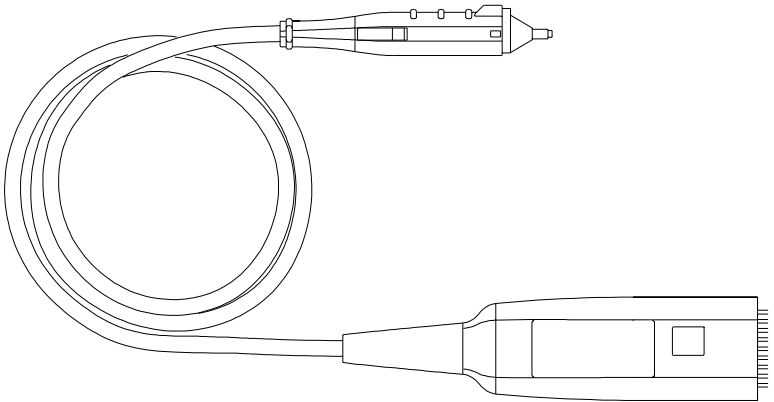


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# User's Guide

Publication number 01156-97000  
September 2001



For Safety information, Warranties, and Regulatory information, see the pages at the back of this guide.

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## 1156A 1.5 GHz Active Probe

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## In This Book

This guide provides user and service information for the 1156A 1.5 GHz Active Probe.

**Chapter 1** gives you general information such as inspection, cleaning, accessories supplied, and specifications and characteristics of the probe.

**Chapter 2** shows you how to operate the probe and gives you information about some important aspects of probing and how to get the best results with your probe.

**Chapter 3** provides service information.

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# 1156A 1.5 GHz Active Probe

The 1156A 1.5 GHz Active Probe is a probe solution for high-frequency applications. This probe is compatible with the AutoProbe Interface which completely configures the Infiniium series of oscilloscopes for the probe.

## To inspect the probe

❑ Inspect the shipping container for damage.

Keep a damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically.

❑ Check the accessories.

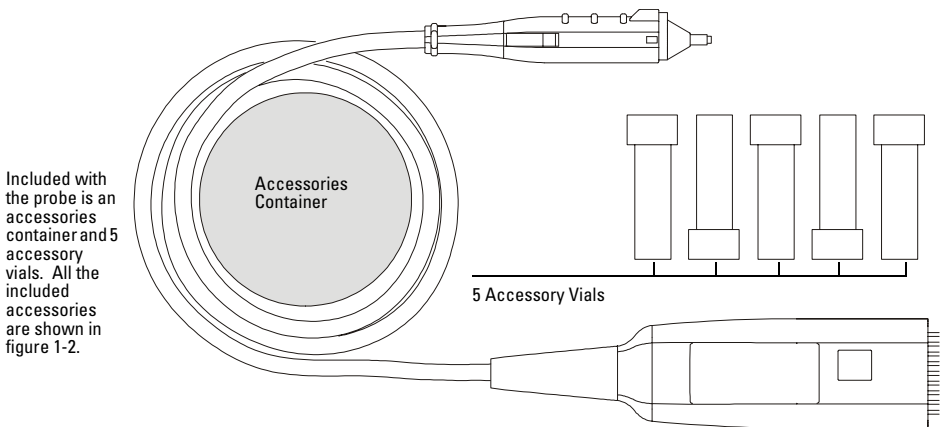
Accessories supplied with the instrument are listed in "Accessories Supplied" in table 1-1 later in this chapter.

- If the contents are incomplete or damaged notify your Agilent Technologies Sales Office.

❑ Inspect the probe.

- If there is mechanical damage or defect, or if the probe does not operate properly or pass performance tests, notify your Agilent Technologies Sales Office.
- If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Agilent Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Technologies Office will arrange for repair or replacement at Agilent Technologies' option without waiting for claim settlement.

**Figure 1-1**



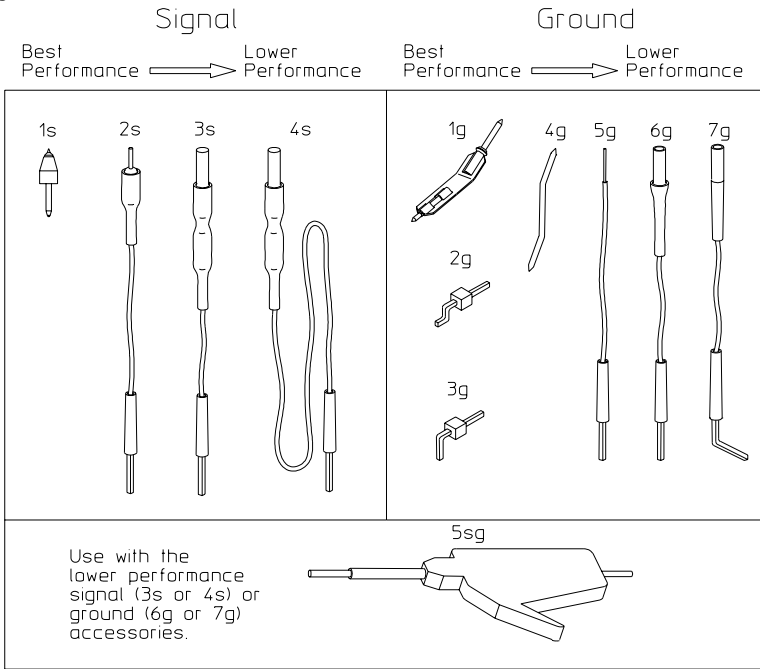
Included with the probe is an accessories container and 5 accessory vials. All the included accessories are shown in figure 1-2.

### 1156A Active Probe

## Accessories Supplied

The following figure and table show the accessories supplied with the 1156A Active Probe.

**Figure 1-2**



**Table 1-1**

**Accessories Supplied**

<b>Item</b>	<b>Description</b>	<b>Qty</b>	<b>Agilent Part Number</b>
1s	130 $\Omega$ resistive signal pin (orange)	12	01156-27616
2s	Solderable-tip 5 cm resistive signal lead	2	01156-82106
3s	Socket-end 5 cm resistive signal lead	2	01156-82105
4s	Socket-end 10 cm resistive signal lead	2	01156-82108
5sg	Micro clip	2	5063-2180
1g	Ground blade assembly	12	01156-23701
2g	Solderable SMT ground pin	12	1253-5054
3g	Solderable through-hole ground pin	12	1252-7150
4g	Offset ground pin	12	01156-27606
5g	Solderable-tip 5 cm ground lead	2	01156-82107
6g	Socket-end 5 cm ground lead	2	01156-82103
7g	Socket-end 5 cm, 90° pin ground lead	2	01156-82104

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## Replaceable Parts and Additional Accessories

**Table 1-2**


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### Replaceable Parts and Additional Accessories

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<b>Agilent Part Number</b>	<b>Description</b>	<b>Qty</b>
E2638A	Solderable-tip 5 cm resistive signal lead	10
	Solderable-tip 5 cm ground lead	3
E2639A	Micro clip	4
E2640A	130 $\Omega$ resistive signal pin (orange)	8
E2641A	Ground blade assembly	8
E2637A	Precision Measurement Kit includes 2 solderable ground sockets and 2 110 $\Omega$ resistive signal pins (green)	1
E2649A	Performance Verification fixture includes two 50 $\Omega$ PV fixtures with 8 110 $\Omega$ resistive signal pins (green)	1
E2654A	EZ-Probe <sup>®</sup> positioner	1

## Characteristics and Specifications

The following characteristics are typical for the active probe.

**Table 1-3**

<b>Characteristics</b>	
<b>Bandwidth<sup>1</sup> (-3 dB)</b>	> 1.5 GHz
<b>Rise and Fall Time (10% to 90%)</b>	< 234 ps calculated from $t_r = \frac{0.35}{\text{Bandwidth}}$
<b>Input Capacitance</b>	0.8 pF
<b>Input Resistance<sup>1</sup></b>	100 k $\Omega$ 1%
<b>Flatness, Swept Response</b>	0.2 dB, 100 kHz to 100 MHz 0.5 dB, 100 MHz to 1.0 GHz 2.0 dB, 1.0 GHz to 1.5 GHz
<b>Flatness, Step Response</b>	8% overshoot, 35 ps input edge 2%, 1 ns after edge
<b>Dynamic Range<sup>2</sup></b>	> 5.0 Vpeak-to-peak
<b>DC Attenuation<sup>1</sup></b>	10:1 $\pm$ 3% before calibration <sup>4</sup> 10:1 $\pm$ 1% after calibration <sup>4</sup>
<b>Zero offset error referred to input<sup>1</sup></b>	< 30 mV before calibration < 5 mV after calibration
<b>Offset Range<sup>1</sup></b>	$\pm$ 15.0 V
<b>Offset Accuracy<sup>1</sup></b>	< 3% of setting before calibration <sup>4</sup> < 1% of setting after calibration <sup>4</sup>
<b>Noise referred to input</b>	3.0 mVrms
<b>Propagation Delay</b>	5.5 ns
<b>Maximum Input Voltage</b>	40 V peak, CAT I <sup>3</sup>
<b>ESD Tolerance</b>	> 5 kV from 100 pF, 300 $\Omega$ HBM
<b>Temperature Drift</b>	Offset: < 1.0 mV/ $^{\circ}$ C Attenuation (Gain): < 0.1 %/ $^{\circ}$ C



1 Denotes Warranted Specifications, all others are typical.

2 For waveforms with edges > 3 ns, the dynamic range is > 12.0 Vpeak-to-peak

3 Installation category (overvoltage category) I: Signal level, special equipment, or parts of equipment, telecommunication, electronic, etc., with smaller transient overvoltages than installation category (overvoltage category) II.

4 Probe calibrated to oscilloscope channel (located in the Probes Setup dialog box).

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## General Characteristics

The following general characteristics apply to the active probe.

**Table 1-4**

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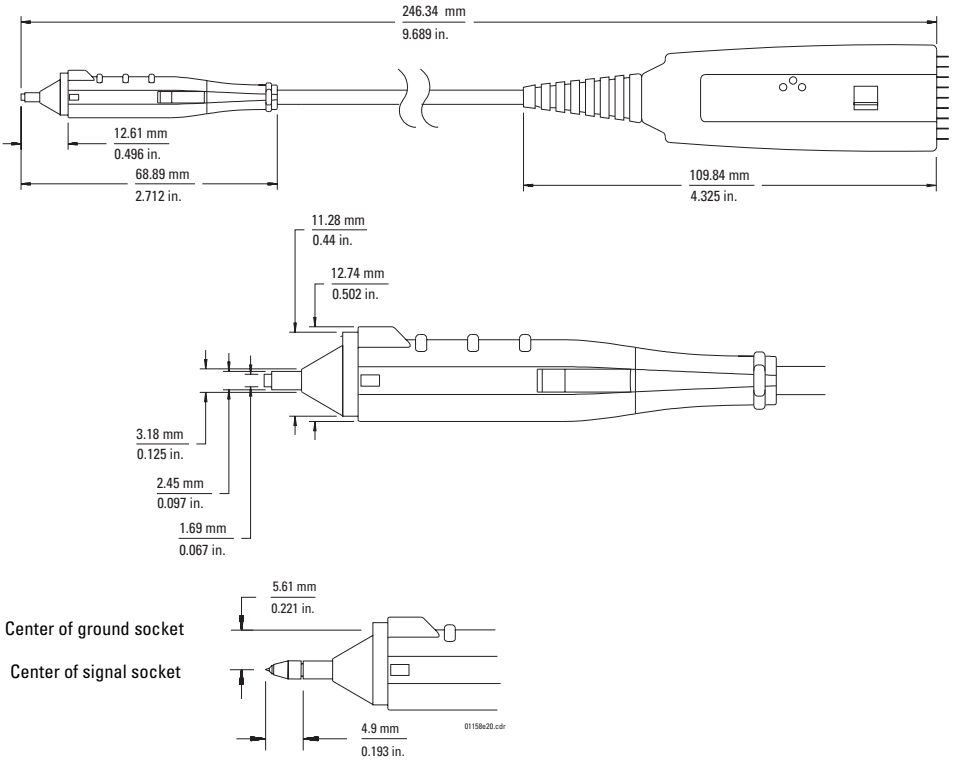
### General Characteristics

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#### Environmental Conditions

	<b>Operating</b>	<b>Non-operating</b>
<b>Temperature</b>	0 °C to +55 °C	-40 °C to +70 °C
<b>Humidity</b>	up to 95% relative humidity (non-condensing) at +40 °C	up to 90% relative humidity at +65 °C
<b>Power Requirements</b>	+12 Vdc @ 3 mA typical +5 Vdc @ 35 mA typical -5 Vdc @ 37 mA typical 0.4 W	(voltages supplied by AutoProbe Interface)
<b>Weight</b>	approximately 0.69 kg	
<b>Dimensions</b>	Refer to the outline in figure 1-3.	
<b>Pollution degree 2</b>	Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.	
<b>Indoor use</b>		

**Figure 1-3**



**1156A Active Probe Dimensions**

## To use the probe

The Infiniium family of oscilloscopes provides both power and offset control to the 1156A active probe through the front panel connector. Probe offset is changed by adjusting the vertical offset control on the Infiniium oscilloscope. The control should be adjusted to center your waveform within the 5 volt peak-to-peak (12 volts peak-to-peak for slow waveforms) dynamic range of the probe.

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## Probe handling considerations

This probe has been designed to withstand a moderate amount of physical and electrical stress. However, with an active probe, the technologies necessary to achieve high performance do not allow the probe to be unbreakable. You should treat the probe with care. It can be damaged if excessive force is applied to the probe tip. This damage is considered to be abuse and will void the warranty when verified by Agilent Technologies service professionals.

- Exercise care to prevent the probe end from receiving mechanical shock.
  - Store the probe in a shock-resistant case such as the foam-lined shipping case which came with the probe.
- 

## Cleaning the probe

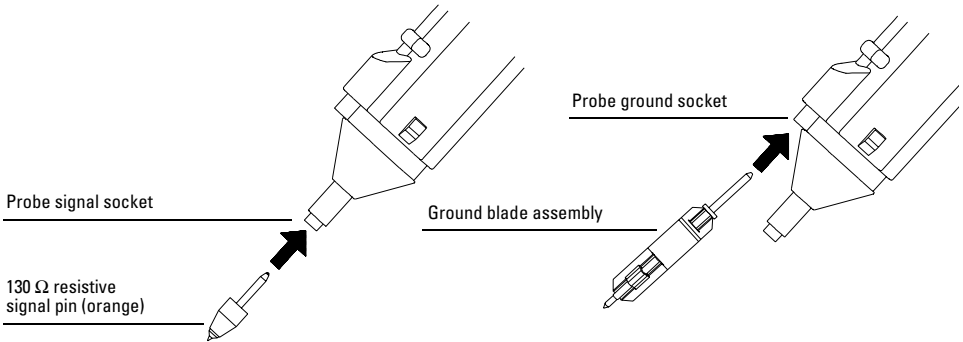
If the probe requires cleaning, disconnect it from the oscilloscope and clean it with a soft cloth dampened with a mild soap and water solution. Make sure the probe is completely dry before reconnecting it to the oscilloscope.

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## Using Probe Accessories

Before you can use the 1156A probe you must install the signal and ground accessories that you want to use. As an example, the following figure shows the installation of the 130  $\Omega$  resistive signal pin (orange) and the ground blade assembly into the probe.

**Figure 1-4**



### Installing the signal and ground pins

There are several probe accessories that can be attached to the 1156A probe which can make it easier to probe different types of circuits and circuit conditions. Each accessory has a different affect on the performance of the probe, as shown in chapter 2.

## To connect the probe

- 1 Connect the probe output to the oscilloscope input.
- 2 Calibrate the oscilloscope and probe combination using the Infiniium probe calibration routine.

When the probe has been calibrated, the dc gain, offset zero, and offset gain will be calibrated. The degree of accuracy specified at the probe tip is dependent on the oscilloscope system specifications.

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## Operating the Probe

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# Introduction

The Agilent 1156A active probe comes with accessories that place a resistor as close as possible to the circuit being probed. The purpose of this resistor is to dampen the resonant circuit created when the probe tip makes physical contact with the circuit. The resonant circuit is made from the parasitics of the physical connection between the point being probed and the internal attenuator of the probe.

All probes suffer from the effects of this resonant circuit at the input of the probe. However, with lower bandwidth probes the resonant frequency is much higher than the bandwidth of the probe making this effect less noticeable.

The bandwidth of the 1156A active probe is higher than the resonant frequency of the physical connection to the probed circuit, even when using the smallest possible physical connection. Placing a resistor between the circuit being probed and the parasitics of the physical connection isolates the circuit being probed from this resonance. This allows the response of the probe ( $V_{out}/V_{in}$ ) to be flat across the entire bandwidth of the probe.

**It is important to understand that the resistor placed at the point being probed is part of the probe.** The optimum value of this resistor depends on the geometry of the physical connection to the circuit being probed. The optimum value of resistance is used in each of the suggested configurations shown in table 2-1.

**Table 2-1**

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## Suggested Configurations and Characteristics

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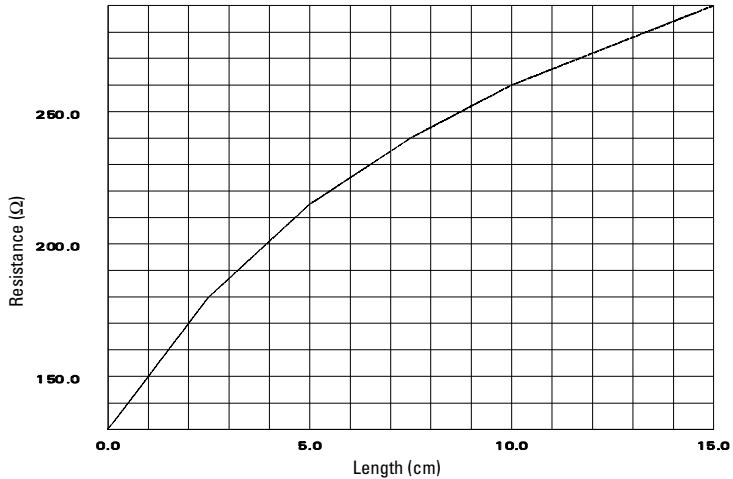
Configuration	Bandwidth	Rise time	Input C	Minimum $ Z_{in} $
110 $\Omega$ Resistive Signal Pin (green) and Solderable Ground Socket	> 1.5 GHz	< 235 ps	0.9 pF	125 $\Omega$
130 $\Omega$ Resistive Signal Pin (orange) and Ground Blade	1.7 GHz	205 ps	0.8 pF	165 $\Omega$
5 cm Resistive Signal Leads and Solderable SMT or Through-hole Ground Pin	1.4 GHz	250 ps	1.2 pF	230 $\Omega$
Socket-end 10 cm Resistive Signal Lead and Solderable SMT or Through-hole Ground Pin	850 MHz	410 ps	1.8 pF	275 $\Omega$

Each suggested configuration is optimized for flattest response and highest input impedance. For response, this means that the waveform at the output of the probe will be as close as possible to the waveform at the input of the probe without introducing overshoot, ringing, or other unwanted perturbations. For input impedance, this means that the input impedance is as high as possible throughout the entire bandwidth of the probe, thus never resonating low due to

the parasitics of the physical connection. Even when using the socket-end 10 cm resistive signal lead, the response and input impedance of the probe are very well behaved.

Other signal lead lengths may be used with this probe but a resistance value needs to be determined from the following figure and a resistor of that value needs to be placed as close as possible to the point being probed.

#### Optimum Damping Resistor Value Versus Signal Lead Length

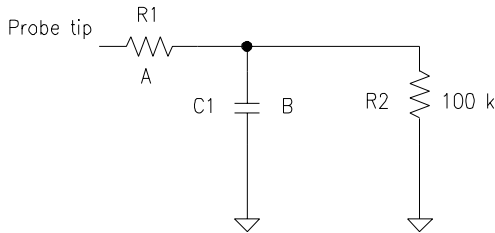


If a resistor is not used, the response of the probe will be very peaked at high frequencies. This will cause overshoot and ringing to be introduced in the step response of waveforms with fast rise times. Use of this probe without a resistor at the point being probed should be limited to measuring only waveforms with slower rise times.

## Operating the Probe

When simulating circuits that include a load model for the probe, a simplified model of the probes input impedance can usually be used. The following figure and table contain the information for the simplified model of the probe. For more accurate load models, see the following sections.

### Simplified probe input impedance model



**Table 2-2**

<b>Configuration</b>	<b>A</b>	<b>B</b>
110 $\Omega$ Resistive Signal Pin (green) and Solderable Ground Socket	125 $\Omega$	0.9 pF
130 $\Omega$ Resistive Signal Pin (orange) and Ground Blade	165 $\Omega$	0.8 pF
5 cm Resistive Signal Leads and Solderable SMT or Through-hole Ground Pin	230 $\Omega$	1.2 pF
Socket-end 10 cm Resistive Signal Lead and Solderable SMT or Through-hole Ground Pin	275 $\Omega$	1.8 pF



## Hints for connecting the probe to the point being measured

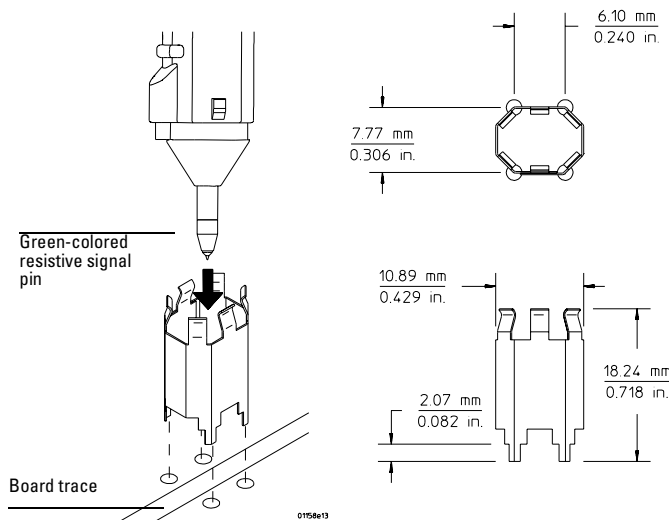
The suggested connection configurations are listed in order of performance. The smallest physical connection to the point being probed produces the highest bandwidth and the largest physical connection produces the lowest bandwidth. Although bandwidth and rise time degrades with the larger connections, each configuration is optimized to produce a flat response. None of the suggested configurations introduce overshoot or ringing into the waveform being measured.

### 110 Ohm Resistive Signal Pin (Green) and Solderable Ground Socket

This configuration produces the best probe performance of > 1.5 GHz or rise times of < 234 ps. The Ground Socket does not come with your probe but can be ordered from Agilent Technologies as part number E2637A.

The Ground Socket comes with a green-colored 110 Ω resistive signal pin which should be used only when using the Ground Socket.

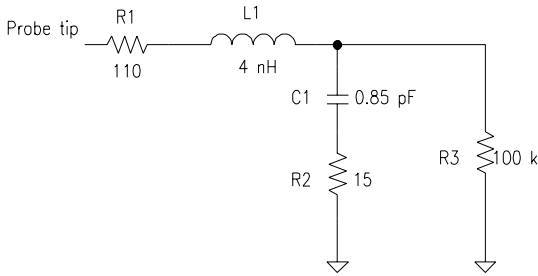
#### 110 Ω resistive signal pin (green) and solderable ground socket



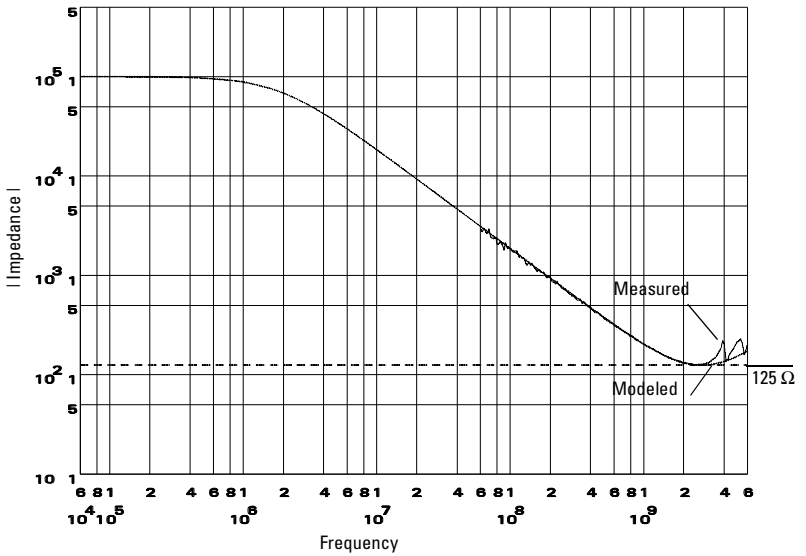
The 1156A probe has an input impedance which varies with frequency. The following schematic shows the circuit model for the input impedance of the probe when using the 110 Ω resistive signal pin (green) and solderable ground socket.

**110 Ohm Resistive Signal Pin (Green) and Solderable Ground Socket**

**110 Ω Resistive Signal Pin (green) and Solderable Ground Socket Input Impedance Model**



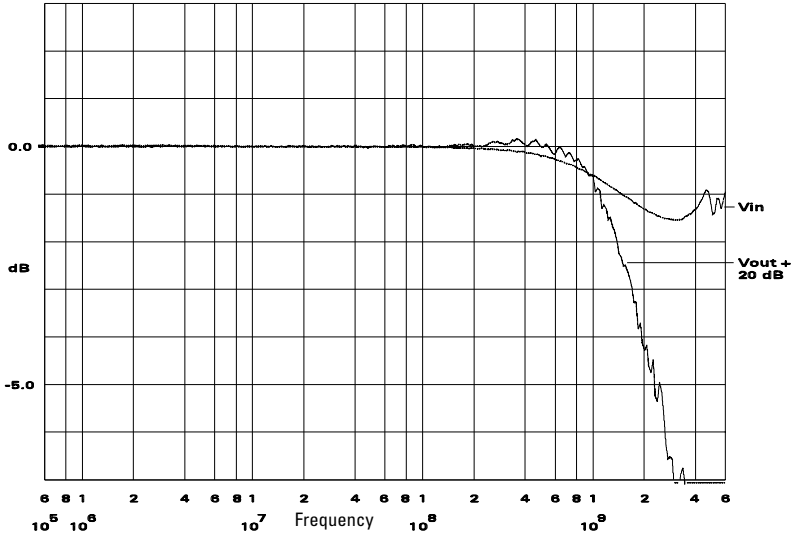
**Magnitude Plot of Probe Input Impedance Versus Frequency**



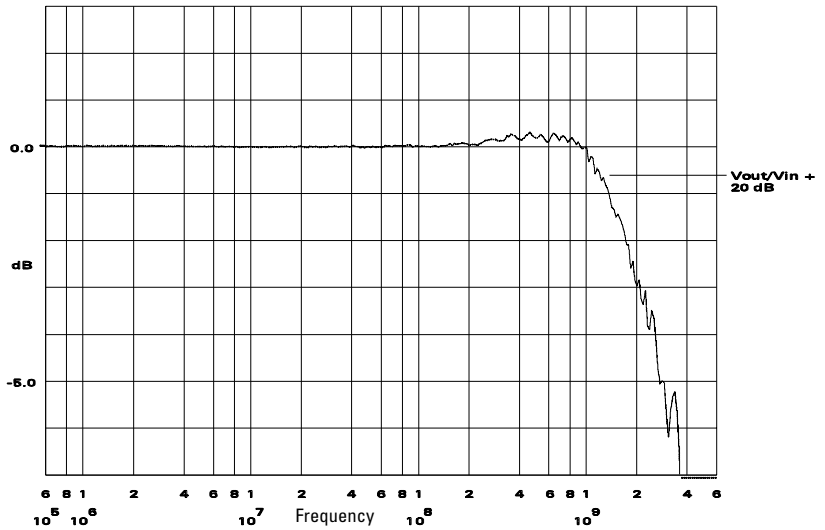
# Operating the Probe

## 110 Ohm Resistive Signal Pin (Green) and Solderable Ground Socket

Graph of  $V_{in}$  to Probe and  $V_{out}$  of Probe with a  $25\ \Omega$  Source

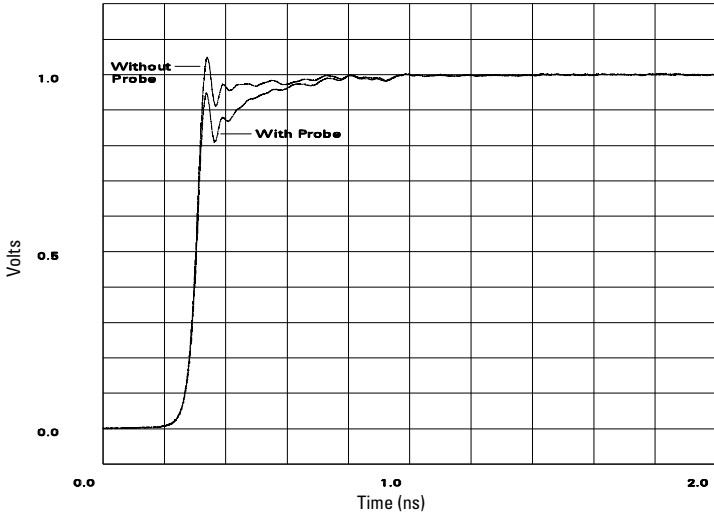


$V_{out}/V_{in}$  Frequency Response

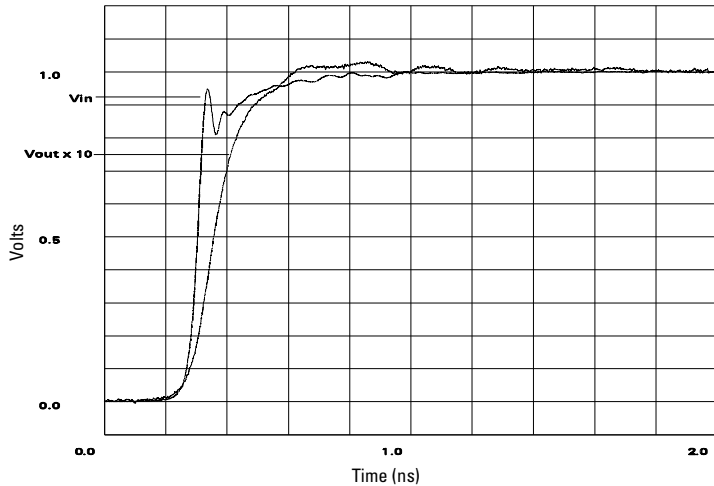


All probes have a loading effect on a circuit when they come in contact with the circuit. The following graph shows how the 110  $\Omega$  resistive signal pin (green) and solderable ground socket configuration affect a step from a 25  $\Omega$  source.

**25  $\Omega$  Step Generator With and Without Probe Connected**



**Vin and Vout of Probe**

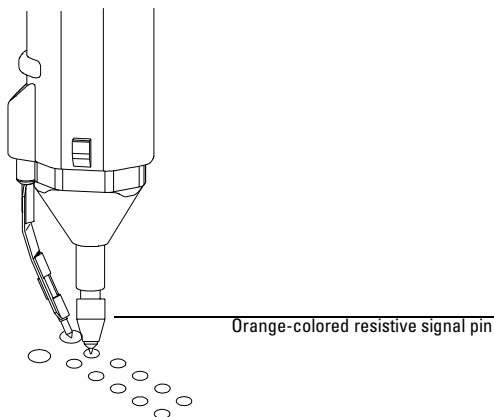


This is not the step response of the probe. The step response of a probe is the output of a probe while the input is a perfect step.

## 130 Ohm Resistive Signal Pin (Orange) and Ground Blade Assembly

This configuration is ideal for general purpose probing of circuit boards with high frequency analog or digital waveforms. This configuration produces a probing bandwidth of 1.7 GHz or rise time of 205 ps.

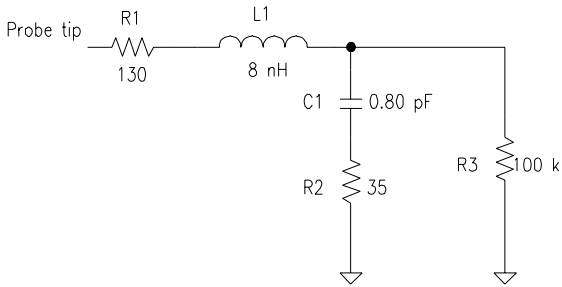
**Probing using the 130  $\Omega$  resistive signal pin (orange) and ground blade assembly**



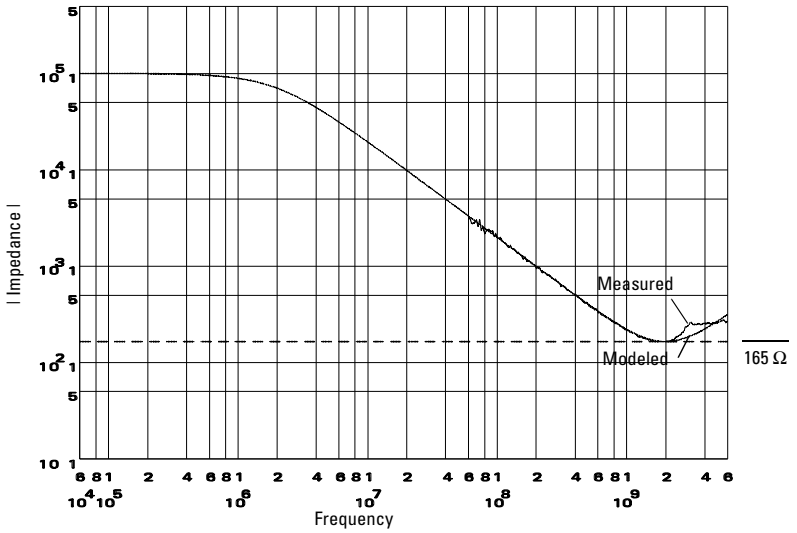
The 1156A probe has an input impedance which varies with frequency. The following schematic shows the circuit model for the input impedance of the probe when using the 130  $\Omega$  resistive signal pin (orange) and ground blade.

### 130 Ohm Resistive Signal Pin (Orange) and Ground Blade Assembly

#### 130 Ω Resistive Signal Pin (Orange) and Ground Blade Input Impedance Model



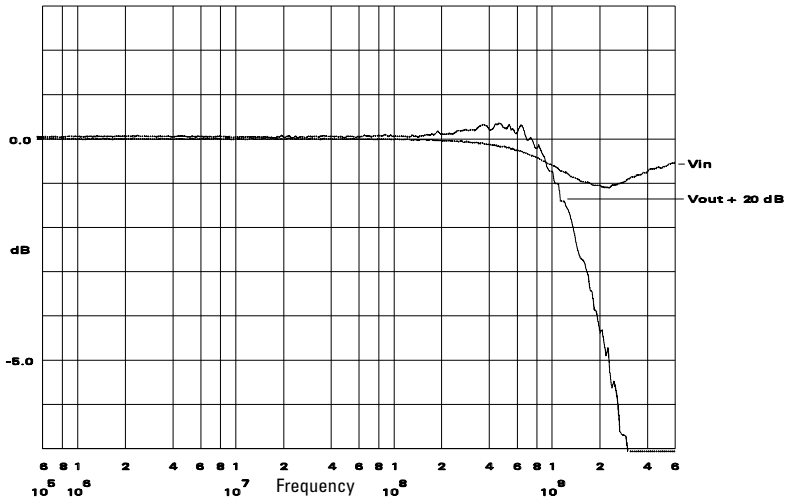
#### Magnitude Plot of Probe Input Impedance Versus Frequency



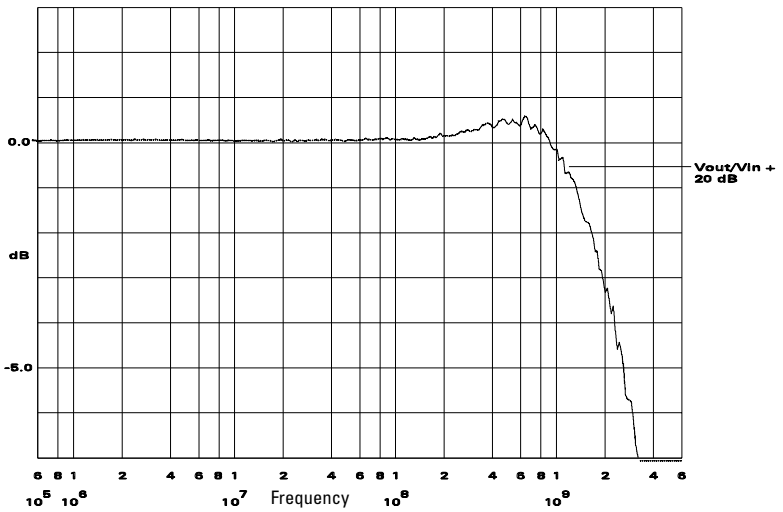
## Operating the Probe

### 130 Ohm Resistive Signal Pin (Orange) and Ground Blade Assembly

Graph of  $V_{in}$  to Probe and  $V_{out}$  of Probe with  $25\ \Omega$  Source

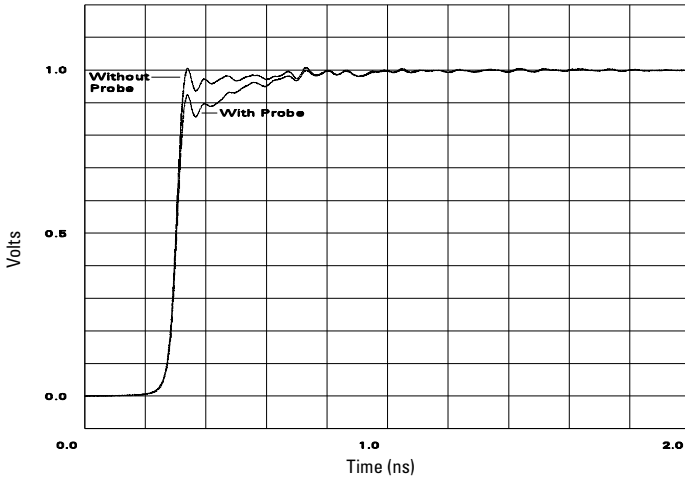


$V_{out}/V_{in}$  Frequency Response

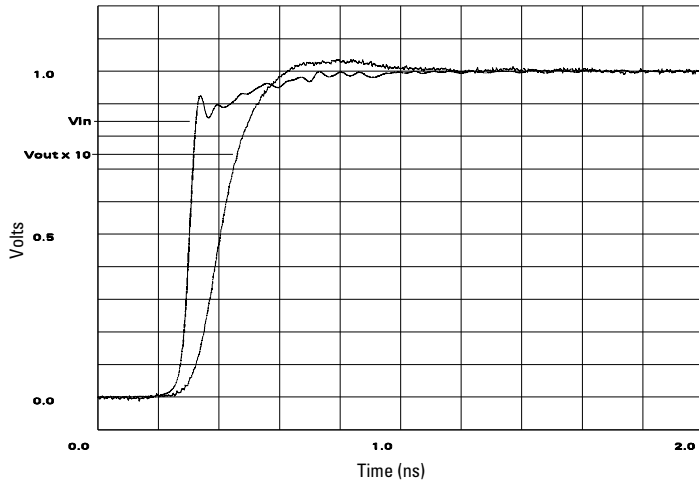


All probes have a loading effect on a circuit when they come in contact with the circuit. The following graph shows how the 130  $\Omega$  resistive signal pin (orange) and ground blade assembly configuration affect a step from a 25  $\Omega$  source.

**25  $\Omega$  Step Generator With and Without Probe Connected**



**Vin and Vout of Probe**



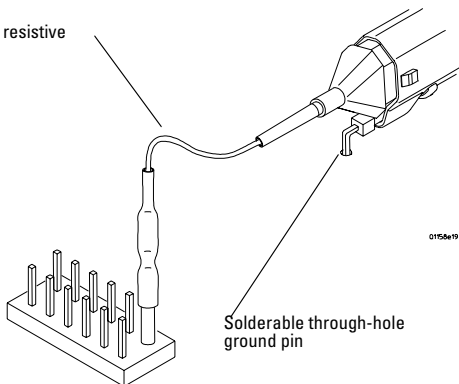
This is not the step response of the probe. The step response of a probe is the output of a probe while the input is a perfect step.

## 5 cm Resistive Signal Leads and Solderable SMT or Solderable Through-hole Ground Pin

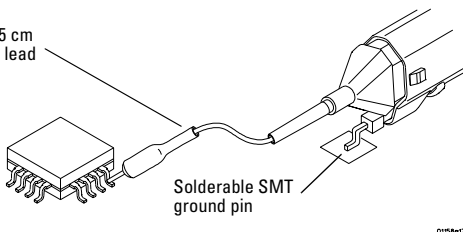
These configurations are used to attach the probe to a round or a square pin of a header or to solder to the legs of a device under test. This configuration produces a probing bandwidth of 1.4 GHz or rise time of 250 ps.

### Probing using the socket-end 5 cm resistive signal lead and solderable-tip 5 cm resistive signal lead

Socket-end 5 cm resistive signal lead



Solderable-tip 5 cm resistive signal lead



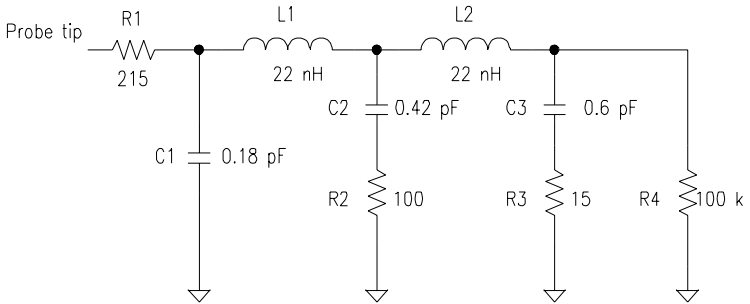
Any combination of 5 cm signal leads and ground pins can be used. Also, if you need to bend the signal pin where it enters the probe you can do this one time without breaking the pin. Be sure to remove the pin from the probe before you bend it.

When using this configuration, always make the ground connection as short as possible. Length in the ground connection makes the response of the probe dependent on the position of the probe, the position of the probe cable and many other variables, hence it makes the response of the probe unrepeatable. Also, keep the signal wire away from AC ground, other components, or your fingers. The damping resistor is optimized assuming that the signal wire is far from AC ground. The properly damped 5 cm wire with a very short ground connection produces a high quality, repeatable 1.4 GHz probe.

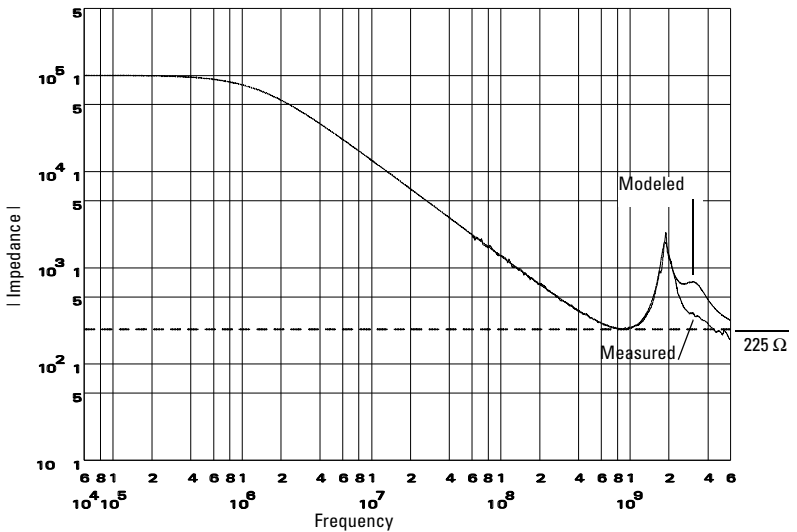
**5 cm Resistive Signal Leads and Solderable SMT or Solderable Through-hole Ground Pin**

The 1156A probe has an input impedance which varies with frequency. The following schematic shows the circuit model for the input impedance of the probe when using the 5 cm resistive signal lead and a solderable smt or through-hole ground lead.

**5 cm Resistive Signal Lead Input Impedance Model**



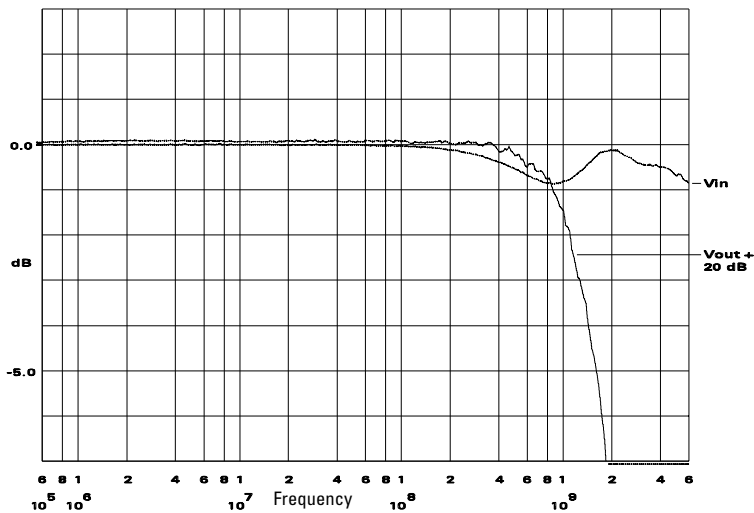
**Magnitude Plot of Probe Input Impedance Versus Frequency**



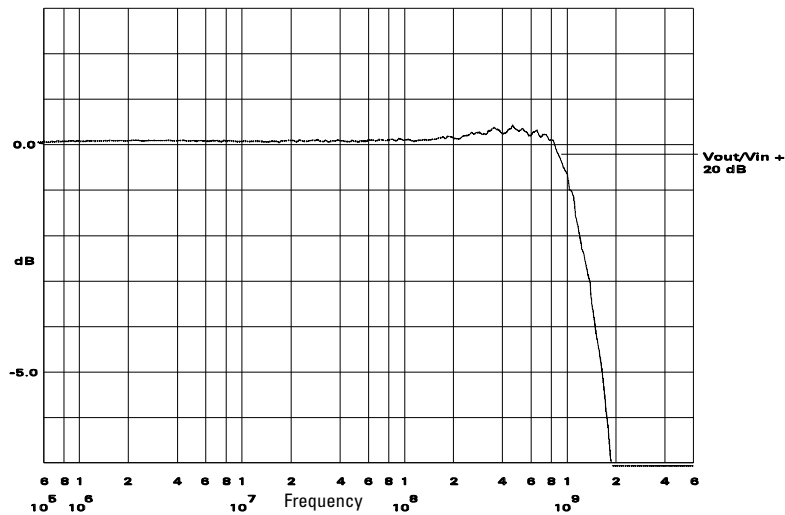
## Operating the Probe

### 5 cm Resistive Signal Leads and Solderable SMT or Solderable Through-hole Ground Pin

#### Graph of $V_{in}$ to Probe and $V_{out}$ of Probe with a $25\ \Omega$ Source

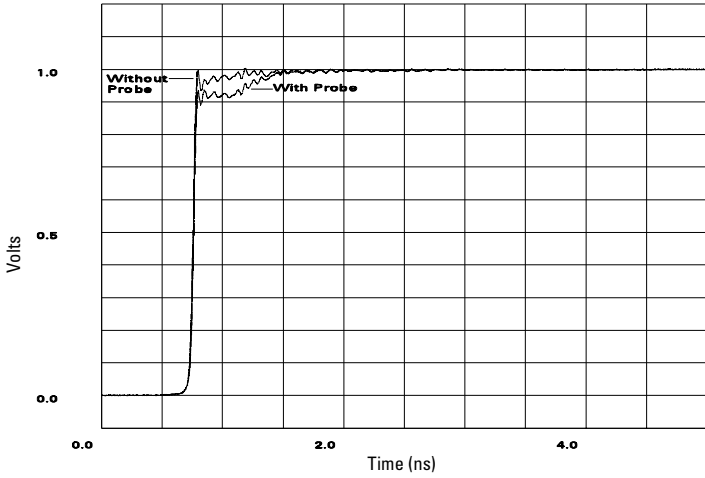


#### $V_{out}/V_{in}$ Frequency Response

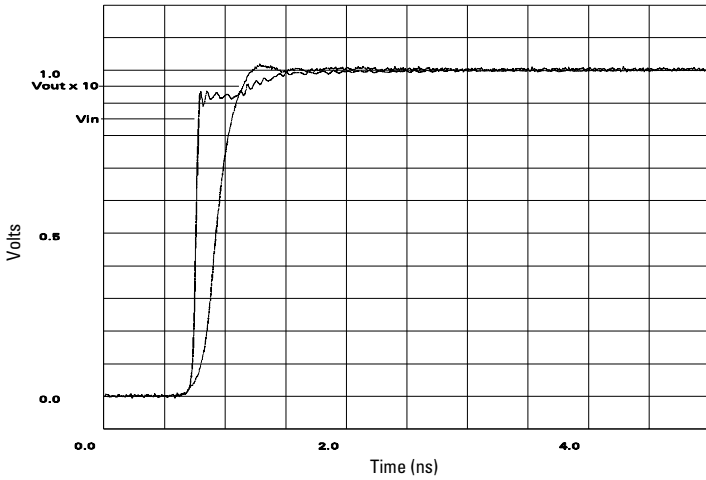


All probes have a loading effect on a circuit when they come in contact with the circuit. The following graph shows how the 5 cm resistive signal lead and a solderable smt or through-hole ground lead configuration affect a step from a  $25\ \Omega$  source.

25  $\Omega$  Step Generator With and Without Probe Connected



Vin and Vout of Probe

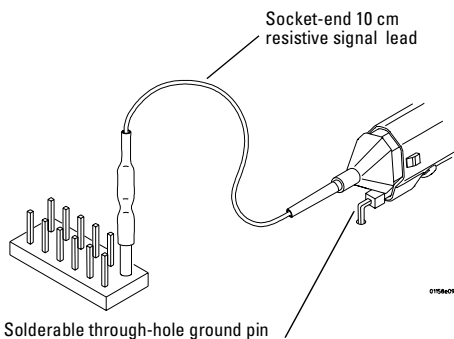


This is not the step response of the probe. The step response of a probe is the output of a probe while the input is a perfect step.

## Socket-end 10 cm Resistive Signal Lead and Solderable SMT or Solderable Through-hole Ground Pin

This configuration is used to attach the probe to a round pin of a header, a square pin of a header, or a soldered in pin. This configuration produces a probing bandwidth of 850 MHz or rise time of 410 ps.

**Figure 2-1**



### Probing using the socket-end 10 cm resistive signal lead

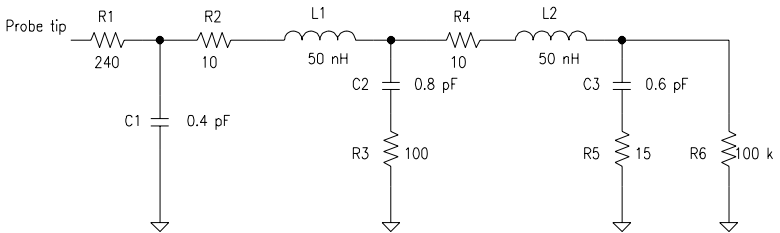
Either ground pin can be used. Also, if you need to bend the pin you can do this one time without breaking the signal pin where it enters the probe. Be sure to remove the pin from the probe before you bend it.

When using this configuration, always make the ground connection as short as possible. Length in the ground connection makes the response of the probe dependent on the position of the probe, the position of probe cable and many other variables, hence it makes the response of the probe unrepeatable. Also, keep the signal wire away from AC ground, other components, or your fingers. The damping resistor is optimized assuming that the signal wire is far from AC ground. The properly damped 10 cm wire with a very short ground connection produces a high quality, repeatable 850 MHz probe.

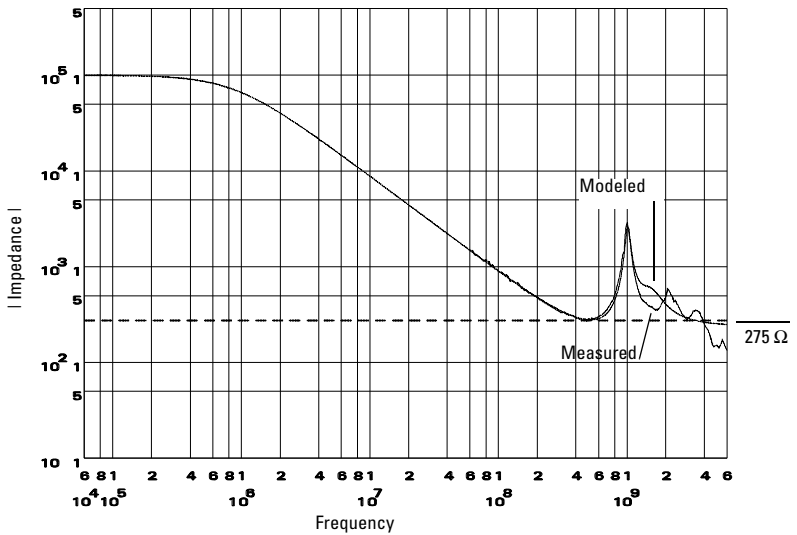
**Socket-end 10 cm Resistive Signal Lead and Solderable SMT or Solderable Through-hole Ground Pin**

The 1156A probe has an input impedance which varies with frequency. The following schematic shows the circuit model for the input impedance of the probe when using the socket-end 10 cm resistive signal lead and a solderable smt or through-hole ground lead.

**10 cm Resistive Signal Lead Input Impedance Model**



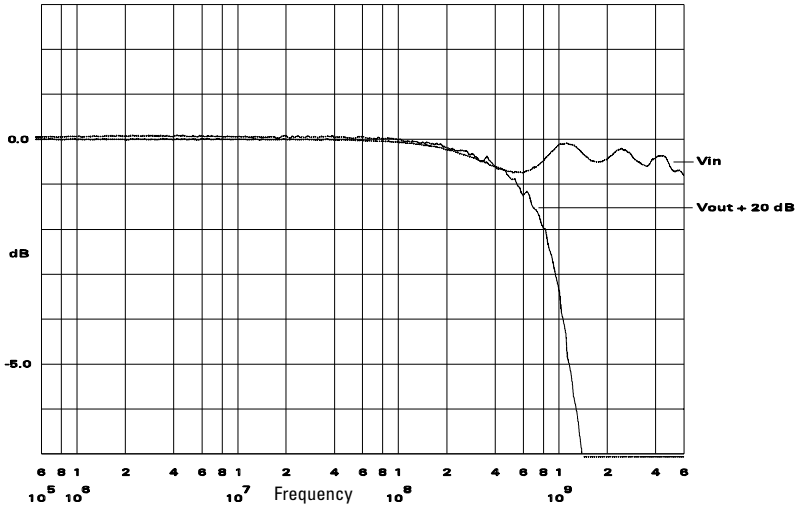
**Magnitude Plot of Probe Input Impedance Versus Frequency**



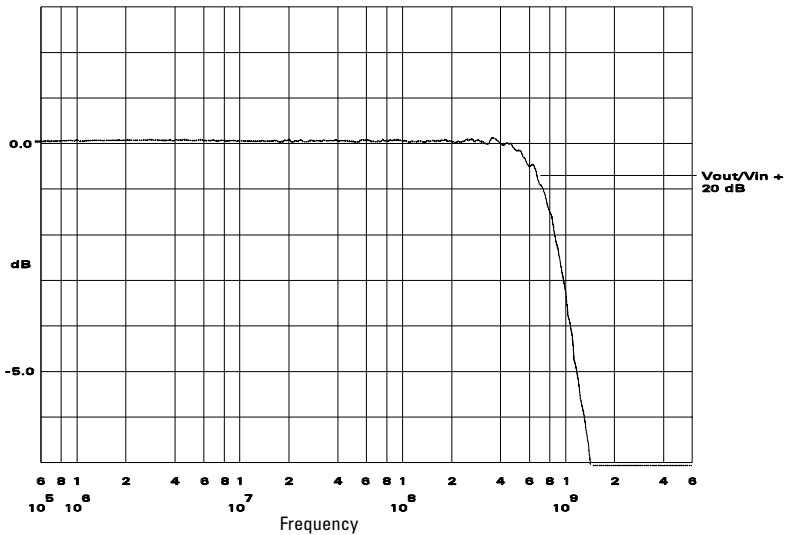
## Operating the Probe

### Socket-end 10 cm Resistive Signal Lead and Solderable SMT or Solderable Through-hole Ground Pin

#### Graph of $V_{in}$ to Probe and $V_{out}$ of Probe with a $25\ \Omega$ Source

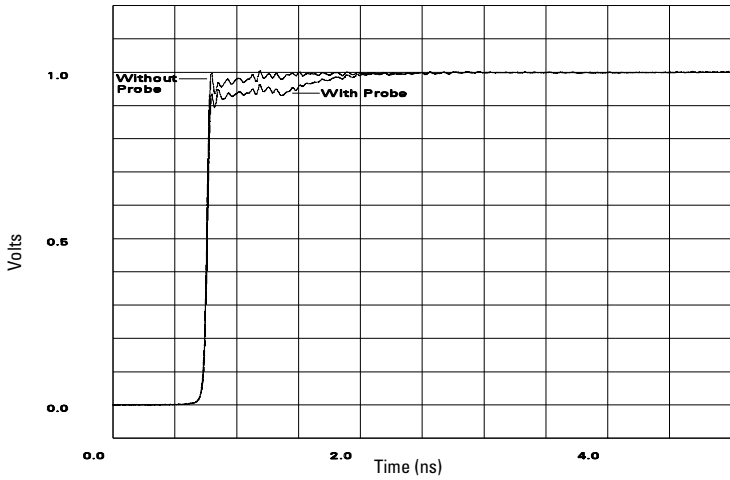


#### $V_{out}/V_{in}$ Frequency Response

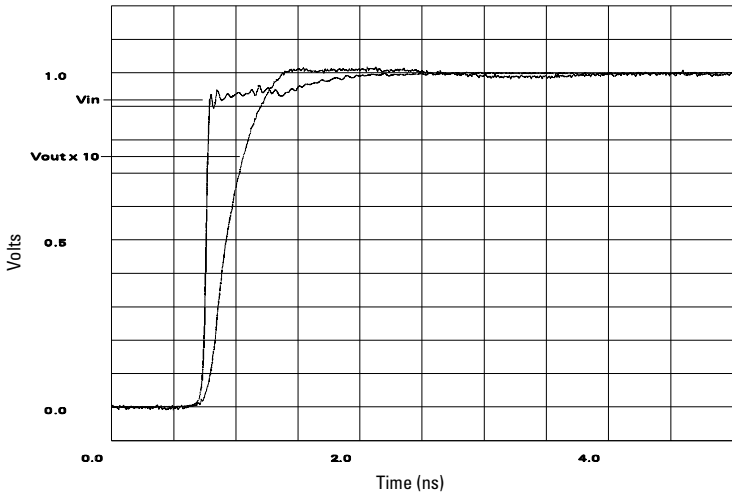


All probes have a loading effect on a circuit when they come in contact with the circuit. The following graph shows how the 10 cm resistive signal lead and a solderable smt or through-hole ground lead affect a step from a  $25\ \Omega$  source.

**25  $\Omega$  Step Generator With and Without Probe Connected**



**Vin and Vout of Probe**



This is not the step response of the probe. The step response of a probe is the output of a probe while the input is a perfect step.

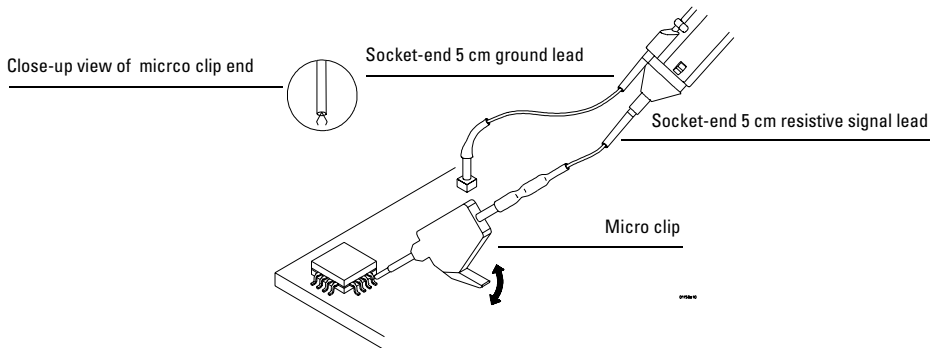
---

## Micro Clip

The Micro Clip is used when easy to connect, hands-free probing of a circuit is required. The Micro Clip can be used on the signal lead, the ground lead, or both.

Although this configuration is damped, it is not optimally damped and should not be used to measure waveforms with rise times less than 1 ns

Figure 2-2



Probing using the micro clip

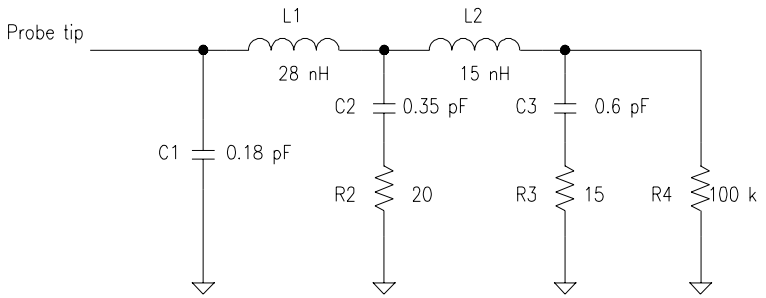
---

## Undamped Accessories

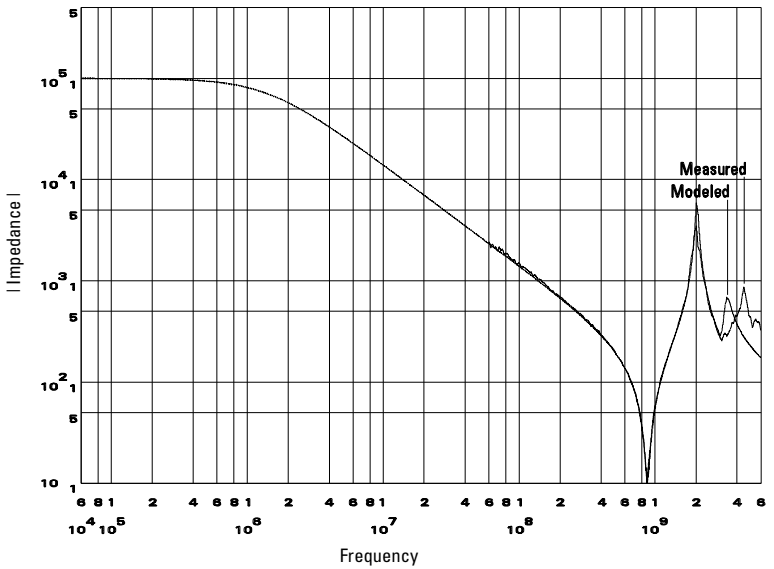
Probes are often used with accessories that do not contain a damping resistor located at the point being probed. As an example, the accessory might be a lead wire provided with a probe or hand made by the user of a probe. All high bandwidth probes suffer from excessive overshoot and ringing when used with undamped accessories.

In order to illustrate the problems that arise due to the use of undamped accessories, the response of an 1158A with an undamped 5cm signal lead wire is shown on the following pages. The responses shown are very similar to the response of ANY high bandwidth probe that is using an undamped 5cm signal lead wire.

**5 cm Undamped Signal Wire Lead**



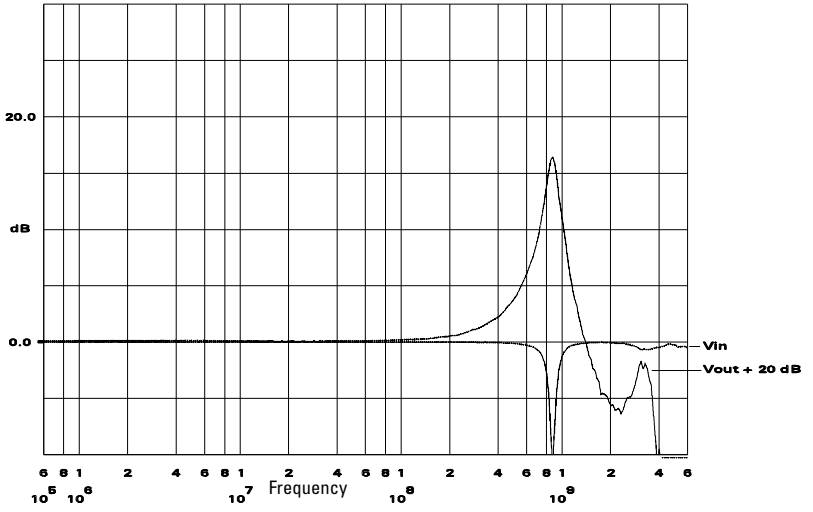
**Magnitude Plot of Probe Input Impedance Versus Frequency**



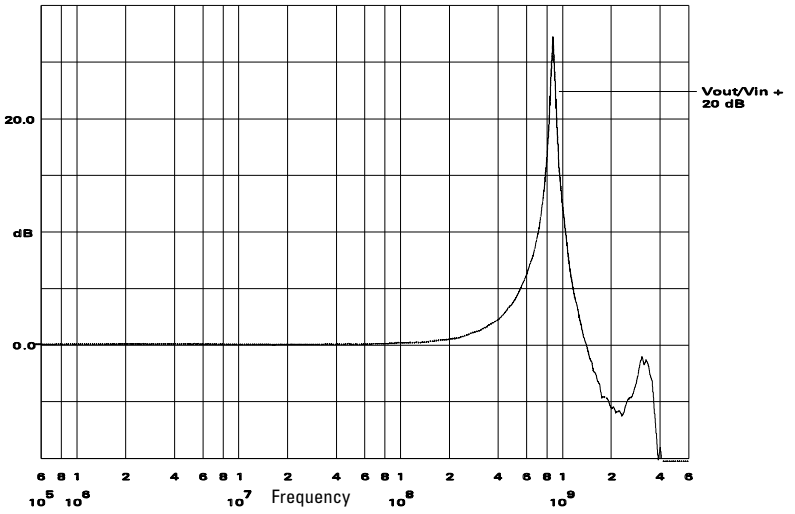
# Operating the Probe

## Undamped Accessories

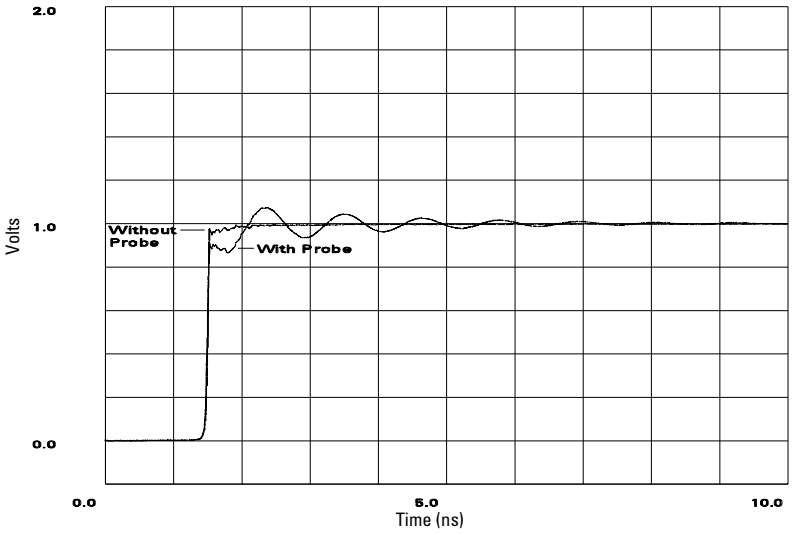
### Graph of $V_{in}$ to Probe and $V_{out}$ of Probe with a $25\ \Omega$ Source



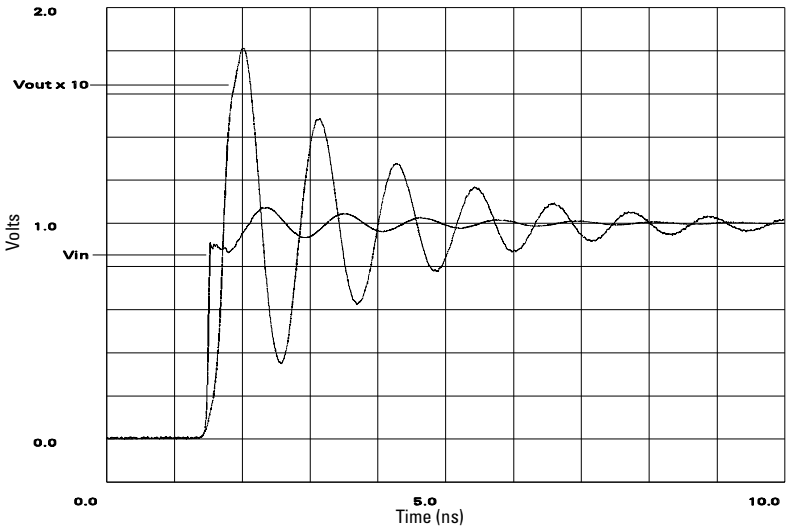
### $V_{out}/V_{in}$ Frequency Response



**25  $\Omega$  Step Generator With and Without Probe Connected**



**Vin and Vout of Probe**







---

# Introduction

This chapter provides service information for the 1156A Active Probe. The following sections are included in this chapter:

- Service strategy
- Returning to Agilent Technologies for service
- Troubleshooting and failure symptoms

---

## Service Strategy

The 1156A Active Probe is a high frequency device with many critical relationships between parts. For example, the frequency response of the amplifier on the hybrid is trimmed to match the output coaxial cable. As a result, to return the probe to optimum performance requires factory repair. If the probe is under warranty, normal warranty services apply. If the probe is not under warranty, a failed probe can be exchanged for a reconditioned one at a nominal cost.

## To return the probe to Agilent Technologies for service

Before shipping the probe to Agilent Technologies, contact your nearest Agilent Technologies Sales Office for additional details.

**1 Write the following information on a tag and attach it to the probe.**

- Name and address of owner
- probe model number
- probe serial number
- Description of the service required or failure indications

**2 Remove all accessories from the probe.**

Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.

**3 Protect the probe by wrapping it in plastic or heavy paper.**

**4 Pack the probe in foam or other shock absorbing material and place it in a strong shipping container.**

You can use the original shipping materials or order materials from an Agilent Technologies Sales Office. If neither are available, place 3 to 4 inches of shock absorbing material around the probe and place it in a box that does not allow movement during shipping.

**5 Seal the shipping container securely.**

**6 Mark the shipping container as FRAGILE.**

In any correspondence, refer to probe by model number and full serial number.

## Troubleshooting

- If your probe is under warranty and requires repair, return it to Agilent Technologies. Contact your nearest Agilent Technologies Service Center.
  - If the failed probe is not under warranty, you may exchange it for a reconditioned probe. See "To Prepare the Probe for Exchange" in this chapter.
- 

## Failure Symptoms

The following symptoms may indicate a problem with the probe or the way it is used. Possible remedies and repair strategies are included.

The most important troubleshooting technique is to try different combinations of equipment so you can isolate the problem to a specific probe.

### **Probe Calibration Fails**

Probe calibration failure with an oscilloscope is usually caused by improper setup. If the calibration will not pass, check the following:

- Check that the probe passes a waveform with the correct amplitude.
- If the probe is powered by the oscilloscope, check that the offset is approximately correct. The probe calibration cannot correct major failures.
- Be sure the oscilloscope passes calibration without the probe.

### **Incorrect High Frequency Response**

Incorrect high frequency response may be caused by a defective probe, oscilloscope, or an improper use such as poor connections or grounding. See chapter 3, in this guide. If the probe use is correct, try the probe with another oscilloscope.

If the probe appears ac coupled at a high frequency, check for a loose probe tip. The high frequency response of the probe is determined by the accessories used to connect the probe, the amplifier hybrid in the probe, and the probe cable.

**If the probe fails to meet the bandwidth specification, factory repair is necessary. Also read "Incorrect Pulse Response" below.**

### **Incorrect Low Frequency Response (pulse flatness)**

If the probe's pulse response shows a top that is not flat (incorrect ac gain), it is most likely caused by an inaccurate 50  $\Omega$  load on the probe. The probe is designed to work into a 50  $\Omega$  load that is accurate within 1.0% ( $\pm 0.5 \Omega$ ). Check the value of the load you are using before you suspect the probe. If the load is accurate, the gain problem with the probe will have to be repaired by the factory. If the probe appears ac coupled at a high frequency, check for a loose or damaged probe tip.

### **Incorrect Input Resistance**

First, check that the probe tip is not loose. The input resistance is determined in the amplifier hybrid in the probe and cannot be repaired in the field. The probe must be returned to the factory for repair.

### **Incorrect Offset**

Incorrect offset can be caused by a misadjusted offset zero (see "Offset Will Not Zero" below) or lack of probe calibration with the oscilloscope.

### **Offset Will Not Zero**

With the input voltage set to 0.0 V and no offset setting, the dc output of the probe should be within  $\pm 3$  mV.

If the probe is connected to an Infiniium oscilloscope, the oscilloscope will calibrate out the offset zero error during a probe calibration. If the offset error cannot be calibrated out, return it to Agilent Technologies for repair.

---

## Verifying probe input resistance

Specification: 100 k $\Omega$   $\pm$ 1%

---

### Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Digital Multimeter (DMM)	Resistance $\pm$ 1%	34401A

- 1 Connect the DMM probes between the probe tip and the ground at the tip of the probe.
- 2 Set up the DMM to measure resistance.  
The resistance should read 100 k $\Omega$   $\pm$ 1 k $\Omega$ .
- 3 Record the resistance.  
Input resistance \_\_\_\_\_.

---

## To test dc gain accuracy

This test checks the dc gain accuracy of the probe. The oscilloscope used in this test accounts for the dc probe attenuation of 10:1. The probe must be calibrated on the oscilloscope to achieve the following result.

Specification =  $\pm 1.0\%$

Equipment	Critical Specification	Part Number
Power Supply	5 Vdc	6114A
DMM	Better than 0.1% accuracy	3458A
Oscilloscope	For Probe Power and Measurements	54846A
Adapter	BNC Male to Safety Hooks	PE33561-12 (Pasternick Enterprises)
Adapter	BNC Female to Banana Male	1251-2277
Probe Accessories (See figure 1-2 on page 8)	Solderable through-hole ground pin (3g) Socket-end 5 cm ground lead (6g)	1252-7150 01156-82104

- 1 Set power supply for 5.0 V and verify with DVM.
- 2 Connect the probe to the oscilloscope.
- 3 Using the probe accessories solderable through-hole ground pin and the socket-end 5 cm ground lead, connect the input of the probe to the safety hooks of the PE33561-12.
- 4 Connect the BNC side of the PE33561-12 to the BNC side of the 1251-2277.
- 5 Connect the banana side of the 1251-2277 to the power supply.
- 6 Set oscilloscope offset to 2.5 V and the volts per division to 1.0 V using the channel menu.
- 7 Read and record the voltage reading on the oscilloscope. \_\_\_\_\_ V
- 8 Short the input pin to the shield of the probe. Record the voltage reading on the oscilloscope. \_\_\_\_\_ mV
- 9 Subtract step 8 from step 7. \_\_\_\_\_ V
- 10 Calculate dc gain.  $Dcgain = ((\text{Result from step 9}) / (5.00 \text{ V})) = \underline{\hspace{2cm}}$
- 11 The result should be between 0.974 and 1.026.

**To test offset to 0.0 V****To test offset to 0.0 V**

<b>Equipment</b>	<b>Critical Specification</b>	<b>Part Number</b>
Oscilloscope	For Probe Power and Measurements	54846A
Probe Accessories (See figure 1-2 on page 8)	Socket-end 5 cm ground lead (6g)	01156-82104

- 1** Set oscilloscope offset to 0.0 V using the channel menu.
- 2** Connect probe to oscilloscope.
- 3** Short the input pin to the shield of the probe using the accessory socket-end 5 cm ground lead.
- 4** The oscilloscope should still be reading 0.0 V

**To test offset accuracy**

This test checks the offset accuracy of the probe

Specification =  $\pm 1.0\%$  of reading

<b>Equipment</b>	<b>Critical Specification</b>	<b>Part Number</b>
Power Supply	5Vdc	6114A
DMM	Better than .1% accuracy	3458A
Oscilloscope	For Probe Power and Measurements	54846A
Adapter	BNC Male to Safety Hooks	PE33561-12 (Pasternick Enterprises)
Adapter	BNC Female to Banana Male	1251-2277
Probe Accessories (See figure 1-2 on page 8)	Solderable through-hole ground pin (3g) Socket-end 5 cm ground lead (6g)	1252-7150 01156-82104

- 1** Connect probe to the oscilloscope and a 5.0 V supply as shown in the dc gain accuracy test, page 49.
- 2** Set the channel offset to 5.0 V on the oscilloscope and 200 mV per division.
- 3** Readjust the trace so it is as close to the centerline as possible after signal has settled.
- 4** Record the position voltage. \_\_\_\_\_V
- 5** The result from step 4 should be between 4.884 V and 5.116 V.

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# DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

**Manufacturer's Name:** Agilent Technologies, Inc.

**Manufacturer's Address:** 1900 Garden of the Gods Road  
Colorado Springs, Colorado  
80907 U.S.A.

## Declares, that the product

**Product Name:** Active Probe for Infiniium Oscilloscope Family

**Model Number(s):** 1156A, 1157A, and 1158A

**Product Option(s):** This declaration covers all options of the above product

## Conforms to the following product standards:

EMC	Standard	Limit
	IEC 61326-1:1997+A1:1998/EN 61326-1:1997+A1:1998	
	CISPR 11:1990 / EN 55011:1991	Group 1, Class A <sup>[1]</sup>
	IEC 61000-4-2:1995+A1:1998/EN 61000-4-2:1995	4kV CD, 8kV AD
	IEC 61000-4-3:1995/EN 61000-4-3:1995	3V/m, 80-1000 MHz
	IEC 61000-4-4:1995/EN 61000-4-4:1995	0.5kV signal lines, 1kV power lines
	IEC 61000-4-6:1996/EN 61000-4-6:1996	3V, 0.15-80 MHz
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
<b>Safety</b>	IEC 61010-1:1990+A1:1992+A2:1995/EN 61010-1:1993+A1:1995	
	Canada: CSA-C22.2 No. 1010.1:1992	

## Conformity/Supplemental Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE-marking accordingly (European Union).

<sup>[1]</sup>This product was tested in a typical configuration with Agilent Technologies test systems.

Date: 07/19/2001

  
\_\_\_\_\_  
Ken Wyatt/Product Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent, or distributor.

# Product Regulations

EMC		Performance Criteria
	IEC 61326-1:1997+A1:1998/EN 61326-1:1997+A1:1998	
	CISPR 11:1990 / EN 55011:1991	
	IEC 61000-4-2:1995+A1:1998/EN 61000-4-2:1995	B
	IEC 61000-4-3:1995/EN 61000-4-3:1995	B
	IEC 61000-4-4:1995/EN 61000-4-4:1995	A
	IEC 61000-4-6:1996/EN 61000-4-6:1996	N/A
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
Safety	IEC 61010-1:1990+A1:1992+A2:1995/EN 61010-1:1993+A1:1995	
	Canada: CSA-C22.2 No. 1010.1:1992	



## Additional Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE-marking accordingly (European Union).

## Performance Criteria:

- A Pass - Normal operation, no effect.
- B Pass - Temporary degradation, self recoverable.
- C Pass - Temporary degradation, operator intervention required.
- D Fail - Not recoverable, component damage.

**Sound Pressure Level**      N/A

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### Document Warranty

The information contained in this document is subject to change without notice.

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Agilent Technologies shall not be liable for errors contained herein or for damages in connection with the furnishing, performance, or use of this material.

### Safety

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. This is a Safety Class I instrument (Provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

### 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.

- 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 fuseholders. To do so could cause a shock of fire hazard.

- Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- If you energize this instrument by an auto transformer (for voltage reduction), make sure the common terminal is connected to the earth terminal of the power source.
- Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.
- Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
- Do not install substitute parts or perform any unauthorized modification to the instrument.
- Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.
- Use caution when exposing or handling the CRT. Handling or replacing the CRT shall be done only by qualified maintenance personnel.

### Safety Symbols



Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.



Hazardous voltage symbol.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

### WARNING

The Warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.

### CAUTION

The Caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a Caution symbol until the indicated conditions are fully understood or met.

---

### **Product Warranty**

This Agilent Technologies product has a warranty against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. For products returned to Agilent Technologies for warranty service, the Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country. Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instructions when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument software, or firmware will be uninterrupted or error free.

### **Limitation of Warranty**

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

**No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability or fitness for a particular purpose.**

### **Exclusive Remedies**

The remedies provided herein are the buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

### **Assistance**

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products. For any assistance, contact your nearest Agilent Technologies Sales Office.

### **Certification**

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

### **About this edition**

This is the *1156A 4 GHz Active Probe User's Guide*.

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New editions are complete revisions of the manual. Many product updates do not require manual changes; and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.









**Agilent Technologies**

**User's Guide**

Agilent Technologies  
Printed in the USA  
Manual Part Number  
01156-97000

