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.

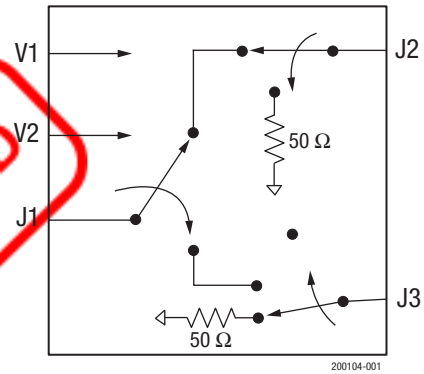
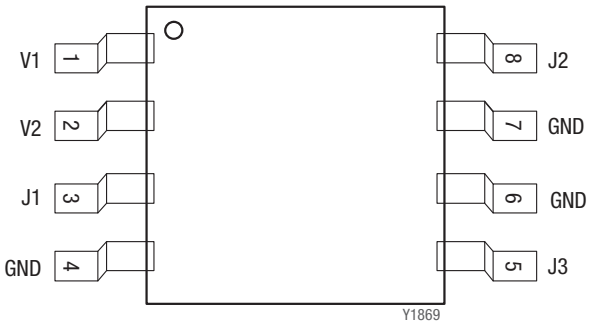



**Figure 1. AS186-302LF Functional Block Diagram**

## 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 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[1]**

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|
| RF input power ($V_{CTL}$ = 0/8 V)<br>f > 500 MHz<br>f < 500 MHz | $P_{IN}$ | | <br><br>100 | <br>1 | <br>W<br>mW |
| Control voltage | $V_{CTL}$ | –0.2 | | 8 | V |
| Operating temperature | $T_{OP}$ | –40 | | +85 | °C |
| Storage temperature | $T_{STG}$ | –65 | | +150 | °C |
| Electrostatic discharge:<br>Human Body Model (HBM), Class 1A | ESD | | | <br>500 | <br>V |

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. Electrical Specifications[1]**
**(–40 °C ≤ TOP ≤ +85 °C, VCTL = 0/5 V, Z0 = 50 Ω, Unless Otherwise Noted)**

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

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.

2 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, Z0 = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|
| Control voltages<br>Low @ 20 µA max<br>High | <br>VCTL_L<br>VCTL_H | | <br>0<br>3 (@ 100 µA) | | <br>0.2<br>5 (@ 200 µA) | <br>V<br>V |
| Input power for 1 dB compression | IP1dB | 0.9 to 4 GHz:<br>VCTL = 0/3 V<br>VCTL = 0/5 V | <br>23<br>27 | <br>25<br>30 | | <br>dBm<br>dBm |
| Input third order intermodulation intercept point | IIP3 | 0.9 to 4 GHz, for two-tone input power 8 dBm:<br>VCTL = 0/3 V<br>VCTL = 0/5 V | <br>27<br>42 | <br>38<br>46 | | <br>dBm<br>dBm |
| Switching characteristics:<br>Rise, fall time<br>On, off time<br>Video feedthru | <br>tR, tF<br>tON, tOFF<br>VFT | <br>10/90% or 90/10% RF<br>50% CTL to 90/10% RF<br>tR = 3 ns, BW = 500 MHz | | <br>30<br>50<br>25 | | <br>ns<br>ns<br>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 | $V_{HIGH}$ | Isolation | Insertion loss |
| $V_{HIGH}$ | 0 | Insertion loss | Isolation |

## Typical Performance Characteristics

**(–40 °C ≤ TOP ≤ +85 °C, VCTL = 0/5 V, Zo = 50 Ω, Unless Otherwise Noted)**

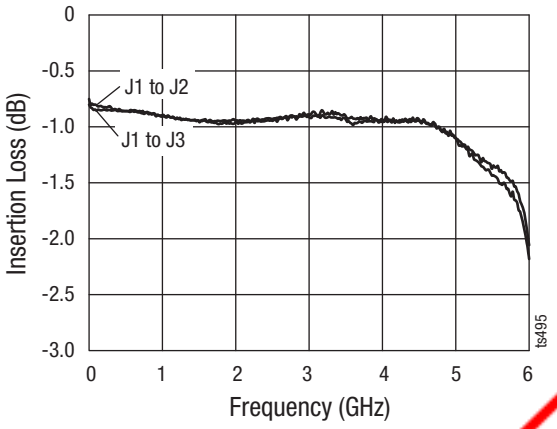



**Figure 2. Insertion Loss vs Frequency**

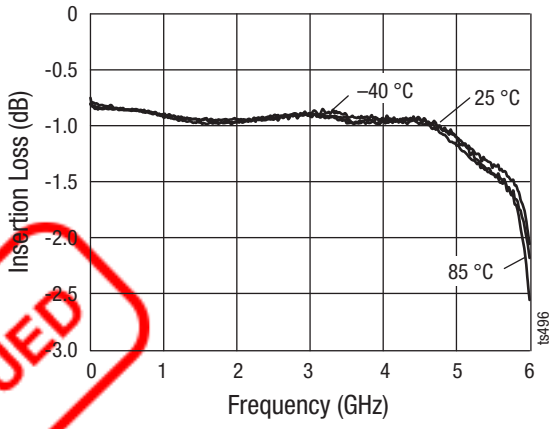



**Figure 3. Insertion Loss vs Frequency at –40, 25, 85 °C**



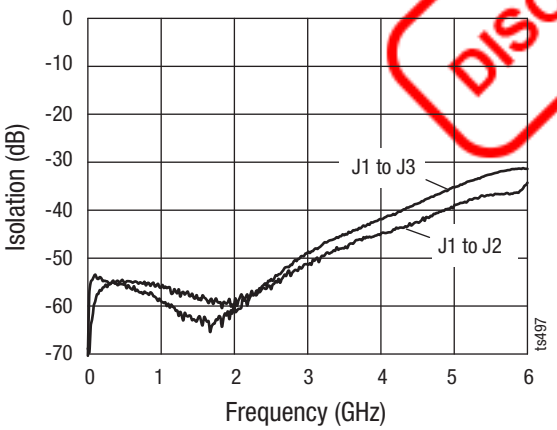



**Figure 4. Isolation vs Frequency**

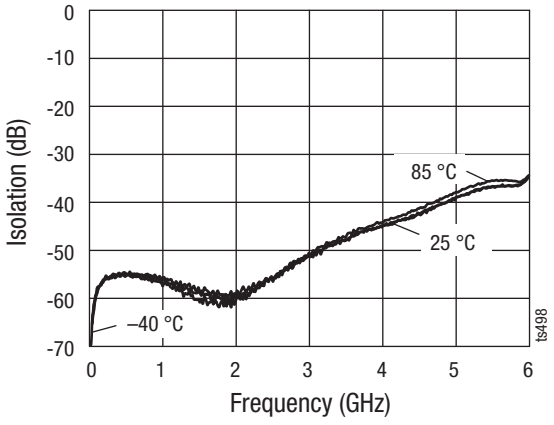



**Figure 5. Isolation vs Frequency at –40, 25, 85 °C**

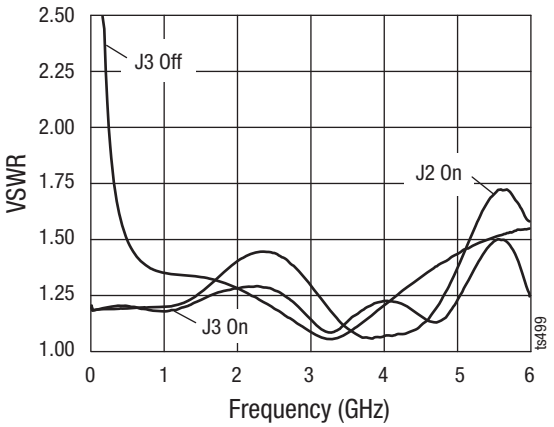



**Figure 6. VSWR vs Frequency**

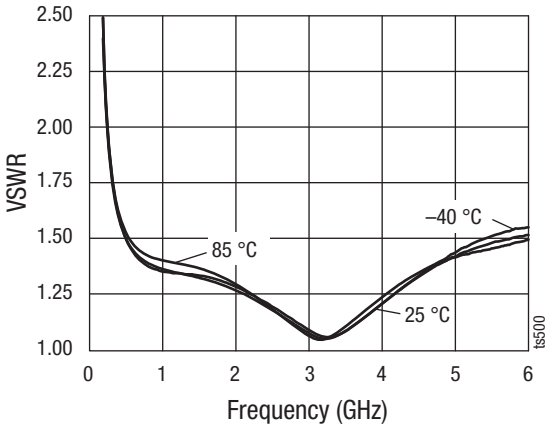



**Figure 7. VSWR vs Frequency at –40, 25, 85 °C (J3 Off)**

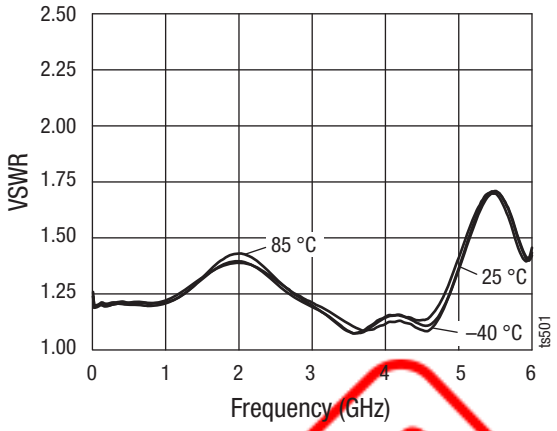



**Figure 8. Input VSWR vs Frequency at –40, 25, 85 °C**



## 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.

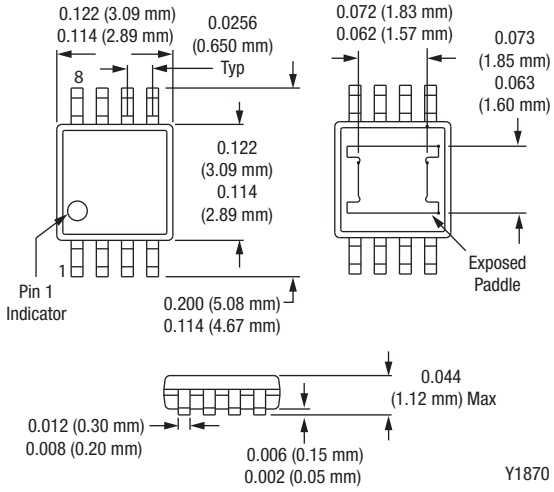



**Figure 9. MSOP-8 Exposed Pad Package Dimension Drawing**