



RFFM8211

Wi-Fi Front End Module

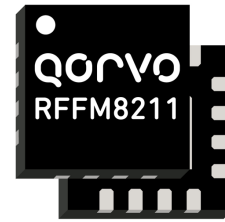
Product Overview

The Qorvo® RFFM8211 is an integrated front end module (FEM) designed for Wi-Fi 802.11b-ac and Bluetooth® systems. The ultra-small form factor and integrated matching minimizes layout area in the application.

Performance is focused on optimizing the PA for a supply voltage range from 4.2 to 3V that balances linear performance vs a voltage drop inherent in battery operated systems. Capable for 5V operation as well. A low loss path for bi-directional transmit and receive of Bluetooth® is integrated in.

Integrated die level filtering for 2nd and 3rd harmonics as well as 5 GHz rejection for DBDC operation are included.

The RFFM8211 integrates a 2.4 GHz power amplifier (PA), regulator, single pole three throw switch (SP3T), bypassable low noise amplifier (LNA) and DC power detector into a single device

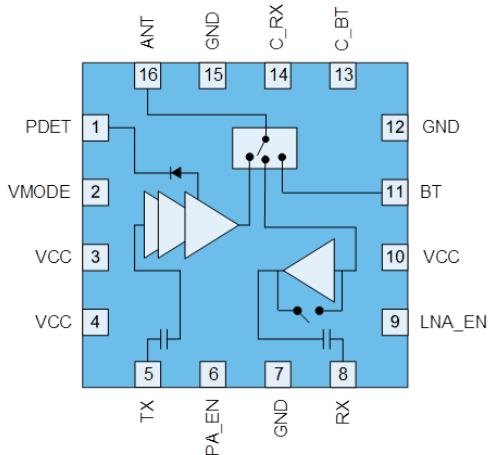


16 Pin 2.5x2.5mm QFN Package

Key Features

- 2412-2484 MHz
- $P_{OUT} = +19dBm$ MCS9 VHT40 -35dB Dynamic EVM
- $P_{OUT} = +20dBm$ MCS7 HT20 -30dB Dynamic EVM
- $P_{OUT} = +22dBm$ 11b Spectral Mask Compliance
- Optimized for +3.6 V Operation
- Capable from <3.3 to 5V Operation
- 27 dB Tx Gain
- 2.5 dB Noise Figure
- 12 dB Rx Gain & 6 dB Bypass Loss
- Low Power Mode Available
- Integrated DC Power Detector

Functional Block Diagram



Top View

Applications

- Mobiles Devices
- Consumer Electronics
- Gaming
- Access Points
- Wireless Routers
- Residential Gateways
- Customer Premise Equipment
- Internet of Things

Ordering Information

| Part Number | Description |
|-----------------|-------------------------------------|
| RFFM8211SB | Sample bag with 5 pieces |
| RFFM8211SQ | Sample bag with 25 pieces |
| RFFM8211SR | 7" reel with 100 pieces |
| RFFM8211TR7 | 7" reel with 2,500 pieces |
| RFFM8211PCK-410 | Assembled Eval Board (3.6V) + 5 pcs |
| RFFM8211PCK-411 | Assembled Eval Board (5V) + 5 pcs |



Absolute Maximum Ratings

| Parameter | Conditions | Rating |
|-----------------------|--|---------------|
| DC Supply Voltage | | -0.5 to +6 V |
| Control Voltage | | -0.5 to +5V |
| Storage Temperature | | -40 to 150 °C |
| RF Input Power at TX | Into 50 Ω Load for 802.11b-ac (No Damage), Transmit Mode | +12 dBm |
| RF Input Power at ANT | (No Damage), Receive LNA On Mode, CW | +12 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 _{CC}) | +3 | +3.6 | +4.2 | V |
| Extended Device Voltage (V _{CC}) | +3 | | +5 | V |
| Control Voltage – High (PA_EN, LNA_EN & C_RX) | +2.8 | +3.1 | V _{CC} | V |
| Control Voltage – Low (PA_EN, LNA_EN & C_RX) | | 0 | +0.2 | V |
| T _{OPERATING} * | -10 | | +70 | °C |
| Extended T _{OPERATING} * | -40 | | +85 | °C |

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. * T_{OPERATING} is temperature at the package ground.

Electrical Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------|---|-------|------|-------|-------|
| TRANSMIT (TX-ANT) MODE | Unless otherwise noted: V_{CC}=3.6V, T=+25°C, PA_EN=High, LNA_EN=Low, C_RX=Low | | | | |
| 11ac VHT40 Output Power | MCS8 256QAM | 17.5 | 18.5 | | dBm |
| Dynamic EVM | | | | -35 | dB |
| 11ac VHT20 Output Power | MCS8 256QAM | 18 | 19 | | dBm |
| Dynamic EVM | | | | -35 | dB |
| 11n HT20 Output Power | MCS7 64 QAM | 19 | 20 | | dBm |
| Dynamic EVM | | | | -30 | dB |
| 11n Spectral Mask | MCS0 HT20/40 | 20 | 21 | | dBm |
| Gain | | 24 | 27 | 31 | dB |
| Gain Flatness | Across any 20 MHz Channel | -0.25 | | +0.25 | dB |
| Gain Flatness | Across Operating Frequency | -0.5 | | +0.5 | dB |
| TX Port Return Loss | | 8 | 10 | | dB |
| ANT Port Return Loss | | 12 | 17 | | dB |



RFFM8211 Wi-Fi Front End Module

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|--|-------|------|-------|---------|
| Quiescent Current | RF Off | | 120 | 180 | mA |
| Operating Current | P _{OUT} = +19 dBm | | 180 | 230 | mA |
| | P _{OUT} = +20 dBm | | 195 | 240 | mA |
| 2 nd Harmonics | P _{OUT} = +22 dBm 802.11b 1 Mbps, T _{OPERATING} | | -10 | -5 | dBm/MHz |
| 3 rd Harmonics | P _{OUT} = +22 dBm 802.11b 1 Mbps, T _{OPERATING} | | -45 | -30 | dBm/MHz |
| ANT-RX Isolation | | 30 | 33 | 40 | dB |
| DC Power Detect Voltage | RF Off | 0.28 | 0.33 | 0.40 | V |
| | P _{OUT} = +16.5 dBm | 0.70 | 0.80 | 0.90 | V |
| | P _{OUT} = +18.5 dBm | 0.80 | 0.90 | 1.00 | V |
| | P _{OUT} = +22 dBm | 0.95 | 1.05 | 1.15 | V |
| Variation from 0-360° Load Pull | 3:1 VSWR | -1.5 | | +1.5 | dB |
| TRANSMIT (TX-ANT) LOW POWER MODE | Unless otherwise noted: V_{CC}=3.6V, T=+25°C, PA_EN=Low, LNA_EN=High, C_RX=High | | | | |
| 11ac VHT40 Output Power | MCS8 256QAM | 10 | 12 | | dBm |
| Dynamic EVM | | | | -35 | dB |
| 11n HT20 Output Power | MCS7 64 QAM | 12 | 14 | | dBm |
| Dynamic EVM | | | | -30 | dB |
| 11n Spectral Mask | MCS0 HT20/40 | 12 | 14 | | dBm |
| Gain | | 23 | 26 | 30 | dB |
| Gain Flatness | Across any 40 MHz Channel | -0.5 | | +0.5 | dB |
| Rx Operating Current | | | 22 | | mA |
| RECEIVE (ANT-RX) LNA ON MODE | Unless otherwise noted: V_{CC}=3.6V, T=+25°C, PA_EN=Low, LNA_EN=High, C_RX=High | | | | |
| Gain | | 9 | 12 | 14 | dB |
| Gain Flatness | Across any 20 MHz Channel | -0.25 | | +0.25 | dB |
| Gain Flatness | Across Operating Frequency | -0.5 | | +0.5 | dB |
| Noise Figure | | | 2.5 | 3 | dB |
| RX Port Return Loss | | 10 | 12 | 20 | dB |
| ANT Port Return Loss | | 3 | 4 | 10 | dB |
| Input P _{1dB} | | -8 | -4 | 0 | dBm |
| LNA Turn On Time | | | 200 | 500 | nS |
| Rx Operating Current | | 7 | 10 | 13.5 | mA |
| RECEIVE (ANT-RX) BYPASS MODE | Unless otherwise noted: V_{CC}=3.6V, T=+25°C, PA_EN=Low, LNA_EN=Low, C_RX=High | | | | |
| Bypass Loss | | 4.5 | 6 | 8 | dB |
| RX Port Return Loss | | 15 | 30 | 40 | dB |
| ANT Port Return Loss | | 8 | 10 | 15 | dB |
| Input P _{1dB} | | +20 | +25 | +30 | dBm |
| BLUETOOTH (ANT<->BT) MODE | Unless otherwise noted: V_{CC}=3.6V, T=+25°C, PA_EN=Low, LNA_EN=Low, C_RX=High | | | | |
| Insertion Loss | | | 0.6 | 1.2 | dB |
| BT Port Return Loss | | 12 | 18 | 30 | dB |
| ANT Port Return Loss | | 12 | 18 | 30 | dB |
| Input P _{1dB} | | +23 | +27 | +30 | dBm |



RFFM8211 Wi-Fi Front End Module

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------------|--|--|------|------|-------|
| GENERAL SPECIFICATIONS | | Unless otherwise noted: T=+25°C | | | |
| Leakage Current | PA, V _{CC} = 3.6V, RF Off, All control lines floating | 0 | 0.5 | 10 | μA |
| Control Current - High | C_RX & C_BT | | 5 | 60 | μA |
| Control Current - Low | C_RX & C_BT | | 0.5 | 10 | μA |
| Control Current | PA_EN | 30 | 40 | 80 | μA |
| Control Current | VMODE | | 300 | 500 | μA |
| Control Current | LNA_EN | 30 | 250 | 500 | μA |
| Control Line Impedance | PA_EN | | 187 | | kΩ |
| Control Line Impedance | LNA_EN | | 228 | | kΩ |
| Control Line Impedance | C_RX & C_BT | | 27 | | MΩ |
| Switching Speed | | | 100 | 500 | nS |
| Switch Turn-On Time | PA + TX | | 200 | 500 | nS |
| Ruggedness | 10:1 VSWR | | | | |
| Thermal Resistance, θ _{jc} | Junction to case | | 37 | | °C/W |

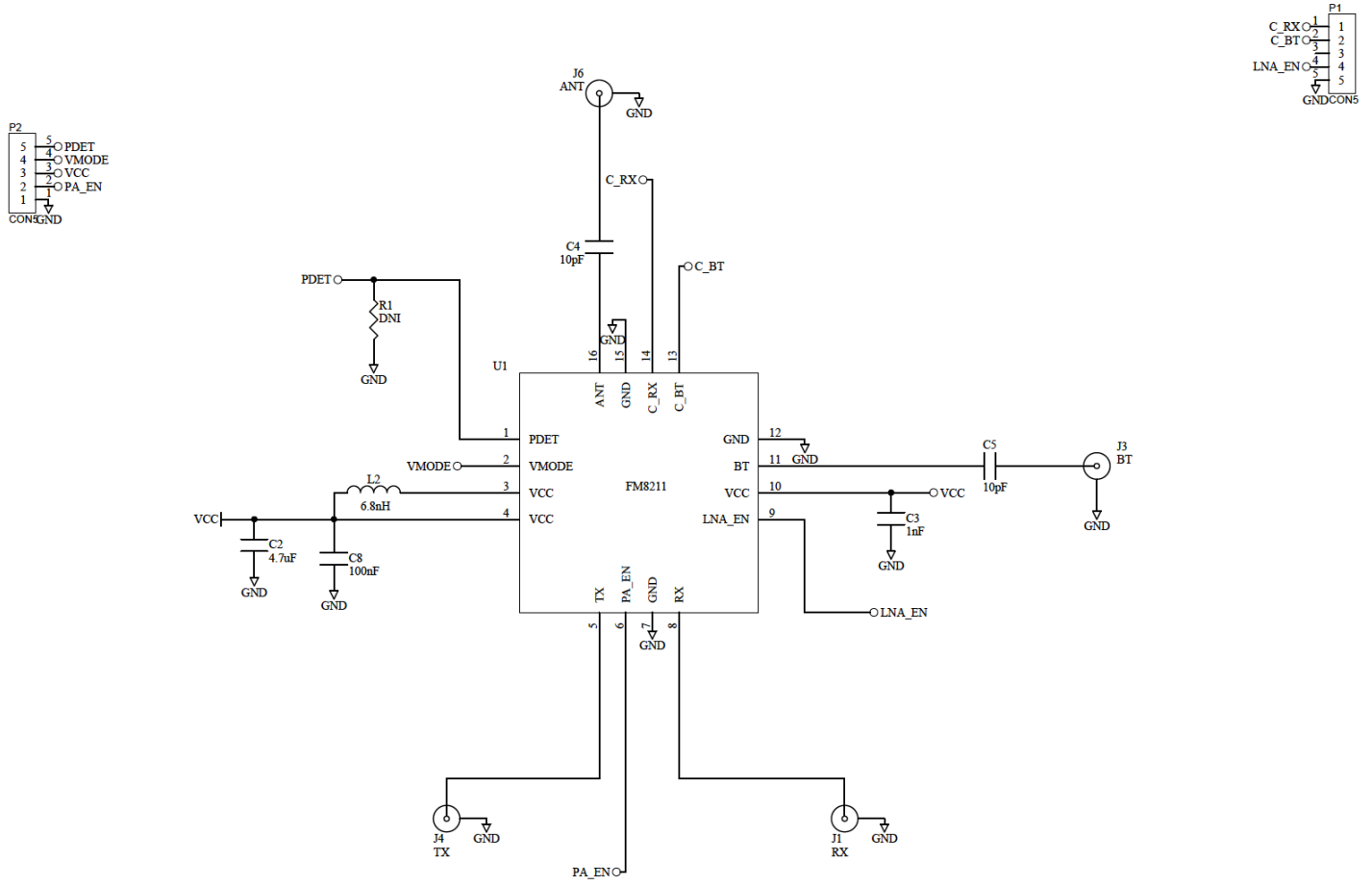
| Parameter | Conditions | Min. | Typ. | Max. | Units |
|-------------------------------------|---|--|------|------|---------|
| TRANSMIT (TX-ANT) MODE | | Unless otherwise noted: V_{CC}=5V, T=+25°C, PA_EN=High, LNA_EN=Low, C_RX=Low | | | |
| 11ac VHT40 Output Power | MCS8 256QAM | | 20 | | dBm |
| Dynamic EVM | | | | -35 | dB |
| 11ac VHT20 Output Power | MCS8 256QAM | | 21 | | dBm |
| Dynamic EVM | | | | -35 | dB |
| 11n HT20 Output Power | MCS7 64 QAM | | 22 | | dBm |
| Dynamic EVM | | | | -30 | dB |
| 11n Spectral Mask | MCS0 HT20/40 | | 23 | | dBm |
| Gain | | 24 | 26 | 30 | dB |
| Gain Flatness | Across Operating Frequency | -0.5 | | +0.5 | dB |
| TX Port Return Loss | | 8 | 10 | | dB |
| ANT Port Return Loss | | 12 | 17 | | dB |
| Quiescent Current | RF Off | | 150 | | mA |
| Operating Current | P _{OUT} = +22 dBm | | 230 | | mA |
| 2 nd Harmonics | P _{OUT} = +22 dBm 802.11b 1 Mbps | | -10 | | dBm/MHz |
| 3 rd Harmonics | P _{OUT} = +22 dBm 802.11b 1 Mbps, T _{OPERATING} | | -28 | | dBm/MHz |
| DC Power Detect Voltage | RF Off | | 0.33 | | V |
| | P _{OUT} = +18.5 dBm | | 1.00 | | V |
| | P _{OUT} = +22 dBm | | 1.25 | | V |
| RECEIVE (ANT-RX) LNA ON MODE | | Unless otherwise noted: V_{CC}=5V, T=+25°C, PA_EN=Low, LNA_EN=High, C_RX=High | | | |
| Gain | | 9 | 12 | 14 | dB |
| Noise Figure | | | 2.5 | 3 | dB |
| RX Port Return Loss | | 10 | 12 | 20 | dB |
| ANT Port Return Loss | | 3 | 4 | 10 | dB |

Logic Truth Table

| Mode | PA_EN | LNA_EN | C_RX | C_BT | VMODE |
|-------------------------|------------------|--------|------|------|-------|
| Transmit Mode | High | Low | Low | Low | Low |
| Transmit Low Power Mode | High | Low | Low | Low | High |
| Receive LNA On Mode | Low | High | High | Low | Low |
| Receive Bypass Mode | Low | Low | High | Low | Low |
| Bluetooth Mode | Low | Low | Low | High | Low |
| Standby | Low | Low | Low | Low | Low |
| Not Supported | All Other States | | | | |

PA_EN and TX switch control are tied together internally..

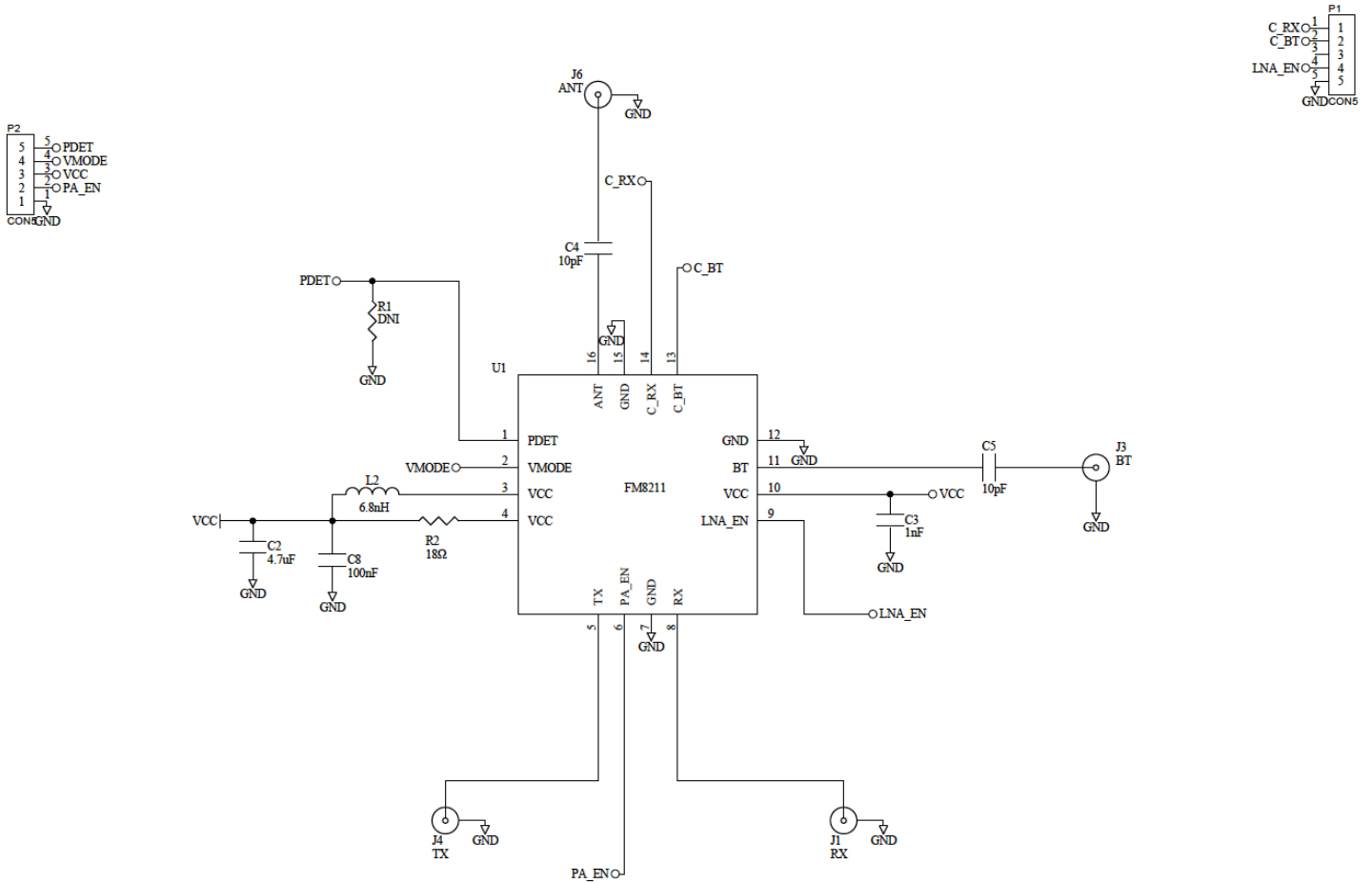
Evaluation Board Schematic – RFFM8211PCK-410 3.6V



Bill of Material – RFFM8211PCK-410 3.6V

| Ref. Des. | Value | Description | Manuf. | Part number |
|-----------|---------|---|-------------|--------------------|
| - | - | Printed Circuit Board | | |
| U1 | - | 2.4GHz Wi-Fi Front End Module | Qorvo | RFFM8211 |
| C8 | 0.1 µF | Capacitor, Chip, 10%, 6.3V, X5R, 0201 | Murata | GRM033R60J104KE19J |
| C4, C5 | 10 pF | Capacitor, Chip, +/-0.5pF, 25V, COG, 0201 | Taiyo Yuden | RM TMK063CG100DT-F |
| C3 | 1000 pF | Capacitor, Chip, 10%, 25V, X7R, 0201 | Samsung EM | CL03B102KA3NNNC |
| C2 | 4.7 µF | Capacitor, Chip +80/-20%, 10V, Y5V, 0805 | Taiyo Yuden | CE LMK212 F475ZG-T |
| L2 | 6.8 nH | Inductor, Chip, 5%, M?L, 0201 | Taiyo Yuden | LG HK 0603 6N8J-T |
| R1 | - | Do Not Install | | |

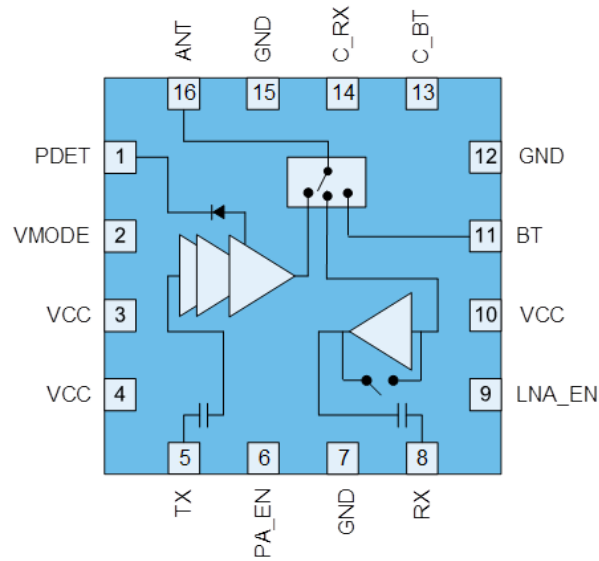
Evaluation Board Schematic – RFFM8211PCK-411 5V



Bill of Material – RFFM8211PCK-411 5V

| Ref. Des. | Value | Description | Manuf. | Part number |
|-----------|---------|---|-------------|--------------------|
| - | - | Printed Circuit Board | | |
| U1 | - | 2.4GHz Wi-Fi Front End Module | Qorvo | RFFM8211 |
| C8 | 100 nF | Capacitor, Chip | | |
| C4, C5 | 10 pF | Capacitor, Chip, +/-0.5pF, 25V, C0G, 0201 | Taiyo Yuden | RM TMK063CG100DT-F |
| C3 | 1000 pF | Capacitor, Chip, 10%, 25V, X7R, 0201 | Samsung EM | CL03B102KA3NNNC |
| C2 | 4.7 μF | Capacitor, Chip +80/-20%, 10V, Y5V, 0805 | Taiyo Yuden | CE LMK212 F475ZG-T |
| L2 | 6.8 nH | Inductor, Chip, 5%, M?L, 0201 | Taiyo Yuden | LG HK 0603 6N8J-T |
| R2 | 18 Ω | Resistor, Chip | | |
| R1 | - | Do Not Install | | |

Pin Configuration and Description

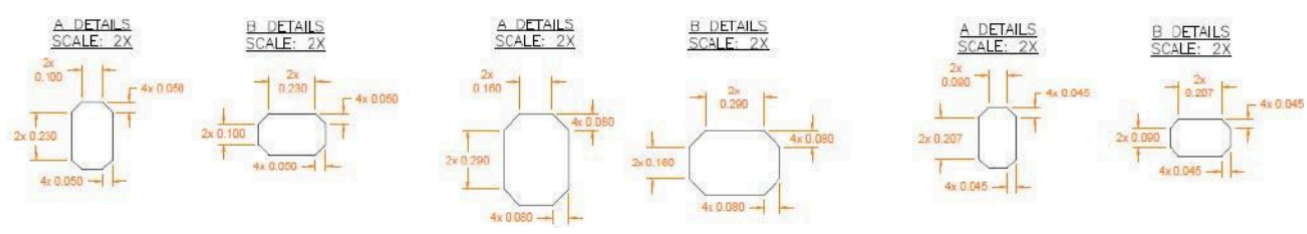
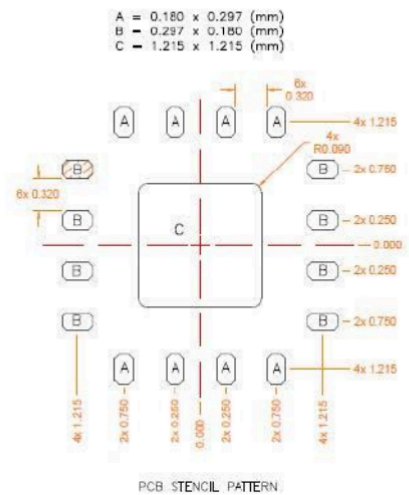
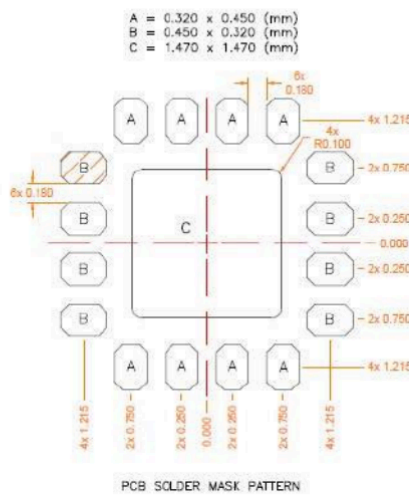
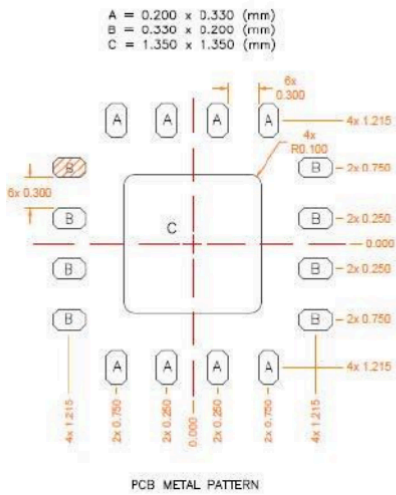
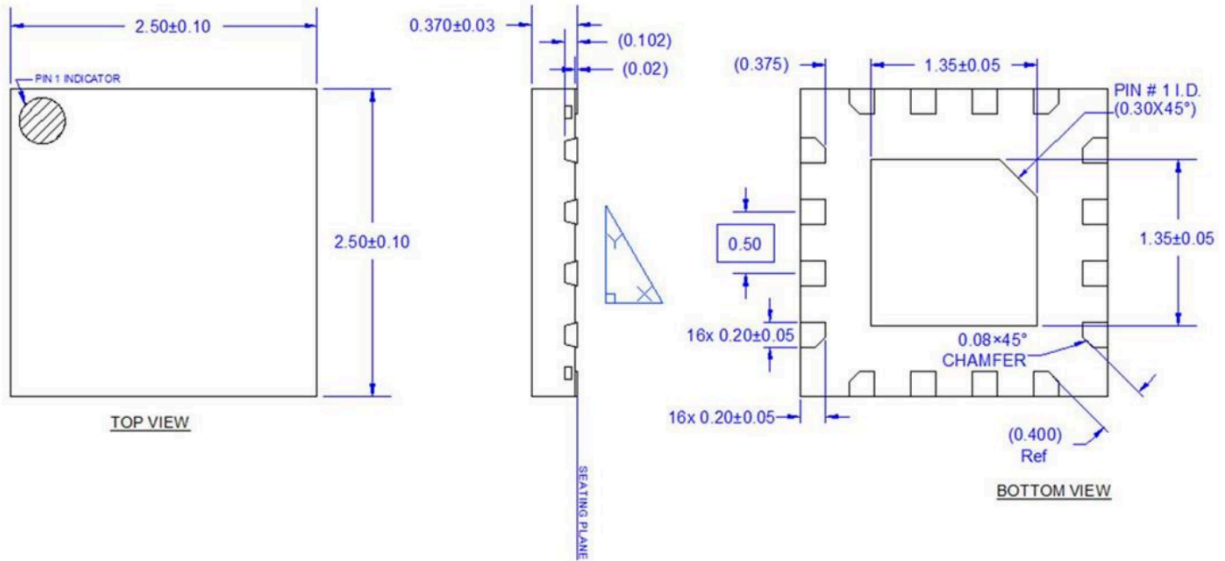


Top View

| Pin Number | Label | Description |
|-----------------|--------|--|
| 1 | PDET | DC power detector. Provides an output voltage proportional to the RF output power level |
| 2 | VMODE | Control pin. |
| 3 | VCC | Output stage supply voltage |
| 4 | VCC | 1 st stage supply voltage |
| 5 | TX | RF input. Internally matched to 50 Ω and DC blocked. |
| 6 | PA_EN | Control pin. |
| 7 | GND | No electrical connection. |
| 8 | RX | RF output from the low noise amplifier. Internally matched to 50 Ω and DC blocked. |
| 9 | LNA_EN | Control pin. |
| 10 | VCC | LNA supply voltage |
| 11 | BT | RF bidirectional port for Bluetooth®. Internally matched to 50Ω. An external DC block is required. |
| 12 | GND | No electrical connection. |
| 13 | C_BT | Control pin. |
| 14 | C_RX | Control pin. |
| 15 | GND | No electrical connection. |
| 16 | ANT | RF bi-directional antenna port. Internally matched to 50 Ω. An external DC block is required. |
| Backside Paddle | GND | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint. |

Mechanical Information

Dimensions and PCB Mounting Pattern



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|----------------|-----------------------|
| ESD – Human Body Model (HBM) | Class 1C (1kV) | ANSI/ESD/JEDEC JS-001 |
| ESD – Charged Device Model (CDM) | Class C3 (1kV) | JESD22-C101 |
| MSL – Moisture Sensitivity Level | Level 2 | IPC/JEDEC J-STD-020 |



Caution!

ESD sensitive device

Solderability

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

Package lead plating: Electrolytic Ni/Pd/AU

RoHS Compliance

This part is compliant with the 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 (C₁₅H₁₂Br₄O₂) Free
- SVHC Free



Contact Information

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

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Email: customer.support@qorvo.com

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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