NISSHINBO

RP112x Series

Low Noise 150 mA LDO Regulator

No. EA-258-231227

OUTLINE

The RP112x is a voltage regulator (LDO) with high output voltage accuracy, low-supply current, low On-resistance transistor, low noise output voltage and high ripple rejection. Each IC is composed of the followings: a voltage reference unit, an error amplifier, a resistor-net for output voltage setting, a current limit circuit, and a chip enable circuit.
The RP112x features ultra-low noise and its Ripple Rejection is as low as 80 dB at f = 1 kHz, 75 dB at f = 10 kHz and 65 dB at f = 100 kHz. The Output Noise is also as low as Typ. 10 μVrms. It is kept the low level at any Output Voltage. RP112x is suitable for the power source for the portable music player and RF module that demands for higher level of noise reduction. SOT-23-5 and SC-88A packages, a 1-mm square DFN(PL)1010-4 package are available.

FEATURES

- Supply Current ....Typ. 75 μA
- Standby Current ....Typ. 0.1 μA
- Dropout Voltage ....Typ. 0.20 V (I_{OUT} = 150 mA, V_{OUT} = 2.8 V)
- Ripple Rejection ....Typ. 80 dB (f = 1 kHz)
Typ. 75 dB (f = 10 kHz)
Typ. 65 dB (f = 100 kHz)
- Output Voltage Accuracy.....................................±1.0%
- Output Voltage Temperature Coefficient..............Typ. ±30 ppm/°C
- Line Regulation ....Typ. 0.02%/V
- Packages ....DFN(PL)1010-4, SC-88A, SOT-23-5
- Input Voltage Range ....2.0 V to 5.25 V
- Output Voltage Range..1.2 V to 4.8 V (0.1 V step)
- Short Current Limit...Typ. 40 mA
- Built-in Foldback Protection Circuit
- Output Noise ....Typ. 10 μVrms
- Ceramic capacitors are recommended to be used with this IC .....1.0 μF 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 equipments.
- Power source for electrical home appliances.
- Power source for the portable music player
- Power source for RF module

SELECTION GUIDE

The output voltage, auto-discharge function[1], package for the ICs can be selected at the user's request.

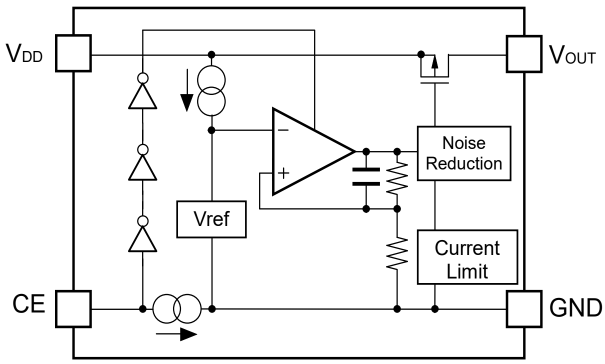
Selection Guide

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP112Kxx1∗-TR	DFN(PL)1010-4	10,000 pcs	Yes	Yes
RP112Qxx2∗-TR-FE	SC-88A	3,000 pcs	Yes	Yes
RP112Nxx1∗-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

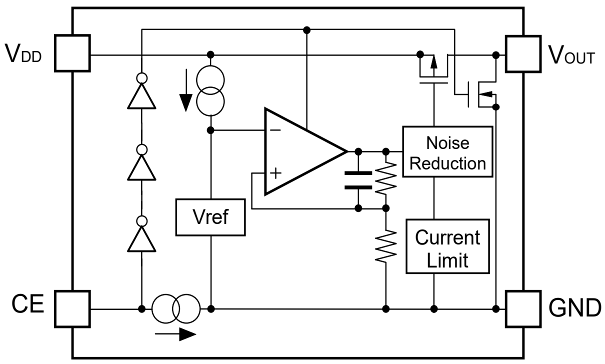
xx: Set output voltage (V_{SET}) is selectable from 1.2 V to 4.8 V in 0.1 V step.
The second decimal point of the voltage is described as below.
1.25 V: RP112x12x∗5
1.85 V: RP112x18x∗5
2.85 V: RP112x28x∗5

∗: Selections of CE pin polarity and Auto-discharge function are as shown below:
(B) CE pin polarity: "H" active, Auto-discharge function: No
(D) CE pin polarity: "H" active, Auto-discharge function: Yes

BLOCK DIAGRAMS



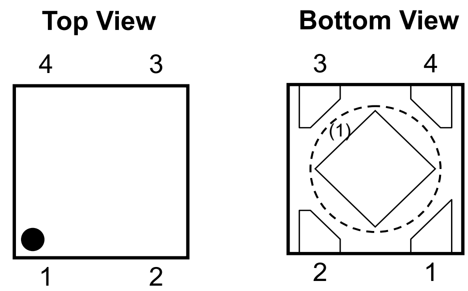
RP112xxxxB Block Diagram



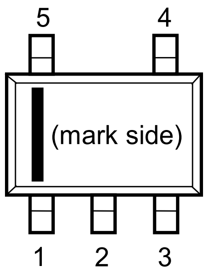
RP112xxxxD Block Diagram

[1] Auto-discharge function quickly lowers the output voltage to 0 V by releasing the electrical charge in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

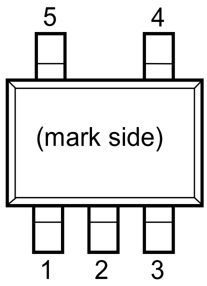
PIN DESCRIPTIONS



DFN(PL)1010-4 Pin Configuration



SC-88A Pin Configuration



SOT-23-5 Pin Configuration

DFN(PL)1010-4 Pin Description

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

SC-88A Pin Description

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

SOT-23-5 Pin Description

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

(1) 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.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item			Rating	Unit
V_{IN}	Input Voltage			6.0	V
V_{CE}	Input Voltage (CE Pin)			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(1)	(DFN(PL)1010-4)	JEDEC STD. 51-7 Test Land Pattern	800	mW
		SC-88A	Standard Test Land Pattern	380	
		SOT-23-5	JEDEC STD. 51-7 Test Land Pattern	660	
Tj	Junction Temperature Range			−40 to 125	C
Tstg	Storage Temperature Range			−55 to 125	°C

ABSOLUTE MAXIMUM RATINGS
Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.0 to 5.25	V
Ta	Operating Temperature	−40 to 85	°C

RECOMMENDED OPERATING CONDITIONS
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.

(1) Refer to *POWEWR DISSIPATION* for detailed information.

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, V_{IN} = 5.25 V (V_{OUT} ≥ 4.1 V), VIN = Set V_{OUT} + 1.0 V (1.5 V < V_{OUT} < 4.1 V), V_{IN} = 2.5 V (V_{OUT} ≤ 1.5 V), I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1.0 μF
The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

RP112xxxxB/D Electrical Characteristics (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{OUT} ≥ 2.0 V	x0.99		x1.01	V
			V_{OUT} < 2.0 V	–20		+20	mV
		−40°C ≤ Ta ≤ 85°C	V_{OUT} ≥ 2.0 V	x0.985		x1.015	V
			V_{OUT} < 2.0 V	−30		+30	mV
I_{OUT}	Output Current			150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	1 mA ≤ I_{OUT} ≤ 150 mA		−14	0	14	mV
V_{DIF}	Dropout Voltage	Refer to *Product-specific Electrical Characteristics*					
I_{SS}	Supply Current	I_{OUT} = 0 mA	V_{OUT} ≥ 4.1 V		80	100	μA
			V_{OUT} < 4.1 V		75		
Istandby	Standby Current	V_{CE} = 0 V			0.1	1.0	μA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set V_{OUT} + 0.3 V ≤ V_{IN} ≤ 5.25 V	V_{OUT} ≥ 4.1 V		0.02	0.10	%/V
		Set V_{OUT} + 0.5 V ≤ V_{IN} ≤ 5.0 V	1.7 V ≤ V_{OUT} < 4.1 V				
		2.2 V ≤ V_{IN} ≤ 5.0 V	V_{OUT} < 1.7 V				
RR	Ripple Rejection	Ripple 0.2 Vp-p, I_{OUT} = 30 mA, V_{IN} = 5.25 V (V_{OUT} ≥ 4.1 V), V_{IN} = Set V_{OUT} + 1.0 V (V_{OUT} < 4.1 V)	f = 1 kHz		80		dB
			f = 10 kHz		75		
			f = 100 kHz		65		
V_{IN}	Input Voltage(1)			2.0		5.25	V
$\Delta V_{OUT}/\Delta Ta$	Output Voltage Temperature Coefficient	−40°C ≤ Ta ≤ 85°C			±30		ppm /°C
I_{SC}	Short Current Limit	V_{OUT} = 0 V			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

All test categories were tested on the products under the pulse load condition (Tj ≈ Ta = 25°C) except Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

(1) The maximum input voltage (Electrical Characteristics) is 5.25 V. If, for any reason the maximum input voltage exceeds 5.25 V, it has to be no more than 5.5 V with 500 hrs of the total operating time.

ELECTRICAL CHARACTERISTICS (continued)

Unless otherwise noted, V_{IN} = 5.25 V (V_{OUT} ≥ 4.1 V), VIN = Set V_{OUT} + 1.0 V (1.5 V < V_{OUT} < 4.1 V), V_{IN} = 2.5 V (V_{OUT} ≤ 1.5 V), I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1.0 μF
The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

RP112xxxxB/D Electrical Characteristics (Ta = 25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
en	Output Noise	BW = 10 Hz to 100 kHz, I_{OUT} = 30 mA		10		μVrms
R_{LOW}	Auto-discharge Nch Tr. ON Resistance (RP112xxxxD only)	V_{IN} = 4.0 V, V_{CE} = 0 V		60		Ω

All test categories were tested on the products under the pulse load condition (Tj ≈ Ta = 25°C) except Output Noise, Ripple Rejection, and Output Voltage Temperature Coefficient.

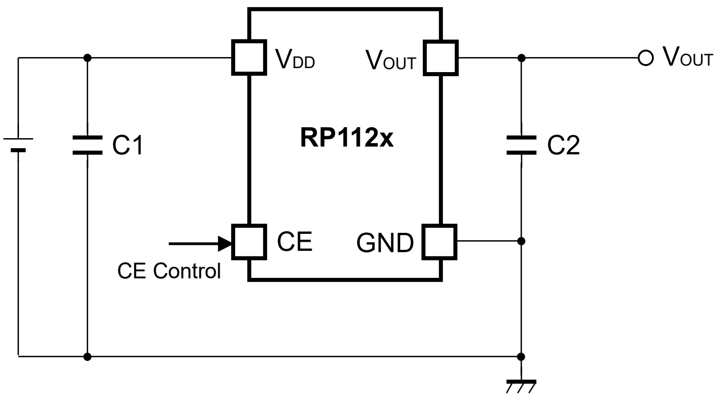
The specifications surrounded by [ ] are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

Product-specific Electrical Characteristics

Product Name	V_{OUT}						V_{DIF}	
	Ta = 25°C			−40°C ≤ Ta ≤ 85°C			Ta = 25°C	
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP112x12xx	1.180	1.20	1.220	1.170	1.20	1.230	0.39	0.80
RP112x12xx5	1.230	1.25	1.270	1.220	1.25	1.280	0.39	0.80
RP112x13xx	1.280	1.30	1.320	1.270	1.30	1.330	0.37	0.70
RP112x14xx	1.380	1.40	1.420	1.370	1.40	1.430	0.34	0.60
RP112x15xx	1.480	1.50	1.520	1.470	1.50	1.530	0.32	0.50
RP112x16xx	1.580	1.60	1.620	1.570	1.60	1.630	0.32	0.50
RP112x17xx	1.680	1.70	1.720	1.670	1.70	1.730	0.29	0.41
RP112x18xx	1.780	1.80	1.820	1.770	1.80	1.830	0.29	0.41
RP112x18xx5	1.830	1.85	1.870	1.820	1.85	1.880	0.29	0.41
RP112x19xx	1.880	1.90	1.920	1.870	1.90	1.930	0.29	0.41
RP112x20xx	1.980	2.00	2.020	1.970	2.00	2.030	0.25	0.36
RP112x21xx	2.079	2.10	2.121	2.069	2.10	2.132	0.25	0.36
RP112x22xx	2.178	2.20	2.222	2.167	2.20	2.233	0.25	0.36
RP112x23xx	2.277	2.30	2.323	2.266	2.30	2.335	0.25	0.36
RP112x24xx	2.376	2.40	2.424	2.364	2.40	2.436	0.25	0.36
RP112x25xx	2.475	2.50	2.525	2.463	2.50	2.538	0.22	0.31
RP112x26xx	2.574	2.60	2.626	2.561	2.60	2.639	0.22	0.31
RP112x27xx	2.673	2.70	2.727	2.660	2.70	2.741	0.22	0.31
RP112x28xx	2.772	2.80	2.828	2.758	2.80	2.842	0.20	0.28
RP112x28xx5	2.822	2.85	2.879	2.807	2.85	2.893	0.20	0.28
RP112x29xx	2.871	2.90	2.929	2.857	2.90	2.944	0.20	0.28
RP112x29xx5	2.921	2.95	2.980	2.906	2.95	2.994	0.20	0.28
RP112x30xx	2.970	3.00	3.030	2.955	3.00	3.045	0.20	0.28
RP112x31xx	3.069	3.10	3.131	3.054	3.10	3.147	0.20	0.28
RP112x31xx5	3.119	3.15	3.182	3.103	3.15	3.197	0.20	0.28
RP112x32xx	3.168	3.20	3.232	3.152	3.20	3.248	0.20	0.28
RP112x33xx	3.267	3.30	3.333	3.251	3.30	3.350	0.20	0.28
RP112x34xx	3.366	3.40	3.434	3.349	3.40	3.451	0.20	0.28
RP112x35xx	3.465	3.50	3.535	3.448	3.50	3.553	0.20	0.28
RP112K35xx5	3.515	3.55	3.586	3.497	3.55	3.603	0.20	0.28
RP112x36xx	3.564	3.60	3.636	3.546	3.60	3.654	0.20	0.28
RP112x37xx	3.663	3.70	3.737	3.645	3.70	3.756	0.20	0.28
RP112x38xx	3.762	3.80	3.838	3.743	3.80	3.857	0.20	0.28
RP112x39xx	3.861	3.90	3.939	3.842	3.90	3.959	0.20	0.28
RP112x40xx	3.960	4.00	4.040	3.940	4.00	4.060	0.20	0.28
RP112x41xx	4.059	4.10	4.141	4.039	4.10	4.162	0.20	0.28
RP112x42xx	4.158	4.20	4.242	4.137	4.20	4.263	0.20	0.28
RP112x43xx	4.257	4.30	4.343	4.236	4.30	4.365	0.20	0.28
RP112x44xx	4.356	4.40	4.444	4.334	4.40	4.466	0.20	0.28
RP112x45xx	4.455	4.50	4.545	4.433	4.50	4.568	0.20	0.28
RP112x46xx	4.554	4.60	4.646	4.531	4.60	4.669	0.20	0.28
RP112x47xx	4.653	4.70	4.747	4.630	4.70	4.771	0.20	0.28
RP112x48xx	4.752	4.80	4.848	4.728	4.80	4.872	0.20	0.28

APPLICATION INFORMATION

TYPICAL APPLICATIONS



External Components

Symbol	Description
C1 (C_{IN})	1.0 μF, Ceramic Capacitor, GRM155B31A105KE15, MURATA
C2 (C_{OUT})	1.0 μF, Ceramic Capacitor, GRM155B31A105KE15, MURATA

TECHNICAL NOTES

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 1.0 μF or more capacitor C2.
In case of using a tantalum capacitor, the output may be unstable due to inappropriate ESR. Therefore, the full range of operating conditions for the capacitor in the application should be considered.

PCB Layout

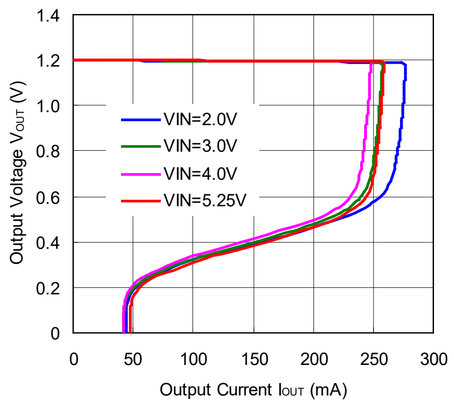
The high impedances of V_{DD} and GND could be a reason for the noise pickup and unstable operation. Therefore, it is imperative that the impedances of V_{DD} and GND be the lowest possible. Also, place a 1.0 μF or more capacitor (C1) between V_{DD} pin and GND pin as close as possible to each other.
As for C2 output capacitor that is used for phase compensation, place it between V_{OUT} pin and GND as close as possible to each other (Refer to *TYPICAL APPLICATIONS*).

TYPICAL CHARACTERISTICS

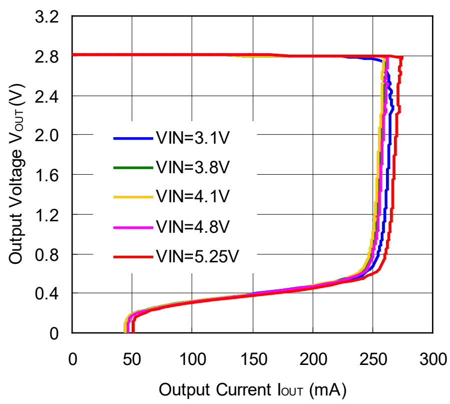
Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Output Voltage vs. Output Current (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, Ta = 25°C)

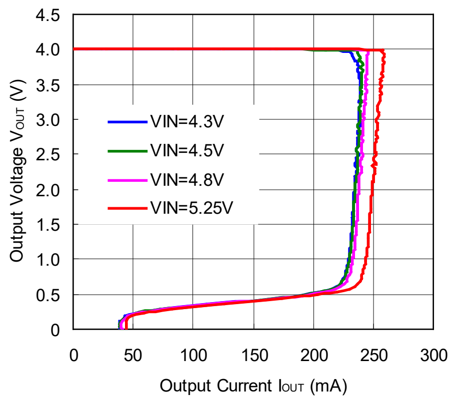
RP112x12xx



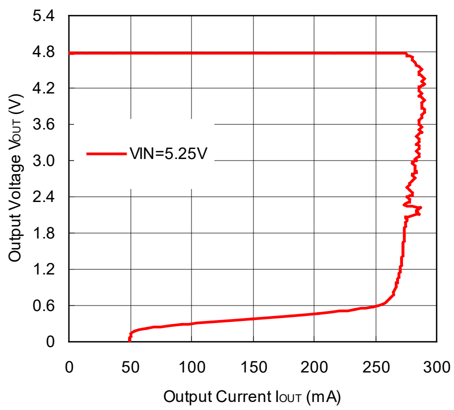
RP112x28xx



RP112x40xx

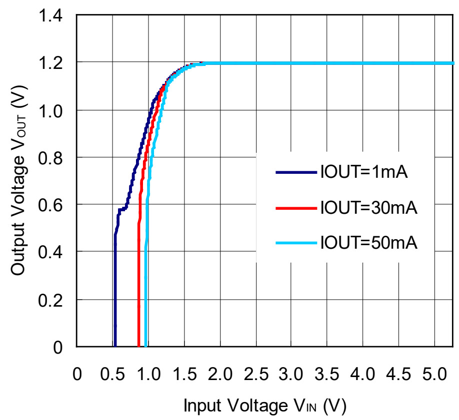


RP112x48xx

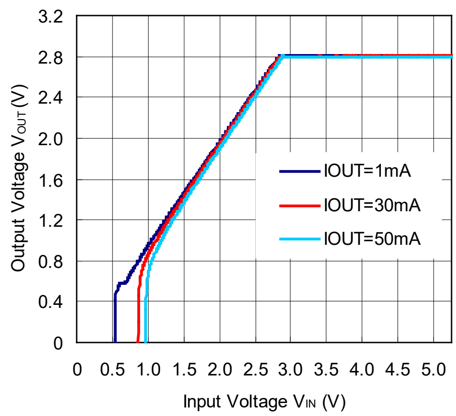


2) Output Voltage vs. Input Voltage (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, Ta = 25°C)

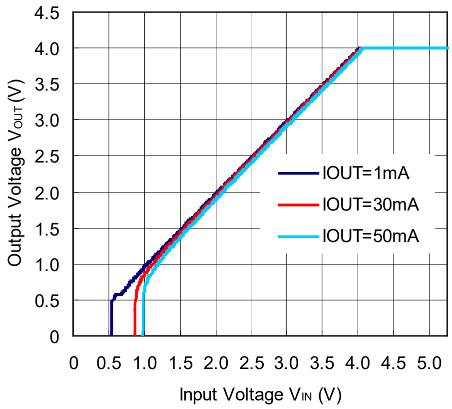
RP112x12xx



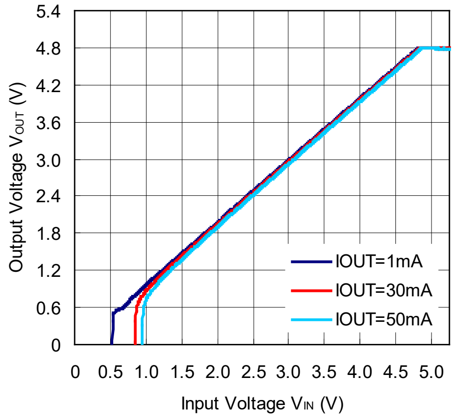
RP112x28xx



RP112x40xx

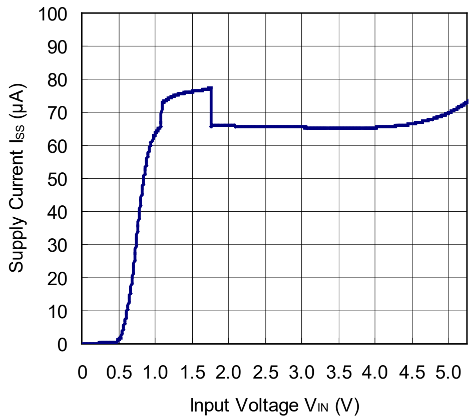


RP112x48xx

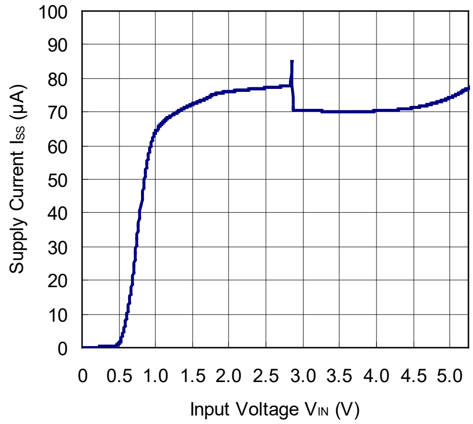


3) Supply Current vs. Input Voltage (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF, Ta = 25°C)

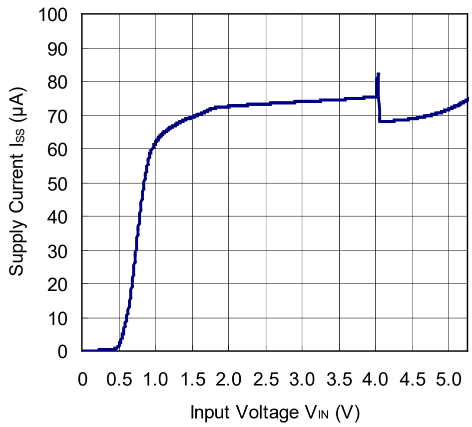
RP112x12xx



RP112x28xx



RP112x40xx



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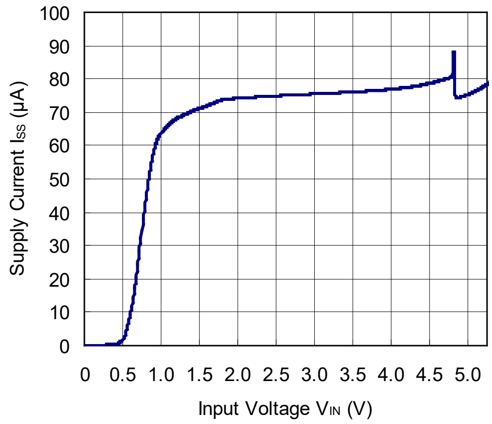
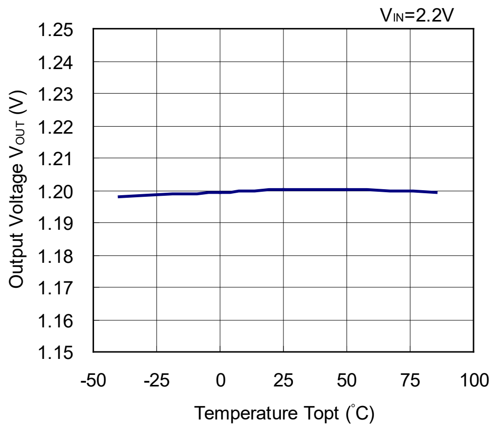
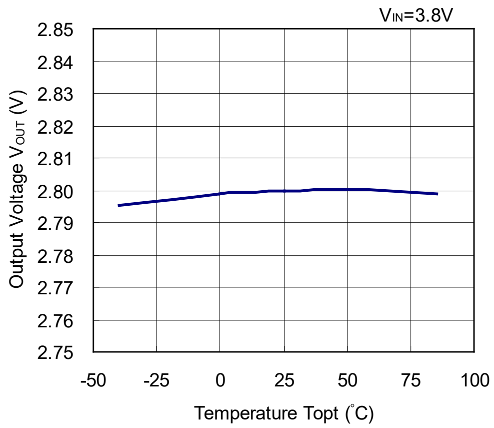


4) Output Voltage vs. Temperature (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF, I_{OUT} = 1 mA)

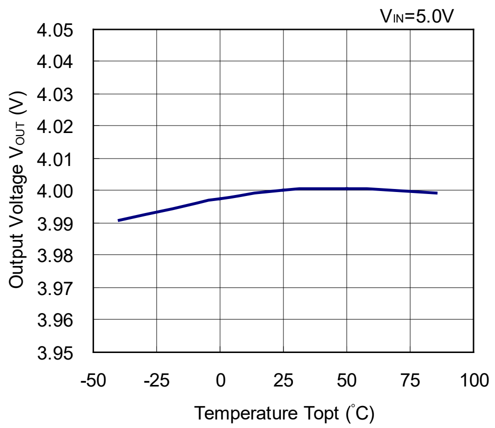
RP112x12xx



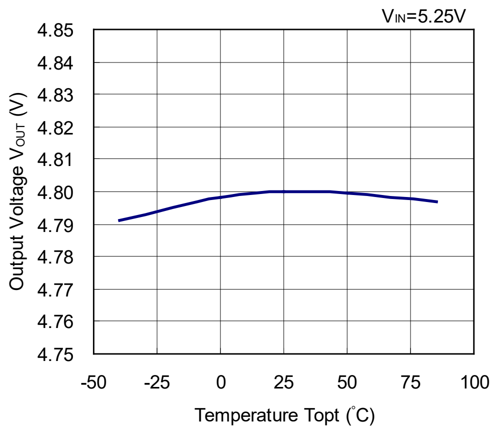
RP112x28xx



RP112x40xx

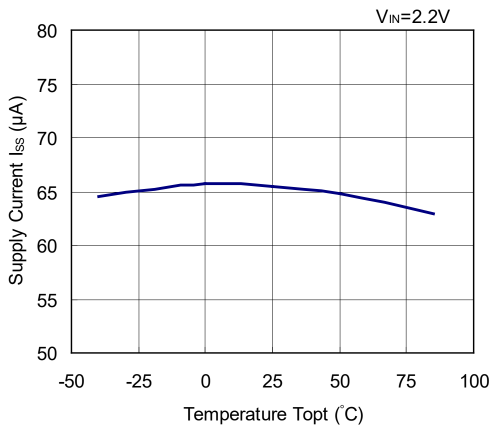


RP112x48xx

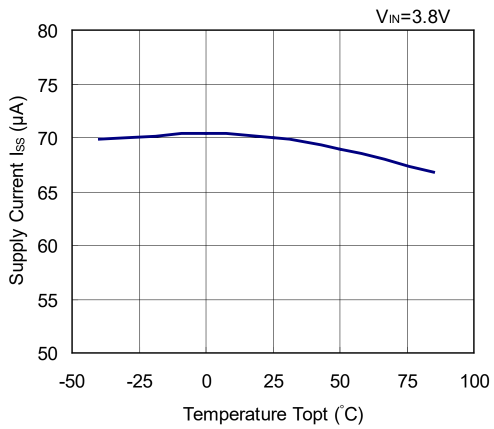


5) Supply Current vs. Temperature (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF, I_{OUT} = 0 mA)

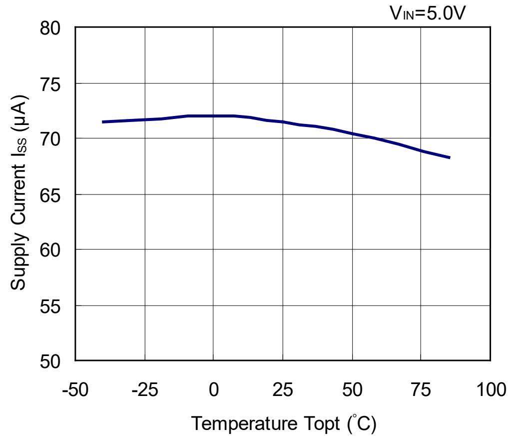
RP112x12xx



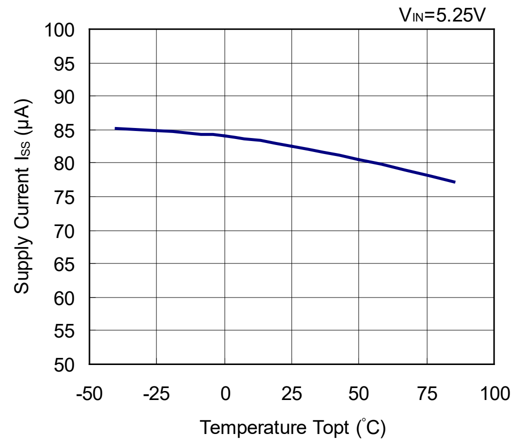
RP112x28xx



RP112x40xx

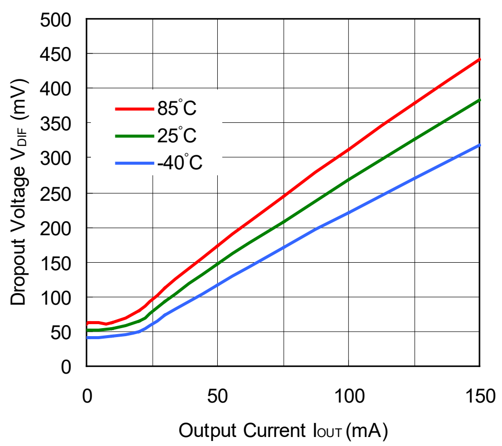


RP112x48xx

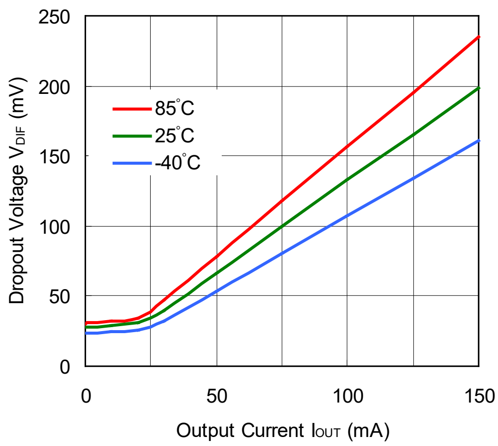


6) Dropout Voltage vs. Output Current (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF)

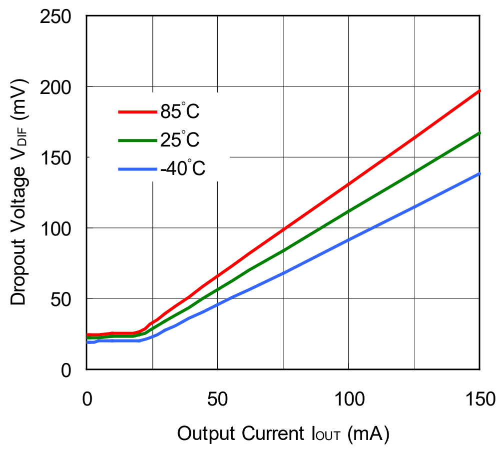
RP112x12xx



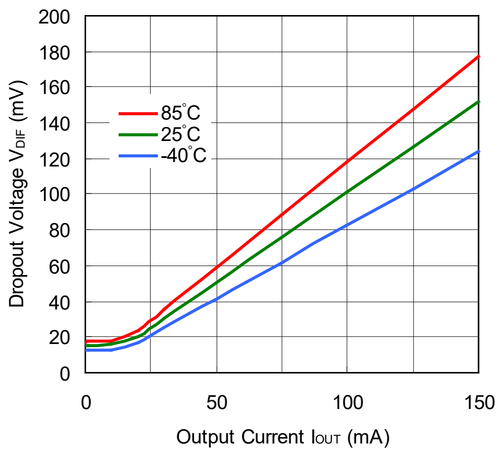
RP112x28xx



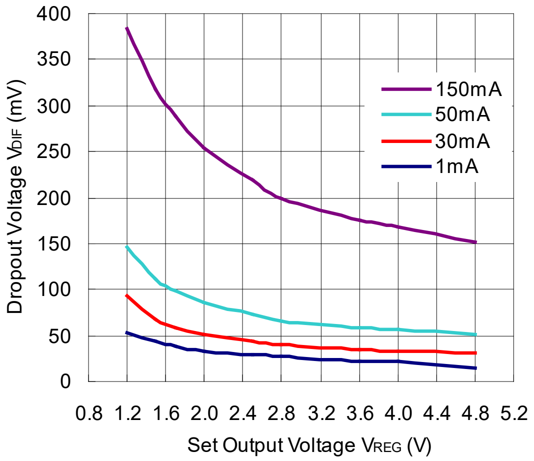
RP112x40xx



RP112x48xx

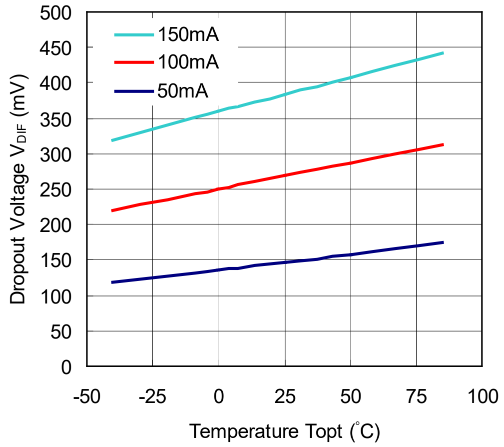


7) Dropout Voltage vs. Set Output Voltage (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF, Ta = 25°C)



8) Dropout Voltage vs. Temperature (C1 = Ceramic 1.0 μF, C2 = Ceramic 1.0 μF)

RP112x12xx



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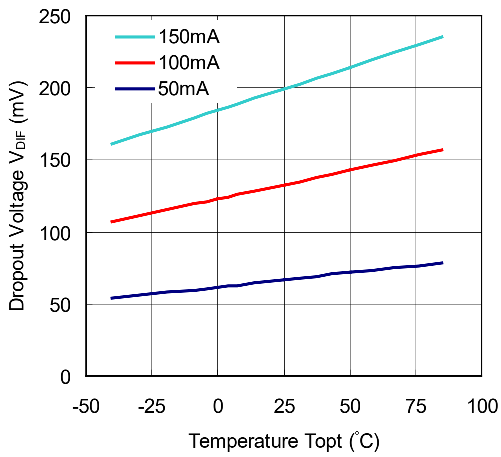

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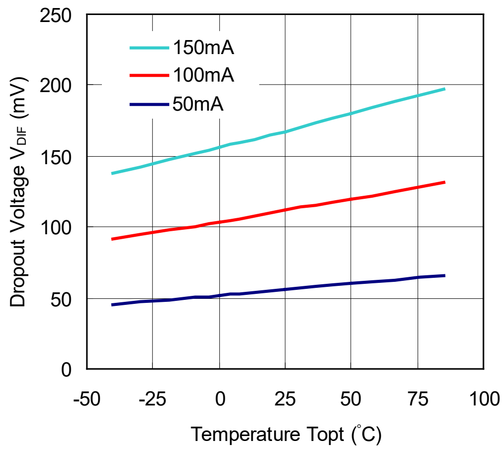

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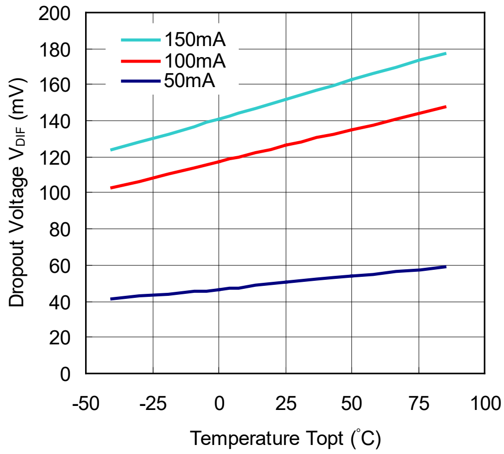
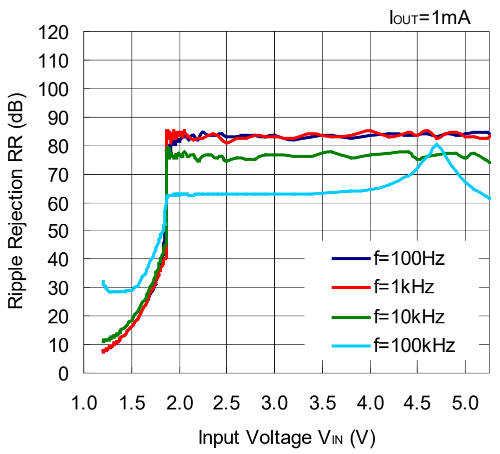
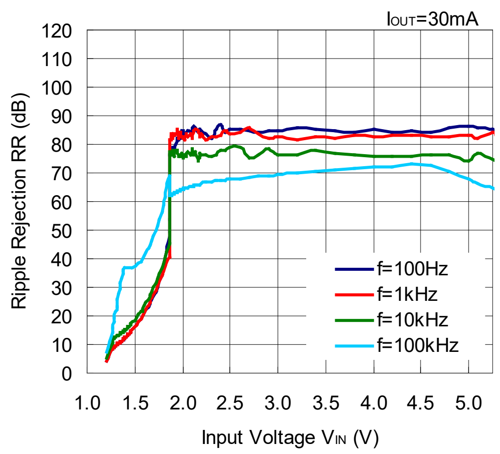


9) Ripple Rejection vs. Input Voltage (C1 = none, C2 = Ceramic 1.0 μF, Ripple = 0.2 Vp-p, Ta = 25°C)

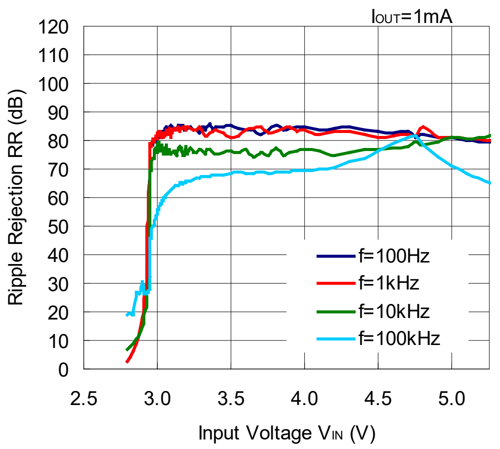
RP112x12xx



RP112x12xx



RP112x28xx



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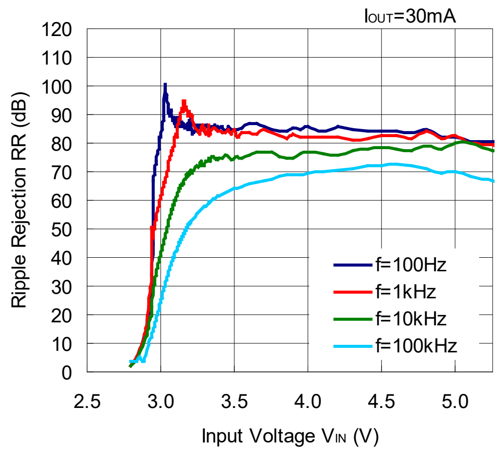

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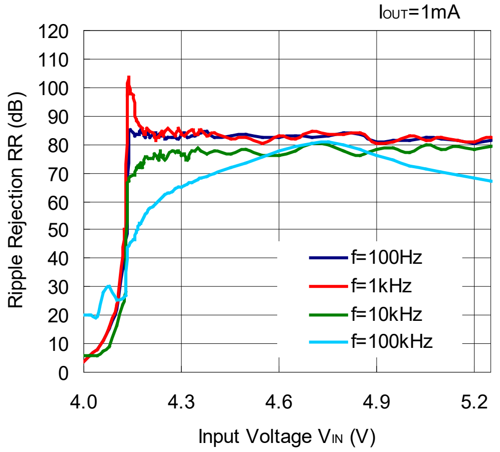
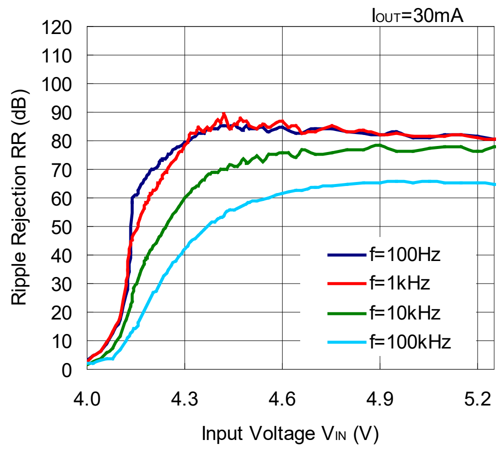
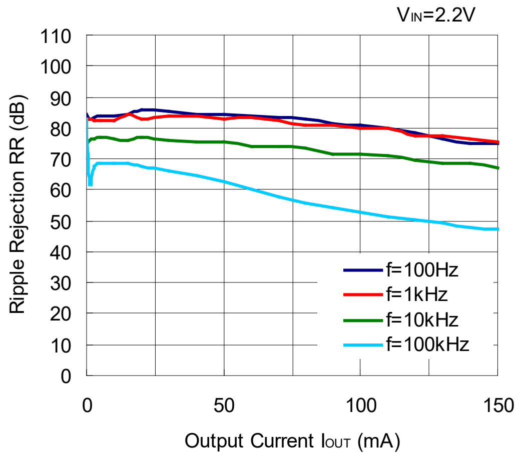


RP112x40xx

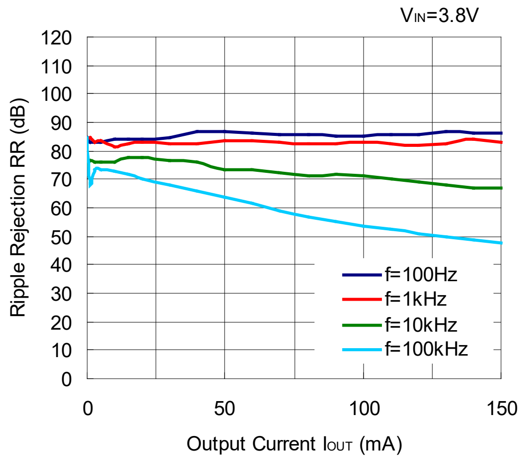


10) Ripple Rejection vs. Output Current (C1 = none, C2 = Ceramic 1.0μF, Ripple = 0.2 Vp-p, Ta = 25°C)

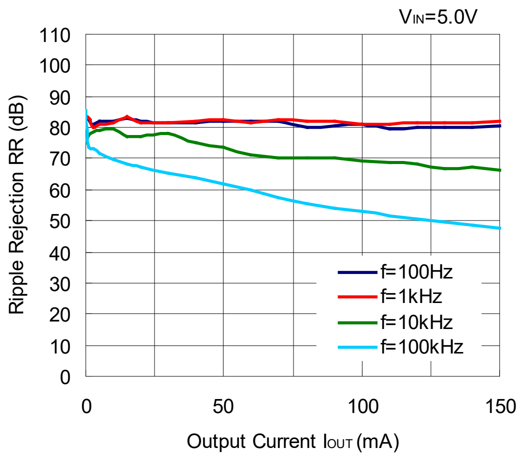
RP112x12xx



RP112x28xx

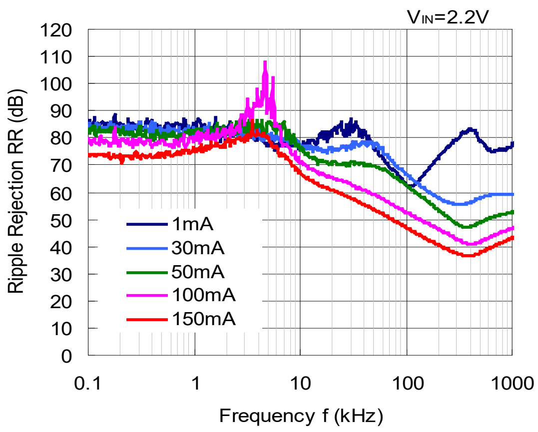


RP112x40xx

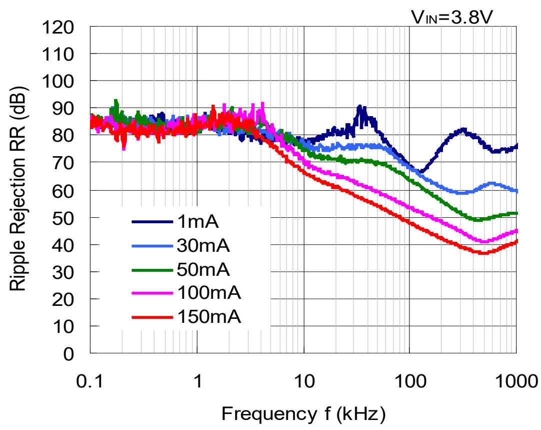


11) Ripple Rejection vs. Frequency (C1 = none, C2 = Ceramic 1.0 μF, Ripple = 0.2 Vp-p, Ta = 25°C)

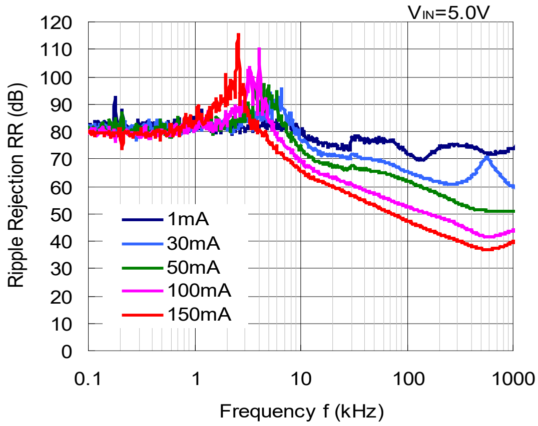
RP112x12xx



RP112x28xx

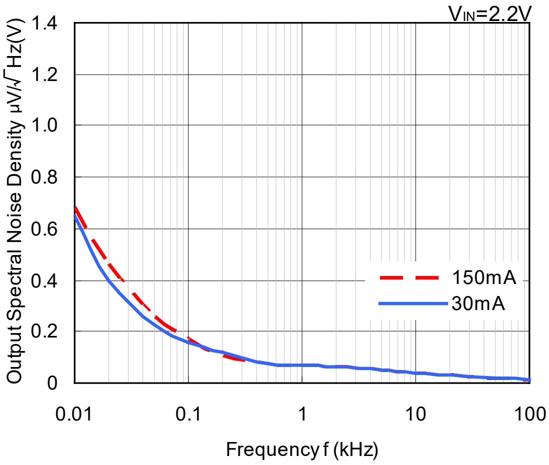


RP112x40xx

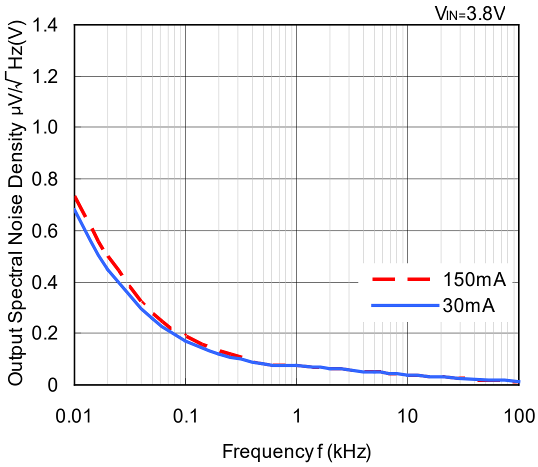


12) Output Spectral Noise Density vs. Frequency (C1 = none, C2 = Ceramic 1.0 μF, Ta = 25°C)

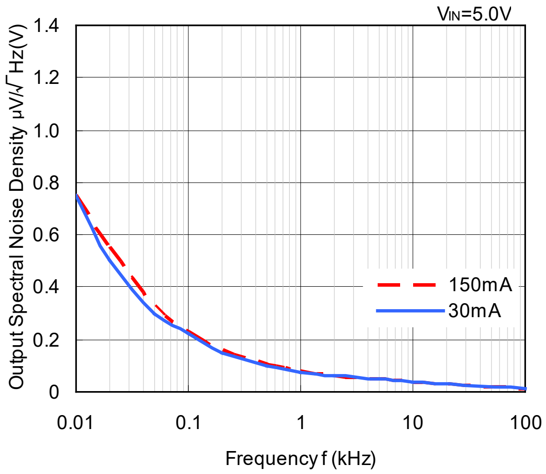
RP112x12xx



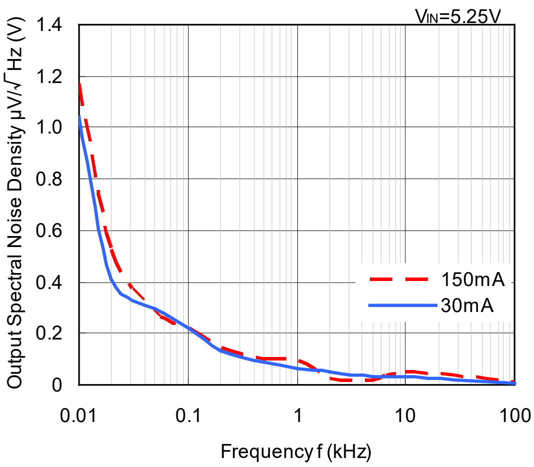
RP112x28xx



RP112x40xx

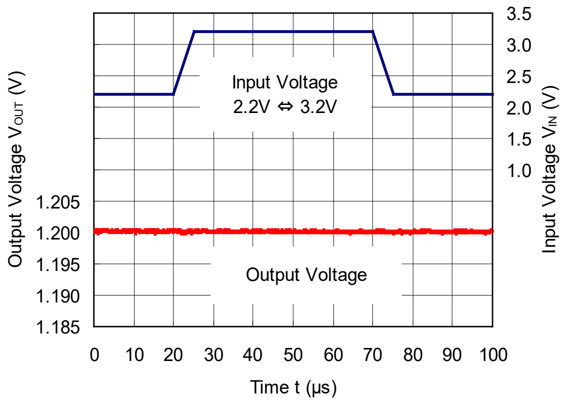


RP112x48xx

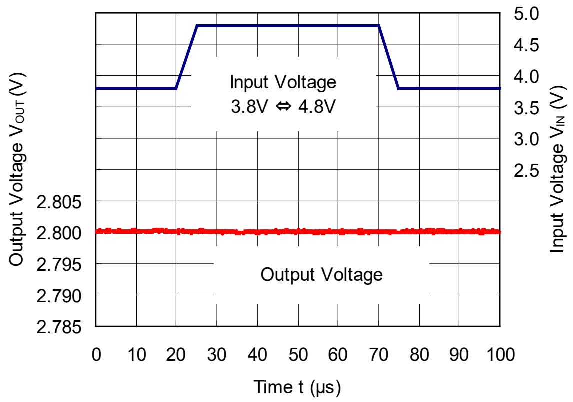


13) Input Transient Response (C1 = none, C2 = Ceramic 1.0 µF, I_{OUT} = 30mA, tr = tf = 5.0 µs, Ta = 25°C)

RP112x12xx



RP112x28xx



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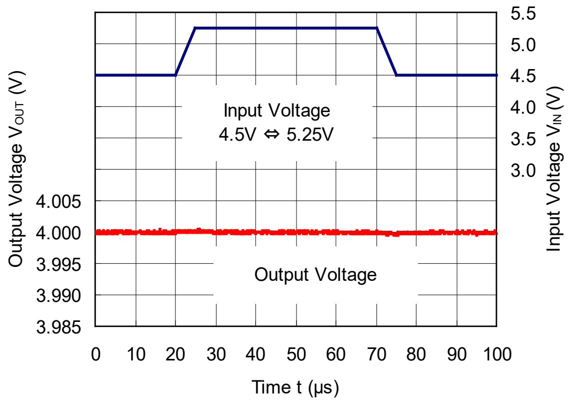
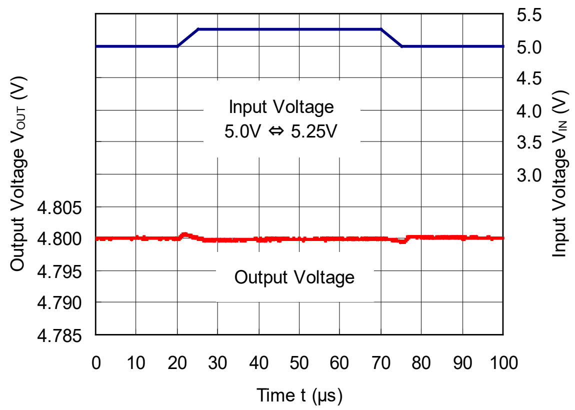
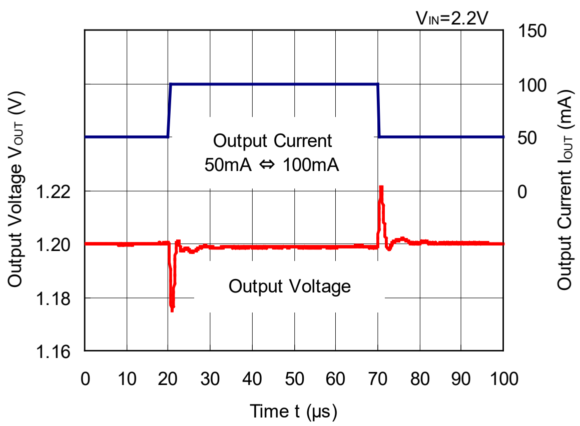


RP112x48xx

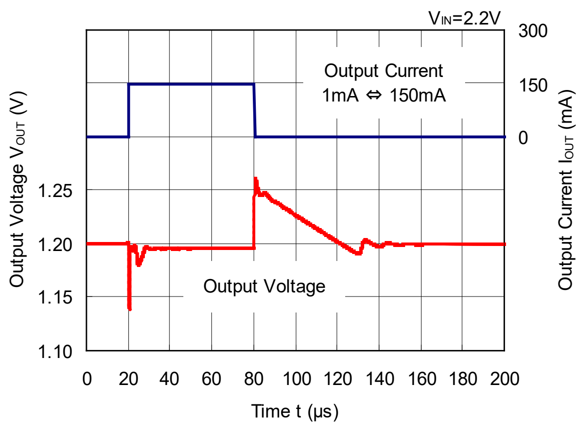


14) Load Transient Response (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, tr = tf = 0.5 µs, Ta = 25°C)

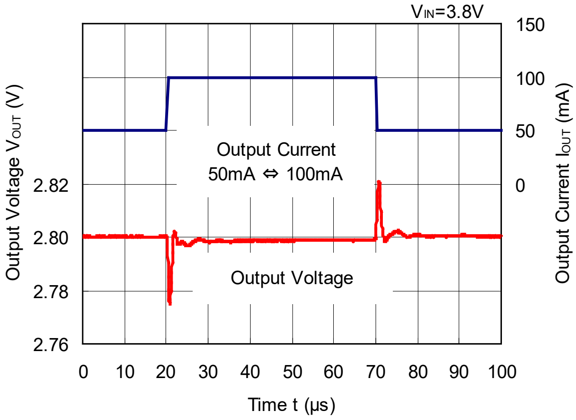
RP112x12xx



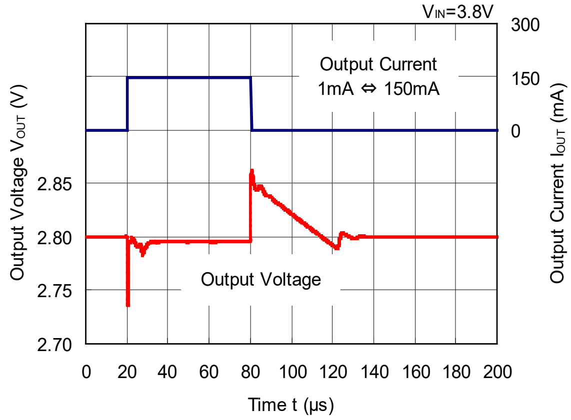
RP112x12xx



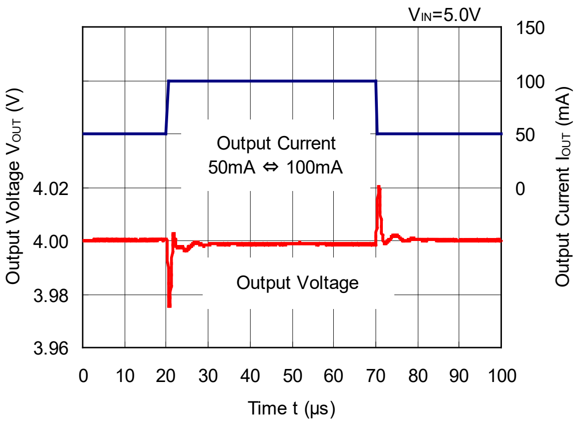
RP112x28xx



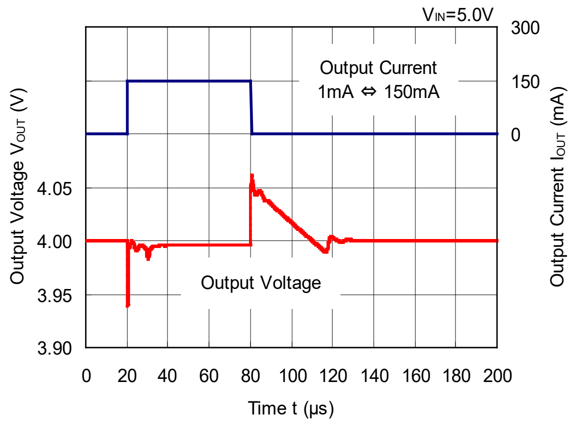
RP112x28xx



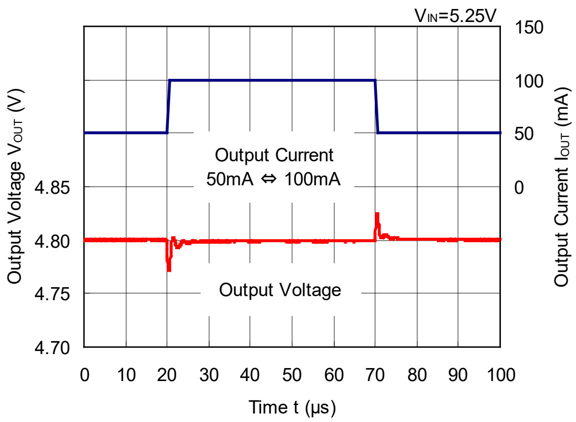
RP112x40xx



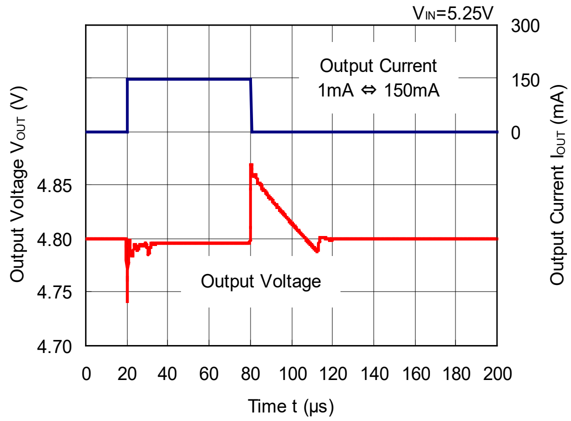
RP112x40xx



RP112x48xx

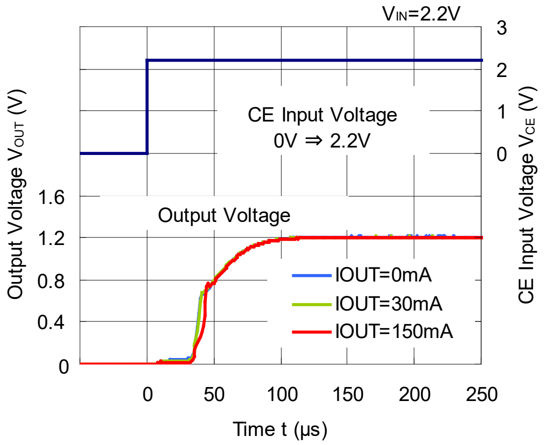


RP112x48xx

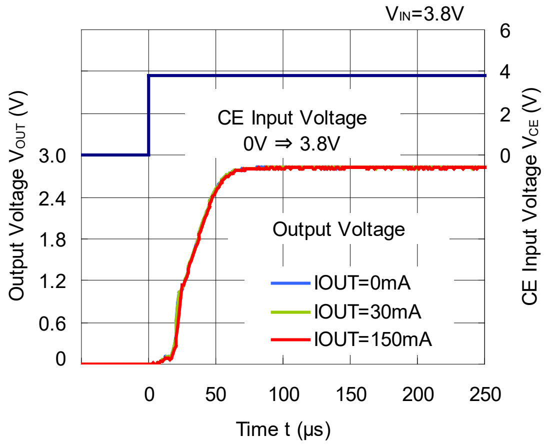


15) Turn on Speed with CE pin (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, Ta = 25°C)

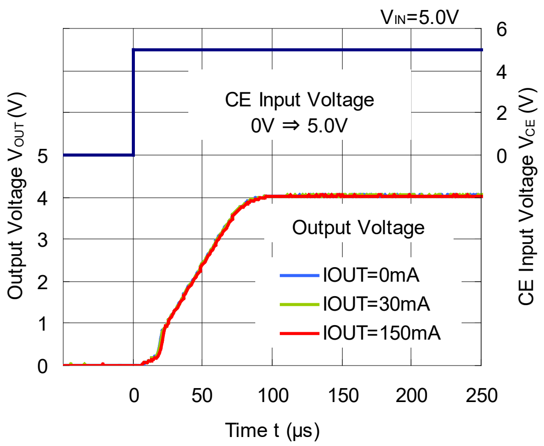
RP112x12xx



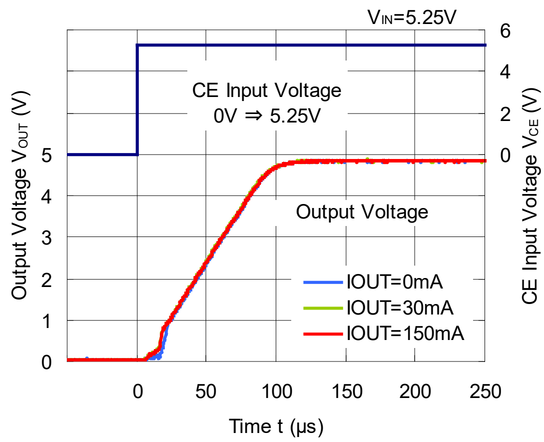
RP112x28xx



RP112x40xx

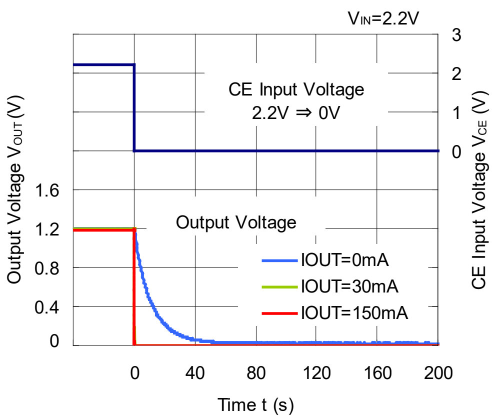


RP112x48xx

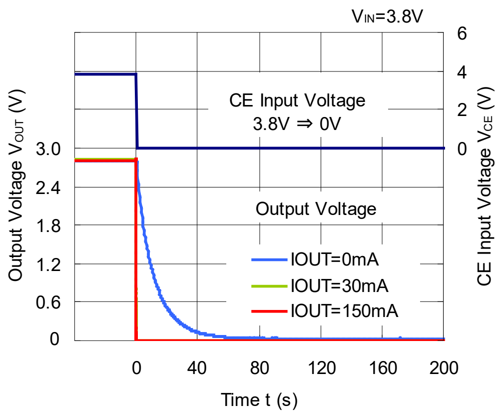


16) Turn off Speed with CE pin (RP112xxxxB) (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, Ta = 25°C)

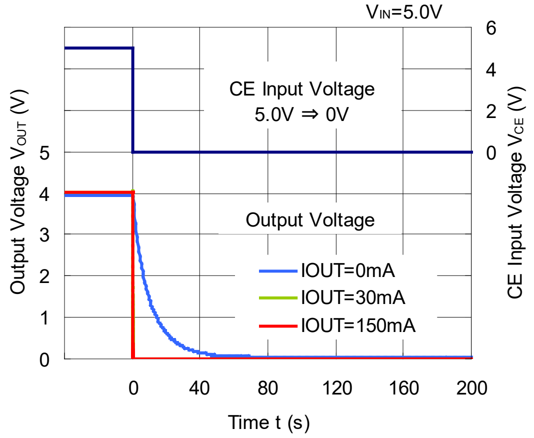
RP112x12xx



RP112x28xx

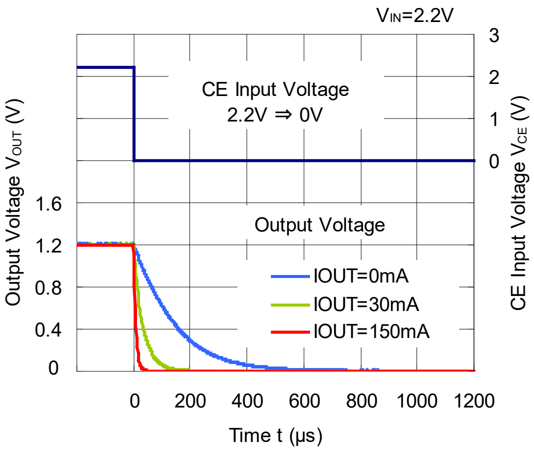


RP112x40xB

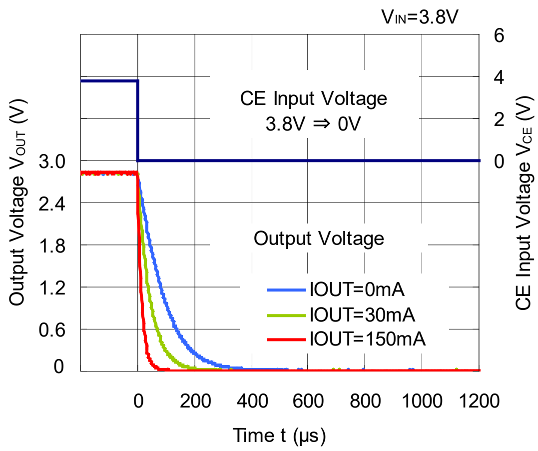


17) Turn off Speed with CE pin (RP112xxxxD) (C1 = Ceramic 1.0 µF, C2 = Ceramic 1.0 µF, Ta = 25°C)

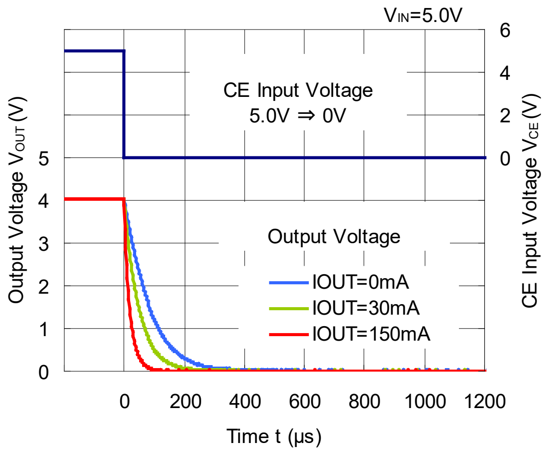
RP112x12xD



RP112x28xD

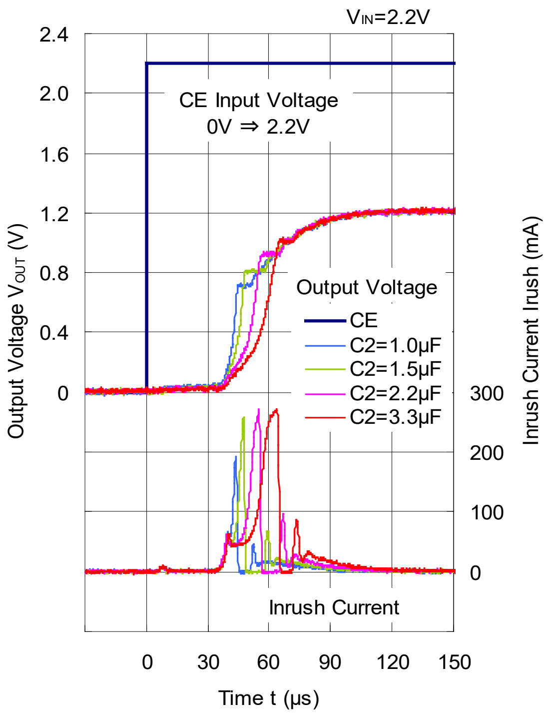


RP112x40xD

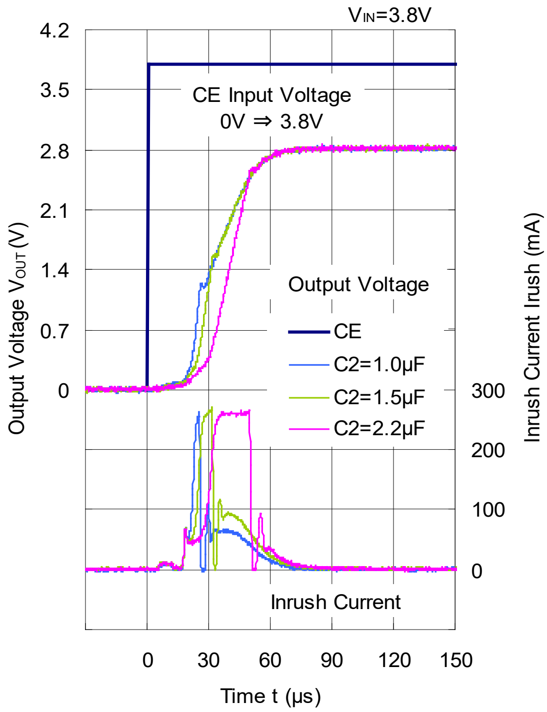


18) Inrush Current (C1 = Ceramic 1.0 µF, I_{OUT} = 0 mA, Ta = 25°C)

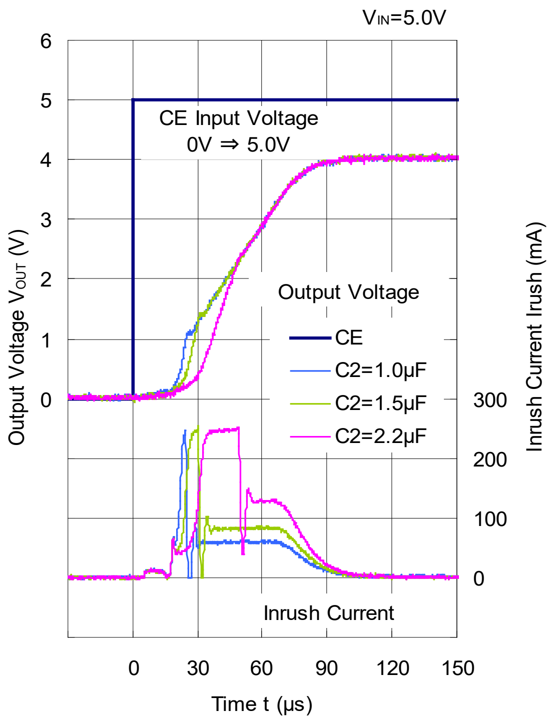
RP112x12xx



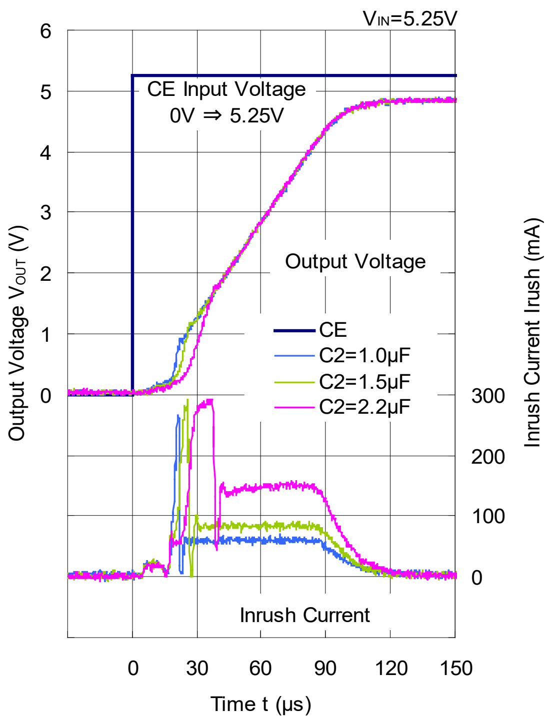
RP112x28xx



RP112x40xx



RP112x48xx



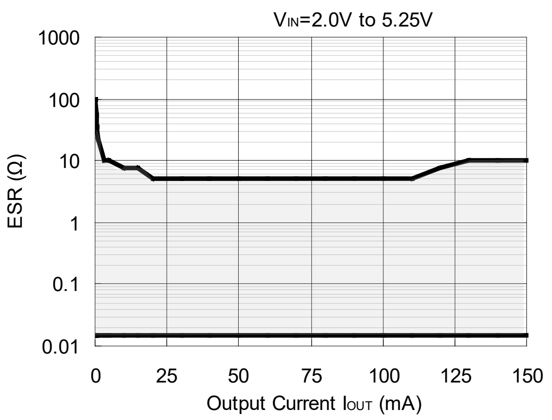
Equivalent Series Resistance vs. Output Current

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

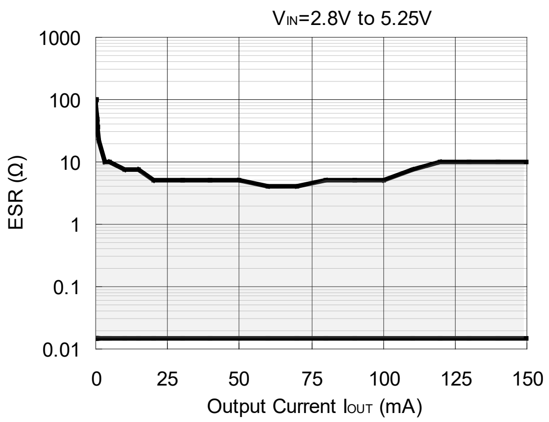
Measurement Conditions

Frequency Band: 10 Hz to 2 MHz
Temperature: −40°C to 85°C
Hatched Area: Noise level is under 40 μV (Avg.)
C1, C2: 1.0 μF or more

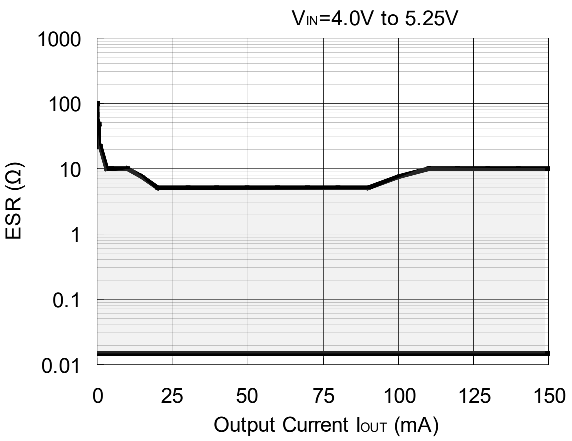
RP112x12xx



RP112x28xx



RP112x40xx



PD-DFN(PL)1010-4-(85125150)-JE-B

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions.
The following measurement conditions are based on JEDEC STD. 51.

Measurement Conditions

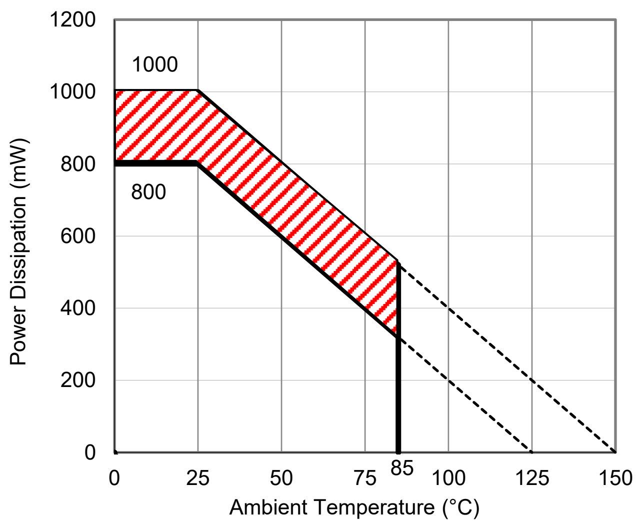
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 21 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

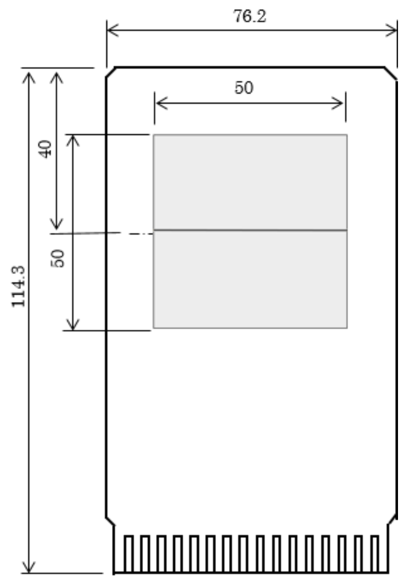
Item	Measurement Result
Power Dissipation	800 mW
Thermal Resistance (θja)	θja = 125°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 58°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



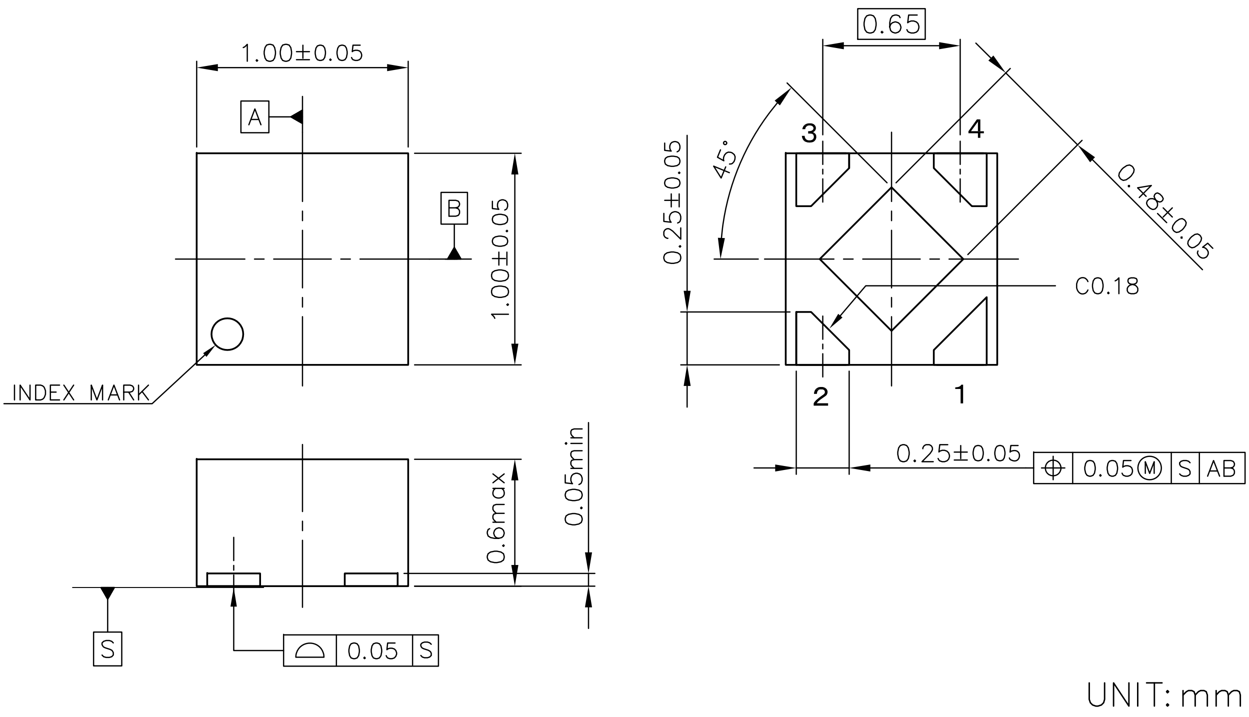
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

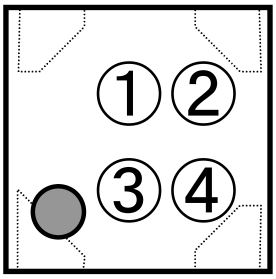
Total Hours of Use	Total Years of Use (4 hours/day)
13,000 hours	9 years



DFN(PL)1010-4 Package Dimensions

①②: Product Code ··· Refer to *Part Marking List*

③④: Lot Number ··· Alphanumeric Serial Number



DFN(PL)1010-4 Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

Part Marking List

RP112Kxx1B

Product Name	①	②
RP112K121B	1	A
RP112K121B5	1	B
RP112K131B	1	C
RP112K141B	1	D
RP112K151B	1	E
RP112K161B	1	F
RP112K171B	1	G
RP112K181B	1	H
RP112K181B5	1	J
RP112K191B	1	K
RP112K201B	1	L
RP112K211B	1	M
RP112K221B	1	N
RP112K231B	1	P
RP112K241B	1	Q
RP112K251B	1	R
RP112K261B	1	S
RP112K271B	1	T
RP112K281B	1	U
RP112K281B5	1	V
RP112K291B	1	W
RP112K301B	1	X
RP112K311B	1	Y
RP112K321B	1	Z
RP112K331B	2	A
RP112K341B	2	B
RP112K351B	2	C
RP112K361B	2	D
RP112K371B	2	E
RP112K381B	2	F
RP112K391B	2	G
RP112K401B	2	H
RP112K411B	2	J
RP112K421B	2	K
RP112K431B	2	L
RP112K441B	2	M
RP112K451B	2	N
RP112K461B	2	P
RP112K471B	2	Q
RP112K481B	2	R
RP112K351B5	2	S

RP112Kxx1D

Product Name	①	②
RP112K121D	3	A
RP112K121D5	3	B
RP112K131D	3	C
RP112K141D	3	D
RP112K151D	3	E
RP112K161D	3	F
RP112K171D	3	G
RP112K181D	3	H
RP112K181D5	3	J
RP112K191D	3	K
RP112K201D	3	L
RP112K211D	3	M
RP112K221D	3	N
RP112K231D	3	P
RP112K241D	3	Q
RP112K251D	3	R
RP112K261D	3	S
RP112K271D	3	T
RP112K281D	3	U
RP112K281D5	3	V
RP112K291D	3	W
RP112K301D	3	X
RP112K311D	3	Y
RP112K321D	3	Z
RP112K331D	4	A
RP112K341D	4	B
RP112K351D	4	C
RP112K361D	4	D
RP112K371D	4	E
RP112K381D	4	F
RP112K391D	4	G
RP112K401D	4	H
RP112K411D	4	J
RP112K421D	4	K
RP112K431D	4	L
RP112K441D	4	M
RP112K451D	4	N
RP112K461D	4	P
RP112K471D	4	Q
RP112K481D	4	R
RP112K291D5	4	S
RP112K311D5	4	T
RP112K351D5	4	V

PD-SC-88A-(85125150)-JE-A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following conditions are used in this measurement.

Measurement Conditions

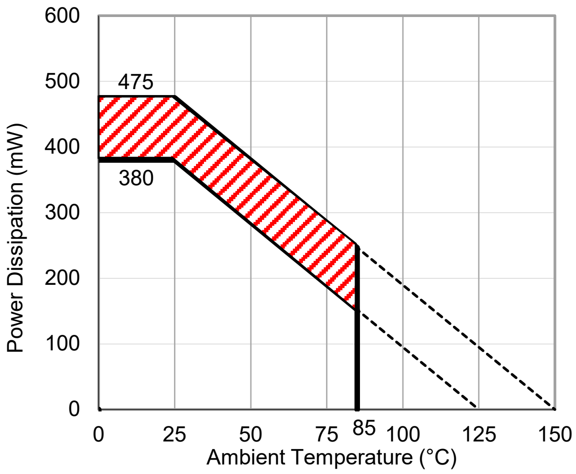
Item	Standard Test Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-Sided Board)
Board Dimensions	40 mm × 40 mm × 1.6 mm
Copper Ratio	Top Side: Approx. 50% Bottom Side: Approx. 50%
Through-holes	ϕ 0.5 mm × 44 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

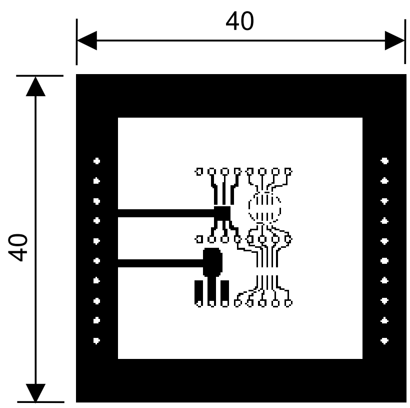
Item	Standard Test Land Pattern
Power Dissipation	380 mW
Thermal Resistance (θja)	θja = 263°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 75°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



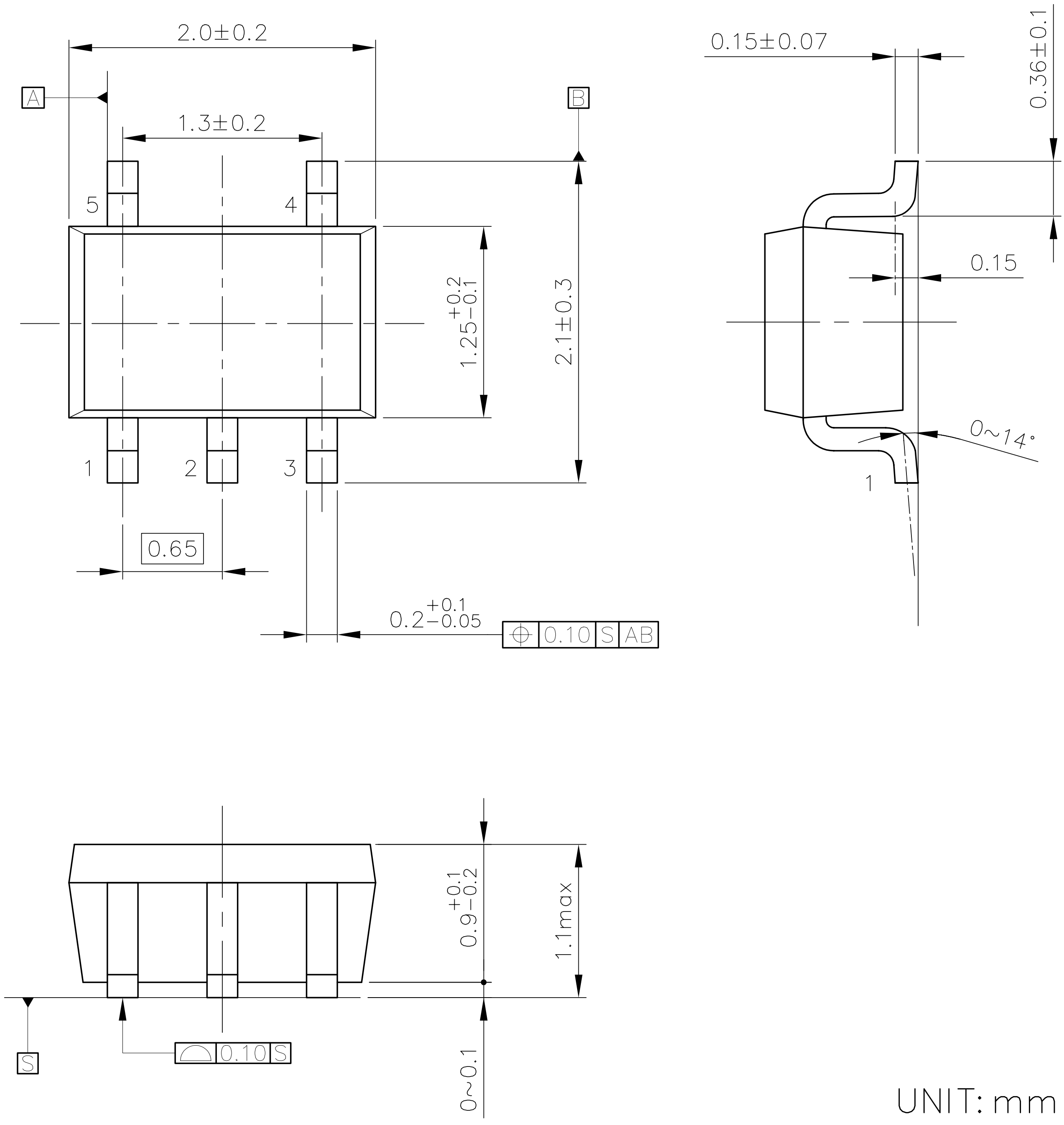
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

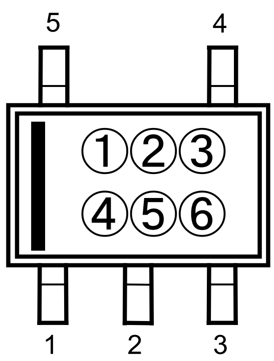
The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

Total Hours of Use	Total Years of Use (4 hours/day)
13,000 hours	9 years



SC-88A Package Dimensions

①②③④: Product Code ··· Refer to *Part Marking List*
⑤⑥: Lot Number ··· Alphanumeric Serial Number



SC-88A Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

Part Marking List

RP112Qxx2B

Product Name	①	②	③	④
RP112Q122B	A	U	1	2
RP112Q132B	A	U	1	3
RP112Q142B	A	U	1	4
RP112Q152B	A	U	1	5
RP112Q162B	A	U	1	6
RP112Q172B	A	U	1	7
RP112Q182B	A	U	1	8
RP112Q192B	A	U	1	9
RP112Q202B	A	U	2	0
RP112Q212B	A	U	2	1
RP112Q222B	A	U	2	2
RP112Q232B	A	U	2	3
RP112Q242B	A	U	2	4
RP112Q252B	A	U	2	5
RP112Q262B	A	U	2	6
RP112Q272B	A	U	2	7
RP112Q282B	A	U	2	8
RP112Q292B	A	U	2	9
RP112Q302B	A	U	3	0
RP112Q312B	A	U	3	1
RP112Q322B	A	U	3	2
RP112Q332B	A	U	3	3
RP112Q342B	A	U	3	4
RP112Q352B	A	U	3	5
RP112Q362B	A	U	3	6
RP112Q372B	A	U	3	7
RP112Q382B	A	U	3	8
RP112Q392B	A	U	3	9
RP112Q402B	A	U	4	0
RP112Q412B	A	U	4	1
RP112Q422B	A	U	4	2
RP112Q432B	A	U	4	3
RP112Q442B	A	U	4	4
RP112Q452B	A	U	4	5
RP112Q462B	A	U	4	6
RP112Q472B	A	U	4	7
RP112Q482B	A	U	4	8
RP112Q122B5	A	U	0	1
RP112Q182B5	A	U	0	2
RP112Q282B5	A	U	0	3

RP112Qxx2D

Product Name	①	②	③	④
RP112Q122D	A	V	1	2
RP112Q132D	A	V	1	3
RP112Q142D	A	V	1	4
RP112Q152D	A	V	1	5
RP112Q162D	A	V	1	6
RP112Q172D	A	V	1	7
RP112Q182D	A	V	1	8
RP112Q192D	A	V	1	9
RP112Q202D	A	V	2	0
RP112Q212D	A	V	2	1
RP112Q222D	A	V	2	2
RP112Q232D	A	V	2	3
RP112Q242D	A	V	2	4
RP112Q252D	A	V	2	5
RP112Q262D	A	V	2	6
RP112Q272D	A	V	2	7
RP112Q282D	A	V	2	8
RP112Q292D	A	V	2	9
RP112Q302D	A	V	3	0
RP112Q312D	A	V	3	1
RP112Q322D	A	V	3	2
RP112Q332D	A	V	3	3
RP112Q342D	A	V	3	4
RP112Q352D	A	V	3	5
RP112Q362D	A	V	3	6
RP112Q372D	A	V	3	7
RP112Q382D	A	V	3	8
RP112Q392D	A	V	3	9
RP112Q402D	A	V	4	0
RP112Q412D	A	V	4	1
RP112Q422D	A	V	4	2
RP112Q432D	A	V	4	3
RP112Q442D	A	V	4	4
RP112Q452D	A	V	4	5
RP112Q462D	A	V	4	6
RP112Q472D	A	V	4	7
RP112Q482D	A	V	4	8
RP112Q122D5	A	V	0	1
RP112Q182D5	A	V	0	2
RP112Q282D5	A	V	0	3

PD-SOT-23-5-(85/125/150)-JE-A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

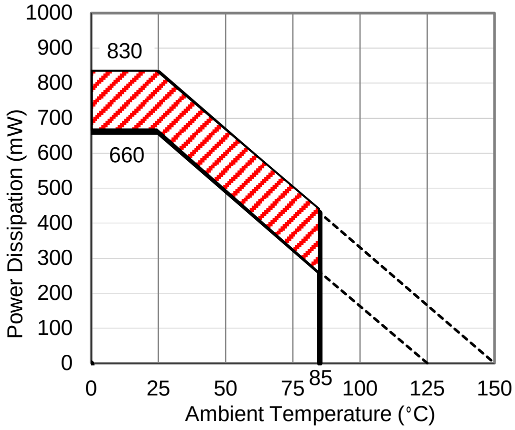
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 7 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

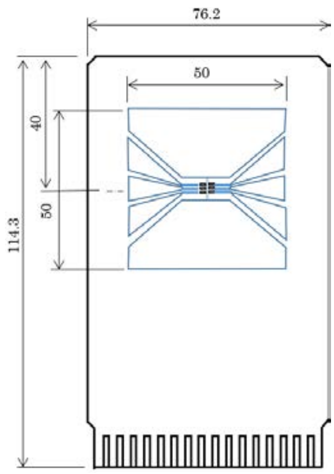
Item	Measurement Result
Power Dissipation	660 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



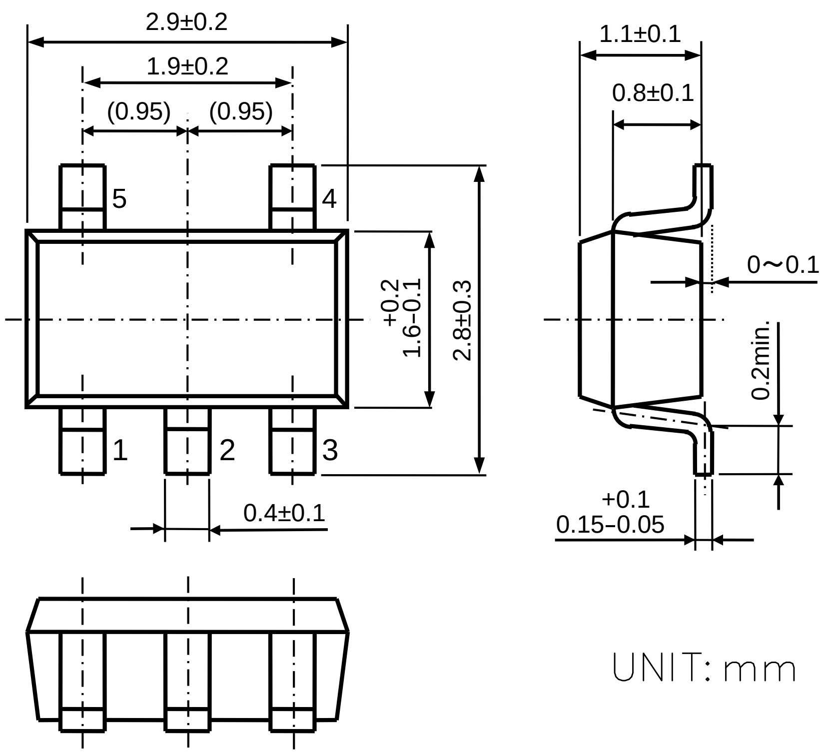
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at Tjmax = 125°C and Tjmax = 150°C. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

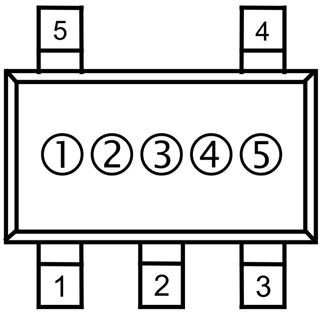
Total Hours of Use	Total Years of Use (4 hours/day)
13,000 hours	9 years



SOT-23-5 Package Dimensions

①②③: Product Code ··· Refer to *Part Marking List*

④⑤: Lot Number ··· Alphanumeric Serial Number



SOT-23-5 Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI.

Part Marking List

RP112Nxx1B

Product Name	①	②	③
RP112N121B	K	1	2
RP112N131B	K	1	3
RP112N141B	K	1	4
RP112N151B	K	1	5
RP112N161B	K	1	6
RP112N171B	K	1	7
RP112N181B	K	1	8
RP112N191B	K	1	9
RP112N201B	K	2	0
RP112N211B	K	2	1
RP112N221B	K	2	2
RP112N231B	K	2	3
RP112N241B	K	2	4
RP112N251B	K	2	5
RP112N261B	K	2	6
RP112N271B	K	2	7
RP112N281B	K	2	8
RP112N291B	K	2	9
RP112N301B	K	3	0
RP112N311B	K	3	1
RP112N321B	K	3	2
RP112N331B	K	3	3
RP112N341B	K	3	4
RP112N351B	K	3	5
RP112N361B	K	3	6
RP112N371B	K	3	7
RP112N381B	K	3	8
RP112N391B	K	3	9
RP112N401B	K	4	0
RP112N411B	K	4	1
RP112N421B	K	4	2
RP112N431B	K	4	3
RP112N441B	K	4	4
RP112N451B	K	4	5
RP112N461B	K	4	6
RP112N471B	K	4	7
RP112N481B	K	4	8
RP112N121B5	K	0	1
RP112N181B5	K	0	2
RP112N281B5	K	0	3

RP112Nxx1D

Product Name	①	②	③
RP112N121D	L	1	2
RP112N131D	L	1	3
RP112N141D	L	1	4
RP112N151D	L	1	5
RP112N161D	L	1	6
RP112N171D	L	1	7
RP112N181D	L	1	8
RP112N191D	L	1	9
RP112N201D	L	2	0
RP112N211D	L	2	1
RP112N221D	L	2	2
RP112N231D	L	2	3
RP112N241D	L	2	4
RP112N251D	L	2	5
RP112N261D	L	2	6
RP112N271D	L	2	7
RP112N281D	L	2	8
RP112N291D	L	2	9
RP112N301D	L	3	0
RP112N311D	L	3	1
RP112N321D	L	3	2
RP112N331D	L	3	3
RP112N341D	L	3	4
RP112N351D	L	3	5
RP112N361D	L	3	6
RP112N371D	L	3	7
RP112N381D	L	3	8
RP112N391D	L	3	9
RP112N401D	L	4	0
RP112N411D	L	4	1
RP112N421D	L	4	2
RP112N431D	L	4	3
RP112N441D	L	4	4
RP112N451D	L	4	5
RP112N461D	L	4	6
RP112N471D	L	4	7
RP112N481D	L	4	8
RP112N121D5	L	0	1
RP112N181D5	L	0	2
RP112N281D5	L	0	3

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8. Quality Warranty
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    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.
9. Anti-radiation design is not implemented in the products described in this document.
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12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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