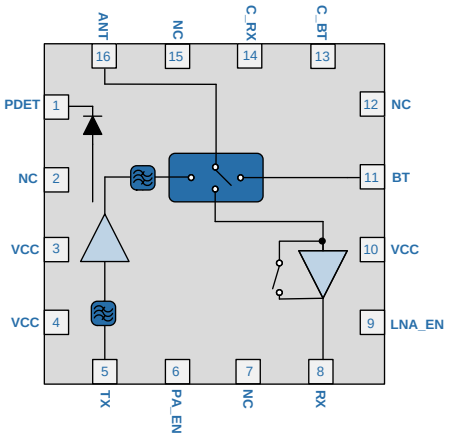
RFFM8202

2.4GHz to 2.5GHz 802.11b/g/n WiFi Front End Module

Package: QFN, 16-pin, 2.5mm x 2.5mm x 0.45

The RFFM8202 provides a complete integrated solution in a single front end module (FEM) for WiFi 802.11b/g/n and Bluetooth® systems. The ultra small form factor and integrated matching greatly reduces the number of external components and layout area in the customer application. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturability cost. The RFFM8202 integrates a 2.4GHz to 2.5GHz power amplifier (PA), low noise amplifier (LNA) with bypass mode, power detector coupler for improved accuracy, SP3T switch, and some filtering for harmonic rejection. The device is provided in 2.5mm x 2.5mm x 0.45mm 16-pin QFN package. This module meets or exceeds the RF front end needs of IEEE 802.11b/g/n WiFi RF systems.



Functional Block Diagram

Features

- P_{OUT} = 19dBm 11g OFDM 2.5% EVM
- P_{OUT} = 21dBm Meeting 11b Spec Mask
- Voltage Range 3.0V to 4.8V
- Input and Output Matched to 50Ω; High Level of Integration
- Supports Wide Voltage Supply Range

Applications

- Cellular Handsets
- Mobile Devices
- Tablets
- Consumer Electronics
- Gaming
- Netbooks/Notebooks
- TV/Monitors/Video
- Smart Energy

Ordering Information

RFFM8202SB	Standard 5 piece sample bag
RFFM8202SQ	Standard 25 piece sample bag
RFFM8202SR	Standard 100 piece reel
RFFM8202TR7	Standard 2500 piece reel
RFFM8202PCK-410	Fully assembled eval board w/5-piece sample bag

RF Micro Devices Inc. 7628 Thorndike Road, Greensboro, NC 27409-9421
For sales or technical support, contact RFMD at +1.336.678.5570 or customerservice@rfmd.com.

DS140710

Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage (No RF Applied)	6	V
DC Supply Current	500	mA
Operating Temperature Range	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Maximum TX Input Power into 50 W Load for 11b/g/n (No Damage)	+10	dBm
Maximum RX input power for both LNA_EN mode and bypass mode (No damage)	+10	dBm
Moisture Sensitivity	MSL1	

Caution! ESD sensitive device.

RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

Nominal Operating Parameters

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Operating Range	2.412		2.484	GHz	
Operating Temperature	-40	25	+85	ºC	
Power Supply V_{CC}	3.0	3.3	4.35	V	Recommended Operating Voltage Range
Extended V_{CC}			4.8	V	Functional with derated performance
Control Voltage-High	2.8	3.1	V_{CC}	V	PA_EN, C_RX, C_BT, LNA_EN.
Control Voltage-Low	0		0.2	V	
Transmit (TX-ANT)					**P_{OUT} = 19dBm; T = 25ºC; V_{CC} = 3.3V; PA_EN = High, C_RX = C_BT = Low; Freq = 2.412GHz to 2.484GHz, measured with a standard IEEE802.11g waveform, unless otherwise noted**
Dynamic EVM - Nominal		2.5	3	%	P_{OUT} = 19dBm; T = 25ºC; V_{CC} = 3.3V
		-32	-30.5	dB	
Dynamic EVM		2.5	3	%	P_{OUT} = 16.5dBm, T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
		-32	-30.5	dB	
Output power meeting Spectral Mask		21	22	dBm	11 Mbps CCK, +/- 11MHz offset from carrier
TX Port Return Loss	8	10		dB	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
ANT Port Return Loss	10	12		dB	
Nominal Gain	23	25	28	dB	T = 25ºC, V_{CC} = 3.3V
Gain	20.5	25	29	dB	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Gain Flatness - 20 MHz Channel	-0.5		0.5	dB	
Gain Flatness - 40 MHz Channel	-0.75		0.75	dB	
Gain Flatness - 100 MHz Band	-1		1	dB	
Out of Band Rejection	4	7		dBc	2110MHz to 2170MHz, T = 25ºC, V_{CC} = 3.3V, frequency = 2.412GHz
Nominal Operating Current		200	240	mA	P_{OUT} = 19dBm; T = 25ºC; V_{CC} = 3.3V
Operating Current		200	230	mA	P_{OUT} = 16.5dBm; T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Quiescent Current		135	200	mA	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
PA_EN Current		30	50	µA	
Leakage Current		1	10	µA	V_{CC} = 4.8V, RF OFF

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Transmit (TX-ANT) (continued)					**P_{OUT} = 19dBm; T = 25ºC; V_{CC} = 3.3V; PA_EN = High, C_RX = C_BT = Low; Freq = 2.412GHz to 2.484GHz, measured with a standard IEEE802.11g waveform, unless otherwise noted**
Second Harmonic		-23	-15	dBm/MHz	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Third Harmonic		-50	-35	dBm/MHz	
Power Detector Voltage	0.1	0.15	0.2	V	P_{OUT} = 0dBm, T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Power Detector Voltage	1.0	1.25	1.5	V	P_{OUT} = 22dBm, T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Variation from 0-360 degree load pull	-1.5		1.5	dB	3:1 VSWR
2.4GHz Receive Parameters					**T = 25ºC; V_{CC} = 3.3V, LNA_EN = High, C_RX = High, C_BT = Low, PA_EN = Low**
Compliance					IEEE802.11b/g/n, FCC CFG 15.247,.205,.209, EN, and JDEC
Frequency Range	2.412		2.484	GHz	
LNA Voltage Supply	3.0	3.3	4.8	V	LNA V_{DD} tied to VBATT at all times
LNA Current Supply		8	12	mA	T = 25°C
		8	14	mA	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
LNA_EN Current		60	100	µA	
Gain					
Receive	10	13	15	dB	LNA ON; V_{CC} = 3.3V; T = 25°C
	8	13	16	dB	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Bypass Mode	-14	-10	-7.5	dB	T = 25°C , LNA Low, C_RX = High, C_BT = Low, PA_EN = Low
	-14.5	-10	-7	dB	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V, LNA_EN = Low, C_RX = High, C_BT = Low, PA_EN = Low
Noise Figure		2	3	dB	
			4		T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Input IP3	-7	2		dBm	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Input P1dB	-12	-5		dBm	
Output Return Loss	8.5	10		dB	
Input Return Loss	4	5		dB	
Bluetooth TX/RX					**T = 25ºC; V_{CC} = 3.3V, LNA_EN = Low, C_RX = Low, C_BT = High, PA_EN = Low**
Input / Output Power	20			dBm	T = -40°C to +85°C, V_{CC} = 3.0V to 4.8V
Insertion Loss		0.5	1.2	dB	
BT Port Return Loss	10	18		dB	
ANT Port Return Loss	10	18		dB	
Isolation					
TX to RX	29	35		dB	In Tx Mode (measured from ANT to RX port)
BT to RX	24	27		dB	In BT Mode (measured from ANT to RX port)
TX to BT	9	18		dB	In Tx Mode (measured from ANT to BT port)
RX to BT	17	25		dB	In Rx High Gain Mode (measured from ANT to BT port)
RX to BT (Bypass mode)	17	20		dB	In Rx Bypass Mode (measured from ANT to BT port)

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
General Specifications					
Switch Control Current – High Each Line		5	60	µA	
Switch Control Current - Low Each Line		0.5	10	µA	
Switching Speed		100		nS	
ESD HBM		1000		V	EIA/JESD22-A114
ESD CDM		1000		V	JESD22-C101
PA Turn-on Time		200	500	nS	10% to 90%

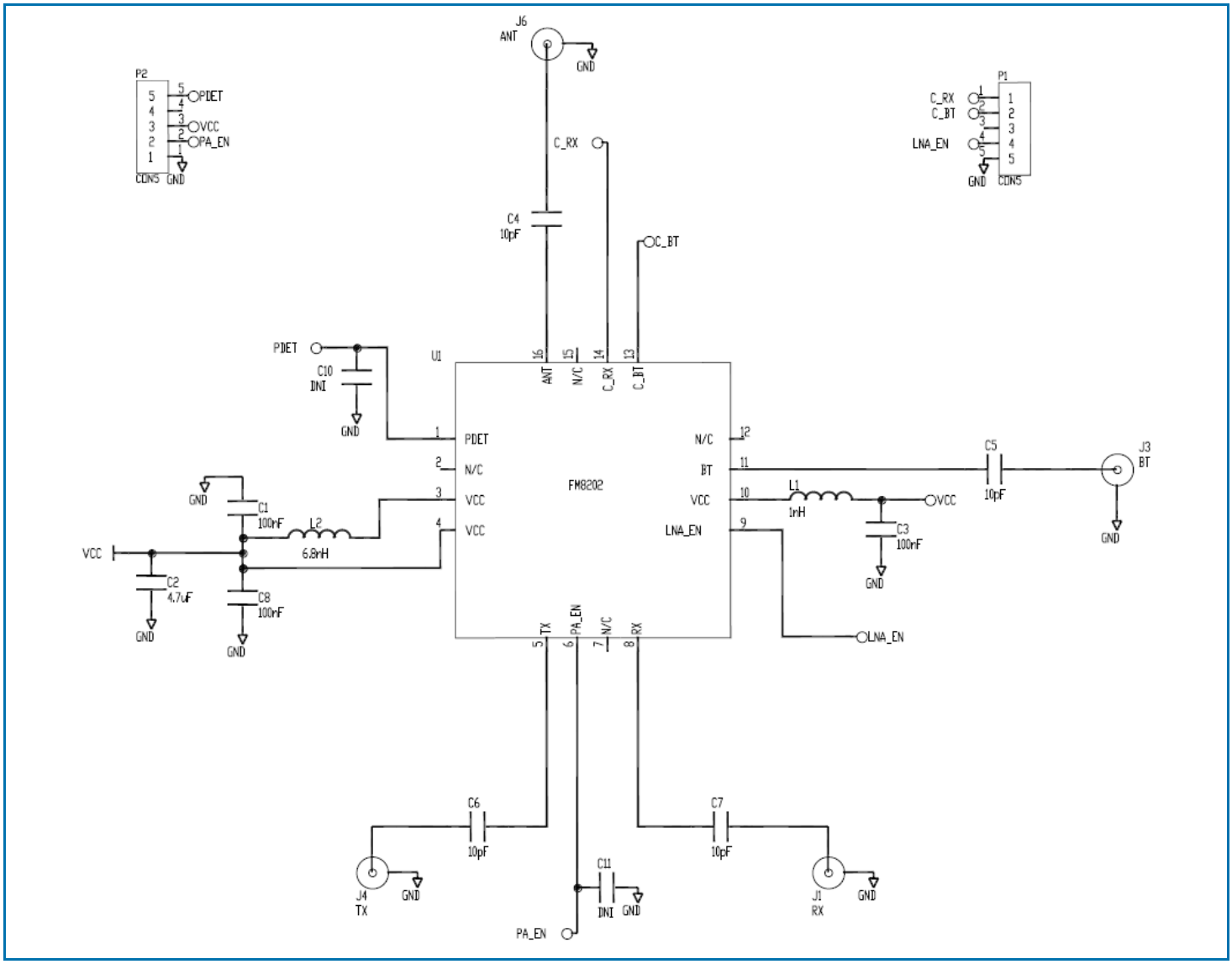
Switch Control Logic Truth Table

Operating Mode	PA_EN	LNA_EN	C_RX	C_BT
Standby	Low	Low	Low	Low
802.11b/g/n Tx	High	Low	Low	Low
802.11b/g/n Rx Gain	Low	High	High	Low
802.11b/g/n Rx Bypass	Low	Low	High	Low
BT RX/TX	Low	Low	Low	High

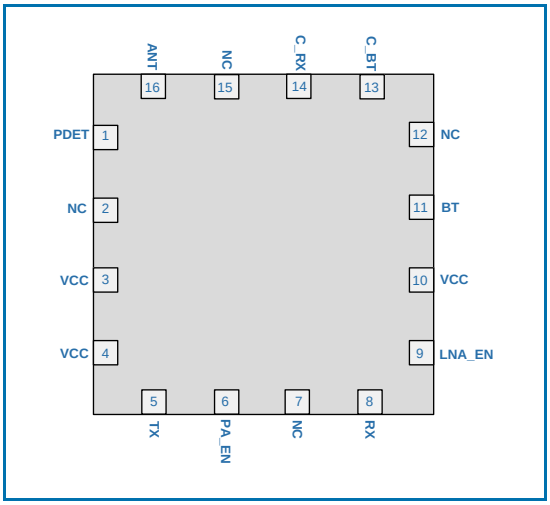
Note:

- PA_EN and TX switch control are tied together internally
- High = 2.8V to V_{CC}, Low = 0V to 0.2V

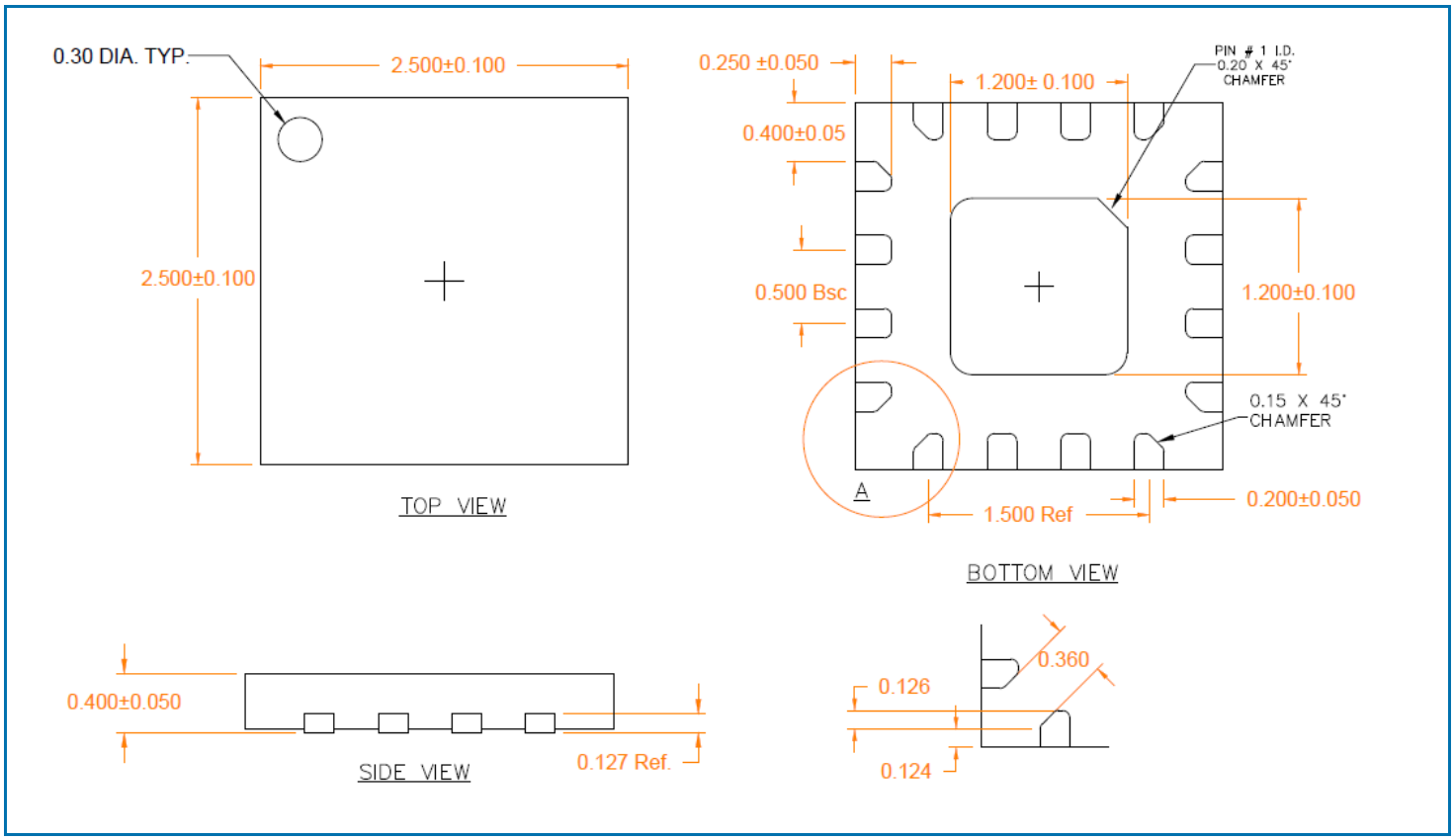
Evaluation Board Schematic



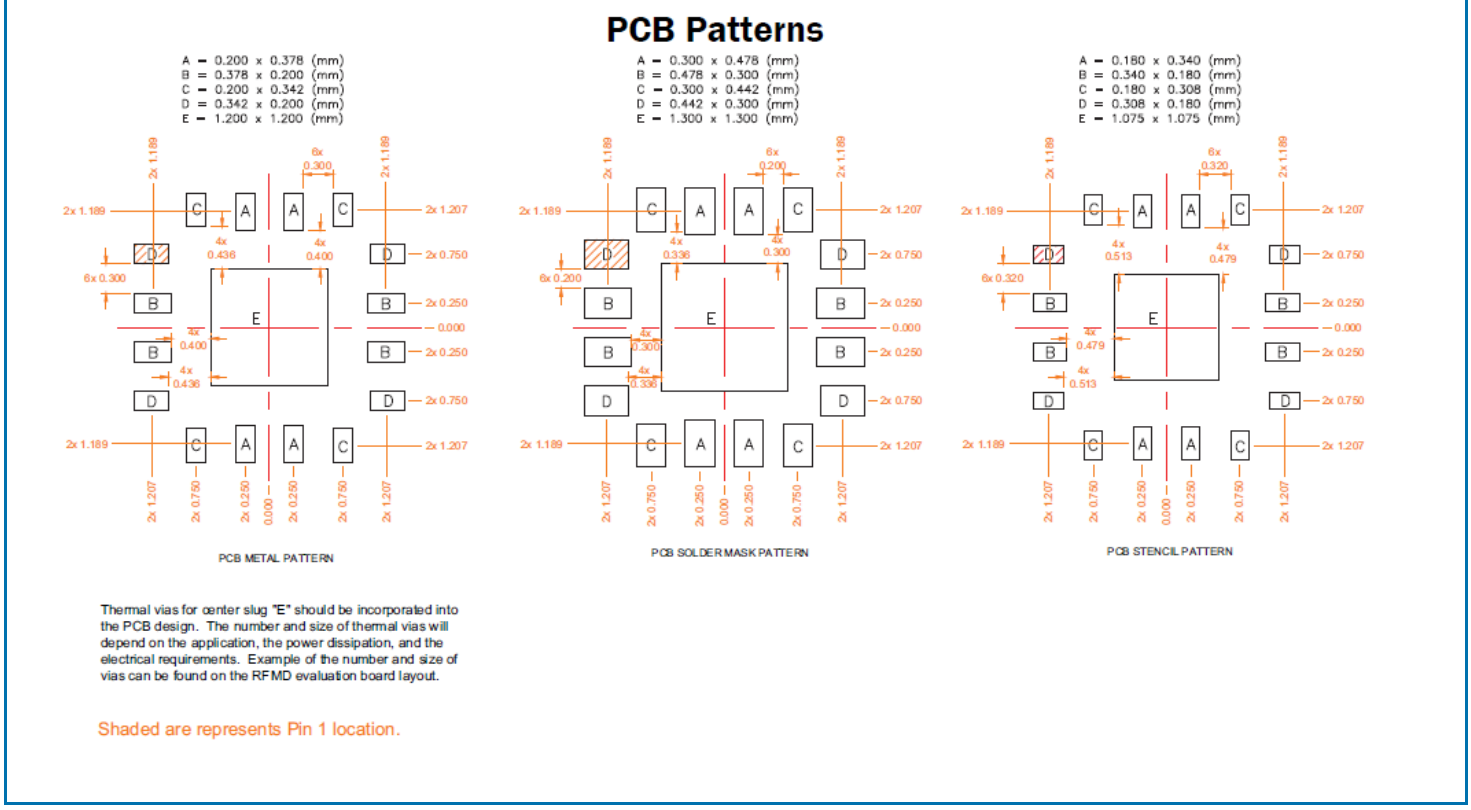
Pin Out



Package Outline and Branding Drawing



PCB Patterns



Pin Names and Descriptions

Pin	Name	Description
1	PDET	Power detector voltage for the TX path. May need external series R and/or shunt C to adjust voltage level and to filter RF noise
2	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
3	VCC	Supply voltage for the output stage of the PA. See applications schematic for biasing and bypassing components.
4	VCC	Supply voltage for the first stage of the PA. See applications schematic for biasing and bypassing components.
5	TX	RF input port for the 802.11b/g/n PA. Input is matched to 50Ω. An external DC block is required.
6	PA_EN	Bias voltae for the PA. This pin also controls the TX switch of the SP3T. See truth table for proper settings.
7	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
8	RX	RF output port for the 802.11b/g/n LNA. Port is matched to 50Ω. An external DC block is required.
9	LNA_EN	Control voltage for the LNA. When this pin is set to a LOW logic state, the bypass mode is enabled.
10	VCC	Supply voltage for the LNA. See applications schematic for biasing and bypassing components.
11	BT	RF bidirectional port for Bluetooth®. Input is matched to 50Ω. An external DC block is required.
12	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
13	C_BT	Bluetooth® switch control pin. See truth table for proper level.
14	C_RX	Receive switch control pin. See switch truth table for proper level.
15	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
16	ANT	RF bidirectional antenna port matched to 50Ω. An external DC block is required.
Pkg Base	GND	Ground connection. The backside of the package should be connected to the ground plane through a short path, i.e., PCB vias under the device are recommended.