

## DATA SHEET

# SKY13585-679LF: 1.0 to 6.0 GHz SPDT Switch

### Applications

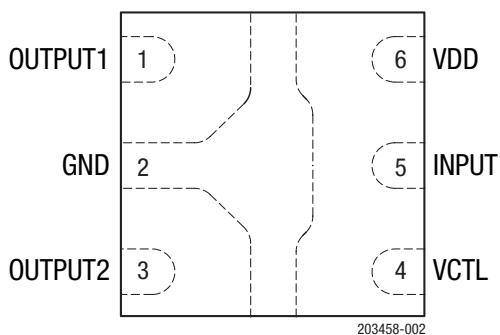
- WLAN 802.11 a/b/g/n/ac networks
- WLAN repeaters
- ISM band radios
- Low power transmit receive systems
- Smartphones
- Connectivity modules

### Features

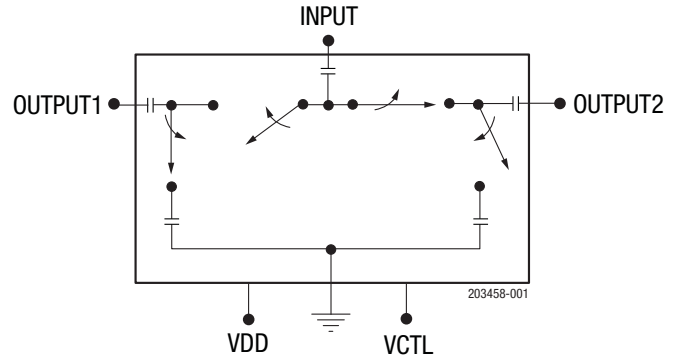
- Broadband frequency range: 1.0 to 6.0 GHz
- Low insertion loss, 0.5 dB typical @ 2.45 GHz
- High isolation, 38 dB typical @ 2.45 GHz
- Excellent linearity performance,  $IP0.1dB = +31$  dBm
- Single control logic
- 1.8 V and 3.3 V logic compatibility
- Wide 3 to 5 V supply voltage range
- Integrated DC blocking capacitors
- Ultra-miniature, MLPD (6-pin,  $1 \times 1 \times 0.32$  mm) 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 2. SKY13585-679LF Pinout (Top View)**



**Figure 1. SKY13585-679LF Block Diagram**

### Description

The SKY13585-679LF is a single-pole, double-throw (SPDT) switch intended for mode switching in WLAN applications. Using advanced switching technologies, the SKY13585-679LF maintains low insertion loss and high isolation for all switching paths.

The high-linearity performance and low insertion loss achieved by the switch make it an ideal choice for low-power transmit/receive applications. Depending on the logic voltage applied to the control pin (VCTL), the INPUT pin is connected to one of the two switched RF outputs (OUTPUT1 or OUTPUT2) using a low insertion loss path, while the path between the INPUT pin and the other OUTPUT pin is in a high-isolation state. The switch is "reflective short" on the isolated port.

The SKY13585-679LF has integrated DC blocking capacitors, so no external DC blocking capacitors are required.

The switch is manufactured in a compact,  $1 \times 1 \times 0.32$  mm, 6-pin exposed pad plastic Micro Lead-frame 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.

**Table 1. SKY13585-679LF Signal Descriptions**

| Pin | Name    | Description | Pin | Name  | Description        |
|-----|---------|-------------|-----|-------|--------------------|
| 1   | OUTPUT1 | RF port     | 4   | VCTL  | DC control voltage |
| 2   | GND     | Ground      | 5   | INPUT | RF port            |
| 3   | OUTPUT2 | RF port     | 6   | VDD   | DC supply voltage  |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13585-679LF are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

The state of the SKY13585-679LF is determined by the logic provided in Table 5. Typical performance characteristics are shown in Figures 3 through 6.

**Table 2. SKY13585-679LF Absolute Maximum Ratings<sup>1</sup>**

| Parameter             | Symbol | Minimum | Maximum | Units |
|-----------------------|--------|---------|---------|-------|
| Input power           | PIN    |         | +32     | dBm   |
| Supply voltage        | VDD    |         | 5.5     | V     |
| Control voltage       | VCTL   |         | 3.7     | V     |
| Storage temperature   | TSTG   | −65     | +150    | °C    |
| Operating temperature | TOP    | −40     | +90     | °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. SKY13585-679LF Recommended Operating Conditions**

| Parameter             | Symbol | Minimum | Typical | Maximum | Units |
|-----------------------|--------|---------|---------|---------|-------|
| Operating frequency   | fo     | 1.0     |         | 6.0     | GHz   |
| Supply voltage        | VDD    | 2.7     | 3.3     | 5       | V     |
| Control voltage:      |        |         |         |         |       |
| Low                   | VCTL_L | 0       |         | 0.4     | V     |
| High                  | VCTL_H | 1.6     |         | 3.6     | V     |
| Operating temperature | TOP    |         | +25     |         | °C    |

**Table 4. SKY13585-679LF Electrical Specifications<sup>1</sup>****(V<sub>DD</sub> = 3.3 V, V<sub>CTL</sub> = 0 V and 1.8 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                                                                             | Minimum    | Typical    | Maximum      | Units      |
|-----------------------------------------|-----------------|--------------------------------------------------------------------------------------------|------------|------------|--------------|------------|
| Insertion loss                          | IL              | 1.0 to 2.5 GHz, NTC <sup>2</sup><br>4.8 to 6.0 GHz, NTC                                    |            | 0.5<br>0.7 | 0.65<br>0.95 | dB<br>dB   |
| Isolation<br>(INPUT to OUTPUT1/OUTPUT2) | ISO             | 1.0 to 2.5 GHz, NTC<br>4.8 to 6.0 GHz, NTC                                                 | 34<br>20   | 38<br>22   |              | dB<br>dB   |
| Isolation<br>(OUTPUT1 to OUTPUT2)       | ISO             | 1.0 to 2.5 GHz, NTC<br>4.8 to 6.0 GHz, NTC                                                 | 33<br>19   | 36<br>22   |              | dB<br>dB   |
| Return loss                             | RL              | 1.0 to 2.5 GHz, NTC<br>4.8 to 6.0 GHz, NTC                                                 | 14<br>14   | 17<br>17   |              | dB<br>dB   |
| P0.1dB compression point                | P0.1dB          | 1.0 to 6.0 GHz, NTC                                                                        |            | +31        |              | dBm        |
| Harmonics                               | 2fo             | P <sub>IN</sub> = +24 dBm:<br>fo = 2.4 GHz, NTC<br>fo = 5.8 GHz, NTC                       |            | -48<br>-50 | -42<br>-46   | dBm<br>dBm |
|                                         | 3fo             | P <sub>IN</sub> = +24 dBm, fo = 2.4 GHz, NTC                                               |            | -48        | -44          | dBm        |
| Input IP3                               | IP3             | P <sub>IN</sub> = +20 dBm/tone:<br>fo = 2.4 GHz, NTC<br>fo = 5.8 GHz, NTC                  | +50<br>+46 | +56<br>+50 |              | dBm<br>dBm |
|                                         |                 |                                                                                            |            |            |              |            |
| Error vector magnitude                  | EVM             | 802.11a, 54 Mbps, P <sub>IN</sub> = +24 dBm<br>802.11g, 54 Mbps, P <sub>IN</sub> = +24 dBm |            | -45<br>-42 | -40<br>-36   | dB<br>dB   |
| Startup time                            | t <sub>s</sub>  | 50% V <sub>DD</sub> to 90% of RF                                                           |            | 2          | 5            | μs         |
| Switching speed                         | t <sub>sw</sub> | 10% RF to 90% RF                                                                           |            | 300        | 450          | ns         |
| Supply current                          | I <sub>DD</sub> | NTC                                                                                        |            | 5          | 10           | μA         |

<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.<sup>2</sup> NTC = nominal test conditions**Table 5. SKY13585-679LF Truth Table<sup>1</sup>**

| VDD (Pin 6) | VCTL (Pin 4) | INPUT to OUTPUT1 Path | INPUT to OUTPUT2 Path |
|-------------|--------------|-----------------------|-----------------------|
| 1           | 0            | Isolation             | Insertion loss        |
| 1           | 1            | Insertion loss        | Isolation             |

<sup>1</sup> "1" indicates VDD = 3 to 5 V, VCTL = 1.6 to 3.6 V.

"0" indicates VCTL = 0 to 0.4 V.

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

## Typical Performance Characteristics

( $V_{DD} = 3.3\text{ V}$ ,  $V_{CTL} = 0\text{ V}$  and  $1.8\text{ V}$ ,  $T_{OP} = +25\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Characteristic Impedance [ $Z_0$ ] =  $50\text{ }\Omega$ , Unless Otherwise Noted)

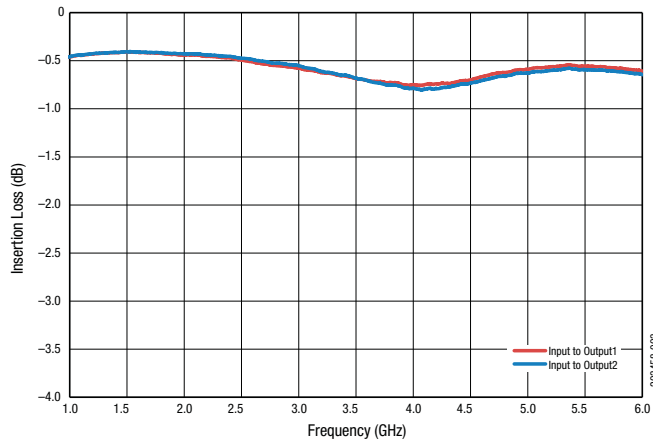


Figure 3. Typical Insertion Loss

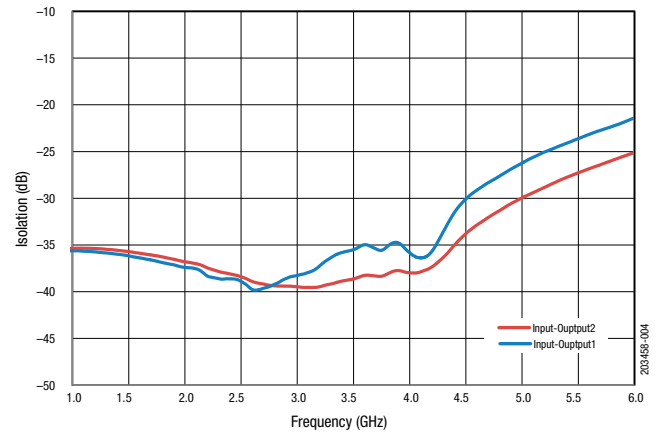


Figure 4. Typical Isolation, Input—Output

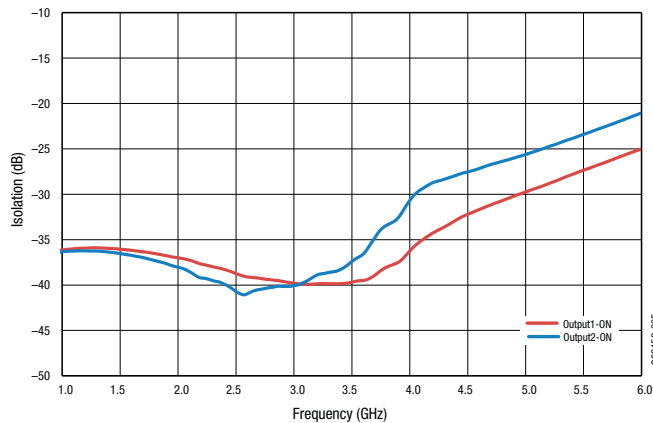


Figure 5. Typical Isolation, Output1—Output2

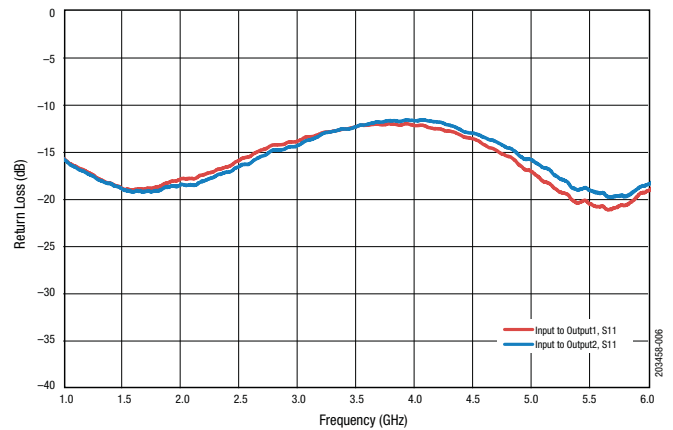


Figure 6. Typical Return Loss

## Evaluation Board Description

The SKY13585-679LF Evaluation Board is used to test the performance of the SKY13585-679LF SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 7. An assembly drawing for the Evaluation Board is shown in Figure 8.

## Package Dimensions

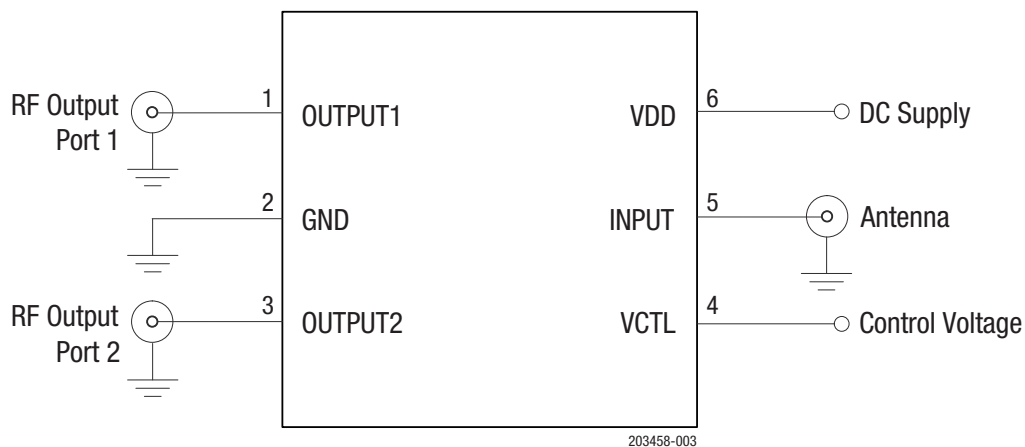
The PCB layout footprint for the SKY13585-679LF is provided in Figure 9. Typical part markings are shown in Figure 10. Package dimensions are shown in Figure 11, and tape and reel dimensions are provided in Figure 12.

## 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 SKY13585-679LF 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 7. SKY13585-679LF Evaluation Board Schematic**

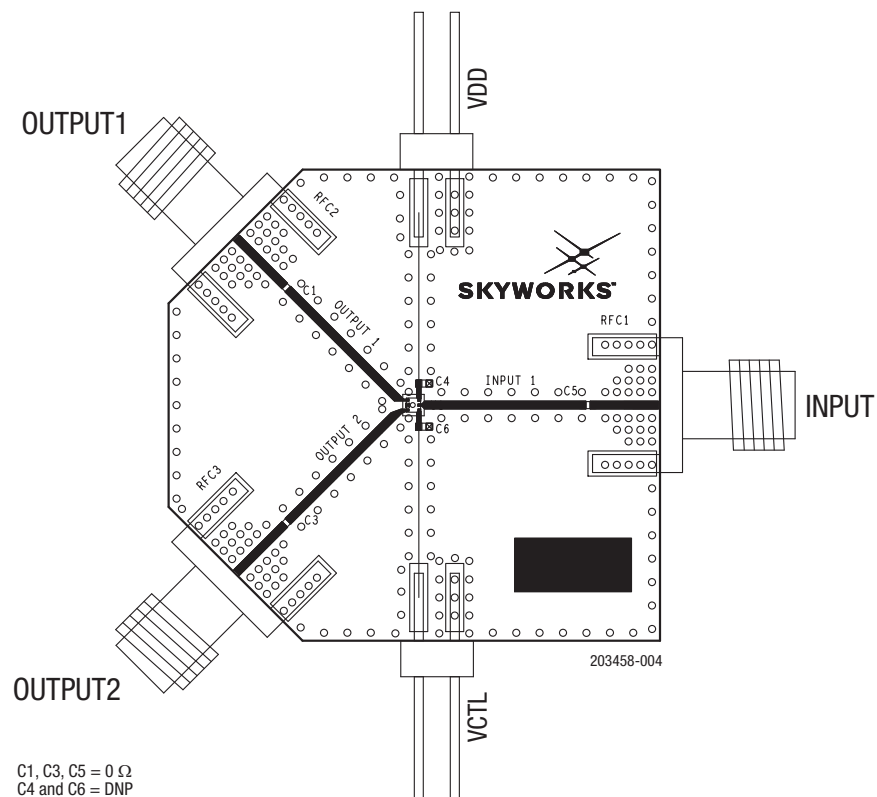
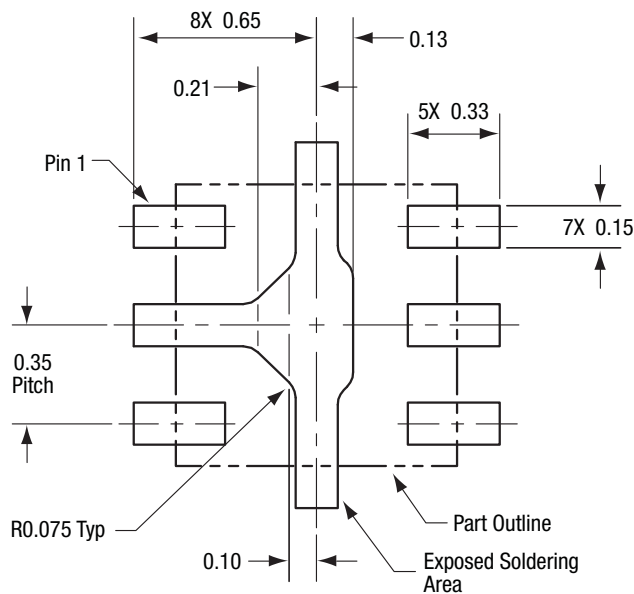


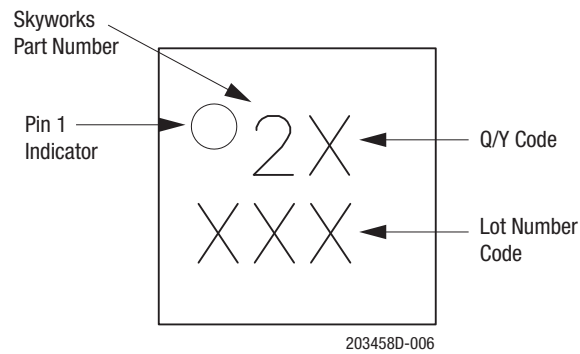
Figure 8. SKY13585-679LF Evaluation Board Assembly Diagram



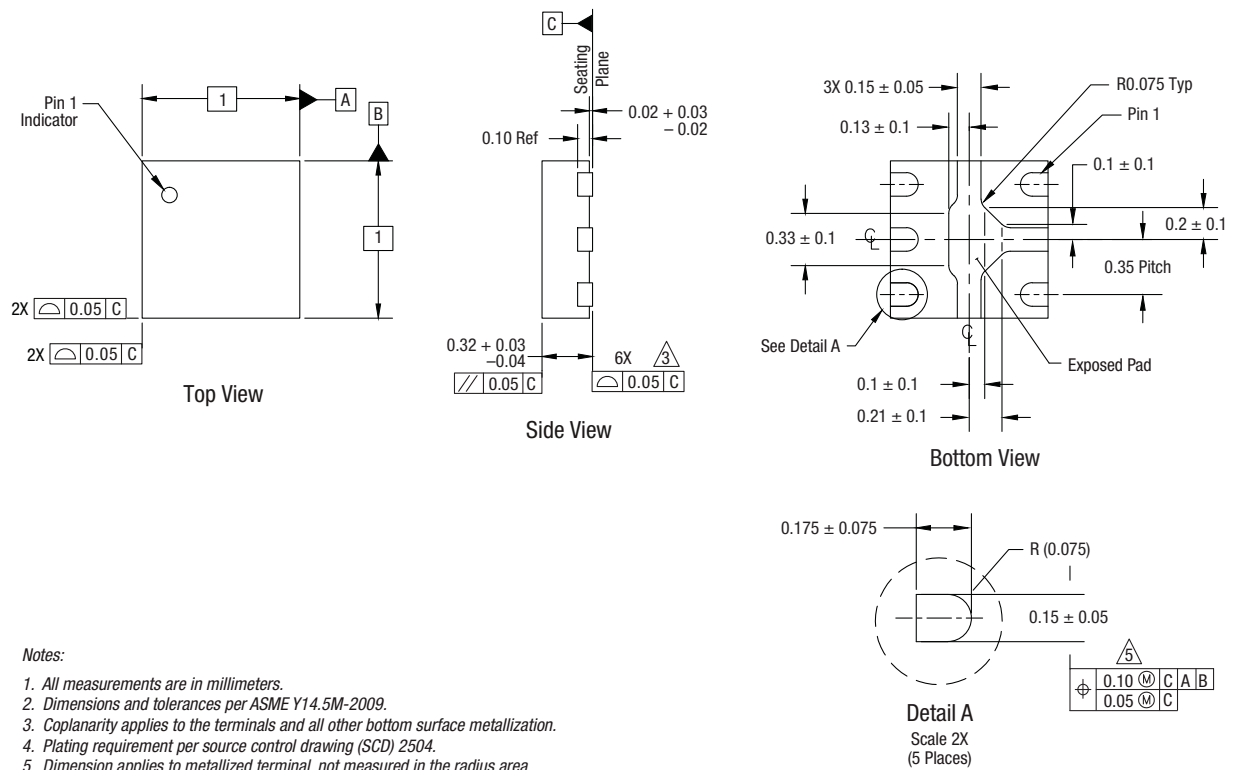
All measurements in millimeters

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Figure 9. SKY13585-679LF PCB Layout Footprint (Top View)

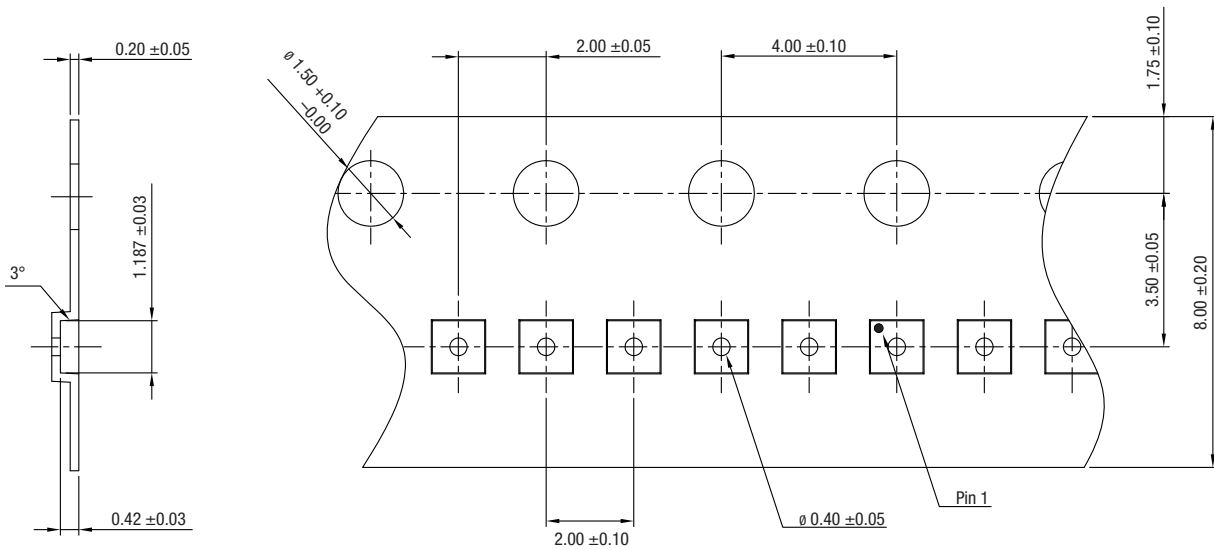


**Figure 10. Typical Part Markings (Top View)**



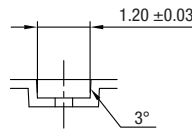
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**Figure 11. SKY13585-679LF Package Dimensions**



*Notes:*

1. 10-sprocket hole pitch cumulative tolerance:  $\pm 0.2$  mm.
2. Camber not to exceed 1 mm in 250 mm.
3. Carrier tape: black conductive polystyrene.
4. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
6. Pocket center and pocket hole center must be the same position.
7. All dimensions are in millimeters.



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### Figure 12. SKY13585-679LF Tape and Reel Dimensions

## Ordering Information

| Model Name                                 | Manufacturing Part Number | Evaluation Board Part Number |
|--------------------------------------------|---------------------------|------------------------------|
| SKY13585-679LF: 1.0 to 6.0 GHz SPDT Switch | SKY13585-679LF            | SKY13585-679LF-EVB           |

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