DATA SHEET

SKYA21012: 20 MHz to 6.0 GHz GaAs 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

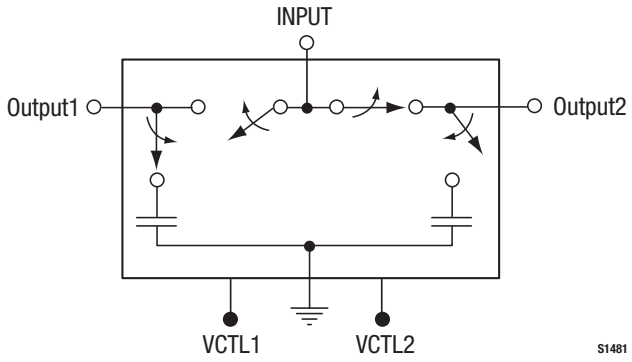


Figure 1. SKYA21012 Block Diagram

Features

- Positive voltage control (0 and 1.8 V to 0 and 5.0 V)
- Broadband frequency range: 20 MHz to 6.0 GHz
- Very low insertion loss, 0.35 dB typical @ 2.45 GHz
- High isolation, 24 dB typical @ 2.45 GHz
- Excellent linearity performance, IP0.5 dB = +30 dBm
- Ultraminiature, MLPD (6-pin, 1 x 1 mm) package
- Designed and manufactured in an ISO/TS16949-certified facility
- JEDEC (JESD22) qualified at 25 °C
- Lead (Pb)-free and RoHS-compliant MSL-1 @ 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.

Description

The SKYA21012 is a pHEMT GaAs FET I/C switch. The switch may be used in transmit/receive applications by connecting the RF common port (INPUT, pin 5) to either the OUTPUT1 or OUTPUT2 port (pin 1 or 3, respectively) using a low loss path (i.e., a positive voltage applied to either VCTL1 or VCTL2 pins). The switch is “reflective short” on the isolated port.

The switch is manufactured in a compact, 1 x 1 mm, 6-pin exposed pad plastic Micro Leadframe Package Dual (MLPD) 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.

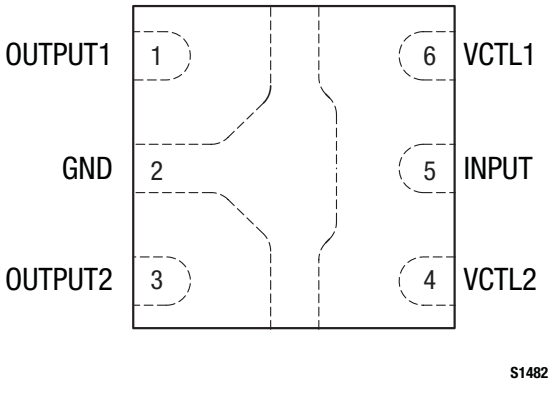


Figure 2. SKYA21012 Pinout – 6-Pin QFN (Top View)

Table 1. SKYA21012 Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	OUTPUT1	RF port. Must be DC blocked.	4	VCTL2	DC control voltage
2	GND	Ground	5	INPUT	RF port. Must be DC blocked.
3	OUTPUT2	RF port. Must be DC blocked.	6	VCTL1	DC control voltage

Table 2. SKYA21012 Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Input power >500 MHz, 5 V, CW >500 MHz, 2.7 V, CW 802.11g, 54 Mbps, 64 QAM, 2.4-2.5 GHz 802.11g, 54 Mbps, 64 QAM, 5.2-5.8 GHz	P_{IN}		 +32 +31 +26 +25	 dBm dBm dBm dBm
Storage temperature	T_{STG}	–65	+150	°C
Operating temperature	T_{OP}	–40	+85	°C

Note: 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.

***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.*

Table 3. SKYA21012 Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency	f	0.02		6.0	GHz
Control voltage: low high	 V_{CTL_L} V_{CTL_H}	 0 1.8		 0.2 5.0	 V V
Operating temperature	T_{OP}		+25		°C

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKYA21012 are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the SKYA21012 are illustrated in Figures 3 through 9.

The state of the SKYA21012 is determined by the logic provided in Table 5.

Table 4. SKYA21012 Electrical Specifications (Note 1)
(V_{CTL} = 0 V and +2.7 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Frequency	f		0.02		6.0	GHz
Insertion loss	IL	0.02-3.0 GHz 3.0-6.0 GHz		0.35 0.50	0.50 0.65	dB dB
Isolation	Iso	0.02-3.0 GHz 3.0-6.0 GHz	22 22	24 26		dB dB
Return loss (insertion loss state)		0.02-3.0 GHz 3.0-6.0 GHz		25 15		dB dB
Switching characteristics: Rise/fall time On/off time		 10/90% or 90/10% RF 50% V_{CTL} to 90/10% RF		 40 100		 ns ns
Video feedthrough				25		mV
0.5 dB Input Compression Point	IP0.5dB	V_{CTL} = 0 and 1.8 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 48 MHz	+21 +29	+22 +30 +26		dBm dBm dBm
Input IP3	IIP3	P_{IN} = +20 dBm/tone V_{CTL} = 0 and 1.8 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 2.45 GHz V_{CTL} = 1.8 V @ 5.8 GHz V_{CTL} = 2.7 V @ 5.8 GHz	 +30 +46	 +32 +50 +30 +46		 dBm dBm dBm dBm
Error Vector Magnitude	EVM	802.11a, 54 Mbps, P_{IN} = <+24 dBm, V_{CTL} = 2.7 V 802.11g, 54 Mbps, P_{IN} = <+25.5 dBm, V_{CTL} = 2.7 V		2.5 2.5		% %
Control voltage: Low High	 V_{CTL_L} V_{CTL_H}		 0 1.8	 2.7	 0.2 5.0	 V V
Supply current	I_{CC}	V_{CTL_L} = 0 V V_{CTL_H} = 5 V		5 5		µA µA

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

Typical Performance Characteristics

(V_{CTL} = 0 V and +2.7 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω, Blocking Capacitors = 100 pF, Bypass Capacitors = 33 pF, Unless Otherwise Noted)

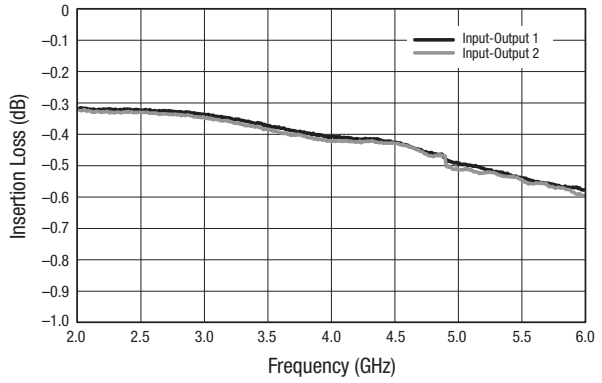


Figure 3. Typical Insertion Loss

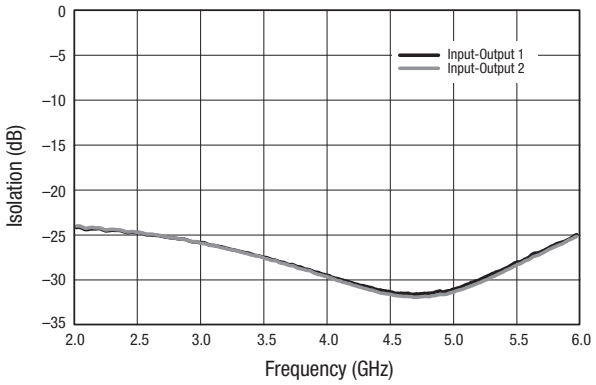


Figure 4. Typical Isolation

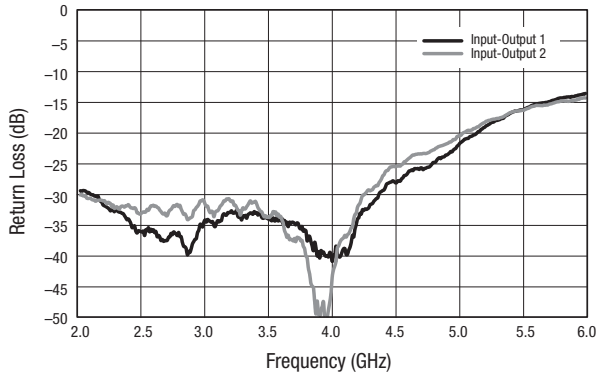


Figure 5. Typical Return Loss

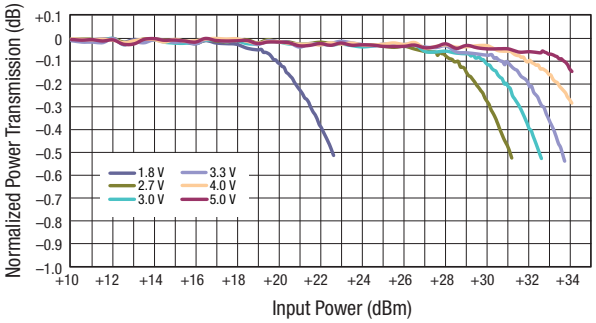


Figure 6. Compression vs Control Voltage (2450 MHz)

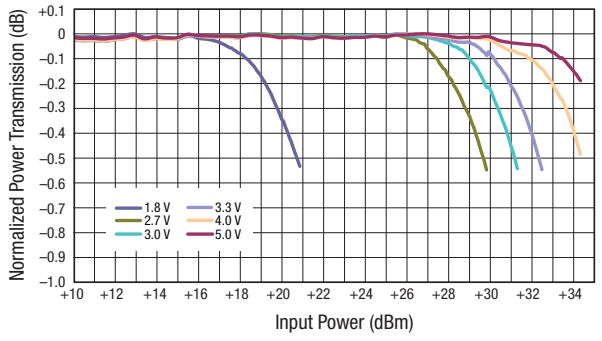


Figure 7. Compression vs Control Voltage (5.2 to 5.8 GHz)

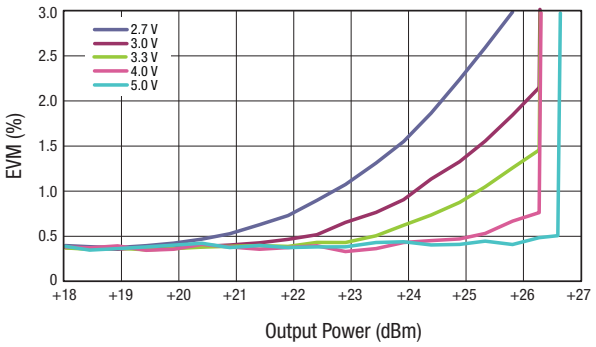


Figure 8. 802.11g EVM vs Output Power @ 2.45 GHz, 54 Mbps

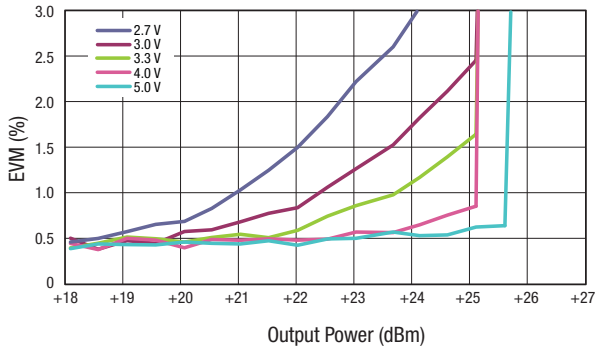


Figure 9. 802.11a EVM vs Output Power, 5.2 to 5.8 GHz, 54 Mbps

Table 5. SKYA21012 Truth Table

VCTL1 (Pin 6)	VCTL2 (Pin 4)	INPUT to OUTPUT1 Path	INPUT to OUTPUT2 Path
1	0	Isolation	Insertion loss
0	1	Insertion loss	Isolation

Note: "1" = +1.8 V to +5 V. "0" = 0 V to +0.2 V. Any state other than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Evaluation Board Description

The SKYA21012 Evaluation Board is used to test the performance of the SKYA21012 SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 10. An assembly drawing for the Evaluation Board is shown in Figure 11.

Package Dimensions

The PCB layout footprint for the SKYA21012 is provided in Figure 12. Typical case markings are shown in Figure 13. Package dimensions for the 6-pin MLPD are shown in Figure 14, and tape and reel dimensions are provided in Figure 15.

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 SKYA21012 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.

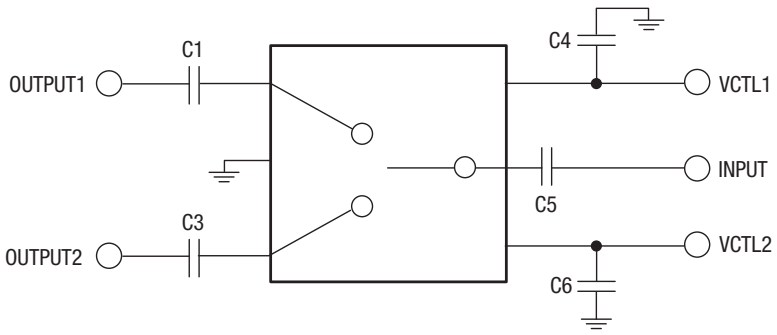


Figure 10. SKYA21012 Evaluation Board Schematic

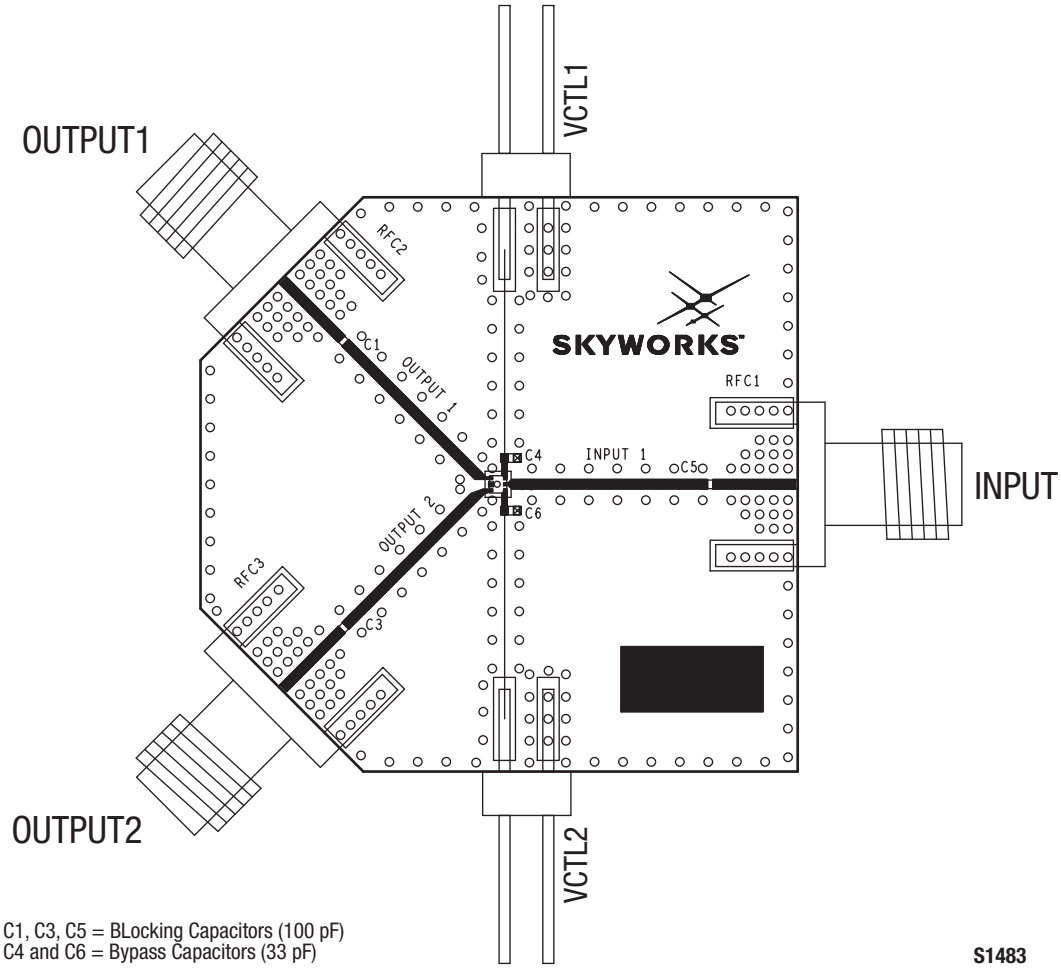


Figure 11. SKYA21012 Evaluation Board Assembly Diagram

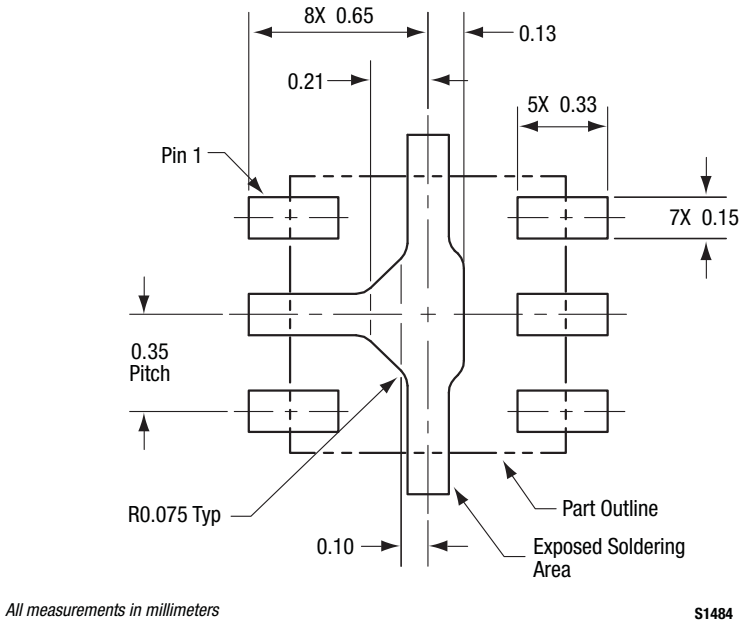


Figure 12. SKYA21012 PCB Layout Footprint
(Top View)

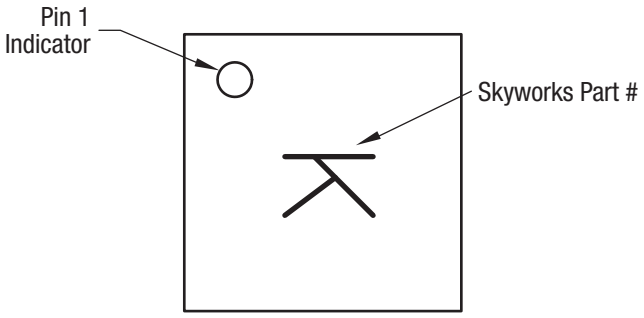


Figure 13. Typical Case Markings
(Top View)

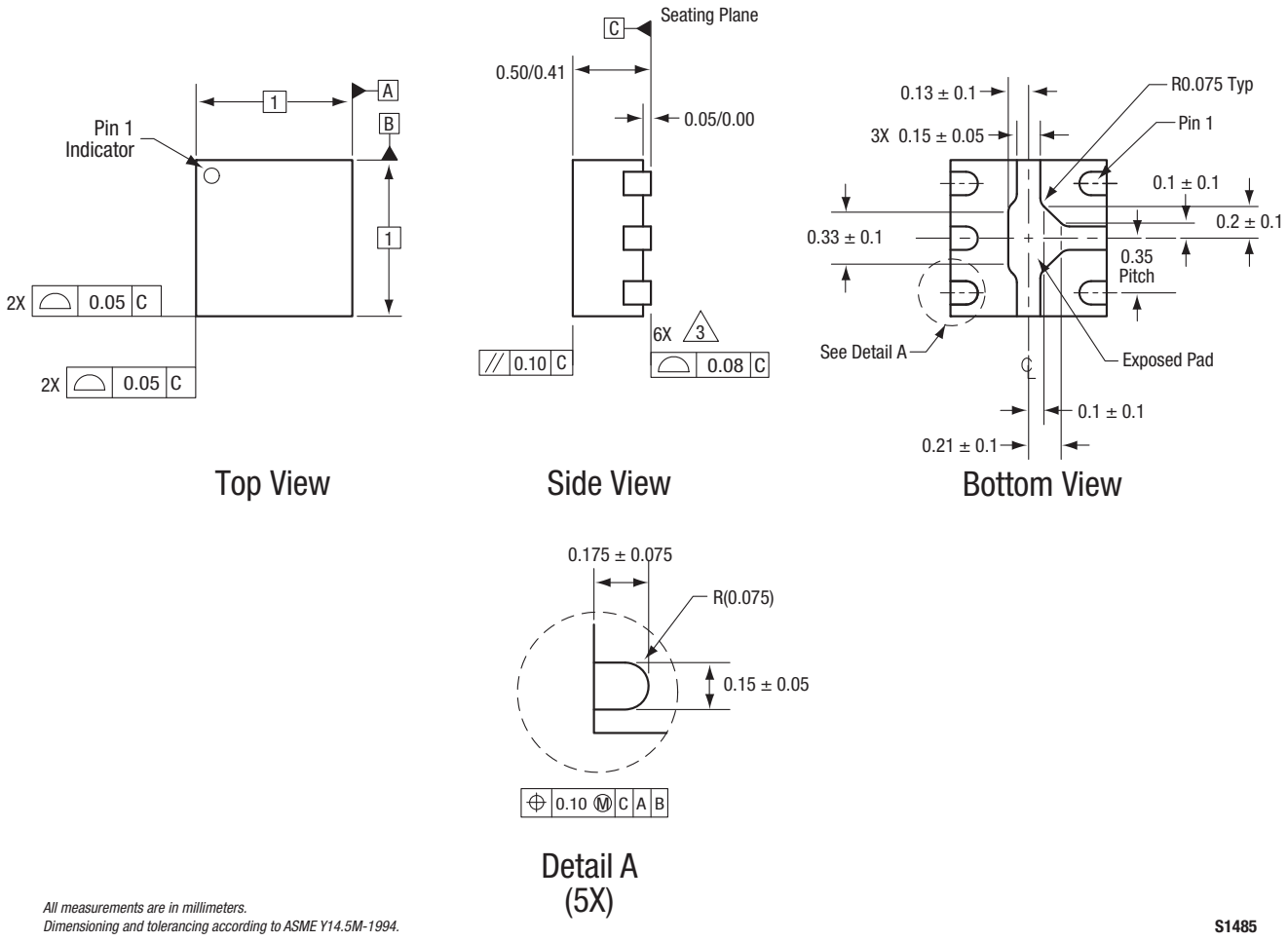
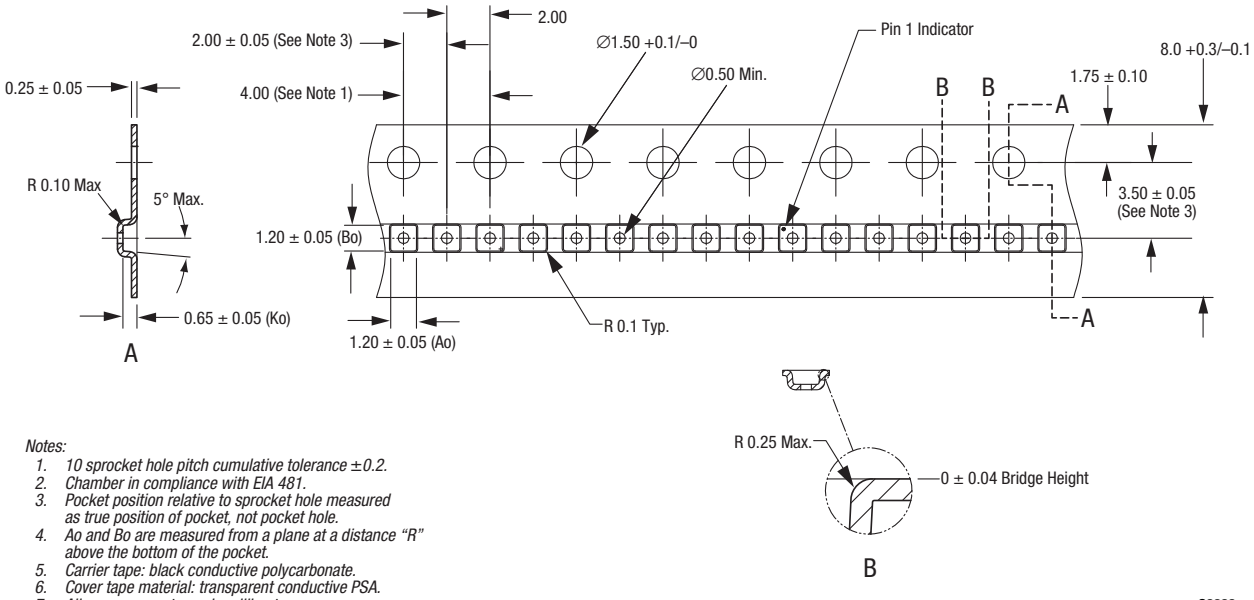


Figure 14. SKYA21012 6-Pin QFN Package Dimensions



Notes:

1. *10 sprocket hole pitch cumulative tolerance ±0.2.*
2. *Chamber in compliance with EIA 481.*
3. *Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.*
4. *Ao and Bo are measured from a plane at a distance "R" above the bottom of the pocket.*
5. *Carrier tape: black conductive polycarbonate.*
6. *Cover tape material: transparent conductive PSA.*
7. *All measurements are in millimeters.*

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Figure 15. SKYA21012 Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKYA21012 SPDT Switch	SKYA21012	SKYA21012-EVB