NEC

GaAs INTEGRATED CIRCUIT

μPG2009TB

L-BAND HIGH POWER SPDT SWITCH

DESCRIPTION

The μPG2009TB is an L-band SPDT (Single Pole Double Throw) GaAs FET switch which was developed for digital cellular or cordless telephone application. The device can operate from 500 MHz to 2.5 GHz, having the low insertion loss and high isolation by 2.8 V control voltage.

FEATURES

- Low insertion loss : L_{INS} = 0.25 dB TYP. @ $V_{cont1/2}$ = 2.8 V/0 V, f = 1.0 GHz
  L_{INS} = 0.30 dB TYP. @ $V_{cont1/2}$ = 2.8 V/0 V, f = 2.0 GHz
- High isolation : ISL = 28 dB TYP. @ $V_{cont1/2}$ = 2.8 V/0 V, f = 2.0 GHz
- High power : $P_{in\ (0.1dB)}$ = 34 dBm TYP. @ $V_{cont1/2}$ = 2.8 V/0 V, f = 1.0 GHz
- 6-pin super minimold package (2.0 × 1.25 × 0.9 mm)

APPLICATION

- L-band digital cellular or cordless telephone
- Buletooth™, W-LAN and WLL applications

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μPG2009TB-E3	6-pin super minimold	G2U	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2009TB

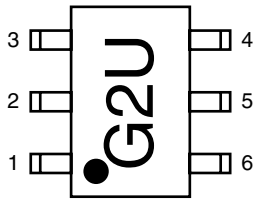
Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

Document No. PG10191EJ02V0DS (2nd edition)
Date Published July 2004 CP(K)
Printed in Japan

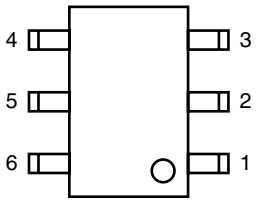
The mark ★ shows major revised points.

★ PIN CONNECTIONS

(Top View)



(Bottom View)



Pin No.	Pin Name
1	OUT1
2	GND
3	OUT2
4	V_{cont2}
5	IN
6	V_{cont1}

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

Parameter	Symbol	Ratings	Unit
Control Voltage 1, 2	$V_{cont1, 2}$	−6.0 to +6.0 Note	V
Input Power	P_{in}	+36	dBm
Total Power Dissipation	P_{tot}	0.15	W
Operating Ambient Temperature	T_A	−45 to +85	°C
Storage Temperature	T_{stg}	−55 to +150	°C

Note $|V_{cont1}-V_{cont2}| \leq 6.0$ V

RECOMMENDED OPERATING RENGE (T_A = +25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Control Voltage (High)	$V_{cont(H)}$	+2.7	+2.8	+3.0	V
Control Voltage (Low)	$V_{cont(L)}$	−0.2	0	+0.2	V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{cont1} = 2.8 V, V_{cont2} = 0 V or V_{cont1} = 0 V, V_{cont2} = 2.8 V, Z_O = 50 Ω, Off chip DC blocking capacitors value; 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	L_{INS}	f = 0.5 to 1.0 GHz	–	0.25	0.45	dB
		f = 2.0 GHz	–	0.30	0.50	dB
		f = 2.5 GHz	–	0.40	–	dB
Isolation	ISL	f = 0.5 to 2.0 GHz	24	28	–	dB
		f = 2.5 GHz	–	25	–	dB
Input Return Loss	RL_{in}	f = 0.5 to 2.5 GHz	15	20	–	dB
Output Return Loss	RL_{out}	f = 0.5 to 2.5 GHz	15	20	–	dB
Input Power at 0.1 dB Compression Point [Note]	$P_{in(0.1\ dB)}$	f = 1.0 GHz, V_{cont} = 2.8 V/0 V	32.5	34	–	dBm
2nd Harmonics	2f0	f = 1.0 GHz, V_{cont} = 2.8 V/0 V, P_{in} = 30.5 dBm	65	75	–	dBc
3rd Harmonics	3f0	f = 1.0 GHz, V_{cont} = 2.8 V/0 V, P_{in} = 30.5 dBm	65	75	–	dBc
Switching Speed	t_{SW}		–	150	–	ns
Control Current	I_{cont}	V_{cont} = 2.8 V/0 V, RF Non	–	1	50	μA

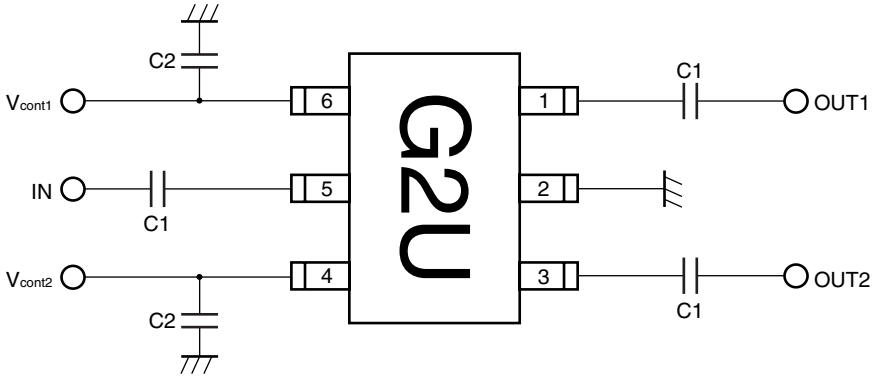
Note $P_{in(0.1\ dB)}$ are measured the input power level when the insertion loss increase more 0.1 than that of linear range. All other characteristics are measured in linear range.

Caution When the μPG2009TB is used it is necessary to use DC blocking capacitors for No.1 (OUT1), No.3 (OUT2) and No.5 (IN). 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.

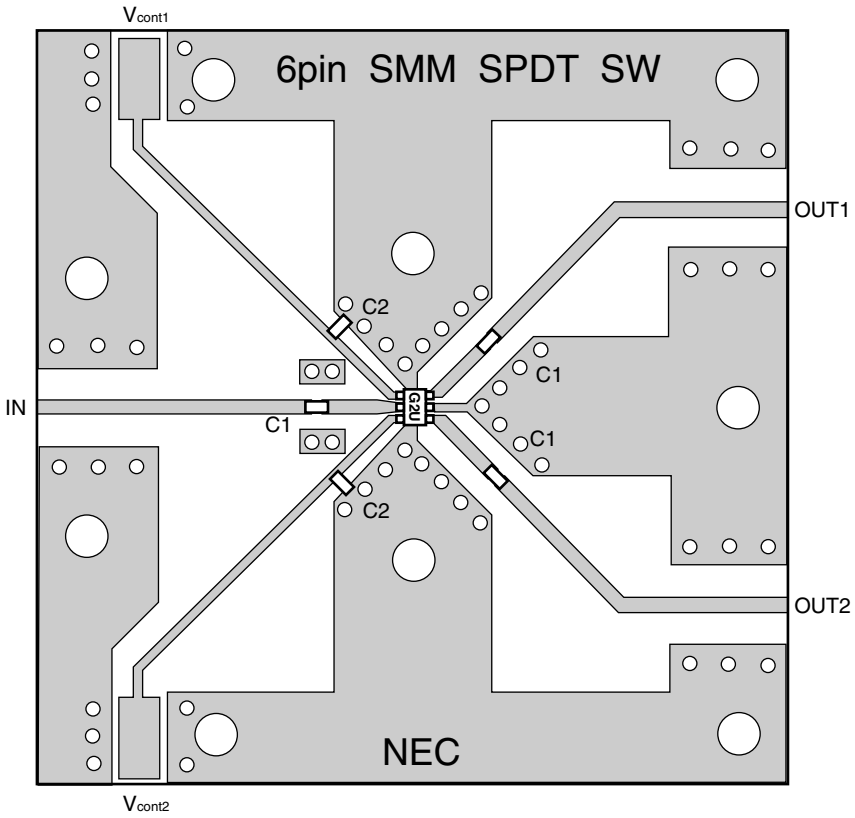
The range of recommended DC blocking capacitor value is less than 100 pF.

EVALUATION CIRCUIT

V_{cont1} = 2.8 V, V_{cont2} = 0 V or V_{cont2} = 0 V, V_{cont1} = 2.8 V, off chip DC blocking capacitors value C1 = 56 pF, C2 = 1 000 pF (Bypass), using NEC standard evaluation board.



EVALUATION BOARD

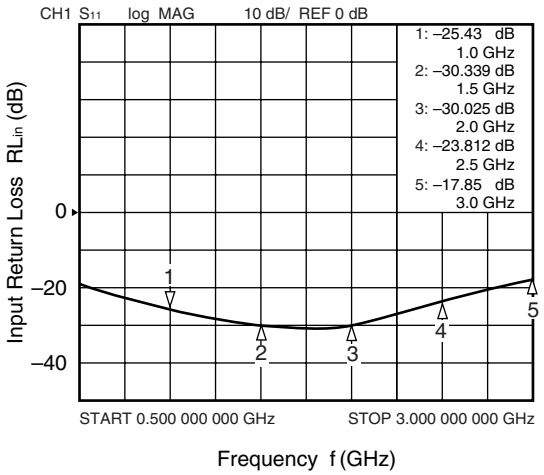


TRUTH TABLE

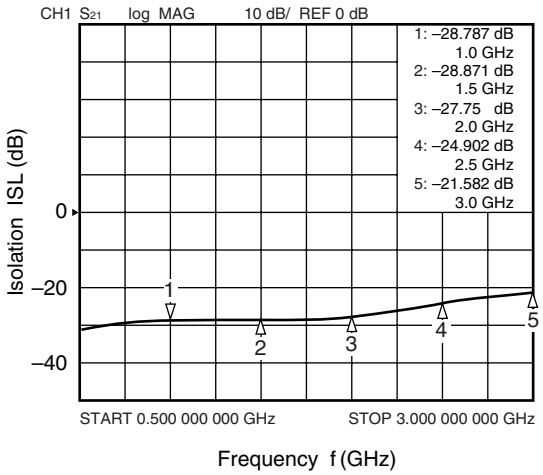
V_{cont1}	V_{cont2}	IN–OUT1	IN–OUT2
Low	High	OFF	ON
High	Low	ON	OFF

TYPICAL CHARACTERISTICS (T_A = +25°C, $V_{cont1/2}$ = 2.8 V/0 V, P_{in} = 0 dBm, OUT2 side is 50 Ω termination, unless otherwise specified)

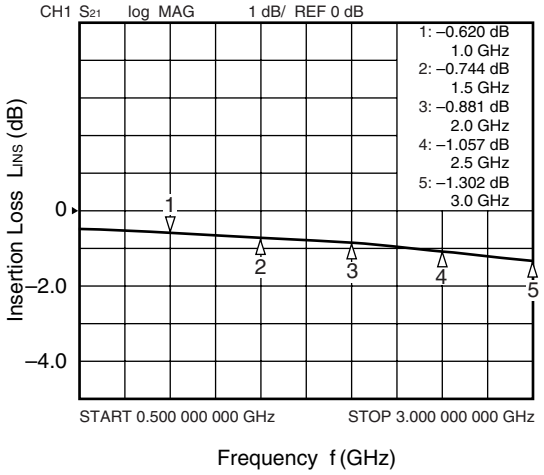
INPUT RETURN LOSS vs. FREQUENCY



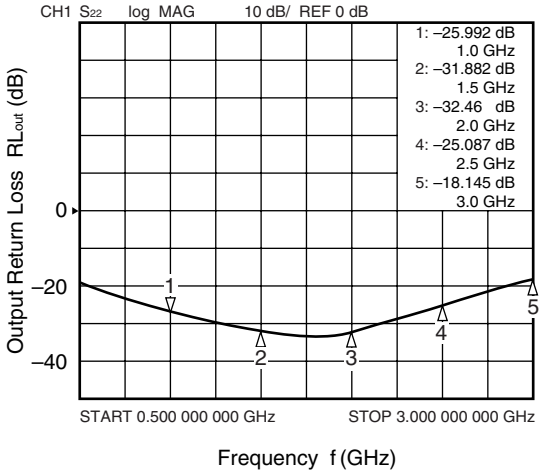
ISOLATION vs. FEQUENCY



INSERTION LOSS vs. FREQUENCY



OUTPUT RETERN LOSS vs. FREQUENCY

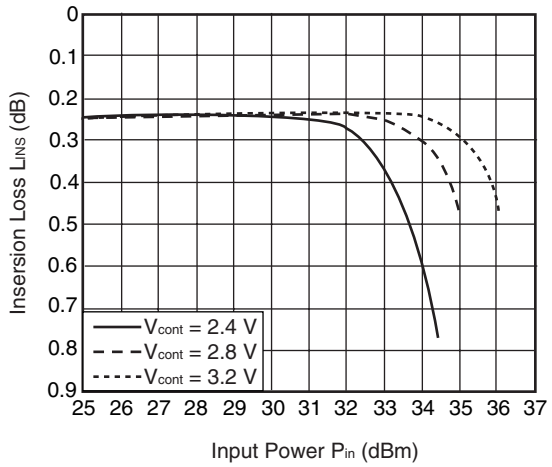


Caution These characteristics values include the losses of the NEC evaluation board.

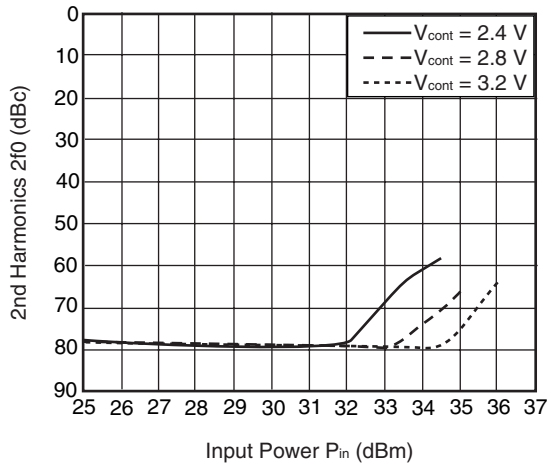
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS
(f = 2 GHz, OUT2 side is 50 Ω termination, unless otherwise specified)

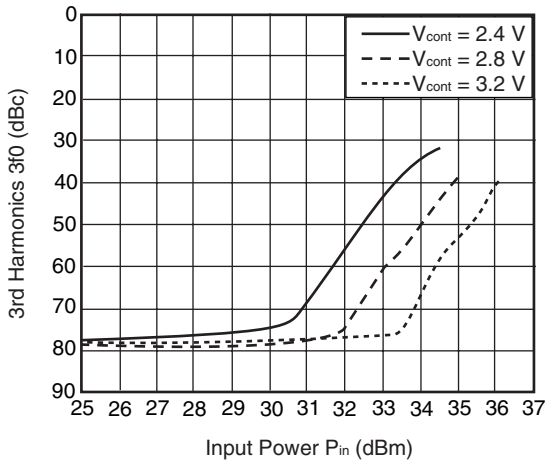
RELATION BETWEEN CONTROL VOLTAGE OF INSERSION LOSS



RELATION BETWEEN CONTROL VOLTAGE OF 2nd HARMONICS



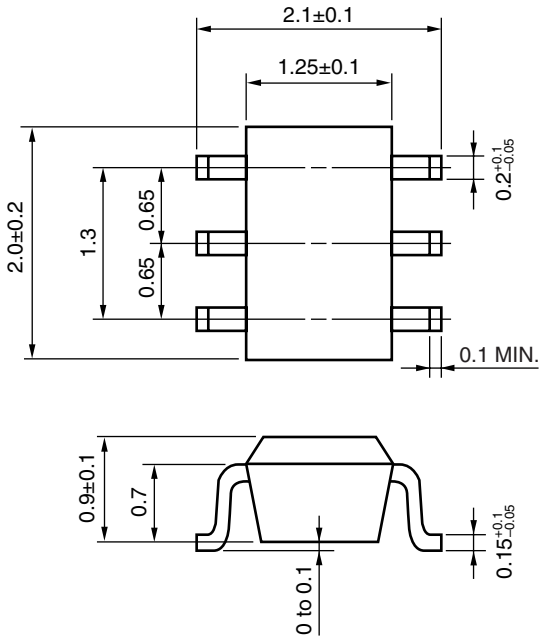
RELATION BETWEEN CONTROL VOLTAGE OF 3rd HARMONICS



Remark The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

6-PIN SUPER MINIMOLD (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) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
VPS	Peak temperature (package surface temperature) Time at temperature of 200°C or higher Preheating time at 120 to 150°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 215°C or below : 25 to 40 seconds : 30 to 60 seconds : 3 times : 0.2%(Wt.) or below	VP215
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (pin temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

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

Bluetooth is a trademark owned by Bluetooth SIG, Inc., U.S.A.

- **The information in this document is current as of July, 2004. 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

SAFETY INFORMATION ON THIS PRODUCT

Caution GaAs Products	The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested. • Do not destroy or burn the product. • Do not cut or cleave off any part of the product. • Do not crush or chemically dissolve the product. • Do not put the product in the mouth. Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.

▶**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: +81-44-435-1588 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

0406