

# **Instructions**



**P6243**

**1 GHz 10X Active Probe**

**070-9408-02**

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# Table of Contents

<b>General Safety Summary</b> .....	<b>iii</b>
<b>Getting Started</b> .....	<b>1</b>
Customer Support .....	1
Features and Accessories .....	2
Configuration .....	6
Functional Check or Probe Compensation .....	6
<b>Operating Basics</b> .....	<b>9</b>
Maximum Non-destructive Input Voltage .....	9
Input Linear Dynamic Range .....	9
Ground Lead Length .....	10
Probe Tip Test Points .....	14
<b>Specifications</b> .....	<b>15</b>

List of Figures

Figure 1: Probe Compensation Connections ..... 7

Figure 2: Waveform Distortion from Ground Lead Length ... 10

Figure 3: Ground Lead Equivalent Circuit ..... 11

Figure 4: Low-inductance Grounding ..... 12

Figure 5: Using a SureFoot Adapter for Grounding ..... 13

Figure 6: Using a Probe Tip as a Test Point ..... 14

Figure 7: Typical Frequency Response ..... 17

Figure 8: Typical Linearity Error vs.  $V_{IN}$  ..... 18

Figure 9: Typical Input Impedance vs. Frequency ..... 19

Figure 10: Typical Non-Destructive Peak Voltage Derating vs.  
Frequency ..... 20



# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

*Only qualified personnel should perform service procedures.*

## Injury Precautions

**Avoid Electric Overload.** To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

**Do Not Operate Without Covers.** To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

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

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

## Product Damage Precautions

**Use Proper Power Source.** Do not operate this product from a power source that applies more than the voltage specified.

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

**Do Not Immerse in Liquids.** Clean the probe using only a damp cloth. The cloth must be dampened with either isopropyl alcohol or a mild detergent and water solution. Do not use any other chemicals or abrasives to clean the probe.

## Safety Terms and Symbols

**Terms in This Manual.** These terms may appear in this manual:



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**WARNING.** *Warning statements identify conditions or practices that could result in injury or loss of life.*

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**CAUTION.** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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**Terms on the Product.** These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

**Symbols on the Product.** These symbols may appear on the product:



DANGER  
High Voltage



Protective Ground  
(Earth) Terminal



ATTENTION  
Refer to Manual



Double  
Insulated





# Getting Started

The Tektronix P6243 is a 1 GHz, 10X active FET probe with less than 1 pF input capacitance. The low input capacitance and high input resistance of the probe minimize circuit loading over a wide bandwidth. The probe has a small profile and low-mass that makes probing crowded circuits fast and easy. The accessory tips and adapters allow for a wide variety of circuit connections.

The P6243 Active Probe obtains power from the host oscilloscope through the TEKPROBE™ interface. For oscilloscopes and instruments that do not have the TEKPROBE interface, use the optional Tektronix 1103 Probe Power Supply.

For service information, including part numbers of standard and optional accessories, refer to the *P6243 Service Manual* (070-9409-XX).

## Customer Support

To help you get the best performance from your probe, Tektronix offers the following customer support:

### Using Your Probe

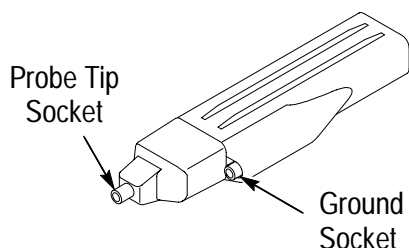
If you need assistance using your probe, please call 1-800-TEK-WIDE (1-800-835-9433) and ask for the Customer Support Center. If you are outside the United States or Canada, please contact your nearest Tektronix Service Center.

### Servicing Your Probe

For service and service related questions, please contact your nearest Tektronix Service Center.

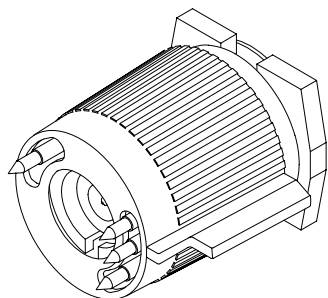
## Features and Accessories

The P6243 Active Probe has features and accessories to make probing and measurement a simpler task. Please take a moment to familiarize yourself with these items and their uses.



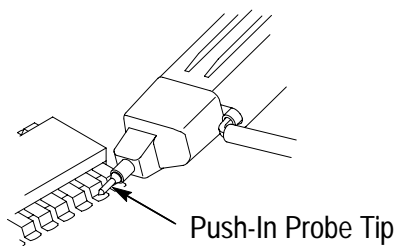
**Probe Head Assembly** — The probe head is designed for ease of use and high performance. Its small size makes it easy to handle in tight areas.

The probe tip socket is sized to easily press onto 0.025 inch pins for direct access. The ground socket provides a short ground path for high fidelity ground connections.



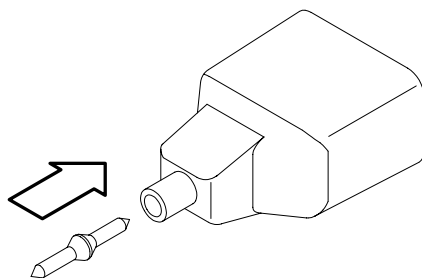
**TEKPROBE™ Interface** — The TEKPROBE interface provides power, signal, and probe characteristic data transfer.

If your oscilloscope does not support the TEKPROBE interface, you can use the optional 1103 probe power supply as an effective interface. Contact your local Tektronix representative for more information.



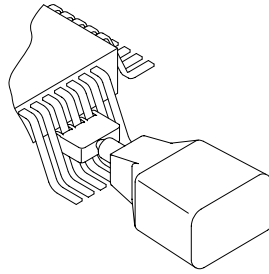
**Push-in Probe Tip** — Use the push-in probe tip for general purpose probing by hand. The tip may also be used as a temporary test point. See page 14 for more information.

The push-in probe tip may also be used with the other socketed leads and adapters.

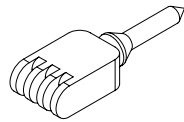


**Installing the Push-in Probe Tip** — Attach the push-in probe tip by seating the tip into the probe tip socket and pushing the tip in until it is seated. Either end of the tip may be used.

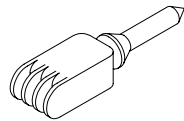
*Do not force the tip.* Also, be careful not to poke yourself with the sharp probe-tip. To remove the tip, *gently* grab the tip with small pliers and pull the tip out.



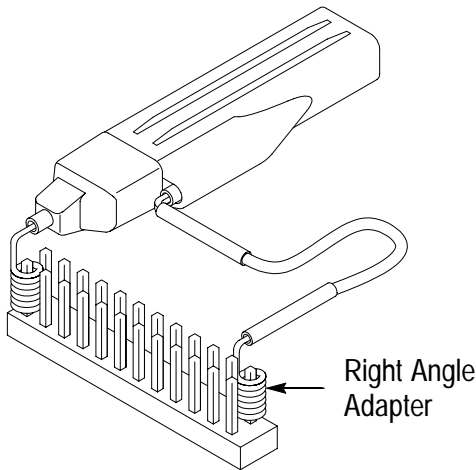
**SureFoot™ probe tip** — The SureFoot tip is an integral probe tip and miniature guide that enables fault-free probing of fine-pitch SMD packages. Attach the SureFoot adapters the same way as the push-in probe tips. They can be used with any of the socketed accessory leads.



The blue SureFoot tip is compatible with 0.025 inch JEDEC and 0.65 mm EIAJ packages.



The red SureFoot tip is compatible with 0.5 mm EIAJ packages.

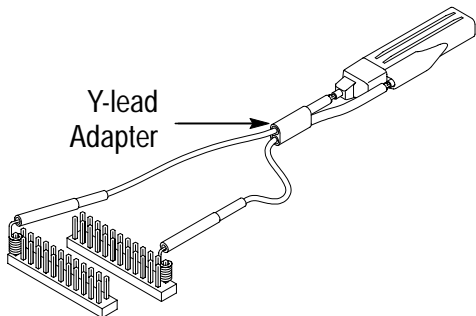


**Right-angle adapter** — Use the right-angle adapter for low-profile probing of 0.025-inch diameter square pins.

The right-angle adapter allows the P6243 to lie flat against a circuit board. This enables probing in vertical circuits such as computer or communications backplanes, or in tight areas such as between circuit cards.

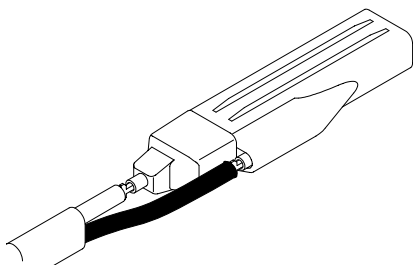
The right-angle adapter can be used directly with the probe head, or attached to the Y-lead adapter or ground leads.

The right-angle adapter is attached the same way as the push-in probe tip, and can be easily removed by hand.

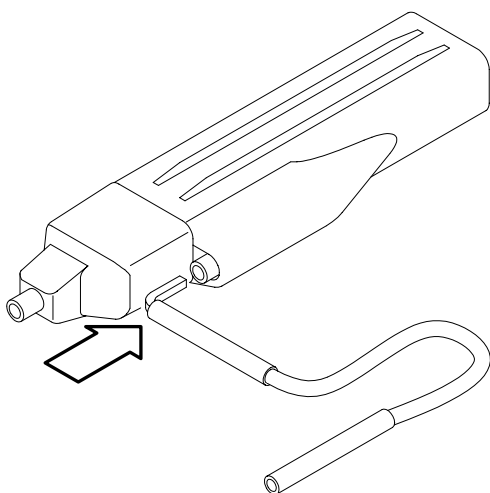


**“Y-lead” adapter**— Use the Y-lead adapter to extend the physical reach of the probe and ground when necessary. The Y-lead adapter accepts any of the probe tips or adapters, and can be pushed directly onto 0.025 inch pins.

When selecting the grounding connection, maintain as short a ground path as possible. Refer to page 10 for more information.



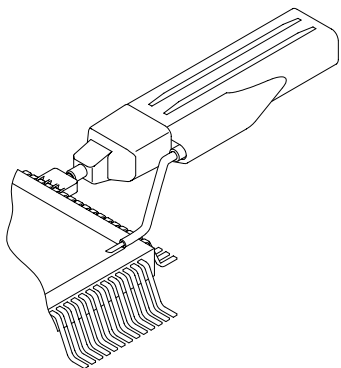
To attach the Y-lead adapter, gently press the lead pins into the probe head tip and ground receptacles. Using the black lead for ground is recommended.



**3 and 6 inch ground leads**— Use the three- and six-inch ground leads for general probing. The socketed end of the leads may be connected to any of the probe tips and adapters, or fitted onto 0.025 inch pins.

To attach the ground leads, press and rotate the lead pin connector into the ground socket on the probe head. The lead may be removed by simply pulling the pin out by hand.

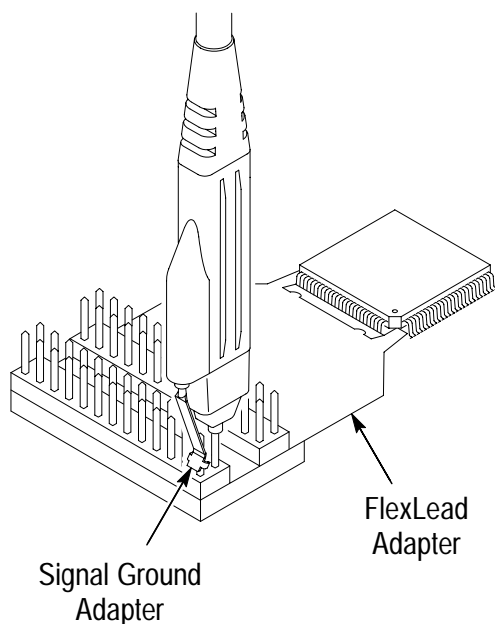
When selecting the grounding connection, maintain as short a ground path as possible. Refer to page 10 for more information.



**Low-inductance ground lead**— Use the low-inductance ground adapter to substantially reduce ground lead inductance. Because the ground lead simply touches the ground reference, you can easily move the probe to different points on the device under test.

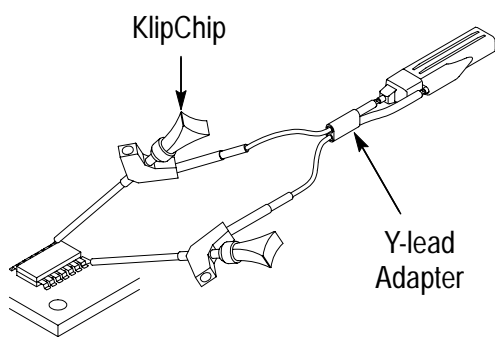
To attach, press the ground lead into the probe-head ground socket.

When selecting the grounding connection, maintain as short a ground path as possible. Refer to page 10 for more information.



**Signal-Ground Adapter** — The signal-ground adapter is ideal for use with signal/ground pairs on 0.100 inch header pins (such as FlexLead™ adapters).

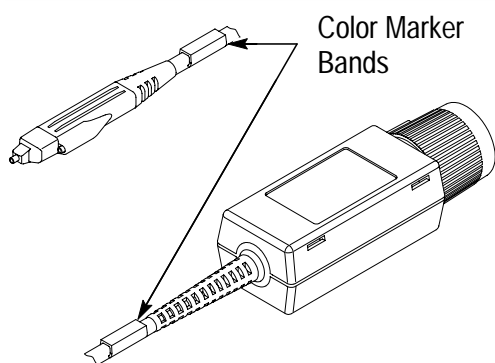
Attach the signal-ground adapter by gently pressing it into the ground socket on the probe head.



**SMT KlipChip™** — Use the SMT KlipChip test clips to access fragile, dense circuitry.

KlipChip test clips connect to the Y-lead or three- or six-inch ground leads. Simply press the lead socket into the KlipChip handle.

The KlipChip body freely turns, allowing better probe orientation. To reduce stress and provide a lower profile on components being tested, the flexible sleeve of the KlipChip bends up to a 35 degree angle.



**Color Marker Bands** — Attach matching pairs of the color marker bands onto the cable at the head and compensation box of each probe. The marker bands enable quick verification of which probe is connected to which instrument channel.

## Configuration

The P6243 Active Probe provides the oscilloscope with the probe model number, serial number, and attenuation factor. When connected to a TEKPROBE oscilloscope, display readouts are corrected for the probe attenuation factor, the instrument input is set to 50  $\Omega$ , and the coupling is set to DC.



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**CAUTION.** Do not attempt to install the P6243 Active Probe on a non-TEKPROBE connector. Damage to the probe and connector may result. If your oscilloscope does not support the TEKPROBE interface, use the optional Tektronix 1103 Probe Power Supply.

*If the P6243 Active Probe is used with the Tektronix 1103 Probe Power Supply, be sure to have a 50  $\Omega$  termination at the oscilloscope. Also, set the oscilloscope channel coupling to DC.*

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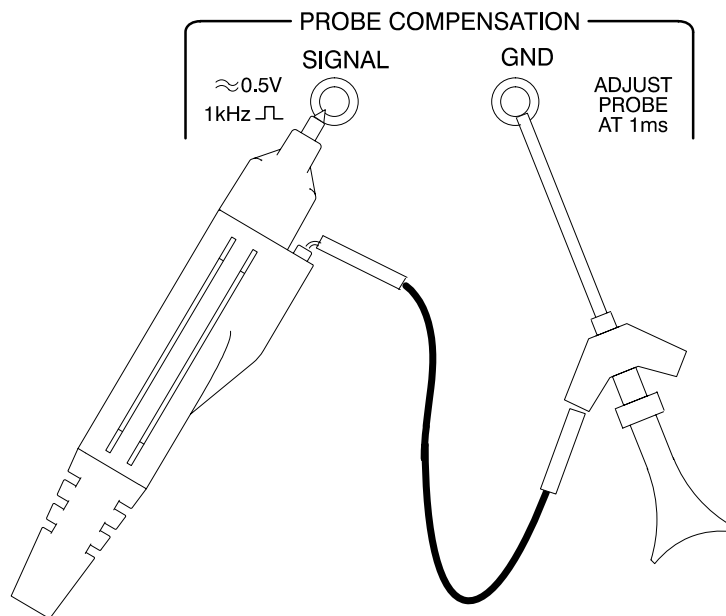
## Functional Check or Probe Compensation

After installing the probe on the oscilloscope, perform a functional check or compensate the probe using the **PROBE COMPENSATION** connections on the front panel of the oscilloscope. See Figure 1. (The ground connection is not necessary for a functional check.)

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**NOTE.** You can compensate the probe only if your oscilloscope supports the TEKPROBE interface and has a calibration routine for that purpose. For instructions, refer to the user manual of your oscilloscope.

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**Figure 1: Probe Compensation Connections**

1. Connect the probe to the oscilloscope.
2. Set the oscilloscope to display the probe channel.
3. If you intend to compensate the probe, connect a ground lead and an SMT KlipChip to the GND terminal.
4. Using a standard tip, hold the probe to the SIGNAL terminal.
5. Press **AUTOSET** (or adjust the oscilloscope) to display the waveform specified for the compensation output.
6. If you intend to compensate the probe, refer to the user manual for your oscilloscope and perform the calibration routine now.
7. Disconnect the probe tip from the SIGNAL terminal and connect it to the GND terminal. The oscilloscope display should be at the ground reference.







# Operating Basics

Please follow these operating guidelines to get optimum performance from your P6243 Active Probe.

## Maximum Non-destructive Input Voltage

The P6243 Active Probe is electrically protected against static voltage; however, applying voltages above its design limits may damage the probe tip amplifier. Please refer to the *Specifications* section of this manual for the maximum non-destructive input voltage and frequency derating information.

## Input Linear Dynamic Range

The probe head amplifier used by the P6243 Active Probe has a limited linear operating range. To keep the input linearity error less than 4% you must limit the signal input voltage to  $\pm 8$  V (DC + peak AC).

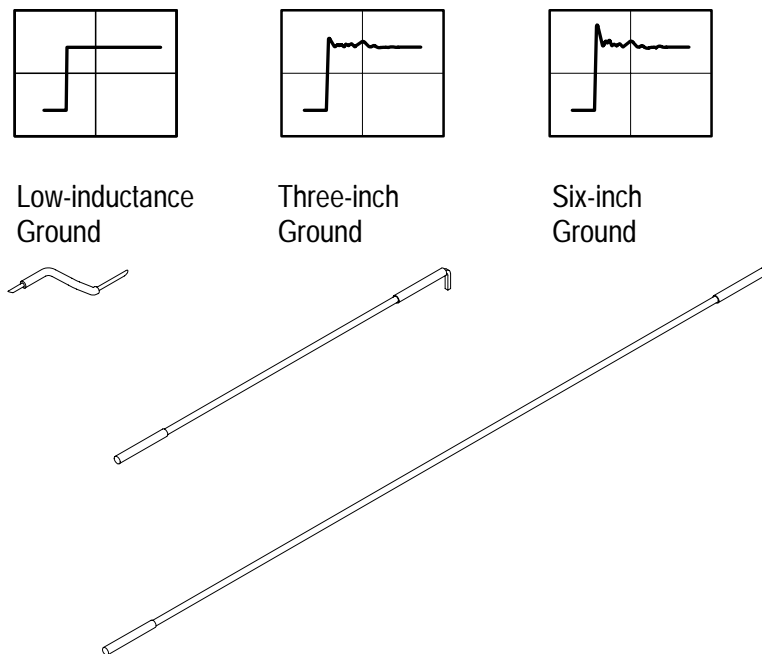
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**NOTE.** *The probe can tolerate input voltages of  $\pm 15$  V without damage; however, the linearity error specification does not apply to input voltages exceeding  $\pm 8$  V (DC + peak AC).*

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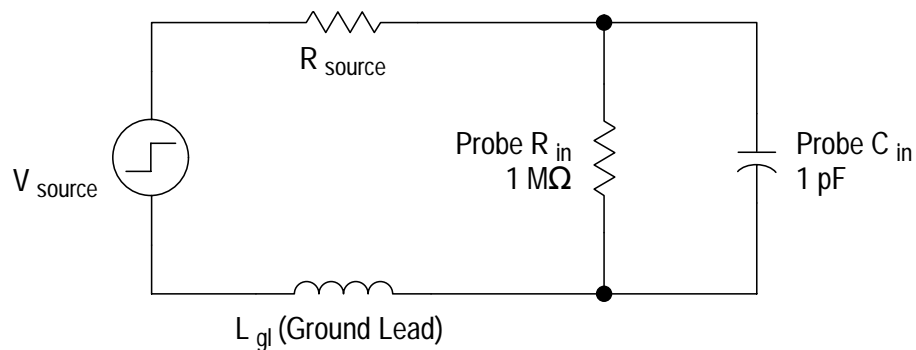
## Ground Lead Length

When you are probing a circuit, you should always use as short a ground lead as possible between the probe head and circuit ground. The input capacitance of the P6243 and the inductance of the ground lead results in a resonant circuit that can ring. Using a shorter ground lead will minimize ringing. See Figure 2.



**Figure 2: Waveform Distortion from Ground Lead Length**

Figure 3 illustrates the resistance, capacitance, and inductance that the probe and ground lead adds to a circuit.



**Figure 3: Ground Lead Equivalent Circuit**

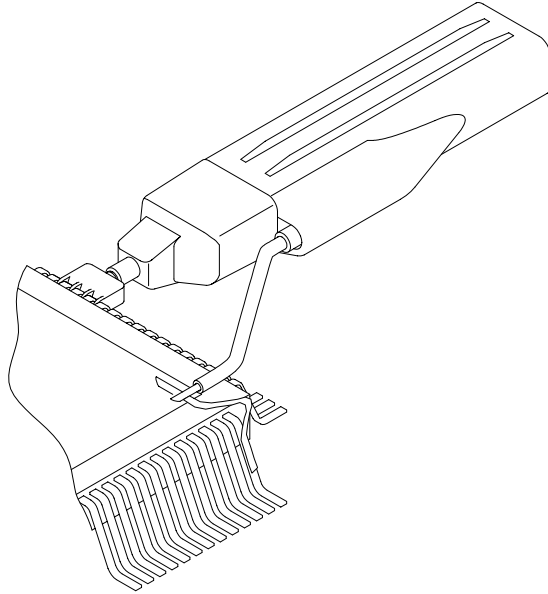
You can determine if ground lead effects may be a problem in your application if you know the inductance ( $L$ ) of the ground lead and input capacitance ( $C$ ) of the probe. Calculate the approximate resonant frequency ( $f_0$ ) at which this parasitic circuit will resonate with the following formula:

$$f_0 = \frac{1}{2\pi \sqrt{LC}}$$

The preceding equation shows that reducing the ground lead inductance will raise the resonant frequency. If your measurements are affected by ringing, your goal is to lower the inductance of your ground path until the resulting resonant frequency is well above the frequency of your measurements.

### Low-inductance Grounding

Placing a ground plane on top of a package being probed can minimize ground lead length and inductance. See Figure 4.



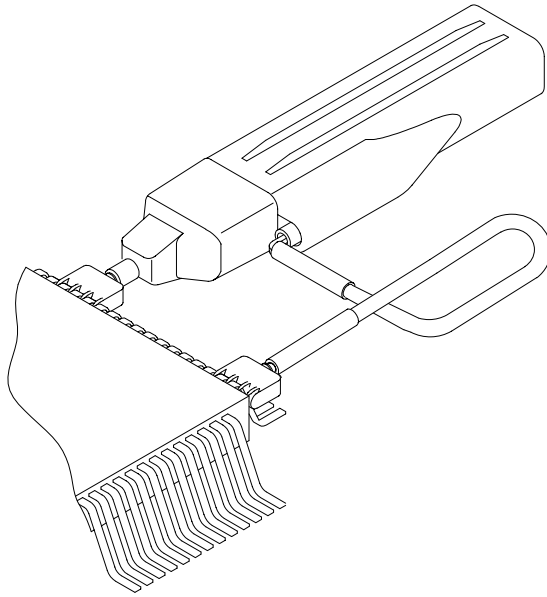
**Figure 4: Low-inductance Grounding**

Attach a thin piece of copper on top of the package and connect it to the package ground connection. Use the low-inductance ground lead provided with the probe to keep the ground lead length as short as possible.

This method is very useful when making many measurements on the same package. Using a ground plane on the package makes probing the package easier, and avoids adding unnecessary ground lead length.

### **SureFoot™ Grounding**

If you cannot use the low-inductance grounding method recommended, the probe may be grounded to the package under test using a SureFoot adapter. Refer to Figure 5.



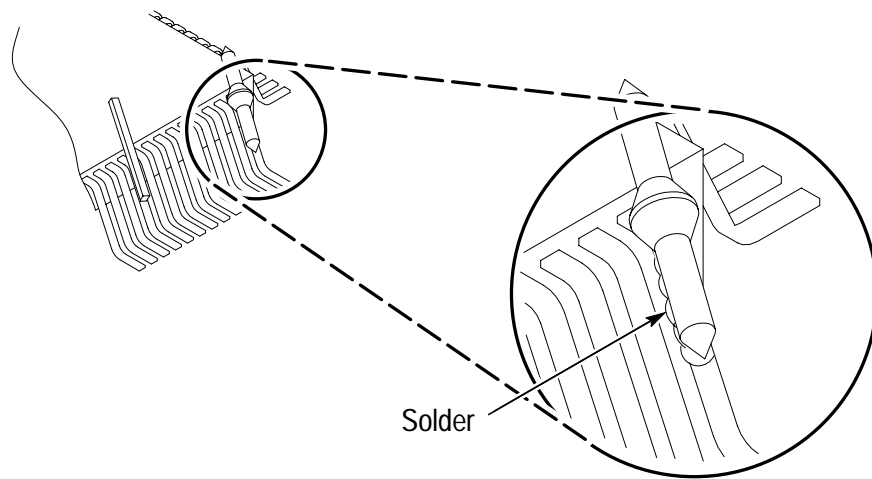
**Figure 5: Using a SureFoot Adapter for Grounding**

## Probe Tip Test Points

The push-in probe tip or a 0.025 square pin can be soldered into a circuit to be used as a temporary test point. See Figure 6.

Solder the tip onto a lead or pin with a low-power soldering iron. Press the probe head onto the tip to make a measurement, and then pull the probe head off when you are done.

The probe tip may be removed and reused by desoldering it from the circuit, and soldering it into another circuit in the future.



**Figure 6: Using a Probe Tip as a Test Point**

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**NOTE.** *It is not recommended that pieces of solid-core copper wire be used as test points. If the wire breaks off in the probe tip socket, it may be impossible to remove the wire, and it will prevent insertion of other accessory tips.*

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# Specifications

The warranted specifications in Table 1 apply to a P6243 Active Probe when the probe and the host instrument are allowed to warm up for 20 minutes before measurements are taken. The warranted specifications that appear in boldface type are specifications checked in the *Performance Verification* section of the service manual.

The specifications in Tables 2 through 5 are provided as general information for your convenience.



**CAUTION.** Do not apply voltages beyond the non-destructive input voltage range to the probe. Damage to the probe or circuit under test may result. Refer to Figure 10.

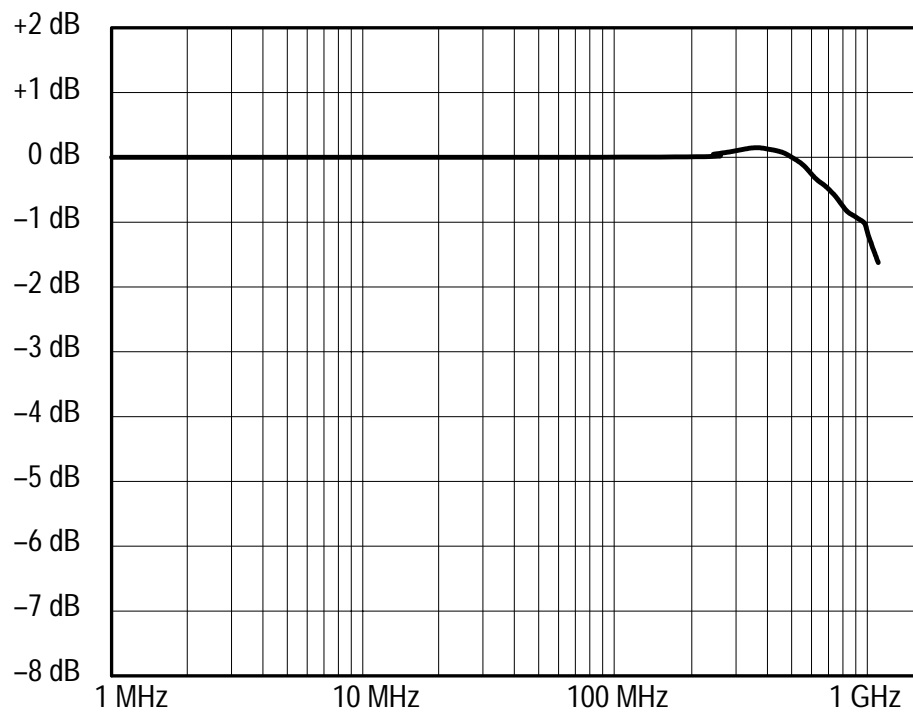
**Table 1: Warranted Electrical Specifications**

Analog Bandwidth (probe only) at +20°C to +30°C (+68°F to +86°F)	> 1.0 GHz
<b>DC Attenuation Accuracy</b> (probe only) at +20°C to +30°C (+68°F to +86°F)	10:1 ±2%
<b>Output Zero</b> at +20°C to +30°C (+68°F to +86°F)	±10 mV or less at output of probe ±100 mV or less displayed on screen with TEKPROBE interface
Rise Time (probe only) at +20°C to +30°C (+68°F to +86°F)	< 350 ps

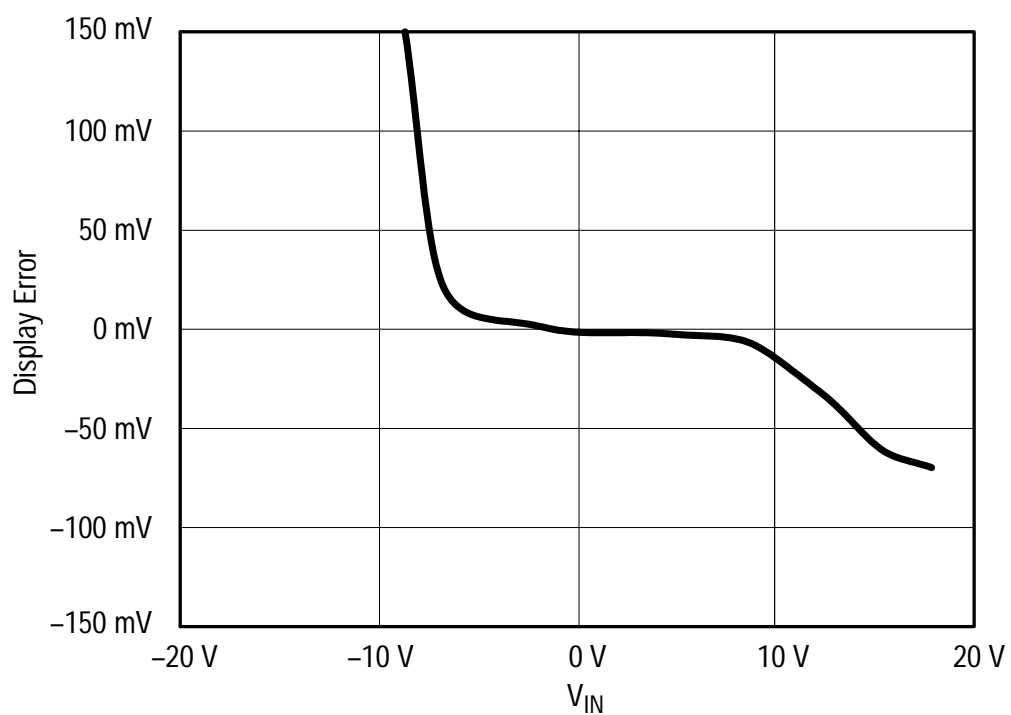
**Table 2: Typical Electrical Characteristics**

Frequency Response (probe only)	See Figure 7
Linear Input Dynamic Range	– 8 V to + 8 V. (Equivalent to – 0.8 V to + 0.8 V at the output of the probe)
Linearity	$\pm 4\%$ or less of dynamic range
Linearity Error vs. $V_{IN}$	See Figure 8
Input Resistance	1 M $\Omega$ at DC. (See Figure 9)
Input Capacitance	< 1.0 pF
Non-Destructive Input Voltage Range	– 15 V to + 15 V (DC + peak AC) (See Figure 10)
DC Offset Drift	100 $\mu\text{V}/^\circ\text{C}$ or less at output of probe  1 mV/ $^\circ\text{C}$ or less displayed on screen with TEKPROBE interface
Delay Time	5.3 ns $\pm 0.2$ ns

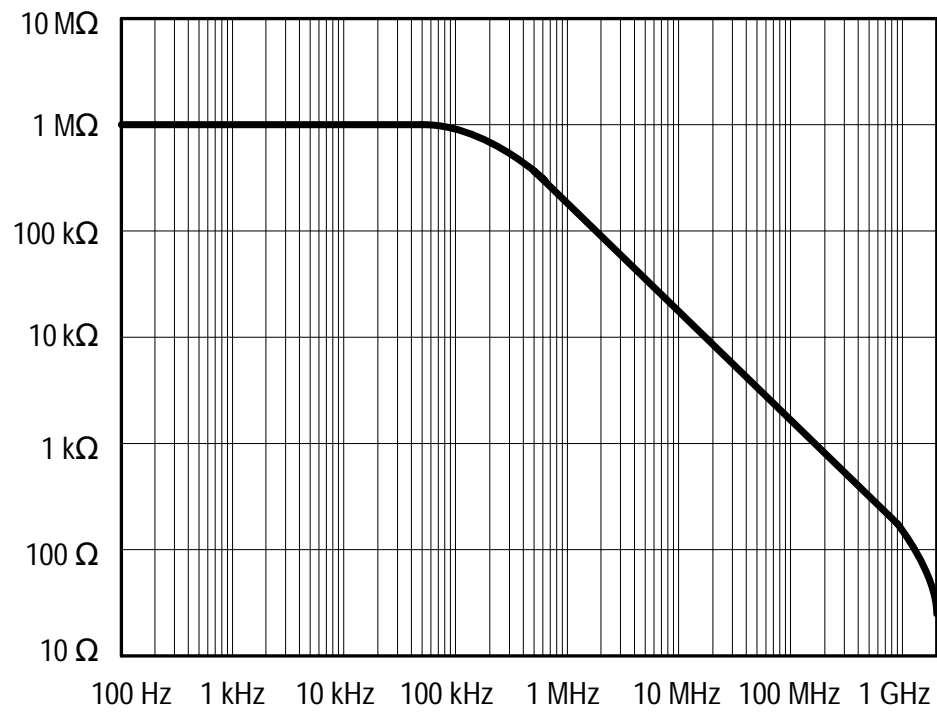




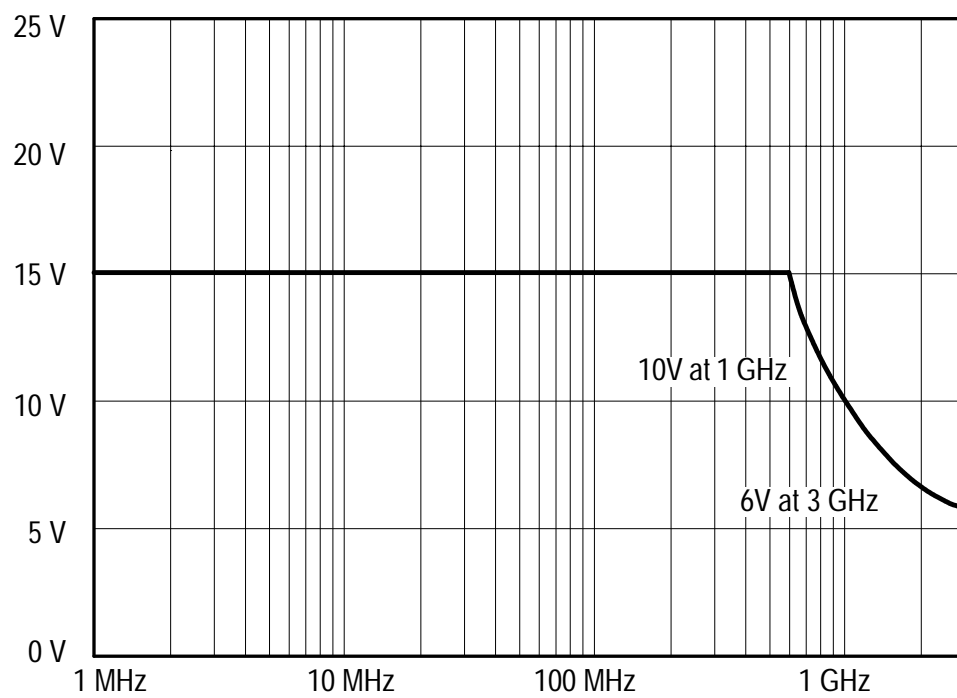
**Figure 7: Typical Frequency Response**



**Figure 8: Typical Linearity Error vs.  $V_{IN}$**



**Figure 9: Typical Input Impedance vs. Frequency**



**Figure 10: Typical Non-Destructive Peak Voltage Derating vs. Frequency**

**Table 3: Physical Characteristics**

Net Weight	63.8 g (2.25 ounces)
Cable Length	1.3 meter (4.3 ft)

**Table 4: Environmental Characteristics**

Operating Temperature	0°C to +50°C (+32°F to +122°F)  The environmental exposure is the procedure stated in Tektronix Design Standard 062-2847-00 for Class 5 equipment
Non-operating Temperature	– 40°C to + 71°C (– 40°F to + 160°F)  The environmental exposure is the procedure stated in Tektronix Design Standard 062-2847-00 for Class 5 equipment
Humidity	The environmental exposure is the procedure stated in Tektronix Design Standard 062-2847-00 for Class 5 equipment
Packaged Product Vibration and Shock	The packaged product qualifies under the Distribution Cycle 1 Assurance Level II for packaged products 0 – 20 lbs. Test 2 for Warehouse and Vehicle Stacking (Compression) is omitted  Tektronix standard 062-2858-00, Rev. B, Class 5
Altitude	Operating: 4,572 m (15,000 ft) Non-Operating: 15,240 m (50,000 ft)

**Table 5: Certifications and Compliances**

EC Declaration of Conformity	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:
	<div>EN 50081–1 Emissions:</div> <div>EN 55022                      Class B: Radiated and Conducted Emissions</div> <div>EN 60555–2                  Power Harmonics</div>
	<div>EN 50082–1 Immunity:</div> <div>IEC 801–2                    Electrostatic Discharge</div> <div>IEC 801–3                    RF Radiated</div> <div>IEC 801–4                    Fast Transients</div> <div>IEC 801–5                    Surge</div>
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47 CFR, Part 15, Subpart B, Class A