



# GaAs HJ-FET INTEGRATED CIRCUIT

## $\mu$ PG2253T6S

### RF FRONT-END IC FOR Bluetooth™ CLASS 1

#### DESCRIPTION

The  $\mu$ PG2253T6S is a RF front-end integrated circuit for Bluetooth Class 1 and includes TX/Bypass switch and a power amplifier with low-pass filter. And this device has no RF matching parts.

This device realizes high efficiency and low harmonics by 3.0 V operation. This device is housed in a 16-pin plastic QFN (Quad Flat Non-leaded) (T6S) package. And this package is able to high-density surface mounting by small external parts.

#### FEATURES

- Operating frequency :  $f_{opt} = 2\ 400$  to  $2\ 500$  MHz (2 450 MHz TYP.)
- Supply voltage :  $V_{DD1, 2, 3} = 3.0$  V TYP.
- Control voltage :  $V_{en} = 3.0$  V TYP.
- Circuit current :  $I_{DD} = 95$  mA TYP. @  $P_{in} = 0$  dBm
- Output power :  $P_{out} = 19$  dBm TYP. @  $P_{in} = 0$  dBm
- High efficiency : PAE = 28% TYP. @  $P_{in} = 0$  dBm
- High-density surface mounting : 16-pin plastic QFN package (T6S) ( $3.0 \times 3.0 \times 0.75$  mm)

#### APPLICATION

- Front-end IC for Bluetooth Class 1, ZigBee™ etc.

#### ORDERING INFORMATION

| Part Number        | Order Number         | Package                            | Marking | Supplying Form   |
|--------------------|----------------------|------------------------------------|---------|--|
| $\mu$ PG2253T6S-E2 | $\mu$ PG2253T6S-E2-A | 16-pin plastic QFN (T6S) (Pb-Free) | G5Y     | <ul style="list-style-type: none"><li>• Embossed tape 8 mm wide</li><li>• Pin 10, 11, 12 face the perforation side of the tape</li><li>• Qty 3 kpcs/reel</li></ul> |

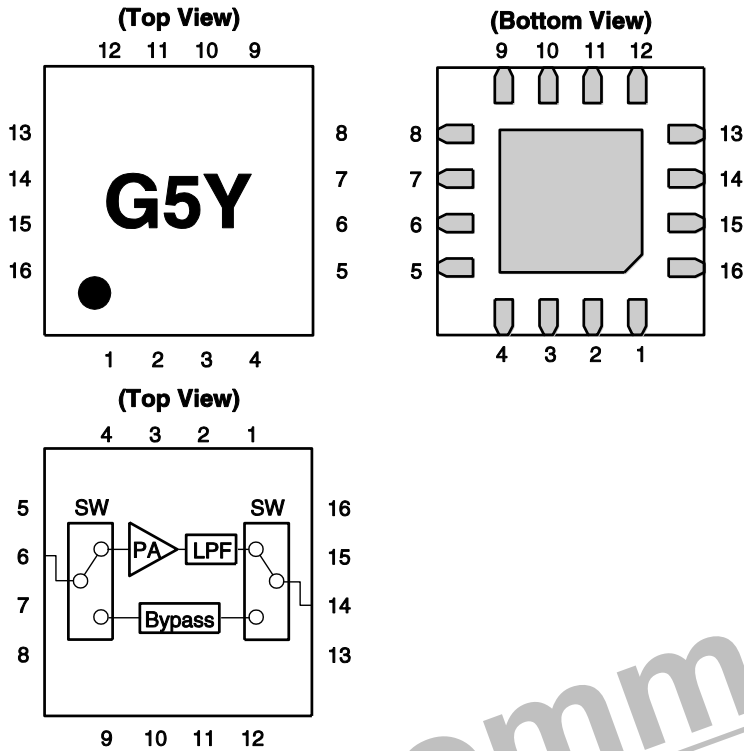
**Remark** To order evaluation samples, please contact your nearby sales office.

Part number for sample order:  $\mu$ PG2253T6S-A

**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.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



| Pin No. | Pin Name            |
|---------|---------------------|
| 1       | GND                 |
| 2       | N.C.                |
| 3       | V <sub>en</sub>     |
| 4       | N.C.                |
| 5       | N.C.                |
| 6       | RFin                |
| 7       | N.C.                |
| 8       | GND                 |
| 9       | V <sub>b1</sub>     |
| 10      | V <sub>b2</sub>     |
| 11      | V <sub>b3</sub> (1) |
| 12      | V <sub>b3</sub> (2) |
| 13      | GND                 |
| 14      | ANT                 |
| 15      | V <sub>sw1</sub>    |
| 16      | V <sub>sw2</sub>    |

Remark Exposed pad : GND

TRUTH TABLE

| V <sub>sw1</sub> | V <sub>sw2</sub> | Tx  | Path |
|------------------|------------------|-----|------|
| 3.0 V            | 0 V              | ON  | OFF  |
| 0 V              | 3.0 V            | OFF | ON   |

ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise specified)

| Parameter                     | Symbol                 | Ratings             | Unit |
|-------------------------------|------------------------|---------------------|------|
| Supply Voltage                | V <sub>DD1, 2, 3</sub> | 5.0                 | V    |
| Control Voltage               | V <sub>en</sub>        | 4.0                 | V    |
| Switching Voltage             | V <sub>SW1, 2</sub>    | 5.0                 | V    |
| Input Power                   | P <sub>in</sub>        | +5                  | dBm  |
| Power Dissipation             | P <sub>D</sub>         | 400 <sup>Note</sup> | mW   |
| Operating Ambient Temperature | T <sub>A</sub>         | -45 to +85          | °C   |
| Storage Temperature           | T <sub>stg</sub>       | -55 to +150         | °C   |

**Note** Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, T<sub>A</sub> = +85°C.

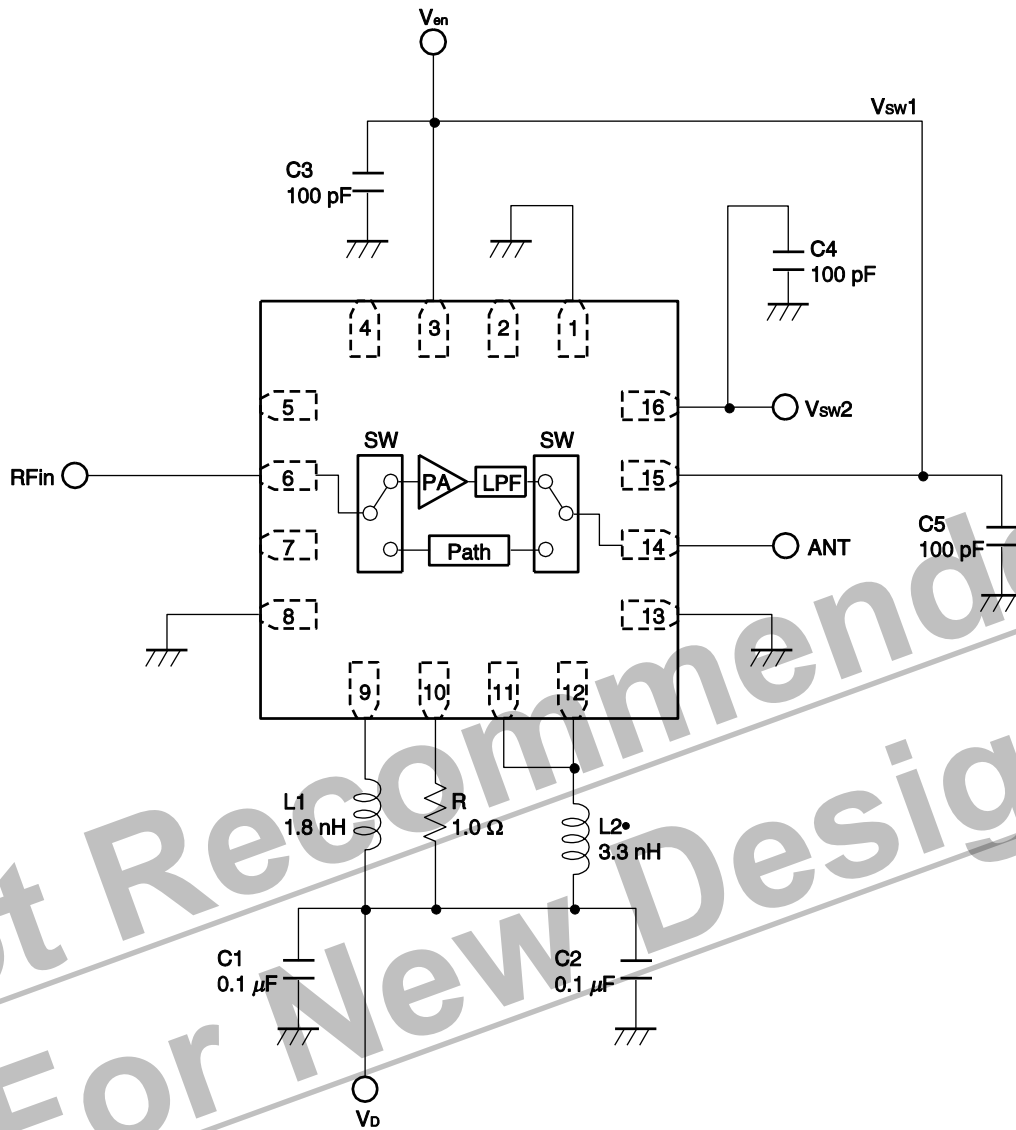
**RECOMMENDED OPERATING RANGE (TA = +25°C, unless otherwise specified)**

| Parameter                  | Symbol                 | MIN.  | TYP.  | MAX.  | Unit |
|----------------------------|------------------------|-------|-------|-------|------|
| Operating Frequency        | f <sub>opt</sub>       | 2 400 | 2 450 | 2 500 | MHz  |
| Supply Voltage             | V <sub>DD1, 2, 3</sub> | 2.7   | 3.0   | 3.6   | V    |
| Switch Control Voltage (H) | V <sub>sw1, 2</sub>    | 1.8   | 3.0   | 3.6   | V    |
| Switch Control Voltage (L) | V <sub>sw1, 2</sub>    | -0.2  | 0.0   | 0.2   | V    |
| Control Voltage (H)        | V <sub>en</sub>        | 1.5   | 3.0   | 3.6   | V    |
| Control Voltage (L)        | V <sub>en</sub>        | -     | 0     | 0.2   | V    |

**ELECTRICAL CHARACTERISTICS (TA = +25°C, V<sub>DD1, 2, 3</sub> = 3.0 V, f = 2 400 to 2 500 MHz, unless otherwise specified)**

| Parameter          | Symbol                 | Test Conditions  | MIN. | TYP. | MAX. | Unit |
|--------------------|------------------------|--|------|------|------|------|
| Circuit Current    | I <sub>DD</sub>        | P <sub>in</sub> = 0 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | 95   | 120  | mA   |
| SW Current         | I <sub>sw</sub>        | RF off, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | 10   | 40   | μA   |
| Shut Down Current  | I <sub>shut down</sub> | P <sub>in</sub> = -30 dBm, V <sub>en</sub> = 0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | 4    | 15   | μA   |
| Output Power       | P <sub>out</sub>       | P <sub>in</sub> = 0 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | 17.5 | 19   | -    | dBm  |
| Power Efficiency   | PAE                    | P <sub>in</sub> = 0 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | 28   | -    | %    |
| Input Return Loss  | RL <sub>in</sub>       | P <sub>in</sub> = -30 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V | -    | -10  | -    | dB   |
| Output Return Loss | RL <sub>out</sub>      | P <sub>in</sub> = -30 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V | -    | -8   | -    | dB   |
| 2nd Harmonics      | 2f <sub>0</sub>        | P <sub>in</sub> = 0 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | -25  | -    | dBm  |
| 3rd Harmonics      | 3f <sub>0</sub>        | P <sub>in</sub> = 0 dBm, V <sub>en</sub> = 3.0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 3.0/0 V   | -    | -40  | -    | dBm  |
| Insertion Loss     | L <sub>ins</sub>       | P <sub>in</sub> = -30 dBm, V <sub>en</sub> = 0 V, V <sub>sw1</sub> /V <sub>sw2</sub> = 0/3.0 V   | -    | 1.5  | 2.0  | dB   |

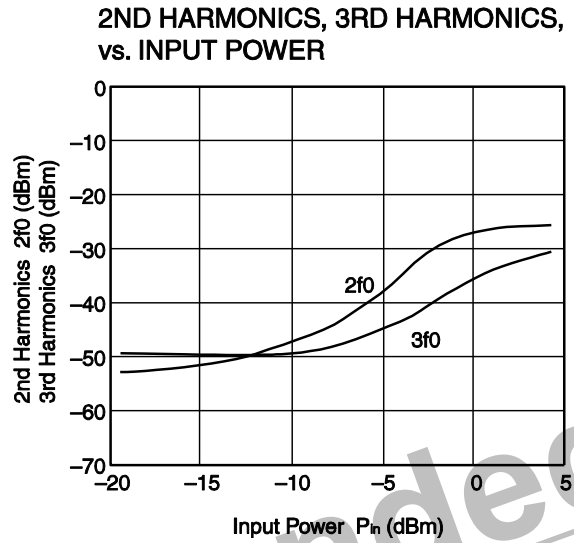
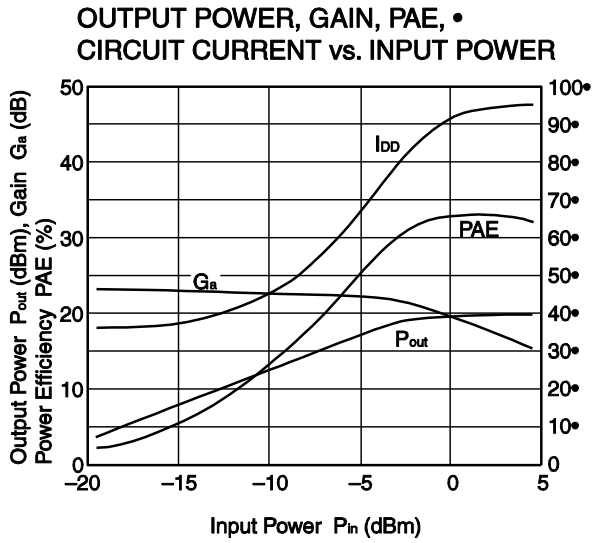
EVALUATION CIRCUIT



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

**TYPICAL CHARACTERISTICS**

( $T_A = +25^\circ\text{C}$ ,  $V_{DD1, 2, 3} = 3.0\text{ V}$ ,  $V_{en} = 3.0\text{ V}$ ,  $V_{sw1}/V_{sw 2} = 3.0\text{ V}/0\text{ V}$ ,  $f = 2.45\text{ GHz}$ , unless otherwise specified)



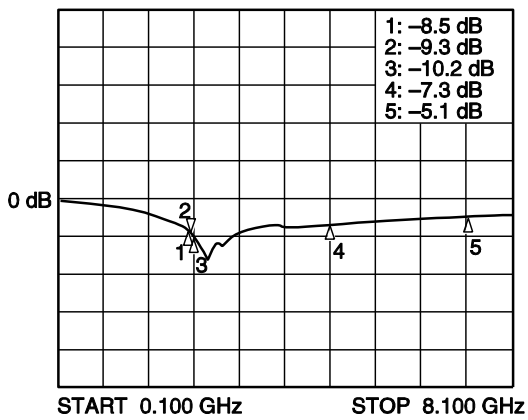
**Remark** The graphs indicate nominal characteristics.

Not Recommended  
For New Design

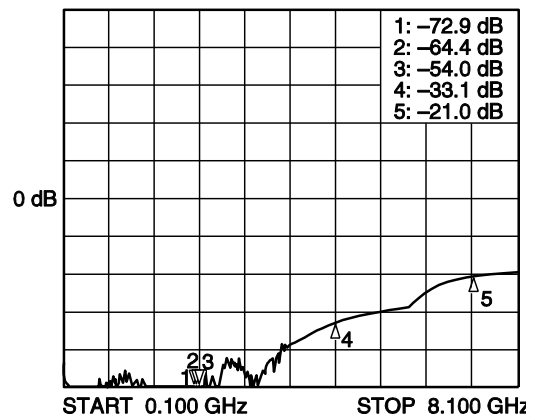
**Tx mode S-PARAMETERS**

Condition : T<sub>A</sub> = +25°C, V<sub>DD1, 2, 3</sub> = 3.0 V, V<sub>en</sub> = 3.0 V, V<sub>sw1</sub>/V<sub>sw2</sub> = 3.0 V/0 V, P<sub>in</sub> = -30 dBm

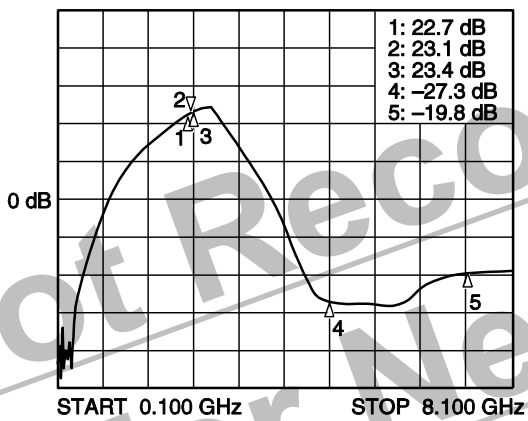
**S<sub>11</sub>-FREQUENCY**



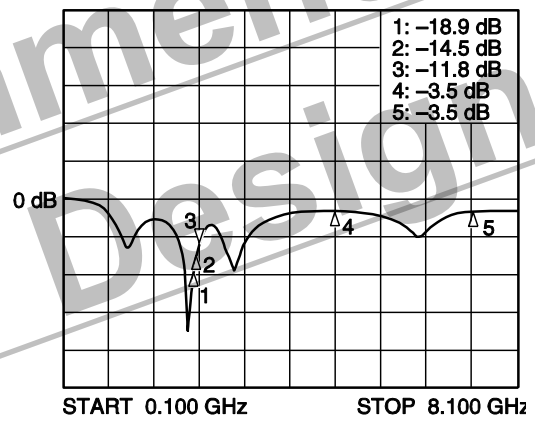
**S<sub>12</sub>-FREQUENCY**



**S<sub>21</sub>-FREQUENCY**



**S<sub>22</sub>-FREQUENCY**



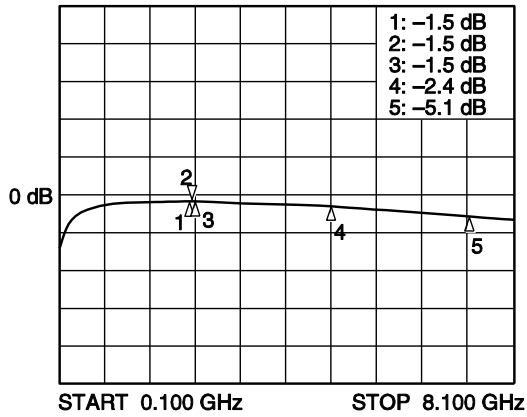
Remarks 1. The graphs indicate nominal characteristics.

- 2. Marker1 : 2.40 GHz
- Marker2 : 2.45 GHz
- Marker3 : 2.50 GHz
- Marker4 : 4.90 GHz
- Marker5 : 7.35 GHz

**Path mode S-PARAMETER**

Condition :  $T_A = +25^\circ\text{C}$ ,  $V_{DD1, 2, 3} = 3.0\text{ V}$ ,  $V_{en} = 3.0\text{ V}$ ,  $V_{sw1}/V_{sw2} = 0\text{ V}/3.0\text{ V}$ ,  $P_{in} = -30\text{ dBm}$

**S<sub>21</sub>-FREQUENCY**



**Remarks 1.** The graph indicates nominal characteristics.

- 2. Marker1 : 2.40 GHz
- Marker2 : 2.45 GHz
- Marker3 : 2.50 GHz
- Marker4 : 4.90 GHz
- Marker5 : 7.35 GHz

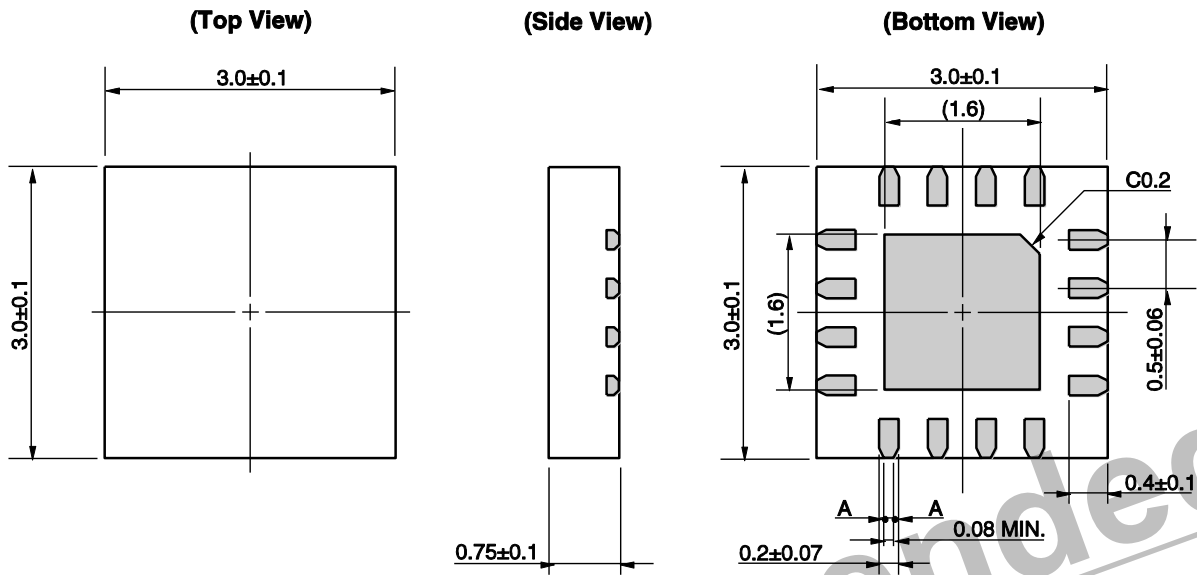
Not Recommended  
For New Design





PACKAGE DIMENSIONS

16-PIN PLASTIC QFN (T6S) (UNIT: mm)



Remark A>0  
( ) : Reference value

Not Recommended  
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**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) : 260°C or below<br>Time at peak temperature : 10 seconds or less<br>Time at temperature of 220°C or higher : 60 seconds or less<br>Preheating time at 120 to 180°C : 120±30 seconds<br>Maximum number of reflow processes : 3 times<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | IR260            |
| Partial Heating  | Peak temperature (terminal temperature) : 350°C or below<br>Soldering time (per side of device) : 3 seconds or less<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below   | HS350            |

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

*Not Recommended  
For New Design*

|                       |                      |   |
|-----------------------|----------------------|---|
| <p><b>Caution</b></p> | <p>GaAs Products</p> | <p>This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.</p> <ul style="list-style-type: none"> <li>• Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.               <ol style="list-style-type: none"> <li>1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.</li> <li>2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.</li> </ol> </li> <li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li> <li>• Do not lick the product or in any way allow it to enter the mouth.</li> </ul> |
|-----------------------|----------------------|---|

**Not Recommended  
For New Design**