



SKYWORKS®

DATA SHEET

SKY13411-374LF: 0.1-6.0 GHz DPDT Switch

Applications

- Dual-band wireless LANs (802.11 a/b/g/n)
- Diversity antenna switching

Features

- Broadband frequency range: 0.1 to 6.0 GHz
- Positive control voltage range: 1.8 to 5.0 V
- Low insertion loss: 0.6 dB typical @ 2.5 GHz
- High isolation: 23.5 dB typical @ 2.5 GHz
- P1dB: +31 dBm typical @ 3 V
- Small, MLPD (6-pin, 1.5 x 1.5 mm) Pb-free 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.

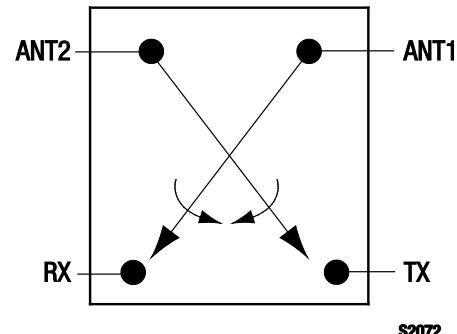


Figure 1. SKY13411-374LF Block Diagram

Description

The SKY13411-374LF is a pHEMT GaAs Double-Pole, Double-Throw (DPDT) switch designed for dual-band wireless LAN applications. The switch provides high linearity performance, low insertion loss, and high isolation.

Switching is controlled by two voltage inputs (V1 and V2). Depending on the logic voltage level applied to the control pins, the ANT1 and ANT2 pins connect to one of two switched RF outputs (RX or TX) through a low insertion loss path while maintaining a high isolation path to the alternate port.

The switch is manufactured in a compact, 1.5 x 1.5 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.

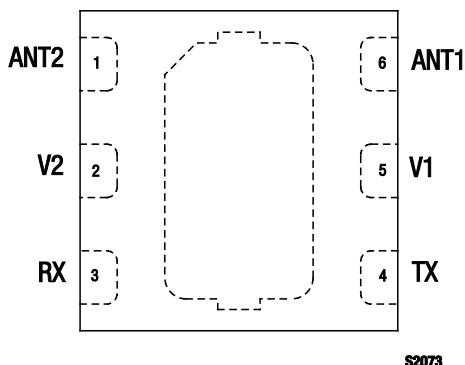


Figure 2. SKY13411-374LF Pinout – 6-Pin MLPD (Top View)

Table 1. SKY13411-374LF Signal Descriptions

| Pin # | Name | Description | Pin # | Name | Description |
|-------|------|---|-------|------|---|
| 1 | ANT2 | Antenna 2 RF port. Must be DC-blocked for proper operation. | 4 | TX | Transmit RF port. Must be DC-blocked for proper operation. |
| 2 | V2 | DC control voltage 2 | 5 | V1 | DC control voltage 1 |
| 3 | RX | Receive RF port. Must be DC-blocked for proper operation. | 6 | ANT1 | Antenna 1 RF port. Must be DC-blocked for proper operation. |

Note: Exposed backside ground pad must be properly grounded through a low impedance path.

Table 2. SKY13411-374LF Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Units |
|-----------------------|------------------|---------|---------|-------|
| Control voltage | V1, V2 | | 6 | V |
| RF input power | P _{IN} | | +32 | dBm |
| Storage temperature | T _{STG} | -40 | +125 | °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. SKY13411-374LF Recommended Operating Conditions

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|-----------------|--------|---------|---------|---------|-------|
| Frequency | f | 0.1 | | 6.0 | GHz |
| Control voltage | V1, V2 | 1.8 | 3.0 | 5.0 | V |

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13411-374LF are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

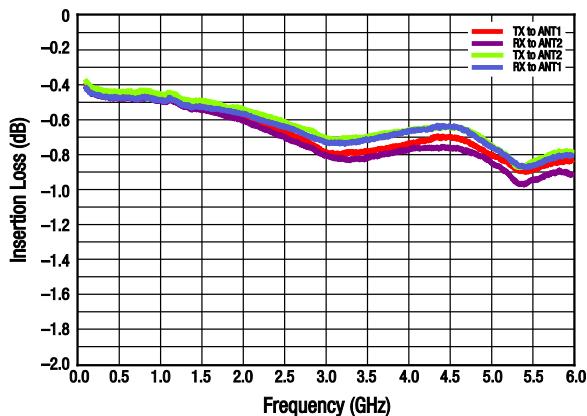
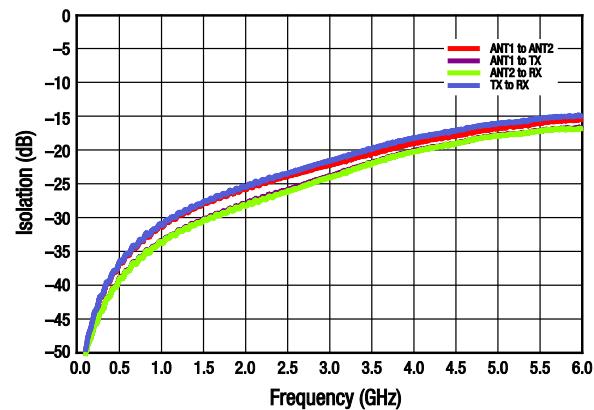
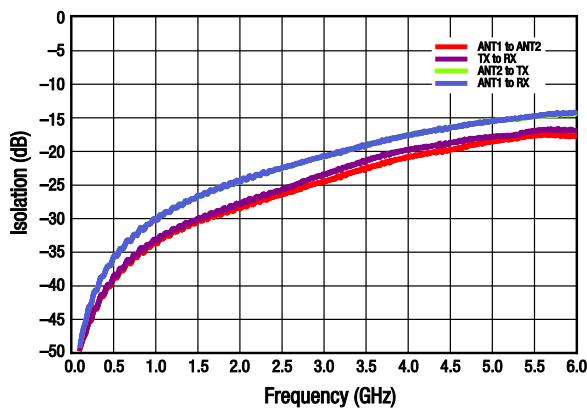
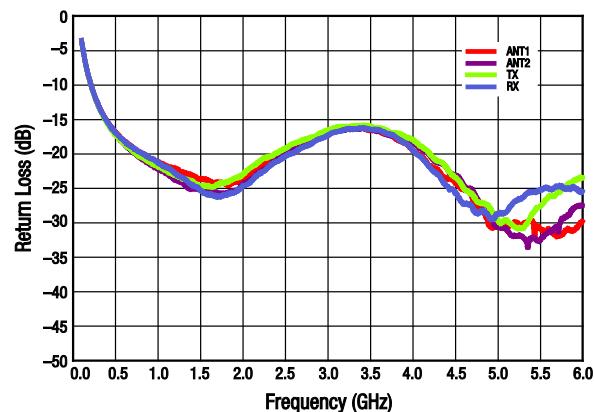
Typical performance characteristics of the SKY13411-374LF are illustrated in Figures 3 through 8.

The state of the SKY13411-374LF is determined by the logic provided in Table 5.

Table 4. SKY13411-374LF Electrical Specifications (Note 1)(V_{CTL} = 0 V and +3.0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---------|---|----------------------|------------------------------|------------------------------|----------------------|
| RF Specifications | | | | | | |
| Insertion loss | IL | ANT1/ANT2 to RX/TX 0.1 to 1.0 GHz 1.0 to 2.5 GHz 2.5 to 4.0 GHz 4.0 to 6.0 GHz | | 0.50 0.60 0.80 0.90 | 0.65 0.75 0.90 1.20 | dB dB dB dB |
| Isolation | Is0 | ANT1/ANT2 to RX/TX, ANT1 to ANT2, TX to RX 0.1 to 1.0 GHz 1.0 to 2.5 GHz 2.5 to 4.0 GHz 4.0 to 6.0 GHz | 23 22 15 12 | 26 26 19 14 | | dB dB dB dB |
| Return loss (Note 2) | S11 | ANT1/ANT2 to RX/TX, 0.1 to 4.0 GHz 4.0 to 6.0 GHz | | 15 15 | | dB dB |
| 1 dB Input Compression Point | IP1dB | 0.1 to 4.0 GHz 4.0 to 6.0 GHz | | +31 +30 | | dBm dBm |
| 0.1 dB Input Compression Point | IP0.1dB | 0.1 to 4.0 GHz 4.0 to 6.0 GHz | | +27 +26 | | dBm dBm |
| 3 rd Order Input Intercept Point | IIP3 | P _{IN} = +20 dBm/tone, Δf = 1 MHz, 0.1 to 6.0 GHz | | +50 | | dBm |
| 2 nd harmonic | 2fo | P _{IN} = +20 dBm, 0.1 to 6.0 GHz | | -70 | | dBc |
| 3 rd harmonic | 3fo | P _{IN} = +20 dBm, 0.1 to 6.0 GHz | | -70 | | dBc |
| Switching speed | | 50% V1/V2 to 90/10% RF 90/10% RF or 10/90% RF | | 70 35 | | ns ns |
| DC Specifications | | | | | | |
| Control voltage: high low | V1, V2 | | 1.8 -0.2 | 3.0 0 | 5.0 0.2 | V V |
| Control current | Icc | | | 5 | | μA |

Note 1: Performance is guaranteed only under the conditions listed in this Table.**Note 2:** Lower frequency return loss is dependent on the DC blocking capacitor value.

Typical Performance Characteristics(V_{CTRL} = 0 V and +3.0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)**Figure 3. Insertion Loss vs Frequency****Figure 4. Isolation vs Frequency,
ANT2-TX/ANT1-RX Insertion Loss Mode****Figure 5. Isolation vs Frequency,
ANT2-RX/ANT1-TX Insertion Loss Mode****Figure 6. Return Loss vs Frequency,**

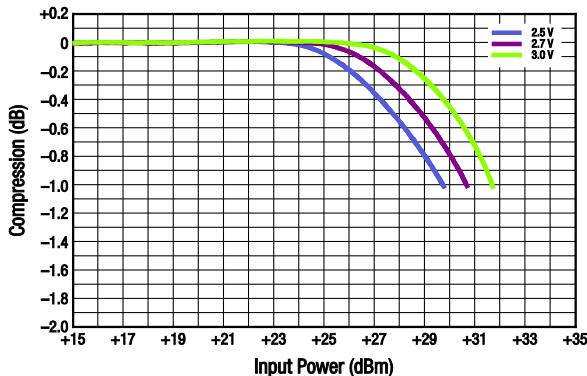


Figure 7. Compression vs Input Power @ 2.4 to 2.5 GHz

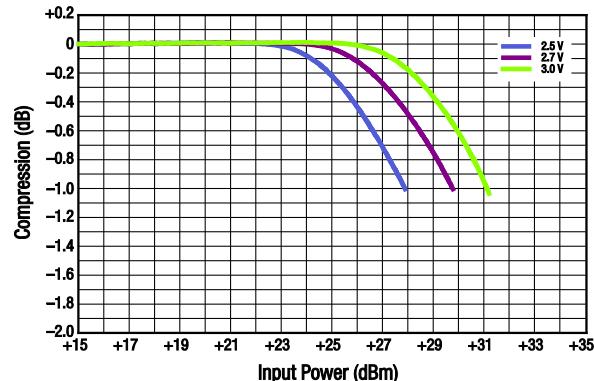


Figure 8. Compression vs Input Power @ 5 to 6 GHz

Table 5. SKY13411-374LF Truth Table

| V1 (Pin 5) | V2 (Pin 2) | ANT1 (Pin 6) to TX (Pin 4) | ANT1 (Pin 6) to RX (Pin 3) | ANT2 (Pin 1) to TX (Pin 4) | ANT2 (Pin 1) to RX (Pin 3) |
|------------|------------|----------------------------|----------------------------|----------------------------|----------------------------|
| High | Low | Isolation state | Insertion loss state | Insertion loss state | Isolation state |
| Low | High | Insertion loss state | Isolation state | Isolation state | Insertion loss state |

Note: High = +1.8 V to +5 V. Low = -0.2 V to +0.2 V.

Evaluation Board Description

The SKY13411-374LF Evaluation Board is used to test the performance of the SKY13411-374LF SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 9. An assembly drawing for the Evaluation Board is shown in Figure 10.

Package Dimensions

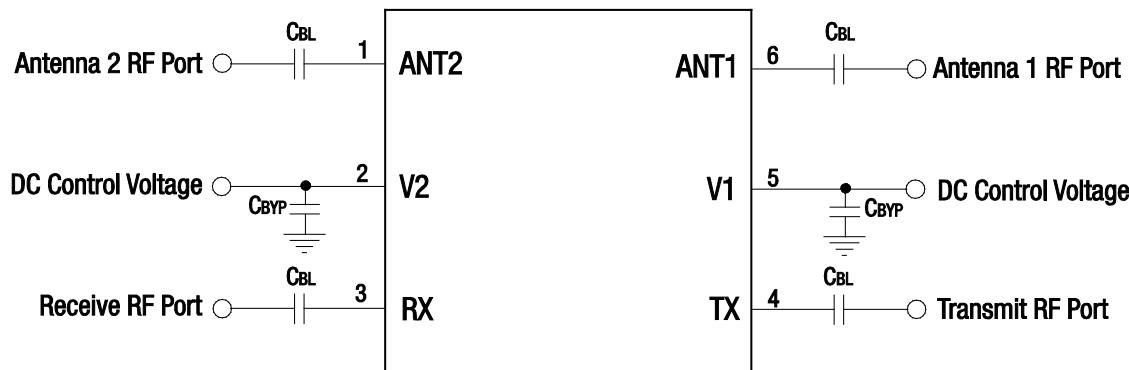
The PCB layout footprint for the SKY13411-374LF is provided in Figure 11. Typical case markings are shown in Figure 12. Package dimensions for the 6-pin MLPD are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

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 SKY13411-374LF 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.

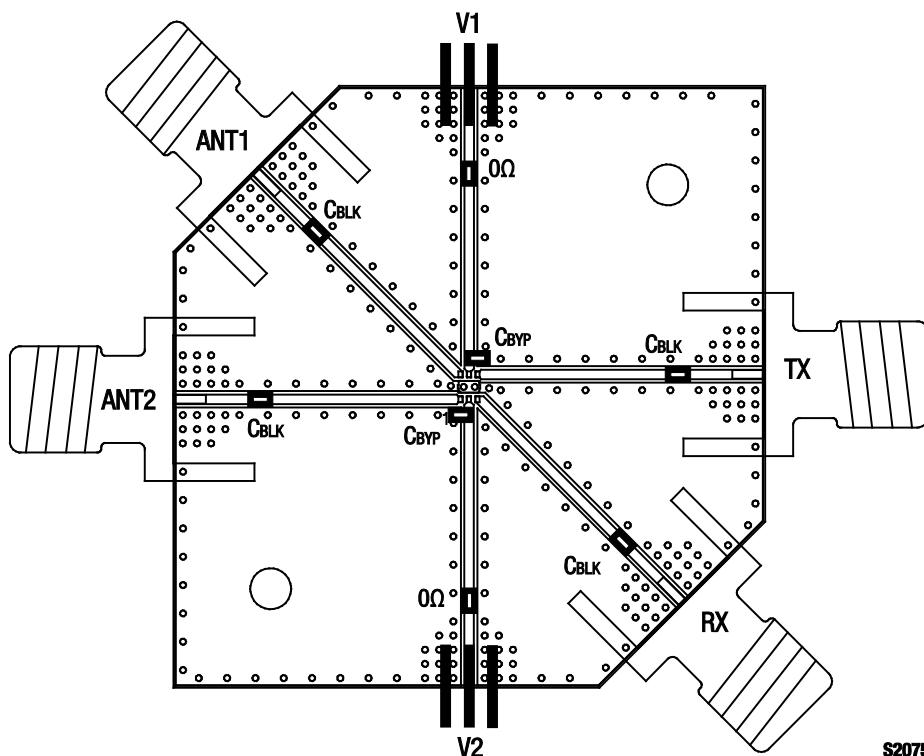


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Figure 9. SKY13411-374LF Evaluation Board Schematic

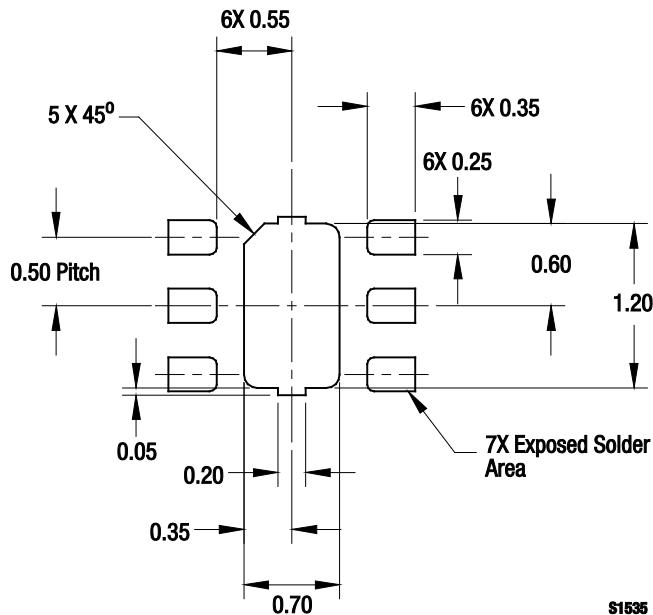
Table 6. SKY13411-374LF Evaluation Board Bill of Materials

| Component | Value | Size | Manufacturer | Characteristic |
|-----------|-------|------|-------------------|-----------------------|
| CBL | 47 pF | 0402 | Murata GRM Series | DC blocking capacitor |
| CBYP | 10 pF | 0402 | Murata GRM Series | Decoupling capacitor |

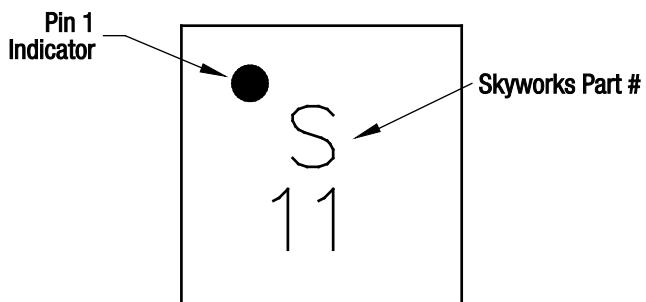


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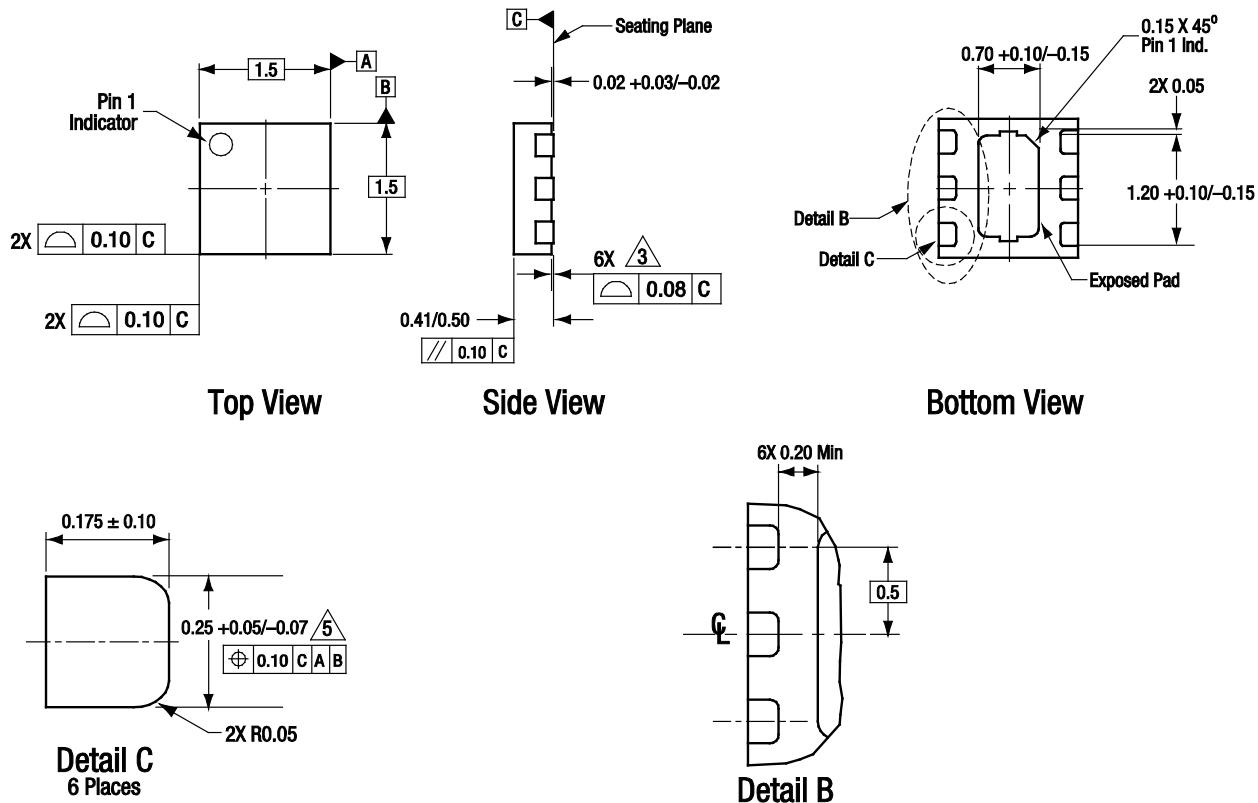
Figure 10. SKY13411-374LF Evaluation Board Assembly Diagram



**Figure 11. SKY13411-374LF PCB Layout Footprint
(Top View)**



**Figure 12. Typical Part Markings
(Top View)**



All measurements are in millimeters.

Dimensioning and tolerancing according to ASME Y14.5M-1994.

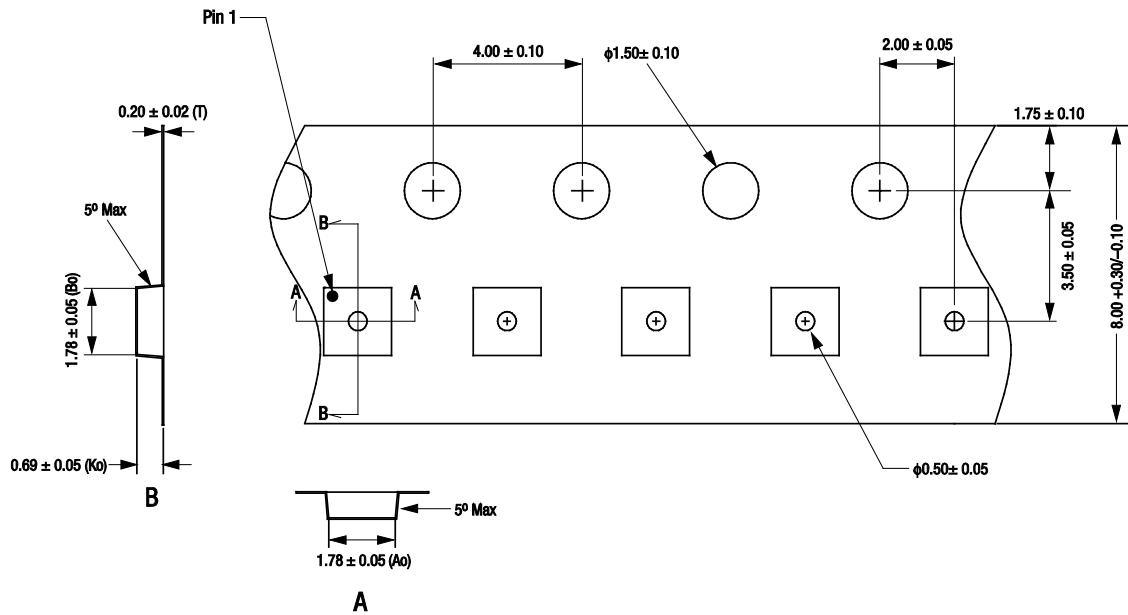
Coplanarity applies to the exposed heat sink slug as well as the terminals..

Plating requirement per source control drawing (SCD) 2504.

Dimension applies to metallized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

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Figure 13. SKY13411-374LF 6-Pin QFN Package Dimensions

**Notes:**

1. Carrier tape: black conductive polycarbonate or polystyrene.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.4 mm width.
4. All measurements are in millimeters.

S1382a

Figure 14. SKY13411-374LF Tape and Reel Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|--|---------------------------|------------------------------|
| SKY13411-374LF 0.1-6.0 GHz DPDT Switch | SKY13411-374LF | SKY13411-374LF-EVB |

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