

DATA SHEET

# SKY13286-359LF: 0.1 to 6.0 GHz High Isolation SPDT Absorptive Switch

## Applications

- GSM, PCS, WCDMA base stations
- 2.4 and 5.8 GHz ISM devices
- Wireless local loops

## Features

- Single, positive voltage control: 0 to 3 and 0 to 5 V
- High isolation 64 dB at 1 GHz and 2 GHz
- Integrated silicon CMOS driver
- Absorptive
- Small, QFN (16-pin, 4 x 4 mm) Pb-free package (MSL1, 260 °C per JEDEC J-STD-020)



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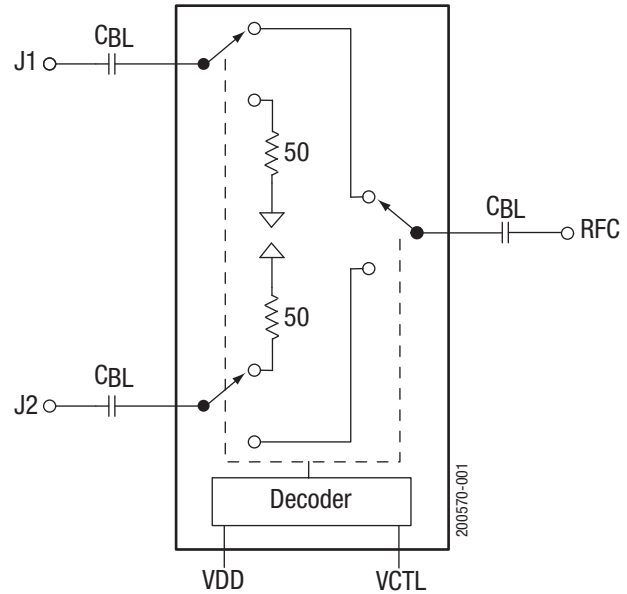
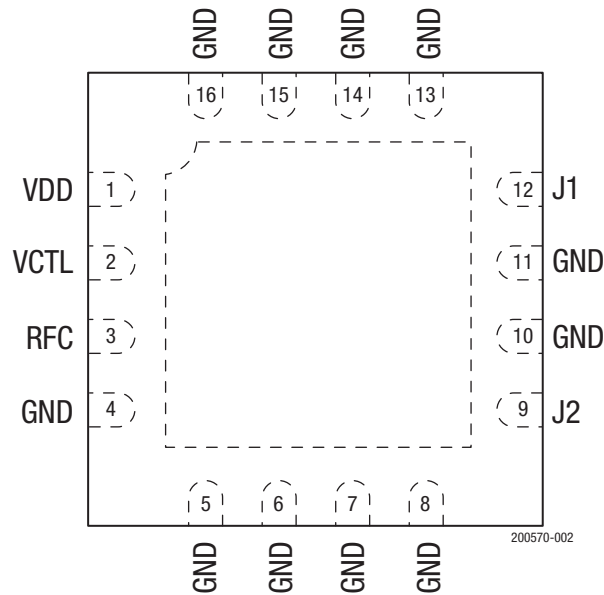


Figure 1. SKY13286-359LF Block Diagram

## Description

The SKY13286-359LF is a GaAs pHEMT FET high-isolation, absorptive switch. The device is an ideal component for base station applications in which synthesizer isolation is critical.

The device is provided in a 4 x 4 mm, 16-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.



**Figure 2. SKY13286-359LF Pinout (Top View)**

**Table 1. SKY13286-359LF Signal Descriptions**

| Pin | Name | Description  | Pin | Name | Description |
|-----|------|--|-----|------|-------------|
| 1   | VDD  | DC power supply  | 9   | J2   | RF output 2 |
| 2   | VCTL | DC switch control pin. Switches insertion loss state from RFC to J1 or J2 (see Table 5). | 10  | GND  | Ground      |
| 3   | RFC  | RF input   | 11  | GND  | Ground      |
| 4   | GND  | Ground   | 12  | J1   | RF output 1 |
| 5   | GND  | Ground   | 13  | GND  | Ground      |
| 6   | GND  | Ground   | 14  | GND  | Ground      |
| 7   | GND  | Ground   | 15  | GND  | Ground      |
| 8   | GND  | Ground   | 16  | GND  | Ground      |

### Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13286-359LF are provided in Table 2. Recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the SKY13286-359LF are illustrated in Figures 3 through 9.

The state of the SKY13286-359LF is determined by the logic provided in Table 5.

**Table 2. SKY13286-359LF Absolute Maximum Ratings<sup>1</sup>**

| Parameter                 | Symbol           | Minimum | Typical | Maximum | Units |
|---------------------------|------------------|---------|---------|---------|-------|
| Supply voltage            | VDD              | 2.7     |         | 5.5     | V     |
| RF input power @ >500 MHz | V <sub>i</sub>   |         | 1       |         | W     |
| Operating temperature     | T <sub>OP</sub>  | -40     |         | +95     | °C    |
| Storage temperature       | T <sub>STG</sub> | -65     |         | +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.

**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. Recommended Operating Conditions**

| Parameter                        | Symbol                | Test Condition  | Min            | Typical                  | Max | Units                    |
|----------------------------------|-----------------------|---|----------------|--------------------------|-----|--------------------------|
| Switching characteristics:       |                       |   |                |                          |     |                          |
| Rise, fall                       |                       | 10/90% or 90/10% RF   |                | 30                       |     | ns                       |
| On/off                           |                       | 50% control to 90/10% RF  |                | 50                       |     | ns                       |
| Video feedthrough                |                       | T <sub>RISE</sub> = 3 ns, measurement bandwidth = 500 MHz   |                | 25                       |     | mV                       |
| Input power for 1 dB compression | P <sub>INPUT</sub>    | VDD = 3V, 0.7-2.0 GHz<br>VDD = 5 V, 0.7-2.0 GHz   | +26            | +23<br>+30               |     | dBm<br>dBm               |
| 2 <sup>nd</sup> harmonic         | 2f <sub>o</sub>       | f <sub>o</sub> = 2400 MHz, P <sub>IN</sub> = -15 dBm  |                | -80                      |     | dBm                      |
| Third order intercept point      | IP3                   | For 2-tone input power, +8 dBm/tone, 1 MHz spacing:<br>VDD = 3.3 V, 0.7-1.0 GHz<br>VDD = 5.0 V, 0.7-1.0 GHz<br>VDD = 3.3 V, 1.0-2.0 GHz<br>VDD = 5.0 V, 1.0-2.0 GHz | +45<br><br>+45 | +49<br>+47<br>+43<br>+46 |     | dBm<br>dBm<br>dBm<br>dBm |
| Control voltage: <sup>1</sup>    |                       |   |                |                          |     |                          |
| Low with VDD = 5 V               | V <sub>CTL_LOW</sub>  |   | 0              |                          | 0.5 | V                        |
| High with VDD = 5 V              | V <sub>CTL_HIGH</sub> |   | 2.7            |                          | VDD | V                        |
| Low with VDD = 3.3 V             | V <sub>CTL_LOW</sub>  |   | 0              |                          | 0.5 | V                        |
| High with VDD = 3.3 V            | V <sub>CTL_HIGH</sub> |   | 2.5            |                          | 3.3 | V                        |
| Supply current                   |                       | VDD = 5 V   |                |                          | 100 | μA                       |
| Control current                  |                       | V <sub>CTL</sub> = low or high  |                | 5                        |     | μA                       |
| Supply voltage                   |                       |   | 2.7            |                          | 5.0 | V                        |

<sup>1</sup> VDD must be applied before a V<sub>ctl</sub> high signal. A latch-up condition may occur if a logic high signal is applied before the VDD voltage. Control voltages switch the VDD voltage to the GaAs switch.

**Table 4. SKY13286-359LF Electrical Specifications<sup>1</sup>**  
 (V<sub>CTL</sub> = 0 V/3 V, V<sub>DD</sub> = 5 V, T<sub>OP</sub> = +25 °C, P<sub>INPUT</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)

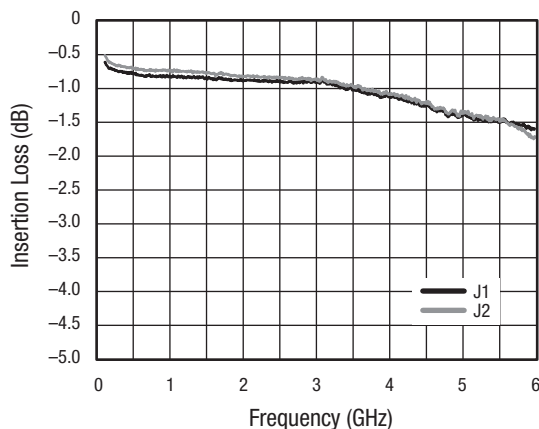
| Parameter                                       | Symbol | Test Condition  | Min | Typical | Max  | Units |
|---|--------|---|-----|---------|------|-------|
| CW insertion loss                               | IL     | 0.1 to 2.0 GHz  |     | 0.8     | 1.10 | dB    |
|   |        | 2.0 to 3.0 GHz  |     | 0.8     | 1.25 | dB    |
|   |        | 3.0 to 4.0 GHz  |     | 1.0     | 1.35 | dB    |
|   |        | 4.0 to 6.0 GHz  |     | 1.5     | 1.80 | dB    |
| Isolation                                       | Iso    | 0.1 to 2.0 GHz  | 60  | 62      |      | dB    |
|   |        | 2.0 to 3.0 GHz  | 58  | 62      |      | dB    |
|   |        | 3.0 to 4.0 GHz  | 55  | 58      |      | dB    |
|   |        | 4.0 to 6.0 GHz  | 40  | 42      |      | dB    |
| Return loss (insertion loss state) <sup>2</sup> | RL     | 0.1 to 2.0 GHz  | 10  | 22      |      | dB    |
|   |        | 2.0 to 3.0 GHz  | 15  | 22      |      | dB    |
|   |        | 3.0 to 4.0 GHz  | 13  | 18      |      | dB    |
|   |        | 4.0 to 6.0 GHz  | 10  | 12      |      | dB    |
| Return loss (isolation state) <sup>2</sup>      | RL     | 0.1 to 2.0 GHz  | 10  | 12      |      | dB    |
|   |        | 2.0 to 3.0 GHz  | 12  | 15      |      | dB    |
|   |        | 3.0 to 4.0 GHz  | 12  | 15      |      | dB    |
|   |        | 4.0 to 6.0 GHz  | 11  | 13      |      | dB    |
| Insertion loss settling time                    | ΔIL    | Insertion loss in db measured @ 1 μs (referenced to a rising 10% RF level on J1 & J2) minus the CW insertion loss in dB. Freq = 2 GHz, T <sub>OP</sub> = +25 °C, V <sub>CTL</sub> = 5 V, pulse width = 1.15 ms, 50% duty cycle. |     |         | 0.40 | dB    |

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

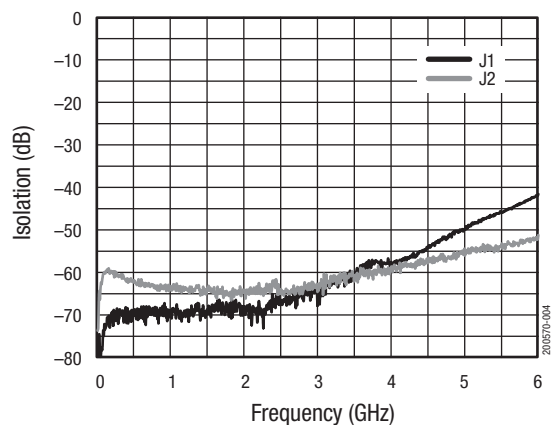
<sup>2</sup> Lower frequency return loss is dependent on DC blocks.

### Typical Performance Characteristics

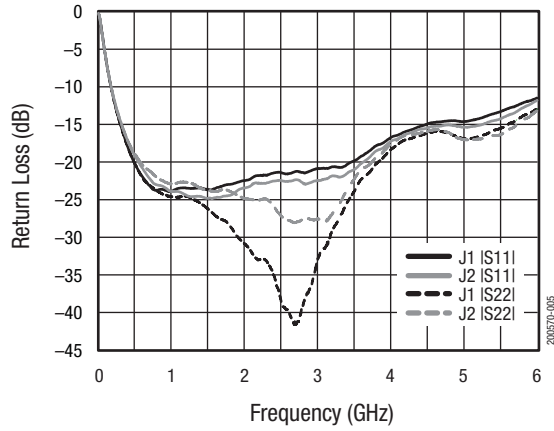
(V<sub>CTL</sub> = 0 V/3 V, V<sub>DD</sub> = 5 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)



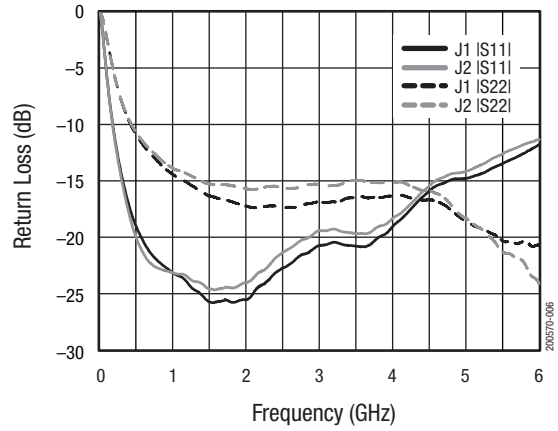
**Figure 3. Insertion Loss vs Frequency**



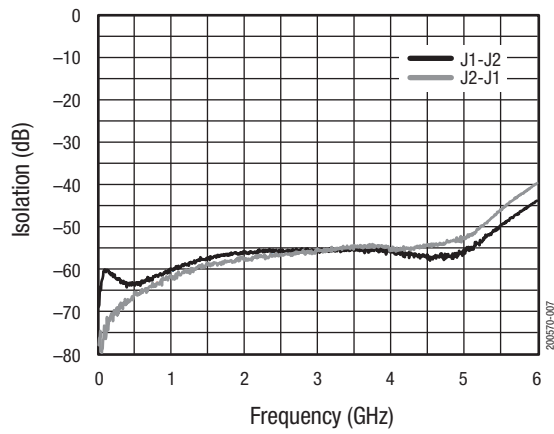
**Figure 4. Isolation vs Frequency**



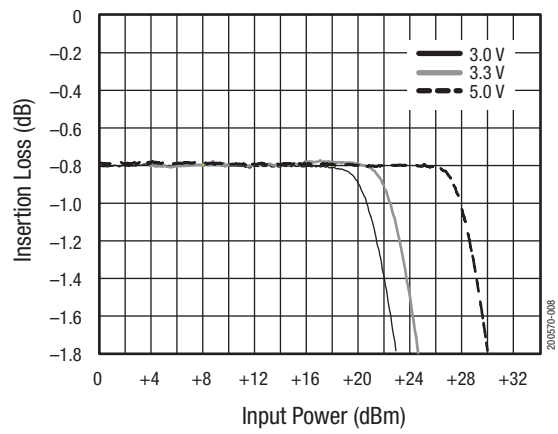
**Figure 5. Return Loss vs Frequency (Insertion Loss State)**



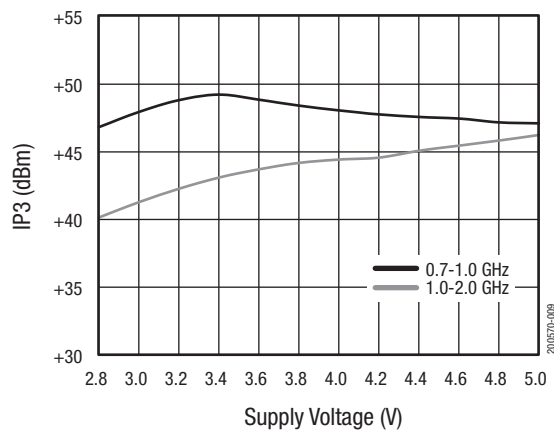
**Figure 6. Return Loss vs Frequency (Isolation State)**



**Figure 7. Output to Output Isolation**



**Figure 8. Insertion Loss vs Input Power Over Voltage**



**Figure 9. IP3 vs VDD Supply Voltage**

**Table 5. SKY13286-359LF Truth Table**

| VCTL | RFC to J1      | RFC to J2      |
|------|----------------|----------------|
| 0    | Insertion loss | Isolation      |
| 1    | Isolation      | Insertion loss |

### Evaluation Board Description

The SKY13286-359LF Evaluation Board is used to test the performance of the SKY13286-359LF SPDT absorptive switch. An assembly drawing for the Evaluation Board is shown in Figure 10.

### Package Dimensions

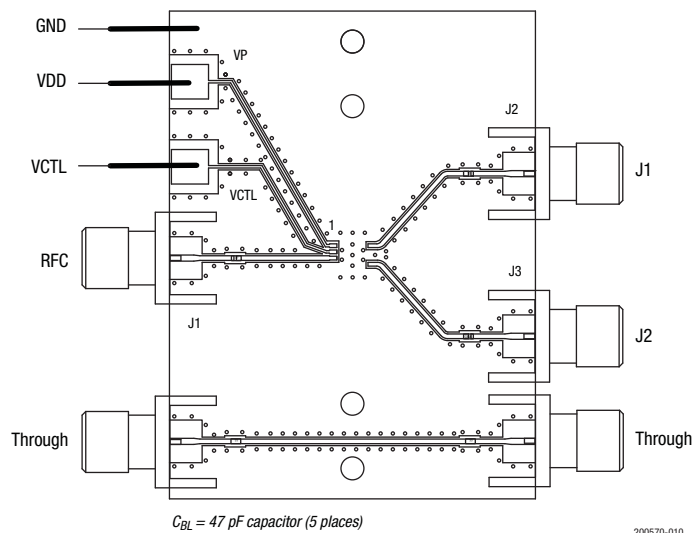
The PCB layout footprint for the SKY13286-359LF is shown in Figure 11. Typical part markings are noted in Figure 12. Package dimensions are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

### 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 SKY13286-359LF 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 10. SKY13286-359LF Evaluation Board Assembly Diagram**

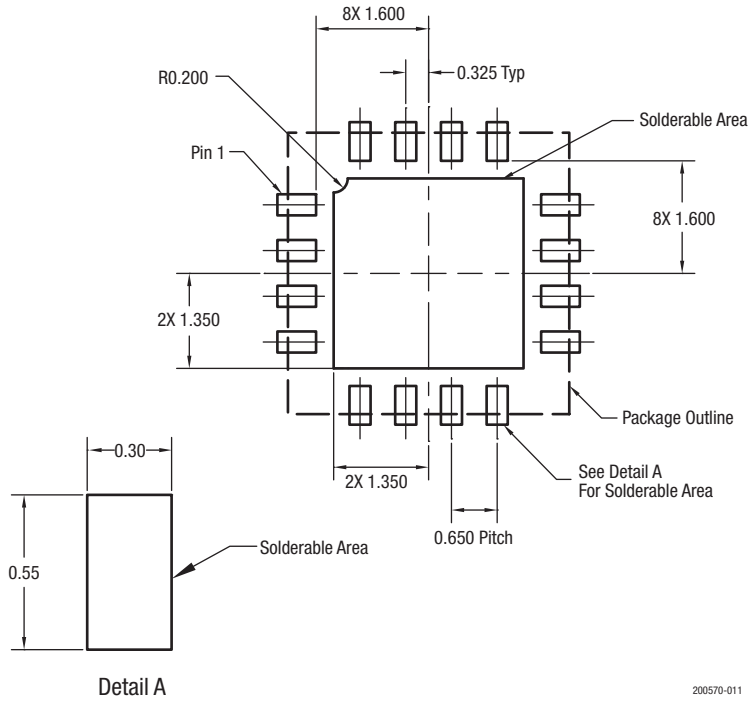


Figure 11. SKY13286-359LF PCB Layout Footprint

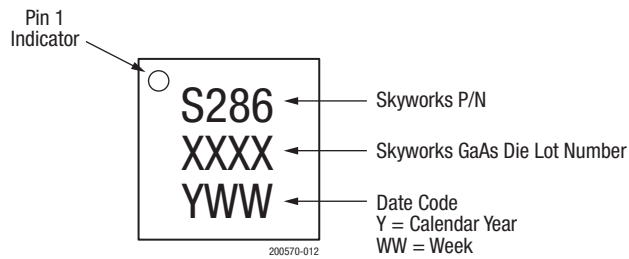
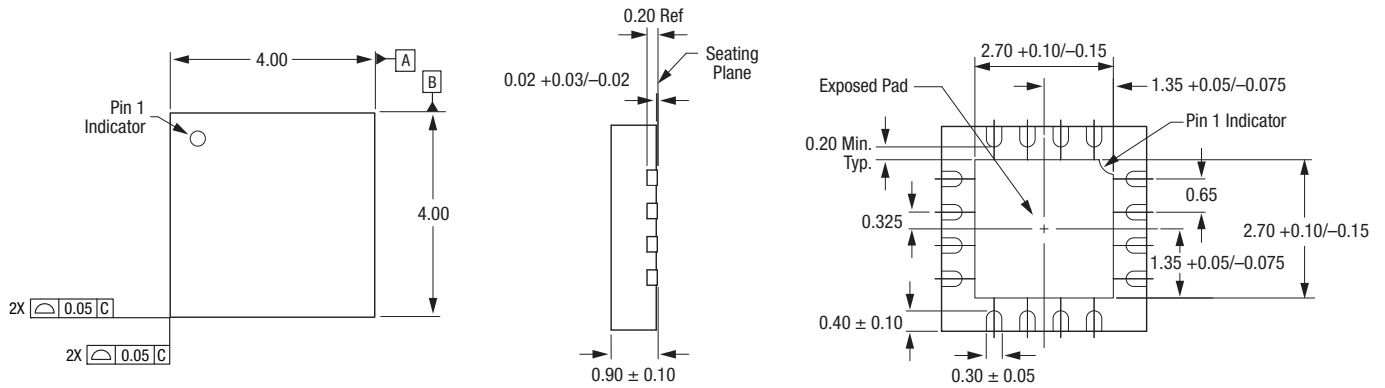


Figure 12. Typical Part Markings

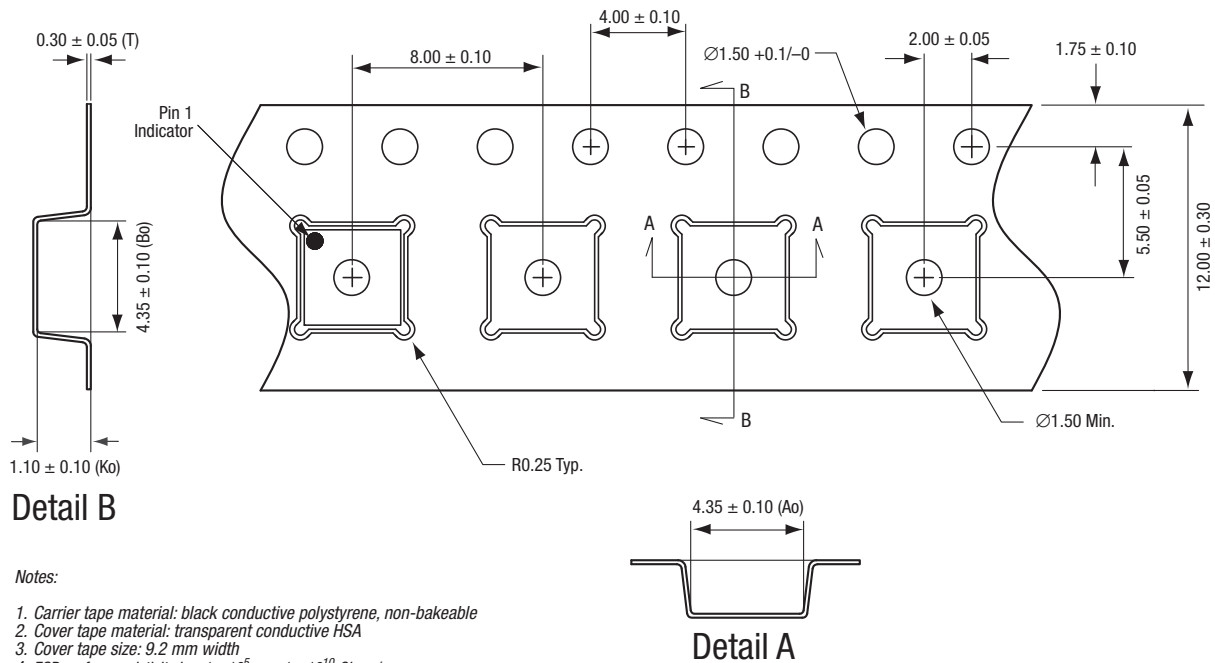
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All dimensions are in millimeters

200570-013

**Figure 13. SKY13286-359LF Package Dimensions**



Notes:

1. Carrier tape material: black conductive polystyrene, non-bakeable
2. Cover tape material: transparent conductive HSA
3. Cover tape size: 9.2 mm width
4. ESD surface resistivity is  $\geq 1 \times 10^5 \sim \leq 1 \times 10^{10}$  Ohms/square per EIA, JEDEC TNR Specification.
5. All measurements are in millimeters

200570-014

**Figure 14. SKY13286-359LF Tape and Reel Dimensions**



## Ordering Information

| Model Name                             | Manufacturing Part Number | Evaluation Board Part Number |
|--|---------------------------|------------------------------|
| SKY13286-359LF: SPDT Absorptive Switch | SKY13286-359LF            | SKY13286-359LF-EVB           |

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