

# **Agilent 54006A High Frequency Probe**

## **User's Guide**

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## Notices

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## Safety Notices

### CAUTION

Caution denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

### WARNING

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

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## The Agilent 54006A—at a glance

The Agilent 54006A high frequency probe provides passive probing of high speed logic circuits and low impedance circuits. The major advantage of this probe is the small amount of capacitive probe tip loading (approximately 250 fF). This makes it possible to probe high frequency circuits without disturbing the circuit with a large capacitive load. Two probe body assemblies are provided with the 54006A giving you the choice of 10:1 and 20:1 probe tip division ratios that may be used with any 50 ohm input instrument. The 20:1 probe assembly is 5 mm (0.2 in.) longer than the 10:1 probe assembly.



### Contents

Unpacking the Probe	4
Using the Probe	5
To replace the probe resistor	6
To protect against electrostatic damage	7
Specifications and Characteristics	9
Replaceable Parts	12
Contacting Agilent	13
Preparing the probe for shipping	13

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## Unpacking the Probe

- 1 Inspect the shipment including the shipping container and probe for damage.

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### CAUTION

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Do not bend the coaxial cable to a radius of less than 1 in (2.54 cm) or internal damage to the cable may occur.

- 2 Locate the shipping list. Verify that you received all the accessories on this list, and all the options that you ordered. The following list shows some of the items that may be on the shipping list. The information on your actual shipping list is more accurate and should supersede the information in this list.

- 10:1 probe body assembly
- 20:1 probe body assembly
- Packag of five 450 $\Omega$  resistor replacements and one sleeve
- Packag of five 950 $\Omega$  resistor replacements and one sleeve
- Coaxial cable, 91 cm (36 in.) long, SMA male connectors
- DC blocking capacitor
- SMA (f) to BNC (m) adapter

Notice that the 20:1 probe assembly is 5 mm (0.2 in.) longer than the 10:1 probe assembly.

If anything is missing or defective, contact your nearest Agilent Technologies Service Office. [Refer to “Contacting Agilent” on page 13.](#) If the shipment was damaged, contact the carrier, then contact the nearest Agilent Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Sales Office will arrange for repair or replacement at Agilent's option without waiting for claim settlement.

- 3 Select one of the probe body assemblies and attach it to either end of the coaxial cable supplied with the probe. The SMA connector can either be finger tight or torqued to 5 in. lbs.

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## Using the Probe

The 54006A high frequency probe may be used with any 50-ohm input instrument. [Figure 1](#) shows the correct technique for holding the probe while making measurements. Hold the probe by its SMA connector. Placing your hand closer to the probe tip adds capacitance to the probe and degrades the probe response.

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### CAUTION

Do not bend the coaxial cable to a radius of less than 1 in (2.54 cm) or internal damage to the cable may occur.

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**Figure 1. Correct method of holding the probe**

**Electrostatic Buildup** Before connecting the probe to the digitizing oscilloscope or digital communications analyzer, eliminate electrostatic buildup from the probe cable. Electrostatic discharge can damage the instrument's inputs. To discharge the probe cable, connect a female short to either end of the cable. Also, briefly touch a short to the instrument's input connector. Always wear a wrist strap connected to an antistatic mat. [Refer to "To protect against electrostatic damage" on page 7](#) for information on setting up a static safe workstation.

**Using the Probe****Connector Savers**

The supplied probe cable has a male connector on each end. If your instrument has a connector saver (female-to-female adapter) use it to connect the probe to the instrument's input connector. Using a connector saver prevents damage to the precision male input connectors on the instrument. The connector saver's part number is 5061-5311.

**Oscilloscope's Probe Attenuation Setting**

On the oscilloscope, change the probe attenuation setting to 10:1 or 20:1 depending on which divider you are using with the probe. The oscilloscope will now display the correct volts-per-div ranges and display the correct voltage levels when voltage measurements are made with the probe.

The resistor probe tips are precut at the factory to a recommended maximum length. This recommended length allows for a probe tip input capacitance of approximately 250 fF. Longer resistor leads add input capacitance and shorter resistor leads decrease the input capacitance. If the resistor lead is completely cut off, the probe's input capacitance will approach 100 fF.

**Probe Resistor Tips**

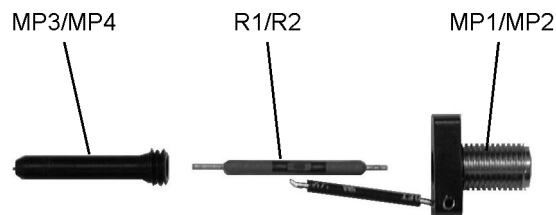
The resistor probe tips are susceptible to wear depending on the amount of usage. Because the resistor probe tips a consumable part that may require periodic replacement, a package of five resistor replacements are supplied for each of the probe tips. For instructions on ordering additional resistor replacement packages, referred to replaceable parts section. To replace a resistor probe tip, refer to ["To replace the probe resistor" on page 6](#).

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## To replace the probe resistor

To replace the resistor inside the probe assembly, perform the following steps.

- 1 If the probe is connected to an instrument, use a wrist strap which is attached to an antistatic mat. Detach the probe from the instrument.
- 2 Unscrew the probe sleeve (MP3/MP4) from the probe assembly.



**Figure 2. Probe Sleeve and Resistor**

- 3** Pull the resistor (R1/R2) out of the probe assembly.
- 4** Obtain a new resistor from the bag of five resistor replacements.
- 5** Insert the resistor lead into the center hole located on the probe assembly socket.
- 6** Screw the probe sleeve into the probe assembly.
- 7** Attach a female short to the cable's SMA connector and touch the short to any test set's connector hex nuts. Reattach the probe to the instrument.

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## To protect against electrostatic damage

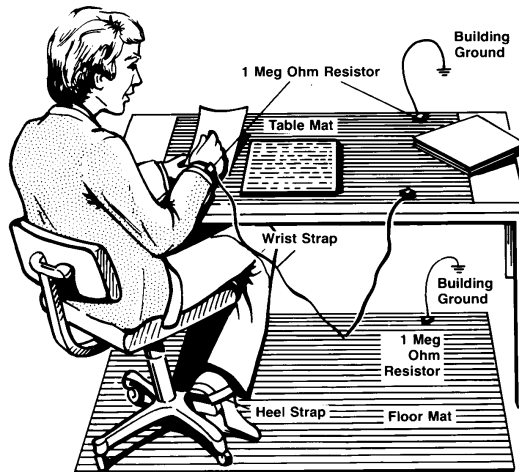
Electrostatic discharge (ESD) can damage or destroy the input circuits of an instrument that the probe is connected to. ESD can also damage or destroy electronic components that you are measuring. All work should be performed at a static-safe work station. [Figure 3 on page 8](#) shows an example of a static-safe work station (without the instrument) using two types of ESD protection:

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 M $\Omega$  of isolation from ground. Refer to [Table 1](#) for information on ordering static-safe accessories.

**Using the Probe****WARNING**

These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.



**Figure 3. Static-Safe Accessories**

**Reducing ESD  
Damage**

The following suggestions may help reduce ESD damage that occurs during testing and servicing operations.

- Personnel should be grounded with a resistor-isolated wrist strap before removing any assembly from the unit.
- Be sure all instruments are properly earth-grounded to prevent a buildup of static charge.

**Table 1. Static-Safe Accessories**

Part Number	Description
9300-0797	3M static control mat 0.6 m × 1.2 m (2 ft× 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).



## Specifications and Characteristics

This chapter lists specification and characteristics of the Agilent 54006A. Figures in this section show the *characteristic* step response of the probe. Notice that cable length affects the probe's response. Using longer or higher loss cables degrades the probe's response even more.

- Specifications describe warranted performance over the temperature range listed in the table (unless otherwise noted). All specifications apply after the probe's temperature has been stabilized after 15 minutes of continuous operation.
- *Characteristics* provide useful information by giving functional, but nonwarranted, performance parameters. *Characteristics are printed in italics.*

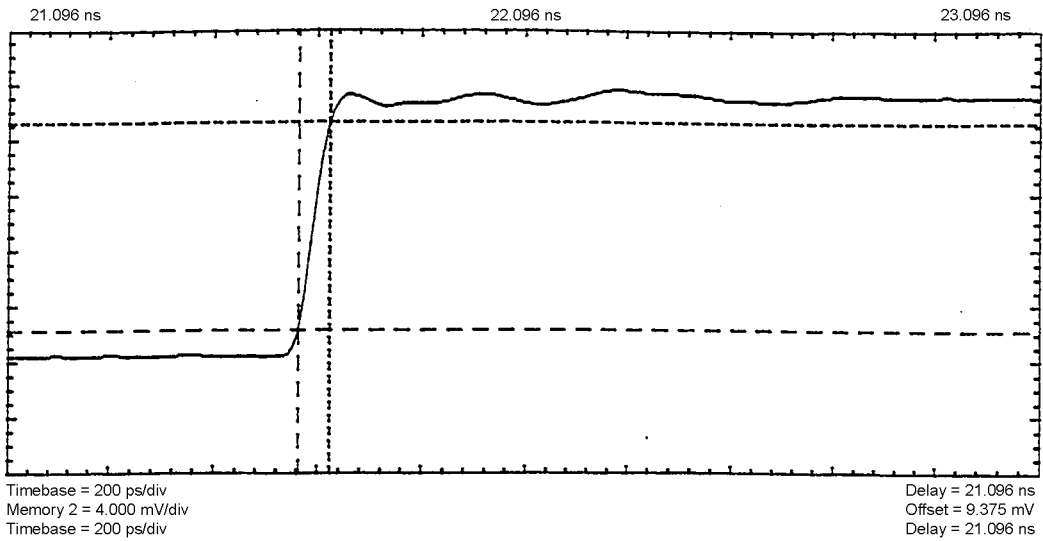
**Table 2. Specifications and Characteristics**

Bandwidth <sup>a</sup>	dc to 6 GHz
Input Resistance 10:1 probe <sup>b</sup>	500 $\Omega$
Input Resistance 20:1 probe <sup>b</sup>	1 k $\Omega$
Maximum input voltage	20 V <sub>peak</sub>
Use	indoor
<i>Input capacitance</i>	<i>250 fF (characteristic)</i>
<i>Temperature</i>	<i>-25° C (-13° F) to +65° C (149° F) (characteristic)</i>
<i>Humidity</i>	<i>Operating - up to 95% (characteristic)</i>
<i>Altitude</i>	<i>4,600 meters (15,000 feet) (characteristic)</i>
<i>Length</i>	<i>91 cm (36 in.) (characteristic)</i>
Connectors	SMA male

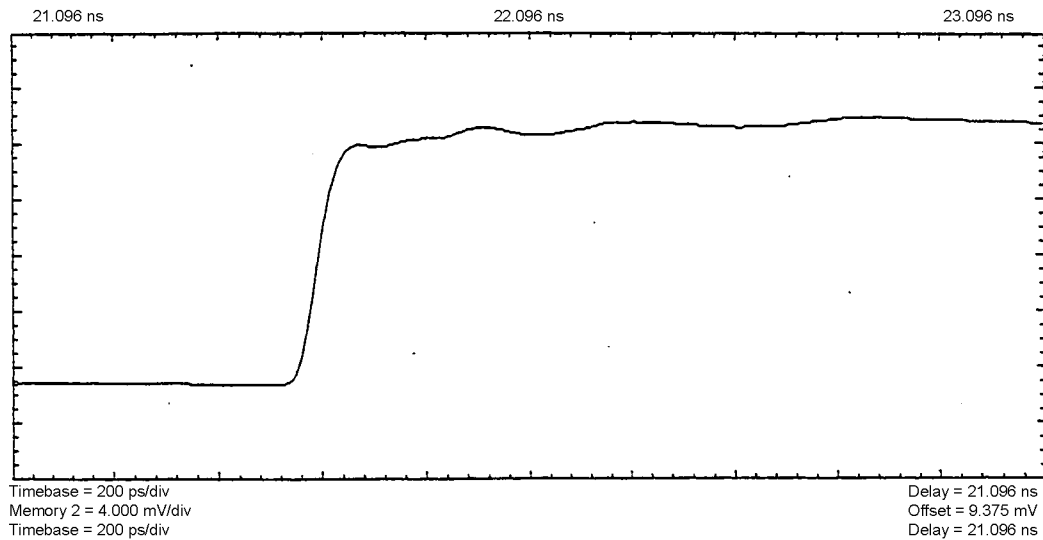
a. Driven by a 25 ohm source.

b. 1% probe resistor terminated into nominal 50 ohm oscilloscope input.

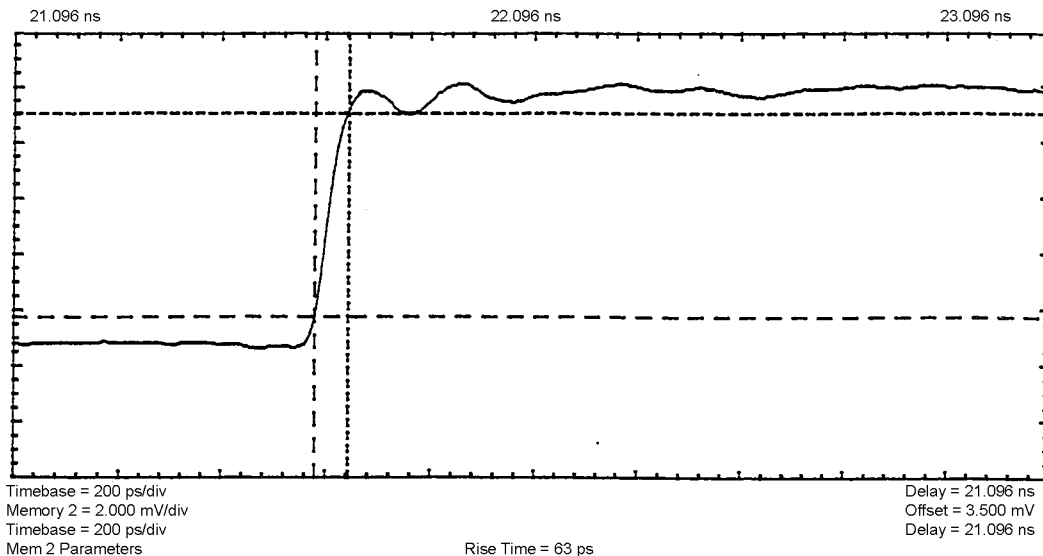
54006A User's Guide  
**Specifications and Characteristics**



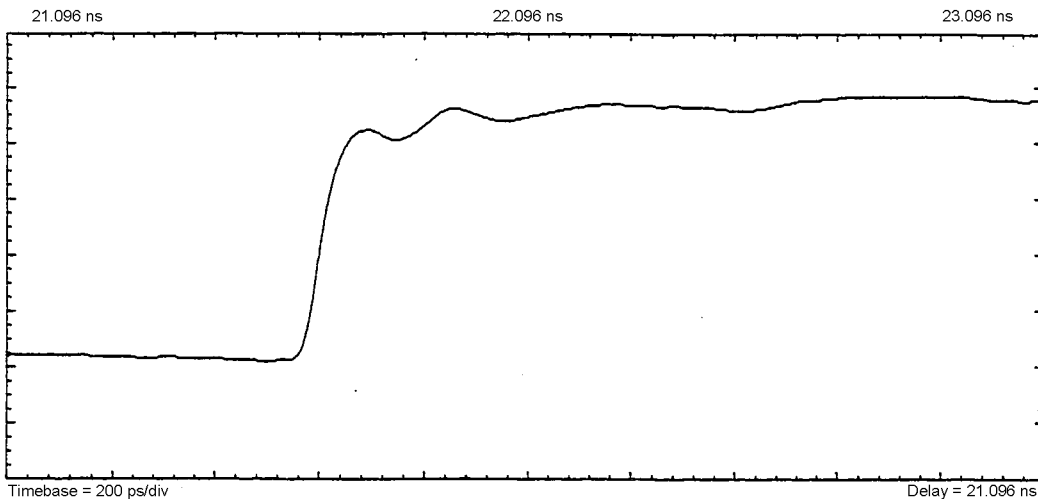
**Figure 4. Characteristic step response of 500 $\Omega$  probe to 50 ps step *without* 36" cable**



**Figure 5. Characteristic step response of 500 $\Omega$  probe to 50 ps step *with* 36" cable**

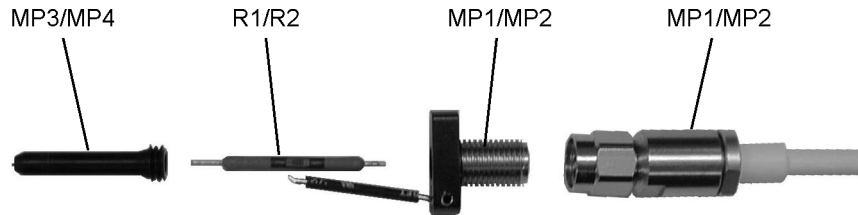


**Figure 6. Characteristic step response of 1 k $\Omega$  probe to 50 ps step *without* 36" cable**



**Figure 7. Characteristic step response of 1 k $\Omega$  probe to 50 ps step *with* 36" cable**

## Replaceable Parts



Part	Agilent Part Number	Qty	Description
C1	11742A	1	DC blocking capacitor
MP1	54006-67601	1	Probe body assembly for 450 $\Omega$ resistor
MP2	54006-67602	1	Probe body assembly for 950 $\Omega$ resistor
MP3	54006-21701	1	Sleeve for MP1
MP4	54006-21702	1	Sleeve for MP2
MP5	1250-2015	1	Adapter, SMA (f) to BNC (m)
MP6	54006-68701	1	Pack of five 450 $\Omega$ resistors for R2 and 1 extra MP3
MP7	54006-68702	1	Pack of five 950 $\Omega$ resistors for R1 and 1 extra MP4
R1	0699-2370	1	Thick film resistor, 950 $\Omega$ resistor, 1W
R2	0699-2371	1	Thick film resistor, 450 $\Omega$ resistor, 0.8W
W1	8210-4977	1	Coaxial cable, SMA (m-m), 36 inches

**Figure 8. Agilent 54006A Replaceable Parts**

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## Contacting Agilent

For technical assistance, you can contact your local Agilent call center. In the Americas, call 1 (800) 452-4844. In other regions, visit <http://www.agilent.com> and click Contact Us. Before returning an probe for service, you must first call the Instrument Support Center, in all regions, at (800) 403-0801. Any special arrangements for the probe can be discussed at this time. This will help the service office repair and return your probe as quickly as possible.

If the probe is under warranty or is covered by an Agilent maintenance contract, it will be repaired under the terms of the warranty or contract. If the probe is no longer under warranty or is not covered by an Agilent maintenance plan, Agilent will notify you of the cost of the repair after examining the unit. When an probe is returned to a Agilent service office for servicing, it must be adequately packaged and have a complete description of the failure symptoms attached. When describing the failure, please be as specific as possible about the nature of the problem.

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## Preparing the probe for shipping

- 1 Write a complete description of the failure and attach it to the probe. Include any specific performance details related to the problem. The following information should be returned with the probe.
  - Type of service required.
  - Date probe was returned for repair.
  - Description of the problem:
    - Whether problem is constant or intermittent.
    - Whether probe is temperature-sensitive.
    - Whether probe is vibration-sensitive.
    - Performance data.
    - Company name and return address.
    - Name and phone number of technical contact person.
    - Model number of returned probe.
    - Full serial number of returned probe.
    - List of any accessories returned with probe.

**Contacting Agilent**

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**CAUTION**

Cover electrical connectors to protect sensitive components from electrostatic damage. Cover optical connectors to protect them from damage due to physical contact or dust.

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**CAUTION**

Probe damage can result from using packaging materials other than the original materials. Never use styrene pellets as packaging material. They do not adequately cushion the probe or prevent it from shifting in the carton. They may also cause probe damage by generating static electricity.

- 2** Pack the probe in the original shipping containers. Original materials are available through any Agilent office. Or, use the following guidelines:
  - Wrap the probe in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
  - For probes weighing less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength.
  - The carton must be large enough to allow approximately 7 cm (3 inches) on all sides of the probe for packing material, and strong enough to accommodate the weight of the probe.
  - Surround the equipment with approximately 7 cm (3 inches) of packing material, to protect the probe and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with air bubbles. Use the pink (antistatic) Air Cap™ to reduce static electricity. Wrapping the probe several times in this material will protect the probe and prevent it from moving in the carton.
- 3** Seal the carton with strong nylon adhesive tape.
- 4** Mark the carton “FRAGILE, HANDLE WITH CARE”.

Retain copies of all shipping papers.