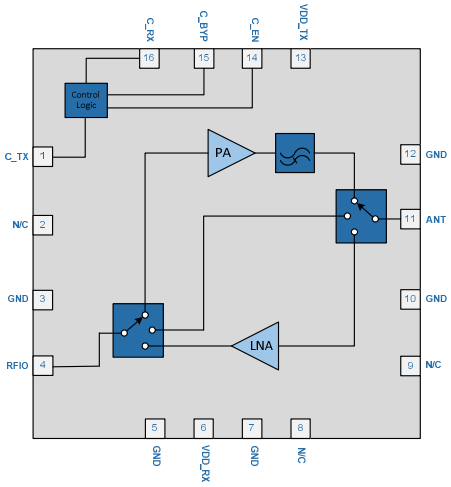
RFFM6205

2.0V to 4.0V, 2.4GHz Front End Module

The RFFM6205 is a complete integrated solution in a single Front End Module (FEM) for Zigbee® applications in the 2.4GHz to 2.5GHz band and Bluetooth® transmitter applications. The ultra-small factor and integrated matching minimizes layout area in the customer's application and greatly reduces the number of external components. This simplifies the total front end solution by reducing the bill of materials, system footprint, and manufacturing cost.

The FEM integrates a power amplifier (PA) plus harmonic filter in the transmit (TX) path, a low noise amplifier (LNA) in the receive (RX) path, and a low loss bidirectional through mode path. The RFFM6205 incorporates two single-pole triple-throw (SP3T) switches to provide a single port for TDD access and a single antenna port for TX, RX, and through mode paths. The device is provided in a 2.5mm x 2.5mm x 0.5mm, 16-pin QFN package.



Functional Block Diagram

Package: QFN, 16-pin,
2.5mm x 2.5mm x 0.5mm

Features

- Tx Output Power = 14dBm
- Integrated RF Front End Module with Rx/Tx switch, PA, Filter, LNA, Bidirectional Thru path and 2-SP3T Switch
- 50Ω single-ended Bidirectional Transceiver Interface.
- Voltage Range = 2.0V to 4.0V
- Rx Noise Figure = 2.5dB

Applications

- ZigBee® 802.15.4 Based Systems for Remote Monitoring and Control
- AA Battery Operation
- 2.4GHz ISM Band Applications
- Smart Meters for Energy Management
- Bluetooth® Transmitter systems

Ordering Information

RFFM6205SB	Standard 5 piece bag
RFFM6205SQ	Standard 25 piece bag
RFFM6205SR	Standard 100 piece reel
RFFM6205TR7	Standard 2500 piece reel
RFFM6205PCK-410	Fully assembled evaluation board w/5 pc bag

Absolute Maximum Ratings

Parameter	Rating	Unit
Voltage	4.5	V
Operating Temperature	-40 to +125	°C
Storage Temperature	-40 to +150	°C
Maximum Input Power to PA	+20	dBm
Maximum Input Power to LNA	+5	dBm
ESD, HBM (Pin-to-GND)	500	V
ESD, CDM (Pin-to-GND)	500	V
Moisture Sensitivity	MSL 2	

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		
					Specifications must be met across supply voltage, control voltage, and temperature ranges unless otherwise specified
TX Frequency	2405		2485	MHz	
RX Frequency	2405		2485	MHz	
Bypass Frequency	2405		2485	MHz	
ANT RF Port Impedance		50		Ω	
RFIO Port Impedance		50		Ω	
V_{BAT}	2.0	3.0	4.0	V	
Off Mode Current - Leakage					**V_{DD}_TX = 3.0V, C_EN = Low, V_{DD}_RX = 3.0V, C_TX = Low, C_RX = Low, C_BYP = Low, Temp =25°C**
Supply Current - IDDTX		50	200	nA	
Supply Current - IDDRX		50	200	nA	
C_RX Current			1.0	nA	
C_TX Current			1.0	nA	
C_BYP Current			1.0	nA	
Transmit Mode - Power Amplifier					**V_{DD}_TX = 3.0V, C_EN = High, V_{DD}_RX = 3.0V, C_TX =High, C_RX =Low, C_BYP =Low, Temp =25°C unless otherwise specified**
Input Return Loss			10.0	dB	
Output Return Loss			8.0	dB	
Small Signal Gain	11.0	14.0		dB	
Gain Flatness	-0.3		0.3	dB	
Rated Output Power		15.0		dBm	VDD_TX = 4.0V
	13.0	14.0		dBm	VDD_TX = 3.3V
	12.5	13.5		dBm	VDD_TX = 3.0V
	10.0	11.0		dBm	VDD_TX = 2.0V

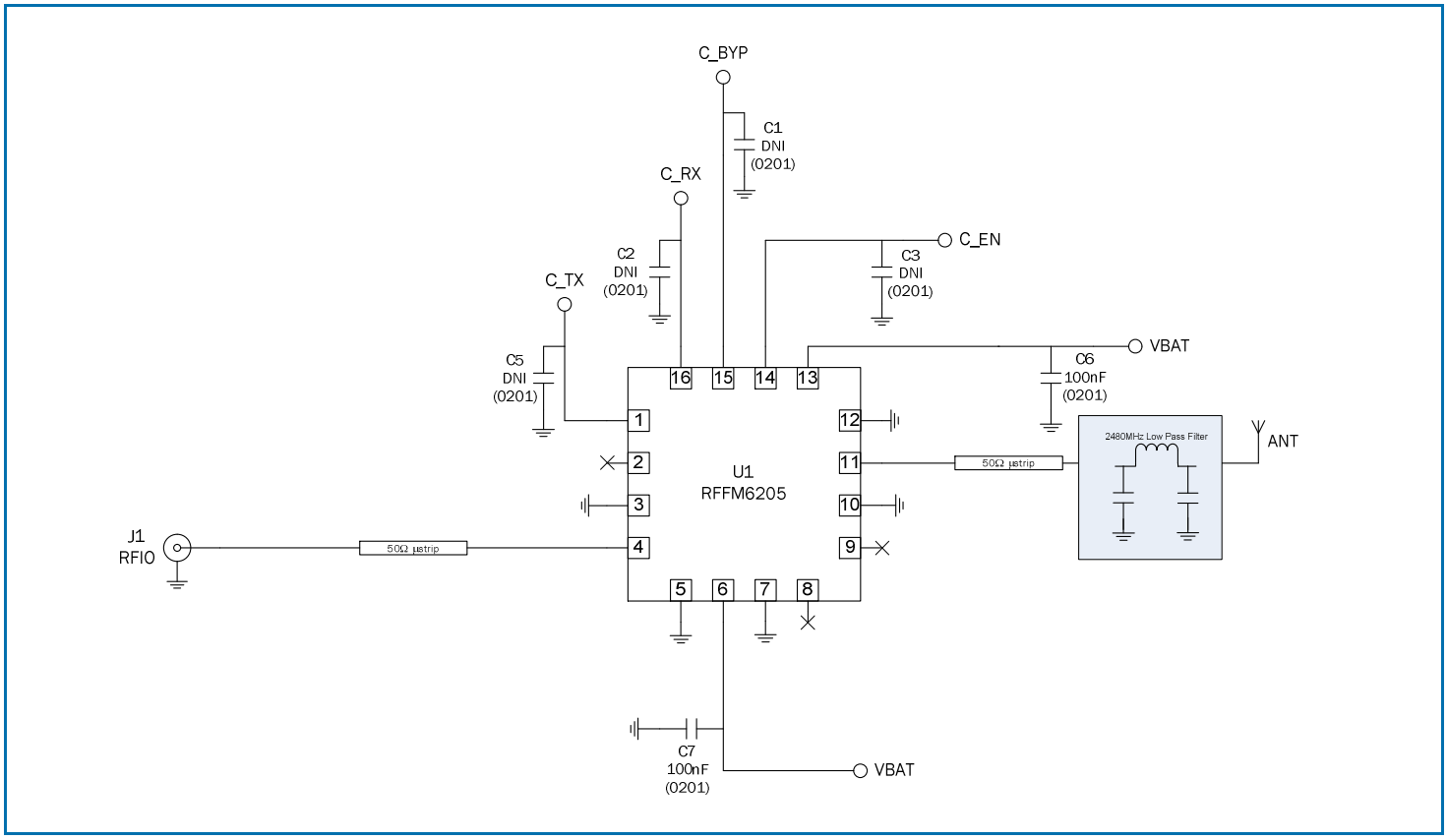
Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Transmit Mode - Power Amplifier (continued)					**V_{DD}_TX = 3.0V, C_EN = High, V_{DD}_RX = 3.0V, C_TX =High, C_RX =Low, C_BYP =Low, Temp =25°C**
Supply Current		13	18	mA	VDD_TX = 2.0V; P_{OUT} = 10dBm
		17	21	mA	VDD_TX = 3.0V; P_{OUT} = 13dBm
		19	23	mA	VDD_TX = 3.3V; P_{OUT} = 14dBm
		21	27	mA	VDD_TX = 4.0V; P_{OUT} = 15dBm
Quiescent Current		5		mA	IDD_RX + IDD_TX
2f0; P_{OUT} = 14dBm		-20.0	-15.0	dBm/MHz	
2f0; P_{OUT} = 14dBm, with external filter		-45.0	-42.0	dBm/MHz	
3f0; P_{OUT} = 14dBm		-50.0		dBm/MHz	
VSWR: Stability (ruggedness)			4:1		
VSWR: No Damage			8:1		
Gain Settling Time		230	300	ns	10% to 90%
Receive Mode – LNA					**V_{DD}_TX = 3.0V, C_EN = High, V_{DD}_RX = 3.0V, C_TX =Low, C_RX =High, C_BYP =Low, Temp =25°C**
Input Return Loss		12.0	9.0	dB	
Output Return Loss		10.0	8.0	dB	
Gain	11.0	14.0	14.5	dB	
Gain Flatness	-0.3		0.3	dB	
Noise Figure		2.5	3.0	dB	
Supply Current	2.0	4.0	7.0	mA	
IIP3		4.0		dBm	
IP1dB	-8.0	-5.0		dBm	
Bidirectional Thru Mode					**V_{DD}_TX = 3.0V, C_EN = High, V_{DD}_RX = 3.0V, C_TX =Low, C_RX =Low, C_BYP =High, Temp =25°C**
Insertion Loss		1.5	2.5	dB	
Input Return Loss			10.0	dB	
Output Return Loss			10.0	dB	
Supply Current		100	400	nA	
IIP3	35.0	40.0		dBm	
Gain flatness	-0.3		0.3	dB	
Maximum Input Power	25			dBm	
Bluetooth Transmitter GFSK					
20dB Bandwidth		870		kHz	
Adjacent Channel Power |M – N| = 2		-63		dBc	
Adjacent Channel Power |M – N| ≥ 3		-72		dBc	
Bluetooth Transmitter EDR					
In-Band Spurious Emission		-35		dBc	
Adjacent Channel Power |M – N| = 2		-33		dBc	
Adjacent Channel Power |M – N| ≥ 3		-45		dBc	

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Logic					
Logic Level "High"	1.6	1.8	V_{BAT}	V	
Logic Level "Low"	0.0		0.2	V	
C_TX Input source current at Logic "High"		100	800	µA	
C_RX Input source current at Logic "High"		100	600	uA	
C_BYP Input source current at Logic "High"		0.1	1.0	uA	
C_EN Input source current at Logic "High"			3.0	uA	
Input source current Logic Level "Low"			0.001	µA	
Switching Time		50		ns	Transmit to LNA On or Bypass Mode
		60		ns	LNA On to Bypass Mode
		60		ns	Bypass to LNA On Mode
		60		ns	LNA On or Bypass to Transmit Mode

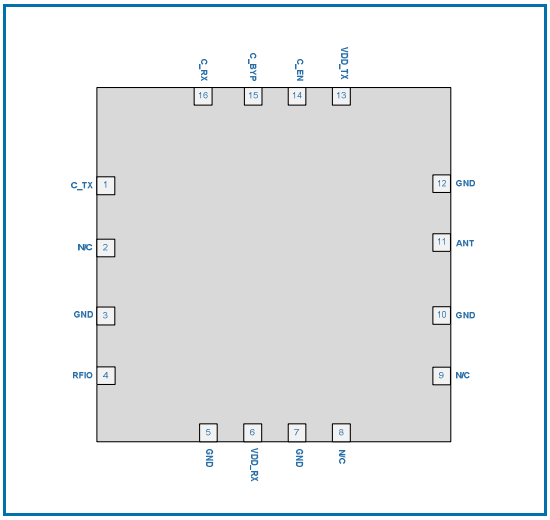
Switch Control Logic Table

Mode	C_EN	C_TX	C_RX	C_BYP
TX Mode	High	High	Low	Low
RX Mode	High	Low	High	Low
Bypass Mode	High	Low	Low	High
Power Down	Low	Low	Low	Low

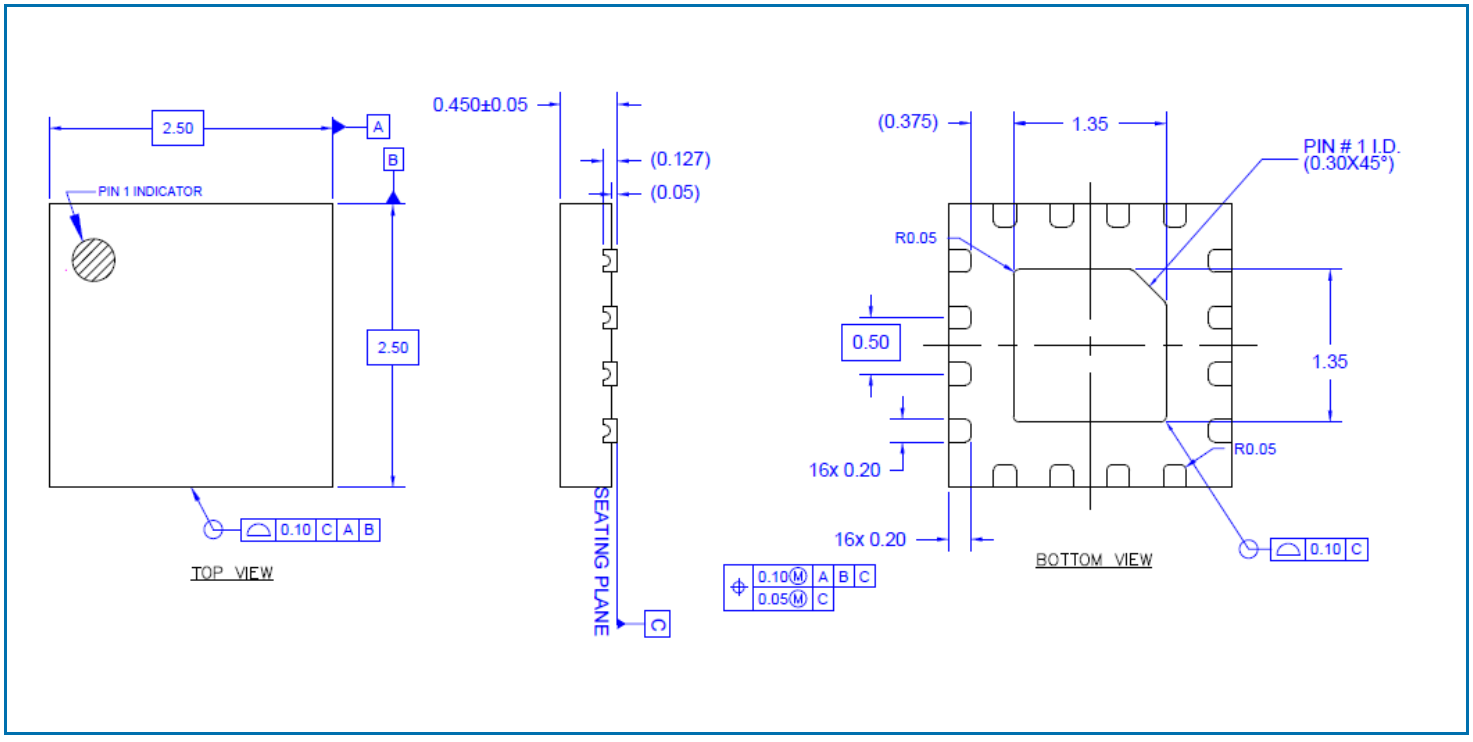
Application Schematic



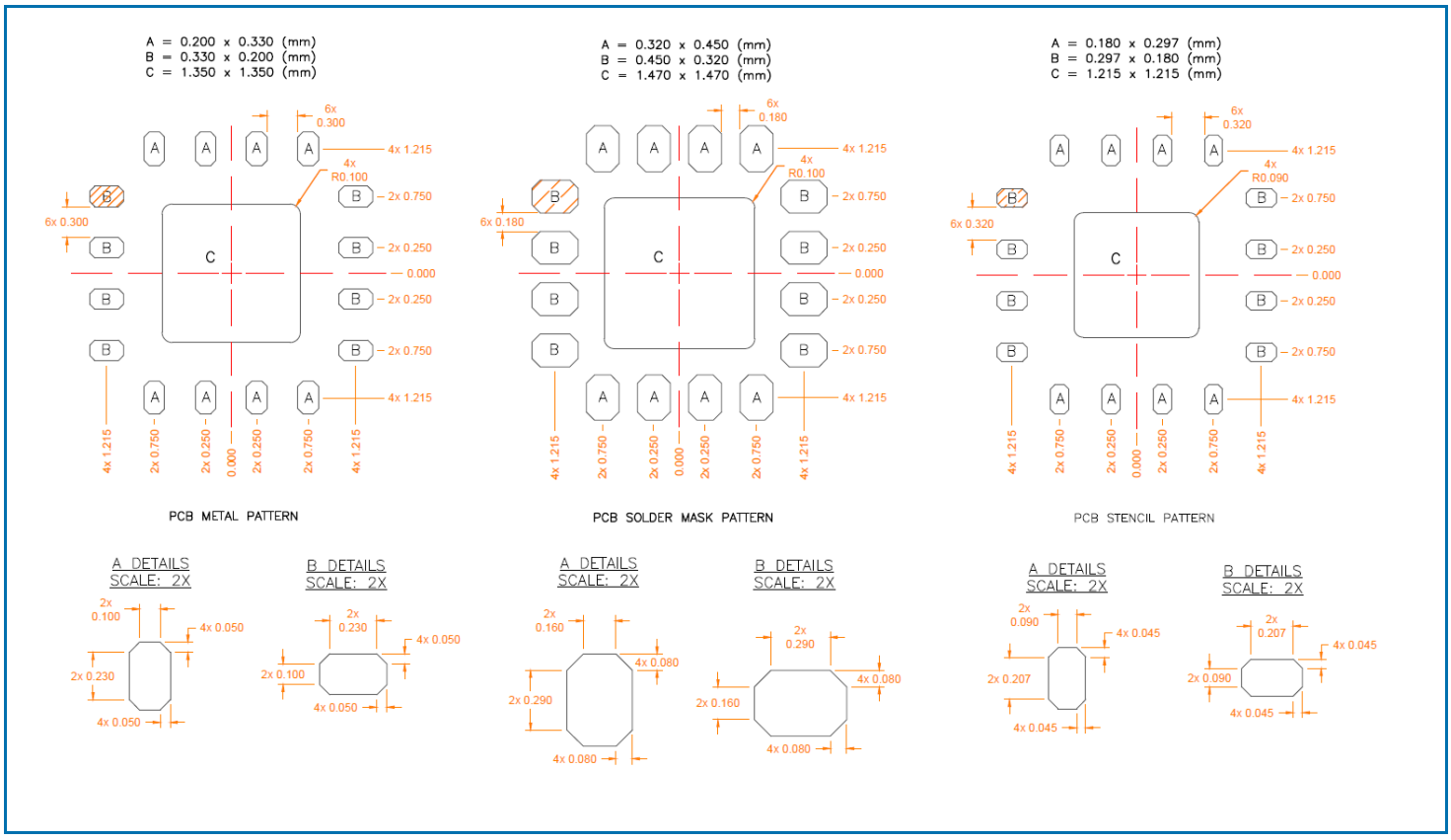
Pin Out



Package Outline and Branding Drawing (Dimensions in millimeters)



Recommended PCB Patterns


A = 0.200 x 0.330 (mm)
B = 0.330 x 0.200 (mm)
C = 1.350 x 1.350 (mm)
PCB METAL PATTERN
A = 0.320 x 0.450 (mm)
B = 0.450 x 0.320 (mm)
C = 1.470 x 1.470 (mm)
PCB SOLDER MASK PATTERN
A = 0.180 x 0.297 (mm)
B = 0.297 x 0.180 (mm)
C = 1.215 x 1.215 (mm)
PCB STENCIL PATTERN
A DETAILS SCALE: 2X
B DETAILS SCALE: 2X
A DETAILS SCALE: 2X
B DETAILS SCALE: 2X
A DETAILS SCALE: 2X
B DETAILS SCALE: 2X

Pin Names and Descriptions

Pin	Name	Description
1	C_TX	Control Pin: Transmit Enable/Disable, view logic table for operation
2	N/C	No Internal Connection; Open on PCB
3	GND	No Internal Connection; Ground on PCB
4	RF I/O	RF Input/Output signal: internally matched to 50Ω, DC Blocked
5	GND	No Internal Connection; Ground on PCB
6	VDD_RX	Receive Low Noise Amplifier Voltage Supply
7	GND	No Internal Connection; Ground on PCB
8	N/C	No Internal Connection; No Connect on PCB
9	N/C	No Internal Connection; No Connect on PCB
10	GND	No Internal Connection; Ground on PCB
11	ANT	Antenna Switch Common Port, internally matched to 50 ohms, DC Blocked
12	GND	No Internal Connection; Ground on PCB
13	VDD_TX	Transmit Power Amplifier Voltage Supply
14	C_EN	Control Pin: Enable FEM, view logic table for operation
15	C_BYP	Control Pin: Bypass Enable/Disable, view logic table for operation
16	C_RX	Control Pin: Receive Enable/Disable, view logic table for operation
Pkg Base	GND	Ground connection. The back side of the package should be connected to the ground plane through as short a connection as possible, e.g., PCB vias under the device are recommended.

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