The R1161x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current, and low ON-resistance. 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.

These ICs perform with low dropout voltage and a chip enable function. To prevent the destruction by over current, current limit circuit is included. The R1161x Series have 3-mode. One is standby mode with CE or standby control pin. Standby mode realizes ultra small consumption current off mode. Other two modes are realized with ECO pin. Fast Transient Mode (FT mode) and Low Power Mode (LP mode) are alternative with ECO pin. Consumption current is reduced at Low Power Mode compared with Fast Transient Mode. Output voltage is maintained between FT mode and LP mode.

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. 3.5μA (Low Power Mode, VOUT<1.6V),
  Typ. 80μA (Fast Transient Mode, VOUT<1.8V)
  Typ. 60μA (Fast Transient Mode, 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, FT Mode)
- **Temperature-Drift Coefficient of Output Voltage** Typ. ±100ppm/°C
- **Line Regulation** .................................................Typ. 0.01%/V (at Fast Transient Mode)
- **Output Voltage Accuracy** ...................................±2.0%(±3.0% at LP Mode)
- **Packages** .........................................................SOT-23-5, SON-6, HSON-6
- **Output Voltage** ..................................................0.8V to 3.3V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- **Input Voltage** ..................................................Min. 1.40V (VOUT ≥ 1.0V)
  Min. 1.45V (VOUT<1.0V)
- **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.
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
**SELECTION GUIDE**

The output voltage, chip enable polarity, auto discharge function, and 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>R1161Nxx1+-TR-FE</td>
<td>SOT-23-5</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1161Dxx1+-TR-FE</td>
<td>SON-6</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1161Dxx2+-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 type, without auto discharge function at off state
  (B) "H" active type, without auto discharge function at off state
  (D) "H" active type, with auto discharge function at off state

* R1161Dxx1 (SON-6) and R1161Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
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>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>ECO</td>
<td>MODE alternative pin</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>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>ECO</td>
<td>MODE alternative pin</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 the IC.)

The tab is better to be connected to the GND, but leaving it open is also acceptable.

The tab suspension leads should be open and do not connect to other wires or land patterns.
### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>VECO</td>
<td>Input Voltage (ECO Pin)</td>
<td>-0.3 ~ 6.5</td>
<td>V</td>
</tr>
<tr>
<td>VCE</td>
<td>Input Voltage (CE/CE Pin)</td>
<td>-0.3 ~ 6.5</td>
<td>V</td>
</tr>
<tr>
<td>VOUT</td>
<td>Output Voltage</td>
<td>-0.3 ~ VIN+0.3</td>
<td>V</td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>350</td>
<td>mA</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation (SOT23-5)*</td>
<td>420</td>
<td>mW</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation (SON-6)*</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation (HSON-6)*</td>
<td>900</td>
<td>mW</td>
</tr>
<tr>
<td>Topt</td>
<td>Operating Temperature Range</td>
<td>-40 ~ 85</td>
<td>°C</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage Temperature Range</td>
<td>-55 ~ 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.

### 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.
ELECTRICAL CHARACTERISTICS

- R1161xxxxA

<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_{\text{OUT}} )</td>
<td>Output Voltage (FT Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}} ) ( 0.98 \text{ μA} \leq I_{\text{OUT}} \leq 30\text{mA} ) Note 1</td>
<td>0.98</td>
<td>1.02</td>
<td>30mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( 0.97 \text{ μA} \leq I_{\text{OUT}} \leq 30\text{mA} ) Note 2</td>
<td>0.97</td>
<td>1.03</td>
<td>45mV</td>
<td></td>
</tr>
<tr>
<td>( I_{\text{OUT}} )</td>
<td>Output Voltage (LP Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=0 ) ( 0.98 \text{ μA} \leq I_{\text{OUT}} \leq 30\text{mA} )</td>
<td>300</td>
<td>40</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Load Regulation (FT Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}} ) ( 1\text{mA} \leq I_{\text{OUT}} \leq 100\text{mA} )</td>
<td>15</td>
<td>30</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load Regulation (LP Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=GND ) ( 1\text{mA} \leq I_{\text{OUT}} \leq 100\text{mA} )</td>
<td>15</td>
<td>30</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>( V_{\text{OF}} )</td>
<td>Dropout Voltage</td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{\text{SS1}} )</td>
<td>Supply Current (FT Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}, V_{\text{OUT}}&lt;1.8V )</td>
<td>80</td>
<td>111</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}, V_{\text{OUT}} \geq 1.8V )</td>
<td>60</td>
<td>90</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>( I_{\text{SS2}} )</td>
<td>Supply Current (LP Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=GND ) ( V_{\text{OUT}}&lt;1.6V )</td>
<td>3.5</td>
<td>8.0</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=GND ) ( V_{\text{OUT}} \geq 1.6V )</td>
<td>4.5</td>
<td>9.0</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>( I_{\text{standby}} )</td>
<td>Supply Current (Standby)</td>
<td>( V_{\text{IN}}=V_{\text{CE}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=GND ) or ( V_{\text{IN}} )</td>
<td>0.1</td>
<td>1.0</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{\text{OUT}}/\Delta V_{\text{IN}} )</td>
<td>Line Regulation (FT Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+0.5V \leq V_{\text{IN}} \leq 6.0V ) ( I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=V_{\text{IN}} ) ( 0.9V \leq V_{\text{IN}} \leq 6.0V )</td>
<td>0.01</td>
<td>0.15</td>
<td>%/V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V ) ( I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=GND ) ( 0.9V \leq V_{\text{IN}} \leq 6.0V )</td>
<td>0.05</td>
<td>0.20</td>
<td>%/V</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{\text{OUT}}/\Delta V_{\text{IN}} )</td>
<td>Line Regulation (LP Mode)</td>
<td>( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+0.5V \leq V_{\text{IN}} \leq 6.0V ) ( I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=GND ) ( 0.9V \leq V_{\text{IN}} \leq 6.0V )</td>
<td>0.05</td>
<td>0.20</td>
<td>%/V</td>
<td></td>
</tr>
<tr>
<td>( RR )</td>
<td>Ripple Rejection (FT Mode)</td>
<td>( f=1kHz ), Ripple 0.2Vp-p ( V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V ) ( I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=V_{\text{IN}} )</td>
<td>65</td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{\text{OUT}}/\Delta T_{\text{OPT}} )</td>
<td>Output Voltage Temperature Coefficient</td>
<td>( I_{\text{OUT}}=30\text{mA} ) ( -40^\circ \text{C} \leq T_{\text{OPT}} \leq 85^\circ \text{C} )</td>
<td>±100</td>
<td></td>
<td>ppm/°C</td>
<td></td>
</tr>
<tr>
<td>( I_{\text{lim}} )</td>
<td>Short Current Limit</td>
<td>( V_{\text{OUT}}=0V )</td>
<td>50</td>
<td></td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>( R_{\text{PU}} )</td>
<td>CE Pull-up Resistance</td>
<td>( V_{\text{CE}}=V_{\text{ECO}} )</td>
<td>1.87</td>
<td>5.00</td>
<td>12.00</td>
<td>MΩ</td>
</tr>
<tr>
<td>( R_{\text{PD}} )</td>
<td>ECO Pull-down Resistance</td>
<td>( V_{\text{CE}}=V_{\text{ECO}} )</td>
<td>1.87</td>
<td>5.00</td>
<td>12.00</td>
<td>MΩ</td>
</tr>
<tr>
<td>( V_{\text{CEL}} )</td>
<td>CE , ECO Input Voltage “L”</td>
<td>( V_{\text{CE}}=V_{\text{ECO}} )</td>
<td>0.0</td>
<td>0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( V_{\text{DEN}} )</td>
<td>Output Noise</td>
<td>( 10Hz ) to 100kHz</td>
<td>30</td>
<td></td>
<td>μVrms</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: ±30mV tolerance for \( V_{\text{OUT}} \leq 1.5V \).

Note 2: ±45mV tolerance for \( V_{\text{OUT}} \leq 1.5V \).
## R1161xxxxB/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>( V_{OUT} )</td>
<td>Output Voltage (FT Mode)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=V_{IN} ) ( 1\mu A \leq I_{OUT} \leq 30mA ) Note 1</td>
<td>( \times 0.98 ) ((-30mV))</td>
<td>( \times 1.02 ) ((30mV))</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=GND ) ( 1mA \leq I_{OUT} \leq 30mV ) Note 2</td>
<td>( \times 0.97 ) ((-45mV))</td>
<td>( \times 1.03 ) ((45mV))</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_{OUT} )</td>
<td>Output Current</td>
<td>( V_{IN}=V_{OUT}=1.0V )</td>
<td>300</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( \Delta V_{OUT}/\Delta I_{OUT} )</td>
<td>Load Regulation (FT Mode)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=V_{IN} ) ( 1mA \leq I_{OUT} \leq 30mA )</td>
<td>40</td>
<td>70</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=GND ) ( 1mA \leq I_{OUT} \leq 100mA )</td>
<td>15</td>
<td>30</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>( V_{DIFF} )</td>
<td>Dropout Voltage</td>
<td></td>
<td></td>
<td></td>
<td>Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE</td>
<td></td>
</tr>
<tr>
<td>( I_{SS1} )</td>
<td>Supply Current (FT Mode)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=V_{IN}, V_{OUT}&lt;1.8V )</td>
<td>80</td>
<td>111</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{ECO}=V_{IN}, V_{OUT}&gt;1.8V )</td>
<td>60</td>
<td>90</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>( I_{SS2} )</td>
<td>Supply Current (LP Mode)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{OUT}&lt;1.6V, V_{ECO}=GND )</td>
<td>4.5</td>
<td>9.0</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{OUT}&gt;1.6V, V_{ECO}=GND )</td>
<td>3.5</td>
<td>8.0</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>( I_{STANDBY} )</td>
<td>Supply Current (Standby)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+1V, V_{EO}=GND, V_{ECO}=GND ) or ( V_{IN} )</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>( \Delta V_{OUT}/\Delta V_{IN} )</td>
<td>Line Regulation (FT Mode)</td>
<td>( V_{IN}=\text{Set } V_{OUT}+0.5V \leq V_{IN} \leq 6.0V ) ( I_{OUT}=30mA, V_{ECO}=V_{IN} ) ( V_{OUT}=0.5V ) ( \leq V_{IN} \leq 6.0V )</td>
<td>0.01</td>
<td>0.15</td>
<td></td>
<td>%V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{IN}=\text{Set } V_{OUT}+0.5V \leq V_{IN} \leq 6.0V ) ( I_{OUT}=30mA, V_{ECO}=GND ) ( V_{OUT}=0.5V \leq V_{IN} \leq 6.0V )</td>
<td>0.05</td>
<td>0.20</td>
<td></td>
<td>%V</td>
</tr>
<tr>
<td>( RR )</td>
<td>Ripple Rejection (FT Mode)</td>
<td>( f=1kHz, \text{Ripple } 0.2Vp-p ) ( V_{IN}=\text{Set } V_{OUT}+1V ) ( I_{OUT}=30mA, V_{ECO}=V_{IN} ) ( 0.01 ) ( \leq V_{OUT} \leq 6.0V )</td>
<td>65</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>( V_{IN} )</td>
<td>Input Voltage</td>
<td></td>
<td>1.4</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( \Delta V_{OUT}/\Delta T_{OPT} )</td>
<td>Output Voltage Temperature Coefficient</td>
<td>( I_{OUT}=30mA ) (-40^\circ C \leq T_{OPT} \leq 85^\circ C )</td>
<td></td>
<td></td>
<td></td>
<td>ppm /°C</td>
</tr>
<tr>
<td>( I_{ILIM} )</td>
<td>Short Current Limit</td>
<td>( V_{OUT}=0V )</td>
<td>50</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( R_{PDC} )</td>
<td>CE Pull-down Resistance</td>
<td></td>
<td>1.87</td>
<td>5.00</td>
<td>12.00</td>
<td>MΩ</td>
</tr>
<tr>
<td>( R_{PDE} )</td>
<td>ECO Pull-down Resistance</td>
<td></td>
<td>1.87</td>
<td>5.00</td>
<td>12.00</td>
<td>MΩ</td>
</tr>
<tr>
<td>( V_{CEH} )</td>
<td>CE, ECO Input Voltage “H”</td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{CEL} )</td>
<td>CE, ECO Input Voltage “L”</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{EN} )</td>
<td>Output Noise</td>
<td>( BW=10Hz \text{to } 100kHz )</td>
<td>30</td>
<td></td>
<td></td>
<td>µVrms</td>
</tr>
<tr>
<td>( R_{LOW} )</td>
<td>Nch On Resistance for auto discharge (applied to D version only)</td>
<td>( V_{CE}=0V )</td>
<td>60</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
</tbody>
</table>

Note 1: \( \pm 30mV \) tolerance for \( V_{OUT} \leq 1.5V \).

Note 2: \( \pm 45mV \) tolerance for \( V_{OUT} \leq 1.5V \).
R1161x

**ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE**

<table>
<thead>
<tr>
<th>Output Voltage V\text{OUT} (V)</th>
<th>Dropout Voltage V\text{DIFF} (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Condition</td>
</tr>
<tr>
<td>0.8 ≤ V\text{OUT}</td>
<td>I\text{OUT}=300mA</td>
</tr>
<tr>
<td>0.9 ≤ V\text{OUT}</td>
<td></td>
</tr>
<tr>
<td>1.0 ≤ V\text{OUT} &lt; 1.5</td>
<td></td>
</tr>
<tr>
<td>1.5 ≤ V\text{OUT} &lt; 2.6</td>
<td></td>
</tr>
<tr>
<td>2.6 ≤ V\text{OUT} ≤ 3.3</td>
<td></td>
</tr>
</tbody>
</table>

**TEST CIRCUITS**

- **Fig.1 Output Voltage vs. Output Current Test Circuit**
- **Fig.2 Output Voltage vs. Input Voltage Test Circuit**

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.

**Fig. 3 Supply Current vs. Input Voltage Test Circuit**

**Fig. 4 Output Voltage vs. Temperature Test Circuit**

**Fig. 5 Supply Current vs. Temperature Test Circuit**

**Fig. 6 Dropout Voltage vs. Output Current/ Set Output Voltage Test Circuit**
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.

**Fig. 7 Ripple Rejection Test Circuit**

**Fig. 8 Input Transient Response Test Circuit**

**Fig. 9 Load Transient Response Test Circuit**

**Fig. 10 Turn on Speed with CE pin Test Circuit**
Fig. 11 MODE Transient Response Test Circuit

Fig. 12 Output Noise Test Circuit (I_{OUT} vs. ESR)

TYPICAL APPLICATION

(External Components)
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
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

R1161x08xx (ECO=H)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
1.45V & 0 \text{ to } 600 \\
V_{\text{IN}} = 2.8V \\
\end{array}
\]

R1161x08xx (ECO=L)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
1.45V & 0 \text{ to } 600 \\
V_{\text{IN}} = 2.8V \\
\end{array}
\]

R1161x15xx (ECO=H)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
1.8V & 0 \text{ to } 600 \\
V_{\text{IN}} = 3.5V \\
\end{array}
\]

R1161x15xx (ECO=L)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
1.8V & 0 \text{ to } 600 \\
V_{\text{IN}} = 3.5V \\
\end{array}
\]

R1161x26xx (ECO=H)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
2.9V & 0 \text{ to } 600 \\
V_{\text{IN}} = 4.6V \\
\end{array}
\]

R1161x26xx (ECO=L)

\[
\begin{array}{cc}
\text{Output Voltage } V_{\text{OUT}} \text{ (V)} & \text{Output Current } I_{\text{OUT}} \text{ (mA)} \\
2.9V & 0 \text{ to } 600 \\
V_{\text{IN}} = 4.6V \\
\end{array}
\]
2) Output Voltage vs. Input Voltage

R1161x

2) Output Voltage vs. Input Voltage

R1161x

---

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
3) Supply Current vs. Input Voltage

R1161x08xx (ECO=H)
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

4) Output Voltage vs. Temperature

R1161x08xx (ECO=H)

R1161x08xx (ECO=L)

R1161x15xx (ECO=H)

R1161x15xx (ECO=L)

R1161x26xx (ECO=H)

R1161x26xx (ECO=L)

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
5) Supply Current vs. Temperature

R1161x33xx (ECO=H)

R1161x33xx (ECO=L)

R1161x08xx (ECO=H)

R1161x08xx (ECO=L)

R1161x15xx (ECO=H)

R1161x15xx (ECO=L)

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
6) Dropout Voltage vs. Output Current

R1161x

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)
R1161xxx1x (ECO=H)

R1161xxx1x (ECO=L)
8) Ripple Rejection vs. Input Bias (Topt=25°C CIN=none, COUT=Ceramic 1.0μF Ripple 0.2Vp-p)

R1161x26xx (IOUT=1mA)

R1161x26xx (IOUT=30mA)

R1161x26xx (IOUT=50mA)

9) Ripple Rejection vs. Frequency (CIN=none)

R1161x08xx (ECO=H)

R1161x08xx (ECO=L)

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

R1161x08xx (ECO=H)

Vin=1.8Vdc+0.2Vp-p,
Cout=Tantal 2.2μF

R1161x08xx (ECO=L)

Vin=1.8Vdc+0.2Vp-p,
Cout=Tantal 2.2μF

R1161x10xx (ECO=H)

Vin=2.0Vdc+0.2Vp-p,
Cout=Ceramic 1.0μF

R1161x10xx (ECO=L)

Vin=2.0Vdc+0.2Vp-p,
Cout=Ceramic 1.0μF

R1161x10xx (ECO=H)

Vin=2.0Vdc+0.2Vp-p,
Cout=Ceramic 2.2μF

R1161x10xx (ECO=L)

Vin=2.0Vdc+0.2Vp-p,
Cout=Ceramic 2.2μF

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

R1161x15xx (ECO=H)

Vin = 2.5Vdc + 0.2Vp-p,
Cout = 1.0μF

R1161x15xx (ECO=L)

Vin = 2.5Vdc + 0.2Vp-p,
Cout = 1.0μF

R1161x15xx (ECO=H)

Vin = 2.5Vdc + 0.2Vp-p,
Cout = 2.2μF

R1161x15xx (ECO=L)

Vin = 2.5Vdc + 0.2Vp-p,
Cout = 2.2μF

R1161x26xx (ECO=H)

Vin = 3.6Vdc + 0.2Vp-p,
Cout = Ceramic 1.0μF

R1161x26xx (ECO=L)

Vin = 3.6Vdc + 0.2Vp-p,
Cout = Ceramic 1.0μF

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
**R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.**

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**R1161x26xx (ECO=H)**

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

**R1161x26xx (ECO=L)**

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

---

**R1161x33xx (ECO=H)**

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

**R1161x33xx (ECO=L)**

\[ V_{\text{IN}}=4.3\text{VDC}+0.2\text{Vp-p}, \]
\[ C_{\text{OUT}} = \text{Ceramic 2.2}\mu\text{F} \]
10) Input Transient Response (Cin = none, tr=tf=5μs)

- **R1161x08xx (ECO=H)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Tantalum 1.0μF
  - IOUT=30mA

- **R1161x08xx (ECO=L)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Tantalum 1.0μF
  - IOUT=10mA

- **R1161x10xx (ECO=H)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Ceramic 1.0μF
  - IOUT=30mA

- **R1161x10xx (ECO=L)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Ceramic 1.0μF
  - IOUT=10mA

- **R1161x26xx (ECO=H)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Ceramic 1.0μF
  - IOUT=30mA

- **R1161x26xx (ECO=L)**
  - Input Voltage VIN = 0V to 3.0V
  - Output Voltage VOUT = 0V to 4V
  - COUT = Ceramic 1.0μF
  - IOUT=10mA

---

*R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.*
11) Load Transient Response \((t_r=t_f=0.5\mu s)\)

**R1161x08x (ECO=H)**

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

**R1161x08x (ECO=H)**

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

**R1161x08x (ECO=L)**

- \(V_{IN}=1.8V, C_{IN}=\text{tantalum }1.0\mu F, C_{OUT}=\text{tantalum }2.2\mu F\)

**R1161x08x (ECO=H)**

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

---

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

R1161x10xx (ECO=H)  \( V_{IN}=2.0\,V \),  
C\(_{IN}\) = Ceramic 1.0\( \mu \)F,  
C\(_{OUT}\) = Ceramic 2.2\( \mu \)F

R1161x10xx (ECO=L)  \( V_{IN}=2.0\,V \),  
C\(_{IN}\) = Ceramic 1.0\( \mu \)F,  
C\(_{OUT}\) = Ceramic 2.2\( \mu \)F

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
R1161x

R1161x26xx (ECO=H)  
$V_{IN}=3.6V$,  
$C_{IN} =$ Ceramic 1.0μF  
$C_{OUT} =$ Ceramic 2.2μF

R1161x26xx (ECO=H)  
$V_{IN}=3.6V$,  
$C_{IN} =$ Ceramic 1.0μF  
$C_{OUT} =$ Ceramic 1.0μF

R1161x26xx (ECO=L)  
$V_{IN}=3.6V$,  
$C_{IN} =$ Ceramic 1.0μF  
$C_{OUT} =$ Ceramic 2.2μF

R1161x26xx (ECO=L)  
$V_{IN}=3.6V$,  
$C_{IN} =$ Ceramic 1.0μF  
$C_{OUT} =$ Ceramic 1.0μF

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
12) Turn on speed with CE pin

**R1161x08xx (ECO=H)**

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

**R1161x08xx (ECO=L)**

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

*R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.*
R1161x33xx (ECO=H)\\  \text{VIN}=4.3\text{V}, \text{CIN}=\text{Ceramic 1.0}\mu\text{F}\\  \text{COUT}=\text{Ceramic 1.0}\mu\text{F}

R1161x33xx (ECO=L)\\  \text{VIN}=4.3\text{V}, \text{CIN}=\text{Ceramic 1.0}\mu\text{F}\\  \text{COUT}=\text{Ceramic 1.0}\mu\text{F}

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
13) Turn-off Speed with CE

**R1161x08xD**  
VIN=1.8V, CIN = Tantalum 1.0μF  
COUT = Tantalum 1.0μF

**R1161x08xD**  
VIN=1.8V, CIN = Tantalum 1.0μF  
COUT = Tantalum 1.0μF

**R1161x08xD**  
VIN=1.8V, CIN = Tantalum 1.0μF  
COUT = Tantalum 1.0μF

**R1161x08xD**  
VIN=1.8V, CIN = Tantalum 1.0μF  
COUT = Tantalum 1.0μF

**R1161x33xD**  
VIN=4.3V, CIN = Ceramic 1.0μF  
COUT = Ceramic 1.0μF

**R1161x33xD**  
VIN=4.3V, CIN = Ceramic 1.0μF  
COUT = Ceramic 1.0μF

**R1161x33xD**  
VIN=4.3V, CIN = Ceramic 1.0μF  
COUT = Ceramic 1.0μF

**R1161x33xD**  
VIN=4.3V, CIN = Ceramic 1.0μF  
COUT = Ceramic 1.0μF

---

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
14) Output Voltage at Mode alternative point

**R1161x08xx**

Vin = 1.8V, Cin = Ceramic 1.0μF  
Cout = Tantalum 1.0μF

**R1161x10xx**

Vin = 2.0V, Cin = Ceramic 1.0μF  
Cout = Ceramic 1.0μF

---

* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.
When using these ICs, consider the following points:

1. **Mounting on PCB**
   Make VDD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with as much as 1.0µF capacitor between VDD 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.

2. **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 more capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Recommended Value of C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOUT&lt;1.0V</td>
<td>1.0µF or more Tantalum Capacitor</td>
</tr>
<tr>
<td>1.0V ≤ VOUT</td>
<td>1.0µF or more Ceramic Capacitor</td>
</tr>
</tbody>
</table>

(Note: When the additional ceramic capacitors are connected to the Output Pin with Output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

If you use a tantalum type capacitor and ESR value of the capacitor is large, output might be unstable. Evaluate your circuit with considering frequency characteristics. Depending on the capacitor size, manufacturer, and part number, the bias characteristics and temperature characteristics are different. Evaluate the circuit with actual using capacitors.)
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 output current is varied. For this purpose, be sure to use a capacitor C_OUT with good frequency characteristics and ESR (Equivalent Series Resistance) in the range described as follows:

The relations between IOUT (Output Current) and ESR of Output Capacitor are shown below. The conditions when the white noise level is under 40μV (Avg.) are marked as the hatched area in the graph.

<Test conditions>
(1) Frequency band: 10Hz to 2MHz
(2) Temperature: 25°C
* R1116Dxx1 (SON-6) and R1116Dxx2 (HSON-6) products are the discontinued product. As of March in 2018.

**R1161x**

**R1161x26xx (ECO=H)**

Vin=3.0V to 6.0V,  
Cin = Ceramic 1.0μF  Cout = Ceramic 1.0μF

**R1161x26xx (ECO=L)**

Vin=3.0V to 6.0V,  
Cin = Ceramic 1.0μF  Cout = Ceramic 1.0μF

**R1161x15xx (ECO=H)**

Vin=2.0V to 6.0V,  
Cin = Ceramic 1.0μF  Cout = Ceramic 1.0μF

**R1161x30xx (ECO=H)**

Vin=3.6V to 6.0V,  
Cin = Ceramic 1.0μF  Cout = Ceramic 1.0μF
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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.

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

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