

SILICON RFIC LOW CURRENT AMPLIFIER FOR CELLULAR/CORDLESS TELEPHONES

FEATURES

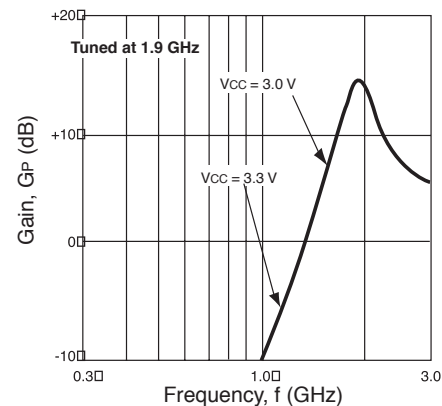
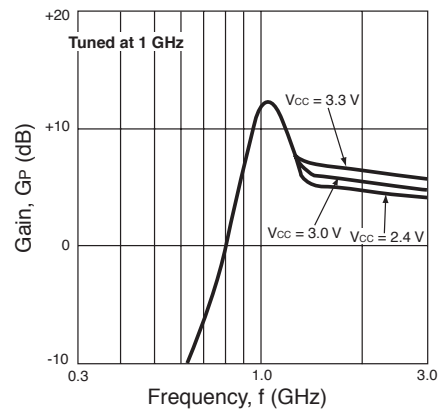
- **SUPPLY VOLTAGE:** $V_{CC} = 2.4$ to 3.3 V
- **LOW CURRENT CONSUMPTION:**
UPC8151TB; $I_{CC} = 4.2$ mA TYP @ 3.0 V
- **HIGH EFFICIENCY:**
UPC8151TB; $P_{1dB} = +2.5$ dBm TYP @ $f = 1$ GHz
- **POWER GAIN:**
UPC8151TB; $G_P = 12.5$ dB TYP @ $f = 1$ GHz
- **OPERATING FREQUENCY:**
100 MHz to 1900 MHz (Output port LC matching)
- **EXCELLENT ISOLATION:**
UPC8151TB; $ISOL = 38$ dB TYP @ $f = 1$ GHz
- **HIGH DENSITY SURFACE MOUNTING:**
6 pin super minimold or SOT-363 package

DESCRIPTION

The UPC8151TB is a silicon RFIC designed as a buffer amplifier for cellular or cordless telephones. This low current amplifier operates on 3.0 V and is housed in a 6 pin super minimold package.

The IC is manufactured using the 20 GHz ft NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials protect the chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformity and reliability.

INSERTION POWER GAIN vs.
FREQUENCY AND VOLTAGE



ELECTRICAL CHARACTERISTICS (TA = 25 °C, VCC = VOUT = 3.0 V, ZL = ZS = 50 Ω, at LC matched frequency)

| PART NUMBER PACKAGE OUTLINE | | | UPC8151TB SO6 | | |
|--------------------------------|--|-------|------------------|---------------|--------------|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| I _{CC} | Circuit Current, No signal | mA | 2.8 | 4.2 | 5.8 |
| G _P | Power Gain f = 1.00 GHz f = 1.90 GHz | dB | 9.5 12.0 | 12.5 15.0 | 14.5 17.0 |
| ISOL | Isolation f = 1.00 GHz f = 1.90 GHz | dB | 33.0 29.0 | 38.0 34.0 | – – |
| P _{1dB} | Output Power at 1 dB Compression Point f = 1.00 GHz f = 1.90 GHz | dBm | -1.0 -3.0 | +2.5 +0.5 | – – |
| NF | Noise Figure f = 1.00 GHz f = 1.90 GHz | dB | – – | 6.0 6.0 | 7.5 7.5 |
| RL _{IN} | Input Return Loss(without matching circuit) f = 1.00 GHz f = 1.90 GHz | dB | 2.0 1.0 | 5.0 4.0 | – – |
| RL _{OUT} | Output Return Loss (with external matching circuit) f = 1.00 GHz f = 1.90 GHz | dB | | 10.0 12.0 | |
| IM ₃ | 3rd Order Intermodulation Distortion f ₁ = 1.000 GHz, f ₂ = 1.001 GHz, P _{O(each)} = -20 dBm f ₁ = 1.900 GHz, f ₂ = 1.901 GHz, P _{O(each)} = -20 dBm | dBc | | -62.0 54.0 | |

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------------|-------|-------------|
| V _{CC} | Supply Voltage | V | 3.6 |
| P _D | Total Power Dissipation ² | mW | 200 |
| T _A | 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 a 50 x 50 x 1.6 mm epoxy glass PWB (T_A = 85°C).

RECOMMENDED OPERATING CONDITIONS

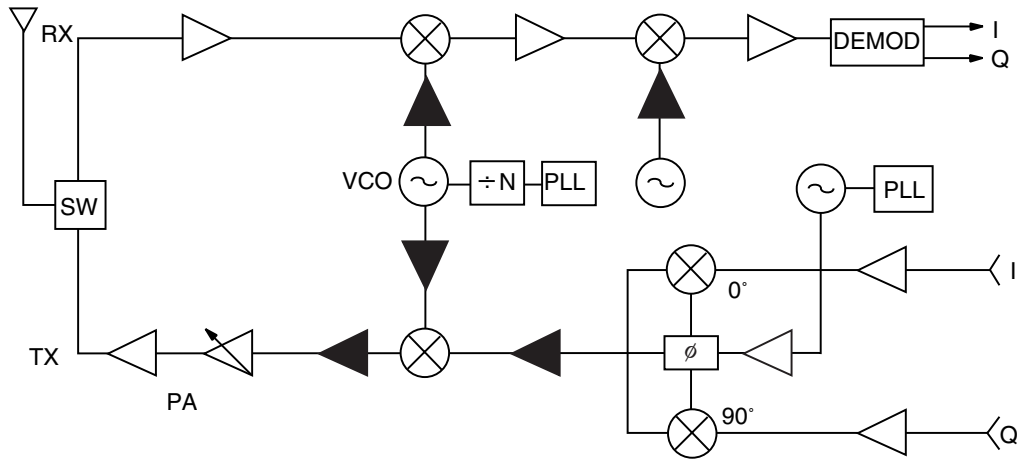
| SYMBOLS | PARAMETERS | UNITS | MIN | TYP | MAX |
|-----------------|-----------------------|-------|-----|-----|------|
| V _{CC} | Supply Voltage | V | 2.4 | 3.0 | 3.3 |
| T _A | Operating Temperature | °C | -40 | +25 | +85 |
| f | Operating Frequency | MHz | 100 | | 1900 |

PIN FUNCTIONS

| Pin No. | Symbol | Applied Voltage | Description | Internal Equivalent Circuit |
|-------------|-----------------|--|--|-----------------------------|
| 1 | INPUT | | Signal input pin. An internal matching circuit provides a 50 Ω match over a wide bandwidth. This pin must be coupled to signal source with a blocking capacitor. | |
| 4 | OUTPUT | V _{CC} through external inductor. | Signal output pin. This output is designed as an open collector. Due to the high impedance output this pin should be externally equipped with an LC matching circuit. | |
| 6 | V _{CC} | 2.4 to 3.3 | Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance. | |
| 2 3 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 APPLICATION EXAMPLE

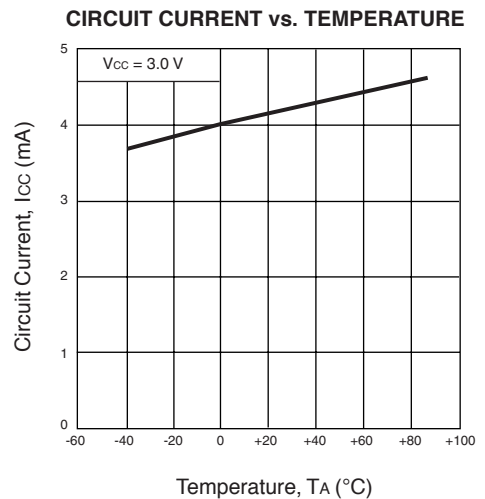
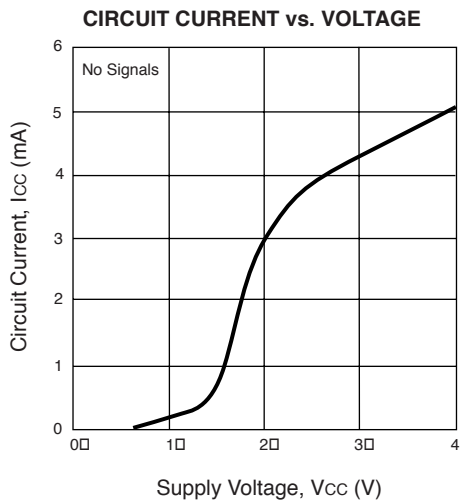
Location Examples in Digital Cellular



PRODUCT LINE-UP (TA = +25 °C, VCC = 3.0 V, ZL = ZS = 50 Ω)

| PARAMETER PART NO. | I _{cc} (mA) | OUTPUT PORT MATCHING FREQUENCY | | | | | | PACKAGES |
|-----------------------|-------------------------|--------------------------------|--------------|---------------------------|------------------------|--------------|---------------------------|----------------------|
| | | 1 GHz | | | 1.9 GHz | | | |
| | | G _P (dB) | ISOL (dB) | P _{1dB} (dBm) | G _P (dB) | ISOL (dB) | P _{1dB} (dBm) | |
| UPC8128TB | 2.8 | 12.5 | 39 | -4.0 | 13.0 | 37 | -4.0 | 6 pin super minimold |
| UPC8151TB | 4.5 | 12.5 | 38 | +2.5 | 15.0 | 34 | +0.5 | 6 pin super minimold |
| UPC8152TB | 5.6 | 23.0 | 40 | -4.5 | 17.5 | 35 | -8.5 | 6 pin super minimold |

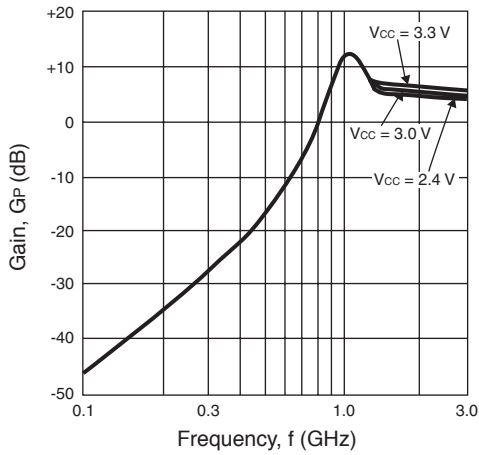
TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise specified)



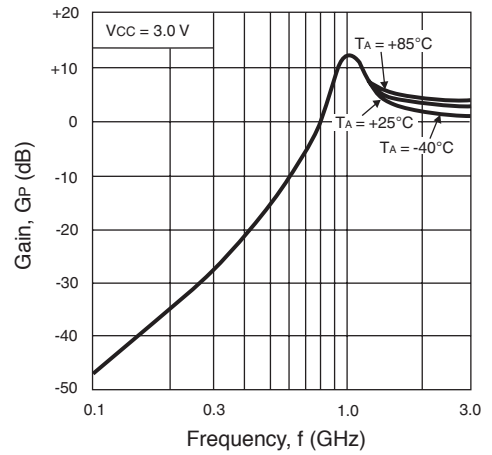
TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$ unless otherwise specified)

1.0 GHz OUTPUT PORT MATCHING

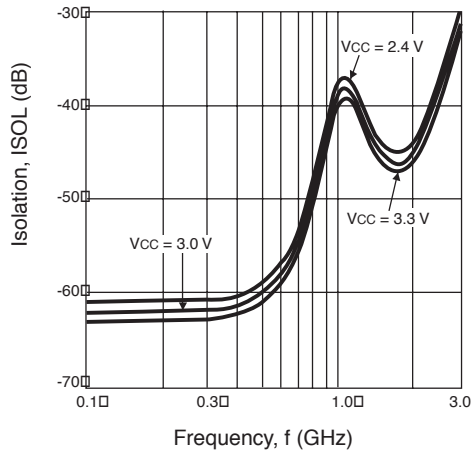
INSERTION POWER GAIN vs. FREQUENCY AND VOLTAGE



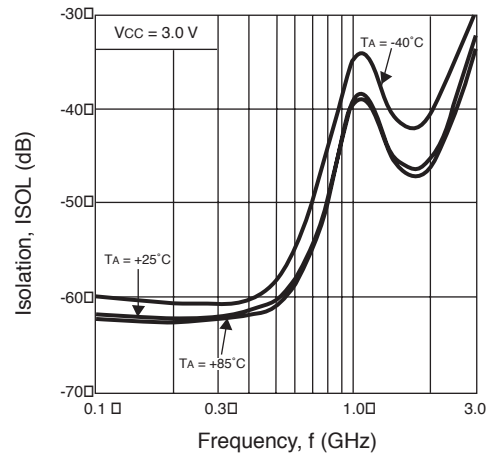
INSERTION POWER GAIN vs. FREQUENCY AND TEMPERATURE



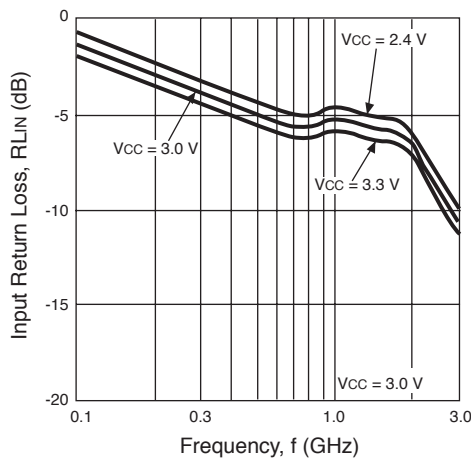
ISOLATION vs. FREQUENCY AND VOLTAGE



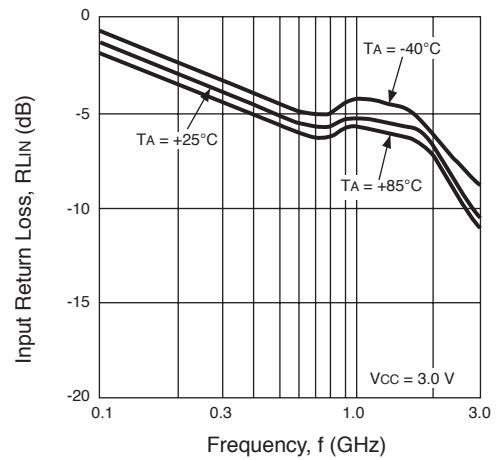
ISOLATION vs. FREQUENCY AND TEMPERATURE



INPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



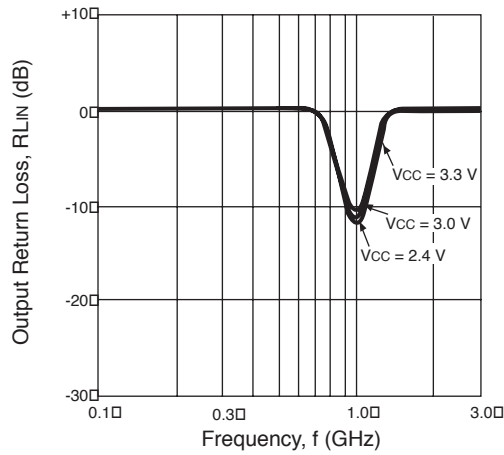
INPUT RETURN LOSS vs. FREQUENCY AND TEMPERATURE



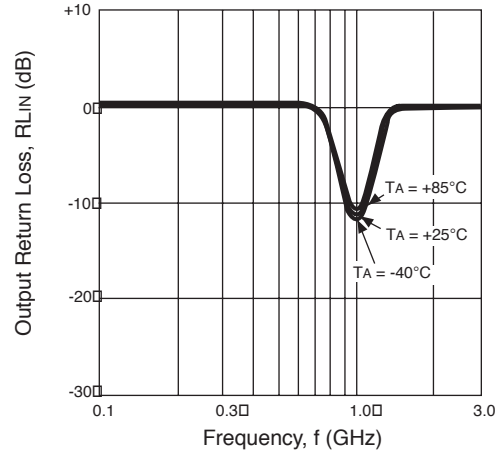
TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise specified)

1.0 GHz OUTPUT PORT MATCHING

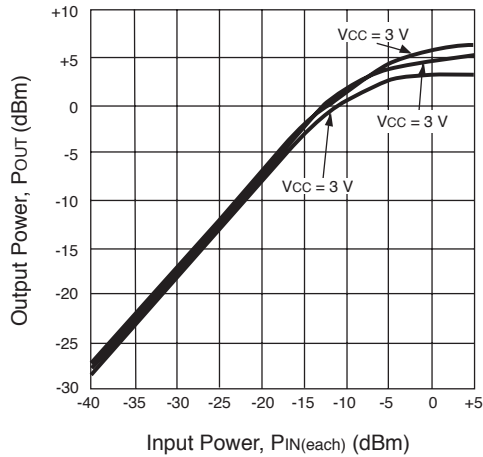
OUTPUT RETURN LOSS vs. FREQUENCY AND VOLTAGE



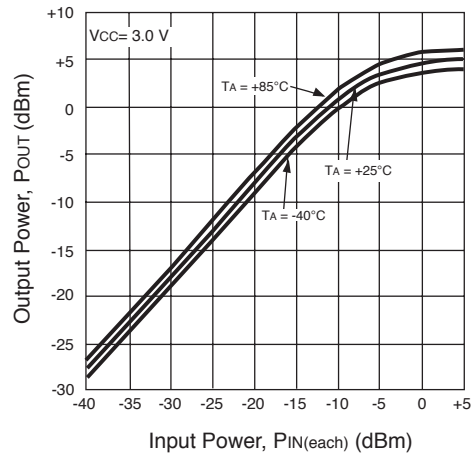
OUTPUT RETURN LOSS vs. FREQUENCY AND TEMPERATURE



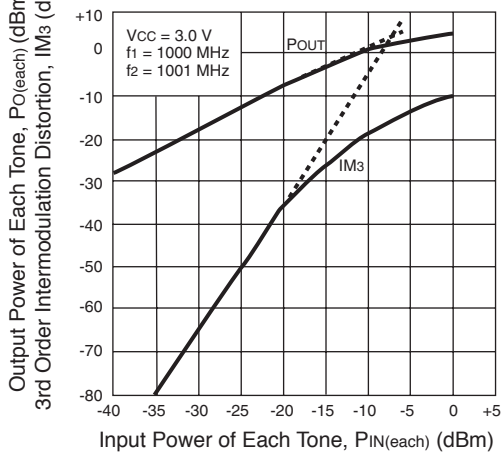
OUTPUT POWER vs. INPUT POWER AND VOLTAGE



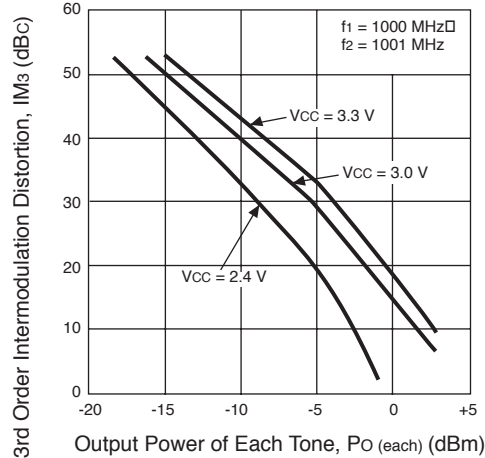
OUTPUT POWER vs. INPUT POWER AND TEMPERATURE



OUTPUT POWER OF EACH TONE AND 3rd ORDER INTERMODULATION DISTORTION vs. INPUT POWER OF EACH TONE

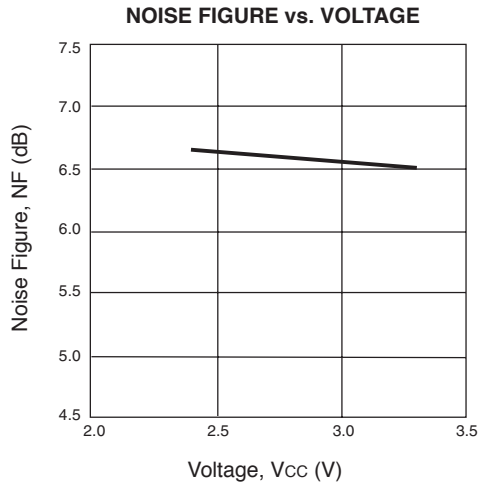


3rd ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE AND VOLTAGE

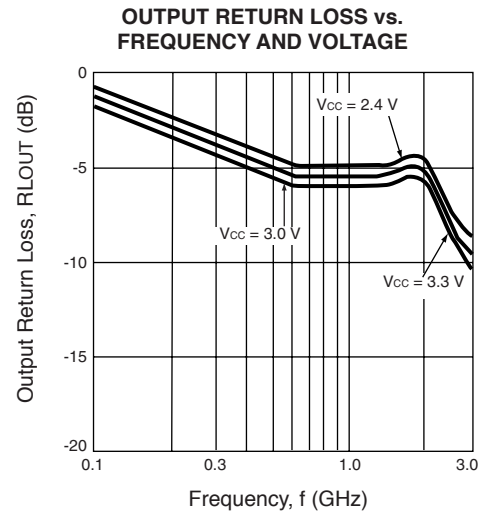
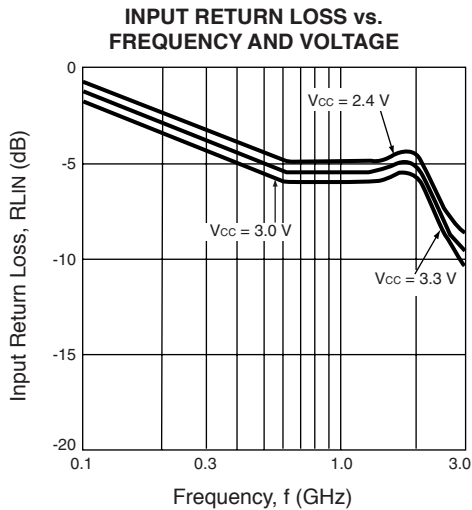
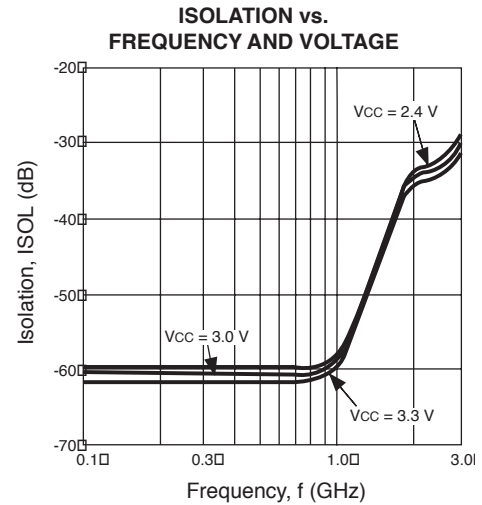
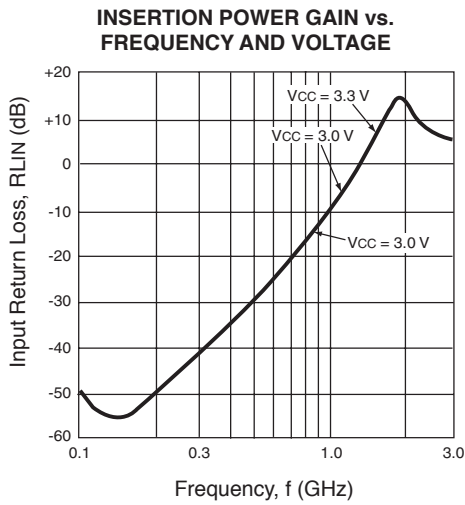


TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise specified)

1.0 GHz Output Port Matching

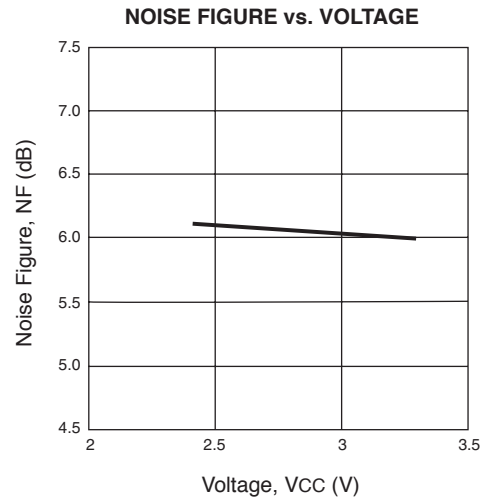
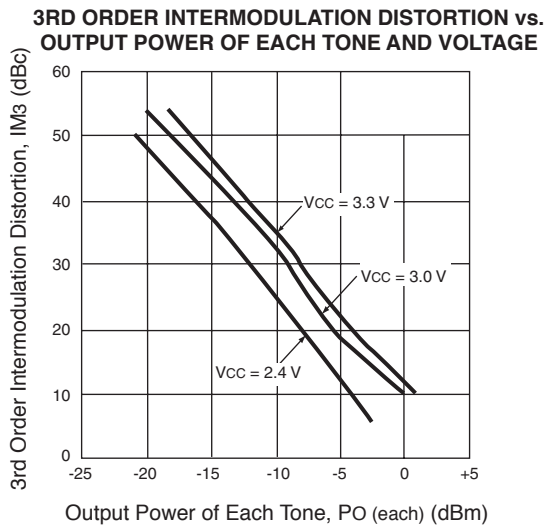
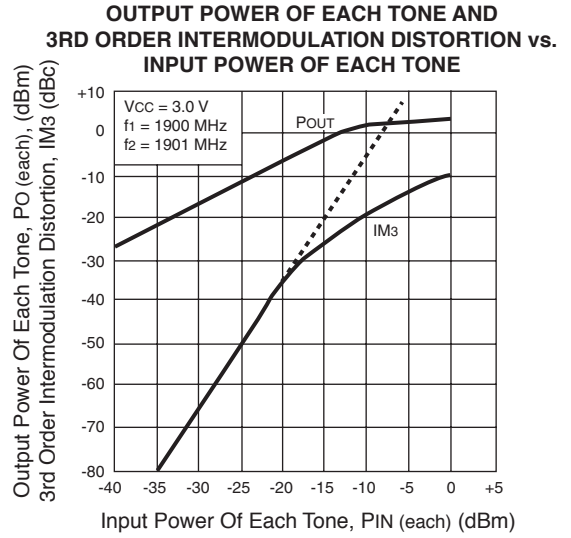
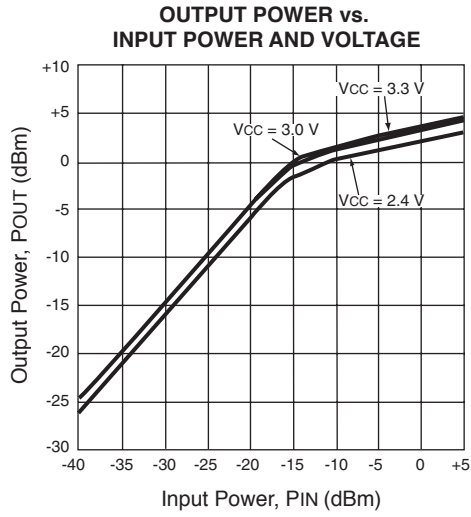


1.9 GHz Output Port Matching

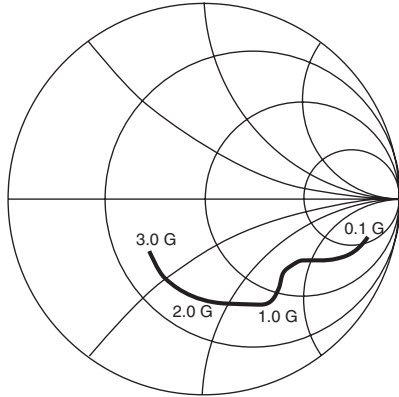


TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise specified)

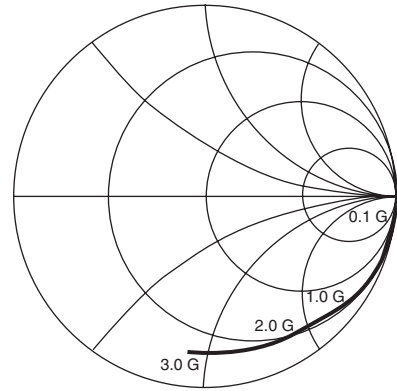
1.9 GHz Output Port Matching



TYPICAL SCATTERING PARAMETERS (TA = 25°C)



S11—Frequency



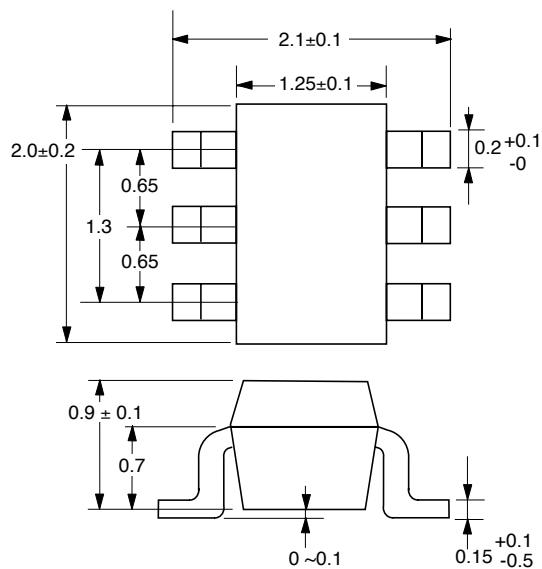
S22—Frequency

Vcc = Vout = 3.0 V, Icc = 4.2 mA

| FREQUENCY MHz | S11 | | S21 | | S12 | | S22 | |
|------------------|------|--------|-------|--------|------|-------|-------|--------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 100 | .843 | -16.0 | 1.202 | -178.9 | .000 | 69.5 | .996 | -3.3 |
| 200 | .752 | -27.1 | 1.197 | -177.5 | .003 | 120.2 | 1.009 | -6.9 |
| 300 | .666 | -32.4 | 1.221 | -175.4 | .003 | 103.2 | .998 | -9.9 |
| 400 | .603 | -36.8 | 1.299 | -174.5 | .004 | 92.8 | .986 | -13.8 |
| 500 | .555 | -40.5 | 1.398 | -174.0 | .005 | 88.8 | .968 | -17.3 |
| 600 | .528 | -44.8 | 1.513 | -174.9 | .005 | 95.2 | .968 | -20.4 |
| 700 | .517 | -49.9 | 1.691 | -176.2 | .007 | 67.5 | .971 | -23.1 |
| 800 | .525 | -54.4 | 1.815 | -178.2 | .007 | 72.4 | .972 | -25.8 |
| 900 | .545 | -58.9 | 2.008 | 179.5 | .006 | 84.5 | .960 | -29.3 |
| 1000 | .571 | -62.8 | 2.189 | 175.7 | .009 | 78.3 | .936 | -32.8 |
| 1100 | .580 | -67.3 | 2.399 | 171.2 | .007 | 60.0 | .926 | -36.3 |
| 1200 | .588 | -71.3 | 2.560 | 165.9 | .007 | 89.5 | .933 | -39.5 |
| 1300 | .571 | -76.4 | 2.736 | 157.5 | .008 | 67.2 | .941 | -42.0 |
| 1400 | .563 | -82.3 | 2.865 | 151.3 | .008 | 79.6 | .930 | -45.0 |
| 1500 | .553 | -88.8 | 2.946 | 143.3 | .006 | 79.9 | .906 | -48.1 |
| 1600 | .552 | -95.2 | 3.077 | 137.0 | .006 | 91.4 | .895 | -51.5 |
| 1700 | .551 | -101.5 | 3.083 | 130.1 | .009 | 102.3 | .888 | -54.8 |
| 1800 | .550 | -107.5 | 3.174 | 123.9 | .009 | 100.5 | .884 | -57.3 |
| 1900 | .536 | -113.3 | 3.164 | 117.4 | .006 | 109.5 | .885 | -60.5 |
| 2000 | .517 | -119.8 | 3.193 | 110.7 | .009 | 115.9 | .881 | -63.4 |
| 2100 | .495 | -127.1 | 3.149 | 104.4 | .010 | 124.2 | .870 | -66.6 |
| 2200 | .484 | -135.3 | 3.143 | 97.3 | .011 | 122.4 | .867 | -69.8 |
| 2300 | .484 | -142.6 | 3.135 | 90.5 | .012 | 131.7 | .866 | -72.3 |
| 2400 | .490 | -148.5 | 3.120 | 83.5 | .015 | 138.1 | .868 | -75.5 |
| 2500 | .499 | -152.5 | 3.053 | 78.4 | .016 | 136.3 | .866 | -78.7 |
| 2600 | .499 | -155.8 | 2.991 | 71.4 | .018 | 142.9 | .864 | -82.5 |
| 2700 | .485 | -157.4 | 2.958 | 68.0 | .018 | 143.9 | .858 | -86.6 |
| 2800 | .464 | -160.6 | 2.810 | 62.9 | .021 | 142.5 | .852 | -89.7 |
| 2900 | .439 | -164.1 | 2.866 | 57.5 | .022 | 149.3 | .872 | -93.4 |
| 3000 | .416 | -168.6 | 2.713 | 54.5 | .025 | 148.4 | .864 | -96.6 |
| 3100 | .403 | -173.6 | 2.635 | 48.0 | .030 | 143.6 | .867 | -101.0 |

OUTLINE DIMENSIONS (Units in mm)

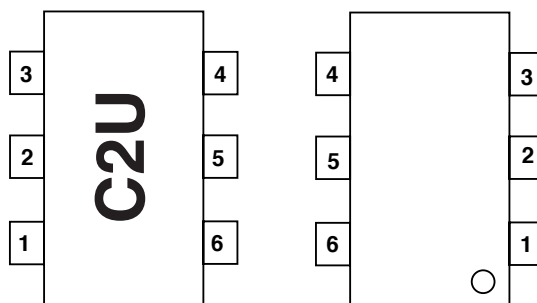
PACKAGE OUTLINE S06



LEAD CONNECTIONS

(Top View)

(Bottom View)



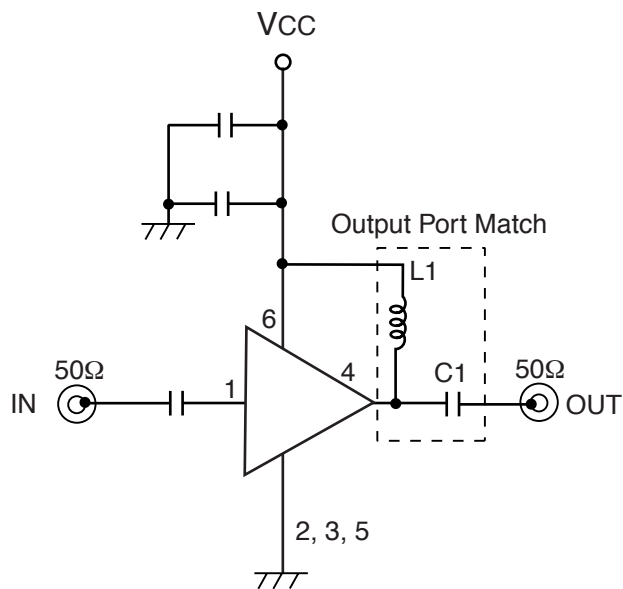
- 1. INPUT
- 2. GND
- 3. GND
- 4. OUTPUT
- 5. GND
- 6. Vcc

ORDERING INFORMATION

| PART NUMBER | QUANTITY | MARKING |
|----------------|----------|---------|
| UPC8151TB-E3-A | 3K/Reel | C2U |

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

TEST CIRCUIT



| FOUR | L1 | C1 | All Other Caps = 1000 pF |
|----------|--------|---------|-----------------------------|
| 900 MHz | 12 nH | 0.68 pF | |
| 1900 MHz | 2.7 nH | 0.47 pF | |

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9/29/2000

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JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

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