

SKYA21003: 0.1 to 8.5 GHz SPDT Switch

Automotive Applications

- Infotainment
- Telematics
- Remote keyless entry
- Automated toll systems
- Automotive smart home control systems
- In-cabin wireless systems
- GPS/Navigation

Features

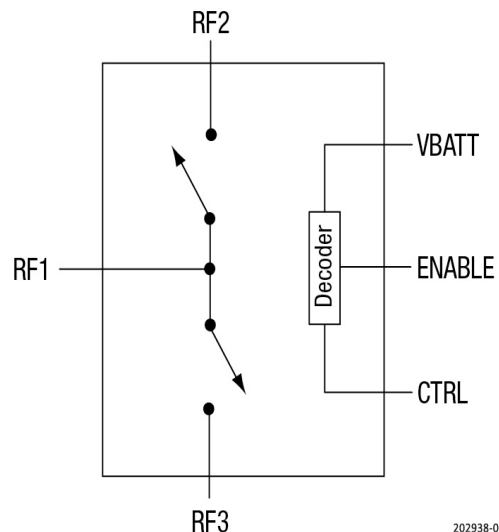
- AEC-Q100 Grade 2 qualified
- Operating temperature range: -40 to +105 °C
- Automotive Level 3 PPAP available
- IMDS material declaration available
- Independent BOM management to minimize PCN risk
- Broadband frequency support: 0.1 to 8.5 GHz
- Single bit control
- Rated for GSM power levels
- ESD: 1,500 V HBM Class 1C, 1,000 V CDM Class C3
- Low insertion loss: < +0.5 dBm at 2.5 GHz
- Excellent linearity: IMD3 < -105 dBm
- Lead (Pb)-free and RoHS-compliant (MSL-1 @ 260 °C per JEDEC J-STD-020)

Description

The SKYA21003 is a CMOS, silicon-on-insulator (SOI) single-pole, double-throw (SPDT) switch. The high linearity and low insertion loss of the SKYA21003 make it an ideal choice for WCDMA data card applications.

The switch is a “reflective short” on the isolated port.

The SKYA21003 SPDT switch is provided in a compact Quad Flat No-Lead (QFN) 2 x 2 mm package. A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

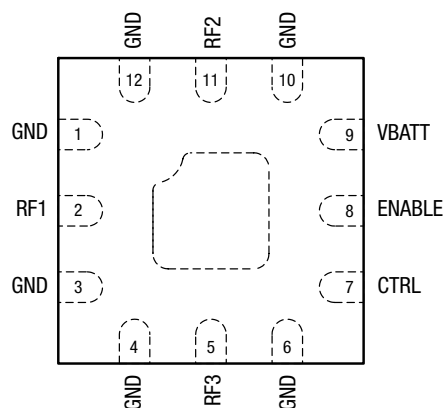


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Figure 1. SKYA21003 Block Diagram



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.



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Figure 2. SKYA21003 Pinout (Top View)

Table 1. SKYA21003 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	7	CTRL	DC control pin (See Table 4)
2	RF1	RF port 1	8	ENABLE	Enable pin (See Table 4)
3	GND	Ground	9	VBATT	DC power supply
4	GND	Ground	10	GND	Ground
5	RF3	RF port 3	11	RF2	RF port 2
6	GND	Ground	12	GND	Ground

Table 2. SKYA21003 Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	VBATT		5.0	V
Control voltage	VCTL		3.3	V
Enable voltage	VEN		3.3	V
Input power	PIN		+40	dBm
Junction temperature	TJ		+150	°C
Storage temperature	TSTG	−40	+125	°C
Operating temperature	TOP	−40	+105	°C
Hot switching GSM signal ²	HS		+35	dBm
Electrostatic discharge:				
— Human Body Model (HBM), Class 1C	ESD		1000	V
— Charged Device Model (CDM), Class C3			1000	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.

² Hot switching in the rare case of a damaged antenna does not reduce performance but is not recommended under normal operation.

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

Functional Description

The SKYA21003 is designed for medium to high power WCDMA data card switching applications. The device can also be used in a variety of other applications that require high performance RF switching such as WLANs (a/b/g/n).

An internal negative voltage generator and decoder eliminate the need for external DC blocking capacitors on the RF ports unless VDC is externally applied.

Switching is controlled by one voltage input (CTRL). Depending on the logic voltage level applied to the control pin, the RF1 pin is connected to one of two switched RF outputs (RF2 or RF3) using a low insertion loss path, while the path between the RF1 pin and the other RF output pin is in a high isolation state.

An internal decoder is used to provide the correct logic to the switch.

Shutdown mode is enabled by connecting the ENABLE pin to logic low. Shutdown mode reduces the overall current consumption of the device to 7 μ A, typical.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKYA21003 are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKYA21003 is determined by the logic provided in Table 4.

Typical performance characteristics of the SKYA21003 are illustrated in Figures 3 through 5.

Table 3. SKYA21003 Electrical Specifications¹
(V_{BATT} = 2.3 V to 4.8 V, CTRL = 0/1.65 V to 3.0 V, TOP = -40 to +105 °C, P_{IN} = 0 dBm,
Characteristic Impedance [Z₀] = 50 Ω, unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Insertion loss	IL	RF1 to RF2/RF3: 0.1 to 1.0 GHz 1.0 to 2.2 GHz 2.2 to 2.5 GHz 2.5 to 5.0 GHz 5.0 to 6.0 GHz 6.0 to 7.125 GHz 7.125 to 8.5 GHz		0.30 0.35 0.35 0.45 0.60 0.60 0.80	0.35 0.50 0.50 0.65 0.80 0.90 1.4	dB
Isolation	ISO	RF1 to RF2/RF3: 0.1 to 1.0 GHz 1.0 to 2.2 GHz 2.2 to 2.5 GHz 2.5 to 5.0 GHz 5.0 to 6.0 GHz 6.0 to 7.125 GHz 7.125 to 8.5 GHz	40 29 29 22 18 16 15	42 34 33 24 21 21 21		dB
Return loss	S ₁₁	RF1 to RF2/RF3, 0.1 to 8.5 GHz		12		dB
0.1 dB compression point	IP0.1dB	RF1 to RF2/RF3, 0.8 to 2.5 GHz		+29		dBm
Third order intermodulation distortion	IMD3	f _{FND} = 1950 MHz @ +20 dBm, f _{BLK} = 1760 MHz @ -15 dBm		-110	-105	dBm
Switching speed		50% VCTL to 10/90% RF ON time 50% VCTL to 90/10% RF OFF time 10/90% RF rise time 90/10% RF fall time		2 2 1 1.5	10 10 5 5	μs
Startup time ²		Shutdown state to any RF switch state		2	10	μs
DC Specifications						
Control voltage: High Low	VCTL_HIGH VCTL_LOW		1.35 0		3.0 0.4	V
Enable voltage: High Low	VCTL_HIGH VCTL_LOW		1.35 0		3.0 0.4	V
Supply voltage	VBATT		2.3		4.8	V
Control voltage low	IBATT	VBATT = 2.3 to 4.8 V		37	100	V
Supply current	ICTRL	CTRL = 1.8 V		1	5	μA
Shutdown mode supply current	IOFF	ENABLE = 0 V, VBATT = 2.3 V to 4.8 V		7	20	
¹ Performance is guaranteed only under the conditions listed in this table. ² Startup time refers to the amount of time it takes for the switch to be fully operational when coming out of shutdown mode (EN = 0).						

Table 4. SKYA21003 Truth Table¹

CTRL	ENABLE	MODE
1	1	RF1 TO RF2
0	1	RF1 TO RF3
X	0	Shutdown
¹ 1 = 1.65 TO 3.0 V s 0 = -0 to 0.4 V (control and enable voltages must be ≤VDD at all times). X = don't care Any state other than described in this table places the switch into an undefined state. An undefined state will not damage the device.		

Typical Performance Characteristics

(VBATT = 2.3 V to 4.8 V, CTRL = 0/1.65 V to 3.0 V, TOP = -40 to +105 °C, PIN = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω , Unless Otherwise Noted)

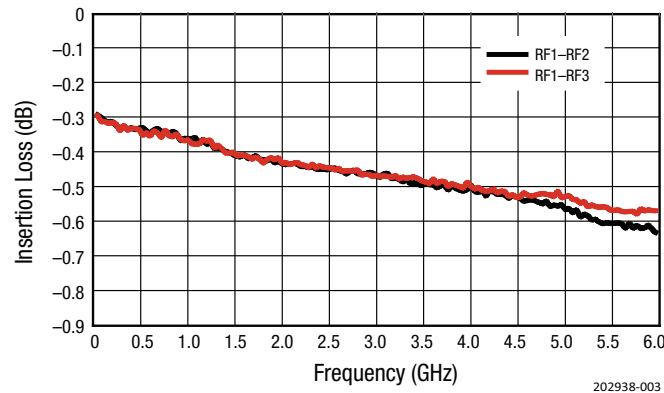


Figure 3. Insertion Loss vs Frequency

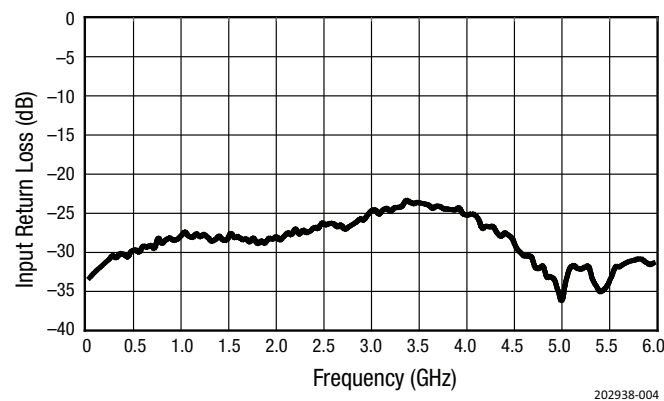


Figure 4. Input Return Loss vs Frequency

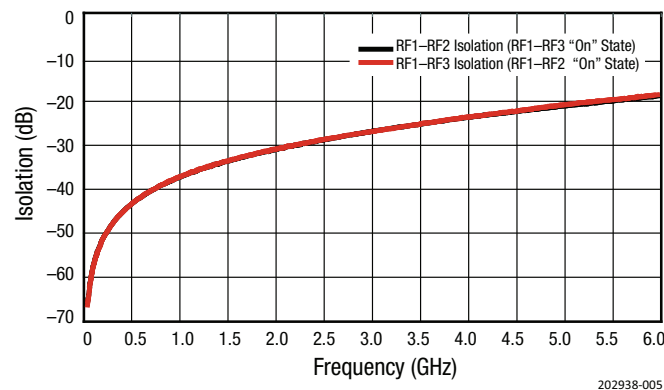
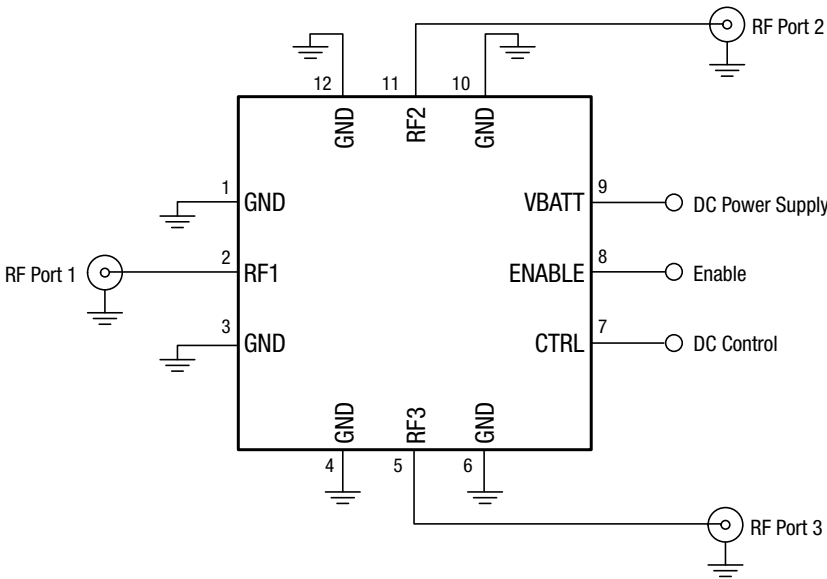


Figure 5. Input to Output Isolation vs Frequency

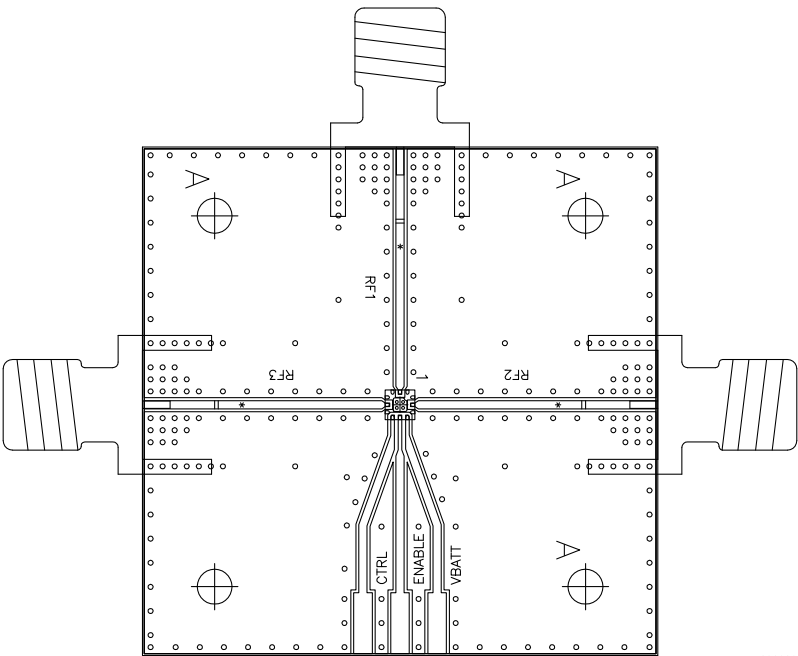
Evaluation Board Description

The SKYA21003 Evaluation Board is used to test the performance of the SKYA21003 SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 6. An assembly drawing for the Evaluation Board is shown in Figure 7.



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Figure 6. SKYA21003 Evaluation Board Schematic



202938-007

Figure 7. SKYA21003 Evaluation Board Assembly Diagram

Package Dimensions

The PCB layout footprint for the SKYA21003 is provided in Figure 8. A typical part marking is shown in Figure 9. Package dimensions are shown in Figure 10, and tape and reel dimensions are provided in Figure 11.

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 SKYA21003 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.

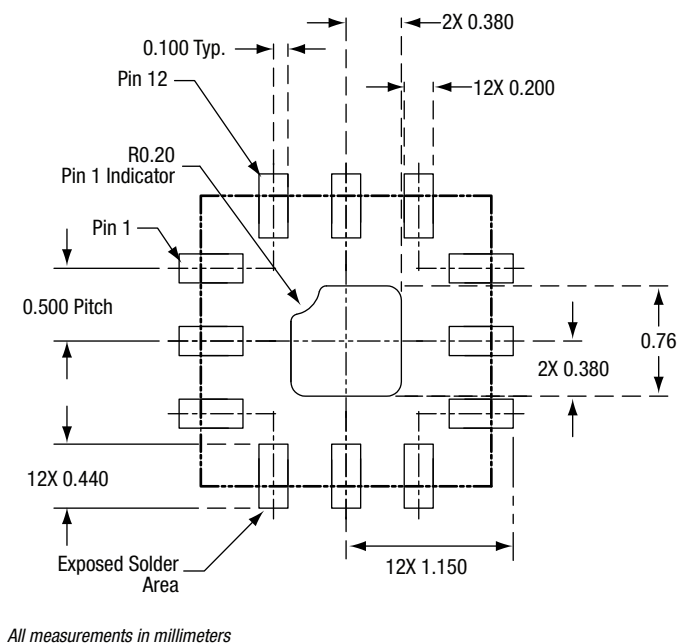
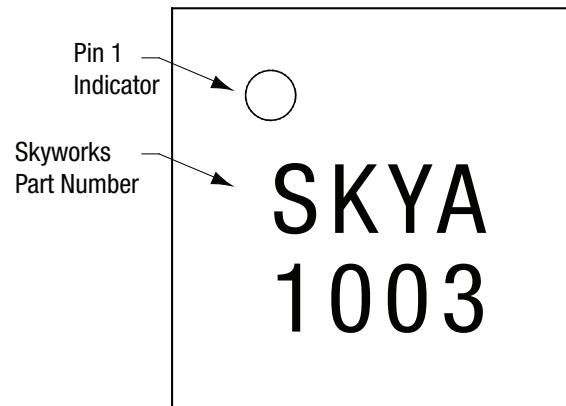
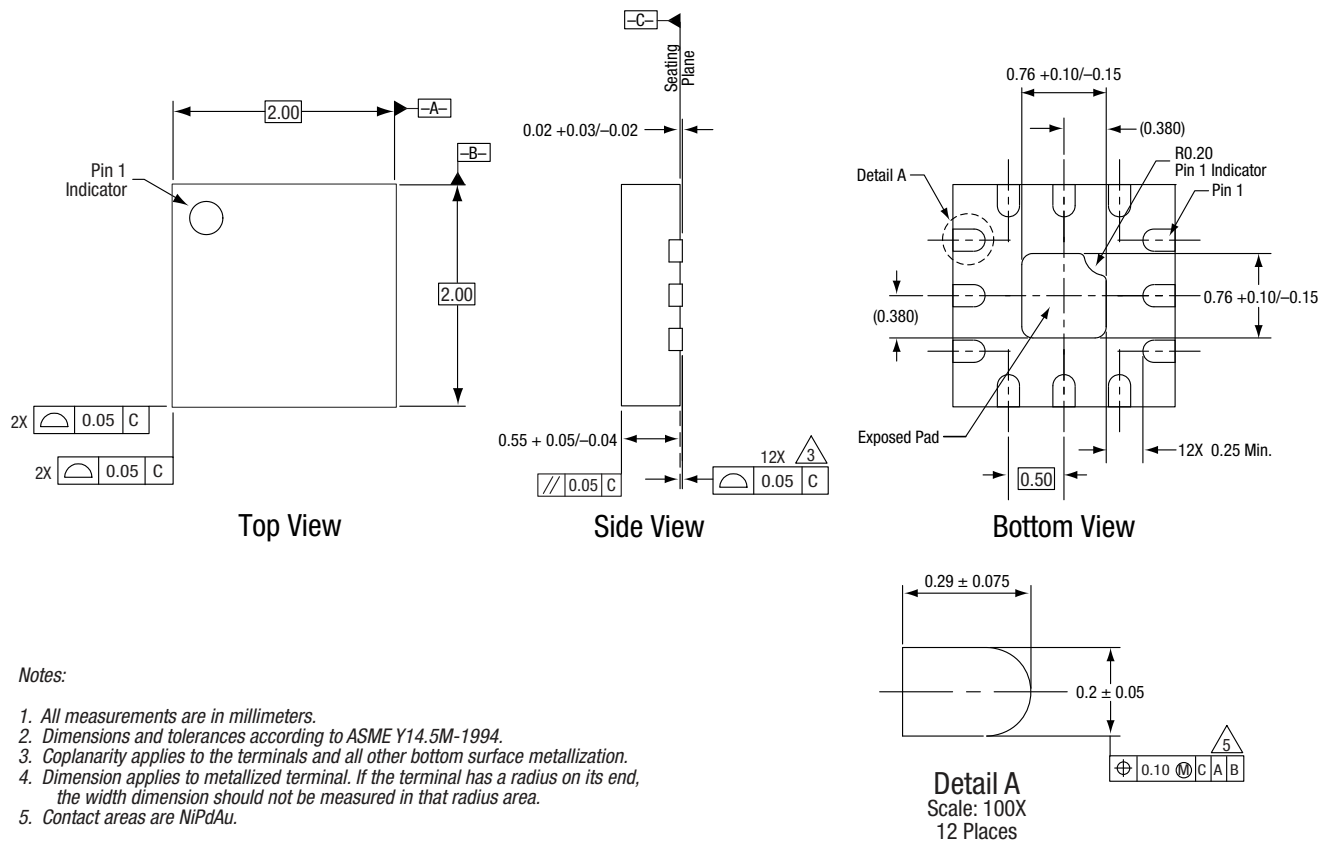


Figure 8. SKYA21003 PCB Layout Footprint (Top View)



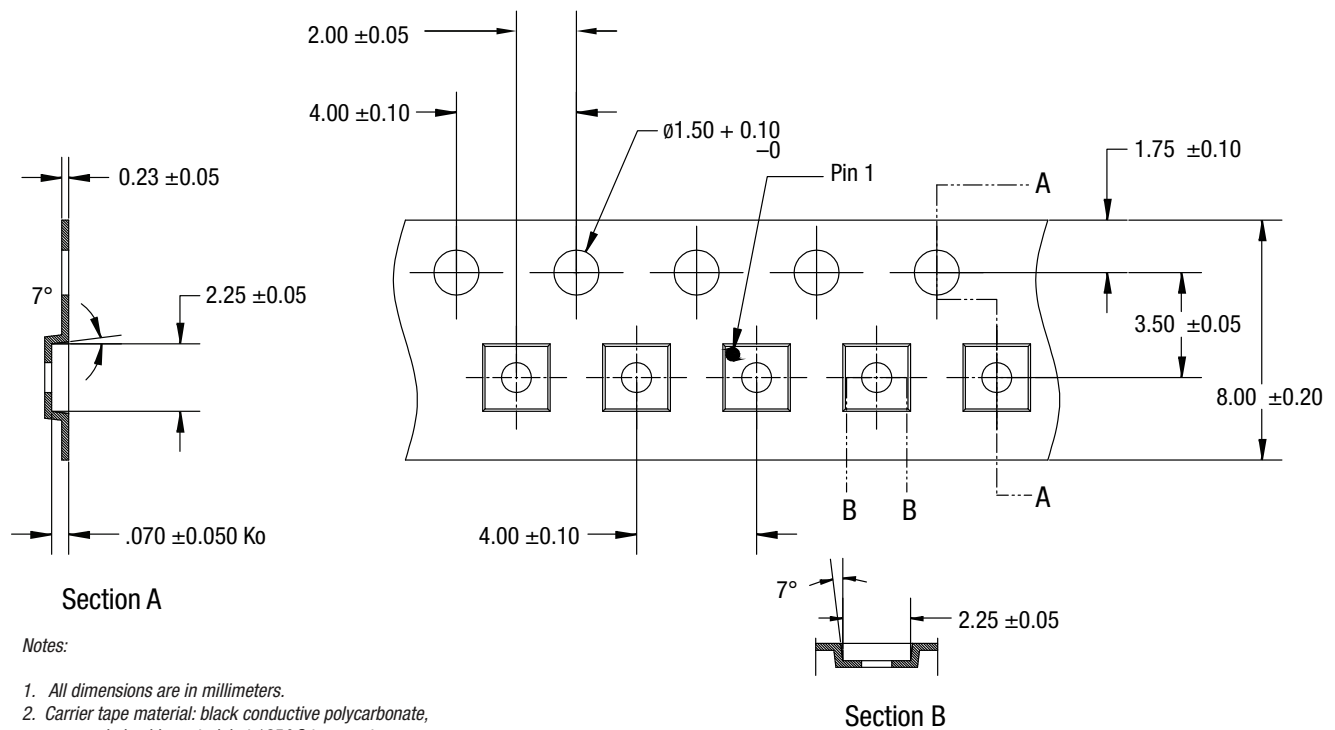
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Figure 9. SKYA21003 Typical Part Marking (Top View)



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Figure 10. SKYA21003 Package Dimensions



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Figure 11. SKYA21003 Tape and Reel Dimensions

Ordering Information

Part Number	Part Description	Evaluation Board Part Number
SKYA21003	0.1 to 8.5 GHz SPDT Switch	SKYA21003-EVB

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