Super low on resistance/Low voltage LDO

NO.EA-123-220509

OUTLINE

The R1173x Series are CMOS-based positive voltage regulator ICs. The R1173x Series have features of super low dropout, 1A output current capability, and -3mV typical load regulation at 1A. Even the output voltage is set at 1.5V, on resistance of internal FET is typically 0.32Ω. Therefore, applications that require a large current at small dropout are suitable for the R1173x series. Low input voltage is acceptable and low output voltage can be set. The minimum input voltage is 1.4V, and the lowest set output voltage is 0.8V. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor net for setting output voltage, a current limit circuit at over-current, a chip enable circuit, a thermal-shutdown circuit, and so on. A stand-by mode with ultra low consumption current can be realized with the chip enable pin. The output voltage types of R1173 are fixed one in the IC and adjustable one (R1173x001x).

Since the packages for these ICs are the SOT-89-5 package, HSON-6, or HSOP-6J, high density mounting of the ICs on boards is possible.

FEATURES

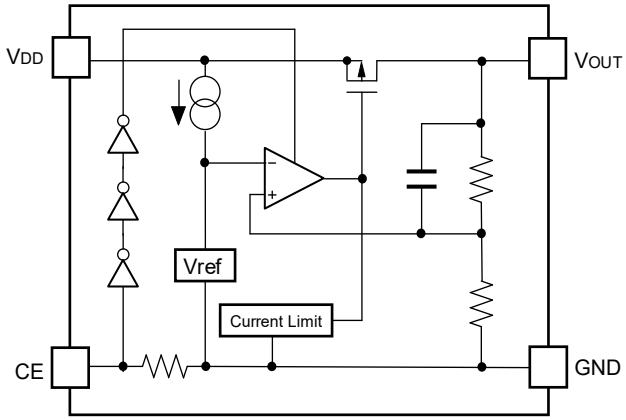
- Output Current 1A
- Supply Current ..... Typ. 60μA
- Standby Current ..... Typ. 0.1μA
- Input Voltage Range ..... 1.4V to 6.0V
- Output Voltage Range ..... 0.8V to 5.0V (0.1V steps) (R1173xxx1)
  1.0V to V_{IN} (R1173x001)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Dropout Voltage ..... Typ. 0.32V (V_{OUT}=1.5V, I_{OUT}=1A)
  Typ. 0.18V (V_{OUT}=2.8V, I_{OUT}=1A)
- Ripple Rejection ..... Typ. 70dB (V_{OUT}=2.8V)
- Output Voltage Accuracy ..... ±2.0%
- Temperature-drift Coefficient of Output Voltage ..... Typ. ±100ppm/°C
- Line Regulation ..... Typ. 0.05%/V
- Load Regulation ..... Typ. −2mV (I_{OUT}=300mA)
  Typ. −3mV (I_{OUT}=1A)
- Packages SOT-89-5, HSON-6, HSOP-6J
- Low inrush current at turning-on ..... Typ. 500mA
- Built-in Thermal Shutdown Circuit
- Built-in Current Limit Circuit ..... Typ. 250mA
- Output capacitors ..... C_{IN}=Ceramic 4.7μF
  C_{OUT}=Tantalum 4.7μF (V_{OUT}<1.0V)
  C_{OUT}=Ceramic 4.7μF (V_{OUT} ≧ 1.0V)

APPLICATIONS

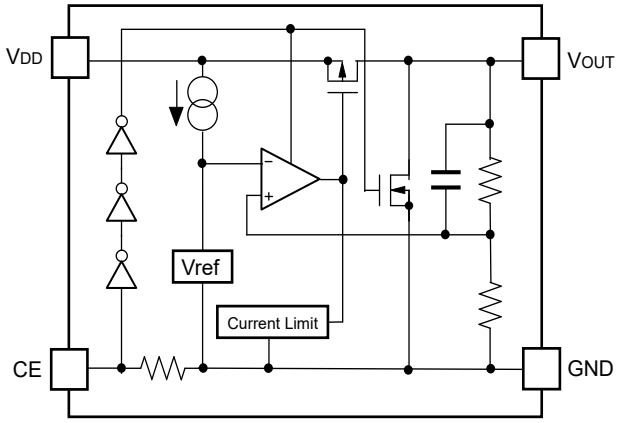
- Local Power source for Notebook PC.
- Local Power source for portable communication equipments, cameras, and videos.
- Local Power source for home appliances.

BLOCK DIAGRAMS

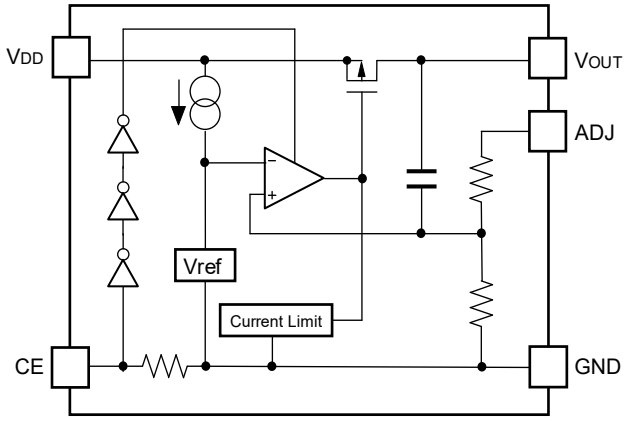
R1173xxx1B



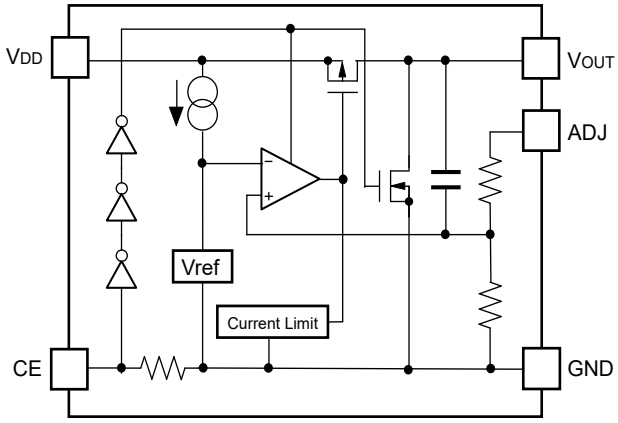
R1173xxx1D



R1173x001B



R1173x001D



SELECTION GUIDE

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

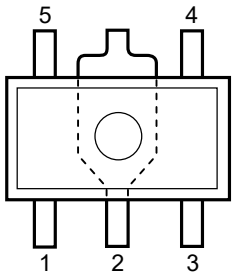
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1173Dxx1∗-TR-FE	HSON-6	3,000 pcs	Yes	Yes
R1173Hxx1∗-T1-FE	SOT-89-5	1,000 pcs	Yes	Yes
R1173Sxx1∗-E2-FE	HSOP-6J	1,000 pcs	Yes	Yes

xx: The output voltage can be designated in the range from 0.8V(08) to 5.0V(50) in 0.1V steps.
External Setting Type: 00 (ADJ pin voltage is fixed at 1.0V.)
(For other voltages, please refer to MARK INFORMATIONS.)

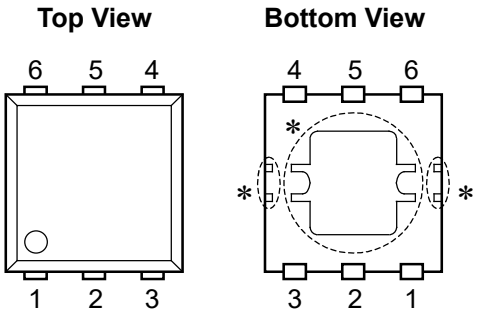
∗ : The auto discharge function at off state are options as follows.
(B) "H" active, without auto discharge function at off state
(D) "H" active, with auto discharge function at off state

PIN CONFIGURATIONS

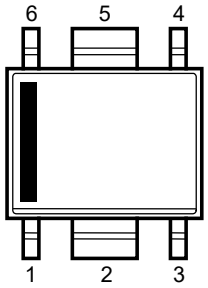
● SOT-89-5



● HSON-6



● HSOP-6J



PIN DESCRIPTIONS

●SOT-89-5

Pin No.	Symbol	Description
1	ADJ	ADJUST Pin (R1173H001x)
	NC	No Connection (R1173Hxx1x)
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	V_{DD}	Input Pin
5	V_{OUT}	Output Pin

●HSON-6

Pin No.	Symbol	Description
1	V_{OUT}*1	Output Pin
2	V_{OUT}*1	Output Pin
3	ADJ	ADJUST Pin (R1173D001x)
	NC	No Connection (R1173Dxx1x)
4	GND	Ground Pin
5	CE	Chip Enable Pin ("H" Active)
6	V_{DD}	Input Pin

∗) Tab and tab suspension leads in the ◌ parts are GND level.
(They are connected to the reverse side of the IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.
The tab suspension leads should be open and do not connect to other wires or land patterns.

∗1) The V_{OUT} pin must be wired together when it is mounted on board.

●**HSOP-6J**

Pin No.	Symbol	Description
1	V_{OUT}	Output Pin
2	GND*1	Ground Pin
3	ADJ	ADJUST Pin (R1173S001x)
	NC	No Connection (R1173Sxx1x)
4	CE	Chip Enable Pin ("H" Active)
5	GND*1	Ground Pin
6	V_{DD}	Input Pin

∗1) The GND pin must be wired together when it is mounted on board.

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	6.5	V
V_{CE}	Input Voltage (CE Input Pin)	−0.3 to 6.5	V
V_{OUT}	Output Voltage	−0.3 to V_{IN}+0.3	V
P_D	Power Dissipation (SOT-89-5)*	900	mW
	Power Dissipation (HSON-6)*	900	
	Power Dissipation (HSOP-6J)*	1700	
Topt	Operating Temperature	−40 to 85	°C
Tstg	Storage Temperature	−55 to 125	°C

∗) For Power Dissipation, please refer to PACKAGE INFORMATION.

ABSOLUTE MAXIMUM RATINGS

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

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

ELECTRICAL CHARACTERISTICS

- **R1173xxxxB/D (Fixed Output Voltage Type)**

Topt=25°C

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.4		6.0	V
I_{SS}	Supply Current	V_{IN}–V_{OUT}=1.0V, V_{CE}=V_{IN}, I_{OUT}=0A			60	100	μA
$I_{standby}$	Standby Current	V_{IN}= 6.0V, V_{CE}=0V			0.1	1.0	μA
V_{OUT}	Output voltage	V_{IN}–V_{OUT}=1.0V I_{OUT}=100mA	V_{OUT}>1.5V	×0.98		×1.02	V
			V_{OUT} ≦ 1.5V	−30		+30	mV
ΔV_{OUT}/ ΔI_{OUT}	Load regulation	V_{IN}–V_{OUT}=0.3V, 1mA ≦ I_{OUT} ≦ 300mA If V_{OUT} ≦ 1.1V, then V_{IN}=1.4V		−15	−2	15	mV
		V_{IN}–V_{OUT}=0.3V, 1mA ≦ I_{OUT} ≦ 1A If V_{OUT} ≦ 1.1V, then V_{IN}=1.7V			−3		
V_{DIF}	Dropout Voltage	Refer to the following table					
ΔV_{OUT}/ ΔV_{IN}	Line regulation	I_{OUT}=100mA, V_{OUT}+0.5V ≦ V_{IN} ≦ 6.0V If V_{OUT} ≦ 0.9V, 1.4V ≦ V_{IN} ≦ 6.0V			0.05	0.20	%/V
RR	Ripple Rejection	f=1kHz (V_{OUT} ≦ 4.0V) f=1kHz (V_{OUT}>4.0V) Ripple 0.5Vp-p,V_{IN}–V_{OUT}=1.0V, I_{OUT}=100mA If V_{OUT} ≦ 1.2V, V_{IN}–V_{OUT}=1.5V, I_{OUT}=100mA			70 60		dB
ΔV_{OUT}/ ΔT_{opt}	Output Voltage Temperature Coefficient	I_{OUT}=100mA, −40°C ≦ Topt ≦ 85°C			±100		ppm/ °C
I_{LIM}	Output Current	V_{IN}–V_{OUT}=1.0V		1			A
I_{SC}	Short Current Limit	V_{OUT}=0V			250		mA
R_{PD}	Pull-down resistance for CE pin			1.9	5.0	15.0	MΩ
V_{CEH}	CE Input Voltage "H"			1.0		6.0	V
V_{CEL}	CE Input Voltage "L"			0		0.4	V
T_{TSD}	Thermal Shutdown Detector Threshold Temperature	Junction Temperature			150		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			120		°C
en	Output Noise	BW=10Hz to 100kHz			30		μVrms

- **Dropout Voltage by Output Voltage**

Topt=25°C

Output Voltage V_{OUT} (V)	Dropout Voltage V_{DIF} (V)		
	I_{OUT}=300mA		I_{OUT}=1A
	Typ.	Max.	Typ.
0.8 ≦ V_{OUT} < 0.9	0.33	0.57	0.72
0.9 ≦ V_{OUT} < 1.0	0.22	0.47	0.64
1.0 ≦ V_{OUT} < 1.5	0.18	0.32	0.56
1.5 ≦ V_{OUT} < 2.6	0.10	0.15	0.32
2.6 ≦ V_{OUT}	0.05	0.10	0.18

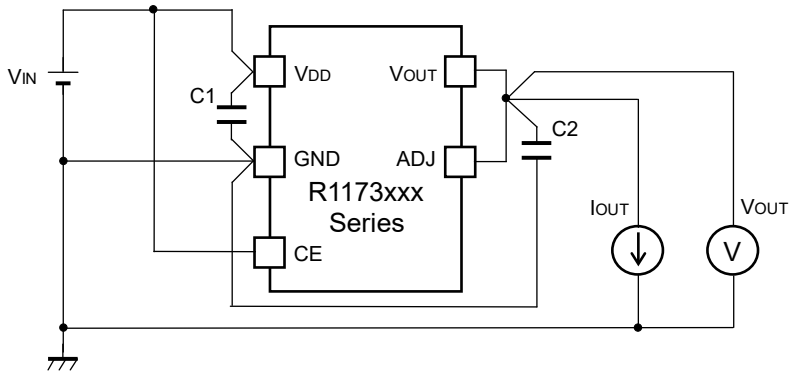
- **R1173x001B/D (Adjustable Output Voltage Type)**

Topt=25°C

Symbol	Item	Conditions		Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage			1.4		6.0	V
I_{SS}	Supply Current	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0$, $V_{CE}=V_{IN}$			60	100	μA
$I_{standby}$	Standby Current	$V_{IN}=6.0V$, $V_{CE}=0V$			0.1	1.0	μA
V_{OUT}	Reference Voltage for Adjustable Voltage Regulator	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0V$ $I_{OUT}=100mA$		0.970	1.000	1.030	V
RV_{OUT}	Output Voltage Range			1.0		V_{IN}	V
$\Delta V_{OUT}/\Delta I_{OUT}$	Load regulation	$V_{IN}=1.4V$ $1mA \leqq I_{OUT} \leqq 300mA$		−15	−2	15	mV
		$V_{IN}=1.7V$ $1mA \leqq I_{OUT} \leqq 1A$			−3		
V_{DIF}	Dropout Voltage	$V_{OUT}=V_{ADJ}$	$I_{OUT}=300mA$		0.18	0.32	V
			$I_{OUT}=1A$		0.56		
$\Delta V_{OUT}/\Delta V_{IN}$	Line regulation	$V_{OUT}=V_{ADJ}$, $I_{OUT}=100mA$ $1.5V \leqq V_{IN} \leqq 6.0V$			0.05	0.20	%/V
RR	Ripple Rejection	f=1kHz Ripple 0.5Vp−p, $V_{OUT}=V_{ADJ}$, $V_{IN}=2.5V$ $I_{OUT}=100mA$			70		dB
$\Delta V_{OUT}/\Delta Topt$	Output Voltage Temperature Coefficient	$I_{OUT}=100mA$ $-40°C \leqq Topt \leqq 85°C$			±100		ppm/°C
I_{LIM}	Output Current	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0$		1			A
I_{SC}	Short Current Limit	$V_{OUT}=V_{ADJ}=0V$			250		mA
R_{PD}	Pull-down resistance for CE pin			1.9	5.0	15.0	MΩ
V_{CEH}	CE Input Voltage "H"			1.0		6.0	V
V_{CEL}	CE Input Voltage "L"			0		0.4	V
T_{TSD}	Thermal Shutdown Detector Threshold Temperature	Junction Temperature			150		°C
T_{TSR}	Thermal Shutdown Released Temperature	Junction Temperature			120		°C
en	Output Noise	BW=10Hz to 100kHz			30		μVrms

Technical Notes on External Components and Typical Application

(Refer to the example of typical application)



Example of the typical application of R1173x (Fixed Output Type)

Phase Compensation

In these ICs, phase compensation is made with the output capacitor for securing stable operation even if the load current is varied. For this purpose, use as much as a capacitor as C2. Recommendation value is as follows:

Mounting on PCB

Make V_{DD} and GND lines sufficient. If their impedance is high, a current flows, the noise picked up or unstable operation may result. Further use a 4.7μF or more value capacitor between V_{DD} pin and GND pin as close as possible.

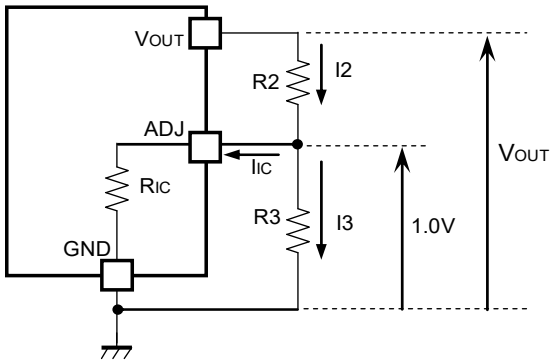
Set an Output capacitor between V_{OUT} pin and GND pin for phase compensation as close as possible.

Output Voltage	C2 recommendation value	Components Recommendation
V_{OUT}<1.0V	Tantalum 4.7μF or more	
1.0 ≦ V_{OUT}<3.3V	Ceramic 4.7μF or more	Kyocera 4.7μF (1608) Part Number: CM105X5R475M06AB Murata 4.7μF (1608) Part Number: GRM188R60J475KE19B Murata 10μF (1608) Part Number: GRM188B30G106ME46B
3.3V ≦ V_{OUT}	Ceramic 4.7μF or more	Kyocera 4.7μF (thin 2012) Part Number: CT21X5R475M06AB Murata 10μF (1608) Part Number: GRM188B30G106ME46B

If you use a tantalum type capacitor and ESR value of the capacitor is large, output might be unstable. Evaluate your circuit with considering frequency characteristics.

Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different. Evaluate the circuit with actual using capacitors.

Technical Notes on Output Voltage Setting of Adjustable Output type (R1173x001x)



The Output Voltage may be adjustable for any output voltage between its 1.0V reference and its V_{DD} setting level. An external pair of resistors is required, as shown above.

The complete equation for the output voltage is described step by step as follows;

$I2 = I_{IC} + I3$ ..... (1)

$I3 = 1.0/R3$ ..... (2)

Thus,

$I2 = I_{IC} + 1.0/R3$ ..... (3)

Therefore,

$V_{OUT} = 1.0 + R2 \times I2$ ..... (4)

Put Equation (3) into Equation (4), then

$V_{OUT} = 1.0 + R2(I_{IC} + 1.0/R3)$

$= 1.0(1 + R2/R3) + R2 \times I_{IC}$ ..... (5)

In 2nd term, or $R2 \times I_{IC}$ will produce an error in V_{OUT}.

In Equation (5),

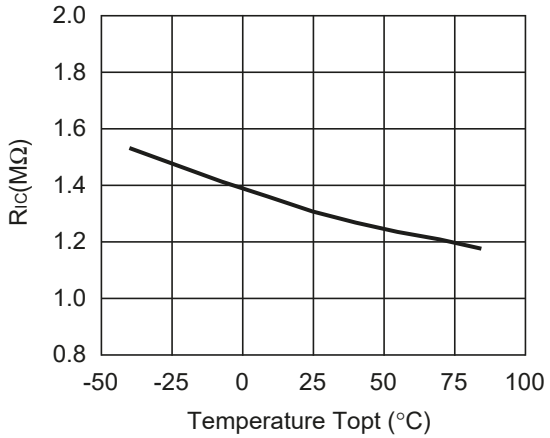
$I_{IC} = 1.0/R_{IC}$ ..... (6)

$R2 \times I_{IC} = R2 \times 1.0/R_{IC}$

$= 1.0 \times R2/R_{IC}$ ..... (7)

For better accuracy, choosing R2 ($<<R_{IC}$) reduces this error.

R1173x001x

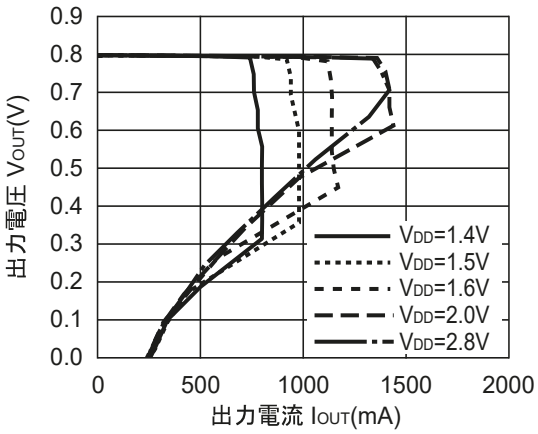


∗) The graph is a typical characteristic , please evaluate the circuit with an actual condition.

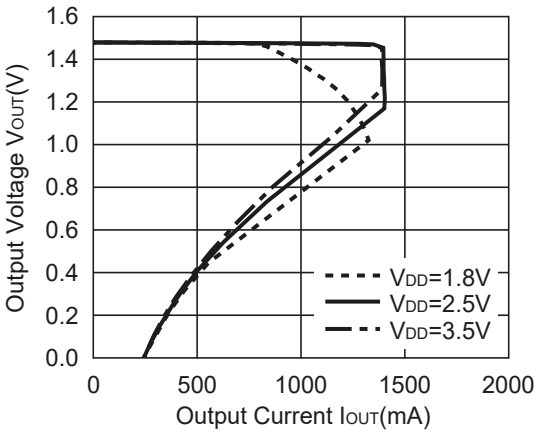
TYPICAL CHARACTERISTICS

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

R1173x081x



R1173x151x



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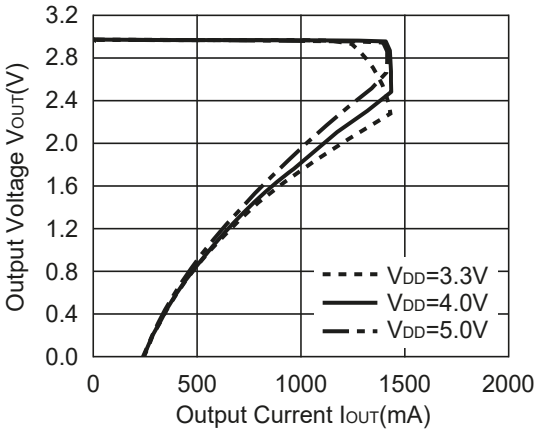
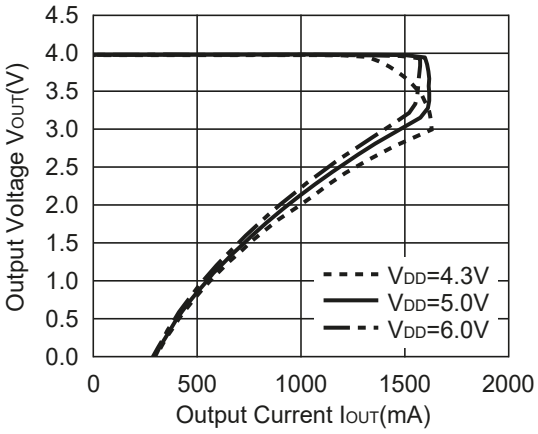


R1173x401x



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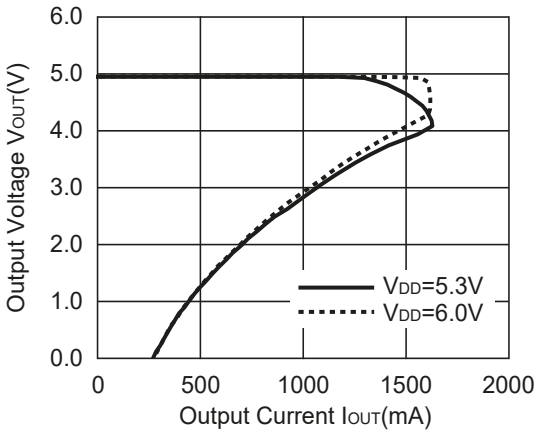
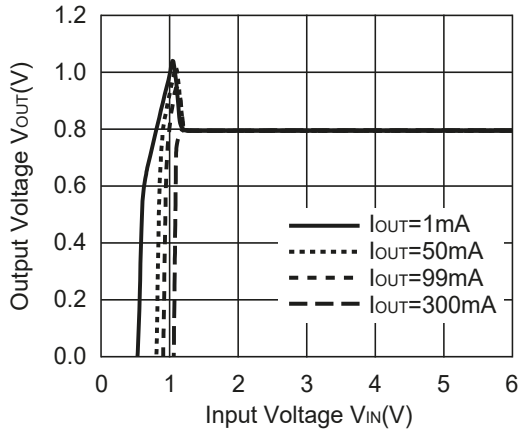


2) Output Voltage vs. Input Voltage (Topt=25°C)

R1173x081x



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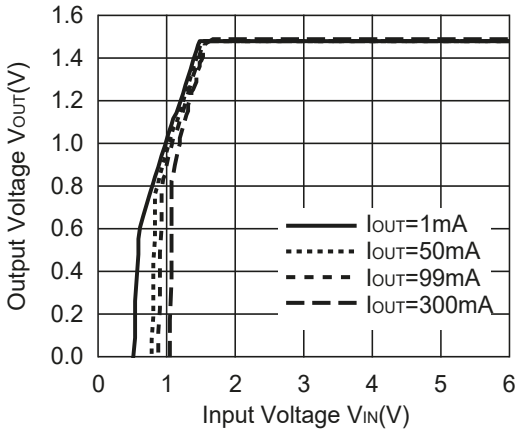

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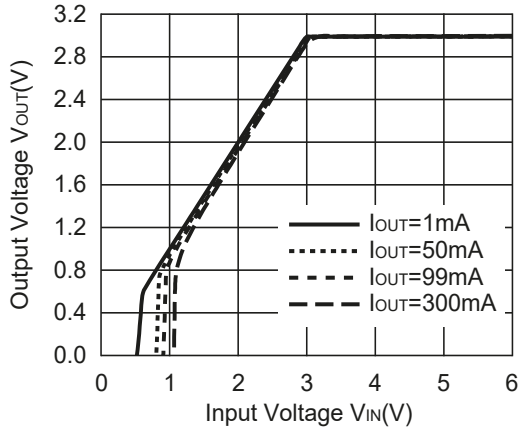

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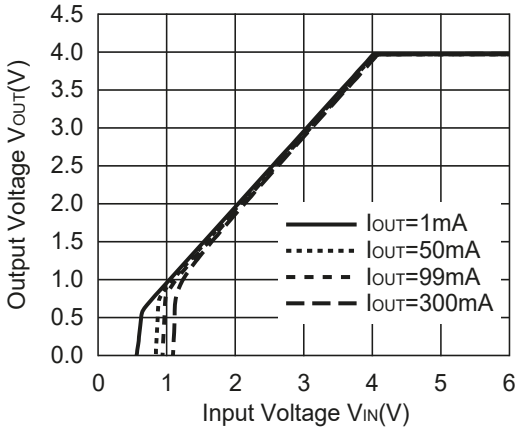

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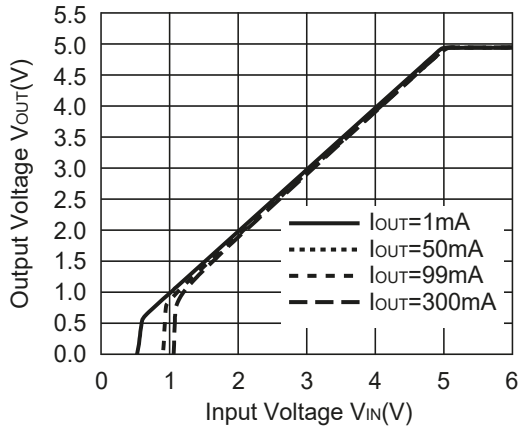
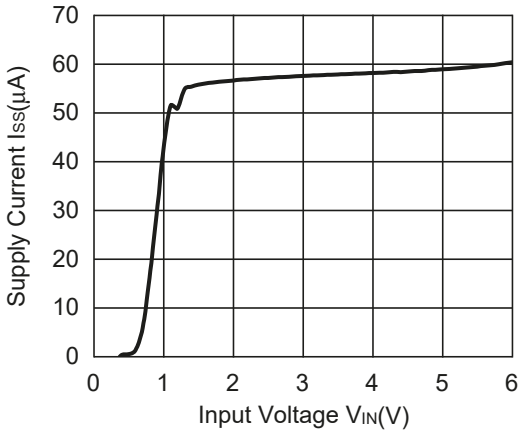
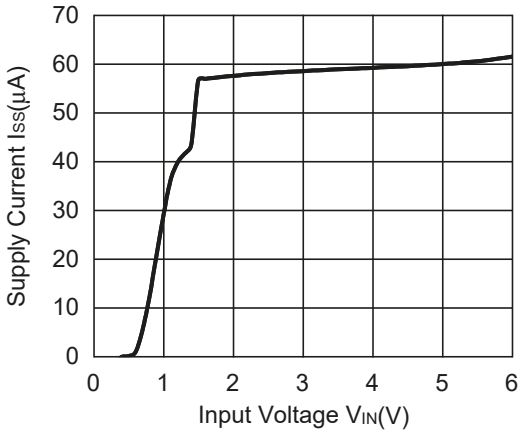


3) Dropout Voltage vs. Output Current (Topt=25°C)

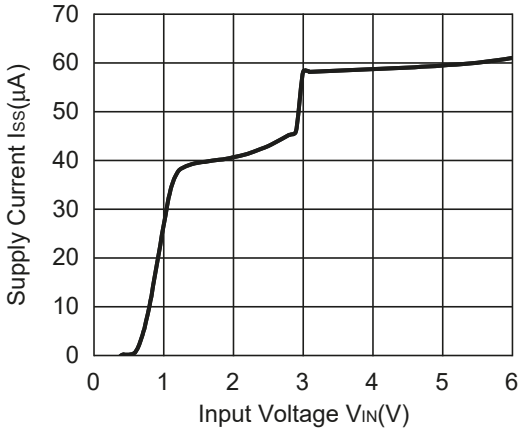
R1173x081x



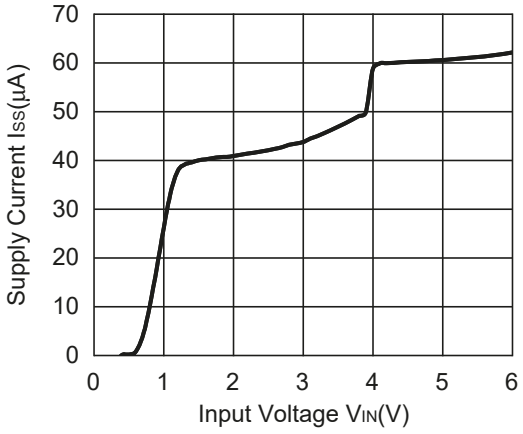
R1173x151x



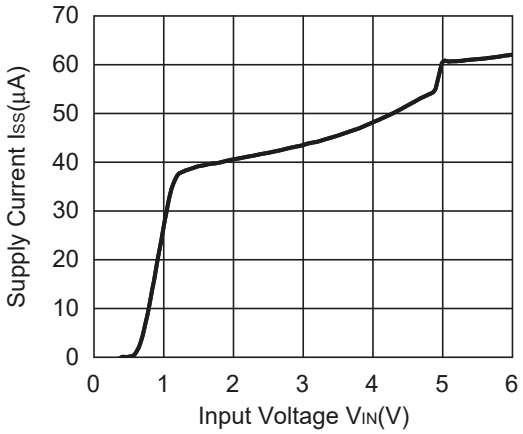
R1173x301x



R1173x401x

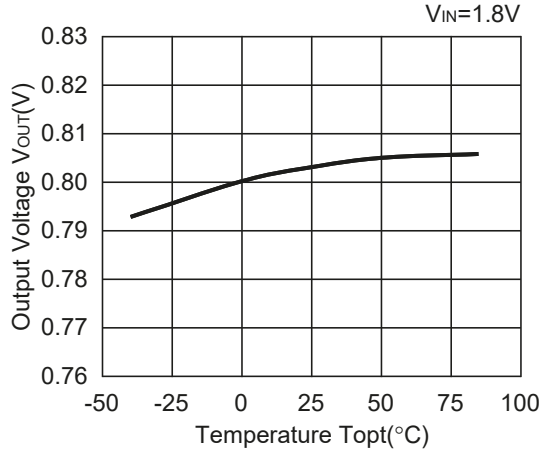


R1173x501x

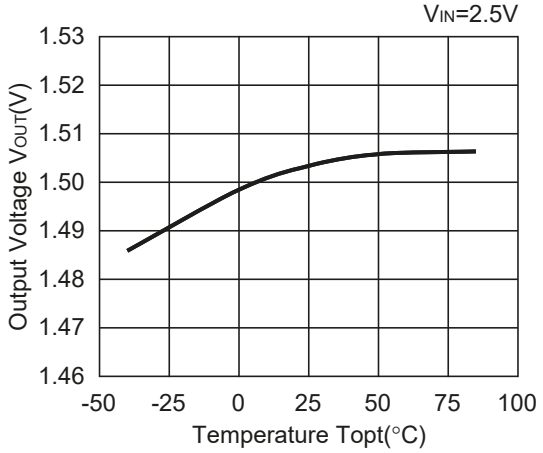


4) Output Voltage vs. Temperature (I_{OUT}=100mA)

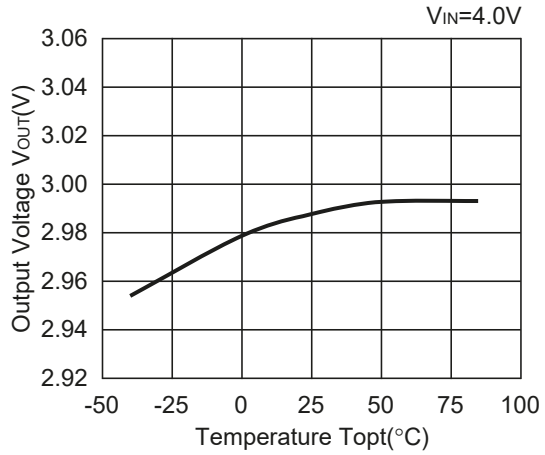
R1173x081x



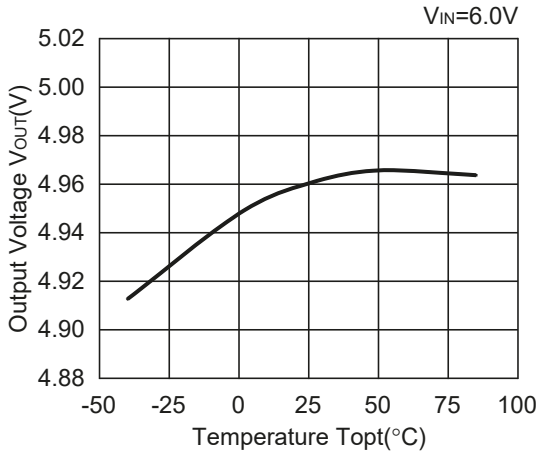
R1173x151x



R1173x301x

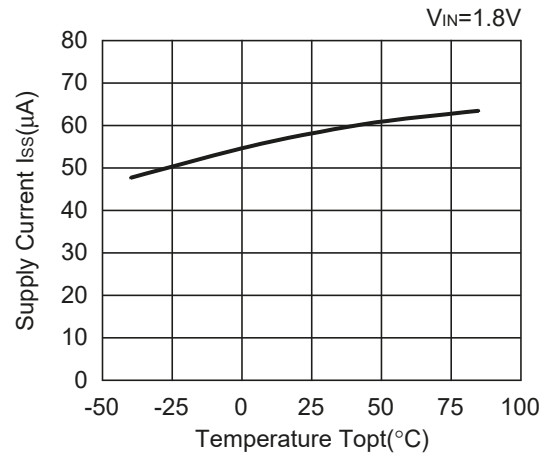


R1173x501x



5) Supply Current vs. Temperature

R1173x081x



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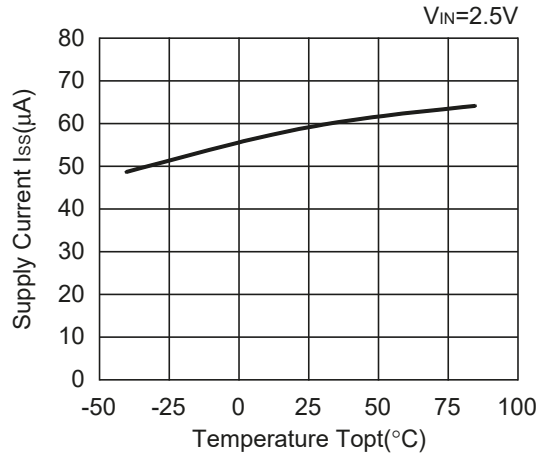

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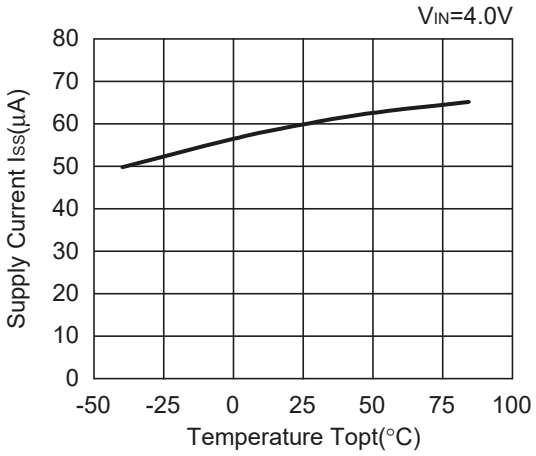
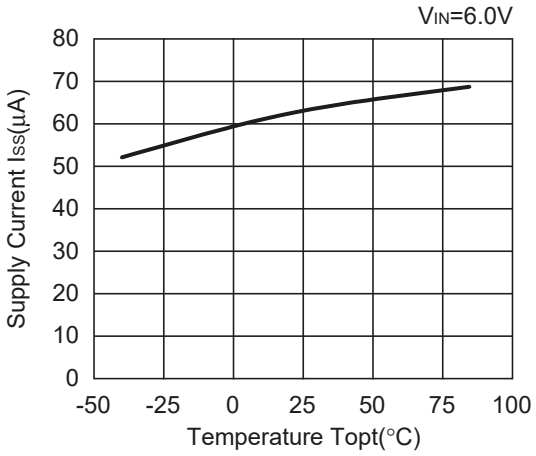
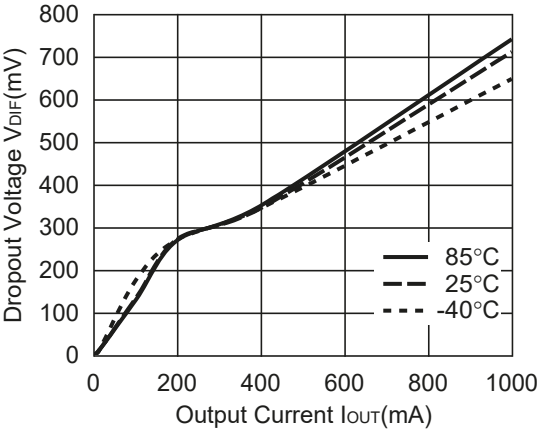


R1173x501x

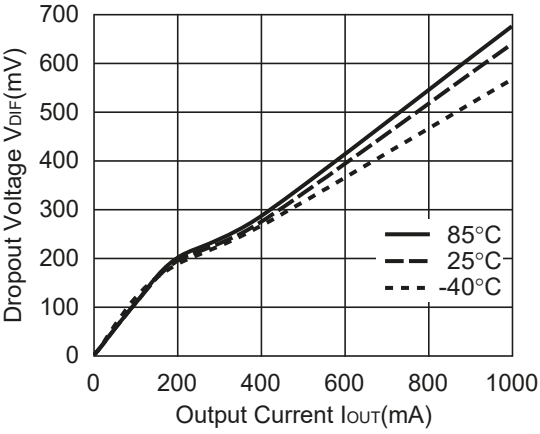


6) Dropout Voltage vs. Output Current

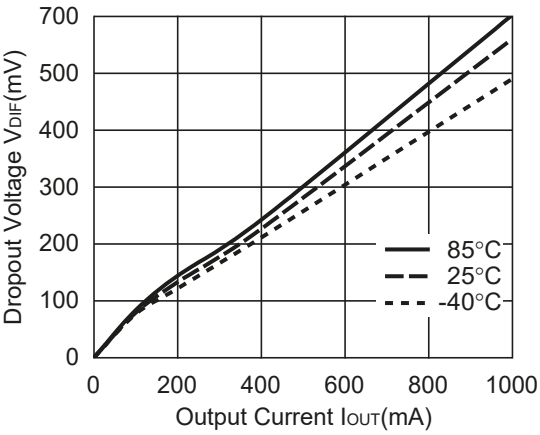
R1173x081x



R1173x091x



R1173x101x



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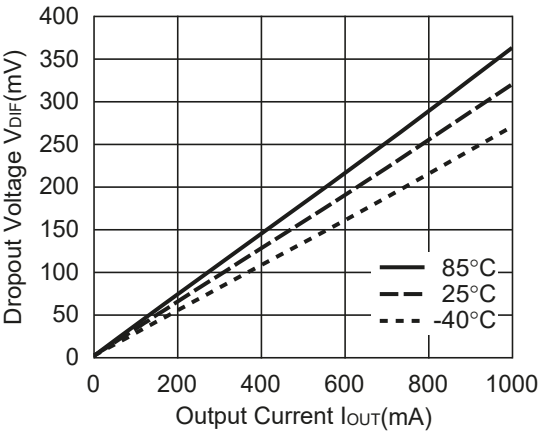
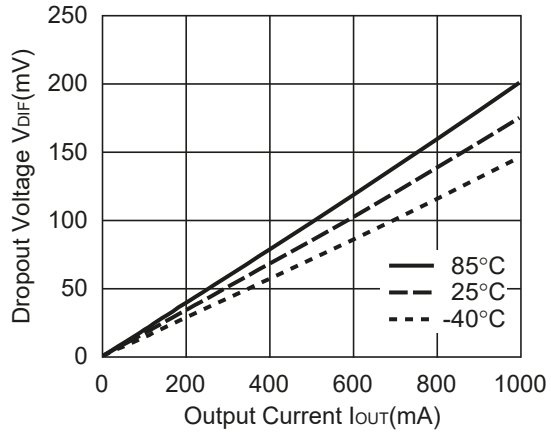
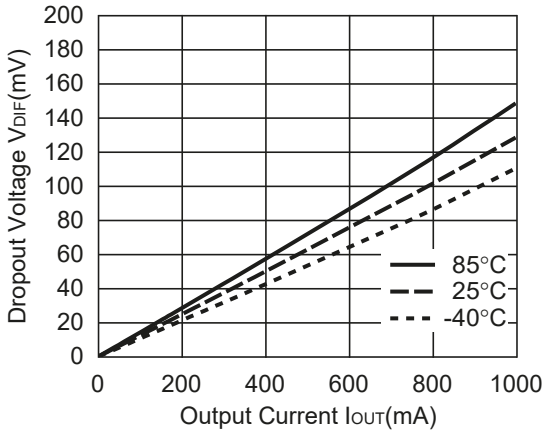


R1173x301x

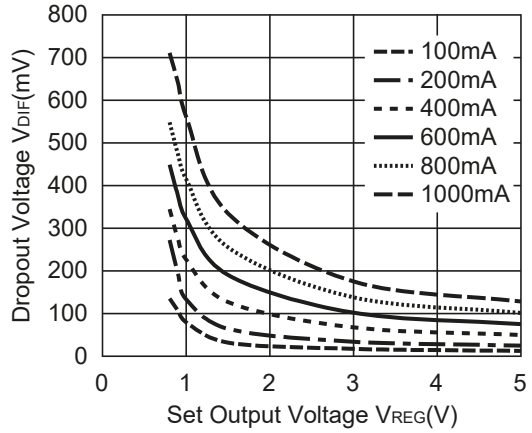


R1173x501x



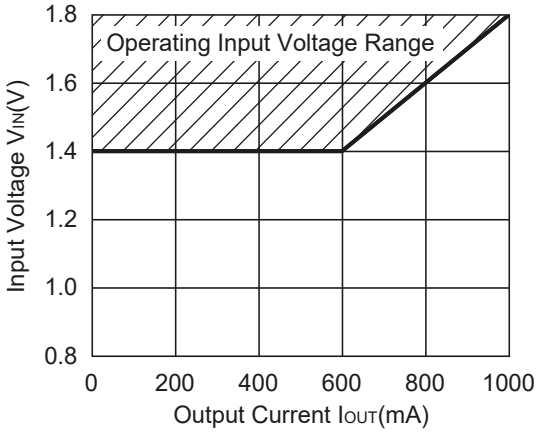
7) Dropout Voltage vs. Set Output Voltage

R1173xxx1x



8) 0.8V Output type, Operating Input Voltage Range

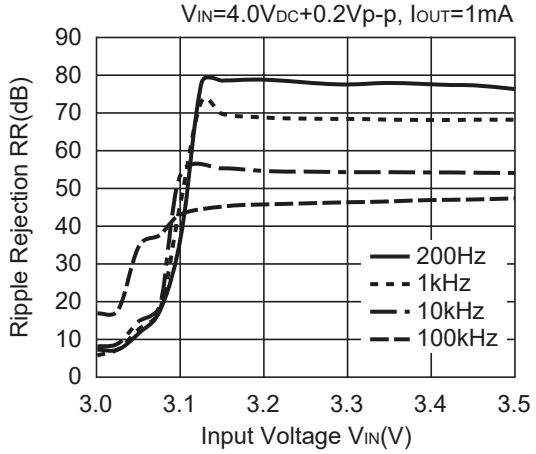
R1173x081x



9) Ripple Rejection vs. Input Bias

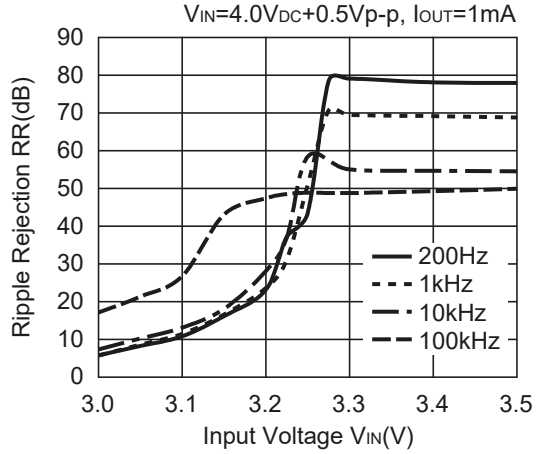
R1173x301x

VIN=4.0VDC+0.2Vp-p, IOUT=1mA



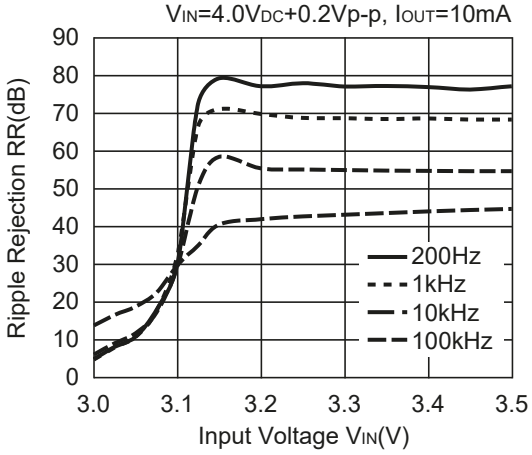
R1173x301x

VIN=4.0VDC+0.5Vp-p, IOUT=1mA



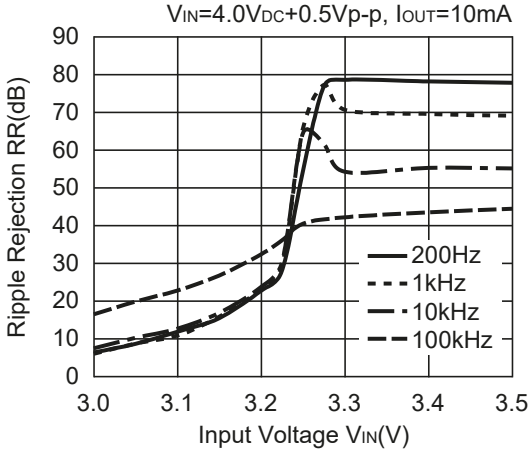
R1173x301x

V_{IN}=4.0V_{DC}+0.2Vp-p, I_{OUT}=10mA



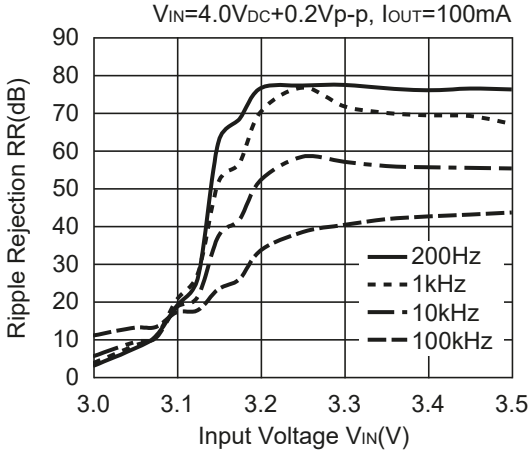
R1173x301x

V_{IN}=4.0V_{DC}+0.5Vp-p, I_{OUT}=10mA



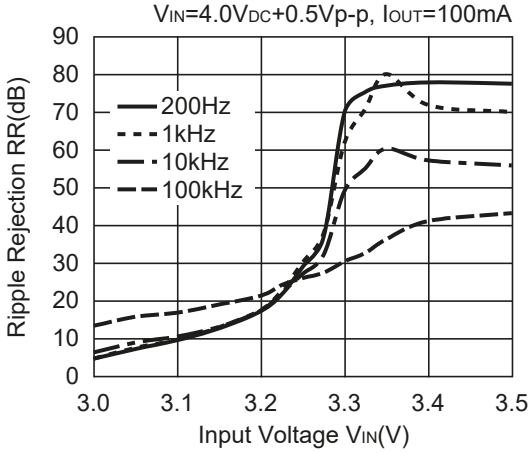
R1173x301x

V_{IN}=4.0V_{DC}+0.2Vp-p, I_{OUT}=100mA



R1173x301x

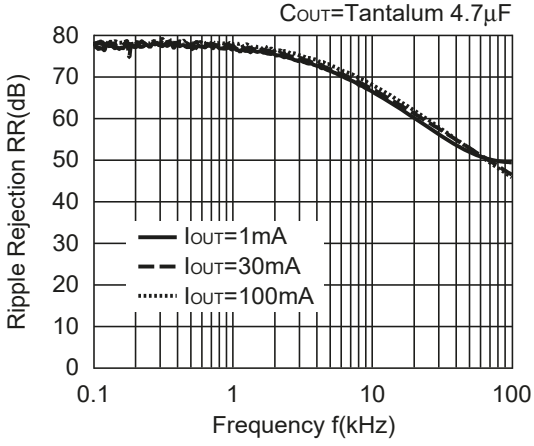
V_{IN}=4.0V_{DC}+0.5Vp-p, I_{OUT}=100mA



10) Ripple Rejection vs. Frequency

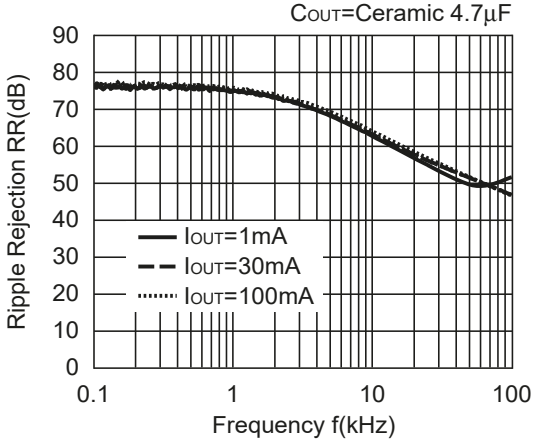
R1173x081x

V_{IN}=1.8V_{DC}+0.5Vp-p,
C_{OUT}=Tantalum 4.7µF

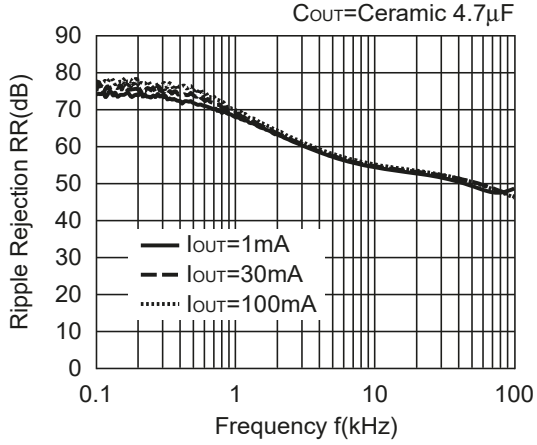


R1173x101x

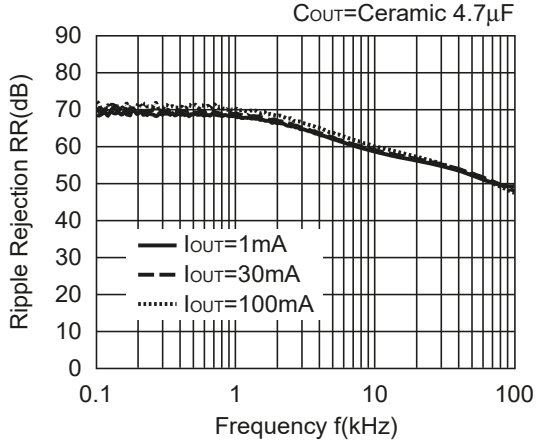
V_{IN}=2.0V_{DC}+0.5Vp-p,
C_{OUT}=Ceramic 4.7µF



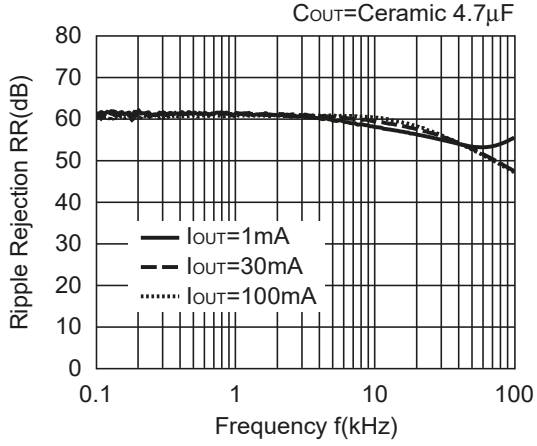
R1173x301x



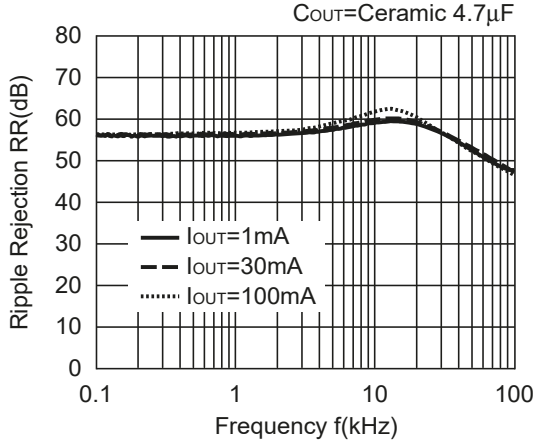
R1173x401x



R1173x451x

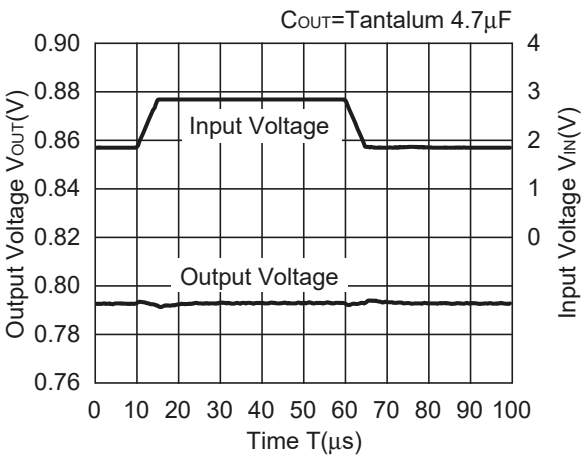


R1173x501x

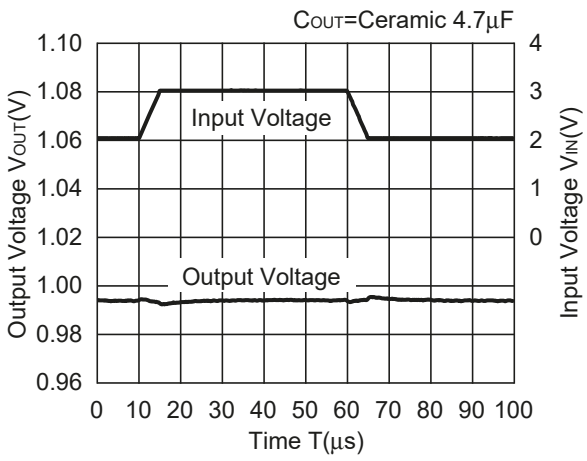


11) Line Transient Response (Tr=Tf=5µs, IOUT=100mA)

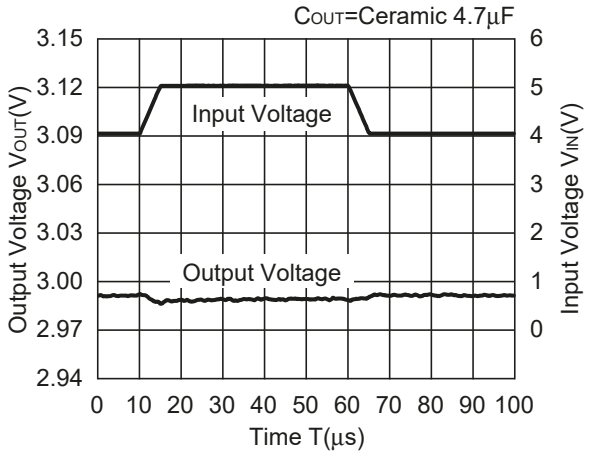
R1173x081x



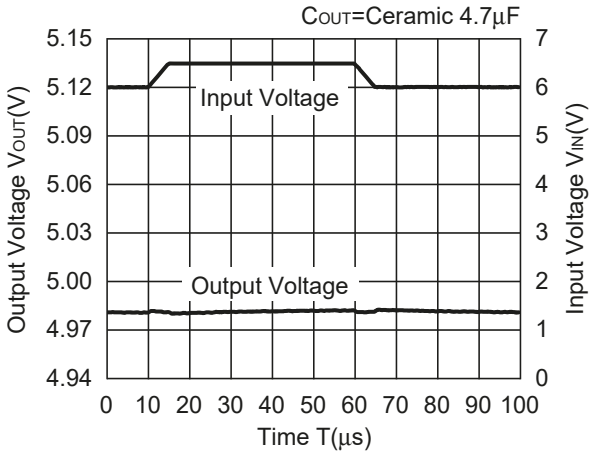
R1173x101x



R1173x301x

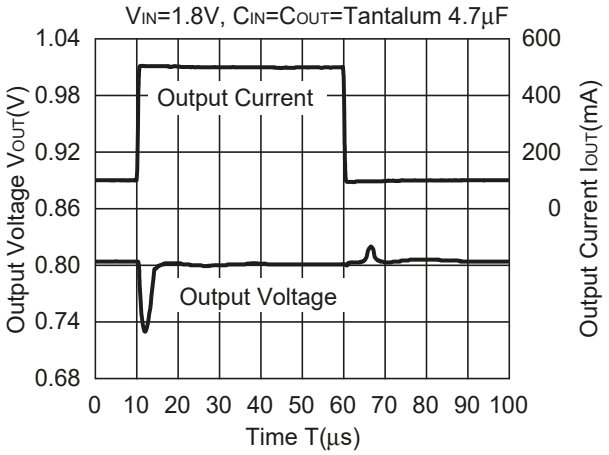


R1173x501x

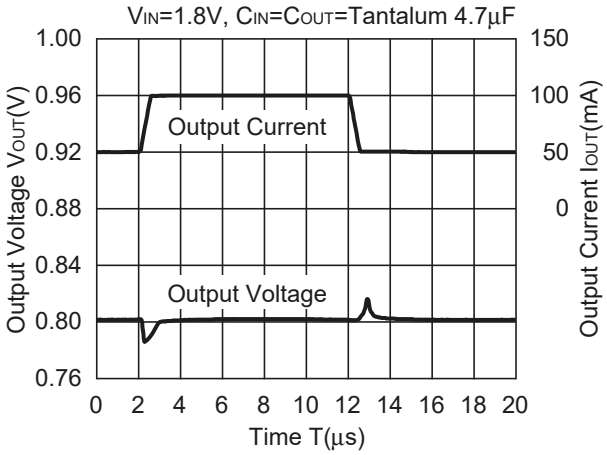


12) Load Transient Response (Tr=Tf=500ns)

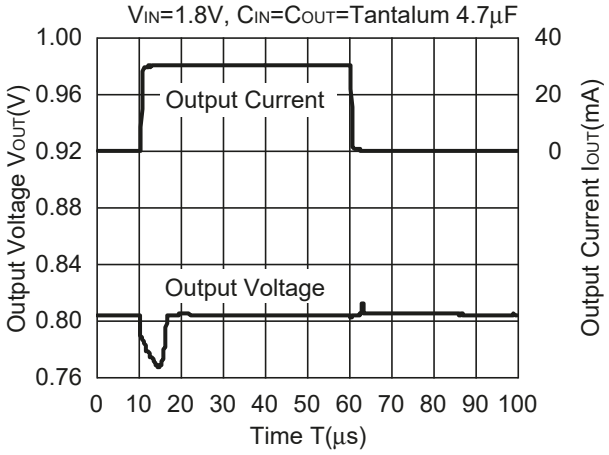
R1173x081x



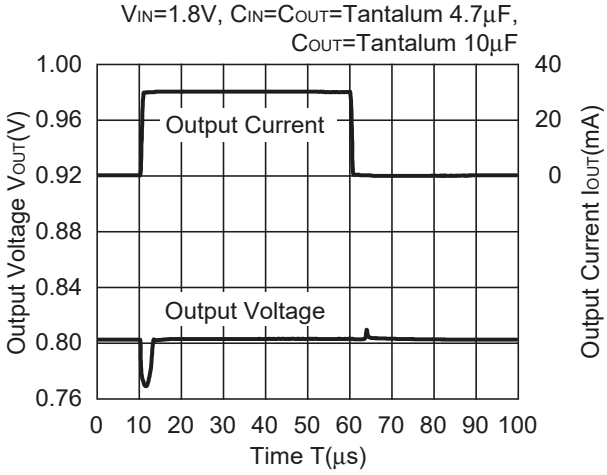
R1173x081x



R1173x081x

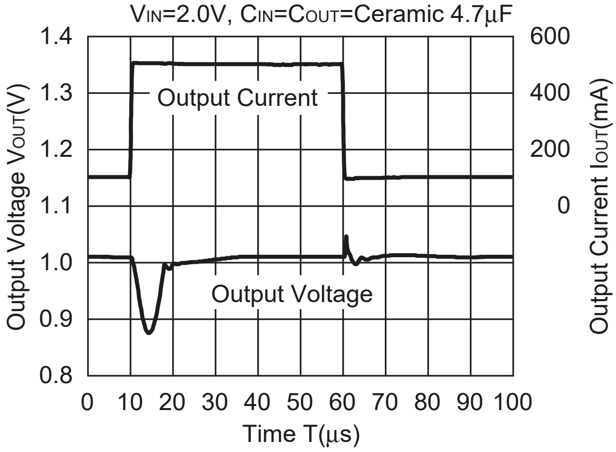


R1173x081x



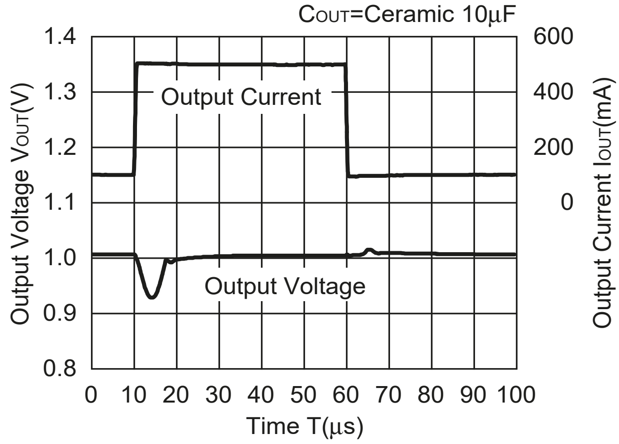
R1173x101x

V_{IN}=2.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



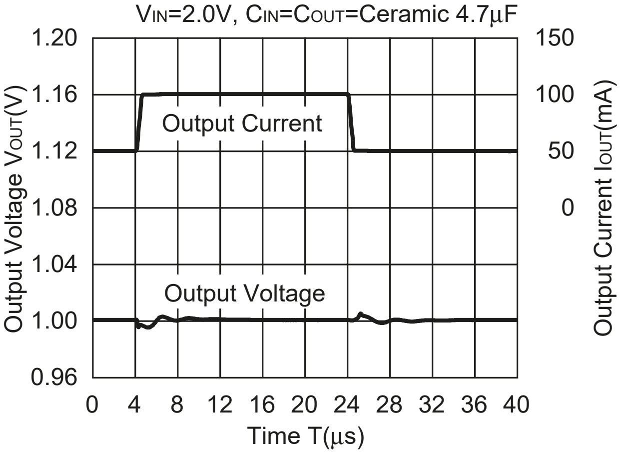
R1173x101x

V_{IN}=2.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



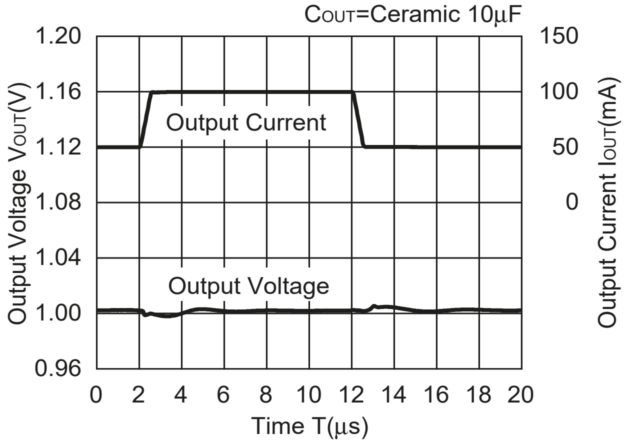
R1173x101x

V_{IN}=2.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



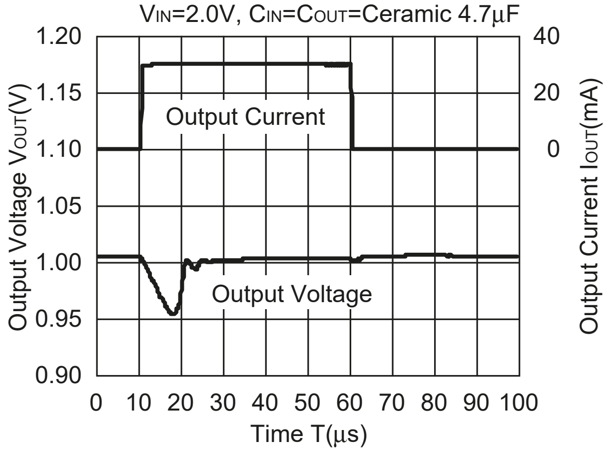
R1173x101x

V_{IN}=2.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



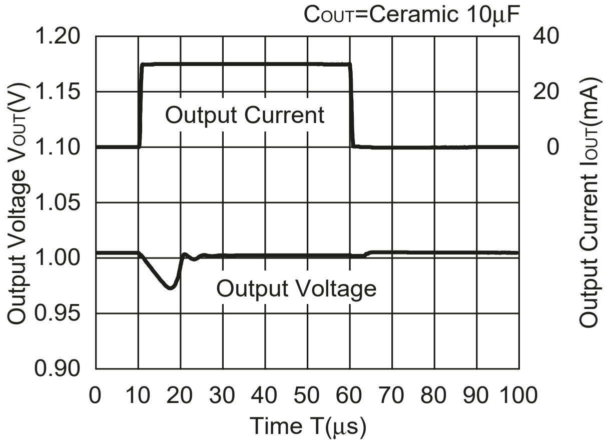
R1173x101x

V_{IN}=2.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



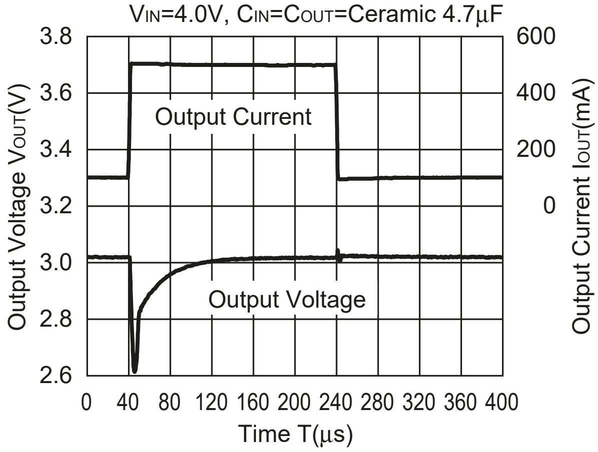
R1173x101x

V_{IN}=2.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



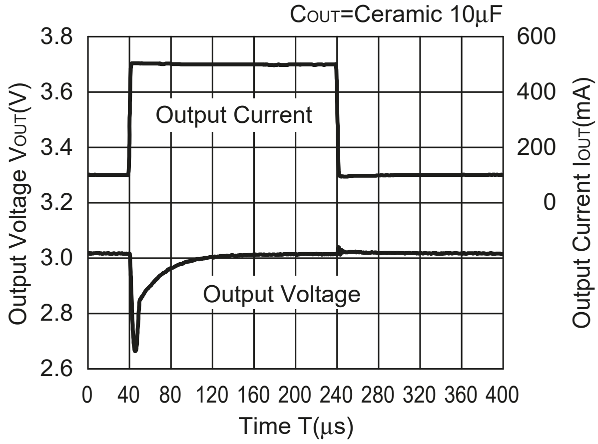
R1173x301x

V_{IN}=4.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



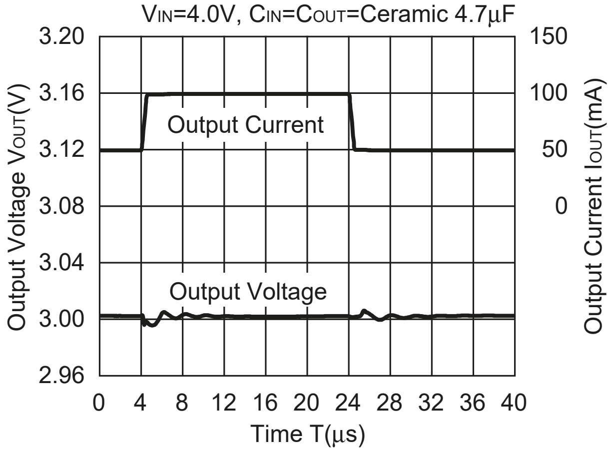
R1173x301x

V_{IN}=4.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



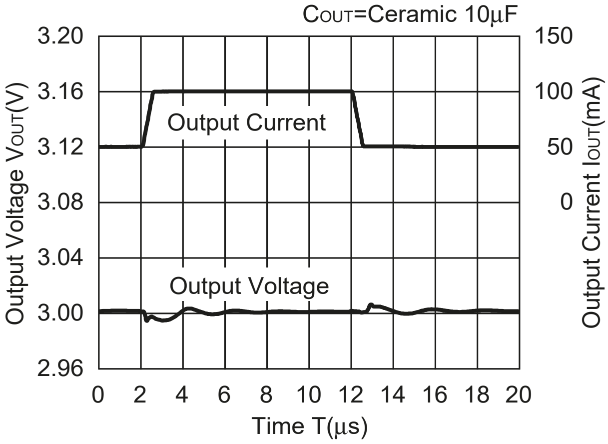
R1173x301x

V_{IN}=4.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



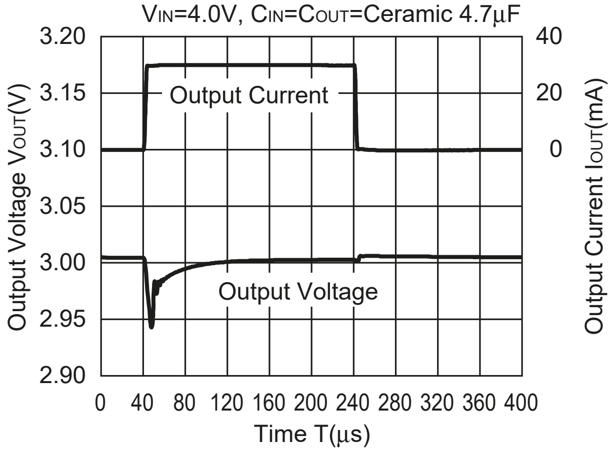
R1173x301x

V_{IN}=4.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



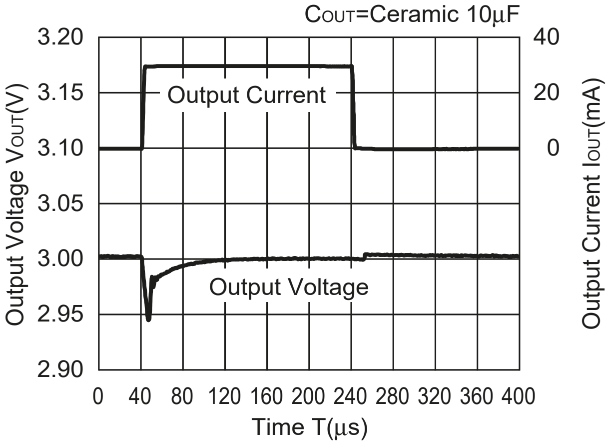
R1173x301x

V_{IN}=4.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



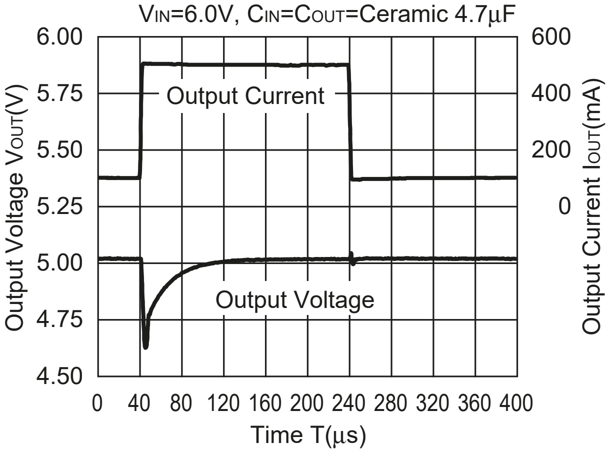
R1173x301x

V_{IN}=4.0V, C_{IN}=Ceramic 4.7µF,
C_{OUT}=Ceramic 10µF



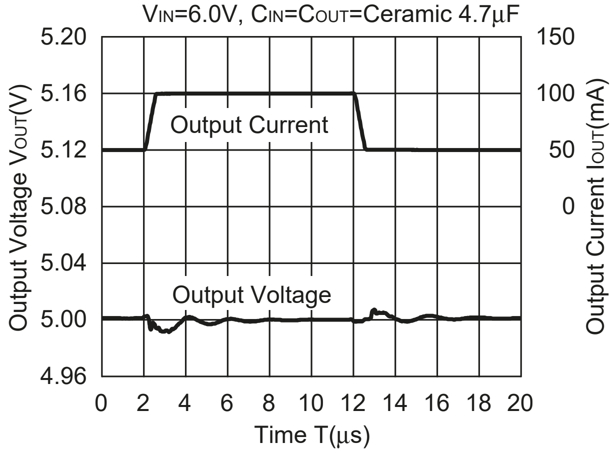
R1173x501x

V_{IN}=6.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



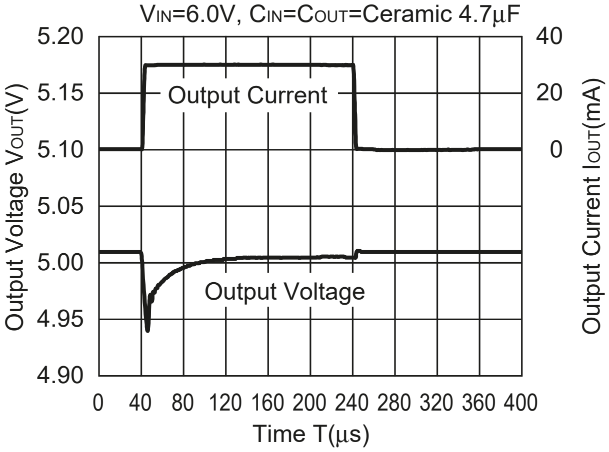
R1173x501x

V_{IN}=6.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



R1173x501x

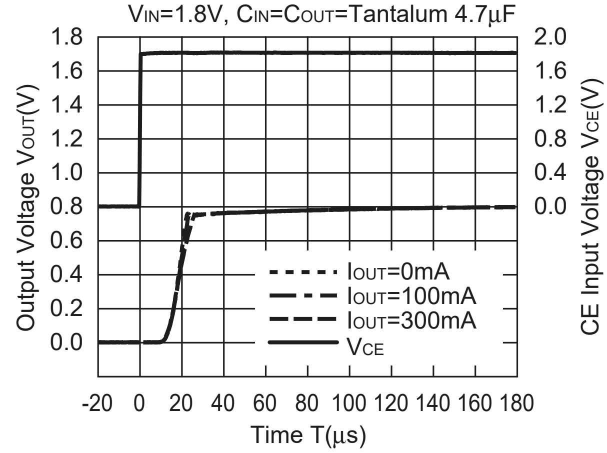
V_{IN}=6.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF



13) Turn-on speed with CE pin control

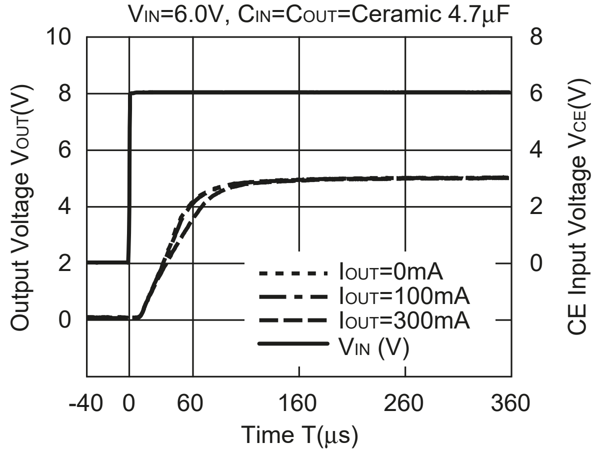
R1173x081x

V_{IN}=1.8V, C_{IN}=C_{OUT}=Tantalum 4.7µF



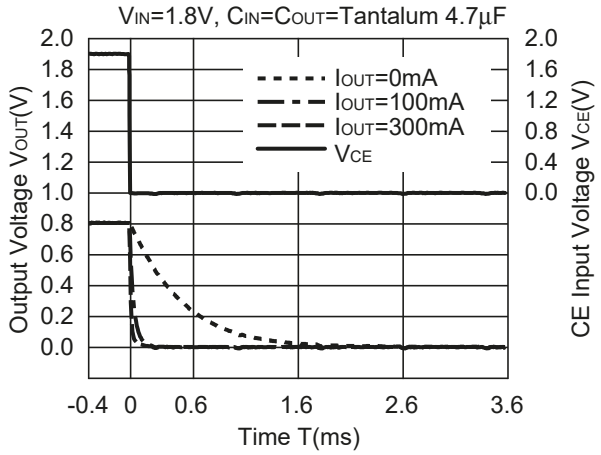
R1173x501x

V_{IN}=6.0V, C_{IN}=C_{OUT}=Ceramic 4.7µF

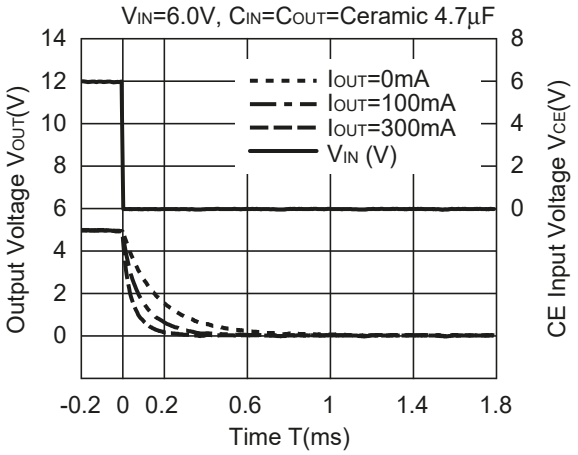


14) Turn-off speed with CE pin control

R1173x081D

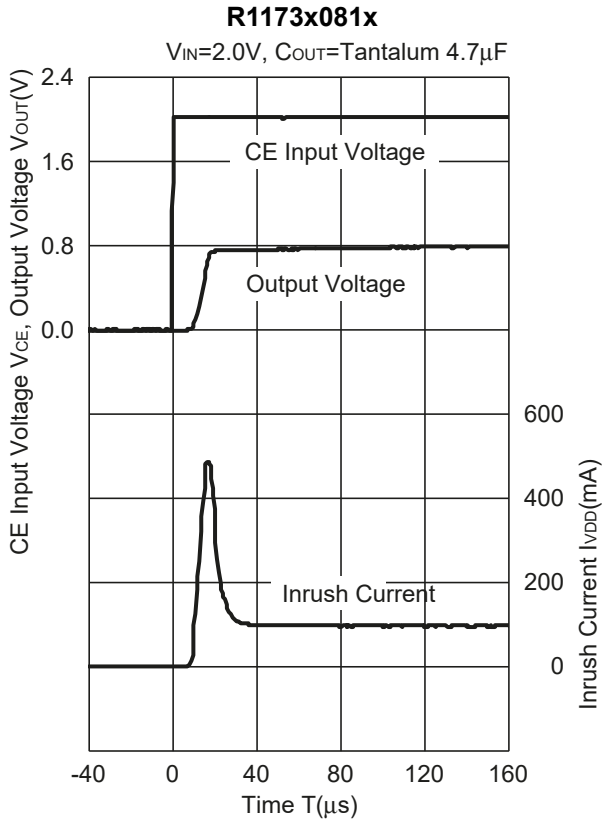


R1173x501D

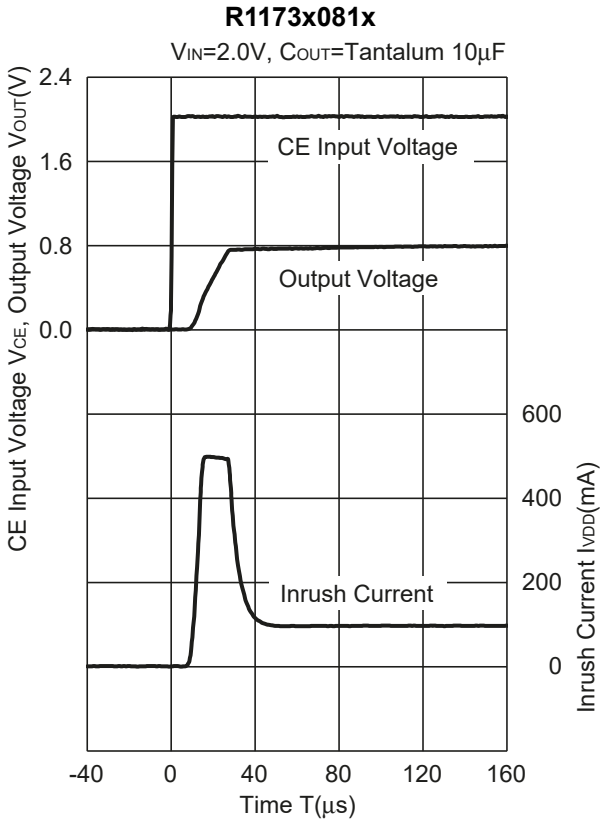


15) Inrush Current

R1173x081x

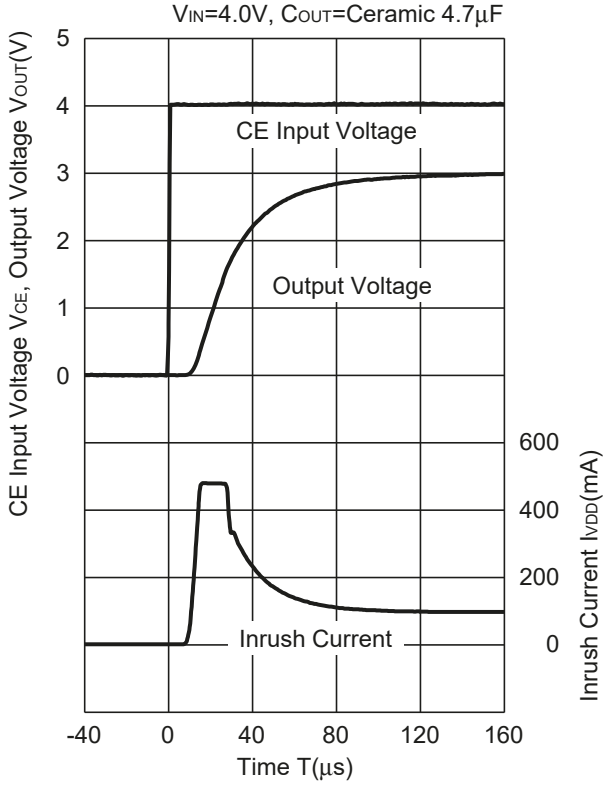


R1173x081x



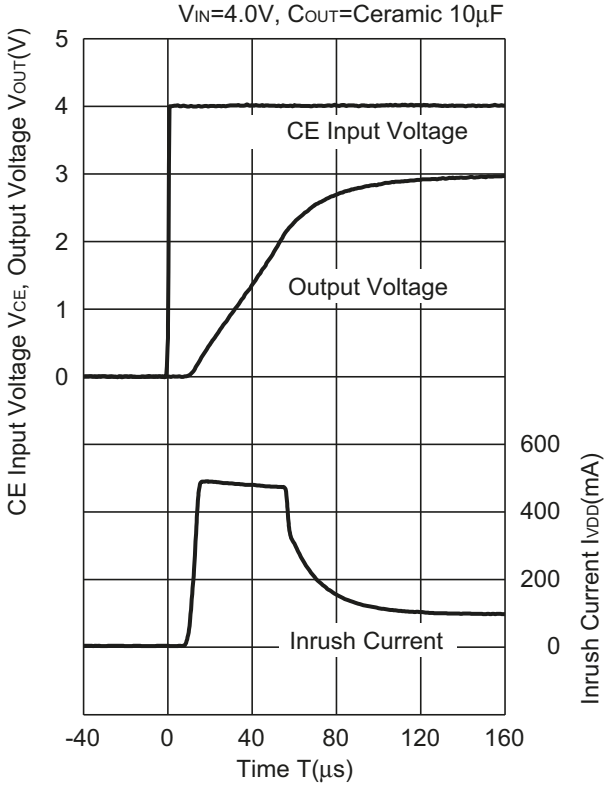
R1173x301x

V_{IN}=4.0V, C_{OUT}=Ceramic 4.7µF



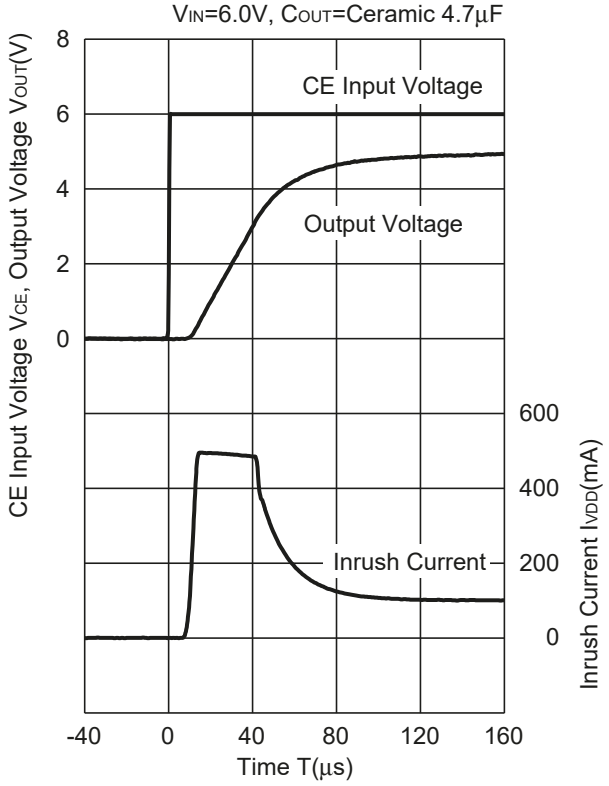
R1173x301x

V_{IN}=4.0V, C_{OUT}=Ceramic 10µF



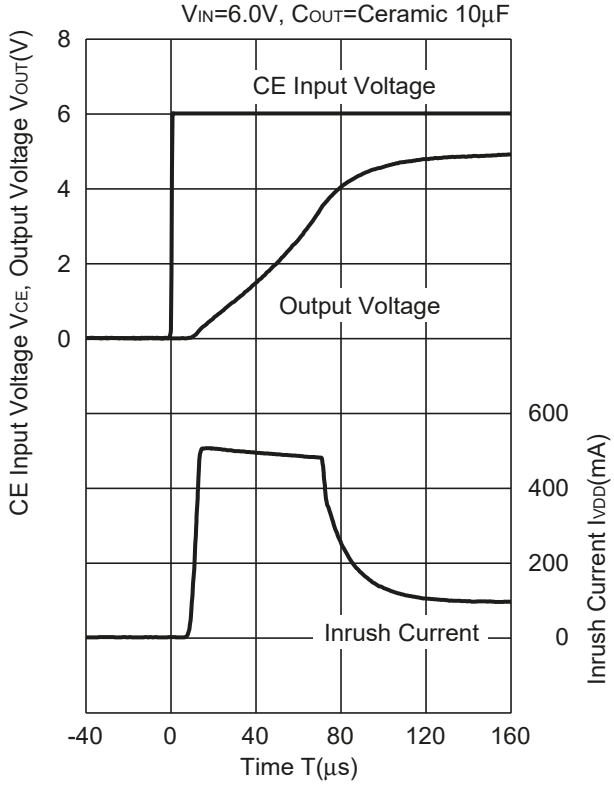
R1173x501x

V_{IN}=6.0V, C_{OUT}=Ceramic 4.7µF



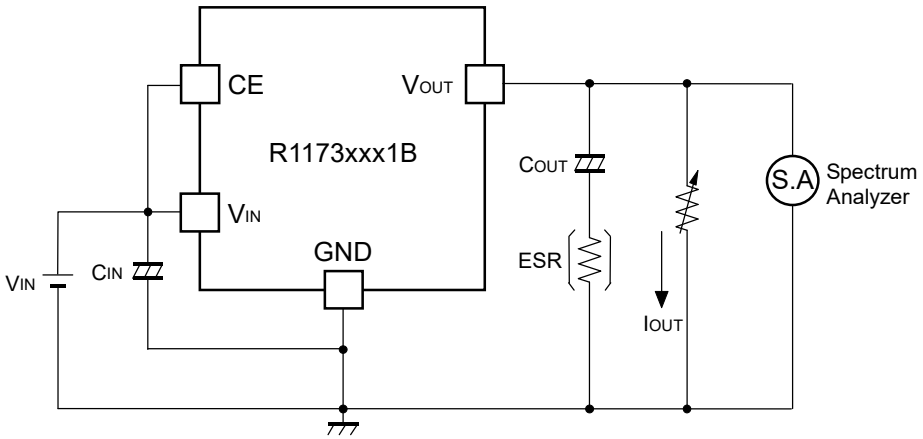
R1173x501x

V_{IN}=6.0V, C_{OUT}=Ceramic 10µF



16) Stable Area: ESR limit vs. Load current

0.8V to 3.3V Output type : C_{OUT}=4.7μF (Kyocera CM105X5R475M06AB)
5.0V Output type : C_{OUT}=4.7μF(Kyocera CT21X5R475K06AB)

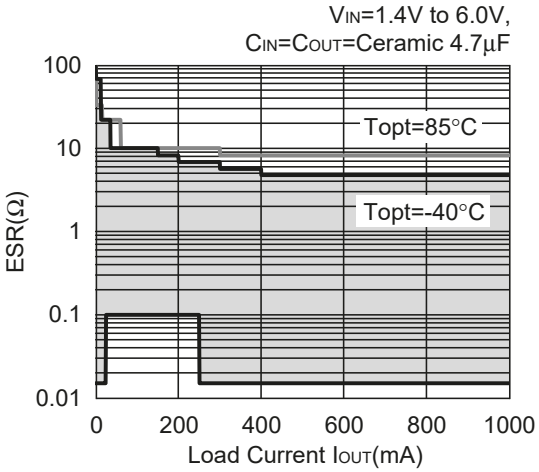


Measurement Conditions
- V_{IN}=V_{OUT}+1V
- Freguency=10Hz to 1MHz
- Topt=25°C

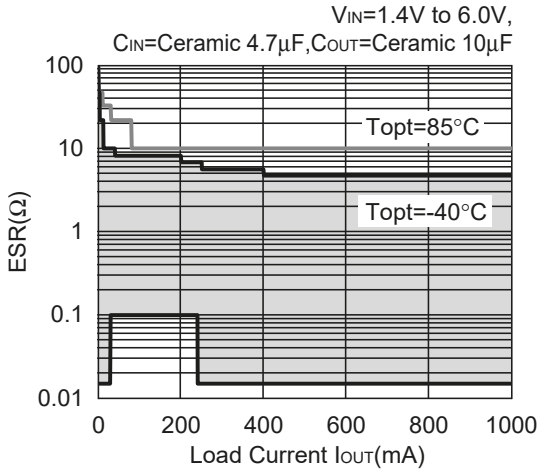
As an output capacitor for this IC, Ceramic capacitor is recommendable. However, other low ESR type capacitor can be used with this IC.

For your reference, noise level is tested, and if the noise level is 40μV or less than 40μV, the ESR values are plotted as stable area. Upper limit is described in the next five graphs, or ESR vs. Output Current. (Hatched area is the stable area.)

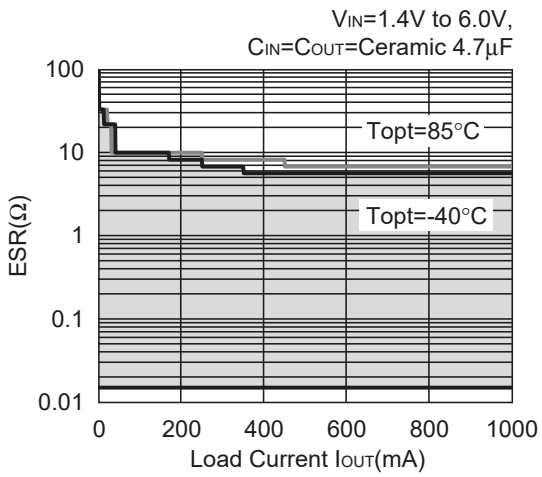
R1173x081x



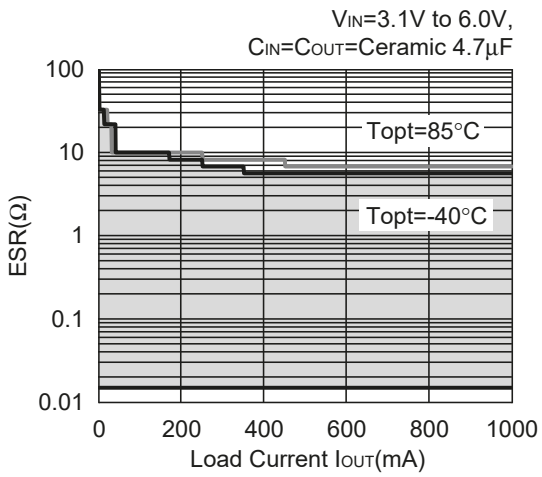
R1173x081x



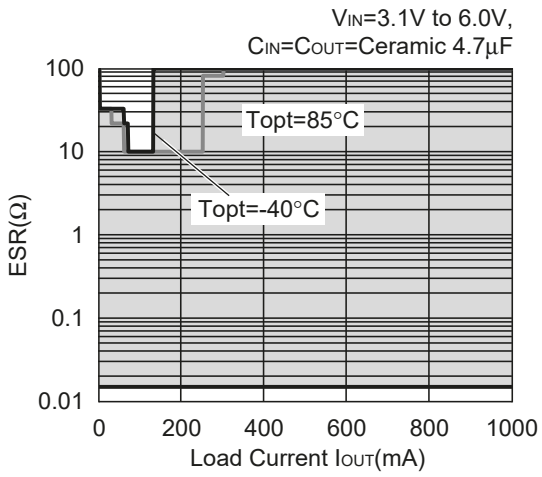
R1173x101x



R1173x301x



R1173x501x



Power Dissipation (SOT-89-5)

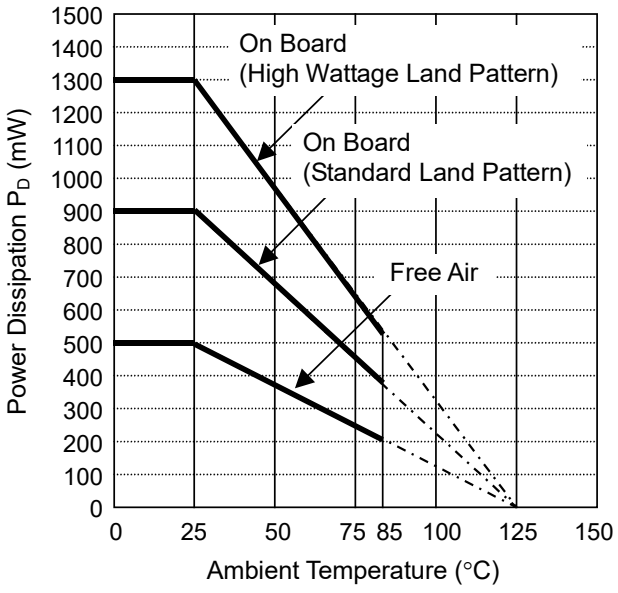
This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

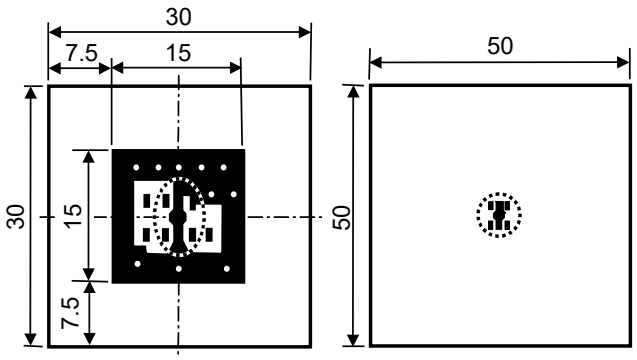
	High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)	Glass cloth epoxy plastic (Double sided)
Board Dimensions	30mm x 30mm x 1.6mm	50mm x 50mm x 1.6mm
Copper Ratio	Top side : Approx. 20% , Back side : Approx. 100%	Top side : Approx. 10% , Back side : Approx. 100%
Through-hole	ϕ0.85mm x 10pcs	-

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

	High Wattage Land Pattern	Standard Land Pattern	Free Air
Power Dissipation	1300mW	900mW	500mW
Thermal Resistance	77°C/W	111°C/W	200°C/W



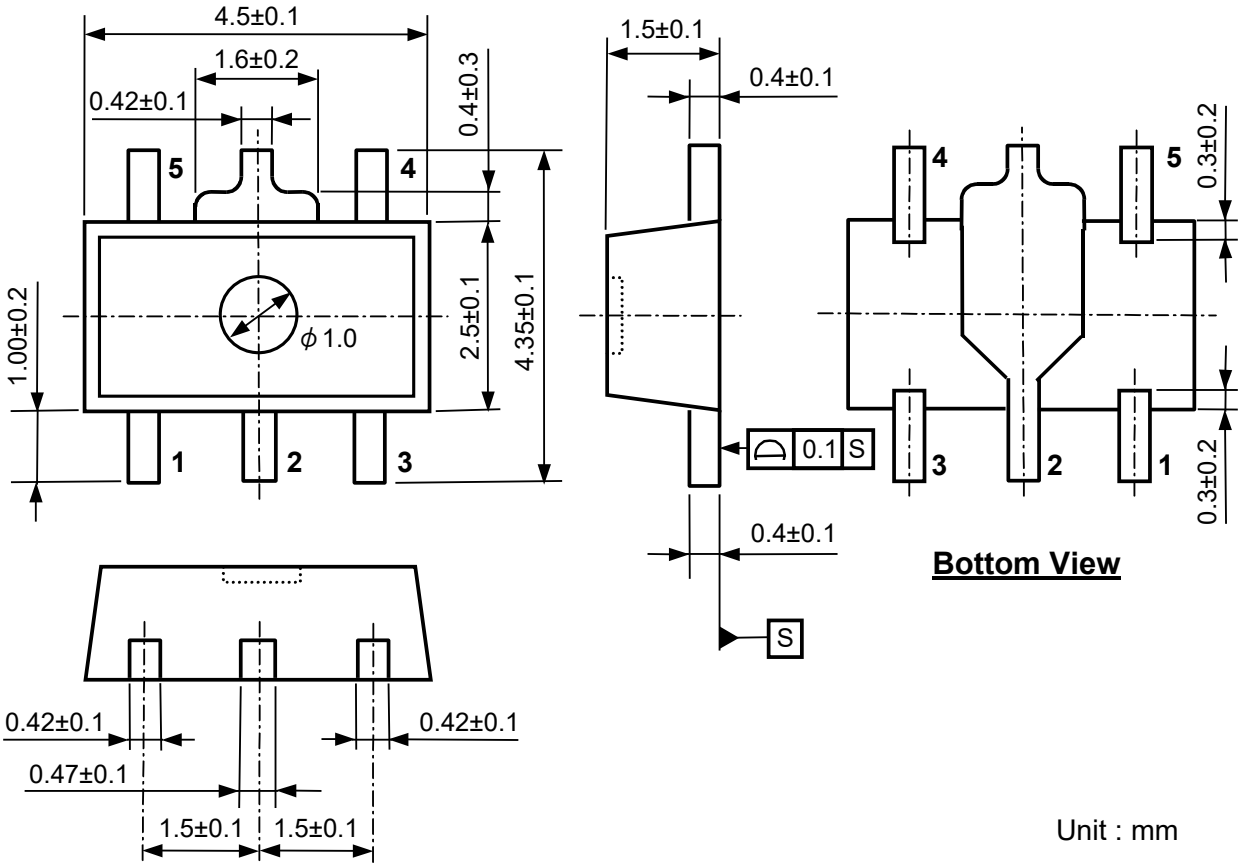
Power Dissipation



Measurement Board Pattern

IC Mount Area Unit : mm

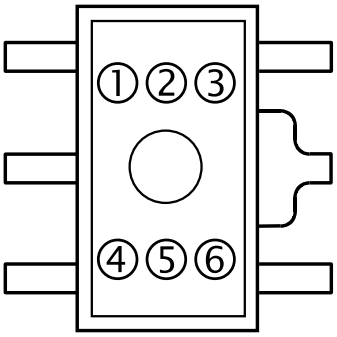
Package Dimensions (SOT-89-5)



Unit : mm

Mark Specification (SOT-89-5)

①②③④ : Product Code .... Refer to the marking list table
⑤⑥ : Lot No. ..... Alphanumeric serial number.



R1173H Series Marking List Table

PKG : SOT-89-5

R1173Hxx1B

Part Number	①②③④
R1173H081B	**L08B**
R1173H091B	**L09B**
R1173H101B	**L10B**
R1173H111B	**L11B**
R1173H121B	**L12B**
R1173H131B	**L13B**
R1173H141B	**L14B**
R1173H151B	**L15B**
R1173H161B	**L16B**
R1173H171B	**L17B**
R1173H181B	**L18B**
R1173H191B	**L19B**
R1173H201B	**L20B**
R1173H211B	**L21B**
R1173H221B	**L22B**
R1173H231B	**L23B**
R1173H241B	**L24B**
R1173H251B	**L25B**
R1173H261B	**L26B**
R1173H271B	**L27B**
R1173H281B	**L28B**
R1173H291B	**L29B**
R1173H301B	**L30B**
R1173H311B	**L31B**
R1173H321B	**L32B**
R1173H331B	**L33B**
R1173H341B	**L34B**
R1173H351B	**L35B**
R1173H361B	**L36B**
R1173H371B	**L37B**
R1173H381B	**L38B**
R1173H391B	**L39B**
R1173H401B	**L40B**
R1173H411B	**L41B**
R1173H421B	**L42B**
R1173H431B	**L43B**
R1173H441B	**L44B**
R1173H451B	**L45B**
R1173H461B	**L46B**
R1173H471B	**L47B**
R1173H481B	**L48B**
R1173H491B	**L49B**
R1173H501B	**L50B**
R1173H181B5	**L01B**
R1173H281B5	**L02B**
R1173H12B5	**L03B**
R1173H001B	**L00B**

R1173Hxx1D

Part Number	①②③④
R1173H081D	**L08D**
R1173H091D	**L09D**
R1173H101D	**L10D**
R1173H111D	**L11D**
R1173H121D	**L12D**
R1173H131D	**L13D**
R1173H141D	**L14D**
R1173H151D	**L15D**
R1173H161D	**L16D**
R1173H171D	**L17D**
R1173H181D	**L18D**
R1173H191D	**L19D**
R1173H201D	**L20D**
R1173H211D	**L21D**
R1173H221D	**L22D**
R1173H231D	**L23D**
R1173H241D	**L24D**
R1173H251D	**L25D**
R1173H261D	**L26D**
R1173H271D	**L27D**
R1173H281D	**L28D**
R1173H291D	**L29D**
R1173H301D	**L30D**
R1173H311D	**L31D**
R1173H321D	**L32D**
R1173H331D	**L33D**
R1173H341D	**L34D**
R1173H351D	**L35D**
R1173H361D	**L36D**
R1173H371D	**L37D**
R1173H381D	**L38D**
R1173H391D	**L39D**
R1173H401D	**L40D**
R1173H411D	**L41D**
R1173H421D	**L42D**
R1173H431D	**L43D**
R1173H441D	**L44D**
R1173H451D	**L45D**
R1173H461D	**L46D**
R1173H471D	**L47D**
R1173H481D	**L48D**
R1173H491D	**L49D**
R1173H501D	**L50D**
R1173H181D5	**L01D**
R1173H281D5	**L02D**
R1173H121D5	**L03D**
R1173H001D	**L00D**

Power Dissipation (HSON-6)

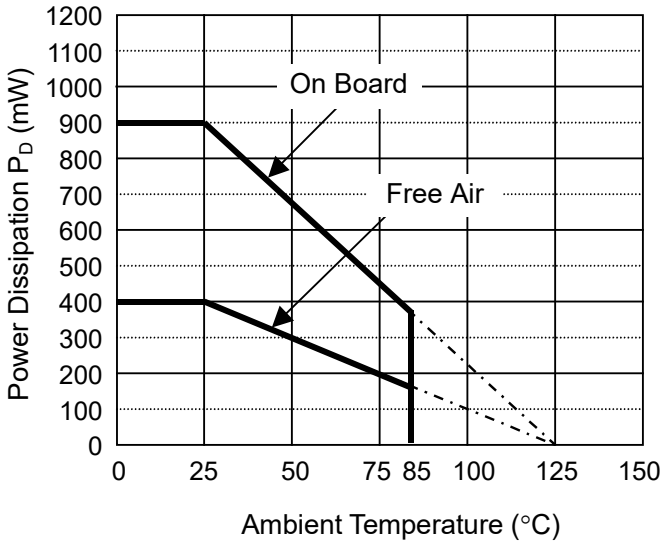
This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

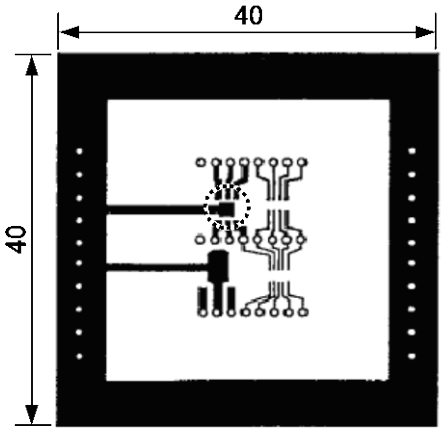
	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)
Board Dimensions	40mm x 40mm x 1.6mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%
Through-hole	ϕ 0.5mm x 44pcs

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

	Standard Land Pattern	**Free Air**
Power Dissipation	900mW	400mW
Thermal Resistance	θja = (125-25 °C) / 0.9W= 111°C/W	250°C/W



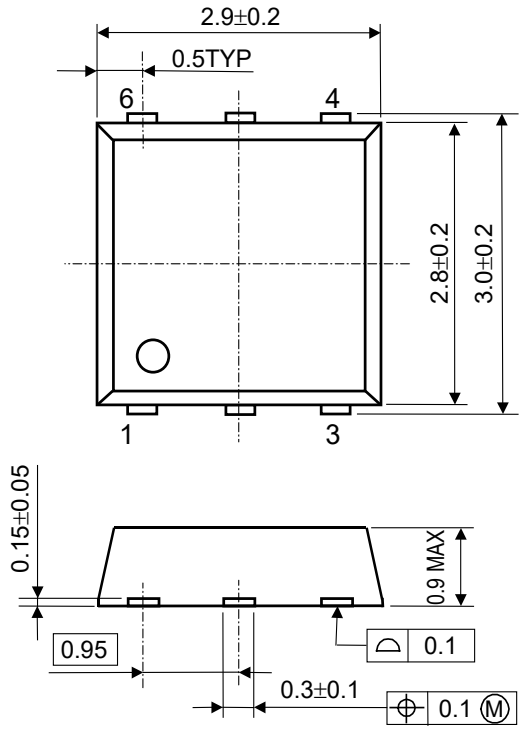
Power Dissipation

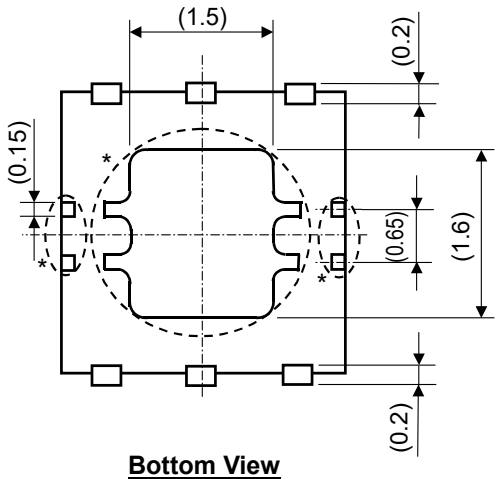


Measurement Board Pattern

IC Mount Area Unit : mm

Package Dimensions (HSON-6)





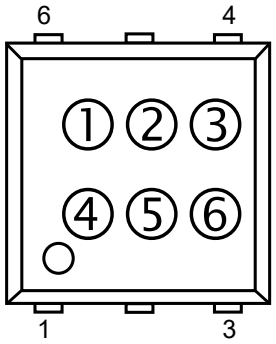
Bottom View

* Attention: Tabs or Tab suspension leads in the parts have V_{DD} or GND level. (They are connected to the reverse side of this IC.)
Refer to PIN DISCRIPTION.
Do not connect to other wires or land patterns.

Unit: mm

Mark Specification (HSON-6)

①②③④ : Product Code . Refer to the marking list table
⑤⑥ : Lot No. ..... Alphanumeric serial number.



R1173D Series Marking List Table

PKG : HSON-6

R1173Dxx1B

Part Number	①②③④
R1173D081B	**H08B**
R1173D091B	**H09B**
R1173D101B	**H10B**
R1173D111B	**H11B**
R1173D121B	**H12B**
R1173D131B	**H13B**
R1173D141B	**H14B**
R1173D151B	**H15B**
R1173D161B	**H16B**
R1173D171B	**H17B**
R1173D181B	**H18B**
R1173D191B	**H19B**
R1173D201B	**H20B**
R1173D211B	**H21B**
R1173D221B	**H22B**
R1173D231B	**H23B**
R1173D241B	**H24B**
R1173D251B	**H25B**
R1173D261B	**H26B**
R1173D271B	**H27B**
R1173D281B	**H28B**
R1173D291B	**H29B**
R1173D301B	**H30B**
R1173D311B	**H31B**
R1173D321B	**H32B**
R1173D331B	**H33B**
R1173D341B	**H34B**
R1173D351B	**H35B**
R1173D361B	**H36B**
R1173D371B	**H37B**
R1173D381B	**H38B**
R1173D391B	**H39B**
R1173D401B	**H40B**
R1173D411B	**H41B**
R1173D421B	**H42B**
R1173D431B	**H43B**
R1173D441B	**H44B**
R1173D451B	**H45B**
R1173D461B	**H46B**
R1173D471B	**H47B**
R1173D481B	**H48B**
R1173D491B	**H49B**
R1173D501B	**H50B**
R1173D181B5	**H01B**
R1173D281B5	**H02B**
R1173D121B5	**H03B**
R1173D001B	**H00B**

R1173Dxx1D

Part Number	①②③④
R1173D081D	**H08D**
R1173D091D	**H09D**
R1173D101D	**H10D**
R1173D111D	**H11D**
R1173D121D	**H12D**
R1173D131D	**H13D**
R1173D141D	**H14D**
R1173D151D	**H15D**
R1173D161D	**H16D**
R1173D171D	**H17D**
R1173D181D	**H18D**
R1173D191D	**H19D**
R1173D201D	**H20D**
R1173D211D	**H21D**
R1173D221D	**H22D**
R1173D231D	**H23D**
R1173D241D	**H24D**
R1173D251D	**H25D**
R1173D261D	**H26D**
R1173D271D	**H27D**
R1173D281D	**H28D**
R1173D291D	**H29D**
R1173D301D	**H30D**
R1173D311D	**H31D**
R1173D321D	**H32D**
R1173D331D	**H33D**
R1173D341D	**H34D**
R1173D351D	**H35D**
R1173D361D	**H36D**
R1173D371D	**H37D**
R1173D381D	**H38D**
R1173D391D	**H39D**
R1173D401D	**H40D**
R1173D411D	**H41D**
R1173D421D	**H42D**
R1173D431D	**H43D**
R1173D441D	**H44D**
R1173D451D	**H45D**
R1173D461D	**H46D**
R1173D471D	**H47D**
R1173D481D	**H48D**
R1173D491D	**H49D**
R1173D501D	**H50D**
R1173D181D5	**H01D**
R1173D281D5	**H02D**
R1173D121D5	**H03D**
R1173D001D	**H00D**

Power Dissipation (HSOP-6J)

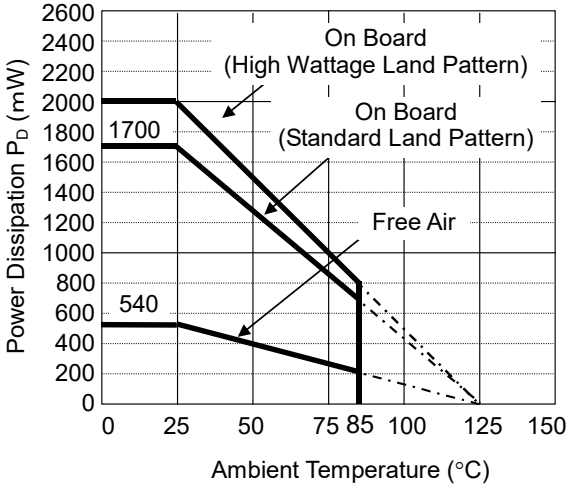
This specification is at mounted on board. Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

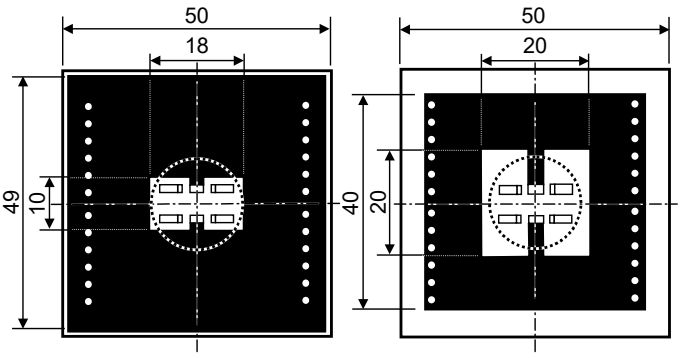
	High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (Double sided)	Glass cloth epoxy plastic (Double sided)
Board Dimensions	50mm x 50mm x 1.6mm	50mm x 50mm x 1.6mm
Copper Ratio	90%	50%
Through-hole	ϕ0.5mm x 24pcs	ϕ0.5mm x 24pcs

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

	High Wattage Land Pattern	Standard Land Pattern	Free Air
Power Dissipation	2000mW	1700mW	540mW
Thermal Resistance	50°C/W	59°C/W	185°C/W



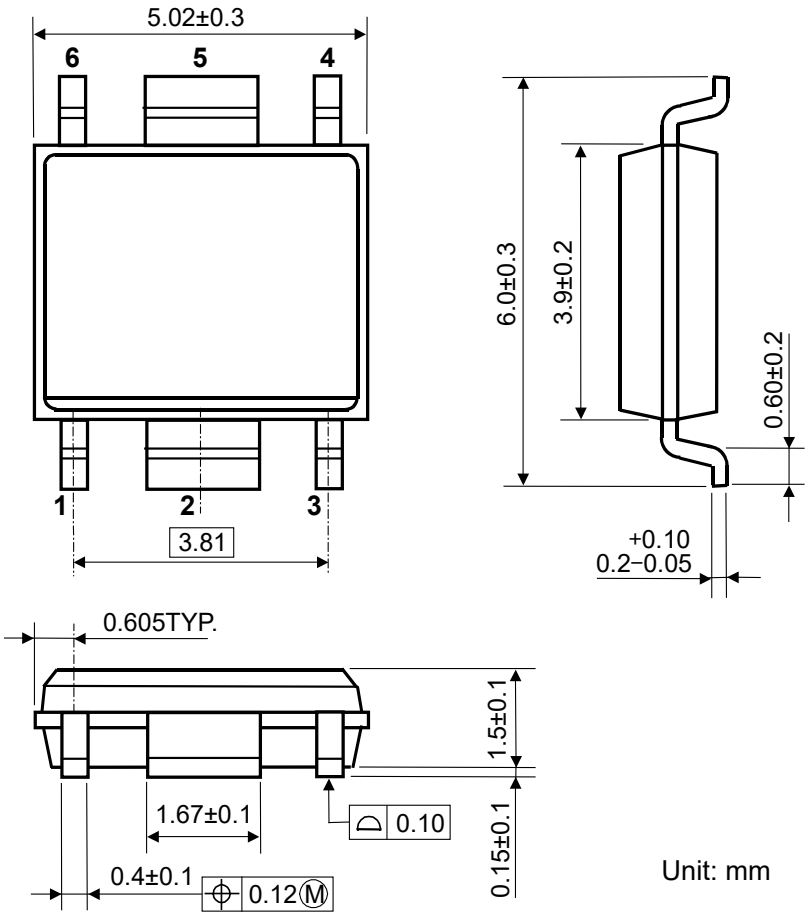
Power Dissipation



Measurement Board Pattern

IC Mount Area Unit : mm

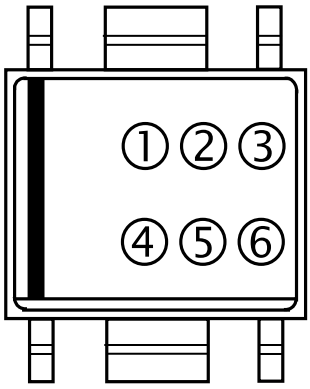
Package Dimensions (HSOP-6J)



Unit: mm

Mark Specification (HSOP-6J)

①②③④ : Product Code.....Refer to the marking list table.
⑤⑥ : Lot No. .....Alphanumeric serial number.



R1173S Series Marking List Table

PKG : HSOP-6J

R1173Sxx1B

Part Number	①②③④
R1173S081B	C08B
R1173S091B	C09B
R1173S101B	C10B
R1173S111B	C11B
R1173S121B	C12B
R1173S131B	C13B
R1173S141B	C14B
R1173S151B	C15B
R1173S161B	C16B
R1173S171B	C17B
R1173S181B	C18B
R1173S191B	C19B
R1173S201B	C20B
R1173S211B	C21B
R1173S221B	C22B
R1173S231B	C23B
R1173S241B	C24B
R1173S251B	C25B
R1173S261B	C26B
R1173S271B	C27B
R1173S281B	C28B
R1173S291B	C29B
R1173S301B	C30B
R1173S311B	C31B
R1173S321B	C32B
R1173S331B	C33B
R1173S341B	C34B
R1173S351B	C35B
R1173S361B	C36B
R1173S371B	C37B
R1173S381B	C38B
R1173S391B	C39B
R1173S401B	C40B
R1173S411B	C41B
R1173S421B	C42B
R1173S431B	C43B
R1173S441B	C44B
R1173S451B	C45B
R1173S461B	C46B
R1173S471B	C47B
R1173S481B	C48B
R1173S491B	C49B
R1173S501B	C50B
R1173S181B5	C01B
R1173S281B5	C02B
R1173S121B5	C03B
R1173S001B	C00B

R1173Sxx1D

Part Number	①②③④
R1173S081D	C08D
R1173S091D	C09D
R1173S101D	C10D
R1173S111D	C11D
R1173S121D	C12D
R1173S131D	C13D
R1173S141D	C14D
R1173S151D	C15D
R1173S161D	C16D
R1173S171D	C17D
R1173S181D	C18D
R1173S191D	C19D
R1173S201D	C20D
R1173S211D	C21D
R1173S221D	C22D
R1173S231D	C23D
R1173S241D	C24D
R1173S251D	C25D
R1173S261D	C26D
R1173S271D	C27D
R1173S281D	C28D
R1173S291D	C29D
R1173S301D	C30D
R1173S311D	C31D
R1173S321D	C32D
R1173S331D	C33D
R1173S341D	C34D
R1173S351D	C35D
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R1173S371D	C37D
R1173S381D	C38D
R1173S391D	C39D
R1173S401D	C40D
R1173S411D	C41D
R1173S421D	C42D
R1173S431D	C43D
R1173S441D	C44D
R1173S451D	C45D
R1173S461D	C46D
R1173S471D	C47D
R1173S481D	C48D
R1173S491D	C49D
R1173S501D	C50D
R1173S181D5	C01D
R1173S281D5	C02D
R1173S121D5	C03D
R1173S001D	C00D

1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without the prior written consent of us.
3. This product and any technical information relating thereto are subject to complementary export controls (so-called KNOW controls) under the Foreign Exchange and Foreign Trade Law, and related politics ministerial ordinance of the law. (Note that the complementary export controls are inapplicable to any application-specific products, except rockets and pilotless aircraft, that are insusceptible to design or program changes.) Accordingly, when exporting or carrying abroad this product, follow the Foreign Exchange and Foreign Trade Control Law and its related regulations with respect to the complementary export controls.
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5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
    - Aerospace Equipment
    - Equipment Used in the Deep Sea
    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
    - Fire Alarms / Intruder Detectors
    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

    In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
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.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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https://www.nisshinbo-microdevices.co.jp/en/

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