OUTLINE

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 overcurrent, 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.

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
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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

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PIN CONFIGURATIONS

SOT-23-5

Top View

Bottom View

(mark side)

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</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</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.

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### 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 (CEI/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>$V_{OUT}$</td>
<td>Output Voltage (FT Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}, V_{ECO}=V_{IN}$, $1\mu A \leq I_{OUT} \leq 30\text{mA}$</td>
<td>$\times0.98$</td>
<td>$\times1.02$</td>
<td></td>
<td>(30mV)</td>
</tr>
<tr>
<td>$I_{OUT}$</td>
<td>Output Voltage (LP Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}, V_{ECO}=GND$</td>
<td>$\times0.97$</td>
<td>$\times1.03$</td>
<td></td>
<td>(45mV)</td>
</tr>
<tr>
<td>$\Delta V_{OUT}$</td>
<td>Load Regulation (FT Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}, V_{ECO}=V_{IN}$</td>
<td>1mA</td>
<td>40</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}$</td>
<td>Load Regulation (LP Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}, V_{ECO}=GND$</td>
<td>1mA</td>
<td>15</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{DIF}$</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>$I_{SS1}$</td>
<td>Supply Current (FT Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}$, $V_{ECO}=V_{IN}$, $V_{OUT}&lt;1.8\text{V}$</td>
<td>80</td>
<td>111</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>$I_{SS2}$</td>
<td>Supply Current (LP Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+1\text{V}$, $V_{ECO}=V_{IN}$, $V_{OUT}&gt;1.8\text{V}$</td>
<td>60</td>
<td>90</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>$I_{standby}$</td>
<td>Supply Current (Standby)</td>
<td>$V_{IN}=V_{CE}=\text{Set } V_{OUT}+1\text{V}$, $V_{ECO}=\text{GND or } V_{IN}$</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}$</td>
<td>Line Regulation (FT Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+0.5\text{V}$ $\leq V_{IN} \leq 6.0\text{V}$</td>
<td>$\times0.01$</td>
<td></td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td>$\Delta V_{OUT}$</td>
<td>Line Regulation (LP Mode)</td>
<td>$V_{IN}=\text{Set } V_{OUT}+0.5\text{V}$ $\leq V_{IN} \leq 6.0\text{V}$</td>
<td>$\times0.05$</td>
<td></td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection (FT Mode)</td>
<td>$f=1\text{kHz}$, Ripple 0.2Vp-p</td>
<td>65</td>
<td>dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{IN}$</td>
<td>Input Voltage</td>
<td></td>
<td>1.4</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{OUT}$</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT}=30\text{mA}$, $-40^\circ\text{C} \leq \text{Topt} \leq 85^\circ\text{C}$</td>
<td>$\pm100$</td>
<td></td>
<td></td>
<td>ppm /°C</td>
</tr>
<tr>
<td>$I_{lim}$</td>
<td>Short Current Limit</td>
<td>$V_{OUT}=0\text{V}$</td>
<td>50</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{PU}$</td>
<td>CE Pull-up Resistance</td>
<td></td>
<td>1.87</td>
<td>5.00</td>
<td>12.00</td>
<td>MΩ</td>
</tr>
<tr>
<td>$R_{PD}$</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>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{CEL}$</td>
<td>CE, ECO Input Voltage “L”</td>
<td></td>
<td>0.0</td>
<td>0.3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{EN}$</td>
<td>Output Noise</td>
<td>$\text{BW}=10\text{Hz} \text{ to } 100\text{kHz}$</td>
<td>30</td>
<td>µVrms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Note1: $\pm30\text{mV}$ tolerance for $V_{OUT} \leq 1.5\text{V}$.
- Note2: $\pm45\text{mV}$ tolerance for $V_{OUT} \leq 1.5\text{V}$.

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### R1161xxxxB/D

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><strong>V_{OUT}</strong></td>
<td>Output Voltage (FT Mode)</td>
<td>$V_{IN}=$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>$V_{OUT}$ Output Voltage (LP Mode)</td>
<td>$V_{IN}=$Set $V_{OUT}+1V, V_{ECO}=GND$ $1\mu A \leq I_{OUT} \leq 30mA$ Note 2</td>
<td>$\times 0.97$ (-45mV)</td>
<td>$\times 1.03$ (45mV)</td>
<td></td>
</tr>
<tr>
<td><strong>I_{OUT}</strong></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><strong>ΔV_{OUT}/ΔI_{OUT}</strong></td>
<td>Load Regulation (FT Mode)</td>
<td>$V_{IN}=$Set $V_{OUT}+1V, V_{ECO}=V_{IN}$ $1mA \leq I_{OUT} \leq 300mA$</td>
<td>40</td>
<td>70</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>Load Regulation (LP Mode)</td>
<td>$V_{IN}=$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><strong>V_{DIF}</strong></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><strong>I_{SS1}</strong></td>
<td>Supply Current (FT Mode)</td>
<td>$V_{IN}=$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>$V_{IN}=$Set $V_{OUT}+1V$ $V_{ECO}=V_{IN}, V_{OUT} \geq 1.8V$</td>
<td>60</td>
<td>90</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td><strong>I_{SS2}</strong></td>
<td>Supply Current (LP Mode)</td>
<td>$V_{IN}=$Set $V_{OUT}+1V$, $V_{OUT} &lt; 1.8V$, $V_{ECO}=GND$</td>
<td>3.5</td>
<td>8.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{IN}=$Set $V_{OUT}+1V$, $V_{OUT} \geq 1.6V$, $V_{ECO}=GND$</td>
<td>4.5</td>
<td>9.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td><strong>I_{standby}</strong></td>
<td>Supply Current (Standby)</td>
<td>$V_{IN}=$Set $V_{OUT}+1V$, $V_{ECO}=GND, V_{ECO}=GND$ or $V_{IN}$</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td><strong>ΔV_{OUT}/ΔV_{IN}</strong></td>
<td>Line Regulation (FT Mode)</td>
<td>Set $V_{OUT}+0.5V \leq V_{IN} \leq 6.0V$ $I_{OUT}=30mA$, $V_{ECO}=V_{IN}$</td>
<td>0.01</td>
<td>0.15</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set $V_{OUT} \leq 0.9V$: $1.4V \leq V_{IN} \leq 6.0V$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line Regulation (LP Mode)</td>
<td>Set $V_{OUT}+0.5V \leq V_{IN} \leq 6.0V$ $I_{OUT}=30mA$, $V_{ECO}=GND$</td>
<td>0.05</td>
<td>0.20</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set $V_{OUT} \leq 0.9V$: $1.4V \leq V_{IN} \leq 6.0V$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RR</strong></td>
<td>Ripple Rejection (FT Mode)</td>
<td>f=1kHz, Ripple 0.2Vp-p $V_{IN}=$Set $V_{OUT}+1V$ $I_{OUT}=30mA$, $V_{ECO}=V_{IN}$</td>
<td>65</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td><strong>V_{IN}</strong></td>
<td>Input Voltage</td>
<td></td>
<td>1.4</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>ΔV_{OUT}/ΔTopt</strong></td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT}=30mA$ $-40°C \leq Topt \leq 85°C$</td>
<td>$\pm 100$</td>
<td></td>
<td></td>
<td>ppm /°C</td>
</tr>
<tr>
<td><strong>IIlim</strong></td>
<td>Short Current Limit</td>
<td>$V_{OUT}=0V$</td>
<td>50</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td><strong>R_{PDCE}</strong></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><strong>R_{PDE}</strong></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><strong>V_{CEH}</strong></td>
<td>CE, ECO Input Voltage “H”</td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>V_{CEL}</strong></td>
<td>CE, ECO Input Voltage “L”</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>V_{EN}</strong></td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td>30</td>
<td></td>
<td></td>
<td>μVrms</td>
</tr>
<tr>
<td><strong>R_{LOW}</strong></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>

Note1: ±30mV tolerance for $V_{OUT} \leq 1.5V$.
Note2: ±45mV tolerance for $V_{OUT} \leq 1.5V$.

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ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

<table>
<thead>
<tr>
<th>Output Voltage $V_{OUT} (V)$</th>
<th>Dropout Voltage $V_{DIF} (V)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Condition</td>
</tr>
<tr>
<td>$0.8 \leq V_{OUT}$</td>
<td>$V_{DIF}=0.8,\text{~V}$</td>
</tr>
<tr>
<td>$0.9 \leq V_{OUT}$</td>
<td>$V_{DIF}=0.7,\text{~V}$</td>
</tr>
<tr>
<td>$1.0 \leq V_{OUT} &lt; 1.5$</td>
<td>$V_{DIF} \approx 0.5,\text{~V}$</td>
</tr>
<tr>
<td>$1.5 \leq V_{OUT} &lt; 2.6$</td>
<td>$V_{DIF} \approx 0.3,\text{~V}$</td>
</tr>
<tr>
<td>$2.6 \leq V_{OUT} \leq 3.3$</td>
<td>$V_{DIF} \approx 0.2,\text{~V}$</td>
</tr>
</tbody>
</table>

TEST CIRCUITS

Fig.1 Output Voltage vs. Output Current Test Circuit

Fig.2 Output Voltage vs. Input Voltage Test Circuit

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
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

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
R1161x

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

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
Fig.11 MODE Transient Response Test Circuit

Fig.12 Output Noise Test Circuit (IOUT vs. ESR)

**TYPICAL APPLICATION**

(External Components)
Output Capacitor: 1.0 μF or more capacity ceramic Type (If VOUT < 1.0V, Tantalum type is recommended)
Input Capacitor: 1.0 μF or more capacity ceramic Type
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

R1161x08xx (ECO=H)

R1161x08xx (ECO=L)

VIN = 2.8V

1.45V

VIN = 3.5V

1.8V

VIN = 4.6V

2.9V

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*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
3) Supply Current vs. Input Voltage

R1161x08xx (ECO=H)

R1161x08xx (ECO=L)

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* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
4) Output Voltage vs. Temperature

**R1161x**

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
5) Supply Current vs. Temperature

- **R1161x33xx (ECO=H)**
- **R1161x33xx (ECO=L)**

- **R1161x08xx (ECO=H)**
- **R1161x08xx (ECO=L)**

- **R1161x15xx (ECO=H)**
- **R1161x15xx (ECO=L)**

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
6) Dropout Voltage vs. Output Current

**R1161x08xx (ECO=H)**

- Dropout Voltage $V_{DIF_H}$ (V)
  - 85°C
  - 25°C
  - -40°C

**R1161x08xx (ECO=L)**

- Dropout Voltage $V_{DIF_L}$ (V)
  - 85°C
  - 25°C
  - -40°C

---

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

R1161x

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
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)

Vin=1.8Vdc+0.2Vp-p,
Cout=Tantal 1.0μF

Vin=1.8Vdc+0.2Vp-p,
Cout=Tantal 1.0μF

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
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

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
R1161x

R1161x15xx (ECO=H)

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

R1161x15xx (ECO=L)

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

R1161x26xx (ECO=H)

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

R1161x26xx (ECO=L)

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

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
R1161x

**R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.**

---

**R1161x26xx (ECO=H)**

VIN=3.6Vdc+0.2Vp-p,  
Cout = Ceramic 2.2μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_H (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

**R1161x26xx (ECO=L)**

VIN=3.6Vdc+0.2Vp-p,  
Cout = Ceramic 2.2μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_L (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

---

**R1161x33xx (ECO=H)**

VIN=4.3Vdc+0.2Vp-p,  
Cout = Ceramic 1.0μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_H (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

**R1161x33xx (ECO=L)**

VIN=4.3Vdc+0.2Vp-p,  
Cout = Ceramic 1.0μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_L (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

---

**R1161x33xx (ECO=H)**

VIN=4.3Vdc+0.2Vp-p,  
Cout = Ceramic 2.2μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_H (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

**R1161x33xx (ECO=L)**

VIN=4.3Vdc+0.2Vp-p,  
Cout = Ceramic 2.2μF

- IOUT = 1mA  
- IOUT = 30mA  
- IOUT = 50mA

Ripple Rejection RR_L (dB)

<table>
<thead>
<tr>
<th>Frequency f (kHz)</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOUT = 1mA</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>IOUT = 30mA</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>IOUT = 50mA</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>
10) Input Transient Response (C<sub>I</sub>N = none, tr=tf=5μs)

R1161x08xx (ECO=H)

\[
\text{I}_{\text{OUT}}=30\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Tantalum } 1.0\mu\text{F}
\]

R1161x08xx (ECO=L)

\[
\text{I}_{\text{OUT}}=10\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Tantalum } 1.0\mu\text{F}
\]

R1161x10xx (ECO=H)

\[
\text{I}_{\text{OUT}}=30\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Ceramic } 1.0\mu\text{F}
\]

R1161x10xx (ECO=L)

\[
\text{I}_{\text{OUT}}=10\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Ceramic } 1.0\mu\text{F}
\]

R1161x26xx (ECO=H)

\[
\text{I}_{\text{OUT}}=30\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Ceramic } 1.0\mu\text{F}
\]

R1161x26xx (ECO=L)

\[
\text{I}_{\text{OUT}}=10\text{mA}, \quad \text{C}_{\text{OUT}} = \text{Ceramic } 1.0\mu\text{F}
\]
11) Load Transient Response (tr=tf=0.5μs)

R1161x08xx (ECO=H)

\[ V_{IN} = 1.8\text{V}, \quad C_{IN} = \text{tantalum} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{tantalum} \ 1.0\mu\text{F} \]

R1161x08xx (ECO=H)

\[ V_{IN} = 1.8\text{V}, \quad C_{IN} = \text{tantalum} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{tantalum} \ 1.0\mu\text{F} \]

R1161x08xx (ECO=H)

\[ V_{IN} = 1.8\text{V}, \quad C_{IN} = \text{tantalum} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{tantalum} \ 2.2\mu\text{F} \]

R1161x08xx (ECO=H)

\[ V_{IN} = 1.8\text{V}, \quad C_{IN} = \text{tantalum} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{tantalum} \ 1.0\mu\text{F} \]

R1161x08xx (ECO=L)

\[ V_{IN} = 1.8\text{V}, \quad C_{IN} = \text{tantalum} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{tantalum} \ 2.2\mu\text{F} \]

R1161x08xx (ECO=H)

\[ V_{IN} = 2.0\text{V}, \quad C_{IN} = \text{Ceramic} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{Ceramic} \ 1.0\mu\text{F} \]

R1161x08xx (ECO=H)

\[ V_{IN} = 2.0\text{V}, \quad C_{IN} = \text{Ceramic} \ 1.0\mu\text{F}, \quad C_{OUT} = \text{Ceramic} \ 1.0\mu\text{F} \]
R1161x

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
12) Turn on speed with CE pin

**R1161x08xx (ECO=H)**

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

**R1161x08xx (ECO=L)**

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

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
R1161x

R1161x33xx (ECO=H)
VIN=4.3V, CIN = Ceramic 1.0μF
COUT = Ceramic 1.0μF

R1161x33xx (ECO=L)
VIN=4.3V, CIN = Ceramic 1.0μF
COUT = Ceramic 1.0μF

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
13) Turn-off Speed with CE

**R1161x08xD**

*VIN*=1.8V, CIN = Tantalum 1.0μF

**R1161x08xD**

*VIN*=1.8V, CIN = Tantalum 1.0μF

**R1161x33xD**

*VIN*=1.8V, CIN = Tantalum 1.0μF

**R1161x33xD**

*VIN*=4.3V, CIN = Ceramic 1.0μF

**R1161x33xD**

*VIN*=4.3V, CIN = Ceramic 1.0μF

---

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
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

---

*R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.*
R1161x26xx
VIN=3.6V, CIN = Ceramic 1.0μF
COUT = Ceramic 1.0μF

<table>
<thead>
<tr>
<th>Time t (ms)</th>
<th>Output Voltage VOUT (V)</th>
<th>ECO Input Voltage VECO (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.2</td>
<td>2.61</td>
<td>0V</td>
</tr>
<tr>
<td>0</td>
<td>2.60</td>
<td>0.2V</td>
</tr>
<tr>
<td>0.2</td>
<td>2.59</td>
<td>0.4V</td>
</tr>
<tr>
<td>0.4</td>
<td>2.60</td>
<td>0.6V</td>
</tr>
<tr>
<td>0.6</td>
<td>2.59</td>
<td>0.8V</td>
</tr>
<tr>
<td>0.8</td>
<td>2.61</td>
<td>1.0V</td>
</tr>
<tr>
<td>1</td>
<td>2.60</td>
<td>1.2V</td>
</tr>
<tr>
<td>1.2</td>
<td>2.59</td>
<td>1.4V</td>
</tr>
<tr>
<td>1.4</td>
<td>2.61</td>
<td>1.6V</td>
</tr>
<tr>
<td>1.6</td>
<td>2.60</td>
<td>1.8V</td>
</tr>
</tbody>
</table>

* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
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 \( I_{OUT} \) (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
* R1161D (SON-6 / HSON-6) is the limited product. As of March in 2014.
1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to Ricoh sales representatives for the latest information therein.

2. The materials in this document may not be copied or otherwise reproduced in whole or in part without prior written consent of Ricoh.

3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.

4. The technical information described in this document shows typical characteristics of and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under Ricoh’s or any third party’s intellectual property rights or any other rights.

5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.

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

For the conservation of the global environment, Ricoh is advancing the decrease of the negative environmental impact material. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive. Basically after Apr. 1, 2012, we will ship out the Power Management ICs of the Halogen Free products only. (Ricoh Halogen Free products are also Antimony Free.)