

TS8043N - 100W CW, Broadband SP4T GaN RF Switch

1.0 Features

- Low insertion loss: 0.37dB @ 1GHz
- High isolation: 45dB @ 400MHz, 36dB @ 1GHz
- 100W CW, 200W Peak Power
- No external DC blocking capacitors on RF lines
- Versatile 2.6-5.25V power supply
- Operating frequency: 30MHz to 2.5GHz

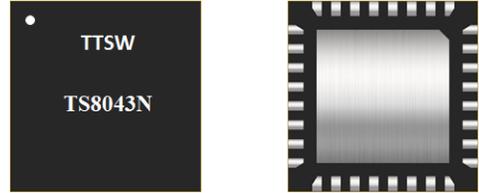


Figure 1 Device Image
(32 Pin 5x5x0.85mm QFN Package)

2.0 Applications

- Private mobile and military radios
- Public safety handsets
- Cellular infrastructure
- Small cells
- LTE relays and microcells
- Satellite terminals



RoHS/REACH/Halogen Free Compliance

3.0 Description

The TS8043N is a 2nd Generation symmetrical reflective Single Pole Four Throw (SP4T) switch designed for broadband, high power switching applications. With a simple broadband match, the TS8043N can cover 30MHz to 2.5GHz bandwidth and provide low insertion loss, high isolation, and high linearity within a small package size. TS8043N is an excellent switch for all applications requiring low insertion loss, high isolation, and high linearity within a small package size.

The TS8043N is packaged into a compact Quad Flat No lead (QFN) 5x5mm 32 leads plastic package.

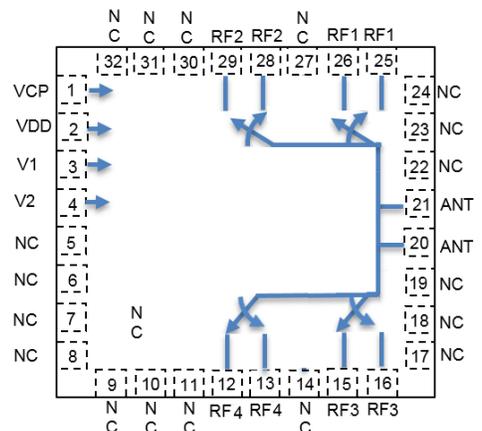


Figure 2 Function Block Diagram
(Top View)

4.0 Ordering Information

Table 1a Ordering Information

| Device Part Number | Package Type | Eval Board Part Number |
|--------------------|-----------------------|------------------------|
| TS8043N | 32 Pin 5x5x0.85mm QFN | TS8043N -EVB |

Table 1b Tape and Reel Information

| Form | Quantity | Reel Diameter | Reel Width |
|---------------|----------|---------------|------------|
| Tape and Reel | 3,000 | 13" (330mm) | 18mm |

5.0 Pin Description

Table 2 Pin Definition

| Pin Number | Pin Name | Description |
|------------------------------------|----------|--|
| 1 | VCP | Internal charge pump voltage output. Connect a 1nF capacitor to GND on this pin to improve switching time. |
| 2 | VDD | DC power supply |
| 3 | V1 | Switch control input 1 |
| 4 | V2 | Switch control input 2 |
| 5,6,7,8,9,10,17, 18,23,24,31,32 | NC | No internal connection, can be grounded |
| 11,14,19,22,27,30 | NC | No internal connection. Do not connect to ground |
| 20,21 | ANT | Antenna port |
| 25,26 | RF1 | RF port 1 |
| 28,29 | RF2 | RF port 2 |
| 15,16 | RF3 | RF port 3 |
| 12,13 | RF4 | RF port 4 |

Note: The backside ground (thermal) pad of the package must be grounded directly to the ground plane of PCB with multiple vias, and adequate heat sinking must be used to ensure proper operation and thermal management.

6.0 Absolute Maximum Ratings
Table 3 Absolute Maximum Ratings @T_A=+25°C Unless Otherwise Specified

| Parameter | Symbol | Value | Unit |
|---|-------------------|--------------|------|
| Electrical Ratings | | | |
| Power Supply Voltage | VDD | 5.5 | V |
| Storage Temperature Range | T _{st} | -55 to +125 | °C |
| Operating Temperature Range | T _{op} | -40 to +85 | °C |
| Maximum Junction Temperature | T _J | +140 | °C |
| Maximum RF input power(400MHz~1000MHz) | RFx/ANT | 51 | dBm |
| Maximum RF input power(30MHz~400MHz) | RFx/ANT | 50 | dBm |
| Maximum RF input power (30MHz, VSWR 8:1) | RFx/ANT | 47 | dBm |
| Maximum RF input Peak Voltage (30MHz, VSWR 8:1) | RFx/ANT | 140 | V |
| Thermal Ratings | | | |
| Thermal Resistance (junction-to-case) – Bottom side | R _{θJC} | 3.5 | °C/W |
| Thermal Resistance (junction-to-top) | R _{θJT} | ≤ 26 | °C/W |
| Soldering Temperature | T _{SOLD} | 260 | °C |
| ESD Ratings | | | |
| Human Body Model (HBM) | Level 1B | 500 to <1000 | V |
| Charged Device Model (CDM) | Level C3 | ≥1000 | V |
| Moisture Rating | | | |
| Moisture Sensitivity Level | MSL | 1 | - |

Attention:

Maximum ratings are absolute ratings. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Exceeding one or a combination of the absolute maximum ratings may cause permanent and irreversible damage to the device and/or to surrounding circuit.

7.0 Electrical Specifications
Table 4 Electrical Specifications @ $T_A=+25^{\circ}\text{C}$ Unless Otherwise Specified; $V_{DD}=+3.3\text{V}$; 50Ω Source/Load.

| Parameter | Condition | Minimum | Typical | Maximum | Unit |
|----------------------------|---|---------|---------|---------|---------------|
| Operating frequency | | 30 | | 2500 | MHz |
| Insertion loss, RFX | 100MHz | | 0.16 | 0.35 | dB |
| | 200MHz | | 0.17 | | |
| | 400MHz | | 0.22 | | |
| | 1000MHz | | 0.37 | | |
| | 2300MHz (matched) | | 0.43 | | |
| Isolation ANT-RFX | 100MHz | | 56 | | dB |
| | 200MHz | | 51 | | |
| | 400MHz | | 45 | | |
| | 1000MHz | | 36 | | |
| | 2300MHz (matched) | | 22 | | |
| Return loss ANT, RFX | 100MHz | | 35 | | dB |
| | 200MHz | | 33 | | |
| | 400MHz | | 30 | | |
| | 1000MHz | | 20 | | |
| | 2300MHz (matched) | | 20 | | |
| Harmonic distortion | | | | | |
| H2 | 800MHz, Pin=47dBm | | 76 | | dBc |
| H3 | 800MHz, Pin=47dBm | | 79 | | dBc |
| IIP3 | 800MHz | | | | dBm |
| P0.1dB ^[1] | 800MHz, CW | | 50 | | dBm |
| P0.1dB ^[1] | 30MHz, CW | | 50 | | dBm |
| Peak P0.1dB ^[1] | 800MHz, 1% duty cycle, 1 mS period. | | 54 | | dBm |
| Switching time | 50% ctrl to 10/90% of the RF value is settled. CP=1nF to ground on VCP pin. | | 12 | | μs |
| Control voltage | Power Supply VDD | 2.6 | 3.3 | 5.25 | V |
| | All control pins high, V_{ih} | 1.0 | 3.3 | 5.25 | V |
| | All control pins low, V_{il} | -0.3 | | 0.5 | V |
| Control current | All control pins low, I_{il} | | 0 | | μA |
| | All control pins high, I_{ih} | | | 7.5 | μA |
| Current consumption, IDD | Active mode (VDD on) | | 160 | 200 | μA |

Note:

[1] P0.1dB is a figure of merit.

[2] No external DC blocking capacitors required on RF pins unless DC voltage is applied on a RF pin.

8.0 Switch Truth Table

Table 5 Switch Truth Table

| V1 | V2 | Active RF Path |
|----|----|----------------|
| 0 | 0 | ANT-RF1 ON |
| 1 | 0 | ANT-RF2 ON |
| 0 | 1 | ANT-RF3 ON |
| 1 | 1 | ANT-RF4 ON |

Attention:

- [1] VDD should be applied first before V1 and V2, otherwise may cause damage to the device.
- [2] There are internal pull-downs to ground on both V1 and V2 control pins, the state at start-up without any control voltage applied will be ANT-RF1 ON.

9.0 Evaluation Board

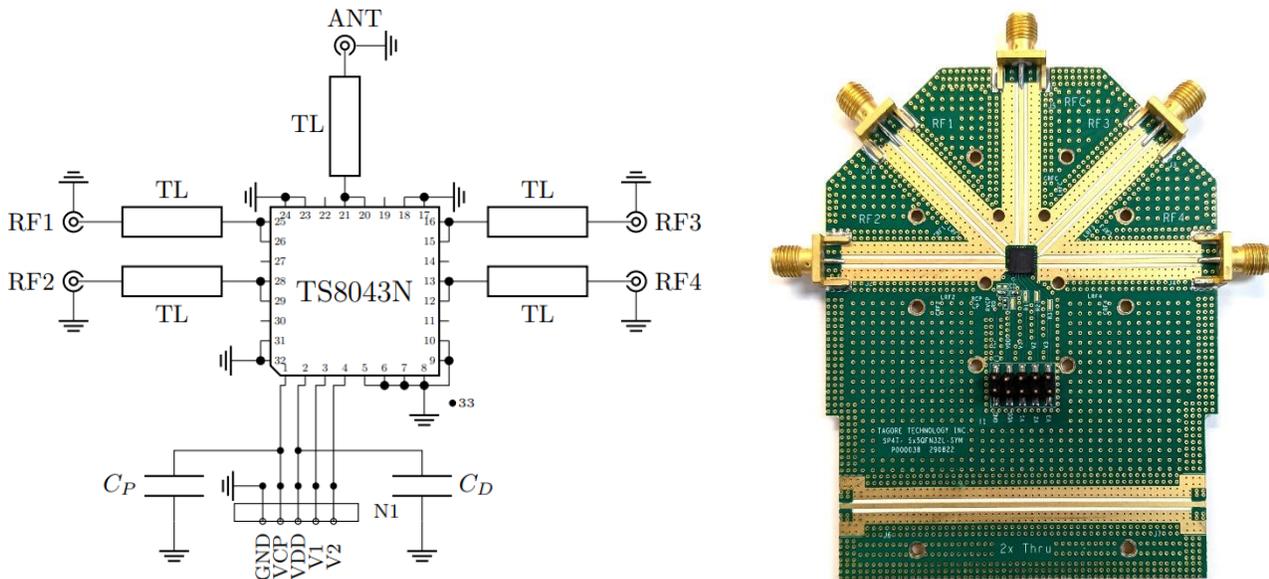


Figure 3 Evaluation Board and Schematic

Attention:

- [1] 33 refers to the center pad of the device. Multiple Plugged through hole vias should be added on this Ground Pad and adequate heat sinking should be used.
- [2] The purpose of connection between VCP and connector N1 is to monitor VCP, do not apply external voltage to VCP.
- [3] Place matching components close to pin of the part.

10.1 Typical Characteristics – Unmatched

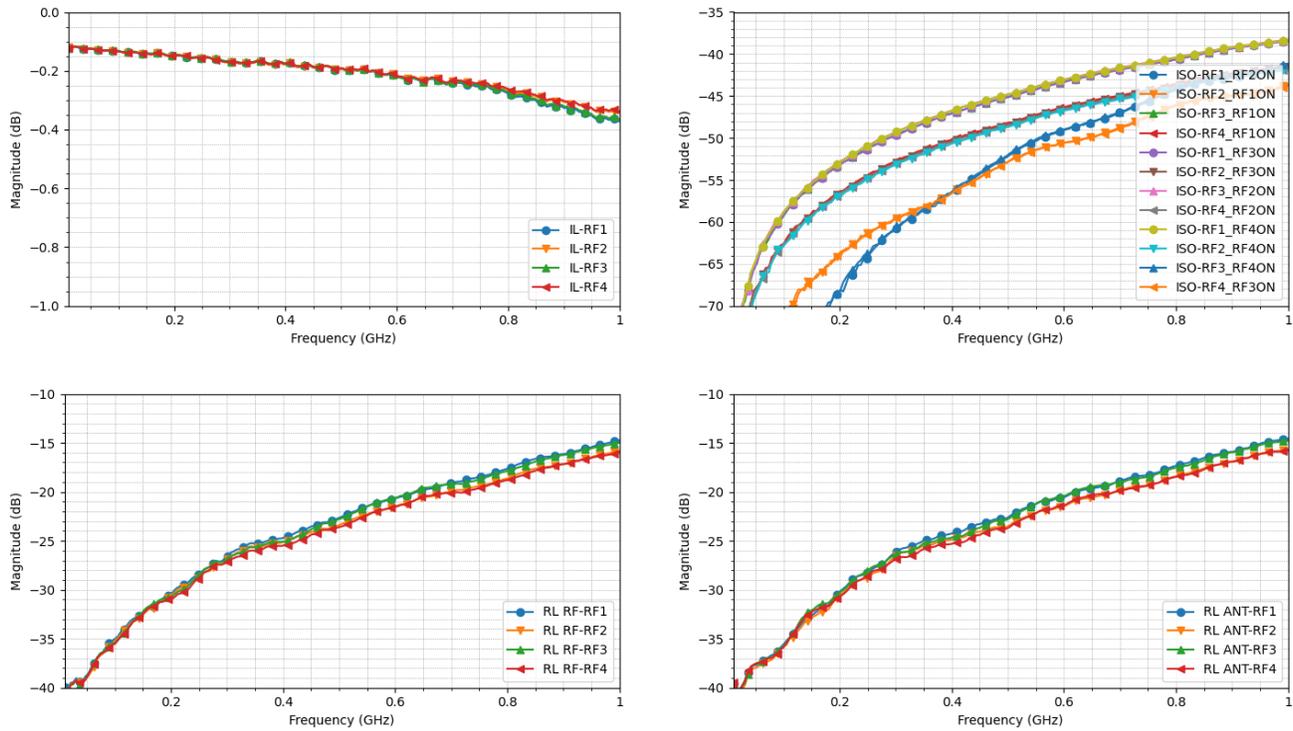


Figure 4.1 Typical characteristics (Unmatched)

10.2 Typical Characteristics – Matched (2200 MHz – 2500 MHz)

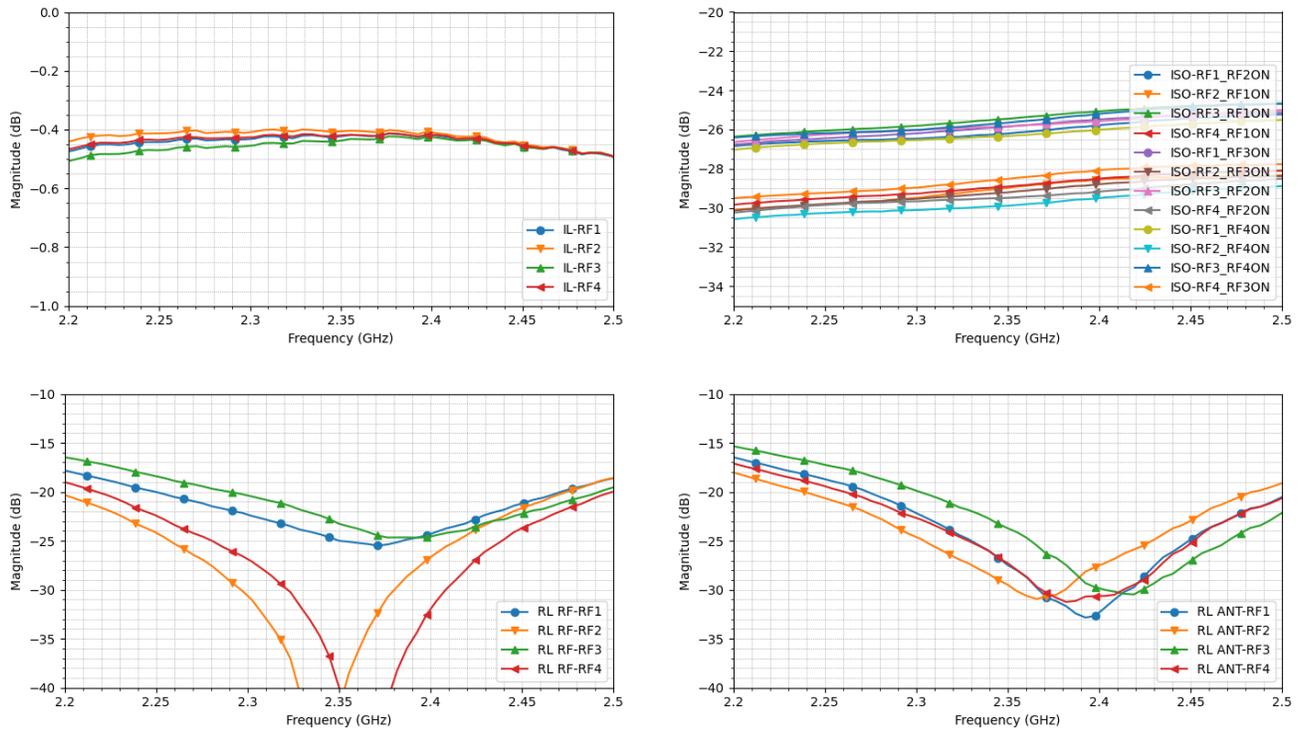


Figure 4.2 Typical characteristics (2200 MHz – 2500 MHz)

Table 6.1 Bill of Materials – Unmatched*

| Component | Part Number | Description | Notes |
|----------------|--------------------|---------------------------------------|-------|
| C _P | GRM155R71H102KA01D | Ceramic capacitor, 1 nF, 50 V, ±10%. | |
| C _D | GRM155R71H103KA88 | Ceramic capacitor, 10 nF, 50 V, ±15%. | |

* For additional details, please contact the TagoreTech support team.

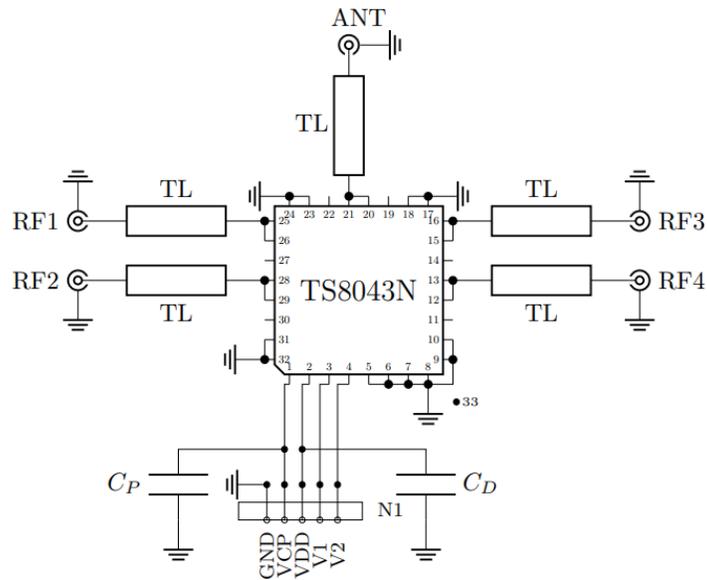


Figure 5.1 Schematic for Unmatched Condition

Table 6.2 Bill of Materials – Matching* (2200 MHz – 2500 MHz)

| Component | Part Number | Description | Notes |
|-----------------|--------------------|---|------------------------------|
| C _P | GRM155R71H102KA01D | Ceramic capacitor, 1 nF, 50 V, ±10%. | |
| C _D | GRM155R71H103KA88 | Ceramic capacitor, 10 nF, 50 V, ±15%. | |
| T _{0a} | 1.0 mm | PCB transmission line length. | From the IC-reference plane. |
| T _{0b} | 0.5 mm | PCB transmission line length. | |
| L _{0a} | 1512SP-2N5K1E_ | Mini Air Core Inductor, 2.5 nH, ±10%. | |
| C _{0a} | 0603N1R2BW251 | Ceramic capacitor, 1.2 pF, 250V, ± 0.1pF. | |

* For additional details, please contact the TagoreTech support team.

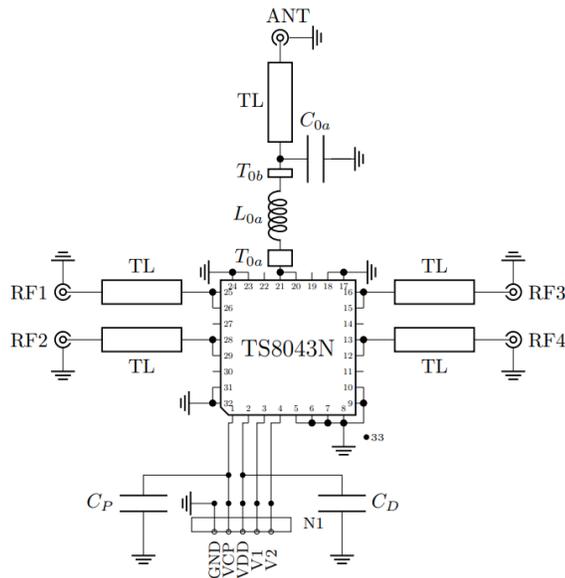


Figure 5.2 Schematic for Matching (2200 MHz – 2500 MHz)

11.0 Device Package Information

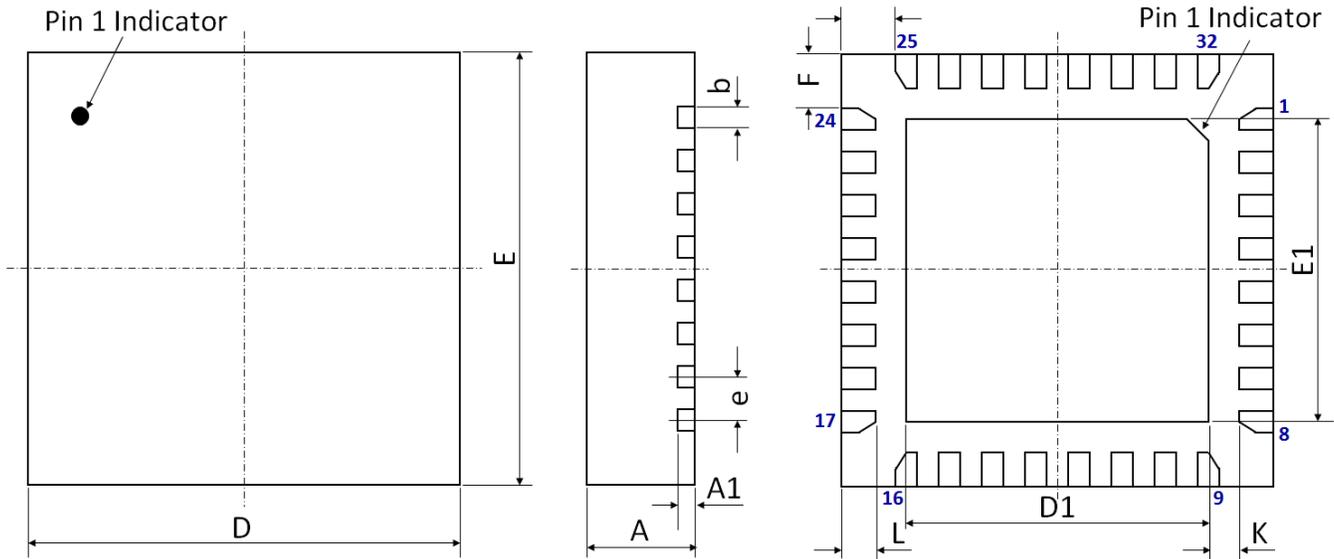


Figure 5 Device Package Drawing
(All dimensions are in mm)

Table 7 Device Package Dimensions

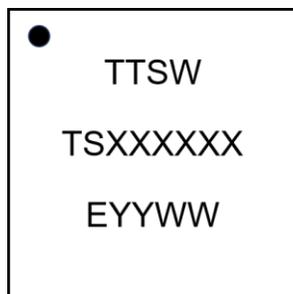
| Dimension (mm) | Value (mm) | Tolerance (mm) | Dimension (mm) | Value (mm) | Tolerance (mm) |
|----------------|------------|----------------|----------------|------------|----------------|
| A | 0.85 | ±0.05 | E | 5.00 BSC | ±0.05 |
| A1 | 0.203 | ±0.02 | E1 | 3.20 | ±0.06 |
| b | 0.25 | +0.05/-0.07 | F | 0.625 | ±0.05 |
| D | 5.00 BSC | ±0.05 | G | 0.625 | ±0.05 |
| D1 | 3.20 | ±0.06 | L | 0.40 | ±0.05 |
| e | 0.50 BSC | ±0.05 | K | 0.50 | ±0.05 |

Note: Lead finish: Pure Sn without underlayer; Thickness: 7.5µm ~ 20µm (Typical 10µm ~ 12µm)

Attention:

Please refer to application notes [TN-001](#) and [TN-002](#) at <http://www.tagoretech.com> for PCB and soldering related guidelines.

Top-marking specification:



- = Pin 1 indicator
- TTSW = Tagore Technology SWitch
- TSXXXXXX = Part number (8 digits max)
- E = A fixed letter before the date code
- YY = Last two digits of assembly year
- WW = Assembly work week

13.0 PCB Stencil Design

Guidelines:

- [1] Laser-cut, stainless steel stencil is recommended with electro-polished trapezoidal walls to improve the paste release.
- [2] Stencil thickness is recommended to be 125µm.

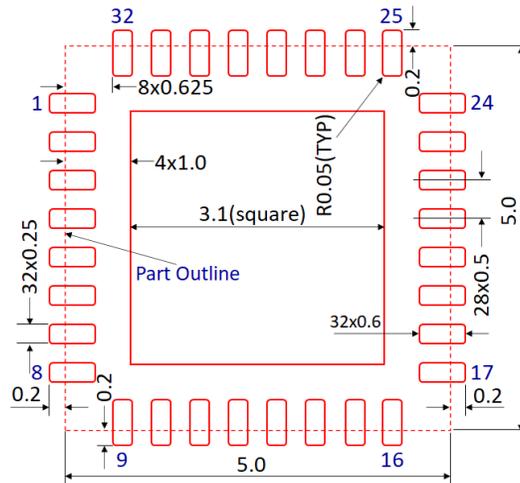


Figure 9 Stencil Openings
(Dimensions are in mm)

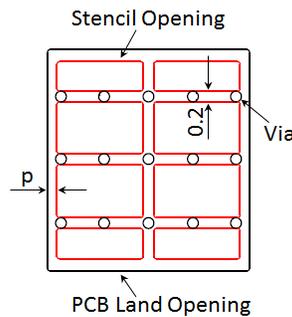


Figure 10 Stencil Openings Shall not Cover Via Areas If Possible
(Dimensions are in mm)

14.0 Tape and Reel Information

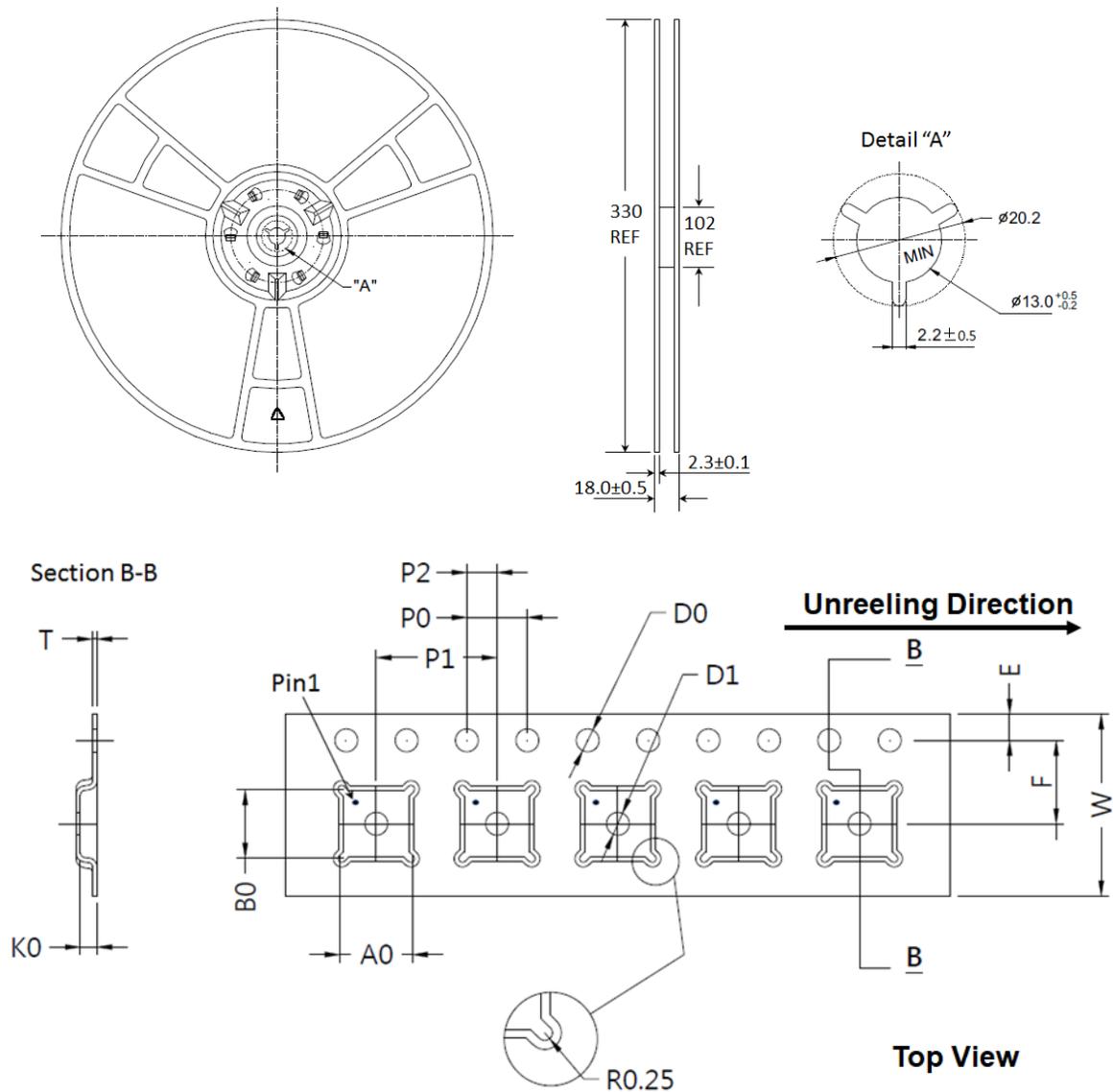


Figure 11 Tape and Reel Drawing

Table 8 Tape and Reel Dimensions

| Dimension (mm) | Value (mm) | Tolerance (mm) | Dimension (mm) | Value (mm) | Tolerance (mm) |
|----------------|------------|----------------|----------------|------------|----------------|
| A0 | 5.25 | ±0.10 | K0 | 1.10 | ±0.10 |
| B0 | 5.25 | ±0.10 | P0 | 4.00 | ±0.10 |
| D0 | 1.5 | +0.10/-0.00 | P1 | 8.00 | ±0.10 |
| D1 | 1.50 | +0.10/-0.00 | P2 | 2.00 | ±0.05 |
| E | 1.75 | ±0.10 | T | 0.30 | ±0.05 |
| F | 5.50 | ±0.05 | W | 12.00 | +0.3/-0.1 |

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Information

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Latest datasheet

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