

DATA SHEET

# SKY13522-644LF: 0.7 to 6.0 GHz High-Isolation (Single-Bit-Control) SPDT Switch

## Applications

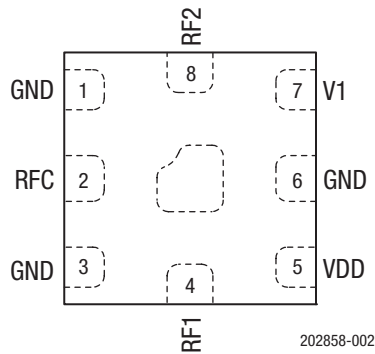
- GSM/DCS/PCS/CDMA/WCDMA/TD-SCDMA single-ended filter switching

## Features

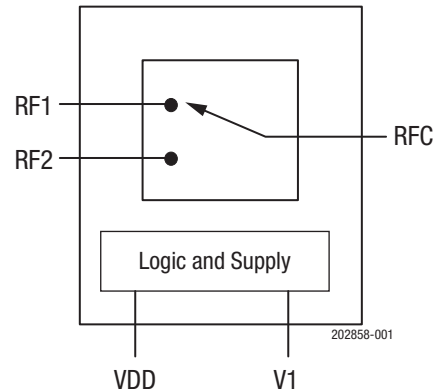
- Broadband frequency range: 0.7 to 6.0 GHz
- High isolation: 47 dB @ 2.2 GHz (typical)
- Single bit control
- Small QFN (8-pin, 1.1 x 1.1 x 0.45 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



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 2. SKY13522-644LF Pinout (Top View)**



**Figure 1. SKY13522-644LF Block Diagram**

## Description

The SKY13522-644LF is a single-pole, double-throw (SPDT) switch used for single-ended switching in cellular applications. Using advanced switching technologies, the SKY13522-644LF maintains low insertion loss and high isolation for all switching paths.

Depending on the logic voltage level applied to the control pin (V1), the antenna port (RFC) is connected to one of two switched RF outputs (RF1 or RF2) through a low insertion loss path, while the path between the antenna port and the other RF port is in a high isolation state.

The SKY13522-644LF is provided in a small 8-pin, 1.1 x 1.1 mm Quad Flat No-Lead (QFN) 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.

**Table 1. SKY13522-644LF Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	5	VDD	Supply voltage
2	RFC	Antenna port	6	GND	Ground
3	GND	Ground	7	V1	Control voltage 1
4	RF1	RF I/O port 1	8	RF2	RF I/O port 2

**Functional Description**

The SKY13522-644LF includes an internal decoder. External DC blocking capacitors are required on the RFC, RF1, and RF2 ports for proper operation. DC decoupling capacitors may be added on the VDD and control lines if necessary.

Switching is controlled by single control voltage input (V1). Depending on the logic voltage level applied to the control pin, the antenna pin is connected to one of two switched RF outputs.

**Electrical and Mechanical Specifications**

The absolute maximum ratings of the SKY13522-644LF are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13522-644LF is determined by the logic provided in Table 4.

Typical performance characteristics are illustrated in Figures 3 through 6.

**Table 2. SKY13522-644LF Absolute Maximum Ratings<sup>1</sup>**

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	VDD		3.7	V
Digital control voltage	VCTL	-0.5	+3.3	V
RF input power	PIN		+26	dBm
VCC supply ripple	VPP		20	mVpp
Operating temperature	TOP	-30	+90	°C
Storage temperature	TSTG	-55	+150	°C

<sup>1</sup> 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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**ESD HANDLING:** *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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

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**Table 3. SKY13522-644LF Electrical Specifications<sup>1</sup>**  
**(V<sub>DD</sub> = 3 V, V<sub>1\_H</sub> = 1.8 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
<b>DC Specifications</b>						
Supply voltage	V <sub>DD</sub>		2.5	3.0	3.3	V
Control voltage:						
Low	V <sub>1_L</sub>		0		0.3	V
High	V <sub>1_H</sub>		1.35	1.8	3.3	V
Supply current	I <sub>DD</sub>	V <sub>DD</sub> = 3.0 V		5	10	μA
Control current	I <sub>1</sub>	V <sub>1</sub> = 1.8 V			2	μA
<b>RF Specifications</b>						
Insertion loss	IL	RFC to RF1/2:				
		704 to 960 MHz		0.6	0.8	dB
		1710 to 2170 MHz		0.65	0.85	dB
		2300 to 3800 MHz		0.7	0.9	dB
3800 to 6000 MHz		0.9	1.2	dB		
Isolation	ISO	RFC to RF1/2:				
		704 to 960 MHz	50	53	dB	
		1710 to 2170 MHz	44	47	dB	
		2300 to 3800 MHz	43	46	dB	
3800 to 6000 MHz	32	35	dB			
Return loss (RFC to RF1/RF2 ports)	RL	700 to 3800 MHz		20		dB
		3800 to 6000 MHz		14		dB
0.1 dB input compression point	I <sub>PO.1dB</sub>	RF1 and RF2: 700 to 3000 MHz		+32		dBm
Third order input intercept point	I <sub>IP3</sub>	RF1 and RF2, P <sub>IN</sub> = +20 dBm/tone, Δf = 1 MHz: 700 to 3000 MHz		+57		dBm
Turn-on/turn-off time		Measured from 50% of final V <sub>DD</sub> supply voltage to final RF power ±1 dB		400	550	ns
Switching speed		Measured from 50% of final V <sub>CTRL</sub> voltage to final RF power ±1 dB		500	700	ns

<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.

**Table 4. SKY13522-644LF Truth Table<sup>1</sup>**

V <sub>DD</sub> (Pin 5)	V <sub>1</sub> (Pin 7)	Insertion Loss Path
1	1	RFC to RF1
1	0	RFC to RF2

<sup>1</sup> "1" = 1.35 V to 3.30 V. "0" = 0 V to +0.3 V.

### Typical Performance Characteristics

(V<sub>CTL</sub> = 0 to 3 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, C<sub>B</sub>L = 100 pF, Unless Otherwise Noted)

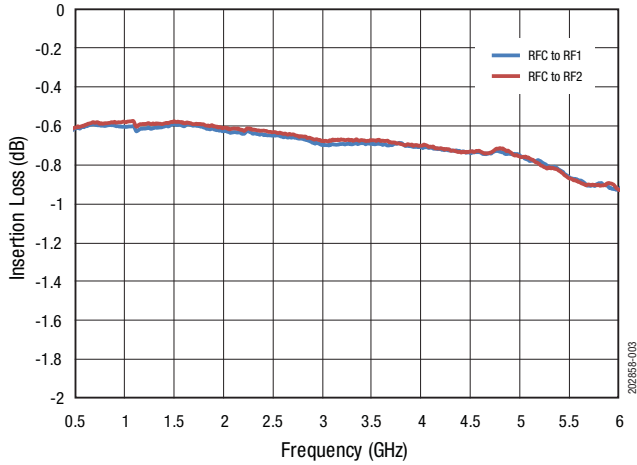


Figure 3. Typical Insertion Loss

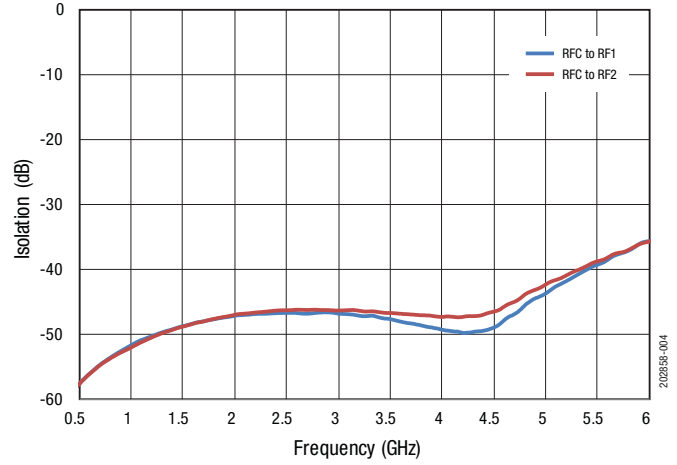


Figure 4. Typical Isolation

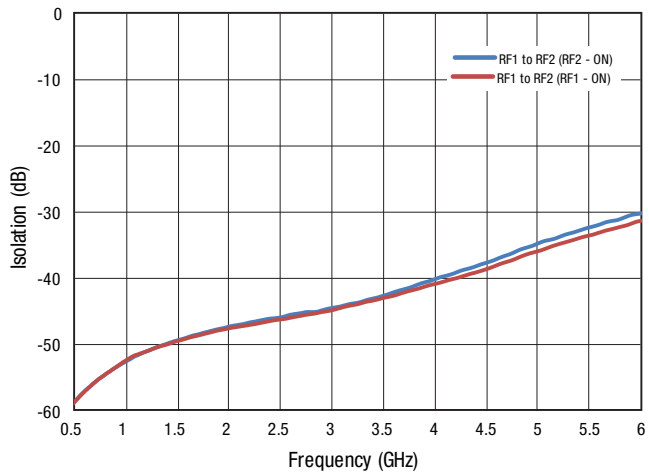


Figure 5. Typical Isolation

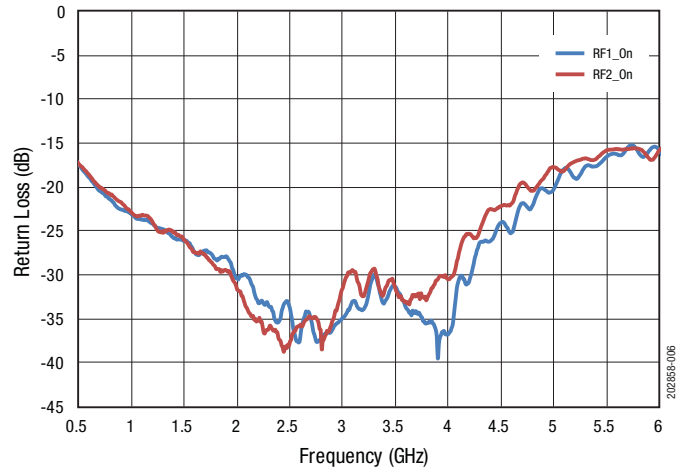
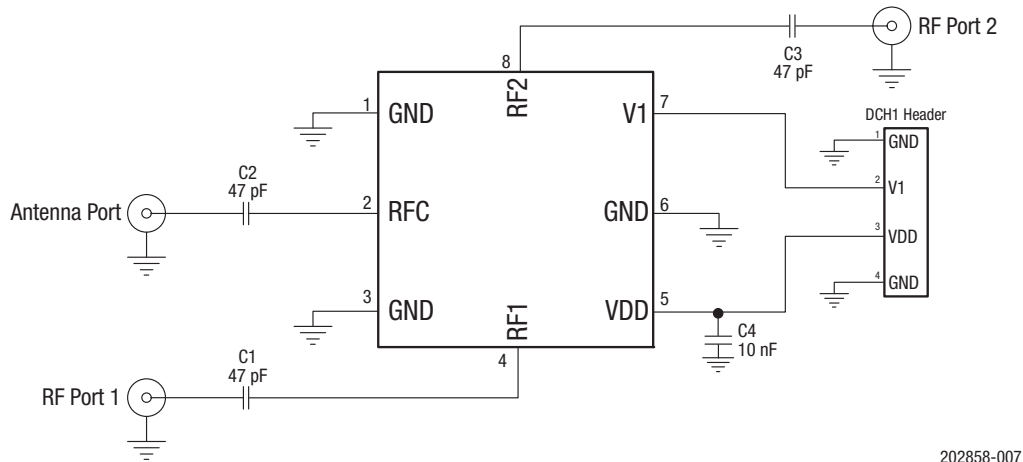


Figure 6. Typical Return Loss

### Evaluation Board Description

The SKY13522-644LF Evaluation Board is used to test the performance of the SKY13522-644LF SPDT Switch.

An Evaluation Board schematic diagram is provided in Figure 7. An assembly drawing for the Evaluation Board is shown in Figure 8.



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**Figure 7. SKY13522-644LF Evaluation Board Schematic**

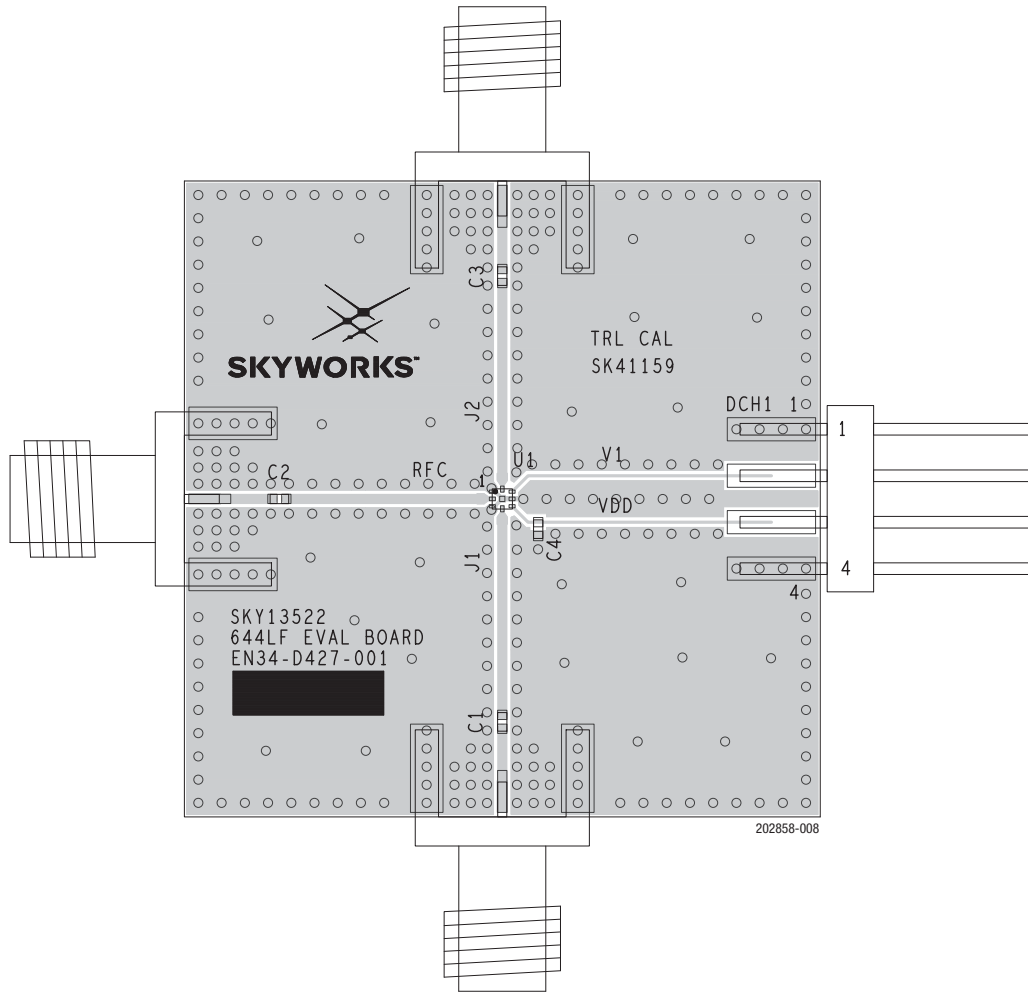


Figure 8. SKY13522-644LF Evaluation Board Assembly Diagram

### Package Dimensions

The PCB layout footprint for the SKY13522-644LF is shown in Figure 9. Typical part markings are shown in Figure 10. Package dimensions are shown in Figure 11, and tape and reel dimensions are provided in Figure 12.

### 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 SKY13522-644LF 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, *Wafer Level Chip Scale Packages: SMT Process Guidelines and Handling Considerations*, document number 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.

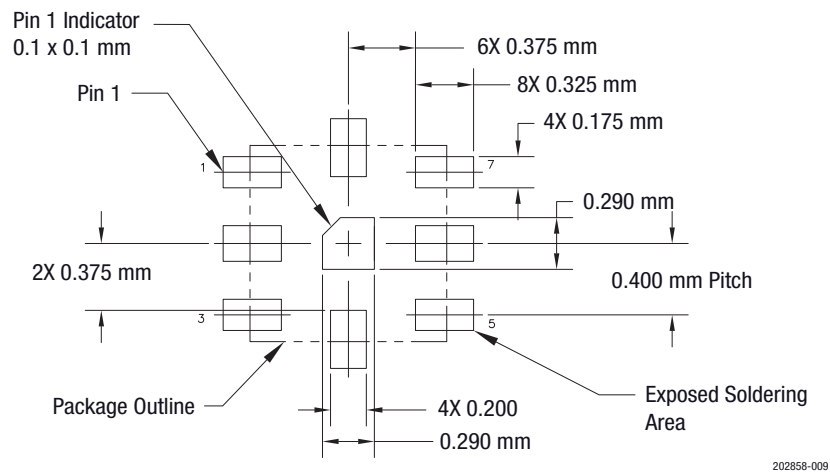


Figure 9. SKY13522-644LF PCB Layout Footprint

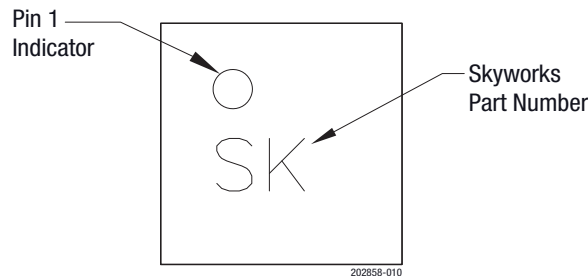
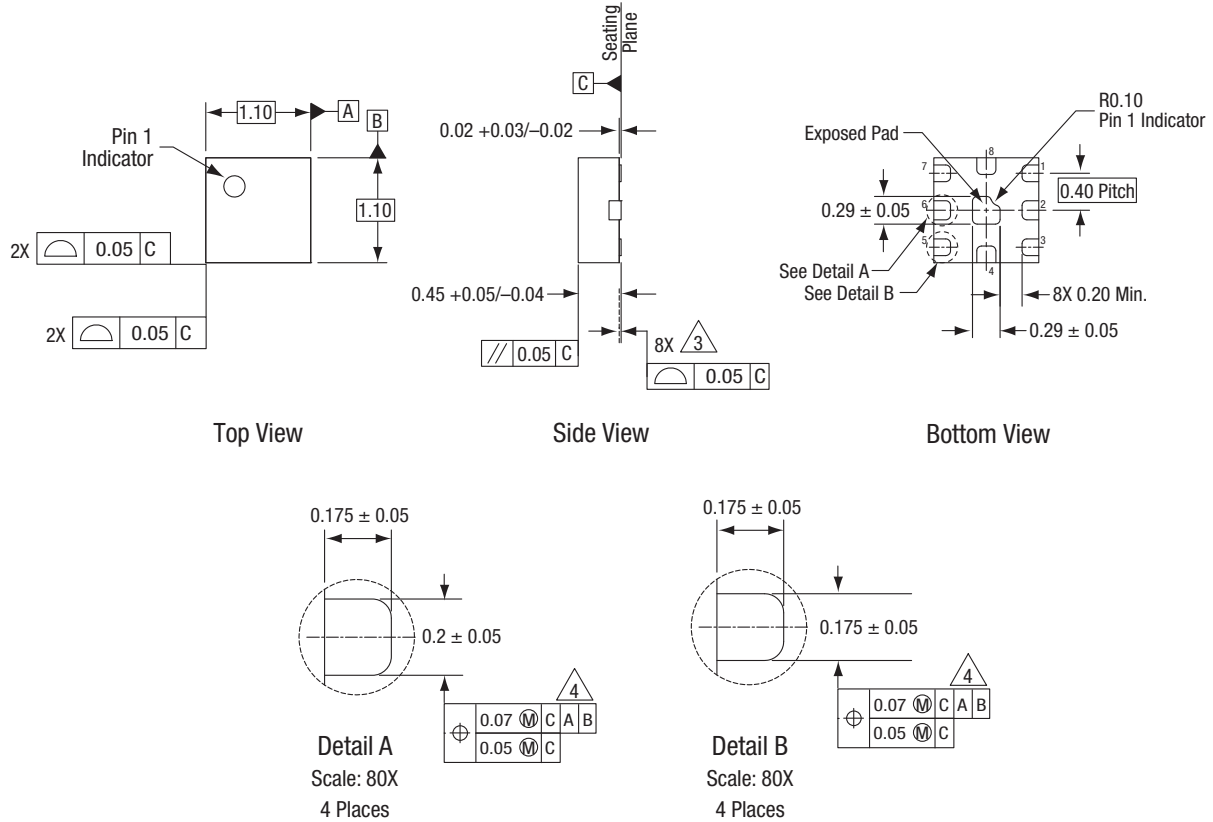


Figure 10. Typical Part Marking



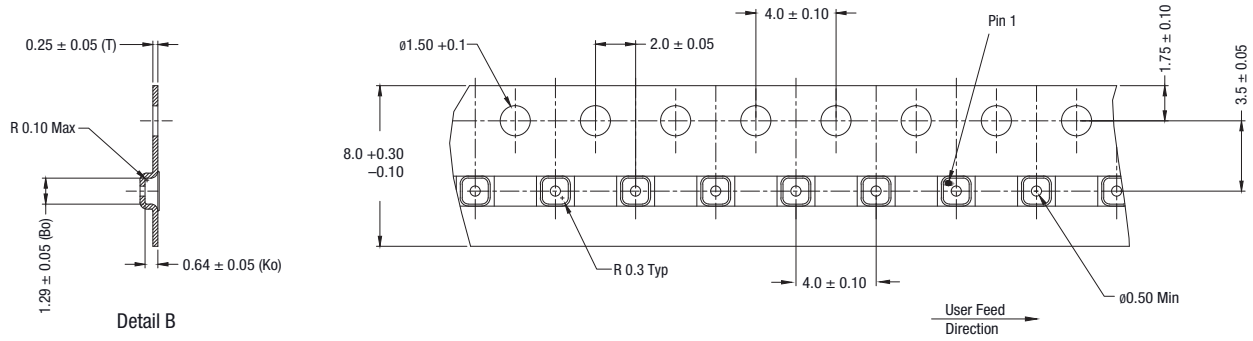
Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the terminals and all other bottom surface metallization.
4. Dimension applies to metallized terminal. If the terminal has a radius on its end, the dimension should not be measured in that radius area.

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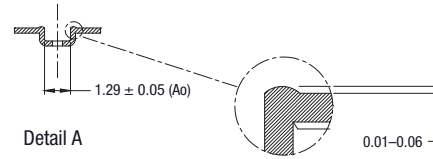
Figure 11. SKY13522-644LF Package Dimensions





Notes:

1. Carrier tape must meet all requirements of Skyworks GP01-D233 procurement spec for tape and reel shipping.
2. Carrier tape material: black conductive polycarbonate or polystyrene.
3. Cover tape material: transparent conductive material.
4. ESD surface resistivity shall be  $\leq 1 \times 10^{10}$  Ohms/square per EIA, JEDEC TNR specification.
5. 10-sprocket hole pitch cumulative tolerance on tape:  $\pm 0.20$  mm.
6. Ao and Bo measured on plane 0.30 mm above the bottom of the pocket.
7. All dimensions are in millimeters.



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**Figure 12. SKY13522-644LF Tape and Reel Dimensions**