

## 3 V SILICON RFIC FREQUENCY UPCONVERTER

### FEATURES

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

### 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 ft NESAT™ III silicon bipolar process.

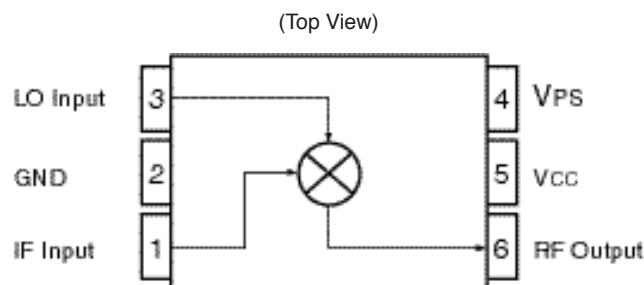
Stringent quality assurance and test procedures ensure the highest reliability and performance.

### ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = V_{RFout} = 3 \text{ V}$ ,  $f_{iFin} = 240 \text{ MHz}$ ,  $PL_{Oin} = -5 \text{ dBm}$ ,  $V_{PS} \geq 2.7 \text{ V}$  unless otherwise specified)

PART NUMBER PACKAGE OUTLINE			UPC8106TB S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
$I_{CC}$	Circuit Current at $V_{PS} \geq 2.7 \text{ V}$ $V_{PS} = 0 \text{ V}$	mA $\mu\text{A}$	4.5	9	13.5 10
CG	Conversion Gain at $f_{RFout} = 0.9 \text{ GHz}$ , $PI_{Fin} = -30 \text{ dBm}$ $f_{RFout} = 1.9 \text{ GHz}$ , $PI_{Fin} = -30 \text{ dBm}$	dB dB	6 4	9 7	12 10
PSAT	Saturated Output Power at $f_{RFout} = 0.9 \text{ GHz}$ , $PI_{Fin} = 0 \text{ dBm}$ $f_{RFout} = 1.9 \text{ GHz}$ , $PI_{Fin} = 0 \text{ dBm}$	dBm dBm	-4 -6.5	-2 -4	
OIP <sub>3</sub>	Output Third-Order Intercept Point at $f_{iFin1} = 240.0 \text{ MHz}$ $f_{iFin2} = 240.4 \text{ MHz}$ $PI_{Fin} = -20 \text{ dBm}$	dBm dBm		+5.5 +2.0	
IM <sub>3</sub>	Third-Order Intermodulation Level at $f_{iFin1} = 240 \text{ MHz}$ $f_{iFin2} = 240.4 \text{ MHz}$ $PI_{Fin} = -20 \text{ dBm}$	dBc dBc		-31 -30	
NF	SSB Noise Figure, $f_{RFout} = 0.9 \text{ GHz}$	dB		8.5	
TPS(RISE)	Power Save Rise Time at $V_{PS}$ : GND→VCC	$\mu\text{S}$		2.0	
TPS(FALL)	Power Save Fall Time at $V_{PS}$ : VCC→GND	$\mu\text{S}$		2.0	

### INTERNAL BLOCK DIAGRAM



### APPLICATION

- CELLULAR/CORDLESS TELEPHONE

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage Pins 5 & 6	V	6.0
V <sub>PS</sub>	Power Save Voltage	V	6.0
P <sub>T</sub>	Total Power Dissipation <sup>2</sup>	mW	200
T <sub>OP</sub>	Operating Temperature	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-55 to +150
P <sub>IN</sub>	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<sub>A</sub> = +85°C).

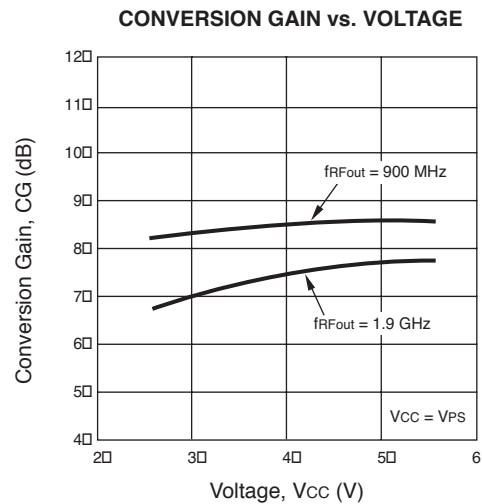
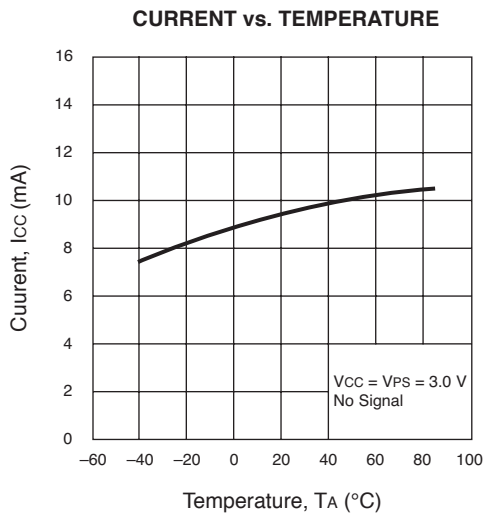
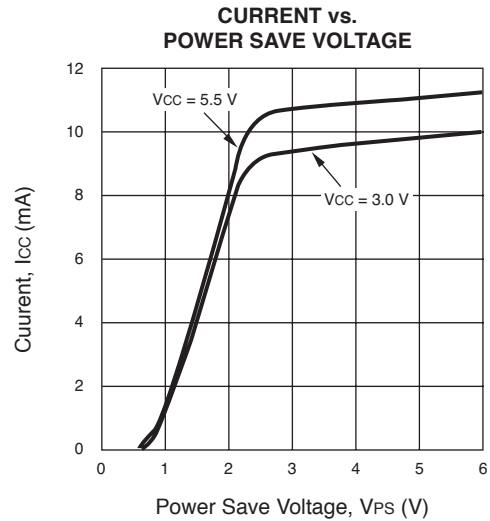
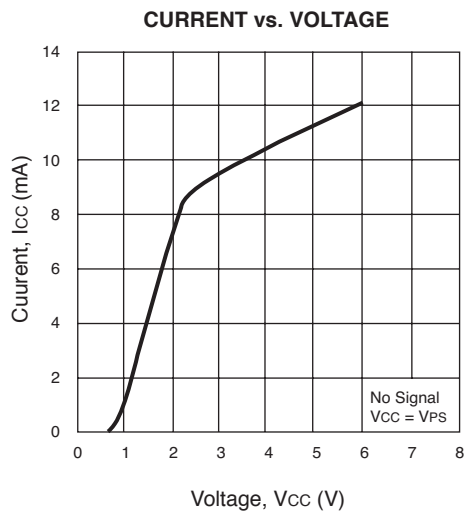
**RECOMMENDED OPERATING CONDITIONS**

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage <sup>1</sup>	V	2.7	3.0	5.5
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85
P <sub>LO</sub>	LO Input Level <sup>2</sup>	dBm	-10	-5	0
f <sub>RFout</sub>	RF Output Frequency <sup>3</sup>	GHz	0.4		2.5
f <sub>IFin</sub>	IF Input Frequency	MHz	100		400

Notes:

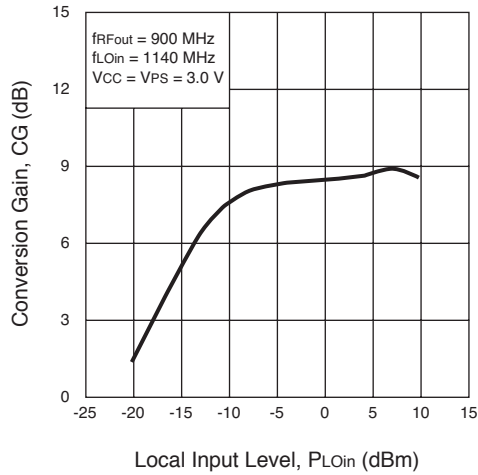
1. The same voltage should be supplied to pin 5 and 6.
2. Z<sub>S</sub> = 50 Ω (without matching).
3. With external matching circuit.

**TYPICAL PERFORMANCE CURVES** (T<sub>A</sub> = +25°C, V<sub>CC</sub> = V<sub>RFout</sub>)

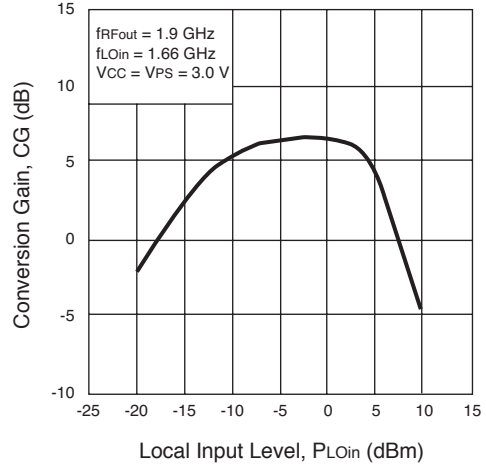


**TYPICAL PERFORMANCE CURVES** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{RFout}$ )

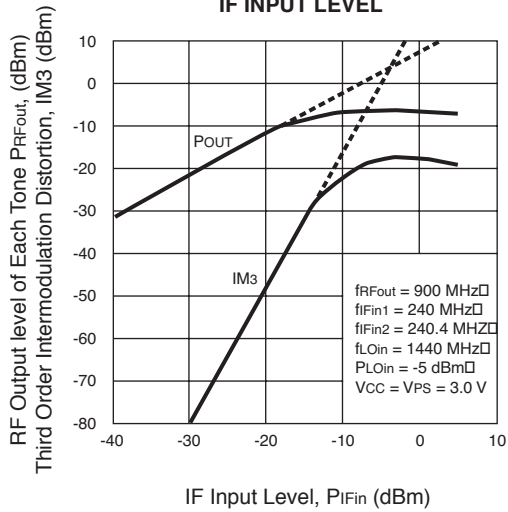
**CONVERSION GAIN vs. LOCAL INPUT LEVEL**



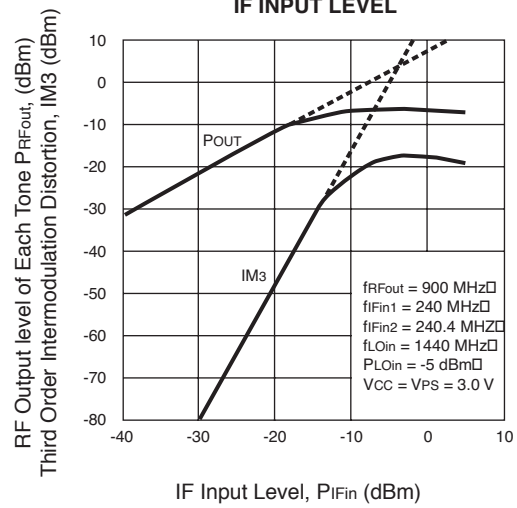
**CONVERSION GAIN vs. LOCAL INPUT LEVEL**



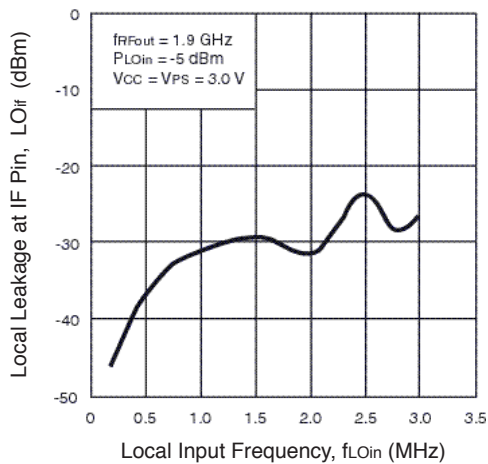
**RF OUTPUT LEVEL AND IM3 vs. IF INPUT LEVEL**



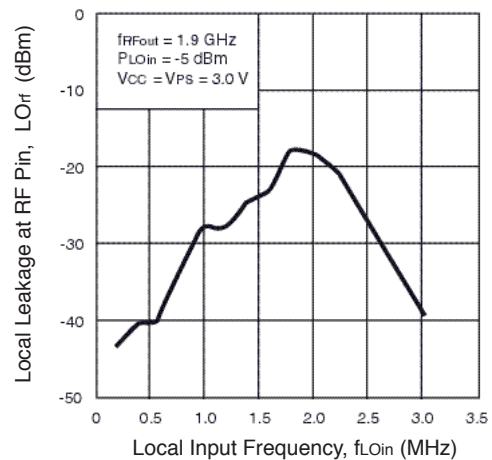
**RF OUTPUT LEVEL AND IM3 vs. IF INPUT LEVEL**



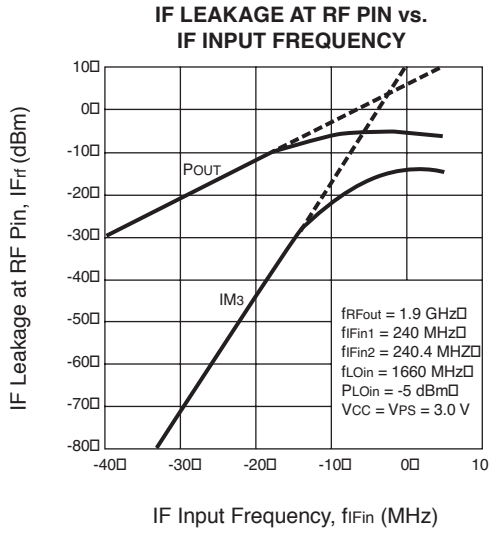
**LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY**



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



**TYPICAL PERFORMANCE CURVES** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{RFout}$ )

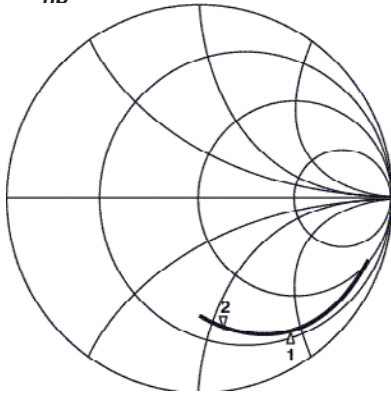


**S-PARAMETERS FOR EACH PORT** ( $V_{CC} = V_{PS} = V_{RFout} = 3.0\text{ V}$ )

LO port

$S_{11}$        $Z$   
 REF 1.0 Units  
 2    200.0 mUnits/  
 ▽    21.201  $\Omega$  -53.748  $\Omega$   
**hp**

MARKER 1  
 1.15 GHz  
 MARKER 2  
 1.65 GHz



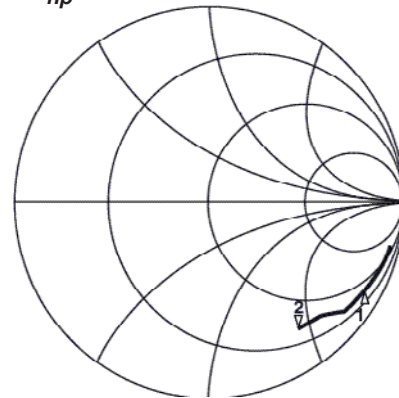
START 0.4 GHz

STOP 1.9 GHz

RF port

$S_{22}$        $Z$   
 REF 1.0 Units  
 2    200.0 mUnits/  
 ▽    26.961  $\Omega$  -87.312  $\Omega$   
**hp**

MARKER 1  
 900 MHz  
 MARKER 2  
 1.9 GHz



START 0.4 GHz

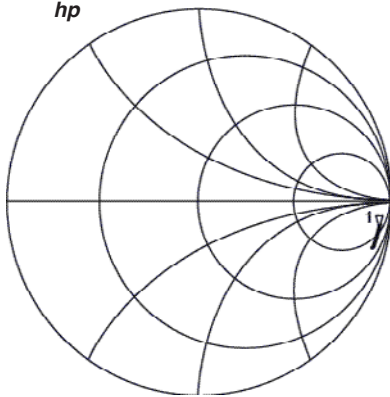
STOP 1.9 GHz

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

IF port

S11 Z  
 REF 1.0 Units  
 1 200.0 mUnits/  
 ∇ 194.16 Ω -579.53 Ω  
**hp**

MARKER 1  
 240 MHz



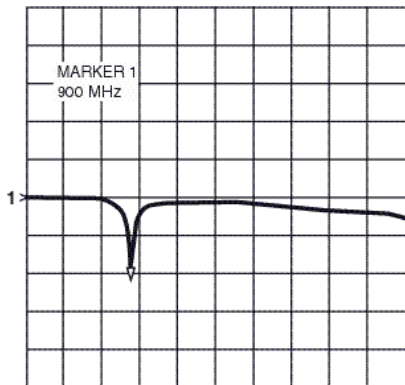
START 0.1 GHz STOP 0.4 GHz

**S-PARAMETERS FOR MATCHED RF OUTPUT**

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

900 MHz (LC-matched) in test circuit

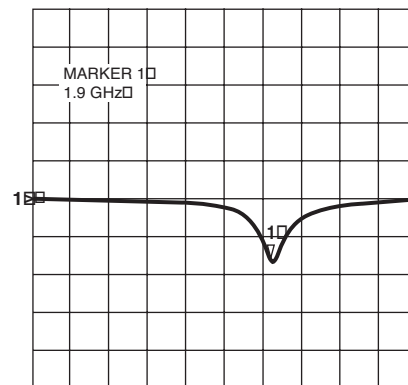
S11 log MAG  
 REF 0.0 dB  
 1 10.0 dB/  
 ∇ -19.567 dB  
**hp**



START 100 MHz STOP 3000 MHz

1.9 GHz (LC-matched) in test circuit

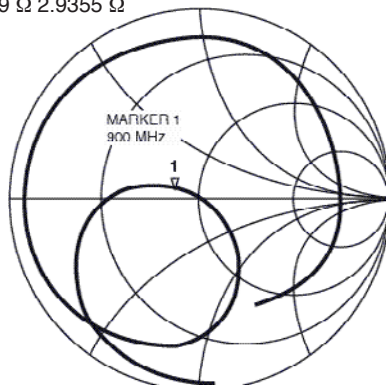
S22 log MAG  
 REF 0.0 dB  
 1 10.0 dB/  
 ∇ -15.213 dB  
**hp**



START 100 MHz STOP 3000 MHz

S22

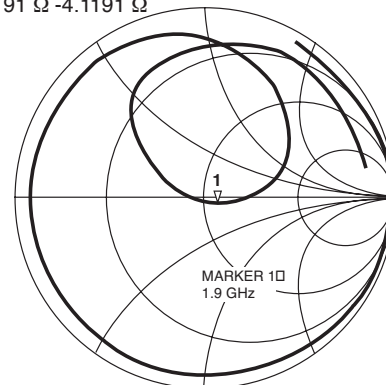
REF 1.0 Units  
 1 200.0 mUnits/  
 ∇ 36.59 Ω 2.9355 Ω  
**hp**



START 100 MHz STOP 3000 MHz

S22

REF 1.0 Units  
 1 200.0 mUnits/  
 ∇ 58.191 Ω -4.1191 Ω  
**hp**



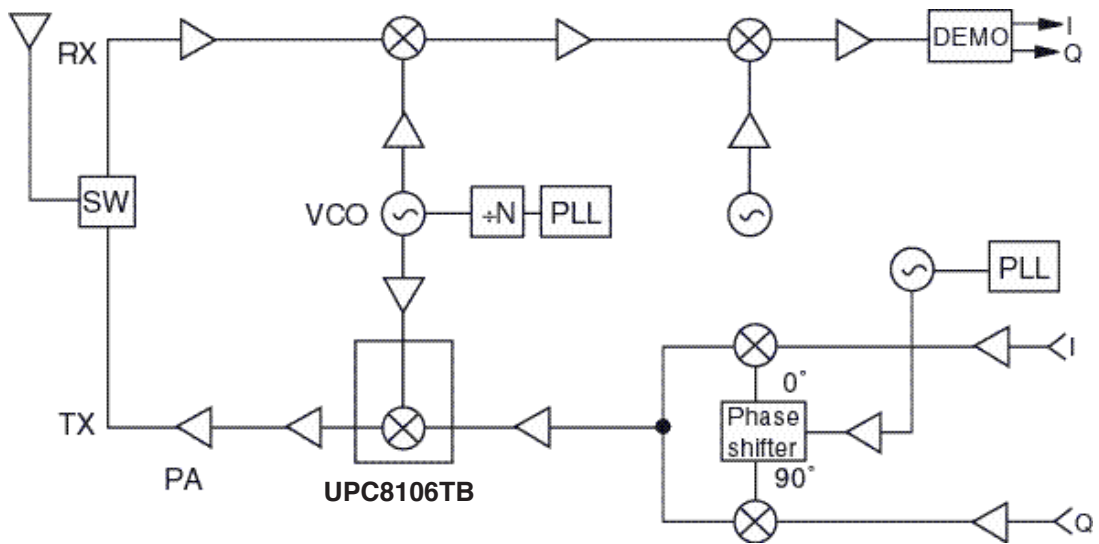
START 100 MHz STOP 3000 MHz

**PIN FUNCTIONS**

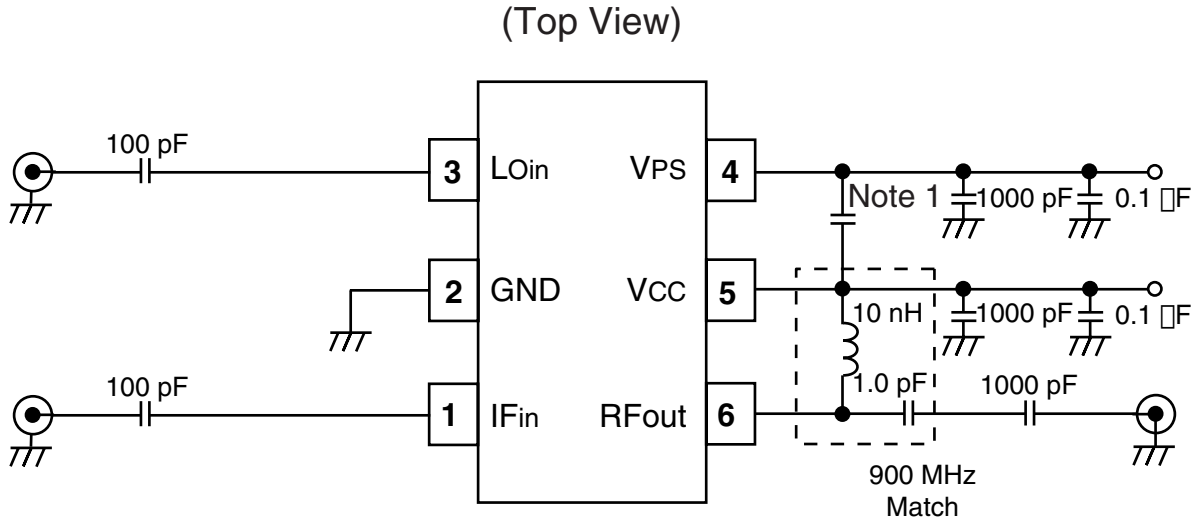
Pin No.	Symbol	Supply Voltage (V)	Pin <sup>1</sup> Voltage (V)	Description	Equivalent Circuit						
1	IF Input	–	1.3	This pin is the IF input to the double balanced mixer. The input is a high impedance.							
2	GND	0	–	GND pin. Ground pattern on the board should be as wide as possible. Trace length should be kept as short as possible to minimize ground impedance.							
3	LOIN	–	2.4	LO input pin. Recommended input level is -10 to 0 dBm.							
5	Vcc	2.7 to 5.5	–	Supply voltage pin.							
6	RF Output	2.7 to 3.6	–	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.							
4	Vps	Vcc/GND	–	Power save control pin. Bias controls operation as follows: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Pin Bias</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>Vcc</td> <td>ON</td> </tr> <tr> <td>GND</td> <td>Power Save</td> </tr> </tbody> </table>	Pin Bias	Control	Vcc	ON	GND	Power Save	
Pin Bias	Control										
Vcc	ON										
GND	Power Save										

**Note:**

1. Each pin voltage is measured with Vcc = Vps = VRFout = 3.0 V

**SYSTEM APPLICATION EXAMPLE****EXAMPLE OF DECT 900 MHz Cordless Phone**

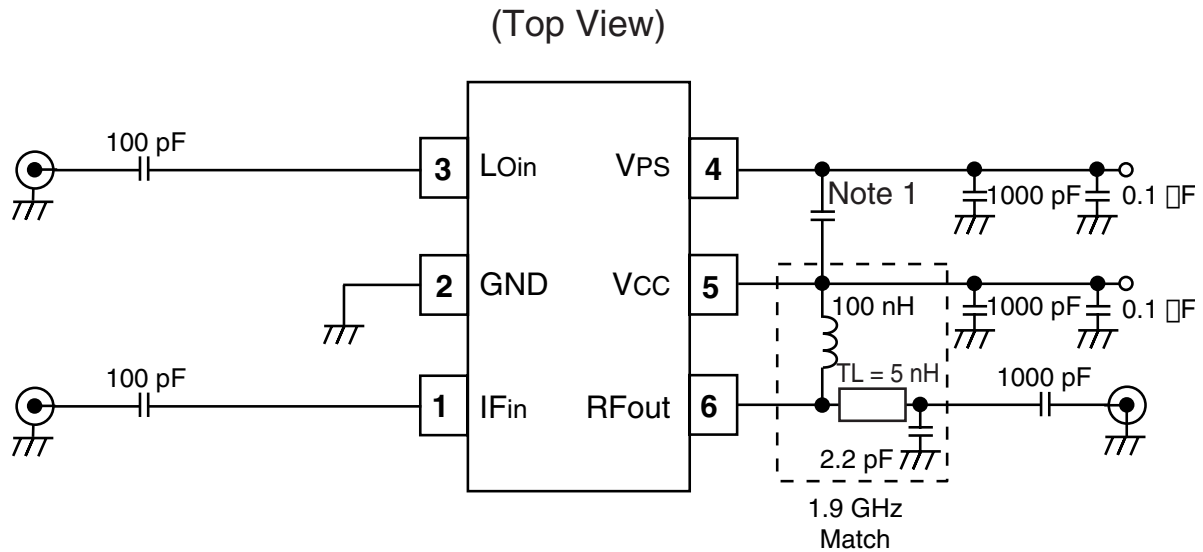
**TEST CIRCUIT 1** (RF<sub>OUT</sub> = 900 MHz)



Note:

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

**TEST CIRCUIT 2** (RF<sub>OUT</sub> = 1.9 GHz)

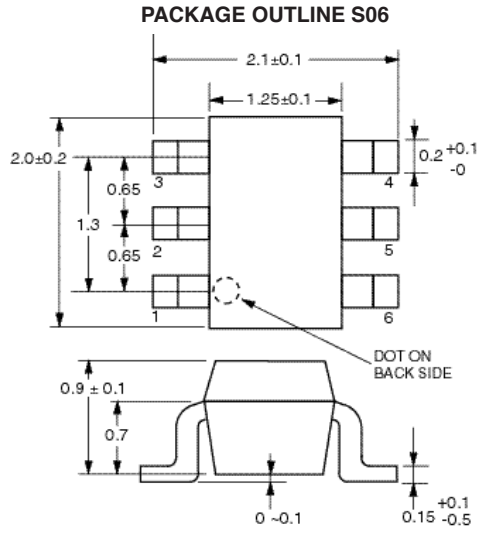


Note:

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

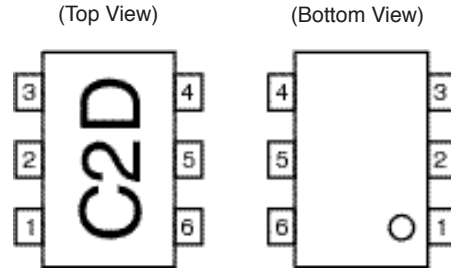


**OUTLINE DIMENSIONS** (Units in mm)



Note:  
All dimensions are typical unless otherwise specified.

**LEAD CONNECTIONS**



- 1. IF INPUT
- 2. GND
- 3. LO INPUT
- 4. POWER SAVE
- 5. V<sub>cc</sub>
- 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.