

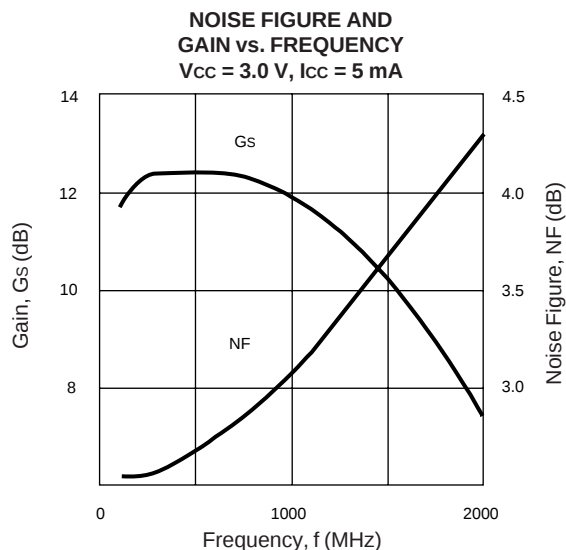
### FEATURES

- **LOW VOLTAGE - LOW CURRENT:** 5 mA at 3 V
- **LOW POWER CONSUMPTION:** 15 mW TYP
- **SUPER SMALL PACKAGE**
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

### DESCRIPTION

The UPC2747T 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. This amplifier was designed for 900 MHz receivers in cellular and cordless telephone applications. Operating on a 3 volt supply (1.8 volt minimum) this IC is ideally suited for hand-held, portable designs.

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



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

| PART NUMBER<br>PACKAGE OUTLINE |                                                                                                                                                                                                                                                                                                                                                                     |                                          | UPC2747T<br>TO6 |                       |            |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------|-----------------------|------------|
| SYMBOLS                        | PARAMETERS AND CONDITIONS                                                                                                                                                                                                                                                                                                                                           | UNITS                                    | MIN             | TYP                   | MAX        |
| $I_{CC}$                       | Circuit Current (no signal)<br>$V_{CC} = 3.0 \text{ V}$<br>$V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                                                                 | mA<br>mA                                 | 3.8             | 5.0<br>3.0            | 7.0        |
| $G_S$                          | Small Signal Gain,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                          | dB<br>dB                                 | 9               | 12<br>5.5             | 14         |
| $f_u^1$                        | Upper Limit Operating Frequency, $V_{CC} = 3.0 \text{ V}$<br>$V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                                                               | GHz<br>GHz                               | 1.5             | 1.8<br>1.8            |            |
| $P_{SAT}$                      | Saturated Output Power,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                     | dBm<br>dBm                               | -9.5            | -7<br>-14             |            |
| NF                             | Noise Figure,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                               | dB<br>dB                                 |                 | 3.3<br>5.2            | 4.5        |
| $RL_{IN}$                      | Input Return Loss,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                          | dB<br>dB                                 | 11              | 14<br>11              |            |
| $RL_{OUT}$                     | Output Return Loss,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                         | dB<br>dB                                 | 7               | 10<br>13              |            |
| ISOL                           | Isolation,<br>$f = 900 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f = 900 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$                                                                                                                                                                                                                                                  | dB<br>dB                                 | 35              | 40<br>34              |            |
| OIP3                           | SSB Output Third Order Intercept,<br>$f_1 = 500 \text{ MHz}$ , $f_2 = 510 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f_1 = 900 \text{ MHz}$ , $f_2 = 902 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f_1 = 1000 \text{ MHz}$ , $f_2 = 1010 \text{ MHz}$ , $V_{CC} = 3.0 \text{ V}$<br>$f_1 = 900 \text{ MHz}$ , $f_2 = 902 \text{ MHz}$ , $V_{CC} = 1.8 \text{ V}$ | dBm<br>dBm<br>dBm<br>dBm                 |                 | -3<br>-3<br>-2<br>-10 |            |
| $R_{TH} (J-A)$                 | Thermal Resistance (Junction to Ambient)<br>Free Air<br>Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB                                                                                                                                                                                                                                                               | $^\circ\text{C/W}$<br>$^\circ\text{C/W}$ |                 |                       | 620<br>230 |

Note:

1. The gain at  $f_u$  is 3 dB down from the gain at 100 MHz.

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

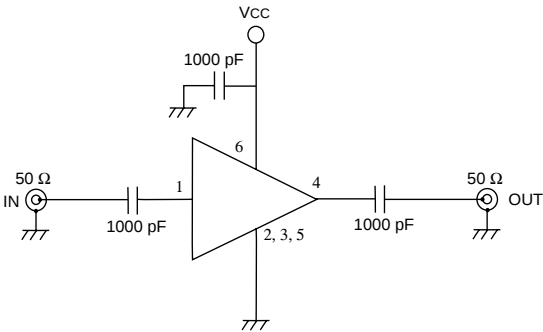
| SYMBOLS          | PARAMETERS                           | UNITS | RATINGS     |
|------------------|--------------------------------------|-------|-------------|
| V <sub>CC</sub>  | Supply Voltage                       | V     | 4.0         |
| I <sub>CC</sub>  | Total Supply Current                 | mA    | 15          |
| P <sub>IN</sub>  | Input Power                          | dBm   | 0           |
| P <sub>T</sub>   | Total Power Dissipation <sup>2</sup> | mW    | 280         |
| T <sub>OP</sub>  | Operating Temperature                | °C    | -40 to +85  |
| T <sub>STG</sub> | Storage Temperature                  | °C    | -55 to +150 |

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

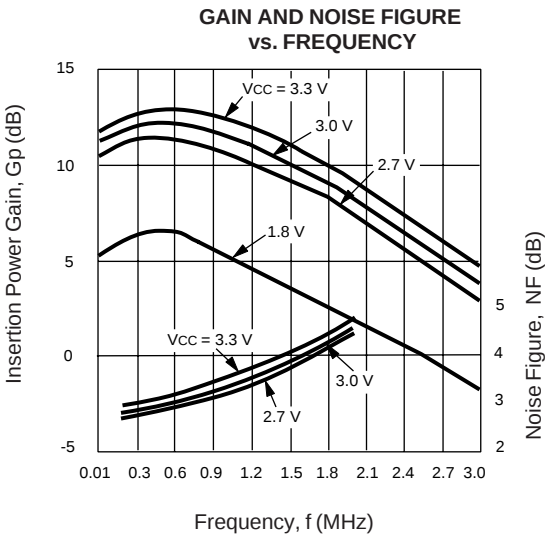
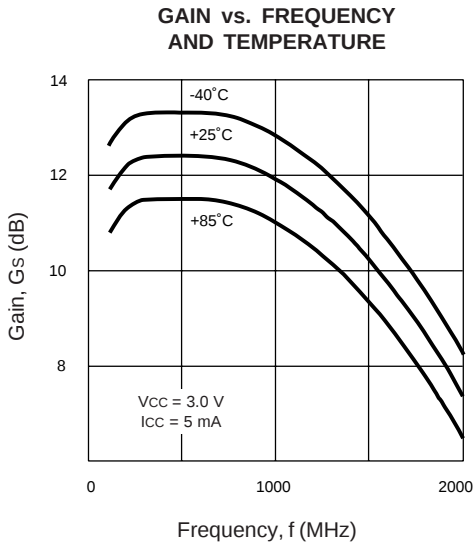
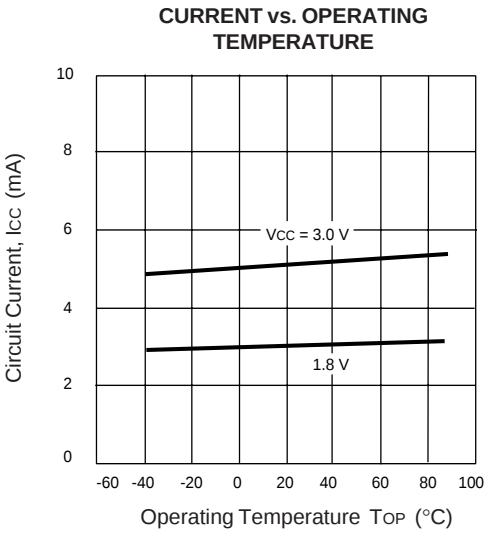
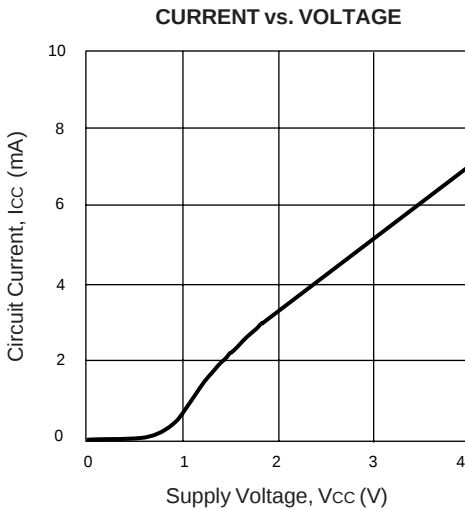
RECOMMENDED OPERATING CONDITIONS

| SYMBOLS         | PARAMETERS            | UNITS | MIN | TYP | MAX |
|-----------------|-----------------------|-------|-----|-----|-----|
| V <sub>CC</sub> | Supply Voltage        | V     | 1.8 | 3   | 3.3 |
| T <sub>OP</sub> | Operating Temperature | °C    | -40 | 25  | 85  |

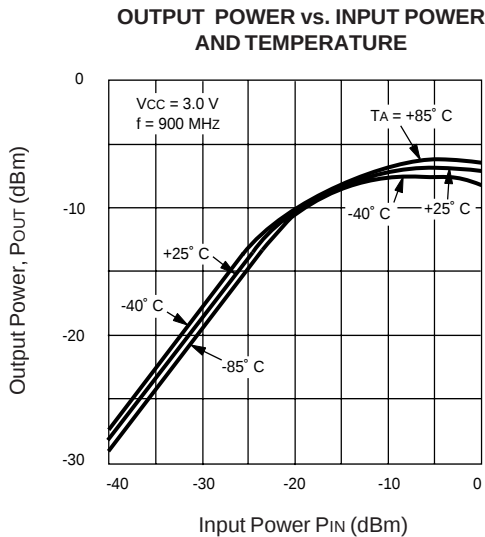
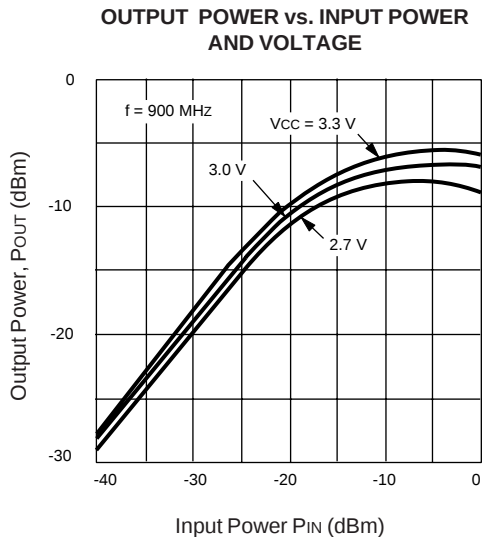
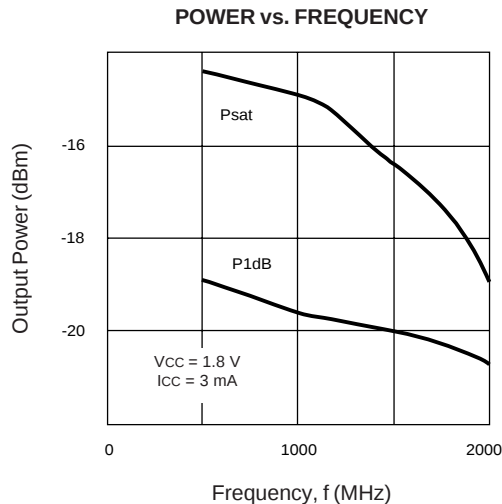
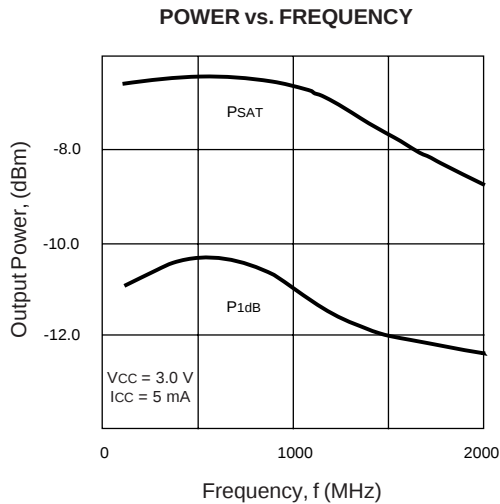
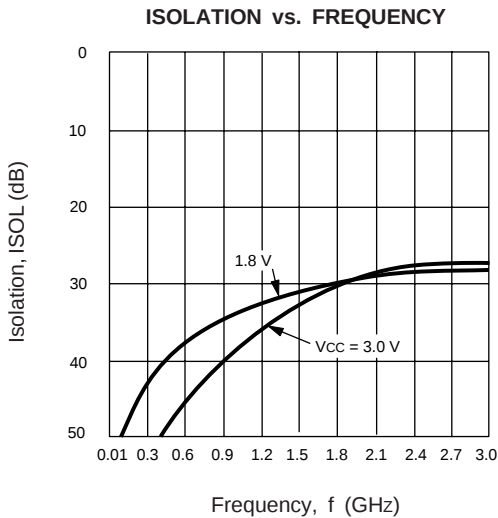
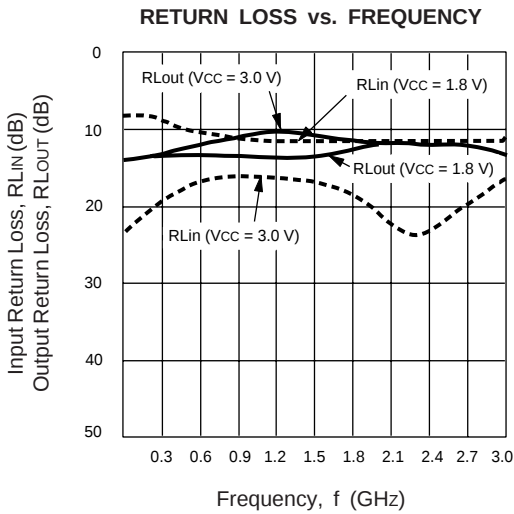
TEST CIRCUIT



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



TYPICAL PERFORMANCE CURVES (TA = 25°C, unless otherwise specified)



TYPICAL SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)V<sub>CC</sub> = 3.0 V, I<sub>CC</sub> = 5.0 mA

| FREQUENCY<br>(GHz) | S <sub>11</sub> |        | S <sub>21</sub> |        | S <sub>12</sub> |       | S <sub>22</sub> |       | K <sup>1</sup> | S <sub>21</sub><br>(dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|-------|-----------------|-------|----------------|-------------------------|
|                    | MAG             | ANG    | MAG             | ANG    | MAG             | ANG   | MAG             | ANG   |                |                         |
| 0.1                | 0.061           | -175.8 | 3.84            | -4.0   | 0.001           | 120.5 | 0.249           | -1.9  | 121.68         | 11.7                    |
| 0.2                | 0.075           | -168.9 | 4.10            | -12.5  | 0.001           | 118.8 | 0.255           | -4.2  | 113.38         | 12.3                    |
| 0.3                | 0.093           | -167.4 | 4.18            | -23.0  | 0.002           | 117.0 | 0.261           | -5.7  | 55.26          | 12.4                    |
| 0.4                | 0.117           | -174.1 | 4.17            | -33.0  | 0.003           | 115.2 | 0.266           | -7.0  | 36.64          | 12.4                    |
| 0.5                | 0.134           | 175.3  | 4.15            | -42.5  | 0.004           | 113.7 | 0.272           | -8.7  | 27.40          | 12.4                    |
| 0.6                | 0.142           | 163.9  | 4.12            | -52.0  | 0.004           | 112.2 | 0.277           | -10.6 | 27.46          | 12.3                    |
| 0.7                | 0.152           | 153.7  | 4.07            | -61.1  | 0.005           | 110.8 | 0.281           | -13.1 | 22.12          | 12.2                    |
| 0.8                | 0.159           | 142.9  | 4.02            | -70.7  | 0.006           | 109.3 | 0.283           | -15.8 | 18.60          | 12.1                    |
| 0.9                | 0.154           | 131.7  | 3.97            | -80.0  | 0.008           | 107.8 | 0.288           | -19.3 | 14.11          | 12.0                    |
| 1.0                | 0.148           | 120.7  | 3.92            | -90.2  | 0.009           | 106.3 | 0.287           | -22.6 | 12.73          | 11.9                    |
| 1.1                | 0.143           | 110.5  | 3.83            | -99.3  | 0.012           | 104.8 | 0.287           | -27.6 | 9.79           | 11.7                    |
| 1.2                | 0.139           | 101.1  | 3.70            | -108.1 | 0.013           | 103.4 | 0.284           | -30.2 | 9.39           | 11.4                    |
| 1.3                | 0.135           | 88.5   | 3.55            | -117.0 | 0.014           | 101.9 | 0.279           | -34.7 | 9.12           | 11.0                    |
| 1.4                | 0.131           | 80.9   | 3.38            | -126.2 | 0.015           | 100.4 | 0.272           | -37.3 | 8.99           | 10.6                    |
| 1.5                | 0.126           | 71.1   | 3.23            | -134.8 | 0.016           | 98.0  | 0.264           | -41.3 | 8.87           | 10.2                    |
| 1.6                | 0.121           | 61.5   | 3.07            | -143.3 | 0.017           | 95.6  | 0.256           | -43.7 | 8.84           | 9.7                     |
| 1.7                | 0.120           | 55.6   | 2.89            | -150.9 | 0.018           | 93.2  | 0.243           | -45.8 | 8.93           | 9.2                     |
| 1.8                | 0.118           | 48.0   | 2.72            | -158.8 | 0.020           | 92.6  | 0.234           | -46.2 | 8.58           | 8.7                     |
| 1.9                | 0.113           | 42.9   | 2.53            | -166.6 | 0.022           | 91.6  | 0.219           | -47.0 | 8.46           | 8.1                     |
| 2.0                | 0.105           | 34.7   | 2.32            | -173.1 | 0.024           | 89.2  | 0.209           | -46.4 | 8.51           | 7.3                     |

V<sub>CC</sub> = 1.8 V, I<sub>CC</sub> = 3.0 mA

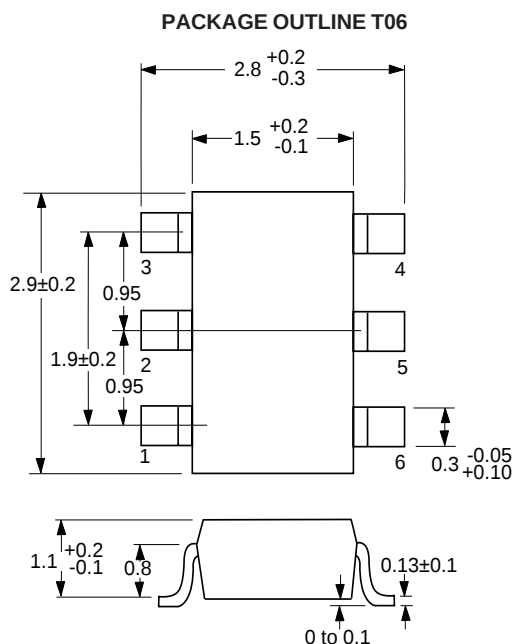
| FREQUENCY<br>GHz | S <sub>11</sub> |        | S <sub>21</sub> |        | S <sub>12</sub> |      | S <sub>22</sub> |       | K <sup>1</sup> | S <sub>21</sub><br>(dB) |
|------------------|-----------------|--------|-----------------|--------|-----------------|------|-----------------|-------|----------------|-------------------------|
|                  | MAG             | ANG    | MAG             | ANG    | MAG             | ANG  | MAG             | ANG   |                |                         |
| 0.1              | 0.436           | -6.3   | 1.79            | -5.1   | 0.003           | 63.5 | 0.259           | -3.8  | 70.31          | 5.1                     |
| 0.2              | 0.428           | -15.1  | 1.89            | -14.8  | 0.004           | 62.0 | 0.260           | -8.1  | 50.34          | 5.5                     |
| 0.3              | 0.416           | -23.9  | 1.94            | -26.3  | 0.005           | 60.6 | 0.259           | -11.9 | 39.74          | 5.8                     |
| 0.4              | 0.388           | -30.7  | 1.97            | -37.5  | 0.006           | 59.1 | 0.256           | -13.9 | 33.54          | 5.9                     |
| 0.5              | 0.366           | -37.2  | 1.96            | -49.1  | 0.008           | 57.6 | 0.252           | -17.5 | 25.83          | 5.8                     |
| 0.6              | 0.352           | -41.4  | 1.92            | -60.3  | 0.009           | 56.1 | 0.247           | -19.9 | 23.77          | 5.7                     |
| 0.7              | 0.337           | -46.8  | 1.87            | -71.0  | 0.011           | 54.6 | 0.240           | -24.3 | 29.27          | 5.4                     |
| 0.8              | 0.332           | -50.4  | 1.82            | -81.8  | 0.013           | 53.2 | 0.232           | -25.9 | 17.75          | 5.2                     |
| 0.9              | 0.327           | -55.0  | 1.74            | -92.4  | 0.014           | 51.7 | 0.224           | -31.0 | 17.37          | 4.8                     |
| 1.0              | 0.328           | -60.3  | 1.67            | -104.2 | 0.015           | 50.2 | 0.215           | -33.1 | 16.95          | 4.5                     |
| 1.1              | 0.328           | -66.2  | 1.60            | -113.8 | 0.017           | 48.7 | 0.207           | -36.1 | 15.66          | 4.1                     |
| 1.2              | 0.329           | -70.9  | 1.54            | -121.2 | 0.019           | 47.3 | 0.199           | -36.5 | 14.60          | 3.8                     |
| 1.3              | 0.328           | -76.7  | 1.48            | -130.0 | 0.021           | 45.8 | 0.194           | -39.8 | 13.78          | 3.4                     |
| 1.4              | 0.324           | -81.9  | 1.42            | -138.9 | 0.021           | 44.3 | 0.189           | -39.9 | 14.43          | 3.0                     |
| 1.5              | 0.318           | -87.2  | 1.36            | -146.6 | 0.022           | 42.8 | 0.185           | -41.3 | 14.47          | 2.7                     |
| 1.6              | 0.311           | -92.6  | 1.29            | -154.5 | 0.022           | 41.3 | 0.181           | -42.9 | 15.36          | 2.2                     |
| 1.7              | 0.302           | -99.0  | 1.22            | -162.7 | 0.022           | 39.9 | 0.177           | -44.2 | 16.36          | 1.7                     |
| 1.8              | 0.288           | -103.8 | 1.16            | -168.3 | 0.021           | 38.4 | 0.172           | -45.6 | 18.23          | 1.3                     |
| 1.9              | 0.267           | -109.8 | 1.10            | -176.1 | 0.020           | 36.9 | 0.166           | -47.2 | 20.49          | 0.8                     |
| 2.0              | 0.243           | -116.2 | 1.04            | 176.8  | 0.019           | 35.4 | 0.156           | -48.5 | 23.20          | 0.3                     |

Note:

1. K Factor Calculation:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

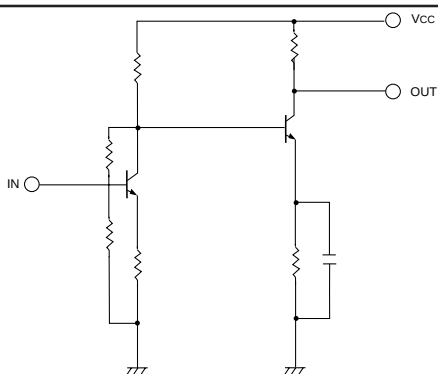
## OUTLINE DIMENSIONS (Units in mm)



Note:

All dimensions are typical unless otherwise specified.

## EQUIVALENT CIRCUIT



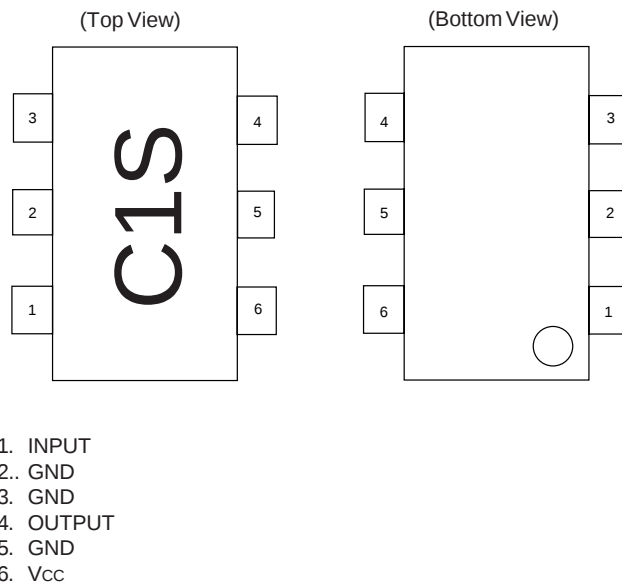
## ORDERING INFORMATION

| PART NUMBER | QTY     |
|-------------|---------|
| UPC2747T-E3 | 3K/Reel |

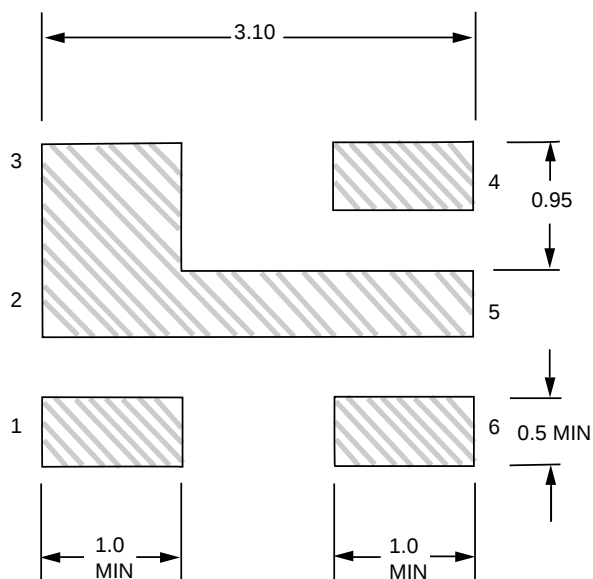
Note:

Embossed Tape, 8 mm wide.

## LEAD CONNECTIONS



## RECOMMENDED P.C.B. LAYOUT (Units in mm)



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