

Features

- 2.4 - 2.5GHz Frequency Range
- Integrated PA, Bypass, Tx/Rx Switch
- Low TX Current for direct battery connection
- 18mA at +10dBm Output Power
- Ultra-Low Bypass Current
- Bi-Directional Bypass with Low Insertion Loss
- 1-Bit Control between Bypass and PA Modes
- Up to 8dBm EDR Output Power
- 2mm x 2mm x 0.45mm 8-Pin DFN 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

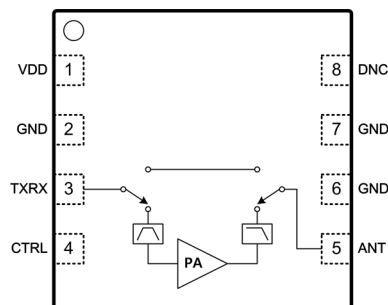


Figure 1: Functional Block Diagram

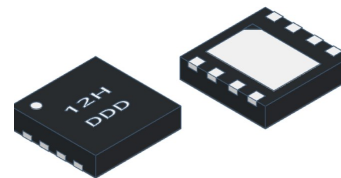
Description

The 8TR1216 is a compact, highly integrated front-end RFIC (Radio Frequency Integrated Circuit) intended for range extension of Bluetooth® Smart, 802.15.4 ZigBee™/ Thread, ANT+, and proprietary ISM wireless systems in the 2.4GHz band.

This application-friendly RFIC provides PA plus Bypass with Tx/Rx switches in an ultra-compact package. It requires only a dual-cell battery supply voltage and a single logic control signal.

The 8TR1216 combines a power amplifier (PA), bypass, and a transmit / receive (T/R) switch in a 2mm x 2mm x 0.45mm 8-pin DFN 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 operation.

The 8TR1216 is compliant to: RoHS2 Directive 2011/65/EU 8 June 2011, and REACH Regulation (EC) No 1907/2006 18 December 2006. It 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.

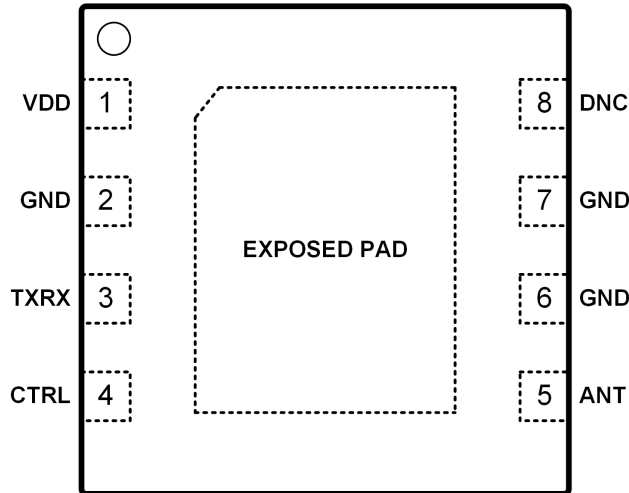


8-Lead 2mm x 2mm x 0.45mm, DFN Package

Figure 2: Package Type

Ordering Information

Part Number	Description
8TR1216	2.4GHz Front-End RFIC in 2mm x 2mm x 0.45mm 8-Pin DFN
8TR1216-EVB	Fully Tested and Characterized Evaluation Board
8TR1216-DWF	2.4GHz Front-End RFIC Die in Wafer Form

Pin Descriptions

Figure 3 :Pin Description (Top View)
Table 1: 8TR1216 Pin Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	VDD	DC Voltage Supply	5	ANT	Antenna port (DC shorted to GND)
2	GND	Ground	6	GND	Ground
3	TXRX	Transmit/Receive Port (DC shorted to GND)	7	GND	Ground
4	CTRL	Control Logic pin	8	DNC	Do Not Connect
EXPOSED PAD		Exposed pad should be connected to GND.			

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 - HBM: 3000V

General Specifications
Table 2: 8TR1216 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: 8TR1216 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: 8TR1216 Transmit Electrical Specifications

 (VDD = 3.0V, T_{Ambient} = 25°C, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Frequency Range	GHz	2.4		2.5	
Saturated Output Power	dBm		13		With Harmonic Filter as specified
EDR Spectral Mask	dBm		8		Spectral Mask compliant, 3Mbps EDR Signal with Harmonic Filter as specified
Small-Signal Gain	dB		13		
Large-Signal Gain	dB		13		+10dBm Pout at P _{ANT}
Current Consumption	mA		18		+10dBm Pout at P _{ANT}
			8		No RF applied
Second Harmonic	dBm/MHz		-60		Up to +10dBm with external harmonic filter as specified
Third Harmonic	dBm/MHz		-60		
Input Return Loss	dB		-12		
Load VSWR for Stability			6:1		All Non-harmonic Spurs Less than -43dBm/MHz
Load VSWR for Ruggedness			10:1		No Damage

Table 5: 8TR1216 Bi-Directional Bypass Electrical Specifications

 (VDD = 3.0V, T_{Ambient} = 25°C, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Frequency Range	GHz	2.4		2.5	
Bypass Current	uA		0.4		
Bypass Insertion Loss with Filter	dB		2.0		Between TXRX and ANT Ports with Harmonic Filter as specified

Table 6: 8TR1216 Switching Time Specifications

 (VDD = 3.0V, T_{Ambient} = 25°C, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
TX to Bypass	usec		0.8		From 50% of CTRL to 10% RF
Bypass to TX	usec		0.8		From 50% of CTRL to 90% RF

Table 7: 8TR1216 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 8TR1216 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

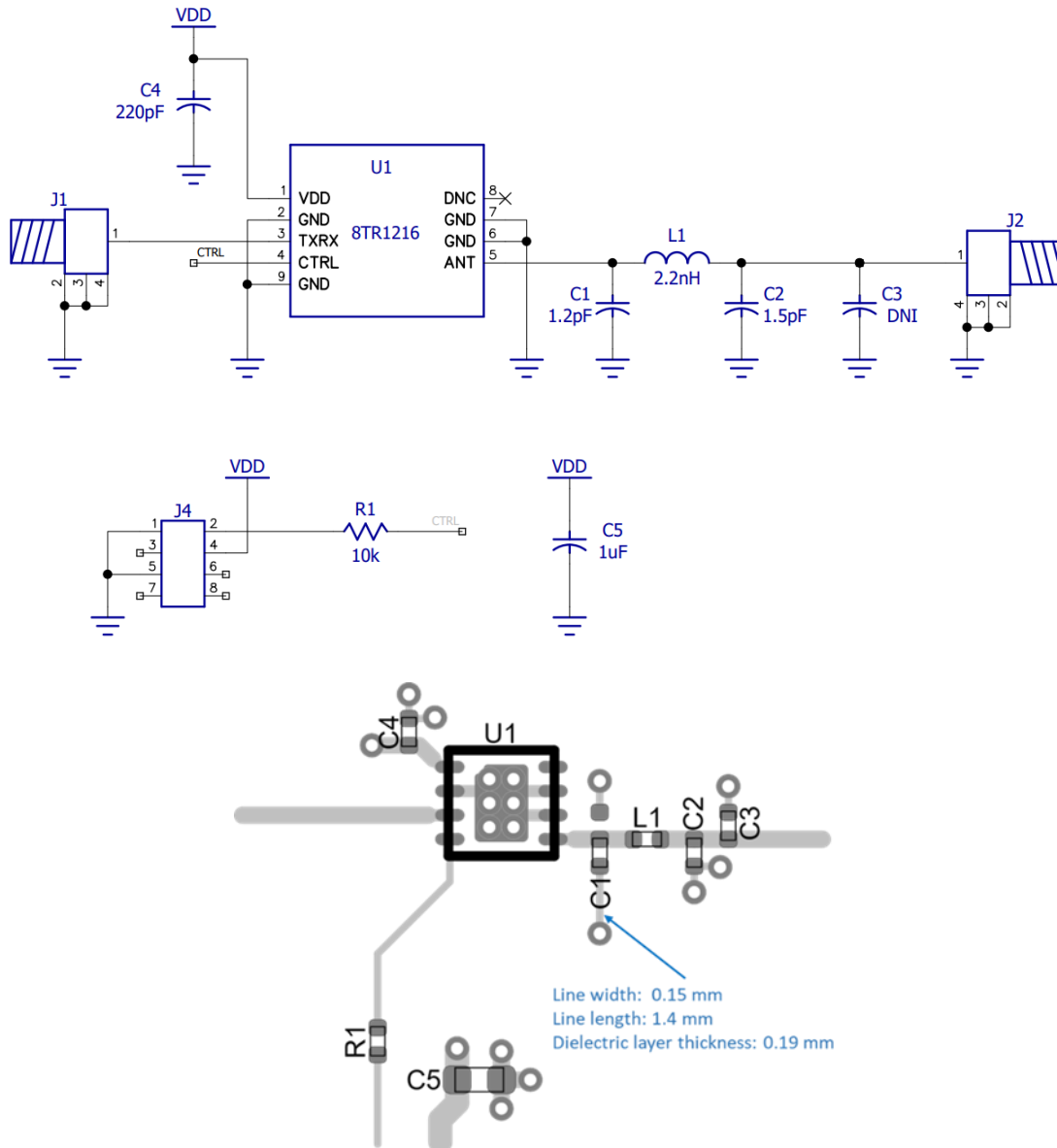
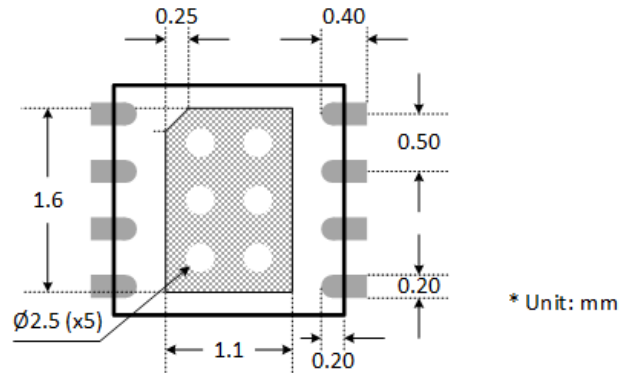
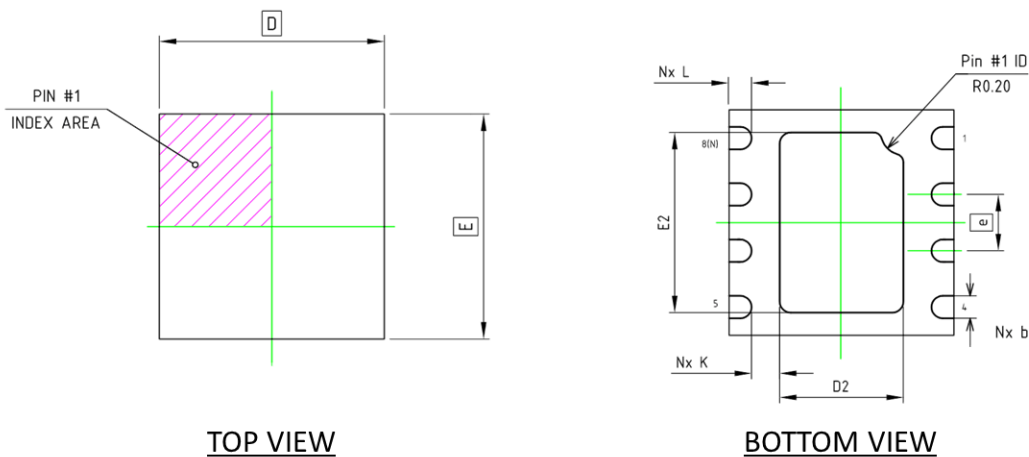
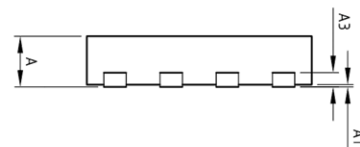


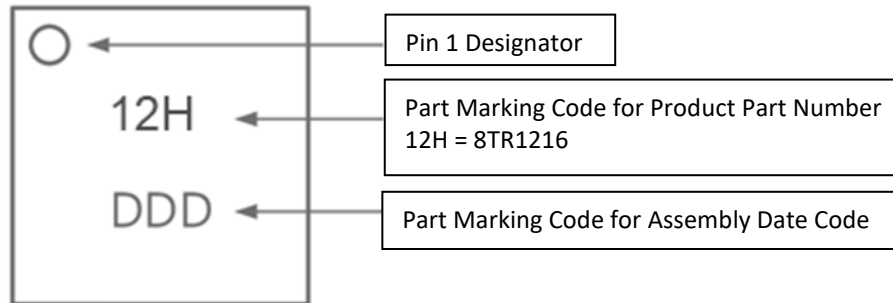
Figure 4: 8TR1216 Reference Design Schematic and PCB Layout

Package Dimensions

Figure 5: 8TR1216 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	0.50 BSC		
D2	1.00	1.10	1.20
E2	1.50	1.60	1.70
K	0.20	---	---
L	0.10	0.20	0.30
N	8		


Figure 6: 8TR1216 Package Dimension

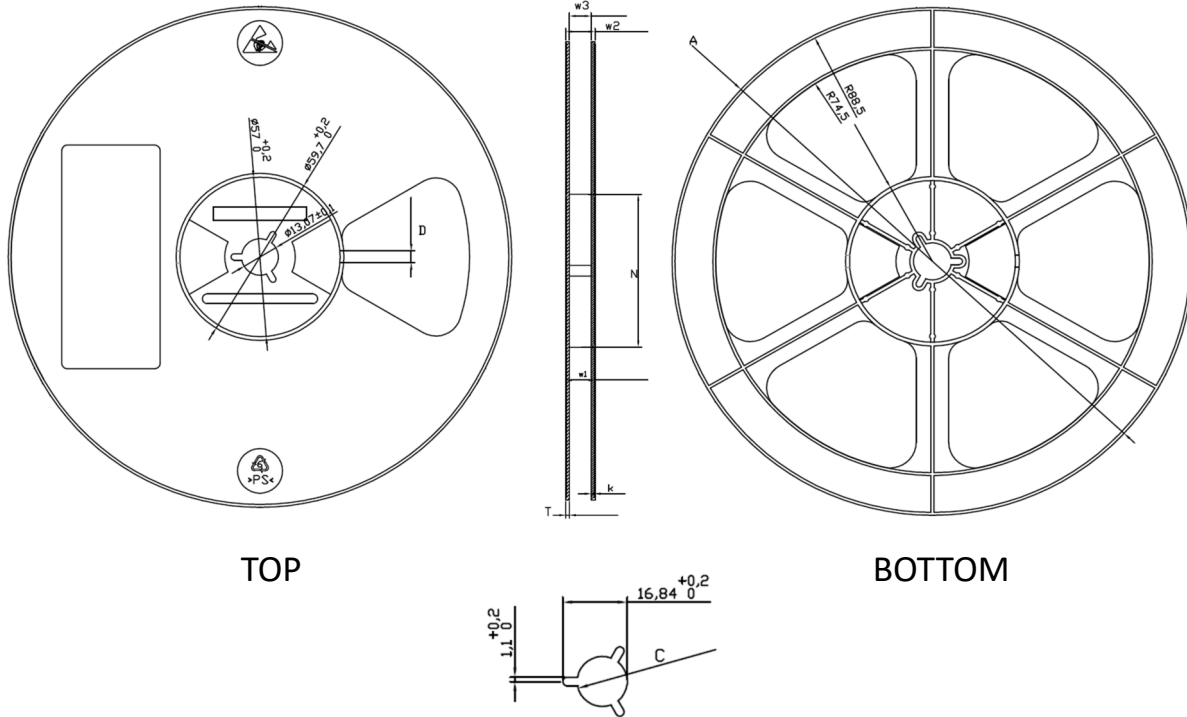
Package Marking



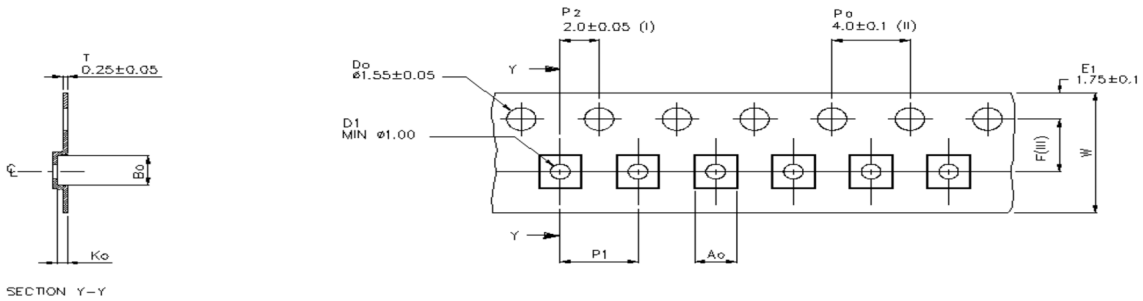
Note: The part marking: 12H represents the Product Part Number: 8TR1216. Due to the size limitations of this package, only three (3) characters can be marked on each of the two (2) rows. Therefore the Product Part Number is represented in the part marking by a 3-character code.

Figure 7: 8TR1216 Typical Part Marking

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 ± 0.5	8.4_{-0}^{+1}	11.6_{-1}^{+1}	8.75_{-1}^{+1}	1.5 ± 0.15	$1.25_{-0.05}^{+0.1}$



Ao	2.20 +/- 0.05
B0	2.20 +/- 0.05
K0	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: 8TR1216 Tape and Reel Dimension