OUTLINE

The R1163x Series consist of CMOS-based voltage regulator ICs with high output voltage accuracy and low supply current. These ICs perform with the chip enable function and realize a standby mode with ultra low supply current. To prevent the destruction by over current, the current limit circuit is included. The R1163x Series have 3-mode. One is standby mode with CE or standby control pin. 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. The output voltage is maintained between FT mode and LP mode.

Further, the reverse current protection circuit is built-in. Therefore, if a higher voltage than VDD pin is forced to the output pin, the reverse current to VDD pin is very small (Max. 0.1µA), so it is suitable for backup circuit.

Since the packages for these ICs are SOT-23-5, SON-6, and DFN(PLP)1616-6 packages, high density mounting of the ICs on boards is possible.

FEATURES

- Supply Current ..................................................... Typ. 6.0µA (Low Power Mode),
  Typ. 70µA (Fast Transient Mode)
- Standby Mode ...................................................... Typ. 0.6µA
- Reverse Current ................................................... Max. 0.1µA
- Input Voltage Range ............................................ 2.0V to 6.0V
- Output Voltage Range .......................................... 1.5V to 5.0V (0.1V steps)
- Output Voltage Accuracy ...................................... ±1.5% (±2.5% at Low Power Mode)
- Temperature-Drift Coefficient of Output Voltage .. Typ. ±100ppm/°C
- Dropout Voltage .................................................. Typ. 0.25V (IOUT=150mA, VOUT=2.8V)
- Ripple Rejection .................................................. Typ. 70dB (f=1kHz, Fast Transient Mode)
- Line Regulation ................................................... Typ. 0.02%/V (Fast Transient Mode)
- Packages ............................................................ DFN(PLP)1616-6, SOT-23-5, SON-6
- Built-in fold-back protection circuit ....................... Typ. 40mA (Current at short mode)
- Performs with Ceramic Capacitors ..................... Cin=Ceramic 1.0µF, Cout=Ceramic 0.47µF

APPLICATIONS

- Precision Voltage References.
- Power source for electrical appliances such as cameras, VCRs and hand-held communication equipment.
- Power source for battery-powered equipment.
# SELECTION GUIDE

The output voltage, 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>R1163Kxx1+-TR</td>
<td>DFN(PLP)1616-6</td>
<td>5,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1163Nxx1+-TR-FE</td>
<td>SOT-23-5</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1163Dxx1+-TR-FE</td>
<td>SON-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 1.5V(15) to 5.0V(50) in 0.1V steps. (For other voltages, please refer to MARK INFORMATIONS.)

* : The auto discharge function at off state are options as follows.
  (B) without auto discharge function at off state
  (D) with auto discharge function at off state
  (E) without auto discharge function at off state, ECO logic reverse type (Low Power mode at ECO=“H”)
PIN CONFIGURATIONS

- DFN(PLP)1616-6
- SOT-23-5
- SON-6

PIN DESCRIPTIONS

**DFN(PLP)1616-6**

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V(_\text{OUT})</td>
<td>Output pin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>3</td>
<td>ECO(_\text{B/D})</td>
<td>R1163xxx1B/D: FT/LP Mode Alternative Pin (&quot;L&quot; LP)</td>
</tr>
<tr>
<td>4</td>
<td>ECO(_\text{E})</td>
<td>R1163xxx1E: FT/LP Mode Alternative Pin (&quot;H&quot; LP)</td>
</tr>
<tr>
<td>5</td>
<td>CE</td>
<td>Chip Enable pin (&quot;H&quot; Active)</td>
</tr>
<tr>
<td>6</td>
<td>V(_\text{DD})</td>
<td>Input Pin</td>
</tr>
</tbody>
</table>

*) Tab is GND level. (They are connected to the reverse side of this IC.)

**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>V(_\text{DD})</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 (&quot;H&quot; Active)</td>
</tr>
<tr>
<td>4</td>
<td>ECO(_\text{B/D})</td>
<td>R1163xxx1B/D: FT/LP Mode Alternative Pin (&quot;L&quot; LP)</td>
</tr>
<tr>
<td>5</td>
<td>ECO(_\text{E})</td>
<td>R1163xxx1E: FT/LP Mode Alternative Pin (&quot;H&quot; LP)</td>
</tr>
</tbody>
</table>

**SON-6**

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V(_\text{DD})</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>V(_\text{OUT})</td>
<td>Output pin</td>
</tr>
<tr>
<td>4</td>
<td>ECO(_\text{B/D})</td>
<td>R1163xxx1B/D: FT/LP Mode Alternative Pin (&quot;L&quot; LP)</td>
</tr>
<tr>
<td>5</td>
<td>ECO(_\text{E})</td>
<td>R1163xxx1E: FT/LP Mode Alternative Pin (&quot;H&quot; LP)</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>7</td>
<td>CE</td>
<td>Chip Enable Pin (&quot;H&quot; Active)</td>
</tr>
</tbody>
</table>

*) Tab suspension leads are GND level. (They are connected to the reverse side of this IC.)

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>$V_{IN}$</td>
<td>Input Voltage</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{ECO}$</td>
<td>Input Voltage (ECO/ECO Pin)</td>
<td>–0.3 ~ 6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CE}$</td>
<td>Input Voltage (CE Pin)</td>
<td>–0.3 ~ 6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OUT}$</td>
<td>Output Voltage</td>
<td>–0.3 ~ 6.5</td>
<td>V</td>
</tr>
<tr>
<td>$I_{OUT}$</td>
<td>Output Current</td>
<td>180</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{D}$</td>
<td>Power Dissipation (DFN(PLP)1616-6)*</td>
<td>640</td>
<td>mW</td>
</tr>
<tr>
<td></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>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.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS (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

<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</td>
<td>FT Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>$0.985$</td>
<td>$1.015$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LP Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=\text{GND}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>$0.975$</td>
<td>$1.025$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{\text{OUT}}$</td>
<td>Output Voltage Deviation between FT Mode and LP Mode</td>
<td>FT Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}$ $I_{\text{OUT}}=30\text{mA}$</td>
<td>$-1.2$</td>
<td>$12$</td>
<td> </td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LP Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=\text{GND}$ $I_{\text{OUT}}=30\text{mA}$</td>
<td>$-24$</td>
<td>$24$</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>$I_{\text{OUT}}$</td>
<td>Output Current</td>
<td>FT Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>$150$</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LP Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=\text{GND}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{\text{OUT}}/\Delta I_{\text{OUT}}$</td>
<td>Load Regulation</td>
<td>FT Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=V_{\text{IN}}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>$20$</td>
<td>$40$</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LP Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V, V_{\text{ECO}}=\text{GND}$ $1\text{mA} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>$20$</td>
<td>$45$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{\text{OF}}$</td>
<td>Dropout Voltage</td>
<td>Refer to the following table</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{\text{SS1}}$</td>
<td>Supply Current (FT Mode)</td>
<td>$V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V$ $V_{\text{ECO}}=V_{\text{IN}}$</td>
<td>$70$</td>
<td>$100$</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>$I_{\text{SS2}}$</td>
<td>Supply Current (LP Mode)</td>
<td>$V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V$ $V_{\text{ECO}}=\text{GND}$</td>
<td>$6.0$</td>
<td>$10.0$</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>$I_{\text{STAND}}$</td>
<td>Supply Current (Standby)</td>
<td>$V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V$ $V_{\text{ECO}}=\text{GND}$ or $V_{\text{IN}}$</td>
<td>$0.6$</td>
<td>$1.0$</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>$\Delta V_{\text{OUT}}/\Delta V_{\text{IN}}$</td>
<td>Line Regulation</td>
<td>FT Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+0.5V \leq V_{\text{IN}} \leq 6.0V$ $I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=V_{\text{IN}}$ If $V_{\text{OUT}} \leq 1.6V$, then $2.2V \leq V_{\text{IN}} \leq 6.0V$</td>
<td>$0.02$</td>
<td>$0.10$</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LP Mode $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+0.5V \leq V_{\text{IN}} \leq 6.0V$ $I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=\text{GND}$ If $V_{\text{OUT}} \leq 1.6V$, then $2.2V \leq V_{\text{IN}} \leq 6.0V$</td>
<td>$0.05$</td>
<td>$0.20$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{\text{R}}$</td>
<td>Ripple Rejection (FT Mode)</td>
<td>Ripple $0.2V_{P-P}$, $V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1V$, $I_{\text{OUT}}=30\text{mA}, V_{\text{ECO}}=V_{\text{IN}}$</td>
<td>$f=1kHz$</td>
<td>$70$</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1.2V$, $f=10kHz$</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>$V_{\text{IN}}$</td>
<td>Input Voltage</td>
<td>$2.0$</td>
<td>$6.0$</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{\text{OUT}}/\Delta T_{\text{OPT}}$</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{\text{OUT}}=30\text{mA}$ $-40^\circ C \leq T_{\text{OPT}} \leq 85^\circ C$</td>
<td>$\pm100$</td>
<td> </td>
<td></td>
<td>ppm/°C</td>
</tr>
<tr>
<td>$I_{\text{SC}}$</td>
<td>Short Current Limit</td>
<td>$V_{\text{OUT}}=0V$</td>
<td>$40$</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$I_{\text{PD}}$</td>
<td>CE Pull-down Current</td>
<td></td>
<td>$0.3$</td>
<td>$0.6$</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>$R_{\text{POE}}$</td>
<td>ECO Pull-down Resistance</td>
<td> </td>
<td>$2$</td>
<td>$5$</td>
<td>$30$</td>
<td>Ω</td>
</tr>
<tr>
<td>$V_{\text{CEH}}$</td>
<td>CE, ECO Input Voltage “H”</td>
<td>$0.35$</td>
<td>$1.0$</td>
<td>$6.0$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{CEL}}$</td>
<td>CE, ECO Input Voltage “L”</td>
<td>$0$</td>
<td> </td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$\text{en}$</td>
<td>Output Noise “H” (FT Mode)</td>
<td>BW=10Hz to 100kHz</td>
<td>$30$</td>
<td> </td>
<td></td>
<td>μVrms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output Noise “L” (LP Mode)</td>
<td>BW=10Hz to 100kHz</td>
<td>$40$</td>
<td> </td>
<td></td>
</tr>
<tr>
<td>$R_{\text{LOW}}$</td>
<td>Low Output Nch Tr. ON Resistance (of D version)</td>
<td>$V_{\text{CE}}=0V$</td>
<td>$60$</td>
<td> </td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>$I_{\text{REV}}$</td>
<td>Reverse Current</td>
<td>$V_{\text{OUT}}&gt;0.5V, 0V \leq V_{\text{IN}} \leq 6V$</td>
<td>$0$</td>
<td>$0.1$</td>
<td></td>
<td>μA</td>
</tr>
</tbody>
</table>
### Symbol | Item | Conditions | Min. | Typ. | Max. | Unit
--- | --- | --- | --- | --- | --- | ---
V<sub>OUT</sub> | Output Voltage | FT Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=\text{GND} \) \( \text{I}_{OUT} \leq 30\text{mA} \) | \( \times 0.985 \) | \( \times 1.015 \) | | V
| | LP Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=V_{IN} \) \( \text{I}_{OUT} \leq 30\text{mA} \) | \( \times 0.975 \) | \( \times 1.025 \) | | V
\( \Delta V_{OUT} \) | Output Voltage Deviation between FT Mode and LP Mode | FT Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, \text{I}_{OUT}=30\text{mA} \) \( V_{OUT} > 2.0V \) | \(-1.2\) | \(0\) | \(1.2\) | |
| | LP Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, \text{I}_{OUT}=30\text{mA} \) \( V_{OUT} \leq 2.0V \) | \(-24\) | \(0\) | \(24\) | mV
I<sub>OUT</sub> | Output Current | FT Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=\text{GND} \) \( \text{I}_{OUT} \leq 150\text{mA} \) | \(20\) | \(40\) | | mV
| | LP Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=V_{IN} \) \( \text{I}_{OUT} \leq 150\text{mA} \) | \(20\) | \(45\) | | mV
\( V_{DF} \) | Dropout Voltage | FT Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=\text{GND} \) | \(70\) | \(100\) | | μA
| | LP Mode | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=V_{IN} \) | \(6.0\) | \(10.0\) | | μA
\( I_{standby} \) | Supply Current (Standby) | \( V_{IN}=\text{Set } V_{OUT}+1V, V_{EC0}=\text{GND} \) \( V_{EC0}=\text{GND} \) \( V_{IN} \) | \(0.6\) | \(1.0\) | | μA
\( \Delta V_{OUT}/\Delta V_{IN} \) | Line Regulation | FT Mode | \( \text{Set } V_{OUT}+0.5V \leq V_{IN} \leq 6.0V \) \( \text{I}_{OUT}=30\text{mA} \) \( V_{EC0}=\text{GND} \) \( \text{If } V_{OUT} \leq 1.6V, \text{then } 2.2V \leq V_{IN} \leq 6.0V \) | \(0.02\) | \(0.10\) | | %/V
| | LP Mode | \( \text{Set } V_{OUT}+0.5V \leq V_{IN} \leq 6.0V \) \( \text{I}_{OUT}=30\text{mA} \) \( V_{EC0}=V_{IN} \) \( \text{If } V_{OUT} \leq 1.6V, \text{then } 2.2V \leq V_{IN} \leq 6.0V \) | \(0.05\) | \(0.20\) | | %/V
RR | Ripple Rejection (FT Mode) | Ripple \( 0.2V_{P-P} \) \( V_{IN}=\text{Set } V_{OUT}+1V, \text{I}_{OUT}=30\text{mA} \) \( V_{EC0}=\text{GND} \) \( \text{If } V_{OUT} \leq 1.7V, \text{then } \text{Set } V_{OUT}+1.2V \) \( f=1kHz \) | | | \(70\) | dB
| | | Ripple \( 0.2V_{P-P} \) \( V_{IN}=\text{Set } V_{OUT}+1V, \text{I}_{OUT}=30\text{mA} \) \( V_{EC0}=\text{GND} \) \( \text{If } V_{OUT} \leq 1.7V, \text{then } \text{Set } V_{OUT}+1.2V \) \( f=10kHz \) | | | \(60\) | dB
\(|V_{IN}|\) | Input Voltage | \( 2.0 \) | \(6.0 \) | | V
\( \Delta V_{OUT}/\Delta T_{opt} \) | Output Voltage Temperature Coefficient | \( \text{I}_{OUT}=30\text{mA} \) \( -40^\circ C \leq T_{opt} \leq 85^\circ C \) | \(\pm 100\) | | ppm /°C
I<sub>SC</sub> | Short Current Limit | \( V_{OUT}=0V \) | | | | mA
I<sub>PD</sub> | CE Pull-down Current | | | | \(0.3 \) | \(0.6 \) | | μA
V<sub>CEH</sub> | CE, ECO Input Voltage "H" | | | | \(1.0 \) | | V
V<sub>CEL</sub> | CE, ECO Input Voltage "L" | | | | \(0 \) | \(0.4 \) | | V
R | Output Noise "H" (FT Mode) | \( \text{BW}=10Hz \text{ to } 100kHz \) | \(30\) | | | μVrms
| | Output Noise "L" (LP Mode) | \( \text{BW}=10Hz \text{ to } 100kHz \) | \(40\) | | | μVrms
I<sub>REV</sub> | Reverse Current | \( V_{OUT}>0.5V, 0V \leq V_{IN} \leq 6V \) | \(0\) | \(0.1 \) | | μA
ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

<table>
<thead>
<tr>
<th>Output Voltage $V_{\text{out}}$ (V)</th>
<th>Dropout Voltage (mV)</th>
<th>Condition</th>
<th>$V_{\text{dif}}$ (FT Mode)</th>
<th>$V_{\text{dif}}$ (LP Mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 $\leq V_{\text{out}} &lt; 1.6$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
<tr>
<td>1.6 $\leq V_{\text{out}} &lt; 1.7$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
<tr>
<td>1.7 $\leq V_{\text{out}} &lt; 1.8$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
<tr>
<td>1.8 $\leq V_{\text{out}} &lt; 2.0$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
<tr>
<td>2.0 $\leq V_{\text{out}} &lt; 2.8$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
<tr>
<td>2.8 $\leq V_{\text{out}} \leq 5.0$</td>
<td></td>
<td>Typ.</td>
<td>Max.</td>
<td>Typ.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I$_{\text{out}}$=150mA</td>
<td>350</td>
<td>420</td>
</tr>
</tbody>
</table>

TYPICAL APPLICATION

(External Components)
Ex.  C1: Ceramic Capacitor 1.0µF
     C2: Ceramic Capacitor 0.47µF  Murata GRM40B474K
     Kyocera CM105B474K

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 0.47µF or more ceramic capacitor C2.
   (Test these ICs with as same external components as ones to be used on the PCB.)

When a tantalum capacitor is used with this IC, if the equivalent series resistor (ESR) of the capacitor is large, output voltage may be unstable.

PCB Layout

Make $V_{\text{dd}}$ 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 $V_{\text{dd}}$ and GND pin as close as possible.

Set external components such as an output capacitor C2, as close as possible to the ICs and make wiring as short as possible.
TEST CIRCUITS

Basic Test Circuit

Test Circuit for Supply Current

Test Circuit for Ripple Rejection, Line Transient Response

C1=Ceramic 1.0μF
C2=Ceramic 0.47μF
Test Circuit for Load Transient Response

Test Circuit for Output Voltage at Mode alternative point

Test Circuit for Turn On Speed with CE pin

R1163x (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
TYPICAL CHARACTERISTICS

Unless otherwise provided, capacitors are ceramic type.

1) Output Voltage vs. Output Current

**R1163x151x FT Mode**

**VIN=2V**

**V_IN=2.5V - 3.5V**

**VIN=2.5V**

**VIN=2.5V - 3.5V**

**R1163x151x LP Mode**

**VIN=2V**

**V_IN=2.5V - 3.5V**

**VIN=2.5V**

**VIN=2.5V - 3.5V**

**R1163x281x FT Mode**

**VIN=3.1V**

**V_IN=3.3V**

**V_IN=3.8V - 4.8V**

**VIN=3.8V**

**VIN=3.8V - 4.8V**

**R1163x281x LP Mode**

**VIN=3.1V**

**V_IN=3.3V**

**V_IN=3.8V - 4.8V**

**VIN=3.8V**

**VIN=3.8V - 4.8V**

**R1163x40x FT Mode**

**VIN=4.3V**

**V_IN=4.5V**

**V_IN=5V - 6V**

**VIN=5V**

**VIN=5V - 6V**

**R1163x40x LP Mode**

**VIN=4.3V**

**V_IN=4.5V**

**V_IN=5V - 6V**

**VIN=5V**

**VIN=5V - 6V**

---

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
2) Output Voltage vs. Input Voltage

**R1163x15x FT Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA

**R1163x15x LP Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA

**R1163x28x FT Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA

**R1163x28x LP Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA

**R1163x40x FT Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA

**R1163x40x LP Mode**

- **Output Voltage** (VOUT), Input Voltage (VIN)
  - **Output Voltage (VOUT)**
    - 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
  - **Input Voltage (VIN)**
    - 0, 1, 2, 3, 4, 5, 6
  - **Current Levels**
    - IOUT=1mA, IOUT=30mA, IOUT=50mA
3) Supply Current vs. Input Voltage

**R1163x151x FT Mode**

**R1163x151x LP Mode**

**R1163x281x FT Mode**

**R1163x281x LP Mode**

**R1163x401x FT Mode**

**R1163x401x LP Mode**

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
4) Output Voltage vs. Temperature

**R1163x151x FT Mode**

**R1163x151x LP Mode**

**R1163x281x FT Mode**

**R1163x281x LP Mode**

**R1163x401x FT Mode**

**R1163x401x LP Mode**

---

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
5) Supply Current vs. Temperature

**R1163x151x FT Mode**

![Graph showing supply current vs. temperature for R1163x151x in FT Mode with VIN=2.5V](image)

**R1163x151x LP Mode**

![Graph showing supply current vs. temperature for R1163x151x in LP Mode with VIN=2.5V](image)

**R1163x281x FT Mode**

![Graph showing supply current vs. temperature for R1163x281x in FT Mode with VIN=3.8V](image)

**R1163x281x LP Mode**

![Graph showing supply current vs. temperature for R1163x281x in LP Mode with VIN=3.8V](image)

**R1163x401x FT Mode**

![Graph showing supply current vs. temperature for R1163x401x in FT Mode with VIN=5.0V](image)

**R1163x401x LP Mode**

![Graph showing supply current vs. temperature for R1163x401x in LP Mode with VIN=5.0V](image)

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
6) Standby Current vs. Input Voltage

![Standby Current vs. Input Voltage graph](image)

7) Reverse Current vs. Output Voltage

![Reverse Current vs. Output Voltage graph](image)

8) Dropout Voltage vs. Output Current

#### R1163x151x FT Mode

![Dropout Voltage vs. Output Current graph for FT Mode](image)

#### R1163x151x LP Mode

![Dropout Voltage vs. Output Current graph for LP Mode](image)
R1163x

**R1163x211x FT Mode**

- Dropout Voltage $V_{DIF\_H}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$

**R1163x211x LP Mode**

- Dropout Voltage $V_{DIF\_L}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$

**R1163x281x FT Mode**

- Dropout Voltage $V_{DIF\_H}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$

**R1163x281x LP Mode**

- Dropout Voltage $V_{DIF\_L}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$

**R1163x401x FT Mode**

- Dropout Voltage $V_{DIF\_H}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$

**R1163x401x LP Mode**

- Dropout Voltage $V_{DIF\_L}(V)$
- Output Current $I_{OUT}(mA)$
- $T_{opt}=85^\circ C$
- $T_{opt}=25^\circ C$
- $T_{opt}=-40^\circ C$
9) Dropout Voltage vs. Set Output Voltage

**R1163x FT Mode**

<table>
<thead>
<tr>
<th>Dropout Voltage H (V)</th>
<th>Dropout Voltage L (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>4.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

- **IOUT=10mA**
- **IOUT=30mA**
- **IOUT=50mA**
- **IOUT=100mA**
- **IOUT=150mA**

**R1163x LP Mode**

<table>
<thead>
<tr>
<th>Dropout Voltage H (V)</th>
<th>Dropout Voltage L (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>4.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

- **IOUT=10mA**
- **IOUT=30mA**
- **IOUT=50mA**
- **IOUT=100mA**
- **IOUT=150mA**

10) Ripple Rejection vs. Input Bias Voltage

**R1163x281x FT Mode**

- **Cin=None, Cout=0.47μF, Iout=1mA Ripple=0.2Vp-p**
- **f=1kHz**
- **f=10kHz**
- **f=100kHz**

**R1162x281x FT Mode**

- **Cin=None, Cout=0.47μF, Iout=30mA Ripple=0.2Vp-p**
- **f=1kHz**
- **f=10kHz**
- **f=100kHz**
11) Ripple Rejection vs. Frequency

**R1163x281x FT Mode**

<table>
<thead>
<tr>
<th>Input Voltage $V_{IN}(V)$</th>
<th>Ripple Rejection $RR(dB)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.9</td>
<td>90</td>
</tr>
<tr>
<td>3.0</td>
<td>80</td>
</tr>
<tr>
<td>3.1</td>
<td>70</td>
</tr>
<tr>
<td>3.2</td>
<td>60</td>
</tr>
<tr>
<td>3.3</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $I_{OUT}=50\text{mA}$ Ripple=0.2Vp-p
- $f=1\text{kHz}$
- $f=10\text{kHz}$
- $f=100\text{kHz}$

**R1163x281x FT Mode**

<table>
<thead>
<tr>
<th>Input Voltage $V_{IN}(V)$</th>
<th>Ripple Rejection $RR(dB)$</th>
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<tbody>
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<td>3.2</td>
<td>60</td>
</tr>
<tr>
<td>3.3</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $I_{OUT}=50\text{mA}$ Ripple=0.5Vp-p
- $f=1\text{kHz}$
- $f=10\text{kHz}$
- $f=100\text{kHz}$

**R1163x151x FT Mode**

<table>
<thead>
<tr>
<th>Frequency $f(\text{kHz})$</th>
<th>Ripple Rejection $RR_{H}(dB)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>80</td>
</tr>
<tr>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $V_{IN}=2.5\text{VDC}+0.2\text{Vp-p}$
- $I_{OUT}=1\text{mA}$
- $I_{OUT}=30\text{mA}$
- $I_{OUT}=50\text{mA}$

**R1163x151x LP Mode**

<table>
<thead>
<tr>
<th>Frequency $f(\text{kHz})$</th>
<th>Ripple Rejection $RR_{L}(dB)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>80</td>
</tr>
<tr>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $V_{IN}=2.5\text{VDC}+0.2\text{Vp-p}$
- $I_{OUT}=1\text{mA}$
- $I_{OUT}=30\text{mA}$
- $I_{OUT}=50\text{mA}$

**R1163x281x FT Mode**

<table>
<thead>
<tr>
<th>Frequency $f(\text{kHz})$</th>
<th>Ripple Rejection $RR_{H}(dB)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
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</tr>
<tr>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $V_{IN}=3.8\text{VDC}+0.2\text{Vp-p}$
- $I_{OUT}=1\text{mA}$
- $I_{OUT}=30\text{mA}$
- $I_{OUT}=50\text{mA}$

**R1163x281x LP Mode**

<table>
<thead>
<tr>
<th>Frequency $f(\text{kHz})$</th>
<th>Ripple Rejection $RR_{L}(dB)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
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<tr>
<td>1</td>
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<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

- $C_{IN}=\text{none}$, $C_{OUT}=0.47\mu F$, $V_{IN}=3.8\text{VDC}+0.2\text{Vp-p}$
- $I_{OUT}=1\text{mA}$
- $I_{OUT}=30\text{mA}$
- $I_{OUT}=50\text{mA}$

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R1163x401x FT Mode

C_{IN}=none, C_{OUT}=0.47\mu F, V_{IN}=5.0V_{DC}+0.2V_{p-p}

Ripple Rejection RR_H(dB)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
f(kHz) & 0.1 & 1 & 10 & 100 \\
\hline
RR_H(dB) & \multicolumn{9}{c}{I_{OUT}=1mA, I_{OUT}=30mA, I_{OUT}=50mA} \\
\hline
\end{tabular}
\end{table}

R1163x401x LP Mode

C_{IN}=none, C_{OUT}=0.47\mu F, V_{IN}=5.0V_{DC}+0.2V_{p-p}

Ripple Rejection RR_L(dB)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
f(kHz) & 0.1 & 1 & 10 & 100 \\
\hline
RR_L(dB) & \multicolumn{9}{c}{I_{OUT}=1mA, I_{OUT}=30mA, I_{OUT}=50mA} \\
\hline
\end{tabular}
\end{table}

12) Input Transient Response

R1163x151x FT Mode

C_{IN}=none, C_{OUT}=0.47\mu F, I_{OUT}=30mA

Input Voltage VIN(V)

Output Voltage VOUT(V)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
Time t(\mu s) & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
VIN(V) & \multicolumn{6}{c}{I_{OUT}=30mA} \\
\hline
VOUT(V) & \multicolumn{6}{c}{I_{OUT}=30mA} \\
\hline
\end{tabular}
\end{table}

R1163x151x LP Mode

C_{IN}=none, C_{OUT}=0.47\mu F, I_{OUT}=10mA

Input Voltage VIN(V)

Output Voltage VOUT(V)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
Time t(ms) & 0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 & 0.8 & 0.9 & 1.0 \\
\hline
VIN(V) & \multicolumn{11}{c}{I_{OUT}=10mA} \\
\hline
VOUT(V) & \multicolumn{11}{c}{I_{OUT}=10mA} \\
\hline
\end{tabular}
\end{table}

R1163x151x LP Mode

C_{IN}=none, C_{OUT}=1\mu F, I_{OUT}=10mA

Input Voltage VIN(V)

Output Voltage VOUT(V)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
Time t(ms) & 0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 & 0.8 & 0.9 & 1.0 \\
\hline
VIN(V) & \multicolumn{11}{c}{I_{OUT}=10mA} \\
\hline
VOUT(V) & \multicolumn{11}{c}{I_{OUT}=10mA} \\
\hline
\end{tabular}
\end{table}

R1163x281x FT Mode

C_{IN}=none, C_{OUT}=1\mu F, I_{OUT}=30mA

Input Voltage VIN(V)

Output Voltage VOUT(V)

\begin{table}
\begin{tabular}{c c c c c c c c c c}
\hline
Time t(\mu s) & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
VIN(V) & \multicolumn{6}{c}{I_{OUT}=30mA} \\
\hline
VOUT(V) & \multicolumn{6}{c}{I_{OUT}=30mA} \\
\hline
\end{tabular}
\end{table}
13) Load Transient Response

**R1163x FT Mode**

- **CIN=None, COUT=1 µF IOUT=10mA**
  - Input Voltage
  - Output Voltage

**R1163x281x FT Mode**

- **VIN=2.5V, CIN=1µF COUT=0.47µF**
  - Output Voltage
  - Output Current

**R1163x151x FT Mode**

- **VIN=2.5V, CIN=1µF COUT=1.0µF**
  - Output Voltage
  - Output Current

---

**R1163K (DFN(PLP)1616-6)** is the non-promotional product as of March 2019.
R1163x151x LP Mode
VIN=2.5V, CIN=1μF, COUT=0.47μF

R1163x151x LP Mode
VIN=3.8V, CIN=1μF, COUT=1μF

R1163x281x FT Mode
VIN=3.8V, CIN=1μF, COUT=0.47μF

R1163x281x FT Mode
VIN=3.8V, CIN=1μF, COUT=1μF

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
14) Turn on speed with CE pin

**R1163x151x FT Mode**

Vin=2.5V, Cin=1μF COut=0.47μF IOUT=0mA

**R1163x151x FT Mode**

Vin=2.5V, Cin=1μF COut=0.47μF IOUT=30mA

**R1163x151x FT Mode**

Vin=2.5V, Cin=1μF COut=0.47μF IOUT=0mA

**R1163x151x FT Mode**

Vin=2.5V, Cin=1μF COut=0.47μF IOUT=30mA

R1163x281x LP Mode

Vin=3.8V, Cin=1μF COut=0.47μF

**R1163x281x LP Mode**

Vin=3.8V, Cin=1μF COut=1μF
VIN=2.5V, CIN=1μF, COUT=0.47μF, IOUT=150mA

VIN=2.5V, CIN=1μF, COUT=0.47μF, IOUT=150mA

VIN=3.8V, CIN=1μF, COUT=0.47μF, IOUT=0mA

VIN=3.8V, CIN=1μF, COUT=0.47μF, IOUT=0mA

VIN=3.8V, CIN=1μF, COUT=0.47μF, IOUT=30mA

VIN=3.8V, CIN=1μF, COUT=0.47μF, IOUT=30mA

R1163K (DFN(PLP)1616-6) is the non-promotional product as of March 2019.
R1163x

**R1163x281x FT Mode**

V_{IN}=3.8V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=150mA

**R1163x281x LP Mode**

V_{IN}=3.8V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=150mA

**R1163x401x FT Mode**

V_{IN}=5.0V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=0mA

**R1163x401x LP Mode**

V_{IN}=5.0V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=0mA

**R1163x401x FT Mode**

V_{IN}=5.0V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=30mA

**R1163x401x LP Mode**

V_{IN}=5.0V,  
C_{IN}=1\mu F, C_{OUT}=0.47\mu F, I_{OUT}=30mA
**R1163x401x FT Mode**

VIN=5.0V, CIN=1μF, COUT=0.47μF, IOUT=150mA

**R1163x401x LP Mode**

VIN=5.0V, CIN=1μF, COUT=0.47μF, IOUT=150mA

15) Turn off speed with CE pin

**R1163x151xD**

VIN=2.5V, CIN=1μF, COUT=0.47μF

**R1163x281xD**

VIN=3.8V, CIN=1μF, COUT=0.47μF

**R1163x401xD**

VIN=5.0V, CIN=1μF, COUT=0.47μF
16) Output Voltage at Mode alternative point

**R1163x151B/D**
- $V_{IN}=2.5\, \text{V}$, $C_{IN}=$ Ceramic $1.0\, \mu\text{F}$,
- $C_{OUT}=$ Ceramic $0.47\, \mu\text{F}$

**R1163x281B/D**
- $V_{IN}=3.8\, \text{V}$, $C_{IN}=$ Ceramic $1.0\, \mu\text{F}$,
- $C_{OUT}=$ Ceramic $0.47\, \mu\text{F}$

**ECO Input Voltage $V_{ECO} (\text{V})$**
- $I_{OUT}=1\, \text{mA}$
- $I_{OUT}=10\, \text{mA}$
- $I_{OUT}=50\, \text{mA}$
- $I_{OUT}=100\, \text{mA}$
- $I_{OUT}=150\, \text{mA}$

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

![Graphs showing output voltage over time for different ECO input voltages and current settings](image-url)
**TECHNICAL NOTES**

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) 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 40µV (Avg.) are marked as the hatched area in the graph.

**<Test conditions>**

1. **Frequency band: 10Hz to 2MHz**

<table>
<thead>
<tr>
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</tr>
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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 a light shield environment. The light exposure can influence functions and characteristics of the products under operation or storage.

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Ricoh is RoHS and Halogen-Free compliant.

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