

# DATA SHEET

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# NEC

## GaAs INTEGRATED CIRCUIT $\mu$ PG2408TK

### 0.05 to 3.0 GHz SPDT SWITCH

#### DESCRIPTION

The  $\mu$ PG2408TK is a GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch for 2.4 GHz wireless LAN, mobile phone and other L, S-band applications.

This device operates with dual control switching voltages of 2.5 to 5.3 V. This device can operate at frequencies from 0.05 to 3.0 GHz, with low insertion loss and high isolation.

This device is housed in a 6-pin lead-less minimold package (1511 PKG) and is suitable for high-density surface mounting.

#### FEATURES

- Switch control voltage :  $V_{\text{cont (H)}} = 3.0 \text{ V TYP.}$   
:  $V_{\text{cont (L)}} = 0 \text{ V TYP.}$
- Low insertion loss :  $L_{\text{ins}} = 0.40 \text{ dB TYP. @ } f = 1.0 \text{ GHz}$   
:  $L_{\text{ins}} = 0.50 \text{ dB TYP. @ } f = 2.5 \text{ GHz}$
- High isolation :  $ISL = 27 \text{ dB TYP. @ } f = 1.0 \text{ GHz}$   
:  $ISL = 18 \text{ dB TYP. @ } f = 2.5 \text{ GHz}$
- Handling power :  $P_{\text{in (0.1 dB)}} = +29.0 \text{ dBm TYP. @ } f = 0.5 \text{ to } 3.0 \text{ GHz}$
- High-density surface mounting : 6-pin lead-less minimold package (1.5 × 1.1 × 0.55 mm)

#### APPLICATIONS

- L, S-band digital cellular or cordless telephone
- W-LAN, WLL and Bluetooth™ etc.

#### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PG2408TK-E2	$\mu$ PG2408TK-E2-A	6-pin lead-less minimold (1511 PKG) (Pb-Free)	G5X	<ul style="list-style-type: none"><li>• Embossed tape 8 mm wide</li><li>• Pin 1, 6 face the perforation side of the tape</li><li>• Qty 5 kpcs/reel</li></ul>

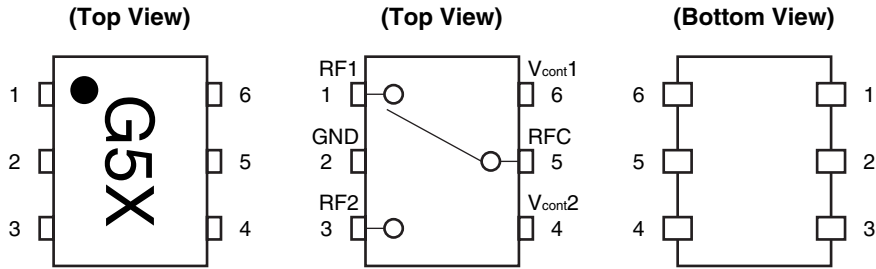
**Remark** To order evaluation samples, please contact your nearby sales office.

Part number for sample order:  $\mu$ PG2408TK

**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 <sub>cont2</sub>
5	RFC
6	V <sub>cont1</sub>

**SW TRUTH TABLE**

ON Path	V <sub>cont1</sub>	V <sub>cont2</sub>
RFC-RF1	Low	High
RFC-RF2	High	Low

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

Parameter	Symbol	Ratings	Unit
Switch Control Voltage	V <sub>cont</sub>	+6.0 <sup>Note</sup>	V
Input Power	P <sub>in</sub>	+33.0	dBm
Operating Ambient Temperature	T <sub>A</sub>	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note** |V<sub>cont1</sub> - V<sub>cont2</sub>| ≤ 6.0 V

**RECOMMENDED OPERATING RANGE (T<sub>A</sub> = +25°C, unless otherwise specified)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating Frequency	f	0.05	-	3.0	GHz
Switch Control Voltage (H)	V <sub>cont (H)</sub>	2.5	3.0	5.3	V
Switch Control Voltage (L)	V <sub>cont (L)</sub>	-0.2	0	0.2	V
Control Voltage Difference	ΔV <sub>cont (H)</sub> , ΔV <sub>cont (L)</sub> <sup>Note</sup>	-0.1	0	0.1	V

**Note** ΔV<sub>cont (H)</sub> = V<sub>cont1 (H)</sub> - V<sub>cont2 (H)</sub>

ΔV<sub>cont (L)</sub> = V<sub>cont1 (L)</sub> - V<sub>cont2 (L)</sub>

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = +25°C, V<sub>cont</sub> (H) = 3.0 V, V<sub>cont</sub> (L) = 0 V, DC blocking capacitors = 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	L <sub>ins1</sub>	f = 0.05 to 0.5 GHz <sup>Note 1</sup>	–	0.40	0.55	dB
Insertion Loss 2	L <sub>ins2</sub>	f = 0.5 to 1.0 GHz	–	0.40	0.55	dB
Insertion Loss 3	L <sub>ins3</sub>	f = 1.0 to 2.0 GHz	–	0.48	0.63	dB
Insertion Loss 4	L <sub>ins4</sub>	f = 2.0 to 2.5 GHz	–	0.50	0.65	dB
Insertion Loss 5	L <sub>ins5</sub>	f = 2.5 to 3.0 GHz	–	0.56	0.70	dB
Isolation 1	ISL1	f = 0.05 to 0.5 GHz <sup>Note 1</sup>	24	27	–	dB
Isolation 2	ISL2	f = 0.5 to 1.0 GHz	24	27	–	dB
Isolation 3	ISL3	f = 1.0 to 2.0 GHz	16	19	–	dB
Isolation 4	ISL4	f = 2.0 to 2.5 GHz	15	18	–	dB
Isolation 5	ISL5	f = 2.5 to 3.0 GHz	14	17	–	dB
Input Return Loss 1	RL <sub>in1</sub>	f = 0.05 to 0.5 GHz <sup>Note 1</sup>	15	20	–	dB
Input Return Loss 2	RL <sub>in2</sub>	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss 1	RL <sub>out1</sub>	f = 0.05 to 0.5 GHz <sup>Note 1</sup>	15	20	–	dB
Output Return Loss 2	RL <sub>out2</sub>	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression	P <sub>in (0.1 dB)</sub>	f = 2.0/2.5 GHz	+27.0	+29.0	–	dBm
Input Power <sup>Note 2</sup>		f = 0.5 to 3.0 GHz	–	+29.0	–	dBm
Input 3rd Order Intercept Point	IIP <sub>3</sub>	f = 0.5 to 3.0 GHz, 2 tone, 5 MHz spicing	–	+60	–	dBm
Switch Control Current	I <sub>cont</sub>	No RF input	–	0.3	20	μA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10% RF	–	50	500	ns

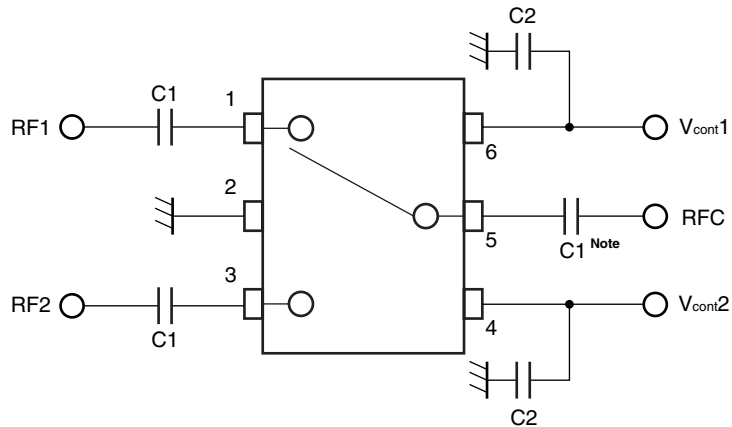
**Notes 1.** DC blocking capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

**2.** P<sub>in (0.1 dB)</sub> is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range.

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

The value of DC blocking capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC blocking capacitor value is less than 100 pF for frequencies above 0.5 GHz, and 1 000pF for frequencies above 0.5 GHz.

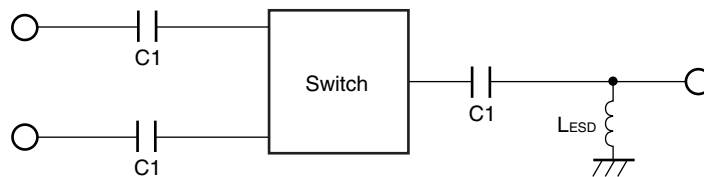
EVALUATION CIRCUIT



**Note** C1 : 0.05 to 0.5 GHz 1 000 pF  
 : 0.5 to 3.0 GHz 56 pF  
 C2 : 1 000 pF

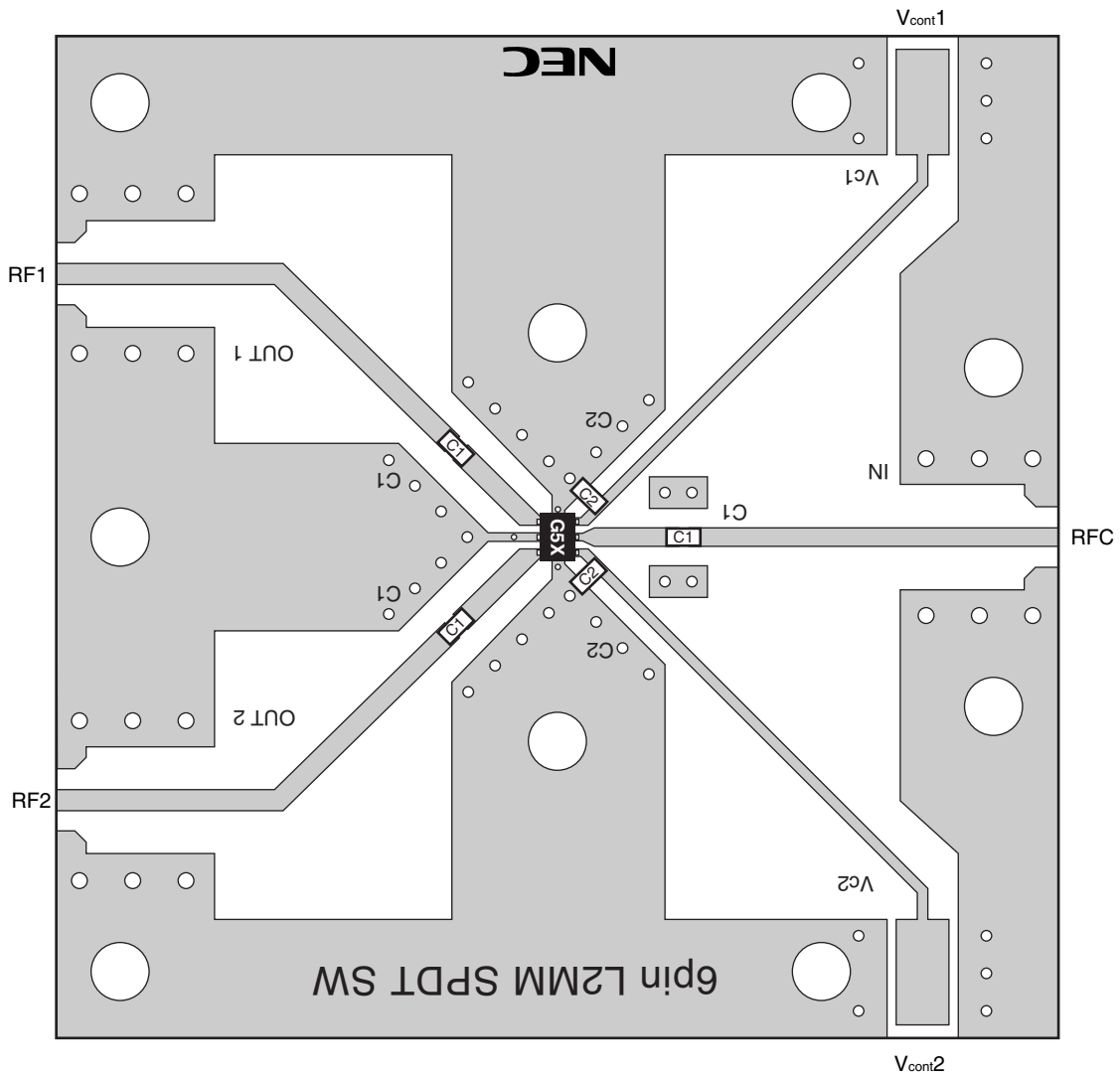
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

APPLICATION INFORMATION



- L<sub>ESD</sub> provides a means to increase the ESD protection on a specific RF port, typically the port attached to the antenna.
- 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.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

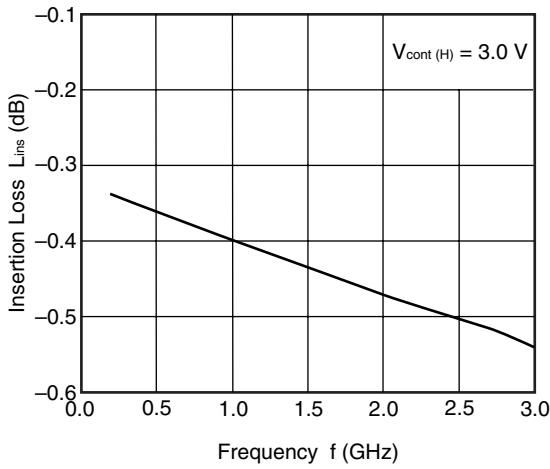


USING THE NEC EVALUATION BOARD

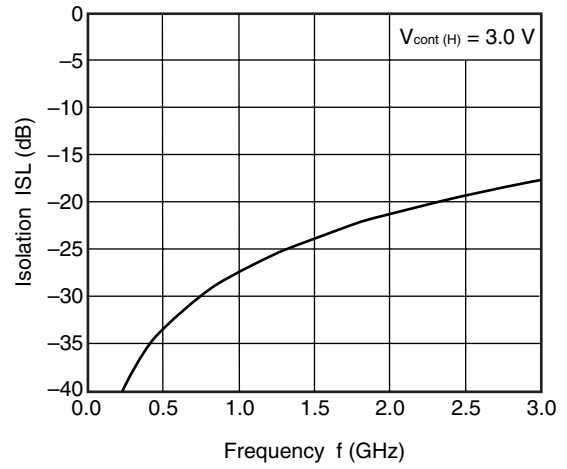
Symbol	Test Conditions	Values
C1	f = 0.05 to 0.5 GHz	1 000 pF
	f = 0.5 to 3.0 GHz	56 pF
C2		1 000 pF

**TYPICAL CHARACTERISTICS (TA = +25°C, DC blocking capacitors = 56 pF, unless otherwise specified)**

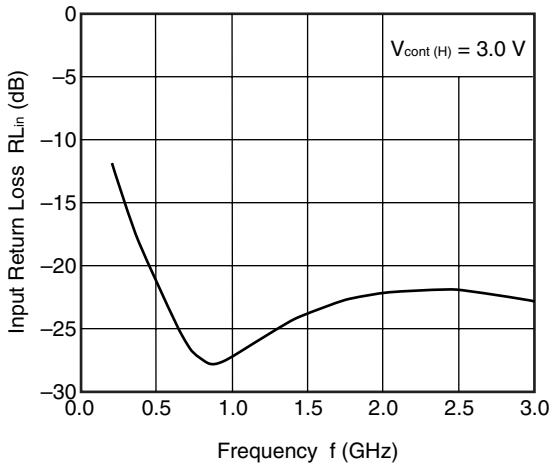
RFC-RF1/RF2  
INSERTION LOSS vs. FREQUENCY



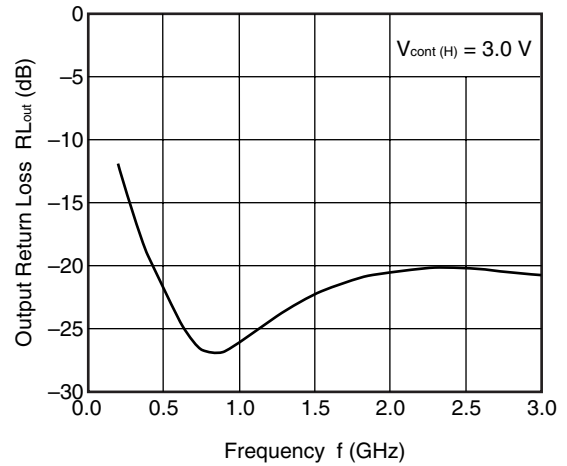
RFC-RF1/RF2  
ISOLATION vs. FREQUENCY



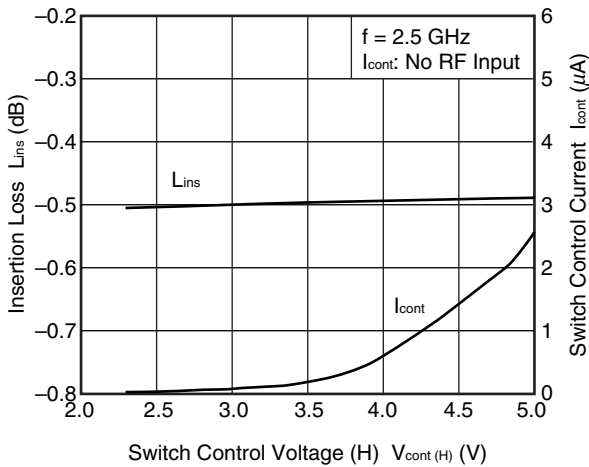
RFC-RF1/RF2  
INPUT RETURN LOSS vs. FREQUENCY



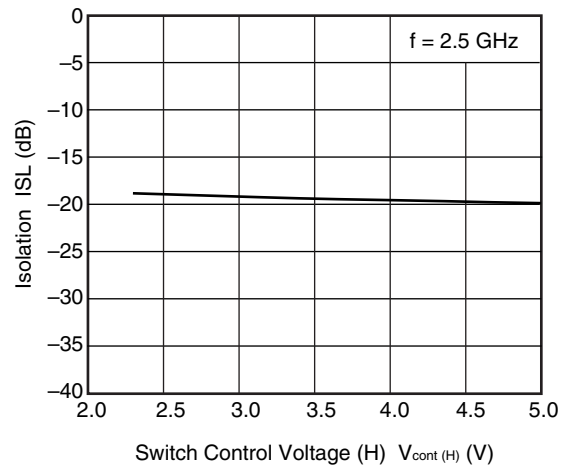
RFC-RF1/RF2  
OUTPUT RETURN LOSS vs. FREQUENCY



RFC-RF1/RF2 INSERTION LOSS,  
I<sub>cont</sub> vs. SWITCH CONTROL VOLTAGE (H)

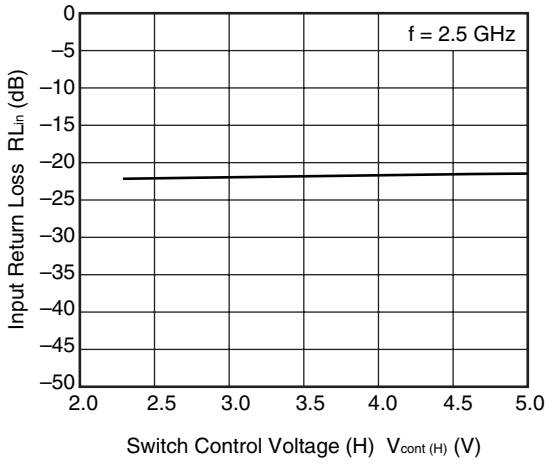


RFC-RF1/RF2 ISOLATION vs.  
SWITCH CONTROL VOLTAGE (H)

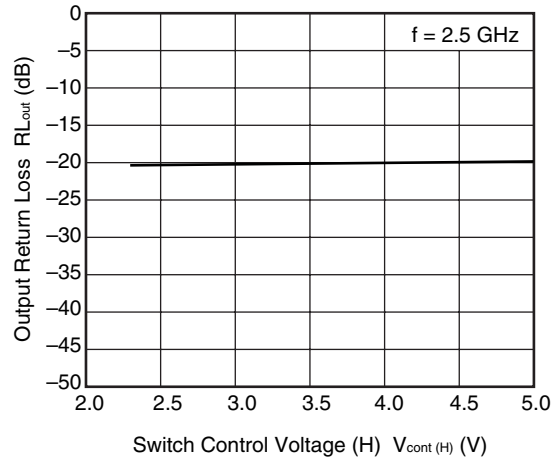


**Remark** The graphs indicate nominal characteristics.

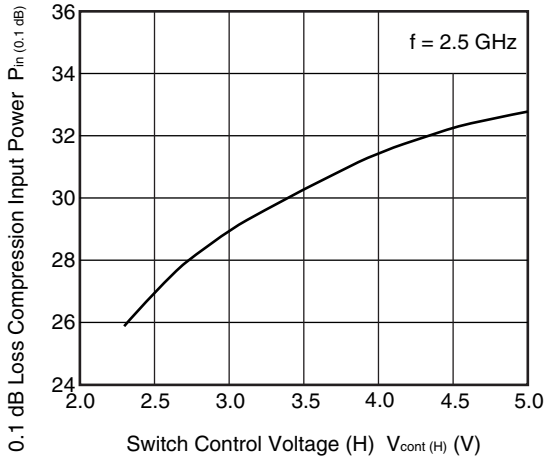
RFC-RF1/RF2 INPUT RETURN LOSS vs. SWITCH CONTROL VOLTAGE (H)



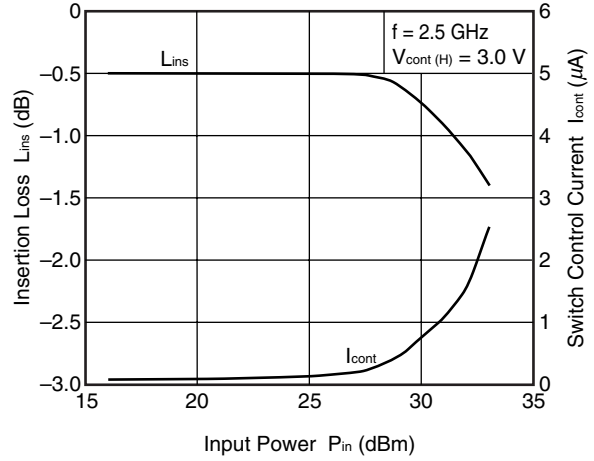
RFC-RF1/RF2 OUTPUT RETURN LOSS vs. SWITCH CONTROL VOLTAGE (H)



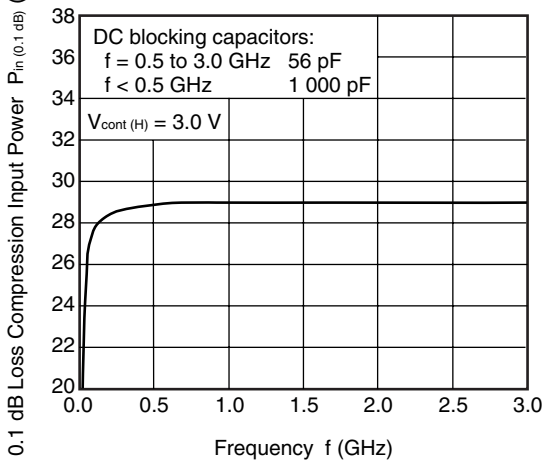
RFC-RF1/RF2 P\_in (0.1 dB) vs. SWITCH CONTROL VOLTAGE (H)



RFC-RF1/RF2 INSERTION LOSS, I\_cont vs. INPUT POWER



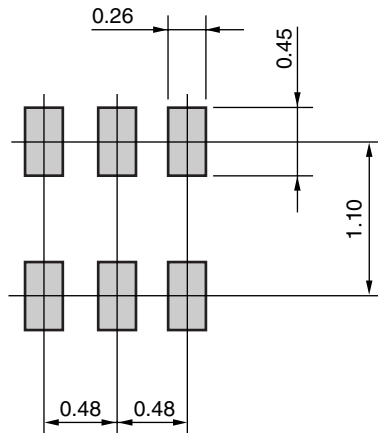
RFC-RF1/RF2 P\_in (0.1 dB) vs. FREQUENCY



**Remark** The graphs indicate nominal characteristics.

**MOUNTING PAD LAYOUT DIMENSIONS**

**6-PIN LEAD-LESS MINIMOLD (1511 PKG) (UNIT: mm)**

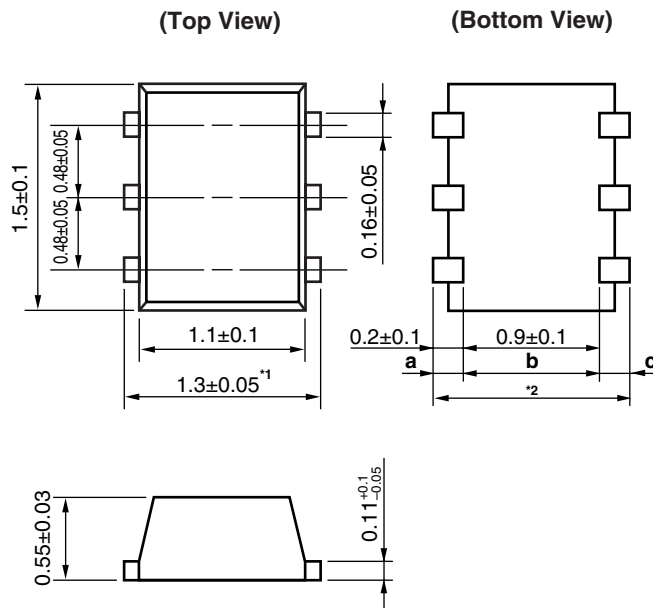


**Remark** The mounting pad layout in this document is for reference only.  
 When designing PCB, please consider workability of mounting, solder joint reliability, prevention of solder bridge and so on, in order to optimize the design.



PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (1511 PKG) (UNIT: mm)



**Remark** Dimension <sup>1</sup> is bigger than dimension <sup>2</sup> (dimension <sup>2</sup> = *a* + *b* + *c*).

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

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M8E0904E

<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>
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