DATA SHEET

SKYA21038: 0.9 to 6.0 GHz SPDT Switch

Applications

- Automotive WLAN 802.11 a/b/g/n/ac networks
- WLAN repeaters
- ISM band radios
- Low power transmit/receive systems
- Automotive infotainment
- IoT M2M modules requiring enhanced robustness

Features

- AEC-Q100 grade 2 qualified
- Low insertion loss, 0.5 dB typical @ 2.45 GHz
- High isolation, 38 dB typical @ 2.45 GHz
- Excellent linearity performance, IP0.1dB = +31 dBm
- Single control logic
- 1.8 V and 3.3 V logic compatibility
- Wide 3 to 5 V supply voltage range
- Integrated DC blocking capacitors
- Wide operating temperature range, –40 °C to +105 °C
- Ultra-miniature, MLPD (6-pin, 1 x 1 x 0.5 mm) package (MSL1, 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the Skyworks Certificate of Conformance.

Description

The SKYA21038 is a single-pole, double-throw (SPDT) switch intended for mode switching in WLAN applications. Using advanced switching technologies, the SKYA21038 maintains low insertion loss and high isolation for all switching paths.

The high-linearity performance and low insertion loss achieved by the switch make it an ideal choice for low-power transmit/receive applications. Depending on the logic voltage applied to the control pin (VCTL), the INPUT pin is connected to one of the two switched RF outputs (OUTPUT1 or OUTPUT2) using a low insertion loss path, while the path between the INPUT pin and the other OUTPUT pin is in a high-isolation state. The switch is “reflective short” on the isolated port.

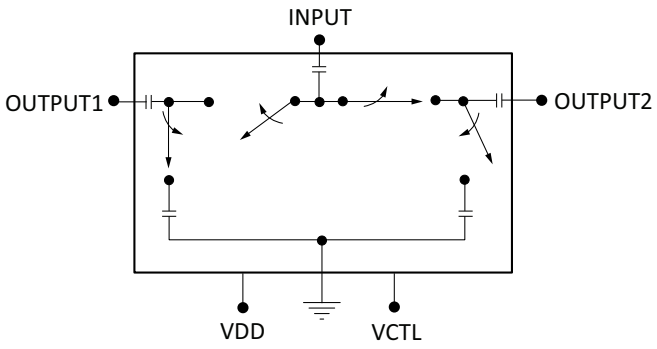


Figure 1. Functional Block Diagram

The SKYA21038 has integrated DC blocking capacitors, so no external DC blocking capacitors are required.

The switch is manufactured in a compact 6-pin exposed pad plastic Micro Lead-frame Package Dual (MLPD) package.

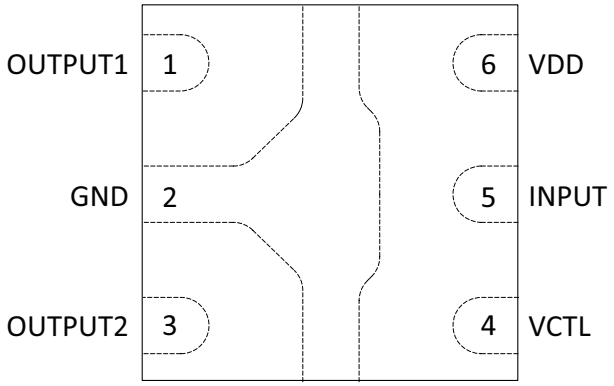


Figure 2. Pinout (Top View)

Table 1. Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	OUTPUT1	RF port	4	VCTL	DC control voltage
2	GND	Ground	5	INPUT	RF port
3	OUTPUT2	RF port	6	VDD	DC supply voltage

Electrical and Mechanical Specifications

Table 2. Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Input power	P_{IN}		+32	dBm
Supply voltage	V_{DD}		5.5	V
Control voltage	V_{CTL}		3.7	V
Storage temperature	T_{STG}	–65	+150	°C
Operating temperature	T_{OP}	–40	+105	°C
Electrostatic discharge: Charged Device Model (CDM), Class C3 Human Body Model (HBM), Class 1C	ESD		 1000 1000	 V V

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. 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. Recommended Operating Conditions[1]

Parameter	Symbol	Min	Typ	Max	Units
Operating frequency	fo	1.0		6.0	GHz
Supply voltage	V_{DD}	3	3.3	5	V
Control voltage: Low High	 V_{CTL_L} V_{CTL_H}	 0 1.6		 0.4 3.6	V
Operating temperature	T_{OP}	–40	+25	+105	°C

1. Exposure to maximum rating conditions for extended periods may reduce device reliability. Exceeding any of the limits listed here may result in permanent damage to the device.

Table 4. Electrical Specifications[1]

(V_{DD} = 3.3 V, V_{CTL} = 0 V and 1.8 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Insertion loss	IL	0.9 to 2.5 GHz, NTC[2] 4.8 to 6.0 GHz, NTC		0.5 0.7	0.70 0.95	dB
Isolation (INPUT to OUTPUT1to OUTPUT2)	ISO	0.9 to 2.5 GHz, NTC 4.8 to 6.0 GHz, NTC	34 18	38 22		dB
Isolation (OUTPUT1 to OUTPUT2)	ISO	0.9 to 2.5 GHz, NTC 4.8 to 6.0 GHz, NTC	33 18	36 22		dB
Return loss	RL	0.9 to 2.5 GHz, NTC 4.8 to 6.0 GHz, NTC	12 10	17 17		dB
P0.1dB compression point	P0.1dB	0.9 to 6.0 GHz, NTC		+31		dBm
Harmonics	2fo	P_{IN} = +24 dBm: fo = 2.4 GHz, NTC fo = 5.8 GHz, NTC		 –48 –50	 –42 –44	dBm
	3fo	P_{IN} = +24 dBm, fo = 2.4 GHz, NTC		–48	–42	dBm
Input IP3	IP3	P_{IN} = +20 dBm/tone: fo = 2.4 GHz, NTC fo = 5.8 GHz, NTC	 +50 +46	 +56 +50		dBm
Error vector magnitude	EVM	802.11a, 54 Mbps, P_{IN} = +24 dBm 802.11g, 54 Mbps, P_{IN} = +24 dBm		–45 –42	–39 –36	dB
Startup time	t_S	50% V_{DD} to 90% of RF		2	5	µs
Switching speed	t_{SW}	10% RF to 90% RF		300	450	ns
Supply current	I_{DD}	NTC		5	10	µA

1. Performance is assured only under the conditions listed in this table.
2. NTC = nominal test conditions.

Table 5. Electrical Specifications[1]

(V_{DD} = 3.3 V, V_{CTL} = 0 V and 1.8 V, T_{OP} = –40 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Insertion loss	IL	0.9 to 2.5 GHz, ETC[2] 4.8 to 6.0 GHz, ETC		0.5 0.7	0.65 0.95	dB
Isolation (INPUT to OUTPUT1 to OUTPUT2)	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	34 18	38 22		dB
Isolation (OUTPUT1 to OUTPUT2)	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	33 19	36 22		dB
Return loss	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	12 12	17 17		dB
P0.1 dB compression point	P0.1dB	0.9 to 6.0 GHz, ETC		31		dB
Harmonics	2fo	P_{IN} = +24 dBm: fo = 2.4 GHz, ETC fo = 5.8 GHz, ETC		–48 –50	–42 –42	dBm
	3fo	P_{IN} = +24 dBm: fo = 2.4 GHz, ETC		–48	–44	dBm
Input IP3	IP3	P_{IN} = +20 dBm/tone: fo = 2.4 GHz, ETC fo = 5.8 GHz, ETC	50 46	56 50		dBm
Error vector magnitude	EVM	P_{IN} = +24 dBm: 802.11a, 54 Mbps 802.11g, 54 Mbps		–45 –42	–40 –36	dB
Startup time	t_S	50% V_{DD} to 90% of RF		2	5	µs
Switching speed	t_{SW}	10% RF to 90% RF		300	450	ns
Supply current	I_{DD}	ETC[2]		5	10	µA

1. Performance is assured only under the conditions listed in this table.
2. ETC = extended test conditions.

Table 6. Electrical Specifications[1]

(V_{DD} = 3.3 V, V_{CTL} = 0 V and 1.8 V, T_{OP} = +105 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Insertion loss	IL	0.9 to 2.5 GHz, ETC[2] 4.8 to 6.0 GHz, ETC		0.5 0.7	0.90 1.00	dB
Isolation (INPUT to OUTPUT1 to OUTPUT2)	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	33 18	38 22		dB
Isolation (OUTPUT1 to OUTPUT2)	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	33 18	36 22		dB
Return loss	ISO	0.9 to 2.5 GHz, ETC 4.8 to 6.0 GHz, ETC	12 12	17 17		dB
P0.1dB compression point	P0.1dB	0.9 to 6.0 GHz, ETC		31		dB
Harmonics	2fo	P_{IN} = +24 dBm: fo = 2.4 GHz, ETC fo = 5.8 GHz, ETC		–48 –50	–42 –38	dBm
	3fo	P_{IN} = +24 dBm: fo = 2.4 GHz, ETC		–48	–44	dBm
Input IP3	IP3	P_{IN} = +20 dBm/tone: fo = 2.4 GHz, ETC fo = 5.8 GHz, ETC	50 46	56 50		dBm
Error vector magnitude	EVM	P_{IN} = +24 dBm: 802.11a, 54 Mbps 802.11g, 54 Mbps		–45 –42	–36 –36	dB dB
Startup time	t_S	50% V_{DD} to 90% of RF		2	5	µs
Switching speed	t_{SW}	10% RF to 90% RF		300	450	ns
Supply current	I_{DD}	ETC [2]		5	10	µA

1. Performance is assured only under the conditions listed in this table.
2. ETC = extended test conditions.

Table 7. Truth Table[1]

VDD (Pin 6)	VCTL (Pin 4)	INPUT to OUTPUT1 Path	INPUT to OUTPUT2 Path
1	0	Isolation	Insertion loss
1	1	Insertion loss	Isolation

1. “1” indicates VDD = 3 to 5 V, VCTL = 1.6 to 3.6 V.
“0” indicates VCTL = 0 to 0.4 V.
Any state other than described in this table places the switch into an undefined state. An undefined state will not damage the device.

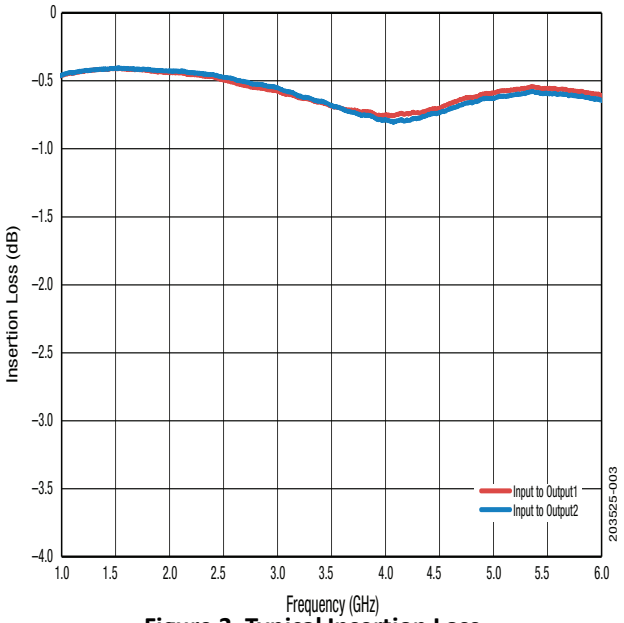


Figure 3. Typical Insertion Loss

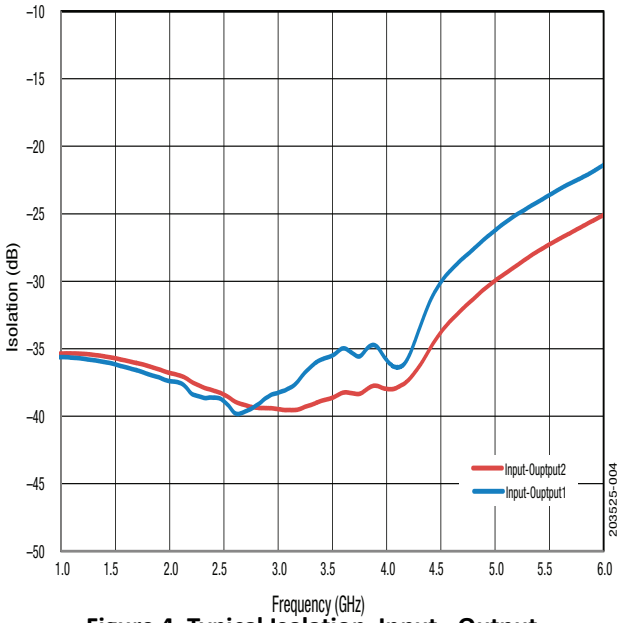


Figure 4. Typical Isolation, Input - Output

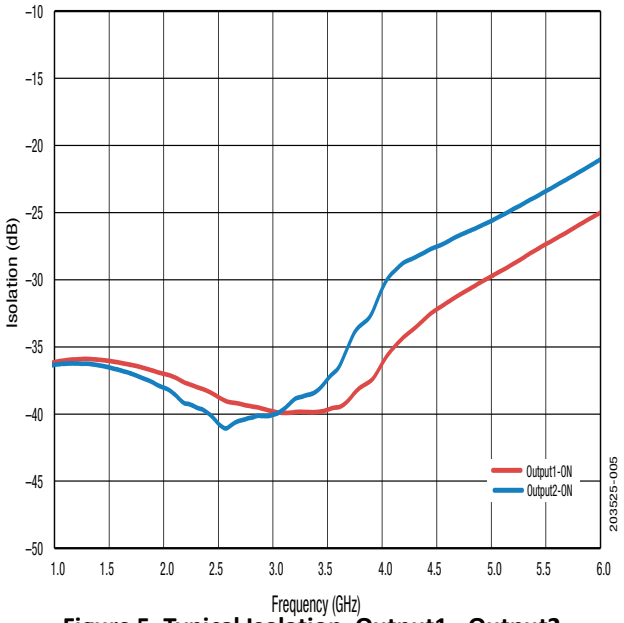


Figure 5. Typical Isolation, Output1 - Output2

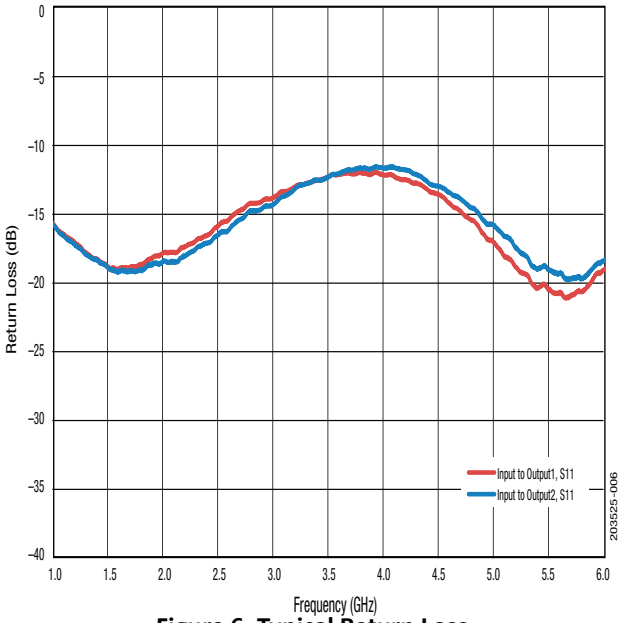


Figure 6. Typical Return Loss

Evaluation Board Description

An evaluation board is used to test the performance of the SKYA21038 SPDT switch. A schematic diagram is provided in Figure 7. An assembly drawing is shown in Figure 8.

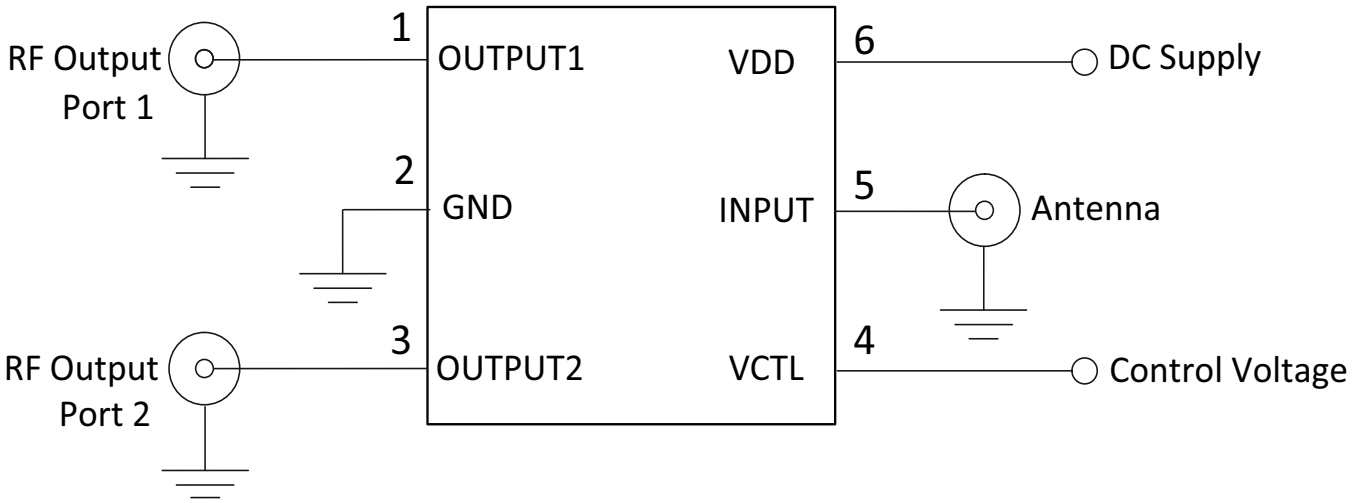


Figure 7. Evaluation Board Schematic

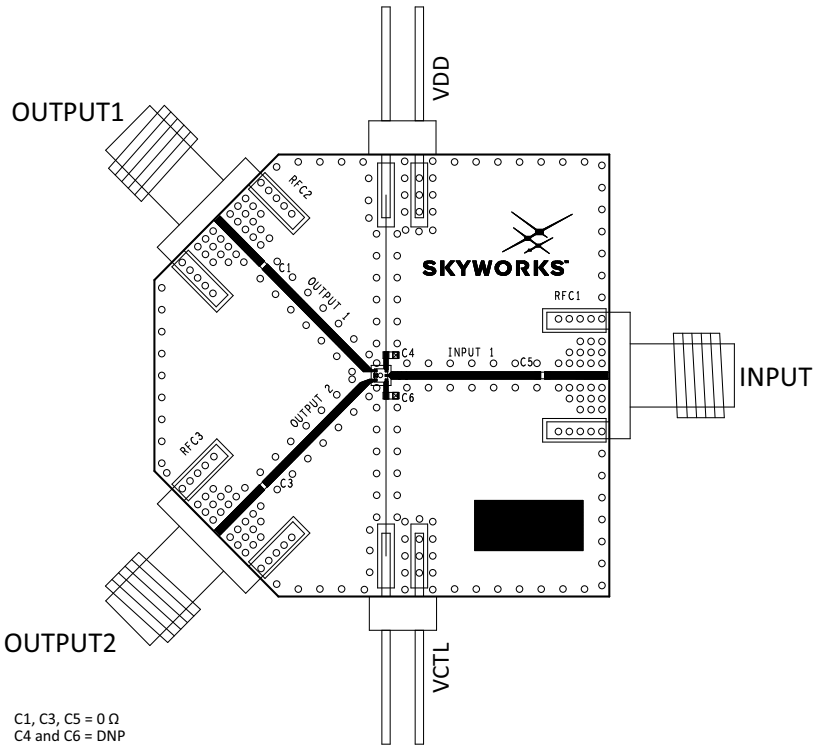


Figure 8. Evaluation Board Assembly Diagram

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 SKYA21038 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.

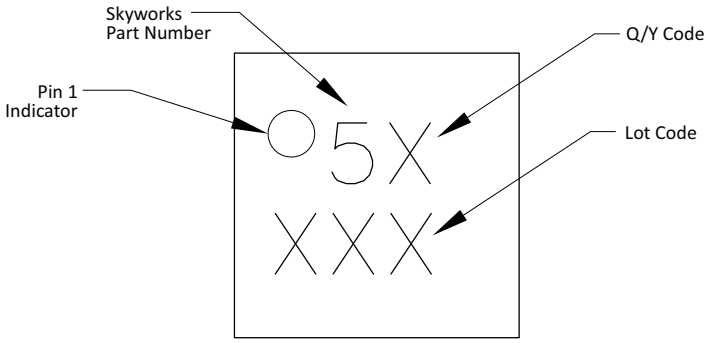
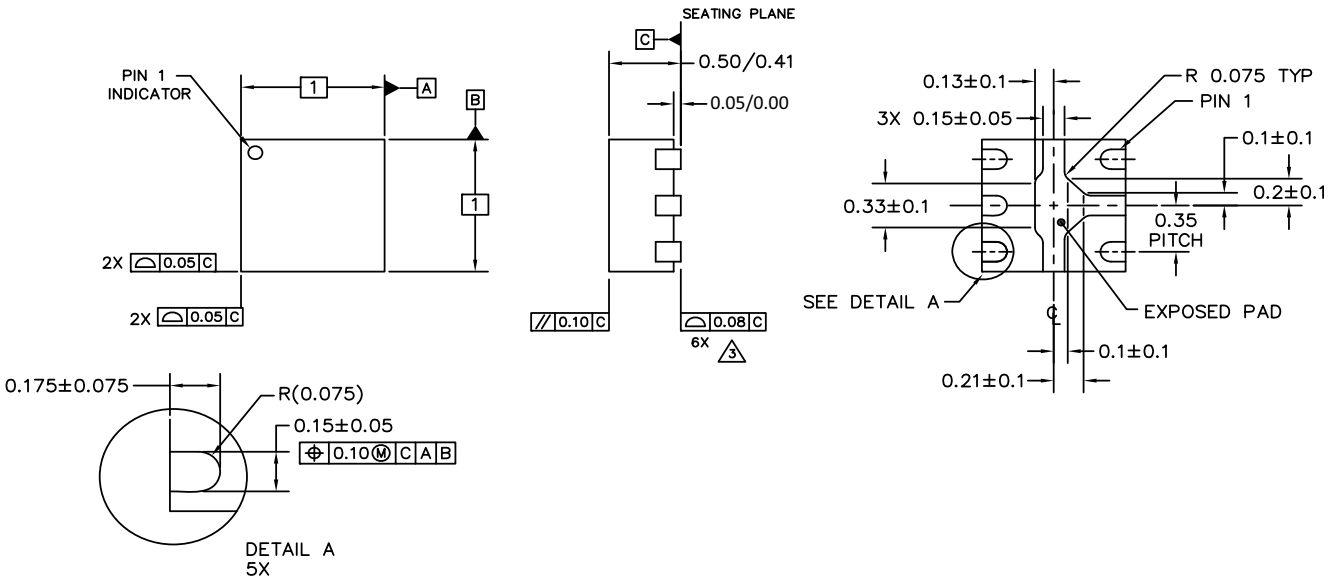
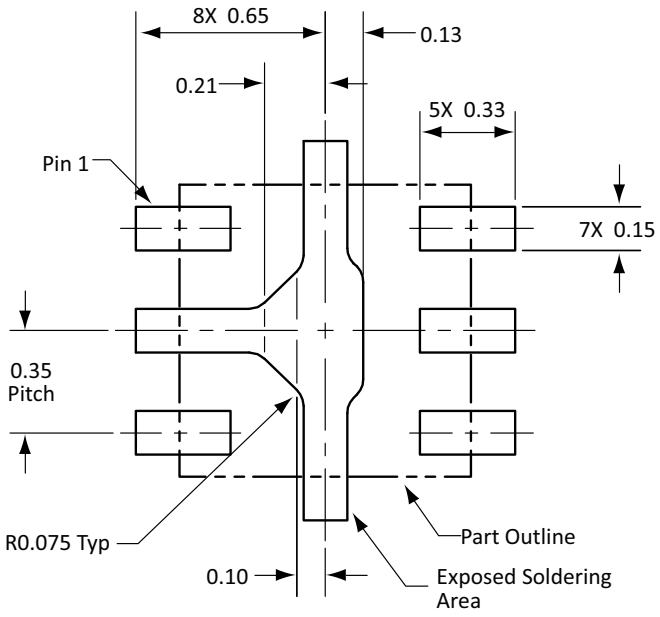


Figure 9. Typical Part Marking



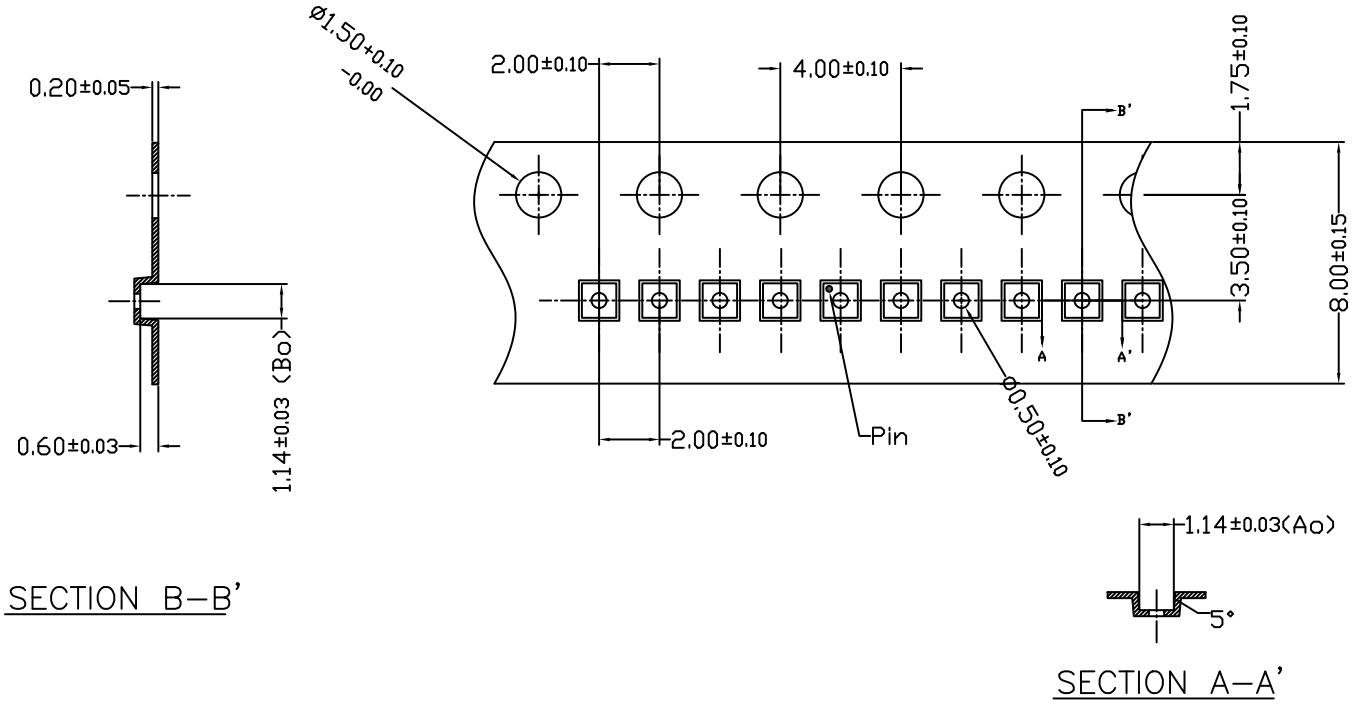
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M – 1994.
2. DIMENSIONS ARE IN MILLIMETERS.

Figure 10. Package Dimensions



All measurements in millimeters

Figure 11. PCB Layout Footprint



10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE : ±0.20mm
Ao & Bo MEASURED ON PLANE 0.30mm ABOVE THE BOTTOM OF THE POCKET.
ALL DIMENSIONS ARE IN MILLIMETERS.

Figure 12. Tape and Reel Information

Ordering Information

Part Number	Part Description	Evaluation Board Part Number
SKYA21038	0.9 to 6.0 GHz SPDT Switch	SKYA21038EK1