

Operating and Service Manual

Agilent U9397A/C FET Solid State Switch (SPDT)



Agilent Technologies

Manufacturing Part Number: U9397-90001

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Contacting Agilent (Americas, Asia Pacific & Japan)

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General Information

FET Solid State Switch Overview

Agilent U9397A/C are 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 U9397A/C FET Solid State Switches

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

Table 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)

General Information

The U9397A/C are 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 350 μ 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 350 μ s
- Integrated TTL/CMOS driver eliminated the need for external drivers

Circuit Logic

Agilent 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 2.

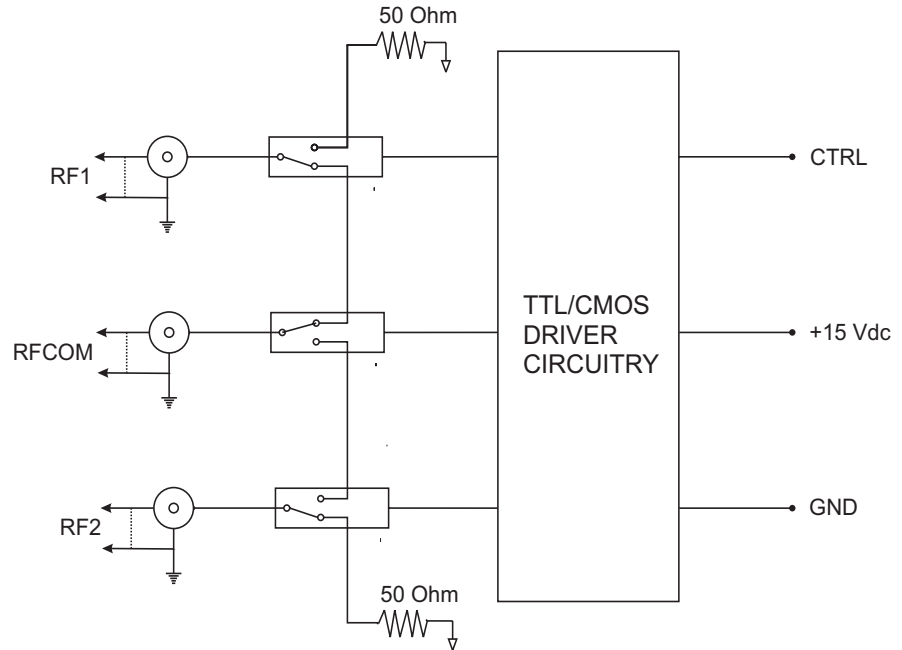


Figure 2 Block Diagram on the Operation of U9397A/C FET Solid State Switches

Table 2 Switch Operation Logic

CTRL Logic	RFCOM to RF1	RFCOM to RF2
0	Low Loss	Isolated
1	Isolated	Low Loss

Specifications

Specifications refer to the performance standards or limits against which the 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 3 RF Specifications for U9397A/C FET Solid State Switches

Agilent Model Number	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 to 8 GHz)	< 5.0 dB (300 kHz to 8 GHz) < 6.5 dB (8 to 18 GHz)
Isolation	100 dB	90 dB
Return Loss - ON & Common Port	> 15 dB	> 10 dB
Return Loss - OFF Port	> 18 dB	> 13 dB
Settling time	<i>350 μs typical</i>	<i>350 μs typical</i>
Switching Speed (Rise/Fall) ¹	<i>5/0.5 μs typical</i>	<i>5/0.5 μs typical</i>
Video Leakage	<i><10 mVpp typical</i>	<i><10 mVpp typical</i>
Characteristic Impedance	<i>50 Ohms nominal</i>	<i>50 Ohms nominal</i>
Connectors	SMA (f)	SMA (f)

1. Switching speed is based on 10% to 90% RF.

Table 4 Absolute Maximum Rating¹ 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 ²		60	mA
Vdc Bias	+12	+24	V
CTRL Input High Voltage	+2.4	+5	V
CTRL Input Low Voltage	0	+0.8	V

1. Operation in excess of any one of these may result in permanent damage to the products.
2. Sinking not allowed.

Environmental Specifications

The U9397A/C solid state switches are designed to fully comply with Agilent Technologies' product operating environmental specifications as shown in [Table 5](#).

Table 5 *U9397A/C FET Solid State Switches Environmental Specifications*

Temperature:	
Operating	-40°C to +65°C
Storage	-65°C to +85°C
Cycling	-65°C to +150°C, 10 cycles @ 20°C per minute, 20 minutes dwell time per MIL-STD-833F, Method 1010.8, Condition C (modified)
Humidity:	
Operating	50% to 95% RH at 40°C, one 24 hour cycle, repeated 5 times
Storage	<95% RH at 40°C, 5 days
Shock:	
Half-sine, smoothed	1000 G @ 0.5 ms, 3 shock pulses per orientation, 18 total per MIL-STD-833F, Method 2002.4, Condition B (modified)
Vibration:	
Broadband, random	50 to 2000 Hz, 7.0 G rms, 15 minutes, per MIL-STD-833F, Method 2026-1 (modified)
Altitude:	
Storage	<15,300 meters (50,000 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

Physical Specifications

Table 6 and Figure 3 illustrate the physical specifications of U9397A/C solid state switches.

Table 6 U9397A/C FET Solid State Switches Physical Specifications

Dimensions	Per Figure 3
Net weight, kg (lb)	0.055 (0.121)

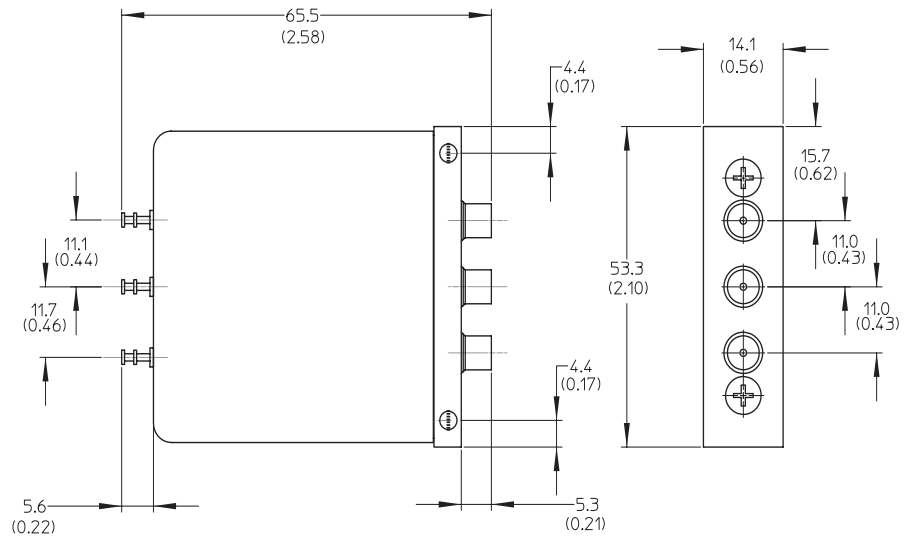


Figure 3 Dimensions of U9397A/C FET Solid State Switches

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” or “Performance Tests”.
 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 Agilent Technologies Sales and Service office. Refer to the Service and Support information in the front matter of this manual. Agilent 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. Agilent Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in the front matter of this manual for the Agilent Technologies nearest 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 Instruction

Operator's Check

The operator's check is supplied to allow 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 [Table 5](#) or RF power applied is greater than the maximum specified as in [Table 4](#) 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.

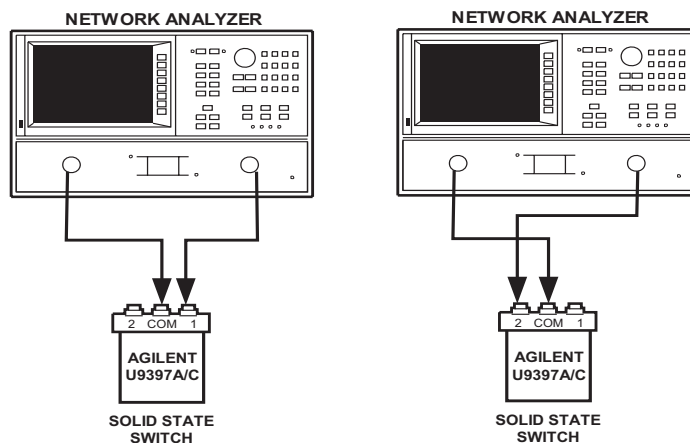


Figure 4 Connection to Perform Quick Check

Performance Tests

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 4](#).
2. Ensure that +24Vdc 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 RF COM to RF1. S_{21} should not exceed specification in [Table 3](#).
4. If RF2 of the switch is connected to Port 2, apply logic '1' to CTRL. This should yield low loss from RF COM to RF2. S_{21} should not exceed specification in [Table 3](#).

Performance Tests

The 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 solid state switches do not have internal adjustments and should not be opened.

Repair

The U9397A/C 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).