

# RFFM5541

## 4.9GHz to 5.85GHz Switch and LNA Front End Solution

The RFFM5541 is designed specifically for high-performance WiFi applications in the 5GHz ISM band. This module integrates the LNA with bypass and a SPDT switch of a Front End solution. The integrated input and output match reduces the number of external components keeping cost down and utilizing minimum layout area for implementation. The RFFM5541 is provided in a 2mm x 2mm x 0.5mm, 12-pin QFN package. This LNA + Switch front-end solution meets or exceeds the specification requirements of IEEE 802.11a RF systems.



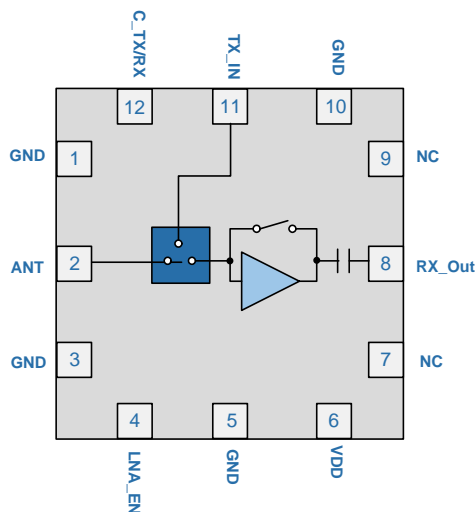
Package: QFN, 12-pin,  
2.0mm x 2.0mm x 0.5mm

### Features

- TX Switch High Linearity: Pin>21dBm with <1% EVM MCS9
- Single Supply Voltage 2.7V to 4.8V
- Integrated 5GHz LNA With Bypass and SPDT

### Applications

- IEEE802.11a WiFi Applications
- Consumer Electronics
- Mobile Devices
- Gaming
- General Purpose Switch and LNA Solution for 4.9GHz to 5.85GHz Frequency Range



Functional Block Diagram

### Ordering Information

RFFM5541SB	Standard 5-piece bag
RFFM5541SQ	Standard 25-piece bag
RFFM5541SR	Standard 100-piece reel
RFFM5541TR	Standard 2500-piece reel
RFFM5541PCK-410	Fully assembled evaluation board w/ 5-piece bag

## Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage	5.5	V
Operating Temperature Range	-40 to +85	°C
Storage Temperature	-40 to +150	°C
ESD - Human Body Model (HBM)	500	V
ESD – Charge Device Model (CDM)	1000	V
LNA Input Power (No Damage)	5	dBm
Moisture Sensitivity	MSL2	



**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

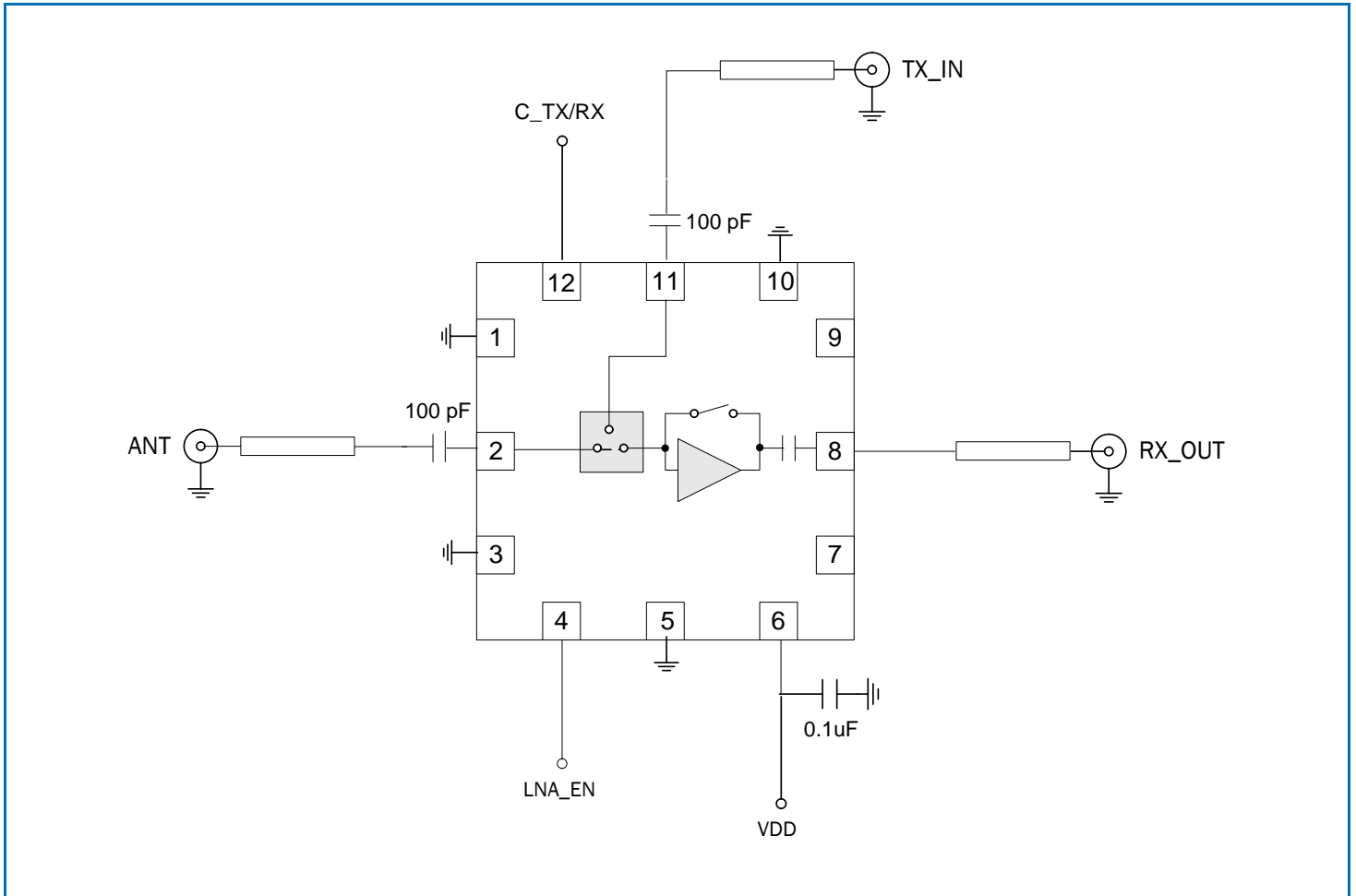
Parameter	Specification			Unit	Condition
	Min	Typ	Max		
<b>Compliance</b>					<b><math>V_{DD} = 2.7V</math> to <math>4.2V</math>, <math>LNA\_EN = 2.5V</math> to <math>V_{DD} - 0.2V</math>, <math>Temp = -15^{\circ}C</math> to <math>+75^{\circ}C</math>, <math>Freq = 4.9GHz</math> to <math>5.85GHz</math>, unless otherwise noted.</b>
<b>Receive Parameters</b>					
Frequency	4.90		5.85	GHz	
Vdd (LNA Voltage Supply)	2.7	3.6	4.2	V	
LNA EN					
ON state	2.5	3.3	Vdd - 0.2	V	
OFF state	0		0.2	V	LNA_EN OFF turns bypass switch ON
Switch Control Logic					
Low		0	0.2	V	
High	2.5	3.3	Vdd - 0.2	V	
LNA Current					
LNA Vdd		17	22	mA	LNA in "ON" State
			25	mA	Extended temp range, $-40^{\circ}C$ to $+85^{\circ}C$
Vdd Leakage Current		5	10	uA	LNA in "OFF" State
			15	uA	Extended temp range, $-40^{\circ}C$ to $+85^{\circ}C$
LNA_EN Current			5	uA	
			10	uA	Extended temp range, $-40^{\circ}C$ to $+85^{\circ}C$
Gain					
WiFi RX	11	16	20	dB	Includes temp range $-40^{\circ}C$ to $+85^{\circ}C$
Bypass Mode	-13	-9	-7	dB	
Noise Figure		2.4	3.0	dB	$V_{DD} > 3.0V$ , including switch; $Temp=25^{\circ}C$
			3.5	dB	Extended temp range $-40^{\circ}C$ to $+85^{\circ}C$ ; $V_{DD} > 3.0V$ , including switch

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
<b>Receive Parameters (continued)</b>					
Passband Ripple					
WiFi RX Mode	-0.9		+0.9	dB	4.9GHz to 5.1GHz
	-0.9		+0.9	dB	Per U-NII band or 100MHz
WiFi RX Bypass Mode	-0.9		+0.9	dB	
WiFi RX Port Return Loss		8		dB	
IP1dB		-9		dBm	
		-10		dBm	Extended temp range -40°C to +85°C
IIP3		3		dBm	
		0		dBm	Extended temp range -40°C to +85°C
<b>Transmit Switch Parameters</b>					
<b>Control voltage = 2.5V to 4.8V, Temp=-15°C to +75°C, unless otherwise noted</b>					
Frequency	4.90		5.85	GHz	
Insertion Loss		1	1.8	dB	Includes temp range -40°C to +85°C
Passband Ripple	-0.2		+0.2	dB	Over all conditions; Per U-NII band or 100MHz
Input P1dB	29	31		dBm	Switch ports only, over all conditions; CW signal
	27			dBm	Extended temp range -40°C to +85°C; CW signal
Input Power	21			dBm	System EVM=0.5% assumed for the incoming signal; 21dBm at the input with 1% composite EVM at the output.
Input Return Loss	9.6	12		dB	Over all conditions
Output Return Loss	8.5	12		dB	
Port Impedance Tuning		50		W	All RF ports tuned for 50Ω system
Isolation TX to RX	20			dB	TX DC mode, path ANT to RX, over all conditions
Isolation RX to TX	20			dB	WiFi RX Bypass Mode, path ANT-TX, over all conditions
Switch Control Current		35	50	uA	Per control line, over all conditions
			100	uA	Extended temp range -40°C to +85°C
Switch Control Speed		75	150	nsec	Over all conditions

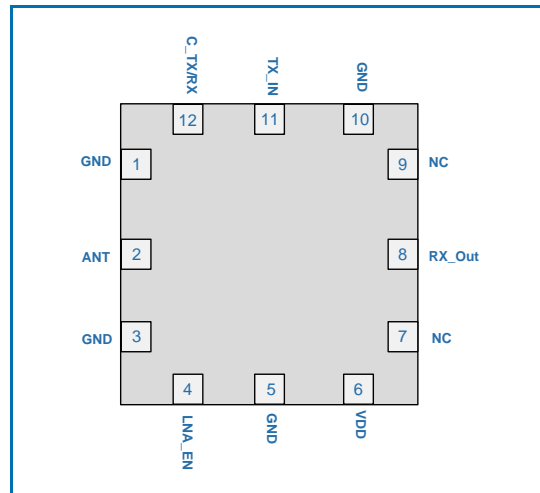
## Switch Logic Truth Table

Mode	C_TX/RX	LNA_EN
RX Gain	L	H
RX Bypass	L	L
TX	H	L

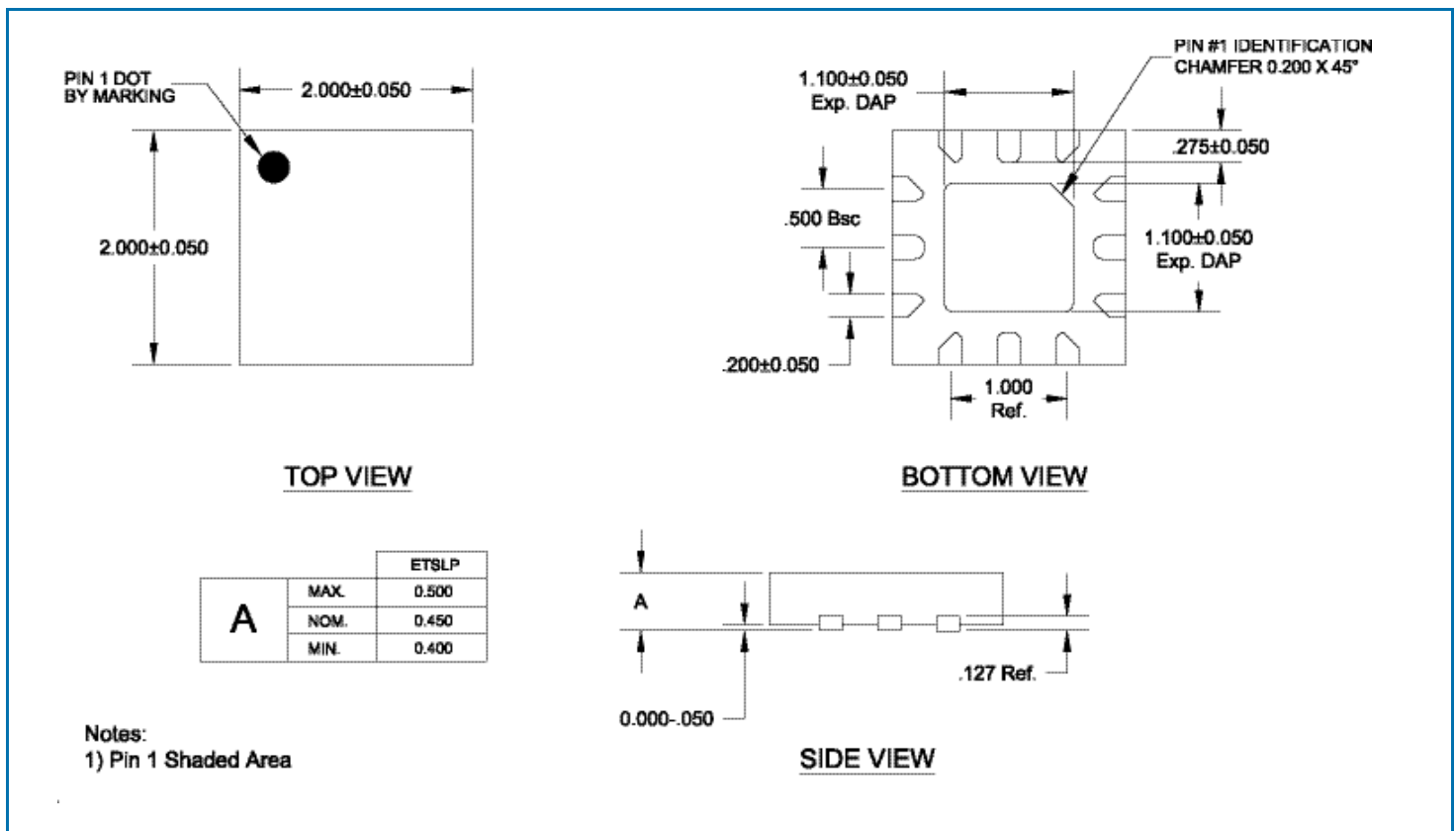
Applications Schematic



Pin Out

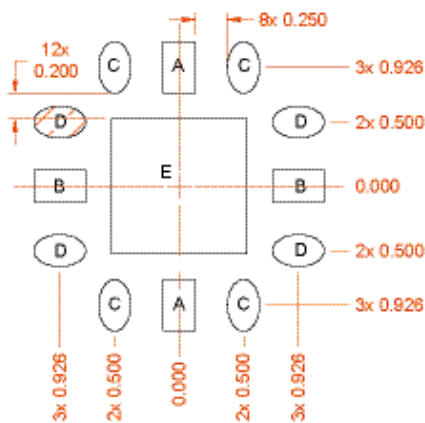


Package Outline and Branding Drawing (Dimensions in millimeters)



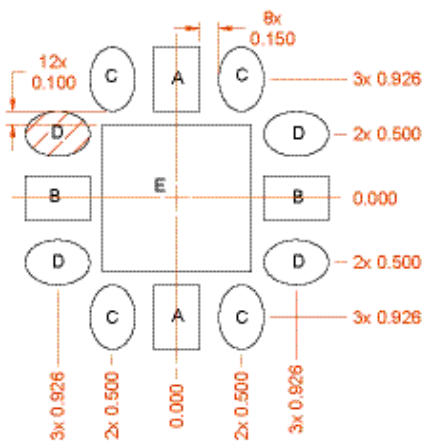
## PCB Pattern

A = 0.250 x 0.402 (mm) Typ  
 B = 0.402 x 0.250 (mm) Typ  
 C = 0.250 x 0.402 (mm) 60% Rounded Rectangle  
 D = 0.402 x 0.250 (mm) 60% Rounded Rectangle  
 E = 1.050 x 1.050 (mm)



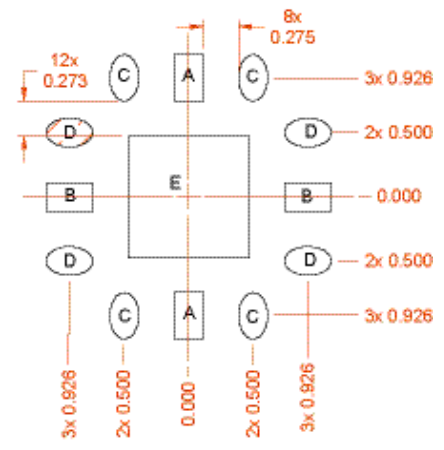
PCB METAL PATTERN

A = 0.350 x 0.502 (mm) Typ  
 B = 0.502 x 0.350 (mm) Typ  
 C = 0.350 x 0.502 (mm) 60% Rounded Rectangle  
 D = 0.502 x 0.350 (mm) 60% Rounded Rectangle  
 E = 1.150 x 1.150 (mm)



PCB SOLDER MASK PATTERN

A = 0.225 x 0.362 (mm)  
 B = 0.362 x 0.225 (mm)  
 C = 0.225 x 0.362 (mm) 60% Rounded Rectangle  
 D = 0.362 x 0.225 (mm) 60% Rounded Rectangle  
 E = 0.945 x 0.945 (mm)



PCB STENCIL PATTERN

Shaded area represents Pin 1 location.

## Pin Names and Descriptions

Pin	Name	Description
1	GND	Ground.
2	ANT	This is the common port (antenna). Matched to 50Ω. External DC blocking capacitor required.
3	GND	Ground.
4	LNA_EN	LNA Enable/Bypass Enable control pin. See switch truth table for proper settings.
5	GND	Ground.
6	VDD	Supply voltage to the LNA.
7	NC	No Board Connection Allowed.
8	RX_OUT	Receive port for 802.11a/n band. RX output includes integrated DC-block and 50Ω match.
9	NC	No Board Connection Allowed.
10	GND	Ground.
11	TX_IN	Transmit port for 802.11a/n band. Matched to 50Ω. External DC blocking capacitor required.
12	C_TX/RX	Transmit and receive mode control pin. See switch truth table for proper settings.