



# 3V, SUPER MINIMOLD MEDIUM POWER SI MMIC AMPLIFIER

## UPC2771TB

### FEATURES

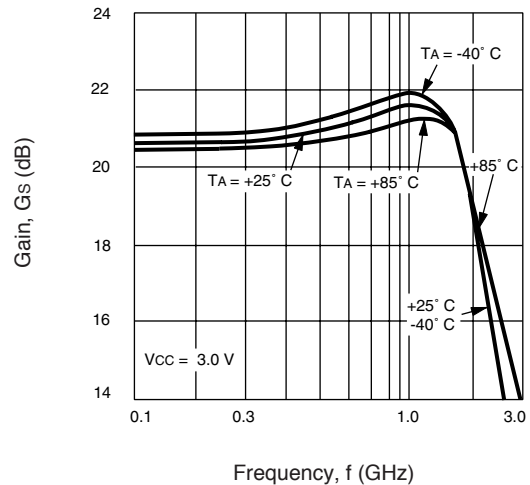
- **HIGH GAIN:** 21 dB at 900 to 1500 MHz Typical
- **HIGH OUTPUT POWER:**  $P_{SAT} = +12.5$  dBm at 900 MHz  
+11 dBm at 1500 MHz
- **LOW BIAS VOLTAGE:** 3.0 V Typical, 2.7 V Minimum
- **SUPER SMALL PACKAGE:** SOT-363
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

### DESCRIPTION

NEC's UPC2771TB is a Silicon Monolithic integrated circuit which is manufactured using the NESAT™ III process. The NESAT III process produces transistors with  $f_T$  approaching 20 GHz. The UPC2771TB is pin compatible and has comparable performance as the larger UPC2771T, so it is suitable for use as a replacement to help reduce system size. The IC is housed in a 6 pin super minimold or SOT-363 package. Operating on a 3 volt supply, this IC is ideally suited for hand-held, portable designs.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

**GAIN vs. FREQUENCY AND TEMPERATURE**



### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , $Z_L = Z_S = 50\ \Omega$ , $V_{CC} = 3.0\text{ V}$ )

| PART NUMBER<br>PACKAGE OUTLINE |   |            | UPC2771TB<br>S06 |               |            |
|--------------------------------|---|------------|------------------|---------------|------------|
| SYMBOLS                        | PARAMETERS AND CONDITIONS   | UNITS      | MIN              | TYP           | MAX        |
| $I_{CC}$                       | Circuit Current (no signal)   | mA         |                  | 36            | 45         |
| $G_s$                          | Small Signal Gain,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$   | dB<br>dB   | 19<br>18         | 21<br>21      | 24<br>24   |
| $f_U$                          | Upper Limit Operating Frequency (The gain at $f_U$ is 3 dB down from the gain at 100 MHz)   | GHz        | 1.8              | 2.2           |            |
| $P_{1dB}$                      | 1 dB Compressed Output Power,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$  | dBm<br>dBm | +9<br>+7         | +11.5<br>+9.5 |            |
| $P_{SAT}$                      | Saturated Output Power,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$  | dBm<br>dBm |                  | +12.5<br>+11  |            |
| NF                             | Noise Figure,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$  | dB<br>dB   |                  | 6<br>6        | 7.5<br>7.5 |
| $RL_{IN}$                      | Input Return Loss,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$   | dB<br>dB   | 10<br>10         | 14<br>14      |            |
| $RL_{OUT}$                     | Output Return Loss,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$  | dB<br>dB   | 6.5<br>5.5       | 9.0<br>8.5    |            |
| ISOL                           | Isolation,<br>$f = 900\text{ MHz}$<br>$f = 1500\text{ MHz}$   | dB<br>dB   | 25<br>25         | 30<br>30      |            |
| OIP3                           | SSB Output Third Order Intercept Point<br>$f = 900, 902\text{ MHz}$ , $P_{OUT} = +4\text{ dBm}$<br>$f = 1500, 1502\text{ MHz}$ , $P_{OUT} = +4\text{ dBm}$                          | dBm<br>dBm |                  | +13<br>+10    |            |
| $P_{ADJ1}$                     | Adjacent Channel Power 1,<br>$f = 900\text{ MHz}$ , $\pi/4$ QPSK wave <sup>1</sup> , $P_{OUT} = +7\text{ dBm}$<br>$\Delta f = \pm 50\text{ kHz}$<br>$\Delta f = \pm 100\text{ kHz}$ | dBc<br>dBc |                  | -61<br>-72    |            |
| $P_{ADJ2}$                     | Adjacent Channel Power 2,<br>$f = 1.5\text{ GHz}$ , $\pi/4$ QPSK wave <sup>1</sup> , $P_{OUT} = +7\text{ dBm}$<br>$\Delta f = \pm 50\text{ kHz}$<br>$\Delta f = \pm 100\text{ kHz}$ | dBc<br>dBc |                  | -59<br>-72    |            |

Note:

1.  $\pi/4$  QPSK modulated wave input, data rate 42 kbps, Filter roll off  $\alpha = 0.5$

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (T<sub>A</sub> = 25°C)

| SYMBOLS          | PARAMETERS                           | UNITS | RATINGS     |
|------------------|--------------------------------------|-------|-------------|
| V <sub>CC</sub>  | Supply Voltage                       | V     | 3.6         |
| I <sub>CC</sub>  | Total Supply Current                 | mA    | 77.7        |
| P <sub>IN</sub>  | Input Power                          | dBm   | +13         |
| P <sub>T</sub>   | Total Power Dissipation <sup>2</sup> | mW    | 200         |
| T <sub>OP</sub>  | Operating Temperature                | °C    | -40 to +85  |
| T <sub>STG</sub> | Storage Temperature                  | °C    | -55 to +150 |

Notes:

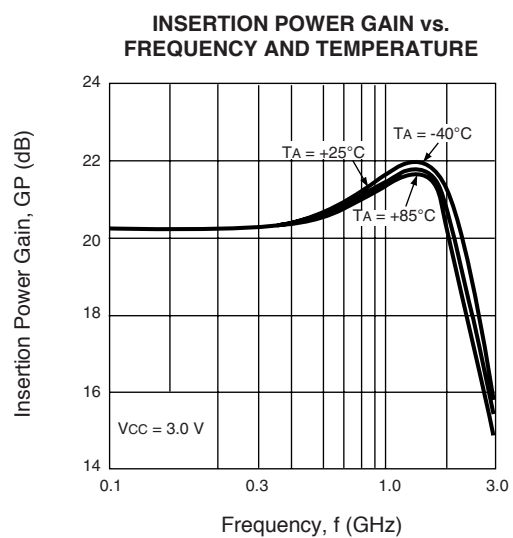
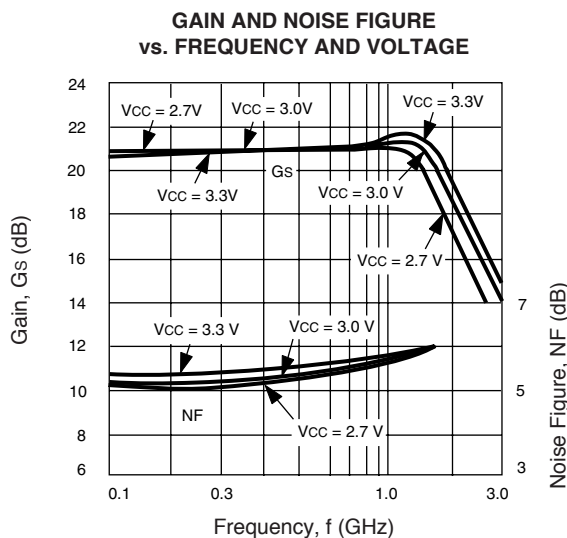
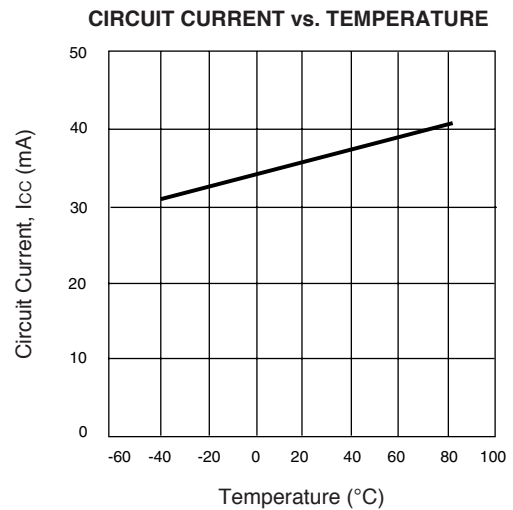
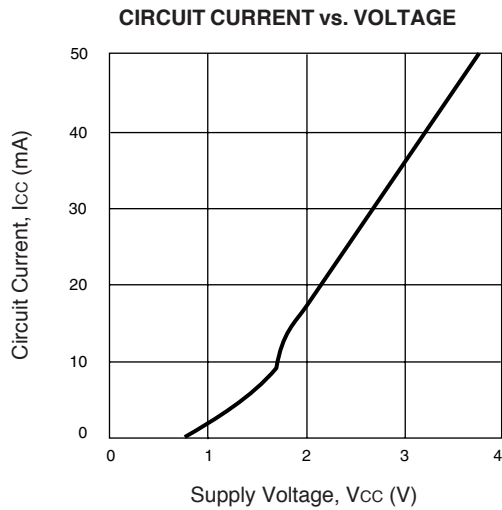
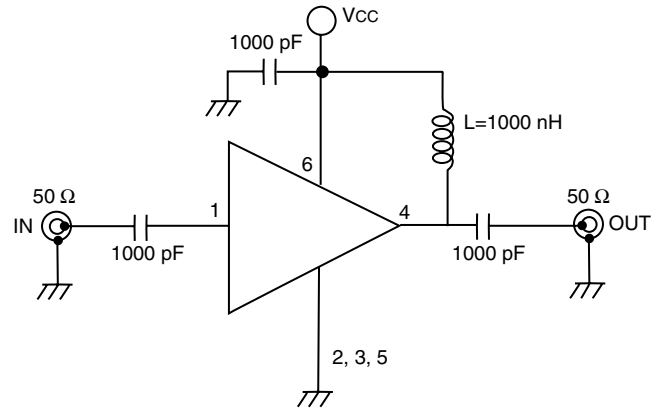
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 X 50 X 1.6 mm epoxy glass PWB (T<sub>A</sub> = 85°C).

**RECOMMENDED OPERATING CONDITIONS**

| SYMBOLS         | PARAMETERS            | UNITS | MIN | TYP | MAX |
|-----------------|-----------------------|-------|-----|-----|-----|
| V <sub>CC</sub> | Supply Voltage        | V     | 2.7 | 3   | 3.3 |
| T <sub>OP</sub> | Operating Temperature | °C    | -40 | +25 | +85 |

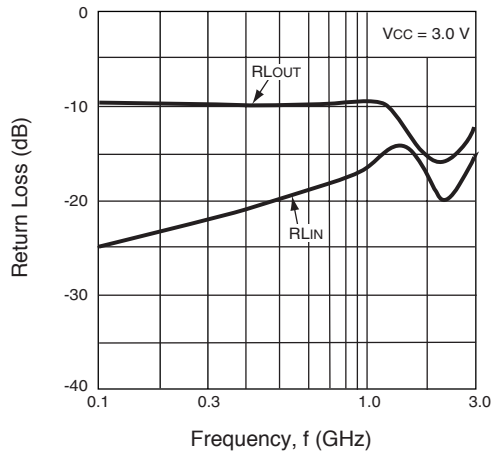
**TYPICAL PERFORMANCE CURVES** (T<sub>A</sub> = 25°C)

**TEST CIRCUIT**

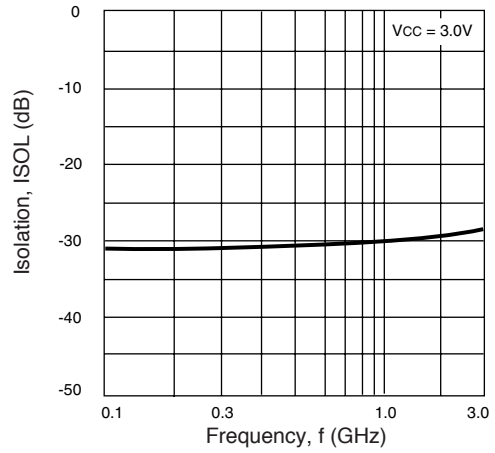


**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ$ )

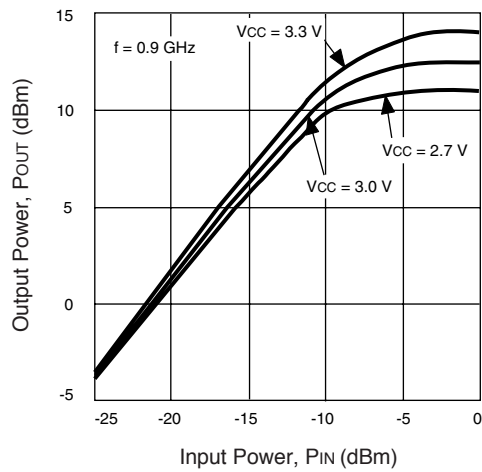
**INPUT RETURN LOSS AND OUTPUT RETURN LOSS vs. FREQUENCY**



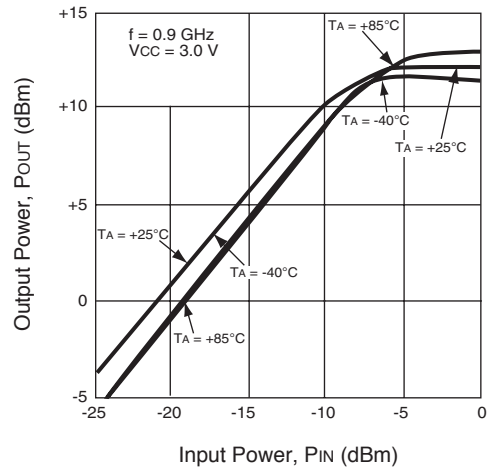
**ISOLATION vs. FREQUENCY**



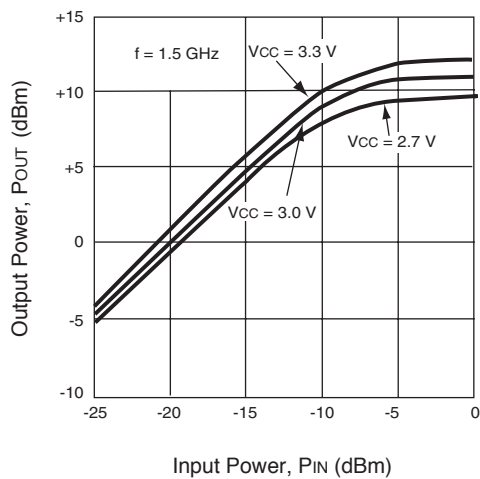
**OUTPUT POWER vs. INPUT POWER AND VOLTAGE**



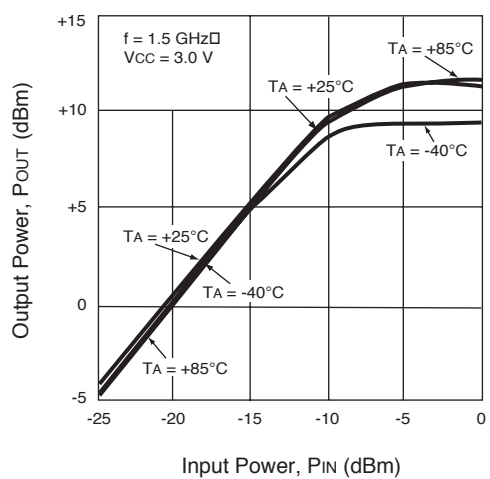
**OUTPUT POWER vs. INPUT POWER AND TEMPERATURE**



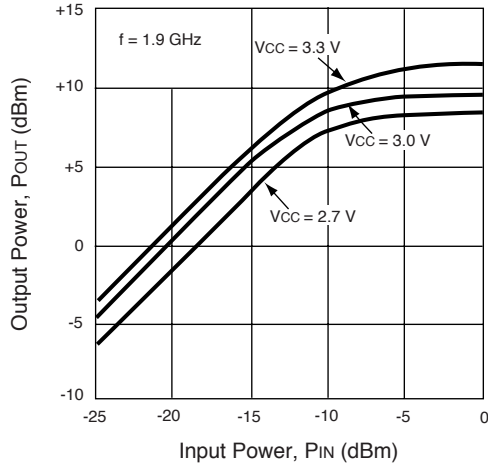
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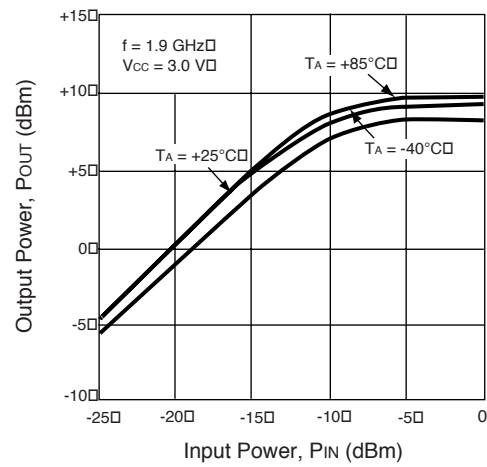
**OUTPUT POWER vs. INPUT POWER AND TEMPERATURE**



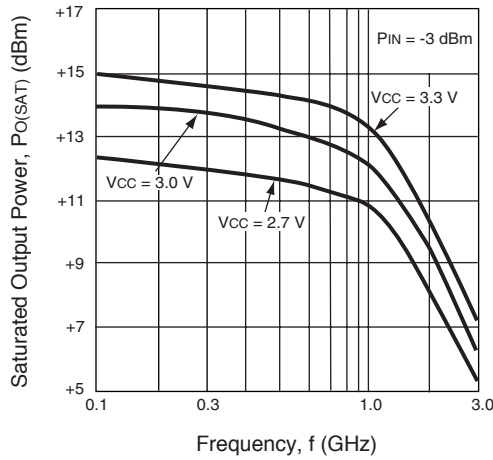
**OUTPUT POWER vs. INPUT POWER AND VOLTAGE**



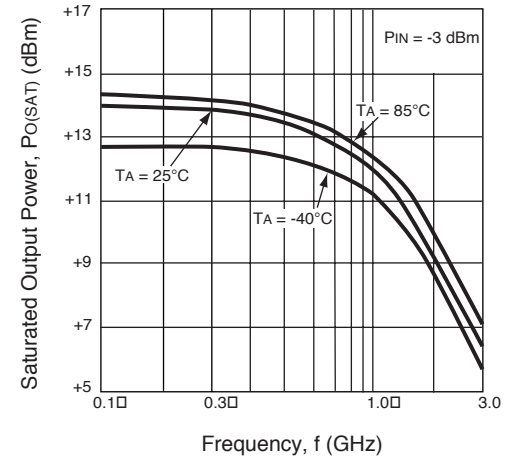
**OUTPUT POWER vs. INPUT POWER AND VOLTAGE**



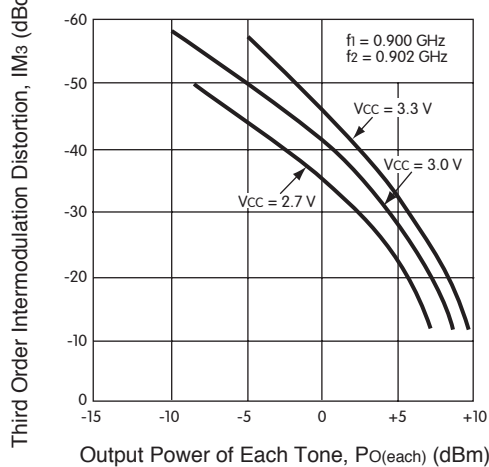
**SATURATED OUTPUT POWER vs. FREQUENCY AND VOLTAGE**



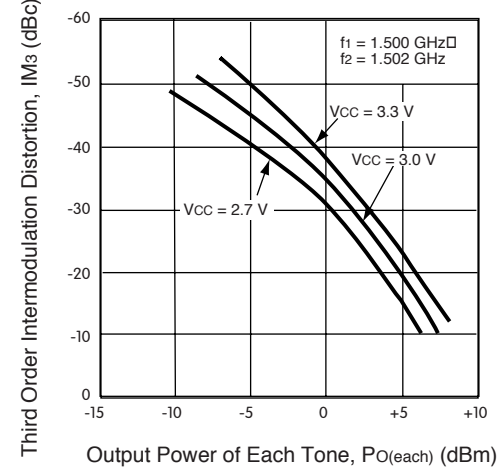
**SATURATED OUTPUT POWER vs. FREQUENCY AND TEMPERATURE**



**THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE AND VOLTAGE**

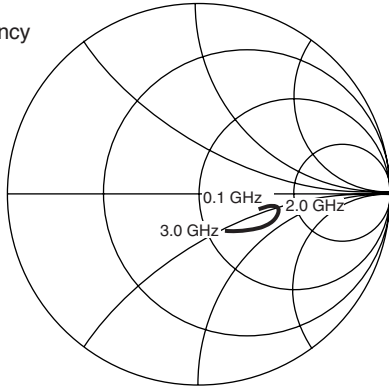


**THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE AND VOLTAGE**

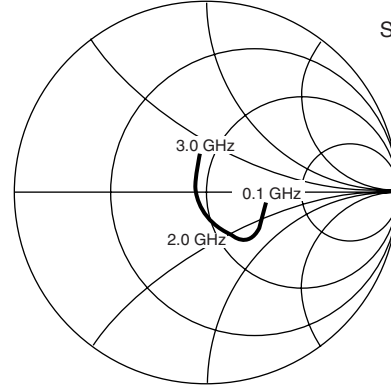


**TYPICAL SCATTERING PARAMETERS** (TA = 25°C)

S11 Frequency



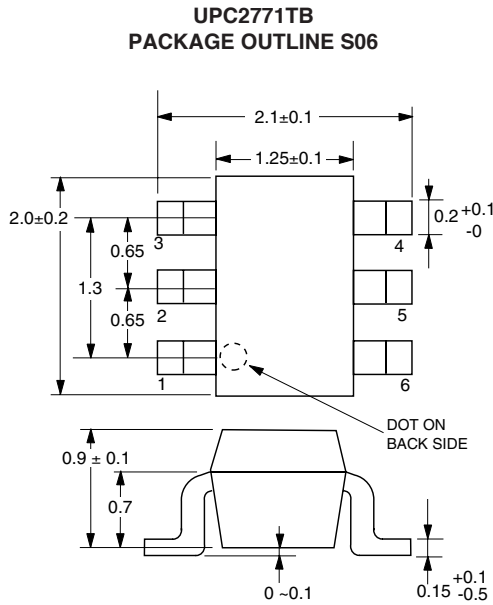
S22 Frequency



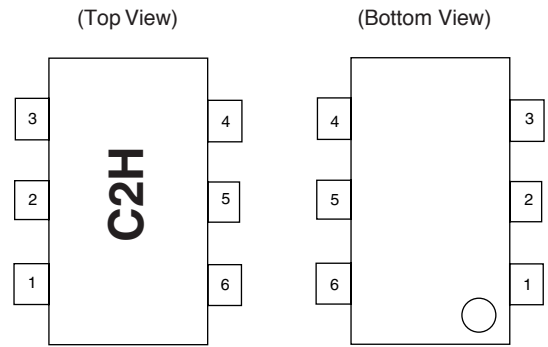
Vcc = Vout = 3.0 V, Icc = 35 mA

| FREQUENCY<br>GHz | S11   |       | S21    |        | S12   |      | S22   |        | K    |
|------------------|-------|-------|--------|--------|-------|------|-------|--------|------|
|                  | MAG   | ANG   | MAG    | ANG    | MAG   | ANG  | MAG   | ANG    |      |
| 0.1              | 0.045 | 19.7  | 10.570 | -4.7   | 0.028 | 0.8  | 0.327 | -6.2   | 1.65 |
| 0.2              | 0.057 | 37.0  | 10.638 | -9.5   | 0.028 | 5.0  | 0.325 | -11.5  | 1.63 |
| 0.3              | 0.075 | 41.3  | 10.775 | -14.1  | 0.029 | 8.6  | 0.323 | -16.2  | 1.58 |
| 0.4              | 0.090 | 43.3  | 11.004 | -19.4  | 0.030 | 11.1 | 0.326 | -20.9  | 1.49 |
| 0.5              | 0.105 | 42.2  | 11.275 | -24.4  | 0.030 | 14.9 | 0.331 | -26.4  | 1.45 |
| 0.6              | 0.118 | 40.2  | 11.586 | -30.0  | 0.031 | 15.8 | 0.342 | -32.0  | 1.37 |
| 0.7              | 0.138 | 34.9  | 12.041 | -35.9  | 0.031 | 19.8 | 0.350 | -37.3  | 1.29 |
| 0.8              | 0.163 | 32.5  | 12.367 | -42.1  | 0.032 | 20.1 | 0.359 | -42.8  | 1.20 |
| 0.9              | 0.186 | 29.4  | 12.844 | -48.8  | 0.032 | 23.2 | 0.361 | -49.4  | 1.15 |
| 1.0              | 0.202 | 26.3  | 13.300 | -56.6  | 0.032 | 23.9 | 0.371 | -56.1  | 1.11 |
| 1.1              | 0.219 | 21.7  | 13.771 | -64.6  | 0.033 | 24.9 | 0.389 | -62.5  | 1.03 |
| 1.2              | 0.233 | 15.4  | 14.082 | -73.5  | 0.033 | 26.6 | 0.400 | -69.3  | 0.99 |
| 1.3              | 0.252 | 8.4   | 14.365 | -83.2  | 0.036 | 28.8 | 0.405 | -75.4  | 0.92 |
| 1.4              | 0.267 | -0.1  | 14.336 | -92.6  | 0.036 | 30.0 | 0.402 | -83.6  | 0.91 |
| 1.5              | 0.285 | -6.8  | 14.142 | -102.4 | 0.036 | 32.0 | 0.406 | -91.6  | 0.90 |
| 1.6              | 0.293 | -13.9 | 13.929 | -112.0 | 0.037 | 31.6 | 0.413 | -99.3  | 0.89 |
| 1.7              | 0.304 | -20.9 | 13.428 | -121.6 | 0.039 | 32.5 | 0.414 | -105.8 | 0.88 |
| 1.8              | 0.290 | -28.1 | 12.722 | -131.0 | 0.038 | 34.7 | 0.401 | -113.7 | 0.96 |
| 1.9              | 0.285 | -35.3 | 11.966 | -139.6 | 0.038 | 36.1 | 0.387 | -120.8 | 1.03 |
| 2.0              | 0.273 | -41.8 | 11.232 | -147.5 | 0.038 | 37.4 | 0.378 | -127.6 | 1.09 |
| 2.1              | 0.267 | -47.4 | 10.500 | -154.8 | 0.039 | 39.1 | 0.366 | -133.1 | 1.14 |
| 2.2              | 0.254 | -51.6 | 9.815  | -161.7 | 0.040 | 41.4 | 0.356 | -138.0 | 1.20 |
| 2.3              | 0.237 | -57.1 | 9.168  | -168.0 | 0.041 | 43.7 | 0.342 | -142.8 | 1.28 |
| 2.4              | 0.221 | -61.1 | 8.570  | -173.7 | 0.041 | 48.3 | 0.325 | -148.3 | 1.37 |
| 2.5              | 0.212 | -68.8 | 7.967  | -179.7 | 0.042 | 48.3 | 0.322 | -152.6 | 1.44 |
| 2.6              | 0.208 | -72.2 | 7.507  | -174.9 | 0.043 | 50.8 | 0.314 | -156.7 | 1.49 |
| 2.7              | 0.202 | -74.1 | 7.004  | -170.0 | 0.045 | 53.7 | 0.309 | -160.1 | 1.53 |
| 2.8              | 0.190 | -76.3 | 6.667  | -164.7 | 0.047 | 54.2 | 0.303 | -164.0 | 1.56 |
| 2.9              | 0.178 | -76.7 | 6.336  | -160.7 | 0.051 | 57.7 | 0.292 | -167.8 | 1.55 |
| 3.0              | 0.154 | -82.3 | 6.003  | -155.6 | 0.051 | 56.5 | 0.287 | -172.8 | 1.62 |
| 3.1              | 0.147 | -88.0 | 5.772  | -151.3 | 0.054 | 59.3 | 0.279 | -176.4 | 1.61 |

**OUTLINE DIMENSIONS** (Units in mm)



**LEAD CONNECTIONS**



- 1. INPUT
- 2. GND
- 3. GND
- 4. OUTPUT
- 5. GND
- 6. Vcc

**PIN DESCRIPTION**

| Pin No. | Pin Name (V) | Applied Voltage | Description   | Internal Equivalent Circuit |
|---------|--------------|-----------------|---|-----------------------------|
| 1       | Input        | —               | Signal input pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. A multi-feedback circuit is designed to cancel the deviations of h <sub>FE</sub> and resistance. This pin must be coupled to the signal source with a blocking capacitor. |                             |
| 4       | Output       | 2.7 to 3.3      | Signal output pin. Connect an inductor between this pin and VCC to supply current to the internal output transistors.   |                             |
| 6       | VCC          |                 | Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.  |                             |
| 2       | GND          | 0               | Ground pins. These pins should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. All the ground pins must be connected together with wide ground pattern to minimize impedance difference.                                   |                             |

**ORDERING INFORMATION**

| PART NUMBER    | QTY     |
|----------------|---------|
| UPC2771TB-E3-A | 3K/Reel |

Note: Embossed Tape, 8 mm wide. Pins 1, 2 and 3 face perforated side of tape.

Life Support Applications

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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 |     |
|-------------------------------|---|--|-----|
|                               |   | -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                           |     |

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

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