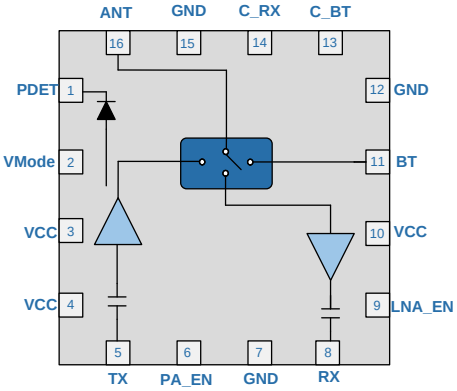
RFFM4211

Wi-Fi Front End Module
2.4GHz to 2.5GHz

Package: QFN, 16-pin,
2.5mm x 2.5mm x 0.40mm

The RFFM4211 provides a complete integrated solution in a single front end module (FEM) for WiFi 802.11b/g/n/ac and Bluetooth® systems. The ultra-small form factor and integrated matching greatly reduces the number of external components and layout area in the customer applications. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturing cost. The RFFM4211 integrates a 2.5GHz power amplifier (PA), a low noise amplifier (LNA), a power detector coupler for improved accuracy, and a Single Pole 3-Throw (SP3T) switch. The device is provided in a 2.5mm x 2.5mm x 0.40mm 16-pin QFN package.



Functional Block Diagram

Features

- P_{OUT} = 19dBm 64QAM MCS7 HT20 at 3.0% (-30.5dB) Dynamic EVM
- P_{OUT} = 18.0dBm 256QAM MCS9 HT40 at 1.8% (-35.0dB) Dynamic EVM
- Input and Output Matched to 50Ω
- High Level of Integration

Applications

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

Ordering Information

RFFM4211SB	Standard 5-piece sample bag
RFFM4211SQ	Standard 25-piece bag
RFFM4211SR	Standard 100-piece reel
RFFM4211TR7	Standard 2500-piece reel
RFFM4211PCK-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.

DS150107

Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage (No RF Applied)	6	V
PA Enable Voltage	-0.5 to 5	VDC
DC Supply Current	500	mA
Operating Temperature Range	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Maximum TX Input Power for 11b/g/n/ac (No Damage)	+12	dBm
Maximum Rx Gain Mode Input Power (No Damage)	+12	dBm
Moisture Sensitivity	MSL2	

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		
Compliance					**802.11b, 802.11g, 802.11n, 802.11ac**
Operating Frequency	2.412		2.484	GHz	
Power Supply V_{CC}	3	3.3	3.6	V	
Control Voltage – High	2.8	3.1	Vcc	V	PA_EN, C_RX, C_BT, LNA_EN
Control Voltage – Low		0	0.2	V	
Transmit (TX-ANT)					**Vcc = 3.3V; Temp = 25°C; 50% Duty Cycle unless otherwise noted**
11ac Output Power	17	18		dBm	
	15.5	16.5		dBm	T = -10ºC to 70ºC, V_{CC} = 3.0V to 3.6V
11ac Dynamic EVM		1.5	1.8	%	256QAM HT40 at Rated Power
		-36.5	-35.0	dB	
11n Output Power	18	19		dBm	
	16.5	17.5		dBm	T = -10ºC to 70ºC, V_{CC} = 3.0V to 3.6V
11n Dynamic EVM		2.5	3.0	%	64QAM HT20 / HT40 at Rated Power
		-32.0	-30.5	dB	
Spectral Mask Margin		2		dB	Pout=20dBm; MCS0 HT20
TX Port Return Loss	8	12		dB	
ANT Port Return Loss	10	18		dB	
Large Signal Gain	24	27	31	dB	
	22	27	32	dB	T = -10ºC to 70ºC, V_{CC} = 3.0V to 3.6V
Gain Flatness	-0.25	0	0.25	dB	20 MHz Channel - Small Signal
	-0.5	0	0.5	dB	Across Band - Small Signal
Operating Current		195	240	mA	Pout = 20dBm
		175	230	mA	Pout = 18dBm; T = -10°C to o70°C; V_{CC} = 3.0V to 3.6V
		155	195	mA	Pout = 16dBm ; T= -10°C to 70°C; V_{CC} = 3.0V to 3.6V
Quiescent Current		120	180		RF = OFF
PA_EN Current		40	80	uA	

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Transmit (TX-ANT)…continued					**Vcc = 3.3V; Temp = 25°C; 50% Duty Cycle unless otherwise noted**
Second Harmonic		-10	-5	dBm/MHz	Pout = 22dBm ; T= -10°C to 70°C; V_{CC} = 3.0V to 3.6V, 11b 1Mbps
Third Harmonic		-40	-25	dBm/MHz	
Power Detector Voltage (idle)	0.28	0.33	0.38	V	Pout = 0dBm (No RF)
Power Detector Voltage	0.70	0.80	0.90		Pout = 16dBm
	0.80	0.90	1.0	V	Pout = 18dBm
	0.9	1.0	1.15	V	Pout = 22dBm
Variation from 0-360º load pull	-1.5		1.5	dB	3:1 VSWR
ANT-RX Isolation	30	32		dB	TX mode
Transmit (TX-ANT) Low Power Mode					**Vcc = 3.3V; Temp = 25°C; 50% Duty Cycle unless otherwise noted**
11ac Output Power	10.0	12.0		dBm	
11ac Dynamic EVM		1.5	1.8	%	256QAM HT40 at Rated Power
		-36.5	-35.0	dB	
11n Output Power	12	14		dBm	
11n Dynamic EVM		2.5	3	%	64QAM HT20 / HT40 at Rated Power
		-32.0	-30.5	dB	
Spectral Mask Margin		2		dB	Pout=14dBm; MCS0 HT20
Operating Current		130	150	mA	P_{OUT}= 12dBm
		140	160	mA	P_{OUT}= 14dBm
V_{MODE} Control Line Current		300	500	µA	
Large Signal Gain	23	26	30	dB	
Gain flatness	-0.5		0.5	dB	Over 80MHz BW
Receive (ANT-RX)					**Vcc = 3.3V; Temp = 25°C; CW, unless otherwise noted**
Gain	13	15	17	dB	Small signal
	12	15	18	dB	T= -10°C to 70°C ; V_{CC} = 3.0V to 3.6V
RX Gain Flatness	-0.25	0	0.25	dB	Over any 20 MHz BW
Gain flatness	-0.5	0	0.5	dB	Across band
Noise Figure		2.5	3	dB	
		2.5	3.7	dB	T= -10°C to 70°C ; V_{CC} = 3.0V to 3.6V
RX Port Return Loss	6	7		dB	
ANT Port Return Loss	3	4		dB	
Input P1dB	-8	-4		dBm	
Current Consumption	7	10	13.5	mA	
	6	10	14.5	mA	T= -10°C to 70°C; V_{CC} = 3.0V to 3.6V
RX Shutdown Isolation	25	28		dB	
LNA_EN Control Current	30	250	500	uA	
LNA Turn On Time		200	500	nS	
Bluetooth TX/RX					**Vcc = 3.3V; Temp = 25°C; CW; unless otherwise noted**
Insertion Loss		0.7	1.0	dB	
		0.7	1.2	dB	Temp = -10°C to 70°C, V_{CC} = 3.0V to 3.6V
Input P1dB	23	27		dBm	
BT Port Return Loss	12	18		dB	
ANT Port Return Loss	12	18		dB	

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	1	µA	
Switching Speed		100	300	ns	
ESD-Human Body Model		1000		V	
ESD-Charge Device Model		1000		V	
PA + TX Switch Turn-On Time		200	500	ns	10% to 90%
Maximum Input Power			12	dBm	Into 50Ω, V_{CC} = 3.3V, 25°C
			12	dBm	6:1 VSWR, V_{CC} = 3.3V, 25°C
			5	dBm	10:1 VSWR, V_{CC} = 3.3V, 25°C
Ruggedness	10:1 VSWR				At typical operating conditions
Leakage Current-PA	0	0.5	10	µA	V_{CC} = 3.3V, RF OFF, All control lines floating

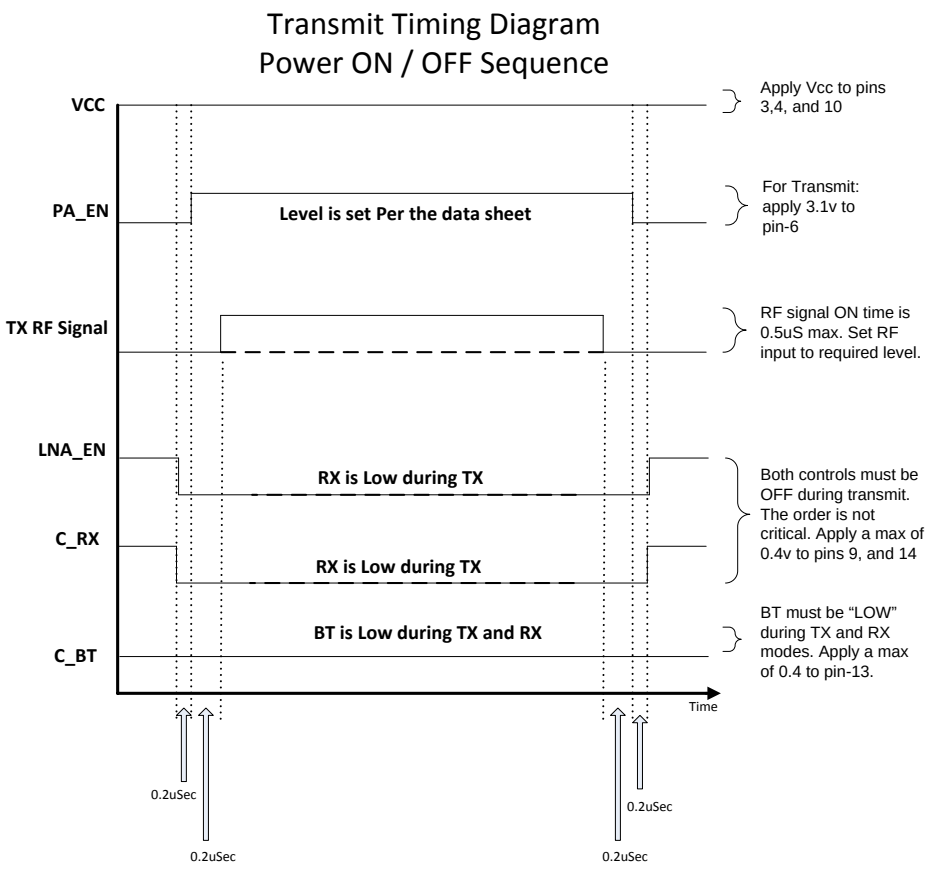
Switch Control Logic Truth Table

Operating Mode	PA_EN	LNA_EN	C_RX	C_BT	VMode
Standby – RX Isolation	Low	Low	Low	Low	Low
802.11b/g/n TX High Power Mode	High	Low	Low	Low	Low
802.11b/g/n TX Low Power Mode	High	Low	Low	Low	High
802.11b/g/n RX Gain	Low	High	High	Low	Low
BT RX/TX	Low	Low	Low	High	Low

Notes:

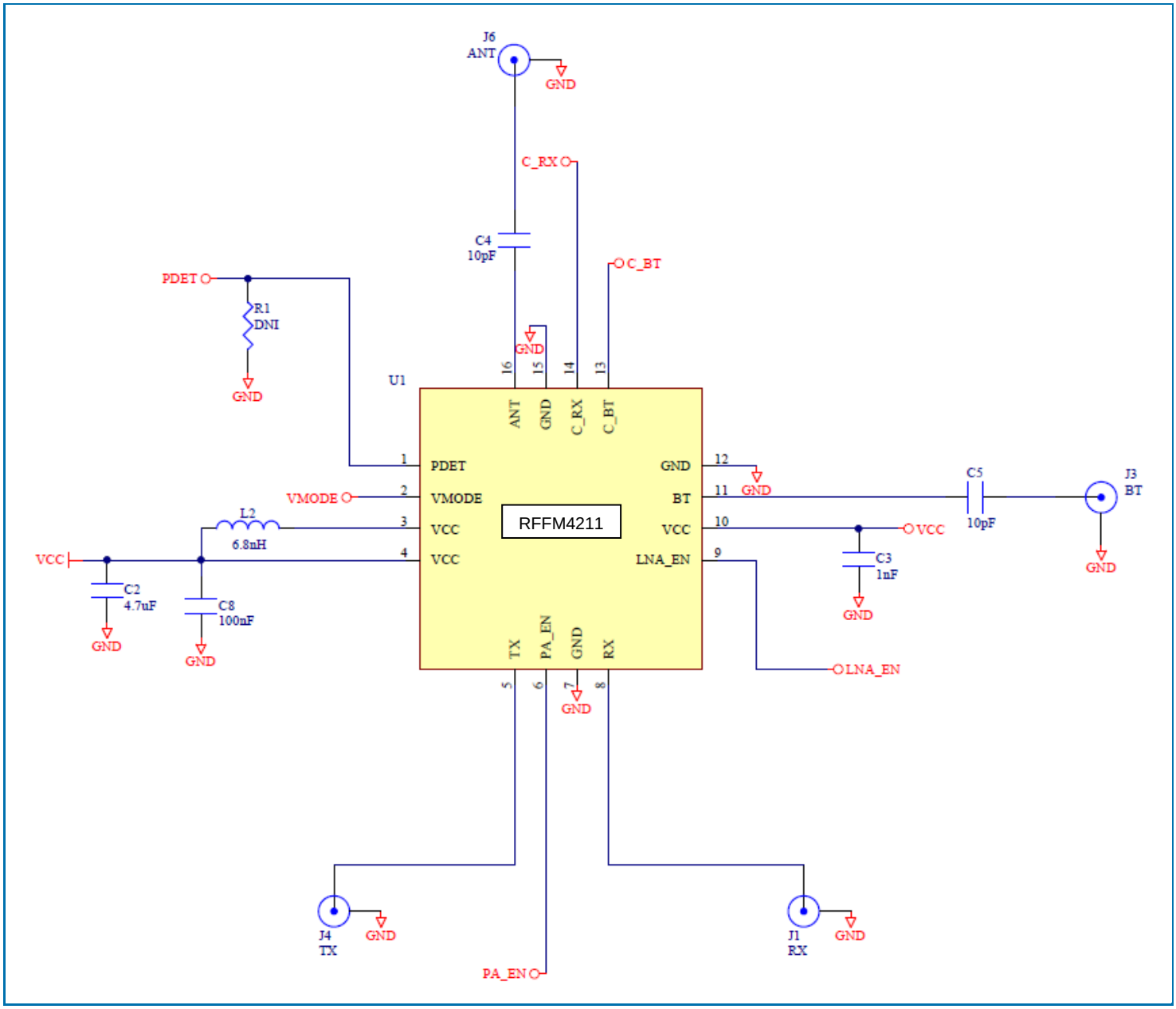
- PA_EN and TX switch control are tied together internally.
- High = 2.8 to V_{CC}. Low = 0V to 0.2V.

Timing Diagram



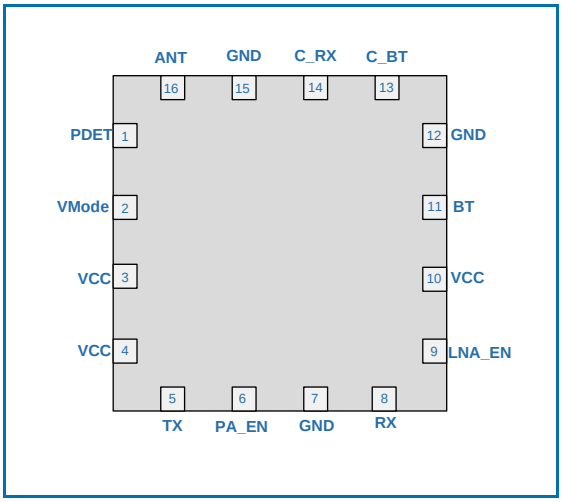
Note1: RF Signal for each specific mode is applied after the DC bias is applied
Note2: Total ON/OFF time includes from 10% of control switching to 90% of RF power
Note3: Listed values on diagram are typical. The maximum is 0.5us for each mode

Applications Schematic

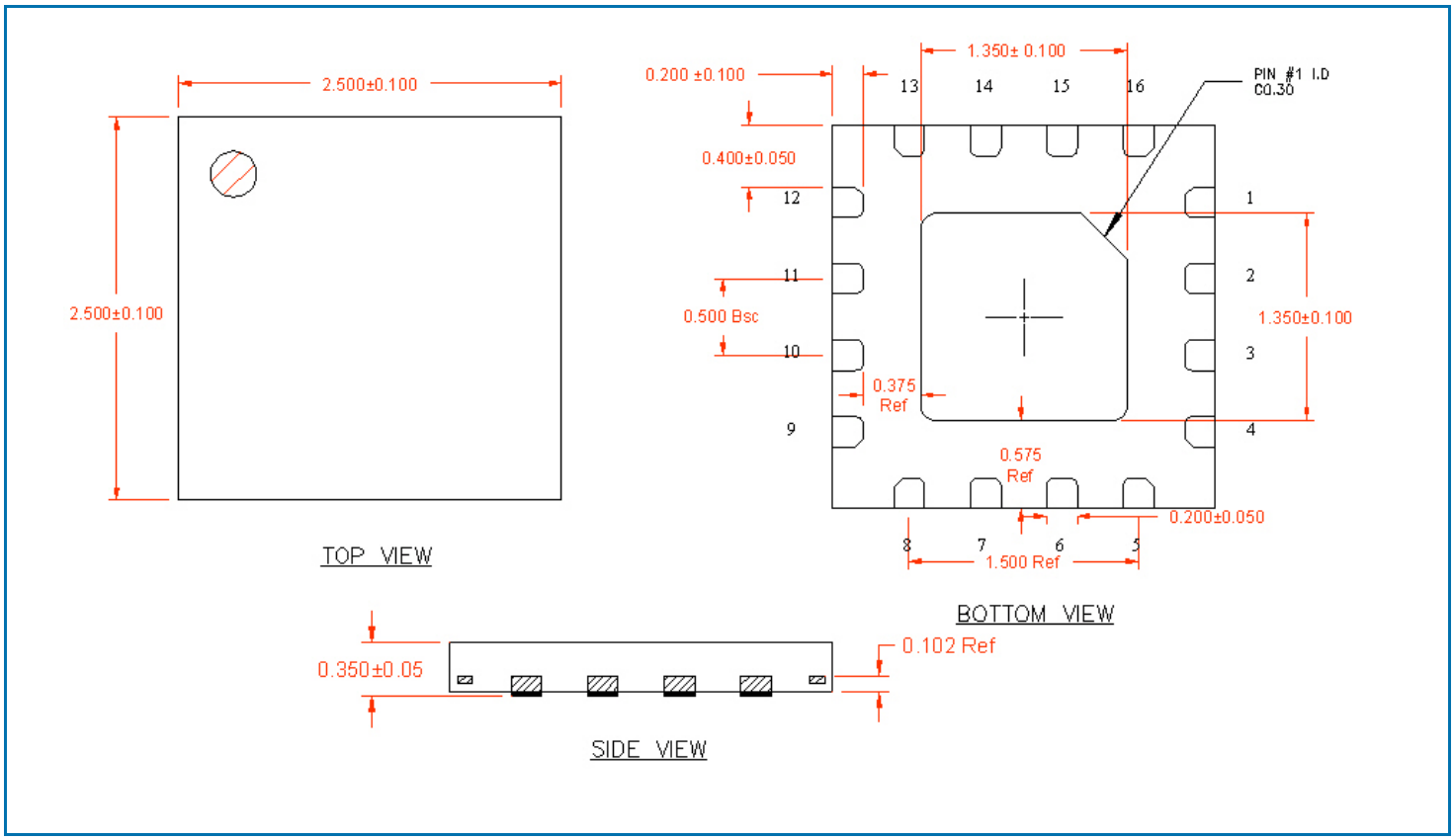


Note: L2 it's optional but recommended for best performance.

Pin Out



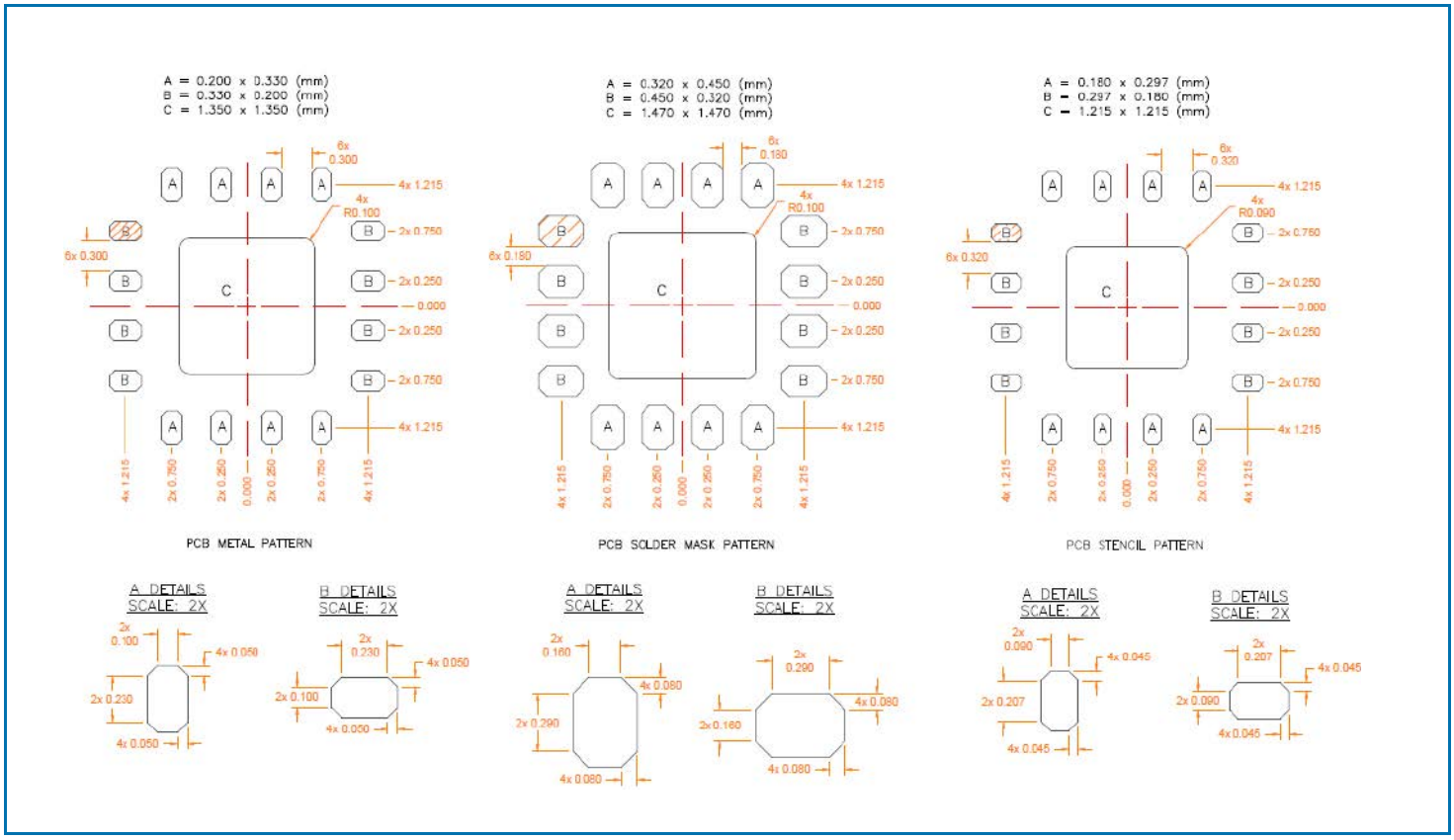
Package Drawing



Notes

1. Shaded area represents Pin 1 locations

PCB Patterns



Pin Names and Descriptions

Pin	Name	Description
1	PDET	Power detector voltage for the TX path. May need external series R/shunt C to adjust voltage level to filter RF noise.
2	VMODE	High/Low power mode control signal. VMODE can be low or floating for nominal conditions (high power mode). Applying 2.8V or greater to this pin enables low power mode.
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. This pin is DC blocked internally.
6	PA_EN	Bias voltage for the PA. This pin also controls the TX switch of the SP3T. See logic table for proper settings.
7	GND	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. This pin is DC blocked internally.
9	LNA_EN	Control voltage for the LNA. See logic table for proper settings.
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	GND	This pin is not connected internally and can be left floating or connected to ground.
13	C_BT	Bluetooth® switch control pin. See logic table for proper settings.
14	C_RX	Receive switch control pin. See logic table for proper settings.
15	GND	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	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.