RFMD
rfmd.com

RFFM8204

2.4GHz TO 2.5GHz 802.11b/g/n WiFi FRONT END MODULE

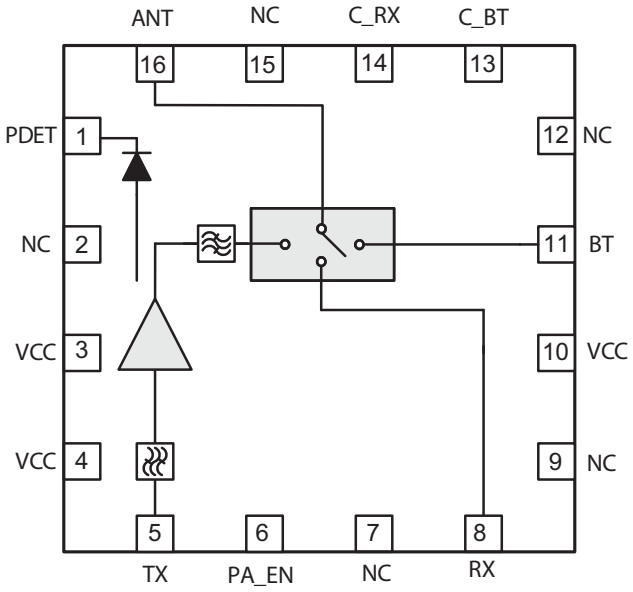
Package Style: QFN, 16-pin, 2.5mmx2.5mmx0.45mm

Features

- P_{OUT} = 19dBm 11g OFDM 2.5% EVM
- P_{OUT} = 21dBm Meeting 11b Spec Mask
- Input and Output Matched to 50Ω; High Level of Integration
- Supports Wide Voltage Supply Range (3.0V to 4.8V)
- Low Height Package

Applications

- Cellular Handsets
- Mobile Devices
- Tablets
- Consumer Electronics
- Gaming
- Netbooks/Notebooks
- TV/Monitors/Video
- Smart Energy



Functional Block Diagram

Product Description

The RFFM8204 provides a complete integrated solution in a single Front End Module (FEM) for WiFi 802.11b/g/n and Bluetooth® systems. The ultrasmall form factor and 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 manufacturability cost. The RFFM8204 integrates a 2.4GHz Power Amplifier (PA), power detector coupler for improved accuracy, SP3T Switch, and some filtering for harmonic rejection. The device is provided in 2.5mm x 2.5mm x 0.45mm 16-pin QFN package. This module meets or exceeds the RF Front End needs of IEEE 802.11b/g/n WiFi RF systems.

Ordering Information

RFFM8204SB	Standard 5-piece sample bag
RFFM8204SQ	Standard 25-piece sample bag
RFFM8204SR	Standard 100-piece reel
RFFM8204TR7	Standard 2500-piece reel
RFFM8204PCK-410	Fully assembled evaluation board with 5-piece bag

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☑ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	☐ RF MEMS
☑ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Absolute Maximum Ratings

Parameter	Rating	Unit
DC Supply Voltage (No RF Applied)	6	V
DC Supply Current	500	mA
Operating Case Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Maximum TX Input Power	+10	dBm
Maximum RX Input Power	+5	dBm
Moisture Sensitivity	MSL1	

Caution! ESD sensitive device.

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.

RFMD Green: RoHS compliant per EU Directive 2002/95/EC, 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.

Parameter	Specification				Condition
	Min.	Typ.	Max.	Unit	
Parameter					
Operating Frequency	2.412	2.442	2.484	GHz	
Operating Temperature	-10	+25	+70	°C	
Extended Operating Temperature	-40	+25	+85	°C	Functional with derated performance
Storage Temperature	-40	+25	150	°C	
Power Supply V_{CC}	3.3	3.7	4.35	V	Recommended operating voltage range
Extended V_{CC}	3	3.7	4.8	V	Functional with derated performance
Control Voltage-high	2.8	3.7	V_{CC}	V	PA_EN, CR_X, C_BT
Control Voltage-low		0	0.2	V	
Transmit (TX-ANT)					T = -10°C to +70°C; V_{CC} = 3.3V to 4.35V; PA_EN = high, CR_X = C_BT = low; 50% duty cycle; frequency = 2.412GHz to 2.484GHz, measured with a standard IEEE802.11g waveform unless otherwise noted.
Dynamic EVM - Nominal		2.5	3	%	T = 25°C, V_{CC} = 3.3v, P_{OUT} = 19dBm
Dynamic EVM		2.5	3	%	P_{OUT} = 18dBm
Output power meeting Spectral Mask		21	22	dBm	11 Mbps CCK, +/- 11MHz offset from carrier
TX Port Return Loss (S11)		-10	-8	dB	50Ω characteristic impedance
ANT Port Return Loss		-12	-10	dB	
Nominal Gain	23	24	27	dB	T = 25°C, V_{CC} = 3.3v
Gain	22	24	28	dB	
Gain Flatness - 20 MHz Channel	-0.5		0.5	dB	
Gain Flatness - 40 MHz Channel	-0.75		0.75	dB	
Gain Flatness - 100 MHz Band	-1		1	dB	
Out of Band Rejection	4	7		dBc	2110MHz to 2170MHz, T = 25°C, V_{CC} = 3.3v, frequency = 2.412GHz
Operating Current		185	210	mA	P_{OUT} = 18dBm
Quiescent Current		135	160	mA	
PA_Enable Current		30	50	µA	
Leakage Current		1	10	µA	V_{CC} = 4.8v, RF OFF
Second Harmonic		-23	-18	dBm/MHz	4.80GHz to 5.00GHz
Third Harmonic		-50	-41	dBm/MHz	7.20GHz to 7.50GHz
Power Detector Voltage	0.1	0.15	0.2	V	P_{OUT} = 0dBm
Power Detector Voltage	1.0	1.25	1.5	V	P_{OUT} = 22dBm
P_{DETECT} Variation from 0-360 load pull	-1.5		1.5	dB	3:1 VSWR

7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or **customerservice@rfmd.com**.

Parameter	Specification				Condition
	Min.	Typ.	Max.	Unit	
Receive (ANT-RX)					T = -10°C to +70°C; V_{CC} = 3.3V to 4.35V; PA_EN = low, CR_X = high, C_BT = low; frequency = 2.412GHz to 2.484GHz, measured with a CW waveform unless otherwise noted.
Insertion Loss (S21)	-1.1	-0.6	-0.3	dB	
Rx Port Return Loss		-20	-15	dB	
ANT Port Return Loss		-20	-15	dB	
Bluetooth TX/RX					
Input / Output Power	20			dBm	
Insertion Loss	-1.1	-0.6	-0.3	dB	
BT Port Return Loss		-20	-15	dB	
ANT Port Return Loss		-20	-15	dB	
Isolation					
ANT-BT; TX Mode		-20	-18	dB	
ANT-BT; RX Gain Mode		-20	-18	dB	
ANT-RX; TX Mode		-25	-20	dB	
ANT-RX; BT Mode		-20	-18	dB	
General Specifications					
Switch Control Current - High - Each Line		5	60	μA	
Switch Control Current - Low - Each Line		0.5	10	μA	
Switching Speed		100	150	nS	
ESD		1000		V	
PA Turn On/Off Time		200	500	nS	Output stable to within 90% of final gain
Maximum Input Power			+5	dBm	Into 50Ω
Ruggedness			10:1		No damage

Switch Control Logic Truth Table

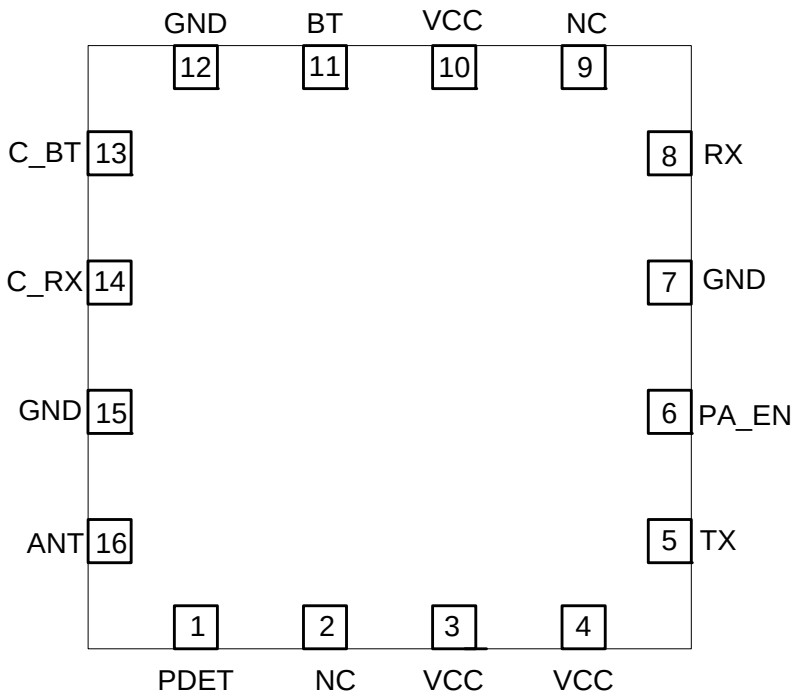
Operating Mode	PA_EN	C_RX	C_BT
Standby	Low	Low	Low
802.11b/g/n TX	High	Low	Low
802.11b/g/n Rx Mode	Low	High	Low
BT RX/TX	Low	Low	High

Note: PA_EN and TX switch control are tied together internally

Pin	Function	Description
1	PDET	Power detector voltage for the TX path. May need external series R/shunt C to adjust voltage level and to filter RF noise.
2	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
3	VCC	Supply voltage for the output stage of the PA. See applications schematic for biasing and bypassing components.
4	VCC	Supply voltage for the first stage of the PA. See applications schematic for biasing and bypassing components.
5	TX	RF input port for the 802.11b/g/n PA. Input is matched to 50Ω. An external DC block is required.
6	PA_EN	Bias voltage for the PA. This pin also controls the TX switch of the SP3T. See truth table for proper settings.
7	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
8	RX	RF output port for the 802.11b/g/n RX path. An external DC block is required.
9	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
10	VCC	Supply voltage for the PA Regulator. See applications schematic for biasing and bypassing components.
11	BT	RF bidirectional port for Bluetooth®. Input is matched to 50Ω. An external DC block is required.
12	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
13	C_BT	Bluetooth® switch control pin. See truth table for proper level.
14	C_RX	Receive switch control pin. See switch truth table for proper level.
15	NC*	No Connect. This pin is not connected internally and can be left floating or connected to ground.
16	ANT	RF bidirectional antenna port matched to 50Ω. An external DC block is required.
Pkg Base	GND	Ground connection. The backside of the package should be connected to the ground plane through a short path, i.e., PCB vias under the device are recommended.

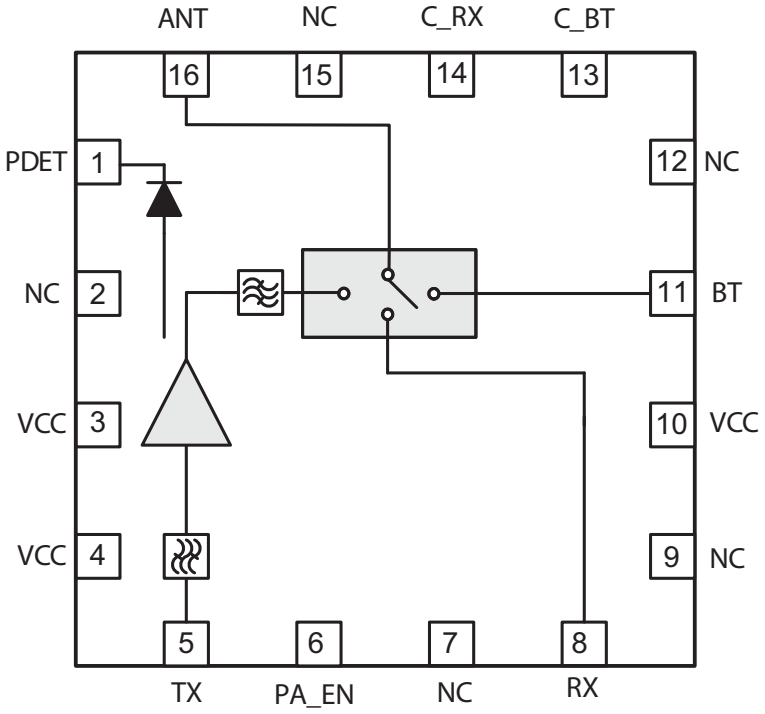
* It is recommended to ground all NC pins.

Pin Out

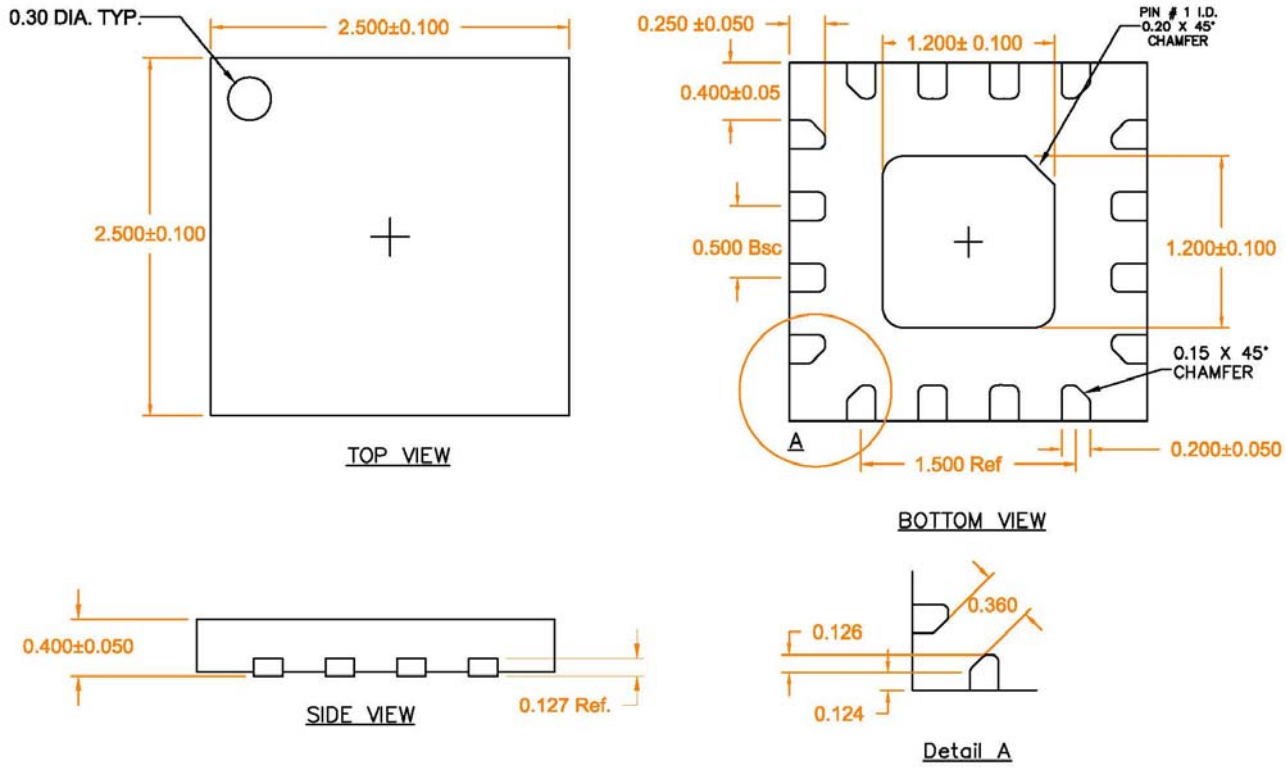


7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

Detailed Functional Block Diagram

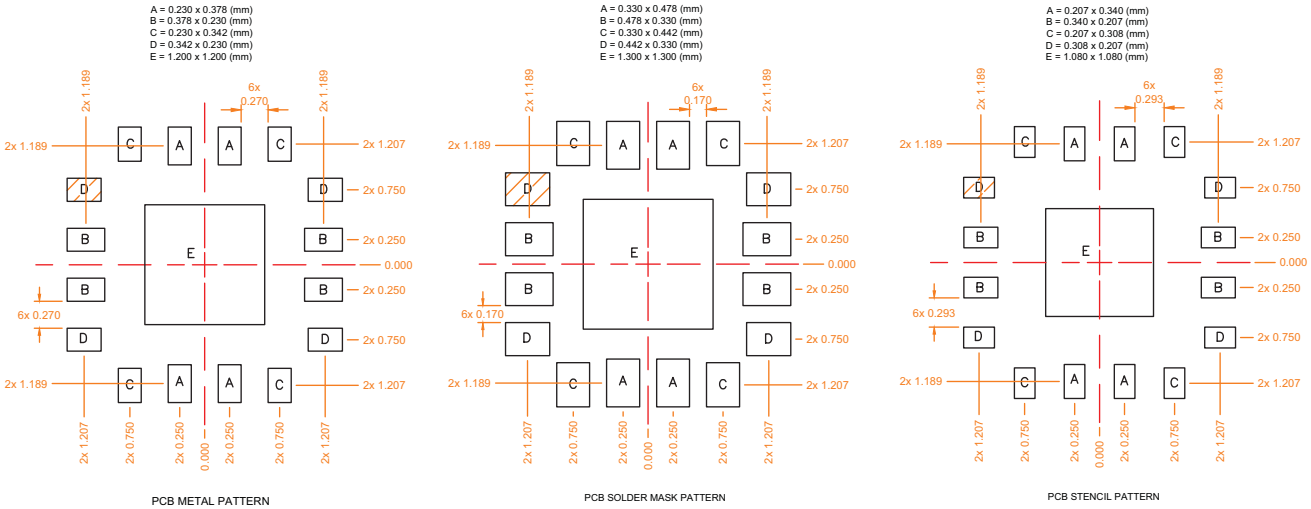


Package Drawing



7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.

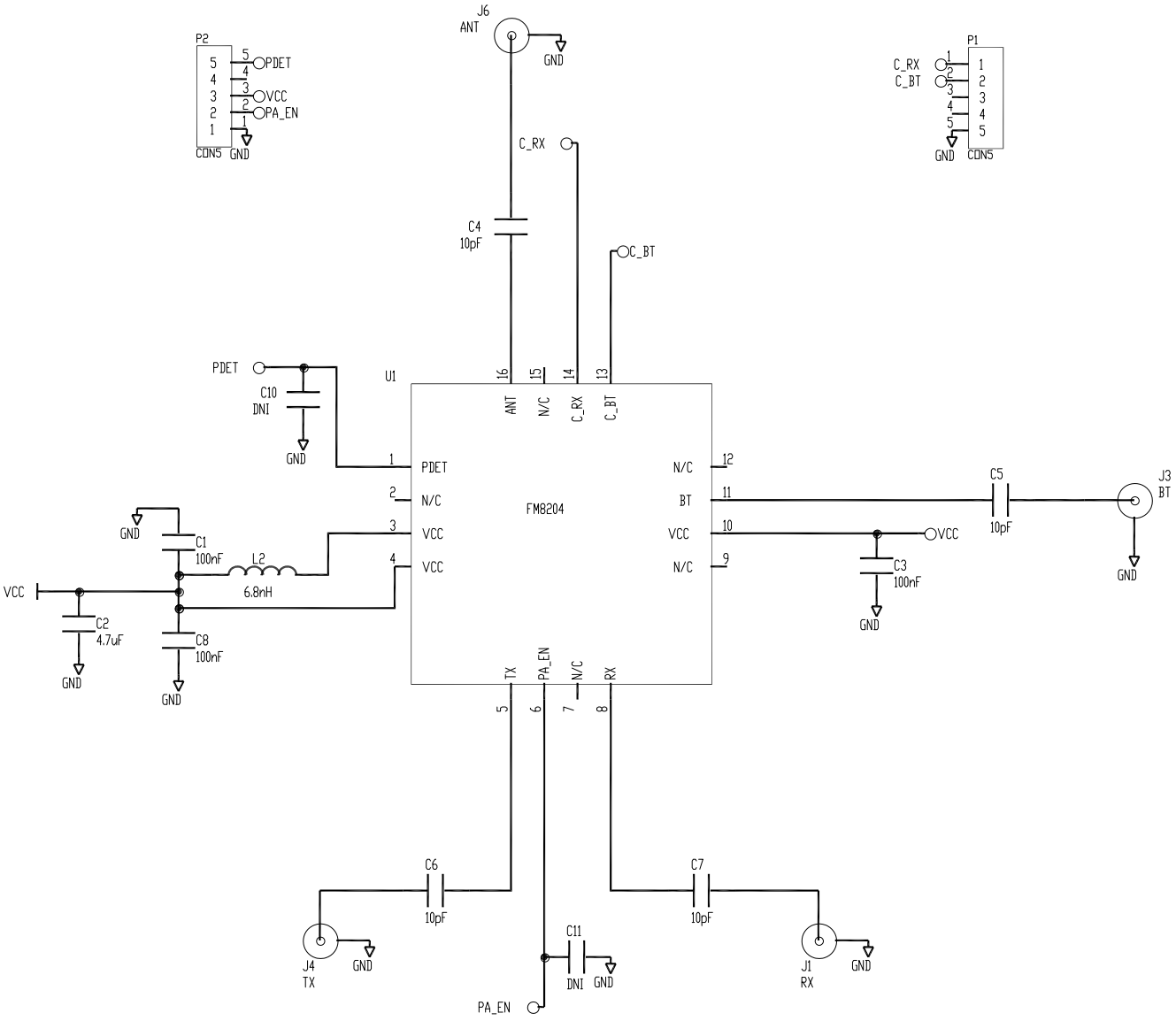
PCB Patterns



Thermal vias for center slug "E" should be incorporated into the PCB design. The number and size of thermal vias will depend on the application, the power dissipation, and the electrical requirements. Example of the number and size of vias can be found on the RFMD evaluation board layout.

Shaded are represents Pin 1 location.

Application Schematic



7628 Thorndike Road, Greensboro, NC 27409-9421 · For sales or technical support, contact RFMD at (+1) 336-678-5570 or customerservice@rfmd.com.