

R1500x SERIES

500 mA LDO REGULATOR (Operating Voltage up to 24 V)

NO.EA-151-160701

OUTLINE

The R1500x series are CMOS-based positive voltage regulator (VR) ICs. The R1500xxxxB has features of high input voltage operating, 500mA 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 R1500x series.

As the operating temperature range is from $-40^{\circ}C$ to $105^{\circ}C$ and maximum input voltage is up to 24V, the R1500x series are suitable for the constant voltage source for car accessories.

The regulator output voltage is fixed in the R1500x. Output voltage accuracy is $\pm 2.0\%$ and output voltage range is from 3.0V to 12.0V with a step of 0.1V. The chip enable pin realizes ultra low supply current standby mode.

Since the packages for these ICs are the SOT-89-5 for high density mounting of the ICs on boards, and the TO-252-5-P2.

*) The DMOS (Double Diffused MOS) transistor adopted by R1500x 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 R1500x 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

- Input Voltage Range4.0V to 24.0V
- Supply CurrentTyp. 70 μ A
- Standby CurrentTyp. 0.1 μ A
- Ripple RejectionTyp. 60dB ($V_{OUT}=5.0V$)
- Temperature-Drift Coefficient of Output VoltageTyp. ± 100 ppm/ $^{\circ}C$
- Output Current.....Min. 500mA ($V_{IN}=V_{OUT}+1V$)
- Line RegulationTyp. 0.05%/V
- Output Voltage Accuracy..... $\pm 2\%$
- Output Voltage.....3.0V to 12.0V (0.1V steps)
(For other voltages, please refer to MARK INFORMATION.)
- Packages.....SOT-89-5, TO-252-5-P2
- Built-in Current Limit Circuit
- Built-in Fold-Back Circuit
- Built-in Thermal Shutdown Circuit
- Operating Temperature range $-40^{\circ}C$ to $105^{\circ}C$

APPLICATIONS

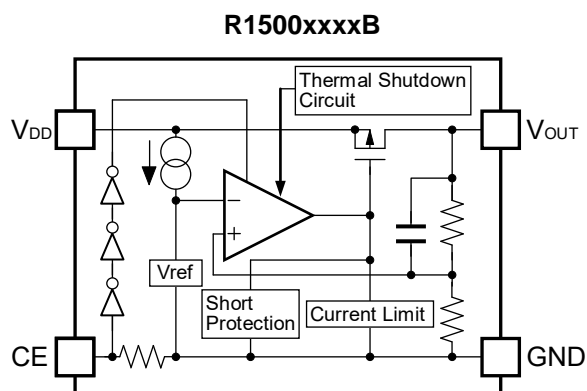
- Power source for home appliances such as refrigerators, rice cookers, electric water warmers, etc.
- Power source for car audio equipment, car navigation system, ETC system, etc.
- Power source for notebook PCs, digital TVs, cordless phones, and private LAN system, etc.
- Power source for office equipment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

* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

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BLOCK DIAGRAMS



SELECTION GUIDE

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

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|------------------|-------------|-------------------|---------|--------------|
| R1500HxxxB-T1-FE | SOT-89-5 | 1,000 pcs | Yes | Yes |
| R1500JxxxB-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.
(For other voltages, please refer to MARK INFORMATION.)

PIN CONFIGURATIONS



PIN DESCRIPTIONS

• SOT-89-5

| Pin No. | Symbol | 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 |

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

• TO-252-5-P2

| Pin No. | Symbol | 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 |

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

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ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit |
|-----------|----------------------------------|----------------------------|-------------|
| V_{IN} | Input Voltage | 36 | V |
| V_{CE} | Input Voltage (CE Pin) | -0.3 to $V_{IN} \leq 36$ | V |
| V_{OUT} | Output Voltage | -0.3 to $V_{IN} \leq 36$ | V |
| P_D | Power Dissipation (SOT-89-5)* | 900 | mW |
| | Power Dissipation (TO-252-5-P2)* | 1900 | |
| T_{opt} | Operating Temperature Range | -40 to 105 | $^{\circ}C$ |
| T_{stg} | Storage Temperature Range | -55 to 125 | $^{\circ}C$ |

*) 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.

ELECTRICAL CHARACTERISTICS

• R1500xxxxB

T_{opt}=25°C

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--|--|---------------------------------|-------|-----------------|--------|
| V _{IN} | Input Voltage | | 4 | | 24 | V |
| I _{SS} | Supply Current | V _{IN} =V _{OUT} +1.0V, V _{IN} =V _{CE} | | 70 | 130 | μA |
| I _{standby} | Standby Current | V _{IN} =24V | | 0.1 | 1.0 | μA |
| V _{OUT} | Output Voltage | V _{IN} =V _{OUT} +1.0V, I _{OUT} =100mA | ×0.98 | | ×1.02 | V |
| ΔV _{OUT} /ΔI _{OUT} | Load Regulation | V _{IN} =V _{OUT} +2.0V, 0.1mA ≤ I _{OUT} ≤ 200mA | | 25 | 60 | mV |
| ΔV _{OUT} /ΔV _{IN} | Line Regulation | V _{OUT} +1V ≤ V _{IN} ≤ 24V, I _{OUT} =10mA | | 0.05 | 0.1 | %/V |
| V _{DIF} | Dropout Voltage | I _{OUT} =200mA | 3.0V ≤ V _{OUT} < 5.0V | 0.135 | 0.225 | V |
| | | | 5.0V ≤ V _{OUT} < 9.0V | 0.115 | 0.180 | |
| | | | 9.0V ≤ V _{OUT} ≤ 12.0V | 0.095 | 0.155 | |
| ΔV _{OUT} /ΔT _{opt} | Output Voltage Temperature Coefficient | V _{IN} =V _{OUT} +2.0V, I _{OUT} =100μA -40°C ≤ T _{opt} ≤ 105°C | | ±100 | | ppm/°C |
| I _{LIM} | Output Current | V _{IN} =V _{OUT} +1.0V | 500 | | | mA |
| 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 _{OUT} +2V | V _{OUT} ≤ 6.0V | 60 | | dB |
| | | | V _{OUT} > 6.0V | 50 | | |
| V _{CEH} | CE Input Voltage "H" | | 2.0 | | V _{IN} | V |
| V _{CEL} | CE Input Voltage "L" | | 0 | | 0.4 | V |
| T _{TSD} | Thermal Shutdown Temperature | Junction Temperature | 150 | 170 | | °C |
| T _{TSR} | Thermal Shutdown Released Temperature | Junction Temperature | | 145 | | °C |

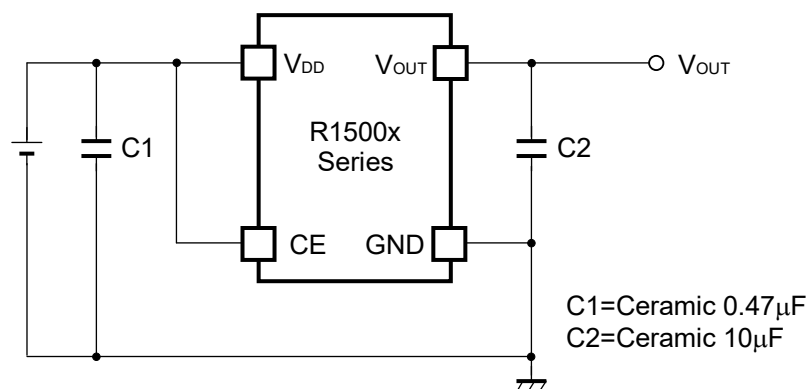
RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

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.

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TYPICAL APPLICATION



(External Components)

C2: Ceramic 10 μ F 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 0.47 μ F or more between V_{DD} and GND pin, and as close as possible to the pins.

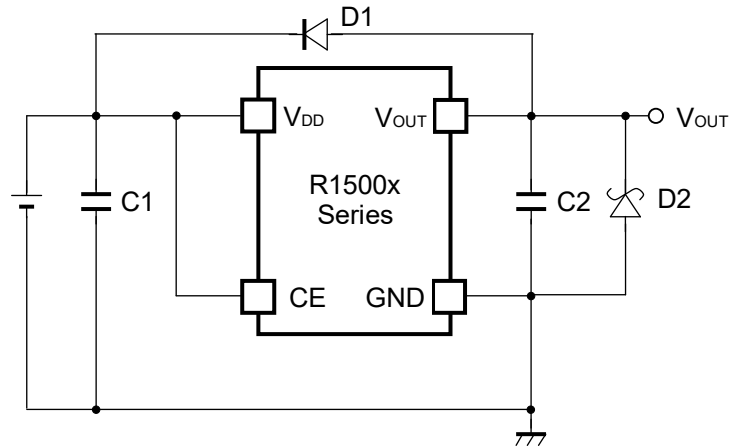
Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

No.2 pin and No.3 pin of SOT-89-5 and TO-252-5-P2 package must be wired to the GND plane when it is mounted on board.

Thermal Shutdown

There is the built-in thermal-shutdown function in R1500x series. It discontinues operation of the IC when the junction temperature becomes over 170°C (Typ.) and IC re-operates when the junction temperature under 145°C. If the temperature increasing keeps the IC repeats ON and OFF operating. The output becomes the pulse condition.

TYPICAL APPLICATION FOR PREVENTING IC DESTRUCTION



C1: 0.47 μ F or more (preventing for unstable operation)

C2: 10 μ F 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.

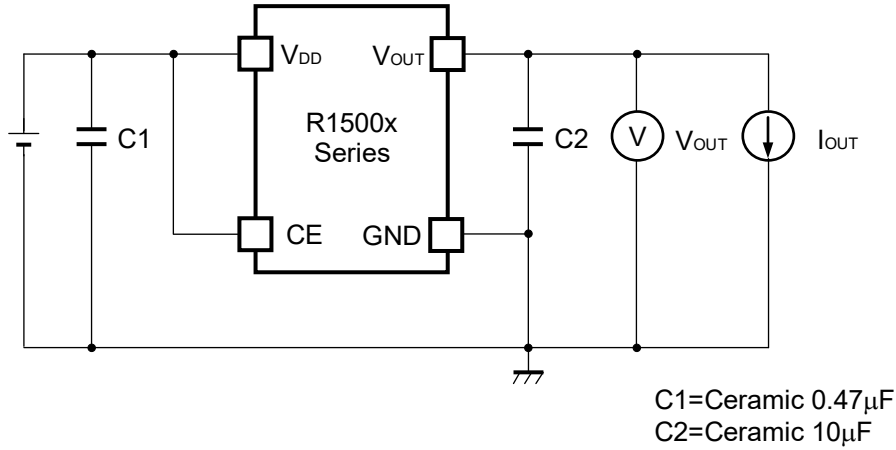
Note: Do not force the voltage to V_{OUT} pin.

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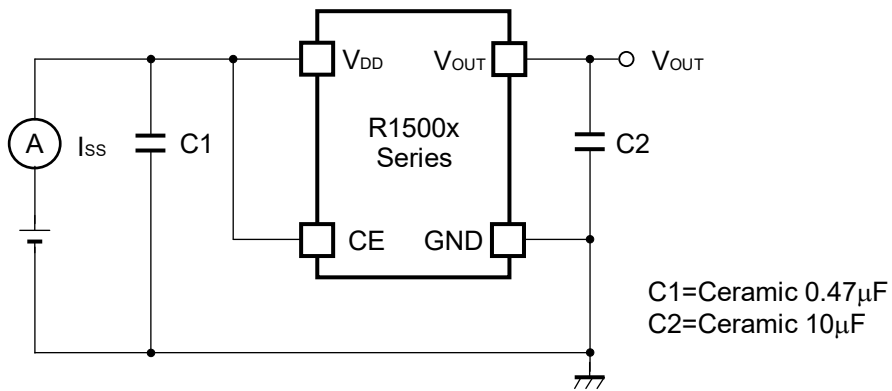
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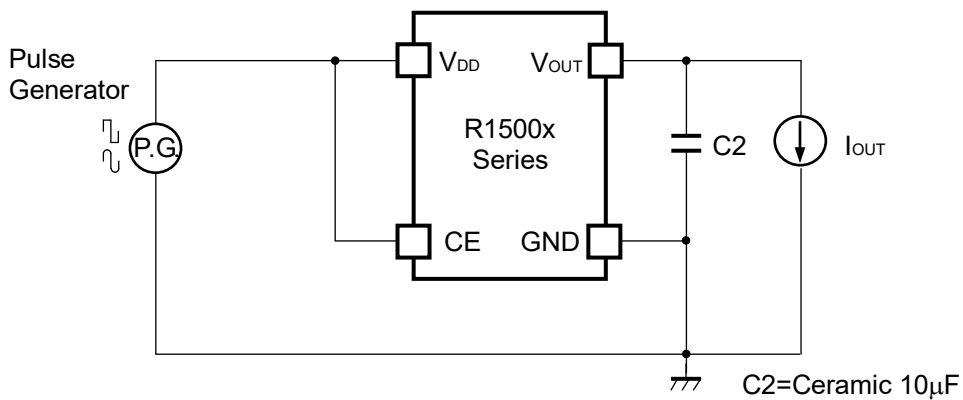
TEST CIRCUITS



Basic Test Circuit



Test Circuit for Supply Current

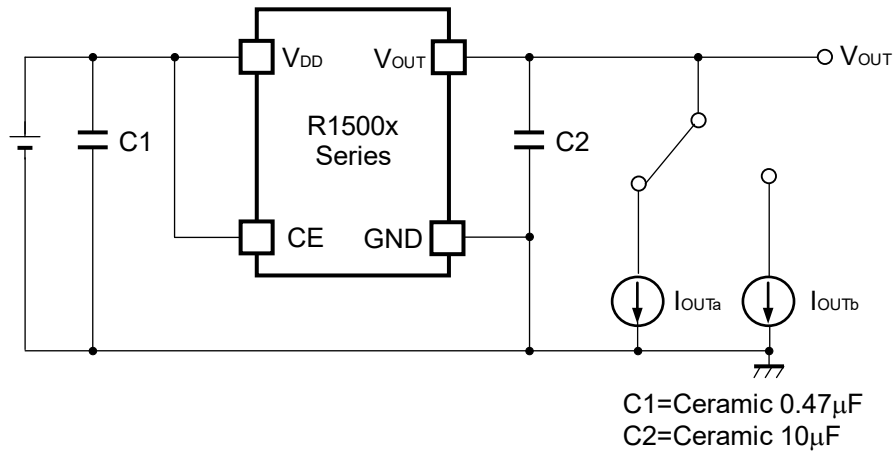


Test Circuit for Ripple Rejection, Input Transient Response

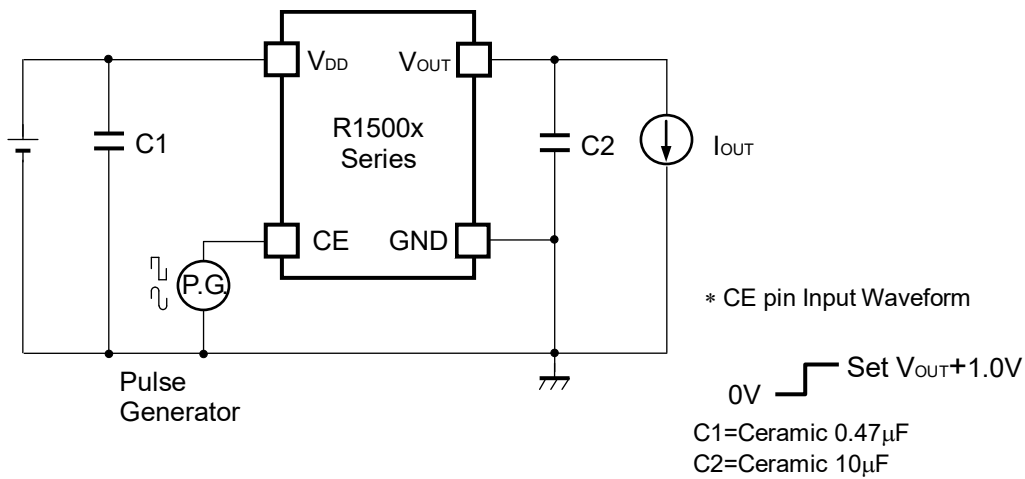
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Test Circuit for Load Transient Response



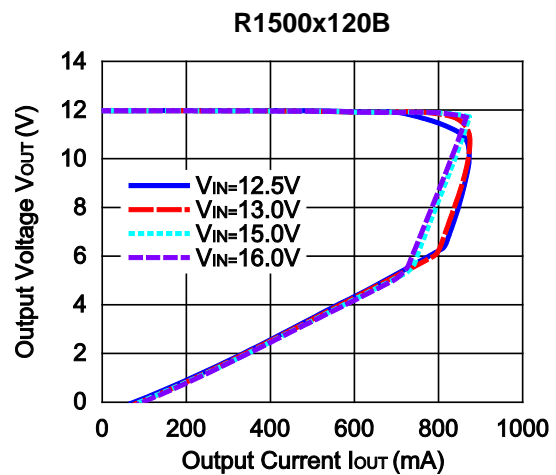
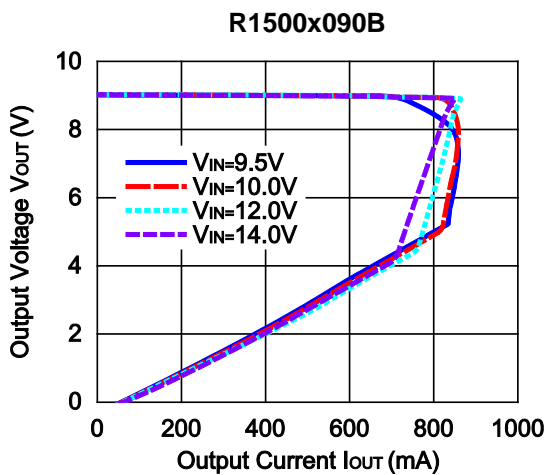
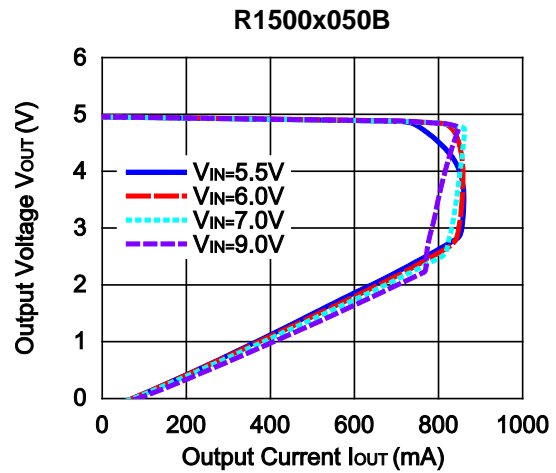
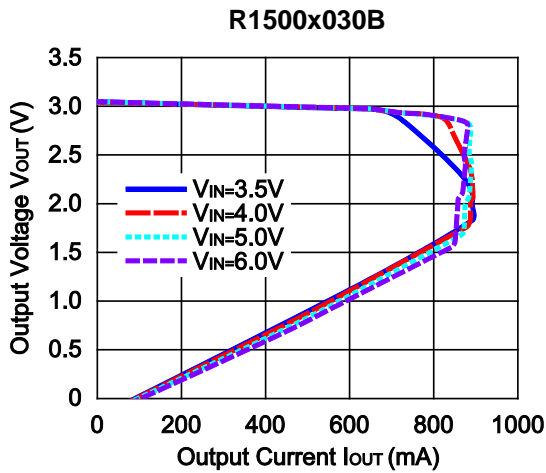
Test Circuit for Turn On Speed with CE pin

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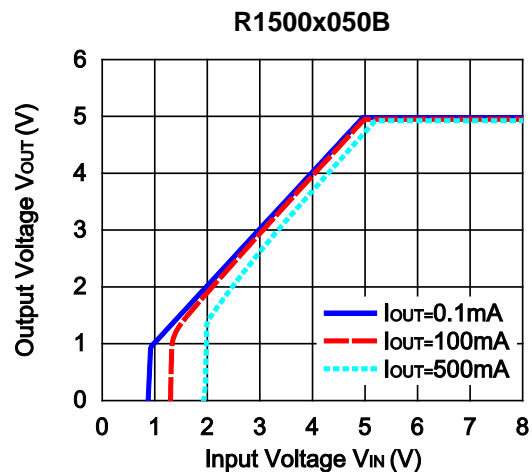
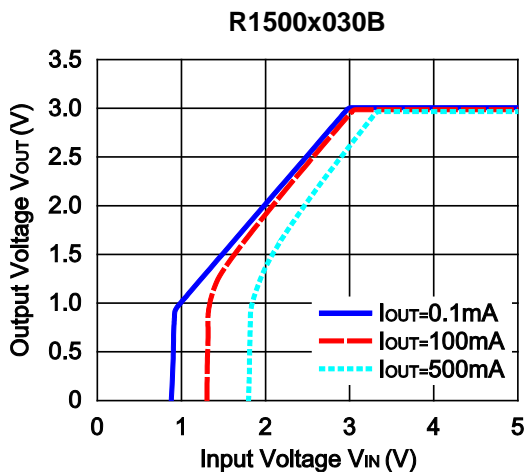
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TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, T_{opt}=25°C)



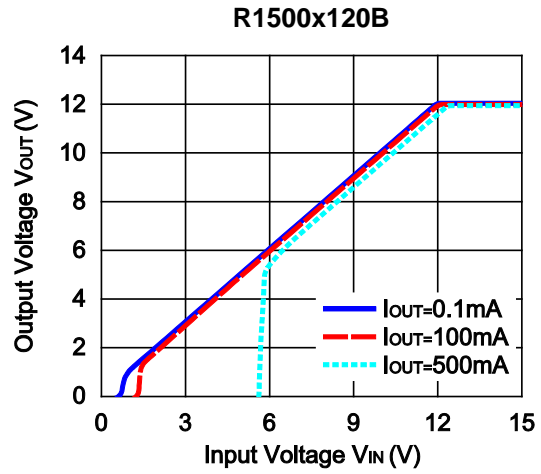
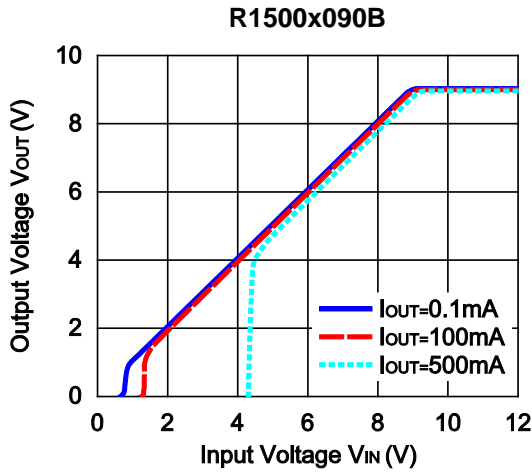
2) Output Voltage vs. Input Voltage (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, T_{opt}=25°C)



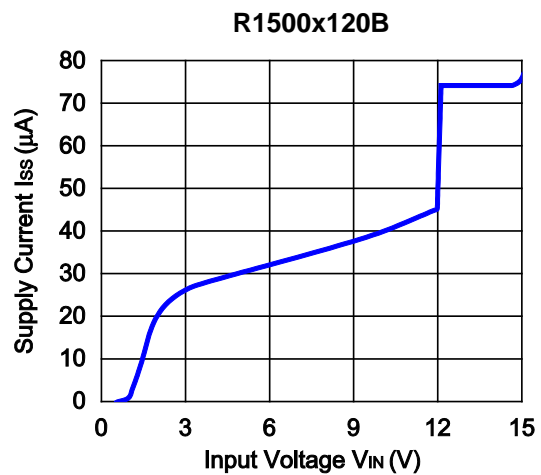
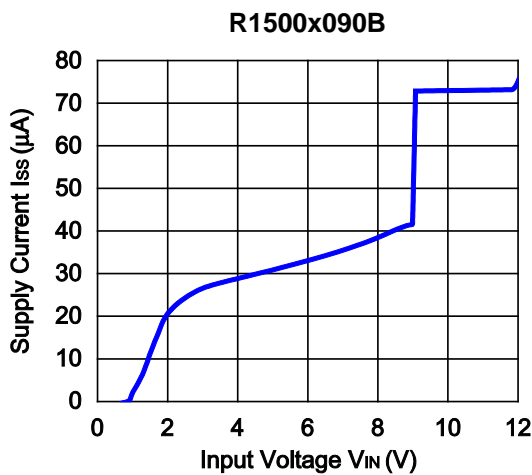
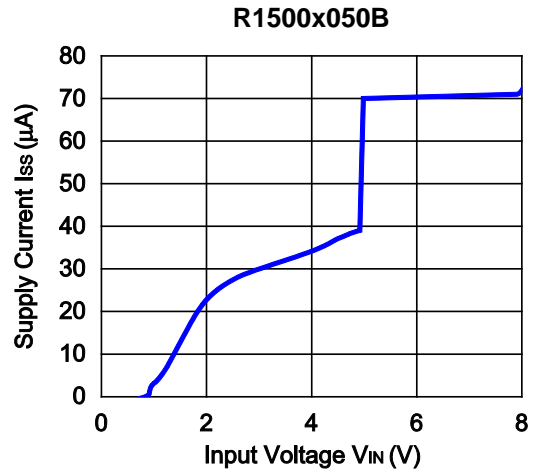
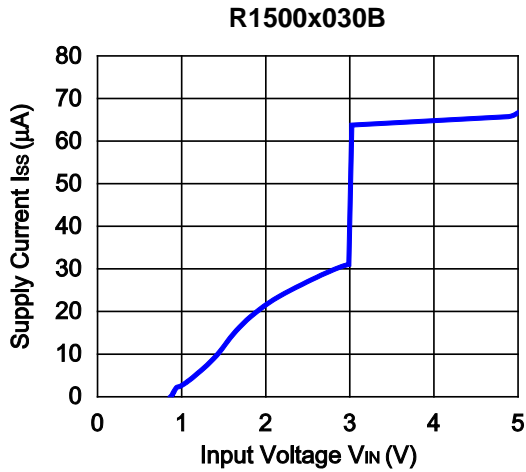
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3) Supply Current vs. Input Voltage (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, Topt=25 $^{\circ}$ C)

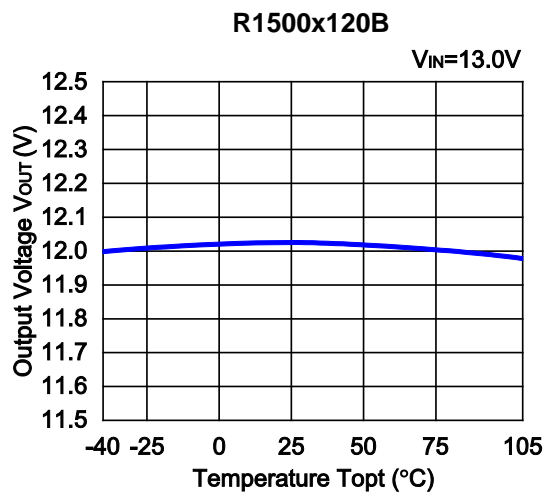
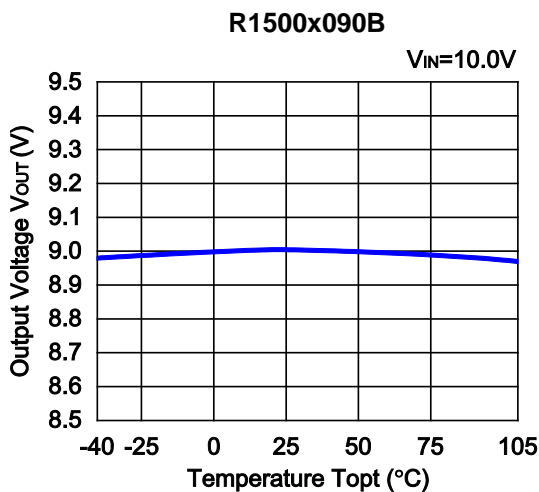
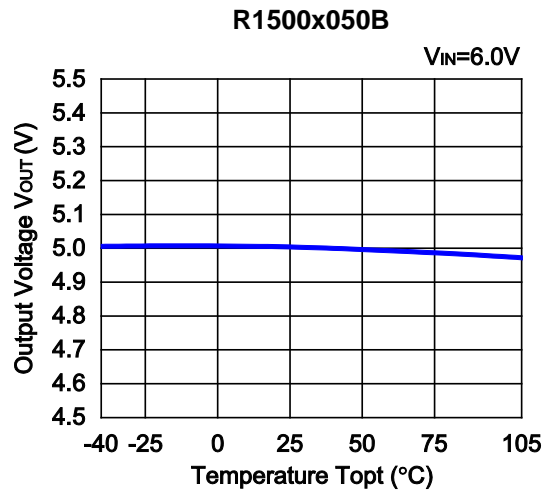
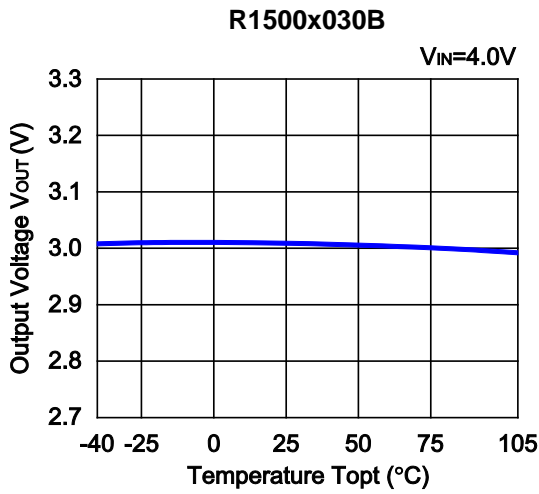


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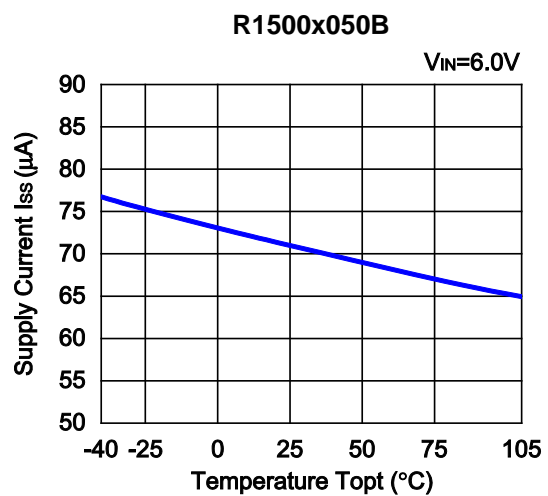
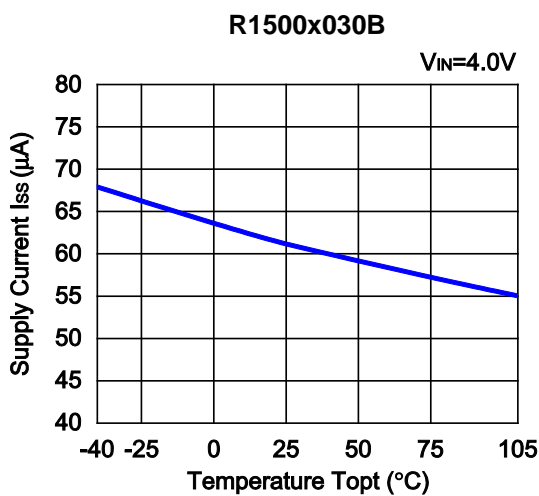
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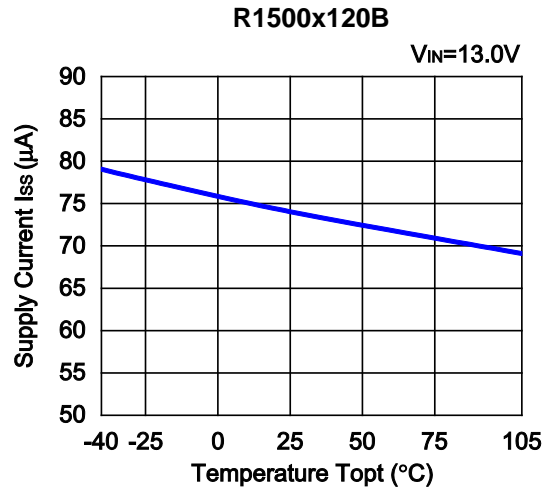
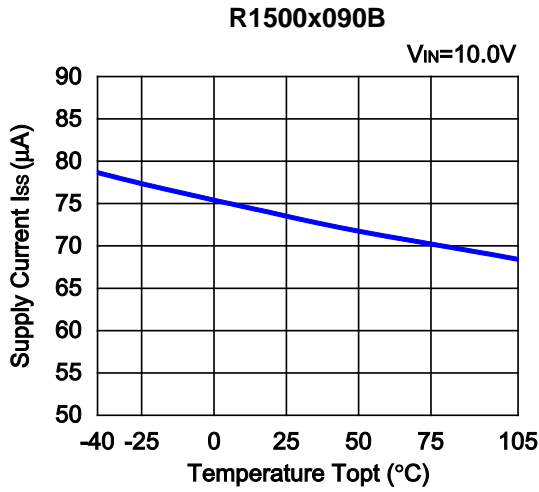
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4) Output Voltage vs. Temperature (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, I_{OUT}=100mA)

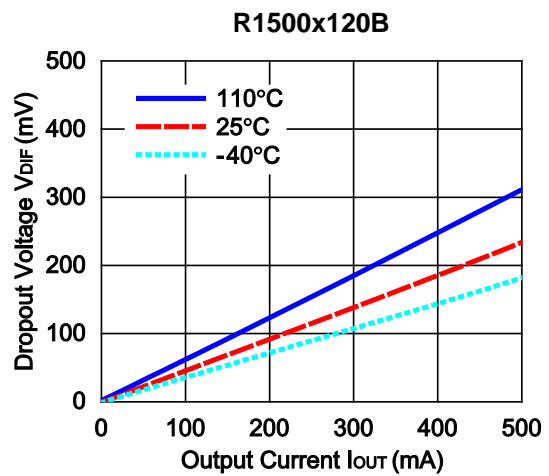
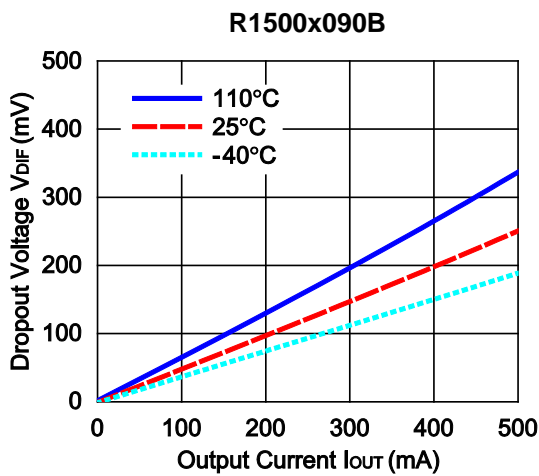
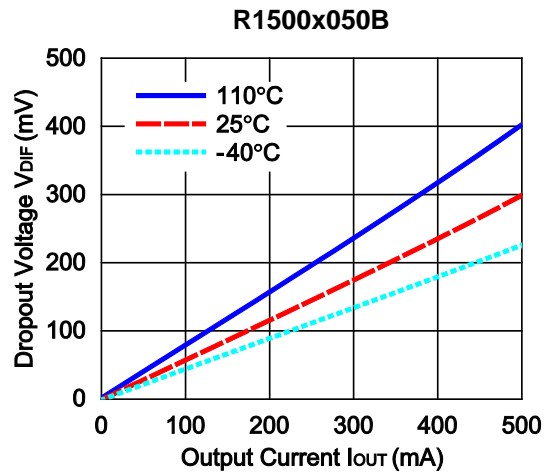
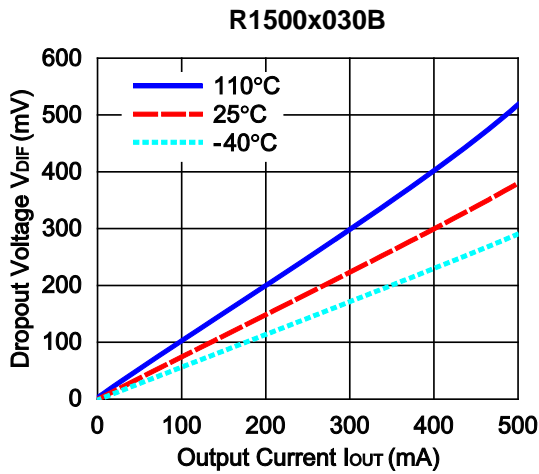


5) Supply Current vs. Temperature (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, I_{OUT}=0mA)





6) Dropout Voltage vs. Output Current ($C1$ =Ceramic $0.47\mu F$, $C2$ =Ceramic $10\mu F$)

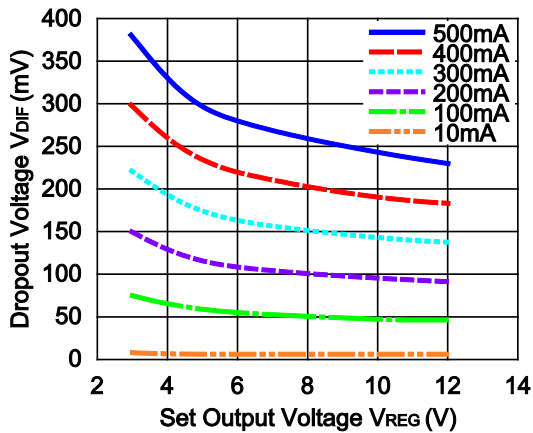


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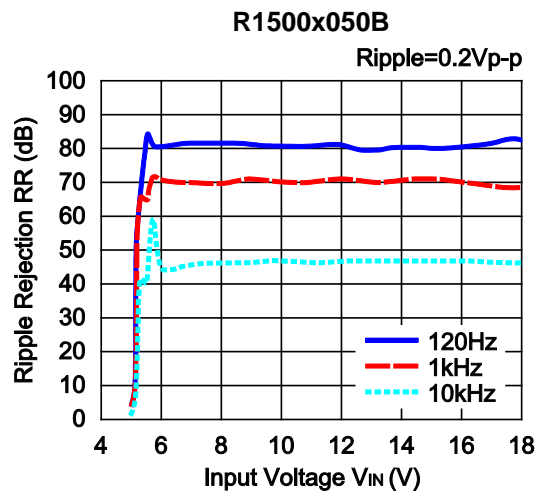
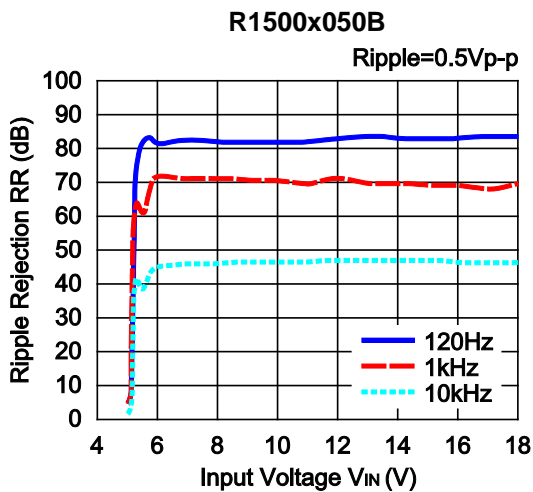
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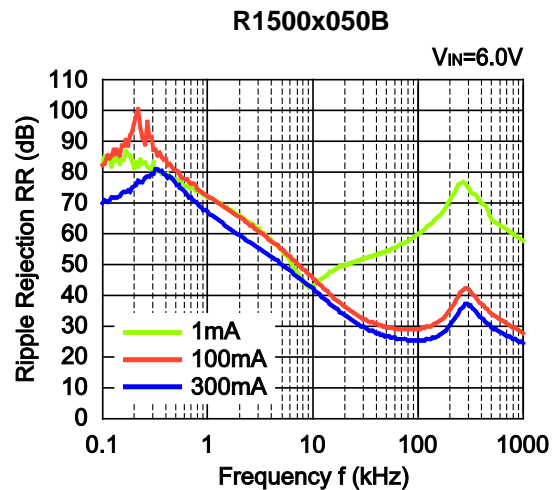
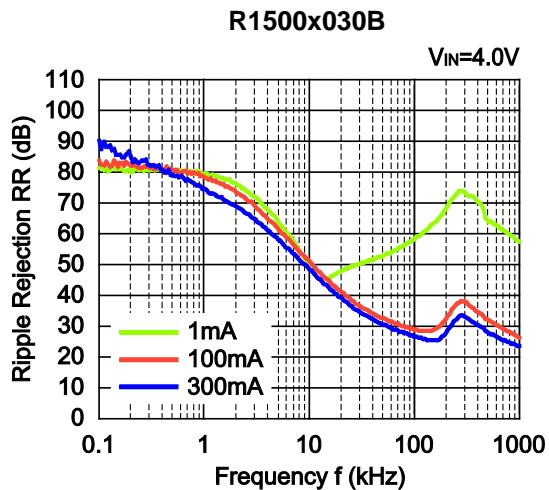
7) Dropout Voltage vs. Set Output Voltage (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, T_{opt}=25°C)

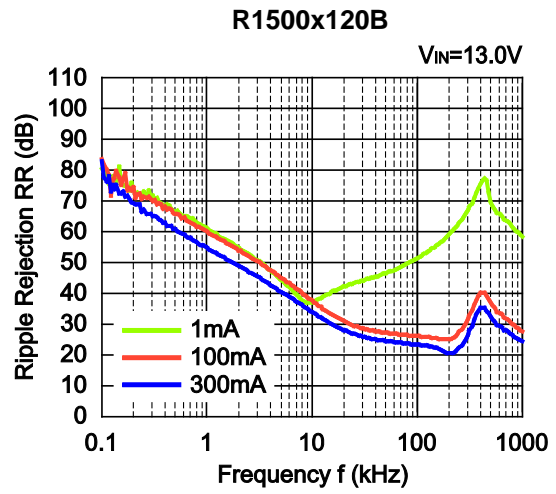
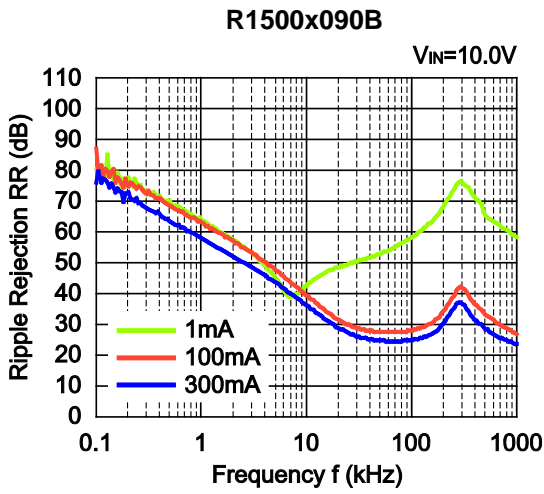


8) Ripple Rejection vs. Input Bias Voltage (C1=none, C2=Ceramic 10 μ F, I_{OUT}=100mA, T_{opt}=25°C)

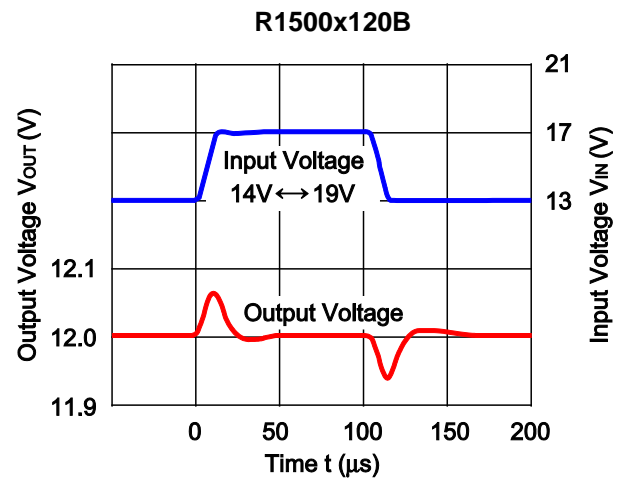
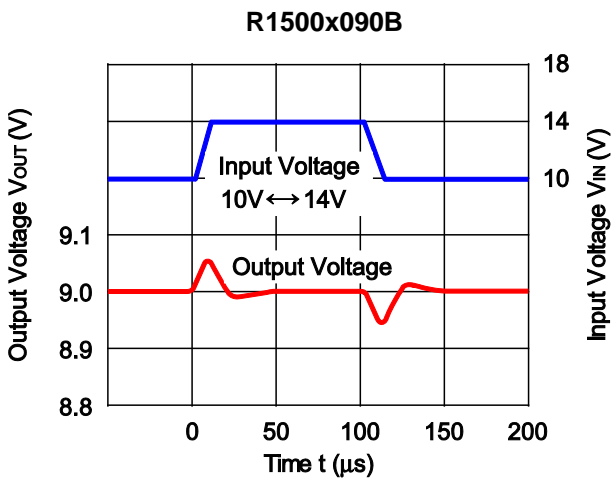
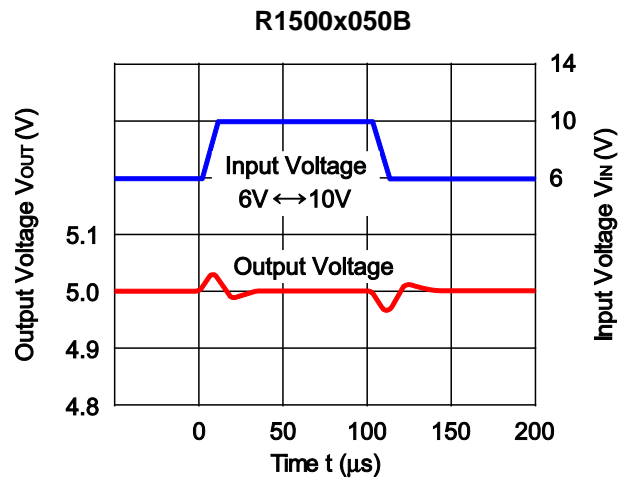
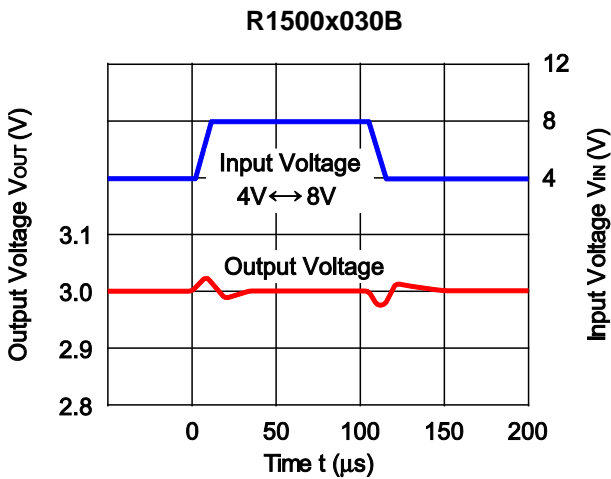


9) Ripple Rejection vs. Frequency (C1=none, C2=Ceramic 10 μ F, Ripple=0.5V_{p-p})





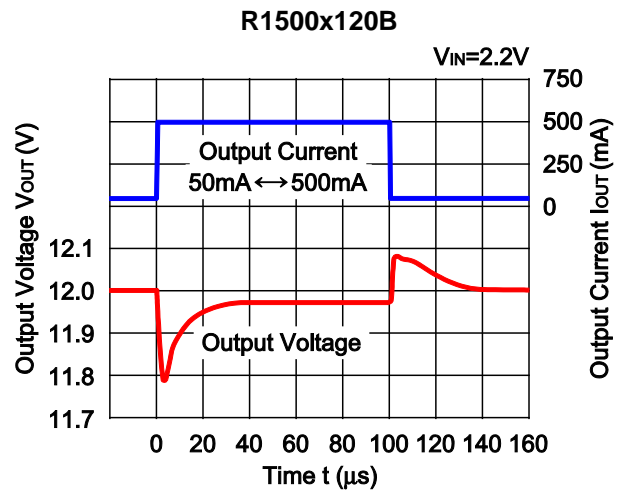
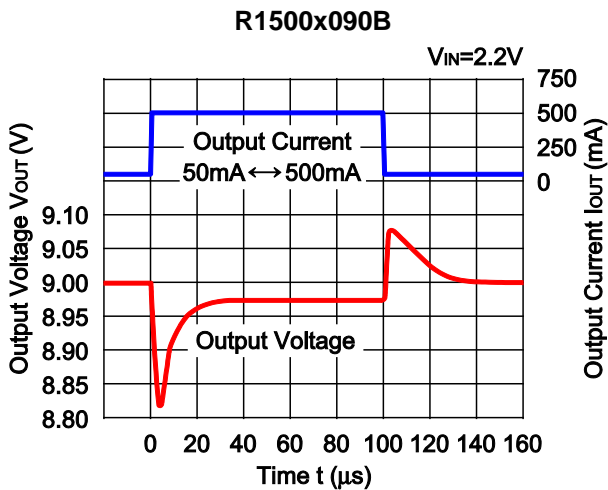
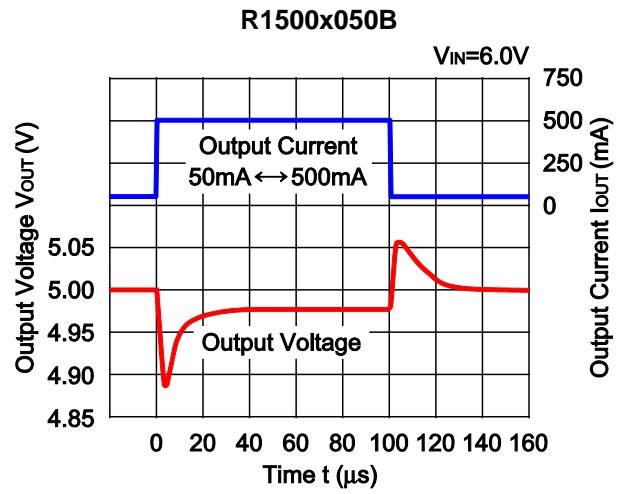
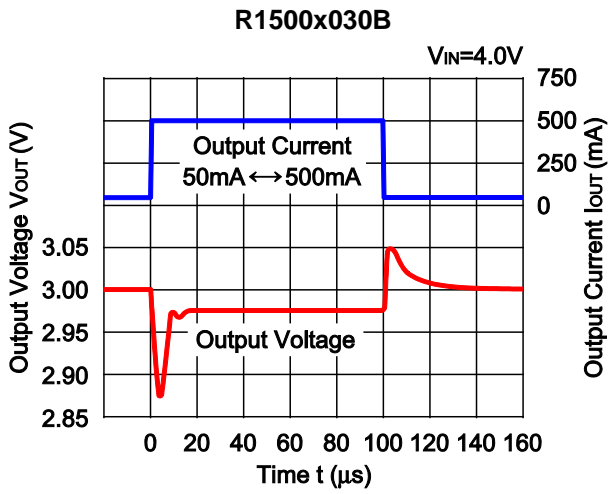
10) Input Transient Response (C1=none, C2=Ceramic 10 μ F, I_{OUT}=100mA, tr=tf=10 μ s, T_{opt}=25 $^{\circ}$ C)



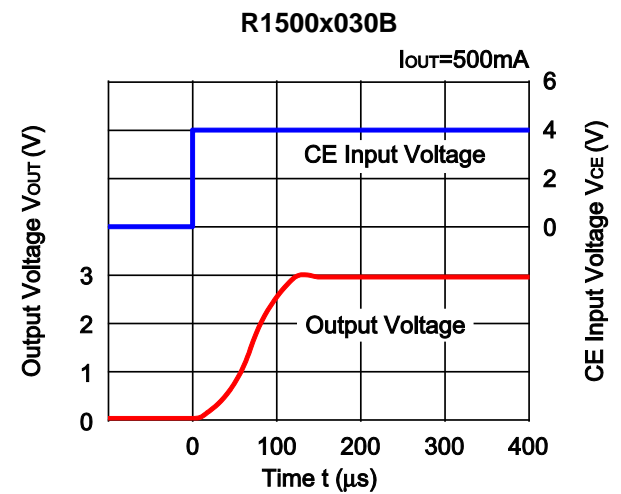
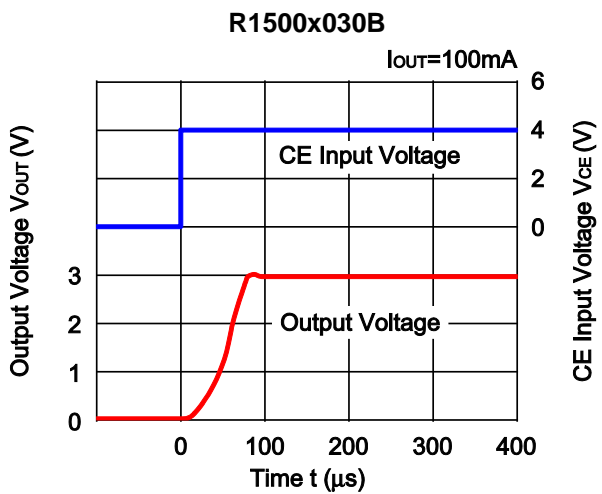
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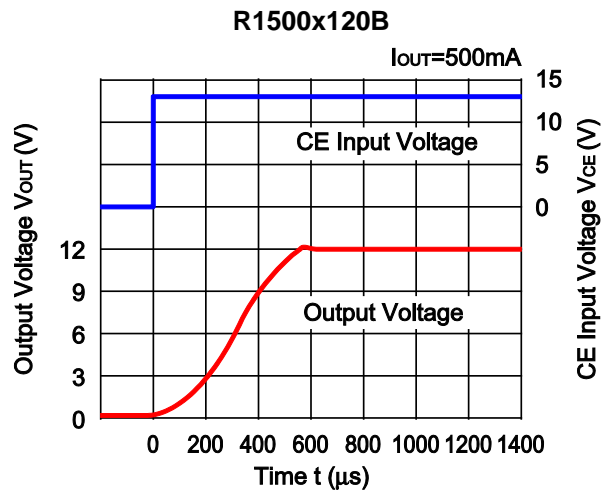
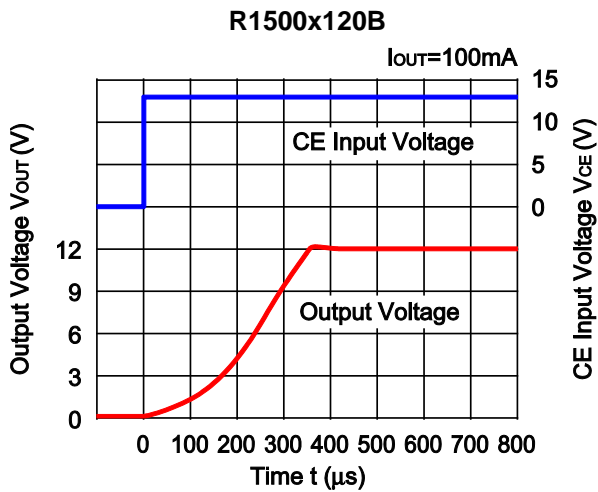
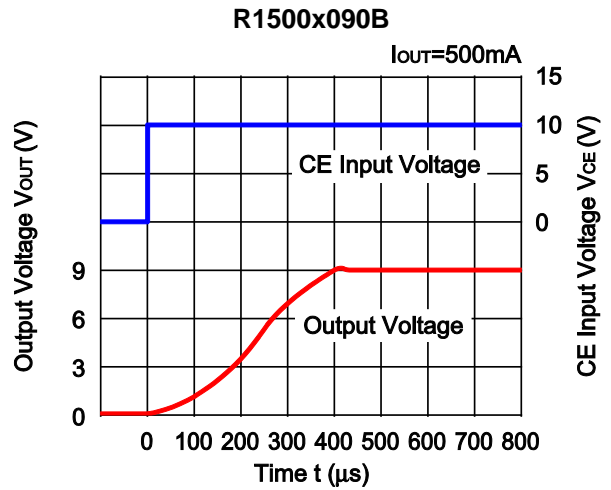
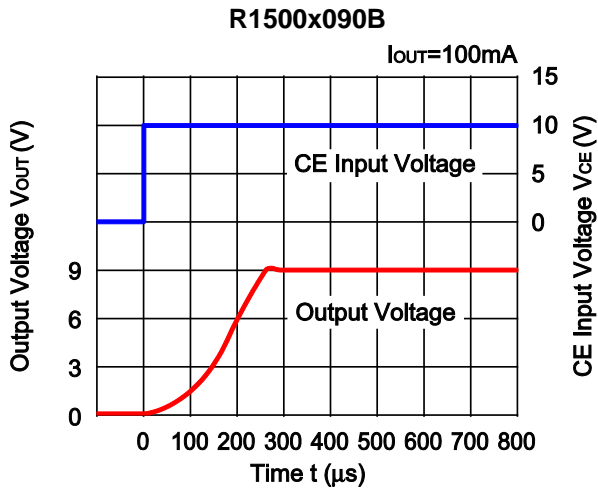
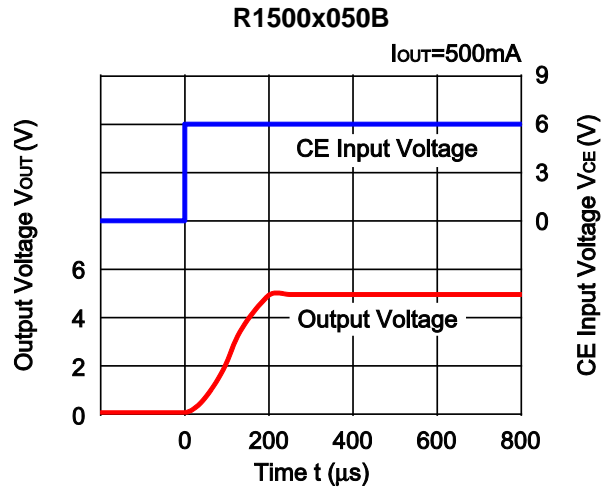
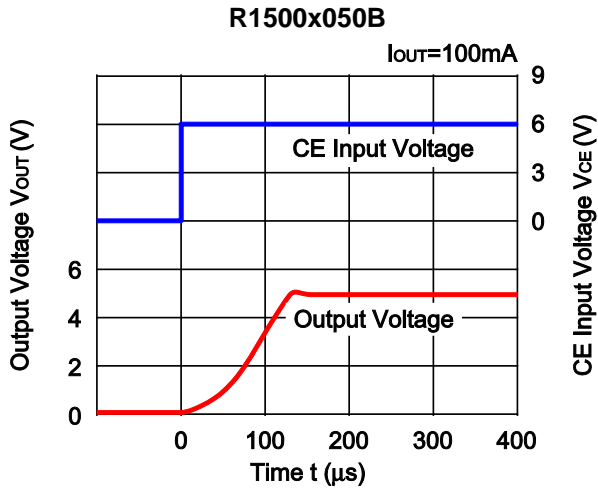
NO.EA-151-160701

11) Load Transient Response (C1=Ceramic 0.47μF, C2=Ceramic 10μF, tr=tf=0.5μs, Topt=25°C)



12) Turn On Speed with CE pin (C1=Ceramic 0.47μF, C2=Ceramic 10μF, Topt=25°C)

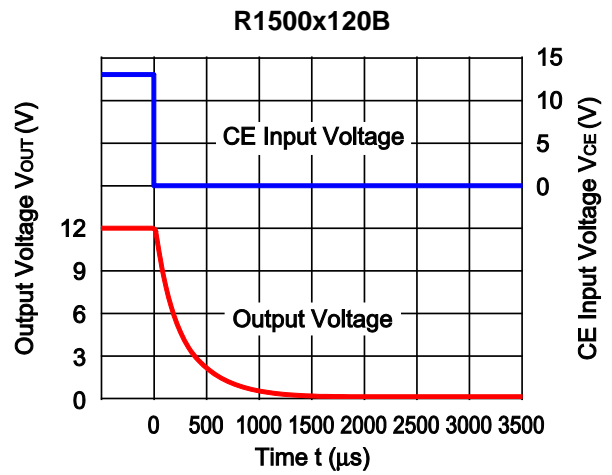
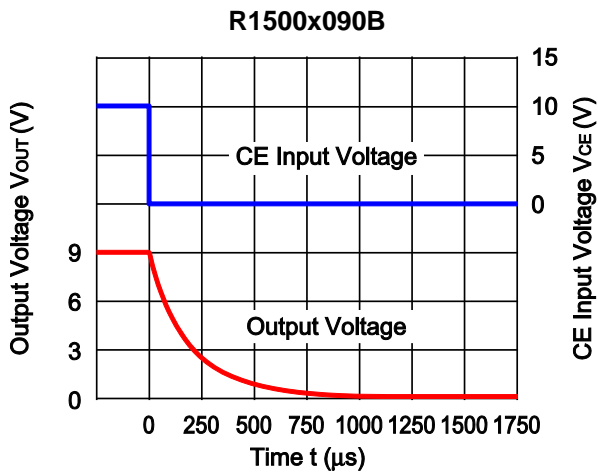
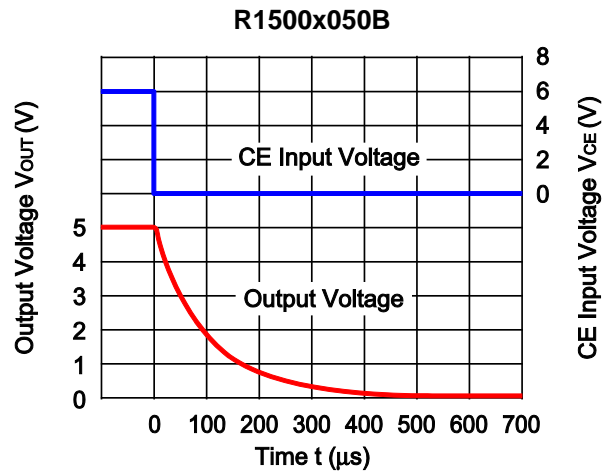
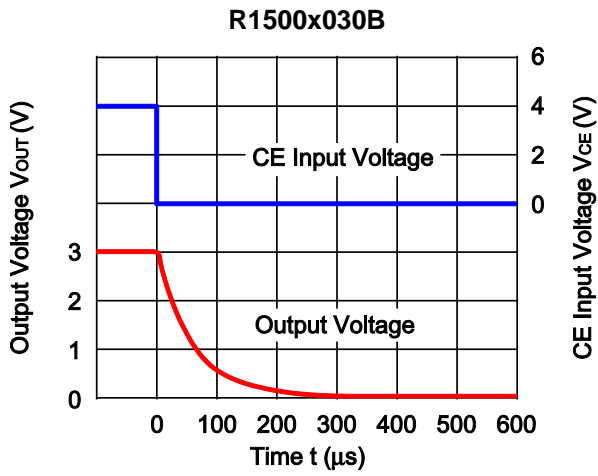




R1500x

NO.EA-151-160701

13) Turn Off Speed with CE (C1=Ceramic 0.47 μ F, C2=Ceramic 10 μ F, I_{OUT}=500mA, T_{opt}=25°C)



ESR vs. Output Current

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below.

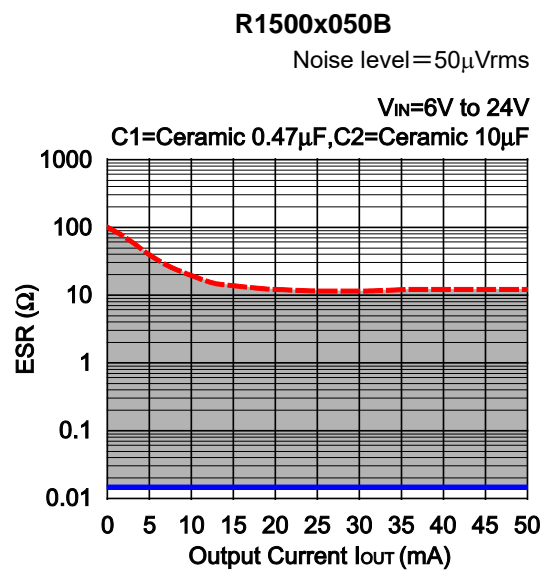
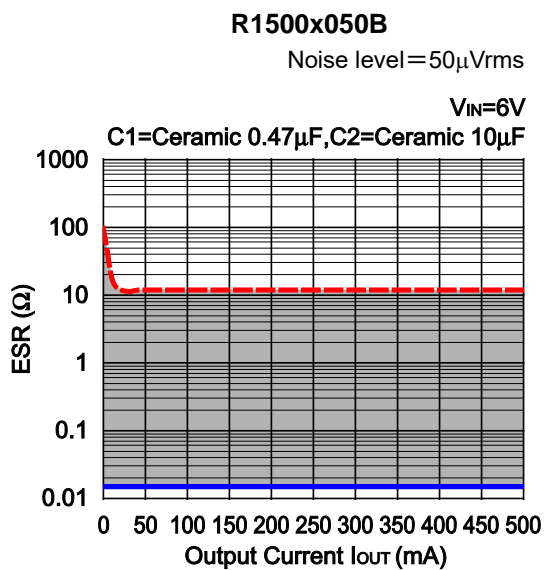
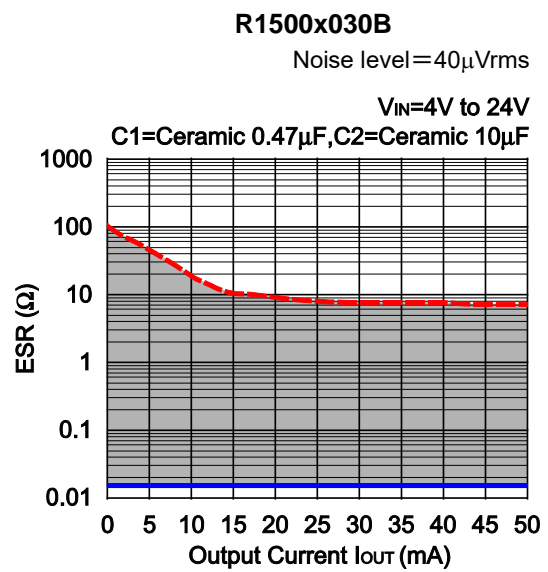
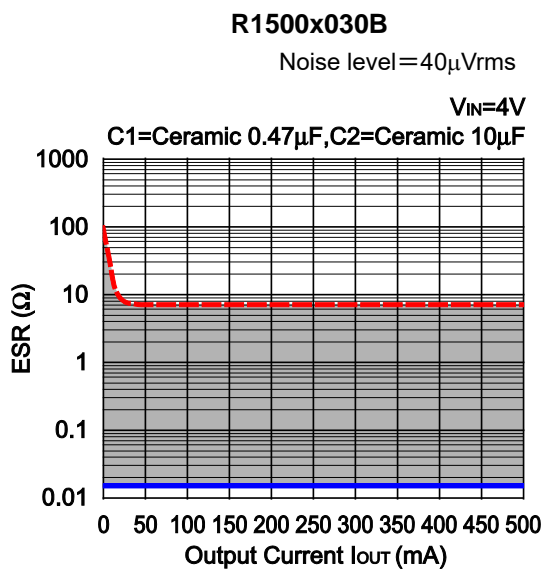
The conditions when the white noise level is under the specified certain level are marked as the hatched area in the graph.

Measurement conditions

Input Voltage : $V_{OUT} + 1V$

Frequency Band : 10Hz to 1MHz

Temperature : $-40^{\circ}C$ to $105^{\circ}C$



* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

R1500x

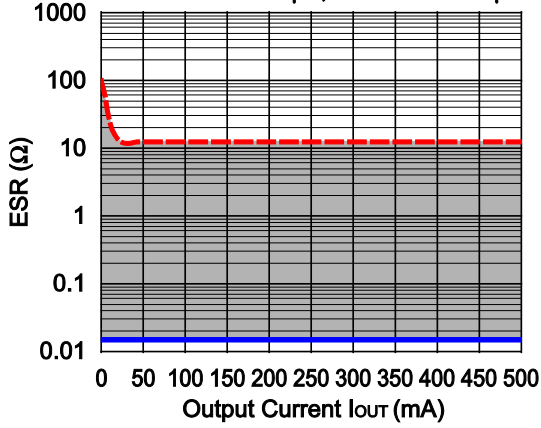
NO.EA-151-160701

R1500x090B

Noise level=

$V_{IN}=10V$

C1=Ceramic 0.47 μ F,C2=Ceramic 10 μ F

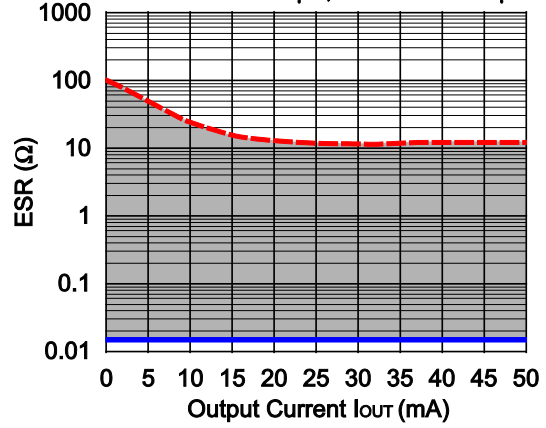


R1500x090B

Noise level=120 μ Vrms

$V_{IN}=10V$ to 24V

C1=Ceramic 0.47 μ F,C2=Ceramic 10 μ F

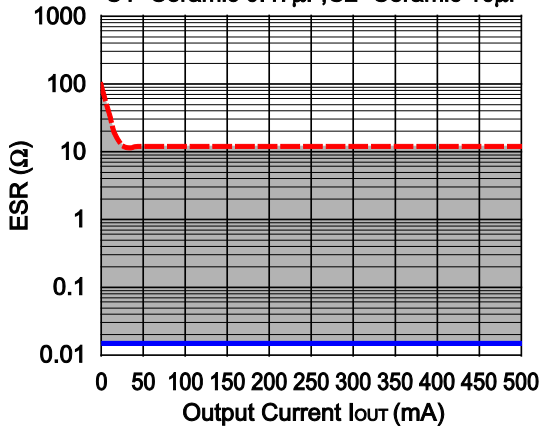


R1500x120B

Noise level=140 μ Vrms

$V_{IN}=13V$

C1=Ceramic 0.47 μ F,C2=Ceramic 10 μ F

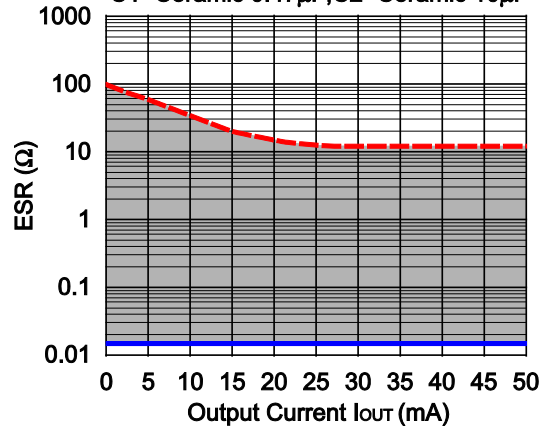


R1500x120B

Noise level=140 μ Vrms

$V_{IN}=13V$ to 24V

C1=Ceramic 0.47 μ F,C2=Ceramic 10 μ F



PACKAGE INFORMATION

Power Dissipation (SOT-89-5)

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

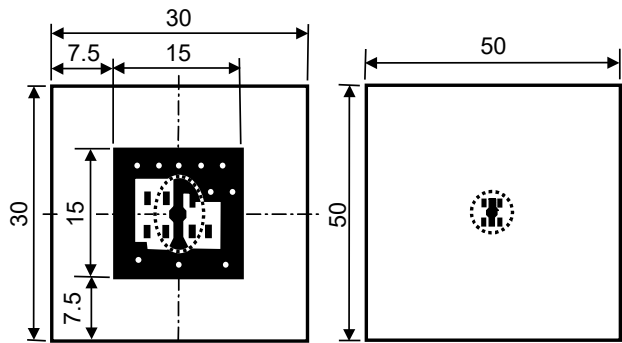
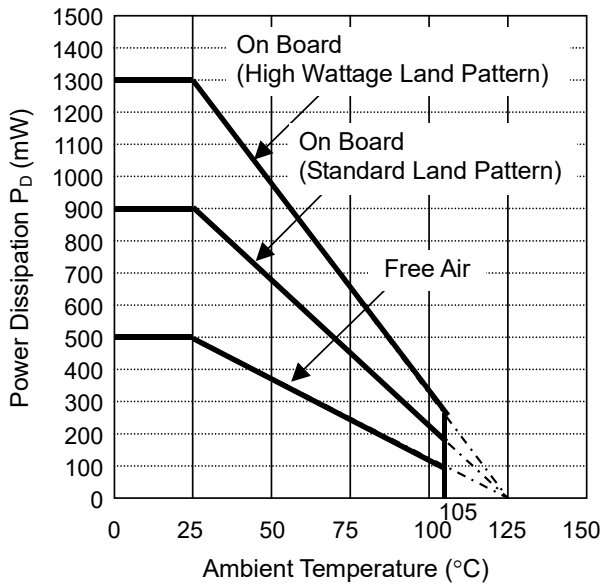
Measurement Conditions

| | 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 × 30mm × 1.6mm | 50mm × 50mm × 1.6mm |
| Copper Ratio | Top side : Approx. 20% , Back side : Approx. 100% | Top side : Approx. 10% , Back side : Approx. 100% |
| Through-hole | φ0.85mm × 10pcs | - |

Measurement Result

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

| | 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 |



High Wattage

Standard

Measurement Board Pattern

○ IC Mount Area (Unit : mm)

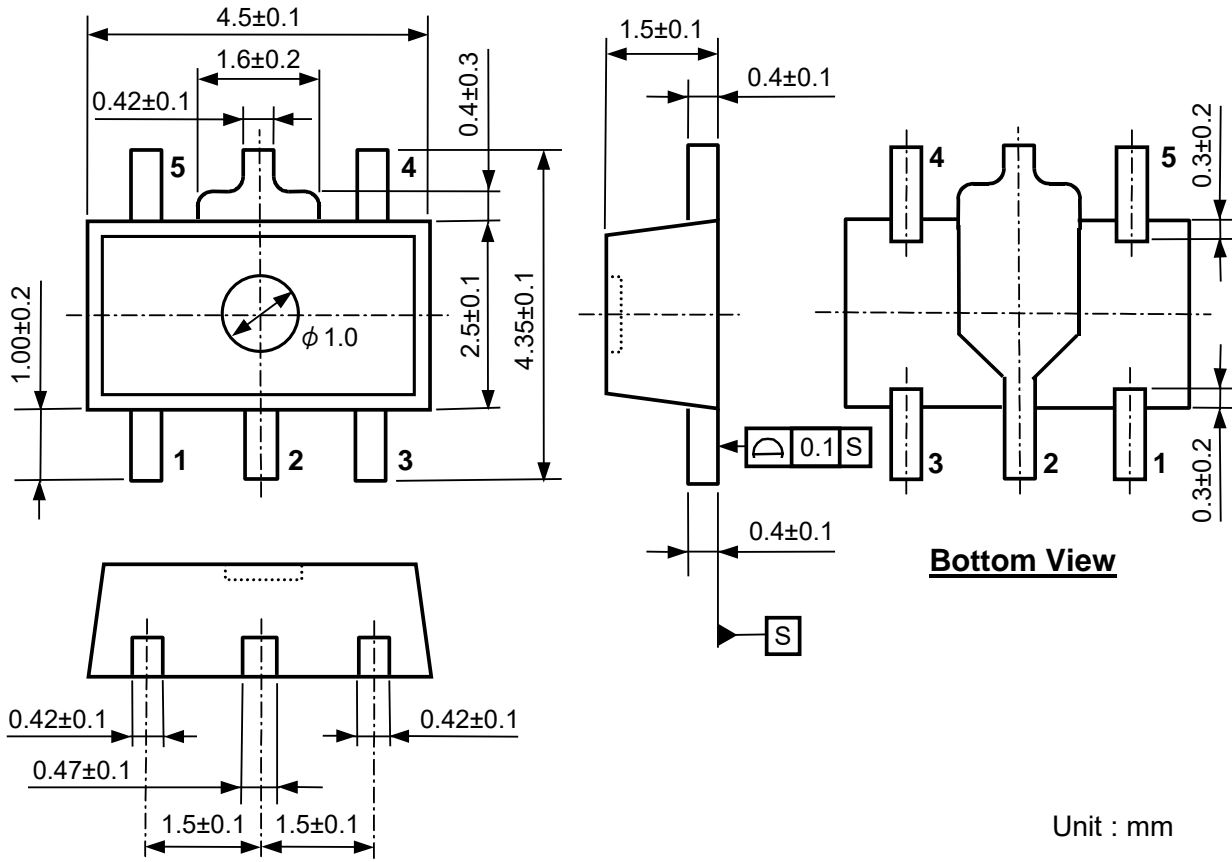
Power Dissipation

* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

R1500x

NO.EA-151-160701

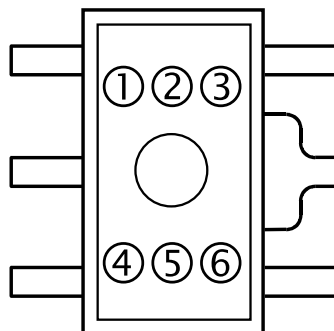
Package Dimensions (SOT-89-5)



Unit : mm

Mark Specifications (SOT-89-5)

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



* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

R1500x

NO.EA-151-160701

R1500H Series marking list table

PKG : SOT-89-5

| Product Name | ①②③④ | Vset |
|--------------|----------------|------|
| R1500H030B | R 0 3 0 | 3.0V |
| R1500H031B | R 0 3 1 | 3.1V |
| R1500H032B | R 0 3 2 | 3.2V |
| R1500H033B | R 0 3 3 | 3.3V |
| R1500H034B | R 0 3 4 | 3.4V |
| R1500H035B | R 0 3 5 | 3.5V |
| R1500H036B | R 0 3 6 | 3.6V |
| R1500H037B | R 0 3 7 | 3.7V |
| R1500H038B | R 0 3 8 | 3.8V |
| R1500H039B | R 0 3 9 | 3.9V |
| | | |
| R1500H040B | R 0 4 0 | 4.0V |
| R1500H041B | R 0 4 1 | 4.1V |
| R1500H042B | R 0 4 2 | 4.2V |
| R1500H043B | R 0 4 3 | 4.3V |
| R1500H044B | R 0 4 4 | 4.4V |
| R1500H045B | R 0 4 5 | 4.5V |
| R1500H046B | R 0 4 6 | 4.6V |
| R1500H047B | R 0 4 7 | 4.7V |
| R1500H048B | R 0 4 8 | 4.8V |
| R1500H049B | R 0 4 9 | 4.9V |
| | | |
| R1500H050B | R 0 5 0 | 5.0V |
| R1500H051B | R 0 5 1 | 5.1V |
| R1500H052B | R 0 5 2 | 5.2V |
| R1500H053B | R 0 5 3 | 5.3V |
| R1500H054B | R 0 5 4 | 5.4V |
| R1500H055B | R 0 5 5 | 5.5V |
| R1500H056B | R 0 5 6 | 5.6V |
| R1500H057B | R 0 5 7 | 5.7V |
| R1500H058B | R 0 5 8 | 5.8V |
| R1500H059B | R 0 5 9 | 5.9V |
| | | |
| | | |

| Product Name | ①②③④ | Vset |
|--------------|----------------|------|
| R1500H060B | R 0 6 0 | 6.0V |
| R1500H061B | R 0 6 1 | 6.1V |
| R1500H062B | R 0 6 2 | 6.2V |
| R1500H063B | R 0 6 3 | 6.3V |
| R1500H064B | R 0 6 4 | 6.4V |
| R1500H065B | R 0 3 5 | 6.5V |
| R1500H066B | R 0 6 6 | 6.6V |
| R1500H067B | R 0 6 7 | 6.7V |
| R1500H068B | R 0 6 8 | 6.8V |
| R1500H069B | R 0 6 9 | 6.9V |
| | | |
| R1500H070B | R 0 7 0 | 7.0V |
| R1500H071B | R 0 7 1 | 7.1V |
| R1500H072B | R 0 7 2 | 7.2V |
| R1500H073B | R 0 7 3 | 7.3V |
| R1500H074B | R 0 7 4 | 7.4V |
| R1500H075B | R 0 7 5 | 7.5V |
| R1500H076B | R 0 7 6 | 7.6V |
| R1500H077B | R 0 7 7 | 7.7V |
| R1500H078B | R 0 7 8 | 7.8V |
| R1500H079B | R 0 7 9 | 7.9V |
| | | |
| R1500H080B | R 0 8 0 | 8.0V |
| R1500H081B | R 0 8 1 | 8.1V |
| R1500H082B | R 0 8 2 | 8.2V |
| R1500H083B | R 0 8 3 | 8.3V |
| R1500H084B | R 0 8 4 | 8.4V |
| R1500H085B | R 0 8 5 | 8.5V |
| R1500H086B | R 0 8 6 | 8.6V |
| R1500H087B | R 0 8 7 | 8.7V |
| R1500H088B | R 0 8 8 | 8.8V |
| R1500H089B | R 0 8 9 | 8.9V |
| | | |
| | | |

| Product Name | ①②③④ | Vset |
|--------------|----------------|-------|
| R1500H090B | R 0 9 0 | 9.0V |
| R1500H091B | R 0 9 1 | 9.1V |
| R1500H092B | R 0 9 2 | 9.2V |
| R1500H093B | R 0 9 3 | 9.3V |
| R1500H094B | R 0 9 4 | 9.4V |
| R1500H095B | R 0 9 5 | 9.5V |
| R1500H096B | R 0 9 6 | 9.6V |
| R1500H097B | R 0 9 7 | 9.7V |
| R1500H098B | R 0 9 8 | 9.8V |
| R1500H099B | R 0 9 9 | 9.9V |
| | | |
| R1500H100B | R 1 0 0 | 10.0V |
| R1500H101B | R 1 0 1 | 10.1V |
| R1500H102B | R 1 0 2 | 10.2V |
| R1500H103B | R 1 0 3 | 10.3V |
| R1500H104B | R 1 0 4 | 10.4V |
| R1500H105B | R 1 0 5 | 10.5V |
| R1500H106B | R 1 0 6 | 10.6V |
| R1500H107B | R 1 0 7 | 10.7V |
| R1500H108B | R 1 0 8 | 10.8V |
| R1500H109B | R 1 0 9 | 10.9V |
| | | |
| R1500H110B | R 1 1 0 | 11.0V |
| R1500H111B | R 1 1 1 | 11.1V |
| R1500H112B | R 1 1 2 | 11.2V |
| R1500H113B | R 1 1 3 | 11.3V |
| R1500H114B | R 1 1 4 | 11.4V |
| R1500H115B | R 1 1 5 | 11.5V |
| R1500H116B | R 1 1 6 | 11.6V |
| R1500H117B | R 1 1 7 | 11.7V |
| R1500H118B | R 1 1 8 | 11.8V |
| R1500H119B | R 1 1 9 | 11.9V |
| | | |
| R1500H120B | R 1 2 0 | 12.0V |

* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

R1500x

NO.EA-151-160701

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.

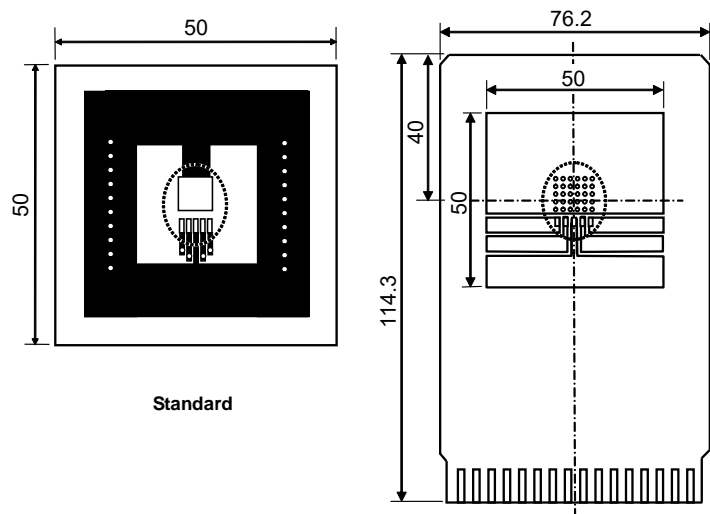
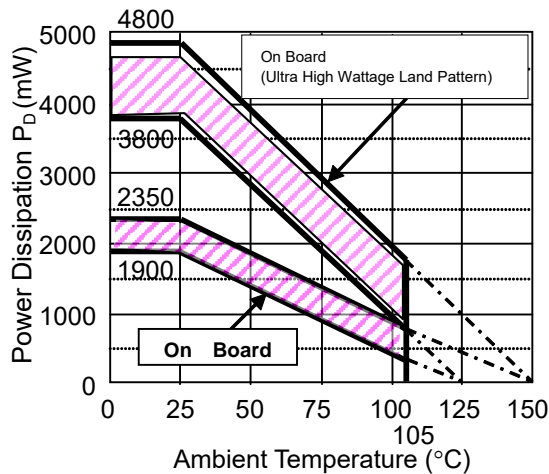
* Measurement conditions

| | 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

($T_a=25^\circ\text{C}$, $T_{j\text{max}}=125^\circ\text{C}$)

| | Standard Land Pattern | Ultra High Wattage Land Pattern |
|--------------------|---|---|
| Power Dissipation | 1900mW | 3800mW |
| Thermal Resistance | $\theta_{ja}=(125-25^\circ\text{C})/1.9\text{W}=53^\circ\text{C/W}$ | $\theta_{ja}=(125-25^\circ\text{C})/3.8\text{W}=26^\circ\text{C/W}$ |
| | $\theta_{jc}=17^\circ\text{C/W}$ | $\theta_{jc}=7^\circ\text{C/W}$ |

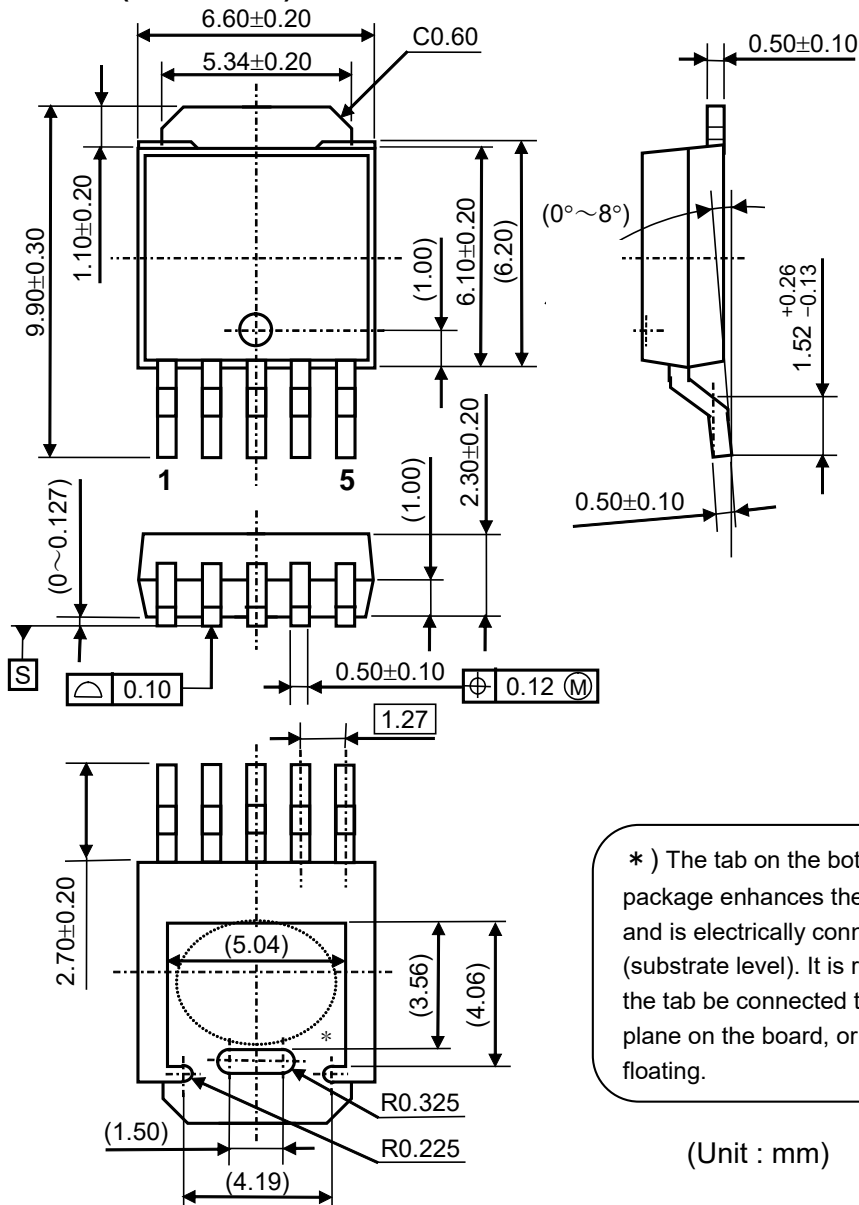


Measurement Board Pattern
○ IC Mount Area (Unit: mm)

The above graph shows the Power Dissipation of the package based on $T_{j\text{max}}=125^\circ\text{C}$ and $T_{j\text{max}}=150^\circ\text{C}$.
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 |

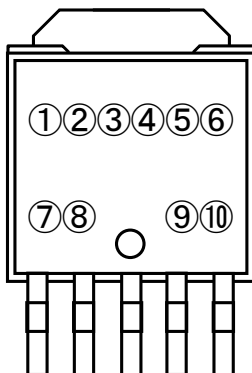
Package Dimensions (TO-252-5-P2)



*) 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)



- ① ② ③ ④ ⑤ ⑥ ⑦ : Product Code ... Refer to the mark list table.
- ⑧ : Blank
- ⑨ ⑩ : Lot Number ... Alphanumeric Serial Number

* R1500J (TO-252-5-P2) is the discontinued product as of July, 2016.

R1500x

NO.EA-151-160701

R1500J Series marking list table

PKG : TO-252-5-P2

| Product Name | ①②③④⑤⑥⑦ | Vset | Product Name | ①②③④⑤⑥⑦ | Vset | Product Name | ①②③④⑤⑥⑦ | Vset |
|--------------|---------------|------|--------------|---------------|------|--------------|---------------|-------|
| R1500J030B | C 1 J 0 3 0 B | 3.0V | R1500J060B | C 1 J 0 6 0 B | 6.0V | R1500J090B | C 1 J 0 9 0 B | 9.0V |
| R1500J031B | C 1 J 0 3 1 B | 3.1V | R1500J061B | C 1 J 0 6 1 B | 6.1V | R1500J091B | C 1 J 0 9 1 B | 9.1V |
| R1500J032B | C 1 J 0 3 2 B | 3.2V | R1500J062B | C 1 J 0 6 2 B | 6.2V | R1500J092B | C 1 J 0 9 2 B | 9.2V |
| R1500J033B | C 1 J 0 3 3 B | 3.3V | R1500J063B | C 1 J 0 6 3 B | 6.3V | R1500J093B | C 1 J 0 9 3 B | 9.3V |
| R1500J034B | C 1 J 0 3 4 B | 3.4V | R1500J064B | C 1 J 0 6 4 B | 6.4V | R1500J094B | C 1 J 0 9 4 B | 9.4V |
| R1500J035B | C 1 J 0 3 5 B | 3.5V | R1500J065B | C 1 J 0 6 5 B | 6.5V | R1500J095B | C 1 J 0 9 5 B | 9.5V |
| R1500J036B | C 1 J 0 3 6 B | 3.6V | R1500J066B | C 1 J 0 6 6 B | 6.6V | R1500J096B | C 1 J 0 9 6 B | 9.6V |
| R1500J037B | C 1 J 0 3 7 B | 3.7V | R1500J067B | C 1 J 0 6 7 B | 6.7V | R1500J097B | C 1 J 0 9 7 B | 9.7V |
| R1500J038B | C 1 J 0 3 8 B | 3.8V | R1500J068B | C 1 J 0 6 8 B | 6.8V | R1500J098B | C 1 J 0 9 8 B | 9.8V |
| R1500J039B | C 1 J 0 3 9 B | 3.9V | R1500J069B | C 1 J 0 6 9 B | 6.9V | R1500J099B | C 1 J 0 9 9 B | 9.9V |
| | | | | | | | | |
| R1500J040B | C 1 J 0 4 0 B | 4.0V | R1500J070B | C 1 J 0 7 0 B | 7.0V | R1500J100B | C 1 J 1 0 0 B | 10.0V |
| R1500J041B | C 1 J 0 4 1 B | 4.1V | R1500J071B | C 1 J 0 7 1 B | 7.1V | R1500J101B | C 1 J 1 0 1 B | 10.1V |
| R1500J042B | C 1 J 0 4 2 B | 4.2V | R1500J072B | C 1 J 0 7 2 B | 7.2V | R1500J102B | C 1 J 1 0 2 B | 10.2V |
| R1500J043B | C 1 J 0 4 3 B | 4.3V | R1500J073B | C 1 J 0 7 3 B | 7.3V | R1500J103B | C 1 J 1 0 3 B | 10.3V |
| R1500J044B | C 1 J 0 4 4 B | 4.4V | R1500J074B | C 1 J 0 7 4 B | 7.4V | R1500J104B | C 1 J 1 0 4 B | 10.4V |
| R1500J045B | C 1 J 0 4 5 B | 4.5V | R1500J075B | C 1 J 0 7 5 B | 7.5V | R1500J105B | C 1 J 1 0 5 B | 10.5V |
| R1500J046B | C 1 J 0 4 6 B | 4.6V | R1500J076B | C 1 J 0 7 6 B | 7.6V | R1500J106B | C 1 J 1 0 6 B | 10.6V |
| R1500J047B | C 1 J 0 4 7 B | 4.7V | R1500J077B | C 1 J 0 7 7 B | 7.7V | R1500J107B | C 1 J 1 0 7 B | 10.7V |
| R1500J048B | C 1 J 0 4 8 B | 4.8V | R1500J078B | C 1 J 0 7 8 B | 7.8V | R1500J108B | C 1 J 1 0 8 B | 10.8V |
| R1500J049B | C 1 J 0 4 9 B | 4.9V | R1500J079B | C 1 J 0 7 9 B | 7.9V | R1500J109B | C 1 J 1 0 9 B | 10.9V |
| | | | | | | | | |
| R1500J050B | C 1 J 0 5 0 B | 5.0V | R1500J080B | C 1 J 0 8 0 B | 8.0V | R1500J110B | C 1 J 1 1 0 B | 11.0V |
| R1500J051B | C 1 J 0 5 1 B | 5.1V | R1500J081B | C 1 J 0 8 1 B | 8.1V | R1500J111B | C 1 J 1 1 1 B | 11.1V |
| R1500J052B | C 1 J 0 5 2 B | 5.2V | R1500J082B | C 1 J 0 8 2 B | 8.2V | R1500J112B | C 1 J 1 1 2 B | 11.2V |
| R1500J053B | C 1 J 0 5 3 B | 5.3V | R1500J083B | C 1 J 0 8 3 B | 8.3V | R1500J113B | C 1 J 1 1 3 B | 11.3V |
| R1500J054B | C 1 J 0 5 4 B | 5.4V | R1500J084B | C 1 J 0 8 4 B | 8.4V | R1500J114B | C 1 J 1 1 4 B | 11.4V |
| R1500J055B | C 1 J 0 5 5 B | 5.5V | R1500J085B | C 1 J 0 8 5 B | 8.5V | R1500J115B | C 1 J 1 1 5 B | 11.5V |
| R1500J056B | C 1 J 0 5 6 B | 5.6V | R1500J086B | C 1 J 0 8 6 B | 8.6V | R1500J116B | C 1 J 1 1 6 B | 11.6V |
| R1500J057B | C 1 J 0 5 7 B | 5.7V | R1500J087B | C 1 J 0 8 7 B | 8.7V | R1500J117B | C 1 J 1 1 7 B | 11.7V |
| R1500J058B | C 1 J 0 5 8 B | 5.8V | R1500J088B | C 1 J 0 8 8 B | 8.8V | R1500J118B | C 1 J 1 1 8 B | 11.8V |
| R1500J059B | C 1 J 0 5 9 B | 5.9V | R1500J089B | C 1 J 0 8 9 B | 8.9V | R1500J119B | C 1 J 1 1 9 B | 11.9V |
| | | | | | | | | |
| | | | | | | R1500J120B | C 1 J 1 2 0 B | 12.0V |



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7. Anti-radiation design is not implemented in the products described in this document.
8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
9. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.
11. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



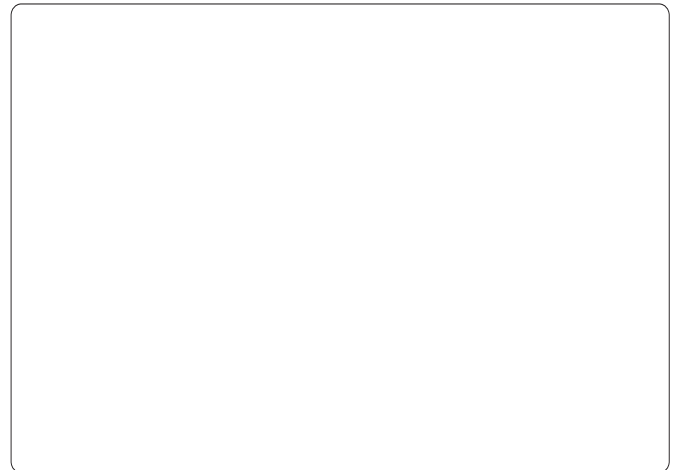
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