# 1A LDO REGULATOR (Operating Voltage up to 24V)

NO.EA-184-160425

## OUTLINE

The R1501x series are CMOS-based positive voltage regulator (VR) ICs. The R1501xxxxB has features of high input voltage operating, 1A output current drive, and low supply current.

A DMOS transistor is used for the driver, high voltage operating and low on resistance (0.6Ω at $V_{OUT}$=10V) device is realized. A standard regulator circuit with a current limit circuit and a thermal shutdown circuit are built in the R1501x series.

As the operating temperature range is from -40°C to 105°C and maximum input voltage is up to 24V, the R1501x series are suitable for the constant voltage source for digital home appliances and car accessories.

The regulator output voltage is fixed in the R1501x. Output voltage accuracy is ±2.0% and output voltage range is from 3.0V to 12.0V with a step of 0.1V, and from 12.5V to 18.0V with a step of 0.5V. The chip enable pin realizes ultra low supply current standby mode.

Since the packages for these ICs are the HSOP-6J for high density mounting of the ICs on boards, and the TO-252-5-P2.

∗) The DMOS (Double Diffused MOS) transistor adopted by R1501x is characterized by a double diffusion structure which comprises a low density n-type (channel) diffused layer and a high density p-type (sources) diffused layer from the edge of the gate electrode. The R1501x series possess outstanding properties of high operating voltage and low on-resistance, which have been achieved by the channel length scaled down to submicron dimensions and decreased thickness of the gate oxide film.

## FEATURES

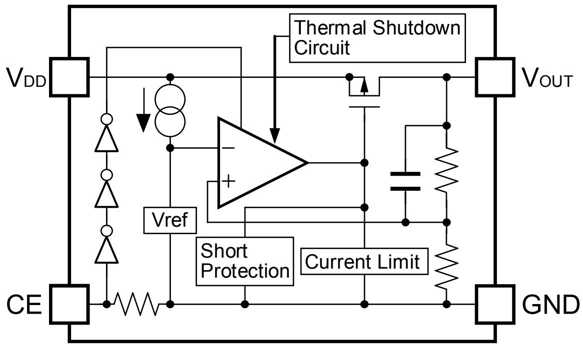
- Supply Current ............................................................Typ. 70μA
- Standby Current .........................................................Typ. 0.1μA
- Output Current.............................................................Min. 1A
- Input Voltage Range ...................................................3.0V to 24.0V
- Ripple Rejection .........................................................Typ. 60dB ($V_{SET}$=5.0V)
- Output Voltage Range..................................................3.0V to 12.0V (0.1V steps)
  12.5V to 18.0V (0.5V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Output Voltage Accuracy..............................................±2%
- Temperature-Drift Coefficient of Output Voltage ..........Typ. ±100ppm/°C
- Line Regulation ...........................................................Typ. 0.05%/V
- Packages.....................................................................HSOP-6J, TO-252-5-P2
- Operating Temperature range ......................................–40°C to 105°C
- Built-in Current Limit Circuit
- Built-in Fold-Back Circuit
- Built-in Thermal Shutdown Circuit

## APPLICATIONS

- Power source for home appliances such as refrigerators, rice cookers, electric water warmers, etc.
- Power source for car audio equipment, car navigation system, ETC system, etc.
- Power source for notebook PCs, digital TVs, cordless phones, and private LAN system, etc.
- Power source for office equipment machines such as copiers, printers, facsimiles, scanners, projectors, etc.

# BLOCK DIAGRAMS

**R1501xxxxB**




# SELECTION GUIDE

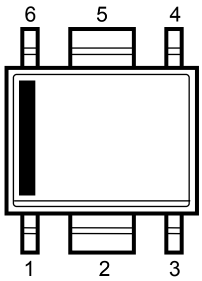
The output voltage, package, etc. for the ICs can be selected at the user's request.

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|---|---|---|---|---|
| R1501SxxxB-E2-FE | HSOP-6J | 1,000 pcs | Yes | Yes |
| R1501JxxxB-T1-FE | TO-252-5-P2 | 3,000 pcs | Yes | Yes |

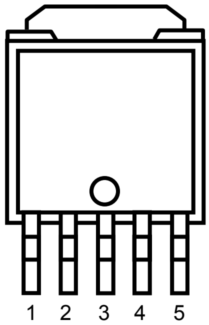
xxx : The output voltage can be designated in the range from 3.0V(030) to 12.0V(120) in 0.1V steps and 12.5V(125) to 18.0V(180) in 0.5V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

# PIN CONFIGURATIONS

● HSOP-6J




● TO-252-5-P2




# PIN DESCRIPTIONS

● **HSOP-6J**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | GND* | Ground Pin |
| 3 | GND* | Ground Pin |
| 4 | CE | Chip Enable Pin ("H" Active) |
| 5 | GND* | Ground Pin |
| 6 | $V_{OUT}$ | Output Pin |

∗) No.2, No.3 and No.5 pins must be wired short each other and connected to the GND plane when it is mounted on board.

● **TO-252-5-P2**

| Pin No | Symbol | Pin Description |
|---|---|---|
| 1 | $V_{DD}$ | Input Pin |
| 2 | GND* | Ground Pin |
| 3 | GND* | Ground Pin |
| 4 | CE | Chip Enable Pin ("H" Active) |
| 5 | $V_{OUT}$ | Output Pin |

∗) No.2 and No.3 pins must be wired short each other and connected to the GND plane when it is mounted on board.

# ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | −0.3 to 36 | V |
| $V_{CE}$ | Input Voltage (CE Pin) | −0.3 to $V_{IN}$ + 0.3 ≦ 36 | V |
| $V_{OUT}$ | Output Voltage | −0.3 to $V_{IN}$ + 0.3 ≦ 36 | V |
| $P_D$ | Power Dissipation (HSOP-6J)* | 1700 | mW |
| | Power Dissipation (TO-252-5-P2)* | 1900 | |
| $T_{opt}$ | Operating Temperature Range | −40 to 105 | °C |
| Tj | Operating Junction Temperature Range | −40 to 125 | °C |
| $T_{stg}$ | Storage Temperature Range | −55 to 125 | °C |

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

**ABSOLUTE MAXIMUM RATINGS**

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

**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

- **R1501xxxxB**

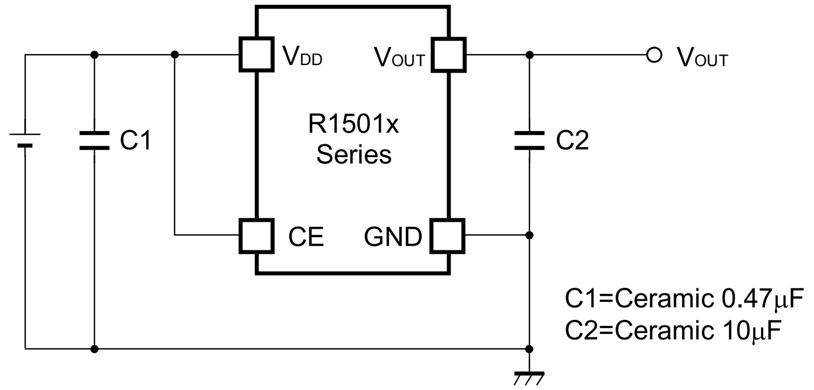
$V_{IN}=V_{SET}+1.0V$, $V_{CE}=V_{IN}$, unless otherwise noted.
The specification in ☐ is checked and guaranteed by design engineering at −40°C ≦ Topt ≦ 105°C.

Topt=25°C

| Symbol | Item | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | | | 3 | | 24 | V |
| $V_{OUT}$ | Output Voltage | $I_{OUT}$=1mA | Topt=25°C | ×0.98 | | ×1.02 | V |
| | | | −40°C ≦ Topt ≦ 105°C | ×0.965 | | ×1.035 | V |
| $I_{SS}$ | Supply Current | $V_{IN}$=24V, $I_{OUT}$=0A | | | 70 | 160 | μA |
| $I_{standby}$ | Standby Current | $V_{IN}$=24V, $V_{CE}$=0V | | | 0.1 | 1.0 | μA |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | 0.1mA ≦ $I_{OUT}$ ≦ 200mA | | | 25 | 60 | mV |
| | | 0.1mA ≦ $I_{OUT}$ ≦ 1A | *guaranteed by design engineering | | 125 | 300 | mV |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | $V_{SET}$+1V ≦ $V_{IN}$ ≦ 24V, $I_{OUT}$=10mA | | | 0.05 | 0.1 | %/V |
| $V_{DIF}$ | Dropout Voltage | $I_{OUT}$=200mA | 3.0V ≦ $V_{SET}$ < 5.0V | | 0.135 | 0.225 | V |
| | | | 5.0V ≦ $V_{SET}$ < 9.0V | | 0.115 | 0.180 | |
| | | | 9.0V ≦ $V_{SET}$ < 12.0V | | 0.095 | 0.155 | |
| | | | 12.0V ≦ $V_{SET}$ ≦ 18.0V | | 0.090 | 0.140 | |
| | | $I_{OUT}$=1A *guaranteed by design engineering | 3.0V ≦ $V_{SET}$ < 5.0V | | 0.675 | 1.125 | V |
| | | | 5.0V ≦ $V_{SET}$ < 9.0V | | 0.575 | 0.900 | |
| | | | 9.0V ≦ $V_{SET}$ < 12.0V | | 0.475 | 0.775 | |
| | | | 12.0V ≦ $V_{SET}$ ≦ 18.0V | | 0.450 | 0.700 | |
| $\Delta V_{OUT}/\Delta Topt$ | Output Voltage Temperature Coefficient | $I_{OUT}$=1mA<br>−40°C ≦ Topt ≦ 105°C | | | ±100 | | ppm/°C |
| $I_{LIM}$ | Output Current | | | 1 | | | A |
| $I_{SC}$ | Short Current Limit | $V_{OUT}$=0V | | | 65 | | mA |
| RR | Ripple Rejection | f=1kHz, Ripple 0.5Vp-p, $I_{OUT}$=100mA, $V_{IN}=V_{SET}$+2V | $V_{SET}$ ≦ 6.0V | | 60 | | dB |
| | | | $V_{SET}$ > 6.0V | | 50 | | |
| $V_{CEH}$ | CE Input Voltage "H" | | | 2.0 | | $V_{IN}$ | V |
| $V_{CEL}$ | CE Input Voltage "L" | | | 0 | | 0.5 | V |
| $T_{TSD}$ | Thermal Shutdown Temperature | Junction Temperature | | | 160 | | °C |
| $T_{TSR}$ | Thermal Shutdown Released Temperature | Junction Temperature | | | 135 | | °C |

All of unit are tested and specified under load conditions such that Topt=25°C except for Output Voltage Temperature Coefficient, Ripple Rejection, Thermal Shutdown Temperature, Thermal Shutdown Released Temperature, Load Regulation at 0.1mA ≦ $I_{OUT}$ ≦ 1A, Dropout Voltage at $I_{OUT}$=1A.

# TYPICAL APPLICATION




(External Components)
C2: Ceramic 10µF MURATA: GRM32DB31E106K (size: 3225)

# TECHNICAL NOTES

When using these ICs, consider the following points:

**Phase Compensation**

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).

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.

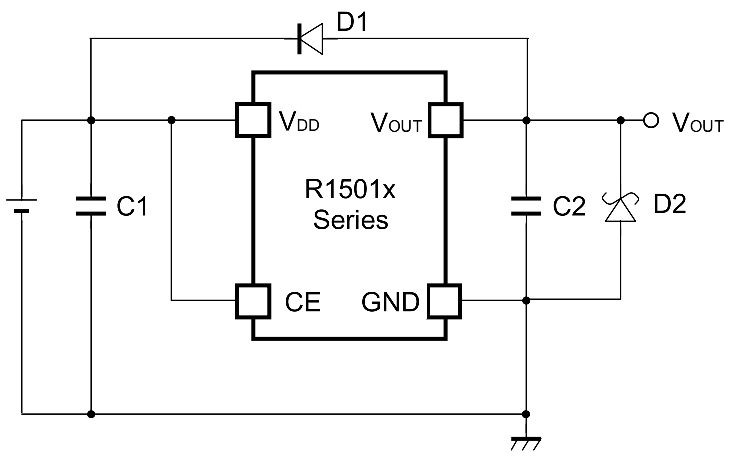
**PCB Layout**

Make $V_{DD}$ and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.47µF or more between $V_{DD}$ and GND pin, and as close as possible to the pins.

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

No.2 pin, No.3 pin and No.5 pin of HSOP-6J package must be wired to the GND plane when it is mounted on board. No.2 pin and No.3 pin of TO-252-5-P2 package must be wired to the GND plane when it is mounted on board.

# TYPICAL APPLICATION FOR PREVENTING IC DESTRUCTION

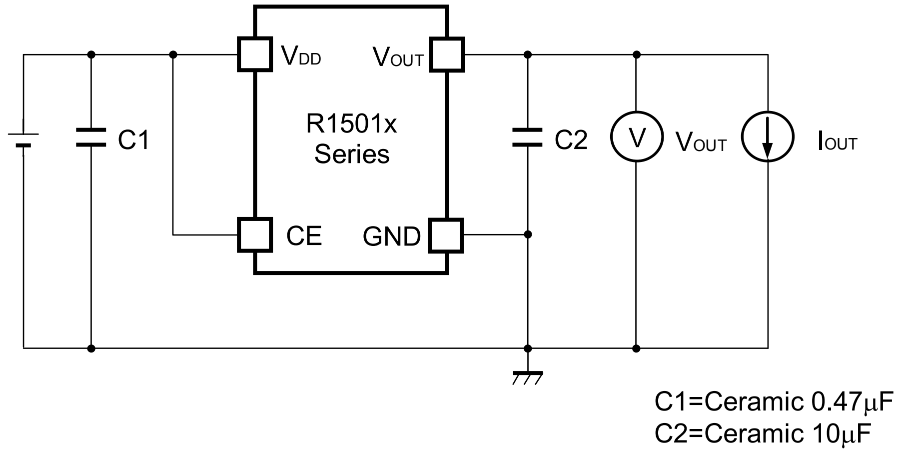



C1: 0.47μF or more (preventing for unstable operation)
C2: 10μF or more (preventing for unstable operation)

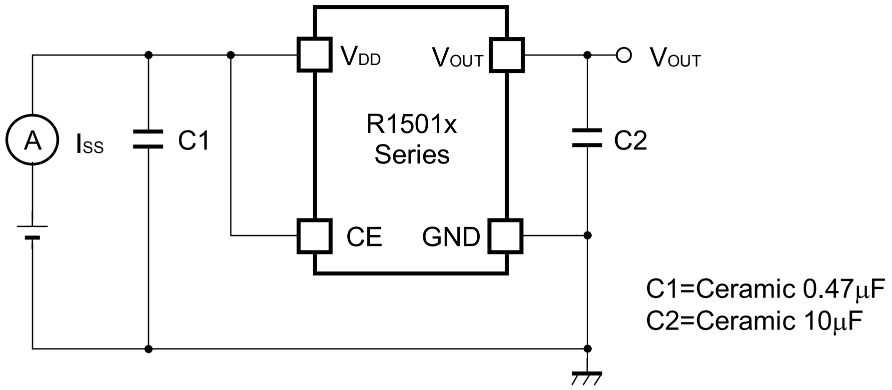
D1: If $V_{OUT}$ pin could be higher than $V_{IN}$ pin, D1 is necessary.
D2: If $V_{OUT}$ pin could be lower than GND pin, SBD is necessary.

Note: Do not force the voltage to $V_{OUT}$ pin.

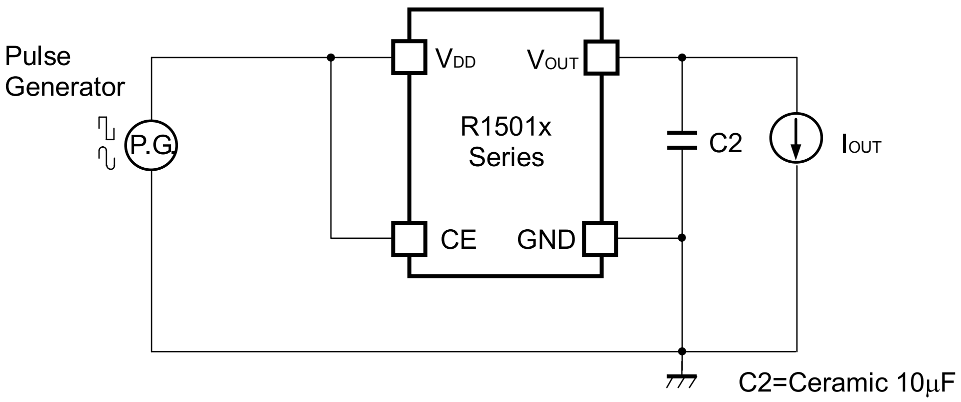
# TEST CIRCUITS



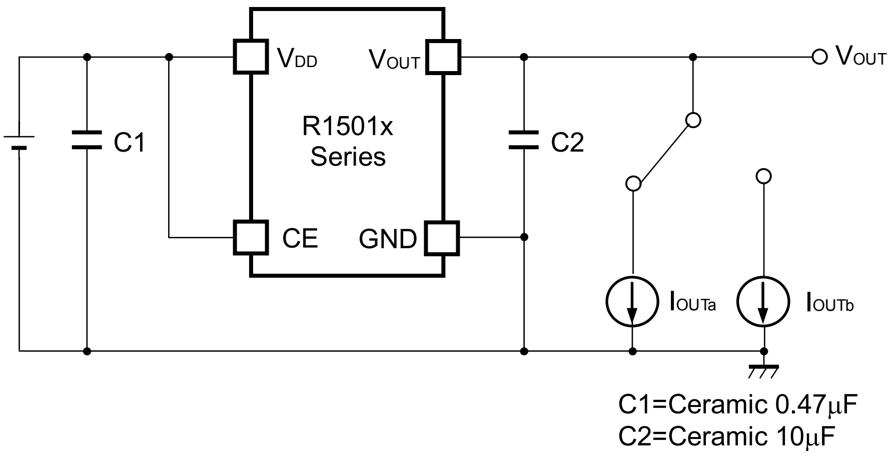

**Basic Test Circuit**



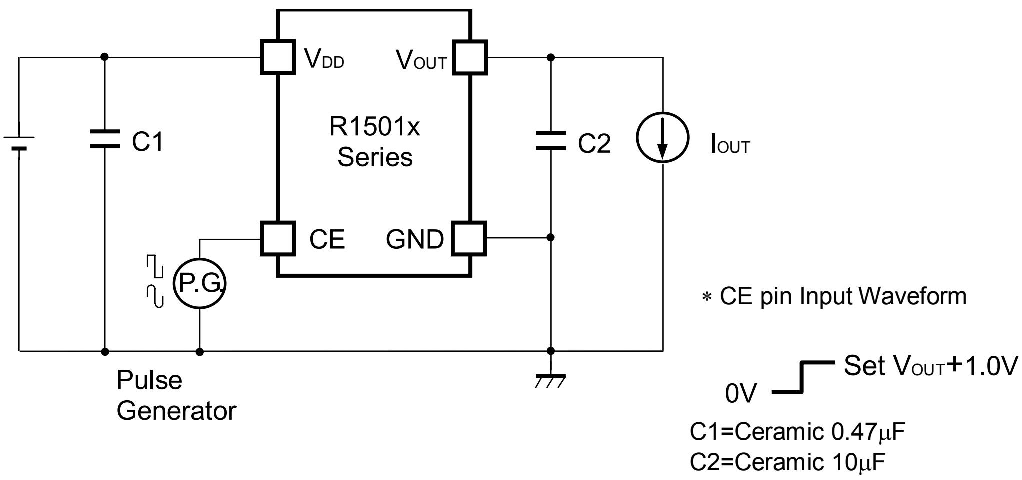

**Test Circuit for Supply Current**




**Test Circuit for Ripple Rejection, Input Transient Response**




**Test Circuit for Load Transient Response**



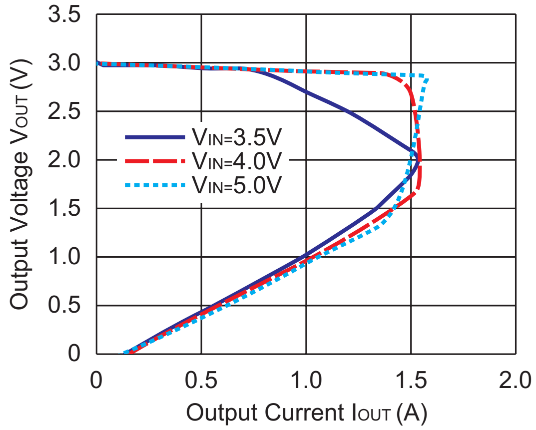

**Test Circuit for Turn On Speed with CE pin**

# TYPICAL CHARACTERISTICS

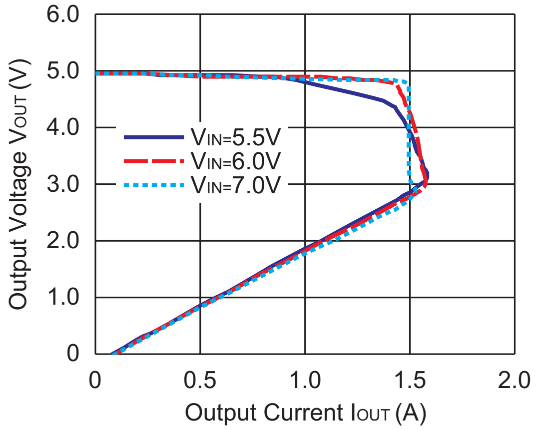
∗Topt=25°C, unless otherwise noted.

## 1) Output Voltage vs. Output Current (C1=Ceramic 0.47µF, C2=Ceramic 10µF)

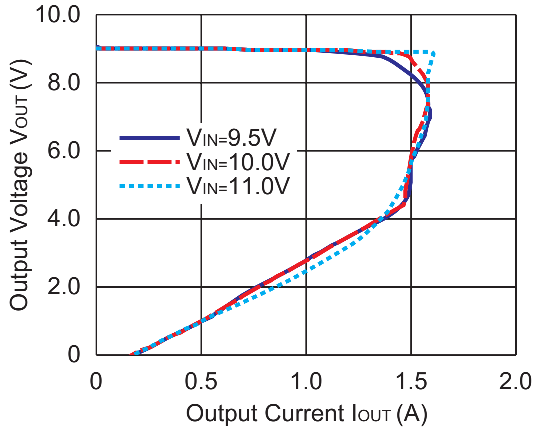
R1501x030B



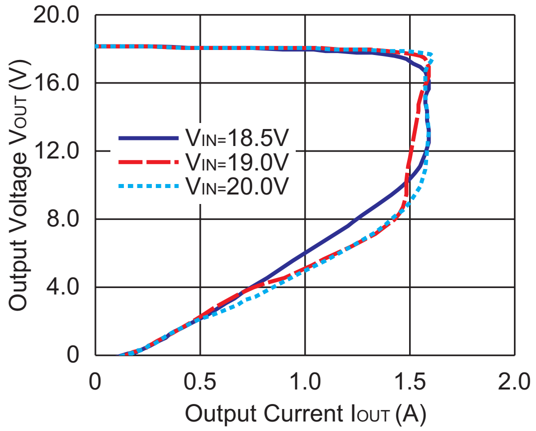

R1501x050B




R1501x090B

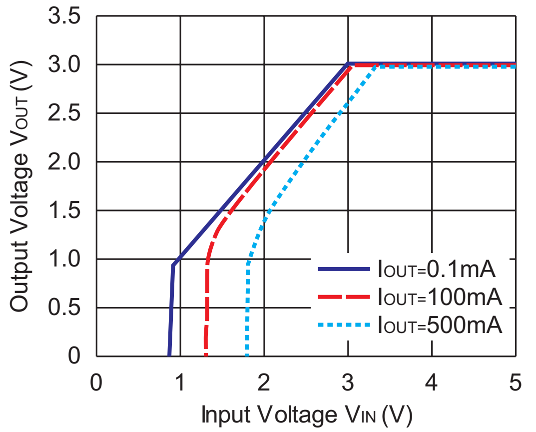



R1501x180B

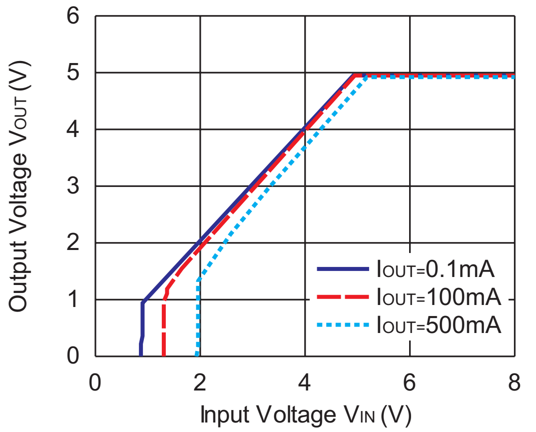



## 2) Output Voltage vs. Input Voltage (C1=Ceramic 0.47µF, C2=Ceramic 10µF)

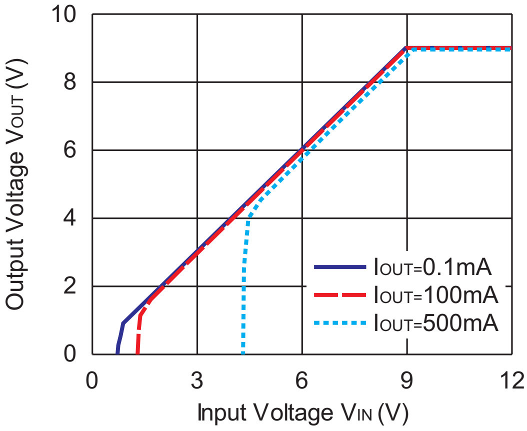
R1501x030B




R1501x050B



**R1501x090B**

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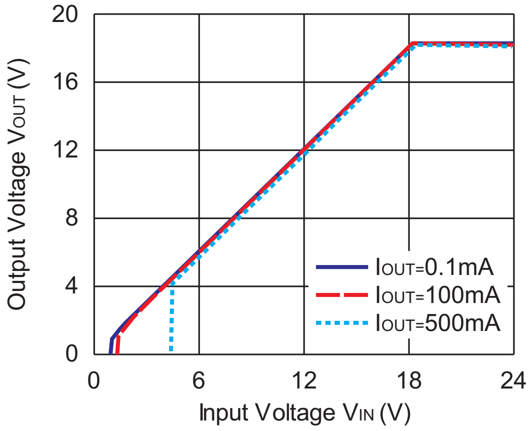
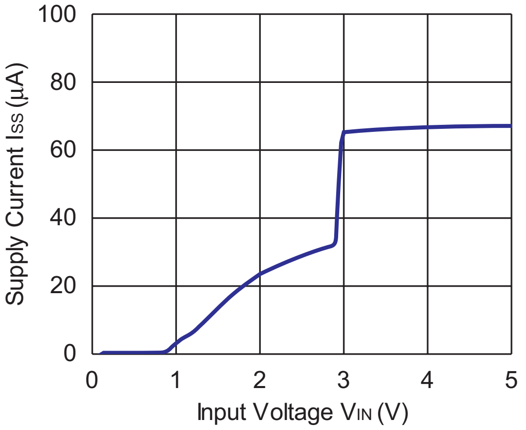



### 3) Supply Current vs. Input Voltage (C1=Ceramic 0.47µF, C2=Ceramic 10µF)

**R1501x030B**

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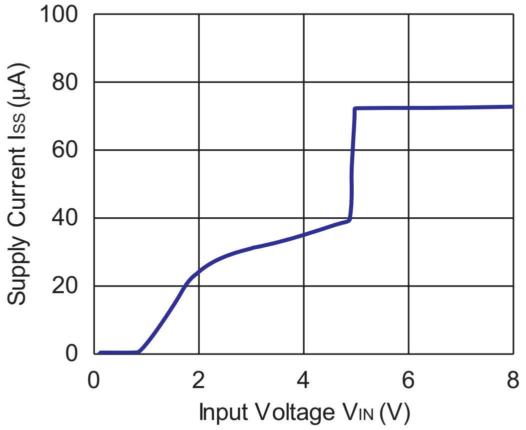


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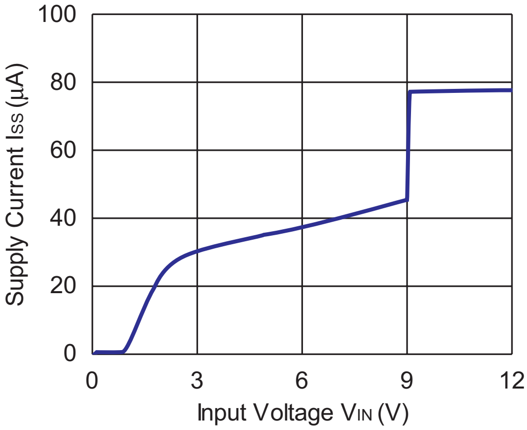


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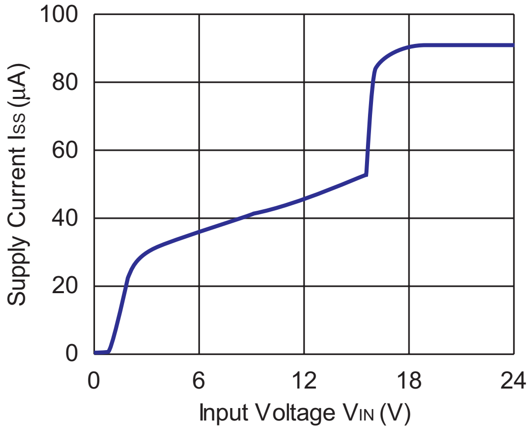
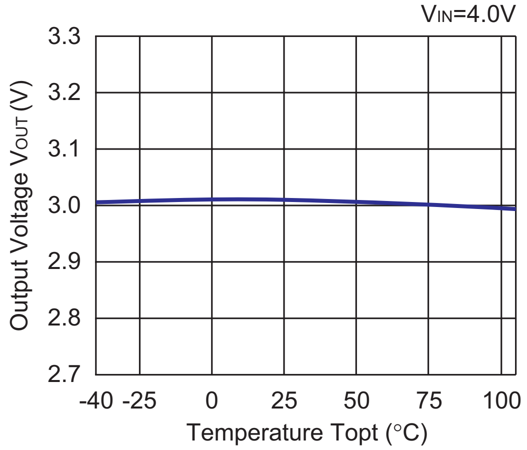
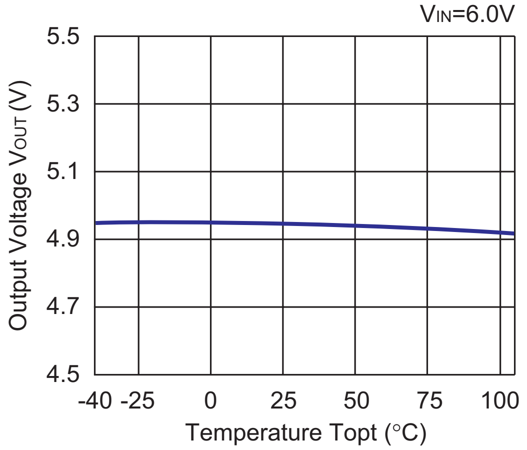


### 4) Output Voltage vs. Temperature (C1=Ceramic 0.47μF, C2=Ceramic 10μF, $I_{OUT}$=1mA)

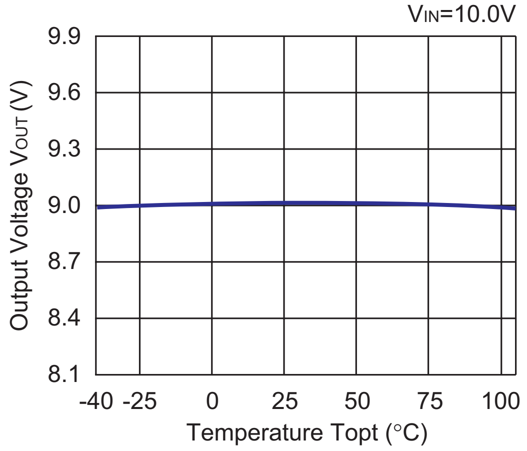
**R1501x030B**



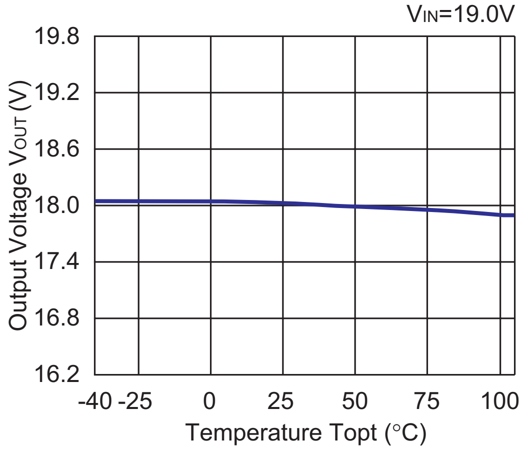

**R1501x050B**




**R1501x090B**

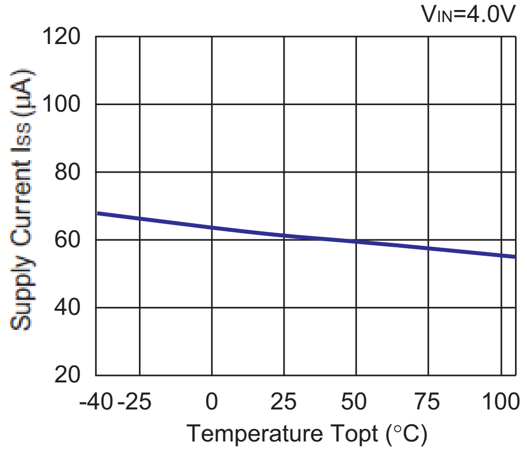



**R1501x180B**




### 5) Supply Current vs. Temperature (C1=Ceramic 0.47μF, C2=Ceramic 10μF, $I_{OUT}$=0mA)

**R1501x030B**

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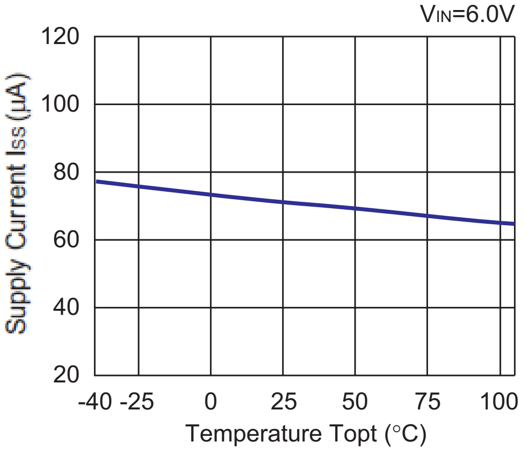

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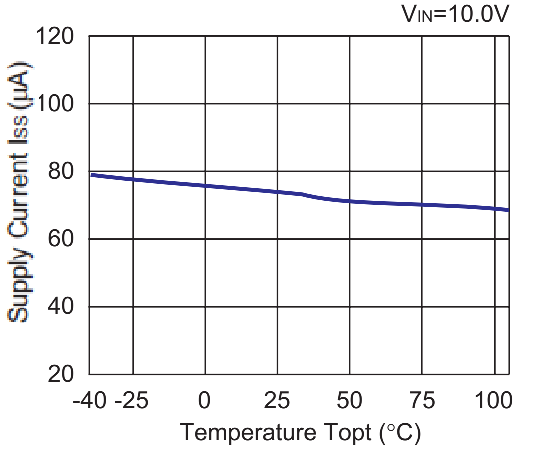
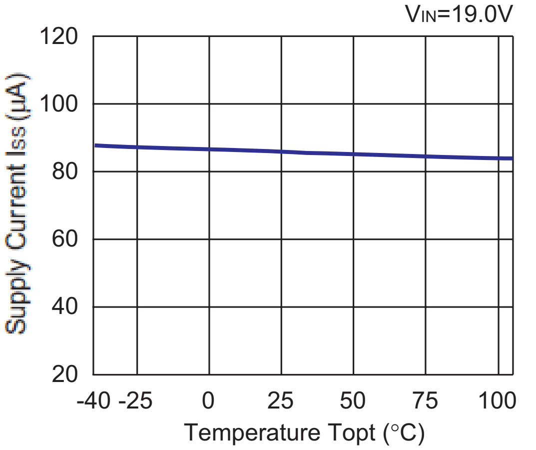
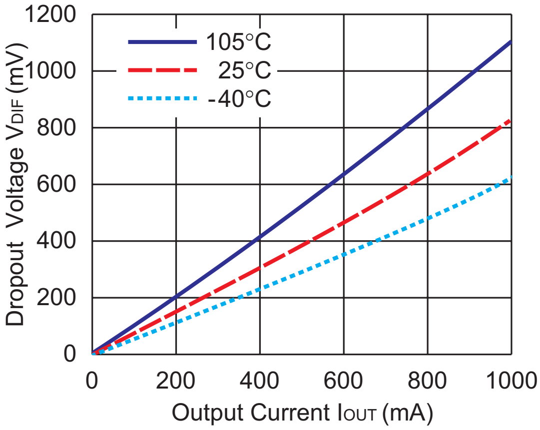



**R1501x180B**




### 6) Dropout Voltage vs. Output Current (C1=Ceramic 0.47µF, C2=Ceramic 10µF)

**R1501x030B**

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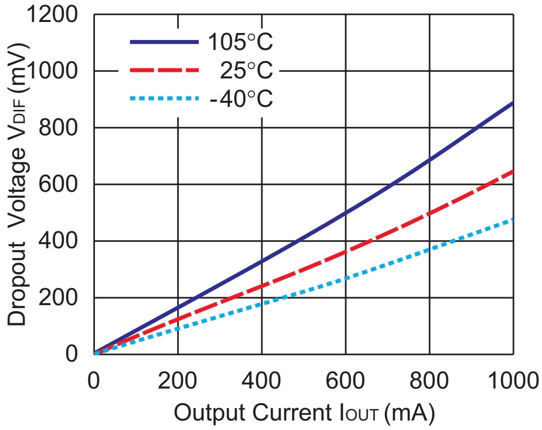
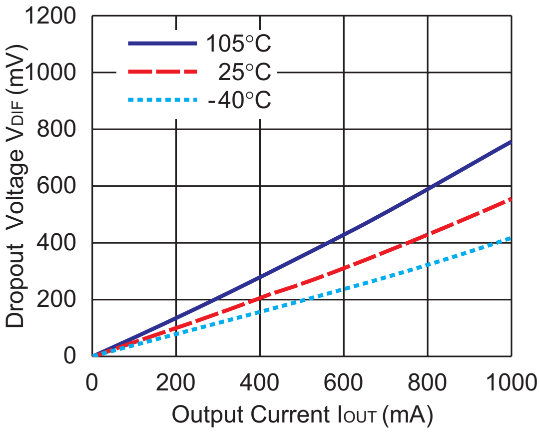
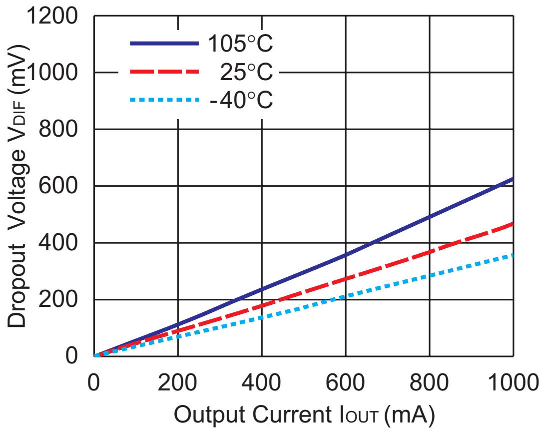


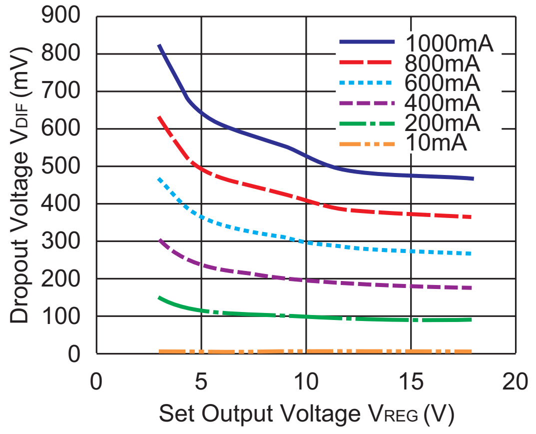

**R1501x090B**



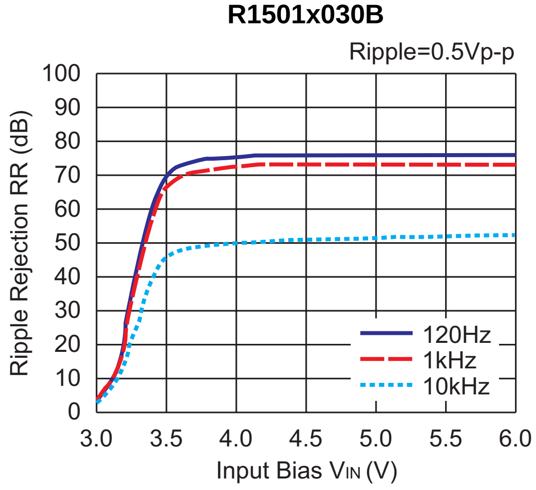

**R1501x180B**

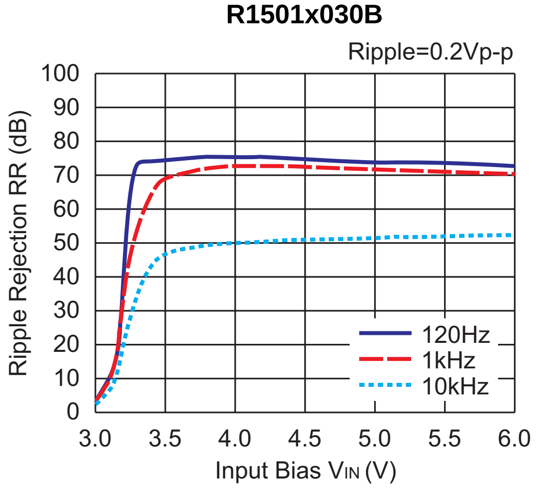


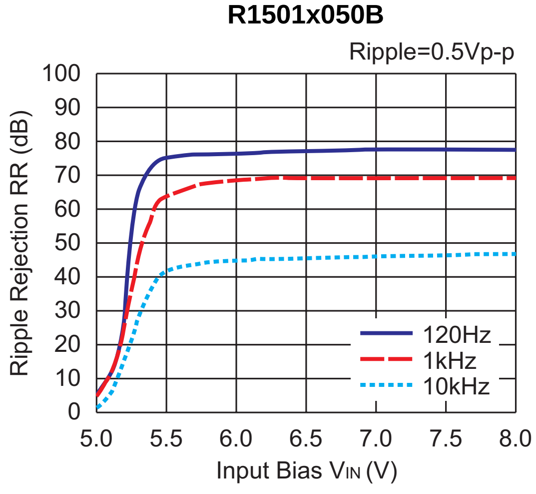
### 7) Dropout Voltage vs. Set Output Voltage (C1=Ceramic 0.47μF, C2=Ceramic 10μF)

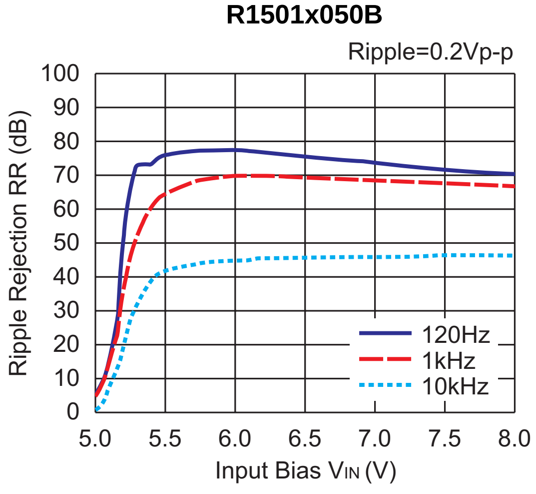



### 8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=Ceramic 10μF, $I_{OUT}$=100mA)

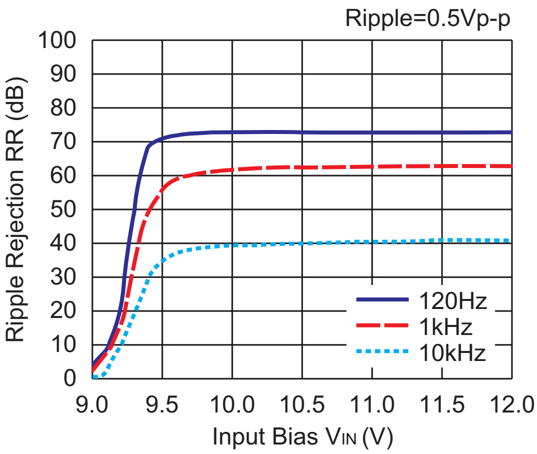


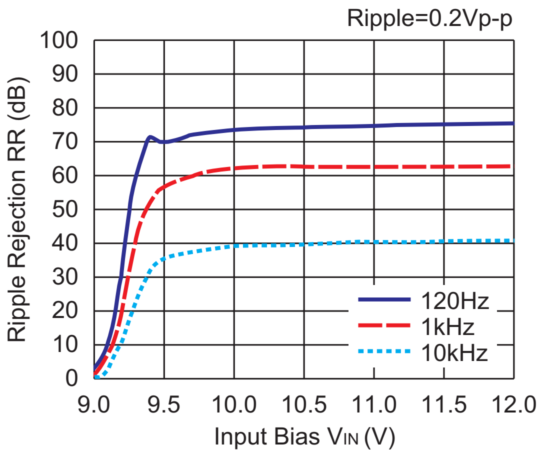



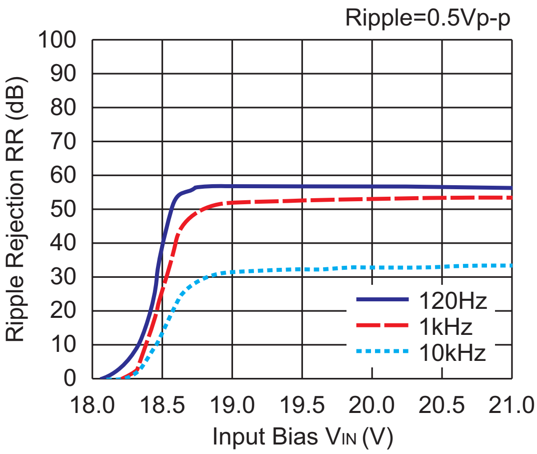
**R1501x090B**



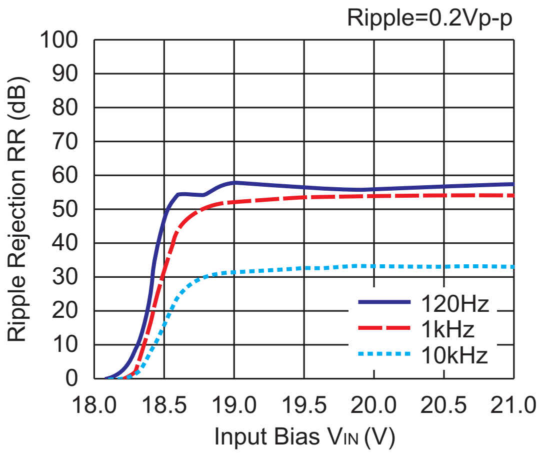

**R1501x090B**




**R1501x180B**

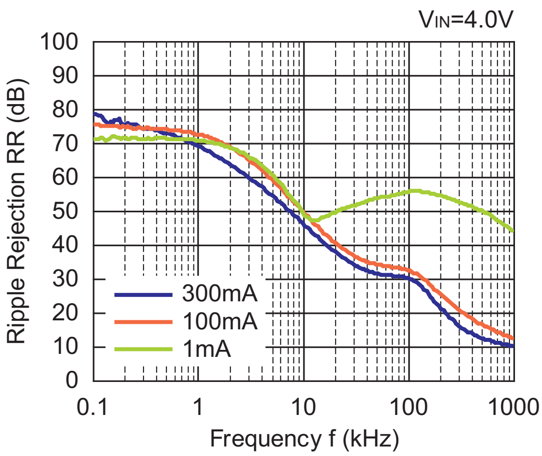



**R1501x180B**

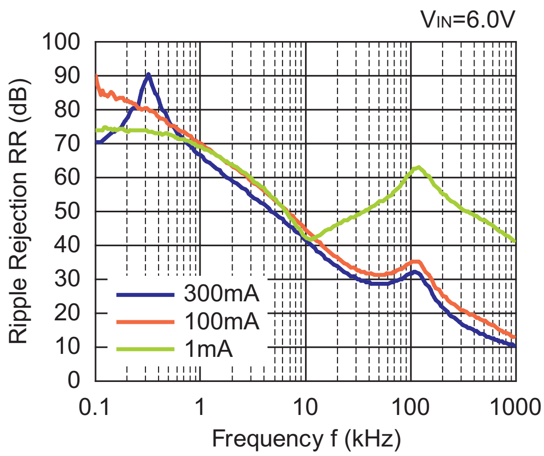



### 9) Ripple Rejection vs. Frequency (C1=none, C2=Ceramic 10μF, Ripple=0.5$V_{p-p}$)

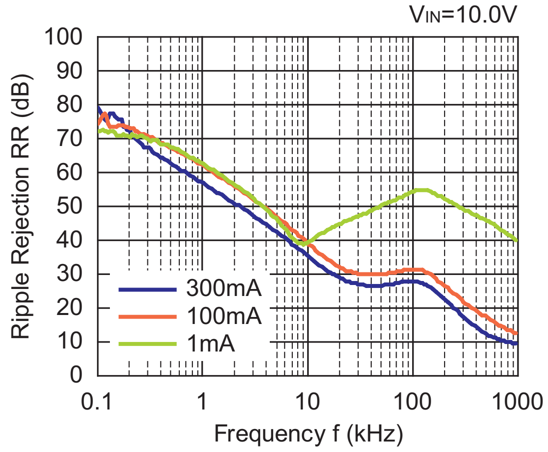
**R1501x030B**



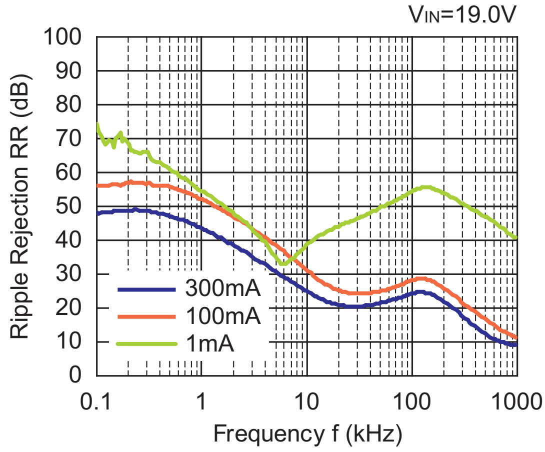

**R1501x050B**



R1501x090B

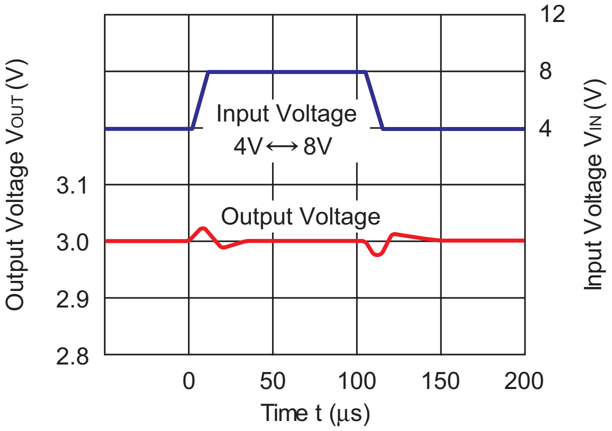



R1501x180B

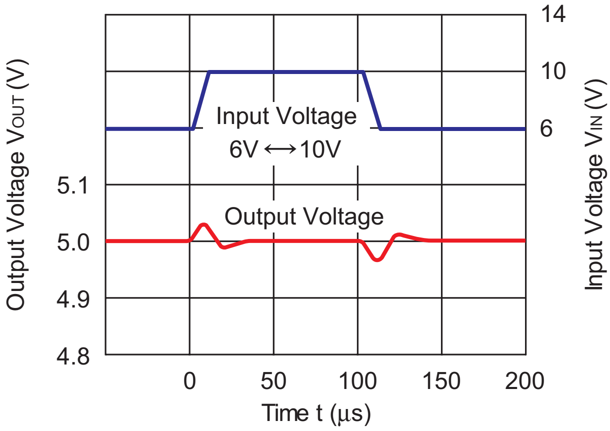



**10) Input Transient Response (C1=none, C2=Ceramic 10µF, $I_{OUT}$=100mA, tr=tf=10µs)**

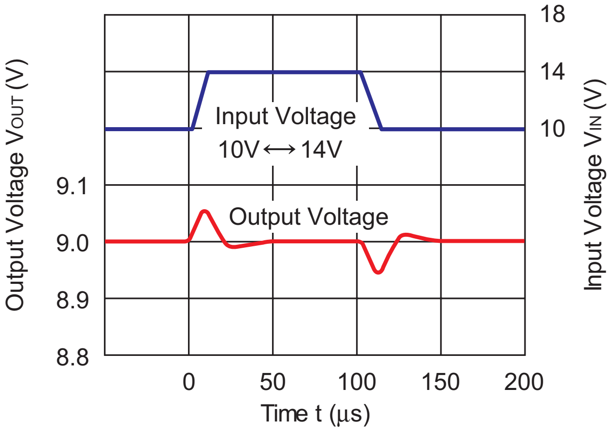
R1501x030B



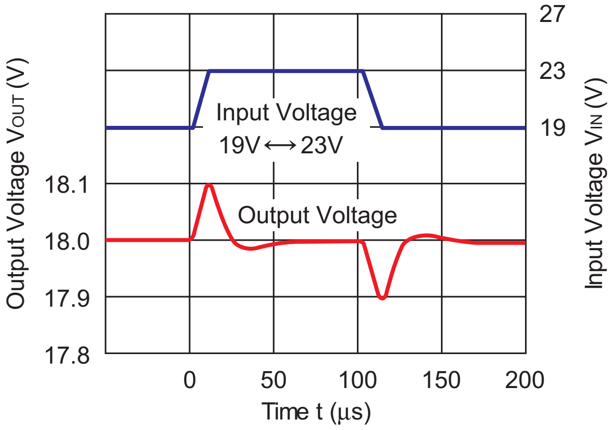

R1501x050B




R1501x090B

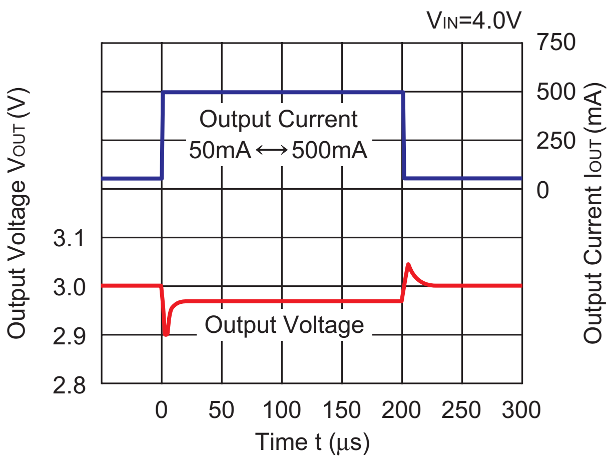



R1501x180B

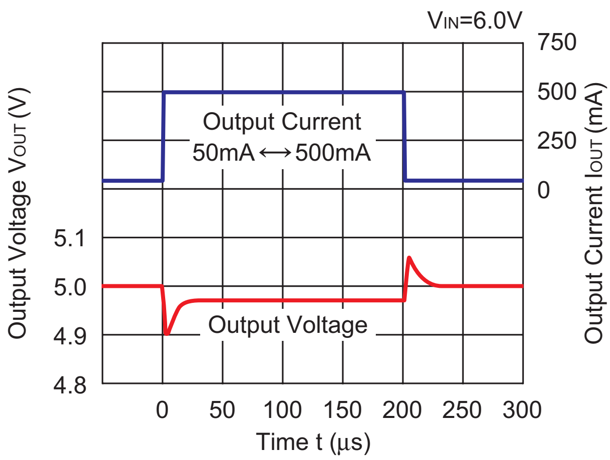


### 11) Load Transient Response (C1=Ceramic 0.47µF, C2=Ceramic 10µF, tr=tf=0.5µs)

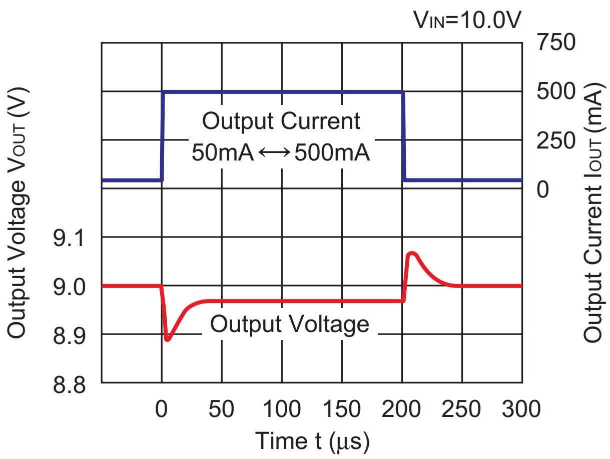
**R1501x030B**



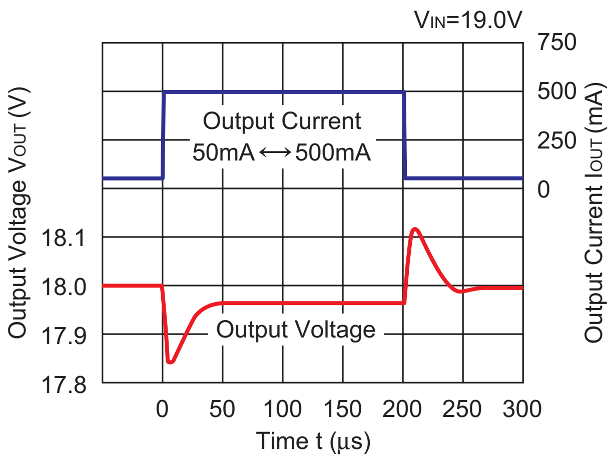

**R1501x050B**




**R1501x090B**

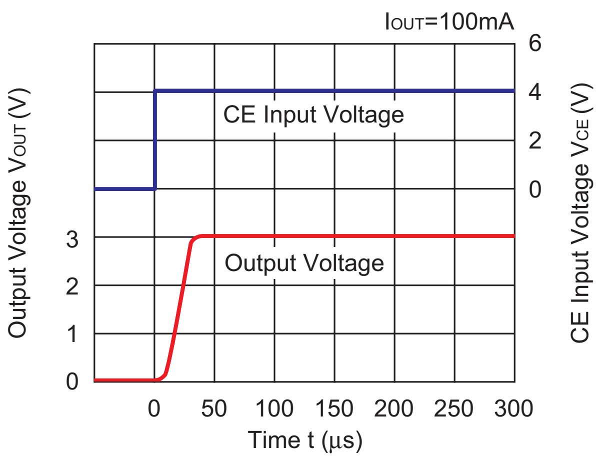



**R1501x180B**

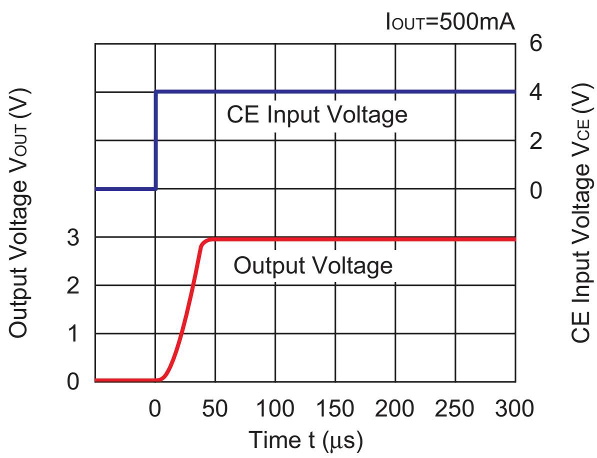



### 12) Turn On Speed with CE pin (C1=Ceramic 0.47µF, C2=Ceramic 10µF, tr=tf=0.5µs)

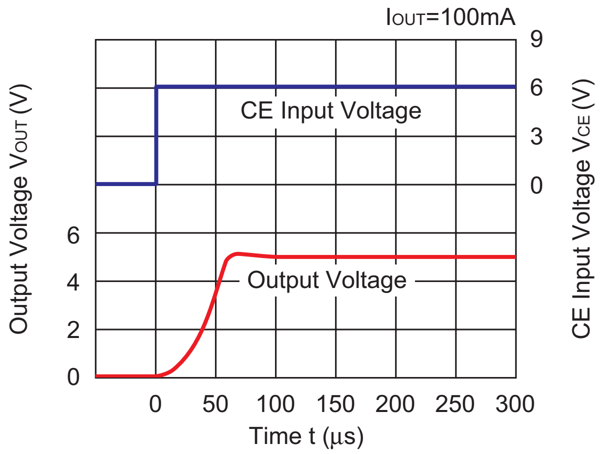
**R1501x030B**



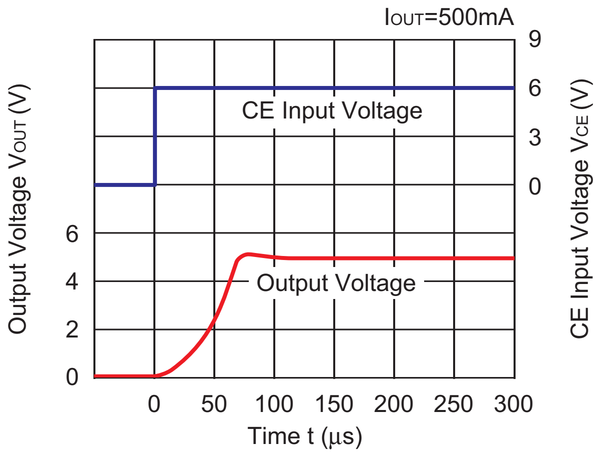

**R1501x030B**



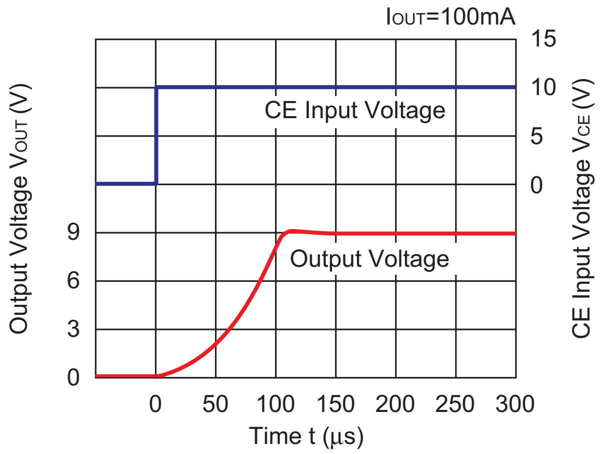
**R1501x050B**



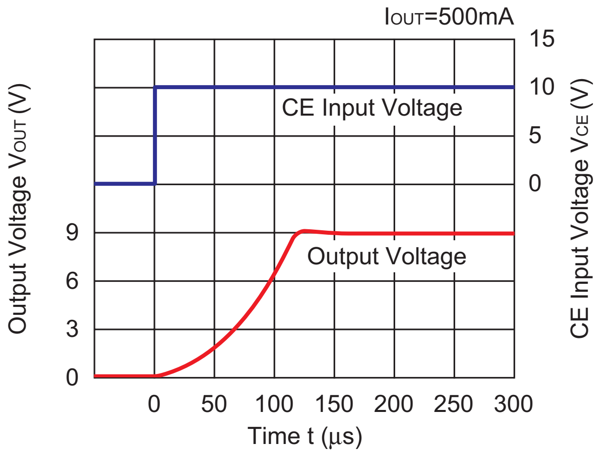

**R1501x050B**



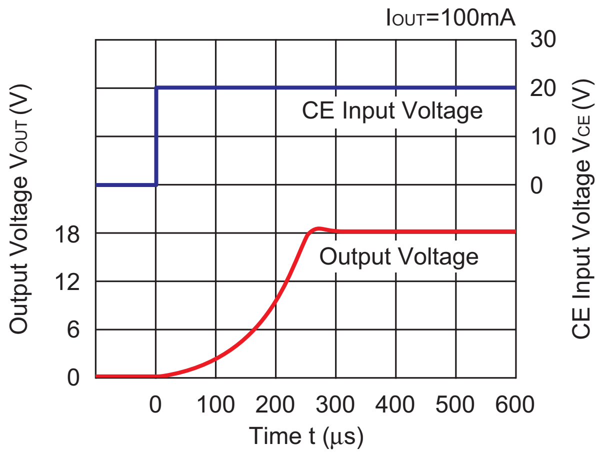

**R1501x090B**



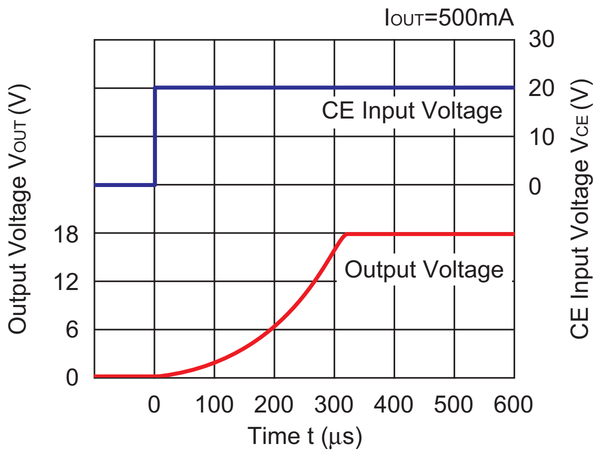

**R1501x090B**




**R1501x180B**

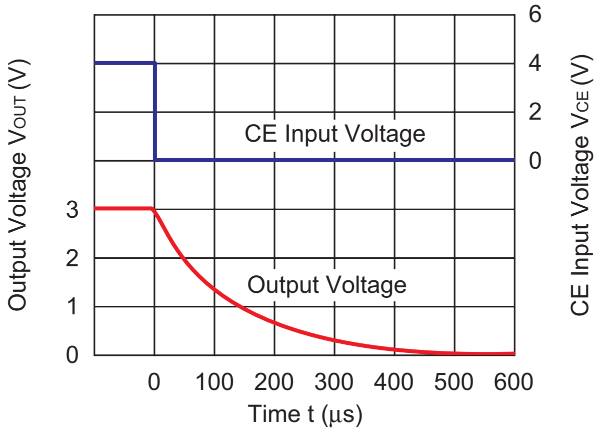



**R1501x180B**

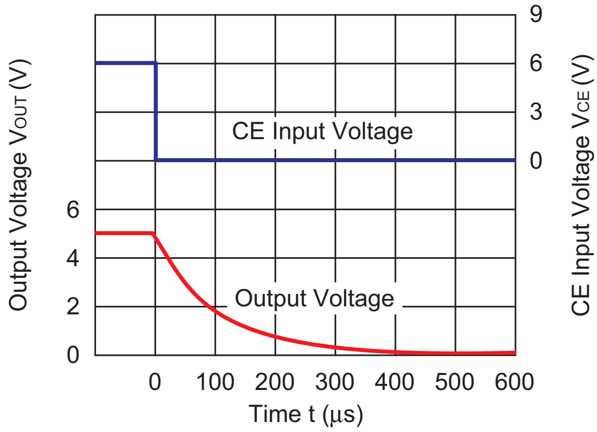


**13) Turn Off Speed with CE (C1=Ceramic 0.47µF, C2=Ceramic 10µF, $I_{OUT}$=500mA, tr=tf=0.5µs)**

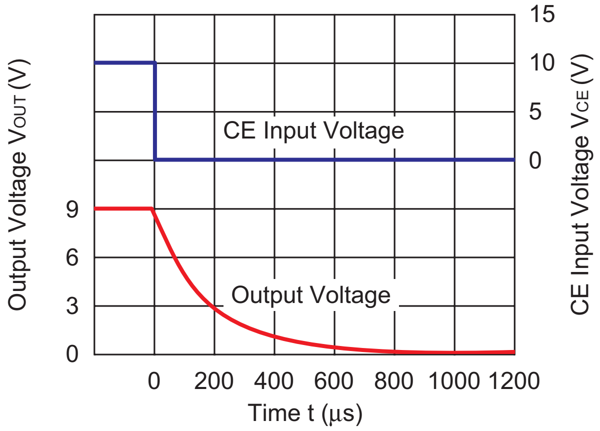
R1501x030B



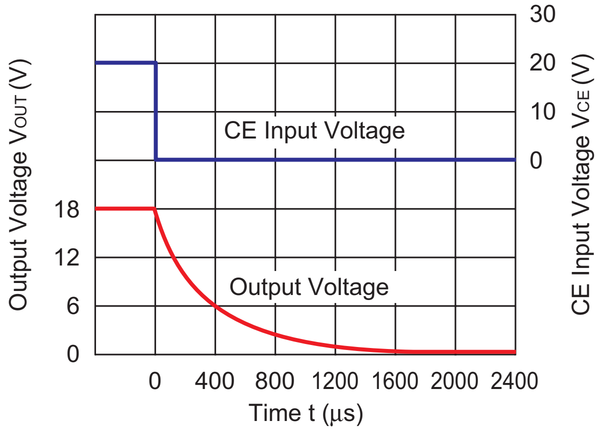

R1501x050B




R1501x090B




R1501x180B



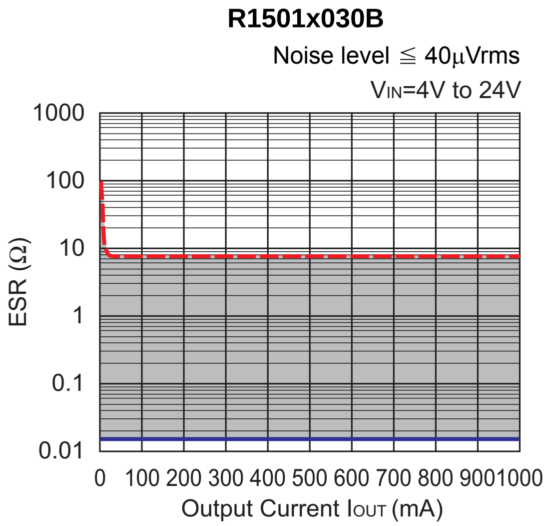
# ESR vs. Output Current

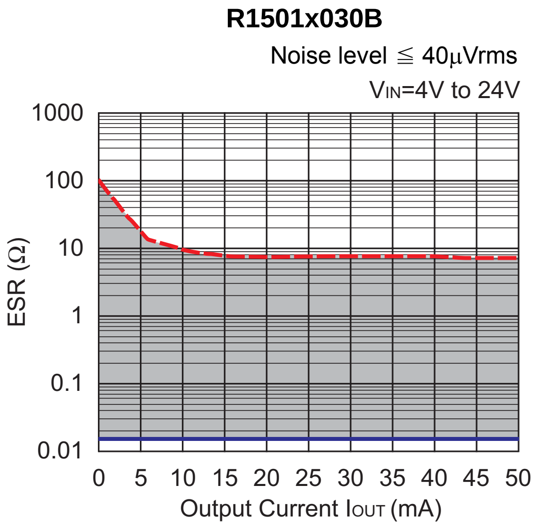
When using these ICs, consider the following points:

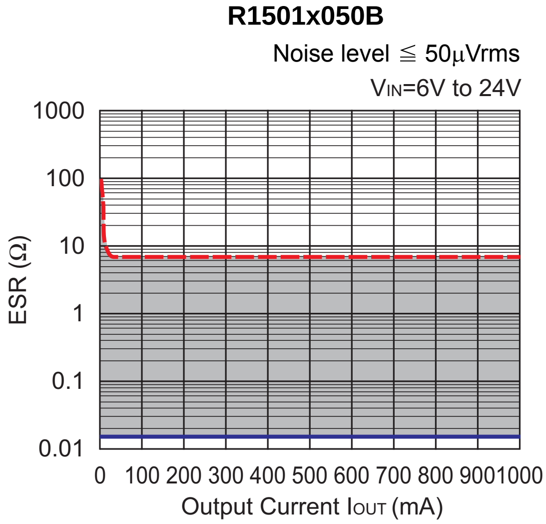
The relations between $I_{OUT}$ (Output Current) and ESR of an output capacitor are shown below.
The conditions when the white noise level is under the specified certain level are marked as the hatched area in the graph.

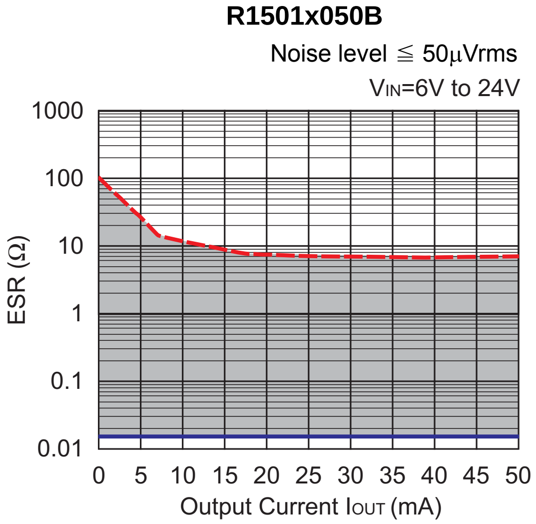
**Measurement conditions**

Input Voltage : $V_{OUT}$ +1V to 24V
Frequency Band : 10Hz to 1MHz
Temperature : –40°C to 105°C
Capacitor : C1=Ceramic 0.47µF
C2=Ceramic 10µF



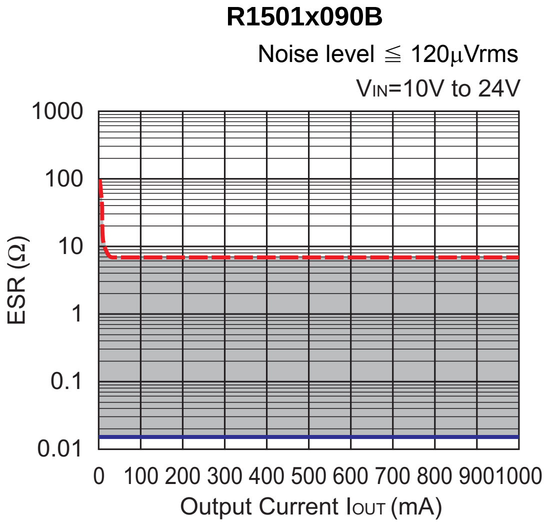



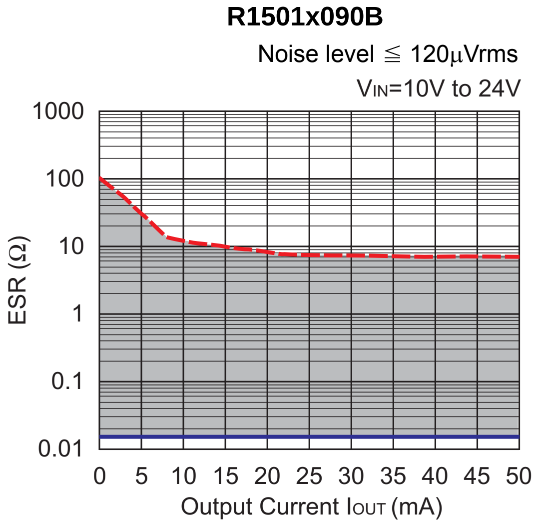



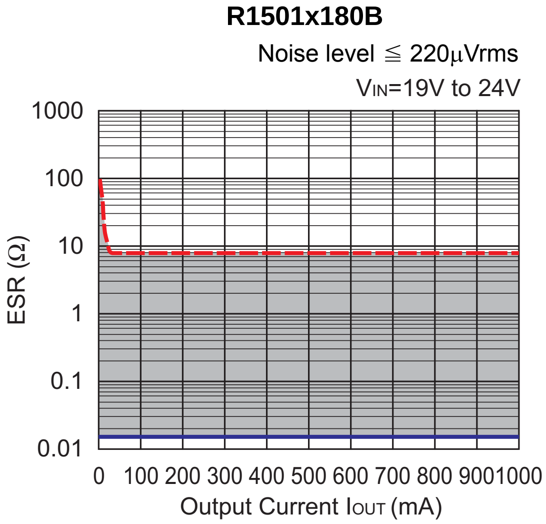



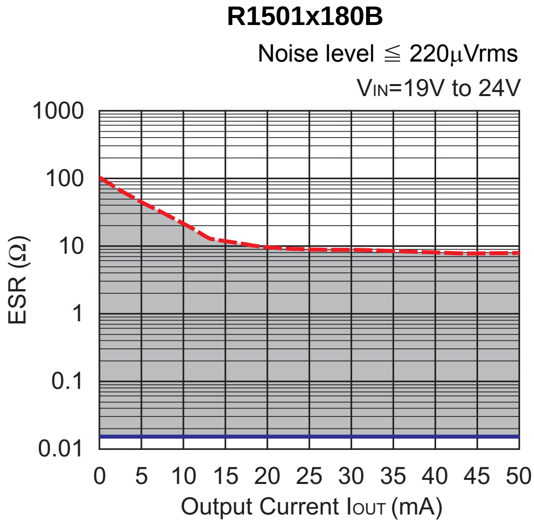



RICOH


R1501x090B
Noise level ≦ 120μVrms
VIN=10V to 24V
1000
100
10
1
0.1
0.01
ESR (Ω)
0 100 200 300 400 500 600 700 800 900 1000
Output Current IOUT (mA)


R1501x090B
Noise level ≦ 120μVrms
VIN=10V to 24V
1000
100
10
1
0.1
0.01
ESR (Ω)
0 5 10 15 20 25 30 35 40 45 50
Output Current IOUT (mA)


R1501x180B
Noise level ≦ 220μVrms
VIN=19V to 24V
1000
100
10
1
0.1
0.01
ESR (Ω)
0 100 200 300 400 500 600 700 800 900 1000
Output Current IOUT (mA)


R1501x180B
Noise level ≦ 220μVrms
VIN=19V to 24V
1000
100
10
1
0.1
0.01
ESR (Ω)
0 5 10 15 20 25 30 35 40 45 50
Output Current IOUT (mA)

# PACKAGE INFORMATION

**Power Dissipation (TO-252-5-P2)**

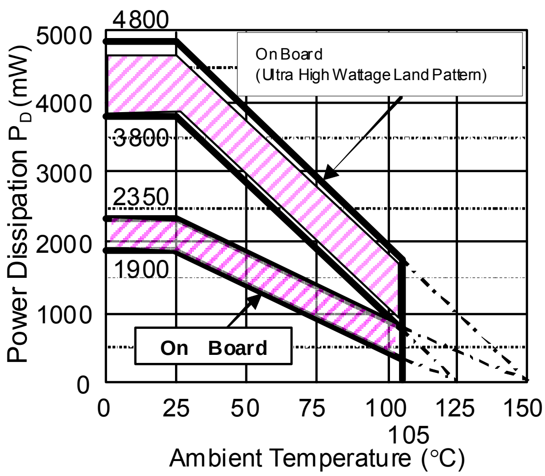
Power Dissipation ($P_D$) depends on conditions of mounting on board.
This specification is based on the measurement at the condition below.

* Measurement conditions

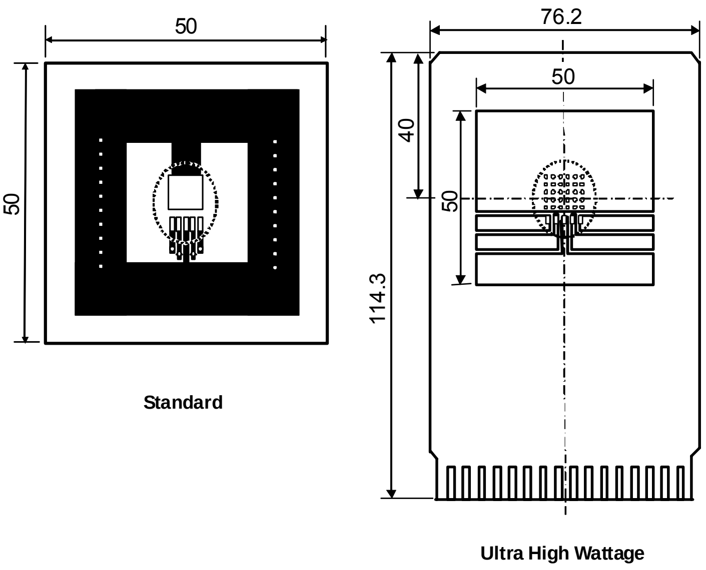
| | Standard Land Pattern | Ultra High Wattage Land Pattern |
|---|---|---|
| Environment | Mounting on board (Wind velocity 0m/s) | |
| Board Material | Glass cloth epoxy plastic (Double layers) | Glass cloth epoxy plastic (Four-layers) |
| Board Dimensions | 50mm x 50mm x 1.6mm | 76.2mm x 114.3mm x 0.8mm |
| Copper Ratio | Top side: Approx. 50%, Back side: Approx. 50% | Top, Back side:50mmSquare Approx. 96%, 2nd, 3rd: 50mmSquare Approx. 100% |
| Through - hole | ϕ 0.5mm x 24pcs | ϕ 0.4mm x 30pcs |

* Measurement Results (Ta=25°C, Tjmax=125°C)

| | Standard Land Pattern | Ultra High Wattage Land Pattern |
|---|---|---|
| Power Dissipation | 1900mW | 3800mW |
| Thermal Resistance | θja=(125-25°C)/1.9W= 53°C/W | θja= (125-25°C)/3.8W = 26°C/W |
| | θjc= 17°C/W | θjc= 7°C/W |




**Power Dissipation**




**Measurement Board Pattern**
IC Mount Area (Unit: mm)

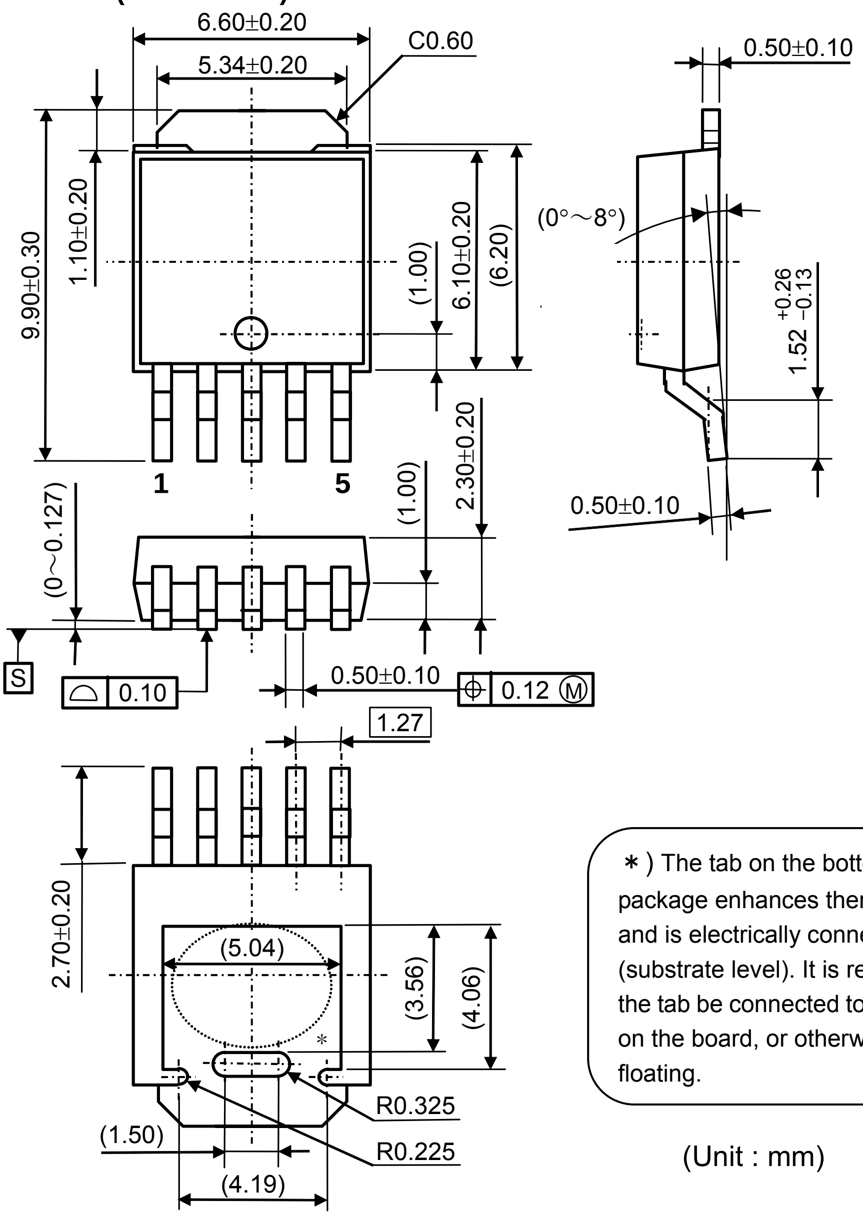
The above graph shows the Power Dissipation of the package based on Tjmax=125°C and Tjmax=150°C. Operating the IC in the shaded area in the graph might have an influence its lifetime. Operating time must be within the time limit described in the table below, in case of operating in the shaded area.

| Operating Time | Estimated years (Operating four hours/day) |
|---|---|
| 13,000 hours | 9 years |



RICOH

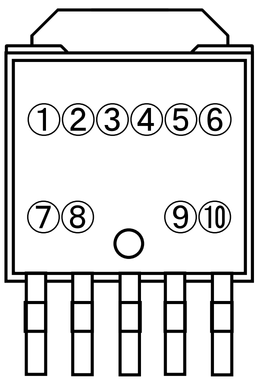
**Package Dimensions (TO-252-5-P2)**




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

(Unit : mm)

**Mark Specification (TO-252-5-P2)**




①②③④⑤⑥⑦ : Product Code … **<u>Refer to the R1501J Series Mark Specification Table.</u>**

⑧ : Blank

⑨⑩ : Lot Number … Alphanumeric Serial Number

# R1501J Series Mark Specification

**(PKG: TO-252-5-P2)**

| Product Name | ①②③④⑤⑥⑦ |
|---|---|
| R1501J030B | A 1 J 0 3 0 B |
| R1501J031B | A 1 J 0 3 1 B |
| R1501J032B | A 1 J 0 3 2 B |
| R1501J033B | A 1 J 0 3 3 B |
| R1501J034B | A 1 J 0 3 4 B |
| R1501J035B | A 1 J 0 3 5 B |
| R1501J036B | A 1 J 0 3 6 B |
| R1501J037B | A 1 J 0 3 7 B |
| R1501J038B | A 1 J 0 3 8 B |
| R1501J039B | A 1 J 0 3 9 B |
| R1501J040B | A 1 J 0 4 0 B |
| R1501J041B | A 1 J 0 4 1 B |
| R1501J042B | A 1 J 0 4 2 B |
| R1501J043B | A 1 J 0 4 3 B |
| R1501J044B | A 1 J 0 4 4 B |
| R1501J045B | A 1 J 0 4 5 B |
| R1501J046B | A 1 J 0 4 6 B |
| R1501J047B | A 1 J 0 4 7 B |
| R1501J048B | A 1 J 0 4 8 B |
| R1501J049B | A 1 J 0 4 9 B |
| R1501J050B | A 1 J 0 5 0 B |
| R1501J051B | A 1 J 0 5 1 B |
| R1501J052B | A 1 J 0 5 2 B |
| R1501J053B | A 1 J 0 5 3 B |
| R1501J054B | A 1 J 0 5 4 B |
| R1501J055B | A 1 J 0 5 5 B |
| R1501J056B | A 1 J 0 5 6 B |
| R1501J057B | A 1 J 0 5 7 B |
| R1501J058B | A 1 J 0 5 8 B |
| R1501J059B | A 1 J 0 5 9 B |
| R1501J060B | A 1 J 0 6 0 B |
| R1501J061B | A 1 J 0 6 1 B |
| R1501J062B | A 1 J 0 6 2 B |
| R1501J063B | A 1 J 0 6 3 B |
| R1501J064B | A 1 J 0 6 4 B |
| R1501J065B | A 1 J 0 6 5 B |
| R1501J066B | A 1 J 0 6 6 B |
| R1501J067B | A 1 J 0 6 7 B |
| R1501J068B | A 1 J 0 6 8 B |
| R1501J069B | A 1 J 0 6 9 B |
| R1501J070B | A 1 J 0 7 0 B |
| R1501J071B | A 1 J 0 7 1 B |
| R1501J072B | A 1 J 0 7 2 B |
| R1501J073B | A 1 J 0 7 3 B |
| R1501J074B | A 1 J 0 7 4 B |
| R1501J075B | A 1 J 0 7 5 B |
| R1501J076B | A 1 J 0 7 6 B |
| R1501J077B | A 1 J 0 7 7 B |
| R1501J078B | A 1 J 0 7 8 B |
| R1501J079B | A 1 J 0 7 9 B |

| Product Name | ①②③④⑤⑥⑦ |
|---|---|
| R1501J080B | A 1 J 0 8 0 B |
| R1501J081B | A 1 J 0 8 1 B |
| R1501J082B | A 1 J 0 8 2 B |
| R1501J083B | A 1 J 0 8 3 B |
| R1501J084B | A 1 J 0 8 4 B |
| R1501J085B | A 1 J 0 8 5 B |
| R1501J086B | A 1 J 0 8 6 B |
| R1501J087B | A 1 J 0 8 7 B |
| R1501J088B | A 1 J 0 8 8 B |
| R1501J089B | A 1 J 0 8 9 B |
| R1501J090B | A 1 J 0 9 0 B |
| R1501J091B | A 1 J 0 9 1 B |
| R1501J092B | A 1 J 0 9 2 B |
| R1501J093B | A 1 J 0 9 3 B |
| R1501J094B | A 1 J 0 9 4 B |
| R1501J095B | A 1 J 0 9 5 B |
| R1501J096B | A 1 J 0 9 6 B |
| R1501J097B | A 1 J 0 9 7 B |
| R1501J098B | A 1 J 0 9 8 B |
| R1501J099B | A 1 J 0 9 9 B |
| R1501J100B | A 1 J 1 0 0 B |
| R1501J101B | A 1 J 1 0 1 B |
| R1501J102B | A 1 J 1 0 2 B |
| R1501J103B | A 1 J 1 0 3 B |
| R1501J104B | A 1 J 1 0 4 B |
| R1501J105B | A 1 J 1 0 5 B |
| R1501J106B | A 1 J 1 0 6 B |
| R1501J107B | A 1 J 1 0 7 B |
| R1501J108B | A 1 J 1 0 8 B |
| R1501J109B | A 1 J 1 0 9 B |
| R1501J110B | A 1 J 1 1 0 B |
| R1501J111B | A 1 J 1 1 1 B |
| R1501J112B | A 1 J 1 1 2 B |
| R1501J113B | A 1 J 1 1 3 B |
| R1501J114B | A 1 J 1 1 4 B |
| R1501J115B | A 1 J 1 1 5 B |
| R1501J116B | A 1 J 1 1 6 B |
| R1501J117B | A 1 J 1 1 7 B |
| R1501J118B | A 1 J 1 1 8 B |
| R1501J119B | A 1 J 1 1 9 B |
| R1501J120B | A 1 J 1 2 0 B |
| R1501J125B | A 1 J 1 2 5 B |
| R1501J130B | A 1 J 1 3 0 B |
| R1501J135B | A 1 J 1 3 5 B |
| R1501J140B | A 1 J 1 4 0 B |
| R1501J145B | A 1 J 1 4 5 B |
| R1501J150B | A 1 J 1 5 0 B |
| R1501J155B | A 1 J 1 5 5 B |
| R1501J160B | A 1 J 1 6 0 B |
| R1501J165B | A 1 J 1 6 5 B |
| R1501J170B | A 1 J 1 7 0 B |
| R1501J175B | A 1 J 1 7 5 B |
| R1501J180B | A 1 J 1 8 0 B |

### Power Dissipation (HSOP-6J)

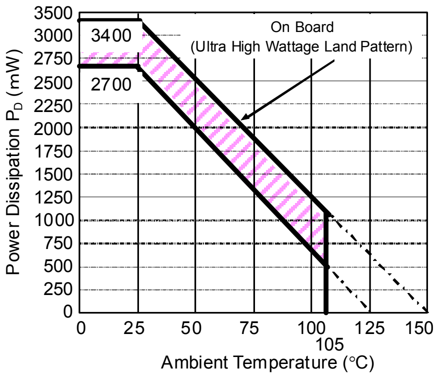
Power Dissipation ($P_D$) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

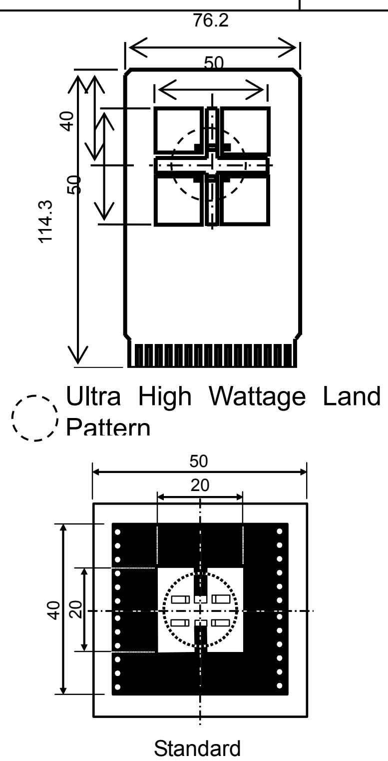
| | Ultra High Wattage Land Pattern | Standard Land Pattern |
|---|---|---|
| Environment | Mounting on Board (Wind velocity=0m/s) | Mounting on Board (Wind velocity=0m/s) |
| Board Material | Glass cloth epoxy plastic (4 Layers) | Glass cloth epoxy plastic (2 Layers) |
| Board Dimensions | 76.2mm × 114.3mm × 0.8mm | 50mm × 50mm × 1.6mm |
| Copper Ratio | 96% | 50% |
| Through-hole | φ0.3mm × 28pcs | φ0.5mm × 24pcs |

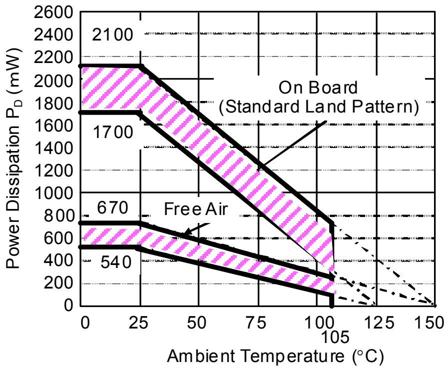
Measurement Result (Ta=25°C, Tjmax=125°C)

| | Ultra High Wattage Land Pattern | Standard Land Pattern | Free Air |
|---|---|---|---|
| Power Dissipation | 2700mW | 1700mW | 540mW |
| Thermal Resistance | 37°C /W | 59°C/W | 185°C/W |




Power Dissipation




Power Dissipation

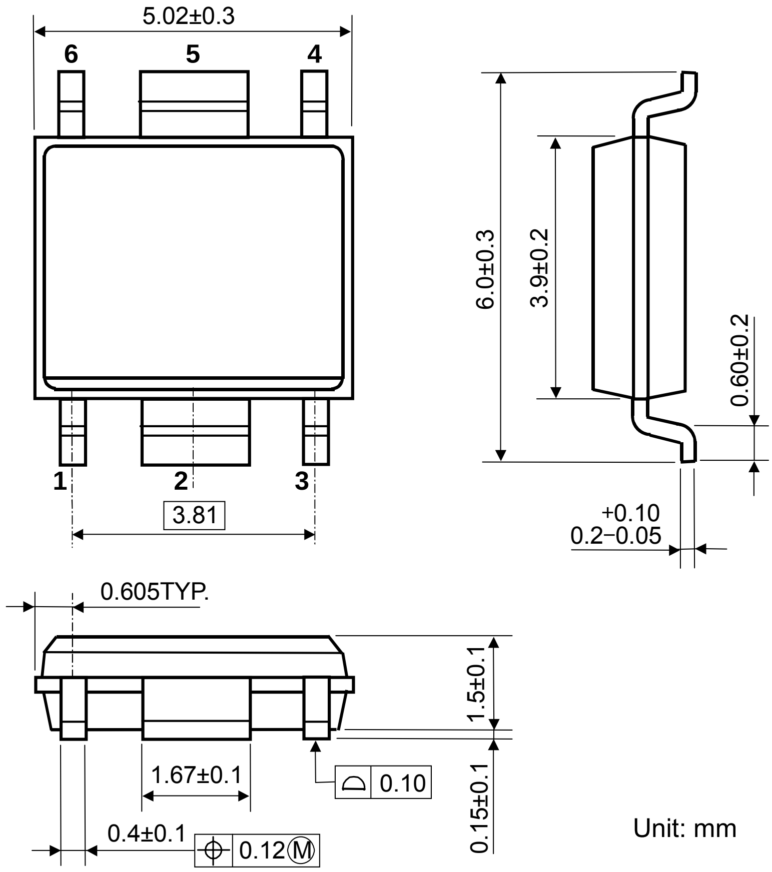
**Measurement Board Pattern**
IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package based on Tjmax=125°C and Tjmax=150°C.

Operating the IC in the shaded area in the graph might have an influence its lifetime. Operating time must be within the time limit described in the table below, in case of operating in the shaded area.

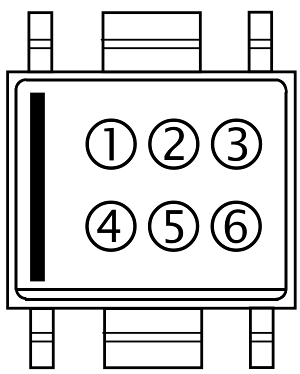
| Operating Time | Estimated years (Operating four hours/day) |
|---|---|
| 13,000 hours | 9 years |

**Package Dimensions (HSOP-6J)**




**Mark Specification (HSOP-6J)**

①②③④ : Product Code … **Refer to the R1501S Series Mark Specification Table.**
⑤⑥ : Lot Number … Alphanumeric Serial Number



# R1501S Series Mark Specification

**(PKG: HSOP-6J)**

| Product Name | ① ② ③ ④ |
|---|---|
| R1501S030B | H 0 3 0 |
| R1501S031B | H 0 3 1 |
| R1501S032B | H 0 3 2 |
| R1501S033B | H 0 3 3 |
| R1501S034B | H 0 3 4 |
| R1501S035B | H 0 3 5 |
| R1501S036B | H 0 3 6 |
| R1501S037B | H 0 3 7 |
| R1501S038B | H 0 3 8 |
| R1501S039B | H 0 3 9 |
| R1501S040B | H 0 4 0 |
| R1501S041B | H 0 4 1 |
| R1501S042B | H 0 4 2 |
| R1501S043B | H 0 4 3 |
| R1501S044B | H 0 4 4 |
| R1501S045B | H 0 4 5 |
| R1501S046B | H 0 4 6 |
| R1501S047B | H 0 4 7 |
| R1501S048B | H 0 4 8 |
| R1501S049B | H 0 4 9 |
| R1501S050B | H 0 5 0 |
| R1501S051B | H 0 5 1 |
| R1501S052B | H 0 5 2 |
| R1501S053B | H 0 5 3 |
| R1501S054B | H 0 5 4 |
| R1501S055B | H 0 5 5 |
| R1501S056B | H 0 5 6 |
| R1501S057B | H 0 5 7 |
| R1501S058B | H 0 5 8 |
| R1501S059B | H 0 5 9 |
| R1501S060B | H 0 6 0 |
| R1501S061B | H 0 6 1 |
| R1501S062B | H 0 6 2 |
| R1501S063B | H 0 6 3 |
| R1501S064B | H 0 6 4 |
| R1501S065B | H 0 6 5 |
| R1501S066B | H 0 6 6 |
| R1501S067B | H 0 6 7 |
| R1501S068B | H 0 6 8 |
| R1501S069B | H 0 6 9 |
| R1501S070B | H 0 7 0 |
| R1501S071B | H 0 7 1 |
| R1501S072B | H 0 7 2 |
| R1501S073B | H 0 7 3 |
| R1501S074B | H 0 7 4 |
| R1501S075B | H 0 7 5 |
| R1501S076B | H 0 7 6 |
| R1501S077B | H 0 7 7 |
| R1501S078B | H 0 7 8 |
| R1501S079B | H 0 7 9 |

| Product Name | ① ② ③ ④ |
|---|---|
| R1501S080B | H 0 8 0 |
| R1501S081B | H 0 8 1 |
| R1501S082B | H 0 8 2 |
| R1501S083B | H 0 8 3 |
| R1501S084B | H 0 8 4 |
| R1501S085B | H 0 8 5 |
| R1501S086B | H 0 8 6 |
| R1501S087B | H 0 8 7 |
| R1501S088B | H 0 8 8 |
| R1501S089B | H 0 8 9 |
| R1501S090B | H 0 9 0 |
| R1501S091B | H 0 9 1 |
| R1501S092B | H 0 9 2 |
| R1501S093B | H 0 9 3 |
| R1501S094B | H 0 9 4 |
| R1501S095B | H 0 9 5 |
| R1501S096B | H 0 9 6 |
| R1501S097B | H 0 9 7 |
| R1501S098B | H 0 9 8 |
| R1501S099B | H 0 9 9 |
| R1501S100B | H 1 0 0 |
| R1501S101B | H 1 0 1 |
| R1501S102B | H 1 0 2 |
| R1501S103B | H 1 0 3 |
| R1501S104B | H 1 0 4 |
| R1501S105B | H 1 0 5 |
| R1501S106B | H 1 0 6 |
| R1501S107B | H 1 0 7 |
| R1501S108B | H 1 0 8 |
| R1501S109B | H 1 0 9 |
| R1501S110B | H 1 1 0 |
| R1501S111B | H 1 1 1 |
| R1501S112B | H 1 1 2 |
| R1501S113B | H 1 1 3 |
| R1501S114B | H 1 1 4 |
| R1501S115B | H 1 1 5 |
| R1501S116B | H 1 1 6 |
| R1501S117B | H 1 1 7 |
| R1501S118B | H 1 1 8 |
| R1501S119B | H 1 1 9 |
| R1501S120B | H 1 2 0 |
| R1501S125B | H 1 2 5 |
| R1501S130B | H 1 3 0 |
| R1501S135B | H 1 3 5 |
| R1501S140B | H 1 4 0 |
| R1501S145B | H 1 4 5 |
| R1501S150B | H 1 5 0 |
| R1501S155B | H 1 5 5 |
| R1501S160B | H 1 6 0 |
| R1501S165B | H 1 6 5 |
| R1501S170B | H 1 7 0 |
| R1501S175B | H 1 7 5 |
| R1501S180B | H 1 8 0 |

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