



# 3 V SILICON MMIC L-BAND FREQUENCY DOWN CONVERTER

## UPC8112TB

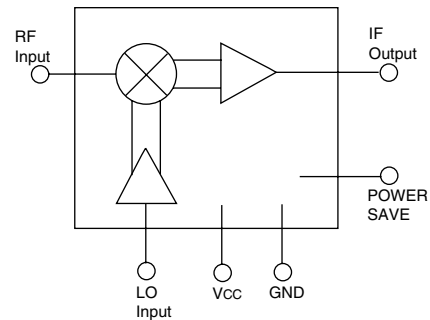
### FEATURES

- **HIGH DENSITY SURFACE MOUNTING:**  
6 Pin Super Minimold or SOT-363 Package
- **BROADBAND OPERATION:**  
RF = 0.8 to 2.0 GHz  
IF = 100 to 300 MHz
- **INPUT IP<sub>3</sub>:** -7 dBm
- **POWER SAVE FUNCTION**
- **SUPPLY VOLTAGE:** V<sub>CC</sub> = 2.7 to 3.3 V

### DESCRIPTION

NEC's UPC8112TB is a silicon RFIC manufactured using the NESAT III process. This device consists of a mixer, an IF amplifier and a LO buffer amplifier. This device is suitable as a 1st IF downconverter for the receiver stage of cellular and other wireless systems. The UPC8112TB is pin compatible and has comparable performance as the larger UPC8112T, so

### INTERNAL BLOCK DIAGRAM



it is suitable for use as a replacement to help reduce system size. The IC is housed in a 6 pin super minimold or SOT-363 package.

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

### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, V<sub>CC</sub> = V<sub>PS</sub> = 3.0 V, P<sub>LO</sub> = -10 dBm)

PART NUMBER PACKAGE OUTLINE			UPC8112TB S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Circuit Current (no input signal) V <sub>CC</sub> = 3.0 V V <sub>PS</sub> = 0.5 V	mA μA	4.9	8.5	11.7 0.1
f <sub>RFIn</sub>	RF Frequency Response	GHz	0.8	1.9	2.0
f <sub>IFOut</sub>	IF Frequency Response <sup>1</sup>	MHz	100	250	300
CG	Conversion Gain f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz	dB	11.5	15	17.5
	f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz	dB		13	
	f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz	dB	9.5	13	15.5
NF	Single Side Band Noise Figure (SSB) f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz	dB		9.0	11
	f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz	dB		11	
	f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz	dB		11.2	13.2
P <sub>1dB</sub>	Output Power at 1 dB gain compression, f <sub>RFIn</sub> = 1.9 GHz f <sub>LOIn</sub> = 1.66 GHz	dBm		-5	
P <sub>SAT</sub>	Saturated Output Power f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz (P <sub>RFIn</sub> = -10 dBm)	dBm	-6.5	-2.5	
		dBm	-7	-3	
IIP <sub>3</sub>	Input 3rd Order Intercept Point, f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz	dBm		-10	
		dBm		-9	
		dBm		-7	
LORF	LO Leakage at RF pin, f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz	dBm		-45	
		dBm		-46	
		dBm		-45	
LOIF	LO Leakage at IF pin, f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz	dBm		-32	
		dBm		-33	
		dBm		-30	
RFLO	RF Leakage at LO Pin f <sub>RFIn</sub> = 900 MHz, f <sub>LOIn</sub> = 1000 MHz <sup>2</sup> f <sub>RFIn</sub> = 1.5 GHz, f <sub>LOIn</sub> = 1.6 GHz <sup>2</sup> f <sub>RFIn</sub> = 1.9 GHz, f <sub>LOIn</sub> = 1.66 GHz <sup>2</sup>	dBm		-80	
		dBm		-57	
		dBm		-55	
R <sub>TH(JA)</sub>	Thermal Resistance (Junction to Ambient) Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB	°C/W			325

Notes:

1. External matching required.

2. P<sub>RFIn</sub> = -30 dBm

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage	V	3.6
I <sub>CC</sub>	Circuit Current	mA	77.7
P <sub>D</sub>	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

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**

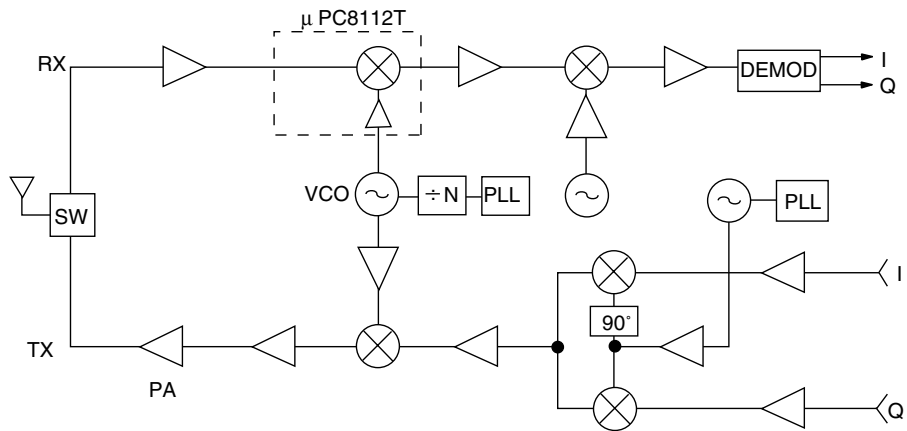
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V <sub>CC</sub>	Supply Voltage	V	2.7	3.0	3.3
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85
P <sub>LOin</sub>	LO Input Level	dBm	-15	-10	0
f <sub>RFin</sub>	RF Input Frequency	GHz	0.8	1.9	2.0
f <sub>IFout</sub>	IF Output Frequency	MHz	100	250	300

**PIN FUNCTIONS**

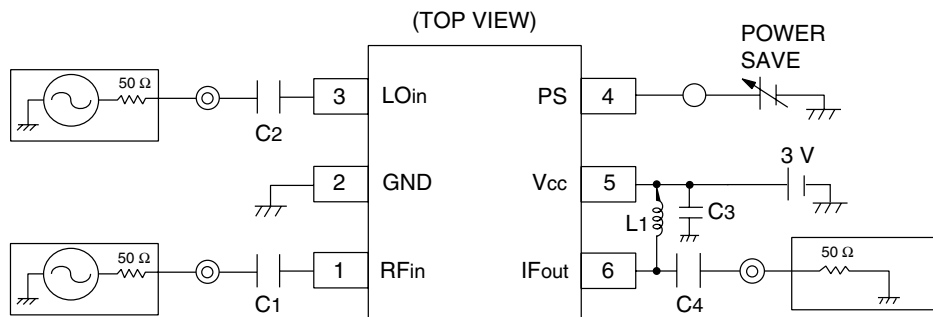
Pin No.	Symbol	Pin Voltage	Description	Internal Equivalent Circuit						
5	V <sub>CC</sub>	2.7 ~ 3.3	Supply Voltage pin. Connect a bypass capacitor (e.g., 1000 pF) to minimize ground impedance.							
6	I <sub>FOUT</sub>	Same as V <sub>CC</sub> voltage through external inductor	IF output pin is an open collector with high impedance. External LC matching circuit is required.							
1	R <sub>FIN</sub>	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	L <sub>OIN</sub>	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	V <sub>PS</sub>	V <sub>CC</sub> or GND	Power-save control pin. Voltage on this pin controls ON/OFF operation as follows: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Operation</th> <th>V<sub>PS</sub></th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>≥2.5 V</td> </tr> <tr> <td>OFF</td> <td>0-0.5 V</td> </tr> </tbody> </table>	Operation	V <sub>PS</sub>	ON	≥2.5 V	OFF	0-0.5 V	
Operation	V <sub>PS</sub>									
ON	≥2.5 V									
OFF	0-0.5 V									

## TYPICAL APPLICATION EXAMPLE

PCS or DIGITAL CELLULAR

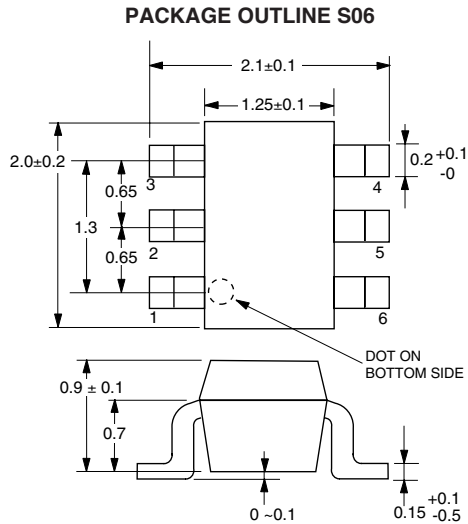


## TEST CIRCUIT

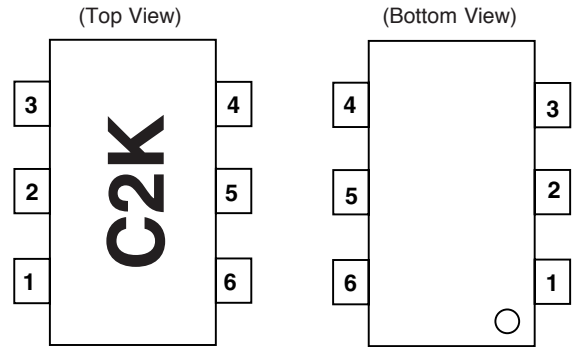


- Note: 1. C1, C2, C3 are 1,000 pF capacitors.  
 2. L1 and C4 are matching elements.  
 L1 = 100nH and C4 = 2.7 pF for  $f_{IF} = 240$  MHz

**OUTLINE DIMENSIONS** (Units in mm)



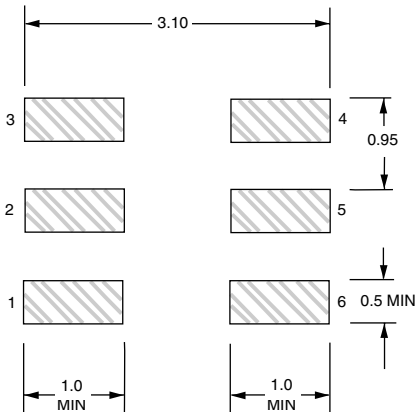
**LEAD CONNECTIONS**



- 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
UPC8112TB-E3-A	3K/Reel

Note:  
Embossed tape, 8 mm wide. Pins 1, 2, 3 are in tape pull-out direction.

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

**CEL CALIFORNIA EASTERN LABORATORIES** • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279  
24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

DATA SUBJECT TO CHANGE WITHOUT NOTICE

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.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.