NISSHINBO

RP173x Series

11 V Input 150 mA LDO

No. EA-256-250325

OUTLINE

The RP173x is a voltage regulator featuring 150 mA output and low supply current of Typ. 2.0 μA. It consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, a current limit circuit, a chip enable circuit and a Reverse Current Protection Circuit. RP173x is suitable for the power source such as the equipment being in the standby-mode. The A version with CE input pin has reduced CE pull-up resistance to make its supply current ultra low.

The RP173x has Max.11 V Input voltage and is applicable to the portable communication equipment that requires the 2-cell Li-ion battery. Also it is applicable to the non-portable communication equipments. As the RP173x includes Reverse Current Protection Circuit, there is little leakage current, if it is used as back-up circuit.

Packages are available in SOT-23-5, SC-88A, and 1-mm square DFN(PL)1010-4 packages. High density mounting of the ICs on boards is possible.

FEATURES

- Output Current.....Typ. 150 mA
- Supply Current .....Typ. 2.0 μA
- Standby Current .....Typ. 0.2 μA
- Dropout Voltage.....Typ. 0.13 V (I_{OUT} = 30 mA, V_{OUT} = 3.0 V)
  Typ. 0.61 V (I_{OUT} = 150 mA, V_{OUT} = 3.0 V)
- Output Voltage Accuracy .....±1.0% (1.5 V < V_{OUT} ≤ 5.5 V, Ta = 25°C)
- Line Regulation .....Typ. 0.02%/V
- Packages .....DFN(PL)1010-4, SC-88A, SOT-23-5
- Input Voltage Range .....2.5 V to Set V_{OUT} + 6.5 V (Max. 11 V)
- Output Voltage Range .....1.2 V to 5.5 V (0.1 V step)
- Built-in Reverse Current Protection Circuit
- Short Current Limit .....Typ. 45 mA
- Built-in Peak Current Limit Circuit
- Output capacitors .....0.1 μF or more

APPLICATIONS

- Power source for portable communication equipments.
- Power source for battery-powered equipments.
- Power source for electrical appliances such as cameras, VSRs and camcorders.
- Power source for digital home appliances.

SELECTION GUIDE

The output voltage, the auto-discharge function(1), and the package for the ICs are user-selectable options.

Selection Guide

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP173Kxx1∗-TR	DFN(PL)1010-4	10,000 pcs	Yes	Yes
RP173Qxx2∗-TR-FE	SC-88A	3,000 pcs	Yes	Yes
RP173Nxx1∗-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes

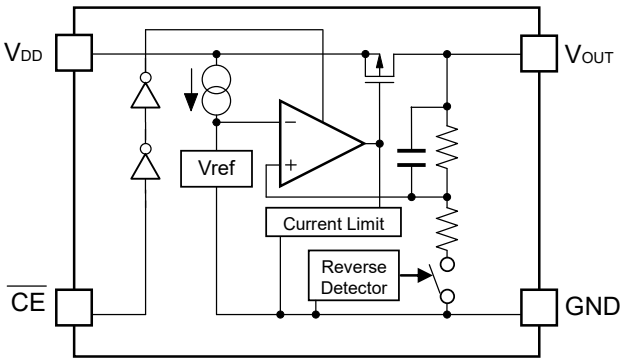
xx: The output voltage can be designated in the range of 1.2 V (12) to 5.5 V (55) in 0.1 V step.

∗ : The auto discharge function at off state are options as follows.
(A) "L" active, without auto discharge function at off state (Pull-up resistance is not built-in)
(B) "H" active, without auto discharge function at off state
(D) "H" active, with auto discharge function at off state

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

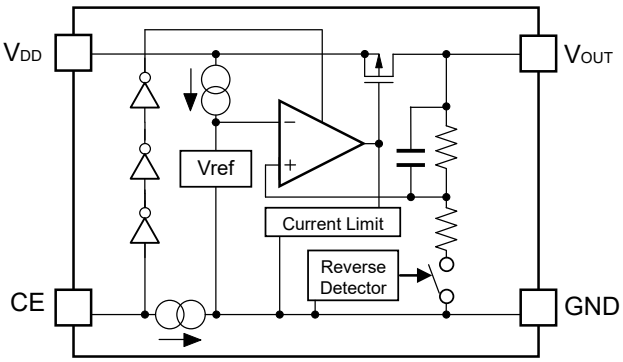
BLOCK DIAGRAMS

RP173xxxxA

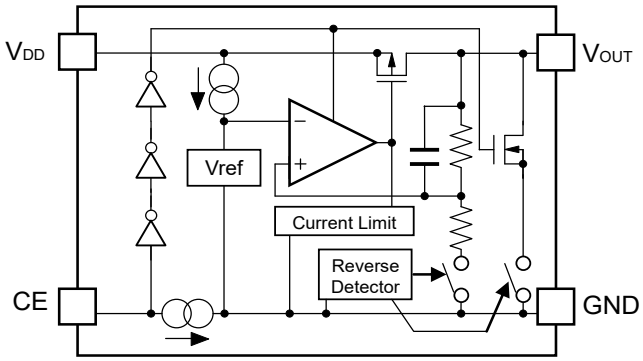


(Pull-up resistance is not built-in.)

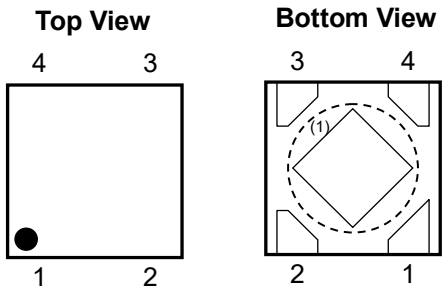
RP173xxxxB



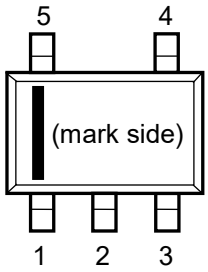
RP173xxxxD



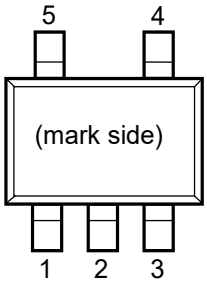
PIN DESCRIPTIONS



RP173K [DFN(PL)1010-4]
Pin Configuration



RP173Q (SC-88A)
Pin Configuration



RP173N (SOT-23-5)
Pin Configuration

RP173K Pin Descriptions

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

RP173Q Pin Descriptions

Pin No.	Symbol	Description
1	$\overline{CE}$ /CE	Chip Enable Pin
2(2)	NC	No Connection
3	GND	Ground Pin
4	V_{OUT}	Output Pin
5	V_{DD}	Input Pin

RP173N Pin Descriptions

Pin No.	Symbol	Description
1	V_{DD}	Input Pin
2	GND	Ground Pin
3	$\overline{CE}$ /CE	Chip Enable Pin
4(3)	NC	No Connection
5	V_{OUT}	Output Pin

(1) The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.
(2) 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.
(3) NC pin is electrically open. It is recommended to connect it to the board when mounting to strengthen mounting strength.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

Symbol	Item			Rating	Unit
V_{IN}	Input Voltage			12	V
V_{CE}	Input Voltage (CE pin)			12	V
V_{OUT}	Output Voltage			−0.3 to 6.0	V
I_{OUT}	Output Current			165	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 permanent damage and may degrade the lifetime 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	2.5 to 11.0(2)	V
Ta	Operating Temperature Range	−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 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 *POWER DISSIPATION* for detailed information.
(2) V_{SET} + 6.5 V ≤ 11.0 V

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, V_{IN} = Set V_{OUT} + 1.0 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 0.1 µF.
The specifications surrounded by ☐ are guaranteed by design engineering at -40°C ≤ Ta ≤ 85°C.

RP173xxxxA (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{OUT} > 1.5 V	x0.99		x1.01	V
			V_{OUT} ≤ 1.5 V	−15		15	mV
		−40°C ≤ Ta ≤ 85°C	V_{OUT} > 1.5 V	x0.982		x1.018	V
			V_{OUT} ≤ 1.5 V	−28		27	mV
I_{OUT}	Output Current			150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	0.1 mA ≤ I_{OUT} ≤ 150 mA		−30	−3	35	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 150 mA		Refer to “Dropout Voltage”.			
I_{SS}	Supply Current	I_{OUT} = 0 mA			2.0	3.7	µA
Istandby	Standby Current	V_{IN} = V_{IN} (Max.) V_{CE} = V_{IN}			0.2	0.6	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Load Regulation	Set V_{OUT} + 0.5 V ≤ V_{IN} ≤ V_{IN} (Max.) When V_{OUT} ≤ 2.0 V, 2.5 V ≤ V_{IN} ≤ V_{IN} (Max.)			0.02	0.20	%/V
RR	Ripple Rejection	f = 1 kHz, Ripple 0.2 Vp−p, I_{OUT} = 10 mA *When V_{OUT} < 2.0 V, V_{IN} = 3.0 V			30		dB
V_{IN}	Input Voltage	1.2 ≤ V_{OUT} < 4.5		2.5		V_{SET} + 6.5	V
		4.5 ≤ V_{OUT} ≤ 5.5		2.5		11	
I_{SC}	Short Current Limit Circuit	V_{OUT} = 0 V			45		mA
V_{CEH}	$\overline{CE}$ Input Voltage "H"			1.7			V
V_{CEL}	$\overline{CE}$ Input Voltage "L"					0.8	V
I_{REV}	Reverse Current	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			0	0.16	µA
V_{REV_DET}(1)	Reverse Current Protection Mode Detection Offset, V_{REV} = V_{DD} - V_{OUT}	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			55	100	mV
V_{REV_REL}(1)	Reverse Current Protection Mode Release Offset	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			70	120	mV

All of units are tested and specified under the pulse load conditions such that Tj ≈ Ta = 25°C except for Ripple Rejection.

(1) The operation coverage of the Reverse Current Protection Circuit is V_{OUT} ≥ 1.5 V. However, under the condition of V_{IN} = V_{OUT} = 0 V, always the Reverse Current Protection Circuit is operating.

Unless otherwise noted, V_{IN} = Set V_{OUT} + 1.0 V, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 0.1 µF.
The specifications surrounded by ☐ are guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C.

RP173xxxxB/D (Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{OUT} > 1.5 V	x0.99		x1.01	V
			V_{OUT} ≤ 1.5 V	−15		15	mV
		−40°C ≤ Ta ≤ 85°C	V_{OUT} > 1.5 V	x0.982		x1.018	V
			V_{OUT} ≤ 1.5 V	−28		27	mV
I_{OUT}	Output Current			150			mA
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	0.1 mA ≤ I_{OUT} ≤ 150 mA		−30	−3	35	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 150 mA		Refer to “Dropout Voltage”.			
I_{SS}	Supply Current	I_{OUT} = 0 mA			2.0	3.7	µA
Istandby	Standby Current	V_{IN} = V_{IN} (Max.) V_{CE} = 0 V			0.2	0.6	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Load Regulation	Set V_{OUT} + 0.5 V ≤ V_{IN} ≤ V_{IN} (Max.) When V_{OUT} ≤ 2.0 V, 2.5 V ≤ V_{IN} ≤ V_{IN} (Max.)			0.02	0.20	%/V
RR	Ripple Rejection	f = 1kHz, Ripple 0.2 Vp-p, I_{OUT} = 10 mA *When V_{OUT} < 2.0 V, V_{IN} = 3.0 V			30		dB
V_{IN}	Input Voltage	1.2 ≤ V_{OUT} < 4.5		2.5		V_{SET} + 6.5	V
		4.5 ≤ V_{OUT} ≤ 5.5		2.5		11	
I_{SC}	Short Current Limit Circuit	V_{OUT} = 0 V			45		mA
I_{PD}	CE Pull-down Current				0.30	0.90	µA
V_{CEH}	CE Input Voltage "H"			1.7			V
V_{CEL}	CE Input Voltage "L"					0.8	V
I_{REV}	Reverse Current	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			0	0.16	µA
V_{REV_DET}[1]	Reverse Current Protection Mode Detection Offset, V_{REV} = V_{DD} - V_{OUT}	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			55	100	mV
V_{REV_REL}[1]	Reverse Current Protection Mode Release Offset	0 ≤ V_{IN} ≤ 11.0 V, V_{OUT} ≥ 1.5 V			70	120	mV
R_{LOW}	Auto-discharge Nch Tr. ON Resistance (RP173xxxxD only)	V_{IN} = 7.0 V, V_{CE} = 0 V			380		Ω

All of units are tested and specified under the pulse load conditions such that Tj ≈ Ta = 25°C except for Ripple Rejection.

[1] The operation coverage of the Reverse Current Protection Circuit is V_{OUT} ≥ 1.5 V. However, under the condition of V_{IN} = V_{OUT} = 0 V, always the Reverse Current Protection Circuit is operating.

Dropout Voltage

Output Voltage V_{OUT} (V)	Dropout Voltages V_{DIF} (V)		
	Condition	TYP.	MAX.
$1.2 \le V_{OUT} < 1.3$	I_{OUT}=150mA	1.68	2.59
$1.3 \le V_{OUT} < 1.5$		1.63	2.49
$1.5 \le V_{OUT} < 1.8$		1.48	2.23
$1.8 \le V_{OUT} < 2.3$		1.16	1.93
$2.3 \le V_{OUT} < 3.0$		0.90	1.47
$3.0 \le V_{OUT} < 4.0$		0.61	1.05
$4.0 \le V_{OUT} \le 5.5$		0.39	0.76

The values in [ ] have been tested and guaranteed by design engineering.

PRODUCT-SPECIFIC ELECTRICAL CHARACTERISTICS

RP173x Product-specific Electrical Characteristics

Product Name	V_{OUT}						V_{DIF}	
	Ta = 25°C			−40°C ≤ Ta ≤ 85°C				
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
RP173x12xx	1.185	1.200	1.215	1.172	1.200	1.227	1.680	2.590
RP173x12xx5	1.235	1.250	1.265	1.222	1.250	1.277	1.680	2.590
RP173x13xx	1.285	1.300	1.315	1.272	1.300	1.327	1.630	2.490
RP173x14xx	1.385	1.400	1.415	1.372	1.400	1.427	1.630	2.490
RP173x15xx	1.485	1.500	1.515	1.472	1.500	1.527	1.480	2.230
RP173x16xx	1.584	1.600	1.616	1.571	1.600	1.629	1.480	2.230
RP173x17xx	1.683	1.700	1.717	1.669	1.700	1.731	1.480	2.230
RP173K171x5	1.733	1.750	1.768	1.719	1.750	1.782	1.480	2.230
RP173x18xx	1.782	1.800	1.818	1.768	1.800	1.832	1.160	1.930
RP173x18xx5	1.832	1.850	1.869	1.817	1.850	1.883	1.160	1.930
RP173x19xx	1.881	1.900	1.919	1.866	1.900	1.934	1.160	1.930
RP173x20xx	1.980	2.000	2.020	1.964	2.000	2.036	1.160	1.930
RP173x21xx	2.079	2.100	2.121	2.062	2.100	2.138	1.160	1.930
RP173x22xx	2.178	2.200	2.222	2.160	2.200	2.240	1.160	1.930
RP173x23xx	2.277	2.300	2.323	2.259	2.300	2.341	0.900	1.470
RP173x24xx	2.376	2.400	2.424	2.357	2.400	2.443	0.900	1.470
RP173x25xx	2.475	2.500	2.525	2.455	2.500	2.545	0.900	1.470
RP173x26xx	2.574	2.600	2.626	2.553	2.600	2.647	0.900	1.470
RP173x27xx	2.673	2.700	2.727	2.651	2.700	2.749	0.900	1.470
RP173x28xx	2.772	2.800	2.828	2.750	2.800	2.850	0.900	1.470
RP173x28xx5	2.822	2.850	2.879	2.799	2.850	2.901	0.900	1.470
RP173x29xx	2.871	2.900	2.929	2.848	2.900	2.952	0.900	1.470
RP173x30xx	2.970	3.000	3.030	2.946	3.000	3.054	0.610	1.050
RP173x31xx	3.069	3.100	3.131	3.044	3.100	3.156	0.610	1.050
RP173x32xx	3.168	3.200	3.232	3.142	3.200	3.258	0.610	1.050
RP173x33xx	3.267	3.300	3.333	3.241	3.300	3.359	0.610	1.050
RP173x34xx	3.366	3.400	3.434	3.339	3.400	3.461	0.610	1.050
RP173x35xx	3.465	3.500	3.535	3.437	3.500	3.563	0.610	1.050
RP173x36xx	3.564	3.600	3.636	3.535	3.600	3.665	0.610	1.050
RP173x37xx	3.663	3.700	3.737	3.633	3.700	3.767	0.610	1.050
RP173x38xx	3.762	3.800	3.838	3.732	3.800	3.868	0.610	1.050
RP173x39xx	3.861	3.900	3.939	3.830	3.900	3.970	0.610	1.050
RP173x40xx	3.960	4.000	4.040	3.928	4.000	4.072	0.390	0.760
RP173x41xx	4.059	4.100	4.141	4.026	4.100	4.174	0.390	0.760
RP173x42xx	4.158	4.200	4.242	4.124	4.200	4.276	0.390	0.760
RP173x43xx	4.257	4.300	4.343	4.223	4.300	4.377	0.390	0.760
RP173x44xx	4.356	4.400	4.444	4.321	4.400	4.479	0.390	0.760
RP173x45xx	4.455	4.500	4.545	4.419	4.500	4.581	0.390	0.760
RP173x46xx	4.554	4.600	4.646	4.517	4.600	4.683	0.390	0.760
RP173x47xx	4.653	4.700	4.747	4.615	4.700	4.785	0.390	0.760
RP173x48xx	4.752	4.800	4.848	4.714	4.800	4.886	0.390	0.760
RP173x49xx	4.851	4.900	4.949	4.812	4.900	4.988	0.390	0.760
RP173x50xx	4.950	5.000	5.050	4.910	5.000	5.090	0.390	0.760
RP173x51xx	5.049	5.100	5.151	5.008	5.100	5.192	0.390	0.760
RP173x52xx	5.148	5.200	5.252	5.106	5.200	5.294	0.390	0.760
RP173x53xx	5.247	5.300	5.353	5.205	5.300	5.395	0.390	0.760
RP173x54xx	5.346	5.400	5.454	5.303	5.400	5.497	0.390	0.760
RP173x55xx	5.445	5.500	5.555	5.401	5.500	5.599	0.390	0.760

THEORY OF OPERATION

REVERSE CURRENT PROTECTION CIRCUIT

The RP173 Series include a Reverse Current Protection Circuit, which stops the reverse current from V_{OUT} pin to V_{DD} pin or to GND pin when V_{OUT} becomes higher than V_{IN}.

Usually, the LDO using Pch output transistor contains a parasitic diode between V_{DD} pin and V_{OUT} pin. Therefore, if V_{OUT} is higher than V_{IN}, the parasitic diode becomes forward direction. As a result, the current flows from V_{OUT} pin to V_{DD} pin.

The ICs of this series switches the mode to the reverse current protection mode before V_{IN} becomes lower than V_{OUT} by connecting the parasitic diode of Pch output transistor to the backward direction, and connecting the gate to V_{OUT} pin. As a result, the Pch output transistor is turned off and the all the current pathways from V_{OUT} pin to GND pin are shut down to maintain the reverse current lower than [I_{REV}] of the Electrical Characteristics.

Switching to either the normal mode or to the reverse current protection mode is determined by the magnitude of V_{IN} voltage and V_{OUT} voltage. For the stable operation, offset and hysteresis are set as the threshold. The detection/ release thresholds of both normal and reverse current protection modes are specified by [V_{REV_DET}] and [V_{REV_REL}] of the Electrical Characteristics. Therefore, the minimum dropout voltage under the small load current condition is restricted by the value of [V_{REV_REL}].

Fig.1 and Fig.2 show the diagrams of each mode, and Fig.3 shows the load characteristics of each mode. When giving the V_{OUT} pin a constant-voltage and decreasing the V_{IN} voltage, the dropout voltage will become lower than the [V_{REV_DET}]. As a result, the reverse current protection starts to function to stop the load current. By increasing the dropout voltage higher than the [V_{REV_REL}], the protection mode will be released to let the load current to flow. If the dropout voltage to be used is lower than [V_{REV_REL}], the detection and the release may be repeated.

The operation coverage of the Reverse Current Protection Circuit is $V_{OUT} \geq 1.5V$. However, under the condition of V_{IN}=0V, always the reverse current protection mode is operating.

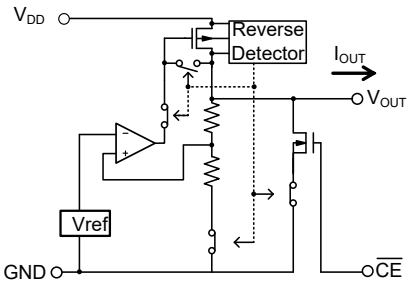


Fig. 1 Normal Mode

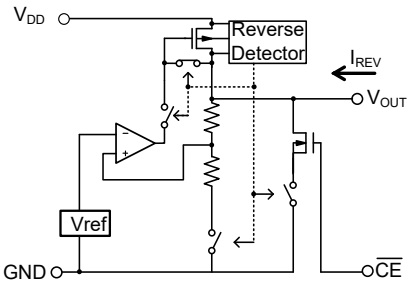


Fig. 2 Reverse Current Protection Mode

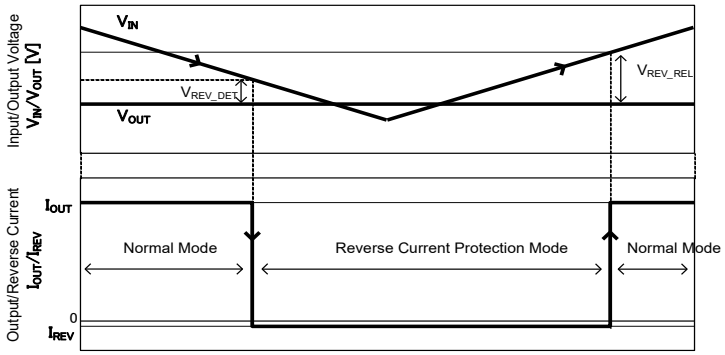
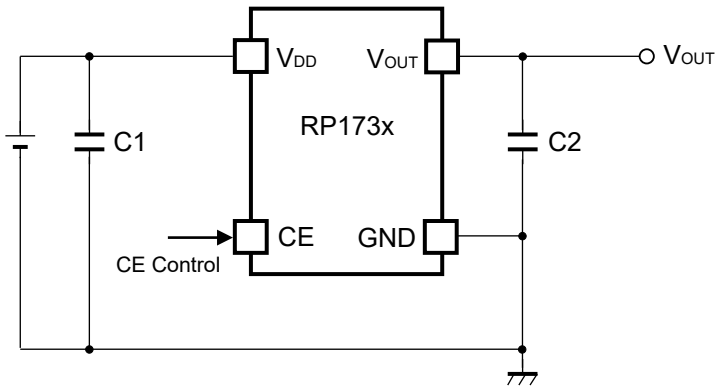


Fig. 3 Reverse Current Protection Mode Detection/ Release &
Reverse Current/ Output Current Characteristics

APPLICATION INFORMATION

TYPICAL APPLICATIONS



RP173xxxxA is "L" active version without a CE pull-up resistor, and is used always active state by connecting the CE pin directly to GND.

RP173xxxxB/RP173xxxxD are used by controlling active or standby state with the CE pin.

Recommended External Components

Symbol	Description
C2 (C_{OUT})	0.1 μF, GRM155B31C104KA87D, MURATA

NOTES ON SELECTING EXTERNAL COMPONENTS

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 0.1μF 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

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.

TECHNICAL NOTES

POWER ACTIVATION

If the ICs are started up with V_{IN} and V_{CE} under the no-load condition, the both pin voltages have to be started up with faster than 2.0V/s. If the IC is started up with slower than 2.0V/s under the no-load condition, start up the IC only with V_{CE}.

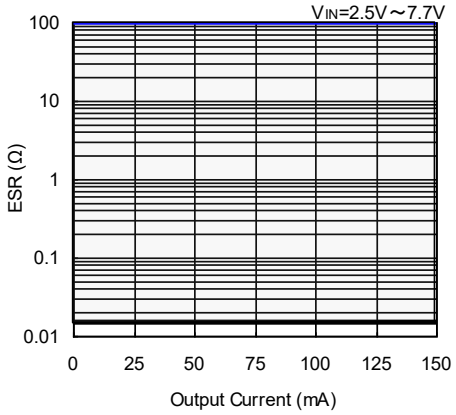
ESR vs. Output Current

When using these ICs, consider the following points: The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below. The conditions when the white noise level is under 40 μV (Avg.) are marked as the hatched area in the graph.

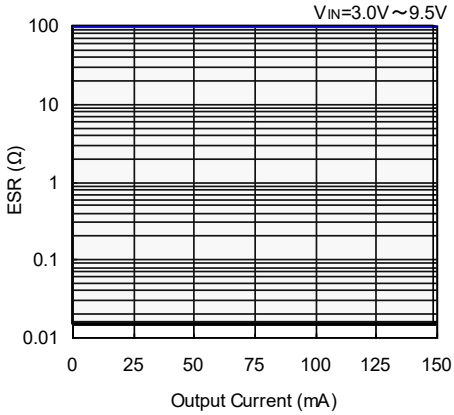
Measurement Conditions

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

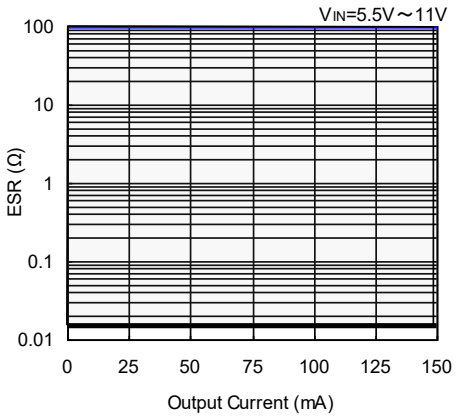
RP173x0121x



RP173x301x



RP173x551x

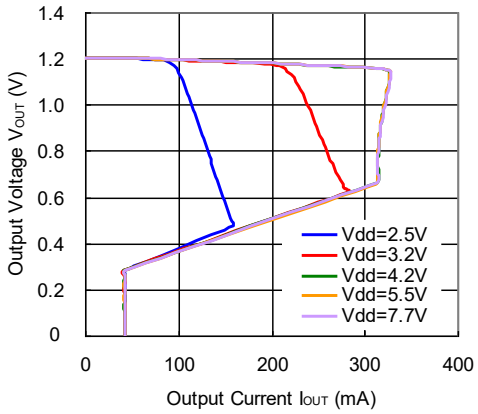


TYPICAL CHARACTERISTICS

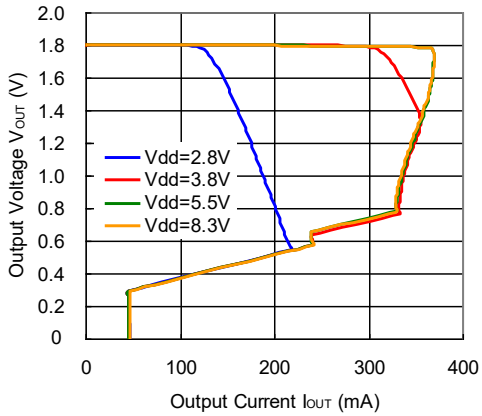
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

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

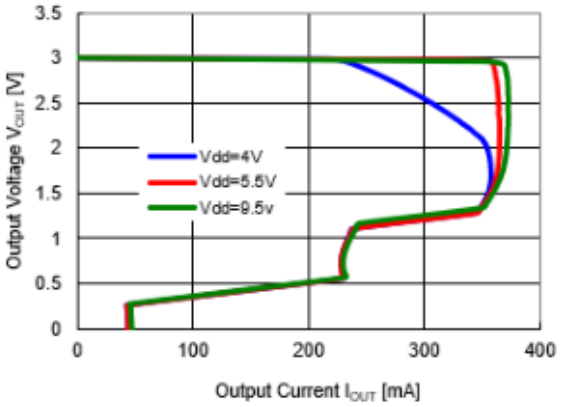
RP173x12xx



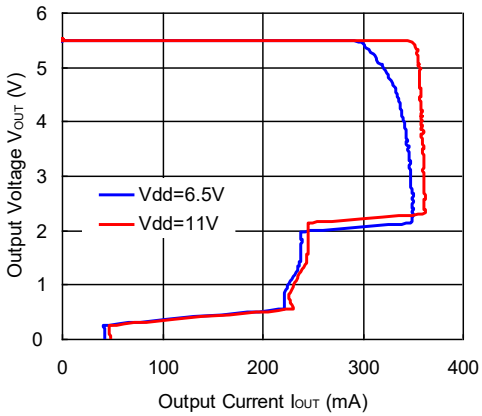
RP173x18xx



RP173x30xx

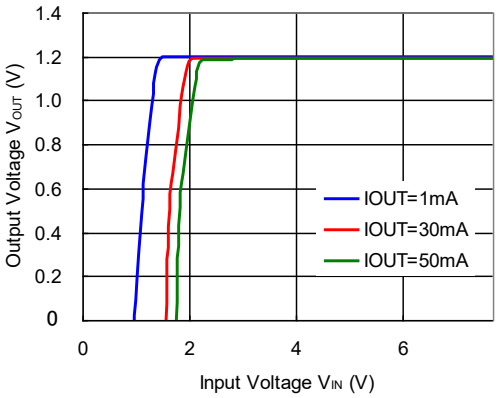


RP173x55xx

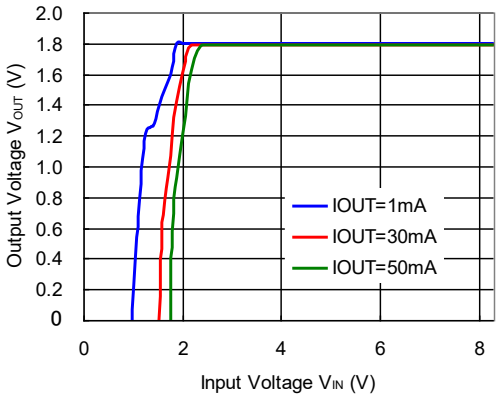


2) Output Voltage vs. Input Voltage (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, Ta = 25°C)

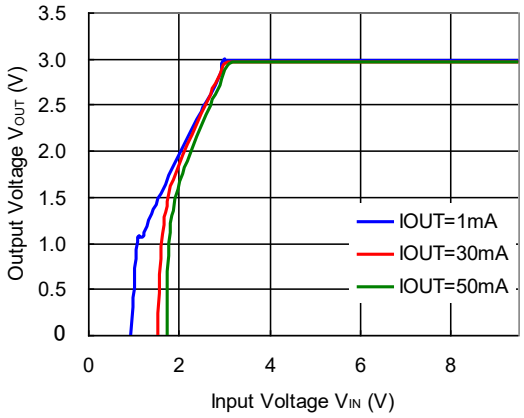
RP173x12xx



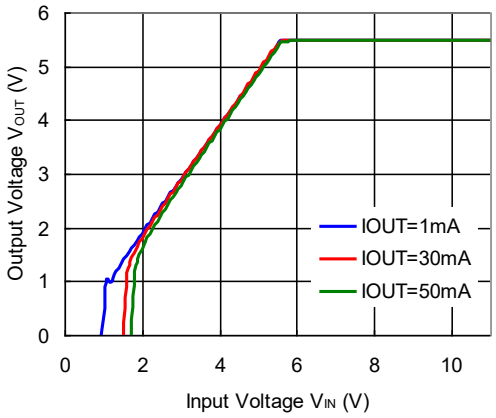
RP173x18xx



RP173x30xx

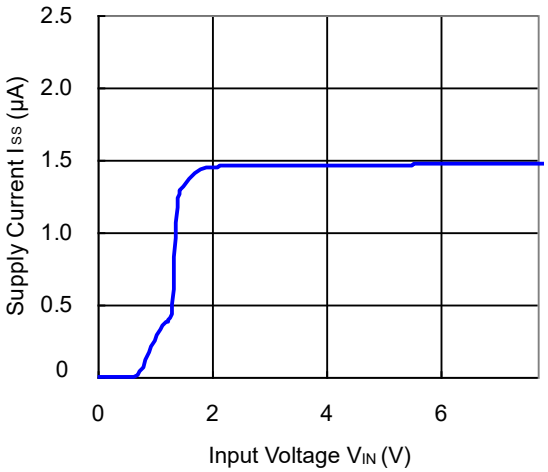


RP173x55xx

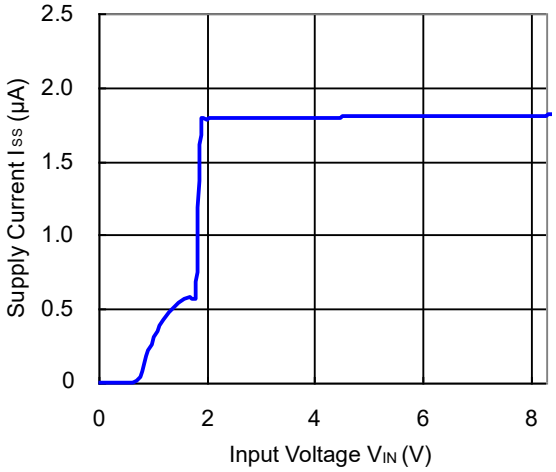


3) Supply Current vs. Input Voltage (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, Ta = 25°C)

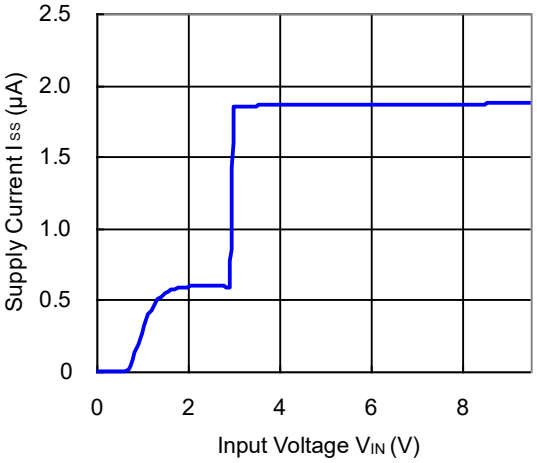
RP173x12xx



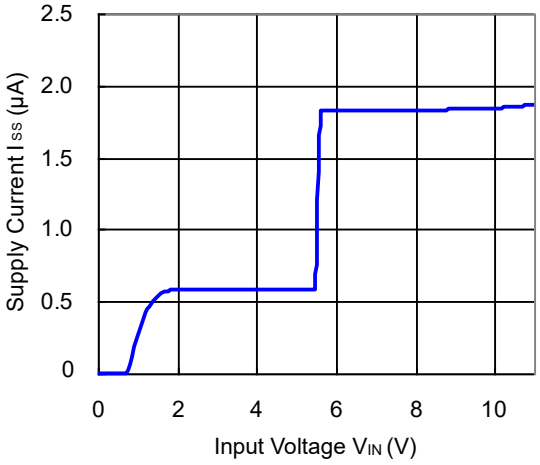
RP173x18xx



RP173x30xx

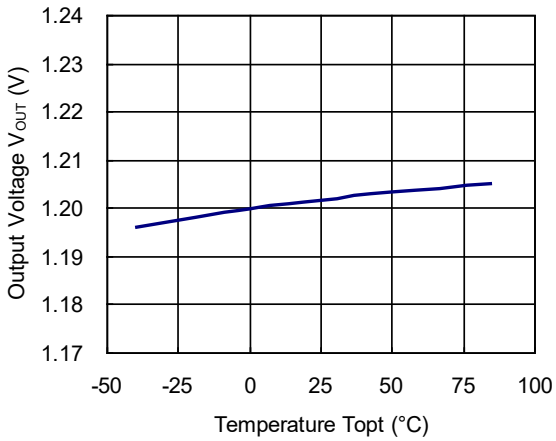


RP173x55xx

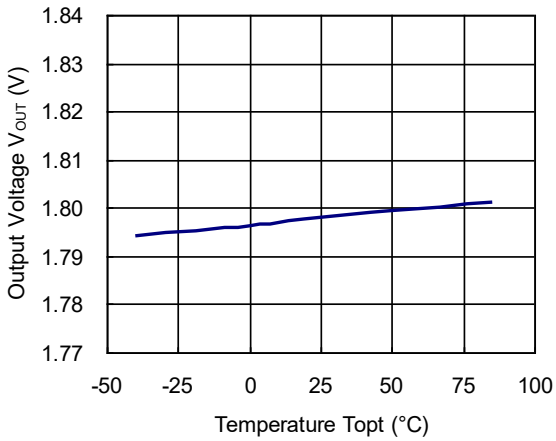


4) Output Voltage vs. Temperature (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, I_{OUT} = 1 mA)

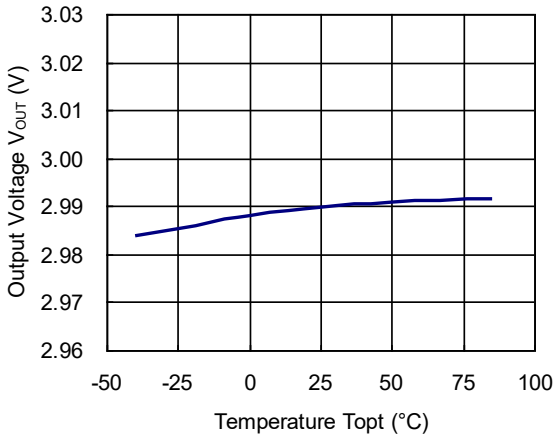
RP173x12xx



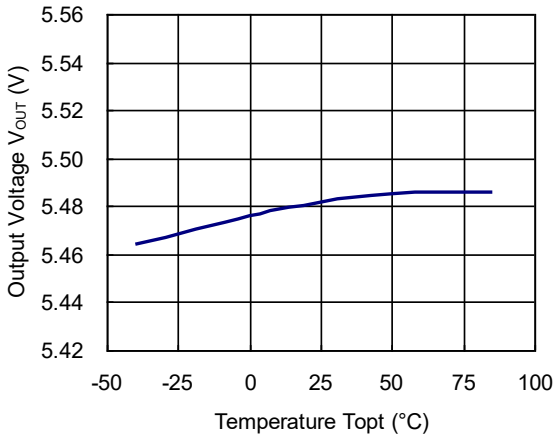
RP173x18xx



RP173x30xx

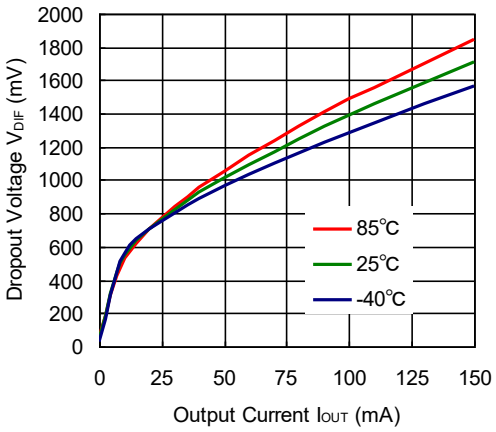


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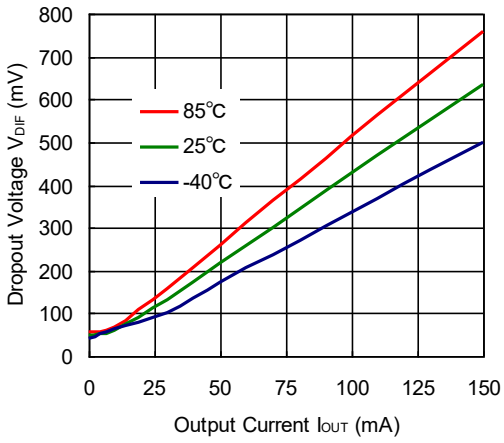


5) Dropout Voltage vs. Output Current (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF)

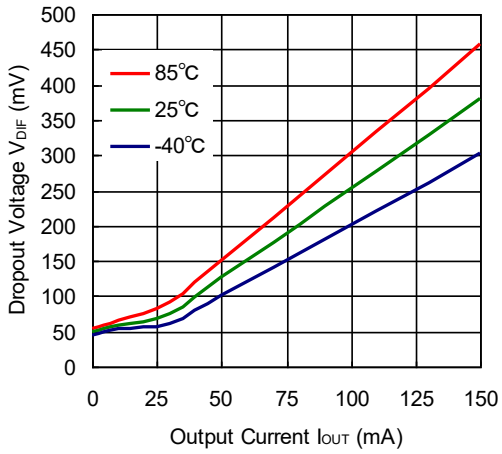
RP173x12xx



RP173x30xx

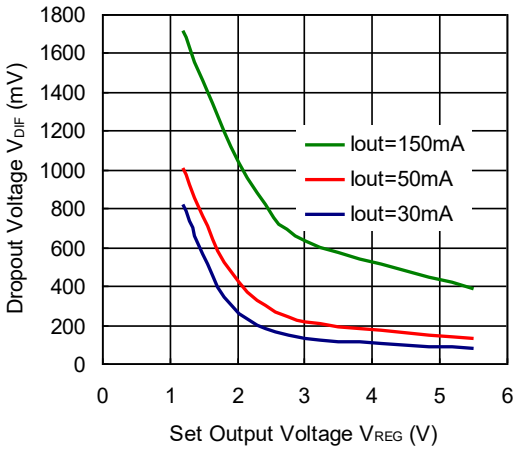


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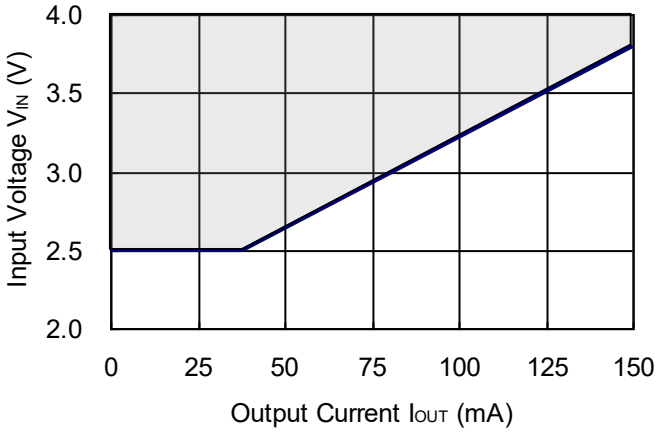


6) Dropout Voltage vs. Set Output Voltage (C1 = Ceramic 0.1 μF, C2 = Ceramic 0.1 μF, Ta = 25°C)

RP173x

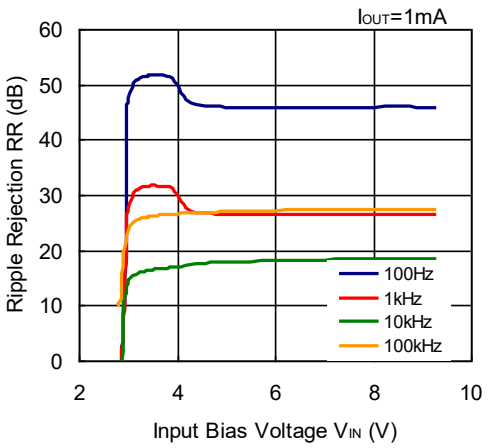


7) Minimum Operating Voltage (C1 = Ceramic 0.1 μF, C2 = Ceramic 0.1 μF, Ta = −40 to 85°C)

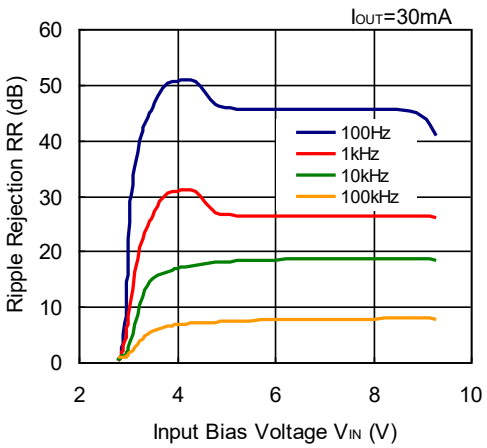


8) Ripple Rejection vs. Input Bias Voltage (C1 = none, C2 = Ceramic 0.1 μF, Ripple = 0.2 Vp-p, Ta = 25°C)

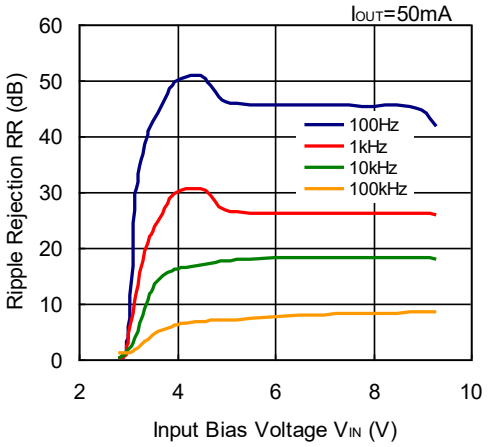
RP173x28xx



RP173x28xx

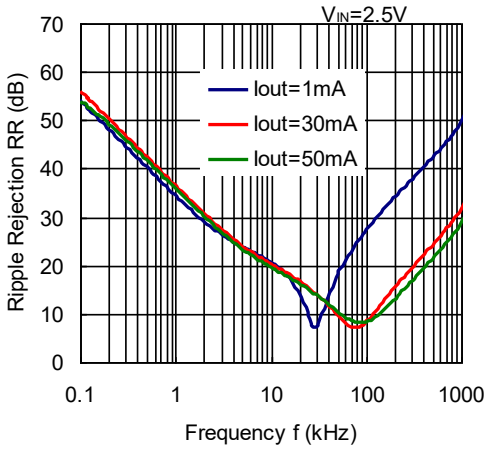


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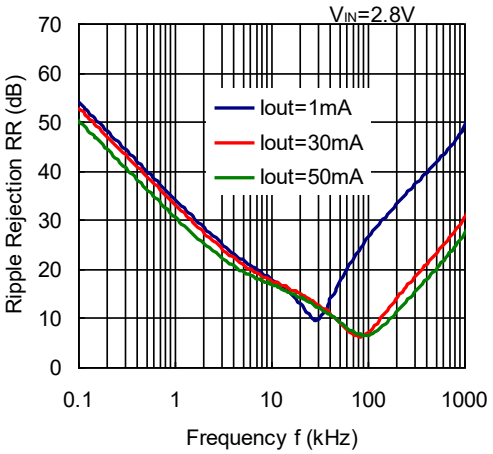


9) Ripple Rejection vs. Frequency (C1 = none, C2 = Ceramic 0.1 μF, Ripple = 0.2 Vp-p, Ta = 25°C)

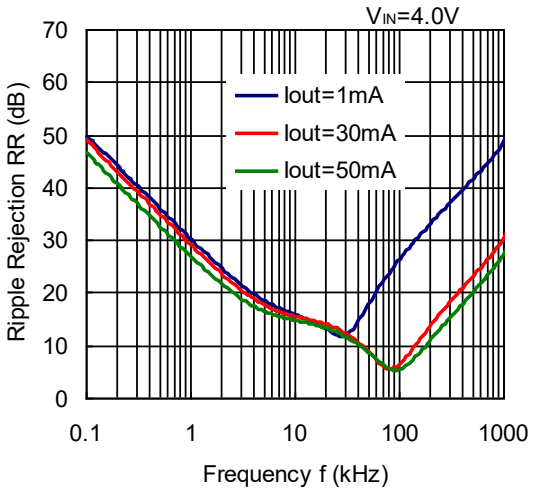
RP173x12xx



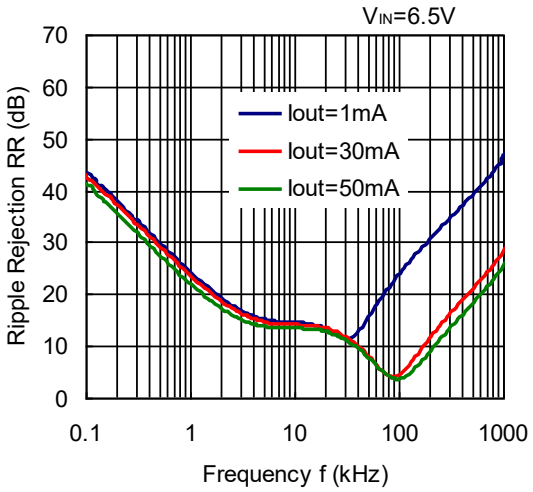
RP173x18xx



RP173x30xx

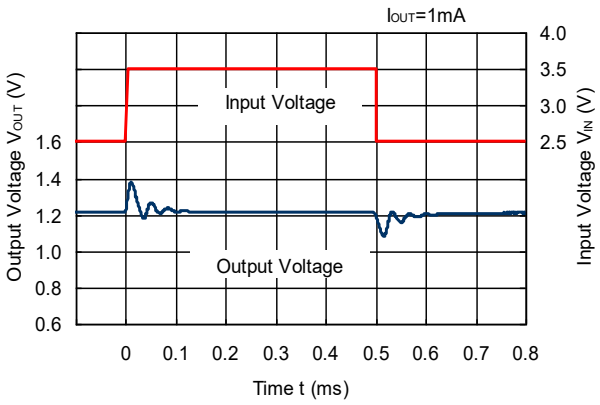


RP173x55xx

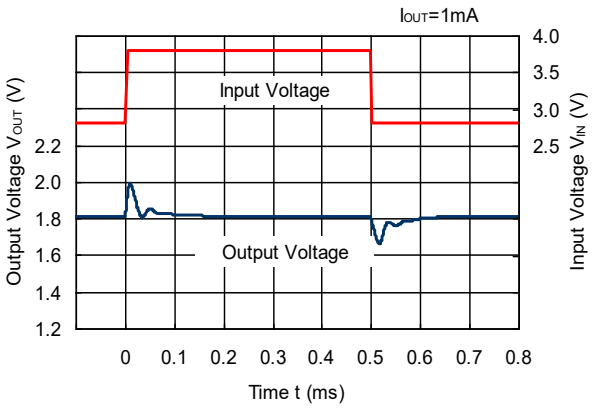


10) Input Transient Response (C1 = none, C2 = Ceramic 0.1 μF, tr = tf = 5.0 μs, Ta = 25°C)

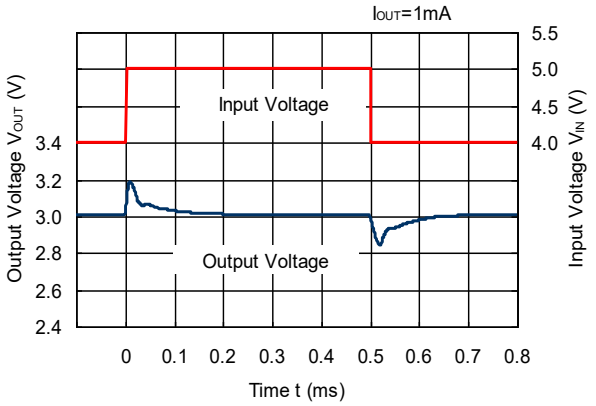
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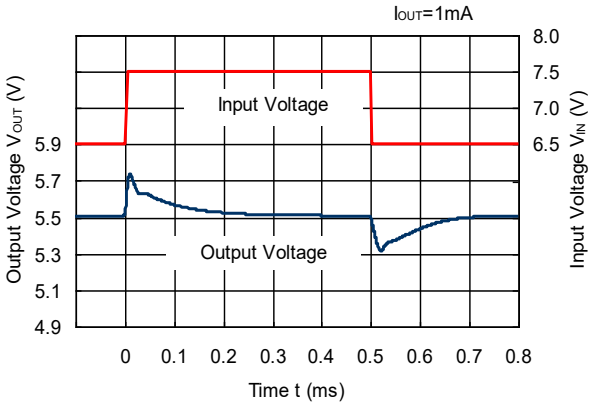
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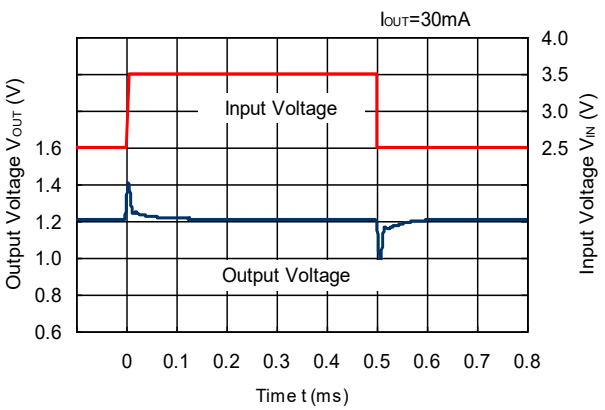
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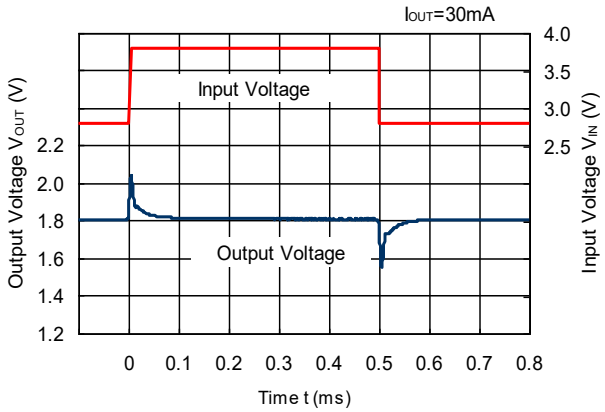
RP173x55xx



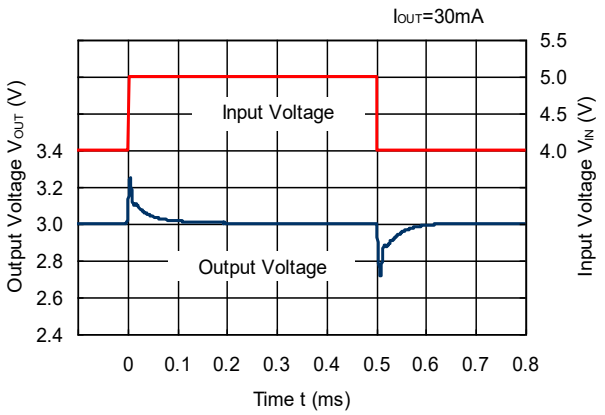
RP173x12xx



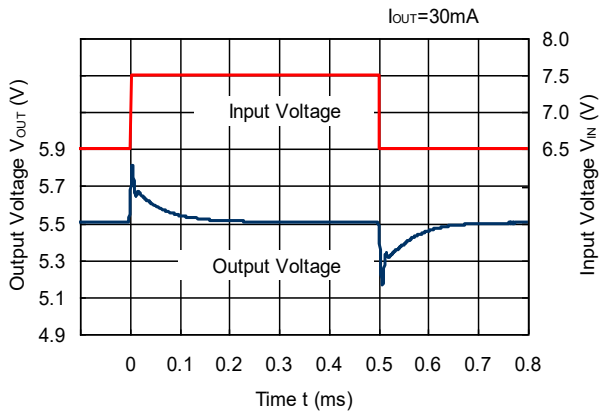
RP173x18xx



RP173x30xx

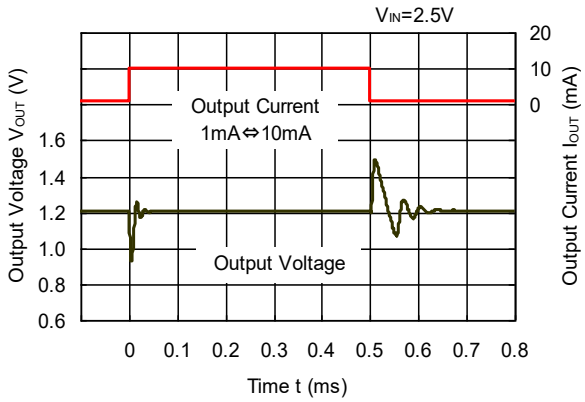


RP173x55xx

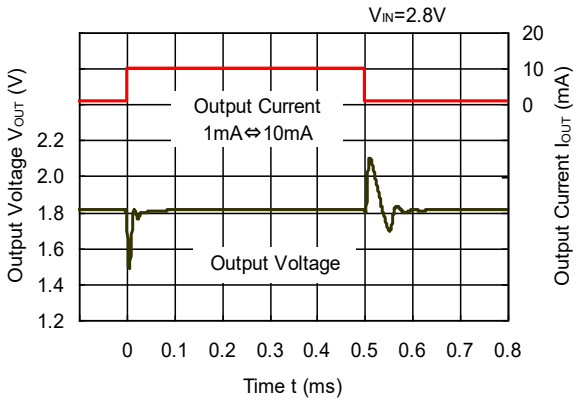


11) Load Transient Response (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, tr = tf = 0.5 µs, Ta = 25°C)

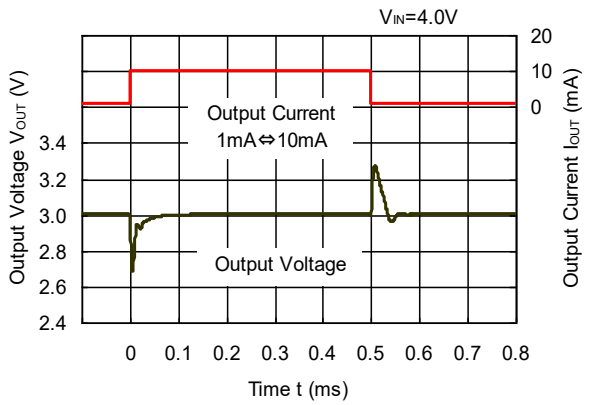
RP173x12xx



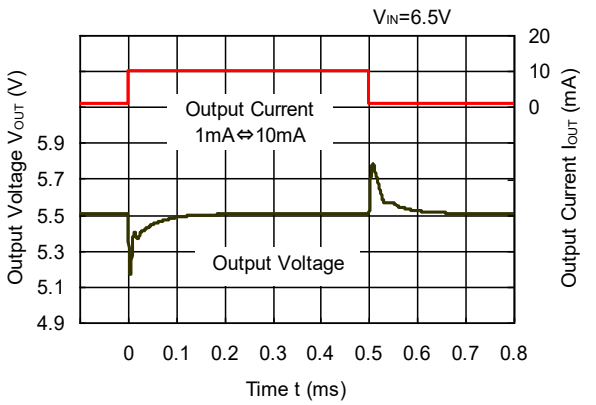
RP173x18xx



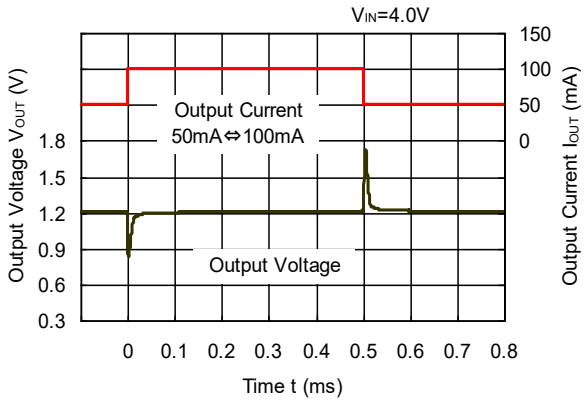
RP173x30xx



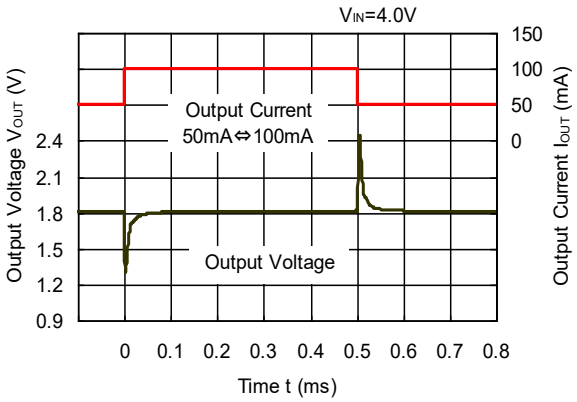
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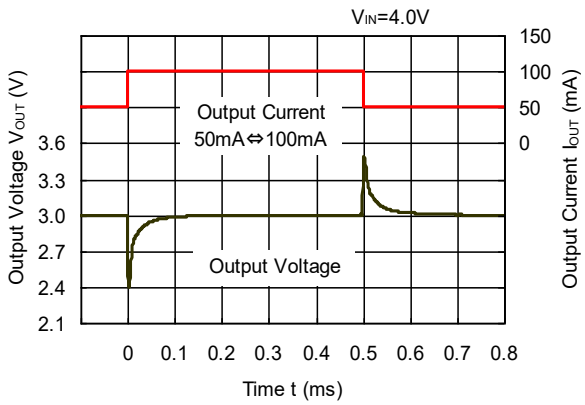
RP173x12xx



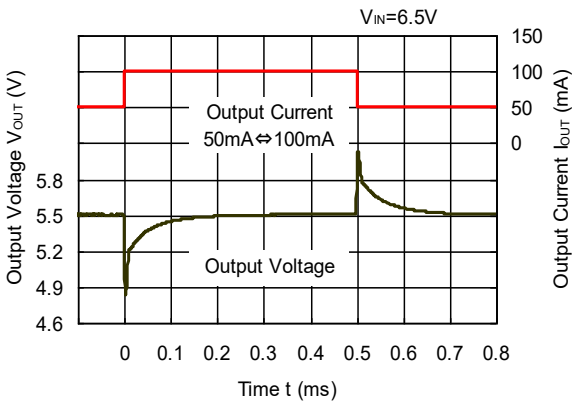
RP173x18xx



RP173x30xx

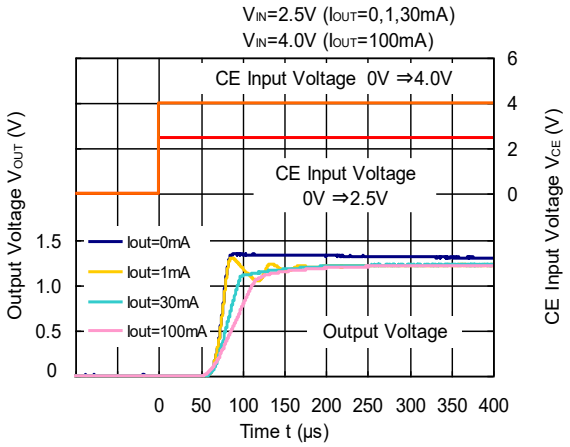


RP173x55xx

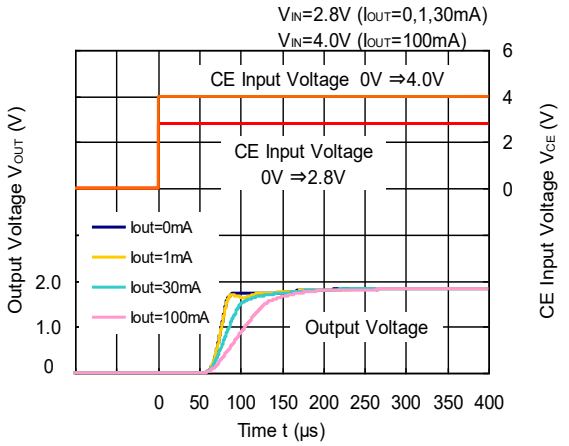


12) Turn on Speed (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, Ta = 25°C)

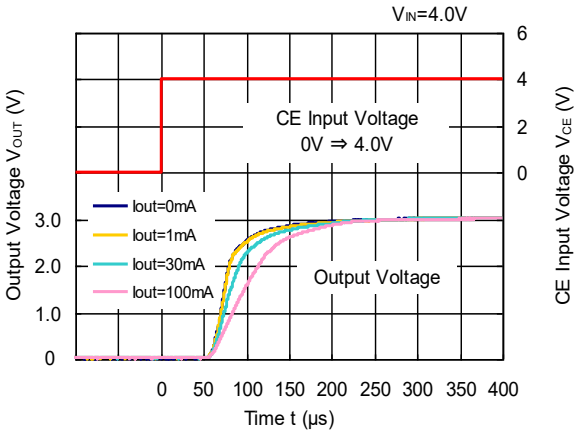
RP173x12xx



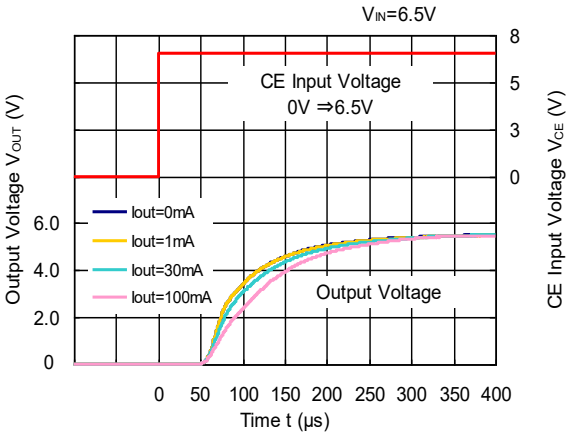
RP173x18xx



RP173x30xx

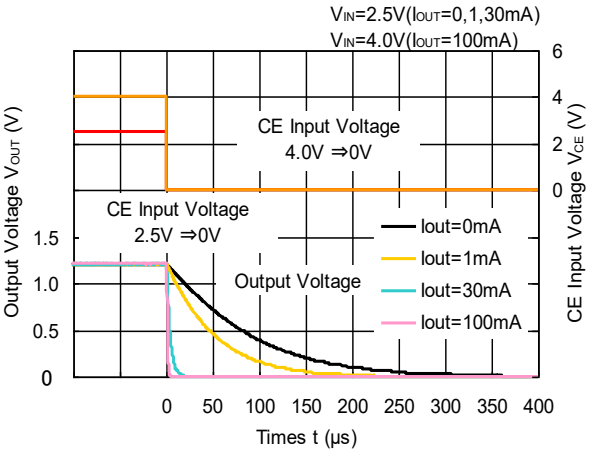


RP173x55xx

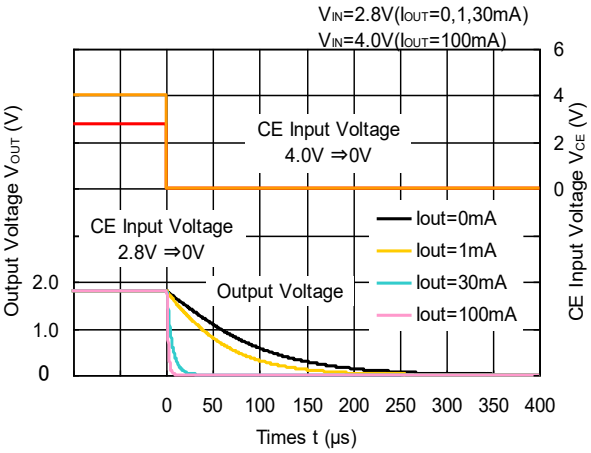


13) Turn off Speed with CE pin (C1 = Ceramic 0.1 µF, C2 = Ceramic 0.1 µF, Ta = 25°C)

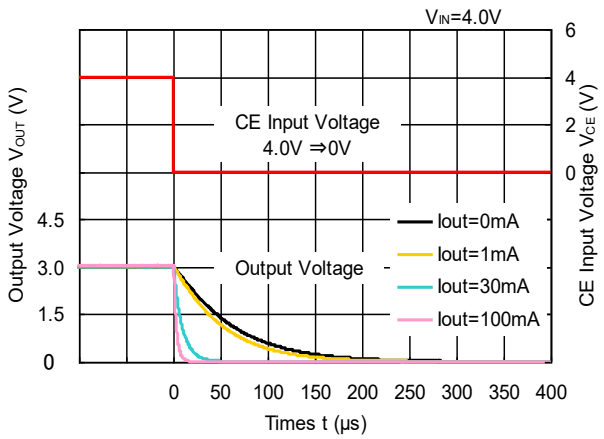
RP173x12xx



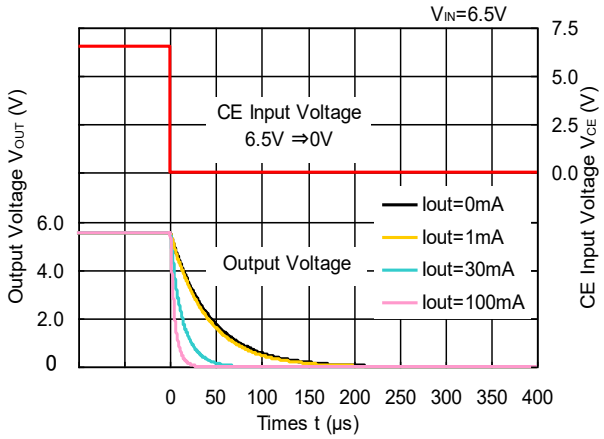
RP173x18xx



RP173x30xx



RP173x55xx



POWER DISSIPATION DFN(PL)1010-4

PD-DFN(PL)1010-4-(85125)-JE-C

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

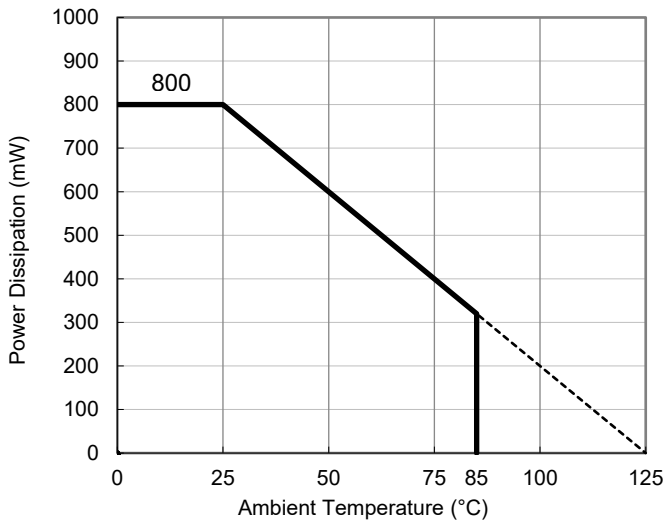
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx.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

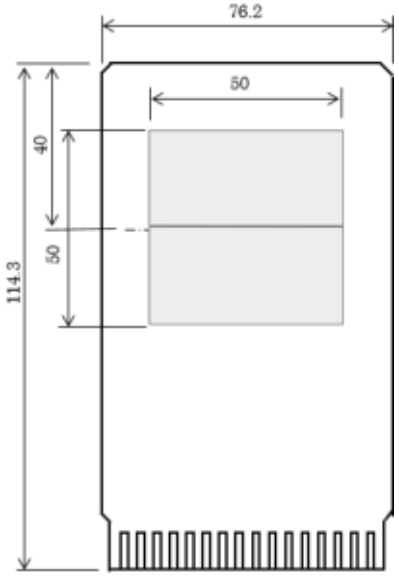
Item	Measurement Result
Power Dissipation	800 mW
Thermal Resistance (θja)	θja = 125°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 58°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



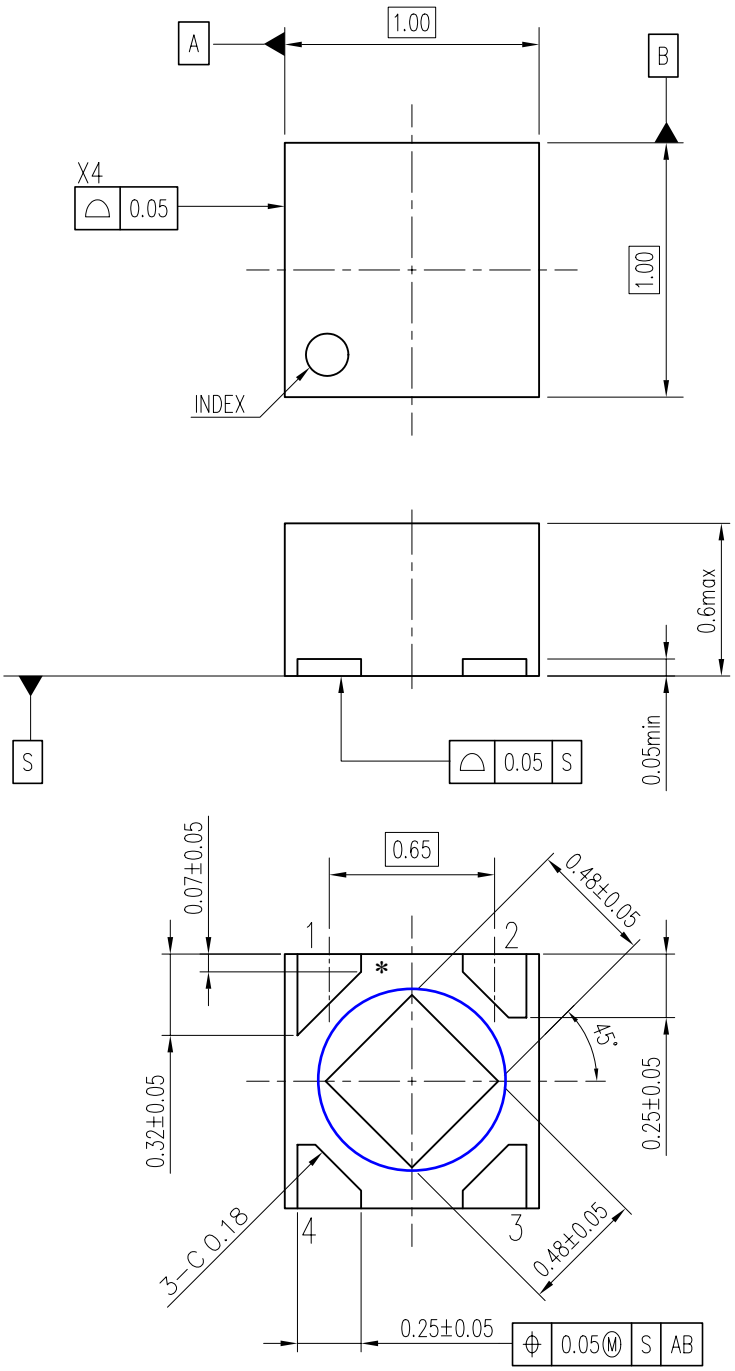
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

PACKAGE DIMENSIONS DFN(PL)1010-4

Ver. A



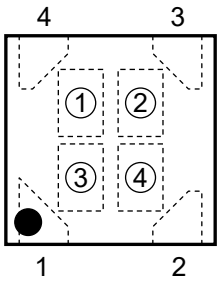
DFN(PL)1010-4 Package Dimensions (Unit: mm)

* The tab on the bottom of the package shown by blue circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane on the board but it is possible to leave the tab floating.

RP173Q(SC-88A) is the NRND product as of April,2023

RP173K SERIES MARK SPECIFICATION

• DFN(PL)1010-4



①, ② : Product Code (Refer to Part Number vs. Product Code)

③, ④ : Lot Number

• Part Number vs. Product Code

RP173Kxx1A Series

Part Number	Product Code	
	①	②
RP173K121A	1	A
RP173K131A	1	C
RP173K141A	1	D
RP173K151A	1	E
RP173K161A	1	F
RP173K171A	1	G
RP173K181A	1	H
RP173K191A	1	K
RP173K201A	1	L
RP173K211A	1	M
RP173K221A	1	N
RP173K231A	1	P
RP173K241A	1	Q
RP173K251A	1	R
RP173K261A	1	S
RP173K271A	1	T
RP173K281A	1	U
RP173K291A	1	W
RP173K301A	1	X
RP173K311A	1	Y
RP173K321A	1	Z
RP173K331A	2	A
RP173K341A	2	B
RP173K351A	2	C
RP173K361A	2	D
RP173K371A	2	E

Part Number	Product Code	
	①	②
RP173K381A	2	F
RP173K391A	2	G
RP173K401A	2	H
RP173K411A	2	J
RP173K421A	2	K
RP173K431A	2	L
RP173K441A	2	M
RP173K451A	2	N
RP173K461A	2	P
RP173K471A	2	Q
RP173K481A	2	R
RP173K491A	2	S
RP173K501A	2	T
RP173K511A	2	U
RP173K521A	2	V
RP173K531A	2	W
RP173K541A	2	X
RP173K551A	2	Y
RP173K121A5	1	B
RP173K181A5	1	J
RP173K281A5	1	V
RP173K171A5	2	Z

RP173Kxx1B Series

Part Number	Product Code	
	①	②
RP173K121B	3	A
RP173K131B	3	C
RP173K141B	3	D
RP173K151B	3	E
RP173K161B	3	F
RP173K171B	3	G
RP173K181B	3	H
RP173K191B	3	K
RP173K201B	3	L
RP173K211B	3	M
RP173K221B	3	N
RP173K231B	3	P
RP173K241B	3	Q
RP173K251B	3	R
RP173K261B	3	S
RP173K271B	3	T
RP173K281B	3	U
RP173K291B	3	W
RP173K301B	3	X
RP173K311B	3	Y
RP173K321B	3	Z
RP173K331B	4	A
RP173K341B	4	B
RP173K351B	4	C
RP173K361B	4	D
RP173K371B	4	E

Part Number	Product Code	
	①	②
RP173K381B	4	F
RP173K391B	4	G
RP173K401B	4	H
RP173K411B	4	J
RP173K421B	4	K
RP173K431B	4	L
RP173K441B	4	M
RP173K451B	4	N
RP173K461B	4	P
RP173K471B	4	Q
RP173K481B	4	R
RP173K491B	4	S
RP173K501B	4	T
RP173K511B	4	U
RP173K521B	4	V
RP173K531B	4	W
RP173K541B	4	X
RP173K551B	4	Y
RP173K121B5	3	B
RP173K181B5	3	J
RP173K281B5	3	V
RP173K171B5	4	Z

MARK INFORMATIONS

• Part Number vs. Product Code

RP173Kxx1D Series

Part Number	Product Code	
	①	②
RP173K121D	5	A
RP173K131D	5	C
RP173K141D	5	D
RP173K151D	5	E
RP173K161D	5	F
RP173K171D	5	G
RP173K181D	5	H
RP173K191D	5	K
RP173K201D	5	L
RP173K211D	5	M
RP173K221D	5	N
RP173K231D	5	P
RP173K241D	5	Q
RP173K251D	5	R
RP173K261D	5	S
RP173K271D	5	T
RP173K281D	5	U
RP173K291D	5	W
RP173K301D	5	X
RP173K311D	5	Y
RP173K321D	5	Z
RP173K331D	6	A
RP173K341D	6	B
RP173K351D	6	C
RP173K361D	6	D
RP173K371D	6	E

Part Number	Product Code	
	①	②
RP173K381D	6	F
RP173K391D	6	G
RP173K401D	6	H
RP173K411D	6	J
RP173K421D	6	K
RP173K431D	6	L
RP173K441D	6	M
RP173K451D	6	N
RP173K461D	6	P
RP173K471D	6	Q
RP173K481D	6	R
RP173K491D	6	S
RP173K501D	6	T
RP173K511D	6	U
RP173K521D	6	V
RP173K531D	6	W
RP173K541D	6	X
RP173K551D	6	Y
RP173K121D5	5	B
RP173K181D5	5	J
RP173K281D5	5	V
RP173K171D5	6	Z

POWER DISSIPATION SC-88A

Ver. B

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

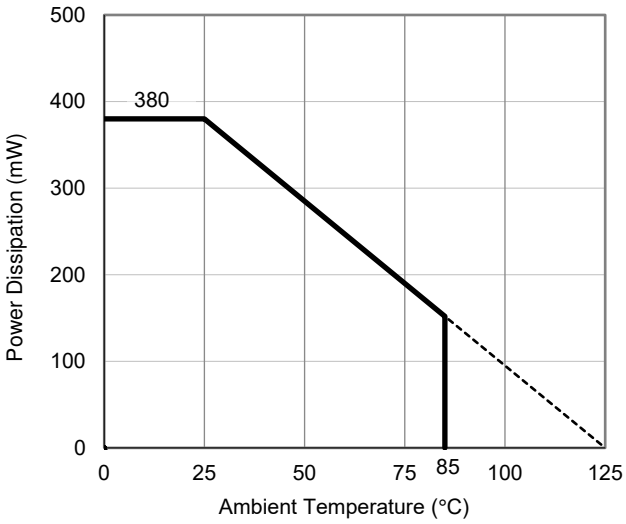
Item	Standard Test Land Pattern
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Double-Sided Board)
Board Dimensions	40 mm × 40 mm × 1.6 mm
Copper Ratio	Top Side: Approx. 50% Bottom Side: Approx. 50%
Through-holes	ϕ 0.5 mm × 44 pcs

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

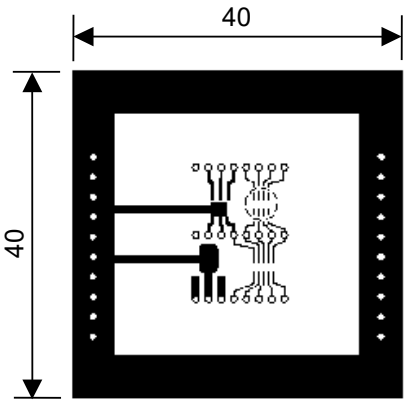
Item	Standard Test Land Pattern
Power Dissipation	380 mW
Thermal Resistance (θja)	θja = 263°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 75°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



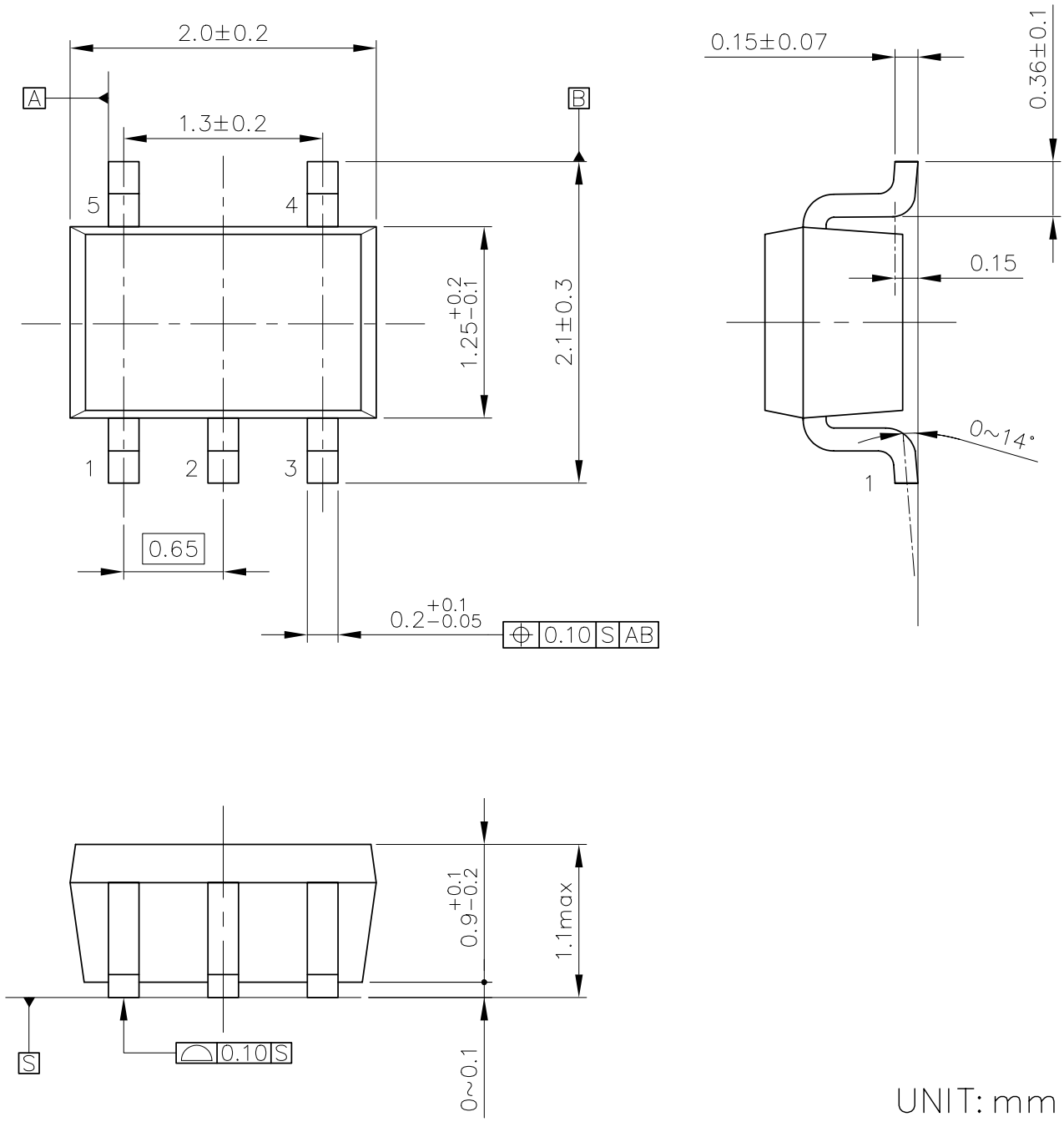
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

PACKAGE DIMENSIONS SC-88A

Ver. A



UNIT: mm

SC-88A Package Dimensions

POWER DISSIPATION SOT-23-5

Ver. 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

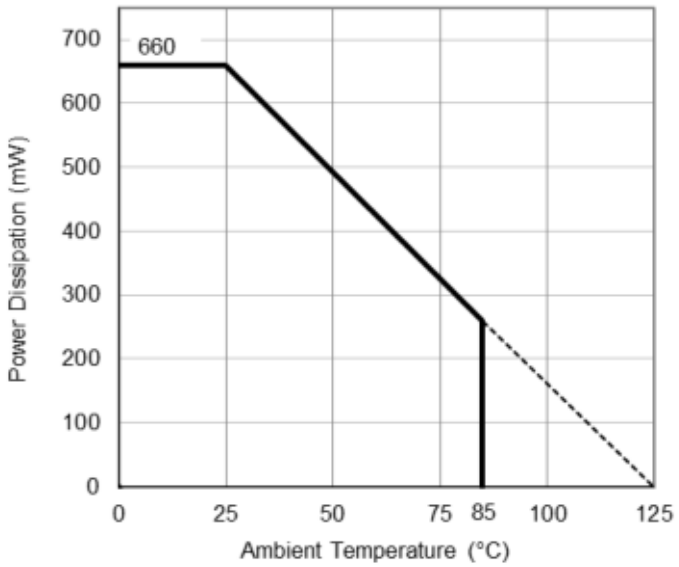
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx.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

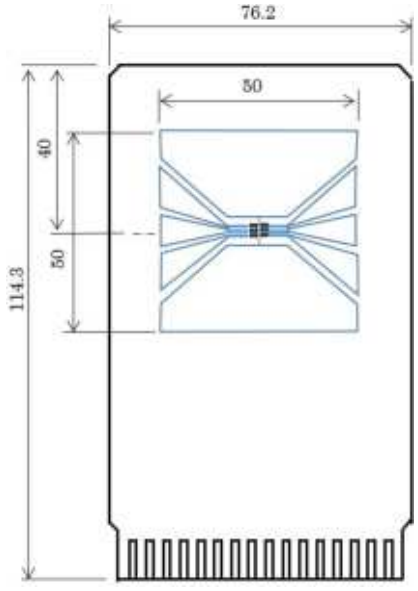
Item	Measurement Result
Power Dissipation	660 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



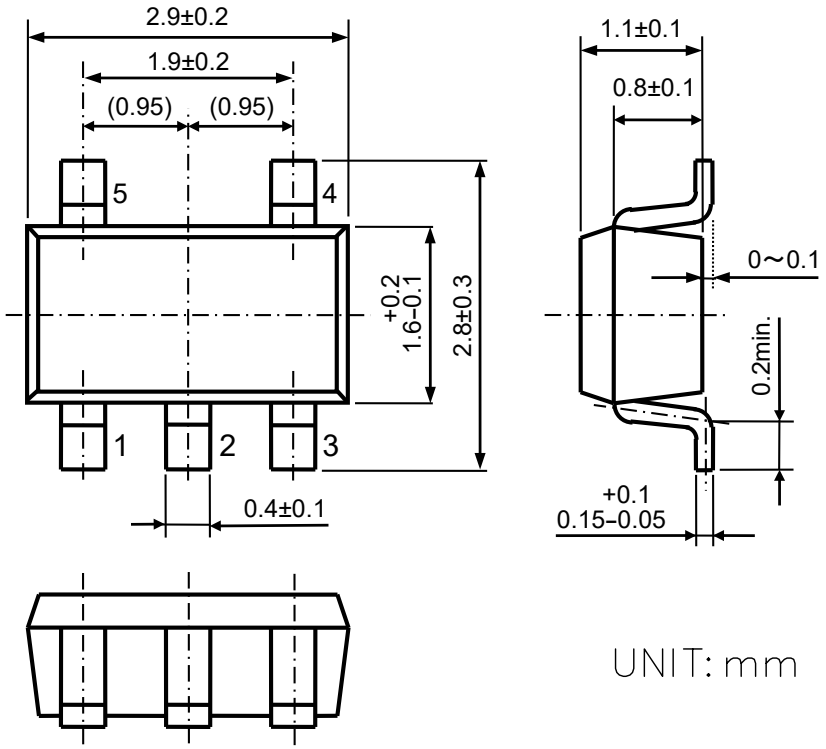
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

PACKAGE DIMENSIONS SOT-23-5

Ver. A

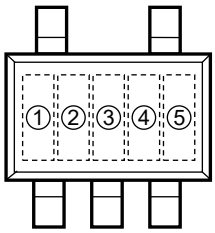


SOT-23-5 Package Dimensions

RP173Q(SC-88A) is the NRND product as of April,2023

RP173N SERIES MARK SPECIFICATION

- **SOT-23-5**



① to ③ : Product Code (Refer to Part Number vs. Product Code)

④ , ⑤ : Lot Number

- **Part Number vs. Product Code**

RP173Nxx1A Series

Part Number	Product Code		
	①	②	③
RP173N121A	D	1	2
RP173N131A	D	1	3
RP173N141A	D	1	4
RP173N151A	D	1	5
RP173N161A	D	1	6
RP173N171A	D	1	7
RP173N181A	D	1	8
RP173N191A	D	1	9
RP173N201A	D	2	0
RP173N211A	D	2	1
RP173N221A	D	2	2
RP173N231A	D	2	3
RP173N241A	D	2	4
RP173N251A	D	2	5
RP173N261A	D	2	6
RP173N271A	D	2	7
RP173N281A	D	2	8
RP173N291A	D	2	9
RP173N301A	D	3	0
RP173N311A	D	3	1
RP173N321A	D	3	2
RP173N331A	D	3	3
RP173N341A	D	3	4
RP173N351A	D	3	5
RP173N361A	D	3	6
RP173N371A	D	3	7
RP173N381A	D	3	8
RP173N391A	D	3	9
RP173N401A	D	4	0
RP173N411A	D	4	1
RP173N421A	D	4	2
RP173N431A	D	4	3
RP173N441A	D	4	4
RP173N451A	D	4	5

Part Number	Product Code		
	①	②	③
RP173N461A	D	4	6
RP173N471A	D	4	7
RP173N481A	D	4	8
RP173N491A	D	4	9
RP173N501A	D	5	0
RP173N511A	D	5	1
RP173N521A	D	5	2
RP173N531A	D	5	3
RP173N541A	D	5	4
RP173N551A	D	5	5
RP173N121A5	D	0	1
RP173N181A5	D	0	2
RP173N281A5	D	0	3

RP173Nxx1B Series

Part Number	Product Code		
	①	②	③
RP173N121B	E	1	2
RP173N131B	E	1	3
RP173N141B	E	1	4
RP173N151B	E	1	5
RP173N161B	E	1	6
RP173N171B	E	1	7
RP173N181B	E	1	8
RP173N191B	E	1	9
RP173N201B	E	2	0
RP173N211B	E	2	1
RP173N221B	E	2	2
RP173N231B	E	2	3
RP173N241B	E	2	4
RP173N251B	E	2	5
RP173N261B	E	2	6
RP173N271B	E	2	7
RP173N281B	E	2	8
RP173N291B	E	2	9
RP173N301B	E	3	0
RP173N311B	E	3	1
RP173N321B	E	3	2
RP173N331B	E	3	3
RP173N341B	E	3	4
RP173N351B	E	3	5
RP173N361B	E	3	6
RP173N371B	E	3	7
RP173N381B	E	3	8
RP173N391B	E	3	9
RP173N401B	E	4	0
RP173N411B	E	4	1
RP173N421B	E	4	2
RP173N431B	E	4	3
RP173N441B	E	4	4
RP173N451B	E	4	5

Part Number	Product Code		
	①	②	③
RP173N461B	E	4	6
RP173N471B	E	4	7
RP173N481B	E	4	8
RP173N491B	E	4	9
RP173N501B	E	5	0
RP173N511B	E	5	1
RP173N521B	E	5	2
RP173N531B	E	5	3
RP173N541B	E	5	4
RP173N551B	E	5	5
RP173N121B5	E	0	1
RP173N181B5	E	0	2
RP173N281B5	E	0	3

MARK INFORMATIONS

• Part Number vs. Product Code

RP173Nxx1D Series

Part Number	Product Code		
	①	②	③
RP173N121D	F	1	2
RP173N131D	F	1	3
RP173N141D	F	1	4
RP173N151D	F	1	5
RP173N161D	F	1	6
RP173N171D	F	1	7
RP173N181D	F	1	8
RP173N191D	F	1	9
RP173N201D	F	2	0
RP173N211D	F	2	1
RP173N221D	F	2	2
RP173N231D	F	2	3
RP173N241D	F	2	4
RP173N251D	F	2	5
RP173N261D	F	2	6
RP173N271D	F	2	7
RP173N281D	F	2	8
RP173N291D	F	2	9
RP173N301D	F	3	0
RP173N311D	F	3	1
RP173N321D	F	3	2
RP173N331D	F	3	3
RP173N341D	F	3	4
RP173N351D	F	3	5
RP173N361D	F	3	6
RP173N371D	F	3	7
RP173N381D	F	3	8
RP173N391D	F	3	9
RP173N401D	F	4	0
RP173N411D	F	4	1
RP173N421D	F	4	2
RP173N431D	F	4	3
RP173N441D	F	4	4
RP173N451D	F	4	5

Part Number	Product Code		
	①	②	③
RP173N461D	F	4	6
RP173N471D	F	4	7
RP173N481D	F	4	8
RP173N491D	F	4	9
RP173N501D	F	5	0
RP173N511D	F	5	1
RP173N521D	F	5	2
RP173N531D	F	5	3
RP173N541D	F	5	4
RP173N551D	F	5	5
RP173N121D5	F	0	1
RP173N181D5	F	0	2
RP173N281D5	F	0	3

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    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

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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.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
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.
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.
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