DATA SHEET

SKY13381-374LF: 0.1-6.0 GHz DPDT Switch

Applications

- Dual-band wireless LANs (802.11 a/b/g/n)
- Diversity antenna switching

Features

- Broadband frequency range: 0.1 to 6.0 GHz
- Positive control voltage range: 1.8 to 5.0 V
- Low insertion loss: 0.6 dB typical @ 2.5 GHz
- High isolation: 24 dB typical @ 2.5 GHz
- IP1dB: +38 dBm typical @ 3 V
- Small, MLPD (6-pin, 1.5 x 1.5 mm) Pb-free 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.

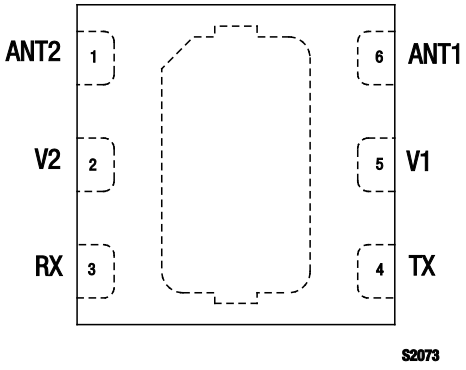


Figure 2. SKY13381-374LF Pinout – 6-Pin MLPD (Top View)

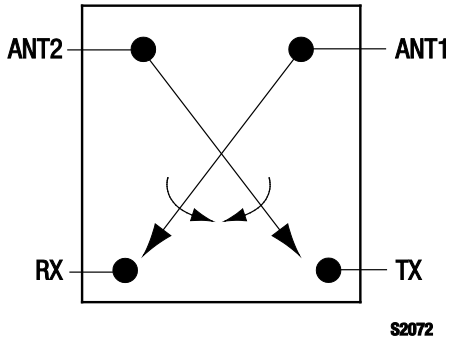


Figure 1. SKY13381-374LF Block Diagram

Description

The SKY13381-374LF is a GaAs pHEMT Double-Pole, Double-Throw (DPDT) switch designed for 2.4 and 6.0 GHz, dual-band wireless LAN applications. The switch provides high linearity performance, low insertion loss, and high isolation in both frequency bands.

Switching is controlled by two voltage inputs (V1 and V2). Depending on the logic voltage level applied to the control pins, the ANT1 and ANT2 pins connect to one of two switched RF outputs (RX or TX) through a low insertion loss path while maintaining a high isolation path to the alternate port.

The switch is manufactured in a compact, 1.5 x 1.5 mm, 6-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.

Table 1. SKY13381-374LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	ANT2	Antenna 2 RF port. Must be DC-blocked for proper operation.	4	TX	Transmit RF port. Must be DC-blocked for proper operation.
2	V2	DC control voltage 2	5	V1	DC control voltage 1
3	RX	Receive RF port. Must be DC-blocked for proper operation.	6	ANT1	Antenna 1 RF port. Must be DC-blocked for proper operation.

Note: Exposed backside ground pad must be properly grounded through a low impedance path.

Table 2. SKY13381-374LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Control voltage	V1, V2		6	V
RF input power	P_{IN}		+39	dBm
Storage temperature	T_{STG}	–40	+125	°C
Operating temperature	T_{OP}	–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. SKY13381-374LF Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency	f	0.1		6.0	GHz
Control voltage	V1, V2	1.8	3.0	5.0	V

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13381-374LF 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 SKY13381-374LF are illustrated in Figures 3 through 5.

The state of the SKY13381-374LF is determined by the logic provided in Table 5.

Table 4. SKY13381-374LF Electrical Specifications (Note 1)
(V1/V2 = 0 V and +3.0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications						
Insertion loss	IL	ANT1/ANT2 to RX/TX				
		0.1 to 1.0 GHz		0.50	0.55	dB
		1.0 to 2.5 GHz		0.60	0.75	dB
		2.5 to 4.9 GHz		1.20	1.45	dB
		4.9 to 6.0 GHz		1.40	1.65	dB
Isolation	Iso	ANT1/ANT2 to RX/TX, ANT1 to ANT2, TX to RX				
		0.1 to 1.0 GHz	28	31		dB
		1.0 to 2.5 GHz	20	24		dB
		2.5 to 4.9 GHz	14	18		dB
		4.9 to 6.0 GHz	10	14		dB
Return loss (Note 2)	|S11|	ANT1/ANT2 to RX/TX:				
		0.1 to 4.0 GHz		20		dB
		4.0 to 6.0 GHz		13		dB
1 dB Input Compression Point	IP1dB	0.1 to 6.0 GHz		+38		dBm
0.1 dB Input Compression Point	IP0.1dB	0.1 to 6.0 GHz		+35		dBm
3rd Order Input Intercept Point	IIP3	P_{IN} = +20 dBm/tone, Δf = 1 MHz, 0.1 to 6.0 GHz		+62		dBm
2nd harmonic	2fo	P_{IN} = +25 dBm, 0.1 to 6.0 GHz		+77		dBc
3rd harmonic	3fo	P_{IN} = +25 dBm, 0.1 to 6.0 GHz		+80		dBc
Switching speed		50% V1/V2 to 90/10% RF		55		ns
		90/10% RF or 10/90% RF		35		ns
DC Specifications						
Control voltage:	V1, V2					
high			1.8	3.0	5.0	V
low			–0.2	0	+0.2	V
Control current	I_{CC}			50		µA

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

Note 2: Lower frequency return loss is dependent on the DC blocking capacitor value.

Typical Performance Characteristics

(V1/V2 = 0 V and +3.0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_O] = 50 Ω, Unless Otherwise Noted)

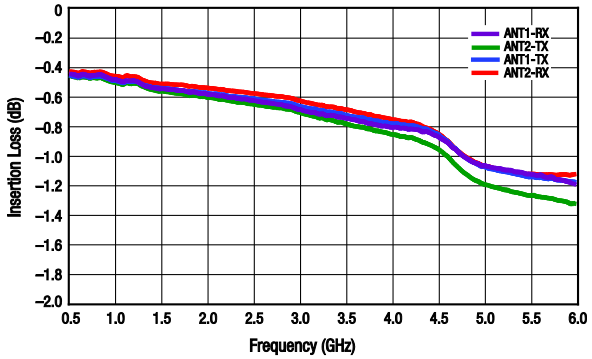


Figure 3. Insertion Loss vs Frequency

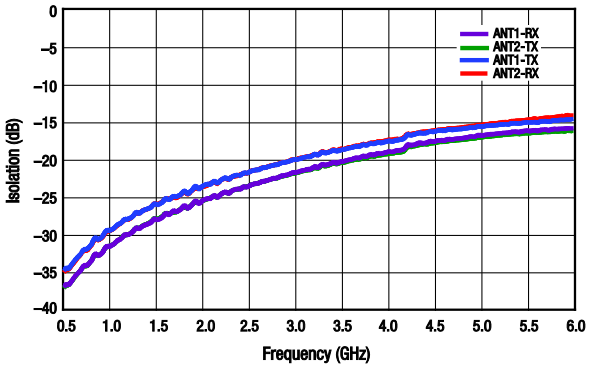


Figure 4. Isolation vs Frequency (ANT1/ANT2 to TX/RX)

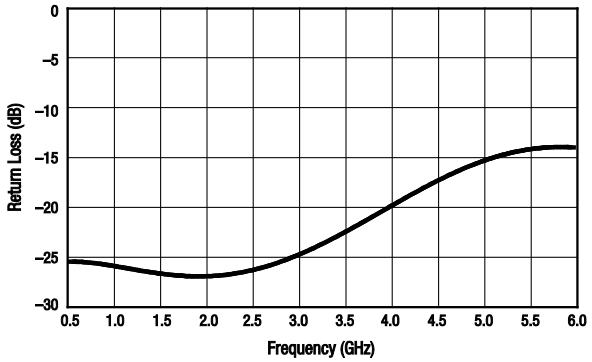


Figure 5. Typical Return Loss of All States (Worst Case)

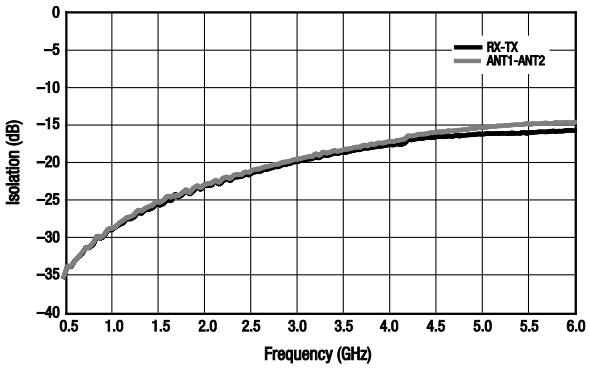


Figure 6. Isolation vs Frequency (ANT1 to ANT2 and TX to RX)

Table 5. SKY13381-374LF Truth Table

V1 (Pin 5)	V2 (Pin 2)	ANT1 (Pin 6) to TX (Pin 4)	ANT1 (Pin 6) to RX (Pin 3)	ANT2 (Pin 1) to TX (Pin 4)	ANT2 (Pin 1) to RX (Pin 3)
High	Low	Isolation state	Insertion loss state	Insertion loss state	Isolation state
Low	High	Insertion loss state	Isolation state	Isolation state	Insertion loss state

Note: High = +1.8 V to +5 V.
Low = –0.2 V to +0.2 V.
Any other state not described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Evaluation Board Description

The SKY13381-374LF Evaluation Board is used to test the performance of the SKY13381-374LF SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 7. Table 6 provides the Bill of Materials (BOM) list for Evaluation Board components. An assembly drawing for the Evaluation Board is shown in Figure 8.

Package Dimensions

The PCB layout footprint for the SKY13381-374LF is provided in Figure 9. Typical case markings are shown in Figure 10. Package dimensions for the 6-pin MLPD 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 SKY13381-374LF 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.

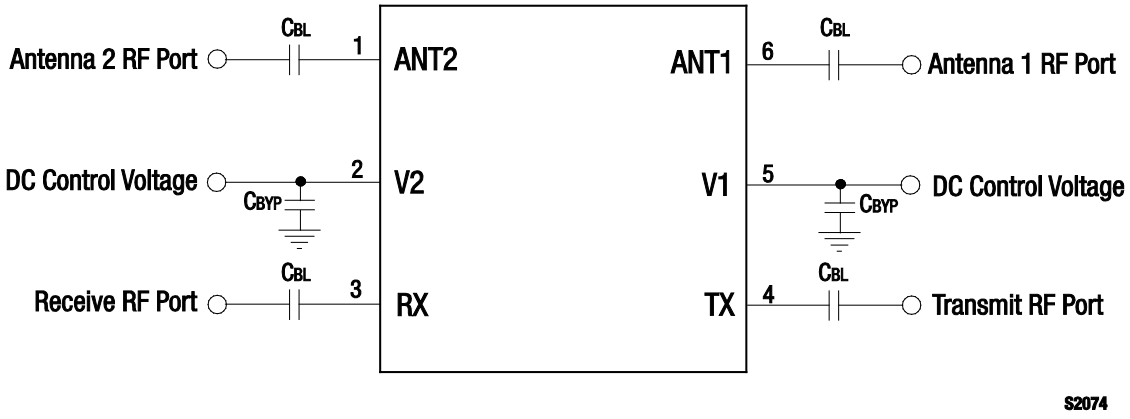


Figure 7. SKY13381-374LF Evaluation Board Schematic

Table 6. SKY13381-374LF Evaluation Board Bill of Materials

Component	Value	Size	Manufacturer	Characteristic
CBL	47 pF	0402	Murata GRM Series	DC blocking capacitor
CBYP	10 pF	0402	Murata GRM Series	Decoupling capacitor

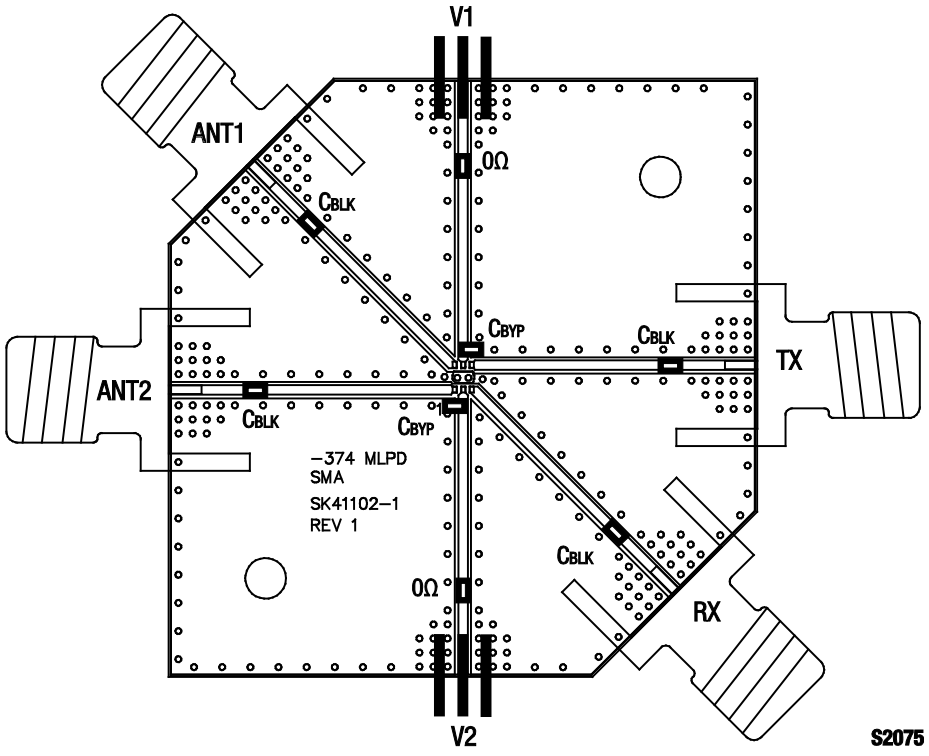


Figure 8. SKY13381-374LF Evaluation Board Assembly Diagram

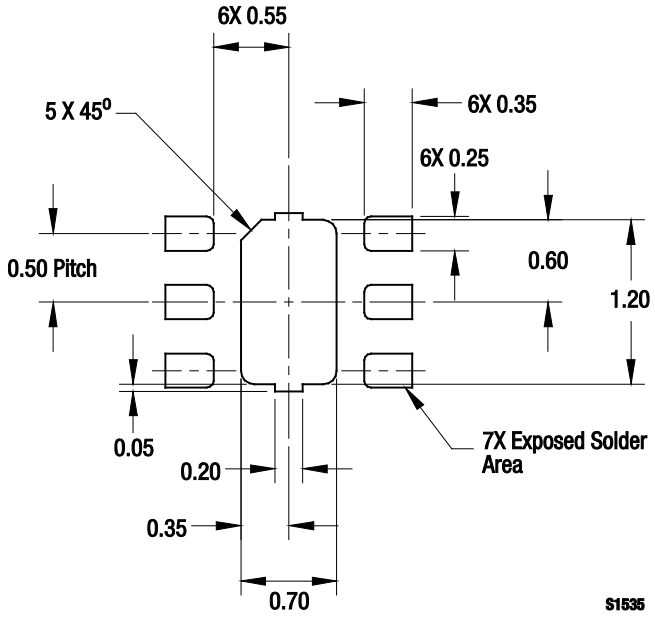


Figure 9. SKY13381-374LF PCB Layout Footprint
(Top View)

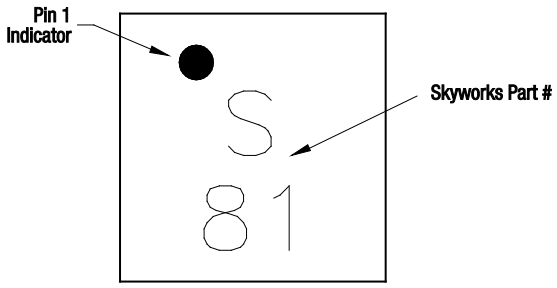
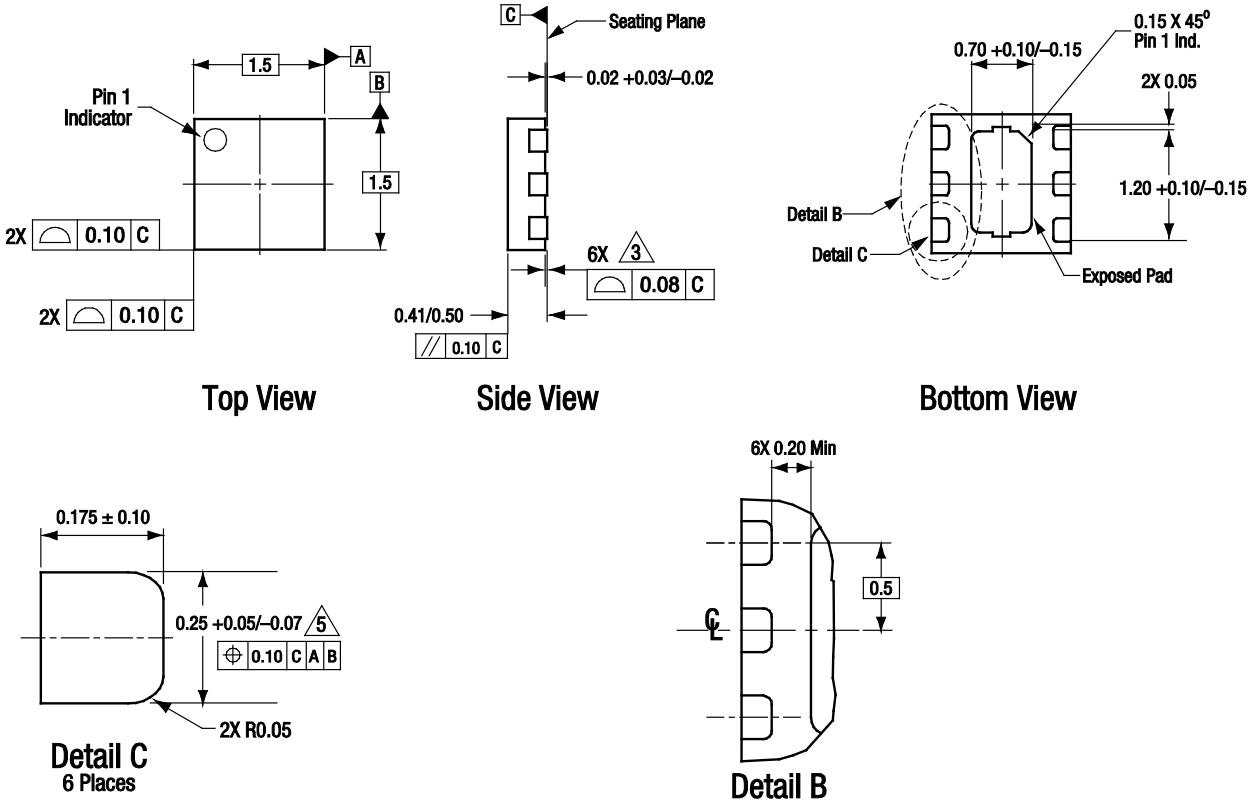


Figure 10. Typical Part Markings (Top View)



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.
Metalized contact areas are NiPdAu.

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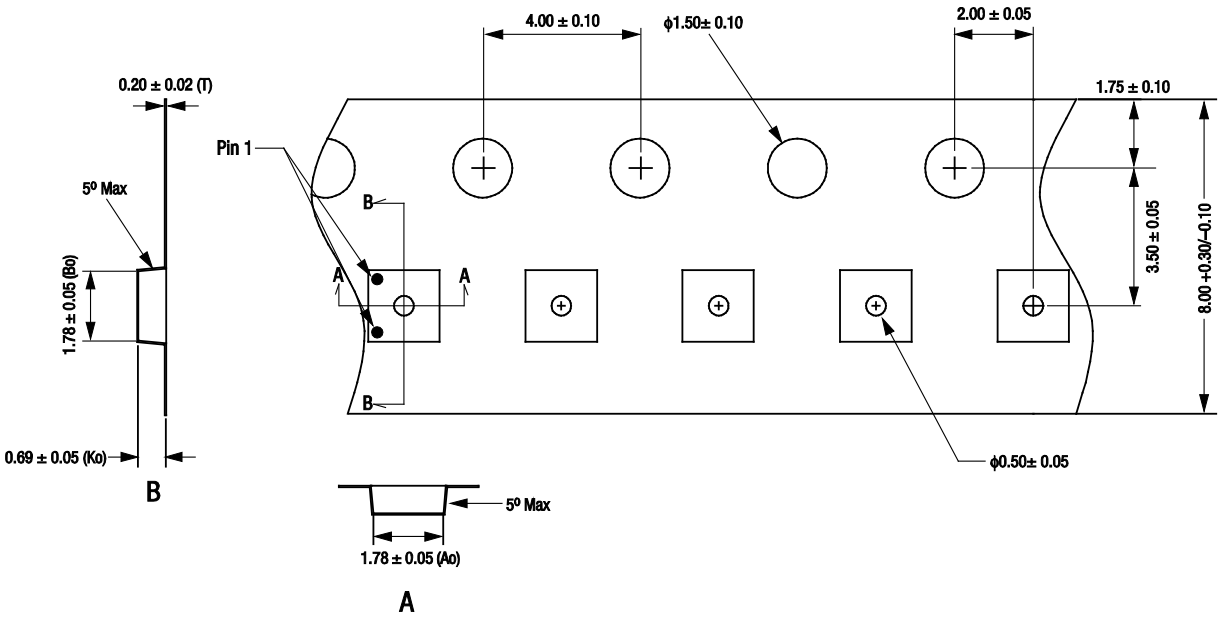
Figure 11. SKY13381-374LF 6-Pin QFN Package Dimensions



Notes:

1. *Carrier tape: black conductive polycarbonate or polystyrene.*
2. *Cover tape material: transparent conductive PSA.*
3. *Cover tape size: 5.4 mm width.*
4. *All measurements are in millimeters.*
5. *Pin 1 orientation is in lower left corner for SOT-666 packages. Pin 1 orientation is in upper left corner for 1.5 x 1.5 mm MLPD, QFN, and DFN packages.*

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Figure 12. SKY13381-374LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13381-374LF DPDT Switch	SKY13381-374LF	SKY13381-374LF-EVB

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