

TS7423L - 30W CW GaN Broadband RF Switch SPDT

1.0 Features

- Low insertion loss: 0.30dB @ 800MHz
- High isolation: 43dB @ 800MHz
- High linear power handling capability
- Versatile 2.6-5.5V power supply
- 43dBm Hot Switching Capable



Figure 1 Device Image
(32 Pin 4x4x0.8mm QFN Package)

2.0 Applications

- Private Mobile radio handsets
- Public safety handsets
- Cellular infrastructure
- Small cells
- LTE relays and microcells
- Satellite terminals

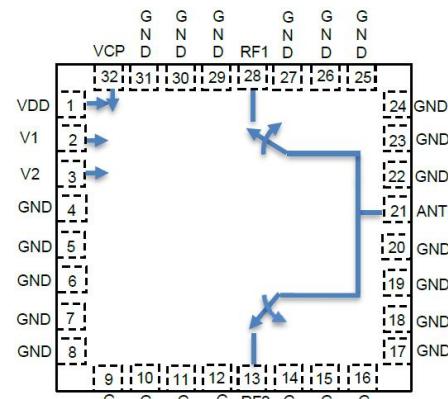


**RoHS/REACH/Halogen Free
Compliance**

3.0 Description

The TS7423L is a symmetrical reflective Single Pole Dual Throw (SPDT) switch designed for broadband, high peak power switching applications. Its broadband behavior from 1MHz to 3GHz makes the TS7423L an excellent switch for all the applications requiring low insertion loss, high isolation and high linearity within a small package size.

The TS7423L is packaged into a compact Quad Flat No lead (QFN) 4x4mm 32 leads plastic package.



**Figure 2 Function Block Diagram
(Top View)**

4.0 Ordering Information

Table 1 Ordering Information

Base Part Number	Package Type	Form	Qty	Reel Diameter	Reel Width	Orderable Part Number
TS7423L	32 Pin 4x4x0.8mm QFN	Tape and Reel	3000	13" (330mm)	18mm	TS7423LMTRPBF
Evaluation Board						TS7423L-EVB

5.0 Pin Description

Table 2 Pin Definition

Pin Number	Pin Name	Description
1	VDD	DC power supply
2	V1	Switch control input 1
3	V2	Switch control input 2
4,5,6,7,8,9,10,11,12,14,15,16,17, 18,19,20,22,23,24,25,26,27,29,30,31	NC	No internal connection, can be grounded
13	RF2	RF port 2
21	ANT	Antenna port
28	RF1	RF port 1
32	VCP	Internal charge pump voltage output. Connect a 1nF capacitor to GND on this pin to improve switching time.

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

6.0 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings @ $T_A=+25^\circ\text{C}$ Unless Otherwise Specified

Parameter	Symbol	Value	Unit
Electrical Ratings			
Power Supply Voltage	VDD	2.6 to 5.5	V
Storage Temperature Range	T_{st}	-55 to +125	$^\circ\text{C}$
Operating Temperature Range	T_{op}	-40 to +85	$^\circ\text{C}$
Maximum Junction Temperature	T_J	+140	$^\circ\text{C}$
RF Input Power CW, $20\text{-}3000\text{MHz}$, $T_C=+85^\circ\text{C}$	RFx	45	dBm
RF Input Power (VSWR 10:1), 1 minute	RFx	44	dBm
Thermal Ratings			
Thermal Resistance (junction-to-case) – Bottom side	$R_{\theta JC}$	10	$^\circ\text{C}/\text{W}$
Thermal Resistance (junction-to-top)	$R_{\theta JT}$	≤ 37	$^\circ\text{C}/\text{W}$
Soldering Temperature	T_{SOLD}	260	$^\circ\text{C}$
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; $VDD=+2.7\text{V}$; 50Ω Source/Load.

Parameter	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		1		3000	MHz
Insertion Loss, RFx	400MHz		0.28		dB
	800MHz		0.30	0.40	
	1.95GHz		0.35	0.50	
	2.6GHz		0.40	0.55	
	6.0GHz		0.60	0.70	
Isolation, ANT-RFx	400MHz		49		dB
	800MHz	40	43		
	1.95GHz	32	35		
	2.6GHz	28	31		
	6.0GHz	16	18		
Return Loss, ANT-RFx	400MHz		32		dB
	800MHz		30		
	1.95GHz		30		
	2.6GHz		25		
	6.0GHz		17		
H2	100 - 800MHz, $\text{Pin}=40\text{dBm}$		-81		dBc
H3	100 - 800MHz, $\text{Pin}=40\text{dBm}$		-86		dBc
IIP3	800MHz		74		dBm
P0.1dB ^[1]	0.1dB compression point, 20MHz - 3GHz		46		dBm
P0.1dB ^[1]	0.1dB compression point, 1 - 10MHz		43.5		dBm
Switching Time	50% ctrl to 10/90% of the RF value is settled. $C1=1\text{nF}$ (refer to Figure 3)		0.9		μs
Control Voltage	Power supply VDD	2.6	3.3	5.5	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		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	1	All OFF
0	0	ANT-RF1
1	0	ANT-RF2

Attention:

- [1] VDD should be applied first before V1 and V2, otherwise may cause damage to the device.
- [2] There is an internal pull-down to ground on V2 control pin, the pin can be left floating when the all OFF state is not used.
- [3] If all OFF state is not used, the switch can be operated with single control pin V1.
- [4] There is also an internal pull-down to ground on V1 control pin, the state at start-up without any control voltage applied will be ANT-RF1 on by default.

9.0 Evaluation Board Schematic

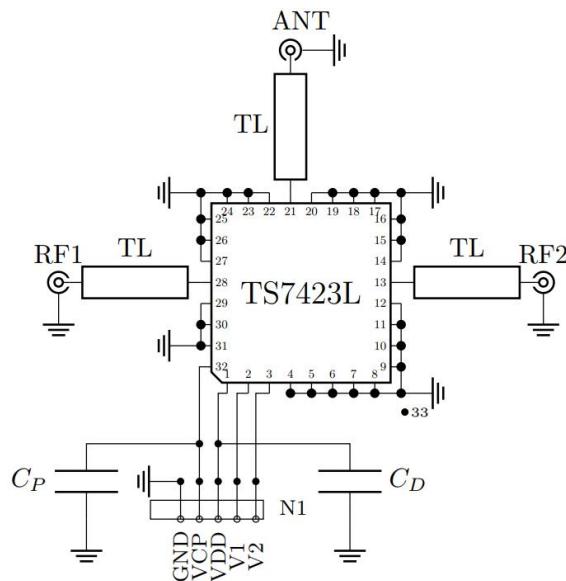


Figure 3 Evaluation Board Schematic

10.1 Typical Characteristics – Unmatched

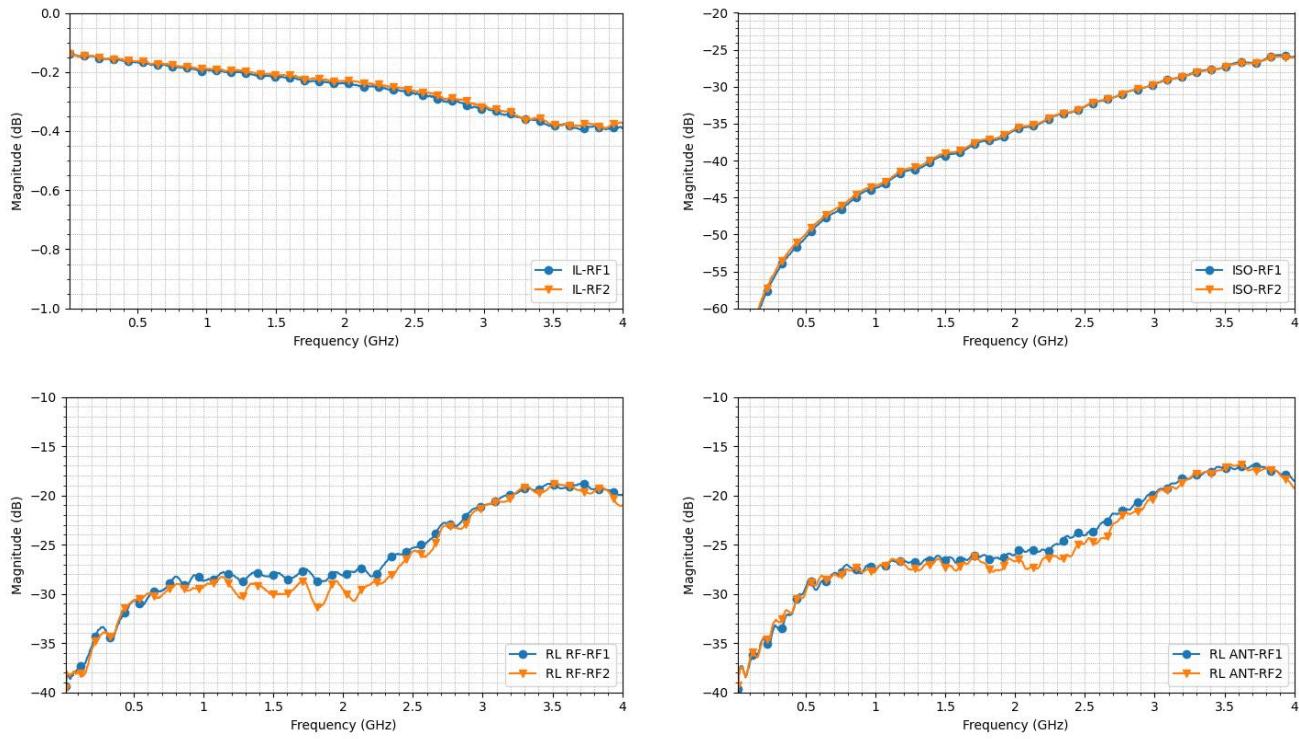


Figure 4.1 Typical characteristics (Unmatched)

10.2 Typical Characteristics – Matched (10 MHz – 6000 MHz)

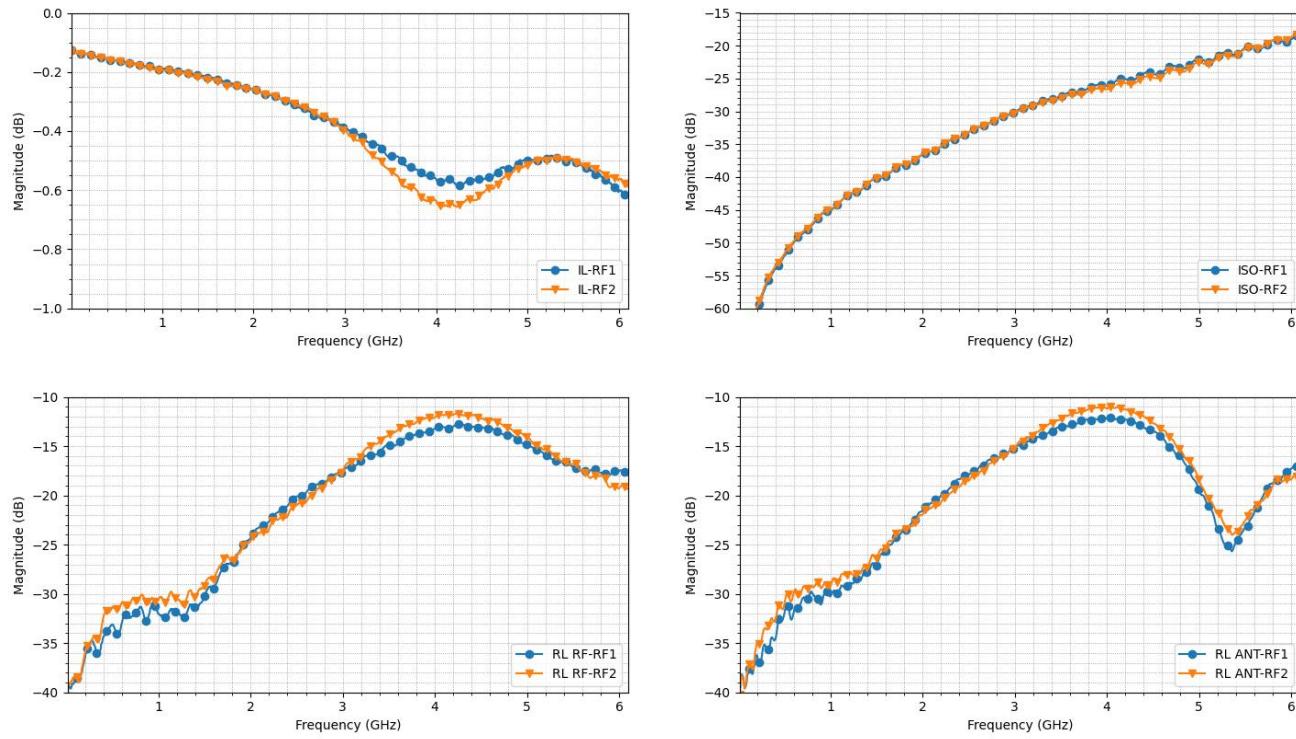


Figure 4.2 Typical characteristics (10 MHz – 6000 MHz)

Table 6.1 Bill of Materials – Unmatched*

Component	Part Number	Description	Notes
C_P	GRM155R71H102KA01D	Ceramic capacitor, 1 nF, 50 V, $\pm 10\%$.	
C_D	GRM155R71H103KA88	Ceramic capacitor, 10 nF, 50 V, $\pm 15\%$.	

* For additional details, please contact the Tagore Technology support team.

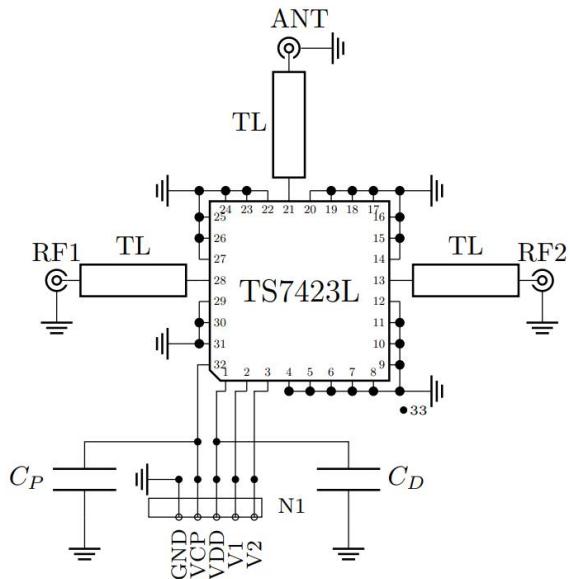
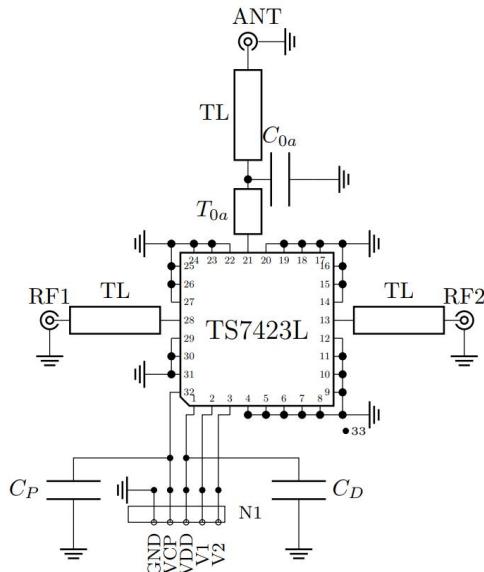


Figure 5.1 Schematic for Unmatched Condition

Table 6.2 Bill of Materials – Matching* (10 MHz – 6000 MHz)

Component	Part Number	Description	Notes
C_P	GRM155R71H102KA01D	Ceramic capacitor, 1 nF, 50 V, $\pm 10\%$.	
C_D	GRM155R71H103KA88	Ceramic capacitor, 10 nF, 50 V, $\pm 15\%$.	
T_{0a}	3.7 mm	PCB transmission line length.	From the IC-reference plane.
C_{0a}	0603N0R5BW251	Ceramic capacitor, 0.2 pF, 250V, $\pm 0.1\text{pF}$.	

* For additional details, please contact the Tagore Technology support team.


Figure 5.2 Schematic for Matching (10 MHz – 6000 MHz)

11.0 Device Package Information

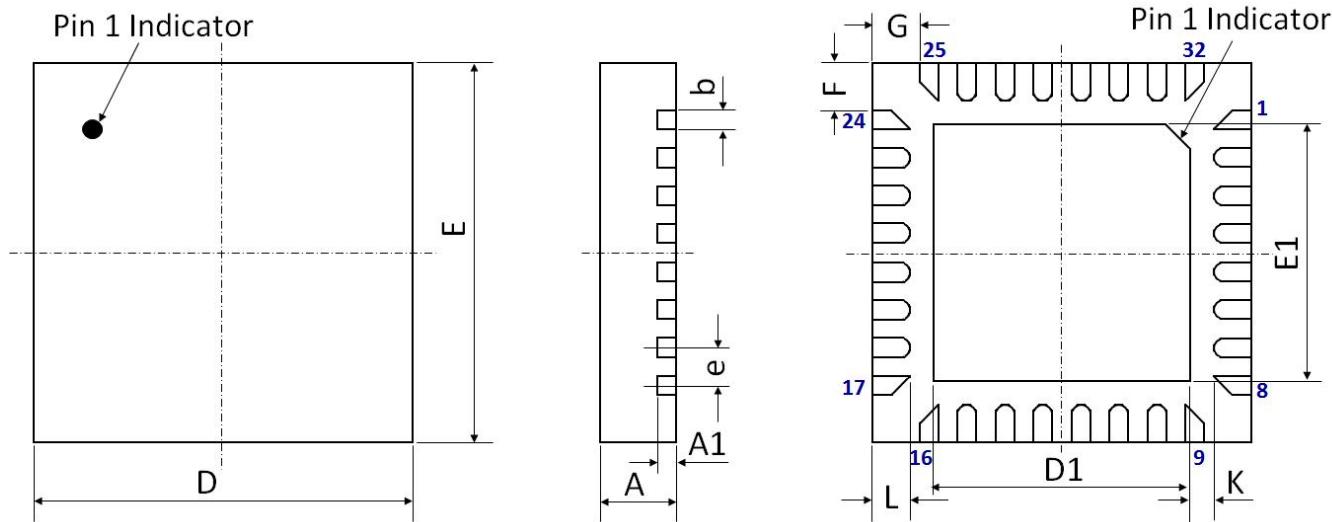


Figure 8 Device Package Drawing
(All dimensions are in mm)

Table 6 Device Package Dimensions

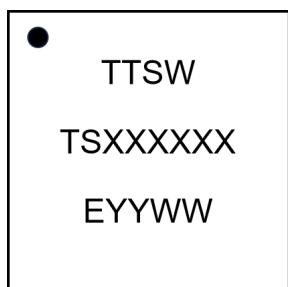
Dimension (mm)	Value (mm)	Tolerance (mm)	Dimension (mm)	Value (mm)	Tolerance (mm)
A	0.80	± 0.05	E	4.00 BSC	± 0.05
A1	0.203	± 0.02	E1	2.70	± 0.05
b	0.20	$+0.05/-0.07$	F	0.50	± 0.05
D	4.00 BSC	± 0.05	G	0.50	± 0.05
D1	2.70	± 0.05	L	0.40	± 0.05
e	0.40 BSC	± 0.05	K	0.25	± 0.05

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

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

12.0 PCB Land Design

Guidelines:

- [1] 4 layer PCB is recommended.
- [2] Via diameter is recommended to be 0.2mm to prevent solder wicking inside the vias.
- [3] Thermal vias shall only be placed on the center pad.
- [4] The maximum via number for the center pad is $4(X) \times 4(Y) = 16$.

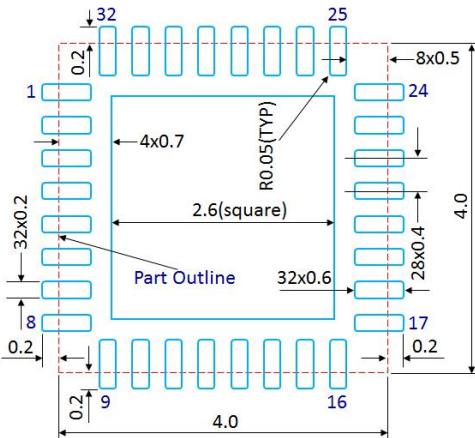


Figure 9 PCB Land Pattern
(Dimensions are in mm)



Figure 10 Solder Mask Pattern
(Dimensions are in mm)

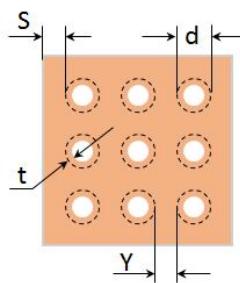


Figure 11 Thermal Via Pattern
(Recommended Values: $S \geq 0.15\text{mm}$; $Y \geq 0.20\text{mm}$; $d = 0.2\text{mm}$; Plating Thickness $t = 25\mu\text{m}$ or $50\mu\text{m}$)

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 125 μ m.

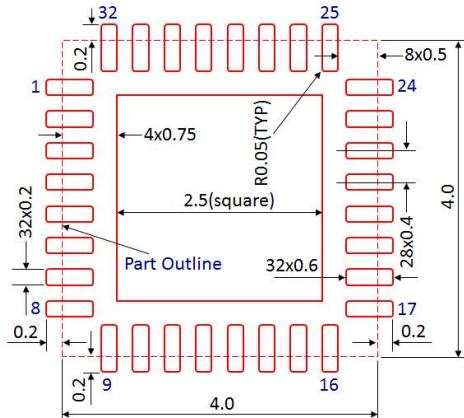


Figure 12 Stencil Openings
(Dimensions are in mm)

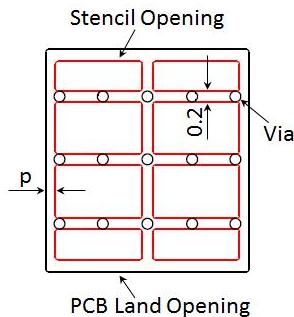


Figure 13 Stencil Openings Shall not Cover Via Areas If Possible
(Dimensions are in mm)

14.0 Tape and Reel Information

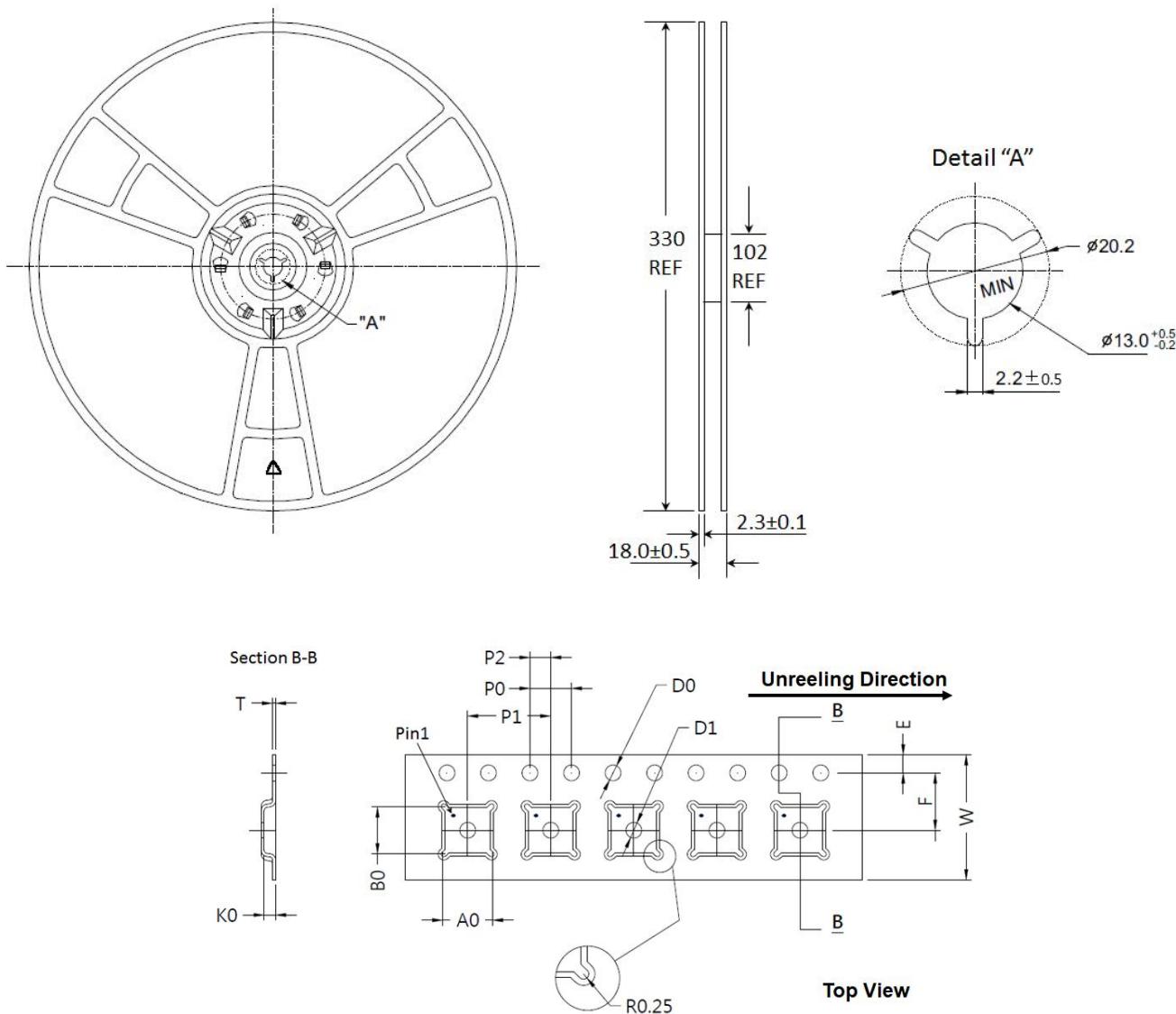


Figure 14 Tape and Reel Drawing

Table 7 Tape and Reel Dimensions

Dimension (mm)	Value (mm)	Tolerance (mm)	Dimension (mm)	Value (mm)	Tolerance (mm)
A0	4.35	±0.10	K0	1.10	±0.10
B0	4.35	±0.10	P0	4.00	±0.10
D0	1.50	+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	±0.30

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