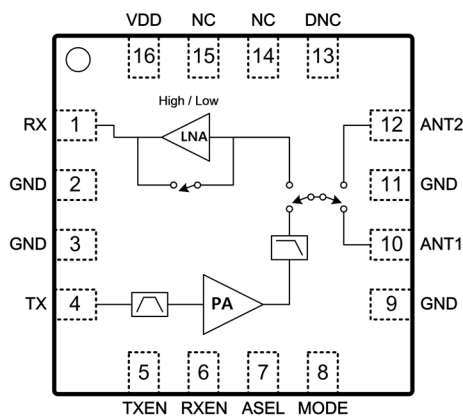


### Features

- 2.4 - 2.5GHz Frequency Range
- High Efficiency Optimized for Battery Operation
- Up to +23dBm Output Power
- 150mA at +23dBm, 3.3V
- 95mA at +20dBm, 3.3V
- 2.7dB LNA Noise Figure, 3.3V
- LNA Bypass Mode
- LNA Low Current and Low Noise Figure Modes
- Integrated PA, LNA, Antenna Diversity Switch
- -40°C to 125°C Extended Temperature Range
- 3mm x 3mm x 0.45mm 16-Pin QFN Package

### Applications

- IoT (Internet of Things) / M2M Connectivity
- Low Power Wide Area Networking (LP-WAN)
- RPMA Networks
- Smart City, Smart Metering, Smart Lighting
- 802.15.4 ZigBee™/ Thread Networks
- 802.15.4g Wireless Smart Utility Network
- Smart Home Gateways, Sensor Nodes
- Industrial, Factory Automation
- Wireless Sensor Networks



**Figure 1: Functional Block Diagram**

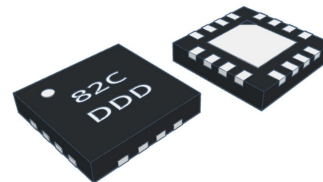
### Description

The 8TR8220 is a compact, multi-function front-end RFIC (radio frequency integrated circuit) intended for range extension in LP-WAN, IoT, 802.15.4 ZigBee™/ Thread, 802.15.4g Wi-SUN, and proprietary ISM wireless systems in the 2.4GHz band.

The 8TR8220 combines a power amplifier (PA), bypass, low noise amplifier (LNA), and a double pole, double throw (DPDT) antenna diversity switch (Figure 1) in a 3mm x 3mm x 0.45mm 16-pin QFN package. It also comes integrated with harmonic filters, and input/output matching circuitry.

The device delivers up to 23dBm output power at a supply voltage of 3.3V.

The 8TR8220 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 detail solder reflow temperature and profile.

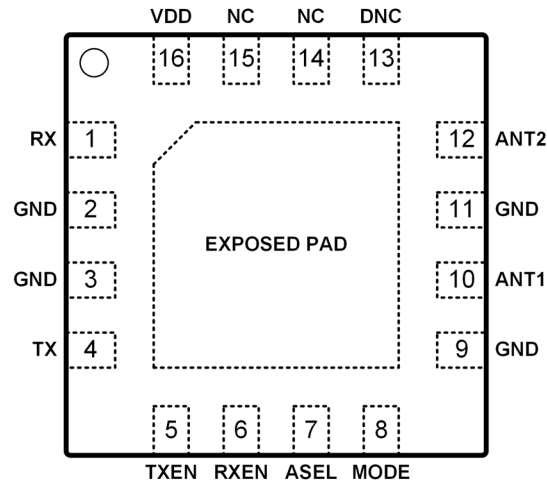


16-Lead 3mm x 3mm x 0.45mm, QFN Package

**Figure 2: Package Type**

### Ordering Information

Part Number	Description
8TR8220	2.4GHz Front-End RFIC 2500 Pieces Per Tape and Reel
8TR8220-EVB	Fully Tested and Characterized Evaluation board
8TR8220-DWF	2.4GHz Front-End RFIC Die in Wafer Form

**Pin Descriptions**

**Figure 3 :Pin Description (Top View)**
**Table 1: 8TR8220 Pin Signal Description**

Pin	Name	Description	Pin	Name	Description
1	RX	Receive Port	9	GND	Ground
2	GND	Ground	10	ANT1	Antenna Port 1
3	GND	Ground	11	GND	Ground
4	TX	Transmit Port	12	ANT2	Antenna Port 2
5	TXEN	Control Logic Pin	13	DNC	Do Not Connect
6	RXEN	Control Logic Pin	14	NC	No Connection
7	ASEL	Antenna Diversity Select	15	NC	No Connection
8	MODE	Control Logic Pin	16	VDD	DC Voltage Supply
EXPOSED PAD		Exposed pad should be connected to GND.			

**General Specifications**
**Table 2: 8TR8220 Absolute Maximum Ratings**

Parameter	Units	Minimum	Maximum
Supply Voltage (VDD)	V	0	3.7
All Control Logic Pin	V	0	VDD
Transmit Output Power at ANT Port	dBm		23.5
Transmit Input Power at TX Port	dBm		10
Receive Input power at ANT Port	dBm		8
Bypass Input Power at ANT Port	dBm		20
Storage Temperature	°C	-65	+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: 8TR8220 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, NODE)	V	1.2		VDD*
Control Pin - Logic Low State (TXEN, RXEN, MODE)	V	0		0.4
Shutdown Current***	uA		0.5	
Control Logic Current (Logic High)	uA			1
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.

\*\*\* For Mode = 0V

**Table 4: 8TR8220 Transmit Electrical Specifications**

(VDD = 3.3V, 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
Operating Frequency Band	GHz	2.4		2.5	
Saturated Output Power	dBm		23		
Large-Signal Gain	dB		30		@22dBm Pout
Current Consumption	mA		150		23dBm Pout, 3.3V
			95		20dBm Pout, 3.3V
Tx Quiescent Current	mA		25		No RF applied
Second Harmonic	dBm/MHz		-48		Up to +23dBm with external harmonic filter as specified
Third Harmonic	dBm/MHz		-48		
Input Return Loss	dB		-10		
Output Return Loss	dB		-6		
Load VSWR for Stability			6:1		All Non-Harmonic Related Spurs Less than -43dBm/MHz, Pout=23dBm
Load VSWR for Ruggedness			10:1		No Damage
Antenna Port Isolation	dB		30		Between ANT1/ANT2, TX Mode

**Table 5: 8TR8220 Receive Electrical Specifications**

 (VDD = 3.3V, 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
Operating Frequency Band	GHz	2.4		2.5	
Small-Signal Gain	dB		11		Low Noise Figure Mode
			8		Low Current Mode
Current Consumption	mA		9		Low Noise Figure Mode
			5		Low Current Mode
Noise Figure	dB		2.7		Low Noise Figure Mode
			3		Low Current Mode
Input P1dB	dBm		-5		Low Noise Figure Mode
Input IP3	dBm		5		Low Noise Figure Mode
Input Return Loss	dB		-10		
Output Return Loss	dB		-10		

**Table 6: 8TR8220 Bypass Electrical Specifications**

 (VDD = 3.3V, 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
Operating Frequency Band	GHz	2.4		2.5	
Bypass Insertion Loss	dB		2.5		TXEN = RXEN = 0V
Bypass Current	uA		0.5*		TXEN = RXEN = 0V

\* For TXEN = RXEN = 0V, ASEL = 1.2V to 3.3V

**Table 7: 8TR8220 Control Logic**

"1" = Logic High, "0" = Logic Low, "X" = either 0 or 1

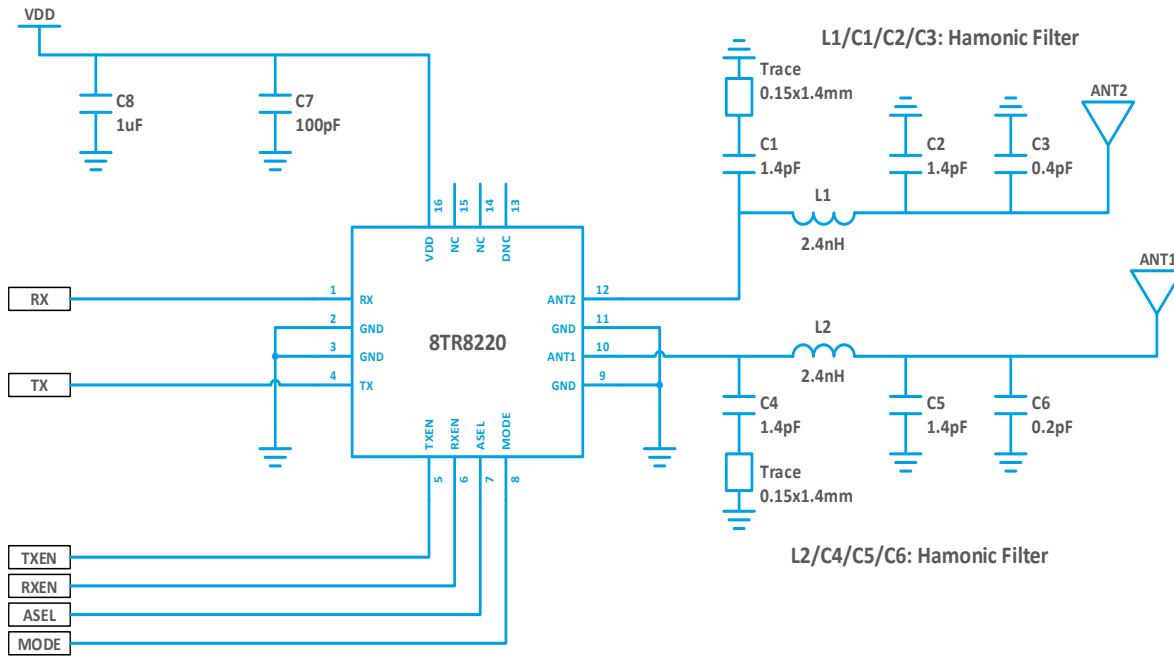
TXEN	RXEN	MODE	Operational Mode
0	0	X	Bypass
1	X	X	TX
0	1	0	RX Low Noise Figure Mode
0	1	1	RX Low Current Mode

ASEL	Active Antenna
0	ANT1
1	ANT2

### Application Notes

The 8TR8220 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



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

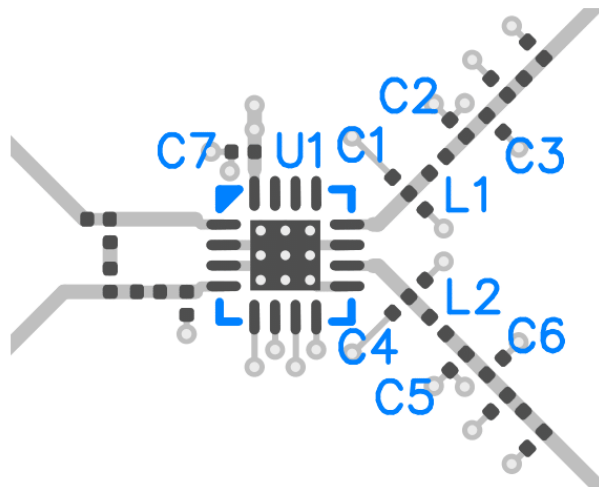


Figure 4: 8TR8220 Reference Design Schematic and PCB Layout

### Package Dimensions

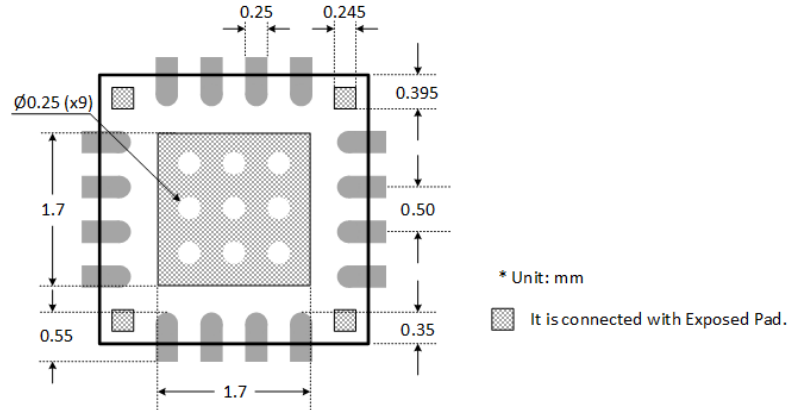
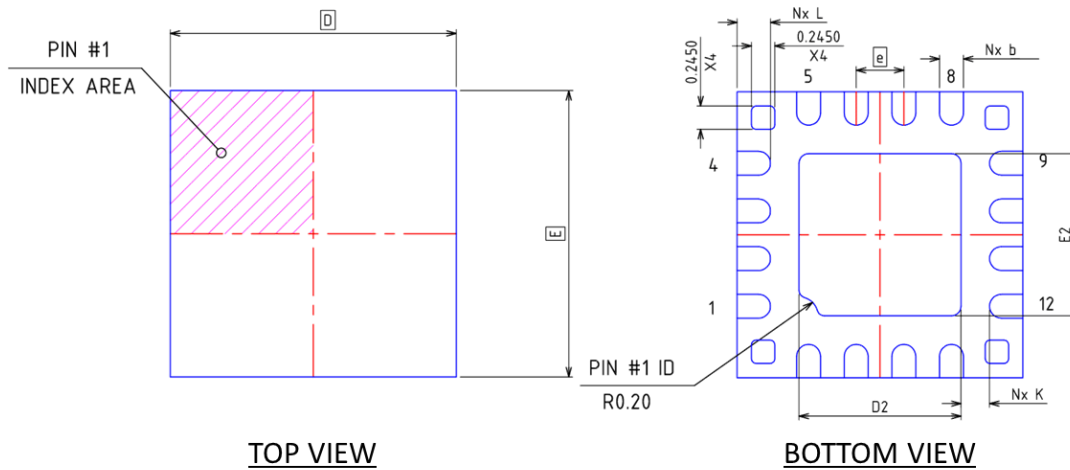
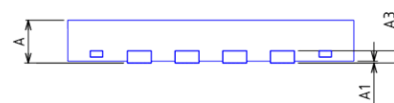


Figure 5: 8TR8220 Recommended PCB Layout Footprint



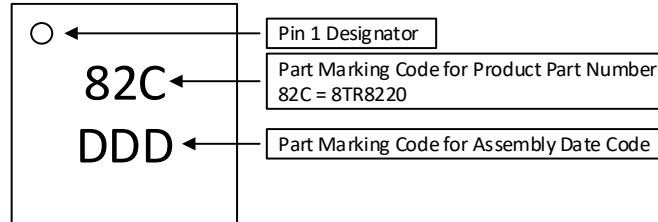
	MIN.	NOM.	MAX.
A	0.41	0.45	0.50
A1	0.00	0.02	0.05
A3	---	0.127 Ref	---
b	0.18	0.25	0.30
D	3.00 BSC		
E	3.00 BSC		
e	0.50 BSC		
D2	1.55	1.70	1.80
E2	1.55	1.70	1.80
K	0.20	---	---
L	0.25	0.35	0.45
N	16		



SIDE VIEW

Figure 6: 8TR8220 Package Dimension

### Package Marking



Note: The part marking: 82C represents the Product Part Number: 8TR8220.

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: 8TR8220 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.

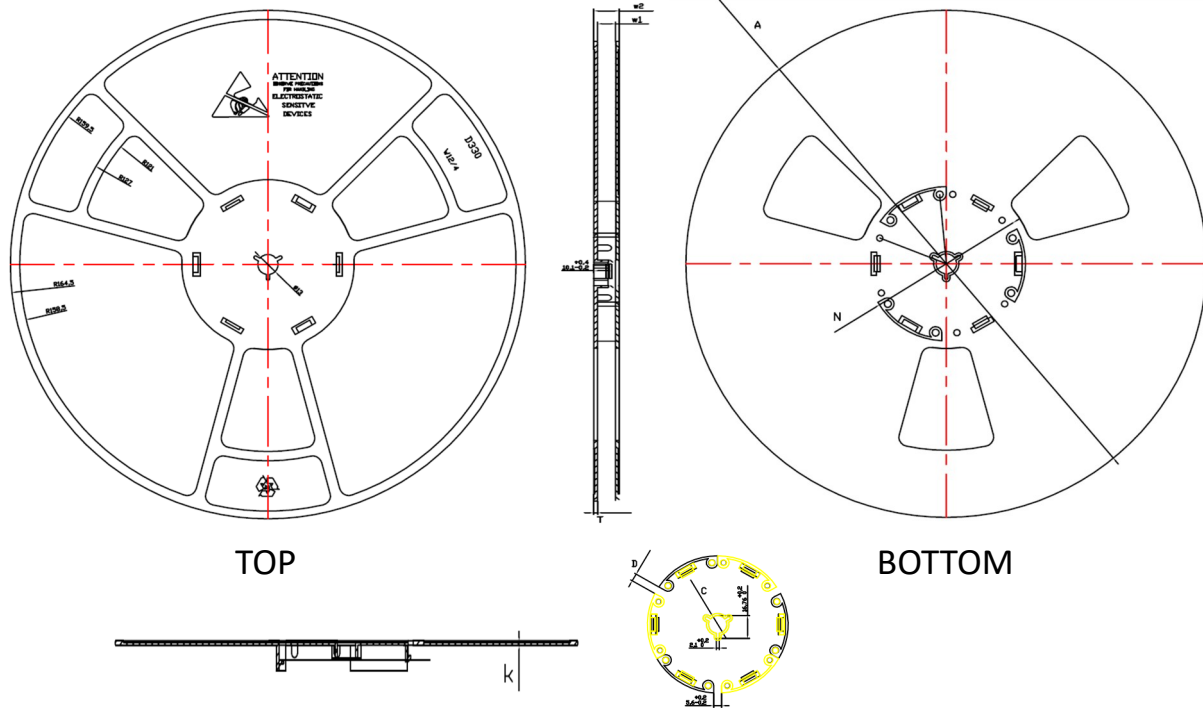
Electrostatic Discharge Rating - 1000V

### RoHS Compliance

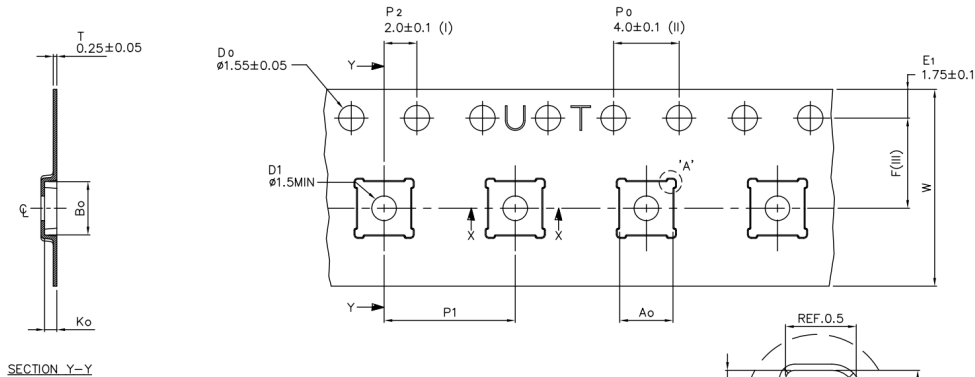
This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

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.

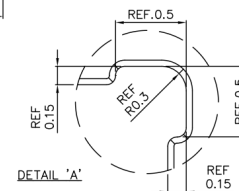
### Tape & Reel



TYPE	A	N	C	D	w1	w2	T	k
12MM	$\phi 330^{+2}$	$\phi 100^{+2}$	$\phi 13,1^{+0,2}$	$5,6^{+0,5}$	$12,4^{+2}_{-0}$	$16,6^{+2}_{-0}$	$2,1 \pm 0,15$	$1,4^{+0,15}_{-0,1}$



Ao	3.25 +/−0.1
Bo	3.25 +/−0.1
Ko	0.75 +/−0.1
F	5.50 +/−0.1
P1	8.00 +/−0.1
W	12.00 +/−0.3



- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20.
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

**Figure 8: 8TR8220 Tape and Reel Dimension**