

**TS8029N - 100W CW, 631W Peak GaN RF Switch**

**1.0 Features**

- Low TX insertion loss: 0.20dB @ 800MHz
- High isolation: 51dB @ 800MHz
- 631W Peak Power Handling
- Versatile 2.6-5.5V power supply
- Operating frequency: 700MHz to 5.0GHz



**Figure 1 Device Image**  
(32 Pin 5×5×0.85mm<sup>3</sup> QFN Package)

**2.0 Applications**

- Cellular infrastructure
- Small cells
- Macrocells
- ADS-B, IFF Systems

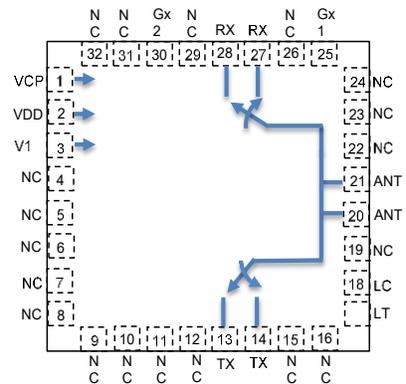


**RoHS/REACH/Halogen Free Compliance**

**3.0 Description**

The TS8029N is an asymmetrical reflective Single Pole Dual Throw (SPDT) switch designed for broadband, high power switching applications. With a simple broadband match, the TS8029N can cover 700MHz to 5.0GHz bandwidth and provide low insertion loss, high isolation and high linearity within a small package size. TS8029N is an excellent switch for all applications requiring low insertion loss, high isolation and high linearity within a small package size.

The TS8029N is packaged into a compact Quad Flat No lead (QFN) 5x5mm<sup>2</sup> 32 leads plastic package.



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

## 4.0 Ordering Information

**Table 1a Ordering Information**

Device Part Number	Package Type	Content
TS8029N	32 Pin 5.0×5.0×0.85mm <sup>3</sup> QFN	Core part number
TS8029N-EVB	Evaluation kit	See Figure 3.
TS8029NMTRPBF	330mm reel, 3 000pcs	Ordering code for full reel

**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
4,5,6,7,8,9,10,11,16,23,24,31,32	NC	No internal connection, can be grounded
12,15,19,22,26,29	NC	No internal connection. Must be left Open
13,14	TX	TX Port
17,18	LT, LC	Tuning Inductor
25,30	Gx1, Gx2	Tuning Capacitors for isolation
20,21	ANT	Antenna Port
27,28	RX	RX Port

**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 @ $T_A=+25^{\circ}\text{C}$  Unless Otherwise Specified**

Parameter	Symbol	Value	Unit
<b>Electrical Ratings</b>			
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, $T_{case}=+85^{\circ}\text{C}$ , 800MHz	TX, ANT	80	W
RF Input Power Peak, $T_{case}=+85^{\circ}\text{C}$ , 800MHz, 10% duty cycle, 10msec pulse width	TX, ANT	400	W
RF Input Power CW, $T_{case}=+85^{\circ}\text{C}$ , 2.6GHz	TX, ANT	70	W
RF Input Power Peak, $T_{case}=+85^{\circ}\text{C}$ , 2.6GHz, 1% duty cycle, 10usec pulse width	TX, ANT	500	W
<b>Thermal Ratings</b>			
Thermal Resistance (junction-to-case) – Bottom side	$R_{\theta JC}$	3.5	$^{\circ}\text{C}/\text{W}$
Soldering Temperature	$T_{SOLD}$	260	$^{\circ}\text{C}$
<b>ESD Ratings</b>			
Human Body Model (HBM)	Level 1B	500 to <1000	V
Charged Device Model (CDM)	Level C3	$\geq 1000$	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<sub>A</sub>=+25°C Unless Otherwise Specified; VDD=+2.7V; 50Ω Source/Load.

Parameter	Condition	Minimum	Typical	Maximum	Unit
Operating frequency	<i>f</i>	700		5000	MHz
Insertion loss, TX	800MHz		0.23		dB
	1400MHz		0.27		
	2400MHz		0.41		
	3300MHz		0.45		
	3800MHz		0.48		
	4200MHz		0.58		
	5000MHz		0.78		
Insertion loss, RX	800MHz		0.52		dB
	1400MHz		0.61		
	2400MHz		0.62		
	3300MHz		0.69		
	3800MHz		0.70		
	4200MHz		0.71		
	5000MHz		0.88		
Isolation ANT-TX	800MHz		21		dB
	1400MHz		37		
	2400MHz		36		
	3300MHz		23		
	3800MHz		27		
	4200MHz		24		
	5000MHz		22		
Isolation ANT-RX	800MHz		53		dB
	1400MHz		46		
	2400MHz		40		
	3300MHz		38		
	3800MHz		36		
	4200MHz		34		
	5000MHz		33		
Return Loss RX	800MHz		21		dB
	1400MHz		19		
	2400MHz		19		
	3300MHz		22		
	3800MHz		23		
	4200MHz		26		
	5000MHz		30		

Return Loss TX	800MHz		19		dB
	1400MHz		21		
	2400MHz		14		
	3300MHz		17		
	3800MHz		20		
	4200MHz		16		
	5000MHz		15		
P0.1dB CW	0.1dB compression point, 800MHz		100		W
P0.1dB Peak	Duty Cycle 1% with 10usec pulse width, 800MHz		600		W
P0.1dB Peak	Duty Cycle 20% with 2.0msec pulse width, 800MHz		350		W
P0.1dB CW	0.1dB compression point, 2600MHz		100		W
P0.1dB Peak	Duty Cycle 1% with 10usec pulse width, 2600MHz		600		W
RF input Power CW	ANT,RX		20		W
Switching time	50% ctrl to 10/90% of the RF value is settled. CP=1nF to ground on VCP pin.		1.2	1.6	$\mu$ s
	800MHz				
	1400MHz				
	2400MHz				
	3300MHz				
	3800MHz				
	4200MHz				
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		$\mu$ A
	All control pins high, $I_{ih}$			7.5	$\mu$ A
Current consumption, $I_{DD}$	Active mode (VDD on)		160	200	$\mu$ 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**

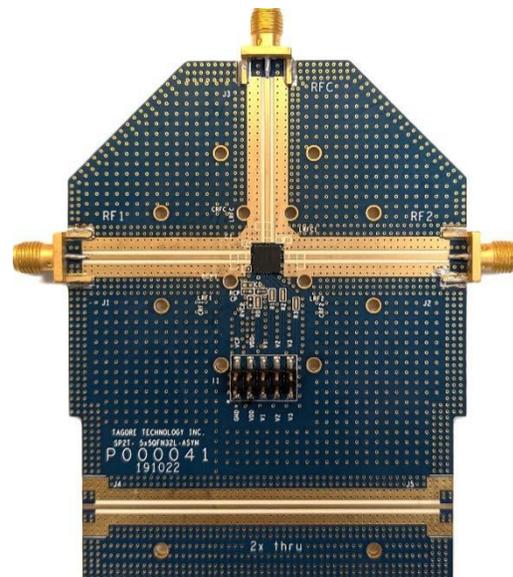
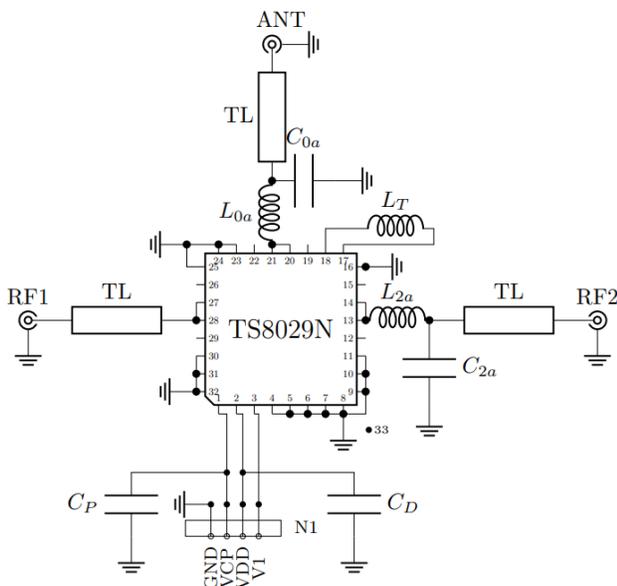
**Table 5 Switch Truth Table**

V1	Active RF Path
0	ANT-RX
1	ANT-TX

**Attention:**

- [1] VDD should be applied first before V1, otherwise may cause damage to the device.
- [2] There is an internal pull-down to ground on V1 control pin, the state at start-up without any control voltage applied will be ANT-RX.

**9.0 Evaluation Board**



**Figure 3 Evaluation Board Schematic and picture**

**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 added.
- [2] The purpose of connection between VCP and connector N1 is to monitor VCP, do not apply external voltage to VCP.

**Table 6 Matching components for various frequency bands**

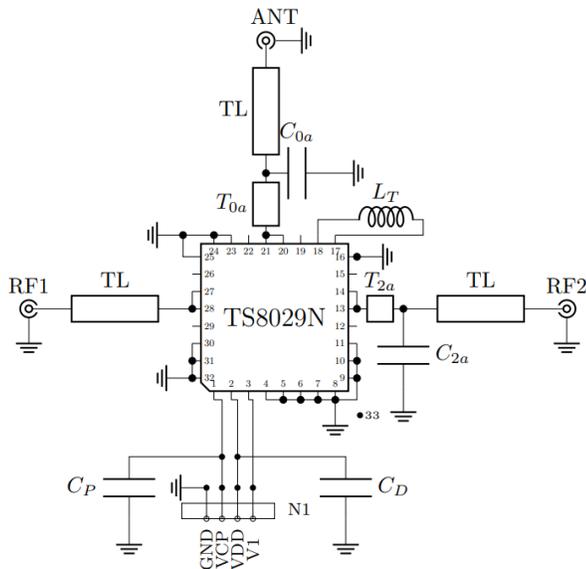
Freq	LT	L0a	L2a	C0a	C2a	CP	CD
0.5 – 1.0GHz	DNP	DNP	DNP	DNP	DNP	1nF	10nF
1.2 – 1.4GHz	39.0nH	3.5nH	DNP	0.8pF	DNP	1nF	10nF
2.3 – 2.6GHz	12.0nH	1.7nH	DNP	0.5pF	DNP	1nF	10nF
3.3 – 3.8GHz	5.4nH	7.0mm (T0a)	7.6mm (T2a)	0.5pF	0.5pF	1nF	10nF
3.8 – 4.2GHz	5.4nH	0.6nH	1.0nH	0.5pF	0.6pF	1nF	10nF
4.4 – 5.0GHz	2.9nH	3.5mm (T0a)	2.5mm (T2a)	0.4pF	0.6pF	1nF	10nF

**Notes:**

Inductors: ATC 0402WL or Coilcraft 0402HP/DC series

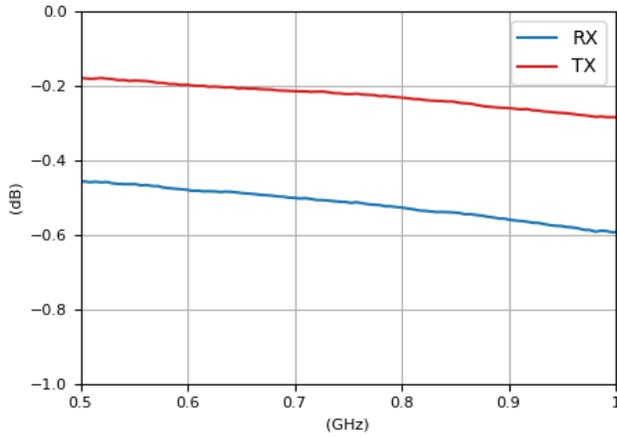
Capacitors: Passive Plus 0603N series

T0a and T2a lengths are reference from the switch edge reference plane to the center of the capacitors.

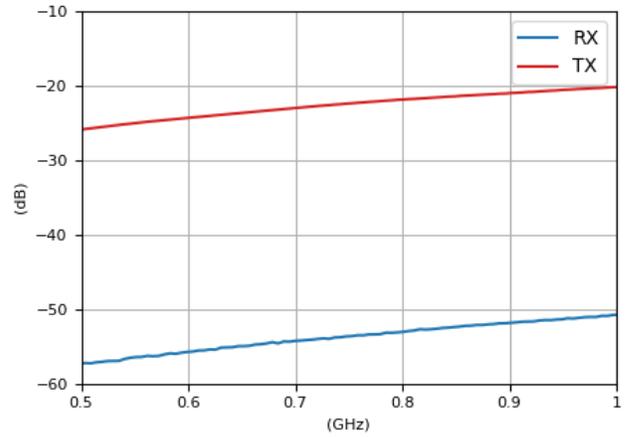


**Schematic for matching with transmission lines.**

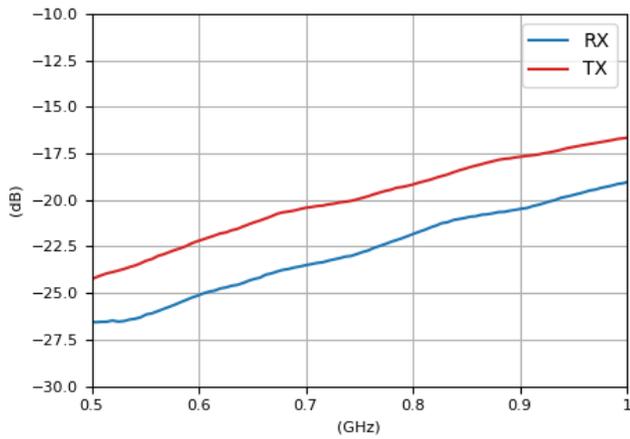
**10.1 Typical Characteristics (Tune 0.5 – 1.0GHz)**



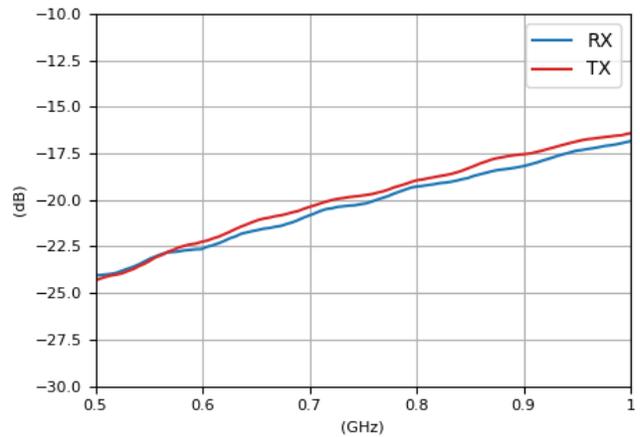
**Figure 4 Insertion Loss**



**Figure 5 Isolation**

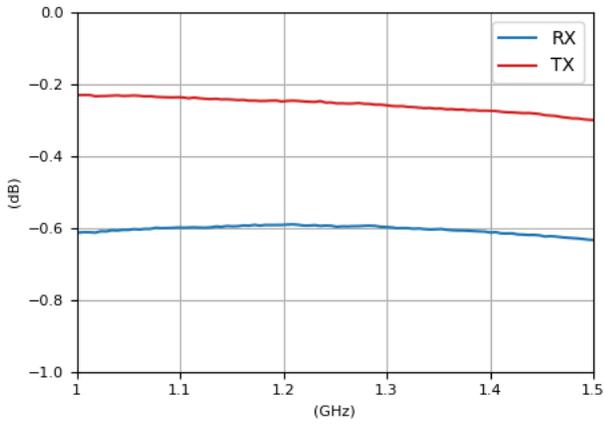


**Figure 6 Return Loss**

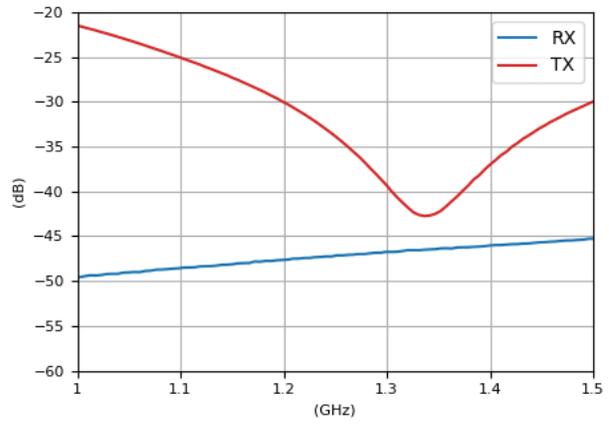


**Figure 7 ANT Return Loss**

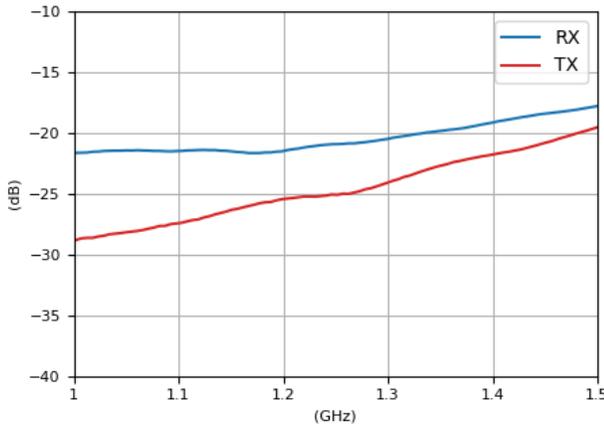
**10.2 Typical Characteristics (Tune 1.2 – 1.4GHz)**



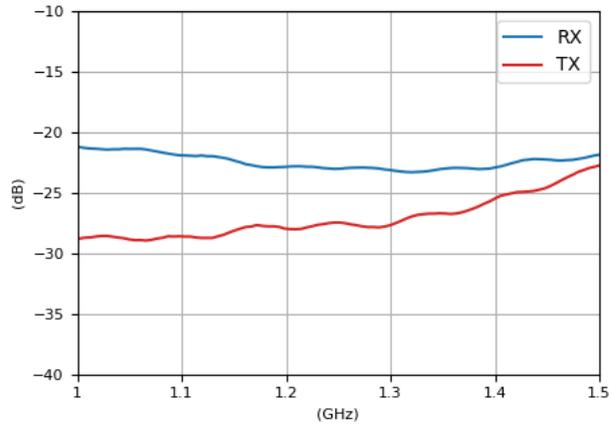
**Figure 8 Insertion Loss**



**Figure 9 Isolation**

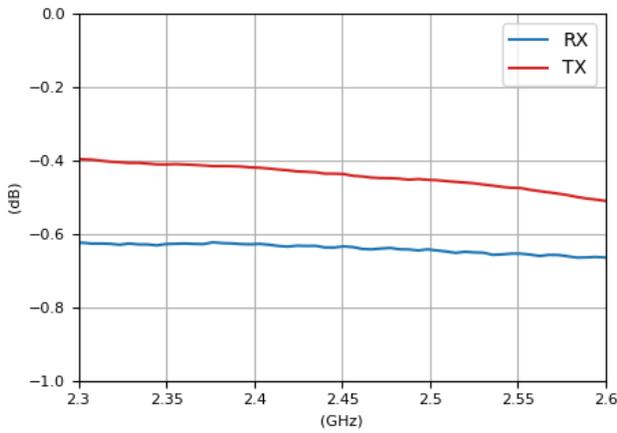


**Figure 10 Return Loss**

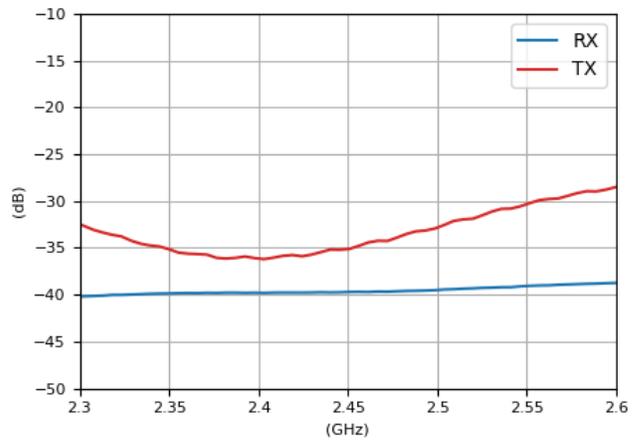


**Figure 11 ANT Return Loss**

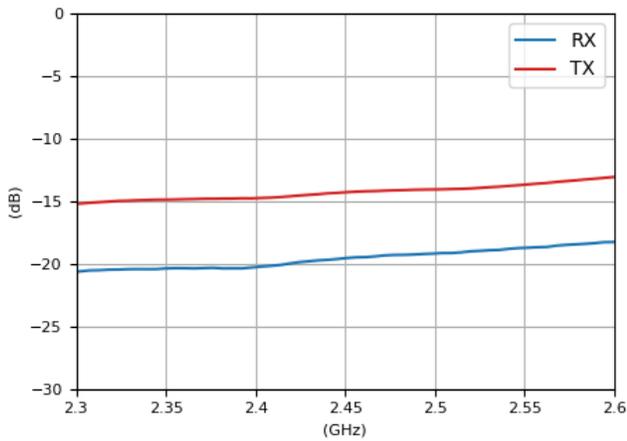
**10.3 Typical Characteristics (Tune 2.3 – 2.6GHz)**



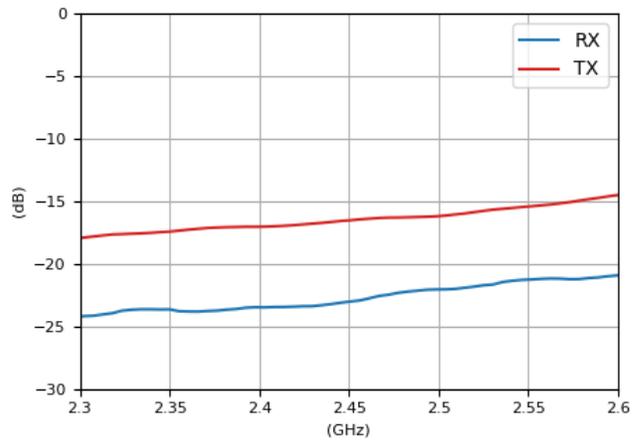
**Figure 12 Insertion Loss**



**Figure 13 Isolation**

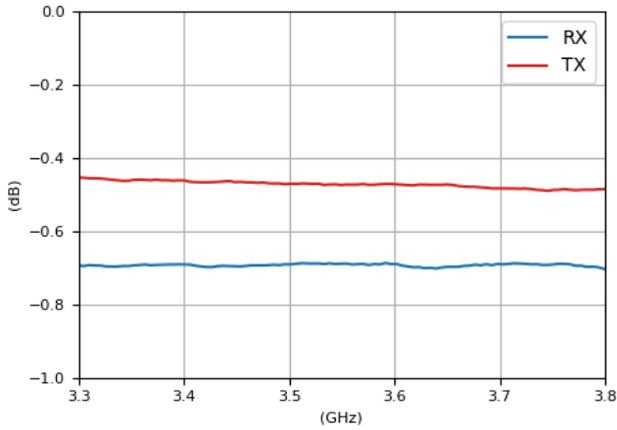


**Figure 14 Return Loss**

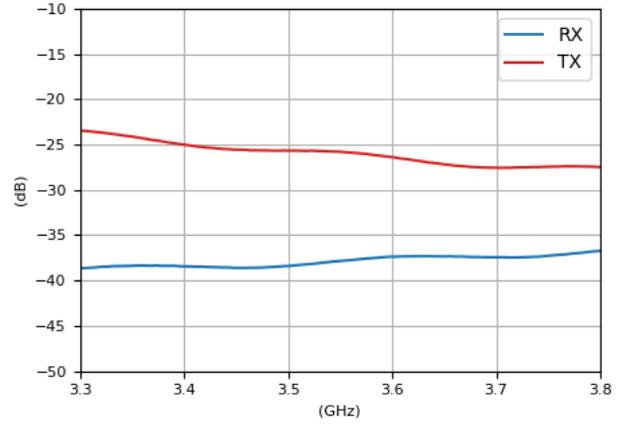


**Figure 15 ANT Return Loss**

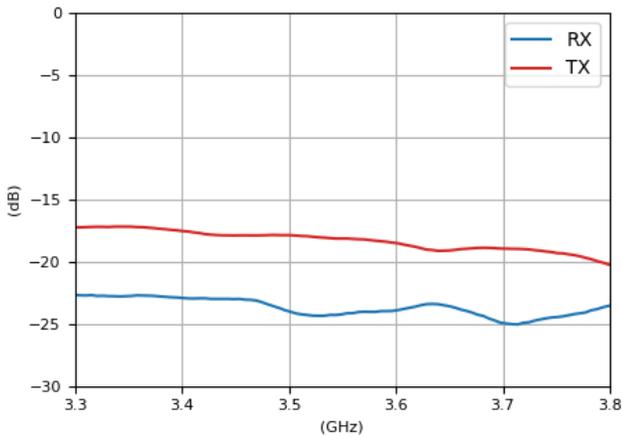
**10.4 Typical Characteristics (Tune 3.3 – 3.8GHz)**



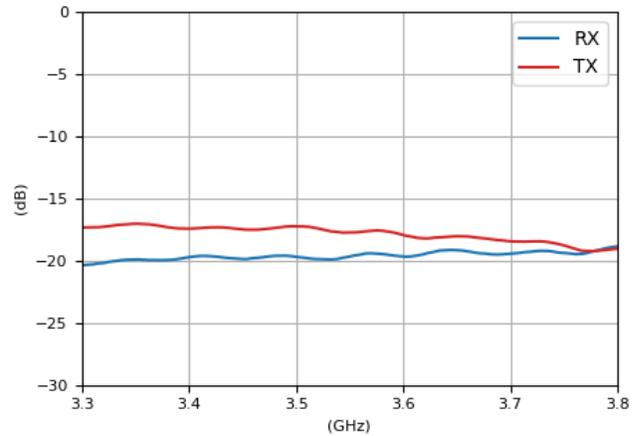
**Figure 16 Insertion Loss**



**Figure 17 Isolation**

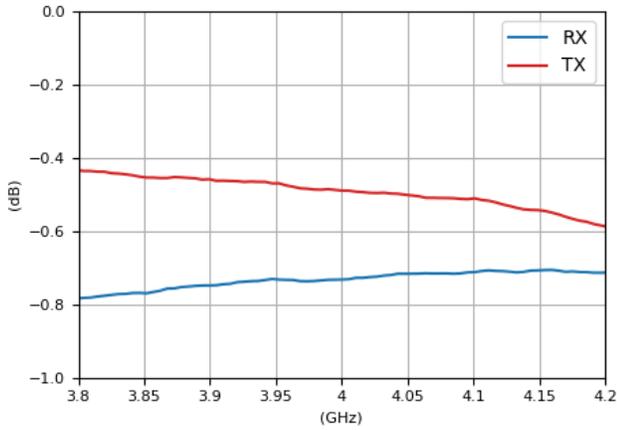


**Figure 18 Return Loss**

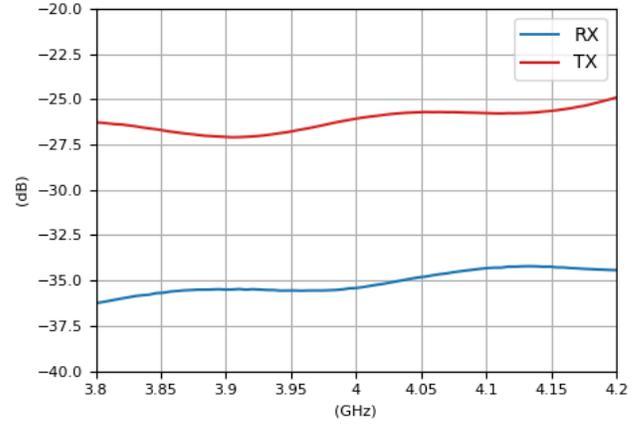


**Figure 19 ANT Return Loss**

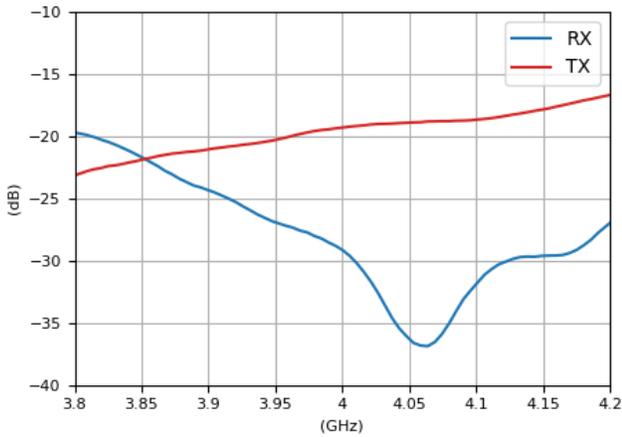
**10.5 Typical Characteristics (Tune 3.8 – 4.2GHz)**



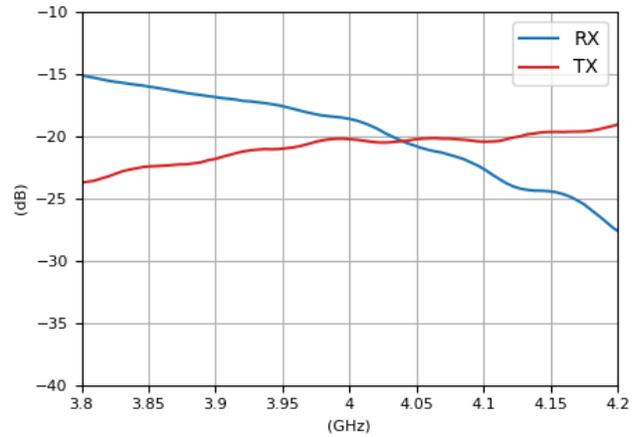
**Figure 20 Insertion Loss**



**Figure 21 Isolation**

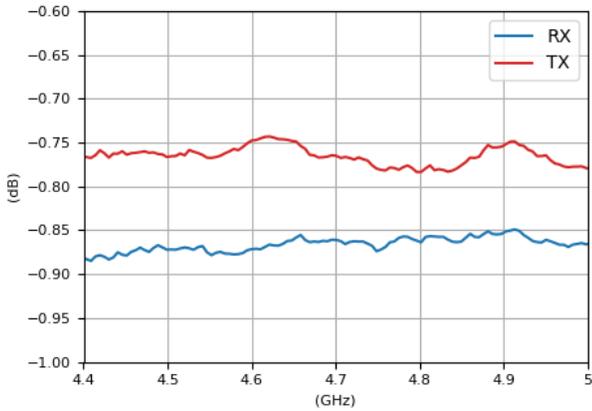


**Figure 22 Return Loss**

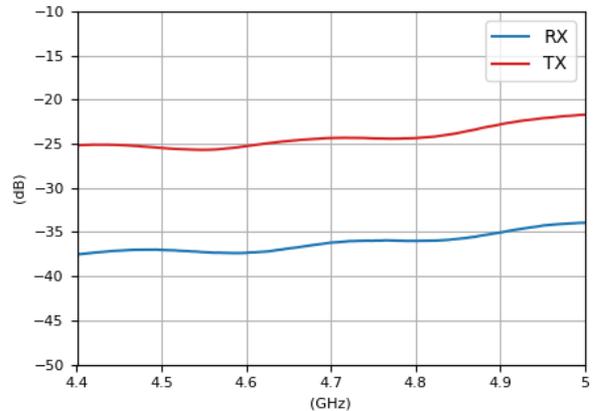


**Figure 23 ANT Return Loss**

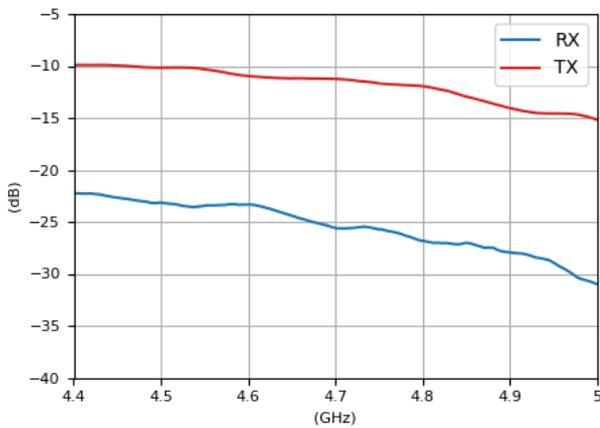
**10.6 Typical Characteristics (Tune 4.4 – 5.0GHz)**



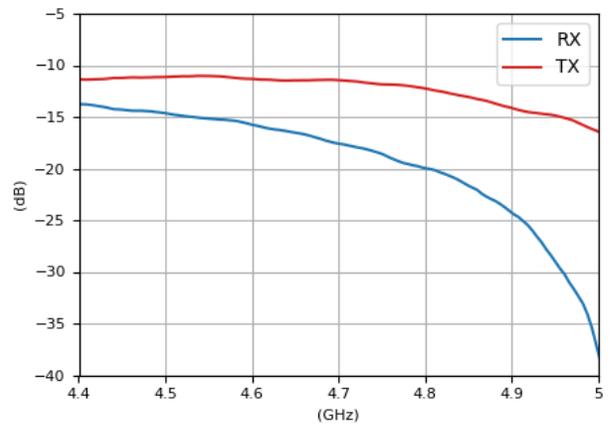
**Figure 24 Insertion Loss**



**Figure 25 Isolation**

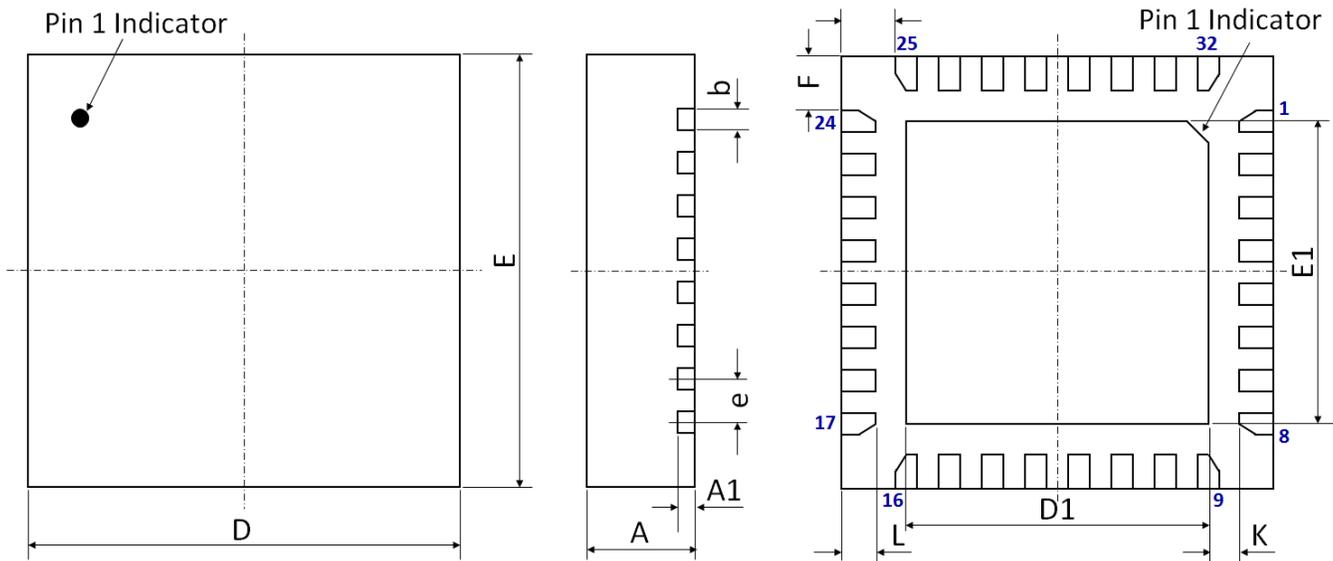


**Figure 26 Return Loss**



**Figure 27 ANT Return Loss**

**11.0 Device Package Information**



**Figure 28 Device Package Drawing**  
(All dimensions are in mm)

**Table 7 Device Package Dimensions**

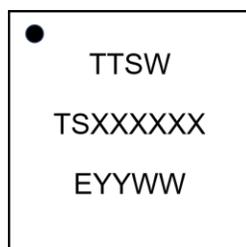
Dimension (mm)	Value (mm)	Tolerance (mm)	Dimension (mm)	Value (mm)	Tolerance (mm)
A	0.85	±0.05	E	5.00 BSC	±0.05
A1	0.203	±0.02	E1	3.20	±0.06
b	0.25	+0.05/-0.07	F	0.625	±0.05
D	5.00 BSC	±0.05	G	0.625	±0.05
D1	3.20	±0.06	L	0.40	±0.05
e	0.50 BSC	±0.05	K	0.50	±0.05

**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 [www.tagoretech.com](http://www.tagoretech.com) for PCB and soldering related guidelines.

**Top Marking Specifications:**

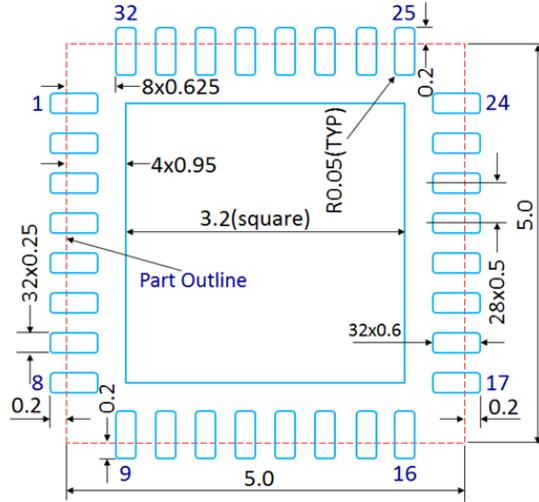


- = Pin 1 indicator
- TTSW = Tagore Technology SWitch
- TSXXXXXX = Part number (8 digits max)
- E = A fixed letter before the date code
- YY = Last two digits of assembly year
- WW = Assembly work week

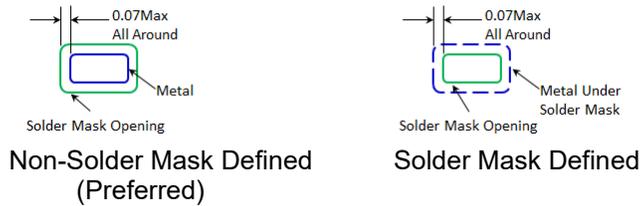
**12.0 PCB Land Design**

**Guidelines:**

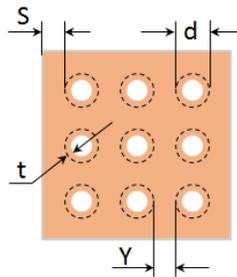
- [1] 4 layer PCB is recommended.
- [2] Via diameter is recommended to be 0.2mm to prevent solder wicking inside the vias.
- [3] Thermal vias shall only be placed on the center pad.
- [4] The maximum via number for the center pad is  $6(X) \times 6(Y) = 36$ .



**Figure 29 PCB Land Pattern**  
(Dimensions are in mm)



**Figure 30 Solder Mask Pattern**  
(Dimensions are in mm)

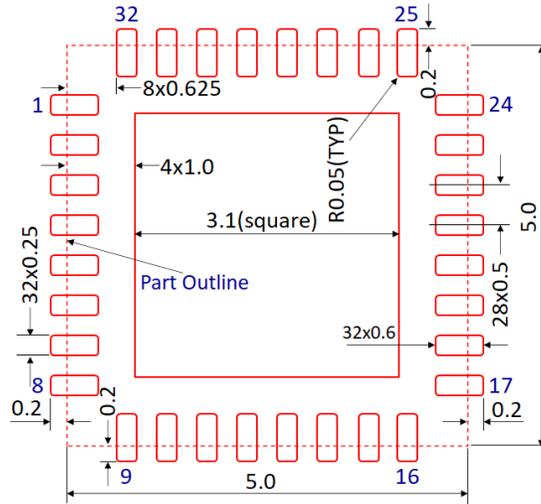


**Figure 31 Thermal Via Pattern**  
(Recommended Values:  $S \geq 0.15\text{mm}$ ;  $Y \geq 0.20\text{mm}$ ;  $d = 0.3\text{mm}$ ; Plating Thickness  $t = 25\mu\text{m}$  or  $50\mu\text{m}$ )

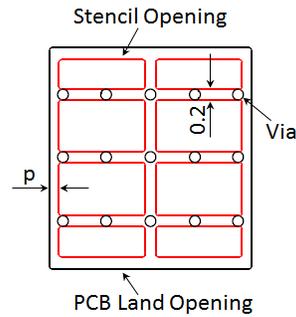
**13.0 PCB Stencil Design**

**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.

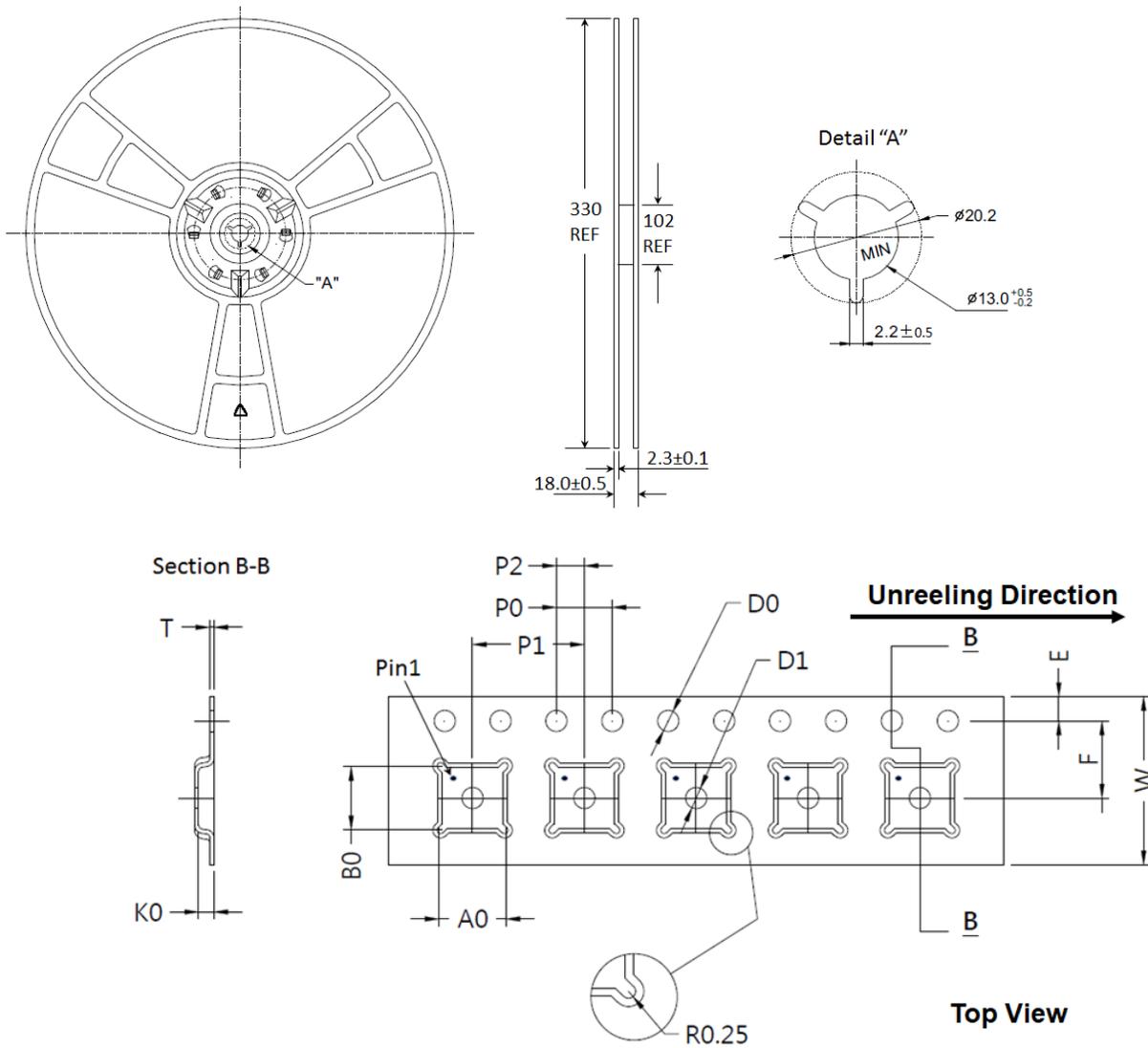


**Figure 32 Stencil Openings**  
(Dimensions are in mm)



**Figure 33 Stencil Openings Shall not Cover Via Areas If Possible**  
(Dimensions are in mm)

**14.0 Tape and Reel Information**



**Figure 34 Tape and Reel Drawing**

**Table 8 Tape and Reel Dimensions**

Dimension (mm)	Value (mm)	Tolerance (mm)	Dimension (mm)	Value (mm)	Tolerance (mm)
A0	5.35	±0.10	K0	1.10	±0.10
B0	5.35	±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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