RFFM8504

4.9GHz TO 5.85GHz 802.11a/n/ac/WiFi FRONT END MODULE

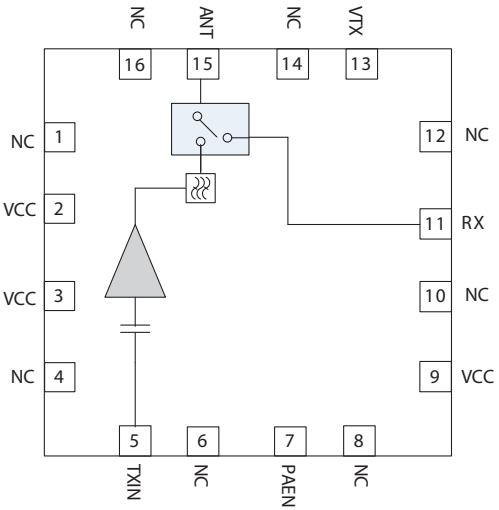
Package: QFN, 16-pin, 2.5mm x 2.5mm x 0.45mm

Features

- Small Size
- High Performance FEM
- Excellent Linearity
- Input and Output Matched to 50Ω
- P_{OUT} = 17.5dBm, 11ac, 80MHz MCS9 at -36dB (1.5%) EVM
- Integrated 5GHz PA and SP2T Switch
- Low Height Package, Suited for SiP and CoB Designs

Applications

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



Functional Block Diagram

Product Description

The RFFM8504 provides a complete integrated solution in a single front end module (FEM) for 4.9GHz to 5.85GHz WiFi 802.11a/n/ac systems. The ultra-small form factor and integrated matching minimizes the layout area in the customer's application and greatly reduces the number of external components. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturability cost. The RFFM8504 integrates a power amplifier (PA) and single-pole double-throw switch (SP2T). The device is provided in a 2.5mm x 2.5mm x 0.45mm, 16-pin QFN package. This module meets or exceeds the RF front end needs of IEEE 802.11a/n/ac WiFi RF systems.

Ordering Information

RFFM8504SQ	Standard 25-piece sample bag
RFFM8504SR	Standard 100-piece reel
RFFM8504TR7	Standard 2500-piece reel
RFFM8504PCK-410	Fully assembled evaluation board with 5-piece bag

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Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage	-0.5 to +5.4	V_{DC}
PA Enable Voltage	-0.5 to 5	V_{DC}
DC Supply Current	500	mA
Maximum Tx and Rx Input Power into 50Ω Load for 11a/n/ac (No Damage)	+12	dBm
Storage Temperature	-40 to +150	°C
Moisture Sensitivity	MSL1	

Caution! ESD sensitive device.

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.

65/EURFMD Green: RoHS compliant per EU Directive 2011/65/EU, 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.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance: 802.11a, 802.11n, 802.11ac					4.9GHz to 5.85GHz Only
Operating Frequency	5.15		5.85	GHz	
Extended Frequency	4.9		5.15	GHz	Functional with derated performance
Input and Output Port Impedance		50		Ω	
Operating Temperature	-30		+85	°C	
Power Supply V_{CC}	3	3.6	4.2	V	
Switch Control Voltage - VTX High	2.75	2.9	4.2	V	TX switch On at high control voltage
Switch Control Voltage - VTX Low		0.1	0.4	V	RX switch On with low control voltage
PA_Enable High	2.75	2.9	4.2	V	PA in "On" state
PA_Enable Low		0.1	0.4	V	PA in "Off" state, Do not leave floating
Transmit (TX-ANT) Mode					V_{CC} = 3.6V; VTX = High, Temperature = 25°C; Unless otherwise noted
Gain (5.15GHz to 5.85GHz)	25.5	29		dB	
20MHz Output Power*		19		dBm	802.11ac HT20 MCS7
11ac 20MHz Dynamic EVM		-33	-30	dB	
		2.2	3.2	%	
40MHz Output Power*		18		dBm	802.11ac VHT40 MCS9
11ac 40MHz Dynamic EVM		-36	-35	dB	
		1.5	1.8	%	
80MHz Output Power*		17		dBm	802.11ac VHT80 MCS9
11ac 80MHz Dynamic EVM		-36	-35	dB	
		1.5	1.8	%	
80MHz Output Power*		13.5		dBm	802.11ac VHT80 MCS9
11ac 80MHz Dynamic EVM		-40		dB	
		1.0		%	
Spectral Mask 20MHz Output Power*		22		dBm	802.11ac HT20 with 3dB margin
Spectral Mask 40MHz Output Power*		21		dBm	802.11ac VHT40 with 3dB margin
Spectral Mask 80MHz Output Power*		20		dBm	802.11ac VHT80 with 3dB margin
Operating Current - Nominal		270	310	mA	P_{OUT} = 19dBm

* For 4900MHz to 5150MHz, P_{OUT} is degraded by 1dB

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Second Harmonic			-40	dBm	Fundamental frequency is between 4900MHz and 5850MHz; RF P_{OUT} =19dBm; measured in 1MHz resolution bandwidth (FCC limit max = -30dBm)
Third Harmonic			-40	dBm	
PA Selectivity/Out of Band Gain					
30MHz to 2900MHz		-6		dB	
3600MHz to 4400MHz		19		dB	
7250MHz to 7750MHz		20		dB	
Tx Port Return Loss	10	12		dB	
ANT Port Return Loss	12	15		dB	
Noise Figure			6	dB	
Receive (ANT-RX) Receive Data					V_{CC} = 3.6V; VTX = Low, Temperature = 25°C; Unless otherwise noted
Insertion Loss		0.9		dB	
RX Port Return Loss	12	15		dB	
ANT Port Return Loss	12	15		dB	
TX - RX Isolation	21			dB	
General Specifications					
Switch Control Current - High			2	µA	
Switch Control Current - Low			0.1	µA	Do not leave floating
PAEN Current - All Conditions		30		µA	
FEM Leakage - Nominal		4	10	µA	RF = Off; PAEN = Low; VTX = Low
Turn-On time from PA_EN edge			300	ns	Output stable within 90% of final gain
Turn-Off time from PA_EN edge			300	ns	Output stable within 90% of final gain
Switching Speed			200	ns	
ESD - Human Body Model	1000			V	EIA/JESD22-114A all pins
ESD - Charge Device Model	1000			V	EIA/JESD22-101C all pins

PA Mode of Operation

PA Mode	PAEN
Enable	High
Disable	Low

Switch Mode of Operation

Switch Mode	VTX
Transmit	High
Receive	Low

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Pin Descriptions

Pin	Name	Description
1	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
2	VCC	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
3	VCC	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
4	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
5	TXIN	RF input port for the 802.11a/n PA. Input is matched to 50Ω. Internally DC blocked.
6	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
7	PAEN	Control voltage for the PA. High PAEN enables the PA and Low PAEN disables the PA (see switch logic tables).
8	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
9	VCC	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
10	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
11	RX	Receive (Rx) 50Ω output pin.
12	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
13	VTX	Switch control voltage. High control voltage turns on the Tx path and low control voltage turns on the Rx path (see switch logic tables).
14	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
15	ANT	RF bidirectional antenna port matched to 50Ω.
16	NC*	No Connect. This pin is not connected internally. It can be left floating or connected to ground.
Pkg Base	GND	Ground connection. The backside of the package should be connected to the ground plane through a short path; PCB vias under the device are recommended.

* It is recommended to ground all NC pins.

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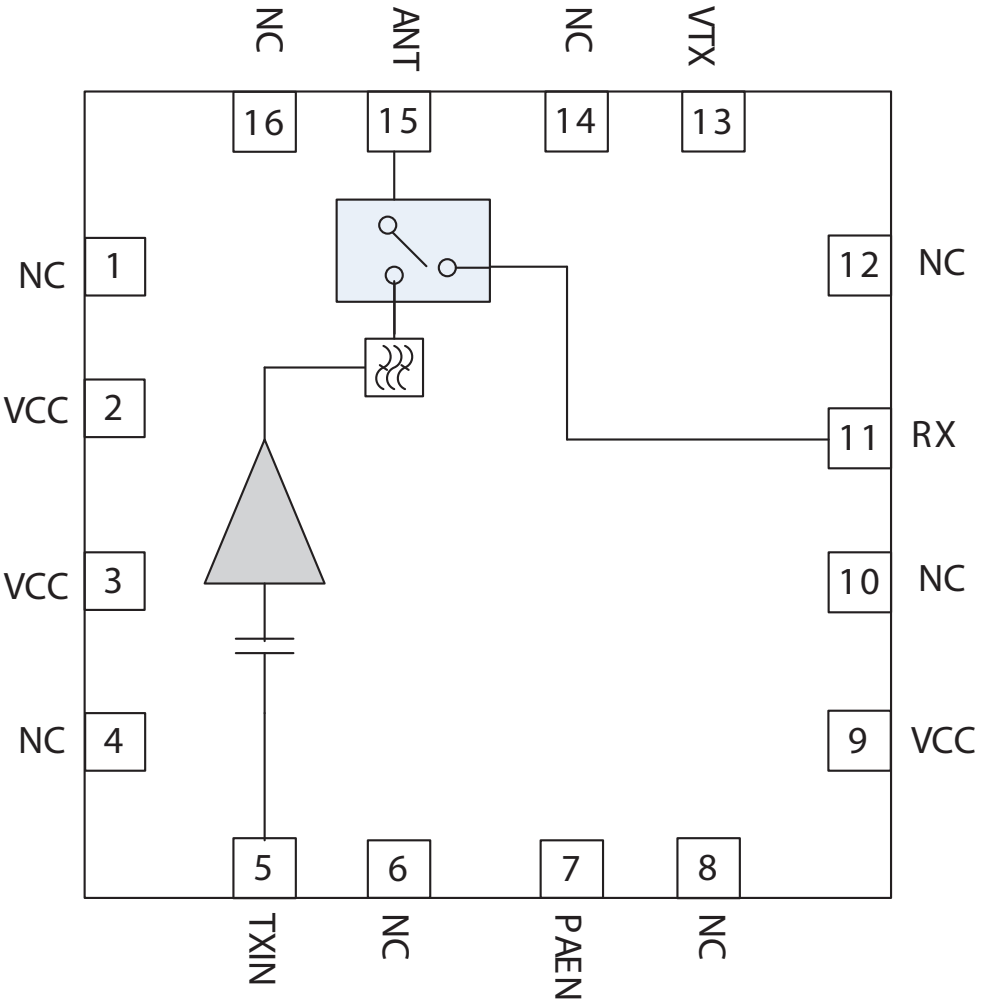
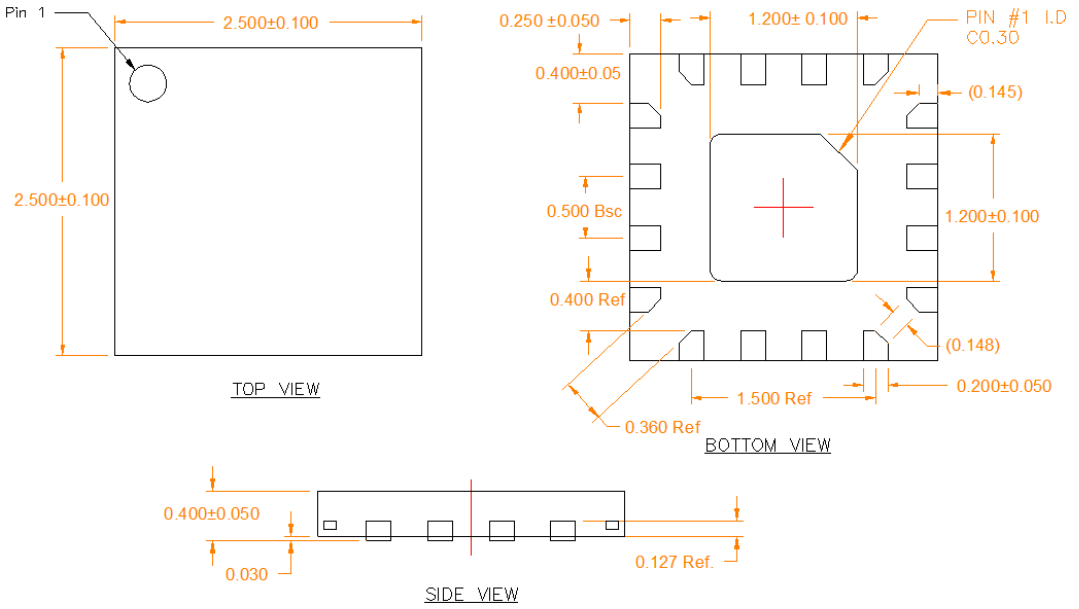
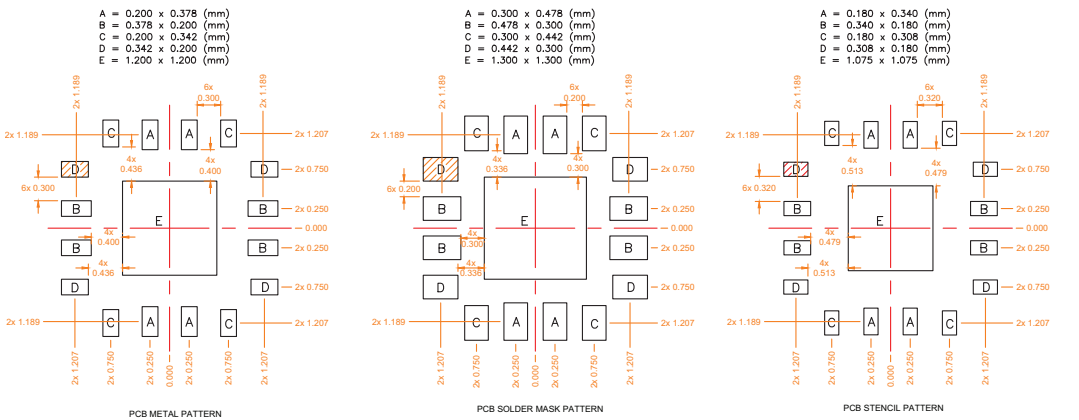
Detailed Functional Block Diagram



Package Drawing



PCB Patterns



Thermal vias for center slug "E" should be incorporated into the PCB design. The number and size of thermal vias will depend on the application, the power dissipation, and the electrical requirements. Example of the number and size of vias can be found on the RFMD evaluation board layout.

Shaded are represents Pin 1 location.

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Evaluation Board Schematic