

DATA SHEET

SKY13408-465LF: 1.0 to 6.0 GHz SP3T Switch, 50 Ω Terminated

Applications

- WiMAX 802.16
- Dual-band WLANs (802.11 a/b/g/n)
- LTE/4G systems
- WLAN 802.11a/c
- 5 GHz video distribution

Features

- 50 Ω matched RF ports in all states from 4.5 to 6.0 GHz
- Low insertion loss: 0.7 dB @ 2.5 GHz and 1.1 dB @ 5.85 GHz
- High isolation: 30 dB @ 2.5 GHz and 24.5 dB @ 5.85 GHz
- IP1dB: +34 dBm
- Small, QFN (12-pin, 2 x 2 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

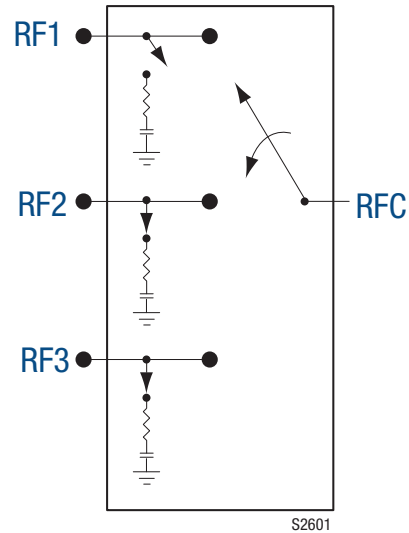


Figure 1. SKY13408-465LF Block Diagram



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Description

The SKY13408-465LF is a GaAs pHEMT single-pole, triple-throw (SP3T) high power switch with 50 Ω terminated outputs. The high linearity performance and low insertion loss achieved by the SKY13408-465LF make it an ideal choice for 802.11a/c, WiMAX, and higher power WLAN applications such as access points.

The switch is manufactured in a compact, 2 x 2 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.

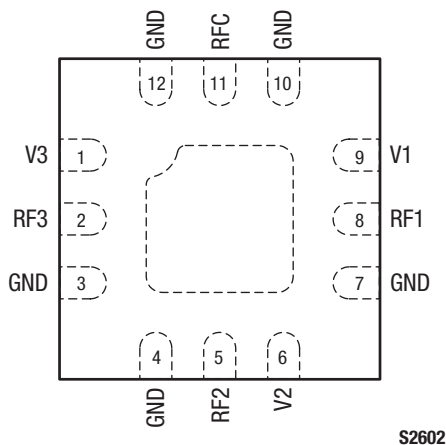


Figure 2. SKY13408-465LF Pinout (Top View)

Table 1. SKY13408-465LF Signal Descriptions

| Pin | Name | Description | Pin | Name | Description |
|-----|------|--|-----|------|--|
| 1 | V3 | DC control voltage. See Table 4. | 7 | GND | Ground |
| 2 | RF3 | RF port 3. DC blocking capacitor required. | 8 | RF1 | RF port 1. DC blocking capacitor required. |
| 3 | GND | Ground | 9 | V1 | DC control voltage. See Table 4. |
| 4 | GND | Ground | 10 | GND | Ground |
| 5 | RF2 | RF port 2. DC blocking capacitor required. | 11 | RFC | RF common input. DC blocking capacitor required. |
| 6 | V2 | DC control voltage. See Table 4. | 12 | GND | Ground |

Functional Description

Switching is controlled by three control voltage inputs, V1, V2, and V3 (pins 9, 6, and 1, respectively). Depending on the logic voltage level applied to the control pins, the RFC pin is connected to one of the three switched RF outputs (RF1, RF2, or RF3) using a low insertion loss path, while the paths between the RFC pin and the other RF pins are in a high isolation state.

DC blocking capacitors are required on all RF ports of the switch. The value of the capacitors determines the low frequency operation. The isolated RF output ports are internally terminated to 50 Ω. The return loss in the isolation state is limited by on-chip capacitors.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13408-465LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY13408-465LF are illustrated in Figures 3 through 6.

The state of the SKY13408-465LF is determined by the logic provided in Table 4.

Table 2. SKY13408-465LF Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|-----------------------|------------------|---------|---------|---------|-------|
| Control voltage | V _{CTL} | | | 6 | V |
| Input power | P _{IN} | | | +40 | dBm |
| Storage temperature | T _{STG} | -40 | | +125 | °C |
| Operating temperature | T _{OP} | -40 | | +85 | °C |

Note 1: 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. SKY13408-465LF Electrical Specifications (Note 1)**($V_{CTL} = 0\text{ V}$ and $+3.0\text{ V}$, $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, $C_{BLK} = 22\text{ pF}$, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|-----------------------------------|-----------|---|-----|---------|-----|---------------|
| RF Specifications | | | | | | |
| Insertion loss | IL | RFC to RF1, RF2 or RF3: | | | | |
| | | 1.0 to 4.5 GHz | | 0.8 | 1.0 | dB |
| | | 4.5 to 5.5 GHz | | 1.0 | 1.2 | dB |
| | | 5.5 to 6.0 GHz | | 1.1 | 1.3 | dB |
| Isolation | Iso | RFC to RF1, RF2 or RF3: | | | | |
| | | 1.0 to 4.5 GHz | 25 | 28 | | dB |
| | | 4.5 to 5.5 GHz | 24 | 26 | | dB |
| | | 5.5 to 6.0 GHz | 22 | 24 | | dB |
| Input return loss (“on” state) | IS11I | RFC or RF1 or RF2 or RF3: | | | | |
| | | 1.0 to 4.5 GHz | | 25 | | dB |
| | | 4.5 to 5.5 GHz | | 25 | | dB |
| | | 5.5 to 6.0 GHz | | 11 | | dB |
| Output return loss (“off” state) | IS22I | Isolated output RF1, RF2, or RF3, 4.5 to 6.0 GHz | | 18 | | dB |
| 1 dB input compression point | IP1dB | $V_{CTL} = 3.0\text{ V}$, 2.3 to 6.0 GHz | | +34 | | dBm |
| Third order input intercept point | IIP3 | $P_{IN} = +25\text{ dBm/ tone}$, $\Delta F = 1\text{ MHz}$, $V_{CTL} = 3.0\text{ V}$, 2.3 to 6.0 GHz | | 54 | | dB |
| 2 nd harmonic | 2fo | $P_{IN} = +25\text{ dBm}$, $V_{CTL} = 3.0\text{ V}$, 4.5 to 6.0 GHz | | +80 | | dBc |
| 3 rd harmonic | 3fo | $P_{IN} = +25\text{ dBm}$, $V_{CTL} = 3.0\text{ V}$, 4.5 to 6.0 GHz | | +75 | | dBc |
| Switching speed | | 50% V_{CTL} to 90/10% RF | | 150 | | ns |
| | | 90/10% RF or 10/90% RF | | 70 | | ns |
| DC Specifications | | | | | | |
| Control voltage | V_{CTL} | | 2.5 | 3.0 | 5.0 | V |
| Control current | I_{CC} | | | 25 | | μA |

Note 1: 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 $[Z_0] = 50\ \Omega$, $C_{BLK} = 22\text{ pF}$, Unless Otherwise Noted)

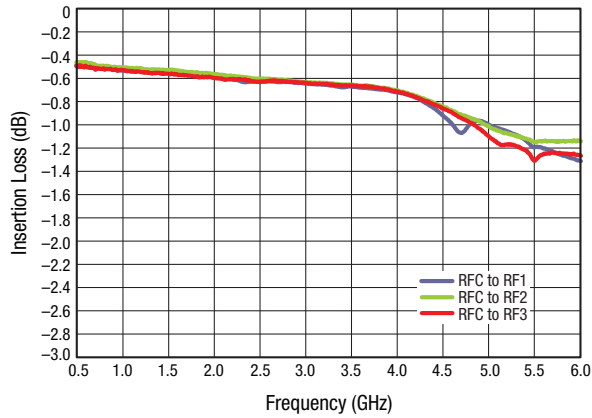


Figure 3. Typical Insertion Loss vs Frequency

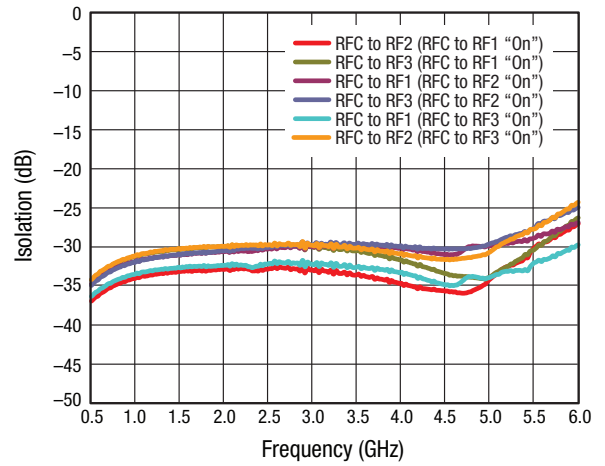


Figure 4. Typical Isolation vs Frequency

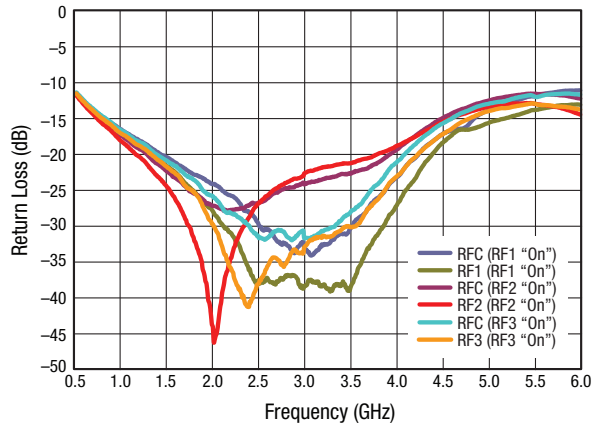


Figure 5. Return Loss vs Frequency (Insertion Loss State)

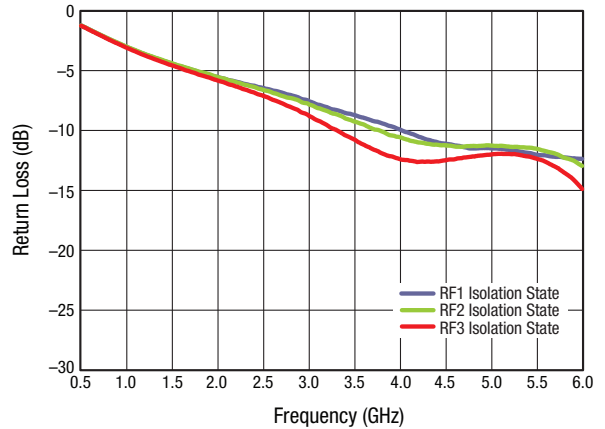


Figure 6. Return Loss vs Frequency (Isolation State)

Table 4. SKY13408-465LF Truth Table (Note 1)

| V1 (Pin 9) | V2 (Pin 6) | V3 (Pin 1) | Insertion Loss State |
|------------|------------|------------|----------------------|
| 1 | 0 | 0 | RFC to RF1 |
| 0 | 1 | 0 | RFC to RF2 |
| 0 | 0 | 1 | RFC to RF3 |

Note: "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 SKY13408-465LF Evaluation Board is used to test the performance of the SKY13408-465LF 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 SKY13408-465LF is provided in Figure 9. Typical case markings are shown in Figure 10. Package dimensions for the 12-pin QFN 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 SKY13408-465LF 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.

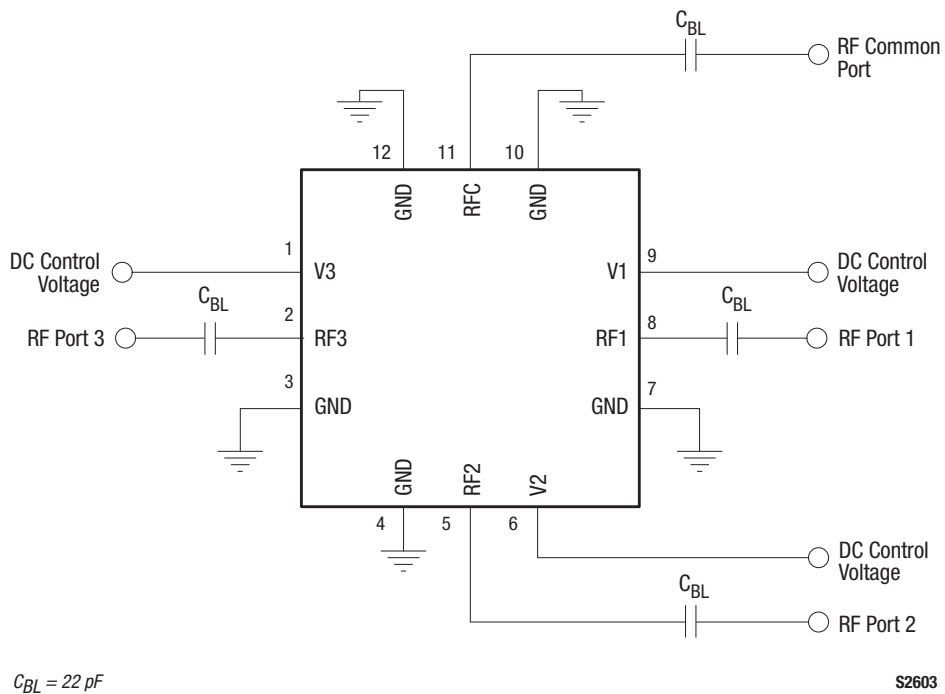


Figure 7. SKY13408-465LF Evaluation Board Schematic

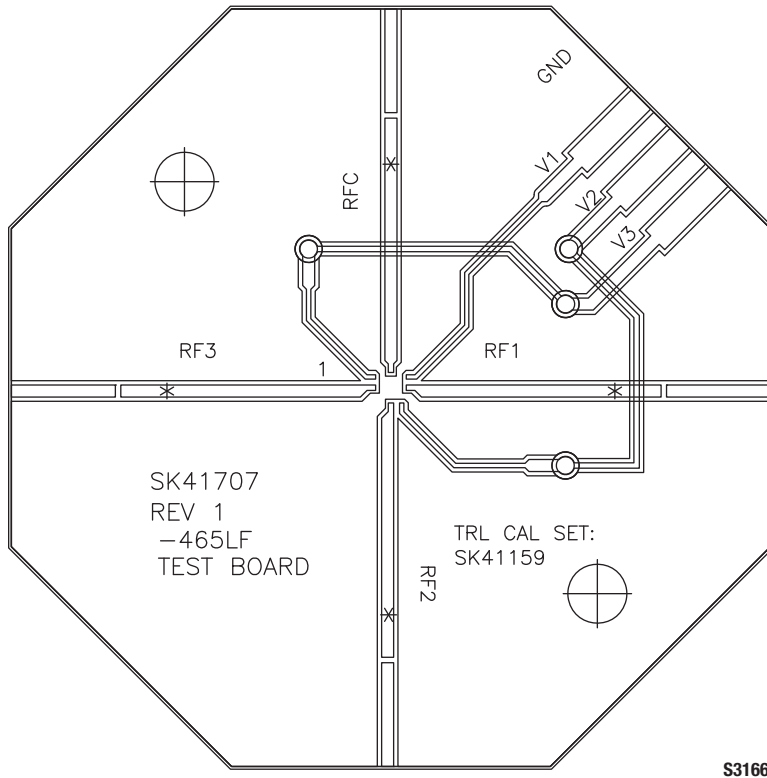


Figure 8. SKY13408-465LF Evaluation Board Assembly Diagram

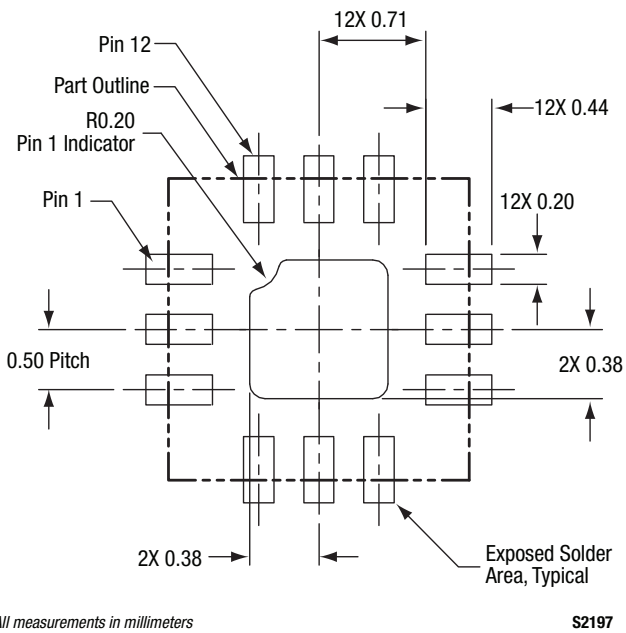


Figure 9. SKY13408-465LF PCB Layout Footprint (Top View)

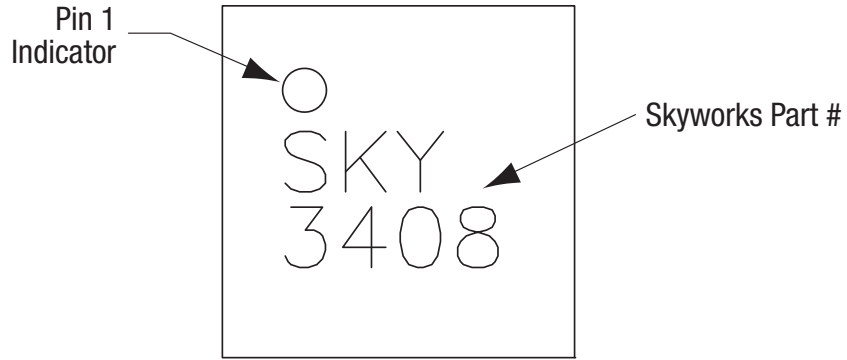
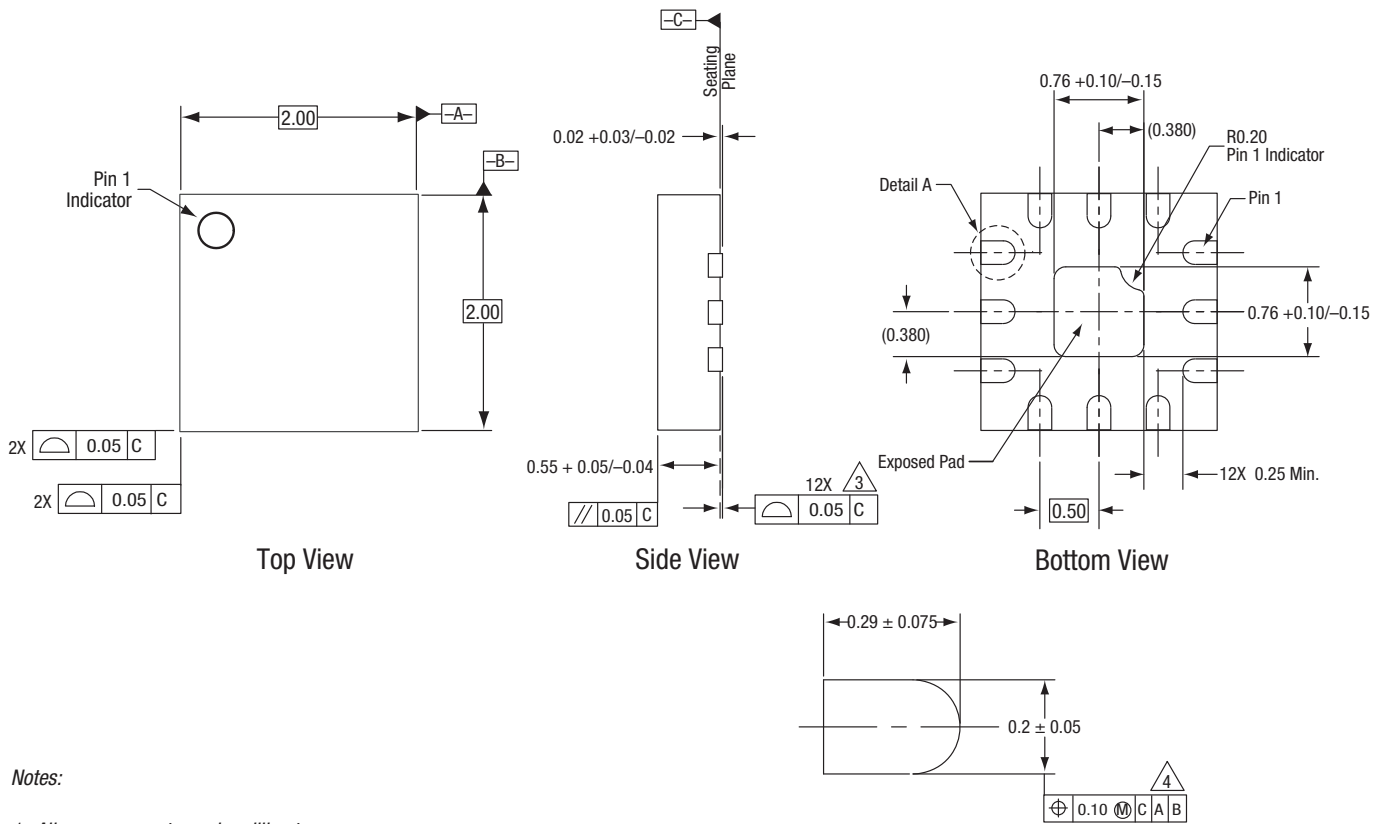


Figure 10. Typical Part Markings (Top View)



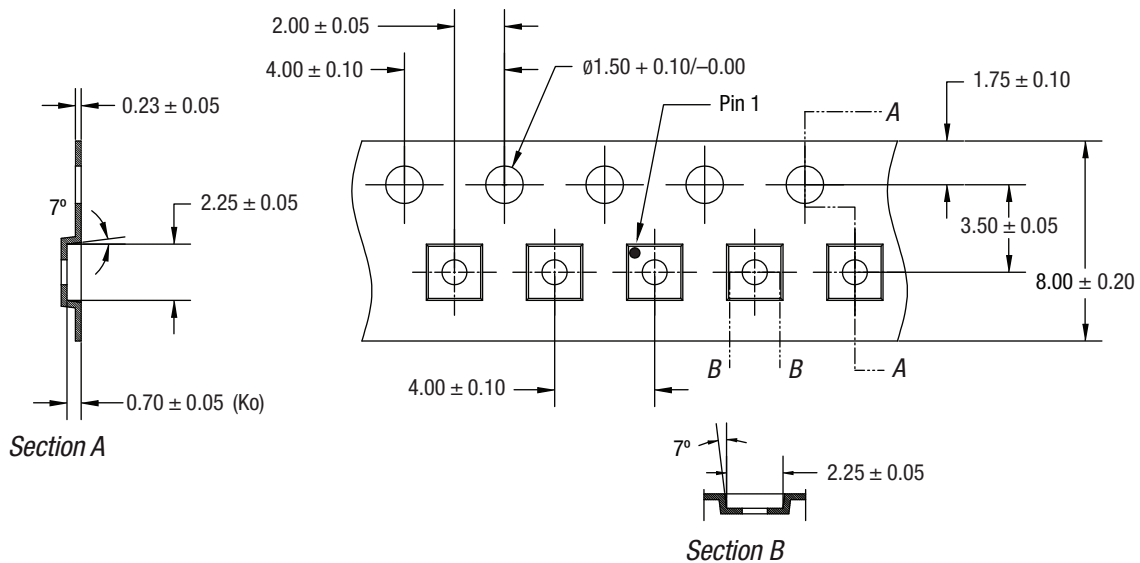
Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the terminals and all other bottom surface metallization.
4. Dimension applies to metallized terminal. If the terminal has a radius on its end, the width dimension should not be measured in that radius area.

Detail A
Scale: 100X
12 Places

S2198

Figure 11. SKY13408-465LF Package Dimensions



Notes:

1. Carrier tape must meet all requirements of Skyworks GP01-D232 procurement spec for tape and reel shipping.
2. Carrier tape shall be black conductive polycarbonate bakeable material at 125 °C temperature.
3. Cover tape shall be transparent conductive with 5.40 mm width.
4. ESD-surface resistivity must meet all ESD requirements of Skyworks specified on GP01-D232.
5. All measurements are in millimeters.

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Figure 12. SKY13408-465LF Tape and Reel Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|-----------------------------|---------------------------|------------------------------|
| SKY13408-465LF: SP3T Switch | SKY13408-465LF | SKY13408-465LF-EVB |

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