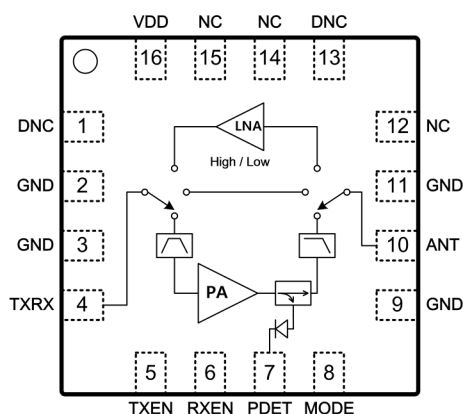


### Features

- 2.4 - 2.5GHz Frequency Range
- High Functionality Front-End RF Integrated Circuit
- PA, LNA, Bypass, T/R Switch
- Low Power Consumption
- Optimized for Battery Operated IoT
- 85mA, +20dBm Saturated Output Power at 3.0V
- 2.5 dB LNA Noise Figure
- LNA High current/Low NF and Low Current modes
- Ultra-Low Shutdown, Bypass Currents
- High Directivity Power Detector for Power Control
- Ideal For ZigBee®, Bluetooth® Power Class 1, 1.5
- -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
- 802.15.4 Zigbee®/Thread, Proprietary ISM
- Bluetooth® Low Energy (BLE) Mesh Networks
- Smart Home Hubs and Gateways
- Smart Lighting
- Smart Metering, Smart Energy
- Consumer Electronics, Smart Appliances
- Home, Industrial, Building Automation
- Wireless Sensor Nodes & Networks
- Wireless Audio & Video
- Remote Control Toys, Drones



**Figure 1: Functional Block Diagram**

### Description

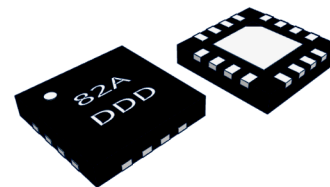
The 8TR8210 is a compact, multi-function front-end RFIC (radio frequency integrated circuit) intended for range extension of 802.15.4 ZigBee™/ Thread, Bluetooth® Smart, RF4CE, and proprietary ISM wireless systems in the 2.4GHz band.

The 8TR8210 is optimized for battery operation with enhanced efficiency operating over a wide voltage supply range from 2.7V to 3.6V, suited for a broad array of applications including battery powered wireless systems.

The 8TR8210 combines a power amplifier (PA), low noise amplifier (LNA), a bypass function, transmit / receive (T/R) switch (Figure 1) in a 3mm x 3mm x 0.45mm 16-pin QFN package. It also comes integrated with filter networks, input/output matching circuitry, and high directivity power detector.

The device delivers up to +20dBm output power at a supply voltage of 3.0V. It comes with Low Noise Figure and High Efficiency options in Receive Mode.

The 8TR8210 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.

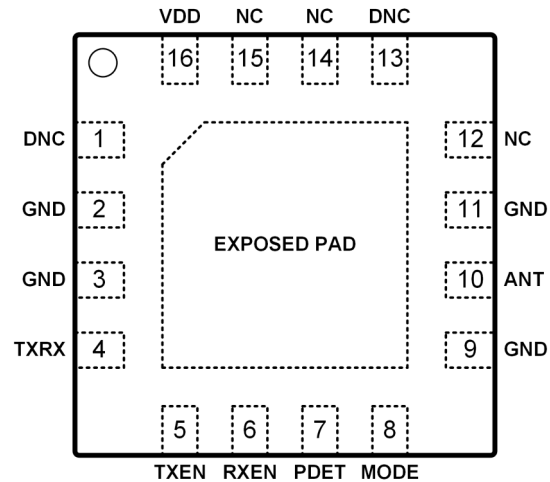


16-Lead 3mm x 3mm x 0.45mm, QFN Package

**Figure 2: Package Type**

### Ordering Information

Part Number	Description
8TR8210	2.4GHz Front-End RFIC 2500 pieces per Tape and Reel
8TR8210-EVB	Fully Tested and Characterize Evaluation Board
8TR8210-DWF	2.4GHz Front-End RFIC in Wafer Form

**Pin Descriptions**

**Figure 3 :Pin Description (Top View)**
**Table 1: 8TR8210 Pin Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	DNC	Do Not Connect	9	GND	Ground
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	PDET	Power Detector Voltage Output	15	NC	Not connected internally
8	MODE	Control Logic Pin	16	VDD	DC Voltage Supply
EXPOSED PAD		Exposed pad should be connected to GND.			

## General Specifications

**Table 2: 8TR8210 Absolute Maximum Ratings**

Parameter	Units	Minimum	Maximum
Supply Voltage (VDD)	V	0	3.7
Control Logic Pin (TXEN, RXEN, MODE)	V	0	VDD
Transmit Output Power at ANT Port	dBm		23
Receive Input power at ANT Port	dBm		5
Bypass Mode Power at TXRX or ANT Port	dBm		20
Transmit Input Power at TXRX Port	dBm		10
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: 8TR8210 Recommended Operating Conditions**

Parameter	Units	Minimum	Typical	Maximum
Operating Frequency Range	GHz	2.4		2.5
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 (TXEN, RXEN, MODE)	V	1.2		VDD*
Control Pin - Logic Low State (TXEN, RXEN, MODE)	V	0		0.4
Control Pin Current (Logic High, 3.3V)	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.

**Table 4: 8TR8210 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		20		
			21		At 3.3V
Large-Signal Gain	dB		23		At +20dBm
Current Consumption	mA		85		At +20dBm at ANT pin
			75		At +20dBm, 3.3V at ANT pin
Tx Quiescent Current	mA		15		No RF Applied
Second Harmonic	dBm/MHz		-50		Up to +21dBm with external harmonic filter as specified
Third Harmonic	dBm/MHz		-45		
Power Detector Voltage(PDET) <sup>1</sup>	V		1		+21dBm Pout at 3.3V
			0.25		+5dBm Pout
Power Detector Load Impedance	KΩ		10		
Input Return Loss	dB		-10		
Load VSWR for Stability			6:1		All Non-harmonic Spurs Less than -43dBm/MHz, 21dBm Pout
Load VSWR for Ruggedness			10:1		No Damage

<sup>1</sup>Keep PDET pin open if power detector is not used.

**Table 5: 8TR8210 Receive 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
Small-Signal Gain	dB		12		High Current/Low NF Mode
			11		Low Current Mode
Current Consumption	mA		8		High Current/Low NF Mode
			5.5		Low Current Mode
Noise Figure	dB		2.5		High Current/Low NF Mode
			3		Low Current Mode
Input P1dB	dBm		-8		High Current/Low NF Mode
Input IP3	dBm		0		High Current/Low NF Mode
Input Return Loss	dB		-8		
Output Return Loss	dB		-8		

**Table 6: 8TR8210 Bi-Directional Bypass and Shutdown 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
Bypass Insertion Loss	dB		2.7		Between TXRX and ANT Ports
Bypass Current (VDD Pin)	uA		1.3	5	TXEN=RXEN=0, MODE=1
Shutdown Isolation	dB		24		Between TXRX and ANT Ports
Shutdown Current (VDD Pin)	uA		0.3		TXEN=RXEN=MODE=0

**Table 7: 8TR8210 Switching Time Specifications**

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

Parameter	Units	Min	Typ	Max	Test Conditions
Shutdown to TX	usec		0.6		From 50% of TXEN to 90% of RF
Shutdown to RX	usec		0.9		From 50% of RXEN to 90% of RF
TX to RX	usec		0.75		From 50% of RXEN to 90% of RX power
TX to Bypass	usec		0.45		From 50% of TXEN to 10% of RF
TX to Shutdown	usec		0.25		From 50% of TXEN to 10% of RF
RX to TX	usec		0.35		From 50% of TXEN to 90% of RF
RX to Bypass	usec		0.45		From 50% of RXEN to 10% of RF
RX to Shutdown	usec		0.15		From 50% of RXEN to 10% of RF
Bypass to TX	usec		0.7		From 50% of TXEN to 90% of RF
Bypass to RX	usec		0.9		From 50% of RXEN to 90% of RF

**Table 8: 8TR8210 Control Logic**

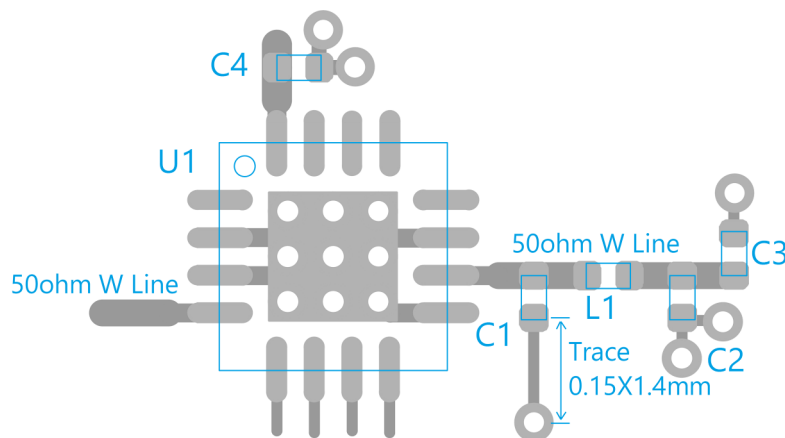
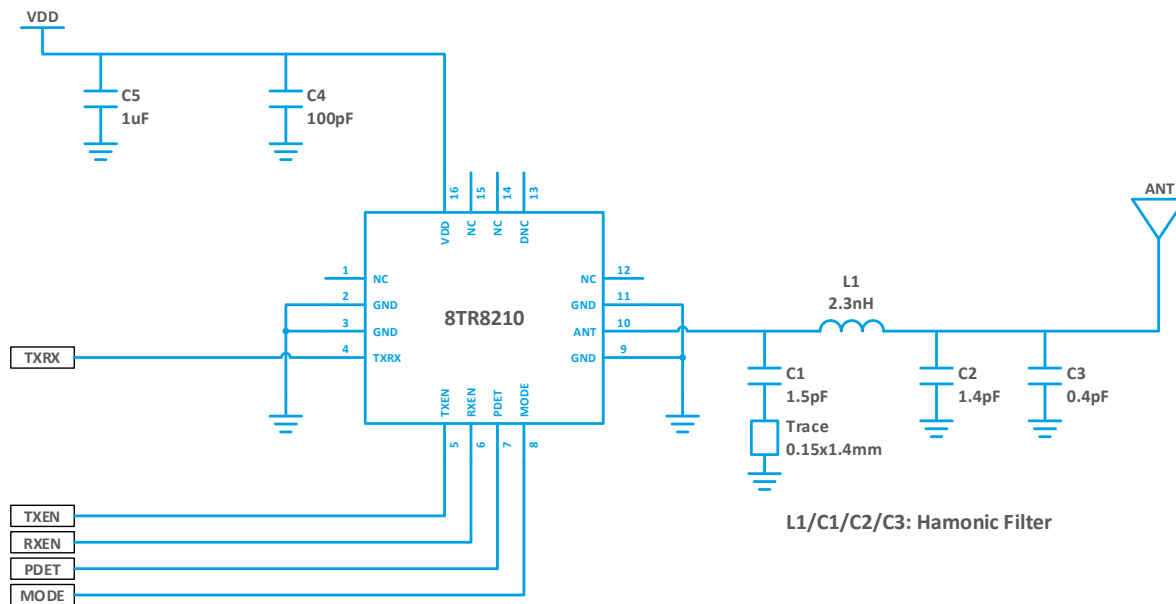
“1” = Logic High, “0” = Logic Low

TXEN	RXEN	MODE	Operational Mode
0	0	0	Shutdown Mode
0	0	1	Bypass Mode
0	1	0	RX High Current/Low NF Mode
0	1	1	RX Low Current Mode
1	0 or 1	0	TX Mode

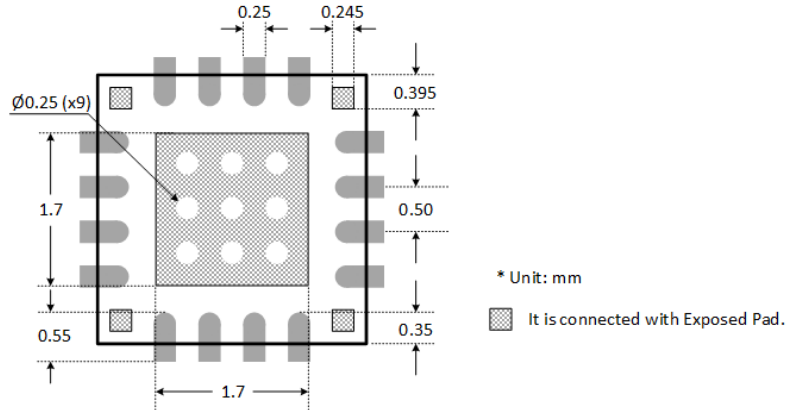
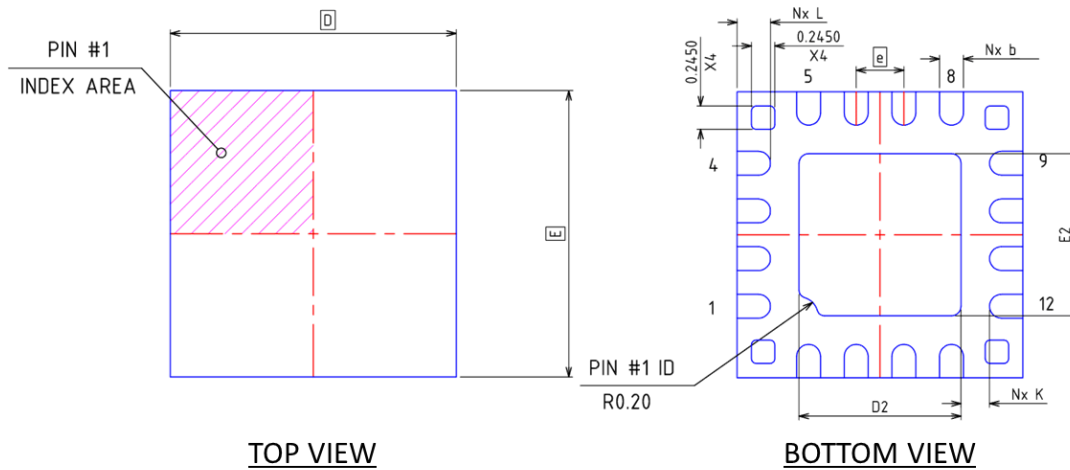
### Application Notes

The 8TR8210 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.

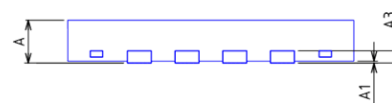
### Application Schematic and PCB Layout



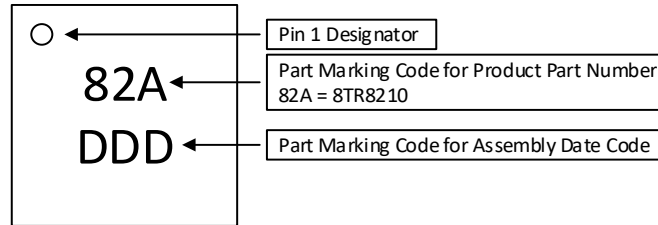
**Figure 4: 8TR8210 Reference Design Schematic and PCB Layout**

**Package Dimensions**

**Figure 5: 8TR8210 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 6: 8TR8210 Package Dimension**

### Package Marking



Note: The part marking: 82A represents the Product Part Number: 8TR8210.

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: 8TR8210 Part Marking Code**

### ESD Handling Information

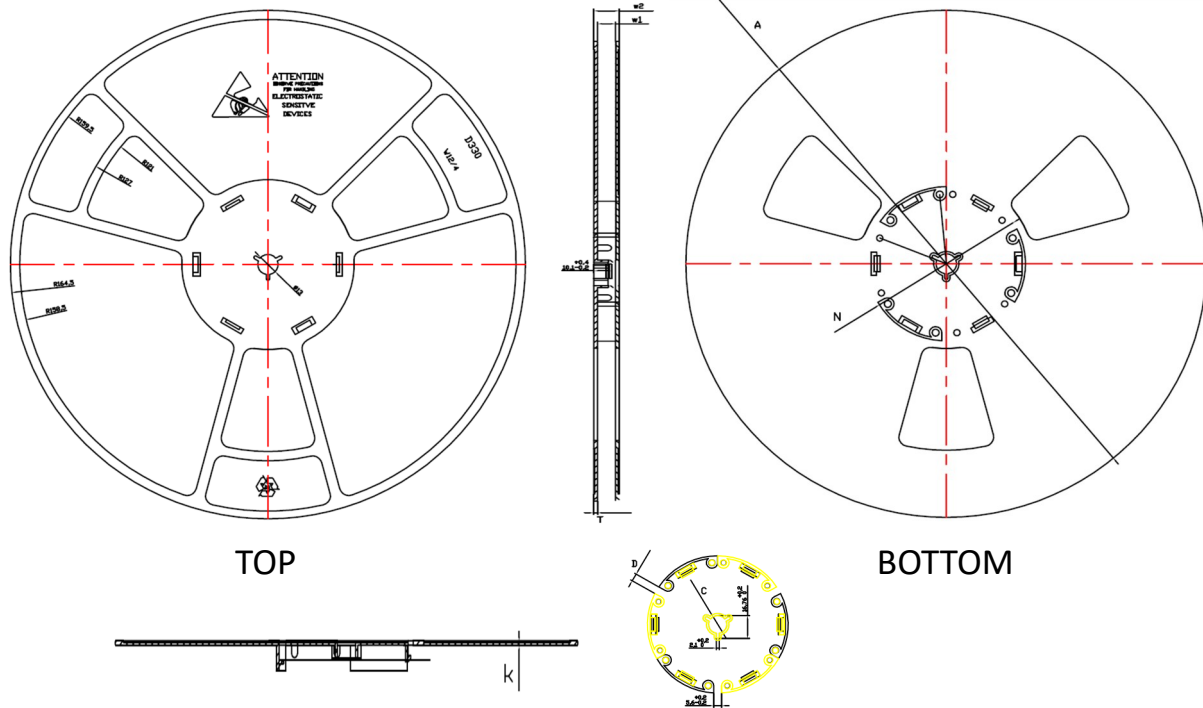
Electro Static Discharge (ESD) can cause immediate (or latent) failures in semiconductor Integrated Circuits (ICs). BeRex, Inc. RFIC products are designed with integral ESD protection structures, and all IC products are tested to meet industry standards for ESD event survival. Users must adhere to all 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.

### RoHS Compliance

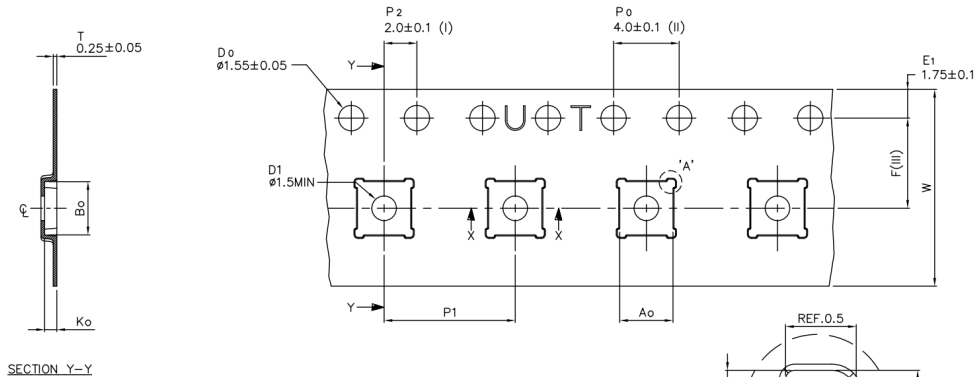
This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

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	T	k
12MM	$\phi 330^{+2}_{-2}$	$\phi 100^{+2}_{-2}$	$\phi 13.1^{+0.2}_{-0.2}$	$5.6^{+0.5}_{-0.5}$	$12.4^{+2}_{-0}$	$16.6^{+2}_{-0}$	$2.1 \pm 0.15$	$1.4^{+0.15}_{-0.1}$



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: 8TR8210 Tape and Reel Dimension**