

**DATA SHEET**

# AS225-313LF: PHEMT GaAs IC 1 W Low Loss 0.1 to 6 GHz SPDT Switch

## Applications

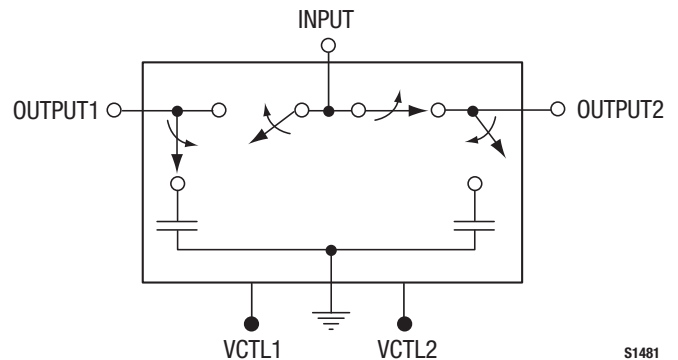
- WLAN 802.11a/b/g

## Features

- Positive low voltage control (0/3 V)
- Low insertion loss (0.6 dB, 0.1 to 6 GHz)
- High linearity (IIP3 = 53 dBm @ 3 V)
- Miniature QFN-6 pin plastic package (2 mm x 3 mm)
- PHEMT process
- MSL-1 @ 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. AS225-313LF Functional Block Diagram**

## Description

The AS225-313LF is a 0.1 to 6 GHz PHEMT GaAs IC single-pole, double-throw (SPDT) antenna switch. Designed for WLAN applications, this device is capable of switching 1 W microwave signals with 3 V control voltage while maintaining high-linearity performance. The switch covers the entire 802.11a, b, and g frequency ranges. The low-loss, high-isolation, high-linearity and low-cost features make this switch ideal for Wireless LAN systems.

Figure 1 shows the functional block diagram of the AS225-313LF.

## Electrical and Mechanical Specifications

The absolute maximum ratings for the AS225-313LF are shown in Table 1. Electrical specifications are provided in Tables 2 and 3.

The state of the AS225-313LF is determined by the logic provided in Table 4.

Typical performance characteristics are shown in Figures 2, 3, and 4.

**Table 1. AS225-313LF Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Minimum	Maximum	Units
Input power @ 0/3 V			+32	dBm
Input power @ 0/5 V			+35	dBm
Operating voltage			8	V
Operating temperature	T <sub>A</sub>	−40	+85	°C
Storage temperature	T <sub>STG</sub>	−65	+150	°C

**Note 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.

**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 2. AS225-313LF Electrical Specifications (Note 1)**

(Z<sub>0</sub> = 50 Ω, V<sub>CTRL</sub> = 0/3 V, C<sub>BLOCK</sub> = 15 pF, T<sub>A</sub> = 25 °C, Unless Otherwise Noted)

Parameter	Test Condition	Frequency	Minimum	Typical	Maximum	Units
Insertion loss	J1–J2, J1–J3	0.10 to 6.00 GHz		0.60	0.75	dB
		2.40 to 2.50 GHz		0.50	0.65	dB
		5.15 to 5.85 GHz		0.60	0.70	dB
Isolation	J1–J2, J1–J3	0.10 to 6.00 GHz	18	20		dB
		2.40 to 2.50 GHz	18	20		dB
		5.15 to 5.85 GHz	19	21		dB
Return loss	J1–J2, J1–J3	0.10 to 6.00 GHz	18	20		dB
		2.40 to 2.50 GHz	23	25		dB
		5.15 to 5.85 GHz	21	23		dB

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

**Table 3. AS225-313LF Electrical Characteristics (Note 1)**  
**( $Z_0 = 50\ \Omega$ ,  $V_{CTRL} = 0/3\ V$ ,  $C_{BLOCK} = 15\ pF$ ,  $T_A = 25\ ^\circ C$ , Unless Otherwise Noted)**

Parameter	Condition	Frequency	Minimum	Typical	Maximum	Units
Switching characteristics:						
Rise, fall	10/90% or 90/10% RF			20		ns
On, off	50% CTL to 90/10% RF			35		ns
P1dB	@ 3 V @ 5 V	5200 MHz 5200 MHz		+30 +34		dBm dBm
2 <sup>nd</sup> harmonic	$P_{IN} = +22\ dBm$ , $V_C = 3\ V$ $V_C = 5\ V$	2450 MHz 2450 MHz		+70 +75		dBc dBc
3 <sup>rd</sup> harmonic	$P_{IN} = +22\ dBm$ , $V_C = 3\ V$ $V_C = 5\ V$	2450 MHz 2450 MHz		+68 +70		dBc dBc
Input IP3	Two-tone 15 dBm, 5 MHz spacing: $V_{CTL} = 0/3\ V$ $V_{CTL} = 0/5\ V$	5200 MHz 5200 MHz		+53 +55		dBm dBm
Control voltage	$V_C\ HIGH$ $V_C\ LOW$		2.5	3.00 -0.25	5.00 0.25	V V
Gate leakage	$V_C = 3\ V$ $V_C = 5\ V$			10 15	100 200	$\mu A$ $\mu A$

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

**Table 4. AS225-313LF Truth Table (Notes 1 and 2)**

V1	V2	J1–J2	J1–J3
0	$V_{HIGH}$	Isolation	Insertion loss
$V_{HIGH}$	0	Insertion loss	Isolation

**Note 1:** All other conditions not recommended.

**Note 2:**  $V_{HIGH} = 2.5$  to  $5\ V$ .

## Typical Performance Characteristics

( $Z_0 = 50\ \Omega$ ,  $V_{CTRL} = 0/3\ V$ ,  $C_{BLOCK} = 15\ pF$ , Unless Otherwise Noted)

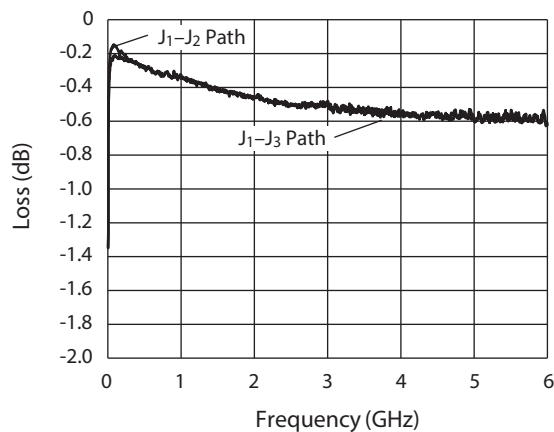


Figure 2. Insertion Loss vs Frequency

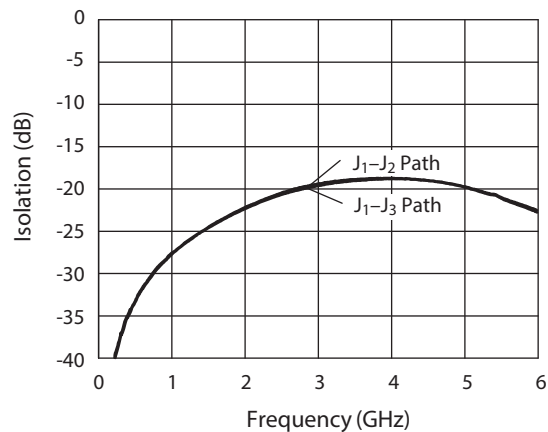


Figure 3. Isolation vs Frequency

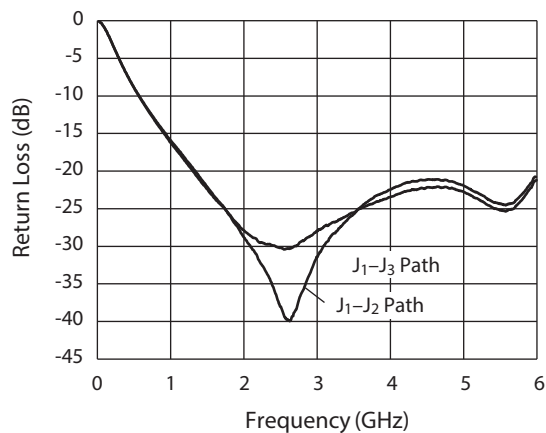


Figure 4. Return Loss vs Frequency

## Evaluation Board and Package Dimensions

The AS225-313LF Evaluation Board is used to test the performance of the AS225-313LF SPDT switch. An assembly drawing for the Evaluation Board is shown in Figure 6.

The PCB layout footprint for the AS225-313LF is shown in Figure 7. The typical part marking is shown in Figure 8. Package dimensions for the 6-pin QFN are shown in Figure 9. The tape and reel dimensions are provided in Figure 10.

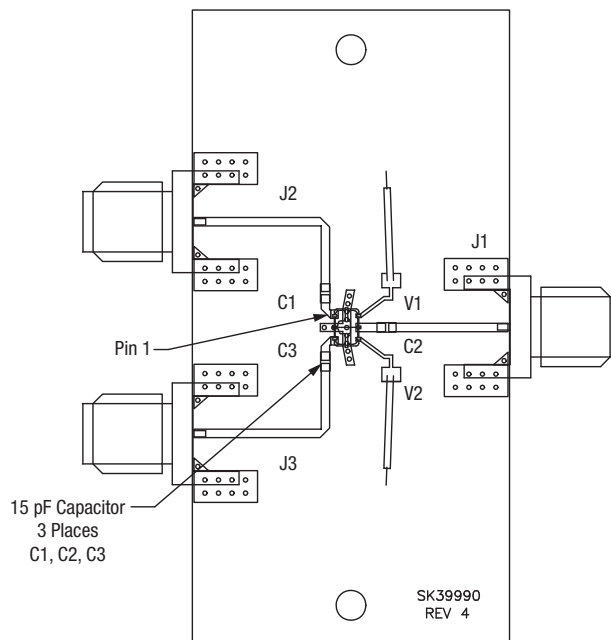
## Package and Handling Information

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.

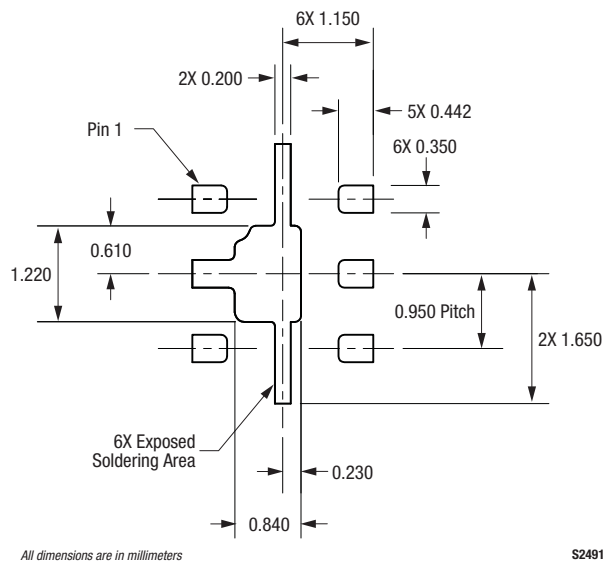
The AS225-313LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C for 5 seconds. They can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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.

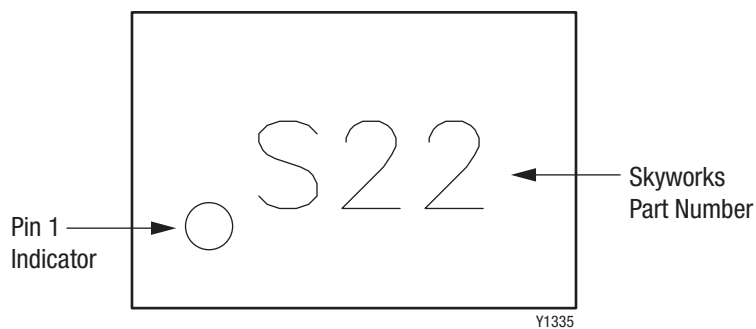
For additional information, refer to the *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation* Application Note.



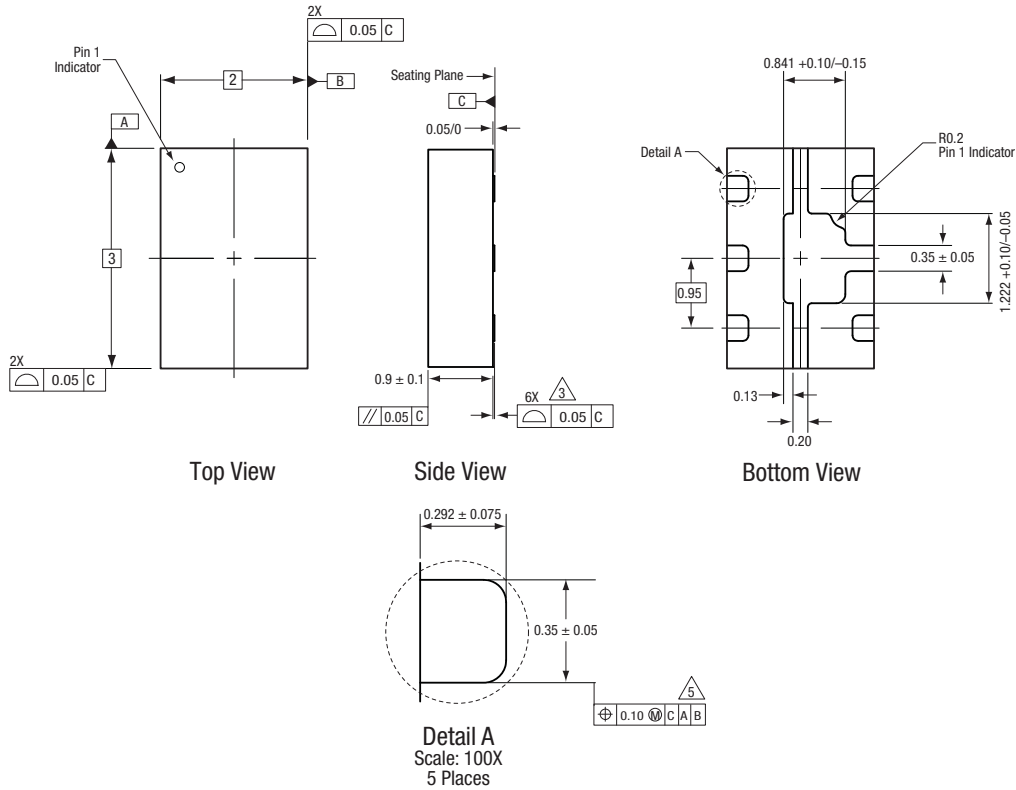
**Figure 6. AS225-313LF Evaluation Board Assembly Drawing**



**Figure 7. AS225-313LF PCB Layout Footprint (Top View)**



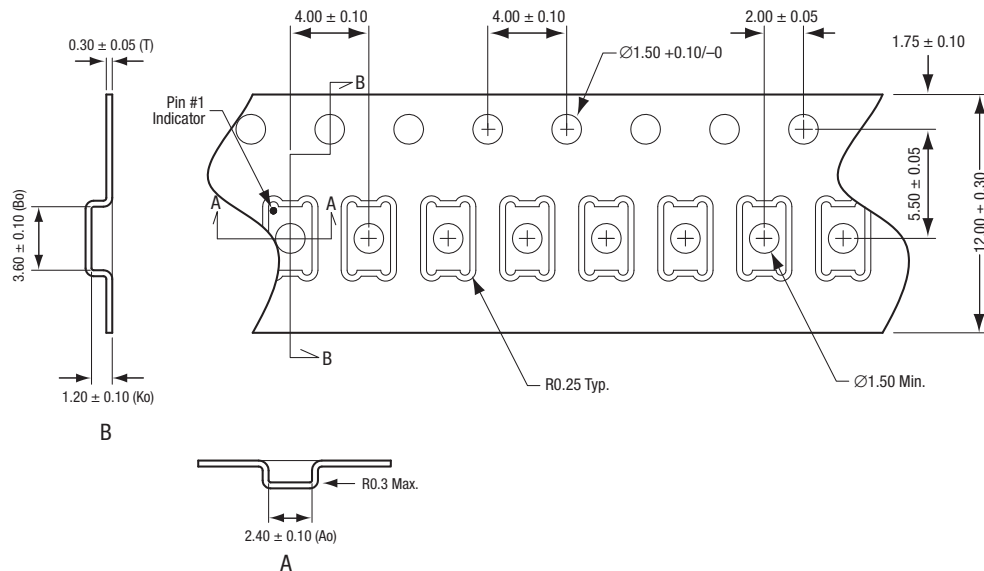
**Figure 8. AS225-313LF Typical Part Marking (Top View)**



*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.*

S2492

### Figure 9. AS225-313LF Package Dimensions



Notes:

1. Carrier tape: black conductive polystyrene, non-bakeable material.
2. Cover tape material: transparent conductive HSA with 9.20 mm width.
3. ESD-surface resistivity is  $\geq 1 \times 10^5 \sim \leq 1 \times 10^{10}$  Ohms/square per EIA, JEDEC TNR Specification.
4. All measurements are in millimeters.

S2653

### Figure 10. AS225-313LF Tape and Reel Dimensions

Copyright © 2002-2007, 2014 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.