RFFM4558A

Wi-Fi Front End Module

General Description

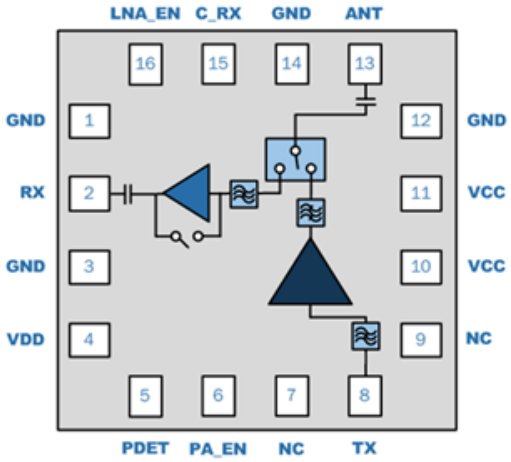
The RFFM4558A provides a complete integrated solution in a single front end module (FEM) for Wi-Fi 802.11a/n/ac systems. The small form factor and integrated matching minimizes layout area in the application and greatly reduces the number of external components.

Performance is focused on conserving power consumption while maintaining the highest linear output power and leading edge throughput.

Integrated die level filtering for 2nd and 3rd harmonics as well as 2.4 GHz rejection for DBDC operation are included

The RFFM4558A integrates a 5 GHz power amplifier (PA), single pole two throw switch (SP2T) and bypassable low noise amplifier (LNA) into a single device.

Functional Block Diagram



Top View

16 Pad 2.5 x 2.5 mm Laminate Package

Product Features

- 4900 – 5925 MHz
- P_{OUT} = +20.5dBm MCS9 VHT80 -35dB Dynamic EVM
- P_{OUT} = +21dBm MCS7 HT20/40 -30dB Dynamic EVM
- P_{OUT} = +24dBm MCS0 HT20 Spectral Mask Compliance
- 160MHz Bandwidth and MCS11 Capable
- Optimized for +5 V Operation
- <0.9 W Power Consumption at P_{OUT} = +20dBm
- 32 dB Tx Gain
- 2.5 dB Noise Figure
- 14 dB Rx Gain & 5 dB Bypass Loss
- 15 dB 2.4 GHz Rejection on Rx Path

Applications

- Access Points
- Wireless Routers
- Residential Gateways
- Customer Premise Equipment
- Internet of Things

Ordering Information

Part No.	Description
RFFM4558ASB	Sample bag with 5 pieces
RFFM4558ASQ	Sample bag with 25 pieces
RFFM4558ASR	7” reel with 100 pieces
RFFM4558ATR7	7” reel with 2,500 pieces
RFFM4558APCK401	Assembled Evaluation Board + 5 pcs Sample Bag

Absolute Maximum Ratings

Parameter	Rating
DC Supply Voltage	−0.5 to +6 V
PA Enable Voltage	-0.5 to +5 V
DC Supply Current	500 mA
Storage Temperature	-40 to +150 °C
TX RF Input Power into 50 Ω Load for 802.11a/n/ac (No Damage)	+10 dBm
RX LNA On RF Input Power (No Damage)	+10 dBm
RX Bypass RF Input Power (No Damage)	+25 dBm

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. This is an InGaP device designed for high duty cycle applications with Tj> °C over ambient.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Operating Frequency	5180		5925	MHz
Extended Operating Frequency	4900		5925	MHz
Device Voltage (V_{CC})	+4.75	+5	+5.25	V
PA Enable Voltage – High	+2.8	+3.1	V_{CC}	V
PA Enable Voltage – Low	+0		+0.2	V
$T_{OPERATING}$	−40		+85	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Parameter	Conditions	Min	Typ	Max	Units
TRANSMIT (TX-ANT) MODE	**Unless otherwise noted: V_{CC}=5V, T=+25ºC, PA_EN=High, LNA_EN=Low, C_RX=Low**				
11ac VHT80 Output Power	MCS11 1024QAM		18		dBm
Dynamic EVM				-40	dB
11ac VHT160 Output Power	MCS9 256QAM		19		dBm
				-35	dB
11ac VHT80 Output Power	MCS9 256QAM	19	20.5		dBm
Dynamic EVM				-35	dB
11n HT20/40 Output Power	MCS7 64QAM	20	21		dBm
Dynamic EVM				-30	dB
Margin to VHT80 Spectral Mask	P_{OUT} = +23 dBm, 11ac MCS0		3	0	dBc
Margin to VHT20 Spectral Mask	P_{OUT} = +24 dBm, 11n MCS0		3	0	dBc

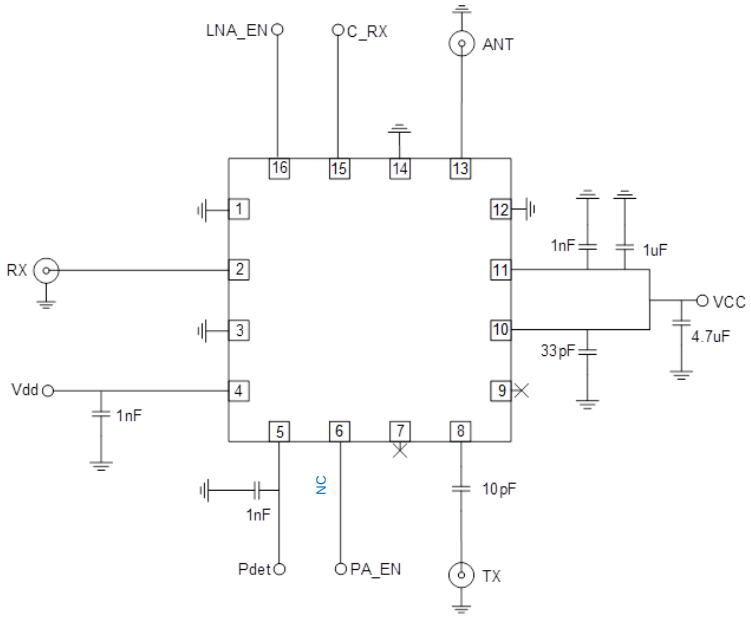
Gain		29	32		dB
Gain Flatness	Across any 80 MHz Channel	-0.25		+0.25	dB
	f = 1600-1950MHz			-30	
Out of Band Gain	*f* = 3200-3900MHz			-5	dB
	f > 7000MHz			10	dB
TX Port Return Loss			12		dB
ANT Port Return Loss			7		dB
Quiescent Current	RF Off		100	125	mA
Operating Current	P_{OUT} = +20 dBm		175	195	mA
	P_{OUT} = +24 dBm		240	265	mA
2nd Harmonics	P_{OUT} = +24 dBm 802.11a 6 MBps		-35	-30	dBm/MHz
3rd Harmonics	P_{OUT} = +24 dBm 802.11a 6 MBps		-45	-35	dBm/MHz
ANT-RX Isolation			35		dB
DC Power Detect Voltage	P_{OUT} = 0 dBm		0.22		V
	P_{OUT} = +20 dBm		0.47		V
	P_{OUT} = +24 dBm		0.67		V
RECEIVE (ANT-RX) LNA ON MODE	**Unless otherwise noted: V_{CC}=5V, T=+25ºC, PA_EN=Low, LNA_EN=High, C_RX=High**				
Gain		12.5	14		dB
Gain Flatness Across any 80 MHz Channel		-0.25		+0.25	dB
Out of Band Gain	*f* = 2400-2500 MHz		-15		dB
Noise Figure			2.5	3	dB
RX Port Return Loss			10		dB
ANT Port Return Loss			5		dB
Input P_{1dB}			3		dBm
Input IP3			3		dBm
Rx Operating Current			14	20	mA
RECEIVE (ANT-RX) BYPASS MODE	**Unless otherwise noted: V_{CC}=5V, T=+25ºC, PA_EN=Low, LNA_EN=Low, C_RX=High**				
Bypass Loss			5		dB
Loss Flatness Across any 80 MHz Channel		-0.25		+0.25	dB
Out of Band Gain	*f* = 2400-2500 MHz		-15		dB
RX Port Return Loss			20		dB
ANT Port Return Loss			12		dB
Input P_{1dB}			+20		dBm
Input IP3			+25		dBm

GENERAL SPECIFICATIONS	Unless otherwise noted: T=+25 degrees C				
FEM Leakage Current			80	200	µA
PA_EN Control Current			1	5	µA
LNA_EN Control Current			150	200	µA
C_RX Control Current			10	20	µA
TX Output P_{1dB}	CW		30		dBm
TX/RX ON/OFF Time	10<->90% Ref from Control Voltage to RF Power		200		nS
Stability - Output VSWR	CW No Spurious above -41.25 dBm/MHz		4:1		
Output Power Range		0		25	dBm
Thermal Resistance, θ_{jc}	Junction to case		30		°C/W

Notes: Unless otherwise noted: T=+25 degrees C

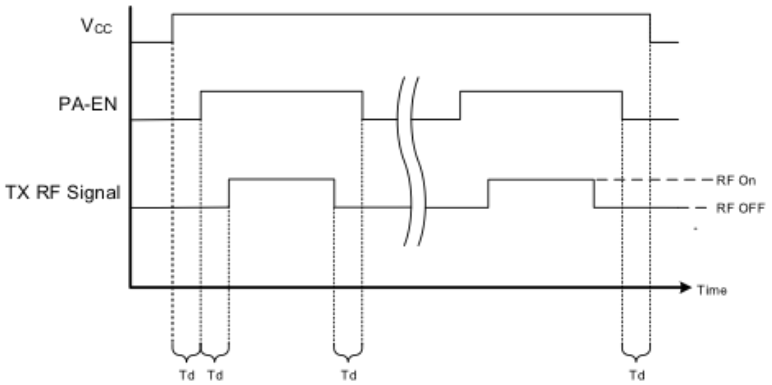
Operating Mode	PA_EN	LNA_EN	C_RX
Standby Mode	Low	Low	Low
Transmit Mode	High	Low	Low
LNA Mode	Low	High	High
Bypass Mode	Low	Low	High

Evaluation Board Schematic



Timing Diagram

RF/DC Power On/Off Sequence

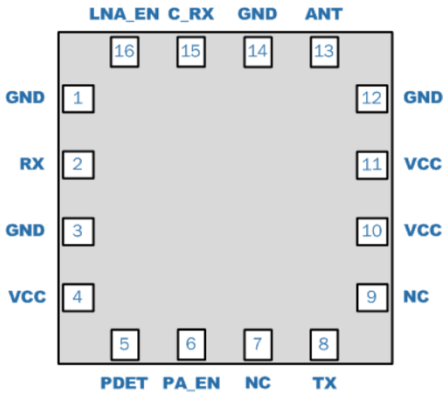


Note: Observe the timing sequence shown in the diagram above and described below.
DC and RF signal levels per data sheet specification

- Apply V_{CC} prior to turning on or pulsing PA enable.
- Turn off PA enable prior to turning off V_{CC}.

- Turn on PA enable prior to applying RF signal.
- Turn off RF signal prior to turning off PA enable.

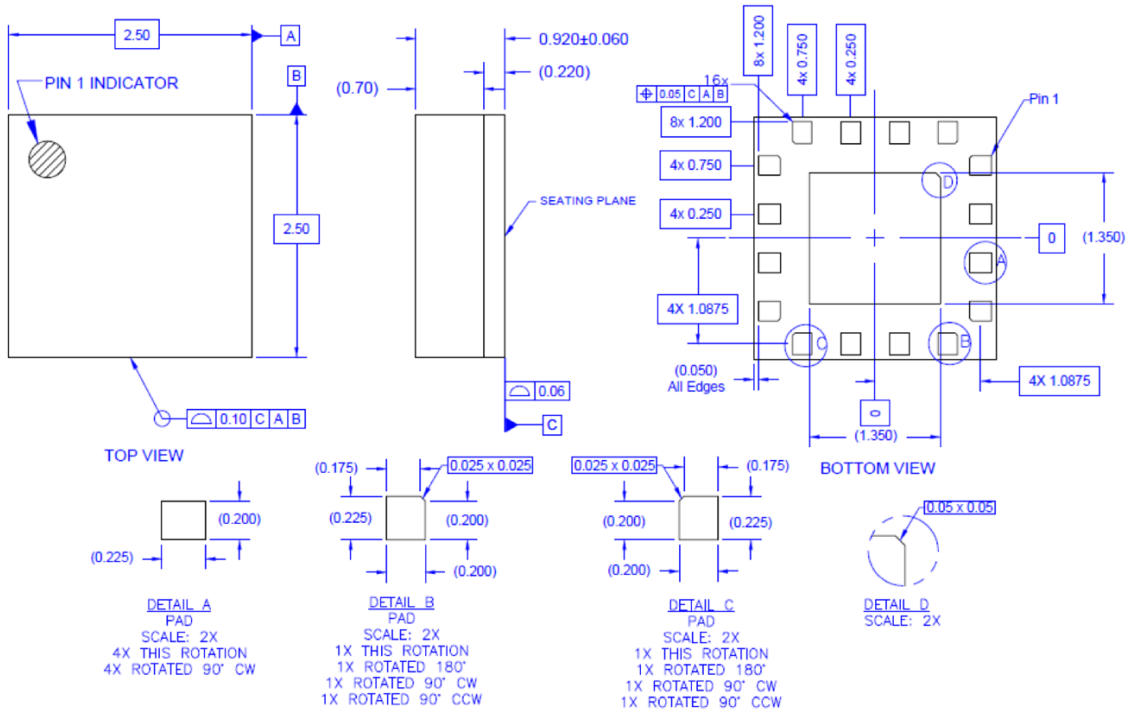
Pin Configuration and Description



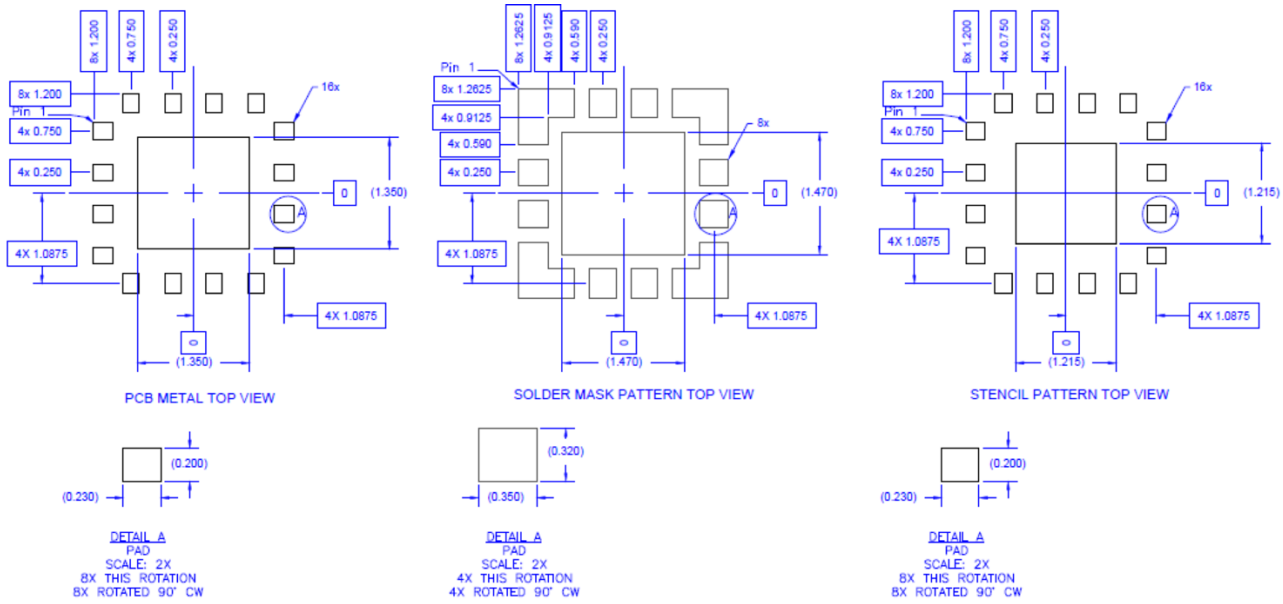
Top View

Pad No.	Label	Description
1	GND	Ground connection.
2	RX	RF output from the low noise amplifier. Internally matched to 50 Ω and DC blocked.
3	GND	Ground connection.
4	VCC	Supply voltage for LNA and regulator
5	PDET	DC power detector. Provides an output voltage proportional to the RF output power level.
6	PA_EN	Input enable bias voltage (Regulated internally)
7	NC	No electrical connection. It may be left floating or connected to ground.
8	TX	RF input. Internally matched to 50 Ω and DC Shorted.
9	NC	No electrical connection. It may be left floating or connected to ground.
10	VCC	1st & 2nd stage supply voltage.
11	VCC	3rd stage supply voltage.
12	GND	Ground connection.
13	ANT	RF bi-directional antenna port. Internally matched to 50 Ω and DC blocked.
14	GND	Ground connection.
15	C_RX	Transmit-receive control voltage.
16	LNA_EN	LNA control voltage.
Backside Paddle	GND	RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

Package Dimensions



PCB Mounting Pattern



Notes:
1. All dimensions are in millimeters. Angles are in degrees.

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	ANSI/ESD/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	JEDEC JESD22-C101
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes.
Solder profiles available upon request.

Contact plating: NiPdAu

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.
This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Tel: **1-844-890-8163**

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