CEL

# BIPOLAR ANALOG INTEGRATED CIRCUIT
# UPC8106TB

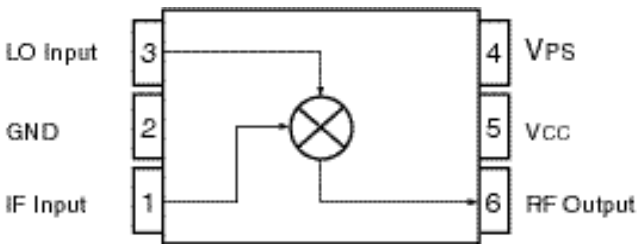
## 3 V SILICON RFIC FREQUENCY UPCONVERTER

## FEATURES

- **RECOMMENDED OPERATING FREQUENCY:**
  $f_{RFout}$ = 0.4 GHz to 2.0 GHz
  $f_{IFin}$ = 100 MHz to 400 MHz
- **SUPPLY VOLTAGE:**
  $V_{CC}$ = 2.7 to 5.5 V
- **HIGH DENSITY SURFACE MOUNTING:**
  6 pin super mini mold package
- **LOW CARRIER LEAKAGE:**
  Due to double balanced mixer
- **BUILT-IN POWER SAVE FUNCTION**

## INTERNAL BLOCK DIAGRAM

(Top View)




## DESCRIPTION

The UPC8106TB is a silicon RFIC designed as a frequency upconverter for cellular/cordless telephone transmitter stages and features improved intermodulation. This device is housed in a 6 pin super mini mold or SOT-363 package making it ideal for reducing system size. The UPC8106TB is manufactured using the 20 GHz $f_T$ NESAT™ III silicon bipolar process.

Stringent quality assurance and test procedures ensure the highest reliability and performance.

## APPLICATION

- **CELLULAR/CORDLESS TELEPHONE**

## ELECTRICAL CHARACTERISTICS

($T_A$ = 25°C, $V_{CC}$ = $V_{RFout}$ = 3 V, $f_{IFin}$ = 240 MHz, $P_{LOin}$ = -5 dBm, $V_{PS}$ ≥ 2.7 V unless otherwise specified)

| PART NUMBER<br>PACKAGE OUTLINE | | | UPC8106TB<br>S06 | | |
|---|---|---|---|---|---|
| **SYMBOLS** | **PARAMETERS AND CONDITIONS** | **UNITS** | **MIN** | **TYP** | **MAX** |
| $I_{CC}$ | Circuit Current at $V_{PS}$ ≥ 2.7 V<br>$V_{PS}$ = 0 V | mA<br>μA | 4.5 | 9 | 13.5<br>10 |
| CG | Conversion Gain at $f_{RFout}$ = 0.9 GHz, $P_{IFin}$ = -30 dBm<br>$f_{RFout}$ = 1.9 GHz, $P_{IFin}$ = -30 dBm | dB<br>dB | 6<br>4 | 9<br>7 | 12<br>10 |
| $P_{SAT}$ | Saturated Output Power at $f_{RFout}$ = 0.9 GHz, $P_{IFin}$ = 0 dBm<br>$f_{RFout}$ = 1.9 GHz, $P_{IFin}$ = 0 dBm | dBm<br>dBm | -4<br>-6.5 | -2<br>-4 | |
| $OIP_3$ | Output Third-Order Intercept Point at<br>$f_{IFin1}$ = 240.0 MHz<br>$f_{IFin2}$ = 240.4 MHz $f_{RFout}$ = 0.9 GHz<br>$P_{IFin}$ = -20 dBm $f_{RFout}$ = 1.9 GHz | <br><br>dBm<br>dBm | | <br><br>+5.5<br>+2.0 | |
| $IM_3$ | Third-Order Intermodulation Level at<br>$f_{IFin1}$ = 240 MHz<br>$f_{IFin2}$ = 240.4 MHz $f_{RFout}$ = 0.9 GHz<br>$P_{IFin}$ = -20 dBm $f_{RFout}$ = 1.9 GHz | <br><br>dBc<br>dBc | | <br><br>-31<br>-30 | |
| NF | SSB Noise Figure, $f_{RFout}$ = 0.9 GHz | dB | | 8.5 | |
| $T_{PS(RISE)}$ | Power Save Rise Time at $V_{PS}$: GND→$V_{CC}$ | μS | | 2.0 | |
| $T_{PS(FALL)}$ | Power Save Fall Time at $V_{PS}$: $V_{CC}$ →GND | μS | | 2.0 | |

## ABSOLUTE MAXIMUM RATINGS[1] ($T_A$ = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---|---|---|---|
| $V_{CC}$ | Supply Voltage Pins 5 & 6 | V | 6.0 |
| $V_{PS}$ | Power Save Voltage | V | 6.0 |
| $P_T$ | Total Power Dissipation[2] | mW | 200 |
| $T_{OP}$ | Operating Temperature | °C | -40 to +85 |
| $T_{STG}$ | Storage Temperature | °C | -55 to +150 |
| $P_{IN}$ | Input Power | dBm | +10 |

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).

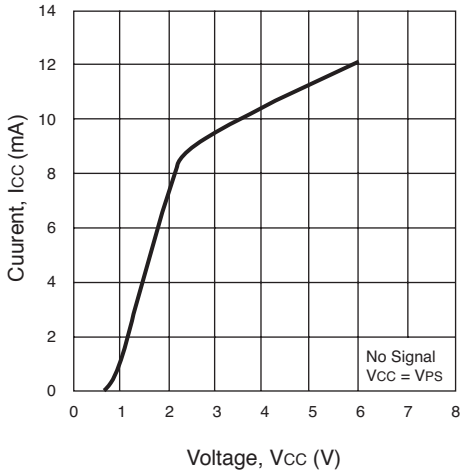
## RECOMMENDED OPERATING CONDITIONS

| SYMBOLS | PARAMETERS | UNITS | MIN | TYP | MAX |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage[1] | V | 2.7 | 3.0 | 5.5 |
| $T_{OP}$ | Operating Temperature | °C | -40 | +25 | +85 |
| $P_{LO}$ | LO Input Level[2] | dBm | -10 | -5 | 0 |
| $f_{RFout}$ | RF Output Frequency[3] | GHz | 0.4 | | 2.5 |
| $f_{IFin}$ | IF Input Frequency | MHz | 100 | | 400 |

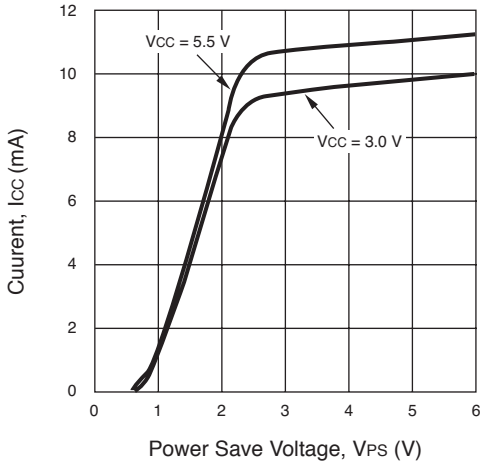
Notes:
1. The same voltage should be supplied to pin 5 and 6.
2. $Z_S$ = 50 Ω (without matching).
3. With external matching circuit.

## TYPICAL PERFORMANCE CURVES ($T_A$ = +25°C, $V_{CC}$ = $V_{RFout}$)

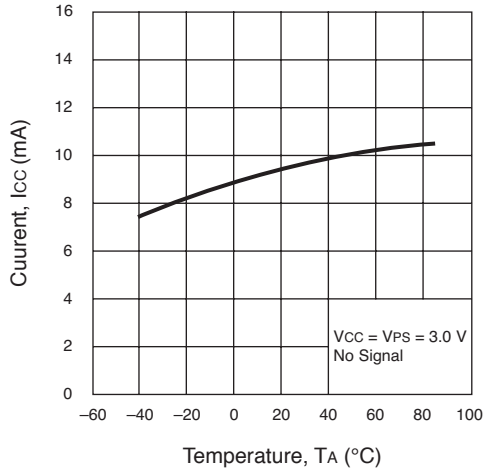
**CURRENT vs. VOLTAGE**



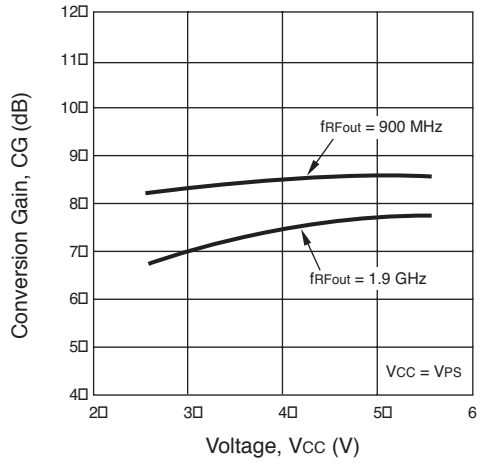

**CURRENT vs. POWER SAVE VOLTAGE**




**CURRENT vs. TEMPERATURE**

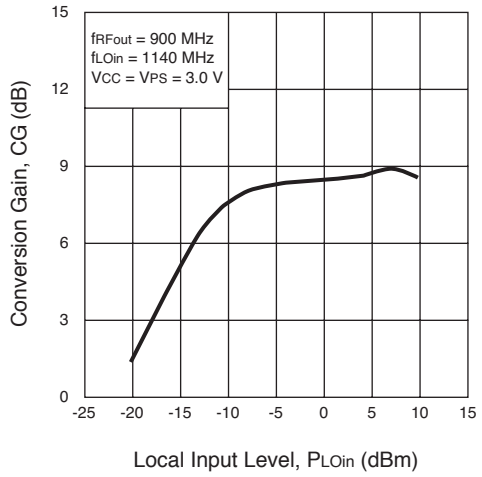



**CONVERSION GAIN vs. VOLTAGE**

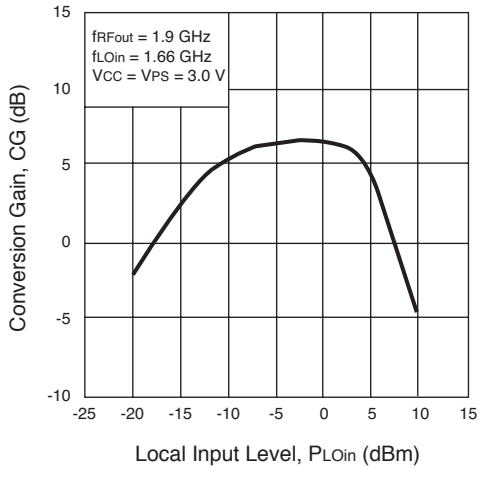


## TYPICAL PERFORMANCE CURVES ($T_A$ = +25°C, $V_{CC}$ = $V_{RFout}$)

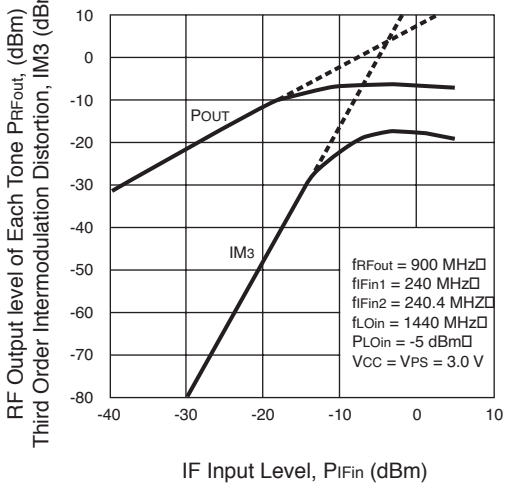
**CONVERSION GAIN vs. LOCAL INPUT LEVEL**



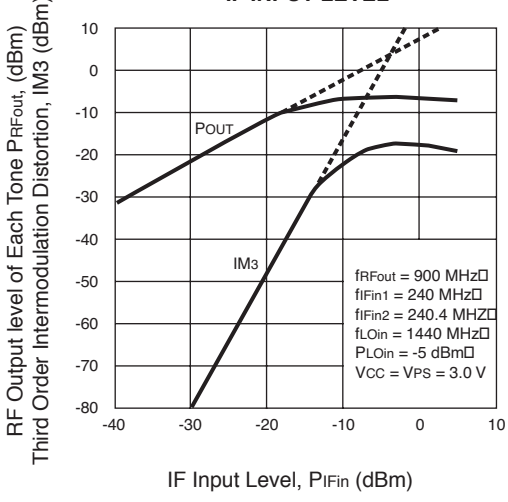

**CONVERSION GAIN vs. LOCAL INPUT LEVEL**



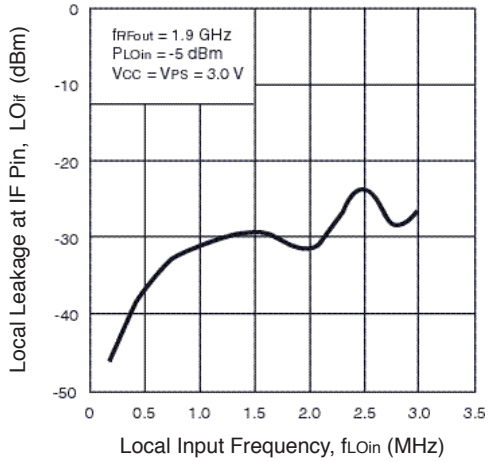

**RF OUTPUT LEVEL AND IM3 vs. IF INPUT LEVEL**



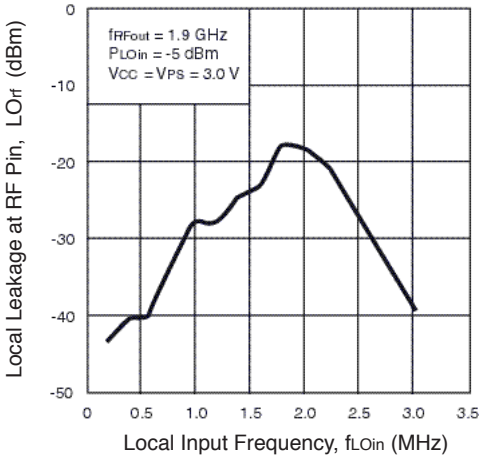

**RF OUTPUT LEVEL AND IM3 vs. IF INPUT LEVEL**




**LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY**

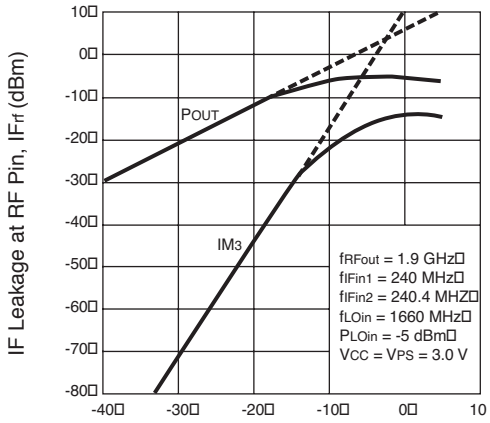



**LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT FREQUENCY**



## TYPICAL PERFORMANCE CURVES ($T_A$ = +25°C, $V_{CC}$ = $V_{RFout}$)

**IF LEAKAGE AT RF PIN vs. IF INPUT FREQUENCY**



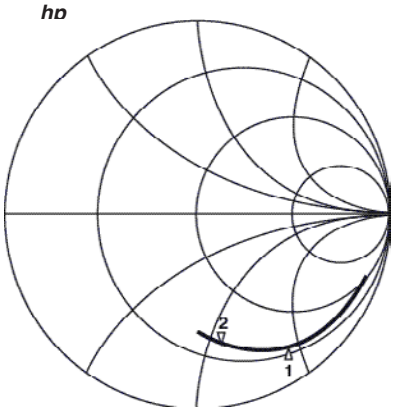

IF Input Frequency, $f_{IFin}$ (MHz)

## S-PARAMETERS FOR EACH PORT ($V_{CC}$ = $V_{PS}$ = $V_{RFout}$ = 3.0 V )

LO port

$S_{11}$ Z
REF 1.0 Units
2 200.0 mUnits/
∇ 21.201 Ω -53.748 Ω
*hp*

MARKER 1
1.15 GHz
MARKER 2
1.65 GHz

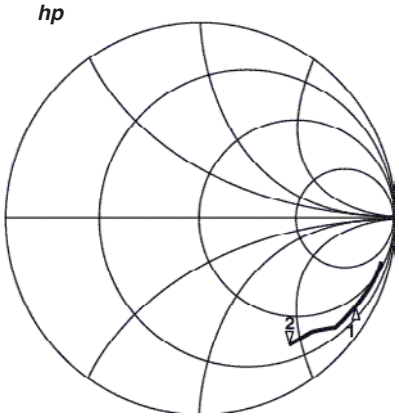



START 0.4 GHz STOP 1.9 GHz

RF port

$S_{22}$ Z
REF 1.0 Units
2 200.0 mUnits/
∇ 26.961 Ω -87.312 Ω
*hp*

MARKER 1
900 MHz
MARKER 2
1.9 GHz



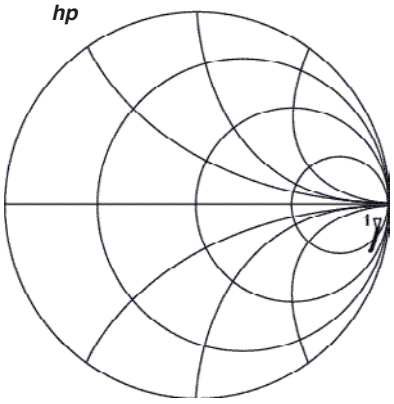

START 0.4 GHz STOP 1.9 GHz

## S-PARAMETERS FOR EACH PORT ($V_{CC}$ = $V_{PS}$ = $V_{RFout}$ = 3.0 V )

IF port

$S_{11}$ Z
REF 1.0 Units
1 200.0 mUnits/
∇ 194.16 Ω -579.53 Ω
*hp*

MARKER 1
240 MHz

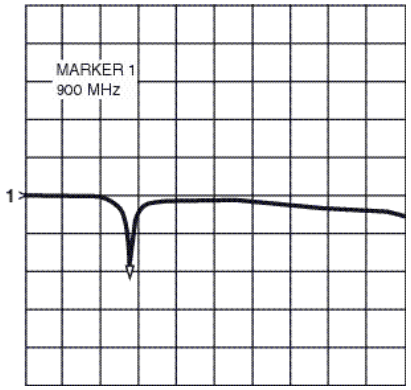



START 0.1 GHz STOP 0.4 GHz

## S-PARAMETERS FOR MATCHED RF OUTPUT

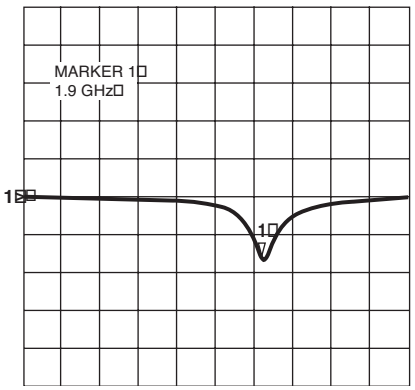
($V_{CC}$ = $V_{PS}$ = $V_{RFout}$ = 3.0 V ) - with TEST CIRCUITS 1 and 2 - ($S_{22}$ data is monitored at RF connector on board.)

900 MHz (LC-matched) in test circuit
$S_{11}$log MAG
REF 0.0 dB
1 10.0 dB/
∇ -19.567 dB
*hp*



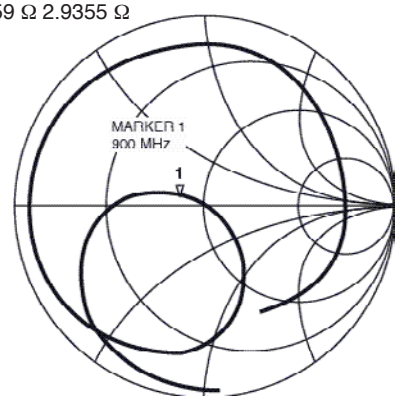

START 100 MHz STOP 3000 MHz

1.9 GHz (LC-matched) in test circuit
$S_{22}$ log MAG
REF 0.0 dB
1 10.0 dB/
∇ -15.213 dB
*hp*



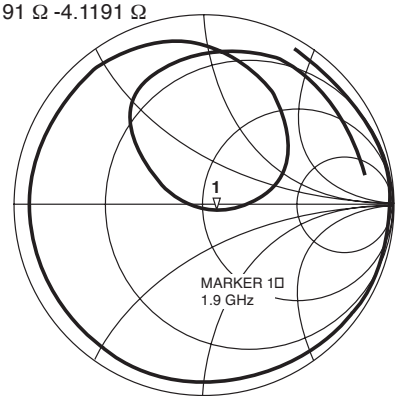

START 100 MHz STOP 3000 MHz

$S_{22}$
REF 1.0 Units
1 200.0 mUnits/
∇ 36.59 Ω 2.9355 Ω
*hp*



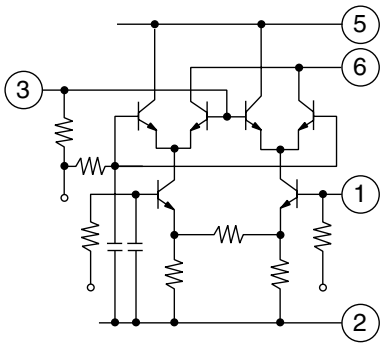
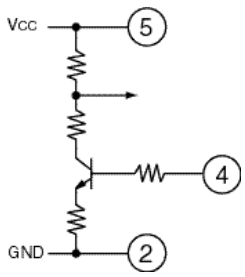

START 100 MHz STOP 3000 MHz

$S_{22}$
REF 1.0 Units
1 200.0 mUnits/
∇ 58.191 Ω -4.1191 Ω
*hp*




START 100 MHz STOP 3000 MHz

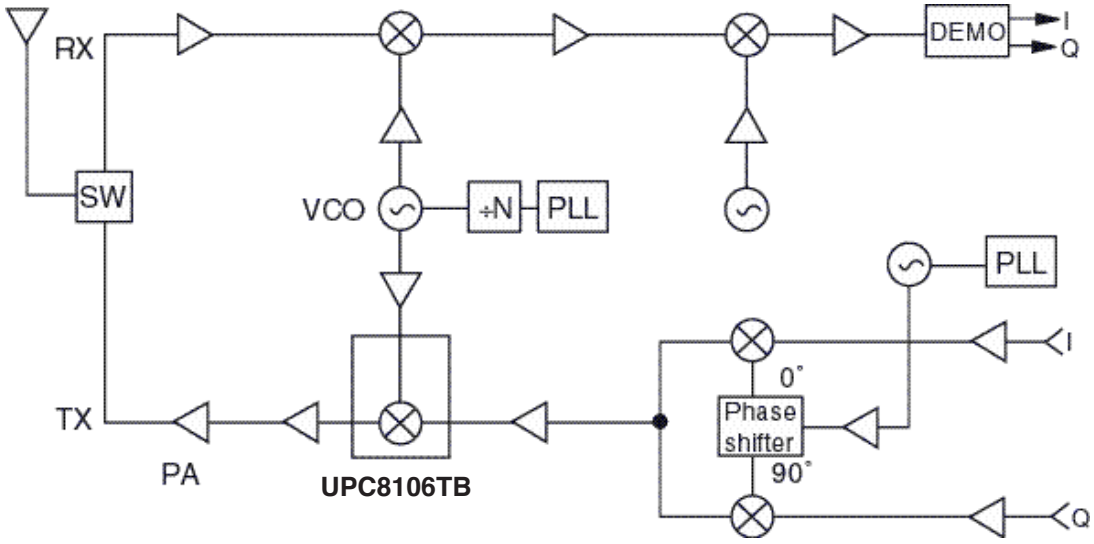
## PIN FUNCTIONS

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Supply Voltage (V)</th><th>Pin[1] Voltage (V)</th><th>Description</th><th>Equivalent Circuit</th></tr>
<tr><td>1</td><td>IF Input</td><td>–</td><td>1.3</td><td>This pin is the IF input to the double balanced mixer. The input is a high impedance.</td><td rowspan="5"> 
</td></tr>
<tr><td>2</td><td>GND</td><td>0</td><td>–</td><td>GND pin. Ground pattern on the board should be as wide as possible. Trace length should be kept as short as possible to minimize ground impedance.</td></tr>
<tr><td>3</td><td>LOIN</td><td>–</td><td>2.4</td><td>LO input pin. Recommended input level is -10 to 0 dBm.</td></tr>
<tr><td>5</td><td>VCC</td><td>2.7 to 5.5</td><td>–</td><td>Supply voltage pin.</td></tr>
<tr><td>6</td><td>RF Output</td><td>2.7 to 3.6</td><td>–</td><td>This pin is the RF output. This pin is designed as an open collector. Due to the high impedance output, this pin requires an external LC matching circuit.</td></tr>
<tr><td>4</td><td>VPS</td><td>VCC/GND</td><td>–</td><td>Power save control pin. Bias controls operation as follows:
<table>
<tr><th>Pin Bias</th><th>Control</th></tr>
<tr><td>VCC</td><td>ON</td></tr>
<tr><td>GND</td><td>Power Save</td></tr>
</table></td><td> 
</td></tr>
</table>

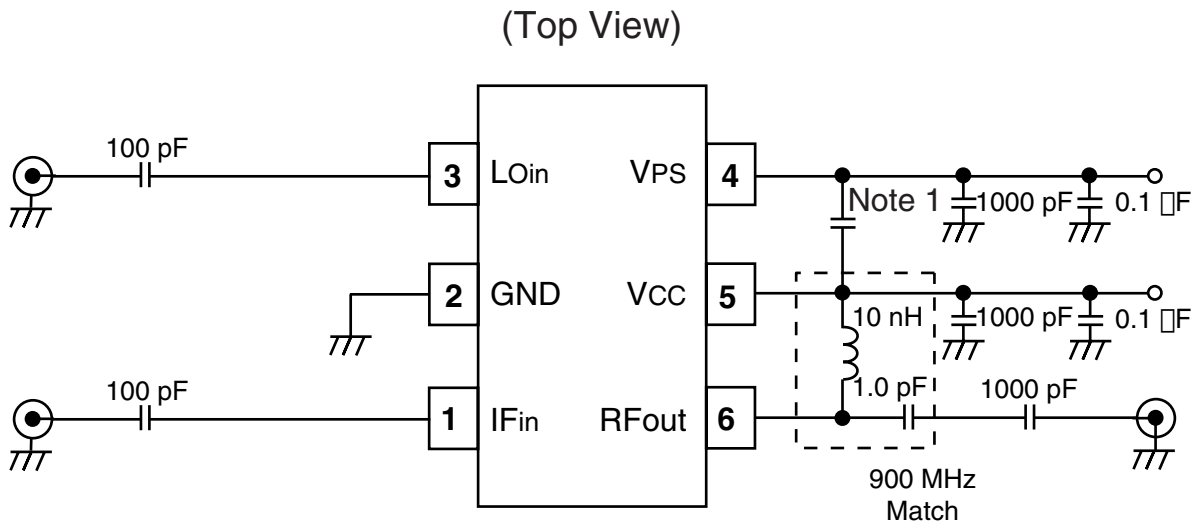
Note:
1. Each pin voltage is measured with $V_{CC}$ = $V_{PS}$ = $V_{RFout}$ = 3.0 V

## SYSTEM APPLICATION EXAMPLE

**EXAMPLE OF DECT 900 MHz Cordless Phone**

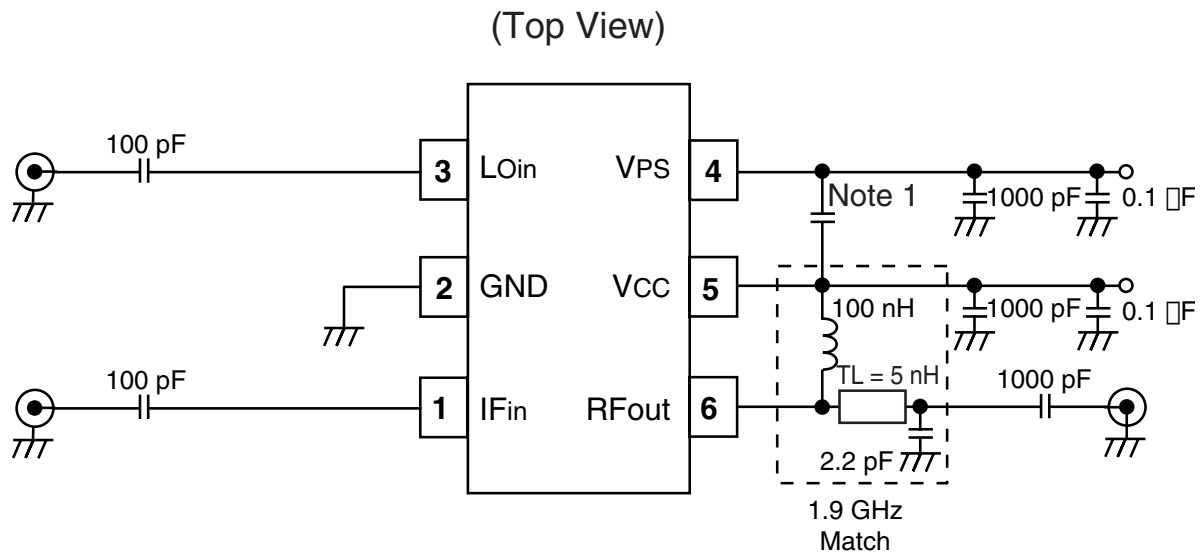


## TEST CIRCUIT 1 ($RF_{OUT}$ = 900 MHz)




Note:
1. In case of unstable operation, connect 100 pF capacitor between pins 4 and 5.

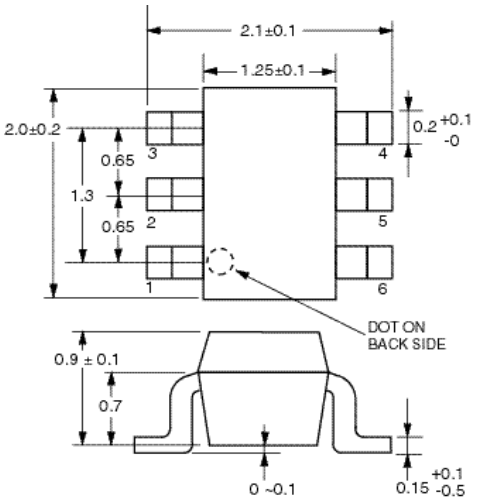
## TEST CIRCUIT 2 ($RF_{OUT}$ = 1.9 GHz)




Note:
1. In case of unstable operation, connect 100 pF capacitor between pins 4 and 5.

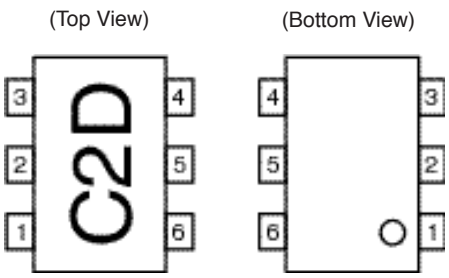
## OUTLINE DIMENSIONS (Units in mm)

**PACKAGE OUTLINE S06**




Note:
All dimensions are typical unless otherwise specified.

## LEAD CONNECTIONS




1. IF INPUT
2. GND
3. LO INPUT
4. POWER SAVE
5. Vcc
6. RF OUTPUT

### ORDERING INFORMATION

| PART NUMBER | QTY |
|---|---|
| UPC8106TB-E3-A | 3K/Reel |

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

# Mouser Electronics

Authorized Distributor

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CEL:

UPC8106TB-EV19 UPC8106TB-EV24 UPC8106TB-EV09 UPC8106TB-A