OUTLINE

The R1180x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, extremely low supply current, and low ON-resistance. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit which prevents the destruction by excess current, and so on. The output voltage of these ICs is fixed with high accuracy. B version has a chip enable pin, therefore ultra-low consumption current standby mode can be realized with the pin.

Since the packages for these ICs are SOT-23-5 (R1180N Series), SC-82AB (R1180Q Series), and SON1612-6 (R1180D Series), therefore high density mounting of the ICs on boards is possible.

FEATURES

- Supply Current ......................................................... Typ. 1μA
  (Except the current through CE pull-down circuit)
- Standby Mode .......................................................... Typ. 0.1μA
- Dropout Voltage ....................................................... Typ. 0.25V (IOUT=150mA 3.0V Output type)
- Temperature-Drift Coefficient of Output Voltage ...... Typ. ±100ppm/°C
- Line Regulation ........................................................ Typ. 0.05%/V
- Output Voltage Accuracy..........................................
  ±2.0%
- Packages .............................................................. SON1612-6, SC-82AB, SOT-23-5
- Output Voltage Range.............................................. 1.2V to 3.6V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Built-in Fold Back Protection Circuit ......................... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC .....0.1μF

APPLICATIONS

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

The output voltage, CE pin polarity, 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>R1180Dxx1-TR-FE</td>
<td>SON1612-6</td>
<td>4,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1180Qxx1-TR-FE</td>
<td>SC-82AB</td>
<td>3,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1180Nxx1-TR-FE</td>
<td>SOT-23-5</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 1.2V(12) to 3.6V(36) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATION.)

*: CE pin polarity are options as follows.
  (B) "H" Active
  (C) without CE pin
PIN CONFIGURATION

● SON1612-6

● SC-82AB

● SOT-23-5

PIN DESCRIPTIONS

• SON1612-6

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

• SC-82AB

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

• SOT-23-5

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Symbol</th>
<th>Pin Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Input Pin</td>
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<tr>
<td>2</td>
<td>GND</td>
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</tr>
<tr>
<td>3</td>
<td>CE or NC</td>
<td>Chip Enable Pin or No Connection</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>No Connection</td>
</tr>
<tr>
<td>5</td>
<td>VOUT</td>
<td>Output pin</td>
</tr>
</tbody>
</table>
### 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>VCE</td>
<td>Input Voltage (CE Pin)</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>VOUT</td>
<td>Output Voltage</td>
<td>−0.3 to VIN+0.3</td>
<td>V</td>
</tr>
<tr>
<td>IOUT</td>
<td>Output Current</td>
<td>180</td>
<td>mA</td>
</tr>
<tr>
<td>Po</td>
<td>Power Dissipation (SON1612-6)*</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Power Dissipation (SC-82AB)*</td>
<td>380</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Power Dissipation (SOT-23-5)*</td>
<td>420</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.

### 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

#### R1180xxx1B/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\text{OUT}</strong></td>
<td>Output Voltage</td>
<td>$V_{\text{IN}}=\text{Set } V_{\text{OUT}}+1\text{V}$ $1\mu\text{A} \leq I_{\text{OUT}} \leq 30\text{mA}$</td>
<td>0.980</td>
<td>1.020</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>I\text{OUT}</strong></td>
<td>Output Current</td>
<td>$V_{\text{IN}}-V_{\text{OUT}}=1.0\text{V}(V_{\text{OUT}} \geq 1.5\text{V})$ $V_{\text{IN}}=2.4\text{V}(V_{\text{OUT}}&lt;1.5\text{V})$</td>
<td>150</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td><strong>\Delta V_{\text{OUT}}/\Delta I_{\text{OUT}}</strong></td>
<td>Load Regulation</td>
<td>$V_{\text{IN}}-V_{\text{OUT}}=1.0\text{V}(V_{\text{OUT}} \geq 1.5\text{V})$ $V_{\text{IN}}=2.4\text{V}(V_{\text{OUT}}&lt;1.5\text{V})$ $1\mu\text{A} \leq I_{\text{OUT}} \leq 150\text{mA}$</td>
<td>20</td>
<td>40</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td><strong>V_{\text{DIFF}}</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_{\text{SS}}</strong></td>
<td>Supply Current</td>
<td>$V_{\text{IN}}-V_{\text{OUT}}=1.0\text{V},I_{\text{OUT}}=0\text{mA}$</td>
<td>1.0</td>
<td>1.5</td>
<td></td>
<td>\mu A</td>
</tr>
<tr>
<td><strong>I_{\text{STANDBY}}</strong></td>
<td>Supply Current (Standby)</td>
<td>$V_{\text{IN}}-V_{\text{OUT}}=1.0\text{V},V_{\text{CE}}=\text{GND}$</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>\mu A</td>
</tr>
<tr>
<td><strong>\Delta V_{\text{OUT}}/\Delta V_{\text{IN}}</strong></td>
<td>Line Regulation</td>
<td>$I_{\text{OUT}}=30\text{mA}$ $V_{\text{OUT}}+0.5\text{V} \leq V_{\text{IN}} \leq 6.0\text{V}$ $(V_{\text{OUT}} \geq 1.5\text{V})$ $2.0\text{V} \leq V_{\text{IN}} \leq 6.0\text{V}$ $(1.2\text{V} \leq V_{\text{OUT}} \leq 1.4\text{V})$</td>
<td>0.05</td>
<td>0.20</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td><strong>V_{\text{IN}}</strong></td>
<td>Input Voltage</td>
<td></td>
<td>1.7</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>\Delta V_{\text{OUT}}/\Delta T_{\text{OPT}}</strong></td>
<td>Output Voltage Temperature Coefficient</td>
<td>$I_{\text{OUT}}=30\text{mA}$ $-40\degree\text{C} \leq T_{\text{OPT}} \leq 85\degree\text{C}$</td>
<td>100</td>
<td></td>
<td></td>
<td>ppm/\degree C</td>
</tr>
<tr>
<td><strong>I_{\text{SC}}</strong></td>
<td>Short Current Limit</td>
<td>$V_{\text{OUT}}=0\text{V}$</td>
<td>40</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td><strong>I_{\text{PD}}</strong></td>
<td>CE Pull-down Constant Current</td>
<td>$(R1180xxx1B)$</td>
<td>0.35</td>
<td></td>
<td></td>
<td>\mu A</td>
</tr>
<tr>
<td><strong>V_{\text{CHE}}</strong></td>
<td>CE Input Voltage &quot;H&quot;</td>
<td>$(R1180xxx1B)$</td>
<td>1.2</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td><strong>V_{\text{CEL}}</strong></td>
<td>CE Input Voltage &quot;L&quot;</td>
<td>$(R1180xxx1B)$</td>
<td>0.0</td>
<td>0.3</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

#### 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><strong>Condition</strong></td>
<td><strong>Typ.</strong></td>
</tr>
<tr>
<td>$1.2 \leq V_{\text{OUT}} &lt; 1.3$</td>
<td>0.85</td>
</tr>
<tr>
<td>$1.3 \leq V_{\text{OUT}} &lt; 1.4$</td>
<td>0.75</td>
</tr>
<tr>
<td>$1.4 \leq V_{\text{OUT}} &lt; 1.5$</td>
<td>0.65</td>
</tr>
<tr>
<td>$1.5 \leq V_{\text{OUT}} &lt; 1.7$</td>
<td>0.60</td>
</tr>
<tr>
<td>$1.7 \leq V_{\text{OUT}} &lt; 1.9$</td>
<td>0.50</td>
</tr>
<tr>
<td>$1.9 \leq V_{\text{OUT}} &lt; 2.1$</td>
<td>0.40</td>
</tr>
<tr>
<td>$2.1 \leq V_{\text{OUT}} &lt; 2.8$</td>
<td>0.35</td>
</tr>
<tr>
<td>$2.8 \leq V_{\text{OUT}} \leq 3.6$</td>
<td>0.25</td>
</tr>
</tbody>
</table>

$T_{\text{OPT}}=25\degree\text{C}$
TYPICAL APPLICATION

![TYPICAL APPLICATION Diagram](image)

(External Components)
Output Capacitor
Ceramic Capacitor 0.1μF

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

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)

![Graph showing output voltage vs. output current for different input voltages (Vin)]

- VIN = 2.0V
- VIN = 2.2V
- VIN = 2.5V
- VIN = 3.5V

- VIN = 2.0V
- VIN = 2.2V
- VIN = 2.5V
- VIN = 3.5V

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

![Graph showing output voltage vs. input voltage for different currents (Iout)]

- 1mA
- 30mA
- 50mA
3) Dropout Voltage vs. Output Current

**R1180x361x**

- Dropout Voltage $V_{DIF}(V)$ vs. Output Current $I_{OUT}(mA)$
  - Dropouts for $85^\circ C$, $25^\circ C$, and $-40^\circ C$
  - Different current levels: 1mA, 30mA, 50mA

**R1180x121x**

- Dropout Voltage $V_{DIF}(V)$ vs. Output Current $I_{OUT}(mA)$
  - Dropouts for $85^\circ C$, $25^\circ C$, and $-40^\circ C$

**R1180x281x**

- Dropout Voltage $V_{DIF}(V)$ vs. Output Current $I_{OUT}(mA)$
  - Dropouts for $85^\circ C$, $25^\circ C$, and $-40^\circ C$
4) Output Voltage vs. Temperature (I_{out}=30mA)

- **R1180x121x (V_{IN}=2.2V)**
- **R1180x281x (V_{IN}=3.8V)**
- **R1180x361x (V_{IN}=4.6V)**

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

- **R1180x121x**
- **R1180x281x**
6) Supply Current vs. Temperature

**R1180x121**(V\textsubscript{IN}=2.2V)

**R1180x281**(V\textsubscript{IN}=3.8V)

**R1180x361**(V\textsubscript{IN}=4.6V)
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

[Graph showing dropout voltage vs. set output voltage for different current levels (10mA, 30mA, 50mA, 150mA).]

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

- **R1180x121x**
  - $V_{IN}=2.4V_{DC}+0.5p-p$
  - $C_{OUT}=\text{Ceramic}0.1\mu F$
  - Frequency [kHz]
  - Ripple Rejection [dB]
  - $I_{OUT}=1mA$, $50mA$, $30mA$

- **R1180x281x**
  - $V_{IN}=3.8V_{DC}+0.5p-p$
  - $C_{OUT}=\text{Ceramic}0.1\mu F$
  - Frequency [kHz]
  - Ripple Rejection [dB]
  - $I_{OUT}=1mA$, $50mA$, $30mA$
9) Ripple Rejection vs. Input Bias Voltage (Topt=25°C, Cin=none, Cout=Ceramic0.1μF)

R1180x281x(I_{OUT}=1mA)

R1180x281x(I_{OUT}=30mA)

R1180x281x(I_{OUT}=50mA)
10) Input Transient Response (C\textsubscript{IN}=none, \textit{tr}=\textit{tf}=5\mu s)

**R1180x281x**

- **Input Voltage**
- **Output Voltage**

**I\textsubscript{OUT}=1mA**

C\textsubscript{OUT}=Ceramic1\mu F

**R1180x281x**

- **Input Voltage**
- **Output Voltage**

**I\textsubscript{OUT}=30mA**

C\textsubscript{OUT}=Ceramic0.1\mu F

**R1180x281x**

- **Input Voltage**
- **Output Voltage**

**I\textsubscript{OUT}=30mA**

C\textsubscript{OUT}=Ceramic0.47\mu F
11) Load Transient Response (tr=0.5μs V_{IN}=3.8V)

**R1180x281x**

Output Voltage $V_{OUT}$ [V]

Output Current $I_{OUT}$ [mA]

Input Voltage $V_{IN}$ [V]

Time $T$ [μs]

Capacitor $C_{OUT}$ = Ceramic 0.1μF

Capacitor $C_{OUT}$ = Ceramic 1μF

Capacitor $C_{OUT}$ = Ceramic 1μF
C010 = Ceramic 1.0μF

Output Voltage

Output Current

Time T[μs]

Output Voltage Vout[V]

Output Current Iout[mA]
ESR vs. Output Current

The relations between $I_{\text{OUT}}$ (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) $V_{\text{IN}}=V_{\text{OUT}}+1$V
(2) Frequency Band: 10Hz to 2MHz (BW=30Hz)
(3) Temperature: $-40^\circ$C to $85^\circ$C

![Graph showing ESR vs. Output Current for R1180x121x and R1180x281x capacitors with specified values for $C_{\text{IN}}$ and $C_{\text{OUT}}$.]
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8. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.

9. WL CSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.

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.

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