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THE DATASHEET OF

SKYA21029

DATA SHEET

SKYA21029: 0.1 to 3.8 GHz SP4T Antenna Switch

Applications

- 2G/3G/4G/4G LTE, 4G LTE-A
- Embedded cellular telematics modules
- OBD-II cellular modems

Features

- Broadband frequency range: 0.1 to 3.8 GHz
- Low insertion loss: 0.45 dB typical @ 2.7 GHz
- High isolation: >31 dB @ 2.7 GHz
- Internal 50 Ω port to control diversity antenna impedance when device is not in use
- Integrated logic
- Automotive Level-3 PPAP available upon request
- IMDS material declaration available at production release
- Extended production life to support automotive requirements
- Independent BOM management to minimize PCN risk
- Small 14-pin, Quad Flat No-Lead (QFN) package, 2.0 x 2.0 mm
  (MSL1, 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the Skyworks Certificate of Conformance.

Description

The SKYA21029 is a single-pole, four-throw (SP4T) antenna switch with an internal 50 Ω termination. The high-linearity performance and low insertion loss achieved by the SKYA21029 make it an ideal choice for embedded cellular telematics modules and OBD-II cellular modems.

The symmetric port designs provide flexibility in signal routing for receive diversity and higher power TD-SCDMA/TDD-LTE, WCDMA/FDD, and LTE transmit/receive applications.

Switching is controlled by three CMOS/TTL-compatible control voltage inputs (V1, V2, and V3). Depending on the logic voltage level applied to the control pins, the

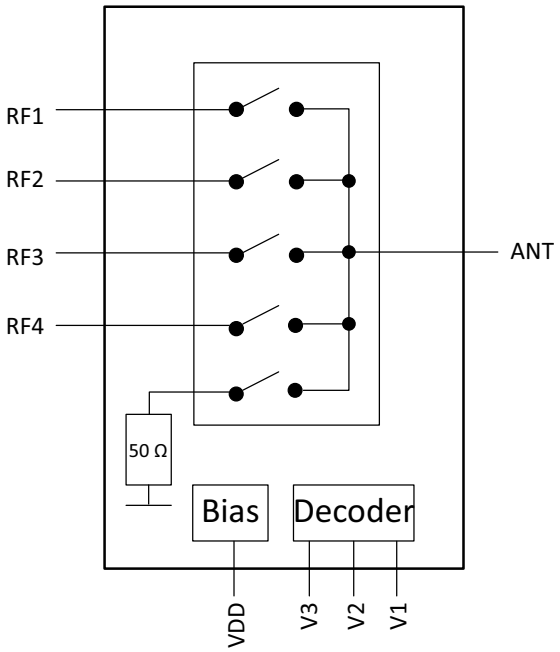


Figure 1. Functional Block Diagram

ANT pin is connected to one of four switched RF outputs (RF1 to RF4) using a low insertion loss path, while the paths between the ANT pin and the other RF pins are in a high isolation state.

The antenna path can also be closed on a 50 Ω load when it must be terminated. The 50 Ω load is internally grounded.

No external blocking capacitors are required on the RF paths unless voltage is externally applied.

A functional block diagram is shown in Figure 1. The pin configuration is shown in Figure 2. Signal pin assignments and descriptions are provided in Table 1.

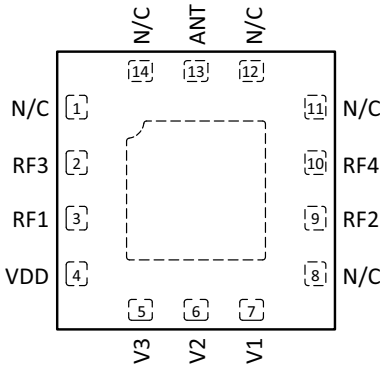


Figure 2. Pinout (Top View)

Table 1. Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	N/C	Not connected	8	N/C	Not connected
2	RF3	RF I/O path 3	9	RF2	RF I/O path 2
3	RF1	RF I/O path 1	10	RF4	RF I/O path 4
4	VDD	DC power supply	11	N/C	Not connected
5	V3	DC control voltage 3	12	N/C	Not connected
6	V2	DC control voltage 2	13	ANT	Antenna port
7	V1	DC control voltage 1	14	N/C	Not connected

Technical Description

The SKYA21029 includes an internal negative voltage generator and decoder that eliminates the need for external blocking capacitors on the RF ports. No external components are required for proper operation. DC decoupling capacitors may be added on the VDD and control lines if necessary.

Switching is controlled by three control voltage inputs, V1, V2, and V3. Depending on the logic voltage level applied to the control pins, the antenna pin is connected to one of four switched RF outputs or a 50 Ω termination.

Shutdown mode is enabled by connecting all three control pins (V1, V2, and V3) to logic high. This mode reduces the overall current consumption of the device to 5 µA typical.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKYA21029 are provided in Table 2. Electrical specifications are provided in Table 3. The state is determined by the logic shown in Table 4.

The isolation matrix shown in Table 5 provides the port-to-port and antenna-to-port isolation for all available RF states at four different frequencies: 1.0 GHz, 2.0 GHz, 2.7 GHz, and 3.8 GHz.

Table 2. Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V_{DD}	2.5	5.0	V
Control voltage (V1, V2, and V3)	V_{CTL}	–0.5	+3.0	V
RF power applied to “on” arm (RF1 to RF4) or ANT port 0.1 to 2.7 GHz (RF1 to RF4 arm) 3.4 to 3.8 GHz (RF2 to RF4 arm)	P_{IN}		 +37.5 +35	dBm
RF power applied to “off” arm (RF1 to RF4)	P_{IN}		+33	dBm
RF power applied to antenna in the 50 Ω switched RF output state	P_{IN}		+27	dBm
Operating temperature	T_{OP}	–40	+85	°C
Storage temperature	T_{STG}	–55	+150	°C
Electrostatic discharge Human Body Model (HBM)	ESD		500	V

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

ESD Handling: *Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this device.*

Table 3. General Electrical Specifications[1]

(VDD = 2.6 V, V1 = V2 = V3 = 0/1.8 V, PIN = 0 dBm, TOP = +25 °C, Characteristic Impedance [ZO] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
DC Specifications						
Supply voltage	V_{DD}		2.5	2.6	4.8	V
Supply current	I_{DD}	VDD = 2.6 V		40	50	µA
Control voltage High Low	 V_{CTL_H} V_{CTL_L}		1.35	1.80	2.70 0.4	V
Control current	I_{CTL}	V_{CTL} = 1.8 V		0.5	1.0	µA
Shutdown mode supply current	I_{OFF}	V1/2/3 = 1.8 V, V_{DD} = 2.6 V		5	10	µA
Turn-on switching time	t_{ON}	50% of control voltage to 90% of final RF power, switching between RF1/2/3/4		1.75	2.20	µs
RF Specifications						
Insertion loss (ANT pin to RF1/2/3/4 pins)	IL	0.1 to 1.0 GHz 1.0 to 2.0 GHz 2.0 to 2.7 GHz 3.4 to 3.8 GHz		0.40 0.40 0.45 0.6	0.50 0.50 0.60 0.8	dB
Isolation (ANT pin to RF1/2/3/4 pins)	Iso	0.1 to 1.0 GHz 1.0 to 2.0 GHz 2.0 to 2.7 GHz 3.4 to 3.8 GHz	38 32 27 20	42 35 31 26		dB
Input return loss (ANT pin to RF1/2/3/4 pins)	RL	0.1 to 1.0 GHz 1.0 to 2.0 GHz 2.0 to 2.7 GHz 3.4 to 3.8 GHz	21 23 15 12	24 25 18 15		dB
Second harmonics (ANT pin to RF1/2/3/4 pins)	2fo	P_{IN} = +26 dBm 0.1 to 3.0 GHz		+99		dBc
Third harmonics (ANT pin to RF1/2/3/4 pins)	3fo	P_{IN} = +26 dBm 0.1 to 3.0 GHz		+105		dBc
Harmonics (ANT to RF2, 3, 4)	2fo	PIN = +26 dBm 3.4 to 3.8 GHz, VSWR = 1:1		–55		dBm
Harmonics (ANT to RF2, 3, 4)	3fo	PIN = +26 dBm 3.4 to 3.8 GHz, VSWR = 1:1		–65		dBm
Harmonics (ANT to RF2, 3, 4)	2fo	PIN = +26 dBm 3.4 to 3.8 GHz, VSWR = 5:1		–50		dBm
Harmonics (ANT to RF2, 3, 4)	3fo	PIN = +26 dBm 3.4 to 3.8 GHz, VSWR = 5:1		–60		dBm
0.1 dB compression point (ANT pin to RF2/3/4 pins)	P0.1dB	0.8 GHz to 3.0 GHz 3.4 to 3.8 GHz		+37.5 +37		dBm
Third order input intercept point	IIP3	@ 2.0 GHz P_{IN} = +26 dBm Δf = 1 MHz		+70		dBm
50 Ω power handling		@ 0.1 to 3.8 GHz			+27	dBm

1. Performance is assured only under the conditions listed in this table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

Table 4. Control Logic[1]

Control Pins			Switched RF Outputs				
V1 (Pin 7)	V2 (Pin 6)	V3 (Pin 5)	RF1 (Pin 3)	RF2 (Pin 9)	RF3 (Pin 2)	RF4 (Pin 10)	50 Ω
0	0	0	Insertion Loss	Isolation	Isolation	Isolation	Isolation
0	0	1	Isolation	Insertion loss	Isolation	Isolation	Isolation
0	1	0	Isolation	Isolation	Insertion loss	Isolation	Isolation
0	1	1	Isolation	Isolation	Isolation	Insertion loss	Isolation
1	0	0	Isolation	Isolation	Isolation	Isolation	Isolation
1	0	1	Isolation	Isolation	Isolation	Isolation	50 Ω
1	1	1	Shutdown mode				

1. “High” = 1.8 V; “Low” = 0 V. Any state other than that described in this table places the switch into an undefined state. An undefined state will not damage the device.

Table 5. Isolation Matrix

“On” Port	Frequency (GHz)	Isolation (dB)			
		RF1	RF2	RF3	RF4
Antenna-to-Port					
RF1	1.0	-	–47	–40	–42
RF1	2.0	-	–39	–31	–35
RF1	2.7	-	–36	–27	–32
RF1	3.8	-	–31	–22	–27
RF2	1.0	–46	-	–40	–40
RF2	2.0	–38	-	–34	–32
RF2	2.7	–35	-	–31	–28
RF2	3.8	–30	-	–26	–23
RF3	1.0	–38	–46	-	–42
RF3	2.0	–30	–39	-	–35
RF3	2.7	–27	–36	-	–32
RF3	3.8	–23	–31	-	–27
RF4	1.0	–45	–38	–41	-
RF4	2.0	–38	–31	–34	-
RF4	2.7	–34	–28	–31	-
RF4	3.8	–30	–24	–26	-

Table 5. Isolation Matrix (Continued)

"On" Port	Frequency (GHz)	Isolation (dB)			
		RF1	RF2	RF3	RF4
Port-to-Port					
RF1	1.0	-	–54	–31	–52
RF1	2.0	-	–43	–25	–43
RF1	2.7	-	–39	–22	–39
RF1	3.8	-	–32	–17	–34
RF2	1.0	–55	-	–48	–31
RF2	2.0	–43	-	–41	–24
RF2	2.7	–38	-	–37	–21
RF2	3.8	–32	-	–33	–17
RF3	1.0	–30	–56	-	–52
RF3	2.0	–24	–45	-	–43
RF3	2.7	–21	–40	-	–39
RF3	3.8	–17	–34	-	–34
RF4	1.0	–56	–30	–48	-
RF4	2.0	–44	–24	–41	-
RF4	2.7	–39	–21	–37	-
RF4	3.8	–32	–17	–32	-

Evaluation Board Description

An evaluation board is used to test the performance of the SKYA21029 SP4T switch. An evaluation board schematic diagram is provided in Figure 3. An assembly drawing is shown in Figure 4.

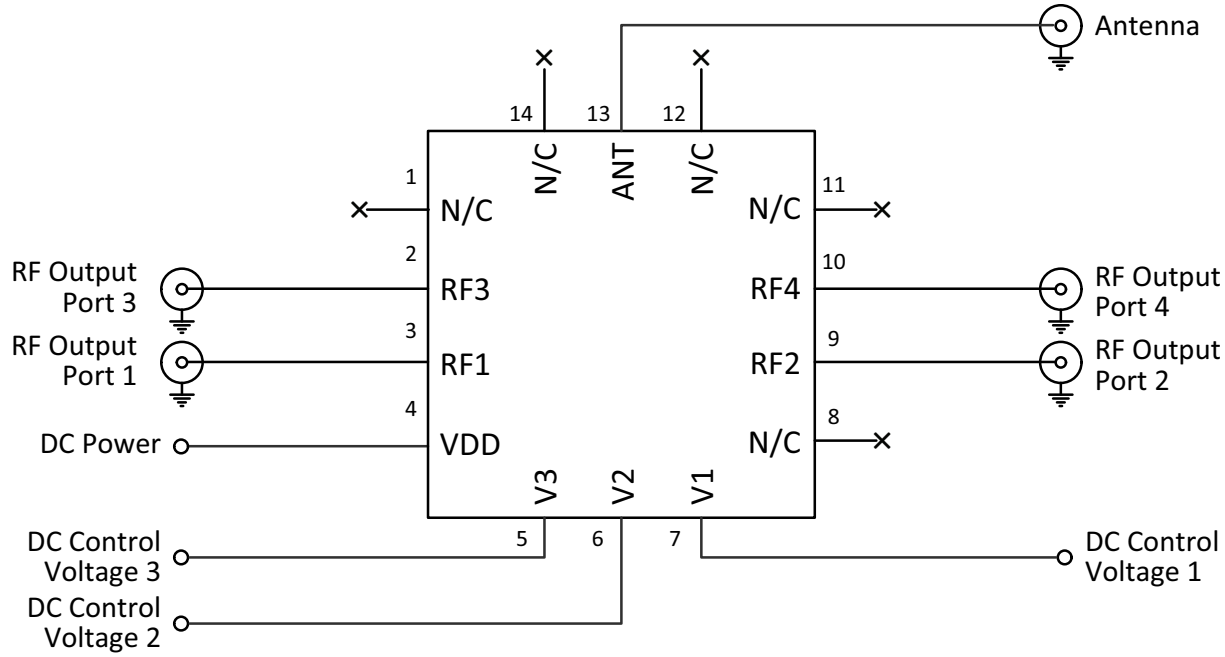


Figure 3. Evaluation Board Schematic

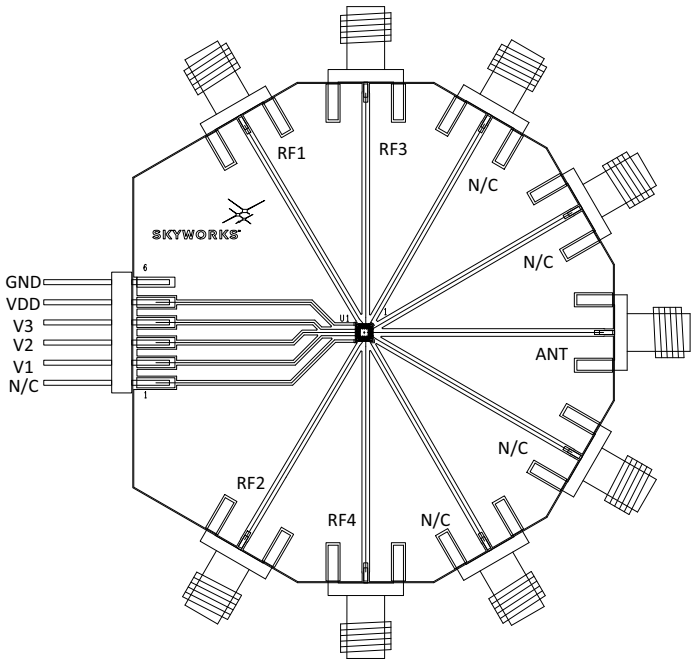


Figure 4. Evaluation Board Assembly Diagram

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKYA21029 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead- or lead-free soldering. For additional information, refer to the Skyworks Application Note, “Solder Reflow Information,” document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

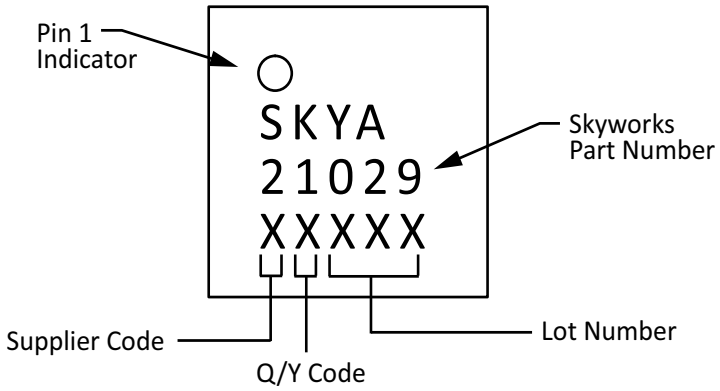
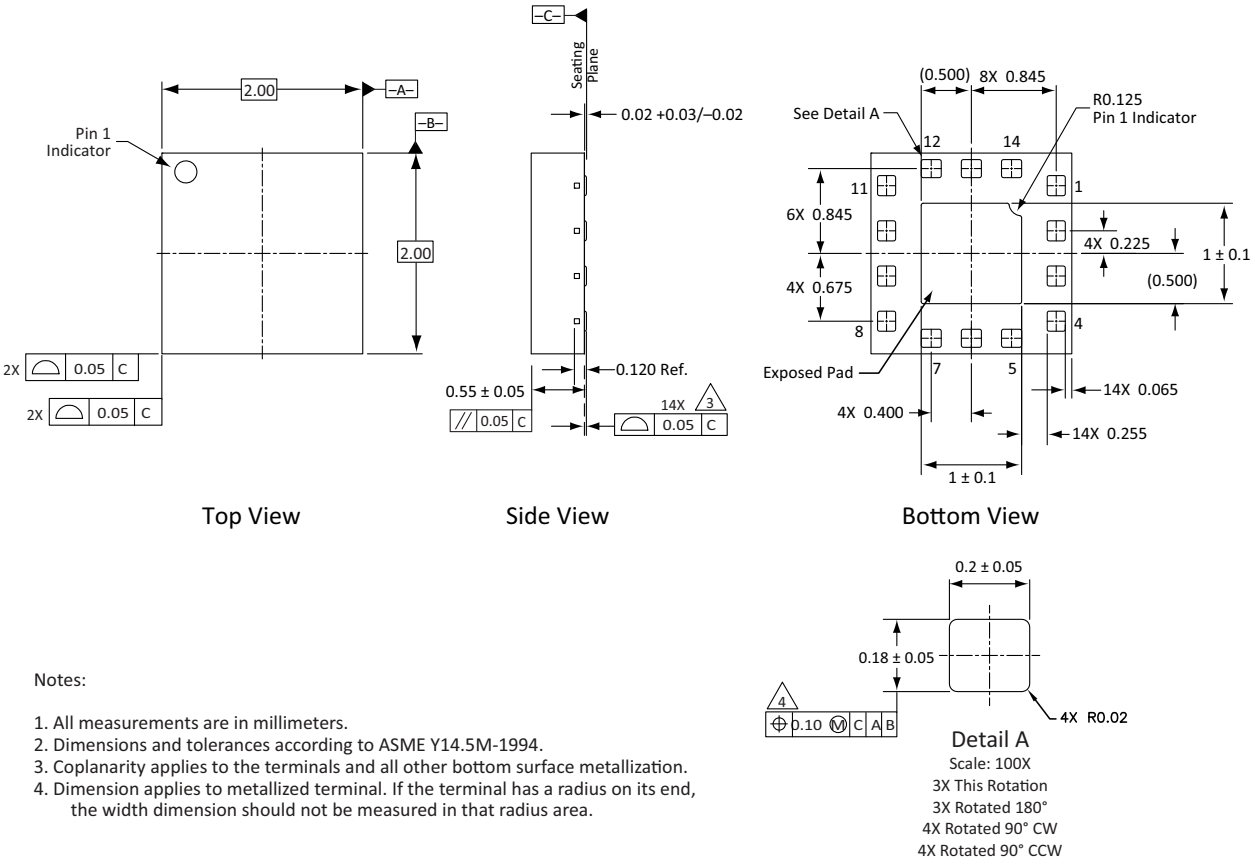


Figure 5. Typical Part Marking



Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the terminals and all other bottom surface metallization.
4. Dimension applies to metallized terminal. If the terminal has a radius on its end, the width dimension should not be measured in that radius area.

Figure 6. Package Dimensions

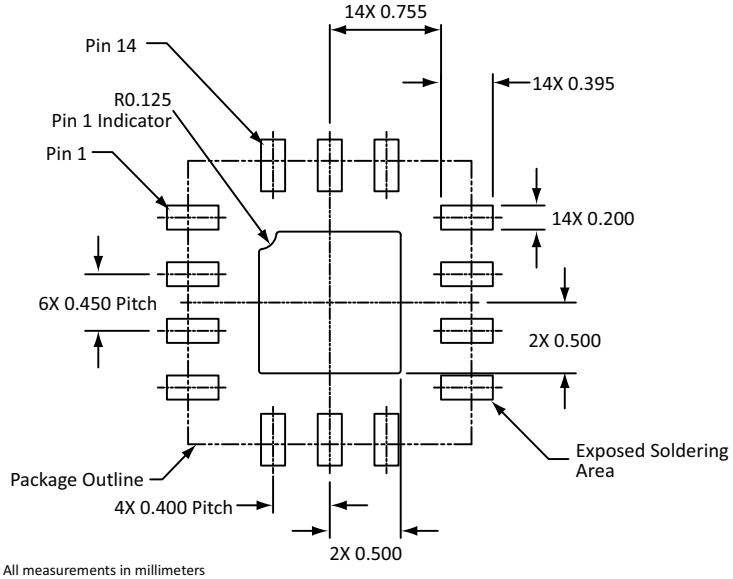
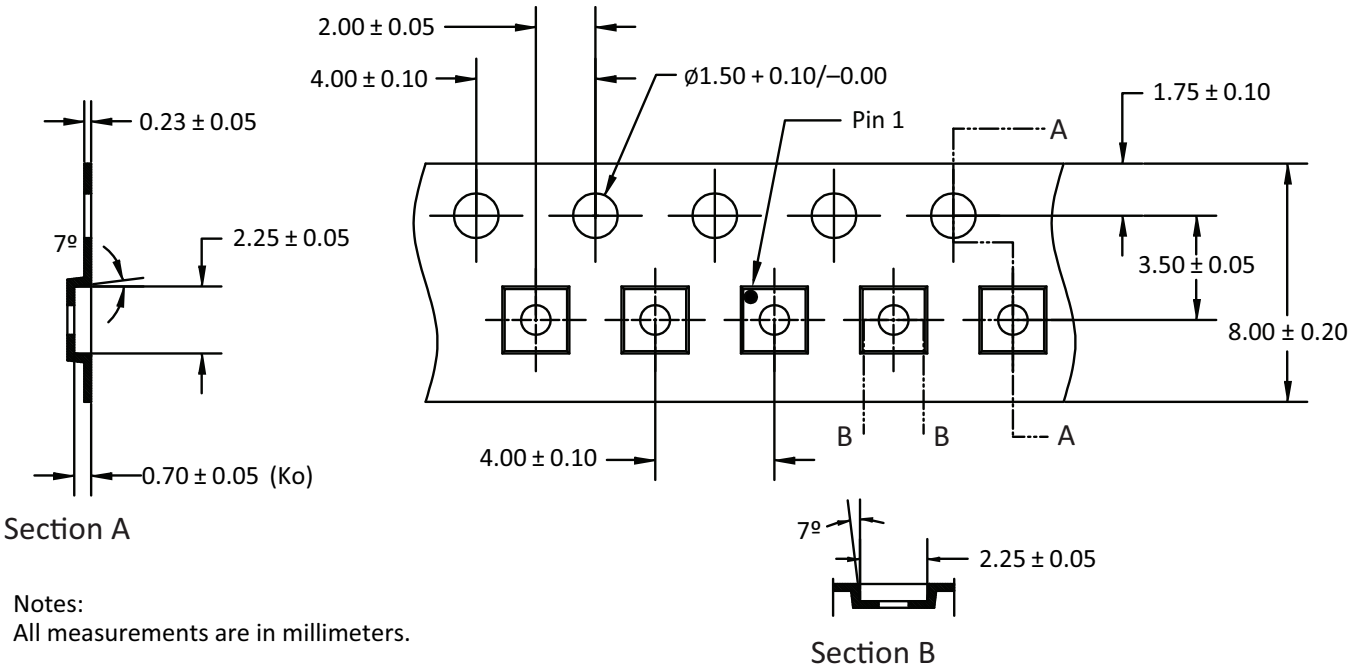


Figure 7. PCB Layout Footprint



Notes:
All measurements are in millimeters.

Figure 8. Tape and Reel Information

Ordering Information

Part Number	Description	Evaluation Board Part Number
SKYA21029	0.1 to 3.8 GHz SP4T Antenna Switch	SKYA21029-EK1

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