

100 mA Ultra-Low Supply Current Voltage Regulator

No. EA-399-181026

OVERVIEW

RP118x is a voltage regulator featuring 0.2 μA ultra-low supply current. This device is ideal for a wearable equipment and IoT which require a long service life and a miniaturization of a battery.

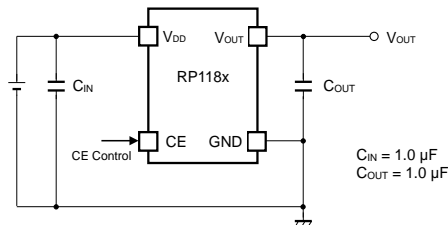
KEY BENEFITS

- Achieves a low supply current (0.2 μA) and contributes to a long-life and a miniaturized battery.
- Provides a small package to achieve the smallest possible footprint solution on boards where area is limited.

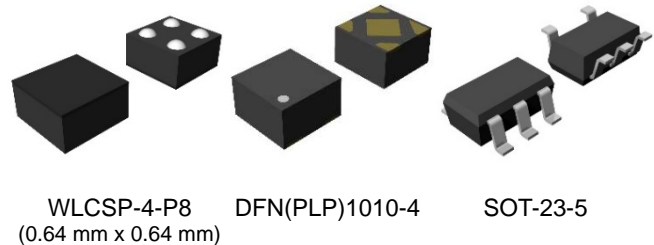
KEY SPECIFICATIONS

- Supply Current Typ. 0.2 μA
- Standby Current Typ. 0.002 μA
- Output Voltage Accuracy $\pm 0.8\%$
- Input Voltage Range (Maximum Rating) 1.7 V to 5.5 V (6.5 V)
- Output Voltage Range 1.2 V to 3.6 V (0.1 V step)
- Built-in Fold Back Protection Circuit Typ. 50 mA (Current at short mode)
- Ceramic capacitors recommended to be used 1.0 μF or more
- Dropout Voltage Typ. 0.1 V ($I_{\text{OUT}} = 100 \text{ mA}$, $V_{\text{SET}} = 2.8 \text{ V}$)
- Operating mode Automatic mode (Automatically shifts between fast response mode and low power mode)

TYPICAL APPLICATIONS



PACKAGE



SELECTION GUIDE

| Product Name | Package |
|------------------|----------------|
| RP118Zxx1*-TR-F | WLCSP-4-P8 |
| RP118Kxx1*-TR | DFN(PLP)1010-4 |
| RP118Nxx1*-TR-FE | SOT-23-5 |

*: Select auto-discharge function

| Version | CE pin | Auto-discharge |
|---------|-------------|----------------|
| B | Active-high | Disable |
| D | Active-high | Auto-discharge |

xx: Set output voltage (V_{SET}) is selectable from 1.2 V to 3.6 V in 0.1 V step.

APPLICATIONS

- Wearable equipment such as SmartWatch, SmartBand, and health monitoring
- Li-ion battery-used equipment and coin cell-used equipment
- Low power RF such as Bluetooth® Low Energy, Zigbee, WiSun, ANT
- Low power CPU, memory, sensor devices, and energy harvesting

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SELECTION GUIDE

The set output voltage, the auto-discharge function, and the package for the ICs are user-selectable options.

Selection Guide

| Product Name | Package | Quantity per Reel | Pb Free | Halogen Free |
|------------------|----------------|-------------------|---------|--------------|
| RP118Zxx1*-TR-F | WLCSP-4-P8 | 5,000 pcs | Yes | Yes |
| RP118Kxx1*-TR | DFN(PLP)1010-4 | 10,000 pcs | Yes | Yes |
| RP118Nxx1*-TR-FE | SOT-23-5 | 3,000 pcs | Yes | Yes |

xx: Set output voltage (V_{SET}) is selectable from 1.2 V (12) to 3.6 V (36) in 0.1 V step.

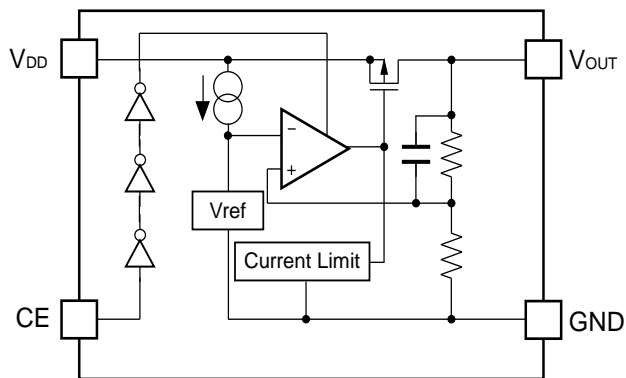
The voltage in 0.05 V step is shown as follows.

1.85 V: RP118x181*5

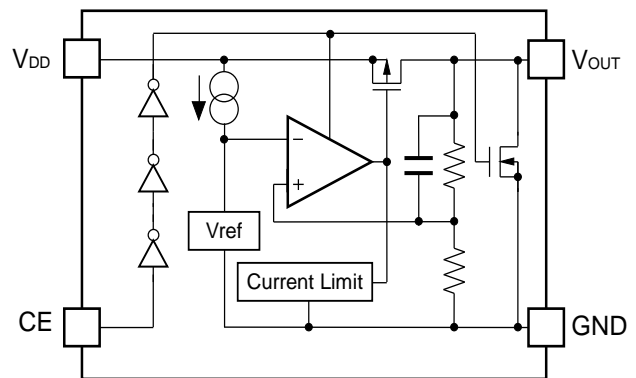
*: Select auto-discharge function

| Version | CE pin | Auto-discharge |
|---------|-------------|----------------|
| B | Active-high | Disable |
| D | Active-high | Auto-discharge |

BLOCK DIAGRAM

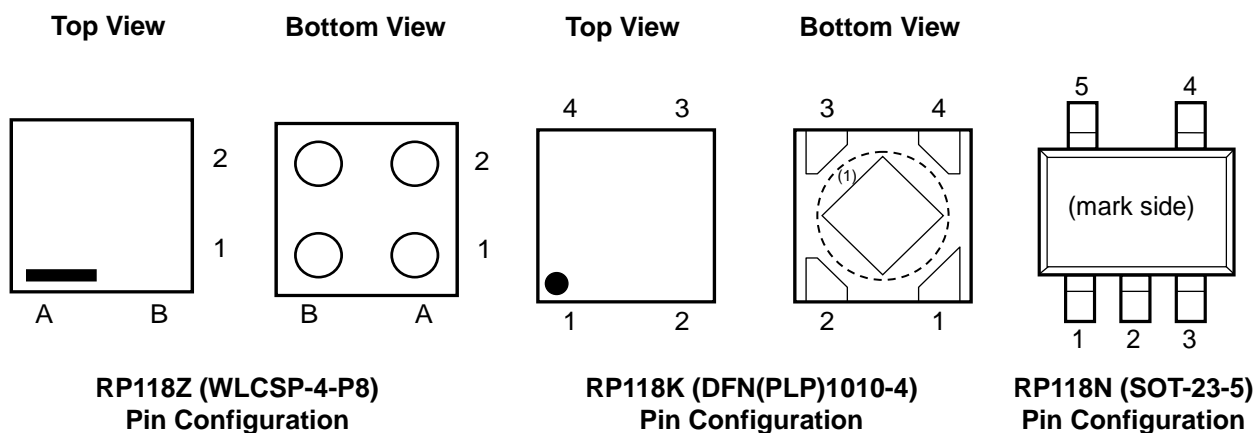


RP118xxx1B Block Diagram



RP118xxx1D Block Diagram

PIN DESCRIPTION



WLCSP-4-P8 Pin Description

| Pin No | Symbol | Pin Description |
|--------|--------|-------------------------------|
| A1 | VDD | Input Pin |
| A2 | VOUT | Output Pin |
| B1 | CE | Chip Enable Pin (Active-high) |
| B2 | GND | Ground Pin |

DFN(PLP)1010-4 Pin Description

| Pin No | Symbol | Description |
|--------|--------|-------------------------------|
| 1 | VOUT | Output Pin |
| 2 | GND | Ground Pin |
| 3 | CE | Chip Enable Pin (Active-high) |
| 4 | VDD | Input Pin |

SOT-23-5 Pin Description

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

(1) パッケージ裏面のタブの電位は基板電位 (GND) です。GND端子と接続するか、オープンとしてください。

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ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

| Symbol | Item | Rating | Unit | |
|-----------|----------------------------------|--|------|----|
| V_{IN} | Input Voltage | -0.3 to 6.5 | V | |
| V_{CE} | CE Pin Input Voltage | -0.3 to 6.5 | V | |
| V_{OUT} | VOUT Pin Voltage | -0.3 to $V_{IN} + 0.3$ | V | |
| I_{OUT} | Output Current | 130 | mA | |
| P_D | Power Dissipation ⁽¹⁾ | WLCSP-4-P8, JEDEC STD. 51-9 Test Land Pattern | 470 | mW |
| | | DFN(PLP)1010-4, JEDEC STD. 51-7 Test Land Pattern | 510 | mW |
| | | SOT-23-5, JEDEC STD. 51-7 Test Land Pattern | 660 | mW |
| 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

Recommended Operating Conditions

| Symbol | Item | Rating | Unit |
|----------|-----------------------------|------------|------|
| V_{IN} | Input Voltage | 1.7 to 5.5 | 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 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.

⁽¹⁾ Refer to *POWER DISSIPATION* for detailed information.

ELECTRICAL CHARACTERISTICS

$V_{IN} = V_{SET} + 1.0 \text{ V}$, $I_{OUT} = 1.5 \text{ mA}$, $C_{IN} = C_{OUT} = 1.0 \mu\text{F}$, unless otherwise noted.

The specifications surrounded by are guaranteed by design engineering at $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$.

RP118xxx1B/D Electrical Characteristics

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

| Symbol | Parameter | Test Conditions/Comments | Min. | Typ. | Max. | Unit | |
|---|---|---|--|---|---|---|----|
| V_{OUT} | Output Voltage (Fast Response Mode) | $T_a = 25^\circ\text{C}$ | $V_{SET} > 2.0 \text{ V}$ | x 0.992 | | x 1.008 | V |
| | | | $V_{SET} \leq 2.0 \text{ V}$ | -16 | | 16 | mV |
| | | $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | $V_{SET} > 2.0 \text{ V}$ | x 0.987 | | x 1.013 | V |
| | | | $V_{SET} \leq 2.0 \text{ V}$ | -26 | | 26 | mV |
| I_{OUT} | Output Current | | 100 | | | mA | |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ | Load Regulation | $1 \mu\text{A} \leq I_{OUT} \leq 1.5 \text{ mA}$ | $V_{SET} > 2.0 \text{ V}$ | x 0.99 | | x 1.01 | V |
| | | | $V_{SET} \leq 2.0 \text{ V}$ | -20 | | 20 | mV |
| | | $1.5 \text{ mA} \leq I_{OUT} \leq 100 \text{ mA}$ | -40 | 2 | 40 | mV | |
| V_{DIF} | Dropout Voltage | $I_{OUT} = 100 \text{ mA}$ | Refer to <i>PRODUCT-SPECIFIC ELECTRICAL CHARACTERISTICS</i> | | | | |
| I_{SS} | Supply Current | $V_{CE} = V_{IN}$, $I_{OUT} = 0 \text{ mA}$ | | 0.2 | 0.42 | μA | |
| | | | | | 0.5 | μA | |
| $I_{STANDBY}$ | Standby Current | $V_{CE} = 0 \text{ V}$ | | 0.002 | 0.055 | μA | |
| I_{OUTH} | Fast Response Mode switch-over current | $I_{OUT} = \text{Light load to Heavy load}$ $V_{IN} = 5.0 \text{ V}$ | | | 1.5 | mA | |
| I_{OUTL} | Low Power Mode switch-over current | $I_{OUT} = \text{Heavy load to Light load}$ $V_{IN} = 5.0 \text{ V}$ | 0.08 | | | mA | |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ | Line Regulation | $V_{SET} + 0.5 \text{ V} \leq V_{IN} \leq 5.5 \text{ V}$ | | 0.02 | 0.2 | %/V | |
| I_{SC} | Short-circuit Current Limit | $V_{OUT} = 0 \text{ V}$ | | 50 | | mA | |
| V_{CEH} | CE Pin Input Voltage, high | | 1.0 | | | V | |
| V_{CEL} | CE Pin Input Voltage, low | | | | 0.4 | V | |
| R_{LOW} | LOW Output NMOS On-state Resistance (RP118xxx1D only) | $V_{IN} = 4.0 \text{ V}$, $V_{CE} = 0 \text{ V}$ | | 50 | | Ω | |

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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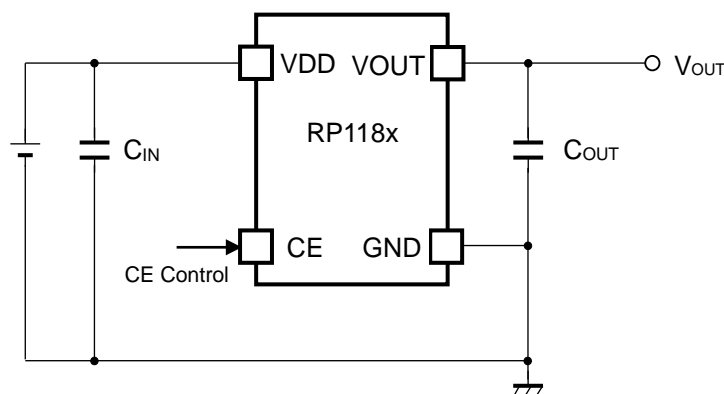
The specifications surrounded by are guaranteed by design engineering at $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$.

Product-specific Electrical Characteristics

| Product Name | V _{OUT} [V] | | | | | | V _{DIF} [V] | |
|--------------|----------------------|-------|-------|---|-------|---|----------------------|---|
| | Ta = 25°C | | | -40°C ≤ Ta ≤ 85°C | | | Typ. | Max. |
| | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| RP118x121x | 1.184 | 1.200 | 1.216 | 1.174 | 1.200 | 1.226 | 0.640 | 0.975 |
| RP118x121x5 | 1.234 | 1.250 | 1.266 | 1.224 | 1.250 | 1.276 | | |
| RP118x131x | 1.284 | 1.300 | 1.316 | 1.274 | 1.300 | 1.326 | 0.560 | 0.890 |
| RP118x141x | 1.384 | 1.400 | 1.416 | 1.374 | 1.400 | 1.426 | 0.490 | 0.770 |
| RP118x151x | 1.484 | 1.500 | 1.516 | 1.474 | 1.500 | 1.526 | 0.410 | 0.660 |
| RP118x161x | 1.584 | 1.600 | 1.616 | 1.574 | 1.600 | 1.626 | 0.340 | 0.560 |
| RP118x171x | 1.684 | 1.700 | 1.716 | 1.674 | 1.700 | 1.726 | 0.280 | 0.435 |
| RP118x181x | 1.784 | 1.800 | 1.816 | 1.774 | 1.800 | 1.826 | 0.230 | 0.380 |
| RP118x181x5 | 1.834 | 1.850 | 1.866 | 1.824 | 1.850 | 1.876 | | |
| RP118x191x | 1.884 | 1.900 | 1.916 | 1.874 | 1.900 | 1.926 | 0.200 | 0.320 |
| RP118x201x | 1.984 | 2.000 | 2.016 | 1.974 | 2.000 | 2.026 | 0.150 | 0.285 |
| RP118x211x | 2.084 | 2.100 | 2.116 | 2.073 | 2.100 | 2.127 | | |
| RP118x221x | 2.183 | 2.200 | 2.217 | 2.172 | 2.200 | 2.228 | 0.130 | 0.230 |
| RP118x231x | 2.282 | 2.300 | 2.318 | 2.271 | 2.300 | 2.329 | | |
| RP118x241x | 2.381 | 2.400 | 2.419 | 2.369 | 2.400 | 2.431 | 0.110 | 0.180 |
| RP118x251x | 2.480 | 2.500 | 2.520 | 2.468 | 2.500 | 2.532 | | |
| RP118x261x | 2.580 | 2.600 | 2.620 | 2.567 | 2.600 | 2.633 | 0.100 | 0.160 |
| RP118x271x | 2.679 | 2.700 | 2.721 | 2.665 | 2.700 | 2.735 | | |
| RP118x281x | 2.778 | 2.800 | 2.822 | 2.764 | 2.800 | 2.836 | 0.090 | 0.145 |
| RP118x291x | 2.877 | 2.900 | 2.923 | 2.863 | 2.900 | 2.937 | | |
| RP118x301x | 2.976 | 3.000 | 3.024 | 2.961 | 3.000 | 3.039 | 0.090 | 0.145 |
| RP118x311x | 3.076 | 3.100 | 3.124 | 3.060 | 3.100 | 3.140 | | |
| RP118x321x | 3.175 | 3.200 | 3.225 | 3.159 | 3.200 | 3.241 | 0.090 | 0.145 |
| RP118x331x | 3.274 | 3.300 | 3.326 | 3.258 | 3.300 | 3.342 | | |
| RP118x341x | 3.373 | 3.400 | 3.427 | 3.356 | 3.400 | 3.444 | 0.090 | 0.145 |
| RP118x351x | 3.472 | 3.500 | 3.528 | 3.455 | 3.500 | 3.545 | | |
| RP118x361x | 3.572 | 3.600 | 3.628 | 3.554 | 3.600 | 3.646 | 0.090 | 0.145 |

APPLICATION INFORMATION

Typical Application



RP118x Typical Application

External Components

| Symbol | Description |
|------------------|---|
| C _{IN} | Ceramic Capacitor 1.0 μF MURATA GRM155R61A105KE15 |
| C _{OUT} | Ceramic Capacitor 1.0 μF MURATA GRM155R61A105KE15 |

Technical Notes on the External Components

- In this device, phase compensation is provided to secure stable operation even when the load current is varied. For this purpose, use a 1.0 μF or more output capacitor (C_{OUT}). In case of using a tantalum type capacitor with a large ESR (Equivalent Series Resistance), the output might become unstable. Evaluate your circuit including consideration of frequency characteristics.
- Ensure the VDD and GND lines are sufficiently robust. If their impedances are too high, noise pickup or unstable operation may result. Connect a 1.0 μF or more input capacitor (C_{IN}) between the VDD and GND pins with shortest-distance wiring. Also, connect an output capacitor (C_{OUT}) between the VOUT and GND pins with shortest-distance wiring.

TECHNICAL NOTES

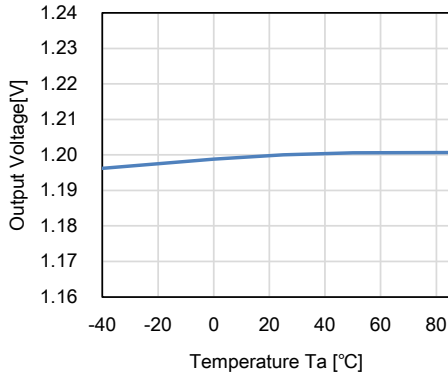
- When an intermediate voltage other than V_{IN} or GND is input to the CE pin, a supply current may be increased with a through current of a logic circuit in the IC. The CE pin is neither pulled up nor pulled down, therefore an operation is not stable at open.

TYPICAL CHARACTERISTICS

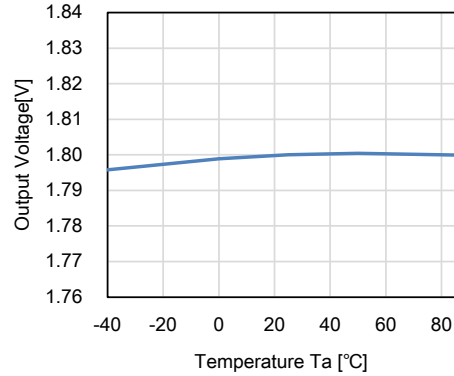
Typical Characteristics are intended to be used as reference data; they are not guaranteed.

1) Output Voltage vs. Temperature ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$)

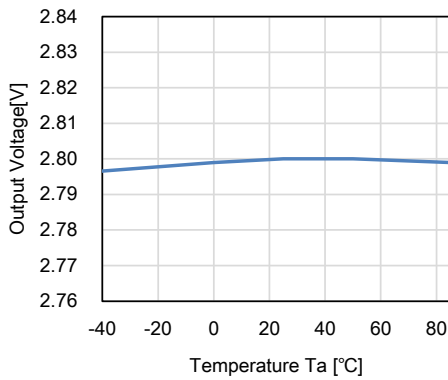
RP118x121x, $V_{IN} = 2.2 \text{ V}$, $I_{OUT} = 1 \text{ mA}$



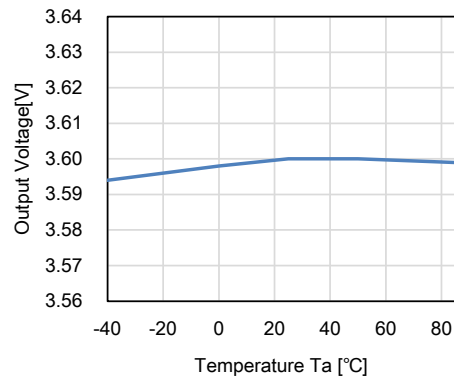
RP118x181x, $V_{IN} = 2.8 \text{ V}$, $I_{OUT} = 1 \text{ mA}$



RP118x281x, $V_{IN} = 3.8 \text{ V}$, $I_{OUT} = 1 \text{ mA}$

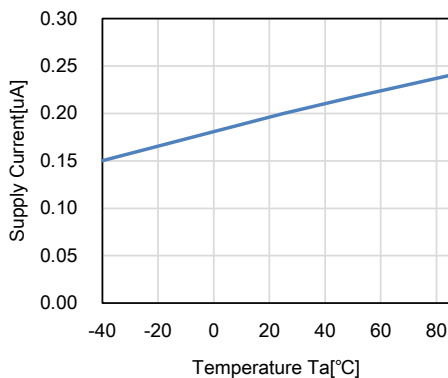


RP118x361x, $V_{IN} = 4.6 \text{ V}$, $I_{OUT} = 1 \text{ mA}$

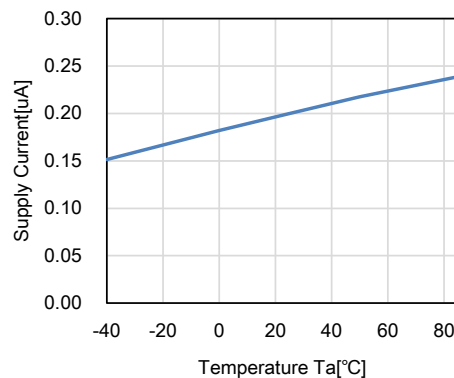


2) Supply Current vs. Temperature ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$)

RP118x121x, $V_{IN} = 2.2 \text{ V}$

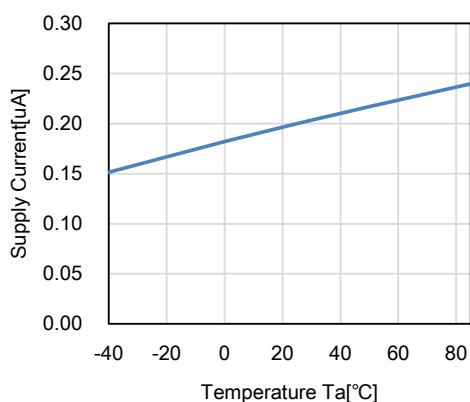


RP118x181x, $V_{IN} = 2.8 \text{ V}$

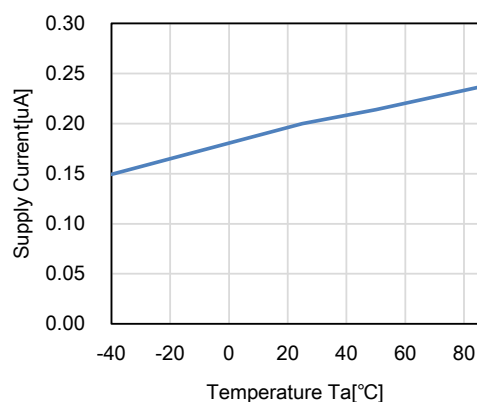


※ Typical characteristics at $I_{OUT} = 1 \text{ mA}$ are evaluated in a fast response mode.

RP118x281x, $V_{IN} = 3.8\text{ V}$

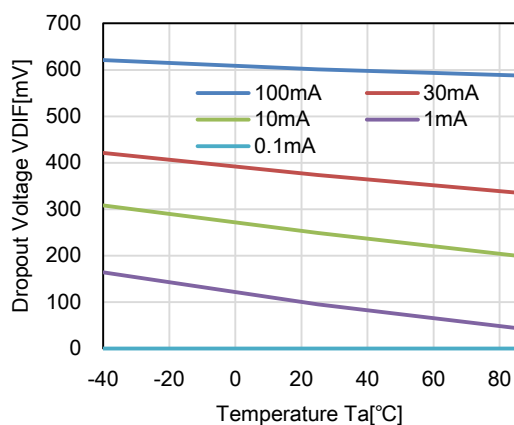


RP118x361x, $V_{IN} = 4.6\text{ V}$

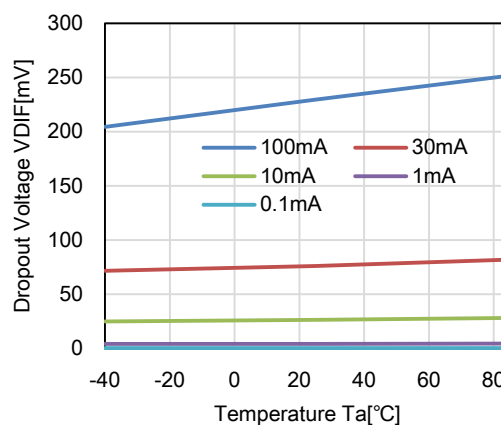


3) Dropout Voltage vs. Temperature ($C_{IN} = \text{Ceramic } 1.0\ \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0\ \mu\text{F}$)

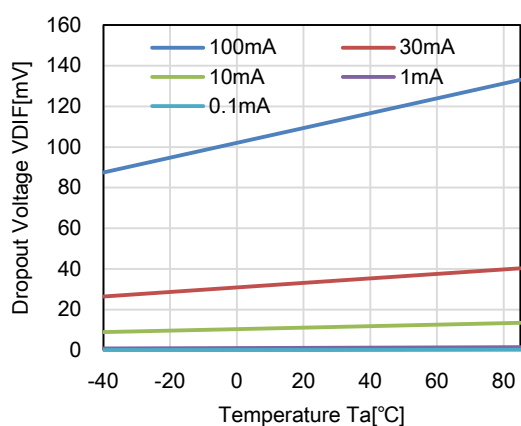
RP118x121x



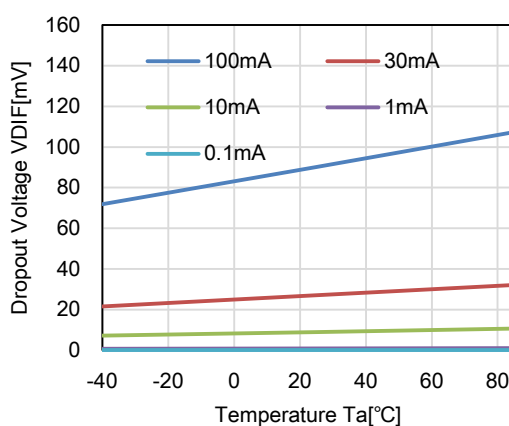
RP118x181x



RP118x281x



RP118x361x

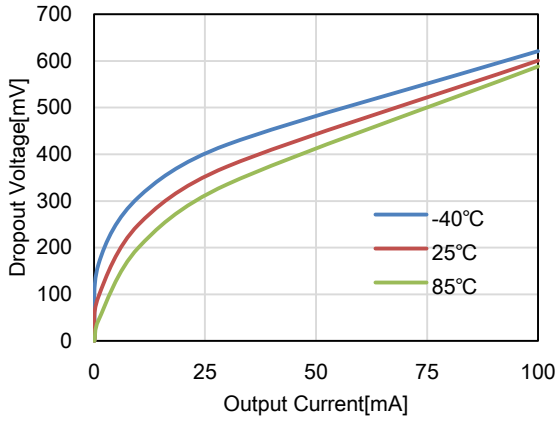


* Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

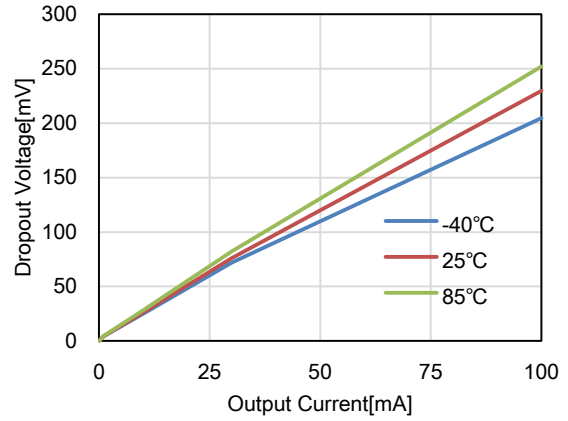
RP118x

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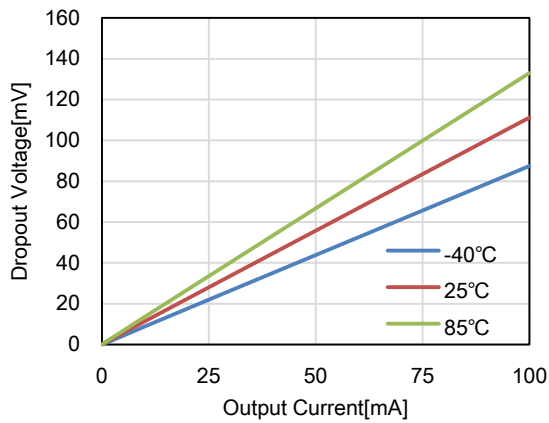
4) Dropout Voltage vs Output Current ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$)



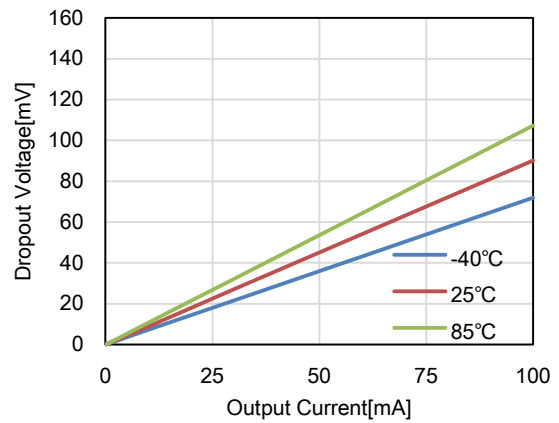
RP118x121x



RP118x181x

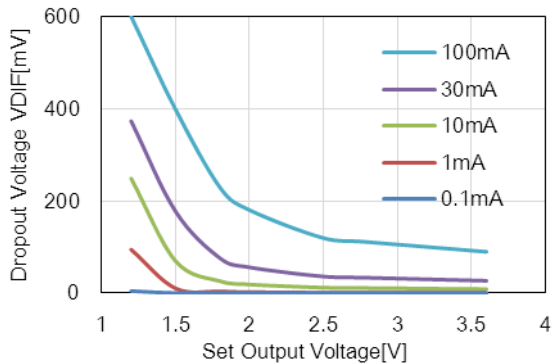


RP118x281x



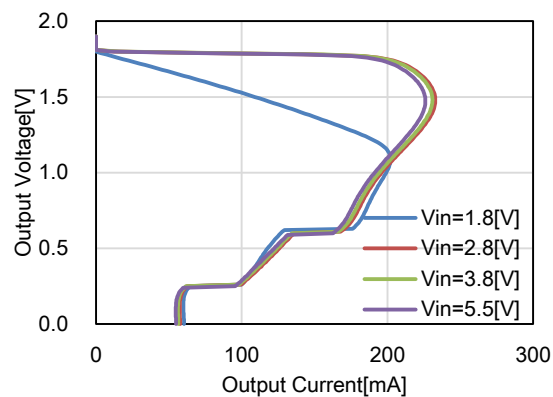
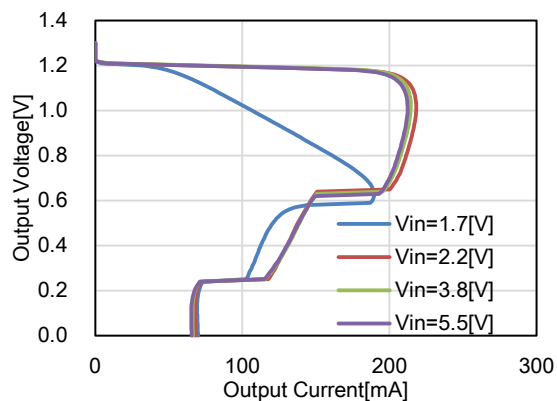
RP118x361x

5) Dropout Voltage vs Set Output Voltage ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$, $T_a = 25^\circ\text{C}$)



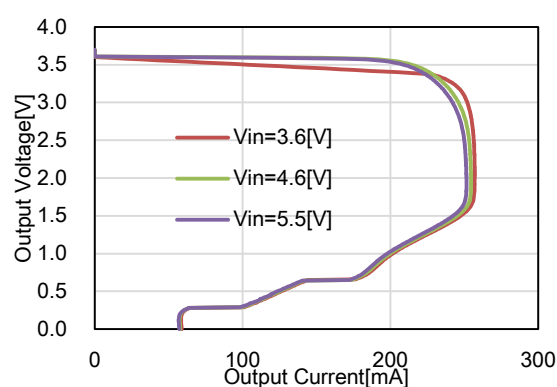
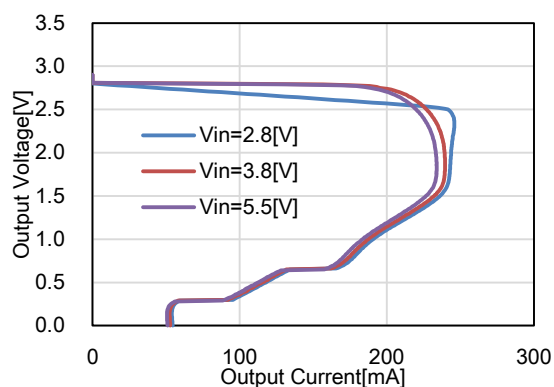
※ Typical characteristics at $I_{OUT} = 1 \text{ mA}$ are evaluated in a fast response mode.

6) Output Voltage vs. Output Current ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$, $T_a = 25^\circ\text{C}$)
RP118x121x **RP118x181x**

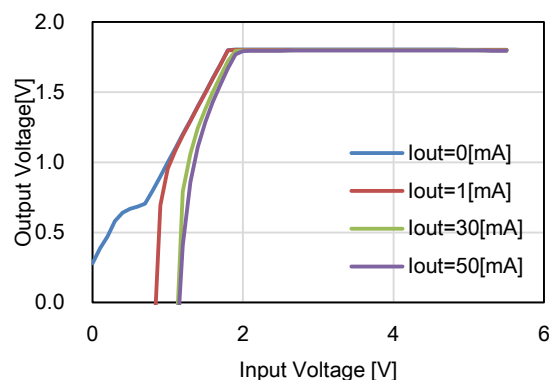
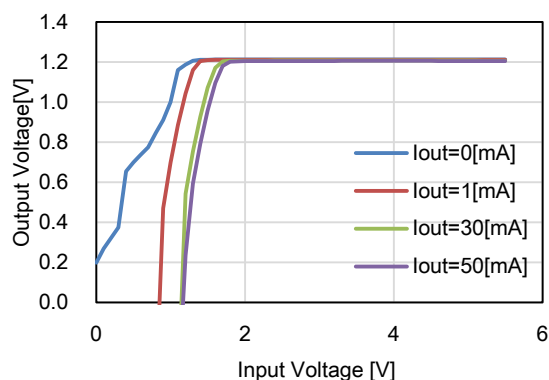


RP118x281x

RP118x361x



7) Output Voltage vs. Input Voltage ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$, $T_a = 25^\circ\text{C}$)
RP118x121x **RP118x181x**

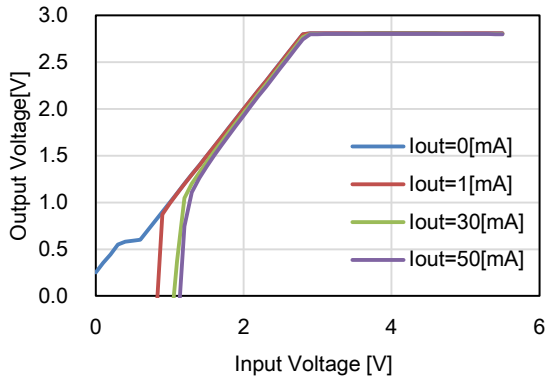


※ Typical characteristics at $I_{OUT} = 1 \text{ mA}$ are evaluated in a fast response mode.

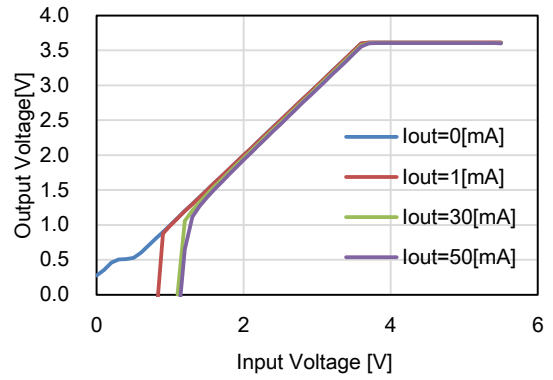
RP118x

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RP118x281x

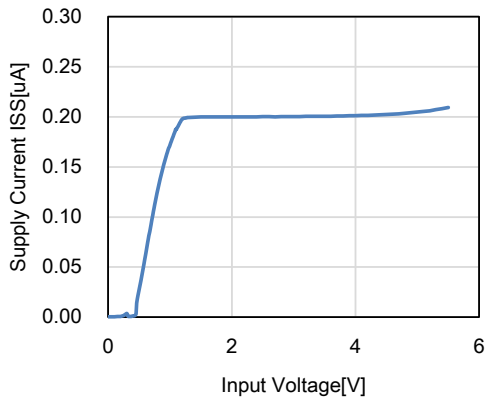


RP118x361x

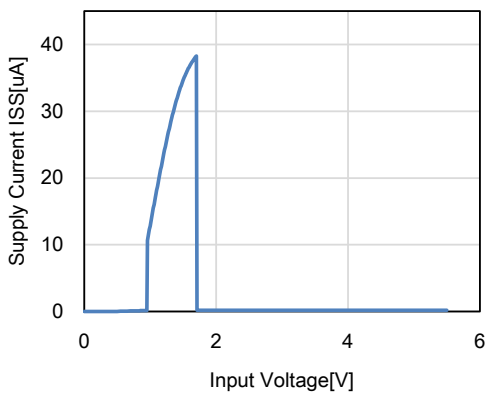


8) Supply Current vs. Input Voltage (C_{IN} = Ceramic 1.0 μ F, C_{OUT} = Ceramic 1.0 μ F, T_a = 25°C)

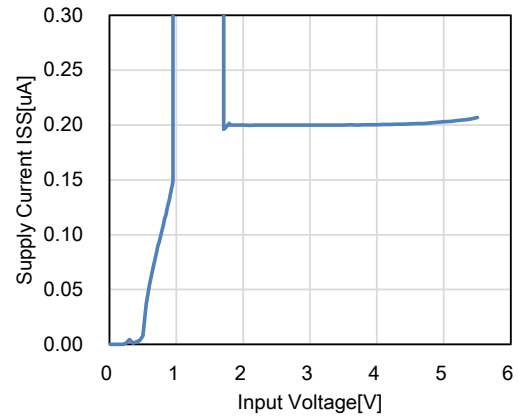
RP118x121x



RP118x181x (10 μ A/div)

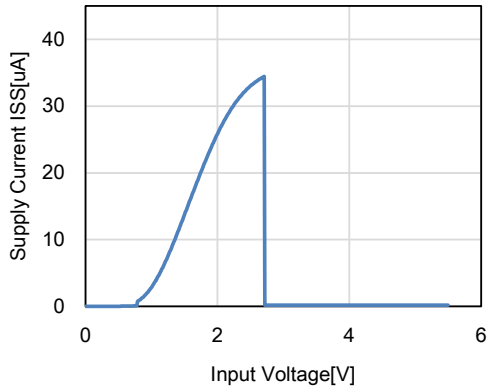


RP118x181x (0.05 μ A/div)

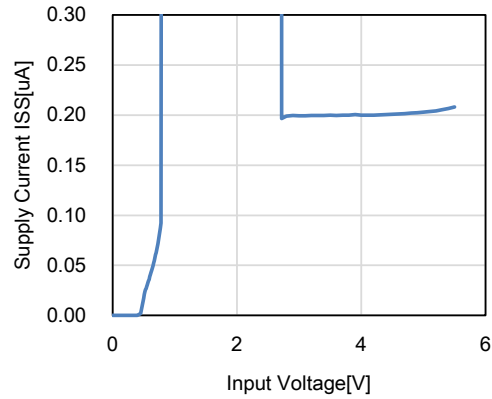


※ Typical characteristics at $I_{OUT} = 1$ mA are evaluated in a fast response mode.

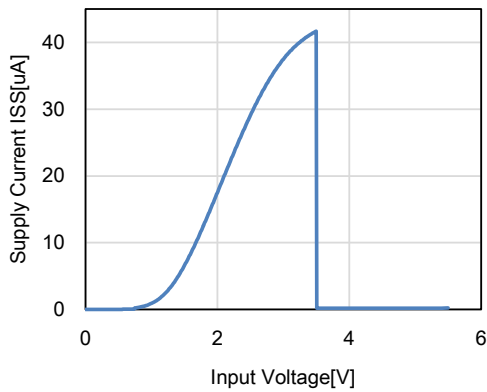
RP118x281x
(10 $\mu\text{A/div}$)



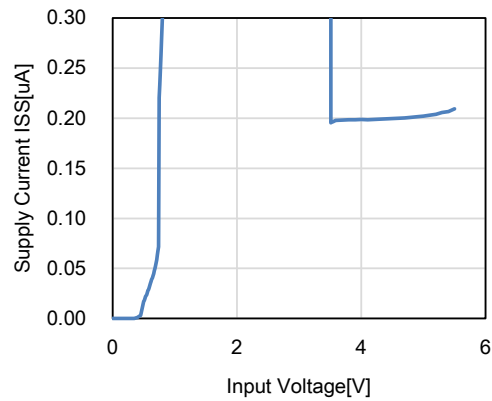
RP118x281x
(0.05 $\mu\text{A/div}$)



RP118x361x
(10 $\mu\text{A/div}$)

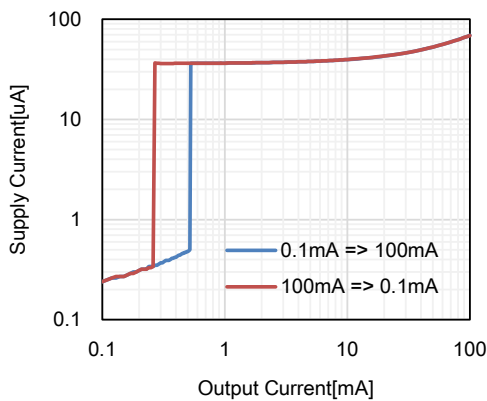


RP118x361x
(0.05 $\mu\text{A/div}$)

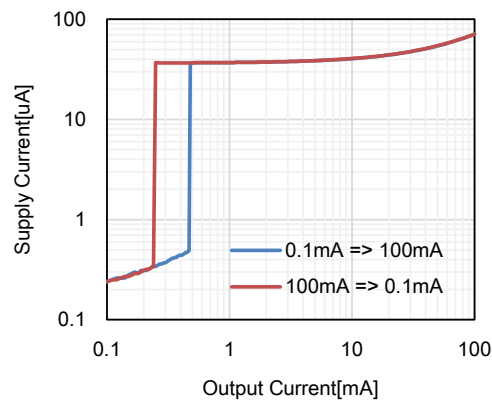


9) Supply Current vs. Output Current (C_{IN} = Ceramic 1.0 μF , C_{OUT} = Ceramic 1.0 μF , T_a = 25°C)

RP118x121x



RP118x181x

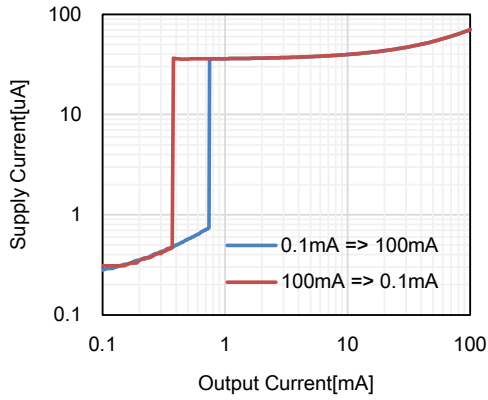


※ Typical characteristics at $I_{OUT} = 1 \text{ mA}$ are evaluated in a fast response mode.

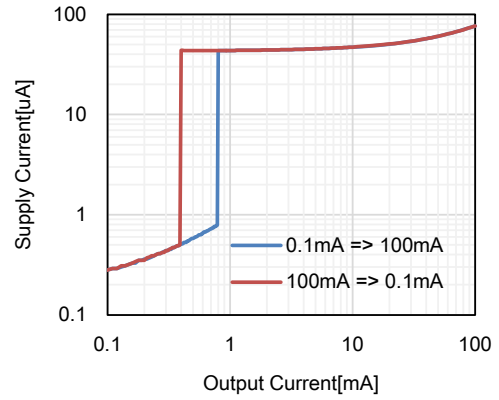
RP118x

No. EA-399-181026

RP118x281x

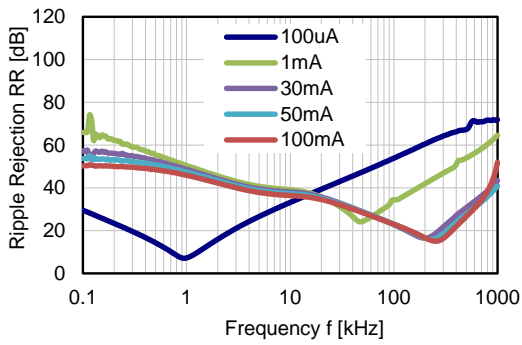


RP118x361x

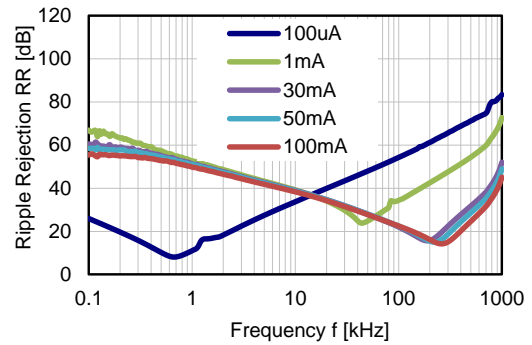


10) Ripple Rejection vs. Frequency (C_{IN} = none, C_{OUT} = Ceramic 1.0 μ F, T_a = 25°C)

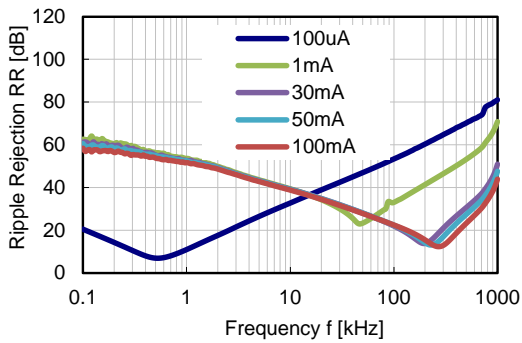
RP118x121x, V_{IN} = 2.2 V



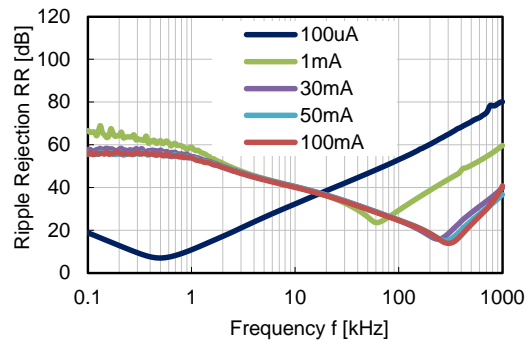
RP118x181x, V_{IN} = 2.8 V



RP118x281x, V_{IN} = 3.8 V

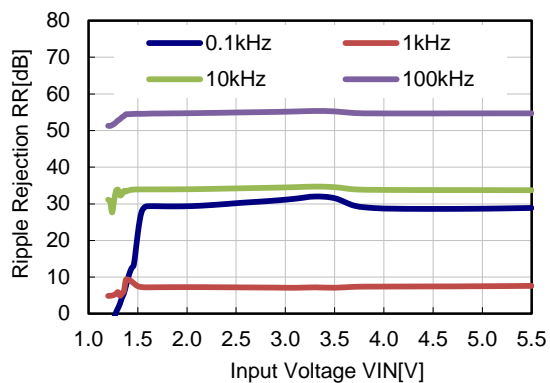


RP118x361x, V_{IN} = 4.6 V

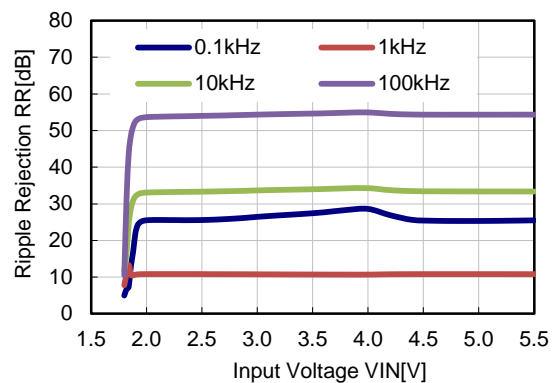


※ Typical characteristics at I_{OUT} = 1 mA are evaluated in a fast response mode.

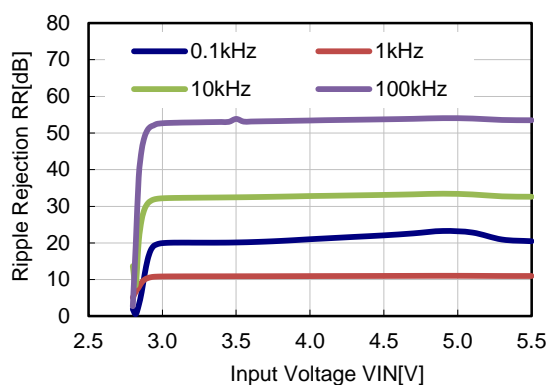
11) Ripple Rejection vs. Input Bias Voltage (C_{IN} = none, C_{OUT} = Ceramic 1.0 μ F, T_a = 25°C)
 RP118x121x, I_{OUT} = 100 μ A RP118x181x, I_{OUT} = 100 μ A



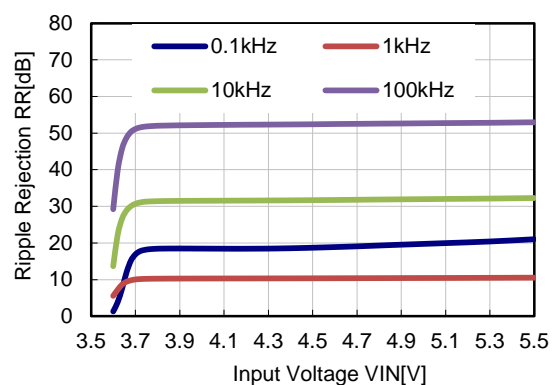
RP118x281x, I_{OUT} = 100 μ A



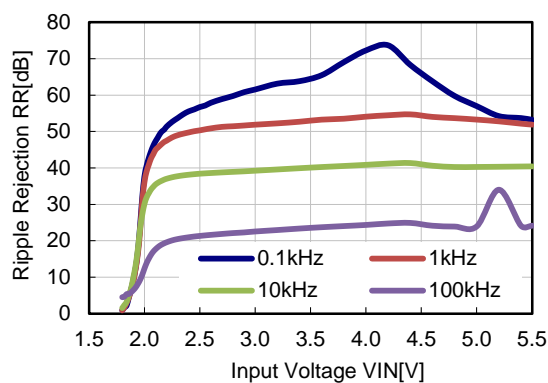
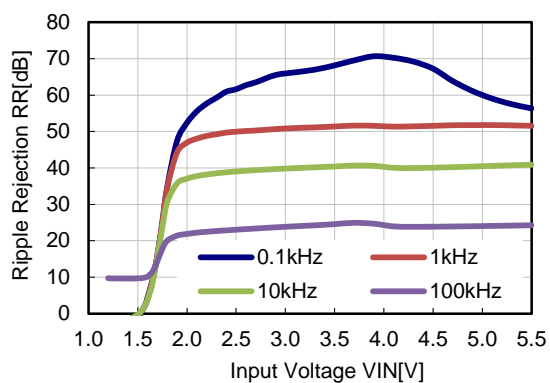
RP118x361x, I_{OUT} = 100 μ A



RP118x121x, I_{OUT} = 30 mA



RP118x181x, I_{OUT} = 30 mA

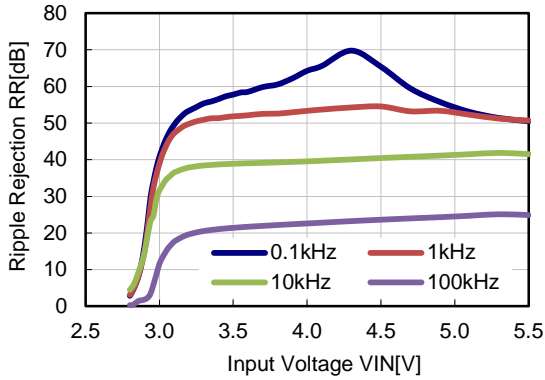


※ Typical characteristics at I_{OUT} = 1 mA are evaluated in a fast response mode.

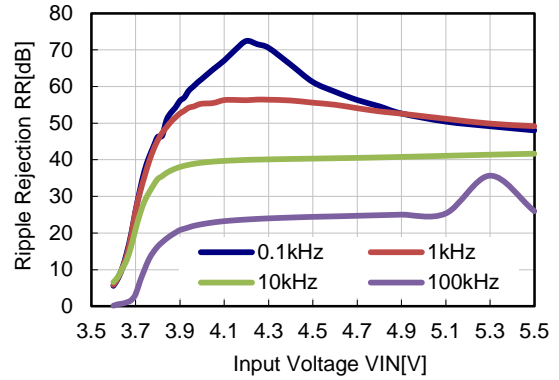
RP118x

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RP118x281x, $I_{OUT} = 30\text{ mA}$

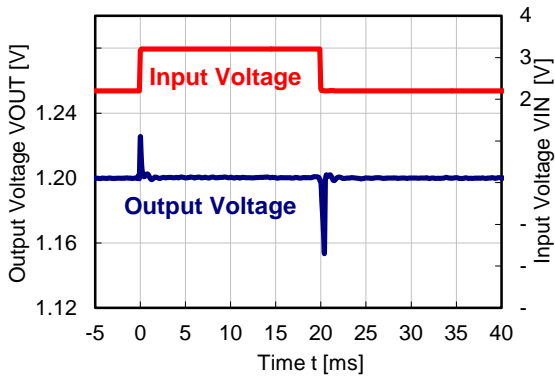


RP118x361x, $I_{OUT} = 30\text{ mA}$

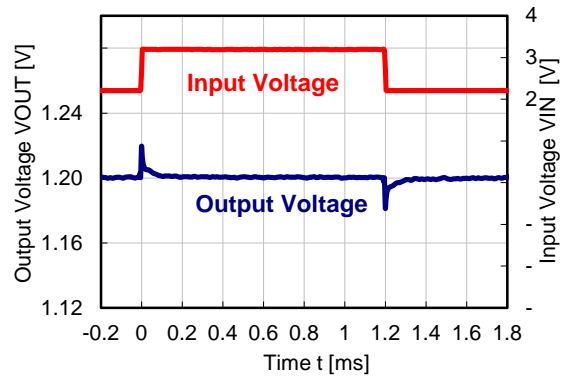


12) Input Transient Response ($C_{IN} = \text{Ceramic } 0.1\ \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0\ \mu\text{F}$, $T_a = 25^\circ\text{C}$)

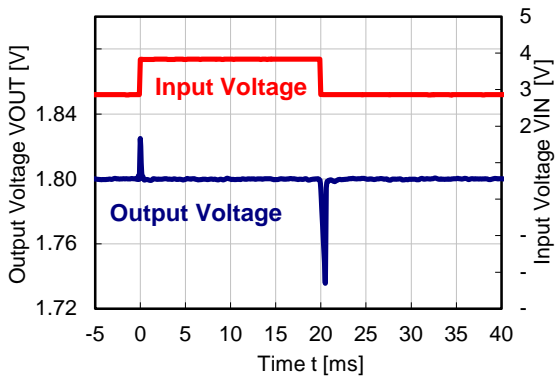
RP118x121x, $I_{OUT} = 100\ \mu\text{A}$, $t_R = t_F = 5\ \mu\text{s}$



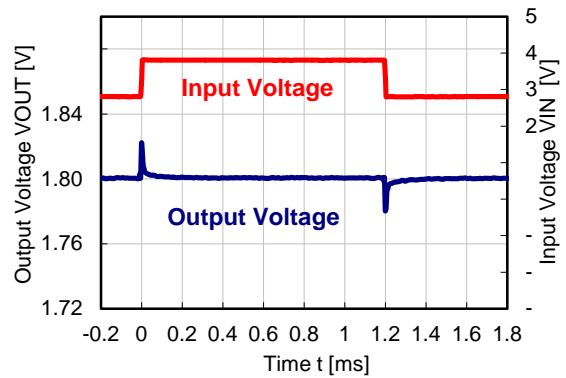
RP118x121x, $I_{OUT} = 30\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$



RP118x181x, $I_{OUT} = 100\ \mu\text{A}$, $t_R = t_F = 5\ \mu\text{s}$

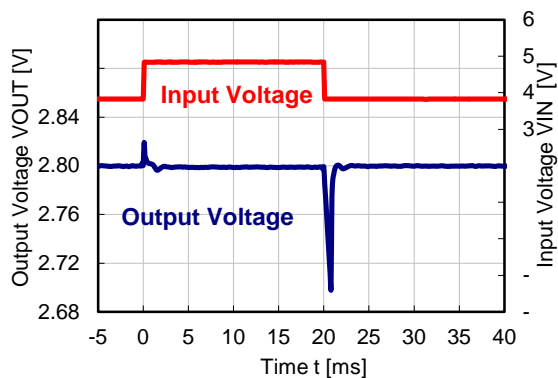


RP118x181x, $I_{OUT} = 30\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$

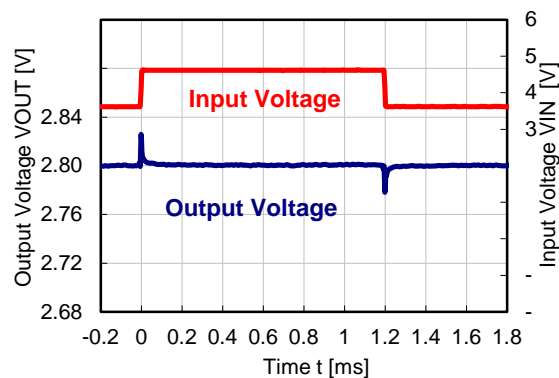


※ Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

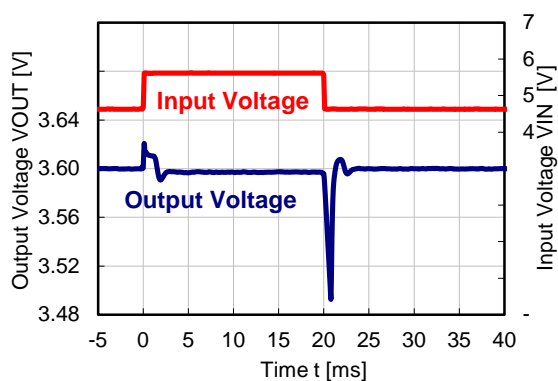
RP118x281x, $I_{OUT} = 100 \mu A$, $t_R = t_F = 5 \mu s$



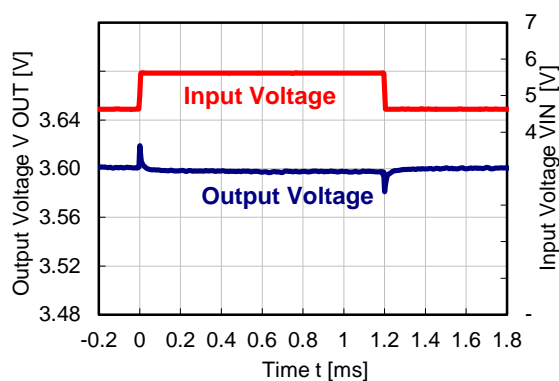
RP118x281x, $I_{OUT} = 30 mA$, $t_R = t_F = 5 \mu s$



RP118x361x, $I_{OUT} = 100 \mu A$, $t_R = t_F = 5 \mu s$



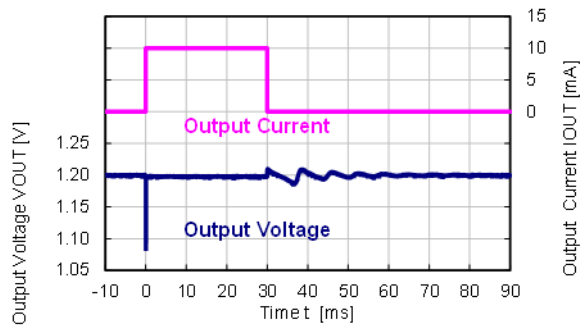
RP118x361x, $I_{OUT} = 30 mA$, $t_R = t_F = 5 \mu s$



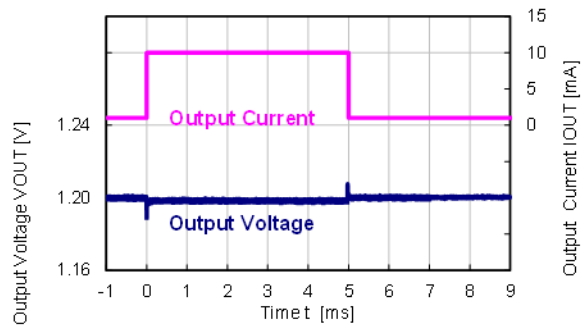
13) Load Transient Response ($C_{IN} = \text{Ceramic } 1.0 \mu F$, $C_{OUT} = \text{Ceramic } 1.0 \mu F$, $T_a = 25^\circ C$)

RP118x121x

$V_{IN} = 2.2 V$, $I_{OUT} = 1 \mu A \Leftrightarrow 10 mA$, $t_R = t_F = 5 \mu s$



$V_{IN} = 2.2 V$, $I_{OUT} = 1 mA \Leftrightarrow 10 mA$, $t_R = t_F = 5 \mu s$

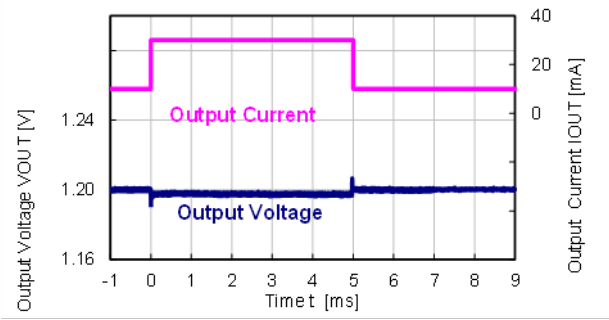


* Typical characteristics at $I_{OUT} = 1 mA$ are evaluated in a fast response mode.

RP118x

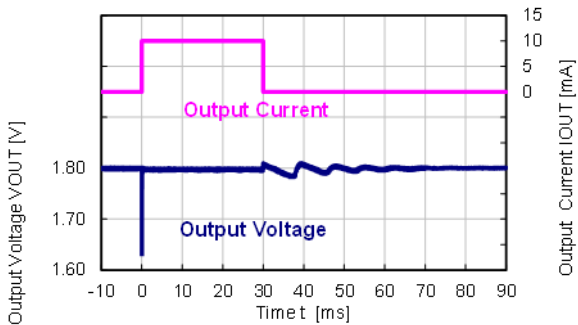
No. EA-399-181026

$V_{IN} = 2.2\text{ V}$, $I_{OUT} = 10\text{ mA} \Leftrightarrow 30\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$

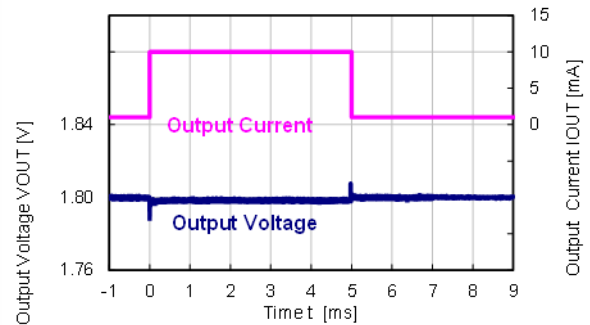


RP118x181x

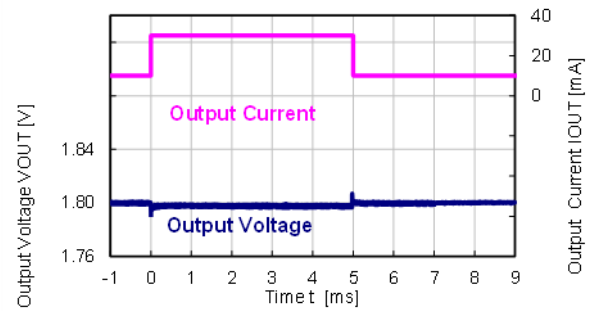
$V_{IN} = 2.8\text{ V}$, $I_{OUT} = 1\ \mu\text{A} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$



$V_{IN} = 2.8\text{ V}$, $I_{OUT} = 1\text{ mA} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$

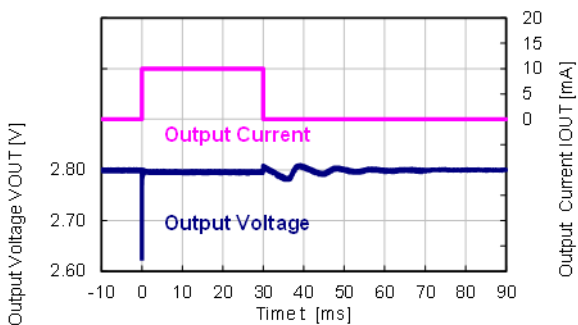


$V_{IN} = 2.8\text{ V}$, $I_{OUT} = 10\text{ mA} \Leftrightarrow 30\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$

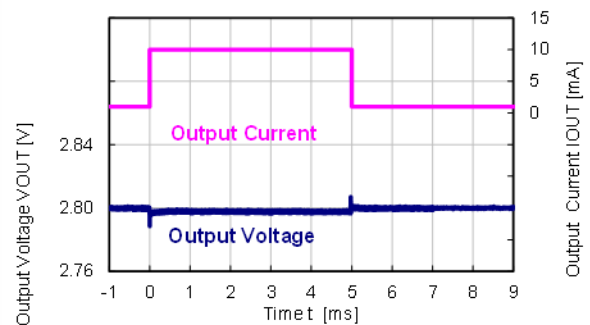


RP118x281x

$V_{IN} = 3.8\text{ V}$, $I_{OUT} = 1\ \mu\text{A} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$

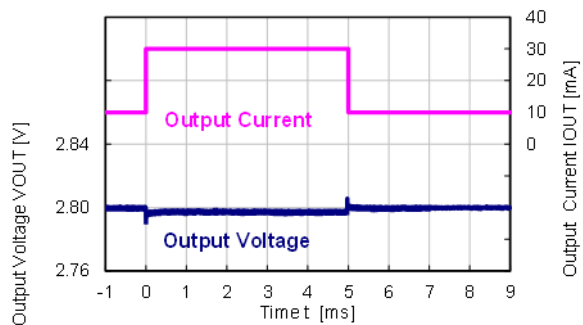


$V_{IN} = 3.8\text{ V}$, $I_{OUT} = 1\text{ mA} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\ \mu\text{s}$



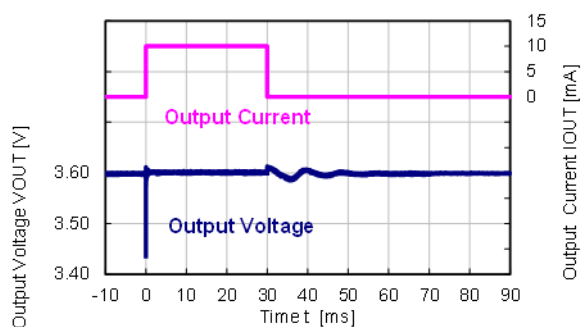
※ Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

$V_{IN} = 3.8\text{ V}$, $I_{OUT} = 10\text{ mA} \Leftrightarrow 30\text{ mA}$, $t_R = t_F = 5\text{ }\mu\text{s}$

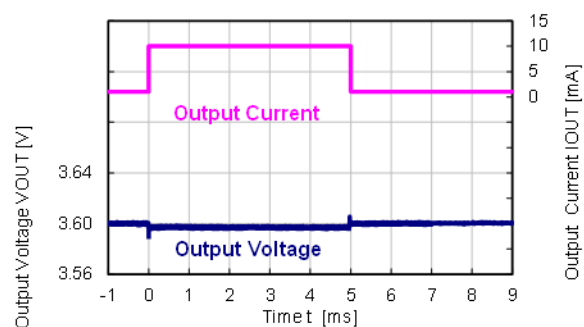


RP118x361x

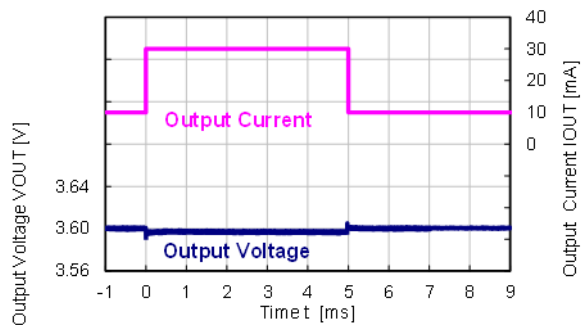
$V_{IN} = 4.6\text{ V}$, $I_{OUT} = 1\text{ }\mu\text{A} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\text{ }\mu\text{s}$



$V_{IN} = 4.6\text{ V}$, $I_{OUT} = 1\text{ mA} \Leftrightarrow 10\text{ mA}$, $t_R = t_F = 5\text{ }\mu\text{s}$



$V_{IN} = 4.6\text{ V}$, $I_{OUT} = 10\text{ mA} \Leftrightarrow 30\text{ mA}$, $t_R = t_F = 5\text{ }\mu\text{s}$



※ Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

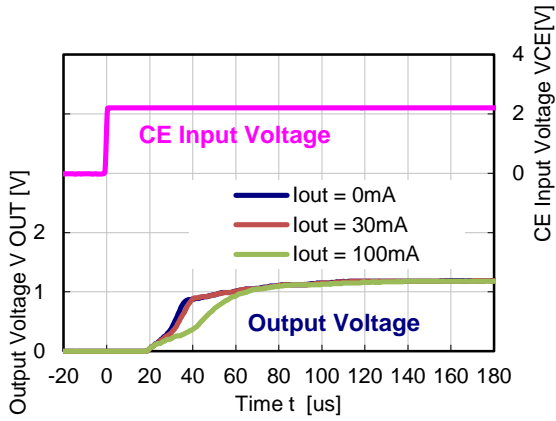
RP118x

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14) Turn On Speed with CE pin (C_{IN} = Ceramic 1.0 μ F, C_{OUT} = Ceramic 1.0 μ F, T_a = 25°C)

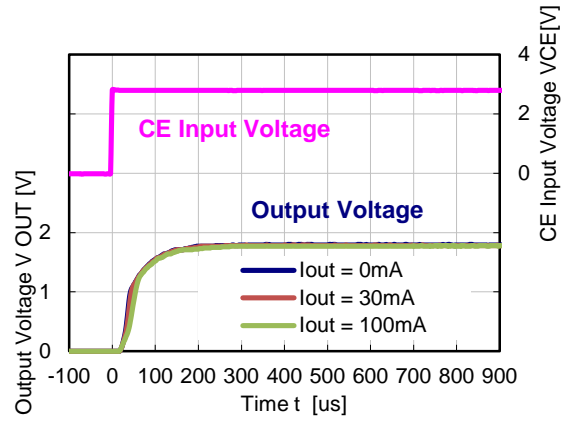
RP118x121x

$V_{IN} = 2.2$ V, $V_{CE} = 0$ V \Rightarrow 2.2 V



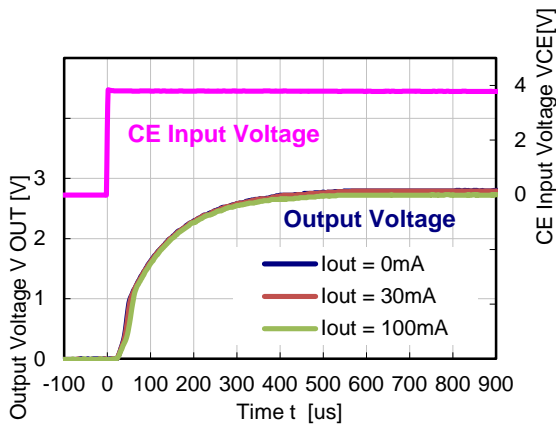
RP118x181x

$V_{IN} = 2.8$ V, $V_{CE} = 0$ V \Rightarrow 2.8 V



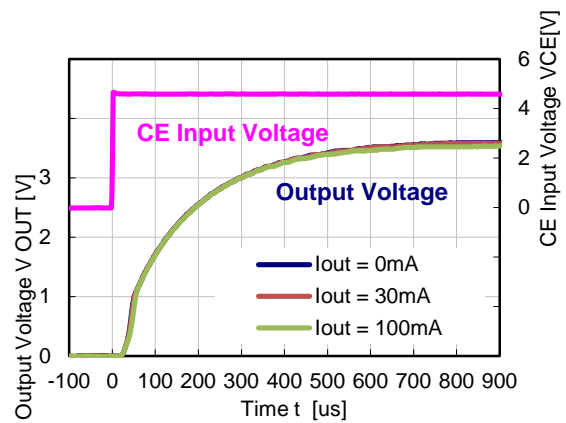
RP118x281x

$V_{IN} = 3.8$ V, $V_{CE} = 0$ V \Rightarrow 3.8 V



RP118x361x

$V_{IN} = 4.6$ V, $V_{CE} = 0$ V \Rightarrow 4.6 V

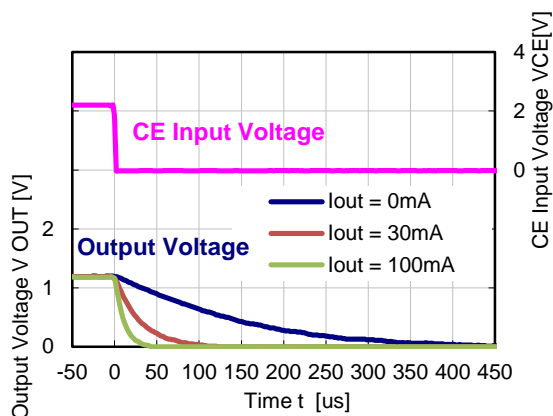


※ Typical characteristics at $I_{OUT} = 1$ mA are evaluated in a fast response mode.

15) Turn OFF Speed with CE pin ($C_{IN} = \text{Ceramic } 1.0 \mu\text{F}$, $C_{OUT} = \text{Ceramic } 1.0 \mu\text{F}$, $T_a = 25^\circ\text{C}$)

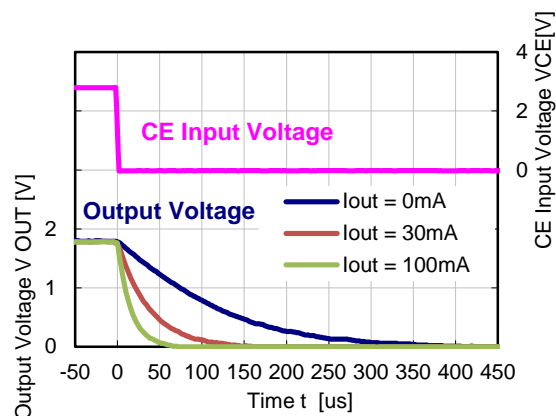
RP118x121D

$V_{IN} = 2.2 \text{ V}$, $V_{CE} = 2.2 \text{ V} \Rightarrow 0 \text{ V}$



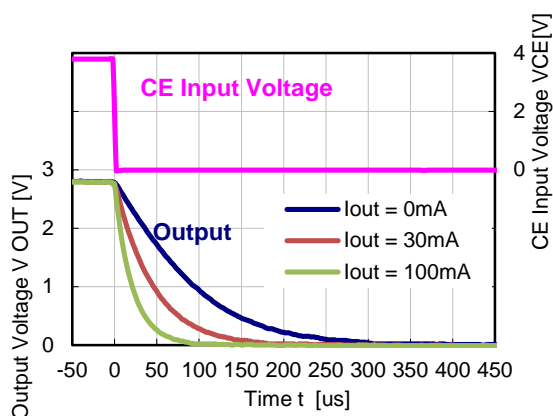
RP118x181D

$V_{IN} = 2.8 \text{ V}$, $V_{CE} = 2.8 \text{ V} \Rightarrow 0 \text{ V}$



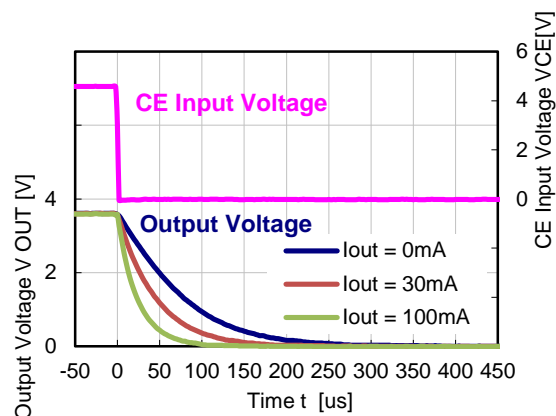
RP118x281D

$V_{IN} = 3.8 \text{ V}$, $V_{CE} = 3.8 \text{ V} \Rightarrow 0 \text{ V}$



RP118x361D

$V_{IN} = 4.6 \text{ V}$, $V_{CE} = 4.6 \text{ V} \Rightarrow 0 \text{ V}$



* Typical characteristics at $I_{OUT} = 1 \text{ mA}$ are evaluated in a fast response mode.

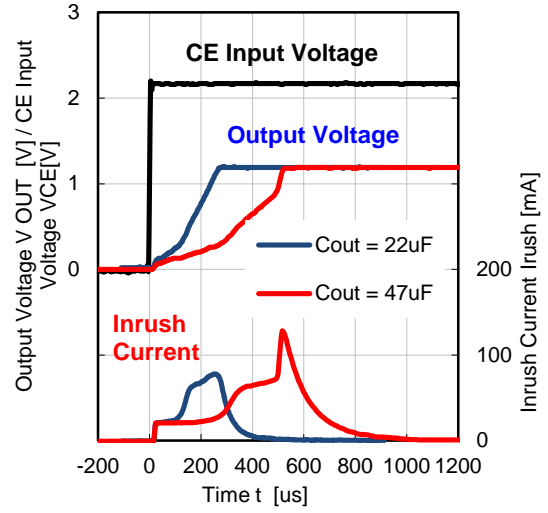
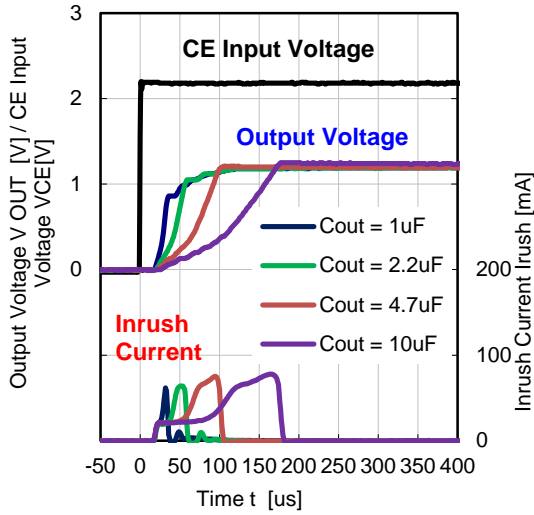
RP118x

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16) Inrush Current at turning on ($C_{IN} = \text{none}$, $T_a = 25^\circ\text{C}$)

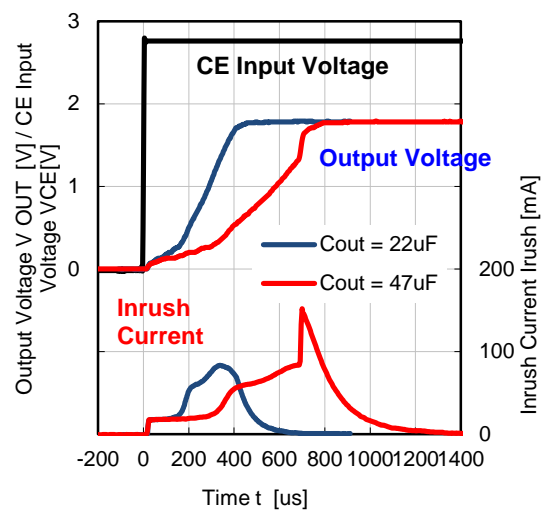
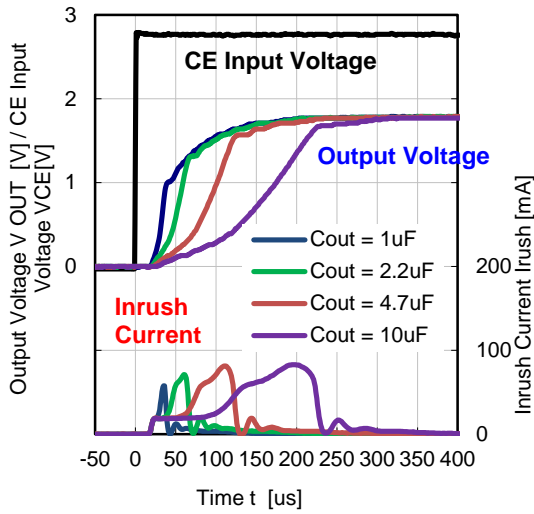
RP118x121x

$V_{IN} = 2.2\text{ V}$, $V_{CE} = 0\text{ V} \Rightarrow 2.2\text{ V}$



RP118x181x

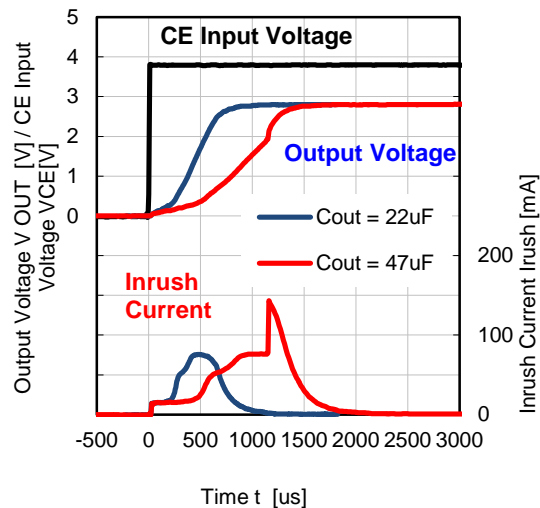
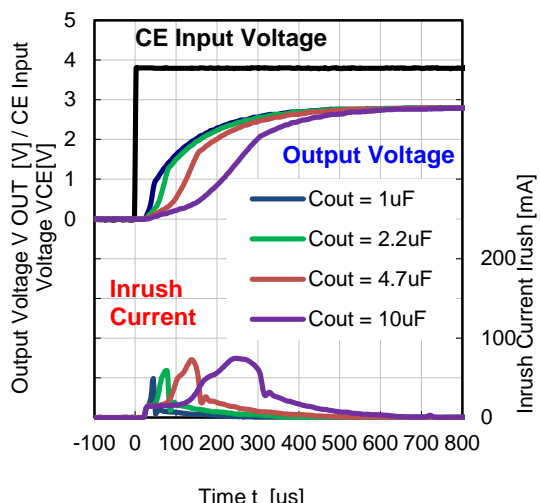
$V_{IN} = 2.8\text{ V}$, $V_{CE} = 0\text{ V} \Rightarrow 2.8\text{ V}$



※ Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

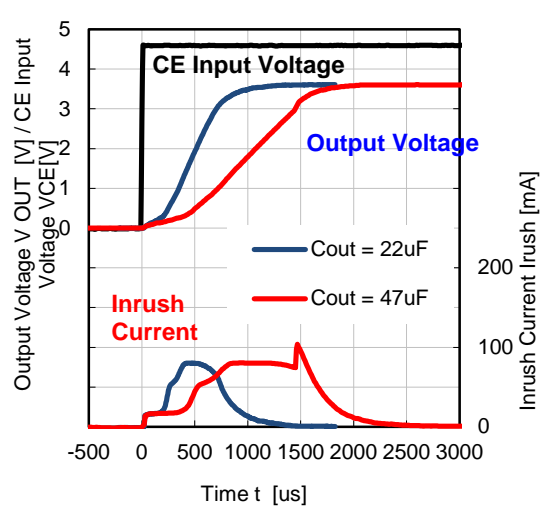
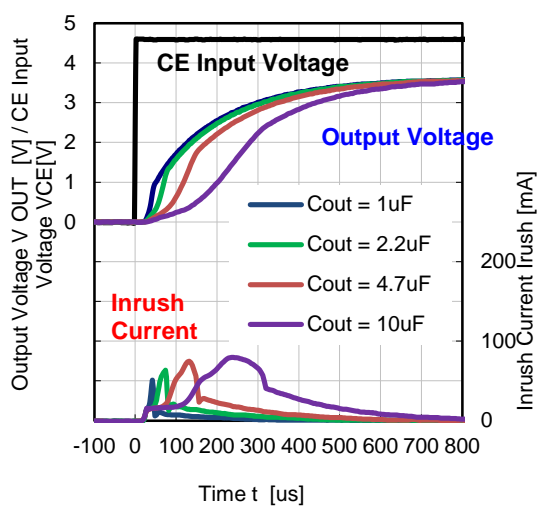
RP118x281x

$V_{IN} = 3.8\text{ V}$, $V_{CE} = 0\text{ V} \Rightarrow 3.8\text{ V}$



RP118x361x

$V_{IN} = 4.6\text{ V}$, $V_{CE} = 0\text{ V} \Rightarrow 4.6\text{ V}$



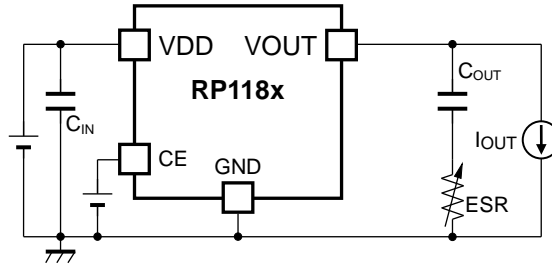
※ Typical characteristics at $I_{OUT} = 1\text{ mA}$ are evaluated in a fast response mode.

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ESR vs. Output Current

It is recommended that a ceramic type capacitor be used for this device. However, other types of capacitors having lower ESR can also be used. The relation between the output current (I_{OUT}) and the ESR of output capacitor is shown below.



Measurement conditions

Frequency Band : 10 Hz to 2 MHz

Temperature : -40°C to 85°C

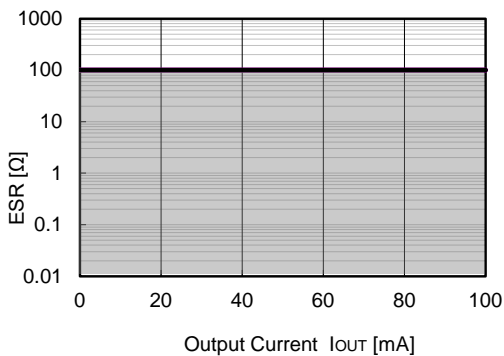
C_{IN} , C_{OUT} : Ceramic $1.0\ \mu\text{F}$

RP118x121x

$V_{IN} = 1.7\ \text{V to } 5.5\ \text{V}$

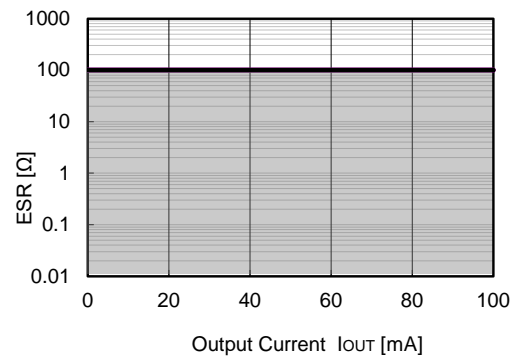
RP118x181x

$V_{IN} = 1.8\ \text{V to } 5.5\ \text{V}$



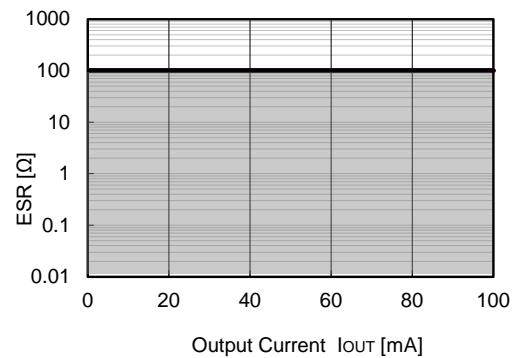
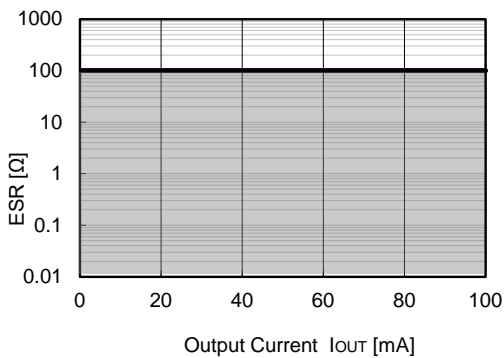
RP118x281x

$V_{IN} = 2.8\ \text{V to } 5.5\ \text{V}$



RP118x361x

$V_{IN} = 3.6\ \text{V to } 5.5\ \text{V}$



The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-9.

Measurement Conditions

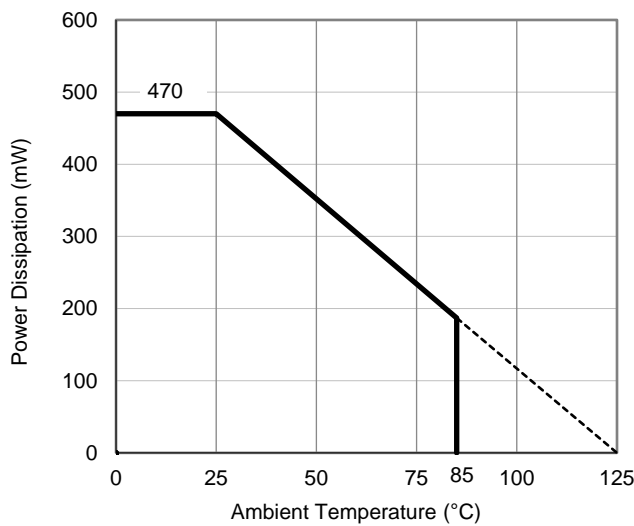
| Item | Measurement Conditions |
|------------------|---|
| Environment | Mounting on Board (Wind Velocity = 0 m/s) |
| Board Material | Glass Cloth Epoxy Plastic (Four-Layer Board) |
| Board Dimensions | 101.5 mm x 114.5 mm x 1.6 mm |
| Copper Ratio | Outer Layer (First Layer): 60% Inner Layers (Second and Third Layers): 100% Outer Layer (Fourth Layer): 60% |

Measurement Result

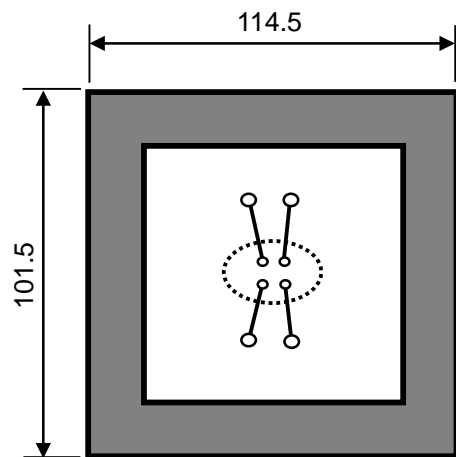
(Ta = 25°C, Tjmax = 125°C)

| Item | Measurement Result |
|--------------------------------------|-------------------------------------|
| Power Dissipation | 470 mW |
| Thermal Resistance (θ_{ja}) | $\theta_{ja} = 212^\circ\text{C/W}$ |

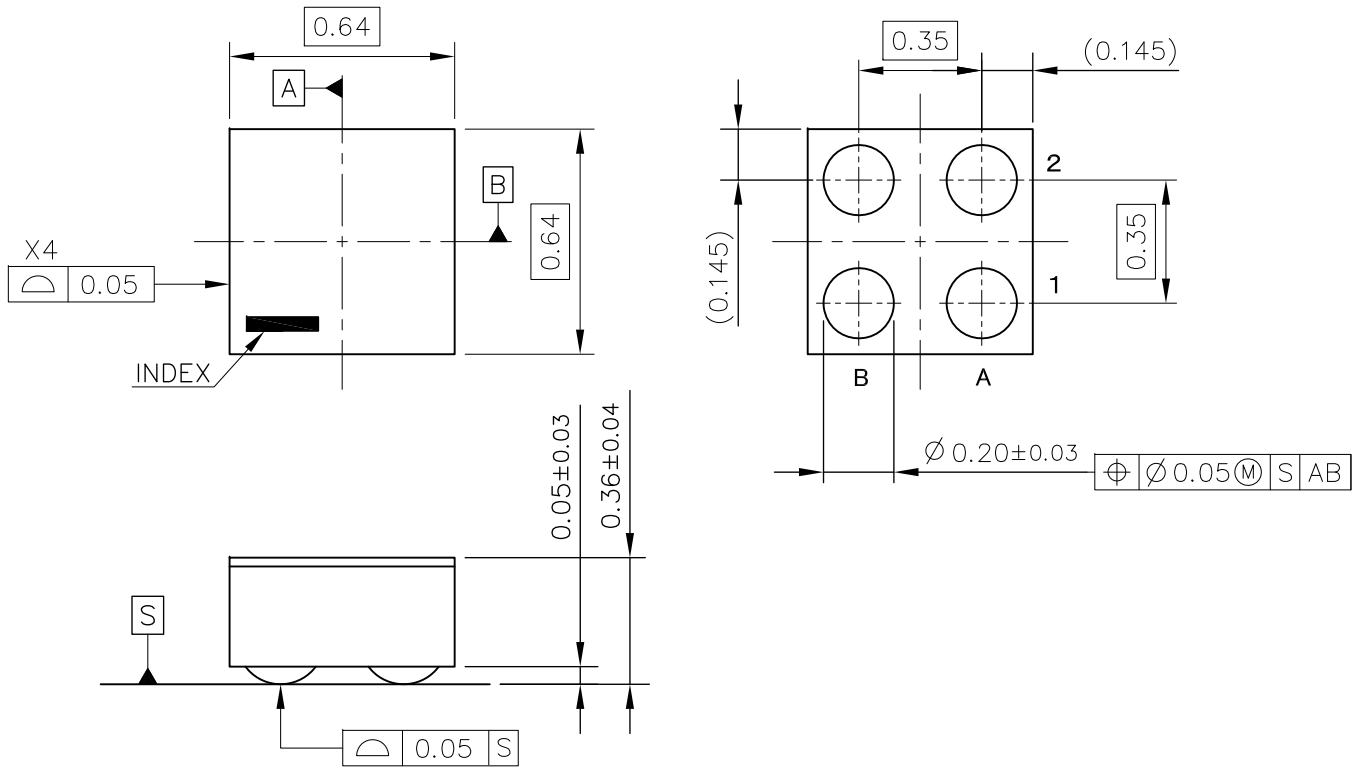
θ_{ja} : Junction-to-Ambient Thermal Resistance



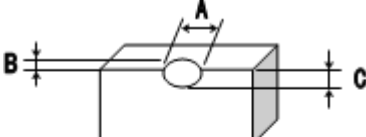
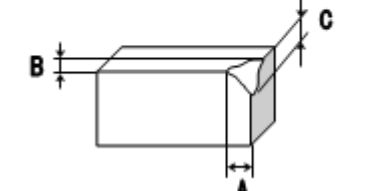
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



WLCSP-4-P8 Package Dimensions (Unit: mm)

| No. | Inspection Items | Inspection Criteria | Figure |
|-----|------------------------------|---|---|
| 1 | Package chipping | <p>$A \geq 0.2\text{mm}$ is rejected $B \geq 0.2\text{mm}$ is rejected $C \geq 0.2\text{mm}$ is rejected And, Package chipping to Si surface and to bump is rejected.</p> |  |
| 2 | Si surface chipping | <p>$A \geq 0.2\text{mm}$ is rejected $B \geq 0.2\text{mm}$ is rejected $C \geq 0.2\text{mm}$ is rejected But, even if $A \geq 0.2\text{mm}$, $B \leq 0.1\text{mm}$ is acceptable.</p> |  |
| 3 | No bump | No bump is rejected. | |
| 4 | Marking miss | To reject incorrect marking, such as another product name marking or another lot No. marking. | |
| 5 | No marking | To reject no marking on the package. | |
| 6 | Reverse direction of marking | To reject reverse direction of marking character. | |
| 7 | Defective marking | To reject unreadable marking. (Microscope: X15/ White LED/ Viewed from vertical direction) | |
| 8 | Scratch | To reject unreadable marking character by scratch. (Microscope: X15/ White LED/ Viewed from vertical direction) | |
| 9 | Stain and Foreign material | To reject unreadable marking character by stain and foreign material. (Microscope: X15/ White LED/ Viewed from vertical direction) | |

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 × 11 pcs |

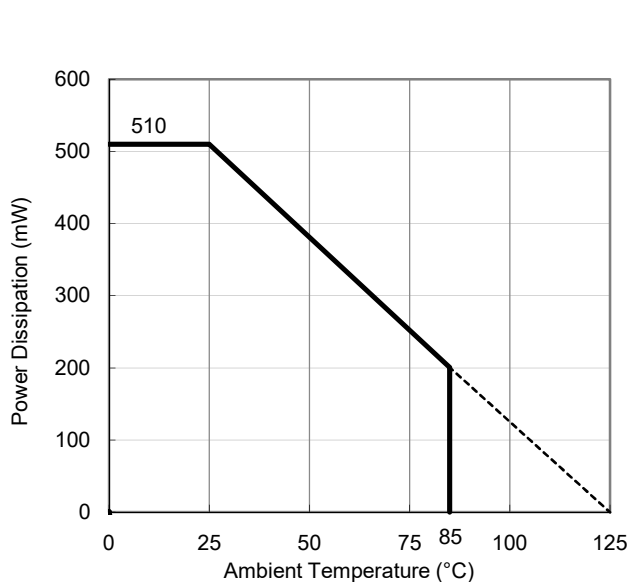
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

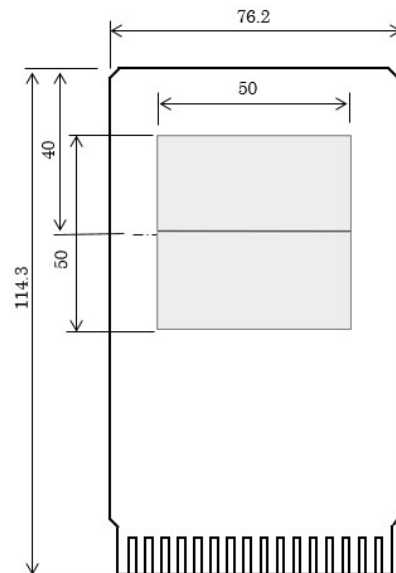
| Item | Measurement Result |
|--|--------------------|
| Power Dissipation | 510 mW |
| Thermal Resistance (θja) | θja = 194°C/W |
| Thermal Characterization Parameter (ψjt) | ψjt = 120°C/W |

θja: Junction-to-Ambient Thermal Resistance

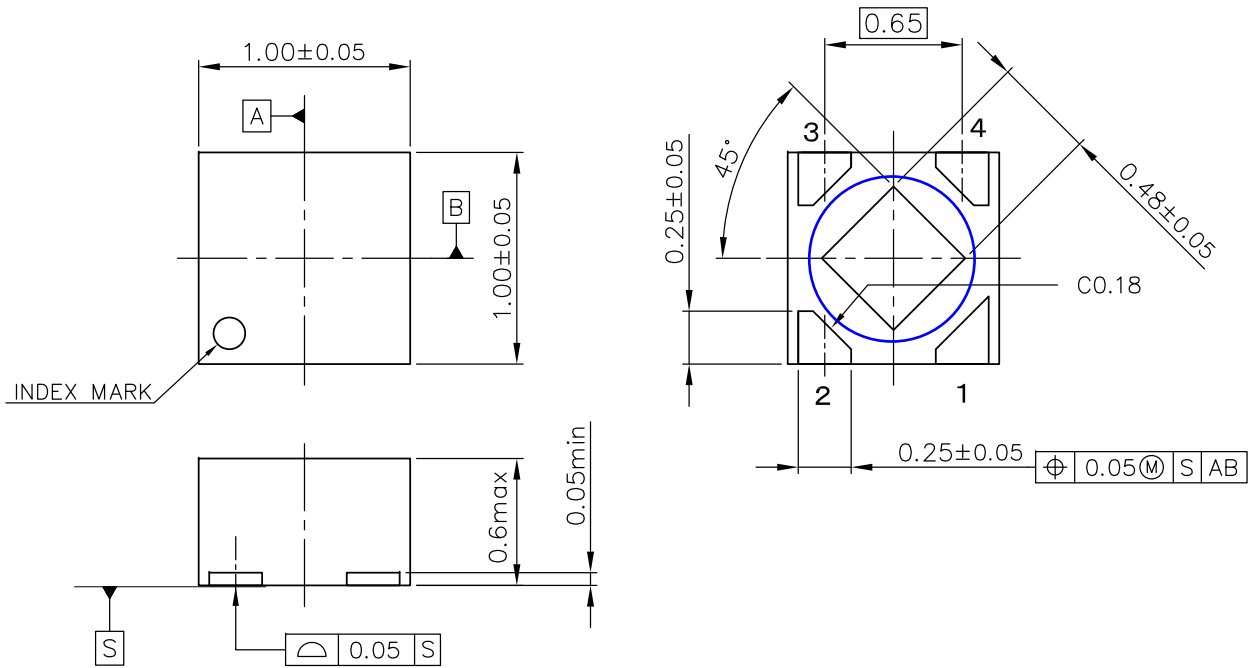
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



UNIT: mm

DFN(PLP)1010-4 Package Dimensions

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

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 × 7 pcs |

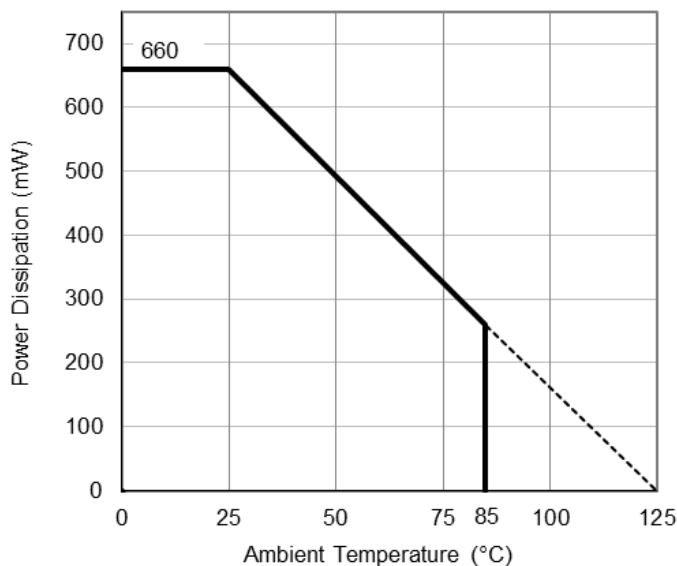
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

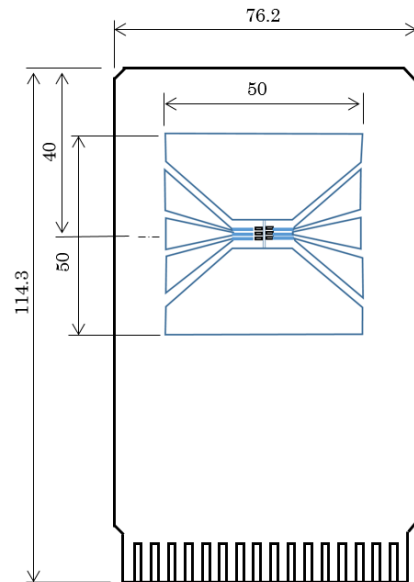
| Item | Measurement Result |
|--|--------------------|
| Power Dissipation | 660 mW |
| Thermal Resistance (θja) | θja = 150°C/W |
| Thermal Characterization Parameter (ψjt) | ψjt = 51°C/W |

θja: Junction-to-Ambient Thermal Resistance

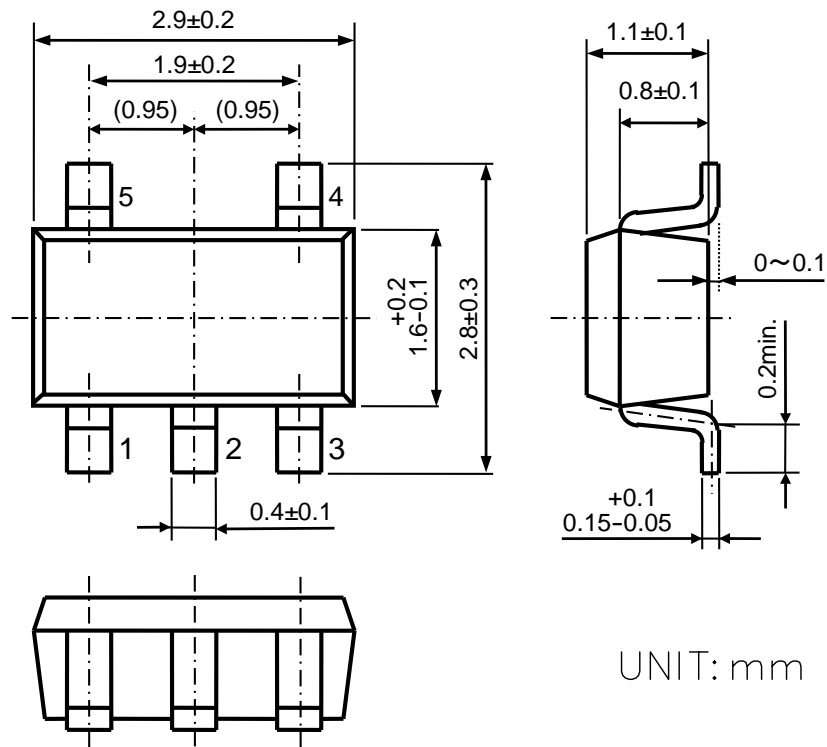
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



SOT-23-5 Package Dimensions



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Sales & Support Offices

Ricoh Electronic Devices Co., Ltd.

Shin-Yokohama Office (International Sales)

2-3, Shin-Yokohama 3-chome, Kohoku-ku, Yokohama-shi, Kanagawa, 222-8530, Japan
Phone: +81-50-3814-7687 Fax: +81-45-474-0074

Ricoh Americas Holdings, Inc.

675 Campbell Technology Parkway, Suite 200 Campbell, CA 95008, U.S.A.
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Ricoh Europe (Netherlands) B.V.

Semiconductor Support Centre

Prof. W.H. Keesomlaan 1, 1183 DJ Amstelveen, The Netherlands
Phone: +31-20-5474-309

Ricoh International B.V. - German Branch

Semiconductor Sales and Support Centre

Oberrather Strasse 6, 40472 Düsseldorf, Germany
Phone: +49-211-6546-0

Ricoh Electronic Devices Korea Co., Ltd.

3F, Haesung Bldg, 504, Teheran-ro, Gangnam-gu, Seoul, 135-725, Korea
Phone: +82-2-2135-5700 Fax: +82-2-2051-5713

Ricoh Electronic Devices Shanghai Co., Ltd.

Room 403, No.2 Building, No.690 Bibo Road, Pu Dong New District, Shanghai 201203,
People's Republic of China
Phone: +86-21-5027-3200 Fax: +86-21-5027-3299

Ricoh Electronic Devices Shanghai Co., Ltd.

Shenzhen Branch

1205, Block D (Jinlong Building), Kingkey 100, Hongbao Road, Luohu District,
Shenzhen, China
Phone: +86-755-8348-7600 Ext 225

Ricoh Electronic Devices Co., Ltd.

Taipei office

Room 109, 10F-1, No.51, Hengyang Rd., Taipei City, Taiwan
Phone: +886-2-2313-1621/1622 Fax: +886-2-2313-1623

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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.