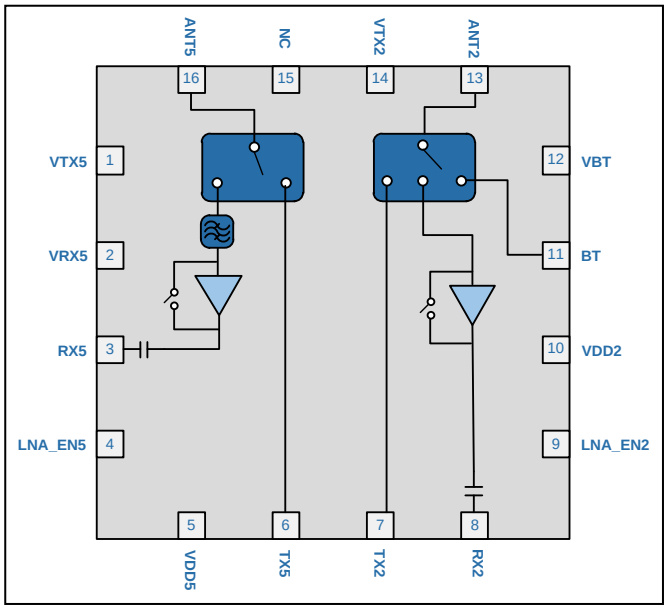
RFFM8850P

Dualband 2.4GHz and 5.0GHz 802.11b/g/n/a/ac Wi-Fi® Switch + LNA Front End Module

The RFFM8850P provides a complete dualband integrated Switch + LNA solution in a single Front End Module (FEM) for Wi-Fi® 802.11b/g/n/a/ac and Bluetooth® systems. The ultra-small form factor and integrated matching greatly reduces the number of external components and layout area. The RFFM8850P integrates a 2.4GHz SP3T Transmit/Receive Switch, a 5.0GHz SP2T Transmit/Receive Switch, a 2.4GHz Low Noise Amplifier with bypass mode, and a 5.0GHz Low Noise Amplifier with bypass mode.



Functional Block Diagram

Package: QFN, 16-pin,
2.3mm x 2.3mm x 0.33mm

Features

- Dualband 2.4GHz & 5.0GHz Wi-Fi® SW+LNA FEM
- 2.4GHz SP3T T/R Switch with Bluetooth® Support
- 2.4GHz LNA with Bypass Mode
- 5.0GHz SP2T T/R Switch
- 5.0GHz LNA with Bypass Mode
- All Input and Output Ports Matched to 50Ω
- Wide Voltage Supply Range
- Supports Wi-Fi® chipsets with Integrated Power Amplifier (iPA)
- Small Package for Chip on Board Designs
- Low Profile Package for Module Designs

Applications

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

Ordering Information

RFFM8850PSB	Standard 5-piece sample bag
RFFM8850PSQ	Standard 25-piece sample bag
RFFM8850PSR	Standard 100-piece reel
RFFM8850PTR7	Standard 2500-piece reel
RFFM8850PPCK-410	Fully assembled evaluation board w/ 5-piece 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
DC Supply Current	100	mA
Operating Case Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Maximum TX Input Power into 50Ω Load for 11b/g/n/ac (No Damage) 2.4GHz and 5.0GHz	+30	dBm
Maximum RX Input Power (No Damage)	+12	dBm
Bypass Mode Maximum RX input power (No damage)	+25	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		
General Specifications					
Operating Frequency	2.412		2.484	GHz	2.4GHz Band
Operating Frequency	5.18		5.825	GHz	5.0GHz Band
Extended Frequency	4.9		5.925	GHz	5.0GHz Band
Operating Temperature	-40	25	85	°C	
Power Supply - VDD2,VDD5	3.0	3.6	5.0	V	
2G Control Voltage-High	2.8	3.1	VDD2	V	VTX2, LNA-EN2, and VBT should not exceed VDD2
2G Control Voltage-Low		0	0.2	V	
5G Control Voltage-High	2.8	3.1	VDD5	V	VTX5, LNA-EN5, and VRX5 should not exceed VDD5
5G Control Voltage-Low		0	0.2	V	
ESD – Human Body Model			1000	V	
ESD – Charge Device Model			1000	V	
Transmit (TX2-ANT2)					**2.4GHz Band, V_{DD2} = 3.6V, unless otherwise noted**
Insertion Loss		0.6	1.2	dB	T = 25°C, V_{DD2} = 3.6V
TX Port Return Loss	12	20		dB	
ANT Port Return Loss	12	20		dB	
Nominal Input P0.1dB	27	30		dBm	T = 25°C, V_{DD2} = 3.6V
ANT-RX Isolation	28	35		dB	TX Mode enabled and at maximum power
Receive (ANT2-RX2)-LNA On					**2.4GHz Band, V_{DD2} = 3.6V, unless otherwise noted**
Gain (S21)	12	14	17	dB	T =25°C, V_{DD2} = 3.6V
	11	14	18	dB	T =-40 to +85C°, V_{DD2} = 3.0V to 5V
Gain Flatness over any 20MHz BW	-1		+1	dB	
Gain Flatness across band	-1		+1	dB	
Noise Figure - Nominal	1.8	2.2	2.7	dB	T = 25°C, V_{DD2} = 3.6V
Noise Figure	1.3	2.5	3.1	dB	T = -40 to +85°C, V_{DD2} = 3.0 to 5.0V, F = 2400 - 2500MHZ
RX2 Port Return Loss	10	15	25	dB	
ANT2 Port Return Loss - Nominal	5	8	10	dB	T = 25°C, V_{DD2} = 3.6V
ANT2 Port Return Loss	4	7.5	12	dB	All Conditions
Input P1dB - Nominal	-8	-6.5		dBm	T = 25°C, V_{DD2} = 3.6V
Current Consumption -Nominal	6	9	13	mA	T = 25°C, V_{DD2} = 3.6V

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Receive (ANT2-RX2)-LNA On					**2.4GHz Band, V_{DD2} = 3.6V, unless otherwise noted**
LNA_EN2 Control Current		50	100	µA	
LNA Turn On Time		200	500	nS	
Receive (ANT2-RX2)-LNA Bypass Mode					**2.4GHz Band, V_{DD2} = 3.6V, unless otherwise noted**
Insertion Loss - Nominal	4	5	7	dB	T= 25°C, V_{DD2} = 3.6V
RX Port Return Loss - Nominal	10	12	20	dB	
ANT Port Return Loss - Nominal	10	15	20	dB	
Input P1dB	+17	+21		dBm	
Bluetooth TX/RX Mode					**2.4GHz Band, V_{DD2} = 3.6, unless otherwise noted**
Input P0.1dB	+24	+28	+32	dBm	T = 25°C, V_{DD2} = 3.6V
Insertion Loss	0.3	0.6	1.3	dB	
BT Port Return Loss	12	18		dB	
ANT2 Port Return Loss	12	18		dB	
Control Line Specifications					**2.4GHz Band, V_{DD2} = 3.6, unless otherwise noted**
Control Line Impedance – VTX2		40		MΩ	
Control Line Impedance – LNAEN2		66		KΩ	
Control Line Impedance - VBT		40		MΩ	
Leakage Current – VDD2		0.2	10	µA	
2G Switch Control Current-High-Each Line		5	100	µA	
2G Switch Control Current-Low-Each Line		0.5	1	µA	
Switching Speed		100	500	ns	
Transmit (TX5-ANT5)					**5.0GHz Band, V_{DD5} = 3.6V, unless otherwise noted**
Insertion Loss - Nominal	0.2	0.8	1.8	dB	T = 25C°, V_{DD5} = 3.6V
TX5 Port Return Loss - Nominal	12	25		dB	
ANT5 Port Return Loss - Nominal	12	25		dB	
Input P0.1dB - Nominal	28	30	31.5	dBm	T = 25°C, V_{DD5} = 3.6V
Max Linear Input power (<1% EVM) - Nominal	20	23	25	dBm	T = 25°C, V_{DD5} = 3.6V
Max Linear Input power (<1% EVM) - Over VT	19	21	25	dBm	All Conditions
ANT5-RX5 Isolation	28	35		dB	TX Mode enabled and at maximum power
Receive (ANT5-RX5)-LNA On					**5.0GHz Band, V_{DD5} = 3.6V, unless otherwise noted**
Gain - Nominal	10	14	15	dB	T = 25°C, V_{DD5} = 3.6V
Gain	9	13	18	dB	All conditions
Gain flatness over any 80MHz BW	-0.5		+0.5	dB	
Gain flatness across band	-1		+1	dB	T = 25°C, V_{DD5} = 3.6V
Noise Figure-Nominal		2.3	3	dB	
Noise Figure		2.5	3.5		T = -40 to +85°C, V_{DD5} = 3.0 to 5.0V
Rx5 Port Return Loss - Nominal	8	12		dB	
ANT5 Port Return Loss - Nominal	5	8		dB	
Nominal Input P1dB	-7.5	-5		dBm	T= 25°C, V_{DD5} = 3.6V
Current Consumption	6	10	13	mA	
LNA_EN5 Control Current	50	140	200	µA	
LNA Turn On Time		400	600	nS	

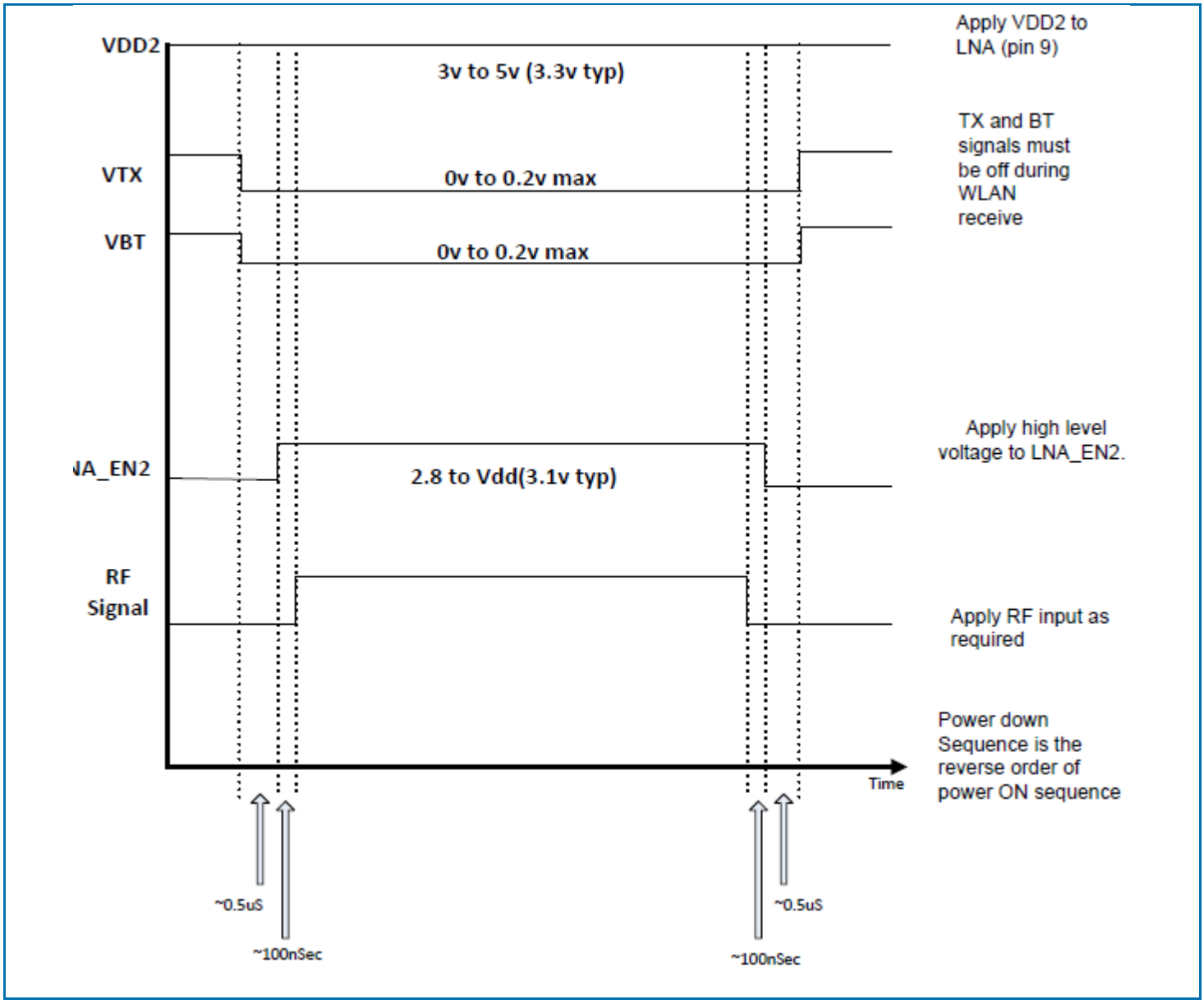
Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Receive (ANT5-RX5)-Bypass Mode					**5.0GHz Band, V_{DD5} = 3.6V, unless otherwise noted**
Insertion Loss - Nominal	5	7	12	dB	T = 25°C, V_{DD5} = 3.6V
RX5 Port Return Loss	10	15		dB	
ANT5 Port Return Loss	12	20		dB	
Input P1dB	+18	+21		dBm	T = 25°C, V_{DD5} = 3.6V
Control Line Specifications					**5.0GHz Band, V_{DD5} = 3.6V, unless otherwise noted**
VDD5 Leakage Current - Nominal	0	0.2	10	uA	
Control Line Impedance – VTX5		40		MΩ	
Control Line Impedance – LNA_EN5		66		kΩ	
Control Line Impedance – VRX5		40		MΩ	
Leakage Current – VDD5		0.2	10	µA	
5G Switch Control Current – High - Each Line		5	100	µA	
5G Switch Control Current – Low - Each Line		0.5	1	µA	T = 25°C, V_{DD5} = 3.6V
Switching Speed		100	500	ns	
Isolation					**V_{DD2} = 3.6V and V_{DD5} = 3.6V, unless otherwise noted**
ANT5 to RX5		25		dB	
ANT2 to RX2		25		dB	
ANT5 to ANT2		40		dB	

Switch Control Logic Truth Table

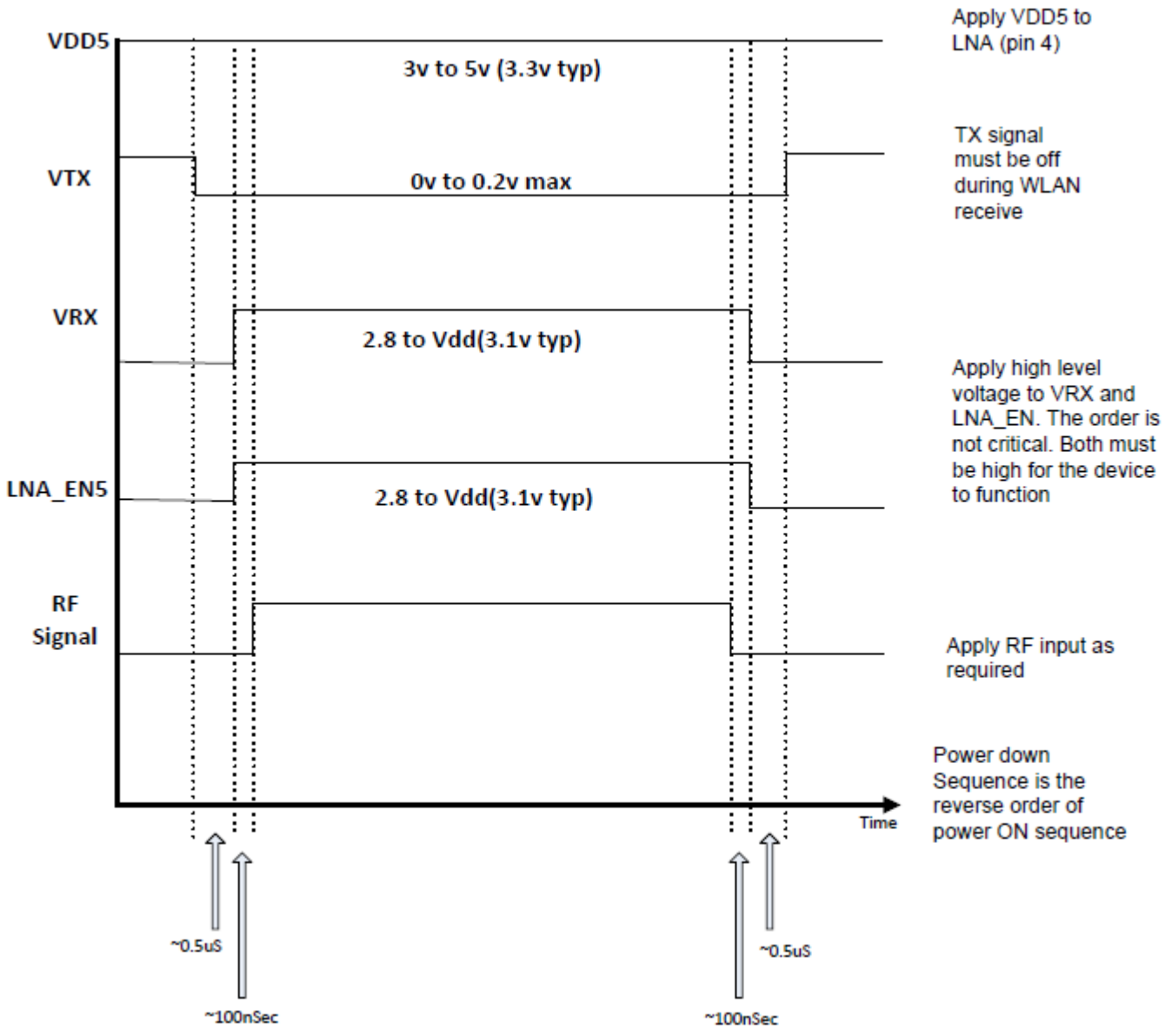
Operating Mode	VTX2	LNAEN2	VBT	VTX5	LNAEN5	VRX5
802.11b/g/n Rx Bypass - Standby	Low	Low	Low			
802.11b/g/n TX2 Mode	High	Low	Low			
802.11b/g/n RX2 Gain Mode	Low	High	Low			
BT TX	Low	Low	High			
5.0 GHz Standby Mode				Low	Low	Low
802.11a/n/ac TX5 Mode				High	Low	Low
802.11a/n/ac RX5 Gain Mode				Low	High	High
802.11a/n/ac RX5 Bypass Mode				Low	Low	High

Note: 2G: High = 2.8 to V_{DD2}, Low = 0V to 0.2V, and 5G: High = 2.8 to V_{DD5}, Low = 0V to 0.2V.

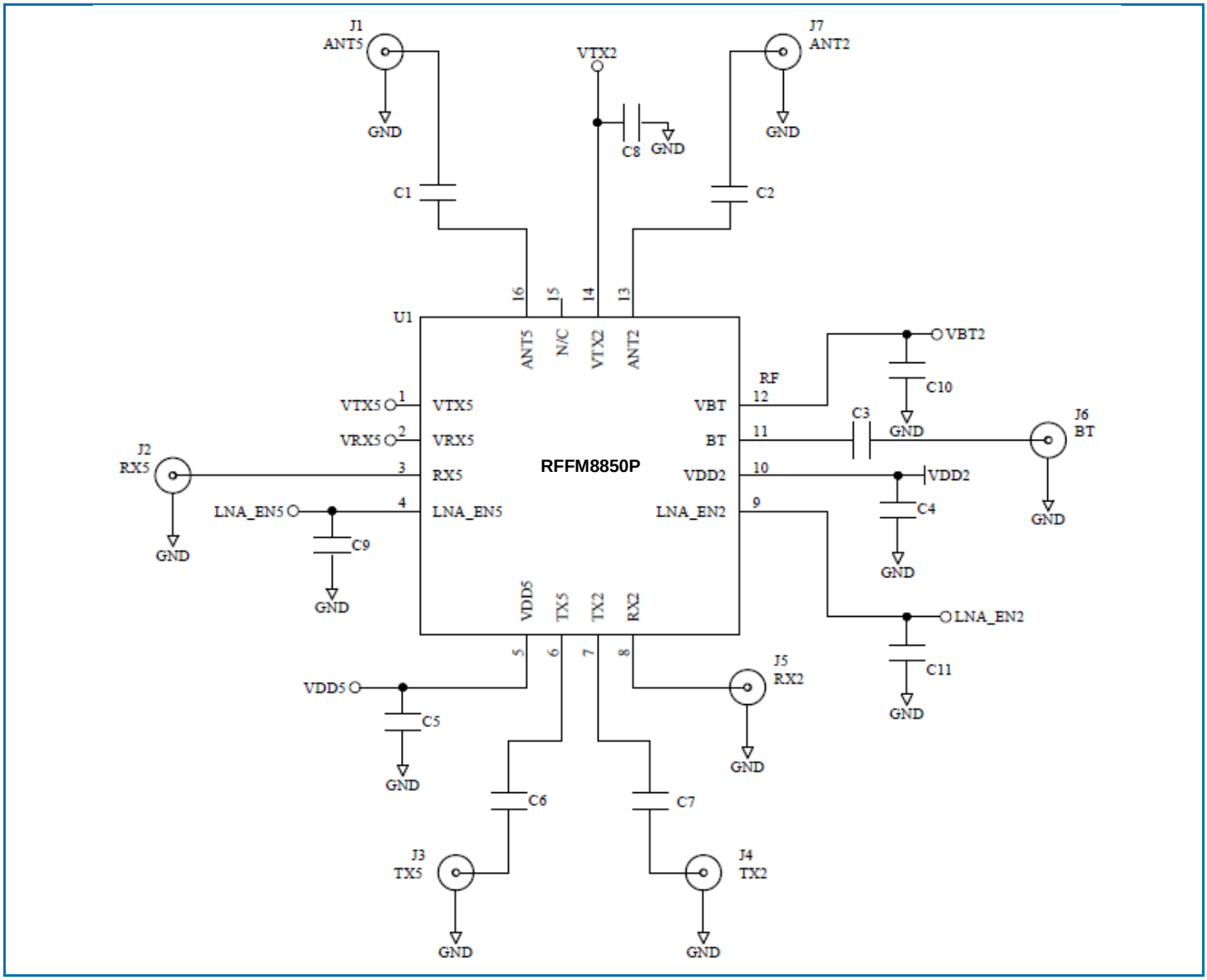
Timing Diagram 2.4GHz Control



Timing Diagram 5.0GHz Control

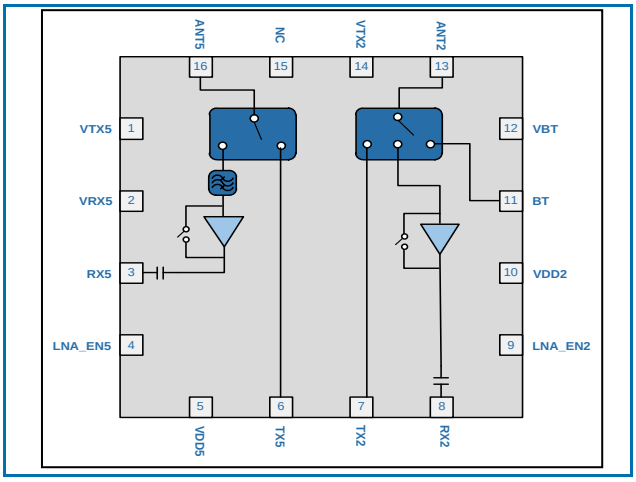


Applications Schematic

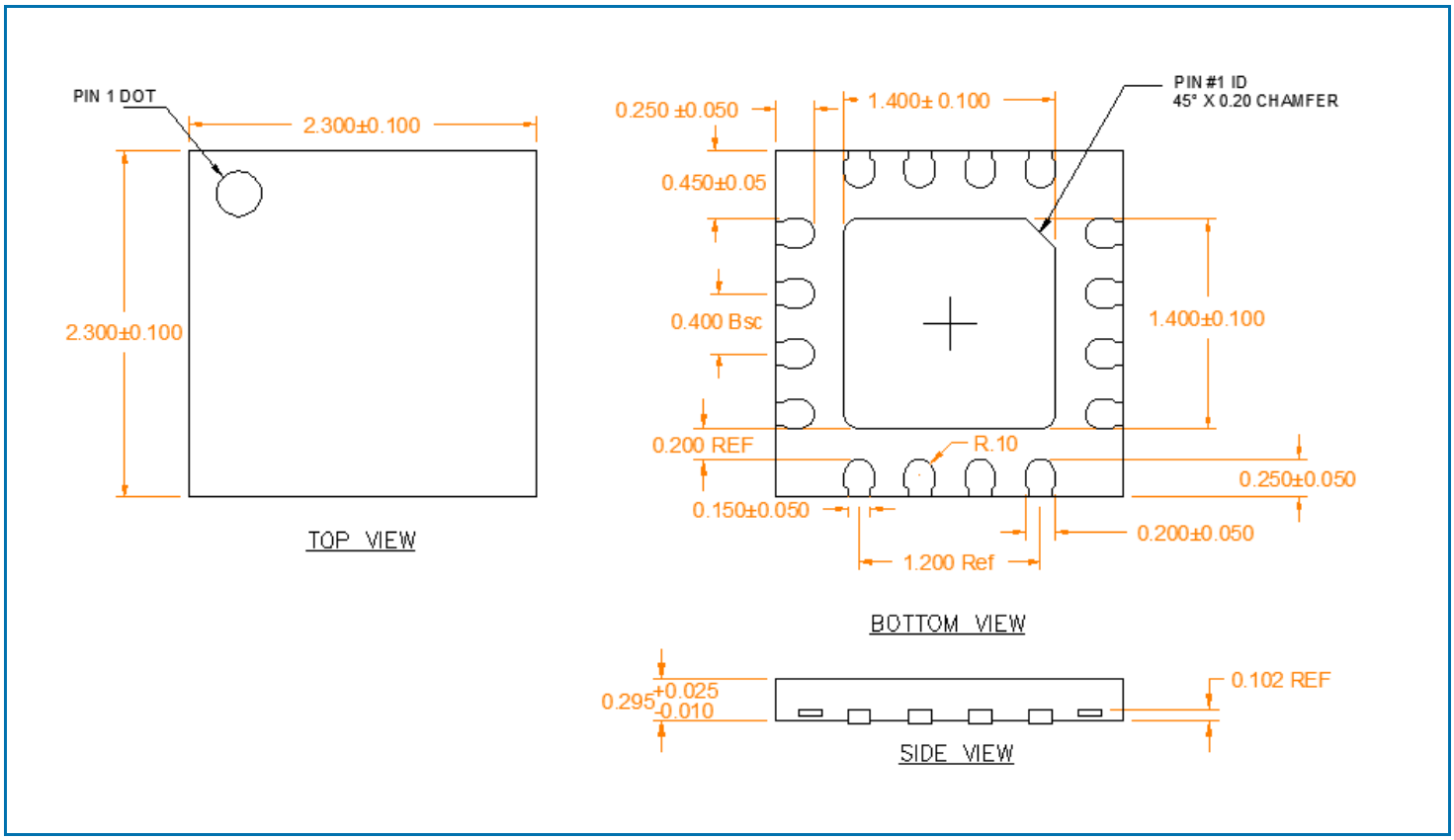


*Note If PIN 11 (BT) is not used then that port should be left open.

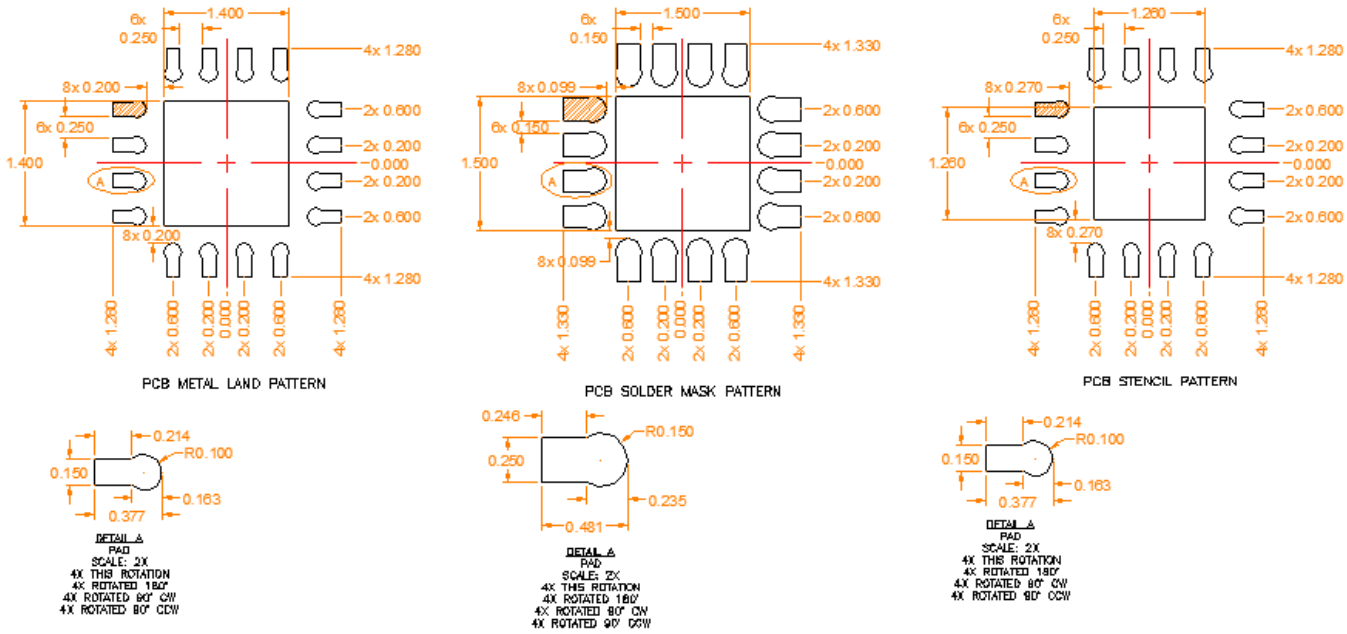
Pin Out



Package Drawing



PCB Patterns



Note:

Thermal vias for center slug “C” should be incorporated into the PCB design. The number and size of thermal vias will depend on the application, power, dissipation and electrical requirements. Example of the number and size of vias can be found on the RFMD evaluation board layout (gerber files are available upon request)

Pin Names and Descriptions

Pin	Name	Description
1	VTX5	5 GHz TX switch control voltage. Refer to logic table for proper settings
2	VRX5	5 GHz RX switch control voltage. Refer to logic table for proper settings
3	RX5	RF output port for the 5 GHz LNA. This port is matched to 50Ω and DC blocked internally
4	LNA_EN5	5 GHz LNA enable voltage. Refer to logic table for proper settings
5	VDD5	Supply voltage for the 5 GHz LNA. See applications schematic for biasing and bypassing components.
6	TX5	RF input port for the TX throw of the 5 GHz T/R switch. An external DC block is required
7	TX2	RF input port for the TX throw of the 2.4 GHz T/R switch. An external DC block is required
8	RX2	RF output port for the 2.4 GHz LNA. This port is matched to 50Ω and DC blocked internally
9	LNA_EN2	2.4 GHz LNA enable voltage. Refer to logic table for proper settings
10	VDD2	Supply voltage for the 2.4 GHz 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	VBT	Bluetooth® switch control pin. See truth table for proper level.
13	ANT2	2.4 GHz RF bidirectional antenna port matched to 50Ω. An external DC block is required.
14	VTX2	2.4 GHz TX switch control voltage. Refer to logic table for proper settings
15	NC	This pin is not connected internally and can be left floating or connected to ground.
16	ANT5	5 GHz 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.

*Note If PIN 11 (BT) is not used then that port should be left open.