

## DATA SHEET

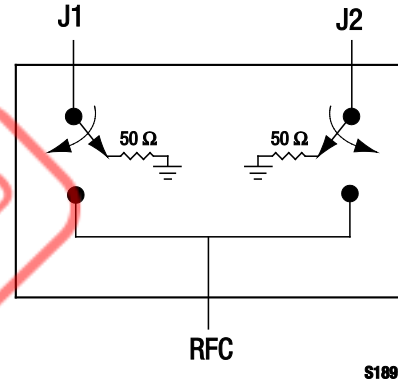
# SKY13348-374LF: 0.5 to 6.0 GHz SPDT Switch, 50 $\Omega$ Terminated

### Applications

- WiMAX 802.16
- WLAN 802.11 a/b/g/n

### Features

- 50  $\Omega$  terminated RF outputs from 0.5 to 6.0 GHz
- Low insertion loss: 0.6 dB @ 2.5 GHz
- High isolation: 27 dB @ 2.5 GHz
- IP1dB: +37 dBm
- Small, MLPD (6-pin, 1.5 x 1.5 mm) package (MSL1, 260 °C per JEDEC J-STD-020)
- For RoHS and other product compliance information, see the [Skyworks Certificate of Conformance](#)



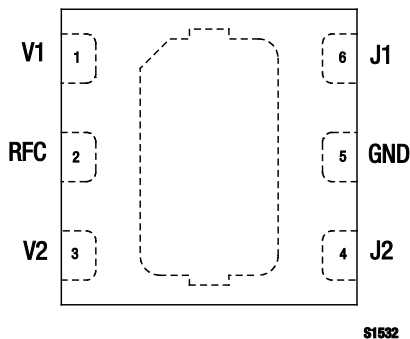
**Figure 1. SKY13348-374LF Block Diagram**

### Description

The SKY13348-374LF is a pHEMT GaAs Single-Pole, Double-Throw (SPDT) high-power switch with 50  $\Omega$  terminated outputs. The high-linearity performance and low insertion loss achieved by the SKY13348-374LF make it an ideal choice for WiMAX and WLAN applications such as 802.11 a/b/g/n where low loss, high isolation, and excellent linearity are key requirements.

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. SKY13348-374LF Pinout  
(Top View)**

**Table 1. SKY13348-374LF Signal Descriptions**

| Pin | Name | Description                                                                                          | Pin | Name | Description                                                                    |
|-----|------|------------------------------------------------------------------------------------------------------|-----|------|--------------------------------------------------------------------------------|
| 1   | V1   | DC control voltage. A logic high voltage enables an insertion loss path between the RFC and J1 pins. | 4   | J2   | RF output: 50 $\Omega$ terminated when in isolation state. Must be DC blocked. |
| 2   | RFC  | RF common input. Must be DC blocked.                                                                 | 5   | GND  | Ground                                                                         |
| 3   | V2   | DC control voltage. A logic high voltage enables an insertion loss path between the RFC and J2 pins. | 6   | J1   | RF output: 50 $\Omega$ terminated when in isolation state. Must be DC blocked. |

## Functional Description

The SKY13348-374LF symmetric SPDT switch is designed using an advanced 0.5-micron GaAs pHEMT foundry process. The switch features linear power handling up to 7 watts with 50  $\Omega$  terminated outputs. Switching is controlled by two control voltage inputs, V1 and V2 (pins 1 and 3, respectively). Depending on the logic voltage level applied to the control pins, the RFC pin is connected to one of the two switched RF outputs, J1 or J2, using a low insertion loss path, while the path between the RFC pin and the other RF pin is in a high isolation state.

DC blocking capacitors are required on all RF ports of the switch, and determine the lower frequency return loss and insertion loss of the insertion loss state. The off RF output is internally terminated to 50  $\Omega$ . The low frequency impedance is determined by an on-chip capacitor and cannot be extended below 500 MHz using external components. The switch is fully operational below 500 MHz. The off port impedance appears as a reflective open. If operated below 100 MHz, the power handling and linearity of the device can be degraded even at high control voltage levels.

If V1 and V2 are biased to both high or low logic levels, the switch appears as a very poor two-way power splitter with low return loss on all RF ports. The switch is not damaged if placed in these states. In normal switching logic modes, V1 and V2 can be set between 1.8 and 5.0 V.

The SKY13348-374LF is designed for medium to high power, dual-band WLAN, WIMAX, and LTE switching applications. The device can also be used in a variety of other applications that require high performance RF switching. The high P0.1dB and advance proprietary fabrication process enables an exceptional third order input intercept point (IIP3), error vector magnitude (EVM), and harmonic performance. Excellent insertion loss, return loss, and isolation are maintained up to 6 GHz.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13348-374LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY13348-374LF are illustrated in Figures 3 through 8.

The state of the SKY13348-374LF is determined by the logic provided in Table 4.

**Table 2. SKY13348-374LF Absolute Maximum Ratings**

| Parameter             | Symbol           | Minimum | Maximum | Units |
|-----------------------|------------------|---------|---------|-------|
| Control voltage       | V <sub>CTL</sub> |         | 6       | V     |
| Input power           | P <sub>IN</sub>  |         | +38     | dBm   |
| Storage temperature   | T <sub>STG</sub> | -40     | +125    | °C    |
| Operating temperature | T <sub>OP</sub>  | -40     | +85     | °C    |

**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. SKY13348-374LF Electrical Specifications<sup>1</sup>****(V<sub>CTL</sub> = 0 V and +3.0 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, C<sub>BLK</sub> = 47 pF, Unless Otherwise Noted)**

| Parameter                                 | Symbol                                | Test Condition                                                                                     | Min | Typ       | Max        | Units    |
|-------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------|-----|-----------|------------|----------|
| Insertion loss                            | IL                                    | All paths                                                                                          |     |           |            |          |
|                                           |                                       | 500 MHz to 2.70 GHz                                                                                |     | 0.60      | 0.75       | dB       |
|                                           |                                       | 2.70 to 3.80 GHz                                                                                   |     | 0.70      | 0.85       | dB       |
|                                           |                                       | 3.80 to 5.85 GHz                                                                                   |     | 1.00      | 1.15       | dB       |
| Isolation                                 | Iso                                   | All paths                                                                                          |     |           |            |          |
|                                           |                                       | 500 MHz to 2.70 GHz                                                                                | 24  | 27        |            | dB       |
|                                           |                                       | 2.70 to 3.80 GHz                                                                                   | 18  | 24        |            | dB       |
|                                           |                                       | 3.80 to 5.85 GHz                                                                                   | 18  | 24        |            | dB       |
| Input return loss                         | S <sub>11</sub>                       | 500 MHz to 6.0 GHz                                                                                 | 10  | 15        |            | dB       |
| Output return loss (off port return loss) | S <sub>22</sub>  <br> S <sub>33</sub> | All ports                                                                                          |     |           |            |          |
|                                           |                                       | 2.00 to 2.70 GHz                                                                                   | 10  | 15        |            | dB       |
|                                           |                                       | 3.30 to 3.80 GHz                                                                                   | 10  | 15        |            | dB       |
|                                           |                                       | 4.90 to 5.85 GHz                                                                                   | 10  | 15        |            | dB       |
| 1 dB input compression point              | IP1dB                                 | All ports, V <sub>CTL</sub> = 3.0 V                                                                |     |           |            |          |
|                                           |                                       | 2.30 to 2.70 GHz                                                                                   | +35 | +37       |            | dBm      |
|                                           |                                       | 3.30 to 3.80 GHz                                                                                   | +35 | +37       |            | dBm      |
|                                           |                                       | 4.90 to 5.85 GHz                                                                                   | +35 | +37       |            | dBm      |
| Third order input intercept point         | IIP3                                  | P <sub>IN</sub> = +25 dBm/tone,<br>1 MHz spacing,<br>V <sub>CTL</sub> = 3.0 V                      |     |           |            |          |
|                                           |                                       | 2.4 GHz                                                                                            | 52  | 60        |            | dB       |
|                                           |                                       | 3.8 GHz                                                                                            | 52  | 60        |            | dB       |
|                                           |                                       | 5.8 GHz                                                                                            | 52  | 57        |            | dB       |
| Error vector magnitude, WLAN              | EVM <sub>WLAN</sub>                   | Input power for 2.5% error, WLAN 2.45 GHz, 802.11g OFDM, 54 Mbps, 64 QAM, V <sub>CTL</sub> = 3.0 V | +28 | +29       |            | dBm      |
| Error vector magnitude, WiMAX             | EVM <sub>WiMAX</sub>                  | Input power for 2.5% error, WiMAX 5.8 GHz, OFDMA, 64 QAM, V <sub>CTL</sub> = 3.0 V                 | +28 | +29       |            | dBm      |
| 2 <sup>nd</sup> harmonic                  | 2fo                                   | P <sub>IN</sub> = +25 dBm,<br>V <sub>CTL</sub> = 3.0 V                                             |     |           |            |          |
|                                           |                                       | 900 MHz                                                                                            | +75 | +80       |            | dBc      |
|                                           |                                       | 1.8 GHz                                                                                            | +75 | +80       |            | dBc      |
|                                           |                                       | 2.4 GHz                                                                                            | +75 | +80       |            | dBc      |
|                                           |                                       | 3.8 GHz                                                                                            | +75 | +80       |            | dBc      |
|                                           |                                       | 5.8 GHz                                                                                            | +69 | +80       |            | dBc      |
| 3 <sup>rd</sup> harmonic                  | 3fo                                   | P <sub>IN</sub> = +25 dBm,<br>V <sub>CTL</sub> = 3.0 V                                             |     |           |            |          |
|                                           |                                       | 900 MHz                                                                                            | +75 | +80       |            | dBc      |
|                                           |                                       | 1.8 GHz                                                                                            | +70 | +80       |            | dBc      |
|                                           |                                       | 2.4 GHz                                                                                            | +69 | +75       |            | dBc      |
|                                           |                                       | 3.8 GHz                                                                                            | +63 | +71       |            | dBc      |
|                                           |                                       | 5.8 GHz                                                                                            | +75 | +80       |            | dBc      |
| Switching speed:                          | t <sub>ON</sub><br>t <sub>FALL</sub>  | 50% control to 90% RF<br>50% control to 10% RF                                                     |     | 100<br>50 | 250<br>250 | ns<br>ns |
|                                           |                                       |                                                                                                    |     |           |            |          |

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

## Typical Performance Characteristics

( $V_{CTL} = 0\text{ V}$  and  $+3.0\text{ V}$ ,  $T_{OP} = +25\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Characteristic Impedance [ $Z_0$ ] =  $50\text{ }\Omega$ ,  $C_{blk} = 47\text{ pF}$ , Unless Otherwise Noted)

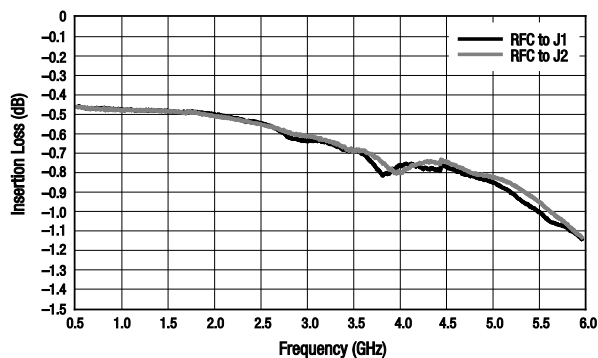


Figure 3. Insertion Loss vs Frequency

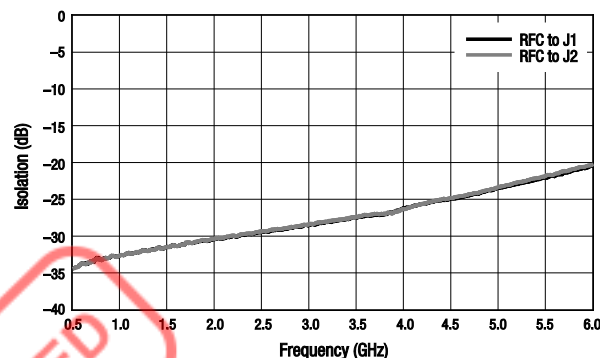


Figure 4. Isolation vs Frequency

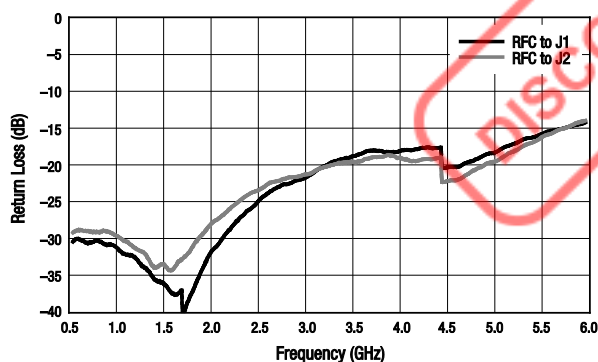


Figure 5. Return Loss vs Frequency, On Ports

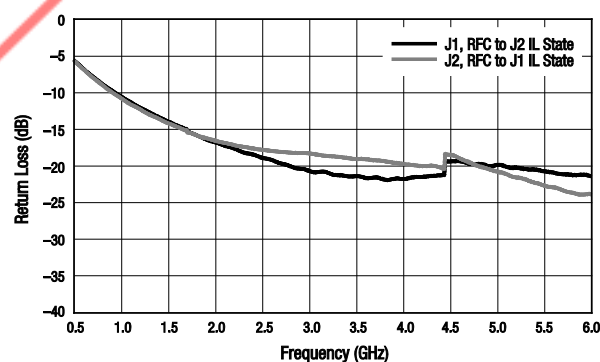


Figure 6. Return Loss vs Frequency, Off Ports

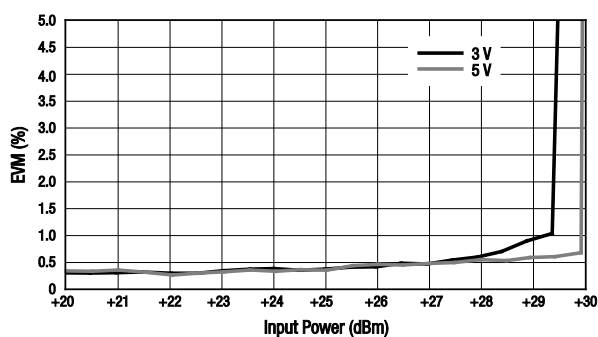


Figure 7. EVM vs Input Power  
(WiMAX 802.16 64 QAM OFDMA,  $f = 3.8\text{ GHz}$ )

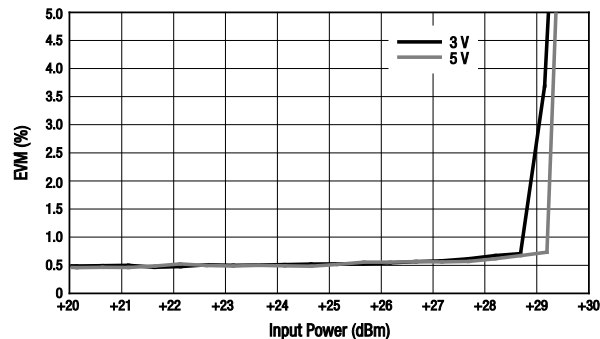


Figure 8. EVM vs Input Power  
(802.11g 64 QAM, 54 Mbps,  $f = 2.45\text{ GHz}$ )

**Table 4. SKY13348-374LF Truth Table<sup>1</sup>**

| V1 (Pin 1) | V2 (Pin 3) | Insertion Loss State |
|------------|------------|----------------------|
| 1          | 0          | RFC to J1            |
| 0          | 1          | RFC to J2            |
| 1          | 1          | undefined            |
| 0          | 0          | undefined            |

<sup>1</sup> "1" = +2.5 V to +5.0 V. "0" = 0 V to +0.2 V. Any state other than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

## Evaluation Board Description

The SKY13348-374LF Evaluation Board is used to test the performance of the SKY13348-374LF 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

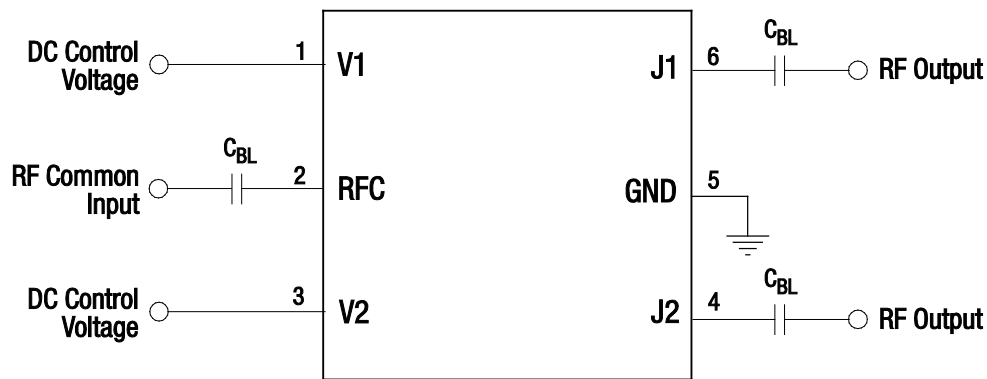
The PCB layout footprint for the SKY13348-374LF is provided in Figure 11. Typical part markings are shown in Figure 12. Package dimensions are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

## 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 SKY13348-374LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering.

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.



$C_{BL} = 47 \text{ pF}$  for >1 GHz operation. Increase value for lower frequency operation.

Exposed ground paddle should be grounded for best performance.

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**Figure 9. SKY13348-374LF Evaluation Board Schematic**

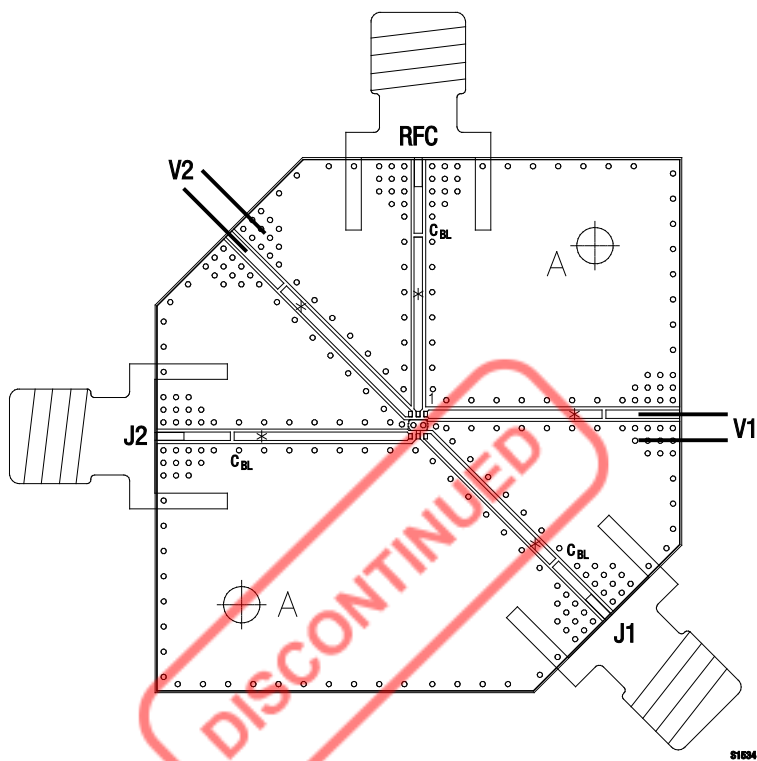


Figure 10. SKY13348-374LF Evaluation Board Assembly Diagram

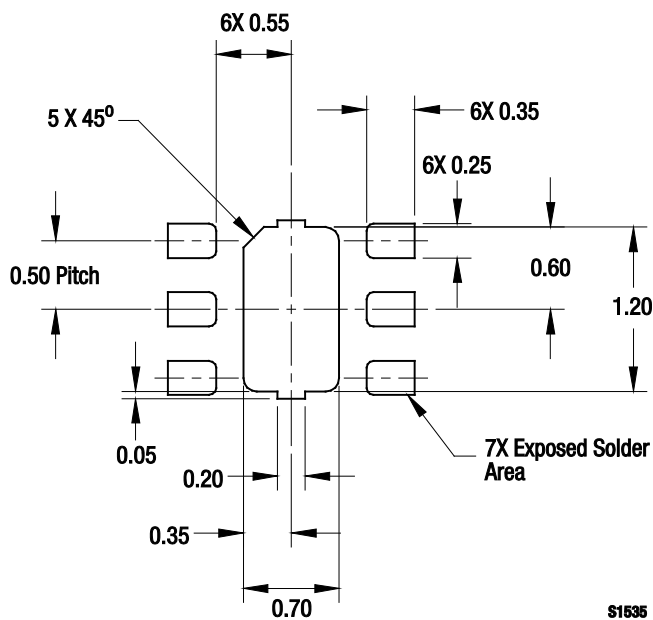
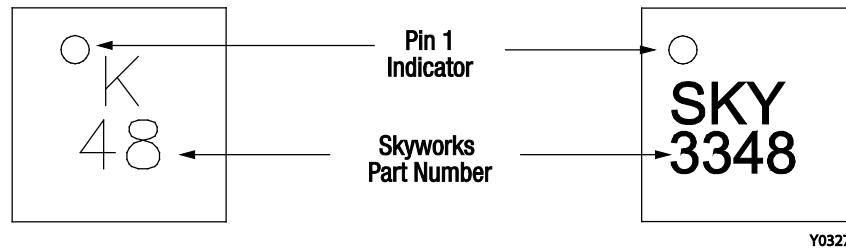
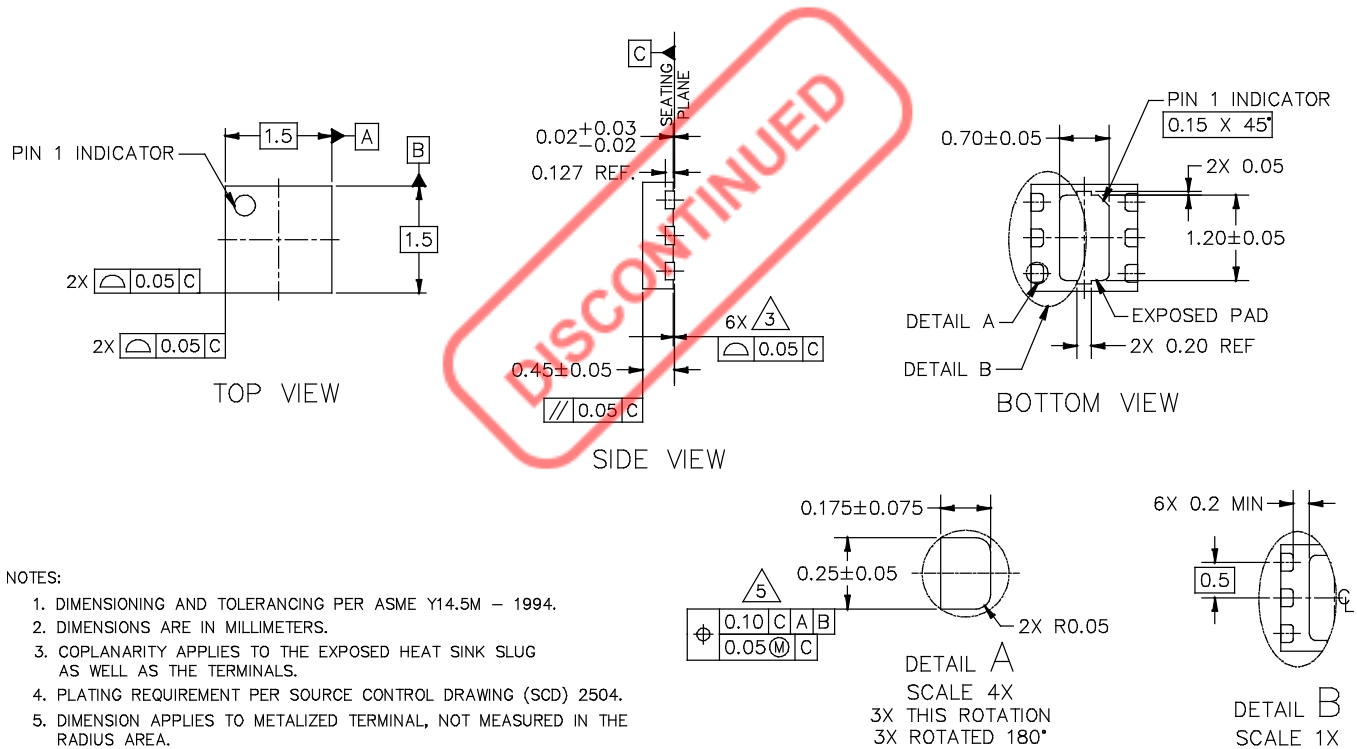


Figure 11. SKY13348-374LF PCB Layout Footprint (Top View)

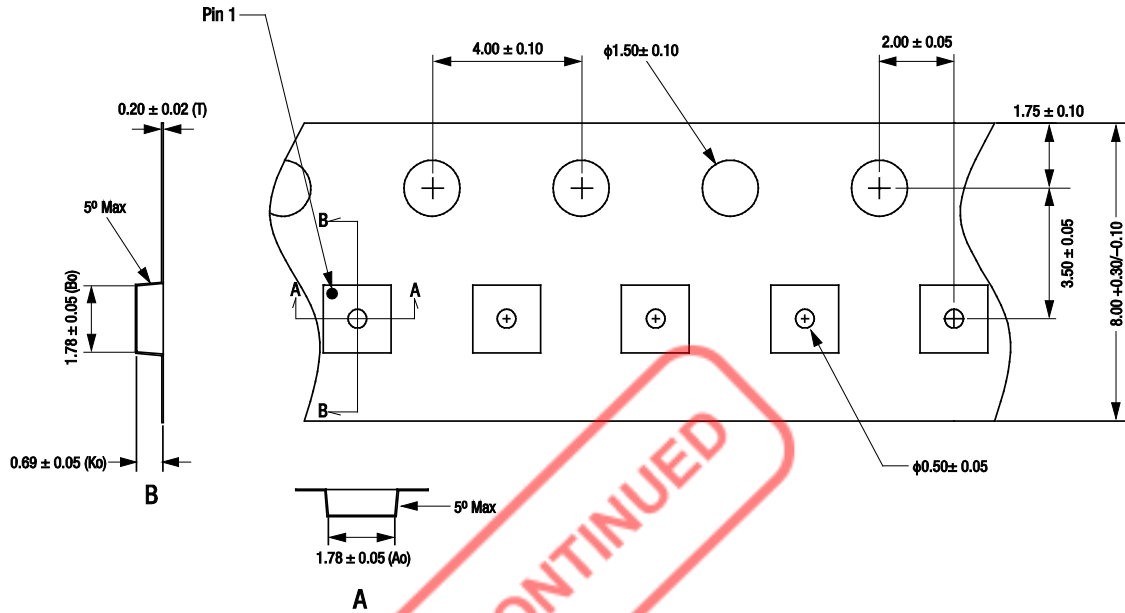


**Figure 12. Typical Part Markings  
(Top View)**



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**Figure 13. SKY13348-374LF 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.

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**Figure 14. SKY13348-374LF Tape and Reel Dimensions**

## Ordering Information

| Product Description         | Product Part Number | Evaluation Kit Part Number |
|-----------------------------|---------------------|----------------------------|
| SKY13348-374LF: SPDT Switch | SKY13348-374LF      | SKY13348-374LF-EVB         |



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