

DATA SHEET

SKY13523-639LF: 0.7 to 3.0 GHz High-Isolation SP3T Switch

Applications

- CDMA/WCDMA/TD-SCDMA/LTE single-ended filter switching

Features

- Broadband frequency range: 0.7 to 3.0 GHz
- High isolation: >45 dB @ 2.0 GHz
- Low insertion loss: 0.5 dB typical @ 2.0 GHz
- Small QFN (14-pin, 1.6 x 1.6 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.

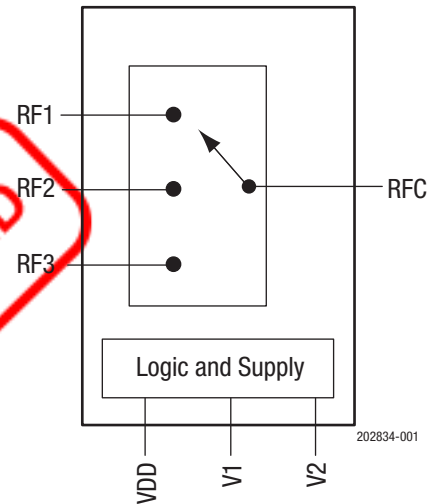
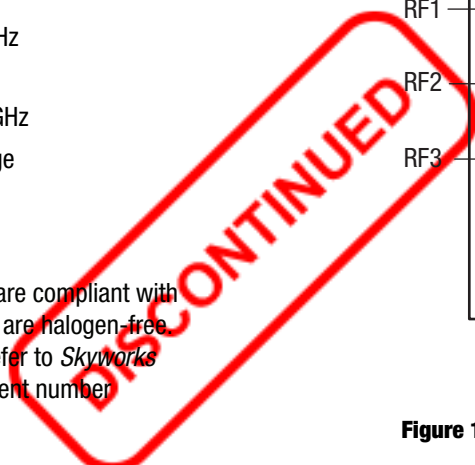


Figure 1. SKY13523-639LF Block Diagram

Description

The SKY13523-639LF is a single pole, triple-throw (SP3T) switch used for single-ended filter switching in cellular applications. The SKY13523-639LF maintains low insertion loss and high isolation for all switching paths.

Depending on the logic voltage level applied to the control pins (V1 and V2), the RFC pin is connected to one of three switched RF outputs (RF1 to RF3) using a low insertion loss path, while the paths between the RFC pin and the other RF pins are in a high isolation state.

The SKY13523-639LF is manufactured in a compact, 14-pin 1.6 x 1.6 mm, Quad Flat No-Lead (QFN) 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.

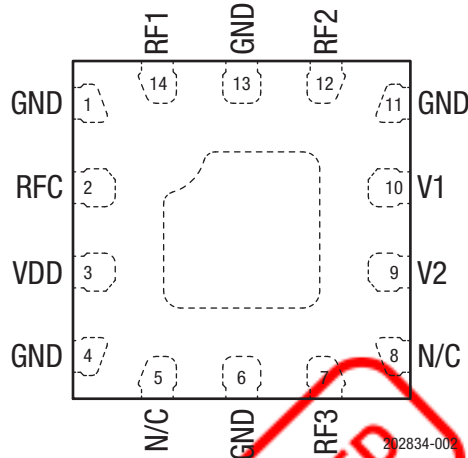


Figure 2. SKY13523-639LF Pinout (Top View)

Table 1. SKY13523-639LF Signal Descriptions¹

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	8	N/C	Not connected
2	RFC	Antenna port. No DC blocking capacitor required.	9	V2	Control voltage 2
3	VDD	DC power supply	10	V1	Control voltage 1
4	GND	Ground	11	GND	Ground
5	N/C	Not connected	12	RF2	RF input/output port 2. DC blocking capacitor required.
6	GND	Ground	13	GND	Ground
7	RF3	RF input/output port 3. DC blocking capacitor required.	14	RF1	RF input/output port 1. DC blocking capacitor required.

¹ Bottom ground paddles must be connected to ground.

Functional Description

The SKY13523-639LF includes an internal decoder and internal blocking capacitors on the RF common ports. External DC blocking capacitors are required on the RF1, RF2, and RF3 ports for proper operation. DC decoupling capacitors may be added on the VDD and control lines if necessary.

Switching is controlled by two control voltage inputs, V1 and V2. Depending on the logic voltage level applied to the control pins, the antenna pin is connected to one of three switched RF outputs.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13523-639LF are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13523-639LF is determined by the logic shown in Table 4.

Table 2. SKY13523-639LF Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V _{DD}		3.7	V
Control voltage (V1,V2)	V _{CTL}	-0.5	+3.3	V
RF input power	P _{IN}		+26	dBm
Operating temperature	T _{OP}	-30	+90	°C
Storage temperature	T _{STG}	-55	+150	°C

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.

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. SKY13523-639LF General Electrical Specifications¹

(V_{DD} = 3.3 V, V1 = V2 = High = 1.8 V, P_{IN} = 0 dBm, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition (Note 2)	Min	Typical	Max	Units
DC Specifications						
Supply voltage	V _{DD}		2.5		3.3	V
Supply current	I _{DD}	V _{DD} = 3.3 V		5	10	μA
Control voltage: High	V _{CTL_H}		1.35	1.80	3.30	V
Low	V _{CTL_L}		0		0.45	V
Control current	I _{CTL}	V1 = V2 = 1.8 V, V _{DD} = 3.3 V			5	μA
RF Specifications						
Insertion loss (RFC pin to RF1/2/3 pins)	IL	704 to 960 MHz		0.65	0.85	dB
		1710 to 2170 MHz		0.75	0.95	dB
		2300 to 2690 MHz		0.8	1.0	dB
Isolation (RFC pin to RF1/2/3 pins)	Iso	704 to 960 MHz	47	50		dB
		1710 to 2170 MHz	45	48		dB
		2300 to 2690 MHz	45	48		dB
Voltage standing wave ratio, all ports	VSWR	0.7 to 3.0 GHz, referenced to 50 Ω		1.4		–
0.1 dB input compression point (RFC pin to RF1/2/3 pins)	IPO.1dB	0.7 to 3.0 GHz		+32		dBm
Third order input intercept point	IIP3	0.7 to 3.0 GHz, all RF ports, f _o = 0.8 to 3.0 GHz, Δf = 1 MHz, P _{IN} = +20 dBm/tone		+56		dBm
Turn-on/turn-off time		Measured from 50% of final V _{DD} supply voltage to final RF power ±1 dB		400	550	ns
Switching speed		Measured from 50% of final V _{CTRL} voltage to final RF power ±1 dB		500	650	ns

¹ Performance is guaranteed only under the conditions listed in this table.

Table 4. SKY13523-639LF Control Logic¹

VDD (Pin 3)	V1 (Pin 10)	V2 (Pin 9)	Insertion Loss Path
1	1	0	RFC to RF1
1	0	0	RFC to RF2
1	0	1	RFC to RF3

¹ "1" = 1.8 V; "0" = 0 V. Any state other than that described in this table places the switch into an undefined state. An undefined state will not damage the device.

Evaluation Board Description

The SKY13523-639LF Evaluation Board is used to test the performance of the SKY13523-639LF SP3T Switch.

An Evaluation Board schematic diagram is provided in Figure 3. An assembly drawing for the Evaluation Board is shown in Figure 4.

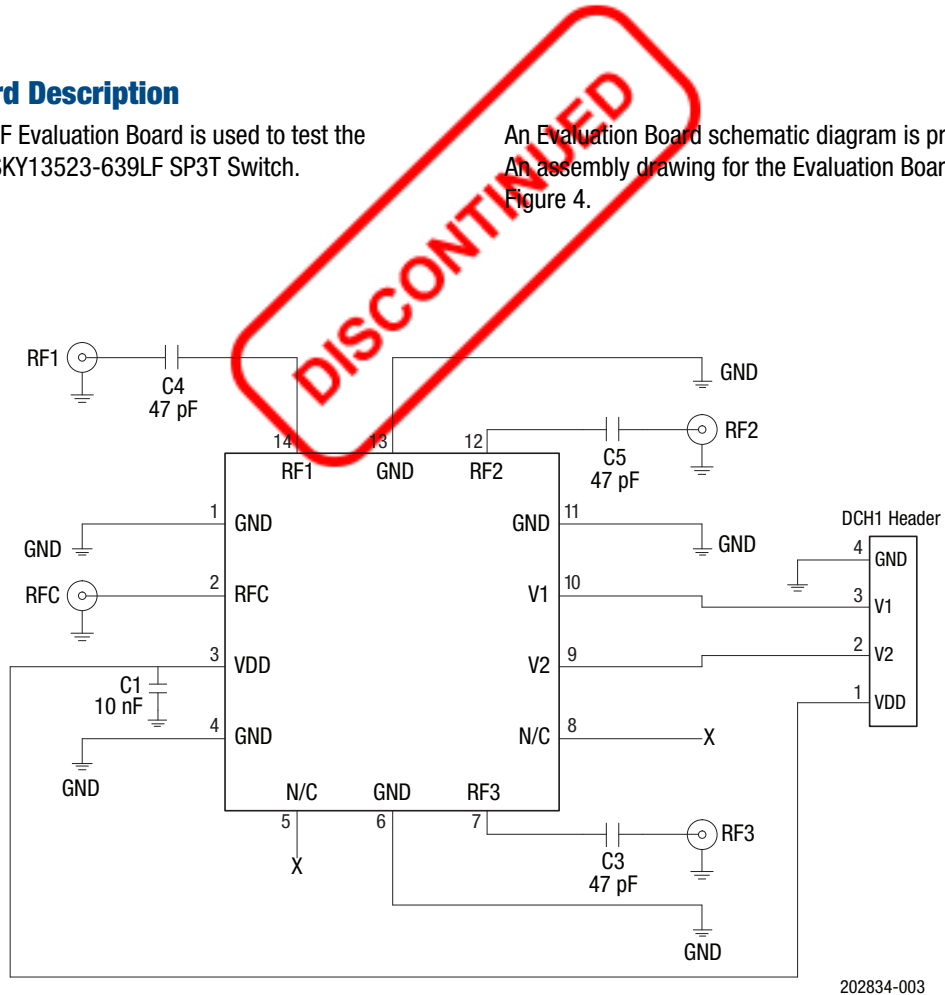


Figure 3. SKY13523-639LF Evaluation Board Schematic

202834-003

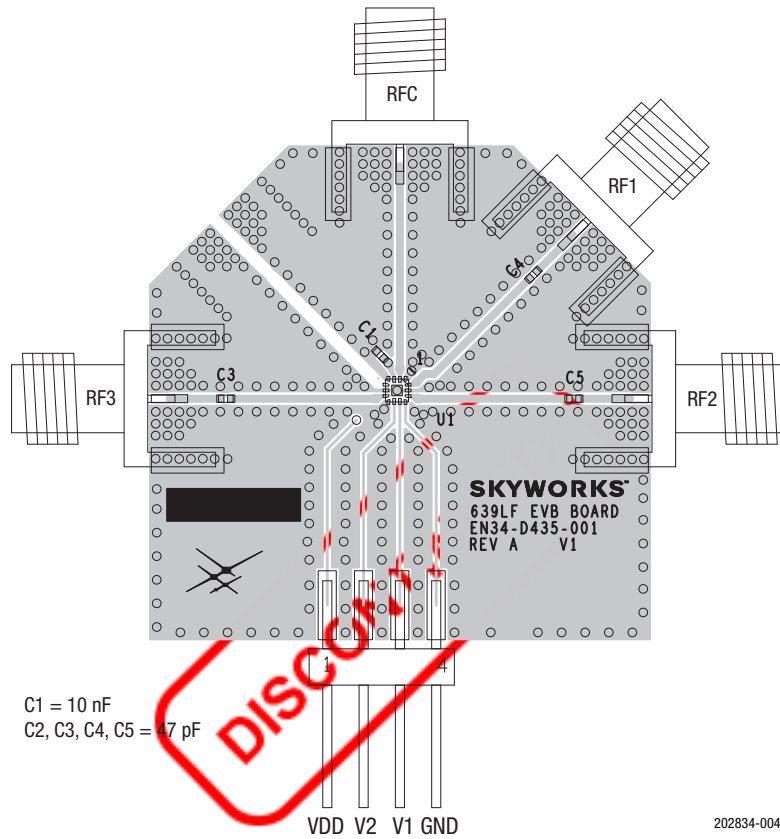


Figure 4. SKY13523-639LF Evaluation Board Assembly Diagram

Package Dimensions

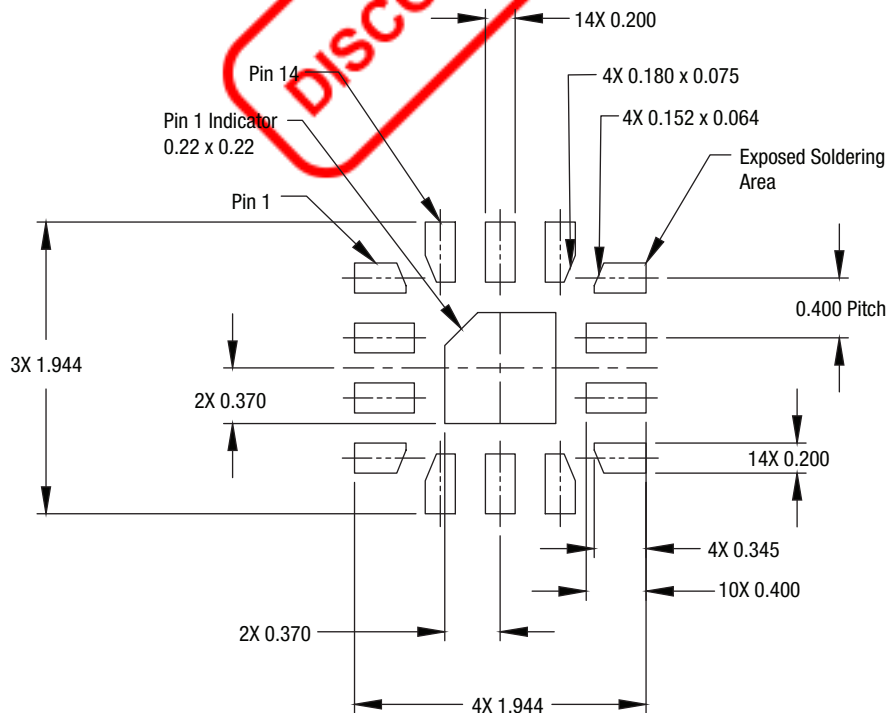
The PCB layout footprint for the SKY13523-639LF is provided in Figure 5. Typical part markings are shown in Figure 6. Package dimensions are shown in Figure 7, and tape and reel dimensions are provided in Figure 8.

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 SKY13523-639LF 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.



All dimensions are in millimeters

202834-005

Figure 5. SKY13523-639LF PCB Layout Footprint (Top View)

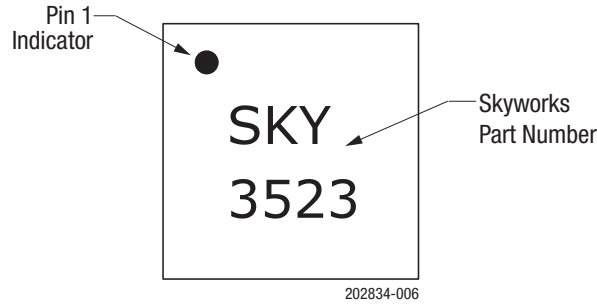
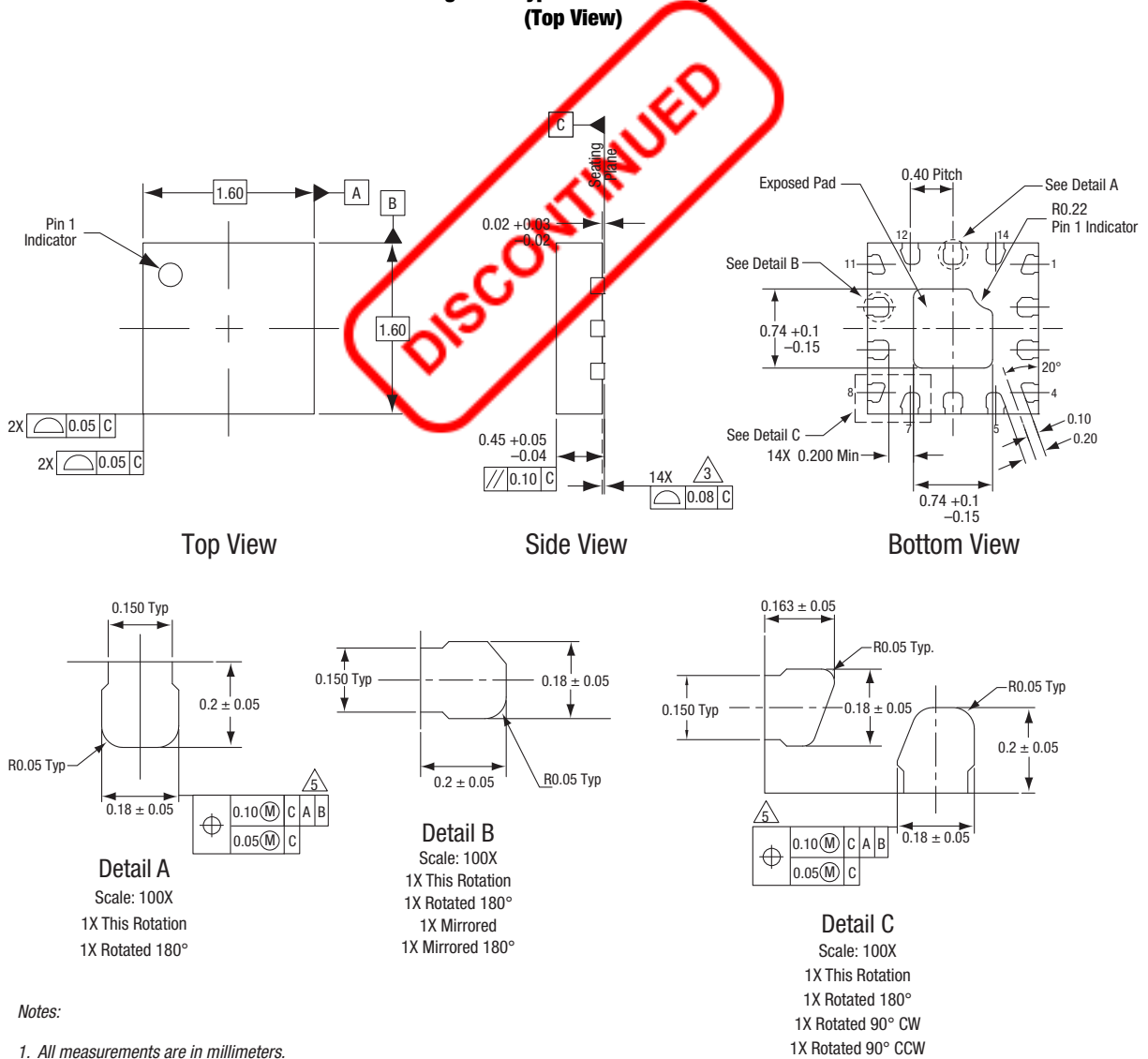


Figure 6. Typical Part Markings (Top View)



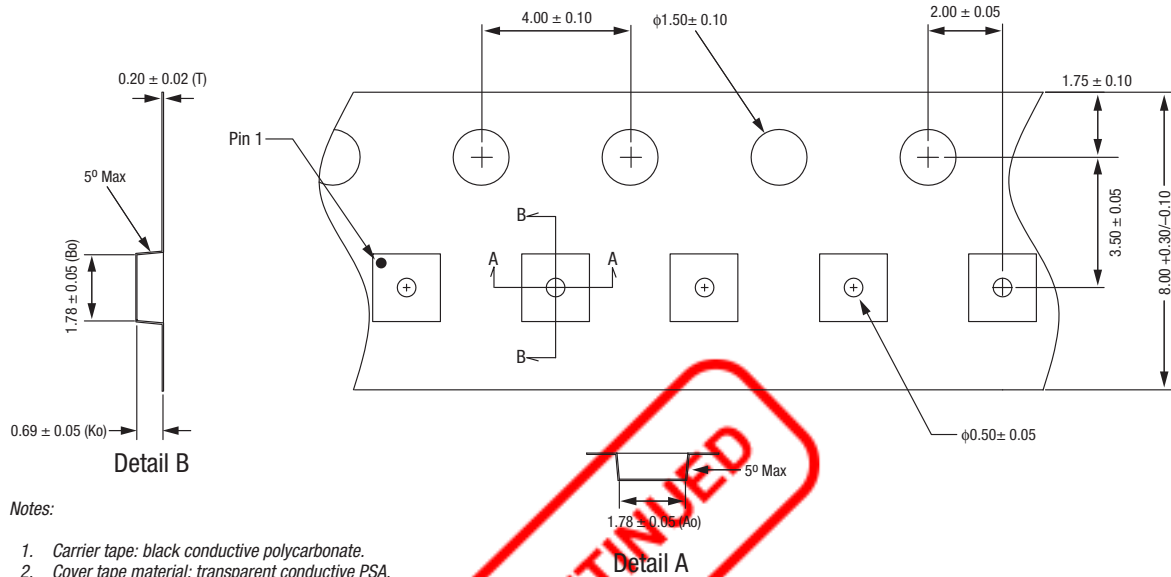
Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the terminals and all other bottom surface metallization.
4. Plating requirement per source control drawing (SCD) 2504.
5. Dimension applies to metallized terminal. If the terminal has a radius on its end, the width dimension should not be measured in that radius area.

202834-007

Figure 7. SKY13523-639LF Package Dimensions

DATA SHEET • SKY13523-639LF: HIGH-ISOLATION SP3T SWITCH



Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape material: transparent conductive PSA.
3. Cover tape size: 5.4 mm width.
4. All measurements are in millimeters.
5. ESD surface resistivity is $\leq 1 \times 10^8$ Ohms/square per IEC, JEDEC tape and reel specification.

202834-008

Figure 8. SKY13523-639LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13523-639LF: 0.7 to 3.0 GHz High Isolation SP3T Switch	SKY13523-639LF	SKY13523-639LF-EVB



Copyright © 2013, 2015, 2017, 2019 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, are incorporated by reference.