

**DATA SHEET**

# SKY13383-001: 0.1-4.0 GHz SP3T Switch

## Applications

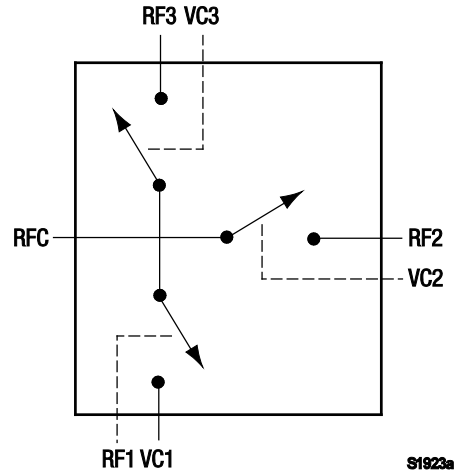
- WLAN b/g

## Features

- Broadband frequency range: 0.1 GHz to 4.0 GHz
- Positive control voltages: 2.7 V to 3.6 V
- Low insertion loss: 0.55 dB typical @ 2.5 GHz
- High isolation: 24 dB typical @ 2.5 GHz
- IP0.5dB: +29 dBm typical @ 3 V
- Small WLCSP (8-bump, 705 x 705 μm) 250 μm ball pitch package



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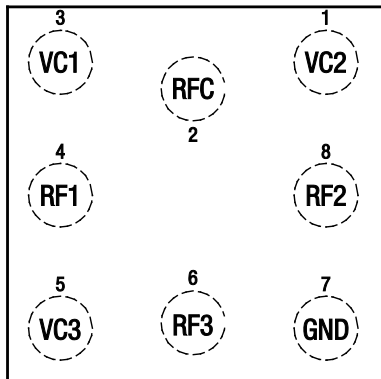
**Figure 1. SKY13383-001 Block Diagram**

## Description

The SKY13383-001 is a GaAs pHEMT Single-Pole, Triple-Throw (SP3T) switch designed for 2.4 GHz WLAN applications.

The SKY13383-001 is manufactured in a compact, 705 x 705 μm, 8-bump Wafer Level Chip Scale Package (WLCSP). The small footprint provides the industry's smallest PCB area needed to implement an integrated SP3T switch.

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 2. SKY13383-001 Pinout – 8-Bump WLCSP (Top View, Bumps Down)**

**Table 1. SKY13383-001 Signal Descriptions**

Pin #	Name	Description	Pin #	Name	Description
1	VC2	Switch logic control 2 (see Table 4)	5	VC3	Switch logic control 3 (see Table 4)
2	RFC	Antenna. Must be DC blocked for proper operation.	6	RF3	RF output port 3. Must be DC blocked for proper operation.
3	VC1	Switch logic control 1 (see Table 4)	7	GND	Ground
4	RF1	RF output port 1. Must be DC blocked for proper operation.	8	RF2	RF output port 2. Must be DC blocked for proper operation.

**Table 2. SKY13383-001 Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Units
Control voltage	VC1, VC2, VC3		6	V
RF input power	P <sub>IN</sub>		+35	dBm
Operating temperature	T <sub>OP</sub>	-40	+85	°C
Storage temperature	T <sub>STG</sub>	-40	+125	°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.

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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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### Technical Description

Switching is controlled by three control voltage inputs (VC1, VC2, and VC3). Depending on the logic voltage level applied to the control pins, the RFC pin is connected to one of three switched RF outputs (RF1, RF2, or RF3) using a low insertion loss path, while maintaining a high isolation path to the alternate ports.

DC blocking capacitors are required on all four RF ports for proper operation and to determine the lower frequency operation of the switch.

### Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13383-001 are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13383-001 is determined by the logic provided in Table 4.

Typical performance characteristics for the SKY13383-001 are illustrated in Figures 3 to 7.

**Table 3. SKY13383-001 Electrical Specifications (Note 1)**

(VC1 = VC2 = VC3 = 3/0 V, P<sub>IN</sub> = 0 dBm, T<sub>OP</sub> = +25 °C, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
<b>RF Specifications</b>						
Insertion loss	IL	2.4 to 2.5 GHz, RFC to RF1/RF2/RF3		0.55	0.65	dB
Isolation	Iso	2.4 to 2.5 GHz, RFC to RF1/RF2/RF3		24		dB
Input return loss	S <sub>11</sub>	2.4 to 2.5 GHz, RFC to RF1/RF2/RF3		22		dB
0.5 dB input compression point	IP0.5dB	2.4 to 2.5 GHz, RFC to RF1/RF2/RF3		+29		dBm
3 <sup>rd</sup> Order Input Intercept Point	IIP3	2.4 to 2.5 GHz, ΔF = 1 MHz, P <sub>IN</sub> = +17 dBm/tone		+54		dBm
Harmonics	2fo, 3fo	2.4 to 2.5 GHz		-70		dBc
Switching speed: 50% control voltage to 90/10% RF 90/10% RF or 10/90% RF				50 40		ns ns
<b>DC Specifications</b>						
Control voltage: High Low	V <sub>HIGH</sub> V <sub>LOW</sub>		2.7 -0.2	3 0	3.6 +0.2	V V
Control current	I <sub>CTL</sub>			5		μA

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

**Table 4. SKY13383-001 Truth Table**

VC1	VC2	VC3	RF1	RF2	RF3
1	0	0	On	Off	Off
0	1	0	Off	On	Off
0	0	1	Off	Off	On

**Note:** "0" = -0.2 V to +0.2 V. "1" = +2.7 V to +3.6 V. "On" = Insertion loss state. "Off" = Isolation state. Any state other than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

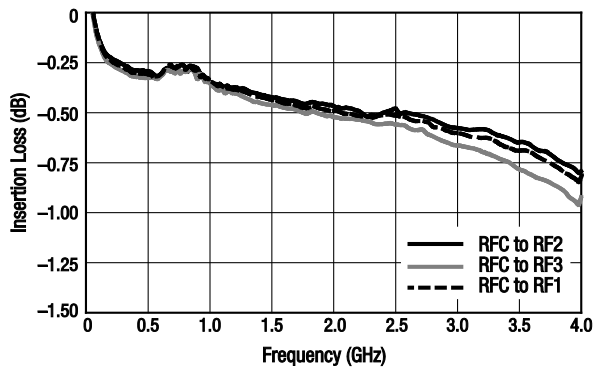


Figure 3. Insertion Loss vs Frequency

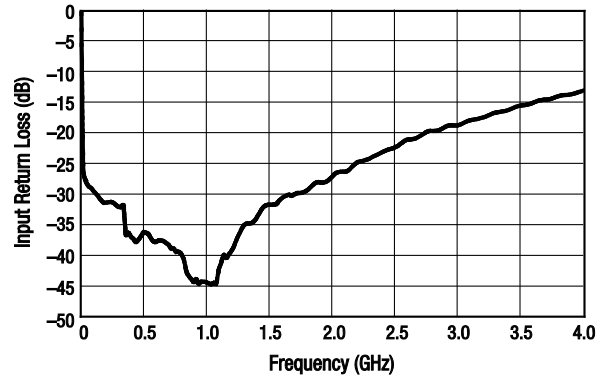


Figure 4. Input Return Loss vs Frequency

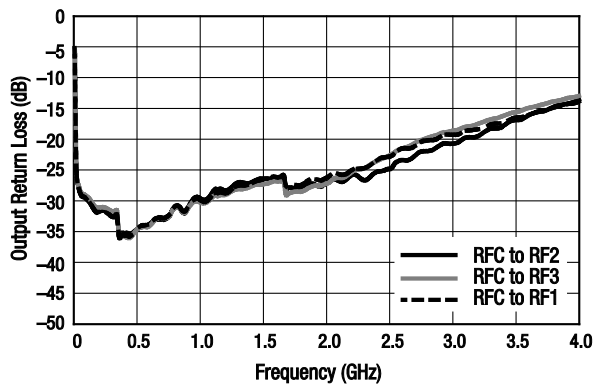


Figure 5. Output Return Loss vs Frequency

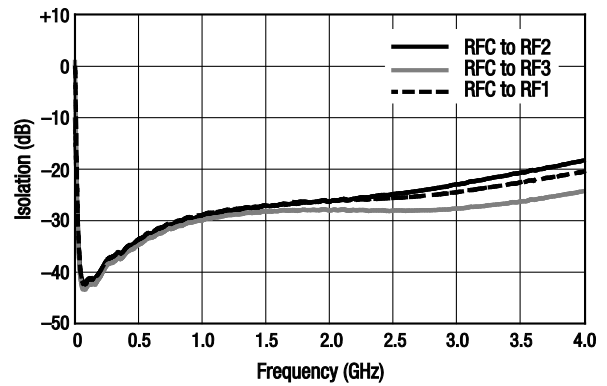


Figure 6. Isolation vs Frequency

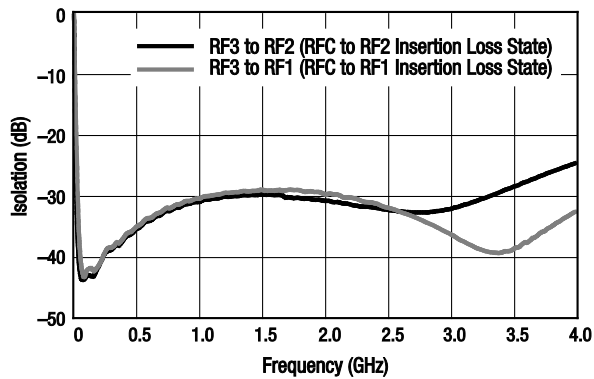


Figure 7. Port-to-Port Isolation vs Frequency

### Evaluation Board Description

The SKY13383-001 Evaluation Board is used to test the performance of the SKY13383-001 SP3T Switch. An Evaluation Board schematic diagram is provided in Figure 8. An assembly drawing for the Evaluation Board is shown in Figure 9.

### Package Dimensions

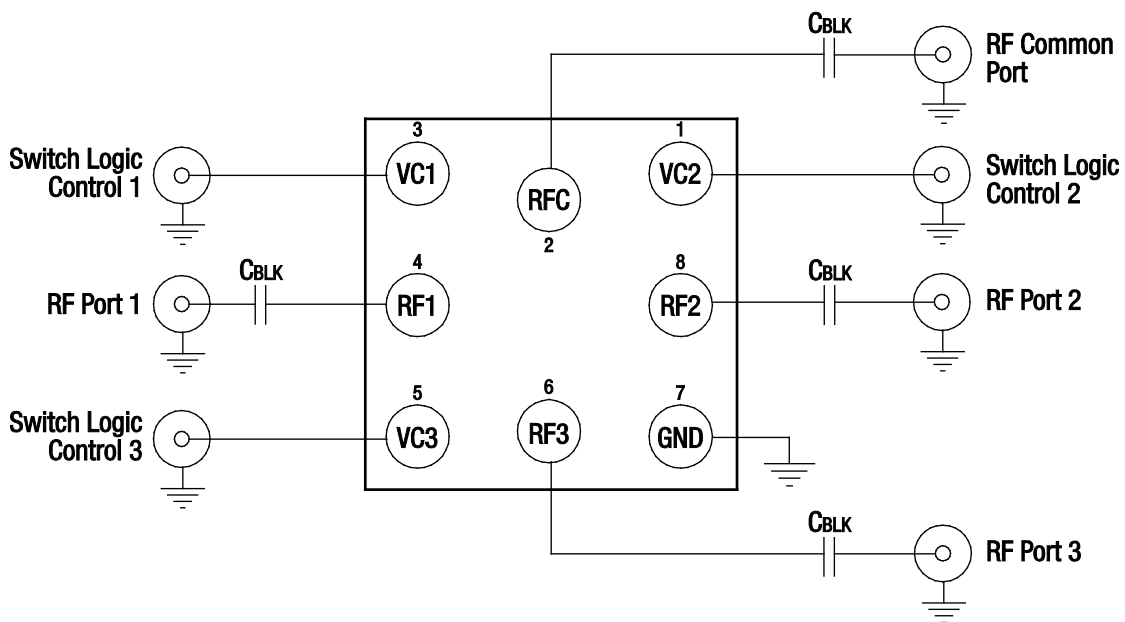
Package dimensions for the 8-bump WLCSP are shown in Figure 10.

### Package and Handling Information

Since the package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. 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.

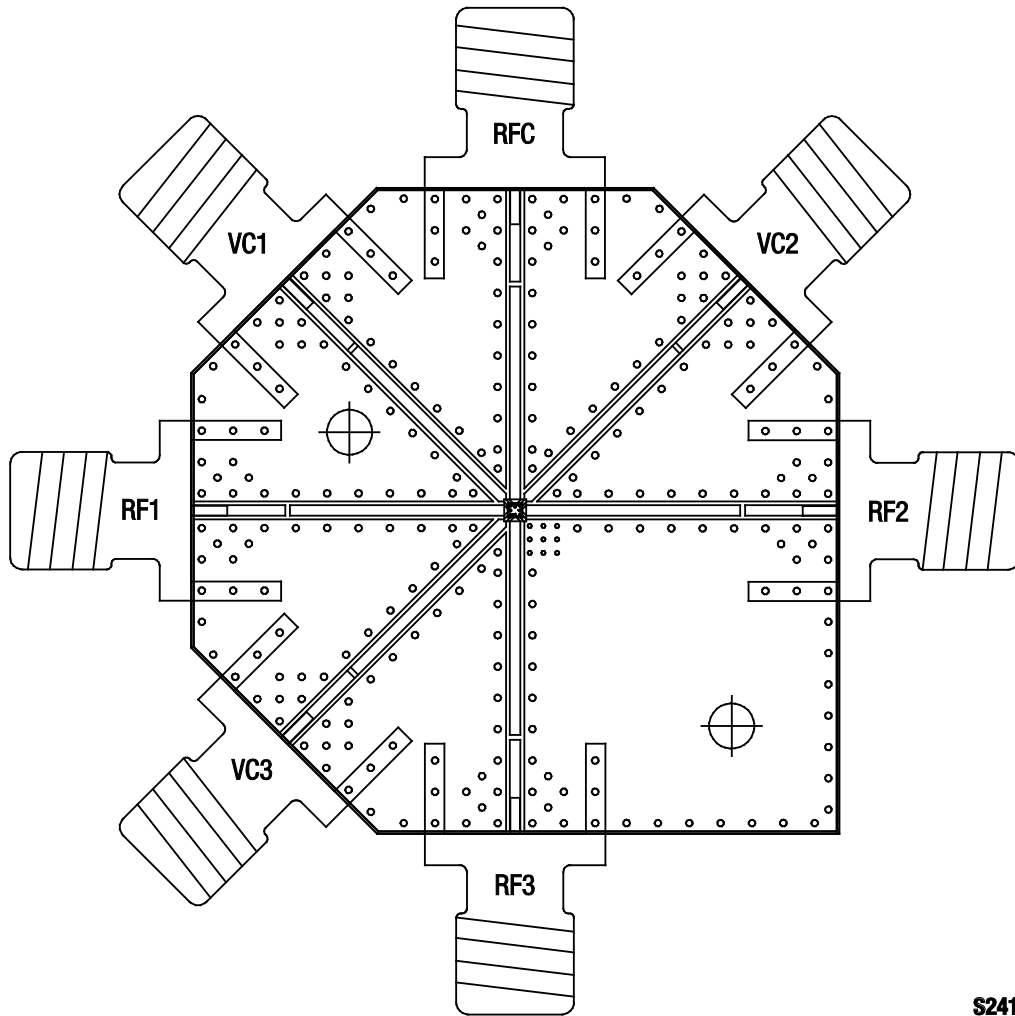
The SKY13383-001 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to Skyworks Application Note, *PCB Design and SMT Assembly Guidelines for Wafer Level Chip Scale Packages* (document #201676).

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.



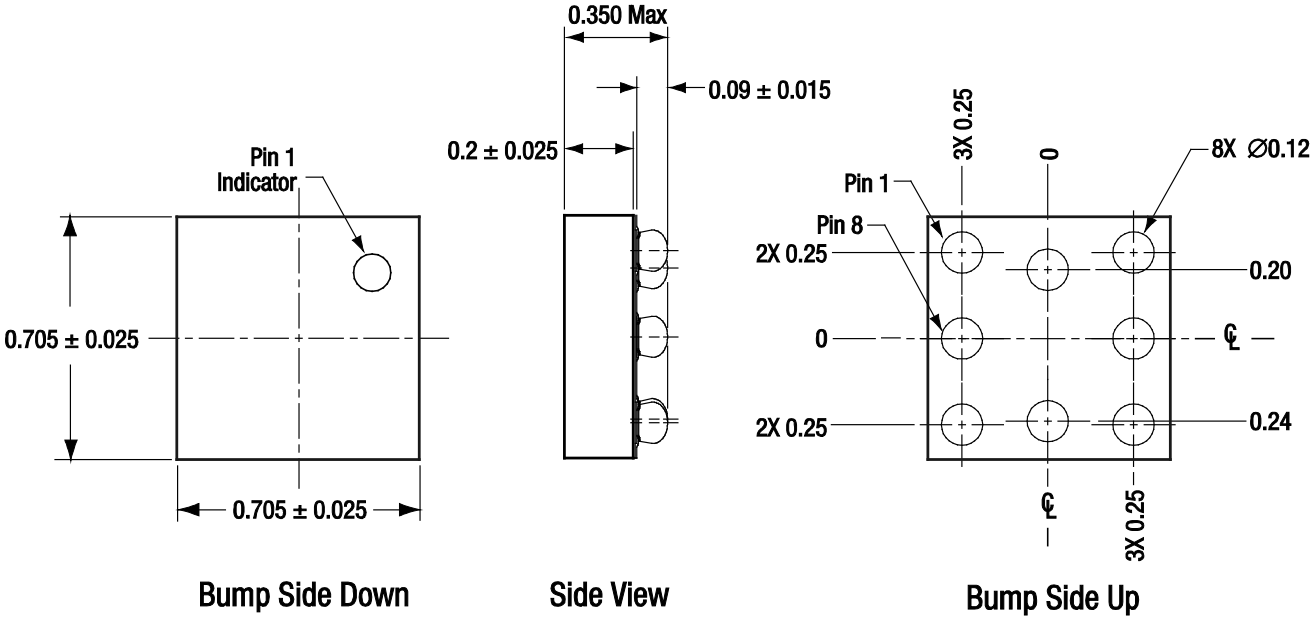
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Figure 8. SKY13383-001 Evaluation Board Schematic



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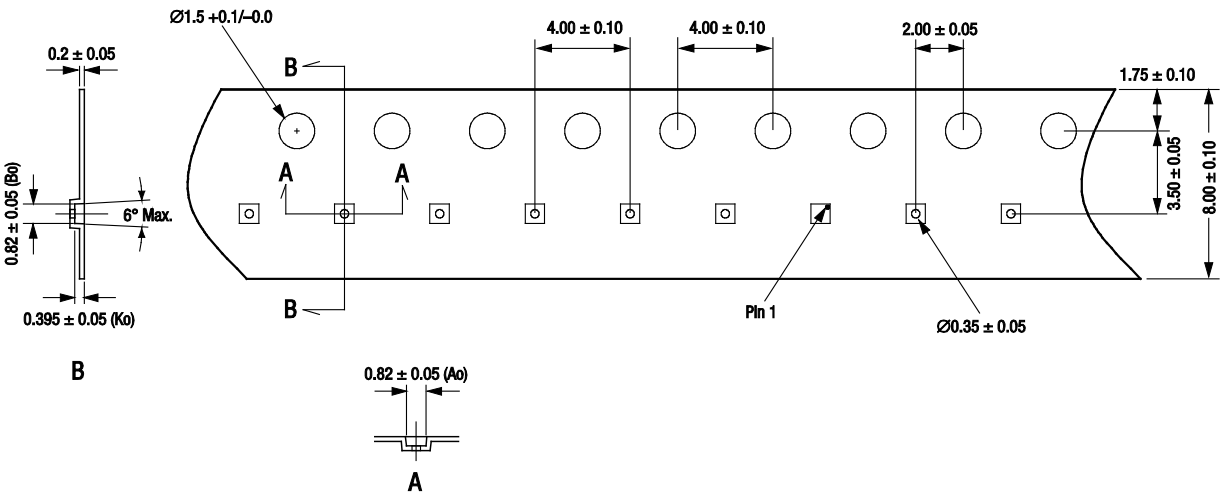
Figure 9. SKY13383-001 Evaluation Board Assembly Diagram



All measurements are in millimeters.  
 Pin 1 indicator not present on wafers that are shipped on film frame.

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Figure 10. SKY13383-001 8-Bump WLCSP Package Dimensions



- Notes:
1. Carrier tape: black conductive polycarbonate.
  2. Cover tape: transparent conductive material.
  3. Po/P1, 10 pitches cumulative tolerance on tape: ±0.20 mm.
  4. Ao and Bo measurement point to be 0.30 mm from bottom pocket.
  5. ESD surface resistivity must meet all Skyworks ESD requirements.
  6. All measurements are in millimeters.

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Figure 11. SKY13383-001 Tape and Reel Dimensions

## Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13383-001 SP3T Switch with LNA	SKY13383-001	SKY13383-001-EVB

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