

Agilent RDX Test Platform for DigRFv4

Hardware Reference Guide



Agilent Technologies

Notices

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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

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.

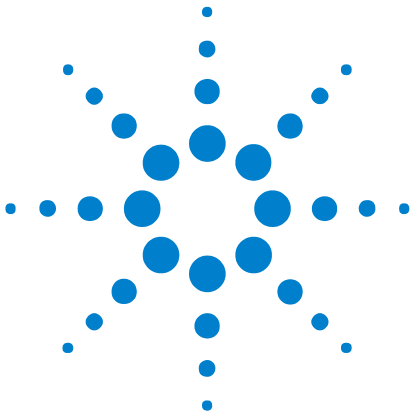
Environmental Information

| | |
|---|---|
|  | <p>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.</p> <p><i>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.</i></p> <p>Do not dispose in domestic household waste.</p> <p>To return unwanted products, contact your local Agilent office, or see www.agilent.com/environment/product/ for more information.</p> |
|---|---|

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1 Introduction

Hardware Architecture 8

This chapter provides information on the modules of DigRF v4 protocol tester in a N5302A/N5304A chassis.

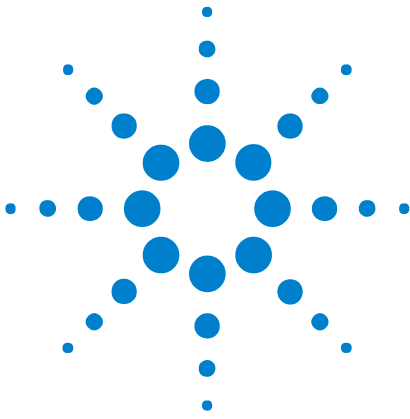
Hardware Architecture

DigRFv4 architecture is based on modules that are plugged into an two slot N5302A chassis. One module is the N5343A exerciser module and the other is the N5344A analyzer module. The N5343A exerciser module connects to a DUT using SMA connectors. The N5344A analyzer module probes the signal using a N5345A soft touch probe or a flying lead probe. Both the exerciser and analyzer module can be connected using USB or LAN.

The following figure shows the N5343A exerciser module and N5344A analyzer module plugged into a two slot N5302A chassis.



Figure 1 Modules in N5302A chassis



2 N5343A Exerciser Module

N5343A Exerciser Module 10

This chapter provides information on the N5343A Exerciser module used for DigRF v4 protocol tester.

N5343A Exerciser Module

The N5343A Exerciser module supports both DigRFv3 and DigRFv4.

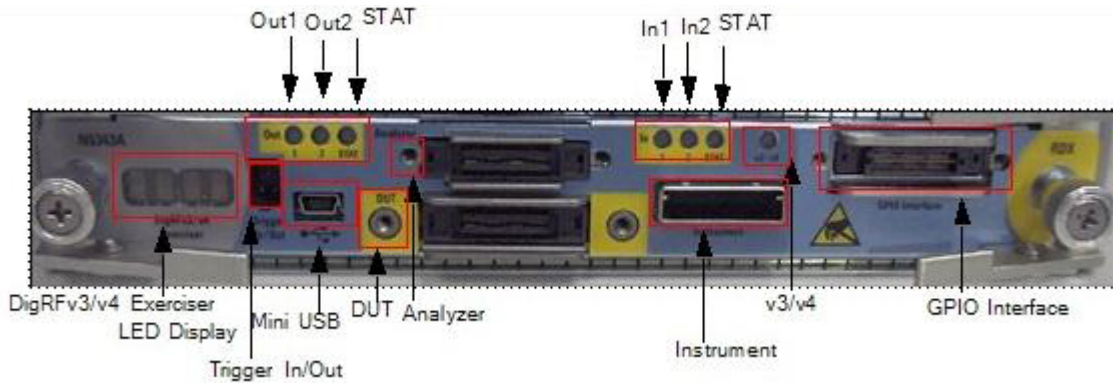


Figure 2 N5343A Exerciser Module

As shown in the above figure, the N5343A exerciser module has the following components:

- **LED Display**— This component is used to display the diagnostic information when fatal faults are discovered, and to indicate progress during the bootstrap. If everything is working properly, then this component displays the module number, such as 103.
- **Mini USB**— The mini USB features a direct USB connection for a PC to the module in order to allow fast data upload.
- **DUT**— The DUT SMA breakout connector is used to connect:
 - a DigRFv4 link (2 In / 2 Out)
 - b DigRFv3 link (2 In / 2 Out)
 - c 2 reference clock inputs
 - d 2 reference clock outputs
 - e 6 DigRFv3/v4 control signals
- **Analyzer**— The analyzer link connects the N5343A exerciser module and the N5344A analyzer module together. Both the input and the output data of the N5343A are transmitted to the analyzer module for further analysis through this link.
- **Instrument**— The instrument connector cable uses SMA to connect to the DUT for stimulus.
- **v3/v4**— Indicates if DigRFv3 or DigRFv4 interface is active.

- **GPIO Interface**– The GPIO bus connector features the 32-bit width GPIO bus which can be used for adding user customized stimulus.
- **LEDs**–
 - In1 – Activity indicator on input line 1
 - In2 – Activity indicator on input line 2
 - STAT – Status of input link
 - Out1 – Activity indicator on output line 1
 - Out2 – Activity indicator on output line 2
 - STAT – Status of output link
- **Trigger IN/OUT**– The 6 pin header connector is used to connect external trigger signals and a 10 MHz time reference clock as shown in the following figure.

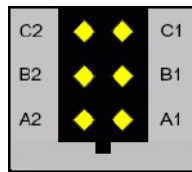


Figure 3 N5343A Trigger I/O connector pinout

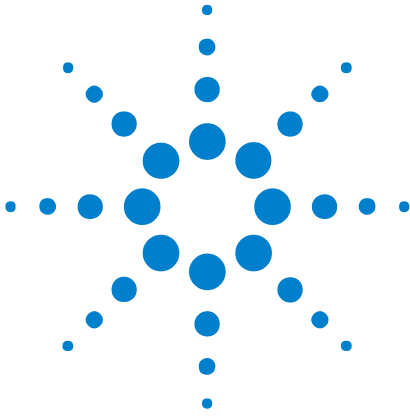
| Pin | Signal Name | Description | Comment |
|--------|----------------------|---|--|
| A1, A2 | Ground | LVTMOS level, active high (low: 0 V; high: 3.3 V) | Signal is active for minimum of 30 ns |
| B1 | External Trigger Out | LVTMOS level, active high (low: 0 V; high: 3.3 V) | Signal must be active for a minimum of 20 ns |
| B2 | External Trigger In | LVTMOS level, active high (low: 0 V; high: 3.3 V) | |
| C1 | 10 MHz TimeRefClk | | |
| C2 | Not connected | | |

WARNING

Do not directly touch any component on the N5343A module. It may be hot.

CAUTION

Components on the N5343A 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 N5343A DUT Cable

N5343A DUT Cable 14

This chapter provides information on the N5343A device under test (DUT) Cable used for DigRF v4 protocol tester.



N5343A DUT Cable

The DUT connector cable uses SMA to connect to the DUT for stimulus.

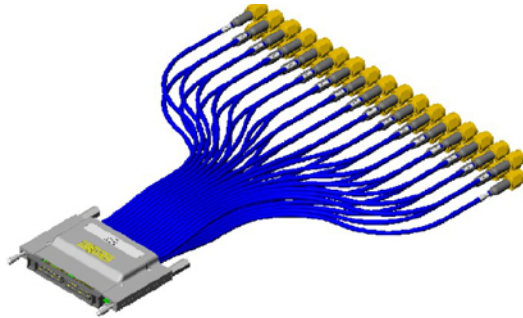


Figure 4 N5343A DUT Cable

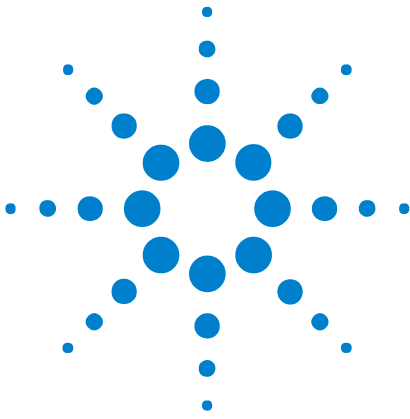
As shown in the previous figure, the N5343A instrument cable has the following connector pin out:

Table 1 N5343A DUT connector pin out

| Pin | Signal Name | Signal Name | Pin |
|-----|-----------------|-----------------|-----|
| 1 | DCOM | DCOM | 2 |
| 3 | V4_REFCLK_IN | V4_OUT1_P | 4 |
| 5 | DCOM | V4_OUT1_N | 6 |
| 7 | V3_SYSCLK_IN | DCOM | 8 |
| 9 | DCOM | V4_IN1_P | 10 |
| 11 | V3_SYSCLKEN_IN | V4_IN1_N | 12 |
| 13 | V3_SYSCLKEN_OUT | DCOM | 14 |
| 15 | DCOM | V4_IN2_P | 16 |
| 17 | V3_OUT2_P | V4_IN2_N | 18 |
| 19 | V3_OUT2_N | DCOM | 20 |
| 21 | DCOM | V4_OUT2_P | 22 |
| 23 | V3_OUT1_P | V4_OUT2_N | 24 |
| 25 | V3_OUT1_N | DCOM | 26 |
| 27 | DCOM | V3_SYSCLK_OUT | 28 |
| 29 | V3_IN1_P | DCOM | 30 |
| 31 | V3_IN1_N | V4_REFCLK_OUT | 32 |
| 33 | DCOM | DCOM | 34 |
| 35 | V3_IN2_P | V4_REFCLKEN_IN | 36 |
| 37 | V3_IN2_N | V4_REFCLKEN_OUT | 38 |
| 39 | V4_DIGRFEN_OUT | V4_DIGRFEN_IN | 40 |

Table 2 N5343A DUT connector signal levels pin out

| Interface | Signal | | Direction | Typical Levels | Maximum Levels |
|-----------|--------------|--------------|-----------|---|---|
| DigRFv4 | IN1 | Differential | Input | Vin diff: 200 mV...400 mV Vcm: 200 mV | Vdiff: 125 mV...2000 mV Vcm: 150 mV...800 mV |
| DigRFv4 | IN2 | Differential | Input | Vin diff: 200 mV...400 mV Vcm: 200 mV | Vdiff: 125 mV...2000 mV Vcm: 150 mV...800 mV |
| DigRFv4 | OUT1 | Differential | Output | Vin diff: 400 mV Vcm: 200 mV | Vdiff: 200 mV...400 mV |
| DigRFv4 | OUT2 | Differential | Output | Vin diff: 400 mV Vcm: 200 mV | Vdiff: 200 mV...400 mV |
| DigRFv3 | In1 | Differential | Input | Vin diff: 200 mV Vcm: 1200 mV | Vin diff: 100 mV...1000 mV Vcm: 50 mV...3000 mV |
| DigRFv3 | In2 | Differential | Input | Vin diff: 200 mV Vcm: 1200 mV | Vin diff: 100 mV...1000 mV Vcm: 50 mV...3000 mV |
| DigRFv3 | OUT1 | Differential | Output | Vout diff: 340 mV Vcm: 1200 mV | Vout diff: 250 mV...455 mV Vcm: 1.125V...1.375V |
| DigRFv3 | OUT2 | Differential | Output | Vout diff: 340 mV Vcm: 1200 mV | Vout diff: 250 mV...455 mV Vcm: 1.125 V...1.375 V |
| DigRFv4 | REFCLK_IN | Single Ended | Input | | 1.8 V compliant |
| DigRFv4 | REFCLK_OUT | Single Ended | Output | | Vout: 1.8 V compliant |
| DigRFv4 | REFCLKEN_IN | Single Ended | Input | | 1.8 V compliant |
| DigRFv4 | REFCLKEN_OUT | Single Ended | Output | | Vout: 1.8 V compliant |
| DigRFv4 | DIGRFEN_IN | Single Ended | Input | | 1.8 V compliant |
| DigRFv4 | DIGRFEN_OUT | Single Ended | Output | | Vout: 1.8 V compliant |
| DigRFv3 | SYSCLK_IN | Single Ended | Input | | 1.8 V compliant |
| DigRFv3 | SYSCLK_OUT | Single Ended | Output | | Vout: 1.8 V compliant |
| DigRFv3 | SYSCLKEN_IN | Single Ended | Input | | 1.8 V compliant |
| DigRFv3 | SYSCLKEN_OUT | Single Ended | Output | | Vout: 1.8 V compliant |



4 GPIO Bus Cable

GPIO Bus Cable 18

This chapter provides information on the GPIO Bus Cable used for DigRF v4 protocol tester.



GPIO Bus Cable

The GPIO bus cable has 36 signals. The pins are split into six different banks. Each bank has its own electrical characteristics.

Table 3 Electrical Characteristics

| Bank | Number of Pins per bank | VCC | Input/Output Configuration | Comment |
|---------|-------------------------|---|---|---|
| BankA/B | 8 | Programmable per bank(1.2 V, 1.8 V, 2.5 V) | Per pin | Fmax 20 MHz @1.2 V 50 MHz @ other voltages |
| BankC/D | 8 | Programmable, same for both bank(1.2 V, 1.8 V, 2.5 V) | Per bank | Fmax 100 MHz |
| BankE | 2 | fix at 3.3 V | Per pin, can be configured as open drain output | |
| BankF | 2 | fix at 1.8 V | Per pin, can be configured as open drain output | |



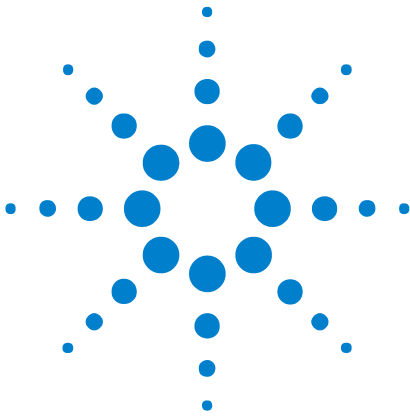
Figure 5 GPIO Bus Cable

As GPIO connector an edgemount samtec is used (QTH-030-01-L-D-EM2). The following table shows the GPIO connector pinout.

Table 4 GPIO Bus connector pinout

| Pin | Signal Name | Signal Name | Pin |
|-----|-------------|-------------|-----|
| 1 | GND | GND | 2 |
| 3 | n.c | n.c | 4 |
| 5 | n.c | n.c | 6 |
| 7 | GND | GND | 8 |
| 9 | n.c. | n.c. | 10 |
| 11 | n.c. | n.c. | 12 |
| 13 | GND | GND | 14 |
| 15 | GPIO_E0 | GPIO_F0 | 16 |
| 17 | GPIO_E1 | GPIO_F1 | 18 |
| 19 | GND | GND | 20 |
| 21 | GPIO_A0 | GPIO_C0 | 22 |
| 23 | GPIO_A1 | GPIO_C1 | 24 |
| 25 | GPIO_A2 | GPIO_C2 | 26 |
| 27 | GPIO_A3 | GPIO_C3 | 28 |
| 29 | GND | GND | 30 |
| 31 | GPIO_A4 | GPIO_C4 | 32 |
| 33 | GPIO_A5 | GPIO_C5 | 34 |
| 35 | GPIO_A6 | GPIO_C6 | 36 |
| 37 | GPIO_A7 | GPIO_C7 | 38 |
| 39 | GND | GND | 40 |
| 41 | GPIO_B0 | GPIO_D0 | 42 |
| 43 | GPIO_B1 | GPIO_D1 | 44 |
| 45 | GPIO_B2 | GPIO_D2 | 46 |
| 47 | GPIO_B3 | GPIO_D3 | 48 |
| 49 | GND | GND | 50 |
| 51 | GPIO_B4 | GPIO_D4 | 52 |
| 53 | GPIO_B5 | GPIO_D5 | 54 |
| 55 | GPIO_B6 | GPIO_D6 | 56 |
| 57 | GPIO_B7 | GPIO_D7 | 58 |
| 59 | GND | GND | 60 |

4 GPIO Bus Cable



5 N5344A Analyzer Module

N5344A Analyzer Module [22](#)

This chapter provides information on the N5344A analyzer module used for DigRF v4 protocol tester.



N5344A Analyzer Module

The N5344A analyzer module can connect to a N5345A soft touch probe or a flying lead probe. Therefore, it can analyze both RX and TX traffic between any BBIC and RFIC.

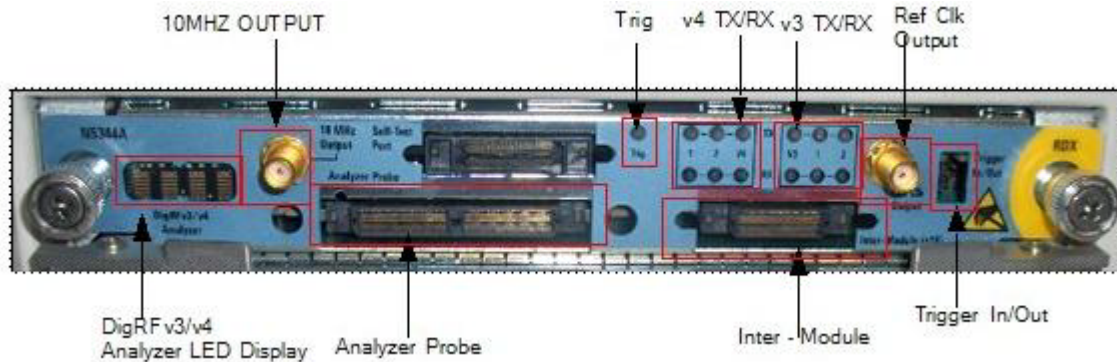


Figure 6 N5344A Analyzer Module

As shown in the above figure, the N5344A analyzer module has the following components:

- **LED Display**– This component is used to display the diagnostic information when fatal faults are discovered, and to indicate progress during the bootstrap. If everything is working properly, then this component displays the module number, such as 103.
- **Analyzer Probe**– The analyzer probe connects to a N5345A soft touch probe or a flying lead probe, which connects the N5344A analyzer module to the DUT.
- **Ref Clk Output**– External reference clock output.
- **Trig** – Activity indicator on trigger.
- **10 MHz Output**– Output a 10 MHz time reference clock.
- **v4 TX/RX**– Activity indicator on TX/RX for DigRFv4. The upper indicators for TX and the lower indicators for RX.
- **v3 TX/RX**– Activity indicator on TX/RX for DigRFv3. Activity indicator on TX/RX for DigRFv4. The upper indicators for TX and the lower indicators for RX.
- **Trigger In/Out** Trigger In/Out connector– This is a six pin header.
 - **In** – Trigger the protocol analyzer from an external source.
 - **Out** – Generate a Trigger Out signal to trigger an external instrument like an oscilloscope.

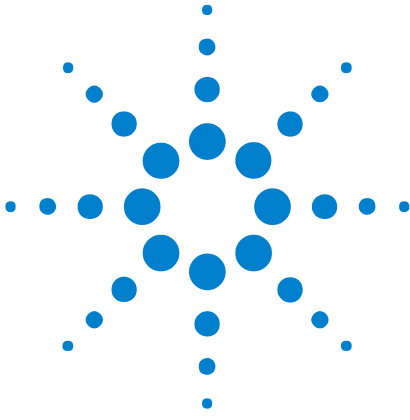
WARNING

Do not directly touch any component on the N5344A analyzer module. It may be hot.

CAUTION

Components on the N5344A 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.

5 N5344A Analyzer Module



6 Analyzer Probing

N5345A Soft Touch Probe 26

N5346A Flying Lead Probe 43

This chapter provides information on the probing options available for use with the N5344A Analyzer module.



N5345A Soft Touch Probe

The N5345A soft touch probe is specially designed to support a full line with two TX and two RX lines.

To use a N5345A soft touch probe, a Soft Touch 2.0 probe footprint must be designed into the target board. A 3 pin header must also be designed into the target board to supply a reference clock to the analyzer.

This document is intended to provide information needed by platform and system design teams for integration of the N5345A soft touch probe into their designs. It provides a mechanical and electrical solution space for the N5345A soft touch probe.

NOTE

Although information on DigRF v4 interface and specifications will be given, this document is not intended to take the place of other DigRF v4 interface 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.



Figure 7 Agilent N5345A Soft Touch Probe

The N5345A soft touch probe offers a number of different options for different applications. The platform designer has the flexibility to configure a probing solution that best meets the needs of the system.

- ["Installation Instructions"](#) on page 27
- ["Characteristics"](#) on page 27
- ["Mechanical Design"](#) on page 28
- ["Electrical Design"](#) on page 33

Installation Instructions

- 1 Solder and secure the retention module onto the device under test (DUT) on two sides of the soft touch 2.0 footprint.
- 2 Connect the wide connector of the N5345A soft touch probe to the analyzer module and tighten the thumbscrews.
- 3 Identify the white bullet on the probe label indicating pin 1.
- 4 Align it to the pin 1 on the layout board.



Figure 8 N5345A soft touch probe aligned over back plane

While designing the layout, make sure pin 1 is defined and marked. A vertically aligned probe is shown in the previous figure.

- 5 Slide the probe into the retention module, and gently tighten the thumbscrews located at the top of the N5345A soft touch probe head.
A screwdriver may be used to ensure that there is a secure connection. The thumbscrews should be tightened to a snug fit and not over tightened.
- 6 Connect the external clock cable of the N5345A soft touch probe to the reference clock header on the target board.

Characteristics

CAUTION

Carefully read the specifications stated below before setting up the design for N5345A soft touch probe.

| | |
|---------------|---|
| Probe Inputs: | Input Voltage: 25 V max or 3 V rms into 250 Ohms. |
| Temperature: | Operating 0 to 40 Deg C with 200 linear feet per minute airflow. Storage -40 to 70 Deg C. |
| Humidity: | Operating 15% to 95% non condensing. |
| Altitude: | Operating: to 3000 meters (10000 ft). |
| Airflow: | For a single probe with no heat sources within 1 inch, 140 linear feet per minute of air flow is required. For two probes, placed side by side with minimum spacing and no other heat sources within 1 inch, 200 linear feet per minute of air flow is required. |

Mechanical Design

This section contains information on mechanical design for the N5345A soft touch probe.

- ["Footprint Dimensions and Specifications"](#) on page 28
- ["Connecting the Retention Module"](#) on page 30

Footprint Dimensions and Specifications

Please ensure the following prerequisites are met for the design:

- Solder mask must not extend above the pad height for a distance of .005 inches from the pad.
- Via-in-pad is allowed if the vias are filled level with the pad or the via hole size is less than .005 inches.
- Permissible surface finishes on pads are HASL, immersion silver, or gold over nickel. The height of the pads contacted by the probe must be within +/- .007 inches of the bottom surface of the retention module.

The N5345A soft touch probe footprint, that needs to be designed into the target board, can be observed in the following figure. The following figure displays the detailed layout dimensions for the footprint. Notice that the connector has 50 pins.

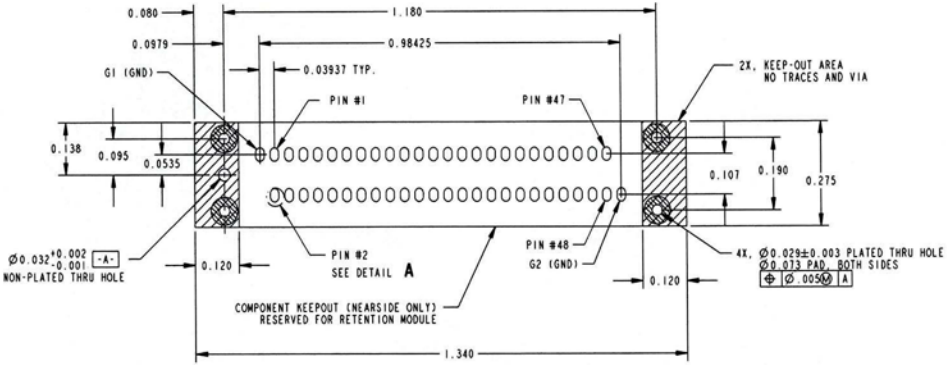


Figure 9 N5345A soft touch probe footprint dimensions, pin numbering, and specification

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

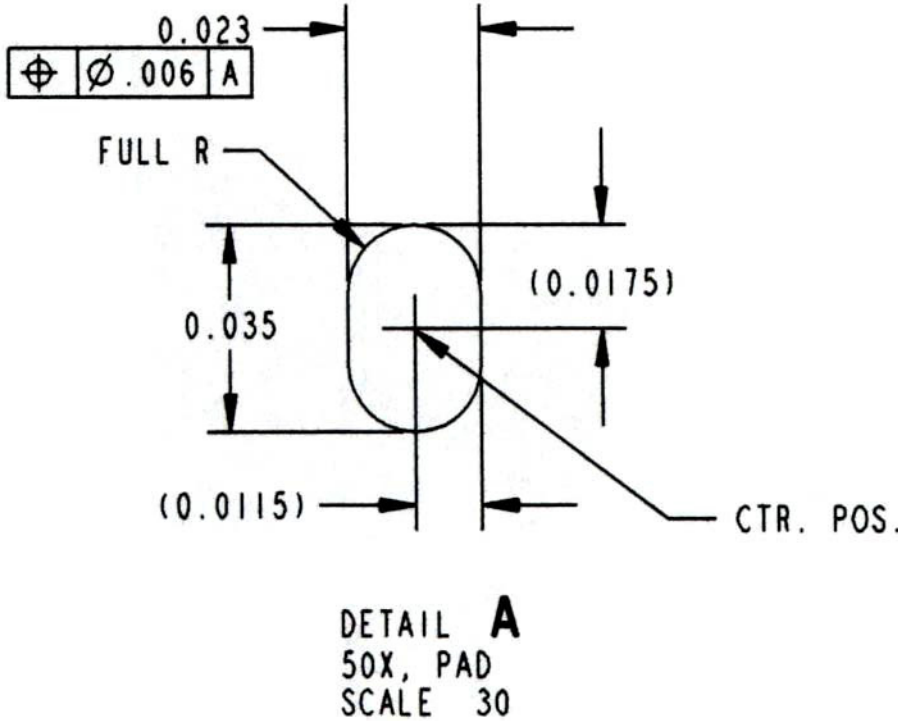


Figure 10 Detail A - detailed view of a pad.

Connecting the Retention Module

The retention module helps to connect the N5345A soft touch probe to the device under test (DUT). To achieve this, the retention module must be soldered onto the DUT. After this is done, the probe can be easily plugged into this retention module.

The following figure displays the dimensions of the N5345A soft touch probe, which is plugged into the retention module.

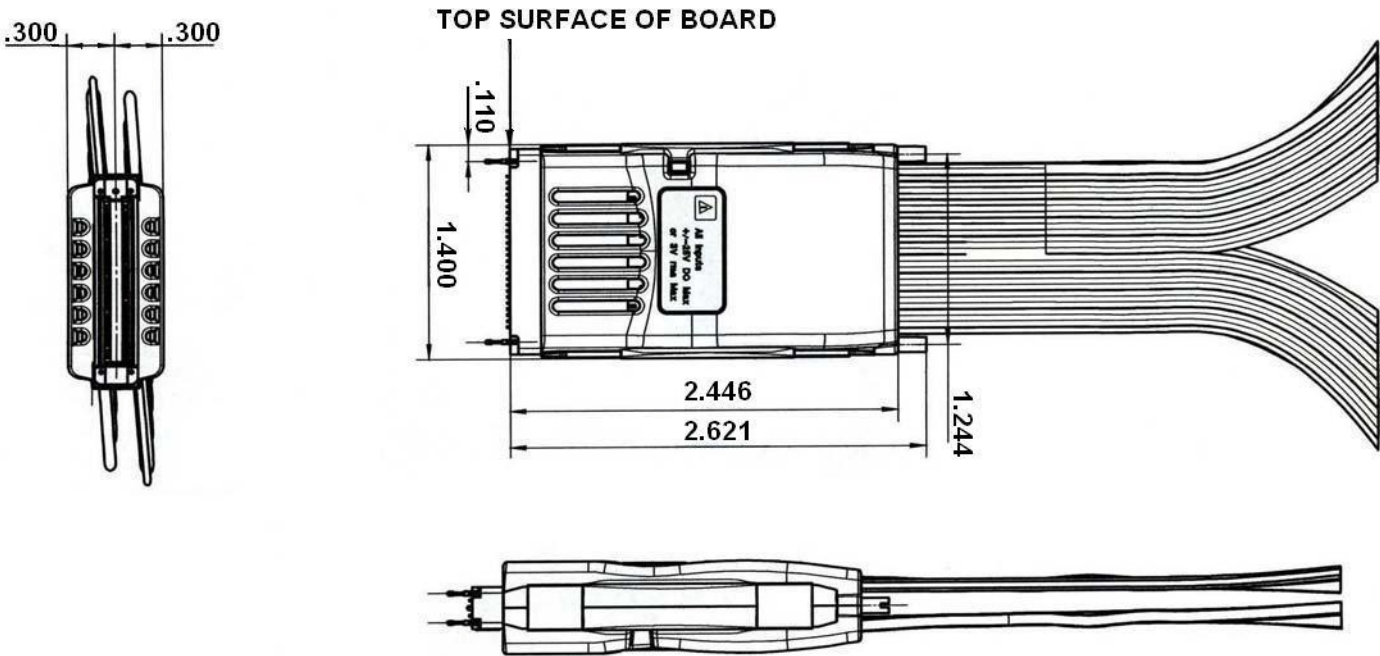


Figure 11 N5345A soft touch probe plugged into the retention module

The following figure displays the retention module.

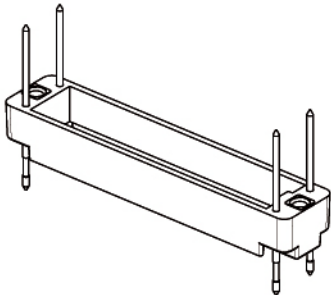


Figure 12 Retention module

The following figures show the dimensions of the retention module from different views.

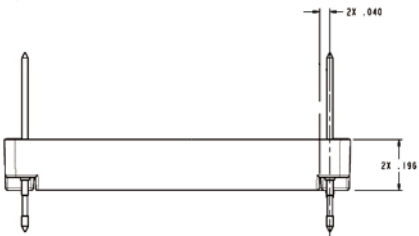


Figure 13 Dimensions of the Retention Module and its Parts

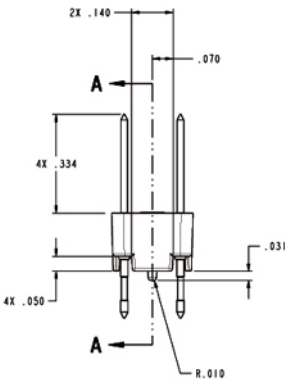


Figure 14 Dimensions of the Retention Module and its Parts

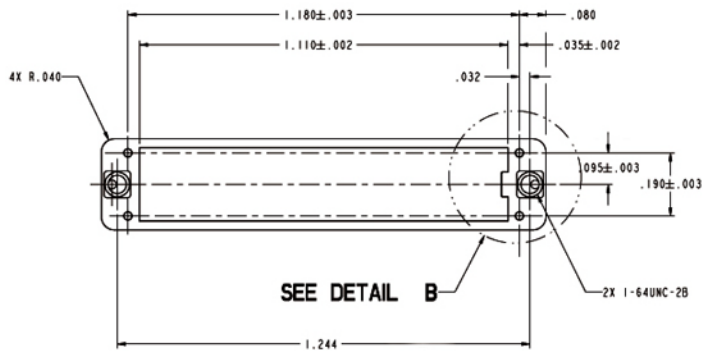


Figure 15 Dimensions of the Retention Module and its Parts

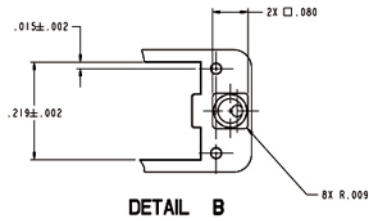


Figure 16 Dimensions of the Retention Module and its Parts

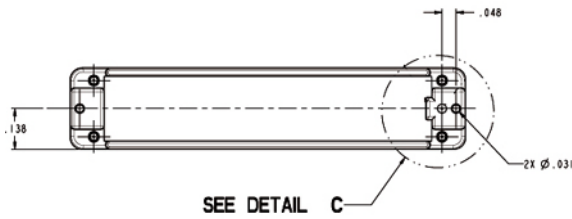


Figure 17 Dimensions of the Retention Module and its Parts

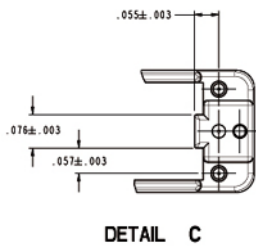


Figure 18 Dimensions of the Retention Module and its Parts

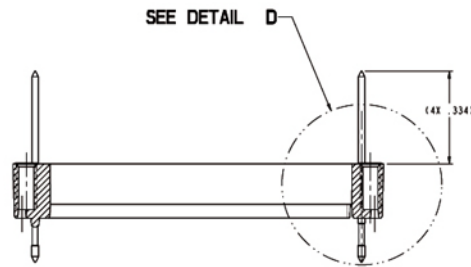


Figure 19 Dimensions of the Retention Module and its Parts

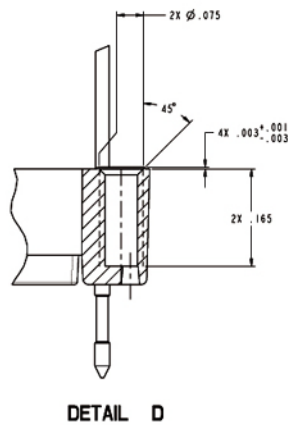


Figure 20 Dimensions of the Retention Module and its Parts

Electrical Design

This section contains electrical design details for the N5345A soft touch probe. These details include analyzer eye requirement definition, system impact due to probe presence, pin assignments, suggested routing patterns, and load models.

- ["N5345A Soft Touch Probe with an Analyzer Interface"](#) on page 34
- ["N5345A probe placement within system topology"](#) on page 34
- ["DigRF v4 Interface N5345A Soft Touch Probe Pin Assignments"](#) on page 36
- ["Suggested Routing Patterns"](#) on page 37
- ["Load Models"](#) on page 41

N5345A Soft Touch Probe with an Analyzer Interface

Logical probing of the DigRF v4 interface is achieved through tapping a small amount of energy off the probed signals and channeling this energy to the analyzer. In order to avoid excessive loading conditions, the use of tip resistors, or isolation resistors, is employed. These relatively high impedance tip resistors enable the analyzer to sample bus traffic without significantly loading the probed signals. A high-level block diagram of a generic DigRF v4 interface bus with an analyzer interface is given in the following figure.

NOTE

This diagram would be repeated for each differential pair within a DigRF v4 interface.

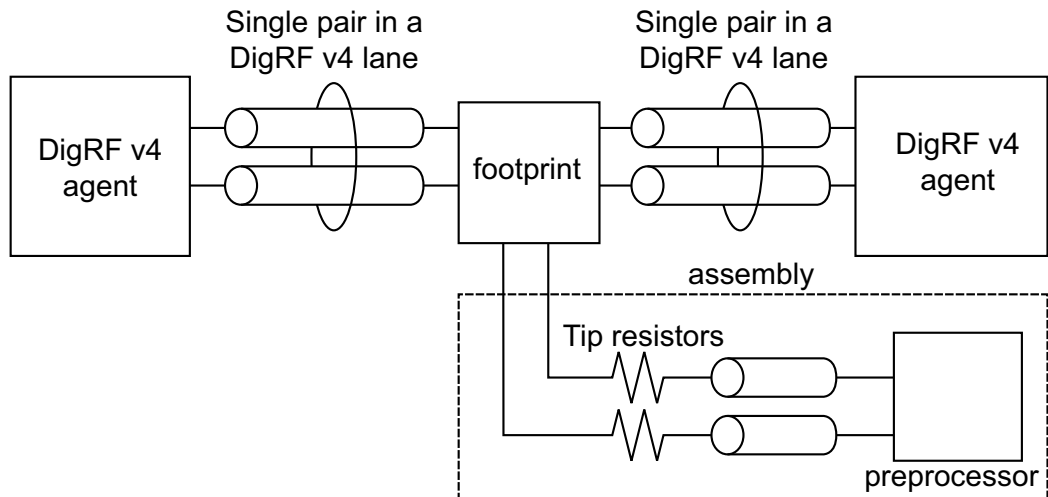


Figure 21 Block diagram example of a DigRF v4 interface with an analyzer

N5345A probe placement within system topology

In order for the analyzer to reliably capture logical transactions on the bus, adequate signal eye must be made available to the N5345A soft touch probe. It is incumbent upon the platform designers to ensure that sufficient signal eye is available to the probe while the probe load is in place so that proper signal capture can be performed. This must be verified via electrical simulation utilizing the load model provided in "[Load Models](#)" on page 41.

The eye requirements are measured by eye height and eye width, forming a diamond shape. These requirements are described pictorially in the following figure.

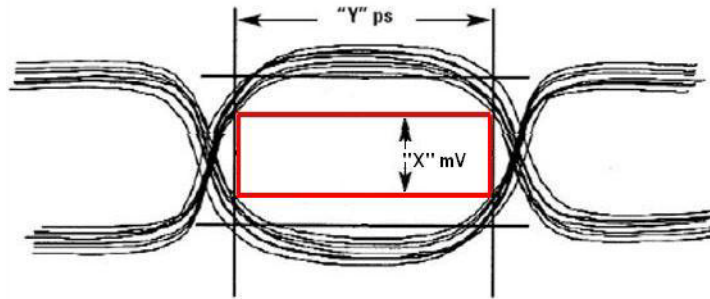


Figure 22 Example of eye specifications as seen at the N5345A probe pad

The following table details the specific eye requirements for Agilent Technologies. Address questions to Agilent Technologies for the most current eye requirements.

Table 5 DigRF v4 interface soft touch footprint placement interconnect specification

| | Agilent Technologies Specification |
|--|--|
| Min. eye height at soft touch pad ¹ | 60 mV |
| Min. eye width at soft touch pad | 0.6 UI (120 ps at soft touch footprint), that is, Jitter tolerance of 0.4 UI |
| Length matching requirements of the P/N sides of the differential pairs ² | ±5 mil |
| Length matching requirements -pair to pair | same as DigRF v4 interface specification |
| ¹ Measured in differential units, for example, $V_{ppdiff} = 2 \cdot (V_p - V_n) $ ² Interconnect must length match ±5 mils from source to soft touch footprint pad for each polarity of the differential pair | |

The eye characteristics given in the above table must be maintained for all probed channels, regardless of direction. Overall, these soft touch placement specifications limit the electrical distance between the driver pin and the probe attach point. Conceivably, probing both directions in lanes of a long DigRF v4 interface link may require two separate footprints and probe assemblies, while probing both directions of relatively short links may be accomplished with one probe. Regardless of implementation, refer to usage restrictions as listed in the "Overview and Configuration Support" section. The same soft touch eye requirements exist for all links substrates (for example, FR4, cables, etc.).

DigRF v4 Interface N5345A Soft Touch Probe Pin Assignments

There is flexibility in the arrangement and layout of the soft touch footprint. Agilent will provide configuration of the probe to support the following pin layouts. There is a detailed view of these connections below.

The pinout for the DigRF v4 interface N5345A soft touch probe is shown in the following table. It is imperative that designers understand there is some freedom associated with the pin/signal assignment relationship. These notes are given here:

| | |
|--|---|
| Footprint channel vs. lane/link designations | <ul style="list-style-type: none"> • Channel = either an upstream OR downstream differential pair for a given lane • C<letter> = the designator for a Channel which accepts a given differential pair of signals • C<letter><'p' or 'n'> = the two signals of the differential pair. The signals within a given pair may be assigned to either 'p' or 'n' regardless of polarity |
| General rules for signal pair assignment | <p>The differential pairs that make up the DigRF v4 interface links must be assigned to specific pins of the footprint. However, there is some freedom in this pair assignment in order to minimize routing constraints on the platform. Additionally, note that the channel to footprint assignment configuration is closely related to the "direction" of the probed link. More specifically, a bi-directional pin assignment is different from a unidirectional pin assignment. See the following table and routing pattern diagrams contained in this section for more information.</p> |

The DigRF v4 interface provides general probing to suit different footprints on DUT.

Table 6 General DigRF v4 Interface N5345A soft touch probe pinout

| Pin# | Signal name | Pin# | Signal name |
|-----------|-------------|-------|-------------|
| | | G1 | GND |
| 2 | GND | 1 | V4_LS_RX0p |
| 4 | V4_LS_TX0p | 3 | V4_LS_RX0n |
| 6 | V4_LS_TX0n | 5 | GND |
| 8 | GND | 7 | V4_LS_RX1p |
| 10 | V4_LS_TX1p | 9 | V4_LS_RX1n |
| 12 | V4_LS_TX1n | 11 | GND |
| 14 | GND | 13 | V4_HS_RX0p |
| 16 | V4_HS_TX0p | 15 | V4_HS_RX0n |
| 18 | V4_HS_TX0n | 17 | GND |
| 20 | GND | 19 | V4_HS_RX1p |
| 22 | V4_HS_TX1p | 21 | V4_HS_RX1n |
| 24 | V4_HS_TX1n | 23 | GND |
| 26 | GND | 25 | V3_RXp |
| 28 | V3_TXp | 27 | V3_RXn |
| 30 | V3_TXn | 29 | GND |
| 32 | GND | 31 | NC |
| 34-48, G2 | NC | 33-47 | NC |

Note: V4_LS... and V4_HS... are the same signals that are required to be routed to more than one pin. The V4_LS... pins capture SYS BURSTs while the V4_HS... pins capture HS BURSTs.

Suggested Routing Patterns

Based on what type of traffic (low speed or high speed) you want to capture, you can implement the required routing patterns through soft touch footprints. This section describes how you should assign the differential pairs of signals to specific pins of the soft touch footprint to get the desired routing pattern.

Low Speed (SYS-BURST) only routing pattern

If you want to capture only the low speed (SYS-BURST) traffic, then you can use a single soft touch footprint to implement a routing pattern. The following diagram illustrates such a low speed only routing pattern.

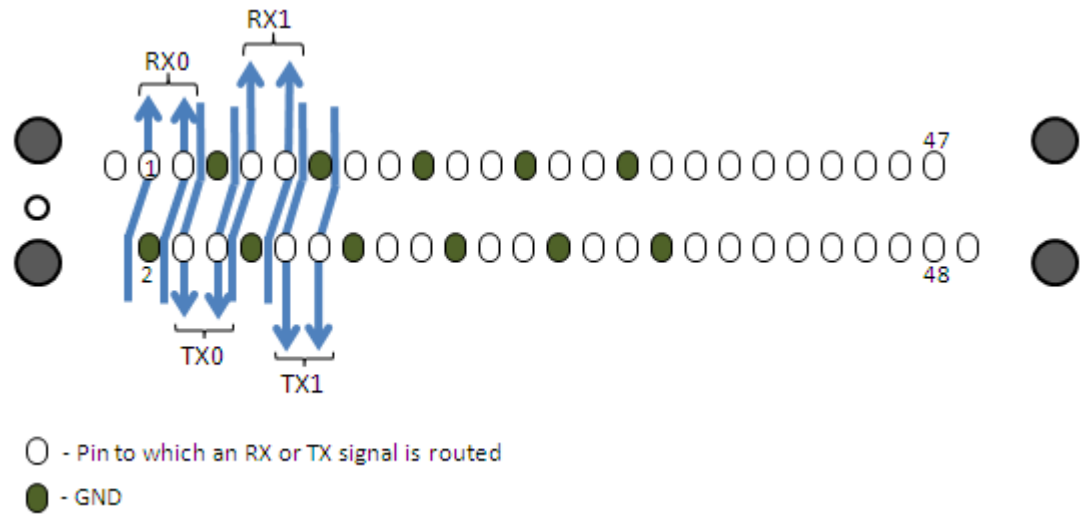


Figure 23 Low speed (SYS BURST) only routing pattern

Notice that the differential pairs of signals are assigned to specific pins on the footprint. RX0 comprises of V4_LS_RX0p and V4_LS_RX0n signals assigned to pin 1 and 3 respectively and TX0 comprises of V4_LS_TX0p and V4_LS_TX0n signals assigned to pin 4 and 6 respectively. Similarly, RX1 comprises of V4_LS_RX1p and V4_LS_RX1n signals assigned to pin 7 and 9 respectively and TX1 comprises of V4_LS_TX1p and V4_LS_TX1n signals assigned to pin 10 and 12 respectively.

High Speed (HS- BURST) only routing pattern

If you want to capture only the high speed (HS-BURST) traffic, then you can use a single soft touch footprint to implement a routing pattern. The following diagram illustrates such a high speed only routing pattern.

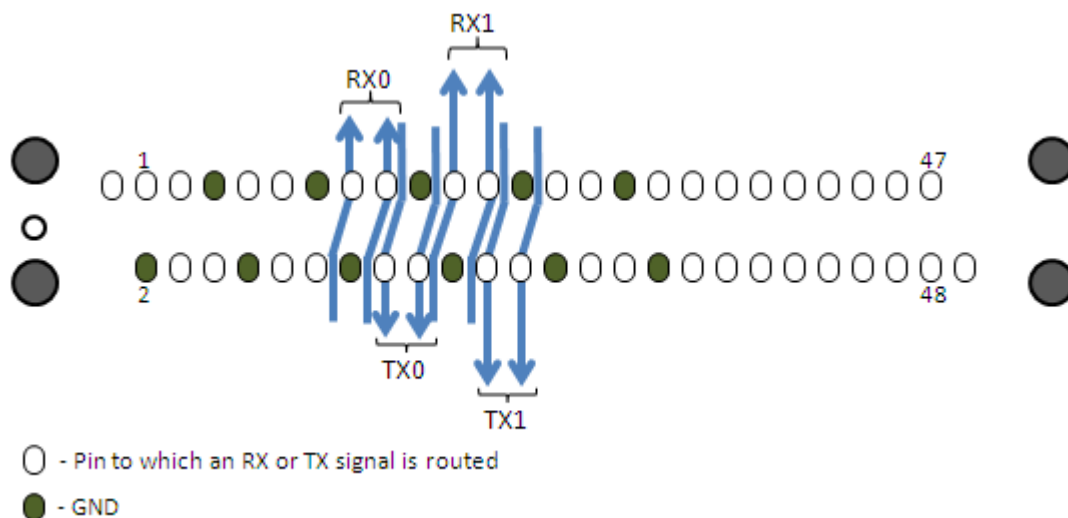


Figure 24 High speed (HS-BURST) only routing pattern

Notice that the differential pairs of signals are assigned to specific pins on the footprint. RX0 comprises of V4_HS_RX0p and V4_HS_RX0n signals assigned to pin 13 and 15 respectively and TX0 comprises of V4_HS_TX0p and V4_HS_TX0n signals assigned to pin 16 and 18 respectively. Similarly, RX1 comprises of V4_HS_RX1p and V4_HS_RX1n signals assigned to pin 19 and 21 respectively and TX1 comprises of V4_HS_TX1p and V4_HS_TX1n signals assigned to pin 22 and 24 respectively.

Both High speed and Low speed routing pattern

If you want to capture both high speed and low speed traffic at the same time, then you may design two soft touch footprints (one for high speed traffic and the other for low speed traffic). Then based on the type of traffic you are capturing, you can move the soft touch probe to the footprint that you designed for that traffic type. The following two options are available to implement this type of routing pattern when both HS and LS traffic is to be captured at the same time.

- **Option 1 - Two layers and longer stubs**

In this option, two different trace layers are used to connect the lanes to each of the HS and LS probe paths. In contrast to Option 2 below, the stubs are longer in this pattern. The following diagram illustrates such a routing pattern.

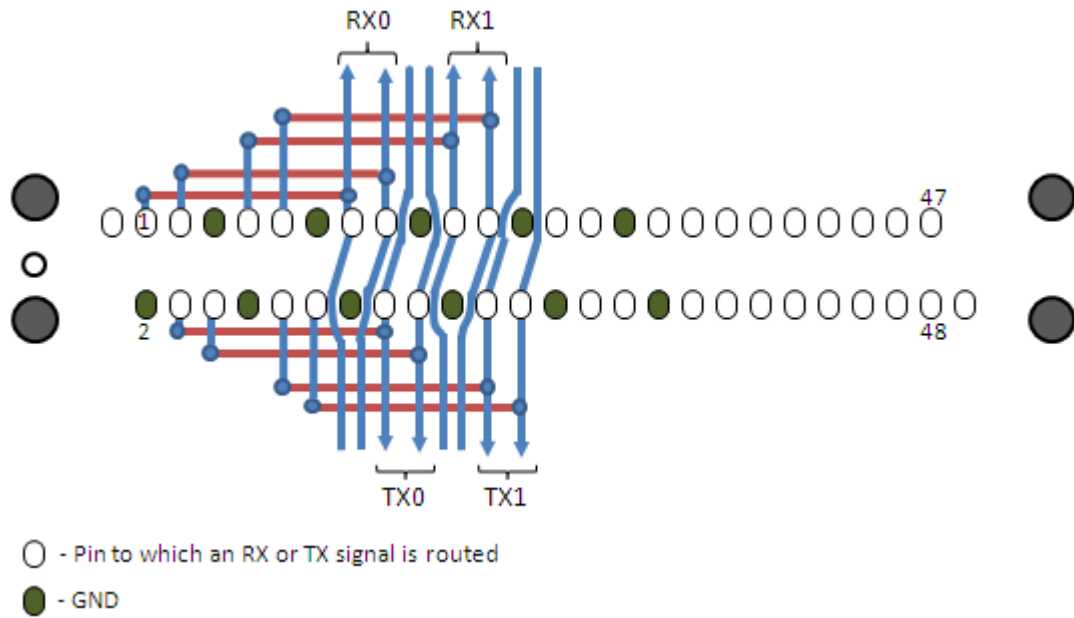


Figure 25 High speed and Low speed routing pattern with two layers and longer stubs

- **Option 2 - Two layers and shorter stubs**

In this option, two different layers with shorter stubs are used for high speed and low speed traffic. The following diagram illustrates such a routing pattern.

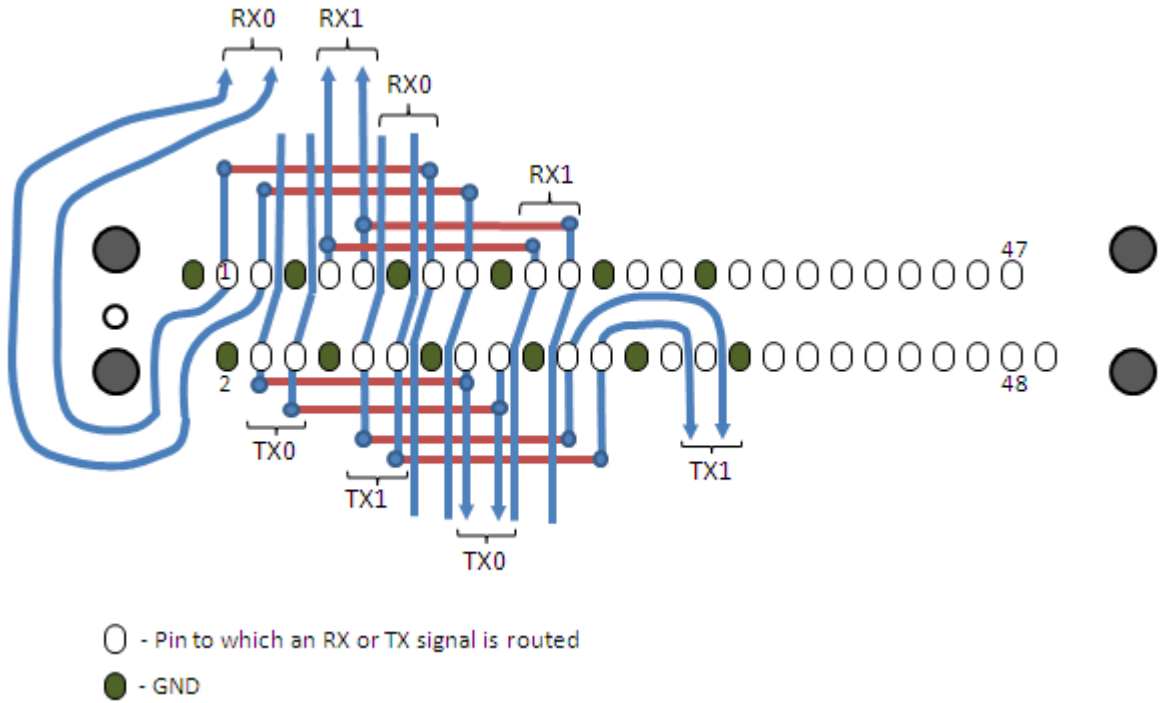


Figure 26 High speed and Low speed routing pattern with two layers and shorter stubs

Load Models

The Agilent Technologies load model for the N5345A soft touch probe is given in the following figures. These models are subject to change. For the most current models, it is recommended that the platform designers contact Agilent Technologies directly.

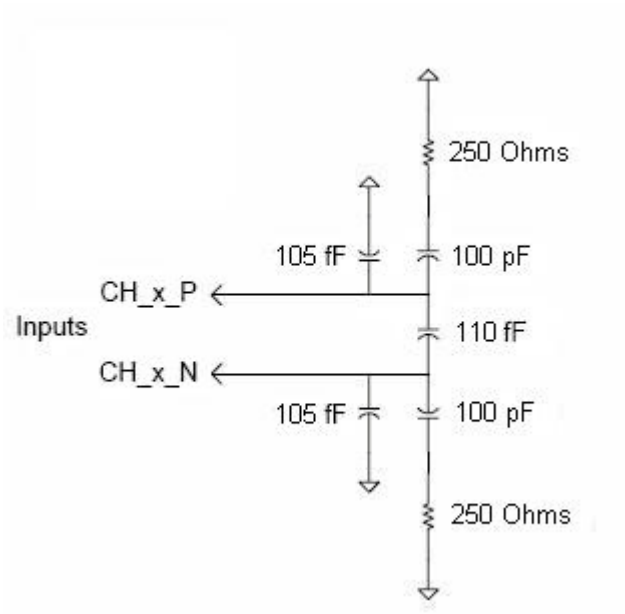


Figure 27 N5345A High Speed path load model

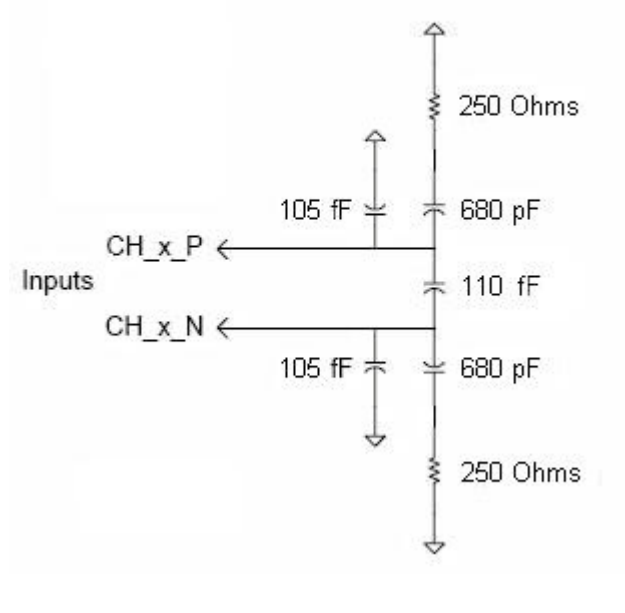


Figure 28 N5345A Low Speed path load model

N5346A Flying Lead Probe

The N5346A flying lead probe is a probing solution for the N5344 I/O module, which you can use in situations where it is difficult to use the N5345A soft touch probe.

The N5346A flying lead probe allows probing of individual lanes, regardless of where they are routed. This eliminates the need to have signals routed to one probing point.

Figure below shows the N5346A flying lead cable set for DigRF v4 protocol tester.

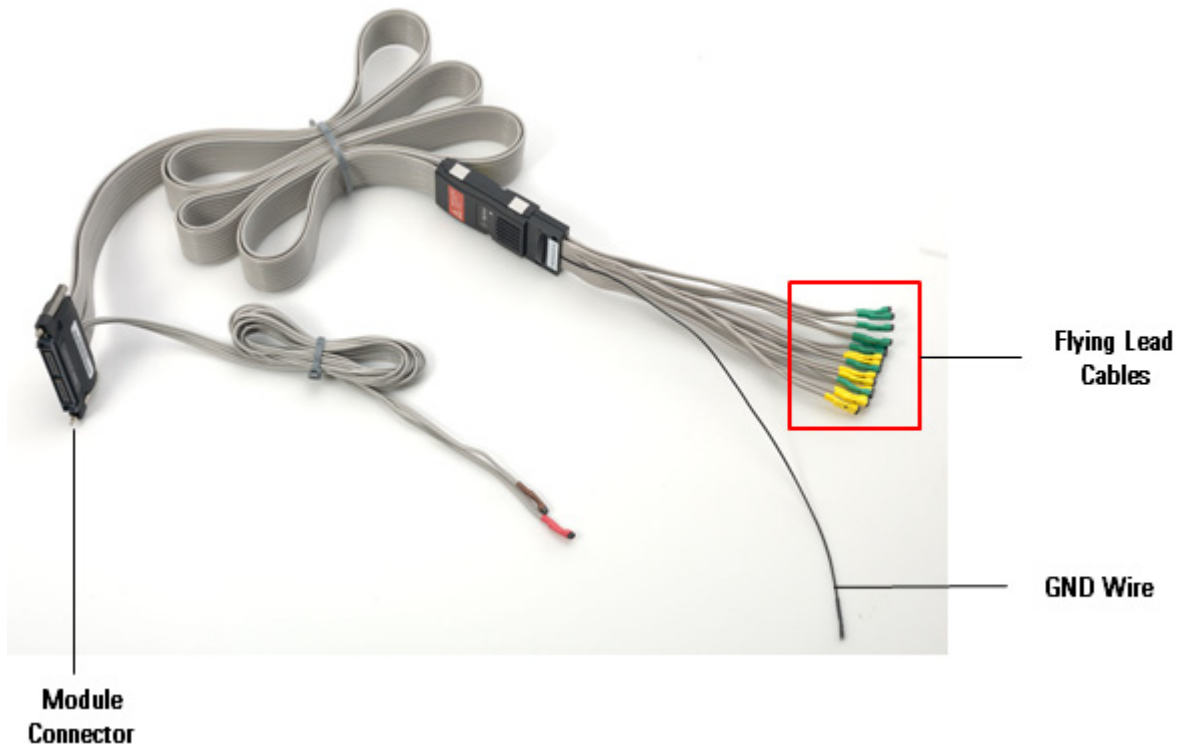


Figure 29 N5346A Flying Lead Probe

The components shown in Figure above are described below:

- **Module Connector**– This component connects to the Analyzer Probe component of the N5343A I/O module.
- **Flying Lead Cables**– This component connects to DUT. There are 16 flying lead cables that you can use to connect to DUT via resistors.

- **GND Wire** - This component connects to a ground node via the grabber tip shipped with the probe. The GND wire is used to connect the N5344A Analyzer module's ground to the DUT ground thereby completing the ground loop. If the GND wire is not used, large glitches might be introduced between the DUT and Analyzer module that can result in the input level of the probe being exceeded, thereby damaging the probe.

Setting up the probe

It is recommended that you make the ground connection before connecting the flying lead cables of the probe to the DUT and before powering up the DUT.

To make the ground connection

- 1 Connect the GND wire to the ground node via the grabber tip (part number *5090-4832*) shipped with the probe.

NOTE

Use a ground node that is as close as possible to the signals being probed. This reduces excessive capacitance in the signal path.

To connect the flying lead cables of the probe to DUT

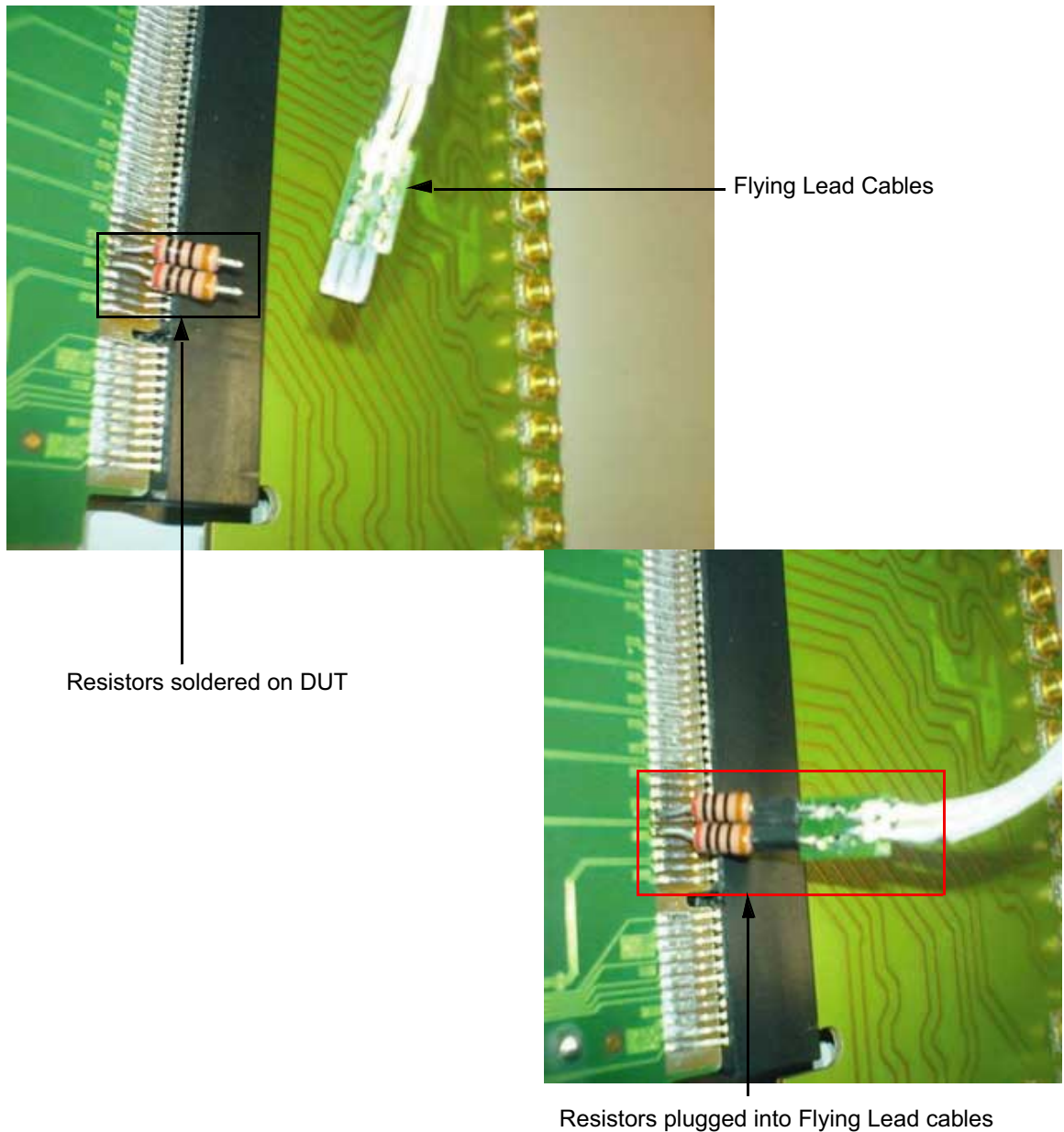


Figure 30 Flying Lead Cables using Resistors to connect with DUT

As shown in the previous figure, the one end of resistors is first soldered onto DUT, and the other end is plugged into the flying lead cables.

The following list provides more information about the N5346A flying lead probe set:

- Its length is 60 inches (152.4 cm), and the length of its flying lead cables is 5.9 inches (15 cm).
- It is supplied with the E5381- 82101 Flying Leads Resistor Kit.

- It is supplied with the grabber tip (part number 5090-4833). This tip is used to connect the GND wire of the probe to a ground node.
- It allows probing of individual lanes, regardless of where they are routed. This eliminates the need to have signals routed to one probing point.
- It uses solder- on resistors for reference clock connections.
- Probe as close as possible to the receiver on the link.
- When soldering resistors, keep the channel side of the resistor as short as possible, as it will act as a stub and create reflection. However, the length of the probing resistors should match by +/- 1 mm.
- Make sure that all resistors used to probe the channels on one direction of a DigRF v4 interface link are placed in the same relative places. Symmetry between the two paired resistors is very important.

WARNING

Do not directly touch any component on the N5346A flying lead cable set. It may be hot.

CAUTION

Components on the N5346A flying lead cable set 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.

- See Also**
- ["Resistor Dimensions"](#) on page 46
 - ["Lane Mapping"](#) on page 47
 - ["Characteristics"](#) on page 49

Resistor Dimensions

The following figure shows the dimensions of the resistors (E5381-82101 Flying Leads Resistor Kit), that come with the flying lead cables.

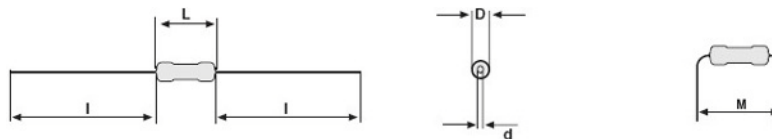


Figure 31 Dimensions of the resistors

NOTE

You can purchase more resistor kits from Agilent Parts Direct using its part number.

The following table provides measurements of the resistor dimensions.

Table 7 Measurements of the resistor dimensions

| Dimension Type | Measurement |
|----------------|-------------|
| Dmax. | 1.6 mm |
| Lmax. | 3.6 mm |
| dnom. | 0.5 mm |
| lmin. | 29.0 mm |
| Mmin. | 5.0 mm |
| MASS | 125 mg |

As given in the table above, the diameter of the resistor ends (dnom.) is 0.5 mm. Therefore, the eye diameter on DUT, to which the one end of the resistor is soldered, should be 0.6 mm to properly hold the resistor. The other end of the resistor, which is plugged into the flying lead cables, should be short enough to avoid it from bending. Additionally, the distance between the eyes on a DUT should be large enough to avoid any contact between adjacently soldered resistors.

The diagram and the highlighted part in the following figure show how you should be connecting resistors with eyes on DUT and flying lead cables.

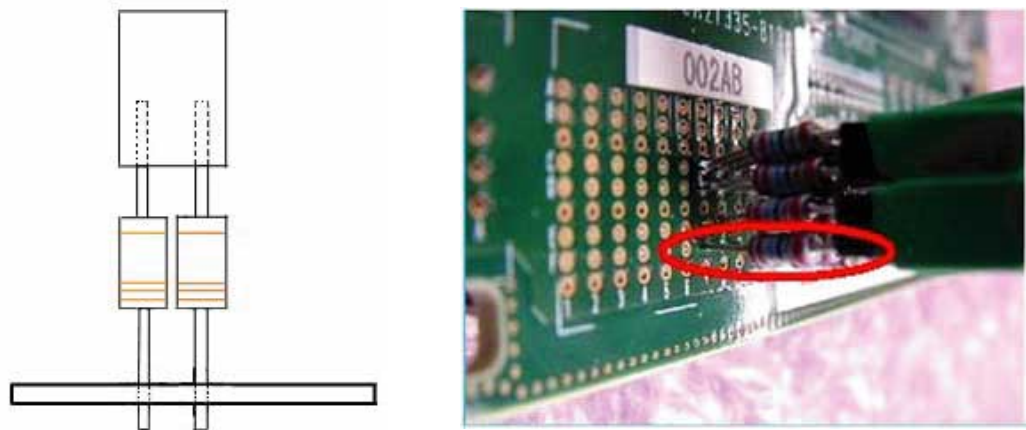


Figure 32 82 ohm resistors attached to signal vias

Lane Mapping

The following table provides the lane mapping information of the flying lead cables.

Table 8 Lane Mapping for N5346A Flying Lead Cables

| Probe Label | DigRF Lane | Probe Label | DigRF Lane |
|-------------|-----------------|-------------|-----------------|
| A0 | V4_LS_RX1 | B0 | V4_LS_TX1 |
| A1 | V4_LS_RX2 | B1 | V4_LS_TX2 |
| A2 | V4_HS_RX1/V3_RX | B2 | V4_HS_TX1/V3_TX |
| A3 | V4_HS_RX2 | B3 | V4_HS_TX2 |
| A4 | V3_RX | B5 | V3_TX |

Note: V4_LS... and V4_HS... are the same signals that are required to be routed to more than one pin. The V4_LS... pins capture SYS BURSTS while the V4_HS... pins capture HS BURSTS.

Load Model

The Agilent Technologies load model for the N5346A flying lead probe is given in the following figures. These models are subject to change. For the most current models, it is recommended that the platform designers contact Agilent Technologies directly.

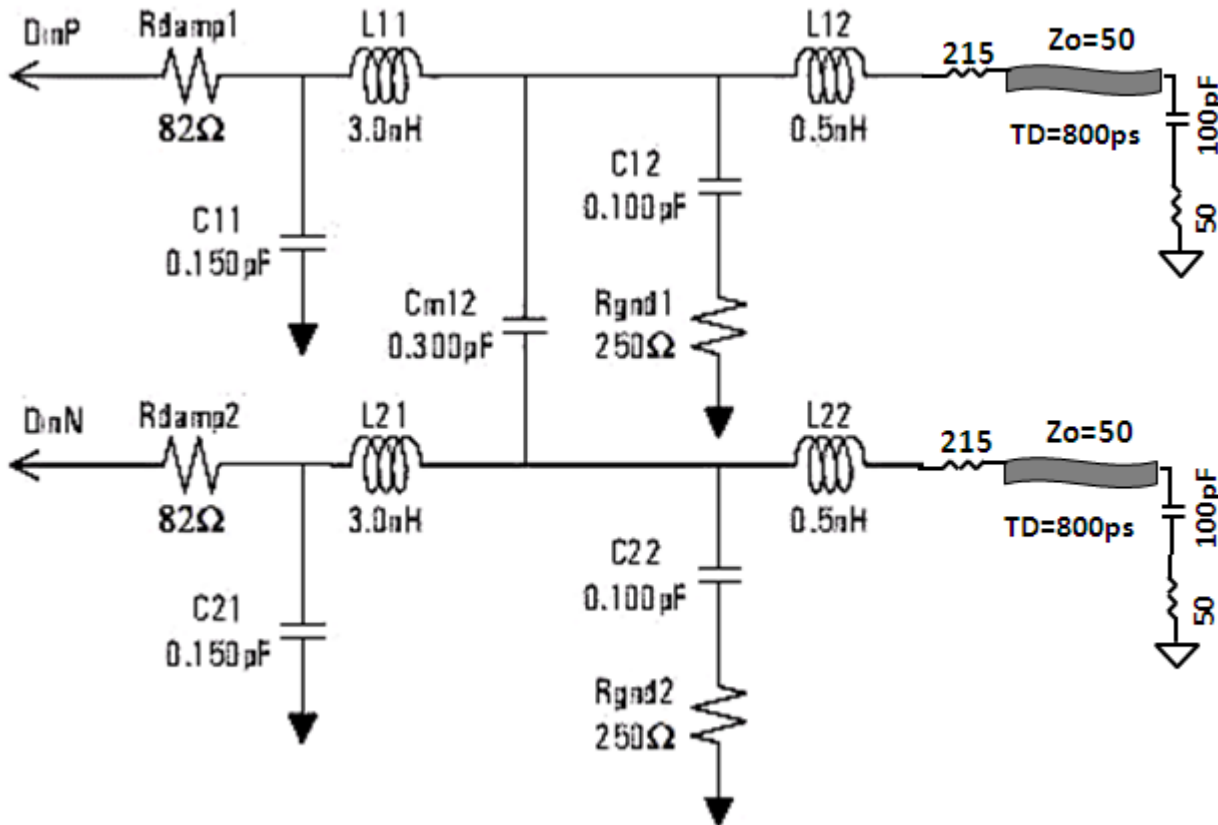


Figure 33 N5346A High Speed path load model

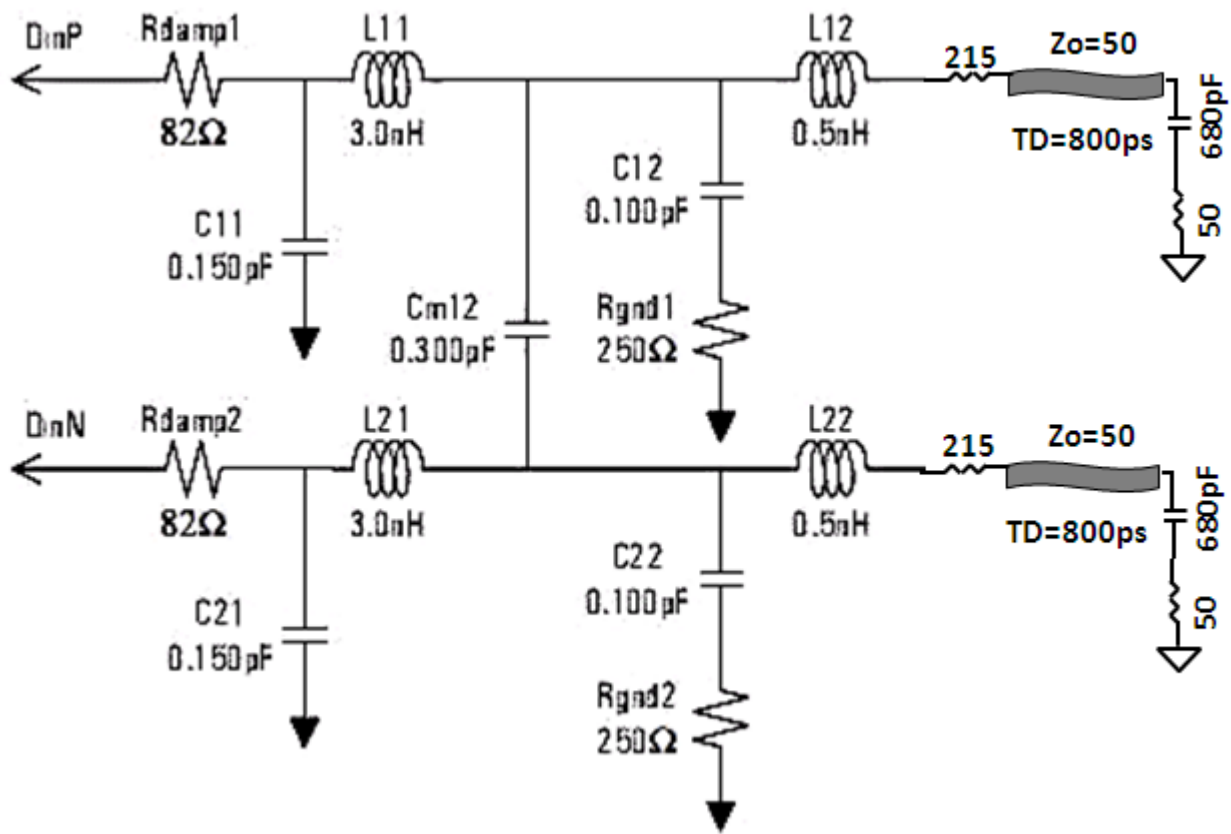


Figure 34 N5346A Low Speed path load model

Characteristics

CAUTION

Carefully read the specifications stated below before setting up the design for N5346A flying lead probe.

| | |
|---------------|---|
| Probe Inputs: | Input Voltage: 25 V max or 3 V rms into 250 Ohms. |
| Temperature: | Operating 0 to 40 Deg C with 200 linear feet per minute airflow. Storage -40 to 70 Deg C. |
| Humidity: | Operating 15% to 95% non condensing. |
| Altitude: | Operating: to 3000 meters (10000 ft). |
| Airflow: | For a single probe with no heat sources within 1 inch, 140 linear feet per minute of air flow is required. For two probes, placed side by side with minimum spacing and no other heat sources within 1 inch, 200 linear feet per minute of air flow is required. |

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