Features

- 2.4 - 2.485GHz Frequency Range
- High Efficiency Optimized for Battery Operation
- Delivers up to +23dBm Output Power at 3.3V
- 160mA at +23dBm Output Power at 3.3V
- 1.6dB LNA Noise Figure at High current mode
- 2.7 - 4.0V Operation
- Single-Ended Transceiver Interface
- -40°C to 125°C Extended Temperature Range
- 3mm x 3mm x 0.45mm 16-Pin QFN Package

Applications

- 802.15.4 ZigBee, RF4CE, Proprietary ISM
- Bluetooth Low Energy (BLE) Mesh Networks
- Thread, Matter
- IoT (Internet of Things) / M2M Connectivity
- Smart Home Hubs and Gateways
- Consumer Electronics, Smart Appliances
- Smart Lighting, Smart Metering
- Drone, Toy, Media Remote Controller
- Industrial Wireless Sensor Networks
- Home, Industrial, Factory Automation
- Wireless Sensor Nodes & Networks
- Wireless Audio & Video

Description

The 8TR8218 is a compact, multi-function Front-End RFIC (Radio Frequency Integrated Circuit) intended for 802.15.4 ZigBee, Thread, Matter, Bluetooth Smart and proprietary ISM wireless protocol systems in the 2.4GHz band.

The 8TR8218 is optimized for battery operation with enhanced efficiency, operating over a wide voltage supply range from 2.7V to 4.0V, suited for a wide array of applications including battery-powered wireless systems.

The 8TR8218 combines a transmit power amplifier (PA), receive low noise amplifier (LNA), a single pole, double throw (SPDT) 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 and input / output matching circuitry. The device delivers up to +23dBm saturated output power at a supply voltage of 3.3V.

The 8TR8218 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.
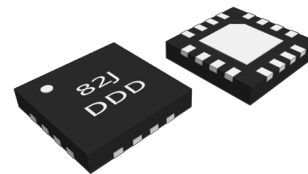
16-Lead 3mm x 3mm x 0.45mm, QFN Package
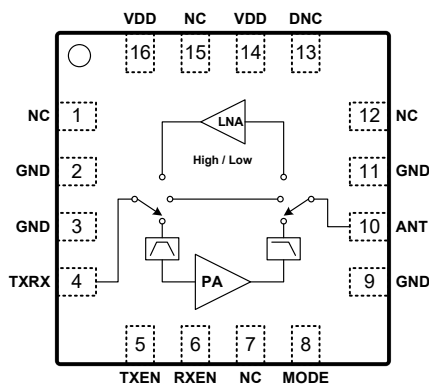**Figure 2: Package Type**

Ordering Information

Part Number	Description
8TR8218	2.4GHz Front-End RFIC 2500pieces per Tape and Reel
8TR8218-EVB	Fully Tested and Characterize Evaluation Board
8TR8218-DWF	2.4GHz Front-End RFIC Die in Wafer Form

Figure 1: Functional Block Diagram

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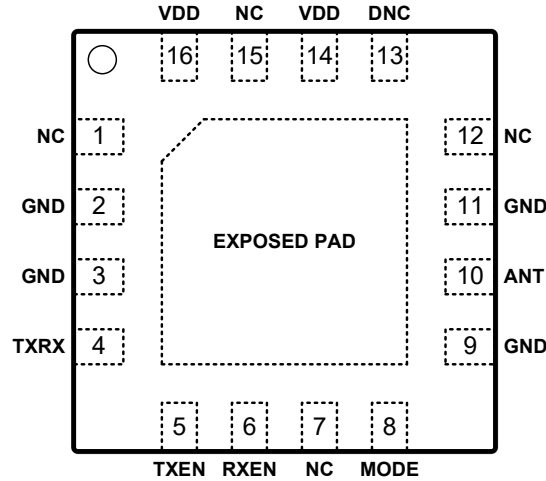
Pin Descriptions

Figure 3: Pin Descriptions (Top View)

Table 1: 8TR8218 Pin Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	NC	Not connected internally	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	VDD	Alternate DC Voltage supply pin (Internally connected to pin 16)
7	NC	Not connected internally	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: 8TR8218 Absolute Maximum Ratings

Parameter		Units	Minimum	Maximum	Remark
Supply Voltage (VDD)		V	0	4.4	
Control Logic Pin (TXEN, RXEN, MODE)		V	0	VDD	
Transmit Output Power at ANT Port		dBm		24.5	
Transmit Input Power at TXRX Port		dBm		10	
Receive Input power at ANT Port		dBm		15	
Bypass Input power at ANT Port		dBm		20	
Storage Temperature		°C	-40	150	
ESD - HBM*	VDD (Pin 14, 16)	V		±500	
	All other pins	V		±3000	
ESD - HBM with application circuits*	All pins	V		±4000	VDD to GND: with shunt TVS Diode and 1uF capacitor**

Note: Sustained operation at or above the Absolute Maximum Ratings for any single or combinations of the parameters above may result in permanent damage to the device and is not recommended. All Maximum RF Input Power Ratings assume 50Ω terminal impedance.
*Electrostatic discharge Human Body Model(HBM) Reference Document: ANSI/ESDA/JEDEC JS-001-2017
**For more details, see the application note 8TR8218_AN230214.

Table 3: 8TR8218 Recommended Operating Conditions

Parameter	Units	Minimum	Typical	Maximum
Supply Voltage (VDD, recommended)	V	2.7	3.3	4
Supply Voltage (VDD, extend supply voltage)**	V	2.2		4
Control Pin - Logic High State (TXEN, RXEN, MODE)	V	1.2		VDD*
Control Pin - Logic Low State (TXEN, RXEN, MODE)	V	0		0.4
Operating Frequency Range	GHz	2.4		2.485
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 2.2V to 2.7V.

Table 4: 8TR8218 Transmit Electrical Specifications

(VDD = 3.3V, TXEN = High, RXEN = High or Low, MODE = Low, $T_{Ambient}$ = 25°C, Excluding PCB and Connector Loss, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Saturated Output Power	dBm		23		
Large-Signal Gain	dB		24		+23dBm Pout
Current Consumption	mA		95		+20dBm Pout
			160		+23dBm Pout
Tx Quiescent Current	mA		20		No RF applied
Second Harmonic	dBm/MHz		-10		+22dBm Pout IEEE 802.15.4 OQPSK signal
Third Harmonic	dBm/MHz		-15		
Input Return Loss	dB		15		
Output Return Loss	dB		10		
Load VSWR for Stability			6:1		All Non-harmonic Spurs Less than -43dBm/MHz Up to +23dBm
Load VSWR for Ruggedness			10:1		No Damage

Table 5: 8TR8218 Receive(High current Mode) Electrical Specifications

(VDD = 3.3V, TXEN = Low, RXEN = High, MODE = Low, $T_{Ambient}$ = 25°C, Excluding PCB and Connector Loss, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Small-Signal Gain	dB		19		
Current Consumption	mA		12		
Noise Figure	dB		1.6		
Input P1dB	dBm		-13		
Input IP3	dBm		-3		Pin = -35dBm/Tone, 1MHz spacing
Input Return Loss	dB		8		
Output Return Loss	dB		10		

Table 6: 8TR8218 Receive(Low current Mode) Electrical Specifications

(VDD = 3.3V, TXEN = Low, RXEN = High, MODE = High, $T_{Ambient}$ = 25°C, Excluding PCB and Connector Loss, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Small-Signal Gain	dB		16.5		
Current Consumption	mA		5.5		
Noise Figure	dB		1.9		
Input P1dB	dBm		-11		
Input IP3	dBm		-2		Pin = -35dBm/Tone, 1MHz spacing
Input Return Loss	dB		7		
Output Return Loss	dB		10		

Table 7: 8TR8218 Bypass Mode Specifications

(VDD = 3.3V, TXEN = Low, RXEN = Low, MODE = High, $T_{Ambient}$ = 25°C, Excluding PCB and Connector Loss, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Bypass Current	uA		3.5		
Insertion Loss	dB		1.7		

Table 8: 8TR8218 Shutdown Mode Specifications

(VDD = 3.3V, TXEN = Low, RXEN = Low, MODE = Low, $T_{Ambient}$ = 25°C, Excluding PCB and Connector Loss, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
Shutdown Current	uA		0.3		
ANT-TXRX Isolation	dB		23		

Table 9: 8TR8218 Switching Time Specifications

(VDD = 3.3V, $T_{Ambient}$ = 25°C, Unless Otherwise Noted)

Parameter	Units	Min	Typ	Max	Test Conditions
TX to RX	nsec		800		From 50% of TXEN to 90% of RX power
TX to Bypass	nsec		250		From 50% of MODE to 90% of Bypass power
TX to Shutdown	nsec		50		From 50% of TXEN to 10% of TX power
RX to TX	nsec		850		From 50% of TXEN to 90% of TX power
RX to Bypass	nsec		250		From 50% of MODE to 90% of Bypass power
RX to Shutdown	nsec		50		From 50% of RXEN to 10% of RX power
Bypass to TX	nsec		850		From 50% of TXEN to 90% of TX power
Bypass to RX	nsec		800		From 50% of RXEN to 90% of RX power
Bypass to Shutdown	nsec		750		From 50% of MODE to 10% of Bypass power
Shutdown to TX	nsec		850		From 50% of TXEN to 90% of TX power
Shutdown to RX	nsec		450		From 50% of RXEN to 90% of RX power
Shutdown to Bypass	nsec		50		From 50% of MODE to 90% of Bypass power

Table 10: 8TR8218 Control Logic

"1" = Logic High, "0" = Logic Low, All Control logic pins must have a state defined as either "0" or "1".

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

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Application Notes

The 8TR8218 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.
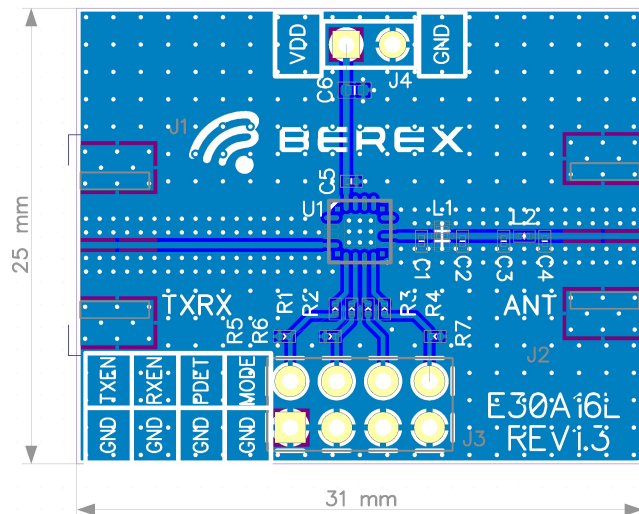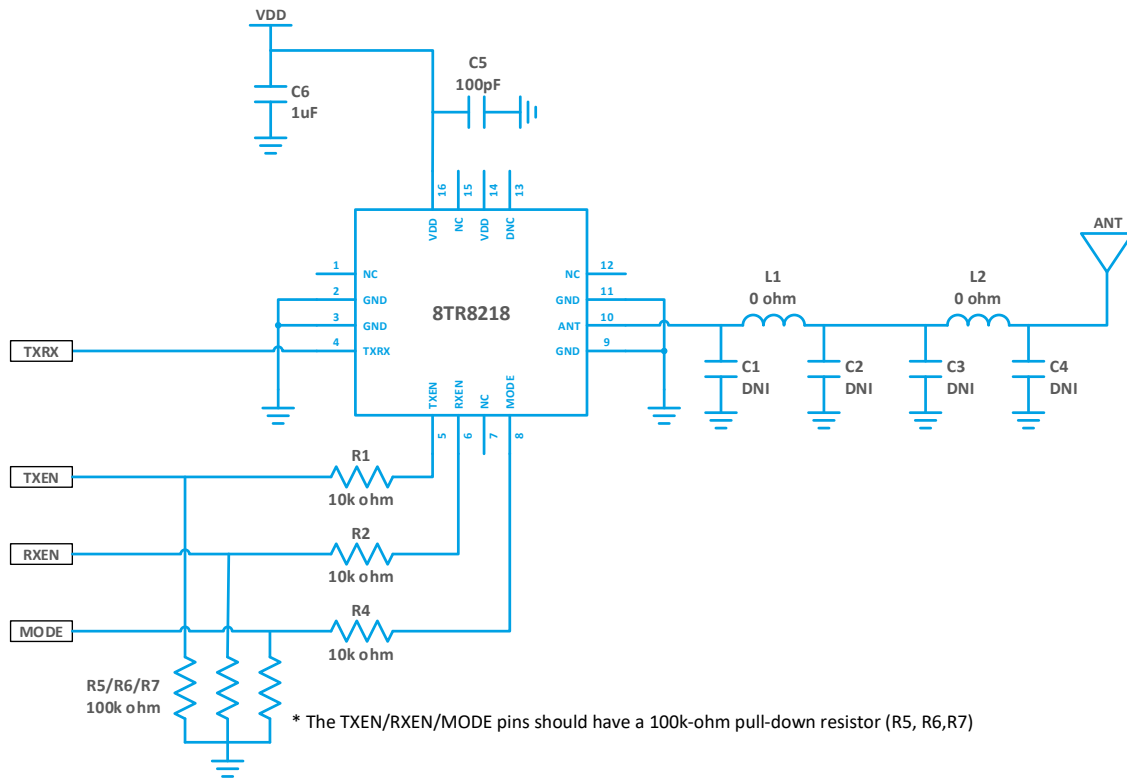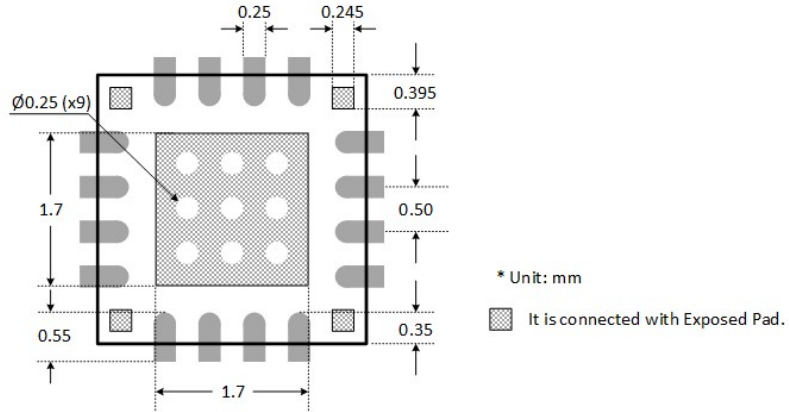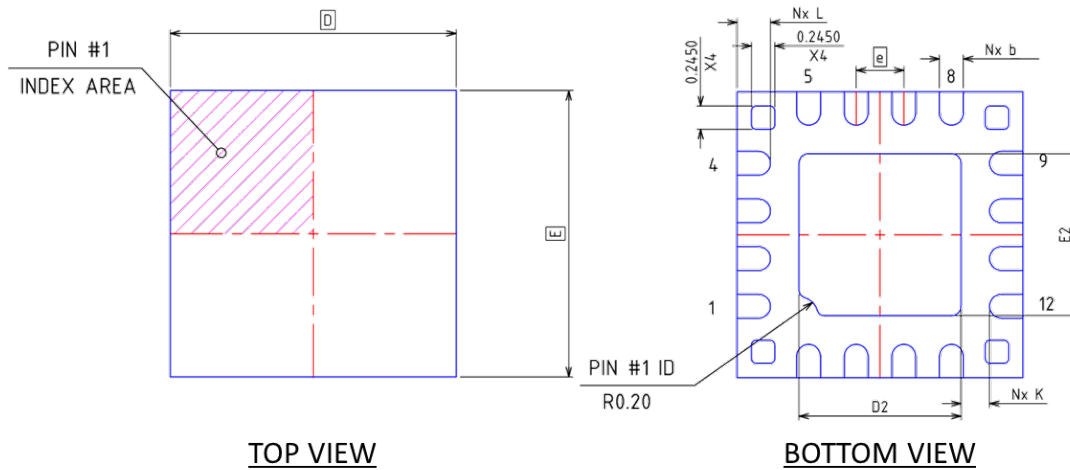
Application Schematic and PCB Layout

* The TXEN/RXEN/MODE pins should have a 100k-ohm pull-down resistor (R5, R6,R7)

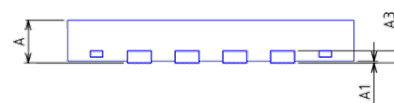**Figure 4: 8TR8218 Reference Design Schematic and PCB Layout**

Package Dimensions

Figure 5: 8TR8218 Recommended PCB Layout Footprint

TOP VIEW   BOTTOM VIEW

	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: 8TR8218 Package Dimension

Package Marking

Figure 7: 8TR8218 Typical Part Marking
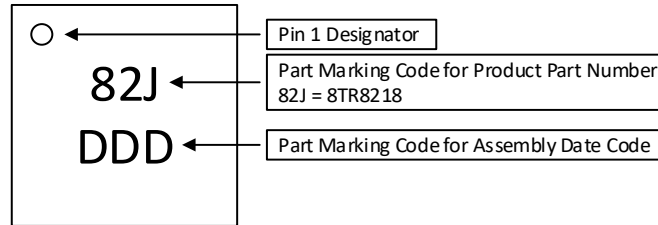
Note: The part marking: 82J represents the Product Part Number: 8TR8218.

    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.
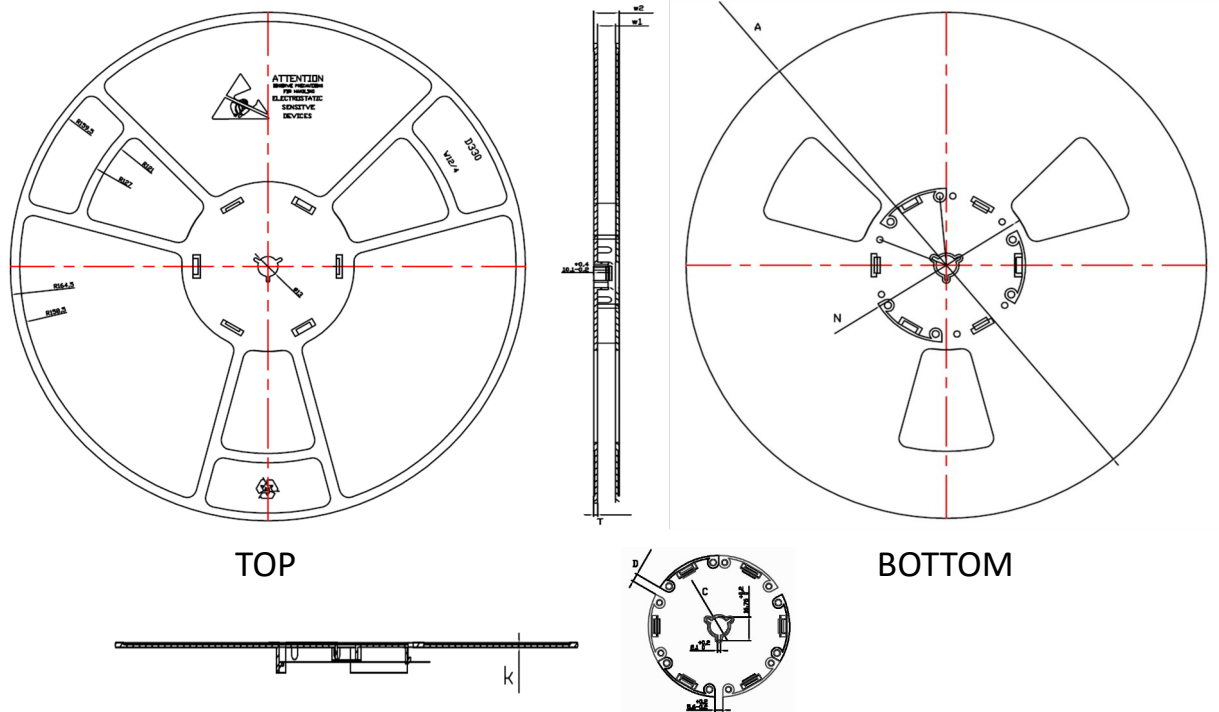
ESD Handling Information

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.
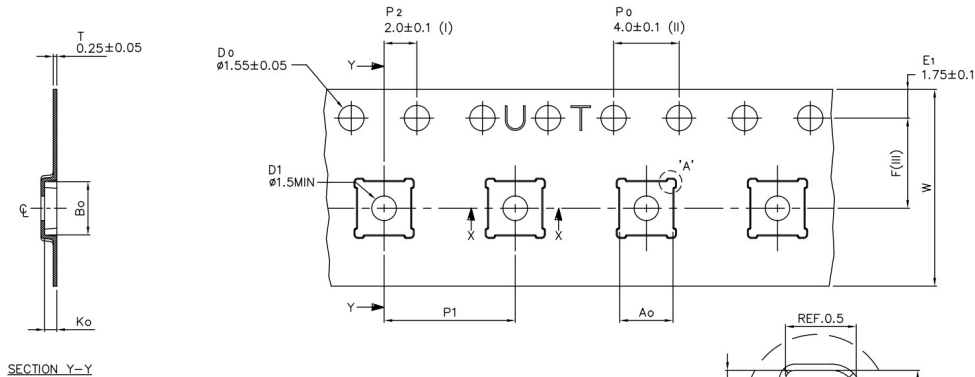
RoHS Compliance

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

TOP   BOTTOM

TYPE	A	N	C	D	w1	w2	T	k
12MM	Ø330 -2 +2	Ø100 -2 +2	Ø13,1 -0,2 +0,2	5,6 -0,5 +0,5	12,4 -0 +2	16,6 -0 +2	2,1±0,15	1,4 -0,1 +0,15

T 0.25±0.05

P2 2.0±0.1 (I)

P0 4.0±0.1 (II)

E1 1.75±0.1

D0 Ø1.55±0.05

D1 Ø1.5MIN

SECTION Y—Y

SECTION X—X

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

REF.0.5

DETAIL 'A'

(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: 8TR8218 Tape and Reel Dimension