

DATA SHEET

SKY13335-381LF: 0.1 to 6.0 GHz GaAs SPDT Switch

Applications

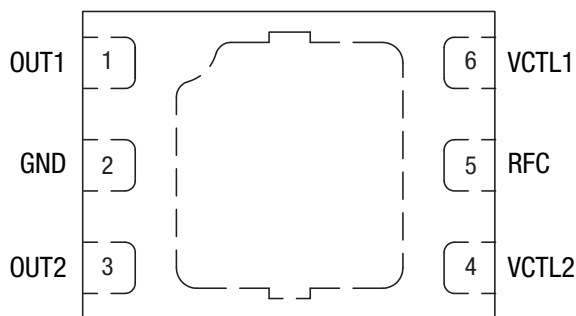
- WLAN 802.11 a/b/g networks
- WLAN repeaters
- ISM band radios
- Low power transmit receive systems

Features

- Positive voltage control
- Control voltage high = 1.8 to 5.0 V
- Broadband, 0.1 to 6.0 GHz
- Very low insertion loss, 0.40 dB typical @ 2.5 GHz
- High isolation, 27 dB typical @ 2.5 GHz
- Excellent linearity performance, P1dB = +29 dBm @ 3 V
- Ultra-miniature, MLPD (6-pin, 1.5 x 2.0 x 0.5 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

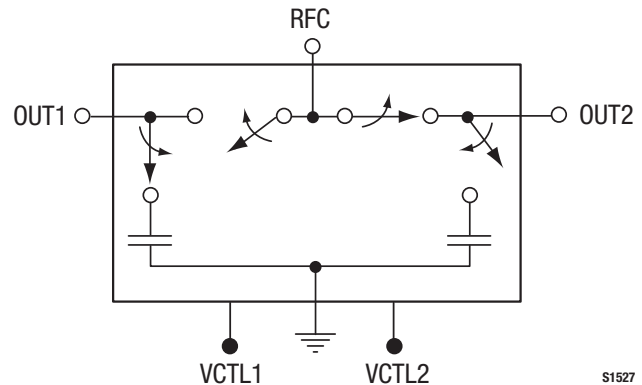


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Figure 2. SKY13335-381LF Pinout – 6-Pin MLPD (Top View)



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Figure 1. SKY13335-381LF Block Diagram

Description

The SKY13335-381LF is a pHEMT GaAs FET I/C switch. The device features low insertion loss and positive voltage operation with very low DC power consumption. The switch is manufactured in a compact, low-cost 1.5 x 2.0 mm, 6-pin Micro Leadframe Package Dual (MLPD) package.

The switch can be used in transmit/receive applications by connecting the RF common port (RFC, pin 5) to either the OUT1 or OUT2 port (pins 1 or 3, respectively) using a low-loss path (i.e., a positive voltage applied to either the VCTL1 or VCTL2 pins). The switch is a reflective short on the isolated port.

A functional block diagram is shown in Figure 1. The 6-pin MLPD package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. SKY13335-381LF Signal Descriptions (Note 1)

| Pin | Name | Description | Pin | Name | Description |
|-----|------|------------------------------|-----|-------|------------------------------|
| 1 | OUT1 | RF port. Must be DC blocked. | 4 | VCTL2 | DC control voltage. |
| 2 | GND | Ground | 5 | RFC | RF port. Must be DC blocked. |
| 3 | OUT2 | RF port. Must be DC blocked. | 6 | VCTL1 | DC control voltage. |

Note 1: Exposed paddle must be connected to ground.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13335-381LF are provided in Table 2, and recommended operating conditions are listed in Table 3. Electrical specifications are provided in Table 4.

Typical performance characteristics for the SKY13335-381LF are shown in Figures 3 through 7.

The state of the SKY13335-381LF is determined by the logic provided in Table 5.

Table 2. SKY13335-381LF Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|---|------------------|---------|---------|------------|------------|
| RF input power: f >500 MHz @ 5 V f >500 MHz @ 3 V | P _{IN} | | | +32 +31 | dBm dBm |
| Operating temperature | T _{OP} | −40 | | +85 | °C |
| Storage temperature | T _{STG} | −65 | | +150 | °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. SKY13335-381LF Recommended Operating Conditions

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|---------------------------------|--|----------|---------|------------|--------|
| Frequency | f | 0.1 | | 6.0 | GHz |
| Control voltage: Low High | V _{CTL_L} V _{CTL_H} | 0 1.8 | | 0.2 5.0 | V V |
| Operating temperature | T _{OP} | | +25 | | °C |

Table 4. SKY13335-381LF Electrical Specifications (Note 1)**($V_{CTL} = 0$ and 3 V , $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|------------------------------|--------------------------------------|-----|---------|-----|---------------|
| Frequency | f | | 0.1 | | 6.0 | GHz |
| Insertion loss | | 0.1 to 6.0 GHz | | 0.6 | 0.7 | dB |
| | | 0.1 to 1.0 GHz | | 0.2 | 0.4 | dB |
| | | 1.0 to 2.0 GHz | | 0.3 | 0.5 | dB |
| | | 2.0 to 2.5 GHz | | 0.4 | 0.6 | dB |
| | | 2.5 to 3.0 GHz | | 0.5 | 0.7 | dB |
| Isolation | | 0.1 to 6.0 GHz | 20 | 24 | | dB |
| | | 0.1 to 1.0 GHz | 26 | 27 | | dB |
| | | 1.0 to 2.0 GHz | 24 | 27 | | dB |
| | | 2.0 to 2.5 GHz | 25 | 27 | | dB |
| | | 2.5 to 3.0 GHz | 26 | 27 | | dB |
| Return loss (insertion loss state) | | 0.1 to 6.0 GHz | | 17 | | dB |
| | | 0.1 to 1.0 GHz | | 20 | | dB |
| | | 1.0 to 2.0 GHz | | 23 | | dB |
| | | 2.0 to 2.5 GHz | | 25 | | dB |
| | | 2.5 to 3.0 GHz | | 25 | | dB |
| Switching characteristics: Rise/fall On/off | | 10/90% or 90/10% RF | | 50 | | ns |
| | | 50% V_{CTL} to 90/10% RF | | 50 | | ns |
| Video feedthrough | | | | 40 | | mV |
| Input power for 1 dB compression | IP1dB | $V_{CTL} = 0$ and 1.8 V, 0.9 GHz | | +18 | | dBm |
| | | $V_{CTL} = 0$ and 3 V, 0.9 GHz | | +29 | | dBm |
| | | $V_{CTL} = 0$ and 1.8 V, 2.45 GHz | | +18 | | dBm |
| | | $V_{CTL} = 0$ and 3 V, 2.45 GHz | | +29 | | dBm |
| | | $V_{CTL} = 0$ and 1.8 V, 4.9-5.8 GHz | | +15 | | dBm |
| 3 rd Order Input Intercept Point | IIP3 | $V_{CTL} = 0$ and 3 V, 4.9-5.8 GHz | | +26 | | dBm |
| | | Pin = 0 dBm/tone | | | | |
| | | $V_{CTL} = 0$ and 1.8 V, 0.9 GHz | | +46 | | dBm |
| | | $V_{CTL} = 0$ and 3 V, 0.9 GHz | | +48 | | dBm |
| | | $V_{CTL} = 0$ and 1.8 V, 2.45 GHz | | +40 | | dBm |
| Control voltage | V_{CTL_L} V_{CTL_H} | $V_{CTL} = 0$ and 3 V, 2.45 GHz | | +45 | | dBm |
| | | $V_{CTL} = 0$ and 1.8 V, 5.8 GHz | | +37 | | dBm |
| Supply current | V_{CTL_L} V_{CTL_H} | $V_{CTL} = 0$ and 3 V, 5.8 GHz | | +41 | | dBm |
| | | | | | | |
| Control voltage | V_{CTL_L} V_{CTL_H} | | 0 | | 0.2 | V |
| | | | 1.8 | | 5.0 | V |
| Supply current | V_{CTL_L} V_{CTL_H} | | | 5 | | μA |
| | | | | 5 | | μA |

Note 1: Performance is guaranteed only under the conditions listed in this table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

Typical Performance Characteristics

($V_{CTL} = 0$ and 3 V , $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Characteristic Impedance [Z_0] = $50\text{ }\Omega$, Unless Otherwise Noted)

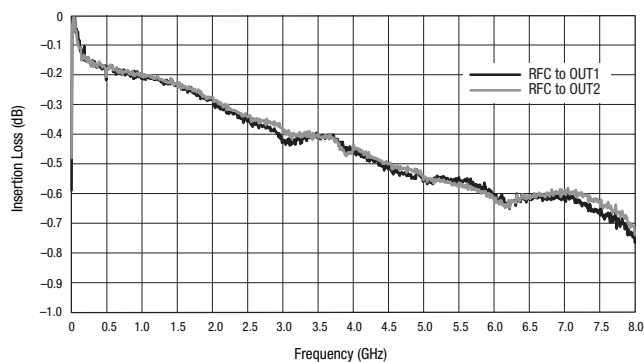


Figure 3. Typical Insertion Loss

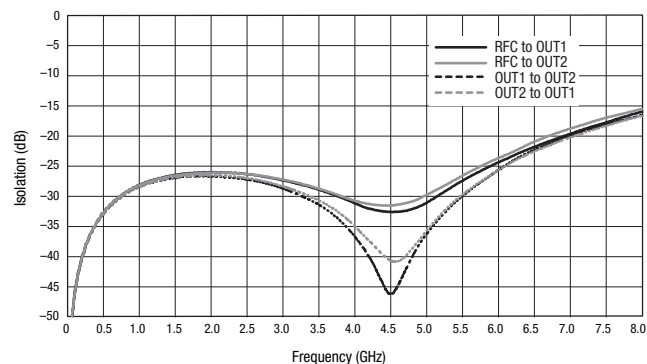


Figure 4. Typical Isolation

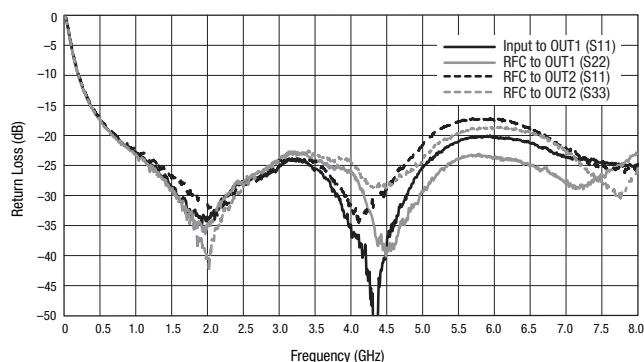


Figure 5. Typical Return Loss

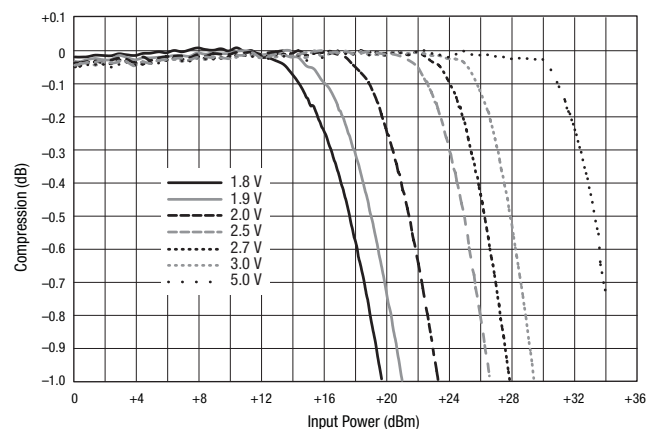


Figure 6. Compression vs Control Voltage (2450 MHz)

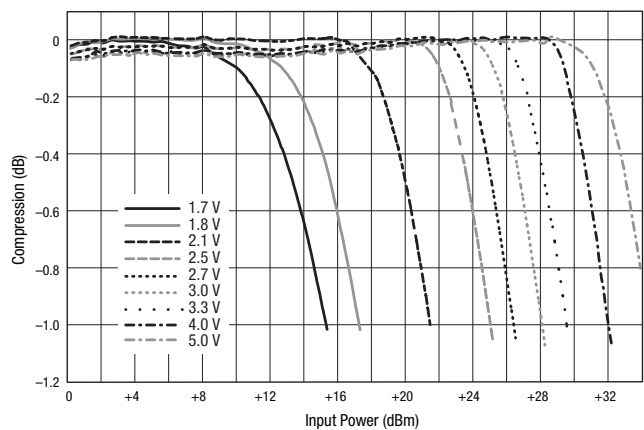


Figure 7. Compression v s Control Voltage (5.2 to 5.8 GHz)

Table 5. Truth Table ($V_{HIGH} = 2$ to 5 V)

| VCTL1 (Pin 6) | VCTL2 (Pin 4) | RFC to OUT1 Path | RFC to OUT2 Path |
|---------------|---------------|------------------|------------------|
| 1 | 0 | Insertion loss | Isolation |
| 0 | 1 | Isolation | Insertion loss |

Note: 0 = 0 to 0.2 V
1 = 1.8 to 5.0 V

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

Evaluation Board Description

The SKY13335-381LF Evaluation Board is used to test the performance of the SKY13335-381LF SPDT switch. An Evaluation Board schematic diagram is provided in Figure 8. An assembly drawing for the Evaluation Board is shown in Figure 9.

Package Dimensions

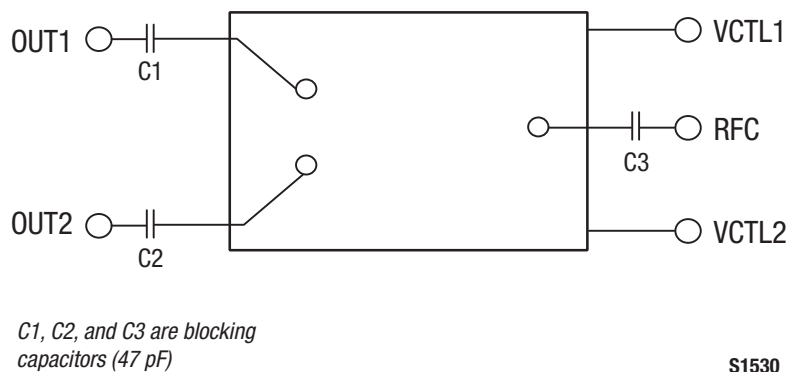
The PCB layout footprint for the SKY13335-381LF is provided in Figure 10. Typical case markings are shown in Figure 11. Package dimensions for the 6-pin MLPD are shown in Figure 12, and tape and reel dimensions are provided in Figure 13.

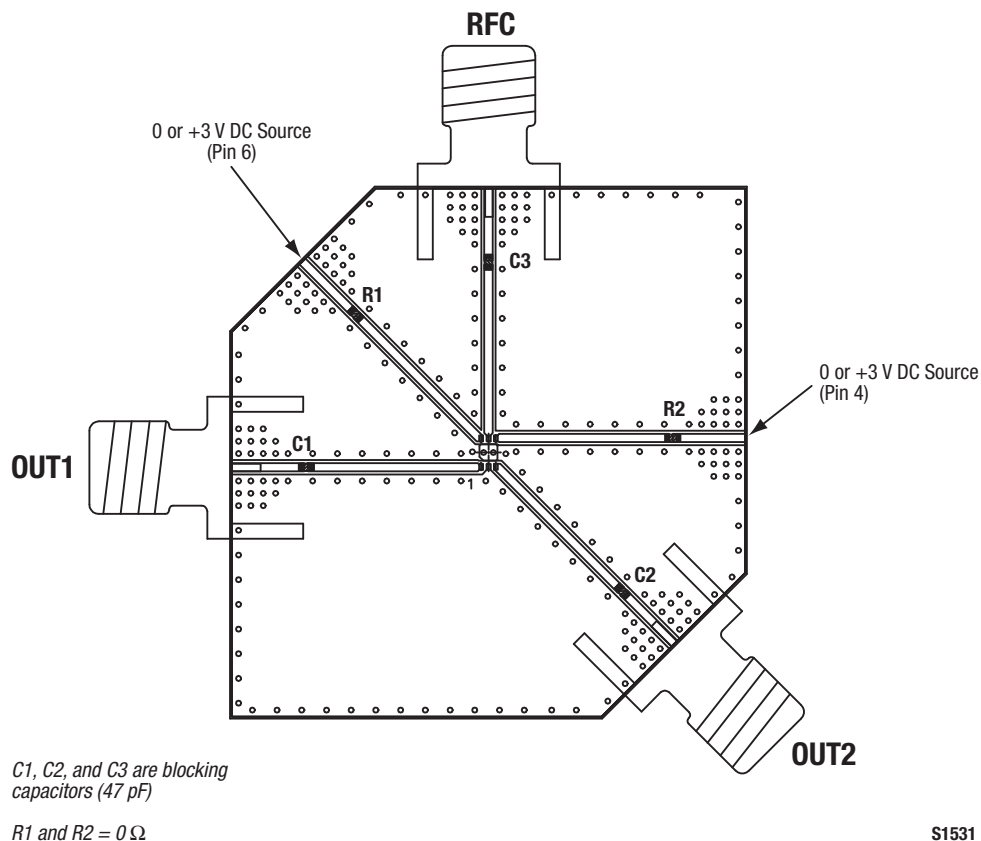
Package and Handling Information

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 SKY13335-381LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering.

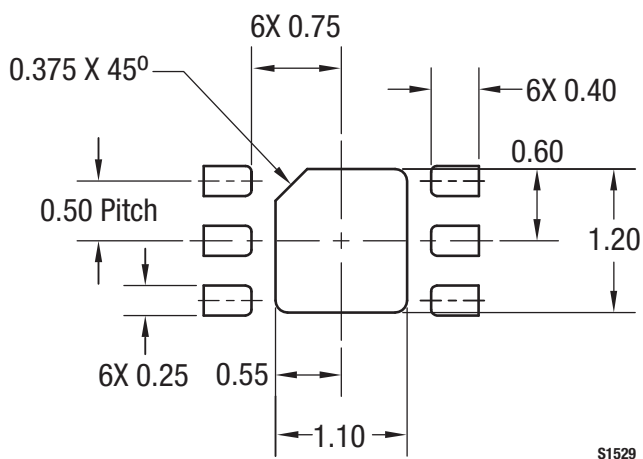
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format. For packaging details, refer to the Skyworks Application Note, *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

**Figure 8. SKY13335-381LF Evaluation Board Schematic**



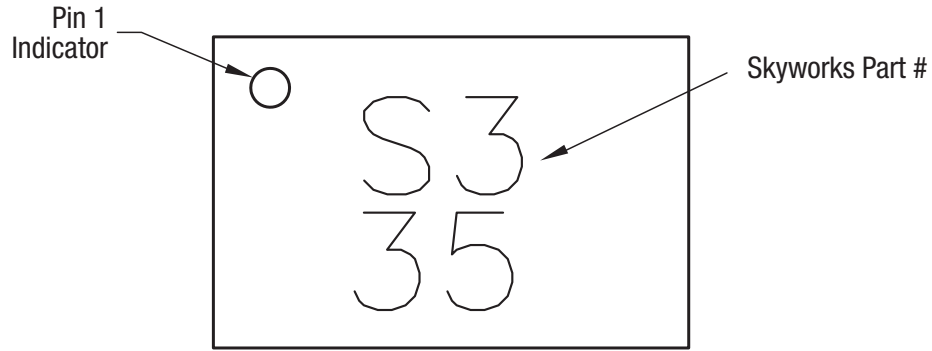
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Figure 9. SKY13335-381LF Evaluation Board Assembly Drawing

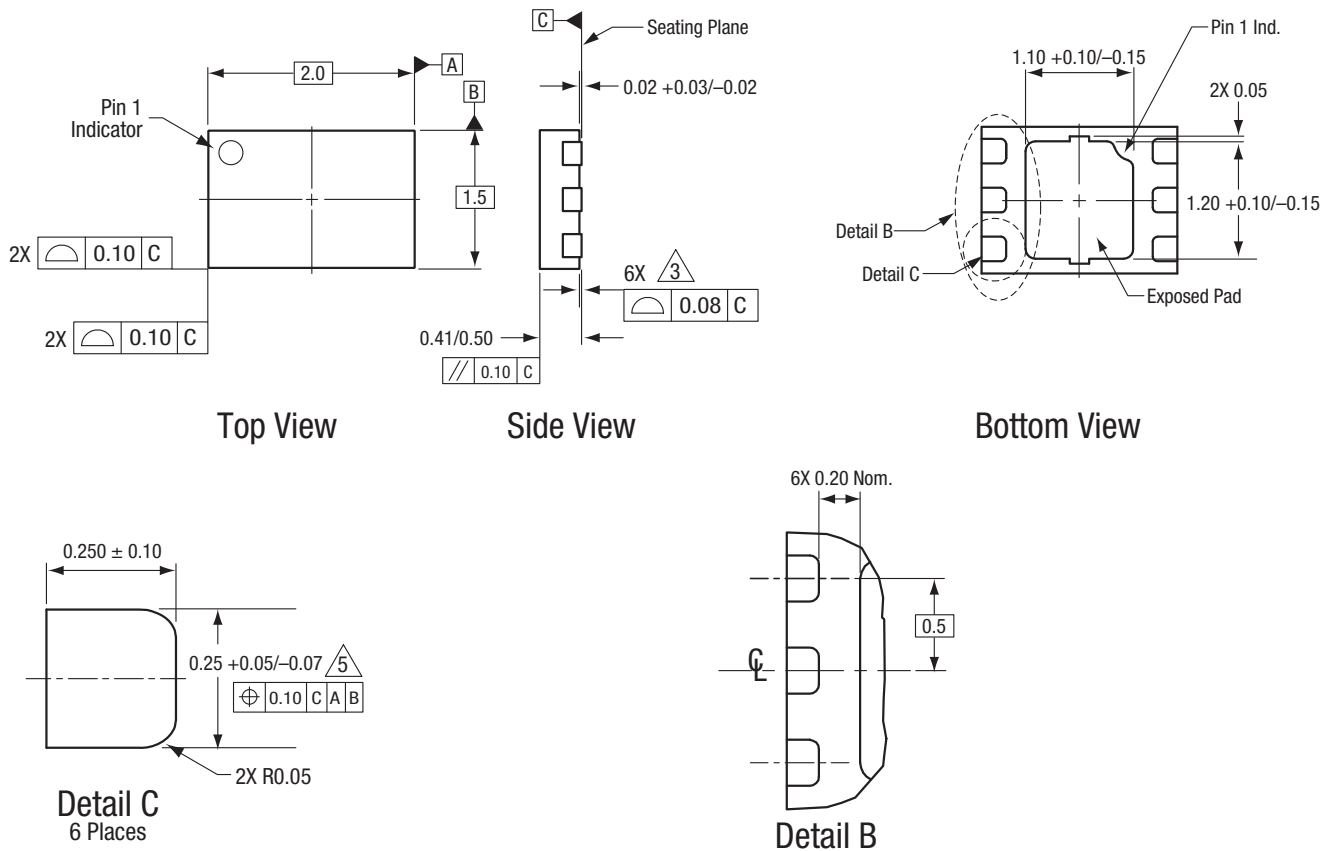


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Figure 10. SKY13335-381LF PCB Layout Footprint



**Figure 11. Typical Case Markings
(Top View)**



All measurements are in millimeters.

Dimensioning and tolerancing according to ASME Y14.5M-1994.

Coplanarity applies to the exposed heat sink slug as well as the terminals..

Plating requirement per source control drawing (SCD) 2504.

Dimension applies to metalized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

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Figure 12. SKY13335-381LF 6-Pin MLPD Package Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Kit Part Number |
|-----------------------------|---------------------------|----------------------------|
| SKY13335-381LF: SPDT Switch | SKY13335-381LF | SK41218-2, Rev. 1 |

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