

### FEATURES

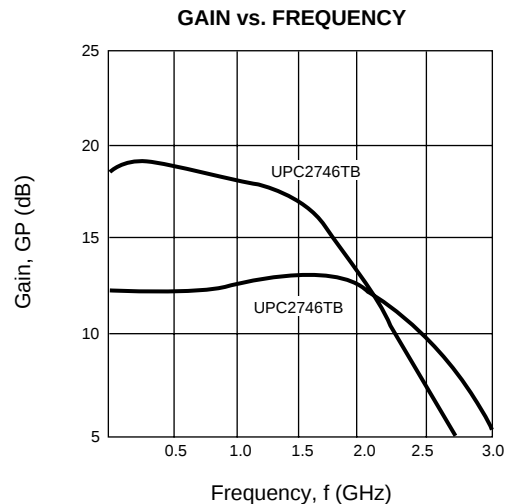
- **HIGH DENSITY SURFACE MOUNTING:**  
6 pin super minimold or SOT-363 package
- **LOW SUPPLY VOLTAGE:**  $V_{CC} = 1.8$  to  $3.3$  V
- **WIDEBAND RESPONSE:**  
UPC2745TB:  $f_u = 2.7$  GHz TYP  
UPC2746TB:  $f_u = 1.5$  GHz TYP
- **HIGH ISOLATION:**  
UPC2745TB: ISOL = 38 dB TYP  
UPC2746TB: ISOL = 45 dB TYP

### DESCRIPTION

The UPC2745TB and UPC2746TB are Silicon MMIC Wideband Amplifiers manufactured using NEC's 20 GHz  $f_T$  NESAT™ III silicon bipolar process. These devices are designed for use as buffer amps in mobile communication applications such as Cellular, PCS, and Cordless handsets, and WLAN transceivers. The UPC2745/46TB are pin compatible and have comparable performance as the larger UPC2745/46T, so they are suitable for use as a replacement to help reduce system size. These IC's are housed in a 6 pin super minimold or SOT-363 package.

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

### TYPICAL PERFORMANCE CURVES



### ELECTRICAL CHARACTERISTICS ( $T_A = +25$ °C, $Z_L = Z_S = 50$ $\Omega$ )

| PART NUMBER<br>PACKAGE OUTLINE |                                                                                                                                                                                                                                           |                          | UPC2745TB<br>S06 |                           |      | UPC2746TB<br>S06 |                   |      |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------|---------------------------|------|------------------|-------------------|------|
| SYMBOLS                        | PARAMETERS AND CONDITIONS                                                                                                                                                                                                                 | UNITS                    | MIN              | TYP                       | MAX  | MIN              | TYP               | MAX  |
| I <sub>CC</sub>                | Circuit Current (no signal), $V_{CC} = 3.0$ V<br>$V_{CC} = 1.8$ V                                                                                                                                                                         | mA<br>mA                 | 5.0              | 7.5<br>4.5                | 10.0 | 5.0              | 7.5<br>4.5        | 10.0 |
| GP                             | Power Gain, $V_{CC} = 3.0$ V, $f = 0.5$ GHz<br>$V_{CC} = 3.0$ V, $f = 1$ GHz<br>$V_{CC} = 3.0$ V, $f = 2$ GHz<br>$V_{CC} = 1.8$ V, $f = 500$ MHz                                                                                          | dB<br>dB<br>dB<br>dB     | 9.0              | 12<br>12<br>11<br>7       | 14   | 16               | 19<br>18.5<br>14  | 21   |
| $f_u$                          | Upper Limit Operating Frequency<br>(3 dB down from the gain at $f = 100$ MHz) $V_{CC} = 3.0$ V<br>$V_{CC} = 1.8$ V                                                                                                                        | GHz<br>GHz               | 2.3              | 2.7<br>1.8                |      | 1.1              | 1.5<br>1.1        |      |
| P <sub>O(SAT)</sub>            | Maximum Output Level<br>$V_{CC} = 3.0$ V, $f = 0.5$ GHz, $P_{IN} = -6$ dBm<br>$V_{CC} = 3.0$ V, $f = 1$ GHz, $P_{IN} = -6$ dBm<br>$V_{CC} = 3.0$ V, $f = 2$ GHz, $P_{IN} = -6$ dBm<br>$V_{CC} = 1.8$ V, $f = 500$ MHz, $P_{IN} = -10$ dBm | dBm<br>dBm<br>dBm<br>dBm | -4               | -1<br>-2.5<br>-3.5<br>-11 |      | -3               | 0<br>-1<br>-8     |      |
| NF                             | Noise Figure, $V_{CC} = 3.0$ V, $f = 0.5$ GHz<br>$V_{CC} = 3.0$ V, $f = 1$ GHz<br>$V_{CC} = 3.0$ V, $f = 2$ GHz<br>$V_{CC} = 1.8$ V, $f = 500$ MHz                                                                                        | dB<br>dB<br>dB<br>dB     |                  | 6<br>5.5<br>5.7<br>8.0    | 7.5  |                  | 4.0<br>4.2<br>5.0 | 5.5  |

ELECTRICAL CHARACTERISTICS (TA = +25 °C, ZL = ZS = 50 Ω)

| PART NUMBER<br>PACKAGE OUTLINE |                                                           |       | UPC2745TB<br>S06 |     |     | UPC2746TB<br>S06 |     |     |
|--------------------------------|-----------------------------------------------------------|-------|------------------|-----|-----|------------------|-----|-----|
| SYMBOLS                        | PARAMETERS AND CONDITIONS                                 | UNITS | MIN              | TYP | MAX | MIN              | TYP | MAX |
| RLIN                           | Input Return Loss, VCC = 3.0 V, f = 0.5 GHz               | dB    | 8                | 11  |     | 10               | 13  |     |
|                                | VCC = 3.0 V, f = 1 GHz                                    | dB    |                  | 10  |     |                  |     |     |
|                                | VCC = 3.0 V, f = 2 GHz                                    | dB    |                  |     |     |                  |     |     |
|                                | VCC = 1.8 V, f = 0.5 GHz                                  | dB    |                  | 10  |     |                  |     |     |
| RLOUT                          | Output Return Loss, VCC = 3.0 V, f = 0.5 GHz              | dB    | 2.5              | 5.5 |     | 5.5              | 8.5 |     |
|                                | VCC = 3.0 V, f = 1 GHz                                    | dB    |                  | 8.5 |     |                  |     |     |
|                                | VCC = 3.0 V, f = 2 GHz                                    | dB    |                  |     |     |                  |     |     |
|                                | VCC = 1.8 V, f = 0.5 GHz                                  | dB    |                  | 9.5 |     |                  |     |     |
| ISOL                           | Isolation, VCC = 3.0 V, f = 0.5 GHz                       | dB    | 33               | 38  |     | 40               | 45  |     |
|                                | VCC = 3.0 V, f = 1 GHz                                    | dB    |                  | 38  |     |                  |     |     |
|                                | VCC = 3.0 V, f = 2 GHz                                    | dB    |                  |     |     |                  |     |     |
|                                | VCC = 1.8 V, f = 0.5 GHz                                  | dB    |                  | 37  |     |                  |     |     |
| IM3                            | 3rd Order Intermodulation Distortion                      |       |                  |     |     |                  |     |     |
|                                | VCC = 3.0 V, POUT = -20 dBm, f1 = 500 MHz, f2 = 502 MHz   | dBc   |                  | -54 |     |                  | -51 |     |
|                                | VCC = 3.0 V, POUT = -20 dBm, f1 = 1000 MHz, f2 = 1002 MHz | dBc   |                  | -50 |     |                  |     |     |
|                                | VCC = 1.8 V, POUT = -20 dBm, f1 = 500 MHz, f2 = 502 MHz   | dBc   |                  | -31 |     |                  | -37 |     |

ABSOLUTE MAXIMUM RATINGS<sup>1</sup> (TA = 25°C)

| SYMBOLS | PARAMETERS                           | UNITS | RATINGS     |
|---------|--------------------------------------|-------|-------------|
| VCC     | Supply Voltage (Pin 5, Pin 8)        | V     | 4.0         |
| PIN     | Input Power                          | dBm   | 0           |
| PT      | Total Power Dissipation <sup>2</sup> | mW    | 200         |
| TOP     | Operating Temperature                | °C    | -45 to +85  |
| TSTG    | 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 double sided copper clad 50 x 50 x 1.6 mm epoxy glass PWB (TA = +85°C).

RECOMMENDED  
OPERATING CONDITIONS

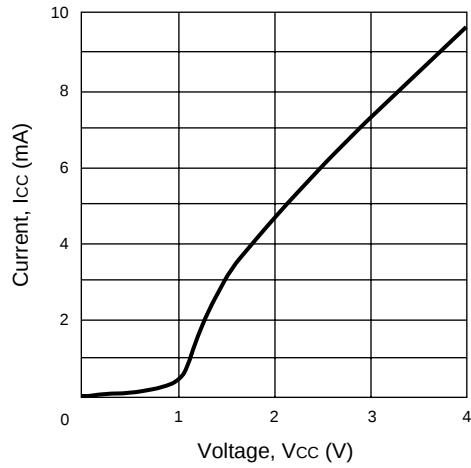
| SYMBOL | PARAMETER             | UNITS | MIN | TYP | MAX |
|--------|-----------------------|-------|-----|-----|-----|
| VCC    | Supply Voltage        | V     | 2.7 | 3.0 | 3.3 |
| TOP    | Operating Temperature | °C    | -40 | +25 | +85 |

PIN DESCRIPTION

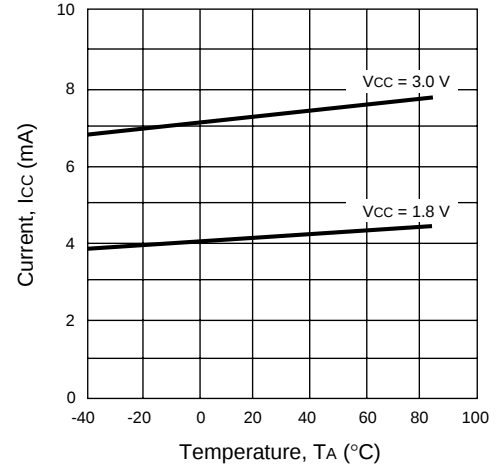
| Pin No.     | Pin Name | Applied Voltage (V) | Description                                                                                                                                                                                                                                                    | Internal Equivalent Circuit |
|-------------|----------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1           | Input    |                     | Signal input pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. This pin must be coupled to the signal source with a blocking capacitor.                                                             |                             |
| 4           | Output   |                     | Signal output pin. An internal matching circuit, configured with resistors, enables 50 Ω connection over a wide bandwidth. This pin must be coupled to the output load with a blocking capacitor.                                                              |                             |
| 6           | VCC      | 2.7 to 3.3          | Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance.                                                                                                                                                 |                             |
| 2<br>3<br>5 | GND      | 0                   | Ground pin. This pin 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. |                             |

# TYPICAL PERFORMANCE CURVES ( $T_A = 25^\circ\text{C}$ )

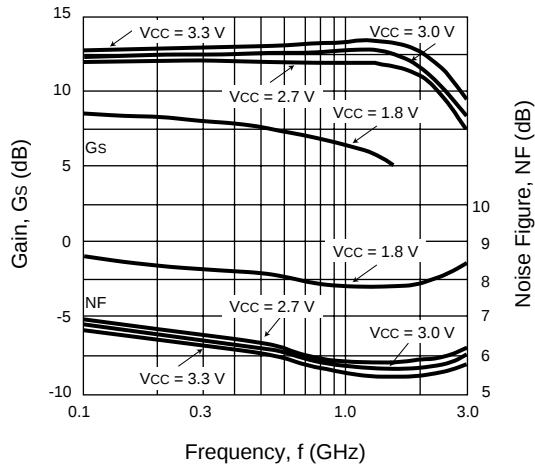
**UPC2745TB**  
CURRENT vs. VOLTAGE



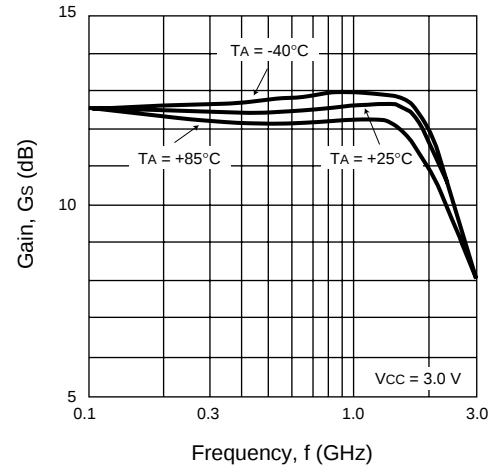
**UPC2745TB**  
CURRENT vs. TEMPERATURE AND VOLTAGE



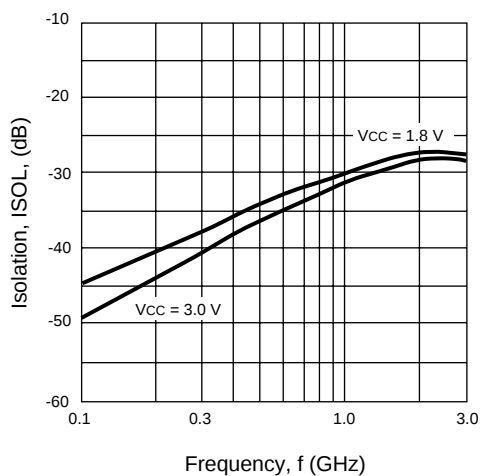
**UPC2745TB**  
GAIN AND NOISE FIGURE vs.  
FREQUENCY AND VOLTAGE



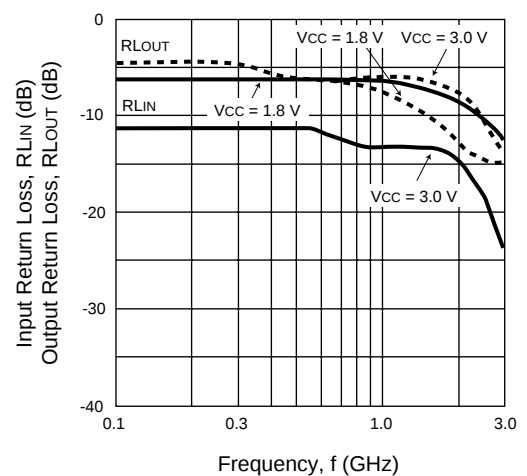
**UPC2745TB**  
GAIN vs.  
FREQUENCY AND TEMPERATURE



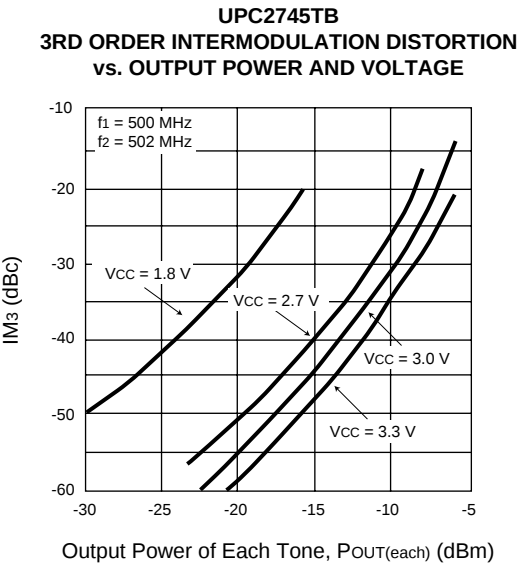
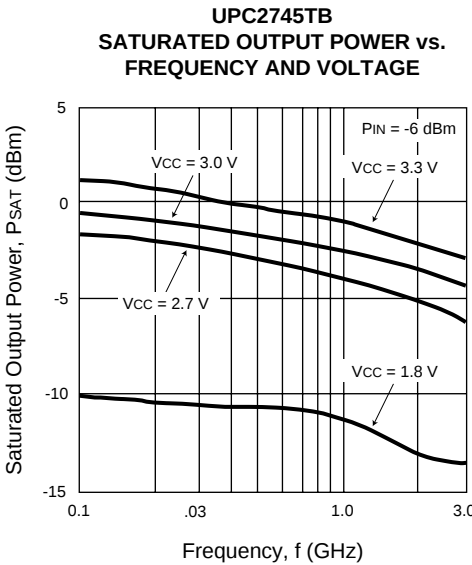
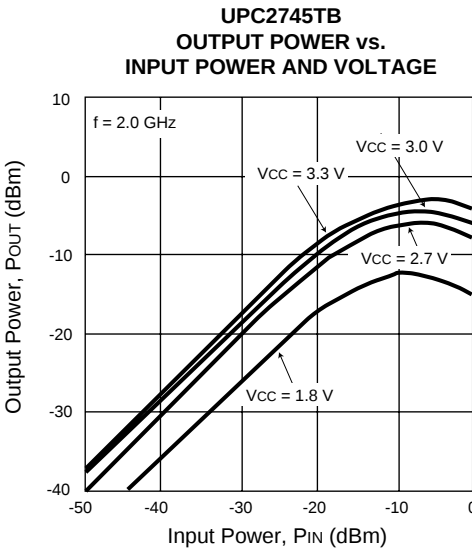
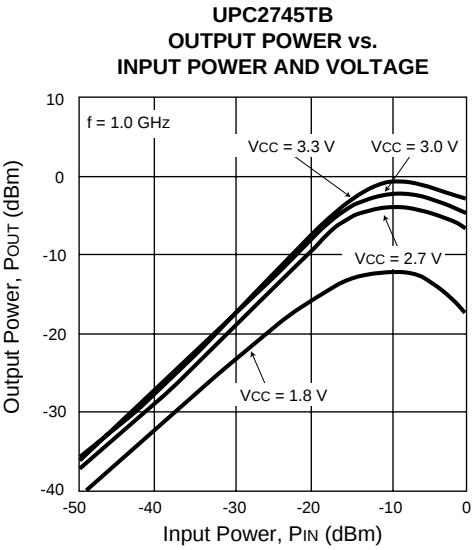
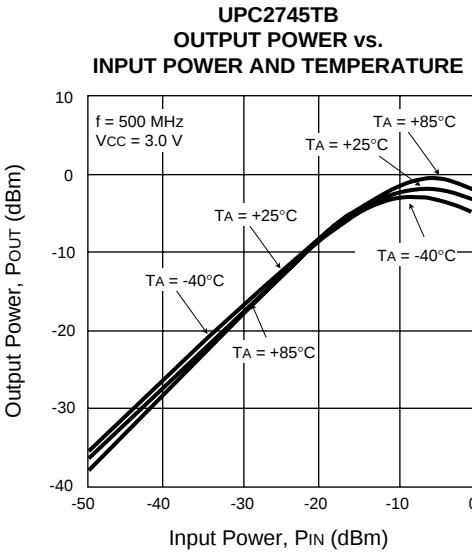
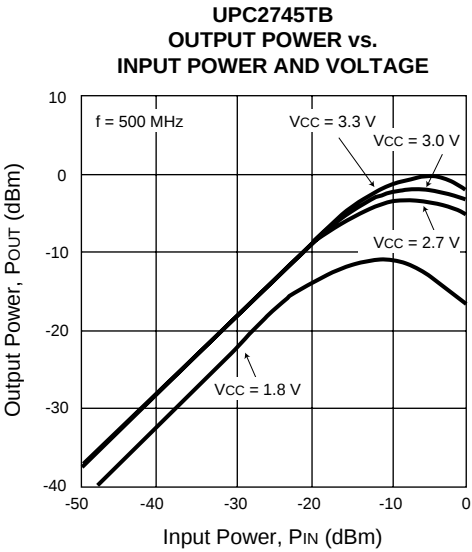
**UPC2745TB**  
ISOLATION vs.  
FREQUENCY AND VOLTAGE



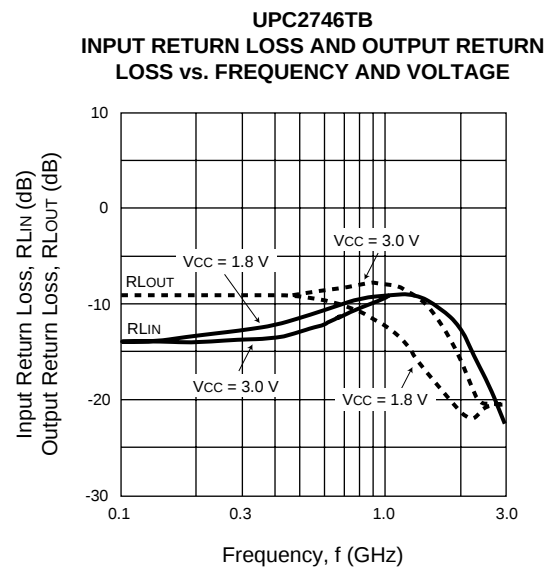
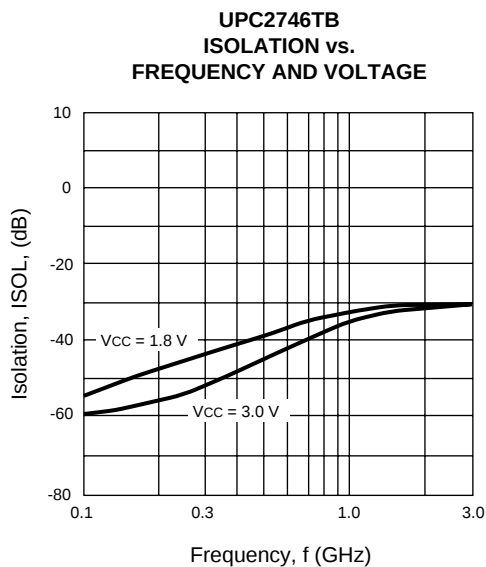
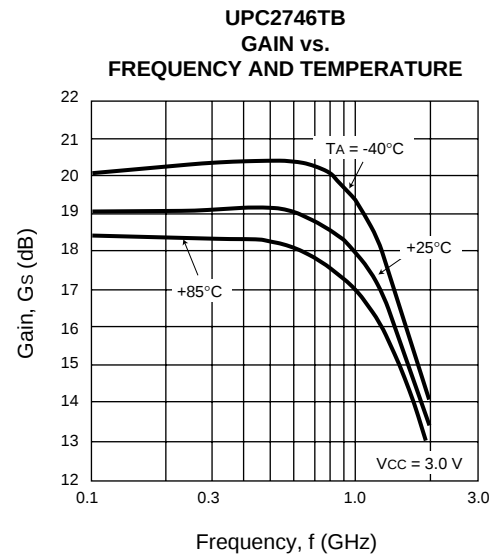
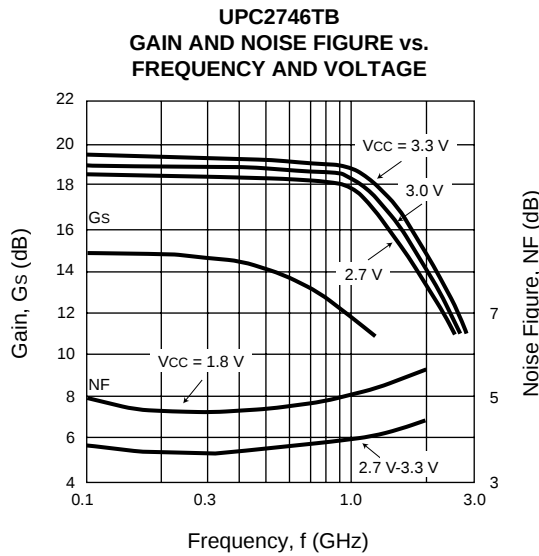
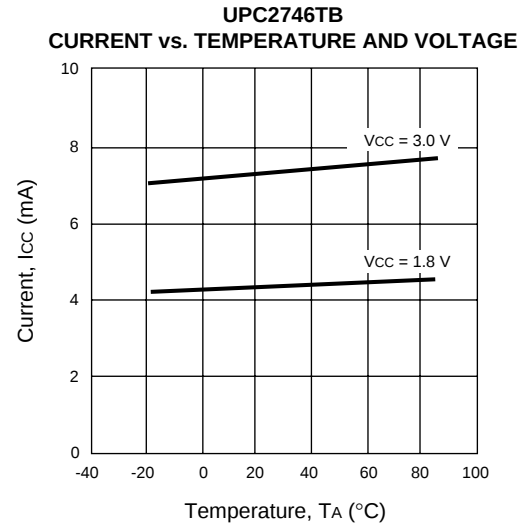
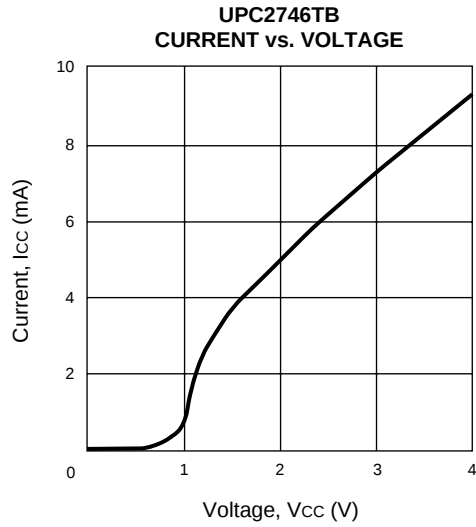
**UPC2745TB**  
INPUT RETURN LOSS AND OUTPUT RETURN  
LOSS vs. FREQUENCY AND VOLTAGE



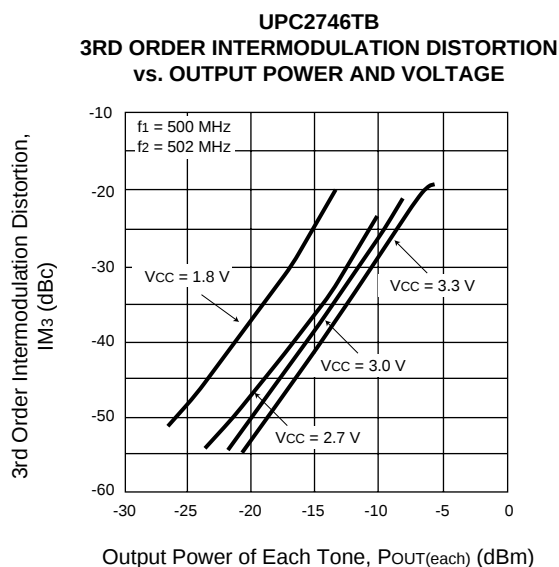
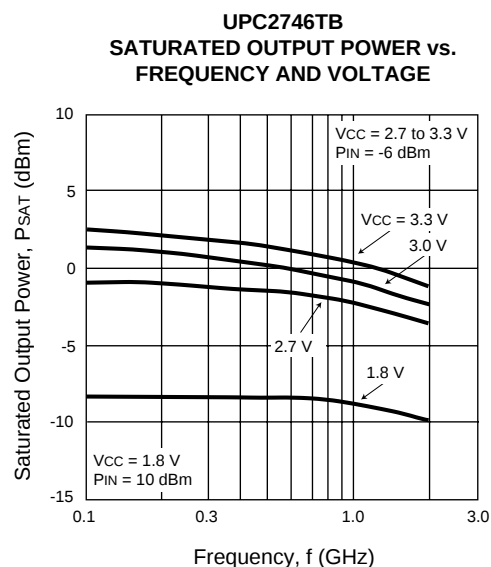
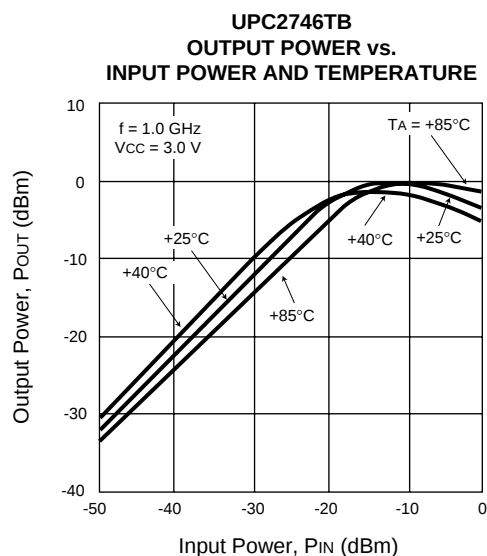
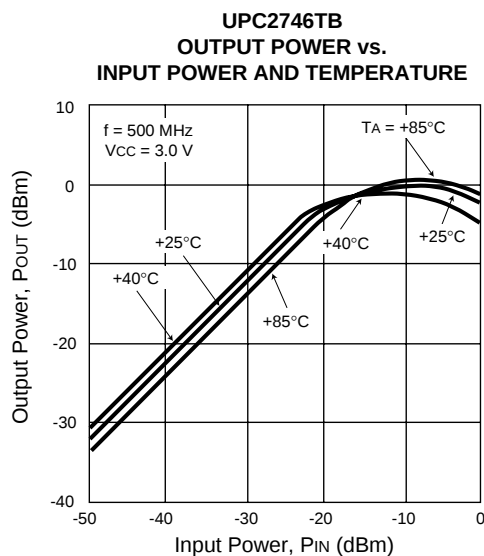
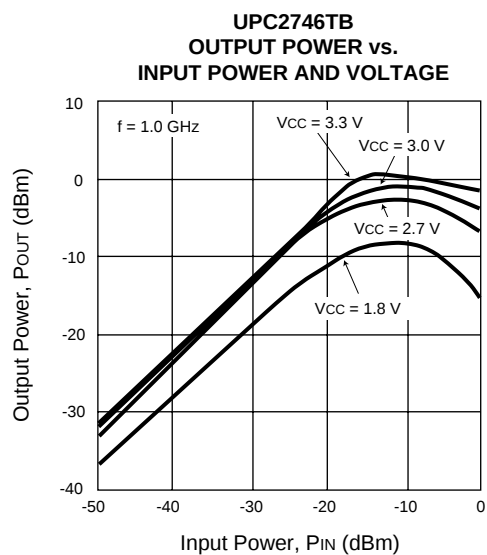
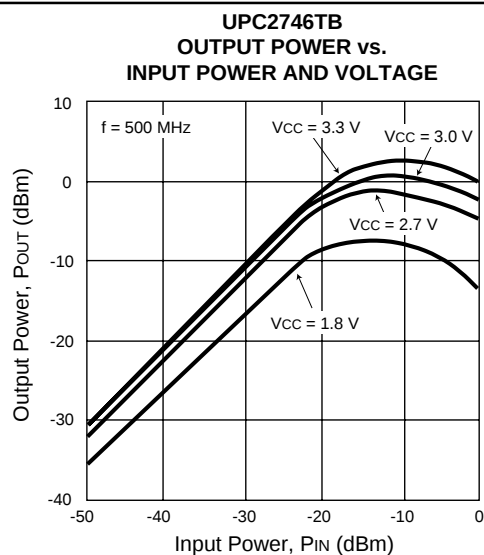
TYPICAL PERFORMANCE CURVES (TA = 25°C)



**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )



## TYPICAL PERFORMANCE CURVES (TA = 25°C)



**TYPICAL SCATTERING PARAMETERS** ( $T_A = 25^\circ\text{C}$ )**UPC2745TB****V<sub>CC</sub> = 3 V, I<sub>CC</sub> = 8.4 mA**

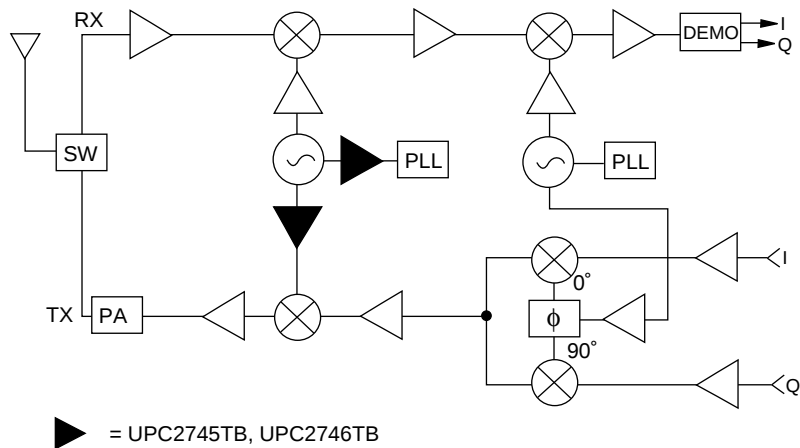
| FREQUENCY<br>(MHz) | S <sub>11</sub> |        | S <sub>21</sub> |         | S <sub>12</sub> |         | S <sub>22</sub> |        | K     |
|--------------------|-----------------|--------|-----------------|---------|-----------------|---------|-----------------|--------|-------|
|                    | MAG             | ANG    | MAG             | ANG     | MAG             | ANG     | MAG             | ANG    |       |
| 100.00             | 0.318           | -3.90  | 4.055           | -17.20  | 0.003           | 62.90   | 0.593           | -6.60  | 20.94 |
| 200.00             | 0.325           | -5.90  | 4.030           | -35.50  | 0.006           | 54.20   | 0.584           | -12.10 | 11.68 |
| 300.00             | 0.346           | -7.20  | 3.985           | -52.50  | 0.009           | 42.00   | 0.579           | -16.50 | 8.29  |
| 400.00             | 0.341           | -8.90  | 3.916           | -70.70  | 0.012           | 29.40   | 0.562           | -20.60 | 6.26  |
| 500.00             | 0.339           | -10.80 | 3.842           | -87.30  | 0.013           | 11.80   | 0.546           | -23.00 | 6.29  |
| 600.00             | 0.326           | -13.90 | 3.775           | -104.70 | 0.015           | 1.60    | 0.527           | -26.20 | 5.50  |
| 700.00             | 0.311           | -20.80 | 3.668           | -121.50 | 0.017           | -11.90  | 0.515           | -29.90 | 5.46  |
| 800.00             | 0.312           | -25.80 | 3.594           | -138.10 | 0.018           | -24.20  | 0.511           | -32.40 | 5.36  |
| 900.00             | 0.325           | -31.90 | 3.525           | -154.20 | 0.020           | -38.40  | 0.512           | -34.80 | 4.91  |
| 1000.00            | 0.356           | -32.80 | 3.497           | -170.30 | 0.019           | -45.90  | 0.523           | -35.80 | 4.93  |
| 1100.00            | 0.382           | -32.70 | 3.503           | 173.70  | 0.020           | -54.30  | 0.525           | -36.30 | 4.56  |
| 1200.00            | 0.416           | -31.20 | 3.542           | 156.70  | 0.022           | -70.50  | 0.530           | -36.80 | 4.14  |
| 1300.00            | 0.416           | -30.90 | 3.569           | 139.10  | 0.023           | -78.40  | 0.518           | -37.50 | 3.92  |
| 1400.00            | 0.415           | -30.80 | 3.520           | 121.40  | 0.025           | -88.40  | 0.509           | -38.80 | 3.53  |
| 1500.00            | 0.393           | -30.30 | 3.501           | 103.70  | 0.025           | -102.90 | 0.492           | -40.50 | 3.68  |
| 1600.00            | 0.386           | -31.30 | 3.429           | 86.80   | 0.025           | -114.10 | 0.481           | -42.50 | 3.78  |
| 1700.00            | 0.373           | -30.50 | 3.355           | 69.70   | 0.026           | -125.70 | 0.474           | -43.80 | 3.68  |
| 1800.00            | 0.369           | -31.60 | 3.303           | 52.70   | 0.028           | -130.30 | 0.468           | -44.80 | 3.50  |
| 1900.00            | 0.366           | -29.60 | 3.229           | 35.80   | 0.028           | -142.50 | 0.457           | -44.80 | 3.63  |
| 2000.00            | 0.353           | -30.00 | 3.179           | 18.80   | 0.030           | -152.40 | 0.440           | -45.00 | 3.62  |
| 2100.00            | 0.344           | -28.60 | 3.081           | 1.50    | 0.031           | -164.90 | 0.416           | -45.00 | 3.85  |
| 2200.00            | 0.313           | -29.50 | 2.999           | -15.40  | 0.031           | -177.10 | 0.389           | -45.40 | 4.23  |
| 2300.00            | 0.293           | -31.60 | 2.911           | -32.50  | 0.033           | 171.10  | 0.365           | -46.40 | 4.23  |
| 2400.00            | 0.267           | -35.10 | 2.802           | -49.40  | 0.034           | 160.80  | 0.346           | -47.40 | 4.40  |
| 2500.00            | 0.262           | -39.90 | 2.695           | -66.00  | 0.036           | 148.30  | 0.331           | -48.20 | 4.45  |
| 2600.00            | 0.253           | -40.30 | 2.598           | -82.30  | 0.036           | 134.80  | 0.321           | -48.30 | 4.54  |
| 2700.00            | 0.253           | -40.90 | 2.496           | -98.60  | 0.034           | 121.40  | 0.311           | -47.60 | 5.08  |
| 2800.00            | 0.248           | -35.50 | 2.400           | -114.60 | 0.036           | 106.50  | 0.299           | -46.70 | 5.01  |
| 2900.00            | 0.237           | -30.20 | 2.306           | -130.20 | 0.032           | 92.80   | 0.279           | -46.30 | 5.88  |
| 3000.00            | 0.230           | -20.60 | 2.209           | -146.60 | 0.031           | 83.60   | 0.254           | -46.20 | 6.49  |

**UPC2746TB****V<sub>CC</sub> = 3 V, I<sub>CC</sub> = 7.7 mA**

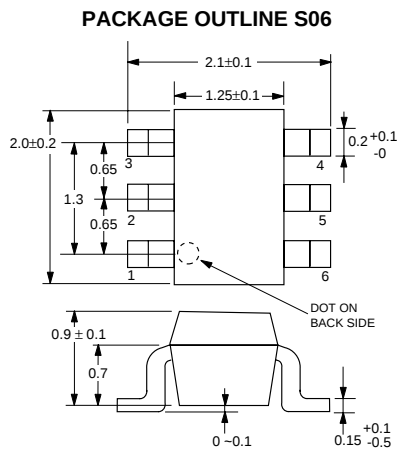
| FREQUENCY<br>(MHz) | S <sub>11</sub> |        | S <sub>21</sub> |         | S <sub>12</sub> |         | S <sub>22</sub> |        | K      |
|--------------------|-----------------|--------|-----------------|---------|-----------------|---------|-----------------|--------|--------|
|                    | MAG             | ANG    | MAG             | ANG     | MAG             | ANG     | MAG             | ANG    |        |
| 100.00             | 0.146           | 165.00 | 6.443           | -19.40  | 0.001           | 77.00   | 0.403           | -5.30  | 108.63 |
| 200.00             | 0.130           | 141.70 | 6.594           | -38.70  | 0.003           | 51.80   | 0.406           | -8.60  | 20.56  |
| 300.00             | 0.117           | 117.90 | 6.623           | -58.10  | 0.004           | 47.70   | 0.418           | -11.10 | 16.33  |
| 400.00             | 0.128           | 100.80 | 6.522           | -77.55  | 0.005           | 51.10   | 0.417           | -14.00 | 12.34  |
| 500.00             | 0.139           | 90.80  | 6.613           | -96.90  | 0.008           | 33.10   | 0.424           | -16.20 | 8.14   |
| 600.00             | 0.145           | 83.10  | 6.481           | -116.10 | 0.009           | 21.70   | 0.422           | -19.40 | 7.22   |
| 700.00             | 0.135           | 77.00  | 6.424           | -135.10 | 0.010           | 14.70   | 0.426           | -23.80 | 6.52   |
| 800.00             | 0.131           | 67.40  | 6.353           | -153.60 | 0.011           | -0.40   | 0.433           | -27.70 | 5.63   |
| 900.00             | 0.119           | 49.30  | 6.234           | -172.10 | 0.014           | -10.50  | 0.442           | -32.10 | 4.80   |
| 1000.00            | 0.142           | 30.40  | 6.137           | 169.60  | 0.015           | -24.20  | 0.455           | -34.70 | 4.44   |
| 1100.00            | 0.170           | 18.10  | 5.992           | 151.10  | 0.016           | -28.70  | 0.455           | -37.50 | 4.02   |
| 1200.00            | 0.219           | 10.60  | 5.972           | 133.30  | 0.019           | -48.00  | 0.453           | -39.70 | 3.49   |
| 1300.00            | 0.245           | 7.40   | 5.867           | 115.10  | 0.019           | -63.40  | 0.433           | -42.70 | 3.40   |
| 1400.00            | 0.268           | 3.10   | 5.679           | 97.00   | 0.022           | -72.20  | 0.409           | -45.50 | 3.16   |
| 1500.00            | 0.270           | 1.50   | 5.582           | 79.10   | 0.021           | -86.90  | 0.375           | -48.30 | 3.38   |
| 1600.00            | 0.268           | -3.90  | 5.380           | 61.80   | 0.022           | -99.60  | 0.349           | -49.90 | 3.36   |
| 1700.00            | 0.258           | -7.80  | 5.122           | 44.50   | 0.024           | -110.70 | 0.318           | -50.00 | 3.42   |
| 1800.00            | 0.251           | -14.30 | 4.880           | 27.90   | 0.024           | -122.90 | 0.294           | -49.20 | 3.67   |
| 1900.00            | 0.249           | -16.70 | 4.634           | 11.70   | 0.025           | -135.30 | 0.268           | -45.40 | 3.73   |
| 2000.00            | 0.240           | -20.50 | 4.475           | -4.40   | 0.026           | -146.00 | 0.248           | -40.50 | 3.91   |

SYSTEM APPLICATION EXAMPLE

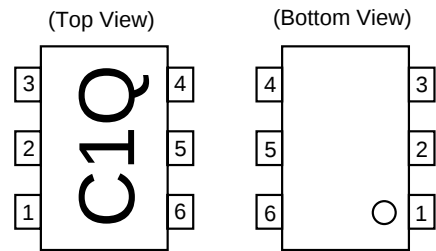
PCS



OUTLINE DIMENSIONS (Units in mm)



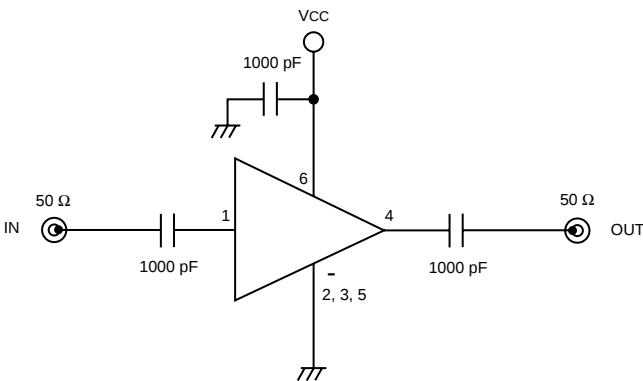
PIN CONNECTIONS



Marking is an example of UPC2745TB

- 1. Input
- 2. GND
- 3. GND
- 4. Output
- 5. GND
- 6. Vcc

TEST CIRCUIT



ORDERING INFORMATION

| PART NUMBER  | MARKING | QTY      |
|--------------|---------|----------|
| UPC2745TB-E3 | C1Q     | 3 K/reel |
| UPC2746TB-E3 | C1R     | 3 K/reel |

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