

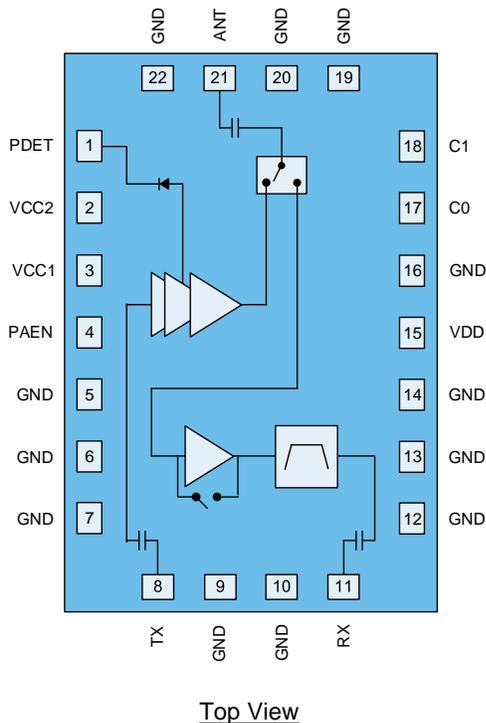
General Description

The QPF7221 provides a complete integrated solution in a single front end module (FEM) for Wi-Fi 802.11b/g/n/ac/ax systems. The small form factor and integrated matching minimizes layout area in the application and greatly reduces the number of external components.

The FEM allows true 5V supply without any modifications to the supply lines and performance is a balance of maximizing on highest linear output power and leading edge throughput. The FEM also provides state of the art LTE coexistence Rx immunity for maximum range and coverage by integrating high performance temperature stable BAW filtering on receive chain.

The QPF7221 integrates a 2GHz power amplifier (PA), single pole two throw switch (SP2T) and bypassable low noise amplifier (LNA) and an Rx BAW filter into a single device.

Functional Block Diagram



22 Pad 3 x 4.5 x 1 mm Laminate Package

Product Features

- 2.4GHz Wi-Fi Channel 1 through 13
- Integrated Rx coexistence BAW with 40 dB rejection in LTE bands & 5GHz
- $P_{OUT} = +22\text{dBm}$ MCS7 HT40 -30dB Dynamic EVM
- $P_{OUT} = +21\text{dBm}$ MCS8 HT40 -35dB Dynamic EVM
- $P_{OUT} = +18\text{dBm}$ MCS11 HE40 -43dB Dynamic EVM
- $P_{OUT} = +25\text{dBm}$ MCS0 Spectral Mask Compliance
- Optimized for +5 V supply (supports 3.3V operation)
- 34 dB Tx Gain
- 2.0 dB Noise Figure
- 15 dB Rx Gain & 10.5 dB Bypass Loss

Applications

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

Ordering Information

Part No.	Description
QPF7221SB	Sample bag with 5 pieces
QPF7221SQ	Sample bag with 25 pieces
QPF7221SR	7" reel with 100 pieces
QPF7221TR13	13" reel with 5000 pieces
QPF7221PCK-01	Assembled Evaluation Board

Absolute Maximum Ratings

Parameter	Rating
DC Supply Voltage	+6 V
DC Supply Current	550 mA
Storage Temperature	-40 to +150 °C
T _{junction} (MTTF>0.7x10 ⁶ hours)	150 °C
TX RF Input Power into 50 Ω Load for 802.11b/g/n/ac (No Damage)	+10 dBm
RX LNA On RF Input Power (No Damage)	+10 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.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Operating Frequency	2412		2484	MHz
Device Voltage (V _{CC})	3.3	+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}	-10		+85	°C
Extended T _{OPERATING}	-20		+85	°C

* T_{OPERATING} is temperature at package ground

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=+25°C, PA_EN=High, C0=Low, C1=High, CH1-11					
11ax HE20/40 Output Power	MCS11 1024QAM	17.5	19		dBm
Dynamic EVM			-40	-38	dB
11ac HT20/40 Output Power	MCS8 256QAM	20	21		dBm
Dynamic EVM			-35	-33	dB
11n HT20/40 Output Power	MCS7 64QAM	21	22		dBm
Dynamic EVM			-30	-28	dB
Margin to HT20/40 Spectral Mask	P _{OUT} = +24 dBm, 11ac MCS8		3	0	dBc
Margin to 802.11b Spectral Mask	P _{OUT} = +25 dBm, DSSS 1Mbps		3	0	dBc
Gain	Small signal	30	34		dB
FCC Restricted Band Edge Emissions (2390 & 2483.5MHz)	P _{OUT} = +18 dBm, MCS7 11n HT20 Conducted measurement		-50		dBm/MHz
Gain Variation	Any 40MHz Channel T = -10 to +85 °C	-0.5		+0.5	dB
Out of Band Gain	f = 1206-1242MHz		-15		dB
	f = 3618-3726MHz		-2		dB
TX Port Return Loss			10		dB
ANT Port Return Loss			10		dB
Quiescent Current	RF Off		210	235	mA
Operating Current	P _{OUT} = +20 dBm		245	275	mA
	P _{OUT} = +22 dBm		265	295	
	P _{OUT} = +25 dBm		350	395	
2 nd Harmonics	P _{OUT} = +25 dBm 802.11b DSSS 1Mbps		-35		dBm/MHz
3 rd Harmonics	P _{OUT} = +25 dBm 802.11b DSSS 1Mbps		-35		dBm/MHz
DC Power Detect Voltage	RF Off		0.25		V
	P _{OUT} = +21 dBm		0.72		V
	P _{OUT} = +26 dBm		0.97		V



QPF7221

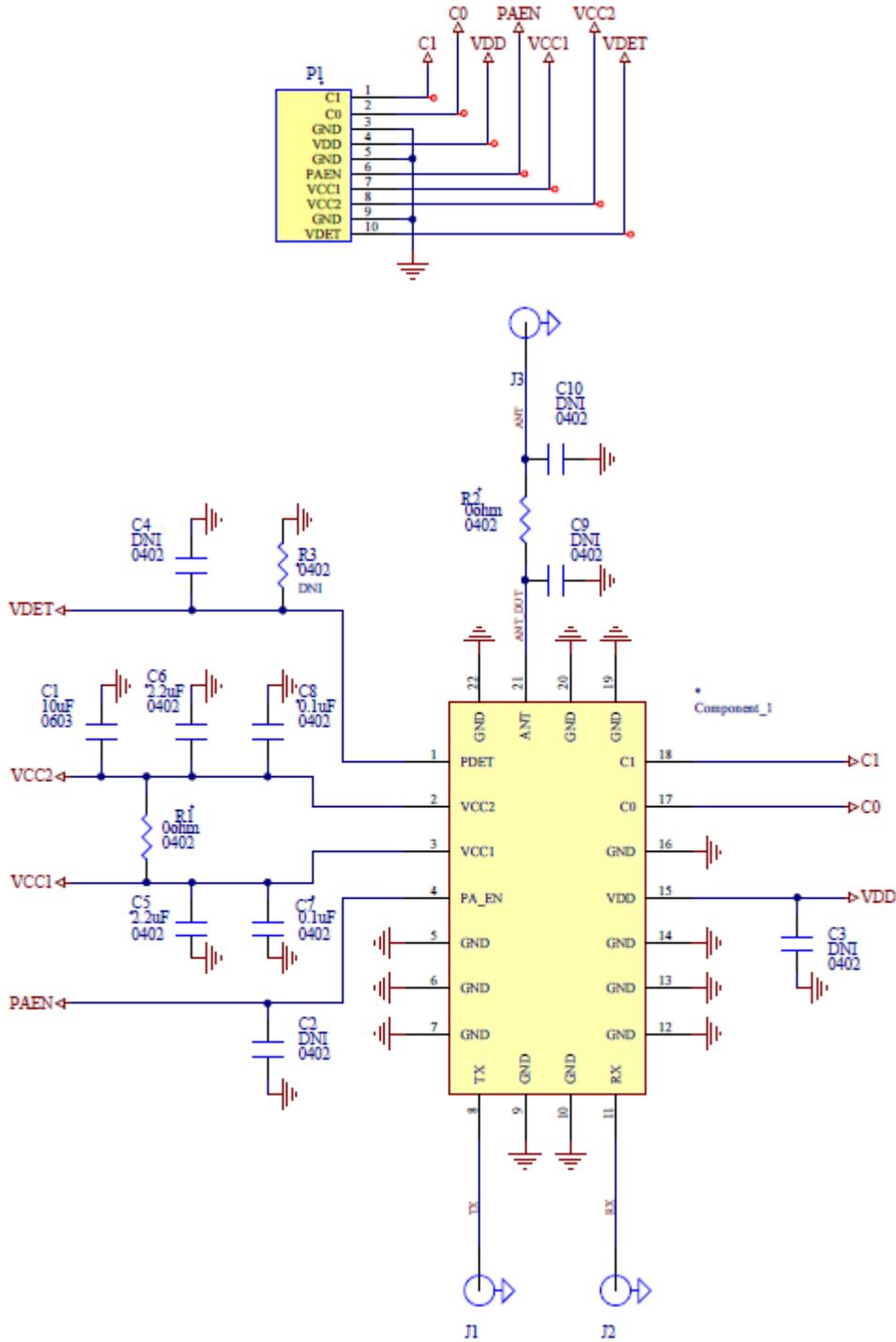
2.4GHz Wi-Fi Front End Module (iFEM)

RECEIVE (ANT-RX) LNA ON MODE	Unless otherwise noted: V _{CC} =5V, T=+25°C, PA_EN=Low, C0=High, C1=Low				
Gain			15		dB
Gain Flatness	From 2412 to 2472 MHz	-1		+1	dB
Out of Band Gain (High Gain Mode)	2170 MHz		-35		dB
	2300 – 2375 MHz (LTE B40)		-44		dBc
	2496 – 2690 MHz (LTE B41)		-28		dBc
	2500 – 2570 MHz		-35		dBc
	4800 – 6000 MHz		-60		dBc
Noise Figure			2.2	2.5	dB
RX Port Return Loss			9		dB
ANT Port Return Loss			8		dB
Input IP3 – LNA mode	LNA Enabled		+10		dBm
Input P _{1dB}			-1.5		dBm
Rx Operating Current			17	22	mA
RECEIVE (ANT-RX) BYPASS MODE	Unless otherwise noted: V _{CC} =5V, T=+25°C, PA_EN=Low, C0=High, C1=High				
Bypass Loss			10.5	13	dB
RX Port Return Loss			10		dB
ANT Port Return Loss			5		dB
Input P _{1dB}		+10	+11.5		dBm
Bypass Current			600		μA
GENERAL SPECIFICATIONS	Unless otherwise noted: V _{CC} =5V, T=+25°C				
FEM Leakage Current			35		μA
PA_EN Control Current			60		μA
LNA_EN Control Current			60		μA
C_RX Control Current	LNA On Mode		90		μA
	Bypass Mode		3		μA
Ramp ON/OFF Time	10<->90% Ref from Control Voltage to RF Power		250	500	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 MCS0 Pout = 25dBm (75% duty Cycle)		40		°C/W

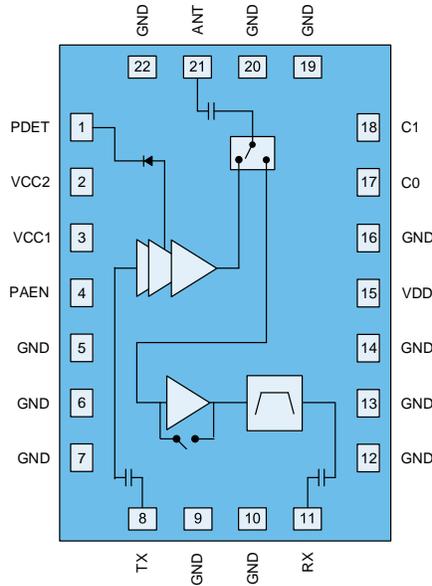
Notes:

Operating Mode	PA_EN	C0	C1
Standby Mode	Low	Low	Low
Transmit Mode	High	Low	High
LNA Gain Mode	Low	High	Low
LNA Bypass Mode	Low	High	High

Evaluation Board Schematic



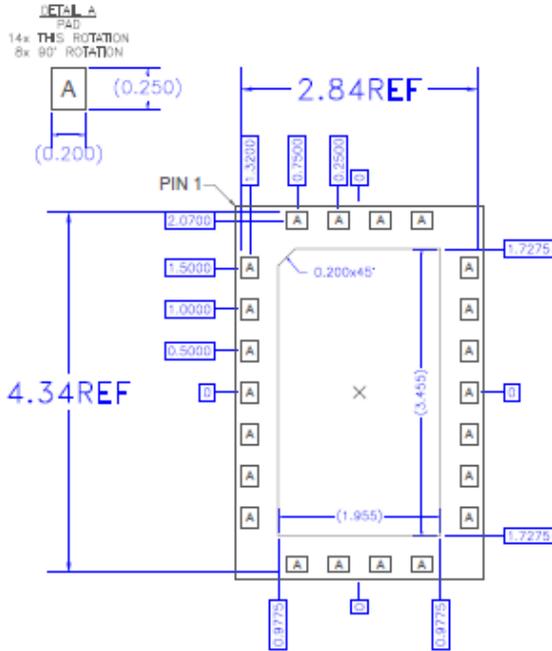
Pin Configuration and Description



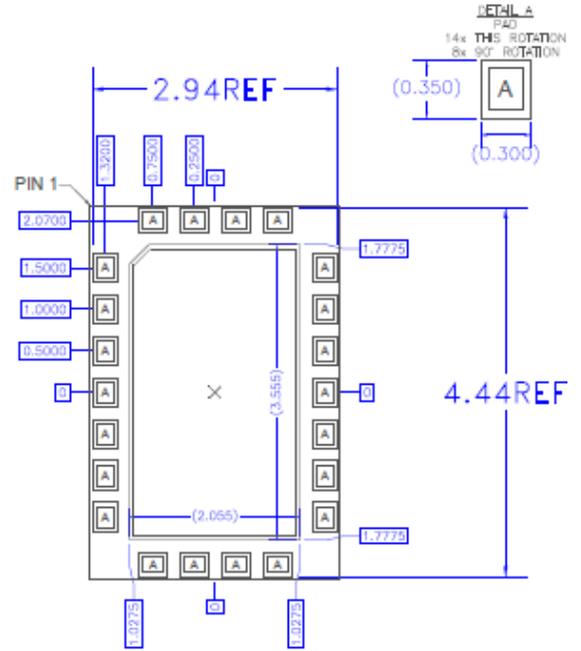
Top View

Pin Function Description		
1	PDET	Power detector output, DC
2	VCC2	DC supply to PA, range of 3.3V - 5.0V, 5.0V preferred
3	VCC1	DC supply to PA, range of 3.3V - 5.0V, 5.0V preferred
4	PAEN	Digital Control to enable/disable PA, 3.3V Logic
5	GND	Connect to GND on EVB
6	GND	Connect to GND on EVB
7	GND	Connect to GND on EVB
8	TX	WLAN transmit input to PA, internally matched to 50 Ohm for RF - DC blocked
9	GND	Connect to GND on EVB
10	GND	Connect to GND on EVB
11	RX	LNA or LNA-bypass output, internally matched to 50 Ohm for RF - DC blocked
12	GND	Connect to GND on EVB
13	GND	This pin is not connected internally. Qorvo recommends to connect this pin to ground.
14	GND	Connect to GND on EVB
15	VDD	DC supply to LNA, VDD range of 3.3V ~5.0V, 5.0V preferred
16	GND	This pin is not connected internally. Qorvo recommends to connect this pin to ground.
17	C0	Switch control 0, 3.3V Logic
18	C1	Switch control 1, 3.3V Logic
19	GND	This pin is not connected internally. Qorvo recommends to connect this pin to ground.
20	GND	This pin is not connected internally. Qorvo recommends to connect this pin to ground.
21	ANT	Antenna port, internally matched to 50 Ohm for RF - DC blocked
22	GND	This pin is not connected internally. Qorvo recommends to connect this pin to ground.
Pkg Base	GND	Ground connection. The backside of the package should be connected to a RF and DC ground plane through a short path, i.e., PCB vias under the device are required for RF, DC, and, thermal management.

PCB Mounting Pattern



**RECOMMENDED
LAND PATTERN**



**RECOMMENDED
LAND PATTERN MASK**

Notes:

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

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1C	ANSI/ESDA/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3	ANSI/ESDA/JEDEC JS-002
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: NiAu

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:

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

Contact Information

For the latest specifications, additional product information, worldwide sa

Tel: 1-844-890-8163

Web: www.qorvo.com

Email: customer.support@qorvo.com

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