

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)



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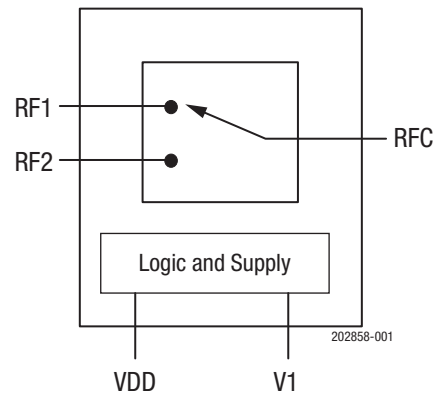


Figure 1. SKY13522-644LF Block Diagram

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.

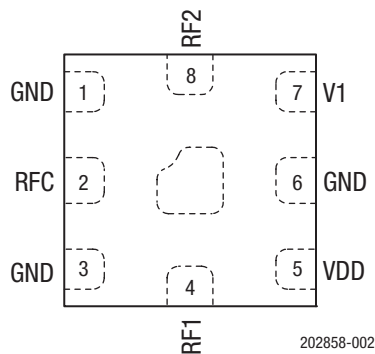


Figure 2. SKY13522-644LF Pinout (Top View)

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 Ratings¹

| 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 |

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.

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.*

Table 3. SKY13522-644LF Electrical Specifications¹**(V_{DD} = 3 V, V_{1_H} = 1.8 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|------------------------------------|---------------------|--|------|------|------|-------|
| DC Specifications | | | | | | |
| Supply voltage | V _{DD} | | 2.5 | 3.0 | 3.3 | V |
| Control voltage: | | | | | | |
| Low | V _{1_L} | | 0 | | 0.3 | V |
| High | V _{1_H} | | 1.35 | 1.8 | 3.3 | V |
| Supply current | I _{DD} | V _{DD} = 3.0 V | | 5 | 10 | μA |
| Control current | I ₁ | V ₁ = 1.8 V | | | 2 | μA |
| RF Specifications | | | | | | |
| 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 _{PO.1dB} | RF1 and RF2: 700 to 3000 MHz | | +32 | | dBm |
| Third order input intercept point | I _{IP3} | RF1 and RF2, P _{IN} = +20 dBm/tone, Δf = 1 MHz: 700 to 3000 MHz | | +57 | | dBm |
| Turn-on/turn-off time | | Measured from 50% of final V _{DD} supply voltage to final RF power ±1 dB | | 400 | 550 | ns |
| Switching speed | | Measured from 50% of final V _{CTRL} voltage to final RF power ±1 dB | | 500 | 700 | ns |

¹ Performance is guaranteed only under the conditions listed in this table.**Table 4. SKY13522-644LF Truth Table¹**

| V _{DD} (Pin 5) | V ₁ (Pin 7) | Insertion Loss Path |
|----------------------------|---------------------------|---------------------|
| 1 | 1 | RFC to RF1 |
| 1 | 0 | RFC to RF2 |

¹ "1" = 1.35 V to 3.30 V. "0" = 0 V to +0.3 V.

Typical Performance Characteristics

(V_{CTL} = 0 to 3 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, C_BL = 100 pF, Unless Otherwise Noted)

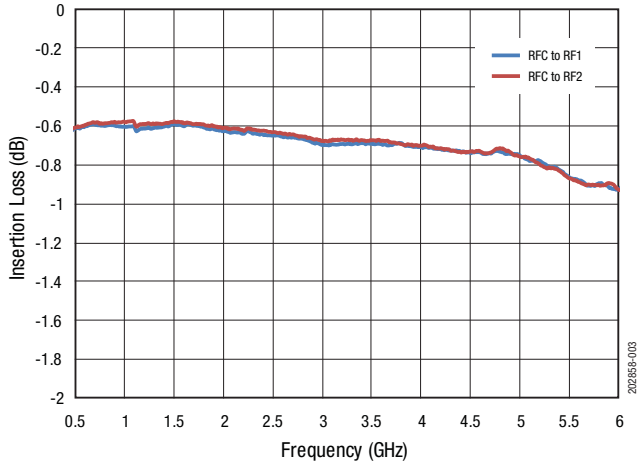


Figure 3. Typical Insertion Loss

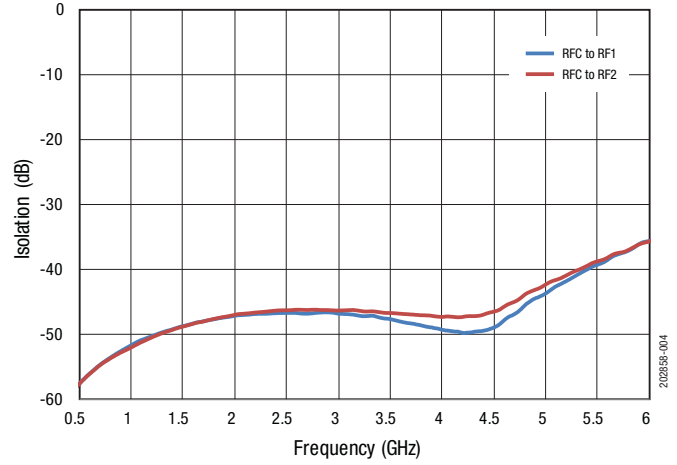


Figure 4. Typical Isolation

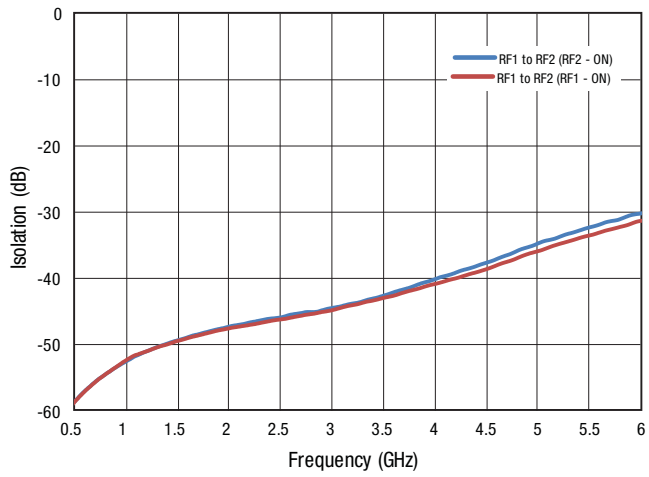


Figure 5. Typical Isolation

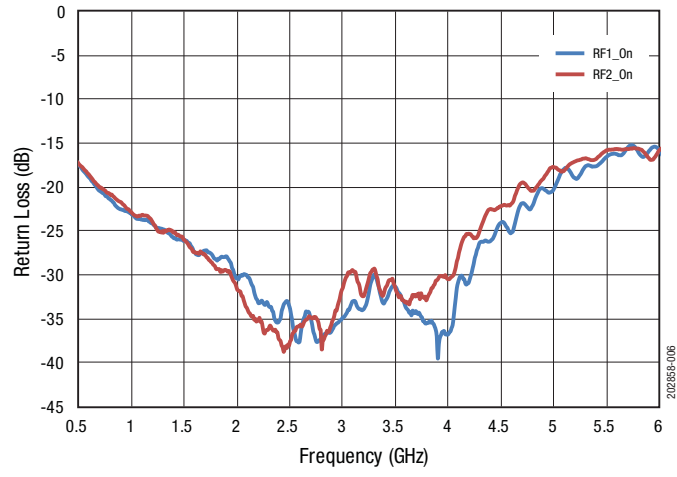
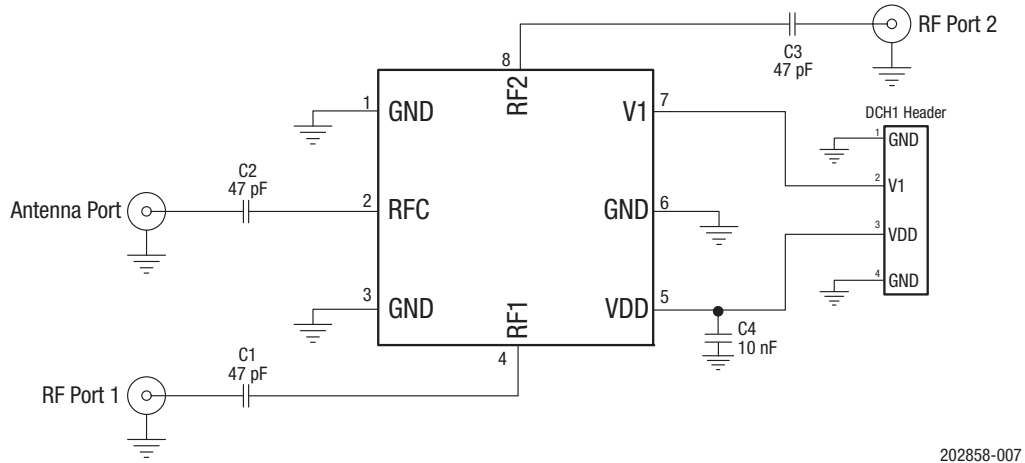


Figure 6. Typical Return Loss

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

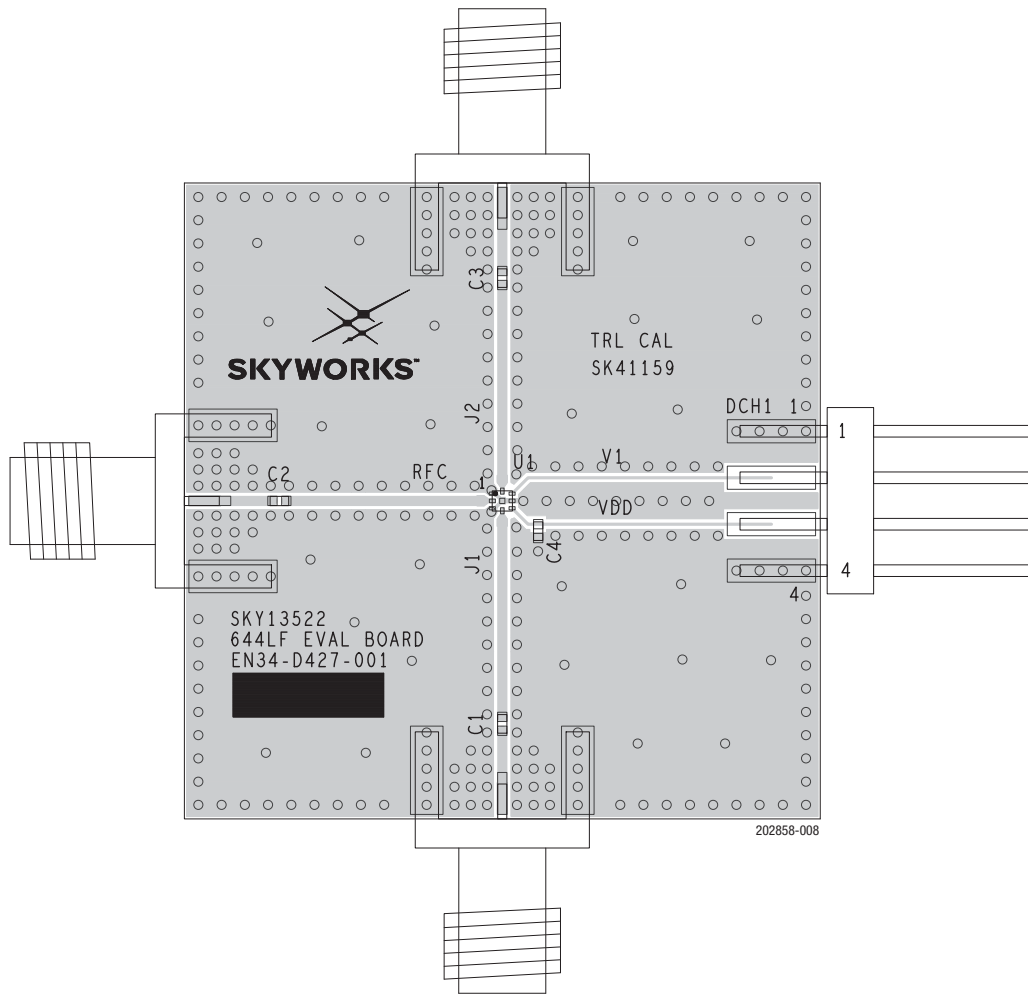


Figure 8. SKY13522-644LF Evaluation Board Assembly Diagram

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.

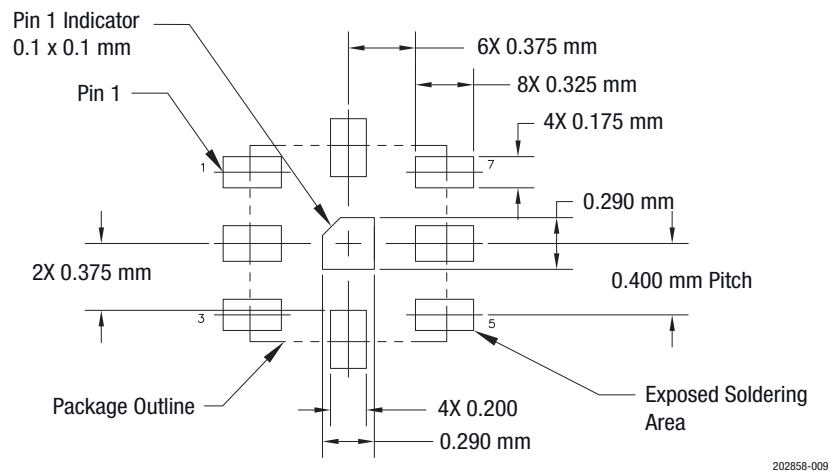


Figure 9. SKY13522-644LF PCB Layout Footprint

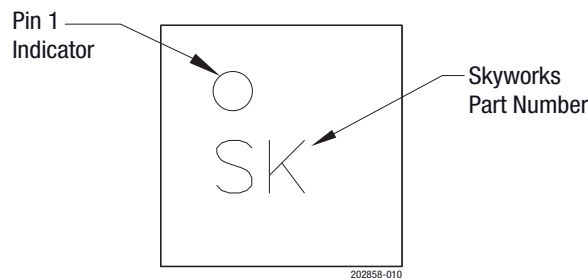
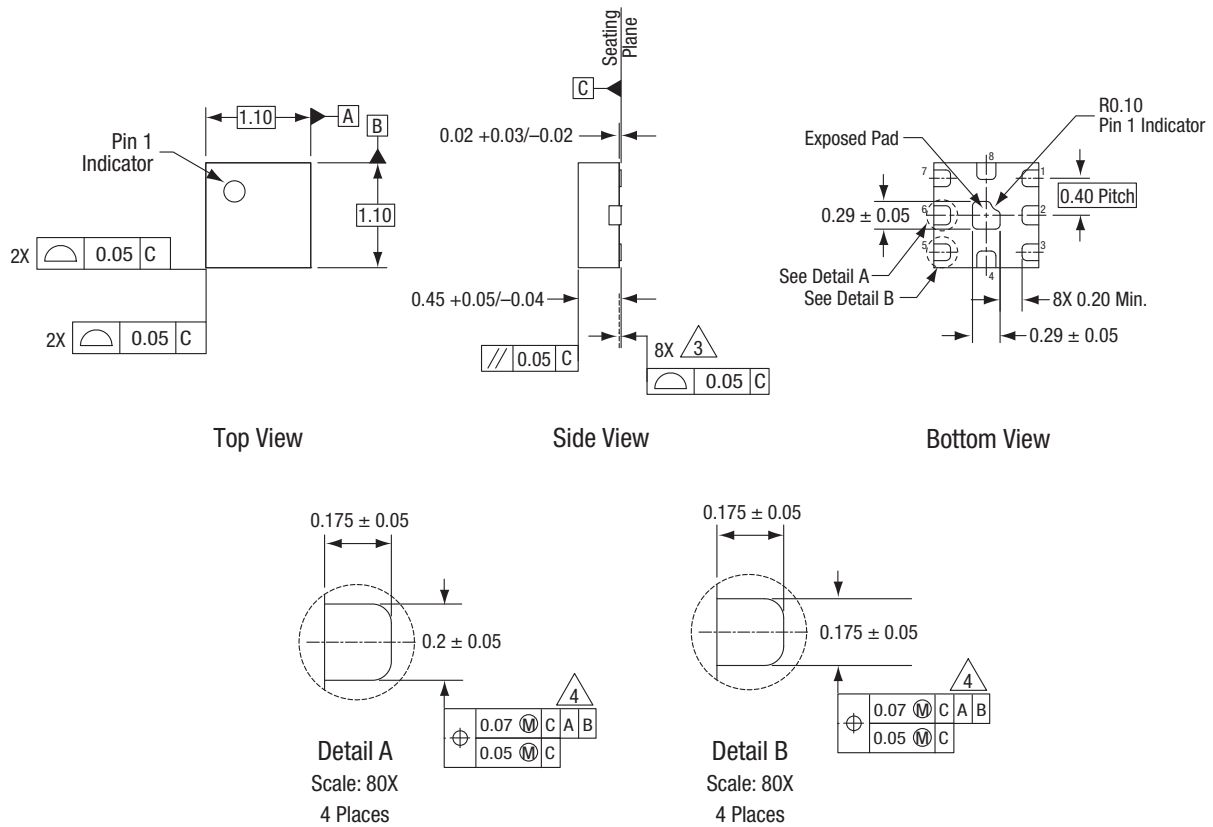


Figure 10. Typical Part Marking

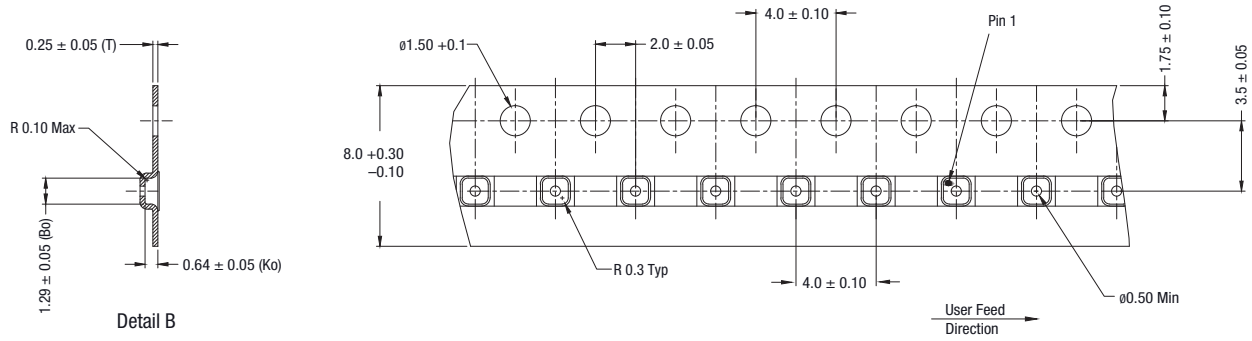


Notes:

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.

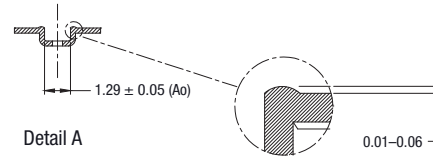
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Figure 11. SKY13522-644LF Package Dimensions



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: ± 0.20 mm.
6. A_0 and B_0 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

Ordering Information

| Product Description | Product Part Number | Evaluation Board Part Number |
|---|---------------------|------------------------------|
| SKY13522-644LF: 0.7 to 6.0 GHz High-Isolation SPDT Switch | SKY13522-644LF | SKY13522-644LF-EVB |

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