

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.

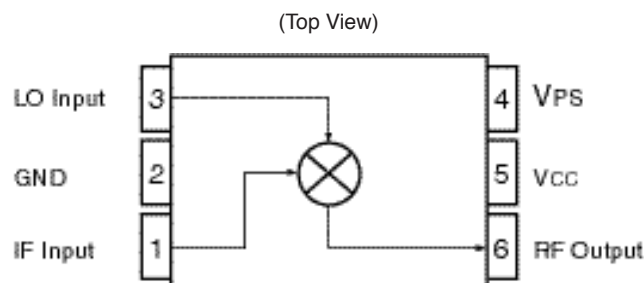
Stringent quality assurance and test procedures ensure the highest reliability and performance.

ELECTRICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$, $V_{CC} = V_{RFout} = 3 \text{ V}$, $f_{IFin} = 240 \text{ MHz}$, $P_{LOin} = -5 \text{ dBm}$, $V_{PS} \geq 2.7 \text{ V}$ 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 μA	4.5	9	13.5 10
CG	Conversion Gain at $f_{RFout} = 0.9 \text{ GHz}$, $P_{IFin} = -30 \text{ dBm}$ $f_{RFout} = 1.9 \text{ GHz}$, $P_{IFin} = -30 \text{ dBm}$	dB dB	6 4	9 7	12 10
PSAT	Saturated Output Power at $f_{RFout} = 0.9 \text{ GHz}$, $P_{IFin} = 0 \text{ dBm}$ $f_{RFout} = 1.9 \text{ GHz}$, $P_{IFin} = 0 \text{ dBm}$	dBm dBm	-4 -6.5	-2 -4	
OIP ₃	Output Third-Order Intercept Point at $f_{IFin1} = 240.0 \text{ MHz}$ $f_{IFin2} = 240.4 \text{ MHz}$ $P_{IFin} = -20 \text{ dBm}$ $f_{RFout} = 0.9 \text{ GHz}$ $f_{RFout} = 1.9 \text{ GHz}$	dBm dBm		+5.5 +2.0	
IM ₃	Third-Order Intermodulation Level at $f_{IFin1} = 240 \text{ MHz}$ $f_{IFin2} = 240.4 \text{ MHz}$ $P_{IFin} = -20 \text{ dBm}$ $f_{RFout} = 0.9 \text{ GHz}$ $f_{RFout} = 1.9 \text{ GHz}$	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→V _{CC}	μS		2.0	
TPS(FALL)	Power Save Fall Time at V_{PS} : V _{CC} →GND	μS		2.0	

INTERNAL BLOCK DIAGRAM



APPLICATION

- **CELLULAR/CORDLESS TELEPHONE**

ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^\circ\text{C}$)

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:

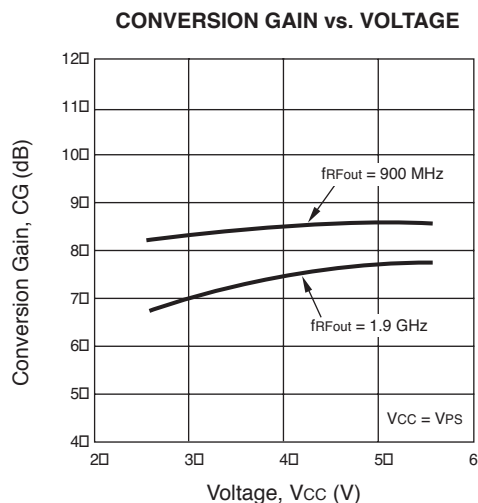
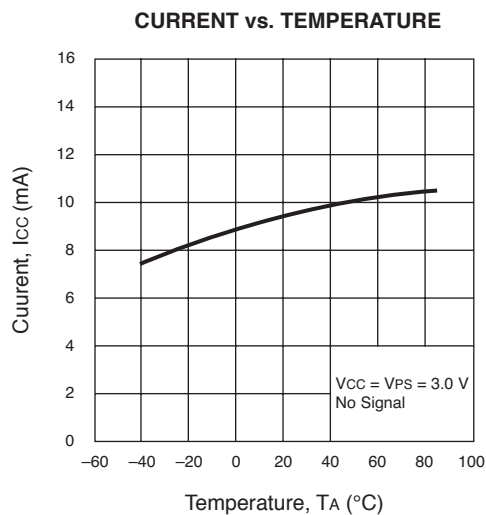
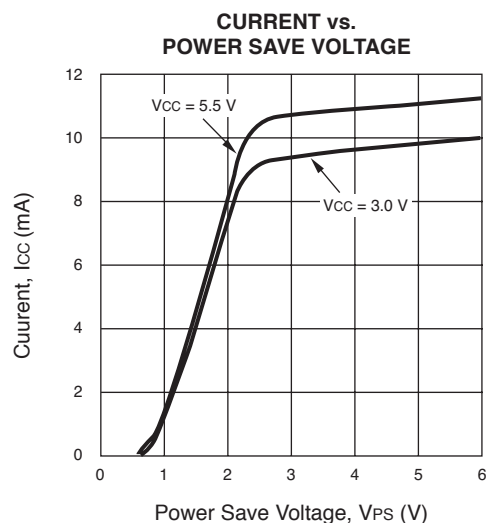
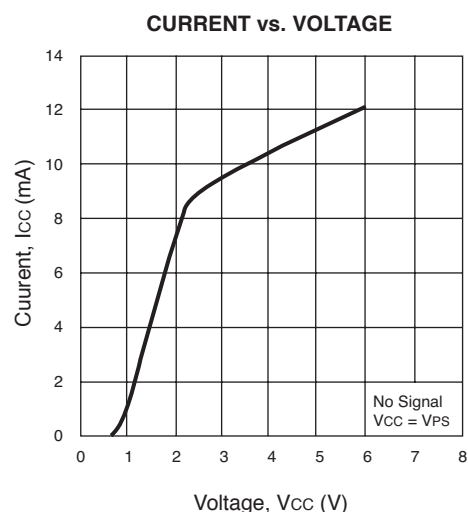
- Operation in excess of any one of these parameters may result in permanent damage.
- Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB ($T_A = +85^\circ\text{C}$).

**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

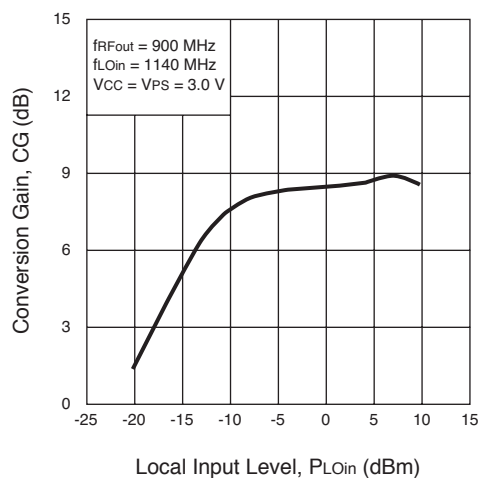
Notes:

- The same voltage should be supplied to pin 5 and 6.
- Z_s = 50 Ω (without matching).
- With external matching circuit.

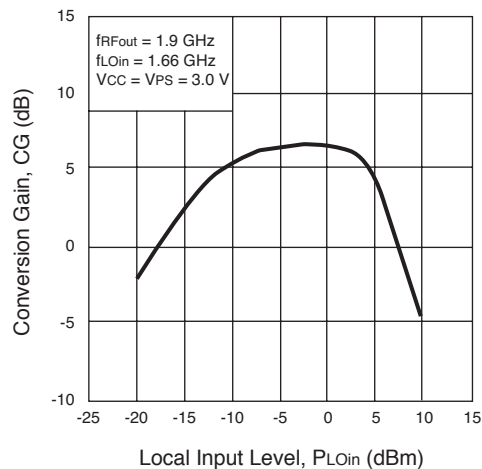
TYPICAL PERFORMANCE CURVES ($T_A = +25^\circ\text{C}$, $V_{CC} = V_{RFout}$)

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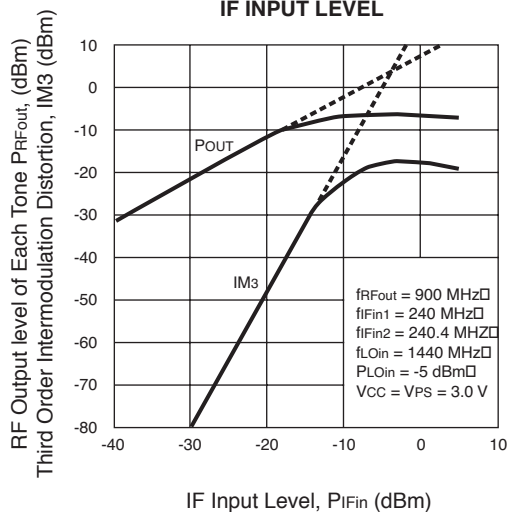
**CONVERSION GAIN vs.
LOCAL INPUT LEVEL**



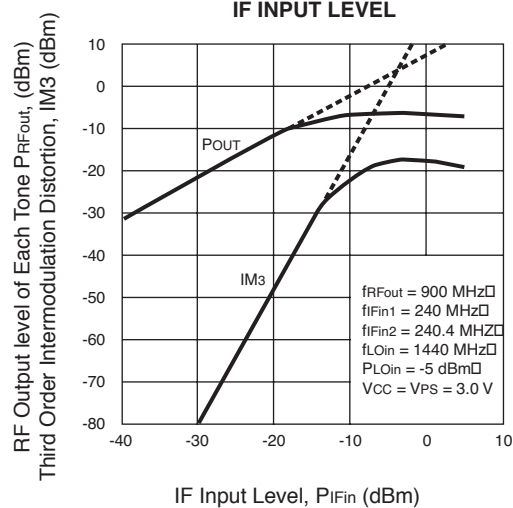
**CONVERSION GAIN vs.
LOCAL INPUT LEVEL**



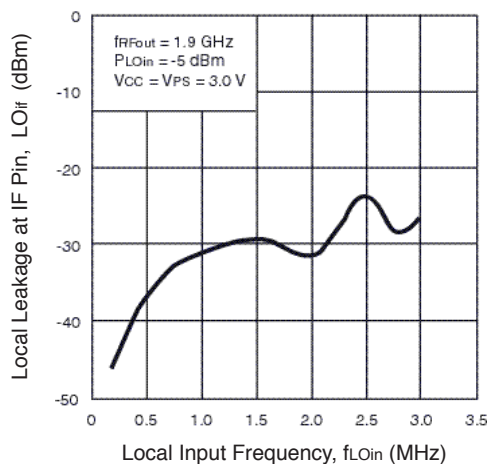
**RF OUTPUT LEVEL AND IM3 vs.
IF INPUT LEVEL**



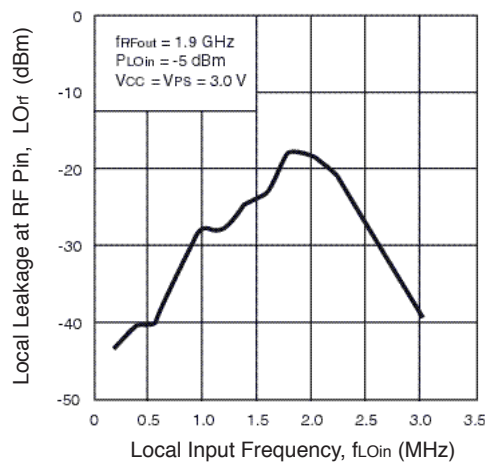
**RF OUTPUT LEVEL AND IM3 vs.
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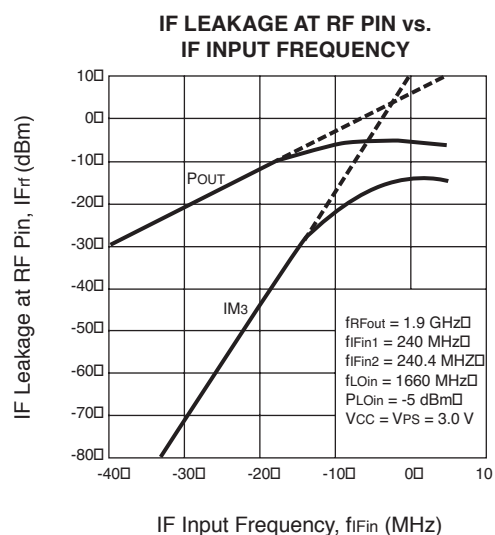
**LOCAL LEAKAGE AT IF PIN vs.
LOCAL INPUT FREQUENCY**



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



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

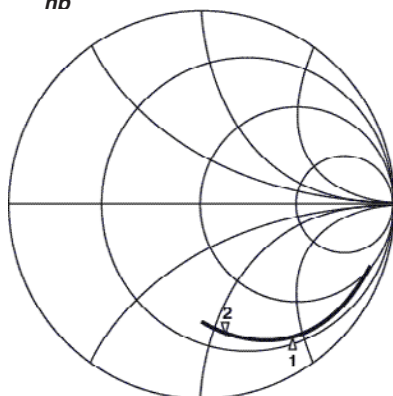


S-PARAMETERS FOR EACH PORT ($V_{CC} = V_{PS} = V_{RFout} = 3.0 \text{ V}$)

LO port

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

MARKER 1
 1.15 GHz
 MARKER 2
 1.65 GHz



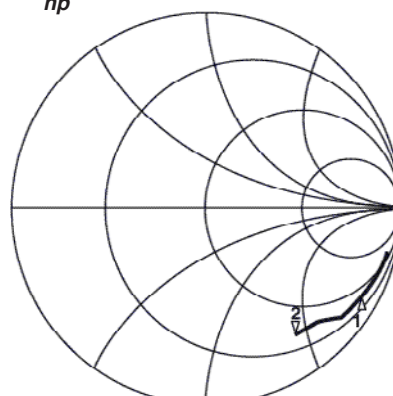
START 0.4 GHz

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

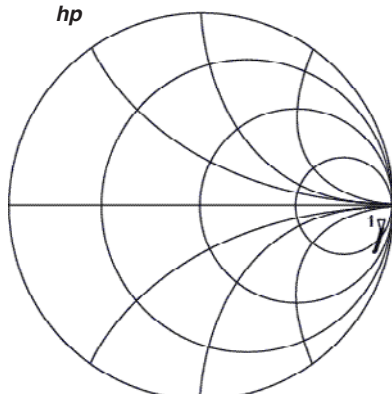
STOP 1.9 GHz

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

IF port

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

MARKER 1
 240 MHz



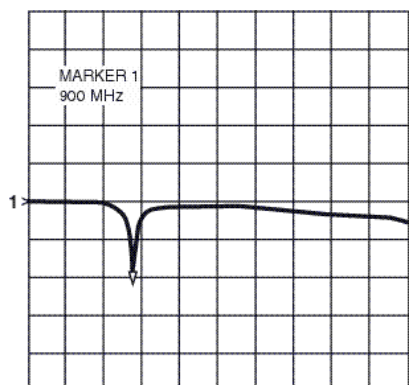
START 0.1 GHz STOP 0.4 GHz

S-PARAMETERS FOR MATCHED RF OUTPUT

$(V_{CC} = V_{PS} = V_{RFout} = 3.0\text{ V})$ - with TEST CIRCUITS 1 and 2 - (S₂₂ data is monitored at RF connector on board.)

900 MHz (LC-matched) in test circuit

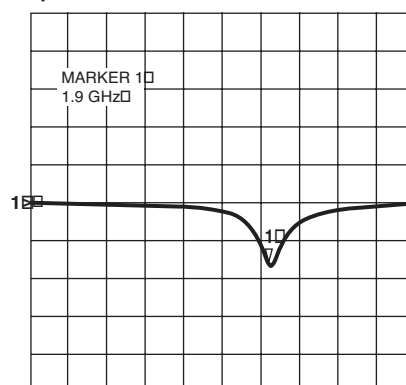
S₁₁ log MAG
 REF 0.0 dB
 1 10.0 dB/
 ∇ -19.567 dB
hp



START 100 MHz STOP 3000 MHz

1.9 GHz (LC-matched) in test circuit

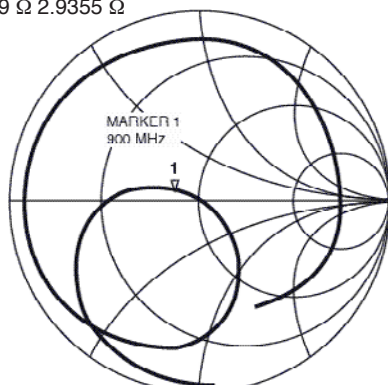
S₂₂ log MAG
 REF 0.0 dB
 1 10.0 dB/
 ∇ -15.213 dB
hp



START 100 MHz STOP 3000 MHz

S₂₂

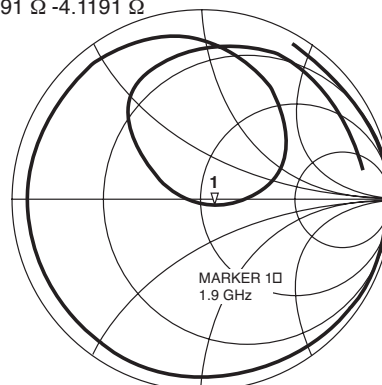
REF 1.0 Units
 1 200.0 mUnits/
 ∇ 36.59 Ω 2.9355 Ω
hp



START 100 MHz STOP 3000 MHz

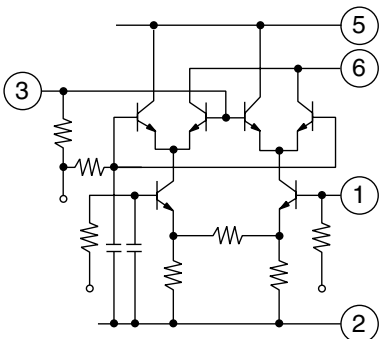
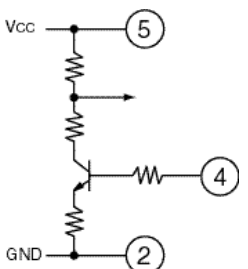
S₂₂

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



START 100 MHz STOP 3000 MHz

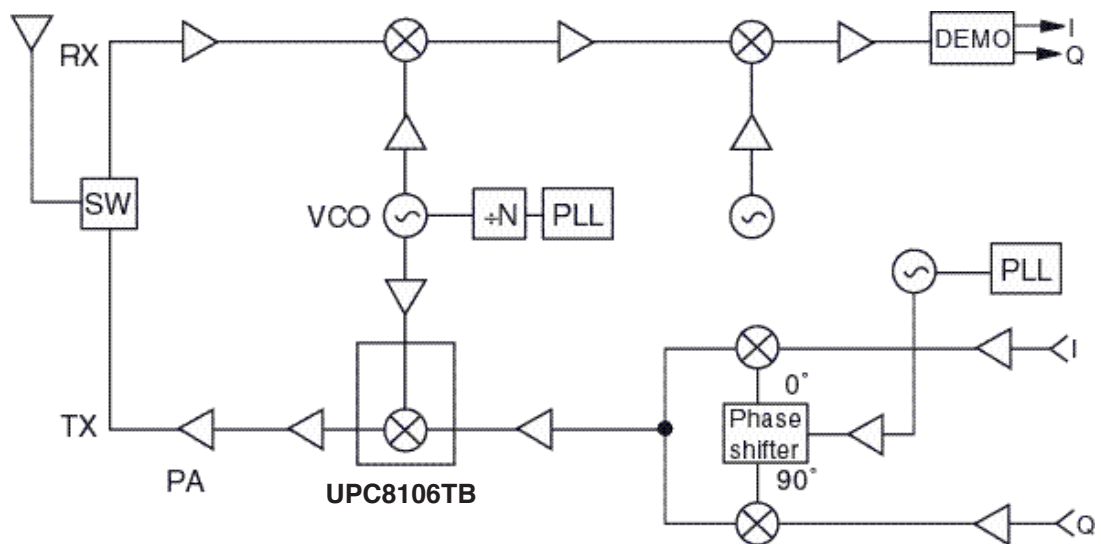
PIN FUNCTIONS

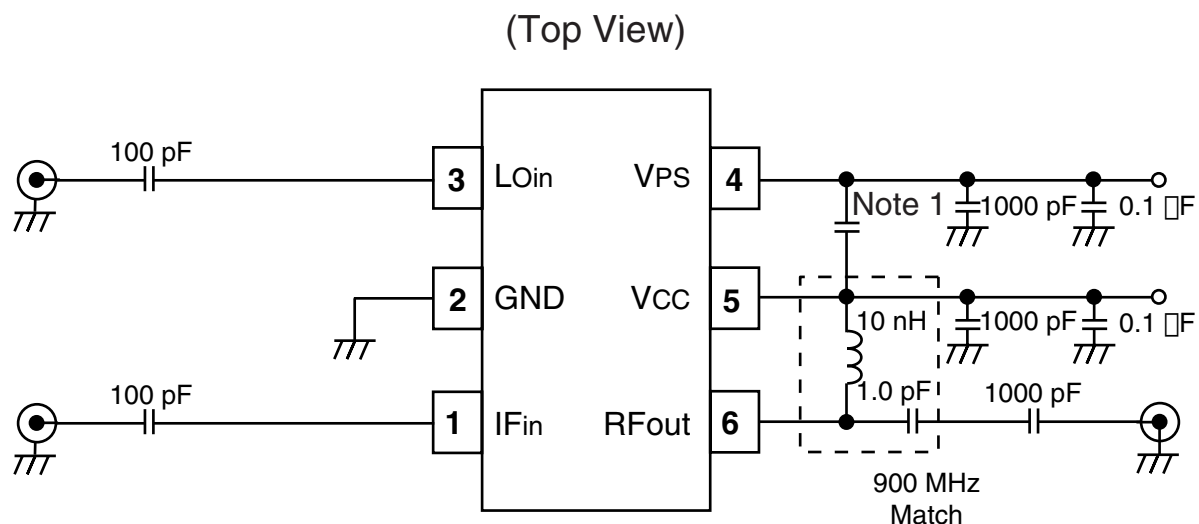
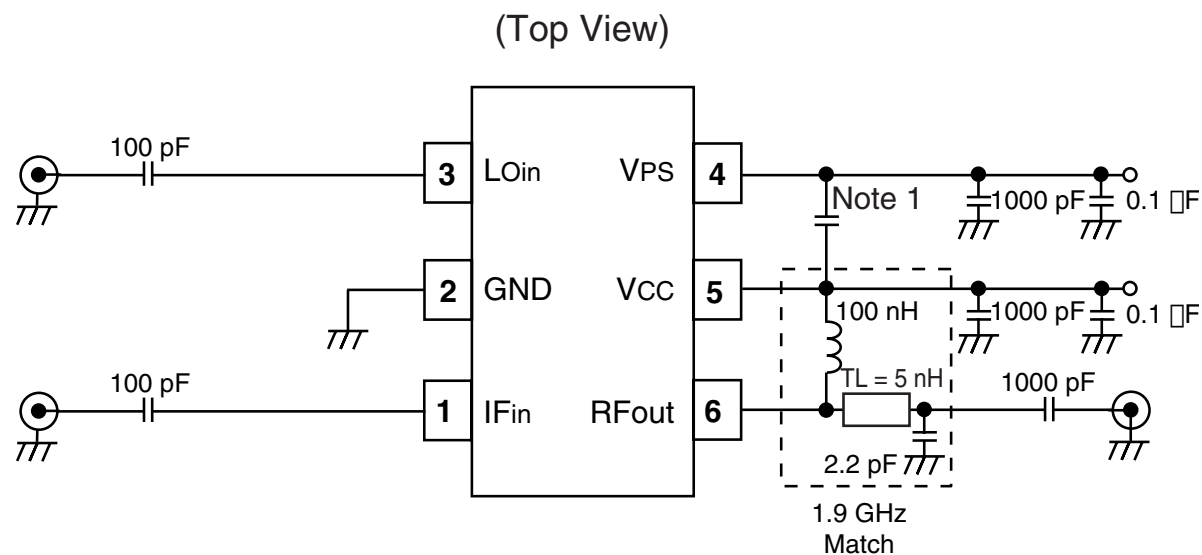
Pin No.	Symbol	Supply Voltage (V)	Pin ¹ Voltage (V)	Description	Equivalent Circuit						
1	IF Input	–	1.3	This pin is the IF input to the double balanced mixer. The input is a high impedance.							
2	GND	0	–	GND pin. Ground pattern on the board should be as wide as possible. Trace length should be kept 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 data-bbox="644 861 971 966"><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>	Pin Bias	Control	VCC	ON	GND	Power Save	
Pin Bias	Control										
VCC	ON										
GND	Power Save										

Note:

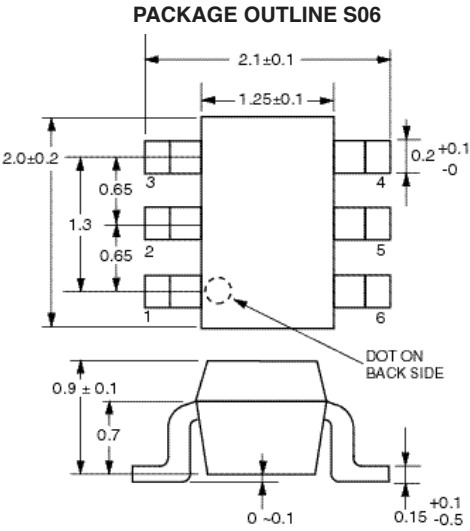
1. Each pin voltage is measured with $V_{CC} = V_{PS} = V_{RFout} = 3.0\text{ V}$

SYSTEM APPLICATION EXAMPLE

EXAMPLE OF DECT 900 MHz Cordless Phone

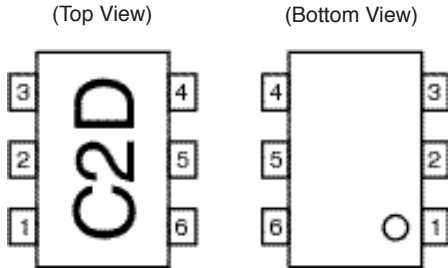
TEST CIRCUIT 1 ($R_{FOUT} = 900 \text{ MHz}$)**TEST CIRCUIT 2** ($R_{FOUT} = 1.9 \text{ GHz}$)

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_{CC}
- 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.