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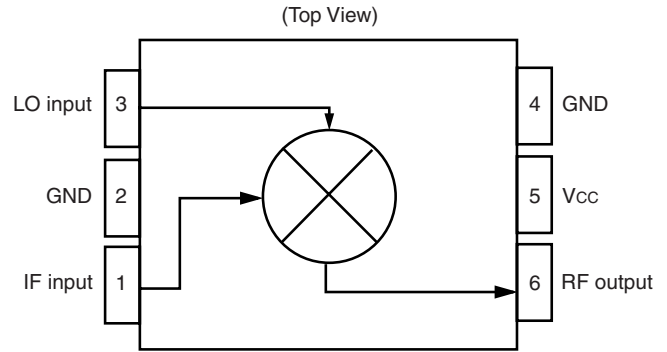
# 3 V SILICON RFIC FREQUENCY UPCONVERTER

## UPC8163TB

### FEATURES

- **RECOMMENDED OPERATING FREQUENCY:**  
 $f_{RFOUT} = 0.8 \text{ GHz to } 2.0 \text{ GHz}$   
 $f_{IFIN} = 50 \text{ MHz to } 300 \text{ MHz}$
- **SUPPLY VOLTAGE:**  
 $V_{CC} = 2.7 \text{ to } 3.3 \text{ V}$
- **HIGH DENSITY SURFACE MOUNTING:**  
 6-pin super minimold package
- **HIGH IP<sub>3</sub>:**  
 $OIP_3 = +9.5 \text{ dBm @ } f_{RFOUT} = 900 \text{ MHz}$
- **MINIMIZED CARRIER LEAKAGE:**  
 Due to double balanced mixer

### BLOCK DIAGRAM



### DESCRIPTION

NEC's UPC8163TB 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 fr NESAT™ III silicon bipolar process.

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

### APPLICATIONS

- Digital Cellular/Cordless Phones

### ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = V_{RFOUT} = 3.0 \text{ V}$ ,  $f_{IFIN} = 240 \text{ MHz}$ ,  $P_{LOIN} = -5 \text{ dBm}$  unless otherwise specified)

PART NUMBER PACKAGE OUTLINE			UPC8163TB S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Circuit Current (no signal)	mA	11.5	16.5	23
CG	Conversion Gain	$f_{RFOUT} = 0.9 \text{ GHz}$ , $P_{IFIN} = -30 \text{ dBm}$	6	9	12
		$f_{RFOUT} = 1.9 \text{ GHz}$ , $P_{IFIN} = -30 \text{ dBm}$	4	7	10
P <sub>SAT</sub>	Saturated Output Power	$f_{RFOUT} = 0.9 \text{ GHz}$	-1.5	0.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$	-4.5	-2	
OIP <sub>3</sub>	Output third Order Intercept Point, $f_{IFIN1} = 240 \text{ MHz}$ $f_{IFIN2} = 240.4 \text{ MHz}$ $P_{IFIN} = -20 \text{ dBm}$	$f_{RFOUT} = 0.9 \text{ GHz}$		+9.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$		+6.0	
NF	SSB Noise Figure	$f_{RFOUT} = 0.9 \text{ GHz}$		12.5	
		$f_{RFOUT} = 1.9 \text{ GHz}$		12.5	

# UPC8163TB

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage <sup>2</sup>	V	3.6
P <sub>T</sub>	Total Power Dissipation <sup>3</sup>	mW	200
P <sub>IN</sub>	Input Power	dBm	+10
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 conditions may result in permanent damage.
2. T<sub>A</sub> = 25°C, pins 5 and 6.
3. Mounted on a double-sided copperclad 50x50x1.6 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	3.3
P <sub>LOIN</sub>	Local Input Level <sup>2</sup>	dBm	-10	-5	0
f <sub>RFOUT</sub>	RF Output Frequency <sup>3</sup>	GHz	0.8	-	2.0
f <sub>IFIN</sub>	IF Input Frequency	MHz	50	-	300
T <sub>OP</sub>	Operating Temperature	°C	-40	+25	+85

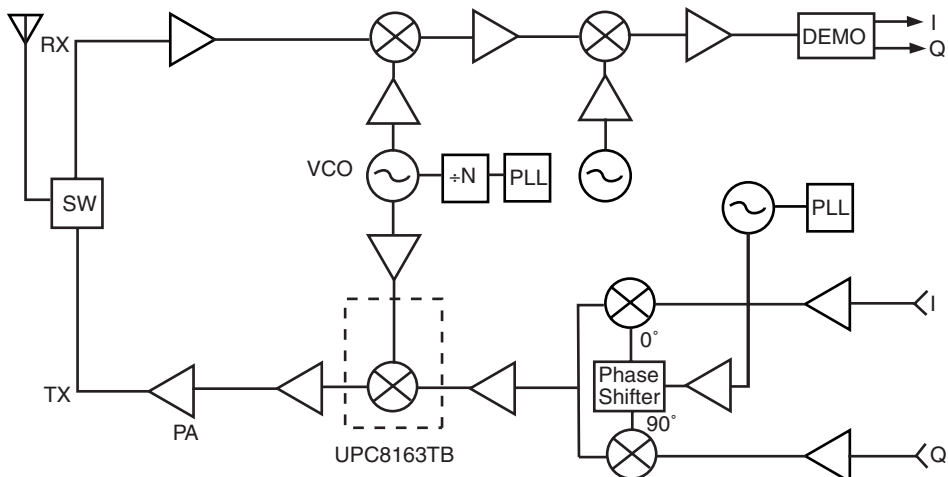
Notes:

1. Same voltage applied to pins 5 and 6
2. Z<sub>S</sub> = 50 Ω (without matching)
3. With external matching circuit

## PIN FUNCTIONS

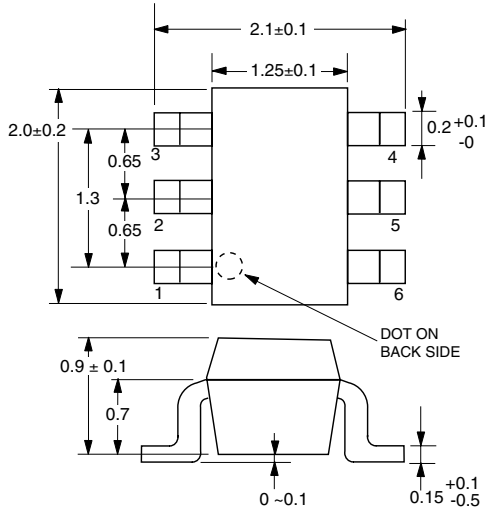
Pin No.	Pin Name	Applied Voltage	Pin Voltage	Description	Equivalent Circuit
1	IFINPUT	—	1.2	This pin is the IF input to double balanced mixer. The input is a high impedance.	
2 4	GND	0	—	GND pin. Ground pattern on the board should be as wide as possible. Trace length should be kept as short as possible to minimize ground impedance.	
3	LOINPUT	—	2.1	LO input pin. Recommended input level is -10 to 0 dBm.	
5	V <sub>CC</sub>	2.7 to 3.3	—	Supply voltage pin.	
6	RFOUTPUT	Same bias as V <sub>CC</sub> through external inductor	—	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.	

## APPLICATION EXAMPLE



**OUTLINE DIMENSIONS** (Units in mm)

**PACKAGE OUTLINE S06**

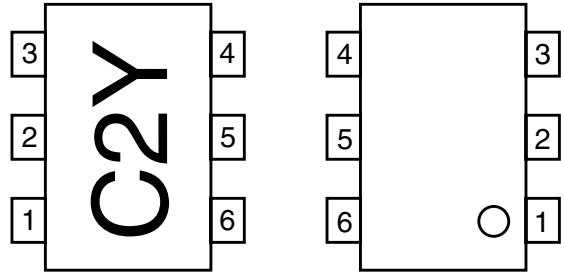


Note:  
All dimensions are typical unless otherwise specified.

**LEAD CONNECTIONS**

(Top View)

(Bottom View)



1. IF INPUT
2. GND
3. LO INPUT
4. GND
5. VCC
6. RF OUTPUT

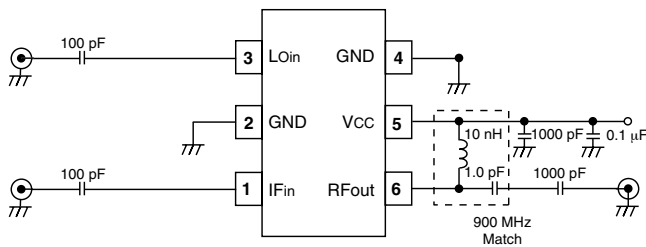
**ORDERING INFORMATION**

PART NUMBER	QUANTITY
UPC8163TB-E3-A	3K/Reel

Note: Embossed tape 8 mm wide. Pins 1,2,3 face tape perforation side.

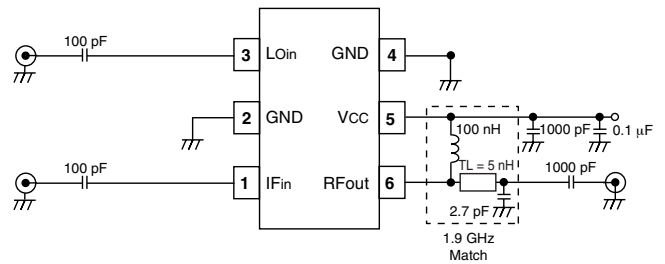
**TEST CIRCUIT 1** (RF<sub>OUT</sub> = 900 MHz)

(Top View)



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

(Top View)



Life Support Applications

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

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Subject: Compliance with EU Directives

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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	

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