

**DATA SHEET**

# SKY13592-689LF: 1.0 to 6.0 GHz SPDT Switch

## Applications

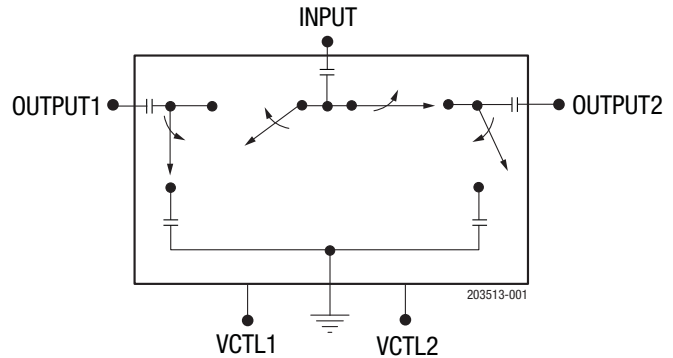
- WLAN 802.11 a/b/g/n/ac networks
- WLAN repeaters
- ISM band radios
- Low power transmit receive systems
- Smartphones
- Connectivity modules

## Features

- Broadband frequency range: 1.0 to 6.0 GHz
- Low insertion loss, 0.45 dB typical @ 2.45 GHz
- High isolation, 35 dB typical @ 2.45 GHz
- Excellent linearity performance, IP0.1dB = +30 dBm
- Integrated DC blocking capacitors
- Ultra-miniature, MLPD (6-pin, 1 × 1 × 0.5 mm) 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 1. SKY13592-689LF Block Diagram**

## Description

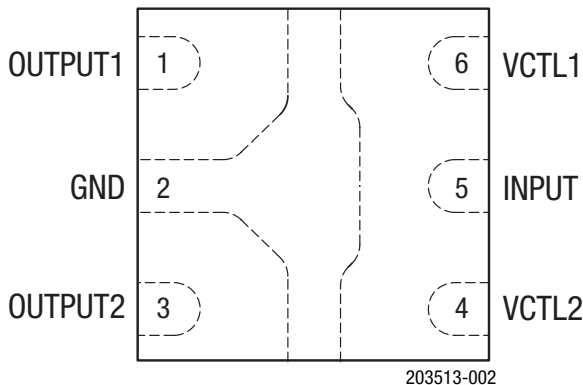
The SKY13592-689LF is a single-pole, double-throw (SPDT) switch intended for mode switching in WLAN applications. Using advanced switching technologies, the SKY13592-689LF maintains low insertion loss and high isolation for all switching paths.

The high-linearity performance and low insertion loss achieved by the switch make it an ideal choice for low-power transmit/receive applications. Depending on the logic voltage applied to the control pins (VCTL), the INPUT pin is connected to one of the two switched RF outputs (OUTPUT1 or OUTPUT2) using a low insertion loss path, while the path between the INPUT pin and the other OUTPUT pin is in a high-isolation state. The switch is "reflective short" on the isolated port.

The SKY13592-689LF has integrated DC blocking capacitors, so no external DC blocking capacitors are required.

The switch is manufactured in a compact, 1 × 1 × 0.5 mm, 6-pin exposed pad plastic Micro Lead-frame 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 2. SKY13592-689LF Pinout (Top View)**

**Table 1. SKY13592-689LF Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	OUTPUT1	RF port.	4	VCTL2	DC control voltage 2
2	GND	Ground	5	INPUT	RF port.
3	OUTPUT2	RF port.	6	VCTL1	DC control voltage 1

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13592-689LF are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

The state of the SKY13592-689LF is determined by the logic provided in Table 5. Typical performance characteristics are shown in Figures 3 through 6.

**Table 2. SKY13592-689LF Absolute Maximum Ratings<sup>1</sup>**

Parameter	Symbol	Minimum	Maximum	Units
Input power	PIN		+32	dBm
Control voltage	VCTL		3.7	V
Storage temperature	TSTG	-65	+150	°C
Operating temperature	TOP	-40	+90	°C

<sup>1</sup> 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.

---

**ESD HANDLING:** *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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

---

**Table 3. SKY13592-689LF Recommended Operating Conditions**

Parameter	Symbol	Min	Typ	Max	Units
Operating frequency	fo	1.0		6.0	GHz
Control voltage:					
Low	VCTL_L		0	0.4	V
High	VCTL_H	3.0	3.3	3.6	V
Operating temperature	TOP		+25		°C

**Table 4. SKY13592-689LF Electrical Specifications<sup>1</sup>**  
**(V<sub>CTL</sub> = 0 V and 3.3 V, T<sub>OP</sub> = +25 °C, P<sub>IN</sub> = 0 dBm, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Insertion loss	IL	1.0 to 2.5 GHz		0.45	0.65	dB
		4.8 to 6.0 GHz		0.55	0.8	dB
Isolation (INPUT to OUTPUT1/OUTPUT2)	ISO	1.0 to 2.5 GHz	31	35		dB
		4.8 to 6.0 GHz	20	24		dB
Isolation (OUTPUT1 to OUTPUT2)	ISO	1.0 to 2.5 GHz	32	36		dB
		4.8 to 6.0 GHz	20	23		dB
Return loss	RL	1.0 to 2.5 GHz		15		dB
		4.8 to 6.0 GHz		15		dB
PO.1dB compression point	P0.1dB	1.0 to 6 GHz		+30		dBm
Harmonics	2fo	fo = 2.4 GHz, P <sub>IN</sub> = +24 dBm, 50 Ω, V <sub>CTL</sub> = 3.3 V		-59	-55	dBm
		fo = 5.8 GHz, P <sub>IN</sub> = +21 dBm, 50 Ω, V <sub>CTL</sub> = 3.3 V		-59		dBm
	3fo	fo = 2.4 GHz, P <sub>IN</sub> = +24 dBm, 50 Ω, V <sub>CTL</sub> = 3.3 V		-40	-36	dBm
		fo = 5.8 GHz, P <sub>IN</sub> = +21 dBm, 50 Ω, V <sub>CTL</sub> = 3.3 V		-48		dBm
Input IP3	IP3	P <sub>IN</sub> = +20 dBm/tone: fo = 2.4 GHz	+50	+55		dBm
		fo = 5.8 GHz	+46	+50		dBm
Error vector magnitude	EVM	802.11g, 54 Mbps, P <sub>IN</sub> = +25.5 dBm, 2.45 GHz		-45		dB
		802.11g, 54 Mbps, P <sub>IN</sub> = +25.5 dBm, 5.8 GHz		-38		dB
		802.11g, 54 Mbps, P <sub>IN</sub> = +21 dBm, 5.8 GHz		-46		dB
Switching speed	tsw	50% V <sub>CTL</sub> to 90% RF		450	550	ns
Rise/fall time		10%/90% or 90%/10% RF		210	250	ns
Control current	I <sub>CTL</sub>	V <sub>CTL</sub> = 3.3 V		200	250	μA

<sup>1</sup> Performance is guaranteed only under the conditions listed in this table.

**Table 5. SKY13592-689LF Truth Table<sup>1</sup>**

VCTL1 (Pin 6)	VCTL2 (Pin 4)	INPUT to OUTPUT1 Path	INPUT to OUTPUT2 Path
1	0	Isolation	Insertion loss
0	1	Insertion loss	Isolation

<sup>1</sup> "1" indicates V<sub>CTL</sub> = 3.0 to 3.6 V.

"0" indicates V<sub>CTL</sub> = 0 to 0.4 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

(VCTL = 0 V and 3.3 V, TOP = +25 °C, PIN = 0 dBm, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

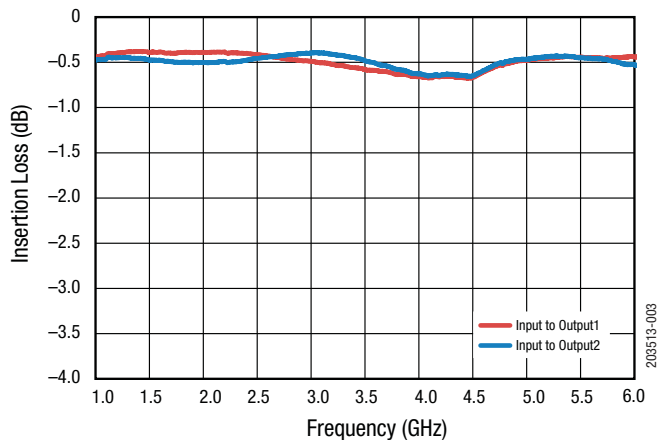


Figure 3. Typical Insertion Loss

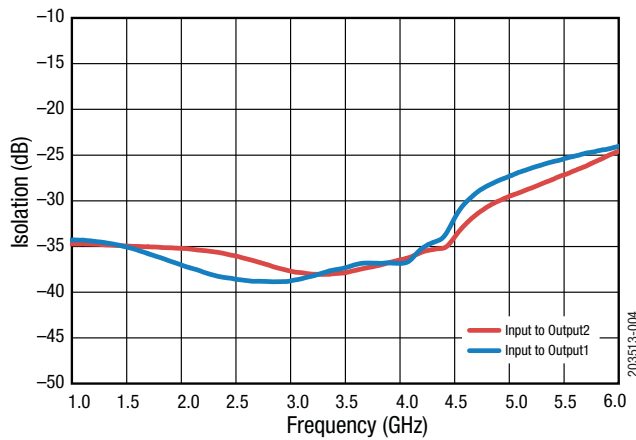


Figure 4. Typical Isolation (Input-Output)

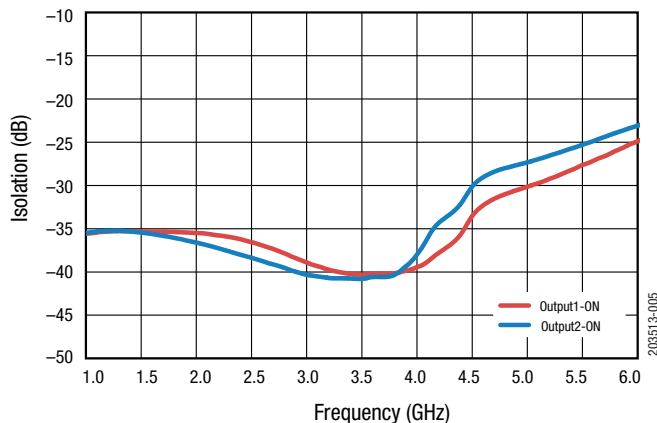


Figure 5. Typical Isolation (Output1-Output2)

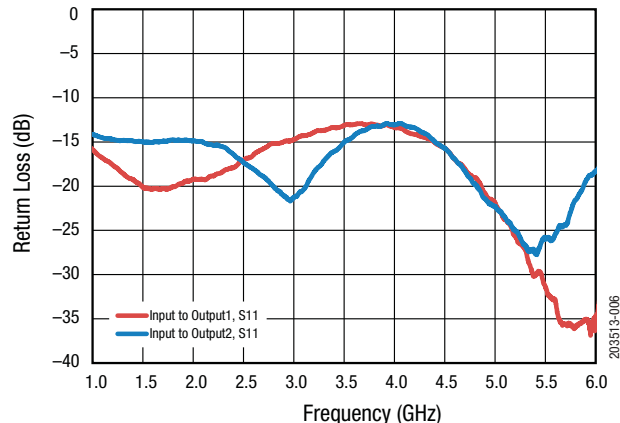


Figure 6. Typical Return Loss

### Evaluation Board Description

The SKY13592-689LF Evaluation Board is used to test the performance of the SKY13592-689LF 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

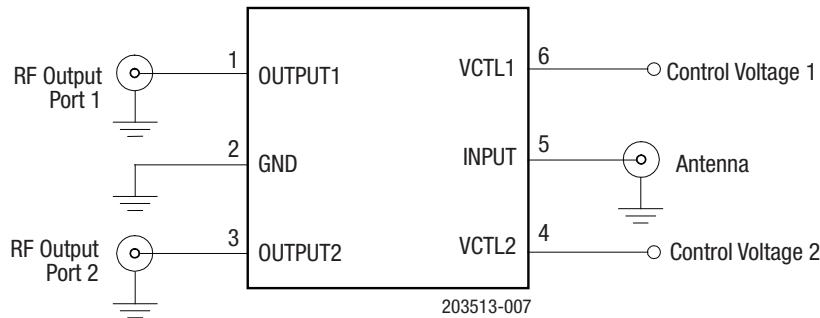
The PCB layout footprint for the SKY13592-689LF is provided in Figure 9. Typical part markings are shown in Figure 10. Package dimensions are shown in Figure 11, and tape and reel dimensions are provided in Figure 12.

### 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 SKY13592-689LF 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. SKY13592-689LF Evaluation Board Schematic**

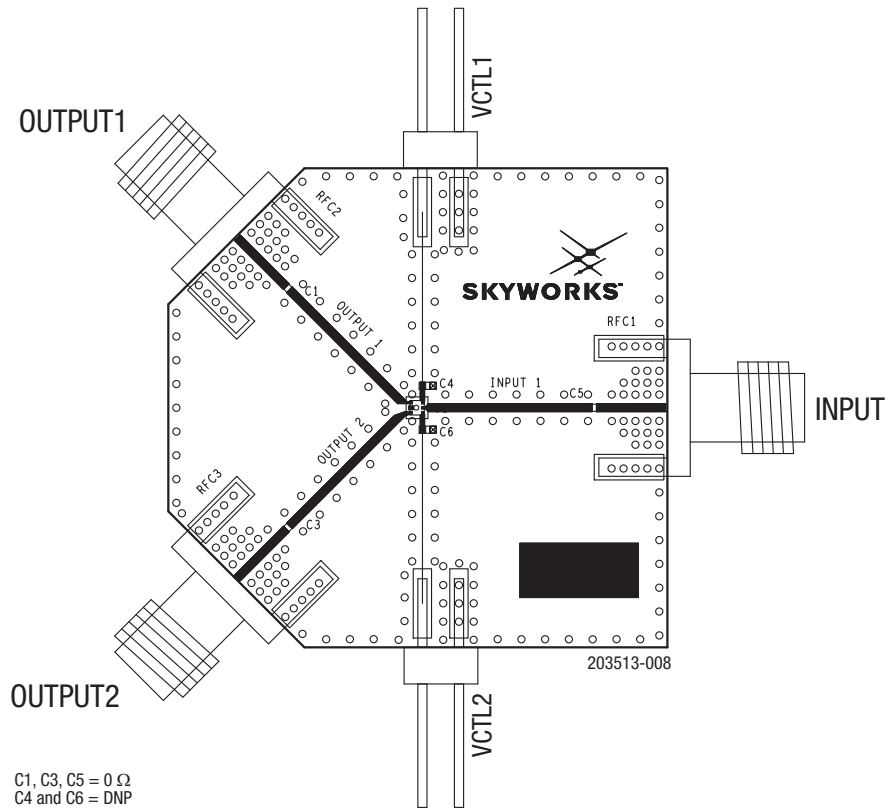
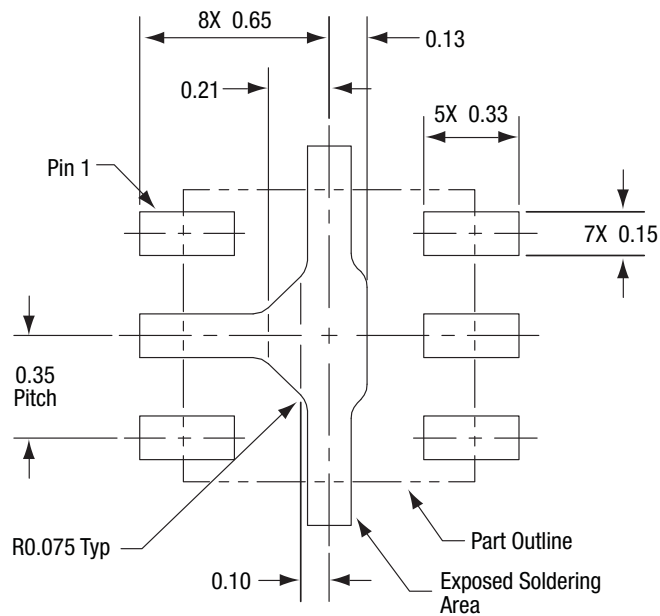


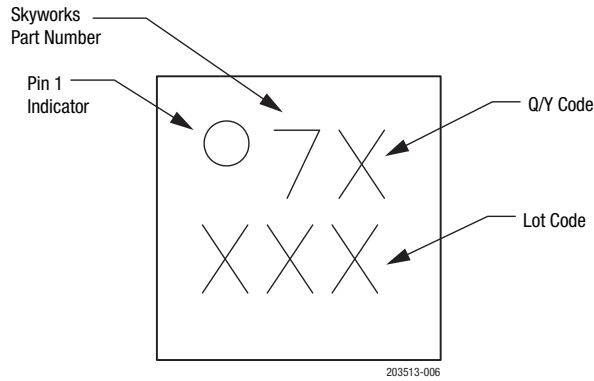
Figure 8. SKY13592-689LF Evaluation Board Assembly Diagram



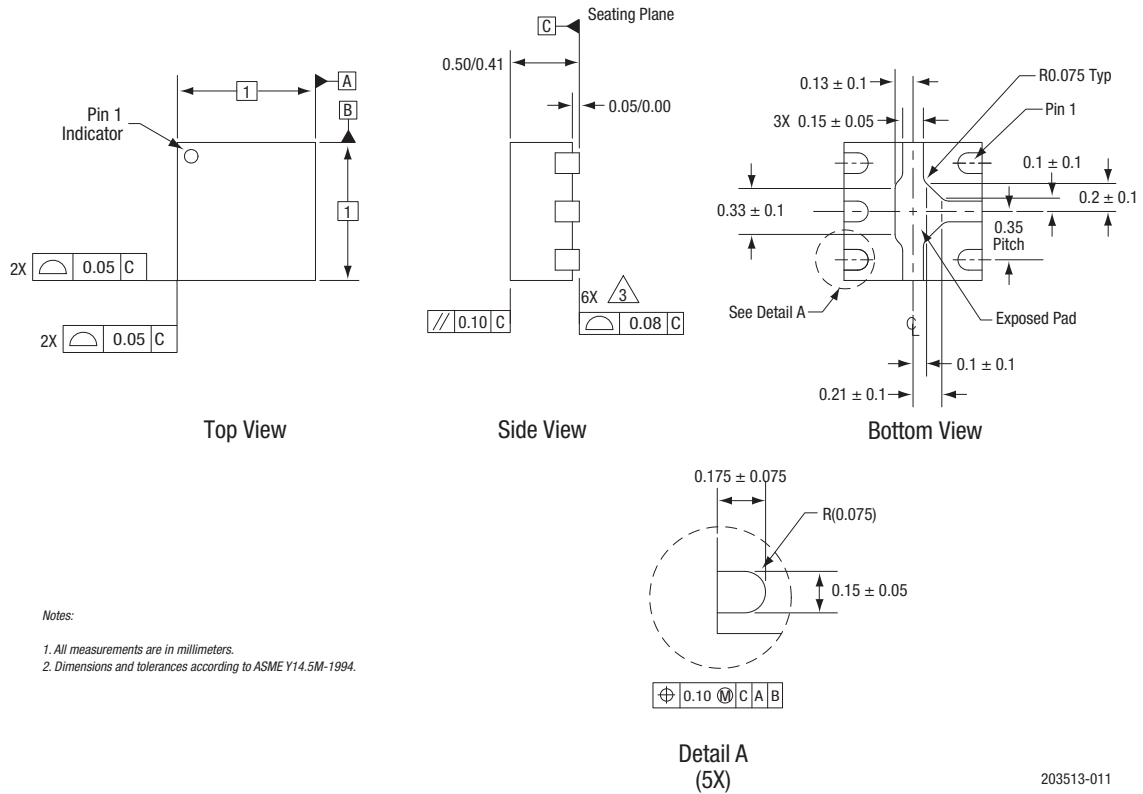
All measurements in millimeters

203513-009

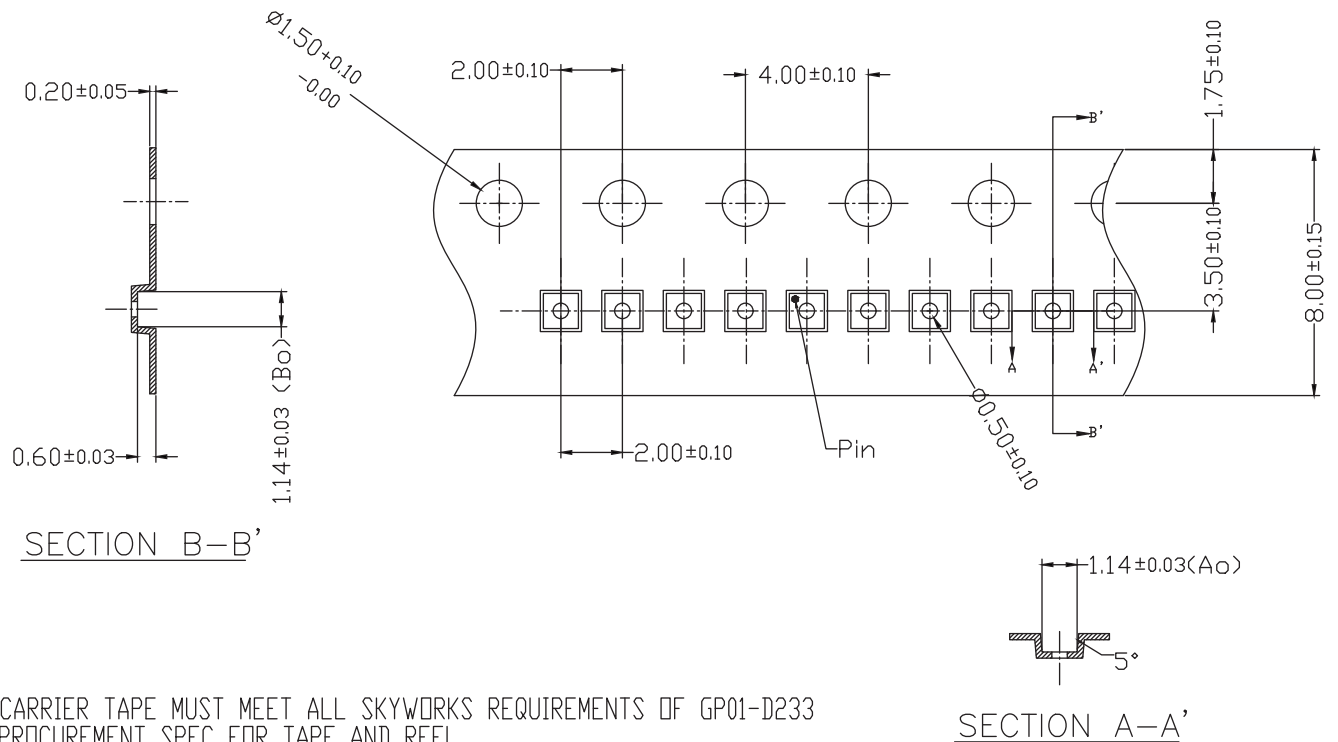
Figure 9. SKY13592-689LF PCB Layout Footprint (Top View)



**Figure 10. Typical Part Markings (Top View)**



**Figure 11. SKY13592-689LF Package Dimensions**



1. CARRIER TAPE MUST MEET ALL SKYWORKS REQUIREMENTS OF GP01-D233 PROCUREMENT SPEC FOR TAPE AND REEL
2. CARRIER TAPE SHALL BE BLACK CONDUCTIVE POLYCARBONATE.
3. COVER TAPE SHALL BE TRANSPARENT CONDUCTIVE MATERIAL
4. ESD-SURFACE RESISTIVITY SHALL MEET GP01-D233
5. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE :  $\pm 0.20\text{mm}$
6.  $A_o$  &  $B_o$  MEASURED ON PLANE  $0.30\text{mm}$  ABOVE THE BOTTOM OF THE POCKET.
7. ALL DIMENSIONS ARE IN MILLIMETERS.

SECTION A-A'

204513-012

Figure 12. SKY13592-689LF Tape and Reel Dimensions



## Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13592-689LF: 1.0 to 6.0 GHz SPDT Switch	SKY13592-689LF	SKY13592-689LF-EVB

Copyright © 2015-2017 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. (“Skyworks”) products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks and the Skyworks symbol are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А