

GaAs MMIC SPDT HIGH POWER SWITCH FROM 4.8 TO 5.85 GHz

DESCRIPTION

The μ PG2022T5G is a GaAs FET MMIC SPDT (Single Pole Double Throw) high power switch. The device can operate from 4.8 to 5.85 GHz, having the low insertion loss. It housed in a 6-pin plastic SON package.

FEATURES

- Operating frequency : $f = 4.8$ to 5.85 GHz
- Low insertion loss : $L_{INS} = 0.8$ dB TYP. @ $f = 4.9$ GHz
: $L_{INS} = 0.7$ dB TYP. @ $f = 5.2$ GHz
: $L_{INS} = 0.8$ dB TYP. @ $f = 5.8$ GHz
- Handling power : $P_{in(0.1\text{ dB})} = +31$ dBm TYP. @ $f = 4.8$ to 5.85 GHz
- Control voltage : $V_{cont} = +2.8$ V/0 V
- High isolation : $ISL1$ (between OUTPUT1 and OUTPUT2) = 22 dB TYP. @ $f = 5.2$ GHz
: $ISL2$ (between INPUT and OUTPUT) = 23 dB TYP. @ $f = 5.2$ GHz
- Input/output return loss : $RL_{in}/RL_{out} = 10$ dB MIN. @ $f = 4.8$ to 5.85 GHz
- Switch control speed : 20 ns @ t_{RISE}/t_{FALL} (10/90% RF)
- 6-pin plastic SON package ($2.0 \times 3.0 \times 0.75$ mm)

APPLICATION

- 5 GHz band wireless LAN

★ ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μ PG2022T5G-E1	μ PG2022T5G-E1-A	6-pin plastic SON (Pb-Free)	G4H	<ul style="list-style-type: none"> • Embossed tape 8 mm wide • Pin 1 indicates pull-out direction of tape • Qty 3 kpcs/reel

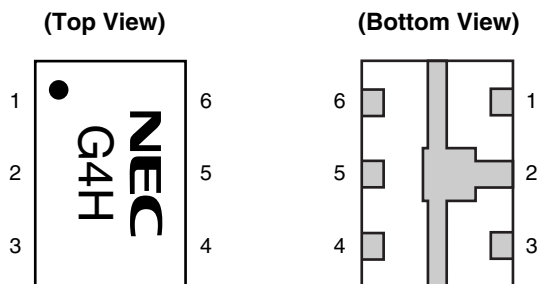
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PG2022T5G

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

PIN CONNECTIONS



Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	$V_{\text{cont}2}$
5	INPUT
6	$V_{\text{cont}1}$

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Switch Control Voltage	$V_{\text{cont}1, 2}$	-6.0 to $+6.0$ ^{Note}	V
Input Power	P_{in}	+36	dBm
Operating Ambient Temperature	T_A	-45 to $+85$	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to $+150$	$^\circ\text{C}$

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

RECOMMENDED OPERATING RANGE ($T_A = +25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	$V_{\text{cont} (H)}$	2.7	2.8	3.3	V
Switch Control Voltage (L)	$V_{\text{cont} (L)}$	-0.2	0	0.2	V
Operating Frequency	f	4.8	—	5.85	GHz
Operating Ambient Temperature	T_A	-40	+25	+85	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{cont} = 2.8 V/0 V, Z_o = 50 Ω , DC block capacitor = 27 pF, each port, unless otherwise specified)

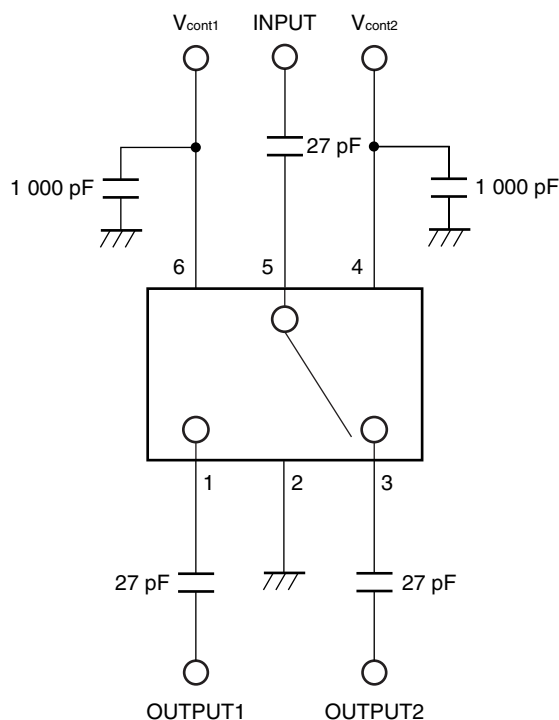
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	L _{INS}	f = 4.9 GHz	–	0.8	1.1	dB
		f = 5.2 GHz	–	0.7	1.1	dB
		f = 5.8 GHz	–	0.8	1.1	dB
Isolation 1 (between OUTPUT1 and OUTPUT2)	ISL1	f = 4.9 GHz	13	18	–	dB
		f = 5.2 GHz	15	22	–	dB
		f = 5.8 GHz	15	20	–	dB
Input Return Loss	RL _{in}	f = 4.9 GHz	10	22	–	dB
		f = 5.2 GHz	10	29	–	dB
		f = 5.8 GHz	10	19	–	dB
Output Return Loss	RL _{out}	f = 4.9 GHz	10	21	–	dB
		f = 5.2 GHz	10	29	–	dB
		f = 5.8 GHz	10	20	–	dB
0.1 dB Gain Compression Input Power	P _{in} (0.1 dB)	f = 4.8 to 5.85 GHz	30	31	–	dBm
Switch Control Speed	t _{sw}	t _{RISE} /t _{FALL} (10/90% RF)	–	20	–	ns
Switch Control Current	I _{cont}		–	0.5	1	μ A

STANDARD CHARACTERISTICS FOR REFERENCE

(T_A = +25°C, V_{cont} = 2.8 V/0 V, Z_o = 50 Ω , DC block capacitor = 27 pF, each port, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Isolation 2 (between INPUT and OUTPUT)	ISL2	f = 4.9 GHz	–	18	–	dB
		f = 5.2 GHz	–	23	–	dB
		f = 5.8 GHz	–	21	–	dB

EVALUATION CIRCUIT



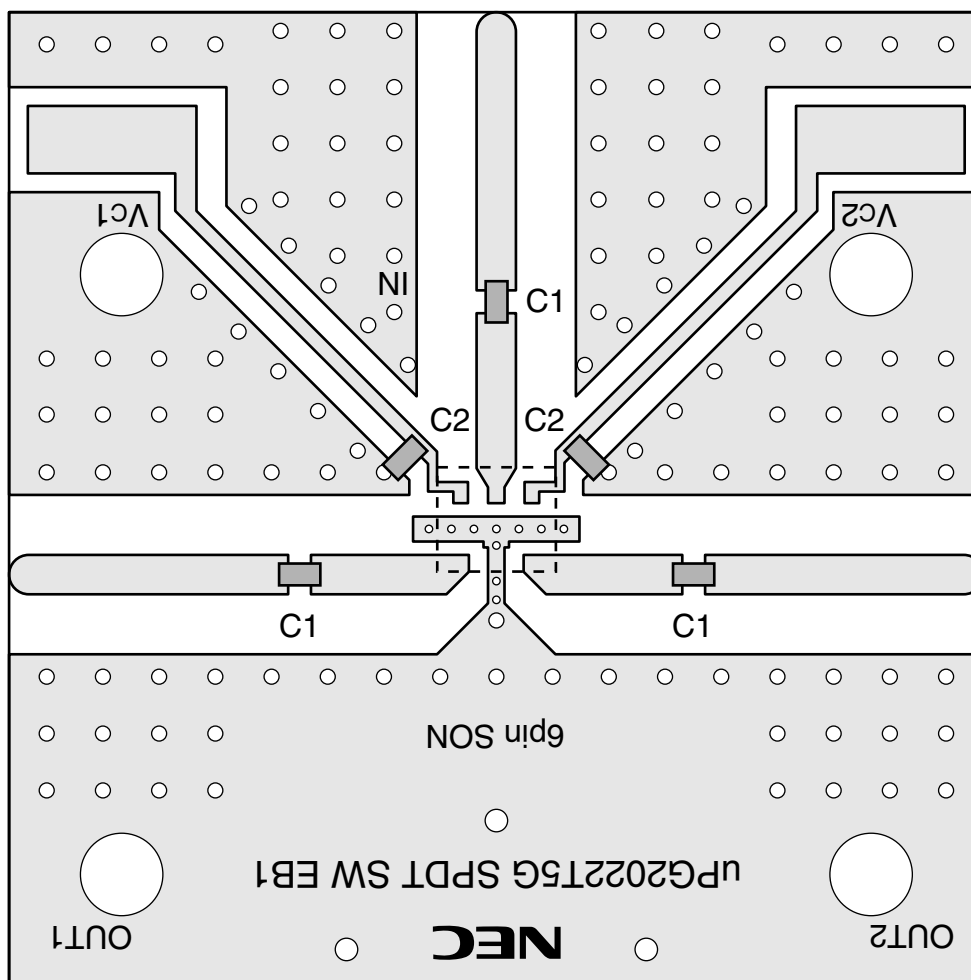
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

TRUTH TABLE OF SWITCHING BY CONDITION OF CONTROL VOLTAGE

		V _{cont1}	
		V _{cont} (H)	V _{cont} (L)
V _{cont2}	V _{cont} (H)	Note INPUT —●— ●— OUTPUT1 ●— OUTPUT2	INPUT —●— ●— OUTPUT1 ●— OUTPUT2
	V _{cont} (L)	INPUT —●— ●— OUTPUT1 ●— OUTPUT2	Note INPUT —●— ●— OUTPUT1 ●— OUTPUT2

Note In case of V_{cont1} = V_{cont2} = High or V_{cont1} = V_{cont2} = Low, (that is same control voltage for both pins), input signal of INPUT (Pin 5) is output from OUTPUT1 (Pin 1) and OUTPUT2 (Pin 3).

★ ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

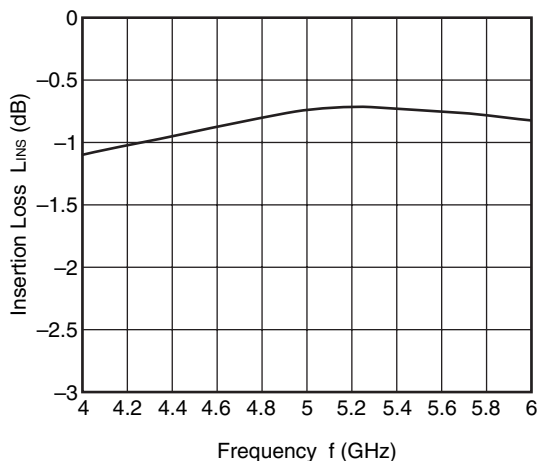


USING THE NEC EVALUATION BOARD

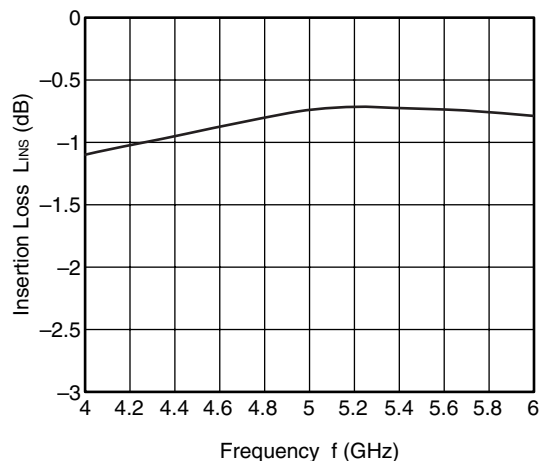
Symbol	Form	Rating	Part Number	Manufacturer
C1	Chip Capacitor	27 pF	GRM36CH270K50	muRata
C2	Chip Capacitor	1 000 pF	GRM36B102K50	muRata
—	PC Terminal	—	A2-2PA-2.54DSA	Hirose
—	RF Connector	—	142-0721-821	Johnson
—	PWB	—	RO4003 (t = 0.51 mm)	Rogers

- ★ **TYPICAL CHARACTERISTICS** ($T_A = +25^\circ\text{C}$, $V_{\text{cont}} = 2.8 \text{ V/O V}$, $Z_0 = 50 \Omega$, DC block capacitor = 27 pF using test fixture, unless otherwise specified)

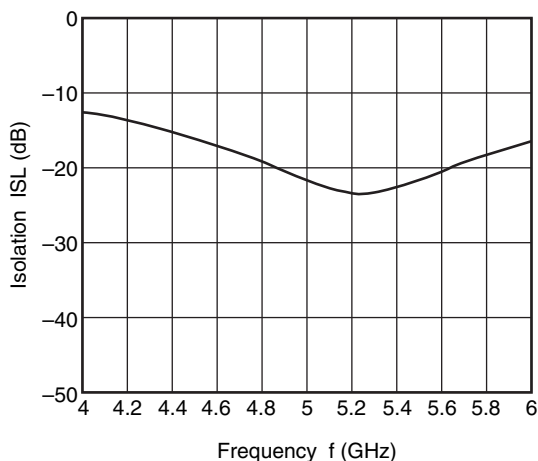
INPUT-OUTPUT1 INSERTION LOSS vs. FREQUENCY
(When INPUT-OUTPUT1 is ON)



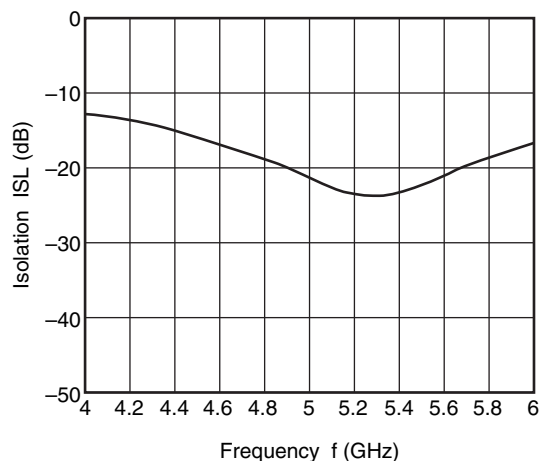
INPUT-OUTPUT2 INSERTION LOSS vs. FREQUENCY
(When INPUT-OUTPUT2 is ON)



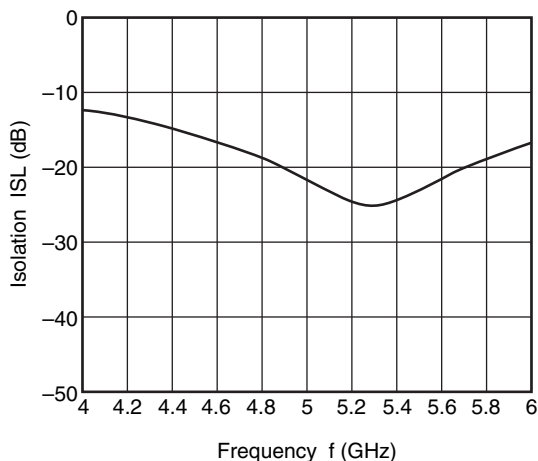
OUTPUT1-OUTPUT2 ISOLATION vs. FREQUENCY
(When INPUT-OUTPUT1 is ON)



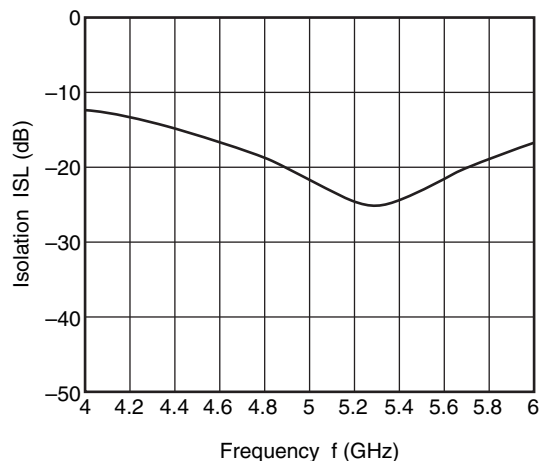
OUTPUT1-OUTPUT2 ISOLATION vs. FREQUENCY
(When INPUT-OUTPUT2 is ON)



INPUT-OUTPUT2 ISOLATION vs. FREQUENCY
(When INPUT-OUTPUT1 is ON)

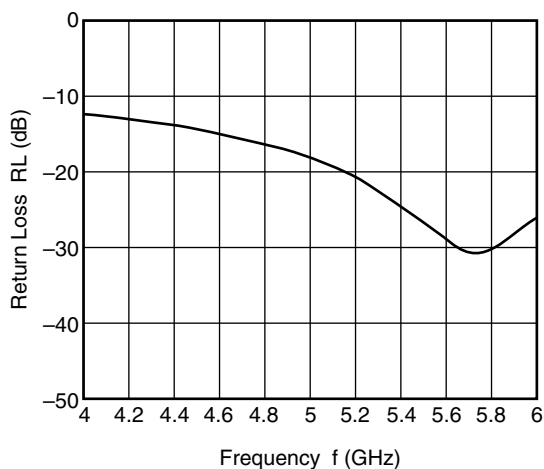


INPUT-OUTPUT1 ISOLATION vs. FREQUENCY
(When INPUT-OUTPUT2 is ON)

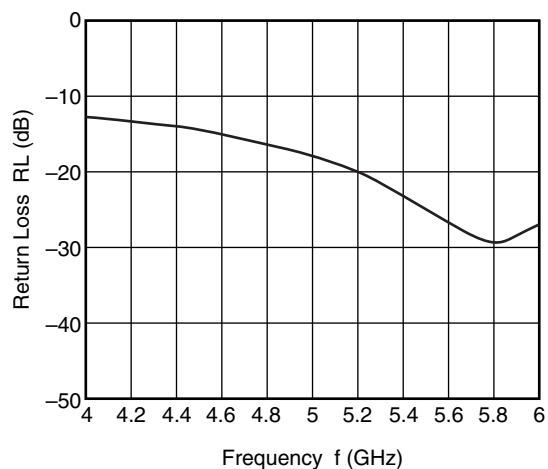


Remark The graphs indicate nominal characteristics.

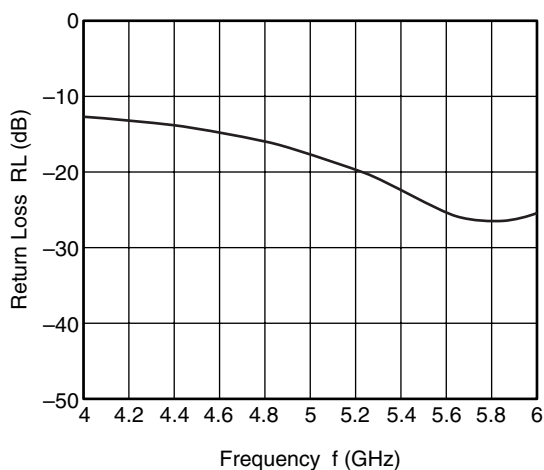
INPUT RETURN LOSS vs. FREQUENCY
(When INPUT-OUTPUT1 is ON)



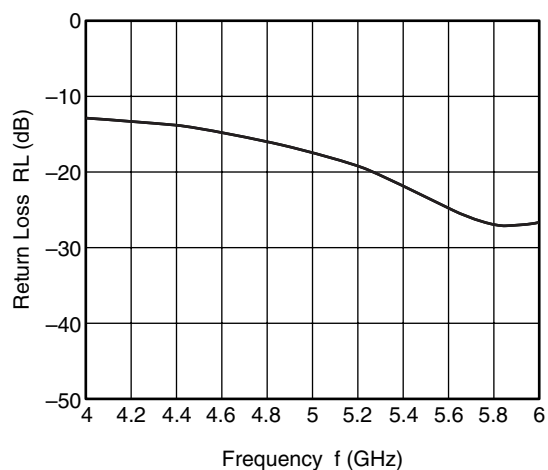
INPUT RETURN LOSS vs. FREQUENCY
(When INPUT-OUTPUT2 is ON)



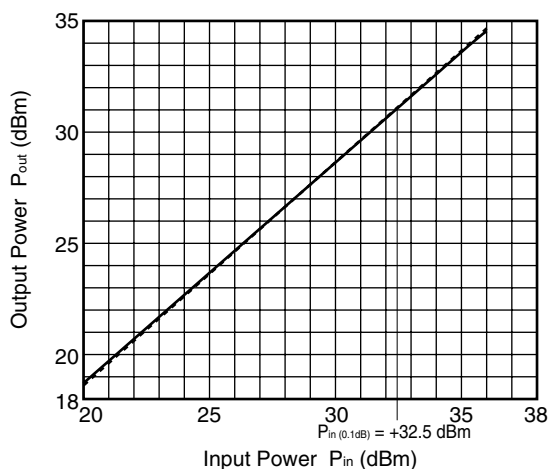
OUTPUT1 RETURN LOSS vs. FREQUENCY
(When INPUT-OUTPUT1 is ON)



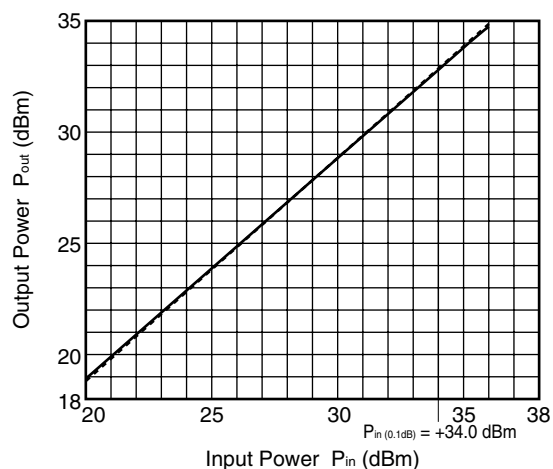
OUTPUT2 RETURN LOSS vs. FREQUENCY
(When INPUT-OUTPUT2 is ON)



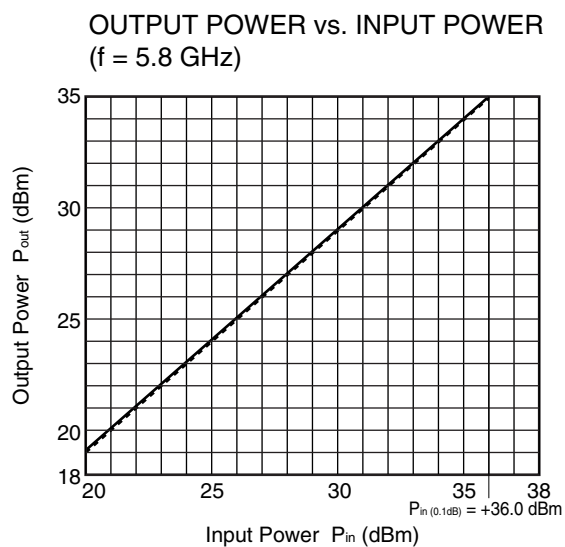
OUTPUT POWER vs. INPUT POWER
(f = 4.9 GHz)



OUTPUT POWER vs. INPUT POWER
(f = 5.2 GHz)



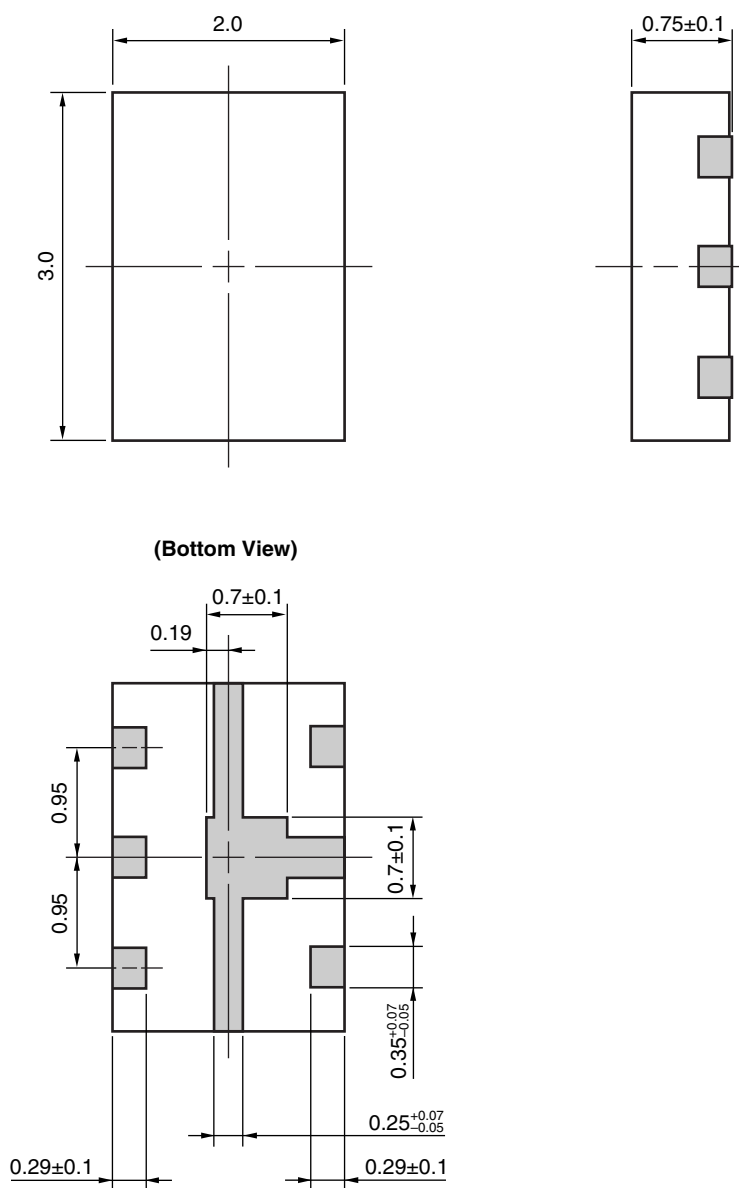
Remark The graphs indicate nominal characteristics.



Remark The graph indicates nominal characteristics.

PACKAGE DIMENSIONS

6-PIN PLASTIC SON (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) : 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).

When the product(s) listed in this document is subject to any applicable import or export control laws and regulation of the authority having competent jurisdiction, such product(s) shall not be imported or exported without obtaining the import or export license.

- **The information in this document is current as of May, 2005. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
 "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
 The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
 (Note)
 (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
 (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

Caution	GaAs Products	<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"> • 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"> 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. 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. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.
----------------	---------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

► For further information, please contact

NEC Compound Semiconductor Devices, Ltd. <http://www.ncsd.necel.com/>

E-mail: salesinfo@ml.ncsd.necel.com (sales and general)

techinfo@ml.ncsd.necel.com (technical)

Sales Division TEL: +81-44-435-1573 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited

E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH <http://www.ee.nec.de/>

TEL: +49-211-6503-0 FAX: +49-211-6503-1327

California Eastern Laboratories, Inc. <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279