NEC

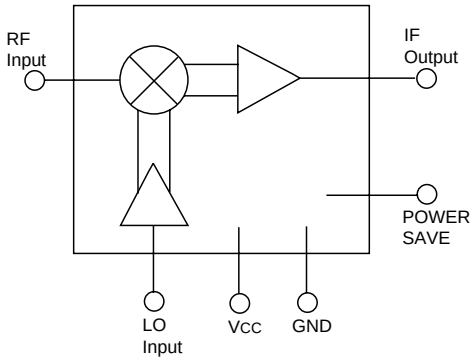
3 V SILICON MMIC L-BAND FREQUENCY DOWN CONVERTER

UPC8112T

FEATURES

- **BROADBAND OPERATION:**
  RF Input: 800 - 2000 MHz
  IF Output: 100 - 300 MHz
- **INPUT IP3:** -7 dBm
- **LOW VOLTAGE OPERATION:** 2.7~3.3 V
- **LOW CURRENT CONSUMPTION:** 8.5 mA
- **POWER SAVE FUNCTION**
- **SUPER SMALL T06 PACKAGE**
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

INTERNAL BLOCK DIAGRAM



DESCRIPTION

The UPC8112T is a silicon Monolithic Microwave Integrated Circuit which is manufactured using the NESAT III process. The NESAT III process produces transistors with f_T approaching 20 GHz. This device consists of a double balance mixer, an IF amplifier, and a LO buffer amplifier. The device was designed to be used as the first down converter for GPS and wireless communications such as cellular, PCS, and 900 MHz cordless phones. Operating on a 3 volt supply, this IC is ideally suited for hand held portable designs.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, V_{CC} = V_{PS} = 3.0 V, P_{LOin} = -10 dBm, Z_L = Z_S = 50 Ω unless otherwise specified)

PART NUMBER PACKAGE OUTLINE			UPC8112T T06		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CC}	Circuit Current (no input signal)	mA	4.9	8.5	11.7
$I_{CC\ (PS)}$	Circuit Current at Power Save Mode, V_{CC} = 3.0 V, V_{PS} = 0.5 V	μA			0.1
f_{RFin}	RF Frequency Response	GHz	0.8	1.9	2.0
f_{IFout}	IF Frequency Response[1]	MHz	100	250	300
CG	Conversion Gain f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz	dB	11.5	15	17.5
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz	dB		13	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz	dB	9.5	13	15.5
NF	Single Side Band Noise Figure (SSB)				
	f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz	dB		9.0	11
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz	dB		11	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz	dB		11.2	13.2
P_{1dB}	Output Power at 1 dB gain compression, f_{RFin} = 1.9 GHz f_{LOin} = 1.66 GHz	dBm		-5	
P_{SAT}	Saturated Output Power f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz	dBm	-6.5	-2.5	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz (P_{RFin} = -10 dBm)	dBm	-7	-3	
IIP_3	Input 3rd Order Intercept Point, f_{RFIN} = 900 MHz, f_{LOIN} = 1000 MHz	dBm		-10	
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz	dBm		-9	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz	dBm		-7	
LO_{RF}	LO Leakage at RF pin, f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz	dBm		-45	
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz	dBm		-46	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz	dBm		-45	
LO_{IF}	LO Leakage at IF pin, f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz	dBm		-32	
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz	dBm		-33	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz	dBm		-30	
RF_{LO}	RF Leakage at LO Pin f_{RFin} = 900 MHz, f_{LOin} = 1000 MHz[2]	dBm		-80	
	f_{RFin} = 1.5 GHz, f_{LOin} = 1.6 GHz[2]	dBm		-57	
	f_{RFin} = 1.9 GHz, f_{LOin} = 1.66 GHz[2]	dBm		-55	

Notes:
1. External matching required.
2. P_{RFin} = -30 dBm

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

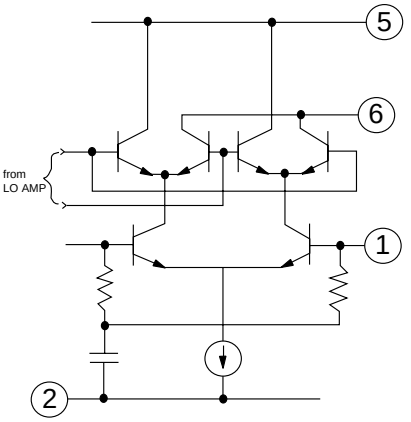
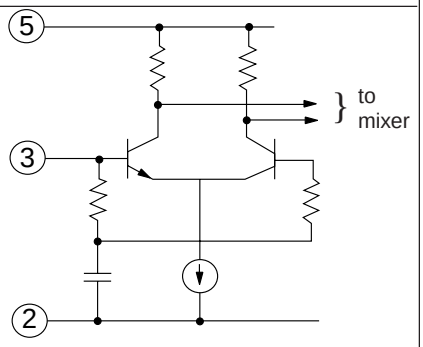
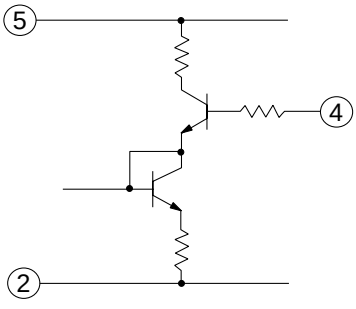
SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CC}	Supply Voltage	V	3.6
I_{CC}	Circuit Current	mA	77.7
P_D	Power Dissipation[2]	mW	280
T_{OP}	Operating Temperature	°C	-40 to +85
T_{STG}	Storage Temperature	°C	-55 to +150

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

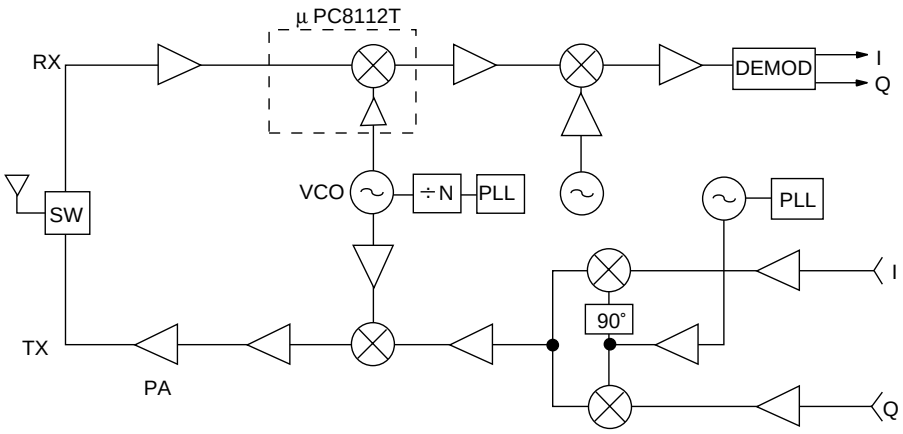
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{CC}	Supply Voltage	V	2.7	3.0	3.3
T_{OP}	Operating Temperature	°C	-40	+25	+85
P_{LOin}	LO Input Level	dBm	-15	-10	0
f_{RFin}	RF Input Frequency	GHz	0.8	1.9	2.0
f_{IFout}	IF Output Frequency	MHz	100	250	300

PIN FUNCTIONS

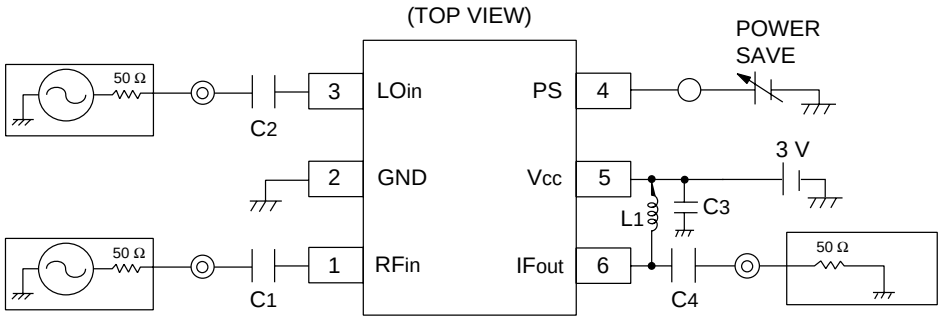
Pin No.	Symbol	Pin Voltage	Description	Internal Equivalent Circuit
5	V_{CC}	2.7 ~ 3.3	Supply Voltage pin. Connect a bypass capacitor (e.g., 1000 pF) to minimize ground impedance.	
6	IF_{OUT}	Same as V_{CC} voltage through external inductor	IF output pin is an open collector with high impedance. External LC matching circuit is required.	
1	RF_{IIN}	1.2	RF input pin to mixer. Mixer is a double balanced Gilbert cell type. Input RF signal to the pin with a 50 Ω source impedance through a coupling capacitor.	
2	GND	0	Ground pin. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible to minimize ground impedance.	
3	LO_{IN}	1.4	LO input pin to a differential buffer amplifier. Input LO signal through a coupling capacitor. Recommended input level: -15 to 0 dBm.	
4	PS	V_{CC} or GND	Power-save control pin. Voltage on this pin controls ON/OFF operation as follows: Operation / VPS ON / ⊕2.5 V OFF / 0-0.5 V	

TYPICAL APPLICATION EXAMPLE

PCS or DIGITAL CELLULAR



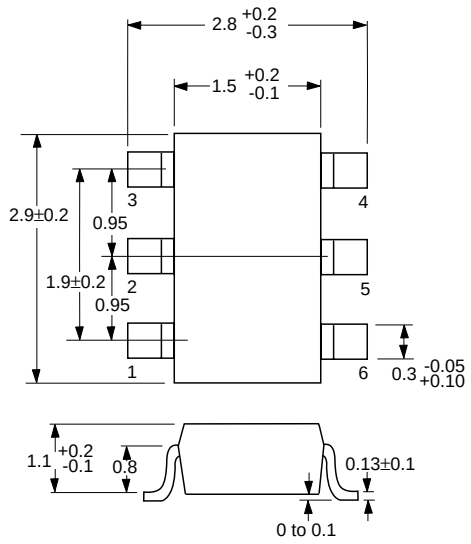
TEST CIRCUIT



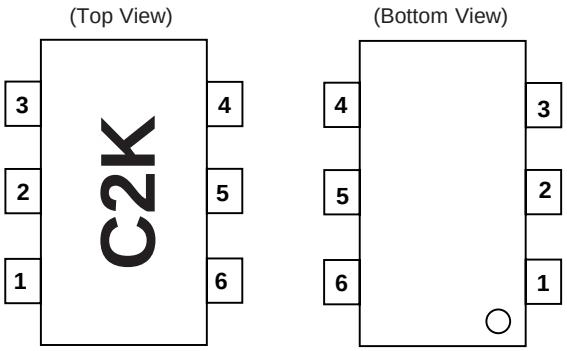
Note: 1. C1, C2, C3 are 1,000 pF capacitors.
2. L1 and C4 are matching elements.
L1 = 100nH and C4 = 2.7 pF for f_{IF} = 240 MHz

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE T06



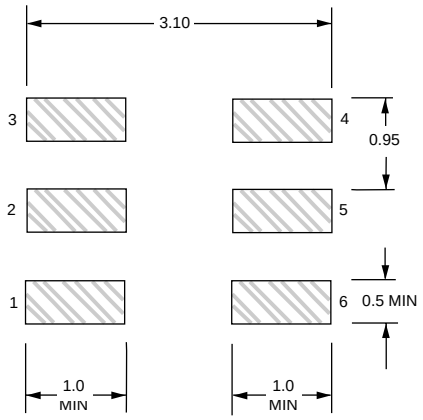
LEAD CONNECTIONS



1. RFIN
2. GND
3. LOIN
4. PS
5. VCC
6. IFOUT

RECOMMENDED P.C.B. LAYOUT (Units in mm)

Note:
All dimensions are typical unless otherwise specified.



ORDERING INFORMATION

PART NUMBER	QTY
UPC8112T-E3	3K/Reel