



# GaAs INTEGRATED CIRCUIT

## $\mu$ PG2251T6M

### +25 dBm MATCHED POWER AMPLIFIER FOR Bluetooth™ Class 1

#### DESCRIPTION

The  $\mu$ PG2251T6M is a fully matched, +25 dBm GaAs MMIC power amplifier for Bluetooth Class 1.

This device realizes high efficiency, high gain and high output power.

This device is housed in a 12-pin plastic TSQFN (Thin Small Quad Flat Non-leaded) (T6M) package, and is suitable for high-density surface mounting.

#### FEATURES

- Operating frequency :  $f_{opt} = 2\ 400$  to  $2\ 500$  MHz (2 450 MHz TYP.)
- Supply voltage :  $V_{DD1, 2, 3} = 2.5$  to  $3.5$  V (3.0 V TYP.)
- Control voltage :  $V_{cont} = 1.5$  to  $2.1$  V (1.8 V TYP.)
- Circuit current :  $I_{DD} = 230$  mA TYP. @  $V_{DD1, 2, 3} = 3.0$  V,  $V_{cont} = 1.8$  V,  $P_{out} = +25$  dBm
- Output power :  $P_{out} = +25.0$  dBm TYP. @  $V_{DD1, 2, 3} = 3.0$  V,  $V_{cont} = 1.8$  V,  $P_{in} = -5$  dBm
- Gain control range : GCR = 70 dB TYP. @  $V_{DD1, 2, 3} = 3.0$  V,  $V_{cont} = 0$  to  $1.8$  V,  $P_{in} = -5$  dBm
- High efficiency : PAE = 47% TYP. @  $V_{DD1, 2, 3} = 3.0$  V,  $V_{cont} = 1.8$  V,  $P_{in} = -5$  dBm
- High-density surface mounting : 12-pin plastic TSQFN (T6M) package ( $2.0 \times 2.0 \times 0.37$  mm)

#### APPLICATIONS

- Power Amplifier for Bluetooth Class 1, ZigBee™ etc.

#### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PG2251T6M-E2	$\mu$ PG2251T6M-E2-A	12-pin plastic TSQFN (T6M) (Pb-Free)	2251	<ul style="list-style-type: none"><li>• Embossed tape 8 mm wide</li><li>• Pin 10, 11, 12 face the perforation side of the tape</li><li>• Qty 3 kpcs/reel</li></ul>

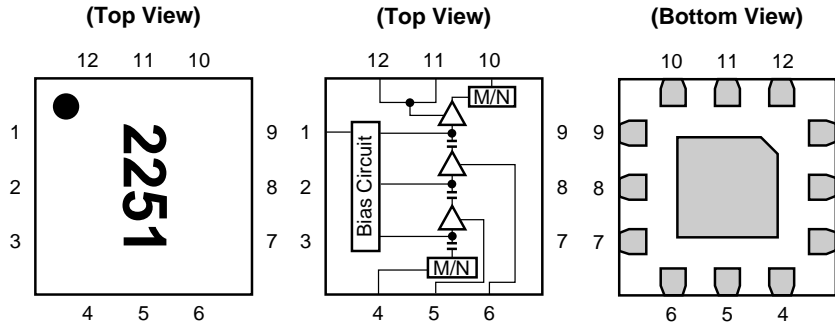
**Remark:** To order evaluation samples, please contact your nearby sales office.

Part number for sample order:  $\mu$ PG2251T6M-A

**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.

**PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM**



Pin No.	Pin Name
1	V <sub>cont</sub>
2	GND
3	GND
4	P <sub>in</sub>
5	V <sub>DD1</sub>
6	V <sub>DD2</sub>
7	GND
8	GND
9	GND
10	P <sub>out</sub>
11	V <sub>DD3</sub>
12	V <sub>DD3</sub>

**Remark** Exposed pad : GND

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

Parameter	Symbol	Ratings	Unit
Supply Voltage	V <sub>DD1, 2, 3</sub>	6.0	V
Control Voltage	V <sub>cont</sub>	3.0	V
Circuit Current	I <sub>DD</sub>	300	mA
Control Current	I <sub>cont</sub>	0.5	mA
Input Power	P <sub>in</sub>	+10	dBm
Power Dissipation	P <sub>D</sub>	600 <sup>Note</sup>	mW
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note** Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, T<sub>A</sub> = +85°C

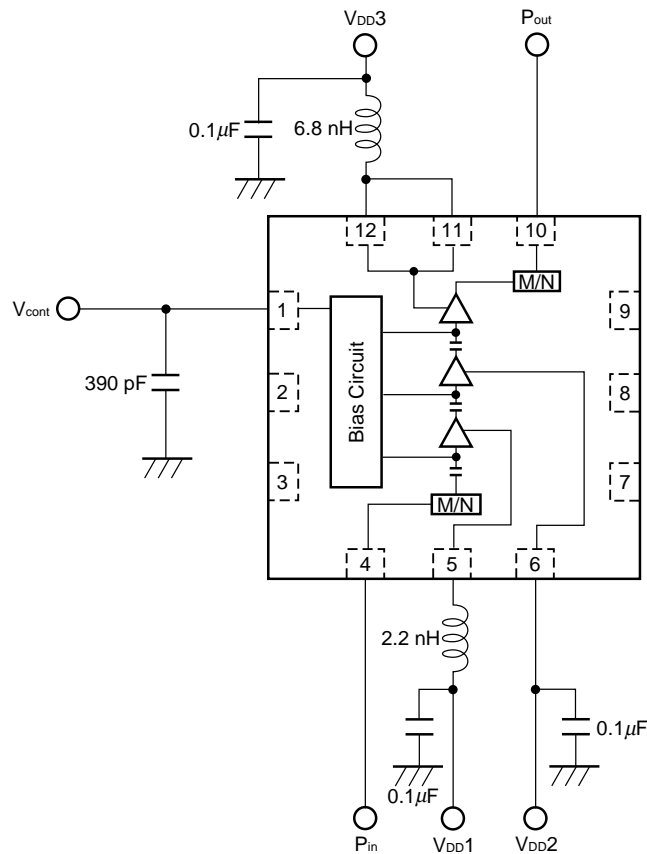
**RECOMMENDED OPERATING RANGE (T<sub>A</sub> = +25°C, unless otherwise specified)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating Frequency	f <sub>opt</sub>	2 400	2 450	2 500	MHz
Supply Voltage	V <sub>DD1, 2, 3</sub>	2.5	3.0	3.5	V
Control Voltage	V <sub>cont</sub>	1.5	1.8	2.1	V

**ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ ,  $V_{DD1, 2, 3} = 3.0\text{ V}$ ,  $V_{cont} = 1.8\text{ V}$ ,  $f = 2.4\text{ to }2.5\text{ GHz}$ , unless otherwise specified)**

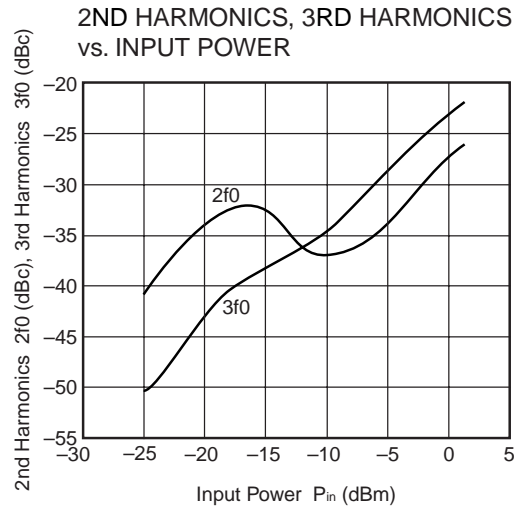
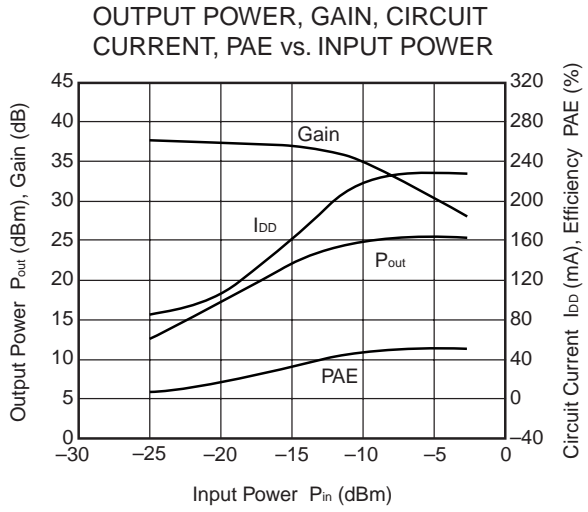
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	$I_{DD}$	$P_{in} = -5\text{ dBm}$	-	230	265	mA
Output Power 1	$P_{out1}$	$P_{in} = -5\text{ dBm}$	+23	+25	-	dBm
Output Power 2	$P_{out2}$	$V_{cont} = 0\text{ V}$ , $P_{in} = -5\text{ dBm}$	-	-45	-30	dBm
Gain Control Range	GCR	$V_{cont} = 0\text{ to }1.8\text{ V}$ , $P_{in} = -5\text{ dBm}$	-	70	-	dB
Efficiency	PAE	$P_{in} = -5\text{ dBm}$	-	47	-	%
2nd Harmonics	2f0	$P_{in} = -5\text{ dBm}$	-	-35	-	dBc
3rd Harmonics	3f0	$P_{in} = -5\text{ dBm}$	-	-30	-	dBc
Input Return Loss	$RL_{in}$	$P_{in} = -30\text{ dBm}$	-	-5	-	dB
Output Return Loss	$RL_{out}$	$P_{in} = -30\text{ dBm}$	-	-10	-	dB

**EVALUATION CIRCUIT**



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

**TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ ,  $V_{DD1, 2, 3} = 3.0\text{ V}$ ,  $V_{cont} = 1.8\text{ V}$ ,  $f = 2.45\text{ GHz}$ , unless otherwise specified)**

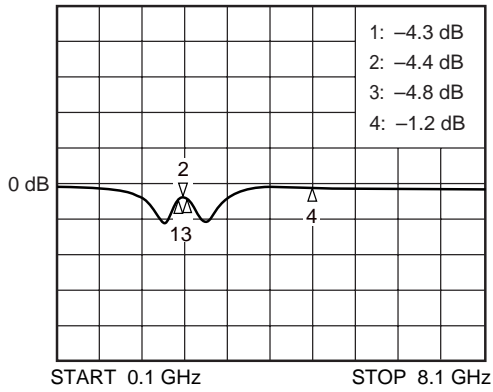


**Remark** The graphs indicate nominal characteristics.

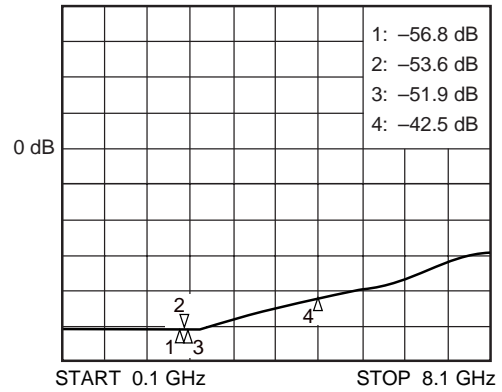
**S-PARAMETERS**

Condition :  $T_A = +25^\circ\text{C}$ ,  $V_{DD1, 2, 3} = 3.0\text{ V}$ ,  $V_{cont} = 1.8\text{ V}$ ,  $P_{in} = -30\text{ dBm}$

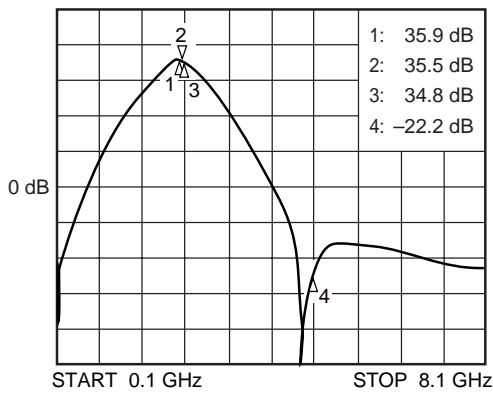
**S<sub>11</sub>-FREQUENCY**



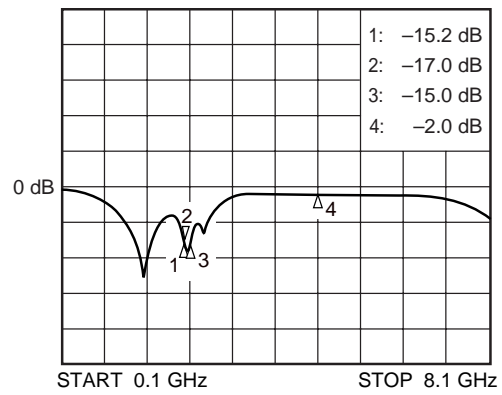
**S<sub>12</sub>-FREQUENCY**



**S<sub>21</sub>-FREQUENCY**



**S<sub>22</sub>-FREQUENCY**



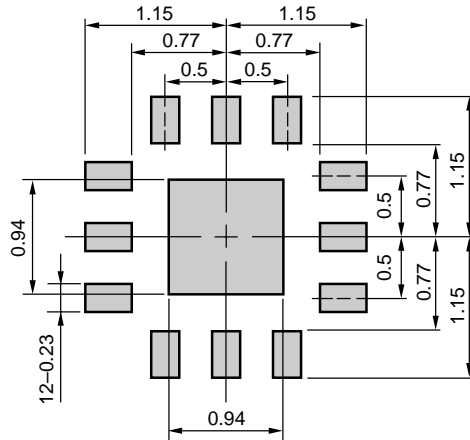
**Remarks 1.** The graphs indicate nominal characteristics.

**2.** Marker 1 : 2.4 GHz, 2 : 2.45 GHz, 3 : 2.5 GHz, 4 : 4.9 GHz

**MOUNTING PAD LAYOUT DIMENSIONS**

**12-PIN PLASTIC TSQFN (T6M) (UNIT: mm)**

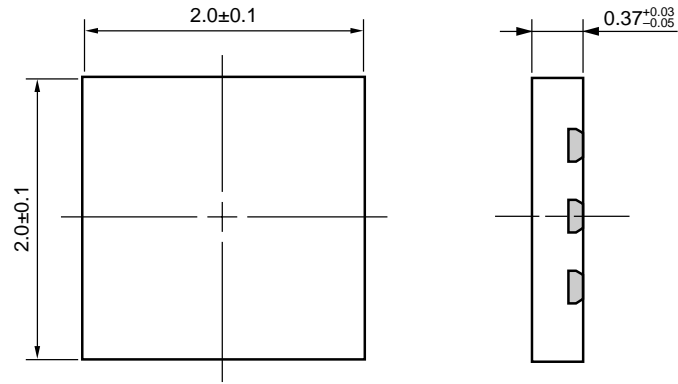
**MOUNTING PAD**



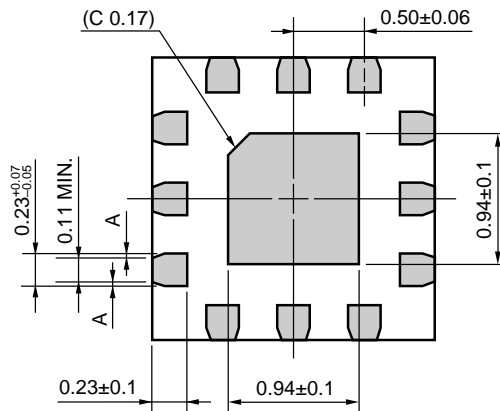
**Remark** The mounting pad layout in this document is for reference only.  
 When designing PCB, please consider workability of mounting, solder joint reliability, prevention of solder bridge and so on, in order to optimize the design.

PACKAGE DIMENSIONS

12-PIN PLASTIC TSQFN (T6M) (UNIT: mm)



(Bottom View)



Remark  $A > 0$

( ): Reference value

**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
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

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



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ZigBee is a trademark of Koninklijke Philips Electronics N.V.

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<b>Caution</b>	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"><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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