CEL

# NEC's POWER AMPLIFIER FOR BLUETOOTH™ CLASS 1

# UPG2301TQ



## 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 × 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, $T_A$ = +25°C, $V_{CC1, 2} = V_{bias}$ = 3.3 V, f = 2,450 MHz, External input and output matching)

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

## ELECTRICAL CHARACTERISTICS

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

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Efficiency | PAE | $V_{cont}$ = 2.5 V, $V_{enable}$ = 2.9 V, $P_{in}$ = +4 dBm | – | 50 | – | % |
| Power Gain | $G_P$ | $V_{cont}$ = 2.5 V, $V_{enable}$ = 2.9 V, $P_{in}$ = –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 Note | mW |
| Operating Ambient Temperature | $T_A$ | –40 to +85 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +150 | °C |
| Input Power | $P_{in}$ | +10 | dBm |

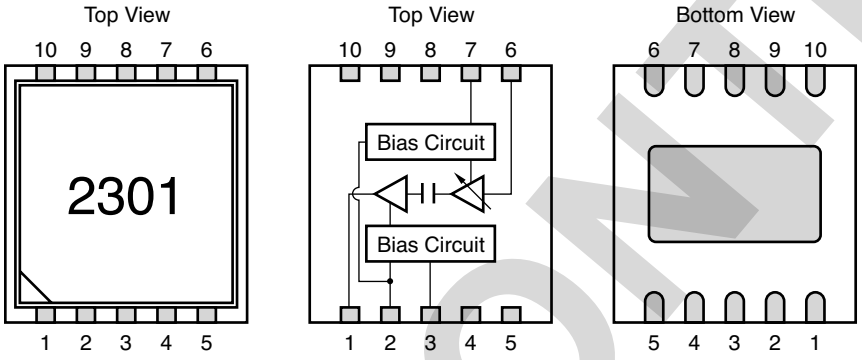
**Note** Mounted on double copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, $T_A$ = +85°C

## RECOMMENDED OPERATING RANGE

($T_A$ = +25°C)

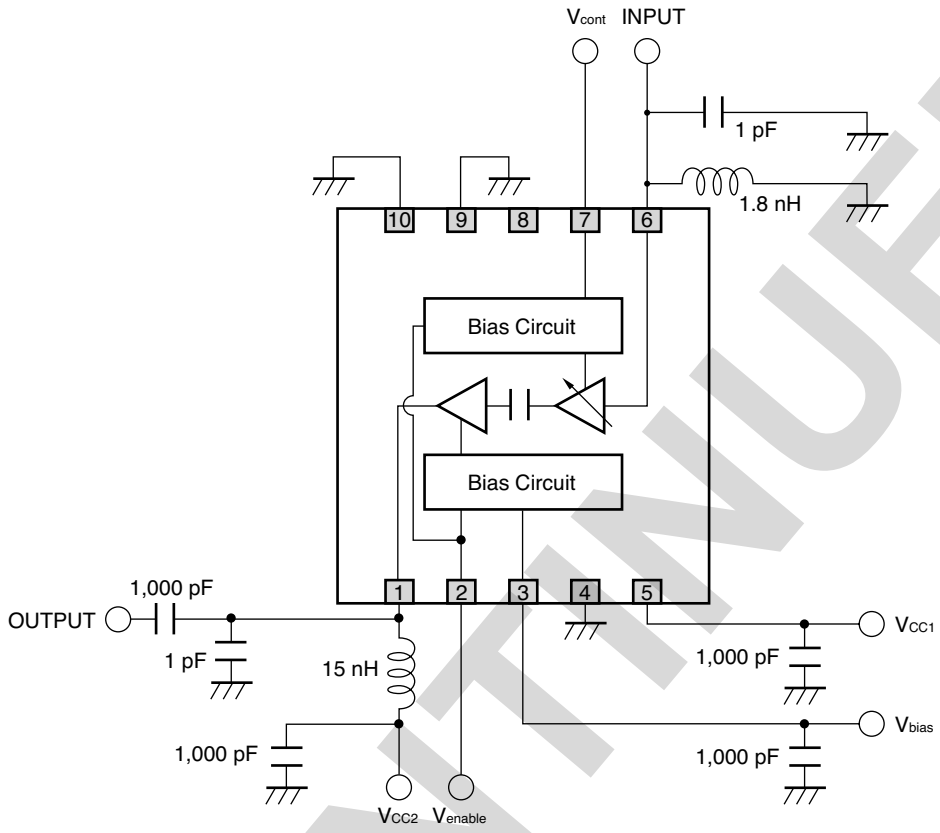
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Operating Frequency | $f_{opt}$ | 2,400 | 2,450 | 2,500 | MHz |
| Supply Voltage | $V_{CC1,2}$ | 2.7 | 3.3 | 3.6 | V |
| | $V_{bias}$ | | | | |
| Control Voltage | $V_{cont}$ | 0 | 2.5 | 3.6 | V |
| | $V_{enable}$ | 0 | 2.9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

## PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



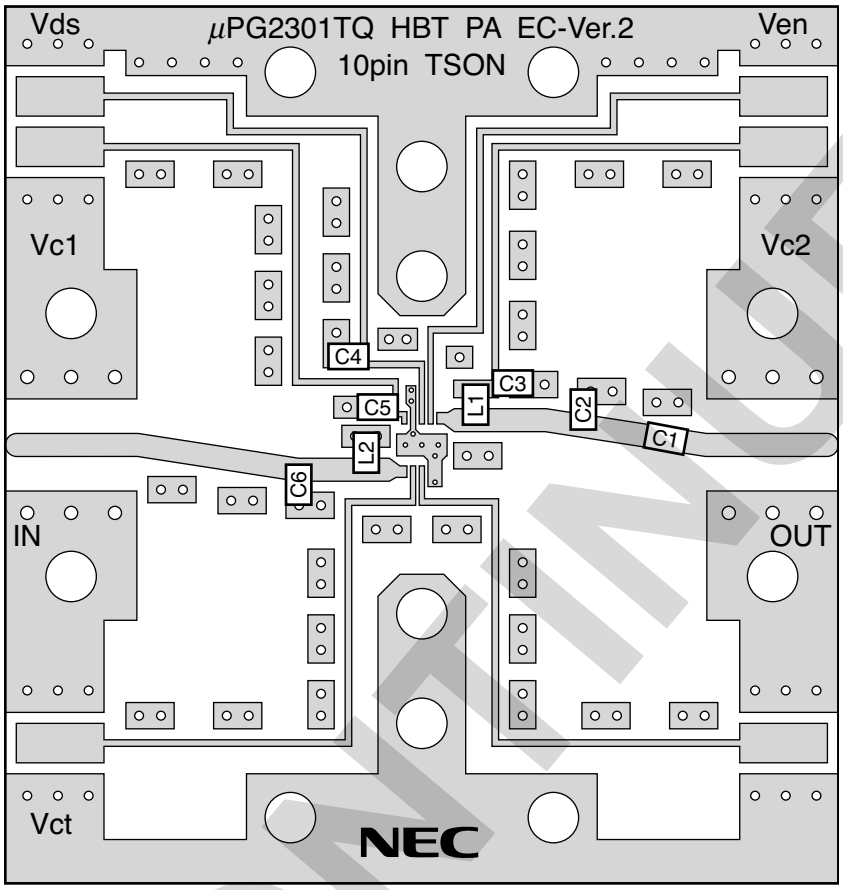

| PIN NO. | PIN NAME |
|---|---|
| 1 | OUTPUT/ $V_{CC2}$ |
| 2 | $V_{enable}$ |
| 3 | $V_{bias}$ |
| 4 | GND |
| 5 | $V_{CC1}$ |
| 6 | INPUT |
| 7 | $V_{cont}$ |
| 8 | N.C. |
| 9 | GND |
| 10 | GND |

## ELEVALUATION CIRCUIT ($V_{CC1, 2}$ = $V_{bias}$ = 3.3 V, f = 2,450 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



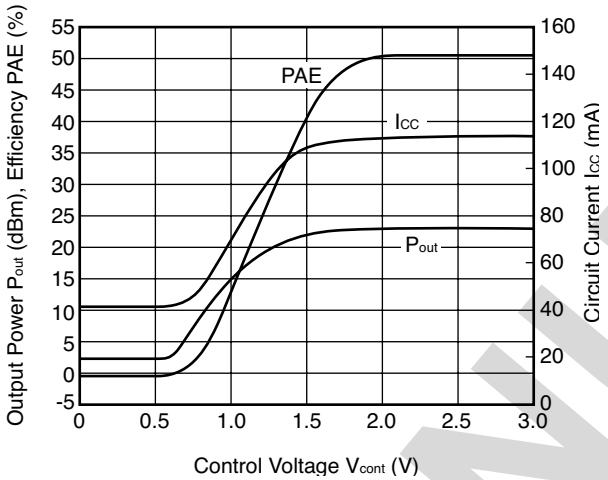

## COMPONENT LIST

| 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 CHARACTERLISTICS

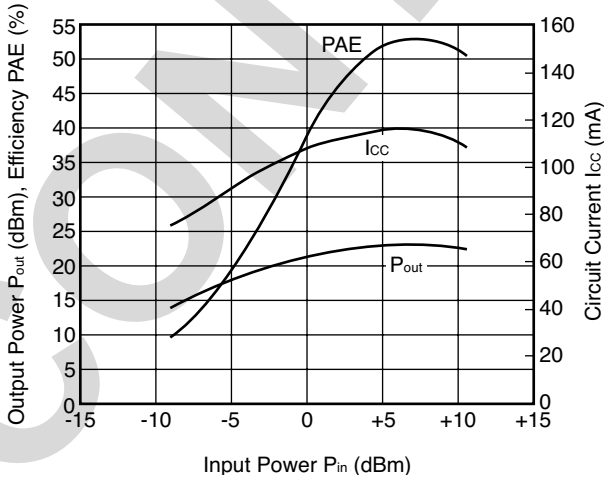
Condition : f = 2,450 MHz, $V_{CC1} = V_{CC2} = V_{bias}$ = 3.3 V, $V_{enable}$ = 2.9 V, $P_{in}$ = +4 dBm, External input and output matching

OUTPUT POWER, EFFICIENCY,
CIRCUIT CURRENT vs. CONTROL VOLTAGE




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

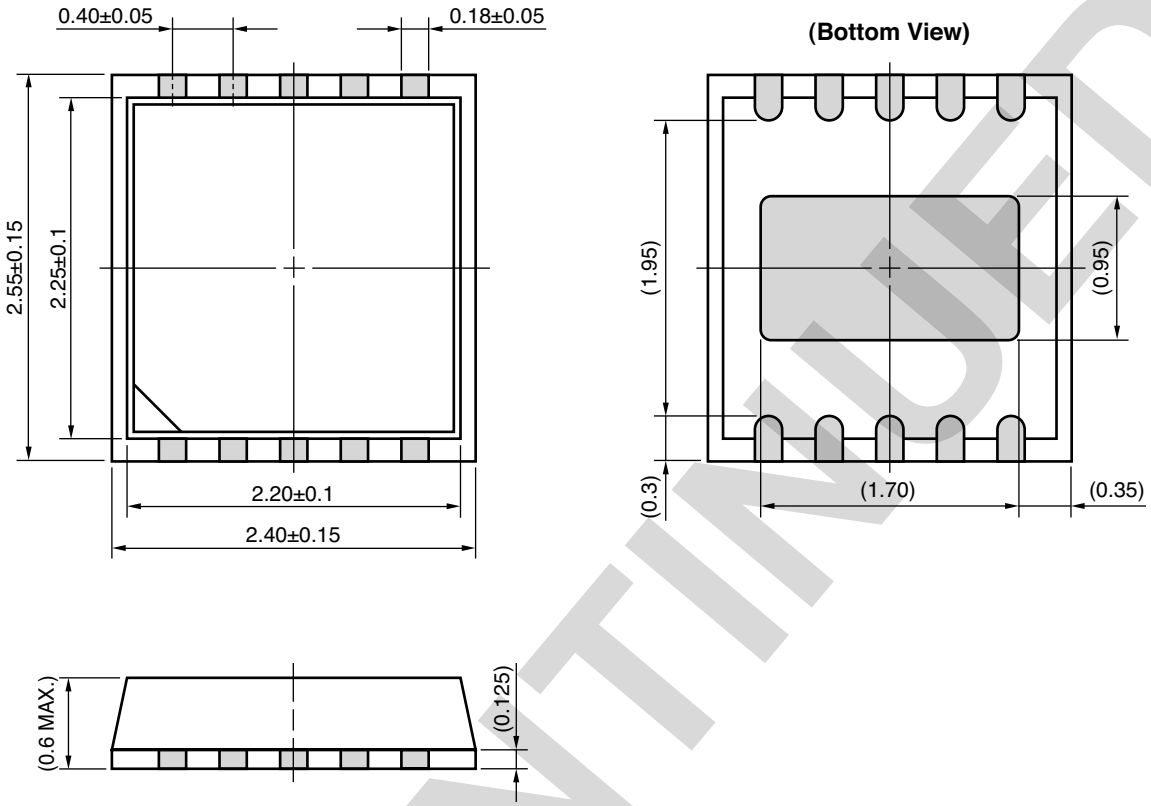
OUTPUT POWER, EFFICIENCY,
CIRCUIT CURRENT vs. INPUT POWER




**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 |
|---|---|---|---|
| μPG2301TQ-E1-A | 10-pin plastic TSON | 2301 | • Embossed tape 8 mm wide<br>• Pin 5, 6 face the perforation side of the tape<br>• Qty 3 kpcs/reel |

**Remark** To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2301TQ

CEL California Eastern Laboratories

4590 Patrick Henry Drive
Santa Clara, CA 95054-1817
Telephone: (408) 919-2500
Facsimile: (408) 988-0279

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

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 | |
|---|---|---|---|
| Lead (Pb) | < 1000 PPM | -A | -AZ |
| | | 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 | |

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.