

# Keysight U9397A/C FET Solid State Switch (SPDT)

# Notices

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### CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

### WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

## Environmental Conditions

The table below shows the general environmental requirements for this instrument.

Environmental condition	Requirement
Temperature	Operating condition: – –40 °C to +65 °C Storage condition: – –65 °C to +85 °C Cycling condition: – –65 °C to +150 °C, 10 cycles at 20 °C per minute, 20 minutes dwell time per MIL-STD-883F, Method 1010.8, Condition C (modified)
Humidity	Operating condition: – 50% to 95% RH at 40 °C, one 24 hour cycle, repeated five times Storage condition: – <95% RH at 40 °C, five days
Shock	Half sine, smoothed: – 1000 G at 0.5 ms, 3 shock pulses per orientation, 18 total per MIL-STD-883F, Method 2002.4, Condition B (modified)
Vibration	Broadband: – 50 to 2000 Hz, 7.0 G rms, 15 minutes, per MIL-STD-883F, Method 2026-1 (modified)
Altitude	Storage condition: – <15300 meters (50000 feet)
ESD immunity	Direct discharge: – 4 kV (to outer conductor) per IEC 61000-4-2 Air discharge: – 8 kV (to center conductor) per IEC 61000-4-2

# Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

## Product category

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

## Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- [www.keysight.com/find/mta](http://www.keysight.com/find/mta)  
(product-specific information and support, software and documentation updates)
- [www.keysight.com/find/assist](http://www.keysight.com/find/assist)  
(worldwide contact information for repair and service)

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# 1 General Information

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This chapter provides an overview of the Keysight U9397A/C FET solid state switches.

## Product Overview

The Keysight U9397A/C is GaAs FET Monolithic Microwave Integrated Circuit (MMIC) based solid state switches which provide superior performance in isolation, settling time, video leakage, and insertion loss across a broad operating frequency range.



**Figure 1-1** U9397A/C FET solid state switches

Table 1-1 shows the two models of FET solid state switches available.

**Table 1-1** List of FET solid state switches

Model	Frequency range	Connector type
U9397A	300 kHz to 8 GHz	SMA (f)
U9397C	300 kHz to 18 GHz	SMA (f)

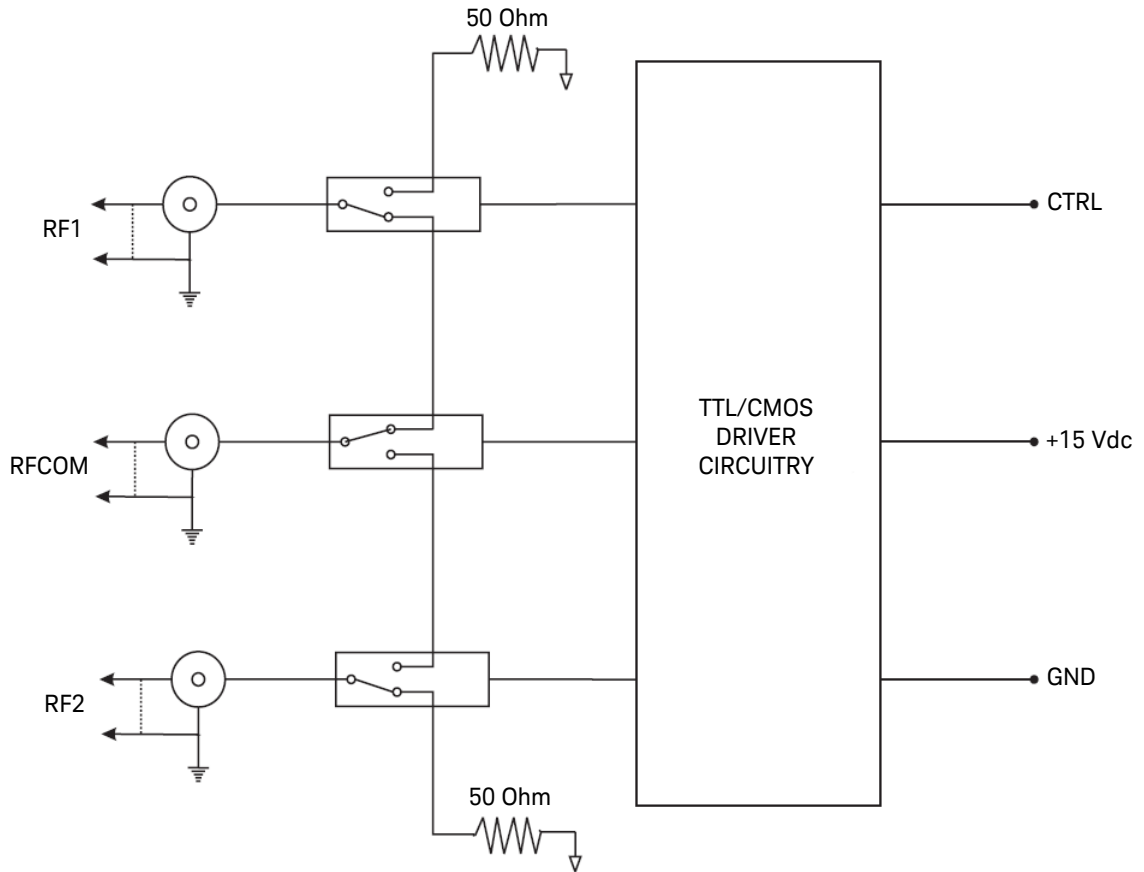
The U9397A/C is particularly suitable for measuring sensitive devices and components such as mixers and low noise amplifiers, where video leakage may cause damage or reliability issues. Typical settling time of 500  $\mu$ s makes these switches ideal for high-speed switching applications in instrumentation, communications, radar, and other test systems. High isolation minimizes crosstalk between measurements, ensuring accurate testing and improving yields.

## Features

- Prevent damage to sensitive devices with low video leakage <10 mVpp
- Minimize crosstalk with exceptionally high isolation 100 dB at 8 GHz.
- Maintain fast throughput with industry leading settling time for FET switches of 500  $\mu$ s
- Integrated TTL/CMOS driver eliminated the need for external drivers

## Circuit Logic

Keysight U9397A/C switches have a GaAs FET MMIC at each RF ports, and the integrated TTL/CMOS driver is configured in such a way that when either the RF1 or RF2 port is not selected to RFCOM, it will be terminated to 50 Ohm as shown in [Figure 1-2](#).



**Figure 1-2** Block diagram on the operation of U9397A/C FET solid state switches

**Table 1-2** Switch operation logic

CTRL logic	RFCOM to RF1	RFCOM to RF2
0	Low loss	Isolated
1	Isolated	Low loss

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# 2 Specifications

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This chapter provides the specifications of the U9397A/C FET solid state switches.

## Specifications

Specifications refer to the performance standards or limits against which the FET solid state switches are tested.

*Typical characteristics are included for additional information only and they are not specifications. These are denoted as “typical”, “nominal”, or “approximate” and are printed in italics.*

**Table 2-1** RF specifications for U9397A/C FET solid state switches

Specification	U9397A	U9397C
Frequency range	300 kHz to 8 GHz	300 kHz to 18 GHz
Insertion loss	<3.0 dB (300 kHz to 4 GHz) <3.5 dB (4 GHz to 8 GHz)	<5.0 dB (300 kHz to 8 GHz) <6.5 dB (8 GHz to 18 GHz)
Isolation	100 dB	90 dB
Return loss (ON and common port)	>15 dB	>10 dB
Return loss (OFF port)	>18 dB	>13 dB
Settling time	500 $\mu$ s (typical)	500 $\mu$ s (typical)
Switching speed rise/fall <sup>[a]</sup>	5/5 $\mu$ s typical	5/5 $\mu$ s typical
Video leakage	<10 mVpp typical	<10 mVpp typical
Characteristic impedance	50 $\Omega$ (nominal)	50 $\Omega$ (nominal)
Connectors	SMA (f)	SMA (f)

[a] Switching speed is based on 10% to 90% RF.

**Table 2-2** Absolute maximum rating<sup>[a]</sup> for U9397A/C FET solid state switches

	Min	Max	Unit
RF input power (average)			
- U9397A		+29	dBm
- U9397C		+27	dBm
DC voltage to RF port	-2.5	+2.5	V
Current sourcing at RF1 or RF2 <sup>[b]</sup>		60	mA
Vdc bias	+12	+24	V
CTRL input high voltage	+2.4	+5	V
CTRL input low voltage	0	+0.8	V

[a] Operation in excess of any one of these may result in permanent damage to the products.

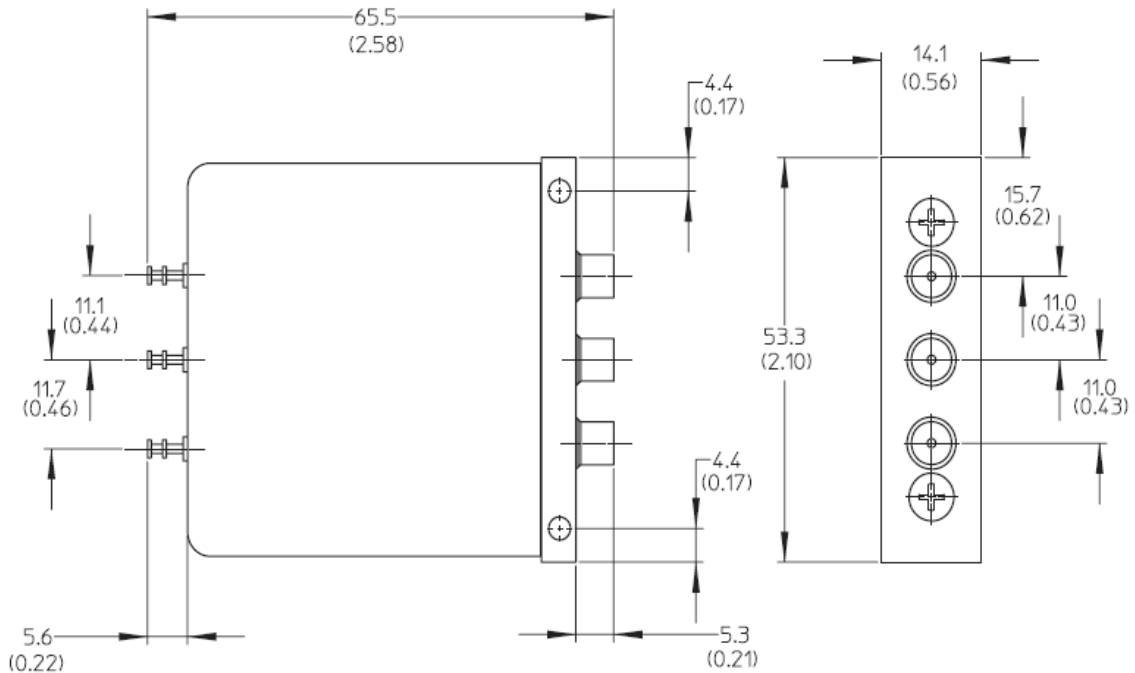
[b] Sinking not allowed.

## Physical Specifications

Table 2-3 and Figure 2-1 illustrate the physical specifications of U9397A/C FET solid state switches.

**Table 2-3** U9397A/C FET solid state switches physical specifications

Dimensions	Per Figure 2-1
Net weight, kg (lb)	0.055 (0.121)



Dimensions are in millimeters (inches).

**Figure 2-1** Dimensions of U9397A/C FET solid state switches

# 3 Operating Guide

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This chapter describes the installation, operating instructions, and service information of the U9397A/C.

## Installation

### Initial inspection

- 1** Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.
  - Check for mechanical damage such as scratches or dents.
  - Procedures for checking electrical performance are given under “**Operator’s check**” on page 23 or “**Performance Tests**” on page 25.
- 2** If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Keysight Technologies Sales and Service office. Refer to “**Sales and Technical Support**” on page 4 of this manual. Keysight Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier’s inspection.
- 3** If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Keysight Technologies can provide packaging materials identical to the original materials. Refer to “**Sales and Technical Support**” on page 4 of this manual for the Keysight Technologies nearest to you. Attach a tag indicating the type of service required, return address, model number, and serial number. Mark the container **FRAGILE** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

## Operating Instructions

### Operator's check

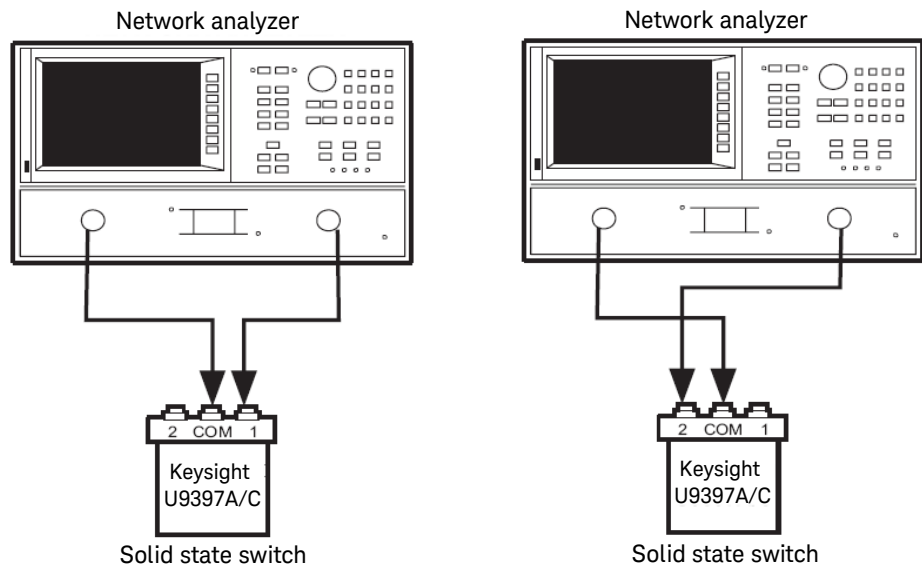
The operator's check allows the operator to make a quick check of the solid state switches prior to use or if a failure is suspected.

#### CAUTION

The RF port center conductors connect directly to the GaAs MMIC and are thus sensitive to electrostatic discharge (ESD). ESD exceeding the level specified in “**Environmental Conditions**” on page 3 or RF power applied is greater than the maximum specified in **Table 2-2** may cause permanent damage to the device.

### Description

The solid state switch is connected to a network analyzer configured for the S-parameter measurement. The network analyzer may be set to sweep over the whole or selected frequency range of the solid state switch to be verified. The  $S_{21}$  (insertion loss) measurement is the best way to determine if the switch is faulty by applying the appropriate logic to the CTRL pin.



**Figure 3-1** Connection to perform quick check

### Quick-check procedure

- 1** Connect RFCOM of the switch to Port 1 of the network analyzer and either RF1 or RF2 to Port 2 as illustrated in [Figure 3-1](#).
- 2** Ensure that +24 Vdc and GND are connected.
- 3** If RF1 of the switch is connected to Port 2, apply logic '0' to CTRL. This should yield low loss from RFCOM to RF1.  $S_{21}$  should not exceed specification in [Table 2-1](#).
- 4** If RF2 of the switch is connected to Port 2, apply logic '1' to CTRL. This should yield low loss from RFCOM to RF2.  $S_{21}$  should not exceed specification in [Table 2-1](#).



## Performance Tests

The FET solid state switches can be tested to the accuracy of the specifications with a network analyzer or equivalent equipment of suitable accuracy. If a network analyzer is available, test the instrument using the procedure in the analyzer's operating manual.

## Service Instructions

### Adjustment

The U9397A/C FET solid state switches do not have internal adjustments and should not be opened.

### Repair

The U9397A/C FET solid state switches are not recommended for repair as most components are not easily removed.

### Maintenance

The connectors, particularly the connector faces, must be kept clean. For instruction on connecting and care of your connectors, refer to the *Microwave Connector Care Quick Reference Card (08510-90360)*.

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This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

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