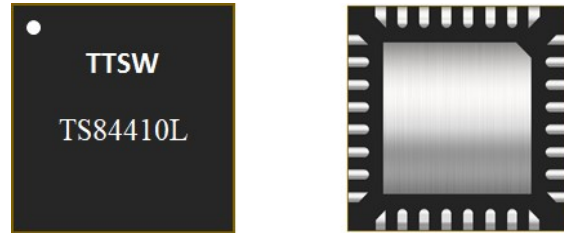


**TS84410L - 30W CW GaN Broadband RF Switch SP4T**
**1.0 Features**

- Low insertion loss: 0.2dB @ 800MHz
- High isolation: 38dB @ 800MHz
- 30W CW power handling capability
- No external DC blocking capacitors on RF lines
- Operating frequency: 30MHz to 4.0GHz
- Versatile 2.6-5.25V power supply



**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
- Low noise instruments

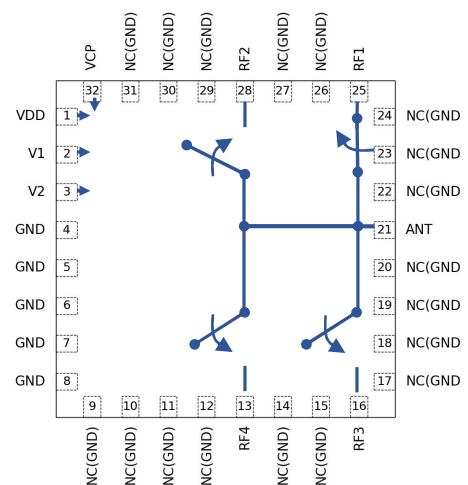


**RoHS/REACH/Halogen Free Compliance**

**3.0 Description**

The TS84410L is a symmetrical reflective Single Pole Four Throws (SP4T) switch designed for broadband, high power switching applications. Its broadband behavior from 30MHz to 4.0GHz frequencies makes the TS84410L an excellent switch for all the applications requiring low insertion loss, high isolation, and high linearity within a small package size. This part has the internal charge pump disabled to eliminate the charge pump spurs. A -18V(Typ) supply is needed on the VCP pin

The TS84410L is packaged into a compact Quad Flat No lead (QFN) 4x4mm 32 leads plastic package.



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

**Note**

- [1] Default state is ANT-RF1 when no control voltage is applied. See Section 8.0 for more details.  
 [2] Pin 33 (not shown), is the pad/ground plane and must be soldered. Refer to schematic in Section 9.0.

#### 4.0 Ordering Information

**Table 1a Ordering Information**

Device Part Number	Package Type	Eval Board Part Number
TS84410L	32 Pin 4×4×0.8mm QFN	TS84410L-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	VDD	DC power supply
2	V1	Switch control input 1
3	V2	Switch control input 2
4,5,6,7,8,9,10,11,12,14,15,17,18,19,20,22,23,24,26,27,29,30,31	NC	No internal connection, can be grounded
33	PAD/GND	It refers to the pad of the switch, which must be soldered.
13	RF4	RF port 4
16	RF3	RF port 3
21	ANT	Antenna port
28	RF2	RF port 2
25	RF1	RF port 1
32	VCP	Negative Voltage Supply

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
<b>Electrical Ratings</b>			
Power Supply Voltage	VDD	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	$^{\circ}\text{C}$
Maximum RF input power(400MHz~4000MHz)	RFx/ANT	45	dBm
Maximum RF input power(30MHz~400MHz)	RFx/ANT	43	dBm
<b>Thermal Ratings</b>			
Thermal Resistance (junction-to-case) – Bottom side	$R_{\theta JC}$	25	$^{\circ}\text{C/W}$
Thermal Resistance (junction-to-top)	$R_{\theta JT}$	$\leq 37$	$^{\circ}\text{C/W}$

Soldering Temperature	T <sub>SOLD</sub>	260	°C
<b>ESD Ratings</b>			
Human Body Model (HBM)	Level 1B	500 to <1000	V
Charged Device Model (CDM)	Level C3	≥1000	V
<b>Moisture Rating</b>			
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;  $V_{DD}=+3.3\text{V}$ ;  $50\Omega$  Source/Load.

Parameter	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		30		4000	MHz
Insertion Loss, RFX	400MHz		0.18		dB
	800MHz		0.22	0.45	
	1.95GHz		0.3		
	2.5GHz		0.35		
	4.0GHz		1.0		
Isolation, ANT-RFX	400MHz		45		dB
	800MHz	34	38		
	1.95GHz		29		
	2.5GHz		26		
	4.0GHz		20		
Return Loss, ANT-RFX	400MHz		35		dB
	800MHz		30		
	1.95GHz		20		
	2.5GHz		17		
	4.0GHz		10		
H2	800MHz, Pin=42dBm		80		dBc
H3	800MHz, Pin=42dBm		77		dBc
IIP3	800MHz		70		dBm
P0.1dB <sup>[1]</sup>	800MHz, 1% duty cycle, 1mS period		48		dBm
	800MHz, CW	45	47		dBm
	30MHz, CW	43			dBm
Switching time	50% ctrl to 10/90% of the RF value is settled. C1=1nF (refer to Figure 3)		0.8		$\mu\text{s}$
VCP	Iload of 10uA	-19	-18	-17	V
VCP Sourcing Current	Sourcing current of external VCP supply	100			$\mu\text{A}$
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		$\mu\text{A}$
	All control pins high, $I_{ih}$			7.5	$\mu\text{A}$
Current Consumption, IDD	Active mode		50	75	$\mu\text{A}$

**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**

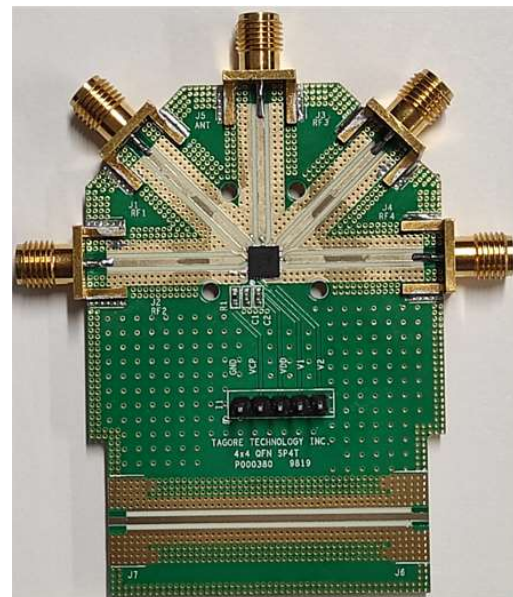
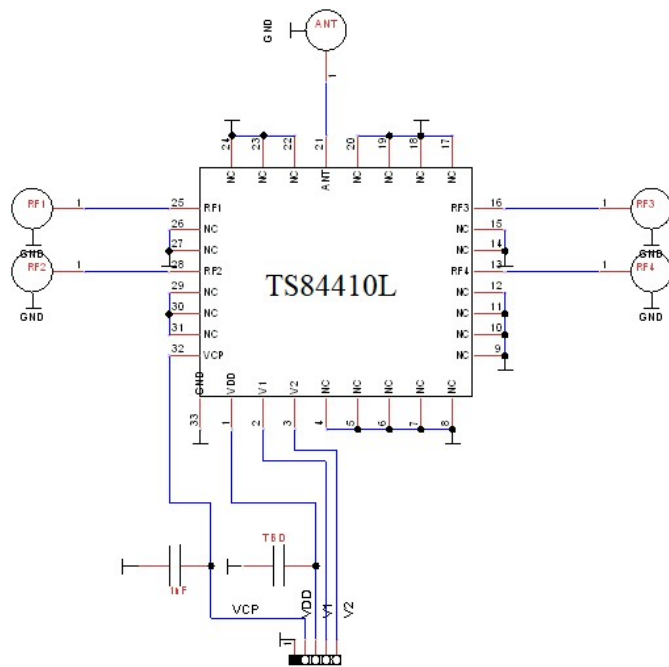
**Table 5 Switch Truth Table**

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

**Attention:**

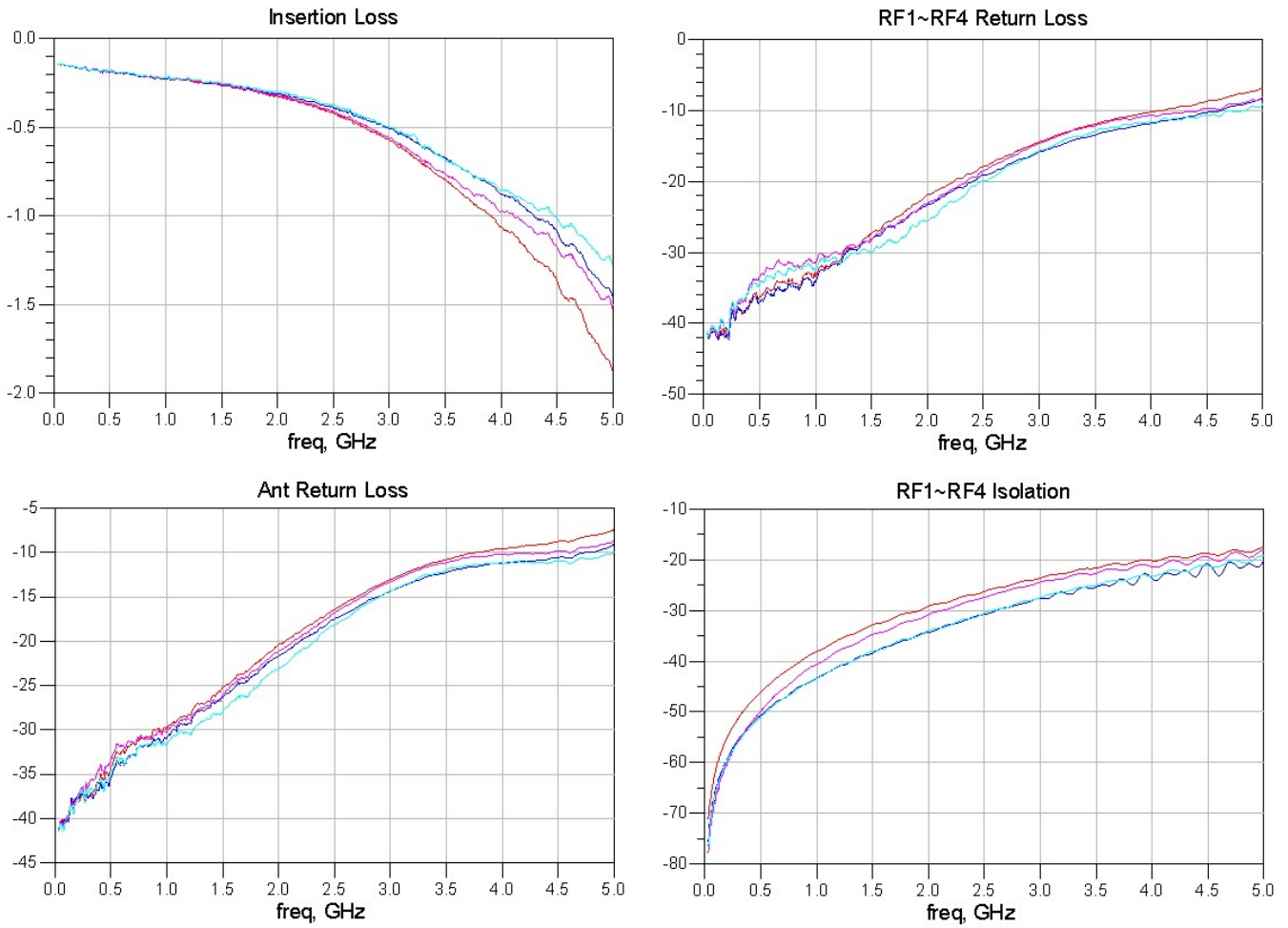
- [1] VDD should be applied first before VCP. The minimum time between VDD and VCP should be 50usec. Otherwise, may cause damage to the device.
- [2] V1, or V2 can be toggled/switched after VCP has settled.
- [3] There is an internal pull-down to ground on V1 and V2 control pins, therefore the switch state at start-up without any control voltage applied will be ANT-RF1 on by default.

**9.0 Evaluation Board Schematic**

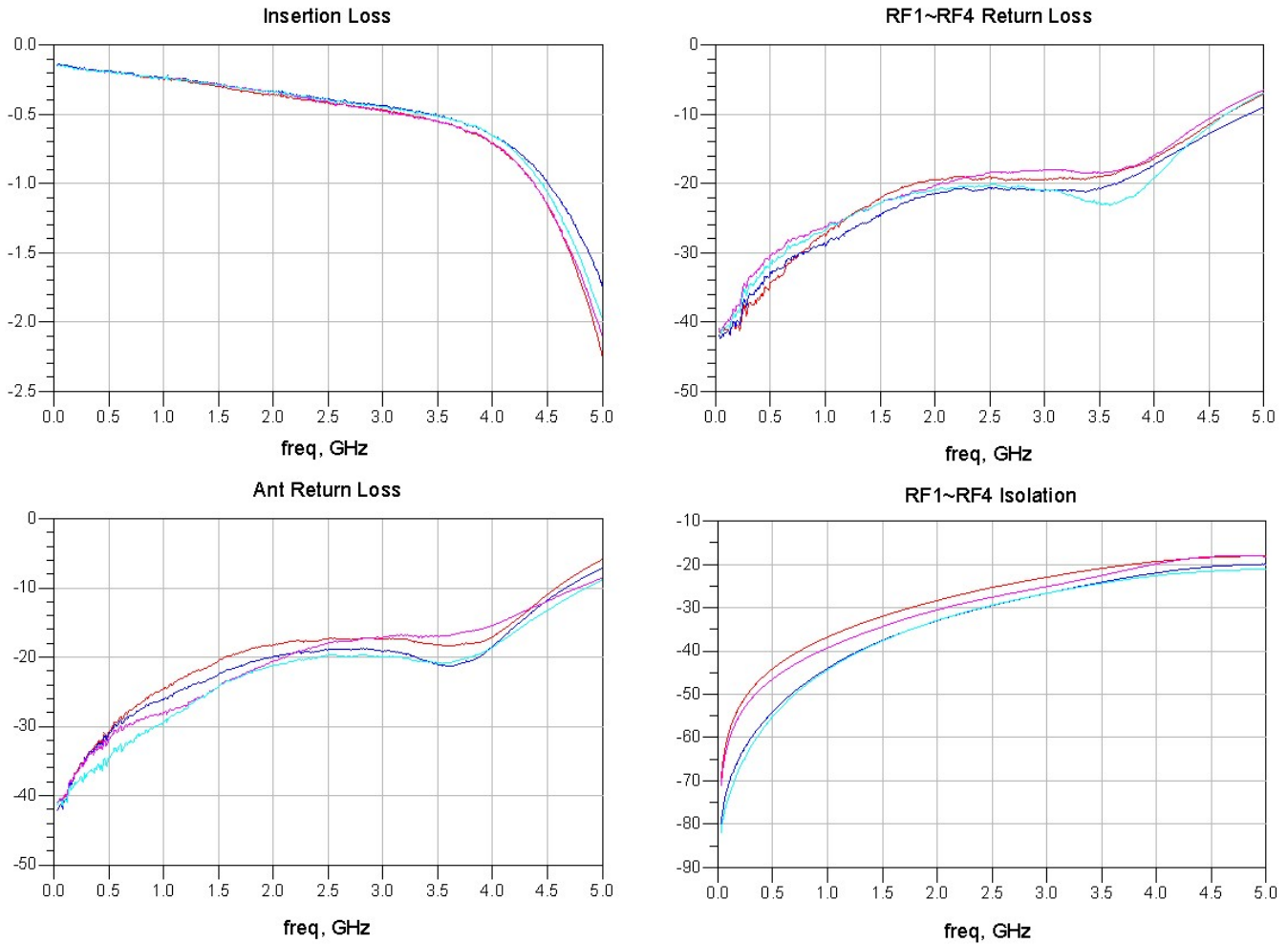


**Figure 3 Evaluation Board and Schematic**

**10.0 Typical Electrical Characteristics**



**Figure 4 Typical Small Signal Characteristics (No Match)**



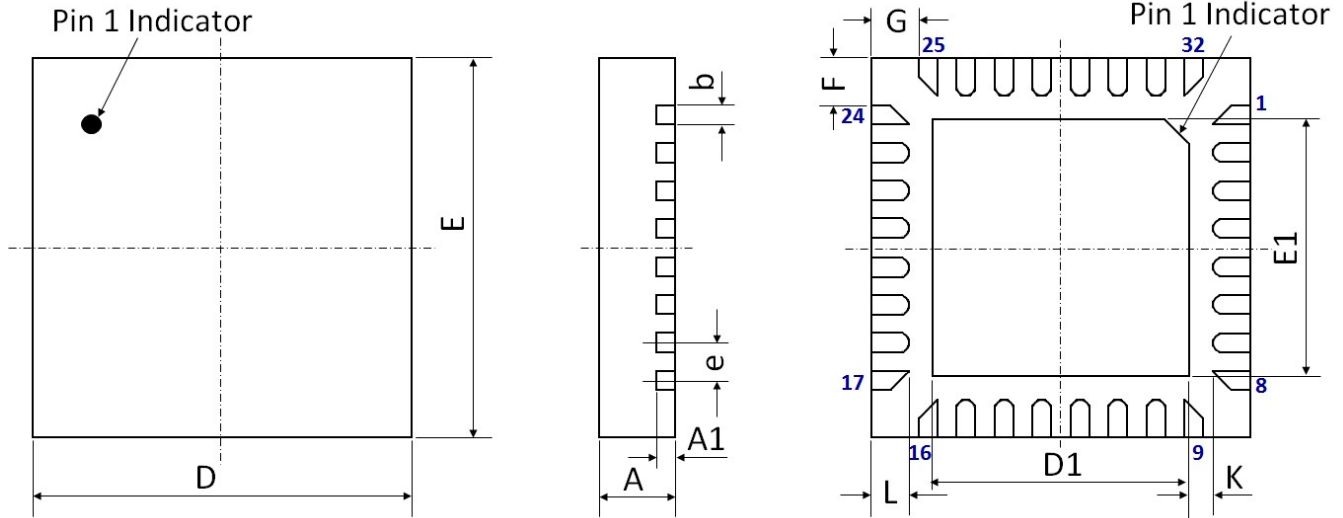
**Figure 5 Typical Small Signal Characteristics (Matched [1])**

[1] Matching circuit: at pin ANT port, add 1nH series inductor followed by 0.4 pF shunt capacitor

**Table 6 Recommended Evaluation Board Component Values**

Reference Designator	Value	Part #	Manufacturer
L	1.0 nH	0402CC-1N0XJL	Coilcraft
C	0.4 pF	0603N0R4BW251	Passive Plus Inc.

**11.0 Device Package Information**



**Figure 6 Device Package Drawing**  
(All dimensions are in mm)

**Table 6 Device Package Dimensions**

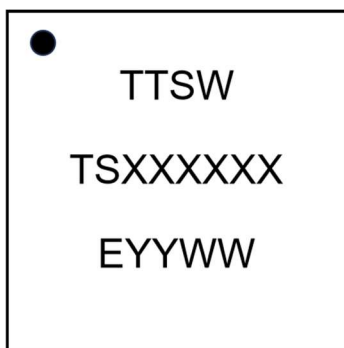
Dimension (mm)	Value (mm)	Tolerance (mm)	Dimension (mm)	Value (mm)	Tolerance (mm)
A	0.80	±0.05	E	4.00 BSC	±0.05
A1	0.203	±0.02	E1	2.70	±0.05
b	0.20	+0.05/-0.07	F	0.50	±0.05
D	4.00 BSC	±0.05	G	0.50	±0.05
D1	2.70	±0.05	L	0.40	±0.05
e	0.40 BSC	±0.05	K	0.25	±0.05

**Note:** Lead finish: Pure Sn without underlayer; Thickness: 7.5µm ~ 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

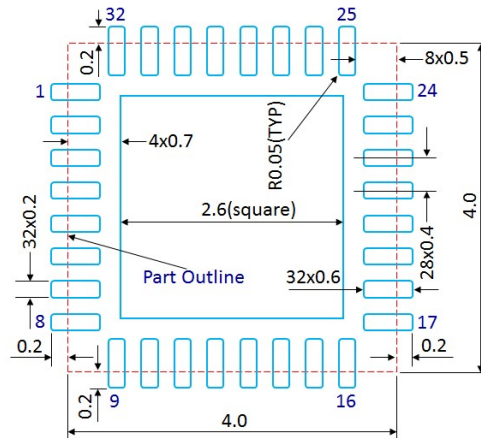




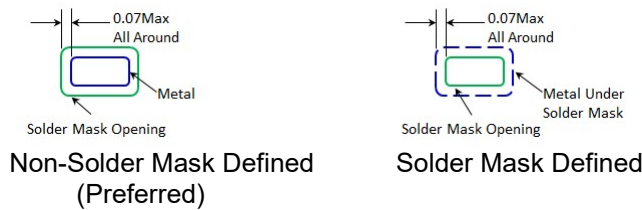
## 12.0 PCB Land Design

### Guidelines:

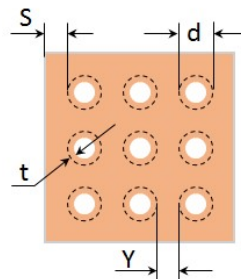
- [1] 4-layer PCB is recommended.
- [2] Via diameter is recommended to be 0.2mm to prevent solder wicking inside the vias.
- [3] Thermal vias shall only be placed on the center pad.
- [4] The maximum via number for the center pad is  $4(X) \times 4(Y) = 16$ .



**Figure 7 PCB Land Pattern**  
(Dimensions are in mm)



**Figure 8 Solder Mask Pattern**  
(Dimensions are in mm)



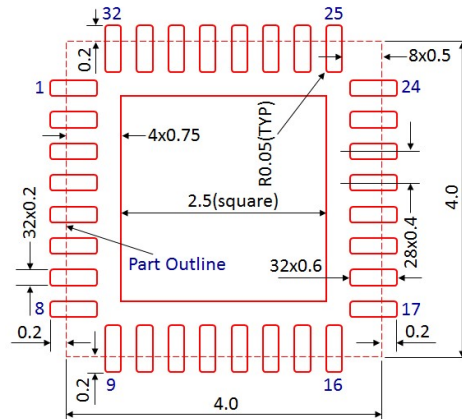
**Figure 9 Thermal Via Pattern**

(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  $50\mu\text{m}$ )

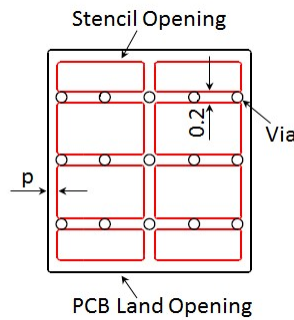
### 13.0 PCB Stencil Design

**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 125µm.

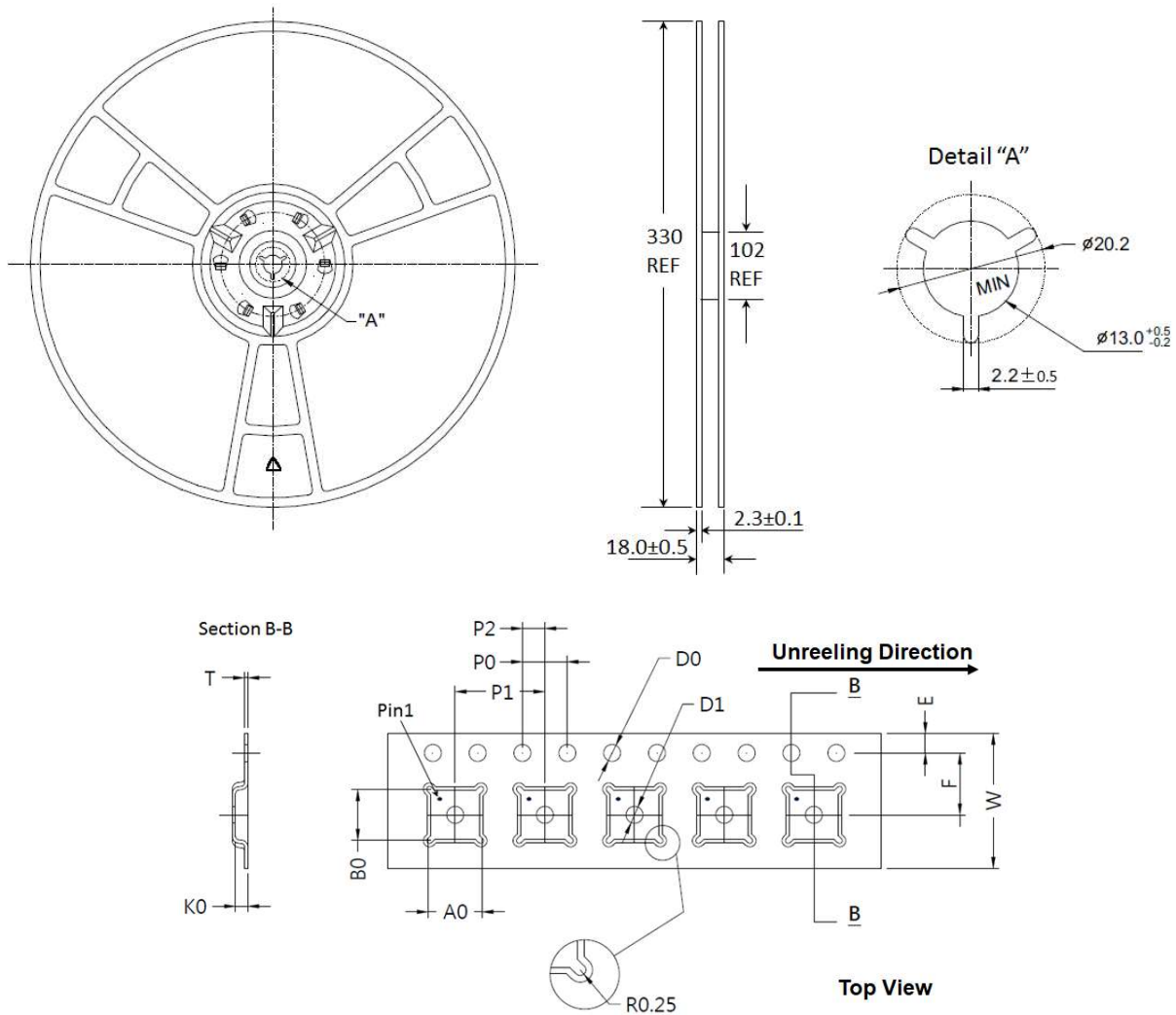


**Figure 10 Stencil Openings**  
(Dimensions are in mm)



**Figure 11 Stencil Openings Shall Not Cover Via Areas If Possible**  
(Dimensions are in mm)

**14.0 Tape and Reel Information**



**Figure 12 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

**Edition Revision 2.0 - 2024-09-03**

**Published by**

TagoreTech Inc.  
601 Campus Drive, Suite C1  
Arlington Heights, IL 60004, USA

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