

μPG2214TB

R09DS0050EJ0400

Rev.4.00

GaAs Integrated Circuit for L, S-Band SPDT Switch

Sep 10, 2012

DESCRIPTION

The μPG2214TB is a GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch which was developed for mobile phone and another L, S-band application.

This device can operate 2 control switching by control voltage 1.8 to 5.3 V. This device can operate frequency from 0.05 to 3.0 GHz, having the low insertion loss and high isolation.

This device is housed in a 6-pin super minimold package. And this package is able to high-density surface mounting.

FEATURES

- Switch control voltage : $V_{\text{cont (H)}} = 1.8 \text{ to } 5.3 \text{ V (3.0 V TYP.)}$
: $V_{\text{cont (L)}} = -0.2 \text{ to } +0.2 \text{ V (0 V TYP.)}$
- Low insertion loss : $L_{\text{ins1}} = 0.25 \text{ dB TYP. @ } f = 0.05 \text{ to } 0.5 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $L_{\text{ins2}} = 0.25 \text{ dB TYP. @ } f = 0.5 \text{ to } 1.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $L_{\text{ins3}} = 0.30 \text{ dB TYP. @ } f = 1.0 \text{ to } 2.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $L_{\text{ins4}} = 0.35 \text{ dB TYP. @ } f = 2.0 \text{ to } 2.5 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $L_{\text{ins5}} = 0.35 \text{ dB TYP. @ } f = 2.5 \text{ to } 3.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
- High isolation : $ISL1 = 32 \text{ dB TYP. @ } f = 0.05 \text{ to } 0.5 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $ISL2 = 28 \text{ dB TYP. @ } f = 0.5 \text{ to } 1.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $ISL3 = 27 \text{ dB TYP. @ } f = 1.0 \text{ to } 2.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $ISL4 = 26 \text{ dB TYP. @ } f = 2.0 \text{ to } 2.5 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $ISL5 = 24 \text{ dB TYP. @ } f = 2.5 \text{ to } 3.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
- Handling power : $P_{\text{in (1 dB)}} = +27.0 \text{ dBm TYP. @ } f = 0.5 \text{ to } 3.0 \text{ GHz, } V_{\text{cont (H)}} = 3.0 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
: $P_{\text{in (1 dB)}} = +20.0 \text{ dBm TYP. @ } f = 0.5 \text{ to } 3.0 \text{ GHz, } V_{\text{cont (H)}} = 1.8 \text{ V, } V_{\text{cont (L)}} = 0 \text{ V}$
- High-density surface mounting : 6-pin super minimold package ($2.0 \times 1.25 \times 0.9 \text{ mm}$)

APPLICATIONS

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

<R> ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μPG2214TB-E4	6-pin super minimold (2012) (Pb-Free)	G4J	- Embossed tape 8 mm wide - Pin 4, 5, 6 face the perforation side of the tape - Qty 3 kpcs/reel

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

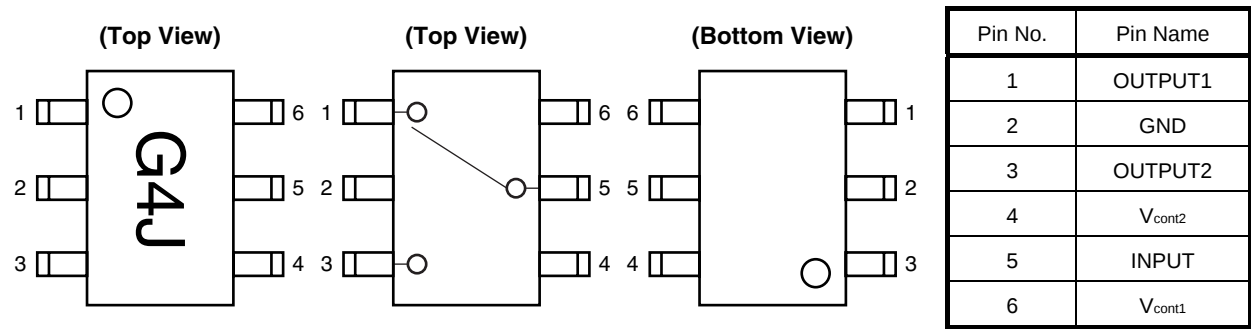
Part number for sample order: μPG2214TB

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

The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



TRUTH TABLE

V _{cont1}	V _{cont2}	INPUT-OUTPUT1	INPUT-OUTPUT2
Low	High	ON	OFF
High	Low	OFF	ON

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	P _{in}	+30	dBm
Operating Ambient Temperature	T _A	−45 to +85	°C
Storage Temperature	T _{stg}	−55 to +150	°C

Note |V_{cont1} − V_{cont2}| ≤ 6.0 V

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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	V _{cont (H)}	1.8	3.0	5.3	V
Switch Control Voltage (L)	V _{cont (L)}	−0.2	0	0.2	V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{cont} (H) = 3.0 V, V_{cont} (L) = 0 V, DC cut capacitors = 100 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	L _{ins1}	f = 0.05 to 0.5 GHz ^{Note 1}	–	0.25	0.45	dB
Insertion Loss 2	L _{ins2}	f = 0.5 to 1.0 GHz	–	0.25	0.45	dB
Insertion Loss 3	L _{ins3}	f = 1.0 to 2.0 GHz	–	0.30	0.50	dB
Insertion Loss 4	L _{ins4}	f = 2.0 to 2.5 GHz	–	0.35	0.55	dB
Insertion Loss 5	L _{ins5}	f = 2.5 to 3.0 GHz	–	0.35	0.60	dB
Isolation 1	ISL1	f = 0.05 to 0.5 GHz ^{Note 1}	29	32	–	dB
Isolation 2	ISL2	f = 0.5 to 1.0 GHz	25	28	–	dB
Isolation 3	ISL3	f = 1.0 to 2.0 GHz	24	27	–	dB
Isolation 4	ISL4	f = 2.0 to 2.5 GHz	23	26	–	dB
Isolation 5	ISL5	f = 2.5 to 3.0 GHz	21	24	–	dB
Input Return Loss 1	RL _{in1}	f = 0.05 to 0.5 GHz ^{Note 1}	15	20	–	dB
Input Return Loss 2	RL _{in2}	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss 1	RL _{out1}	f = 0.05 to 0.5 GHz ^{Note 1}	15	20	–	dB
Output Return Loss 2	RL _{out2}	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression Input Power ^{Note 2}	P _{in} (0.1 dB)	f = 2.0/2.5 GHz	+21.0	+23.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+23.0	–	dBm
1 dB Loss Compression Input Power ^{Note 3}	P _{in} (1 dB)	f = 0.5 to 3.0 GHz	–	+27.0	–	dBm
2nd Harmonics	2f ₀	f = 2.0 GHz, P _{in} = +15 dBm	–	–55	–47	dBc
		f = 2.5 GHz, P _{in} = +15 dBm	–	–55	–47	dBc
3rd Harmonics	3f ₀	f = 2.0 GHz, P _{in} = +15 dBm	–	–55	–47	dBc
		f = 2.5 GHz, P _{in} = +15 dBm	–	–55	–47	dBc
Intermodulation Intercept Point	IIP ₃	f = 0.5 to 3.0 GHz, 2 tone, P _{in} = +16 dBm, 5 MHz spicing	–	+58	–	dBm
Switch Control Current	I _{cont}		–	4	20	μA
Switch Control Speed	t _{sw}	50% CTL to 90/10% RF	–	20	200	ns

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

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

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

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{cont} (H) = 1.8 V, V_{cont} (L) = 0 V, DC cut capacitors = 100 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 6	L _{ins6}	f = 0.05 to 0.5 GHz ^{Note 1}	–	0.25	0.50	dB
Insertion Loss 7	L _{ins7}	f = 0.5 to 1.0 GHz	–	0.25	0.50	dB
Insertion Loss 8	L _{ins8}	f = 1.0 to 2.0 GHz	–	0.30	0.55	dB
Insertion Loss 9	L _{ins9}	f = 2.0 to 2.5 GHz	–	0.35	0.60	dB
Insertion Loss 10	L _{ins10}	f = 2.5 to 3.0 GHz	–	0.35	0.65	dB
Isolation 6	ISL6	f = 0.05 to 0.5 GHz ^{Note 1}	27	30	–	dB
Isolation 7	ISL7	f = 0.5 to 2.0 GHz	23	27	–	dB
Isolation 8	ISL8	f = 2.0 to 2.5 GHz	21	25	–	dB
Isolation 9	ISL9	f = 2.5 to 3.0 GHz	20	24	–	dB
Input Return Loss 3	RL _{in3}	f = 0.05 to 3.0 GHz ^{Note 1}	15	20	–	dB
Output Return Loss 3	RL _{out3}	f = 0.05 to 3.0 GHz ^{Note 1}	15	20	–	dB
0.1 dB Loss Compression Input Power ^{Note 2}	P _{in} (0.1 dB)	f = 2.0/2.5 GHz	+14.0	+17.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+17.0	–	dBm
1 dB Loss Compression Input Power ^{Note 3}	P _{in} (1 dB)	f = 0.5 to 3.0 GHz	–	+20.0	–	dBm
Switch Control Current	I _{cont}		–	4	20	μA
Switch Control Speed	t _{sw}	50% CTL to 90/10% RF	–	20	200	ns

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

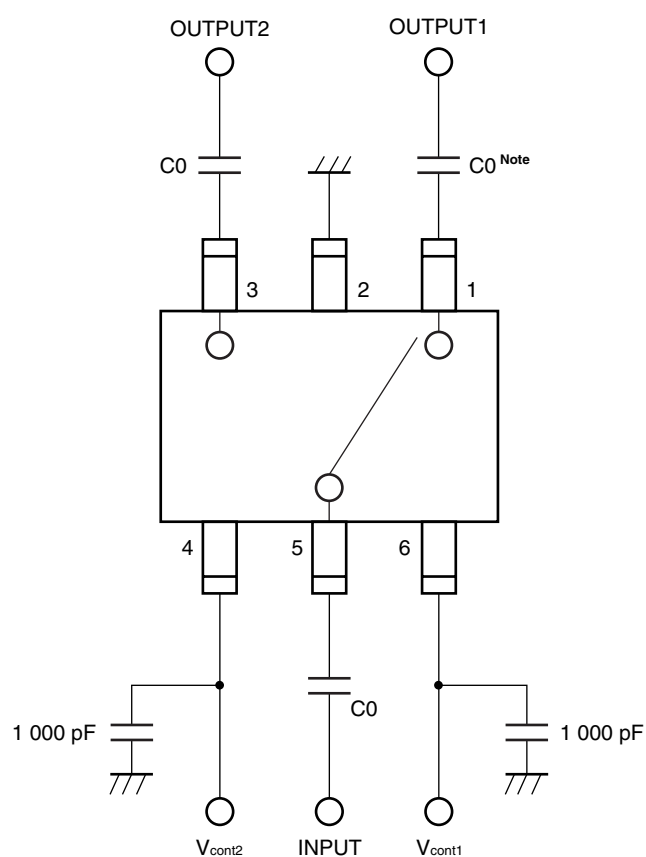
2. P_{in} (0.1 dB) is measured the input power level when the insertion loss increases more 0.1 dB than that of linear range.

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

Caution This device is used it is necessary to use DC cut capacitors.

The value of DC cut 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 cut capacitor value is less than 100 pF.

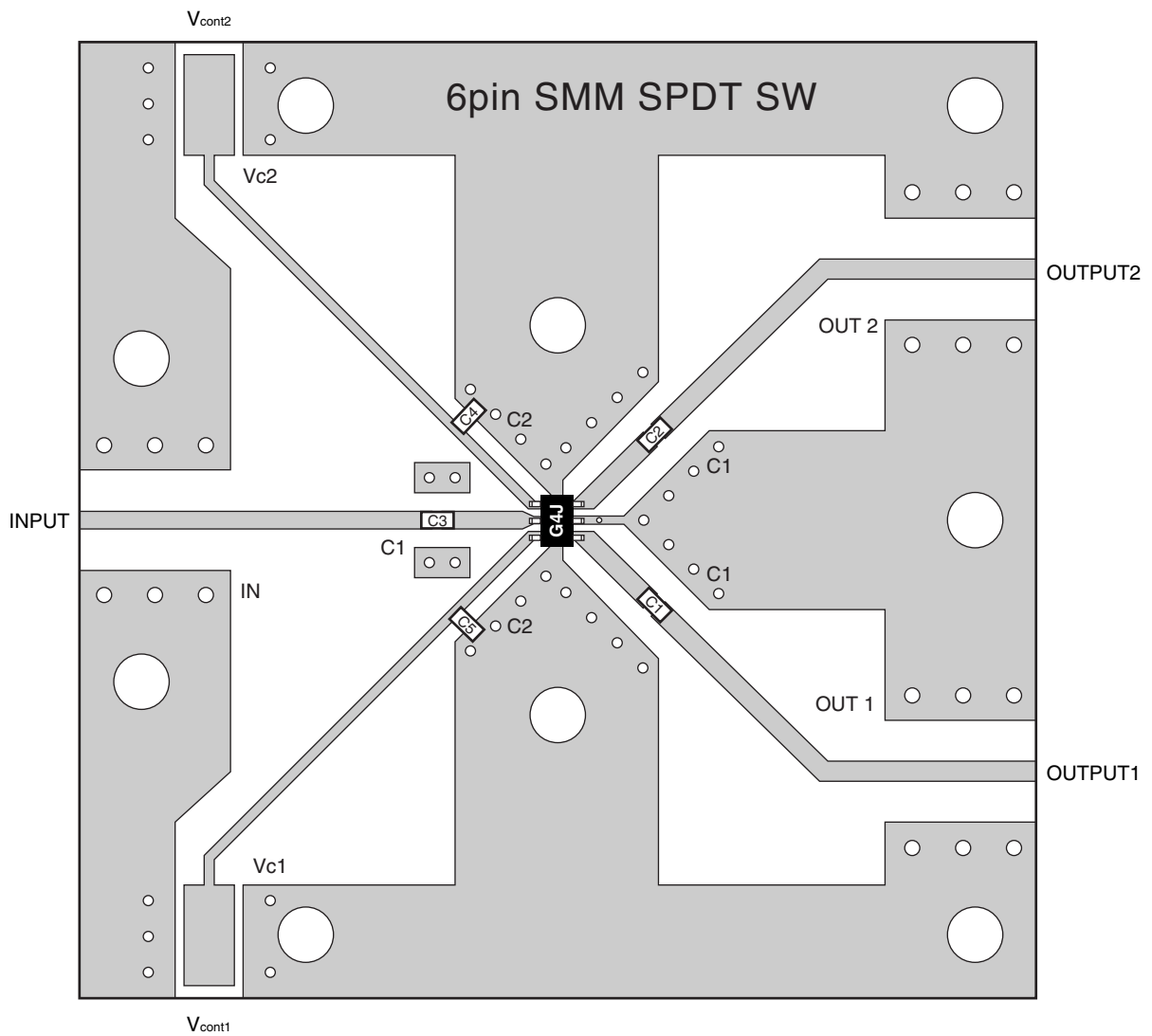
EVALUATION CIRCUIT



Note C0 : 0.05 to 0.5 GHz 1 000 pF
: 0.5 to 3.0 GHz 100 pF

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

<R> ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

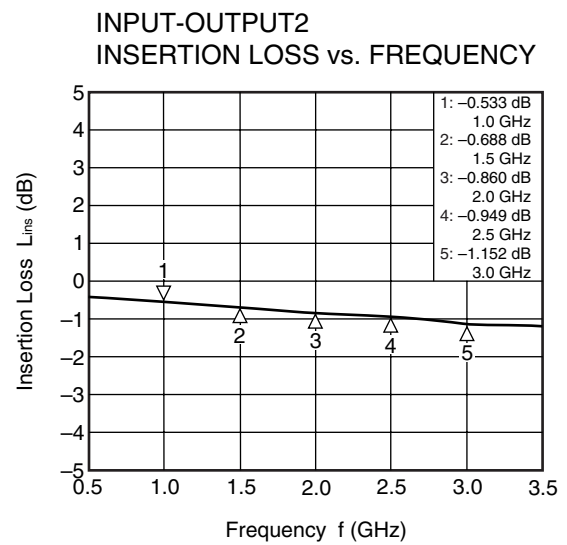
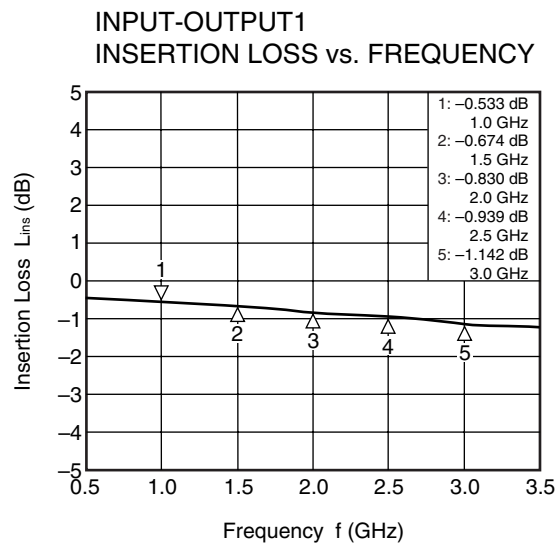


USING THE NEC EVALUATION BOARD

Symbol	Values
C1, C2, C3	100 pF
C4, C5	1 000 pF

TYPICAL CHARACTERISTICS

($T_A = +25^\circ\text{C}$, $V_{\text{cont}}(\text{H}) = 3.0\text{ V}$, $V_{\text{cont}}(\text{L}) = 0\text{ V}$, DC cut capacitors = 100 pF, unless otherwise specified)

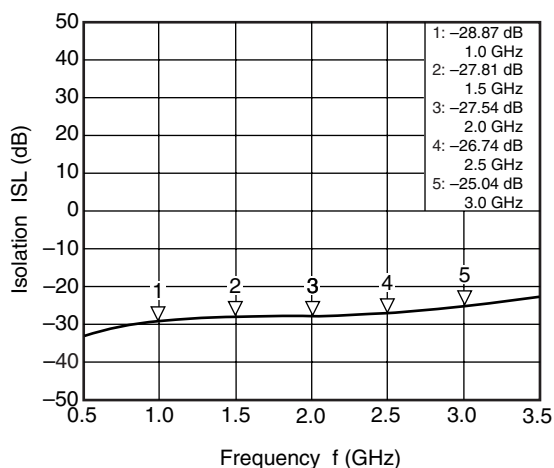


Remark The graphs indicate nominal characteristics.

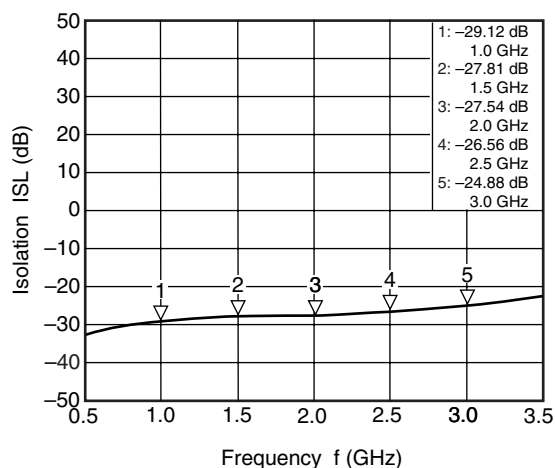
Caution These characteristics values include the losses of the NEC evaluation board.

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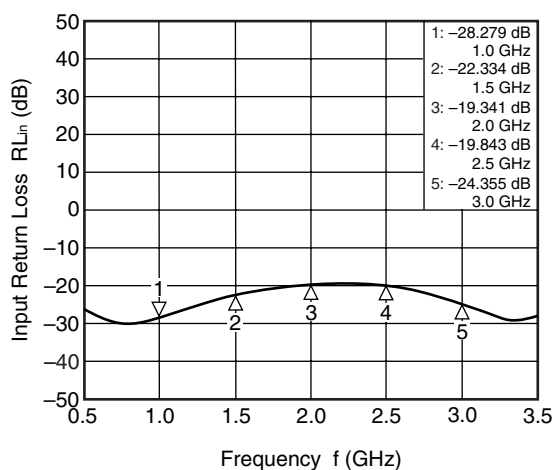
INPUT-OUTPUT1
ISOLATION vs. FREQUENCY



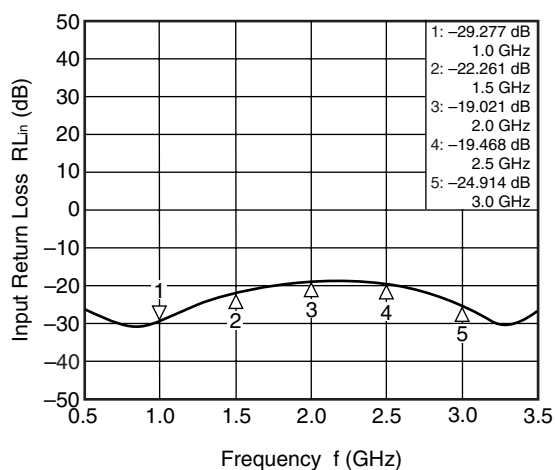
INPUT-OUTPUT2
ISOLATION vs. FREQUENCY



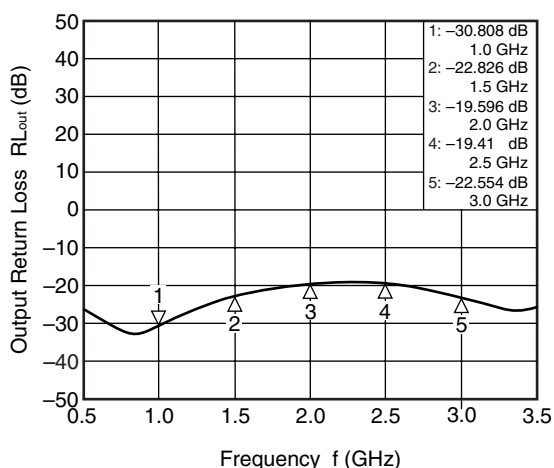
INPUT-OUTPUT1
INPUT RETURN LOSS vs. FREQUENCY



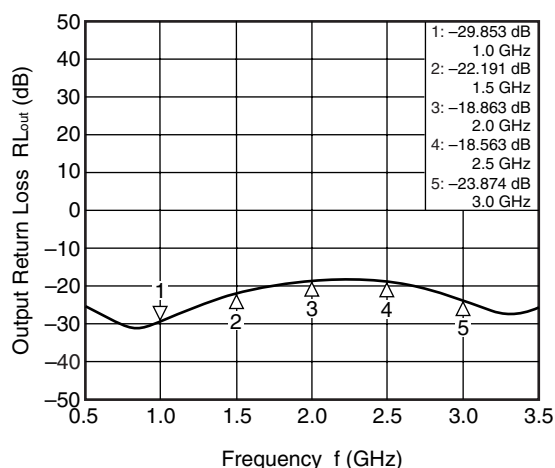
INPUT-OUTPUT2
INPUT RETURN LOSS vs. FREQUENCY



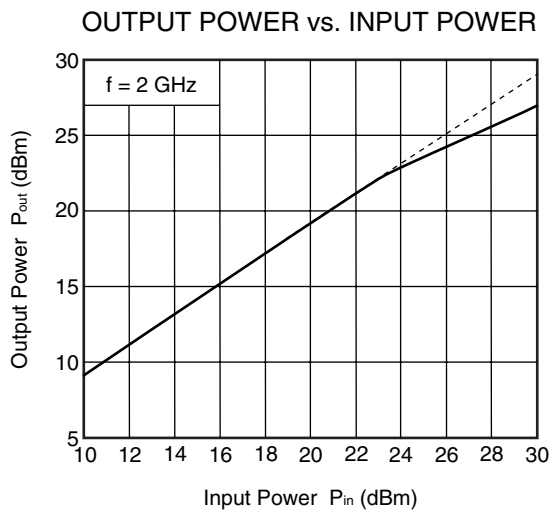
INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY



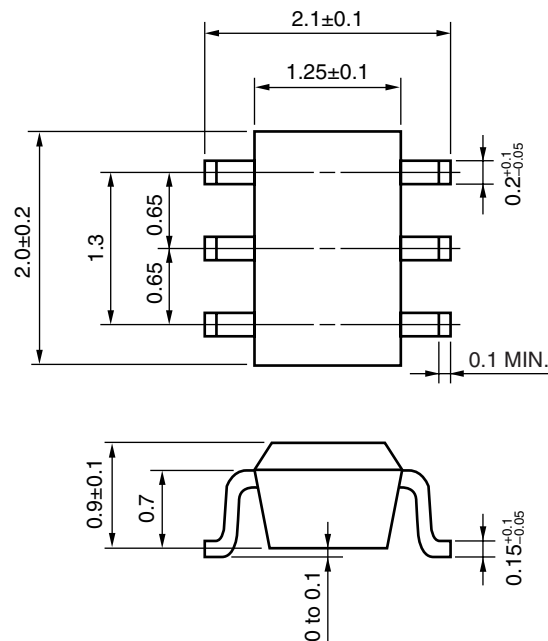
Remark The graphs indicate nominal characteristics.



Remark The graph 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) : 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
VPS	Peak temperature (package surface temperature) : 215°C or below Time at temperature of 200°C or higher : 25 to 40 seconds Preheating time at 120 to 150°C : 30 to 60 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	VP215
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 (pin 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).

Caution	GaAs Products	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. • 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. 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.
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Revision History	μPG2214TB Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Mar 10, 2004	–	First edition issued
2.00	Apr 12, 2004	pp.3,4	Modification of ELECTRICAL CHARACTERISTICS
3.00	Oct 20, 2004	p.1	Modification of ORDERING INFORMATION
		pp.7 to 9	Addition of TYPICAL CHARACTERISTICS
4.00	Sep 10, 2012	p.1	Modification of ORDERING INFORMATION
		p.6	Modification of ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD
		p.8	Modification of TYPICAL CHARACTERISTICS

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California Eastern Laboratories, Inc.
4590 Patrick Henry Drive, Santa Clara, California 95054, U.S.A.
Tel: +1-408-919-2500, Fax: +1-408-988-0279

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

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Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
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