LOW NOISE 150mA LDO REGULATOR

NO.EA-204-240515

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 0.1μF ceramic capacitor.

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

FEATURES

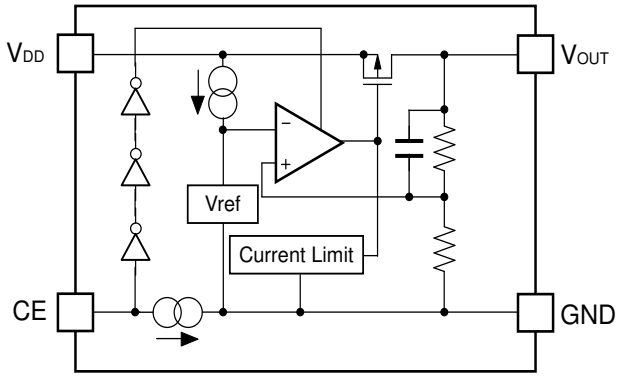
- Supply Current ..... Typ. 50μA
- Standby Mode ..... Typ. 0.1μA
- Dropout Voltage..... Typ. 0.25V (I_{OUT}=150mA, V_{OUT}=2.5V)
- Ripple Rejection ..... Typ. 75dB (f=1kHz, V_{OUT}=2.5V)
- Temperature-Drift Coefficient of Output Voltage ..... Typ. ±100ppm/°C (V_{OUT}<1.8V)
  Typ. ±30ppm/°C (V_{OUT}≥1.8V)
- Line Regulation ..... Typ. 0.02%/V
- Output Voltage Accuracy..... ±1.0%
- Packages..... DFN(PL)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 INFORMATIONS.)
- Built-in Fold Back Protection Circuit..... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC .... 0.1μF or more

APPLICATIONS

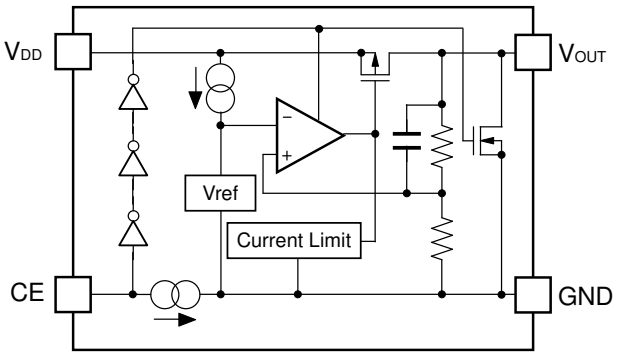
- Power source for portable communication equipment.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
- Power source for home appliances.

BLOCK DIAGRAMS

RP109xxxxB



RP109xxxxD



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(PL)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

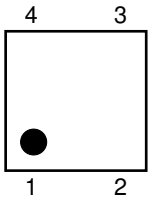
2.85V: RP109x28x∗5

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

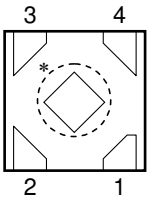
PIN CONFIGURATIONS

● DFN(PL)0808-4

Top View

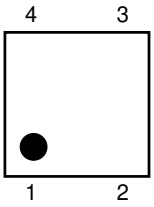


Bottom View

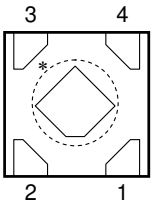


● DFN1010-4

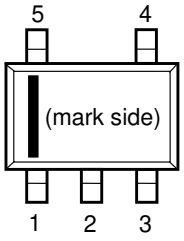
Top View



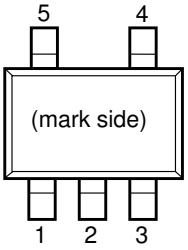
Bottom View



● SC-88A



● SOT-23-5



PIN DESCRIPTIONS

● **DFN(PL)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(PL)0808-4)	286	mW
	Power Dissipation* (DFN1010-4)	400	
	Power Dissipation* (SC-88A)	380	
	Power Dissipation* (SOT-23-5)	420	
Ta	Operating Temperature Range	−40 to 85	°C
Tstg	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}≤1.5V), I_{OUT}=1mA, C_{IN}=C_{OUT}=0.1µF, unless otherwise noted.

The specifications surrounded by ▭ are guaranteed by Design Engineering at -40ºC ≤ Ta ≤ 85 ºC.

RP109x Series (Ta=25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta= 25°C	V_{SET} ≥ 1.8V	x 0.99		x 1.01	V
			V_{SET} < 1.8V	-18		+18	mV
		-40°C ≤ Ta ≤ 85°C	V_{SET} ≥ 1.8V	x 0.985		x 1.015	V
			V_{SET} < 1.8V	-50		+50	mV
I_{OUT}	Output Current			150			mA
ΔV_{OUT} /ΔI_{OUT}	Load Regulation	1mA ≤ I_{OUT} ≤ 150mA			5	30	mV
V_{DIF}	Dropout Voltage	Please see *Dropout Voltage* on the next page.					
I_{SS}	Supply Current	I_{OUT} = 0mA			50	70	µA
Istandby	Supply Current (Standby Mode)	V_{CE} = 0V			0.1	1.0	µA
ΔV_{OUT} /ΔV_{IN}	Line Regulation	V_{SET}+0.5V ≤ V_{IN} ≤ 5.25V V_{IN} ≥ 1.4V			0.02	0.10	%/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			1.4		5.25	V
ΔV_{OUT} /ΔTa	Output Voltage Temperature Coefficient	-40°C ≤ Ta ≤ 85°C	V_{SET} ≥ 1.8V		±30		ppm /°C
			V_{SET} < 1.8V		±100		
I_{SC}	Short Current Limit	V_{OUT} = 0V			40		mA
I_{PD}	CE Pull-down Current				0.3	0.6	µA
V_{CEH}	CE Input Voltage “H”			1.0			V
V_{CEL}	CE Input Voltage “L”					0.4	V
en	Output Noise	BW = 10Hz to 100kHz	V_{SET} ≥ 1.8V		20 x V_{SET}		µVrms
			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		Ω

All test items listed under *Electrical Characteristics* are done under the pulse load condition (Tj≈Ta=25ºC) 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.

The specifications surrounded by ▭ are guaranteed by Design Engineering at -40ºC ≤ Ta ≤ 85 ºC.

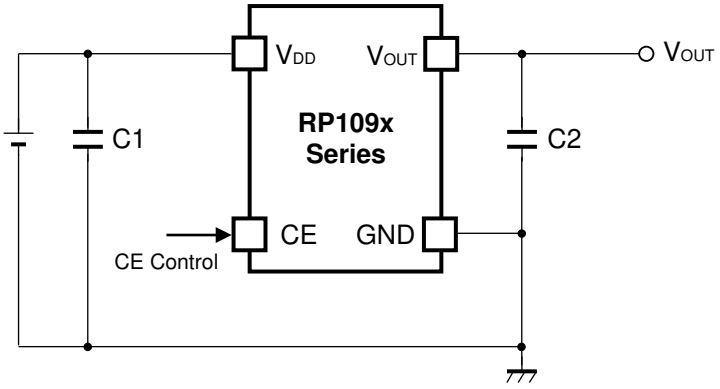
Dropout Voltage (Ta=25°C)

Set Output Voltage V_{SET} (V)	Dropout Voltage V_{DIF} (V)		
	Condition	Typ.	Max.
V_{SET} = 0.8	I_{OUT} = 150mA	0.70	1.00
V_{SET} = 0.85		0.70	1.00
V_{SET} = 0.9		0.62	0.91
1.0 ≤ V_{SET} < 1.2		0.56	0.82
1.2 ≤ V_{SET} < 1.4		0.47	0.67
1.4 ≤ V_{SET} < 1.8		0.39	0.54
1.8 ≤ V_{SET} < 2.1		0.33	0.48
2.1 ≤ V_{SET} < 2.5		0.28	0.40
2.5 ≤ V_{SET} < 3.0		0.25	0.35
3.0 ≤ V_{SET} ≦ 3.6		0.23	0.32

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 0.1μF 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 0.1μF or more and good ESR (Equivalent Series Resistance).

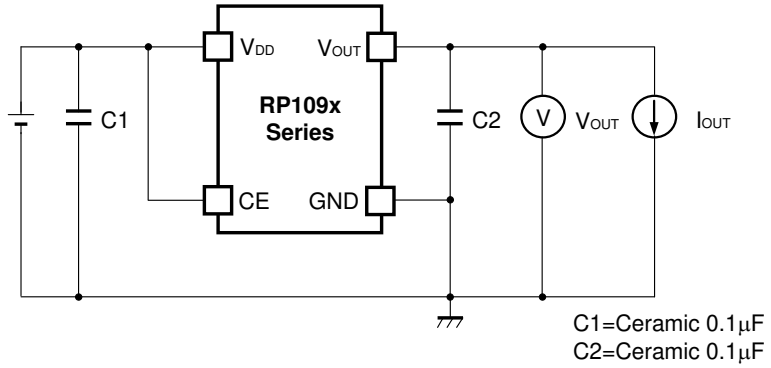
(Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

PCB Layout

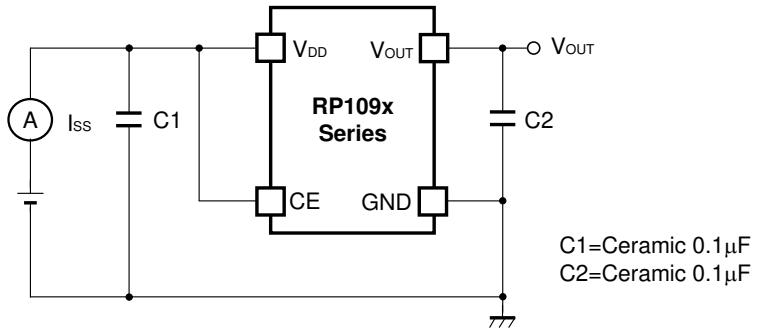
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.1μF or more between V_{DD} and GND pin, and as close as possible to the pins.

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

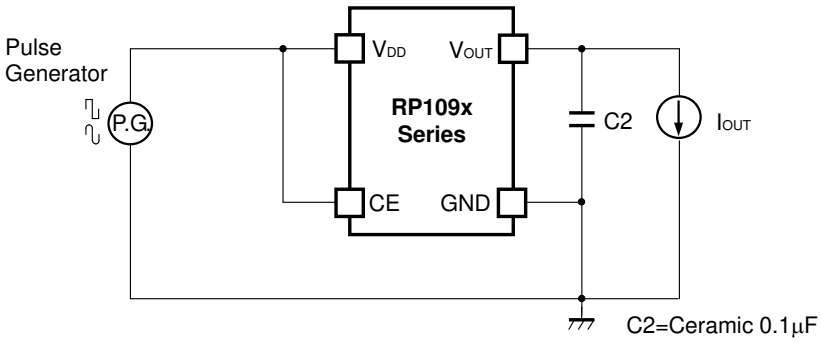
TEST CIRCUITS



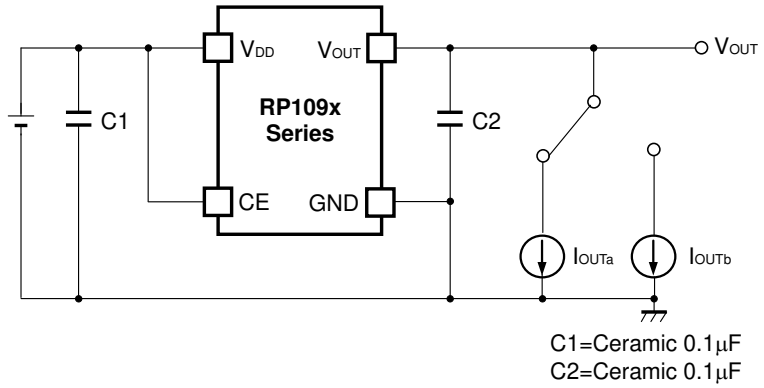
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection

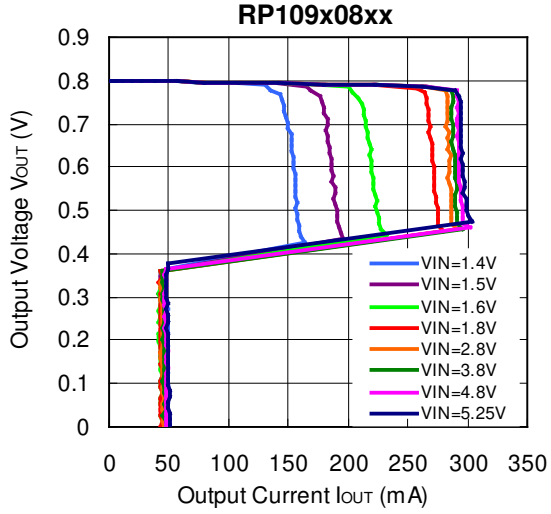


Test Circuit for Load Transient Response

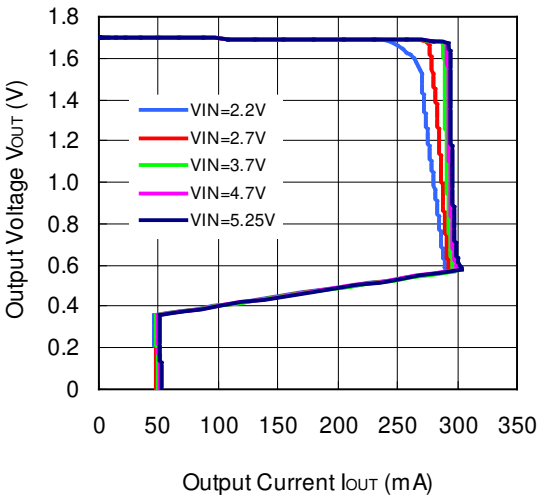
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (C1=0.1μF, C2=0.1μF, Topt=25°C)

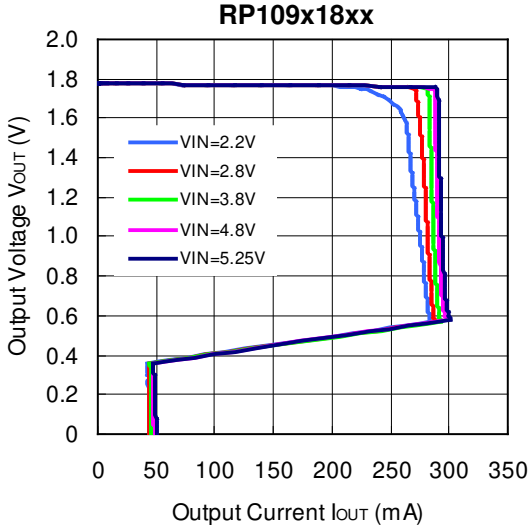
RP109x08xx



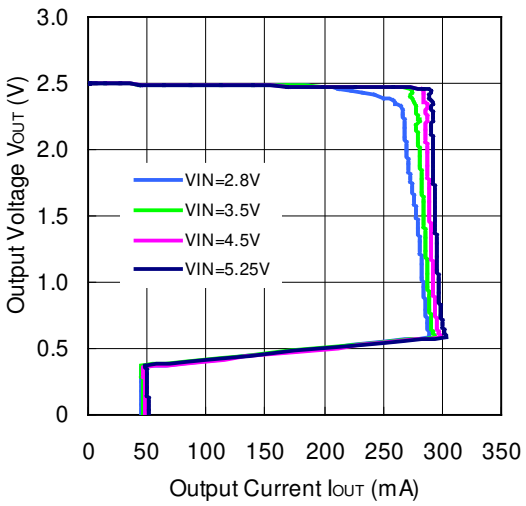
RP109x17xx



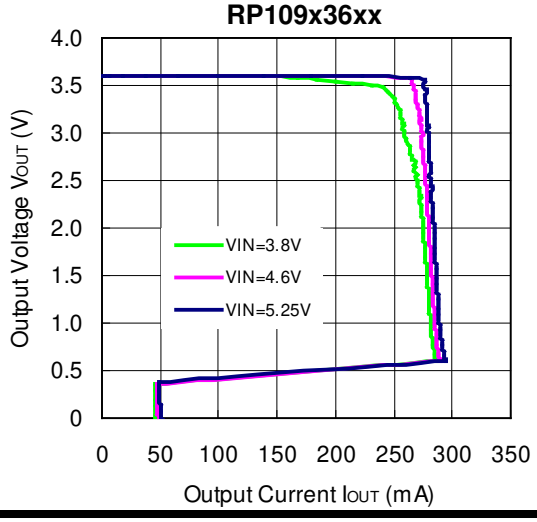
RP109x18xx



RP109x25xx

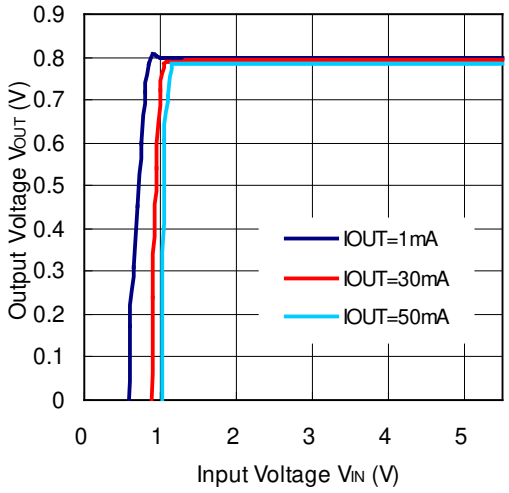


RP109x36xx

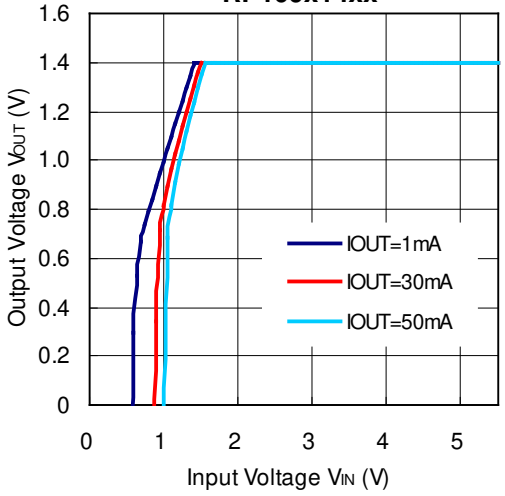


2) Output Voltage vs. Input Voltage (C1=0.1μF, C2=0.1μF, Topt=25°C)

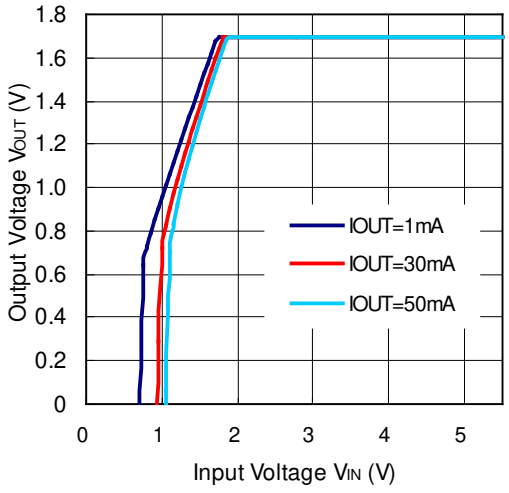
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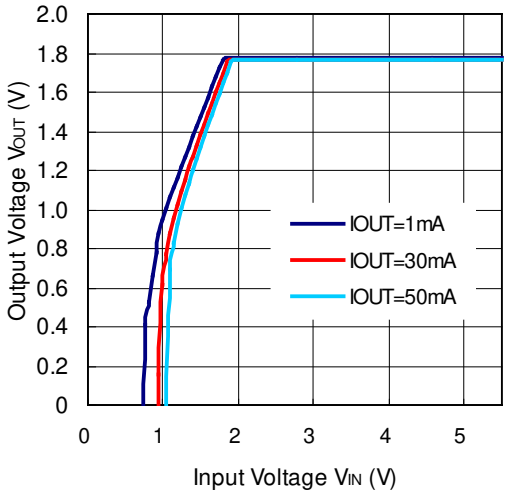
RP109x14xx



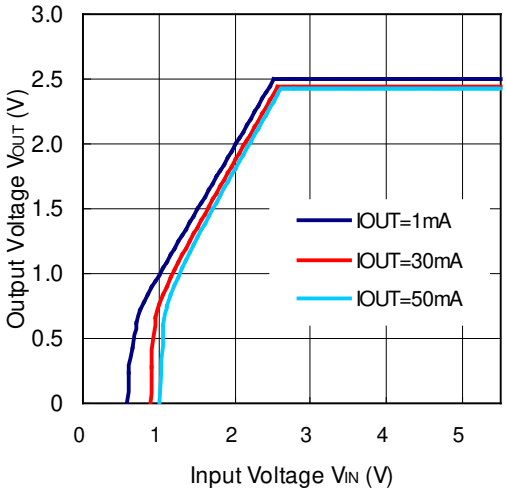
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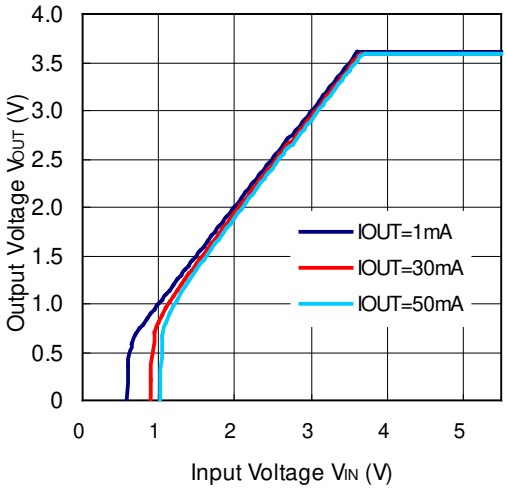
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RP109x25xx

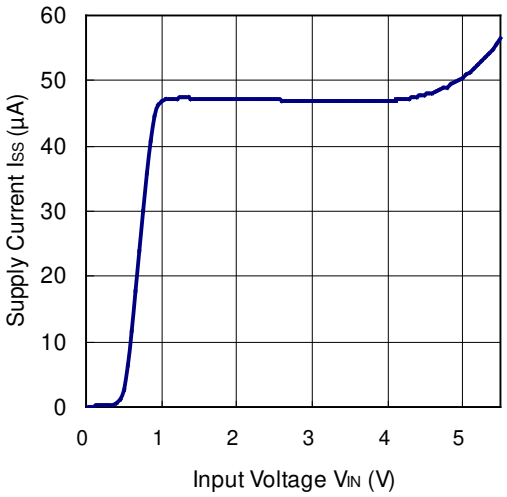


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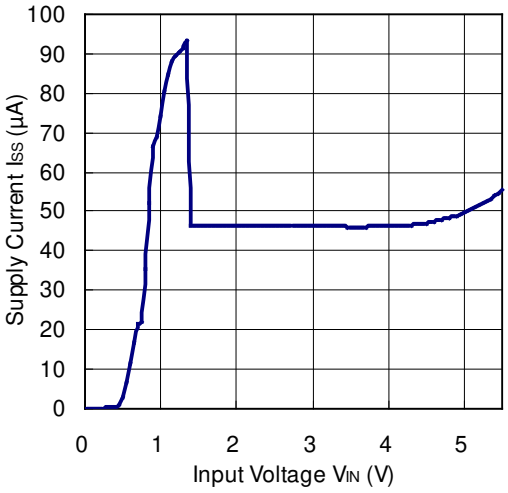


3) Supply Current vs. Input Voltage (C1=0.1μF, C2=0.1μF, Topt=25°C)

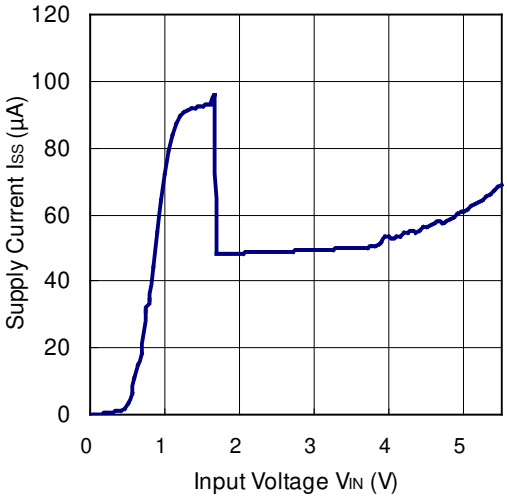
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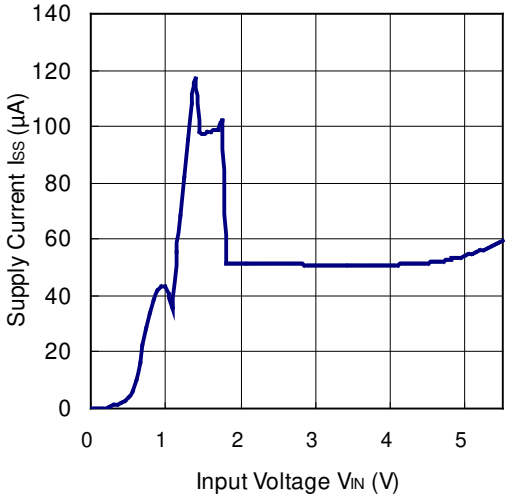
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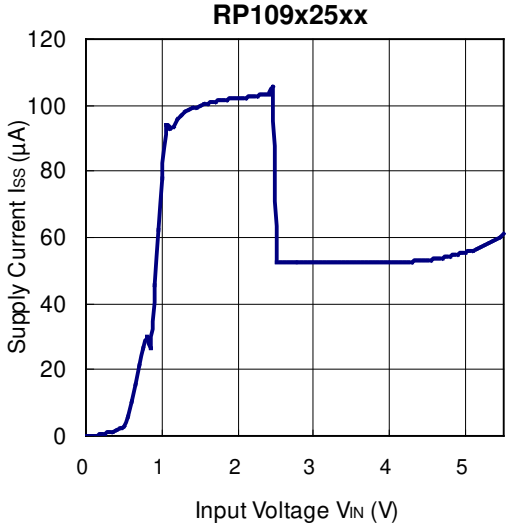
RP109x17xx



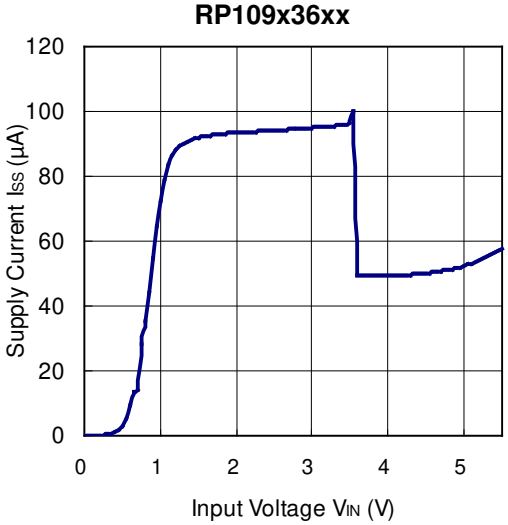
RP109x18xx



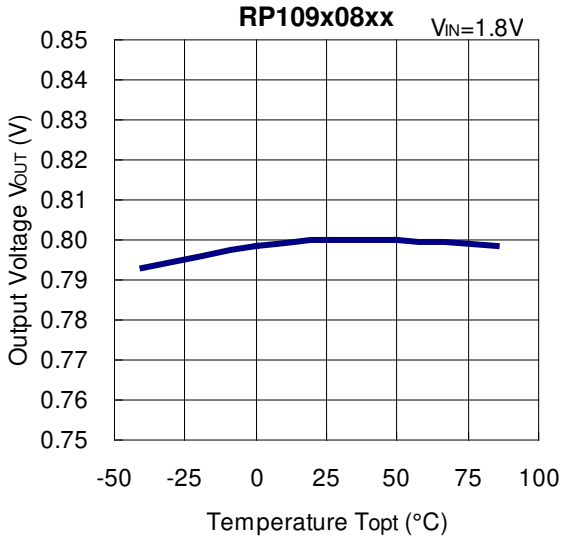
RP109x25xx

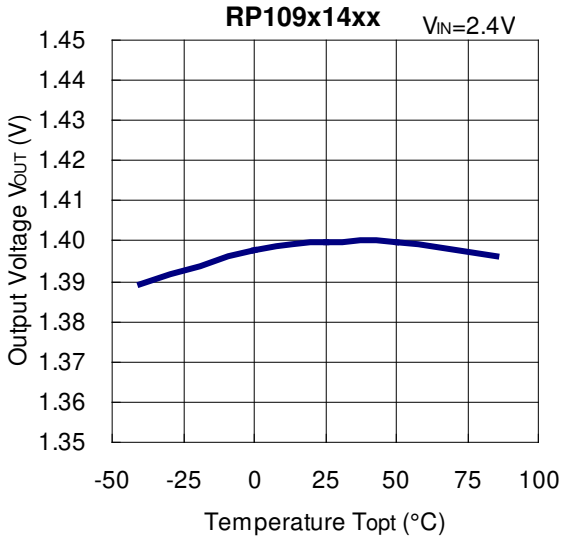


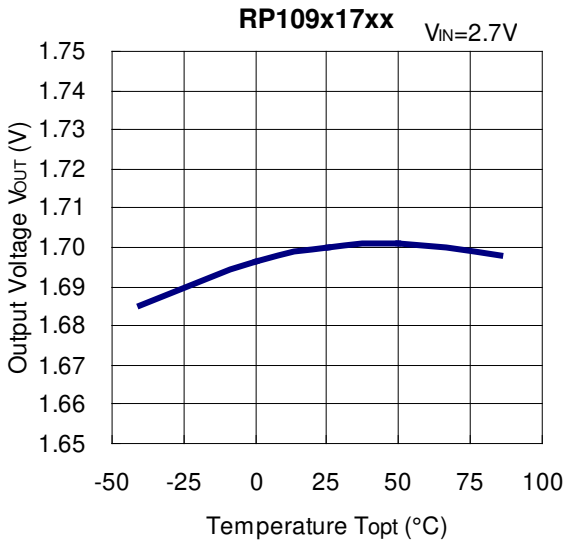
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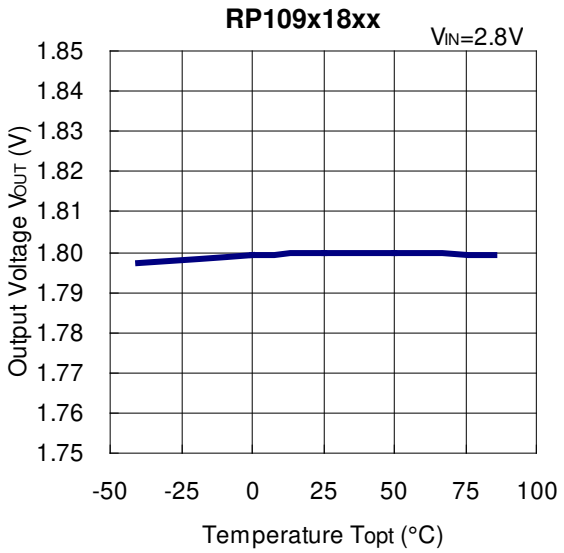


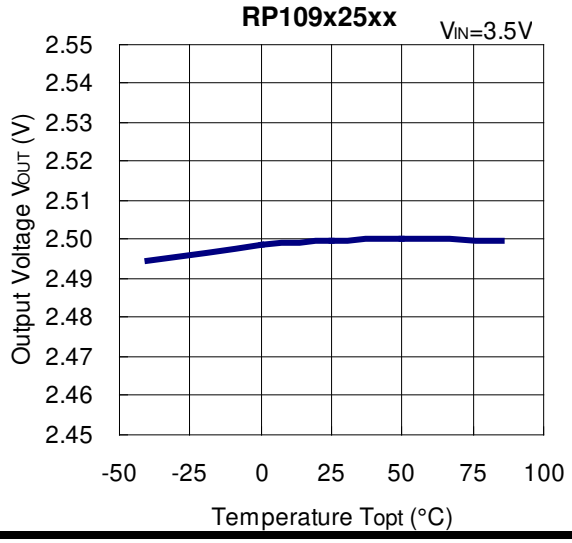
4) Output Voltage vs. Temperature (C1=0.1μF, C2=0.1μF, I_{OUT}=1mA)

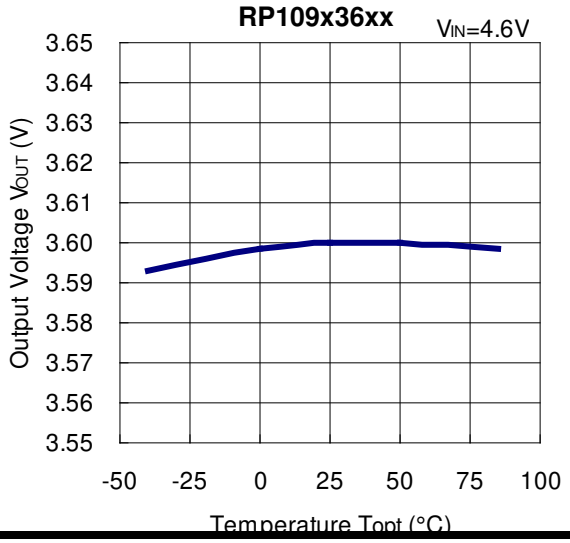






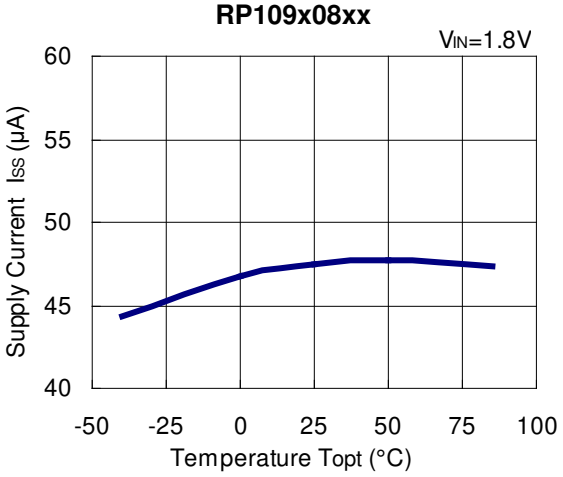




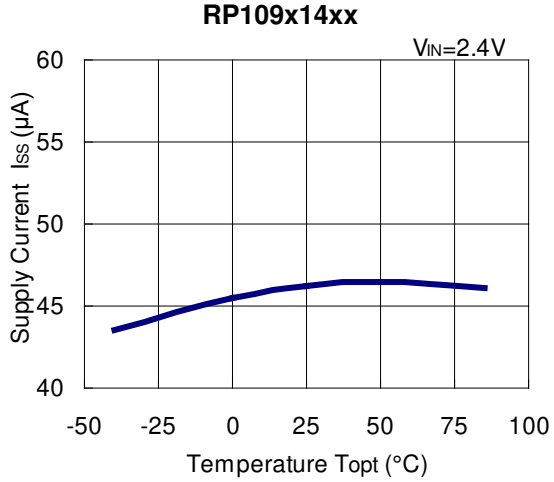


5) Supply Current vs. Temperature (C1=0.1μF, C2=0.1μF, I_{OUT}=0mA)

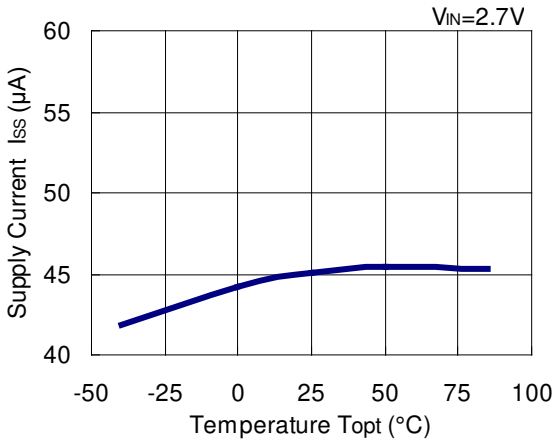
RP109x08xx



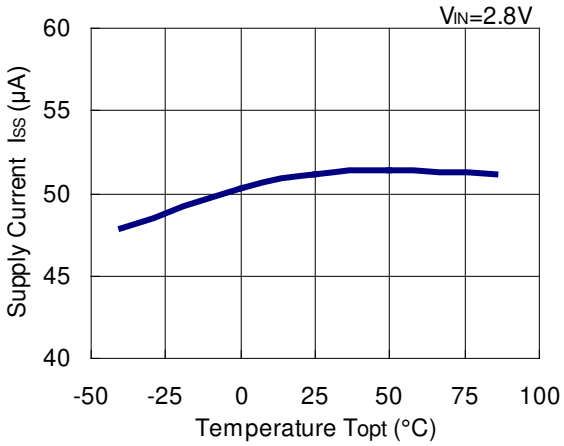
RP109x14xx



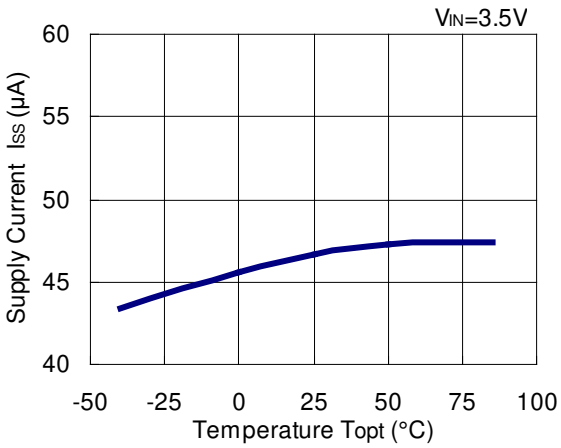
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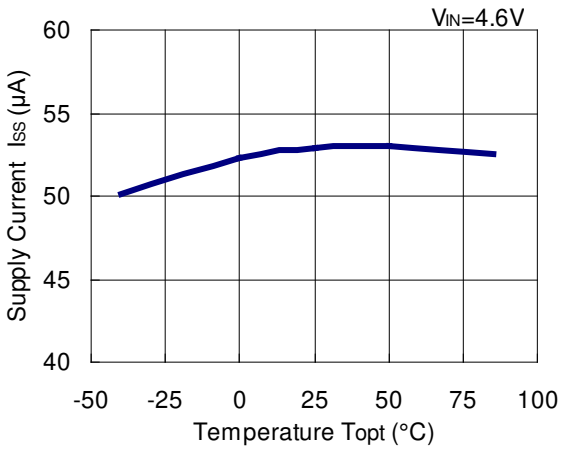
RP109x18xx



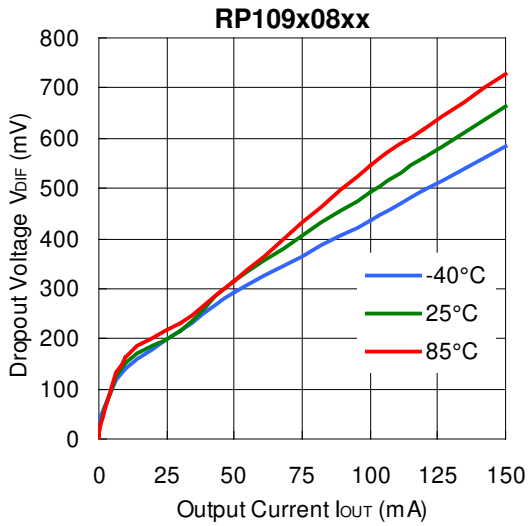
RP109x25xx

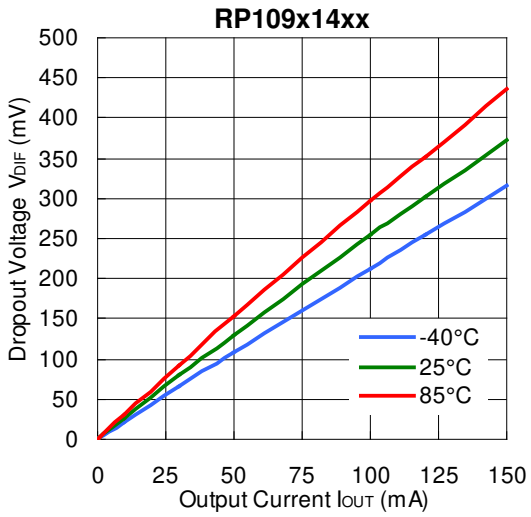


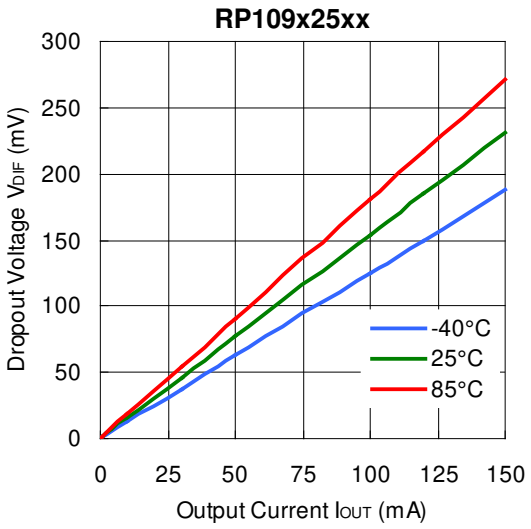
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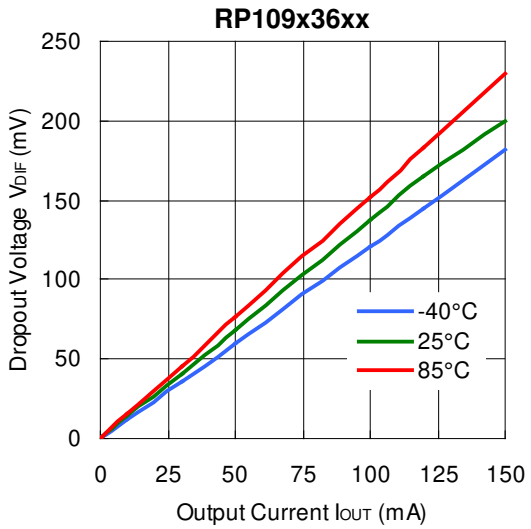


6) Dropout Voltage vs. Output Current (C1=0.1μF, C2=0.1μF)

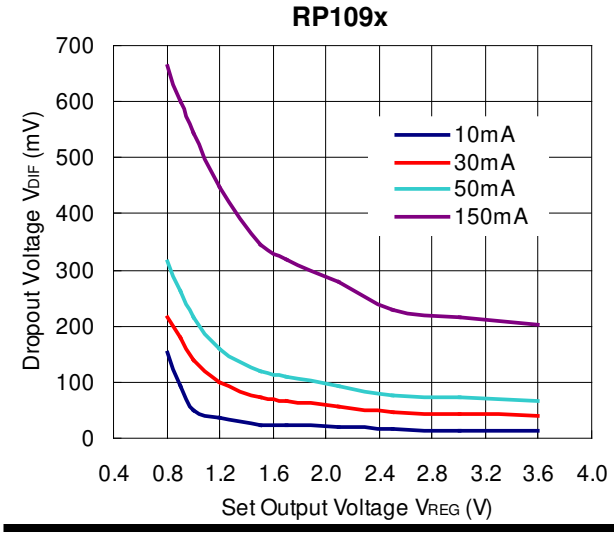




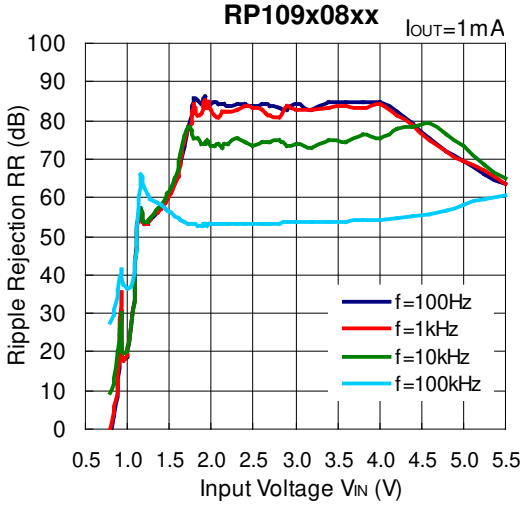


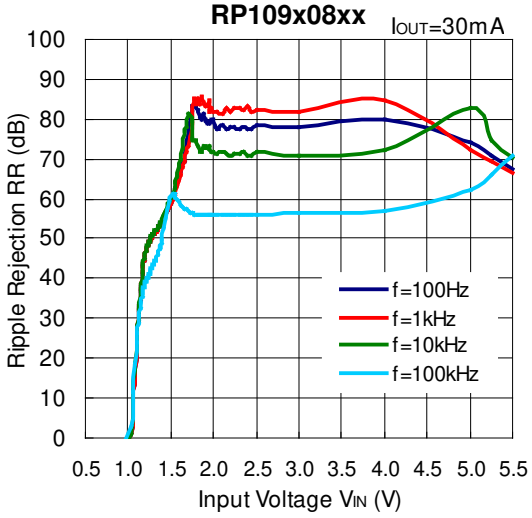


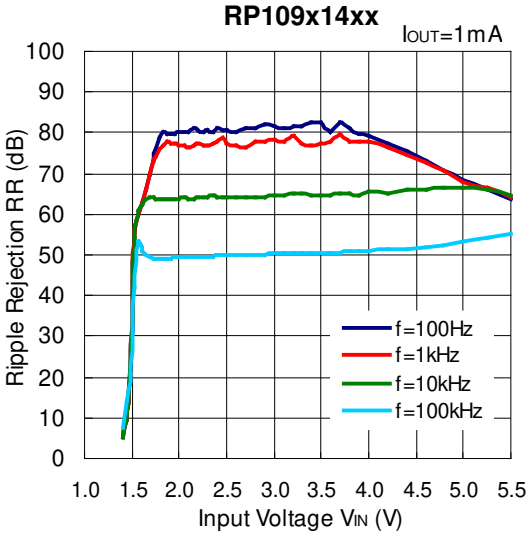
7) Dropout Voltage vs. Set Output Voltage (C1=0.1μF, C2=0.1μF, Topt=25°C)

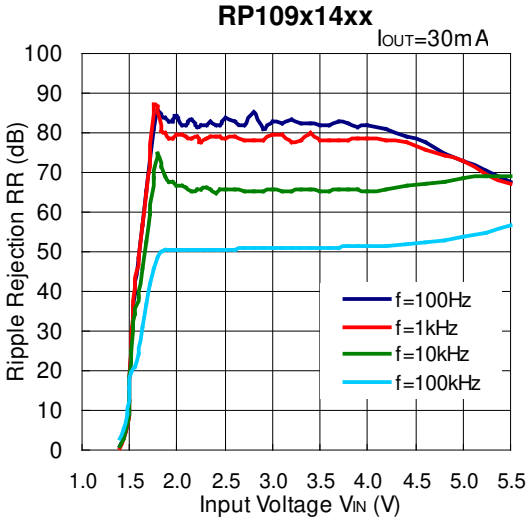


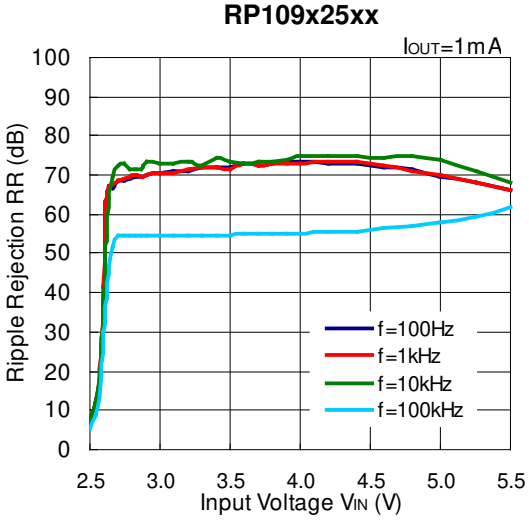
8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=0.1μF, Ripple=0.2Vp-p, Topt=25°C)

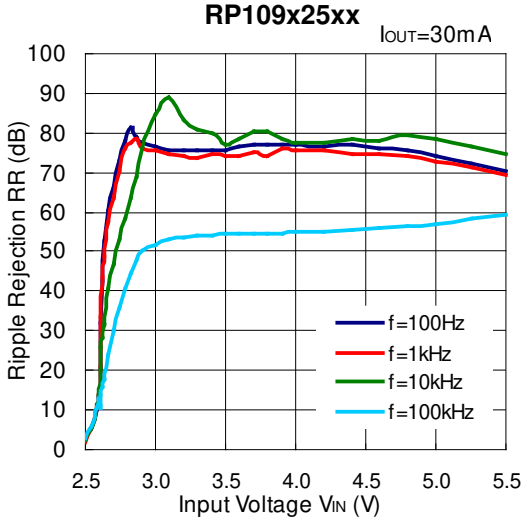


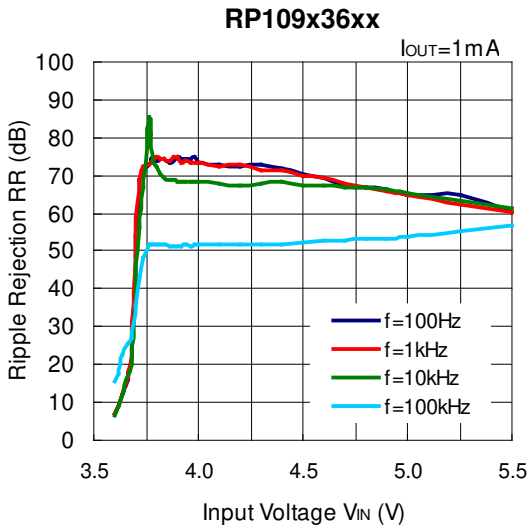


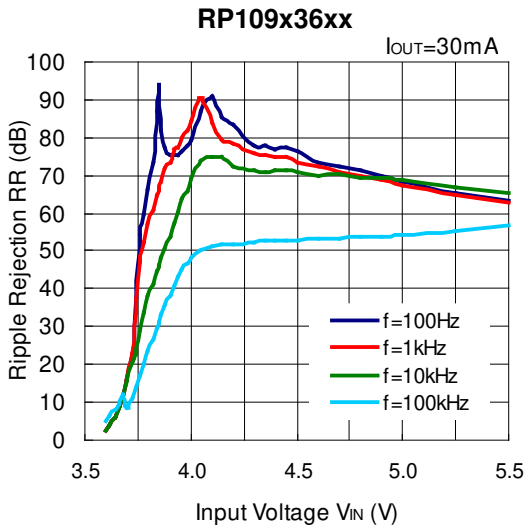




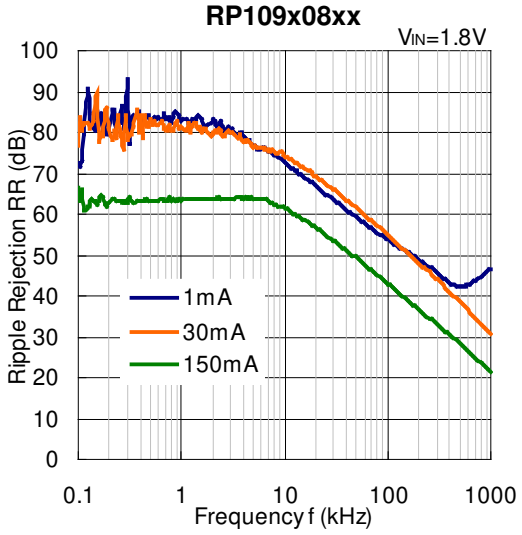


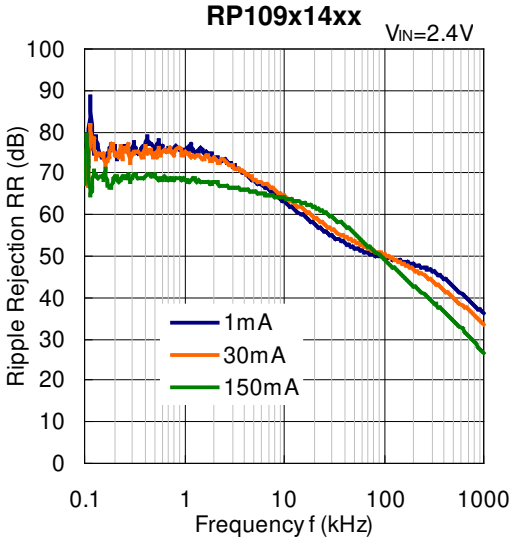


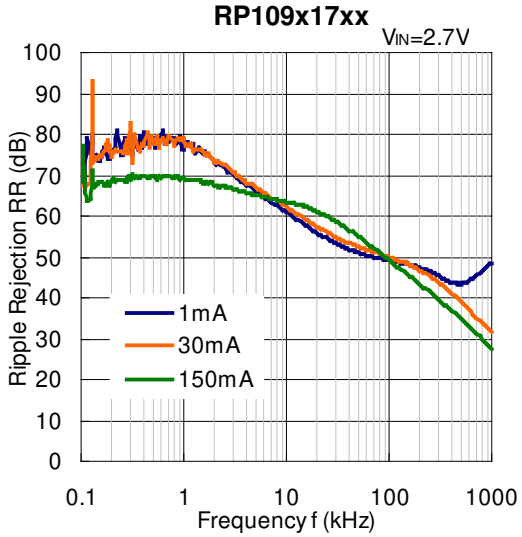


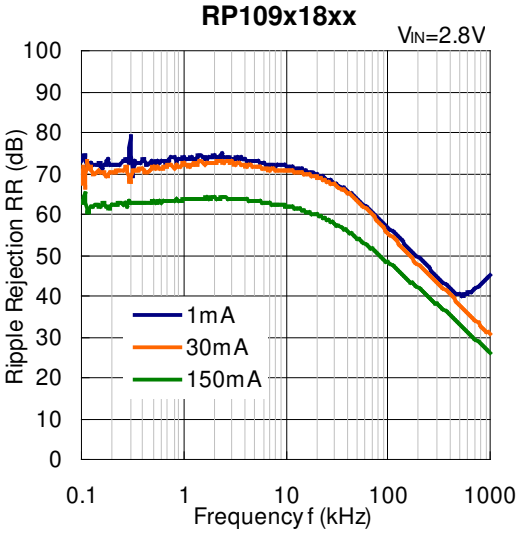


9) Ripple Rejection vs. Frequency (C1=none, C2=0.1μF, Ripple=0.2Vp-p)

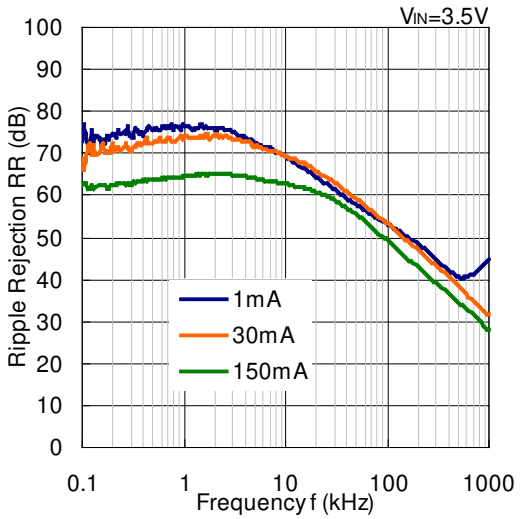




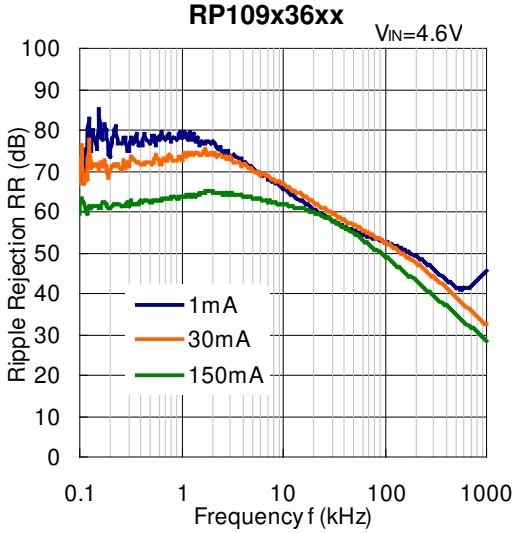




RP109x25xx

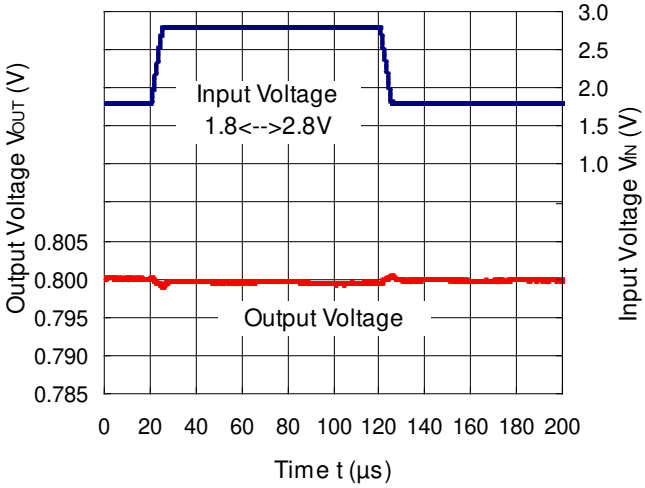


RP109x36xx

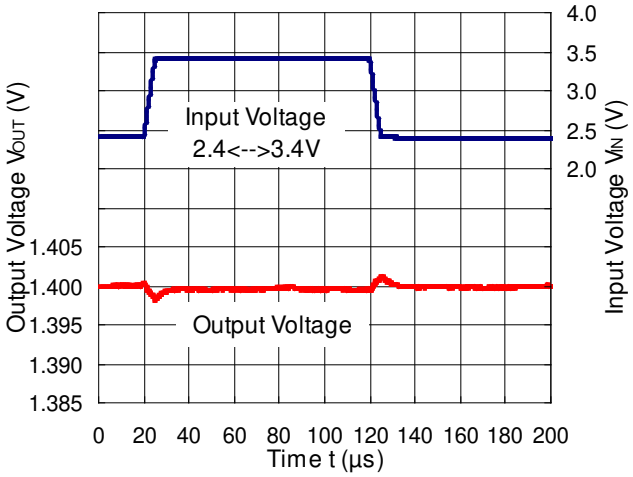


10) Input Transient Response (C1=none, C2=0.1µF, IOUT=30mA, tr=tf=5µs, Topt=25°C)

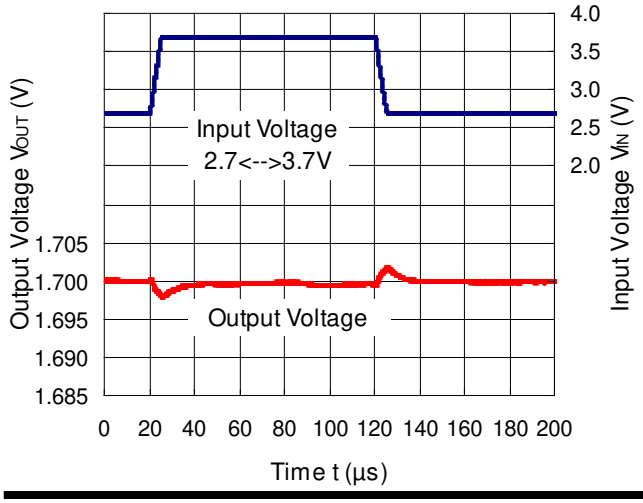
RP109x08xx



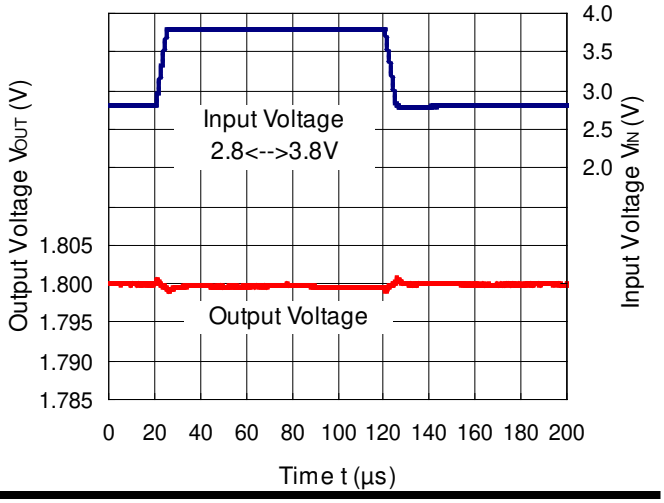
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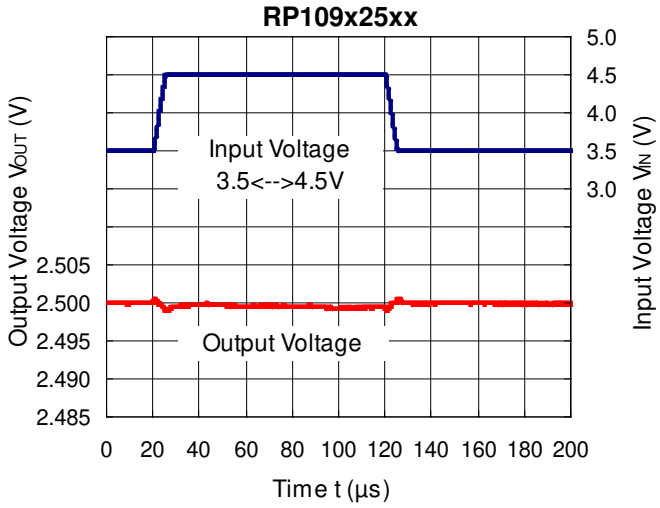


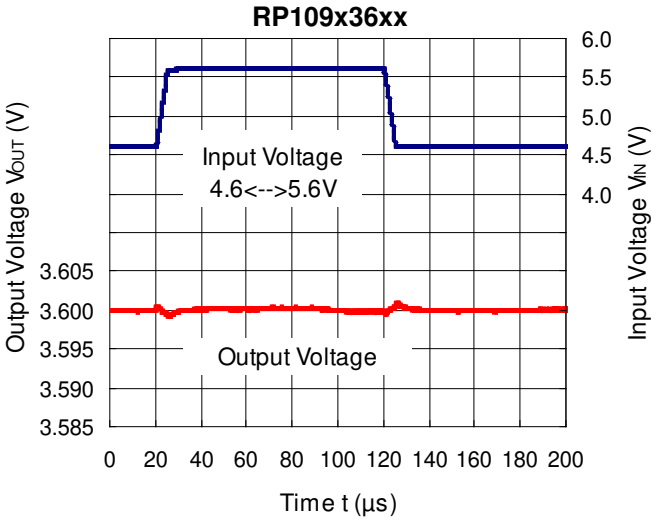
RP109x17xx



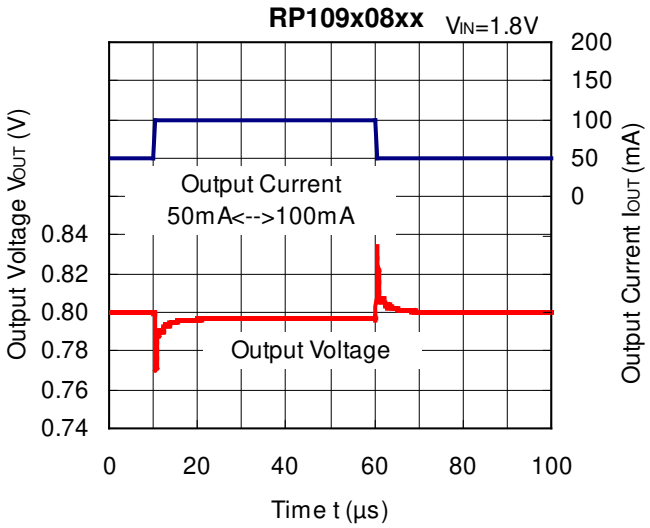
RP109x18xx

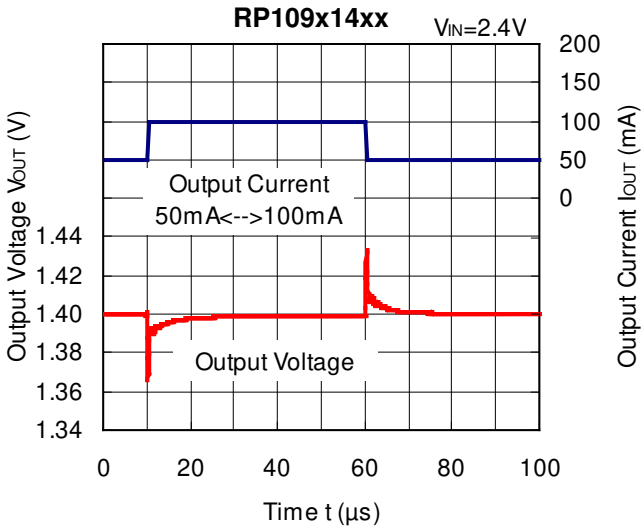


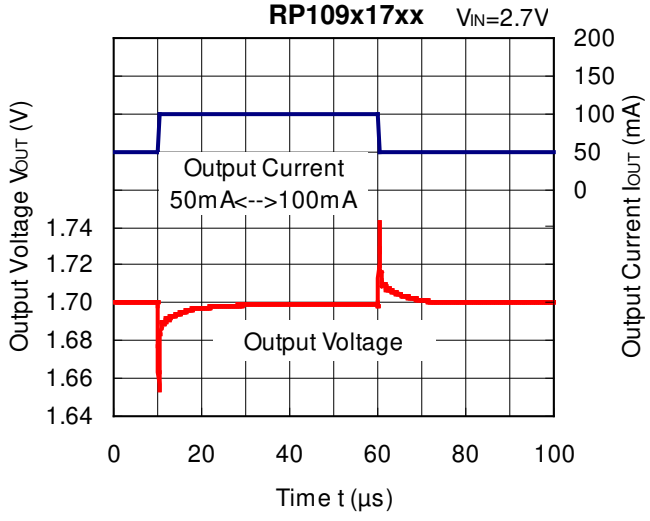


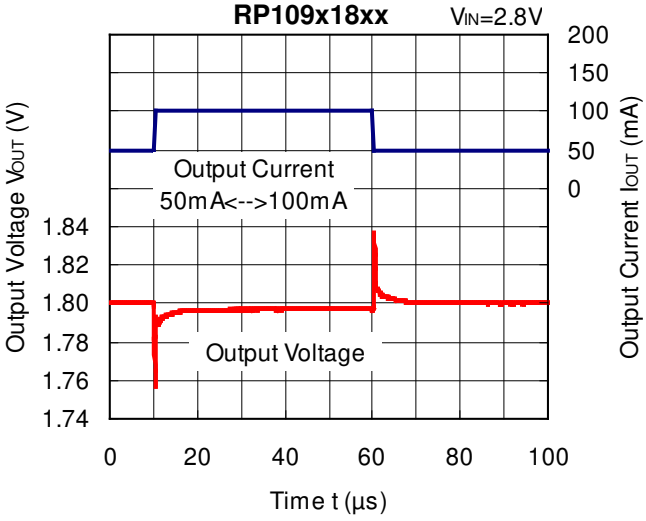


11) Load Transient Response (C1=0.1µF, C2=0.1µF, tr=tf=5µs, Topt=25°C)

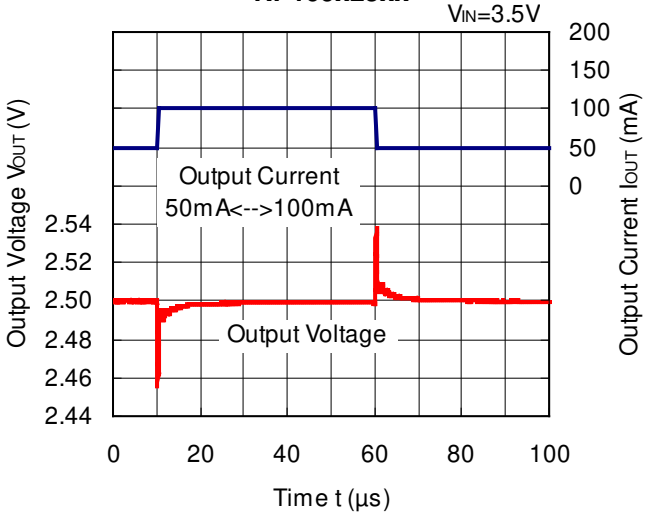




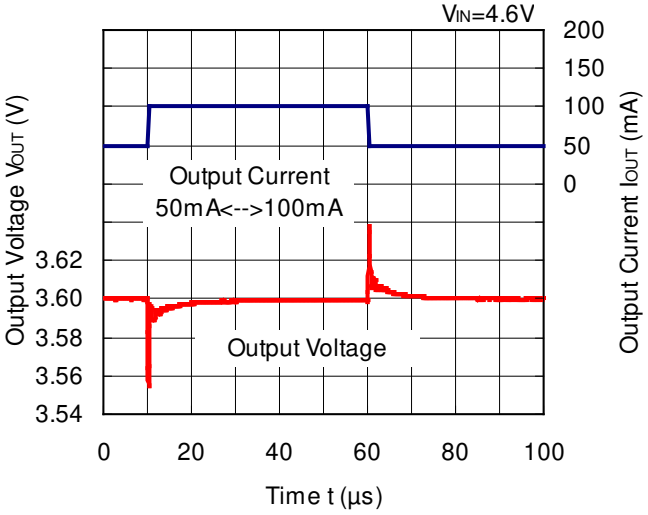




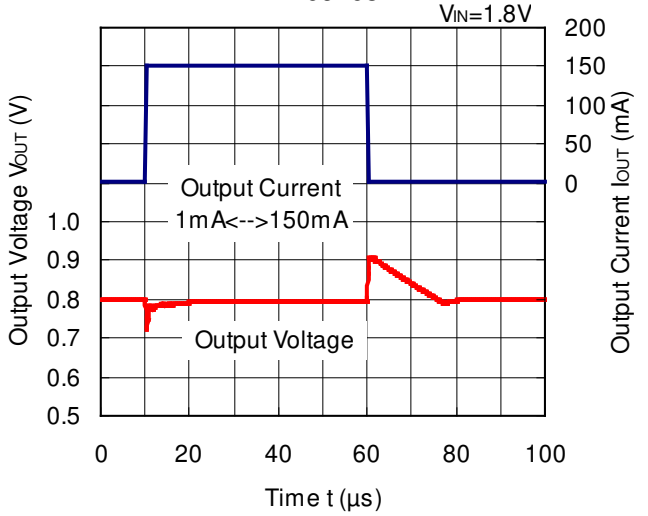
RP109x25xx



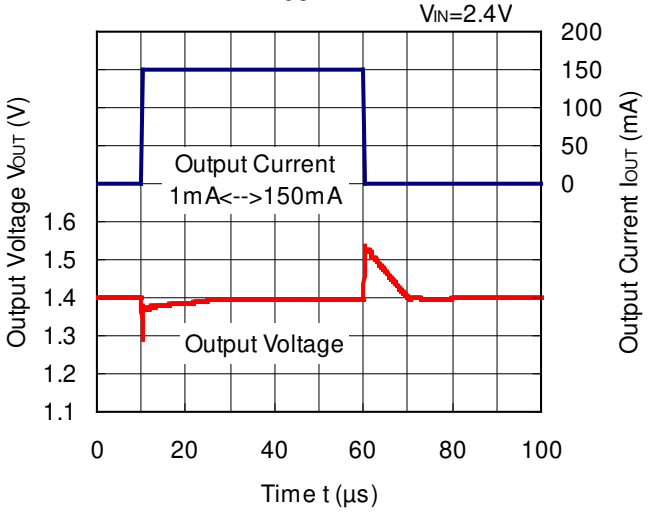
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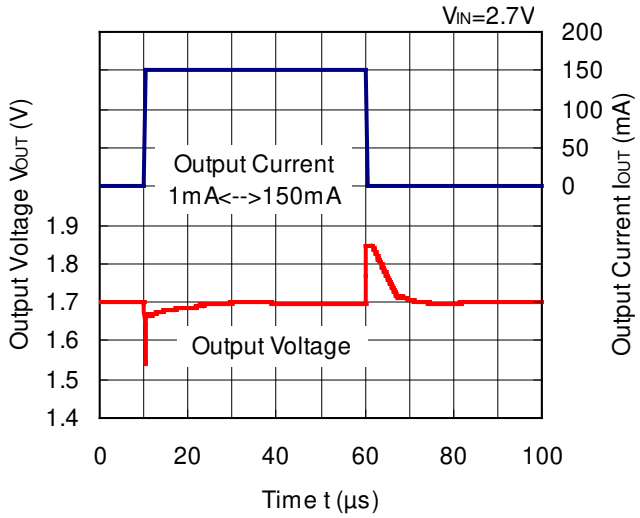
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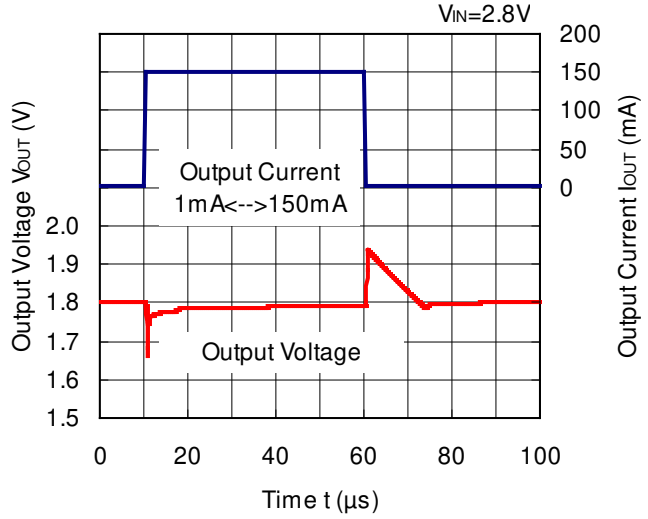
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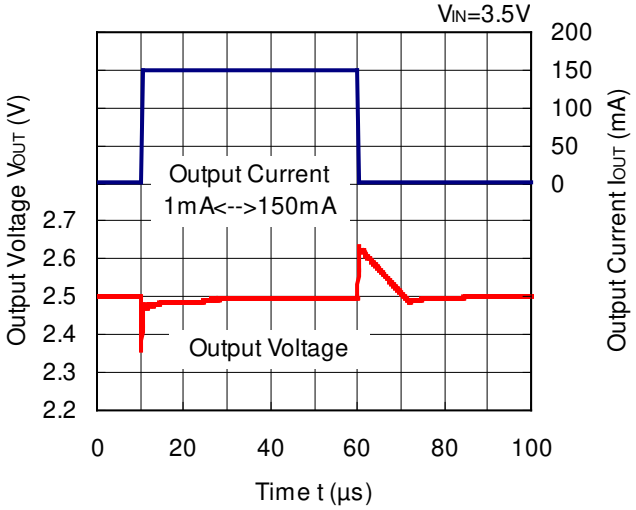
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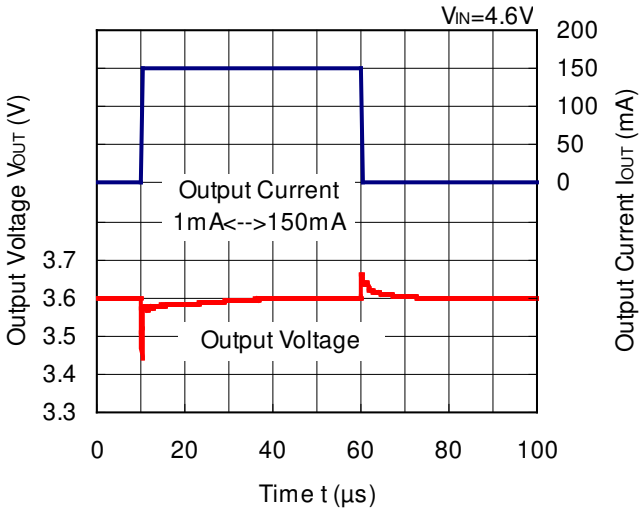
RP109x18xx



RP109x25xx

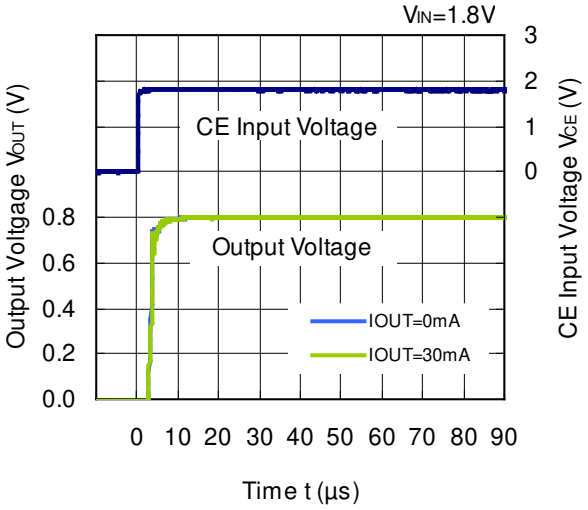


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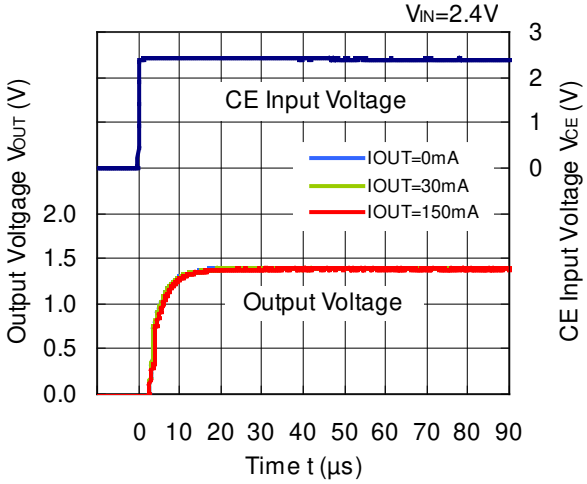


12) Turn On Speed with CE pin (C1=0.1µF, C2=0.1µF, Topt=25°C)

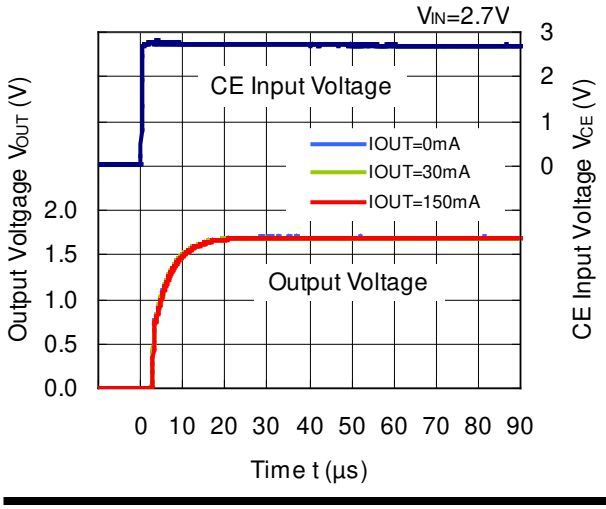
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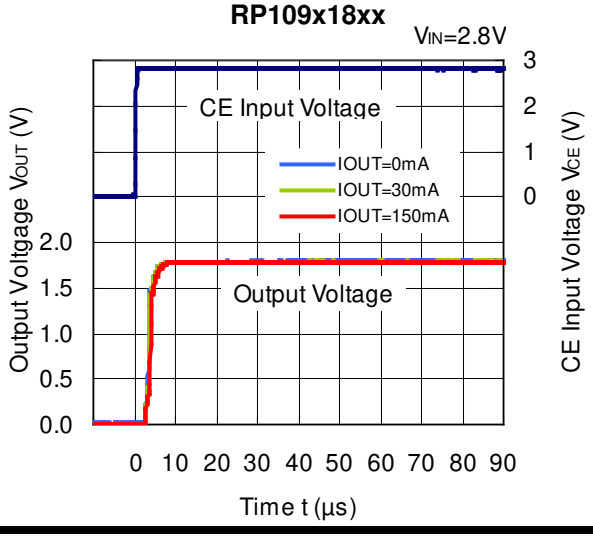
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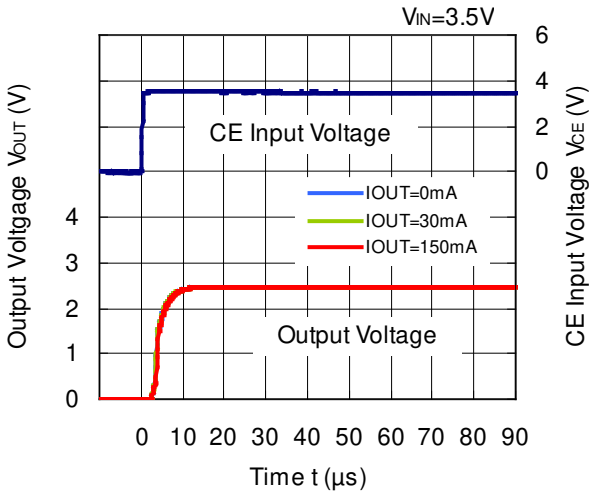
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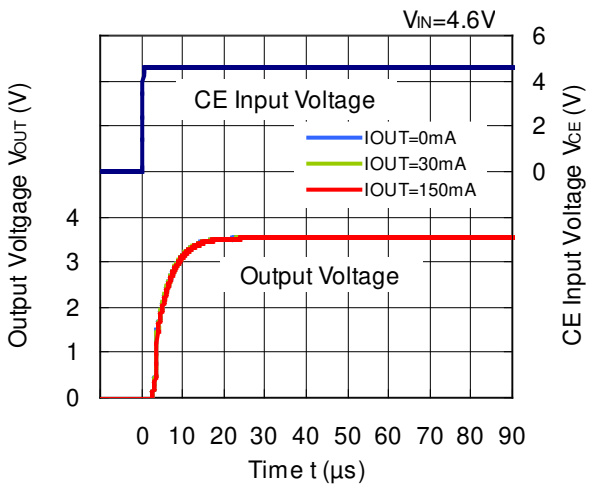
RP109x18xx



RP109x25xx

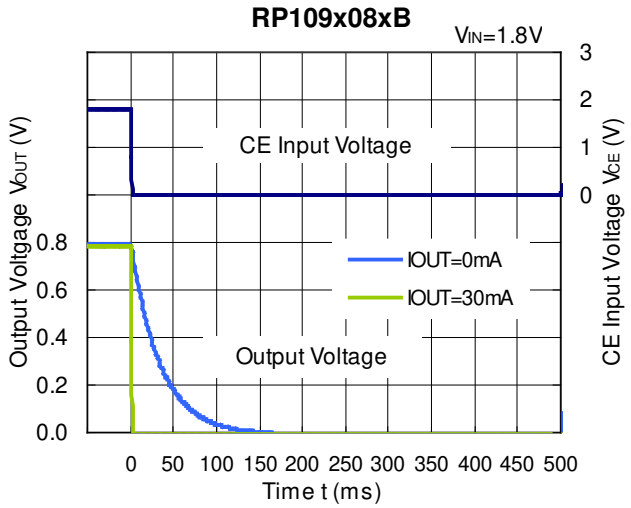


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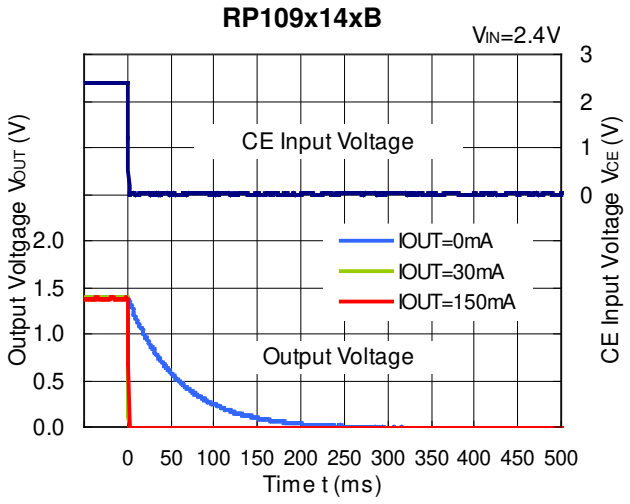


13) Turn Off Speed with CE pin (B Version) (C1=0.1µF, C2=0.1µF, Topt=25°C)

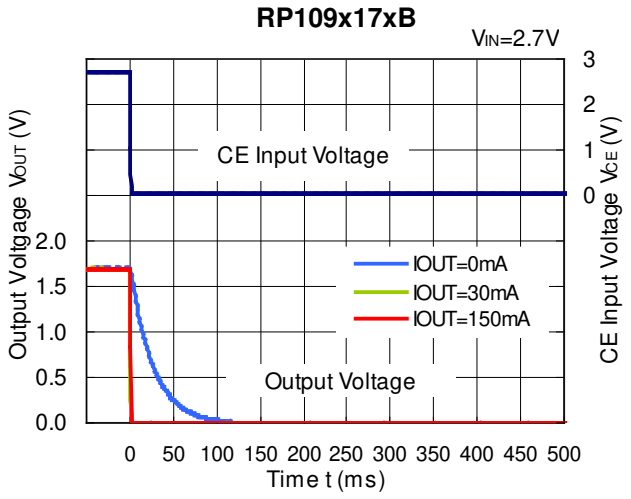
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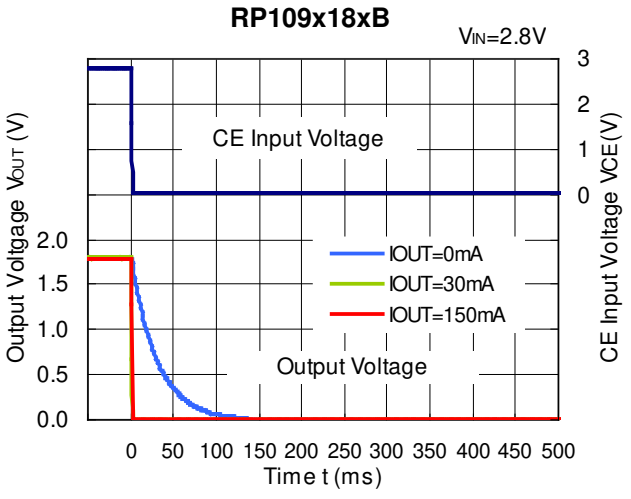
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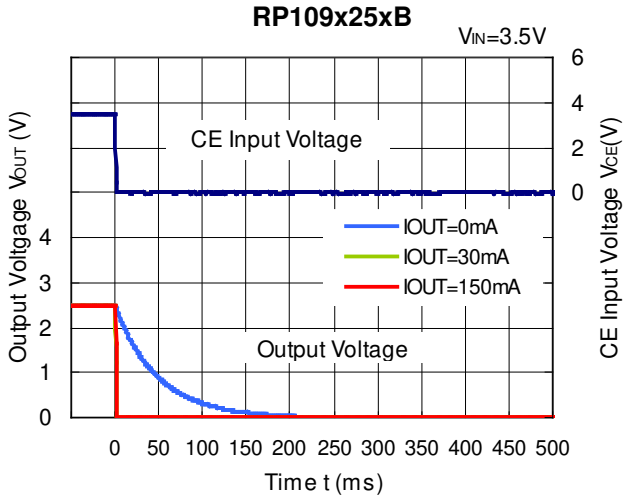


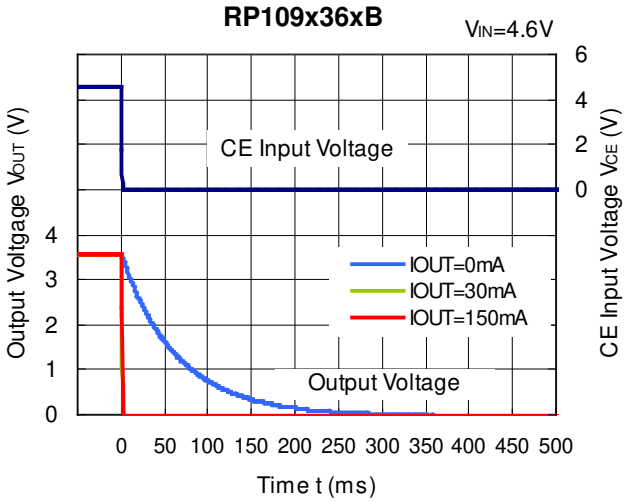
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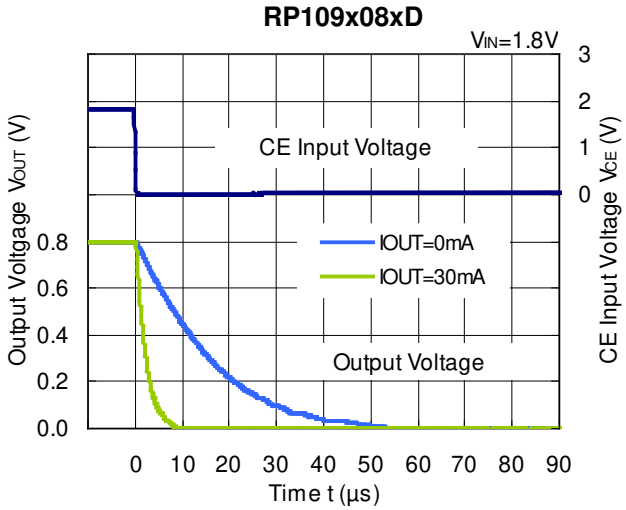
RP109x18xB

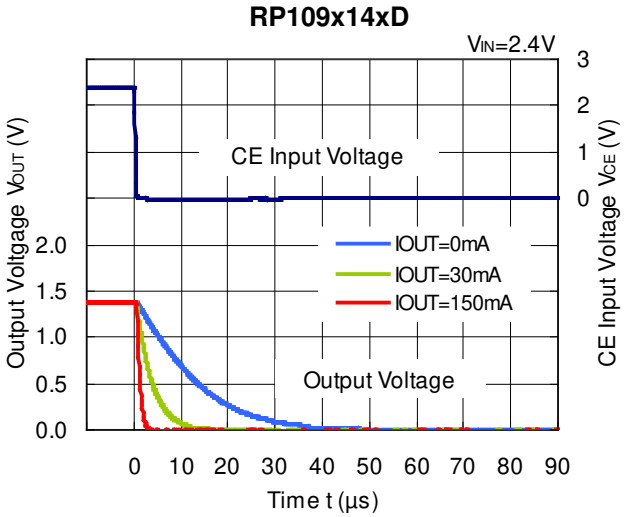


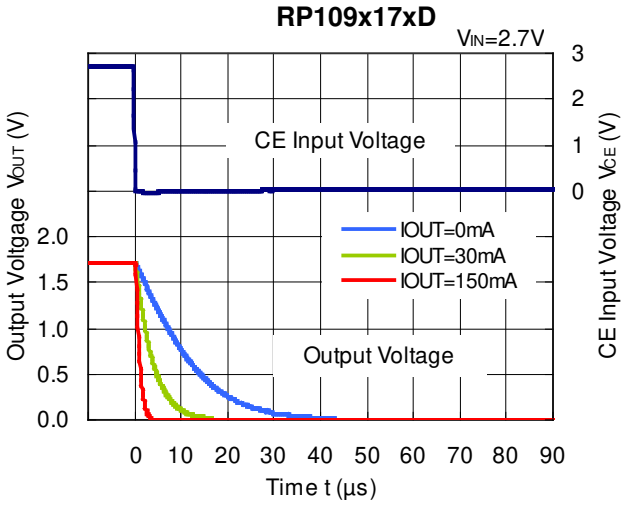


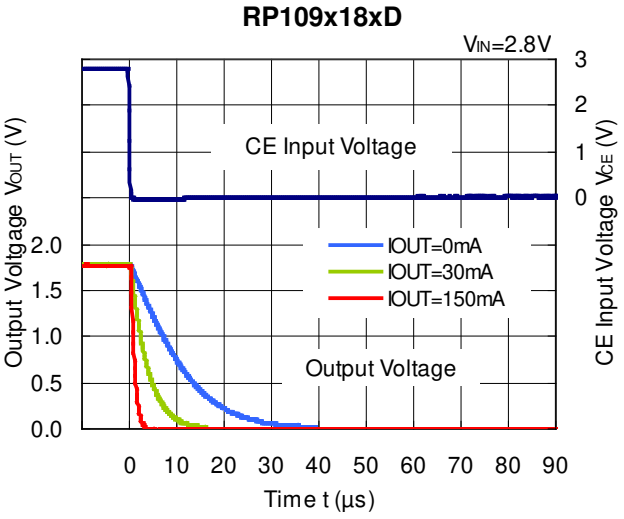


14) Turn Off Speed with CE pin (D Version) (C1=0.1µF, C2=0.1µF, Topt=25°C)

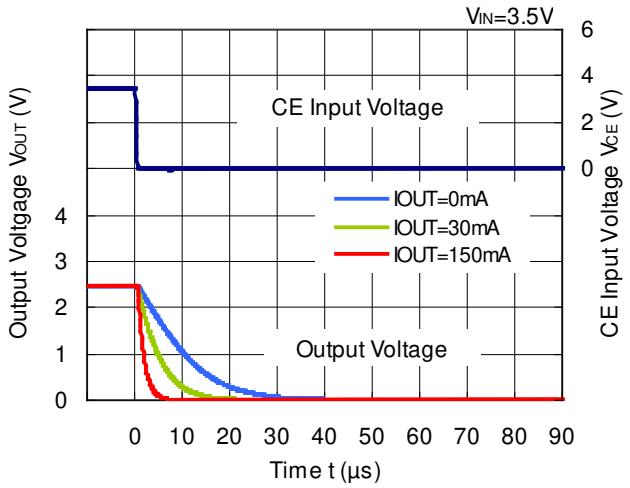




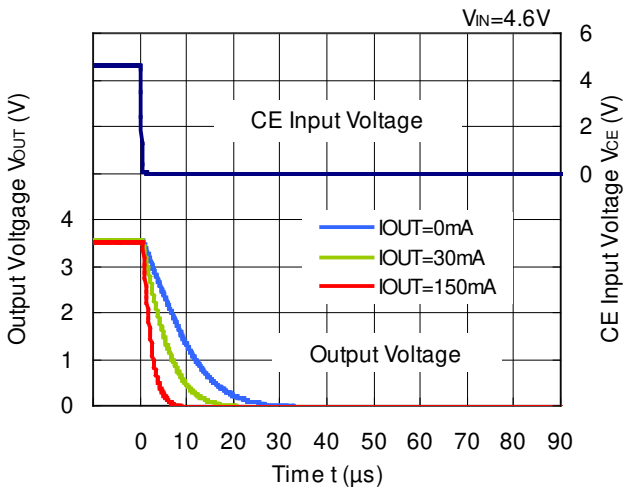




RP109x25xD

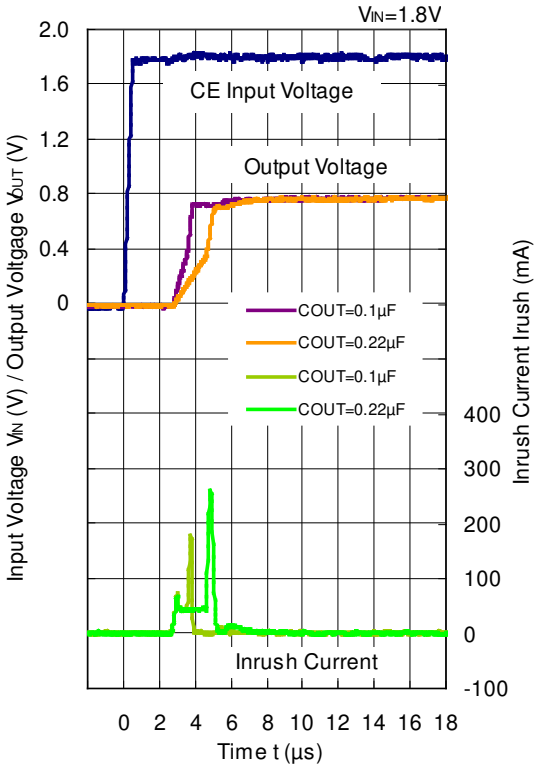


RP109x36xD

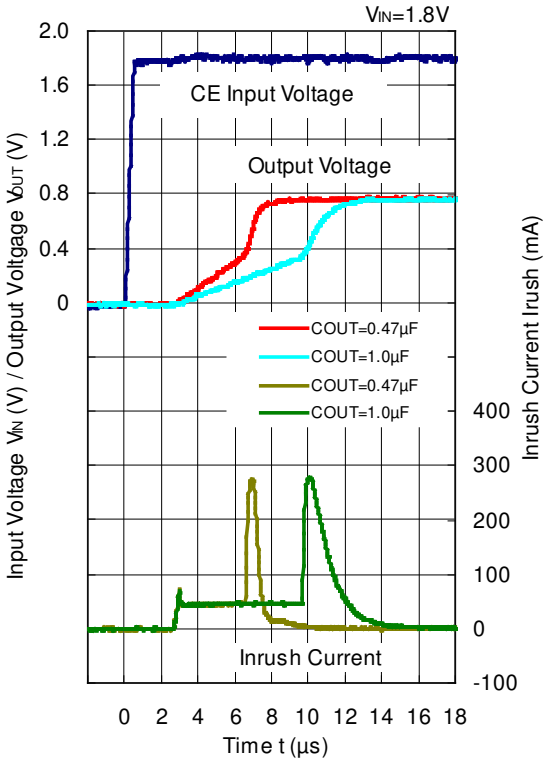


15) Inrush Current (C1=4.7µF, I_{OUT}=0mA, Topt=25°C)

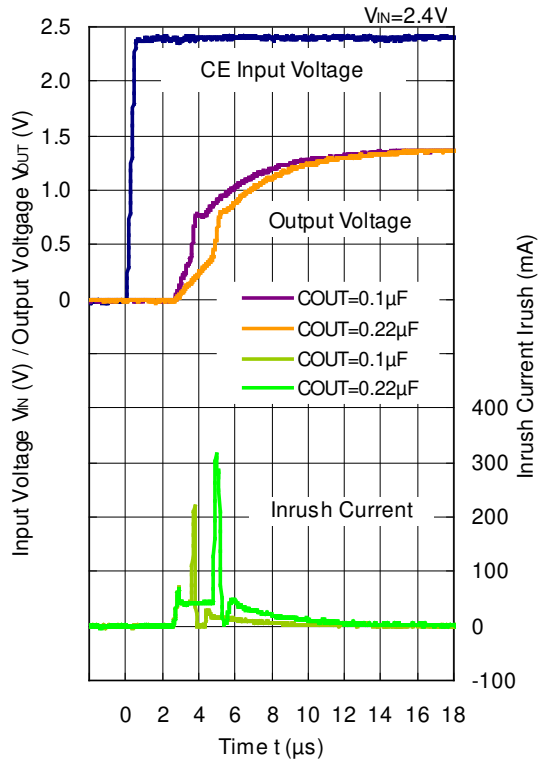
RP109x08xx



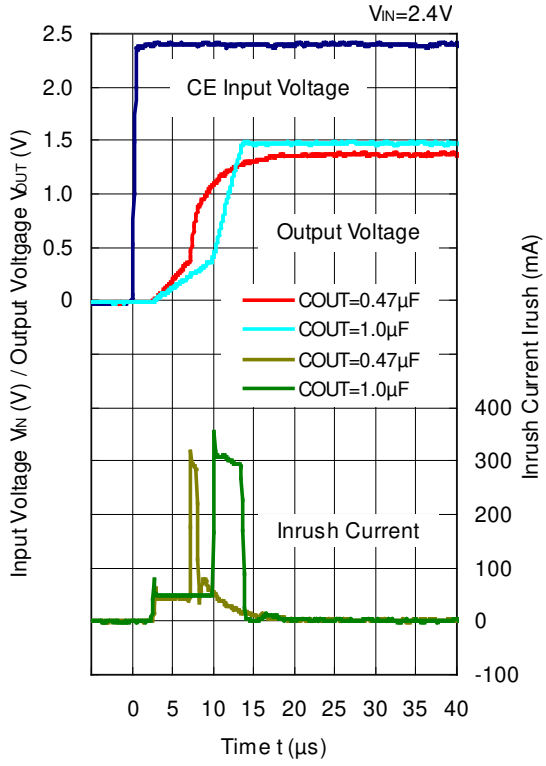
RP109x08xx



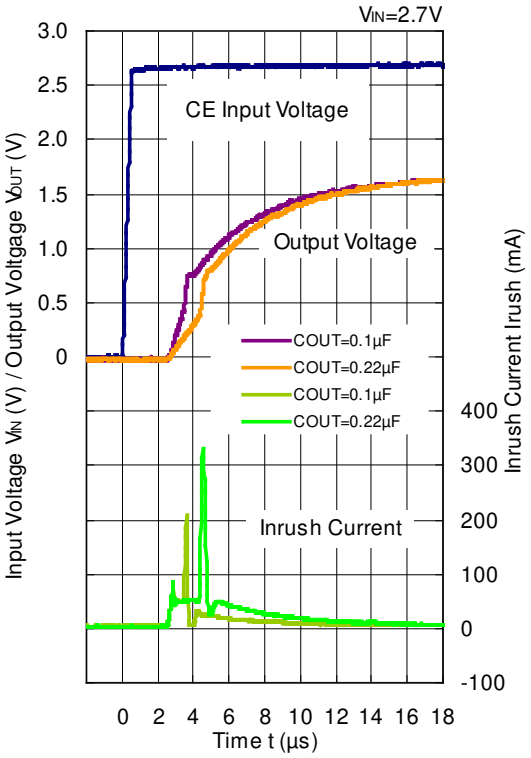
RP109x14xx



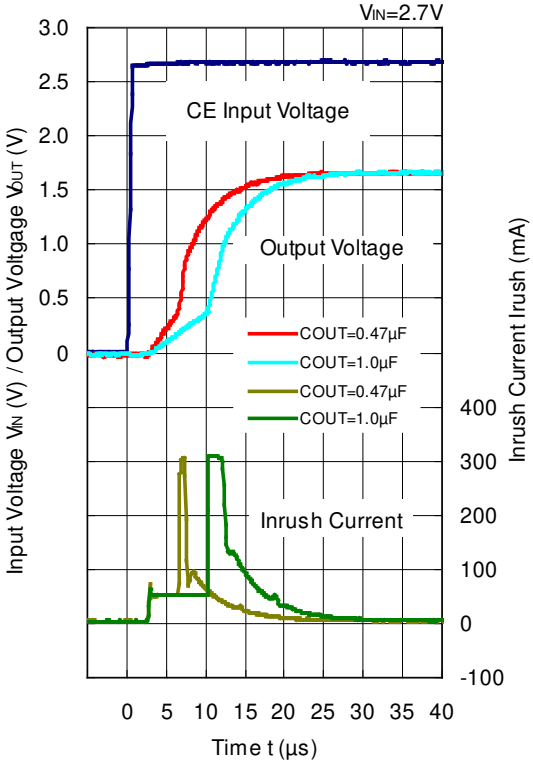
RP109x14xx



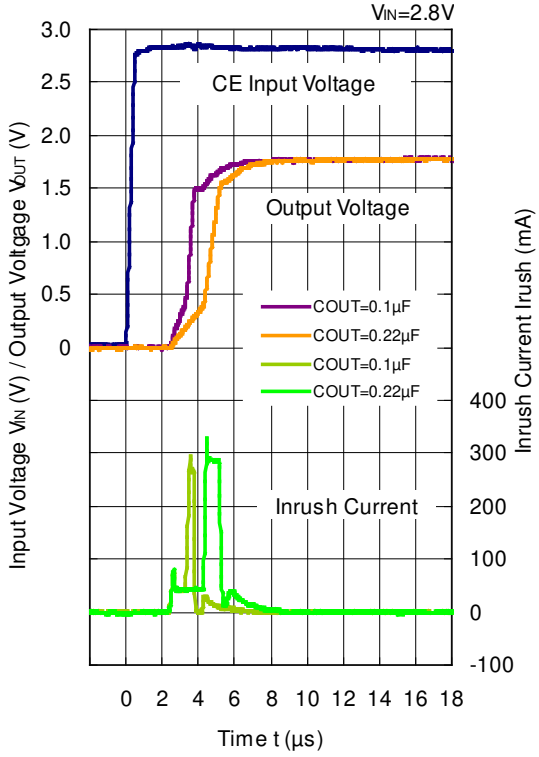
RP109x17xx



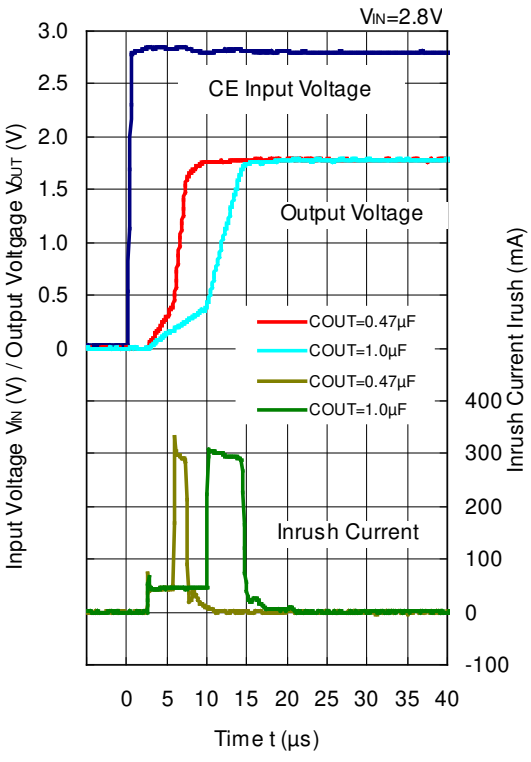
RP109x17xx



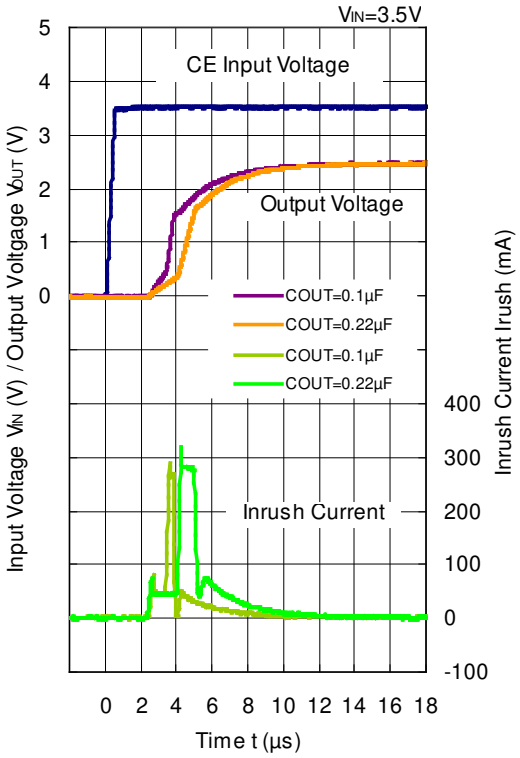
RP109x18xx



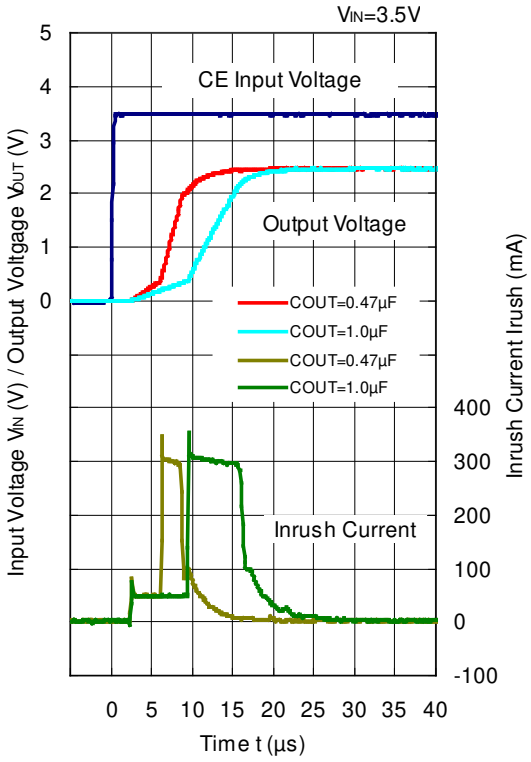
RP109x18xx



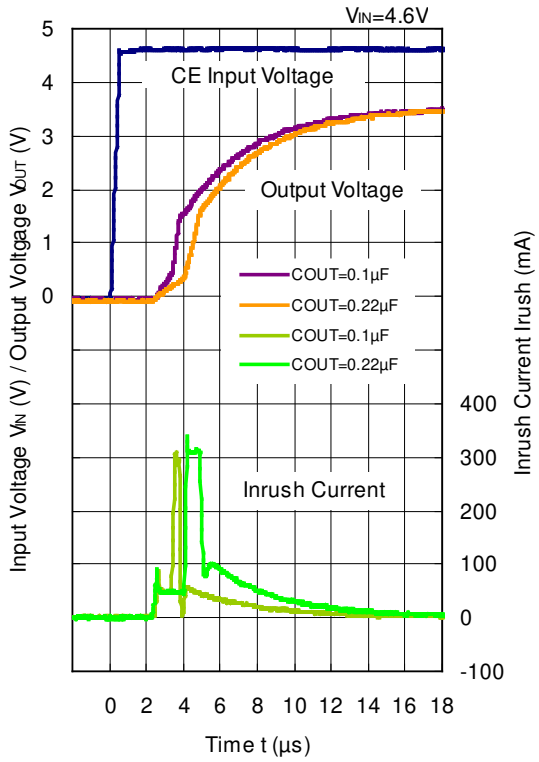
RP109x25xx



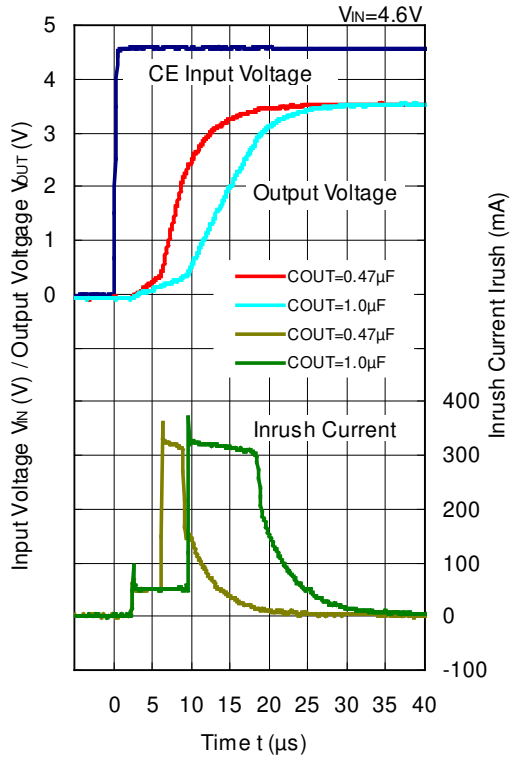
RP109x25xx



RP109x36xx

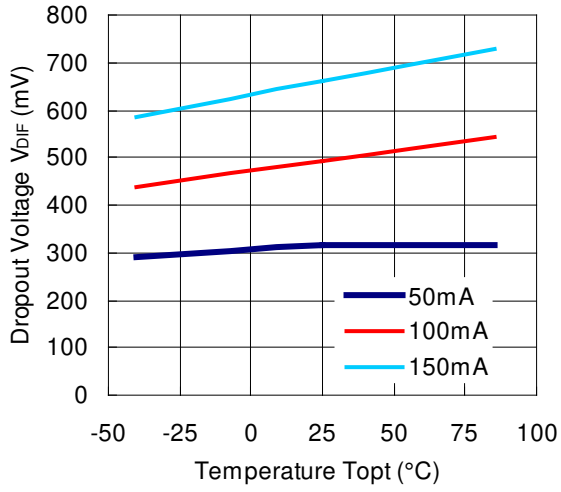


RP109x36xx

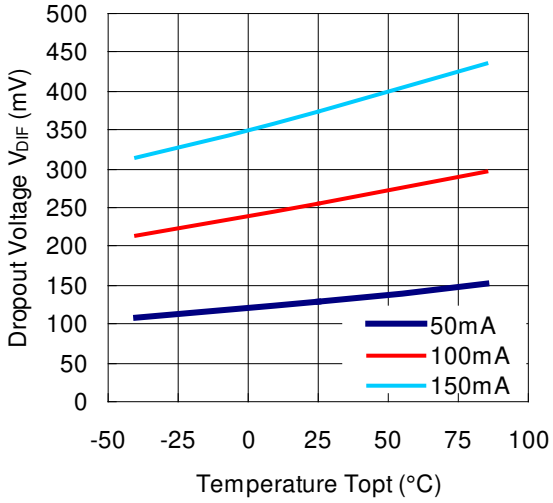


16) Dropout Voltage vs. Temperature (C1=0.1μF, C2=0.1μF)

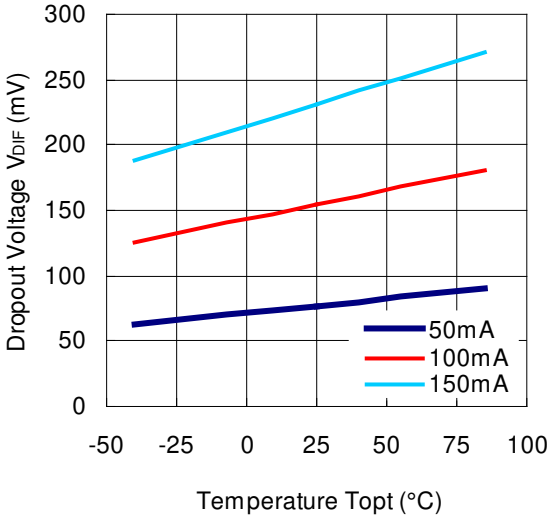
RP109x08xx



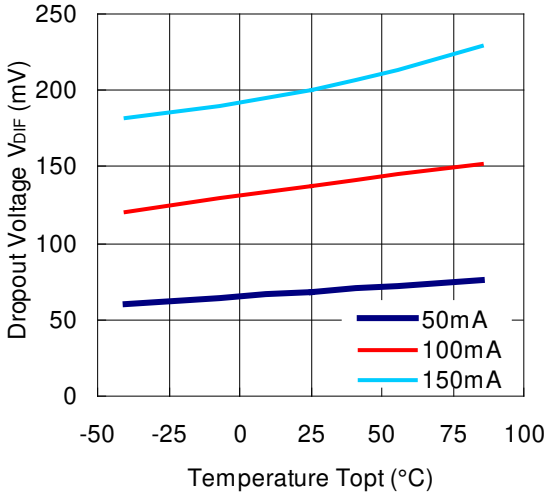
RP109x14xx



RP109x25xx



RP109x36xx



ESR vs. Output Current

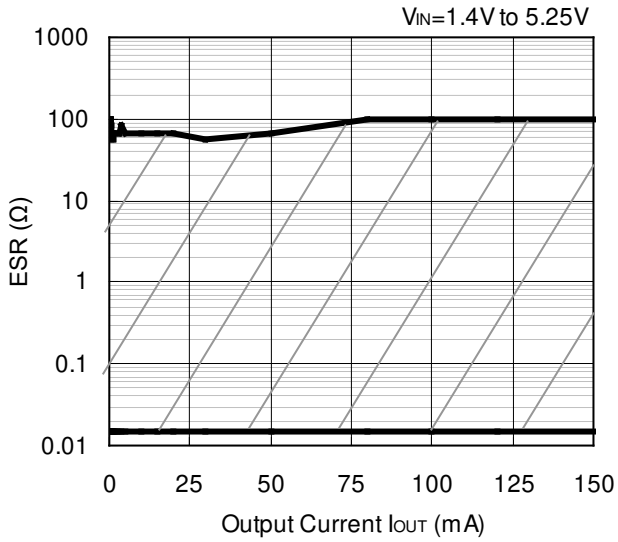
When using these ICs, consider the following points:

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 40μV (Avg.) are marked as the hatched area in the graph.

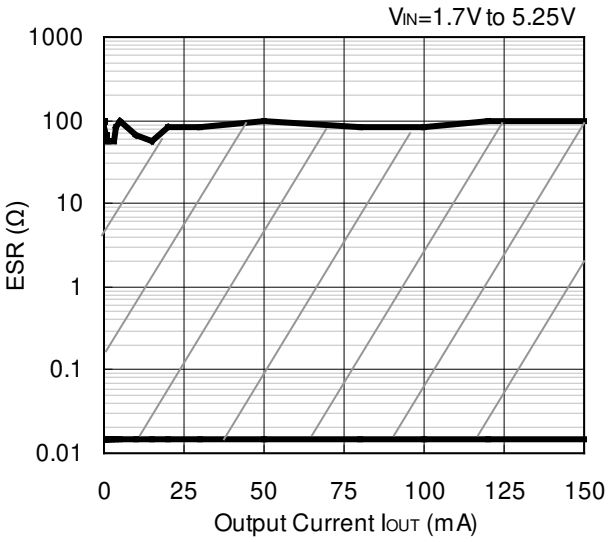
Measurement conditions

Frequency Band : 10Hz to 2MHz
Temperature : −40°C to 85°C
C1, C2 : Ceramic 0.1μF

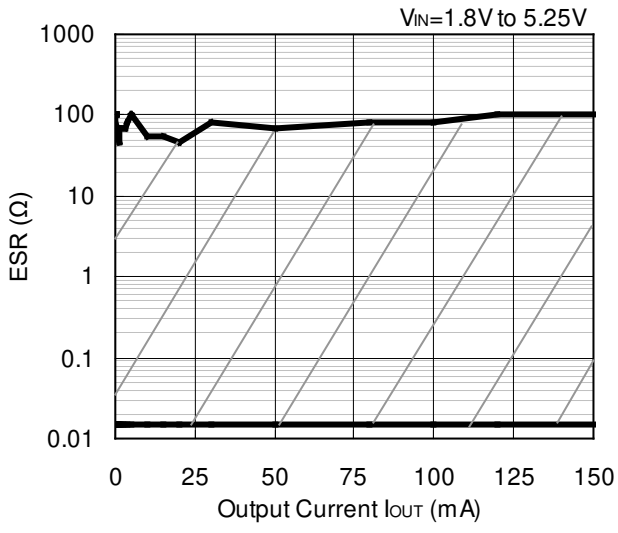
RP109x08xx



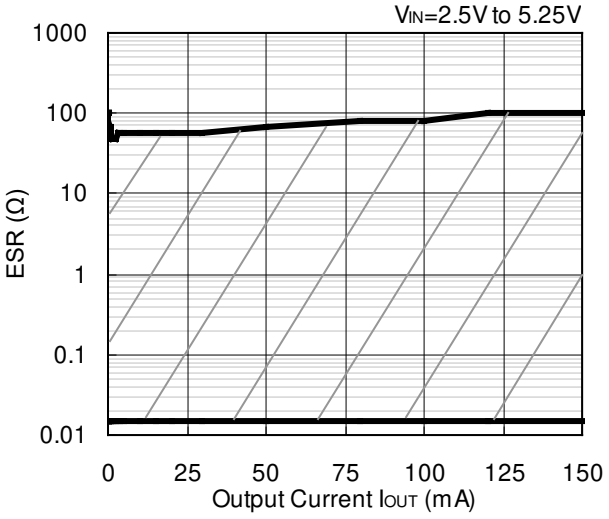
RP109x17xx



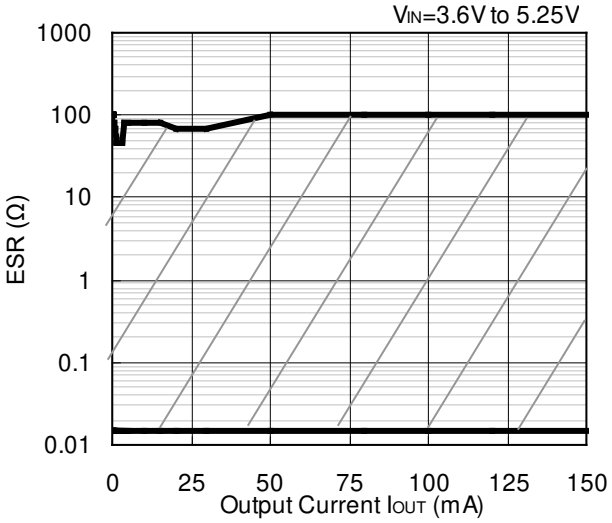
RP109x18xx



RP109x25xx



RP109x36xx


VIN=3.6V to 5.25V
1000
100
10
1
0.1
0.01
ESR (Ω)
0
25
50
75
100
125
150
Output Current IOUT (mA)

PACKAGE INFORMATION

- **Power Dissipation (DFN (PL) 0808-4)**

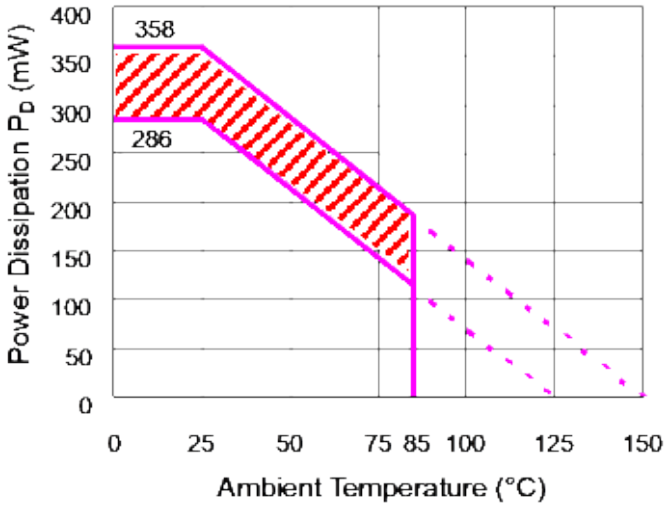
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions:

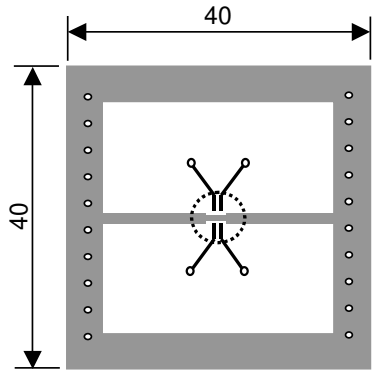
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double-sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.5mm × 24pcs

Measurement Results: (Ta=25°C)

	Standard Land Pattern
Power Dissipation	286mW (Tjmax=125°C) 358mW (Tjmax=150°C)
Thermal Resistance	θja = (125-25°C)/0.286W= 350°C/W
	θjc= 90°C/W



Power Dissipation



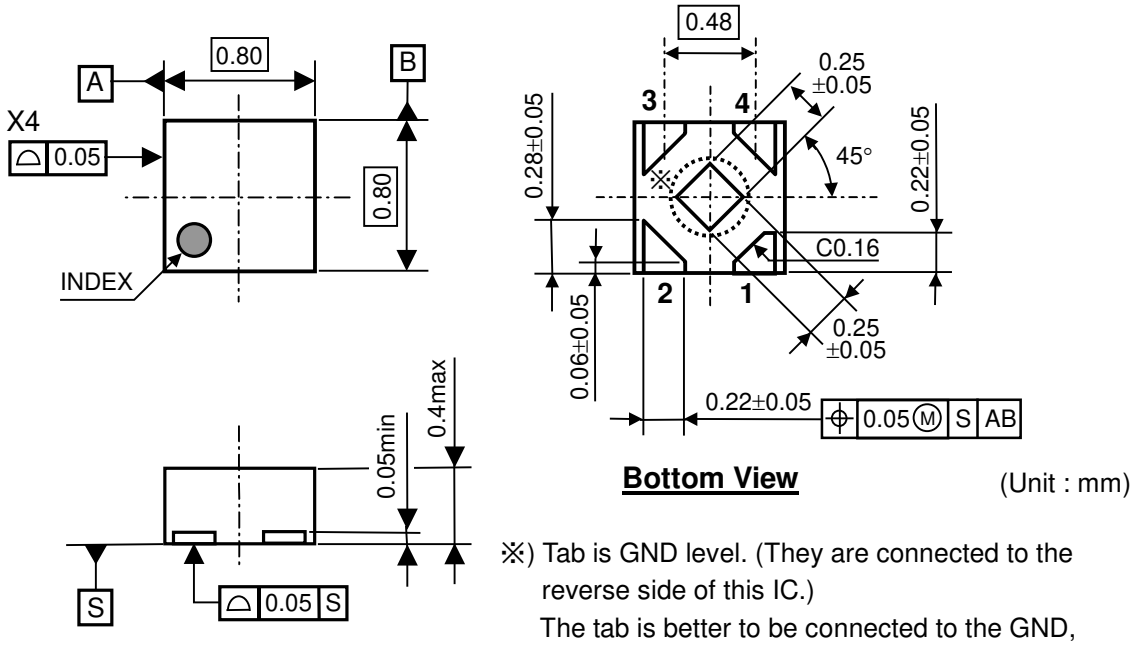
Measurement Board Pattern

IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of Tjmax=125°C and Tjmax=150°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 (PL) 0808-4)**



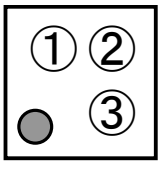
Bottom View

(Unit : mm)

※) 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 (PL) 0808-4)**

①: Product Code … **Refer to "RP109K Series Mark Specification Table".**
②③: Lot Number … Alphanumeric Serial Number



Power Dissipation (DFN1010-4)

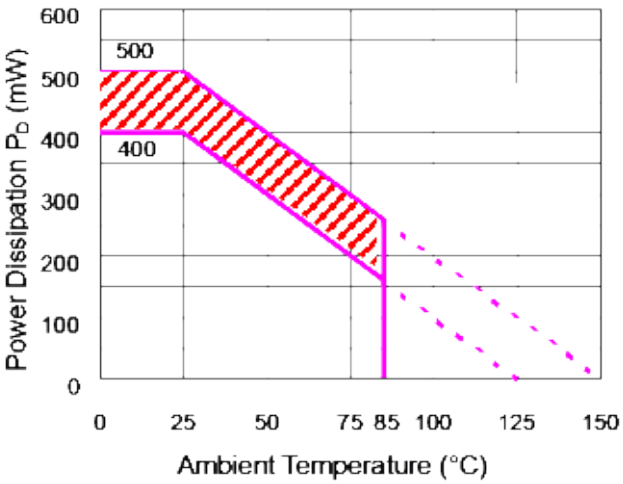
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions:

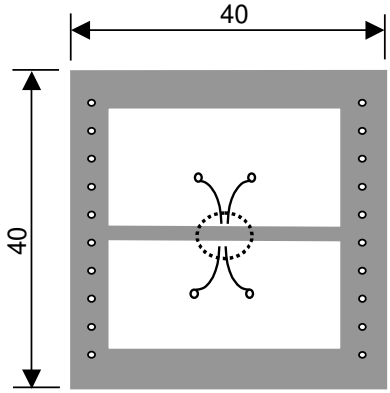
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.54mm × 24pcs

Measurement Results: (Ta=25°C)

	Standard Land Pattern
Power Dissipation	400mW (Tjmax=125°C) 500mW (Tjmax=150°C)
Thermal Resistance	θja = (125-25°C)/0.4W= 250°C/W
	θjc= 67°C/W



Power Dissipation



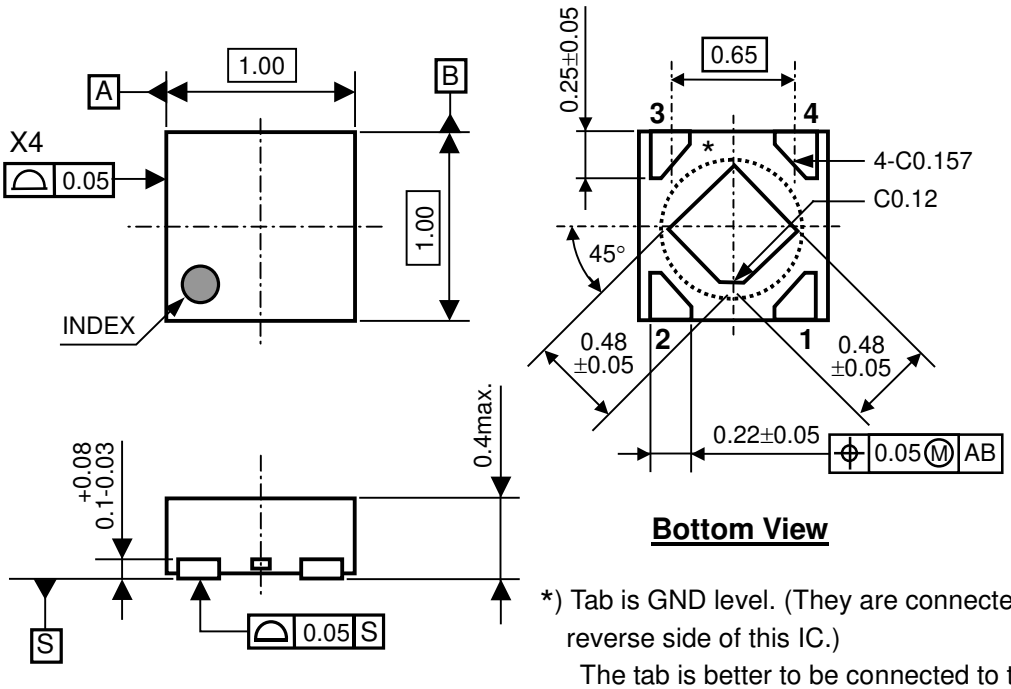
Measurement Board Pattern

IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of Tjmax=125°C and Tjmax=150°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 (DFN1010-4)**

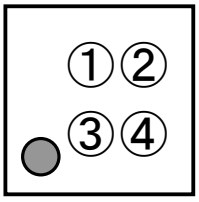


(Unit : mm)

*) 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



• Power Dissipation (SOT-23-5)

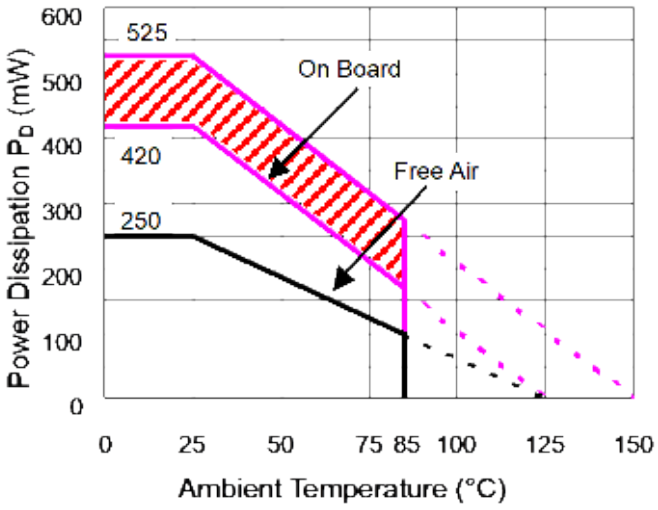
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:
(Power Dissipation (SOT-23-5) is substitution of SOT-23-6.)

Measurement Conditions:

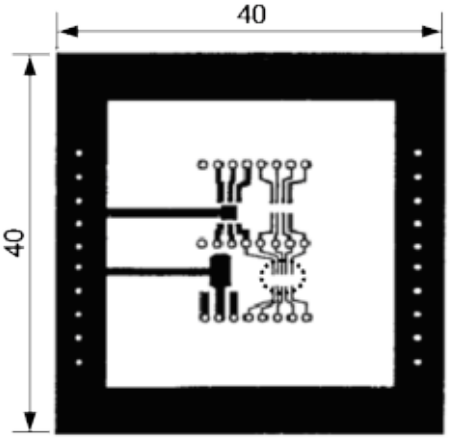
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm × 40mm × 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-holes	ϕ 0.5mm × 44pcs

Measurement Results: (Ta=25°C)

	Standard Land Pattern	Free Air
Power Dissipation	420mW (Tjmax=125°C) 525mW (Tjmax=150°C)	250mW
Thermal Resistance	θja = (125-25°C)/0.42W= 238°C/W	400°C/W



Power Dissipation



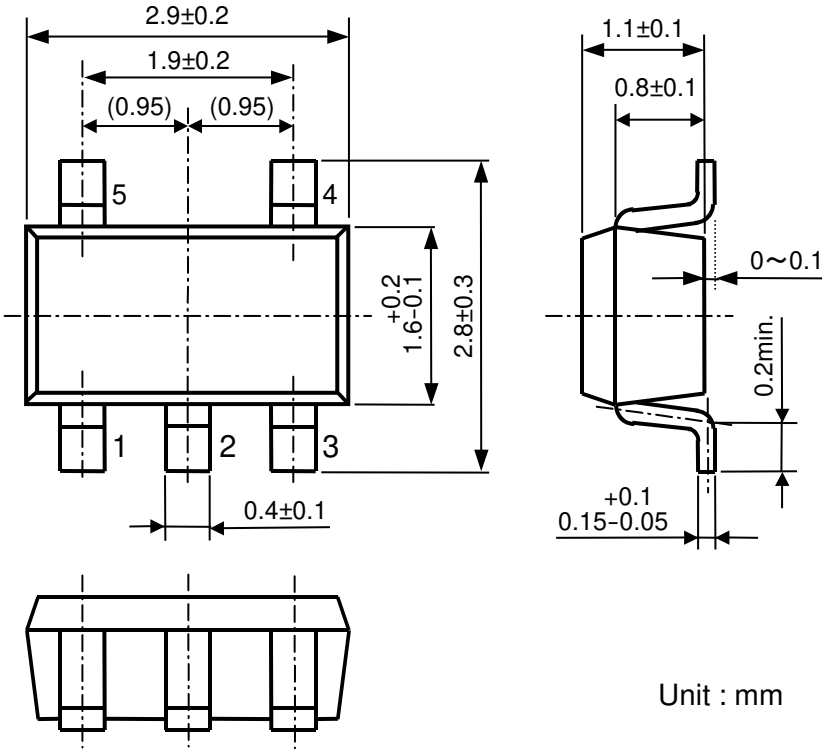
Measurement Board Pattern

IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package under the conditions of Tjmax=125°C and Tjmax=150°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 (SOT-23-5)**

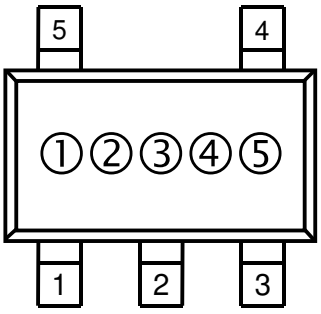


Unit : mm

- **Mark Specification (SOT-23-5)**

①②③: Product Code …**Refer to "RP109N Mark Specification Table".**

④⑤: Lot Number … Alphanumeric Serial Number



• Power Dissipation (SC-88A)

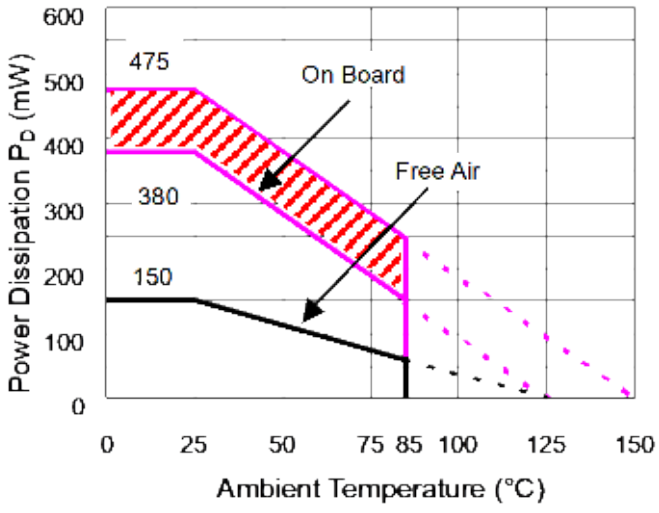
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

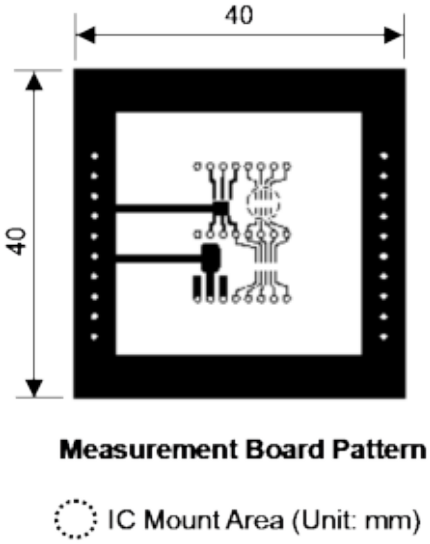
Measurement Conditions:

	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: (Ta=25°C)

	Standard Land Pattern	Free Air
Power Dissipation	380mW (Tjmax=125°C) 475mW (Tjmax=150°C)	150mW
Thermal Resistance	θja=(125-25°C)/0.38W=263°C/W	θja=(125-25°C)/0.15W=667°C/W
	θjc=75°C/W	-





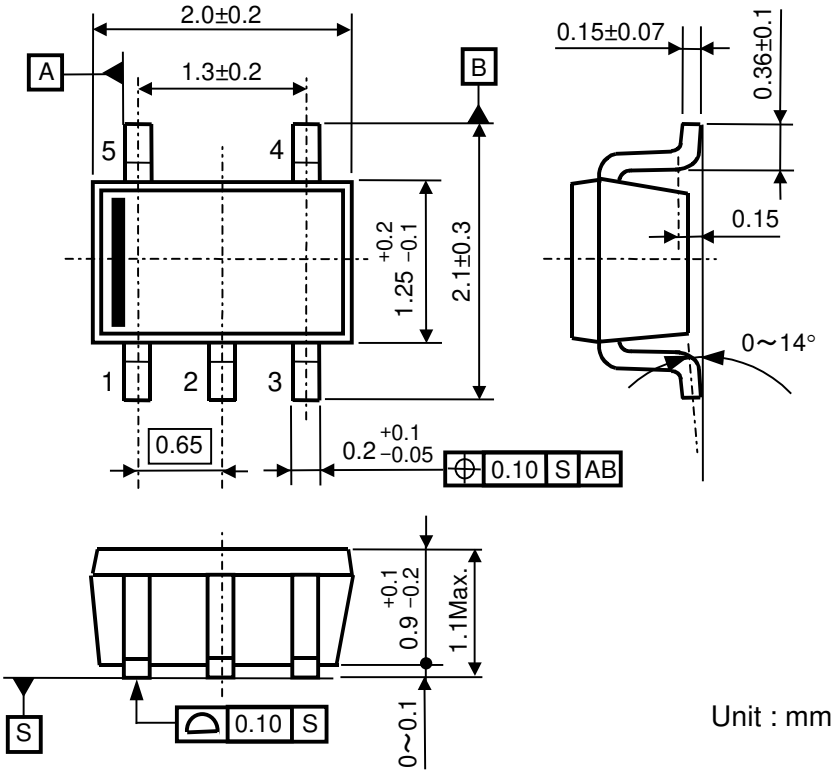
Power Dissipation

The above graph shows the Power Dissipation of the package under the conditions of Tjmax=125°C and Tjmax=150°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)**

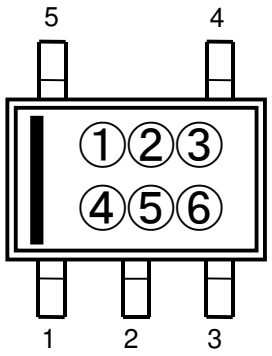


Unit : mm

- **Mark Specification (SC-88A)**

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

⑤⑥: Lot Number … Alphanumeric Serial Number



- **RP109K Series Mark Specification Table (DFN(PL)0808-4)**

RP109Kxx1B

Product Name	①	V_{SET}
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
RP109K341B5	**A**	3.45V
RP109K101B5	**A**	1.05V
RP109K171B5	**A**	1.75V
RP109K111B5	**A**	1.15V

RP109Kxx1D

Product Name	①	V_{SET}
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
RP109K341D5	**A**	3.45V
RP109K101D5	**A**	1.05V
RP109K171D5	**A**	1.75V
RP109K111D5	**A**	1.15V

RP109L Series Mark Specification Table (DFN1010-4)

RP109Lxx1B

Product Name	①②	V_{SET}
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
RP109L341B5	**J2**	3.45V
RP109L101B5	**J4**	1.05V
RP109L171B5	**J5**	1.75V
RP109L111B5	**J6**	1.15V
RP109L081B5	**J7**	0.85V

RP109Lxx1D

Product Name	①②	V_{SET}
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
RP109L341D5	**K2**	3.45V
RP109L101D5	**K4**	1.05V
RP109L171D5	**K5**	1.75V
RP109L111D5	**K6**	1.15V
RP109L081D5	**K7**	0.85V

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

RP109Nxx1B

Product Name	①②③	V_{SET}
RP109N081B	**NAA**	0.8V
RP109N091B	**NAB**	0.9V
RP109N101B	**NAC**	1.0V
RP109N111B	**NAD**	1.1V
RP109N121B	**NAE**	1.2V
RP109N131B	**NAF**	1.3V
RP109N141B	**NAG**	1.4V
RP109N151B	**NAH**	1.5V
RP109N161B	**NAJ**	1.6V
RP109N171B	**NAK**	1.7V
RP109N181B	**NAL**	1.8V
RP109N191B	**NAM**	1.9V
RP109N201B	**NAN**	2.0V
RP109N211B	**NAP**	2.1V
RP109N221B	**NAQ**	2.2V
RP109N231B	**NAR**	2.3V
RP109N241B	**NAS**	2.4V
RP109N251B	**NAT**	2.5V
RP109N261B	**NAU**	2.6V
RP109N271B	**NAV**	2.7V
RP109N281B	**NAW**	2.8V
RP109N291B	**NAX**	2.9V
RP109N301B	**NAY**	3.0V
RP109N311B	**NAZ**	3.1V
RP109N321B	**PAA**	3.2V
RP109N331B	**PAB**	3.3V
RP109N341B	**PAC**	3.4V
RP109N351B	**PAD**	3.5V
RP109N361B	**PAE**	3.6V
RP109N121B5	**PAF**	1.25V
RP109N181B5	**PAG**	1.85V
RP109N281B5	**PAH**	2.85V
RP109N341B5	**PAJ**	3.45V
RP109N101B5	**PAK**	1.05V
RP109N171B5	**PAL**	1.75V
RP109N111B5	**PAM**	1.15V
RP109N081B5	**PAN**	0.85V

RP109Nxx1D

Product Name	①②③	V_{SET}
RP109N081D	**NBA**	0.8V
RP109N091D	**NBB**	0.9V
RP109N101D	**NBC**	1.0V
RP109N111D	**NBD**	1.1V
RP109N121D	**NBE**	1.2V
RP109N131D	**NBF**	1.3V
RP109N141D	**NBG**	1.4V
RP109N151D	**NBH**	1.5V
RP109N161D	**NBJ**	1.6V
RP109N171D	**NBK**	1.7V
RP109N181D	**NBL**	1.8V
RP109N191D	**NBM**	1.9V
RP109N201D	**NBN**	2.0V
RP109N211D	**NBP**	2.1V
RP109N221D	**NBQ**	2.2V
RP109N231D	**NBR**	2.3V
RP109N241D	**NBS**	2.4V
RP109N251D	**NBT**	2.5V
RP109N261D	**NBU**	2.6V
RP109N271D	**NBV**	2.7V
RP109N281D	**NBW**	2.8V
RP109N291D	**NBX**	2.9V
RP109N301D	**NBY**	3.0V
RP109N311D	**NBZ**	3.1V
RP109N321D	**PBA**	3.2V
RP109N331D	**PBB**	3.3V
RP109N341D	**PBC**	3.4V
RP109N351D	**PBD**	3.5V
RP109N361D	**PBE**	3.6V
RP109N121D5	**PBF**	1.25V
RP109N181D5	**PBG**	1.85V
RP109N281D5	**PBH**	2.85V
RP109N341D5	**PBJ**	3.45V
RP109N101D5	**PBK**	1.05V
RP109N171D5	**PBL**	1.75V
RP109N111D5	**PBM**	1.15V
RP109N081D5	**PBN**	0.85V

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

RP109Qxx2B

Product Name	①②③④	V_{SET}
RP109Q082B	**AE08**	0.8V
RP109Q092B	**AE09**	0.9V
RP109Q102B	**AE10**	1.0V
RP109Q112B	**AE11**	1.1V
RP109Q122B	**AE12**	1.2V
RP109Q132B	**AE13**	1.3V
RP109Q142B	**AE14**	1.4V
RP109Q152B	**AE15**	1.5V
RP109Q162B	**AE16**	1.6V
RP109Q172B	**AE17**	1.7V
RP109Q182B	**AE18**	1.8V
RP109Q192B	**AE19**	1.9V
RP109Q201B	**AE20**	2.0V
RP109Q212B	**AE21**	2.1V
RP109Q222B	**AE22**	2.2V
RP109Q232B	**AE23**	2.3V
RP109Q242B	**AE24**	2.4V
RP109Q252B	**AE25**	2.5V
RP109Q262B	**AE26**	2.6V
RP109Q272B	**AE27**	2.7V
RP109Q282B	**AE28**	2.8V
RP109Q292B	**AE29**	2.9V
RP109Q302B	**AE30**	3.0V
RP109Q312B	**AE31**	3.1V
RP109Q322B	**AE32**	3.2V
RP109Q332B	**AE33**	3.3V
RP109Q342B	**AE34**	3.4V
RP109Q352B	**AE35**	3.5V
RP109Q362B	**AE36**	3.6V
RP109Q122B5	**AE37**	1.25V
RP109Q182B5	**AE38**	1.85V
RP109Q282B5	**AE39**	2.85V
RP109Q342B5	**AE40**	3.45V
RP109Q102B5	**AE41**	1.05V
RP109Q172B5	**AE42**	1.75V
RP109Q112B5	**AE43**	1.15V

RP109Qxx2D

Product Name	①②③④	V_{SET}
RP109Q082D	**AF08**	0.8V
RP109Q092D	**AF09**	0.9V
RP109Q102D	**AF10**	1.0V
RP109Q112D	**AF11**	1.1V
RP109Q122D	**AF12**	1.2V
RP109Q132D	**AF13**	1.3V
RP109Q142D	**AF14**	1.4V
RP109Q152D	**AF15**	1.5V
RP109Q162D	**AF16**	1.6V
RP109Q172D	**AF17**	1.7V
RP109Q182D	**AF18**	1.8V
RP109Q192D	**AF19**	1.9V
RP109Q202D	**AF20**	2.0V
RP109Q212D	**AF21**	2.1V
RP109Q222D	**AF22**	2.2V
RP109Q232D	**AF23**	2.3V
RP109Q242D	**AF24**	2.4V
RP109Q252D	**AF25**	2.5V
RP109Q262D	**AF26**	2.6V
RP109Q272D	**AF27**	2.7V
RP109Q282D	**AF28**	2.8V
RP109Q292D	**AF29**	2.9V
RP109Q302D	**AF30**	3.0V
RP109Q312D	**AF31**	3.1V
RP109Q322D	**AF32**	3.2V
RP109Q332D	**AF33**	3.3V
RP109Q342D	**AF34**	3.4V
RP109Q352D	**AF35**	3.5V
RP109Q362D	**AF36**	3.6V
RP109Q122D5	**AF37**	1.25V
RP109Q182D5	**AF38**	1.85V
RP109Q282D5	**AF39**	2.85V
RP109Q342D5	**AF40**	3.45V
RP109Q102D5	**AF41**	1.05V
RP109Q172D5	**AF42**	1.75V
RP109Q112D5	**AF43**	1.15V

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8. Quality Warranty

    8-1. Quality Warranty Period

    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.

    8-2. Quality Warranty Remedies

    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.

    8-3. Remedies after Quality Warranty Period

    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
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11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
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