

Agilent P9400A/C Solid State PIN Diode Transfer Switches

Operating and Service Manual



Agilent Technologies

Notices

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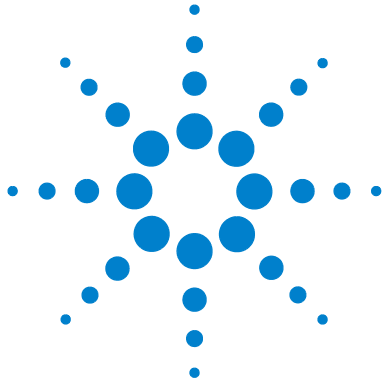
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1 Introduction

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This chapter provides an overview specifications of Agilent solid state PIN diode transfer switches.



Product Overview

Agilent P9400A/C consist of 8/18 GHz solid state transfer switches which are developed based on PIN diode technology. These solid state switches offer superior performance in terms of isolation, insertion loss and return loss throughout a broad frequency range.

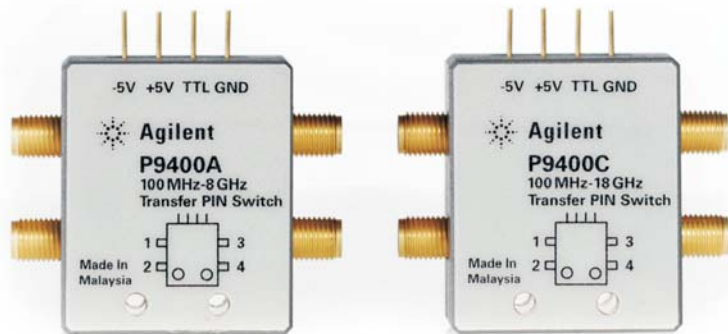


Figure 1 Agilent P9400A and P9400C Solid State PIN Diode Transfer Switches

Table 1 List of Solid State PIN Diode Transfer Switches

Agilent Model Number	Frequency Range	Connector Type
P9400A	100 MHz to 8 GHz	SMA (f)
P9400C	100 MHz to 18 GHz	SMA (f)

Agilent P9400A/C solid state PIN diode transfer switches are designed to fit exceptionally well into ultra fast RF and microwave switching applications in instrumentation, radar, communication test systems, switch matrices and various other test systems where speed and lifetime of the switch are uncompromisingly crucial. The P9400A/C switches consist of series PIN diode switch IC and multiple shunt PIN diodes which offer unmatched isolation between ports. Ultra fast switching speed of < 200 ns assures fast, reliable and accurate switching that is compatible with today's high demand for superior RF performance system.

Features

- Minimize crosstalk with exceptionally high port to port isolation of > 80 dB
- Increase test setup flexibility with a broad operating frequency range
- Increase test throughput effectively with high-speed switching time of < 200 ns
- Optimize system dynamic range with low insertion loss
- Eliminate the need for external drivers with integrated TTL-compatible driver

Circuit Logic

Agilent P9400A/C switches come with integrated TTL-compatible driver that is configured in such a way that when a TTL high (logic 1) is applied to TTL pin of the switch, the paths from Port 1 to Port 2 and port 3 to Port 4 of the switch are at low loss, while the paths from Port 1 to Port 3 and Port 2 to Port 4 are at high isolation. When TTL low (logic 0) is applied to TTL pin of the switch, the paths from Port 1 to Port 3 and Port 2 to Port 4 of the switch are at low loss, while the paths from Port 1 to Port 2 and Port 3 to Port 4 are at high isolation.

Table 2 Switch Operation Logic

Logic Control	State	Port 1 to Port 2	Port 1 to Port 3
		Port 3 to Port 4	Port 2 to Port 4
TTL high	A	Low Loss	High Isolation
TTL low	B	High Isolation	Low Loss

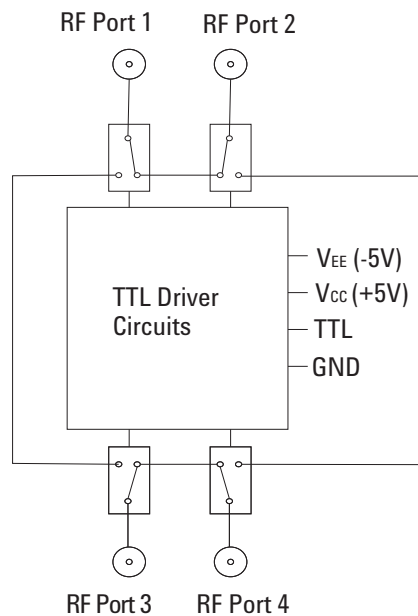


Figure 2 Diagram of P9400A/C Switches in State A

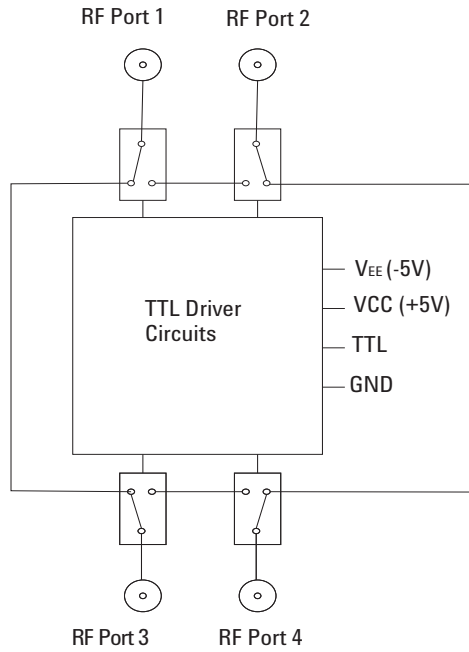


Figure 3 Diagram of P9400A/C Switches in State B

Specifications

Specifications refer to the performance standards or limits against which the solid state PIN diode transfer 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 P9400A/C Solid State PIN Diode Transfer Switches

Agilent Model Number	P9400A	P9400C
Frequency range	100 MHz to 8 GHz	100 MHz to 18 GHz
Insertion loss	< 3.0 dB (100 MHz to 4 GHz) < 3.5 dB (4 GHz to 8 GHz)	< 3.5 dB (100 MHz to 8 GHz) < 4.2 dB (8 GHz to 18 GHz)
Isolation	> 80 dB	> 80 dB
Return loss (ON Ports)	> 15 dB	> 10 dB
<i>Switching speed*</i>	<i>200 ns (typical)</i>	<i>200 ns (typical)</i>
<i>Video leakage</i>	<i>0.6 Vpp (typical)</i>	<i>0.6 Vpp (typical)</i>
<i>Characteristic Impedance</i>	<i>50 Ω (nominal)</i>	<i>50 Ω (nominal)</i>
Connectors	SMA (f)	SMA (f)

* Switching speed is based on 50% TTL to 90% RF (ON time) or 50% TTL to 10% RF (OFF time)

Table 4 Absolute Maximum Ratings of P9400A/C*

Parameters	Min	Max
RF input power (average)	–	+ 23 dBm
V _{CC} DC Supply Voltage	– 0.5 V	+ 6.0 V
V _{EE} DC Supply Voltage	– 6.0 V	0 V
TTL Control Input	– 0.5 V	(V _{CC} + 0.5) V

* Operation in excess of any one of these may result in permanent damage to the products

Table 5 DC Operating Range of P9400A/C*

Parameters	Min	Max
V _{CC} DC Supply Voltage	+ 4.5 V	+ 5.5 V
V _{EE} DC Supply Voltage	– 5.5 V	– 4.5 V
Control Input (TTL) high	+ 2.4 V	V _{CC}
Control Input (TTL) low	– 0.5 V	+ 0.8 V

* Recommended parameters for optimum RF performance

1 Introduction



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“P9400A/C Dimensions”

This chapter contains the environmental tests on the P9400A/C that fully comply with Agilent Technologies’ product operating environmental specifications. The physical dimensions are illustrated in the later section.



Environmental Specifications

Agilent P9400A/C solid state PIN diode transfer switches are designed to fully comply with Agilent Technologies' product operating environmental specifications as shown in [Table 6](#).

Table 6 P9400A/C Solid State PIN Diode Transfer Switches Environmental Specifications

Temperature:

- Operating -40 ° C to +85 ° C
- Storage -65 ° C to +125 ° C
- Cycling -65° C to +150 ° C, 10 cycles @ 20 ° C per minute ramp rate, 20 minutes dwell time per MIL-STD-833F, Method 1010.8, Condition C (modified)

Humidity:

- Operating 50% to 95% RH @ 40 ° C, one 24 hour cycle, repeated 5 times
- Storage <90% RH at 65 ° C, 24 hours

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 2.0 kV per IEC 61000-4-2
 - Air discharge 4.0 kV per IEC 61000-4-2
-

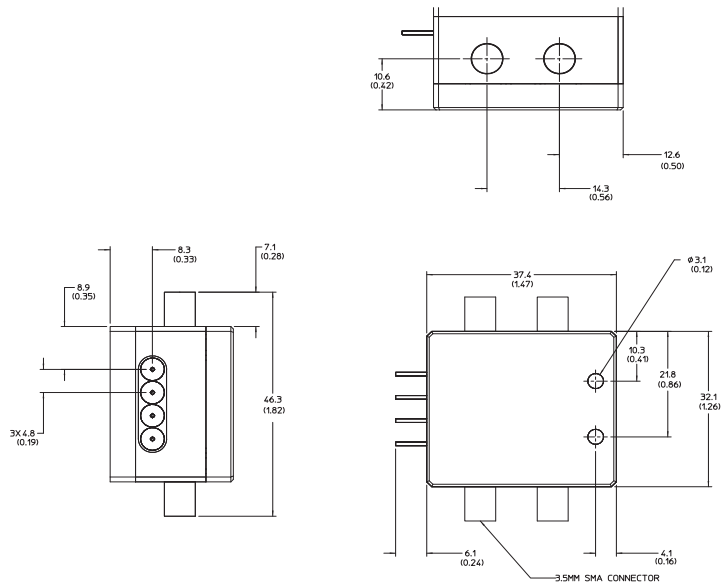
Physical Dimensions

Table 7 illustrates the physical dimensions of P9400A/C solid state PIN diode transfer switches.

P9400A/C Dimensions

Table 7 P9400A/C Solid State PIN Diode Transfer Switches Physical Dimensions

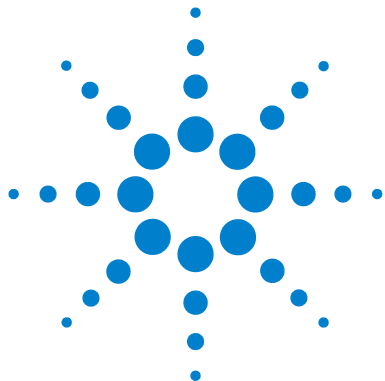
Dimensions	Per Figure 4
Net weight, kg (lb)	0.07 (0.154)



Dimensions in millimetres (inches)

Figure 4 Dimensions of P9400A/C Solid State PIN Diode Transfer Switches

2 Environmental Specifications & Physical Dimensions



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This chapter describes the installation of the P9400A/C. The operating instruction quick-check procedure is included for verification test prior to usage. Service instructions on the repair and maintenance of the P9400A/C are also included in this chapter.



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 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 Instruction

Operator's Check

The operator's check is supplied to allow the operator to make quick-check of the switches prior to use or if a failure is suspected.

CAUTION

ESD exceeding the level specified in Table 6 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 PIN diode transfer 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 PIN diode transfer switch to be verified. The s-parameter measurements are required to determine if the switch is working properly by applying the appropriate logic to the TTL pin.

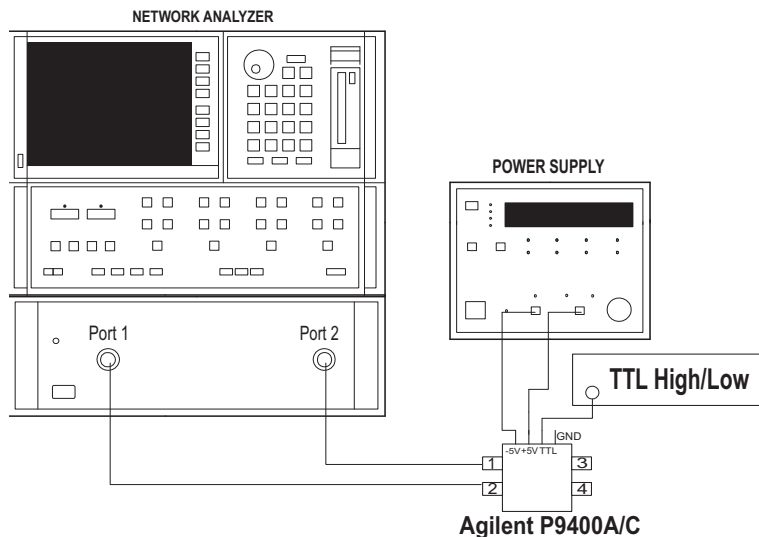


Figure 5 Quick-check Configuration for P9400A/C

Quick-Check Procedure

- 1 Calibrate the network analyzer with full 2- port cal using the appropriate electronic/mechanical calibration kit.
- 2 Connect network analyzer's Port 1 and Port 2 to Port 1 and Port 2 of the switch respectively.
- 3 Turn ON Port 1 to Port 2 of the switch by applying logic '1' (+2.4 V to +5 V) to TTL. Then, measure S11 and S22 (return loss) and S21 (insertion loss) and verify them against [Table 3](#).
- 4 Repeat Step 2 and 3 for Port 3 and Port 4 of the switch.
- 5 Repeat Step 2 and 3 for Port 1 and Port 3 of the switch by applying logic '0' (0 V to +0.8 V) to TTL.
- 6 Repeat Step 2 and 3 for Port 2 and Port 4 of the switch by applying logic '0' (0 V to +0.8 V) to TTL.

Performance Tests

The solid state PIN diode transfer 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 instrument using the procedure in the analyzer's operating manual.

Service Instructions

Adjustment

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

Repair

The P9400A/C solid state PIN diode transfer 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 Microwave Connector Care Quick Reference Card (08510-90360).