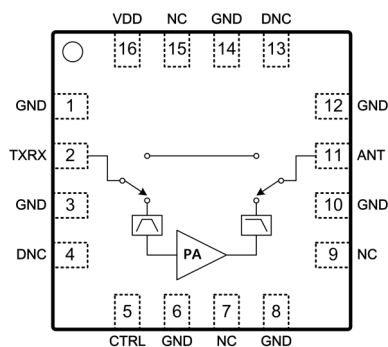


### Features

- 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**

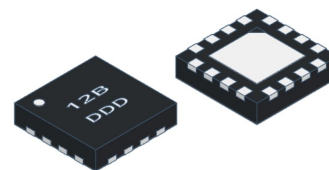
### Description

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 RoHS compliant, halogen-free, and REACH Compliant. It is rated for Moisture Sensitivity Level 1 (MSL1), reflow at 260°C per JEDEC J-STD-020. Refer to IPC/JEDEC J-STD-020 for detailed solder reflow temperature and profile.



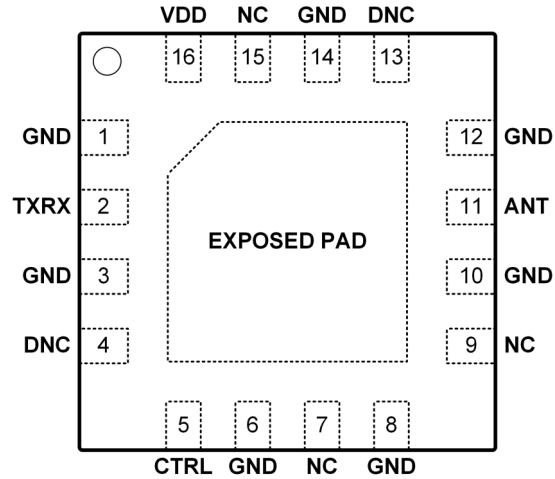
16-Lead 2mm x 2mm x 0.45mm, QFN Package

**Figure 2: Package Type**

### Ordering Information

Part Number	Description
8TR1211	2.4GHz Front-End RFIC 2500 Pieces Per Tape and Reel
8TR1211-EVB	Fully Tested and Characterize Evaluation Board
8TR1211-DWF	2.4GHz Front-End RFIC Die 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 (DC shorted to GND)	10	GND	Ground
3	GND	Ground	11	ANT	Antenna Port (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

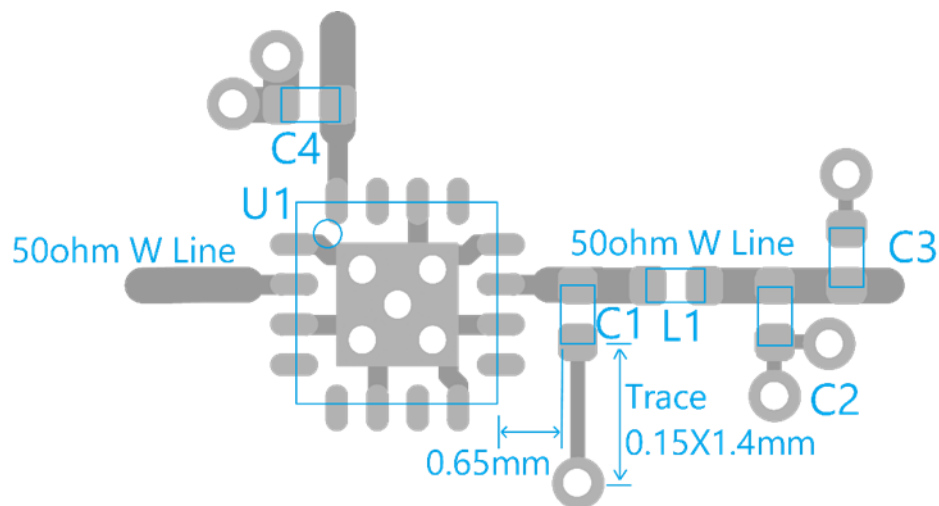
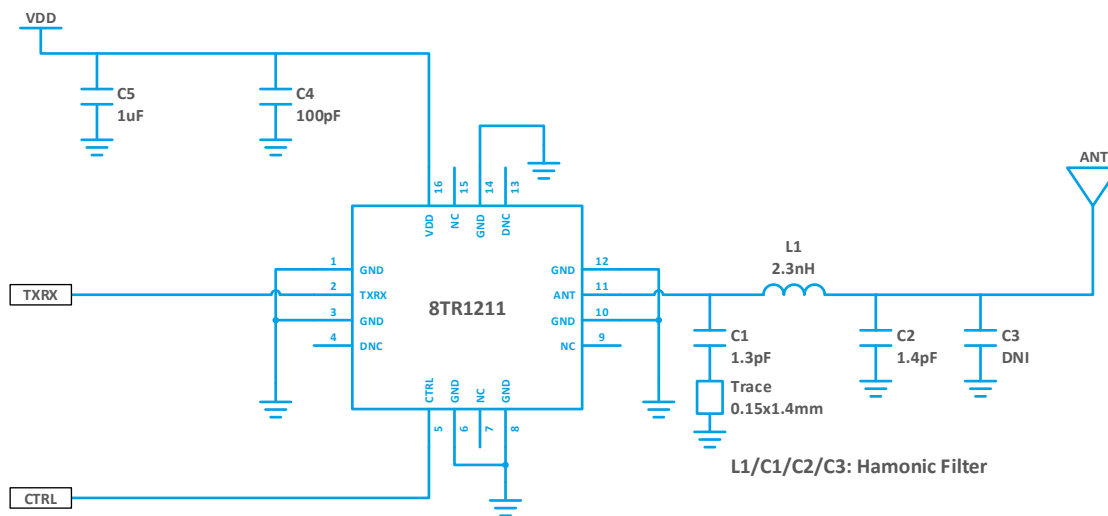
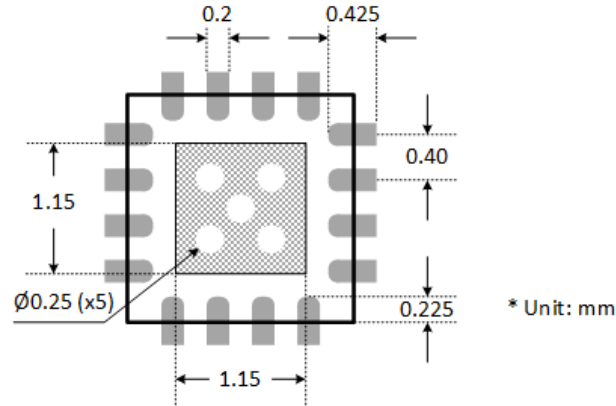
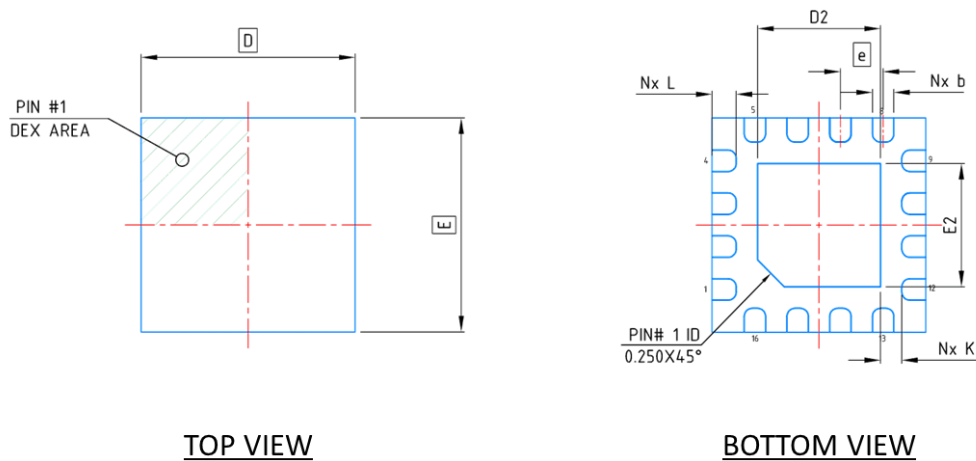


Figure 4: 8TR1211 Reference Design Schematic and PCB Layout

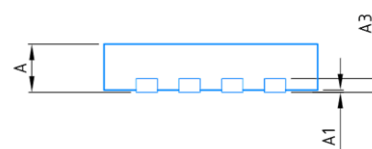
### Package Dimensions



**Figure 5: 8TR1211 Recommended PCB Layout Footprint**



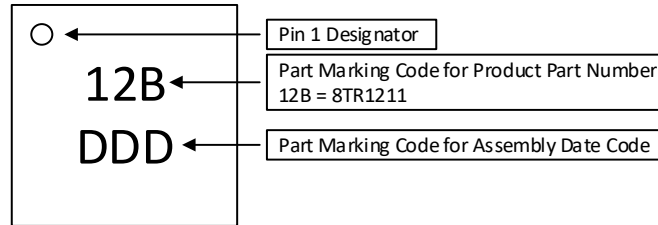
	MIN.	NOM.	MAX.
A	0.41	0.45	0.50
A1	0.00	0.02	0.05
A3	---	0.127 Ref	---
b	0.15	0.20	0.25
D	2.00 BSC		
E	2.00 BSC		
e	0.40 BSC		
D2	1.00	1.15	1.25
E2	1.00	1.15	1.25
K	0.20	---	---
L	0.125	0.225	0.325
N	16		



**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.

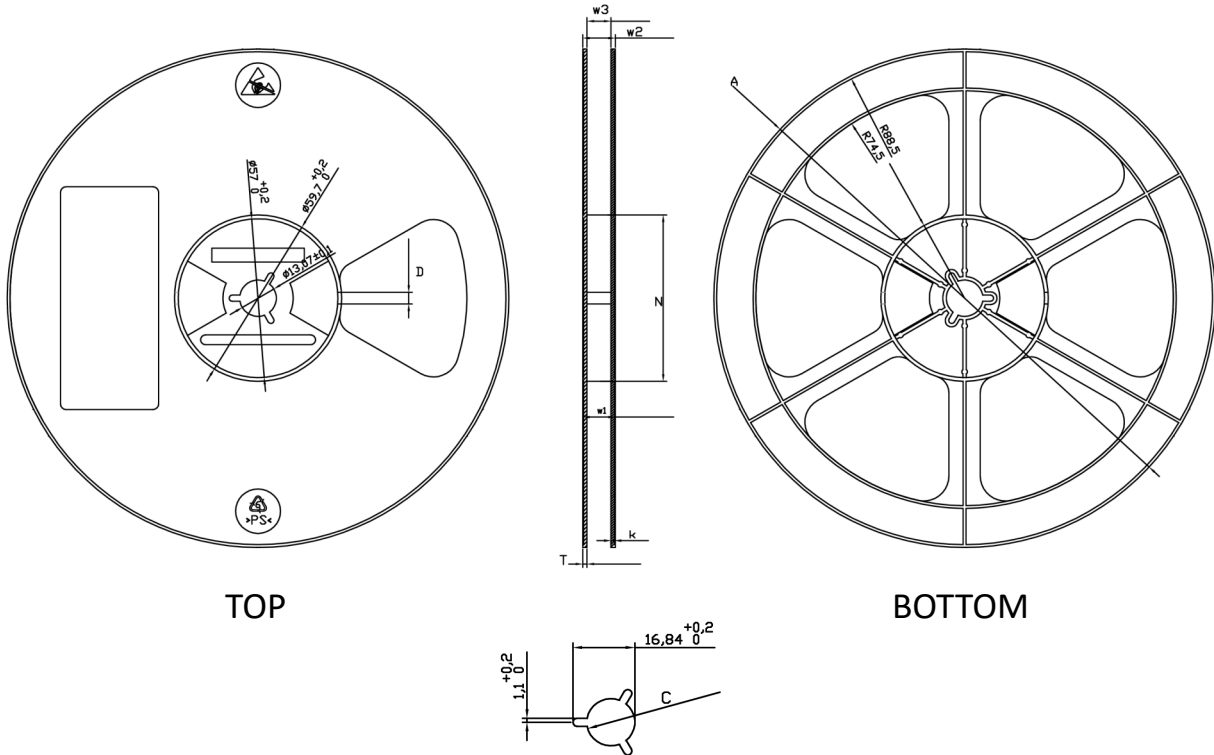
Electrostatic Discharge Rating - 4000V

### RoHS Compliance

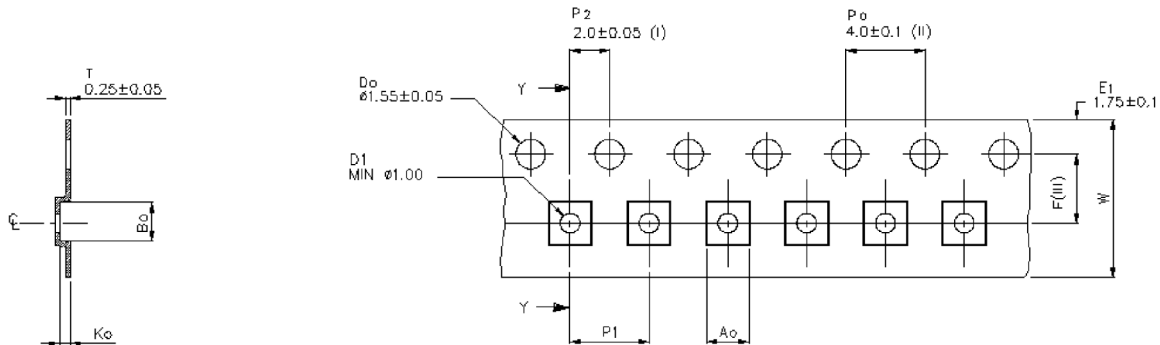
This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

This part is lead-free, halogen-free and 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 component 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	$\phi 180 \begin{smallmatrix} +2 \\ -2 \end{smallmatrix}$	$\phi 60 \begin{smallmatrix} +1 \\ -1 \end{smallmatrix}$	$\phi 13.1 \begin{smallmatrix} +0.2 \\ -0.2 \end{smallmatrix}$	$4.2 \pm 0.5$	$8.4 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$	$11.6 \begin{smallmatrix} +1 \\ -1 \end{smallmatrix}$	$8.75 \begin{smallmatrix} +1 \\ -1 \end{smallmatrix}$	$1.5 \pm 0.15$	$1.25 \begin{smallmatrix} +0.1 \\ -0.05 \end{smallmatrix}$



SECTION Y-Y

A <sub>0</sub>	2.20 +/- 0.05
B <sub>0</sub>	2.20 +/- 0.05
K <sub>0</sub>	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 ± 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