Agilent Technologies

User's Guide

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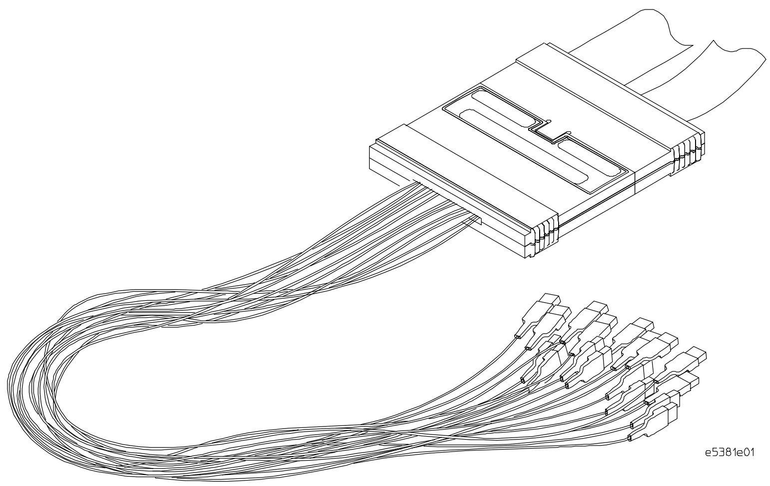


For Safety information and Regulatory information, see the pages at the back of this guide.

E5381A Differential Flying Leads

In This Book

This guide provides user and service information for the E5381A Differential Flying Lead Probe Set.

Chapter 1 gives you general information such as inspection, accessories supplied, 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.

Contents

1

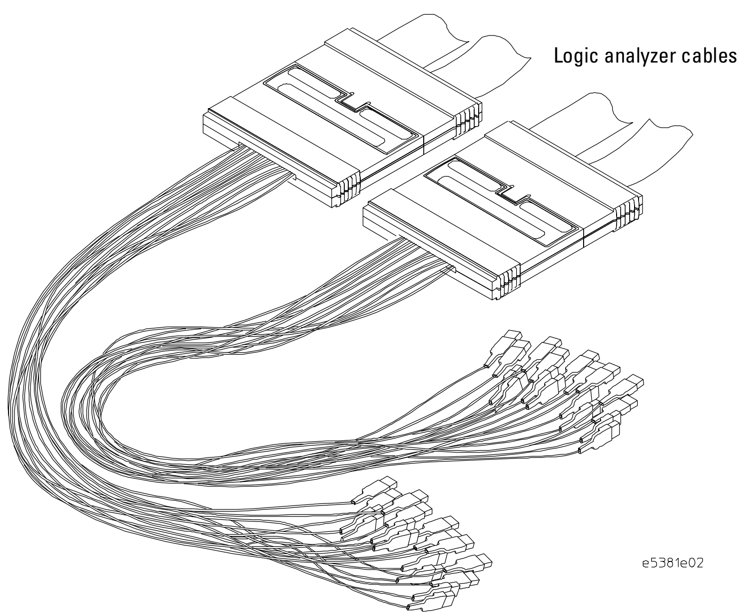
General Information

E5381A Differential Flying Lead Probe Set

The E5381A is a 17-channel differential flying lead probe set, compatible with the Agilent 16753A, 16754A, 16755A, 16756A, and 16760A logic analysis modules. The E5381A enables you to acquire signals from randomly located points in your target system.

Two E5381As are required to support all 34 channels on one 16760A. Four E5381As are required to support all 68 channels of one 16753/54/55/56A.

A variety of accessories are supplied with the E5381A to allow you to access signals on various types of components on your PC board.



Differential flying lead probe set and Agilent logic analysis module.

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.

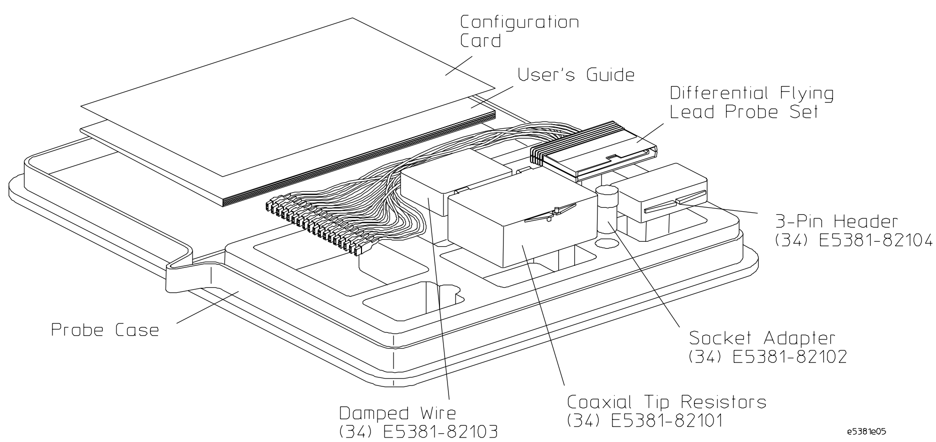
❑ Check the accessories.

Accessories supplied with the instrument are listed in “Accessories Supplied” in table later in this chapter.

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

❑ Inspect the probe.

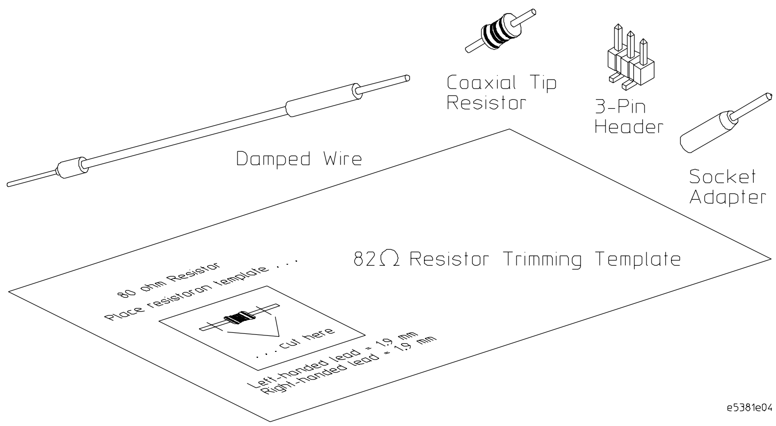
- If there is mechanical damage or defect, or if the probe does not operate properly or pass performance tests, notify your Agilent Technologies Sales Office.
- If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Agilent Technologies 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.



Probe case contents

Accessories

The following figure shows the accessories supplied with the E5381A Differential Flying Lead Probe Set.



Accessories supplied

The following table shows the part numbers for ordering replacement parts and additional accessories.

Replaceable Parts and Additional Accessories

Description	Qty	Agilent Part Number
82Ω Resistor Trimming Template	1	01131-94309
Accessory Kit - Coaxial Tip Resistors (82Ω)	34	E5381-82101
Accessory Kit - Socket Adapter	34	E5381-82102
Accessory Kit - Damped Wire (160Ω)	34	E5381-82103
Accessory Kit - 3-Pin Header	34	E5381-82104
Cable - Main	1	E5381-61601

Characteristics, Specifications, and Dimensions

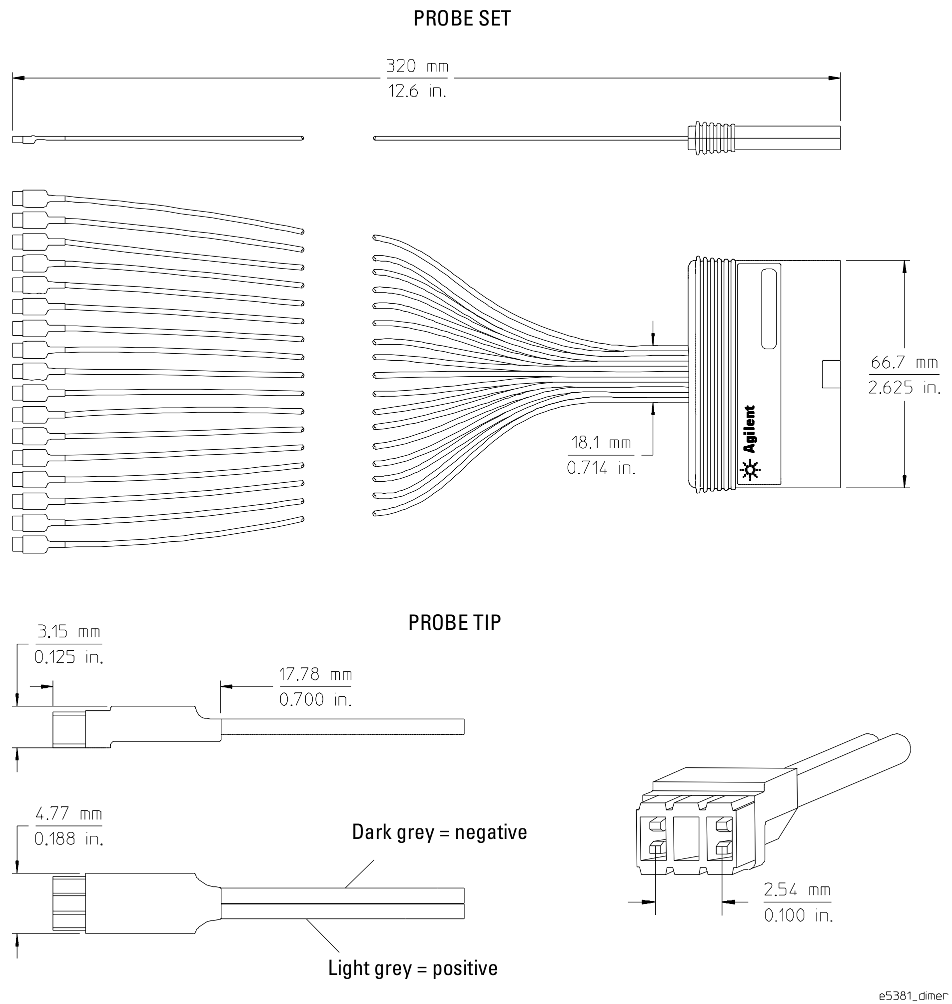
The following characteristics are typical for the probe set.

Characteristics	
Input Resistance	20 kΩ
Input Capacitance	0.9 pF (accessory-specific, see accessories)
Maximum Recommended State Data Rate	1.5 Gb/s (accessory-specific, see accessories)
Minimum Data Voltage Swing	100 mV p-p each side
Minimum Diff. Clock Voltage Swing	100 mV p-p each side
Input Dynamic Range	-3 Vdc to +5 Vdc
Threshold Accuracy	±(30 mV +1% of setting)
Threshold Range	-3.0 V to +5.0 V
Maximum Nondestructive Input Voltage	±40 Vdc, CAT 1 (mains isolated)
Maximum Input Slew Rate	5 V/ns
Clock Input	differential [2]
Number of Inputs [1]	17 (1 clock and 16 data)[2]

[1] refer to specifications on specific modes of operation for details on how inputs can be used

[2] if using the clock and data as single-ended, the unused negative input must be grounded and the minimum voltage swing for single-ended signal operation is 250mV p-p

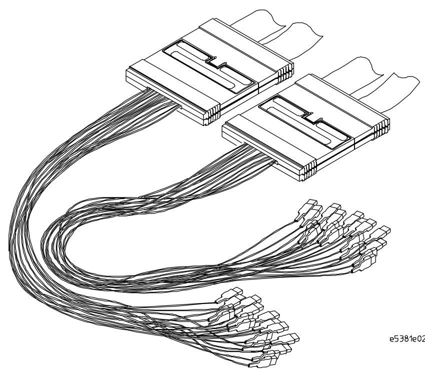
Environmental Conditions		
	Operating	**Non-operating**
Humidity	up to 95% relative humidity (non-condensing) at +40 °C	up to 90% relative humidity at +65 °C
Weight	approximately 0.69 kg	
Dimensions	Refer to the figure below.	
Pollution degree 2	Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.	
Indoor use		



E5381A Differential Flying Lead Probe Set and Probe Tip Dimensions

To probe differential signals

1 Connect the differential probe to the logic analysis module.



2 Set the thresholds.

The logic analyzer will automatically set the thresholds to “differential”.

3 Connect the flying leads to your target system.

The next section in this manual shows the recommended probe configurations in the order of best performance. Select the configuration that works with your target system.

To probe single-ended signals

1 Connect the signal using the positive side of the probe tip.

The light grey side of the cable is positive.

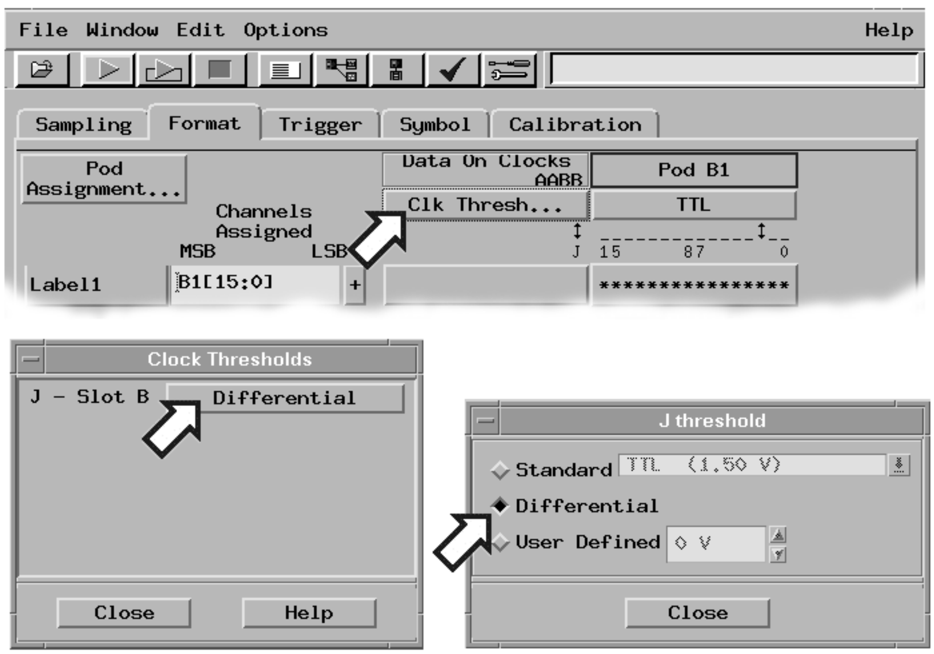
2 Connect the negative side of the probe tip to ground.

The dark grey side of the cable is negative. Each probe tip that you are observing a signal on must have the negative terminal grounded.

3 Adjust the thresholds on the logic analyzer.

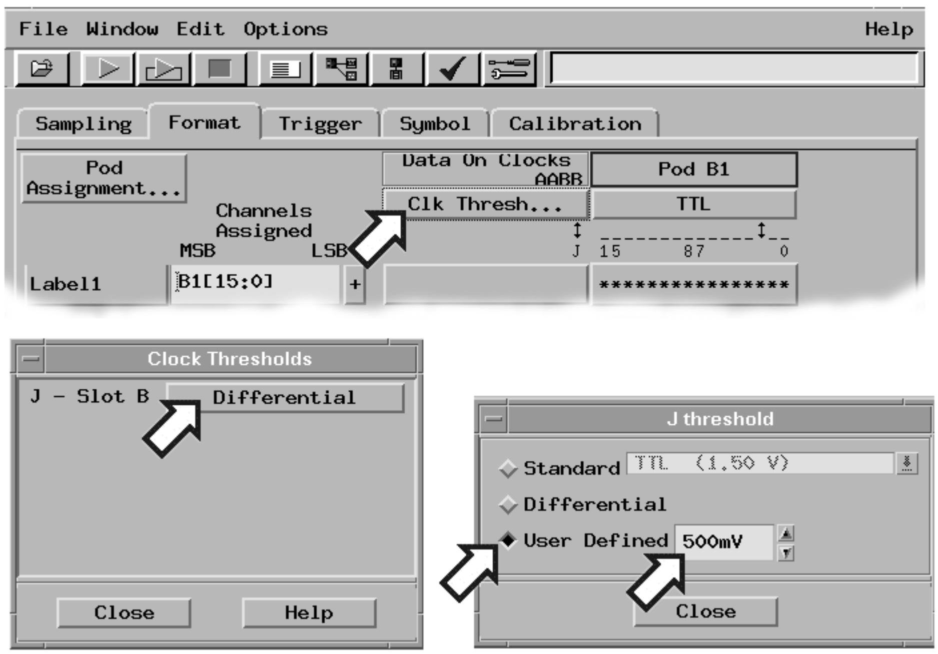
The thresholds can be set on a per/pod basis. The clock threshold can be adjusted separately.

a In the format screen in the logic analyzer, if you are using a differential clock, select differential clock threshold.



Differential threshold

b If your clock is not differential, ground the unused clock input and set the threshold to the desired level.



User defined threshold

c Repeat for data.

2

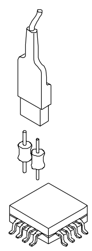
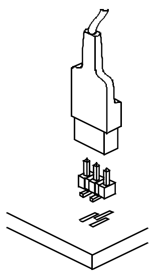
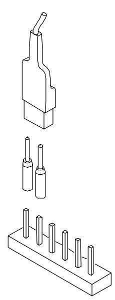
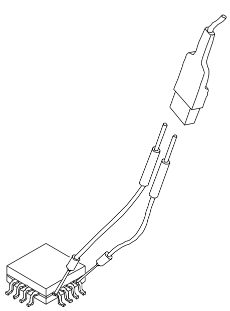
Operating the Probe

Introduction

The Agilent E5381A differential flying lead probe set comes with accessories that trade off flexibility, ease of use, and performance. Discussion and comparisons between four of the most common intended uses of the accessories are included in this section. The table on this page is an overview of the trade-offs between the various accessories. Each of the four configurations have been characterized for probe loading effects, probe step response, and maximum usable state speed. For more detailed information, refer to the pages indicated for each configuration.

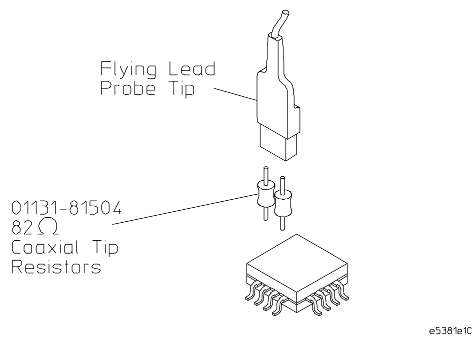
When simulating circuits that include a load model for the probe, a simplified model of the probe's input impedance can usually be used. The following table contains information for the simplified model of the probe using suggested accessory configurations. For more accurate load models and detailed discussion of each configuration's performance, refer to the pages indicated.

Suggested Configurations and Characteristics

Configuration	Description	Total lumped input C	Maximum recommended state speed	Details on page
	Coaxial Tip Resistor (82 Ω blue)	0.9 pF	1.5 Gb/s	page 18
	3-Pin Header	1.0 pF	1.5 Gb/s	page 30
	Socket Adapter	1.1 pF	1.5 Gb/s	page 41
	Damped Wire (160 Ω)	1.3 pF	1.5 Gb/s	page 53

Coaxial Tip Resistor (82 ohm)

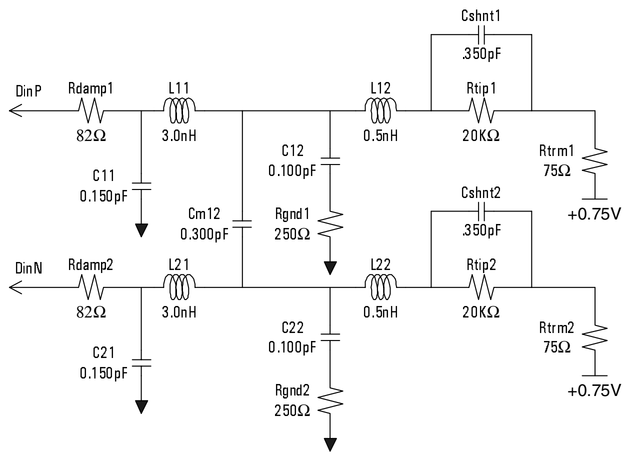
This configuration is recommended for solder-down probing of individual test points. Use the resistor cutting template card (part number 01131-94309) to trim the resistor leads to the appropriate length. Insert the resistors into the positive and negative terminals of the flying lead probe tip, this will hold the resistors in place while the other end of the resistor leads are soldered to the target signals.



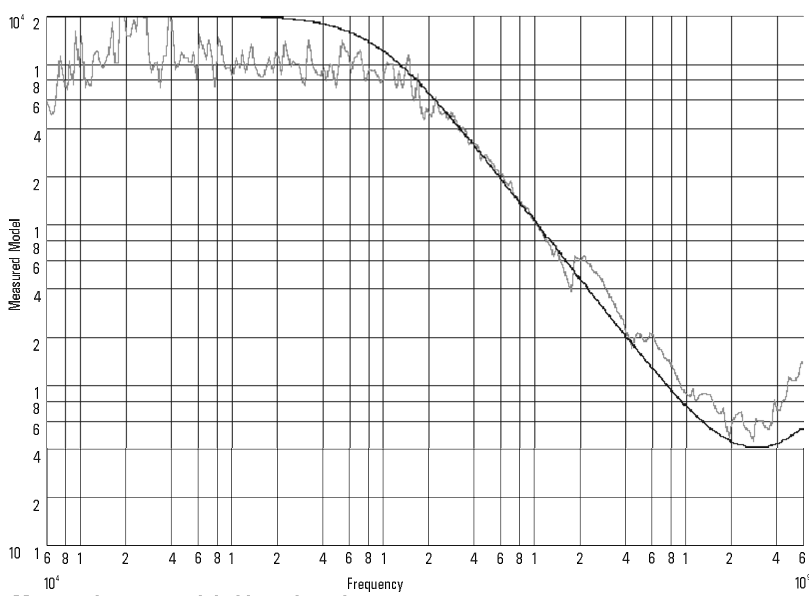
Solder-down probing configuration

Input Impedance

The E5381A probes have an input impedance which varies with frequency, and depends on which accessories are being used. The following schematic shows the circuit model for the input impedance of the probe when using the 82 Ω coaxial tip resistors. This model is a simplified equivalent load of the measured input impedance seen by the target.



Equivalent load model



Measured versus modeled input impedance

Tip Resistor Comparison

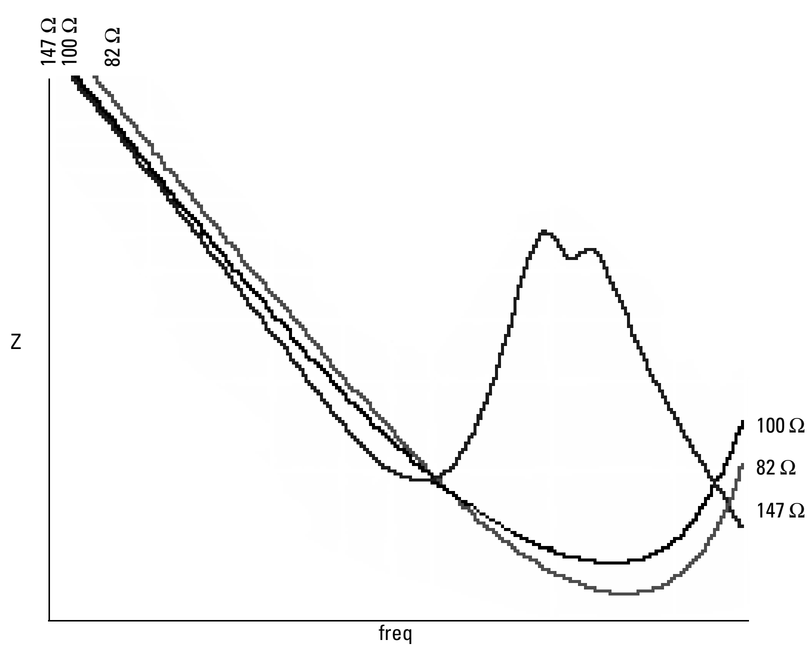
The E5381A allows the user to use coaxial tip resistors to connect to the target. These resistors serve two purposes. First, they allow the user to solder to the target signals without damaging the E5381A probe. Second, the tip resistor isolates the target from the capacitance of the probe and reduces the loading on the target system. The electrical specifications of the tip resistor will affect the loading on the target as well as the probe performance.

The most important factor of the tip resistor is its parasitic series inductance. A high series inductance will cause a resonance with the capacitance of the probe at a lower than acceptable frequency. The 82 Ω High Frequency Metal Film resistors that are shipped with the E5381A have a very low series inductance and are the recommended tip resistor.

A comparison of three common tip resistors are shown in the following graph to demonstrate the impact of the resistor selection on the E5381A's load impedance. The three resistors compared are:

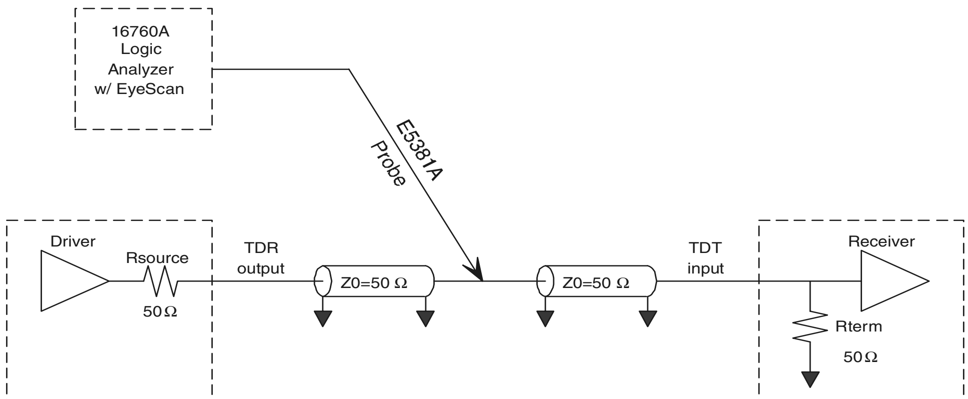
- 82 Ω High-Frequency Metal-Film Resistor - Series Inductance = 3.5nH
- 100 Ω Thin-Film Resistor - Series Inductance = 5nH
- 147 Ω Wire-Wound Resistor - Series Inductance = 50nH

If an alternate tip resistor must be used in place of the 82 Ω, High Frequency, Metal Film Resistor provided, avoid using a wire wound resistor. The series inductance is too high. However, the 100 Ω, Thin Film resistor is adequate.



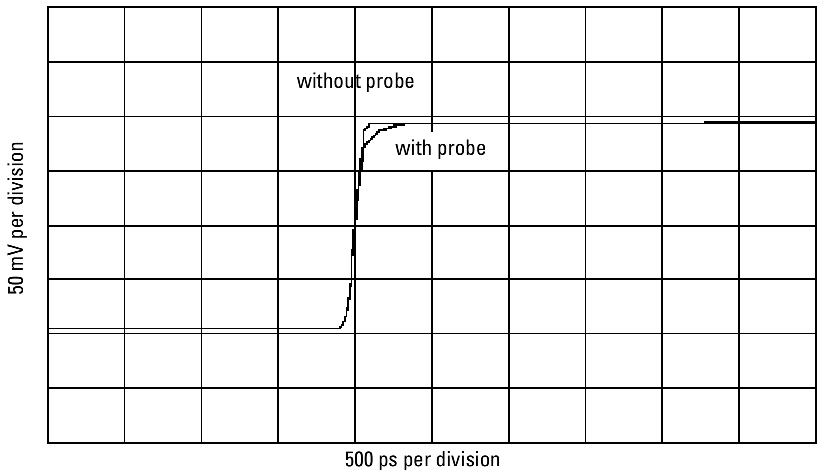
Time domain transmission (TDT)

All probes have a loading effect on the circuit when they come in contact with the circuit. Time domain transmission (TDT) measurements are useful for understanding the probe loading effects as seen at the target receiver. The following TDT measurements were made mid-bus on a 50 Ω transmission line load terminated at the receiver. These measurements show how the 82 Ω coaxial tip resistor affect the step seen by the receiver for various rise times.

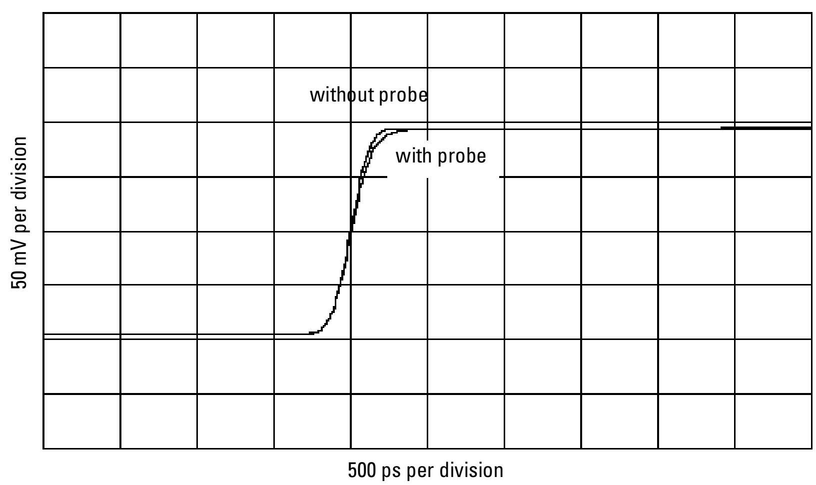


TDT measurement schematic

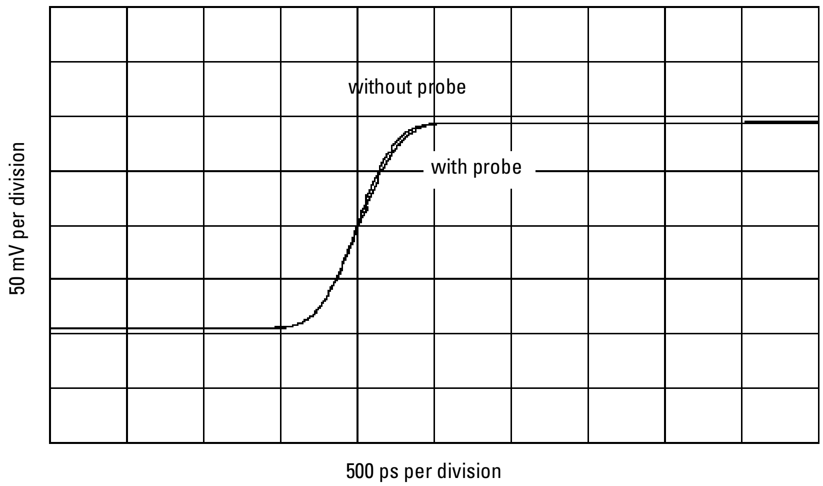
The 82 Ω coaxial tip resistor configuration is the least intrusive of the four recommended configurations. The graphs show that the loading effects are virtually invisible for targets with rise times ≥ 500 ps, negligible for targets with 250 ps rise times, and usable for 150 ps rise times. Ultimately, you must determine what is an acceptable amount of distortion of the target signal.



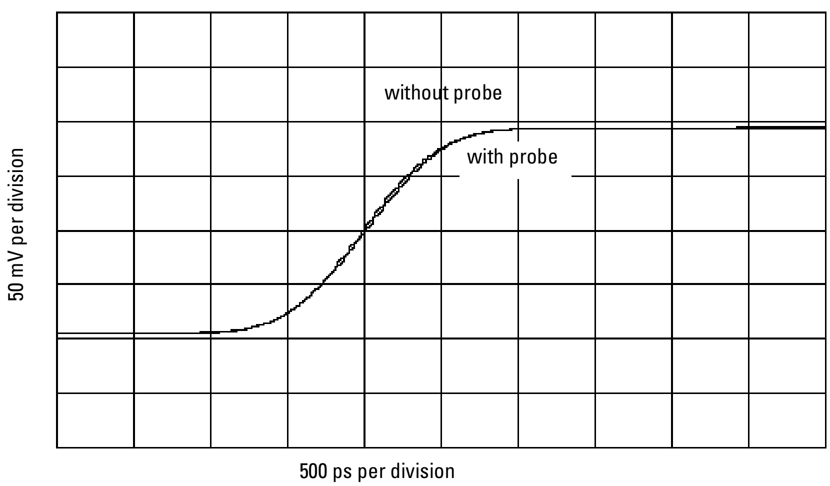
TDT measurement at receiver with and without probe load for 150 ps rise time



TDT measurement at receiver with and without probe load for 250 ps rise time



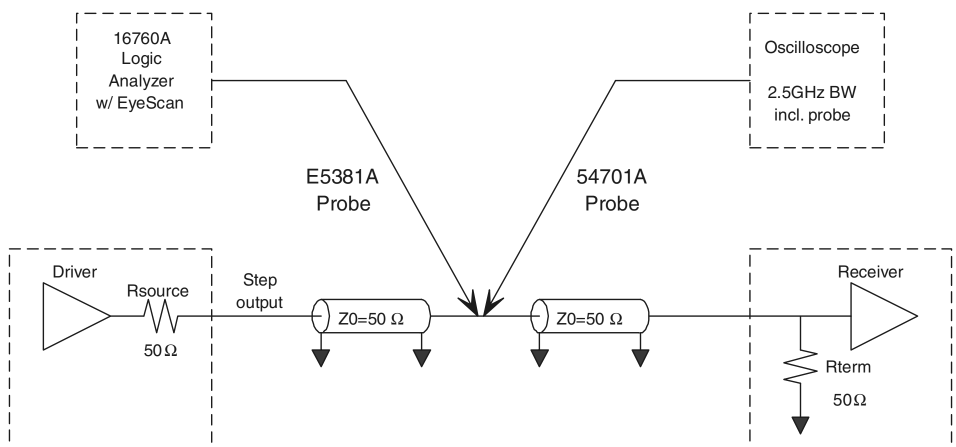
TDT measurement at receiver with and without probe load for 500 ps rise time



TDT measurement at receiver with and without probe load for 1 ns rise time

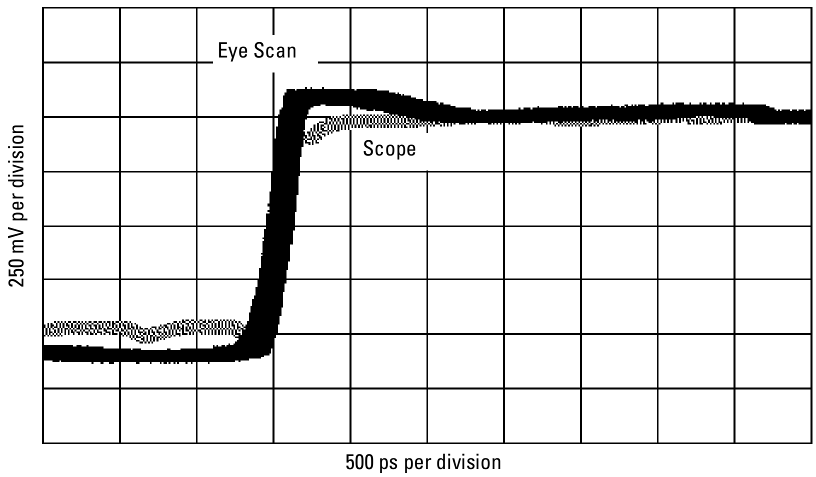
Step inputs

Maintaining signal fidelity to the logic analyzer is critical if the analyzer is to accurately capture data. One measure of a system's signal fidelity is to compare V_{in} to V_{out} for various step inputs. For the following graphs, V_{in} is the signal at the logic analyzer probe tip measured by double probing with an Agilent 54701A probe into an Agilent 54750A oscilloscope (total 2.5 GHz BW). Eye Scan is used to measure V_{out}, the signal seen by the logic analyzer. The measurements were made on a mid-bus connection to a 50 Ω transmission line load terminated at the receiver. These measurements show the logic analyzer's response while using the 82 Ω coaxial tip resistor.

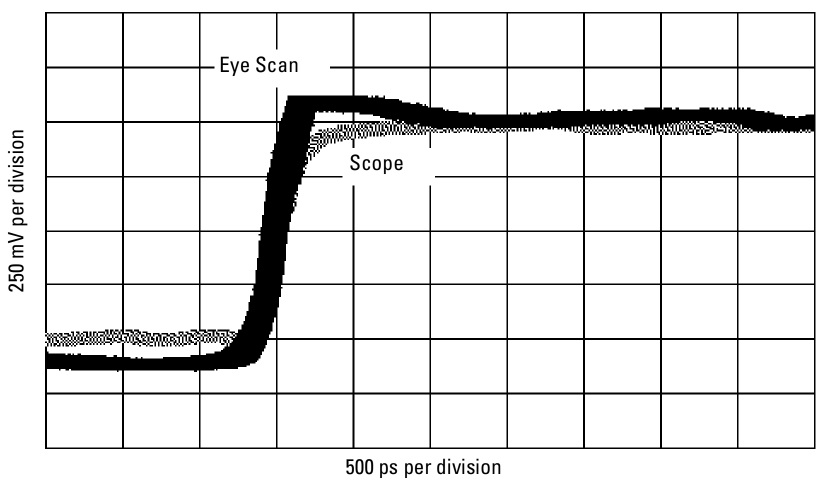


Step input measurement schematic

The following graphs demonstrate the logic analyzer's probe response to different rise times. These graphs are included for you to gain insight into the expected performance of the different recommended configurations.

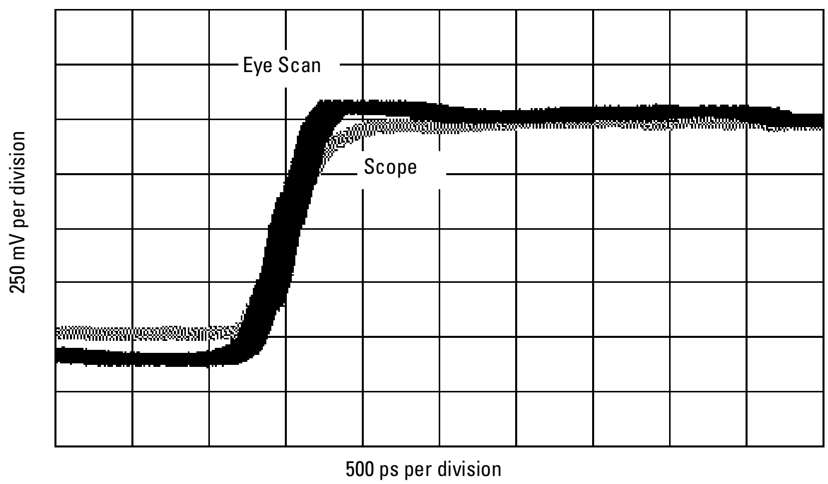


Logic analyzer's response to a 150 ps rise time

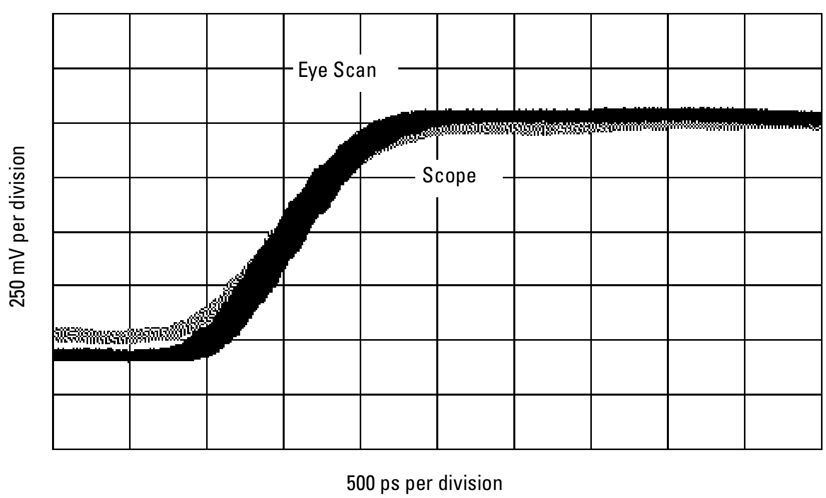


Logic analyzer's response to a 250 ps rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.



Logic analyzer's response to a 500 ps rise time

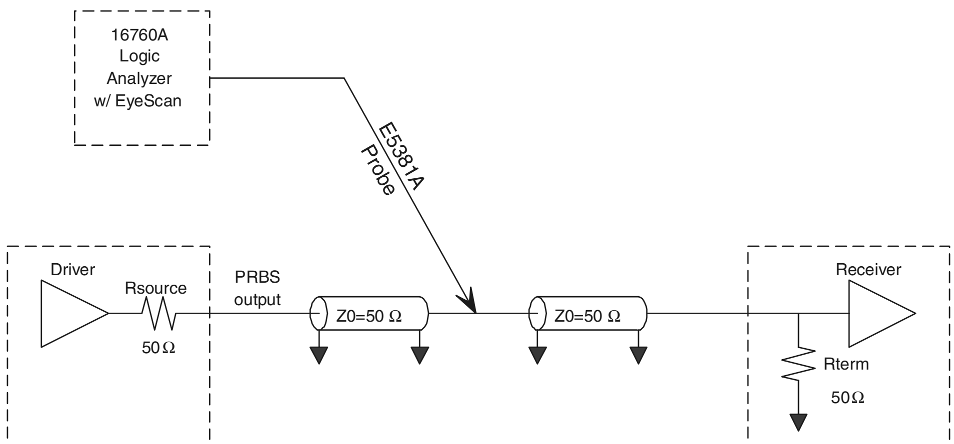


Logic analyzer's response to a 1 ns rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.

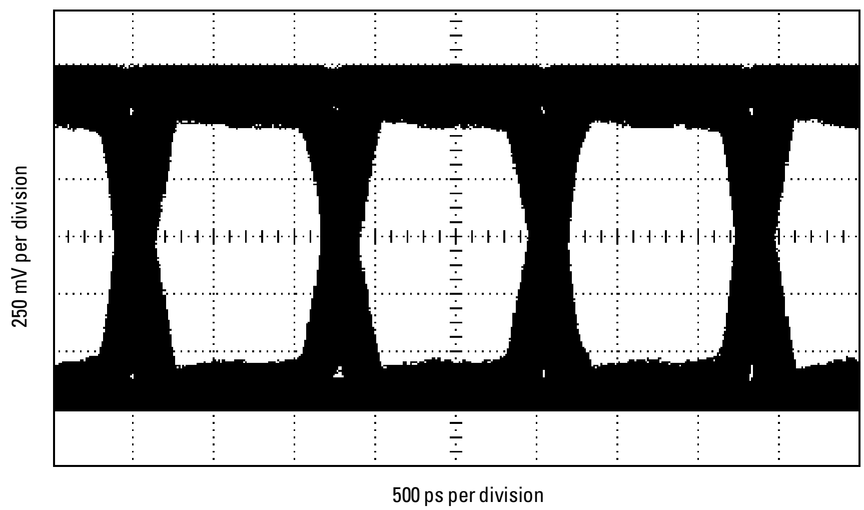
Eye opening

The eye opening at the logic analyzer is the truest measure of an analyzer's ability to accurately capture data. Seeing the eye opening at the logic analyzer is possible with Eye Scan. Eye opening helps you know how much margin the logic analyzer has, where to sample and at what threshold. Any probe response that exhibits overshoot and ringing, probe non-flatness, noise and other issues all deteriorate the eye opening seen by the logic analyzer. The following eye diagrams were measured using Eye Scan probed mid-bus on a 50 Ω transmission line load terminated at the receiver. The data patterns were generated using a $2^{23}-1$ pseudo random bit sequence (PRBS). These measurements show the remaining eye opening at the logic analyzer while using the 82 Ω coaxial tip resistor.

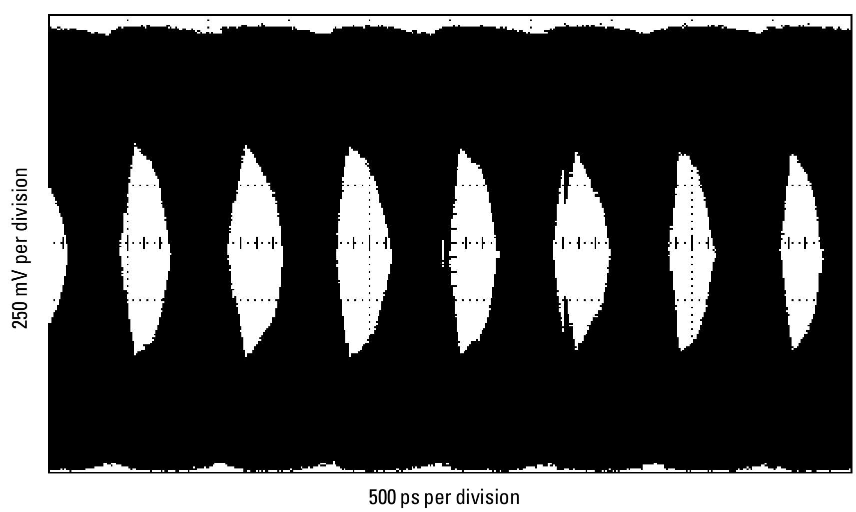


Eye opening measurement schematic

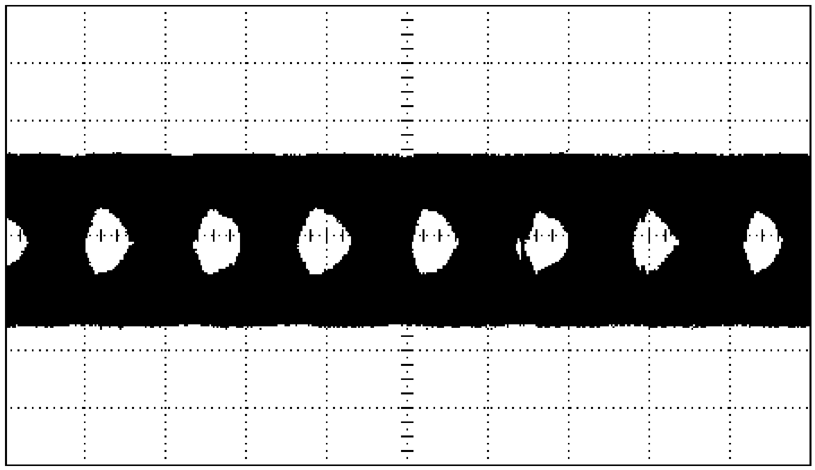
The logic analyzer Eye Scan measurement uses the same circuitry as the synchronous state mode analysis. Therefore, the eye openings measured are exact representations of what the logic analyzer sees and operates on in state mode. The following measurements demonstrate how the eye opening starts to collapse as the clock rate is increased. At 1500 Mb/s, the eye opening is noticeably deteriorating as jitter on the transitions increase and voltage margins decrease. As demonstrated by the last eye diagram, the 82 Ω coaxial tip resistor has a usable eye opening at 1500 Mb/s and minimum signal swing.



Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 800 Mb/s data rate



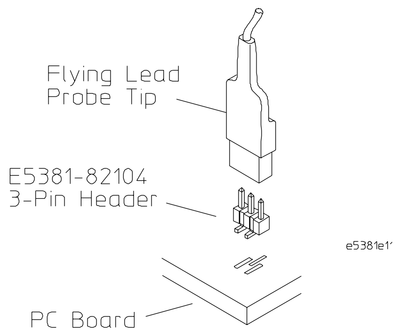
Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 1500 Mb/s data rate



Logic analyzer eye opening for a PRBS signal of 200 mV p-p, 1500 Mb/s data rate

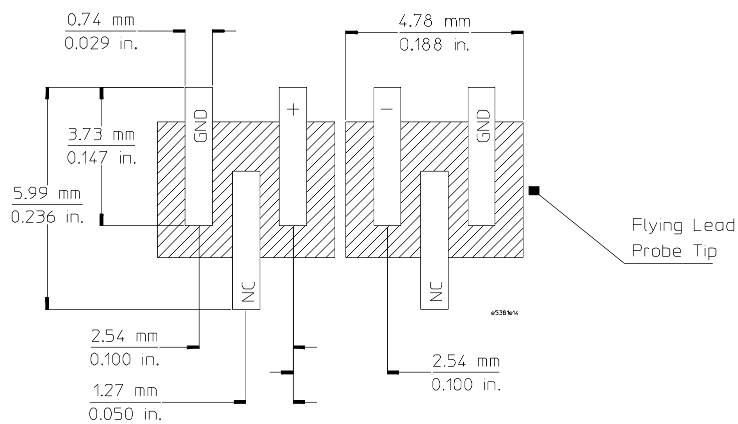
3-Pin Header

This configuration is recommended for probing individual signals. The 3-pin headers provided are SMT compatible and can be loaded during PC board assembly or hand soldered in place at a later time.



3-pin header probe configuration

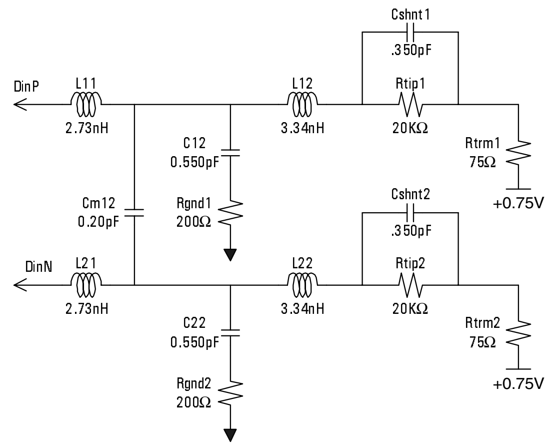
The following figure shows the footprint dimensions for surface mounting the 3-pin header on your PC board. Two footprints are shown illustrating minimum clearance.



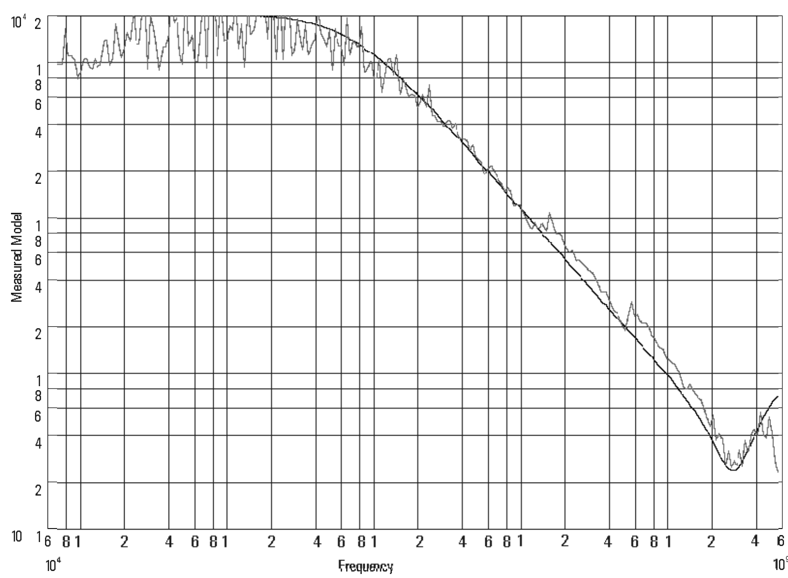
3-pin header probe PC board footprint configuration

Input Impedance

The E5381A probes have an input impedance which varies with frequency, and depends on which accessories are being used. The following schematic shows the circuit model for the input impedance of the probe when using the 3-pin header. This model is a simplified equivalent load of the measured input impedance seen by the target.



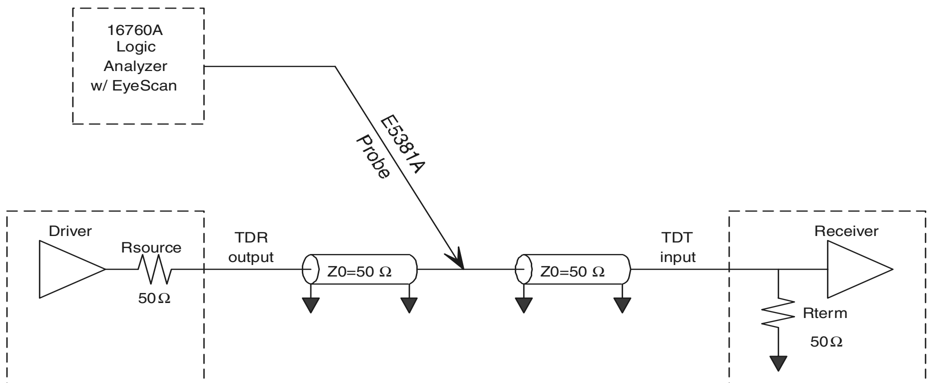
Equivalent load model



Measured versus modeled input impedance

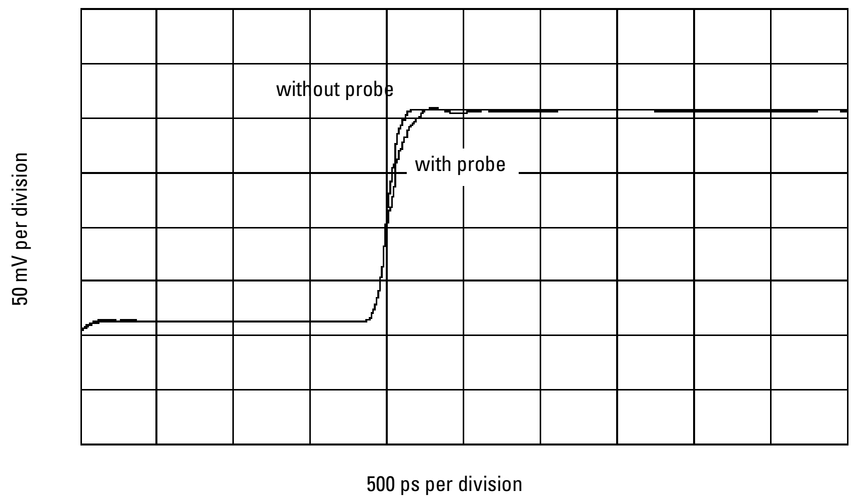
Time domain transmission (TDT)

All probes have a loading effect on the circuit when they come in contact with the circuit. Time domain transmission (TDT) measurements are useful for understanding the probe loading effects as seen at the target receiver. The following TDT measurements were made mid-bus on a 50 Ω transmission line load terminated at the receiver. These measurements show how the 3-pin header configuration affects the step seen by the receiver for various rise times.

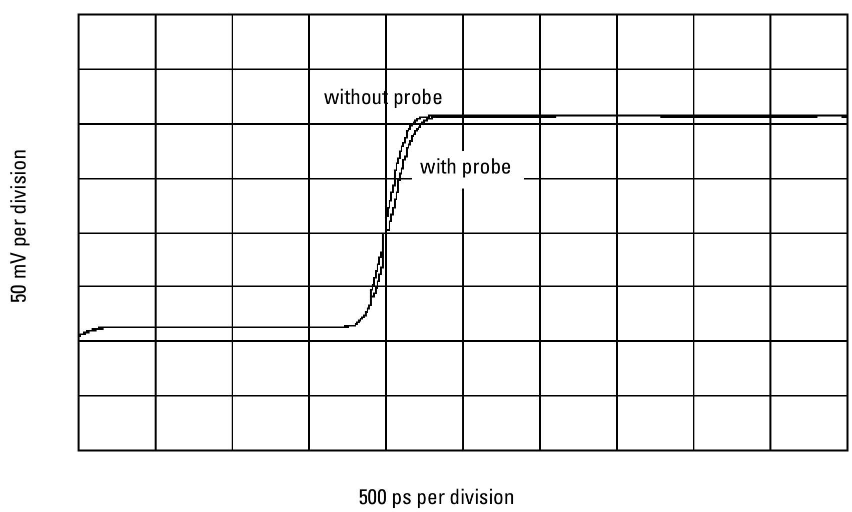


TDT measurement schematic

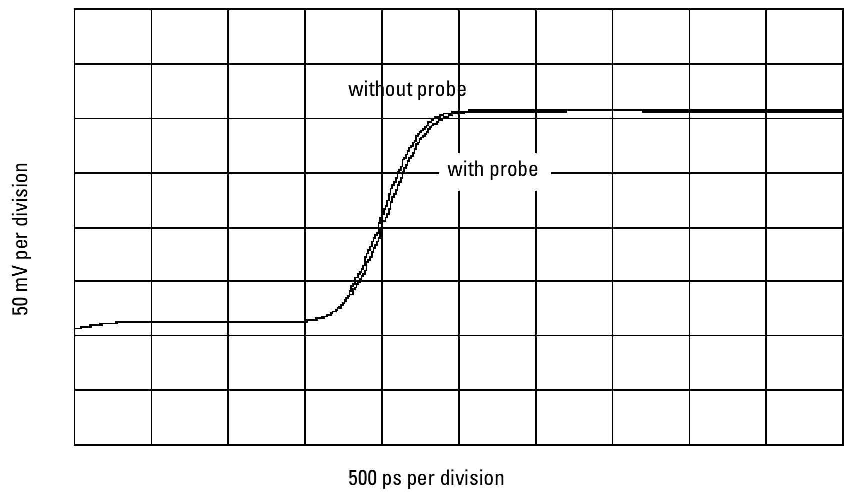
The recommended configurations are listed in order of loading on the target. As the following graphs demonstrate, the 3-pin header configuration has the 2nd best loading of the four recommended configurations. The graphs show that the loading effects are virtually invisible for targets with rise times ≥ 500 ps, negligible for targets with 250 ps rise times, and probably still acceptable for 150 ps rise times. Ultimately, you must determine what is an acceptable amount of distortion of the target signal.



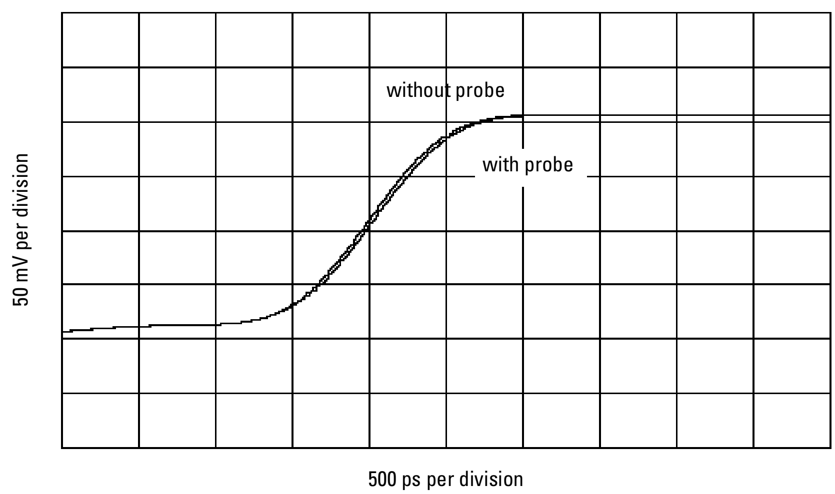
TDT measurement at receiver with and without probe load for 150 ps rise time



TDT measurement at receiver with and without probe load for 250 ps rise time



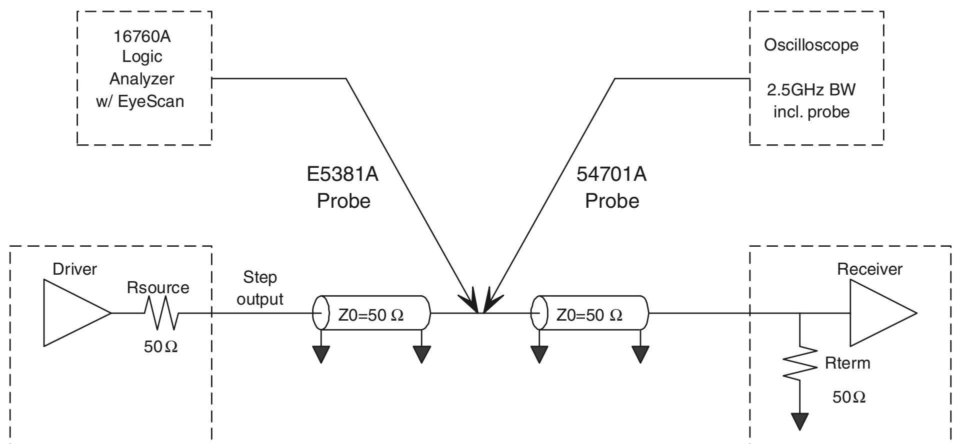
TDT measurement at receiver with and without probe load for 500 ps rise time



TDT measurement at receiver with and without probe load for 1 ns rise time

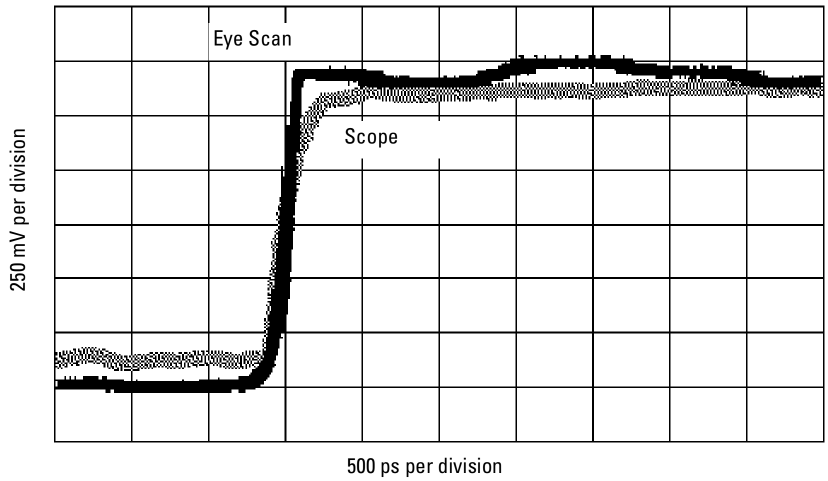
Step input

Maintaining signal fidelity to the logic analyzer is critical if the analyzer is to accurately capture data. One measure of a system's signal fidelity is to compare V_{in} to V_{out} for various step inputs. For the following graphs, V_{in} is the signal at the logic analyzer probe tip measured by double probing with an Agilent 54701A probe into an Agilent 54750A oscilloscope (total 2.5 GHz BW). Eye Scan is used to measure V_{out}, the signal seen by the logic analyzer. The measurements were made on a mid-bus connection to a 50 Ω transmission line load terminated at the receiver. These measurements show the logic analyzer's response while using the 3-pin header configuration.

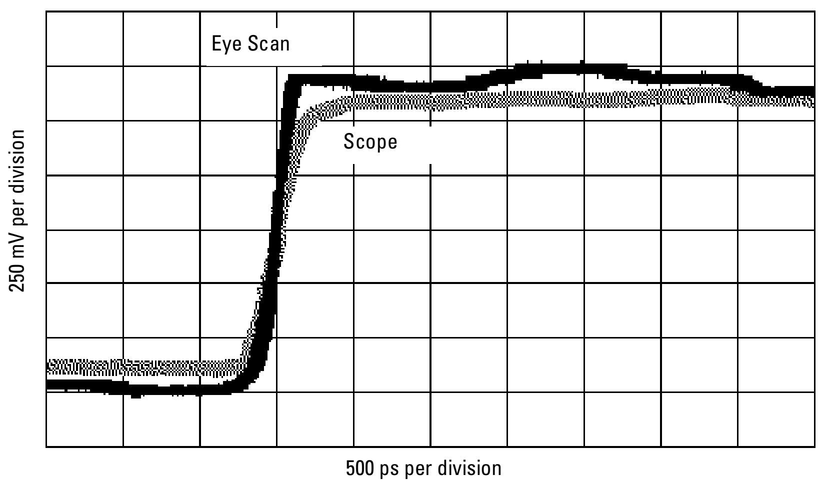


Step input measurement schematic

The following graphs demonstrate the logic analyzer's probe response to different rise times. These graphs are included for you to gain insight into the expected performance of the different recommended configurations.

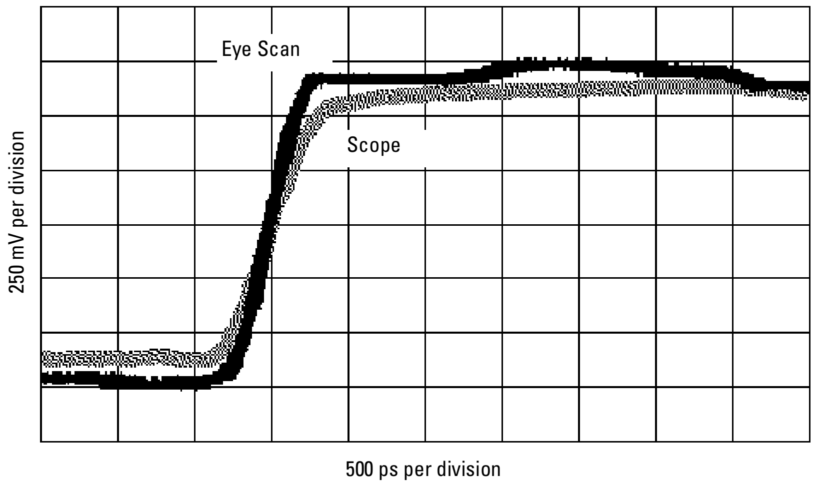


Logic analyzer's response to a 150 ps rise time

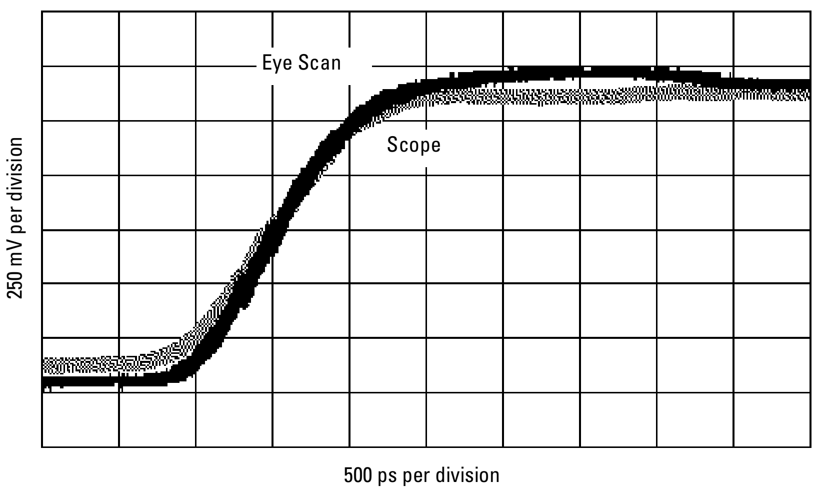


Logic analyzer's response to a 250 ps rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.



Logic analyzer's response to a 500 ps rise time

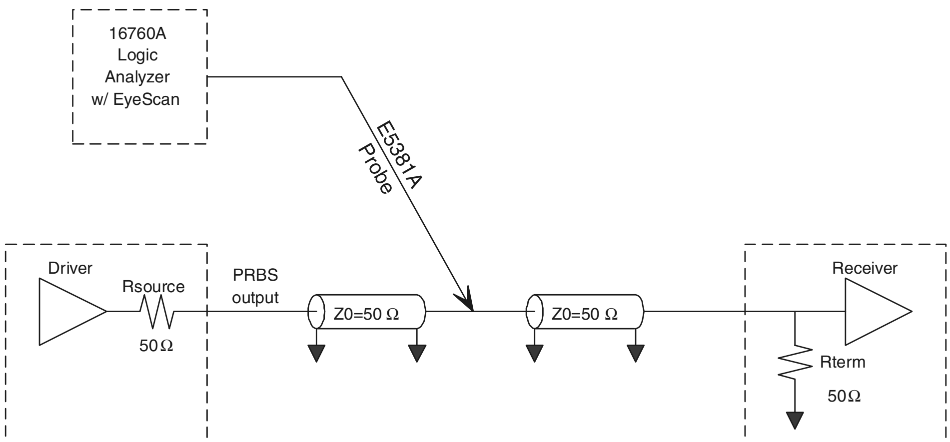


Logic analyzer's response to a 1 ns rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.

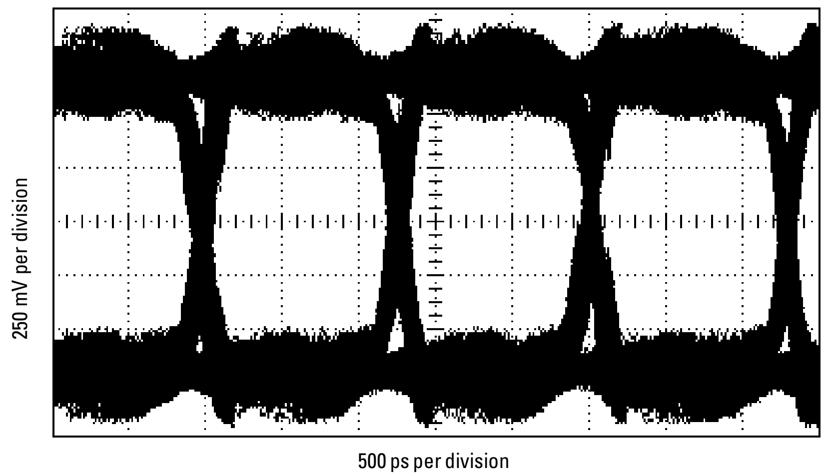
Eye opening

The eye opening at the logic analyzer is the truest measure of an analyzer's ability to accurately capture data. Seeing the eye opening at the logic analyzer is possible with Eye Scan. Eye opening helps you know how much margin the logic analyzer has, where to sample and at what threshold. Any probe response that exhibits overshoot and ringing, probe non-flatness, noise and other issues all deteriorate the eye opening seen by the logic analyzer. The following eye diagrams were measured using Eye Scan probed mid-bus on a 50 Ω transmission line load terminated at the receiver. The data patterns were generated using a $2^{23}-1$ pseudo random bit sequence (PRBS). These measurements show the remaining eye opening at the logic analyzer while using the 3-pin header configuration.

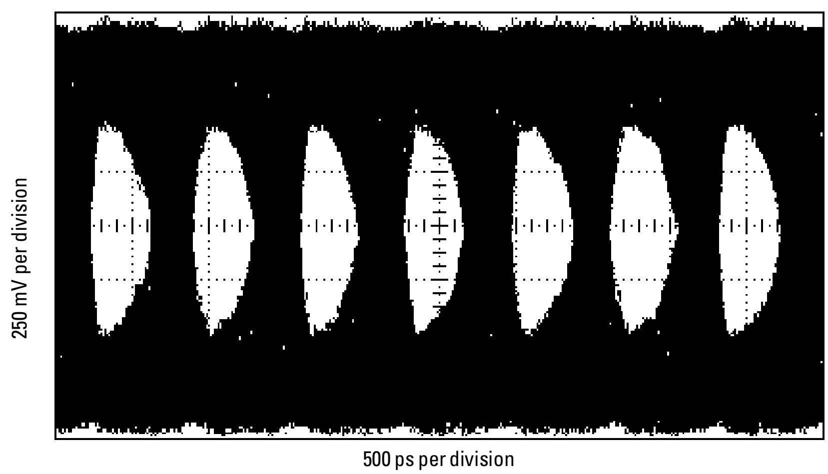


Eye opening measurement schematic

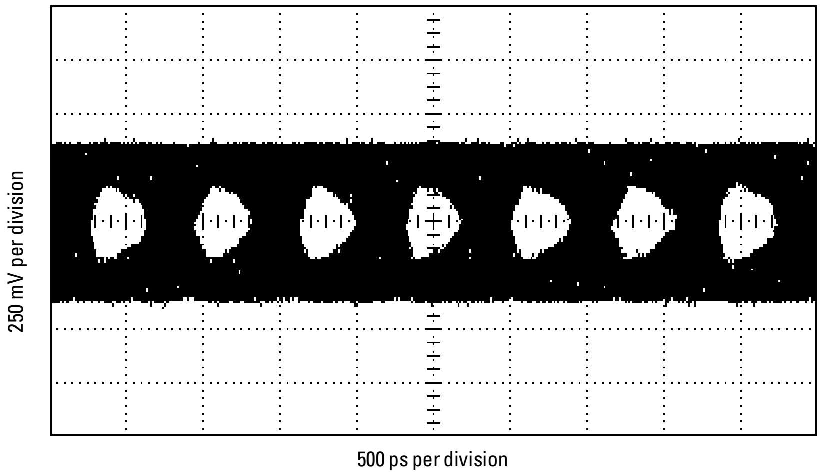
The logic analyzer Eye Scan measurement uses the same circuitry as the synchronous state mode analysis. Therefore, the eye openings measured are exact representations of what the logic analyzer sees and operates on in state mode. The following measurements demonstrate how the eye opening starts to collapse as the clock rate is increased. At 1500 Mb/s, the eye opening is noticeably deteriorating but still usable as jitter on the transitions increase and voltage margins decrease.



Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 800 Mb/s data rate



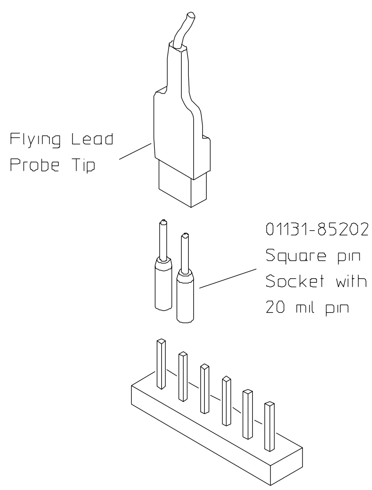
Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 1500 Mb/s data rate



Logic analyzer eye opening for a PRBS signal of 200 mV p-p, 1500 Mb/s data rate

Socket Adapters

This configuration is recommended if you already have 0.635 mm (0.025 inch) pins on 2.54 mm (0.1 inch) centers as test points where you wish to connect the probe. The E5381A only accepts 0.508 mm (0.020 inch) pins. The probe will be damaged if 0.635 mm (0.025 inch) pins are forced into the probe receptacle. The socket adapter provides a means of probing these headers while protecting the flying lead probe tip.

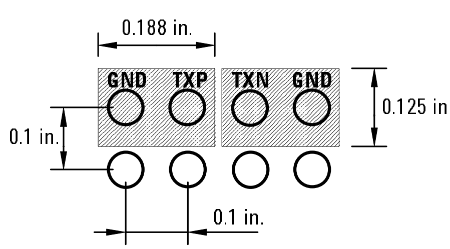


Socket adapter configuration

All of the following measurements for the socket adapter were made on a header with 0.635 mm (0.025 inch) pins on 2.54 mm (0.1 inch) centers that where converted to 0.508 mm (0.020 inch) pins using the socket adapter.

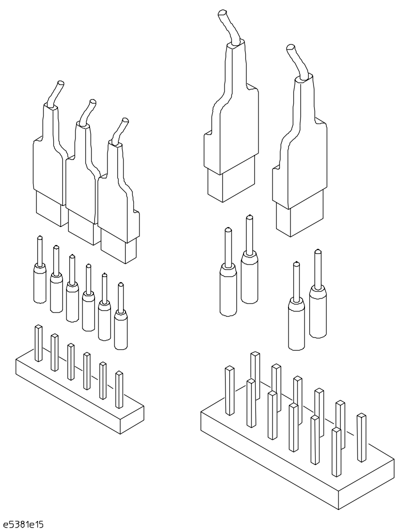
Using multiple socket adapters

The grey boxes in the following diagram show the dimensions of the socket adapters

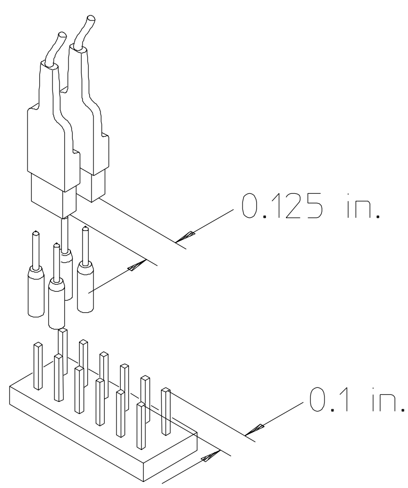


Socket adapter clearance.

Multiple adapters can be used side-by-side or in tandem by skipping 1 or more pins as shown.

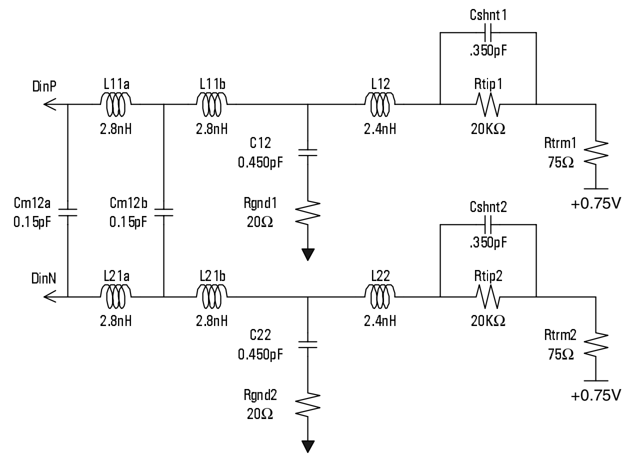


Mechanical clearance does not allow the adapters to be used back-to-back as shown.

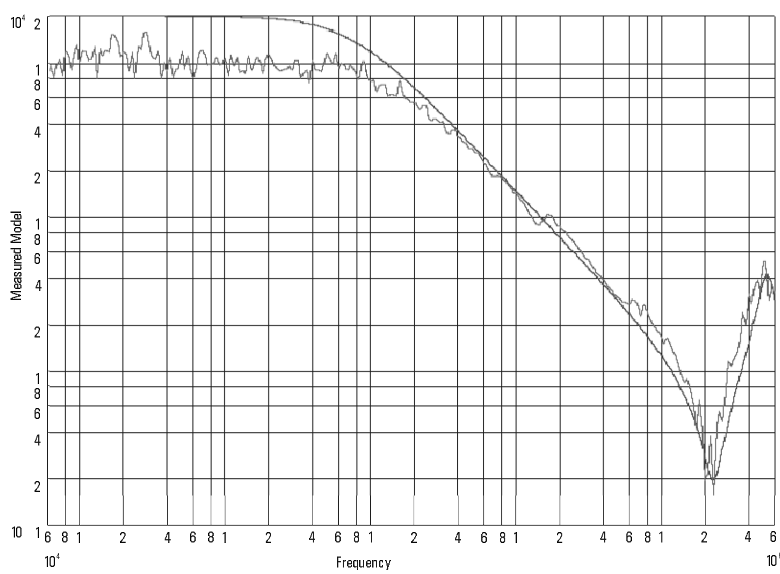


Input Impedance

The E5381A probes have an input impedance which varies with frequency, and depends on which accessories are being used. The following schematic shows the circuit model for the input impedance of the probe when using socket adapters. This model is a simplified equivalent load of the measured input impedance seen by the target.



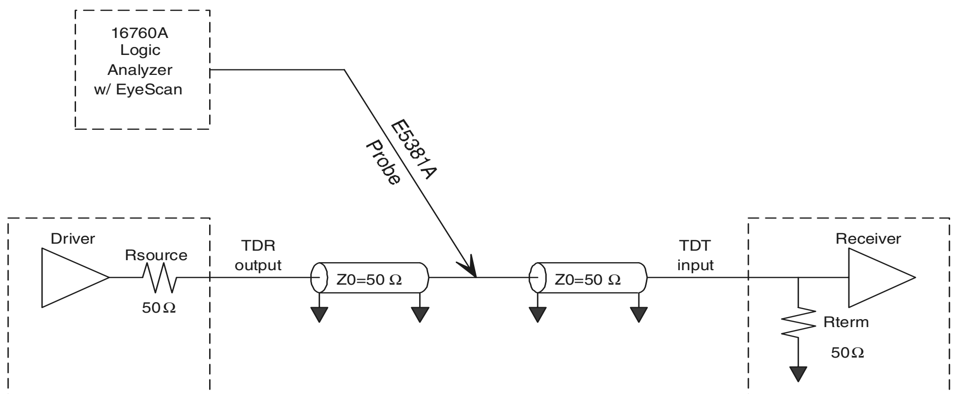
Equivalent load model



Measured versus modeled input impedance

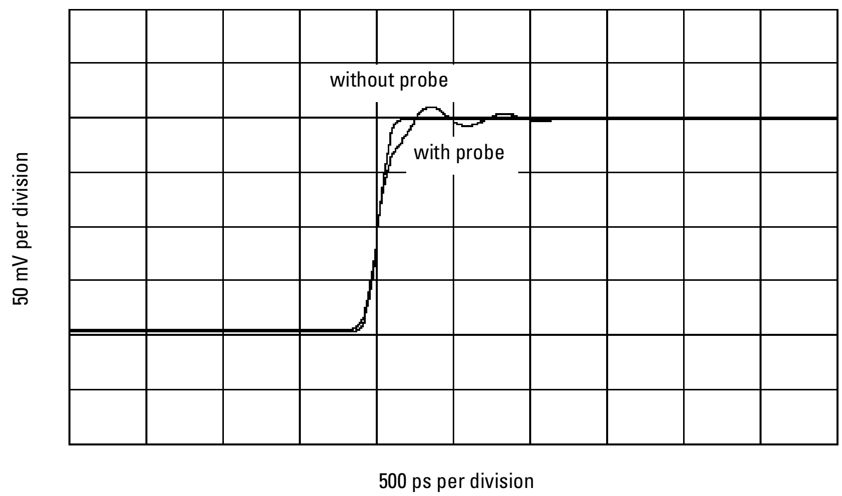
Time domain transmission (TDT)

All probes have a loading effect on the circuit when they come in contact with the circuit. Time domain transmission (TDT) measurements are useful for understanding the probe loading effects as seen at the target receiver. The following TDT measurements were made mid-bus on a 50 Ω transmission line load terminated at the receiver. These measurements show how the flying lead and socket adapter configuration affect the step seen by the receiver for various rise times.

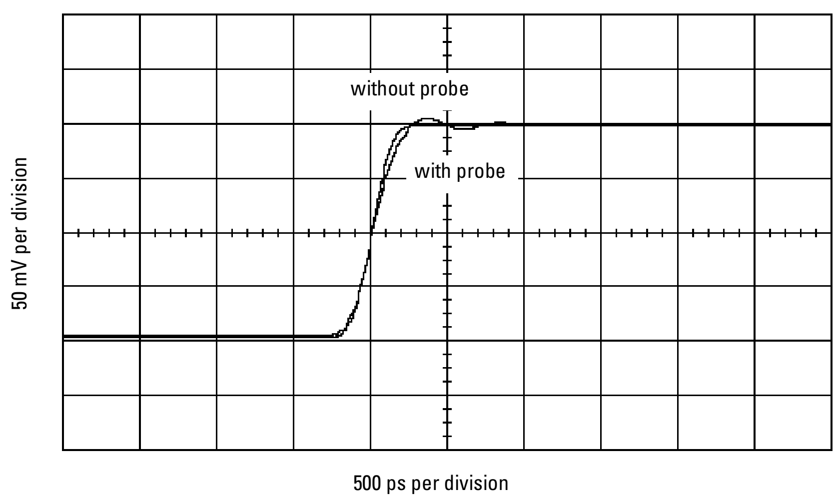


TDT measurement schematic

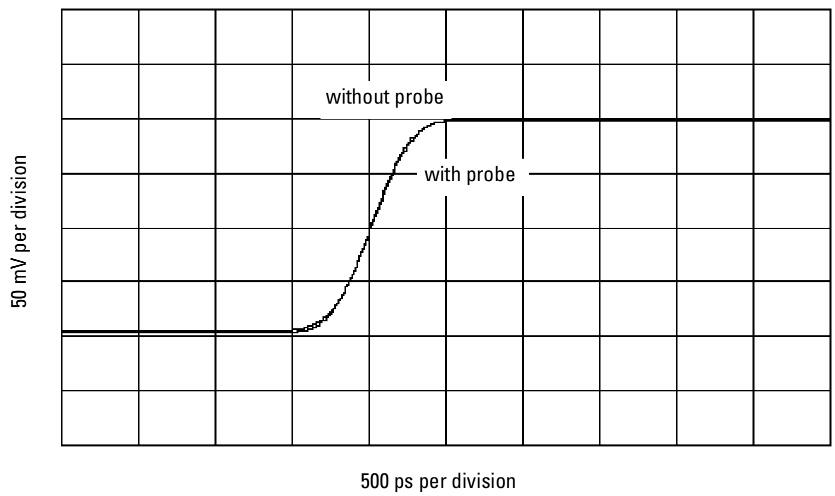
The recommended configurations are listed in order of loading on the target. As the following graphs demonstrate, the flying lead and socket adapter configuration has the 3rd best loading of the four recommended configurations. The graphs show that the loading effects are negligible for targets with rise times ≥ 500 ps, probably still acceptable for targets with 250 ps rise times, and may be considered significant for 150 ps rise times. Ultimately, you must determine what is an acceptable amount of distortion of the target signal.



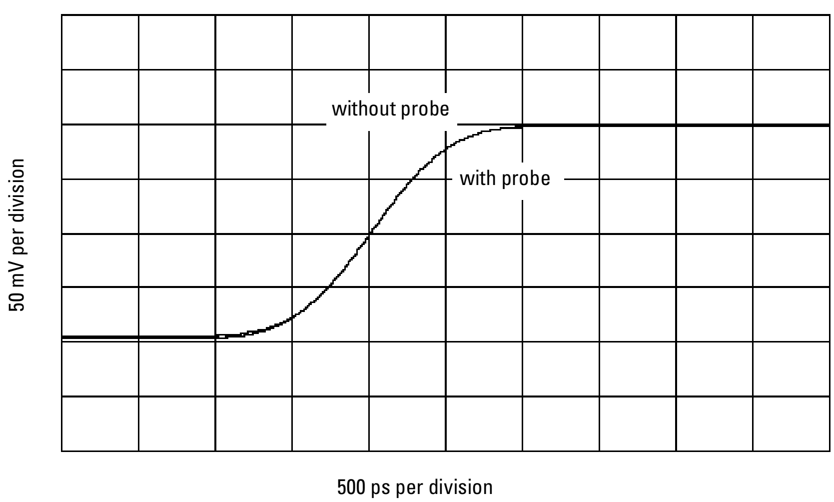
TDT measurement at receiver with and without probe load for 150 ps rise time



TDT measurement at receiver with and without probe load for 250 ps rise time



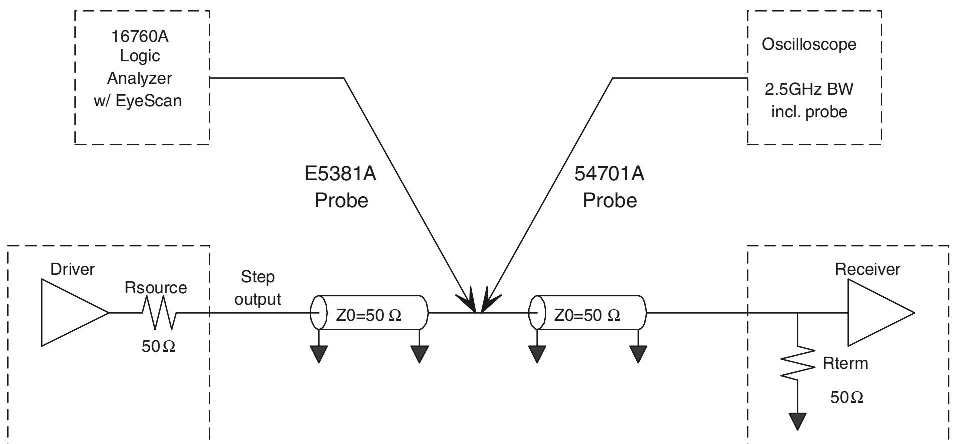
TDT measurement at receiver with and without probe load for 500 ps rise time



TDT measurement at receiver with and without probe load for 1 ns rise time

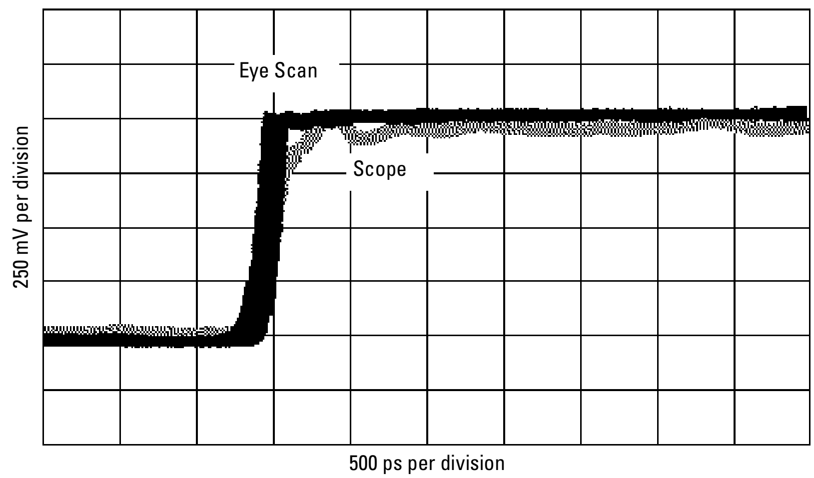
Step input

Maintaining signal fidelity to the logic analyzer is critical if the analyzer is to accurately capture data. One measure of a system's signal fidelity is to compare V_{in} to V_{out} for various step inputs. For the following graphs, V_{in} is the signal at the logic analyzer probe tip measured by double probing with an Agilent 54701A probe into an Agilent 54750A oscilloscope (total 2.5 GHz BW). Eye Scan is used to measure V_{out}, the signal seen by the logic analyzer. The measurements were made on a mid-bus connection to a 50 Ω transmission line load terminated at the receiver. These measurements show the logic analyzer's response while using the flying lead and socket adapter configuration.

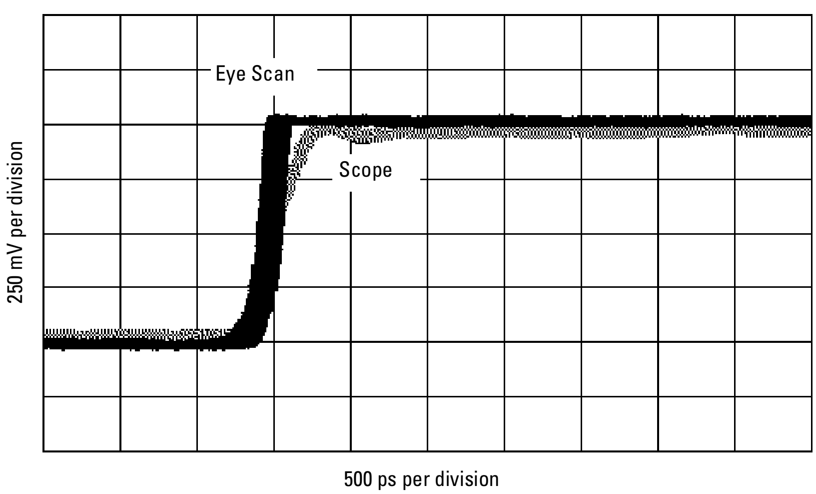


Step measurement schematic

The following graphs demonstrate the logic analyzer's probe response to different rise times. These graphs are included for you to gain insight into the expected performance of the different recommended accessory configurations.

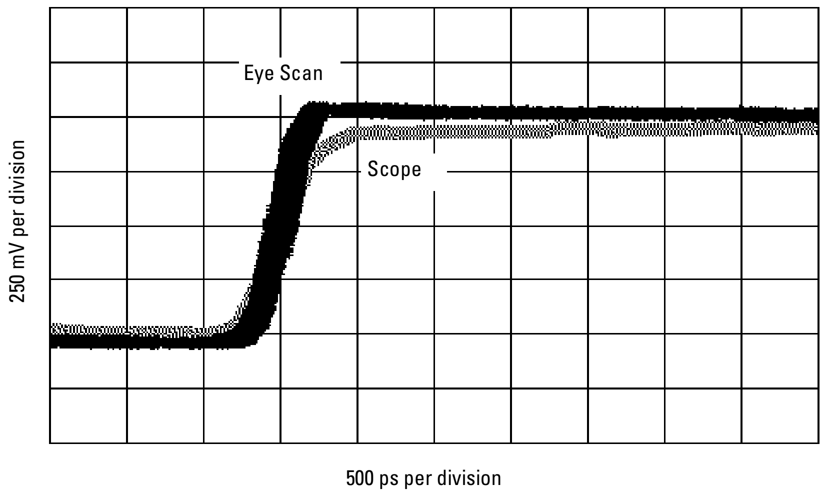


Logic analyzer's response to a 150 ps rise time

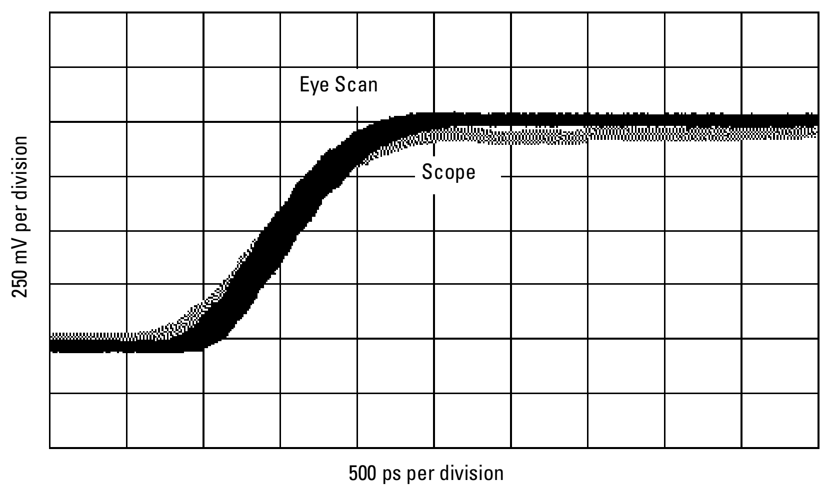


Logic analyzer's response to a 250 ps rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.



Logic analyzer's response to a 500 ps rise time

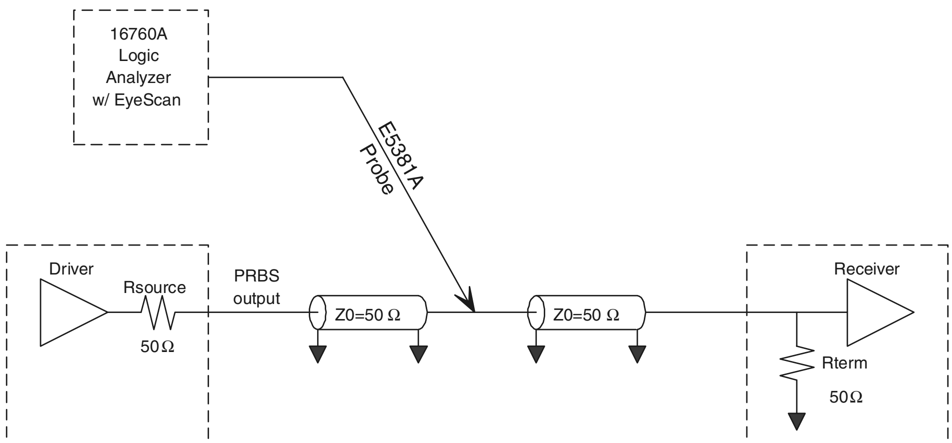


Logic analyzer's response to a 1 ns rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.

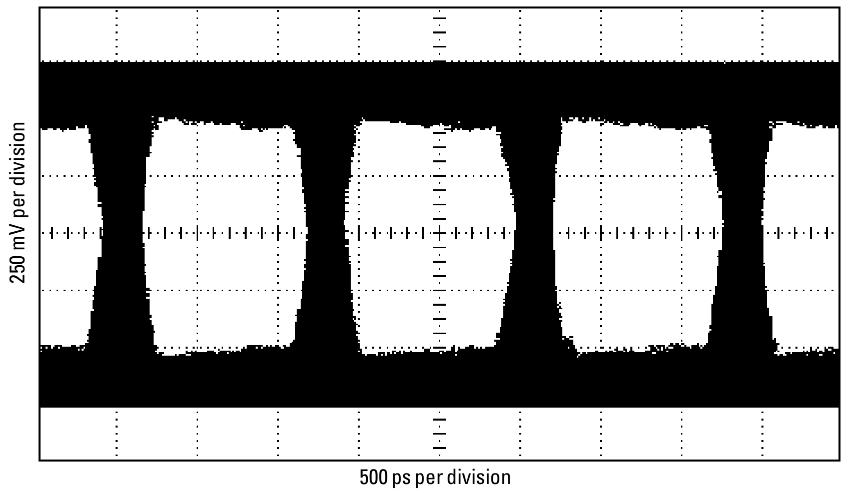
Eye opening

The eye opening at the logic analyzer is the truest measure of an analyzer's ability to accurately capture data. Seeing the eye opening at the logic analyzer is possible with Eye Scan. Eye opening helps you know how much margin the logic analyzer has, where to sample and at what threshold. Any probe response that exhibits overshoot and ringing, probe non-flatness, noise and other issues all deteriorate the eye opening seen by the logic analyzer. The following eye diagrams were measured using Eye Scan probed mid-bus on a 50 **Ω** transmission line load terminated at the receiver. The data patterns were generated using a $2^{23}-1$ pseudo random bit sequence (PRBS). These measurements show the remaining eye opening at the logic analyzer while using the flying lead and socket adapter configuration.

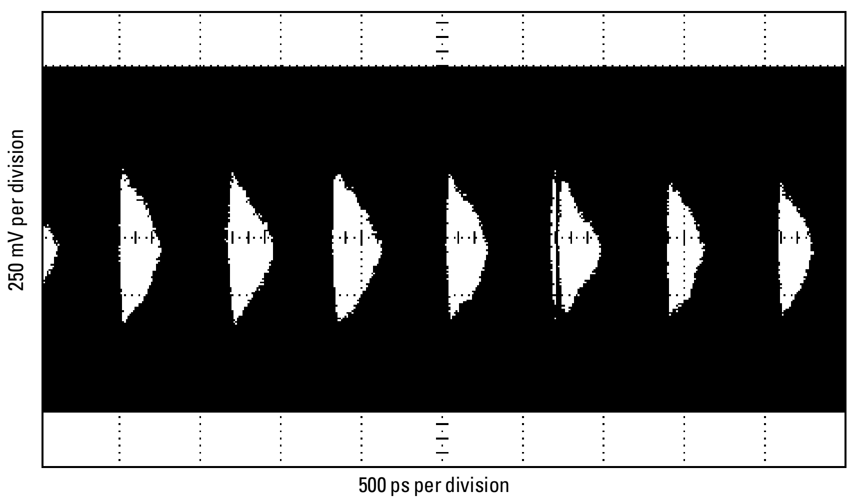


Eye opening measurement schematic

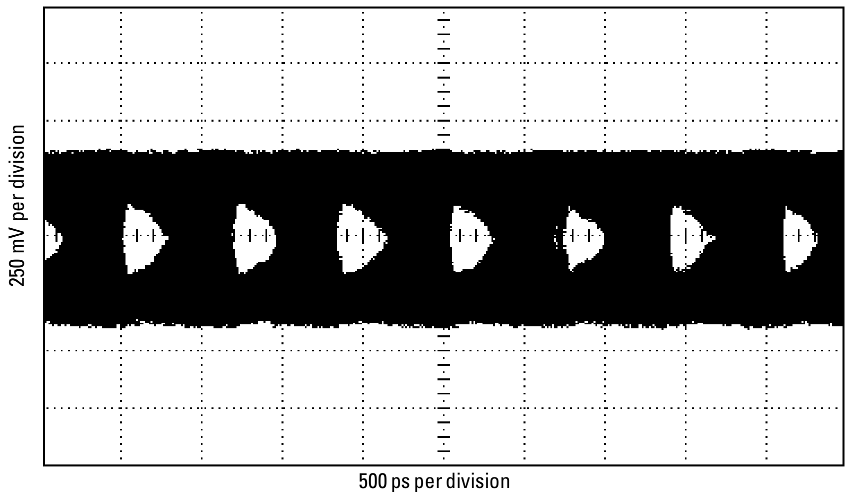
The logic analyzer Eye Scan measurement uses the same circuitry as the synchronous state mode analysis. Therefore, the eye openings measured are exact representations of what the logic analyzer sees and operates on in state mode. The following measurements demonstrate how the eye opening starts to collapse but is still usable as the clock rate is increased.



Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 800 Mb/s data rate



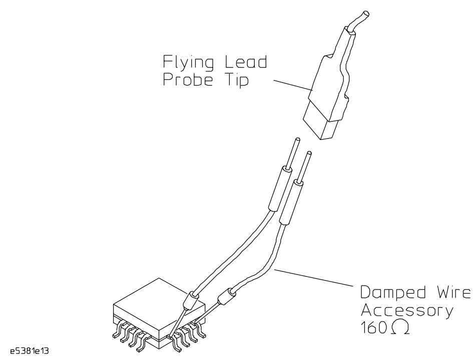
Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 1500 Mb/s data rate



Logic analyzer eye opening for a PRBS signal of 200 mV p-p, 1500 Mb/s data rate

Damped Wire Accessory (160 ohm)

Using the damped wire accessory gives the greatest flexibility for attaching the probe to component leads. The damped wires can be easily formed to reach very constricted regions of the target. However, as you can see from the following information, the signal quality is slightly compromised by this configuration.

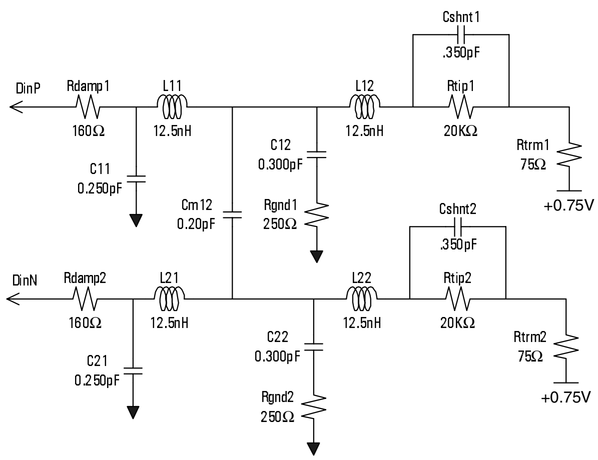


Damped wire configuration

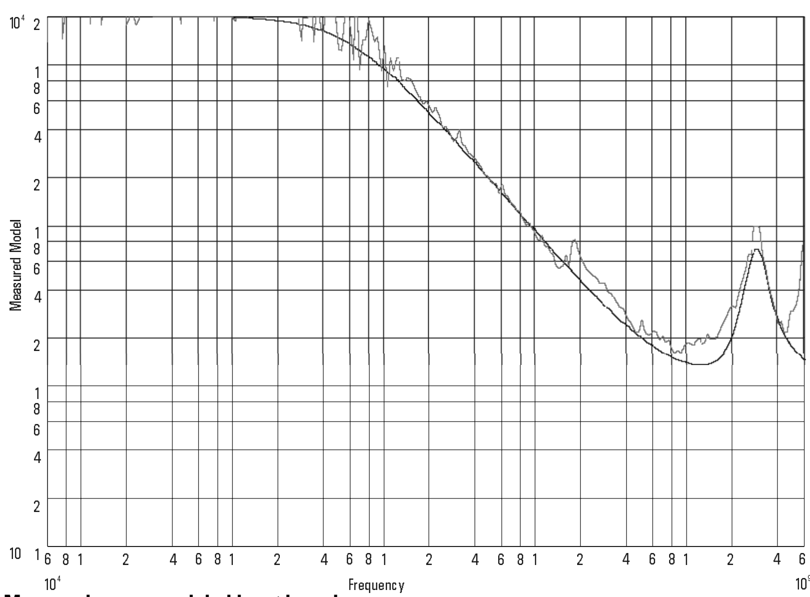
The damped wire accessory is a 160 Ω tip resistor that is followed by a length of wire prior to attaching to the probe tip. This configuration provides flexibility to the user and isolation between the target and the probe capacitance. However, the 160 Ω resistor and the capacitance of the wire form an RC filter that rolls off the response of the signal that the probe tip sees.

Input Impedance

The E5381A probes have an input impedance which varies with frequency, and depends on which accessories are being used. The following schematic shows the circuit model for the input impedance of the probe when using the damped wire configuration. This model is a simplified equivalent load of the measured input impedance seen by the target.

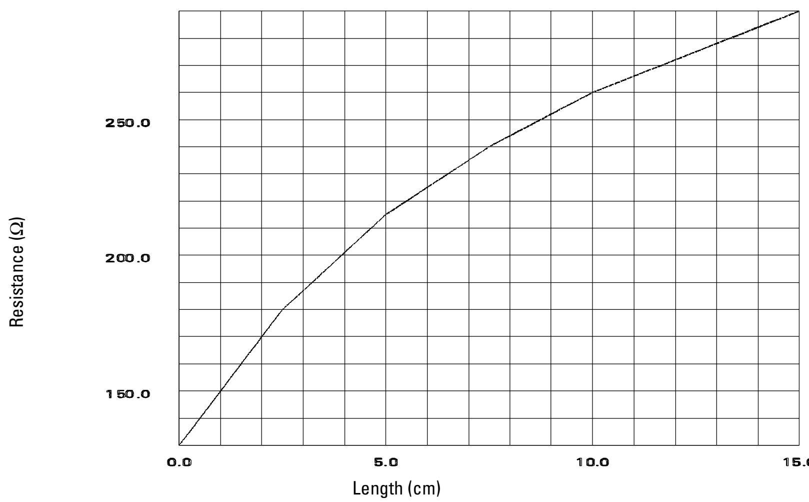


Equivalent load model



Measured versus modeled input impedance

Other signal lead lengths may be used with these probes 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.

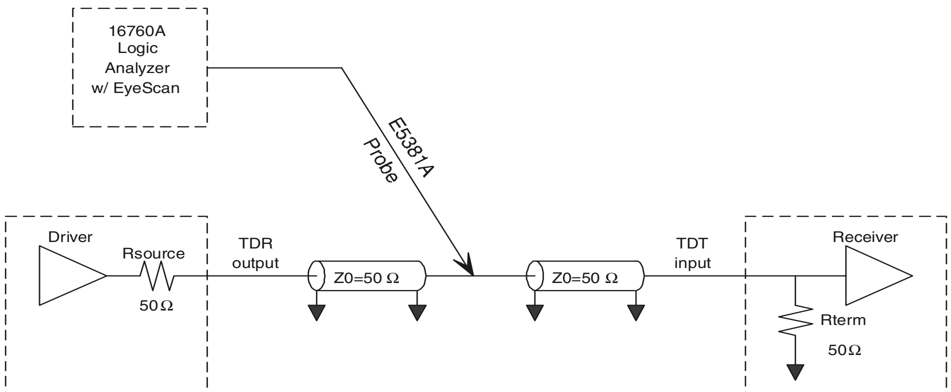


Optimum Damping Resistor Value Versus Signal Lead Length

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.

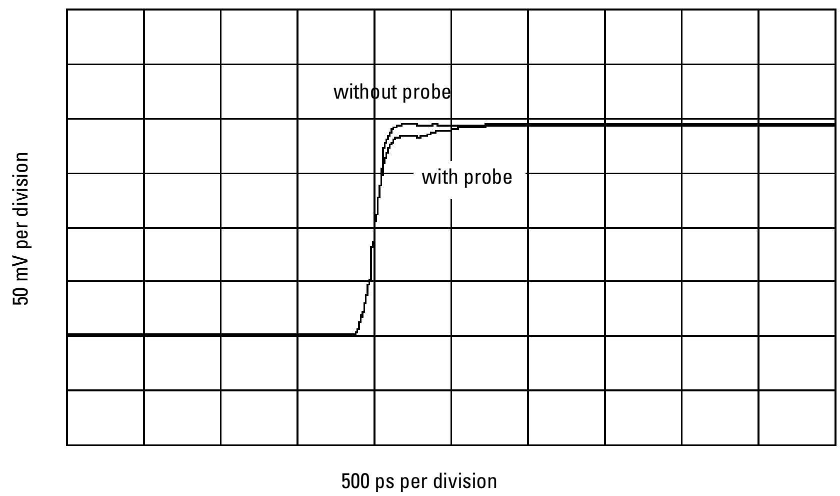
Time domain transmission (TDT)

All probes have a loading effect on the circuit when they come in contact with the circuit. Time domain transmission (TDT) measurements are useful for understanding the probe loading effects as seen at the target receiver. The following TDT measurements were made mid-bus on a 50 Ω transmission line load terminated at the receiver. These measurements show how the damped wire configuration affect the step seen by the receiver for various rise times.

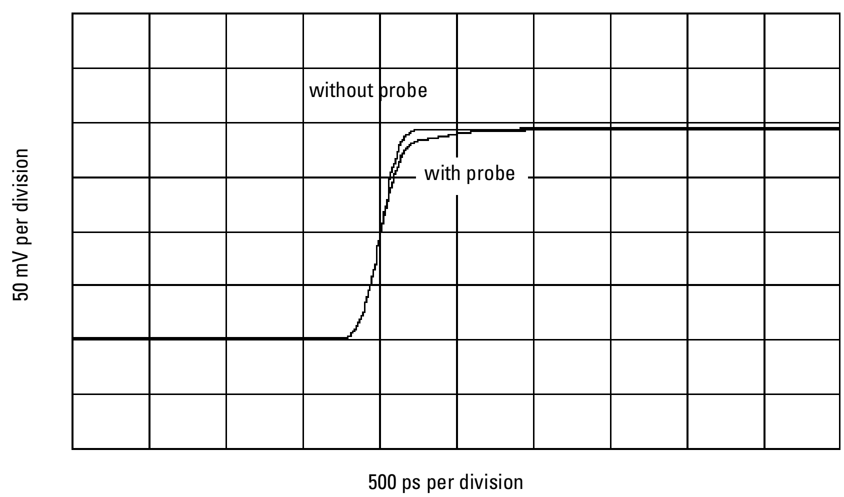


TDT measurement schematic

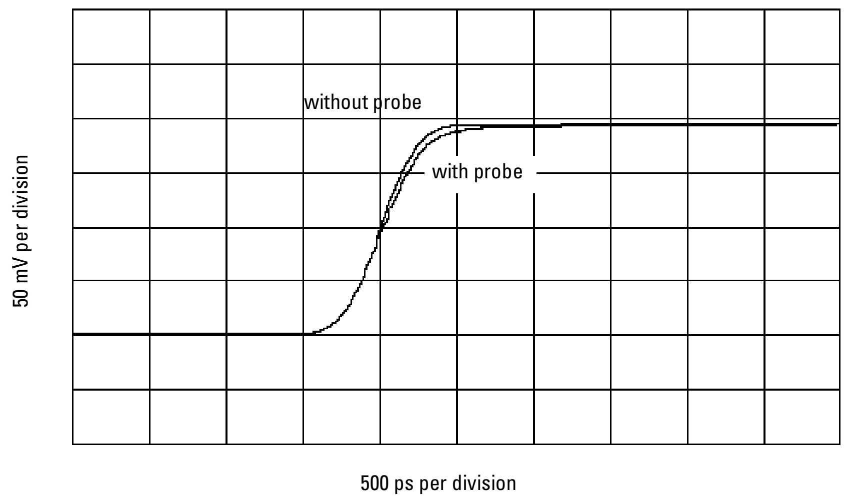
The loading of the damped wire accessory on the target is still very good. Having the 160 Ω resistor very close to the target isolates the target to from the capacitance of the probe. Ultimately, you must determine what is an acceptable amount of distortion of the target system.



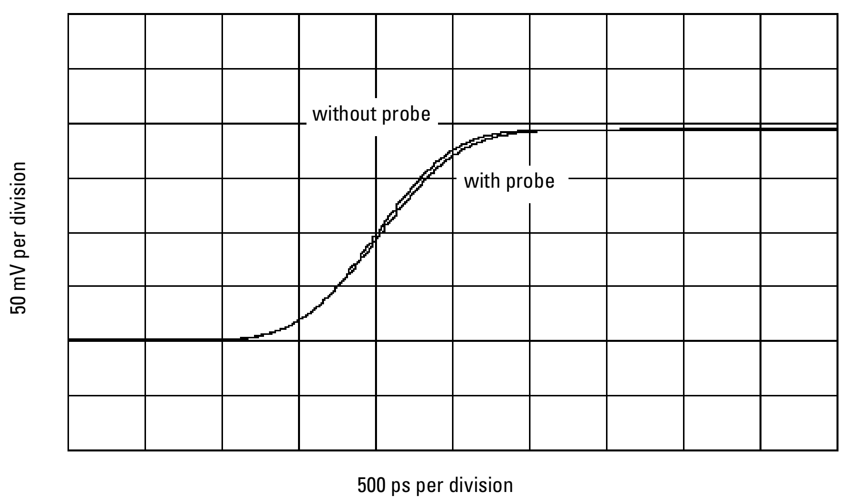
TDT measurement at receiver with and without probe load for 150 ps rise time



TDT measurement at receiver with and without probe load for 250 ps rise time



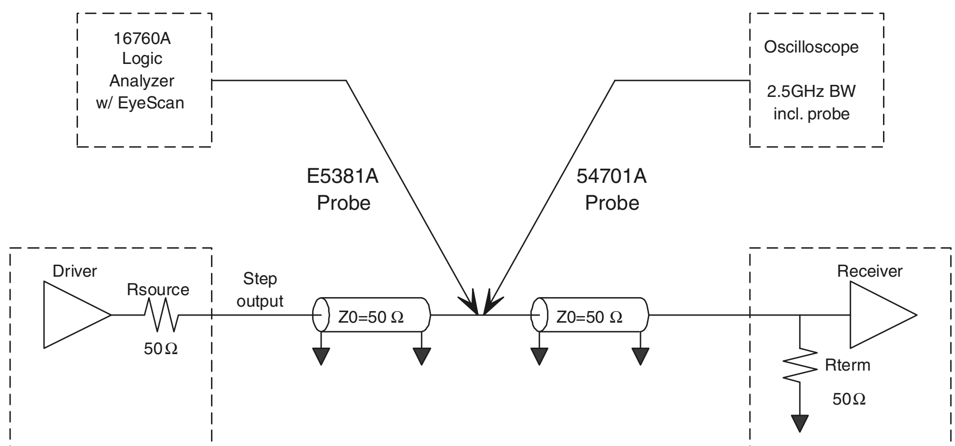
TDT measurement at receiver with and without probe load for 500 ps rise time



TDT measurement at receiver with and without probe load for 1 ns rise time

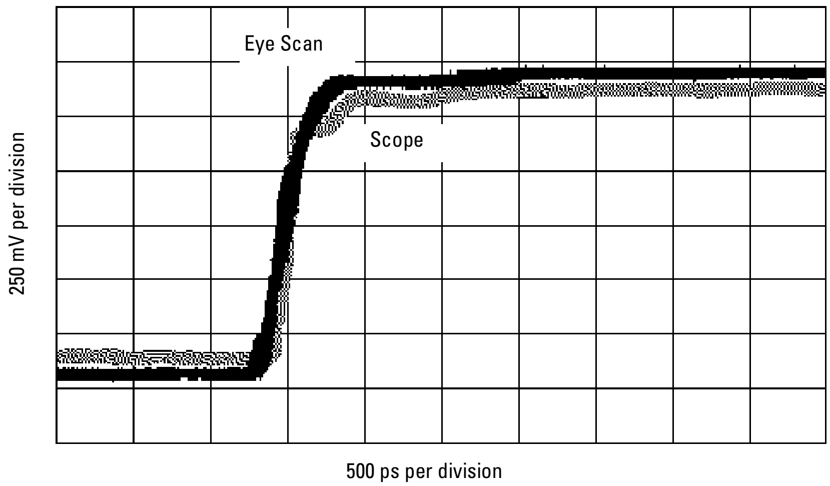
Step input

Maintaining signal fidelity to the logic analyzer is critical if the analyzer is to accurately capture data. One measure of a system's signal fidelity is to compare V_{in} to V_{out} for various step inputs. For the following graphs, V_{in} is the signal at the logic analyzer probe tip measured by double probing with an Agilent 54701A probe into an Agilent 54750A oscilloscope (total 2.5 GHz BW). Eye Scan is used to measure V_{out}, the signal seen by the logic analyzer. The measurements were made on a mid-bus connection to a 50 Ω transmission line load terminated at the receiver. These measurements show the logic analyzer's response while using the damped wire configuration.

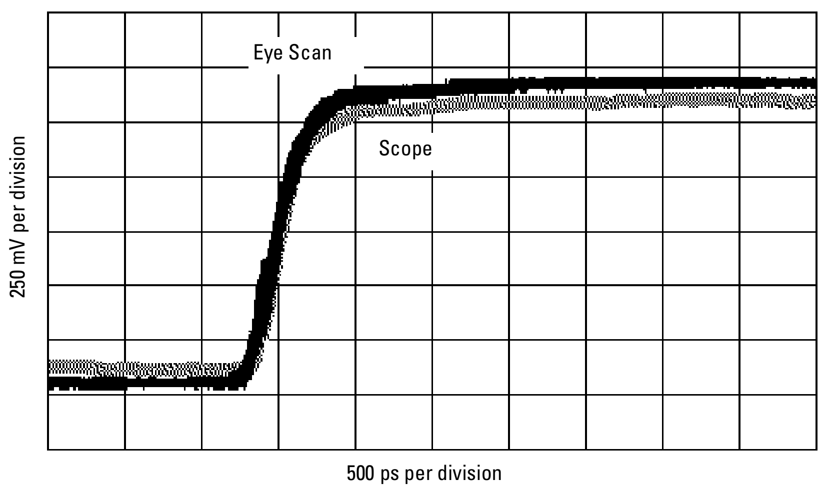


Step measurement schematic

The following graphs demonstrate the logic analyzer's probe response to different rise times. These graphs are included for you to gain insight into the expected performance of the different recommended accessory configurations, particularly for the damped wire configuration. These plots show how the target signals have minimal loading while the signal that the probe tip sees (Eye Scan) is being slightly rolled off. This is due to the RC filter effect of the damped wire configuration.

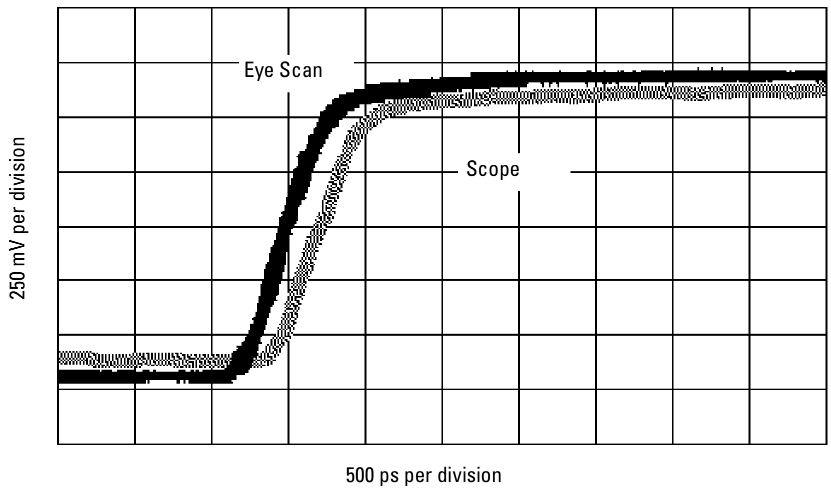


Logic analyzer's response to a 150 ps rise time

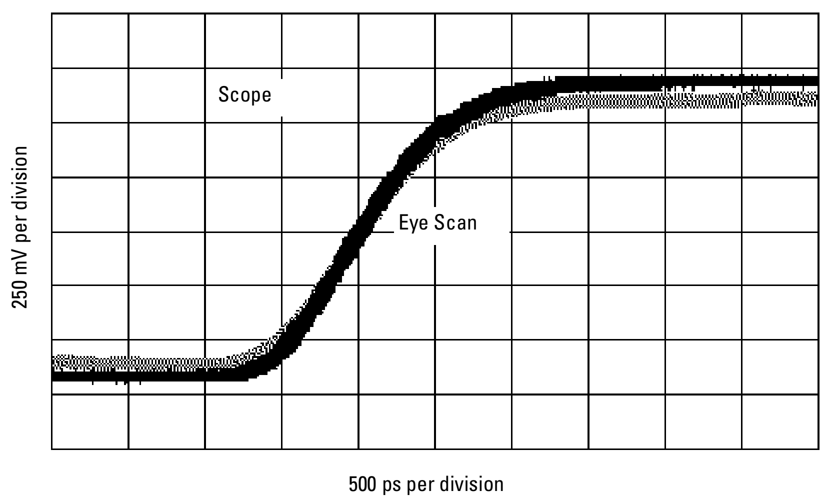


Logic analyzer's response to a 250 ps rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.



Logic analyzer's response to a 500 ps rise time



Logic analyzer's response to a 1 ns rise time

Note: These measurements are not the true step response of the probes. The true step response of a probe is the output of the probe while the input is a perfect step.

Eye opening

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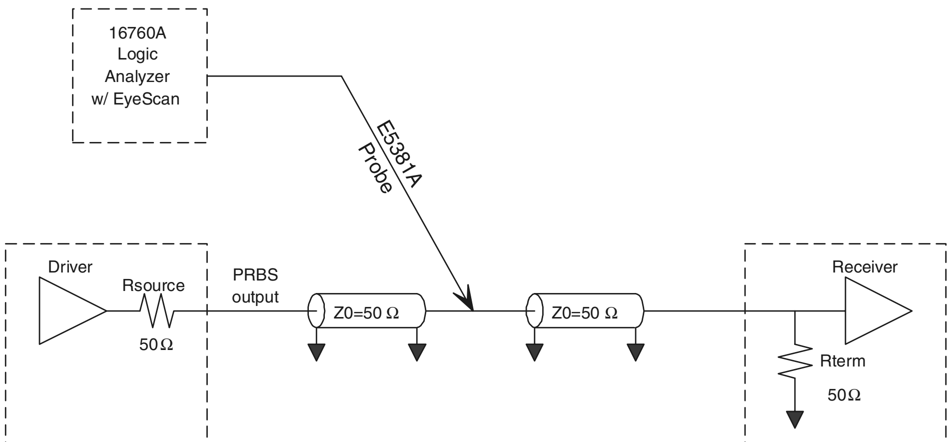
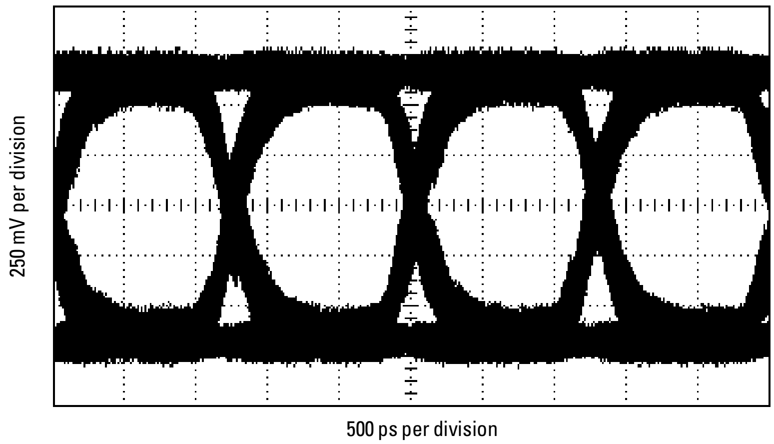
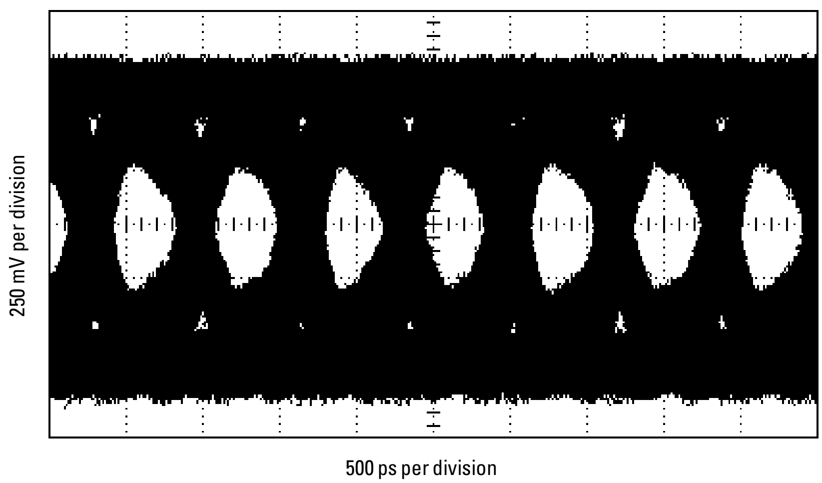


Eye opening measurement schematic

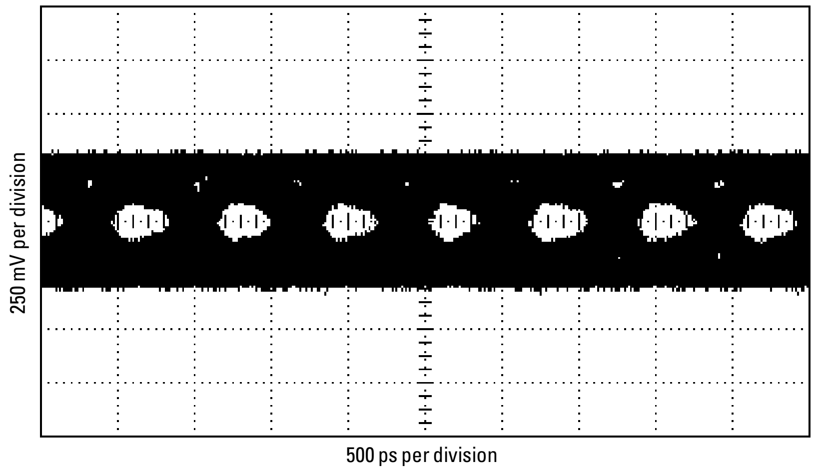
The logic analyzer Eye Scan measurement uses the same circuitry as the synchronous state mode analysis. Therefore, the eye openings measured are exact representations of what the logic analyzer sees and operates on in state mode. The following measurements demonstrate how the eye opening at the logic analyzer is effected by changes in clock speed and voltage level.



Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 800 Mb/s data rate



Logic analyzer eye opening for a PRBS signal of 500 mV p-p, 1500 Mb/s data rate



Logic analyzer eye opening for a PRBS signal of 200 mV p-p,1500 Mb/s data rate

Index

Safety Notices

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."

Warnings

• 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 or fire hazard.

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be 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.

• 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.

• 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.

• 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 use the instrument in a manner not specified by the manufacturer.

To clean the instrument

If the instrument requires cleaning: (1) Remove power from the instrument. (2) Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water. (3) Make sure that the instrument is completely dry before reconnecting it to a power source.

Safety Symbols

Instruction manual symbol: "Caution" or "Warning" risk of danger marked on product. See "Safety Notices" on this page and refer to warnings in this document that describe specific danger.

Hazardous voltage symbol.

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

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Notices

Manual Part Number

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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Trademark Acknowledgements

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