

NEC

LOW POWER CONSUMPTION SILICON MMIC AMPLIFIER

UPC2714T UPC2715T

FEATURES

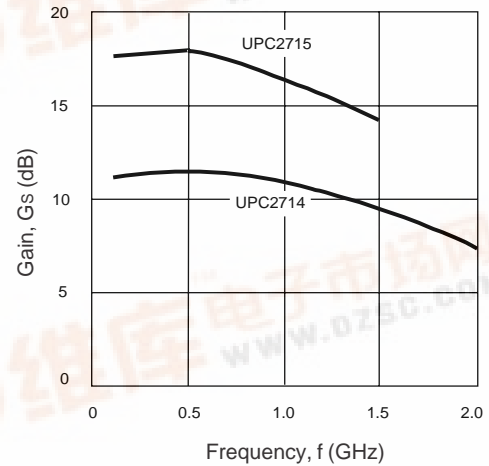
- **LOW POWER CONSUMPTION:**
15 mW ($V_{CC} = 3.4$ V, $I_{CC} = 4.5$ mA)
- **HIGH POWER GAIN:** 20 dB (UPC2715T)
- **WIDE FREQUENCY RESPONSE:**
2 GHz (UPC2714T)
- **INTERNAL CURRENT REGULATION MINIMIZES GAIN CHANGE OVER TEMPERATURE**
- **SUPER SMALL PACKAGE**
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

DESCRIPTION

The UPC2714T and UPC2715T are Silicon Monolithic integrated circuits manufactured using the NESAT III process. These devices are suitable for applications which require low power consumption and wide frequency operation. They are designed for low cost, low power consumption gain stages in cellular radios, GPS receivers, and PCN applications.

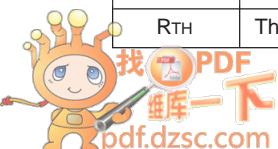
NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

GAIN vs. FREQUENCY



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, $f = 0.5$ GHz, $V_{CC} = 3.4$ V)

| PART NUMBER PACKAGE OUTLINE | | | UPC2714T T06 | | | UPC2715T T06 | | |
|--------------------------------|--|---------------------------|-----------------|-----------|------|-----------------|-----------|-----|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | MIN | TYP | MAX |
| I_{CC} | Circuit Current | mA | 3.3 | 4.5 | 5.7 | 3.3 | 4.5 | 5.7 |
| G_s | Small Signal Gain | dB | 8.5 | 11.5 | 15.5 | 16 | 19 | 23 |
| f_u | Upper Limit Operating Frequency (The gain at f_u is 3 dB down from the gain at 0.1 GHz) | GHz | 1.4 | 1.8 | | 0.9 | 1.2 | |
| ΔG_s | Gain Flatness, $f = 0.1 \sim 0.6$ GHz | dB | | ± 1.0 | | | ± 1.0 | |
| P_{SAT} | Saturated Output Power | dBm | -10 | -7 | | -9 | -6 | |
| NF | Noise Figure | dB | | 5.0 | 6.5 | | 4.5 | 6.0 |
| RL_{IN} | Input Return Loss | dB | 10 | 13 | | 12 | 17 | |
| RL_{OUT} | Output Return Loss | dB | 5 | 8 | | 5 | 8 | |
| ISOL | Isolation | dB | 22 | 27 | | 28 | 33 | |
| ΔG_T | Gain-Temperature Coefficient | dB/ $^\circ\text{C}$ | | +0.006 | | | +0.006 | |
| R_{TH} | Thermal Resistance (Junction to Ambient) | $^\circ\text{C}/\text{W}$ | | | 200 | | | 200 |



UPC2714T, UPC2715T

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------------|-------|-------------|
| V _{CC} | Supply Voltage | V | 4.0 |
| P _{IN} | Input Power | dBm | -5 |
| P _T | Total Power Dissipation ² | mW | 200 |
| T _{OP} | Operating Temperature | °C | -40 to +85 |
| T _{STG} | Storage Temperature | °C | -55 to +150 |

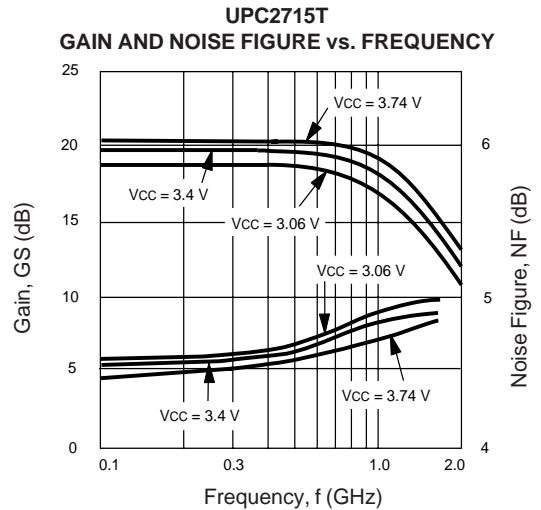
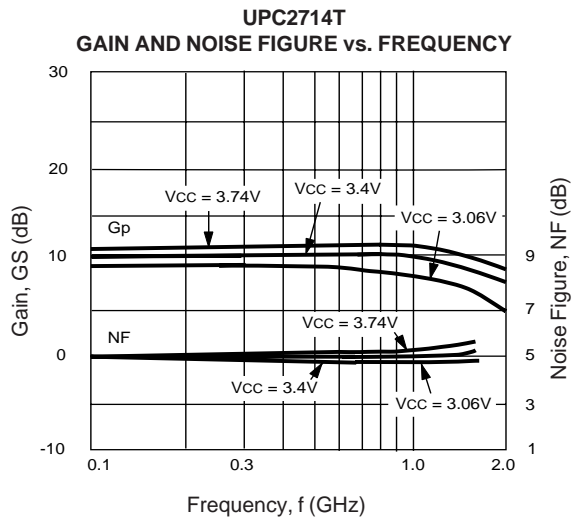
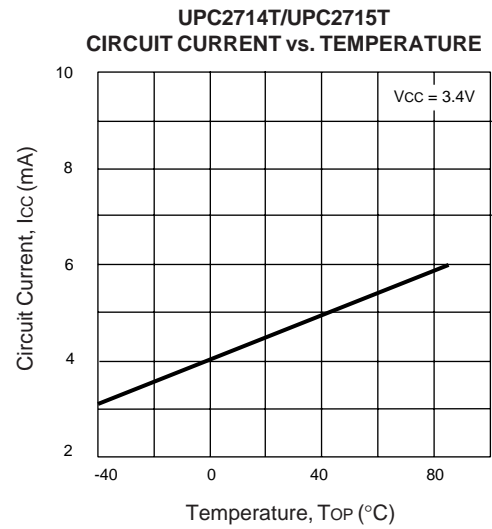
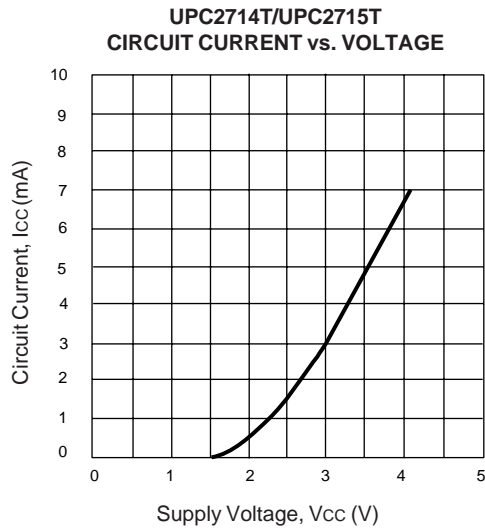
Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on 50 x 50 x 1.6 mm epoxy glass PWB (T_A = 85°C).

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | UNITS | MIN | TYP | MAX |
|-----------------|----------------|-------|------|-----|------|
| V _{CC} | Supply Voltage | V | 3.06 | 3.4 | 3.74 |

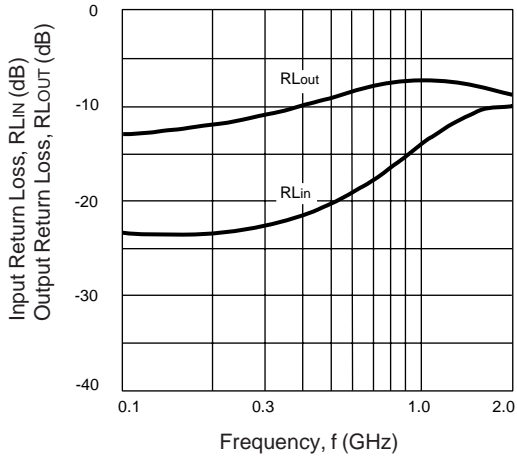
TYPICAL PERFORMANCE CURVES (T_A = 25°C)



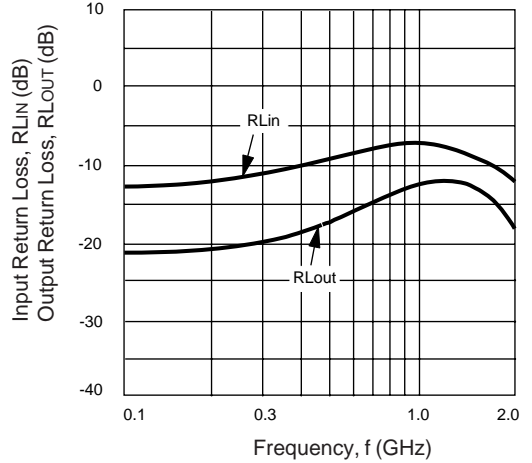
UPC2714T, UPC2715T

TYPICAL PERFORMANCE CURVES (TA = 25°C, VCC = 3.4 V)

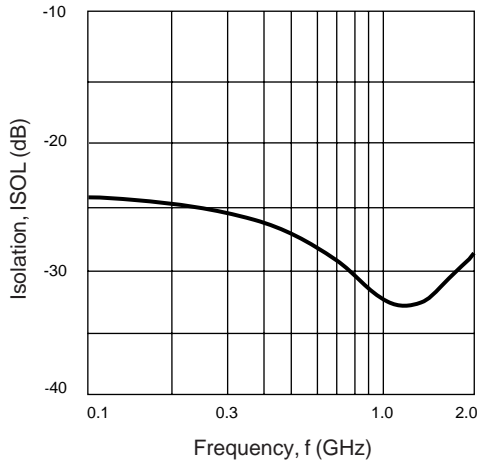
UPC2714T
INPUT RETURN LOSS AND
OUTPUT RETURN LOSS vs. FREQUENCY



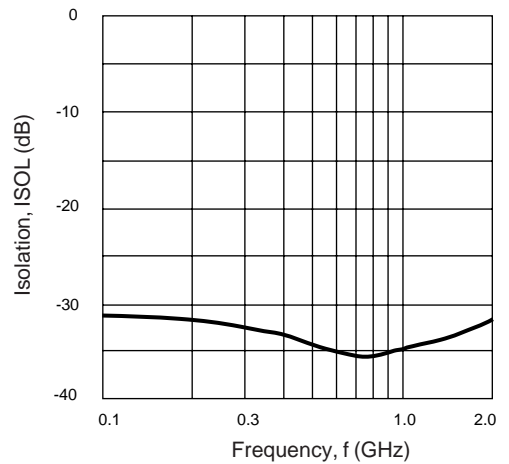
UPC2715T
INPUT RETURN LOSS AND
OUTPUT RETURN LOSS vs. FREQUENCY



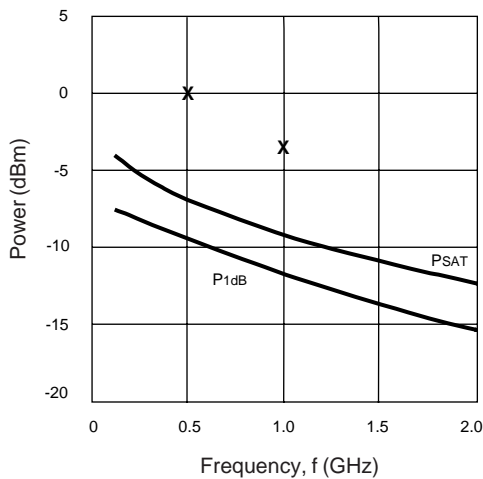
UPC2714T
ISOLATION vs. FREQUENCY



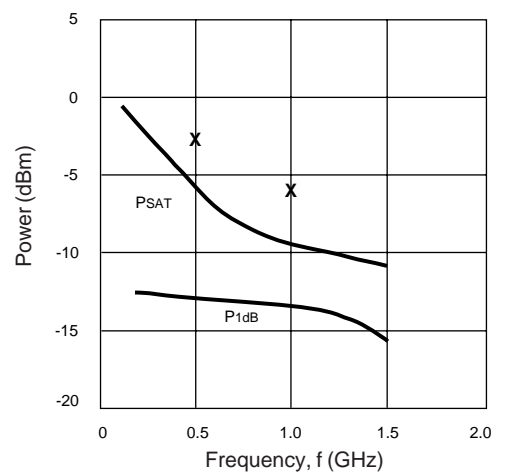
UPC2715T
ISOLATION vs. FREQUENCY



UPC2714T
POWER vs. FREQUENCY



UPC2715T
POWER vs. FREQUENCY

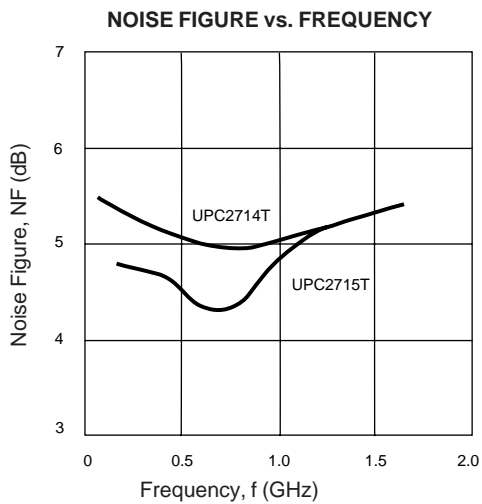
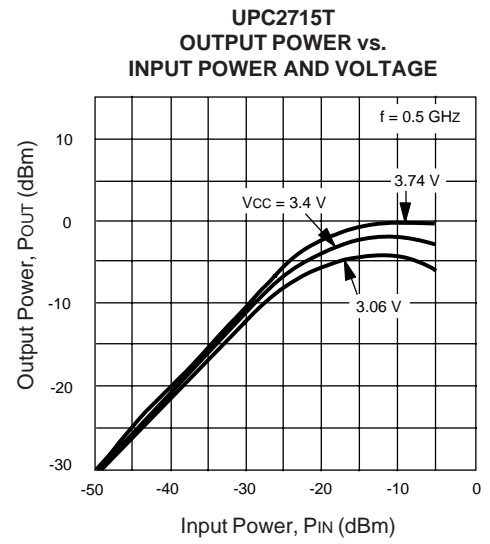
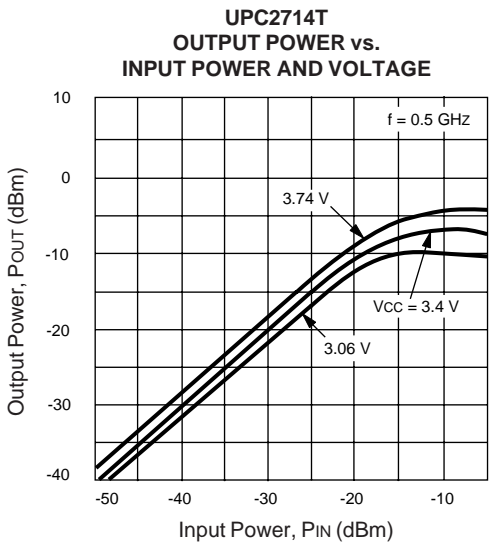
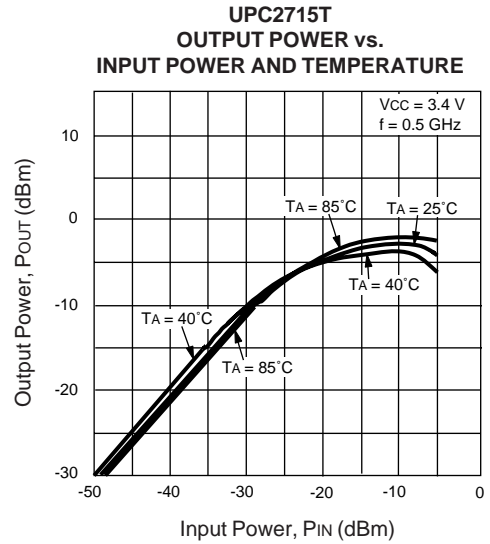
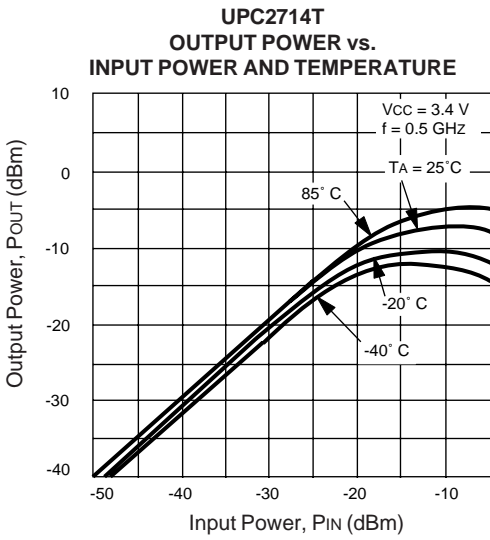


X: Typical SSB Third Order Intercept Point

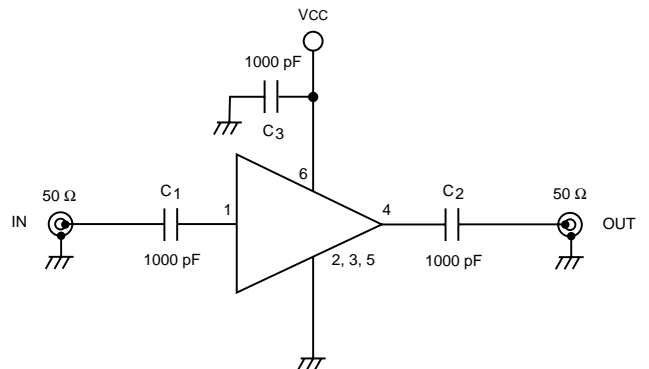
X: Typical SSB Third Order Intercept Point

UPC2714T, UPC2715T

TYPICAL PERFORMANCE CURVES (TA = 25°C)



TEST CIRCUIT



UPC2714T, UPC2715T

TYPICAL SCATTERING PARAMETERS (TA = 25°C)

UPC2714T

VCC = 3.4 V, ICC = 4.5 mA

| FREQUENCY (GHz) | S11 | | S21 | | S12 | | S22 | | K ¹ | S21 (dB) |
|--------------------|-------|--------|-----|--------|-------|-------|-------|--------|----------------|-------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.10 | 0.123 | -169.9 | 3.6 | -6.4 | 0.069 | -12.0 | 0.190 | 13.3 | 2.04 | 11.2 |
| 0.20 | 0.133 | 167.3 | 3.7 | -19.2 | 0.061 | -24.5 | 0.266 | 8.7 | 2.17 | 11.3 |
| 0.30 | 0.139 | 150.5 | 3.7 | -30.6 | 0.056 | -32.7 | 0.326 | 2.9 | 2.25 | 11.4 |
| 0.40 | 0.151 | 135.1 | 3.8 | -41.8 | 0.048 | -42.9 | 0.366 | -4.0 | 2.49 | 11.5 |
| 0.50 | 0.165 | 120.6 | 3.8 | -53.2 | 0.040 | -48.8 | 0.394 | -11.1 | 2.86 | 11.5 |
| 0.60 | 0.176 | 105.6 | 3.7 | -64.7 | 0.035 | -53.4 | 0.414 | -19.4 | 3.19 | 11.4 |
| 0.70 | 0.187 | 91.5 | 3.7 | -76.3 | 0.031 | -52.7 | 0.429 | -27.3 | 3.55 | 11.4 |
| 0.80 | 0.197 | 77.8 | 3.7 | -87.9 | 0.025 | -51.7 | 0.436 | -35.3 | 4.36 | 11.3 |
| 0.90 | 0.205 | 64.6 | 3.6 | -99.5 | 0.024 | -47.1 | 0.439 | -43.2 | 4.60 | 11.1 |
| 1.00 | 0.215 | 51.9 | 3.5 | -111.1 | 0.022 | -43.5 | 0.439 | -50.6 | 5.08 | 11.0 |
| 1.10 | 0.219 | 39.2 | 3.4 | -122.5 | 0.023 | -38.2 | 0.432 | -58.0 | 5.00 | 10.8 |
| 1.20 | 0.225 | 28.3 | 3.3 | -133.8 | 0.024 | -32.0 | 0.422 | -64.8 | 4.96 | 10.5 |
| 1.30 | 0.228 | 17.3 | 3.2 | -145.0 | 0.025 | -31.8 | 0.412 | -71.4 | 4.97 | 10.2 |
| 1.40 | 0.231 | 6.6 | 3.1 | -156.1 | 0.026 | -31.7 | 0.400 | -77.8 | 5.01 | 9.8 |
| 1.50 | 0.231 | -2.8 | 3.0 | -166.8 | 0.028 | -31.4 | 0.387 | -83.4 | 4.90 | 9.5 |
| 1.60 | 0.232 | -12.7 | 2.9 | -177.4 | 0.029 | -34.1 | 0.374 | -88.9 | 4.97 | 9.1 |
| 1.70 | 0.231 | -21.3 | 2.7 | 172.2 | 0.030 | -36.7 | 0.359 | -94.1 | 5.11 | 8.7 |
| 1.80 | 0.229 | -29.4 | 2.6 | 162.0 | 0.032 | -37.1 | 0.348 | -98.5 | 5.08 | 8.3 |
| 1.90 | 0.226 | -38.0 | 2.5 | 151.9 | 0.033 | -40.2 | 0.335 | -103.2 | 5.20 | 7.9 |
| 2.00 | 0.223 | -44.8 | 2.4 | 142.3 | 0.035 | -41.0 | 0.322 | -107.4 | 5.21 | 7.5 |
| 2.10 | 0.216 | -51.3 | 2.2 | 132.3 | 0.036 | -47.1 | 0.311 | -111.5 | 5.39 | 7.0 |
| 2.20 | 0.212 | -57.8 | 2.1 | 122.8 | 0.037 | -49.4 | 0.298 | -115.3 | 5.57 | 6.6 |
| 2.30 | 0.208 | -63.4 | 2.0 | 113.7 | 0.039 | -52.7 | 0.287 | -118.9 | 5.61 | 6.2 |
| 2.40 | 0.204 | -68.2 | 1.9 | 104.6 | 0.040 | -58.2 | 0.276 | -122.2 | 5.81 | 5.7 |
| 2.50 | 0.201 | -72.9 | 1.8 | 95.6 | 0.041 | -58.7 | 0.270 | -125.7 | 5.97 | 5.3 |

UPC2715T

VCC = 3.4 V, ICC = 4.5 mA

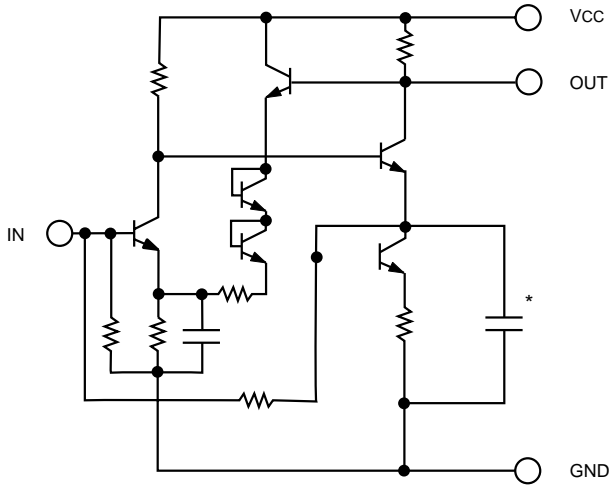
| FREQUENCY (GHz) | S11 | | S21 | | S12 | | S22 | | K ¹ | S21 (dB) |
|--------------------|-------|--------|-----|--------|-------|-------|-------|--------|----------------|-------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.10 | 0.052 | 33.7 | 7.7 | -8.4 | 0.031 | -7.8 | 0.254 | 8.1 | 2.07 | 17.7 |
| 0.20 | 0.087 | 21.3 | 7.8 | -25.7 | 0.028 | -12.6 | 0.279 | 3.6 | 2.20 | 17.8 |
| 0.30 | 0.121 | 9.5 | 7.9 | -40.9 | 0.025 | -17.8 | 0.311 | -1.0 | 2.35 | 17.9 |
| 0.40 | 0.141 | -2.1 | 7.9 | -55.9 | 0.022 | -20.3 | 0.351 | -6.4 | 2.54 | 18.0 |
| 0.50 | 0.159 | -12.4 | 7.9 | -69.5 | 0.020 | -21.2 | 0.383 | -13.0 | 2.68 | 18.0 |
| 0.60 | 0.175 | -27.8 | 7.7 | -84.9 | 0.019 | -19.7 | 0.409 | -21.3 | 2.79 | 17.7 |
| 0.70 | 0.181 | -40.7 | 7.4 | -98.4 | 0.019 | -15.7 | 0.426 | -30.2 | 2.82 | 17.4 |
| 0.80 | 0.184 | -52.3 | 7.2 | -112.0 | 0.019 | -13.3 | 0.432 | -39.1 | 2.87 | 17.2 |
| 0.90 | 0.187 | -66.1 | 6.9 | -125.6 | 0.020 | -12.3 | 0.432 | -48.1 | 2.83 | 16.8 |
| 1.00 | 0.187 | -78.4 | 6.6 | -138.9 | 0.021 | -11.2 | 0.426 | -56.3 | 2.85 | 16.4 |
| 1.10 | 0.186 | -89.3 | 6.3 | -150.8 | 0.022 | -11.6 | 0.412 | -64.2 | 2.87 | 16.0 |
| 1.20 | 0.182 | -101.5 | 6.1 | -162.7 | 0.023 | -12.1 | 0.394 | -71.2 | 2.93 | 15.6 |
| 1.30 | 0.178 | -113.8 | 5.7 | -174.5 | 0.024 | -14.5 | 0.377 | -77.5 | 3.06 | 15.0 |
| 1.40 | 0.173 | -125.4 | 5.3 | 174.3 | 0.025 | -16.3 | 0.359 | -83.4 | 3.22 | 14.4 |
| 1.50 | 0.167 | -137.1 | 4.9 | 163.7 | 0.026 | -18.3 | 0.343 | -88.3 | 3.35 | 13.9 |
| 1.60 | 0.163 | -148.4 | 4.6 | 153.2 | 0.027 | -20.6 | 0.328 | -93.1 | 3.53 | 13.2 |
| 1.70 | 0.157 | -160.0 | 4.2 | 143.1 | 0.028 | -22.2 | 0.315 | -97.2 | 3.72 | 12.5 |
| 1.80 | 0.152 | -171.6 | 3.9 | 133.2 | 0.029 | -23.9 | 0.306 | -100.8 | 3.90 | 11.9 |
| 1.90 | 0.148 | 176.8 | 3.7 | 123.5 | 0.030 | -25.6 | 0.296 | -104.7 | 4.07 | 11.3 |
| 2.00 | 0.142 | 164.7 | 3.4 | 114.5 | 0.031 | -27.1 | 0.286 | -108.9 | 4.28 | 10.6 |

Note:

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

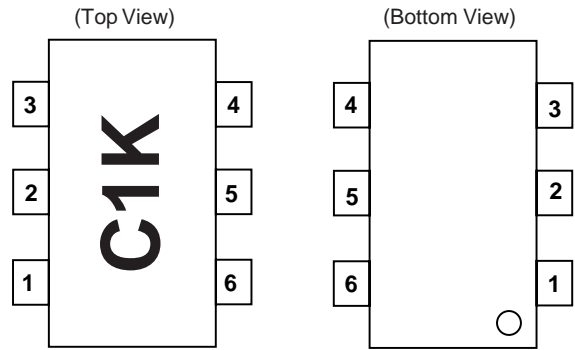
UPC2714T, UPC2715T

EQUIVALENT CIRCUIT



*Used in UPC2714T only

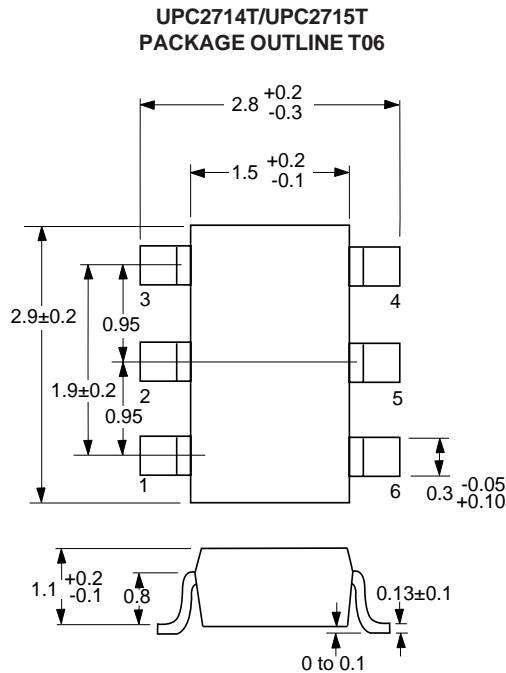
LEAD CONNECTIONS



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

Note: Package Markings:
C1K - UPC2714T
C1L - UPC2715T

OUTLINE DIMENSIONS (Units in mm)



Note:
All dimensions are typical unless otherwise noted.

ORDERING INFORMATION

| PART NUMBER | QTY |
|-------------|---------|
| UPC2714T-E3 | 3K/Reel |
| UPC2715T-E3 | 3K/Reel |

Embossed Tape, 8 mm wide.
Pins 1, 2, 3 are in tape pull-out direction.

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

