NISSHINBO

RP131x SERIES

LOW ON RESISTANCE / LOW VOLTAGE 1A LDO

NO.EA-174-240417

OUTLINE

The RP131x Series are voltage-regulators with a built-in low ON-resistance transistor and output current is 1A capability. These ICs are capable of the low input voltage (Min.1.6V) and also the minimum output voltage can be set from 0.8V. (The output voltage is fixed in the IC.)

Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor net for setting output voltage, a chip enable circuit, current limit circuits for over-current and short, and a thermal-shutdown circuit.

A standby mode with ultra low supply current can be realized with the chip enable function.

The packages for these ICs are DFN1616-6B and DFN(PL)1820-6 which are suitable for high density mounting of the ICs on boards. SOT-89-5, HSOP-6J and TO-252-5-P2 with high power dissipation are also available.

FEATURES

- Output Current ..... Min. 1A
- Supply Current..... Typ. 65μA
- Standby Current ..... Typ. 0.15μA
- Input Voltage Range ..... 1.6V to 6.5V
- Output Voltage Range ..... 0.8V to 5.5V [(1)](0.1V steps)
- Dropout Voltage..... Typ. 0.5V (V_{OUT}=2.8V, I_{OUT}=1A)
- Ripple Rejection ..... Typ. 70dB (f=1kHz, V_{OUT}=2.8V)
- Output Voltage Accuracy..... ±1.0%
- Temperature-Drift Coefficient of Output Voltage..... Typ. ±100ppm/°C
- Line Regulation..... Typ. 0.05%/V
- Load Regulation ..... Typ. 20mV at I_{OUT}=300mA, Typ. 80mV at I_{OUT}=1A
- Packages ..... DFN1616-6B, DFN(PL)1820-6, SOT-89-5, HSOP-6J, TO-252-5-P2
- Built-in Inrush current limit circuit ..... Typ. 500mA
- Built-in Fold-Back Protection Circuit ..... Typ. 250mA (Current at short mode)
- Built-in Thermal Shutdown Circuit ..... Thermal Shutdown Temperature ; Typ. 165°C
  Released Temperature ; Typ. 135°C
- Built-in Auto Discharge Function ..... D version
- Ceramic capacitors are recommended to be used with this IC..... 2.2μF or more (V_{OUT}≤3.6V)
  4.7μF or more (V_{OUT}>3.6V)

APPLICATIONS

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

(1) For other voltages, please refer to MARK INFORMATIONS.

SELECTION GUIDE

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

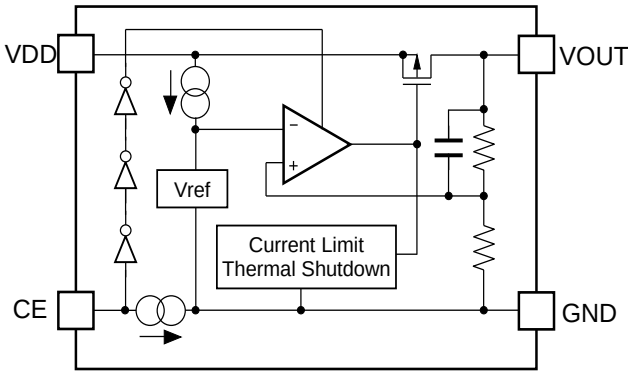
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP131Lxx1∗-TR	DFN1616-6B	5,000 pcs	Yes	Yes
RP131Kxx1∗-TR	DFN(PL)1820-6	5,000 pcs	Yes	Yes
RP131Hxx1∗-T1-FE	SOT-89-5	1,000 pcs	Yes	Yes
RP131Sxx1∗-E2-FE	HSOP-6J	1,000 pcs	Yes	Yes
RP131Jxx1∗-T1-FE	TO-252-5-P2	3,000 pcs	Yes	Yes

xx : The output voltage can be designated in the range from 0.8V(08) to 5.5V(55) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

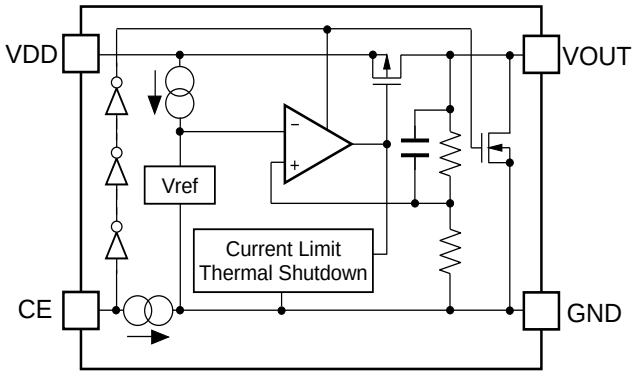
∗ : The auto discharge function at off state are options as follows.(1)
(B) without auto discharge function at off state
(D) with auto discharge function at off state

BLOCK DIAGRAMS

RP131xxx1B

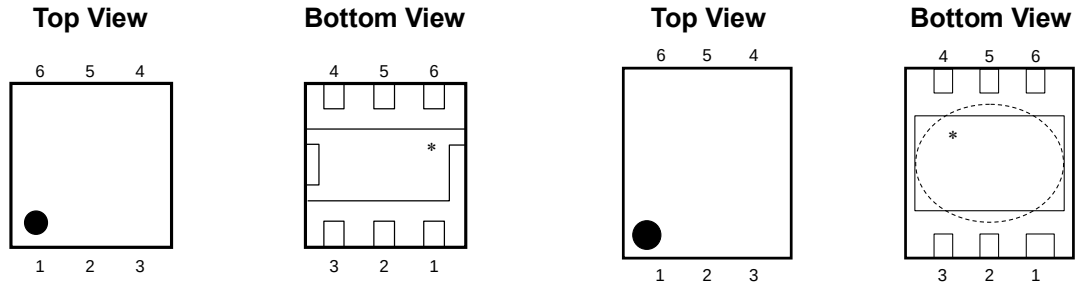


RP131xxx1D

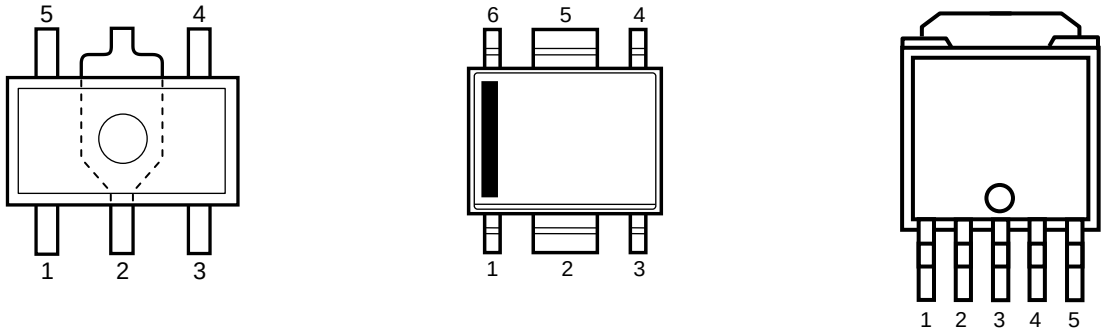


(1) Auto-discharge function quickly lowers the output voltage to 0V, when the chip enable signal is switched from the active mode to the standby mode, by releasing the electrical charge accumulated in the external capacitor.

PIN DESCRIPTIONS



DFN1616-6B **DFN(PL)1820-6**



SOT-89-5 **HSOP-6J** **TO-252-5-P2**

∗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.

RP131L (DFN1616-6B) Pin Description

Pin No.	Symbol	Pin Description
1	VOUT	Output Pin(1)
2	VOUT	Output Pin(1)
3	GND	Ground Pin
4	CE	Chip Enable Pin ("H" Active)
5	VDD	Input Pin(1)
6	VDD	Input Pin(1)

(1) When you use this IC, please make sure be wired with 1pin with 2pin and 5pin with 6pin.

RP131K (DFN(PL)1820-6) Pin Description

Pin No.	Symbol	Pin Description
1	VOUT	Output Pin(1)
2	VOUT	Output Pin(1)
3	GND	Ground Pin
4	CE	Chip Enable Pin ("H" Active)
5	VDD	Input Pin(1)
6	VDD	Input Pin(1)

RP131H (SOT-89-5) Pin Description

Pin No.	Symbol	Pin Description
1	NC	No Connection
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	VDD	Input Pin
5	VOUT	Output Pin

RP131S (HSOP-6J) Pin Description

Pin No.	Symbol	Pin Description
1	VOUT	Output Pin
2	GND	Ground Pin(2)
3	NC	No Connection
4	CE	Chip Enable Pin ("H" Active)
5	GND	Ground Pin(2)
6	VDD	Input Pin

RP131J (TO-252-5-P2) Pin Description

Pin No.	Symbol	Pin Description
1	VOUT	Output Pin
2	GND	Ground Pin(3)
3	GND	Ground Pin(3)
4	CE	Chip Enable Pin ("H" Active)
5	VDD	Input Pin

(1) When you use this IC, please make sure be wired with 1pin with 2pin and 5pin with 6pin.
(2) When you use this IC, please make sure be wired with 2pin and 5pin.
(3) When you use this IC, please make sure be wired with 2pin and 3pin.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage		7.0	V
V_{CE}	Input Voltage (CE Pin)		−0.3 to 7.0	V
V_{OUT}	Output Voltage		−0.3 to V_{IN}+0.3	V
P_D	Power Dissipation(1)	DFN1616-6B	2400	mW
		DFN(PL)1820-6	2200	
		SOT-89-5	2600	
		HSOP-6J	2700	
		TO-252-5-P2	3800	
T_j	Junction Temperature Range		−40 to 125	°C
T_{stg}	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

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	1.6 to 6.5	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 when they are used over such ratings 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.

ELECTRICAL CHARACTERISTICS

V_{IN}=Set V_{OUT}+1V, I_{OUT}=1mA
The specification in ☐ is checked and guaranteed by design engineering at −40°C≤Ta≤85°C, unless otherwise noted.

RP131xxx1B/D

(Ta = 25°C)

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Ta = 25°C	V_{OUT}>1.5V	×0.99		×1.01	V
			V_{OUT}≤1.5V	−15		15	mV
		−40°C ≤ Ta ≤ 85°C	V_{OUT}>1.5V	×0.974		×1.018	V
			V_{OUT}≤1.5V	−40		27	mV
$\Delta V_{OUT}/\Delta I_{OUT}$	Load Regulation	0.1mA ≤ I_{OUT} ≤ 300mA			20	40	mV
		0.1mA ≤ I_{OUT} ≤ 1A			80	120	
V_{DIF}	Dropout Voltage	Refer to the following table					
I_{SS}	Supply Current	I_{OUT}=0mA (V_{IN}=6.5V)			65	90	µA
Istandby	Standby Current	V_{CE}=0V, V_{IN}=6.5V			0.15	0.60	µA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	Set V_{OUT}+0.5V ≤ V_{IN} ≤ 6.5V ∗However, V_{IN} ≥ 1.6V			0.05	0.1	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.2Vp-p I_{OUT}=100mA	V_{OUT}≤3.3V		70		dB
			V_{OUT}>3.3V		60		
V_{IN}	Input Voltage			1.6		6.5	V
I_{LIM}	Output Current Limit			1			A
$\Delta V_{OUT}/\Delta Ta$	Output Voltage Temperature Coefficient	−40°C≤Ta≤85°C			±100		ppm /°C
I_{SC}	Short Current Limit	V_{OUT}=0V			250		mA
I_{PD}	CE Pull-down Current				0.3		µA
V_{CEH}	CE Input Voltage "H"			1.0			V
V_{CEL}	CE Input Voltage "L"					0.4	V
en	Output Noise	BW=10Hz to 100kHz, I_{OUT}=1mA			45		µVrms
T_{TSD}	Thermal Shutdown Temperature	Junction Temperature			165		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			135		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (of D version)	V_{IN}=4.0V, V_{CE}=0V			30		Ω

All test items listed under Electrical Characteristics are done under the pulse load condition (Tj≈Ta = 25°C) except for Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient, Dropout Voltage at 1A Output Current and Thermal Shutdown items.

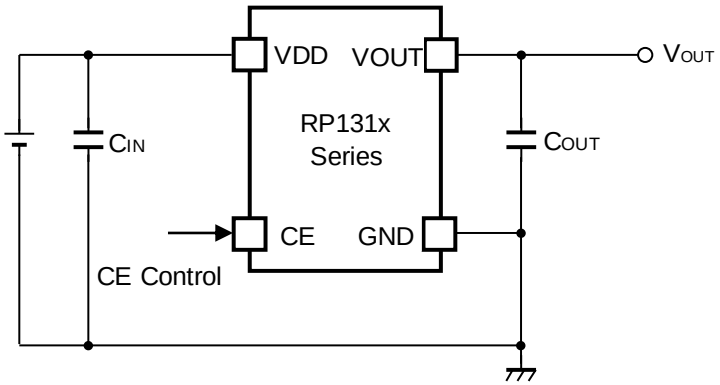
The specification in ☐ is checked and guaranteed by design engineering at −40°C ≤ Ta ≤ 85°C, unless otherwise noted.

Dropout Voltage **(Ta = 25°C)**

Output Voltage V_{OUT} (V)	Dropout Voltage V_{DIF} (V)					
	Condition	Typ.	Max.	Condition	Typ.	Max.
0.8 ≤ V_{OUT} < 0.9	I_{OUT}=300mA	0.600	0.780	I_{OUT}=1A	1.100	1.650
0.9 ≤ V_{OUT} < 1.0		0.550	0.690		1.050	1.500
1.0 ≤ V_{OUT} < 1.1		0.450	0.610		1.000	1.450
1.1 ≤ V_{OUT} < 1.2		0.340	0.540		0.930	1.420
1.2 ≤ V_{OUT} < 1.5		0.290	0.500		0.900	1.380
1.5 ≤ V_{OUT} < 2.6		0.230	0.310		0.700	1.100
2.6 ≤ V_{OUT} < 3.3		0.150	0.180		0.500	0.750
3.3 ≤ V_{OUT} ≤ 5.5		0.140	0.170		0.450	0.650

APPLICATION INFORMATION

Typical Application Circuits



Recommendation value of the external capacitors

V_{OUT}	Capacitors		
$V_{OUT} \leq 3.6V$	C_{IN}	Kyocera 2.2μF (size:1005)	[CM05X5R225M06AB]
	C_{OUT}	Kyocera 2.2μF (size:1608)	[CM105X5R225K06AB]
$V_{OUT} > 3.6V$	C_{IN}	Kyocera 2.2μF (size:1608)	[CM105X5R225K06AB]
	C_{OUT}	Kyocera 4.7μF (size:1608)	[CM105X5R475M06AB]

Technical Notes on the External Components

When using this IC, consider following points:

Phase Compensation

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C_{OUT} with good frequency characteristics and ESR (Equivalent Series Resistance).

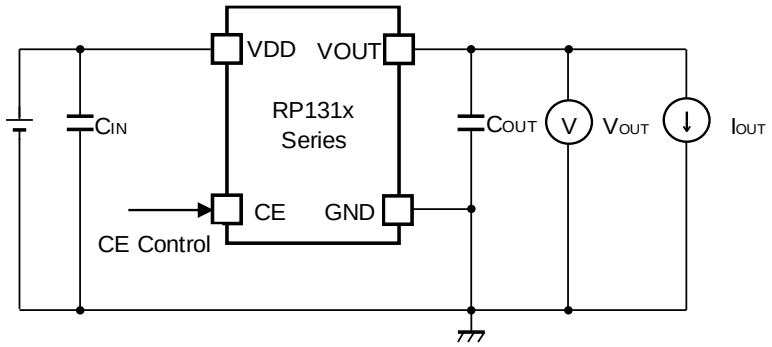
If a tantalum capacitor is used, and its ESR of C_{OUT} is large, the loop oscillation may result. Because of this, select C_{OUT} carefully considering its frequency characteristics.

PCB Layout

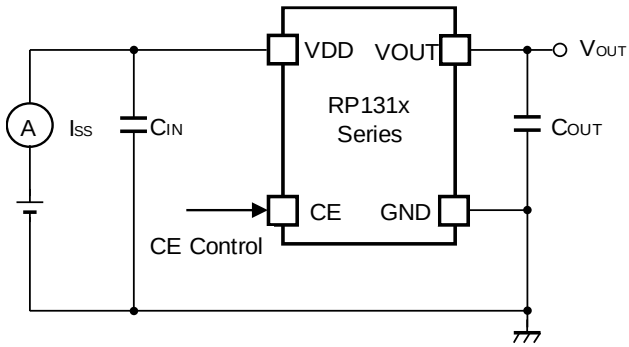
Make VDD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C_{IN} between VDD and GND pin with a capacitance value as "Recommendation value of the external capacitors" above or more, and as close as possible to the pins.

Set external components, especially the output capacitor C_{OUT}, as close as possible to the ICs, and make wiring as short as possible.

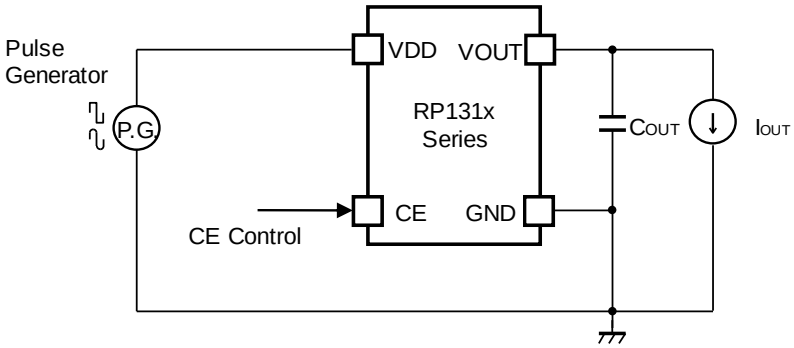
TEST CIRCUITS



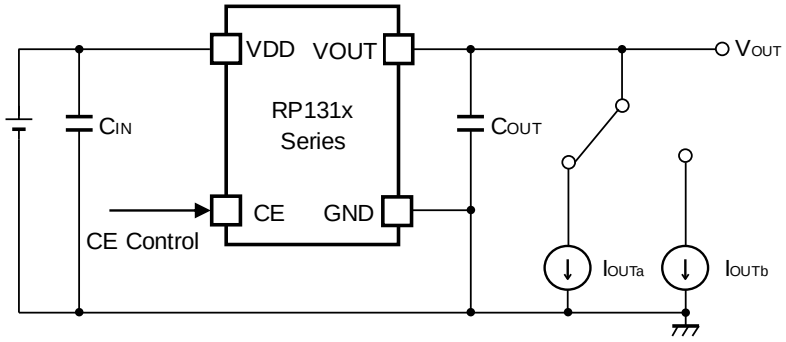
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection



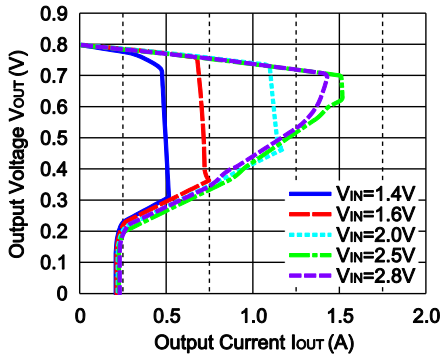
Test Circuit for Load Transient Response

TYPICAL CHARACTERISTICS

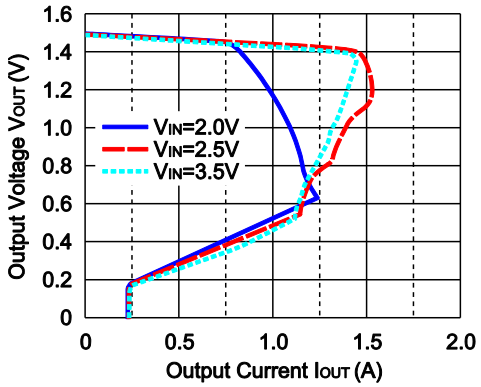
Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Output Voltage vs. Output Current (Ta = 25°C)

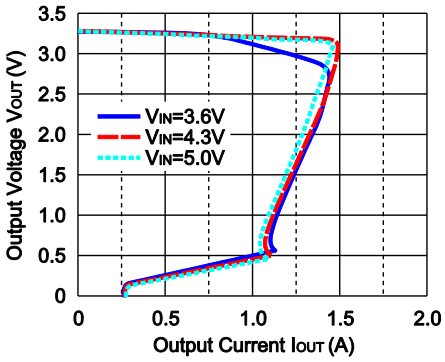
RP131x081x



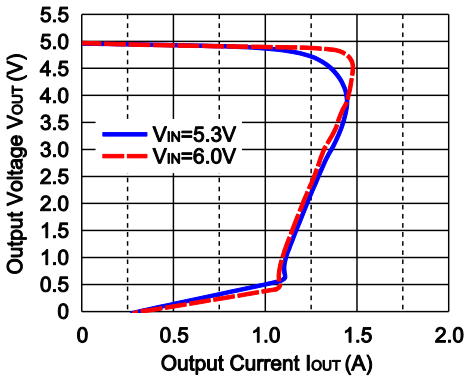
RP131x151x



RP131x331x

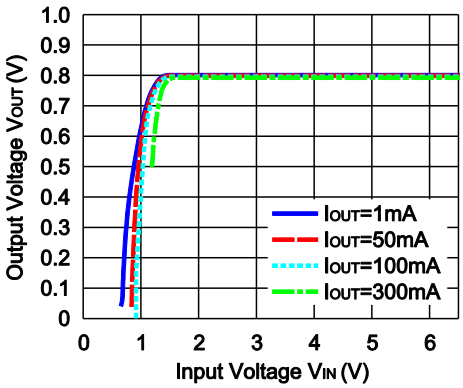


RP131x501x

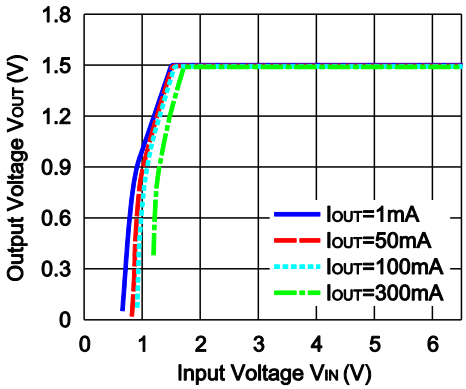


2) Output Voltage vs. Input Voltage (Ta=25°C)

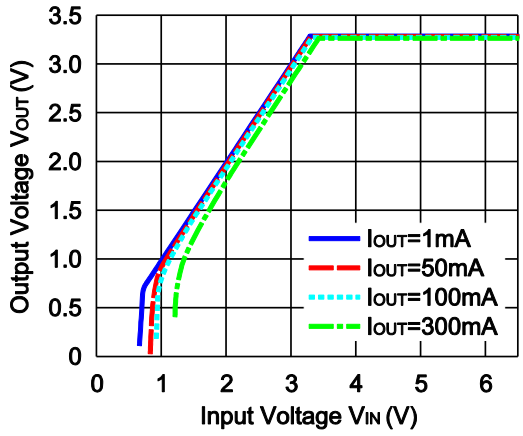
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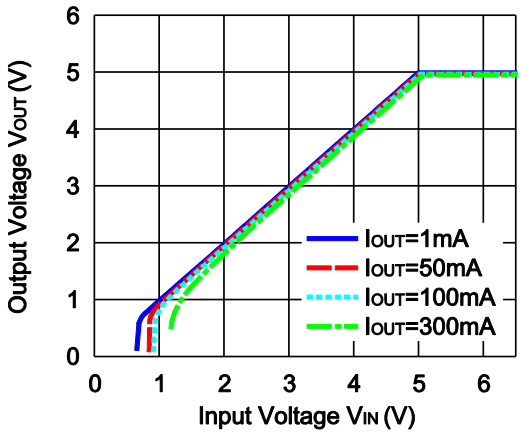
RP131x151x



RP131x331x

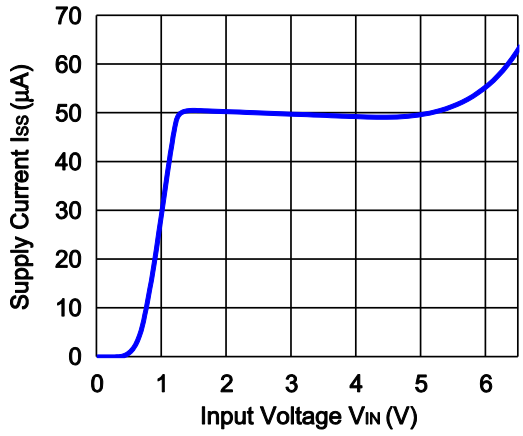


RP131x501x

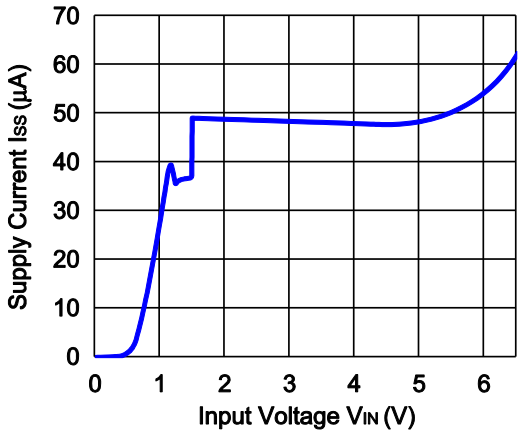


3) Supply Current vs. Input Voltage (Ta=25°C)

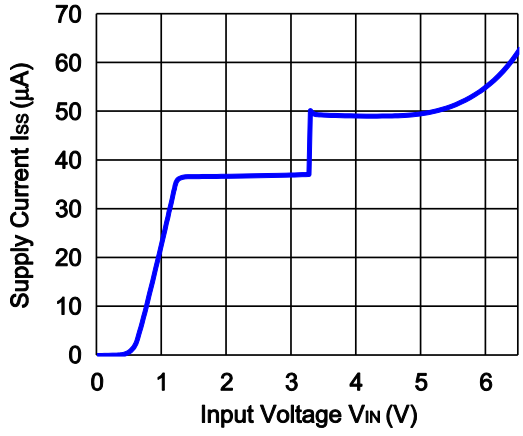
RP131x081x



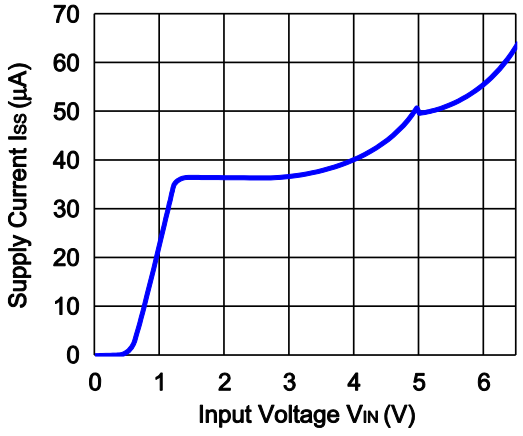
RP131x151x



RP131x331x

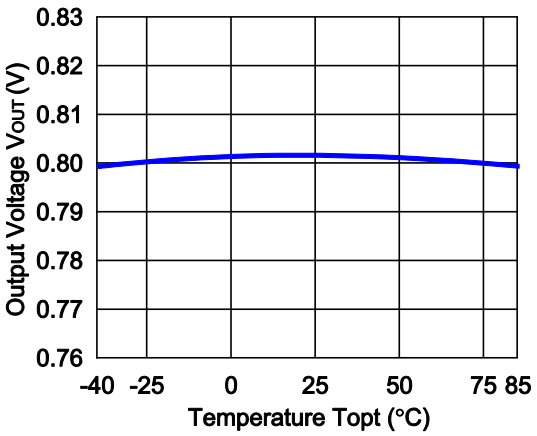


RP131x501x

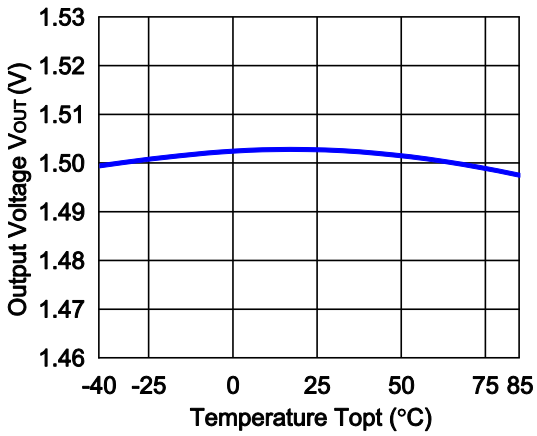


4) Output Voltage vs. Temperature

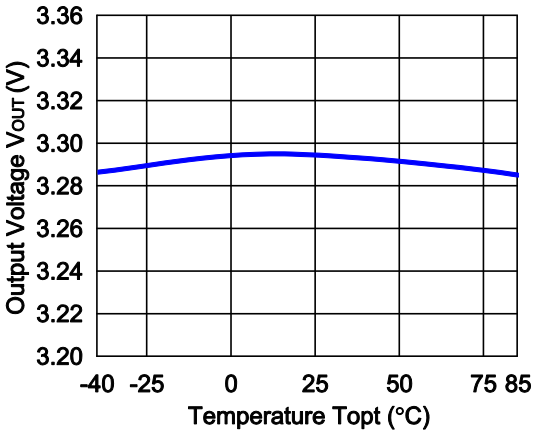
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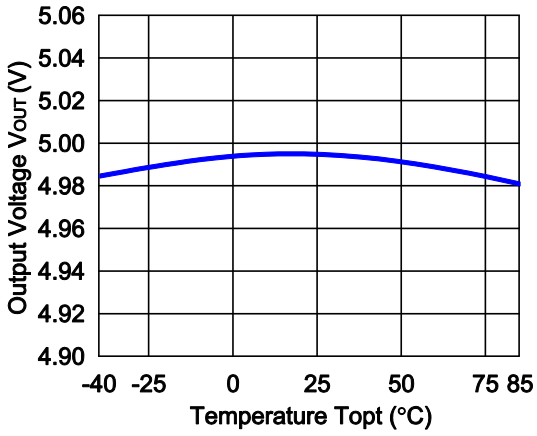
RP131x281x



RP131x331x

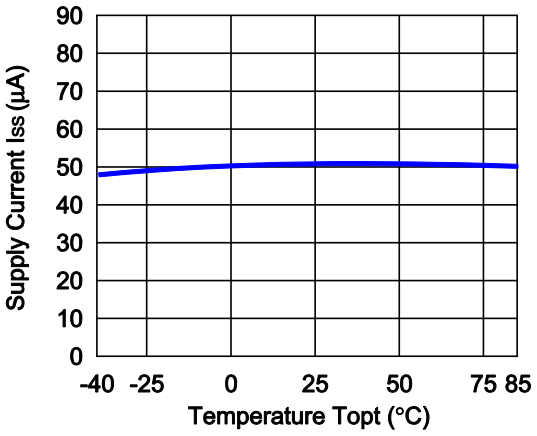


RP131x501x

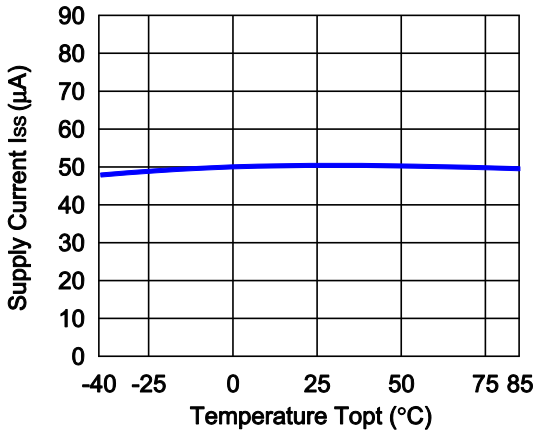


5) Supply Current vs. Temperature

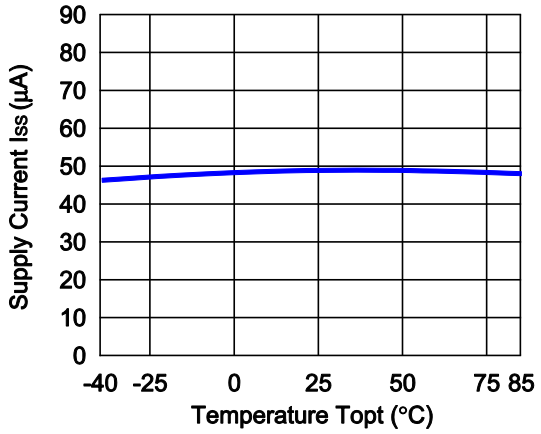
RP131x081x



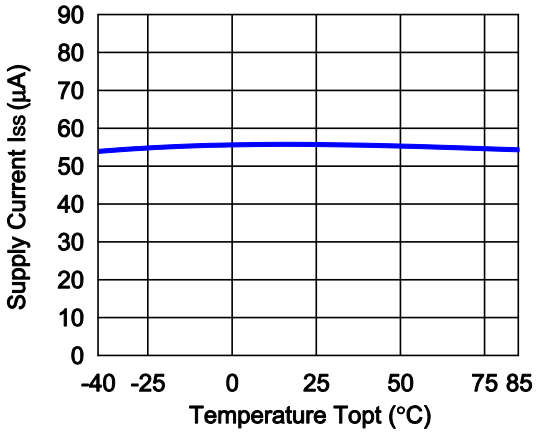
RP131x151x



RP131x331x

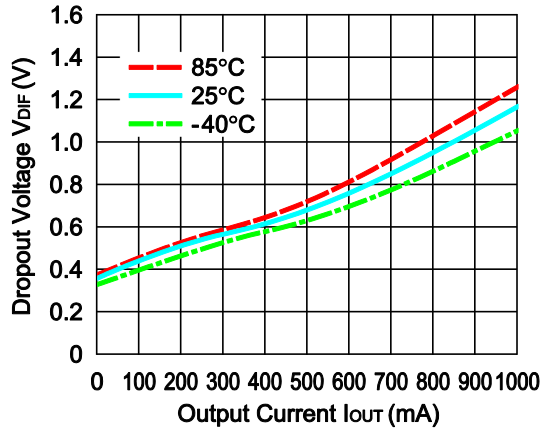


RP131x501x

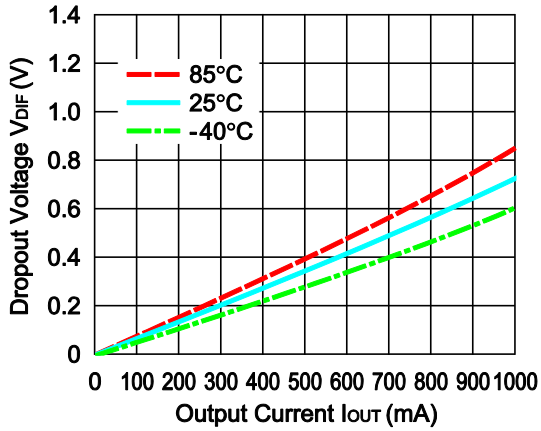


6) Dropout Voltage vs. Output Current

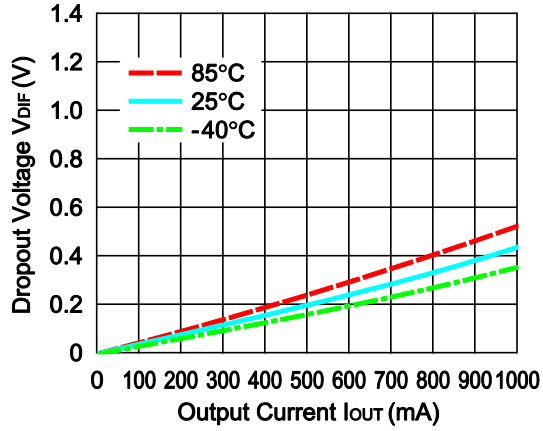
RP131x081x



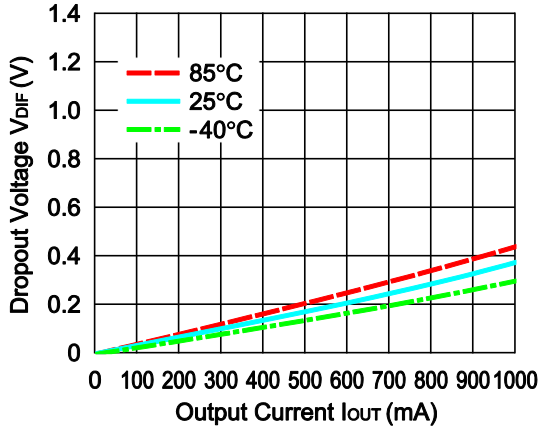
RP131x151x



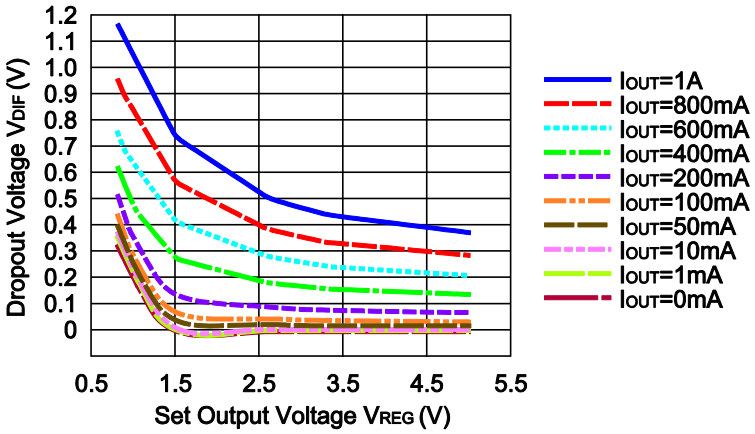
RP131x331x



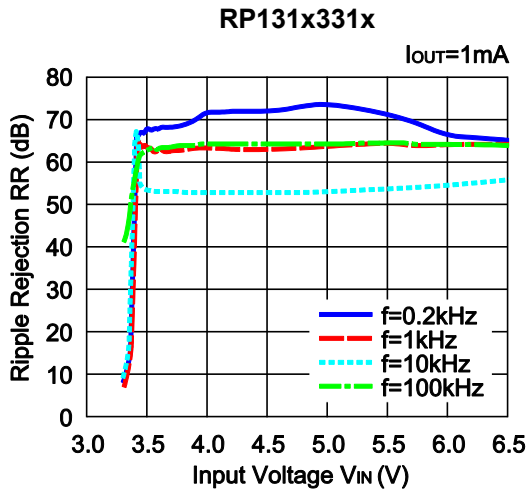
RP131x501x

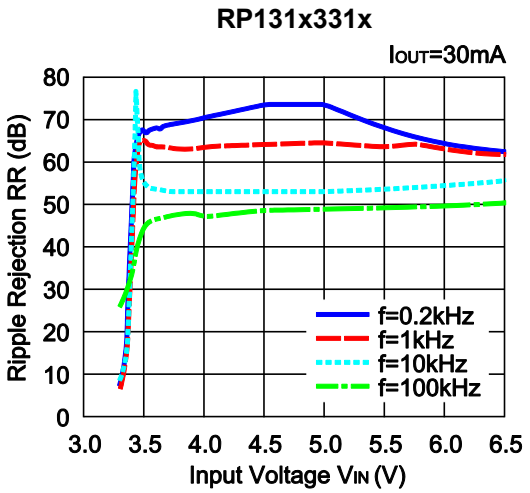


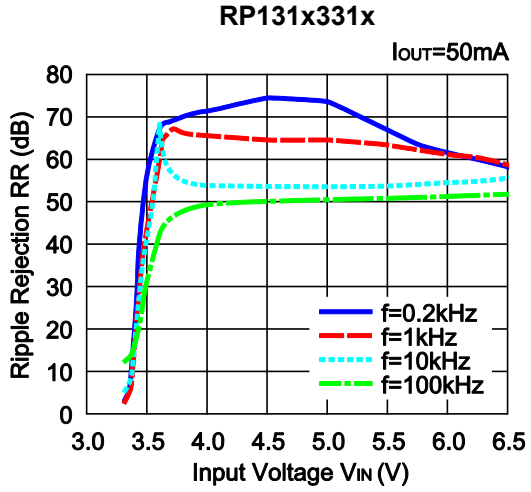
7) Dropout Voltage vs. Set Output Voltage

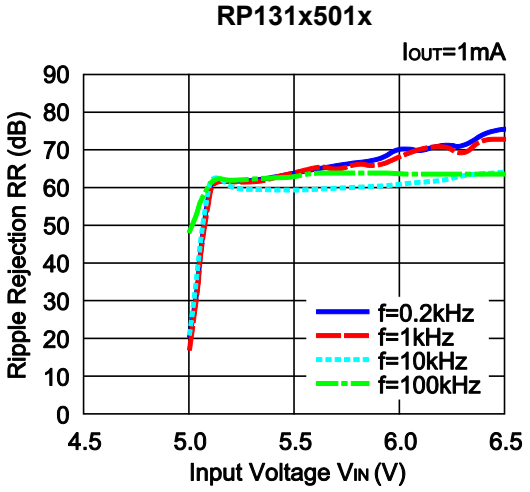


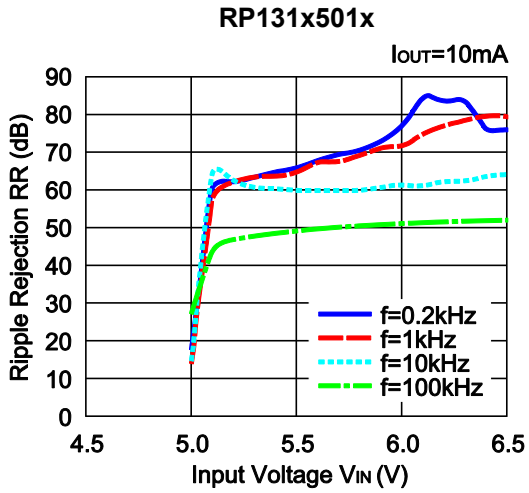
8) Ripple Rejection vs. Input Bias Voltage (C_{IN}=none, C_{OUT}=Ceramic 1.0µF, Ripple=0.2Vp-p, Ta=25°C)

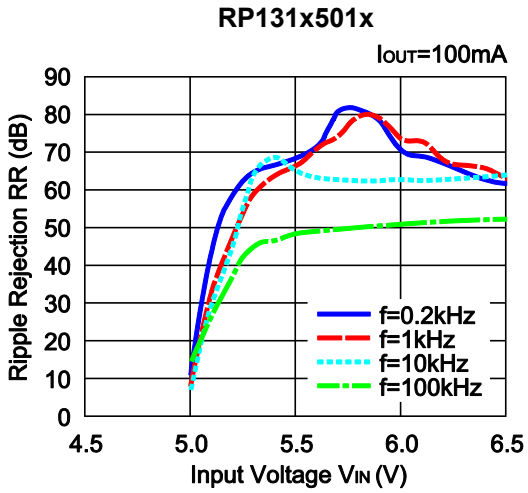




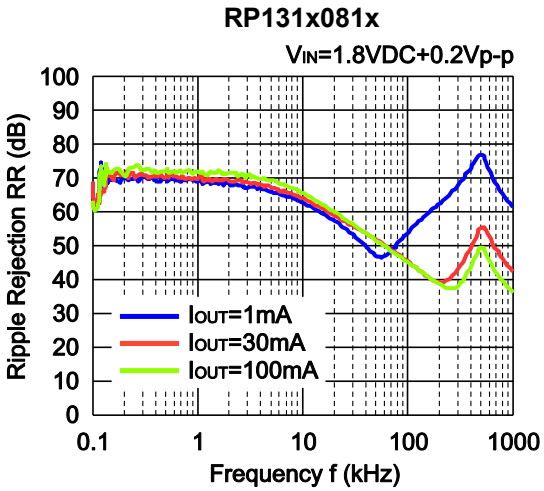


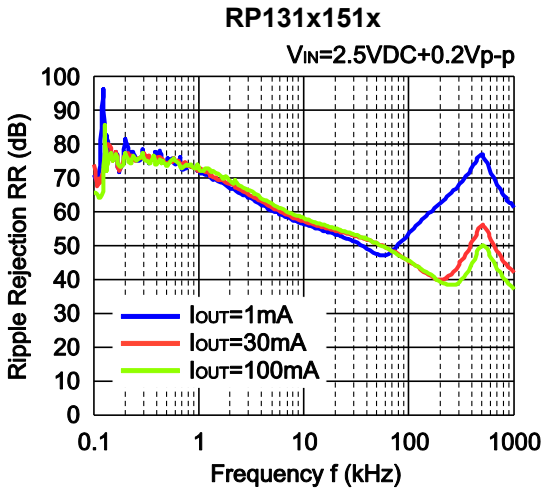


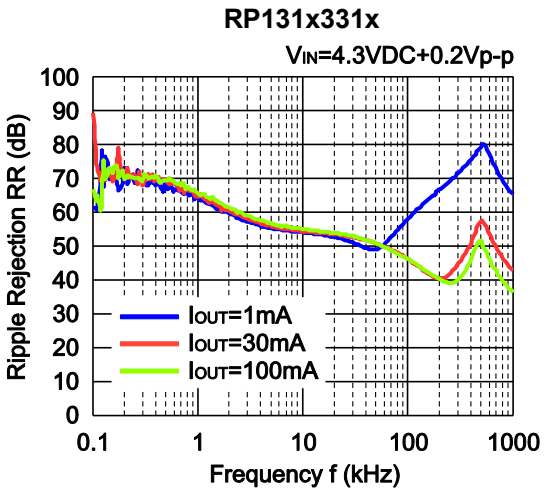


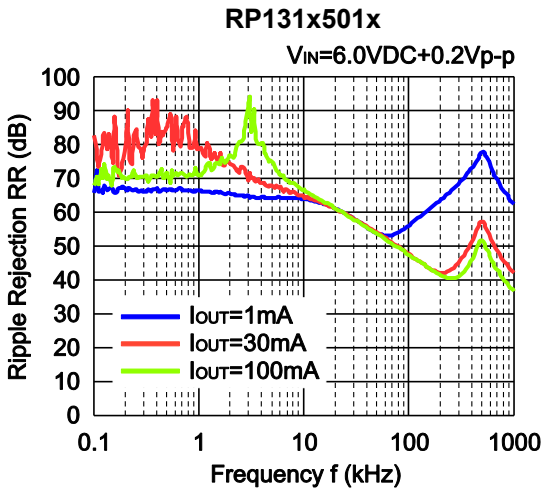


9) Ripple Rejection vs. Frequency (CIN=none, COUT=Ceramic 4.7µF, Ta=25°C)



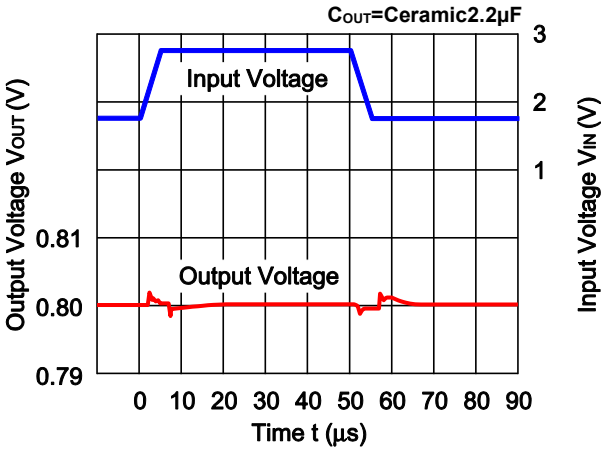




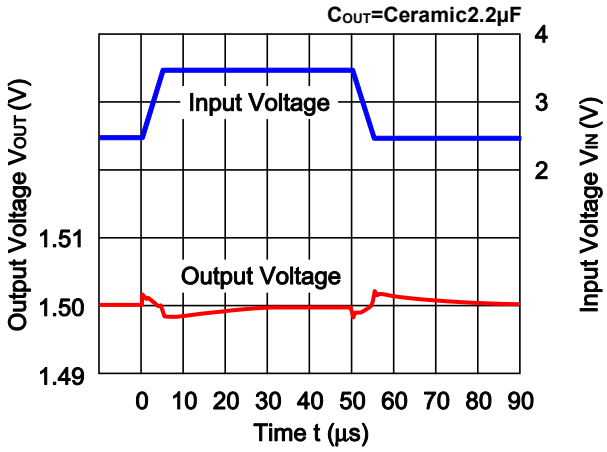


10) Input Transient Response (I_{OUT}=100mA, tr=tf=5µs, C_{IN}=none, Ta=25°C)

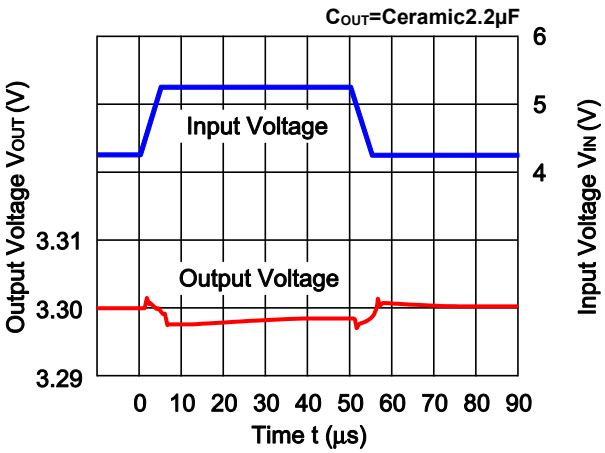
RP131x081x



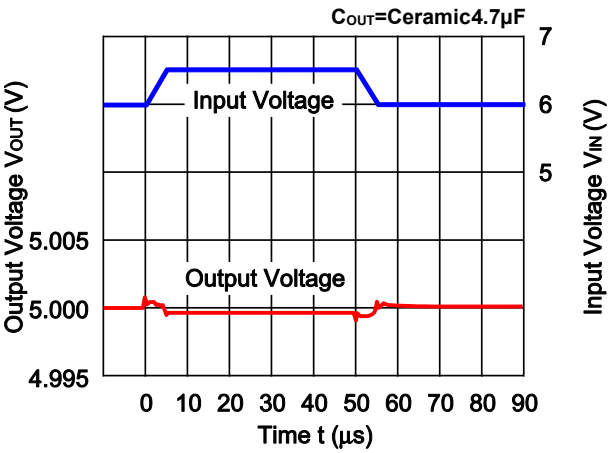
RP131x151x



RP131x331x

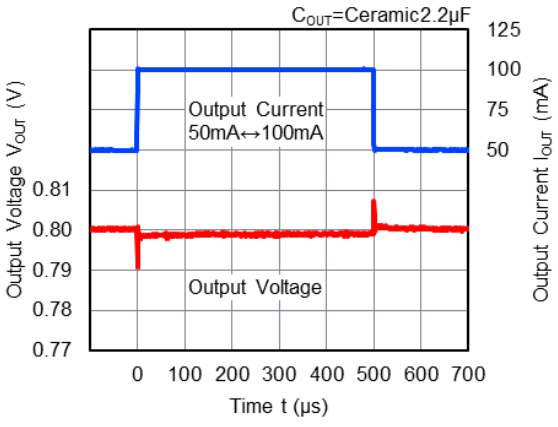


RP131x501x

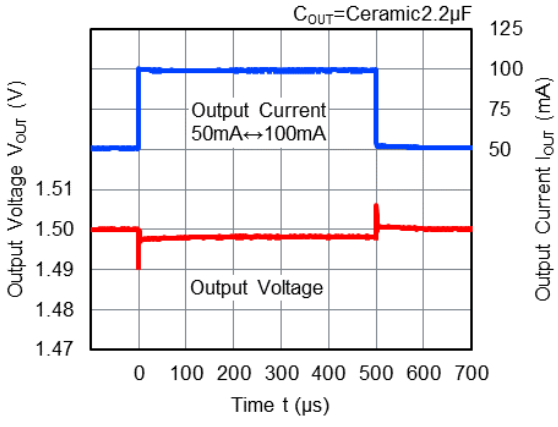


11) Load Transient Response (tr=tf=0.5µs, C_{IN}=Ceramic 2.2µF, V_{IN}=V_{OUT}+1.0V, Ta=25°C)

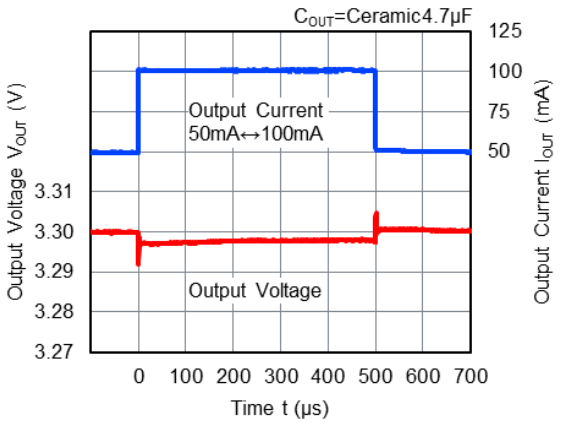
RP131x081x



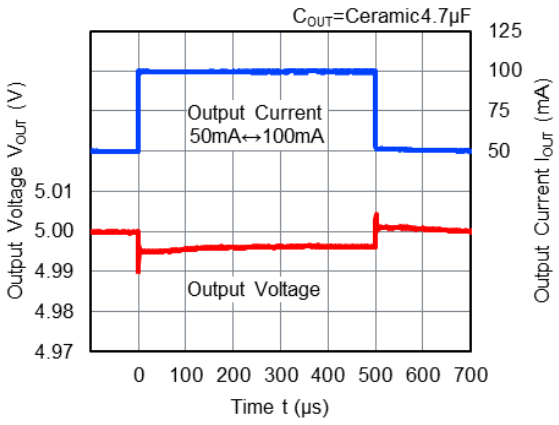
RP131x151x



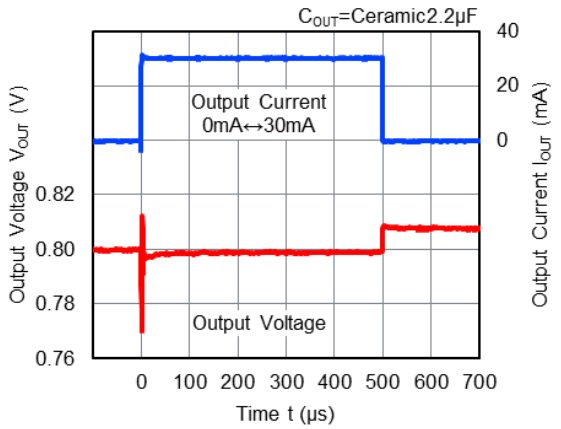
RP131x331x



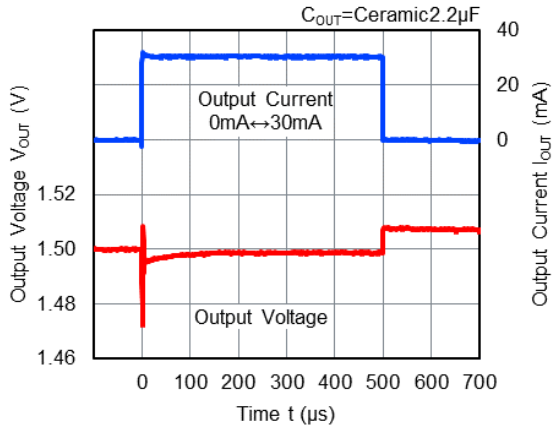
RP131x501x



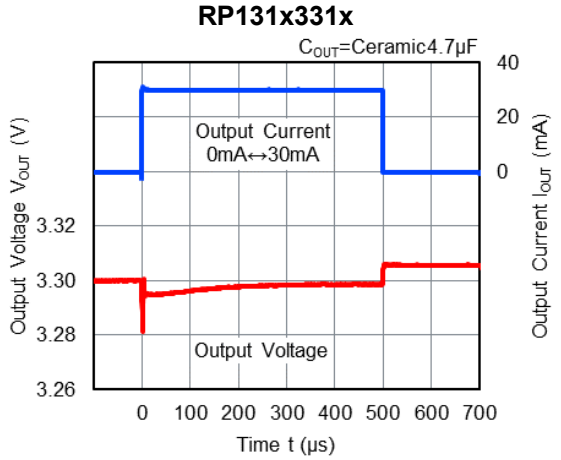
RP131x081x



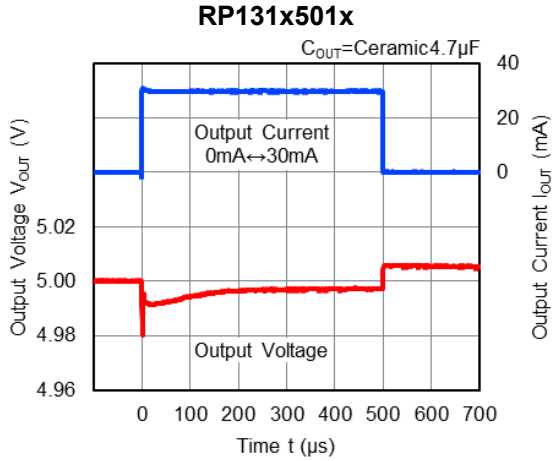
RP131x151x



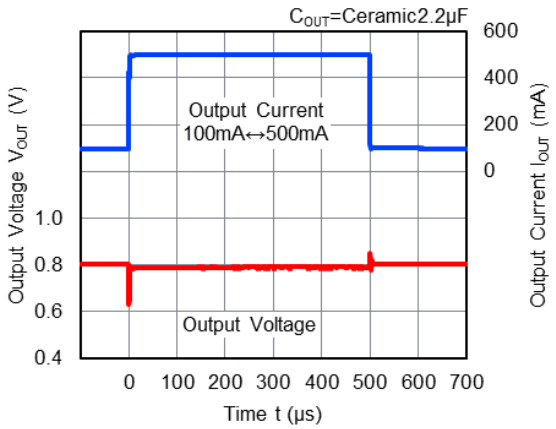
RP131x331x



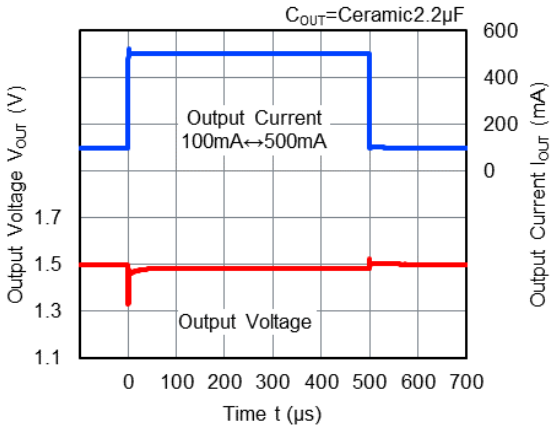
RP131x501x



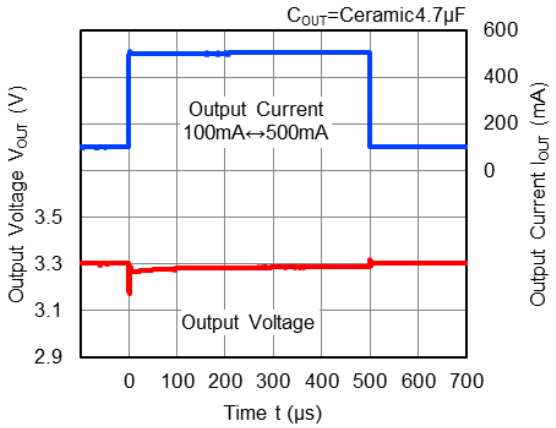
RP131x081x



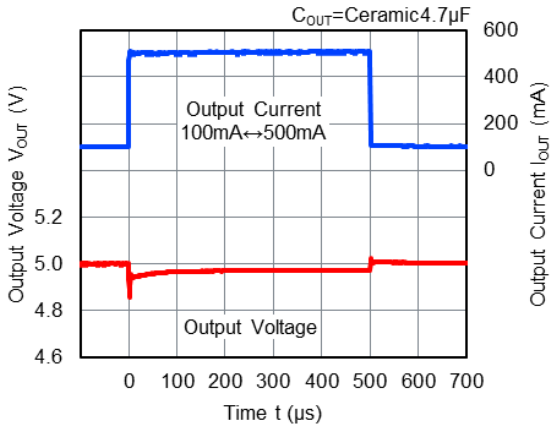
RP131x151x



RP131x331x

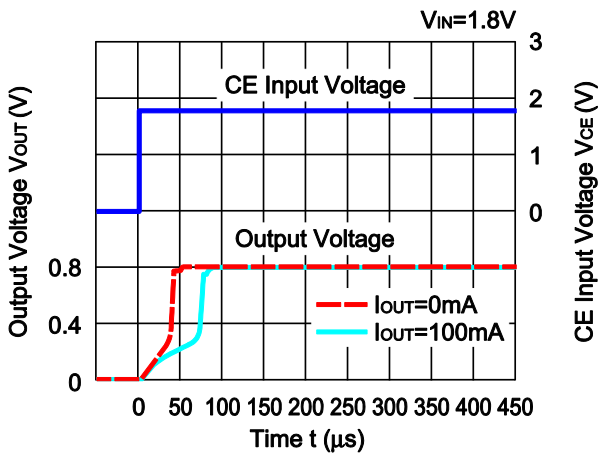


RP131x501x

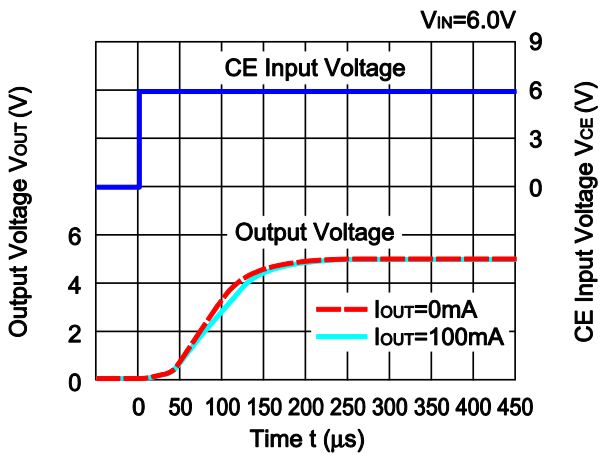


12) Turn On Speed with CE pin (CIN=Ceramic 2.2µF, COUT=Ceramic 4.7µF, Ta=25°C)

RP131x081x

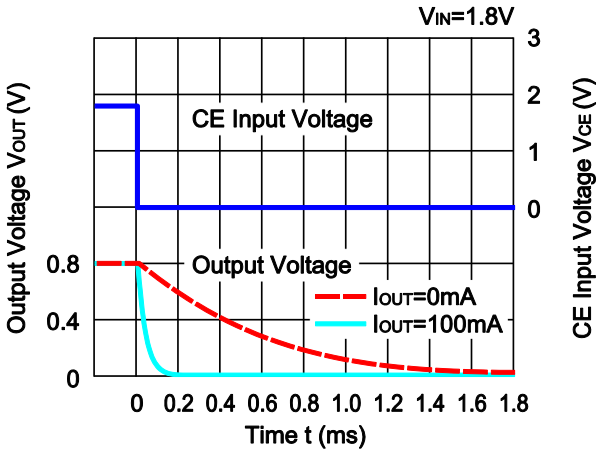


RP131x501x

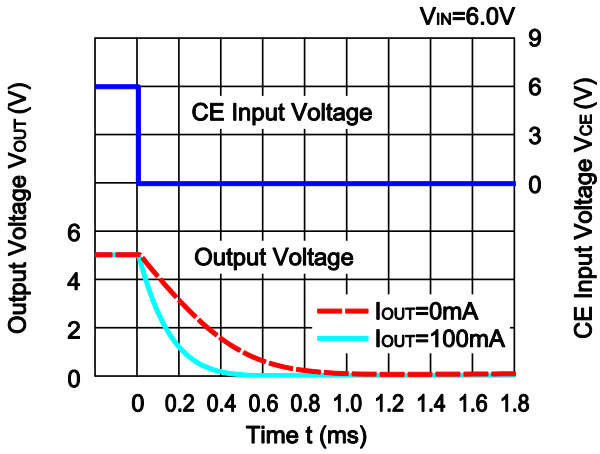


13) Turn Off Speed with CE pin (D Version) (C_{IN}=Ceramic 2.2µF, C_{OUT}=Ceramic 4.7µF, Ta=25°C)

RP131x081D

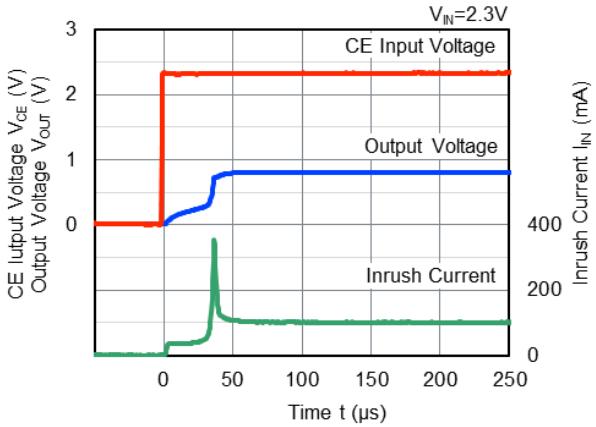


RP131x501D

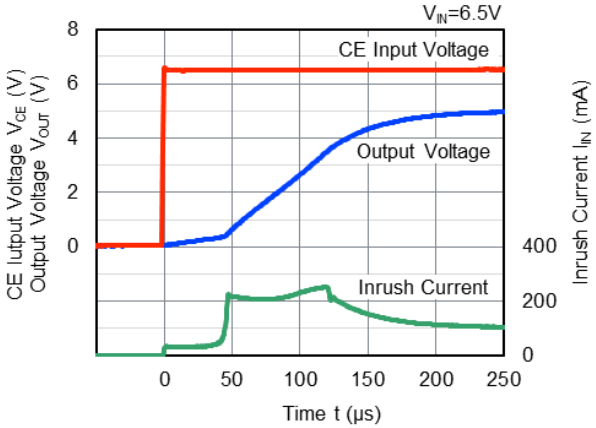


14) Inrush Current at turning on (C_{IN}=Ceramic 2.2µF, C_{OUT}=Ceramic 4.7µF, Ta=25°C)

RP131x081x

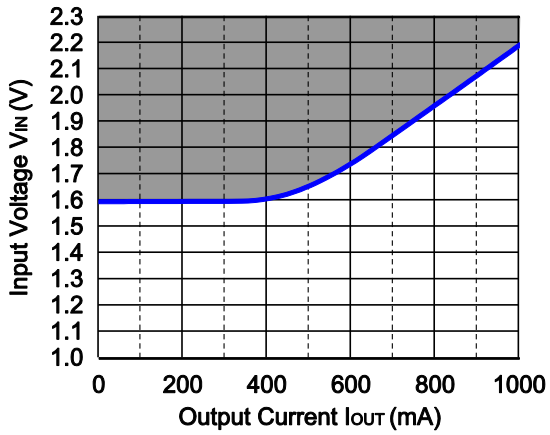


RP131x501x



15) Minimum Operating Voltage

RP131x081x



Hatched area is available for 0.8V output.

ESR vs. Output Current

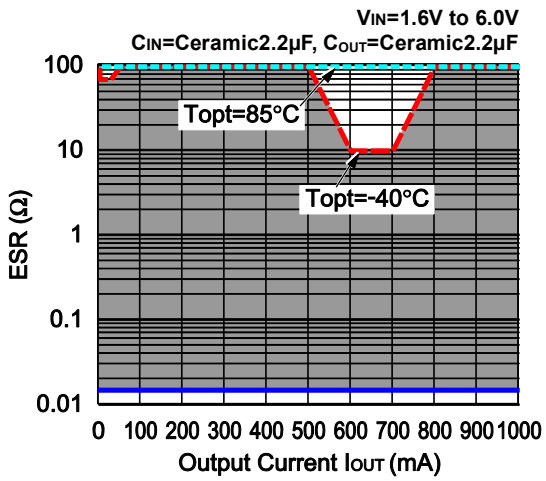
When using these ICs, consider the following points:

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

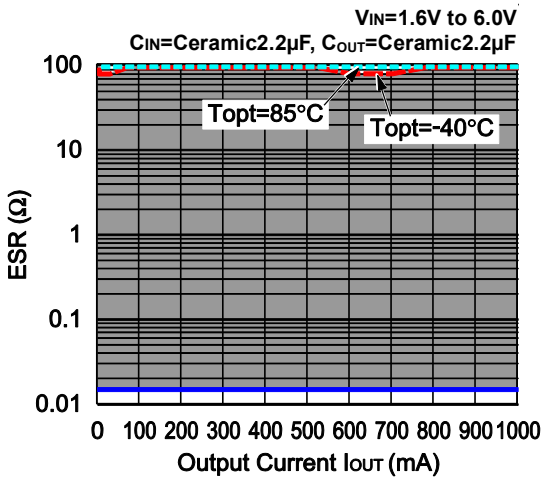
Measurement conditions

Frequency Band : 10Hz to 3MHz
Temperature : −40°C to 85°C
C_{IN} : 2.2μF (Kyocera, CM05X5R225M04AD)
C_{OUT} : 2.2μF (Kyocera, CM105X5R225K06AE)
4.7μF (Kyocera, CM105X5R475M06AB)

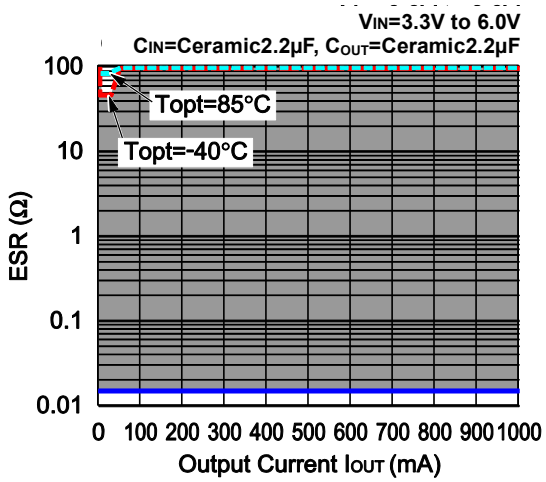
RP131x081x



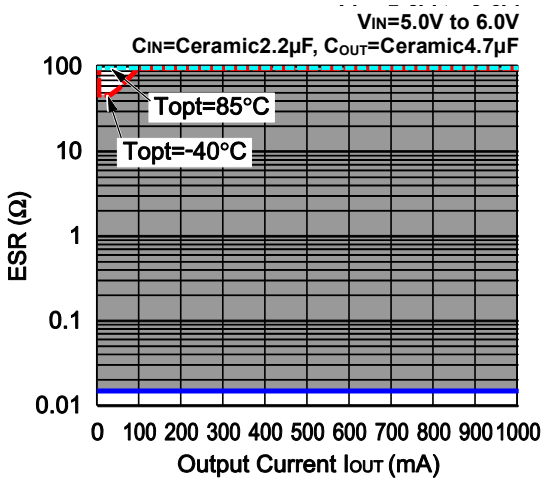
RP131x151x



RP131x331x

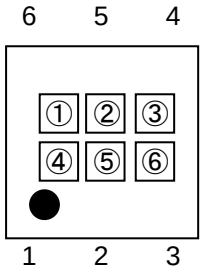


RP131x501x



RP131L SERIES MARK SPECIFICATION

- **DFN1616-6B**



① to ④ : Product Code (Refer to Part Number vs. Product Code)

⑤, ⑥ : Lot Number

- **Part Number vs. Product Code**

RP131Lxx1B Series

Part Number	Product Code			
	①	②	③	④
RP131L081B	C	B	0	1
RP131L091B	C	B	0	2
RP131L101B	C	B	0	3
RP131L111B	C	B	0	4
RP131L121B	C	B	0	5
RP131L131B	C	B	0	7
RP131L141B	C	B	0	8
RP131L151B	C	B	0	9
RP131L161B	C	B	1	0
RP131L171B	C	B	1	1
RP131L181B	C	B	1	2
RP131L191B	C	B	1	4
RP131L201B	C	B	1	5
RP131L211B	C	B	1	6
RP131L221B	C	B	1	7
RP131L231B	C	B	1	8
RP131L241B	C	B	1	9
RP131L251B	C	B	2	0
RP131L261B	C	B	2	1
RP131L271B	C	B	2	2
RP131L281B	C	B	2	3
RP131L291B	C	B	2	5

Part Number	Product Code			
	①	②	③	④
RP131L301B	C	B	2	6
RP131L311B	C	B	2	7
RP131L321B	C	B	2	8
RP131L331B	C	B	2	9
RP131L341B	C	B	3	0
RP131L351B	C	B	3	1
RP131L361B	C	B	3	2
RP131L371B	C	B	3	3
RP131L381B	C	B	3	4
RP131L391B	C	B	3	5
RP131L401B	C	B	3	6
RP131L411B	C	B	3	7
RP131L421B	C	B	3	8
RP131L431B	C	B	3	9
RP131L441B	C	B	4	0
RP131L451B	C	B	4	1
RP131L461B	C	B	4	2
RP131L471B	C	B	4	3
RP131L481B	C	B	4	4
RP131L491B	C	B	4	5
RP131L501B	C	B	4	6
RP131L511B	C	B	4	8
RP131L521B	C	B	4	9
RP131L531B	C	B	5	0
RP131L541B	C	B	5	1
RP131L551B	C	B	5	2
RP131L101B5	C	B	4	7
RP131L121B5	C	B	0	6
RP131L181B5	C	B	1	3
RP131L281B5	C	B	2	4

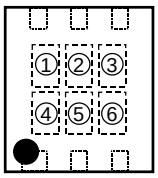
RP131Lxx1D Series

Part Number	Product Code			
	①	②	③	④
RP131L081D	C	C	0	1
RP131L091D	C	C	0	2
RP131L101D	C	C	0	3
RP131L111D	C	C	0	4
RP131L121D	C	C	0	5
RP131L131D	C	C	0	7
RP131L141D	C	C	0	8
RP131L151D	C	C	0	9
RP131L161D	C	C	1	0
RP131L171D	C	C	1	1
RP131L181D	C	C	1	2
RP131L191D	C	C	1	4
RP131L201D	C	C	1	5
RP131L211D	C	C	1	6
RP131L221D	C	C	1	7
RP131L231D	C	C	1	8
RP131L241D	C	C	1	9
RP131L251D	C	C	2	0
RP131L261D	C	C	2	1
RP131L271D	C	C	2	2
RP131L281D	C	C	2	3
RP131L291D	C	C	2	5

Part Number	Product Code			
	①	②	③	④
RP131L301D	C	C	2	6
RP131L311D	C	C	2	7
RP131L321D	C	C	2	8
RP131L331D	C	C	2	9
RP131L341D	C	C	3	0
RP131L351D	C	C	3	1
RP131L361D	C	C	3	2
RP131L371D	C	C	3	3
RP131L381D	C	C	3	4
RP131L391D	C	C	3	5
RP131L401D	C	C	3	6
RP131L411D	C	C	3	7
RP131L421D	C	C	3	8
RP131L431D	C	C	3	9
RP131L441D	C	C	4	0
RP131L451D	C	C	4	1
RP131L461D	C	C	4	2
RP131L471D	C	C	4	3
RP131L481D	C	C	4	4
RP131L491D	C	C	4	5
RP131L501D	C	C	4	6
RP131L511D	C	C	4	8
RP131L521D	C	C	4	9
RP131L531D	C	C	5	0
RP131L541D	C	C	5	1
RP131L551D	C	C	5	2
RP131L101D5	C	C	4	7
RP131L121D5	C	C	0	6
RP131L181D5	C	C	1	3
RP131L281D5	C	C	2	4

RP131K SERIES MARK SPECIFICATION

- **DFN(PL)1820-6**



① to ④ : Product Code (Refer to Part Number vs. Product Code)

⑤, ⑥ : Lot Number

- **Part Number vs. Product Code**

RP131Kxx1B Series

Part Number	Product Code			
	①	②	③	④
RP131K081B	A	M	0	1
RP131K091B	A	M	0	2
RP131K101B	A	M	0	3
RP131K111B	A	M	0	4
RP131K121B	A	M	0	5
RP131K131B	A	M	0	7
RP131K141B	A	M	0	8
RP131K151B	A	M	0	9
RP131K161B	A	M	1	0
RP131K171B	A	M	1	1
RP131K181B	A	M	1	2
RP131K191B	A	M	1	4
RP131K201B	A	M	1	5
RP131K211B	A	M	1	6
RP131K221B	A	M	1	7
RP131K231B	A	M	1	8
RP131K241B	A	M	1	9
RP131K251B	A	M	2	0
RP131K261B	A	M	2	1
RP131K271B	A	M	2	2
RP131K281B	A	M	2	3
RP131K291B	A	M	2	5

Part Number	Product Code			
	①	②	③	④
RP131K301B	A	M	2	6
RP131K311B	A	M	2	7
RP131K321B	A	M	2	8
RP131K331B	A	M	2	9
RP131K341B	A	M	3	0
RP131K351B	A	M	3	1
RP131K361B	A	M	3	2
RP131K371B	A	M	3	3
RP131K381B	A	M	3	4
RP131K391B	A	M	3	5
RP131K401B	A	M	3	6
RP131K411B	A	M	3	7
RP131K421B	A	M	3	8
RP131K431B	A	M	3	9
RP131K441B	A	M	4	0
RP131K451B	A	M	4	1
RP131K461B	A	M	4	2
RP131K471B	A	M	4	3
RP131K481B	A	M	4	4
RP131K491B	A	M	4	5
RP131K501B	A	M	4	6
RP131K511B	A	M	4	9
RP131K521B	A	M	5	0
RP131K531B	A	M	5	1
RP131K541B	A	M	5	2
RP131K551B	A	M	4	8
RP131K101B5	A	M	4	7
RP131K121B5	A	M	0	6
RP131K181B5	A	M	1	3
RP131K281B5	A	M	2	4

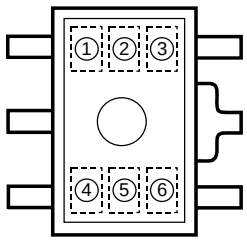
RP131Kxx1D Series

Part Number	Product Code			
	①	②	③	④
RP131K081D	A	N	0	1
RP131K091D	A	N	0	2
RP131K101D	A	N	0	3
RP131K111D	A	N	0	4
RP131K121D	A	N	0	5
RP131K131D	A	N	0	7
RP131K141D	A	N	0	8
RP131K151D	A	N	0	9
RP131K161D	A	N	1	0
RP131K171D	A	N	1	1
RP131K181D	A	N	1	2
RP131K191D	A	N	1	4
RP131K201D	A	N	1	5
RP131K211D	A	N	1	6
RP131K221D	A	N	1	7
RP131K231D	A	N	1	8
RP131K241D	A	N	1	9
RP131K251D	A	N	2	0
RP131K261D	A	N	2	1
RP131K271D	A	N	2	2
RP131K281D	A	N	2	3
RP131K291D	A	N	2	5

Part Number	Product Code			
	①	②	③	④
RP131K301D	A	N	2	6
RP131K311D	A	N	2	7
RP131K321D	A	N	2	8
RP131K331D	A	N	2	9
RP131K341D	A	N	3	0
RP131K351D	A	N	3	1
RP131K361D	A	N	3	2
RP131K371D	A	N	3	3
RP131K381D	A	N	3	4
RP131K391D	A	N	3	5
RP131K401D	A	N	3	6
RP131K411D	A	N	3	7
RP131K421D	A	N	3	8
RP131K431D	A	N	3	9
RP131K441D	A	N	4	0
RP131K451D	A	N	4	1
RP131K461D	A	N	4	2
RP131K471D	A	N	4	3
RP131K481D	A	N	4	4
RP131K491D	A	N	4	5
RP131K501D	A	N	4	6
RP131K511D	A	N	4	9
RP131K521D	A	N	5	0
RP131K531D	A	N	5	1
RP131K541D	A	N	5	2
RP131K551D	A	N	4	8
RP131K101D5	A	N	4	7
RP131K121D5	A	N	0	6
RP131K181D5	A	N	1	3
RP131K281D5	A	N	2	4

RP131H SERIES MARK SPECIFICATION

- **SOT-89-5**



① to ④ : Product Code (Refer to Part Number vs. Product Code)

⑤, ⑥ : Lot Number

- **Part Number vs. Product Code**

RP131Hxx1B Series

Part Number	Product Code			
	①	②	③	④
RP131H081B	U	0	8	B
RP131H091B	U	0	9	B
RP131H101B	U	1	0	B
RP131H111B	U	1	1	B
RP131H121B	U	1	2	B
RP131H131B	U	1	3	B
RP131H141B	U	1	4	B
RP131H151B	U	1	5	B
RP131H161B	U	1	6	B
RP131H171B	U	1	7	B
RP131H181B	U	1	8	B
RP131H191B	U	1	9	B
RP131H201B	U	2	0	B
RP131H211B	U	2	1	B
RP131H221B	U	2	2	B
RP131H231B	U	2	3	B
RP131H241B	U	2	4	B
RP131H251B	U	2	5	B
RP131H261B	U	2	6	B
RP131H271B	U	2	7	B
RP131H281B	U	2	8	B
RP131H291B	U	2	9	B
RP131H301B	U	3	0	B
RP131H311B	U	3	1	B
RP131H321B	U	3	2	B
RP131H331B	U	3	3	B
RP131H341B	U	3	4	B
RP131H351B	U	3	5	B
RP131H361B	U	3	6	B
RP131H371B	U	3	7	B
RP131H381B	U	3	8	B
RP131H391B	U	3	9	B

Part Number	Product Code			
	①	②	③	④
RP131H401B	U	4	0	B
RP131H411B	U	4	1	B
RP131H421B	U	4	2	B
RP131H431B	U	4	3	B
RP131H441B	U	4	4	B
RP131H451B	U	4	5	B
RP131H461B	U	4	6	B
RP131H471B	U	4	7	B
RP131H481B	U	4	8	B
RP131H491B	U	4	9	B
RP131H501B	U	5	0	B
RP131H511B	U	5	1	B
RP131H521B	U	5	2	B
RP131H531B	U	5	3	B
RP131H541B	U	5	4	B
RP131H551B	U	5	5	B
RP131H101B5	U	0	4	B
RP131H121B5	U	0	1	B
RP131H181B5	U	0	2	B
RP131H281B5	U	0	3	B

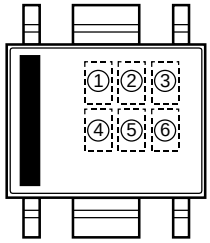
RP131Hxx1D Series

Part Number	Product Code			
	①	②	③	④
RP131H081D	U	0	8	D
RP131H091D	U	0	9	D
RP131H101D	U	1	0	D
RP131H111D	U	1	1	D
RP131H121D	U	1	2	D
RP131H131D	U	1	3	D
RP131H141D	U	1	4	D
RP131H151D	U	1	5	D
RP131H161D	U	1	6	D
RP131H171D	U	1	7	D
RP131H181D	U	1	8	D
RP131H191D	U	1	9	D
RP131H201D	U	2	0	D
RP131H211D	U	2	1	D
RP131H221D	U	2	2	D
RP131H231D	U	2	3	D
RP131H241D	U	2	4	D
RP131H251D	U	2	5	D
RP131H261D	U	2	6	D
RP131H271D	U	2	7	D
RP131H281D	U	2	8	D
RP131H291D	U	2	9	D
RP131H301D	U	3	0	D
RP131H311D	U	3	1	D
RP131H321D	U	3	2	D
RP131H331D	U	3	3	D
RP131H341D	U	3	4	D
RP131H351D	U	3	5	D
RP131H361D	U	3	6	D
RP131H371D	U	3	7	D
RP131H381D	U	3	8	D
RP131H391D	U	3	9	D

Part Number	Product Code			
	①	②	③	④
RP131H401D	U	4	0	D
RP131H411D	U	4	1	D
RP131H421D	U	4	2	D
RP131H431D	U	4	3	D
RP131H441D	U	4	4	D
RP131H451D	U	4	5	D
RP131H461D	U	4	6	D
RP131H471D	U	4	7	D
RP131H481D	U	4	8	D
RP131H491D	U	4	9	D
RP131H501D	U	5	0	D
RP131H511D	U	5	1	D
RP131H521D	U	5	2	D
RP131H531D	U	5	3	D
RP131H541D	U	5	4	D
RP131H551D	U	5	5	D
RP131H101D5	U	0	4	D
RP131H121D5	U	0	1	D
RP131H181D5	U	0	2	D
RP131H281D5	U	0	3	D

RP131S SERIES MARK SPECIFICATION

- **HSOP-6J**



① to ④ : Product Code (Refer to Part Number vs. Product Code)

⑤, ⑥ : Lot Number

- **Part Number vs. Product Code**

RP131Sxx1B Series

Part Number	Product Code			
	①	②	③	④
RP131S081B	G	0	8	B
RP131S091B	G	0	9	B
RP131S101B	G	1	0	B
RP131S111B	G	1	1	B
RP131S121B	G	1	2	B
RP131S131B	G	1	3	B
RP131S141B	G	1	4	B
RP131S151B	G	1	5	B
RP131S161B	G	1	6	B
RP131S171B	G	1	7	B
RP131S181B	G	1	8	B
RP131S191B	G	1	9	B
RP131S201B	G	2	0	B
RP131S211B	G	2	1	B
RP131S221B	G	2	2	B
RP131S231B	G	2	3	B
RP131S241B	G	2	4	B
RP131S251B	G	2	5	B
RP131S261B	G	2	6	B
RP131S271B	G	2	7	B
RP131S281B	G	2	8	B
RP131S291B	G	2	9	B
RP131S301B	G	3	0	B
RP131S311B	G	3	1	B
RP131S321B	G	3	2	B
RP131S331B	G	3	3	B
RP131S341B	G	3	4	B
RP131S351B	G	3	5	B
RP131S361B	G	3	6	B
RP131S371B	G	3	7	B
RP131S381B	G	3	8	B
RP131S391B	G	3	9	B

Part Number	Product Code			
	①	②	③	④
RP131S401B	G	4	0	B
RP131S411B	G	4	1	B
RP131S421B	G	4	2	B
RP131S431B	G	4	3	B
RP131S441B	G	4	4	B
RP131S451B	G	4	5	B
RP131S461B	G	4	6	B
RP131S471B	G	4	7	B
RP131S481B	G	4	8	B
RP131S491B	G	4	9	B
RP131S501B	G	5	0	B
RP131S511B	G	5	1	B
RP131S521B	G	5	2	B
RP131S531B	G	5	3	B
RP131S541B	G	5	4	B
RP131S551B	G	5	5	B
RP131S101B5	G	0	4	B
RP131S121B5	G	0	1	B
RP131S181B5	G	0	2	B
RP131S281B5	G	0	3	B

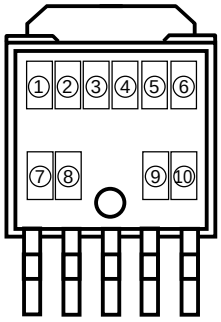
RP131Sxx1D Series

Part Number	Product Code			
	①	②	③	④
RP131S081D	G	0	8	D
RP131S091D	G	0	9	D
RP131S101D	G	1	0	D
RP131S111D	G	1	1	D
RP131S121D	G	1	2	D
RP131S131D	G	1	3	D
RP131S141D	G	1	4	D
RP131S151D	G	1	5	D
RP131S161D	G	1	6	D
RP131S171D	G	1	7	D
RP131S181D	G	1	8	D
RP131S191D	G	1	9	D
RP131S201D	G	2	0	D
RP131S211D	G	2	1	D
RP131S221D	G	2	2	D
RP131S231D	G	2	3	D
RP131S241D	G	2	4	D
RP131S251D	G	2	5	D
RP131S261D	G	2	6	D
RP131S271D	G	2	7	D
RP131S281D	G	2	8	D
RP131S291D	G	2	9	D
RP131S301D	G	3	0	D
RP131S311D	G	3	1	D
RP131S321D	G	3	2	D
RP131S331D	G	3	3	D
RP131S341D	G	3	4	D
RP131S351D	G	3	5	D
RP131S361D	G	3	6	D
RP131S371D	G	3	7	D
RP131S381D	G	3	8	D
RP131S391D	G	3	9	D

Part Number	Product Code			
	①	②	③	④
RP131S401D	G	4	0	D
RP131S411D	G	4	1	D
RP131S421D	G	4	2	D
RP131S431D	G	4	3	D
RP131S441D	G	4	4	D
RP131S451D	G	4	5	D
RP131S461D	G	4	6	D
RP131S471D	G	4	7	D
RP131S481D	G	4	8	D
RP131S491D	G	4	9	D
RP131S501D	G	5	0	D
RP131S511D	G	5	1	D
RP131S521D	G	5	2	D
RP131S531D	G	5	3	D
RP131S541D	G	5	4	D
RP131S551D	G	5	5	D
RP131S101D5	G	0	4	D
RP131S121D5	G	0	1	D
RP131S181D5	G	0	2	D
RP131S281D5	G	0	3	D

RP131J SERIES MARK SPECIFICATION

- **TO-252-5-P2**



① to ⑧ : Product Code (Refer to Part Number vs. Product Code)
⑨, ⑩ : Lot Number

- **Part Number vs. Product Code**

RP131Jxx1B Series

Part Number	Product Code							
	①	②	③	④	⑤	⑥	⑦	⑧
RP131J081B	D	1	J	0	8	1	B	
RP131J091B	D	1	J	0	9	1	B	
RP131J101B	D	1	J	1	0	1	B	
RP131J111B	D	1	J	1	1	1	B	
RP131J121B	D	1	J	1	2	1	B	
RP131J131B	D	1	J	1	3	1	B	
RP131J141B	D	1	J	1	4	1	B	
RP131J151B	D	1	J	1	5	1	B	
RP131J161B	D	1	J	1	6	1	B	
RP131J171B	D	1	J	1	7	1	B	
RP131J181B	D	1	J	1	8	1	B	
RP131J191B	D	1	J	1	9	1	B	
RP131J201B	D	1	J	2	0	1	B	
RP131J211B	D	1	J	2	1	1	B	
RP131J221B	D	1	J	2	2	1	B	
RP131J231B	D	1	J	2	3	1	B	
RP131J241B	D	1	J	2	4	1	B	
RP131J251B	D	1	J	2	5	1	B	
RP131J261B	D	1	J	2	6	1	B	
RP131J271B	D	1	J	2	7	1	B	
RP131J281B	D	1	J	2	8	1	B	
RP131J291B	D	1	J	2	9	1	B	
RP131J301B	D	1	J	3	0	1	B	
RP131J311B	D	1	J	3	1	1	B	
RP131J321B	D	1	J	3	2	1	B	
RP131J331B	D	1	J	3	3	1	B	
RP131J341B	D	1	J	3	4	1	B	
RP131J351B	D	1	J	3	5	1	B	
RP131J361B	D	1	J	3	6	1	B	
RP131J371B	D	1	J	3	7	1	B	
RP131J381B	D	1	J	3	8	1	B	
RP131J391B	D	1	J	3	9	1	B	
RP131J401B	D	1	J	4	0	1	B	
RP131J411B	D	1	J	4	1	1	B	
RP131J421B	D	1	J	4	2	1	B	
RP131J431B	D	1	J	4	3	1	B	
RP131J441B	D	1	J	4	4	1	B	
RP131J451B	D	1	J	4	5	1	B	
RP131J461B	D	1	J	4	6	1	B	
RP131J471B	D	1	J	4	7	1	B	
RP131J481B	D	1	J	4	8	1	B	
RP131J491B	D	1	J	4	9	1	B	
RP131J501B	D	1	J	5	0	1	B	
RP131J511B	D	1	J	5	1	1	B	
RP131J521B	D	1	J	5	2	1	B	
RP131J531B	D	1	J	5	3	1	B	
RP131J541B	D	1	J	5	4	1	B	
RP131J551B	D	1	J	5	5	1	B	
RP131J101B5	D	1	J	1	0	1	B	5
RP131J121B5	D	1	J	1	2	1	B	5
RP131J181B5	D	1	J	1	8	1	B	5
RP131J281B5	D	1	J	2	8	1	B	5

RP131Jxx1D Series

Part Number	Product Code							
	①	②	③	④	⑤	⑥	⑦	⑧
RP131J081D	D	1	J	0	8	1	D	
RP131J091D	D	1	J	0	9	1	D	
RP131J101D	D	1	J	1	0	1	D	
RP131J111D	D	1	J	1	1	1	D	
RP131J121D	D	1	J	1	2	1	D	
RP131J131D	D	1	J	1	3	1	D	
RP131J141D	D	1	J	1	4	1	D	
RP131J151D	D	1	J	1	5	1	D	
RP131J161D	D	1	J	1	6	1	D	
RP131J171D	D	1	J	1	7	1	D	
RP131J181D	D	1	J	1	8	1	D	
RP131J191D	D	1	J	1	9	1	D	
RP131J201D	D	1	J	2	0	1	D	
RP131J211D	D	1	J	2	1	1	D	
RP131J221D	D	1	J	2	2	1	D	
RP131J231D	D	1	J	2	3	1	D	
RP131J241D	D	1	J	2	4	1	D	
RP131J251D	D	1	J	2	5	1	D	
RP131J261D	D	1	J	2	6	1	D	
RP131J271D	D	1	J	2	7	1	D	
RP131J281D	D	1	J	2	8	1	D	
RP131J291D	D	1	J	2	9	1	D	
RP131J301D	D	1	J	3	0	1	D	
RP131J311D	D	1	J	3	1	1	D	
RP131J321D	D	1	J	3	2	1	D	
RP131J331D	D	1	J	3	3	1	D	
RP131J341D	D	1	J	3	4	1	D	
RP131J351D	D	1	J	3	5	1	D	
RP131J361D	D	1	J	3	6	1	D	
RP131J371D	D	1	J	3	7	1	D	
RP131J381D	D	1	J	3	8	1	D	
RP131J391D	D	1	J	3	9	1	D	
RP131J401D	D	1	J	4	0	1	D	
RP131J411D	D	1	J	4	1	1	D	
RP131J421D	D	1	J	4	2	1	D	
RP131J431D	D	1	J	4	3	1	D	
RP131J441D	D	1	J	4	4	1	D	
RP131J451D	D	1	J	4	5	1	D	
RP131J461D	D	1	J	4	6	1	D	
RP131J471D	D	1	J	4	7	1	D	
RP131J481D	D	1	J	4	8	1	D	
RP131J491D	D	1	J	4	9	1	D	
RP131J501D	D	1	J	5	0	1	D	
RP131J511D	D	1	J	5	1	1	D	
RP131J521D	D	1	J	5	2	1	D	
RP131J531D	D	1	J	5	3	1	D	
RP131J541D	D	1	J	5	4	1	D	
RP131J551D	D	1	J	5	5	1	D	
RP131J101D5	D	1	J	1	0	1	D	5
RP131J121D5	D	1	J	1	2	1	D	5
RP131J181D5	D	1	J	1	8	1	D	5
RP131J281D5	D	1	J	2	8	1	D	5

POWER DISSIPATION DFN1616-6B

PD-DFN1616-6B-(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.

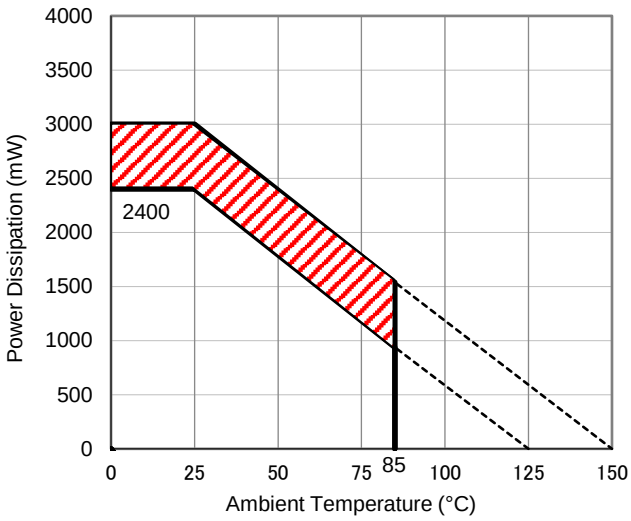
Measurement Conditions

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 × 25 pcs

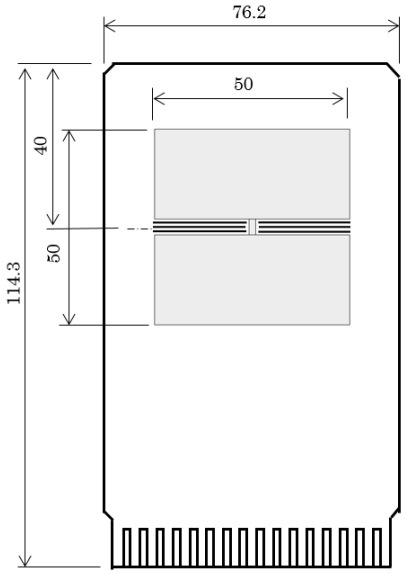
Measurement Result (Ta = 25°C, Tjmax = 125°C)

Item	Measurement Result
Power Dissipation	2400 mW
Thermal Resistance (θja)	θja = 41°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 11°C/W

θja: Junction-to-Ambient Thermal Resistance
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



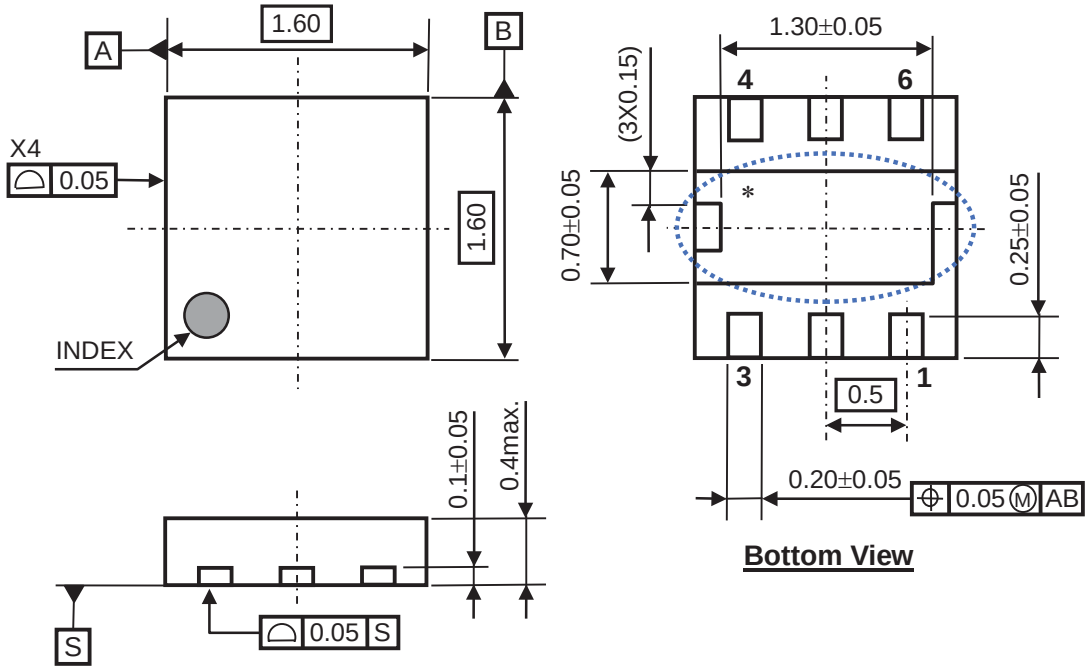
Measurement Board Pattern

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

PACKAGE DIMENSIONS DFN1616-6B

Ver. A



DFN1616-6B 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 pin on the board but it is possible to leave the tab floating.

POWER DISSIPATION DFN(PL)1820-6

PD-DFN(PL)1820-6-(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

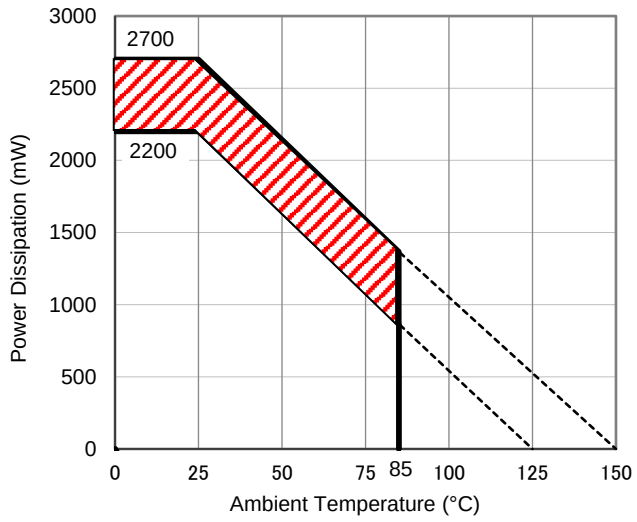
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 36 pcs

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

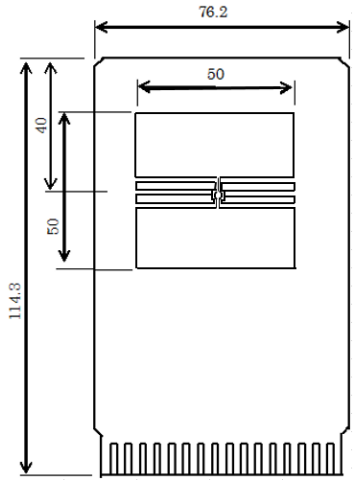
Item	Measurement Result
Power Dissipation	2200 mW
Thermal Resistance (θja)	θja = 45°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 18°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



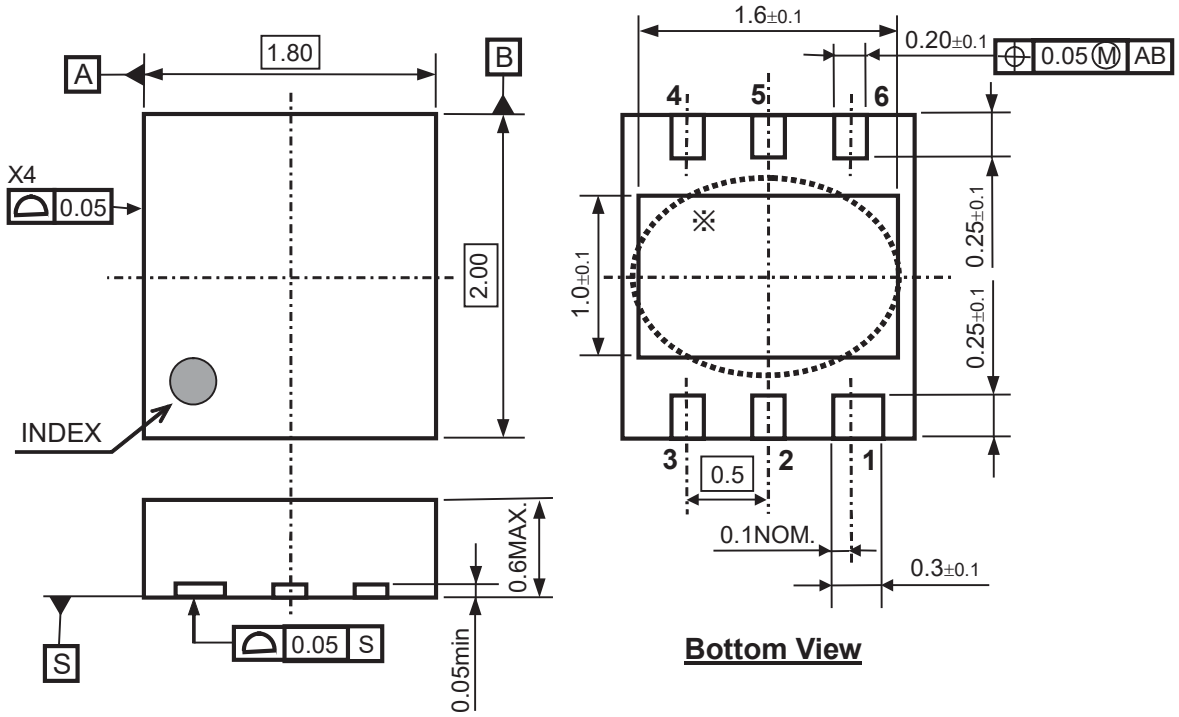
Measurement Board Pattern

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

PACKAGE DIMENSIONS DFN(PL)1820-6

Ver. A



DFN(PL)1820-6 Package Dimensions (Unit: mm)

∗ The tab on the bottom of the package is substrate level (GND). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

POWER DISSIPATION SOT-89-5

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

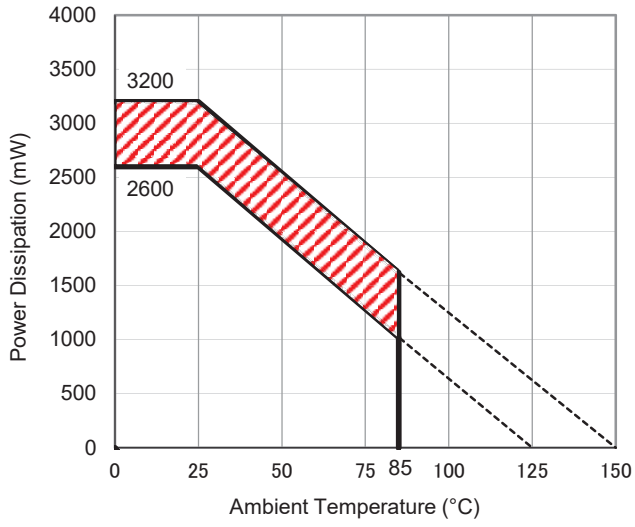
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 13 pcs

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

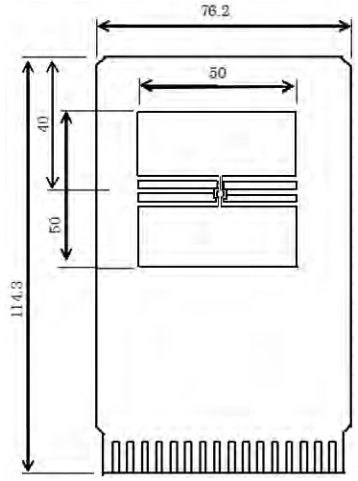
Item	Measurement Result
Power Dissipation	2600 mW
Thermal Resistance (θja)	θja = 38°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 13°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



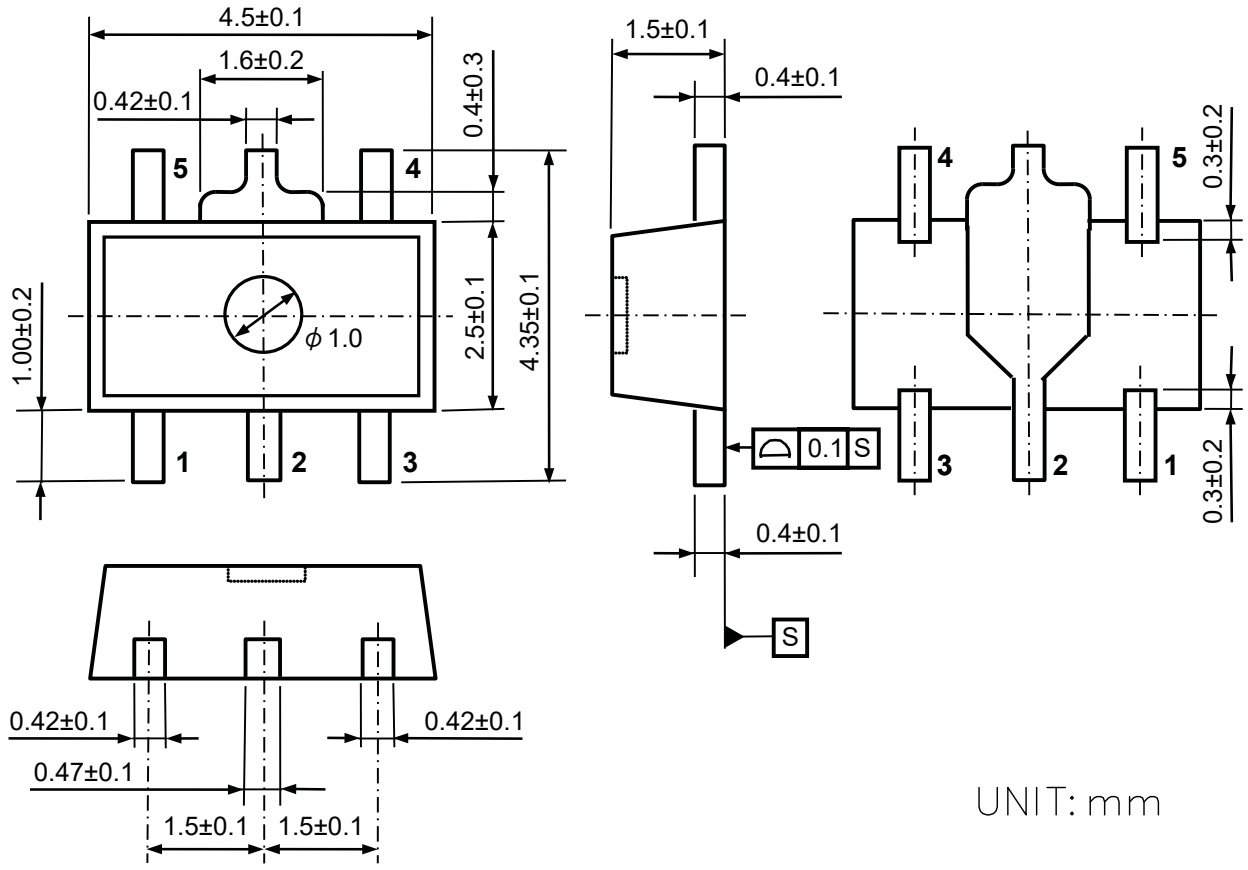
Measurement Board Pattern

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

PACKAGE DIMENSIONS SOT-89-5

Ver. A



SOT-89-5 Package Dimensions

POWER DISSIPATION HSOP-6J

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

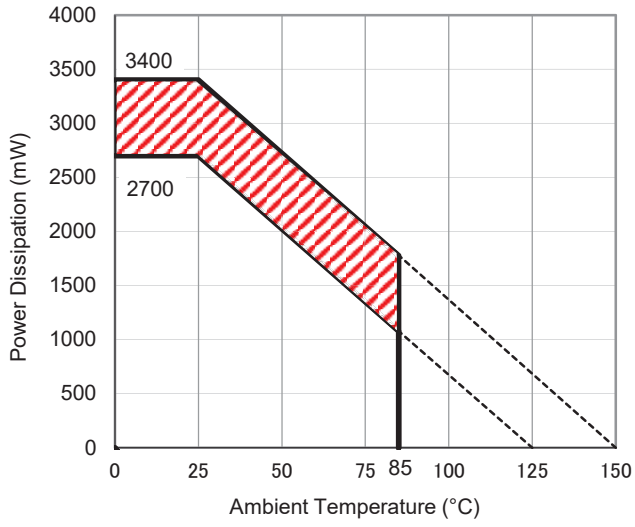
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 28 pcs

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

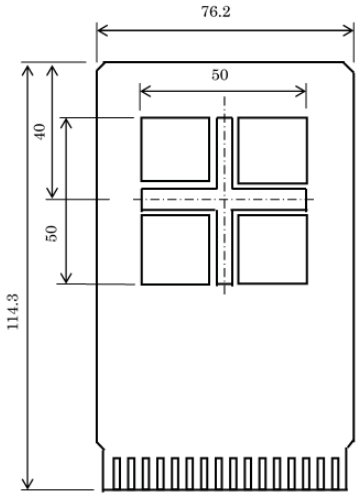
Item	Measurement Result
Power Dissipation	2700 mW
Thermal Resistance (θja)	θja = 37°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 7°C/W

θja: Junction-to-Ambient Thermal Resistance

ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



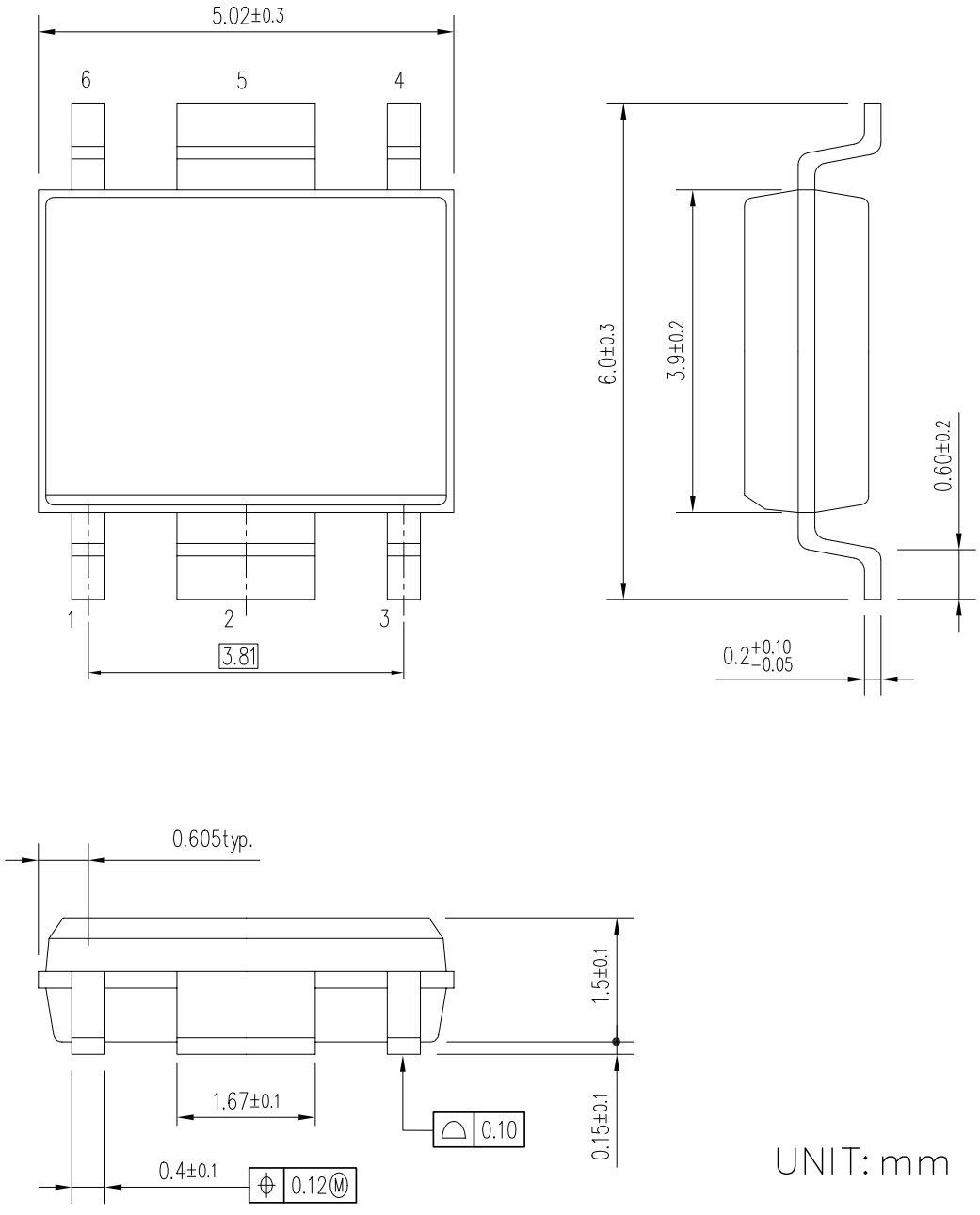
Measurement Board Pattern

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

PACKAGE DIMENSIONS HSOP-6J

Ver. A



HSOP-6J Package Dimensions

POWER DISSIPATION TO-252-5

Ver. 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. 51-7.

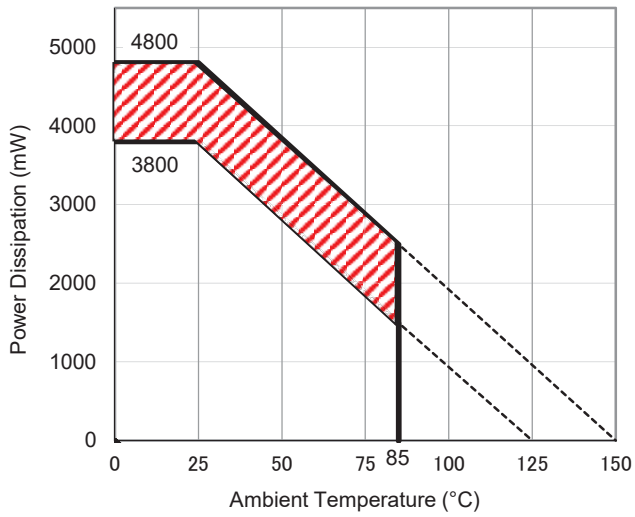
Measurement Conditions

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. 4mm × 30pcs

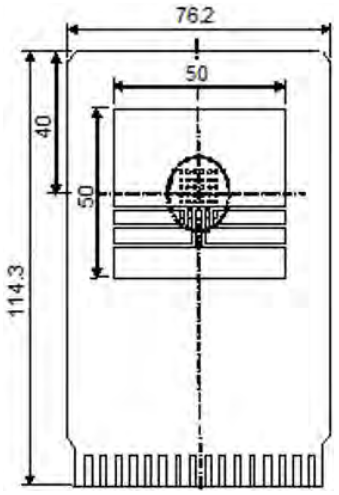
Measurement Result (Ta = 25°C, Tjmax = 125°C)

Item	Measurement Result
Power Dissipation	3800 mW
Thermal Resistance (θja)	θja = 26°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 7°C/W

θja: Junction-to-Ambient Thermal Resistance
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



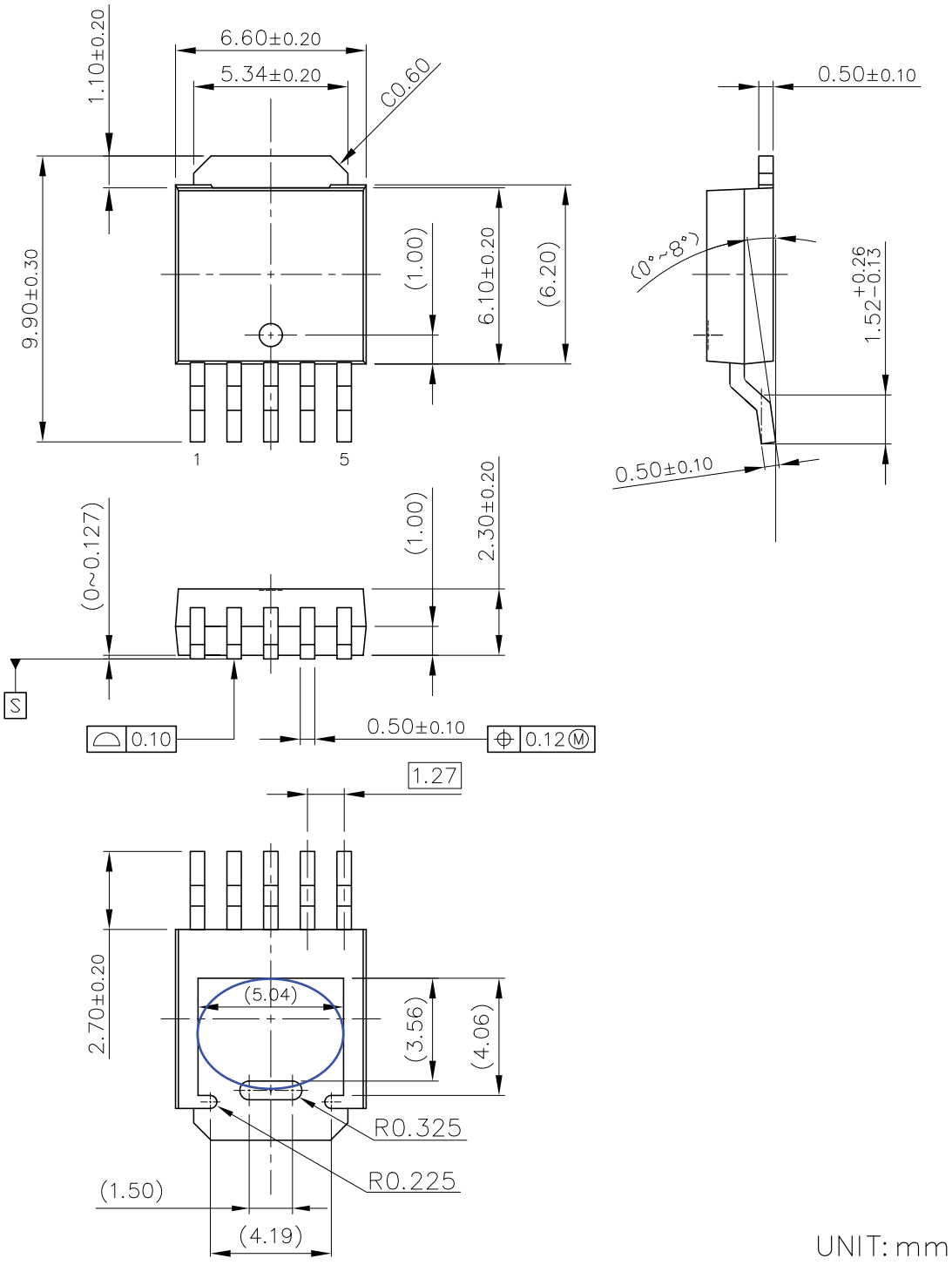
Measurement Board Pattern

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

PACKAGE DIMENSIONS TO-252-5-P2

Ver. A



TO-252-5-P2 Package Dimensions

* 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.

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8. Quality Warranty
    8-1. Quality Warranty Period
    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
    8-2. Quality Warranty Remedies
    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
    8-3. Remedies after Quality Warranty Period
    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
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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