A small, black, rectangular component with the text "A46T" printed in white. A small white dot is visible in the top right corner of the component. The component is centered in the upper half of the page against a background of white acoustic foam.

Antenna Datasheet

Product OC: YSOS001AA

Version: 1.3

Date: 2023-12-05

Status: Released

Product Name: Single Pole Quad Throw (SP4T) RF Antenna

Key Features:

Dimensions: 1.1 mm × 1.5 mm

RoHS, REACH and WEEE Compliant Package

Overview

The YSOS001AA is a Single Pole Quad Throw (SP4T) RF antenna aperture switch optimized for low COFF enabling applications up to 6.0 GHz. This single supply chip integrates on-chip CMOS logic driven by a simple, single-pin CMOS or TTL compatible control input signal. Unlike GaAs technology, the 0.1dB compression point exceeds the switch maximum input power level, resulting in linear performance at all signal levels and external DC blocking capacitors at the RF ports are only required if DC voltage is applied externally. Due to its very high RF voltage ruggedness it is suited for switching any reactive devices such as inductors and capacitors in RF matching circuits without significant losses in quality factors.

- Designed for high linearity and high RF voltage tuning applications
- Multiple selectable switch configurations:
Each throw directly and independently controlled
- Low RON resistance of 1.6 ohm at each port in ON state
- Low COFF capacitance of 120 fF at each port in OFF state
- High bidirectional RF operating voltage of 36 V in OFF state
- Low harmonic generation
- 2 GPIO pins control interface
- Supply voltage range: 1.65–3.6 V
- No RF parameter change within supply voltage range
- Small form factor 1.1 mm × 1.5 mm (MSL1, 260 °C per JEDEC J-STD-020)
- RoHS and WEEE compliant package

Contents

Overview	1
Contents	2
1 Specification	3
1.1. Mechanical & Environmental	3
2 Overall Performance	7
2.1. Test Setup	7
2.2. Logic Truth Table.....	10
2.3. Application Information	10
3 Product Size	12
4 Packaging	16
Contact Us	18
Legal Notices	19
Revision History	21

1 Specification

1.1. Mechanical & Environmental

Mechanical	
Dimensions	1.1 mm × 1.5 mm
Environmental	
RoHS, REACH and WEEE Compliant Package	Yes

Maximum Ratings (T _A = 25 °C, Unless Otherwise Specified)		
Frequency Range	≥ 0.1 GHz	¹⁾
Supply Voltage ²⁾	-0.5 V to 3.6 V	Only for infrequent and short duration time periods
Storage Temperature Range	-55 °C to 150 °C	
RF Input Power	≤ 39 dBm	Pulsed RF input power, duty cycle of 25 % with T period = 4620 μs, ON-state, setup as of Fig. 1.
RF Voltage	≤ 48 V	Short term peaks (1 μs, duty cycle 0.1%), isolation mode, test setup acc. Fig. 2/Fig. 3 and exceeding typical linearity, <i>RON</i> and <i>COFF</i> parameters.
ESD Capability, CDM ³⁾	-1.5 kV to 1.5 kV	-
ESD Capability, HBM ⁴⁾	-1 kV to 1 kV	-
ESD Capability, System Level (RF Port) ⁵⁾	-8 kV to 8 kV	RF vs system GND, with 27 nH shunt inductor
Junction Temperature	≤ 125 °C	-
Thermal Resistance Junction - Soldering Point	≤ 45 K/W	-
Maximum DC-voltage on RF-Ports and RF-Ground	0 V	No DC voltages allowed on RF-Ports

Control Voltage Levels	-0.7 - VDD + 0.7 (Max. 3.6) V	-
Moisture Sensitivity Level	1	-

- 1) Switch has a low-pass response. For higher frequencies, losses have to be considered for their impact on thermal heating. The DC voltage at RF ports (V_{RFDC}) has to be 0 V.
- 2) Note: Consider potential ripple voltages on top of V_{IO} . Including RF ripple, V_{IO} must not exceed the Max. ratings: $V_{Ctrl} = V_{DC} + V_{Ripple}$.
- 3) Field Induced Charged Device Model (CMD) ANSI/ESDA/JEDEC JS-002. The CDM Simulates charging/discharging events that occur in production equipment and processes. Potential for CDM ESD events occurs whenever there is metal-to-metal contact in manufacturing.
- 4) Human Body Model ANSI/ESDA/JEDEC JS-001 ($R = 1.5 \text{ k}\Omega$, $C = 100 \text{ pF}$).
- 5) IEC 61000-4-2 ($R = 330 \text{ }\Omega$, $C = 150 \text{ pF}$), Contact Discharge.

Warning: Stresses above the Max. values listed here may cause permanent damage to the device. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit. Exposure to conditions at or below absolute maximum rating but above the specified maximum operation conditions may affect device reliability and life time. Functionality of the device might not be given under these conditions.

RF Small Signal Parameter

Frequency Range	0.1–6 GHz	-
Switch ON Resistance	1.6 Ω Typ.	RFx to RFC
Switch OFF Capacitance	120 fF Typ.	RFx to GND; Extracted Value for 2 GHz
Parasitic RF Shunt Capacitance	42 fF Typ.	-
Switch Series Inductance	0.1 nH Typ.	-
Insertion Loss ^{(1), (2)} 600–960 MHz	0.15 dB Min. 0.22 dB Typ. 0.36 dB Max.	VDD = 1.65–3.6 V Z0 = 50 Ω
Insertion Loss ^{(1), (2)} 1710–1980 MHz	0.23 dB Min. 0.37 dB Typ. 0.47 dB Max.	TA = -40 °C to + 85 °C
Insertion Loss ^{(1), (2)} 1980–2170 MHz	0.29 dB Min. 0.39 dB Typ. 0.49 dB max	VDD = 1.65–3.6 V Z0 = 50 Ω TA = -40 °C to + 85 °C
Insertion Loss ^{(1), (2)} 2170–2690 MHz	0.36 dB Min. 0.46 dB Typ. 0.59 dB Max.	VDD = 1.65–3.6 V Z0 = 50 Ω TA = -40 °C to + 85 °C

Return Loss ^{1), 2)} All Ports @ 600–960 MHz	20 dB Min. 22 dB Typ. 26 dB Max.	VDD = 1.65–3.6 V Z0 = 50 Ω
Return Loss ^{1), 2)} All Ports @ 1710–2690 MHz	17 dB Min. 21 dB Typ. 25 dB Max.	TA = –40 °C to + 85 °C
Isolation RFx to RFC ^{1), 2)} 600–960 MHz	29 dB Min. 31 dB Typ. 38 dB Max.	
Isolation RFx to RFC ^{1), 2)} 1710–1980 MHz	21 dB Min. 25 dB Typ. 35 dB Max.	VDD = 1.65–3.6 V Z0 = 50 Ω
Isolation RFx to RFC ^{1), 2)} 1980–2170 MHz	20 dB Min. 23 dB Typ. 35 dB Max.	TA = –40 °C to + 85 °C
Isolation RFx to RFC ^{1), 2)} 2170–2690 MHz	17 dB Min. 20 dB Typ. 27 dB Max.	

- 1) Valid for all RF power levels, no compression behavior.
- 2) On application board without any matching components.

RF Large Signal Parameter

RF Operating Voltage	≤ 36 V	All Switch throws operated in isolation Mode, except one throw switched ON with open termination. Test condition schematic in Fig.2. All RF parameters in specs including harmonic distortion.
Harmonic Generation (up to 12.75 GHz) ^{1), 2), 3)} All RF Ports – Second Order Harmonics	105 dBc Typ.	25 dBm, 50 Ω, $f_0 = 786$ MHz
Harmonic Generation (up to 12.75 GHz) ^{1), 2), 3)} All RF Ports – Third Order Harmonics	115 dBc Typ.	25 dBm, 50 Ω, $f_0 = 786$ MHz
Harmonic Generation (up to 12.75 GHz) ^{1), 2), 3)} All RF Ports - Second Order Harmonics	93 dBc Typ.	33 dBm, 50 Ω, $f_0 = 824$ MHz
Harmonic Generation (up to 12.75 GHz) ^{1), 2), 3)} All RF Ports– Third Order Harmonics	94 dBc Typ.	33 dBm, 50 Ω, $f_0 = 824$ MHz
Harmonic Generation (up to 12.75 GHz) ^{1), 2), 3)} All RF Ports	≥ 105 dBc	25 dBm, 50 Ω
Intermodulation Distortion IMD2 ^{1), 2), 3)} IIP2, Low	110 dBm Typ.	IIP2 Conditions Table 1
Intermodulation Distortion IMD2 ^{1), 2), 3)} IIP2, High	120 dBm Typ.	-

Intermodulation Distortion IMD2 ^{1), 2), 3)} IIP3	75 dBm Typ.	IIP3 Conditions Table 2
SV LTE Intermodulation ^{1), 2), 3)} IIP3, SVLTE	75 dBm Typ.	SVLTE Conditions Table 3

- 1) Terminating Port Impedance: $Z_0 = 50 \Omega$.
- 2) Supply Voltage: $V_{DD} = 1.65\text{--}3.6 \text{ V}$.
- 3) On application board without any matching components.

2 Overall Performance

2.1. Test Setup

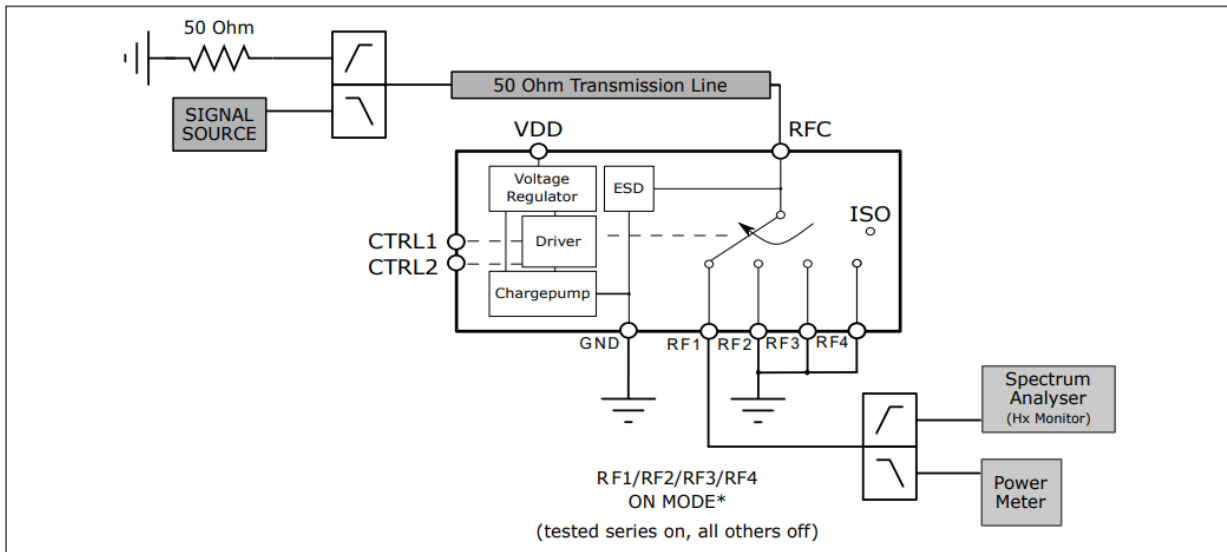


Figure 1: RF Operating and Harmonics Generation Measurement Configuration - RFX ON Mode

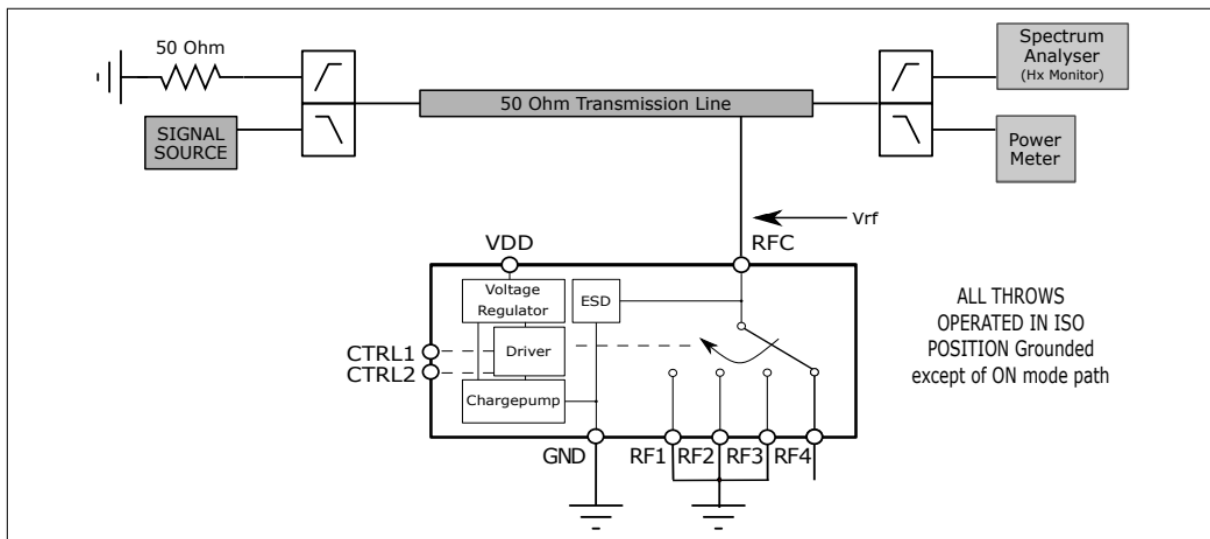


Figure 2: RF Operating Voltage Measurement Configuration - OFF Mode at RFC

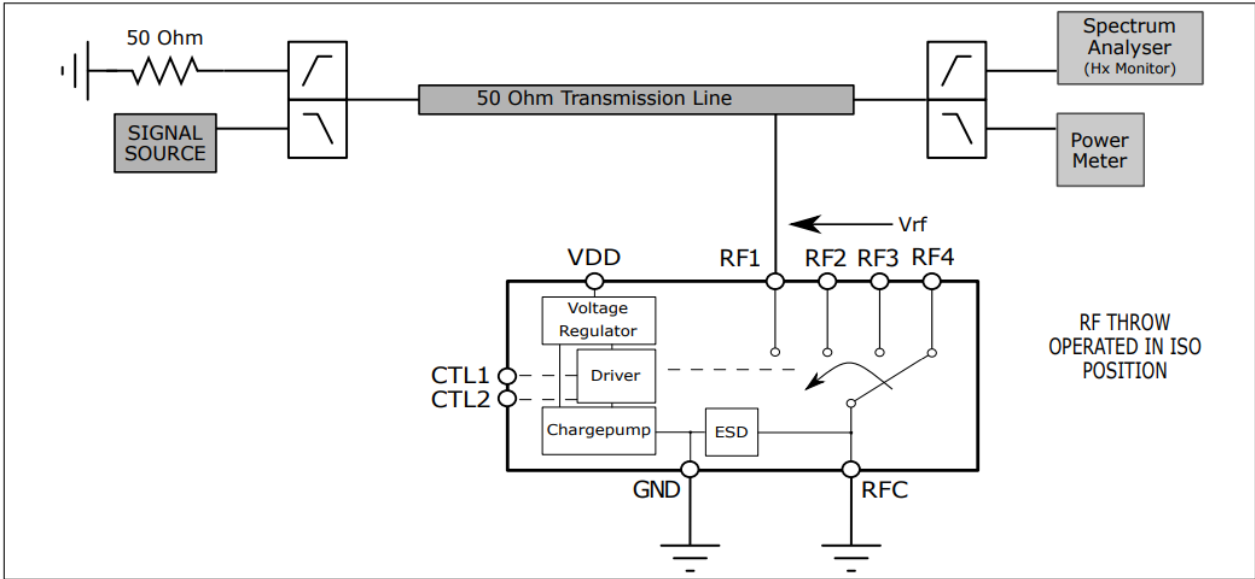


Figure 3: RF Operating Voltage Measurement Configuration - OFF Mode at RFx

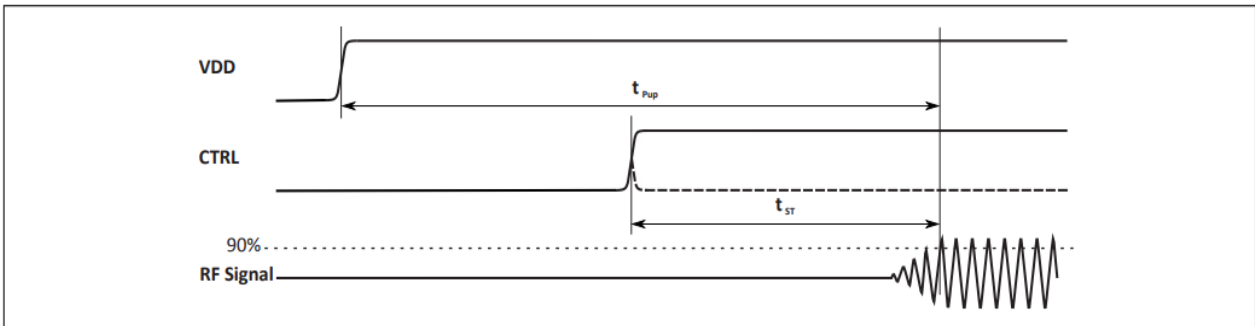


Figure 4: Switching Time Definition

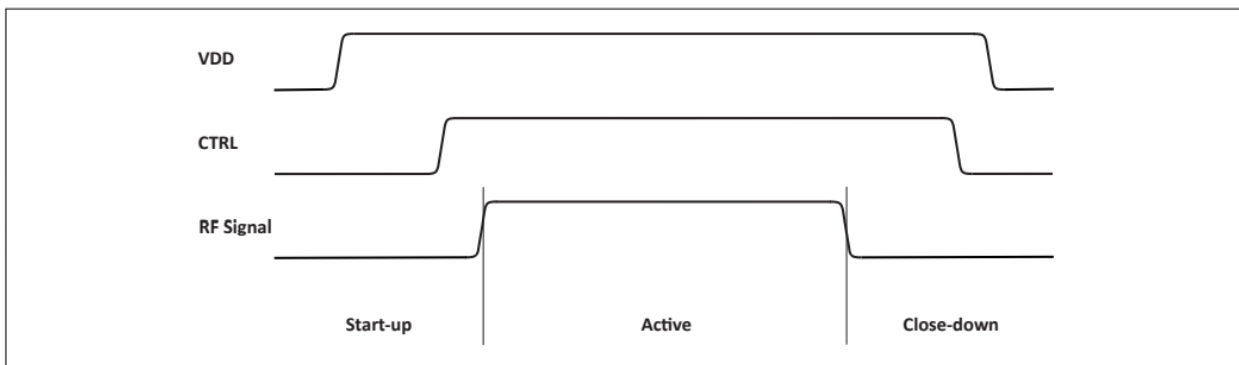


Figure 5: Timing of Control and RF Signals for Valid Operation

Table 1: IIP2 Conditions

Band	In-Band Frequency [MHz]	Blocker Frequency1 [MHz]	Blocker Power1 [dBm]	Blocker Frequency2 [MHz]	Blocker Power2 [dBm]
Band 1 Low	2140	1950	20	190	-15
Band 1 High	2140	1950	20	4090	-15
Band 5 Low	881.5	836.5	20	45	-15
Band 5 High	881.5	836.5	20	1718	-15

Table 2: IIP3 Conditions

Band	In-Band Frequency [MHz]	Blocker Frequency1 [MHz]	Blocker Power1 [dBm]	Blocker Frequency2 [MHz]	Blocker Power2 [dBm]
Band 1	2140	1950	20	1760	-15
Band 5	881.5	836.5	20	791.5	-15

Table 3: SVLTE Conditions

Band	In-Band Frequency [MHz]	Blocker Frequency1 [MHz]	Blocker Power1 [dBm]	Blocker Frequency2 [MHz]	Blocker Power2 [dBm]
Band 5	872	827	23	872	14
Band 13	747	786	23	747	14
Band 20	878	833	23	2544	14

2.2. Logic Truth Table

Table 4: Modes of Operation

State	Mode	CTRL1	CTRL2
1	RF1 to RFc	0	0
2	RF2 to RFc	0	1
3	RF3 to RFc	1	0
4	RF4 to RFc	1	1

- Mapping of Switch Rows to Bit: ON = 1, OFF = 0.

2.3. Application Information

- Pin Configuration and Function

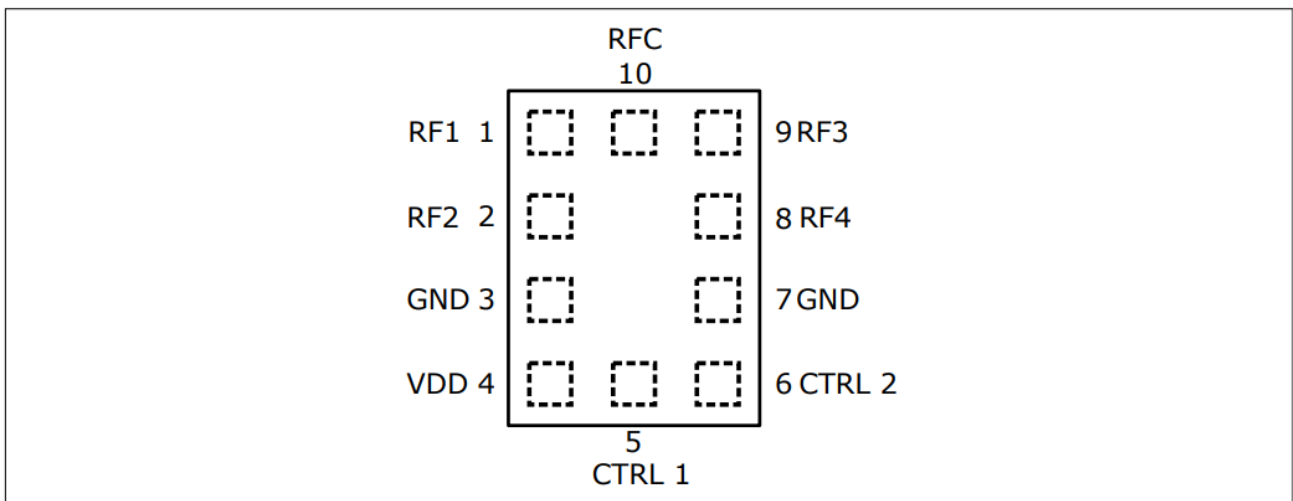


Figure 6: YSOS001AA Pin Configuration (Top View)

Table 5: Pin Configuration and Function

Pin No.	Name	Function
1	RF1	RF1 Port
2	RF2	RF2 Port
3	GND	Ground
4	VDD	Power Supply
5	CTRL1	GPIO Digital Control Line
6	CTRL2	GPIO Digital Control Line
7	GND	Ground
8	RF4	RF4 Port
9	RF3	RF3 Port
10	RFC	Common RF

3 Product Size

Table 6: Mechanical Data

Parameter	Symbol	Value	Unit
X-Dimension	X	1.1 ±0.05	mm
Y-Dimension	Y	1.5 ±0.05	mm
Size	Size	2.25	mm ²
Height	H	0.375 + 0.025/ 0.375 - 0.015	mm

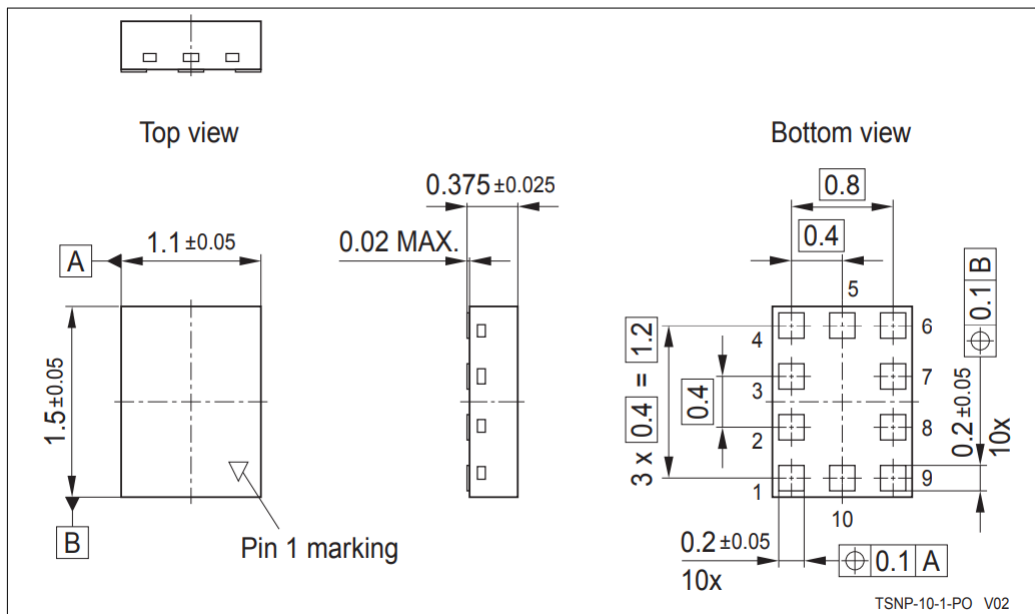


Figure 7: TSNP-10-1 Package Outline (Top, Side and Bottom Views)

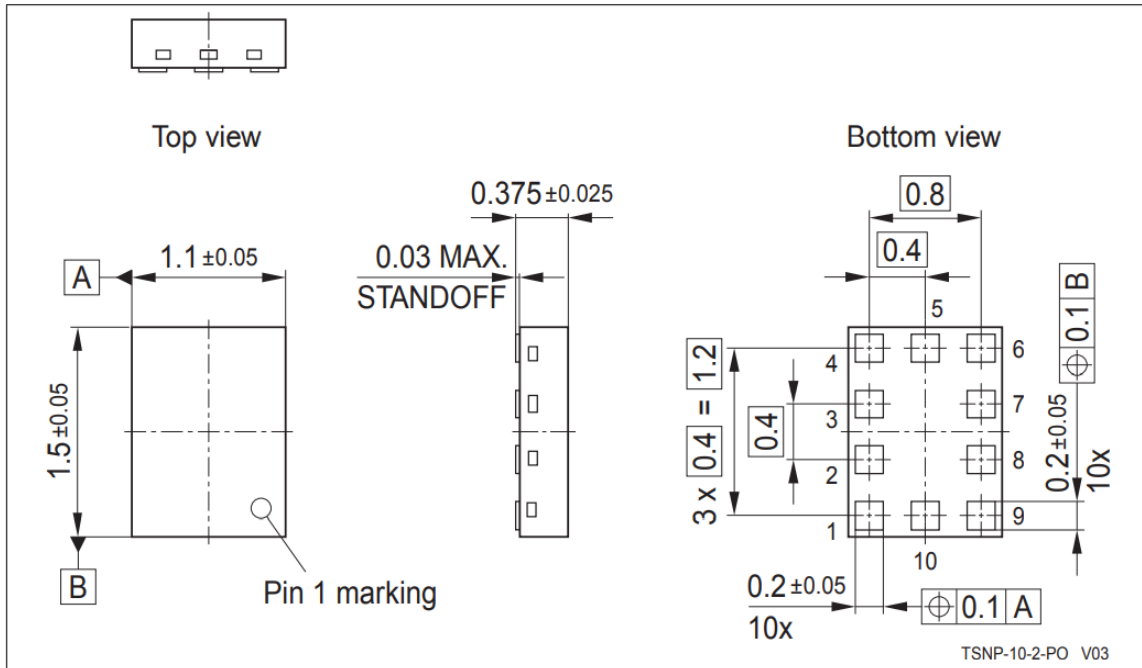


Figure 8: TSNP-10-2 Package Outline (Top, Side and Bottom Views)

Table 7: Year Data Code Marking – Digit “Y”

Year	"Y"	Year	"Y"	Year	"Y"
2010	0	2020	0	2030	0
2011	1	2021	1	2031	1
2012	2	2022	2	2032	2
2013	3	2023	3	2033	3
2014	4	2024	4	2034	4
2015	5	2025	5	2035	5
2016	6	2026	6	2036	6
2017	7	2027	7	2037	7
2018	8	2028	8	2038	8
2019	9	2029	9	2039	9

Table 8: Week Date Code Marking - Digit “W”

Week	"W"	Week	"W"	Week	"W"	Week	"W"	Week	"W"
1	A	12	N	23	4	34	h	45	v
2	B	13	P	24	5	35	j	46	x
3	C	14	Q	25	6	36	k	47	y
4	D	15	R	26	7	37	l	48	z
5	E	16	S	27	a	38	n	49	8
6	F	17	T	28	b	39	p	50	9
7	G	18	U	29	c	40	q	51	2
8	H	19	V	30	d	41	r	52	3
9	J	20	W	31	e	42	s	53	M
10	K	21	Y	32	f	43	t	-	-
11	L	22	Z	33	g	44	u	-	-

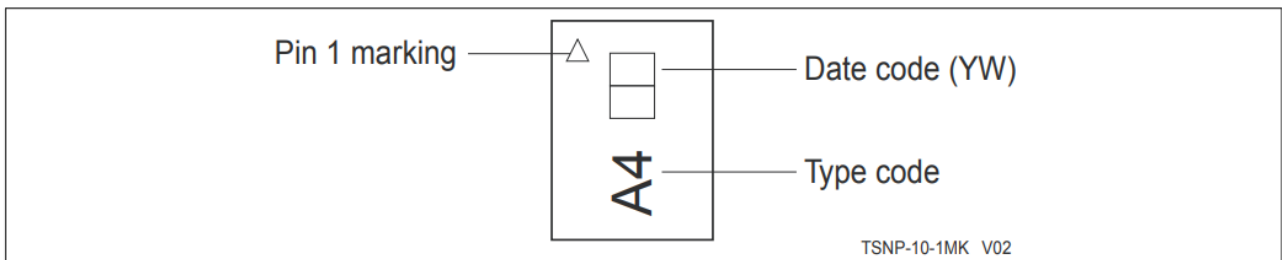


Figure 9: TSNP10-1 Marking Specification (Top View): Data Code Digits Y and W (Defined in Table 11/12)

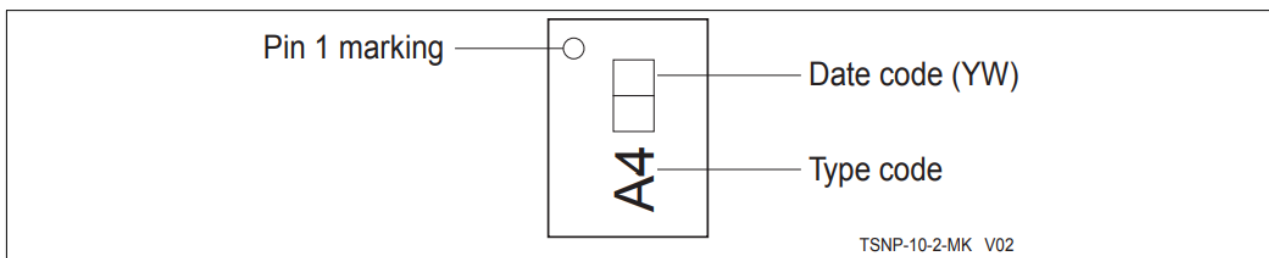


Figure 10: TSNP10-2 Marking Specification (Top View): Data Code Digits Y and W (Defined in Table 11/12)

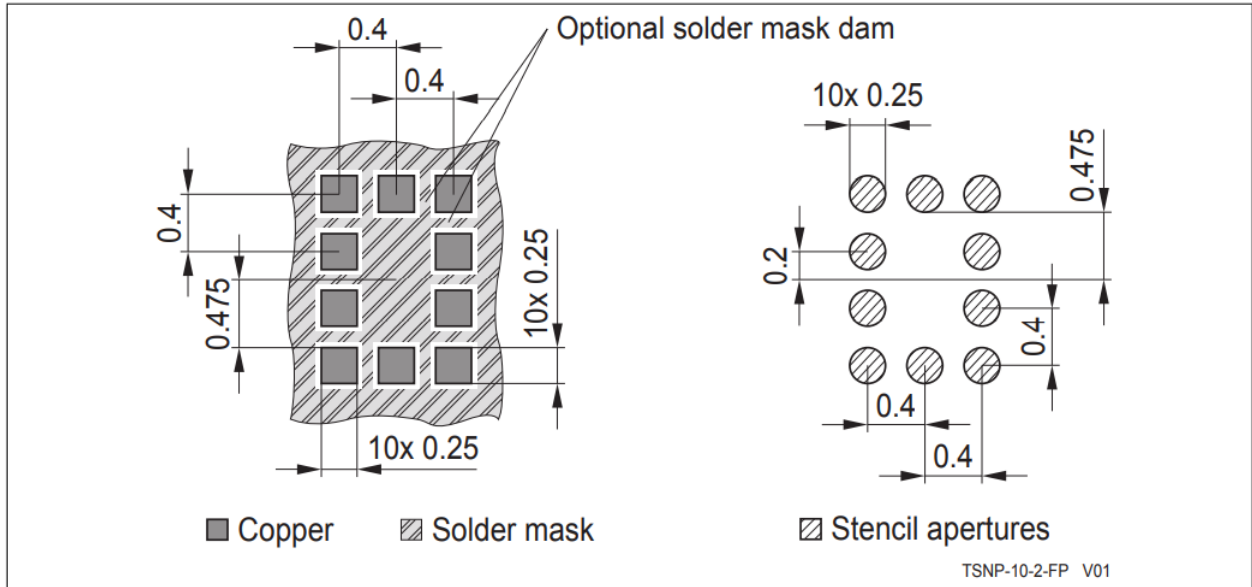


Figure 11: Land Pattern and Stencil Mask (TSNP-10-1/-2)

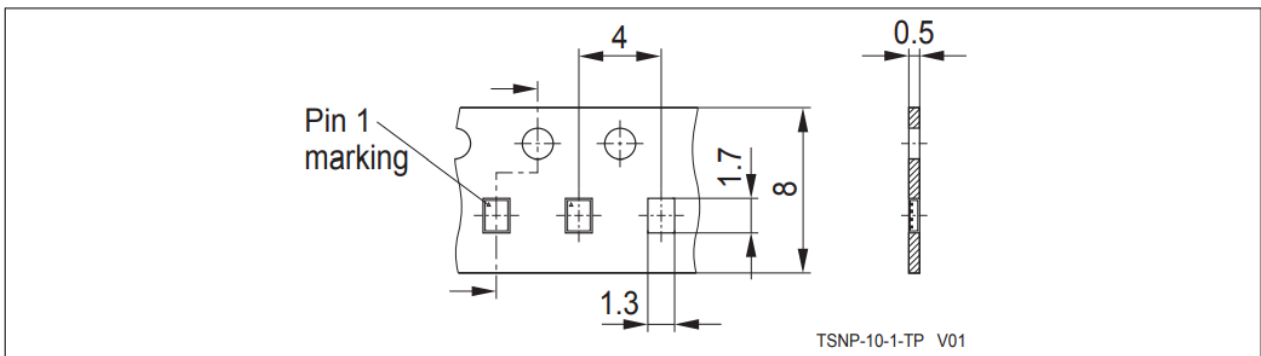


Figure 12: Carrier Tape (TSNP-10-1)

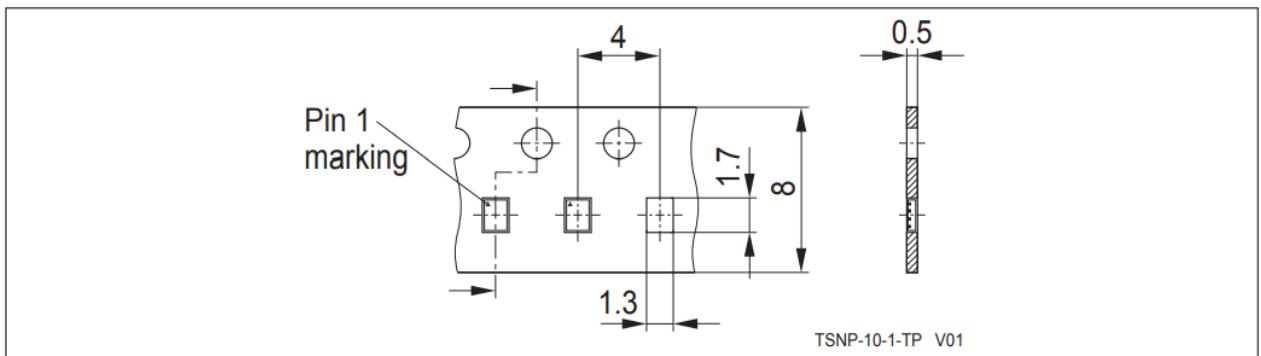
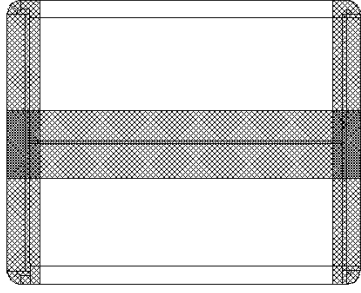


Figure 13: Carrier Tape (TSNP-10-2)

4 Packaging

Step	Packaging Picture / 2D Picture	Description
1		Reel
2		7500 pcs Antenna products/Reel Reel tape is vacuumed into the inner box
3		9 Inner Boxes / Carton Box (67500 PCS Antennas / Carton Box) <u>Carton Size: L × W × H = 210 × 210 × 240 mm</u>
4		Position for Attaching Labels ① Carton Label ② Quality Label

5



Sealing Cartons

“工” type sealing cartons

Note

The initial packaging method described above is for reference only, and the final actual packaging method shall be subject to the actual shipping packaging.

Contact Us

At Quectel, our aim is to provide timely and comprehensive services to our customers. If you require any assistance, please contact our headquarters:

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

Tel: +86 21 5108 6236

Email: info@quectel.com

Or our local offices. For more information, please visit:

<http://www.quectel.com/support/sales.htm>.

For technical support, or to report documentation errors, please visit:

<http://www.quectel.com/support/technical.htm>.

Or email us at: support@quectel.com.

Legal Notices

We offer information as a service to you. The provided information is based on your requirements and we make every effort to ensure its quality. You agree that you are responsible for using independent analysis and evaluation in designing intended products, and we provide reference designs for illustrative purposes only. Before using any hardware, software or service guided by this document, please read this notice carefully. Even though we employ commercially reasonable efforts to provide the best possible experience, you hereby acknowledge and agree that this document and related services hereunder are provided to you on an “as available” basis. We may revise or restate this document from time to time at our sole discretion without any prior notice to you.

Use and Disclosure Restrictions

License Agreements

Documents and information provided by us shall be kept confidential, unless specific permission is granted. They shall not be accessed or used for any purpose except as expressly provided herein.

Copyright

Our and third-party products hereunder may contain copyrighted material. Such copyrighted material shall not be copied, reproduced, distributed, merged, published, translated, or modified without prior written consent. We and the third party have exclusive rights over copyrighted material. No license shall be granted or conveyed under any patents, copyrights, trademarks, or service mark rights. To avoid ambiguities, purchasing in any form cannot be deemed as granting a license other than the normal non-exclusive, royalty-free license to use the material. We reserve the right to take legal action for noncompliance with abovementioned requirements, unauthorized use, or other illegal or malicious use of the material.

Trademarks

Except as otherwise set forth herein, nothing in this document shall be construed as conferring any rights to use any trademark, trade name or name, abbreviation, or counterfeit product thereof owned by Quectel or any third party in advertising, publicity, or other aspects.

Third-Party Rights

This document may refer to hardware, software and/or documentation owned by one or more third parties (“third-party materials”). Use of such third-party materials shall be governed by all restrictions and obligations applicable thereto.

We make no warranty or representation, either express or implied, regarding the third-party materials, including but not limited to any implied or statutory, warranties of merchantability or fitness for a particular purpose, quiet enjoyment, system integration, information accuracy, and non-infringement of any third-party intellectual property rights with regard to the licensed technology or use thereof. Nothing herein constitutes a representation or warranty by us to either develop, enhance, modify, distribute, market, sell, offer for sale, or otherwise maintain production of any our products or any other hardware, software, device, tool, information, or product. We moreover disclaim any and all warranties arising from the course of dealing or usage of trade.

Privacy Policy

To implement module functionality, certain device data are uploaded to Quectel's or third-party's servers, including carriers, chipset suppliers or customer-designated servers. Quectel, strictly abiding by the relevant laws and regulations, shall retain, use, disclose or otherwise process relevant data for the purpose of performing the service only or as permitted by applicable laws. Before data interaction with third parties, please be informed of their privacy and data security policy.

Disclaimer

- a) We acknowledge no liability for any injury or damage arising from the reliance upon the information.
- b) We shall bear no liability resulting from any inaccuracies or omissions, or from the use of the information contained herein.
- c) While we have made every effort to ensure that the functions and features under development are free from errors, it is possible that they could contain errors, inaccuracies, and omissions. Unless otherwise provided by valid agreement, we make no warranties of any kind, either implied or express, and exclude all liability for any loss or damage suffered in connection with the use of features and functions under development, to the maximum extent permitted by law, regardless of whether such loss or damage may have been foreseeable.
- d) We are not responsible for the accessibility, safety, accuracy, availability, legality, or completeness of information, advertising, commercial offers, products, services, and materials on third-party websites and third-party resources.

Copyright © Quectel Wireless Solutions Co., Ltd. 2023. All rights reserved.

Revision History

Version	Date	Author	Note
-	2021-12-16	Rison LI	Creation of the document
1.0	2021-12-16	Rison LI	First official release
1.1	2022-03-10	Rison LI	Updated the antenna picture (Chapter 2).
1.2	2023-07-21	Vinnie LIU	Updated the template.
1.3	2023-12-05	Aria CHU	Added REACH compliant (Chapter 1.1).

QUECTEL

www.quectel.com