

Product Description

The BFM4120 is a compact, multi-function Front-End RFIC (Radio Frequency Integrated Circuit) intended for 802.15.4 ZigBee™/ Thread, Bluetooth® Smart, and proprietary ISM wireless protocol systems in the 2.4GHz band.

The BFM4120 is optimized for battery operation with enhanced efficiency, operating over a wide voltage supply range from 2.7V to 3.6V, suited for a wide array of applications including battery-powered wireless systems.

The BFM4120 combines a transmit power amplifier (PA), receive low noise amplifier (LNA), a single pole, double throw (SPDT) transmit / receive (T/R) switch, and an SPDT antenna switch (Figure 1) in a 3mm x 3mm x 0.45mm 16-pin QFN package. It also comes integrated with filter networks and input/output matching circuitry. The device delivers up to +21dBm saturated output power at a supply voltage of 3.3V.

The 8TR8201 is rated for Moisture Sensitivity Level 1 (MSL1), reflow at °260C per JEDEC J-STD-020. Refer to IPC/JEDEC J-STD-020 for detail solder reflow temperature and profile.

Applications

- IoT (Internet of Things) / M2M Connectivity
- 802.15.4 Zigbee, RF4CE, Proprietary ISM
- Bluetooth® Low Energy (BLE) Mesh Networks
- Smart Home Hubs and Gateways
- Consumer Electronics, Smart Appliances
- Smart Lighting, Smart Metering
- Drone, Toy, Media Remote Controller
- Industrial Wireless Sensor Networks
- Home, Industrial, Factory Automation
- Wireless Sensor Nodes & Networks
- Wireless Audio & Video

Package Type



16-Lead 3mm x 3mm x 0.45mm, QFN Package

Figure 1: Package Type

Device Features

- 2.4 - 2.5 GHz Frequency Range
- High Efficiency Optimized for Battery Operation
- Delivers up to +21dBm Output Power at 3.3V
- 75mA at +20dBm Output Power at 3.3 V
- 2.6dB LNA Noise Figure
- 2.7 - 3.6V Operation
- Single-Ended Transceiver Interface
- -40°C to 125°C Extended Temperature Range
- 3mm x 3mm x 0.45 mm 16-Pin QFN Package

Block Diagram

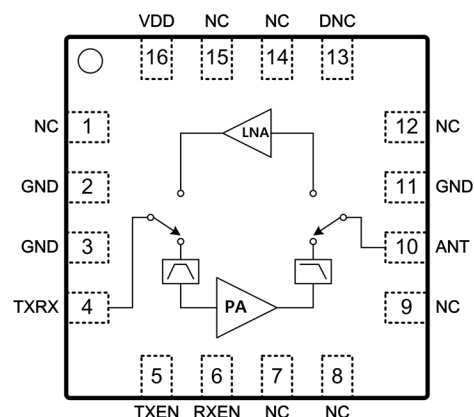


Figure 2: Functional Block Diagram

Table 1: BFM4120 Pin Signal Description

| Pin | Name | Description | Pin | Name | Description |
|-----|------|--|-----|------|-------------------------------------|
| 1 | NC | Not connected internally | 9 | NC | Not connected internally |
| 2 | GND | Ground | 10 | ANT | Antenna Port (DC shorted to GND) |
| 3 | GND | Ground | 11 | GND | Ground |
| 4 | TXRX | Transmit/Receive Port (DC shorted to GND) | 12 | NC | Not connected internally |
| 5 | TXEN | Control Logic Pin | 13 | DNC | Do Not Connect |
| 6 | RXEN | Control Logic Pin | 14 | NC | Not connected internally |
| 7 | NC | Not connected internally | 15 | NC | Not connected internally |
| 8 | NC | Not connected internally | 16 | VDD | DC Voltage Supply |

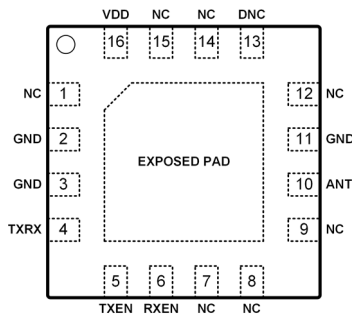


Figure 3 :Pin Description (Top View)

General Specifications

Table 2: BFM4120 Absolute Maximum Ratings

| Parameter | Units | Minimum | Maximum |
|-----------------------------------|-------|---------|---------|
| Supply Voltage (VDD) | V | 0 | 3.7 |
| Control Logic Pin (TXEN, RXEN) | V | 0 | VDD |
| Transmit Output Power at ANT Port | dBm | | 23 |
| Transmit Input Power at TXRX Port | dBm | | 10 |
| Receive Input power at ANT Port | dBm | | 5 |
| Storage Temperature | °C | -40 | 150 |

Note: Sustained operation at or above the Absolute Maximum Ratings for any single or combinations of the parameters above may result in permanent damage to the device and is not recommended. All Maximum RF Input Power Ratings assume 50-Ohm terminal impedance.

ESD Handling Information

Electro Static Discharge (ESD) can cause immediate (or latent) failures in semiconductor Integrated Circuits (ICs). BeRex, Inc. RFIC products are designed with integral ESD protection structures, and all IC products are tested to meet industry standards for ESD event survival. Users must adhere to all precautions for handling ESD sensitive devices throughout the manufacturing, test, shipping, handling, or operational processes, and during field service operations in order to achieve optimum system performance and life expectancy. Production quantities of this product are shipped in a standard tape and reel format.

Table 3: BFM4120 Recommended Operating Conditions

| Parameter | Units | Minimum | Typical | Maximum |
|---|-------|---------|---------|---------|
| Supply Voltage (VDD, recommended) | V | 2.7 | 3.3 | 3.6 |
| Supply Voltage (VDD, extend supply voltage)** | V | 1.8 | | 3.6 |
| Control Pin - Logic High State (TXEN, RXEN) | V | 1.2 | | VDD* |
| Control Pin - Logic Low State (TXEN, RXEN) | V | 0 | | 0.4 |
| Operating Frequency Range | GHz | 2.4 | | 2.5 |
| Operating Temperature | °C | -40 | 25 | 125 |

*For Control Voltages > 3.0V, a 10kΩ series resistor should be used at the Control Logic Pins.

**Functional working with degraded performance for the supply voltage range 1.8V to 2.7V.

Table 4: BFM4120 Transmit Electrical Specifications

(VDD = 3.3V, T_{Ambient} = 25°C, With External Harmonic Filter, Excluding PCB and Connector Loss, Unless Otherwise Noted)

| Parameter | Units | Min | Typ | Max | Test Conditions |
|--------------------------|---------|-----|------|-----|--|
| Frequency Range | GHz | 2.4 | | 2.5 | |
| Saturated Output Power | dBm | | 21 | | |
| Large-Signal Gain | dB | | 24 | | +20dBm Pout |
| Current Consumption | mA | | 75 | | +20dBm Pout |
| | | | 90 | | +21dBm Pout |
| Tx Quiescent Current | mA | | 15 | | |
| Second Harmonic | dBm/MHz | | -50 | | Up to +21dBm with Harmonic Filter as specified |
| Third Harmonic | dBm/MHz | | -50 | | |
| Input Return Loss | dB | | -10 | | |
| Load VSWR for Stability | | | 6:1 | | All Non-harmonic Spurs Less than -43dBm/MHz Up to +21dBm |
| Load VSWR for Ruggedness | | | 10:1 | | No Damage |

Table 5: BFM4120 Receive Electrical Specifications

(VDD = 3.3V, T_{Ambient} = 25°C, With External Harmonic Filter, Excluding PCB and Connector Loss, Unless Otherwise Noted)

| Parameter | Units | Min | Typ | Max | Test Conditions |
|---------------------|-------|-----|------|-----|-----------------|
| Frequency Range | GHz | 2.4 | | 2.5 | |
| Small-Signal Gain | dB | | 11.5 | | |
| Current Consumption | mA | | 8 | | |
| Noise Figure | dB | | 2.6 | | |
| Input P1dB | dBm | | -8 | | |
| Input IP3 | dBm | | 0 | | |
| Input Return Loss | dB | | -8 | | |
| Output Return Loss | dB | | -8 | | |

Table 6: BFM4120 Shutdown Mode Specification

 (VDD = 3.3V, T_{Ambient} = 25°C, With External Harmonic Filter, Excluding PCB and Connector Loss, Unless Otherwise Noted)

| Parameter | Units | Min | Typ | Max | Test Conditions |
|----------------------------------|-------|-----|------|-----|-----------------|
| Shutdown Current | uA | | 0.15 | | |
| Shutdown Mode ANT-TXRX Isolation | dB | | 23 | | |

Table 7: BFM4120 Shutdown Mode Specification

 (VDD = 3.3V, T_{Ambient} = 25°C, With External Harmonic Filter, Unless Otherwise Noted)

| Parameter | Units | Min | Typ | Max | Test Conditions |
|----------------|-------|-----|------|-----|------------------------------------|
| TX to RX | μsec | | 0.7 | | From 50% of RXEN to 90% of RX powe |
| TX to Shutdown | μsec | | 0.25 | | From 50% of TXEN to 10% RF |
| RX to TX | μsec | | 0.3 | | From 50% of TXEN to 90% RF |
| RX to Shutdown | μsec | | 0.15 | | From 50% of RXEN to 10% RF |
| Shutdown to TX | μsec | | 0.5 | | From 50% of TXEN to 90% RF |
| Shutdown to RX | μsec | | 0.85 | | From 50% of RXEN to 90% RF |

Table 8: BFM4120 Control Logic

"1" = Logic High, "0" = Logic Low

| TXEN | RXEN | Operational Mode |
|------|------|------------------|
| 0 | 0 | Shutdown Mode |
| 0 | 1 | RX Mode |
| 1 | 0 | TX Mode |
| 1 | 1 | TX Mode |

Application Notes

The BFM4120 Application note provides detailed descriptions and test data over various operating conditions. Visit www.berex.com or contact BeRex at sales@berex.com to request additional documentation.

Application Schematic and PCB Layout

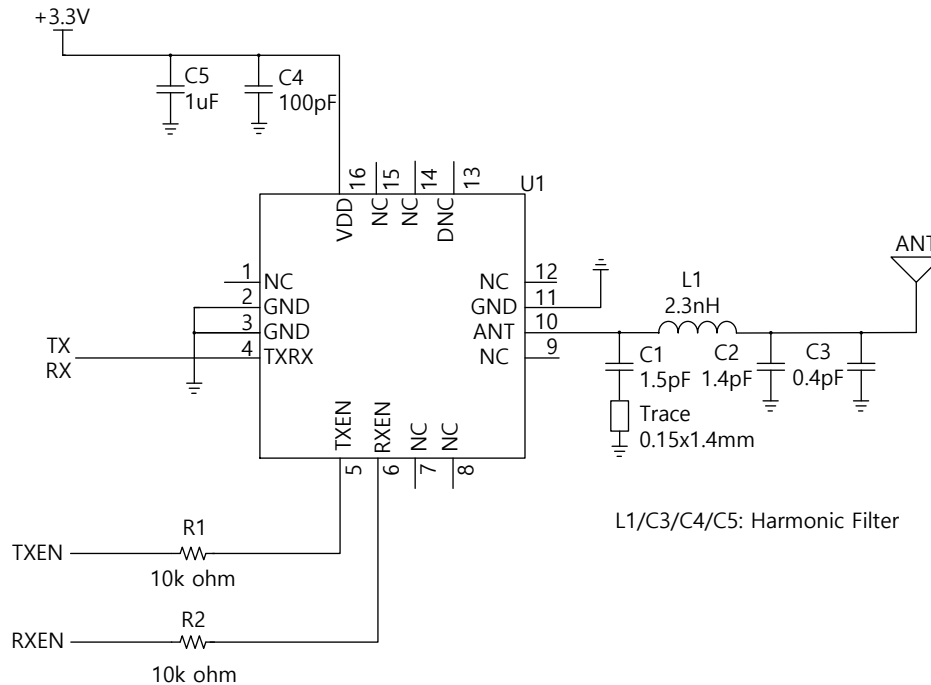
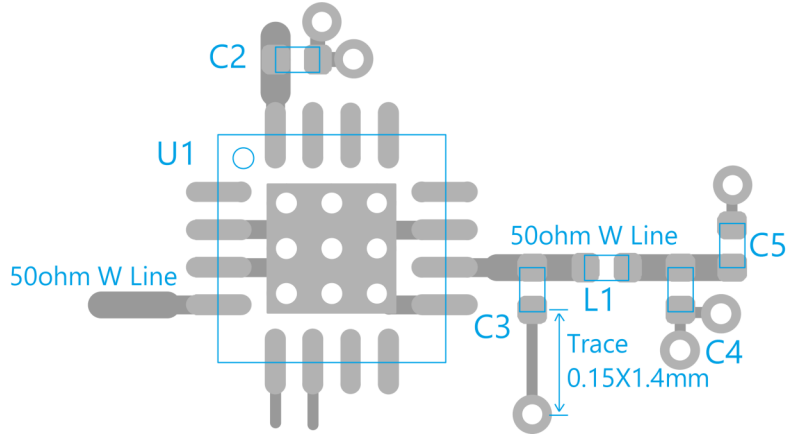
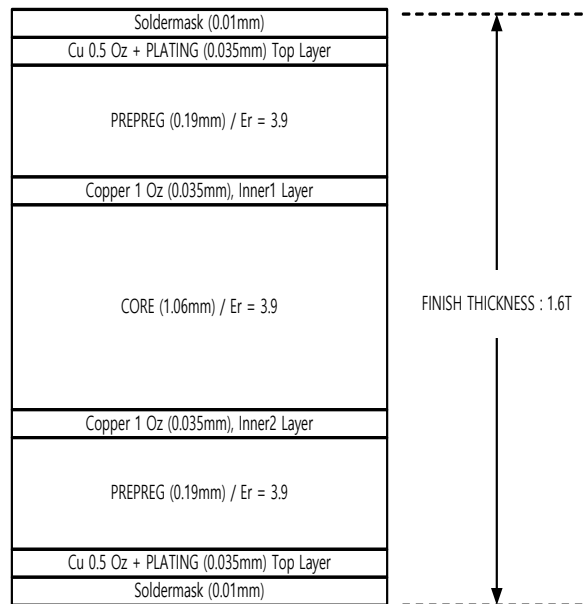


Figure 4 : Evaluation Board Schematic

Table 9: Bill-of-Material (BOM)

| Component# | Component Value | Manufacturer's P/N | Manufacturer's Name |
|------------|-----------------|--------------------|---------------------|
| C5 | 1 uF 0402 | | Murata |
| C4 | 100pF 0201 | | Murata |
| C1 | 1.5pF 0201 | GRM0335C1E1R5BA01D | Murata |
| C2 | 1.4pF 0201 | GRM0335C1H1R4BA01D | Murata |
| C3 | 0.4pF 0201 | GRM0335C1HR40WA01E | Murata |
| L1 | 2.3nH 0201 | LQP03TN2N3B02D | Murata |
| R1, R2 | 10kohm 0201 | ERJ-1GEJ103C | Panasonic |
| U1 | | BFM4120 | BeRex |

Application Schematic and PCB Layout

Figure 5: Reference Design Schematic and PCB Layout

Figure 6: Evaluation Board PCB Layer Information

Package Dimensions

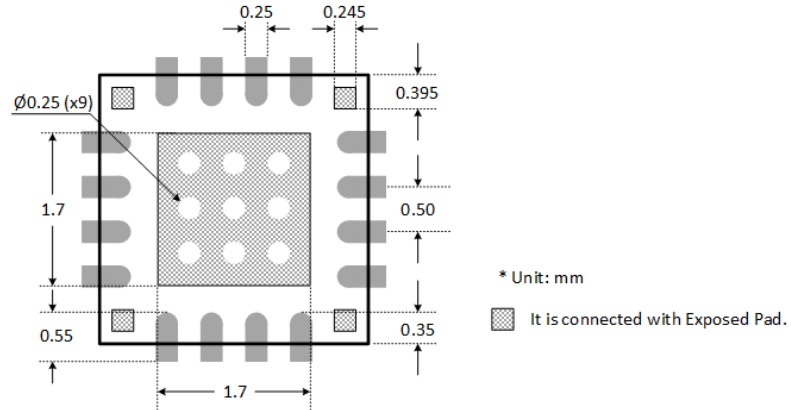
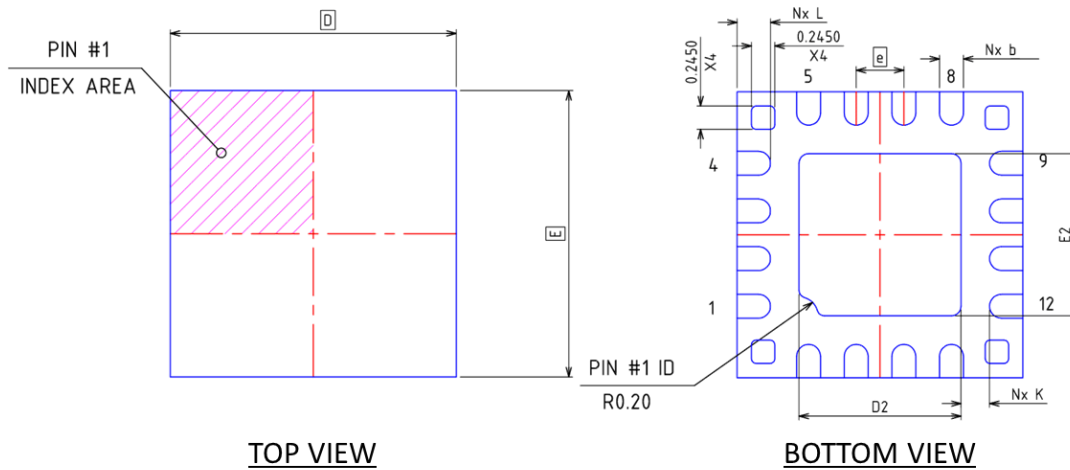


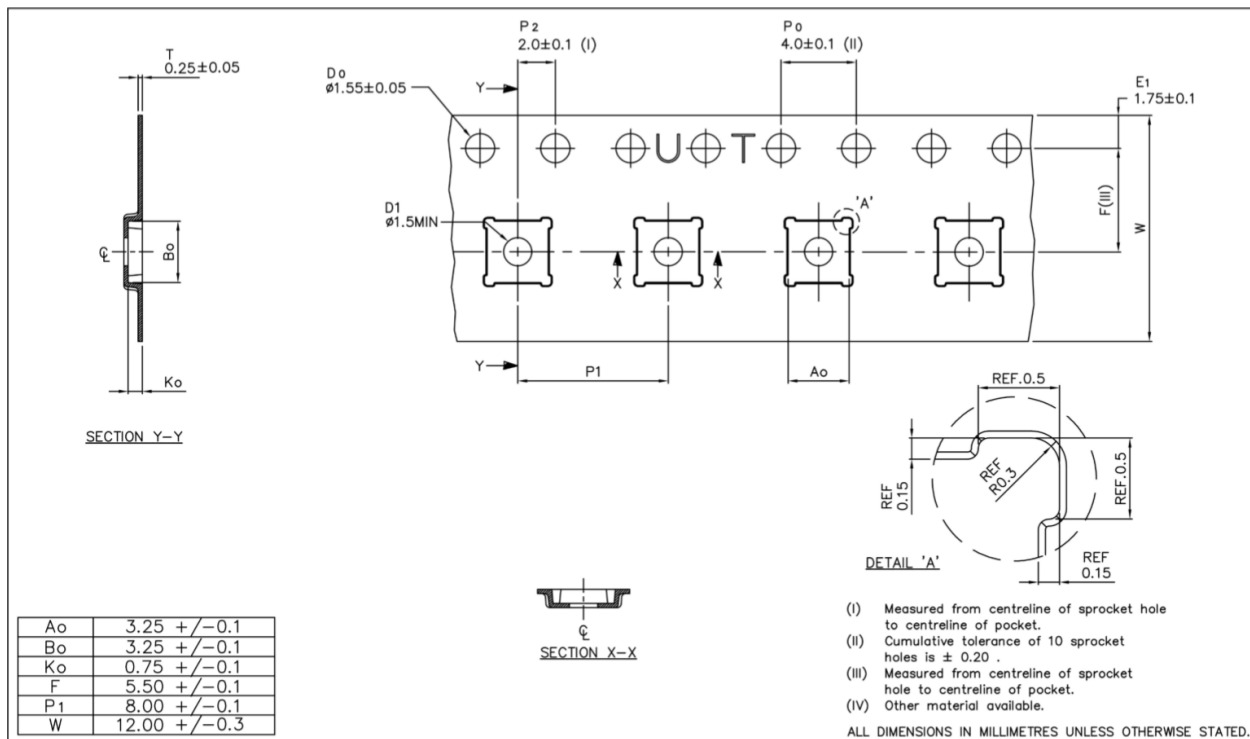
Figure 7: BFM4120 Recommended PCB Layout Footprint



| | MIN. | NOM. | MAX. |
|----|----------|-----------|------|
| A | 0.41 | 0.45 | 0.50 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | --- | 0.127 Ref | --- |
| b | 0.18 | 0.25 | 0.30 |
| D | 3.00 BSC | | |
| E | 3.00 BSC | | |
| e | 0.50 BSC | | |
| D2 | 1.55 | 1.70 | 1.80 |
| E2 | 1.55 | 1.70 | 1.80 |
| K | 0.20 | --- | --- |
| L | 0.25 | 0.35 | 0.45 |
| N | 16 | | |

Figure 8: BFM4120 Package Dimension

Tape & Reel



Packaging information :

Tape Width (mm) : 12

Reel Size (inches) : 7

Device Cavity Pitch (mm) : 8

Device Per Reel : 1000EA

Figure 9: Tape & Reel

Package Marking



BF4120 : BFM4120

YY=Year

WW=Work Week

XX=Lot Number

Figure 10: Package Marking

Lead plating finish**100% Tin Matte finish**

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

MSL / ESD Rating

ESD Rating : Class 1C
Value : Passes < 2000V
Test : Human Body Model (HBM)
Standard : JEDEC Standard JESD22-A114B

MSL Rating : MSL1 at +260°C convection reflow
Standard : JEDEC Standard J-STD-020



Proper ESD procedures should be followed when handling the device.

NATO CAGE code:

| | | | | |
|----------|----------|----------|----------|----------|
| 2 | N | 9 | 6 | F |
|----------|----------|----------|----------|----------|