

Features

- 2.4 - 2.525GHz Frequency Range
- High Functionality Front-End RF Integrated Circuit
- Integrated PA, LNA, Bypass, T/R Switch
- Low Current Optimized for Battery Operated IoT
- +13dBm Output Power at 3.0V, Up to +15dBm, 3.6V
- 25mA at +13dBm Output Power
- 3.1dB LNA Noise Figure
- Low Bi-Directional Bypass Insertion Loss
- Ultra-Low Bypass Current, Ideal for Bluetooth® Power Class 1.5 Operation
- Filter Networks, Input / Output Matching
- 2mm x 2mm x 0.45 mm QFN-16 Package
- -40°C to 105°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

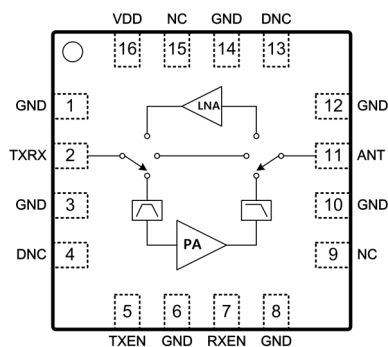


Figure 1: Functional Block Diagram

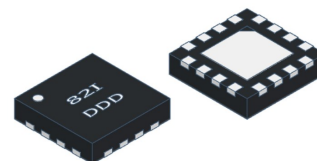
Description

The 8TR8211C is a compact, highly integrated front-end RFIC (Radio Frequency Integrated Circuit) intended for range extension of Bluetooth® Smart / Bluetooth® Low Energy (BLE) and proprietary ISM wireless systems in the 2.4GHz band.

The 8TR8211C is optimized for battery operation with enhanced efficiency operating over a wide voltage supply range from 2.7V to 3.6V, suited for a wide array of applications including battery powered wireless systems.

The 8TR8211C combines a power amplifier (PA), low noise amplifier (LNA), a transmit / receive (T/R) switch, (Figure 1), in a 2mm x 2mm x 0.45mm 16-pin QFN package. It also comes integrated with filter networks, and input / output matching circuitry.

The 8TR8211C 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.

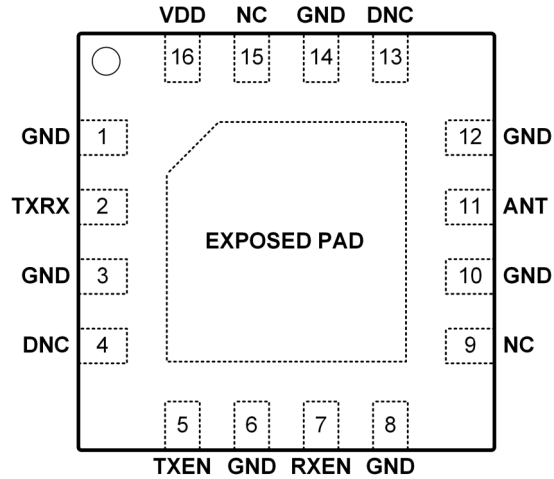


16-Lead 2mm x 2mm x 0.45mm, QFN Package

Figure 2: Package Type

Ordering Information

| Part Number | Description |
|--------------|--|
| 8TR8211C | 2.4GHz Front-End RFIC 2500 Pieces per Tape and Reel |
| 8TR8211C-EVB | Fully Tested and Characterize Evaluation Board |
| 8TR8211C-DWF | 2.4GHz Front-End RFIC Die in Wafer Form |

Pin Descriptions

Figure 3 :Pin Description (Top View)
Table 1: 8TR8211C 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: 8TR8211C 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 | | 13 |
| Receive Input power at ANT Port | dBm | | 10 |
| Bypass Input power at ANT Port | dBm | | 25 |
| TXRX Port Input Power | 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: 8TR8211C 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 (TXEN, RXEN) | V | 1.2 | | VDD* |
| Control Pin - Logic Low State (TXEN, RXEN) | V | 0 | | 0.4 |
| Control Pin Current (Logic High, 1.8V) | uA | | 0.4 | |
| Operating Frequency Range | GHz | 2.4 | | 2.525 |
| Operating Temperature | °C | -40 | 25 | 105 |

*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: 8TR8211C 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 | | 2.525 | |
| Saturated Output Power | dBm | | 14 | | VDD: 3.3V |
| | | | 13 | | VDD: 3.0V |
| | | | 12 | | VDD: 2.7V |
| Large-Signal Gain | dB | | 11 | | +13dBm Pout |
| Current Consumption | mA | | 15 | | +10dBm Pout |
| | | | 25 | | +13dBm Pout |
| Tx Quiescent Current | mA | | 5 | | No RF Applied |
| Second Harmonic | dBm/MHz | | -40 | | Up to +13dBm with Harmonic Filter as Specified |
| Third Harmonic | dBm/MHz | | -60 | | |
| Input Return Loss | dB | | -9 | | |
| Load VSWR for Stability | | | 6:1 | | All Non-harmonic Spurs Less than -43dBm/MHz Up to +10dBm |
| Load VSWR for Ruggedness | | | 10:1 | | No Damage |

Table 5: 8TR8211C 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 | | 2.525 | |
| Small-Signal Gain | dB | | 9 | | |
| Quiescent Current | mA | | 3.5 | | No RF Applied |
| Noise Figure | dB | | 3.1 | | |
| Input P1dB | dBm | | 0 | | |
| Input IP3 | dBm | | -4 | | P _{IN} = -35dBm/tone, 1MHz Spacing |
| Input Return Loss | dB | | -11 | | |
| Output Return Loss | dB | | -4 | | |

Table 6: 8TR8211C Bi-Directional 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 | | 2.525 | |
| Bypass Insertion Loss | dB | | 2.6 | | Between TXRX and ANT Ports |
| Bypass Current | uA | | 0.6 | | |

Table 7: 8TR8211C 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 | usec | | 0.8 | | From 50% of RXEN to 90% of RX power |
| TX to Bypass | usec | | 0.5 | | From 50% of TXEN to 10% RF |
| RX to TX | usec | | 0.35 | | From 50% of TXEN to 90% RF |
| RX to Bypass | usec | | 0.45 | | From 50% of RXEN to 10% RF |
| Bypass to TX | usec | | 0.4 | | From 50% of TXEN to 90% RF |
| Bypass to RX | usec | | 0.9 | | From 50% of RXEN to 90% RF |

Table 8: 8TR8211C 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 provides an ultra-low current consumption, as in a conventional Sleep Mode.

Application Notes

The 8TR8211C 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

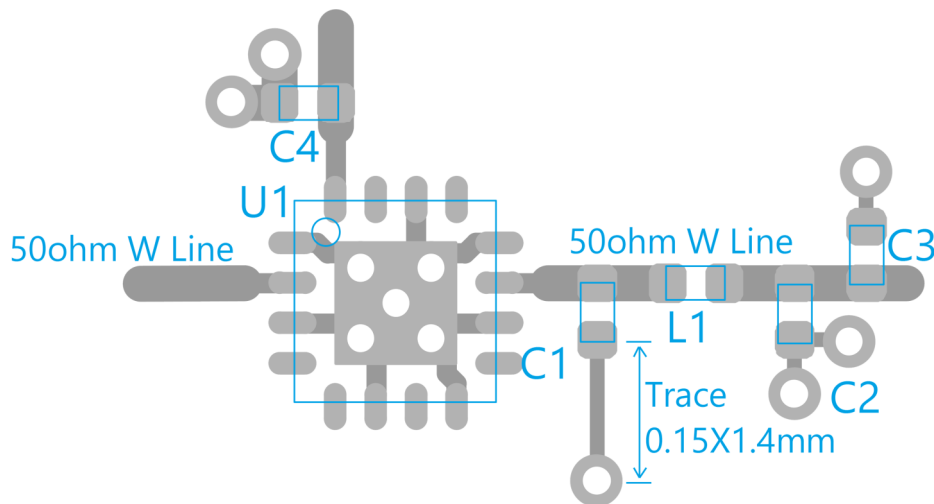
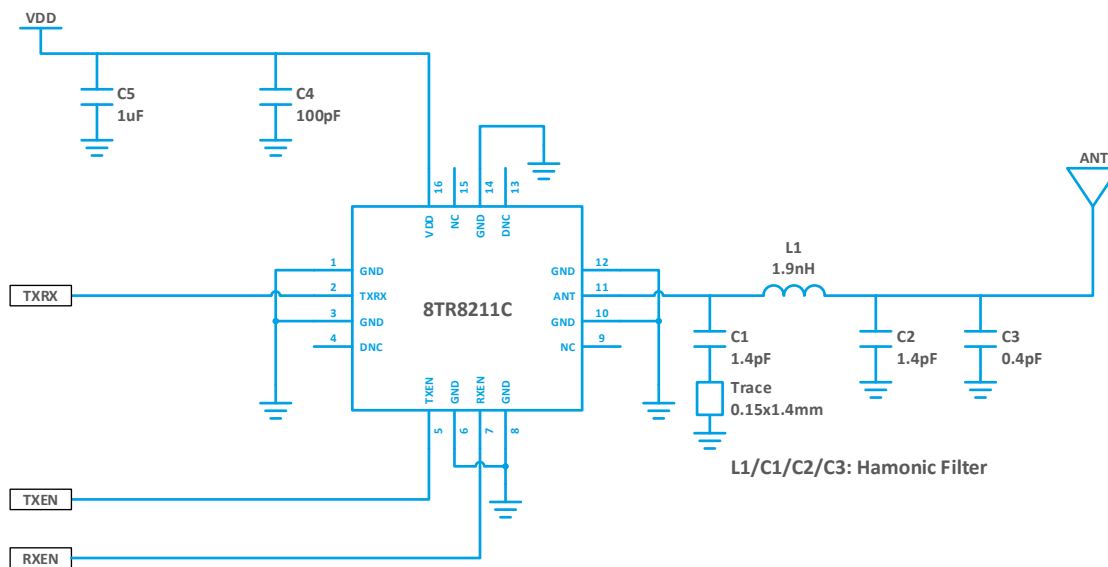
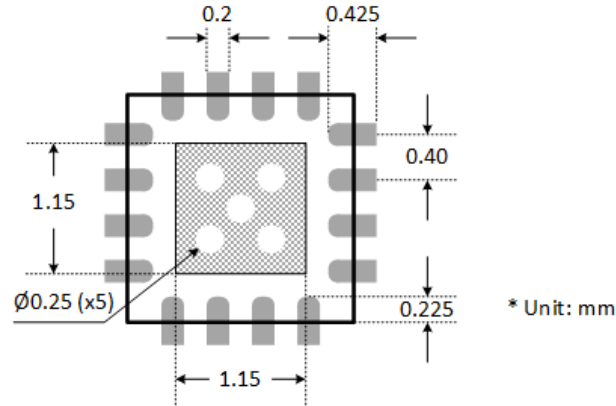
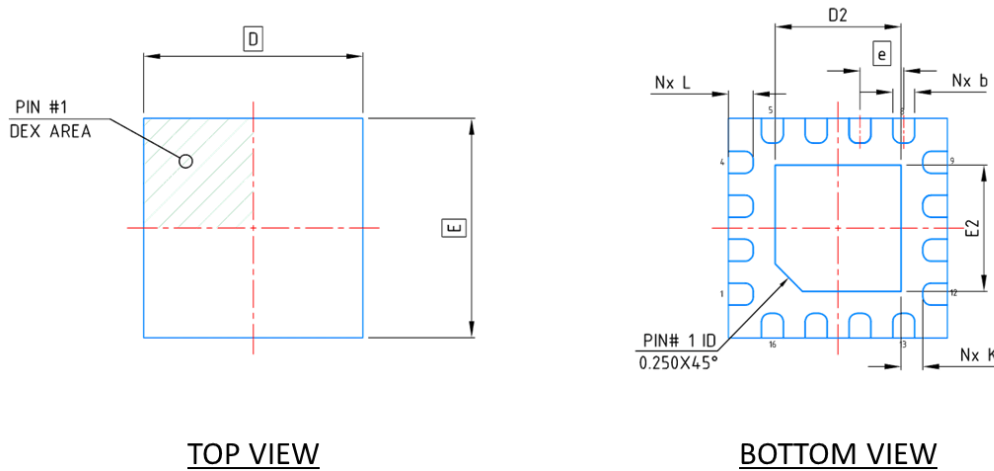
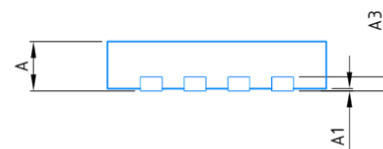


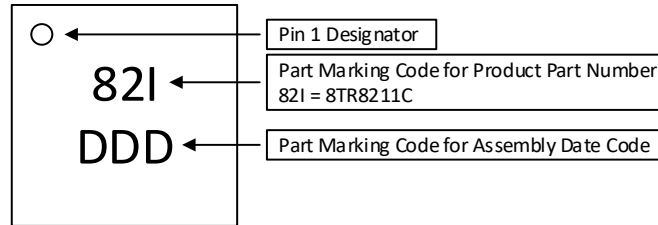
Figure 4: 8TR8211C Reference Design Schematic and PCB Layout

Package Dimensions

Figure 5: 8TR8211C 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 | | |


SIDE VIEW
Figure 6: 8TR8211C Package Dimension

Package Marking



Note: The part marking: 82I represents the Product Part Number: 8TR8211C.

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: 8TR8211C Typical Part Marking

ESD Handling Information

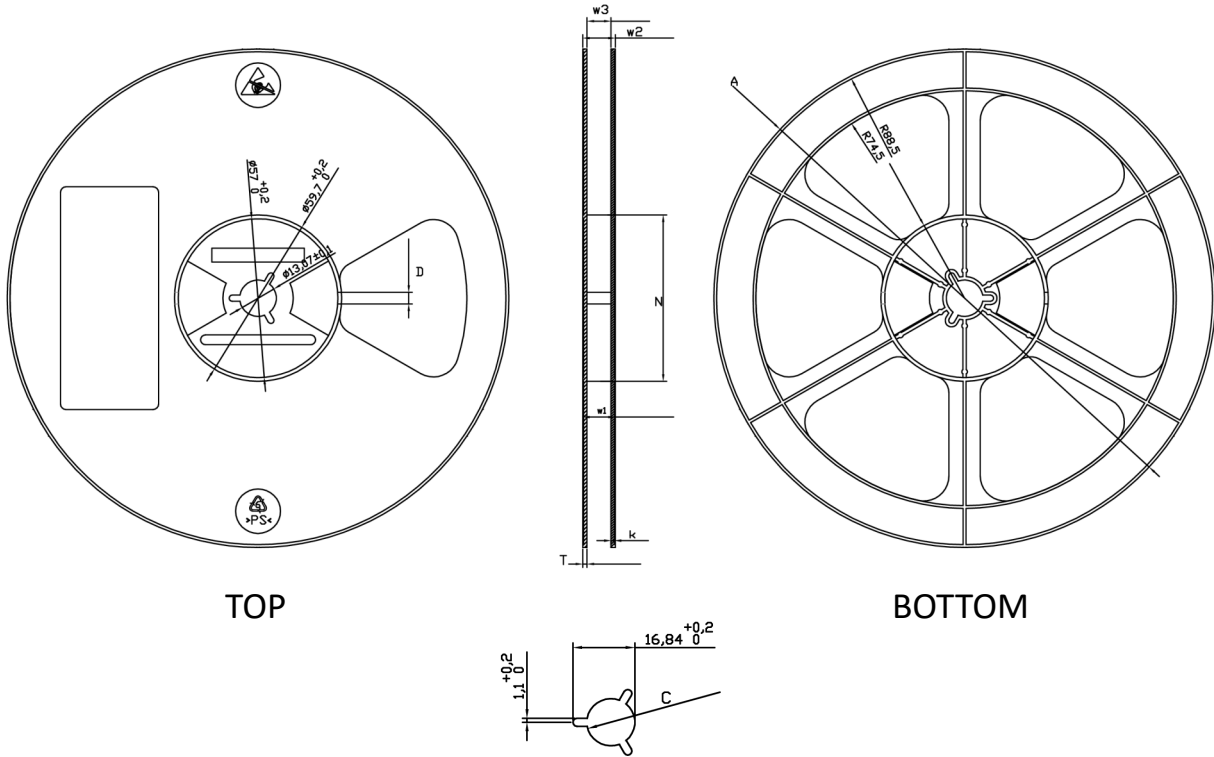
Electro Static Discharge (ESD) can cause immediate (or latent) failures in semiconductor Integrated Circuits (ICs). BeRex, Inc. RFIC products are designed with integral ESD protection structures, and all IC products are tested to meet industry standards for ESD event survival. Users must adhere to all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

RoHS Compliance

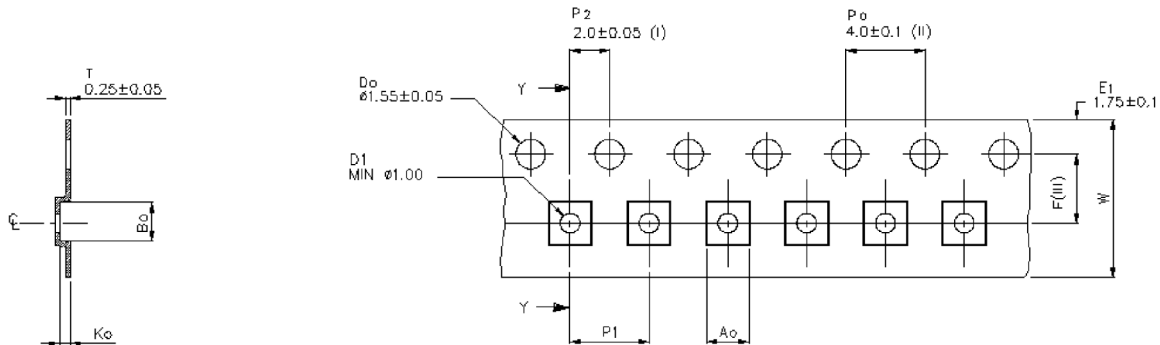
This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

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 | $\phi 180^{+2}_{-2}$ | $\phi 60^{+1}_{-1}$ | $\phi 13.1^{+0.2}_{-0.2}$ | 4.2 ± 0.5 | 8.4^{+1}_{-0} | 11.6^{+1}_{-1} | 8.75^{+1}_{-1} | 1.5 ± 0.15 | $1.25^{+0.1}_{-0.05}$ |



SECTION Y-Y

| | |
|----------------|----------------|
| A ₀ | 2.20 +/−0.05 |
| B ₀ | 2.20 +/−0.05 |
| K ₀ | 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: 8TR8211C Tape and Reel Dimension