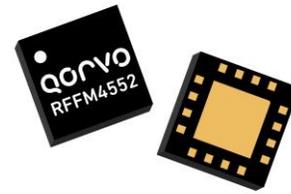


Product Description

The RFFM4552 provides a complete integrated solution in a single front end module (FEM) for Wi-Fi 802.11a/n/ac systems. The ultra-small factor and integrated matching minimizes layout area in the customer's application and greatly reduces the number of external components. Performance is focused on linear output power under a number of conditions including duty cycle and packet length while balancing power consumption needs of leading edge device platforms. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturing cost.

The RFFM4552 integrates a 5GHz power amplifier (PA), single pole two throw switch (SP2T) and an LNA with bypass. Also this FEM includes integrated 2nd and 3rd Harmonic filters and integrated out of band rejection filters. The device is provided in a 3.0mm x 3.0mm x 0.98mm, 16-pin package. This module meets or exceeds the RF front end needs of IEEE 802.11a/n/ac Wi-Fi RF systems.

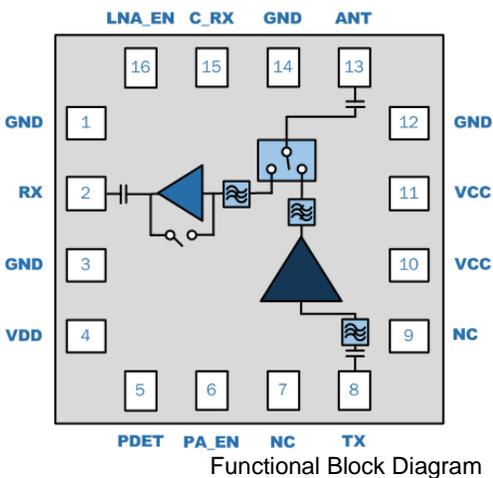


Package: Laminate, 16-pin
3.0mm x 3.0mm x 0.98mm

Feature Overview

- 5.0V Operation
- P_{OUT} = +20dBm, 802.11ac, 80MHz MCS9 at 1.8% Dynamic EVM
- P_{OUT} = +21dBm, 802.11n, MCS7 HT20/40 at 3.0% Dynamic EVM
- P_{OUT} = +24dBm, MCS0 HT20 at Spectral Mask Compliance
- High efficiency
- Input and Output Matched to 50Ω
- Integrated 5GHz PA, SP2T, LNA with Bypass and power detector.
- Integrated RX notch filter @ 2.5GHz for DBDC operation.
- High Impedance PA Enable

Functional Block Diagram



Applications

- Customer Premise Equipment
- Set-Top Boxes
- Netbooks/Notebooks
- Mobile Routers/Access Points
- Data Cards
- TV/Monitors/Video

Ordering Information

PART NUMBER	DESCRIPTION
RFFM4552SB	Standard 5 piece sample bag
RFFM4552SQ	Standard 25 piece sample bag
RFFM4552SR	Standard 100 piece reel
RFFM4552TR7	Standard 2500 piece reel
RFFM4552PCK-410	Fully assemble EVB + 5pcs sample bag

Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage (No RF Applied)	-0.5 to +6.0	V _{DC}
PA Enable 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 (No Damage)	+10	dBm
LNA On Maximum RX input power (No damage)	+5	dBm
Bypass Mode Maximum RX input power (No damage)	+25	dBm
Moisture Sensitivity	MSL3	

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 PA designed for high duty cycle applications with T_J>100°C

Electrical Specifications

Parameter	Condition	Min	Typ	Max	Unit
Compliance	802.11a, 802.11n, 802.11ac				
Operating Frequency		5.18		5.925	GHz
Extended Frequency		4.9		5.925	GHz
Operating Temperature		-40		+85	°C
Power Supply V _{CC}		4.75	5	5.25	V
Control Voltage-High	PA_EN, LNA_EN, C_RX	2.8	3.1	V _{CC}	V
Control Voltage-Low	PA_EN, LNA_EN, C_RX		0	0.2	V
Transmit (TX-ANT) High Power Mode	V _{CC} =5V, T=+25°C, f = 5.15 -5.925 GHz PA_EN= High, LNA_EN & C_RX=Low; Unless otherwise noted				
802.11ac 80MHz Output Power	MCS9	19	20		
Dynamic EVM			1.5	1.8	%
			-36	-35	dB
802.11ac 160MHz Output Power	MCS9		19		
Dynamic EVM			1.5	1.8	%
			-36	-35	dB
802.11a/n 20/40MHz Output Power	54Mbps/MCS7	20	21		
Dynamic EVM			2.5	3	%
			-32	-30	dB
Margin to 802.11ac 80MHz Spectral Mask	P _{OUT} = +23dBm, MCS0		3	0	dBc
Margin to 802.11ac 20 MHz Spectral Mask	P _{OUT} = +24dBm, MCS0		3	0	dBc
Large Signal Gain		30	32		dB
	T = 85°C	27	29		
TX Port Return Loss			-12	-7	dB
ANT Port Return Loss			-12	-7	dB

Parameter	Condition	Min	Typ	Max	Unit
Operating Current	$P_{OUT} = 20\text{dBm}$, 802.11ac MCS9 HT80, $T = 25^{\circ}\text{C}$, $V_{CC} = 5.0\text{V}$		175	195	mA
	$P_{OUT} = 24\text{dBm}$, 802.11n MCS0 HT20, $T = 25^{\circ}\text{C}$, $V_{CC} = 5.0\text{V}$ $T = 25^{\circ}\text{C}$, $V_{CC} = 5.0\text{V}$		240	265	mA
Quiescent Current	RF=Off, TX mode		100	125	mA
2 nd Harmonics	$P_{OUT} = +24\text{dBm}$ 802.11a 6MBps		-35	-30	dBm/MHz
3 rd Harmonics	$P_{OUT} = +24\text{dBm}$ 802.11a 6MBps		-45	-35	dBm/MHz
Power Detector Voltage	$P_{OUT} = +10\text{dBm}$		0.22		V
	$P_{OUT} = +20\text{dBm}$		0.47		V
	$P_{OUT} = +24\text{dBm}$		0.67		
Out Of Band Gain	@ 1.60 to 1.95 GHz		-40	-30	dB
	@ 3.2 to 3.9GHz		-15	-5	dB
	@ 7GHz		5	10	dB
ANT-RX Isolation	FEM in TX mode	25	40		dB
Receive (ANT-RX) LNA On	$V_{CC}=5.0\text{V}$, $T=25^{\circ}\text{C}$, $f = 5.15\text{GHz} - 5.925\text{GHz}$ $PA_EN= \text{Low}$, $LNA_EN \& C_RX=High$; Unless otherwise noted				
Gain		12.5	14		dB
	$T = 85^{\circ}\text{C}$	10.5	12		dB
Out Of Band Gain	@ frequency = 2.4 to 2.5GHz		-15	-13	dB
Noise Figure			2.3	2.9	dB
Rx Port Return Loss			-10		dB
ANT Port Return Loss			-7		dB
Input $P_{1\text{dB}}$		-10	-5		dBm
ANT-TX Isolation	FEM is in RX LNA on Mode		-30	-25	dB
RX Operating Current		9.5	13		mA
Receive (ANT-RX) Bypass Mode	$V_{CC}=5.0\text{V}$, $T=25^{\circ}\text{C}$, $f = 5.15\text{GHz} - 5.925\text{GHz}$ $PA_EN= \text{Low}$, $LNA_EN = \text{Low} \& C_RX=High$; Unless otherwise noted				
Bypass Loss			-5		dB
RX Port Return Loss			-20		dB
ANT Port Return Loss			-15		dB
Input $P_{1\text{dB}}$		15	20		dBm
ANT-TX Isolation	FEM is in RX bypass Mode		-50	-40	dB
General Specifications	$V_{CC}=5.0\text{V}$, $T=25^{\circ}\text{C}$, $f = 5.15\text{GHz} - 5.925\text{GHz}$ Unless otherwise noted				
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
Tx to Rx Switching Speed				300	nS
ESD – Human Body Model		500			V

Parameter	Condition	Min	Typ	Max	Unit
ESD – Charge Device Model		1000			V
PA Turn-on Time from PA_EN edge	10% to 90% of final gain		200	500	nS
PA Stability	Unconditional into 4:1 VSWR; No spurs above -50dBm/MHz				

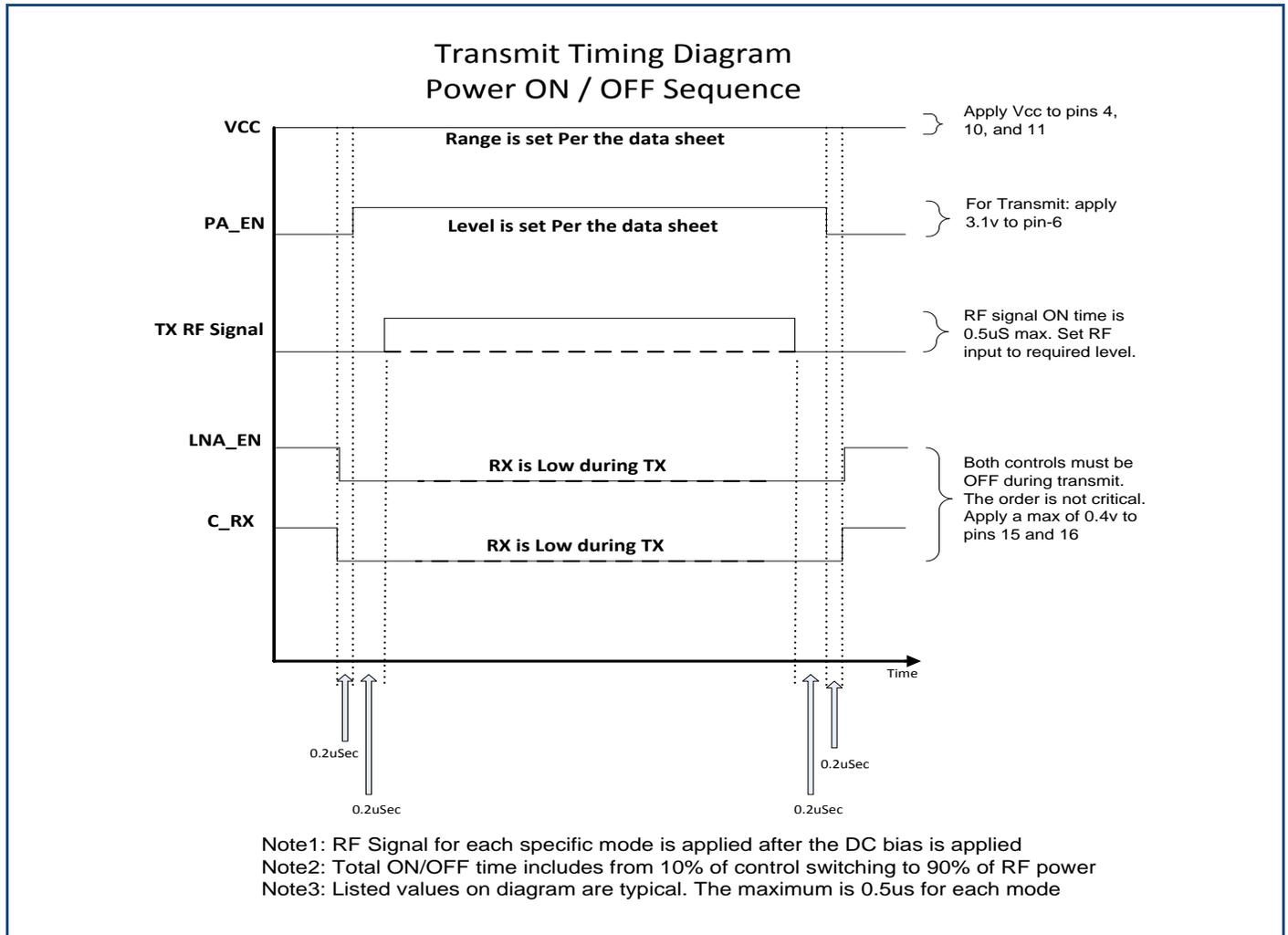
Switch Control Logic Truth Table

Operating Mode	PA_EN	LNA_EN	C_RX
Standby	Low	Low	Low
802.11a/n/ac TX High Power Mode	High	Low	Low
802.11a/n/ac RX Gain	Low	High	High
802.11a/n/ac RX Bypass	Low	Low	High

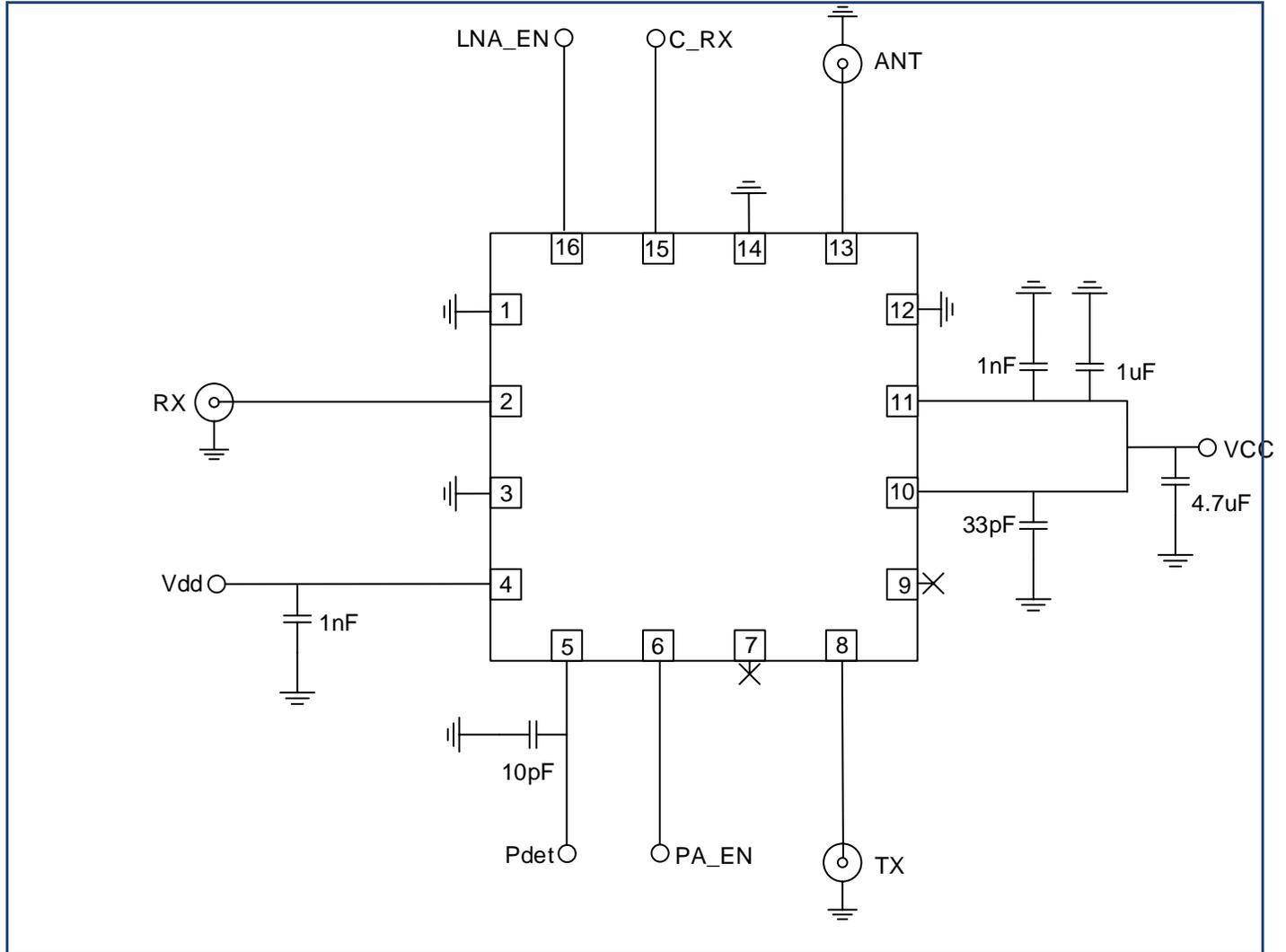
Notes:

- PA_EN and TX switch control lines are tied together internally.
- High = 2.8 to VCC.
- Low = 0V to 0.2V.

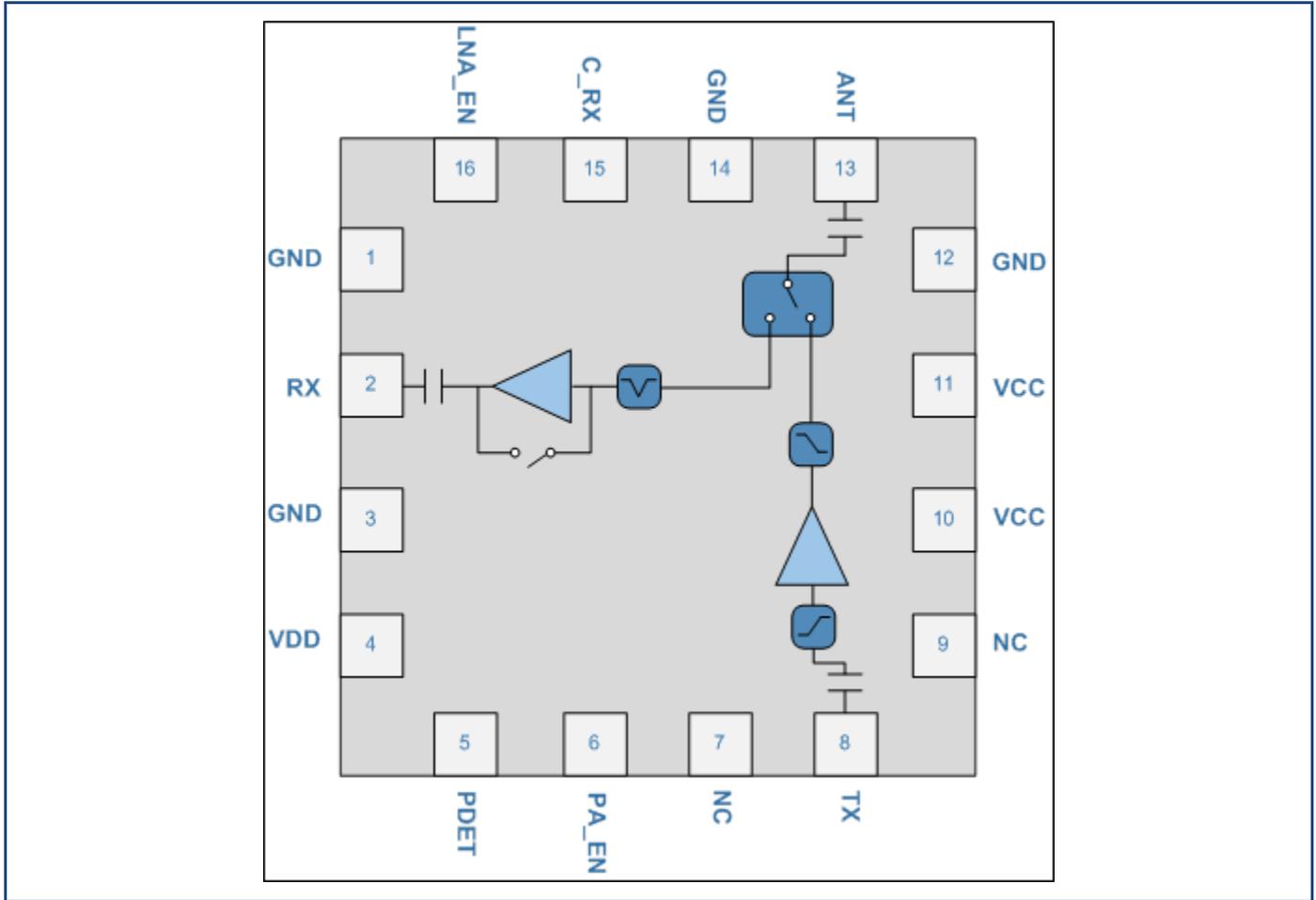
Timing Diagrams



Evaluation Board Schematic



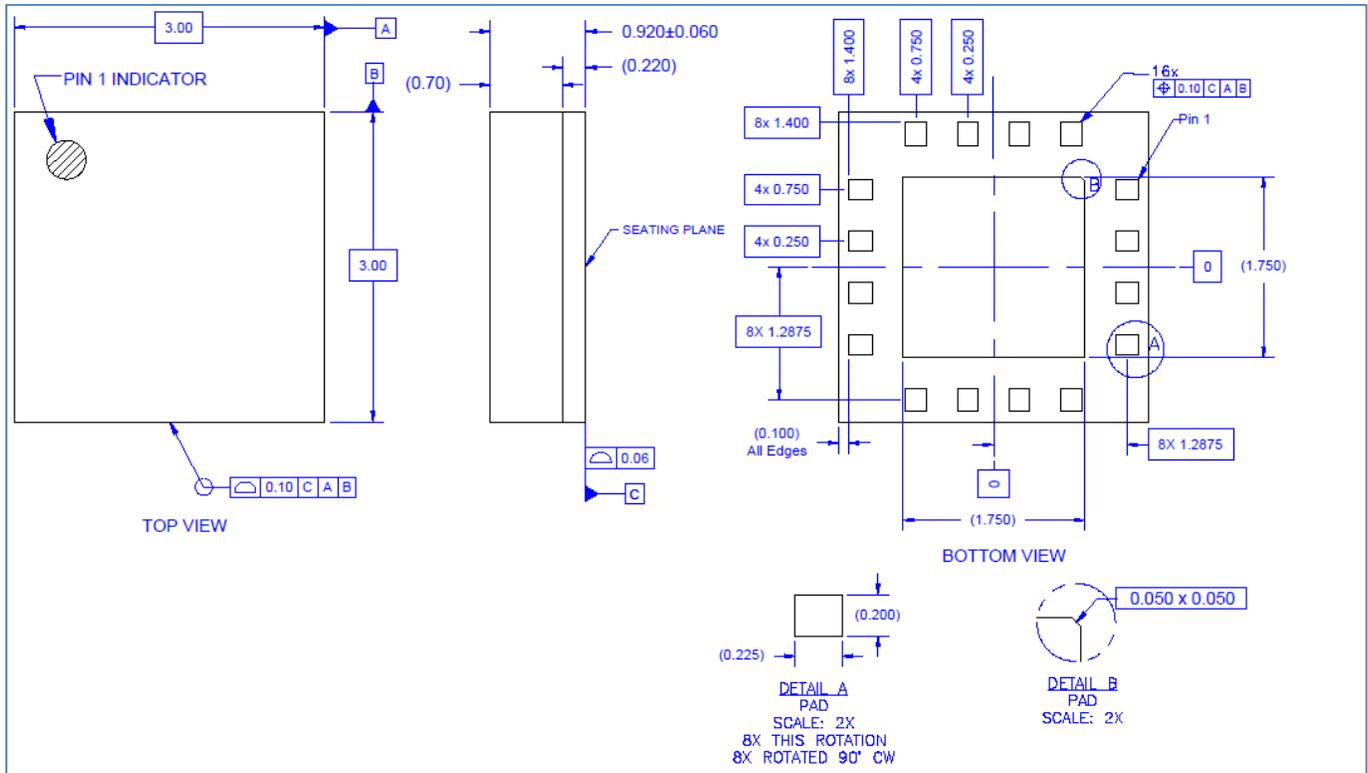
Pin Out



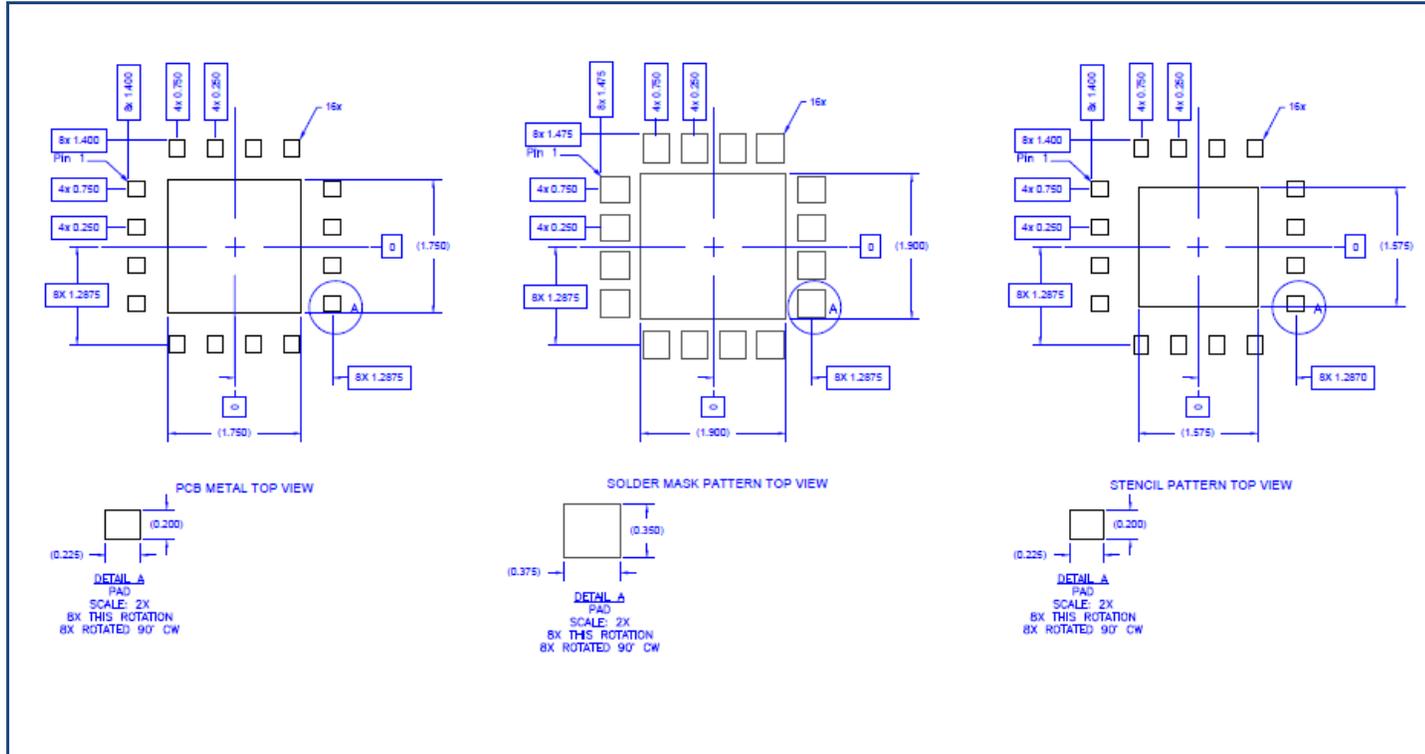
Pin Names and Descriptions

Pin	Name	Description
1	GND	Ground connection
2	RX	RF output port for the 802.11a/n/ac LNA. This port is matched to 50Ω and DC block is provided internally.
3	GND	Ground connection
4	VDD	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 truth table for proper 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 802.11a/n PA. Input is matched to 50Ω and DC block is provided 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 PA. See applications schematic for biasing and bypassing components.
11	VCC	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
12	GND	Ground connection
13	ANT	RF bidirectional antenna port matched to 50Ω and DC block is provided internally.
14	GND	Ground connection
15	CRX	Receive switch control pin. See truth table
16	LNA_EN	Control voltage for the LNA. When this pin is set to a low logic state, the bypass mode is enabled.
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 Drawing



PCB Pattern



Handling Precautions

PARAMETER	RATING	STANDARD
ESD – Human Body Model (HBM)	Class 1A	ESDA / JEDEC JS-001-2012
ESD – Charged Device Model (HBM)	Class C3	JEDEC JESD22-C101F
MSL – Moisture Sensitivity Level	Level 3	JEDEC IPC/JEDEC J-STD-02020



Caution! ESD sensitive device



ESD Sensitivity Ratings

ESD Rating: Class 1A
 Voltage: 250 V to < 500 V
 Test: Human Body Model (HBM)
 Standard: ESDA / JEDEC Standard JS-001-2012

ESD Rating: Class C3
 Voltage: Passes \geq 1000 V
 Test: Charged Device Model (CDM)
 Standard: JEDEC Standard JESD22-C101F

MSL Rating

MSL Rating: Level 3
 Test: 260°C convection reflow
 Standard: JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with both lead-free and tin/lead reflow solder processes. Recommended solder profiles are available at www.qorvo.com

RoHS Compliance

The 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 and Bromine)
- Antimony Free
- TBBP-A Free
- PFOS Free
- SVHC Free
- Qorvo Green



Contact Information

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