

## DATA SHEET

# AS186-302LF: GaAs IC High-Isolation Positive Control SPDT Nonreflective Switch LF to 4 GHz

## Applications

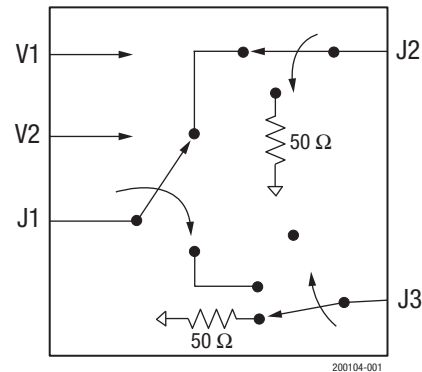
- GSM, PCS, WCDMA, 2.4 GHz ISM and 3.5 GHz wireless local loop

## Features

- Positive voltage control (0/3 to 0/5 V)
- High isolation (55 dB @ 0.9 GHz and 1.9 GHz)
- Three-switch solution for base station synthesizer switch
- Nonreflective
- Operation to 6 GHz
- Miniature lead (Pb)-free and RoHS-compliant MSOP-8 exposed pad package (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.

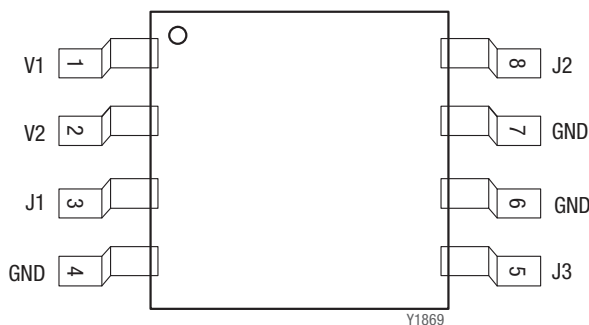


**Figure 1. AS186-302LF Functional Block Diagram**

## Description

The AS186-302LF is a GaAs FET IC SPDT nonreflective switch, packaged in an MSOP-8 exposed pad plastic package for low-cost, high-isolation commercial applications.

A functional block diagram for the AS186-302LF is shown in Figure 1. This device is available in an ultra-miniature SOT-6 package. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.



$C_{BL} = 47 \text{ pF}$  for operation > 500 MHz

**Figure 1. AS186-302LF Pinout Diagram**

**Table 1. AS186-302LF Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	V1	DC control voltage	5	J3	RF output
2	V2	DC control voltage	6	GND	Ground
3	J1	RF output	7	GND	Ground
4	GND	Ground	8	J2	RF output

## Electrical and Mechanical Specifications

The absolute maximum ratings of the AS186-302LF are provided in Table 2. Electrical specifications are provided in Tables 3 through 6. The truth table is shown in Table 7.

Typical performance characteristics of the AS186-302LF are shown in Figures 2 through 8.

**Table 2. Absolute Maximum Ratings<sup>1</sup>**

Parameter	Symbol	Minimum	Typical	Maximum	Units
RF input power ( $V_{CTL} = 0/8\text{ V}$ ) f > 500 MHz f < 500 MHz	PIN		100	1	W mW
Control voltage	VCTL	-0.2		8	V
Operating temperature	TOP	-40		+85	°C
Storage temperature	TSTG	-65		+150	°C
Electrostatic discharge: Human Body Model (HBM), Class 1A	ESD			500	V

<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. Electrical Specifications<sup>1</sup>****(-40 °C ≤ TOP ≤ +85 °C, VCTL = 0/5 V, Zo = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Insertion loss	IL	LF to 2 GHz		0.8	1.05	dB
		LF to 3 GHz		0.9	1.15	dB
		LF to 4 GHz		1.0	1.25	dB
Isolation (Note 2)	ISO	LF to 2 GHz	50	55		dB
		LF to 3 GHz	45	50		dB
		LF to 4 GHz	35	40		dB
VSWR (On state)	VSWR	LF to 2 GHz		1.3:1	1.5:1	
		LF to 4 GHz		1.3:1	1.6:1	
VSWR (Off state)	VSWR	0.5 to 4 GHz		1.35:1	1.7:1	

<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.

<sup>2</sup> Backside of exposed pad must be connected to RF ground to obtain specified isolation.

**Table 4. Electrical Specifications: Operating Characteristics****(-40 °C < TOP < +85 °C, VCTL = 0/5 V, Zo = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Control voltages						
Low @ 20 μA max	VCTL_L		0		0.2	V
High	VCTL_H		3 (@ 100 μA)		5 (@ 200 μA)	V
Input power for 1 dB compression	IP1dB	0.9 to 4 GHz: VCTL = 0/3 V VCTL = 0/5 V	23 27	25 30		dBm dBm
Input third order intermodulation intercept point	IIP3	0.9 to 4 GHz, for two-tone input power 8 dBm: VCTL = 0/3 V VCTL = 0/5 V	27 42	38 46		dBm dBm
Switching characteristics:						
Rise, fall time	tr, tf	10/90% or 90/10% RF		30		ns
On, off time	ton, toff	50% CTL to 90/10% RF		50		ns
Video feedthru	VFT	tr = 3 ns, BW = 500 MHz		25		mV
Thermal resistance	ΘJA			25		°C/W

**Table 5. Compression Point vs Voltage and Temperature @ 900 MHz**

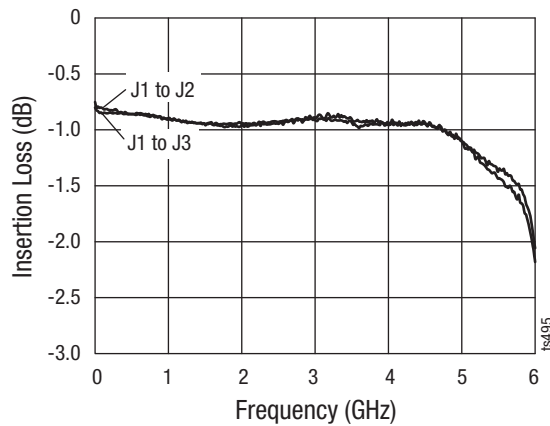
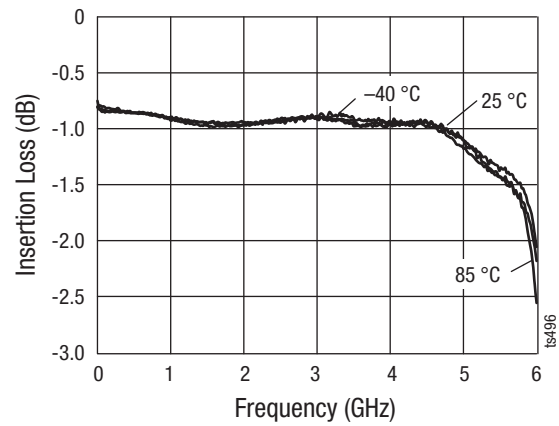
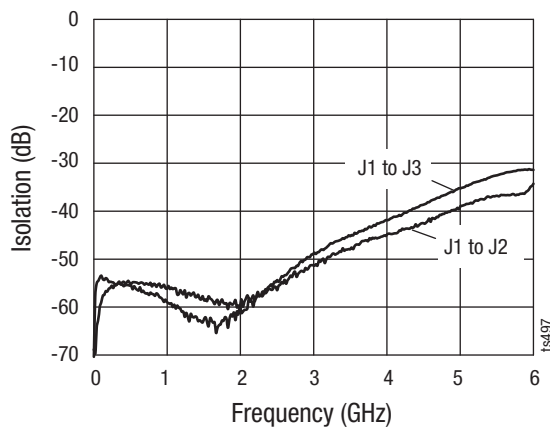
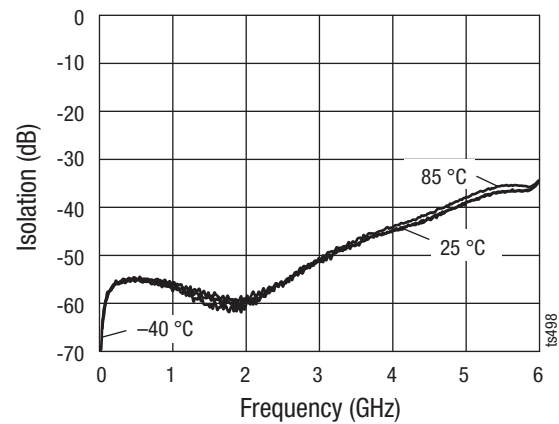
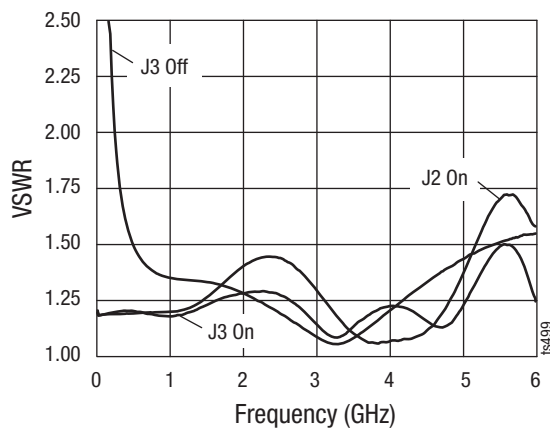
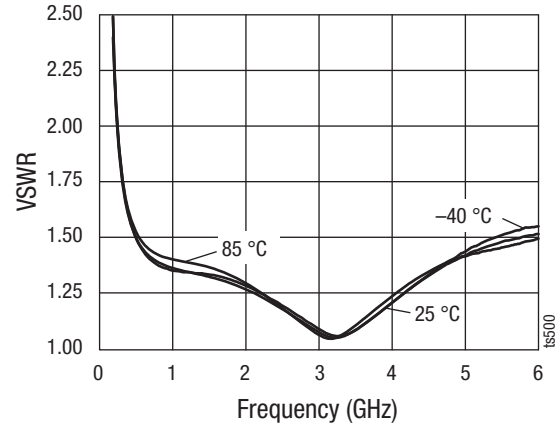
Control voltage (V)	Temperature (°C)	Input Power @ 1 dB Compression (dBm)	Input Power @ 0.1 dB Compression (dBm)
3	-40	20.5	16.5
3	+25	20	15.3
3	+85	19	14
5	-40	28.5	23
5	+25	28	23
5	+85	27.5	23

**Table 6. IP3 vs Voltage and Temperature @ Tone Frequency: 900 and 901 MHz**

Control voltage (V)	Temperature (°C)	IP3 @ 8 dBm Each Tone (dBm)
3	–40	44
3	+25	38
3	+85	29.5
5	–40	47.5
5	+25	46.5
5	+85	45.5

**Table 7. Truth Table**

V1	V2	J1 to J2	J1 to J3
0	V <sub>HIGH</sub>	Isolation	Insertion loss
V <sub>HIGH</sub>	0	Insertion loss	Isolation

**Typical Performance Characteristics****( $-40\text{ }^{\circ}\text{C} \leq T_{op} \leq +85\text{ }^{\circ}\text{C}$ ,  $V_{CTL} = 0/5\text{ V}$ ,  $Z_o = 50\text{ }\Omega$ , Unless Otherwise Noted)****Figure 2. Insertion Loss vs Frequency****Figure 3. Insertion Loss vs Frequency at  $-40, 25, 85\text{ }^{\circ}\text{C}$** **Figure 4. Isolation vs Frequency****Figure 5. Isolation vs Frequency at  $-40, 25, 85\text{ }^{\circ}\text{C}$** **Figure 6. VSWR vs Frequency****Figure 7. VSWR vs Frequency at  $-40, 25, 85\text{ }^{\circ}\text{C}$  (J3 Off)**

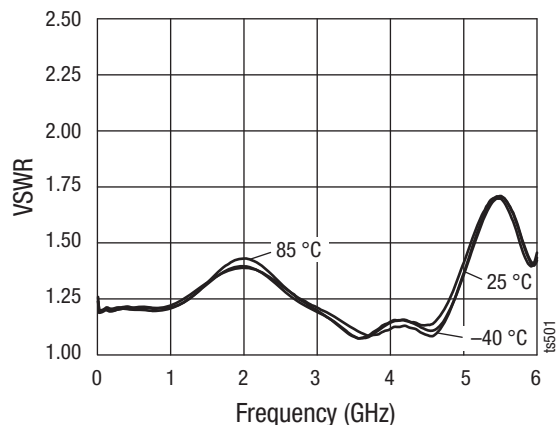


Figure 8. Input VSWR vs Frequency at -40, 25, 85 °C

## Package Information

The MSOP-8 exposed pad plastic package is shown in Figure 9.

For the recommended solder reflow profiles, refer to the “Recommended Solder Reflow Profile” Application Note.

For tape and reel information, refer to the “Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation” Application Note.

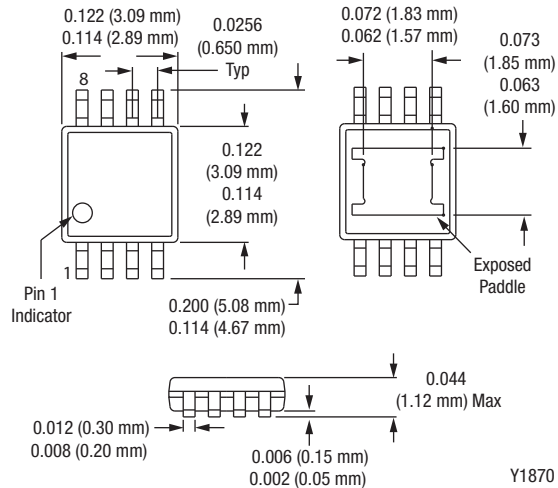


Figure 9. MSOP-8 Exposed Pad Package Dimension Drawing

Copyright © 2002-2007, 2009-2015, 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.