

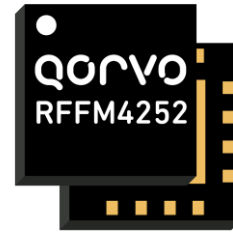
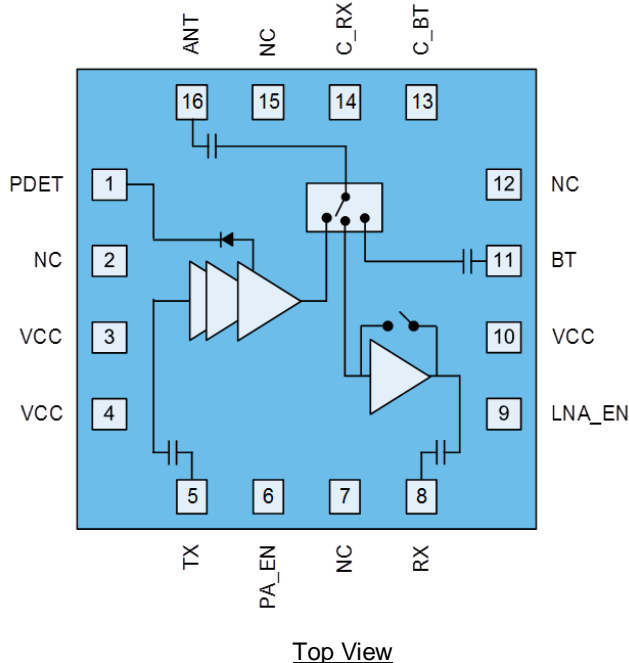
### General Description

The RFFM4252 provides a complete integrated solution in a single front end module (FEM) for Wi-Fi 802.11b/g/n/ac and Bluetooth® systems. The small form factor and integrated matching minimizes layout area in the application and greatly reduces the number of external components.

The module allows true 5V supply without any modifications to the supply lines and performance is a balance of maximizing on highest linear output power and leading edge throughput while integrating die level filtering for 2<sup>nd</sup> and 3<sup>rd</sup> harmonics as well as LO spur rejection are included

The RFFM4252 integrates a 2 GHz power amplifier (PA), single pole three throw switch (SP3T) and bypassable low noise amplifier (LNA) into a single device.

### Functional Block Diagram



16 Pad 3 x 3 mm Laminate Package

### Product Features

- 2412 – 2484 MHz
- P<sub>OUT</sub> = +21dBm MCS8 HT40 -35dB Dynamic EVM
- P<sub>OUT</sub> = +22dBm MCS7 HT20/40 -30.5dB Dynamic EVM
- P<sub>OUT</sub> = +25dBm 802.11b DSSS 1Mbps Spectral Mask Compliance
- MCS11 Capable
- Optimized for +5 V Operation
- 29 dB Tx Gain
- 2.5 dB Noise Figure
- 15 dB Rx Gain & 7 dB Bypass Loss
- 8 dB 5 GHz Rejection on Rx Path

### Applications

- Access Points
- Wireless Routers
- Residential Gateways
- Customer Premise Equipment
- Internet of Things

### Ordering Information

| Part No.        | Description                        |
|-----------------|------------------------------------|
| RFFM4252SB      | Sample bag with 5 pieces           |
| RFFM4252SQ      | Sample bag with 25 pieces          |
| RFFM4252SR      | 7" reel with 100 pieces            |
| RFFM4252TR7     | 7" reel with 2,500 pieces          |
| RFFM4252PCK-410 | Assembled Evaluation Board + 5 pcs |

### Absolute Maximum Ratings

| Parameter   | Rating         |
|---|----------------|
| DC Supply Voltage   | +6 V           |
| DC Supply Current   | 600 mA         |
| T <sub>junction</sub> (MTTF>0.7x10 <sup>6</sup> hours)          | 160 °C         |
| Storage Temperature   | -40 to +150 °C |
| TX RF Input Power into 50 Ω Load for 802.11b/g/n/ac (No Damage) | +10 dBm        |
| RX LNA On RF Input Power (No Damage)                            | +10 dBm        |

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.

### Recommended Operating Conditions

| Parameter                         | Min  | Typ  | Max             | Units |
|-----------------------------------|------|------|-----------------|-------|
| Operating Frequency               | 2412 |      | 2484            | MHz   |
| Device Voltage (V <sub>CC</sub> ) | 4.75 | +5   | 5.25            | V     |
| PA Enable Voltage – High          | +2.8 | +3.1 | V <sub>CC</sub> | V     |
| PA Enable Voltage – Low           | +0   |      | +0.2            | V     |
| T <sub>OPERATING</sub> *          | -10  |      | +85             | °C    |
| Extended T <sub>OPERATING</sub>   | -40  |      | +85             | °C    |

\* T<sub>OPERATING</sub> is temperature at package ground

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

| Parameter  | Conditions                                    | Min | Typ  | Max | Units   |
|--|---|-----|------|-----|---------|
| <b>TRANSMIT (TX-ANT) MODE</b>  |   |     |      |     |         |
| Unless otherwise noted: V <sub>CC</sub> =5V, T=+25°C, PA_EN=High, LNA_EN=Low, C_RX=Low, C_BT=Low |   |     |      |     |         |
| 11ac HT40 Output Power   | MCS11 1024QAM                                 |     | 15   |     | dBm     |
| Dynamic EVM  |   |     |      | -40 | dB      |
| 11ac HT40 Output Power   | MCS8 256QAM                                   | 20  | 21   | -35 | dBm     |
|  |   |     |      | -36 | -35     |
| 11n HT20/40 Output Power   | MCS7 64QAM                                    | 21  | 22   |     | dBm     |
| Dynamic EVM  |   |     |      | -32 | -30.5   |
| Margin to HT20/40 Spectral Mask  | P <sub>OUT</sub> = +23.5 dBm, 11ac MCS8       |     |      | 0   | dBc     |
| Margin to 802.11b Spectral Mask  | P <sub>OUT</sub> = +25 dBm, DSSS 1MBps        |     |      | 0   | dBc     |
| Gain   |   | 27  | 29   |     | dB      |
| Gain Variation   | T = -10 to +85 °C                             | -3  |      | +2  | dB      |
| Out of Band Gain   | f = 1206-1242MHz                              |     | -3   | 0   | dB      |
|  | f = 3618-3726MHz                              |     | -7   | -3  | dB      |
| TX Port Return Loss  |   | 7   | 9    |     | dB      |
| ANT Port Return Loss   |   | 10  | 15   |     | dB      |
| Quiescent Current  | RF Off  |     | 180  |     | mA      |
| Operating Current  | P <sub>OUT</sub> = +21 dBm                    |     | 230  | 275 | mA      |
|  | P <sub>OUT</sub> = +25 dBm                    |     | 300  | 380 | mA      |
| 2 <sup>nd</sup> Harmonics  | P <sub>OUT</sub> = +25 dBm 802.11b DSSS 1MBps |     | -30  | -25 | dBm/MHz |
| 3 <sup>rd</sup> Harmonics  | P <sub>OUT</sub> = +25 dBm 802.11b DSSS 1MBps |     | -35  | -30 | dBm/MHz |
| ANT-RX Isolation   |   |     | 37   |     | dB      |
| DC Power Detect Voltage  | RF Off  |     | 0.12 |     | V       |
|  | P <sub>OUT</sub> = +20 dBm                    |     | 0.66 |     | V       |
|  | P <sub>OUT</sub> = +25 dBm                    |     | 1.10 |     | V       |



# RFFM4252

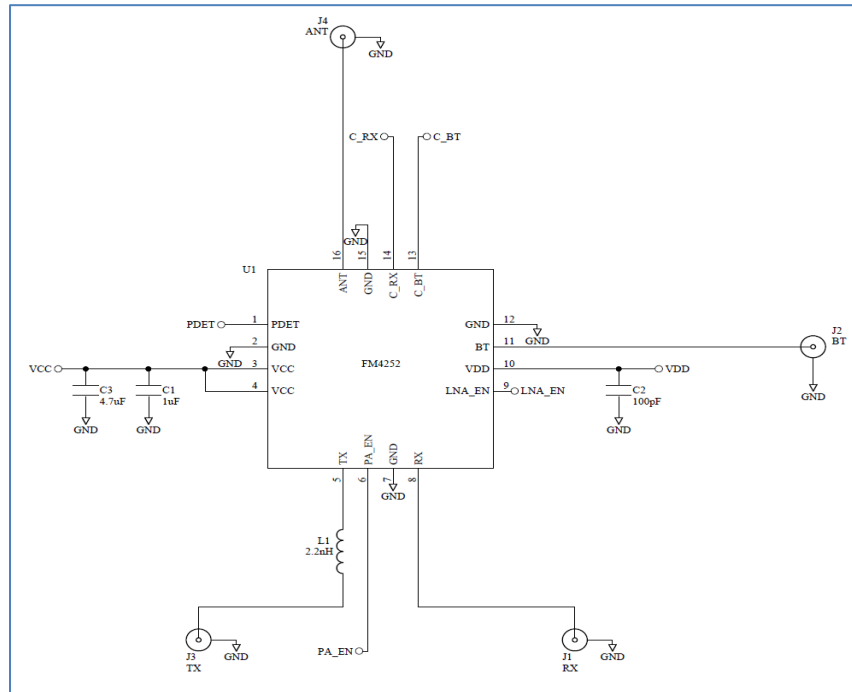
## Wi-Fi Front End Module

| RECEIVE (ANT-RX) LNA ON MODE        | Unless otherwise noted: V <sub>CC</sub> =5V, T=+25°C, PA_EN=Low, LNA_EN=High, C_RX=High, C_BT=Low |     |     |    |      |
|-------------------------------------|---|-----|-----|----|------|
| Gain                                |   | 13  | 15  |    | dB   |
| Gain Flatness                       | From 2412 to 2484 MHz   | -1  |     | +1 | dB   |
| Out of Band Gain                    | f = 5000-6000 MHz   |     | -8  | -2 | dB   |
| Noise Figure                        |   |     | 2.5 | 3  | dB   |
| RX Port Return Loss                 |   |     | 11  |    | dB   |
| ANT Port Return Loss                |   |     | 5   |    | dB   |
| Input P <sub>1dB</sub>              |   |     | -5  |    | dBm  |
| Rx Operating Current                |   |     | 13  |    | mA   |
| RECEIVE (ANT-RX) BYPASS MODE        | Unless otherwise noted: V <sub>CC</sub> =5V, T=+25°C, PA_EN=Low, LNA_EN=Low, C_RX=High, C_BT=Low  |     |     |    |      |
| Bypass Loss                         |   |     | 7   |    | dB   |
| RX Port Return Loss                 |   |     | 11  |    | dB   |
| ANT Port Return Loss                |   |     | 8   |    | dB   |
| Input P <sub>1dB</sub>              |   | +10 | +15 |    | dBm  |
| Bypass Current                      |   |     | 180 |    | μA   |
| BLUETOOTH (ANT-BT) MODE             | Unless otherwise noted: V <sub>CC</sub> =5V, T=+25°C, PA_EN=Low, LNA_EN=Low, C_RX=Low, C_BT=High  |     |     |    |      |
| Insertion Loss                      |   |     | 1.4 |    | dB   |
| RX Port Return Loss                 |   |     | 11  |    | dB   |
| ANT Port Return Loss                |   |     | 11  |    | dB   |
| Input P <sub>1dB</sub>              |   | +25 | +30 |    | dBm  |
| ANT-RX Isolation                    |   |     | 25  |    | dB   |
| GENERAL SPECIFICATIONS              | Unless otherwise noted: V <sub>CC</sub> =5V, T=+25°C  |     |     |    |      |
| FEM Leakage Current                 |   |     | 35  |    | μA   |
| PA_EN Control Current               |   |     | 60  |    | μA   |
| LNA_EN Control Current              |   |     | 60  |    | μA   |
| C_RX Control Current                | LNA On Mode   |     | 90  |    | μA   |
|                                     | Bypass and Bluetooth Mode   |     | 3   |    | μA   |
| Ramp ON/OFF Time                    | 10<->90% Ref from Control Voltage to RF Power   |     | 250 |    | nS   |
| Stability - Output VSWR             | CW No Spurious above -41.25 dBm/MHz   |     | 4:1 |    |      |
| Output Power Range                  |   | 0   |     | 25 | dBm  |
| Thermal Resistance, θ <sub>jc</sub> | Junction to case, MCS0 P <sub>OUT</sub>   |     | 44  |    | °C/W |

Notes:

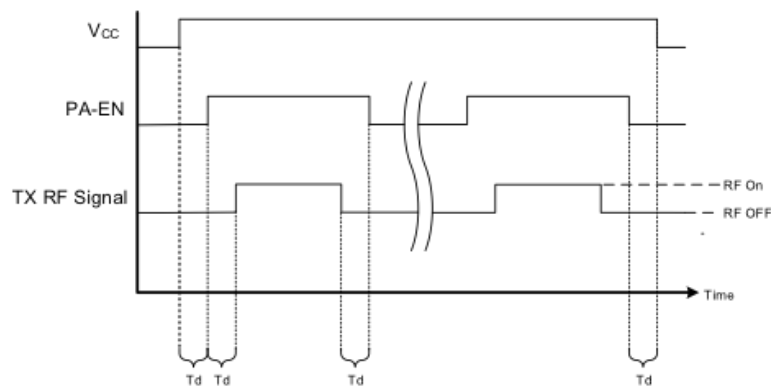
| Operating Mode | PA_EN | LNA_EN | C_RX | C_BT |
|----------------|-------|--------|------|------|
| Standby Mode   | Low   | Low    | Low  | Low  |
| Transmit Mode  | High  | Low    | Low  | Low  |
| LNA Mode       | Low   | High   | High | Low  |
| Bypass Mode    | Low   | Low    | High | Low  |
| Bluetooth Mode | Low   | Low    | Low  | High |

### Evaluation Board Schematic



### Timing Diagram

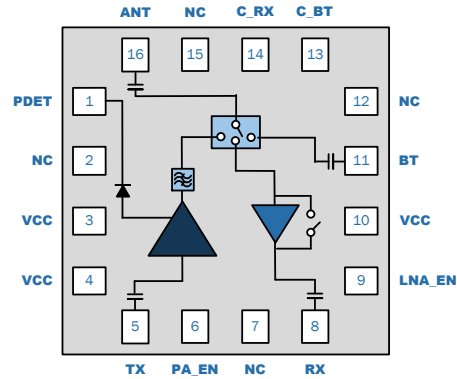
RF/DC Power On/Off Sequence



Note: Observe the timing sequence shown in the diagram above and described below.  
DC and RF signal levels per data sheet specification

- Apply  $V_{CC}$  prior to turning on or pulsing PA enable.
- Turn off PA enable prior to turning off  $V_{CC}$ .
- Turn on PA enable prior to applying RF signal.
- Turn off RF signal prior to turning off PA enable.

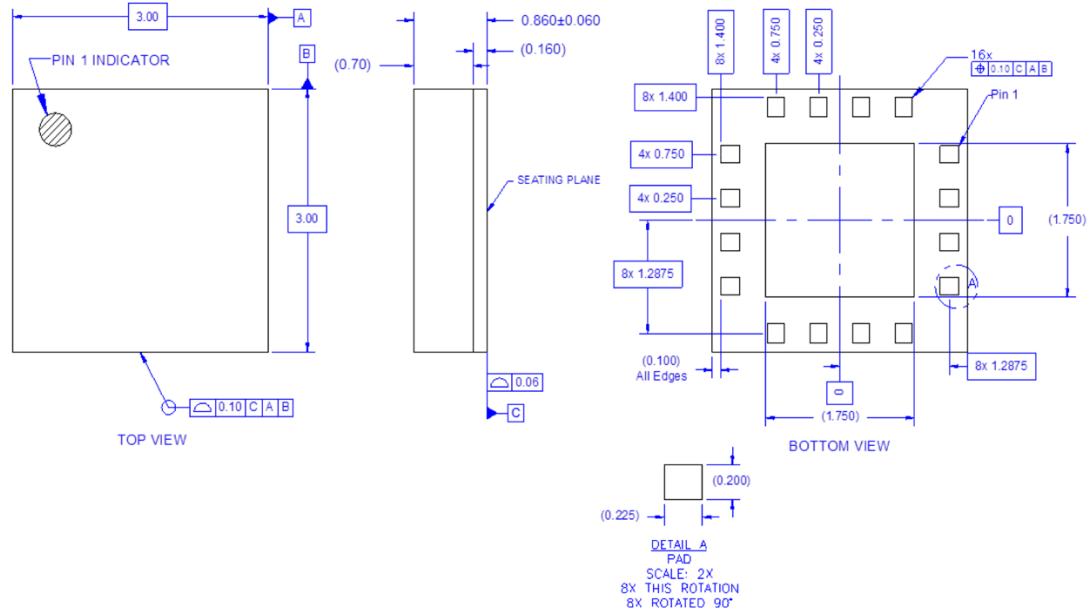
### Pin Configuration and Description



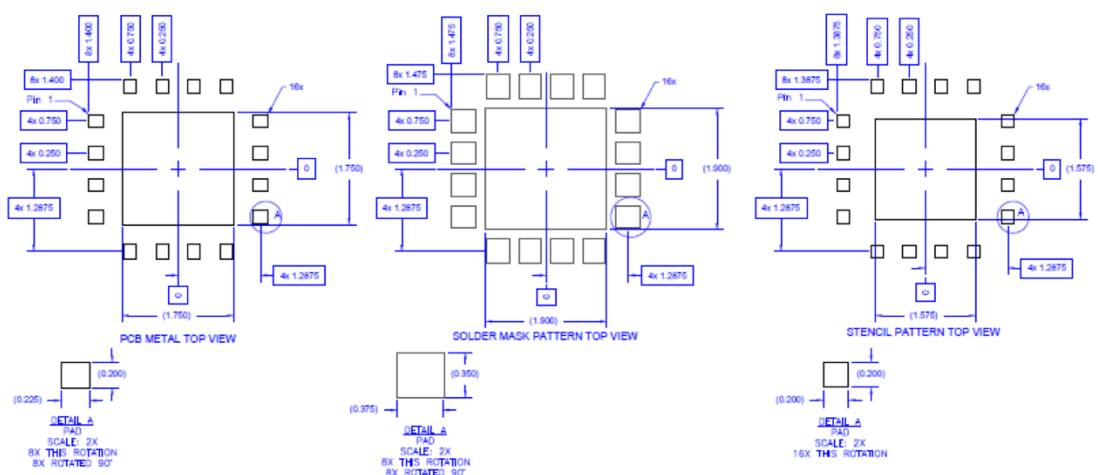
Top View

| Pad No.         | Label  | Description  |
|-----------------|--------|--|
| 1               | PDET   | DC power detector. Provides an output voltage proportional to the RF output power level.   |
| 2               | NC     | No electrical connection. Recommend to connect to ground but it may be left floating.  |
| 3               | VCC    | 2 <sup>nd</sup> stage supply voltage.  |
| 4               | VCC    | 1 <sup>st</sup> stage supply voltage.  |
| 5               | TX     | RF input. Internally matched to 50 $\Omega$ and DC blocked.  |
| 6               | PA_EN  | Input enable bias voltage (Regulated internally)   |
| 7               | NC     | No electrical connection. Recommend to connect to ground but it may be left floating.  |
| 8               | RX     | RF output from the low noise amplifier. Internally matched to 50 $\Omega$ and DC blocked.  |
| 9               | LNA_EN | LNA control voltage.   |
| 10              | VDD    | Supply voltage for LNA and regulator   |
| 11              | BT     | RF bi-directional port. Internally matched to 50 $\Omega$ and DC blocked.  |
| 12              | GND    | Ground connection.   |
| 13              | C_BT   | Transmit-receive control voltage.  |
| 14              | C_RX   | Switch control voltage.  |
| 15              | GND    | Ground connection.   |
| 16              | ANT    | RF bi-directional antenna port. Internally matched to 50 $\Omega$ and DC blocked.  |
| Backside Paddle | GND    | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |

### Package Dimensions



### PCB Mounting Pattern



**Notes:**

1. All dimensions are in millimeters. Angles are in degrees.

### Handling Precautions

| Parameter                        | Rating   | Standard               |
|----------------------------------|----------|------------------------|
| ESD – Human Body Model (HBM)     | Class 1C | ANSI/ESDA/JEDEC JS-001 |
| ESD – Charged Device Model (CDM) | Class C3 | ANSI/ESDA/JEDEC JS-002 |
| MSL – Moisture Sensitivity Level | Level 3  | IPC/JEDEC J-STD-020    |



Caution!  
ESD-Sensitive Device

### Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes.

Solder profiles available upon request.

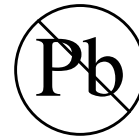
Contact plating: NiPdAu

### RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- PFOS Free
- SVHC Free



### Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Tel: 1-844-890-8163

Web: [www.qorvo.com](http://www.qorvo.com)

Email: [customer.support@qorvo.com](mailto:customer.support@qorvo.com)

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