PCI Express Gen3

Hardware and Probing Guide

Agilent Technologies

Notices

Document History

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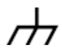
Safety Summary

Safety Symbols on Instruments

Safety Symbol	Description
	Indicates warning or caution. If you see this symbol on a product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.
	Frame or chassis ground terminal. Typically connects to the equipment's metal frame.
	Indicates hazardous voltages and potential for electrical shock.
	Indicates that antistatic precautions should be taken.
	Indicates hot surface. Please do not touch.
	Indicates laser radiation turned on.
	CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.
	CE compliance marking to the EU Safety and EMC Directives. ISM GRP-1A classification according to the international EMC standard. ICES/NMB-001 compliance marking to the Canadian EMC standard.

General Safety Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

General

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

Environment Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters.

Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Environmental Information

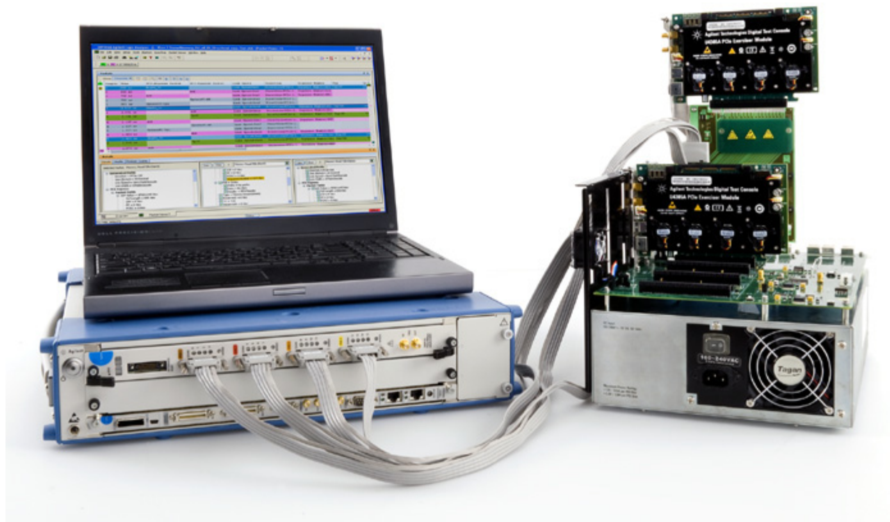
This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/ electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste.

To return unwanted products, contact your local Agilent office, or see www.agilent.com/environment/product/ for more information.

Hardware and Probing for PCI Express Gen3—At a Glance



The PCIe Gen3 exerciser and protocol analyzer support all PCIe 3.0 speeds, including 2.5 GT/s (Gen1) and 5.0 GT/s (Gen2) through PCIe 8 GT/s (Gen3), and they support link widths from x1 to x16.

The U4305 PCIe Gen3 exerciser lets you use a link training sequencer state machine (LTSSM) exerciser to provide stimulus when testing links. The U4305 exerciser is a standard height, half-length card as described in the PCI Express specification, and fits into DUT or test backplane slots.

The U4301A PCIe Gen3 analyzer lets you capture and decode PCI Express data and view it in a Protocol Viewer window. The U4301A analyzer is a module (or modules) installed in an Agilent AXIe chassis (for example the M9502A portable 2-slot chassis).

You can use a U4301A analyzer module to capture data in a unidirectional (upstream or downstream upto x16 link width) setup or a bidirectional (upto x8 link width) setup. This module supports x1 to x8 bidirectional data capture using the same module.

There are currently three DUT probing options for the U4301A analyzer module:

- U4321A Solid Slot Interposer
- U4322A Soft Touch midbus 3.0 probe
- U4324A PCIe Gen3 Flying Lead probe

See • "In This Guide" on page 6

In This Guide

For an overview and list of features, see: "Hardware and Probing for PCI Express Gen3—At a Glance" on page 5

This guide describes the probing options available for PCI Express Gen3 devices and how to make connections from the device under test (DUT) to the Agilent PCIe Gen3 protocol analyzer and exerciser modules.

See Also

- For information on Agilent chassis, module, and software installation, see: *"Agilent AXIe based Logic Analysis and Protocol Test Modules Installation Guide"*. This guide is available on www.agilent.com and is also installed with the Logic Analyzer software.
- For information on using the protocol analysis application software, see the application software's online help.

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4 Soft Touch Midbus 3.0 Probes

5 PCIe Gen3 Flying Lead Probes

1
U4305A Exerciser Card

This chapter provides information on the U4305A exerciser card used for testing PCIe devices. This chapter describes the card's emulation modes, hardware features, components, and sample hardware configuration scenarios for this card in the overall setup.

U4305A Exerciser Card - Introduction

The Agilent U4305A exerciser card is a test and debug tool that provides features for testing the next generation of PCI Express technology. You can use this card to stimulate components on system boards and cards with various test scenarios. The Exerciser card can emulate a PCIe device or topology and can provide test conditions to test components on system boards and cards.

In this release, the U4305A Exerciser card provides only the functions of an LTSSM to help you perform thorough PCIe link testing and validation testing for the DUT's LTSSM. As an LTSSM Tester, the Exerciser card helps you verify the DUT's LTSSM state transitions and timeout implementations.

The U4305A Exerciser card can emulate a PCIe endpoint and act as a Downstream Component (DSC) for a System Under Test. It can also emulate a root complex and act as an Upstream Component to stimulate a PCIe Device Under Test. Refer to the topics “U4305A Exerciser Card as an Endpoint" on page 19 and “U4305A Exerciser Card as a Root Complex" on page 20 to know more.

NOTE

For information on installing and configuring the U4305A exerciser card, refer to Agilent PCIE Exerciser Gen3, Installation Guide.

For information on how to use the U4305A exerciser card, refer to Agilent Protocol Exerciser for PCI Express, User Guide.

Features

This topic describes the features of the U4305A exerciser card.

- U4305A is a standard height, half-length card as described in the PCI Express specification, and fits into every system including blade servers.
- U4305A supports LTSSM functions for up to x16 link widths.
- U4305A supports simultaneous use of LTSSM and Protocol Exerciser functions, without requiring any configuration.
- U4305A supports Gen1 (2.5 GT/s), Gen2 (5.0 GT/s), and Gen3 (8.0 GT/s) speeds as per PCIe specifications.
- You can manage, control, and use the U4305A Exerciser card using the Protocol Exerciser GUI and APIs.

Components

This topic describes the hardware components of the U4305A exerciser card.

Figure 1 and Figure 2 display the U4305A exerciser card to indicate the various components of this card.

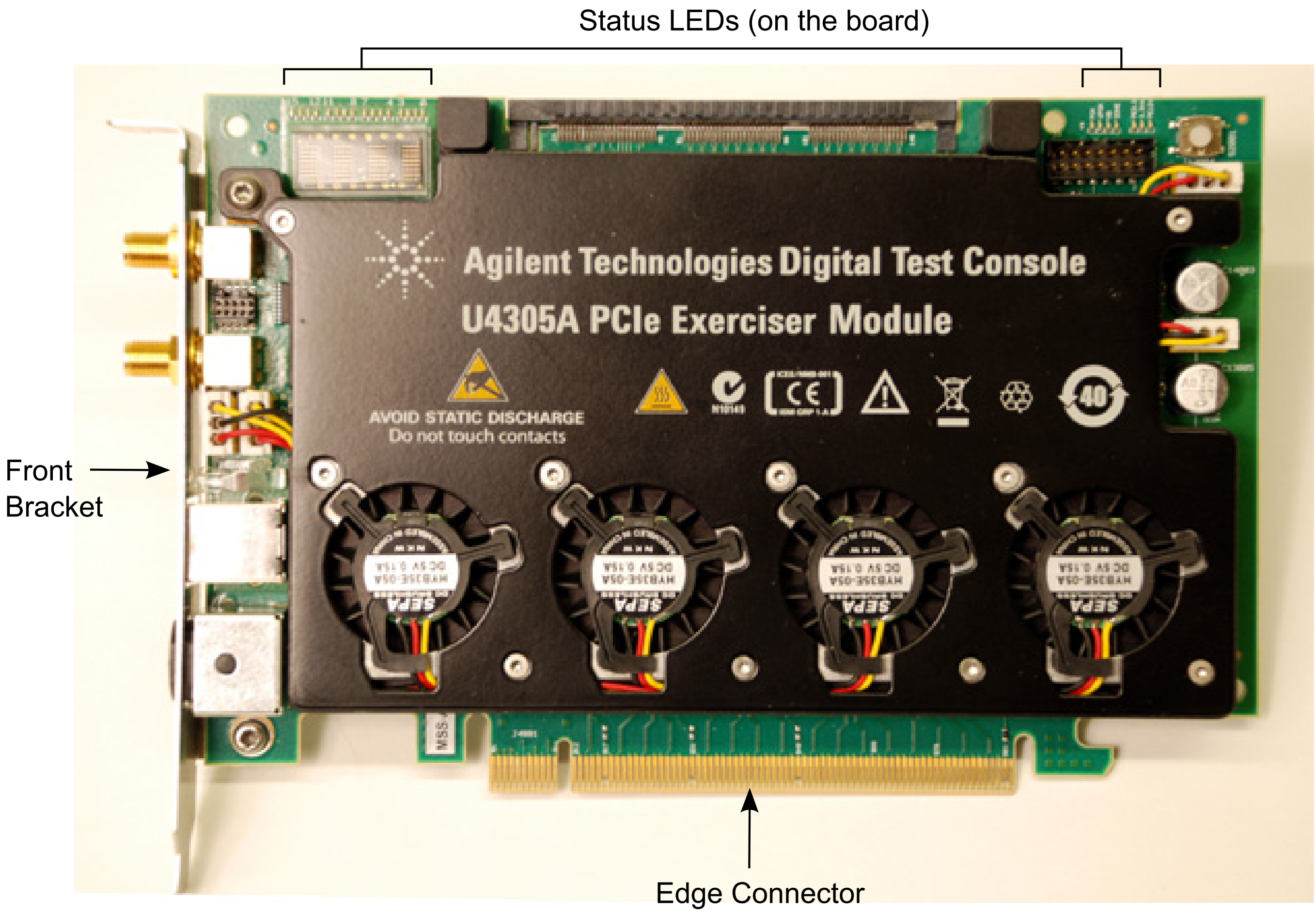


Figure 1 U4305A Exerciser Card

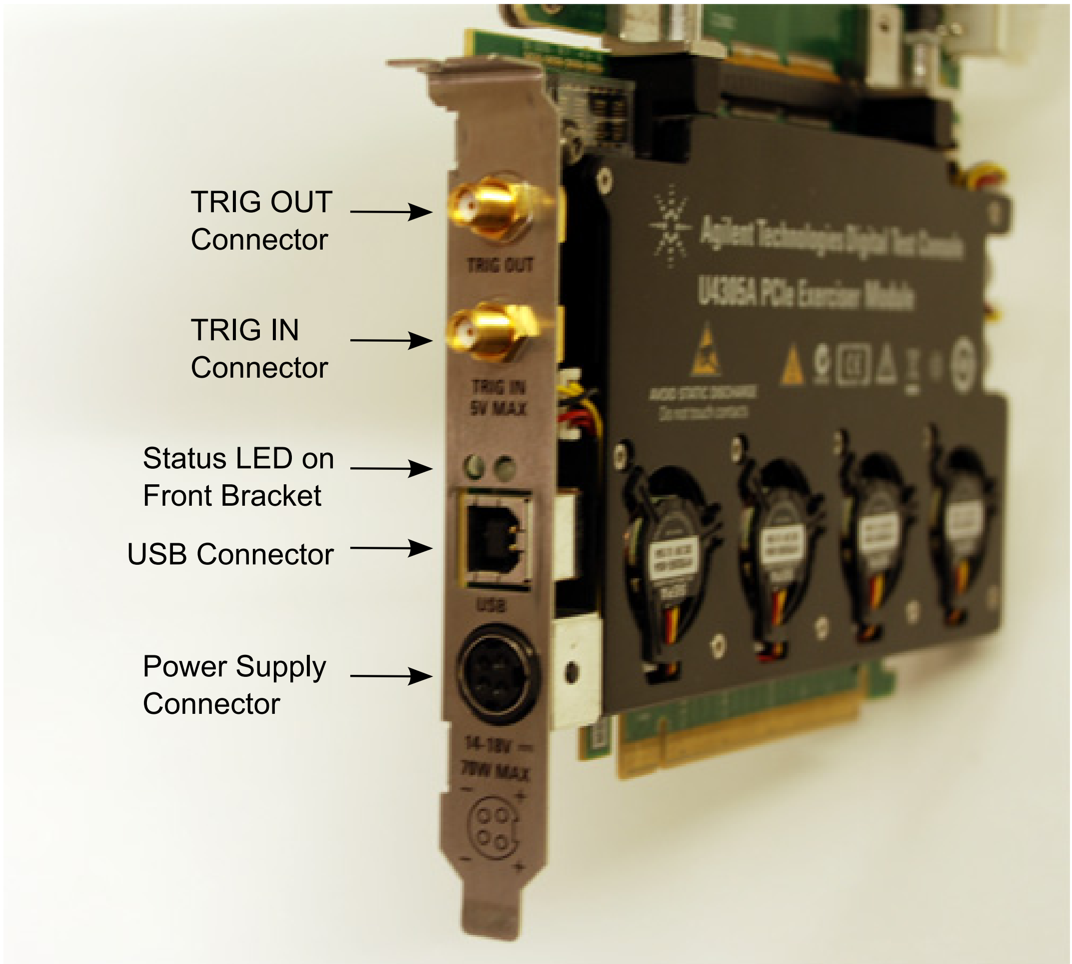


Figure 2 U4305A Exerciser Card components on front bracket

The hardware components displayed in the above figures of the U4305A Exerciser card are described:

- **Edge Connector–** This component is used to connect the U4305A card with a PCIe Connector on the backplane board, or with a system.
- **Status LEDs (on board)–** This component has the LEDs to display the status information about the participating lanes of the link and power status of board and exerciser card. Sixteen LEDs displaying the lane status are in the upper left corner of the board and the remaining seven LEDs are in the upper right corner of the board. The module number to which U4305A is configured is also displayed in the upper left corner.

  To get a description of each LED on the board, refer to “Exerciser Card Status LEDs" on page 17.

- **Status LEDs (on front bracket)**– The green LED represents the link speed status and has the following different states:
  - *No light* means there is no link up between the Exerciser card and DUT.
  - *Green light* means there is a link up at the Gen3 speed (8.0 GT/s).
  - *Fast blinking light* means there is a link up at the Gen2 speed (5.0 GT/s).
  - *Slow blinking light* means there is a link up at the Gen1 speed (2.5 GT/s).

  The red LED on the front bracket will be on until the FPGA receives a valid configuration.
- **USB Connector**– This component is used to connect U4305A with the controller PC using the USB cable.
- **Power Supply Connector**– This component is used to connect U4305A with the external power supply.

  Use the power supply delivered with U4305A only.
- **TRIG OUT Connector**– This component is used to connect the U4305A card with other instruments such as a Protocol Analyzer to trigger these instruments. The Exerciser card generates a trigger out pulse when a specified trigger out condition is met.

  The electrical characteristics of TRIG OUT are: TTL levels series terminated with 50 Ohms. Vout High Min (no load termination) = 2.4V, Vout Low Max (no load termination) = 0.4V; Vout High Min (with 50 Ohms External termination to GND) = 1.2V, Vout Low Max (with 50 Ohms External termination to GND) = 0.2V.
- **TRIG IN Connector**– This component is used to connect the U4305A card with other instruments such as a Protocol Analyzer to receive a trigger from these instruments when a specified condition is met.

  The electrical characteristics of TRIG IN are: Vin Low Max = 0.9V, Vin High Min = 2.0V max, Input current +/- 5uA.

WARNING **Do not directly touch any component on the U4305A exerciser card. It may be hot.**

CAUTION Components on the U4305A exerciser card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

This component comes with a protective foam cover to protect it from electrostatic damage (Figure 3).

Figure 3 Protective Foam Cover for Edge Connector

NOTE Please remove the protective foam cover before using the card, and attach it again when the card is not in use.

Exerciser Card Status LEDs

The U4305A Exerciser card has a number of status LEDs on the board and on the front bracket. This topic describes the meaning of each of these status LEDs.

The following figure displays the status LEDs on board.

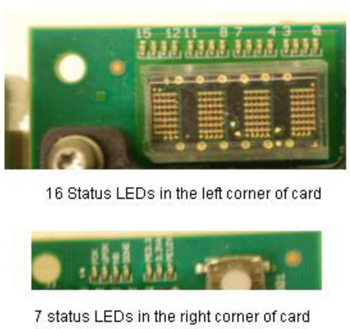


Figure 4 Exerciser card status LEDs

The following tables describe the status LEDs on board and on the front bracket.

Table 1 Status LEDs on the board

LED Name/Label	Description
16 status LEDs in upper left corner of the board	Displays the status of the lanes (x1- x16) in the link. All these LEDs are off if the link is not up. If the link is up, then the LEDs are on for only those lanes that are participating in the link.
POK	When this LED is ON, it indicates that the FPGA power supplies are operating. This is displayed in the upper right corner of the board.
UPOK	When this LED is ON, it indicates that the Power supplies for the microprocessor system and USB are operating. This is displayed in the upper right corner of the board.
HB	This LED represents the Heartbeat. It blinks at about 1 second rate to indicate that the microprocessor is operating. This is displayed in the upper right corner of the board.
DONE	When this LED is on, it indicates that FPGA has been programmed successfully. This is displayed in the upper right corner of the board.
PE3.3	When this LED is on, it indicates that the +3.3V PCI Express power supply from the bottom (SYS) connector is up. This is displayed in the upper right corner of the board.
3.3VA	When this LED is on, it indicates that the +3.3V Aux PCI Express power supply from the bottom (SYS) connector is up. This is displayed in the upper right corner of the board.
PE12V	When this LED is on, it indicates that the +12V PCI Express power supply from the bottom (SYS) connector is up. This is displayed in the upper right corner of the board.

Table 2 Status LEDs on front bracket

LED Name/Label	Description
Green LED, *No light*	There is no link up between the Exerciser card and DUT.
Green LED, *Green*	There is a link up at the Gen3 speed (8.0 GT/s).
Green LED, *Fast Blinking light*	There is a link up at the Gen2 speed (5.0 GT/s).
Green LED, *Slow Blinking light*	There is a link up at the Gen1 speed (2.5 GT/s).
Red LED	The red LED on the front bracket will be on until the FPGA receives a valid configuration.

U4305A Exerciser Card as an Endpoint

This topic introduces you to the U4305A exerciser card emulating a PCIe endpoint.

NOTE For detailed information on how to set up the U4305A exerciser card as a PCIe endpoint, refer to the Agilent PCIE Exerciser Gen3 Installation guide.

You can use the U4305A exerciser card as an endpoint to stimulate a System Under Test into various test scenarios for LTSSM testing. To accomplish this, you plug the exerciser card as a normal PCIe device into the motherboard under test through the Edge connector of the card.

A controller system hosts the Protocol Exerciser software and hardware support services to control and manage the Exerciser card. Exerciser card is connected to this controller system through a USB cable. The following figure displays a sample hardware setup in which the U4305A exerciser card is emulating a PCIe endpoint.

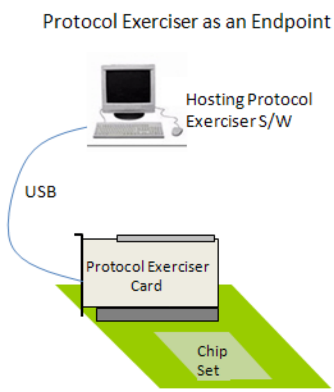


Figure 5 Exerciser card emulating a PCIe endpoint

U4305A Exerciser Card as a Root Complex

This topic introduces you to the U4305A exerciser card emulating a root complex.

NOTE

For detailed information on how to set up the U4305A exerciser card as a root complex, refer to the Agilent PCIE Exerciser Gen3 Installation guide.

You can use the U4305A exerciser card as a root complex to stimulate a DUT into various LTSSM test scenarios. To accomplish this, you plug the exerciser card into a passive backplane board through the Edge connector of the card. In this case, the Exerciser card communicates to the DUT through the bottom connectors.

A controller system hosts the Protocol Exerciser software and hardware support services to control and manage the Exerciser card. Exerciser card is connected to this controlling system through a USB cable. The following figure displays a sample hardware setup in which the U4305A exerciser card is emulating a PCIe root complex.

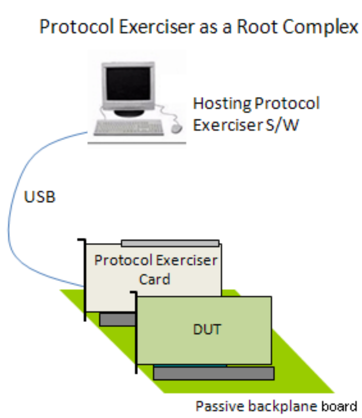


Figure 6 Exerciser card emulating a root complex

Keep-Out Volume for U4305A Exerciser Card

All dimensions in the following figure are in millimeters.

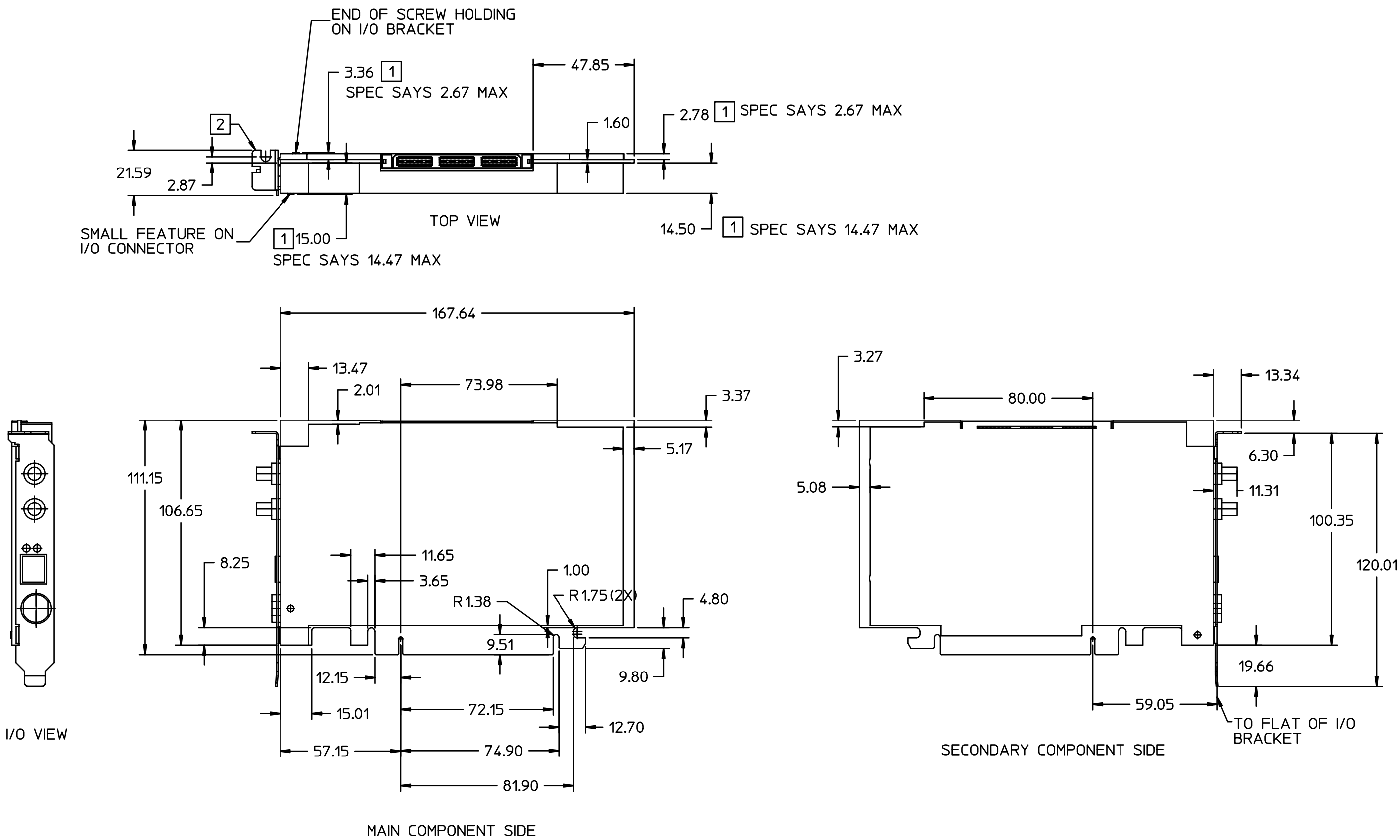


Figure 7 Keep-Out Volume for U4305A Exerciser Card

2
U4301A Analyzer Module

This chapter provides information on the U4301A analyzer module used for PCIe.

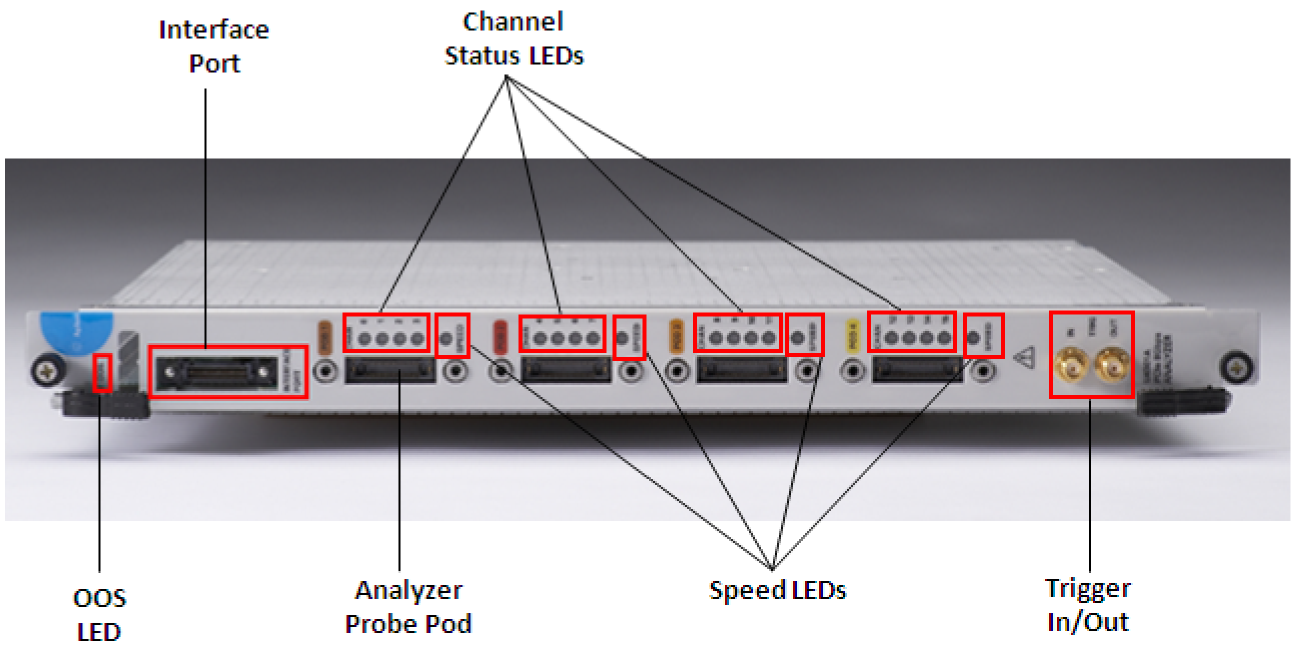


Figure 8 U4301A Analyzer Module

As shown in Figure 8, the U4301A analyzer module has the following components:

Component	Description
OOS (Out of Service) LED	Indicates the power-ready status of the U4301A module. This LED turns red during the power-on-self-test execution on the chassis bootup. The LED then dims and finally turns off when the U4301A module is in a power-ready status. The LED turns red again only when a power fault condition occurs for the module. • **Red, steady** - If the LED remains red and does not turn off, then it indicates a power fault condition. In such a situation, the module may require repair/service. Contact your Agilent representative to replace or service the module. • **Off** - This indicates that the module has detected no power failures and is in a power-ready status.
Interface Port	This component is used to share information with another U4301A analyzer module in the same chassis. The features of this component are not yet supported.
Pods 1-4	The module has four Pod inputs labelled as Pod 1-4 in different colors. You use these pod inputs to connect the U4301A module to probes to create a unidirectional (upstream or downstream and upto x16) or a bidirectional (upto x8) setup.
Channel Status LEDs	Each pod input on the module provides four channels. For each of these channels, a channel status LED is provided making it a total of 16 channel LEDs on the module. These 16 LEDs, labeled 0 to 15, are used to indicate the status of each channel. The following color coding is used for these LEDs to indicate the channel status. • **Red** - This means that there are no signals or the lane is electrically idle. • **Blinking Red** - This means that there is no frame sync on the lane. • **Orange** - This means that the data on the lane is not de-skewed. • **Green** - This means that the data on the lane is de-skewed. • **Off** - This means that the lane is not configured. Based on the link width that you select in the U4301 Connection Setup tab of the Logic Analyzer GUI, the number of lanes on the U4301 module are used. The LEDs of only the used lanes glow. For example, if you are using the x4 link width, then the LEDs of only four channels will glow and the rest of the LEDs will be off.

<table>
<tr><th>Component</th><th>Description</th></tr>
<tr><td>Speed LEDs</td><td>Each pod has a speed LED making it a total of four speed LEDs for a U4301A Analyzer module. These LEDs indicate the link speed associated with the pod channels. Out of these four speed LEDs, the speed LED of only that pod glows on which the logical lane 0 is present. The remaining three speed LEDs will be off. In case of a x8 bidirectional configuration of a U4301A module, the speed LEDs of only those two pods glow on which the logical lane 0 is present for upstream and downstream directions. The remaining two speed LEDs will be off. For instance, if pod1 has logical lane 0 for the upstream direction and pod3 has logical lane 0 for the downstream direction, then the speed LEDs of only these two pods will glow.
The following color coding is used to interpret the status of the speed LED of the pod on which the logical lane 0 is present.
• Off - This means that the system is not configured.
• Red - This means that the link speed is not detected or not configured.
• Yellow - This means that the link speed is 2.5 Gb/s.
• Green - This means that the link speed is 5 Gb/s.
• Blue - This means that the link speed is 8 Gb/s.
If you selected a fixed speed (Gen1, Gen2, or Gen3) for U4301A in the Capture setup tab of the Logic Analyzer GUI, then the speed LED will glow according to the selected speed. If you selected the Auto speed option, then the speed LED will glow according to the detected speed.</td></tr>
<tr><td>Trigger In/Out</td><td>These connectors are used to listen to an external trigger in from a device or to send an external trigger out to another device. However, these connectors on the U4301A module are not currently functional. Instead of using these connectors, you can use the Trigger In/Out connectors located on the Embedded System Module (ESM) of the Agilent AXIe chassis to send or receive external trigger in and out events.
The following are some important points about the Trigger In/Out connectors:
• The Trigger In connector of the AXIe chassis has an adjustable threshold input of +/-5V range and 250 mV minimum swing.
• The Trigger Out connector of the AXIe chassis extends the parallel trigger bus to external instruments. The trigger out characteristics are 3.3V CMOS, 50W line drive, and 3-state.
• Maximum trigger input voltage should not exceed 3.3 V.
• Trigger Out and 10 MHz Out have nominal output level of 2.0 V with 20 ns minimum pulse width.
• Minimum Trigger In duration is 20 ns.</td></tr>
</table>

WARNING **Do not directly touch any component on the analyzer module. It may be hot.**

CAUTION Components on the analyzer module are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

3
U4321A Solid Slot Interposer Card

This chapter provides information on the U4321A solid slot interposer card used for PCIe Gen3.

U4321A Solid Slot Interposer Description

The *U4321A solid slot interposer* card comes in four form factors: x1, x4, x8, and x16 link width.

The following figures show the U4321A solid slot interposer card for the x16 link width.

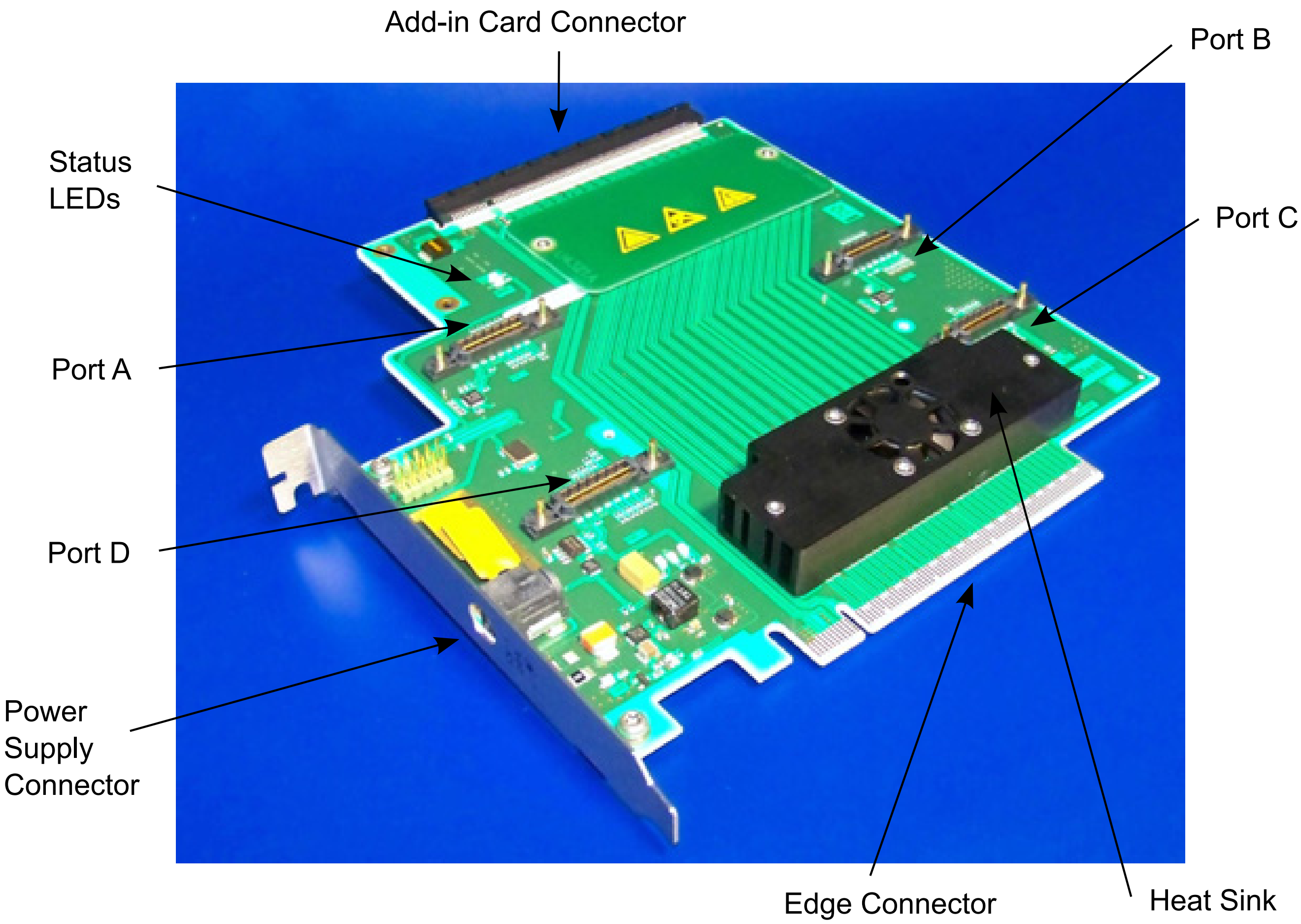


Figure 9 U4321A Solid Slot Interposer Card (primary side)

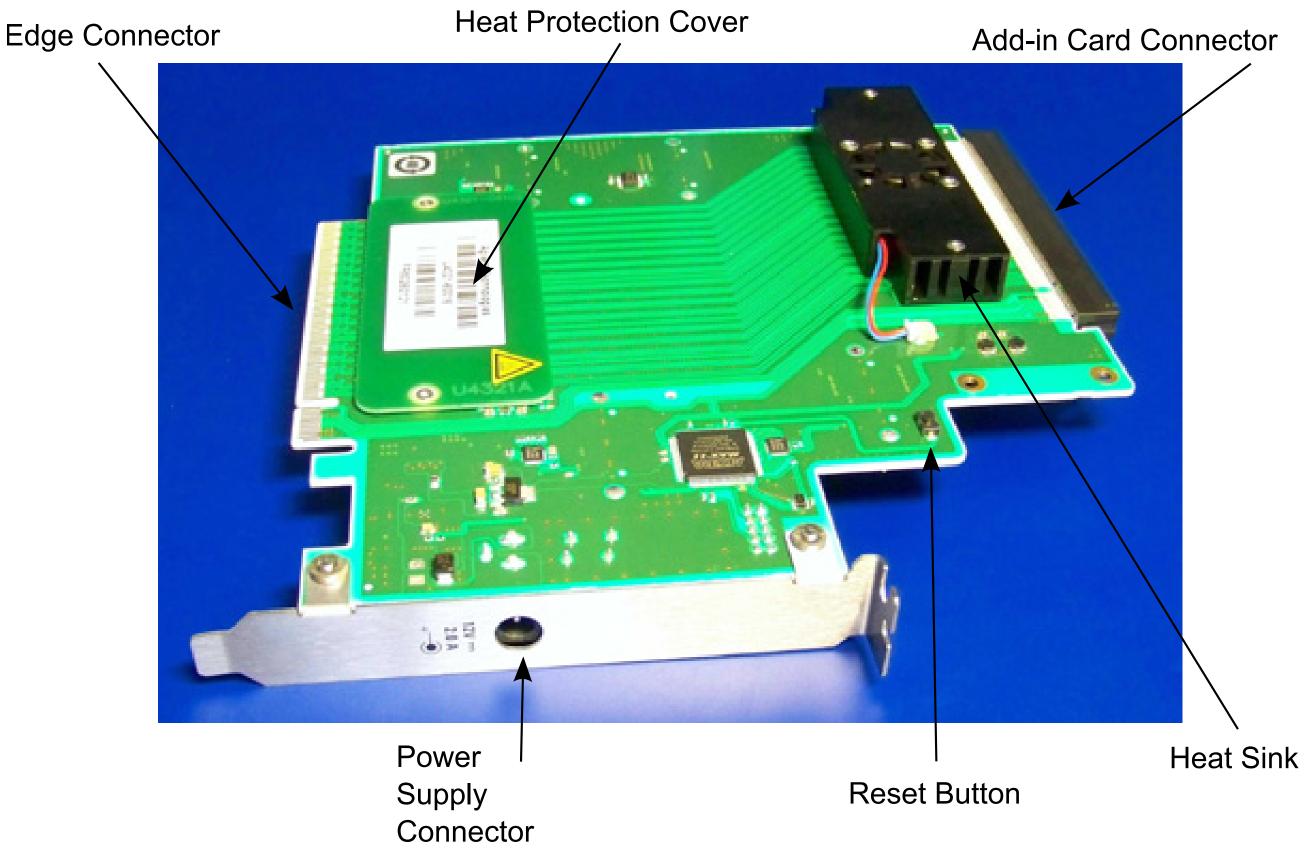


Figure 10 U4321A Solid Slot Interposer Card (secondary side)

Components shown in the above figure are described below:

- **Add-in Card Connector**– This component is used to connect any add-in PCIe card at the top of the U4321A solid slot interposer.
- **Edge Connector**– This component is used to connect U4321A solid slot interposer with a PCIe Connector on the backplane board or with a system.

  This component comes with a protective foam cover to protect it from electrostatic damage.

Figure 11 Protective Foam Cover for Edge Connector

NOTE Please remove the protective foam cover before using the card, and attach it again when the card is not in use.

- **Ports**– The U4321A solid slot interposer has the following ports:
  - **Port A** – This port is for lanes 0-7, upstream.
  - **Port B** – This port is for lanes 8-15, upstream.
  - **Port C** – This port is for lanes 8-15, downstream.
  - **Port D** – This port is for lanes 0-7, downstream.

  If you use the U4321A solid slot interposer for x1, x4, or x8 link widths, Ports B and C are not available.
- **Cables**– These are the *U4321-61601 Solid Slot Interposer* cables that connect the U4301A PCIe 8Gb/s analyzer module to the U4321A solid slot interposer.

  The following figure shows one U4321-61601 cable.

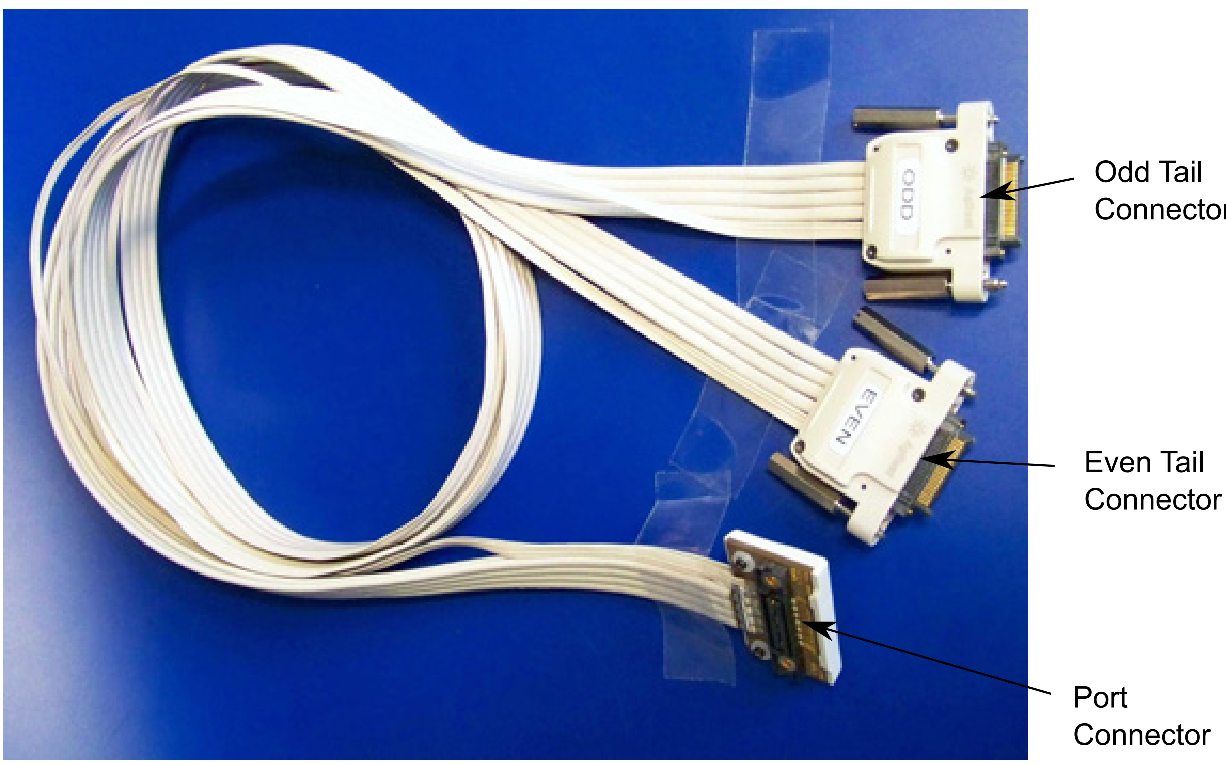


Figure 12 U4321-61601 Solid Slot Interposer Cable

To use this cable, plug its *tail connectors* into the POD connectors of the U4301A analyzer module, and plug its *port connector* into the ports of the U4321A solid slot interposer.

A x8 (or x4 and x1) setup requires two U4321-61601 cables, and a x16 setup requires four U4321-61601 cables.

The following figure shows two U4321-61601 cables connected to Ports A and D.

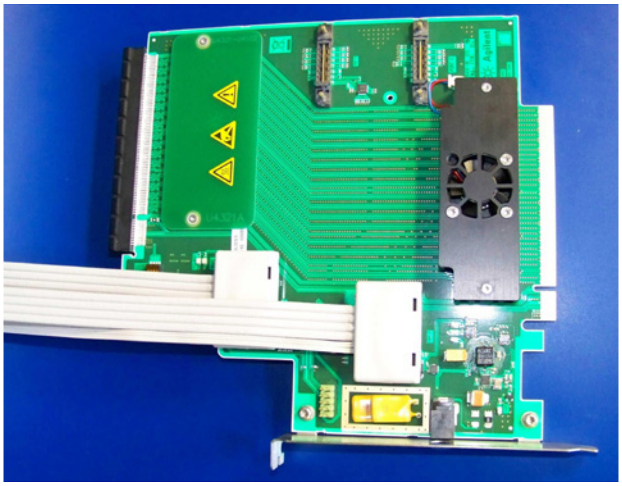


Figure 13 U4321A Solid Slot Interposer Card with attached cables for x8 link width

The following figure shows four U4321-61601 cables connected to all the four ports.

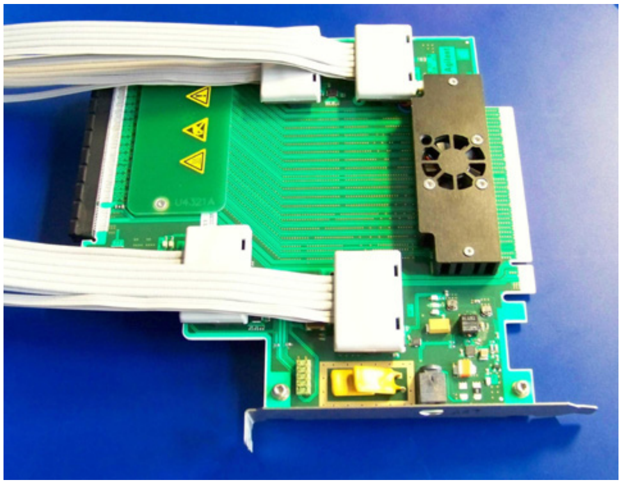


Figure 14 U4321A Solid Slot Interposer Card with attached cables for x16 link width

- **Status LED1**– This component indicates whether the U4321A solid slot interposer is powered. It has the following two states:
  - *No light* state means the solid slot interposer is not powered.
  - *Green light* means the solid slot interposer is powered.
- **Status LED2**– This component indicates whether the overheating protection is turned on. It has the following two states:
  - *No light* state means the overheating protection turned off. The U4321A solid slot interposer works in the operating mode.
  - *Red light* means the overheating protection turned on. The U4321A solid slot interposer works in overheating protection mode and operative voltage is turned down. Key the **Reset Button** to leave off overheating protection mode.
- **Reset Button**– This component switches off the heating protection mode and resets "PCIe Reset" LED.
- **Heat Sink**– This component absorbs and dissipates heat of the solid slot interposer.
- **Heat Protection Cover**– This component prevents unpremeditated touch to underside.
- **Power Supply Connector**– This component is used to connect the U4321A solid slot interposer to the external power supply.

  Only use the power supply delivered with the U4321A solid slot interposer.

NOTE

Power supply specifications are:

Input: 100 - 250V~, 50/60Hz 1.25-0.56A MAX

DC Output: +12V 5A 60W MAX

WARNING

Do not directly touch any component on the U4321A solid slot interposer card. It may be hot.

CAUTION

Components on the U4321A solid slot interposer card are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

Setting up a bidirectional (x1-x8) configuration using a U4321A SSI Card

For a x8 bidirectional configuration

You need a single U4301A Analyzer module and a U4321A SSI card with two U4321-61601 cables for a x8 bidirectional setup.

Perform the following steps for a x8 bidirectional hardware and probing setup.

1. Plug the port connector of the first U4321-61601 cable into the upstream Port A of the U4321A solid slot interposer.
2. Plug the tail connectors of the first U4321-61601 cable into the POD connectors of Pod 1 and 2 of the U4301A Analyzer module.
3. Plug the port connector of the second U4321-61601 cable into the downstream Port D of the U4321A solid slot interposer.
4. Plug the tail connectors of the second U4321-61601 cable into the POD connectors of Pod 3 and 4 of the same U4301A analyzer module.

The following figure illustrates a x8 bidirectional setup when a single U4301A module is used to probe and capture data in downstream as well as upstream directions.

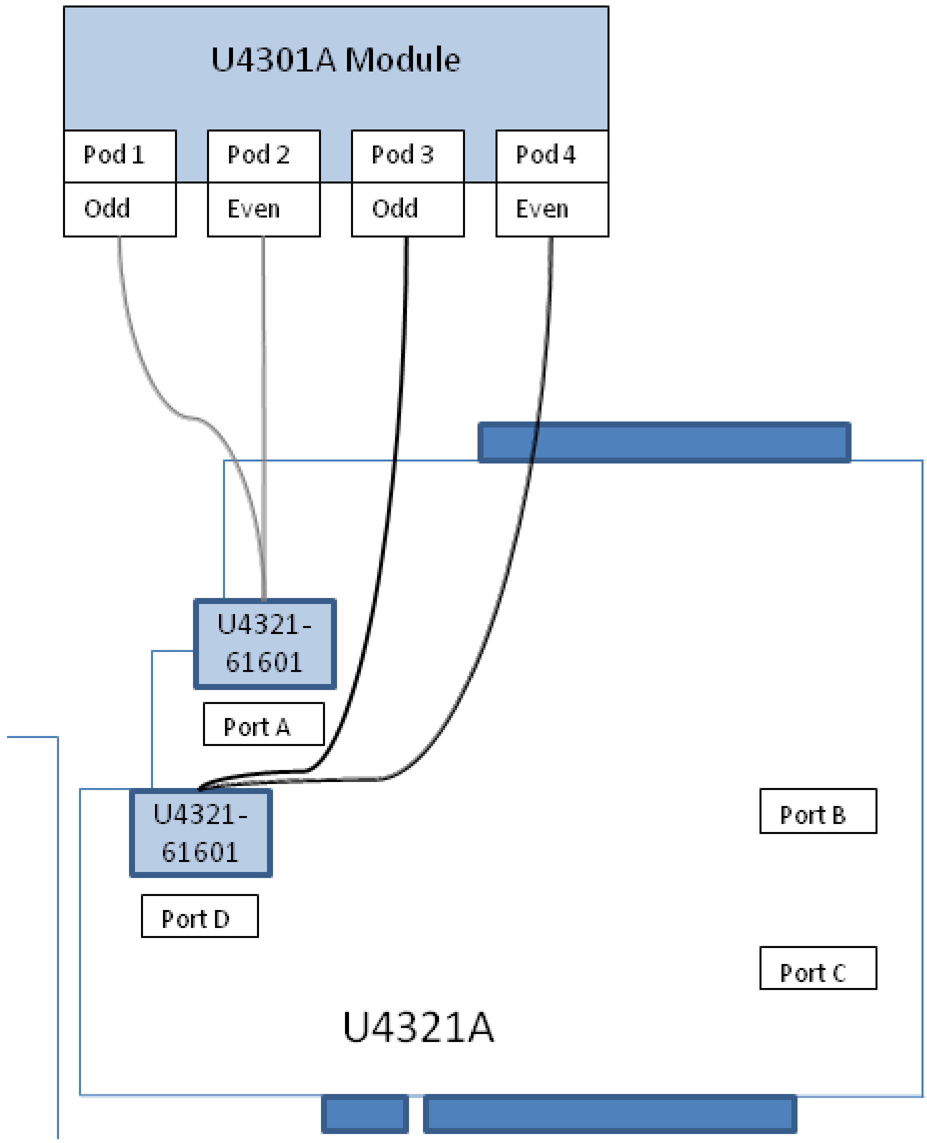


Figure 15 x8 bidirectional setup using a U4321A solid slot interposer card and a single U4301A module

For a x1, x2, or x4 bidirectional configuration

For a x1, x2, or x4 bidirectional setup, you need the same hardware and probing setup as described above for a x8 bidirectional setup. The only difference would be that you need to plug the tail connectors of the:

- first U4321-61601 cable into the POD connector of Pod 2 of the U4301A Analyzer module.
- second U4321-61601 cable into the POD connector of Pod 4 of the U4301A Analyzer module.

Setting up a unidirectional (x1-x16) configuration using a U4321A SSI Card

For a x16 downstream configuration

You need a single U4301A Analyzer module and a U4321A SSI card with two U4321-61601 cables for a x16 downstream setup.

Perform the following steps for a x16 downstream hardware and probing setup.

1 Plug the port connector of the first U4321-61601 cable into Port D of the U4321A solid slot interposer.

2 Plug the port connector of the second U4321-61601 cable into Port C of the U4321A solid slot interposer.

3 Plug the tail connectors of the first U4321-61601 cable into POD 1 and 2 of the U4301A analyzer module.

4 Plug the tail connectors of the second U4321-61601 cable into POD 3 and 4 of the U4301A analyzer module.

   The upstream ports A and B of the U4321A SSI card will not be utilized in this setup.

The following figure illustrates a x16 downstream setup.

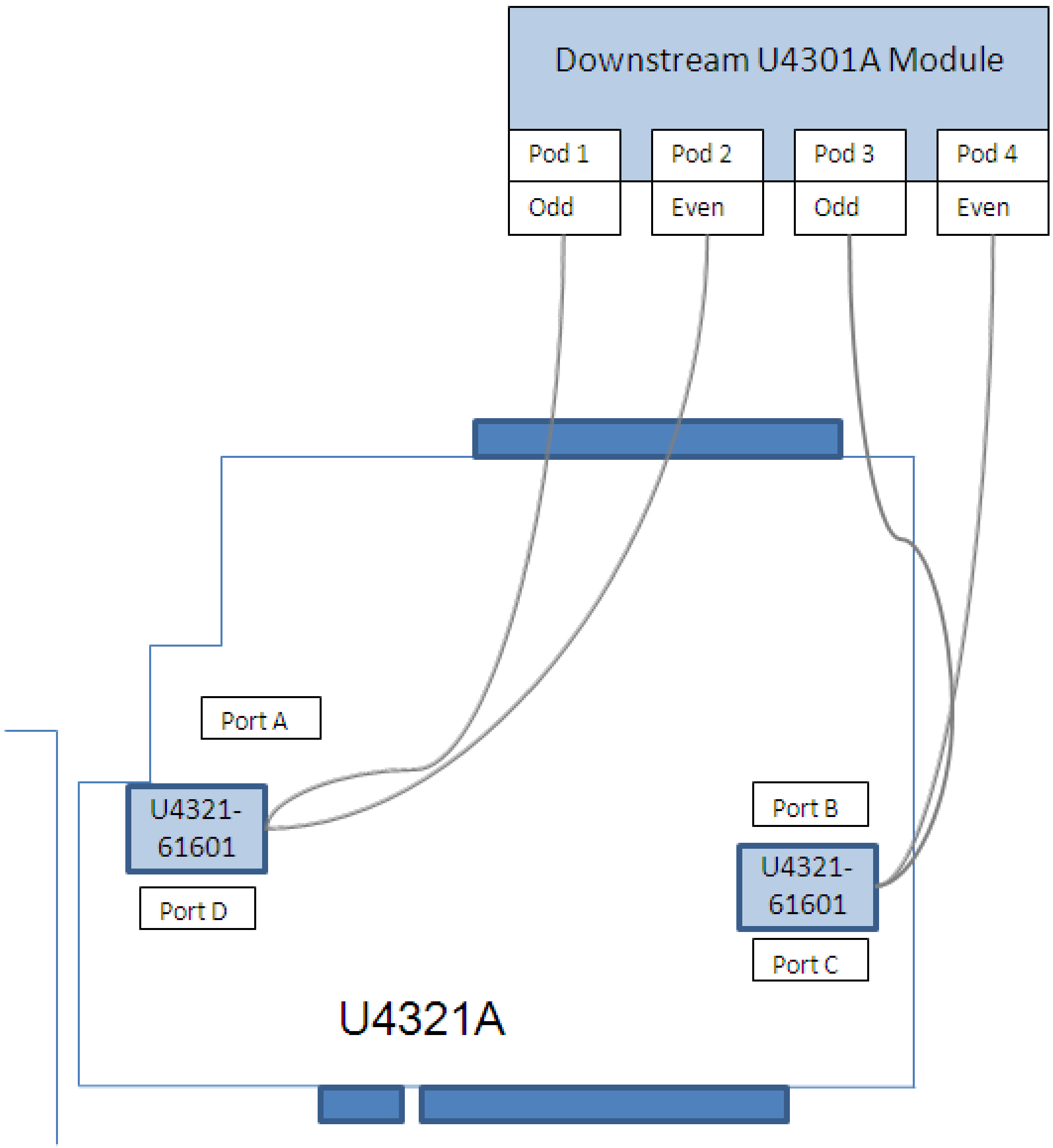


Figure 16 x16 downstream setup using a U4321A Slot Interposer card and a U4301A module

For a x1, x2, x4, or x8 downstream configuration

For a x1, x2, x4, or x8 downstream setup, you need a a single U4301A Analyzer module, a U4321A SSI card, and a U4321-61601 cable. For these setups, follow the same steps as described above for a x16 downstream setup except with the following differences:

- you would use only Port D of the SSI card

- you would use Pod 1 and 2 of the U4301A module (in case of a x8 setup) and Pod 2 of the U4301A module (in case of a x1, x2, or x4 setup).

For a x16 upstream configuration

You need a single U4301A Analyzer module and a U4321A SSI card with two U4321-61601 cables for a x16 upstream setup.

Perform the following steps for a x16 upstream hardware and probing setup.

1. Plug the port connector of the first U4321-61601 cable into Port A of the U4321A solid slot interposer.
2. Plug the port connector of the second U4321-61601 cable into Port B of the U4321A solid slot interposer.
3. Plug the tail connectors of the first U4321-61601 cable into POD 1 and 2 of the U4301A analyzer module.
4. Plug the tail connectors of the second U4321-61601 cable into POD 3 and 4 of the U4301A analyzer module.

   The downstream ports C and D of the U4321A SSI card will not be utilized in this setup.

The following figure illustrates a x16 upstream setup.

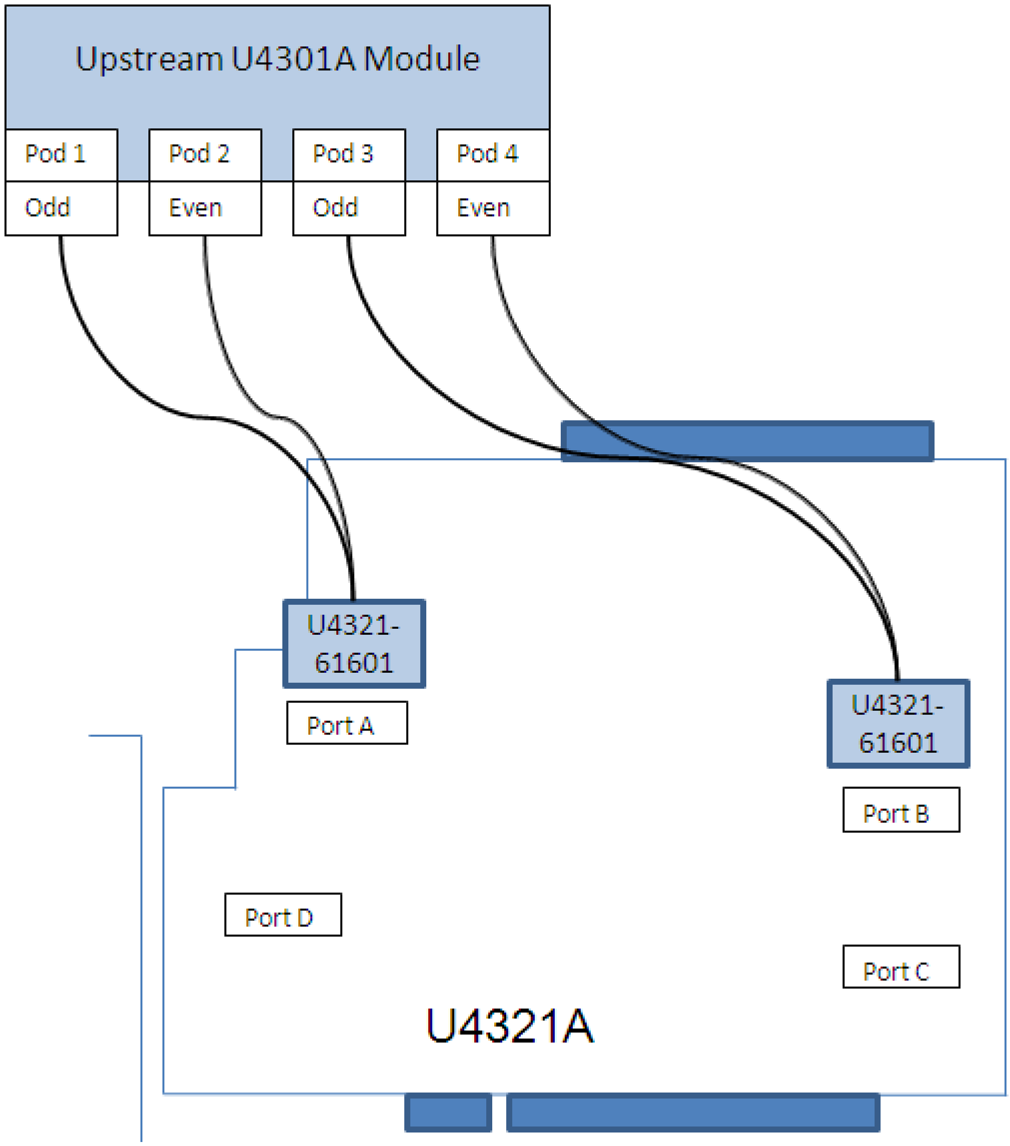


Figure 17 x16 upstream setup using a U4321A Slot Interposer card and a U4301A module

For a x1, x2, x4, or x8 upstream configuration

For a x1, x2, x4, or x8 upstream setup, you need a a single U4301A Analyzer module, a U4321A SSI card, and a U4321-61601 cable. For these setups, follow the same steps as described above for a x16 upstream setup except with the following differences:

- you would use only Port A of the SSI card

- you would use Pod 1 and 2 of the U4301A module (in case of a x8 setup) and Pod 2 of the U4301A module (in case of a x1, x2, or x4 setup).

Setting up a x16 upstream and downstream configuration using a U4321A SSI Card

If you want to probe and capture upstream as well downstream data with x16 link width, you need two U4301A Analyzer modules, a U4321A SSI card and four U4321-61601 cables.

Perform the following steps for a x16 upstream and downstream hardware and probing setup.

Upstream setup

1 Plug the port connector of the first U4321-61601 cable into Port A of the U4321A solid slot interposer.

2 Plug the port connector of the second U4321-61601 cable into Port B of the U4321A solid slot interposer.

3 Plug the tail connectors of the first U4321-61601 cable into POD 1 and 2 of the U4301A analyzer module that you selected for the upstream setup.

4 Plug the tail connectors of the second U4321-61601 cable into POD 3 and 4 of the U4301A analyzer module that you selected for the upstream setup.

Downstream setup

1 Plug the port connector of the third U4321-61601 cable into Port D of the U4321A solid slot interposer.

2 Plug the port connector of the fourth U4321-61601 cable into Port C of the U4321A solid slot interposer.

3 Plug the tail connectors of the third U4321-61601 cable into POD 1 and 2 of the U4301A analyzer module that you selected for the downstream setup.

4 Plug the tail connectors of the fourth U4321-61601 cable into POD 3 and 4 of the U4301A analyzer module that you selected for the downstream setup.

The following figure illustrates a x16 upstream and downstream setup.

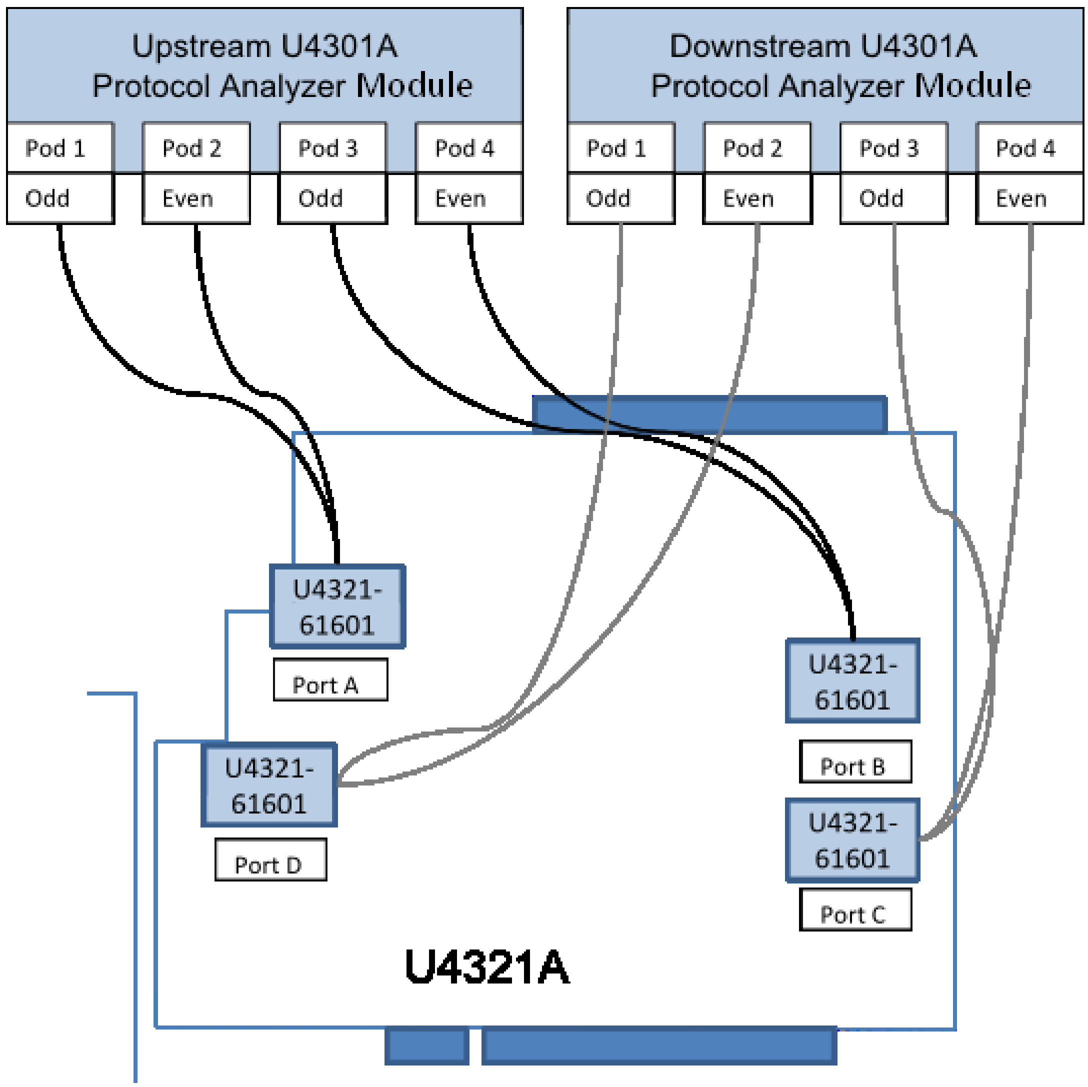


Figure 18 x16 upstream and downstream setup using a U4321A Slot Interposer card and two U4301A modules

U4321A Solid Slot Interposer Dimensions

All dimensions in the following figure are in millimeters.

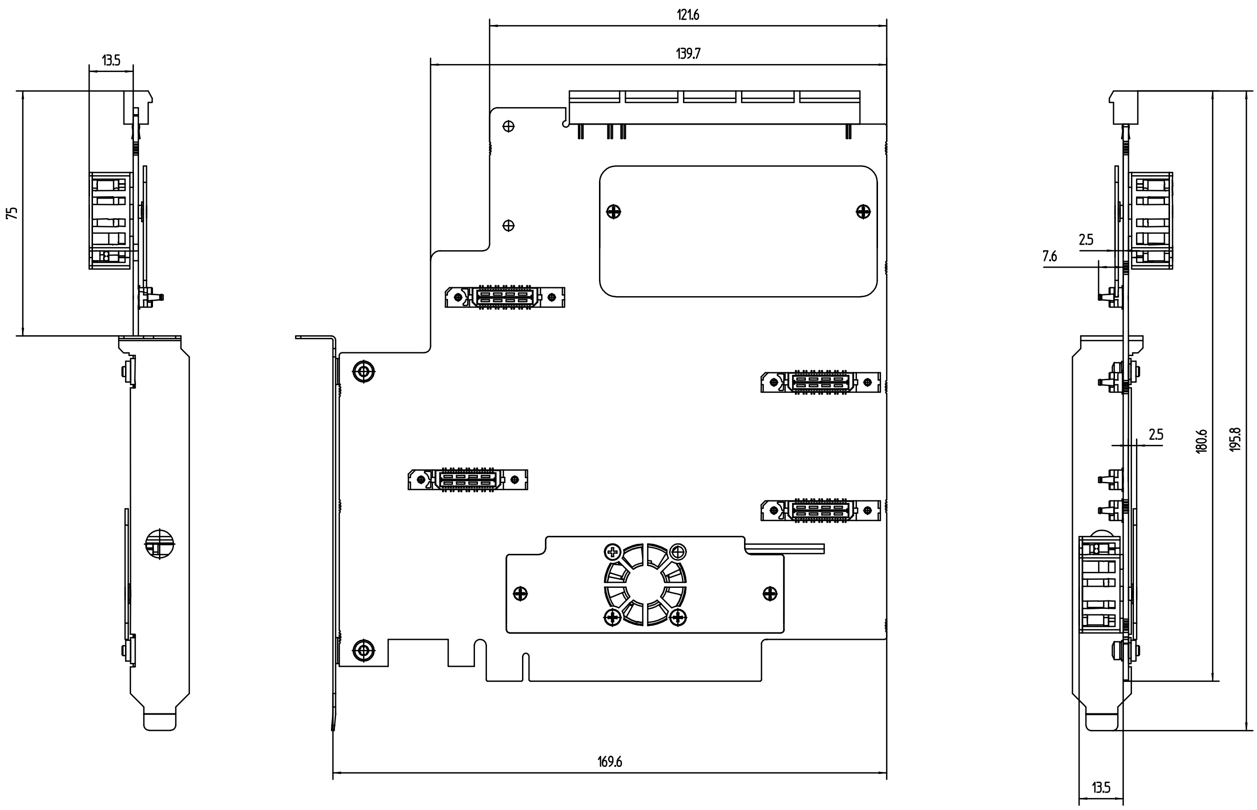


Figure 19 U4321A Solid Slot Interposer Card Dimensions

4
Soft Touch Midbus 3.0 Probes

The Agilent midbus 3.0 series of probes using soft touch technology are specially designed to provide support for up to 16 channel probing solutions.

To integrate a midbus probe, a midbus probe footprint must be designed into the device under test (DUT).

A 3-pin header must also be designed into the DUT if it needs to supply a reference clock to the protocol analyzer.

This chapter is intended to provide information needed by platform and system design teams for integration of midbus 3.0 probes into their designs. It provides a mechanical and electrical solution space for Midbus Probe placement with the PCI Express bus.

Although information on PCI Express topology and specifications will be given, this information is not intended to take the place of other PCI Express design documentation. It is assumed that a design team utilizing this document for their design constraints will validate their designs through pre- and post-route electrical simulation and keep-out volume analysis.

Nomenclature

- U4322A refers to midbus 3.0 probe.
- Midbus connection, midbus probe, and midbus footprint refer to the Agilent midbus 3.0 footprint connector (U4322A) PCI Express compression cable set.
- "channel" refers to either an upstream differential pair OR downstream differential pair for a given lane. In other words, a "channel" refers to either a transmit-differential pair OR a receive-differential pair for a given lane.

Link Configuration Support

The midbus 3.0 offers a number of different probing options for different applications. The platform designer has the flexibility to configure a probing solution that best meets the needs of the system. With midbus 3.0 offering upto 16 channel probing solutions, the following configurations may be made*:

- Upstream and downstream channels of one x8 link.
- Upstream or downstream channels of one x16 link.
- Upstream or downstream channels of up to four x4, x2, or x1 links.

*As long as the Midbus Probe placement within the system requirements are met. System designers should verify that their system requirements are supported by the midbus 3.0 by contacting Agilent Technologies directly.

NOTE Other combinations may be available. Contact Agilent Technologies for the latest support configurations.

Retention Modules

The retention module secures the midbus probe to the device under test (DUT). To achieve this, the retention module must be bolted onto the DUT.

Note that there is a keying feature on the retention module and probe head. If the retention module alignment is off by 180 degrees, it does not work.

After the retention module is properly bolted onto the DUT, the probe can be easily plugged into the retention module (see "Probe Installation Instructions" on page 84).

One kit of 5 retention modules is supplied with each U4322A midbus probe.

Contact your local sales representative to order additional retention modules:

- Part Number: U4322-68702, RETENTION MODULES FOR MIDBUS PROBE 3.0 - 5 PCS.

Reference Clock Connector

Midbus probes provide reference clock connections for situations where it is necessary to probe the reference clock from the device under test (DUT).

For many solution setups, an external reference clock is not required. However, if any of the following cases are true, an external reference clock must be supplied for each PCI Express clock domain for which the case applies.

- When the midbus probe is used with a system that supports Spread Spectrum Clocking (SSC) on the reference clock to all the PCI Express agents and the SSC cannot be disabled

- When testing must be done with SSC enabled, because a problem does not manifest with SSC disabled.
- If the link frequency is intentionally margin tested outside the standard ±300 ppm tolerance.

NOTE This is more restrictive than the PCI Express standard of ±300 ppm, but must be considered. For more information, contact Agilent Technologies directly.

The reference clock can be a dedicated clock, in which case appropriate terminators must be provided on the board. Alternately, the signals may be a tap off an existing clock, since the probes are designed to not significantly load the signals. Note that if the reference clock signal is series/source terminated then the position of the tap point must be at the far end of the line. However, this needs to be verified by the system platform designers to verify proper functionality. See reference clock model for more information.

See Also

- "Footprint for Reference Clock Connector" on page 49
- "Keep-Out Volume for Reference Clock Connector" on page 50
- "Electrical Requirements for Reference Clock Connector" on page 54
- "Load Model for Reference Clock Connector" on page 54

DUT Mechanical Design Considerations

- "Footprint for Probe" on page 46
- "Keep-Out Volume for Probe and Retention Module Dimensions" on page 49
- "Footprint for Reference Clock Connector" on page 49
- "Keep-Out Volume for Reference Clock Connector" on page 50

Footprint for Probe

The Midbus probe 3.0 footprint that needs to be designed into the device under test can be observed in the following figure which shows the detailed layout dimensions. Notice that the connector has 41 pins.

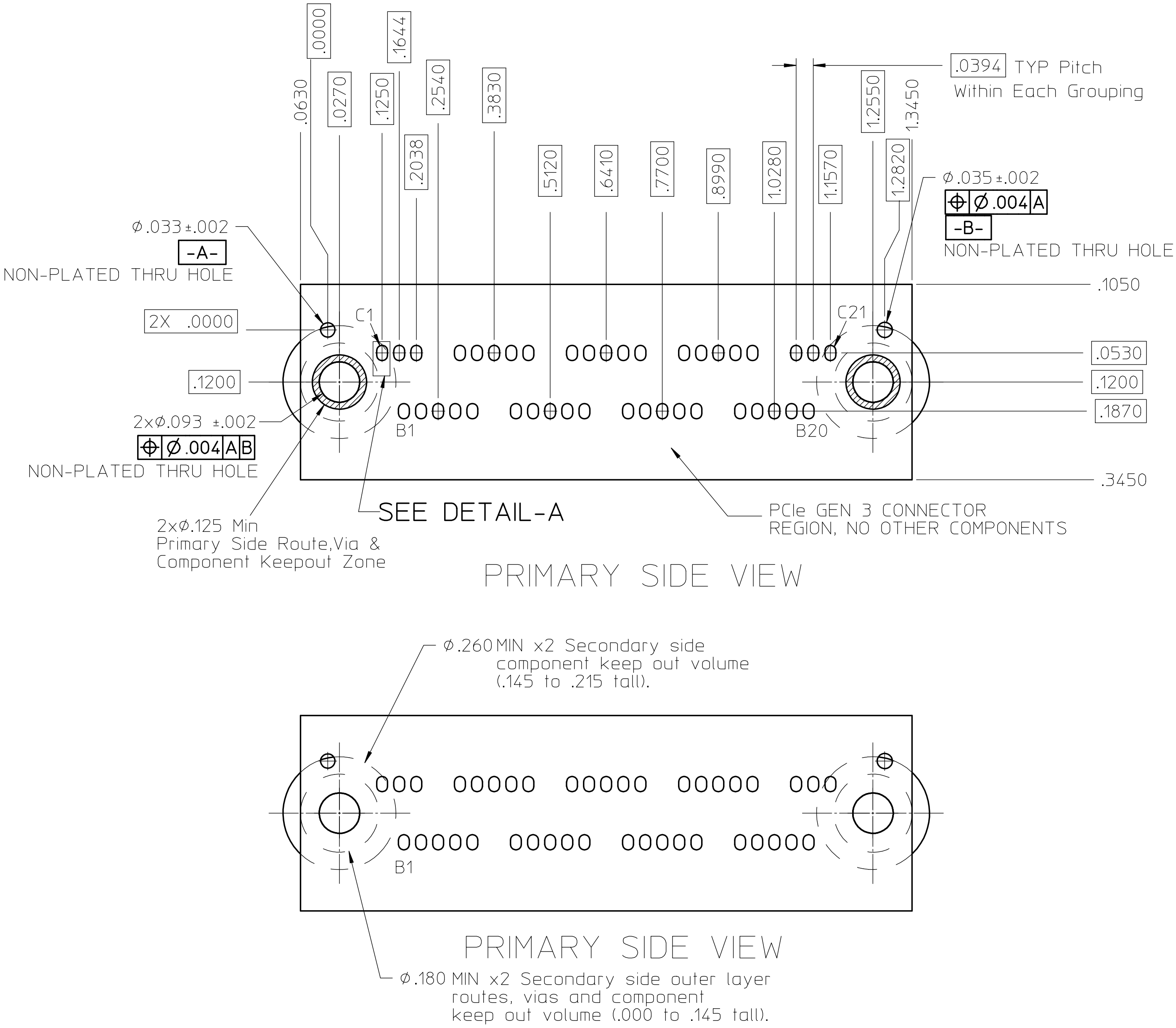


Figure 20 Midbus 3.0 Footprint Dimensions, Pin Numbering, and Specification

Notes:

1 All dimensions are in inches.

2 Solder mask must not extend above the pad height for a distance of 0.005 inches from the pad.

3 Via-in-pad is allowed if the vias are filled level with the pad or the via hole size is less than 0.005 inches.

4 Permissible surface finishes on the pads are HASL, immersion silver, or gold over nickel. The height of the pads contacted by the probe must be within +/- 0.007 inches of the bottom surface of the retention module.

The following figure shows the detailed view of a pad with geometrical information on it.

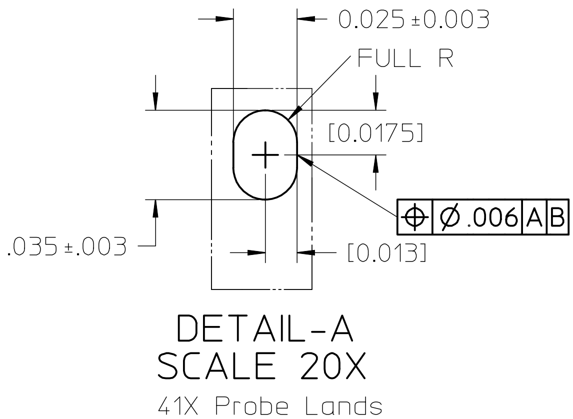


Figure 21 Detail A - Detailed View of a Pad

Keep-Out Volume for Probe and Retention Module Dimensions

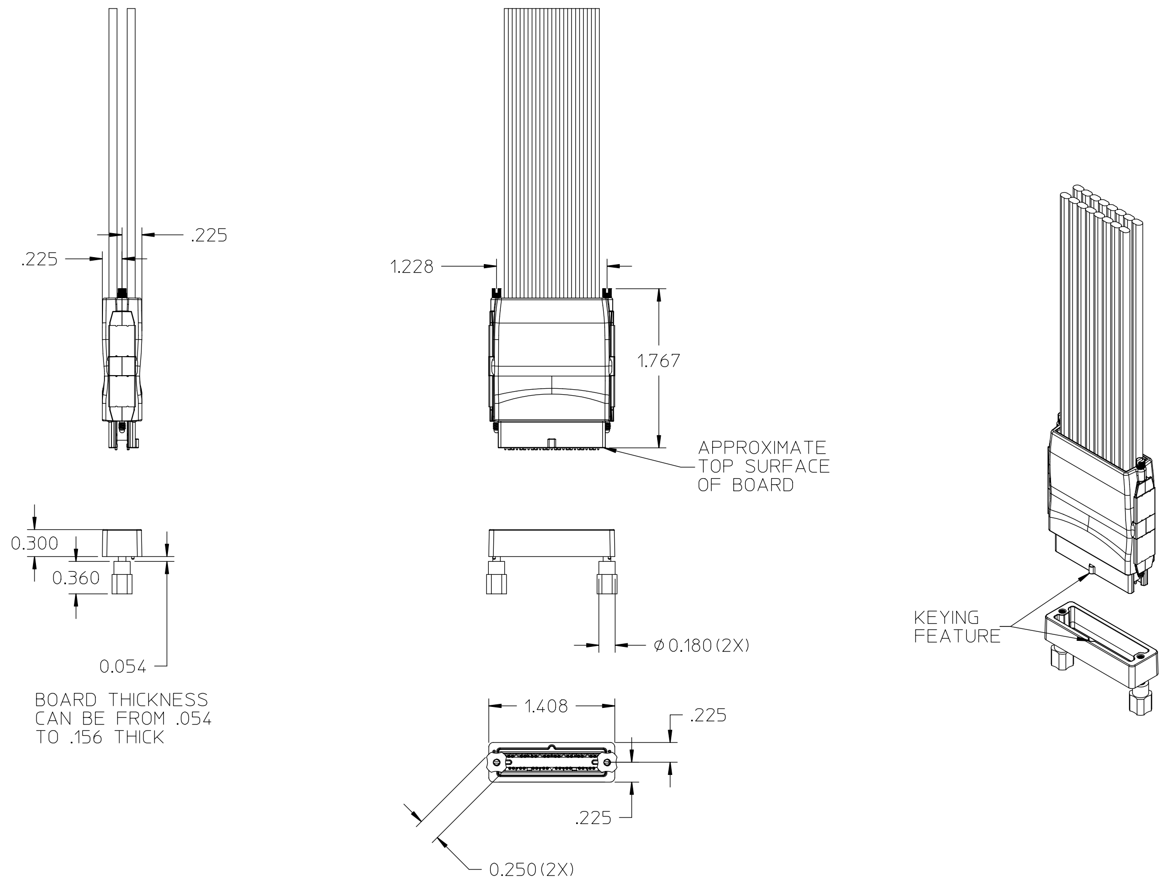


Figure 22 Midbus 3.0 Probe Keep-Out Volume

Notes:

1. All dimensions are in inches.
2. See the footprint drawing ("Footprint for Probe" on page 46) for dimensions and details that include hole locations.

Footprint for Reference Clock Connector

A 3-pin header (1 by 3, 0.05 inch center spacing) will provide the connection for reference clock to the midbus. A small high impedance clock probe will connect to this header to the midbus. Note that an individual reference clock header is required for each PCI Express clock domain on the system.

The following are recommended part numbers for through-hole and surface mount versions of the 3-pin header for reference clock:

- Through-hole:

  Samtec* TMS-103-02-S-S
- Surface mount:

  Samtec* FTR-103-02-S-S

Table 3 Reference clock header pinout

Signal	Pin Number
REFCLKp	1 (or 3)*
GND or N/C	2
REFCLKn	3 (or 1)*
* The probe can be plugged onto the pin header in either orientation.	

See Also • "Keep-Out Volume for Reference Clock Connector" on page 50

Keep-Out Volume for Reference Clock Connector

Keep-out volumes for the reference clock probes are given in the following figure. The pin headers reside symmetrically within the keep-out volume on the device under test. For more specific information on keep-out volumes for particular solutions please contact Agilent Technologies.

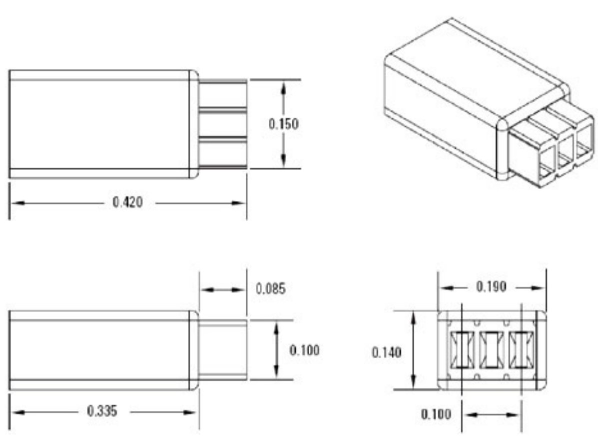


Figure 23 Reference clock probe keep-out volume

DUT Electrical Design Considerations

- "Routing Considerations" on page 51
- "Load Model for Probe" on page 53
- "Electrical Requirements for Reference Clock Connector" on page 54
- "Load Model for Reference Clock Connector" on page 54

Routing Considerations

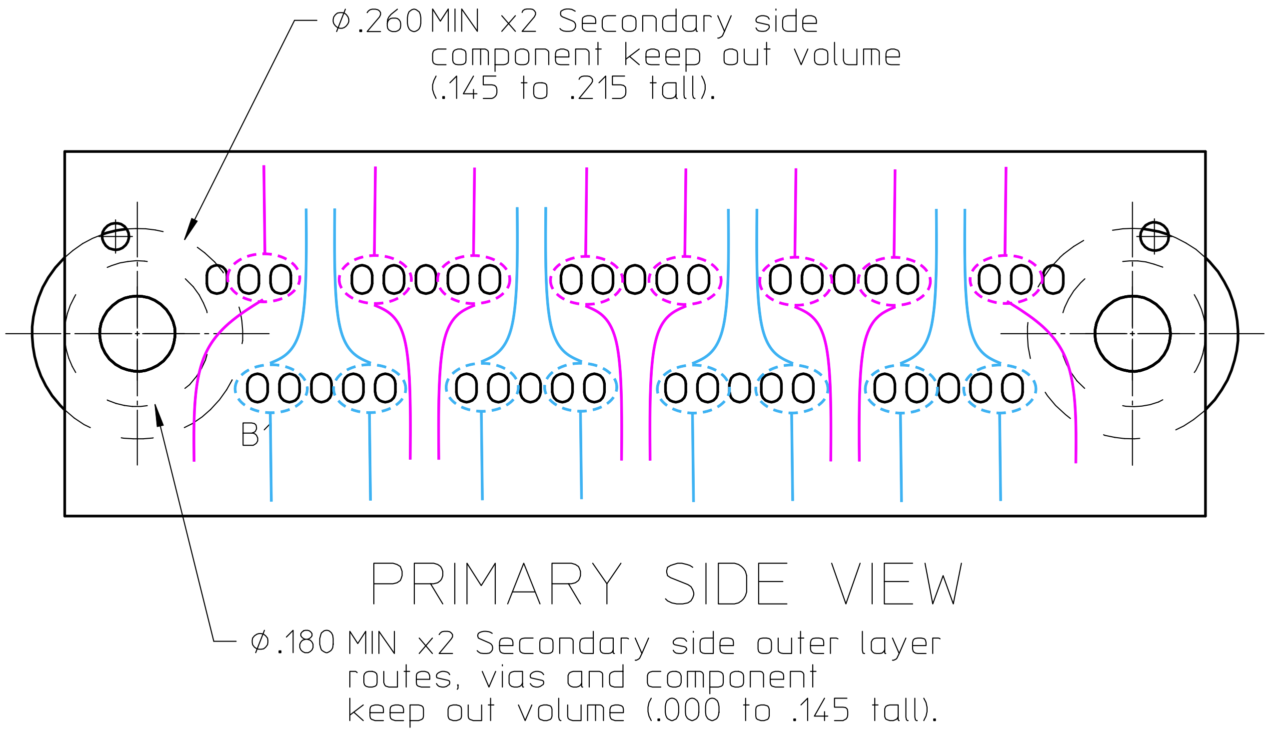


Figure 24 Sample Top Layer Routing Pattern

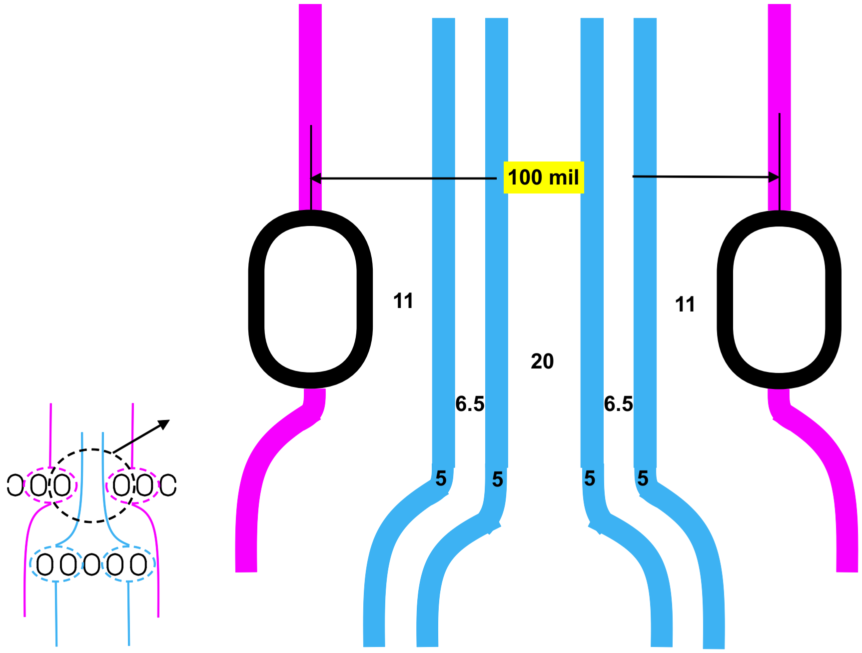


Figure 25 Sample Top Layer Routing Pattern Detail

NOTE

The trace widths and spaces in the previous "routing pattern details" figure are suggestions only. These suggestions should be validated against stackup and other signal integrity considerations.

Load Model for Probe

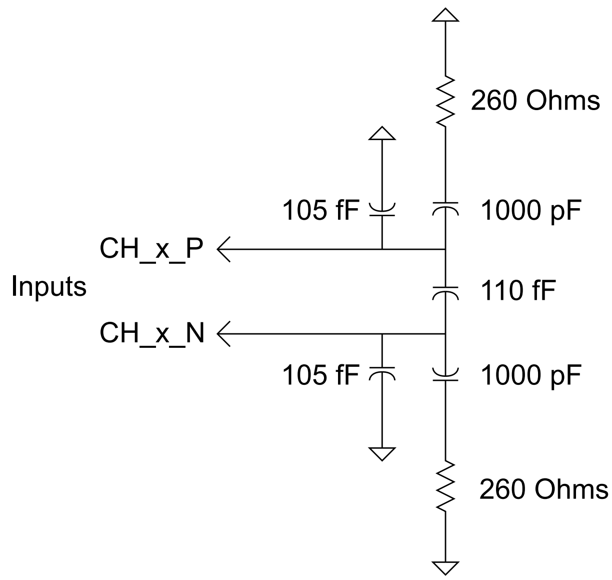


Figure 26 Load Model for Midbus 3.0 Probe

For PCI Express Gen3, it is not meaningful to talk about eye openings as an input requirement to a receiver, because for Gen3 you are dealing with a closed eye. In this consideration, PCI Express Gen3 compliant receivers are required to have equalization capabilities, and the Equalizing Snoop Probe is no different in this regard. In fact, the Equalizing Snoop Probe has a wide range of equalization capabilities in its receiver — a range that is too extensive to attempt to enumerate in a model.

The good news is that the PCI Express 3.0 specification takes this into account already in its Receiver Compliance testing section of the PCI Express Gen3 Specification (sections 4.3.4.3.2 and sections 4.3.6.4 referring to spec version 0.9), and the Equalizing Snoop Probe passes this testing. The way to evaluate this is to run the traditional channel simulation with the provided load model, and evaluate the signal at the probe tip using the method described in the receiver compliance testing section (that is, section 4.3.4.4). If the eye present at the probe tip is at least the size of the stressed eye specification (after performing the appropriate post-processing), then you can be assured of reliable data capture. PCI-SIG also provides a freely-available tool that supports the post processing steps required. See "http://www.pcisig.com/specifications/pciexpress/base2/seasim_package/" at "www.pcisig.org".

Electrical Requirements for Reference Clock Connector

Table 4 Reference Clock Electrical Requirements

Midbus Requirement	Symbol	Min.	Max.	Comments
Differential voltage at ref clock attach point	Vppdiff	0.8 V	2 V	Vppdiff = |2*(Vrefclockp – Vrefclockn)|
Reference clock frequency without SSC	f	100 MHz -300 ppm	100 MHz +300 ppm	
Reference clock frequency with SSC	f	100 MHz -0.5%	100 MHz +0%	

If reference clock tolerance is less than ±300 ppm, there is no need for providing reference to the midbus. If the reference clock tolerance is greater than ±300 ppm, there is a need for providing reference (SSC) to the midbus.

See Also • "Load Model for Reference Clock Connector" on page 54

Load Model for Reference Clock Connector

Load models for the reference clock probe are given in this section. System designers will be expected to perform simulations of the reference clock networks with the header and midbus load models to ensure good signal integrity of the reference clocks at the header to the midbus. The pin header parasitics may be obtained from the connector vendor.

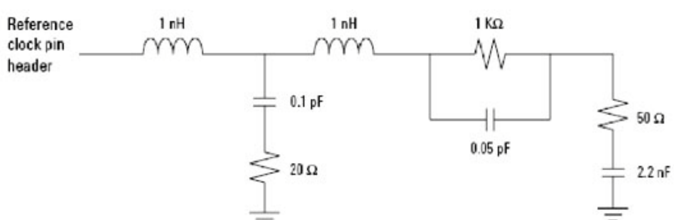


Figure 27 Reference clock probe load model

Supported Footprint Pinouts and Pod Connections

Table 5 Supported Footprint Summary

Supported Footprint Configuration	Probe Required	Number of U4301A Protocol Analyzer Modules Required
"x16 Straight Footprint" on page 56	2 x Full Size Mid-Bus (U4322A)	2
"x16 Swizzled Footprint" on page 58	2 x Full Size Mid-Bus (U4322A)	2
"x16 Unidirectional Footprint" on page 61	1 x Full Size Mid-Bus (U4322A)	1
"x8 Bidirectional Footprint" on page 63	1 x Full Size Mid-Bus (U4322A)	1
"Two x8 Unidirectional Footprint" on page 65	1 x Full Size Mid-Bus (U4322A)	2
"Two x4 Bidirectional Footprint" on page 67	1 x Full Size Mid-Bus (U4322A)	2
"x4 Bidirectional Footprint" on page 69	1 x Full Size Mid-Bus (U4322A)	1
"Two x4 Unidirectional Footprint" on page 71	1 x Full Size Mid-Bus (U4322A)	2
"Two x2 Bidirectional Footprint" on page 73	1 x Full Size Mid-Bus (U4322A)	2
"Two x2 Unidirectional Footprint" on page 75	1 x Full Size Mid-Bus (U4322A)	2
"x1 Bi-directional Footprint" on page 77	1 x Full Size Mid-Bus (U4322A)	1
"Two x1 Bidirectional Footprint" on page 79	1 x Full Size Mid-Bus (U4322A)	2
"Two x1 Unidirectional Footprint" on page 81	1 x Full Size Mid-Bus (U4322A)	2

The pod connection pictures that appear in the following footprint descriptions also appear as "Connection diagrams" in the *Agilent Logic Analyzer* application's Setup dialog for the PCIe analyzer module.

x16 Straight Footprint

One bidirectional x16 link in two unidirectional full-width PCI Express midbus probe footprints pinout.

Table 6 x16 Straight Footprint Pinout

Module 1					Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**		**Signal Name**	**Pin #**	**Pin #**	**Signal Name**
		C1	GND				C1	GND
up1p	B1	C2	up0p		down1p	B1	C2	down0p
up1n	B2	C3	up0n		down1n	B2	C3	down0n
GND	B3				GND	B3		
up2p	B4	C4	up3p		down2p	B4	C4	down3p
up2n	B5	C5	up3n		down2n	B5	C5	down3n
		C6	GND				C6	GND
up5p	B6	C7	up4p		down5p	B6	C7	down4p
up5n	B7	C8	up4n		down5n	B7	C8	down4n
GND	B8				GND	B8		
up6p	B9	C9	up7p		down6p	B9	C9	down7p
up6n	B10	C10	up7n		down6n	B10	C10	down7n
		C11	GND				C11	GND
up9p	B11	C12	up8p		down9p	B11	C12	down8p
up9n	B12	C13	up8n		down9n	B12	C13	down8n
GND	B13				GND	B13		
up10p	B14	C14	up11p		down10p	B14	C14	down11p
up10n	B15	C15	up11n		down10n	B15	C15	down11n
		C16	GND				C16	GND
up13p	B16	C17	up12p		down13p	B16	C17	down12p
up13n	B17	C18	up12n		down13n	B17	C18	down12n
GND	B18				GND	B18		
up14p	B19	C19	up15p		down14p	B19	C19	down15p
up14n	B20	C20	up15n		down14n	B20	C20	down15n
		C21	GND				C21	GND

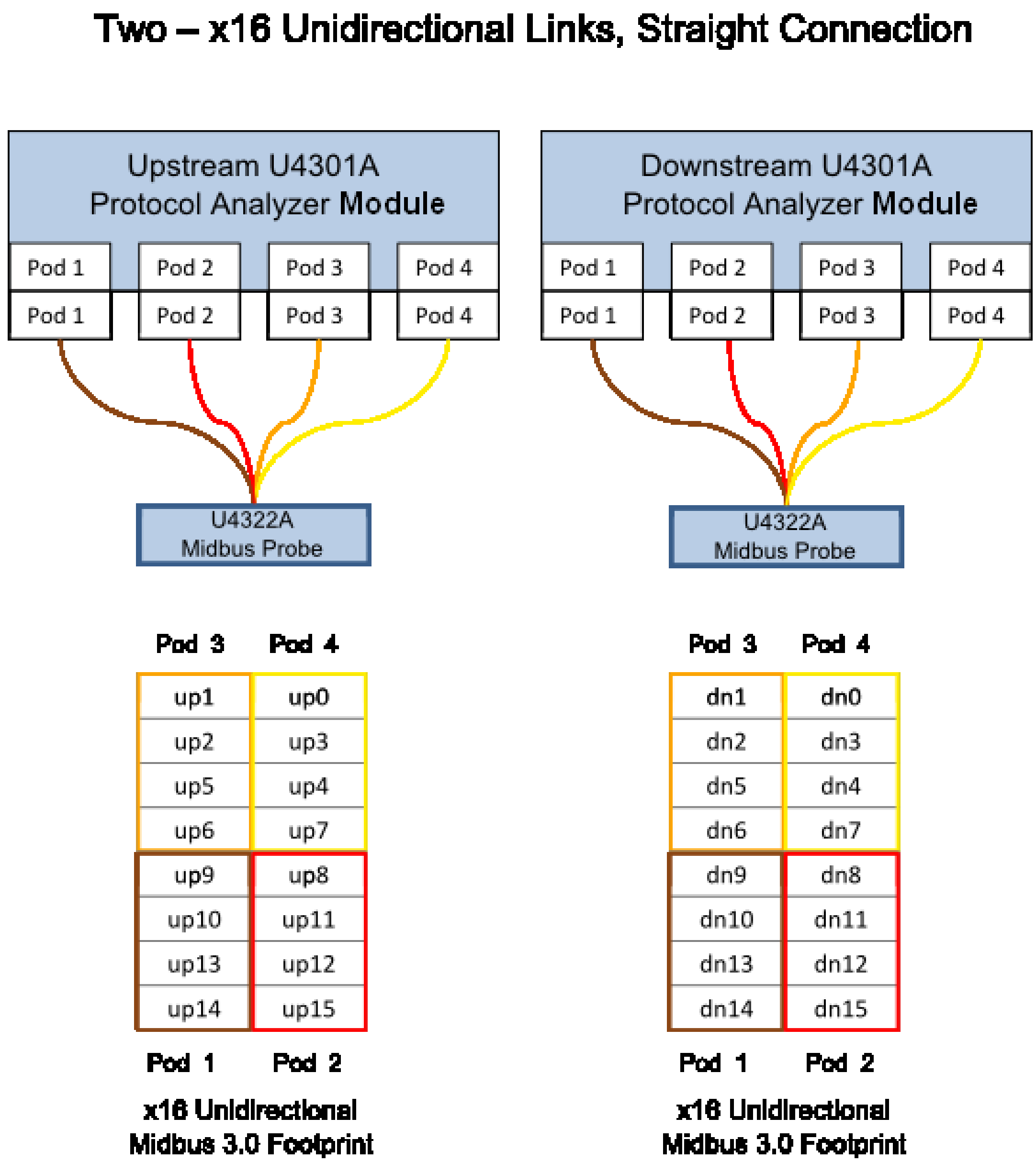


Figure 28 x16 Straight Footprint Pod Connection

x16 Swizzled Footprint

One bidirectional x16 link in two bidirectional full-width PCI Express midbus probe footprints pinout.

Table 7 x16 Swizzled Footprint Pinout

Downstream Module 1		Upstream Module 2			Downstream Module 1		Upstream Module 2	
Signal Name	**Pin #**	**Pin #**	**Signal Name**		**Signal Name**	**Pin #**	**Pin #**	**Signal Name**
		C1	GND				C1	GND
down0p	B1	C2	up0p		down8p	B1	C2	up8p
down0n	B2	C3	up0n		down8n	B2	C3	up8n
GND	B3				GND	B3		
down1p	B4	C4	up1p		down9p	B4	C4	up9p
down1n	B5	C5	up1n		down9n	B5	C5	up9n
		C6	GND				C6	GND
down2p	B6	C7	up2p		down10p	B6	C7	up10p
down2n	B7	C8	up2n		down10n	B7	C8	up10n
GND	B8				GND	B8		
down3p	B9	C9	up3p		down11p	B9	C9	up11p
down3n	B10	C10	up3n		down11n	B10	C10	up11n
		C11	GND				C11	GND
down4p	B11	C12	up4p		down12p	B11	C12	up12p
down4n	B12	C13	up4n		down12n	B12	C13	up12n
GND	B13				GND	B13		
down5p	B14	C14	up5p		down13p	B14	C14	up13p
down5n	B15	C15	up5n		down13n	B15	C15	up13n
		C16	GND				C16	GND
down6p	B16	C17	up6p		down14p	B16	C17	up14p
down6n	B17	C18	up6n		down14n	B17	C18	up14n
GND	B18				GND	B18		
down7p	B19	C19	up7p		down15p	B19	C19	up15p

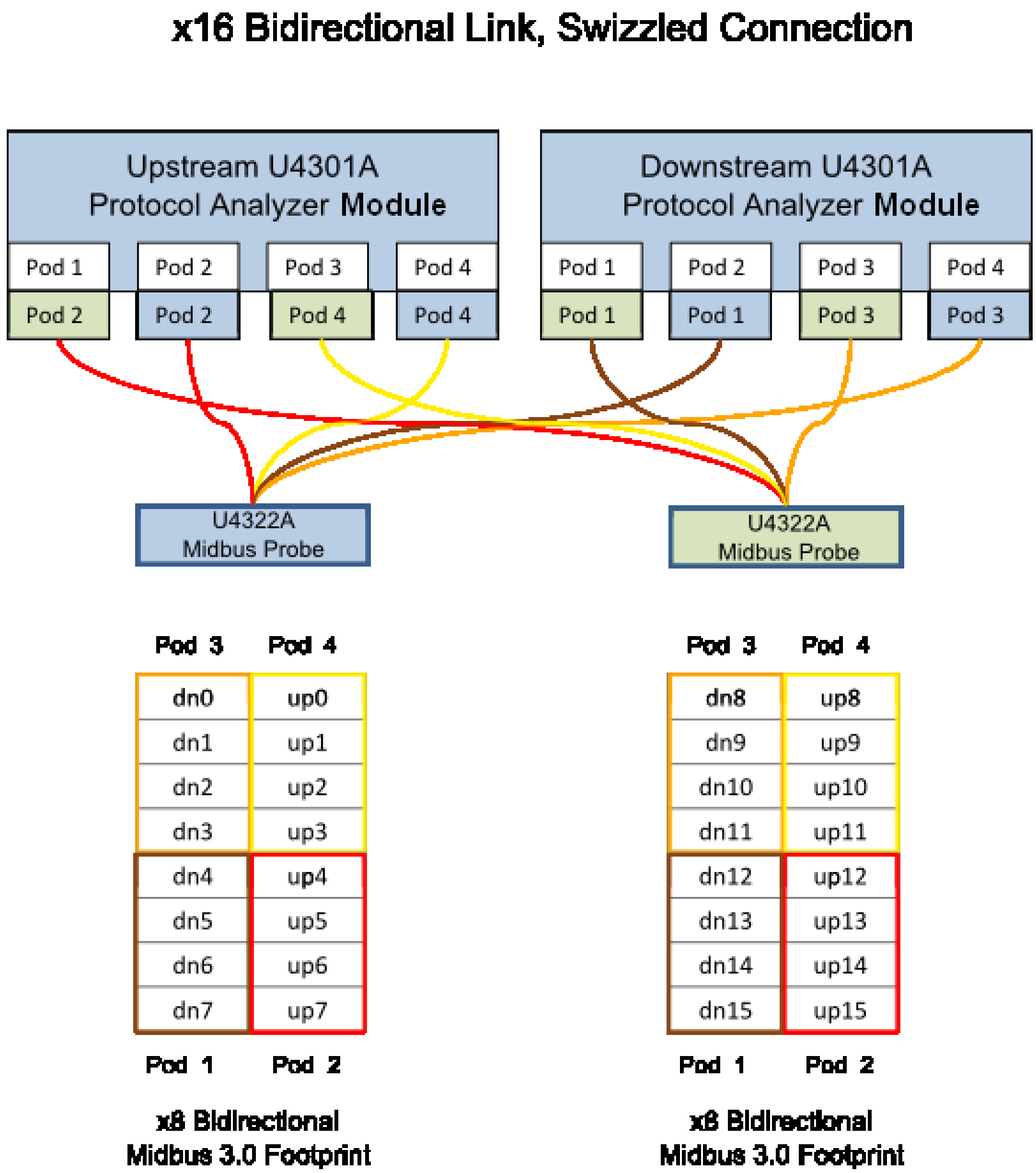


Figure 29 x16 Swizzled Footprint Pod Connection

x16 Unidirectional Footprint

One x16 unidirectional specific 16 channel PCI Express.

Table 8 x16 Unidirectional Footprint Pinout

Module 1			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
lane1p	B1	C2	lane0p
lane1n	B2	C3	lane0n
GND	B3		
lane2p	B4	C4	lane3p
lane2n	B5	C5	lane3n
		C6	GND
lane5p	B6	C7	lane4p
lane5n	B7	C8	lane4n
GND	B8		
lane6p	B9	C9	lane7p
lane6n	B10	C10	lane7n
		C11	GND
lane9p	B11	C12	lane8p
lane9n	B12	C13	lane8n
GND	B13		
lane10p	B14	C14	lane11p
lane10n	B15	C15	lane11n
		C16	GND
lane13p	B16	C17	lane12p
lane13n	B17	C18	lane12n
GND	B18		
lane14p	B19	C19	lane15p
lane14n	B20	C20	lane15n
		C21	GND

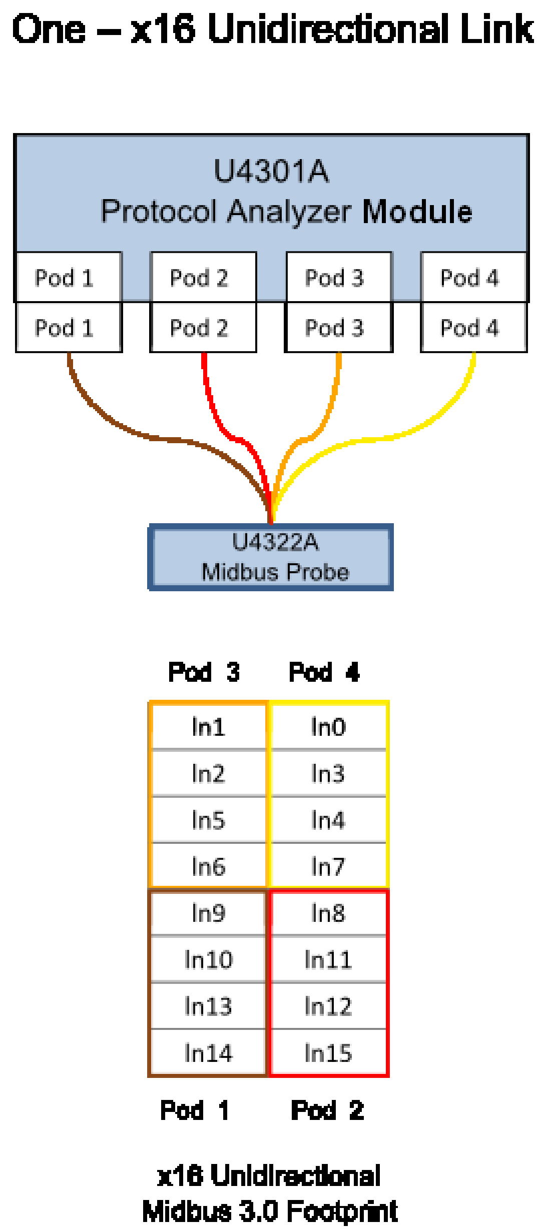


Figure 30 x16 Unidirectional Footprint Pod Connection

x8 Bidirectional Footprint

You can use a single U4301A module with a Midbus 3.0 probe to create a x8 bidirectional setup.

One x8 bidirectional specific 16 channel PCI Express

Table 9 x8 Bidirectional Footprint Pinout when a single U4301A module is used

Module 1			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
down0p	B1	C2	up0p
down0n	B2	C3	up0n
GND	B3		
down1p	B4	C4	up1p
down1n	B5	C5	up1n
		C6	GND
down2p	B6	C7	up2p
down2n	B7	C8	up2n
GND	B8		
down3p	B9	C9	up3p
down3n	B10	C10	up3n
		C11	GND
down4p	B11	C12	up4p
down4n	B12	C13	up4n
GND	B13		
down5p	B14	C14	up5p
down5n	B15	C15	up5n
		C16	GND
down6p	B16	C17	up6p
down6n	B17	C18	up6n
GND	B18		
down7p	B19	C19	up7p
down7p	B20	C20	up7p
		C21	GND

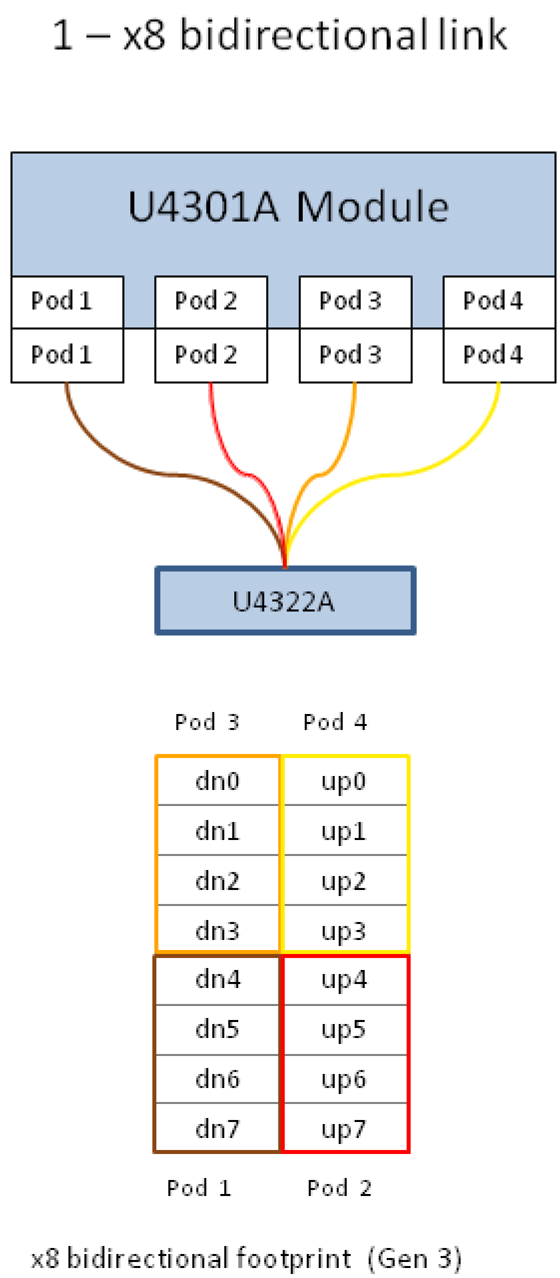


Figure 31 x8 Bidirectional Footprint Pod Connection when a single U4301A module is used

Two x8 Unidirectional Footprint

Two x8 unidirectional specific 16 channel PCI Express.

Table 10 Two x8 Unidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$lane1_1p$	B1	C2	$lane0_1p$
$lane1_1n$	B2	C3	$lane0_1n$
GND	B3		
$lane2_1p$	B4	C4	$lane3_1p$
$lane2_1n$	B5	C5	$lane3_1n$
		C6	GND
$lane5_1p$	B6	C7	$lane4_1p$
$lane5_1n$	B7	C8	$lane4_1n$
GND	B8		
$lane6_1p$	B9	C9	$lane7_1p$
$lane6_1n$	B10	C10	$lane7_1n$
Module 1			
		C11	GND
$lane1_2p$	B11	C12	$lane0_2p$
$lane1_2n$	B12	C13	$lane0_2n$
GND	B13		
$lane2_2p$	B14	C14	$lane3_2p$
$lane2_2n$	B15	C15	$lane3_2n$
		C16	GND
$lane5_2p$	B16	C17	$lane4_2p$
$lane5_2n$	B17	C18	$lane4_2n$
GND	B18		
$lane6_2p$	B19	C19	$lane7_2p$
$lane6_2n$	B20	C20	$lane7_2n$
		C21	GND

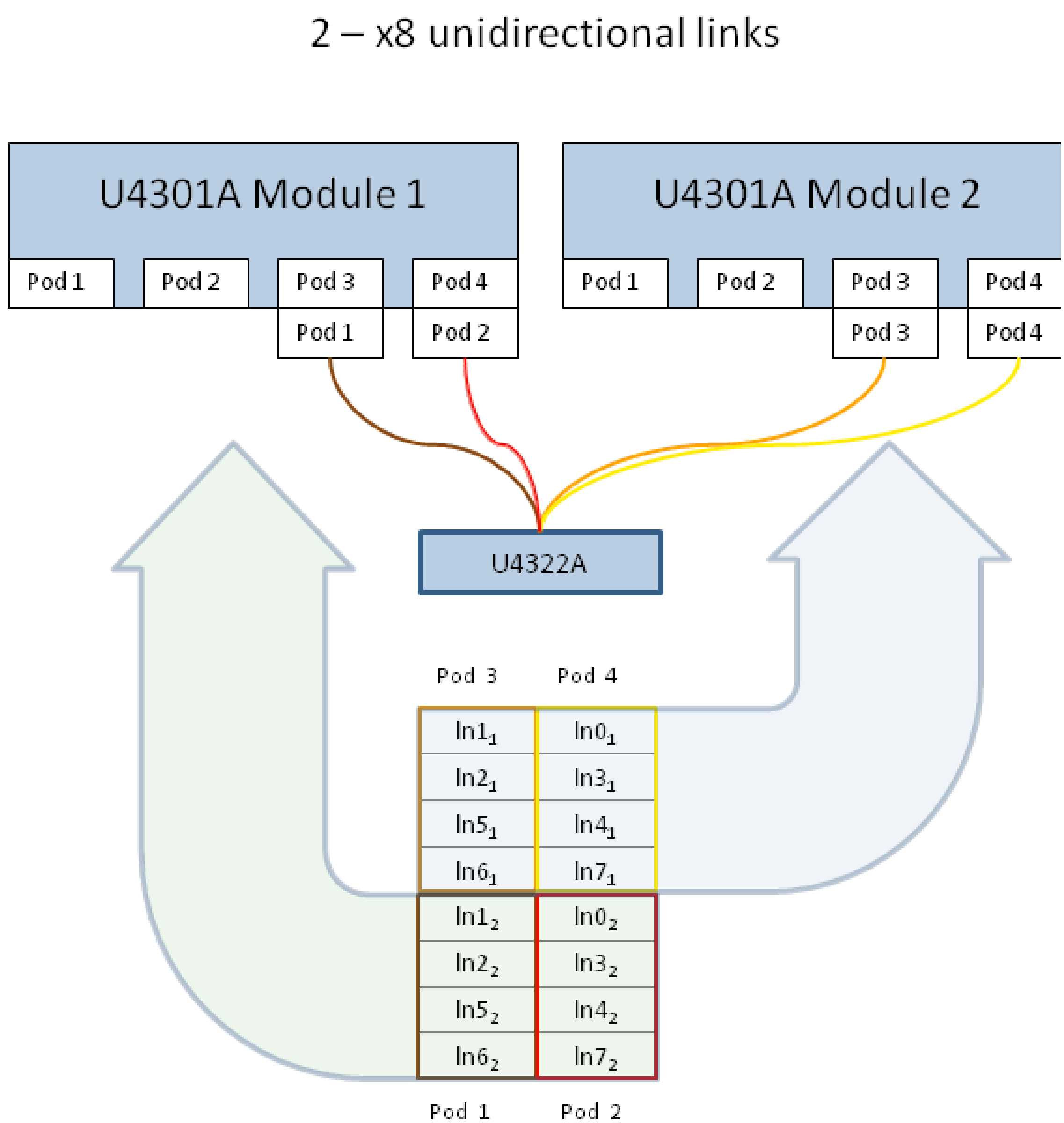


Figure 32 Two x8 Unidirectional Footprint Pod Connection

Two x4 Bidirectional Footprint

Two x4 bidirectional specific 16 channel PCI Express.

Table 11 Two x4 Bidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$down0_1p$	B1	C2	$up0_1p$
$down0_1n$	B2	C3	$up0_1n$
GND	B3		
$down1_1p$	B4	C4	$up1_1p$
$down1_1n$	B5	C5	$up1_1n$
		C6	GND
$down2_1p$	B6	C7	$up2_1p$
$down2_1n$	B7	C8	$up2_1n$
GND	B8		
$down3_1p$	B9	C9	$up3_1p$
$down3_1n$	B10	C10	$up3_1n$
Module 1			
		C11	GND
$down0_2p$	B11	C12	$up0_2p$
$down0_2n$	B12	C13	$up0_2n$
GND	B13		
$down1_2p$	B14	C14	$up1_2p$
$down1_2n$	B15	C15	$up1_2n$
		C16	GND
$down2_2p$	B16	C17	$up2_2p$
$down2_2n$	B17	C18	$up2_2n$
GND	B18		
$down3_2p$	B19	C19	$up3_2p$
$down3_2n$	B20	C20	$up3_2n$
		C21	GND

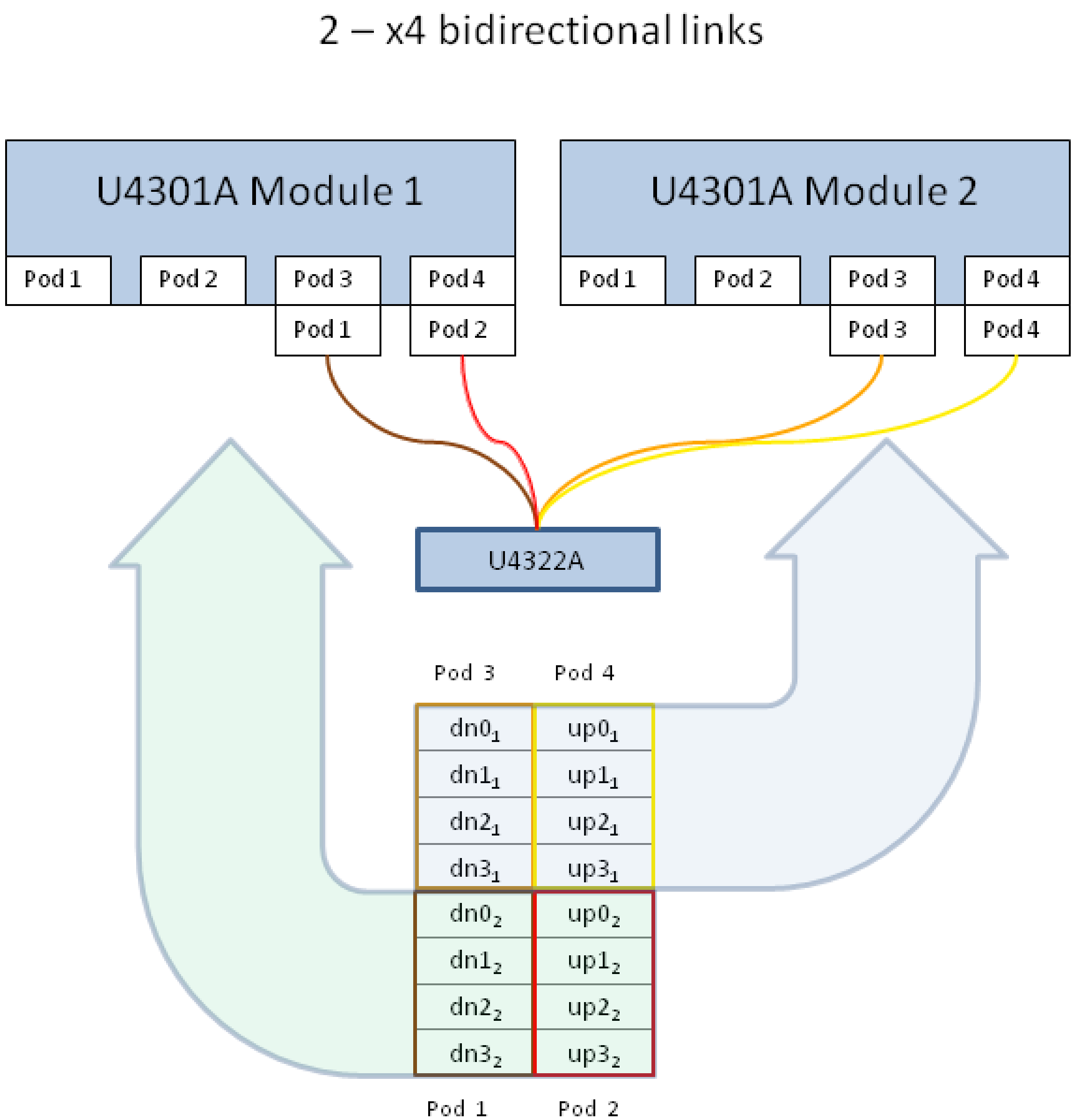


Figure 33 Two x4 Bidirectional Footprint Pod Connection

x4 Bidirectional Footprint

You can use a single U4301A module with a Midbus 3.0 probe to create a x4 bidirectional setup.

One x4 bidirectional specific 16 channel PCI Express.

Table 12 x4 Bidirectional Footprint Pinout

Module1			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
down0p	B1	C2	up0p
down0n	B2	C3	up0n
GND	B3		
down1p	B4	C4	up1p
down1n	B5	C5	up1n
		C6	GND
down2p	B6	C7	up2p
down2n	B7	C8	up2n
GND	B8		
down3p	B9	C9	up3p
down3n	B10	C10	up3n
		C11	GND
NC	B11	C12	NC
NC	B12	C13	NC
GND	B13		
NC	B14	C14	NC
NC	B15	C15	NC
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

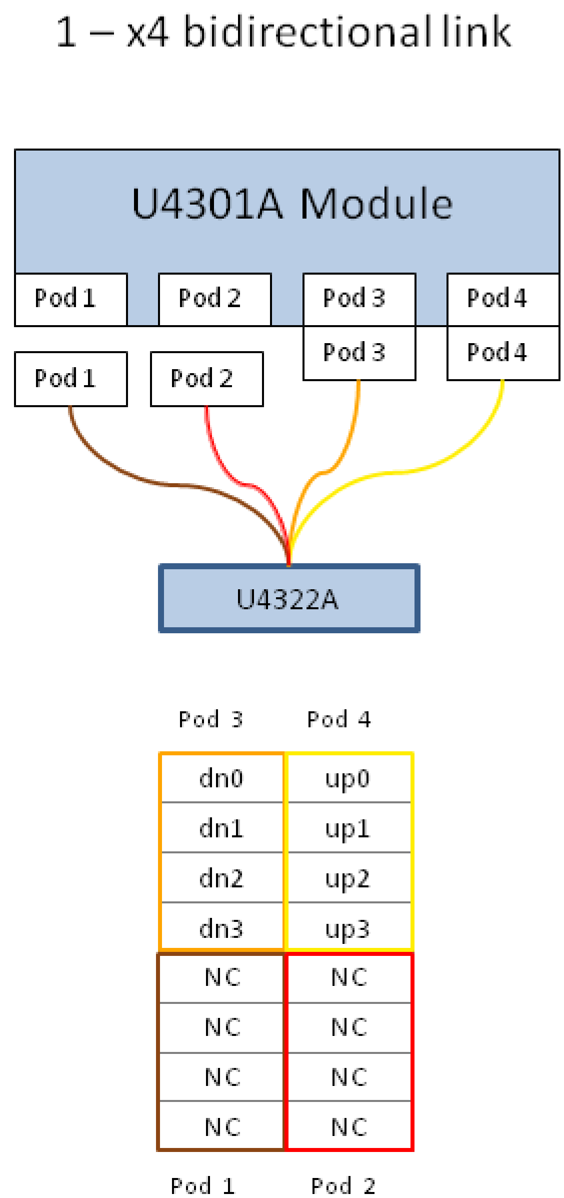


Figure 34 x4 Bidirectional Footprint Pod Connection

Two x4 Unidirectional Footprint

Four x4 unidirectional specific 16 channel PCI Express.

Table 13 Two x4 Unidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$lane1_1p$	B1	C2	$lane0_1p$
$lane1_1n$	B2	C3	$lane0_1n$
GND	B3		
$lane2_1p$	B4	C4	$lane3_1p$
$lane2_1n$	B5	C5	$lane3_1n$
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
Module 1			
		C11	GND
$lane1_2p$	B11	C12	$lane0_2p$
$lane1_2n$	B12	C13	$lane0_2n$
GND	B13		
$lane2_2p$	B14	C14	$lane3_2p$
$lane2_2n$	B15	C15	$lane3_2n$
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

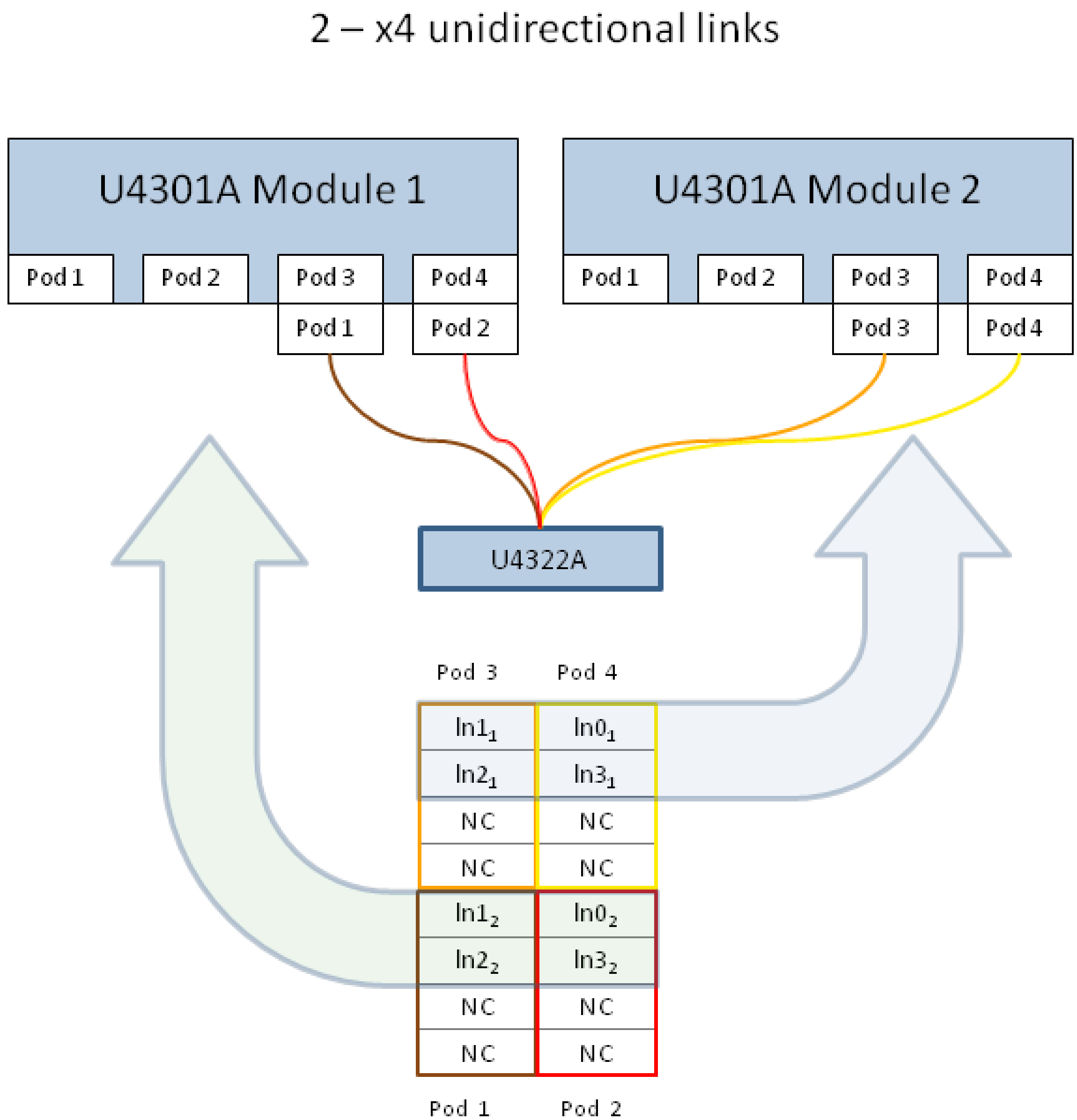


Figure 35 Two x4 Unidirectional Footprint Pod Connection

Two x2 Bidirectional Footprint

Two x2 bi-directional specific 16 channel PCI Express.

Table 14 Two x2 Bidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$down0_1p$	B1	C2	$up0_1p$
$down0_1n$	B2	C3	$up0_1n$
GND	B3		
$down1_1p$	B4	C4	$up1_1p$
$down1_1n$	B5	C5	$up1_1n$
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
Module 1			
		C11	GND
$down0_2p$	B11	C12	$up0_2p$
$down0_2n$	B12	C13	$up0_2n$
GND	B13		
$down1_2p$	B14	C14	$up1_2p$
$down1_2n$	B15	C15	$up1_2n$
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

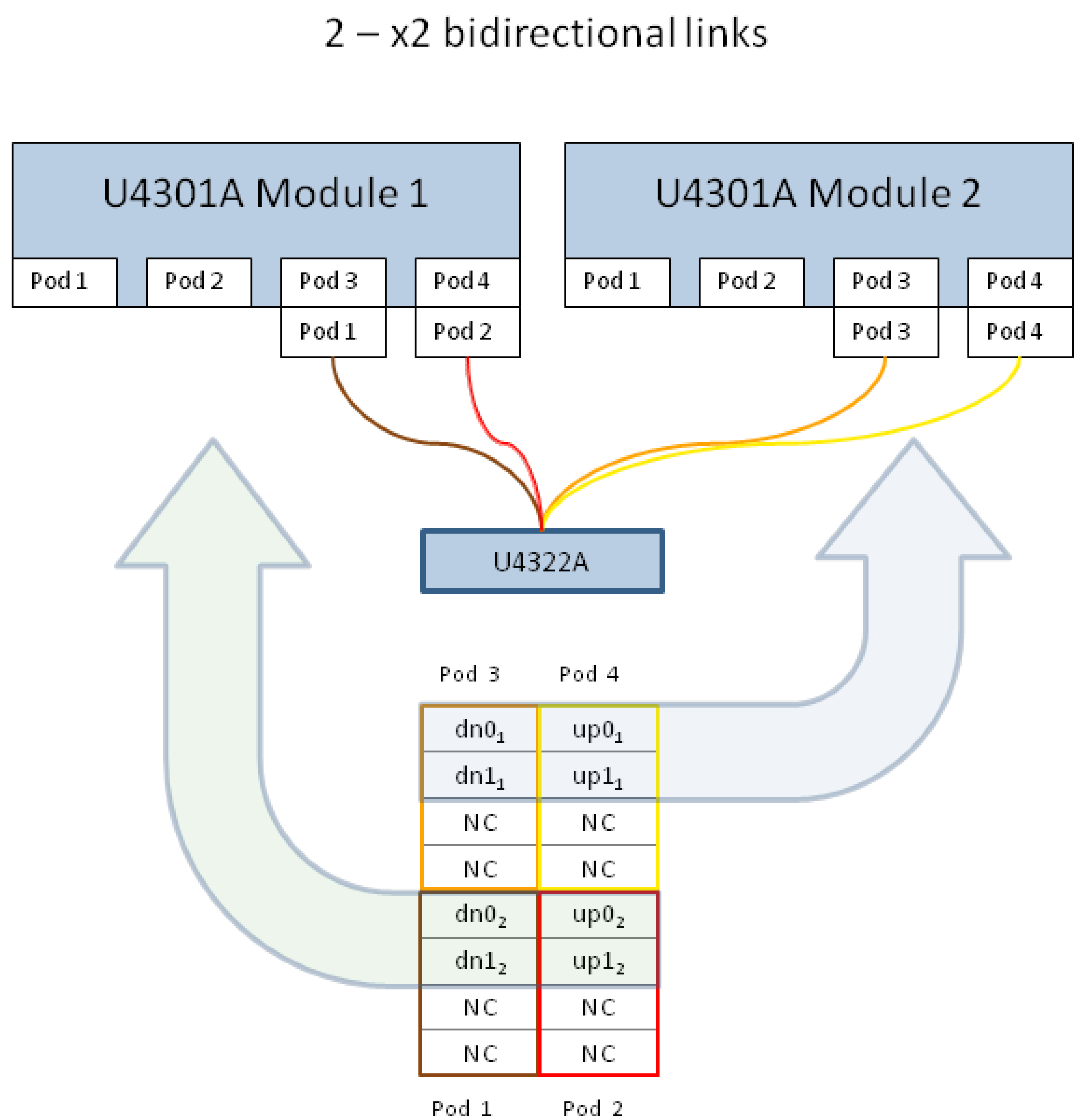


Figure 36 Two x2 Bidirectional Footprint Pod Connection

Two x2 Unidirectional Footprint

Two x2 unidirectional specific 16 channel PCI Express.

Table 15 Two x2 Unidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$lane1_1p$	B1	C2	$lane0_1p$
$lane1_1n$	B2	C3	$lane0_1n$
GND	B3		
NC	B4	C4	NC
NC	B5	C5	NC
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
Module 1			
		C11	GND
$lane1_2p$	B11	C12	$lane0_2p$
$lane1_2n$	B12	C13	$lane0_2n$
GND	B13		
NC	B14	C14	NC
NC	B15	C15	NC
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

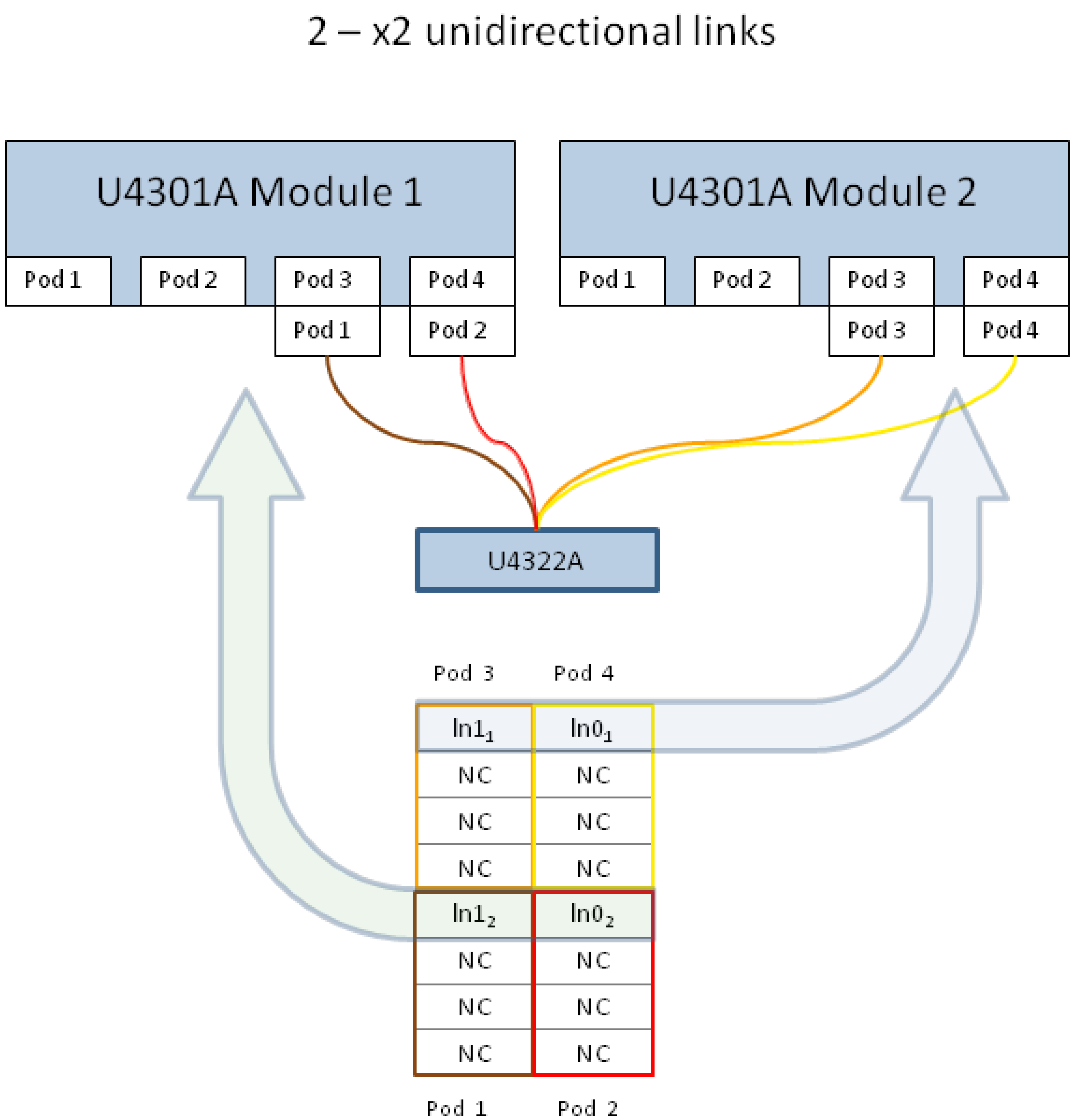


Figure 37 Two x2 Unidirectional Footprint Pod Connection

x1 Bi-directional Footprint

You can use a single U4301A module with a Midbus 3.0 probe to create a x1 bi-directional setup.

One x1 bi-directional specific 16 channel PCI Express.

Table 16 x1 Bidirectional Footprint Pinout

Module 1			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
down0p	B1	C2	up0p
down0n	B2	C3	up0n
GND	B3		
NC	B4	C4	NC
NC	B5	C5	NC
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
		C11	GND
NC	B11	C12	NC
NC	B12	C13	NC
GND	B13		
NC	B14	C14	NC
NC	B15	C15	NC
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

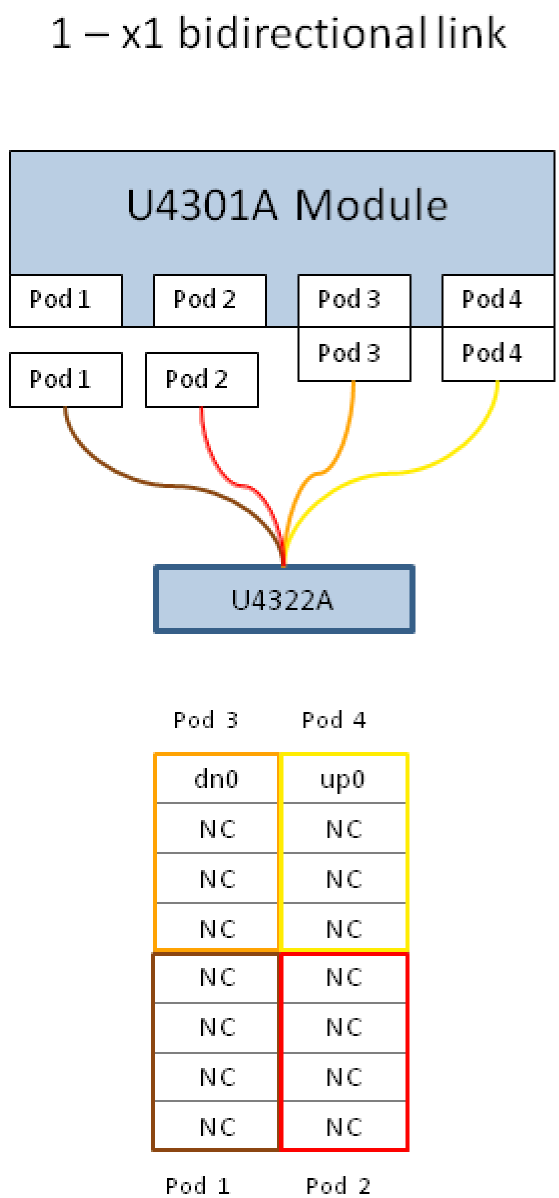


Figure 38 x1 Bidirectional Footprint Pod Connection

Two x1 Bidirectional Footprint

Two x1 bidirectional specific 16 channel PCI Express.

Table 17 Two x1 Bidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
$down0_1p$	B1	C2	$up0_1p$
$down0_1n$	B2	C3	$up0_1n$
GND	B3		
NC	B4	C4	NC
NC	B5	C5	NC
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
Module 1			
		C11	GND
$down0_2p$	B11	C12	$up0_2p$
$down0_2n$	B12	C13	$up0_2n$
GND	B13		
NC	B14	C14	NC
NC	B15	C15	NC
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

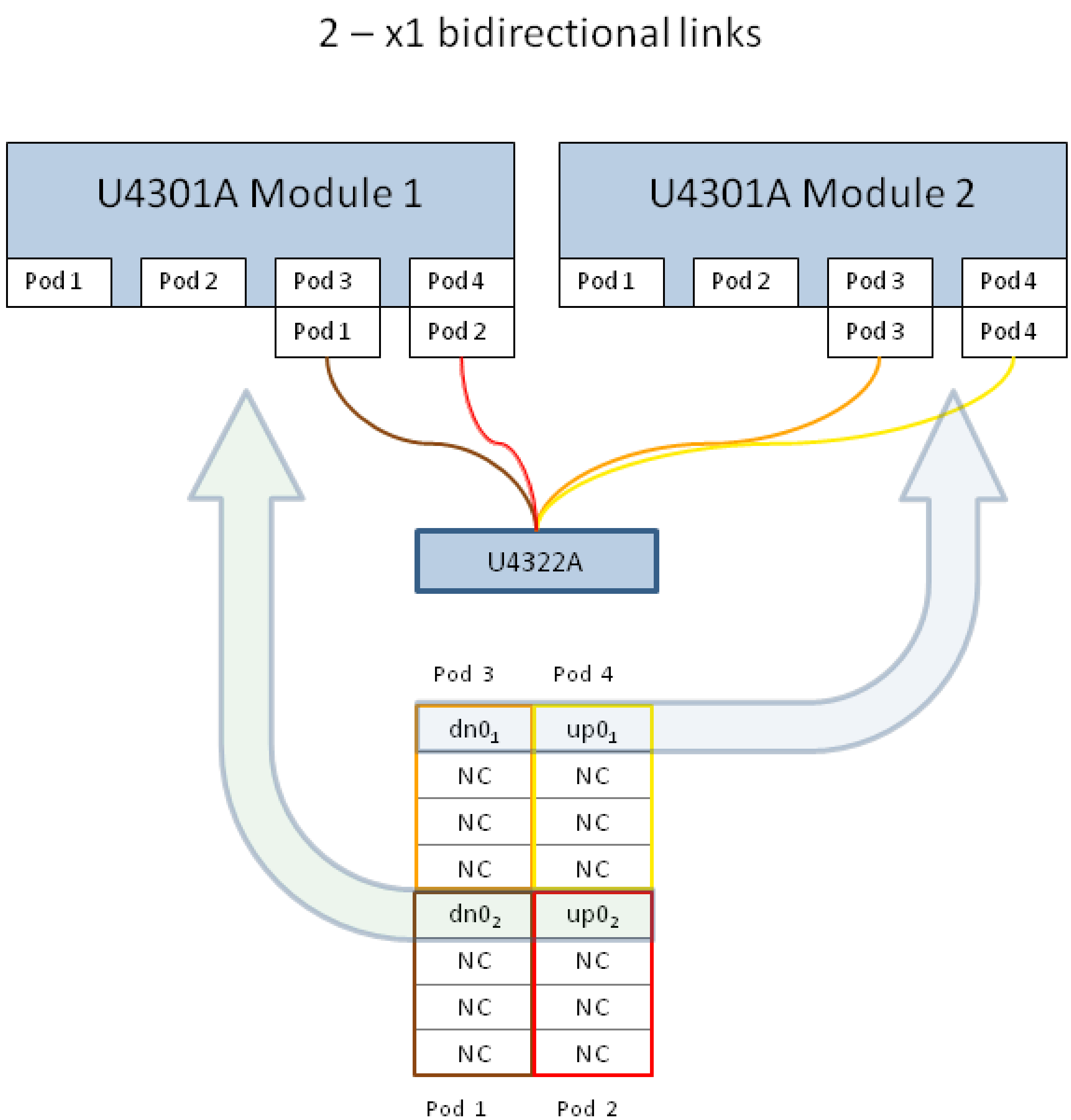


Figure 39 Two x1 Bidirectional Footprint Pod Connection

Two x1 Unidirectional Footprint

Two x1 unidirectional specific 16 channel PCI Express.

Table 18 Two x1 Unidirectional Footprint Pinout

Module 2			
Signal Name	**Pin #**	**Pin #**	**Signal Name**
		C1	GND
NC	B1	C2	$lane0_1p$
NC	B2	C3	$lane0_1n$
GND	B3		
NC	B4	C4	NC
NC	B5	C5	NC
		C6	GND
NC	B6	C7	NC
NC	B7	C8	NC
GND	B8		
NC	B9	C9	NC
NC	B10	C10	NC
Module 1			
		C11	GND
NC	B11	C12	$lane0_2p$
NC	B12	C13	$lane0_2n$
GND	B13		
NC	B14	C14	NC
NC	B15	C15	NC
		C16	GND
NC	B16	C17	NC
NC	B17	C18	NC
GND	B18		
NC	B19	C19	NC
NC	B20	C20	NC
		C21	GND

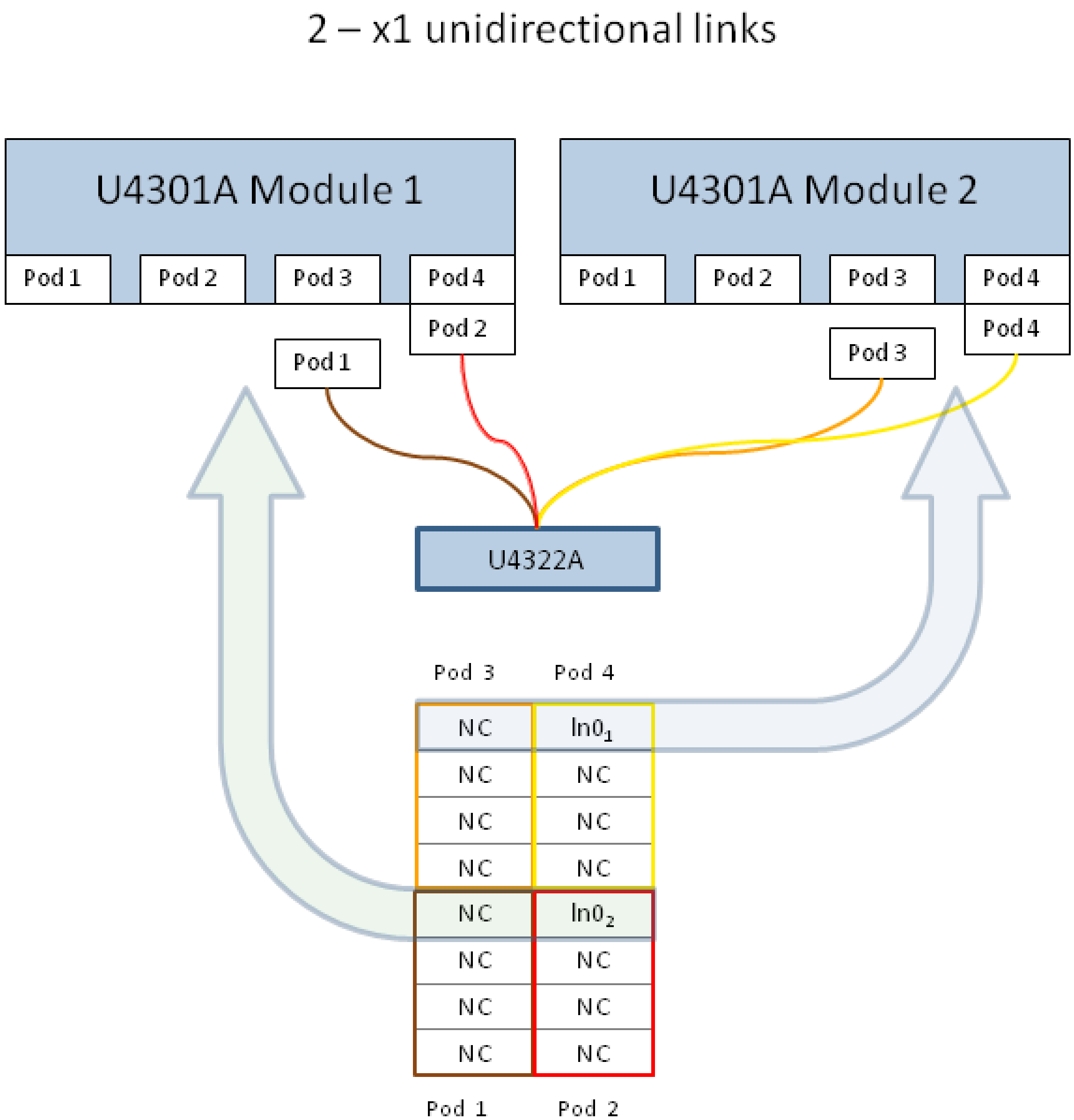


Figure 40 Two x1 Unidirectional Footprint Pod Connection

Probe Installation Instructions

1 Connect the midbus 3.0 probe's pod connectors to the protocol analyzer blade.

CAUTION Over-tightening the module connector screws can damage the probe. Because of the size of the screws, you may need to use a screwdriver; however, only tighten the screws as much as if you were finger-tightening them.

2 There are two methods for connecting the probe head to the DUT:

- "Bolting Probe Head and Retention Module onto DUT" on page 84 — you can use this method when the bottom side of the DUT circuit board is easily accessible. This method provides extra protection for the pins on the probe head.
- "Inserting Probe Head into Retention Module on DUT" on page 86 — you can use this method in situations where the retention module is already bolted to the DUT circuit board.

3 Finally, if an external reference clock signal is to be supplied to protocol analyzer, connect the external clock cable (of the midbus) to the reference clock header on the device under test.

See Also • "Supported Footprint Pinouts and Pod Connections" on page 55

Bolting Probe Head and Retention Module onto DUT

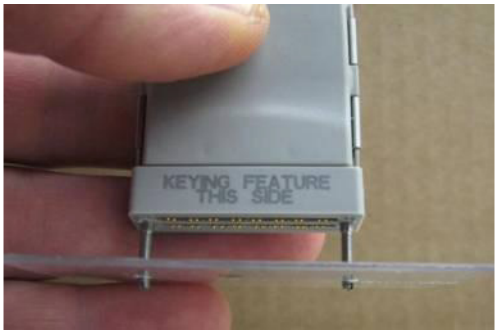
When using this method of probe installation, the probe head is already screwed into the retention module, and together they are bolted onto the DUT circuit board.

This method of probe installation provides some extra protection for the pins on the probe head, but you must have access to the bottom side of the DUT circuit board.

1 Screw the retention module onto the probe head first.

2 Use the bolts as the alignment pins.

By doing this, the risk of dragging the probe head pins across the retention module is removed. With the bolts now being the longest feature, the pins have some protection from other components on the DUT that they could come in contact with.



3 Tighten the thumb nuts onto the back side.

CAUTION You may need to check the tightness of the retaining module periodically, but be careful not to over-tighten the thumb nuts. If the thumb nuts become stripped, you must replace the retaining module.

See Also

• "Inserting Probe Head into Retention Module on DUT" on page 86

Inserting Probe Head into Retention Module on DUT

This method of probe installation is useful in situations where access to the bottom side of the DUT circuit board is difficult and the retention module must be bolted onto the DUT before the probe head is installed.

1 Bolt the retention module onto the device under test (DUT) on both sides of the midbus 3.0 probe footprint.

   Note that there is a keying feature on the retention module and probe head. If the retention module alignment is off by 180 degrees, it does not work.

2 Connect the midbus 3.0 probe head to the retention module in the device under test (DUT):

   a Insert the probe head into the retention module in a straight down motion.

   b Hold probe head down, fully compressing the pins evenly across the array of pins. You must push the probe head down evenly.

   c Tighten the screws.

   A screwdriver may be used to ensure that there is a secure connection. The thumbscrews should be tightened to a snug fit, but do not over-tighten.

3 Finally, if an external reference clock signal is to be supplied to protocol analyzer, connect the external clock cable (of the midbus) to the reference clock header on the device under test.

See Also

• "Bolting Probe Head and Retention Module onto DUT" on page 84

Probe Characteristics

Probe Inputs:	Input Voltage: 25 V max or 3 V rms into 250 Ohms.
Temperature:	Operating 0 to 40 Deg C. Storage -40 to 70 Deg C.
Humidity:	Operating 15% to 95% non condensing.
Altitude:	Operating: to 3000 meters (10000 ft).

5
PCIe Gen3 Flying Lead Probes

This chapter provides information on the U4324A PCIe Gen3 Flying Leads probe used with the U4301A Analyzer module.

U4324A PCIe Gen3 Flying Lead Probe Description

The U4324A flying lead probe is an Agilent probing solution provided for the U4301A PCIe Gen3 Analyzer module. This probing solution consists of one to four probes. Each of these probes provides support for probing one to four channels of a PCIe link making it a total of 16 channels probing support for a set of four probes. This probe supports 2.5 Gb/s, 5 Gb/s and 8.0 Gb/s operations.

You connect a U4324A probe to the DUT by connecting the leads of the probe via Zero Insertion Force (ZIF) tips to the DUT. You can make these connections at the multiple target points on the DUT. This allows flexible connections to individual signals and establishes a direct physical communication with the bus at multiple probing points.

The probe provides low capacitive loading to minimize signal distortion.

When to use a U4324A Flying Lead Probe

A U4324A flying lead probe is suitable for use in situations where it is not possible to use a U4321A solid slot interposer card for probing and it is difficult to use a U4322A midbus probe. Some such situations are:

- When you want to probe a system which does not have a predesigned card slot thereby eliminating the usage of a solid slot interposer card for probing.
- When you want to probe individual lanes. You can connect the leads of the U4324A probe directly to the DUT and thereby eliminate the need to have signals routed to one probing point.
- When no built-in test points are available. This probing solution does not require any designed connectors and probes signals without built-in test points.

Probe Components

The following figure displays a U4324A PCIe Gen3 Flying Lead probe with labels pointing to the components of this probe.

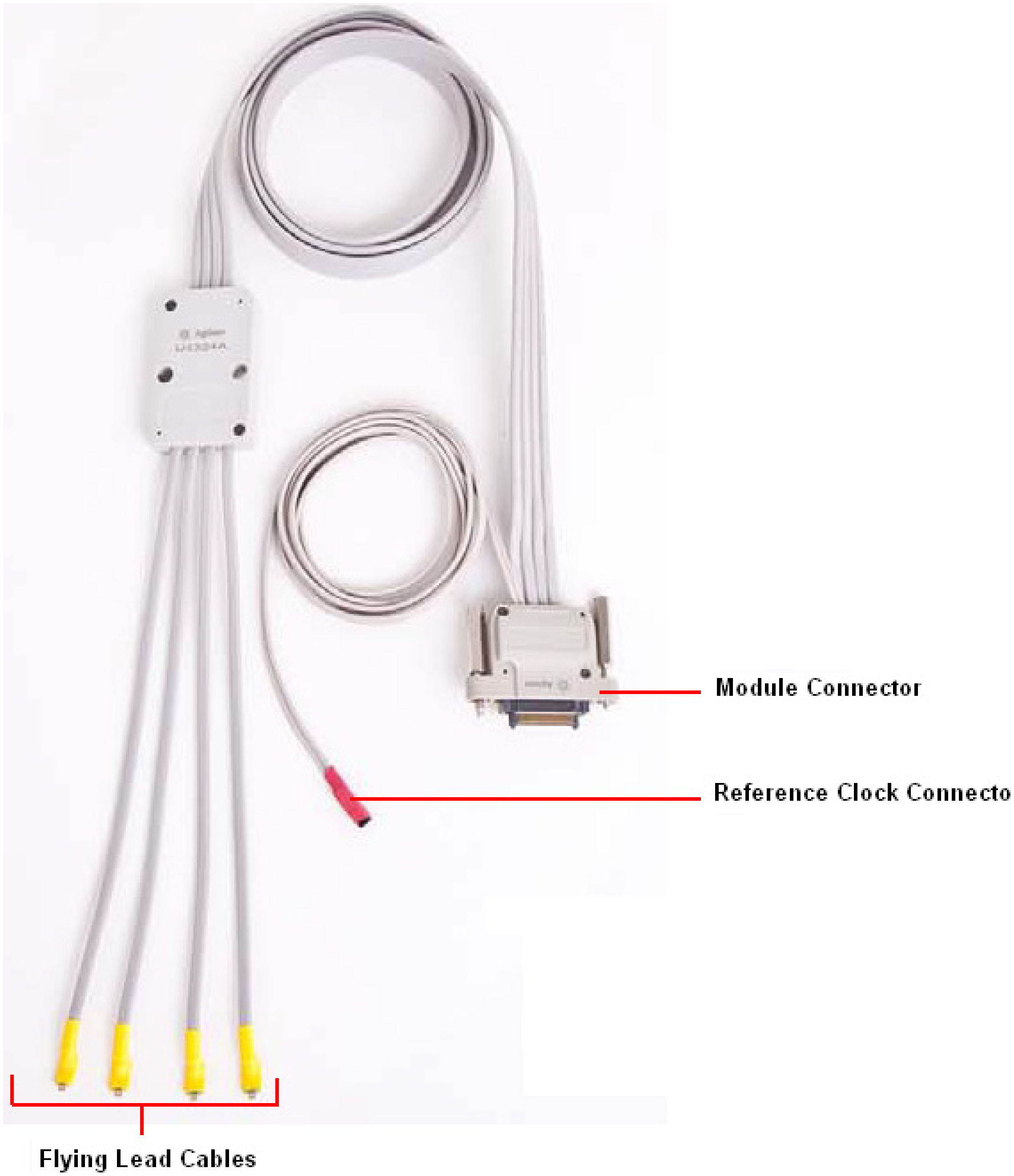


Figure 41 U4324A PCIe Gen3 Flying Lead Probe

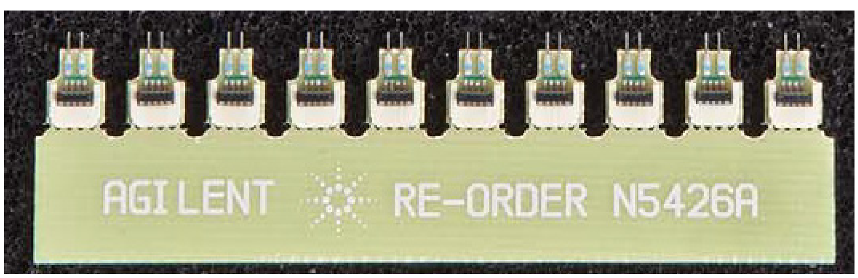
The following table briefly describes each of the components of the U4324A probe labeled in the above figure.

Component	Description
Module Connector	This component connects the U4324A probe to the U4301A Analyzer module. You plug this component into one of the four POD inputs available on the front panel of the U4301A Analyzer module.
Reference Clock Connector	This component is required in situations where you need to probe the reference clock from DUT. You use a 3-pin header to connect the reference clock connector to DUT. The reference clock connector of the U4324A probe is the same as the reference clock connector of the U4322A Midbus 3.0 probe. Refer to the chapter "Soft Touch Midbus 3.0 Probes" on page 43 to know more about reference clock connectors.
Flying Lead Cables	This component connects the U4324A probe to the DUT via N5426A Zero Insertion Force (ZIF) Tips. There are four flying lead cables in each probe and these are labeled as 0, 1, 2, and 3. Each flying lead cable when connected to the DUT allows you to probe a channel which refers to either an upstream differential pair OR downstream differential pair for a given lane.

N5426A ZIF Tip

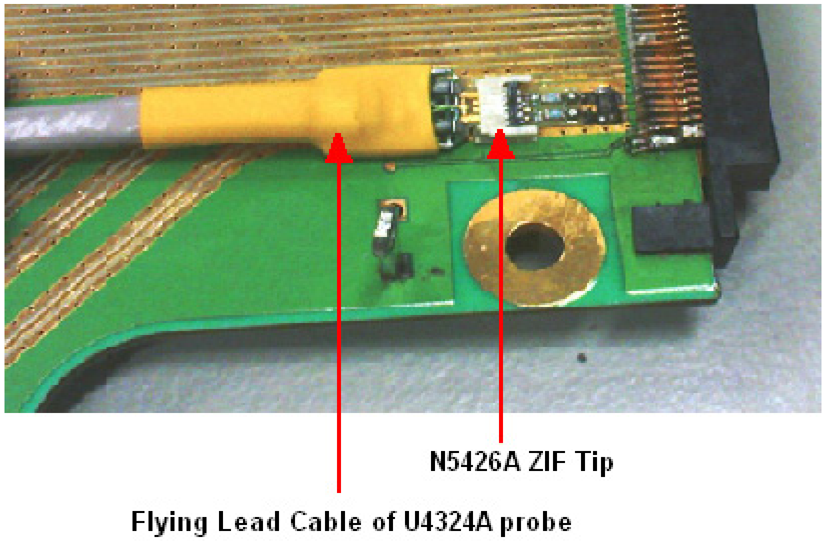
A N5426A ZIF tip kit is included in the U4324A probe shipment. This kit has a set of 10 ZIF tips.

The following figure displays a N5426A ZIF tip kit with 10 ZIF tips



A ZIF tip is a connection accessory used to connect the flying lead cables of the probe to the DUT. This tip connects to a flying lead cable on one end using a zero insertion force connector and is soldered onto the DUT on the other end.

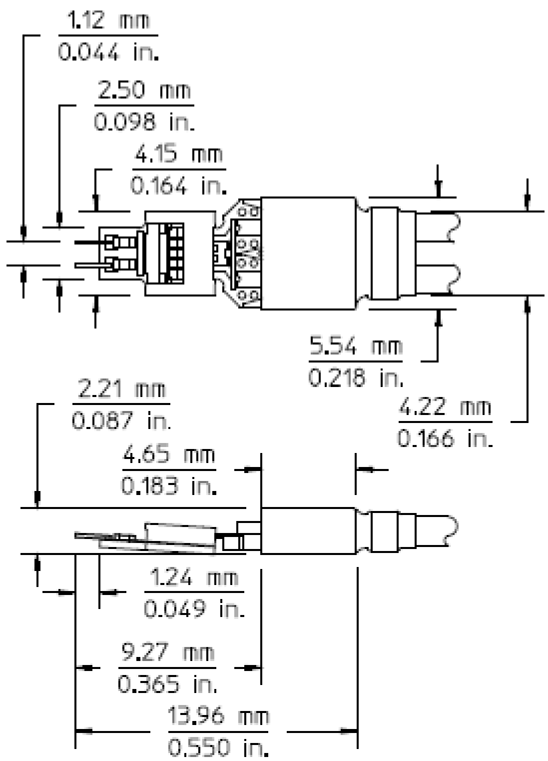
The following figure displays a N5426A ZIF tip soldered onto a DUT and ready to be connected to a flying lead cable of the probe.



You need to solder the ZIF tips onto the DUT before plugging in the flying lead cables in these tips. Refer to the topic "Installing a U4324A Probe" on page 96 to know how to attach a ZIF tip to a DUT.

If you need more ZIF tips than the number of ZIF tips included in the probe shipment, you can order these from www.parts.agilent.com. On this site, specify the product number as **N5426A** in the **Find a Part** section and then click **Find**. Alternatively, you can contact your nearest Agilent Sales office for assistance.

N5426A ZIF Tip Dimensions



Probe Characteristics

Electrical Characteristics	
Absolute maximum ratings	Amplitude data signal: 2 V_{ppdiff} Amplitude ref. CLK: 5 V_{ppdiff}
Capacitive loading	. 250 fF
Ref. CLK	Amplitude • Minimum: 800 mV_{ppdiff} • Maximum: 2000 mV_{ppdiff} DC offset • Minimum: 0 mV • Maximum: 500 mV Frequency • Minimum: 100 MHz –300 ppm • Maximum: 100 MHz +300 ppm SSC • Minimum: –0.5% • Maximum: 0%

Other Characteristics	
Temperature	Operating range: 0 °C to +55 °C Storage (non-operating range): –40 °C to +70 °C
Humidity	Operating: Maximum 95% @ 40 °C temperature Storage: Maximum 90% @ 65 °C temperature
Vibration	Random: 5-500 Hz, Survival: 2.09 Gms
Shock	2mS Half sine Delta velocity 1.6 m/sec (63 in/sec)

Installing a U4324A Probe

Before you start installing the probes, plan the type of link configuration you want to probe. Refer to the topics that follow to know about the various link configurations that the probe supports and how to set up the probe for these various configurations.

To install a U4324A probe

1 Plug the module connector of the U4324A probe into one of the four pod inputs on the front panel of the U4301A Analyzer module.

2 Hand-tighten the module connector screws. Do not over tighten the screws as it can damage the probe.

The following figure displays four U4324A probes connected to the four pod inputs of the U4301A module.

3 Each flying lead cable of the U4324A probe connects to the DUT via a N5426A ZIF tip. Therefore, first attach a N5426A ZIF tip to the DUT by performing the following steps:

a Apply flux to pads.

b Apply solder to pads. Be cautious not to short pads while doing this.

c Apply flux to the solder and ZIF tip.

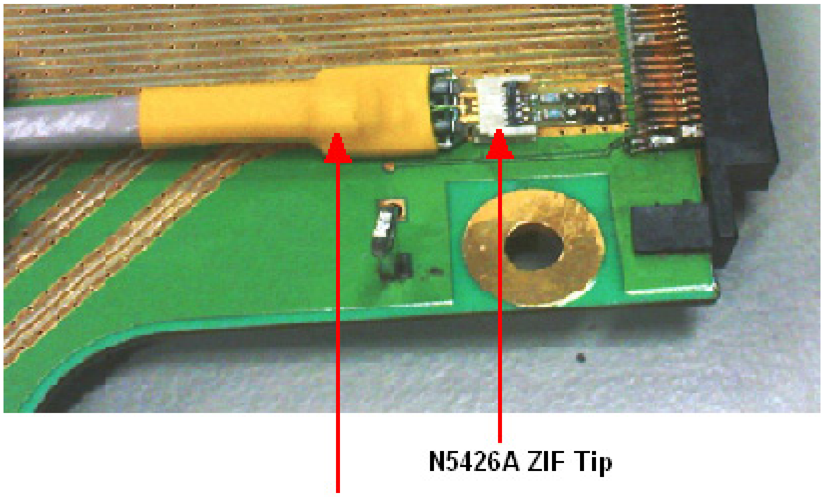
d Solder the ZIF tip onto the DUT.

e Apply a 3M foam tape under the soldered tip.

To view a demo on how to attach a ZIF tip to a DUT, go to www.agilent.com, search for N5426A, and click the demo file displayed under **Document Library** -> **Demos** link.

4 Lift the latch of the soldered ZIF tip to allow the insertion of the flying lead cable into the tip with zero insertion force. Then plug the flying lead cable of the U4324A probe into the ZIF tip.

The following figure displays a flying lead cable of the U4324A probe connected to a DUT via a N5426A ZIF tip soldered onto the DUT.



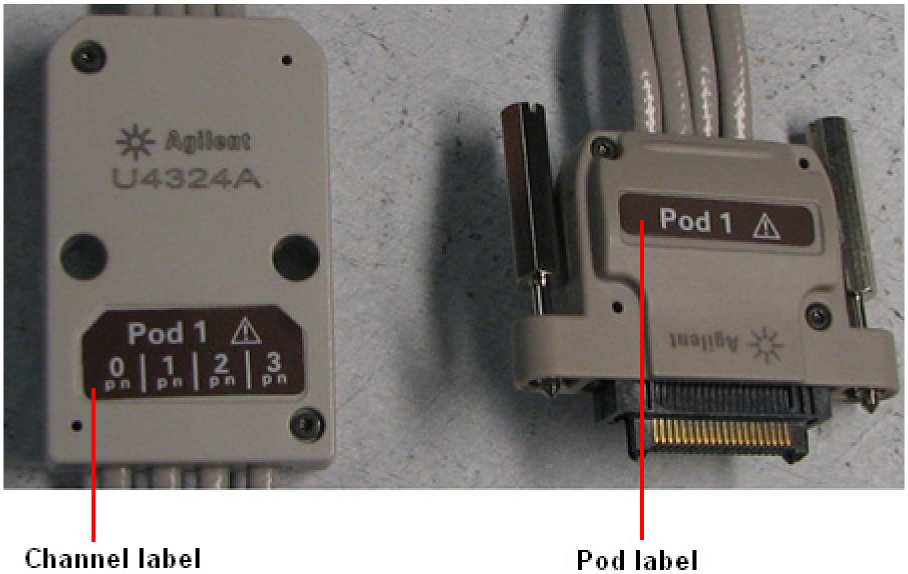
5 If you want an external reference clock to be supplied to the U4301A module, connect the Reference Clock Connector component of the U4324A probe to the reference clock header on the DUT. The reference clock connector of the U4324A probe is the same as the reference clock connector of the U4322A Midbus 3.0 probe. Refer to the chapter "Soft Touch Midbus 3.0 Probes" on page 43 to know more about reference clock connectors.

Labelling the probes

A label sheet is provided with the U4324A probe shipment. Use this label sheet to place the pod and channel labels on the U4324A probe as follows:

1 Place the Pod label on the module connector of the probe that you plugged into the Analyzer module's POD input.
2 Place the channel label on the space provided on the block in the cable housing of the probe.
3 While placing these labels, match with the color coding of the label on the Analyzer module's Pod input location in which you plugged the probe.

   The following figure displays a U4324A probe's module connector and cable housing block with Pod and channel labels placed.



NOTE

- Be careful while plugging in or out a flying lead cable from the soldered ZIF Tip.
- While detaching a module connector from the U4301A module, disengage the screws completely from the module and then pull the module connector straight out to remove.

WARNING

Do not directly touch any component on the U4324A probe. It may be hot.

CAUTION

Components on the U4324A probe are sensitive to the static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

Supported Link Configurations

A single U4324A probe provides four channels and can support:

- a x1, a x2, or a x4 unidirectional link configuration
- a x1 or a x2 bidirectional link (swizzled) configuration.

A set of U4324A probes supports the following link configuration setups:

Supported Link Configuration	Probe(s) Required	Number of U4301A Module(s) Required
Unidirectional		
For a x1 unidirectional link configuration	1 U4324A probe	1
For two x1 unidirectional links configuration	2 U4324A probes	2
For a x2 unidirectional link configuration (See page 102)	1 U4324A probe	1
For a x4 unidirectional link configuration (See page 102)	1 U4324A probe	1
For two x2 or x4 unidirectional links configuration	2 U4324A probes	2
For a x8 unidirectional link configuration	2 U4324A probes	1
For two x8 unidirectional links configuration	4 U4324A probes	2
For a x16 unidirectional link configuration	4 U4324A probes	1
Bidirectional		
For a x1 bidirectional link configuration	• 2 U4324A probes if a bidirectional link in straight configuration is needed. • 1 U4324A probe if a bidirectional link in swizzled configuration is needed.	1

Supported Link Configuration	Probe(s) Required	Number of U4301A Module(s) Required
For two x1 bidirectional links configuration	• 4 U4324A probes if bidirectional links in straight configuration are needed. • 2 U4324A probe if bidirectional links in swizzled configuration are needed.	2
For a x2 bidirectional link configuration	• 2 U4324A probes if a bidirectional link in straight configuration is needed. • 1 U4324A probe if a bidirectional link in swizzled configuration is needed.	1
For two x2 bidirectional link configuration (See page 121)	• 4 U4324A probes if bidirectional links in straight configuration are needed. • 2 U4324A probe if bidirectional links in swizzled configuration are needed.	2
For a x4 bidirectional link configuration	2 U4324A probes	1
For two x4 bidirectional link configuration (See page 121)	4 U4324A probes	2
For a x8 bidirectional link configuration	4 U4324A probes	1
For a x16 upstream and downstream configuration (See page 123)	8 U4324A probes	2

Setting Up a Unidirectional Configuration using U4324A Probes

For a x1 unidirectional link configuration

You need a single U4301A Analyzer module and a U4324A flying lead probe for a x1 unidirectional setup.

Perform the following steps for a x1 unidirectional hardware and probing setup.

1. Plug the module connector of the U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.
2. Connect the probe's flying lead cable labeled as 0 to the appropriate target point on the DUT via a ZIF tip. Other flying lead cables of the probe will not be connected in this scenario.

The following figure illustrates a x1 unidirectional setup using a U4324A probe.

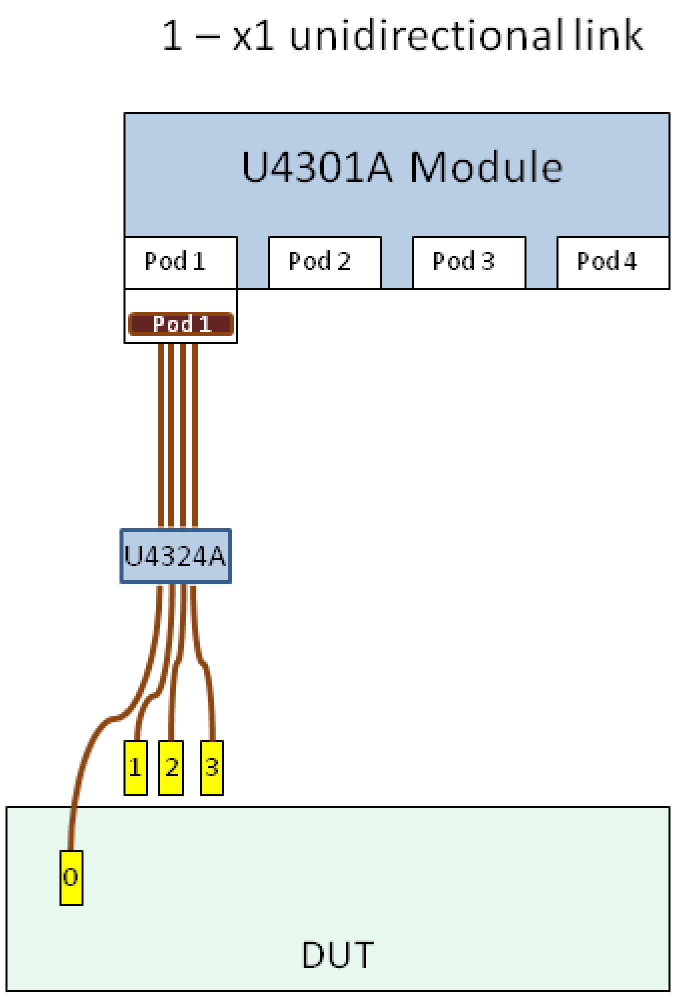


Figure 42 x1 unidirectional setup using a U4324A probe

For a x2 or a x4 unidirectional link configuration

For a x2 or a x4 unidirectional setup, you need the same hardware and probing setup as described above for a x1 unidirectional setup. The only difference would be that you need to connect:

- the probe's flying lead cables labeled as 0 and 1 to the appropriate target points on the DUT via ZIF tips for a x2 setup.
- all the four flying lead cables of the probe to the appropriate target points on the DUT via ZIF tips for a x4 setup.

The following figures illustrate a x2 and a x4 unidirectional setup using a U4324A probe.

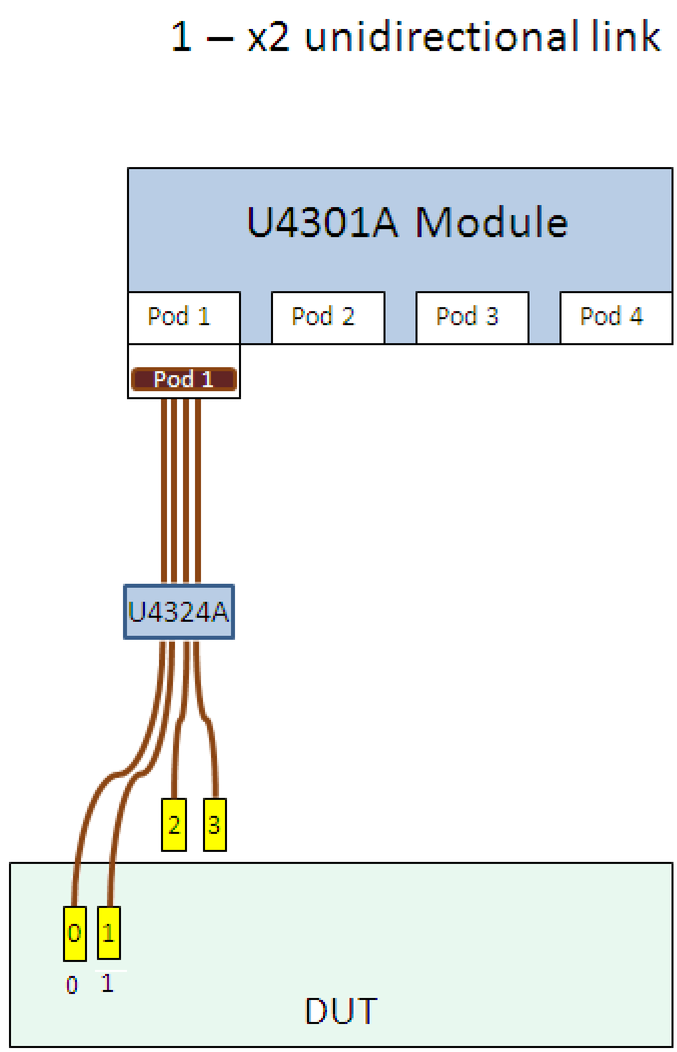


Figure 43 x2 unidirectional setup using a U4324A probe

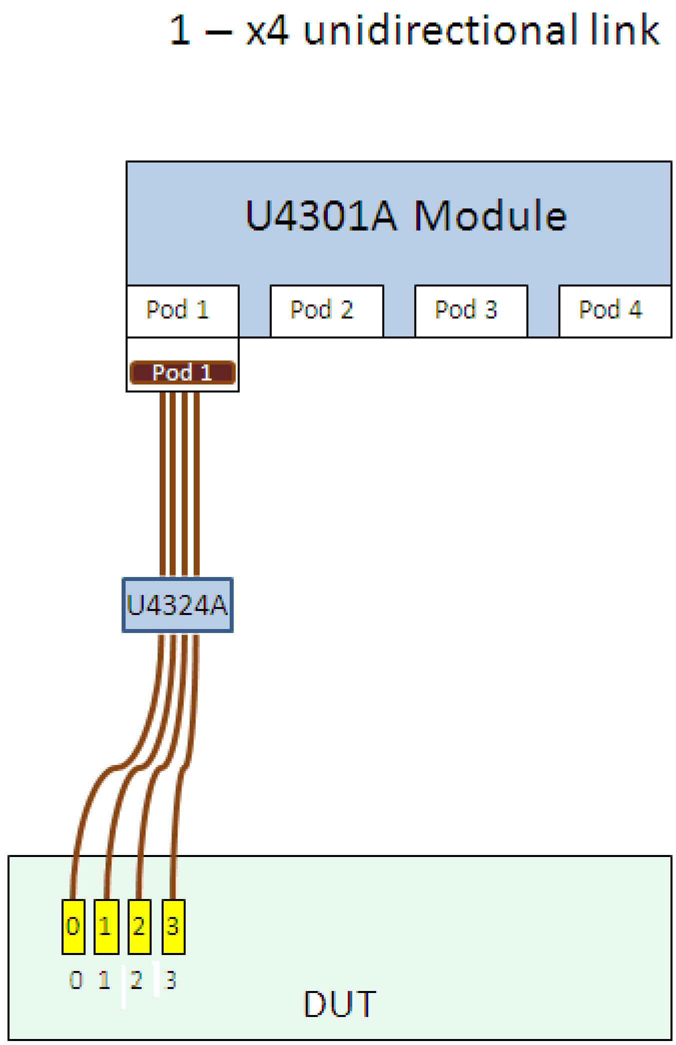


Figure 44 x4 unidirectional setup using a U4324A probe

For a x8 unidirectional link configuration

You need a single U4301A Analyzer module and two U4324A flying lead probes for a x8 unidirectional setup.

Perform the following steps for a x8 unidirectional hardware and probing setup.

1. Plug the module connectors of the U4324A flying lead probes into Pod 1 and Pod 2 of the U4301A Analyzer module.
2. Connect all the four flying lead cables of both the probes to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates a x8 unidirectional setup using two U4324A probes.

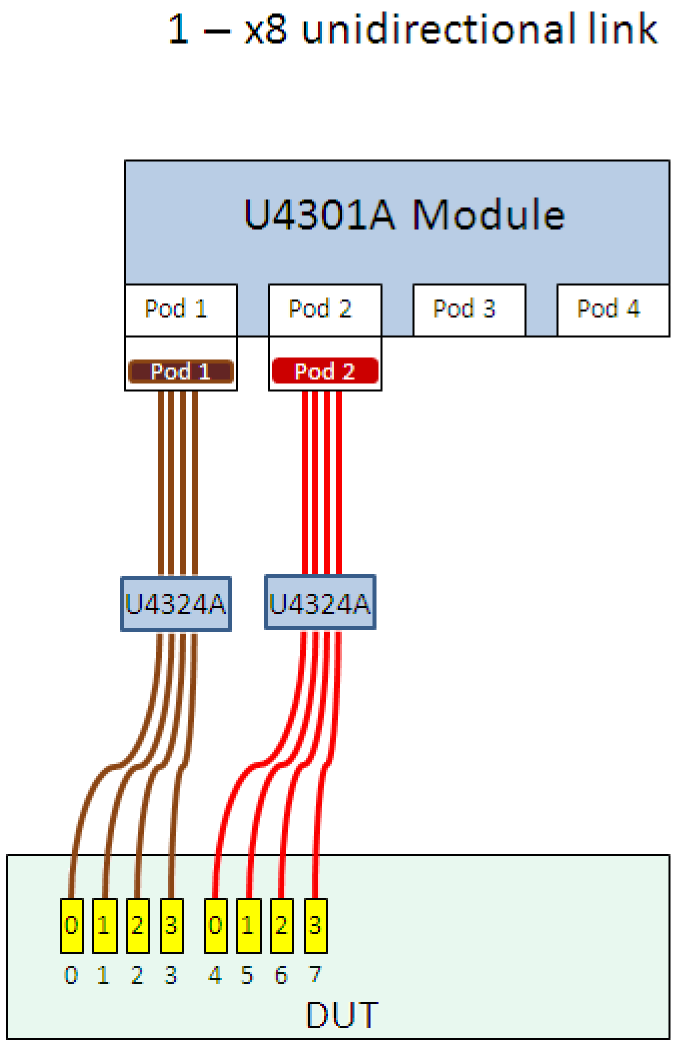


Figure 45 x8 unidirectional setup

For a x16 unidirectional link configuration

You need a single U4301A Analyzer module and four U4324A flying lead probes for a x16 unidirectional setup.

Perform the following steps for a x16 unidirectional hardware and probing setup.

1. Plug the module connectors of the U4324A flying lead probes into Pod 1, 2, 3, and 4 of the U4301A Analyzer module.
2. Connect all the four flying lead cables of all the four probes to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates a x16 unidirectional setup using four U4324A probes.

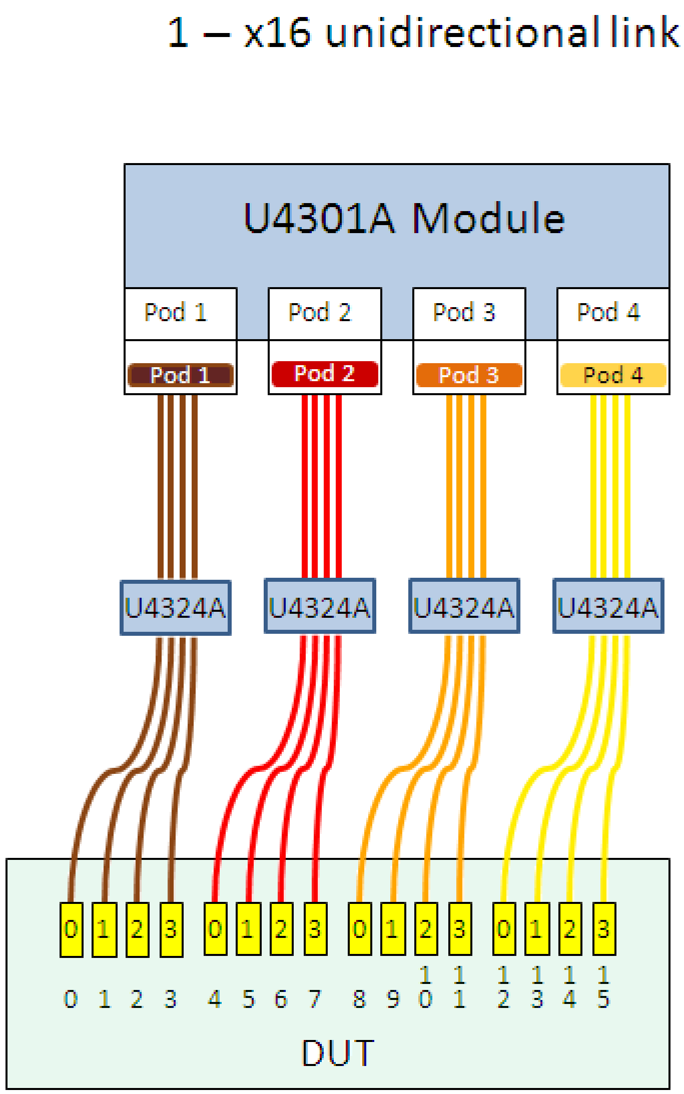


Figure 46 x16 unidirectional setup

For two x1 unidirectional links configuration

You need two U4301A Analyzer modules and two U4324A flying lead probes for two x1 unidirectional setups.

Perform the following steps for two x1 unidirectional hardware and probing setups.

1 Plug the module connector of the first U4324A flying lead probe into Pod 1 of the U4301A Analyzer module 1.

2 Plug the module connector of the second U4324A flying lead probe into Pod 1 of the U4301A Analyzer module 2.

3 Connect the first probe's flying lead cable labeled as 0 to the appropriate target point on the DUT via a ZIF tip. Other flying lead cables of the probe will not be connected in this scenario.

4 Connect the second probe's flying lead cable labeled as 0 to the appropriate target point on the DUT via a ZIF tip. Other flying lead cables of the probe will not be connected in this scenario.

The following figure illustrates two x1 unidirectional setups using U4324A probes.

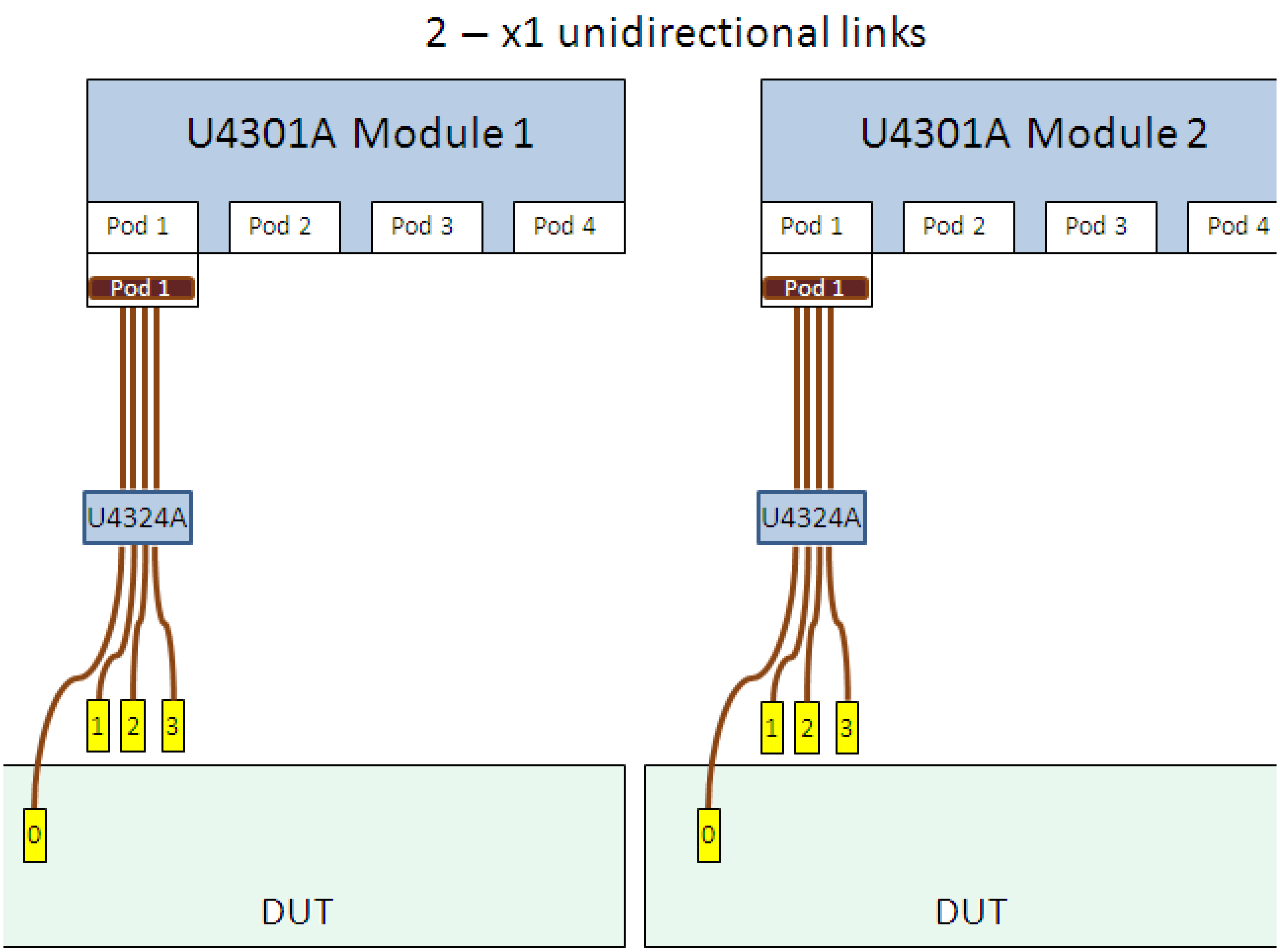


Figure 47 Two x1 unidirectional setups using U4324A probes

For two x2 or x4 unidirectional links configuration

For two x2 or two x4 unidirectional setups, you need the same hardware and probing setup as described above for two x1 unidirectional setups. The only difference would be that you need to connect:

- the flying lead cables labeled as 0 and 1 of both the probes to the appropriate target points on the DUT via ZIF tips for a x2 setup.
- all the four flying lead cables of both the probe to the appropriate target points on the DUT via ZIF tips for a x4 setup.

The following figures illustrate two x2 and two x4 unidirectional setups using U4324A probes.

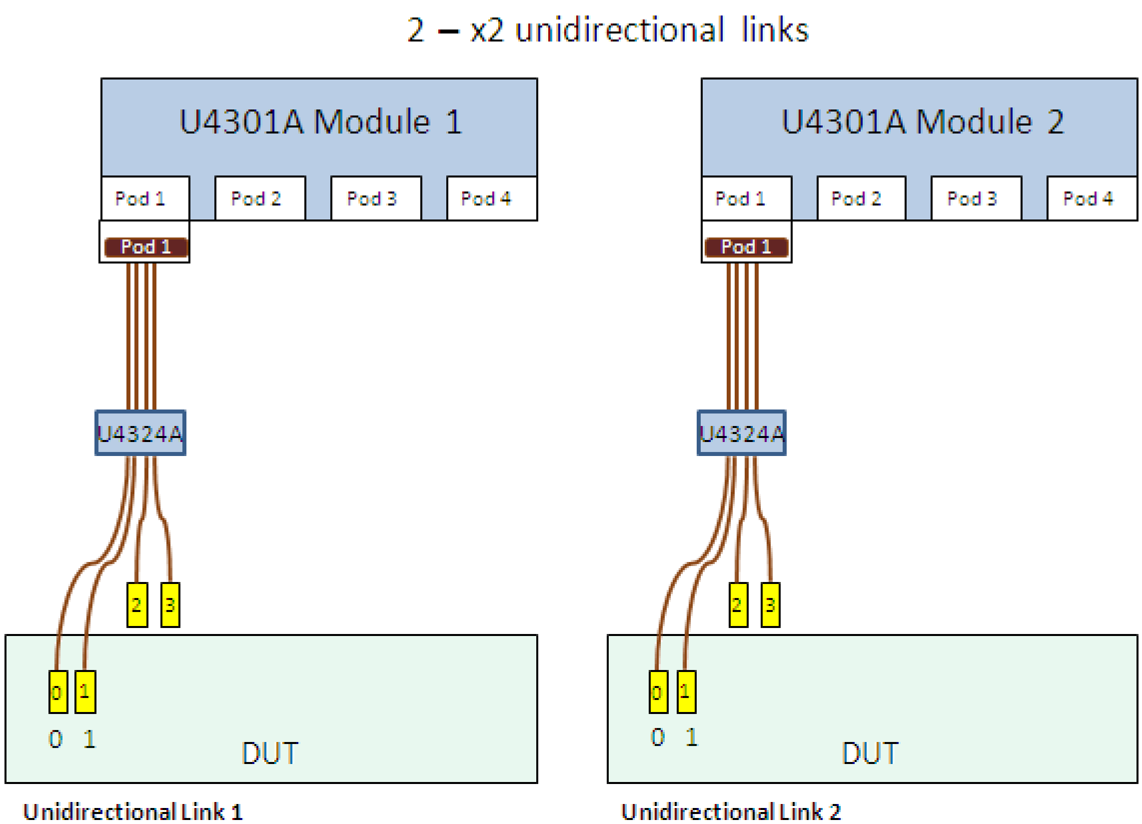


Figure 48 Two x2 unidirectional setups using U4324A probes

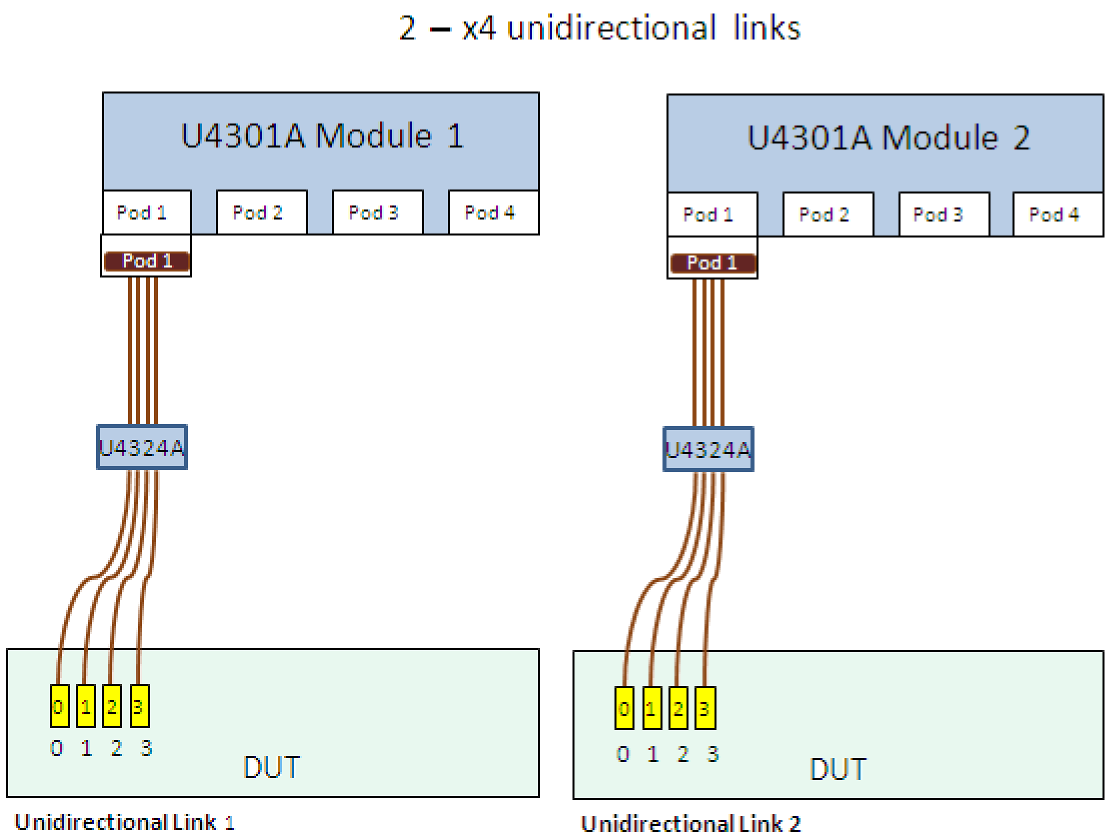


Figure 49 Two x4 unidirectional setups using U4324A probes

For two x8 unidirectional links configuration

You need two U4301A Analyzer modules and four U4324A flying lead probes for two x8 unidirectional setups.

Perform the following steps for two x8 unidirectional hardware and probing setups.

1 Plug the module connectors of the four U4324A flying lead probe into Pod 1 and 2 of the U4301A Analyzer module 1. and 2.

2 Connect all the four flying lead cables of all the four probes to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates two x8 unidirectional setups using U4324A probes.

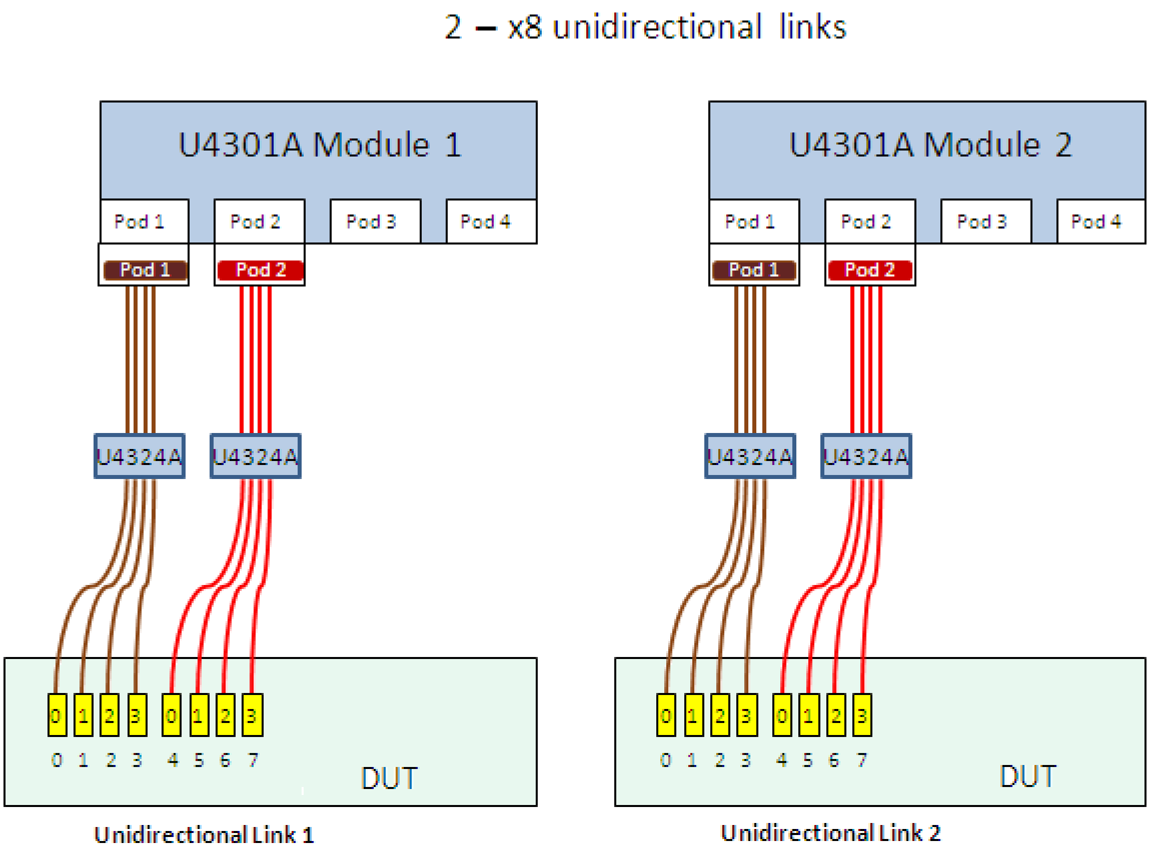


Figure 50 Two x8 unidirectional setups using U4324A probes

Setting Up a Bidirectional Configuration using U4324A Probes

The U4324A probes support both straight and swizzled bidirectional link configurations.

For a x1 bidirectional link configuration

You can set up a x1 bidirectional configuration either using two U4324A probes in a straight configuration or using a single U4324A probe in a swizzled configuration.

x1 bidirectional link straight configuration

You need a single U4301A Analyzer module and two U4324A flying lead probes for a x1 bidirectional link in a straight configuration.

Perform the following steps for a x1 bidirectional hardware and probing setup.

1 Plug the module connector of the first U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.
2 Plug the module connector of the second U4324A flying lead probe into Pod 3 of the U4301A Analyzer module.
3 Connect the flying lead cables labeled as 0 of the two probes to the appropriate target points on the DUT via ZIF tips. Other flying lead cables of the probes will not be connected in this scenario.

The following figure illustrates a x1 bidirectional (straight) setup using U4324A probes.

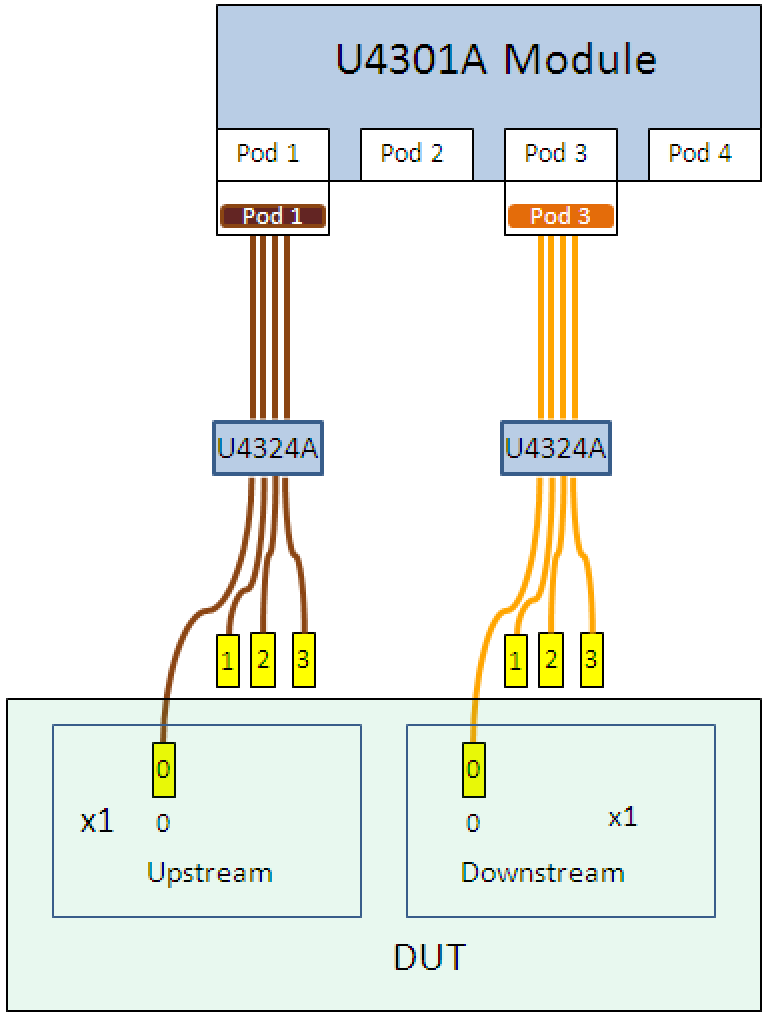


Figure 51 x1 bidirectional (straight) setup using U4324A probes

x1 bidirectional link swizzled configuration

You need a single U4301A Analyzer module and a single U4324A flying lead probe for a x1 bidirectional link in a swizzled configuration.

Perform the following steps for a x1 bidirectional swizzled hardware and probing setup.

1. Plug the module connector of the U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.
2. For upstream direction - Connect the flying lead cable labeled as 0 of the probe to the appropriate target point on the DUT via a ZIF tip.
3. For downstream direction - Connect the flying lead cable labeled as 1 of the probe to the appropriate target point on the DUT via a ZIF tip.

4 Other flying lead cables of the probe will not be connected in this scenario.

The following figure illustrates a x1 bidirectional (swizzled) setup using a single U4324A probe.

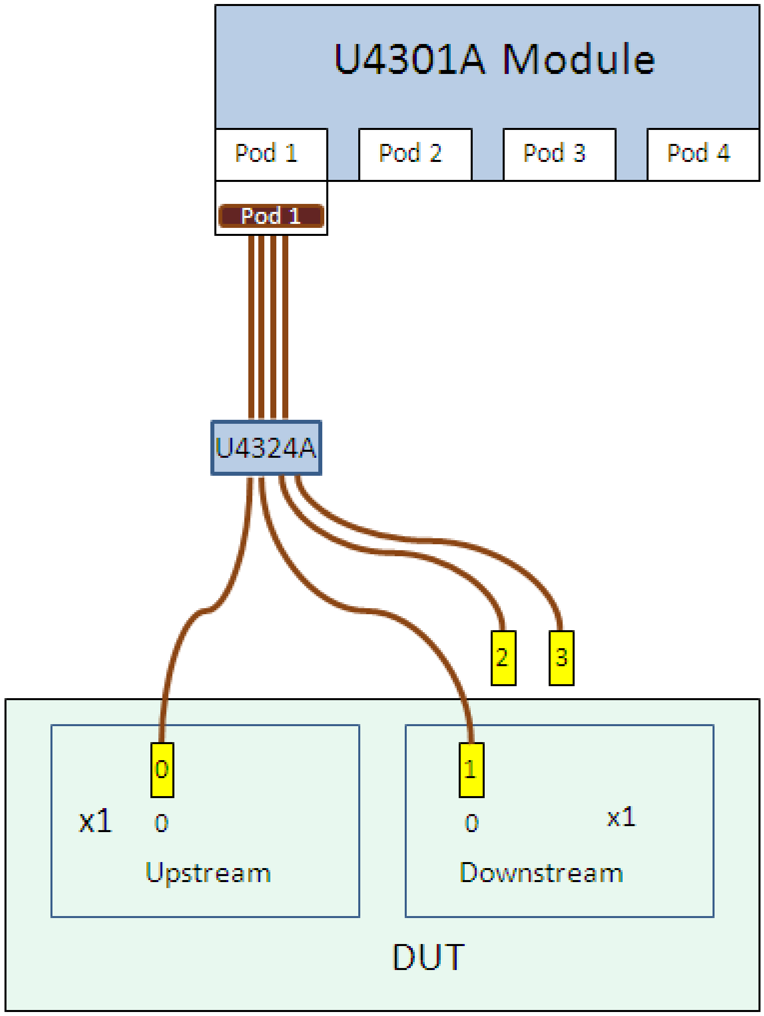


Figure 52 x1 bidirectional (swizzled) setup using a single U4324A probe

For a x2 bidirectional link configuration

You can set up a x2 bidirectional configuration either using two U4324A probes in a straight configuration or a single U4324A probe in a swizzled configuration.

x2 bidirectional link straight configuration

For a x2 bidirectional straight setup, you need the same hardware and probing setup as described above for a x1 bidirectional straight setup. The only difference would be that you need to connect:

- the flying lead cables labeled as 0 and 1 of both the probes to the appropriate target points on the DUT via ZIF tips for a x2 setup.

The following figures illustrate a x2 bidirectional straight setup using U4324A probes.

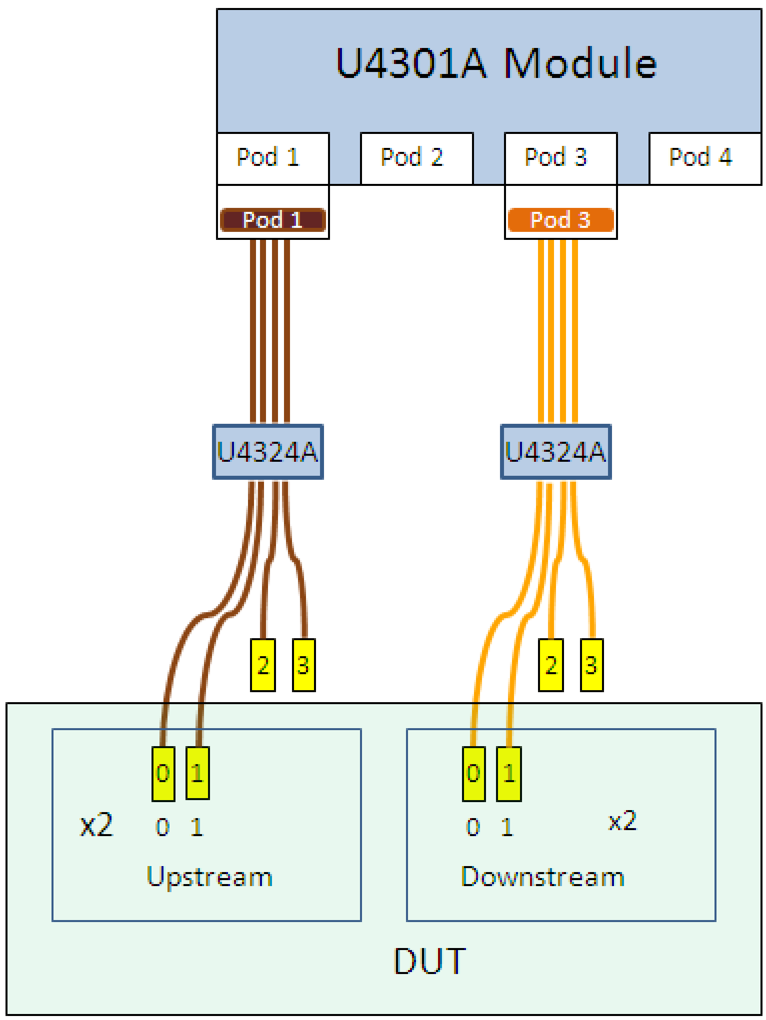


Figure 53 x2 bidirectional straight setup using U4324A probes

x2 bidirectional link swizzled configuration

You need a single U4301A Analyzer module and a single U4324A flying lead probe for a x2 bidirectional link in a swizzled configuration.

Perform the following steps for a x2 bidirectional swizzled hardware and probing setup.

1 Plug the module connector of the U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.

2 For upstream direction - Connect the flying lead cables labeled as 0 and 2 of the probe to the appropriate target points on the DUT via ZIF tips.

3 For downstream direction - Connect the flying lead cable labeled as 1 and 3 of the probe to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates a x2 bidirectional (swizzled) setup using a single U4324A probe.

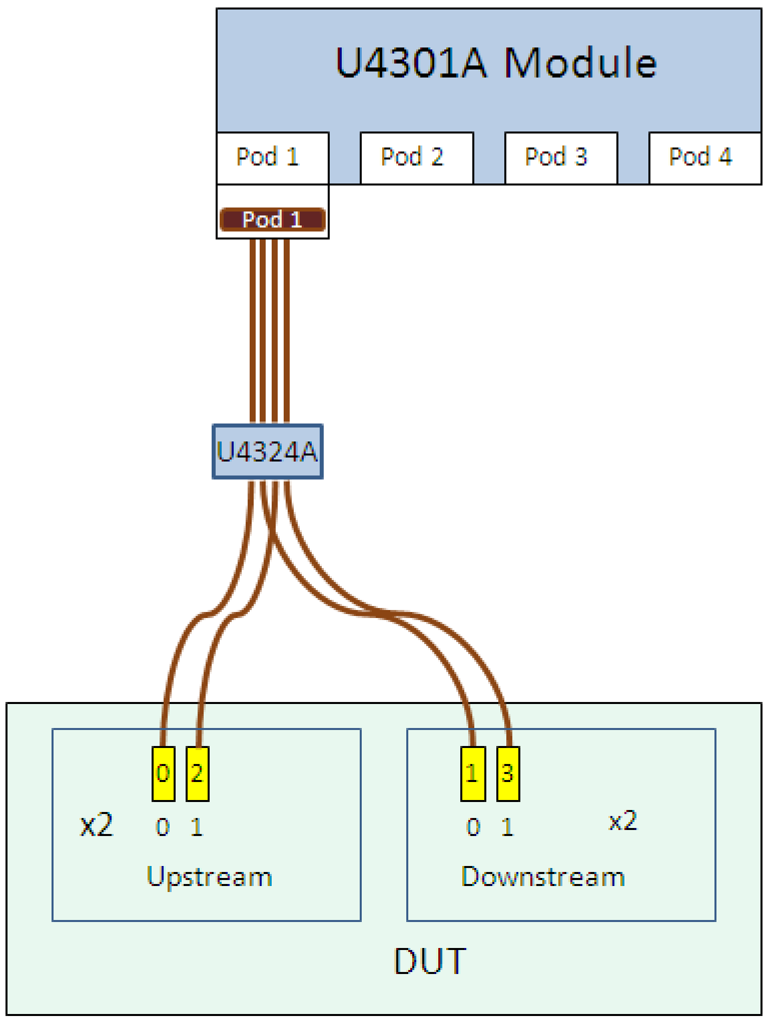


Figure 54 x2 bidirectional (swizzled) setup using a single U4324A probe

For a x4 bidirectional link configuration

You can set up a x4 bidirectional configuration using two U4324A probes in a straight or a swizzled configuration.

x4 bidirectional link straight configuration

For a x4 bidirectional straight setup, perform the following steps.

1. Plug the module connector of the first U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.
2. Plug the module connector of the second U4324A flying lead probe into Pod 3 of the U4301A Analyzer module.
3. For the upstream direction, connect all the four flying lead cables of the first probe to the appropriate target points on the DUT via ZIF tips.
4. For the downstream direction, connect all the four flying lead cables of the second probe to the appropriate target points on the DUT via ZIF tips.

The following figures illustrate a x4 bidirectional straight setup using U4324A probes.

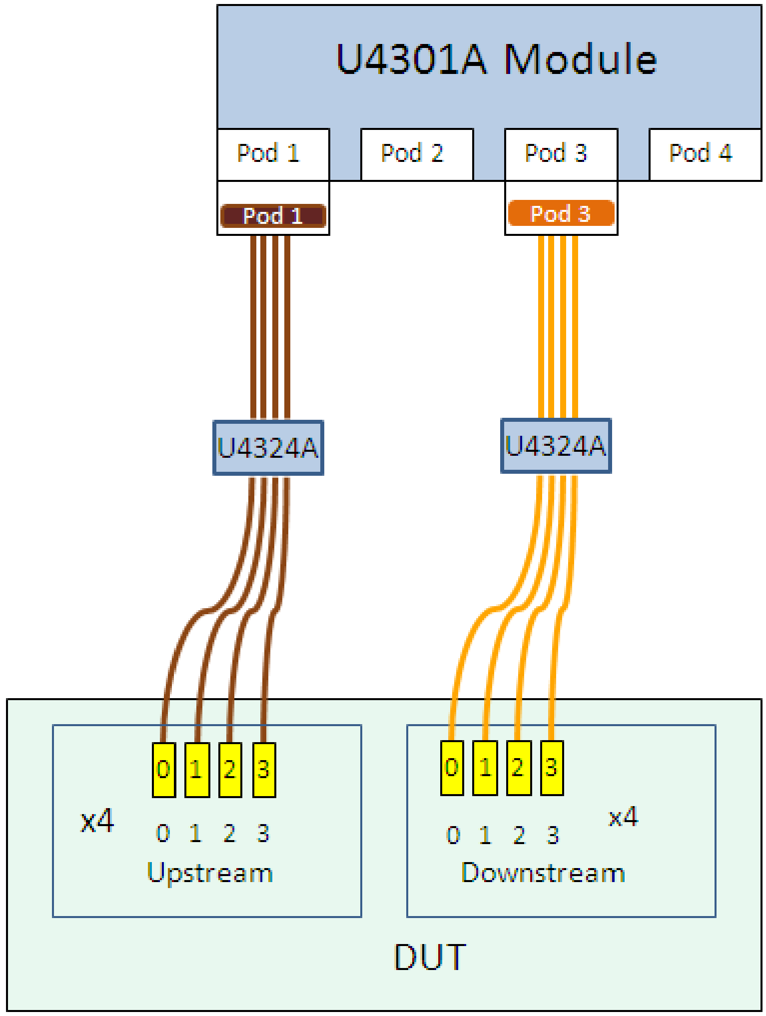


Figure 55 x4 bidirectional straight setup using U4324A probes

x4 bidirectional link swizzled configuration

For a x4 bidirectional swizzled setup, perform the following steps.

1 Plug the module connector of the first U4324A flying lead probe into Pod 1 of the U4301A Analyzer module.

2 Plug the module connector of the second U4324A flying lead probe into Pod 3 of the U4301A Analyzer module.

3 For the upstream direction, connect the flying lead cables labelled as 0 and 2 of both the probes to the appropriate target points on the DUT via ZIF tips.

4 For the downstream direction, connect the flying lead cables labelled as 1 and 3 of both the probes to the appropriate target points on the DUT via ZIF tips.

The following figures illustrate a x4 bidirectional swizzled setup using U4324A probes.

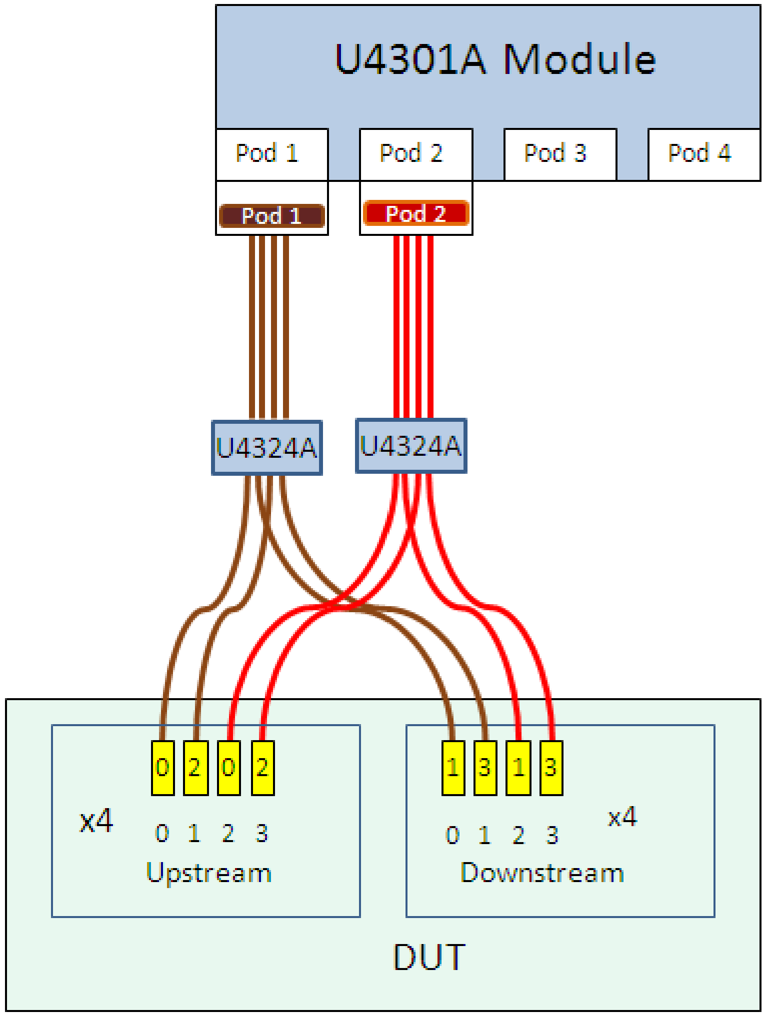


Figure 56 x4 bidirectional swizzled setup using U4324A probes

For a x8 bidirectional link configuration

You need a single U4301A Analyzer module and four U4324A flying lead probes for a x8 bidirectional setup.

Perform the following steps for a x8 bidirectional hardware and probing setup.

1 Plug the module connectors of the four U4324A flying lead probes into Pod 1, 2, 3, and 4 of the U4301A Analyzer module.

2 Connect all the flying lead cables of the four probes to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates a x8 bidirectional setup using U4324A probes.

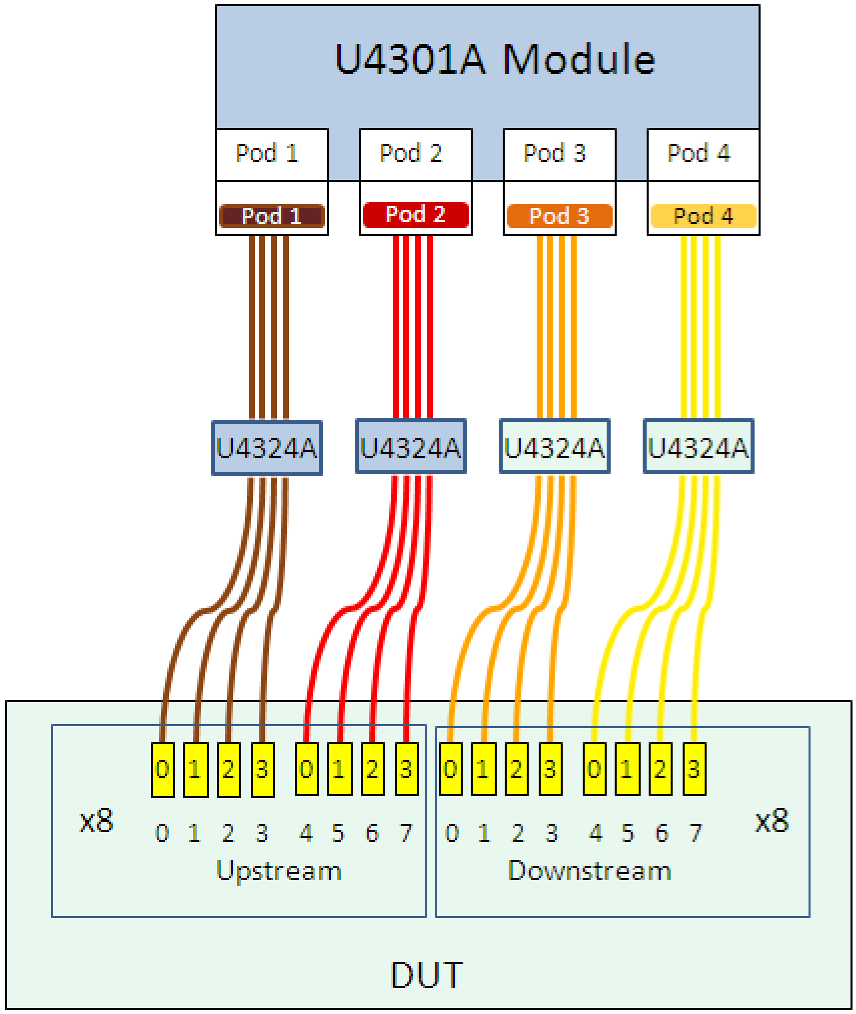


Figure 57 x8 bidirectional setup using U4324A probes

x8 bidirectional link swizzled configuration

For a x8 bidirectional swizzled setup, perform the following steps.

1 Plug the module connectors of the four U4324A flying lead probes into Pod 1, 2, 3, and 4 of the U4301A Analyzer module.

2 For the upstream direction, connect the flying lead cables labelled as 0 and 2 of all the four probes to the appropriate target points on the DUT via ZIF tips.

3 For the downstream direction, connect the flying lead cables labelled as 1 and 3 of all the four probes to the appropriate target points on the DUT via ZIF tips.

The following figures illustrate a x8 bidirectional swizzled setup using U4324A probes.

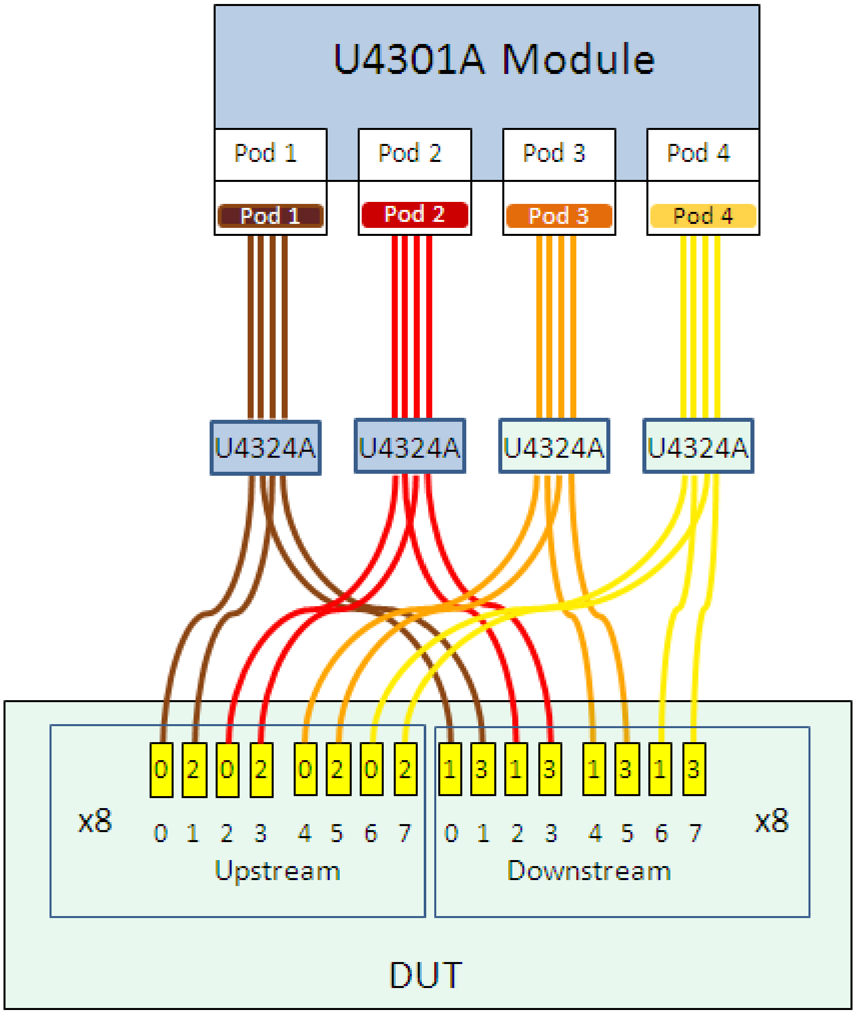


Figure 58 x8 bidirectional swizzled setup using U4324A probes

For two x1 bidirectional links configuration

You need two U4301A Analyzer modules and four U4324A flying lead probes for two x1 bidirectional setups.

Perform the following steps for two x1 bidirectional hardware and probing setups.

1 Plug the module connector of the first and second U4324A flying lead probes into Pod 1 and 3 of the U4301A Analyzer module 1.
2 Plug the module connectors of the third and fourth U4324A flying lead probes into Pod 1 and 3 of the U4301A Analyzer module 2.
3 Connect the flying lead cable labeled as 0 of the four probes to the appropriate target points on the DUT via ZIF tips. Other flying lead cables of the probe will not be connected in this scenario.

The following figure illustrates two x1 bidirectional setups using U4324A probes.

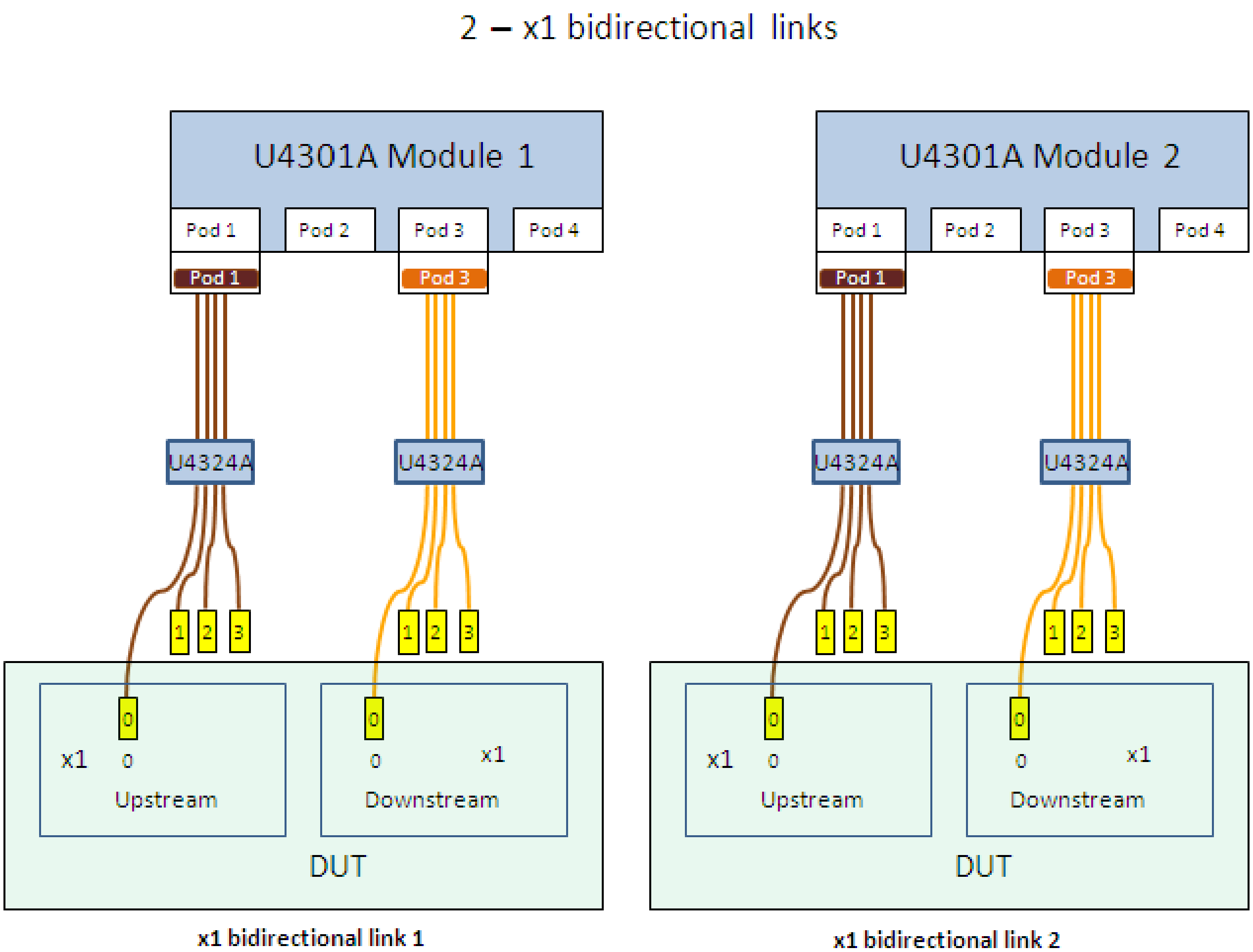


Figure 59 Two x1 bidirectional setups using U4324A probes

For two x2 or x4 bidirectional links configuration

For two x2 or two x4 bidirectional setups, you need the same hardware and probing setup as described above for two x1 bidirectional setups. The only difference would be that you need to connect:

- the flying lead cables labeled as 0 and 1 of the four probes to the appropriate target points on the DUT via ZIF tips for a x2 setup.
- all the four flying lead cables of the four probes to the appropriate target points on the DUT via ZIF tips for a x4 setup.

The following figures illustrate two x2 and two x4 bidirectional setups using U4324A probes.

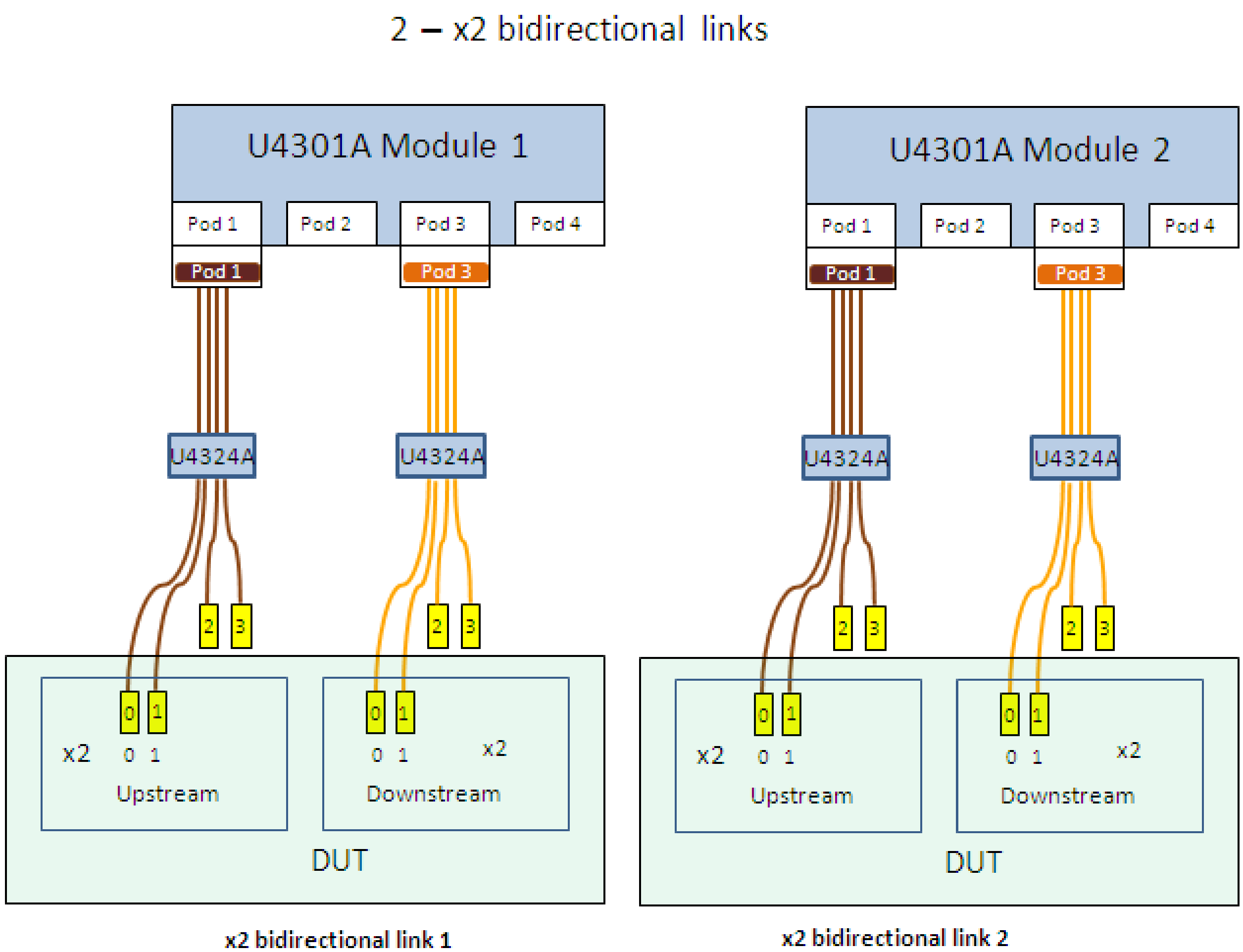


Figure 60 Two x2 bidirectional setups using U4324A probes

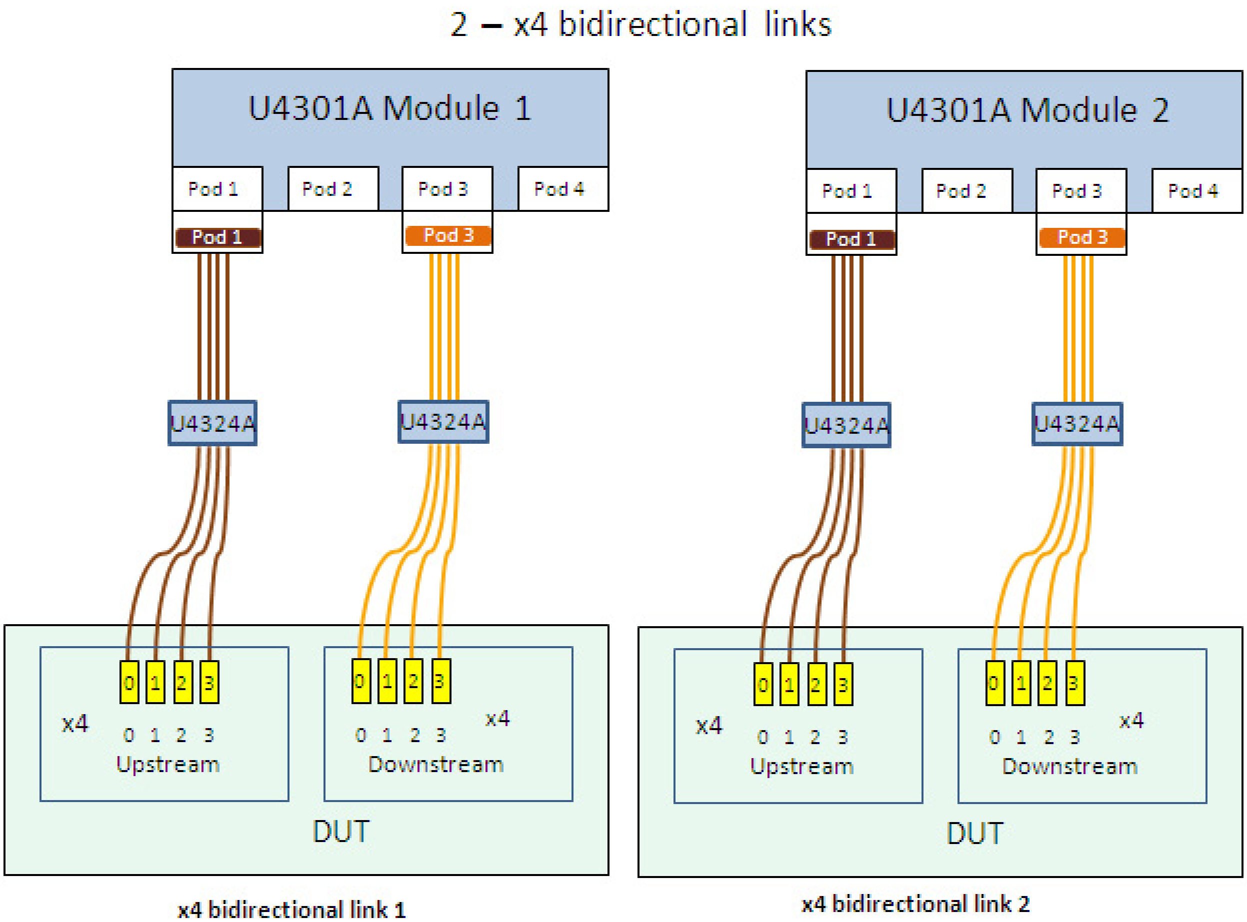


Figure 61 Two x4 bidirectional setups using U4324A probes

Setting up a x16 upstream and downstream configuration using U4324A probes

If you want to probe and capture upstream as well downstream data with x16 link width, you need two U4301A Analyzer modules and eight U4324A probes

Perform the following steps for a x16 upstream and downstream hardware and probing setup.

1 Plug the module connectors of the four U4324A flying lead probes into Pod 1, 2, 3, and 4 of the U4301A Analyzer module that you are using as the upstream module.

2 Plug the module connectors of the remaining four U4324A flying lead probes into Pod 1, 2, 3, and 4 of the U4301A Analyzer module that you are using as the downstream module.

3 Connect all the four flying lead cables of all the eight probes to the appropriate target points on the DUT via ZIF tips.

The following figure illustrates a x16 upstream and downstream setup.

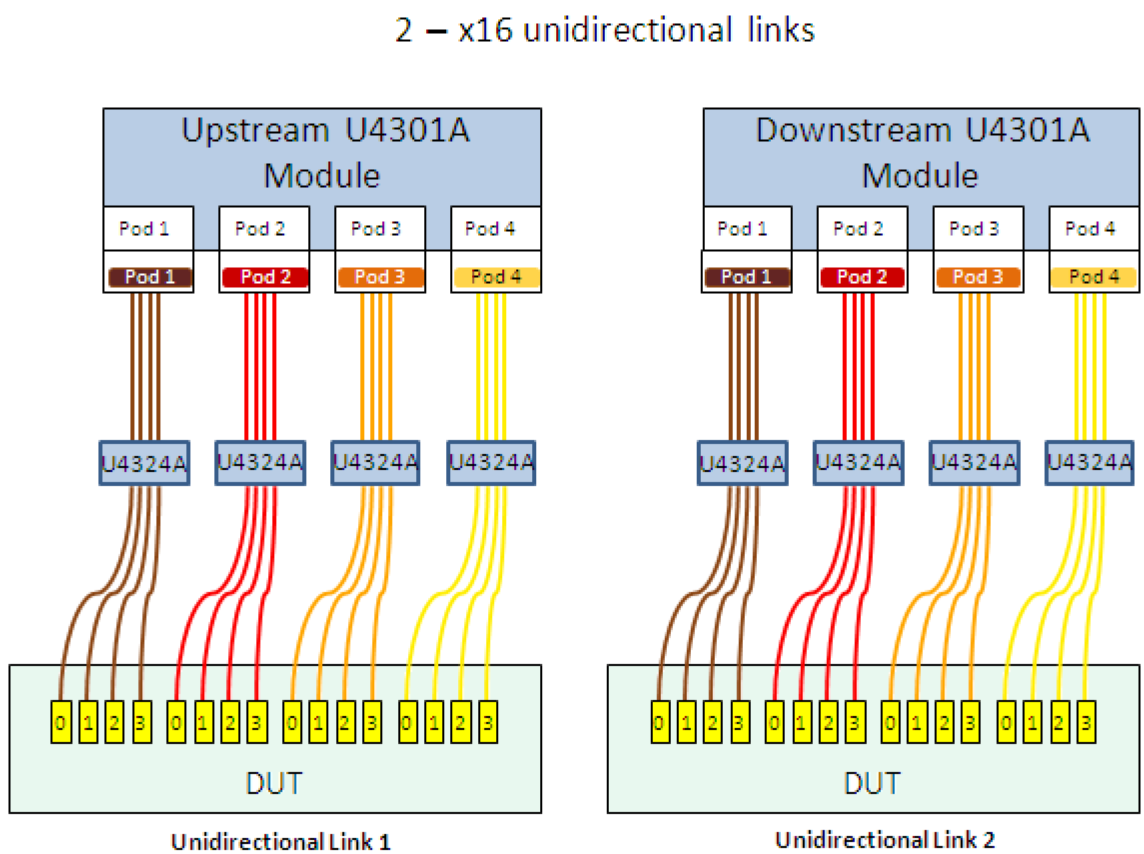


Figure 62 x16 upstream and downstream setup using U4324A probes

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