

**DATA SHEET**

# SKYA21013: 0.1 to 6.0 GHz SPDT Switch

## Automotive Applications

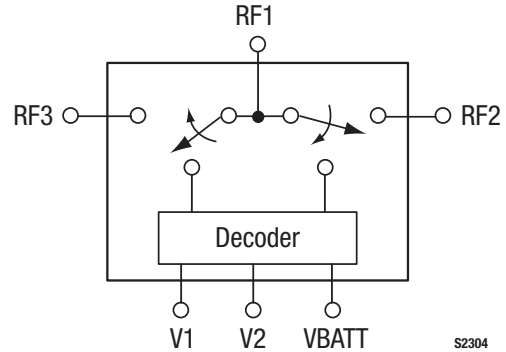
- Infotainment
- Automated toll systems
- Garage door opener
- 802.11 b/g/n WLAN, Bluetooth® systems
- Wireless control systems
- Outdoor lighting control
- Remote keyless entry
- Telematics
- GPS/Navigation

## Features

- Broadband frequency range: 0.1 to 6.0 GHz
- Low insertion loss: 0.35 dB @ 1 GHz, 0.8 dB @ 6 GHz
- No external DC blocking capacitors required
- Positive low control voltage: 1.65 to 3.0 V ( $V_{CTRL}$ ), 2.5 to 4.8 V ( $V_{BATT}$ )
- Small QFN (12-pin, 2 x 2 mm) package
- Designed and manufactured in an ISO/TS16949-certified facility
- JEDEC (JESD22) qualified at 25 °C
- Lead (Pb)-free and RoHS-compliant MSL1 @ 260 °C per JEDEC J-STD-020



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.



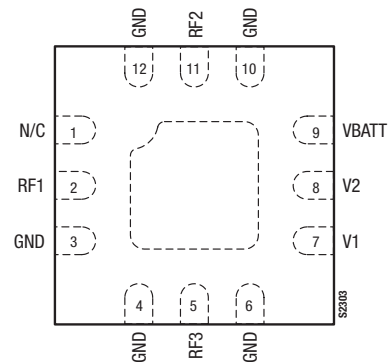
**Figure 1. SKYA21013 Block Diagram**

## Description

The SKYA21013 is a CMOS Silicon-on-Insulator (SOI) single-pole, double-throw (SPDT) WCDMA band switch. The high linearity performance and low insertion loss achieved by the device makes it an ideal choice for medium to high power WCDMA handset and data card applications.

The high 0.1 dB Input Compression Point (IP0.1dB) and advance proprietary fabrication process enable exceptional WCDMA harmonic and Adjacent Channel Power (ACP) performance. Excellent insertion loss and isolation is maintained over WCDMA bands 1 to 6 and 8 to 11.

The SKYA21013 SPDT switch is provided in a compact Quad Flat No-Lead (QFN) 2 x 2 mm package with 0.5 mm lead pitch for ease of manufacturing. 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.



**Figure 2. SKYA21013 Pinout – 12-Pin QFN (Top View)**

**Table 1. SKYA21013 Signal Descriptions**

Pin #	Name	Description	Pin #	Name	Description
1	N/C	No connection	7	V1	DC control voltage. See Table 4.
2	RF1	RF port 1	8	V2	DC control voltage. 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

**Note:** Exposed pad must be properly grounded using a low impedance path.

**Table 2. SKYA21013 Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V <sub>BATT</sub>	2.5	4.8	V
Control voltage	V <sub>CTL</sub>	1.65	3.00	V
Input power	P <sub>IN</sub>		+39	dBm
Storage temperature	T <sub>STG</sub>	-40	+125	°C
Operating temperature	T <sub>OP</sub>	-40	+85	°C

**Note 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.

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**CAUTION:** Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

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## Functional Description

Switching is controlled by two control voltage inputs (V1 and V2). Depending on the logic voltage level applied to these pins, 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 path is in a high isolation state.

An internal negative voltage generator and decoder eliminate the need for external DC blocking capacitors on the RF ports. No external components are required for proper operation. DC decoupling capacitors may be added on the VBATT and control lines if necessary.

Shutdown mode is enabled by connecting both control pins (V1 and V2) to logic low. This mode reduces the overall current consumption of the device to 5 μA typical.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKYA21013 are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKYA21013 is determined by the logic provided in Table 4.

Typical performance characteristics of the SKYA21013 are illustrated in Figures 3 through 5.

**Table 3. SKYA21013 Electrical Specifications (Note 1)**

(VBATT = 2.5 to 4.8 V, V1/V2 = 0/1.65 to 3.0 V, TOP = +25 °C, PIN = 0 dBm, Characteristic Impedance [Z0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
<b>RF Specifications</b>						
Insertion loss	IL	RF1 to RF2/RF3:				
		0.1 to 1.0 GHz		0.35	0.40	dB
		1.0 to 2.2 GHz		0.45	0.55	dB
		2.2 to 3.0 GHz		0.50	0.60	dB
		4.9 to 6.0 GHz		0.8	1.00	dB
Isolation	Iso	RF1 to RF2/RF3:				
		0.1 to 2.2 GHz	30	34		dB
		2.2 to 3.0 GHz	25	28		dB
		4.9 to 6.0 GHz	18	22		dB
Shutdown isolation	ISO_SHUTDOWN			16		dB
Return loss	IS11I	RF1 to RF2/RF3, 0.1 to 6.0 GHz		17		dB
0.1 dB Input Compression Point	IPO.1dB	RF1 to RF2/RF3, 0.5 to 6.0 GHz		+39		dBm
3 <sup>rd</sup> Order Input Intercept Point	IIP3	0.8 to 3.0 GHz, Δf = 1 MHz, PIN = +26 dBm/tone		+68		dBm
<b>Switching Speed Specifications</b>						
Switching speed @ 2.45 GHz		50% VCTL to 90% RF		1200		ns
		50% VCTL to 10% RF		1200		ns
		10% RF to 90% RF rise		200		ns
		90% RF to 10% RF fall		150		ns
Startup time		Shutdown to any RF switch state		20		μs
<b>DC Specifications</b>						
Control voltage: High Low	V1, V2		1.65 0		3.00 0.30	V V
Supply voltage	VBATT		2.5		4.8	V
Supply current	IBATT	VBATT = 3 V		40		μA
Control current	ICTL	V1/V2 = 1.8 V		2		μA
Shutdown mode supply current	I <sub>OFF</sub>	V1/V2 = 0 V, VBATT = 1.8 V		5		μA

**Note 1:** Performance is guaranteed only under the conditions listed in this Table.

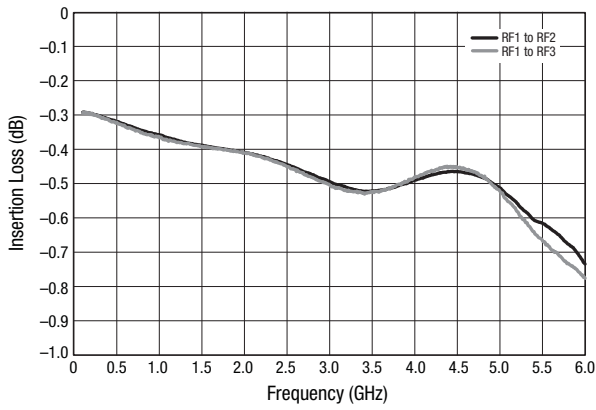
**Table 4. SKYA21013 Truth Table**

V1	V2	State
0	0	Shutdown mode
1	0	RF1 to RF2
0	1	RF1 to RF3

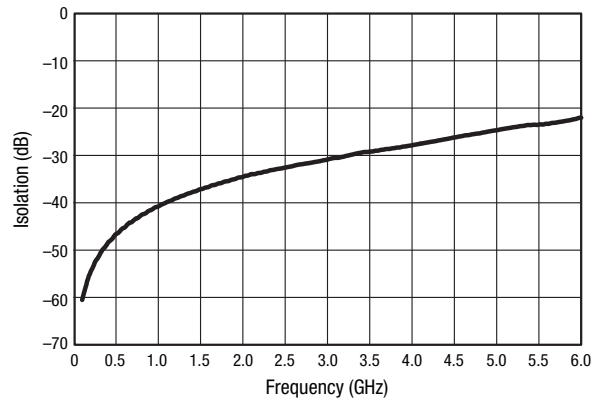
**Note:** 1 = 1.65 to 3.0 V  
0 = -0.1 to 0 V  
Any state other than described in this Table places the switch into an undefined state.

### Typical Performance Characteristics

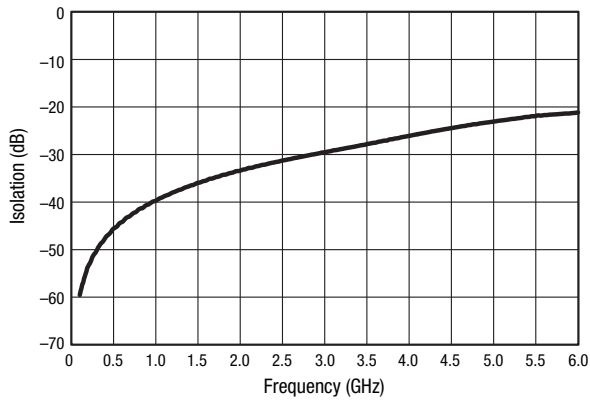
( $V_{CTL} = 0\text{ V}$  and  $+3.0\text{ V}$ ,  $T_{OP} = +25\text{ }^\circ\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Characteristic Impedance [ $Z_0$ ] =  $50\ \Omega$ , Unless Otherwise Noted)



**Figure 3. Typical Insertion Loss vs Frequency**



**Figure 4. Typical Isolation vs Frequency (RF1 to RF2 Insertion Loss State)**



**Figure 5. Typical Isolation vs Frequency (RF1 to RF3 Insertion Loss State)**

### Evaluation Board Description

The SKYA21013 Evaluation Board is used to test the performance of the SKYA21013 SPDT Switch.

An Evaluation Board schematic diagram is provided in Figure 6. An assembly drawing for the Evaluation Board is shown in Figure 7.

### Package Dimensions

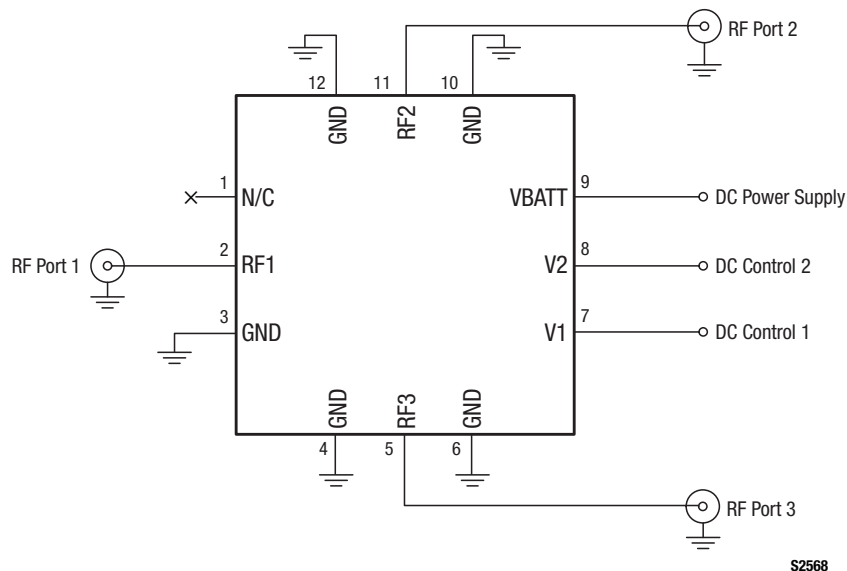
The PCB layout footprint for the SKYA21013 is provided in Figure 8. Typical case markings are shown in Figure 9. Package dimensions for the 12-pin QFN are shown in Figure 10, and tape and reel dimensions are provided in Figure 11.

### 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.

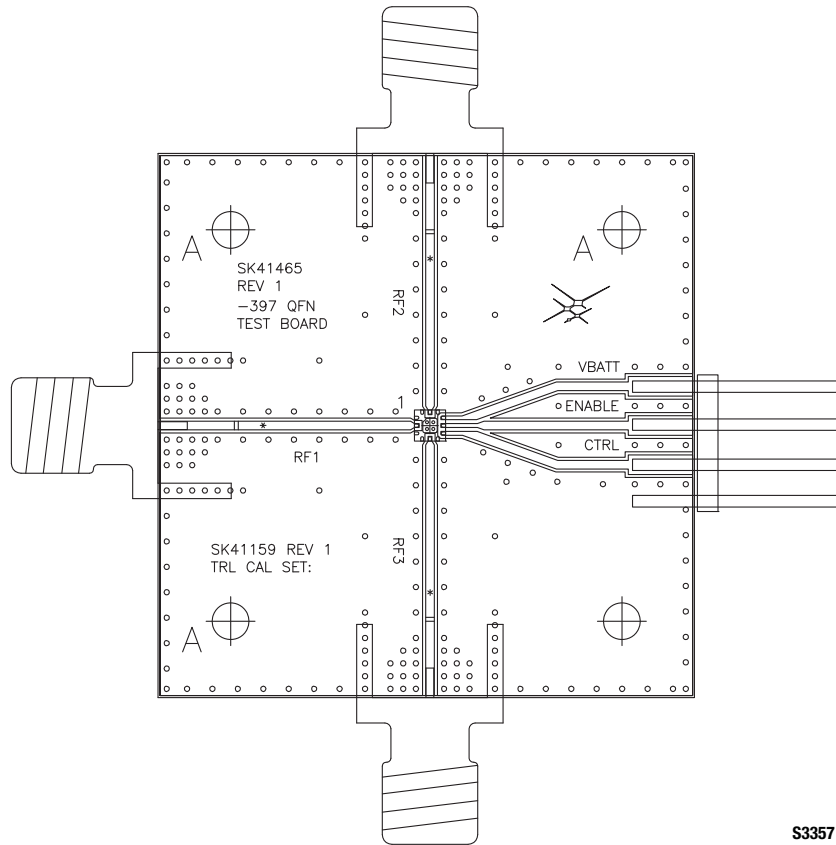
The SKYA21013 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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.



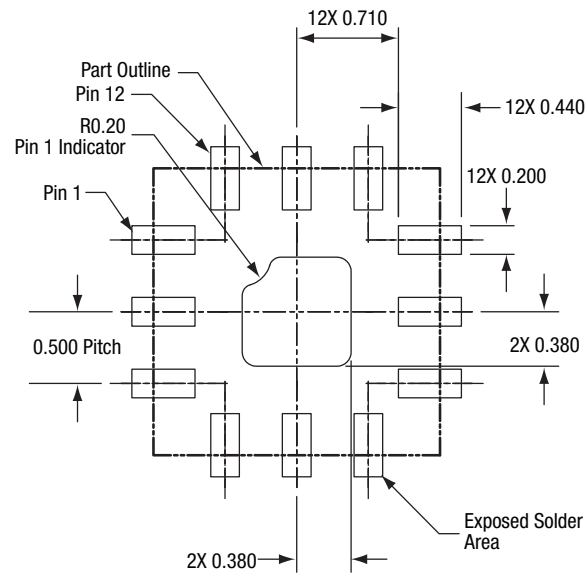
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Figure 6. SKYA21013 Evaluation Board Schematic



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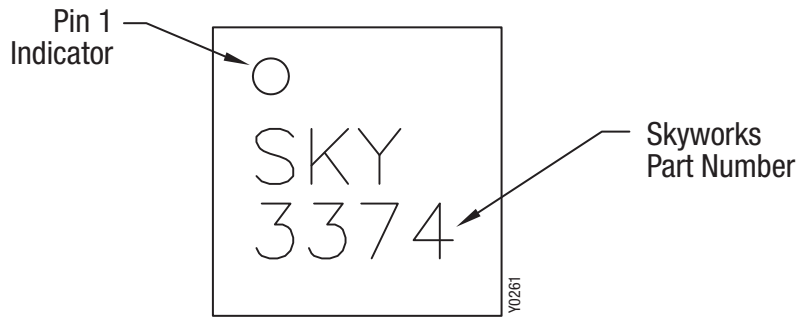
Figure 7. SKYA21013 Evaluation Board Assembly Diagram



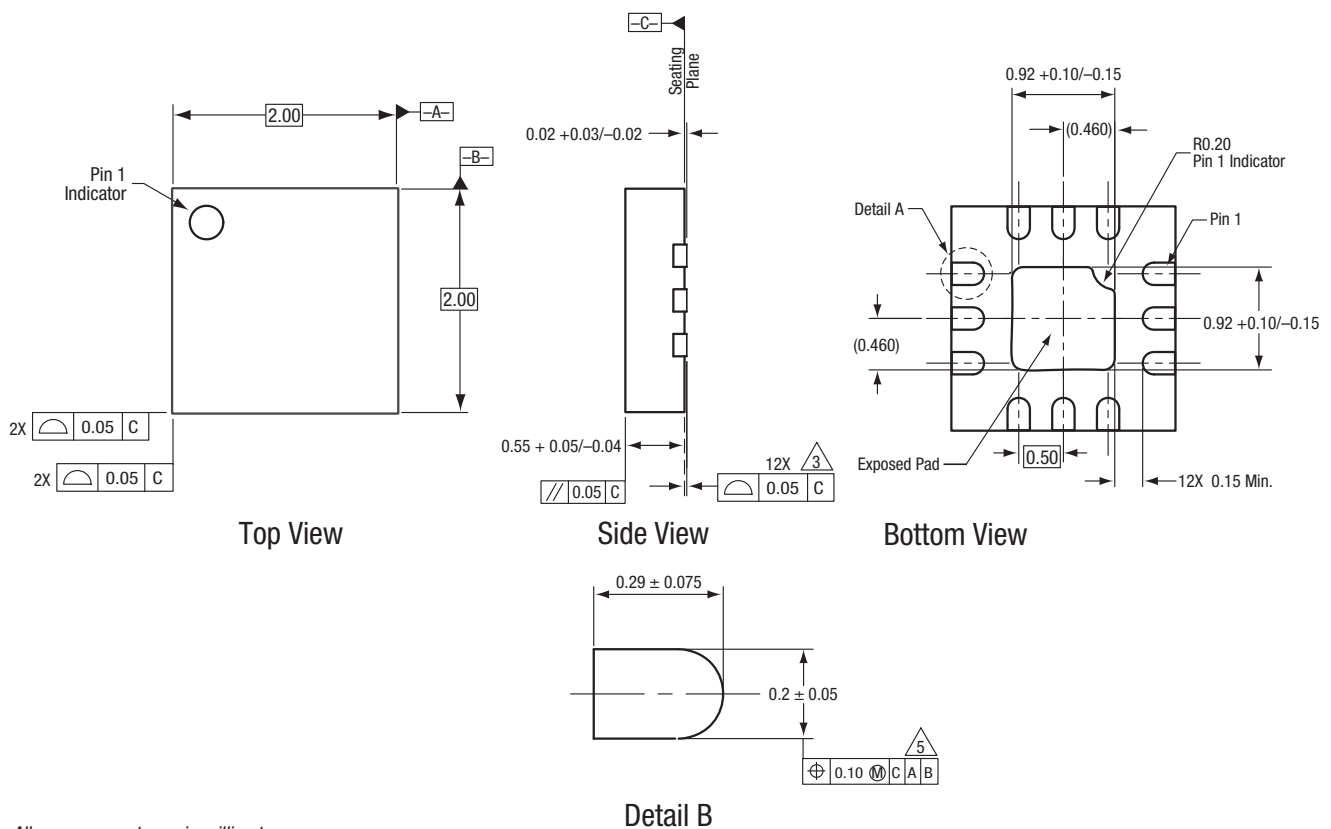
All measurements in millimeters

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Figure 8. SKYA21013 PCB Layout Footprint (Top View)



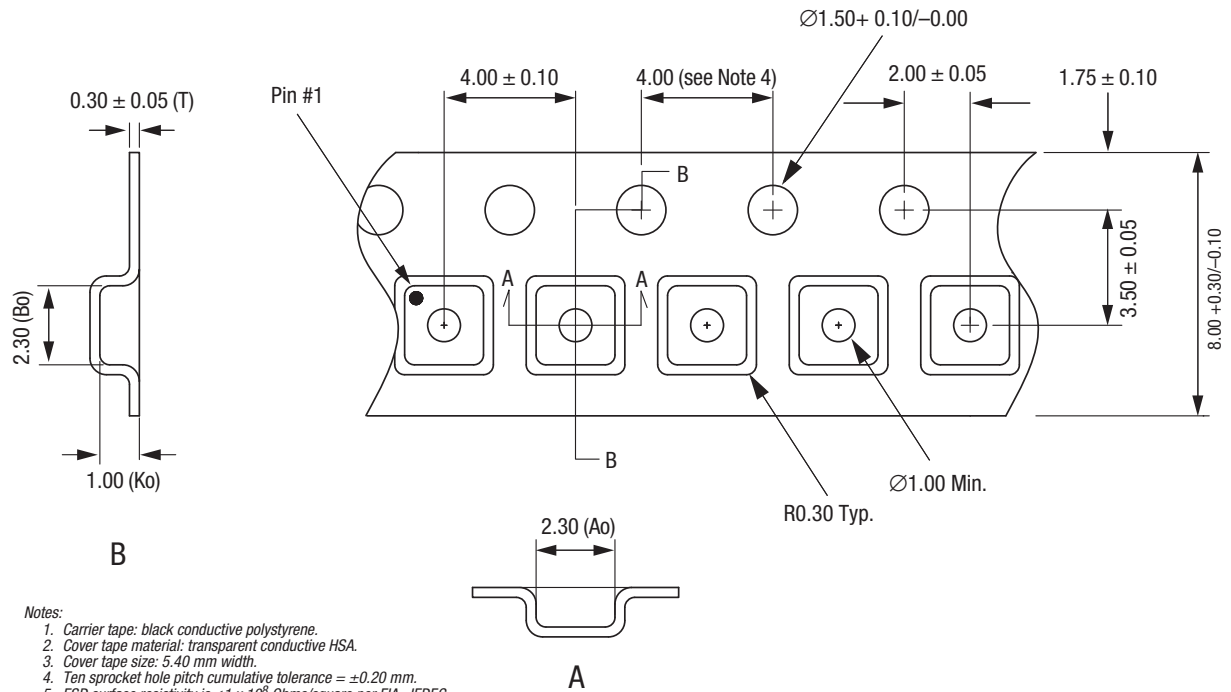
**Figure 9. Typical Case Markings (Top View)**



All measurements are in millimeters.  
 Dimensioning and tolerancing according to ASME Y14.5M-1994.  
 Coplanarity applies to the terminals and all other bottom surface metalization.  
 Dimension applies to metalized terminal. If the terminal has a radius on its end,  
 the width dimension should not be measured in that radius area.

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**Figure 10. SKYA21013 12-Pin QFN Package Dimensions**



- Notes:
1. Carrier tape: black conductive polystyrene.
  2. Cover tape material: transparent conductive HSA.
  3. Cover tape size: 5.40 mm width.
  4. Ten sprocket hole pitch cumulative tolerance = ±0.20 mm.
  5. ESD surface resistivity is  $\leq 1 \times 10^9$  Ohms/square per EIA, JEDEC tape and reel specification.
  6. Ao and Bo measurement point to be 0.30 mm from bottom pocket.
  7. All measurements are in millimeters.

S1601

Figure 11. SKYA21013 Tape and Reel Dimensions



**Ordering Information**

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKYA21013 SPDT Switch	SKYA21013	SKYA21013-EVB

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