The R1183Z Series are CMOS-based voltage regulator ICs with extremely low supply current, and low dropout voltage realized with the built-in low ON-resistance Tr.

150mA output current is guaranteed, and the supply current of IC itself is Typ. 1μA at no load.

The R1183Z series have almost same characteristics as R1180x Series. Only difference is ultra small chip size package (WLCSP4-P2: 0.79mm × 0.79mm) and built-in auto discharge function is available with D version, and output voltage accuracy improved to ±1.2%.

Since the package for these ICs is WLCSP-4-P2, the mount area size is less than 1/4 of R1180D Series (SON1612-6).

FEATURES

- Supply Current ..................................................... Typ. 1μA (Except the current through CE pull-down circuit)
- Standby Mode .................................................... Typ. 0.1μA
- Dropout Voltage ................................................ Ty. 0.25V (IOUT=150mA, VOUT=3.0V)
- Temperature-Drift Coefficient of Output Voltage .. Typ. ±100ppm/°C
- Line Regulation ................................................... Typ. 0.05%/V
- Output Voltage Accuracy................................. ±1.2%
- Output Voltage Range........................................ 1.2V to 3.6V (0.1V steps)

(For other voltages, please refer to MARK INFORMATIONS.)

- Input Voltage Range ............................................. 1.7V to 6.0V
- Package ............................................................... WLCSP-4-P2
- Built-in Fold Back Protection Circuit ................. Typ. 40mA
- Built-in Auto Discharge Function..................... D Version
- Ceramic capacitors are recommended to be used with this IC .... 0.1μF or more

APPLICATIONS

- Stable voltage reference.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
R1183Z

BLOCK DIAGRAMS

R1183Zxx1B

R1183Zxx1C

R1183Zxx1D

Non-Promotion
### SELECTION GUIDE

The output voltage, auto discharge function, package, etc. for the ICs can be selected at the user’s request.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Package</th>
<th>Quantity per Reel</th>
<th>Pb Free</th>
<th>Halogen Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1183Zxx1+-TR-F</td>
<td>WLCSP-4-P2</td>
<td>5,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*xx*: The output voltage can be designated in the range from 1.2V(12) to 3.6V(36) in 0.1V steps. (For other voltages, please refer to MARK INFORMATION.)

* : The auto discharge function at off state are options as follows.
- (B) without auto discharge function at off state
- (C) without CE pin
- (D) with auto discharge function at off state
PIN CONFIGURATION

- WLCSP-4-P2

Mark Side  Bump Side

1  4  3  2

PIN DESCRIPTIONS

- R1183Zxx1B/D

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_DD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>CE</td>
<td>Chip Enable Pin (&quot;H&quot; Active)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>4</td>
<td>V_OUT</td>
<td>Output Pin</td>
</tr>
</tbody>
</table>

- R1183Zxx1C

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V_DD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>4</td>
<td>V_OUT</td>
<td>Output Pin</td>
</tr>
</tbody>
</table>
## ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IN}$</td>
<td>Input Voltage</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CE}$</td>
<td>Input Voltage(CE Pin)</td>
<td>−0.3 to 6.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{OUT}$</td>
<td>Output Voltage</td>
<td>−0.3 to $V_{IN}$+0.3</td>
<td>V</td>
</tr>
<tr>
<td>$I_{OUT}$</td>
<td>Output Current</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power Dissipation (WLCSP-4-P2) *</td>
<td>530</td>
<td>mW</td>
</tr>
<tr>
<td>Topt</td>
<td>Operating Temperature Range</td>
<td>−40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage Temperature Range</td>
<td>−55 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

* For Power Dissipation, please refer to PACKAGE INFORMATION.

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.

The functional operation at or over these absolute maximum ratings is not assured.
## ELECTRICAL CHARACTERISTICS

### R1183Zxx1B/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</td>
<td>$V_{IN}-V_{OUT}=1.0V$</td>
<td>$V_{OUT}&gt;1.5V$</td>
<td>$\times0.988$</td>
<td>$\times1.012$</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_{OUT}=1mA$</td>
<td>$V_{OUT} \leq 1.5V$</td>
<td>$-18$</td>
<td>$+18$</td>
<td>mV</td>
</tr>
<tr>
<td>$I_{OUT}$</td>
<td>Output Current</td>
<td>$V_{IN}-V_{OUT}=1.0V$ ($V_{OUT} \geq 1.5V$)</td>
<td>$I_{OUT}&lt;1.5V$, $V_{IN}=2.4V$</td>
<td>150</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta I_{OUT}$</td>
<td>Load Regulation</td>
<td>$V_{IN}-V_{OUT}=1.0V$ ($V_{OUT} \geq 1.5V$)</td>
<td>$I_{OUT}&lt;1.5V$, $V_{IN}=2.4V$</td>
<td>20</td>
<td>40</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{DF}$</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>$I_{SS}$</td>
<td>Supply Current*</td>
<td>$V_{IN}-V_{OUT}=1.0V$, $I_{OUT}=0mA$</td>
<td>1.0</td>
<td>1.5</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>$I_{standby}$</td>
<td>Standby Current</td>
<td>$V_{IN}-V_{OUT}=1.0V$, $V_{CE}=GND$</td>
<td>0.1</td>
<td>1.0</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta V_{IN}$</td>
<td>Line Regulation</td>
<td>$I_{OUT}=30mA$</td>
<td>$V_{OUT}+0.5V \leq V_{IN} \leq 6.0V$</td>
<td>(V$_{OUT} \geq 1.5V$)</td>
<td>0.05</td>
<td>0.20</td>
</tr>
<tr>
<td>$V_{IN}$</td>
<td>Input Voltage</td>
<td></td>
<td></td>
<td>1.7</td>
<td>6.0</td>
<td>V</td>
</tr>
<tr>
<td>$\Delta V_{OUT}/\Delta T_{Topt}$</td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{OUT}=30mA$</td>
<td>$-40^\circ C \leq T_{Topt} \leq 85^\circ C$</td>
<td></td>
<td>$\pm100$</td>
<td>ppm</td>
</tr>
<tr>
<td>$I_{SC}$</td>
<td>Short Current Limit</td>
<td>$V_{OUT}=0V$</td>
<td></td>
<td></td>
<td>40</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{PD}$</td>
<td>CE Pull-down Constant Current</td>
<td></td>
<td></td>
<td></td>
<td>0.35</td>
<td>0.80</td>
</tr>
<tr>
<td>$V_{CEH}$</td>
<td>CE Input Voltage &quot;H&quot;</td>
<td></td>
<td></td>
<td></td>
<td>1.2</td>
<td>6.0</td>
</tr>
<tr>
<td>$V_{CEL}$</td>
<td>CE Input Voltage &quot;L&quot;</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.3</td>
</tr>
<tr>
<td>$R_{LOW}$</td>
<td>ON Resistance of Nch.Tr. for Auto discharge (of D version)</td>
<td>$V_{CE}=0V$</td>
<td></td>
<td></td>
<td>90</td>
<td>Ω</td>
</tr>
</tbody>
</table>

*) Except the pull-down constant current through CE pin.

### RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

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

#### Symbol | Item | Conditions | Min. | Typ. | Max. | Unit
--- | --- | --- | --- | --- | --- | ---
V<sub>OUT</sub> | Output Voltage | V<sub>IN</sub>−V<sub>OUT</sub>=1.0V, I<sub>OUT</sub>=1mA | V<sub>OUT</sub>&gt;1.5V &times;0.988 | &times;1.012 | V
 | | | V<sub>OUT</sub> &le; 1.5V | −18 | +18 | mV
I<sub>OUT</sub> | Output Current | V<sub>IN</sub>−V<sub>OUT</sub>=1.0V (V<sub>OUT</sub> &ge; 1.5V) | If V<sub>OUT</sub>&lt;1.5V, V<sub>IN</sub>=2.4V | 150 | mA
ΔV<sub>OUT</sub>/ΔI<sub>OUT</sub> | Load Regulation | V<sub>IN</sub>−V<sub>OUT</sub>=1.0V (V<sub>OUT</sub> &ge; 1.5V) | If V<sub>OUT</sub>&lt;1.5V, V<sub>IN</sub>=2.4V | 20 | 40 | mV
V<sub>DIFF</sub> | Dropout Voltage | Refer to the ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE
I<sub>SS</sub> | Supply Current | V<sub>IN</sub>−V<sub>OUT</sub>=1.0V, I<sub>OUT</sub>=0mA | 1.0 | 1.5 | μA
ΔV<sub>OUT</sub>/ΔV<sub>IN</sub> | Line Regulation | I<sub>OUT</sub>=30mA | V<sub>OUT</sub>=0.5V &le; V<sub>IN</sub> &le; 6.0V (V<sub>OUT</sub> &ge; 1.5V) | 0.05 | 0.20 | %/V
 | | | If V<sub>OUT</sub>&lt;1.5V, 2.0V &le; V<sub>IN</sub> &le; 6.0V |
V<sub>IN</sub> | Input Voltage | 1.7 | 6.0 | V
ΔV<sub>OUT</sub>/ΔT<sub>TOPT</sub> | Temperature Coefficient | I<sub>OUT</sub>=30mA | −40°C &le; T<sub>TOPT</sub> &leq; 85°C | ±100 | ppm | °C
I<sub>SC</sub> | Short Current Limit | V<sub>OUT</sub>=0V | 40 | mA

---

#### Output Voltage V<sub>OUT</sub> (V) vs Dropout Voltage V<sub>DIF</sub> (V)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Typ.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.3</td>
<td>0.85</td>
<td>1.20</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.4</td>
<td>0.75</td>
<td>1.10</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.5</td>
<td>0.65</td>
<td>1.00</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.7</td>
<td>0.60</td>
<td>0.90</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.9</td>
<td>0.50</td>
<td>0.75</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 2.1</td>
<td>0.40</td>
<td>0.65</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 2.8</td>
<td>0.35</td>
<td>0.55</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 3.6</td>
<td>0.25</td>
<td>0.40</td>
</tr>
</tbody>
</table>
TYPICAL APPLICATION

![Circuit Diagram](image)

(External Components)
Output Capacitor
Ceramic Capacitor 0.1μF
murata GRM155B31C104KA87B
kyocera CM05X5R104K16AB

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, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance). (Note: If additional ceramic capacitors are connected with parallel to the output pin with an 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.)

PCB Layout
Make VDD and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 0.1μF or more between VDD and GND pin, and as close as possible to the pins.
Set external components, especially the output capacitor C2, as close as possible to the ICs, and make wiring as short as possible.
TEST CIRCUITS

C1=Ceramic 1.0μF
C2=Ceramic 0.1μF

Standard test Circuit

Supply Current Test Circuit

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

1) Output Voltage vs. Output Current (Topt=25°C)

**R1183Z121x**

![Graph 1](image1)

**R1183Z281x**

![Graph 2](image2)

**R1183Z361x**

![Graph 3](image3)

2) Output Voltage vs. Input Voltage (Topt=25°C)

**R1183Z121x**

![Graph 4](image4)

**R1183Z281x**

![Graph 5](image5)
3) Dropout Voltage vs. Output Current

**R1183Z121x**

- **85°C**
- **25°C**
- **-40°C**

**R1183Z281x**

- **85°C**
- **25°C**
- **-40°C**

**R1183Z361x**

- **85°C**
- **25°C**
- **-40°C**
4) Output Voltage vs. Temperature ($I_{OUT}=30mA$)

- R1183Z121x ($V_{IN}=2.2V$)
- R1183Z281x ($V_{IN}=3.8V$)
- R1183Z361x ($V_{IN}=4.6V$)

5) Supply Current vs. Input Voltage (Topt=25°C)

- R1183Z121x
- R1183Z281x
6) Supply Current vs. Temperature

**R1183Z121x (VIN=2.2V)**

**R1183Z281x (VIN=3.8V)**

**R1183Z361x (VIN=4.6V)**
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

8) Ripple Rejection vs. Frequency (Cm=none)
9) Ripple Rejection vs. Input Bias Voltage (Topt=25°C, Cin=none, Cout=ceramic0.1μF)

R1183Z361x (IOUT=1mA)

R1183Z361x (IOUT=30mA)

R1183Z361x (IOUT=50mA)
10) Input Transient Response (C_in=none, tr_tf=5μs)

**R1183Z**

**I_{out}=1mA**

C_{out}=Ceramic1μF

**R1183Z**

**I_{out}=30mA**

C_{out}=Ceramic0.1μF

**R1183Z**

**I_{out}=30mA**

C_{out}=Ceramic0.47μF
11) Load Transient Response ($tr=tf=0.5\mu s$, $V_{in}=3.8V$)

R1183Z281x

C_{out}=Ceramic1\mu F

I_{out}=30mA

R1183Z281x

C_{out}=Ceramic0.1\mu F

R1183Z281x

C_{out}=Ceramic1\mu F
12) Turn-on speed with CE pin signal

**R1183Z121x**

- **VIN=2.2V, COUT=0.1μF, IOUT=0mA**
- **VIN=2.2V, COUT=0.1μF, IOUT=30mA**
- **VIN=2.2V, COUT=1μF, IOUT=100mA**

**R1183Z121x**

- **VIN=2.2V, COUT=0.1μF, IOUT=0mA**
- **VIN=2.2V, COUT=0.1μF, IOUT=30mA**
- **VIN=2.2V, COUT=1μF, IOUT=100mA**
VIN=2.2V, COUT=1µF, IOUT=30mA

VIN=2.2V, COUT=1µF, IOUT=100mA

VIN=3.8V, COUT=0.1µF, IOUT=0mA

VIN=3.8V, COUT=0.1µF, IOUT=30mA

VIN=3.3V, COUT=0.1µF, IOUT=150mA

VIN=4.6V, COUT=0.1µF
13) Turn off speed with CE pin signal

**R1183Z121D**

VIN = 2.2V, COUT = 0.1µF

**R1183Z281D**

VIN = 3.8V, COUT = 0.1µF

**R1183Z121D**

VIN = 2.2V, COUT = 1µF

**R1183Z281D**

VIN = 3.8V, COUT = 1µF
VIN=4.6V, COUT=0.1μF

Output Voltage VOUT(V)

IOUT=0mA
IOUT=30mA
IOUT=100mA
IOUT=150mA

VIN=4.6V, COUT=1μF

Output Voltage VOUT(V)

IOUT=0mA
IOUT=30mA
IOUT=100mA
IOUT=150mA

Non-Promotion
ESR vs. Output Current

The relations between $I_{OUT}$ (Output Current) and ESR of an output capacitor are shown above. The conditions when the white noise level is under $40\mu V$ (Avg.) are marked as the hatched area in the graph.

<Measurement conditions>
(1) $V_{IN} = V_{OUT} + 1V$
(2) Frequency Band: 10Hz to 2MHz (BW=30Hz)
(3) Temperature: $-40^\circ C$ to $85^\circ C$
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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.

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Ricoh continually strives to promote customer satisfaction, and shares the achievements of its management quality improvement program with people and society.

Ricoh awarded ISO 14001 certification.
The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.

Ricoh completed the organization of the Lead-free production for all of our products.
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.

http://www.ricoh.com/lsi/

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