

# RF5601

4.9GHz to 5.85GHz  
Low Noise Amplifier with Bypass

The RF5601 is a high performance Low Noise Amplifier designed for 802.11a/n/ac applications and other portable consumer electronics. The small form factor and high level of integration (input and output match, internal DC blocking capacitors) reduces the number of external components keeping cost down and minimizing layout area for implementation. The RF5601 is featured in a 2.2mm x 2.2mm x 0.5mm 8-pin QFN package.



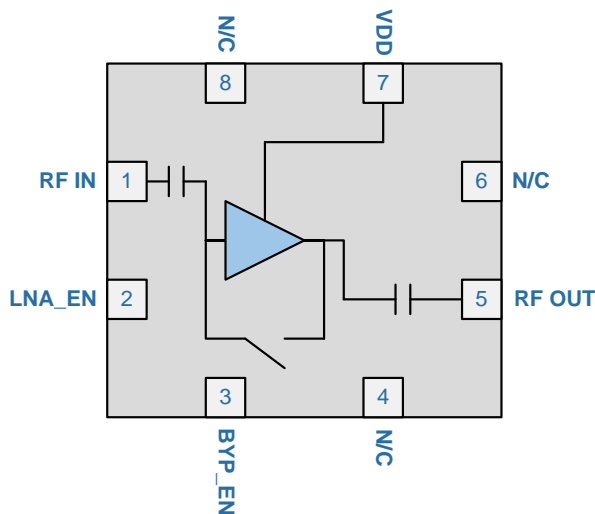
Package: QFN, 8-pin,  
2.2mm x 2.2mm x 0.5mm

## Features

- Single Supply Voltage 2.3V to 4.8V
- 1.8 dB Noise Figure
- 12 dB Typical Gain
- 5dB IL in Bypass Mode

## Applications

- 802.11a/n/ac WiFi Applications
- Consumer Electronics
- Mobile Devices
- Gaming
- General Purpose 5GHz LNA



Functional Block Diagram

## Ordering Information

RF5601	Standard 25 piece bag
RF5601SR	Standard 100 piece reel
RF5601TR7	Standard 2500 piece reel
RF5601PCK-410	Fully populated evaluation board w/ 5 piece bag

## Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage	5.5	V
RF Input Power	+5*	dBm
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Moisture Sensitivity	MSL2	

\*Note: Maximum input power with a 50Ω load in High Gain mode.



**Caution!** ESD sensitive device.



RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), 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.

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.

## Nominal Operating Parameters

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
<b>Typical Conditions</b>					<b>Temp = 25°C, V<sub>DD</sub> = 3.3V, LNA_EN = 3.3V, BYP_EN = 3.3V in high gain mode, BYP_EN = 0V in Bypass mode, Frequency = 4.9 GHz to 5.85 GHz unless otherwise noted</b>
Frequency	4.9		5.85	GHz	
DC Voltage Supply (V <sub>DD</sub> )	2.3	3.3	4.8	V	
LNA_EN Low			0.2	V	LNA OFF. See logic table for additional control settings.
LNA_EN High	2.3	3.3	VDD	V	LNA ON. BYP_EN control must be high simultaneously for High Gain Mode. See control table.
BYP_EN Low			0.2	V	Bypass mode ON. See logic table for more details.
BYP_EN High	1.8	3.3	VDD	V	Bypass mode OFF. See logic table for more details.
LNA Current					
LNA I <sub>DD</sub>		12	17	μA	LNA in "On" state, over full DC supply range, LNA_EN supply range and over normal operating temperature range (-20°C to 75°C)
		3	5	μA	LNA in "Off" state, V <sub>DD</sub> = 0V; LNA_EN = 0V, BYP_EN = 0V
LNA Enable		2	10	μA	V <sub>DD</sub> = 2.3V to 4.8V, LNA_EN = 2.3V to 4.8V, over full frequency range, and over normal operating temperatures - 20°C to +75°C
High Gain Mode					
Gain	9	12	15	dB	Over full V <sub>DD</sub> and LNA_EN ranges, over frequency and over full temperature range from -40°C to +85°C
Noise Figure					
Hi Gain Mode		1.8	2.6	dB	Over full V <sub>DD</sub> , LNA_EN, and BYP_EN voltages, over frequency and normal operating temperatures (-20°C to +75°C)
Bypass Mode					
Insertion Loss		5.0	7.0	dB	
Passband Ripple	-1.0		+1.0	dB	LNA is in High Gain mode, over full frequency range, over full V <sub>DD</sub> and LNA_EN voltage range
Input IP3		+9		dBm	High Gain mode
RF Port Return Loss	9.6	15.0		dB	Input and output. No external matching.

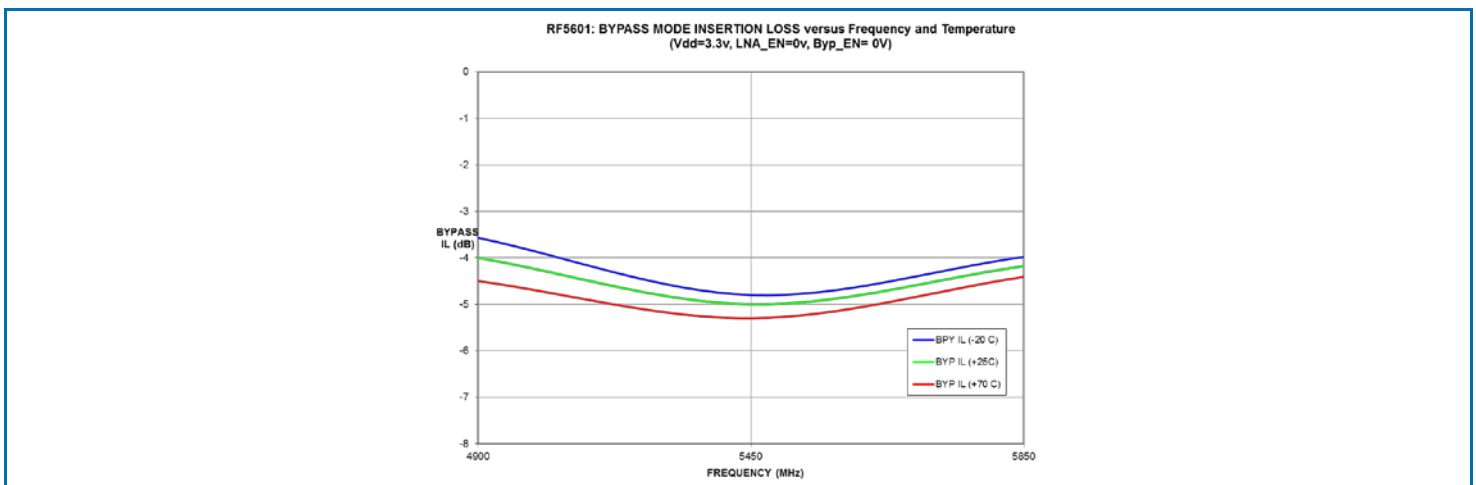
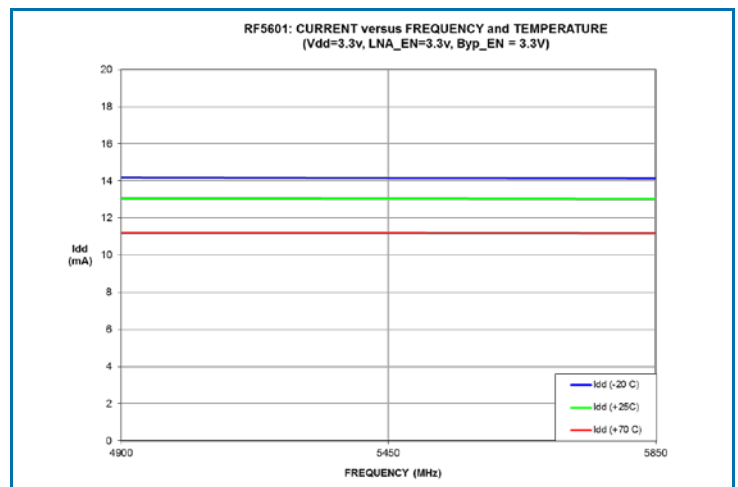
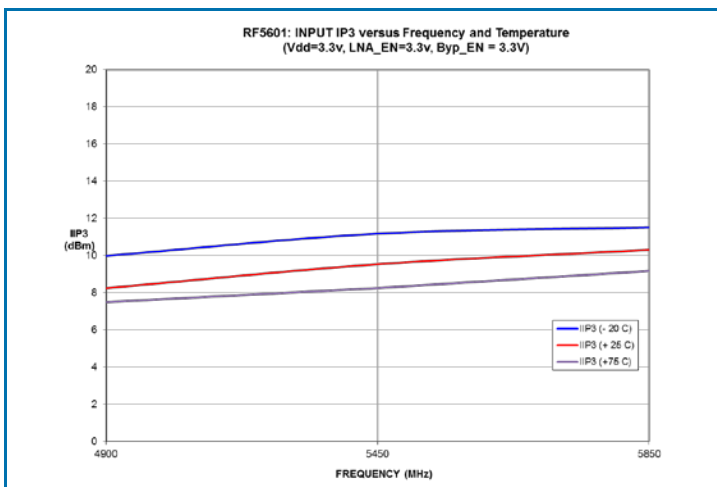
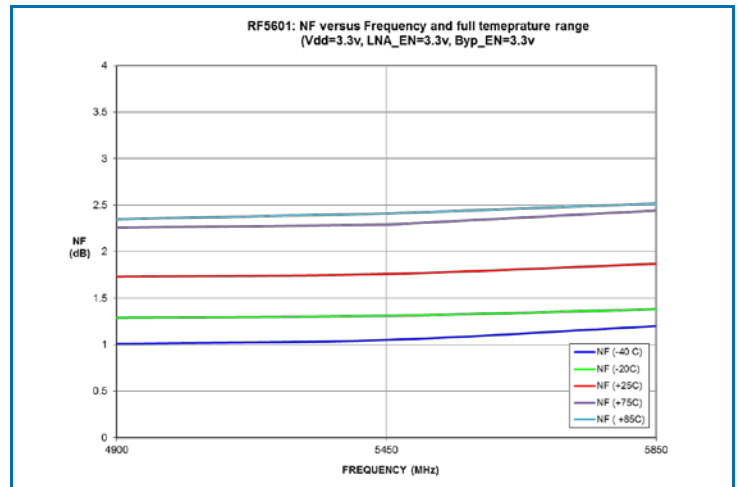
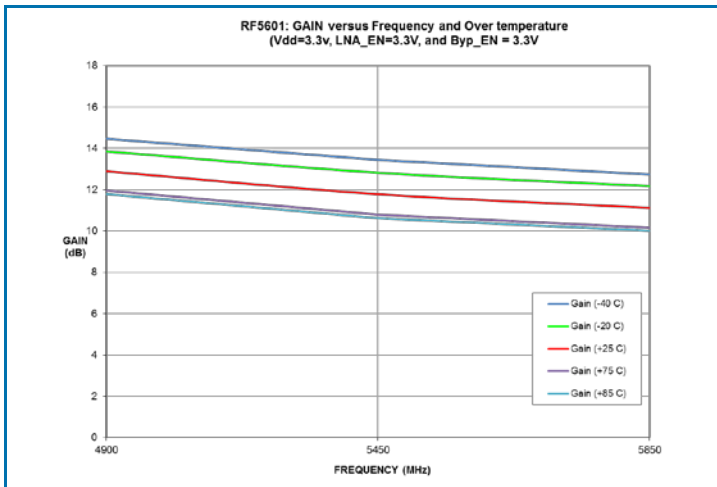
Parameter	Specification			Unit	Condition
	Min	Typ	Max		
<b>Typical Conditions (continued)</b>					<b>Temp = 25°C, VDD = 3.3V, LNA_EN = 3.3V, BYP_EN = 3.3V in high gain mode, BYP_EN = 0V in Bypass mode, Frequency = 4.9 GHz to 5.85 GHz unless otherwise noted</b>
RF Port Impedance		50		Ω	Input and output. No external matching
LNA Turn On/Off Time		100	160	nSec	
ESD					
Human Body Model	500			V	EIA/JESD22-114A RF pins
	500			V	EIA/JESD22-114A DC pins
Charge Device Model	350			V	JESD22-C101C all pins

### Control Logic Table

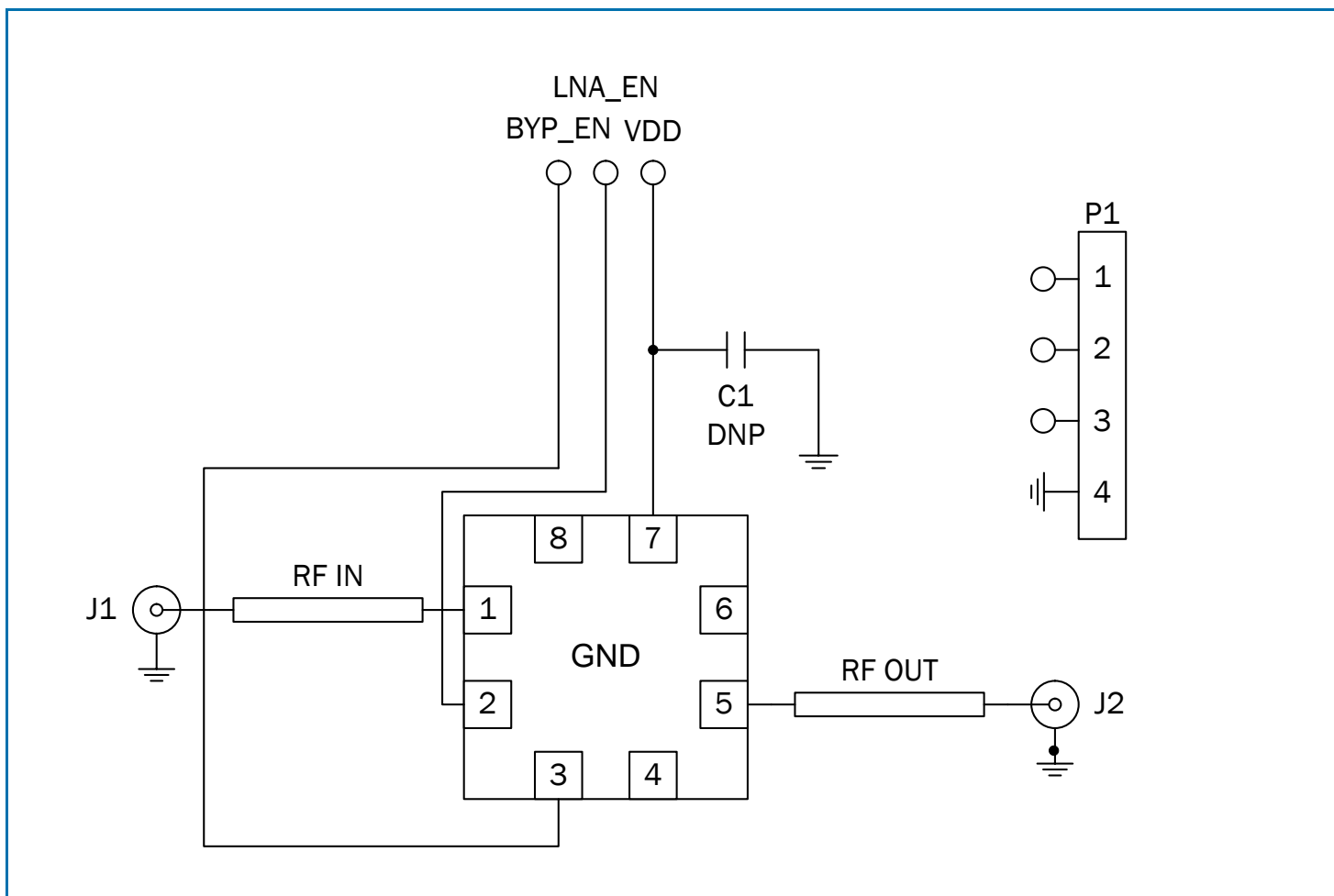
Mode	Controls		
	VDD	LNA_EN	BYP_EN
High Gain	High	High	High
Bypass Mode	High	Low	Low
Undefined*	High	High	Low
High In/Out Isolation	High	Low	High

\*This state is not recommended

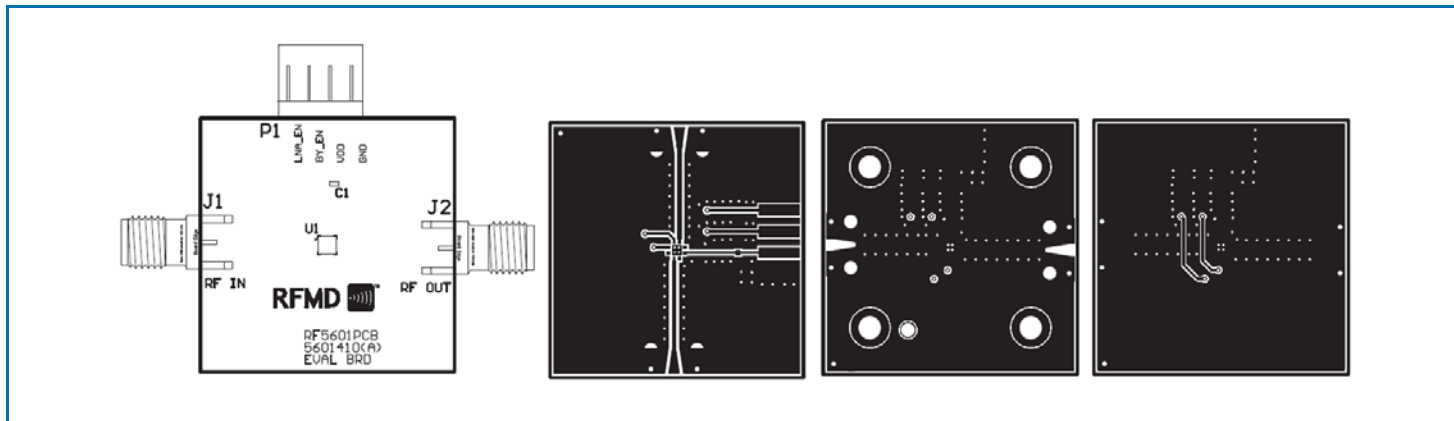
## Plots



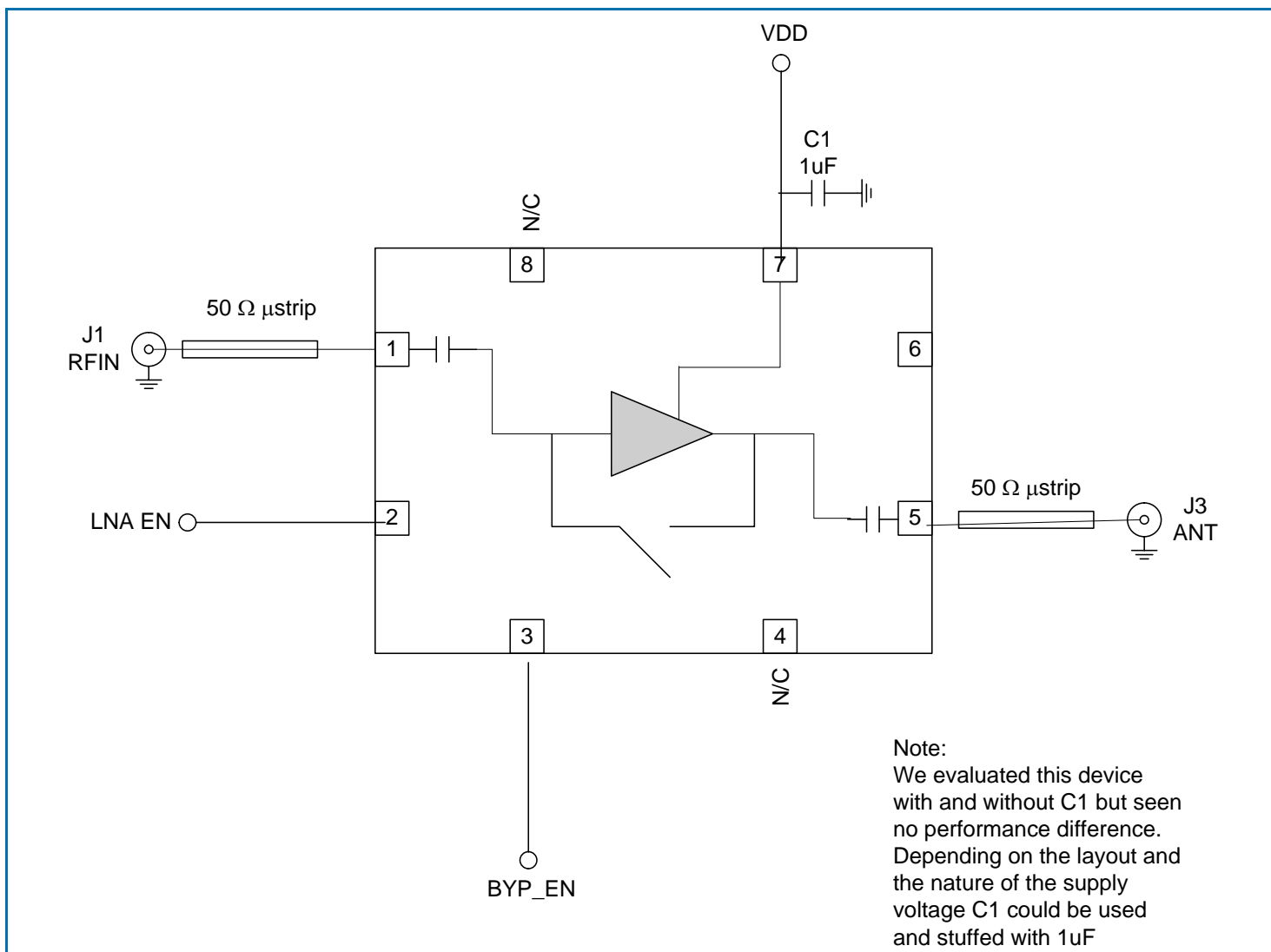
## Evaluation Board Schematic



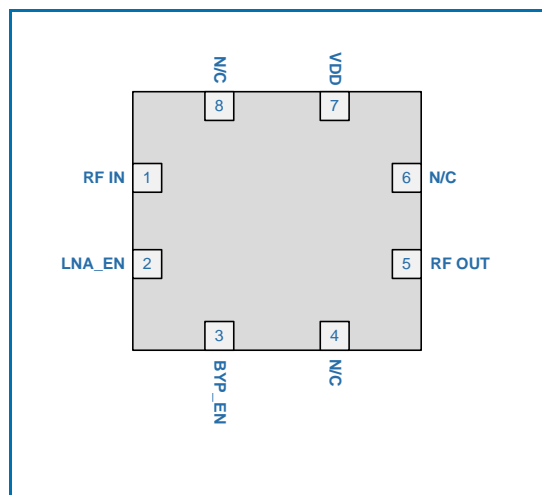
## Evaluation Board Layout



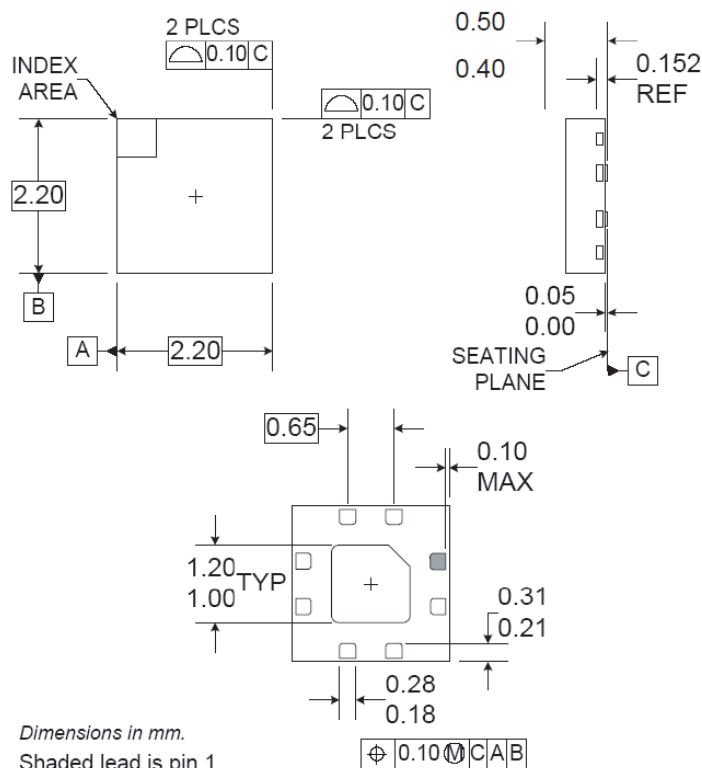
## Application Schematic – 4.9GHz to 5.85GHz



## Pin Out



## Package Drawing



## Pin Names and Descriptions

Pin	Name	Description
1	RF IN	RF Input. Input is matched to 50Ω and DC block is provided internally.
2	LNA_EN	LNA Enable. Please see truth table for operation.
3	BYP_EN	Bypass Enable. Please see truth table for operation.
4	NC	No Connect.
5	RF OUT	RF Output. Output is matched to 50Ω and DC-block is provided internally.
6	NC	No Connect.
7	VDD	Supply voltage for the LNA circuit.
8	NC	No Connect
Pkg Base		The center metal base of the QFN package provides DC and RF ground as well as heat sink for the amplifier.



## Tape and Reel

Carrier tape basic dimensions are based on EIA 481. The pocket is designed to hold the part for shipping and loading onto SMT manufacturing equipment, while protecting the body and the solder terminals from damaging stresses. The individual pocket design can vary from vendor to vendor, but width and pitch will be consistent.

Carrier tape is wound or placed onto a shipping reel either 330 mm (13 inches) in diameter or 178 mm (7 inches) in diameter. The center hub design is large enough to ensure the radius formed by the carrier tape around it does not put unnecessary stress on the parts.

Prior to shipping, moisture sensitive parts (MSL level 2a-5a) are baked and placed into the pockets of the carrier tape. A cover tape is sealed over the top of the entire length of the carrier tape. The reel is sealed in a moisture barrier ESD bag with the appropriate units of desiccant and a humidity indicator card, which is placed in a cardboard shipping box. It is important to note that unused moisture sensitive parts need to be resealed in the moisture barrier bag. If the reels exceed the exposure limit and need to be rebaked, most carrier tape and shipping reels are not rated as bakeable at 125°C. If baking is required, devices may be baked according to section 4, table 4-1, of Joint Industry Standard IPC/JEDEC J-STD-033.

The table below provides useful information for carrier tape and reels used for shipping the devices described in this document.

RFMD Part Number	Reel Diameter Inch (mm)	Hub Diameter Inch (mm)	Width (mm)	Pocket Pitch (mm)	Feed	Units per Reel
RF5601TR7	7 (178)	2.4 (61)	12	4	Single	2500

