



**NEC's POWER AMPLIFIER  
FOR BLUETOOTH™ CLASS 1**

**UPG2301TQ**

**FEATURES**

- **OPERATION FREQUENCY**  
f<sub>opt</sub> = 2,400 to 2,500 MHz (2 450 MHz TYP.)
- **SUPPLY VOLTAGE**  
V<sub>CC1,2</sub> = V<sub>bias</sub> = 2.7 to 3.6 V (3.3 V TYP.)
- **CONTROL VOLTAGE**  
V<sub>cont</sub> = 0 to 3.6 V (2.5 V TYP.)  
V<sub>enable</sub> = 0 to 3.1 V (2.9 V TYP.)
- **CIRCUIT CURRENT**  
I<sub>CC</sub> = 120 mA TYP.@ V<sub>CC1,2</sub> = V<sub>bias</sub> = 3.3 V, V<sub>cont</sub> = 2.5 V,  
V<sub>enable</sub> = 2.9 V, P<sub>in</sub> = +4 dBm
- **MAXIMUM POWER**  
P<sub>out(MAX.)</sub> = +23 dBm TYP.@ V<sub>CC1,2</sub> = V<sub>bias</sub> = 3.3 V,  
V<sub>cont</sub> = 2.5 V, V<sub>enable</sub> = 2.9 V, P<sub>in</sub> = +4 dBm
- **GAIN CONTROL RANGE**  
GCR = 23 dB TYP.@ V<sub>CC1,2</sub> = V<sub>bias</sub> = 3.3 V,  
V<sub>cont</sub> = 0 to 2.5 V, V<sub>enable</sub> = 2.9 V, P<sub>in</sub> = +4 dBm
- **POWER GAIN**  
G<sub>P</sub> = 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 × 2.55 × 0.6 mm)

**DESCRIPTION**

NEC's μPG2301TQ is a GaAs HBT MMIC for power amplifier 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 low profile 10-pin plastic TSON package.

**APPLICATION**

- **POWER AMPLIFIER FOR BLUETOOTH CLASS 1**
- **WIRELESS LAN**

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified, T<sub>A</sub> = +25°C, V<sub>CC1,2</sub> = V<sub>bias</sub> = 3.3 V, f = 2,450 MHz, External input and output matching)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Circuit Current	I <sub>CC</sub>	V <sub>cont</sub> = 2.5 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = +4 dBm	110	120	130	mA
Shut Down Current	I <sub>shut down</sub>	V <sub>cont</sub> = 2.5 V, V <sub>enable</sub> = 0 V, P <sub>in</sub> = +4 dBm	-	0.1	1.0	μA
Output Power 1	P <sub>out1</sub>	V <sub>cont</sub> = 2.5 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = +4 dBm	+21	+23	+24.5	dBm
Output Power 2	P <sub>out2</sub>	V <sub>cont</sub> = 0 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = +4 dBm	-	0	+1	dBm
Gain Control Range	GCR	V <sub>cont</sub> = 0 to 2.5 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = +4 dBm	20	23	-	dB

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified, T<sub>A</sub> = +25°C, V<sub>CC1,2</sub> = V<sub>bias</sub> = 3.3 V, f = 2,450 MHz, External input and output matching)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Efficiency	PAE	V <sub>cont</sub> = 2.5 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = +4 dBm	-	50	-	%
Power Gain	G <sub>P</sub>	V <sub>cont</sub> = 2.5 V, V <sub>enable</sub> = 2.9 V, P <sub>in</sub> = -5 dBm	-	23	-	dB

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{CC1,2}$	5.0	V
	$V_{bias}$		
Control Voltage	$V_{cont}$	3.6	V
	$V_{enable}$		
Circuit Current	$I_{cc}$	400	mA
Control Current	$I_{cont}$	0.5	mA
	$I_{enable}$		
Power Dissipation	$P_D$	700 <sup>Note</sup>	mW
Operating Ambient Temperature	$T_A$	-40 to +85	°C
Storage Temperature	$T_{stg}$	-55 to +150	°C
Input Power	$P_{in}$	+10	dBm

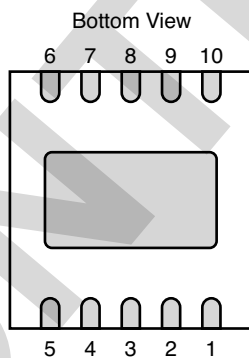
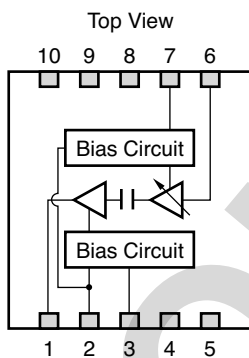
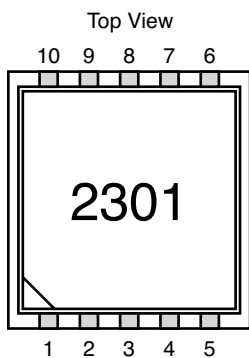
**Note** Mounted on double copper-clad 50 × 50 × 1.6 mm epoxy glass PWB,  $T_A = +85^\circ\text{C}$

**RECOMMENDED OPERATING RANGE**

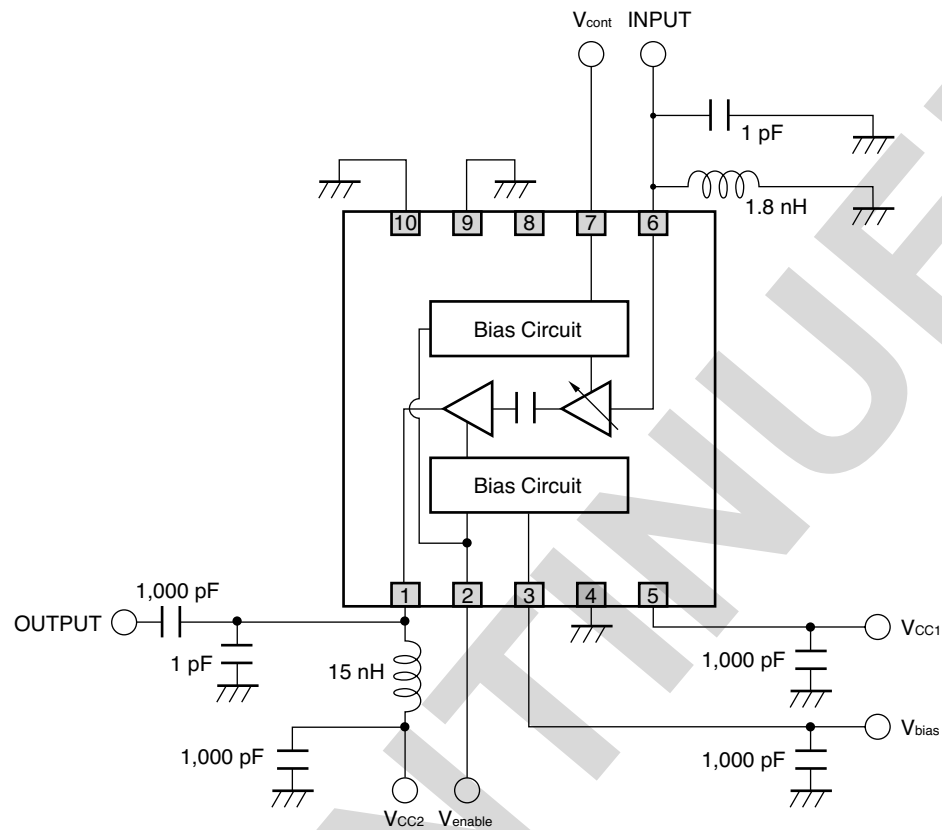
( $T_A = +25^\circ\text{C}$ )

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Frequency	$f_{opt}$	2,400	2,450	2,500	MHz
Supply Voltage	$V_{CC1,2}$	2.7	3.3	3.6	V
	$V_{bias}$				
Control Voltage	$V_{cont}$	0	2.5	3.6	V
	$V_{enable}$	0	2.9	3.1	

**PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM**

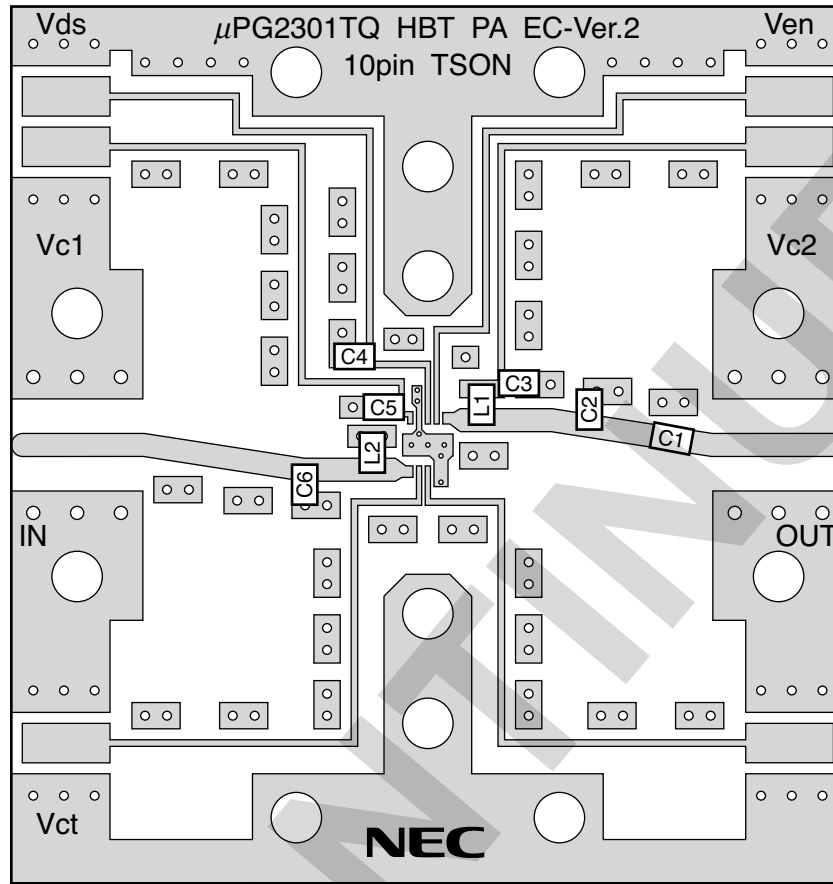


PIN NO.	PIN NAME
1	OUTPUT/ $V_{CC2}$
2	$V_{enable}$
3	$V_{bias}$
4	GND
5	$V_{CC1}$
6	INPUT
7	$V_{cont}$
8	N.C.
9	GND
10	GND

**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

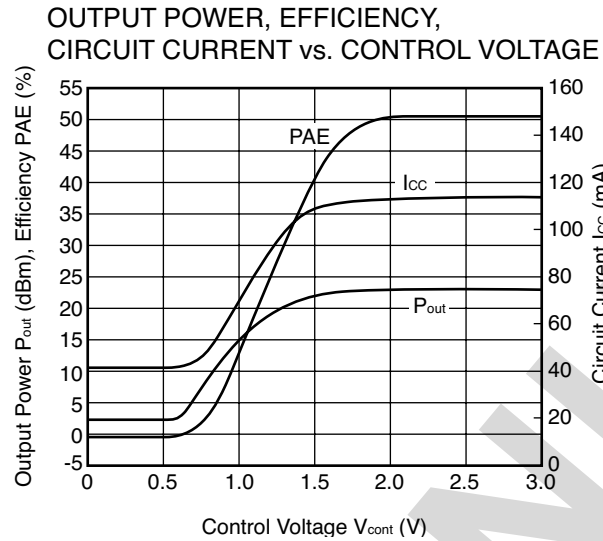


COMPONENT LIST

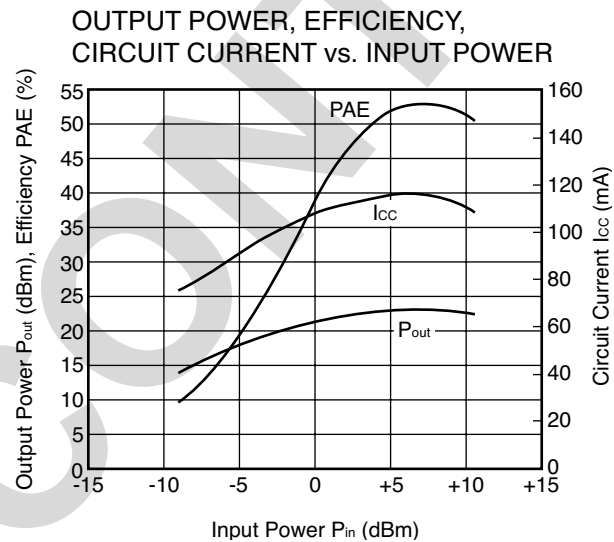
SYMBOL	RATING	PART NUMBER	MANUFACTURER
C1, C3, C4, C5	1,000 pF	GRM39CH102J50	muRata
C2, C6	1 pF	GRM39CH010C50	muRata
L1	15 nH	TFL0816-15N	Susumu
L2	1.8 nH	TFL0816-1N8	Susumu

## 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



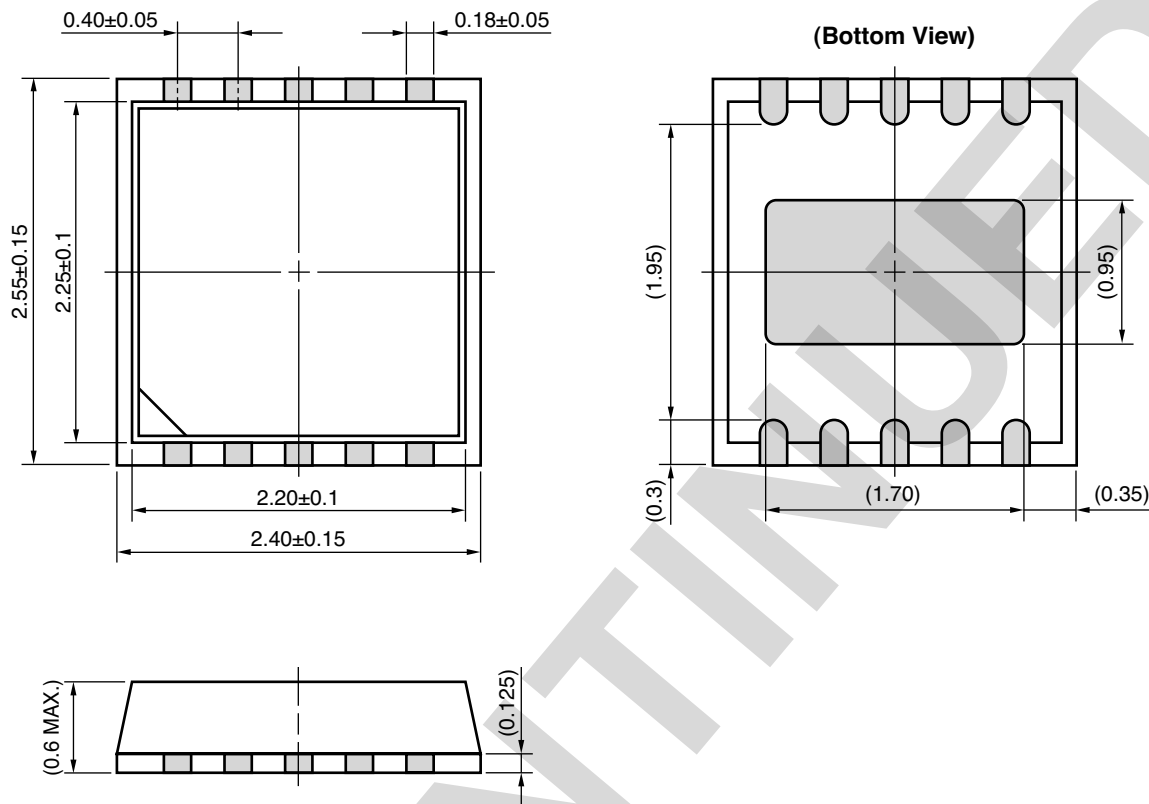
Condition :  $f = 2,450 \text{ MHz}$ ,  $V_{CC1} = V_{CC2} = V_{bias} = 3.3 \text{ V}$ ,  $V_{enable} = 2.9 \text{ V}$ ,  $V_{cont} = 2.5 \text{ V}$ , External input and output matching



**Remark** The graphs indicate nominal characteristics.

**PACKAGE DIMENSIONS**

**10-PIN PLASTIC TSON (UNIT: mm)**



**Note** ( ) : Reference value

**ORDERING INFORMATION**

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM
$\mu$ PG2301TQ-E1-A	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

**Life Support Applications**

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

02/04/2004

Subject: Compliance with EU Directives

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CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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