

# Keysight N2818/9A Differential Probes

User's Guide



# Notices

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## Safety Notices

### 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.

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# Keysight N2818/9A Differential Probes User's Guide

## Introduction

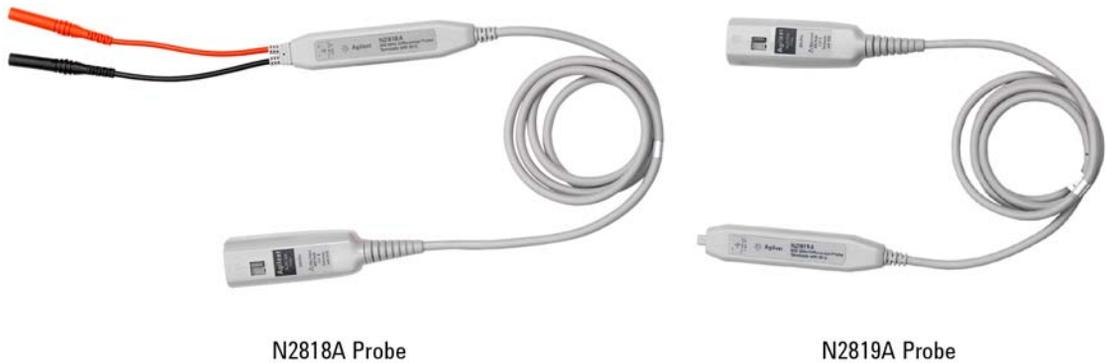
The N2818A and N2819A differential probes provide superior general-purpose differential signal measurements that are required for high-speed power measurements, vehicle bus measurements, and high-speed digital system designs.

### CAUTION

Before using the probe, refer to **“Safety Information”** on page 19.

**Table 1** Quick Probe Comparison

	N2818A	N2819A
Bandwidth	200 MHz	800 MHz
Attenuation Ratio	10:1	10:1
Input Resistance	1 M $\Omega$	200 k $\Omega$
Input Capacitance	3.5 pF	1 pF



**Figure 1** Probes (Accessories Not Shown)

## Oscilloscope Compatibility

The N2818A and N2819A probes are compatible with the Keysight oscilloscopes shown in **Table 2**. Up to four probes can be connected to the oscilloscope at the same time. The table also lists the minimum required firmware version for the oscilloscope.

### NOTE

The N2818A and N2819A probes are designed for oscilloscopes with 50 $\Omega$  AutoProbe-interface channel inputs. The AutoProbe interface provides the power to the probe.

Is Your Oscilloscope Software Up-to-Date? Keysight periodically releases software updates to support your probe, fix known defects, and incorporate product enhancements. To download the latest firmware, go to [www.keysight.com](http://www.keysight.com) and search for your oscilloscope's topic. Click on the "Drivers, Firmware & Software" tab.

**Table 2** Compatible Oscilloscopes and Support

Oscilloscope	Required Firmware Version	Adapter Required
<b>Infiniium Oscilloscopes</b>		
90000 Q-Series	$\geq 4.30$	N5442A
90000 X-Series	$\geq 4.30$	N5442A
90000A	$\geq 4.30$	–
9000 H-Series	$\geq 4.30$	–
9000A-Series	$\geq 4.30$	–
<b>InfiniiVision Oscilloscopes</b>		
4000 X-Series	$\geq 3.20$	–
3000 X-Series	$\geq 2.35$	–

## Handling the Probe

Handle the probe with care and refer to the safety notices in this manual. Note that the probe cable is a sensitive part of the probe and, therefore, you should be careful not to damage it through excessive bending or pulling. You should also avoid any mechanical shocks to this product in order to guarantee accurate performance and protection.

### CAUTION

**Always wear an ESD wrist strap when working with active probes. Not doing so can result in the probe becoming permanently damaged.**

---

## Channel Identification Rings

When multiple probes are connected to the oscilloscope, use the channel identification rings to associate the channel inputs with each probe. Place one colored ring near the probe's channel connector and place an identical color ring near the probe head.

## To Clean the Probe

Disconnect the probe from the oscilloscope and clean the probe with a soft cloth dampened with a mild soap and water solution. Make sure that the probe is completely dry before reconnecting it to an oscilloscope. Avoid using abrasive cleaners and chemicals containing benzene or similar solvents.

## Inspecting the Probe

- Inspect the shipping container for damage.  
Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the probe has been checked mechanically and electrically.
- Check the accessories.
- If the contents are incomplete or damaged, notify your Keysight Technologies Sales Office.
- Inspect the probe. If there is mechanical damage or defect, or if the probe does not operate properly or pass calibration tests, notify your Keysight Technologies Sales Office.

## Introduction

If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Keysight Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Keysight Technologies office will arrange for repair or replacement at Keysight Technologies' option without waiting for claim settlement.

## Accessories

### N2818A

The N2818A probe comes with the accessories shown in **Figure 2**. These accessories are not compatible with N2819A probes. Replacements can be ordered with the N2792-68700 replacement kit. The quantity for each accessory in the kit is the same as listed in the table and originally provided with the probe.

**WARNING**

**The measurement category of a combination of a PROBE ASSEMBLY and an accessory is the lower of the measurement categories of the PROBE ASSEMBLY and of the accessory.**

---



Hook Clips  
(Qty. 2)



Alligator Clips  
(Qty. 2)



Offset Adjustment Tool  
(Qty. 1)

**Figure 2** N2818A Supplied Accessories

## N2819A

The N2819A probe comes with the accessories shown in **Figure 3** and listed in **Table 3** on page 11. These accessories are not compatible with N2819A probes. Replacements can be ordered with the N2793-68700 replacement kit. The quantity for each accessory in the kit is the same as listed in the table and originally provided with the probe.



**Figure 3** N2819A Supplied Accessories

**Table 3** N2819A Supplied Accessories

Accessory	Qty
Pincer Clip (red)	1
Pincer Clip (black)	1
Micro IC Clip (red)	1
Micro IC Clip (black)	1
Extension Lead, 0.8 mm J-P, 5 cm long (red)	1
Extension Lead, 0.8 mm J-P, 5 cm long (black)	1
Extension Lead, 0.8 mm J-P, 10 cm long (red)	1
Extension Lead, 0.8 mm J-P, 10 cm long (black)	1
Dual Signal Pin, 12.8 mm long	2
Dual Signal Pin, 16.8 mm long	2
Single Signal Pin, 8 mm long	6
DC Blocking Capacitor	2
Variable Pitch Spacing Adapter	2
Offset Adjustment Tool	1

## Using the N2818A Probe

Before you can use the N2818A probe, gently push the supplied hook clips or alligator clips onto the probe leads as shown in **Figure 4**. Use the hook clips to clamp onto smaller components and the alligator clips to clamp onto thicker gauge devices.

### WARNING

**Must be Grounded. Before making connections to the input leads of this probe, ensure that the probe's output connector is attached to the channel input of the oscilloscope and the oscilloscope is properly grounded.**

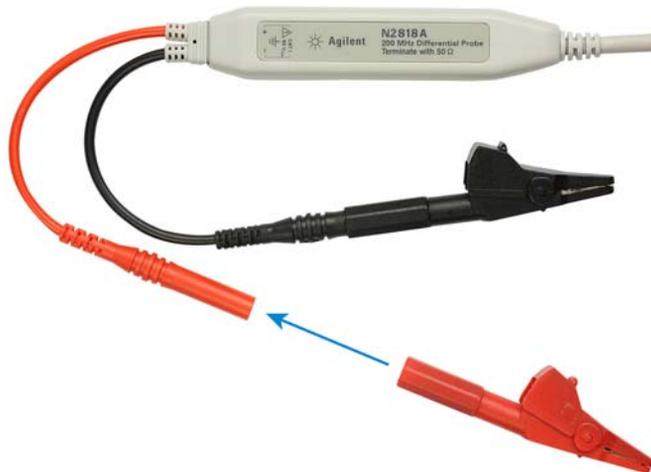


### CAUTION

To protect against electrical shock, use only the accessories supplied with this probe or in the accessory kit.

### CAUTION

This probe is to carry out differential measurements between two points on the circuit under test. This probe is not for electrically insulating the circuit under test and the measuring instrument.



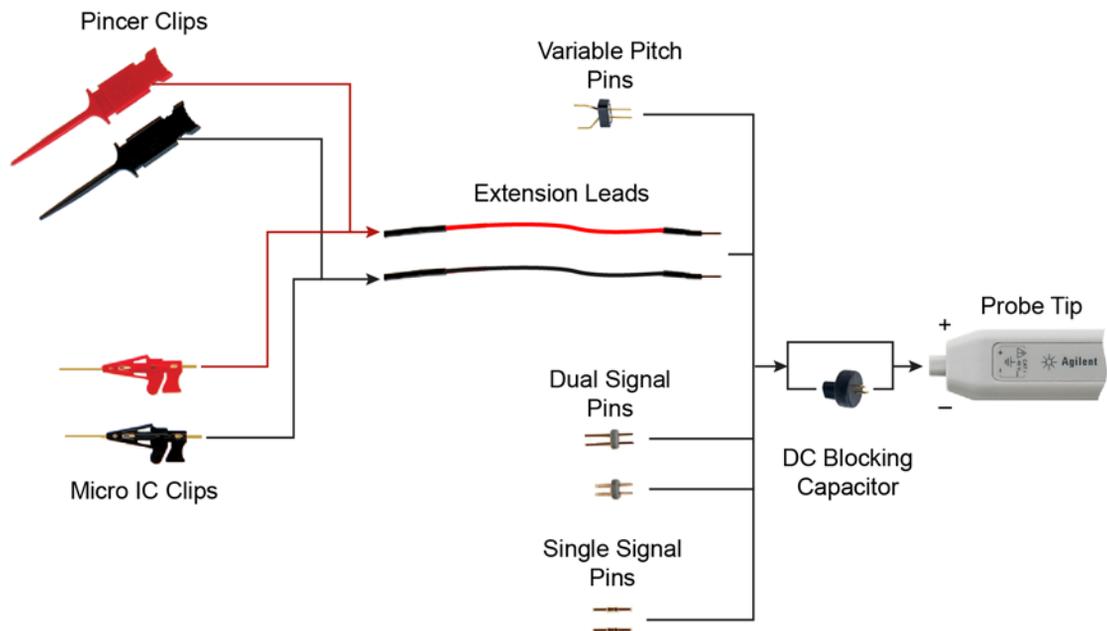
**Figure 4** Inserting the Supplied Clips

## Using the N2819A Probe

Before using the N2819A probe, attach the supplied probing accessories to connect the probe inputs to the circuit under test. **Figure 5** shows the options for connecting the supplied clips, leads, and pins. Gently press the probing accessories into the end of the probe's tip. A label on the probe tip identifies the probe's positive and negative leads.

### WARNING

**Must be Grounded.** Before making connections to the input leads of this probe, ensure that the probe's output connector is attached to the channel input of the oscilloscope and the oscilloscope is properly grounded.



**Figure 5** Probe Clip, Lead, and Pin Connections

**CAUTION**

To protect against electrical shock, use only the accessories supplied with this probe or in the accessory kit.

---

**CAUTION**

This probe is designed to perform differential measurements between two points on the circuit under test. This probe is not for electrically insulating the circuit under test and the measuring instrument.

---

### Single, Dual, and Variable Pitch Signal Pins

Insert the single or dual signal pins into the probe tip as shown in **Figure 6**. Directly probing with either one of these pins results in the best possible signal integrity when compared to the other probing accessories.

**NOTE**

The single signal pins are symmetrical. Either end of the pin may be inserted into the probe tip.

---

Two Single Signal Pins



One Dual Signal Pin



**Figure 6** Signal Pins Inserted into the Probe Tip

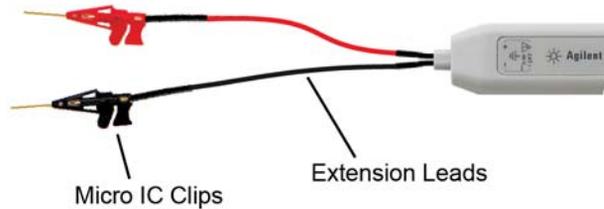
**Figure 7** shows the variable pitch pins inserted into the probe tip. Gently rotate the pins to change the distance between the pins.



**Figure 7** Variable Pitch Pins Inserted into the Probe Tip

## Extension Leads

If the length of the pins is not adequate for your measurement setup or if you need to use the pincer or micro IC clips, the extension leads can be placed over the pins as shown below. The probe comes with both 5 cm and 10 cm long extensions leads.



**Figure 8** Extension Leads on Probe

## Micro IC Clips and Pincer Clips

Use the micro IC and pincer clips to probe miniature IC and components. These clips attach to the end of the extension leads. Squeeze the lever on the micro IC clips to extend the grasping jaws. Push the back of the pincer clips to extend their connectors.

## DC Blocking Capacitor

Use the DC blocking capacitor to block out unwanted DC components on the input signal.



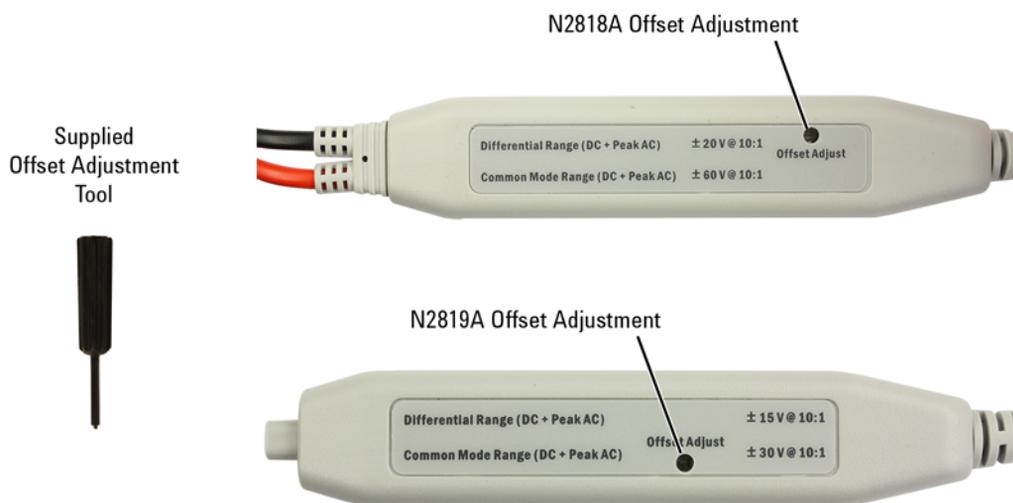
**Figure 9** DC Blocking Capacitor Inserted into the Probe Tip

## Probe Offset Adjustment

Always calibrate the probe before making any critical measurements. A probe calibration removes attenuation errors, offset errors, and timing delays that are introduced by the probe. Additional information on the probe calibration procedure is located in the oscilloscope's manual or online help.

**NOTE**

Allow the oscilloscope and probe to warm up for 20 minutes before performing the adjustment.



**Figure 10** Location of the Offset Adjustment

## On Infiniium Oscilloscopes

- 1 Connect the probe to one of the oscilloscope's channels, turn on the oscilloscope, and wait 20 minutes to allow the oscilloscope and probe to warm up.
- 2 If the oscilloscope needs calibration, perform a user calibration before the probe calibration. On the oscilloscope, click **Utilities > Calibration**.
- 3 On the oscilloscope, click **Setup > Probes**.
- 4 In the Probe Calibration dialog box, select the tab representing the channel that has the probe attached.
- 5 In the dialog box, select the probe head. Select the type of calibration. On 9000 series oscilloscopes, select **Attenuation/Offset Calibration**. On 90000 Series oscilloscopes, select **DC Attenuation/Offset Calibration**.
- 6 Click **Start** and follow the instructions shown on the oscilloscope. When instructed, use the supplied offset adjustment tool to position the displayed trace at the center of the screen.

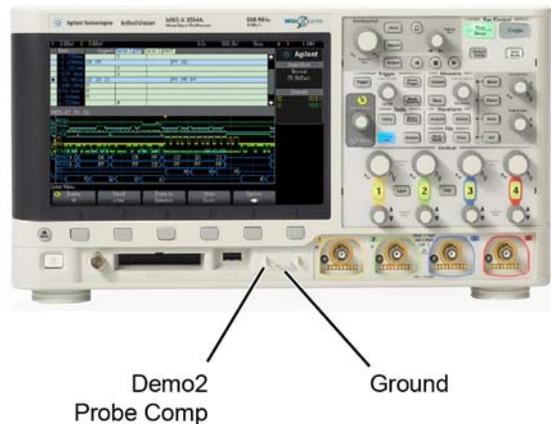
## On InfiniiVision Oscilloscopes

- 1 Connect the probe to one of the oscilloscope's channels, turn on the oscilloscope, and wait 20 minutes to allow the oscilloscope and probe to warm up.

### NOTE

When you connect the probe, the Calibrate Probe softkey in the Channel Probe Menu becomes active.

- 
- 2 Connect the probe to the calibration terminals. On 3000 X series oscilloscopes, connect the probe's signal tip to the front-panel **Demo 2 / Probe Comp** terminal and the ground tip to the ground terminal.



**Figure 11** Probe Calibration Terminals on 3000 X Series Oscilloscope

- 3** Press the Channel on/off key to turn the channel on (if the channel is off).
- 4** In the Channel menu, press the **Probe** softkey.
- 5** In the Channel Probe menu, the second softkey from the left is for specifying your probe head (and attenuation). Repeatedly press this softkey to select **10:1 differential browser (no attenuator)**.
- 6** Press the **Calibrate Probe** softkey and follow the instructions on the display. When instructed, use the supplied offset adjustment tool to position the displayed trace at the center of the screen.

## Safety Information



This manual provides information and warnings essential for operating this probe in a safe manner and for maintaining it in safe operating condition. Before using this equipment and to ensure safe operation and to obtain maximum performance from the probe, carefully read and observe the following warnings, cautions, and notes.

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Note the external markings on the probe that are described in this document.

### WARNING

**To avoid personal injury and to prevent fire or damage to this product or products connected to it, review and comply with the following safety precautions. Be aware that if you use this probe assembly in a manner not specified, the protection this product provides may be impaired.**

---

### WARNING

**Observe Maximum Working Voltage. To avoid injury, do not use the N2818A probe above 60V between each input lead and earth or between the two input leads and do not use the N2819A probe above 40V between each input lead and earth or between the two input leads.**

---

### WARNING

**Must be Grounded. Before making connections to the input leads of this probe, ensure that the probe is connected to the oscilloscope's channel input and the oscilloscope is properly grounded.**

---

### WARNING

**The measurement category of a combination of a PROBE ASSEMBLY and an accessory is the lower of the measurement categories of the PROBE ASSEMBLY and of the accessory.**

---

### WARNING

**Do Not Operate Without Covers. To avoid electrical shock or fire hazard, do not operate this probe with the covers removed.**

---

**WARNING**

**Do Not Operate in Wet / Damp Conditions.** To avoid electrical shock, do not operate this probe in wet or damp conditions.

---

**WARNING**

**Do Not Operate in an Explosive Atmosphere.** To avoid injury or fire hazard, do not operate this probe in an explosive atmosphere.

---

**WARNING**

**Avoid Exposed Circuit.** To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

---

**WARNING**

**For Indoor Use Only.** Only use this probe indoors.

---

**WARNING**

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this probe, have it inspected by a qualified service personnel.

---

**WARNING**

**Connect and Disconnect Properly.** Connect the probe to the oscilloscope and connect the ground lead to earth ground before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground lead from the circuit under test before disconnecting the probe from the oscilloscope.

---

**WARNING**

**Do not use a probe which is cracked, damaged or has defective leads.**

---

**WARNING**

**Do not install substitute parts or perform any unauthorized modification to the probe.**

---

**WARNING**

**Do not use the probe or oscilloscope in a manner not specified by the manufacturer.**

---

**CAUTION**

The probe cable is a sensitive part of the probe and, therefore, you should be careful not to damage it through excessive bending or pulling. Avoid any mechanical shocks to this product in order to guarantee accurate performance and protection.

---

Concerning the Oscilloscope or Voltage Measuring Instrument to Which the Probe is Connected

**WARNING**

Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

---

**WARNING**

If you energize the instrument by an auto transformer (for voltage reduction or mains isolation), the ground pin of the input connector terminal must be connected to the earth terminal of the power source.

---

**WARNING**

Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

---

**WARNING**

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

---

**WARNING**

Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

---

## Specifications and Characteristics

The following tables list the characteristics for the N2818A and N2819A differential probes. Before any testing and to allow the probe to warm up, connect the probe to a powered-on oscilloscope for at least 20 minutes. Ensure that the environmental conditions do not exceed the probe's specified limits.

**Table 4** Electrical Specifications and Characteristics

Description	N2818A*	N2819Aa
Bandwidth (-3 dB)†	200 MHz	800 MHz
Attenuation Ratio	10:1	10:1
Probe Risetime (10% – 90%)	1.75 ns	437 ps
Gain Accuracy (% of reading)†	±2%	±2%
Absolute Maximum Rated Input Voltage (each side to ground)	±60V	±40V
Maximum Differential Input Voltage (DC + AC Peak)	±20V	±15V
Maximum Common Mode Input Voltage	±60V	±30V
Input Resistance    Capacitance		
Each Side to Ground:	500 k $\Omega$    7 pF	100 k $\Omega$    2 pF
Between Inputs:	1 M $\Omega$    3.5 pF	200 k $\Omega$    1 pF
Output Voltage Swing	±2V (driving 50 $\Omega$ scope input)	±1.5V (driving 50 $\Omega$ scope input)
Offset (typical)	±2 mV	±5 mV
Offset Adjustment Range	-95 mV to +95 mV	-20 mV to +20 mV
AC CMRR	> -80 dB at 60 Hz > -50 dB at 10 MHz 6 mV <sub>rms</sub>	> -60 dB at 60 Hz > -15 dB at 500 MHz 4.7 mV <sub>rms</sub>
Noise Referenced to Input, Probe Only	6 mV <sub>rms</sub>	4.7 mV <sub>rms</sub>
Power Requirements	AutoProbe Interface	

\* All entries are typical unless otherwise noted.

† Warranted Specification.

**Table 5** Environmental Specifications

Description	Specification
Temperature	Operating: -10 °C to +40 °C Nonoperating: -30 °C to +70 °C
Altitude	Operating: 3,000 m (9,842 feet) Nonoperating: 15,300 m (50,196 feet)
Humidity	Operating: 25 – 85% room humidity Nonoperating: 25 – 85% room humidity
Pollution Degree	Pollution Degree 2

**Table 6** N2818/9A Safety Specifications

Description
CEI/IEC 61010-031 CAT II

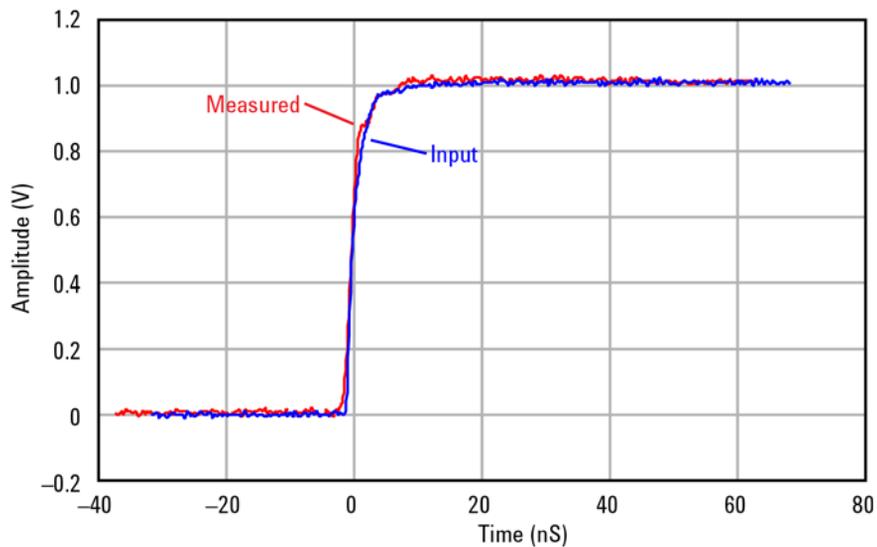
**Table 7** Mechanical Characteristics

Description	N2818A	N2819A
Approximate Weight (not including accessories)	170g (6 oz)	170g (6 oz)
BNC Cable Length	120 cm (47 inches)	120 cm (47 inches)
Length of Input Leads	15 cm (5.9 inches)	n/a
Housing Dimensions (L x W x H)	111 mm x 22 mm x 14 mm (4.4 in x 0.9 in x 0.6 in)	111 mm x 22 mm x 14 mm (4.4 in x 0.9 in x 0.6 in)

**Table 8** DC Blocking Capacitor Electrical Characteristics

Description	Characteristic (All Are Typical)
Bandwidth (-3 dB)	30 kHz to 1 GHz
Impedance	50Ω
Maximum Input Range	100V
Insertion Loss (30 kHz to 1 GHz)	1.0 dB maximum
VSWR (30 kHz to 1 GHz)	1.35:1 maximum
Operating Temperature Range	-25 °C to +85 °C
Compatibility	With the N2819A and probe accessories

## N2818A Performance Plots



## Input Step Signal

10 – 90% rise time: . . . . . 3.5 ns

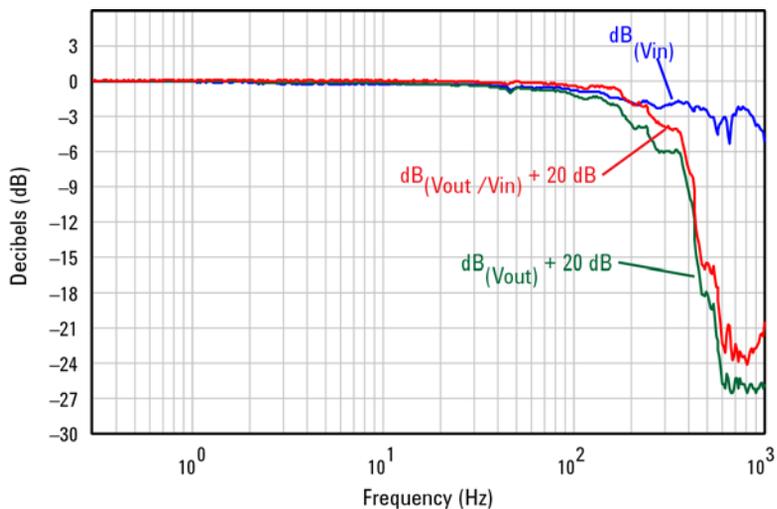
20 – 80% rise time: . . . . . 2.2 ns

## Measured Step Response

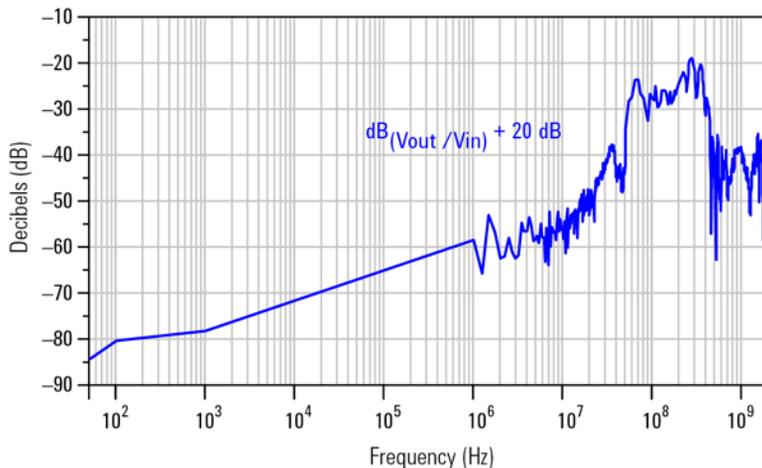
10 – 90% rise time: . . . . . 3.5 ns

20 – 80% rise time: . . . . . 2.2 ns

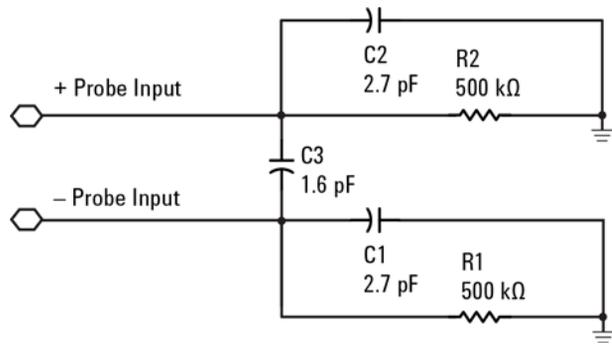
**Figure 12** N2818A Normalized Differential Step Response (50Ω)



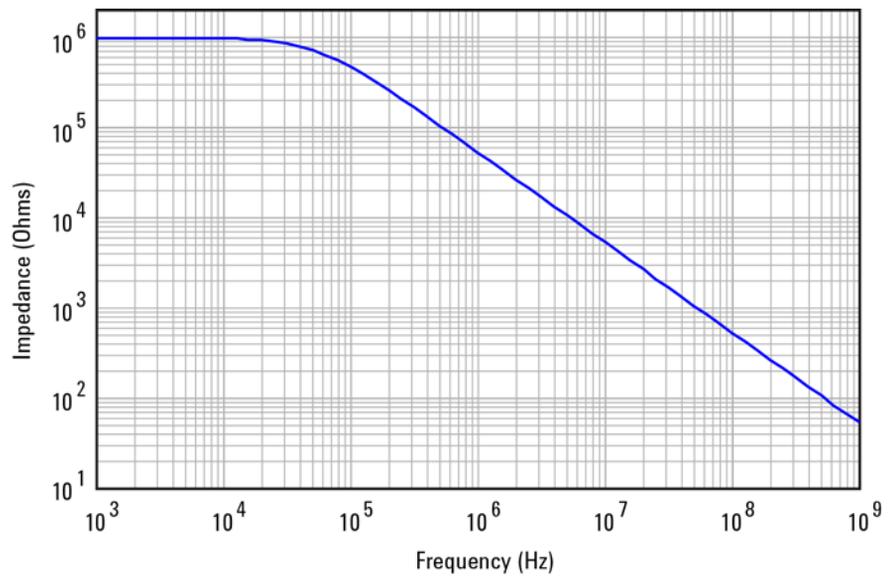
**Figure 13** N2818A Frequency Response



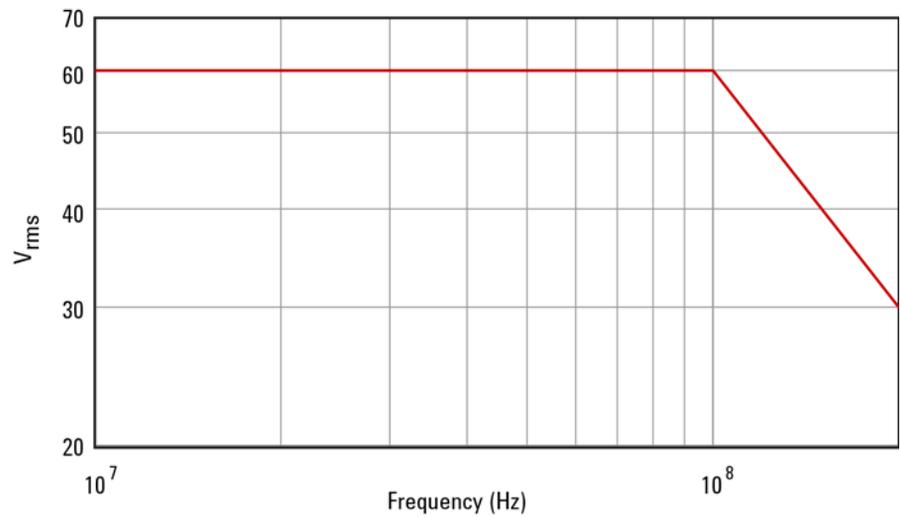
**Figure 14** N2818A Frequency Response when Inputs Driven in Common Mode (CMRR)



**Figure 15** N2818A Input Impedance Equivalent Model Showing Measured Input Capacitance Values

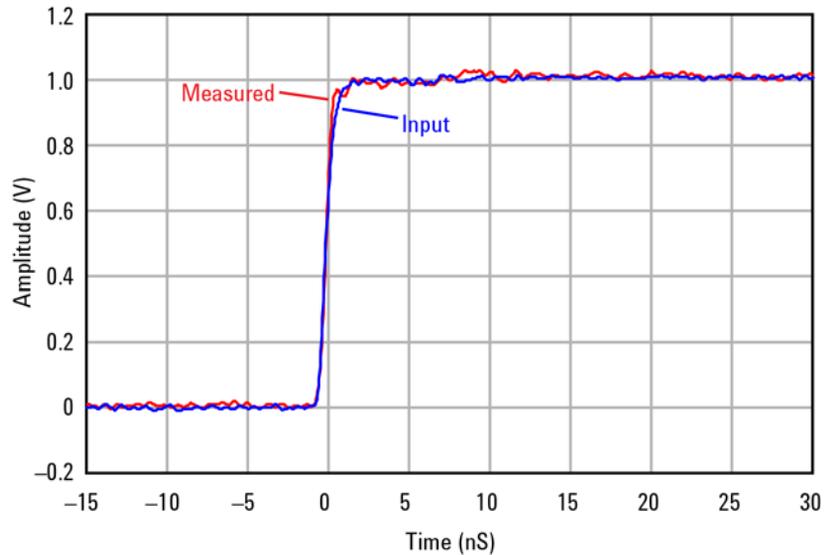


**Figure 16** N2818A Typical Input Impedance Plot



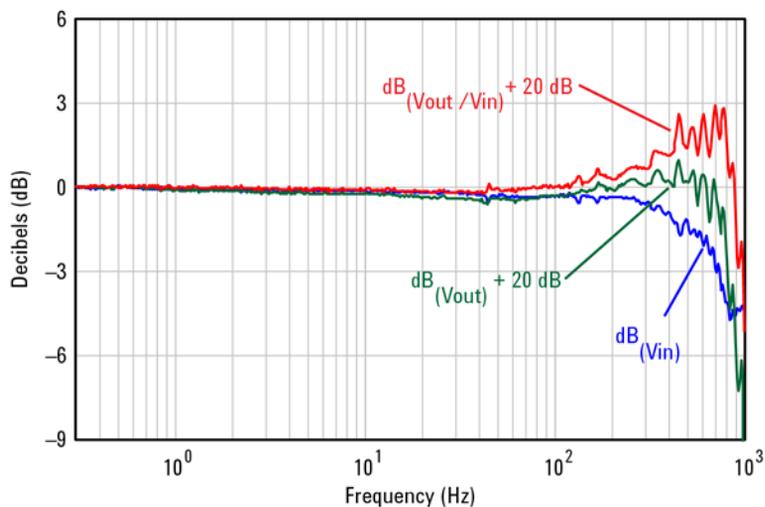
**Figure 17** N2818A Typical Derating Curve of the Absolute Maximum Input Voltage (Either Input to Ground)

## N2819A Performance Plots

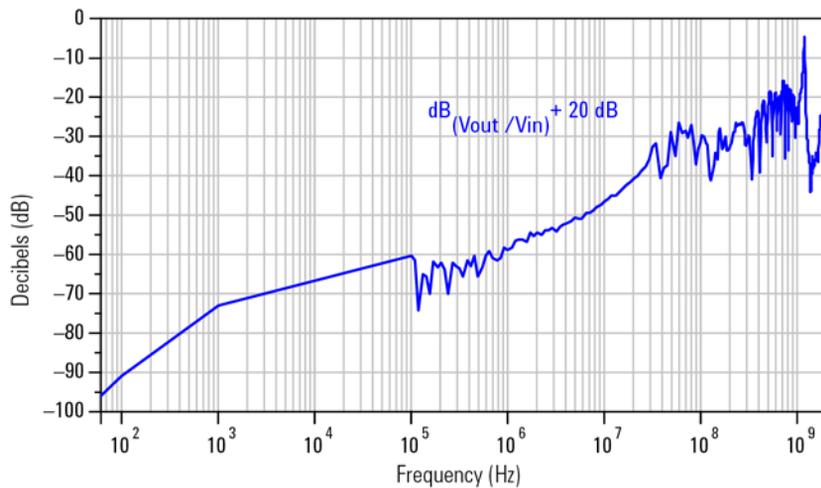


Input	
10 – 90% rise time: . . . . .	900 ps
20 – 80% rise time: . . . . .	800 ps
Measured	
10 – 90% rise time: . . . . .	900 ps
20 – 80% rise time: . . . . .	800 ps

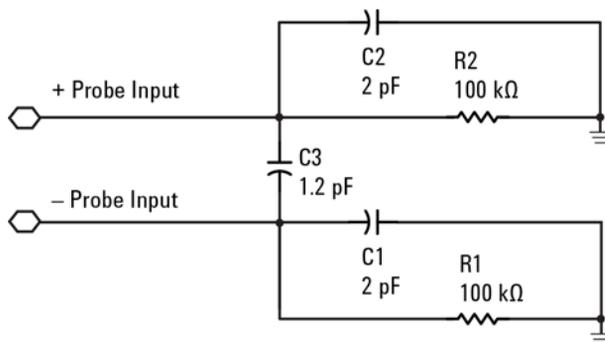
**Figure 18** N2819A Normalized Differential Step Response (50Ω)



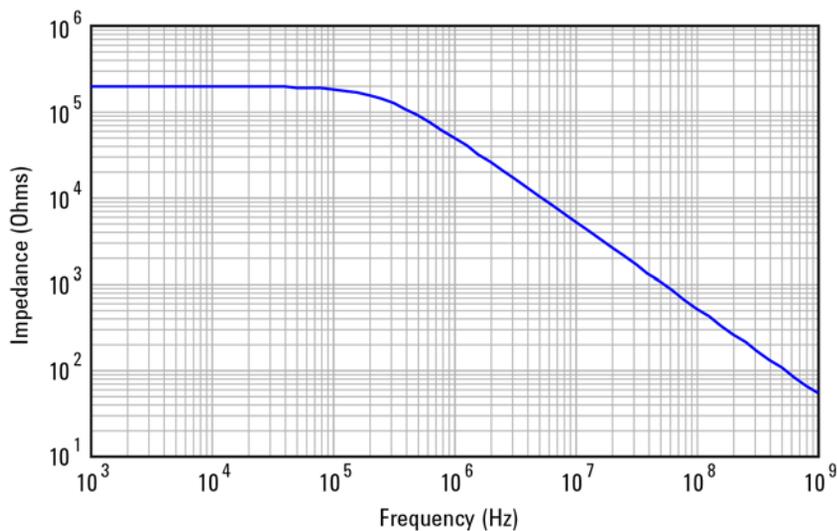
**Figure 19** N2819A Frequency Response



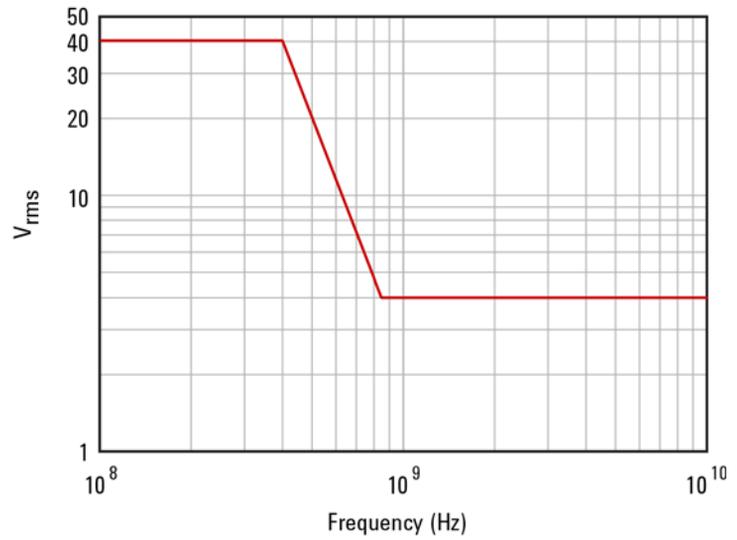
**Figure 20** N2819A Frequency Response when Inputs Driven in Common Mode (CMRR)



**Figure 21** N2819A Input Impedance Equivalent Model Showing Measured Input Capacitance Values



**Figure 22** N2819A Typical Input Impedance Plot



**Figure 23** N2819A Typical Derating Curve of the Absolute Maximum Input Voltage (Either Input to Ground)

## N2818A Performance Verification

The following procedure can be used to test the N2818A probe's DC differential gain accuracy and bandwidth, which are warranted specifications.

### NOTE

The recommended test interval is 1 year.

**Table 9** Required Test Equipment

Description	Critical Specifications	Recommended Model Part Number	Functions
Digitizing Oscilloscope	Band width: >200 MHz 1 M $\Omega$ /50 $\Omega$ selectable input	Agilent MS09254A	Display probe output
Signal Generator Precision DC voltage source	Amplitude accuracy: less than or equal to 0.25% 1 M $\Omega$ / 50 $\Omega$ selectable load Sine wave greater than or equal to 200 MHz	Fluke 9500B High Performance Oscilloscope Calibrator or Agilent E8257D+1EU option	Signal source for DC gain and band width
BNC Adapter	BNC (f) to Dual Banana (m) Adapter	Agilent 1251-2277	Interconnection between probe and generator
50 $\Omega$ BNC Feed Through Adapter	50 $\Omega$ precision feed through	Agilent 0960-0301	Termination between probe and calibrator for band width verification

## Scope Vertical Accuracy

- 1 Configure the oscilloscope to the following settings:
  - Amplitude Scale (Channel 1): . . . . . 20 mV/div
  - Amplitude Scale (Channel 2): . . . . . 500 mV/div
  - Time Scale: . . . . . 200  $\mu$ s/div
  - Acquisition mode: . . . . . 32 averages
  - Input impedance: . . . . . 50 $\Omega$ .
  - Trigger: . . . . . Channel 2
- 2 On the 9500B calibrator, configure **CH2** to the following settings:
  - Type: . . . . . TRIGGER
  - Load: . . . . . 50 $\Omega$
- 3 On the 9500B, connect the **CH2** active head to channel 2 on the oscilloscope.  
Connect the **CH1** active head to channel 1 on the oscilloscope
- 4 On the N9500B, set **CH1** to the following settings and enable the output:
  - Waveform: . . . . . square wave
  - Load: . . . . . 1 M $\Omega$
  - Amplitude: . . . . . 0.1V pk-pk
  - Frequency: . . . . . 1 kHz
- 5 On the oscilloscope, select the amplitude measurement and record the DC amplitude (approximately 100 mV) of the square wave. This measurement is only the oscilloscope.

## DC Differential Gain

- 6 Disable the 9500B's output and disconnect the active head from channel 1 of the oscilloscope.
- 7 Connect the **N2818A** probe output to channel 1 of the oscilloscope.
- 8 Attach the BNC adapter to the 9500B's **CH1** active head.
- 9 Attach the differential probe input leads by clipping the alligator clamp to the BNC adapter banana post.
- 10 On the N9500B, configure **CH1** to the following settings and enable the output:
  - Waveform: . . . . . square wave
  - Load: . . . . . 1 M $\Omega$
  - Amplitude: . . . . . 1V
  - Frequency: . . . . . 1 kHz
- 11 Enable the output of the calibrator.

- 12 Record the DC amplitude of the square wave and divide 10 into just the amplitude of the oscilloscope. Verify that the probe gain accuracy is  $\pm 2\%$  + scope gain accuracy. Record the test results as DC Differential Gain Accuracy in **Table 10** on page 36.

### Bandwidth

- 13 Disable the 9500B's output.
- 14 Connect the 50Ω BNC feed through adapter to the N9500B's **CH1** active head.
- 15 Attach the BNC (f)-to-banana post adapter to the BNC feed through adapter.
- 16 Attach the differential probe input leads by clipping the alligator clamp to the BNC adapter banana post.
- 17 Enable the 9500B's output.
- 18 Configure the oscilloscope to the following settings:  
 Amplitude Scale (Channel 1): . . . . . 500 mV/div  
 Time Scale: . . . . . 2 ns/div  
 Acquisition mode: . . . . . Peak Detect
- 19 Center the trace on the oscilloscope.
- 20 On the N9500B, configure **CH1** to the following settings:  
 Waveform: . . . . . sine wave  
 Load: . . . . . 1 MΩ  
 Amplitude: . . . . . .3V pk-pk  
 Frequency: . . . . . 200 MHz
- 21 Measure the peak-to-peak amplitude on the oscilloscope. It should be greater than or equal to 210 mV – scope vertical accuracy. Record the test results as Bandwidth in **Table 10** on page 36.
- 22 Disable the N9500B's output and disconnect the probe input.

**Table 10** N2818A Performance Test Record

Certification Details			
Serial Number:		Tested By:	
Certification Date:		Recommended Date of Next Certification:	
Certification Temperature:			
Test	Probe Setting	Test Limits	Test Results
DC Differential Gain Accuracy	10:1	98 mV – scope vertical accuracy to 102 mV + scope vertical accuracy	
Bandwidth	10:1	≥ (210 mV – scope vertical accuracy)	

# N2819A Performance Verification

The following procedure can be used to test the N2819A probe's DC differential gain accuracy and bandwidth, which are warranted specifications.

**NOTE**

The recommended test interval is 1 year.

**Table 11** Required Test Equipment

Description	Critical Specifications	Recommended Model Part Number	Functions
Digitizing Oscilloscope	Band width: >1 GHz 1 M $\Omega$ /50 $\Omega$ selectable input	Agilent MSO9254A	Display probe output
Signal Generator Precision DC voltage source	Amplitude accuracy: less than or equal to 0.25% 1 M $\Omega$ /50 $\Omega$ selectable load Sine wave greater than or equal to 800 MHz	Fluke 9500B or Agilent E8257D+1EU option	Signal source for DC gain and band width
Performance Verification (PV) Fixture	50 $\Omega$ impedance controlled microstrip trace	Agilent E2655C	Probing trace for band width test
Terminator	50 $\Omega$ matched load		Termination for the PV fixture
BNC Adapter	BNC (f) to SMA (m)		Interconnection between calibrator and PV fixture
BNC Adapter	BNC(f) to Dual Banana (m) adapter	Agilent 1251-2277	Termination between probe and calibrator

## Scope Vertical Accuracy

- Configure the oscilloscope to the following settings:  
 Amplitude Scale (Channel 1): . . . . . 20 mV/div  
 Amplitude Scale (Channel 2): . . . . . 500 mV/div  
 Time Scale: . . . . . 200  $\mu$ s/div  
 Acquisition mode: . . . . . 32 averages  
 Input impedance: . . . . . 50 $\Omega$ .

- Trigger: ..... Channel 2
- 2** On the 9500B calibrator, configure **CH2** to the following settings:  
 Type: ..... TRIGGER  
 Load: ..... 50 $\Omega$
- 3** On the 9500B, connect the **CH2** active head to channel 2 on the oscilloscope.  
 Connect the **CH1** active head to channel 1 on the oscilloscope
- 4** On the N9500B, set **CH1** to the following settings and enable the output:  
 Waveform: ..... square wave  
 Load: ..... 1 M $\Omega$   
 Amplitude: ..... 0.1V pk-pk  
 Frequency: ..... 1 kHz
- 5** On the oscilloscope, select the amplitude measurement and record the DC amplitude (approximately 100 mV) of the square wave. This measurement is only the oscilloscope.

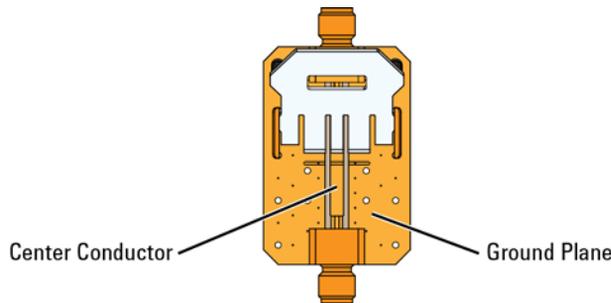
## DC Differential Gain

- 6** Disable the 9500B's output and disconnect the active head from channel 1 of the oscilloscope.
- 7** Connect the N2818A probe output to channel 1 of the oscilloscope.
- 8** Attach the BNC adapter to the 9500B's **CH1** active head.
- 9** Attach the differential probe input leads by clipping the alligator clamp to the BNC adapter banana post.
- 10** On the N9500B, configure **CH1** to the following settings and enable the output:  
 Waveform: ..... square wave  
 Load: ..... 1 M $\Omega$   
 Amplitude: ..... 1V  
 Frequency: ..... 1 kHz
- 11** Enable the output of the calibrator.
- 12** Record the DC amplitude of the square wave and divide 10 into just the amplitude of the oscilloscope. Verify that the probe gain accuracy is  $\pm 2\%$  + scope gain accuracy. Record the test results as DC Differential Gain Accuracy in [Table 12](#) on page 40.

## Bandwidth

- 13** Disable the 9500B's output.

- 14 Connect the PV fixture to the N9500B's **CH1** active head.
- 15 Configure the oscilloscope to the following settings:  
Amplitude Scale (Channel 2): . . . . . 500 mV/div
- 16 On the 9500B calibrator, configure **CH2** to the following settings:  
Type: . . . . . TRIGGER  
Load: . . . . . 50 $\Omega$
- 17 On the 9500B, connect the **CH2** active head to channel 2 on the oscilloscope.
- 18 Terminate PV fixture's 50 $\Omega$  trace with the matched 50 $\Omega$  terminator.
- 19 Insert the probe's dual signal pins into the probe tip.
- 20 Use a probe positioner to gently place the probe pin tips onto the PV fixture's center conductor and ground plane as identified in **Figure 24**.



**Figure 24** Probing Locations on PV Fixture

- 21 Enable the 9500B's output.
- 22 Configure the oscilloscope to the following settings:  
Amplitude Scale (Channel 1): . . . . . 500 mV/div  
Time Scale: . . . . . 2 ns/div  
Acquisition mode: . . . . . Peak Detect
- 23 Center the trace on the oscilloscope.
- 24 On the N9500B, configure **CH1** to the following settings:  
Waveform: . . . . . sine wave  
Load: . . . . . 50 $\Omega$   
Amplitude: . . . . . 3V pk-pk  
Frequency: . . . . . 800 MHz

- 25** Measure the peak-to-peak amplitude on the oscilloscope. It should be greater than or equal to 210 mV – scope vertical accuracy. Record the test results as Bandwidth in **Table 12**.
- 26** Disable the N9500B’s output and disconnect the probe input.

**Table 12** N2819A Performance Test Record

Certification Details			
Serial Number:		Tested By:	
Certification Date:		Recommended Date of Next Certification:	
Certification Temperature:			
Test	Probe Setting	Test Limits	Test Results
DC Differential Gain Accuracy	10:1	98 mV – scope vertical accuracy to 102 mV + scope vertical accuracy	
Band width	10:1	≥ (210 mV – scope vertical accuracy)	

## Returning the Probe for Service

If the probe is found to be defective we recommend sending it to an authorized service center for all repair and calibration needs. Perform the following steps before shipping the probe back to Keysight Technologies for service.

- 1 Contact your nearest Agilent sales office for information on obtaining an RMA number and return address.
- 2 Write the following information on a tag and attach it to the malfunctioning equipment.
  - Name and address of owner
  - Product model number (for example, N2818A)
  - Product Serial Number (for example, MYXXXXXXXX)
  - Description of failure or service required.

### NOTE

Include probing and browsing heads if you feel the probe is not meeting performance specifications or a yearly calibration is requested.

- 3 Protect the probe by wrapping in plastic or heavy paper.
- 4 Pack the probe in the original carrying case or if not available use bubble wrap or packing peanuts.
- 5 Place securely in sealed shipping container and mark container as "FRAGILE".

### NOTE

If any correspondence is required, refer to the product by serial number and model number.

## Contacting Keysight Technologies

For technical assistance, contact your local Keysight Call Center.

- In the Americas, call 1 (800) 829-4444
- In other regions, visit <http://www.keysight.com/find/assist>
- Before returning an instrument for service, you must first call the Call Center at 1 (800) 829-4444.

Returning the Probe for Service

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