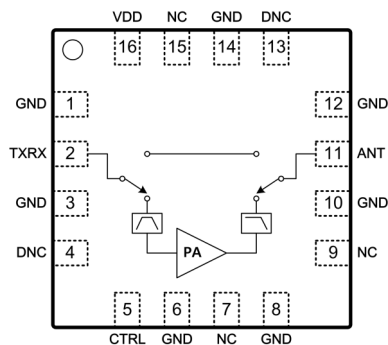


### Features

- 2.4 - 2.5GHz Frequency Range
- High Functionality Front-End RF Integrated Circuit
- Integrated PA, Bypass, T/R Switch
- Low Current Optimized for Battery Operated IoT
- Up to +15dBm  $P_{SAT}$  at 3.0V, Up to +17dBm, 3.6V
- 23mA at +13dBm Output Power
- 2.1dB Bi-Directional Bypass Insertion Loss
- Up to 10dBm EDR Output Power
- 1-Bit Control: Bi-Directional Bypass / Tx PA Modes
- Ultra-Low Bypass/Sleep Current, Ideal for Bluetooth® Power Class 1 & 1.5 Operation
- Filter Networks, Input / Output Matching
- 2mm x 2mm x 0.45mm QFN-16 Package
- -40°C to 125°C Temperature Range
- Die in Wafer Form available

### Applications

- Bluetooth® Low Energy (BLE) Devices
- IoT (Internet of Things) / M2M Connectivity
- Bluetooth® Audio
- Bluetooth® Mesh Networks
- Sports and Medical Wearables
- Consumer Electronics, Toys
- Smart Home Appliances, Remote Controllers
- Wireless Sensor Nodes
- Beacons
- Proximity Sensors
- Range Extenders



**Figure 1: Functional Block Diagram**

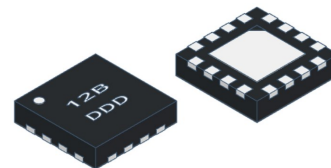
### Description

The 8TR1211 is a compact, highly integrated front-end RFIC (Radio Frequency Integrated Circuit) intended for range extension of Bluetooth® Smart / Bluetooth® Low Energy (BLE) and proprietary ISM wireless systems in the 2.4GHz band.

The 8TR1211 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 8TR1211 combines a power amplifier (PA), bypass, and a transmit / receive (T/R) switch, as shown in Figure 1, in a 2mm x 2mm x 0.45mm 16-pin QFN package. The device also comes integrated with filter networks, and input / output matching circuitry. This device is ideal for extended range BLE applications for Class 1 / Class 1.5 operation.

The 8TR1211 is rated for Moisture Sensitivity Level 1 (MSL1), reflow 260°C per JEDEC J-STD-020. Refer to IPC/JEDEC J-STD-020D.1 for detail solder reflow temperature and profile.



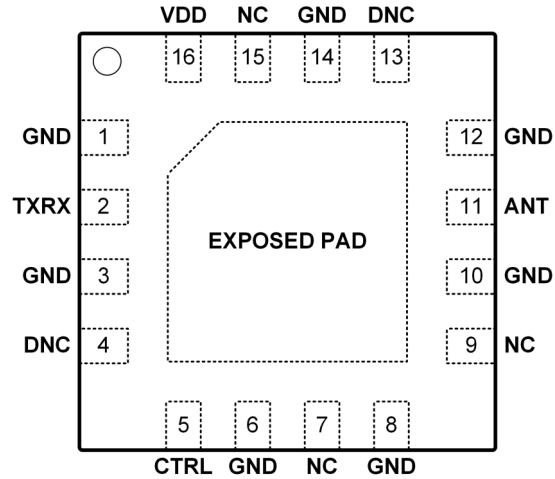
16-Lead 2mm x 2mm x 0.45mm, QFN Package

**Figure 2: Package Type**

### Ordering Information

| Part Number | Description  |
|-------------|--|
| 8TR1211     | 2.4GHz Front-End RFIC<br>2500 Pieces Per Tape and Reel |
| 8TR1211-EVB | Fully Tested and Characterize<br>Evaluation Board      |
| 8TR1211-DWF | 2.4GHz Front-End RFIC Die<br>in Wafer Form             |

## Pin Descriptions



**Figure 3 :Pin Description (Top View)**

**Table 1: 8TR1211 Pin Signal Descriptions**

| Pin         | Name | Description                                  | Pin | Name | Description                         |
|-------------|------|--|-----|------|-------------------------------------|
| 1           | GND  | Ground                                       | 9   | NC   | Not connected internally            |
| 2           | TXRX | Transmit/Receive Port<br>(DC shorted to GND) | 10  | GND  | Ground                              |
| 3           | GND  | Ground                                       | 11  | ANT  | Antenna Port<br>(DC shorted to GND) |
| 4           | DNC  | Do Not Connect                               | 12  | GND  | Ground                              |
| 5           | CTRL | Control Logic Pin                            | 13  | DNC  | Do Not Connect                      |
| 6           | GND  | Ground                                       | 14  | GND  | Ground                              |
| 7           | NC   | Not connected internally                     | 15  | NC   | Not connected internally            |
| 8           | GND  | Ground                                       | 16  | VDD  | DC Voltage Supply                   |
| EXPOSED PAD |      | Exposed pad should be connected to GND.      |     |      |                                     |

## General Specifications

**Table 2: 8TR1211 Absolute Maximum Ratings**

| Parameter                             | Units | Minimum | Maximum |
|---------------------------------------|-------|---------|---------|
| Supply Voltage (VDD)                  | V     | 0       | 3.7     |
| Control Logic Pin (CTRL)              | V     | 0       | VDD     |
| Transmit Output Power at ANT Port     | dBm   |         | 16      |
| Transmit Input Power at TXRX Port     | dBm   |         | 10      |
| Bypass Mode Power at ANT or TXRX Port | dBm   |         | 20      |
| Storage Temperature                   | °C    | -40     | 150     |

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

**Table 3: 8TR1211 Recommended Operating Conditions**

| Parameter                                     | Units | Minimum | Typical | Maximum |
|---|-------|---------|---------|---------|
| Supply Voltage (VDD, recommended)             | V     | 2.7     | 3.0     | 3.6     |
| Supply Voltage (VDD, extend supply voltage)** | V     | 1.8     |         | 3.6     |
| Control Pin - Logic High State                | V     | 1.2     |         | VDD*    |
| Control Pin - Logic Low State                 | V     | 0       |         | 0.4     |
| Control Pin Current (Logic High, 1.8V)        | uA    |         | 0.2     |         |
| 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: 8TR1211 Transmit Electrical Specifications**

(VDD = 3.0V, T<sub>Ambient</sub> = 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     |     | 17   |     | VDD: 3.6V   |
|                          |         |     | 15   |     | VDD: 3.0V   |
| EDR Spectral Mask        | dBm     |     | 10   |     | Spectral Mask compliant, 3Mbps EDR signal               |
| Large-Signal Gain        | dB      |     | 14   |     | +13dBm Pout   |
| Current Consumption      | mA      |     | 15   |     | +10dBm Pout   |
|                          |         |     | 23   |     | +13dBm Pout   |
| Tx Quiescent Current     | mA      |     | 7    |     | No RF applied   |
| Second Harmonic          | dBm/MHz |     | -50  |     | Up to +15dBm with external Harmonic Filter as specified |
| Third Harmonic           | dBm/MHz |     | -55  |     |   |
| Input Return Loss        | dB      |     | -9   |     |   |
| Load VSWR for Stability  |         |     | 6:1  |     | All Non-harmonic Spurs Less than -43dBm/MHz Up to+14dBm |
| Load VSWR for Ruggedness |         |     | 10:1 |     | No Damage   |

**Table 5: 8TR1211 Bi-Directional Bypass Electrical Specifications**

(VDD = 3.0V, T<sub>Ambient</sub> = 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 |                            |
| Bypass Insertion Loss | dB    |     | 2.1 |     | Between TXRX and ANT Ports |
| Bypass Current        | uA    |     | 0.7 |     | VDD: 3.0V                  |
|                       |       |     | 0.4 |     | VDD: 2.7V                  |

**Table 6: 8TR1211 Switching Time Specifications**

(VDD = 3.0V, T<sub>Ambient</sub> = 25°C, With External Harmonic Filter, Unless Otherwise Noted)

| Parameter    | Units | Min | Typ  | Max | Test Conditions               |
|--------------|-------|-----|------|-----|-------------------------------|
| TX to Bypass | usec  |     | 0.4  |     | From 50% of CTRL to 10% of RF |
| Bypass to TX | usec  |     | 0.35 |     | From 50% of CTRL to 90% of RF |

**Table 7: 8TR1211 Control Logic**

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

| CTRL | Operational Mode |
|------|------------------|
| 0    | Bypass Mode*     |
| 1    | TX PA Mode       |

\*The Bypass Mode feature provides an ultra-low current consumption, as in a conventional sleep Mode.

### Application Notes

The 8TR1211 Application note provides detailed descriptions and test data over various operating conditions. Visit [www.berex.com](http://www.berex.com) or contact BeRex at [sales@berex.com](mailto:sales@berex.com) to request additional documentation.

### Application Schematic and PCB Layout

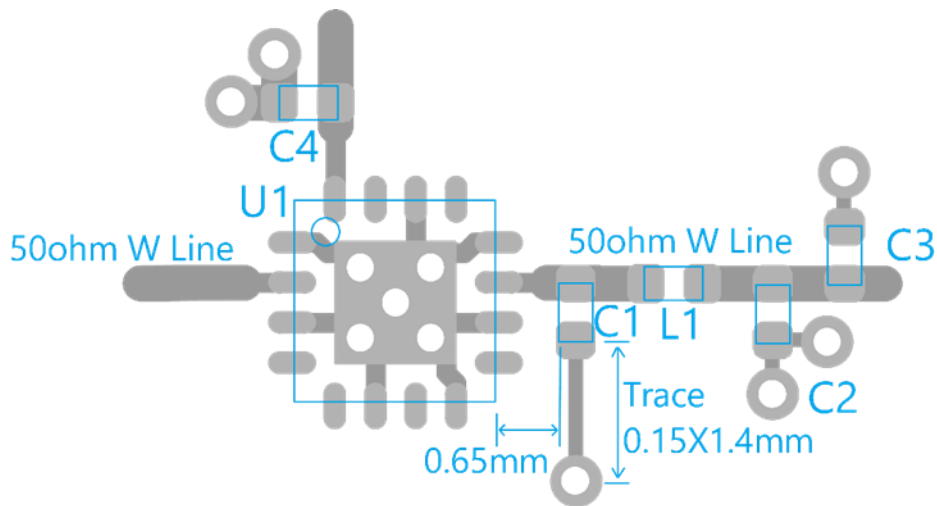
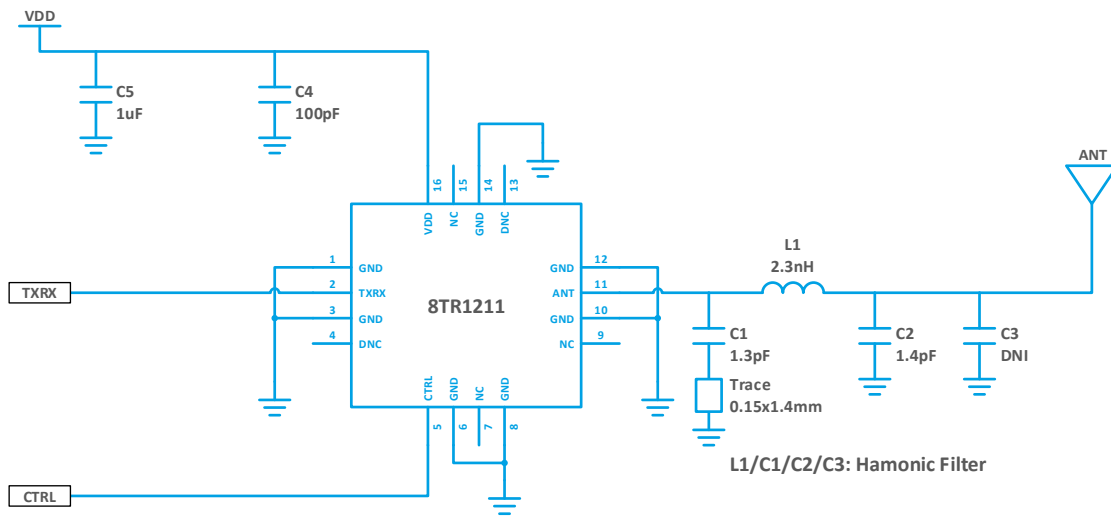
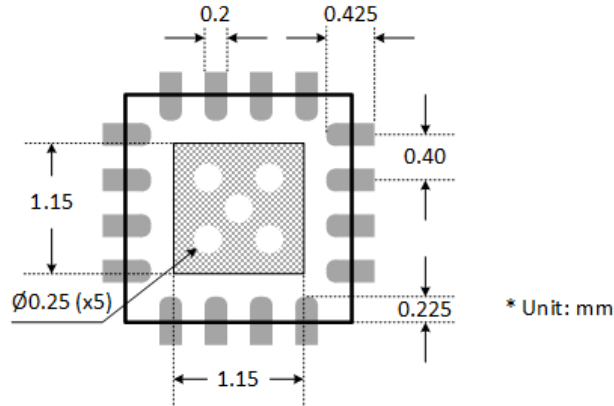
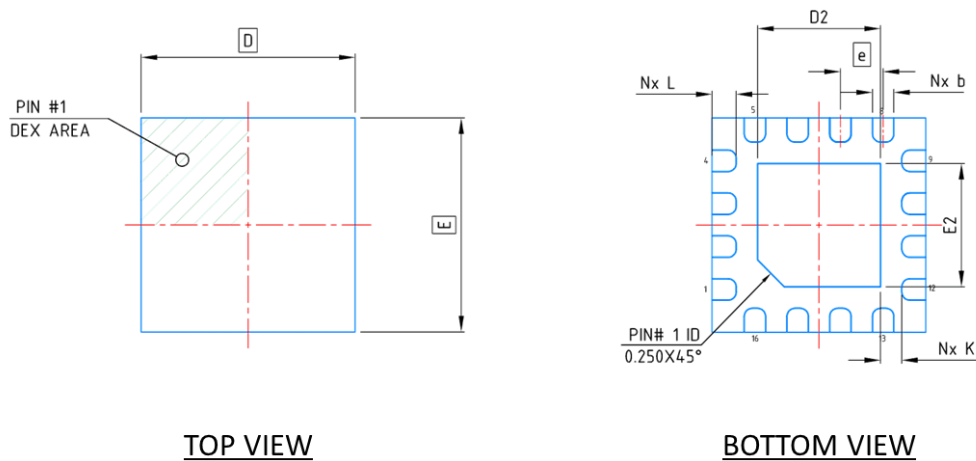
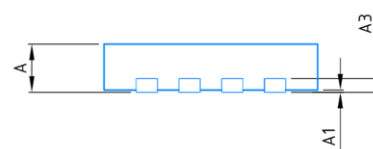


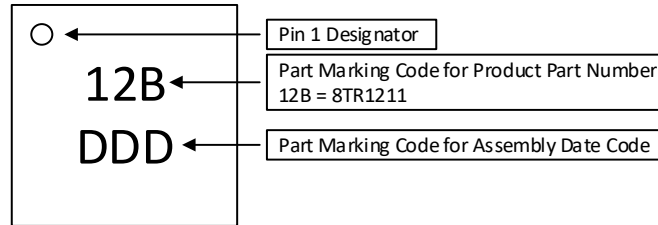
Figure 4: 8TR1211 Reference Design Schematic and PCB Layout

**Package Dimensions**

**Figure 5: 8TR1211 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  | 0.15     | 0.20      | 0.25  |
| D  | 2.00 BSC |           |       |
| E  | 2.00 BSC |           |       |
| e  | 0.40 BSC |           |       |
| D2 | 1.00     | 1.15      | 1.25  |
| E2 | 1.00     | 1.15      | 1.25  |
| K  | 0.20     | ---       | ---   |
| L  | 0.125    | 0.225     | 0.325 |
| N  | 16       |           |       |


**SIDE VIEW**
**Figure 6: 8TR1211 Package Dimension**

### Package Marking



Note: The part marking: 12B represents the Product Part Number: 8TR1211.

Due to the size limitations of this package, only three (3) characters can be marked on each of two (2) rows. Therefore the Product Part Number is represented in the part marking by a 3-character code.

**Figure 7: 8TR1211 Typical Part Marking**

### 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.

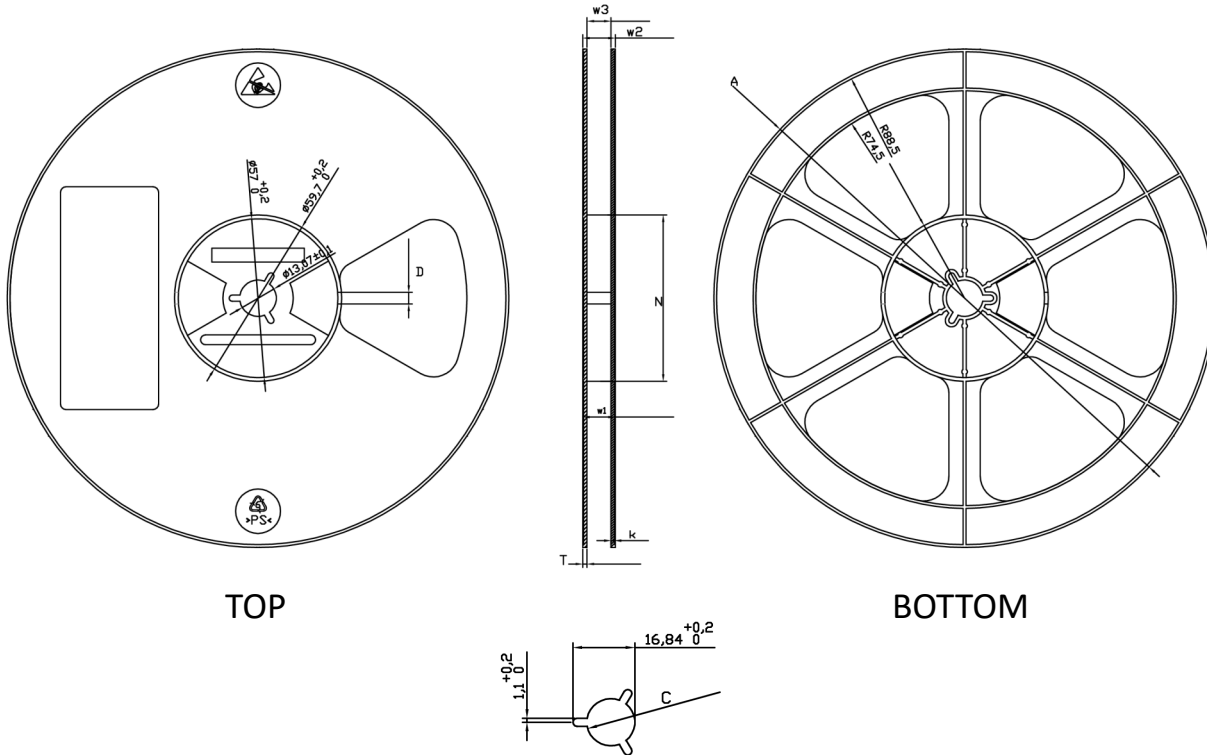
Electrostatic Discharge Rating - 4000V

### RoHS Compliance

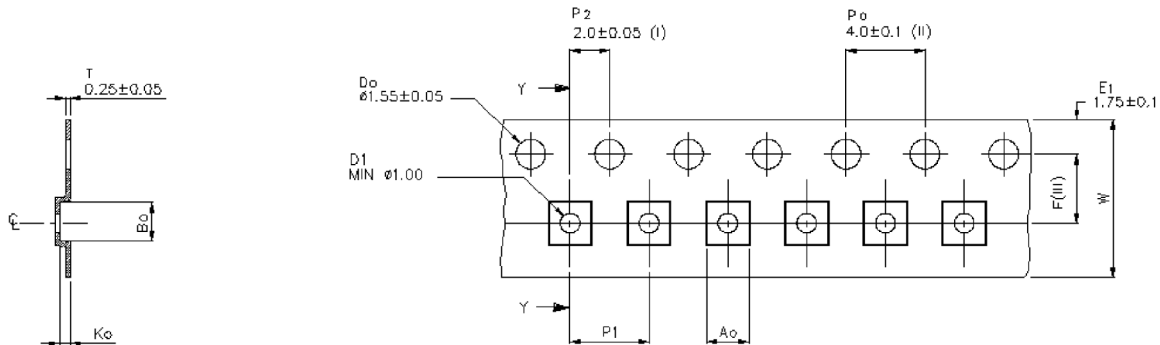
This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

This product also is compliant with a concentration of the Substances of Very High Concern (SVHC) candidate list which are contained in a quantity of less than 0.1%(w/w) in each components of a product and/or its packaging placed on the European Community market by the BeRex and Suppliers.

### Tape & Reel



| TYPE | A                    | N                   | C                         | D               | w1              | w2               | w3               | T                | k                     |
|------|----------------------|---------------------|---------------------------|-----------------|-----------------|------------------|------------------|------------------|-----------------------|
| 8MM  | $\phi 180_{-2}^{+2}$ | $\phi 60_{-1}^{+1}$ | $\phi 13.1_{-0.2}^{+0.2}$ | $4.2_{\pm 0.5}$ | $8.4_{-0}^{+1}$ | $11.6_{-1}^{+1}$ | $8.75_{-1}^{+1}$ | $1.5_{\pm 0.15}$ | $1.25_{-0.05}^{+0.1}$ |



#### SECTION Y-Y

|          |                |
|----------|----------------|
| A $\phi$ | 2.20 +/- 0.05  |
| B $\phi$ | 2.20 +/- 0.05  |
| K $\phi$ | 0.55 +/- 0.05  |
| F        | 3.50 +/- 0.05  |
| P1       | 4.00 +/- 0.10  |
| W        | 8.00 +0.3/-0.1 |

- (i) Measured from centreline of sprocket hole to centreline of pocket.
- (ii) Cumulative tolerance of 10 sprocket Hole is  $\pm 0.20$ .
- (iii) Measured from centreline of sprocket hole to centreline of pocket.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

**Figure 8: 8TR1211 Tape and Reel Dimension**