

DATA SHEET

SKY13353-337LF: 0.5 – 3.0 GHz DPDT Diversity Switch

Applications

- 802.11 a/n diversity WLANs

Features

- Broadband operation: 0.5 to 3.0 GHz
- Positive voltage operation: +1.8 to +5 V
- Low insertion loss: 0.7 dB typical @ 2.5 GHz
- High isolation: 22 dB typical @ 2.4 GHz
- IP1dB: +32 dBm typical @ +3 V
- Small, QFN (12-pin, 3 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.

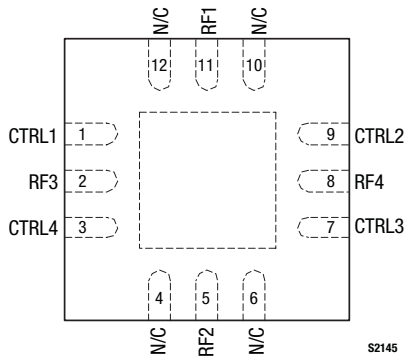


Figure 2. SKY13353-337LF Pinout – 12-Pin QFN (Top View)

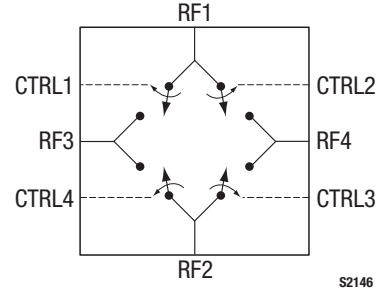


Figure 1. SKY13353-337LF Block Diagram

Description

The SKY13353-337LF is a GaAs pHEMT Double-Pole, Double-Throw (DPDT) switch designed for 0.5 to 3.0 GHz diversity WLAN applications that use two antennas for both transmit and receive paths.

The device provides high linearity, low insertion loss, and high isolation. Switching is controlled by four control voltage inputs (CTRL1, CTRL2, CTRL3, and CTRL4). Depending on the logic voltage level applied to the control pins, the four RF ports (RF1, RF2, RF3, and RF4) are connected together using a low insertion loss path, while maintaining a high isolation path to the alternate ports. Series DC blocking capacitors are required on all RF ports for proper operation.

The SKY13353-337LF is provided in a 3 x 3 mm, 12-pin 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.

Table 1. SKY13353-337LF Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	CTRL1	DC control voltage 1	7	CTRL3	DC control voltage 3
2	RF3	RF port 3. DC blocking capacitors required.	8	RF4	RF port 4. DC blocking capacitors required.
3	CTRL4	DC control voltage 4	9	CTRL2	DC control voltage 2
4	N/C	No connection required. May be connected to ground with no change in performance.	10	N/C	No connection required. May be connected to ground with no change in performance.
5	RF2	RF port 2. DC blocking capacitors required.	11	RF1	RF port 1. DC blocking capacitors required.
6	N/C	No connection required. May be connected to ground with no change in performance.	12	N/C	No connection required. May be connected to ground with no change in performance.

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

Table 2. SKY13353-337LF Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Control voltage	CTRL1, CTRL2, CTRL3, CTRL4		+6	V
RF input power	P _{IN}		+34	dBm
Operating temperature	T _{OP}	-40	+85	°C
Storage temperature	T _{STG}	-40	+125	°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 SKY13353-337LF are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the SKY13353-337LF is determined by the logic provided in Table 4.

Typical performance characteristics are illustrated in Figures 3, 4, and 5.

Table 3. SKY13353-337LF Electrical Specifications (Note 1)

(CTRL1 = CTRL2 = CTRL3 = CTRL4 = 3/0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications						
Insertion loss	IL	0.5 to 1.0 GHz		0.5	1.2	dB
		1.0 to 2.0 GHz		0.6	1.2	dB
		2.0 to 2.5 GHz		0.7	1.2	dB
		2.5 to 3.0 GHz		0.8	1.2	dB
Isolation	Iso	0.5 to 1.0 GHz	17	28		dB
		1.0 to 2.0 GHz	17	21		dB
		2.0 to 2.5 GHz	17	19		dB
		2.5 to 3.0 GHz	17	18		dB
Return loss	IS11I	0.5 GHz to 3.0 GHz		20		dB
1 dB Input Compression Point	IP1dB	@ 2.4 GHz				
		CTRL1/2/3/4 = 2.3 V CTRL1/2/3/4 = 5.0 V		+32 +36		dBm dBm
3 rd Order Input Intercept Point	IIP3	@ 2.45 GHz, Δf = 5 MHz, P _{IN} = +5 dBm/tone				
		CTRL1/2/3/4 = 2.3 V CTRL1/2/3/4 = 3.0 V		+52 +52		dBm dBm
Second harmonic	2fo	@ 2.4 GHz, P _{IN} = +20 dBm, CTRL1/2/3/4 = 2.5 V		+70		dBc
Third harmonic	3fo	@ 2.4 GHz, P _{IN} = +20 dBm, CTRL1/2/3/4 = 2.5 V		+85		dBc
Switching speed		50% control voltage to 90% RF		15		ns
		50% control voltage to 10% RF		35		ns
DC Specifications						
Control voltage: High Low	V _{HIGH}		1.8	3.0	5.0	V
	V _{LOW}		-0.2	0	+0.2	V
Control current	I _{CC}			5	50	μA

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

Table 4. SKY13353-337LF Truth Table

Insertion Loss State	CTRL1	CTRL2	CTRL3	CTRL4
RF1 to RF3	1	0	0	0
RF1 to RF4	0	1	0	0
RF2 to RF4	0	0	1	0
RF2 to RF3	0	0	0	1
RF1 to RF3 and RF2 to RF4	1	0	1	0
RF1 to RF4 and RF2 to RF3	0	1	0	1

Note: "1" = +1.8 to +5.0 V
 "0" = -0.2 to +0.2 V
 Any other state than described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Typical Performance Characteristics

(CTRL1 = CTRL2 = CTRL3 = CTRL4 = 3/0 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

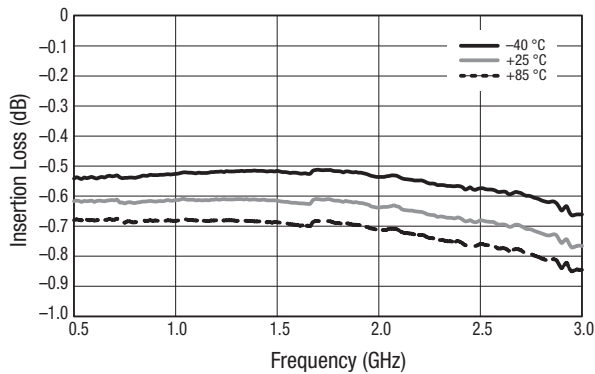


Figure 3. Insertion Loss vs Frequency Over Temperature

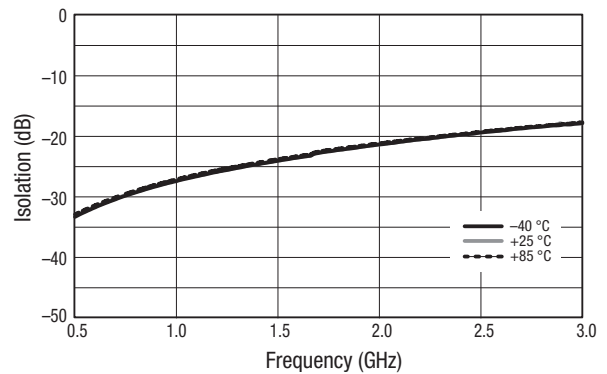


Figure 4. Isolation vs Frequency Over Temperature

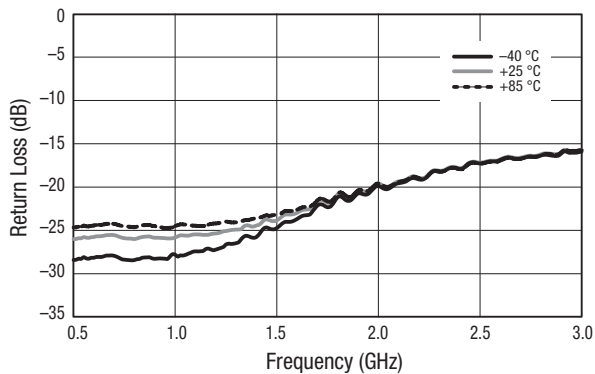


Figure 5. Return Loss vs Frequency Over Temperature

Evaluation Board Description

The SKY13353-337LF Evaluation Board is used to test the performance of the SKY13353-337LF DPDT switch. An Evaluation Board schematic diagram is shown in Figure 6. An assembly drawing for the Evaluation Board is shown in Figure 7.

Package Dimensions

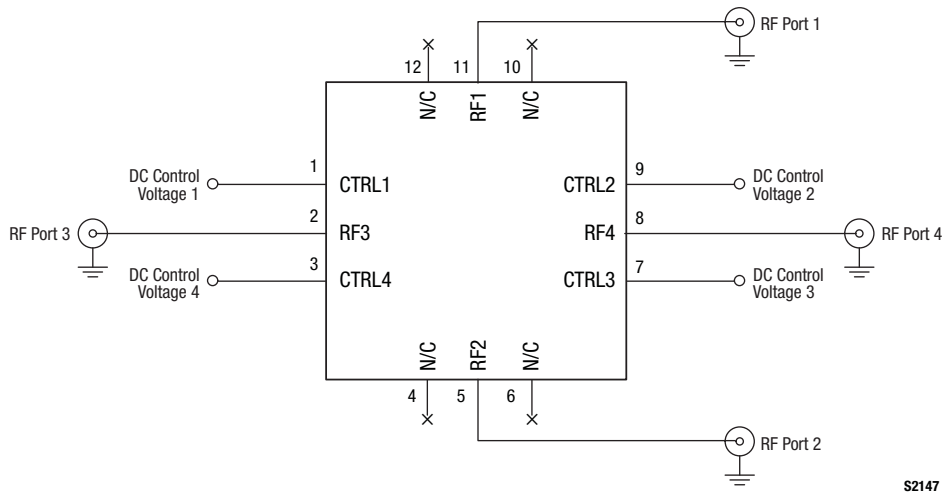
The PCB layout footprint for the SKY13353-337LF is shown in Figure 8. Typical case markings are noted in Figure 9. Package dimensions for the 12-pin QFN are shown in Figure 10, and tape and reel dimensions are provided in Figure 11.

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.

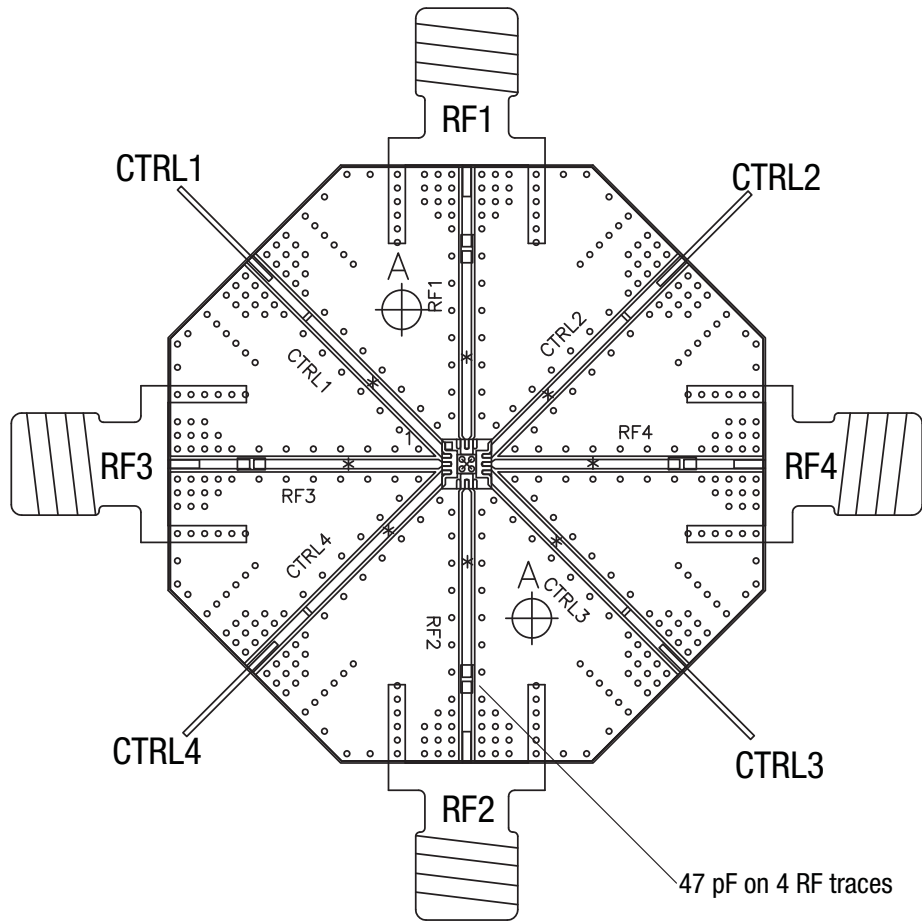
The SKY13353-337LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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.



S2147

Figure 6. SKY13353-337LF Evaluation Board Schematic Diagram



S2154

Figure 7. SKY13353-337LF Evaluation Board Assembly Diagram

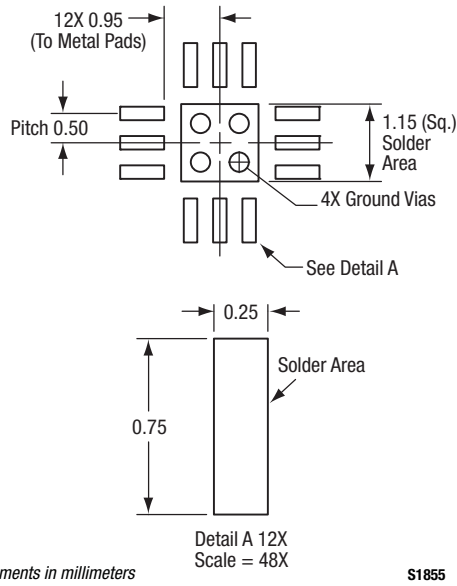
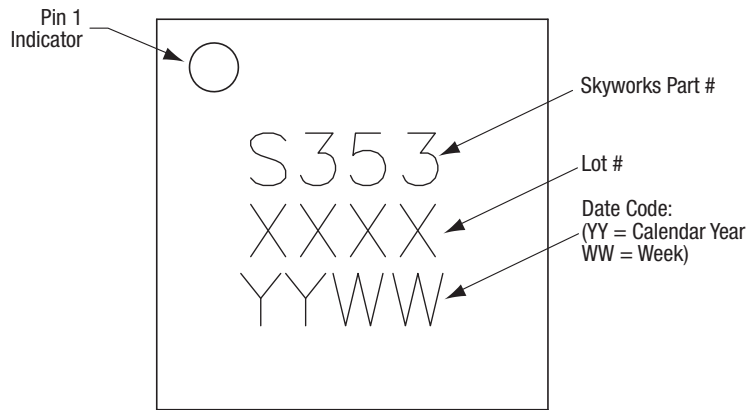
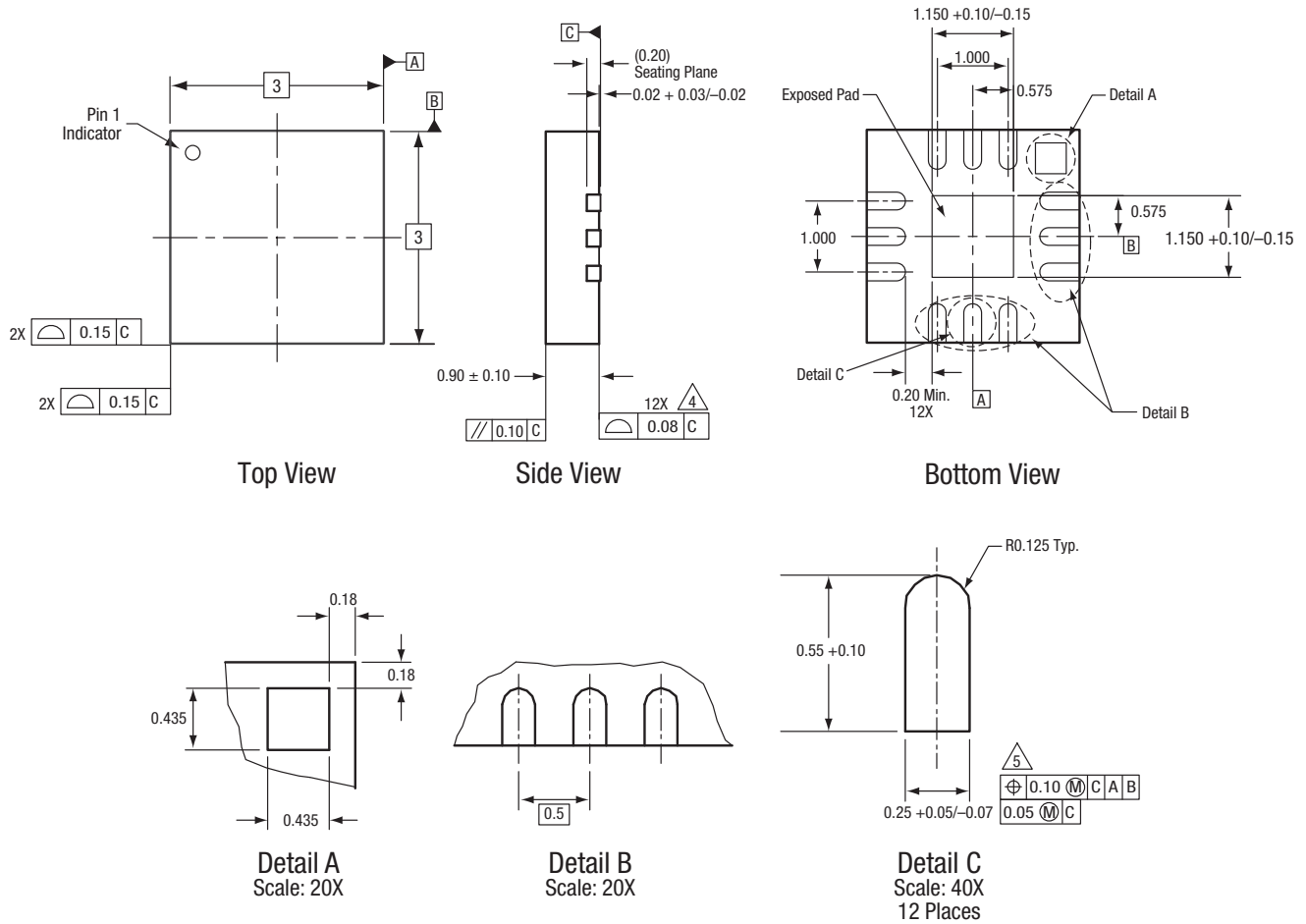


Figure 8. SKY13353-337LF PCB Layout Footprint



**Figure 9. Typical Part Markings
(Top View)**



All measurements are in millimeters.
 Dimensioning and tolerancing according to ASME Y14.5M-1994.
 Unilateral coplanarity applies to the exposed heat sink slug as well as the terminals.
 Plating requirement per source control drawing (SCD) 2504.
 Dimension applies to metallized terminal and is measured between 0.15 and 0.30 mm from the terminal tip. Do not measure at radius area.

S1866

Figure 10. SKY13353-337LF 12-Pin QFN Package Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Numbers
SKY13353-337LF 0.5-3.0 GHz DPDT Diversity Switch	SKY13353-337LF	SKY13353-337LF-EVB

Copyright © 2010 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, the Skyworks symbol, and "Breakthrough Simplicity" 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.