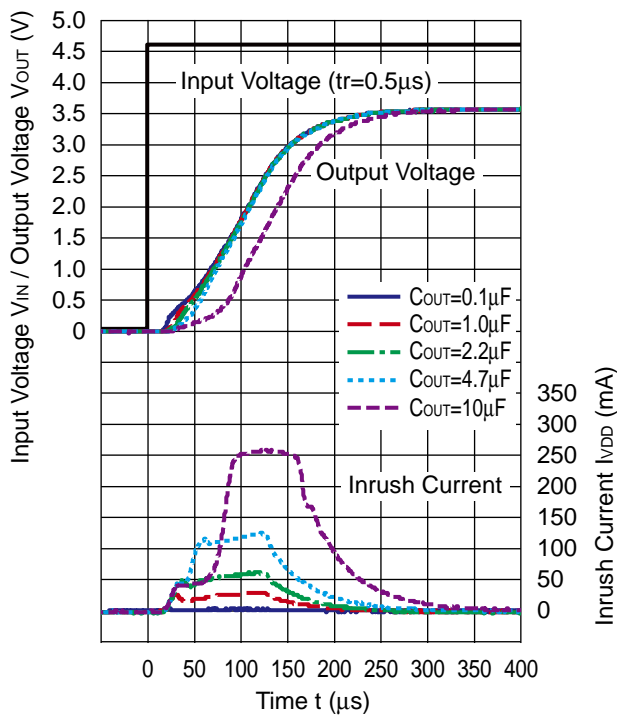
RP110x25xC



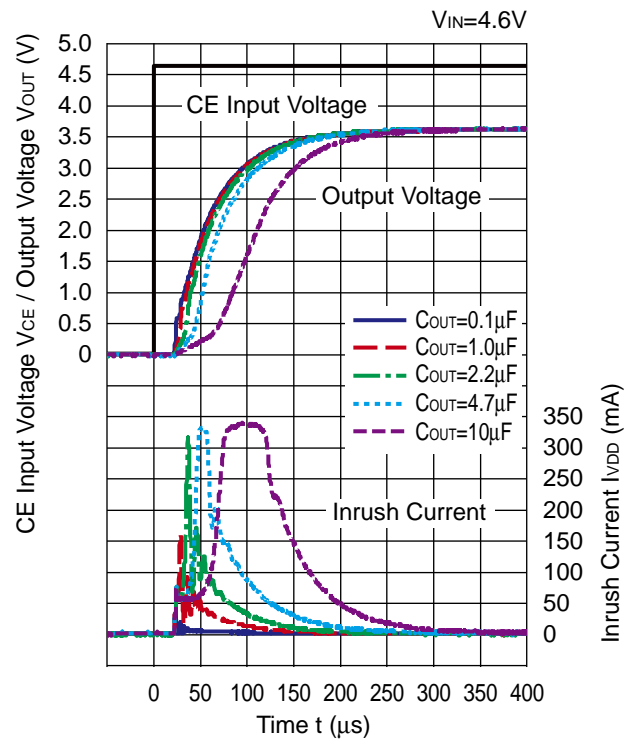
RP110x25xB/D



RP110x36xC



RP110x36xB/D



## 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.

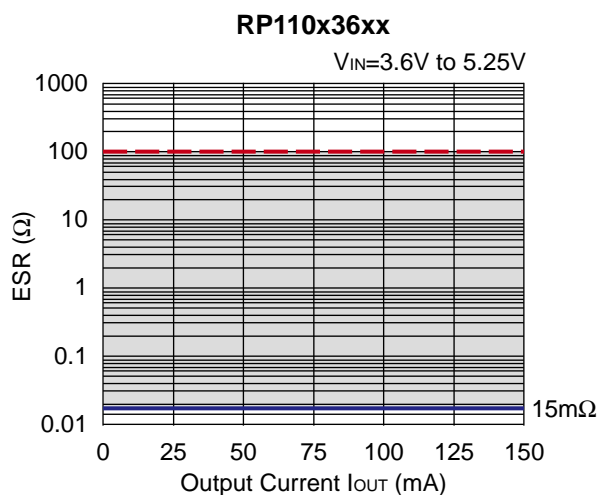
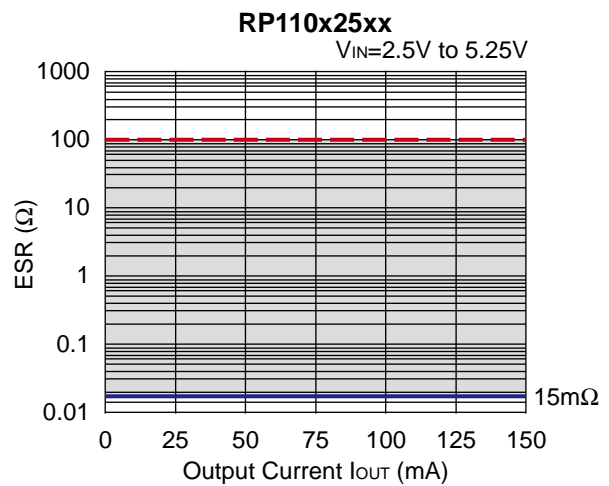
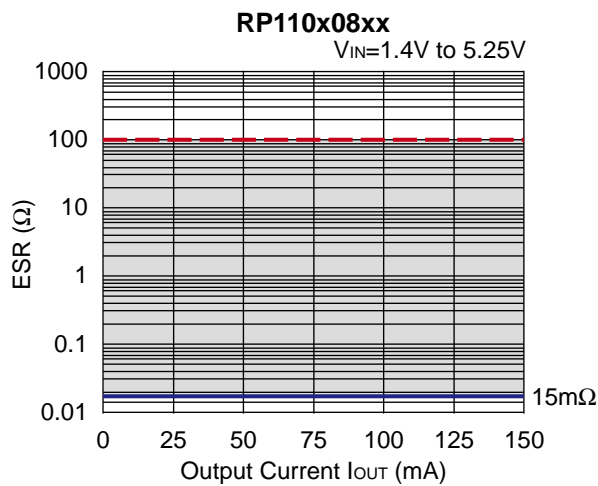
### Measurement conditions

Frequency Band : 10Hz to 2MHz

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

Hatched Area : Noise level is under  $40\mu\text{V}$ (Avg.)

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





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#### Sales & Support Offices

##### **RICOH ELECTRONIC DEVICES CO., LTD.**

**Higashi-Shinagawa Office (International Sales)**  
3-32-3, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8655, Japan  
Phone: +81-3-5479-2857 Fax: +81-3-5479-0502

##### **RICOH EUROPE (NETHERLANDS) B.V.**

**Semiconductor Support Centre**  
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##### **RICOH ELECTRONIC DEVICES KOREA CO., LTD.**

3F, Haesung Bldg. 504, Teheran-ro, Gangnam-gu, Seoul, 135-725, Korea  
Phone: +82-2-2135-5700 Fax: +82-2-2051-5713

##### **RICOH ELECTRONIC DEVICES SHANGHAI CO., LTD.**

Room 403, No.2 Building, No.690 Bilbo Road, Pu Dong New District, Shanghai 201203,  
People's Republic of China  
Phone: +86-21-5027-3200 Fax: +86-21-5027-3299

##### **RICOH ELECTRONIC DEVICES CO., LTD.**

**Taipei office**  
Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan (R.O.C.)  
Phone: +886-2-2313-1621/1622 Fax: +886-2-2313-1623