

### POWER AMPLIFIER FOR Bluetooth™ Class 1

#### DESCRIPTION

The  $\mu$ PG2301TQ is GaAs HBT MMIC for power amplifier which were developed for Bluetooth Class 1.

This device realizes high efficiency, high gain and high output power by using InGaP HBT. This device is housed in a 10-pin plastic TSON package. And this package is able to high-density surface mounting.

#### FEATURES

- Operation frequency :  $f_{opt} = 2\ 400$  to  $2\ 500$  MHz (2 450 MHz TYP.)
- Supply voltage :  $V_{CC1,2} = V_{bias} = 2.7$  to  $3.6$  V (3.3 V TYP.)
- Control voltage :  $V_{cont} = 0$  to  $3.6$  V (2.5 V TYP.)  
:  $V_{enable} = 0$  to  $3.1$  V (2.9 V TYP.)
- Circuit current :  $I_{CC} = 120$  mA TYP. @  $V_{CC1,2} = V_{bias} = 3.3$  V,  $V_{cont} = 2.5$  V,  $V_{enable} = 2.9$  V,  $P_{in} = +4$  dBm
- Maximum power :  $P_{out(MAX.)} = +23$  dBm TYP. @  $V_{CC1,2} = V_{bias} = 3.3$  V,  $V_{cont} = 2.5$  V,  $V_{enable} = 2.9$  V,  $P_{in} = +4$  dBm
- Gain Control Range : GCR = 23 dB TYP. @  $V_{CC1,2} = V_{bias} = 3.3$  V,  $V_{cont} = 0$  to  $2.5$  V,  $V_{enable} = 2.9$  V,  $P_{in} = +4$  dBm
- Power gain :  $G_P = 23$  dB TYP.(Reference value)
- High efficiency : PAE = 50% TYP.(Reference value)
- Shut down function
- High-density surface mounting : 10 pin plastic TSON package ( $2.4 \times 2.55 \times 0.6$  mm)

#### APPLICATION

- Power Amplifier for Bluetooth Class 1 etc.
- Wireless LAN etc.

#### ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
$\mu$ PG2301TQ-E1	10-pin plastic TSON	2301	<ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 5, 6 face the perforation side of the tape</li> <li>• Qty 3 kpcs/reel</li> </ul>

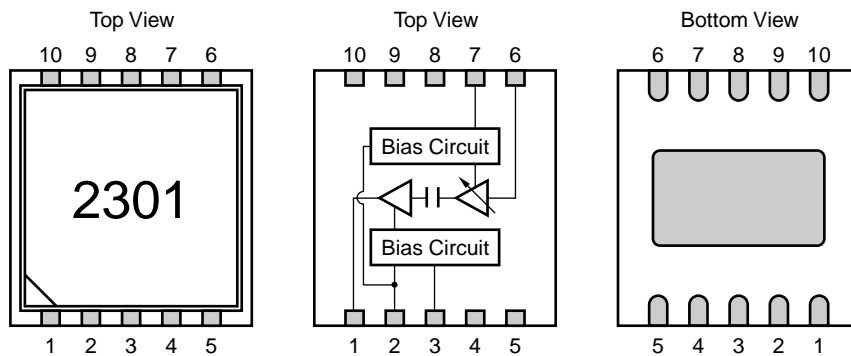
**Remark** To order evaluation samples, contact your nearby sales office.

Part number for sample order:  $\mu$ PG2301TQ

#### Caution Electro-static sensitive devices

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name
1	OUTPUT/ V <sub>CC2</sub>
2	V <sub>enable</sub>
3	V <sub>bias</sub>
4	GND
5	V <sub>CC1</sub>
6	INPUT
7	V <sub>cont</sub>
8	N.C.
9	GND
10	GND

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

Parameter	Symbol	Ratings	Unit
Supply Voltage	V <sub>CC1,2</sub>	5.0	V
	V <sub>bias</sub>		
Control Voltage	V <sub>cont</sub>	3.6	V
	V <sub>enable</sub>		
Circuit Current	I <sub>CC</sub>	400	mA
Control Current	I <sub>cont</sub>	0.5	mA
	I <sub>enable</sub>		
Power Dissipation	P <sub>D</sub>	700 <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
Input Power	P <sub>in</sub>	+10	dBm

**Note** Mounted on double 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)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating Frequency	f <sub>opt</sub>	2 400	2 450	2 500	MHz
Supply Voltage	V <sub>CC1,2</sub>	2.7	3.3	3.6	V
	V <sub>bias</sub>				
Control Voltage	V <sub>cont</sub>	0	2.5	3.6	V
	V <sub>enable</sub>	0	2.9	3.1	

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $T_A = +25^\circ\text{C}$ ,  $V_{CC1, 2} = V_{bias} = 3.3\text{ V}$ ,  $f = 2\ 450\text{ MHz}$ , External input and output matching)

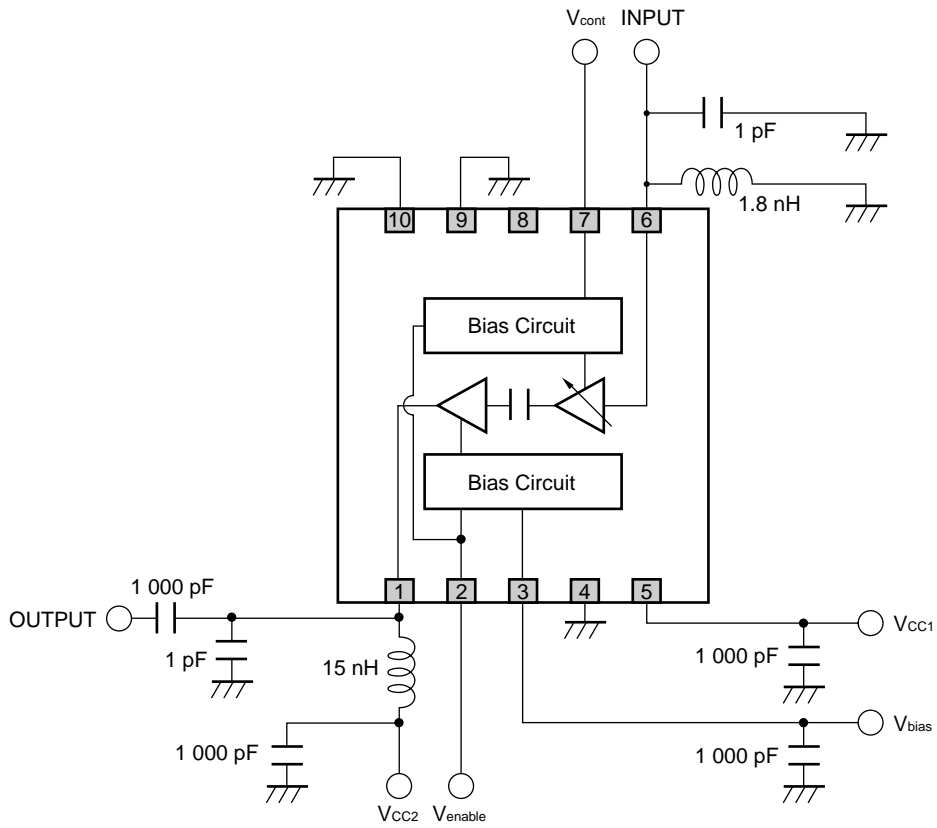
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	$I_{CC}$	$V_{cont} = 2.5\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = +4\text{ dBm}$	110	120	130	mA
Shut Down Current	$I_{shut\ down}$	$V_{cont} = 2.5\text{ V}$ , $V_{enable} = 0\text{ V}$ , $P_{in} = +4\text{ dBm}$	–	0.1	1.0	μA
Output Power 1	$P_{out1}$	$V_{cont} = 2.5\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = +4\text{ dBm}$	+21	+23	+24.5	dBm
Output Power 2	$P_{out2}$	$V_{cont} = 0\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = +4\text{ dBm}$	–	0	+1	dBm
Gain Control Range	GCR	$V_{cont} = 0\text{ to }2.5\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = +4\text{ dBm}$	20	23	–	dB

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $T_A = +25^\circ\text{C}$ ,  $V_{CC1, 2} = V_{bias} = 3.3\text{ V}$ ,  $f = 2\ 450\text{ MHz}$ , External input and output matching)

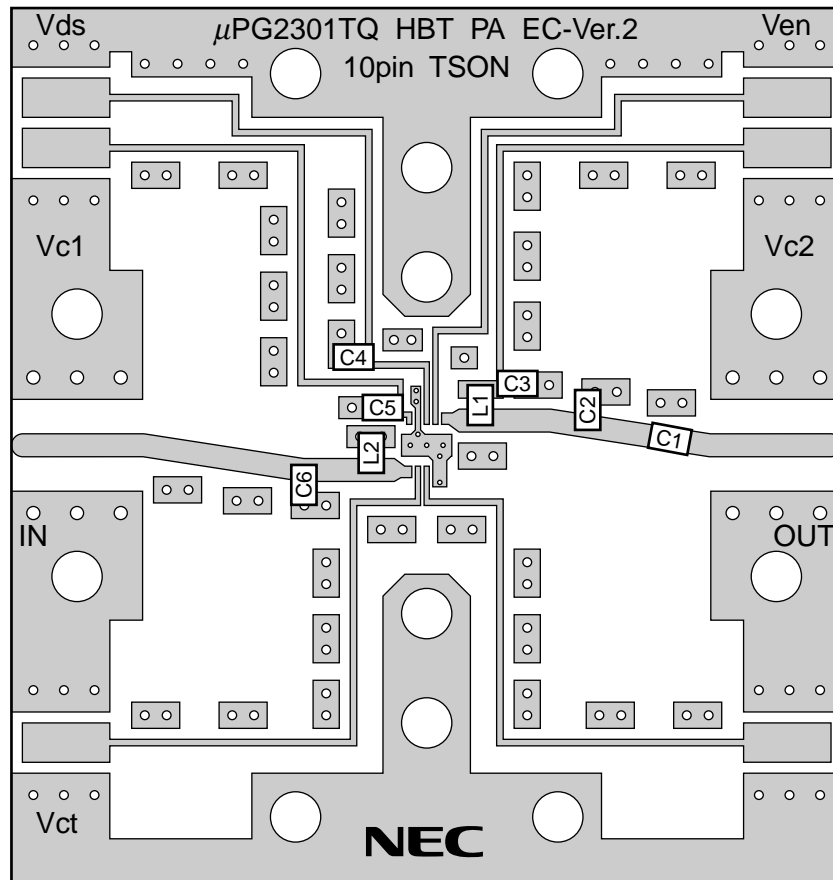
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Efficiency	PAE	$V_{cont} = 2.5\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = +4\text{ dBm}$	–	50	–	%
Power Gain	GP	$V_{cont} = 2.5\text{ V}$ , $V_{enable} = 2.9\text{ V}$ , $P_{in} = -5\text{ dBm}$	–	23	–	dB

EVALUATION CIRCUIT ( $V_{CC1,2} = V_{bias} = 3.3\text{ V}$ ,  $f = 2\ 450\text{ MHz}$ )



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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

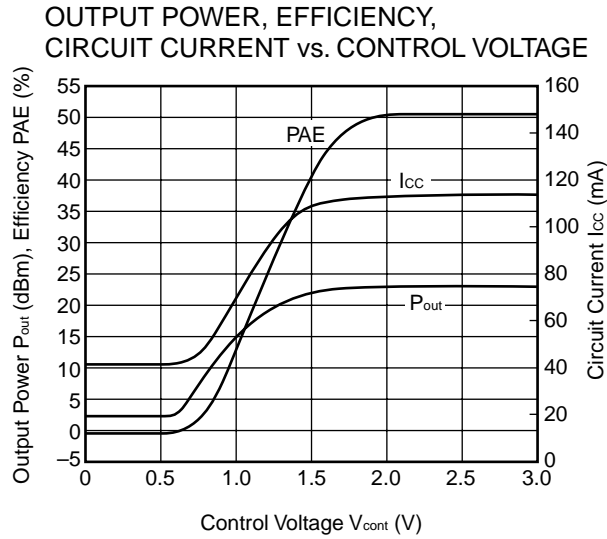


COMPONENT LIST

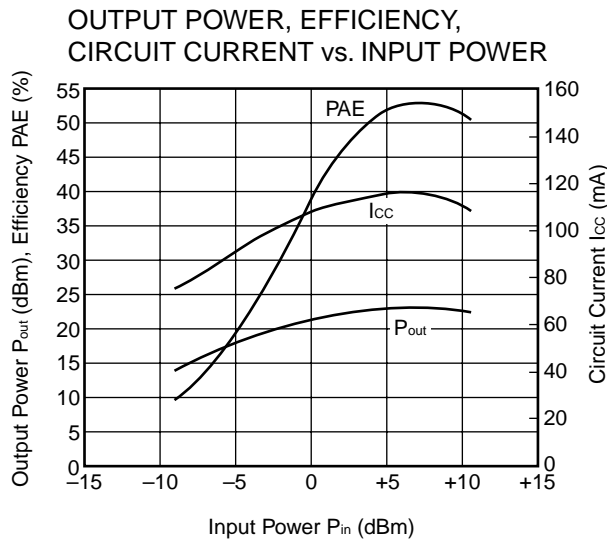
Symbol	Rating	Part Number	Manufacturer
C1, C3, C4, C5	1 000 pF	GRM39CH102J50	muRata
C2, C6	1 pF	GRM39CH010C50	muRata
L1	15 nH	TFL0816-15N	Susumu
L2	1.8 nH	TFL0816-1N8	Susumu

TYPICAL CHARACTERISTICS

Condition :  $f = 2\,450\text{ MHz}$ ,  $V_{CC1} = V_{CC2} = V_{bias} = 3.3\text{ V}$ ,  $V_{enable} = 2.9\text{ V}$ ,  $P_{in} = +4\text{ dBm}$ , External input and output matching



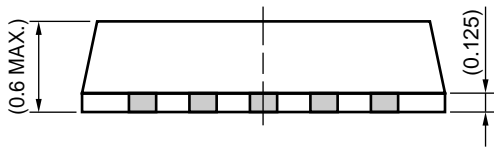
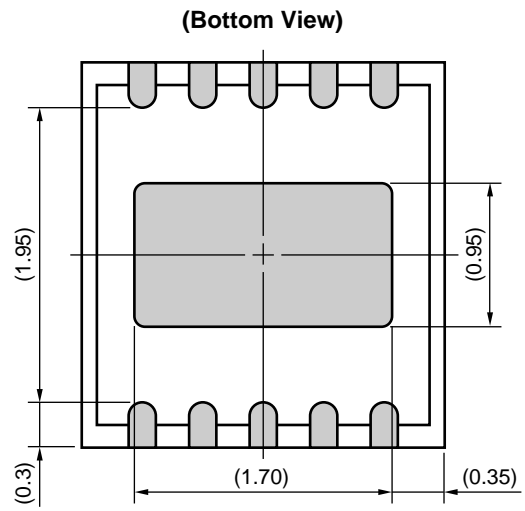
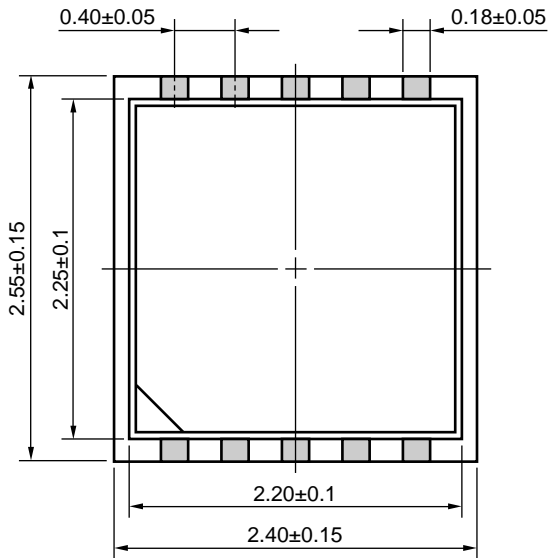
Condition :  $f = 2\,450\text{ MHz}$ ,  $V_{CC1} = V_{CC2} = V_{bias} = 3.3\text{ V}$ ,  $V_{enable} = 2.9\text{ V}$ ,  $V_{cont} = 2.5\text{ V}$ , External input and output matching



**Remark** The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

10-PIN PLASTIC TSON (UNIT: mm)



Note ( ) : 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	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).**



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M8E 00.4-0110

**SAFETY INFORMATION ON THIS PRODUCT**

<p><b>Caution</b></p>	<p>GaAs Products</p>	<p>The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested.</p> <ul style="list-style-type: none"> <li>• Do not destroy or burn the product.</li> <li>• Do not cut or cleave off any part of the product.</li> <li>• Do not crush or chemically dissolve the product.</li> <li>• Do not put the product in the mouth.</li> </ul> <p>Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.</p>
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► **Business issue**

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