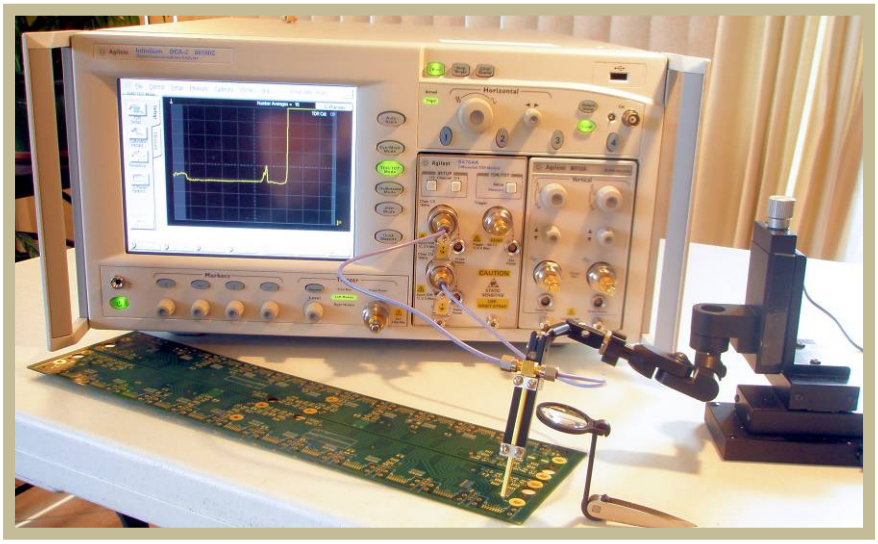
Using the GigaProbes® 30Ghz TDR Hand Probes With the Agilent 86100C DCA-J mainframe 54754A TDR module

Perform Single Ended or Differential Impedance Measurements and Extract Insertion and Return Loss S-parameters on Giga/bit Interconnects

This application note demonstrates how, using the GigaProbes®, a true multi mode 30GHz TDR hand probe, to set up and perform Single Ended or Differential Impedance measurements and extract Insertion/Return loss S-parameters from TDR/TDT measurements on a variety of Gigabit interconnects where direct connection to the Device Under Test (DUT) and the Agilent 86100C DCA-J mainframe TDR modules is not practical.

This document describes how to setup the probes on the DUT and calibrate the GigaProbes® to the Agilent 86100C DCA-J mainframe's and 54754A TDR modules. System component part numbers are provided for each measurement procedure to include test results printouts for each the following Gigabit interconnects:

- **50 ohm Package Testing and Failure Analysis:** Impedance and Comparative FA Analysis Technique
- **10G/bit Molex Ipass SAS/SATA Connector PCB:** Differential and S-parameter Analysis
- **1.5G/bit SATA Cable:** Differential and S-parameter Analysis
- **Differential Coupon Testing:** Differential and S-parameter Analysis



Index

Page # Description

System Components

Test Equipment System Components
Used to make all Application Measurements in this Document

Agilent 86100C DCA-J Mainframe

(2) Agilent 54754A - Differential TDR modules. (Some measurements were made with the (obsolete) 54753A but this module can be replaced with the 54754A for two port TDR/T S-parameter measurements)

DVT Solutions, LLC : DVT30-1MM - GigaProbes®(set of two probes and accessories kit)

DVT Solutions, LLC : DVT24GHZ-10 Qty four (4) 12" - 24Ghz SMA to SMA cables

DVT Solutions, LLC : DVT2650 Qty one (1) 50 ohm SMA Male Load

Agilent Part# N1020A-K05 - Calibration Substrate (50ohm calibrate at probe tips)

The DVT Solutions, LLC SOLT KIT (#TDRSOLTKIT) was used to Calibrate the TDR reference plane to the SMA cable end in this paper. The Agilent N1024A SOLT calibration kit seen below is also recommended for this calibration procedure:

Agilent SOLT kit Product Number: N1024A

N1024A Calibration Kit (3.5mm)		
Device	Qty	Part #
Male Load	2	00902-60003
Male Short	2	0960-0055
Female Load	2	00902-60004
Female Short	2	1250-1834
Cables	2	8120-4948
BNC-M to SMA-F	1	1250-1700
3.5mm F-F	2	5061-5311
Torque Wrench	1	8710-1765

The DVT Solutions, LLC: TDRTSLOTKIT – Qty two (2) each: Female SMA Short, Load, Open, Through)

Probing Solutions, Inc GP2-45-L-12AL-VM - Qty two (2) Probe Manipulator or Cascade Ez-Probe

Probing Solutions, Inc FS-2-VB - Fixed Vacuum Chuck For holding Up To 2" X 2" Device Packages and Small PCB's

Probing Solutions, Inc AVPLN-V1 - Vacuum Pump, Low Noise 45db Dimension 17" Cube (vacuum hold down for GP2-45-L-12AL-VM & FS-2-VB)

Setting TDR Reference Plane

50 ohm Single-Ended TDR:
Set TDR Reference Plane at GigaProbes® Probe Tips

1) Connect the GigaProbes® configured to 50 ohm mode (fig 1) to a SMA Cable

2) Select the TDR/T setup menu on the Agilent 86100C DCA-J mainframe and follow Calibration instructions (fig 2)

3) Use the Agilent Part# N1020A-K05 (Fig 4) Calibration Substrate for the 50 ohm & Short measurement to establish TDR reference plane at probe tips (Fig 3). *Important: Use the 5x micro lens enclosed in the GigaProbes® accessory kit (or equivalent) to visually verify that both probe tips are making contact so excessive force is not applied to either probe tips*

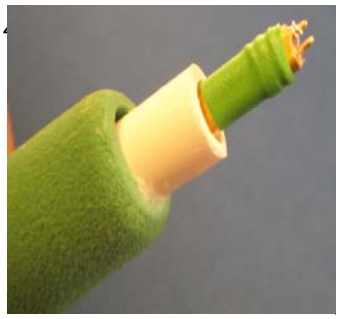


Fig 1) Use 50 ohm conversion kit to short one probe tip to Twin-Ax probe shield. Instructions: http://www.gigaprobes.com/usingaccessories/50ohmprobesetup.html

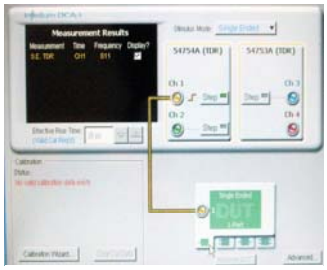


Fig 2) On the Agilent 86100C DCA-J mainframe menu select TDR/T setup. The above display will appear. Select Single Ended and follow calibration instructions

Fig 3) Use the Agilent Part# N1020A-K05 Calibration Substrate for the 50 ohm & Short measurement to establish TDR reference plane at probe tips

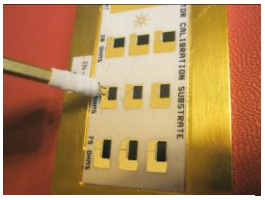


Fig 4) Agilent Part# N1020A-K05 Calibration Substrate

Calibration Results: 50 ohm TDR Reference at Probe Tip

The following screen displays validate the calibration as accurate. Figure 5 demonstrates no load across the probe tips and the orange arrow is the TDR reference plane marker established at the probe tip. Without a load across the probes the waveform appears to oscillate but this oscillation is eliminated when a load is applied across the probe. Several measurements were taken across the Calibration Substrate to validate measurement accuracy.

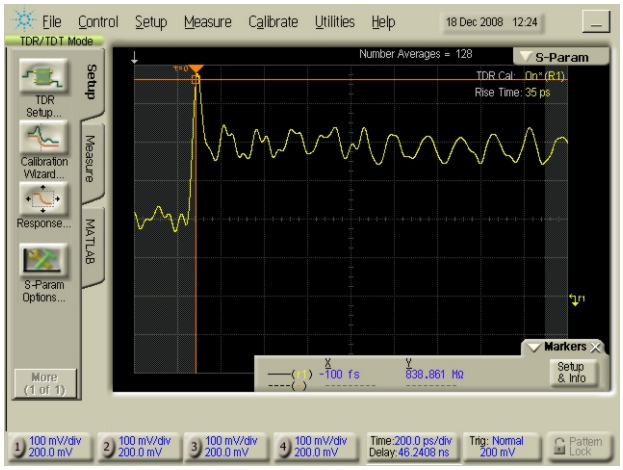


Fig 5) No load on GigaProbes® tip. TDR reference marker is turned on. Turning on a 2nd marker the measurements are reference between the two markers. The Gray out sections are data outside the time base calibration zone. The time base for this setup is 200ps and shows ringing from the probe tips multi path reflections but the ringing is significantly reduced when a lode is applied, as in Fig. 6 (SHORT), Fig. 7 (75 ohm), Fig. 8 (50 ohm) & Fig. 9 (28 ohm).

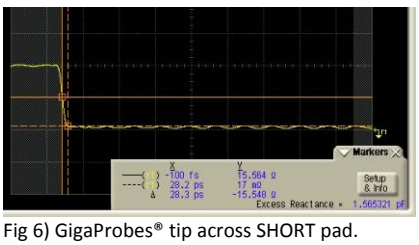


Fig 6) GigaProbes® tip across SHORT pad.

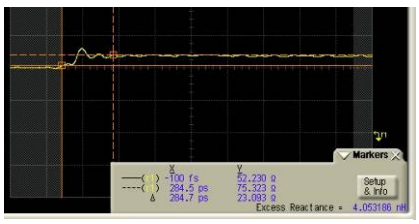


Fig 7) GigaProbes® tip across 75 ohm pad.

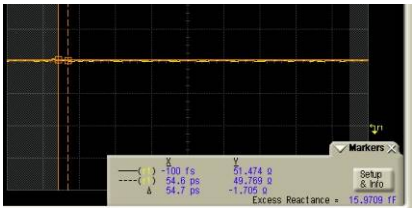


Fig 8) GigaProbes® tip across 50 ohm pad.

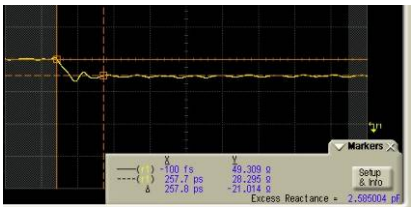


Fig 9) GigaProbes® tip across 28 ohm pad.

Setting TDR Reference Plane

50 ohm Single-Ended TDR:
Setting TDR Reference Plane at Cable SMA End

1) Connect SMA –SMA cables to Agilent 54754A Differential TDR module channel 1 (do not attach probe at this time)
2) Select the TDR/T setup menu (Fig 10) on the Agilent 86100C DCA-J Mainframe, follow calibration instructions
3) Attach to the end of the SMA Cable a Female SMA Load and Short contained in the SLOT kit (Fig 11) when required by the Agilent 86100C DCA-J mainframe TDR reference plane calibration routine.
4) With the TDR reference plane completed, the reference plane is now established at the SMA end of the cable.
5) Take off the SMA adapters and connect a GigaProbes Configured to 50 ohm mode (fig 12)

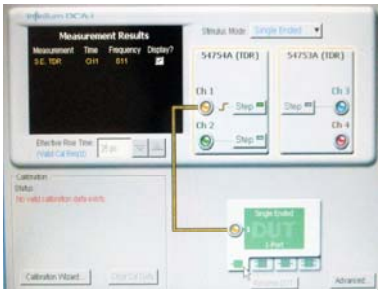


Fig 10) On the Agilent 86100C DCA-J mainframe menu select TDR/T setup. The above display will appear. Select Single Ended and follow Calibration instructions

Fig 11) DVT Solutions LLC TDRSOLTKIT TDR Calibration Kit.

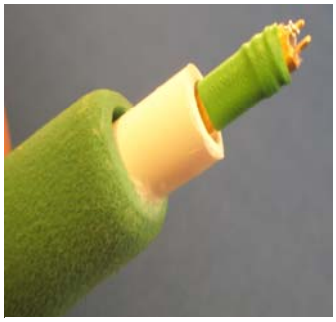


Fig 12) Use 50 ohm conversion kit to short one probe tip to Twin-Ax probe shield. Look up http://www.gigaprobes.com/usingaccessories/50ohmprobesetup.html

Calibration Results: 50 ohm TDR Reference at Cable SMA End

Even though the TDR calibration reference plane was established at the SMA Cable end and not the probe tips, several measurements taken across the Calibration Substrate to validate measurement accuracy were better than 3%. To the established TDR reference plane, turn on marker one and **set** it at the probe tip when probe is not connected (Fig 13). This establishes time Zero. Turn on the 2nd marker to make impedance measurements reference to the 1st marker. Several measurements taken across the Calibration Substrate to validate measurement accuracy were better than 3%.

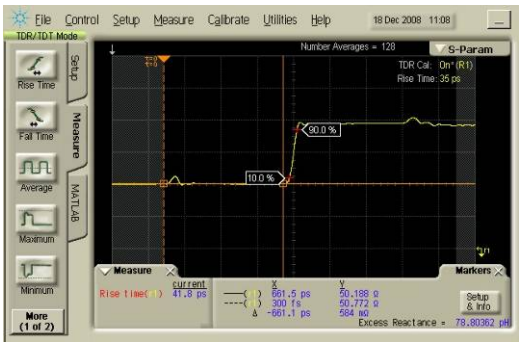


Fig 13) with no load on GigaProbes® probe tips set a TDR reference marker (solid line) to established a TDR reference plane. Turning on a 2nd marker and the measurements are reference between the two markers Measurements were taken to validate the accuracy as show in Figures 14 (SHORT), Fig.) 15 (75 ohm), Fig.)16 (50 ohm).

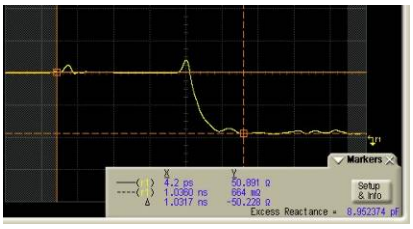


Fig 14) GigaProbes™ tip across SHORT pad.

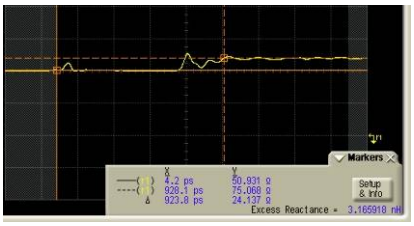


Fig 15) GigaProbes™ tip across 75 ohm pad.

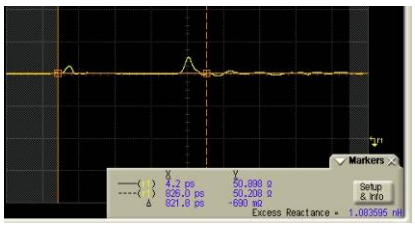


Fig 16) GigaProbes™ tip across 50 ohm pad.

Recommendations: If averaging is being used, the user can simply depress the "Clear Display" button to clear the measurement (clear older data) to validate the measurement has stabilized. Put probes in manipulators when possible. Use the 5x micro lens enclosed in the GigaProbes™ accessory kit (or equivalent) to visually verify that both probe tips are making contact so excessive force is not applied to either probe tip.

Setting TDR Reference Plane

100 ohm Differential TDR:
Set TDR/T reference plane at Cable SMA End

1. Connect Four SMA –SMA cables to the two Agilent 54754A Differential TDR modules (do not attach probes)
2. Select the TDR/T setup menu (Fig 15) on the Agilent 86100C DCA-J mainframe, follow calibration instructions
3. When required, attach to end of the each SMA Cable a Female SMA SHORT, 50 ohm LOAD from the SLOT kit (Fig 17).
4. When required connect Ch1 & Ch3 and Ch2 & Ch4 (Fig 16) using the THROUGH adapters from the SLOT kit (Fig 17)
5. When the TDR/T reference plane is completed the reference plane is now established at the SMA end of each of the cables.
6. Take off the SMA adapters and attach both GigaProbes® configured to 100 ohm mode.

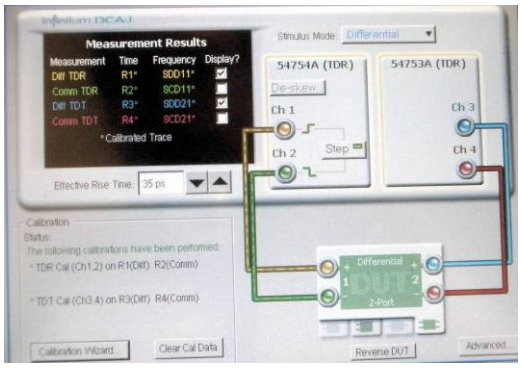


Fig 15) On the Agilent 86100C DCA-J mainframe menu select TDR/T setup. Set Stimulus Mode to Differential and follow calibration instructions

Fig 16) Connect Ch1 & Ch3 and Ch2 & Ch4 when required for the THROUGH calibration

Fig 17) DVT Solutions, LLC TDRSLOTKIT – Qty two (2) each: Female SMA Short, Load, Open, Through). Contains optional Qty two (2) Male 50 ohm loads for TDR module calibration

Calibration Results: 100 ohm TDR Reference at Cable SMA End

Even though the TDR calibration reference plane was established at the SMA Cable end and not the probe tips, measurements taken across the calibration substrate (Fig 18) validates the impedance measurement accuracy are better than 3%. To the established TDR reference plane using markers, turn on marker one and set it at the probe tip when probe is not connected. This establishes time Zero. Turn on 2nd marker to make measurements referenced to the 1st marker as in Fig. 19.

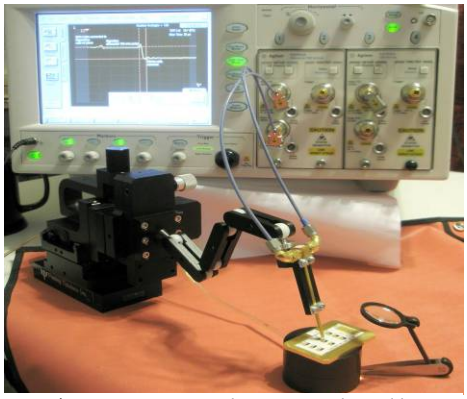


Fig 18) Measurements taken across the calibration substrate validates the impedance measurement accuracy is better than 3%

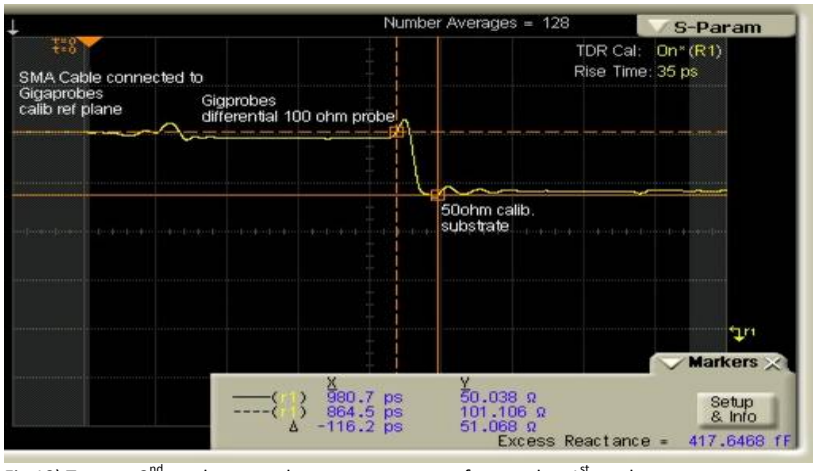


Fig 19) Turn on 2nd marker to make measurements referenced to 1st marker.

Measurement Applications

50 ohm Package Testing and Failure Analysis

1) **Convert the GigaProbes®** to 50 ohm as in Figure 20
2) **Set the TDR reference plane of the GigaProbes®** (at probe tip or at SMA connect end) as described in section 3.
3) ***Hand Probing Packages***: Slip the Ez-Grip (Fig. 22) hand hold adapter over the GigaProbes® and connect the GigaProbes® to the **DVT24GHZ-12** SMA-SMA 12" 24 GHz cable to the Agilent **54754A** TDR module.
4) ***Using a Probe Manipulator***: In this example (figure 21), the GigaProbes® was installed in the **GP2-45-L-12AL-VM from Probing Solutions inc.** or equivalent probe manipulator by removing the Ez-Grip adapter and attaching the GPMMA adapter on the probe manipulator. Loosen the two cross bars on the GPMMA and push the probe forward until the 1st cross bar is over the twin SMA coupler where it attaches to the 100 ohm Twin-Ax coax. Tighten down the 1st cross bar over the Twin coupler and then tighten the 2nd cross bar. Do not tighten 1st cross bar over Twin-Ax coax as this may damage the probe.
5) **Holding the Device Package:** Put Device Package on the **FS-2-VB** - Fixed Vacuum Chuck (Fig 21) that accommodates up to 2" X 2" Device Packages. This Chuck can also be used to secure small PCB's.
6) **Connect the GP2-45-L-12AL-VM and FS-2-VB** - Fixed Vacuum Chuck to the **AVPLN-V1** Vacuum Pump to secure the manipulator and device package to keep from moving during setup and probing. Use the 5x micro lens to locate and probe the pads on the device package.
7) **For a faster TDR pulse**, connect the output of the **Agilent 54754A** 35ps TDR module to the PSPL 4020 or 4022TDRT 9ps pulse module Fig. 23). Connect the GigaProbes® to the pulse head driver for ~ 15 -22ps TDR rise time from the probe (Rt vary depending on couplers and cables use with setup).
8) **Comparative Failure Analysis Technique**: Figure 25 impedance plot shows overlapping known good waveforms from a similar part with a suspect waveform from the defective Device Package to locate failure.

Fig 20) Use 50 ohm conversion kit to short one probe tip to Twin-Ax probe shield.

Fig21) GigaProbes® installed in a probe manipulator to probe a device package held by a vacuum chuck. Results display in Fig 24.

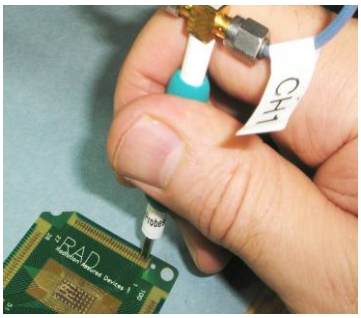


Fig22) Hand probing package with GigaProbes™ with Ez-grip adapter sleeve

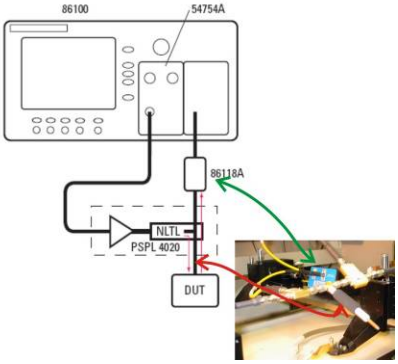


Fig23) ~15-22ps TDR pulse can be achieved by connecting the Agilent 54754A to the PSPL 4000 pulse modules.

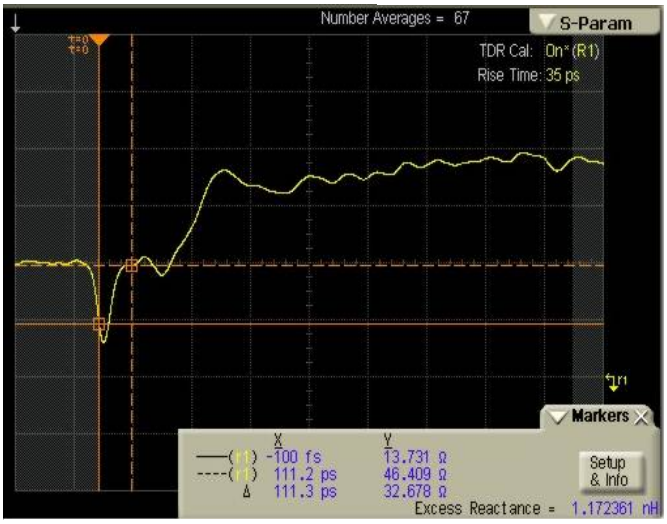


Fig24) GigaProbes® test results of probing a device package. The TDR reference plane was established at the probe tip using the Agilent **SLOT Substrate Part# N1020A-K05**

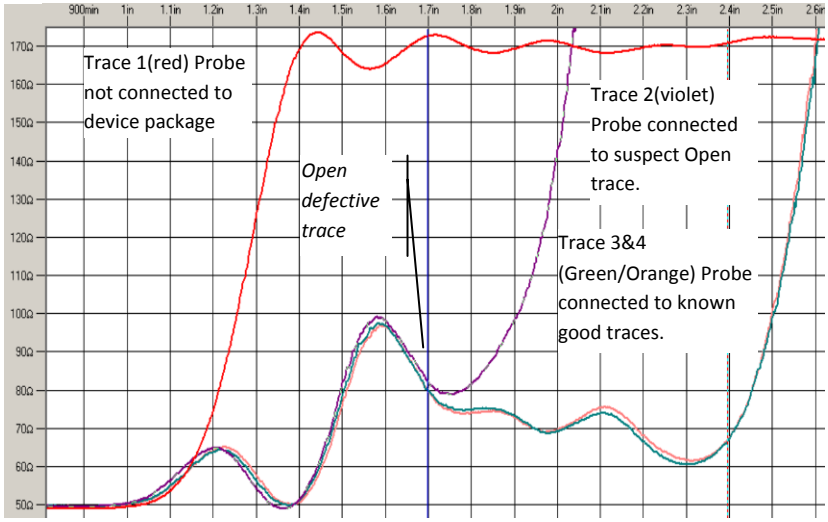


Fig 25) Comparative Failure Analysis Technique: By overlapping known good waveforms from a similar part with a suspect waveform the defective Device Package failure location can be determined. In this case, it is identified as an open trace.

Measurement Applications

10G/bit Molex Ipass SAS/SATA Connector PCB Differential Impedance and S-parameter Analysis

1. **Convert two GigaProbes®** to 100 ohm
2. **Set the TDR/T reference plane of the four cables** to the SMA connector end as described on page 5
3. ***Install the Probes in two probe Manipulators***: In this example (figure 26), the GigaProbes® was installed in two **GP2-45-L-12AL-VM's from Probing Solutions inc.** or equivalent probe manipulator by removing the Ez-Grip adapter and attaching the GPMMA adapter on the probe manipulator. Loosen the two cross bars on the GPMMA and push the probe forward until the 1st cross bar is over the twin SMA coupler where it attaches to the 100 ohm Twin-Ax semi-ridged coax. Tighten down the 1st cross bar over the Twin coupler and then tighten the 2nd cross bar. Do not tighten 1st cross bar over Twin-Ax coax or the probe could be damaged.
4. **Holding the Device Package:** Put SAS/SATA connector on the **FS-2-VB** - Fixed Vacuum Chuck (Fig 27) that accommodates this small PCB connector.
5. **Connect the two GP2-45-L-12AL-VM's and the FS-2-VB** - Fixed Vacuum Chuck to the **AVPLN-V1** Vacuum Pump to secure the manipulator and PCB from moving during setup and probing. Use the 5x micro lens to locate and probe the pads on the device package.
6. Figure 28/29 show differential TDR impedance, TDT measurement, and SAS/SATA connector insertion/return loss

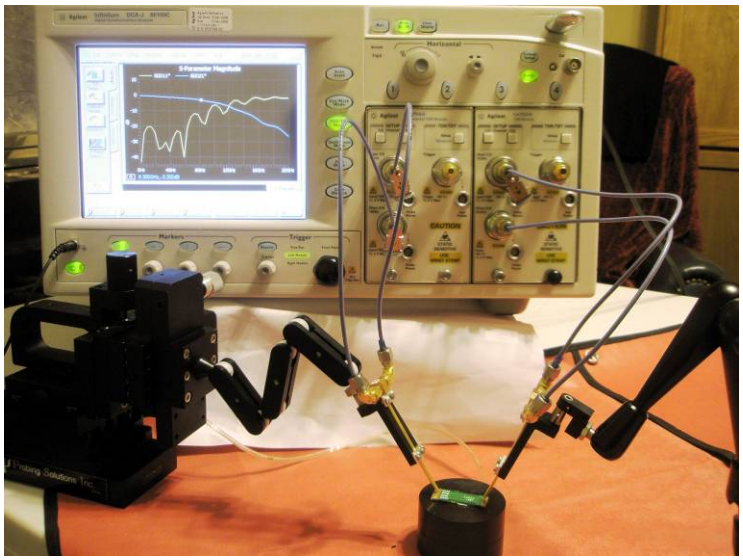


Fig.26) Full setup for hooking up GigaProbes® to make Differential Impedance and two port (SDD11/21) and return and insertion loss measurements. The display on the **Agilent 86100C DCA-J mainframe** shows the two S-parameter plots**.**

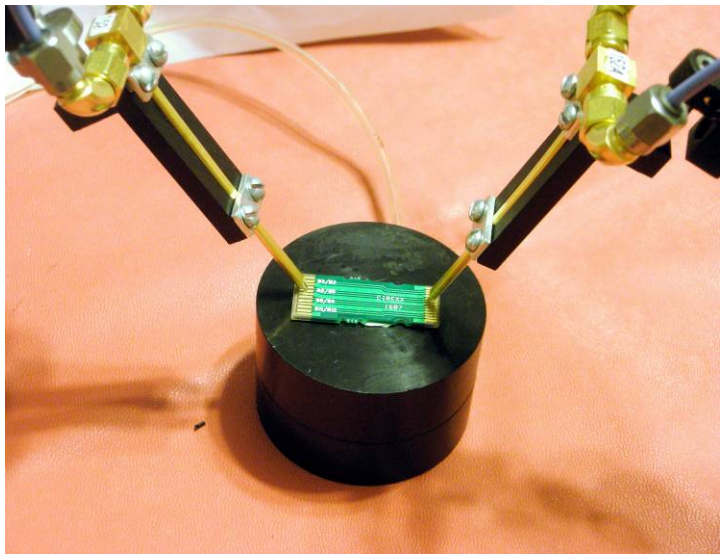


Fig. 27) Close up of the SAS/SATA connector on the **FS-2-VB** - Fixed Vacuum Chuck be being probed by the GigaProbes™.

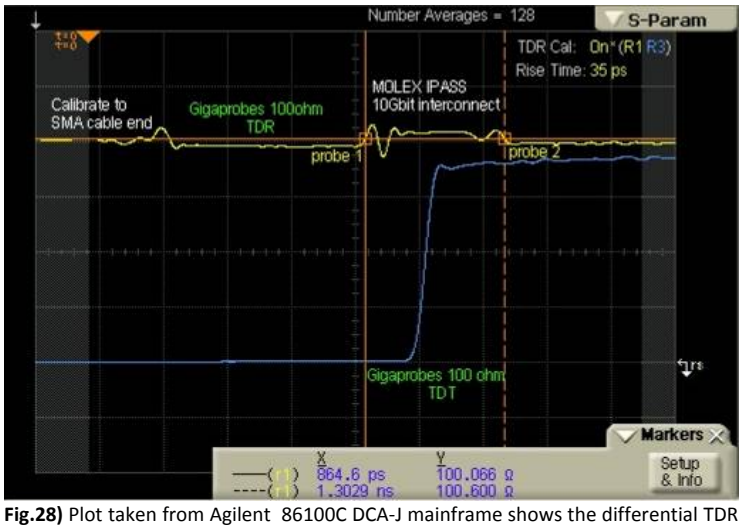


Fig.28) Plot taken from Agilent 86100C DCA-J mainframe shows the differential TDR impedance and TDT SAS/SATA connector measurements. Establish TDR reference plane at the SMA connector end. Establish measurement plan, place curser #1(solid line) where the probe connects to the PCB and use curser #2 (dotted line) to make Impedance measurements.

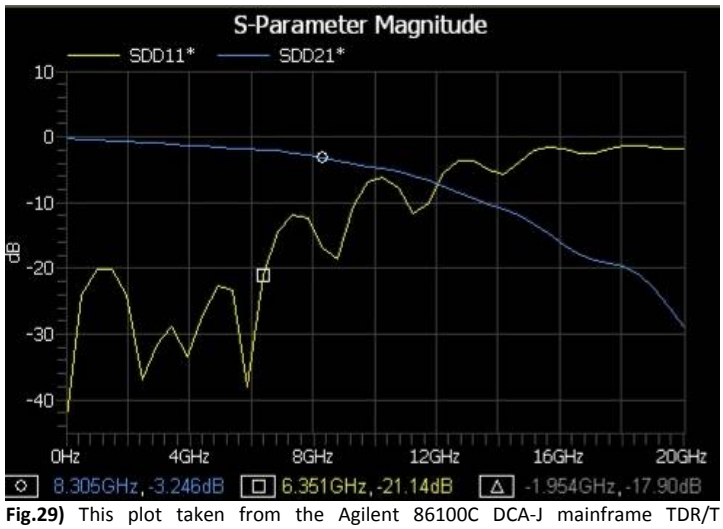


Fig.29) This plot taken from the Agilent 86100C DCA-J mainframe TDR/T measurements (Fig. 28) are then converted to Insertion and Return loss S-parameters to determine the bandwidth parameters.

Measurement Applications

1.5G/bit SATA Cable
Differential Impedance and S-parameter Analysis

1 **Convert two GigaProbes®** to 100 ohm
2 **Set the TDR/T reference plane of the four cables** to the SMA connector end as described on page 5
3 ***Install the Probes in two probe Manipulators***: In this example (figure 30), the GigaProbes® were installed a **GP2-45-L-12AL-VM's from Probing Solutions inc.** and the other probe in a Cascade Ez-Probe manipulator. Remove the Ez-Grip adapter and attach the GPMMA adapter on the probe manipulators. Loosen the two cross bars on the GPMMA and push the probe forward until the 1st cross bar is over the twin SMA coupler where it attaches to the 100 ohm Twin-Ax coax. Tighten down the 1st cross bar over the Twin coupler and then tighten the 2nd cross bar. Do not tighten 1st cross bar over Twin-Ax coax or the probe could be damaged.
4 **Holding the SATA Connectors for probing:** Put both connector ends in a vice (Fig 31) and carefully put enough pressure on them so they are secure. Make sure the connectors pin layouts are complement to each other so pin 1 connector 1 lines up to pin 1 to connector 2.
5 Figure 32/33 shows differential TDR impedance, TDT measurement and insertion/return loss of the SATA cable.

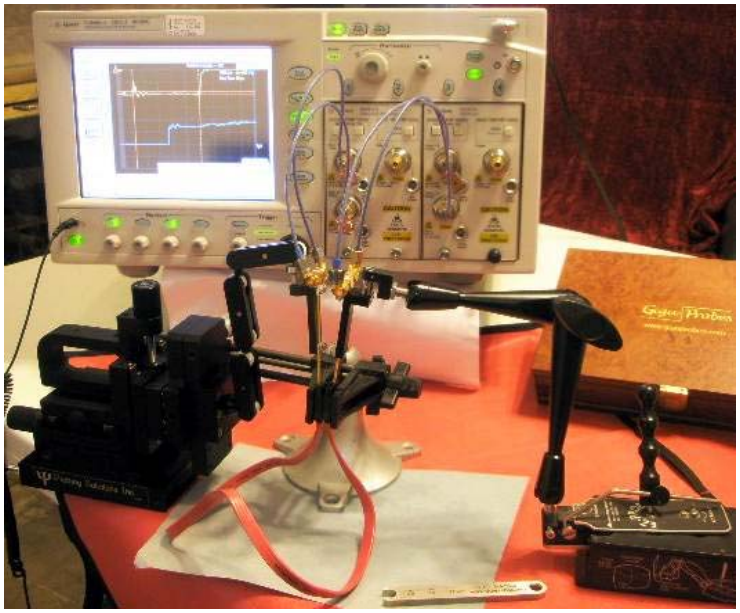


Fig. 30) Picture of the SATA cable test setup uses two different manipulators and a vice to hold the connectors.

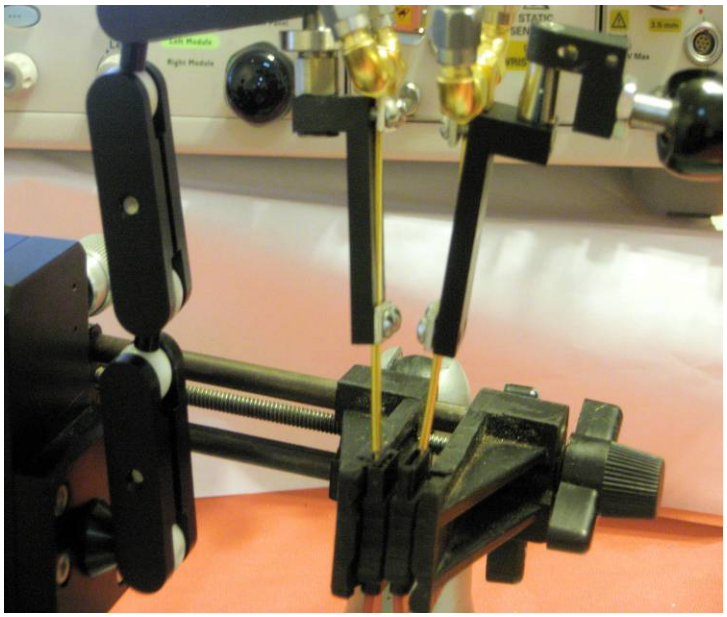


Fig. 31) SATA cables connectors being held in the vertical vice. Both GigaProbes™ are held in place using probe manipulators.

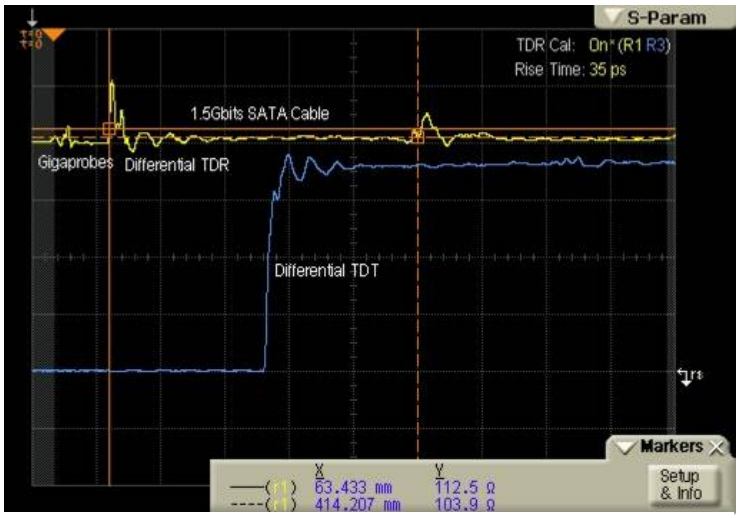


Fig. 32) Plot taken from the Agilent 86100C DCA-J mainframe shows differential TDR impedance and TDT SATA cable measurements. TDR reference plane established at the SMA connector end. To establish a reference plane, curser #1(solid line) is placed where the probe connects to the PCB and use curser #2 (dotted line) to make impedance measurements.

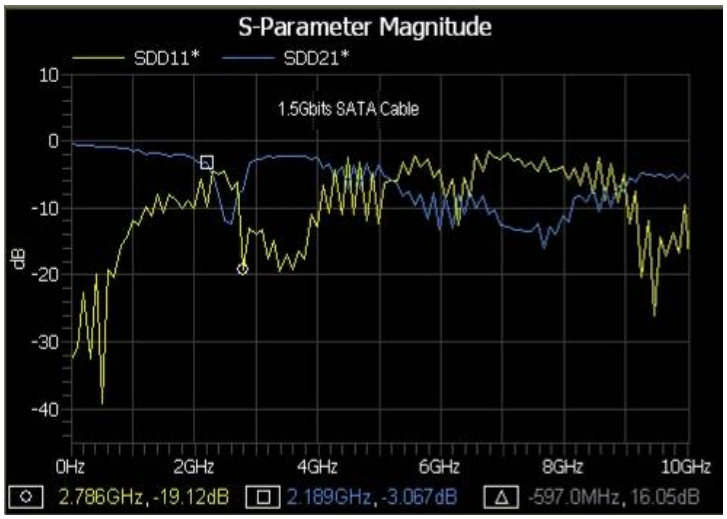


Fig. 33) Plot taken from TDR/T measurements (Fig. 32) are then converted to Insertion and Return loss S-parameters to determine the SATA cable bandwidth parameters.

Measurement Applications

Differential PCB Coupon Testing
Differential Impedance and S-parameter Analysis

1. **Convert two GigaProbes®** to 100 ohm
2. **Set the TDR/T reference plane of the four cables** to the SMA connector end as described on page 5
3. ***Install the Probes in two probe Manipulators***: In this example (figures 34/35), the GigaProbes® was installed in two **GP2-45-L-12AL-VM's from Probing Solutions inc.** and the Cascade EZ-Probe manipulator by removing the Ez-Grip adapter and attaching the GPMMA adapter on each probe manipulator. Loosen the two cross bars on the GPMMA and push the probe forward until the 1st cross bar is over the twin SMA coupler where it attaches to the 100 ohm Twin-Ax coax. Tighten down the 1st cross bar over the Twin coupler and then tighten the 2nd cross bar. Do not tighten 1st cross bar over Twin-Ax coax or the probe could be damaged.
4. **Holding the Test PCB Coupon:** If there is no fixture to hold test coupon use earthquake putty or a piece of tape.
5. Figure36/37 show differential TDR impedance, TDT measurement, insertion/return loss of the 6.2 in test coupon.

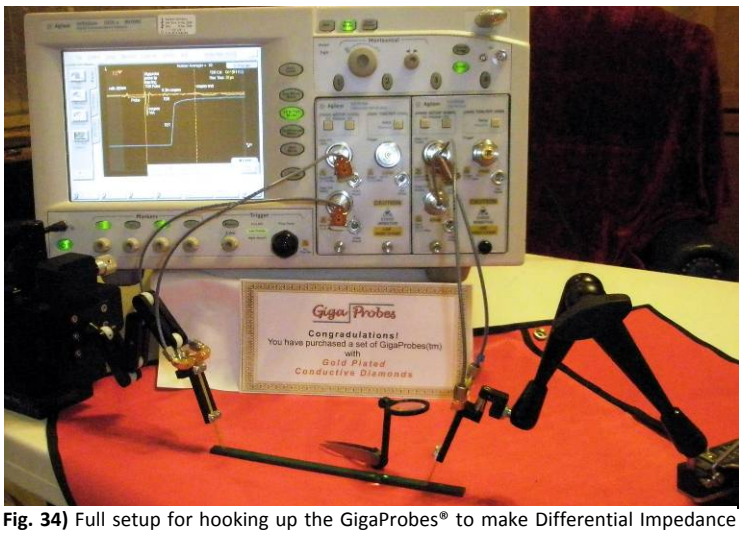


Fig. 34) Full setup for hooking up the GigaProbes® to make Differential Impedance and two port (SDD11/21) and return and insertion loss measurements on a test coupon. The display on the **Agilent 86100C DCA-J mainframe** shows the TDR/T plots.

Fig. 35) Close up of the GigaProbes® connected to each end of the Test PCB coupon. Use the 5x micro lens to carefully place the probe on the test pads.

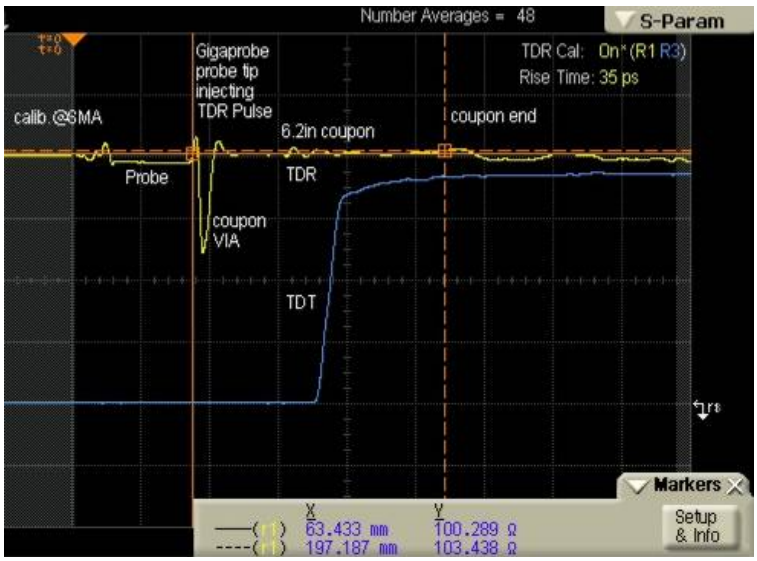


Fig.36) Plot taken from Agilent 86100C DCA-J mainframe shows differential TDR impedance and TDT measurement of the 6.2 inch test coupon. The TDR reference plane was established at the SMA connector end. To establish a measurement reference plane, curser #1(solid line) is placed where the probe connects to the PCB and use curser #2 (dotted line) to make Impedance measurements.

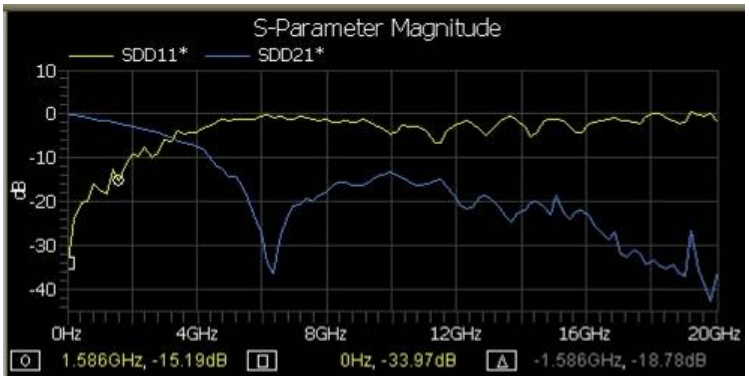


Fig.37) Insertion and Return loss S-parameters plot was derived from TDR/T measurements (Fig. 36) and used to determine the test coupon bandwidth parameters.

Technical References

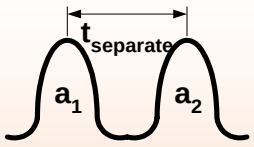
Web Sites
Agilent: http://www.home.agilent.com
GigaProbes: http://www.gigaprobes.com/instrumentcompatibility/agilent.html

Characterization of Standards	Data Rate (Gb/s)	Required bandwidth, GHz
Infiniband, PCI Express	2.50	6.25
SATA II	3.00	7.50
XAUI	3.125	7.813
4 Gb/s FC	4.25	10.63
SATA II	6.00	15.00
Double XAUI	6.25	15.63
8 Gb/s FC	8.50	21.25
10 G Base-R	10.31	25.78
10 G Base-R FEC	11.10	27.75

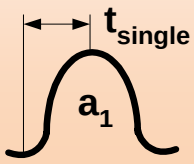
An inner board layer (a stripline) is much more representative of the typical board run. Additionally, it is useful to provide the resolution data for propagation in free air. For stripline, we assume Vp = 0.446xclight=1.34x108, and the resulting resolution data, based on the rule of t_{TDR} /2, is summarized in table below.

Rise time, ps	Resolution in air, mm	Resolution in FR4, buried run (vp=0.446*Clight), mm
10	1.50	0.67
15	2.25	1.00
20	3.00	1.34
28	4.20	1.87
40	6.00	2.68
150	22.50	10.04

Accepted Rules for Resolving Discontinuities using TDR



To resolve a_1 and a_2 as separate discontinuities:
$t_{separate} > t_{TDR\_risetime}$ /2



a_1 is not resolved if
$t_{single} << t_{TDR\_risetime}$

Two discontinuities will be observed as two separate ones if the distance between them is at least half the TDR rise time. There is no similar rule for how small a single discontinuity can be, but such discontinuity cannot be much smaller than half the TDR rise time until it can no longer be resolved. Nonetheless, smaller discontinuities can be analyzed and electrically characterized, but will need relative or comparative TDR measurements to be performed.

Hand Held Probes for Agilent 86100C DCA-J TDR Oscilloscope

30 GHz 100 Ω Differential & 50 Ω Impedance

With Gold Plated Conductive Diamond Probe Tips

DVT30-1MM GigaProbes® (patent pending) multi-mode, 100 Ω Differential or 50 Ω Impedance TDR probe, to capture 30 GHz, ODD/EVEN impedance profiles with a typical differential launch discontinuity of <20 mv and a fall-time of 20ps. The probe masks ~ 0.5 mm of the device under test. This small discontinuity mask becomes significant when characterizing IC packages where net lengths are very short.

The DVT30-1MM comes with a set of cushion grips for comfortable hand probing and comes with accessories to easily attach the probes to articulating arms or most probe manipulators.

The Signal-to-Signal probe pitch can be set to 0.8 mm, 1.0 mm or 1.27 mm using the patent pending Pitch Calibration SMA wrench. The pitch can be customized using other tools supplied in the DVT30-1MM GigaProbes™ accessory kit. The wrench also serves to attach SMA-SMA cables to the probes.

Product Description

DVT30-1MM GigaProbes® are stored in a durable box also containing probe calibration and support accessories. Each DVT30-1MM GigaProbes® kit contains:

Qty 2: 30 GHz TDR Probes (patent pending) Convertible to Single 50 ohm or Differential 100 ohm, with gold plated Conductive Diamond probe tips for repeatable high-bandwidth TDR measurements when probing at ANY angle

Qty 2: GPMMA Attaches probe to Articulating arms or any standard micro-positioner

Qty 1: Stainless Steel 110mm Tweezers for Fine Pitch Probe Adjustments and used to attach ground lead to convert probe to 50 ohms

Qty 1: Desk-Top 5X Macro-Lens Inspection Station

Qty 1: Model 10 SMA Wrench (patent pending) with Quick Calibrator Holes to set probe pitch and planarize probes to 0.8 mm, 1.0 mm, or 1.27 mm

Qty 2: Hand Held Probe Sleeve Adapters with EZ-Hold Foam Cushions

Qty 4: Right Angle SMA Elbows for easy routing of TDR of SMA cables

Qty 1: 50 ohm conversion kit includes 2 SMA shorting caps, ground strap and shrink wrap.

Qty 2: Cable Routing Sleeve to combine SMA cables for easy cable management

Features & Benefits

30 GHz Bandwidth

True Odd Mode 100 ohm Differential Input Impedance

Probe can be converted to 50 ohm input impedance

TDR Launch Discontinuity <20 mv

Fall Time 20 ps or <5 ps Fall Time Degradation

Fully Balanced Differential Signals without Ground Contact

Adjustable Probe Pitch from 0.25 mm to 2.0 mm

Probe Tip diameter 0.254 mm

Probe at any angle with gold plated Conductive Diamond non oxidizing probe tips, improve repeatable measurements with a probe force <10 grams

Characteristics

Attenuation: 1X

Probe Only Bandwidth: 30 GHz

TDR Degradation: <5 ps

Probe Pitch: **0.**25 mm to 2 mm (signal tip to signal tip)

Connector Type: SMA

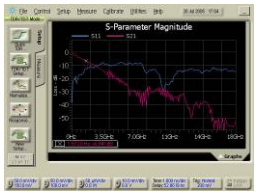
Measured Reflected TDR Fall Time: 20 ps (TDR Specific)

Impedance: 100 Ω differential, 50 Ω common mode,

Max Voltage In: 5.0 V

(Note: numeric values shown are typical).

DVT30-1MM GigaProbes®
Complete *Agilent* 86100C DCA-J mainframe
TDR/TDT Interconnect Probing kit



Create Two Port Insertion and Return loss S-parameters from TDR/T measurement using Agilent 86100C DCA-J mainframe, 54754A TDR modules and the GigaProbes®