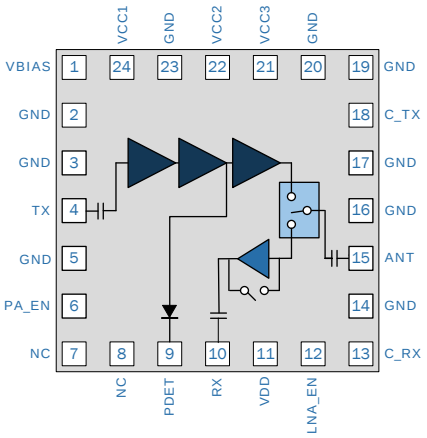
RFFM4204

WiFi 802.11b/g/n/ac Front End Module
2.4GHz to 2.5GHz

Package: Laminate, 24-pin,
6.0mm x 6.0mm x 0.9mm

The RFFM4204 provides a complete solution in a single front end module (FEM) by integrating the power amplifier (PA), low noise amplifier (LNA) with bypass, power detector, a Single Pole Double Throw (SPDT) switch, and some filtering for harmonic rejection. The integrated matching greatly reduces the number of external components and layout area in the customer application. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturing cost. The RFFM4204 is provided in a 6.0mm X 6.0mm X 0.9mm 24-pin laminate package. The FEM meets or exceeds the RF front end needs of IEEE 802.11b/g/n/ac WiFi RF systems.



Functional Block Diagram

Features

- Voltage Supply: 5V
- P_{OUT} = 24dBm, 256QAM MCS9 HT40 at 1.8% DEVM
- P_{OUT} = 25dBm, 64QAM MCS7 HT20 and HT40 at 3% DEVM
- Input and Output Matched to 50Ω
- Integrated PA, SPDT, and LNA with bypass
- High Impedance Enable Pin

Applications

- IEEE 802.11b/g/n/ac WiFi Systems
- Wireless Access Points, Gateways, Router and Set Top Box Applications
- ISM Band Transmitter Applications

Ordering Information

RFFM4204SB	Standard 5-piece sample bag
RFFM4204SQ	Standard 25-piece sample bag
RFFM4204SR	Standard 100-piece reel
RFFM4204TR13	Standard 2500-piece reel
RFFM4204PCK-410	Fully assembled evaluation board w/5 pc bag

RF Micro Devices Inc. 7628 Thorndike Road, Greensboro, NC 27409-9421
For sales or technical support, contact RFMD at +1.336.678.5570 or customerservice@rfmd.com.

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (RF Applied)	-0.5 to +5.5	V
Supply Voltage (No RF Applied)	-0.5 to +6.0	V
DC Supply Current	1000	mA
Input RF Power (TX and RX) No damage	+10*	dBm
Operating Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Moisture Sensitivity	MSL3	

*Maximum Input Power with a 50Ω load.

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		
Compliance					**802.11b, 802.11g, 802.11n, 802.11ac**
DC Operating Conditions					
Power Supply		5	5.25	V	Operating Voltage for V_{CC} (PA) and V_{DD} (LNA)
ENABLE Voltage - High	2.8	3.0	V_{CC} – 0.2	V	PA_EN; LNA_EN
ENABLE Voltage - Low		0	0.2	V	
Control Voltage - High	2.8	3.0	V_{CC} – 0.2	V	C_TX, C_RX
Control Voltage - Low		0	0.2	V	
Transmit Performance					**T= 25°C, V_{CC}= 5.0V, Control voltage= 3V, unless otherwise noted**
Frequency	2412		2484	MHz	
802.11n Output Power	24	25		dBm	HT20 and HT40
802.11n Dynamic EVM			3	%	
			-30.5	dB	
802.11ac Output Power	23	24		dBm	HT40
802.11ac Dynamic EVM			1.8	%	
			-35	dB	
Second Harmonic		-30	-25	dBm/MHz	P_{OUT} = 26dBm 11b 11Mbps CCK Modulation
Third Harmonic		-33	-25	dBm/MHz	
Spectral Mask HT20/HT40 Output Power		25		dBm	MCS0; CCK 11Mbps
Gain	31	34		dB	At rated P_{OUT}
Gain variation	-2.5		2.5	dB	Over temperature of -10°C to +70°C
Power Detector Voltage Range	0.15		1	V	P_{OUT} = 0dBm to 29dBm
Power Detector Nominal Voltage		0.6		V	At rated 11ac P_{OUT}
Input Return Loss	9	10		dB	In specified frequency band
Output Return Loss	7	8		dB	
Operating Current	350	450	550	mA	P_{OUT} = 24dBm
		450	600	mA	P_{OUT} = 24dBm, over temp
Quiescent Current		175		mA	V_{CC} = 5.0V, PA Enable = 3V, and RF = OFF

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Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Transmit Performance (continued)					**T= 25°C, V_{CC}= 5.0V, Control voltage= 3V, unless otherwise noted**
Leakage Current		650		uA	V_{CC} = 5V, Control voltage = 0.2V
Turn-On Time		200	400	ns	Output stable to within 90% of final value
Turn-Off Time		250	500	ns	
Stability	-25		34	dBm	No spurs above -47dBm into 4:1 VSWR
Output P1dB		31		dBm	CW signal
RX Performance					**T= 25°C, V_{CC}= 5.0V, Control voltage= 3V, unless otherwise noted**
LNA High Gain mode	9	12	14	dB	
Bypass Insertion Loss	5	8	11	dB	
LNA Current		12	18	mA	
LNA Leakage Current			5	uA	
Noise Figure		2.2		dB	
		2.2	3.3	dB	Over temperature
Input Return Loss (High Gain)	5	6		dB	
Output Return Loss (High Gain)	10	16		dB	
ANT to RX Isolation	25	30		dB	FEM in TX mode
Input IP3 (High Gain)	3	7		dBm	
Input IP3 (Bypass mode)	13	18		dBm	
General Specifications					
T/R Switching Time		150	300	nS	10% to 90% of RF Power
Control Current - Logic High		5	10	uA	
Thermal Resistance (Th-j)		33		°C/W	
ESD					
Human Body Model		1000		V	EIA/JESD22-114A, Class 1C, all pins
Charge Device Model		1000		V	JESD22-C101C, all pins

Control Logic Table

Operating Mode	PA_EN	LNA_EN	C_RX	C_TX
Standby	Low	Low	Low	Low
Transmit Mode	High	Low	Low	High
Receive High Gain Mode	Low	High	High	Low
Receive Bypassed Mode	Low	Low	High	Low

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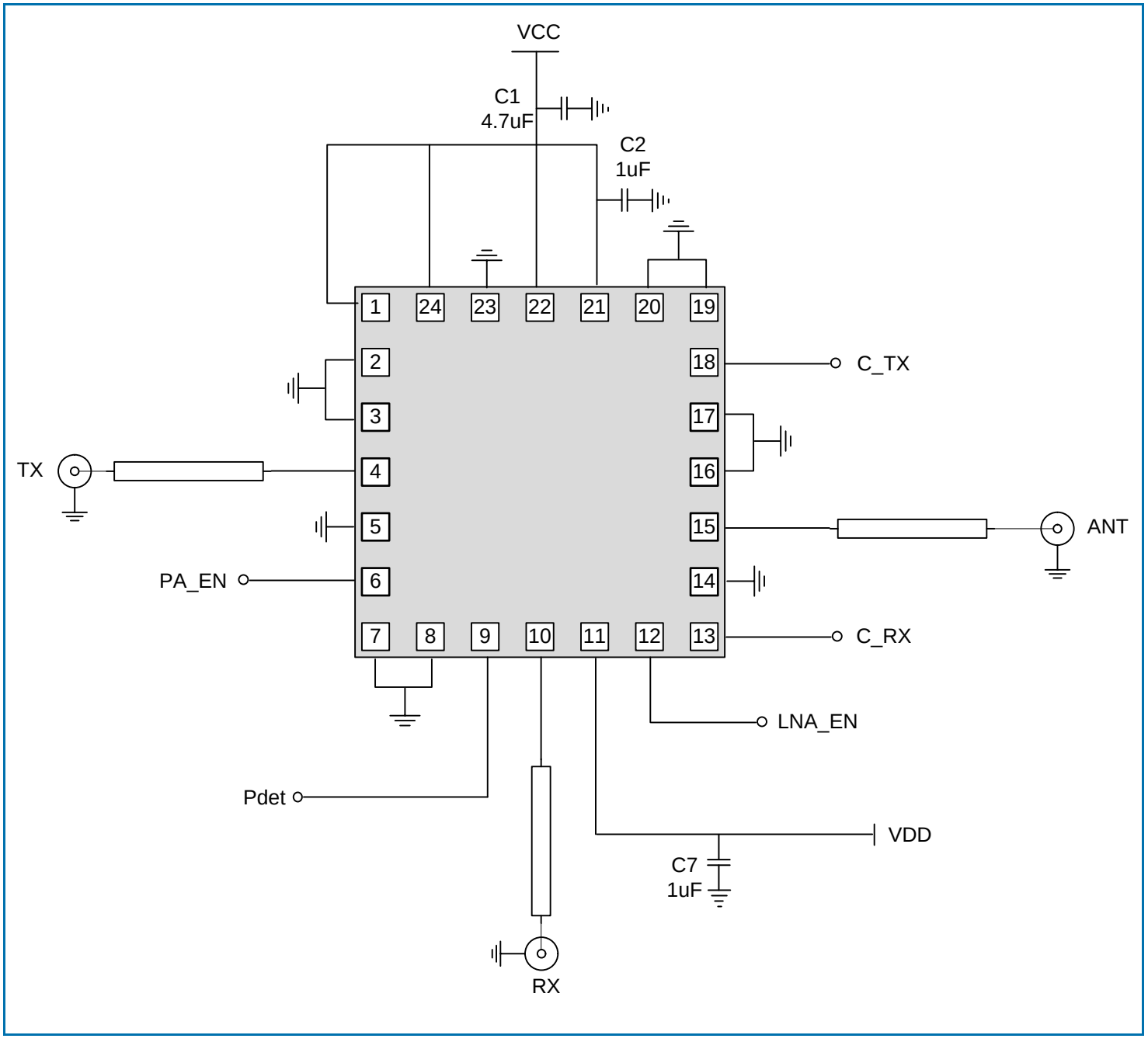
Applications Schematic



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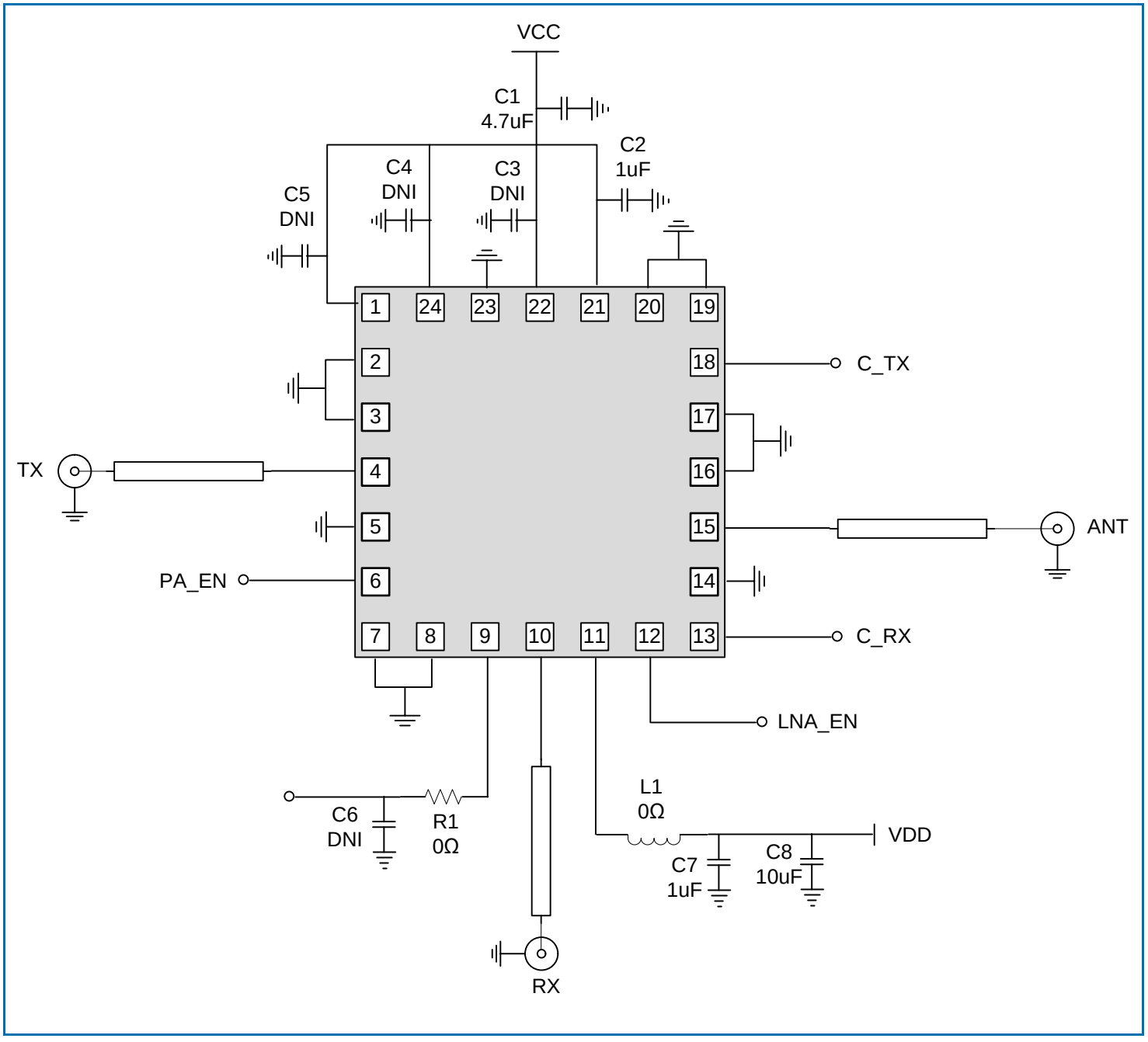
Evaluation Board Schematic



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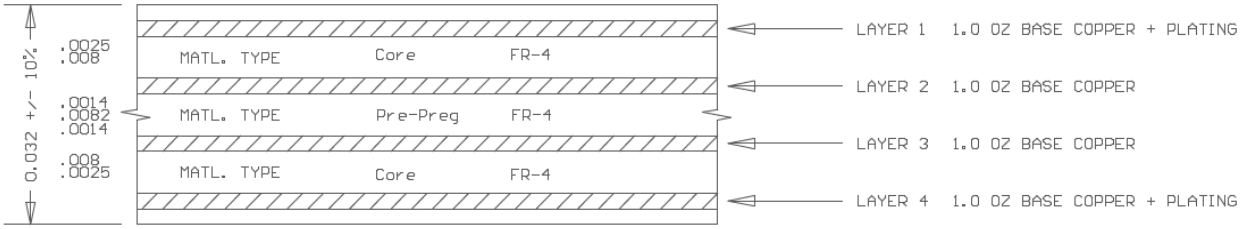
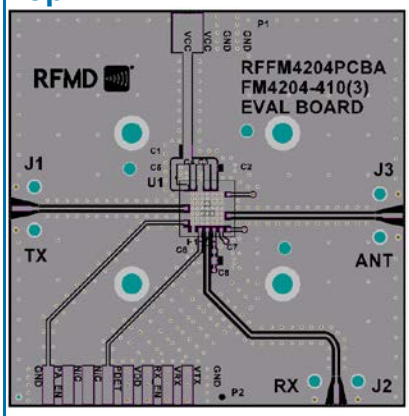
Evaluation Board Characteristics:

1) Material: FR4 4-layer board
2) Surface finish: ENIG
3) Size: 2x2x0.032 in +/- 10%
4) Layer stack up

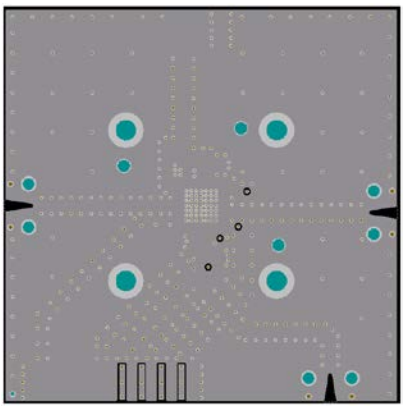


Layer description

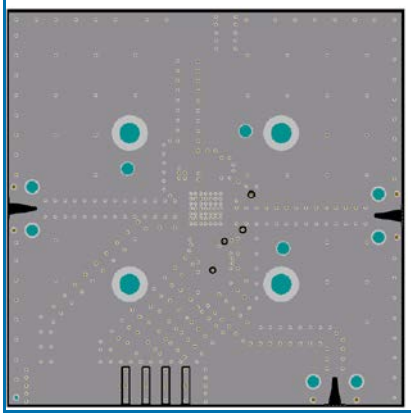
Top



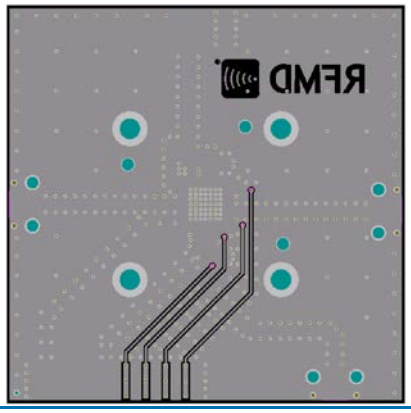
Mid1



Mid2



Bottom



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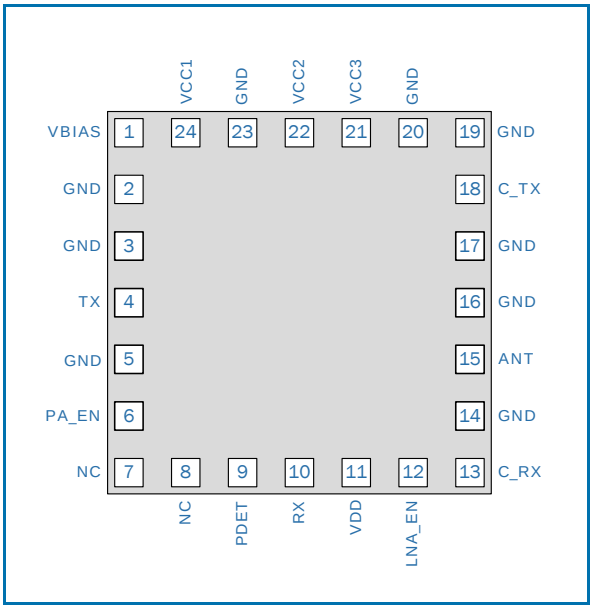
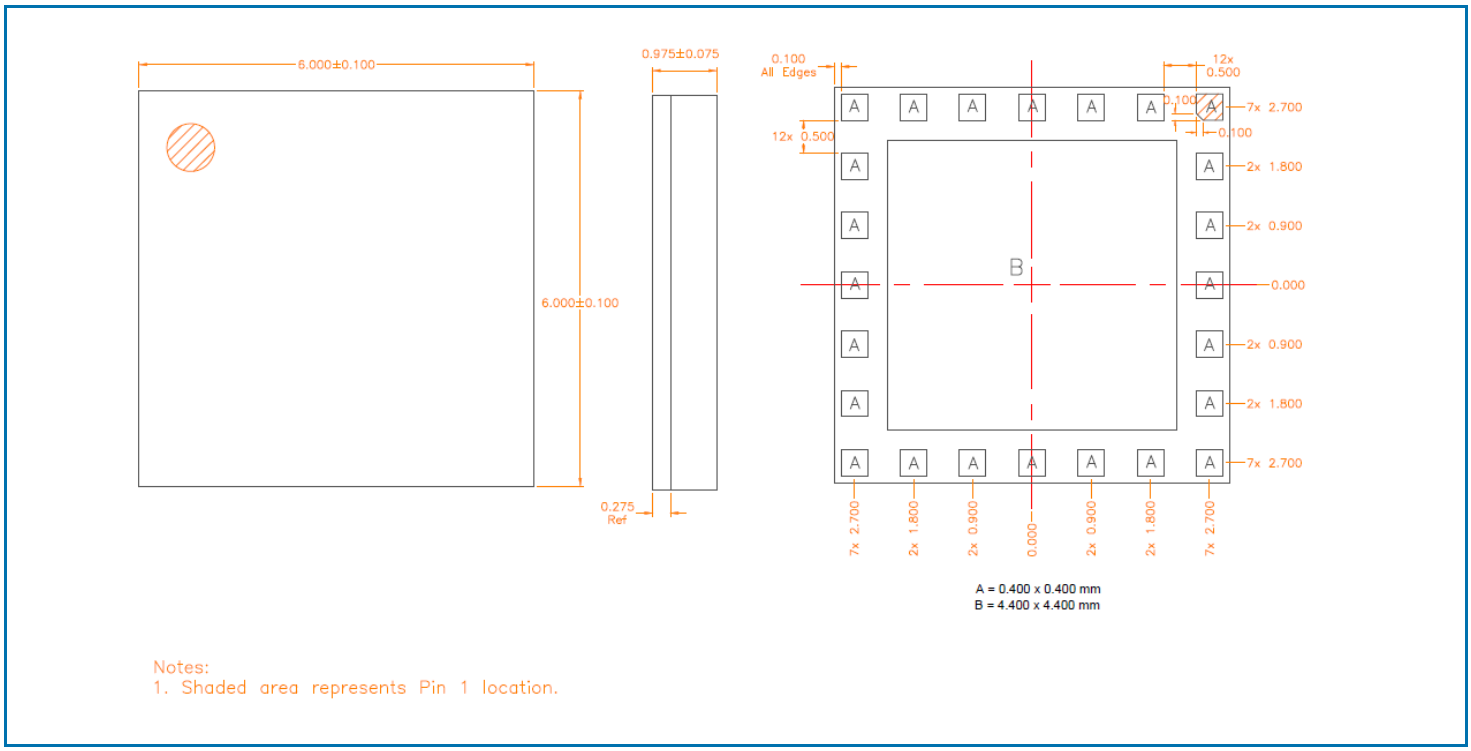
Pin Out



Package Outline and Branding Drawing (Dimensions in millimeters)



Notes:
1. Shaded area represents Pin 1 location.

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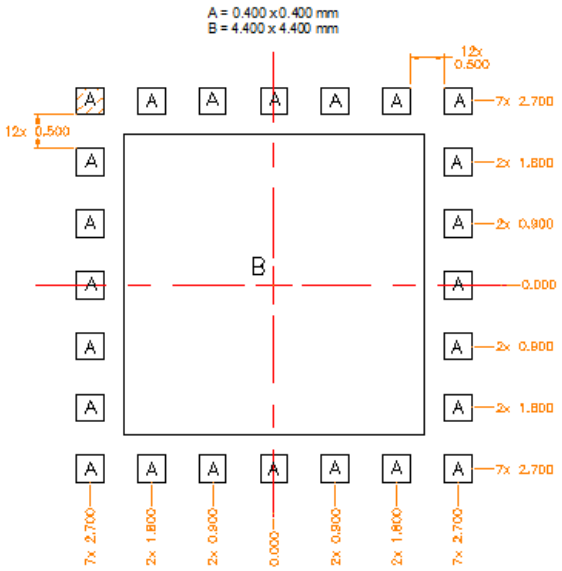
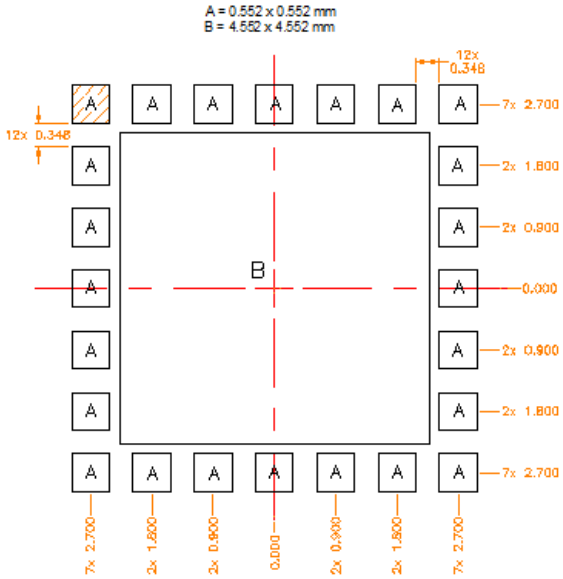
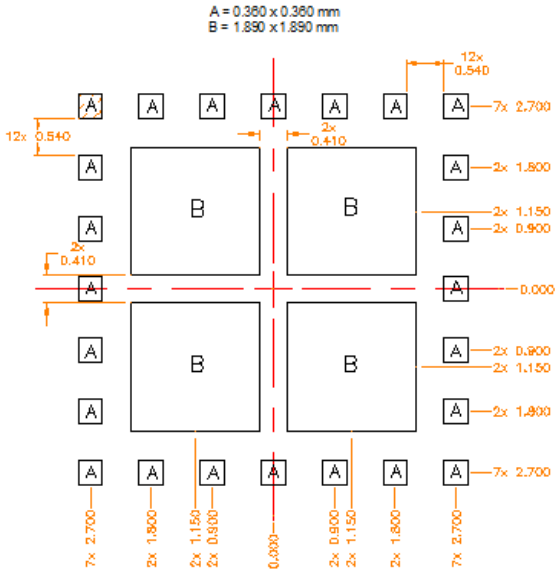
PCB Patterns



PCB Metal Land Pattern



PCB Solder Mask Pattern



PCB Stencil Pattern

Note: shaded area represents Pin 1 location

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Pin Description Table

Pin	Name	Description
1	VBIAS	Bias voltage for the PA. This pin should be tied to V_{CC}
2	GND	Ground connection
3	GND	Ground connection
4	TX	RF Input Port for the PA. Input is matched to 50Ω and DC blocked internally.
5	GND	Ground connection
6	PA_EN	Control voltage for the PA and Tx switch. See truth table for proper settings.
7	NC	No Connect. Can be connected to GND or open.
8	NC	No Connect. Can be connected to GND or open.
9	PDET	Power detector voltage for transmit mode. P_{DET} voltage varies with output power and may need external decoupling for noise decoupling.
10	RX	RF Output Port for the LNA, Input is matched to 50Ω and DC blocked internally.
11	Vdd	Supply voltage for the LNA. See applications schematic for biasing and bypassing components.
12	LNA_EN	Control Voltage for the LNA. When this pin is set “LOW” LNA bypass switch is closed.
13	C_RX	Receive switch control pin. See switch truth table for proper level.
14	GND	Ground connection
15	ANT	RF bidirectional antenna port matched to 50Ω and DC blocked internally.
16	GND	Ground connection
17	GND	Ground connection
18	C_TX	Transmit switch control pin. See switch truth table for proper level.
19	GND	Ground connection
20	GND	Ground connection
21	VCC3	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
22	VCC2	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
23	GND	Ground connection
24	VCC1	Supply voltage for the PA. See applications schematic for biasing and bypassing components.
PKG Base	GND	Ground slug connection. The backside of the package should be connected directly to the reference ground plane with as many ground vias as possible to minimize ground inductance.

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