**OUTLINE**

The RP108J is a voltage regulator IC featuring 3 A output with low ON-resistance developed with CMOS process technology.

This device consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a fold-back protection circuit, and a thermal shutdown circuit. This device features both low supply current and high output current, and the dropout voltage is much smaller than bi-polar’s. The minimum input voltage is as low as 1.6 V and the output voltage can be set from 0.8 V, therefore it can be connected with the DC/DC converter as the latter power supply for high density LSI that is operated by low output voltage.

The output voltage of RP108J081x is externally adjustable by using external divide resistors. The CE pin of the RP108J can switch the regulator to standby mode. In addition to a fold-back protection circuit, which is already built in the conventional regulators, this device contains a thermal shutdown circuit, a constant slope circuit as a soft-start function and a reverse current protection circuit. Ceramic capacitors can be used.

**FEATURES**

- Input Voltage Range (Maximum Rating) ...................... 1.6 V to 5.25 V (6.0 V)
- Operating Temperature..................................................−40°C to 105°C (※)
- Output Current.............................................................. Min. 3 A
- Supply Current.............................................................. Typ. 350 µA
- Standby Current ........................................................... Typ. 2 µA
- Output Voltage Range .................................................. 0.8 V/1.2 V/1.5 V/1.8 V/2.5 V/3.0 V/3.3 V
  Contact Ricoh sales representatives for other voltages.
- Output Voltage Accuracy .............................................. ±1.0% (Ta = 25°C)
  (±15 mV accuracy, when VSET ≤ 1.5 V)
- Output Voltage Temperature-drift Coefficient .............. Typ. ±100 ppm/°C
- Ripple Rejection ........................................................... Typ. 65 dB (f = 1 kHz, VSET = 2.5 V)
- Dropout Voltage ........................................................... Typ. 0.51 V (VSET = 2.5 V)
- Line Regulation ............................................................ Typ. 0.1%/V
- Package ........................................................................ TO-252-5-P2
- Built-in Fold-back Protection Circuit ......................... Typ. 220 mA
- Built-in Thermal Shutdown Circuit .............................. Stops at 165°C
- Built-in Constant Slope Circuit
- Built-in Reverse Current Protection Circuit
- Ceramic capacitors are recommended to be used with this IC ···· 10 µF or more

※This product is usable for the high-temperature applications since have passed a test at the high temperature. In addition, this product has a high-reliability since having passed Ricoh’s rigorous quality standards. To distinguish from the consumer products, “-Yx” is added at the end of the product name.

**APPLICATIONS**

- Industrial equipments such as FAs and smart meters
- Equipments used under high-temperature conditions
- Equipments accompanied by self-heating
BLOK DIAGRAMS

RP108Jxx1B/E

VDD

VOUT

VFB

GND

CE

Current Limit
Thermal Shutdown

Reverse Detector

RP108Jxx1D/F

VDD

VOUT

VFB

GND

CE

Current Limit
Thermal Shutdown

Reverse Detector

SELECTION GUIDE

The output voltage and auto-discharge function, and the soft-start time for the device can be selected at the user’s request.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Package</th>
<th>Quantity per Reel</th>
<th>Pb Free</th>
<th>Halogen Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP108Jxx1*1-T1-YE</td>
<td>TO-252-5-P2</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

xx: Specify the set output voltage (VSET)
- 0.8 V (08), 1.2 V (12), 1.5 V (15), 1.8 V (18), 2.5 V (25), 3.0 V (30), 3.3 V (33)

Contact Ricoh sales representatives for other voltages.

*: Specify the auto-discharge function at off state and the soft-start time

(B) No auto-discharge function, soft start time typ. 180 μs
(D) Auto-discharge function, soft start time typ. 180 μs
(E) No auto-discharge function, soft start time typ. 570 μs
(F) Auto-discharge function, soft start time typ. 570 μs

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

Refer to CONSTANT SLOPE CIRCUIT for detailed information on the difference of soft-start time and its effect.
**PIN DESCRIPTION**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CE</td>
<td>Chip Enable Pin (Active-high)</td>
</tr>
<tr>
<td>2</td>
<td>VDD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>4</td>
<td>VOUT</td>
<td>Output Pin</td>
</tr>
<tr>
<td>5</td>
<td>VFB</td>
<td>Feedback Pin</td>
</tr>
</tbody>
</table>

*1 The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left floating. The VOUT pin should be connected to the VFB pin when using RP108J as an internal fixed output voltage type. In case of using this device as an external adjustable type, refer to *Adjustable Output Voltage Type Settings* for detailed information.
### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IN}$</td>
<td>Input Voltage</td>
<td>6.0</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CE}$</td>
<td>Input Voltage (CE Input Pin)</td>
<td>−0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>$V_{FB}$</td>
<td>Input Voltage ($V_{FB}$ Pin)</td>
<td>−0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OUT}$</td>
<td>Output Voltage</td>
<td>−0.3 to $V_{IN}$ + 0.3</td>
<td>V</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>(TO-252-5-P2)$^1$ Standard Land Pattern</td>
<td>1900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ultra High Wattage Land Pattern</td>
<td>3800</td>
<td></td>
</tr>
<tr>
<td>$T_j$</td>
<td>Junction Temperature</td>
<td>−40 to 125</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>Storage Temperature</td>
<td>−55 to 125</td>
<td>°C</td>
</tr>
</tbody>
</table>

$^1$ Refer to PACKAGE INFORMATION for detailed information.

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IN}$</td>
<td>Input Voltage$^1$</td>
<td>1.6 to 5.25</td>
<td>V</td>
</tr>
<tr>
<td>$T_a$</td>
<td>Operating Temperature Range</td>
<td>−40 to 105</td>
<td>°C</td>
</tr>
</tbody>
</table>

$^1$ In case of exceeding the maximum Input Voltage of 5.25 V, the device must be operated on condition that the Input Voltage is up to 5.5 V and the total operating time is within 500 hrs.

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.
**ELECTRICAL CHARACTERISTICS**

\[ V_{IN} = V_{SET} + 1.0 \, V, \; I_{OUT} = 1 \, mA, \; C_{IN} = C_{OUT} = 10 \, \mu F, \; \text{unless otherwise noted.} \]

The specifications surrounded by [ ] are guaranteed by design engineering at \(-40°C \leq T_a \leq 105°C\).

### RP108Jxx1B/D/E/F (Ta = 25°C)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{OUT} )</td>
<td>Output voltage</td>
<td>( T_a = 25°C )</td>
<td>( V_{SET} &gt; 1.5 , V )</td>
<td>( V_{SET} \leq 1.5 , V )</td>
<td>-15</td>
<td>15 mV</td>
</tr>
<tr>
<td>( V_{OUT} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( -40°C \leq T_a \leq 105°C )</td>
<td>( V_{SET} &gt; 1.5 , V )</td>
</tr>
<tr>
<td>( I_{LIM} )</td>
<td>Output Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.0 A</td>
</tr>
<tr>
<td>( \Delta V_{OUT} / \Delta I_{OUT} )</td>
<td>Load regulation</td>
<td>1 mA ( \leq I_{OUT} \leq 300 , mA )</td>
<td>-15</td>
<td>2.0</td>
<td>20 mV</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{OUT} / \Delta V_{IN} )</td>
<td>Line regulation</td>
<td>( V_{SET} + 0.5 , V \leq V_{IN} \leq 5.25 , V, ) ( I_{OUT} = 1 , mA )</td>
<td>( \text{When} \ V_{SET} \leq 1.1 , V, ; V_{IN} = 1.6 , V )</td>
<td>0.10</td>
<td>0.15 %/V</td>
<td></td>
</tr>
<tr>
<td>( I_{SC} )</td>
<td>Short Current Limit</td>
<td>( V_{OUT} = 0 , V )</td>
<td></td>
<td></td>
<td>220 mA</td>
<td></td>
</tr>
<tr>
<td>( I_{PD} )</td>
<td>CE Pull-down Current</td>
<td></td>
<td></td>
<td></td>
<td>0.3</td>
<td>0.7 ( \mu A )</td>
</tr>
<tr>
<td>( V_{CEH} )</td>
<td>CE Input Voltage &quot;H&quot;</td>
<td></td>
<td></td>
<td></td>
<td>1.0 V</td>
<td></td>
</tr>
<tr>
<td>( V_{CEL} )</td>
<td>CE Input Voltage &quot;L&quot;</td>
<td></td>
<td></td>
<td></td>
<td>0.4 V</td>
<td></td>
</tr>
<tr>
<td>( T_{TSD} )</td>
<td>Thermal Shutdown Temperature</td>
<td>Junction Temperature</td>
<td></td>
<td></td>
<td>165 °C</td>
<td></td>
</tr>
<tr>
<td>( T_{TSR} )</td>
<td>Thermal Shutdown Released Temperature</td>
<td>Junction Temperature</td>
<td></td>
<td></td>
<td>95 °C</td>
<td></td>
</tr>
<tr>
<td>( R_{LOW} )</td>
<td>Low Output Nch Tr. ON Resistance (of D/F version)</td>
<td>( V_{IN} = 4.0 , V, ; V_{CE} = 0 , V )</td>
<td></td>
<td></td>
<td>30 Ω</td>
<td></td>
</tr>
<tr>
<td>( I_{REV} )</td>
<td>Reverse Current Limit</td>
<td>( V_{OUT} &gt; 0.5 , V, ; 0 \leq V_{IN} \leq 5.25 , V )</td>
<td></td>
<td></td>
<td>10 ( \mu A )</td>
<td></td>
</tr>
</tbody>
</table>

All test items listed under Electrical Characteristics are done under the pulse load condition (\( T_j = T_a = 25°C \)).
The specifications surrounded by [ ] are guaranteed by design engineering at \(-40^\circ C \leq T_a \leq 105^\circ C\).

### Product-specific Electrical Characteristics

**Product Name** | **$V_{OUT}$ (V) \,(T_a = 25^\circ C)** | **$V_{OUT}$ (V) \,(-40^\circ C \leq T_a \leq 105^\circ C)** | **$V_{DIF}$ (V) \,(I_{OUT} = 3000\, mA)**
--- | --- | --- | ---
RP108J081x | 0.785 | 0.800 | 0.815 | 0.755 | 3.300 | 0.836 | 0.910 | 1.155
RP108J121x | 1.185 | 1.200 | 1.215 | 1.155 | 1.200 | 1.236 | 0.720 | 0.890
RP108J151x | 1.485 | 1.500 | 1.515 | 1.455 | 1.500 | 1.536 | 0.630 | 0.790
RP108J181x | 1.782 | 1.800 | 1.818 | 1.746 | 1.800 | 1.843 | 0.510 | 0.670
RP108J251x | 2.475 | 2.500 | 2.525 | 2.425 | 2.500 | 2.560
RP108J301x | 2.970 | 3.000 | 3.030 | 2.910 | 3.000 | 3.072
RP108J331x | 3.267 | 3.300 | 3.333 | 3.201 | 3.300 | 3.379 | 0.480 | 0.590
TYPICAL APPLICATIONS

Internally Fixed Output Voltage

Externally Adjustable Output Voltage

External Components

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 (C\text{IN}), C2 (C\text{OUT})</td>
<td>10 µF, Ceramic Capacitor, Kyocera CM21X7R106M06AB</td>
</tr>
</tbody>
</table>
TECHNICAL NOTES

When using the RP108J, please consider the following points.

When using an internally fixed output voltage type, please connect the V_OUT pin to the V_FB pin. However, in the case of using the Adjustable Output Voltage Type, please follow the Adjustable Output Voltage Setting.

Phase Compensation

In this device, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a 10 μF or more capacitor C2.

In case of using a tantalum capacitor, and its ESR is large, the output may be unstable. Therefore, select C2 carefully considering its frequency characteristics.

The recommended temperature characteristics for C1 and C2 capacitors are the followings.

- X7R Characteristics: Temperature range from −55°C to 125°C, Capacitance change of ±15%

The recommended capacitor’s tolerable voltage is twice as large as the voltage of use (C1: Input voltage, C2: Output voltage). The upper limit of the capacitance value for C2 is 100 μF.

However, the increase of C2 leads to the increase of inrush current. Refer to CONSTANT SLOPE CIRCUIT for detailed information.

PCB Layout

Make V_DD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result.

Connect a capacitor C1 with a capacitance value as much as 10 μF or more between V_DD and GND pin, and as close as possible to the pins.

Set external components, especially the output capacitor C2, as close as possible to the device, and make wiring as short as possible (Refer to TYPICAL APPLICATION).

Transient Response

When using the Adjustable Output Voltage Type, the transient response could be affected by the external resistors. Evaluate the circuit taking the actual conditions of use into account.
TYPICAL APPLICATION FOR IC CHIP BREAKDOWN PREVENTION

Internally Fixed Output Voltage

Externally Adjustable Output Voltage

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

• Output Voltage Setting Method

RP108J081x is capable of adjusting the output voltage by using the external divider resistors.

If the VFB voltage fixed in the device is described as setVFB, the output voltage can be set by using the following equations. SetVFB is equal to 0.8 V. The VOUT pin of RP108J081x should be connected to the VFB pin.

\[ I_1 = I_{IC} + I_2 \] \hspace{1cm} (1)

\[ I_2 = \frac{\text{setVFB}}{R_2} \] \hspace{1cm} (2)

Thus,

\[ I_1 = I_{IC} + \frac{\text{setVFB}}{R_2} \] \hspace{1cm} (3)

Therefore,

\[ V_{\text{OUT}} = \text{setVFB} + R_1 \times I_1 \] \hspace{1cm} (4)

Put Equation (3) into Equation (4), then

\[ V_{\text{OUT}} = \text{setVFB} + R_1 \times \left( I_{IC} + \frac{\text{setVFB}}{R_2} \right) \]
\[ = \text{setVFB} \times \left( 1 + \frac{R_1}{R_2} \right) + R_1 \times I_{IC} \] \hspace{1cm} (5)

In Equation (5), \( R_1 \times I_{IC} \) is the error-causing factor in \( V_{\text{OUT}} \).

As for \( I_{IC} \),

\[ I_{IC} = \frac{\text{setVFB}}{R_{IC}} \] \hspace{1cm} (6)

Therefore, the error-causing factor \( R_1 \times I_{IC} \) can be described as follows.

\[ R_1 \times I_{IC} = R_1 \times \frac{\text{setVFB}}{R_{IC}} \]
\[ = \text{setVFB} \times \frac{R_1}{R_{IC}} \] \hspace{1cm} (7)

For better accuracy, choosing \( R_1 \ll R_{IC} \) reduces this error.

Without the error-causing factor \( R_1 \times I_{IC} \), the output voltage can be calculated by the following equation

\[ V_{\text{OUT}} = \text{setVFB} \times \left( \frac{R_1 + R_2}{R_2} \right) \] \hspace{1cm} (8)

\( R_{IC} \) of RP108J is approximately Typ.1.6 MΩ (\( Ta = 25^\circ\text{C} \), this value is guaranteed by design).

The value could be affected by the temperature, therefore evaluate the circuit taking the actual conditions of use into account. The output voltage of the externally adjustable output voltage type should be set to 4.2 V or less. Also, total resistors value of \( R_1 \) and \( R_2 \) should be 20 kΩ or less.
REVERSE CURRENT PROTECTION CIRCUIT

The RP108J includes a Reverse Current Protection Circuit, which stops the reverse current from V_{OUT} pin to V_{DD} pin or to GND pin when V_{OUT} becomes higher than V_{IN}.

Usually, the LDO using Pch output transistor contains a parasitic diode between V_{DD} pin and V_{OUT} pin. Therefore, if V_{OUT} is higher than V_{IN}, the parasitic diode becomes forward direction. As a result, the current flows from V_{OUT} pin to V_{DD} pin.

This device switches the mode to the reverse current protection mode before V_{IN} becomes lower than V_{OUT} by connecting the parasitic diode of Pch output transistor to the backward direction, and connecting the gate to V_{OUT} pin. As a result, the Pch output transistor is turned off and the all the current pathways from V_{OUT} pin to GND pin are shut down to maintain the reverse current lower than 10 \mu A.

Switching to either the normal mode or to the reverse current protection mode is determined by the magnitude of V_{IN} voltage and V_{OUT} voltage. For the stable operation, offset and hysteresis are set as the threshold. Offset is set to 30 mV (Typ. 25°C) and hysteresis is set to 5 mV (Typ. 25°C).

Therefore, the minimum dropout voltage under the small load current condition is restricted by the value of 35 mV (Typ. 25°C).

Fig. 1 and Fig. 2 show the diagrams of each mode, and Fig. 3 shows the load characteristics of each mode. When giving the V_{OUT} pin a constant-voltage and decreasing the V_{IN} voltage, the dropout voltage will become lower than 30 mV (Typ. 25°C). As a result, the reverse current protection starts to function to stop the load current. By increasing the dropout voltage higher than 35 mV (Typ. 25°C), the protection mode will be released to let the load current to flow. If the dropout voltage to be used is lower than 30 mV (Typ. 25°C), the detection and the release may be repeated.
CONSTANT SLOPE CIRCUIT (RP108Jxx1B/xx1D)

RP108Jxx1B/xx1D has a Constant Slope Circuit (soft-start circuit) which allows the output voltage to start-up gradually. The capacitor to create the start-up slope is built-in the IC so that it does not require any external components. The upper limit of inrush current during the start-up is controlled by the short current ISC and the output current limit ILIM.

In the following characteristics \( C_{OUT} = 10 \ \mu F \ (R_{LOAD} = 380 \ \Omega) \), the inrush current \( I_{RUSH} \) is not controlled by the short current ISC and the output current limit ILIM. Therefore the output voltage rises with the soft-start time \( T_{SLOPE} \) set inside IC, and it enables to control the overshoot of the output voltage and the inrush current. \( T_{SLOPE} \) is typ. 180 \( \mu s \).

In the characteristics \( C_{OUT} = 20 \ \mu F \), \( I_{RUSH} \) at the low output voltage is controlled by the short current ISC. After the current is released from ISC, the output voltage rises with the soft-start time \( T_{SLOPE} \).

In the characteristics \( C_{OUT} = 100 \ \mu F \), \( I_{RUSH} \) at the low output voltage is controlled by the short current ISC. After the current is released from ISC, it is controlled by the output current limit. The output voltage rises with the soft-start time \( T_{SLOPE} \) or longer.

The relation of the inrush current and the constant slope depends on the output voltage since the inrush current is a sum of the charge current of \( C_{OUT} \) and the load current. Use RP108Jxx1E/xx1F to avoid an influence on peripheral components due to the inrush current generated in the use environment conditions (\( C_{OUT} \) and output voltage).

RP108J381B/D Inrush current characteristics
CONSTANT SLOPE CIRCUIT (RP108Jxx1E/xx1F)

RP108Jxx1E/xx1F has a constant slope circuit (soft-start circuit) which allows the output voltage to start-up gradually. The capacitor to create the start-up slope is built-in the IC so that it does not require any external components. The upper limit of inrush current during the start-up is controlled by the output current limit ILIM.

As shown in the following Foldback Characteristics, the inrush current is not controlled by the short current ISC during the soft-start time at the start-up. Therefore the output voltage rises with the soft-start time (T_SLOPE) set inside IC, and it enables to control the overshoot of the output voltage and the inrush current. T_SLOPE is typ. 570 µs (max. 900 µs/85°C). Use RP108Jxx1B/xx1D to avoid an influence on peripheral components due to the output start-up time is slow in the system.

In the characteristics C_OUT = 20 µF, the inrush current is lower or equal to the output current limit ILIM. The output voltage rises with the soft-start time (T_SLOPE).

Similarly in the characteristics C_OUT = 100 µF, the inrush current is lower or equal to the output current limit ILIM. The output voltage rises with the soft-start time (T_SLOPE).

The relation of the inrush current and the constant slope depends on the output voltage since the inrush current is a sum of the charge current of C_OUT and the load current.

RP108J381E/F Inrush current characteristics
## PACKAGE INFORMATION

### POWER DISSIPATION (TO-252-5-P2)

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

<table>
<thead>
<tr>
<th><em>Measurement conditions</em></th>
<th>Standard Land Pattern</th>
<th>Ultra High Wattage Land Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Mounting on board ( (\text{Wind velocity 0 m/s}) )</td>
<td></td>
</tr>
<tr>
<td>Board Material</td>
<td>Glass cloth epoxy plastic ( \text{(Double layers)} )</td>
<td>Glass cloth epoxy plastic ( \text{(Four-layers)} )</td>
</tr>
<tr>
<td>Board Dimensions</td>
<td>50 mm x 50 mm x 1.6 mm</td>
<td>76.2 mm x 114.3 mm x 0.8 mm</td>
</tr>
<tr>
<td>Copper Ratio</td>
<td>Top side: Approx. 50%, Back side: Approx. 50%</td>
<td>Top, Back side: Approx. 96%, 2nd, 3rd: 100%</td>
</tr>
<tr>
<td>Through - hole</td>
<td>( \phi 0.5 \text{ mm x 24 pcs} )</td>
<td>( \phi 0.4 \text{ mm x 30 pcs} )</td>
</tr>
</tbody>
</table>

*Measurement Results \( (\text{Ta} = 25^\circ \text{C}, \text{Tjmax} = 125^\circ \text{C}) \)

<table>
<thead>
<tr>
<th></th>
<th>Standard Land Pattern</th>
<th>Ultra High Wattage Land Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation</td>
<td>1900 mW</td>
<td>3800 mW</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>( \theta ja = (125-25^\circ \text{C})/1.9 \text{ W} = 53^\circ \text{C/W} )</td>
<td>( \theta ja = (125-25^\circ \text{C})/3.8 \text{ W} = 26^\circ \text{C/W} )</td>
</tr>
<tr>
<td></td>
<td>( \theta jc = 17^\circ \text{C/W} )</td>
<td>( \theta jc = 7^\circ \text{C/W} )</td>
</tr>
</tbody>
</table>

### Power Dissipation

![Power Dissipation Graph](image)

- **On Board (Ultra High Wattage Land Pattern)**
- **On Board (Standard Land Pattern)**

### Measurement Board Pattern

- **IC Mount Area \( \text{(Unit : mm)} \)**
  - Standard
  - Ultra High Wattage
PACKAGE DIMENSIONS (TO-252-5-P2)

![Diagram of package dimensions]

MARK SPECIFICATION (TO-252-5-P2)

①②③④⑤⑥: Product Code...Refer to MARK SPECIFICATION TABLE
⑦⑧: Lot Number ... Alphanumeric Serial Number

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

(Unit: mm)
### MARK SPECIFICATION TABLE (TO-252-5-P2)

<table>
<thead>
<tr>
<th>Product Name</th>
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<tbody>
<tr>
<td><strong>RP108Jxx1B</strong></td>
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<tr>
<td><strong>Product Name</strong></td>
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<tr>
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<td><strong>E J 1 2 1 B</strong></td>
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<tr>
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<td><strong>E J 1 5 1 B</strong></td>
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<tr>
<td><strong>RP108J181B</strong></td>
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<tr>
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TEST CIRCUITS

Internally Fixed Output Voltage (RP108Jxx1x)

Basic Test Circuit

Test Circuit for Supply Current

Test Circuit for Standby Current

C1 = Ceramic 10 µF
C2 = Ceramic 10 µF
Externally Adjustable Output Voltage (RP108J081x)

Refer to *Adjustable Output Voltage Setting* when using R1 and R2 as output resistors.

**Basic Test Circuit**

**Test Circuit for Supply Current**

**Test Circuit for Standby Current**
TYPICAL CHARACTERISTICS

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

1) Output Voltage vs. Input Voltage (C1 = Ceramic 10 µF, C2 = Ceramic 10 µF, Ta = 25°C)

2) Output Voltage vs. Ambient Temperature (C1 = Ceramic 10 µF, C2 = Ceramic 10 µF, Ta = −40°C to 105°C)
3) Supply Current vs. Input Voltage (C1 = Ceramic 10 µF, C2 = Ceramic 10 µF, I_{OUT} = 0 mA, T_a = 25°C)

**RP108J081x**

**RP108J151x**

**RP108J281x**

**RP108J421x**
4) Short Current Limit vs. Temperature/Current Limit vs. Temperature

RP108J includes a Fold-back Protection Circuit, while a Fold-back Protection Circuit is operated, Thermal Shutdown Circuit starts to operate. Therefore RP108J is not allowed to test "Output voltage vs. Output Current" on condition that a Thermal Shutdown Circuit is operated to prevent heat generated by itself.

See the following graphs for short current limit and current limit characteristics.

![Short Current Limit vs. Temperature](image1)

![Current Limit vs. Temperature](image2)

5) Supply Current vs. Ambient Temperature (C1 = Ceramic 10 µF, C2 = Ceramic 10 µF, Iout = 0 mA)

![Supply Current vs. Temperature](image3)

![Supply Current vs. Temperature](image4)
6) Dropout Voltage vs. Output Current (C1 = Ceramic 10 \mu F, C2 = Ceramic 10 \mu F)

\[\text{RP108J251x}\]

7) Dropout Voltage vs. Set Output Voltage (C1 = Ceramic 10 \mu F, C2 = Ceramic 10 \mu F, Ta = 25^\circ C)
8) Ripple Rejection vs. Input Voltage (C1 = C2 = 10 µF, Ripple = 0.2 Vp-p, I_{OUT} = 100 mA, Ta = 25°C)

- **RP108J081x**
- **RP108J251x**

9) Ripple Rejection vs. Frequency (C1 = none, C2 = 10 µF, I_{OUT} = 100 mA, Ta = 25°C)

- **RP108J081x**
- **RP108J421x**
10) Input Transient Response (C1 = none, C2 = 10 µF, IOUT = 30 mA, tr = tf = 5 µs, Ta = 25°C)

11) Load Transient Response (C1 = C2 = 10 µF, tr = tf = 0.5 µs, Ta = 25°C)
12) Turn on Speed with CE pin (C1 = Ceramic 10 $\mu$F, C2 = Ceramic 10 $\mu$F, Ta = 25°C)

RP108J081B/D

13) Turn off Speed with CE pin (C1 = Ceramic 10 $\mu$F, C2 = Ceramic 10 $\mu$F, Ta = 25°C)

RP108J081D/F
14) Inrush Current
ESR vs. OUTPUT CURRENT

When using this device, 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: 10 Hz to 2 MHz
- Temperature: $-40^\circ$C to $85^\circ$C
- Hatched area: Noise level is under 40 $\mu$V
- C1, C2: 10 $\mu$F or more

![Graph of ESR vs. Output Current for RP108J081x and RP108J421x](image)
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6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.

7. Anti-radiation design is not implemented in the products described in this document.

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

9. WL CSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.

10. There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact Ricoh sales or our distributor before attempting to use AOI.

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