CEL

3 V SILICON RFIC FREQUENCY UPCONVERTER

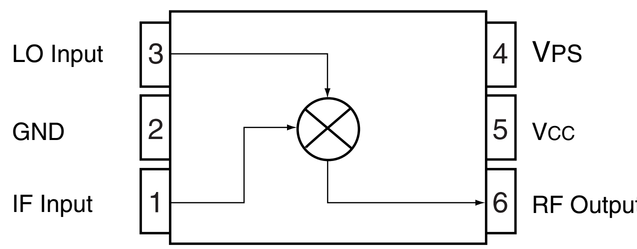
UPC8106TB

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

NEC's 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 NEC's 20 GHz f_T NESAT™III silicon bipolar process.

NEC's 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 PACKAGE OUTLINE			UPC8106TB S06		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CC}	Circuit Current at V_{PS} ≥ 2.7 V V_{PS} = 0 V	mA µA	4.5	9	13.5 10
CG	Conversion Gain at f_{RFout} = 0.9 GHz, P_{IFin} = -30 dBm f_{RFout} = 1.9 GHz, P_{IFin} = -30 dBm	dB dB	6 4	9 7	12 10
P_{SAT}	Saturated Output Power at f_{RFout} = 0.9 GHz, P_{IFin} = 0 dBm f_{RFout} = 1.9 GHz, P_{IFin} = 0 dBm	dBm dBm	-4 -6.5	-2 -4	
OIP_3	Output Third-Order Intercept Point at f_{IFin1} = 240.0 MHz f_{IFin2} = 240.4 MHz f_{RFout} = 0.9 GHz P_{IFin} = -20 dBm f_{RFout} = 1.9 GHz	dBm dBm		+5.5 +2.0	
IM_3	Third-Order Intermodulation Level at f_{IFin1} = 240 MHz f_{IFin2} = 240.4 MHz f_{RFout} = 0.9 GHz P_{IFin} = -20 dBm f_{RFout} = 1.9 GHz	dBc dBc		-31 -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).

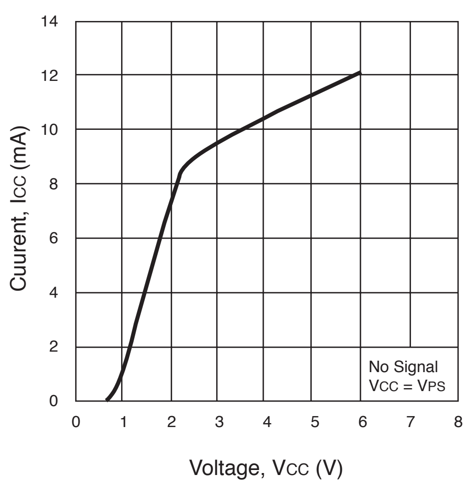
RECOMMENDED OPERATING CONDITIONS

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

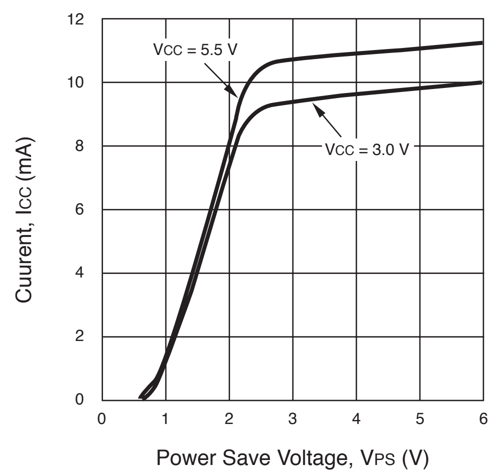
Notes:
1. The same voltage should be supplied to pin 5 and 6.
2. Z_S = 50 Ω (without matching).
3. With external matching circuit.

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

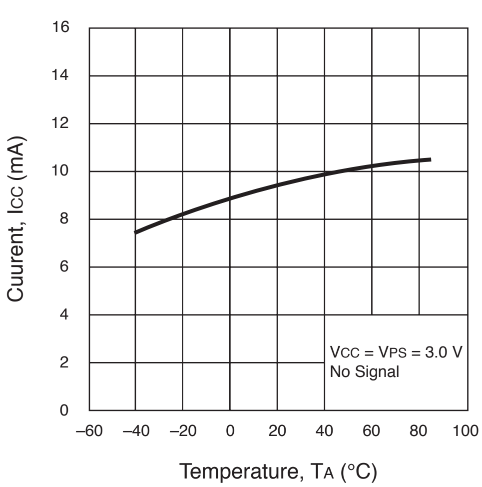
CURRENT vs. VOLTAGE



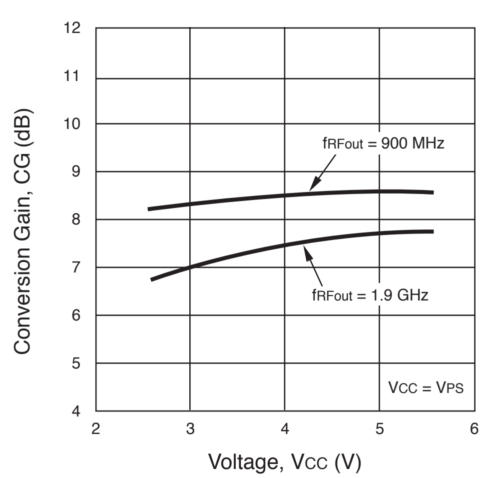
CURRENT vs. POWER SAVE VOLTAGE



CURRENT vs. TEMPERATURE

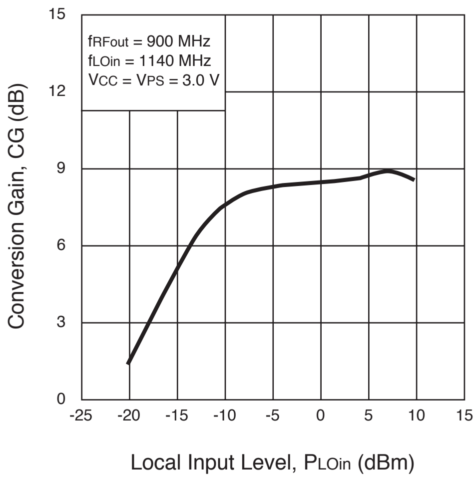


CONVERSION GAIN vs. VOLTAGE

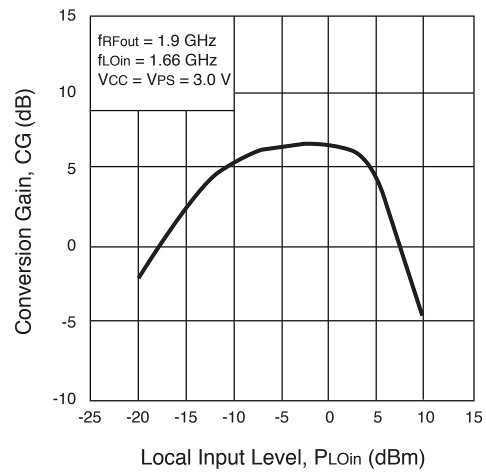


TYPICAL PERFORMANCE CURVES (T_A = +25°C, V_{CC} = V_{RFout})

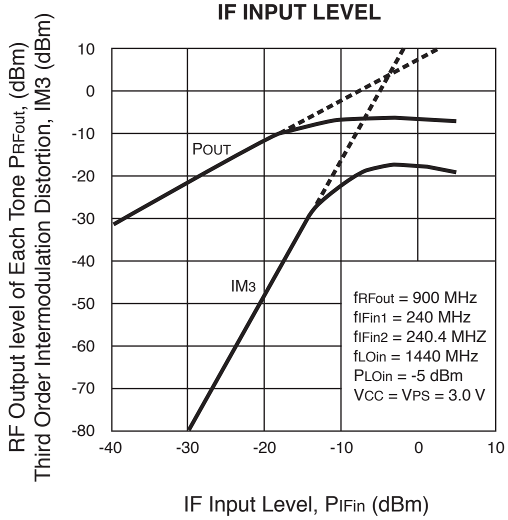
CONVERSION GAIN vs.
LOCAL INPUT LEVEL



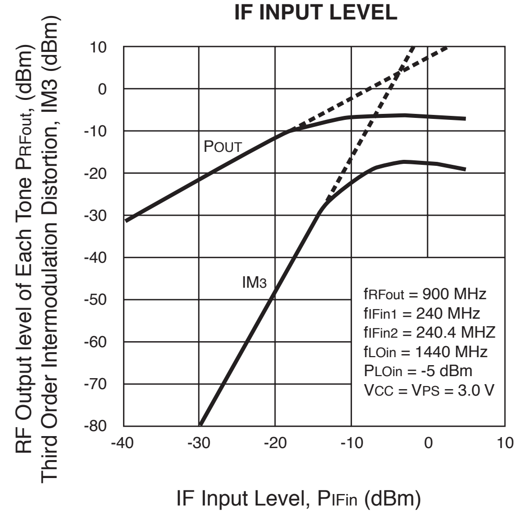
CONVERSION GAIN vs.
LOCAL INPUT LEVEL



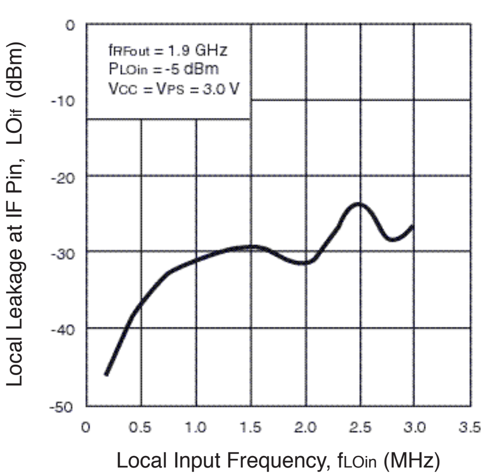
RF OUTPUT LEVEL AND IM3 vs.
IF INPUT LEVEL



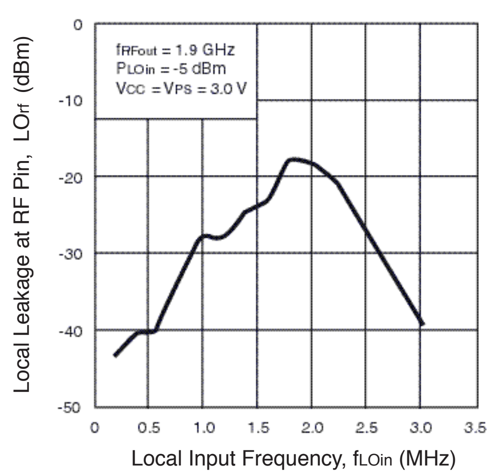
RF OUTPUT LEVEL AND IM3 vs.
IF INPUT LEVEL



LOCAL LEAKAGE AT IF PIN vs.
LOCAL INPUT FREQUENCY

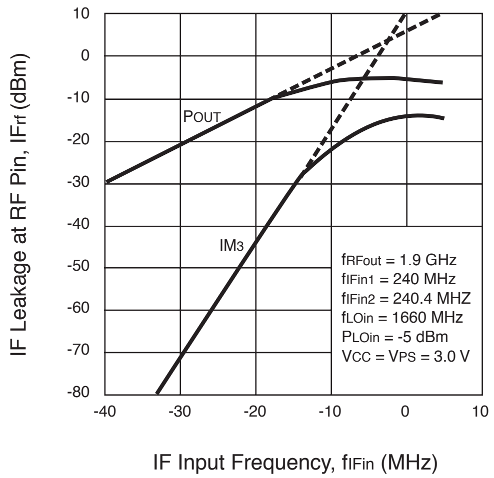


LOCAL LEAKAGE AT RF PIN vs.
LOCAL INPUT FREQUENCY



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

IF LEAKAGE AT RF PIN vs. IF INPUT FREQUENCY

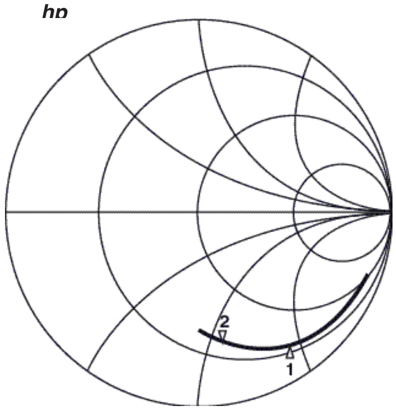


S-PARAMETERS FOR EACH PORT (V_{CC} = V_{PS} = V_{RFout} = 3.0 V)

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

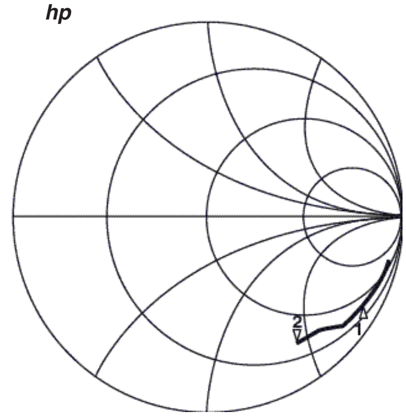


START 0.4 GHz STOP 1.9 GHz

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



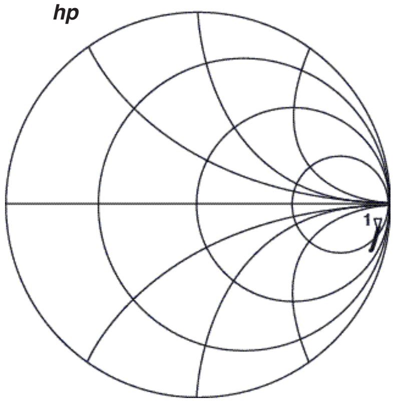
START 0.4 GHz STOP 1.9 GHz

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

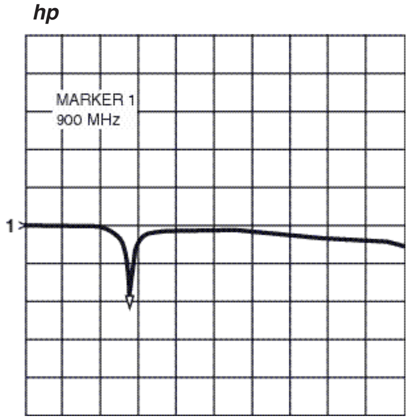


START 0.1 GHz STOP 0.4 GHz

S-PARAMETERS FOR MATCHED RF OUTPUT

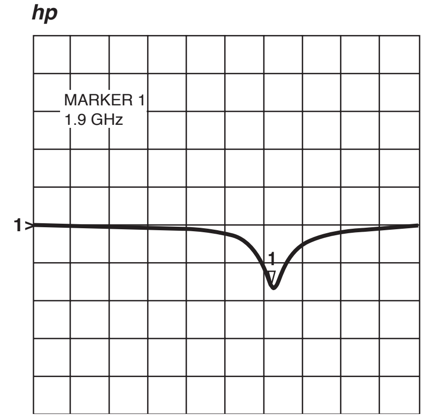
(V_{CC} = V_{PS} = V_{RFout} = 3.0 V) - with TEST CIRCUITS 1 and 2 - (S_{22} data is monitored at RF connector on board.)

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



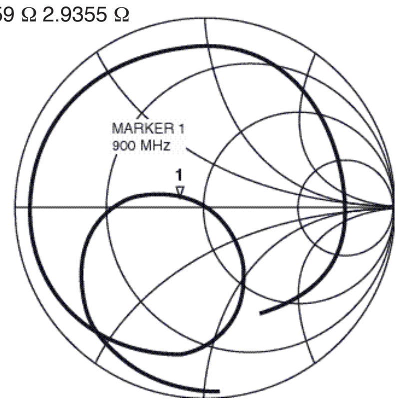
START 100 MHz STOP 3000 MHz

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



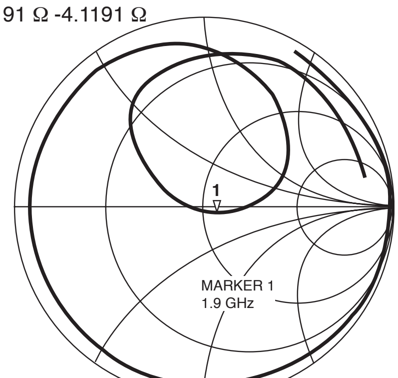
START 100 MHz STOP 3000 MHz

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



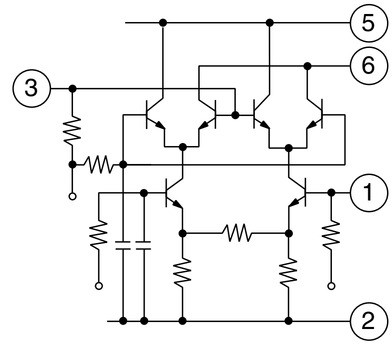
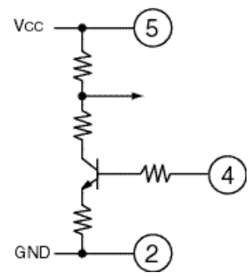
START 100 MHz STOP 3000 MHz

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



START 100 MHz STOP 3000 MHz

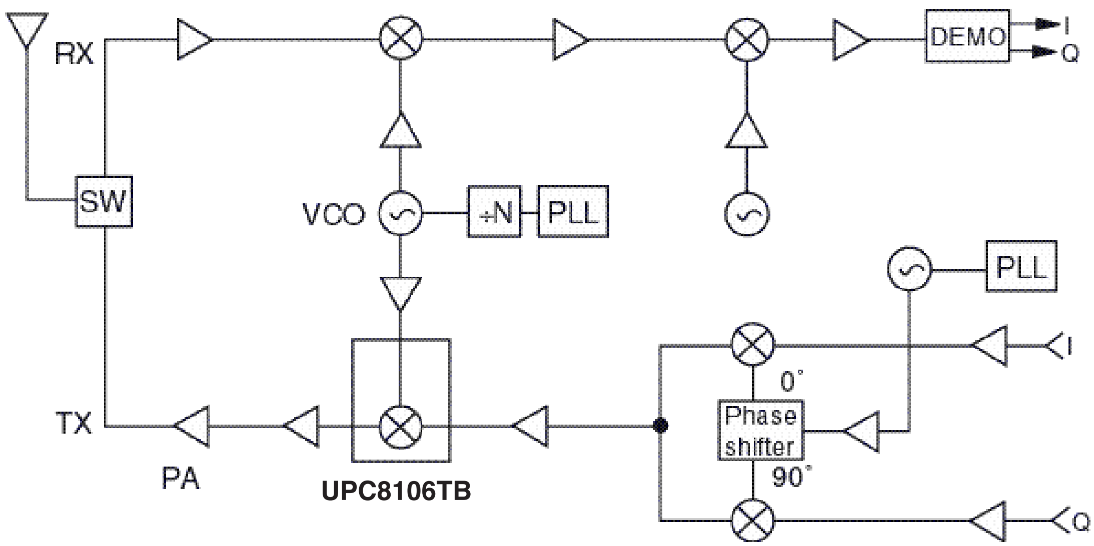
PIN FUNCTIONS

<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>LO_{IN}</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>V_{CC}</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>V_{PS}</td><td>V_{CC}/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>V_{CC}</td><td>ON</td></tr>
<tr><td>GND</td><td>Power Save</td></tr>
</table></td><td>
</td></tr>
</table>

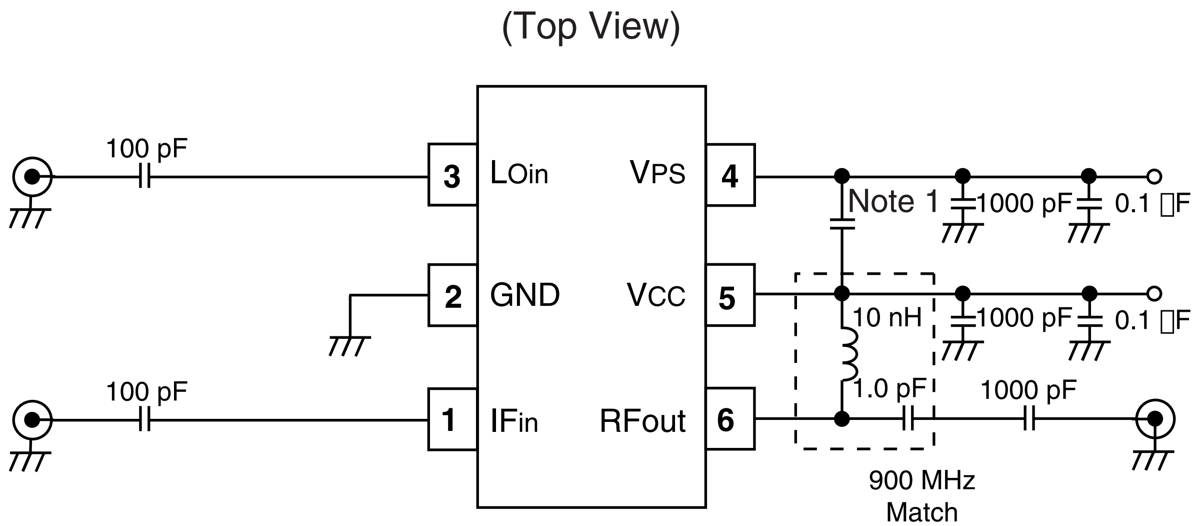
Note:
1. Each pin voltage is measured with $V_{CC} = V_{PS} = V_{RFout} = 3.0$ V

SYSTEM APPLICATION EXAMPLE

EXAMPLE OF DECT 900 MHz Cordless Phone

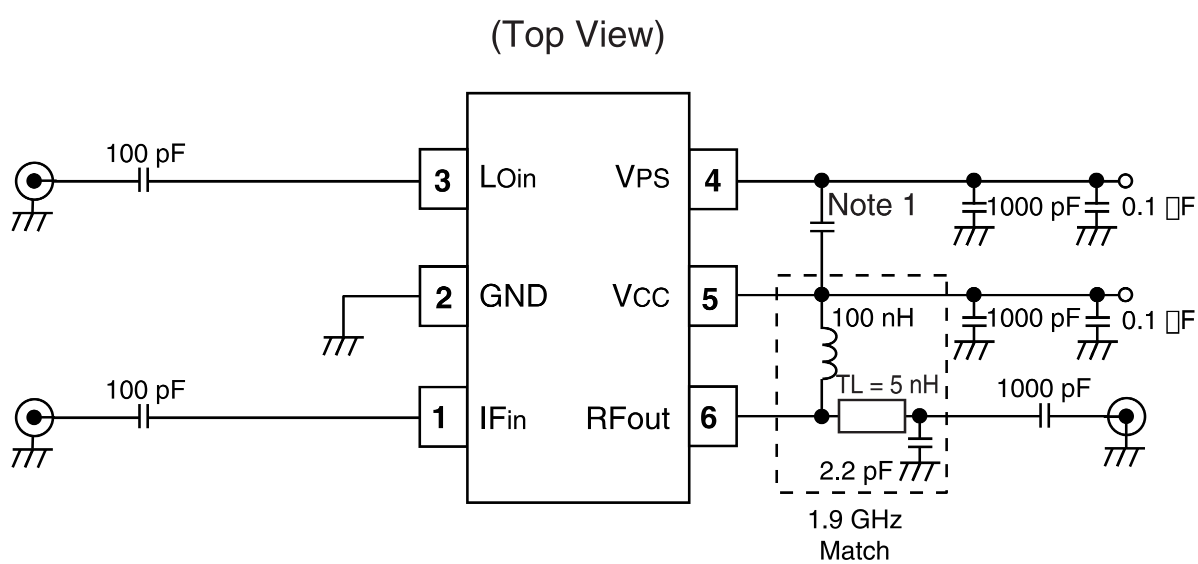


TEST CIRCUIT 1 (RFOUT = 900 MHz)



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

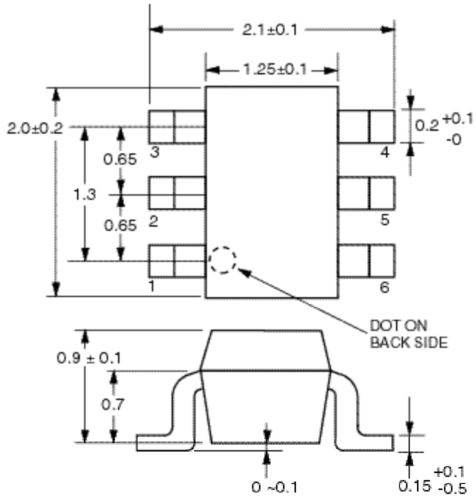
TEST CIRCUIT 2 (RFOUT = 1.9 GHz)



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

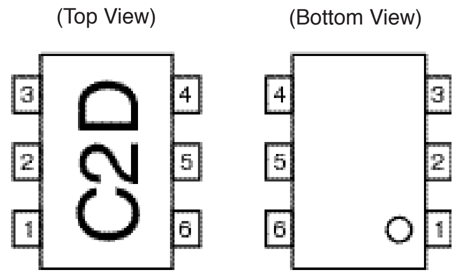
OUTLINE DIMENSIONS (Units in mm)

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. 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.

CEL California Eastern Laboratories

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Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.