

DATA SHEET

SKY13399-468LF: 0.7 – 2.7 GHz DPx3T Switch

Applications

- GSM, DCS, PCS, CDMA, WCDMA, and TD-SCDMA differential filter switching

Features

- Broadband frequency range: 0.7-2.7 GHz
- Low insertion loss: 0.35 dB typical @ 1 GHz and 0.4 dB typical @ 2.2 GHz
- Positive battery control: 1.8 V
- Wide V_{DD} supply range: 2.5 to 5.0 V
- Crossovers implemented on die for ease of use
- Small, QFN (18-pin, 2 x 2 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



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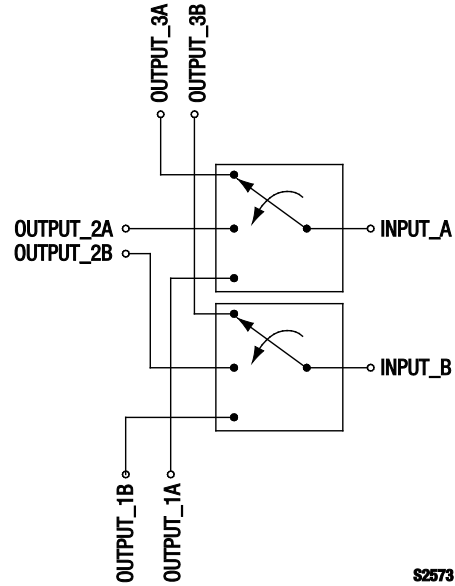


Figure 1. SKY13399-468LF Block Diagram

Description

The SKY13399-468LF is a double-pole, six-throw (DPx3T) switch with on-die crossovers. The two inputs can be switched to three different pairs of outputs. Two control lines are used to determine which pair of outputs is connected.

The SKY13399-468LF is manufactured using a state of the art Silicon on Insulator (SOI) process, and is provided in a compact Quad Flat No-Lead (QFN) 2 x 2 mm 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.

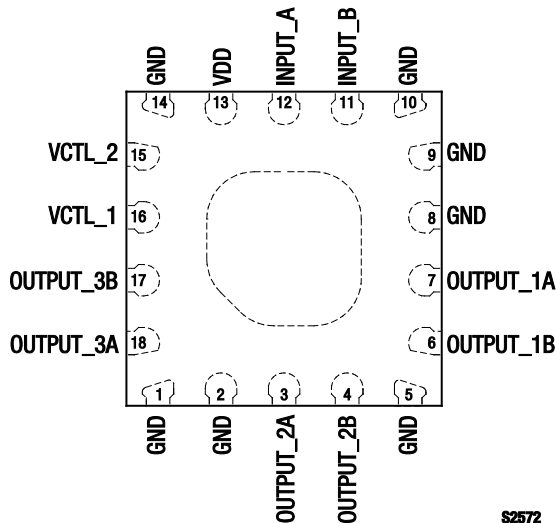


Figure 2. SKY13399-468LF Pinout – 18-Pin QFN (Top View)

Table 1. SKY13399-468LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	GND	Ground	10	GND	Ground
2	GND	Ground	11	INPUT_B	RF input
3	OUTPUT_2A	RF output paired with output 2B	12	INPUT_A	RF input
4	OUTPUT_2B	RF output paired with output 2A	13	VDD	Supply voltage input.
5	GND	Ground	14	GND	Ground
6	OUTPUT_1B	RF output paired with output 1A	15	VCTL2	Switch control voltage 2
7	OUTPUT_1A	RF output paired with output 1B	16	VCTL1	Switch control voltage 1
8	GND	Ground	17	OUTPUT_3B	RF output paired with output 3A
9	GND	Ground	18	OUTPUT_3A	RF output paired with output 3B

Table 2. SKY13399-468LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V _{DD}		5	V
Control voltage	V _{CTL}		3.0	V
Input power	P _{IN}		+30	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.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13399-468LF are provided in Table 2. Electrical specifications are provided in Table 3.

Operating logic is described in Table 4.

Typical performance characteristics of the SKY13399-468LF are illustrated in Figures 3 through 8.

Table 3. SKY13399-468LF Electrical Specifications (1 of 2) (Note 1)**(V_{DD} = 2.7 V, V_{CTL} = 1.8 V, P_{IN} = 0 dBm, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Insertion loss (INPUT_A/B to OUTPUT_1A/B, OUTPUT_2A/B, and OUTPUT_3A/B)		0.7 to 1.0 GHz		0.35	0.45	dB
		1.8 to 2.2 GHz		0.40	0.55	dB
Isolation (INPUT_A/B to OUTPUT_1A/B, OUTPUT_2A/B, and OUTPUT_3A/B)		0.7 to 1.0 GHz	35	40		dB
		1.8 to 2.2 GHz	25	30		dB
Isolation (INPUT_A to INPUT_B)	ANT _{iso}	0.7 to 1.0 GHz	25	27		dB
		1.8 to 2.2 GHz	19	21		dB
Return loss (INPUT_A/B to OUTPUT_1A/B, OUTPUT_2A/B, and OUTPUT_3A/B)		0.7 to 2.2 GHz	15	20		dB
Phase error (A vs B path)			-3		+3	deg
Switching on/off time		50% V _{CTL} to 90/10% RF		750		ns
0.1 dB Input Compression Point	IP0.1dB	0.7 to 2.2 GHz		+30		dBm
Harmonics		P _{IN} = +10 dBm, 0.7 to 2.2 GHz		+100		dBc
Triple beat ratio		Transmit power = -24 dBm, blocking power = -20 dBm, transmit frequency = 826 and 827 MHz, blocking frequency = 871 MHz, measured at 870 and 872 MHz		+110		dBc
2 nd Order Intermodulation Distortion	IMD2	Transmit power = -30 dBm, blocking power = -15 dBm Band 5: transmit frequency = 836.5 MHz, blocking frequency = 45.1718 MHz, receive frequency = 881.5 MHz Band 8: transmit frequency = 897.5 MHz, blocking frequency = 45 and 1840 MHz, receive frequency = 942.5 MHz Band 17: transmit frequency = 710 MHz, blocking frequency = 30 and 1450 MHz, receive frequency = 740 MHz		+130		dBc
3 rd Order Intermodulation Distortion	IMD3	Transmit power = -24 dBm, blocking power = -20 dBm Band 5: transmit frequency = 836.5 MHz, blocking frequency = 791.5 and 2554.5 MHz, receive frequency = 881.5 MHz Band 8: transmit frequency = 897.5 MHz, blocking frequency = 852.5 and 2737.5 MHz, receive frequency = 942.5 MHz Band 17: transmit frequency = 710 MHz, blocking frequency = 680 and 2160 MHz, receive frequency = 740 MHz		+130		dBc

Table 3. SKY13399-468LF Electrical Specifications (2 of 2) (Note 1)

(V_{DD} = 2.7 V, V_{CTL} = 1.8 V, P_{IN} = 0 dBm, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Spurious emissions		Any frequency, no RF input			-110	dBm
Control voltage	V _{CTL_HIGH}		0		0.50	V
	V _{CTL_LOW}		1.65		2.70	V
Supply voltage	V _{DD}		2.5		5.0	V
Supply current		V _{DD} = 2.7 V			40	μA
		V _{CTL} = low/high			5	μA

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

Table 4. SKY13399-468LF Truth Table

VCTL1 (Pin 16)	VCTL2 (Pin 15)	Insertion Loss Path
1	0	INPUT_A to OUTPUT_1A, INPUT_B to OUTPUT_1B
0	0	INPUT_A to OUTPUT_2A, INPUT_B to OUTPUT_2B
0	1	INPUT_A to OUTPUT_3A, INPUT_B to OUTPUT_3B

Note: "1" = +1.65 to +2.70 V. "0" = 0 V to +0.5 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} = 2.7 V, V_{CTL} = 1.8 V, P_{IN} = 0 dBm, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

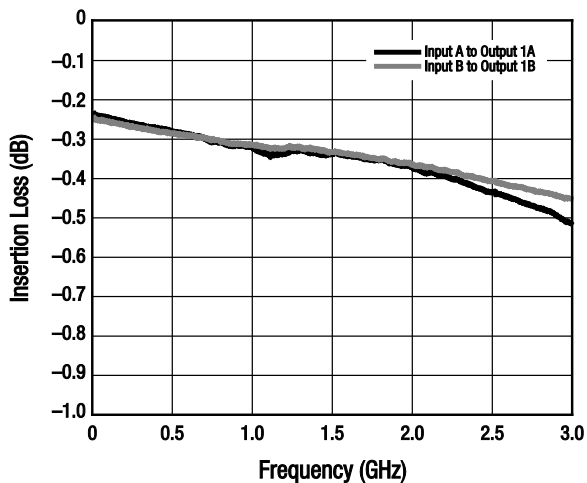


Figure 3. Insertion Loss vs Frequency (1A, 1B)

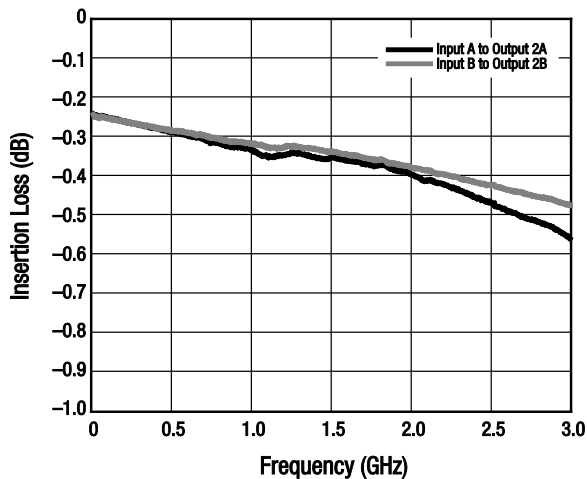


Figure 4. Insertion Loss vs Frequency (2A, 2B)

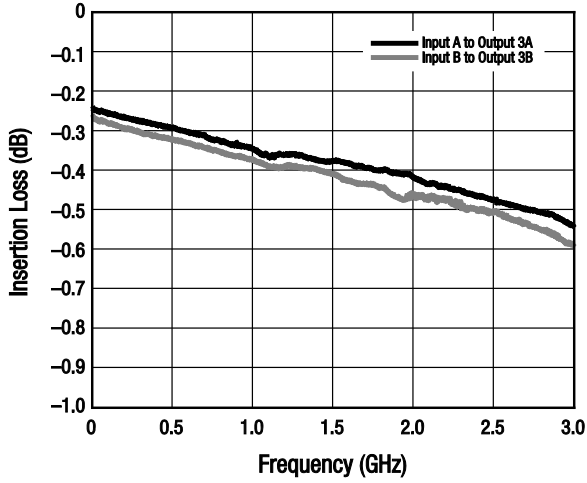


Figure 5. Insertion Loss vs Frequency (3A, 3B)

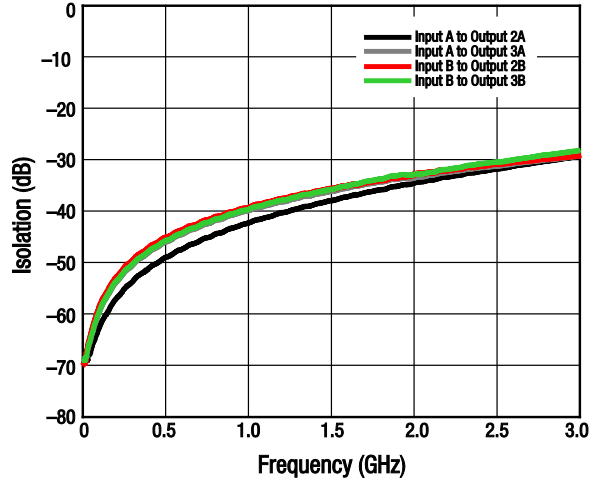


Figure 6. Isolation vs Frequency (1A, 1B On)

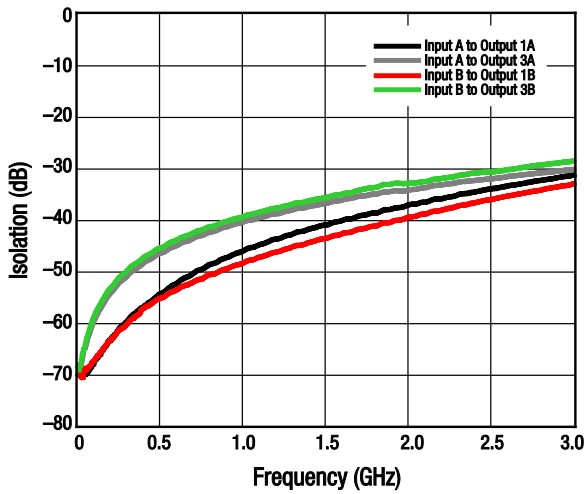


Figure 7. Isolation vs Frequency (2A, 2B On)

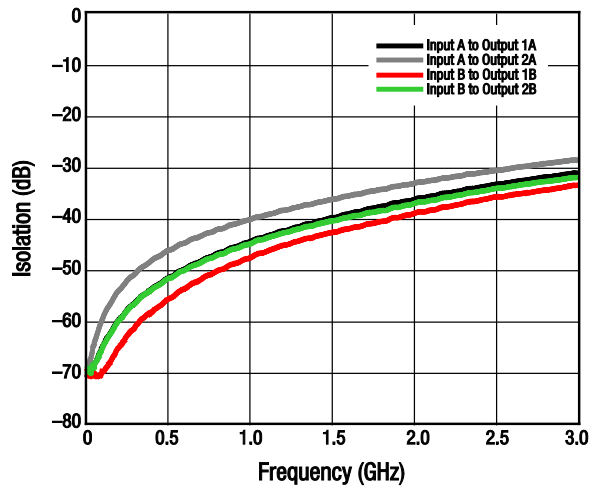


Figure 8. Isolation vs Frequency (3A, 3B On)

Evaluation Board

The SKY13399-468LF Evaluation Board is used to test the performance of the SKY13399-468LF DPx3T 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

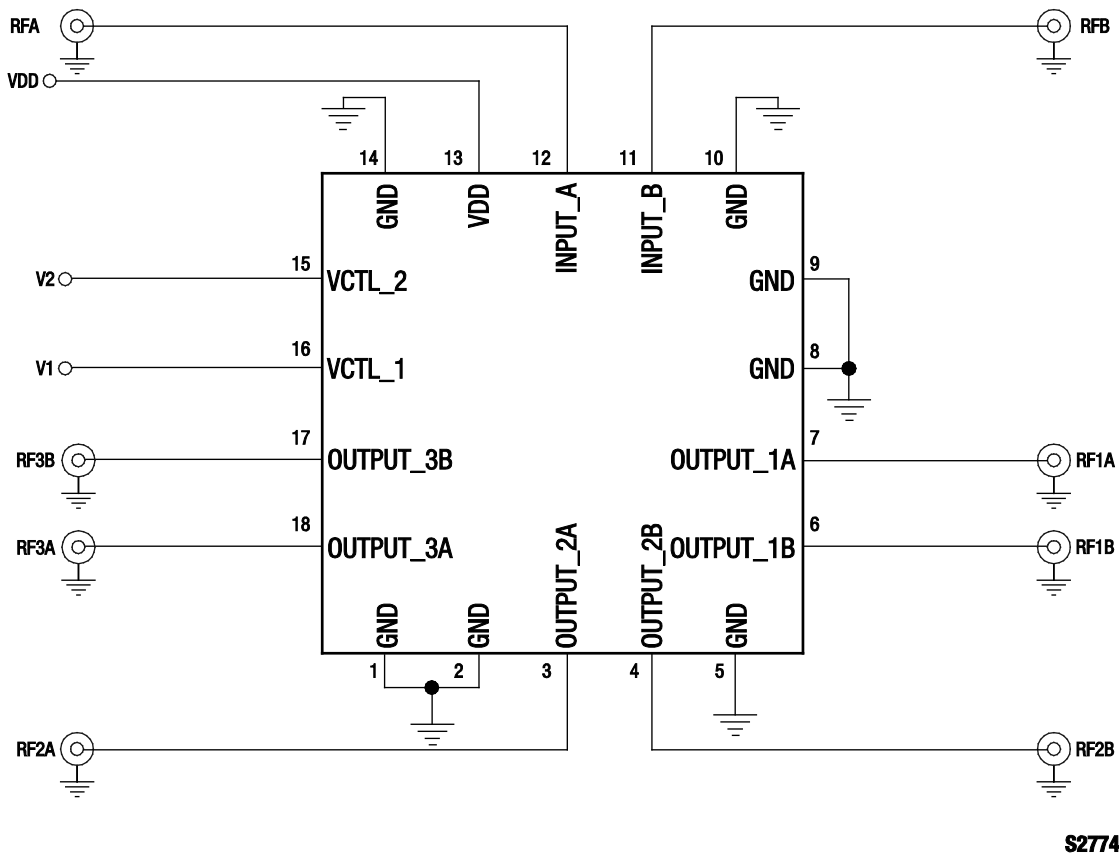
The PCB layout footprint for the SKY13399-468LF is provided in Figure 11. Typical case markings are shown in Figure 12. Package dimensions for the 18-pin QFN are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

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 SKY13399-468LF 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.



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Figure 9. SKY13399-468LF Evaluation Board Schematic

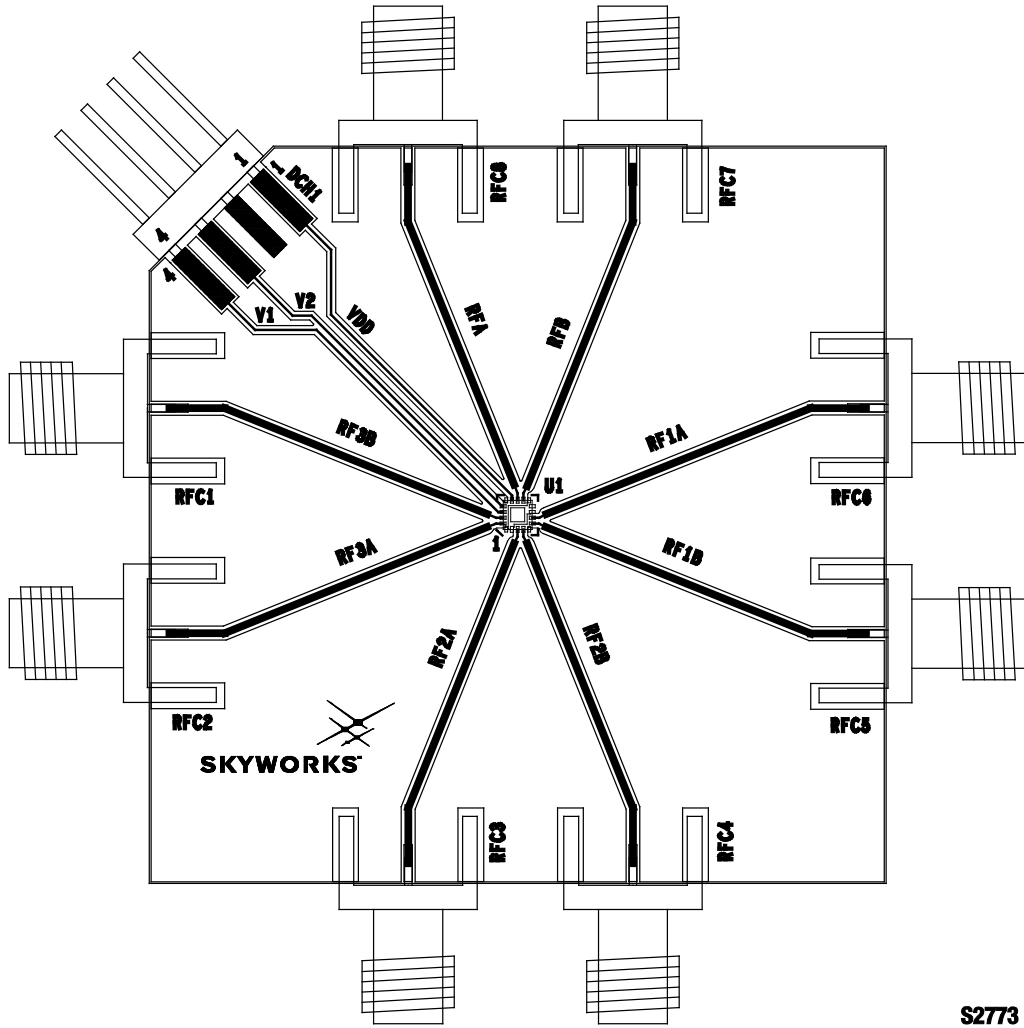
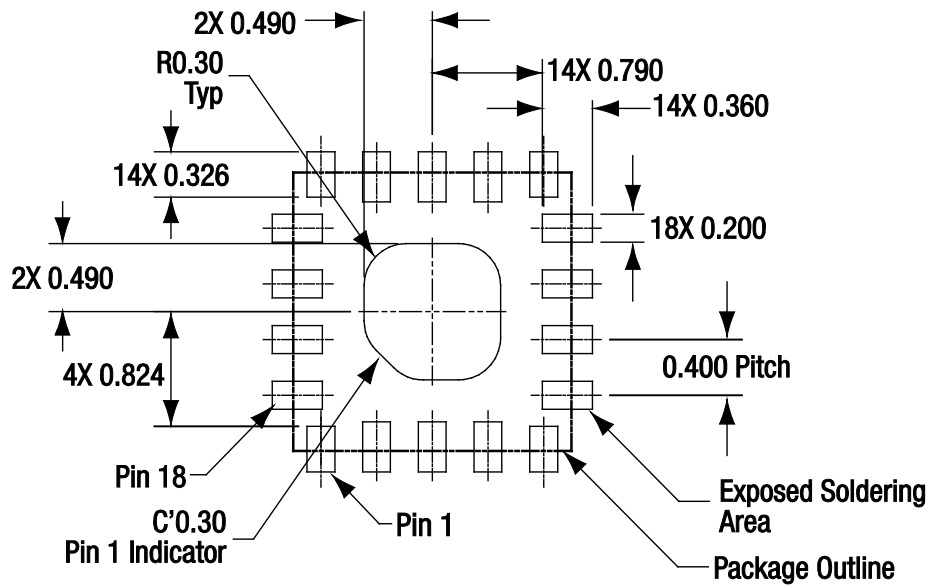


Figure 10. SKY13399-468LF Evaluation Board Assembly Diagram

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All measurements in millimeters

S2808

Figure 11. SKY13399-468LF PCB Layout Footprint

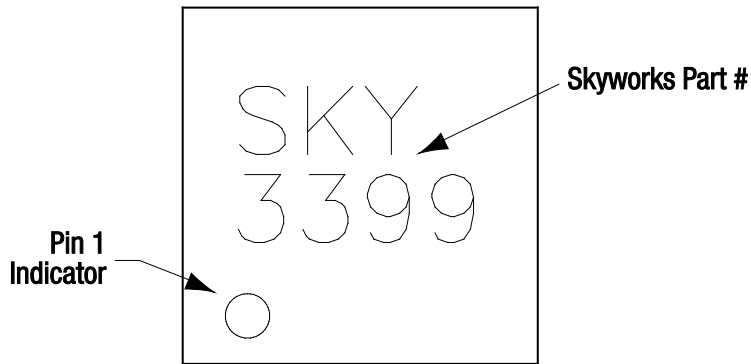
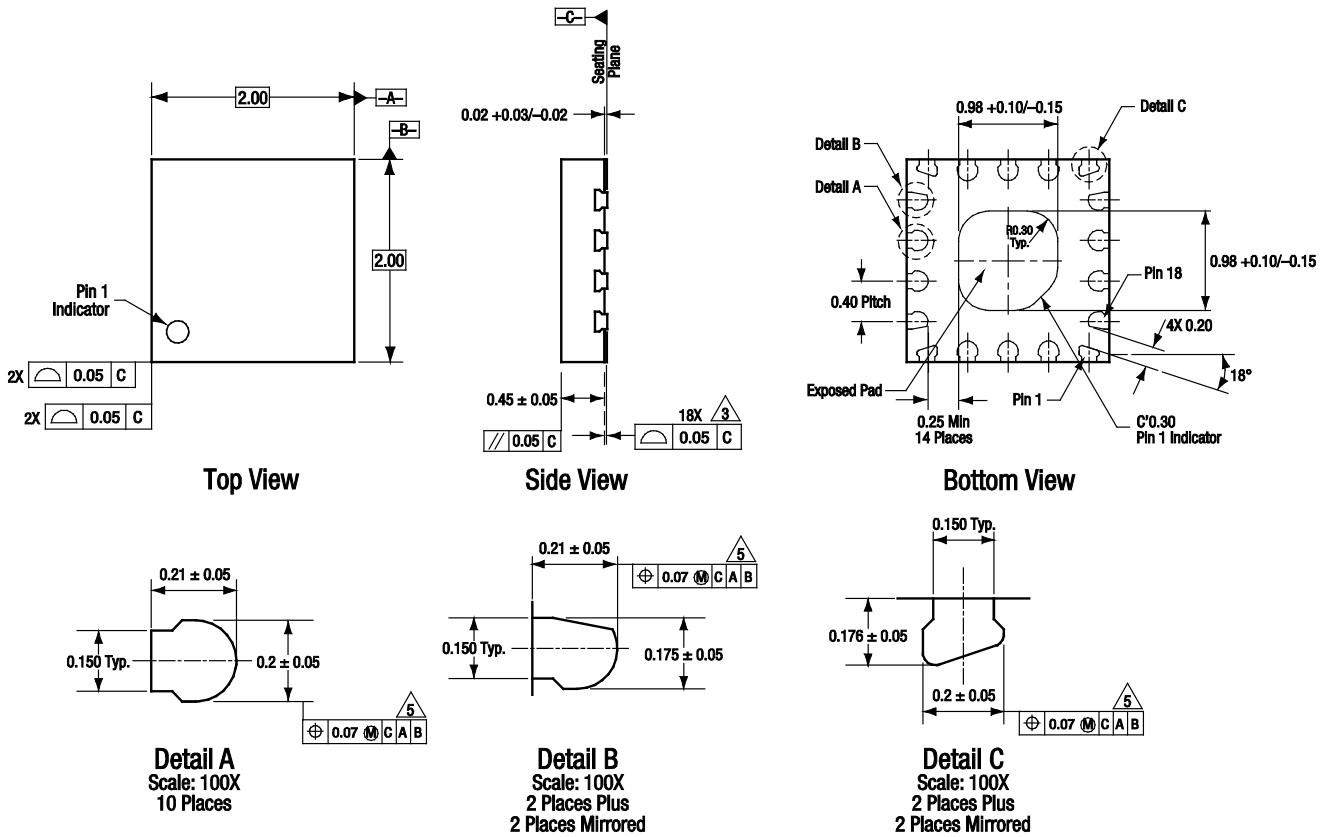


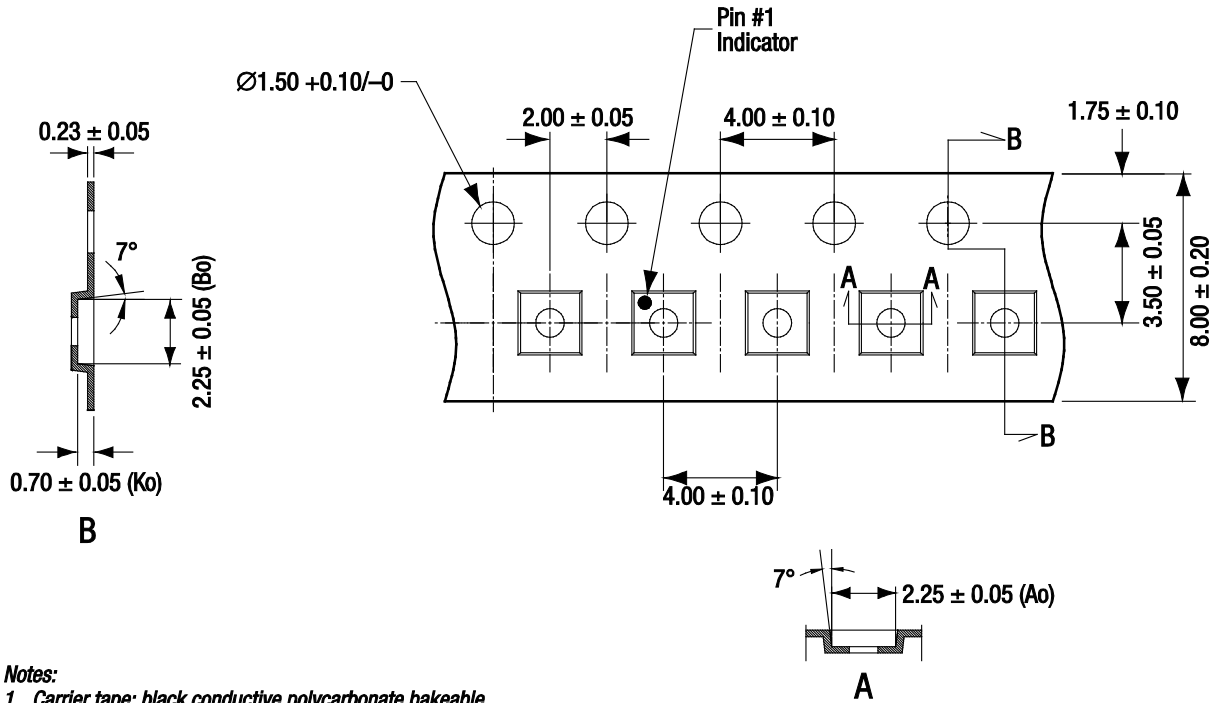
Figure 12. Typical Case Markings (Top View)



All measurements are in millimeters.
 Dimensioning and tolerancing according to ASME Y14.5M-1994.
 Coplanarity applies to the terminals and all other bottom surface metalization.
 Dimension applies to metalized terminal. If the terminal has a radius on its end,
 the width dimension should not be measured in that radius area.

S2571

Figure 13. SKY13399-468LF 18-Pin QFN Package Dimensions



Notes:

1. Carrier tape: black conductive polycarbonate bakeable material at 125°C.
2. Carrier tape material: transparent conductive PSA.
3. Cover tape material: transparent conductive with 5.40 mm width.
4. ESD-surface resistivity is $\geq 1 \times 10^4 \sim \leq 1 \times 10^8$ Ohms/square per EIA, JEDEC TNR Specification.
5. All dimensions are in millimeters.

S2712

Figure 14. SKY13399-468LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13399-468LF DPx3T Switch	SKY13399-468LF	SKY13399-468LF-EVB

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