

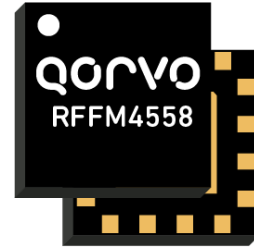
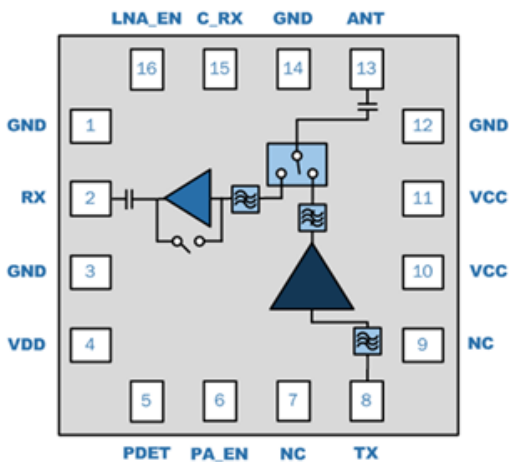
Product Description

The RFFM4558 provides a complete integrated solution in a single front end module (FEM) for Wi-Fi 802.11 a/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.

The RFFM4558 integrates a 5GHz power amplifier (PA), single-pole two-throw switch (SP2T) and a low noise amplifier (LNA) with bypass. Integrated filtering includes 2nd and 3rd harmonic as well as 2.4GHz rejection for dual-band dual-concurrent operation. The device is provided in a 2.5mm x 2.5mm x 0.98mm, 16-pin laminate package.

Functional Block Diagram



Package: Laminate, 16-pin,
2.5mm x 2.5mm x 0.98mm max

Feature Overview

- P_{OUT} = +20dBm, 802.11ac, VHT80 MCS9 at -35dB Dynamic EVM
- P_{OUT} = +21dBm, 802.11n, HT20/40 MCS7 at -30dB Dynamic EVM
- P_{OUT} = +24dBm, HT20 MCS0 at Spectral Mask Compliance
- 5V Operation
- Low Power Consumption <1W at +20dBm
- LNA Gain = 14dB
- Noise Figure = 2.3dB
- Bypass Loss = 5dB
- Input and Output Matched to 50Ω
- Integrated 2.4GHz Rejection Filter

Applications

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

Ordering Information

PART NUMBER	DESCRIPTION
RFFM4558SB	Sample bag with 5 pieces
RFFM4558SQ	Sample bag with 25 pieces
RFFM4558SR	7" Reel with 100 pieces
RFFM4558TR7	7" Reel with 2500 pieces
RFFM4558TR13-10K	13" Reel with 10,000 pieces
RFFM4558PCK-410	Assembled Evaluation Board + 5 pcs

Absolute Maximum Ratings

PARAMETER	RATING	UNIT
DC Supply Voltage (No RF Applied)	-0.5 to +6	V _{DC}
Control Voltage	-0.5 to +5	V _{DC}
DC Supply Current	500	mA
Storage Temperature	-40 to +150	°C
Maximum TX Input Power into 50Ω Load for 11a/n/ac (No Damage)	+10	dBm
Maximum RX Input Power - LNA On Mode (No Damage)	+10	dBm
Maximum RX Input Power – Bypass Mode (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. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied. This is an InGaP device designed for high duty cycle applications with T_J>30 °C over ambient

Nominal Operating Parameters

PARAMETER	MIN	TYP	MAX	UNIT	CONDITION
COMPLIANCE					802.11A, 802.11N, 802.11AC
Operating Frequency	5.180		5.925	GHz	
Extended Operating Frequency	4.9		5.925	GHz	
Operating Temperature	-40		+85	°C	
Power Supply V _{CC}	4.75	5	5.25	V	
Control Voltage-High	2.8	3.1	V _{CC}	V	PA_EN, LNA_EN, C_RX
Control Voltage-Low	0		0.2	V	PA_EN, LNA_EN, C_RX

TRANSMIT (TX-ANT) MODE					V_{CC}=5V, T=+25°C, f=5.18-5.925GHz, PA_EN=High, LNA_EN & C_RX=Low; Unless otherwise noted
11ac VHT80 Output Power	19	20		dBm	MCS9
Dynamic EVM		1.5	1.8	%	
		-36	-35	dB	
11n HT20/40 Output Power	20	21		dBm	MCS7
Dynamic EVM		2.5	3	%	
		-32	-30	dB	
Margin to 802.11ac 80MHz Spectral Mask		3	0	dBc	P _{OUT} = +23dBm, MCS0
Margin to 802.11n 20MHz Spectral Mask		3	0	dBc	P _{OUT} = +24dBm, MCS0
Large Signal Gain	29	32		dB	
	27	29		dB	T = +85°C
Out of Band Gain			-30	dB	f = 1600-1950MHz
			-5	dB	f = 3200-3900MHz
			10	dB	f > 7000MHz
Quiescent Current		100	125	mA	RF=Off

PARAMETER	MIN	TYP	MAX	UNIT	CONDITION
Operating Current		175	195	mA	P _{OUT} = 20dBm
		240	265	mA	P _{OUT} = 24dBm
TX Port Return Loss		12		dB	
ANT Port Return Loss		7		dB	
2 nd Harmonics		-35		dBm/MHz	P _{OUT} = 24dBm 802.11a 6Mbps
3 rd Harmonics		-45		dBm/MHz	P _{OUT} = 24dBm 802.11a 6Mbps
ANT-RX Isolation	25			dB	
Power Detector Voltage		0.22		mV	P _{OUT} = 0dBm
		0.47		mV	P _{OUT} = +20dBm
		0.67		mV	P _{OUT} = +24dBm

RECEIVE (ANT-RX) LNA ON MODE					V _{CC} =5V, T=+25°C, f=5.18-5.925GHz, PA_EN=Low, LNA_EN & C_RX=High; Unless otherwise noted
Gain	12.5	14		dB	
	10.5	12		dB	T = +85°C
Out of Band Gain		-15	-13	dB	f = 2400-2500MHz
Noise Figure		2.3	2.9	dB	
RX Operating Current	9.5	13		mA	
RX Port Return Loss		10		dB	
ANT Port Return Loss		5		dB	
Input P ^{1dB}	-10	-5		dBm	
ANT-RX Isolation	25			dB	

RECEIVE (ANT-RX) BYPASS MODE					V _{CC} =5V, T=+25°C, f=5.18-5.925GHz, PA_EN & LNA_EN=Low, C_RX=High; Unless otherwise noted
Bypass Loss		5		dB	
RX Port Return Loss		20		dB	
ANT Port Return Loss		12		dB	
Input P ^{1dB}	+15	+20		dBm	
ANT-RX Isolation	40			dB	

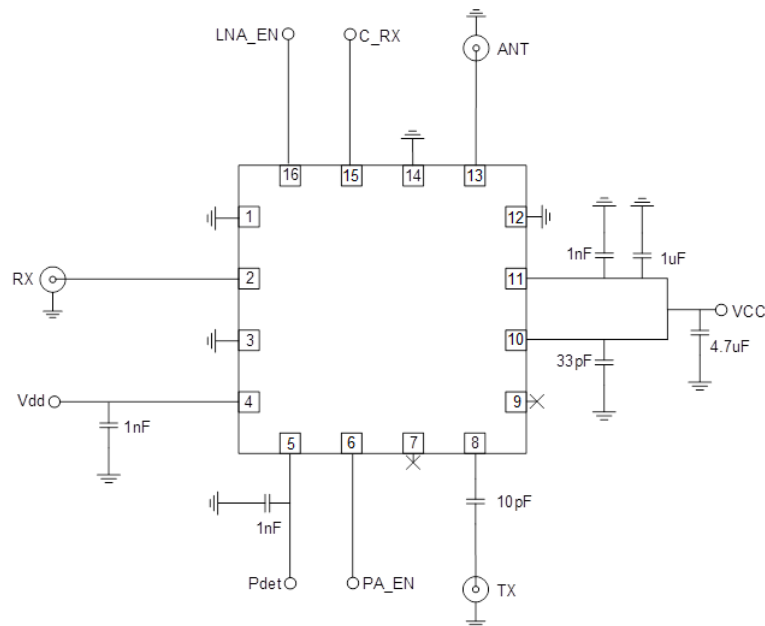
PARAMETER	MIN	TYP	MAX	UNIT	CONDITION
GENERAL SPECIFICATIONS					
FEM Leakage Current		8	250	μA	
PA_EN Control Current		1	5	μA	
LNA_EN Control Current		150	200	μA	
C_RX Control Current		10	20	μA	
PA Turn-On Time		500		nS	10%<->90%; Referencing from control voltage to RF power
LNA Turn-On Time		500		nS	
PA Stability	Unconditional into 4:1 VSWR; No spurs above -50dBm/MHz				

Switch Control Logic Truth Table

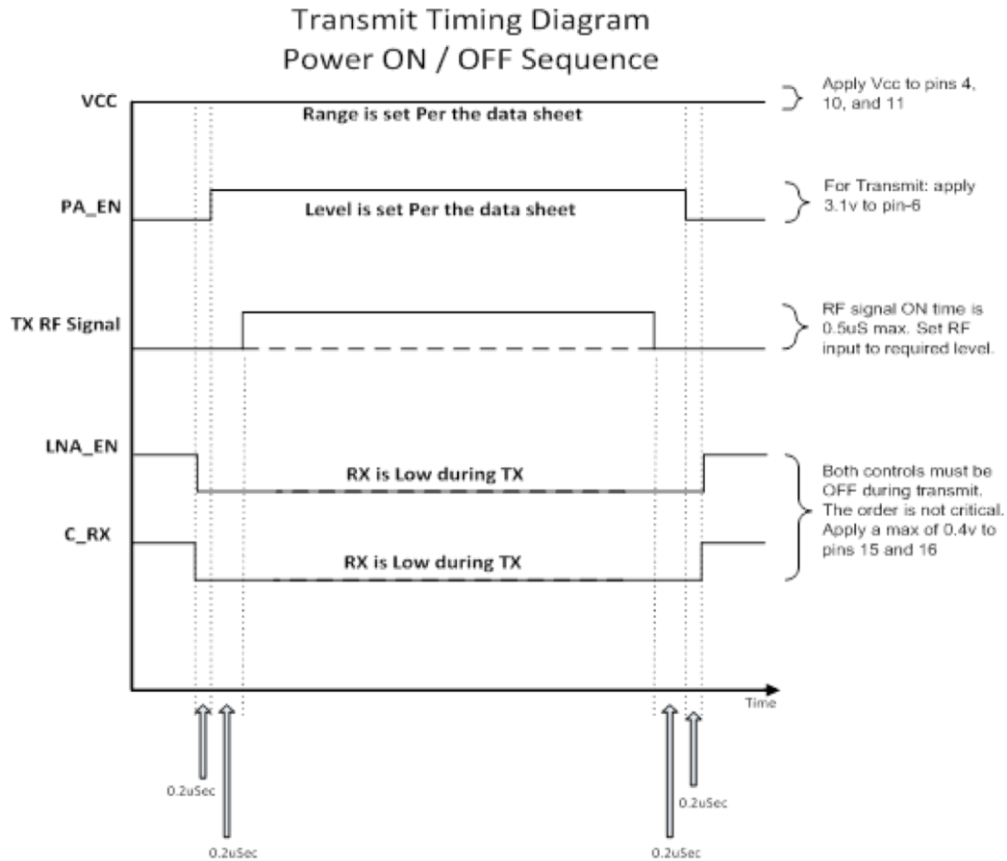
OPERATING MODE	PA_EN	LNA_EN	C_RX
Standby Mode	Low	Low	Low
Transmit Mode	High	Low	Low
LNA Mode	Low	High	High
Bypass Mode	Low	Low	High

Note:
High = 2.8 to V_{cc}. Low = 0V to 0.2V.

Evaluation Board Schematic

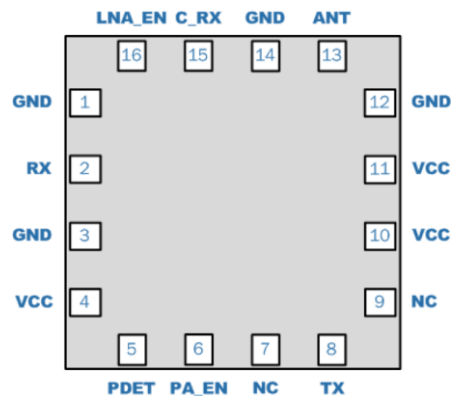


Transmit Timing Diagram



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

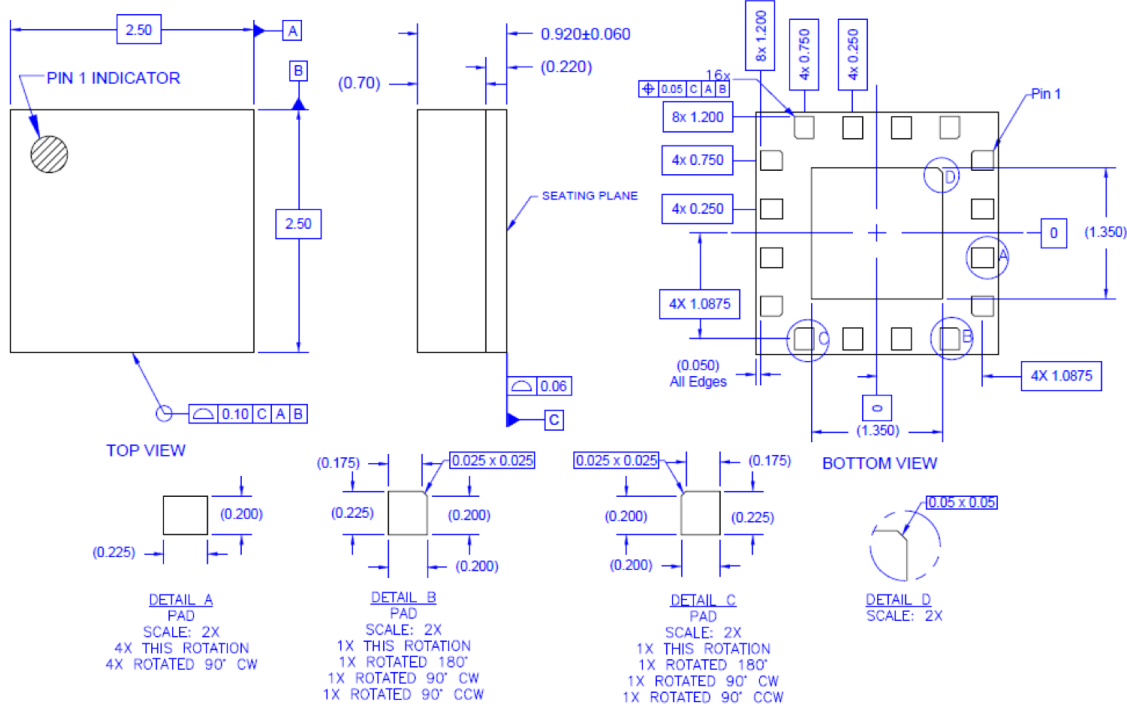
Pin Out



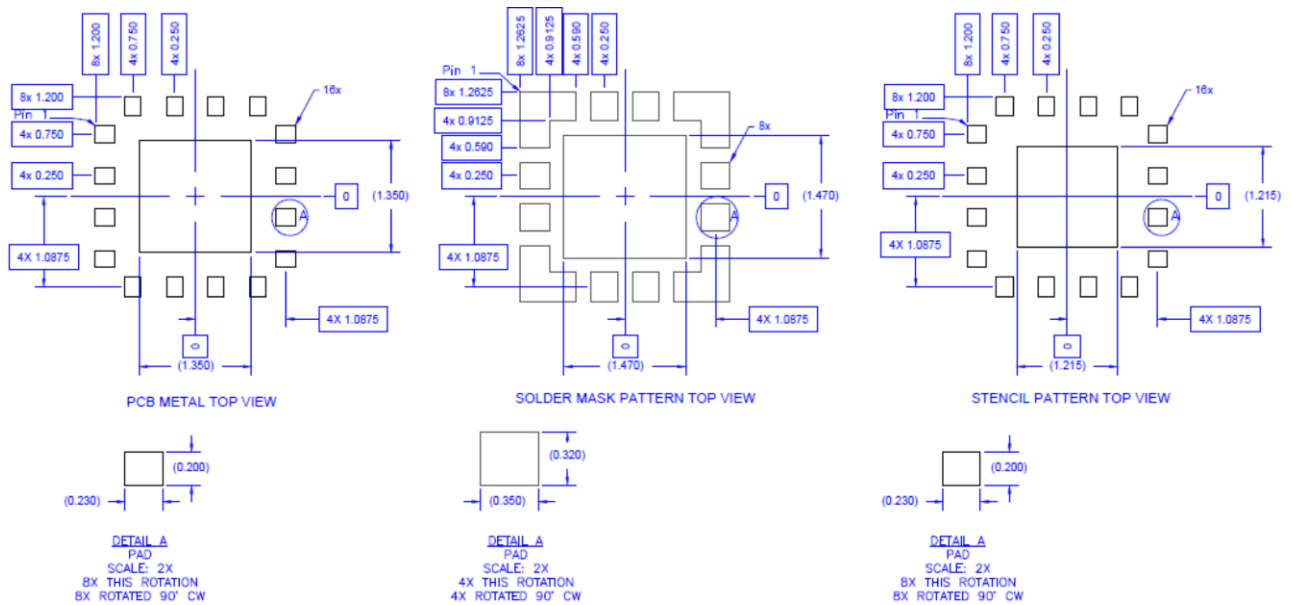
Pin Names and Descriptions

PIN	NAME	DESCRIPTION
1	GND	Ground connection
2	RX	RF output port for the LNA. This port is matched to 50Ω and DC blocked internally.
3	GND	Ground connection.
4	VCC	Supply voltage for the LNA and PA Regulator. See applications schematic for biasing and bypassing components.
5	PDET	Power Detector voltage for the TX path. May need external series R/shunt C to adjust voltage level and to filter RF noise.
6	PA_EN	Control voltage for the PA and TX switch. See Switch Control Logic Truth Table for proper voltage settings.
7	NC	No connect. This pin is not connected internally and can be left floating or connected to ground.
8	TX	RF input port for the PA. This port is matched to 50Ω and DC shorted internally.
9	NC	No connect. This pin is not connected internally and can be left floating or connected to ground.
10	VCC	Supply voltage for the 1 st and 2 nd stages of the PA. See applications schematic for biasing and bypassing components.
11	VCC	Supply voltage for the final stage of the PA. See applications schematic for biasing and bypassing components.
12	GND	Ground connection
13	ANT	RF bi-directional antenna port matched to 50Ω and DC blocked internally.
14	GND	Ground connection
15	C_RX	Transmit-Receive Switch control pin. See Switch Control Logic Truth Table for proper voltage settings.
16	LNA_EN	Control voltage for LNA. When this pin is set to a Low logic state, the Bypass Mode is enabled. See Switch Control Logic Truth Table for proper voltage settings.
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.

Package Outline (Dimensions in millimeters)



PCB Mounting Pattern (Dimensions in millimeters)



Product Compliance Information



Caution! ESD-Sensitive Device

ESD Sensitivity Ratings

ESD Rating: Class 1B
Voltage: Passes $\geq 500V$ to $< 1000V$
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class C3
Voltage: Passes $\geq 1000V$
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

MSL Rating

MSL Rating: Level 3
Test: $260^{\circ}C$ convection reflow
Standard: JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with both lead-free ($260^{\circ}C$ max. reflow temperature) and tin/lead ($245^{\circ}C$ max. reflow temperature) soldering processes.

RoHS Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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