GaAs INTEGRATED CIRCUIT

# μPG2409TB

## HIGH POWER SPDT SWITCH FOR WiMAX™

### DESCRIPTION

The μPG2409TB is a GaAs MMIC high power SPDT (Single Pole Double Throw) switch which were designed for WiMAX.

This device can operate frequency from 0.5 to 3.8 GHz, having the low insertion loss and high isolation.

This device is housed in a 6-pin super minimold package (SC-88/SOT-363 type). And this package is suitable for high-density surface mounting.

### FEATURES

- Switch control voltage : $V_{cont\ (H)}$ = 3.0 V TYP.
  : $V_{cont\ (L)}$ = 0 V TYP.
- Low insertion loss : $L_{ins}$ = 0.35 dB TYP. @ f = 1.0 GHz
  : $L_{ins}$ = 0.45 dB TYP. @ f = 2.5 GHz
  : $L_{ins}$ = 0.50 dB TYP. @ f = 3.0 GHz
- High isolation : ISL = 32 dB TYP. @ f = 1.0 GHz
  : ISL = 26 dB TYP. @ f = 2.5 GHz
  : ISL = 23 dB TYP. @ f = 3.0 GHz
- Handling power : $P_{in\ (1\ dB)}$ = +35.0 dBm TYP. @ f = 0.5 to 3.8 GHz
- High-density surface mounting : 6-pin super minimold package (SC-88/SOT-363 type) (2.0 × 1.25 × 0.9 mm)

### APPLICATIONS

- WiMAX and wireless LAN (IEEE802.11b/g/n)

### ORDERING INFORMATION

| Part Number | Order Number | Package | Marking | Supplying Form |
|---|---|---|---|---|
| μPG2409TB-E4 | μPG2409TB-E4-A | 6-pin super minimold (SC-88/SOT-363 type) (Pb-Free) | G5T | • Embossed tape 8 mm wide<br>• Pin 4, 5, 6 face the perforation side of the tape<br>• Qty 3 kpcs/reel |

**Remark** To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPG2409TB

**Caution Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.**



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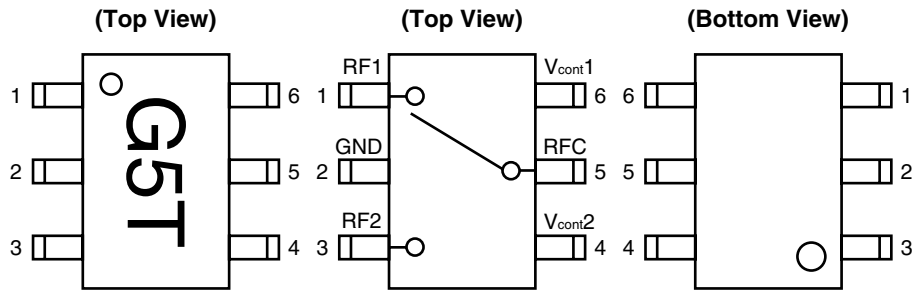
## PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM




| Pin No. | Pin Name |
|---|---|
| 1 | RF1 |
| 2 | GND |
| 3 | RF2 |
| 4 | $V_{cont}2$ |
| 5 | RFC |
| 6 | $V_{cont}1$ |

## SW TRUTH TABLE

| On Path | $V_{cont}1$ | $V_{cont}2$ |
|---|---|---|
| RFC-RF1 | High | Low |
| RFC-RF2 | Low | High |

## ABSOLUTE MAXIMUM RATINGS ($T_A$ = +25°C, unless otherwise specified)

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Switch Control Voltage | | $V_{cont}$ | +6.0 Note | V |
| Input Power | $V_{cont}$ = 3 V | $P_{in}$ | +35 | dBm |
| | $V_{cont}$ = 5 V | $P_{in}$ | +37 | |
| Power Dissipation (average) | | $P_D$ | 150 | mW |
| Operating Ambient Temperature | | $T_A$ | –45 to +85 | °C |
| Storage Temperature | | $T_{stg}$ | –55 to +150 | °C |

**Note** $|V_{cont}1 - V_{cont}2| \leq 6.0$ V

## RECOMMENDED OPERATING RANGE ($T_A$ = +25°C, unless otherwise specified)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Operating Frequency | f | 0.5 | – | 3.8 | GHz |
| Switch Control Voltage (H) | $V_{cont\ (H)}$ | 2.7 | 3.0 | 5.3 | V |
| Switch Control Voltage (L) | $V_{cont\ (L)}$ | –0.2 | 0 | 0.2 | V |
| Control Voltage Difference | $\Delta V_{cont\ (H)}$, $\Delta V_{cont\ (L)}$ Note | –0.1 | 0 | 0.1 | V |

**Note** $\Delta V_{cont\ (H)} = V_{cont}1\ (H) - V_{cont}2\ (H)$

$\Delta V_{cont\ (L)} = V_{cont}1\ (L) - V_{cont}2\ (L)$

## ELECTRICAL CHARACTERISTICS

**($T_A$ = +25°C, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V, $Z_O$ = 50 Ω, DC blocking capacitors = 8 pF, unless otherwise specified)**

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Insertion Loss 1 | $L_{ins}1$ | f = 0.5 to 1.0 GHz Note 1 | – | 0.35 | 0.60 | dB |
| Insertion Loss 2 | $L_{ins}2$ | f = 1.0 to 2.0 GHz Note 1 | – | 0.40 | 0.65 | dB |
| Insertion Loss 3 | $L_{ins}3$ | f = 2.0 to 2.5 GHz | – | 0.45 | 0.70 | dB |
| Insertion Loss 4 | $L_{ins}4$ | f = 2.5 to 3.0 GHz | – | 0.50 | 0.75 | dB |
| Insertion Loss 5 | $L_{ins}5$ | f = 3.0 to 3.8 GHz | – | 0.60 | 0.85 | dB |
| Isolation 1 | ISL1 | f = 0.5 to 1.0 GHz Note 1 | 29 | 32 | – | dB |
| Isolation 2 | ISL2 | f = 1.0 to 2.0 GHz Note 1 | 25 | 28 | – | dB |
| Isolation 3 | ISL3 | f = 2.0 to 2.5 GHz | 23 | 26 | – | dB |
| Isolation 4 | ISL4 | f = 2.5 to 3.0 GHz | 20 | 23 | – | dB |
| Isolation 5 | ISL5 | f = 3.0 to 3.8 GHz | 16 | 19 | – | dB |
| Return Loss | RL | f = 0.5 to 3.8 GHz Note 1 | 15 | 20 | – | dB |
| 0.1 dB Loss Compression Input Power Note 2 | $P_{in\ (0.1\ dB)}$ | f = 2.5 GHz | – | +33.5 | – | dBm |
| 1 dB Loss Compression Input Power 1 Note 3 | $P_{in\ (1\ dB)}1$ | f = 0.5 to 3.8 GHz Note 1<br>$V_{cont}$ = 3 V | – | +35 | – | dBm |
| 1 dB Loss Compression Input Power 2 Note 3 | $P_{in\ (1\ dB)}2$ | f = 0.5 to 3.8 GHz Note 1<br>$V_{cont}$ = 5 V | – | +37 | – | dBm |
| 2nd Harmonics | $2f_0$ | f = 2.5 GHz, $P_{in}$ = +26 dBm | – | 75 | – | dBc |
| 3rd Harmonics | $3f_0$ | f = 2.5 GHz, $P_{in}$ = +26 dBm | – | 80 | – | dBc |
| Input 3rd Order Intercept Point | $IIP_3$ | f = 2.5 GHz | – | +60 | – | dBm |
| Switch Control Current | $I_{cont}$ | No RF input | – | 0.1 | 10 | μA |
| Switch Control Speed | $t_{SW}$ | 50% CTL to 90/10% RF | – | 100 | 250 | ns |

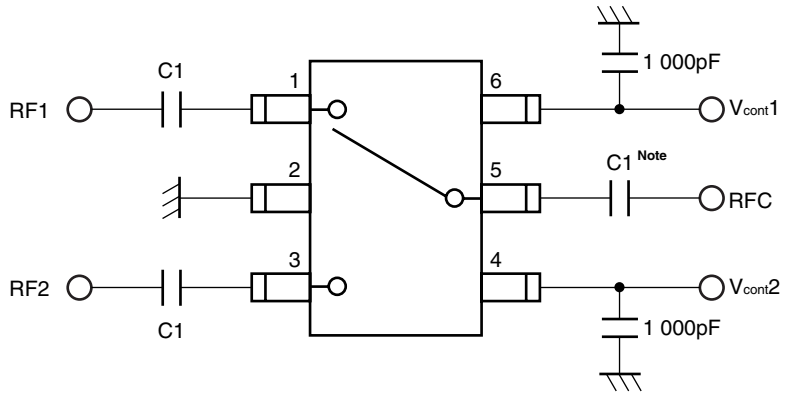
**Notes 1.** DC blocking capacitors = 56 pF at f = 0.5 to 2.0 GHz

**2.** $P_{in\ (0.1\ dB)}$ is the measured input power level when the insertion loss increases 0.1 dB more than that of the linear range.

**3.** $P_{in\ (1\ dB)}$ is the measured input power level when the insertion loss increases 1 dB more than that of the linear range.

**Caution It is necessary to use DC blocking capacitors with this device.**

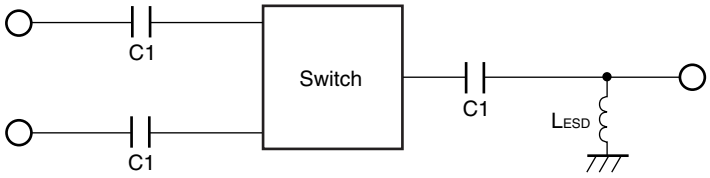
## EVALUATION CIRCUIT




**Note** C1 : 0.5 to 2.0 GHz 56 pF
: 2.0 to 3.8 GHz 8 pF

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

## APPLICATION INFORMATION

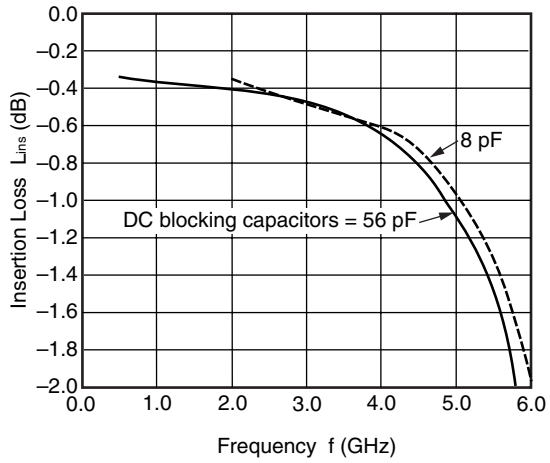



- C1 are DC blocking capacitors external to the device.
  The value may be tailored to provide specific electrical responses.
- The RF ground connections should be kept as short as possible and connected to directly to a good RF ground for best performance.
- $L_{ESD}$ provides a means to increase the ESD protection on a specific RF port, typically the port attached to the antenna.

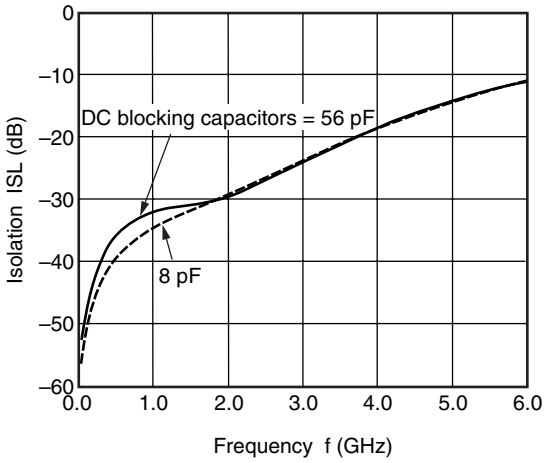
## TYPICAL CHARACTERISTICS

**($T_A$ = +25°C, $V_{cont\ (H)}$ = 2.7 to 5.3 V, $V_{cont\ (L)}$ = –0.2 to 0.2V, unless otherwise specified)**

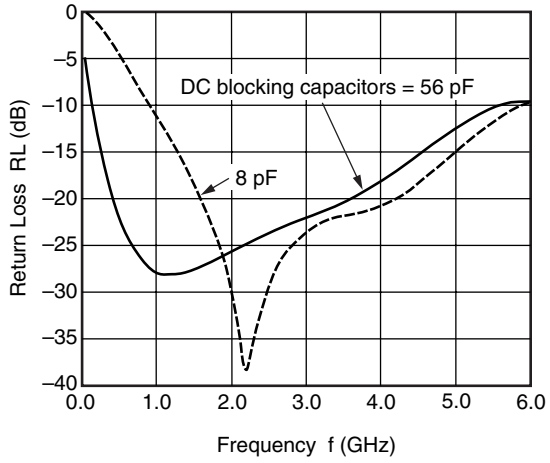
RFC-RF1/RF2
INSERTION LOSS vs. FREQUENCY



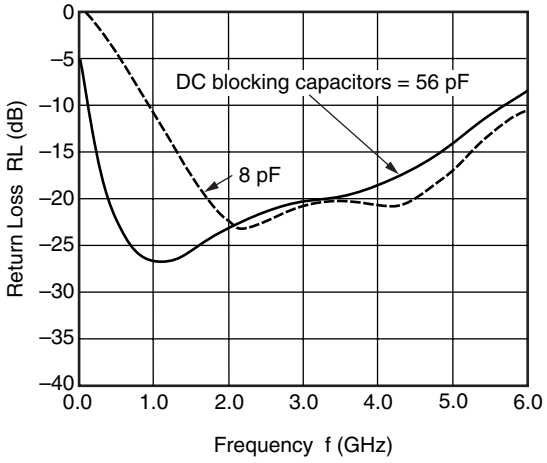

RFC-RF1/RF2
ISOLATION vs. FREQUENCY



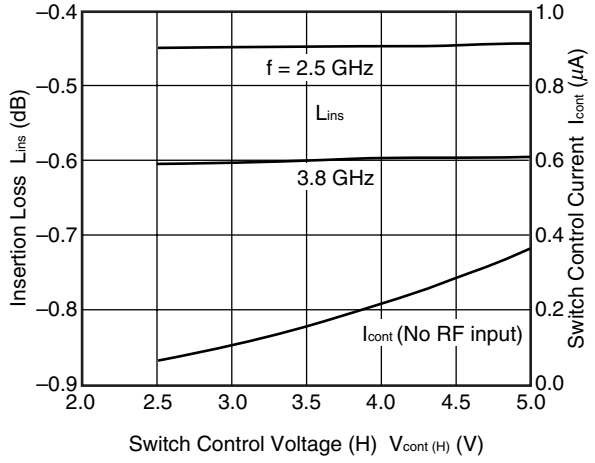

RFC RETURN LOSS vs. FREQUENCY



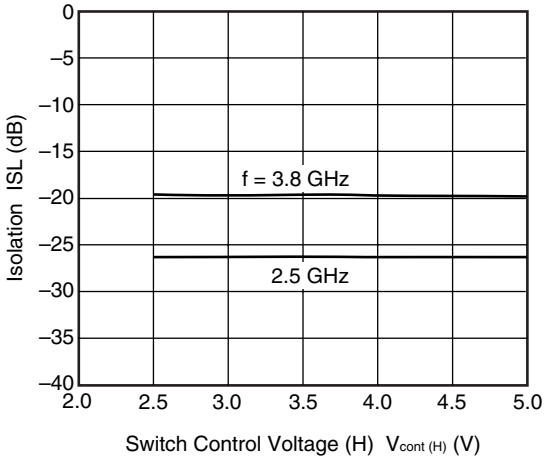

RF1/RF2 RETURN LOSS vs. FREQUENCY




RFC-RF1/RF2 INSERTION LOSS,
$I_{cont}$ vs. SWITCH CONTROL VOLTAGE (H)

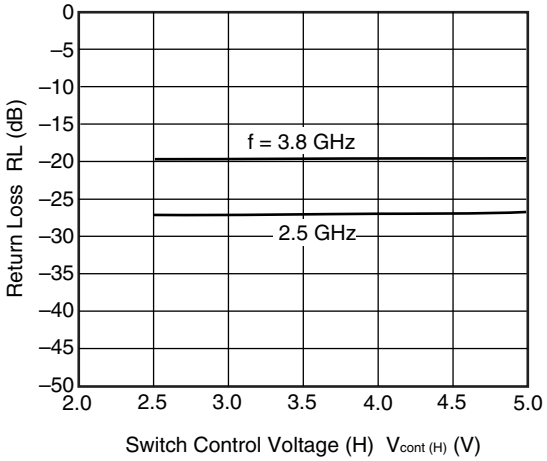



RFC-RF1/RF2 ISOLATION vs.
SWITCH CONTROL VOLTAGE (H)

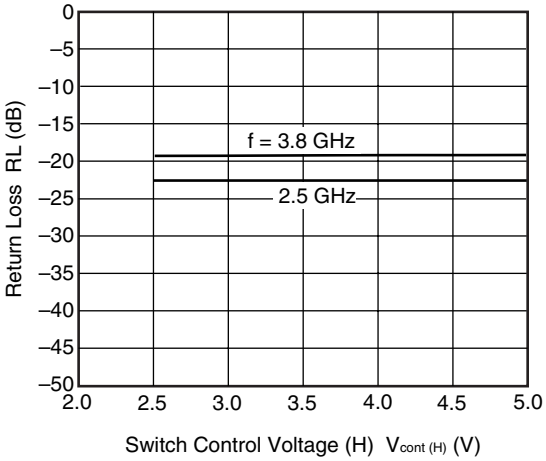



**Remark** The graphs indicate nominal characteristics.

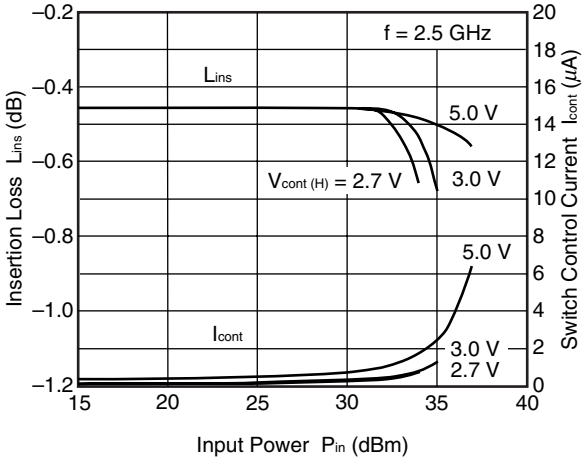
RFC RETURN LOSS vs.
SWITCH CONTROL VOLTAGE (H)



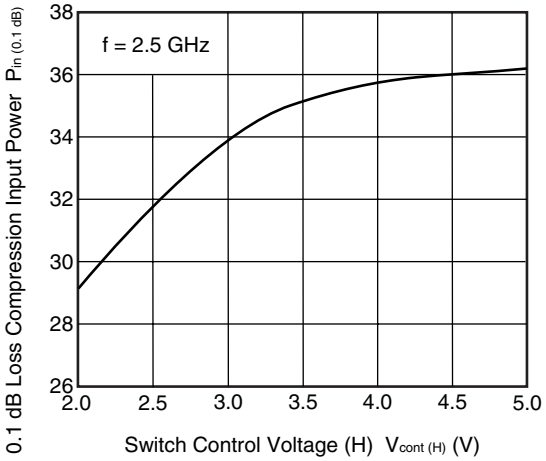

RF1/RF2 RETURN LOSS vs.
SWITCH CONTROL VOLTAGE (H)



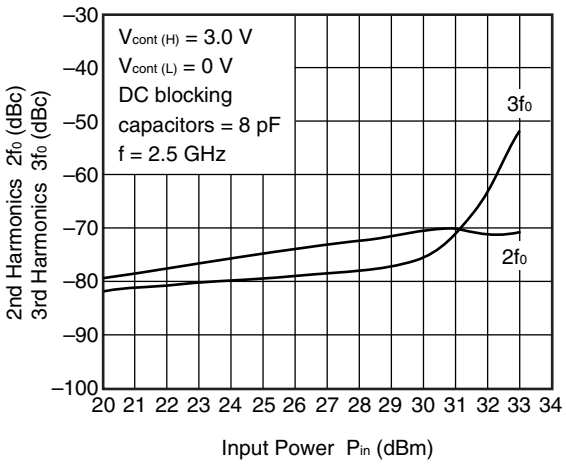

RFC-RF1/RF2 INSERTION LOSS,
Icont vs. INPUT POWER



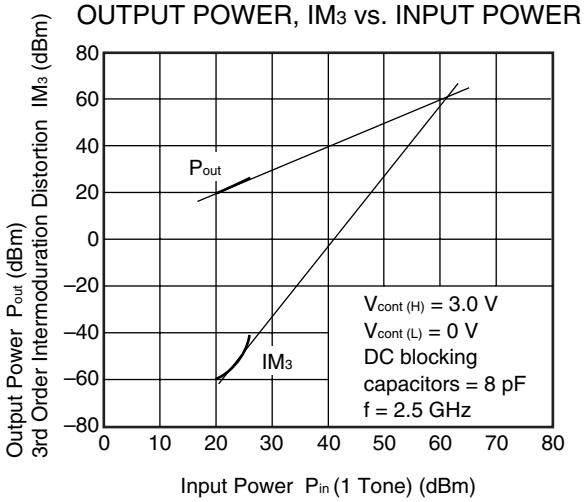

RFC-RF1/RF2 Pin (0.1 dB) vs.
SWITCH CONTROL VOLTAGE (H)




RFC-RF1/RF2
2f0, 3f0 vs. INPUT POWER



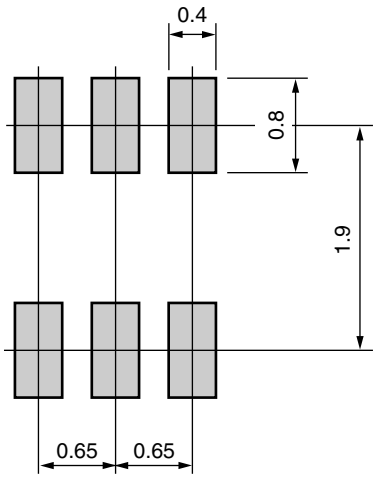

RFC-RF1/RF2
OUTPUT POWER, IM3 vs. INPUT POWER




**Remark** The graphs indicate nominal characteristics.

## MOUNTING PAD LAYOUT DIMENSIONS

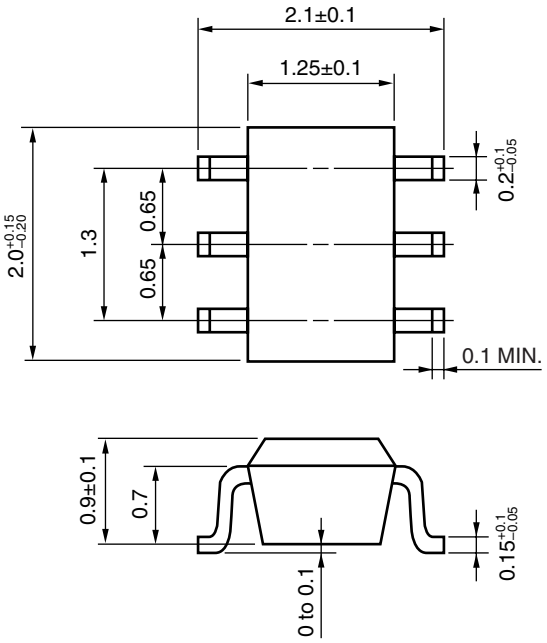
### 6-PIN SUPER MINIMOLD (SC-88/SOT-363 type) (UNIT: mm)




**Remark** The mounting pad layout in this document is for reference only.
When designing PCB, please consider workability of mounting, solder joint reliability, prevention of solder bridge and so on, in order to optimize the design.

## PACKAGE DIMENSIONS

### 6-PIN SUPER MINIMOLD (SC-88/SOT-363 type) (UNIT: mm)



## RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

| Soldering Method | Soldering Conditions | | Condition Symbol |
|---|---|---|---|
| Infrared Reflow | Peak temperature (package surface temperature)<br>Time at peak temperature<br>Time at temperature of 220°C or higher<br>Preheating time at 120 to 180°C<br>Maximum number of reflow processes<br>Maximum chlorine content of rosin flux (% mass) | : 260°C or below<br>: 10 seconds or less<br>: 60 seconds or less<br>: 120±30 seconds<br>: 3 times<br>: 0.2%(Wt.) or below | IR260 |
| Wave Soldering | Peak temperature (molten solder temperature)<br>Time at peak temperature<br>Preheating temperature (package surface temperature)<br>Maximum number of flow processes<br>Maximum chlorine content of rosin flux (% mass) | : 260°C or below<br>: 10 seconds or less<br>: 120°C or below<br>: 1 time<br>: 0.2%(Wt.) or below | WS260 |
| Partial Heating | Peak temperature (terminal temperature)<br>Soldering time (per side of device)<br>Maximum chlorine content of rosin flux (% mass) | : 350°C or below<br>: 3 seconds or less<br>: 0.2%(Wt.) or below | HS350 |

**Caution Do not use different soldering methods together (except for partial heating).**

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M8E0904E

| | |
|---|---|
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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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