

LOW ON RESISTANCE / LOW VOLTAGE 1A LDO

NO.EA-174-200128

OUTLINE

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

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

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

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

FEATURES

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

APPLICATIONS

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

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

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SELECTION GUIDE

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

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

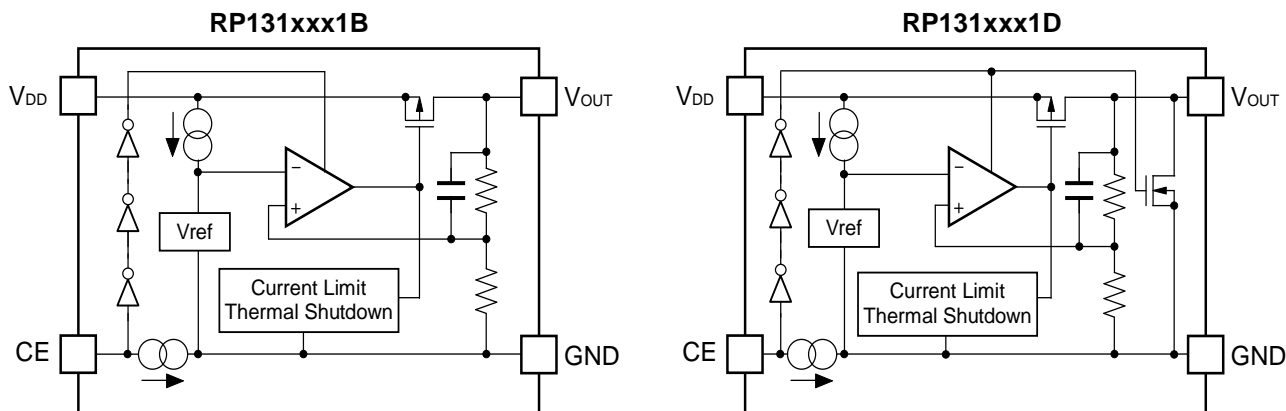
xx : The output voltage can be designated in the range from 0.8V(08) to 5.5V(55) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

* : The auto discharge function at off state are options as follows.⁽¹⁾

(B) without auto discharge function at off state

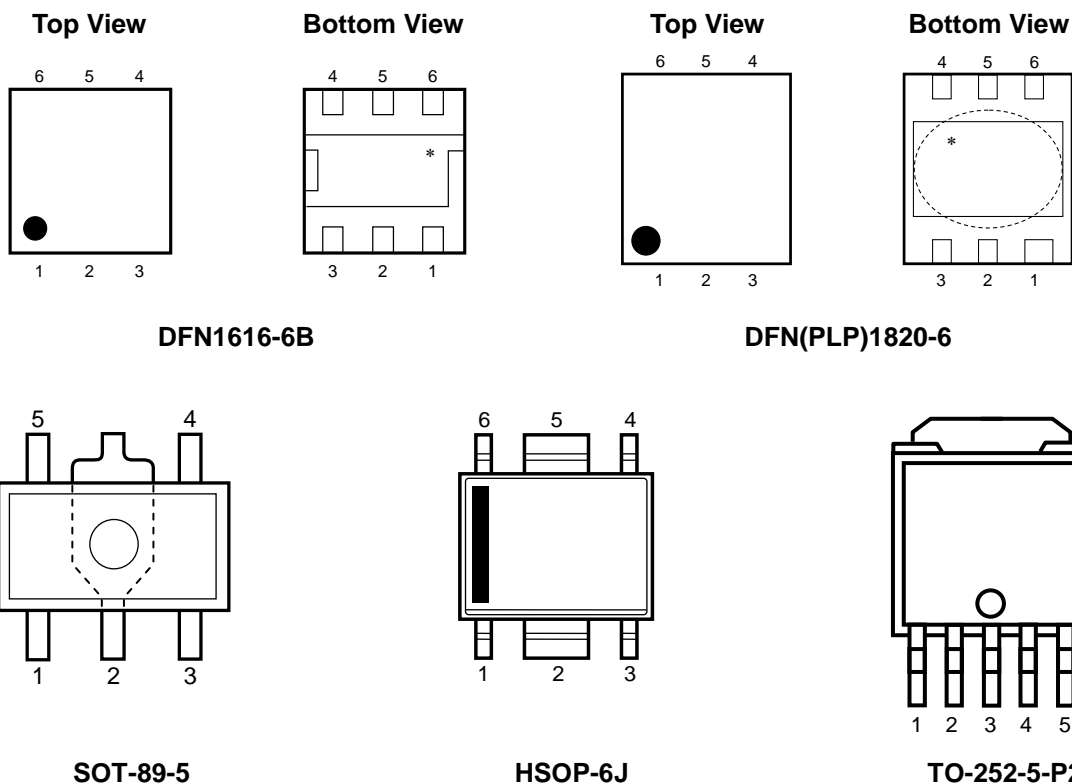
(D) with auto discharge function at off state

BLOCK DIAGRAMS



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

PIN DESCRIPTIONS



*Tab is GND level. (They are connected to the reverse side of this IC.) The tab is better to be connected to the GND, but leaving it open is also acceptable.

RP131L (DFN1616-6B) Pin Description

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

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

* RP131L(DFN1616-6B) is the limited product as of February 2021.

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

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

RP131H (SOT-89-5) Pin Description

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

RP131S (HSOP-6J) Pin Description

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

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

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

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

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

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

ABSOLUTE MAXIMUM RATINGS

| Symbol | Item | Rating | Unit | |
|-----------|----------------------------------|--------------------------------|------|----|
| V_{IN} | Input Voltage | 7.0 | V | |
| V_{CE} | Input Voltage (CE Pin) | -0.3 to 7.0 | V | |
| V_{OUT} | Output Voltage | -0.3 to $V_{IN}+0.3$ | V | |
| P_D | Power Dissipation ⁽¹⁾ | DFN1616-6B, JEDEC STD.51-7 | 2400 | mW |
| | | DFN(PLP)1820-6, JEDEC STD.51-7 | 2200 | |
| | | SOT-89-5, JEDEC STD.51-7 | 2600 | |
| | | HSOP-6J, JEDEC STD.51-7 | 2700 | |
| | | TO-252-5-P2, JEDEC STD.51-7 | 3800 | |
| T_j | Junction Temperature Range | -40 to 125 | °C | |
| T_{stg} | Storage Temperature Range | -55 to 125 | °C | |

ABSOLUTE MAXIMUM RATINGS

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

RECOMMENDED OPERATING CONDITIONS

| Symbol | Item | Rating | Unit |
|----------|-----------------------------|------------|------|
| V_{IN} | Input Voltage | 1.6 to 6.5 | V |
| T_a | Operating Temperature Range | -40 to 85 | °C |

RECOMMENDED OPERATING CONDITIONS

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

⁽¹⁾ Refer to POWER DISSIPATION for detailed information.

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ELECTRICAL CHARACTERISTICS

$V_{IN} = \text{Set } V_{OUT} + 1V, I_{OUT} = 1mA$

The specification in is checked and guaranteed by design engineering at $-40^{\circ}C \leq T_a \leq 85^{\circ}C$, unless otherwise noted.

RP131xxx1B/D

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

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

All test items listed under Electrical Characteristics are done under the pulse load condition ($T_j \approx T_a = 25^{\circ}C$) except for Output Noise, Ripple Rejection, Output Voltage Temperature Coefficient, Dropout Voltage at 1A Output Current and Thermal Shutdown items.

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The specification in is checked and guaranteed by design engineering at $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$, unless otherwise noted.

Dropout Voltage

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

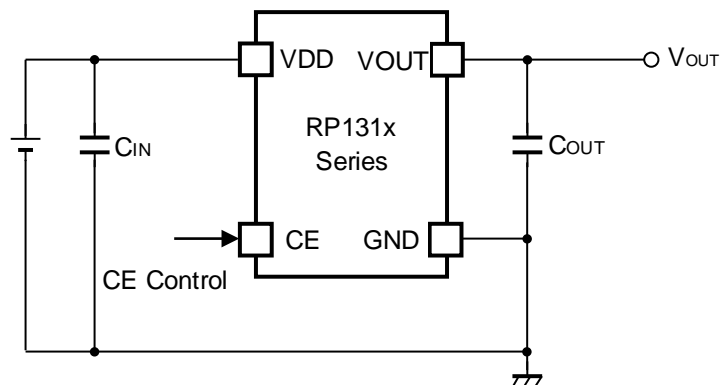
| Output Voltage V_{OUT} (V) | Dropout Voltage V_{DIF} (V) | | | | | |
|--|--------------------------------------|-------|--------------------------------|----------------------------|-------|--------------------------------|
| | Condition | Typ. | Max. | Condition | Typ. | Max. |
| $0.8 \leq V_{\text{OUT}}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

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APPLICATION INFORMATION

Typical Application Circuits



Recommendation value of the external capacitors

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

Technical Notes on the External Components

When using this IC, consider following points:

Phase Compensation

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

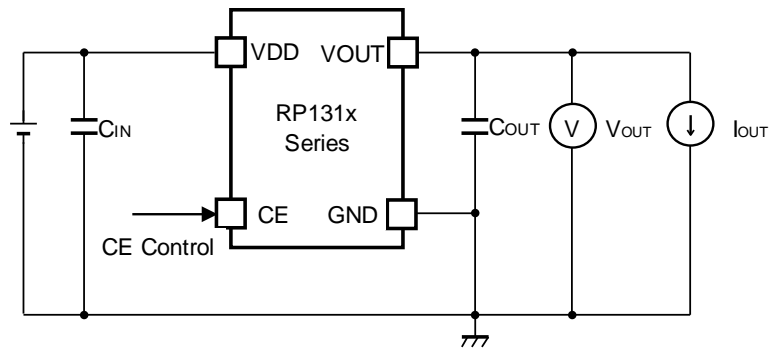
If a tantalum capacitor is used, and its ESR of C_{OUT} is large, the loop oscillation may result. Because of this, select C_{OUT} carefully considering its frequency characteristics.

PCB Layout

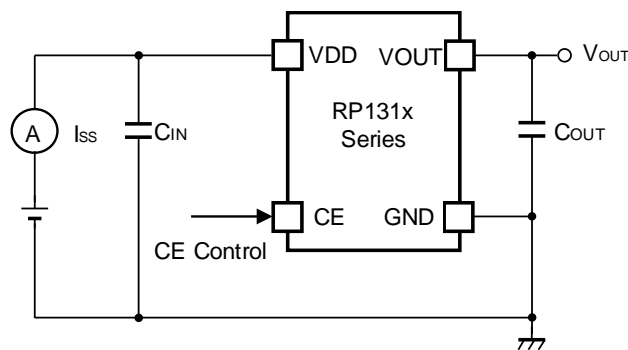
Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C_{IN} between V_{DD} and GND pin with a capacitance value as "Recommendation value of the external capacitors" above or more, and as close as possible to the pins.

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

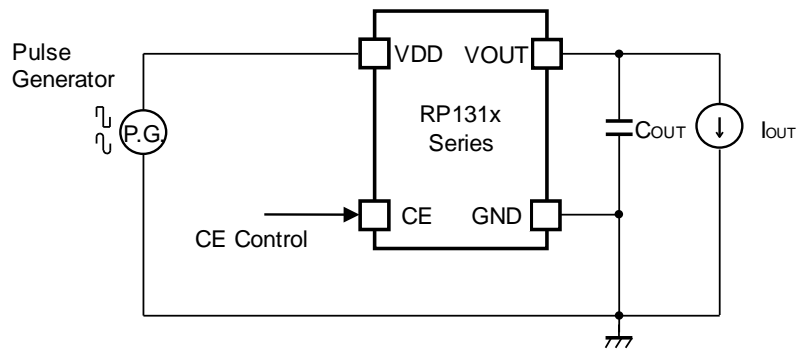
TEST CIRCUITS



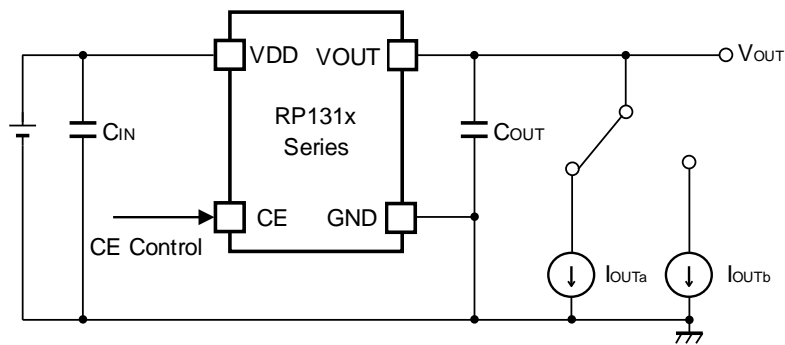
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection



Test Circuit for Load Transient Response

RP131x

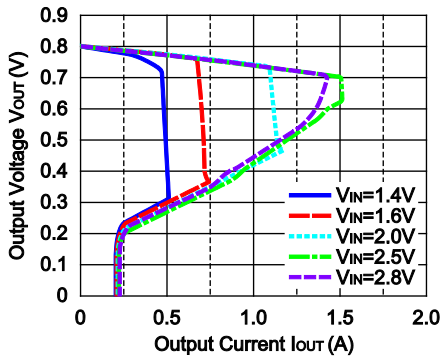
NO.EA-174-200128

TYPICAL CHARACTERISTICS

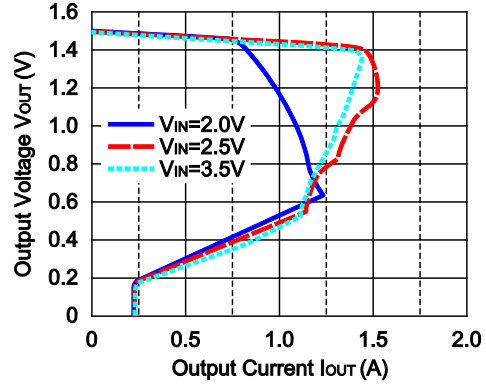
Typical Characteristics are intended to be used as reference data; they are not guaranteed.

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

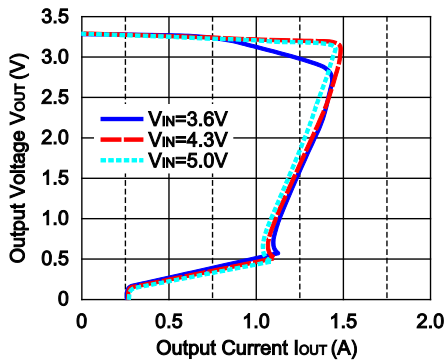
RP131x081x



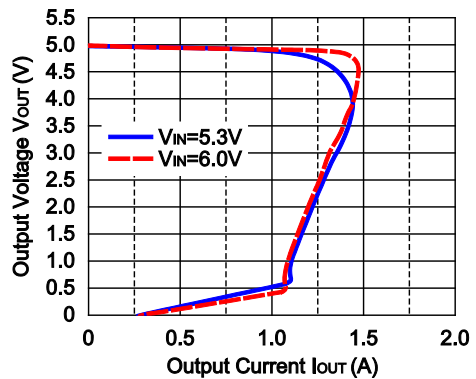
RP131x151x



RP131x331x

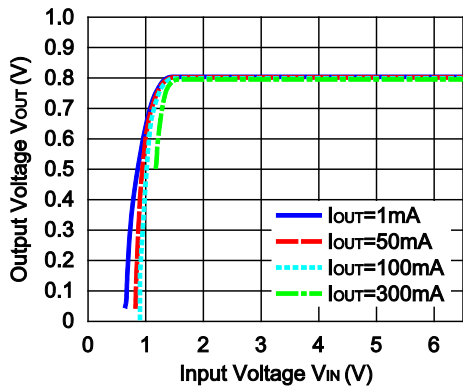


RP131x501x

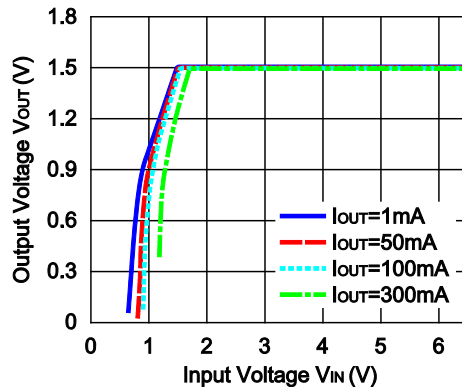


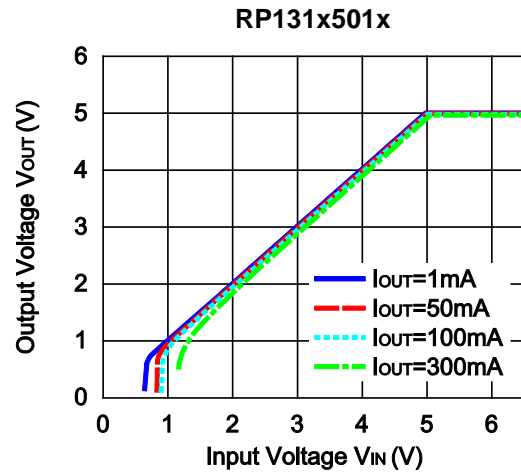
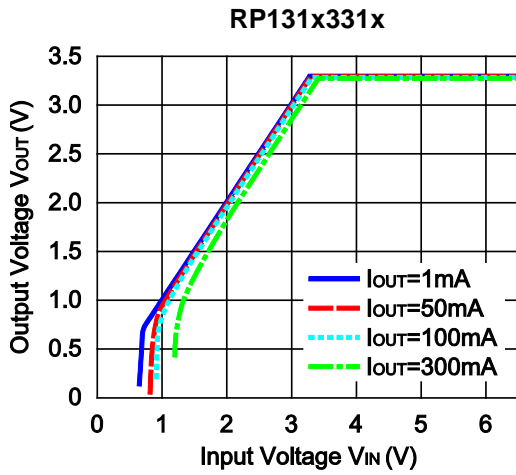
2) Output Voltage vs. Input Voltage ($T_a = 25^\circ\text{C}$)

RP131x081x

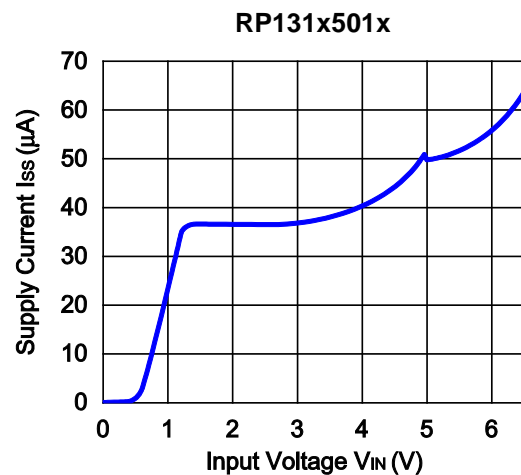
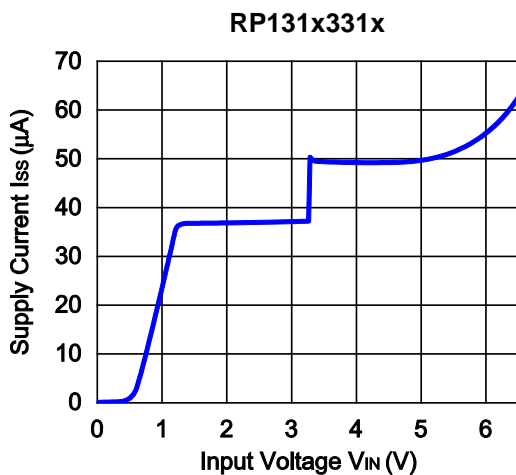
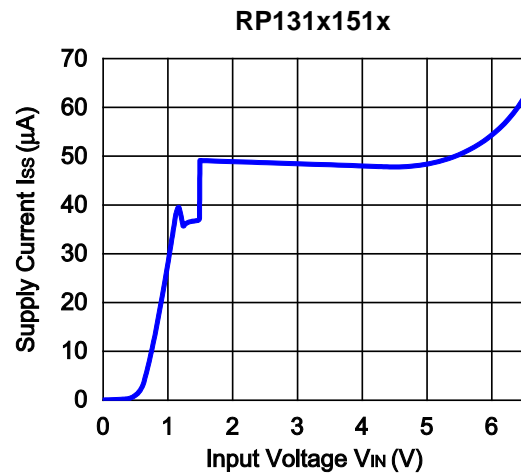
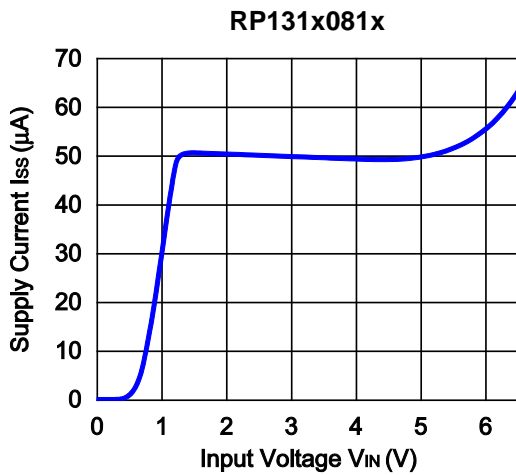


RP131x151x





3) Supply Current vs. Input Voltage ($T_a=25^{\circ}\text{C}$)

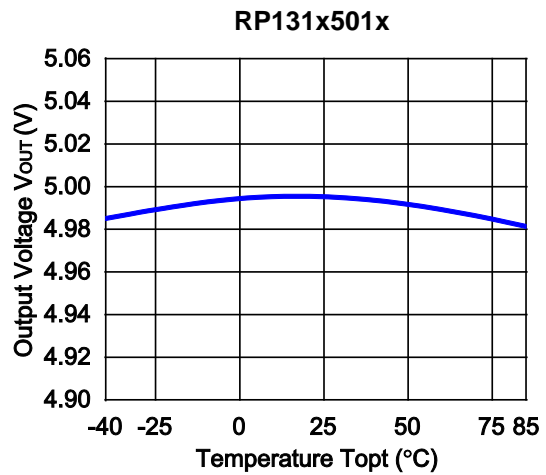
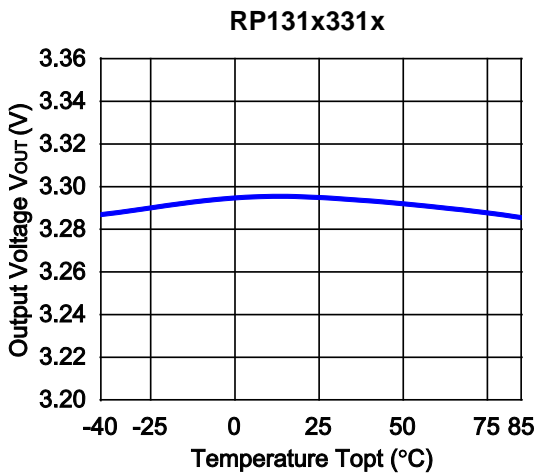
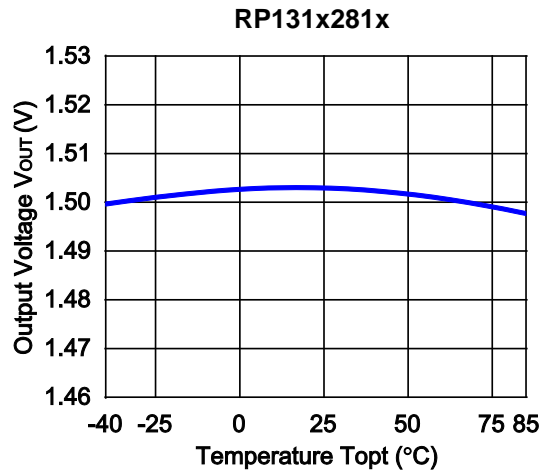
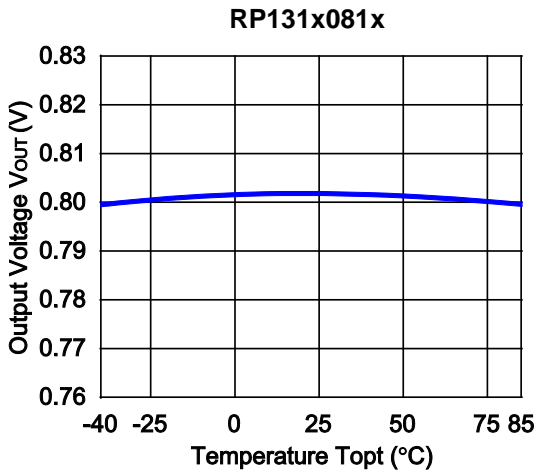


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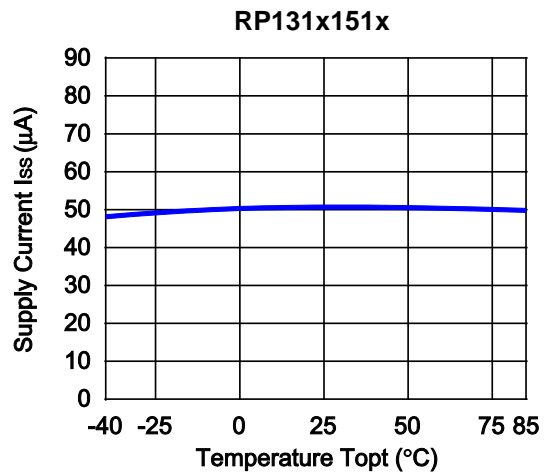
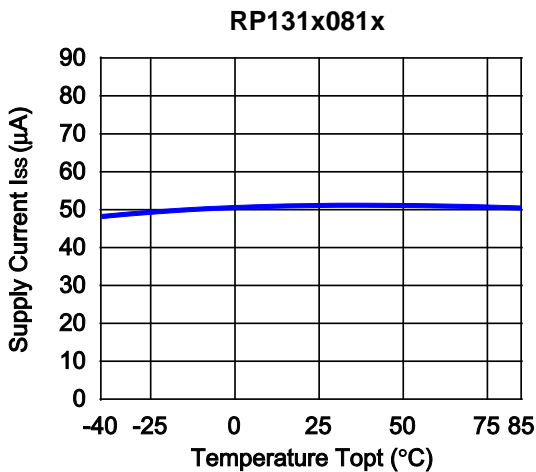
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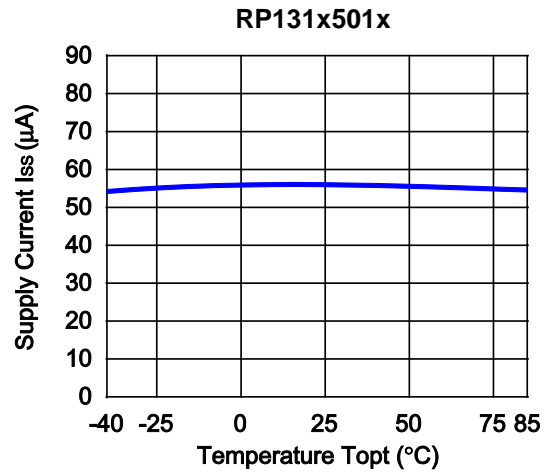
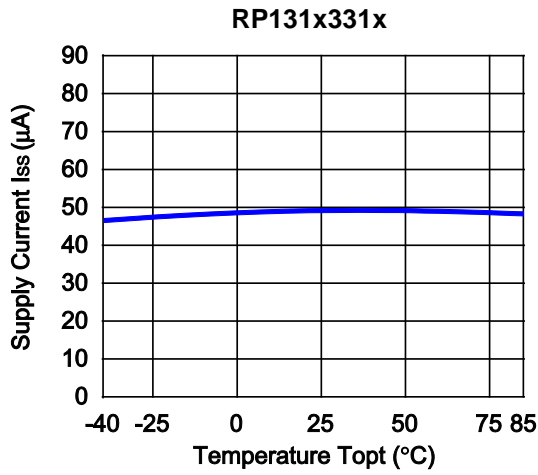
4) Output Voltage vs. Temperature



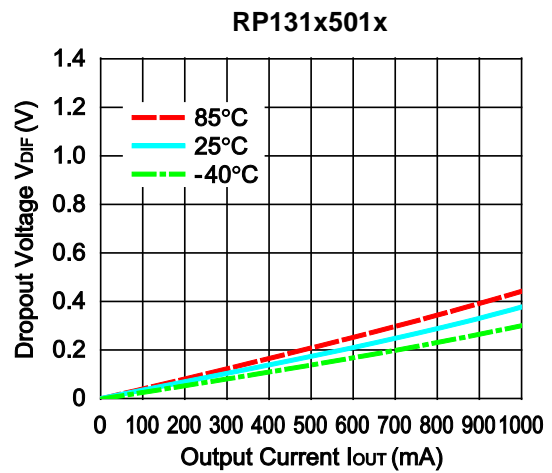
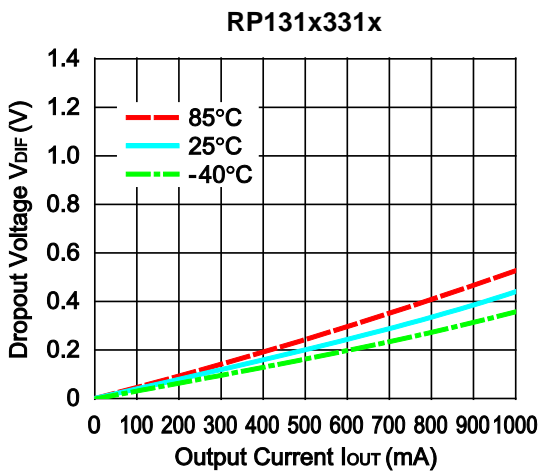
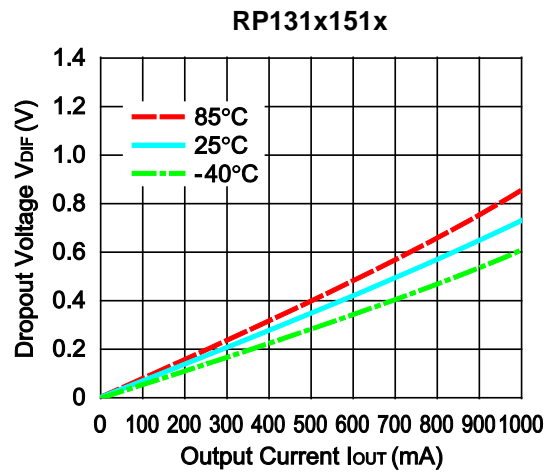
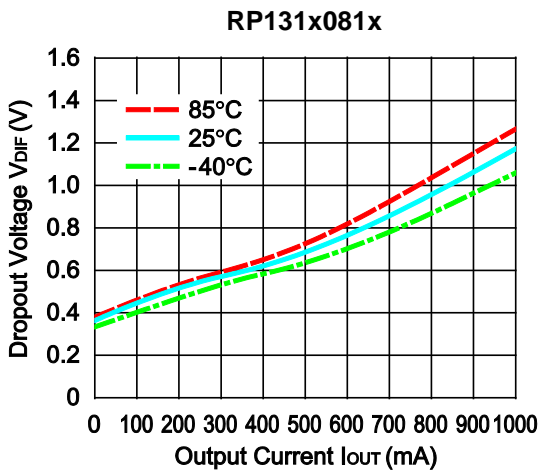
5) Supply Current vs. Temperature



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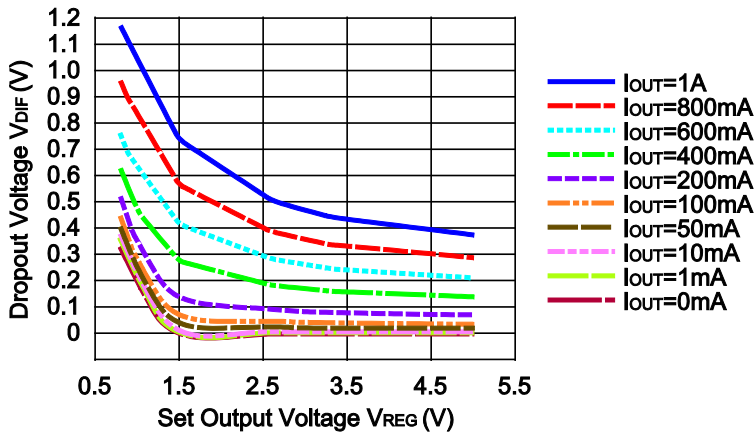
6) Dropout Voltage vs. Output Current



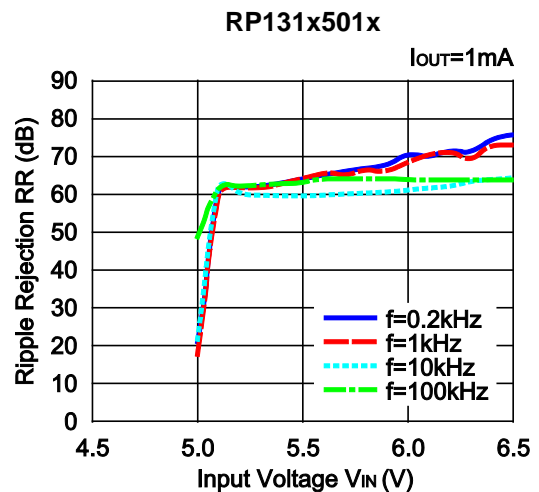
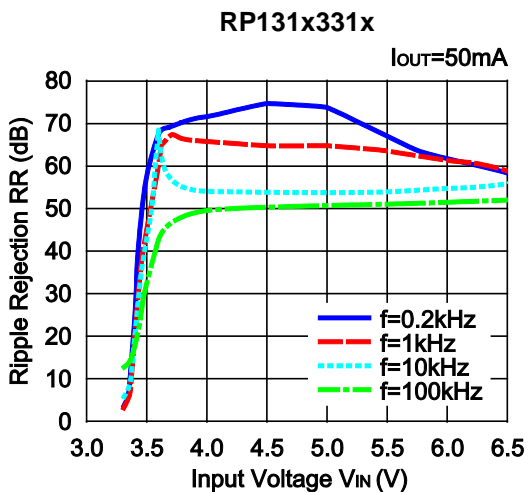
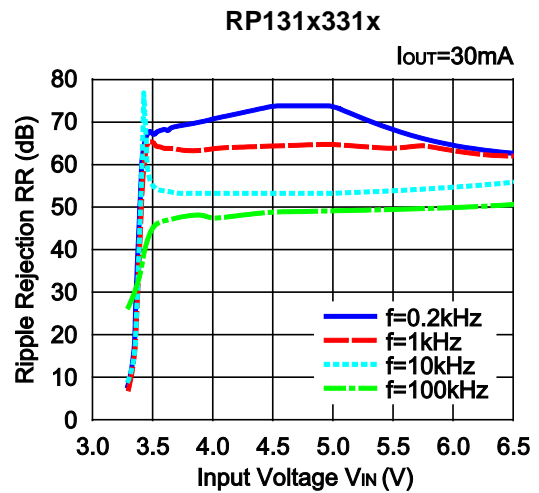
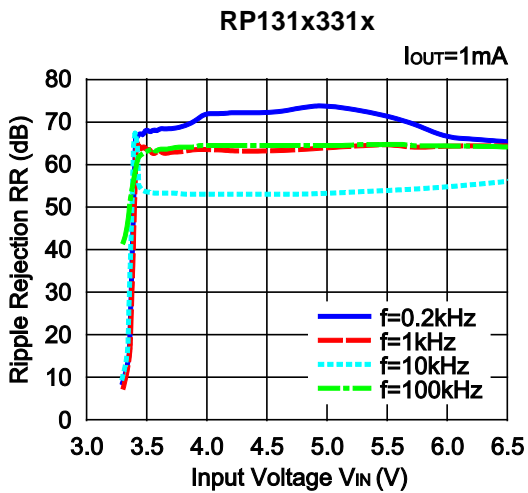
RP131x

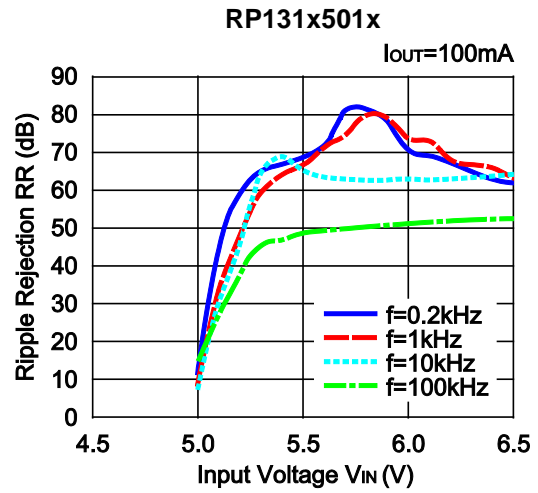
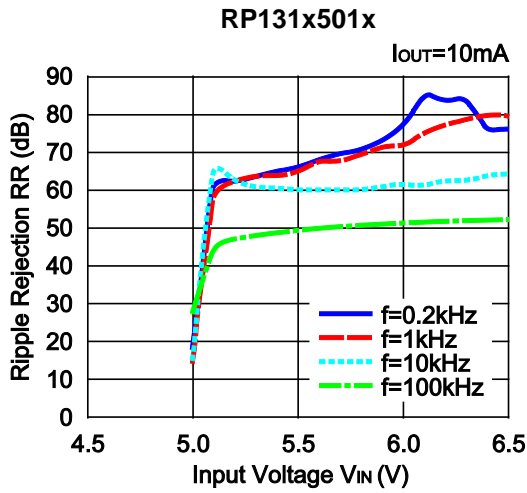
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7) Dropout Voltage vs. Set Output Voltage

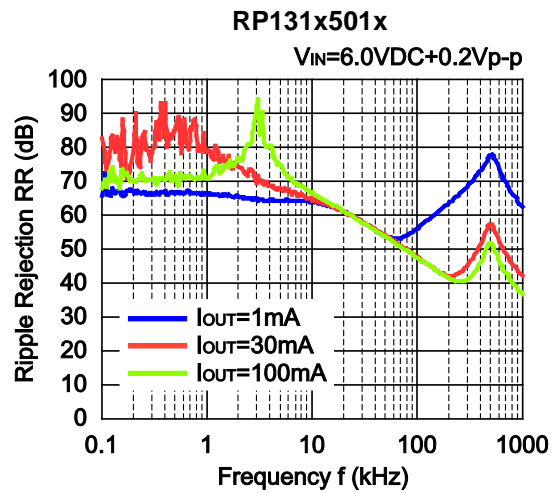
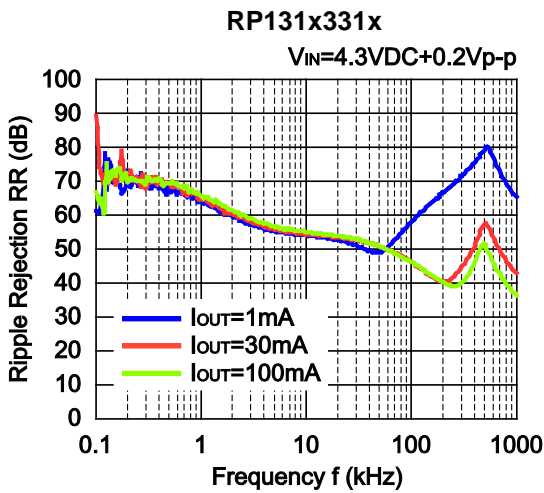
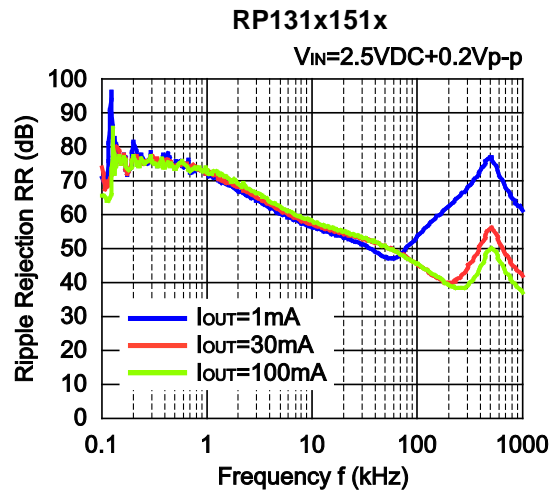
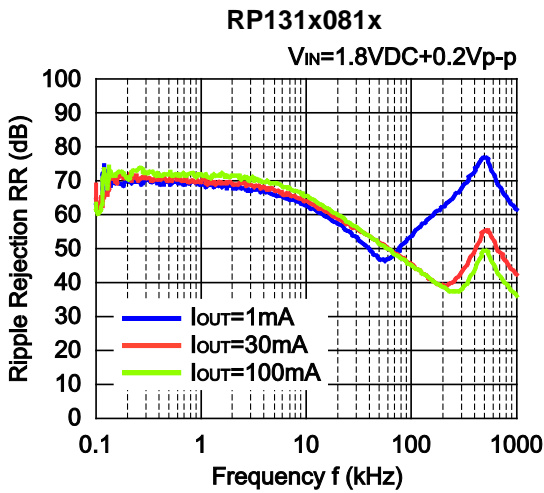


8) Ripple Rejection vs. Input Bias Voltage ($C1=none$, $C2=Ceramic\ 1.0\mu F$, Ripple= $0.2V_{pp}$, $T_a=25^\circ C$)





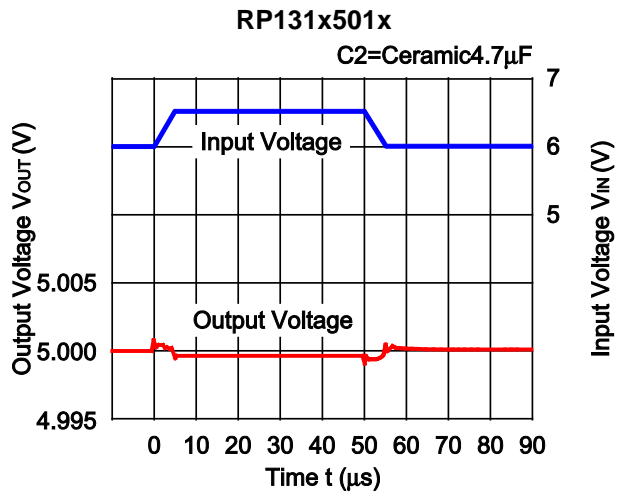
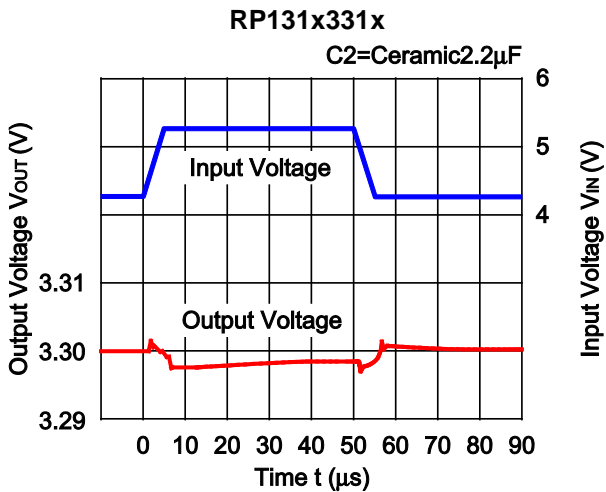
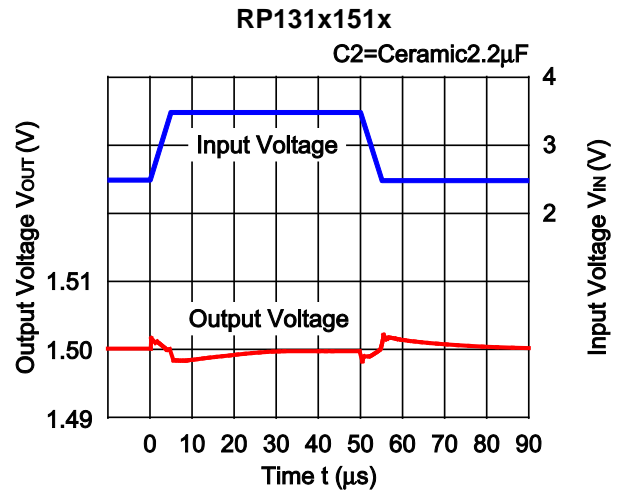
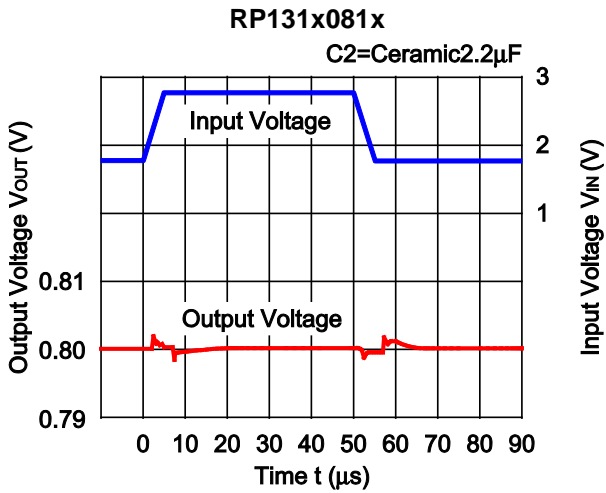
9) Ripple Rejection vs. Frequency (C1=none, C2=Ceramic 4.7μF, Ta=25°C)



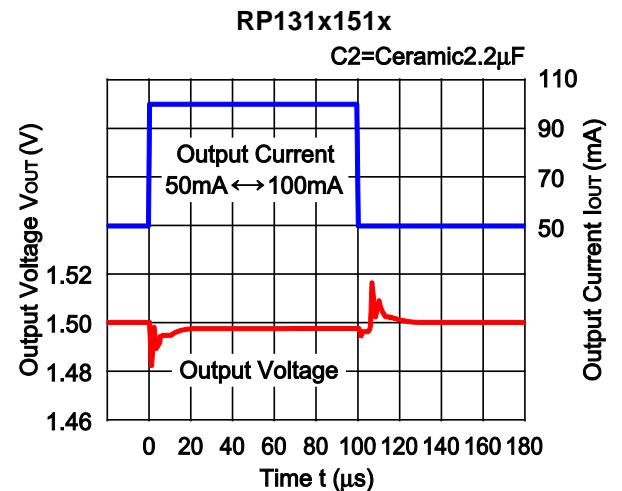
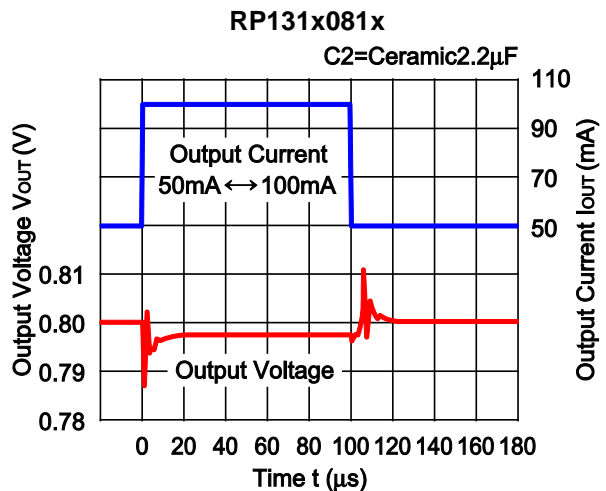
RP131x

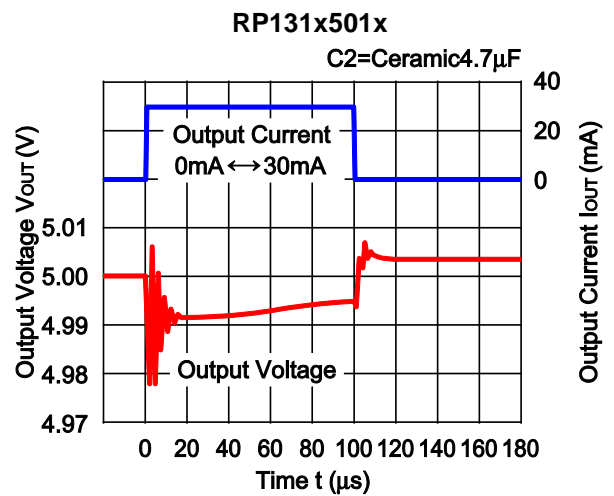
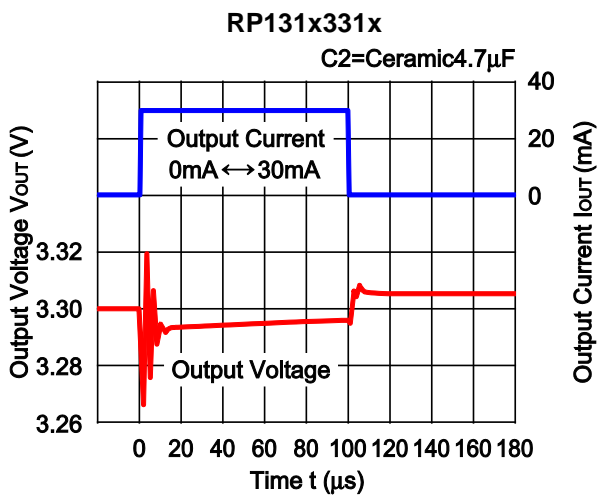
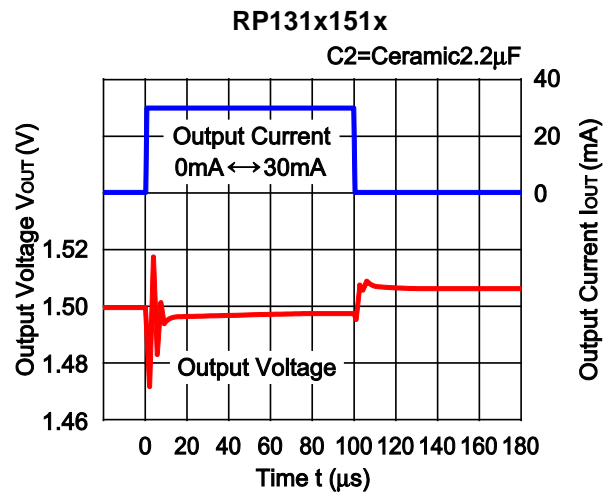
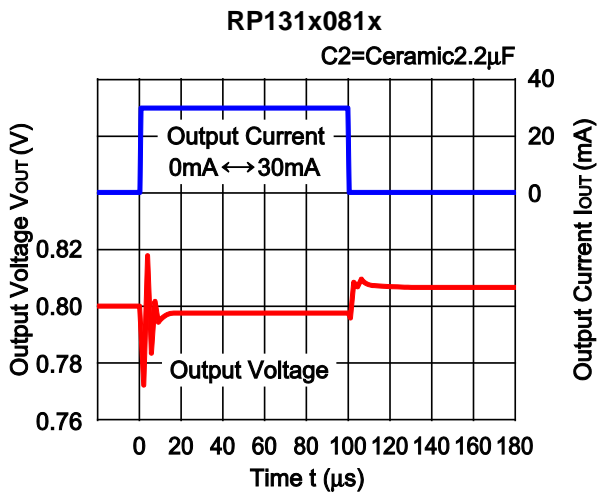
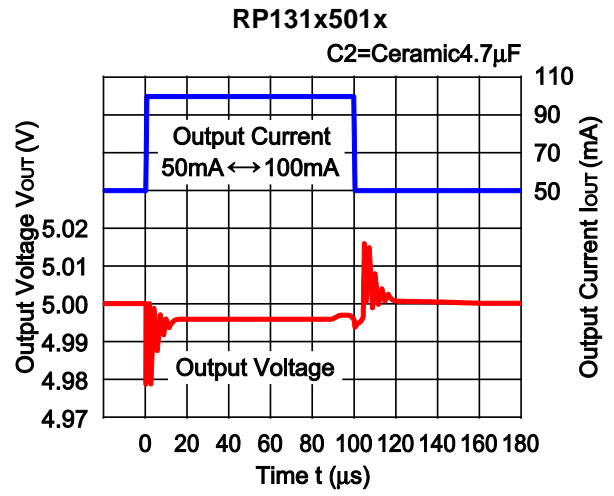
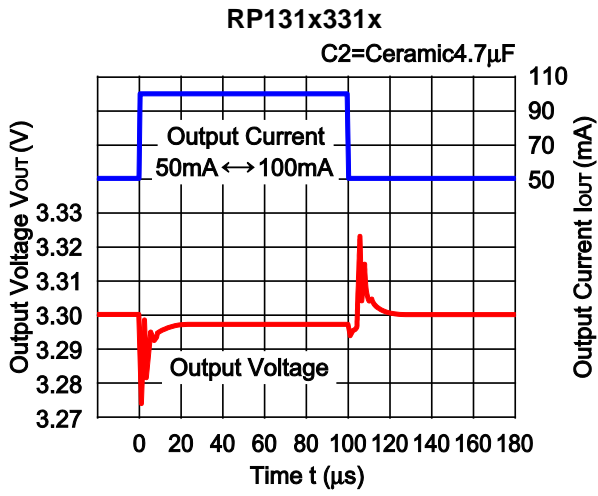
NO.EA-174-200128

10) Input Transient Response ($I_{OUT}=100mA$, $t_r=t_f=5\mu s$, $C1=none$, $T_a=25^\circ C$)



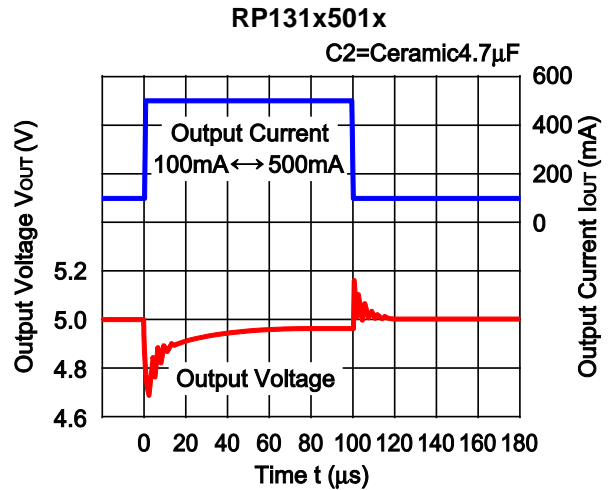
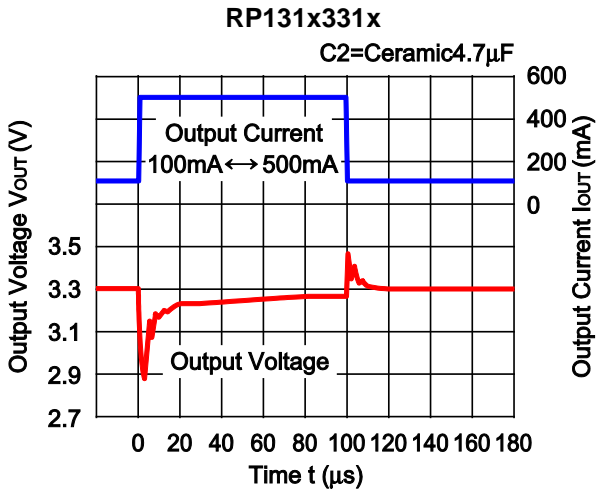
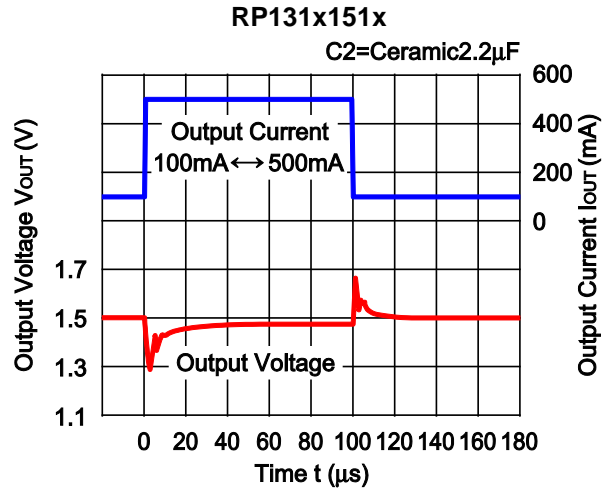
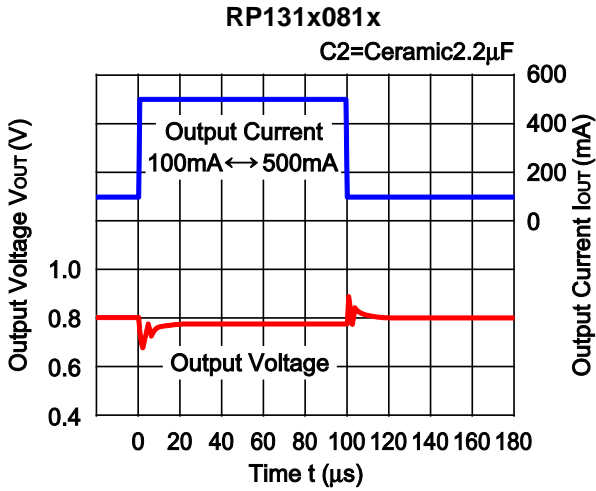
11) Load Transient Response ($t_r=t_f=0.5\mu s$, $C1=Ceramic\ 2.2\mu F$, $V_{IN}=V_{OUT}+1.0V$, $T_{opt}=25^\circ C$)



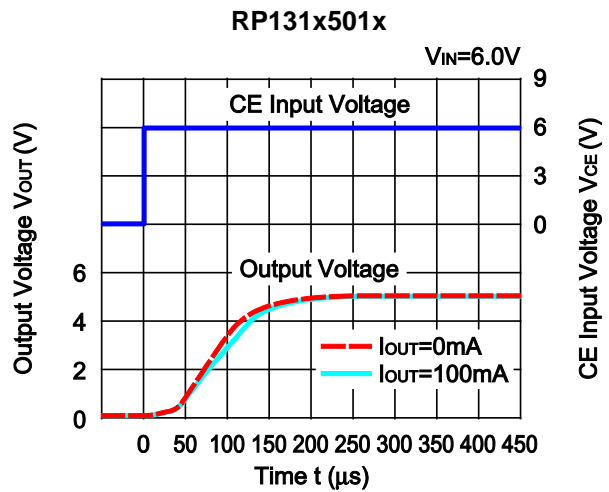
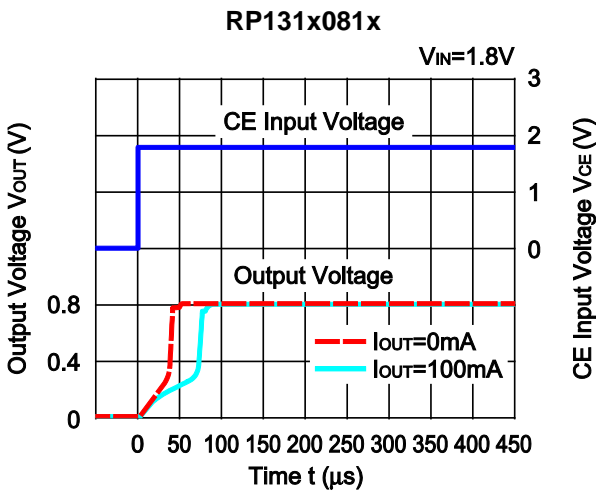


RP131x

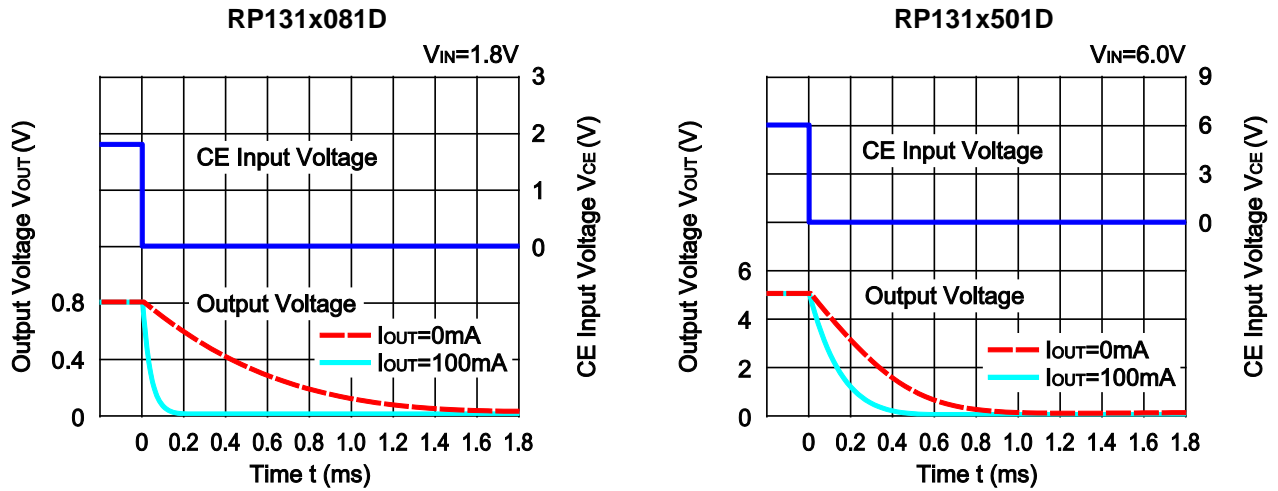
NO.EA-174-200128



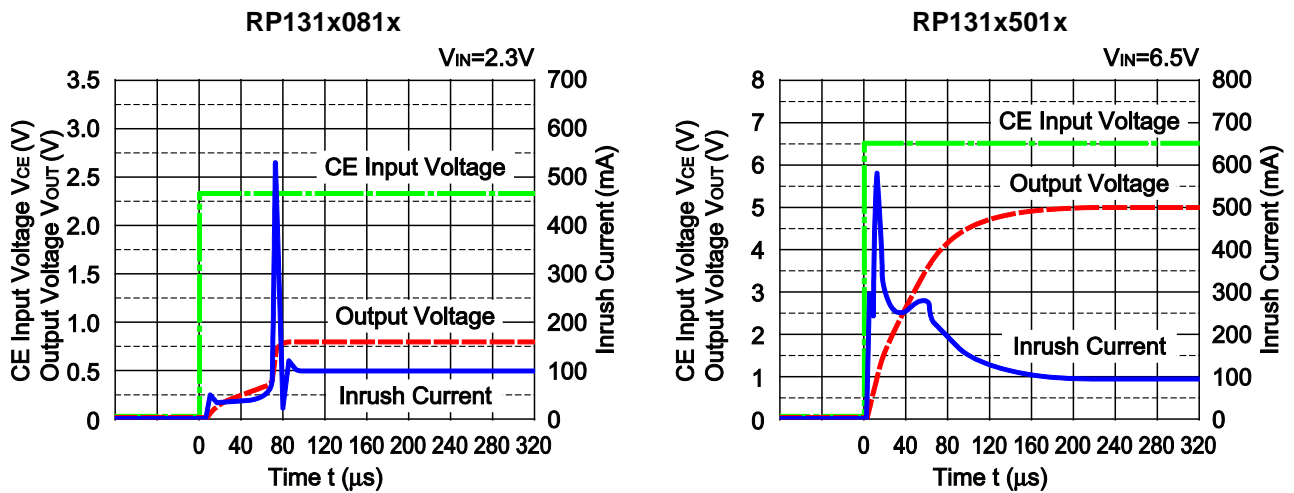
12) Turn On Speed with CE pin (C1=Ceramic 2.2 μ F, C2=Ceramic 4.7 μ F, T_{opt}=25°C)



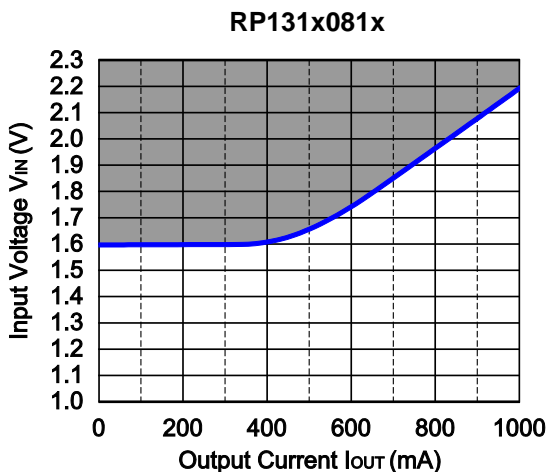
13) Turn Off Speed with CE pin (D Version) (C1=Ceramic 2.2 μ F, C2=Ceramic 4.7 μ F, T_a=25°C)



14) Inrush Current at turning on (C1=Ceramic 2.2 μ F, C2=Ceramic 4.7 μ F, T_{opt}=25°C)



15) Minimum Operating Voltage



Hatched area is available for 0.8V output.

RP131x

NO.EA-174-200128

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 $40\mu V$ (Avg.) are marked as the hatched area in the graph.

Measurement conditions

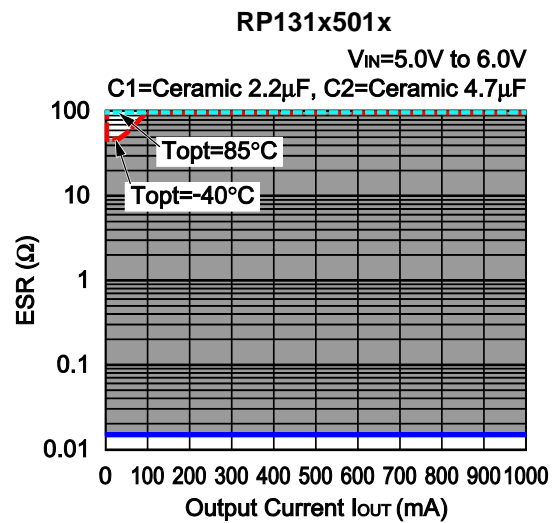
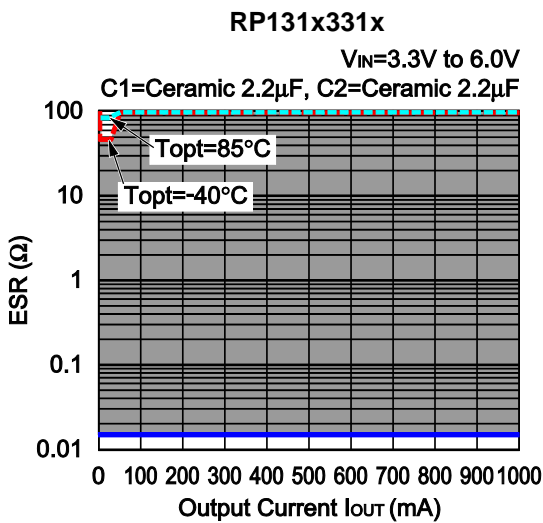
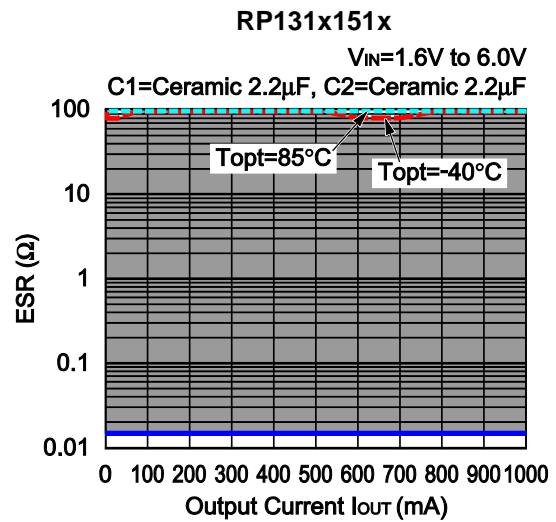
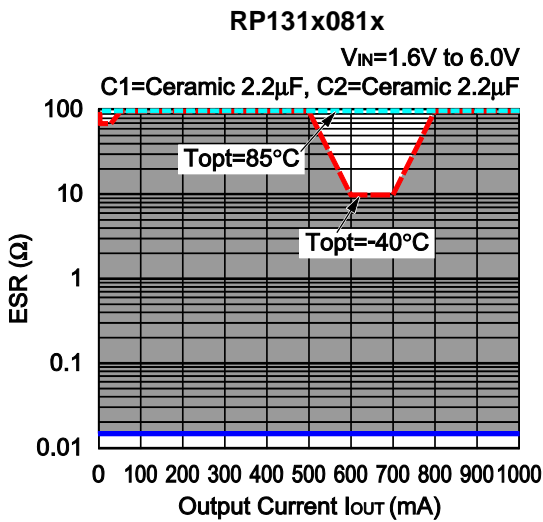
Frequency Band : 10Hz to 3MHz

Temperature : $-40^{\circ}C$ to $85^{\circ}C$

C1 : $2.2\mu F$ (Kyocera, CM05X5R225M04AD)

C2 : $2.2\mu F$ (Kyocera, CM105X5R225K06AE)

$4.7\mu F$ (Kyocera, CM105X5R475M06AB)



* RP131L(DFN1616-6B) is the limited product as of February 2021.

POWER DISSIPATION

DFN1616-6B

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

| Item | Measurement Conditions |
|------------------|--|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm |
| Copper Ratio | Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes | φ 0.2 mm × 15 pcs |

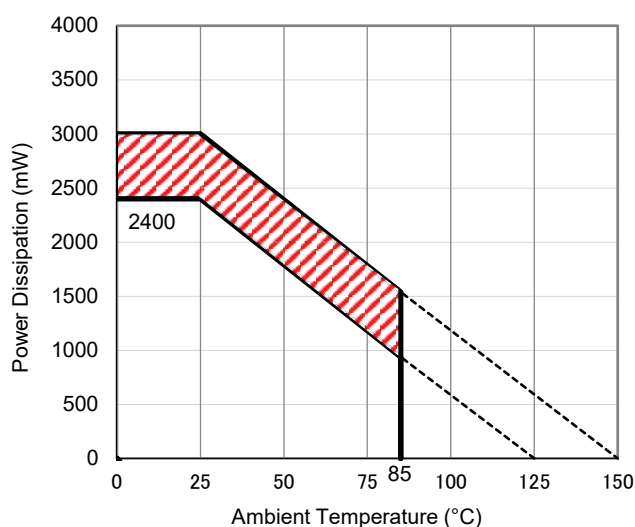
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

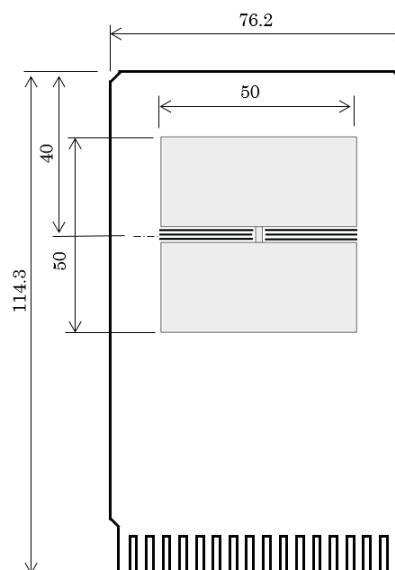
| Item | Measurement Result |
|--|--------------------------------------|
| Power Dissipation | 2400 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 41^{\circ}\text{C/W}$ |
| Thermal Characterization Parameter (ψ_{jt}) | $\psi_{jt} = 11^{\circ}\text{C/W}$ |

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at $T_{jmax} = 125^{\circ}\text{C}$ and $T_{jmax} = 150^{\circ}\text{C}$. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

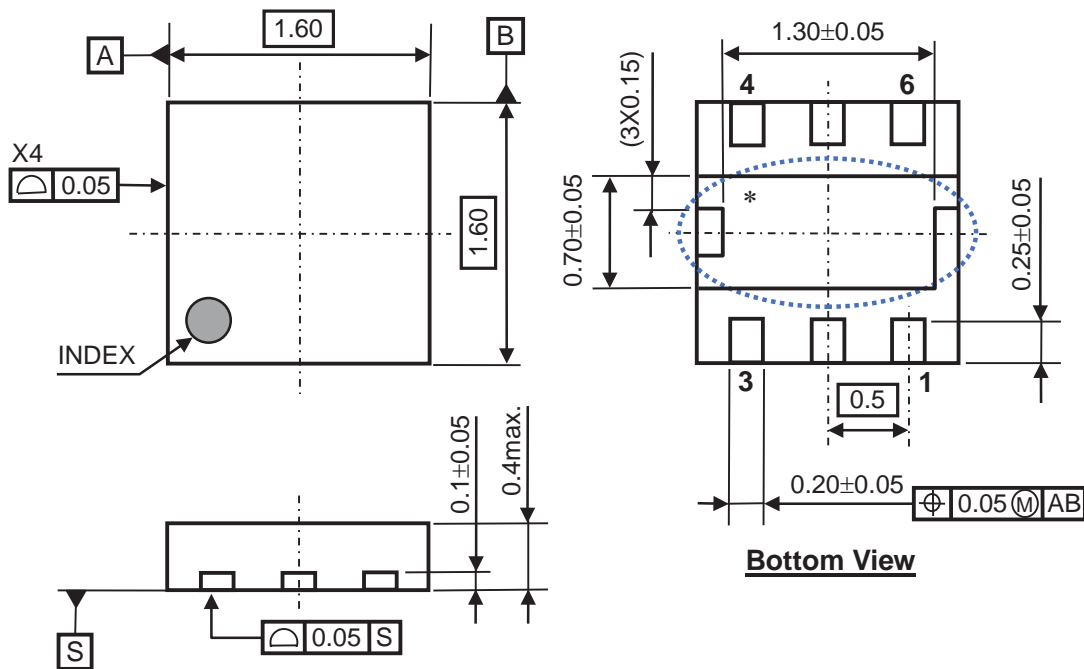
| | |
|--------------------|----------------------------------|
| Total Hours of Use | Total Years of Use (4 hours/day) |
| 13,000 hours | 9 years |

* RP131L(DFN1616-6B) is the limited product as of February 2021.

PACKAGE DIMENSIONS

DFN1616-6B

Ver. A



DFN1616-6B Package Dimensions (Unit: mm)

* The tab on the bottom of the package shown by blue circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane pin on the board but it is possible to leave the tab floating.

POWER DISSIPATION

DFN(PLP)1820-6

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

| Item | Measurement Conditions |
|------------------|--|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm |
| Copper Ratio | Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes | φ 0.2 mm × 34 pcs |

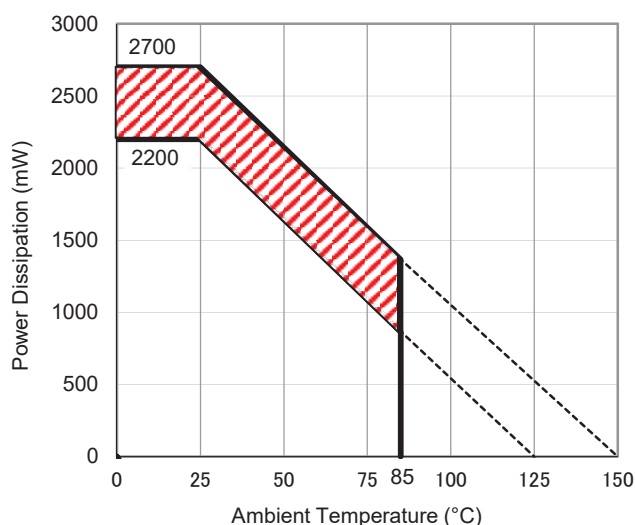
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

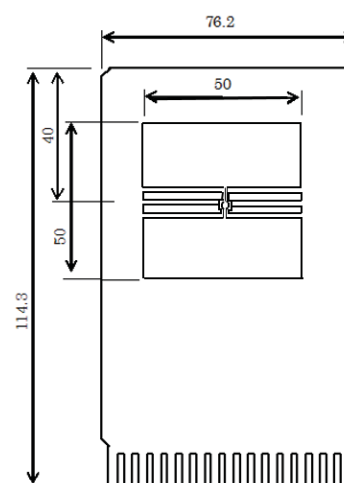
| Item | Measurement Result |
|--|------------------------------------|
| Power Dissipation | 2200 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 45^\circ\text{C/W}$ |
| Thermal Characterization Parameter (ψ_{jt}) | $\psi_{jt} = 18^\circ\text{C/W}$ |

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at $T_{jmax} = 125^\circ\text{C}$ and $T_{jmax} = 150^\circ\text{C}$. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

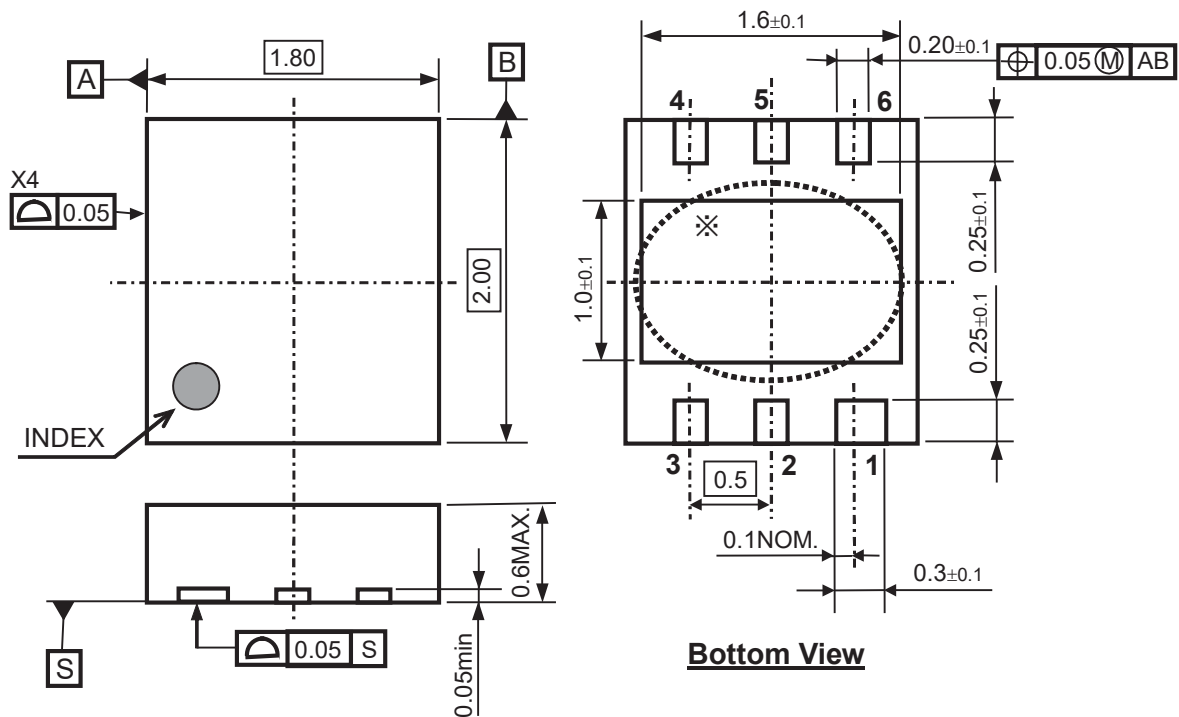
| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours | 9 years |

* RP131L(DFN1616-6B) is the limited product as of February 2021.

PACKAGE DIMENSIONS

DFN(PLP)1820-6

Ver. A



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

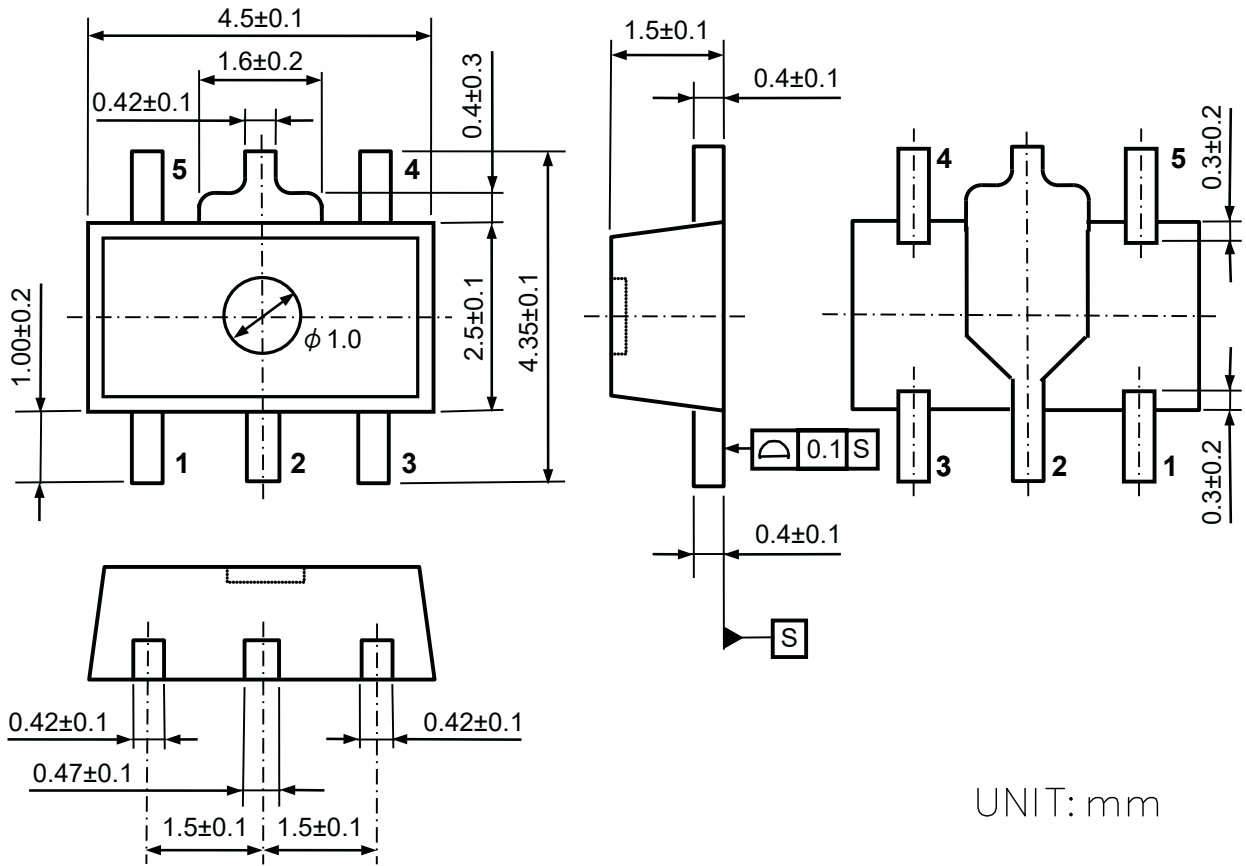
* The tab on the bottom of the package is substrate level (GND). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating.

* RP131L(DFN1616-6B) is the limited product as of February 2021.

PACKAGE DIMENSIONS

SOT-89-5

Ver. A



SOT-89-5 Package Dimensions

POWER DISSIPATION

SOT-89-5

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

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

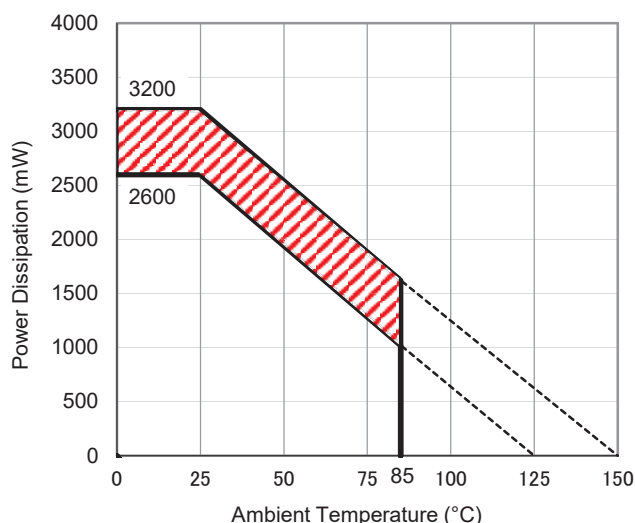
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

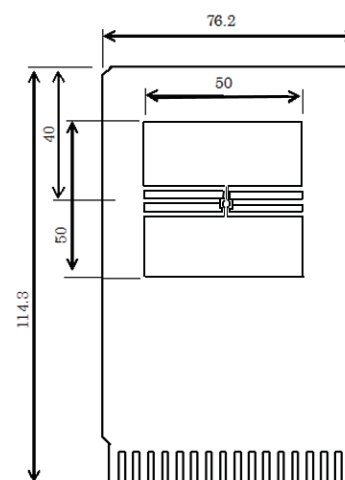
| Item | Measurement Result |
|--|--------------------------------------|
| Power Dissipation | 2600 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 38^{\circ}\text{C/W}$ |
| Thermal Characterization Parameter (ψ_{jt}) | $\psi_{jt} = 13^{\circ}\text{C/W}$ |

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at $T_{jmax} = 125^{\circ}\text{C}$ and $T_{jmax} = 150^{\circ}\text{C}$. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours | 9 years |

POWER DISSIPATION

HSOP-6J

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

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

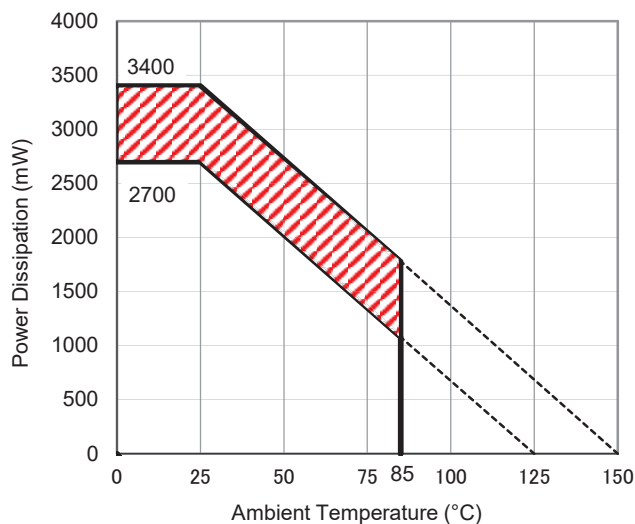
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

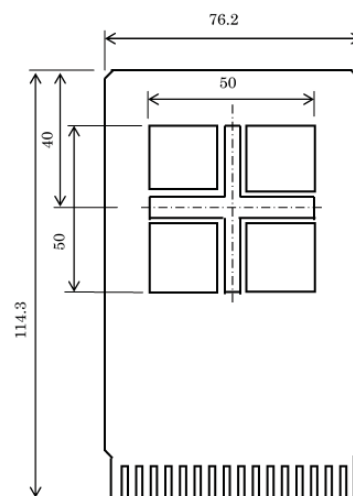
| Item | Measurement Result |
|--|--------------------------------------|
| Power Dissipation | 2700 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 37^{\circ}\text{C/W}$ |
| Thermal Characterization Parameter (ψ_{jt}) | $\psi_{jt} = 7^{\circ}\text{C/W}$ |

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at $T_{jmax} = 125^{\circ}\text{C}$ and $T_{jmax} = 150^{\circ}\text{C}$. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

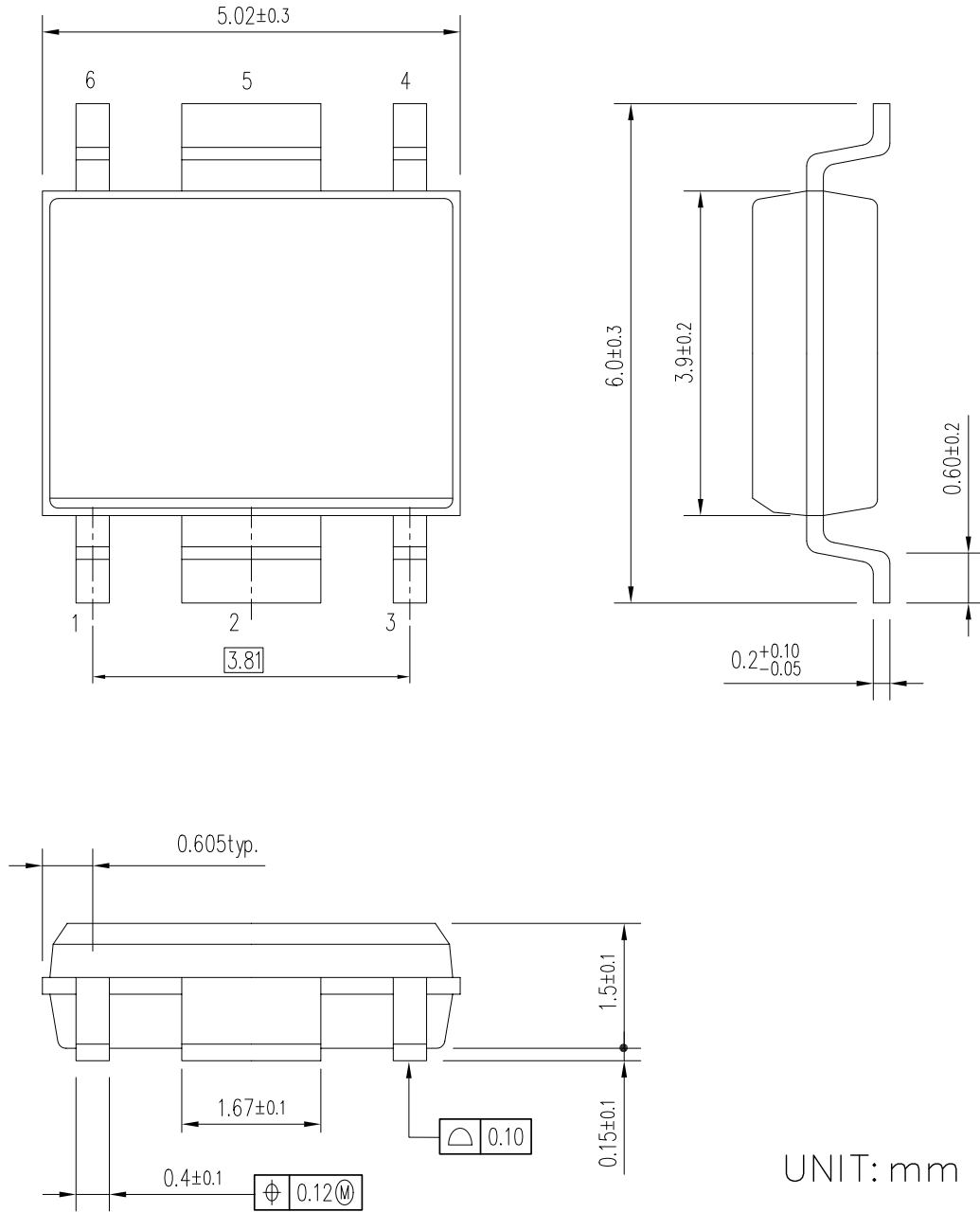
| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours | 9 years |

* RP131L(DFN1616-6B) is the limited product as of February 2021.

PACKAGE DIMENSIONS

HSOP-6J

Ver. A



HSOP-6J Package Dimensions

POWER DISSIPATION

TO-252-5

Ver. A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

| Item | Measurement Conditions |
|------------------|--|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm |
| Copper Ratio | Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes | φ 0.3 mm × 21 pcs |

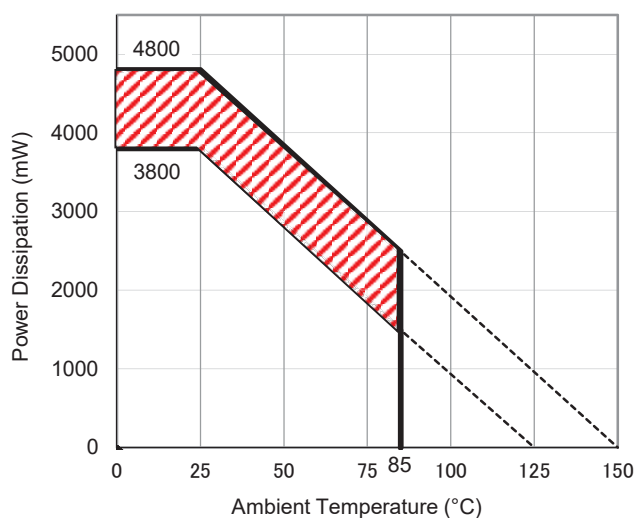
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

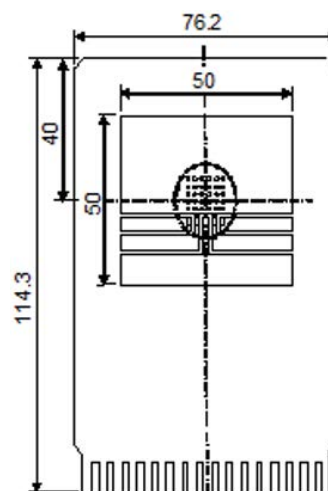
| Item | Measurement Result |
|--|--------------------------------------|
| Power Dissipation | 3800 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 26^{\circ}\text{C/W}$ |
| Thermal Characterization Parameter (ψ_{jt}) | $\psi_{jt} = 7^{\circ}\text{C/W}$ |

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

The above graph shows the power dissipation of the package at $T_{jmax} = 125^{\circ}\text{C}$ and $T_{jmax} = 150^{\circ}\text{C}$. Operating the device in the hatched range might have a negative influence on its lifetime. The total hours of use and the total years of use must be limited as follows:

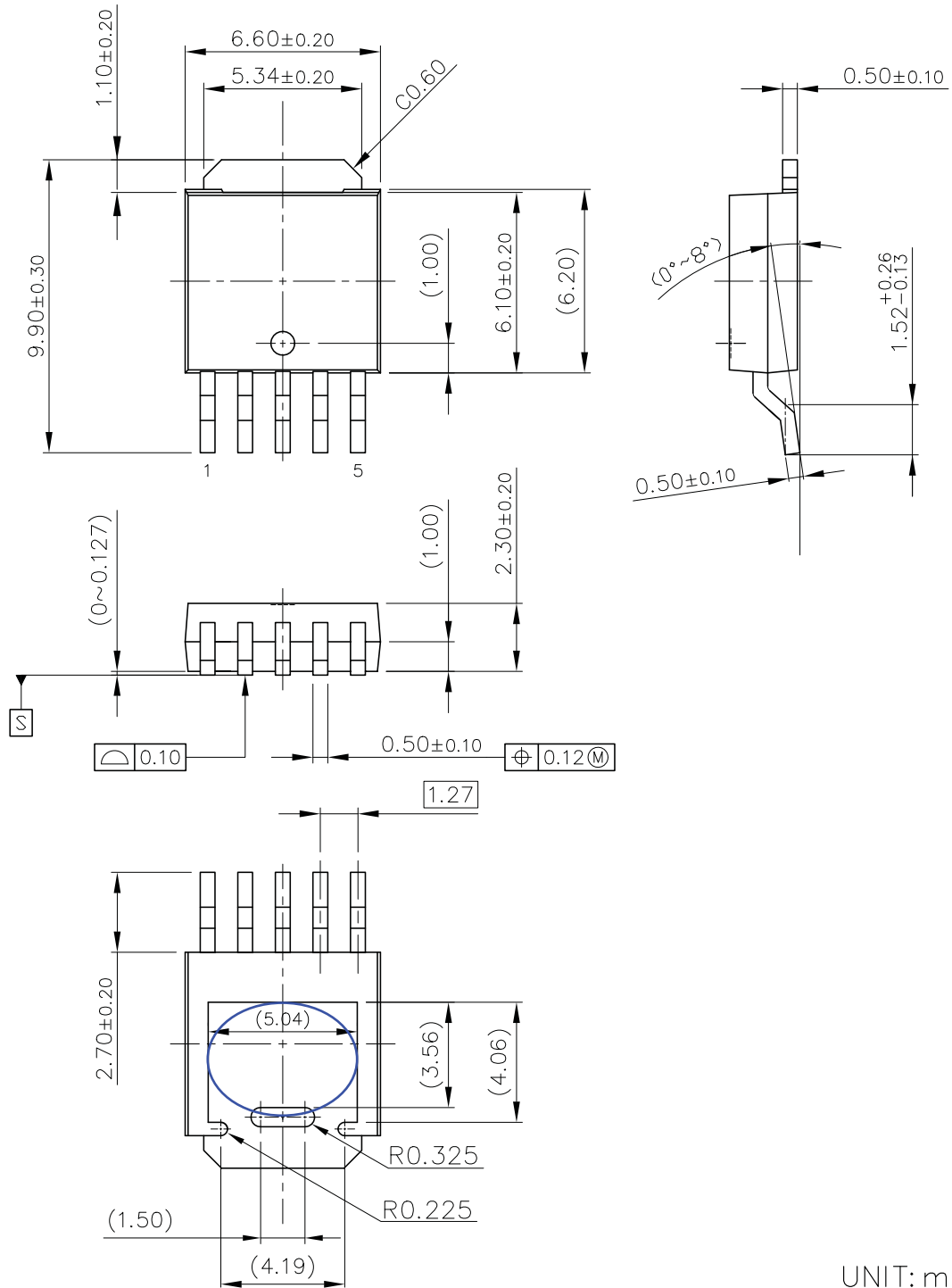
| Total Hours of Use | Total Years of Use (4 hours/day) |
|--------------------|----------------------------------|
| 13,000 hours | 9 years |

* RP131L(DFN1616-6B) is the limited product as of February 2021.

PACKAGE DIMENSIONS

TO-252-5-P2

Ver. A



UNIT: mm

TO-252-5-P2 Package Dimensions

* The tab on the bottom of the package shown by blue circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane on the board but it is possible to leave the tab floating.



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8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
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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.
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Nisshinbo Micro Devices Inc.

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Purchase information

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