8TR8213

2.4GHz BLE® / Bluetooth Smart Front End

2.4 - 2.5GHz

Preliminary Datasheet

Features

- 2.4 - 2.5GHz Frequency Range
- Integrated PA, LNA, Bypass, T/R Switch
- Low TX Current Optimized for battery operation
- 35mA at +15dBm Output Power
- 2.5dB LNA Noise Figure
- Ultra-Low Bypass(=Shutdown) Current
- Bi-Directional Bypass with Low Insertion Loss
- Up to +10dBm EDR Power
- 2mm x 2mm x 0.45mm QFN-16 Package
- -40°C to 125°C Temperature Range

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

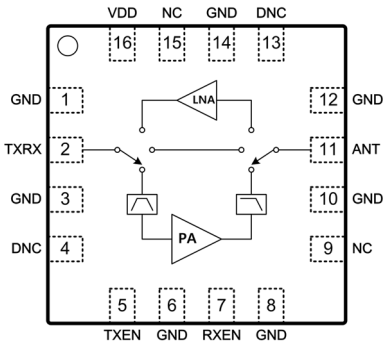


Figure 1: Functional Block Diagram

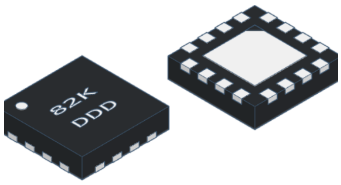
Description

The 8TR8213 is a compact, highly integrated front-end RFIC (Radio Frequency Integrated Circuit) intended for range extension of Bluetooth® Smart / Bluetooth® Low Energy and proprietary ISM wireless systems in the 2.4GHz band.

The 8TR8213 is optimized for battery operation with enhanced efficiency operating over a wide voltage supply range from 2.7V to 3.3V, suited for a wide array of applications including battery powered wireless systems.

The 8TR8213 combines a power amplifier (PA), Low Noise Amplifier (LNA), bypass, and a transmit / receive (T/R) switch 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.

The 8TR8213 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
8TR8213	2.4GHz Front-End RFIC in 2mm x 2mm x 0.45 mm 16-Pin QFN
8TR8213-EVB	Fully Tested and Characterized Evaluation Board
8TR8213-DWF	2.4GHz Front-End RFIC Die in Wafer Form

Pin Descriptions

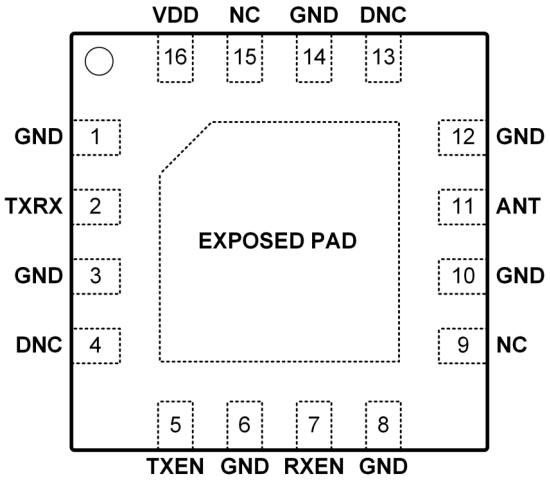


Figure 3 :Pin Description (Top View)

Table 1: 8TR8213 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	TXEN	Control Logic Pin	13	DNC	Do Not Connect
6	GND	Ground	14	GND	Ground
7	RXEN	Control Logic Pin	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: 8TR8213 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		17
Receive Input power at ANT Port	dBm		10
Transmit Input Power at TXRX Port	dBm		10
Bypass Mode Power at TXRX or ANT 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: 8TR8213 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	3.3
Supply Voltage (VDD, extend supply voltage)**	V	1.8	3.0	3.6
Control Pin - Logic High State (TXEN, RXEN)	V	1.2		VDD*
Control Pin - Logic Low State (TXEN, RXEN)	V	0		0.3
Contro; Pin Current (Logic High, 1.8V)	uA		0.2	
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: 8TR8213 Transmit Electrical Specifications

(VDD = 3.0V, $T_{Ambient}$= 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		16		
EDR Spectral Mask	dBm		10		Spectral Mask compliant, 3Mbps EDR signal
Large-Signal Gain	dB		14.5		+14dBm Pout
Current Consumption	mA		35		Without Harmonic filter +15dBm Pout
			42		With Harmonic filter +15dBm Pout
			15		No RF Applied
Second Harmonic	dBm/MHz		-47		Up to +16dBm*
Third Harmonic	dBm/MHz		-47		
Input Return Loss	dB		-10		
Load VSWR for Stability			6:1		All Non-harmonic Spurs Less than -50dBm/MHz up to 14dBm
Load VSWR for Ruggedness			10:1		No Damage

Table 5: 8TR8213 Receive Electrical Specifications

(VDD = 3.0V, $T_{Ambient}$= 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		12		
Current Consumption	mA		7		
Noise Figure	dB		2.5		
Input P1dB	dBm		-7		
Input IP3	dBm		0		
Input Return Loss	dB		-10		
Output Return Loss	dB		-5		

Table 6: 8TR8213 Bi-Drictional Bypass Electrical Specifications

(VDD = 3.0V, $T_{Ambient}$= 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	
Bypass Insertion Loss	dB		2.0		Between TXRX and ANT Ports
Bypass Current	uA		0.1		VDD=3.0V

Table 7: 8TR8213 Switching Time Specifications

(VDD = 3.0V, $T_{Ambient}$= 25°C, With External Harmonic Filter, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
TX to RX	µsec		0.65		From 50% of RXEN to 90% of RX power
TX to Bypass	µsec		0.5		From 50% of TXEN to 10% of RF
RX to TX	µsec		0.35		From 50% of TXEN to 90% of RF
RX to Bypass	µsec		0.45		From 50% of RXEN to 10% of RF
Bypass to TX	µsec		0.4		From 50% of TXEN to 90% of RF
Bypass to RX	µsec		0.85		From 50% of RXEN to 90% of RF

Table 8: 8TR8213 Control Logic

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

TXEN	RXEN	Operational Mode
0	0	Bypass Mode*
0	1	RX Mode
1	0	TX Mode
1	1	TX Mode

* The Bypass Mode feature providers an ultra-low current consumption, as in a conventional Sleep Mode

Application Notes

The 8TR8213 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

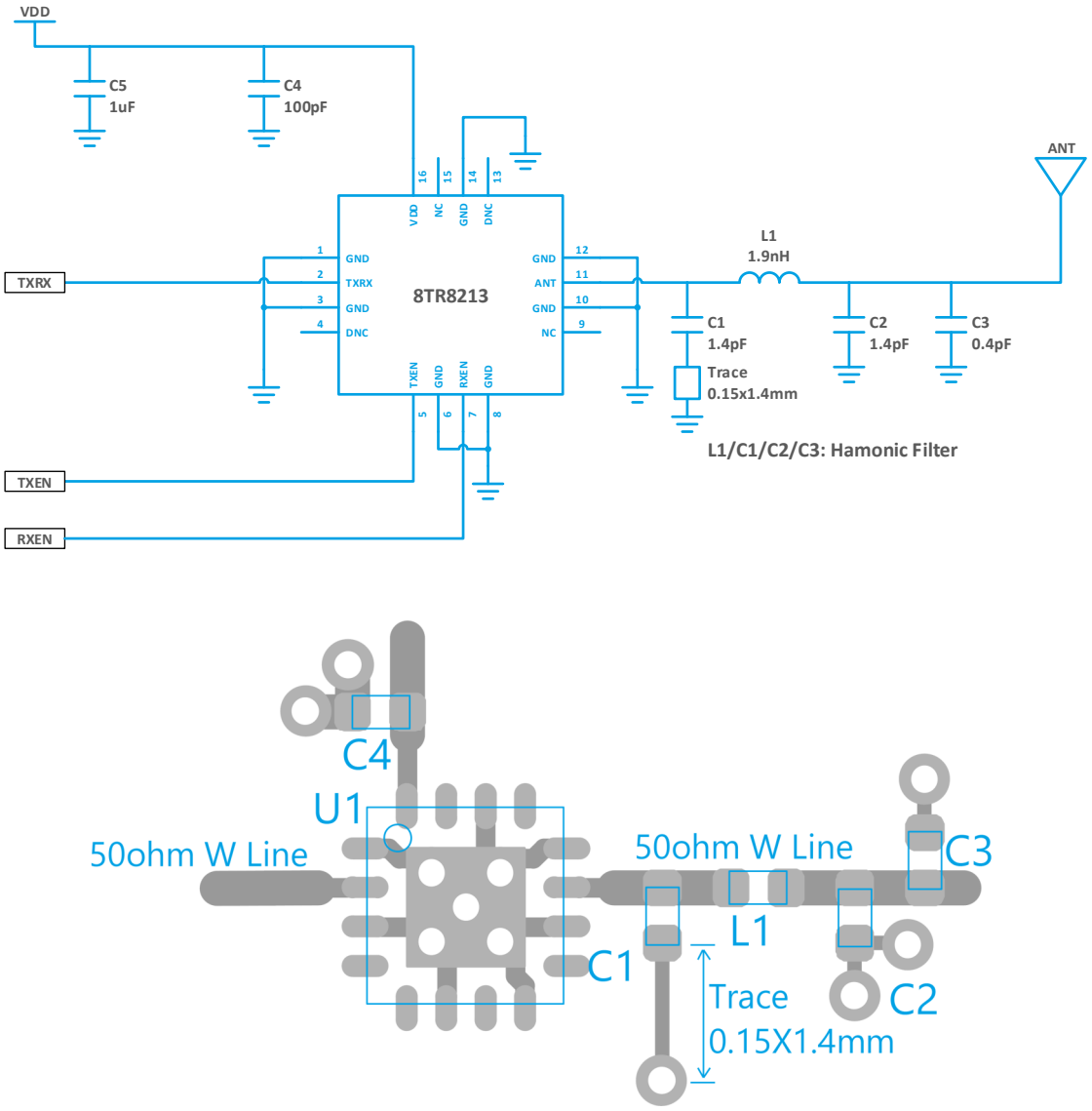


Figure 4: 8TR8213 Reference Design Schematic and PCB Layout

Package Dimensions

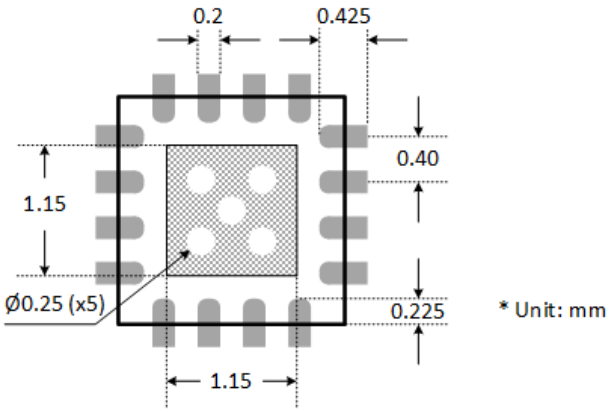
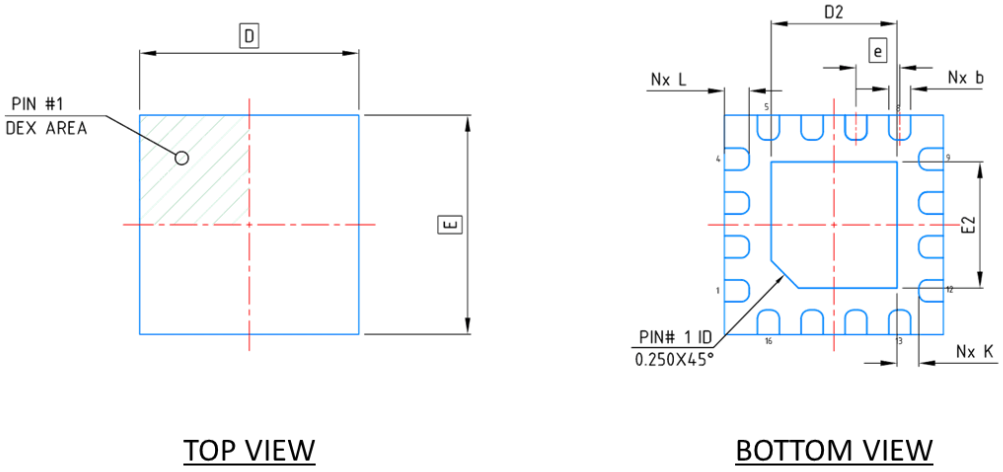


Figure 5: 8TR8213 Recommended PCB Layout Footprint



	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	

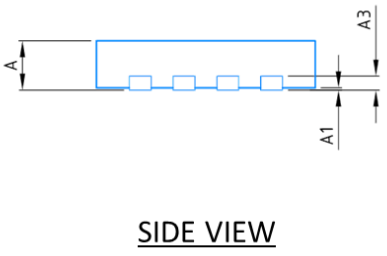
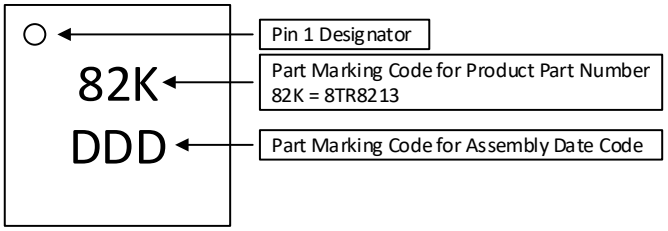


Figure 6: 8TR8213 Package Dimension

Package Marking



Note: The part marking: 82K represents the Product Part Number: 8TR8213.
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: 8TR8213 Part Marking Code

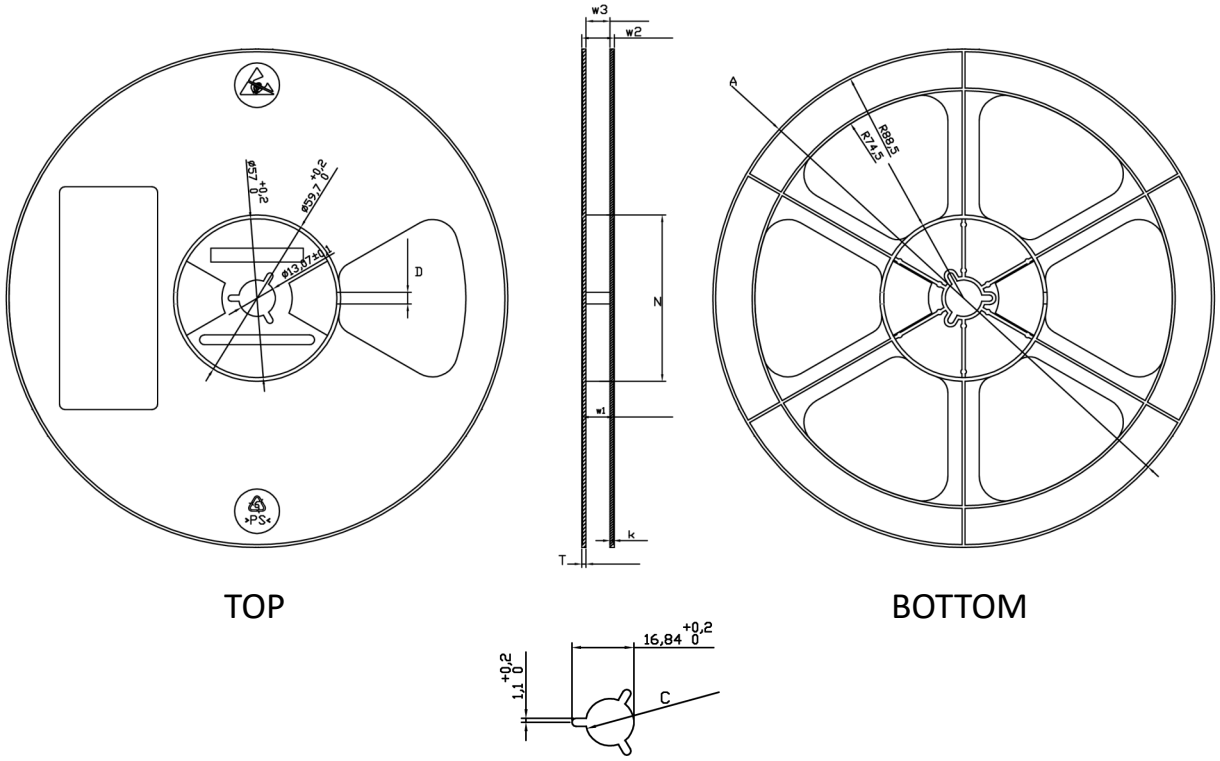
ESD Handling Information

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.

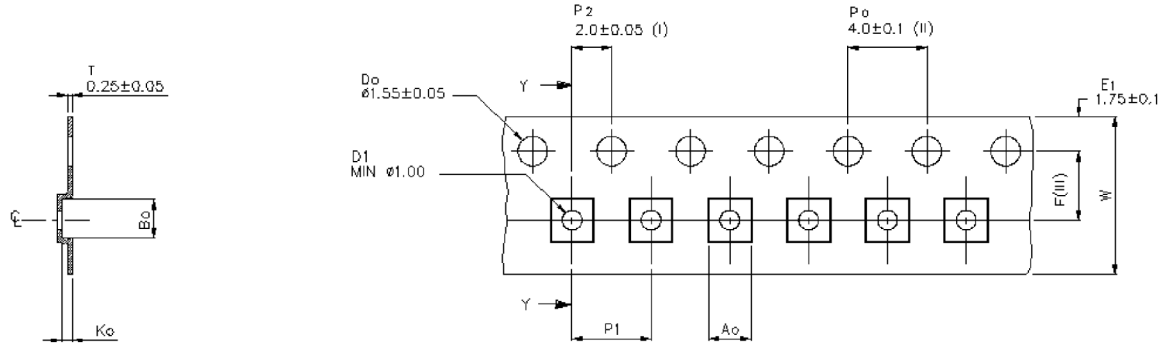
RoHS Compliance

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	w3	T	k
8MM	+2 ø180−2	+1 ø60−1	+0,2 ø13,1−0,2	4,2±0,5	+1 8,4−0	+1 11,6−1	+1 8,75−1	1,5±0,15	1,25 +0.1 −0.05



Ao	2.20 +/−0.05
Bo	2.20 +/−0.05
Ko	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 MIDENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

Figure 8: 8TR8213 Tape and Reel Dimension