



SKYWORKS®

## DATA SHEET

# SKY13352-337LF: 4.5 – 6.0 GHz DPDT Diversity Switch

## Applications

- 802.11 a/n diversity WLANs

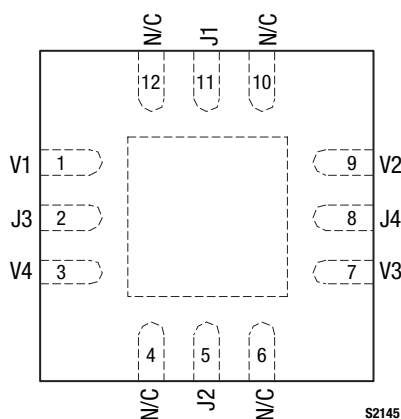
## Features

- Broadband operation: 4.5 to 6.0 GHz
- Positive voltage operation: +1.8 to +5 V
- DC blocking capacitors integrated on RF paths of device
- Low insertion loss: 1.3 dB typical @ 5.8 GHz
- High isolation: 25 dB typical @ 5.8 GHz
- IP1dB: +31 dBm typical @ +3 V
- Small, QFN (12-pin, 3 x 3 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

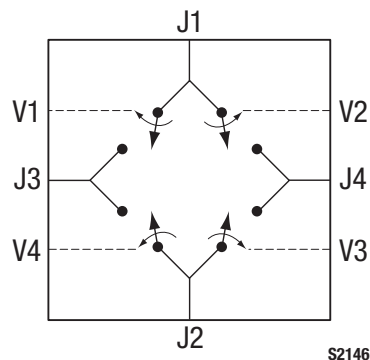
**NEW**



Skyworks Green™ products are RoHS (Restriction of Hazardous Substances)-compliant, conform to the EIA/EICTA/JEITA Joint Industry Guide (JIG) Level A guidelines, are halogen free according to IEC-61249-2-21, and contain <1,000 ppm antimony trioxide in polymeric materials.



**Figure 2. SKY13352-337LF Pinout – 12-Pin QFN (Top View)**



**Figure 1. SKY13352-337LF Block Diagram**

## Description

The SKY13352-337LF is a GaAs pHEMT Double-Pole, Double-Throw (DPDT) switch designed for 4.5 to 6.0 GHz diversity WLAN applications that use two antennas for both transmit and receive paths.

The device provides high linearity, low insertion loss, and high isolation. Switching is controlled by four control voltage inputs (V1, V2, V3, and V4). Depending on the logic voltage level applied to the control pins, the four RF ports (J1, J2, J3, and J4) are connected together using a low insertion loss path, while maintaining a high isolation path to the alternate ports. All of the necessary DC blocking capacitors are integrated on die for all RF ports, which eliminates the need to add external blocking capacitors.

The SKY13352-337LF is provided in a 3 x 3 mm, 12-pin 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. SKY13352-337LF Signal Descriptions**

| Pin # | Name | Description                                                                       | Pin # | Name | Description                                                                       |
|-------|------|-----------------------------------------------------------------------------------|-------|------|-----------------------------------------------------------------------------------|
| 1     | V1   | DC control voltage 1                                                              | 7     | V3   | DC control voltage 3                                                              |
| 2     | J3   | RF port 3                                                                         | 8     | J4   | RF port 4                                                                         |
| 3     | V4   | DC control voltage 4                                                              | 9     | V2   | DC control voltage 2                                                              |
| 4     | N/C  | No connection required. May be connected to ground with no change in performance. | 10    | N/C  | No connection required. May be connected to ground with no change in performance. |
| 5     | J2   | RF port 2                                                                         | 11    | J1   | RF port 1                                                                         |
| 6     | N/C  | No connection required. May be connected to ground with no change in performance. | 12    | N/C  | No connection required. May be connected to ground with no change in performance. |

**Note:** Exposed pad must be grounded through a low impedance path.

**Table 2. SKY13352-337LF Absolute Maximum Ratings**

| Parameter             | Symbol           | Minimum | Maximum | Units |
|-----------------------|------------------|---------|---------|-------|
| Control voltage       | V1, V2, V3, V4   |         | +6      | V     |
| RF input power        | P <sub>IN</sub>  |         | +33     | 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.

**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.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13352-337LF are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13352-337LF is determined by the logic provided in Table 4.

Typical performance characteristics are illustrated in Figures 3, 4, and 5.

**Table 3. SKY13352-337LF Electrical Specifications (Note 1)****(V1 = V2 = V3 = V4 = 3/0 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  | Typical | Max  | Units |
|---------------------------------------------|--------|-----------------------------------------------------------------|------|---------|------|-------|
| RF Specifications                           |        |                                                                 |      |         |      |       |
| Insertion loss                              | IL     | 4.5 to 4.9 GHz                                                  |      | 1.2     | 1.4  | dB    |
|                                             |        | 4.9 to 5.2 GHz                                                  |      | 1.2     | 1.4  | dB    |
|                                             |        | 5.2 to 5.8 GHz                                                  |      | 1.3     | 1.5  | dB    |
| Isolation                                   | Iso    | 4.5 to 4.9 GHz                                                  | 15   | 25      |      | dB    |
|                                             |        | 4.9 to 5.2 GHz                                                  | 20   | 25      |      | dB    |
|                                             |        | 5.2 to 5.8 GHz                                                  | 20   | 25      |      | dB    |
| Return loss                                 | S11    | 4.5 GHz to 6.0 GHz                                              |      | 25      |      | dB    |
| 1 dB Input Compression Point                | IP1dB  | @ 5.2 GHz                                                       |      |         |      |       |
|                                             |        | V1/2/3/4 = 2.7 V                                                |      | +31     |      | dBm   |
|                                             |        | V1/2/3/4 = 3.0 V                                                |      | +31     |      | dBm   |
|                                             |        | V1/2/3/4 = 5.0 V                                                |      | +32     |      | dBm   |
| 2 <sup>nd</sup> Order Input Intercept Point | IIP2   | @ 5.2 GHz,<br>PIN = +15 dBm/tone,<br>V1/2/3/4 = 3 V             |      | +85     |      | dBm   |
| 3 <sup>rd</sup> Order Input Intercept Point | IIP3   | @ 5.2 GHz, Δf = 5 MHz,<br>PIN = +15 dBm/tone,<br>V1/2/3/4 = 3 V |      | +51     |      | dBm   |
|                                             |        | @ 5.8 GHz, Δf = 5 MHz,<br>PIN = +15 dBm/tone,<br>V1/2/3/4 = 5 V |      | +52     |      | dBm   |
|                                             |        |                                                                 |      |         |      |       |
|                                             |        |                                                                 |      |         |      |       |
| Second harmonic                             | 2fo    | @ 5.2 GHz,<br>PIN = +20 dBm/tone,<br>V1/2/3/4 = 3 V             |      | +75     |      | dBc   |
| Third harmonic                              | 3fo    | @ 5.2 GHz,<br>PIN = +20 dBm/tone,<br>V1/2/3/4 = 3 V             |      | +78     |      | dBc   |
| Switching speed                             |        | 10% to 90% RF                                                   |      | 15      |      | ns    |
|                                             |        | 90% to 10% RF                                                   |      | 40      |      | ns    |
|                                             |        | 50% control voltage to<br>90% RF                                |      | 30      |      | ns    |
|                                             |        | 50% control voltage to<br>10% RF                                |      | 40      |      | ns    |
| DC Specifications                           |        |                                                                 |      |         |      |       |
| Control voltage:<br>High<br>Low             | VHIGH  |                                                                 | 1.8  | 3.0     | 5.0  | V     |
|                                             | VLOW   |                                                                 | −0.2 | 0       | +0.2 | V     |
| Control current                             | Icc    |                                                                 |      | 5       | 50   | μA    |

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

**Table 4. SKY13352-337LF Truth Table**

| Insertion Loss State  | V1 | V2 | V3 | V4 |
|-----------------------|----|----|----|----|
| J1 to J3              | 1  | 0  | 0  | 0  |
| J1 to J4              | 0  | 1  | 0  | 0  |
| J2 to J4              | 0  | 0  | 1  | 0  |
| J2 to J3              | 0  | 0  | 0  | 1  |
| J1 to J3 and J2 to J4 | 1  | 0  | 1  | 0  |
| J1 to J4 and J2 to J3 | 0  | 1  | 0  | 1  |

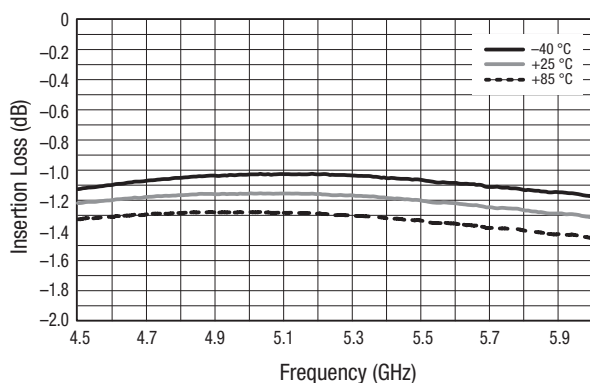
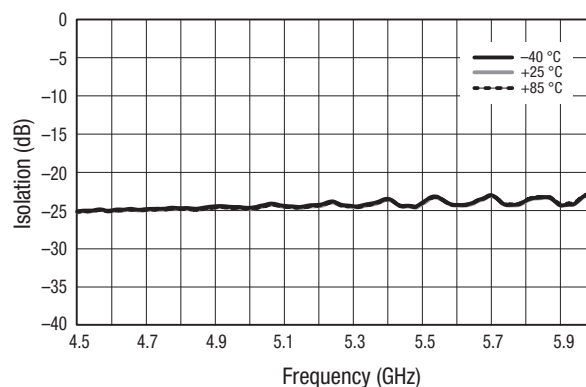
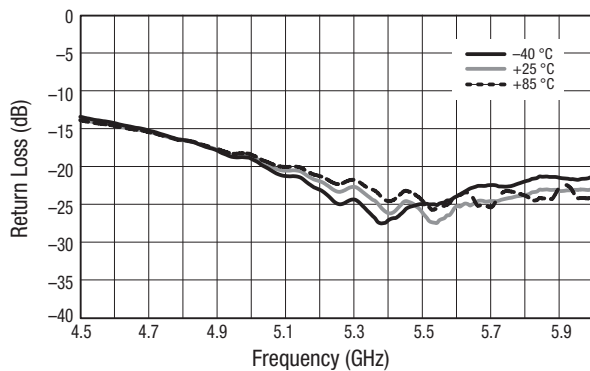
Note: "1" = +1.8 to +5.0 V

"0" = -0.2 to +0.2 V

Any other state than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

## Typical Performance Characteristics

(V<sub>1</sub>/2/3/4 = 3/0 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)

**Figure 3. Insertion Loss vs Frequency Over Temperature****Figure 4. Isolation vs Frequency Over Temperature****Figure 5. Return Loss vs Frequency Over Temperature**

## Evaluation Board Description

The SKY13352-337LF Evaluation Board is used to test the performance of the SKY13352-337LF DPDT switch. An Evaluation Board schematic diagram is shown in Figure 6. An assembly drawing for the Evaluation Board is shown in Figure 7.

## Package Dimensions

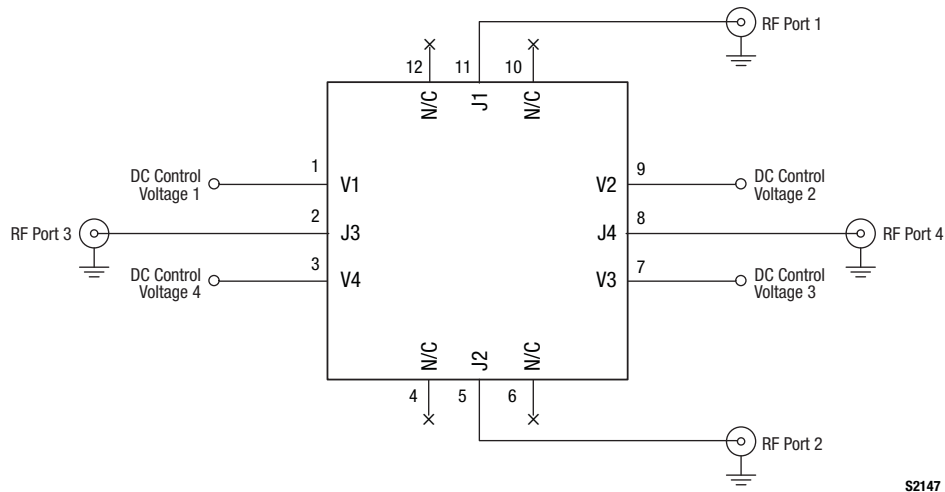
The PCB layout footprint for the SKY13352-337LF is shown in Figure 8. Typical case markings are noted in Figure 9. Package dimensions for the 12-pin QFN are shown in Figure 10, and tape and reel dimensions are provided in Figure 11.

## Package and Handling Information

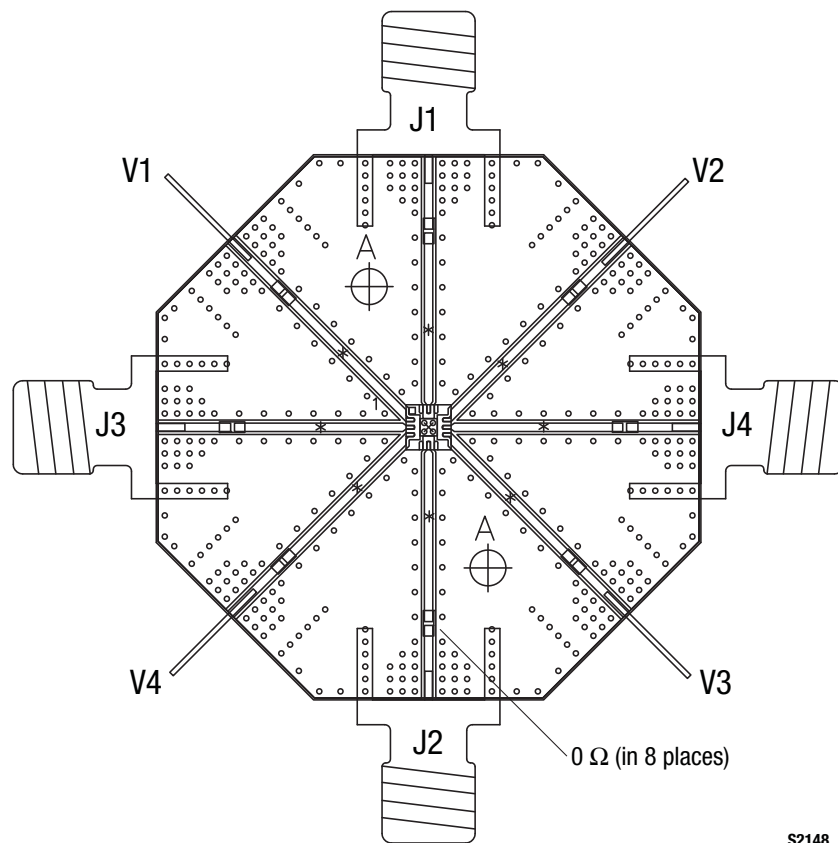
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY13352-337LF 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.

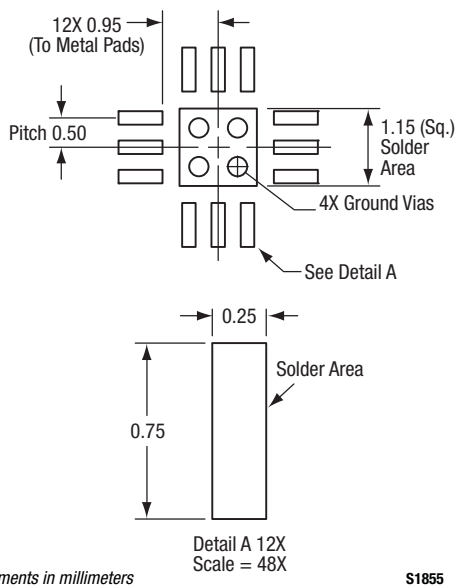
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



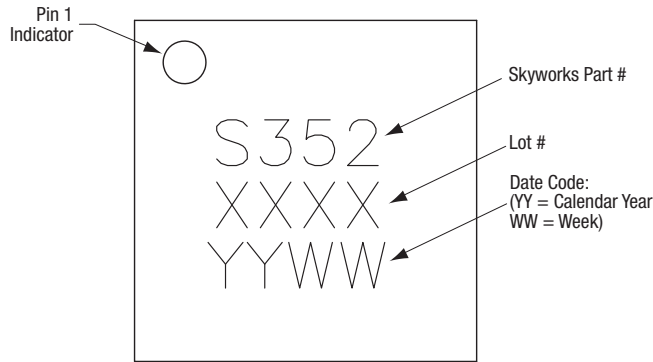
**Figure 6. SKY13352-337LF Evaluation Board Schematic Diagram**



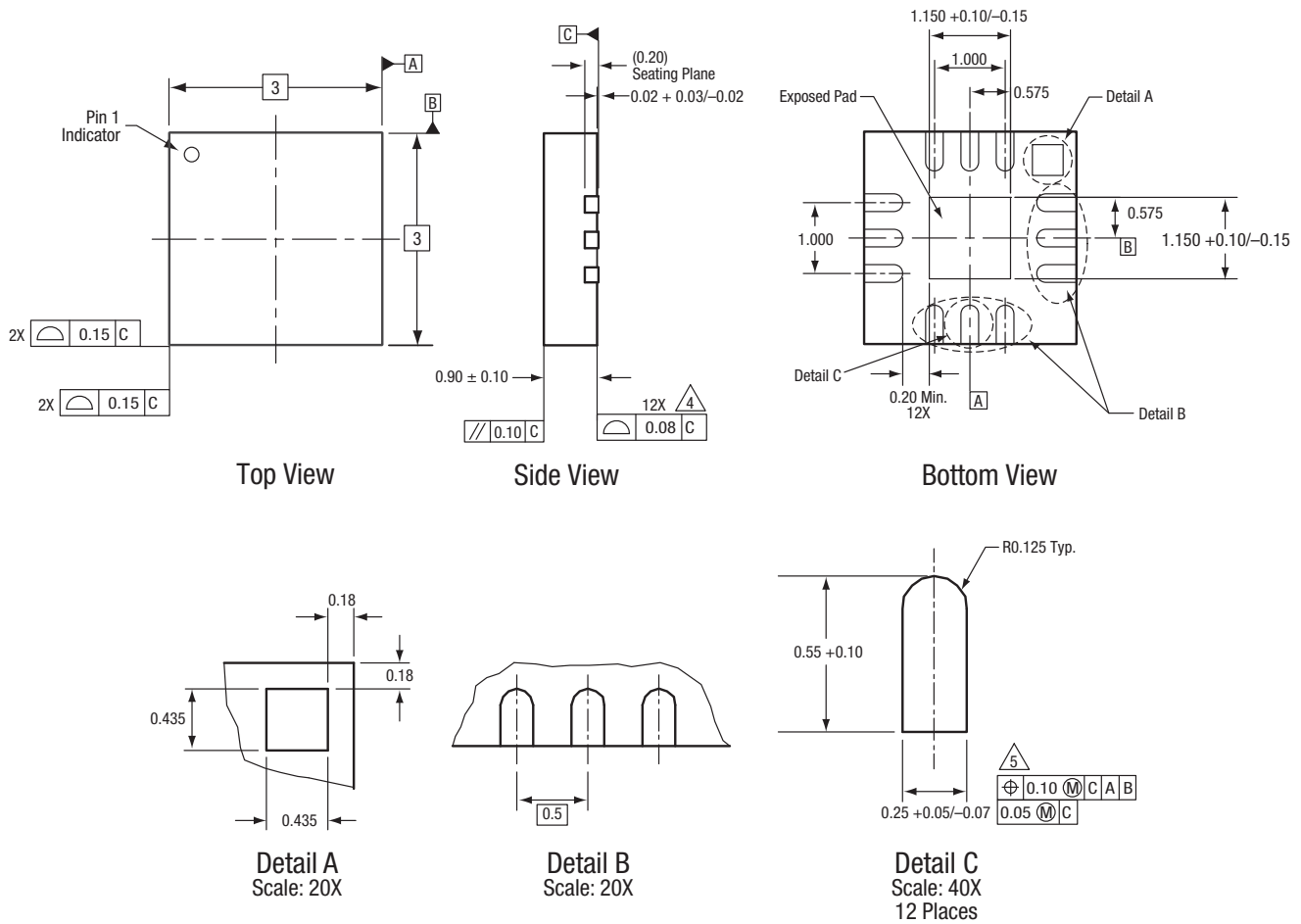
**Figure 7. SKY13352-337LF Evaluation Board Assembly Diagram**



**Figure 8. SKY13352-337LF PCB Layout Footprint**



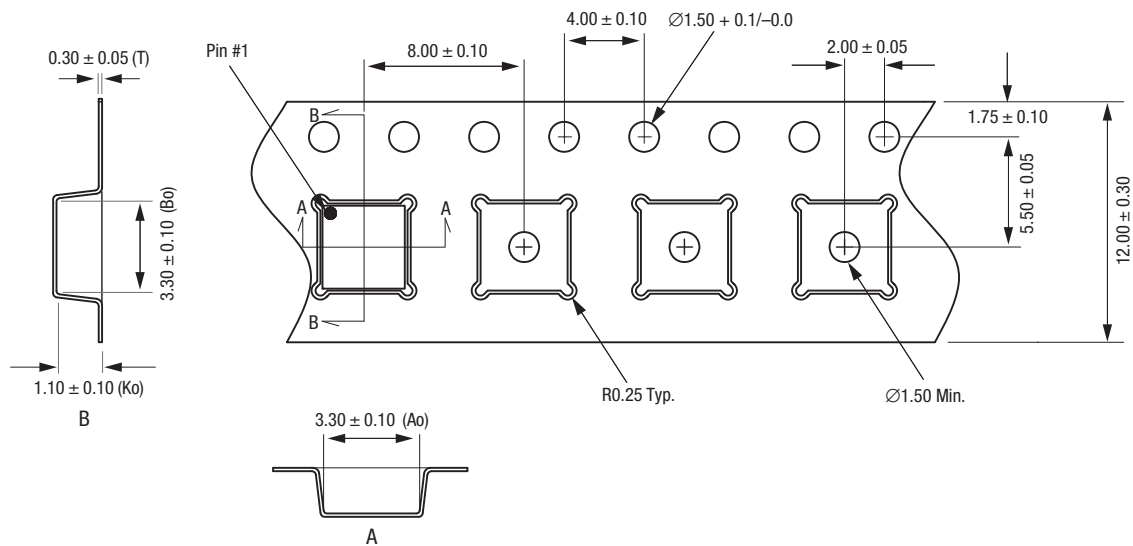
**Figure 9. Typical Part Markings (Top View)**



All measurements are in millimeters.  
 Dimensioning and tolerancing according to ASME Y14.5M-1994.  
 Unilateral 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 and 0.30 mm from the terminal tip. Do not measure at radius area.

S1866

**Figure 10. SKY13352-337LF 12-Pin QFN Package Dimensions**



Notes:  
 1. Carrier tape: black conductive polystyrene, non-bakeable material.  
 2. Cover tape material: transparent conductive HSA.  
 3. Cover tape size: 9.20 mm width.  
 4. All measurements are in millimeters.

S1698

**Figure 11. SKY13352-337LF Tape and Reel Dimensions**

## Ordering Information

| Model Name                           | Manufacturing Part Number | Evaluation Board Part Numbers |
|--------------------------------------|---------------------------|-------------------------------|
| SKY13352-337LF DPDT Diversity Switch | SKY13352-337LF            | SKY13352-337LF-EVB            |

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