

50 mA Voltage Regulator (Wide Input Voltage Range) for Automotive Applications

NO. EC-153-150701

OUTLINE

The R1515x series are CMOS-based positive voltage regulator (VR) ICs featuring 50mA output current. The R1515xxxxB has features of high input voltage and ultra-low supply current. A peak current limit circuit, a short current limit circuit, and a thermal shutdown circuit are built in the R1515x series.

The operating temperature is -40°C to 105°C and the maximum input voltage is 36V, the R1515x series are very suitable for power source of car accessories.

The regulator output voltage is fixed in the R1515xxxxB and can be selected with a step of 0.1V in the range of 2.0V to 12.0V. Output voltage accuracy is $\pm 2\%$.

The packages for these ICs are the SOT-89-5 for space saving and the HSOP-6J for higher power applications.

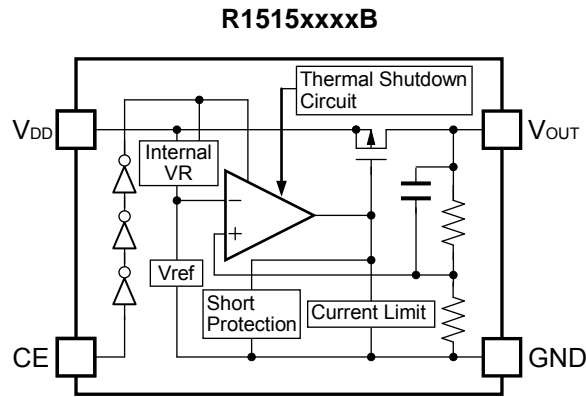
FEATURES

- Input Voltage Range (Maximum Rating)..... 4V to 36V (50V)
- Supply Current Typ. $9\mu\text{A}$
- Standby Current..... Typ. $0.1\mu\text{A}$
- Temperature-Drift Coefficient of Output Voltage ... Typ. $\pm 100\text{ppm}/^{\circ}\text{C}$
- Output Current Min. 50mA ($V_{\text{IN}}=V_{\text{OUT}}+3.0\text{V}$)
- Line Regulation Typ. 0.05%/V
- Output Voltage Accuracy..... $\pm 2\%$
- Packages SOT-89-5, HSOP-6J
- Output Voltage Range..... 2.0V to 12.0V (0.1V step)
- Built-in Peak Current Limit Circuit
- Built-in Short Current Limit Circuit Typ. 50mA
- Built-in Thermal Shutdown Circuit
- Operating Temperature -40°C to 105°C

APPLICATIONS

- Power source for car accessories such as car audio equipment, car navigation system, and ETC system.
- Power source for ECUs such as EV inverter and battery charge control unit.

BLOCK DIAGRAM



SELECTION GUIDE

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

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|------------------|----------|-------------------|---------|--------------|
| R1515HxxxB-T1-#E | SOT-89-5 | 1,000 pcs | Yes | Yes |
| R1515SxxxB-E2-#E | HSOP-6J | 1,000 pcs | Yes | Yes |

xxx : The output voltage can be designated in the range of 2.0V (020) to 12.0V (120) in 0.1V step.

: Specify Automotive Class Code

| | Operating Temperature Range | Guaranteed Specs Temperature Range | Screening |
|---|-----------------------------|------------------------------------|--------------------------|
| A | -40°C to 105°C | 25°C | High Temperature |
| J | -40°C to 105°C | 25°C | High and Low Temperature |

PIN DESCRIPTIONS



• SOT-89-5

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

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

• HSOP-6J

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

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

R1515x

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ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | | Rating | Unit | |
|-----------|----------------------------------|----------|---------------------------------|------|----|
| V_{IN} | Input Voltage | | -0.3~50 | V | |
| V_{IN} | Peak Input Voltage ^{*1} | | 60 | V | |
| V_{CE} | Input Voltage (CE Pin) | | -0.3~ $V_{IN}+0.3\leq 50$ | V | |
| V_{OUT} | Output Voltage | | -0.3~ $V_{IN}+0.3\leq 50$ | V | |
| I_{OUT} | Output Current | | 150 | mA | |
| P_D | Power Dissipation ^{*2} | SOT-89-5 | Standard Land Pattern | 900 | mW |
| | | | High Wattage Land Pattern | 1300 | |
| | | HSOP-6J | Standard Land Pattern | 1700 | |
| | | | Ultra High Wattage Land Pattern | 2700 | |
| T_j | Junction Temperature | | -40 to 125 | °C | |
| T_{stg} | Storage Temperature Range | | -55 to 125 | °C | |

^{*1} Duration time: 200ms

^{*2} Refer to *PACKAGE INFORMATION* for detailed 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

| Symbol | Item | Rating | Unit |
|----------|-----------------------------|------------|------|
| V_{IN} | Input Voltage | 4 to 36 | V |
| T_a | Operating Temperature Range | -40 to 105 | °C |

RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such 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

The specifications surrounded by \square are guaranteed by design engineering at $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$.

R1515xxxxB

($T_a=25^{\circ}\text{C}$)

| Symbol | Item | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------------------------|--|---|-----------------------|----------------|-----------------------|
| I_{SS} | Supply Current | $V_{IN}=V_{OUT}+3.0\text{V}$, $I_{OUT}=0\text{mA}$ | | 9 | $\square 20$ | μA |
| $I_{standby}$ | Standby Current | $V_{IN}=36\text{V}$, $V_{CE}=0\text{V}$ | | 0.1 | $\square 1.0$ | μA |
| V_{OUT} | Output Voltage | $V_{IN}=V_{OUT}+3.0\text{V}$, $I_{OUT}=1\text{mA}$ | $T_a = 25^{\circ}\text{C}$ | $\times 0.98$ | $\times 1.02$ | V |
| | | | $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ | $\square \times 0.97$ | | $\square \times 1.03$ |
| I_{OUT} | Output Current | $V_{IN}=V_{OUT}+3.0\text{V}$ | $\square 50$ | | | mA |
| $\Delta V_{OUT}/\Delta I_{OUT}$ | Load Regulation | $V_{IN}=V_{OUT}+3.0\text{V}$, $1\text{mA} \leq I_{OUT} \leq 40\text{mA}$ | Refer to the <i>Product-specific Electrical Characteristics</i> | | | |
| $\Delta V_{OUT}/\Delta V_{IN}$ | Line Regulation | $V_{OUT}+1.5\text{V} \leq V_{IN} \leq 36\text{V}$, $I_{OUT}=1\text{mA}$ | | 0.05 | $\square 0.20$ | %/V |
| V_{DIF} | Dropout Voltage | $I_{OUT}=20\text{mA}$ | Refer to the <i>Product-specific Electrical Characteristics</i> | | | |
| I_{SC} | Short Current Limit | $V_{OUT}=0\text{V}$ | | 50 | | mA |
| V_{CEH} | CE Input Voltage "H" | | $\square 1.5$ | | V_{IN} | V |
| V_{CEL} | CE Input Voltage "L" | | 0 | | $\square 0.3$ | V |
| T_{TSD} | Thermal Shutdown Temperature | Junction Temperature | | 150 | | $^{\circ}\text{C}$ |
| T_{TSR} | Thermal Shutdown Released Temperature | Junction Temperature | | 125 | | $^{\circ}\text{C}$ |

All test items listed under Electrical Characteristics are done under the pulse load condition ($T_j \approx T_a = 25^{\circ}\text{C}$).

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Product-specific Electrical Characteristics

The specifications surrounded by are guaranteed by design engineering at $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$

($T_a = 25^{\circ}\text{C}$)

| Product Name | V_{OUT} [V] | | | | | | $\Delta V_{\text{OUT}}/\Delta I_{\text{OUT}}$ [mV] | | V_{DIF} [V] | | |
|--------------|----------------------------|-------|-------|---|-------|---|--|--|----------------------|--|--|
| | $T_a = 25^{\circ}\text{C}$ | | | $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ | | | TYP. | MAX. | TYP. | $T_a = 25^{\circ}\text{C}$ | $-40^{\circ}\text{C} \leq T_a \leq 105^{\circ}\text{C}$ |
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | | | | MAX. | MAX. |
| R1515x020B | 1.960 | 2.000 | 2.040 | 1.940 | 2.000 | 2.060 | 10 | 25 | - | 2.00 | 2.00 |
| R1515x021B | 2.058 | 2.100 | 2.142 | 2.037 | 2.100 | 2.163 | | | | 1.90 | 1.90 |
| R1515x022B | 2.156 | 2.200 | 2.244 | 2.134 | 2.200 | 2.266 | | | | 1.80 | 1.80 |
| R1515x023B | 2.254 | 2.300 | 2.346 | 2.231 | 2.300 | 2.369 | | | | 1.70 | 1.70 |
| R1515x024B | 2.352 | 2.400 | 2.448 | 2.328 | 2.400 | 2.472 | | | | 1.60 | 1.60 |
| R1515x025B | 2.450 | 2.500 | 2.550 | 2.425 | 2.500 | 2.575 | | | | 1.50 | 1.50 |
| R1515x026B | 2.548 | 2.600 | 2.652 | 2.522 | 2.600 | 2.678 | | | | 1.40 | 1.40 |
| R1515x027B | 2.646 | 2.700 | 2.754 | 2.619 | 2.700 | 2.781 | | | | 1.30 | 1.30 |
| R1515x028B | 2.744 | 2.800 | 2.856 | 2.716 | 2.800 | 2.884 | | | | 1.20 | 1.20 |
| R1515x029B | 2.842 | 2.900 | 2.958 | 2.813 | 2.900 | 2.987 | | | | 1.10 | 1.10 |
| R1515x030B | 2.940 | 3.000 | 3.060 | 2.910 | 3.000 | 3.090 | | | | 1.00 | 1.00 |
| R1515x031B | 3.038 | 3.100 | 3.162 | 3.007 | 3.100 | 3.193 | | | | 0.90 | 0.90 |
| R1515x032B | 3.136 | 3.200 | 3.264 | 3.104 | 3.200 | 3.296 | | | | 0.80 | 0.80 |
| R1515x033B | 3.234 | 3.300 | 3.366 | 3.201 | 3.300 | 3.399 | | | | 0.70 | 0.70 |
| R1515x034B | 3.332 | 3.400 | 3.468 | 3.298 | 3.400 | 3.502 | | | | 0.60 | 0.70 |
| R1515x035B | 3.430 | 3.500 | 3.570 | 3.395 | 3.500 | 3.605 | | | 0.50 | 0.60 | |
| R1515x036B | 3.528 | 3.600 | 3.672 | 3.492 | 3.600 | 3.708 | | | 0.40 | 0.60 | |
| R1515x037B | 3.626 | 3.700 | 3.774 | 3.589 | 3.700 | 3.811 | | | 0.35 | 0.60 | 0.60 |
| R1515x038B | 3.724 | 3.800 | 3.876 | 3.686 | 3.800 | 3.914 | | | | | |
| R1515x039B | 3.822 | 3.900 | 3.978 | 3.783 | 3.900 | 4.017 | | | | | |
| R1515x040B | 3.920 | 4.000 | 4.080 | 3.880 | 4.000 | 4.120 | | | 0.25 | 0.40 | 0.50 |
| R1515x041B | 4.018 | 4.100 | 4.182 | 3.977 | 4.100 | 4.223 | | | | | |
| R1515x042B | 4.116 | 4.200 | 4.284 | 4.074 | 4.200 | 4.326 | | | | | |
| R1515x043B | 4.214 | 4.300 | 4.386 | 4.171 | 4.300 | 4.429 | | | | | |
| R1515x044B | 4.312 | 4.400 | 4.488 | 4.268 | 4.400 | 4.532 | | | | | |
| R1515x045B | 4.410 | 4.500 | 4.590 | 4.365 | 4.500 | 4.635 | | | | | |
| R1515x046B | 4.508 | 4.600 | 4.692 | 4.462 | 4.600 | 4.738 | | | | | |
| R1515x047B | 4.606 | 4.700 | 4.794 | 4.559 | 4.700 | 4.841 | | | | | |
| R1515x048B | 4.704 | 4.800 | 4.896 | 4.656 | 4.800 | 4.944 | | | | | |
| R1515x049B | 4.802 | 4.900 | 4.998 | 4.753 | 4.900 | 5.047 | | | | | |

(Ta=25°C)

| Product Name | V _{OUT} [V] | | | | | | ΔV _{OUT} /ΔI _{OUT} [mV] | | V _{DIF} [V] | | |
|--------------|----------------------|-------|-------|--------------------|-------|-------|---|------|----------------------|-----------|--------------------|
| | Ta = 25°C | | | -40°C ≤ Ta ≤ 105°C | | | TYP. | MAX. | TYP. | Ta = 25°C | -40°C ≤ Ta ≤ 105°C |
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | | | | MAX. | MAX. |
| R1515x050B | 4.900 | 5.000 | 5.100 | 4.850 | 5.000 | 5.150 | 20 | 35 | 0.20 | 0.35 | 0.40 |
| R1515x051B | 4.998 | 5.100 | 5.202 | 4.947 | 5.100 | 5.253 | | | | | |
| R1515x052B | 5.096 | 5.200 | 5.304 | 5.044 | 5.200 | 5.356 | | | | | |
| R1515x053B | 5.194 | 5.300 | 5.406 | 5.141 | 5.300 | 5.459 | | | | | |
| R1515x054B | 5.292 | 5.400 | 5.508 | 5.238 | 5.400 | 5.562 | | | | | |
| R1515x055B | 5.390 | 5.500 | 5.610 | 5.335 | 5.500 | 5.665 | | | | | |
| R1515x056B | 5.488 | 5.600 | 5.712 | 5.432 | 5.600 | 5.768 | | | | | |
| R1515x057B | 5.586 | 5.700 | 5.814 | 5.529 | 5.700 | 5.871 | | | | | |
| R1515x058B | 5.684 | 5.800 | 5.916 | 5.626 | 5.800 | 5.974 | | | | | |
| R1515x059B | 5.782 | 5.900 | 6.018 | 5.723 | 5.900 | 6.077 | | | | | |
| R1515x060B | 5.880 | 6.000 | 6.120 | 5.820 | 6.000 | 6.180 | | | | | |
| R1515x061B | 5.978 | 6.100 | 6.222 | 5.917 | 6.100 | 6.283 | | | | | |
| R1515x062B | 6.076 | 6.200 | 6.324 | 6.014 | 6.200 | 6.386 | | | | | |
| R1515x063B | 6.174 | 6.300 | 6.426 | 6.111 | 6.300 | 6.489 | | | | | |
| R1515x064B | 6.272 | 6.400 | 6.528 | 6.208 | 6.400 | 6.592 | | | | | |
| R1515x065B | 6.370 | 6.500 | 6.630 | 6.305 | 6.500 | 6.695 | | | | | |
| R1515x066B | 6.468 | 6.600 | 6.732 | 6.402 | 6.600 | 6.798 | | | | | |
| R1515x067B | 6.566 | 6.700 | 6.834 | 6.499 | 6.700 | 6.901 | | | | | |
| R1515x068B | 6.664 | 6.800 | 6.936 | 6.596 | 6.800 | 7.004 | | | | | |
| R1515x069B | 6.762 | 6.900 | 7.038 | 6.693 | 6.900 | 7.107 | | | | | |
| R1515x070B | 6.860 | 7.000 | 7.140 | 6.790 | 7.000 | 7.210 | | | | | |
| R1515x071B | 6.958 | 7.100 | 7.242 | 6.887 | 7.100 | 7.313 | | | | | |
| R1515x072B | 7.056 | 7.200 | 7.344 | 6.984 | 7.200 | 7.416 | | | | | |
| R1515x073B | 7.154 | 7.300 | 7.446 | 7.081 | 7.300 | 7.519 | | | | | |
| R1515x074B | 7.252 | 7.400 | 7.548 | 7.178 | 7.400 | 7.622 | | | | | |
| R1515x075B | 7.350 | 7.500 | 7.650 | 7.275 | 7.500 | 7.725 | | | | | |
| R1515x076B | 7.448 | 7.600 | 7.752 | 7.372 | 7.600 | 7.828 | | | | | |
| R1515x077B | 7.546 | 7.700 | 7.854 | 7.469 | 7.700 | 7.931 | | | | | |
| R1515x078B | 7.644 | 7.800 | 7.956 | 7.566 | 7.800 | 8.034 | | | | | |
| R1515x079B | 7.742 | 7.900 | 8.058 | 7.663 | 7.900 | 8.137 | | | | | |
| R1515x080B | 7.840 | 8.000 | 8.160 | 7.760 | 8.000 | 8.240 | | | | | |
| R1515x081B | 7.938 | 8.100 | 8.262 | 7.857 | 8.100 | 8.343 | | | | | |
| R1515x082B | 8.036 | 8.200 | 8.364 | 7.954 | 8.200 | 8.446 | | | | | |
| R1515x083B | 8.134 | 8.300 | 8.466 | 8.051 | 8.300 | 8.549 | | | | | |
| R1515x084B | 8.232 | 8.400 | 8.568 | 8.148 | 8.400 | 8.652 | | | | | |
| R1515x085B | 8.330 | 8.500 | 8.670 | 8.245 | 8.500 | 8.755 | | | | | |
| R1515x086B | 8.428 | 8.600 | 8.772 | 8.342 | 8.600 | 8.858 | | | | | |
| R1515x087B | 8.526 | 8.700 | 8.874 | 8.439 | 8.700 | 8.961 | | | | | |
| R1515x088B | 8.624 | 8.800 | 8.976 | 8.536 | 8.800 | 9.064 | | | | | |
| R1515x089B | 8.722 | 8.900 | 9.078 | 8.633 | 8.900 | 9.167 | | | | | |

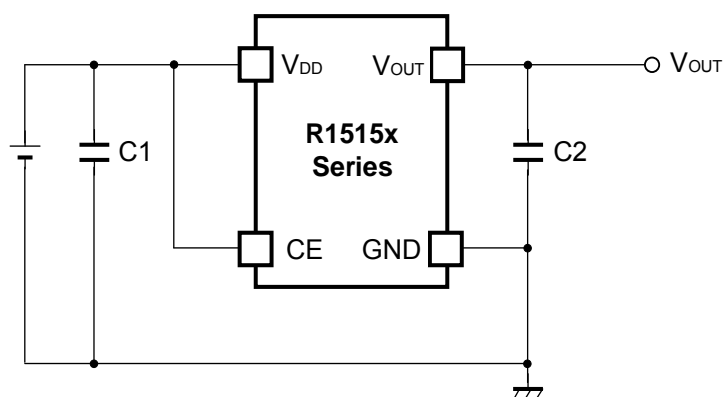
R1515x

NO.EC-153-150701

(Ta = 25°C)

| Product Name | V _{OUT} [V] | | | | | | ΔV _{OUT} /ΔI _{OUT} [mV] | | V _{DIF} [V] | | |
|--------------|----------------------|--------|--------|--------------------|--------|--------|---|------|----------------------|-----------|--------------------|
| | Ta = 25°C | | | -40°C ≤ Ta ≤ 105°C | | | TYP. | MAX. | TYP. | Ta = 25°C | -40°C ≤ Ta ≤ 105°C |
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | | | | MAX. | MAX. |
| R1515x090B | 8.820 | 9.000 | 9.180 | 8.730 | 9.000 | 9.270 | 20 | 35 | 0.20 | 0.35 | 0.40 |
| R1515x091B | 8.918 | 9.100 | 9.282 | 8.827 | 9.100 | 9.373 | | | | | |
| R1515x092B | 9.016 | 9.200 | 9.384 | 8.924 | 9.200 | 9.476 | | | | | |
| R1515x093B | 9.114 | 9.300 | 9.486 | 9.021 | 9.300 | 9.579 | | | | | |
| R1515x094B | 9.212 | 9.400 | 9.588 | 9.118 | 9.400 | 9.682 | | | | | |
| R1515x095B | 9.310 | 9.500 | 9.690 | 9.215 | 9.500 | 9.785 | | | | | |
| R1515x096B | 9.408 | 9.600 | 9.792 | 9.312 | 9.600 | 9.888 | | | | | |
| R1515x097B | 9.506 | 9.700 | 9.894 | 9.409 | 9.700 | 9.991 | | | | | |
| R1515x098B | 9.604 | 9.800 | 9.996 | 9.506 | 9.800 | 10.094 | | | | | |
| R1515x099B | 9.702 | 9.900 | 10.098 | 9.603 | 9.900 | 10.197 | | | | | |
| R1515x100B | 9.800 | 10.000 | 10.200 | 9.700 | 10.000 | 10.300 | | | | | |
| R1515x101B | 9.898 | 10.100 | 10.302 | 9.797 | 10.100 | 10.403 | | | | | |
| R1515x102B | 9.996 | 10.200 | 10.404 | 9.894 | 10.200 | 10.506 | | | | | |
| R1515x103B | 10.094 | 10.300 | 10.506 | 9.991 | 10.300 | 10.609 | | | | | |
| R1515x104B | 10.192 | 10.400 | 10.608 | 10.088 | 10.400 | 10.712 | | | | | |
| R1515x105B | 10.290 | 10.500 | 10.710 | 10.185 | 10.500 | 10.815 | | | | | |
| R1515x106B | 10.388 | 10.600 | 10.812 | 10.282 | 10.600 | 10.918 | | | | | |
| R1515x107B | 10.486 | 10.700 | 10.914 | 10.379 | 10.700 | 11.021 | | | | | |
| R1515x108B | 10.584 | 10.800 | 11.016 | 10.476 | 10.800 | 11.124 | | | | | |
| R1515x109B | 10.682 | 10.900 | 11.118 | 10.573 | 10.900 | 11.227 | | | | | |
| R1515x110B | 10.780 | 11.000 | 11.220 | 10.670 | 11.000 | 11.330 | | | | | |
| R1515x111B | 10.878 | 11.100 | 11.322 | 10.767 | 11.100 | 11.433 | | | | | |
| R1515x112B | 10.976 | 11.200 | 11.424 | 10.864 | 11.200 | 11.536 | | | | | |
| R1515x113B | 11.074 | 11.300 | 11.526 | 10.961 | 11.300 | 11.639 | | | | | |
| R1515x114B | 11.172 | 11.400 | 11.628 | 11.058 | 11.400 | 11.742 | | | | | |
| R1515x115B | 11.270 | 11.500 | 11.730 | 11.155 | 11.500 | 11.845 | | | | | |
| R1515x116B | 11.368 | 11.600 | 11.832 | 11.252 | 11.600 | 11.948 | | | | | |
| R1515x117B | 11.466 | 11.700 | 11.934 | 11.349 | 11.700 | 12.051 | | | | | |
| R1515x118B | 11.564 | 11.800 | 12.036 | 11.446 | 11.800 | 12.154 | | | | | |
| R1515x119B | 11.662 | 11.900 | 12.138 | 11.543 | 11.900 | 12.257 | | | | | |
| R1515x120B | 11.760 | 12.000 | 12.240 | 11.640 | 12.000 | 12.360 | | | | | |

TYPICAL APPLICATION



External Parts Example:

| | |
|----|-----------------------|
| C1 | 0.1 μ F (Ceramic) |
| C2 | 0.1 μ F (Ceramic) |

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation

Phase Compensation of the R1515x Series has been made internally for stable operation even though the load current would vary. Therefore, without the capacitors, C1 and C2, the output voltage is regulated, however, for more stable operation, use capacitors as C1 and C2. Especially, if the input line is long and impedance is high, C1 is necessary. Moreover, if you use rather large C2, transient response will be improved. Recommended value is in the range from 0.1 μ F to 10 μ F. Wiring should be made as short as possible.

Connect the capacitor, C1 between V_{DD} pin and GND pin and C2 between V_{OUT} and GND as close as possible.

GND wiring of mounting on board

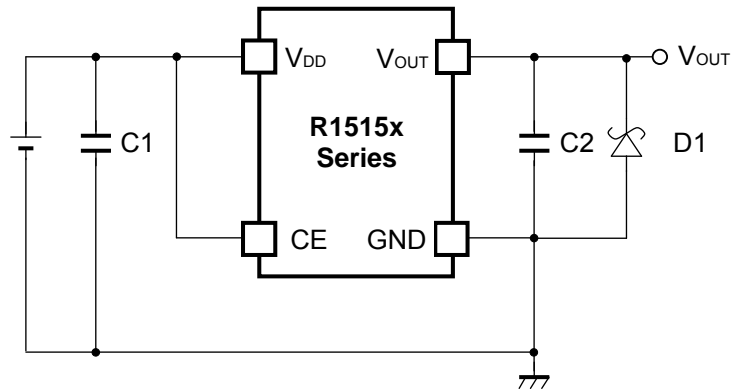
No.2 pin and No.4 pin of SOT-89-5 package must be wired to the GND plane. No.2 pin, No.4 pin and No.5 pin of HSOP-6J package must be wired to the GND plane when it is mounted on board.

Thermal Shutdown

Thermal shutdown function is included in the R1515x Series, if the junction temperature is equal or more than +150°C (Typ.), the operation of regulator would stop. After that, when the junction temperature is equal or less than +125°C (Typ.), the operation of regulator would restart. Unless the cause of rising temperature would remove, the regulator repeats on and off, and output waveform would be like consecutive pulses.

Chip Enable Circuit

Do not make voltage level of chip enable pin keep floating level, or in between V_{CEH} and V_{CEL}. Otherwise, the output voltage would be unstable or indefinite, or unexpected current would flow internally.

TYPICAL APPLICATION FOR IC CHIP BREAKDOWN PREVENTION

When a sudden surge of electrical current travels along the V_{OUT} pin and GND due to a short-circuit, electrical resonance of a circuit involving an output capacitor (C2) and a short circuit inductor generates a negative voltage and may damage the device or the load devices. Connecting a schottky diode (D1) between the V_{OUT} pin and GND has the effect of preventing damage to them.

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:

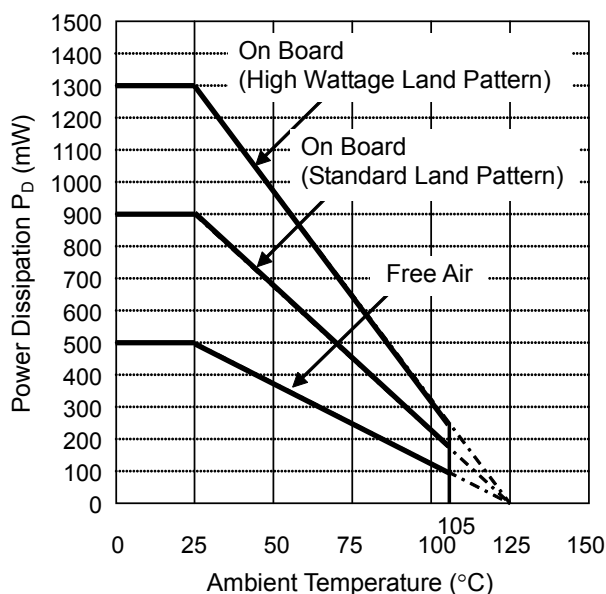
Measurement Conditions (SOT-89-5)

| | High Wattage Land Pattern | Standard Land Pattern |
|------------------|--|--|
| Environment | Mounting on board (Wind velocity = 0 m/s) | Mounting on board (Wind velocity = 0 m/s) |
| Board Material | Glass cloth epoxy plastic (Double sided) | Glass cloth epoxy plastic (Double sided) |
| Board Dimensions | 30 mm x 30 mm x 1.6 mm | 50 mm x 50 mm x 1.6 mm |
| Copper Ratio | Top side: Approx. 20% , Back side: Approx. 100% | Top side: Approx. 10% , Back side: Approx. 100% |
| Through-hole | $\phi 0.85$ mm x 10 pcs | - |

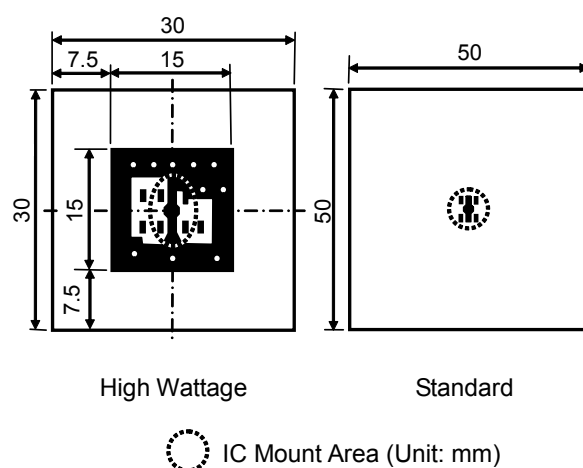
Measurement Result (SOT-89-5)

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

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



Power Dissipation vs. Ambience Temperature
(SOT-89-5)

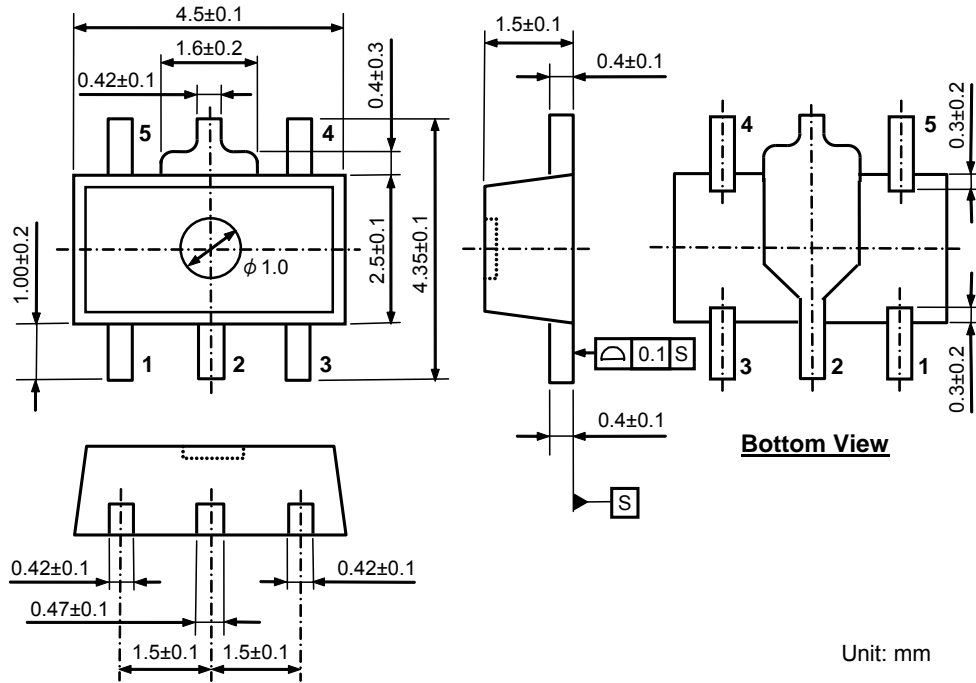


Measurement Board Pattern
(SOT-89-5)

R1515x

NO.EC-153-150701

PACKAGE DIMENSIONS (SOT-89-5)

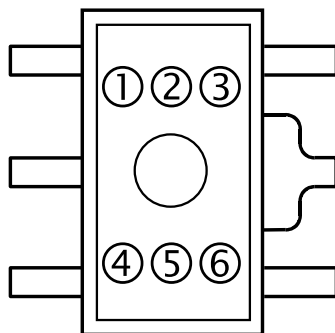


Unit: mm

MARK SPECIFICATION (SOT-89-5)

①②③④: Product Code ... Refer to R1515H MARK SPECIFICATION TABLE

⑤⑥: Lot Number ... Alphanumeric Serial Number



R1515H MARK SPECIFICATION TABLE (SOT-89-5)

| Product Name | ①②③④ | V _{SET} | Product Name | ①②③④ | V _{SET} | Product Name | ①②③④ | V _{SET} |
|--------------|---------|------------------|--------------|---------|------------------|--------------|---------|------------------|
| R1515H020B | N 0 2 0 | 2.0 V | R1515H060B | N 0 6 0 | 6.0 V | R1515H100B | N 1 0 0 | 10.0 V |
| R1515H021B | N 0 2 1 | 2.1 V | R1515H061B | N 0 6 1 | 6.1 V | R1515H101B | N 1 0 1 | 10.1 V |
| R1515H022B | N 0 2 2 | 2.2 V | R1515H062B | N 0 6 2 | 6.2 V | R1515H102B | N 1 0 2 | 10.2 V |
| R1515H023B | N 0 2 3 | 2.3 V | R1515H063B | N 0 6 3 | 6.3 V | R1515H103B | N 1 0 3 | 10.3 V |
| R1515H024B | N 0 2 4 | 2.4 V | R1515H064B | N 0 6 4 | 6.4 V | R1515H104B | N 1 0 4 | 10.4 V |
| R1515H025B | N 0 2 5 | 2.5 V | R1515H065B | N 0 6 5 | 6.5 V | R1515H105B | N 1 0 5 | 10.5 V |
| R1515H026B | N 0 2 6 | 2.6 V | R1515H066B | N 0 6 6 | 6.6 V | R1515H106B | N 1 0 6 | 10.6 V |
| R1515H027B | N 0 2 7 | 2.7 V | R1515H067B | N 0 6 7 | 6.7 V | R1515H107B | N 1 0 7 | 10.7 V |
| R1515H028B | N 0 2 8 | 2.8 V | R1515H068B | N 0 6 8 | 6.8 V | R1515H108B | N 1 0 8 | 10.8 V |
| R1515H029B | N 0 2 9 | 2.9 V | R1515H069B | N 0 6 9 | 6.9 V | R1515H109B | N 1 0 9 | 10.9 V |
| R1515H030B | N 0 3 0 | 3.0 V | R1515H070B | N 0 7 0 | 7.0 V | R1515H110B | N 1 1 0 | 11.0 V |
| R1515H031B | N 0 3 1 | 3.1 V | R1515H071B | N 0 7 1 | 7.1 V | R1515H111B | N 1 1 1 | 11.1 V |
| R1515H032B | N 0 3 2 | 3.2 V | R1515H072B | N 0 7 2 | 7.2 V | R1515H112B | N 1 1 2 | 11.2 V |
| R1515H033B | N 0 3 3 | 3.3 V | R1515H073B | N 0 7 3 | 7.3 V | R1515H113B | N 1 1 3 | 11.3 V |
| R1515H034B | N 0 3 4 | 3.4 V | R1515H074B | N 0 7 4 | 7.4 V | R1515H114B | N 1 1 4 | 11.4 V |
| R1515H035B | N 0 3 5 | 3.5 V | R1515H075B | N 0 7 5 | 7.5 V | R1515H115B | N 1 1 5 | 11.5 V |
| R1515H036B | N 0 3 6 | 3.6 V | R1515H076B | N 0 7 6 | 7.6 V | R1515H116B | N 1 1 6 | 11.6 V |
| R1515H037B | N 0 3 7 | 3.7 V | R1515H077B | N 0 7 7 | 7.7 V | R1515H117B | N 1 1 7 | 11.7 V |
| R1515H038B | N 0 3 8 | 3.8 V | R1515H078B | N 0 7 8 | 7.8 V | R1515H118B | N 1 1 8 | 11.8 V |
| R1515H039B | N 0 3 9 | 3.9 V | R1515H079B | N 0 7 9 | 7.9 V | R1515H119B | N 1 1 9 | 11.9 V |
| R1515H040B | N 0 4 0 | 4.0 V | R1515H080B | N 0 8 0 | 8.0 V | R1515H120B | N 1 2 0 | 12.0 V |
| R1515H041B | N 0 4 1 | 4.1 V | R1515H081B | N 0 8 1 | 8.1 V | | | |
| R1515H042B | N 0 4 2 | 4.2 V | R1515H082B | N 0 8 2 | 8.2 V | | | |
| R1515H043B | N 0 4 3 | 4.3 V | R1515H083B | N 0 8 3 | 8.3 V | | | |
| R1515H044B | N 0 4 4 | 4.4 V | R1515H084B | N 0 8 4 | 8.4 V | | | |
| R1515H045B | N 0 4 5 | 4.5 V | R1515H085B | N 0 8 5 | 8.5 V | | | |
| R1515H046B | N 0 4 6 | 4.6 V | R1515H086B | N 0 8 6 | 8.6 V | | | |
| R1515H047B | N 0 4 7 | 4.7 V | R1515H087B | N 0 8 7 | 8.7 V | | | |
| R1515H048B | N 0 4 8 | 4.8 V | R1515H088B | N 0 8 8 | 8.8 V | | | |
| R1515H049B | N 0 4 9 | 4.9 V | R1515H089B | N 0 8 9 | 8.9 V | | | |
| R1515H050B | N 0 5 0 | 5.0 V | R1515H090B | N 0 9 0 | 9.0 V | | | |
| R1515H051B | N 0 5 1 | 5.1 V | R1515H091B | N 0 9 1 | 9.1 V | | | |
| R1515H052B | N 0 5 2 | 5.2 V | R1515H092B | N 0 9 2 | 9.2 V | | | |
| R1515H053B | N 0 5 3 | 5.3 V | R1515H093B | N 0 9 3 | 9.3 V | | | |
| R1515H054B | N 0 5 4 | 5.4 V | R1515H094B | N 0 9 4 | 9.4 V | | | |
| R1515H055B | N 0 5 5 | 5.5 V | R1515H095B | N 0 9 5 | 9.5 V | | | |
| R1515H056B | N 0 5 6 | 5.6 V | R1515H096B | N 0 9 6 | 9.6 V | | | |
| R1515H057B | N 0 5 7 | 5.7 V | R1515H097B | N 0 9 7 | 9.7 V | | | |
| R1515H058B | N 0 5 8 | 5.8 V | R1515H098B | N 0 9 8 | 9.8 V | | | |
| R1515H059B | N 0 5 9 | 5.9 V | R1515H099B | N 0 9 9 | 9.9 V | | | |

POWER DISSIPATION (HSOP-6J)

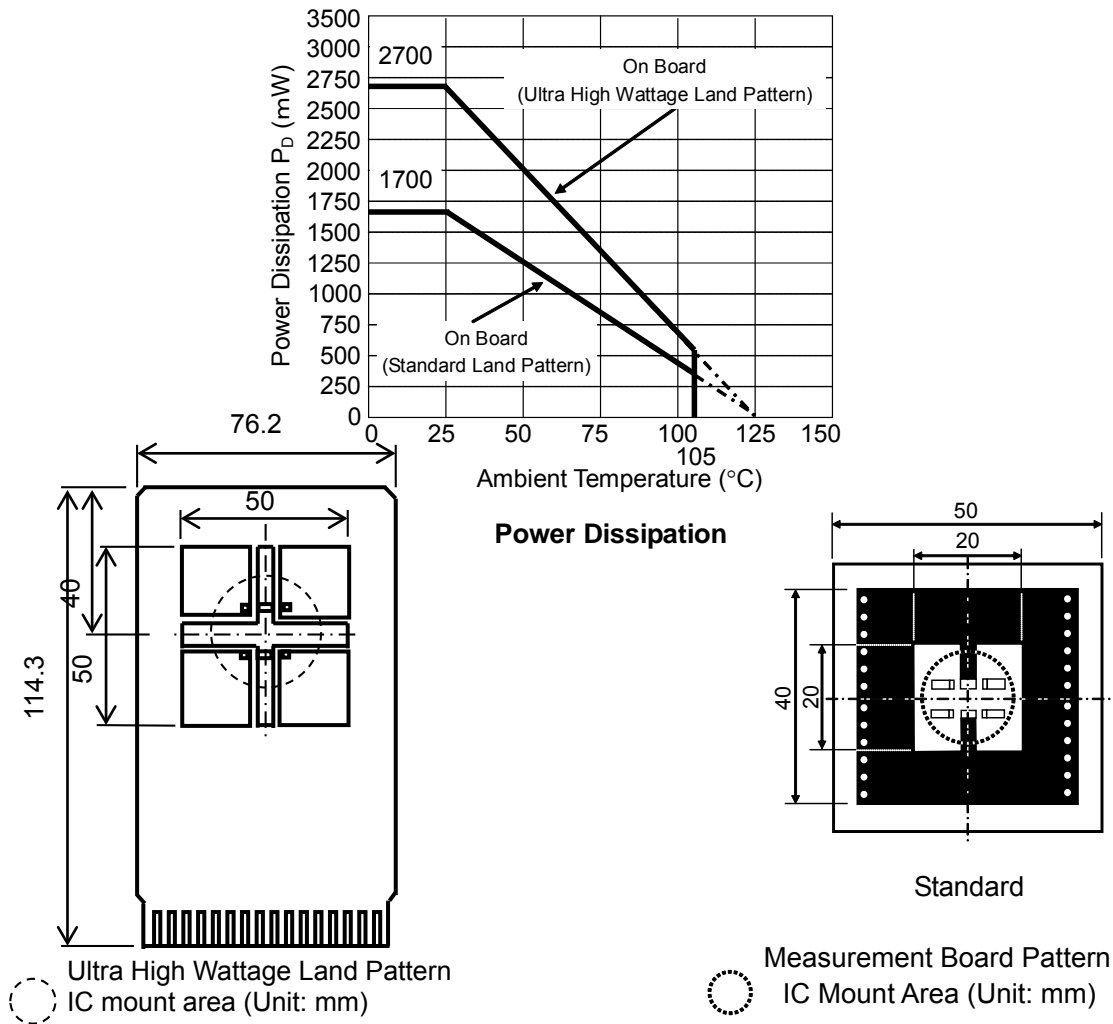
Power Dissipation (P_D) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

Measurement Conditions

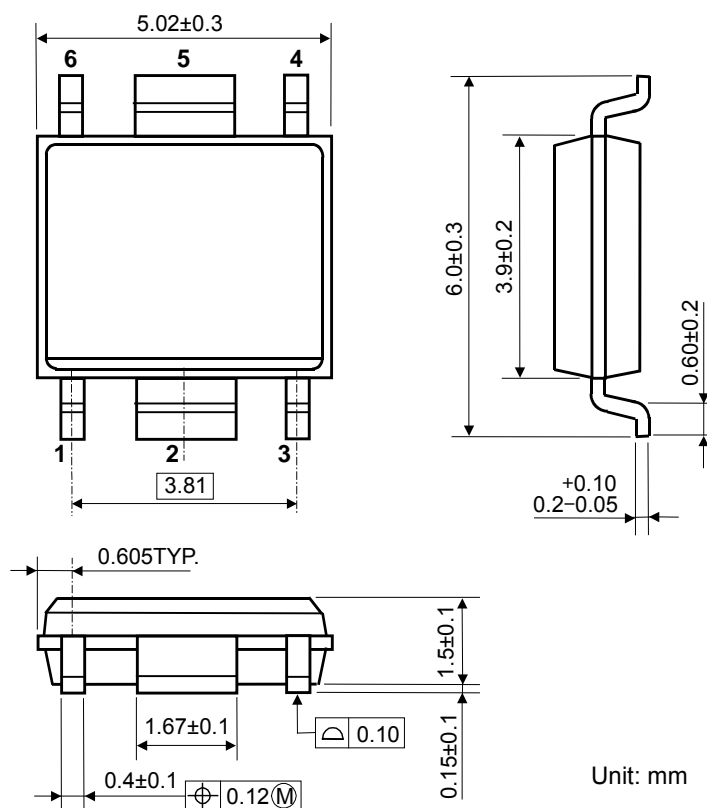
| | Ultra High Wattage Land Pattern | Standard Land Pattern |
|------------------|---|---|
| Environment | Mounting on Board (Wind velocity = 0 m/s) | Mounting on Board (Wind velocity = 0 m/s) |
| Board Material | Glass cloth epoxy plastic (4 Layers) | Glass cloth epoxy plastic (2 Layers) |
| Board Dimensions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

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

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



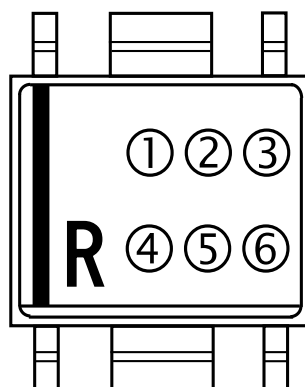
PACKAGE DIMENSIONS (HSOP-6J)



MARK SPECIFICATION (HSOP-6J)

①②③④: Product Code ... Refer to R1515S MARK SPECIFICATION TABLE

⑤⑥: Lot Number ... Alphanumeric Serial Number



R1515x

NO.EC-153-150701

R1515S MARK SPECIFICATION TABLE (HSOP-6J)

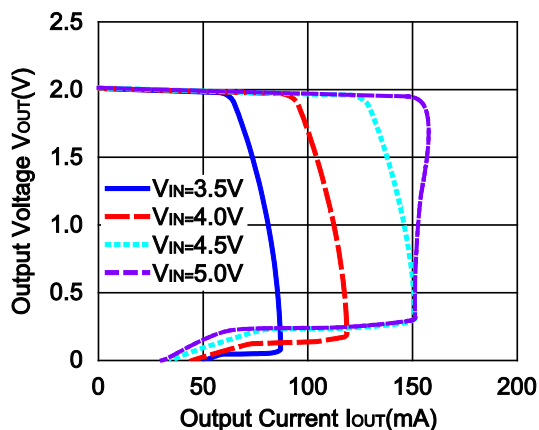
| Product Name | ①②③④ | V _{SET} | Product Name | ①②③④ | V _{SET} | Product Name | ①②③④ | V _{SET} |
|--------------|---------|------------------|--------------|---------|------------------|--------------|---------|------------------|
| R1515S020B | F 0 2 0 | 2.0 V | R1515S060B | F 0 6 0 | 6.0 V | R1515S100B | F 1 0 0 | 10.0 V |
| R1515S021B | F 0 2 1 | 2.1 V | R1515S061B | F 0 6 1 | 6.1 V | R1515S101B | F 1 0 1 | 10.1 V |
| R1515S022B | F 0 2 2 | 2.2 V | R1515S062B | F 0 6 2 | 6.2 V | R1515S102B | F 1 0 2 | 10.2 V |
| R1515S023B | F 0 2 3 | 2.3 V | R1515S063B | F 0 6 3 | 6.3 V | R1515S103B | F 1 0 3 | 10.3 V |
| R1515S024B | F 0 2 4 | 2.4 V | R1515S064B | F 0 6 4 | 6.4 V | R1515S104B | F 1 0 4 | 10.4 V |
| R1515S025B | F 0 2 5 | 2.5 V | R1515S065B | F 0 6 5 | 6.5 V | R1515S105B | F 1 0 5 | 10.5 V |
| R1515S026B | F 0 2 6 | 2.6 V | R1515S066B | F 0 6 6 | 6.6 V | R1515S106B | F 1 0 6 | 10.6 V |
| R1515S027B | F 0 2 7 | 2.7 V | R1515S067B | F 0 6 7 | 6.7 V | R1515S107B | F 1 0 7 | 10.7 V |
| R1515S028B | F 0 2 8 | 2.8 V | R1515S068B | F 0 6 8 | 6.8 V | R1515S108B | F 1 0 8 | 10.8 V |
| R1515S029B | F 0 2 9 | 2.9 V | R1515S069B | F 0 6 9 | 6.9 V | R1515S109B | F 1 0 9 | 10.9 V |
| R1515S030B | F 0 3 0 | 3.0 V | R1515S070B | F 0 7 0 | 7.0 V | R1515S110B | F 1 1 0 | 11.0 V |
| R1515S031B | F 0 3 1 | 3.1 V | R1515S071B | F 0 7 1 | 7.1 V | R1515S111B | F 1 1 1 | 11.1 V |
| R1515S032B | F 0 3 2 | 3.2 V | R1515S072B | F 0 7 2 | 7.2 V | R1515S112B | F 1 1 2 | 11.2 V |
| R1515S033B | F 0 3 3 | 3.3 V | R1515S073B | F 0 7 3 | 7.3 V | R1515S113B | F 1 1 3 | 11.3 V |
| R1515S034B | F 0 3 4 | 3.4 V | R1515S074B | F 0 7 4 | 7.4 V | R1515S114B | F 1 1 4 | 11.4 V |
| R1515S035B | F 0 3 5 | 3.5 V | R1515S075B | F 0 7 5 | 7.5 V | R1515S115B | F 1 1 5 | 11.5 V |
| R1515S036B | F 0 3 6 | 3.6 V | R1515S076B | F 0 7 6 | 7.6 V | R1515S116B | F 1 1 6 | 11.6 V |
| R1515S037B | F 0 3 7 | 3.7 V | R1515S077B | F 0 7 7 | 7.7 V | R1515S117B | F 1 1 7 | 11.7 V |
| R1515S038B | F 0 3 8 | 3.8 V | R1515S078B | F 0 7 8 | 7.8 V | R1515S118B | F 1 1 8 | 11.8 V |
| R1515S039B | F 0 3 9 | 3.9 V | R1515S079B | F 0 7 9 | 7.9 V | R1515S119B | F 1 1 9 | 11.9 V |
| R1515S040B | F 0 4 0 | 4.0 V | R1515S080B | F 0 8 0 | 8.0 V | R1515S120B | F 1 2 0 | 12.0 V |
| R1515S041B | F 0 4 1 | 4.1 V | R1515S081B | F 0 8 1 | 8.1 V | | | |
| R1515S042B | F 0 4 2 | 4.2 V | R1515S082B | F 0 8 2 | 8.2 V | | | |
| R1515S043B | F 0 4 3 | 4.3 V | R1515S083B | F 0 8 3 | 8.3 V | | | |
| R1515S044B | F 0 4 4 | 4.4 V | R1515S084B | F 0 8 4 | 8.4 V | | | |
| R1515S045B | F 0 4 5 | 4.5 V | R1515S085B | F 0 8 5 | 8.5 V | | | |
| R1515S046B | F 0 4 6 | 4.6 V | R1515S086B | F 0 8 6 | 8.6 V | | | |
| R1515S047B | F 0 4 7 | 4.7 V | R1515S087B | F 0 8 7 | 8.7 V | | | |
| R1515S048B | F 0 4 8 | 4.8 V | R1515S088B | F 0 8 8 | 8.8 V | | | |
| R1515S049B | F 0 4 9 | 4.9 V | R1515S089B | F 0 8 9 | 8.9 V | | | |
| R1515S050B | F 0 5 0 | 5.0 V | R1515S090B | F 0 9 0 | 9.0 V | | | |
| R1515S051B | F 0 5 1 | 5.1 V | R1515S091B | F 0 9 1 | 9.1 V | | | |
| R1515S052B | F 0 5 2 | 5.2 V | R1515S092B | F 0 9 2 | 9.2 V | | | |
| R1515S053B | F 0 5 3 | 5.3 V | R1515S093B | F 0 9 3 | 9.3 V | | | |
| R1515S054B | F 0 5 4 | 5.4 V | R1515S094B | F 0 9 4 | 9.4 V | | | |
| R1515S055B | F 0 5 5 | 5.5 V | R1515S095B | F 0 9 5 | 9.5 V | | | |
| R1515S056B | F 0 5 6 | 5.6 V | R1515S096B | F 0 9 6 | 9.6 V | | | |
| R1515S057B | F 0 5 7 | 5.7 V | R1515S097B | F 0 9 7 | 9.7 V | | | |
| R1515S058B | F 0 5 8 | 5.8 V | R1515S098B | F 0 9 8 | 9.8 V | | | |
| R1515S059B | F 0 5 9 | 5.9 V | R1515S099B | F 0 9 9 | 9.9 V | | | |

TYPICAL CHARACTERISTICS

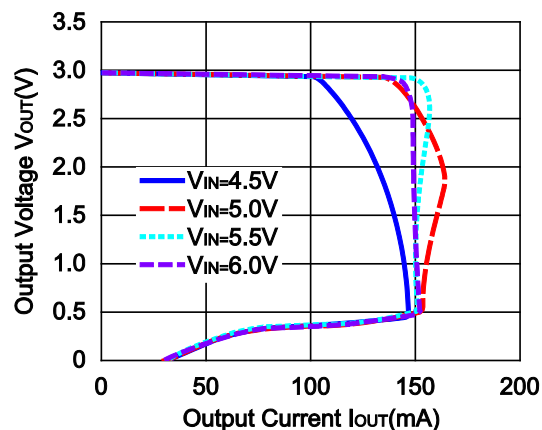
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Output Voltage vs. Output Current ($T_a=25^\circ\text{C}$)

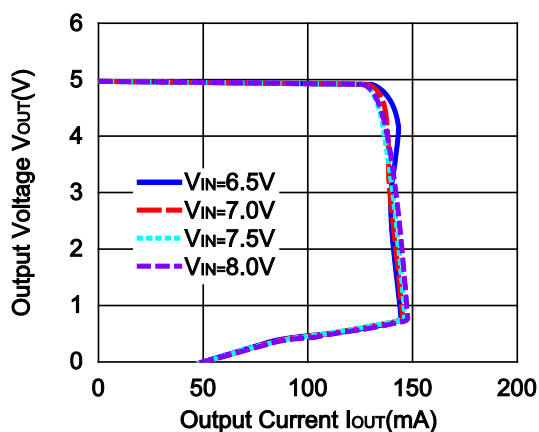
R1515x020B



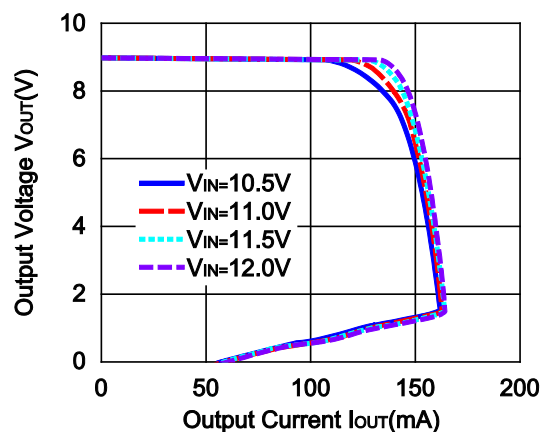
R1515x030B



R1515x050B

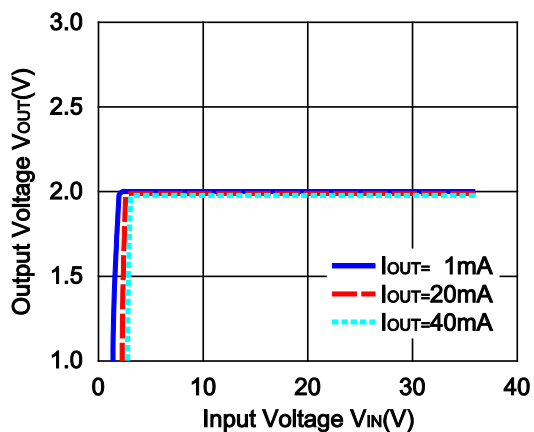


R1515x090B

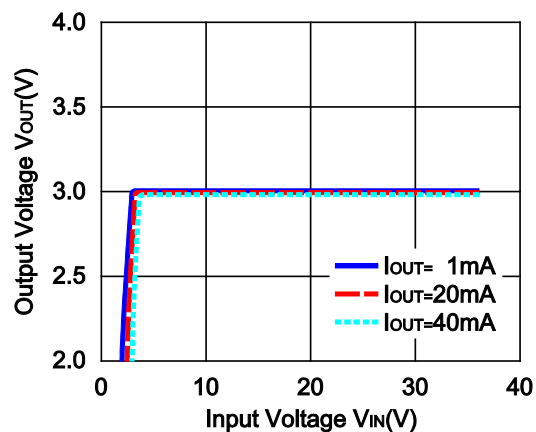


2) Output Voltage vs. Input Voltage ($T_a=25^\circ\text{C}$)

R1515x020B



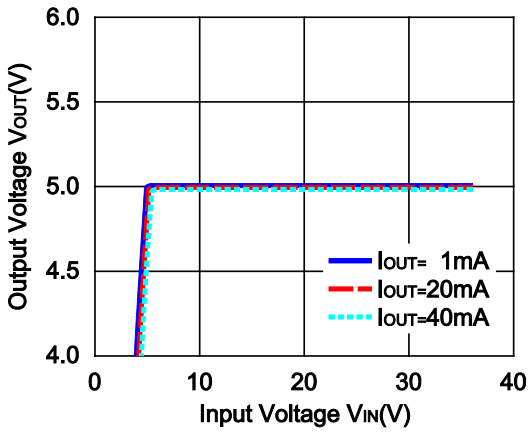
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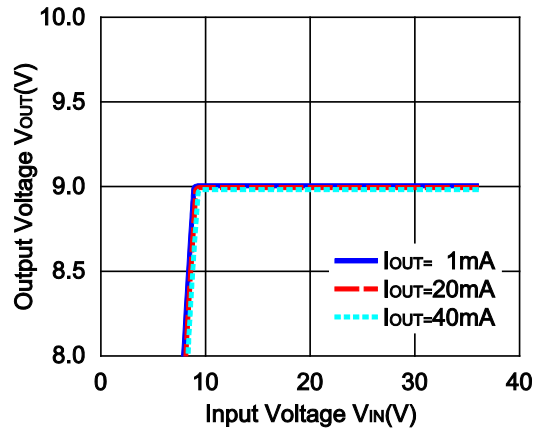
R1515x

NO.EC-153-150701

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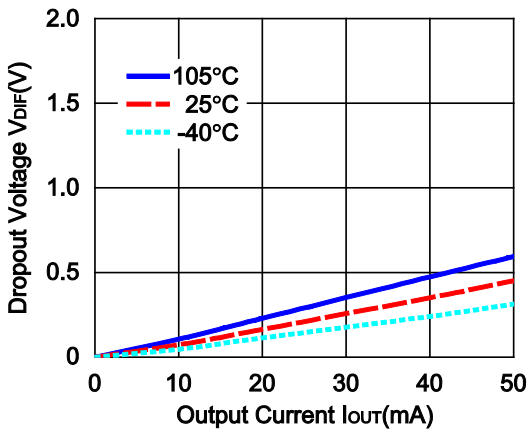


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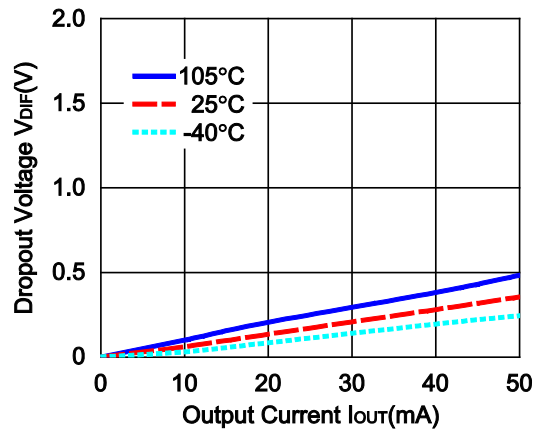


3) Dropout Voltage vs. Output Current

R1515x050B

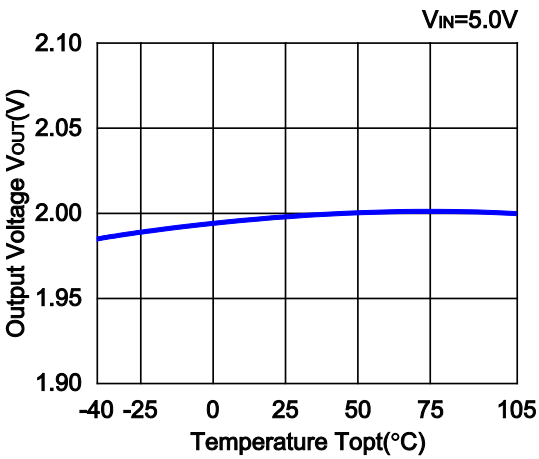


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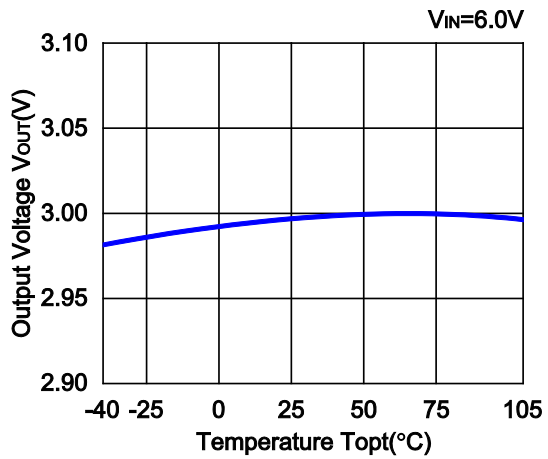


4) Output Voltage vs. Temperature

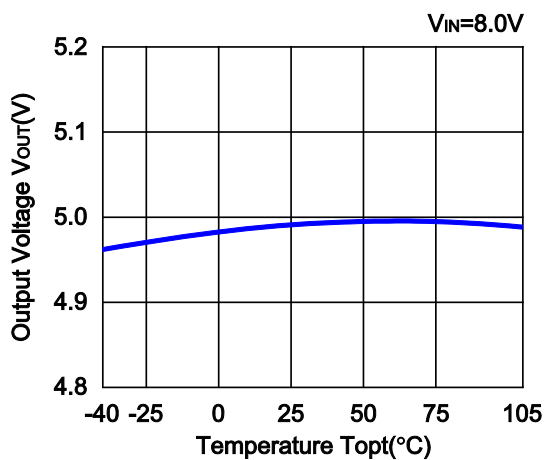
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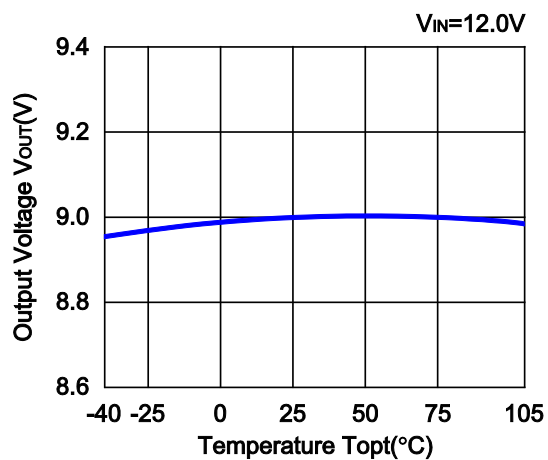
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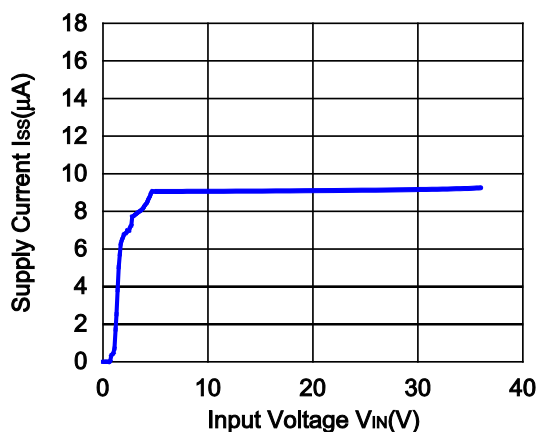


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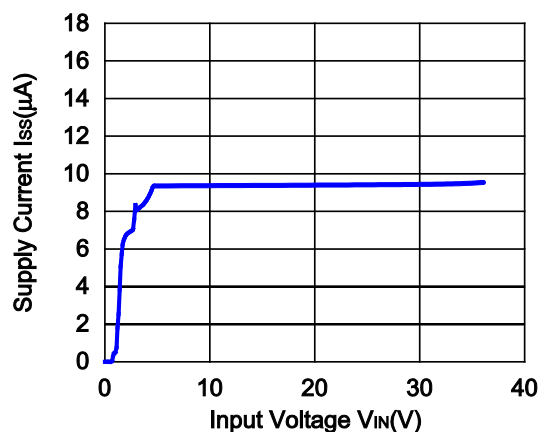


5) Supply Current vs. Input Voltage ($T_a=25^\circ C$)

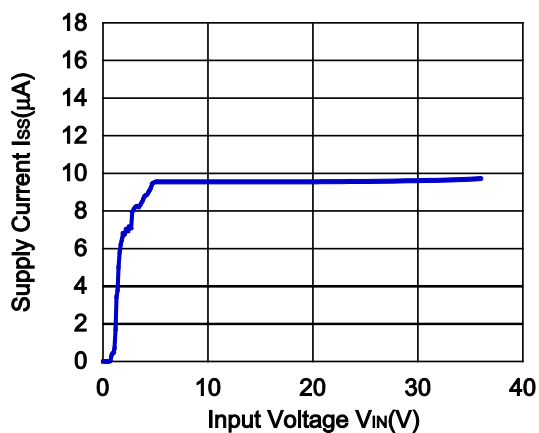
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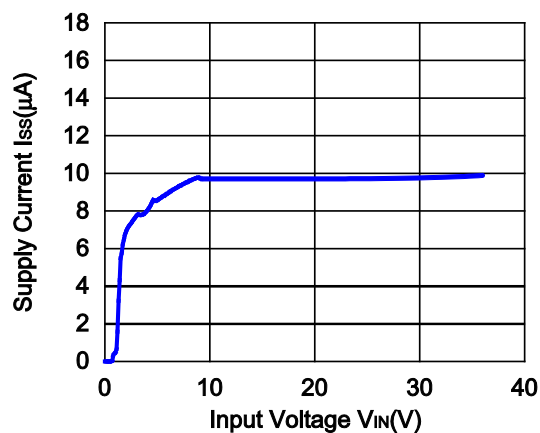
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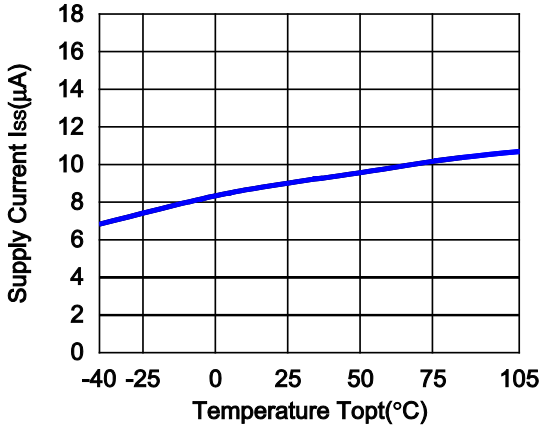


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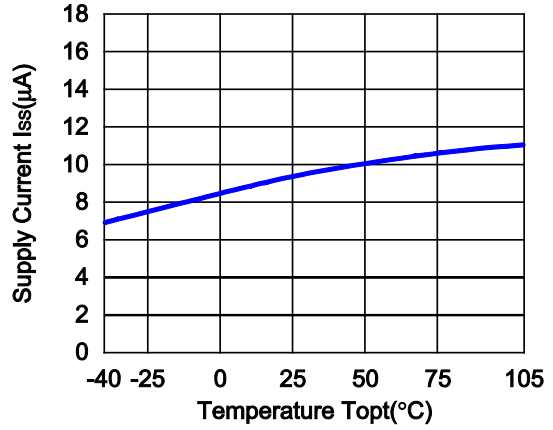


6) Supply Current vs. Temperature

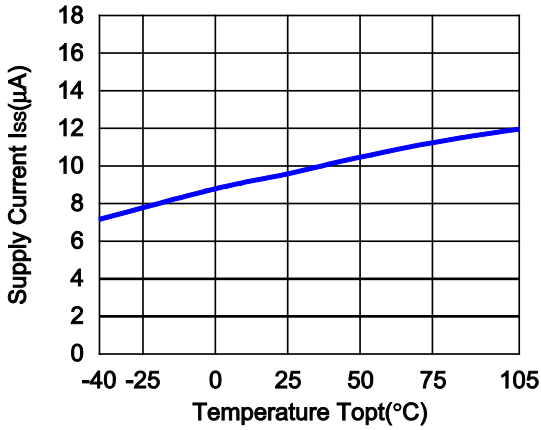
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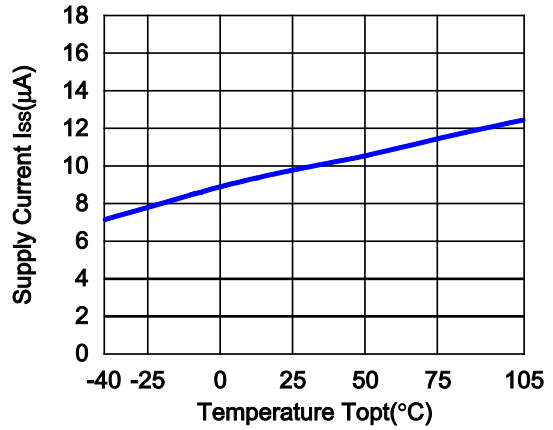
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R1515x050B

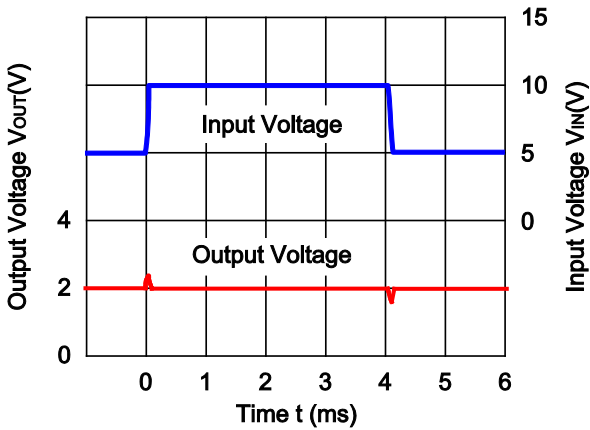


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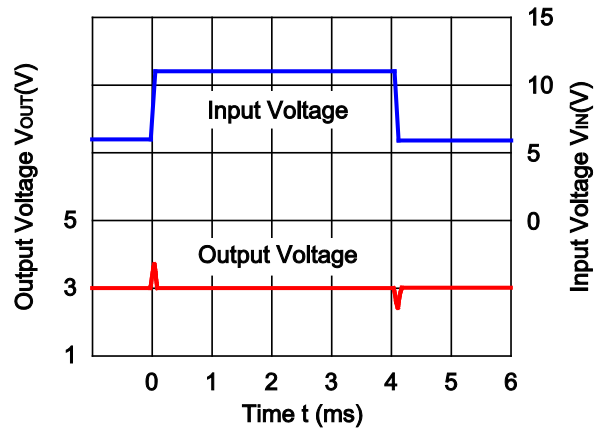


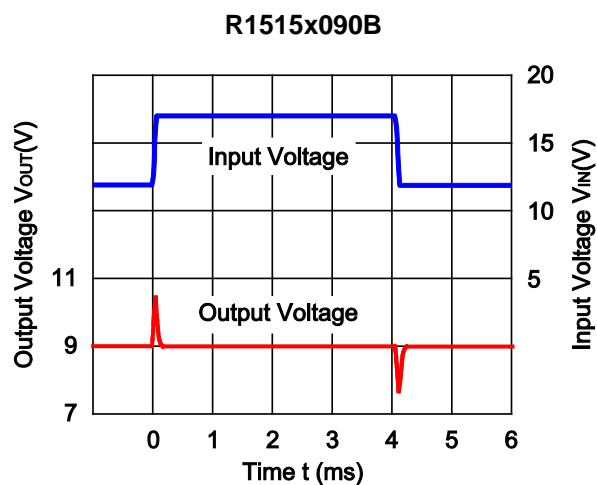
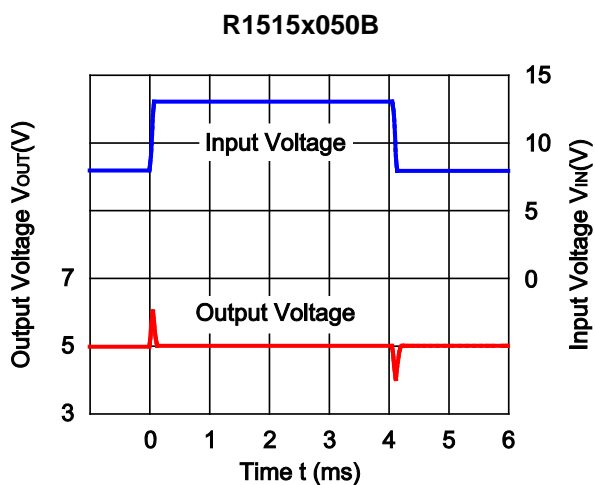
7) Input Transient Response (I_{OUT}=1mA, t_r=t_f=50µs, C₂=Ceramic 0.1µF, T_a=25°C)

R1515x020B

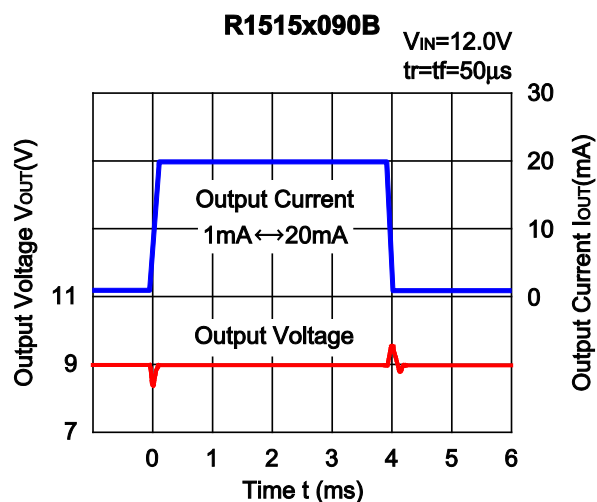
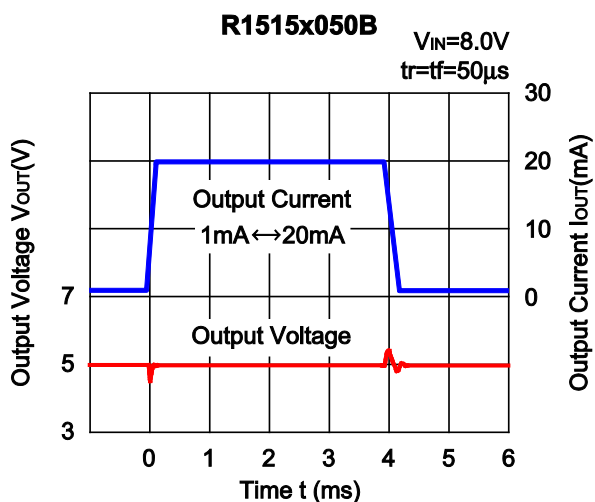
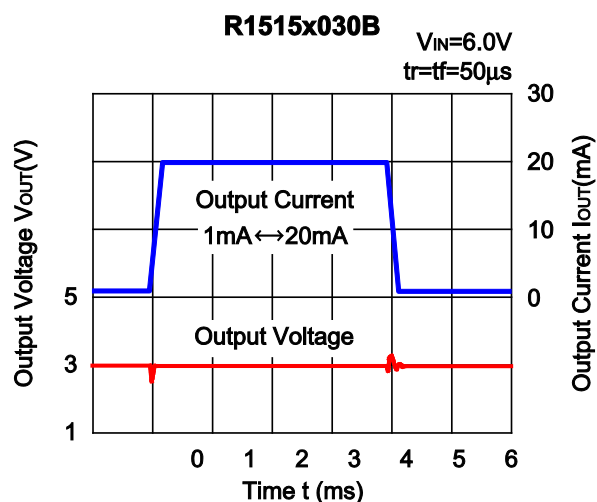
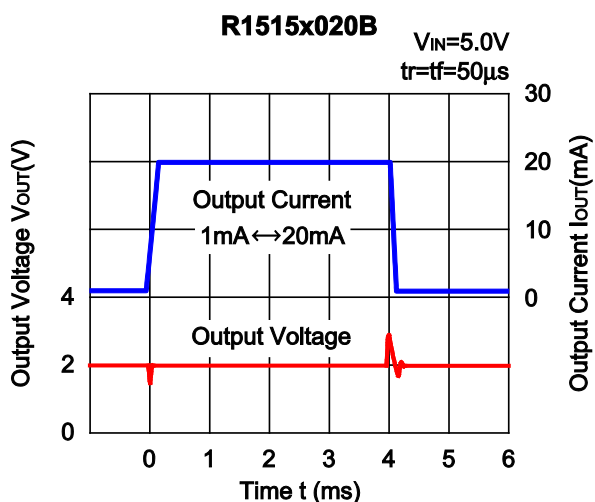


R1515x030B





8) Load Transient Response (C_2 =Ceramic 0.1 μ F, T_a =25 $^{\circ}$ C)





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