**OUTLINE**

The R1131x Series are CMOS-based low voltage regulator ICs with output voltage range from 0.8V to 3.3V. The minimum operating voltage is 1.4V. Each of these voltage regulator ICs consists of a voltage reference unit, an error amplifier, resistors for setting output voltage, a current limit circuit, and a chip enable circuit.

To prevent the destruction by over current, current limit circuit is included. Standby mode realizes ultra small consumption current.

The output voltage of these ICs is internally fixed with high accuracy. Since the packages for these ICs are SOT-23-5, SON-6, and HSON-6, high density mounting of the ICs on boards is possible.

**FEATURES**

- Supply Current ..................................................Typ. 80μA (Vout < 1.8V)
  Typ. 60μA (Vout ≥ 1.8V)
- Standby Mode ..................................................Typ. 0.1μA
- Dropout Voltage ................................................Typ. 0.48V(Iout=300mA Output Voltage=1.0V Type)
  Typ. 0.31V(Iout=300mA Output Voltage=1.5V Type)
  Typ. 0.23V(Iout=300mA Output Voltage=3.0V Type)
- Ripple Rejection ..............................................Typ. 65dB(f=1kHz)
- Temperature-Drift Coefficient of Output Voltage....Typ. ±100ppm/°C
- Line Regulation ................................................Typ. 0.01%/V
- Output Voltage Accuracy ..................................±2.0%
- Output Voltage Range .....................................0.8V to 3.3V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONs.)
- Input Voltage Range .........................................1.4V to 6.0V
- Packages .........................................................SOT-23-5, SON-6, HSON-6
- Built-in fold-back protection circuit ....................Typ. 50mA (Current at short mode)
- External Capacitors ........................................CIN=COUT=Tantalum 1.0μF (Vout < 1.0V)
  CIN=COUT=Ceramic 1.0μF (Vout ≥ 1.0V)

**APPLICATIONS**

- Precision Voltage References.
- Power source for electrical appliances such as cameras, VCRs and hand-held communication equipment.
- Power source for battery-powered equipment.
* R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.
SELECTION GUIDE

The output voltage, CE pin polarity, auto discharge function, package, etc. for the ICs 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>R1131Nxx1+-TR-FE</td>
<td>SOT-23-5</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1131Dxx1+-TR-FE</td>
<td>SON-6</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1131Dxx2+-TR-FE</td>
<td>HSON-6</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

xx: The output voltage can be designated in the range from 0.8V(08) to 3.3V(33) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

*: CE pin polarity and auto discharge function at off state are options as follows.
(A) "L" active, without auto discharge function at off state
(B) "H" active, without auto discharge function at off state
(D) "H" active, with auto discharge function at off state

* R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.
PIN CONFIGURATIONS

- **SOT-23-5**
- **SON-6**
- **HSON-6**

PIN DESCRIPTIONS

- **SOT-23-5**

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>3</td>
<td>CE or CE</td>
<td>Chip Enable Pin</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>VOUT</td>
<td>Output pin</td>
</tr>
</tbody>
</table>

- **SON-6, HSON-6**

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>VOUT</td>
<td>Output pin</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>6</td>
<td>CE or CE</td>
<td>Chip Enable Pin</td>
</tr>
</tbody>
</table>

*) Tab and tab suspension leads are 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.

The tab suspension leads do not be connect to other wires or land patterns.

*R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.*
**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>6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CE}$</td>
<td>Input Voltage (CE /CE Pin)</td>
<td>$-0.3$ to 6.5</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>$I_{OUT}$</td>
<td>Output Current</td>
<td>350</td>
<td>mA</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation (SOT-23-5)</td>
<td>420</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Power Dissipation (SON-6)</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Power Dissipation (HSON-6)</td>
<td>900</td>
<td>mW</td>
</tr>
<tr>
<td>$T_{opt}$</td>
<td>Operating Temperature Range</td>
<td>$-40$ to $85$</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>Storage Temperature Range</td>
<td>$-55$ to $125$</td>
<td>°C</td>
</tr>
</tbody>
</table>

*) For Power Dissipation please refer to PACKAGE 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.
### ELECTRICAL CHARACTERISTICS

**• R1131xxxxA**

**TopT=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&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Output Voltage</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;= Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, 1μA ≤ I&lt;sub&gt;OUT&lt;/sub&gt; ≤ 30mA</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; &gt;1.5V</td>
<td>×0.98</td>
<td>×1.02</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.5V</td>
<td>−30</td>
<td>−30</td>
<td>mV</td>
</tr>
<tr>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Output Current</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;−V&lt;sub&gt;OUT&lt;/sub&gt;=1.0V</td>
<td>300</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ΔI&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Load Regulation</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, 1mA ≤ I&lt;sub&gt;OUT&lt;/sub&gt; ≤ 300mA</td>
<td>40</td>
<td>70</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>V&lt;sub&gt;DIFF&lt;/sub&gt;</td>
<td>Dropout Voltage</td>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;=300mA</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;=0.8V</td>
<td>620</td>
<td>850</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;=0.9V</td>
<td>550</td>
<td>780</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0V ≤ V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 1.5V</td>
<td>480</td>
<td>700</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.5V ≤ V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 2.6V</td>
<td>310</td>
<td>450</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.6V ≤ V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 3.3V</td>
<td>230</td>
<td>350</td>
<td>mV</td>
</tr>
<tr>
<td>I&lt;sub&gt;SS1&lt;/sub&gt;</td>
<td>Supply Current</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 1.8V</td>
<td>80</td>
<td>111</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, V&lt;sub&gt;OUT&lt;/sub&gt; ≥ 1.8V</td>
<td>60</td>
<td>90</td>
<td>μA</td>
</tr>
<tr>
<td>I&lt;sub&gt;STANDBY&lt;/sub&gt;</td>
<td>Standby Current</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=V&lt;sub&gt;CE&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ΔV&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Line Regulation</td>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;=30mA</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;+0.5V ≤ V&lt;sub&gt;IN&lt;/sub&gt; ≤ 6.0V (V&lt;sub&gt;OUT&lt;/sub&gt; &gt; 0.9V)</td>
<td>0.01</td>
<td>0.15</td>
<td>%/V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.4V ≤ V&lt;sub&gt;IN&lt;/sub&gt; ≤ 6.0V (V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 0.9V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>f=1kHz, Ripple 0.2Vp-p</td>
<td>65</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>V&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Input Voltage</td>
<td>1.4</td>
<td>6.0</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ΔT&lt;sub&gt;TOP&lt;/sub&gt;</td>
<td>Temperature Coefficient</td>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;=30mA</td>
<td>−40°C ≤ T&lt;sub&gt;TOP&lt;/sub&gt; ≤ 85°C</td>
<td>±100</td>
<td></td>
<td>ppm /°C</td>
</tr>
<tr>
<td>I&lt;sub&gt;SC&lt;/sub&gt;</td>
<td>Short Current Limit</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;=0V</td>
<td>50</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>R&lt;sub&gt;PU&lt;/sub&gt;</td>
<td>CE Pull-up Resistance</td>
<td>1.87</td>
<td>5.0</td>
<td>12.0</td>
<td></td>
<td>MΩ</td>
</tr>
<tr>
<td>V&lt;sub&gt;CEH&lt;/sub&gt;</td>
<td>CE Input Voltage “H”</td>
<td>1.0</td>
<td>6.0</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;CYL&lt;/sub&gt;</td>
<td>CE Input Voltage “L”</td>
<td>0</td>
<td>0.3</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>en</td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td>30</td>
<td></td>
<td></td>
<td>μVrms</td>
</tr>
</tbody>
</table>

### RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.
### R1131xxxxB/D

<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>VOUT</td>
<td>Output Voltage</td>
<td>$V_{IN}=Set\ V_{OUT}+1V \ 1\mu A \leq I_{OUT} \leq 30\ mA$</td>
<td>$V_{OUT} &gt; 1.5\ V$</td>
<td>$x 0.98$</td>
<td>$x 1.02$</td>
<td>$V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{OUT} \leq 1.5\ V$</td>
<td>$-30$</td>
<td>$+30$</td>
<td>$mV$</td>
<td></td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>$V_{IN}-V_{OUT}=1.0\ V$</td>
<td></td>
<td></td>
<td></td>
<td>$mA$</td>
</tr>
<tr>
<td>ΔVOUT/ΔIOUT</td>
<td>Load Regulation</td>
<td>$V_{IN}=Set\ V_{OUT}+1V \ 1mA \leq I_{OUT} \leq 300mA$</td>
<td></td>
<td></td>
<td></td>
<td>$mV$</td>
</tr>
<tr>
<td>VDIFF</td>
<td>Dropout Voltage</td>
<td>$I_{OUT}=300mA$</td>
<td>$V_{OUT}=0.8\ V$</td>
<td>620</td>
<td>850</td>
<td>$mV$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{OUT}=0.9\ V$</td>
<td>550</td>
<td>780</td>
<td>$mV$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$1.0\ V \leq V_{OUT} &lt; 1.5\ V$</td>
<td>480</td>
<td>700</td>
<td>$mV$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$1.5\ V \leq V_{OUT} &lt; 2.6\ V$</td>
<td>310</td>
<td>450</td>
<td>$mV$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$2.6\ V \leq V_{OUT} \leq 3.3\ V$</td>
<td>230</td>
<td>350</td>
<td>$mV$</td>
</tr>
<tr>
<td>ISS1</td>
<td>Supply Current</td>
<td>$V_{IN}=Set\ V_{OUT}+1V, \ V_{OUT} &lt; 1.8V$</td>
<td></td>
<td>80</td>
<td>111</td>
<td>$\mu A$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{IN}=Set\ V_{OUT}+1V, \ V_{OUT} \geq 1.8V$</td>
<td></td>
<td>60</td>
<td>90</td>
<td>$\mu A$</td>
</tr>
<tr>
<td>Istandby</td>
<td>Standby Current</td>
<td>$V_{IN}=Set\ V_{OUT}+1V, \ V_{CE}=GND$</td>
<td></td>
<td>0.1</td>
<td>1.0</td>
<td>$\mu A$</td>
</tr>
<tr>
<td>ΔVOUT/ΔVIN</td>
<td>Line Regulation</td>
<td>$I_{OUT}=30mA$</td>
<td>$V_{OUT}=0.5\ V \leq V_{IN} \leq 6.0\ V(V_{OUT} &gt; 0.9\ V)$</td>
<td>0.01</td>
<td>0.15</td>
<td>$%/V$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$1.4\ V \leq V_{IN} \leq 6.0\ V(V_{OUT} \leq 0.9\ V)$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>$f=1kHz, \ Ripple\ 0.2Vp-p$</td>
<td>$V_{IN}=Set\ V_{OUT}+1V, \ I_{OUT}=30mA$</td>
<td></td>
<td>65</td>
<td>$dB$</td>
</tr>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td></td>
<td>$V_{OUT}=0V$</td>
<td>1.4</td>
<td>6.0</td>
<td>$V$</td>
</tr>
<tr>
<td>ΔVOUT/ΔTopt</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT}=30mA$</td>
<td>$-40^\circ C \leq T_{OPT} \leq 85^\circ C$</td>
<td>$\pm 100$</td>
<td></td>
<td>$ppm/^\circ C$</td>
</tr>
<tr>
<td>ISC</td>
<td>Short Current Limit</td>
<td>$V_{OUT}=0V$</td>
<td></td>
<td>50</td>
<td></td>
<td>$mA$</td>
</tr>
<tr>
<td>RPD</td>
<td>CE Pull-down Resistance</td>
<td></td>
<td></td>
<td>1.87</td>
<td>5.0</td>
<td>12.0</td>
</tr>
<tr>
<td>VCEH</td>
<td>CE Input Voltage “H”</td>
<td></td>
<td></td>
<td>1.0</td>
<td>6.0</td>
<td>$V$</td>
</tr>
<tr>
<td>VCEL</td>
<td>CE Input Voltage “L”</td>
<td></td>
<td></td>
<td>0</td>
<td>0.3</td>
<td>$V$</td>
</tr>
<tr>
<td>en</td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td></td>
<td>30</td>
<td></td>
<td>$\mu Vi ms$</td>
</tr>
<tr>
<td>RLOW</td>
<td>Nch On Resistance for auto discharge (D version only)</td>
<td>$V_{CE}=0V$</td>
<td></td>
<td>60</td>
<td></td>
<td>$\Omega$</td>
</tr>
</tbody>
</table>

---

**RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)**

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

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R1131x

TYPICAL APPLICATION

<External Components examples>
- C2  1.0μF  CM05X5R105K06AB (Kyocera)
- C2  1.0μF  C1005JBOJ105K (TDK)
- C2  1.0μF  GRM155B30J105KE18B (Murata)

Output Capacitor; 1.0μF or more capacity ceramic Type
(If V_{out} < 1.0V, Tantalum Type is recommended)
Input Capacitor, 1.0μF or more capacity ceramic Type

TECHNICAL NOTES

When using these ICs, consider the following points:

Phase Compensation
In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a 1.0μF or more capacitor C_{OUT} with good frequency characteristics and ESR (Equivalent Series Resistance).
(Note: If a tantalum capacitor is connected to the Output pin for phase compensation, if the ESR value of the capacitor is too large, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)
Chip capacitor characteristics of Bias dependence and Temperature characteristics may vary depending on its size, manufacturer, and part number.

PCB Layout
Make V_{DD} and GND lines sufficient. If their impedance is high, pick-up the noise or unstable operation may result. Connect a capacitor with as much as 1.0μF capacitor between V_{DD} and GND pin as close as possible.
Set external components, especially the output capacitor, as close as possible to the ICs, and make wiring as short as possible.

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**TEST CIRCUIT**

**Standard Test Circuit**

**Supply Current Test Circuit**

**Ripple Rejection, Line Transient Response Test Circuit**

**Load Transient Response Test Circuit**

**Turn on Speed with CE pin Test Circuit**

- C1 = C2 = Tantalum 1.0 μF (VOUT < 1.0 V)
- C1 = C2 = Ceramic 1.0 μF (VOUT ≥ 1.0 V)
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

R1131x08xx

\[ V_{IN} = 2.8V \]
\[ V_{OUT} = 1.45V \]

R1131x15xx

\[ V_{IN} = 1.8V \]
\[ V_{OUT} = 2.5V, 2.0V \]

R1131x26xx

\[ V_{IN} = 2.9V \]
\[ V_{OUT} = 3.6V, 3.1V \]

R1131x33xx

\[ V_{IN} = 3.6V \]
\[ V_{OUT} = 4.3V, 3.8V \]

2) Output Voltage vs. Input Voltage

R1131x08xx

\[ I_{OUT} = 1mA, 30mA, 50mA \]

R1131x15xx

\[ I_{OUT} = 1mA, 30mA, 50mA \]
3) Supply Current vs. Input Voltage

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4) Output Voltage vs. Temperature

- **R1131x08xx**

- **R1131x15xx**

- **R1131x26xx**

- **R1131x33xx**

5) Supply Current vs. Temperature

- **R1131x08xx**

- **R1131x15xx**

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6) Dropout Voltage vs. Output Current

* R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

8) Ripple Rejection vs. Input Bias (Topt=25°C, CIN=none, COUT=Ceramic 1.0μF Ripple 0.2Vp-p)

* R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.
9) Ripple Rejection vs. Frequency (C\textsubscript{IN}=\text{none})

R1131x08xx

\text{Vin}=1.8\text{VDC}+0.2\text{Vp-p}, \quad \text{C\textsubscript{OUT}=Tantalum 1.0\mu F}

R1131x10xx

\text{Vin}=2.0\text{VDC}+0.2\text{Vp-p}, \quad \text{C\textsubscript{OUT}=Ceramic 1.0\mu F}

R1131x08xx

\text{Vin}=1.8\text{VDC}+0.2\text{Vp-p}, \quad \text{C\textsubscript{OUT}=Tantalum 2.2\mu F}

R1131x10xx

\text{Vin}=2.0\text{VDC}+0.2\text{Vp-p}, \quad \text{C\textsubscript{OUT}=Ceramic 2.2\mu F}

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R1131x

R1131x15xx

\[ V_{IN}=2.5V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 1.0\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

R1131x15xx

\[ V_{IN}=2.5V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 2.2\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

R1131x26xx

\[ V_{IN}=3.6V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 1.0\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

R1131x26xx

\[ V_{IN}=3.6V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 2.2\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

R1131x33xx

\[ V_{IN}=4.3V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 1.0\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

R1131x33xx

\[ V_{IN}=4.3V_{DC}+0.2V_{p-p}, \]
\[ C_{OUT}=\text{Ceramic } 2.2\mu F \]

Ripple Rejection RR(dB)

\[
\begin{array}{c|cccc}
\text{Frequency f (kHz)} & 0.1 & 1 & 10 & 100 \\
\hline
\text{Iout = 1mA} &  &  &  & \\
\text{Iout = 30mA} &  &  &  & \\
\text{Iout = 50mA} &  &  &  & \\
\end{array}
\]

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10) Input Transient Response (CIN=none, $t_r=t_f=5\mu s$)

**R1131x08xx**

- $I_{OUT}=30mA$, $C_{OUT}=Tantalum\ 1.0\mu F$

**R1131x10x**

- $I_{OUT}=30mA$, $C_{OUT}=Ceramic\ 1.0\mu F$

**R1131x26xx**

- $I_{OUT}=30mA$, $C_{OUT}=Ceramic\ 1.0\mu F$

11) Load Transient Response ($t_r=t_f=0.5\mu s$)

**R1131x08xx**

- $V_{IN}=1.8V$, $C_{IN}=Tantalum\ 1.0\mu F$, $C_{OUT}=Tantalum\ 1.0\mu F$

**R1131x08xx**

- $V_{IN}=1.8V$, $C_{IN}=Tantalum\ 1.0\mu F$, $C_{OUT}=Tantalum\ 2.2\mu F$

---

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R1131x10xx
$V_{IN}=2.0\text{V}$ $C_{IN}=$Ceramic $1.0\mu F$, $C_{OUT}=$Ceramic $1.0\mu F$

Output Voltage $V_{OUT}(V)$
Output Current $I_{OUT}(mA)$

Time $t(\mu s)$

Output Voltage
Output Current

R1131x10xx
$V_{IN}=2.0\text{V}$ $C_{IN}=$Ceramic $1.0\mu F$, $C_{OUT}=$Ceramic $2.2\mu F$

Output Voltage $V_{OUT}(V)$
Output Current $I_{OUT}(mA)$

Time $t(\mu s)$

Output Voltage
Output Current

R1131x26xx
$V_{IN}=3.6\text{V}$ $C_{IN}=$Ceramic $1.0\mu F$, $C_{OUT}=$Ceramic $1.0\mu F$

Output Voltage $V_{OUT}(V)$
Output Current $I_{OUT}(mA)$

Time $t(\mu s)$

Output Voltage
Output Current

R1131x26xx
$V_{IN}=3.6\text{V}$ $C_{IN}=$Ceramic $1.0\mu F$, $C_{OUT}=$Ceramic $2.2\mu F$

Output Voltage $V_{OUT}(V)$
Output Current $I_{OUT}(mA)$

Time $t(\mu s)$

Output Voltage
Output Current

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12) Turn on speed with CE pin

**R1131x08xx**

\( V_{IN}=1.8\,V\)  
\( C_{IN}=\text{Tantalum 1.0}\,\mu\text{F},\)  
\( C_{OUT}=\text{Tantalum 1.0}\,\mu\text{F} \)

- **CE Input Voltage**  
  - 0V → 1.8V

- **Output Voltage**  
  - \( I_{OUT}=0\,\text{mA} \)

**R1131x08xx**

\( V_{IN}=1.8\,V\)  
\( C_{IN}=\text{Tantalum 1.0}\,\mu\text{F},\)  
\( C_{OUT}=\text{Tantalum 1.0}\,\mu\text{F} \)

- **CE Input Voltage**  
  - 0V → 1.8V

- **Output Voltage**  
  - \( I_{OUT}=30\,\text{mA} \)

**R1131x08xx**

\( V_{IN}=1.8\,V\)  
\( C_{IN}=\text{Tantalum 1.0}\,\mu\text{F},\)  
\( C_{OUT}=\text{Tantalum 1.0}\,\mu\text{F} \)

- **CE Input Voltage**  
  - 0V → 4.3V

- **Output Voltage**  
  - \( I_{OUT}=300\,\text{mA} \)

**R1131x08xx**

\( V_{IN}=4.3\,V\)  
\( C_{IN}=\text{Ceramic 1.0}\,\mu\text{F},\)  
\( C_{OUT}=\text{Ceramic 1.0}\,\mu\text{F} \)

- **CE Input Voltage**  
  - 0V → 4.3V

- **Output Voltage**  
  - \( I_{OUT}=0\,\text{mA} \)

*R1131Dxx2 (HSON-6) is the discontinued product. As of June in 2016.*
R1131x

R1131x33xx (ECO=H)  
$V_{IN}=4.3\,V$  
$C_{IN}=\text{Ceramic } 1.0\,\mu\text{F}$,  
$C_{OUT}=\text{Ceramic } 1.0\,\mu\text{F}$

R1131x33xx (ECO=L)  
$V_{IN}=4.3\,V$  
$C_{IN}=\text{Ceramic } 1.0\,\mu\text{F}$,  
$C_{OUT}=\text{Ceramic } 1.0\,\mu\text{F}$

13) Turn-off Speed with CE

R1131x08xD  
$V_{IN}=1.8\,V$  
$C_{IN}=\text{Tantalum } 1.0\,\mu\text{F}$,  
$C_{OUT}=\text{Tantalum } 1.0\,\mu\text{F}$

R1131x33xD  
$V_{IN}=4.3\,V$  
$C_{IN}=\text{Ceramic } 1.0\,\mu\text{F}$,  
$C_{OUT}=\text{Ceramic } 1.0\,\mu\text{F}$

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R1131x33xD

$V_{IN}=4.3V$  $C_{IN}=$Ceramic 1.0μF,  
$C_{OUT}=$Ceramic 1.0μF

Output Voltage $V_{OUT}(V)$

CE Input Voltage $V_{CE}(V)$

$I_{OUT}=30mA$

Time $t$(ms)  0  0.1  0.2  0.3  0.4  0.5  0.6  0.7

Output Voltage $V_{OUT}(V)$

CE Input Voltage $V_{CE}(V)$

$I_{OUT}=300mA$

Time $t$(ms)  0  0.1  0.2  0.3  0.4  0.5  0.6  0.7

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ESR vs. Output Current

When using these ICs, consider the following points:

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, be sure to use a capacitor \( C_{OUT} \) with good frequency characteristics and ESR (Equivalent Series Resistance) of which is in the range described as follows:

The relations between \( I_{OUT} \) (Output Current) and ESR of 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.

<Test conditions>

(1) Frequency band: 10Hz to 2MHz
(2) Temperature: 25°C

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VIN=3.6V to 6.0V,
CIN=Ceramic 1.0μF COUT=Ceramic 1.0μF

R1131xx

Output Current IOUT (mA)

ESR (Ω)

0 50 100 150 200 250 300

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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.

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.

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11. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.

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