

**DATA SHEET**

# SKY13322-375LF: 20 MHz-6.0 GHz GaAs SP4T Switch

**Applications**

- Multiband telecommunications up to 6 GHz

**Features**

- Broadband frequency range: 20 MHz to 6.0 GHz
- Low insertion loss: 0.45 dB @ 1 GHz
- Very high isolation: 28 dB @ 1 GHz
- Excellent linearity performance: P1dB = +30 dBm @ 3.3 V
- Operating voltage range from 1.8 to 5.0 V
- Small, MLPD (10-pin, 2 x 3 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

**NEW**

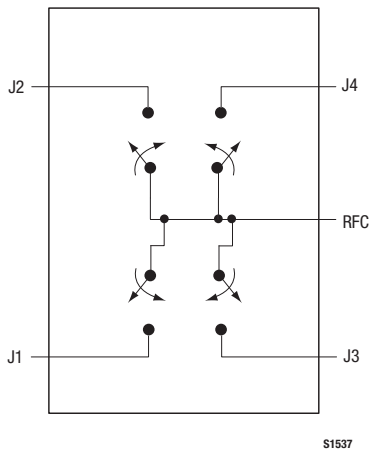

Skyworks Green™ products are RoHS (Restriction of Hazardous Substances)-compliant, conform to the EIA/EICTA/JEITA Joint Industry Guide (JIG) Level A guidelines, are halogen free according to IEC-61249-2-21, and contain <1,000 ppm antimony trioxide in polymeric materials.

**Description**

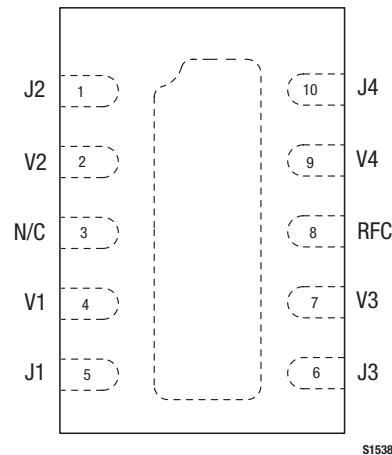
The SKY13322-375LF is a GaAs FET I/C single-pole, four-throw (SP4T) switch. This general purpose switch is an ideal choice for a variety of multiband telecommunication applications up to 6 GHz.

The switch is manufactured in a compact, 2 x 3 mm, 10-pin exposed pad plastic Micro Leadframe 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.



**Figure 1. SKY13322-375LF Block Diagram**



**Figure 2. SKY13322-375LF Pinout – 10-Pin MLPD (Top View)**

**Table 1. SKY13322-375LF Signal Descriptions**

| Pin # | Name | Description        | Pin # | Name | Description              |
|-------|------|--------------------|-------|------|--------------------------|
| 1     | J2   | RF output (Note 1) | 6     | J3   | RF output (Note 1)       |
| 2     | V2   | DC control voltage | 7     | V3   | DC control voltage       |
| 3     | N/C  | No connection      | 8     | RFC  | RF common input (Note 1) |
| 4     | V1   | DC control voltage | 9     | V4   | DC control voltage       |
| 5     | J1   | RF output (Note 1) | 10    | J4   | RF output (Note 1)       |

**Note 1:** A 47 pF blocking capacitor is required for >1 GHz operation. Use larger value capacitors for lower frequency operation.

**Table 2. SKY13322-375LF Absolute Maximum Ratings**

| Parameter             | Symbol           | Minimum | Typical | Maximum | Units |
|-----------------------|------------------|---------|---------|---------|-------|
| Input power           | P <sub>IN</sub>  |         | +33     |         | dBm   |
| Voltage range         | V <sub>CTL</sub> |         | 6       |         | V     |
| Storage temperature   | T <sub>STG</sub> | −65     |         | +150    | °C    |
| Operating temperature | T <sub>OP</sub>  | −40     |         | +85     | °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.

**Table 3. SKY13322-375LF Recommended Operating Conditions**

| Parameter        | Symbol             | Minimum | Typical | Maximum | Units |
|------------------|--------------------|---------|---------|---------|-------|
| Frequency        | f                  | 0.02    |         | 6.0     | GHz   |
| Control voltage: |                    |         |         |         |       |
| Low              | V <sub>CTL_L</sub> | 0       |         | 0.2     | V     |
| High             | V <sub>CTL_H</sub> | 1.8     | 3.3     | 5.0     | V     |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13322-375LF are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the SKY13322-375LF are illustrated in Figures 3 through 8.

The state of the SKY13322-375LF is determined by the logic provided in Table 5.

**Table 4. SKY13322-375LF Electrical Specifications (Note 1)****( $V_{CTL} = 0\text{ V}$  and  $+3.3\text{ V}$ ,  $T_{OP} = +25\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Characteristic Impedance  $[Z_0] = 50\text{ }\Omega$ , Unless Otherwise Noted)**

| Parameter                          | Symbol   | Test Condition                             | Min | Typical | Max  | Units         |
|------------------------------------|----------|--------------------------------------------|-----|---------|------|---------------|
| Insertion loss                     | IL       | 0.02-1.0 GHz                               |     | 0.45    | 0.60 | dB            |
|                                    |          | 1.0-2.5 GHz                                |     | 0.60    | 0.75 | dB            |
|                                    |          | 2.5-3.0 GHz                                |     | 0.75    | 0.95 | dB            |
|                                    |          | 3.0-4.0 GHz                                |     | 1.00    | 1.25 | dB            |
|                                    |          | 4.0-6.0 GHz                                |     | 2.00    |      | dB            |
| Isolation                          | Iso      | 0.02-1.0 GHz                               | 26  | 28      |      | dB            |
|                                    |          | 1.0-2.5 GHz                                | 23  | 26      |      | dB            |
|                                    |          | 2.5-3.0 GHz                                | 23  | 27      |      | dB            |
|                                    |          | 3.0-4.0 GHz                                | 23  | 27      |      | dB            |
|                                    |          | 4.0-6.0 GHz                                |     | 18      |      | dB            |
| Return loss (insertion loss state) |          | 0.02-1.0 GHz                               | 15  | 22      |      | dB            |
|                                    |          | 1.0-2.5 GHz                                | 15  | 22      |      | dB            |
|                                    |          | 2.5-3.0 GHz                                | 15  | 22      |      | dB            |
|                                    |          | 3.0-4.0 GHz                                | 10  | 13      |      | dB            |
|                                    |          | 4.0-6.0 GHz                                |     | 7.5     |      | dB            |
| Switching characteristics:         |          |                                            |     |         |      |               |
| Rise/fall time                     |          | 10/90% or 90/10% RF                        |     | 60      |      | ns            |
| On/off time                        |          | 50% $V_{CTL}$ to 90/10% RF                 |     | 60      |      | ns            |
| Video feedthrough                  |          |                                            |     | 40      |      | mV            |
| 1 dB Input Compression Point       | IP1dB    | $f = 0.9\text{ GHz}/2.45\text{ GHz}$       |     |         |      |               |
|                                    |          | $V_{CTL} = 0\text{ V}/1.8\text{ V}$ ,      |     | +21.0   |      | dBm           |
|                                    |          | $V_{CTL} = 0\text{ V}/2.7\text{ V}$        |     | +27.5   |      | dBm           |
|                                    |          | $V_{CTL} = 0\text{ V}/3.3\text{ V}$        |     | +30.0   |      | dBm           |
| 0.1 dB Input Compression Point     | IP0.1dB  | $f = 0.9\text{ GHz}/2.45\text{ GHz}$       |     |         |      |               |
|                                    |          | $V_{CTL} = 0\text{ V}/1.8\text{ V}$ ,      |     | +17.5   |      | dBm           |
|                                    |          | $V_{CTL} = 0\text{ V}/2.7\text{ V}$        |     | +24.5   |      | dBm           |
|                                    |          | $V_{CTL} = 0\text{ V}/3.3\text{ V}$        |     | +27.0   |      | dBm           |
| Input IP3                          | IIP3     | $P_{IN} = +15\text{ dBm}/\text{tone}$ ,    |     |         |      |               |
|                                    |          | tone spacing = 1 MHz                       |     |         |      |               |
|                                    |          | $f = 0.9\text{ GHz}$ ,                     |     | +54     |      | dBm           |
|                                    |          | $f = 2.45\text{ GHz}$                      |     | +51     |      | dBm           |
| 2 <sup>nd</sup> harmonic           | 2fo      | $P_{IN} = +17\text{ dBm}$                  |     |         |      |               |
|                                    |          | $f = 0.9\text{ GHz}$                       |     | 76      |      | dBc           |
|                                    |          | $f = 2.45\text{ GHz}$                      |     | 70      |      | dBc           |
| 3 <sup>rd</sup> harmonic           | 3fo      | $P_{IN} = +17\text{ dBm}$                  |     |         |      |               |
|                                    |          | $f = 0.9\text{ GHz}$                       |     | 70      |      | dBc           |
|                                    |          | $f = 2.45\text{ GHz}$                      |     | 65      |      | dBc           |
| Supply current                     | $I_{CC}$ | $V_{CTL} = 1.8\text{ V}$ to $5.0\text{ V}$ |     | 5       |      | $\mu\text{A}$ |

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

## Typical Performance Characteristics

( $V_{CTL} = 0\text{ V}$  and  $+3.3\text{ V}$ ,  $T_{OP} = +25\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Characteristic Impedance  $[Z_0] = 50\text{ }\Omega$ , Blocking Capacitors =  $47\text{ pF}$ , Unless Otherwise Noted)

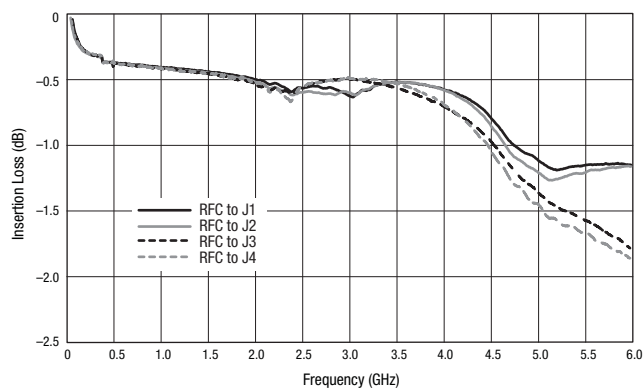


Figure 3. Insertion Loss vs Frequency

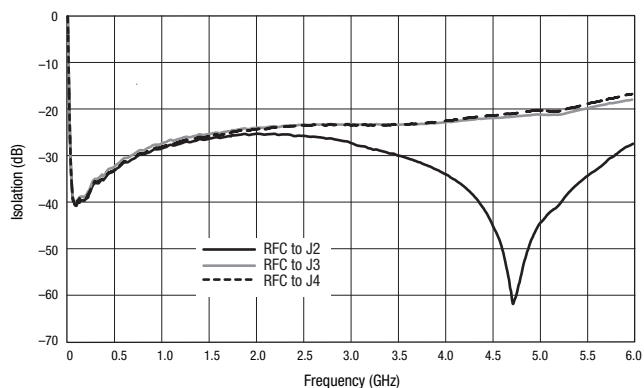


Figure 4. Isolation vs Frequency  
(RFC to J1 Insertion Loss State)

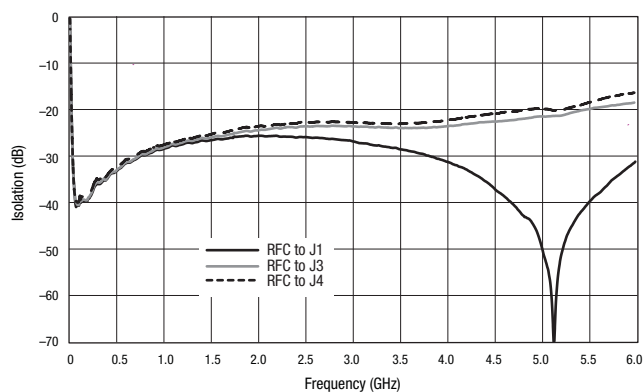


Figure 5. Isolation vs Frequency  
(RFC to J2 Insertion Loss State)

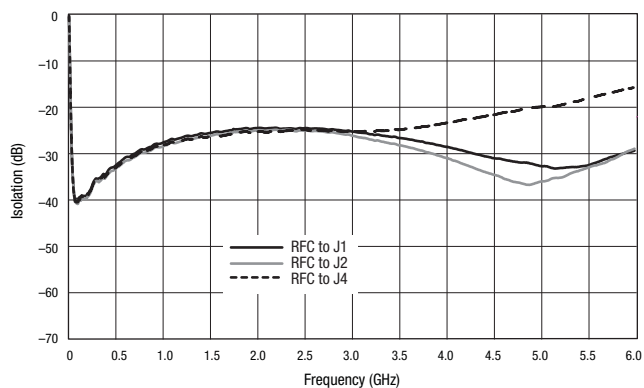


Figure 6. Isolation vs Frequency  
(RFC to J3 Insertion Loss State)

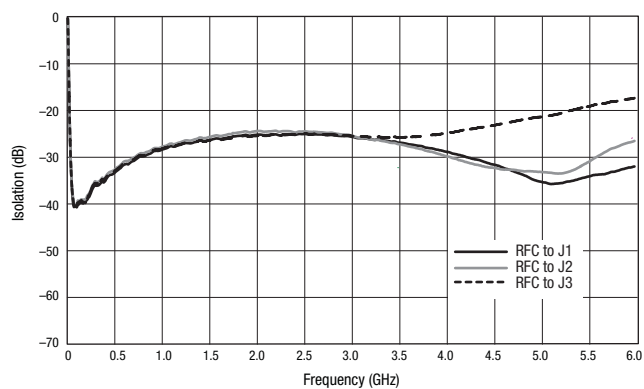


Figure 7. Isolation vs Frequency  
(RFC to J4 Insertion Loss State)

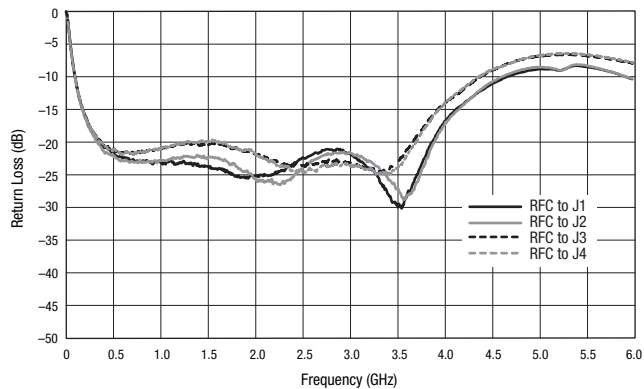


Figure 8. RFC Return Loss vs Frequency

**Table 5. SKY13322-375LF Truth Table**

| V1 (Pin 4) | V2 (Pin 2) | V3 (Pin 7) | V4 (Pin 9) | RFC to J1      | RFC to J2      | RFC to J3      | RFC to J4      |
|------------|------------|------------|------------|----------------|----------------|----------------|----------------|
| 1          | 0          | 0          | 0          | Insertion loss | Isolation      | Isolation      | Isolation      |
| 0          | 1          | 0          | 0          | Isolation      | Insertion loss | Isolation      | Isolation      |
| 0          | 0          | 1          | 0          | Isolation      | Isolation      | Insertion loss | Isolation      |
| 0          | 0          | 0          | 1          | Isolation      | Isolation      | Isolation      | Insertion loss |

**Note:** "1" = +1.8 V to +5 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 SKY13322-375LF Evaluation Board is used to test the performance of the SKY13322-375LF SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 9. An assembly drawing for the Evaluation Board is shown in Figure 10.

## Package Dimensions

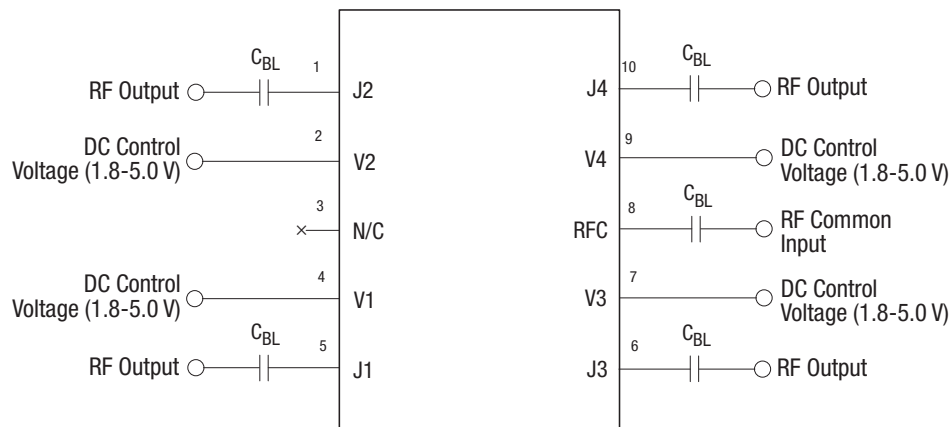
The PCB layout footprint for the SKY13322-375LF is provided in Figure 11. Typical case markings are shown in Figure 12. Package dimensions for the 10-pin MLPD are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

## Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. 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 SKY13322-375LF 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.

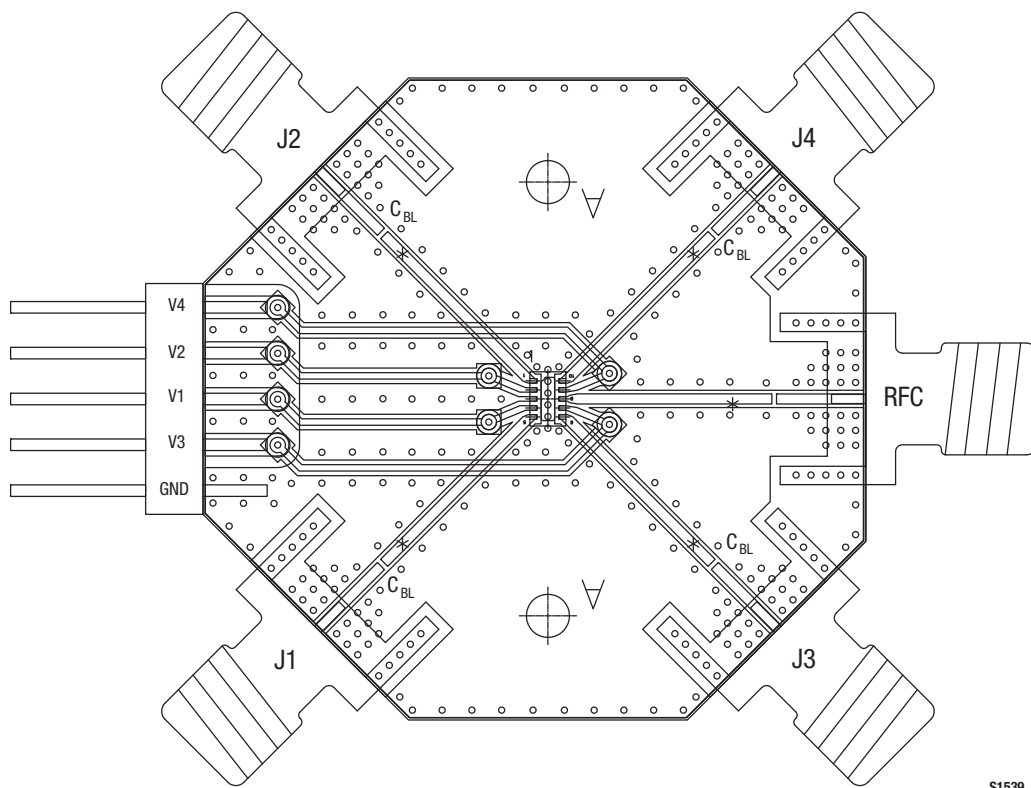


$C_{BL} = 47 \text{ pF}$  for >1 GHz operation.  
Exposed ground paddle should be grounded  
for best performance.

Use 10 nF blocking capacitors ( $C_{BL}$ ) for <50 MHz operation.

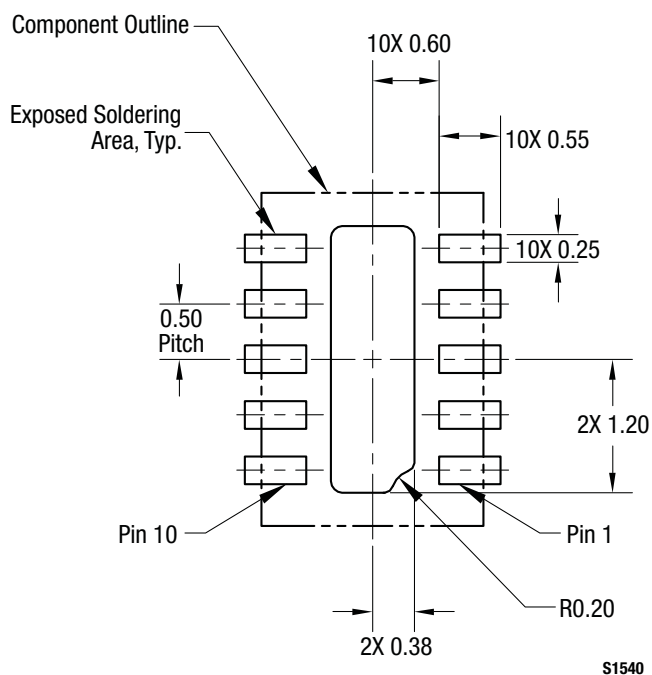
S1551

**Figure 9. SKY13322-375LF Evaluation Board Schematic**



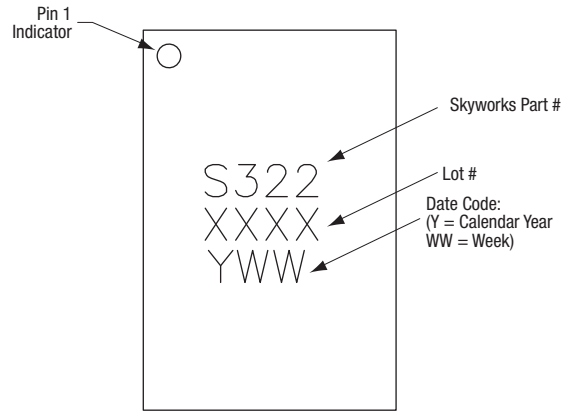
S1539

**Figure 10. SKY13322-375LF Evaluation Board Assembly Diagram**

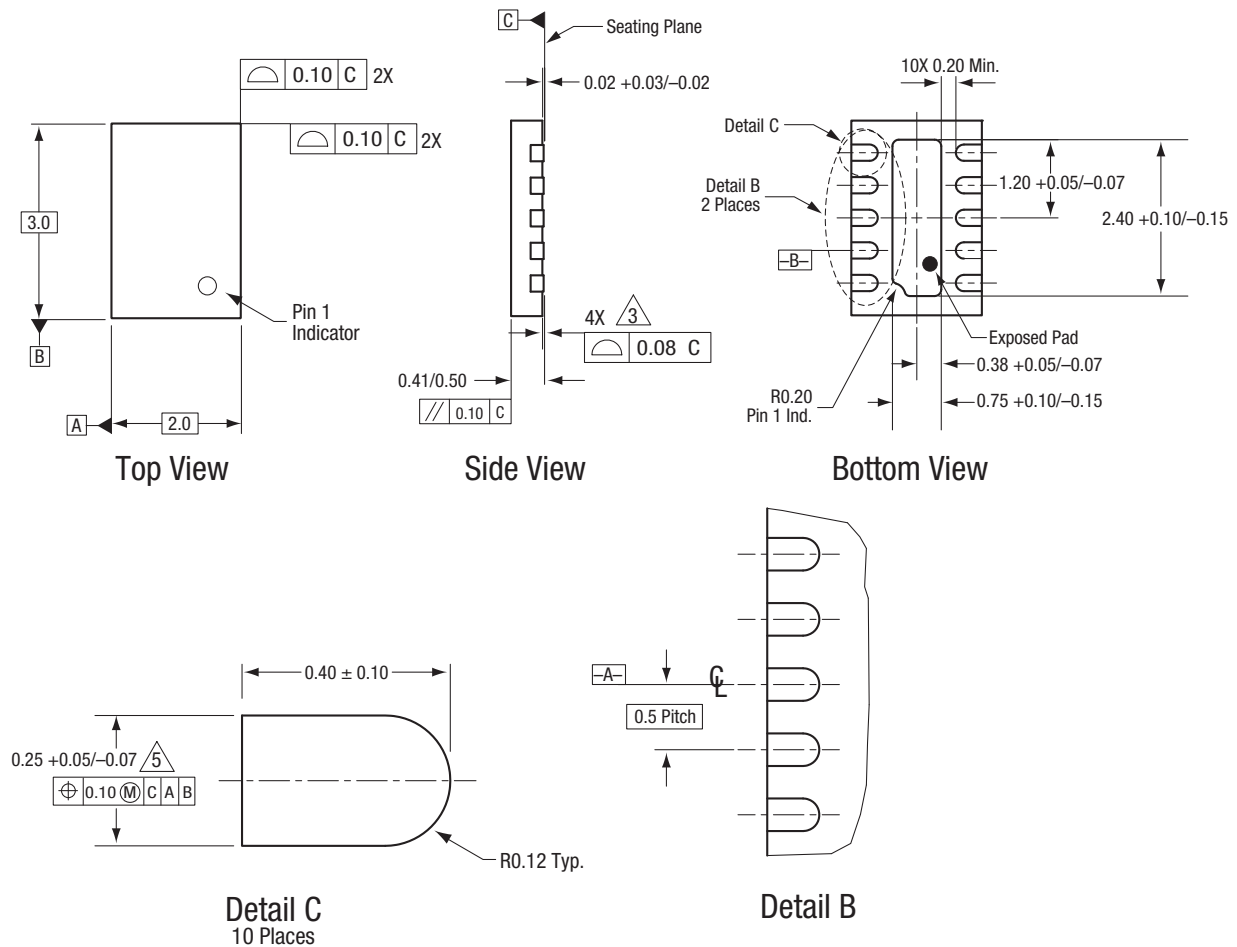


S1540

**Figure 11. SKY13322-375LF PCB Layout Footprint (Top View)**



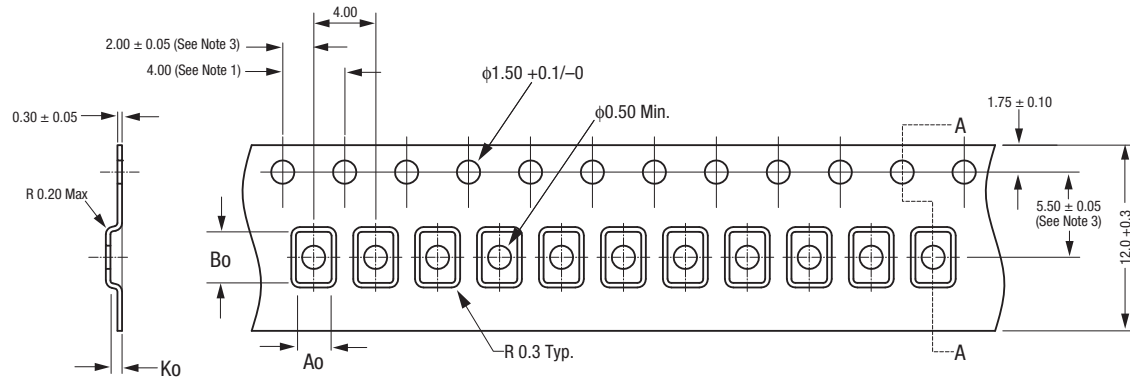
**Figure 12. Typical Case Markings  
(Top View)**



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.

S1541

**Figure 13. SKY13322-375LF 6-Pin QFN Package Dimensions**



Section A

Notes:

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
2. Chamber in compliance with EIA 481.
3. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
4. Carrier tape: black conductive polycarbonate or polystyrene.
5. Cover tape material: transparent conductive PSA.
6. Cover tape size: 9.3mm width.
7. All measurements are in millimeters.

A0 = 2.30  
B0 = 3.30  
K0 = 0.75

S1552

Figure 14. SKY13322-375LF Tape and Reel Dimensions



## Ordering Information

| Model Name                 | Manufacturing Part Number | Evaluation Kit Part Number |
|----------------------------|---------------------------|----------------------------|
| SKY13322-375LF SP4T Switch | SKY13322-375LF            | SKY13322-375LF-EVB         |

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