The R1116x Series are CMOS-based voltage regulator ICs with high output voltage accuracy, low supply current, low on Resistance, and high ripple rejection. Each of these ICs consists of a voltage reference unit, an error amplifier, resistor-net for voltage setting, a short current limit circuit, a chip enable circuit, and so on.

These ICs perform with low dropout voltage and the chip-enable function. The supply current at no load of this IC is only 10μA, and the line transient response and the load transient response of the R1116x Series are excellent, thus these ICs are very suitable for the power supply for hand-held communication equipment.

The supply current at no load of R1116x Series is remarkably reduced compared with R1114x Series. The mode change signal to reduce the supply current is not necessary. The output voltage accuracy is also improved. (±1.5%)

The output voltage of these ICs is fixed with high accuracy. Since the packages for these ICs are SOT-23-5 and SON1612-6 therefore high density mounting of the ICs on boards is possible.

R1126N Series that a pin configuration differs from R1116N Series are available.

**FEATURES**

- Supply Current ................................................................. Typ. 10μA
- Standby Current ............................................................... Typ. 0.1μA
- Input Voltage Range ......................................................... 1.8V to 6.0V
- Output Voltage Range ....................................................... 1.5V to 4.0V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Dropout Voltage ............................................................... Typ. 0.29V (IOUT=150mA, VOUT=2.8V)
- Ripple Rejection .............................................................. Typ. 70dB (f=1kHz, VOUT=3.0V)
  Typ. 53dB (f=10kHz)
- Output Voltage Accuracy ................................................... ±1.5% (1.5V ≤ VOUT ≤ 3.0V), ±2.0% (VOUT>3.0V)
- Temperature-Drift Coefficient of Output Voltage ............. Typ. ±100ppm/°C
- Line Regulation ............................................................... Typ. 0.02%/V
- Packages .............................................................. SOT-23-5 , SON1612-6
- Built-in Fold Back Protection Circuit ............................... Typ. 40mA (Current at short mode)
- Ceramic capacitors are recommended to be used with this IC  ... CIN=COUT=1.0μF (Ceramic)

**APPLICATIONS**

- Power source for portable communication equipment.
- Power source for portable music player.
- Power source for electrical appliances such as cameras, VCRs and camcorders.
- Power source for battery-powered equipment.
**BLOCK DIAGRAMS**

![Block Diagrams](image)

**SELECTION GUIDE**

The output voltage, auto discharge function, package, and the taping type, 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>R1116Dxx1*-TR-FE</td>
<td>SON1612-6</td>
<td>4,000 pcs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R1116Nxx1*-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 1.5V(15) to 4.0V(40) 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.
  (B) "H" active, without auto discharge function at off state
  (D) "H" active, with auto discharge function at off state

---

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
PIN CONFIGURATIONS

- **SOT-23-5**

- **SON1612-6**

PIN DESCRIPTIONS

**SOT-23-5**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Input Pin</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground Pin</td>
</tr>
<tr>
<td>3</td>
<td>CE</td>
<td>Chip Enable Pin</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>

**SON1612-6**

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

* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
**ABSOLUTE MAXIMUM RATINGS**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Item</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V\text{IN}</td>
<td>Input Voltage</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>V\text{CE}</td>
<td>Input Voltage (CE Pin)</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>V\text{OUT}</td>
<td>Output Voltage</td>
<td>(-0.3\text{V\text{IN}}+0.3)</td>
<td>V</td>
</tr>
<tr>
<td>I\text{OUT}</td>
<td>Output Current</td>
<td>160</td>
<td>mA</td>
</tr>
<tr>
<td>P\text{D}</td>
<td>Power Dissipation (SOT-23-5)</td>
<td>420</td>
<td>mW</td>
</tr>
<tr>
<td>P\text{D}</td>
<td>Power Dissipation (SON1612-6)</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td>T\text{opt}</td>
<td>Operating Temperature Range</td>
<td>(-40\text{~85})</td>
<td>°C</td>
</tr>
<tr>
<td>T\text{stg}</td>
<td>Storage Temperature Range</td>
<td>(-55\text{~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**

- **R1116xxx1B/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>V&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Output Voltage</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt; = Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V &lt;br&gt; 1mA ≤ I&lt;sub&gt;OUT&lt;/sub&gt; ≤ 30mA &lt;br&gt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 3.4V &lt;br&gt; V&lt;sub&gt;OUT&lt;/sub&gt; &gt; 3.4V</td>
<td>×0.985</td>
<td>×0.980</td>
<td>×1.015</td>
<td>×1.020</td>
</tr>
<tr>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Output Current</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;−V&lt;sub&gt;OUT&lt;/sub&gt;=1.0V</td>
<td>150</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ ΔI&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Load Regulation</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V &lt;br&gt; 1mA ≤ I&lt;sub&gt;OUT&lt;/sub&gt; ≤ 150mA &lt;br&gt; 1.5V ≤ V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 2.0V &lt;br&gt; 2.0V ≤ V&lt;sub&gt;OUT&lt;/sub&gt; &lt; 3.0V &lt;br&gt; 3.0V ≤ V&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>28</td>
<td>33</td>
<td>55</td>
<td>66</td>
</tr>
<tr>
<td>V&lt;sub&gt;DIF&lt;/sub&gt;</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&lt;sub&gt;SS&lt;/sub&gt;</td>
<td>Supply Current</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, I&lt;sub&gt;OUT&lt;/sub&gt;=0mA</td>
<td>10</td>
<td>18</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>I&lt;sub&gt;standby&lt;/sub&gt;</td>
<td>Supply Current (Standby)</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=Set V&lt;sub&gt;OUT&lt;/sub&gt;+1V, V&lt;sub&gt;C&lt;/sub&gt;=V&lt;sub&gt;DD&lt;/sub&gt;</td>
<td>0.1</td>
<td>1.0</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ ΔV&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Line Regulation</td>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;=30mA &lt;br&gt; Set V&lt;sub&gt;OUT&lt;/sub&gt;+0.5V ≤ V&lt;sub&gt;IN&lt;/sub&gt; ≤ 6.0V</td>
<td>0.02</td>
<td>0.10</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>f=1kHz &lt;br&gt; f=10kHz &lt;br&gt; Ripple 0.2Vp-p &lt;br&gt; V&lt;sub&gt;IN&lt;/sub&gt;=V&lt;sub&gt;OUT&lt;/sub&gt;=1.0V, I&lt;sub&gt;OUT&lt;/sub&gt;=30mA</td>
<td>70</td>
<td>53</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>V&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Input Voltage</td>
<td></td>
<td>1.8</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;OUT&lt;/sub&gt;/ ΔTopt</td>
<td>Output Voltage Temperature Coefficient</td>
<td>I&lt;sub&gt;OUT&lt;/sub&gt;=30mA &lt;br&gt; -40°C ≤ Topt ≤ 85°C</td>
<td>±100</td>
<td></td>
<td></td>
<td>ppm /°C</td>
</tr>
<tr>
<td>I&lt;sub&gt;SC&lt;/sub&gt;</td>
<td>Short Current Limit</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;=0V</td>
<td>40</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I&lt;sub&gt;PD&lt;/sub&gt;</td>
<td>CE Pull-down Current</td>
<td></td>
<td>0.5</td>
<td></td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>V&lt;sub&gt;CEH&lt;/sub&gt;</td>
<td>CE Input Voltage “H”</td>
<td></td>
<td>1.0</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>V&lt;sub&gt;CLE&lt;/sub&gt;</td>
<td>CE Input Voltage “L”</td>
<td></td>
<td>0.0</td>
<td>0.3</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>en</td>
<td>Output Noise</td>
<td>BW=10Hz to 100kHz</td>
<td>30</td>
<td></td>
<td></td>
<td>μVrms</td>
</tr>
<tr>
<td>R&lt;sub&gt;LOW&lt;/sub&gt;</td>
<td>On Resistance of Nch Tr. for auto-discharge (Only for D version)</td>
<td>V&lt;sub&gt;C&lt;/sub&gt;=0V</td>
<td>70</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
</tbody>
</table>

**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.

---

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
- **ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE**

<table>
<thead>
<tr>
<th>Output Voltage V&lt;sub&gt;OUT&lt;/sub&gt; (V)</th>
<th>Dropout Voltage V&lt;sub&gt;DIFF&lt;/sub&gt; (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Typ.</td>
</tr>
<tr>
<td>V&lt;sub&gt;OUT&lt;/sub&gt; = 1.5V</td>
<td>0.54</td>
</tr>
<tr>
<td>1.5V &lt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.6V</td>
<td>0.50</td>
</tr>
<tr>
<td>1.6V &lt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 1.7V</td>
<td>0.46</td>
</tr>
<tr>
<td>1.7V &lt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 2.0V</td>
<td>0.44</td>
</tr>
<tr>
<td>2.0V &lt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 2.7V</td>
<td>0.37</td>
</tr>
<tr>
<td>2.7V &lt; V&lt;sub&gt;OUT&lt;/sub&gt; ≤ 4.0V</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Topt = 25°C* 

**TYPICAL APPLICATIONS**

(R1116x Series)

(R1116x is the non-promotion product. As of March in 2014.)

C<sub>1</sub> Ceramic 1.0 μF

C<sub>2</sub> Ceramic 1.0 μF

C<sub>2</sub> Ceramic 1.0 μF

(External Components)

C<sub>2</sub> Ceramic 1.0 μF

Ex. Murata GRM155B30J105KE18B

Kyocera CM05X5R105K06AB
TEST CIRCUITS

Fig.1 Standard test Circuit

Fig.2 Supply Current Test Circuit

Fig.3 Ripple Rejection, Line Transient Response Test Circuit

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
TYPICAL CHARACTERISTICS

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

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

* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
4) Output Voltage vs. Temperature

<table>
<thead>
<tr>
<th>Temperature Topt(°C)</th>
<th>Output Voltage VOUT(V)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>1.52</td>
</tr>
<tr>
<td></td>
<td>1.47</td>
</tr>
<tr>
<td></td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>1.51</td>
</tr>
<tr>
<td></td>
<td>1.53</td>
</tr>
</tbody>
</table>

5) Supply Current vs. Temperature

<table>
<thead>
<tr>
<th>Temperature Topt(°C)</th>
<th>Supply Current ISS(μA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
6) Dropout Voltage vs. Temperature

* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
7) Dropout Voltage vs. Set Output Voltage (Topt=25°C)

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
8) Ripple Rejection vs. Input Bias Voltage (Topt=25°C, Cin = none, Cout = 1μF)

- **R1116x281x**
  - Ripple Vp-p=0.2V, Iout=1mA
  - Ripple Vp-p=0.5V, Iout=1mA
- **R1116x281x**
  - Ripple Vp-p=0.2V, Iout=30mA
  - Ripple Vp-p=0.5V, Iout=30mA
- **R1116x281x**
  - Ripple Vp-p=0.2V, Iout=50mA
  - Ripple Vp-p=0.5V, Iout=50mA

* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
9) Ripple Rejection vs. Frequency (C_{in}=none)

**R1116x151x**

- **V_{in}=2.7\text{Vdc}+0.5\text{Vp-p}, C_{out}=1\mu\text{F}**

**R1116x281x**

- **V_{in}=3.8\text{Vdc}+0.5\text{Vp-p}, C_{out}=1\mu\text{F}**

**R1116x401x**

- **V_{in}=5\text{Vdc}+0.5\text{Vp-p}, C_{out}=1\mu\text{F}**

**R1116x151x**

- **V_{in}=2.7\text{Vdc}+0.5\text{Vp-p}, C_{out}=2.2\mu\text{F}**

**R1116x281x**

- **V_{in}=3.8\text{Vdc}+0.5\text{Vp-p}, C_{out}=2.2\mu\text{F}**

**R1116x401x**

- **V_{in}=5\text{Vdc}+0.5\text{Vp-p}, C_{out}=2.2\mu\text{F}**

---

*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
10) Input Transient Response (I_{out}=30mA, C_{IN}= none, t_{R}=t_f=5\mu s, C_{OUT}= Ceramic 1\mu F)

11) Load Transient Response (t_{R}=t_f=0.5\mu s, C_{IN}=Ceramic 1\mu F)

* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
*R1116D (SON1612-6) is the non-promotion product. As of March in 2014.*
* R1116D (SON1612-6) is the non-promotion product. As of March in 2014.
12) Turn-on/off speed with CE pin (D version) (Cᵢᵡ=Ceramic 1.0µF, Cₒᵤᵡ=Ceramic 1.0µF)

R1116x151D

VIN=2.5V

Output Voltage

CE Input Voltage

Output Voltage

Iₒᵤᵡ=0mA

Iₒᵤᵡ=30mA

Iₒᵤᵡ=150mA

Time t(μs)

-5 0 10 15 20 25 30 35 40 45

6 5 4 3 2 1 0

Output Voltage

CE Input Voltage

Output Voltage

Iₒᵤᵡ=0mA

Iₒᵤᵡ=30mA

Iₒᵤᵡ=150mA

Time t(μs)

-40 0 40 80 120 160 200 240 280 320 360

6 5 4 3 2 1 0

Output Voltage

CE Input Voltage

Output Voltage

Iₒᵤᵡ=0mA

Iₒᵤᵡ=30mA

Iₒᵤᵡ=150mA

Time t(μs)
R1116x281D

Output Voltage $V_{OUT} (V)$ vs. CE Input Voltage $V_{CE} (V)$

$V_{IN} = 3.8V$

- $I_{OUT} = 0mA$
- $I_{OUT} = 30mA$
- $I_{OUT} = 150mA$

Time $t$ ($\mu s$)

R1116x401D

Output Voltage $V_{OUT} (V)$ vs. CE Input Voltage $V_{CE} (V)$

$V_{IN} = 5.0V$

- $I_{OUT} = 0mA$
- $I_{OUT} = 30mA$
- $I_{OUT} = 150mA$

Time $t$ ($\mu s$)

* R1116D (SON1612-6) is the non-promotion 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 with a capacitance value as much as 1.0μF or more as C1 between VDD and GND pin, and as close as possible to the pins.
   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, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).
   (Note: If additional ceramic capacitors are connected in parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with the 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.

(External Components)
C2 Ceramic 1.0μF Ex. Murata GRM155B30J105KE18B
Kyocera CM05X5R105K06AB
C1 Ceramic 1.0μF
ESR vs. Output Current

When using these ICs, consider the following points:

The relations between $\text{I}_{\text{OUT}}$ (Output Current) and ESR of an output capacitor are shown below.

The conditions when the white noise level is under 40\(\mu\text{V (Avg.)}\) are marked as the hatched area in the graph.

**Measurement conditions**

- $V_{\text{IN}}=V_{\text{OUT}}+1\text{V}$
- $C_{\text{OUT}}$: GRM155B30J105KE18B
- Frequency Band: 10Hz to 2MHz
- Temperature: $-40^\circ\text{C}$ to $25^\circ\text{C}$

---

* R1116D (SON1612-6) is the non-promotion 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 thereon.

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, space vehicle, 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, firecontainment 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.

http://www.ricoh.com/LSI/

Ricoh presented with the Japan Management Quality Award for 1999. 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.