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μPG2214TB

Data Sheet
R09DS0050EJ0400
Rev.4.00
Sep 10, 2012

GaAs Integrated Circuit for L, S-Band SPDT Switch

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

APPLICATIONS

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

<R> ORDERING INFORMATION

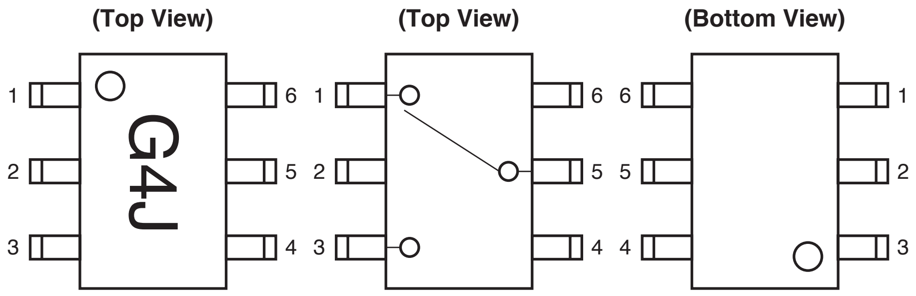
Part Number	Package	Marking	Supplying Form
μPG2214TB-E4	6-pin super minimold (2012) (Pb-Free)	G4J	• Embossed tape 8 mm wide • Pin 4, 5, 6 face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2214TB-A

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



Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	V_{cont2}
5	INPUT
6	V_{cont1}

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 $|V_{cont1} - V_{cont2}| \le 6.0$ 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

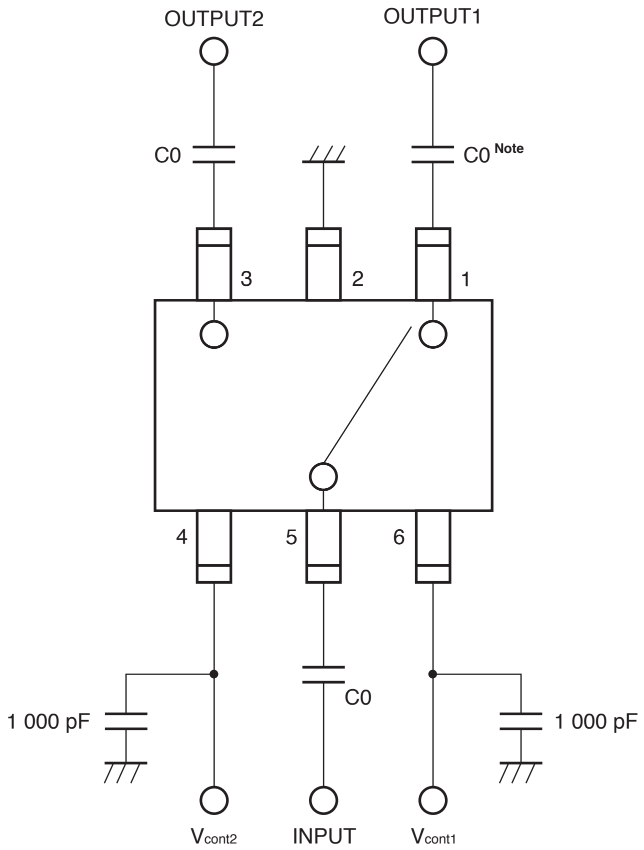
Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

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.

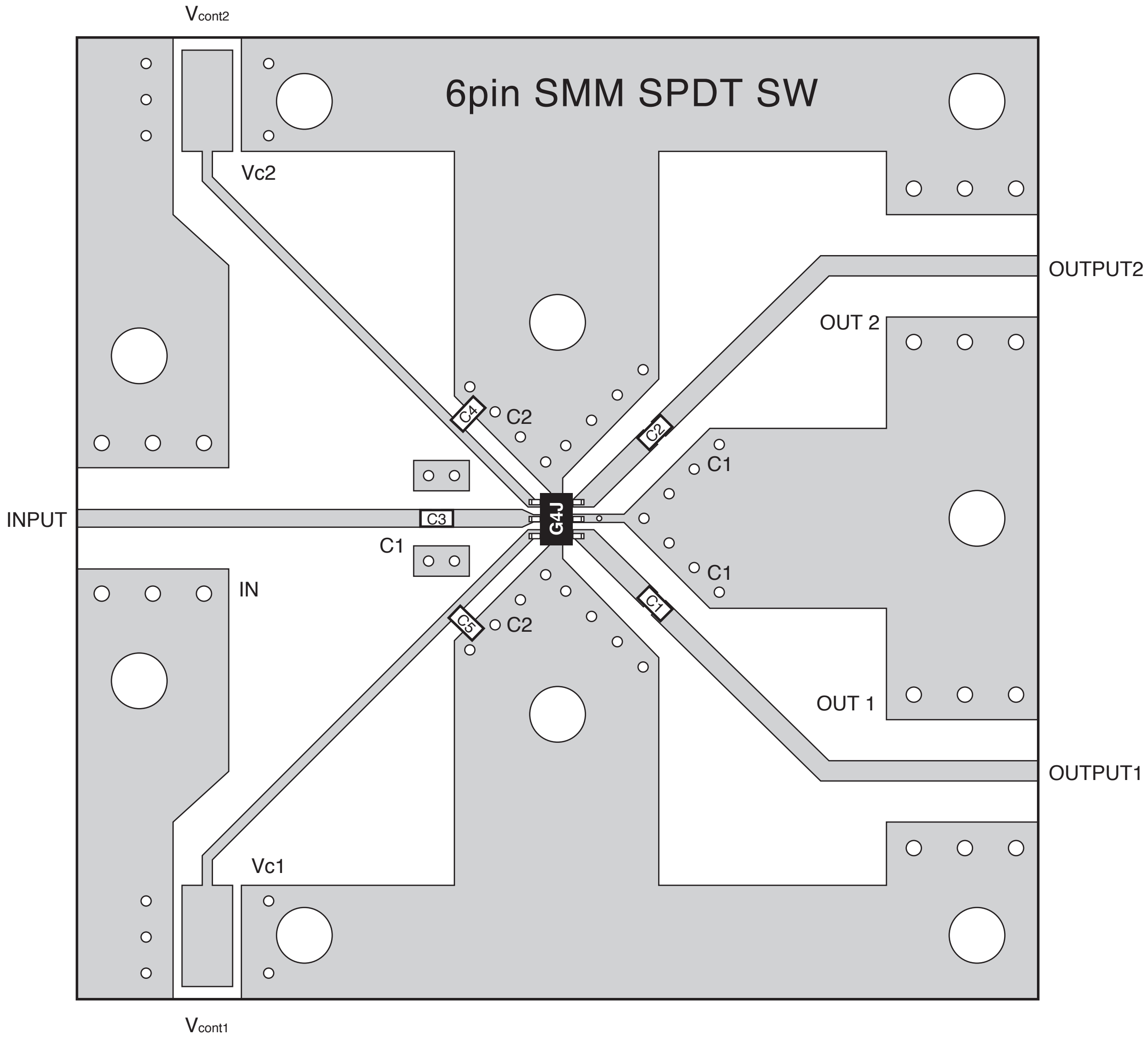
EVALUATION CIRCUIT



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



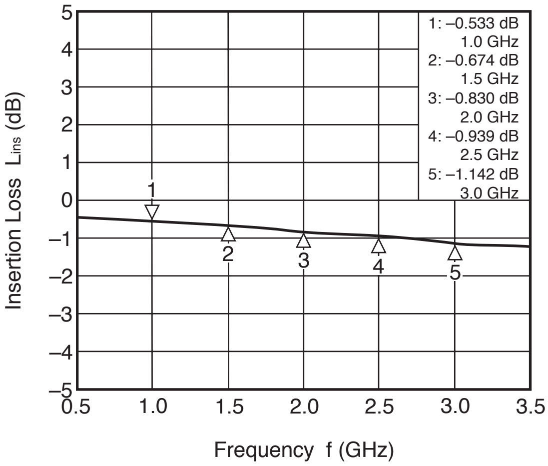
USING THE NEC EVALUATION BOARD

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

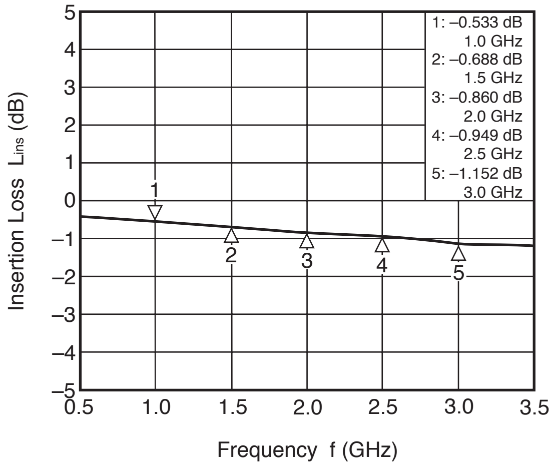
TYPICAL CHARACTERISTICS

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

INPUT-OUTPUT1
INSERTION LOSS vs. FREQUENCY



INPUT-OUTPUT2
INSERTION LOSS vs. FREQUENCY

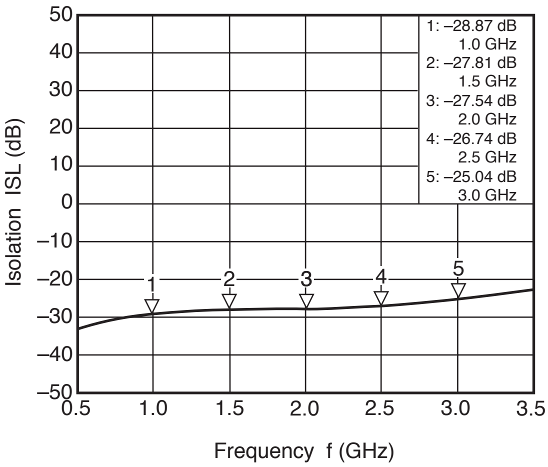


Remark The graphs indicate nominal characteristics.

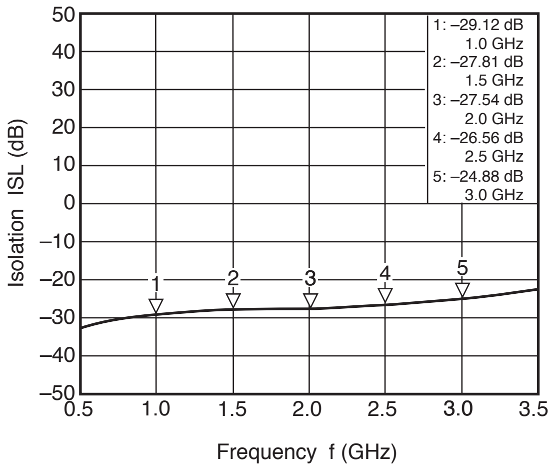
Caution These characteristics values include the losses of the NEC evaluation board.

<R>

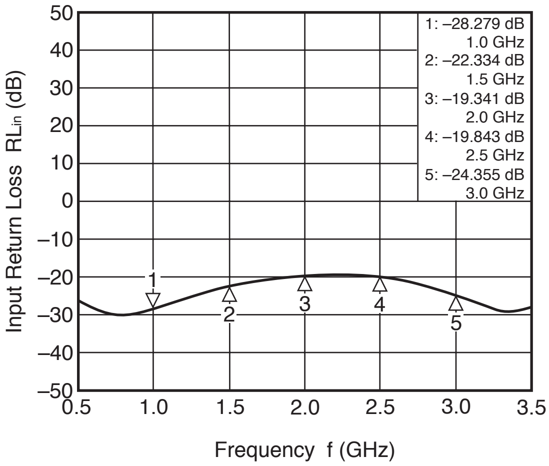
INPUT-OUTPUT1
ISOLATION vs. FREQUENCY



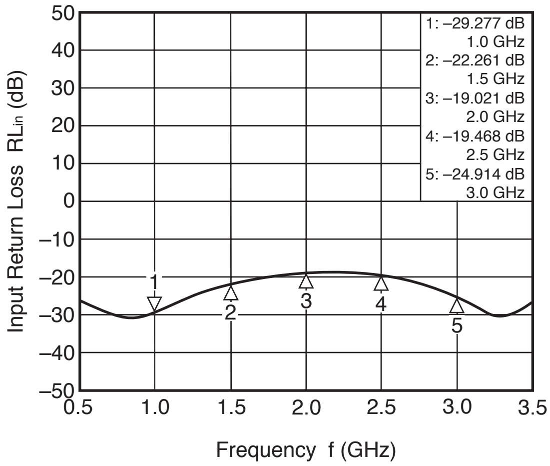
INPUT-OUTPUT2
ISOLATION vs. FREQUENCY



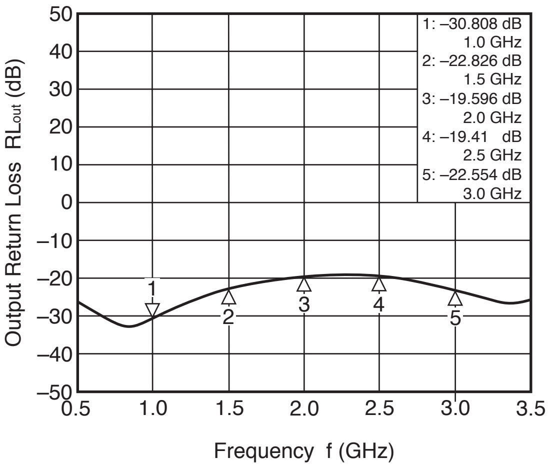
INPUT-OUTPUT1
INPUT RETURN LOSS vs. FREQUENCY



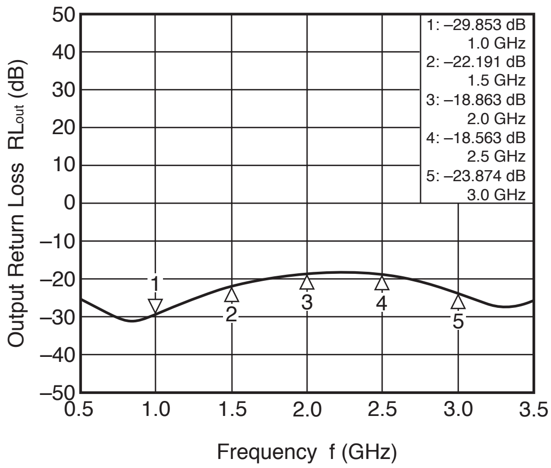
INPUT-OUTPUT2
INPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY

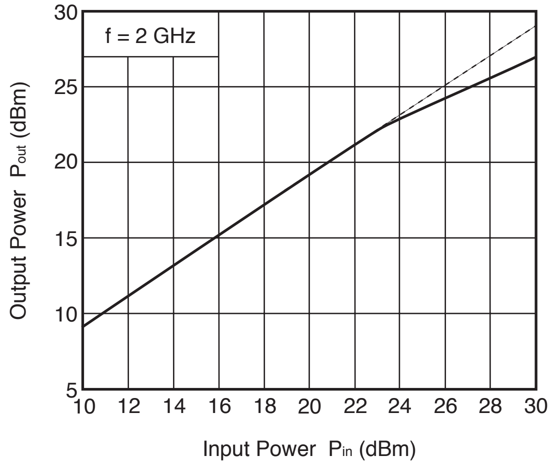


INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY



Remark The graphs indicate nominal characteristics.

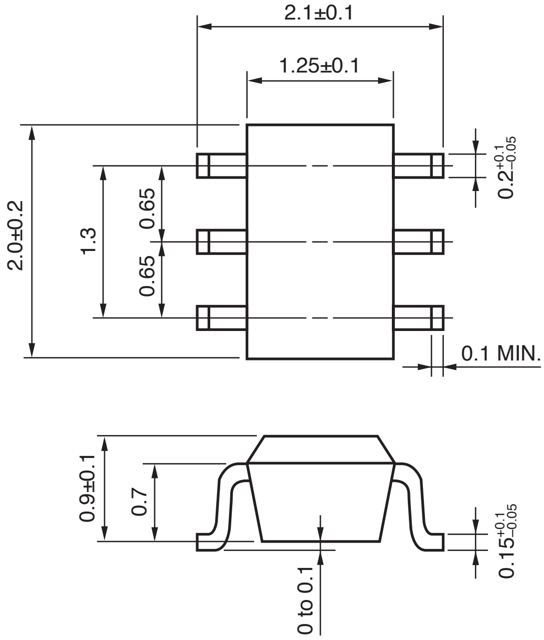
OUTPUT POWER vs. INPUT POWER



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) 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).

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.

Revision History	μPG2214TB Data Sheet

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**