Keysight U4431A MIPI M-PHY Protocol Analyzer

Hardware and Probing Guide

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Safety Notices

CAUTION

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

WARNING

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

Safety Summary

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 or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements. Product manuals are provided with your instrument on CD-ROM and/or in printed form. Printed manuals are an option for many products. Manuals may also be available on the Web. Go to www.keysight.com and type in your product number in the Search field at the top of the page.

General Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described in "Safety Symbols".

Ground the Instrument If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal 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.

Fuses See the user's guide or operator's manual for information about line-fuse replacement. Some instruments contain an internal fuse, which is not user accessible.

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 Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Cleaning Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Modify the Instrument Do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Keysight Sales and Service Office for service and repair to ensure that safety features are maintained.

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

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

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

Safety Symbols

Table 1   **Safety Symbol**

Symbol	Description
	Direct current
	Alternating current
	Both direct and alternating current
	Three phase alternating current
	Three phase alternating current
	Earth ground terminal
	Protective earth ground terminal
	Frame or chassis ground terminal
	Terminal is at earth potential
	Equipotentiality
N	Neutral conductor on permanently installed equipment
L	Line conductor on permanently installed equipment
	On (mains supply)
	Off (mains supply)
	Standby (mains supply). The instrument is not completely disconnected from the mains supply when the power switch is in the standby position
	In position of a bi-stable push switch

Symbol	Description
	Out position of a bi-stable push switch
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION
	Caution, refer to accompanying documentation
	Caution, risk of electric shock
	Do not apply around or remove from HAZARDOUS LIVE conductors
	Application around and removal from HAZARDOUS LIVE conductors is permitted
	Caution, hot surface
	Ionizing radiation
CAT I	IEC Measurement Category I
CAT II	Measurement Category II
CAT III	Measurement Category III
CAT IV	Measurement Category IV

Informations relatives à la sécurité

Les consignes de sécurité générales présentées dans cette section doivent être appliquées au cours des différentes phases d'utilisation de cet appareil. Le non-respect de ces précautions ou des avertissements et consignes d'utilisation spécifiques mentionnés dans les manuels des produits constitue une violation des normes de sécurité relatives à la conception, à la fabrication et à l'usage normal de l'instrument. Keysight Technologies ne saurait être tenu responsable du non-respect de ces consignes. Les manuels des produits sont fournis avec votre instrument sur CD-ROM et/ou en version papier. Les versions papier des manuels sont en option pour de nombreux produits. Certains manuels sont également disponibles en ligne. Pour y accéder, allez sur le site www.keysight.com et saisissez la référence de votre produit dans le champ Rechercher qui se trouve en haut de la page.

Généralités
Utilisez ce produit uniquement dans le cadre prévu par le fabricant. Si vous ne respectez pas les instructions d'utilisation, les fonctions de sécurité du produit risquent d'être inhibées.

Avant la mise sous tension
Vérifiez que vous avez bien respecté toutes les consignes de sécurité. Faites tous les branchements au niveau de l'appareil avant de mettre ce dernier sous tension. Tenez compte des marquages externes à l'instrument décrits à la section «Symboles de sécurité».

Mise à la terre de l'instrument
Si une prise de mise à la terre est fournie avec le produit, le châssis et le capot de l'instrument doivent être reliés à la terre afin de limiter les risques d'électrocution. Le contact à la terre doit être solidement connecté à une borne de terre (de sécurité) au niveau de la prise de courant . Toute interruption du conducteur de protection (mise à la terre) ou tout débranchement de la borne de terre de protection donne lieu à un risque d'électrocution pouvant entraîner des blessures graves.

Fusibles
Pour obtenir des instructions sur le changement des fusibles de ligne, consultez le guide de l'utilisateur ou le manuel d'instructions. Certains instruments comportent un fusible interne inaccessible à l'utilisateur.

Ne pas utiliser en atmosphère explosive
N'utilisez pas l'instrument en présence de gaz ou de vapeurs inflammables.

Ne pas démonter le capot de l'instrument
Seules des personnes qualifiées, formées à la maintenance et conscientes des risques d'électrocution encourus sont autorisées à démonter les capots de l'instrument. Débranchez toujours le cordon d'alimentation secteur et tous les circuits externes avant de démonter le capot de l'instrument.

Nettoyage
Nettoyez la partie externe de l'instrument à l'aide d'un chiffon doux et non pelucheux, légèrement humidifié. N'utilisez pas de détergents ou de solvants chimiques.

Ne pas modifier l'instrument
N'installez pas de composants de remplacement et n'apportez aucune modification non autorisée à l'appareil. Pour toute opération de maintenance ou de réparation, renvoyez l'appareil à un bureau de vente et de service après-vente Keysight, afin d'être certain que les fonctions de sécurité seront maintenues.

En cas de dommages
Les instruments endommagés ou défectueux doivent être désactivés et protégés contre toute utilisation involontaire jusqu'à ce qu'ils aient été réparés par une personne qualifiée.

ATTENTION La mention ATTENTION indique un risque. Si la manoeuvre ou le procédé correspondant n'est pas exécuté correctement, il peut y avoir un risque de dommages à l'appareil ou de perte de données importantes. En présence de la mention ATTENTION, il convient de s'interrompre tant que les conditions indiquées n'ont pas été parfaitement comprises et respectées.

AVERTISSEMENT **La mention AVERTISSEMENT signale un danger pour la sécurité de l'opérateur. Si la manœuvre ou le procédé correspondant n'est pas exécuté correctement, il peut y avoir un risque pour la santé des personnes. En présence d'une mention AVERTISSEMENT, il convient de s'interrompre tant que les conditions indiquées n'ont pas été parfaitement comprises et respectées.**

Symboles de sécurité:

Table 2 **Description des Symboles de Sécurité qui pourraient apparaître sur le produit.**

Symboles	Description
	Courant continu.
	Courant alternatif.
	Courant continu et alternatif.
	Courant alternative triphasé.
	Borne de terre (masse).
	Borne de terre de protection.
	Borne de terre reliée au cadre ou au châssis.
	Borne au potentiel de la terre.
	Equipotentialité
N	Conducteur neutre sur un équipement installé à demeure
L	Conducteur de phase sur un équipement installé à demeure.

Symboles	Description
	Alimentation en marche.
	Alimentation à l'arrêt.
	Alimentation en mode veille. Lorsque l'interrupteur est en mode veille, l'unité n'est pas complètement déconnectée de l'alimentation secteur.
	Position Marche d'un interrupteur par bouton poussoir bi-stable.
	Position Arrêt d'un interrupteur par bouton poussoir bi-stable.
	Appareil entièrement protégé par DOUBLE ISOLATION ou ISOLATION RENFORCÉE
	Attention. Consultez la documentation fournie.
	Attention, danger d'électrocution.
	Ne pas appliquer ou enlever sur des conducteurs SOUS TENSION DANGEREUSE
	Application ou retrait autorisés sur les conducteurs SOUS TENSION DANGEREUSE
	Attention, surface chaude
	Rayonnement ionisant
CAT I	Appareil de mesure de catégorie I selon la norme CEI applicable
CAT II	Appareil de mesure de catégorie II selon la norme CEI applicable
CAT III	Appareil de mesure de catégorie III selon la norme CEI applicable
CAT IV	Appareil de mesure de catégorie IV selon la norme CEI applicable

Compliance and Environmental Information

Table 3   Compliance and Environmental Information

Safety Symbol	Description
	CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.
	The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.
	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.
	KC certification mark to demonstrate compliance with the South Korean EMC requirements. **South Korean Class A EMC declaration** This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

Table 4   Environmental Information

Safety Symbols	Description
	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 requirement 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 Keysight office, or see* www.keysight.com/environment/product/ *for more information.*

About This Guide

This guide describes the probing options available for use with the U4431A module. It describes how to make probing connections from the device under test (DUT) to the Keysight U4431A module for various probing situations.

See Also

- For information on Keysight AXIe chassis, U4431A module, how to set up the chassis, module, and host computer and how to obtain and install the associated software components, see: *"Keysight AXIe based Logic Analysis and Protocol Test Modules Installation Guide"*. This guide is available on www.keysight.com and is also installed with the Logic Analyzer software.

- For information on how to use the U4431A module for analysis, refer to the Keysight Logic and Protocol Analyzer software's online help.

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This chapter provides information on the hardware components of the U4431A module.

U4431A Module Hardware Components

The Keysight U4431A MIPI M-PHY Protocol Analyzer module (hereafter referred to as the U4431A module) provides acquisition capabilities to test and debug an M-PHY component independently or as an integrated M-PHY based design. You can analyze and debug the captured M-PHY data using various Keysight tools and viewers available in the Keysight Logic and Protocol Analyzer GUI.

You can use a single U4431A module to capture M-PHY traffic on a:

· unidirectional link (either Tx or Rx sublink)

· or a bidirectional link (Tx and Rx sublinks)

A single U4431A module supports data capture for a link width of up to 4 lanes per sublink.

The following figure displays a U4431A module with its components labeled.
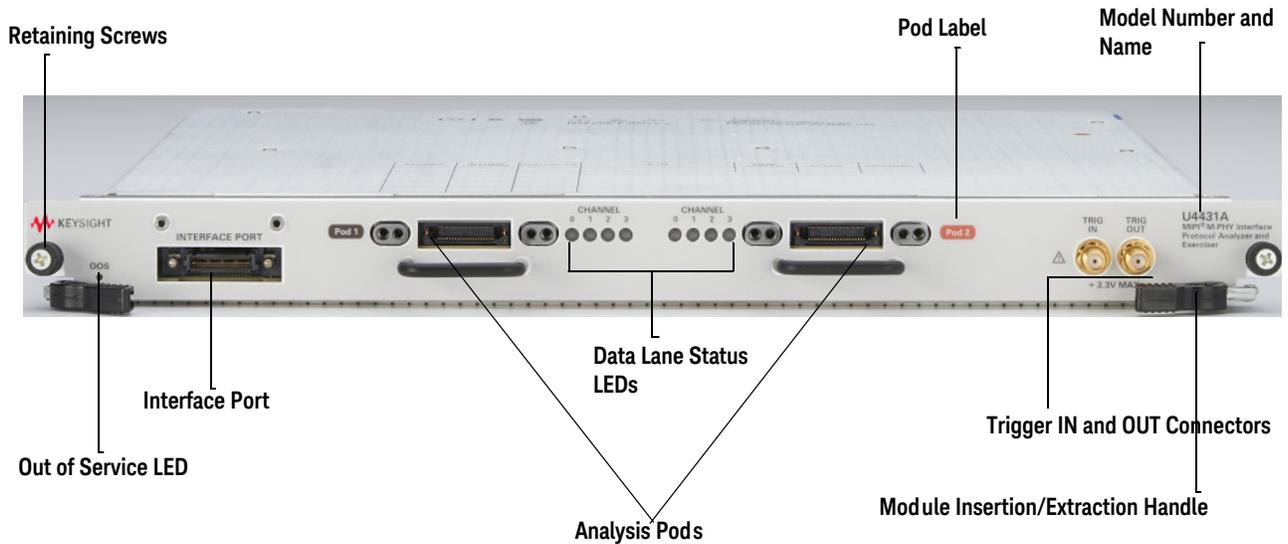

Figure 1   U4431 Module Components

As shown in the above figure, the U4431A module has the following components:

Component	Description
OOS (Out of Service) LED	Indicates the power-ready status of the U4431A module. This LED may turn red during the power-on-self-test phase of the chassis boot cycle. The LED then turns off when the U4431A module is in a power-ready state. 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 Keysight representative to replace or service the module. ▪ **Off** - 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 U4431A module in the same chassis. The features of this component are not yet supported.
Analysis Pods	This component is used to connect the U4431A module with one of the following two Keysight probes provided for the U4431A module: ▪ U4433A differential ZIF flying lead probe ▪ U4432A differential SMA probe You use this component to capture and analyze data from DUT. Refer page 17 and page 31 to know more.
Pod label	A colored label assigned to each pod input on the front panel of the module. You should match the color coding used in these pod labels with the color coding for the labels that you put on the pod cables.
Data Lane Status LEDs	Each analysis pod on the module supports probing one to four lanes of a sublink. For each of these lanes, a lane status LED is provided, labeled 0 to 3, to indicate the status of the lane. The following color coding is used for these LEDs to indicate the lane status. ▪ **Red** - This means that the lane is in the ultra-low power state (HIBERN8). ▪ **Blinking Red** - This means that the lane state is unknown. This can happen when the U4431A module is in the process of syncing up to the current link configurations. ▪ **Green** - This means that the lane is transmitting HS-BURST in HS-MODE. ▪ **Blinking Green** - This means that the lane is in the STALL state - the power saving state in HS-MODE. ▪ **Yellow** - This means that the lane is transmitting LS-BURST in LS-MODE. ▪ **Blinking Yellow** - This means that the lane is in the SLEEP state - the power saving state in LS-MODE. ▪ **Off** - This means that the lane is not configured/available. Based on the link width that you select in the U4431 Connection Setup tab of the Logic and Protocol Analyzer GUI, the number of lanes on the U4431A module are used. The LEDs of only the used lanes glow. For example, if you are using the x2 link width, then the LEDs of only two lanes being used will glow and the rest of the LEDs will be off. All Lane Status LEDs will be off until the host computer has established a connection to the chassis and module and the Logic and Protocol Analyzer application has started.
Trigger In/Out	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 U4431A 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 Keysigt 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.
Retaining Screws	The screws on both ends of the module are used to retain the module tightly inside the AXIe chassis slot once you have fully placed it inside the chassis. To remove the module, you first need to loosen these screws ensuring that these screws disengage completely.
Module Insertion/Extraction Handles	The handles on both sides of the module to insert or eject the module from the slot of the AXIe chassis.
Module Number and Name	Identifies the module's product number and title. When contacting Keysight support, report this information.

WARNING   Do not directly touch any component on the U4431A module. It may be hot.

CAUTION   Components on the U4431A module are sensitive to static electricity. Therefore, take necessary anti-static precautions, such as wear a grounded wrist strap, to minimize the possibility of electrostatic damage.

You can install a U4431A module in a Keysight M950XA AXIe chassis. To achieve time correlation, you can install multiple modules in the same chassis or across multiple chassis. You can use a desktop PC, a laptop PC, or a Keysight M9536A AXIe Embedded Controller module as the host computer for the U4431A module.

For more information

- For information on Keysight AXIe chassis, U4431A module, how to set up the chassis, module, and host computer and how to obtain and install the associated software components, see: *"Keysight AXIe based Logic Analysis and Protocol Test Modules Installation Guide"*. This guide is available on www.keysight.com and is also installed with the Logic and Protocol Analyzer software.
- Refer to the *Keysight Logic and Protocol Analyzer Online Help* installed and integrated with the Keysight Logic and Protocol Analyzer software to learn how to use the U4431A module.

2 Setting up a U4433A Differential ZIF Flying Lead Probe Configuration

This chapter provides information on the U4433A Differential ZIF Flying Leads probe used with the U4431A M-PHY Analyzer module.

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U4433A Differential ZIF Flying Lead Probe Description

The U4433A flying lead probe is a Keysight probing solution provided for the U4431A Analyzer module. This module has two analysis pods located on its front panel that you can use to connect two U4433A probes with the module.

A U4433A probe provides support for probing one to four lanes of a Tx or an Rx sublink of an M-PHY link. A set of two probes provides support for probing one to four lanes of both Tx as well as Rx sublinks using a single U4431A module.

A U4433A probe allows you to probe individual lanes. You connect a U4433A 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 multiple target points on the DUT. This allows flexible connections to individual signals and eliminates the need to have signals routed to one probing point.

This probing solution does not require any designed connectors and probes signals without built-in test points.

Probe Components

The following figure displays a U4433A Flying Lead probe with labels pointing to the components of this probe.
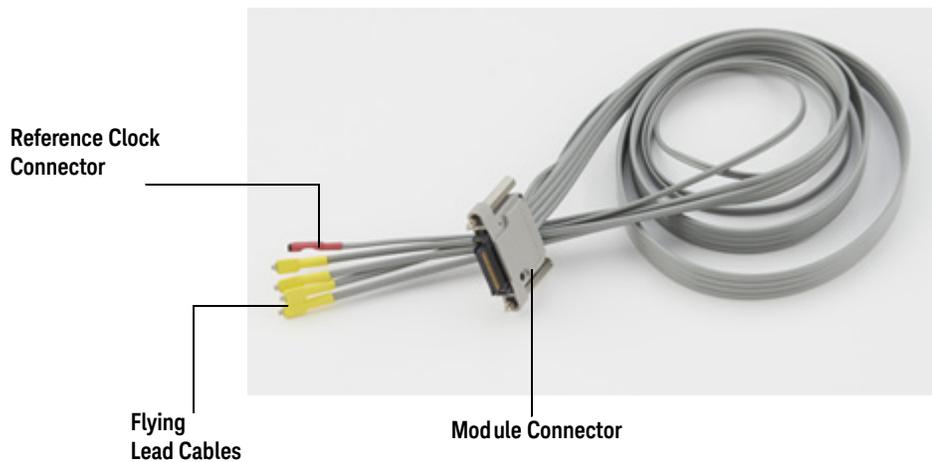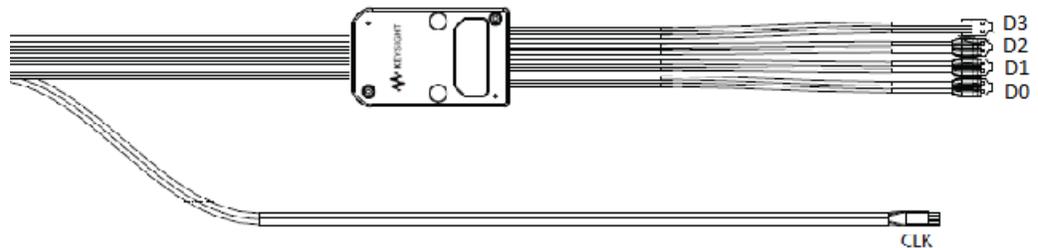

Figure 2   U4433A Flying Lead Probe Components

The following table briefly describes each of the components of the U4433A probe labeled in the above figure.
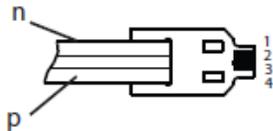
Component	Description
Module Connector	This component connects the U4433A probe to the U4431A Analyzer module. You plug this component into one of the two pod inputs available on the front panel of the U4431A Analyzer module.
Flying Lead Cables	This component connects the U4433A probe to the DUT via N5426A Zero Insertion Force (ZIF) tips (see page 26). 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 lane which refers to either a Tx differential pair OR an Rx differential pair for a given lane. The tip of each flying lead has positions for four pins as displayed in the following figure. Pin 1 connects to the negative side of the differential probe input and pin 4 to the positive side, The two pins in the middle are not connected/used. Refer to "M-PHY Signal to U4433A Flying Lead Mapping" on page 20 to know about the flying lead pins to use for probing various M-PHY signals.
Reference Clock Connector	This component is used in situations where you need to probe the reference clock from DUT. Currently, the U4431A module does not support receiving or supplying an external reference clock and therefore this connector is not used.

M-PHY Signal to U4433A Flying Lead Mapping

The following table provides a mapping between the M-PHY signals to be probed and the U4433A flying lead cable and its pins to be used.

M-PHY Signal to be Probed	Flying Lead Cable to Use	Flying Lead Cable Pin to Use
D0_N	D0	1
D0_P		4
D1_N	D1	1
D1_P		4
D2_N	D2	1
D2_P		4
D3_N	D3	1
D3_P		4
Clk P	Clk 1 (Currently not supported)	1
Clk N	Clk 0 (Currently not supported)	3

Supported Link Configurations

Before you start installing the U4433A probes, plan the type of link configuration you want to probe. This topic describes the link configurations that a U4433A probe supports.

A single U4433A probe provides four channels and can probe:

- one to four lanes of a Tx or an Rx sublink in a "One Sublink" probing setup.
- one to four lanes of a Tx or an Rx sublink in a "Both Sublinks" probing setup.

NOTE   In a "Both Sublinks" (Tx and Rx) setup, you can use the U4433A probe to probe different number of lanes for Tx and Rx sublinks. For instance, a x2 linkwidth for the Tx sublink and a x4 linkwidth for the Rx sublink.

Supported Link Configuration	Number of Probe(s) Required	Module Pod(s) to be used	Number of Flying Lead Tips to be used
One sublink of a link (Unidirectional)			
For a x1 Tx or Rx sublink probing	1 U4433A probe	Pod1	1
For a x2 Tx or Rx sublink probing	1 U4433A probe	Pod1	2
For a x3 Tx or Rx sublink probing	1 U4433A probe	Pod1	3
For a x4 Tx or Rx sublink probing	1 U4433A probe	Pod1	4
Both sublinks of a link (Bidirectional)			
For a x1 to x4 Tx and Rx sublinks probing	2 U4433A probes (one for each direction)	Pod1 for one direction Pod2 for another direction	Based on the link width of each sublink to be probed.

NOTE   A single U4431A module can be used to probe sublinks of a single M-PHY link. If you want to probe multiple M-PHY links, you need multiple U4431A modules.

The following are some examples illustrating the U4433A probe configurations.

Example – For a x1 Tx or Rx sublink probing

The following figure illustrates a x1 unidirectional probing setup using a U4433A probe.
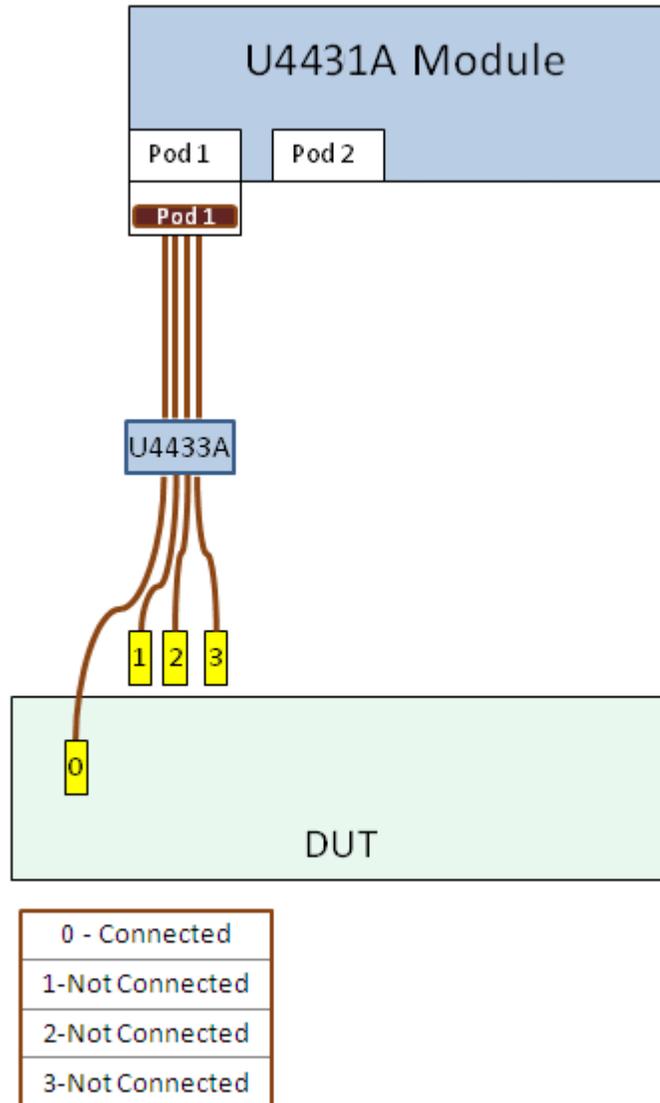

Figure 3   x1 Unidirectional Probing Setup

Example – For a x2 Tx and Rx sublinks (bidirectional) probing

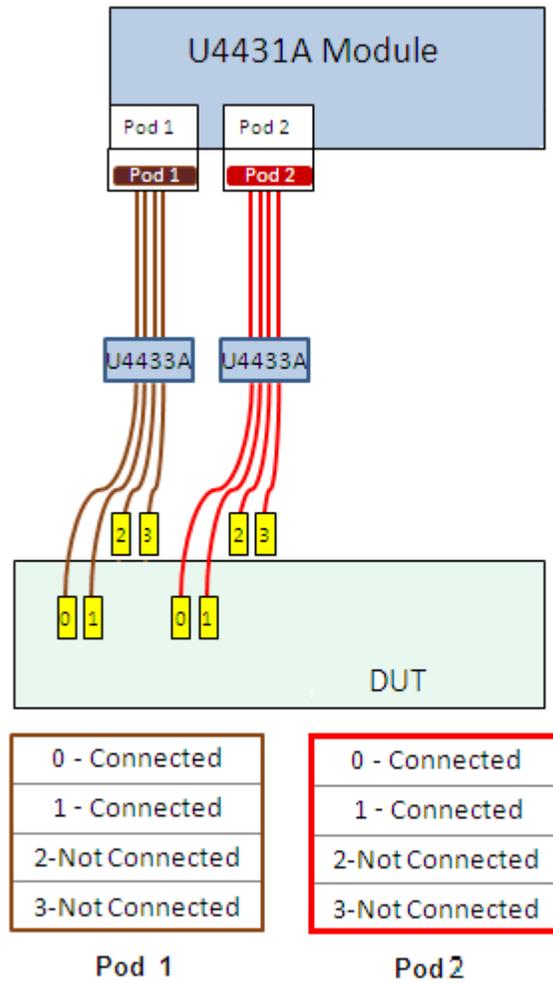The following figure illustrates a x2 bidirectional probing setup using U4433A probes.

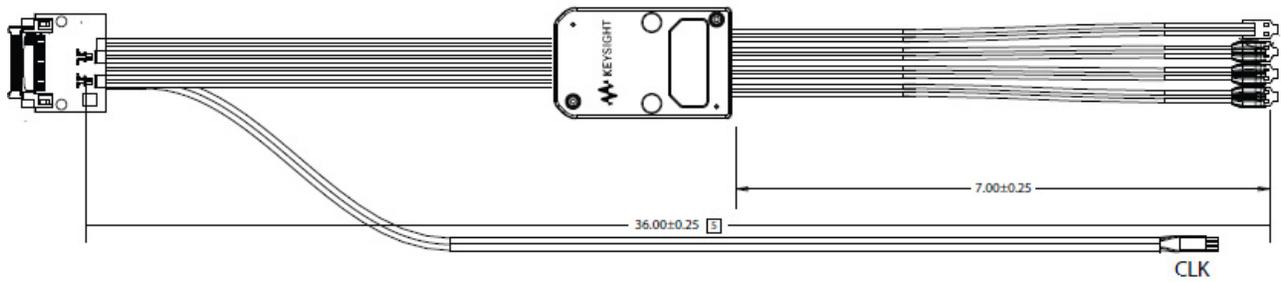Figure 4   x2 Bidirectional Probing Setup

U4433A Probe Dimensions

Figure 5   U4433A Probe Dimensions

All dimensions are in inches.
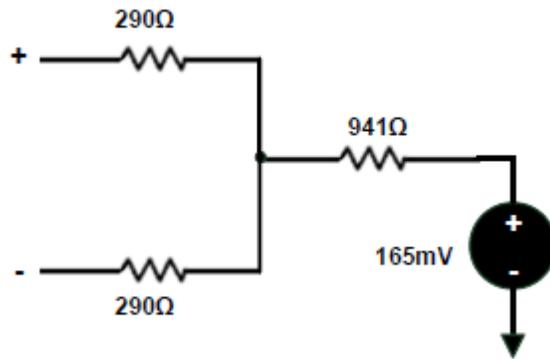
U4433A Probe DC Load Model

Figure 6   U4433A DC Load Model

N5426A ZIF Tips

A N5426A ZIF tip kit is included in the U4433A probe shipment. This kit has a set of 10 12GHz InfiniMax ZIF tips.

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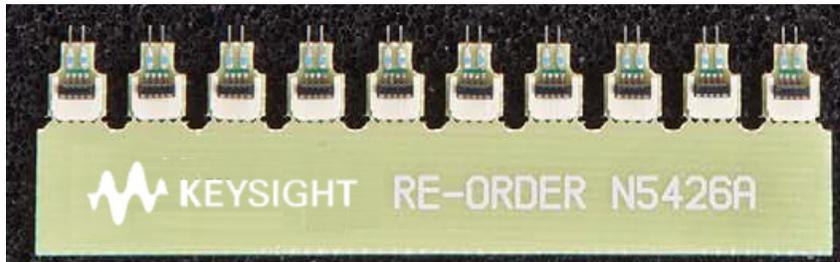

Figure 7   N5426A ZIF Tip Kit

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.

N5426A ZIF Tip

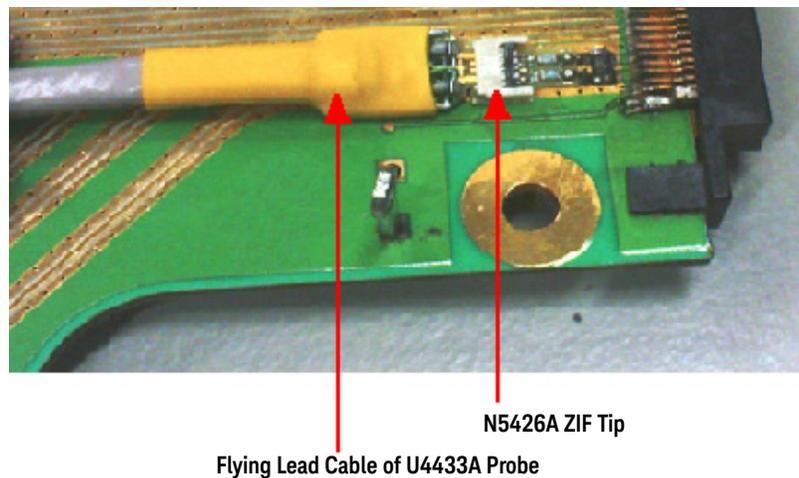**Flying Lead Cable of U4433A Probe**

Figure 8   U4433A Probe Connection to ZIP Tip

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 U4433A Probe" on page 28 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.keysight.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 Keysight Sales office for assistance.
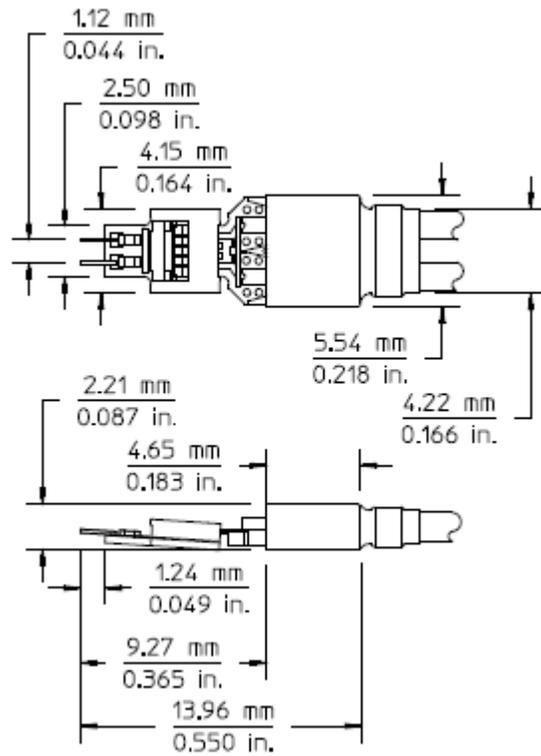
N5426A ZIF Tip Dimensions

Figure 9   N5426A Zip Tip Dimensions

Installing a U4433A Probe

To install a U4433A probe

1   Plug the module connector of the U4433A probe into one of the two pod inputs on the front panel of the U4431A Analyzer module.

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

3   Each flying lead cable of the U4433A 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.keysight.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 U4433A probe into the ZIF tip.

The following figure displays a flying lead cable of the U4433A probe connected to a DUT via a N5426A ZIF tip soldered onto the DUT.

N5426A ZIF Tip

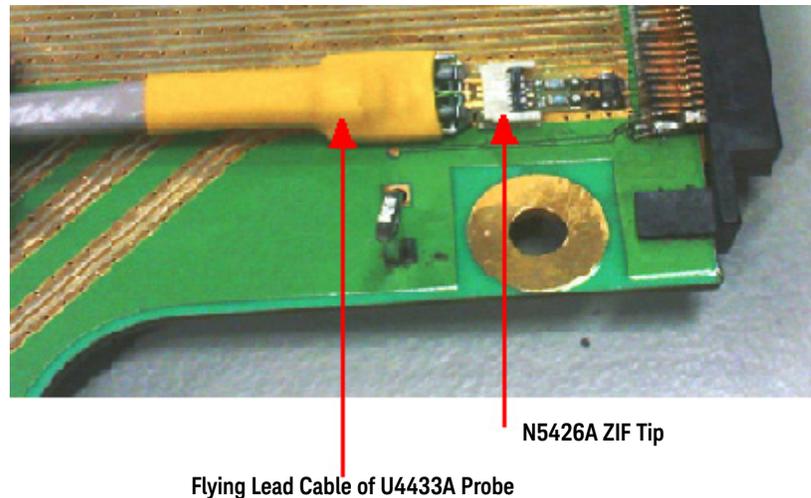**Flying Lead Cable of U4433A Probe**

Figure 10   U4433A Probe Connection to ZIF Tip

NOTE

Currently, the U4431A module does not support receiving or supplying an external reference clock. Therefore, do not use the Reference Clock Connector component of the U4433A probe.

Labeling the Probes

A label sheet is provided with the U4433A probe shipment. Use this label sheet to place the pod and channel labels on the U4433A 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 U4433A probe's module connector and cable housing block with Pod and channel labels placed.
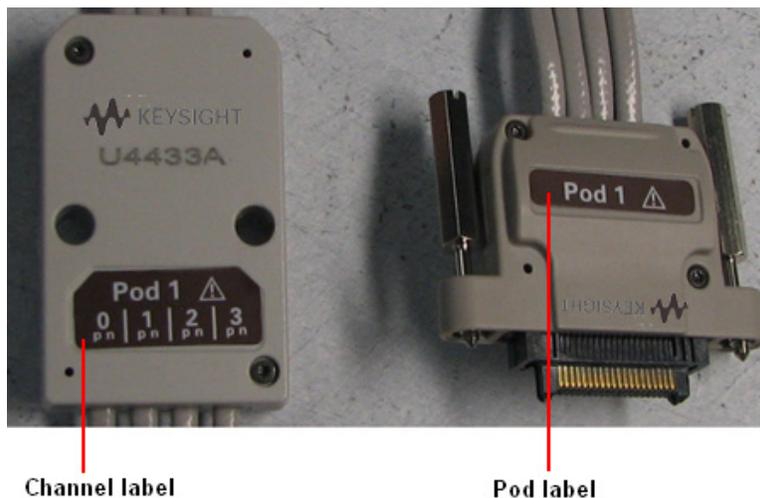

Figure 11   U4433 Channel Label and Pod Label

NOTE	Be careful while plugging in or out a flying lead cable from the soldered ZIF Tip. While detaching a module connector from the U4431A module, disengage the screws completely from the module and then pull the module connector straight out to remove.

CAUTION	Components on the U4433A 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.

Probe Characteristics

Description	Value
Electrical Characteristics	
Input	10 V max common mode
Capacitive loading	0.250 fF
Other Characteristics	
Temperature	Operating range: +5 to +40°C Storage: -40 to 70°C temperature
Humidity	Operating 80% RH @ 40°C temperature Storage: 90% RH @ 65 °C
Vibration	2.09 Grms (5 to 500 Hz random)
Shock	1.6 m/s [63 in/s] (2 mS half sine)

3   Setting up a U4432A SMA Differential Probe Configuration

This chapter provides information on the U4432A SMA Differential probe used with the U4431A M-PHY Analyzer module.

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U4432A SMA Differential Probe Description

The U4432A SMA probe is a Keysight probing solution that connects the U4431A Analyzer module to the target system. This probe is a MIPI M-PHY, 21 leads/6 Gbps SMA cable that provides coaxial SMA connections for each of the lines of the M-PHY bus.

Though U4433A Differential Flying Lead probe is recommended in most situations, you may find the U4432A SMA probe particularly useful to get quick connections to a prototype's existing SMA connectors.

A single U4432A probe provides support for probing one to four lanes of a Tx or an Rx sublink of an M-PHY link. For a bidirectional probing, you need a single U4431A module and a set of two U4432A probes (one probe each for one to four lanes of each sublink).

The U4431A module has two analysis pods located on its front panel that you can use to connect two U4432A probes with the module.

Probe Components

The following figure displays a U4432A SMA probe with labels pointing to the components of this probe.
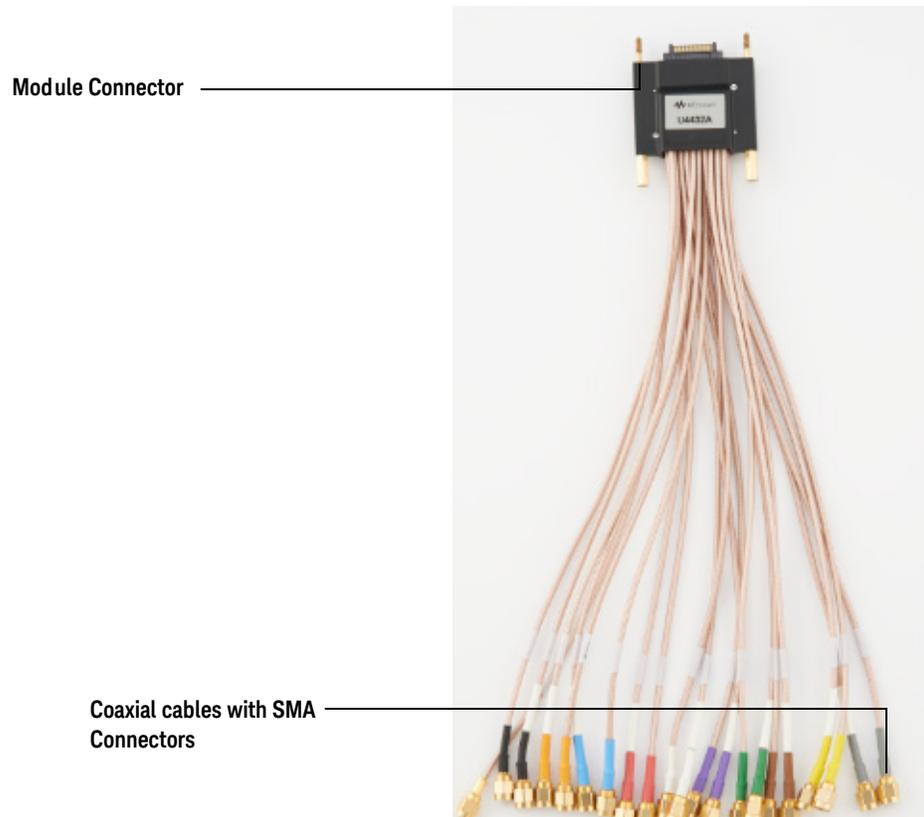

Figure 12   U4432A SMA Probe Components

The following table briefly describes each of the components of the U4432A probe labeled in the above figure.

Component	Description
Module Connector	This component connects the U4432A probe to the U4431A Analyzer module. You plug this component into one of the two pod inputs available on the front panel of the U4431A Analyzer module.
Coaxial Cables with SMA Connectors	This component connects the U4432A probe to the DUT. There are 21 SMA cables in each probe. Each cable connects to the positive or negative side of the differential probe input for a Tx or an Rx lane. In this probe, a pair of same colored cables represent the positive and negative sides of the differential probe input for a given lane. Refer to "Labeling and Color Coding of Coaxial Cables" on page 34 to know about the pins to use for probing various M-PHY signals.

Labeling and Color Coding of Coaxial Cables

To help you identify the appropriate coaxial cable to use in a given situation, the coaxial cables of the U4432A probe are labeled and color coded.

NOTE

In addition to the M-PHY data lines, the probe also provides a reference clock to the DUT. However, currently, the U4431A module does not support receiving or supplying an external reference clock.

The following table lists the label, color coding, and pin number mapping of each of these coaxial cables.

Label	Color Coding	Pin Number
Refn	Red with white	5
Refp	Red	7
TX0n	White with white	11
TX0p	White	13
RX0n	Black with white	12
RX0p	Black	14
TX1n	Violet with white	18
TX1p	Violet	20
RX1n	Blue with white	17
RX1p	Blue	19
TX2n	Yellow with white	23
TX2p	Yellow	25
RX2n	Orange with white	24
RX2p	Orange	26
TX3n	Grey with white	30
TX3p	Grey	32
RX3n	Green with white	29
RX3p	Green	31
Clkp	Brown	38
Clkn	Brown with white	36
Vsense		8

Supported Link Configurations

Before you start installing the U4432A probes, plan the type of link configuration you want to probe. This topic describes the link configurations that a U4432A probe supports.

A single U4432A probe provides four channels and can probe:

· one to four lanes of a Tx or an Rx sublink in a "One Sublink" probing setup.
· one to four lanes of a Tx or an Rx sublink in a "Both Sublinks" probing setup.

NOTE   In a "Both Sublinks" (Tx and Rx) setup, you can use the U4432A probe to probe different number of lanes for Tx and Rx sublinks. For instance, a x2 linkwidth for the Tx sublink and a x4 linkwidth for the Rx sublink.

Supported Link Configuration	Number of Probe(s) Required	Module Pod(s) to be used	Number of SMA cable pair to be used
One sublink of a link (Unidirectional)			
For a x1 Tx or Rx sublink probing	1 U4432A probe	Pod1	1
For a x2 Tx or Rx sublink probing	1 U4432A probe	Pod1	2
For a x3 Tx or Rx sublink probing	1 U4432A probe	Pod1	3
For a x4 Tx or Rx sublink probing	1 U4432A probe	Pod1	4
Both sublinks of a link (Bidirectional)			
For a x1 to x4 Tx and Rx sublinks probing	2 U4432A probes (one for each direction)	Pod1 for one direction Pod2 for another direction	Based on the link width of each sublink to be probed.

NOTE   A single U4431A module can be used to probe sublinks of a single M-PHY link. If you want to probe multiple M-PHY links, you need multiple U4431A modules.

U4432A Probe DC Load Model

2:1 splitters can typically be tolerated when running in Large Amplitude (LA) mode. Alternately, the 5340-104-10DB pick-off tee from Picosecond Pulse Labs has demonstrated an impedance model similar to the U4432A probe. Refer to the load model as described in the Picosecond Pulse Labs data sheet.

The following figure displays the load model for each U4432A differential channel pair.
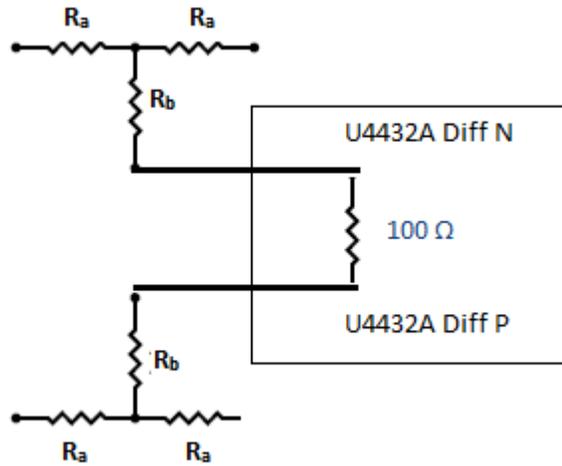

Figure 13   Differential Channel Pair of Load Model

Connecting the U4432A Probe to the U4431A Module and DUT

The U4432A probe connects to the DUT via 50-ohm coaxial cables using SMA connectors.

1   Plug the module connector (refer figure on page 32) of the U4432A probe to one of the pods on the front panel of the U4431A module.

Pod1 on module

Figure 14   U4431 Module Connection Pod

2   Hand-tighten the thumb screws on both sides of the module connector of the probe.

3   Connect the appropriate coaxial cables (with SMA connectors) of the probe to the DUT. (You can refer to page 34 to verify which coaxial cables to connect.)

  a   Based on the link width needed, connect the set of cables for M-Phy data lanes 0 to 3.

       You may leave the coaxial cables for the unused data lanes disconnected.

  b   Connect the cable for the DUT's supply voltage sense signal (labeled *Vsense*) to the DUT's power supply. The DUT sends this signal to the module to indicate when the module can actively send M-Phy signals to the DUT.

NOTE	While detaching a probe's module connector from the U4431A module, disengage the screws completely from the module and then pull the module connector straight out to remove.

CAUTION	Components on the U4432A 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.

Probe Characteristics

Description	Value
Electrical Characteristics	
Minimum Vdiff	100 mV
Input Impedance (DC)	128 Ω, typical
Other Characteristics	
Temperature	Operating range: +5 to +40°C Storage: -40 to 70°C temperature
Humidity	Operating 80% RH @ 40°C temperature Storage: 90% RH @ 65 °C
Vibration	Operating: 0.21 Grms (5 to 500 Hz random) Survival: 2.09 Grms (5 to 500 Hz random)
Shock	1.6 m/s [60 in/s] (2 mS half sine)
Altitude	Operating: 10 Kilo feet/3.1 Kilometers Storage: 15 Kilo feet/4.6 Kilometers

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