Keysight Technologies
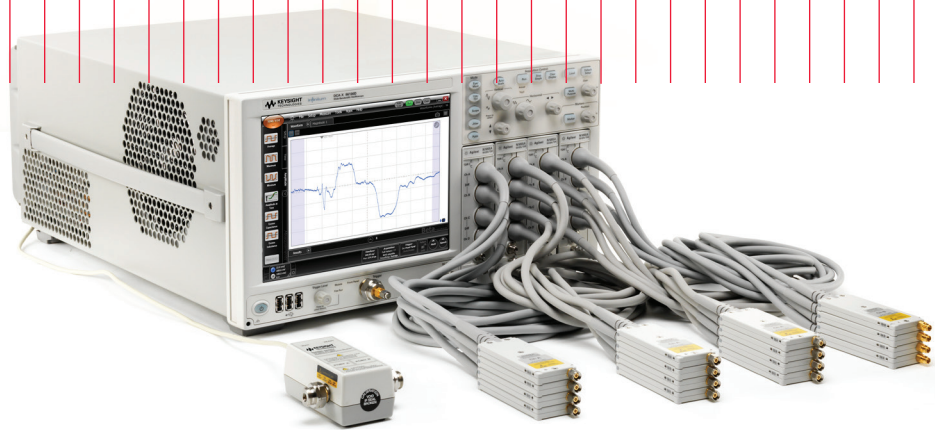# N1055A Remote Head Module
35/50 GHz 2/4 Port TDR/TDT

For the 86100D DCA-X Series
Oscilloscope Mainframe

Data Sheet

Engineered for easy, accurate impedance and
S-parameter measurements on multi-port
10/25/28 Gbps (40G/100G) designs

– Highest resolution TDR/TDT measurements

– Fast and accurate multiport S-parameters, up to 16 ports

– World's easiest-to-use solution

KEYSIGHT
TECHNOLOGIES

Signal integrity challenges abound

As new digital designs increase in data rates to 28 Gb/s and beyond, signal integrity issues become more challenging. Additionally, industry standards such as IEEE 802.3 ba/bj/bm (40 Gb/100 Gb Ethernet), Optical Inter-networking Forum (OIF) CEI 3.0, Fibre channel, PCI Express, USB, and InfiniBand require the use of TDR/TDT and S-parameter measurements to ensure compliance and system interoperability.

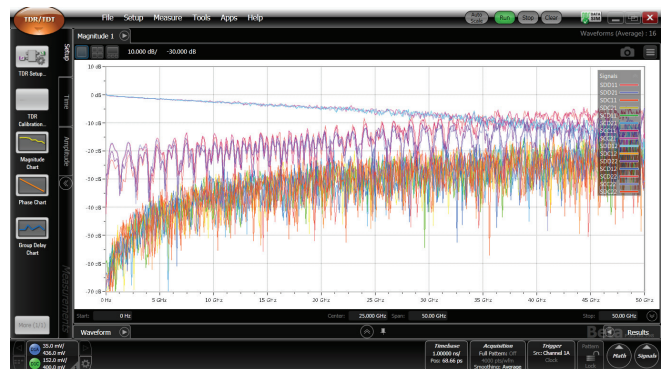# A fully–integrated 86100D TDR/TDT/S-parameter measurement system

Designed for both novice and expert users alike, the Keysight Technologies, Inc. N1055A remote head module provides time-domain reflectometry and transmission (TDR/TDT) capability for the 86100D DCA-X oscilloscope platform, providing fast and accurate impedance and S-parameter measurements on high-speed designs that have up to 16 ports. The 86100D DCA-X oscilloscope mainframe can be configured with one to four N1055A TDR/TDT plug-in modules to provide a 2- to 16-channel TDR/TDT measurement system that is both economical and accurate. The 2/4 port TDR/TDT remote heads can be configured with sampler bandwidth of 35 GHz or 50 GHz, providing single-ended and differential measurement capability including True-Mode stimulus functionality.
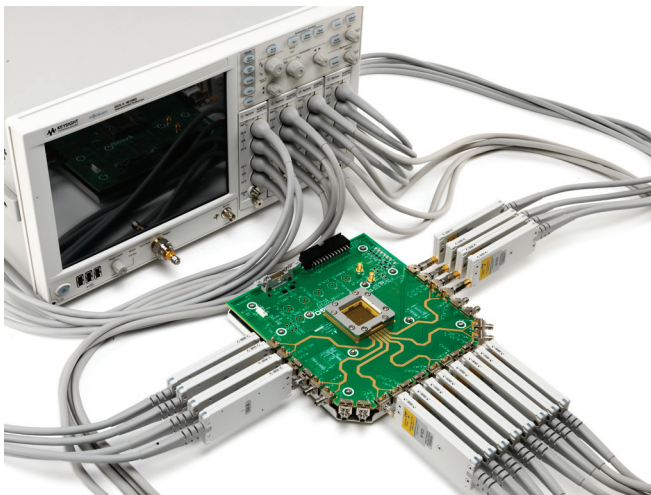
2- to 16-channel TDR/TDT/S-parameter measurement system.

Measurements include:

— **Time-Domain Reflectometry (TDR)**
  — Impedance measurements
  — Locate the position and nature of each discontinuity
  — Propagation/time delay
  — Excess reactance (capacitance or inductance)
  — Effective dielectric constant

— **Time-Domain Transmission (TDT)**
  — Step response
  — Propagation/time delay
  — Propagation velocity
  — Rise-time degradation
  — Near-end crosstalk (NEXT)
  — Far-end crosstalk (FEXT)
  — Skew

— **S-parameters (86100D-202)**
  — Return loss
  — Insertion loss
  — Crosstalk
  — Mode conversion
    –– Differential- to common-mode conversion (SCDxx)
    –– Common- to differential-mode conversion (SDCxx)

Fast and accurate S-parameter measurements.

The 86100D DCA-X mainframe, equipped with N1055A modules, creates a fully-integrated TDR/TDT/S-parameter measurement system that provides calibrated results on up to 16 channels in real-time

Single-ended and differential device testing

Each TDR/TDT module provides single-ended, differential and common mode measurement capability, including True-Mode stimulus capability.

Complete S-parameter analysis

Full S-parameter measurements from DC to more than 50 GHz on up to 16 ports. Export single-ended and mixed-mode data in Touchstone file format.

Real-time results

Calibrated impedance and S-parameter results are displayed in real-time (no external application, monitor or computer required).

ECal DC - 67 GHz module support

Electronic calibration (ECal) modules provide fast and accurate calibrations with a minimum number of connections.
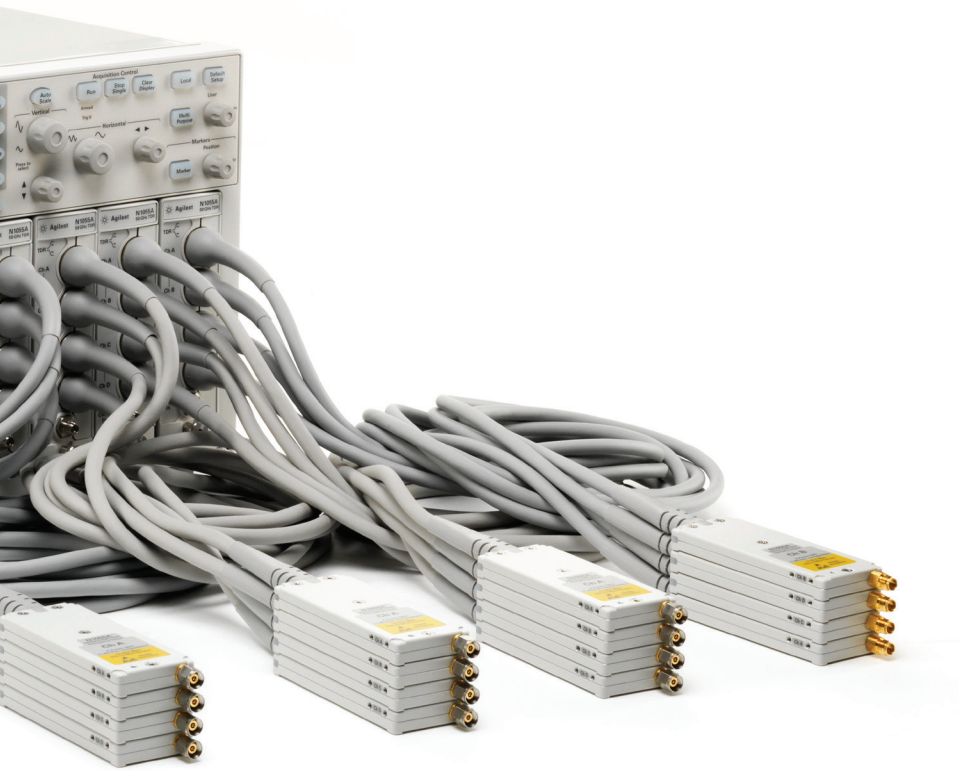
Calibration made easy

TDR/TDT calibration improves measurement accuracy. A built-in calibration wizard supports both mechanical standards (SOLT) and ECal modules.

Fast TDR edge speed

Fast edge speeds yield higher TDR resolution.

– 8 ps (typ) 50 GHz, calibrated

– 9 ps (typ) 50 GHz

– 18 ps (typ) 35 GHz

3
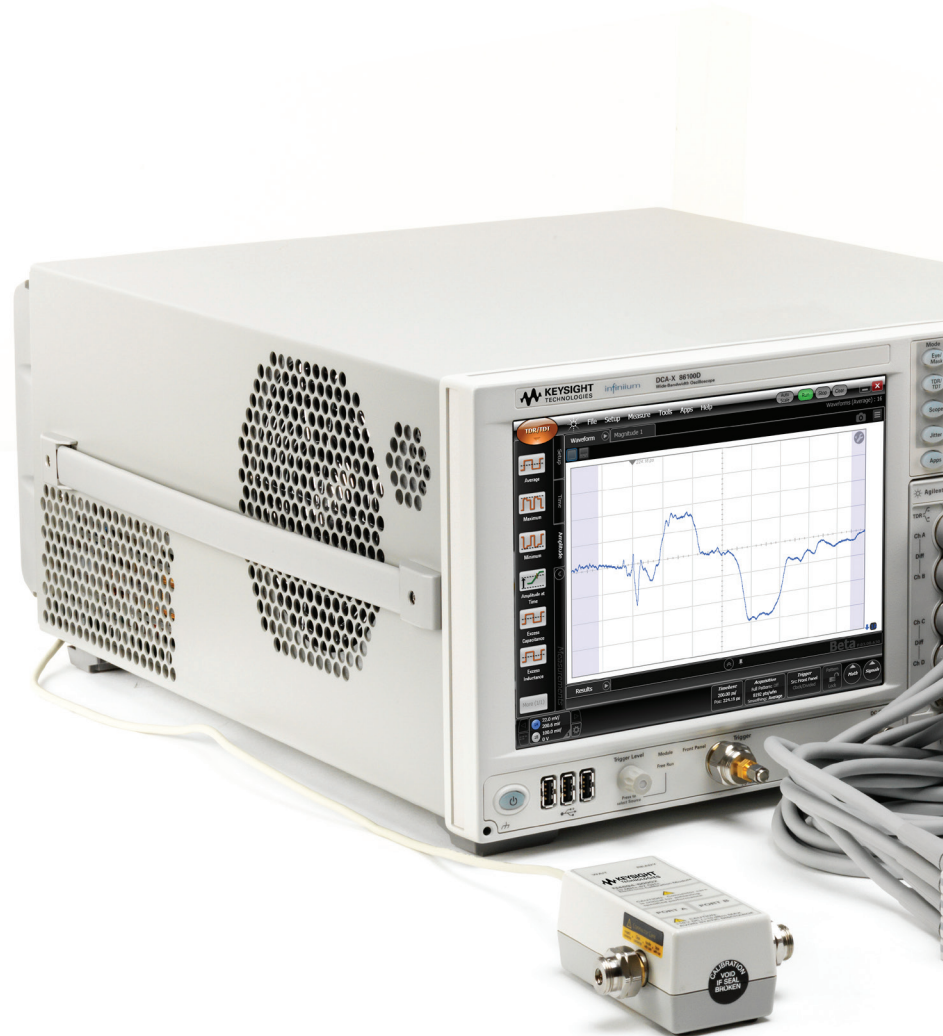
Built-in ESD/EOS protection

Each remote head integrates 67-GHz diode limiters to help protect against electrostatic discharge (ESD) and electrical overstress (EOS).

Adjustable edge speed

The effective TDR edge speed may be adjusted (faster or slower) to comply with standards-based testing.

N1055A bandwidth options

- 35 GHz (2.92 mm)*
- 50 GHz (1.85 mm)

    *upgradable to 50 GHz

N1055A channel count options

- 2 channels per module*
- 4 channels per module

    *upgradable to 4 channel

High-bandwidth oscilloscope

The N1055A's receiver can be used as an oscilloscope to analyze waveforms and perform precision jitter analysis (86100D-200) on high-speed data signals.

Up to 16 channels per main-frame

Up to 16 TDR/TDT channels per 86100D DCA-X mainframe minimize cable reconnections and facilitate efficient near-end crosstalk (NEXT) and far-end crosstalk (FEXT) measurements.

Connector type option

Minimize use of adapters and cables (and save money) by choosing the connector style that suits your needs (male or female connector).

Highest resolution TDR/TDT measurements

High TDR resolution is essential for accurately characterizing complex high-speed structures. With TDR step edge speeds as fast as 8 ps and receiver bandwidths of 50 GHz, the DCA-TDR solution resolves the magnitude and location of impedance discontinuities with unmatched performance.

The flexible, upgradable design offers 2- and 4-channel remote head modules.

Bandwidth options:

– 35 GHz (2.92 mm connector)
– 50 GHz (1.85 mm connector)

Remote head may be configured with male or female connectors (chosen at time of order).

Bandwidth upgrades:
Upgrade a 35-GHz module to 50 GHz by ordering the appropriate N1055AU option (requires Return-to-Keysight).

Channel/port Count:

– 2 channel
– 4 channel

Channel count upgrades:
For example, a 4-channel module is required to perform both TDR and TDT measurements on a device having two differential pairs (4 ports). Upgrade from 2 channels to 4 channels by ordering the appropriate N1055AU option (requires Return-to-Keysight).

TDR edge speed

TDR resolution is determined by the rise time of the TDR step generator and the effective dielectric constant of the device under test (DUT).
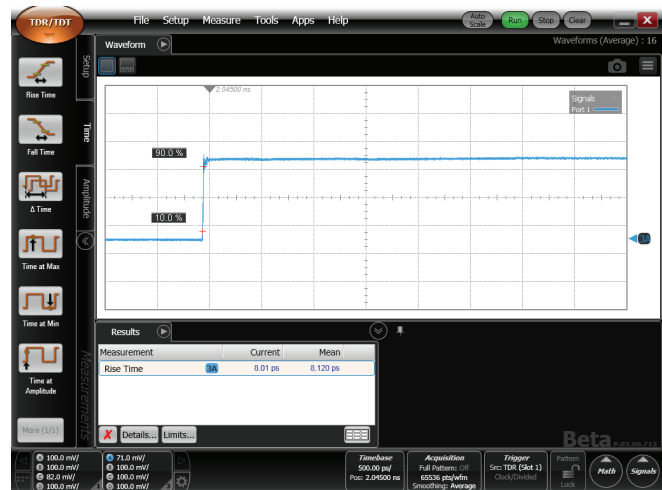
The edge speed that is delivered to the DUT is called the transmitted edge speed. It is measured at the output of the remote head by a high-bandwidth receiver.

10-90% edge speed (raw hardware performance):

– 35 GHz option: < 18 ps typical
– 50 GHz option: < 9 ps typical

## 10-90% edge speed (calibrated performance):

– 35 GHz option: 18 ps typical
– 50 GHz option: 8 ps typical

The ultra-fast TDR step generator (raw hardware step shown above) provides industry-leading TDR resolution.

Adjustable TDR rise time

Standards typically specify 10-90% or 20-80% edge speeds to be used for compliant measurements. FlexDCA makes it easy to control the effective rise time of the stimulus pulse so users can perform compliant measurements.
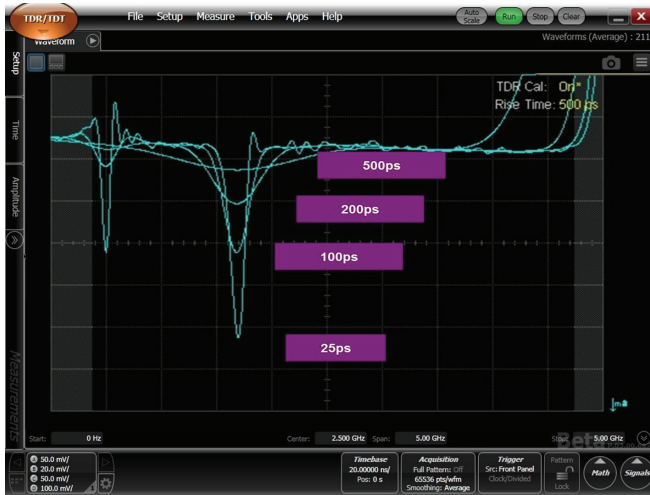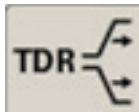

Adjustable effective TDR rise time ensures compliant measurements.
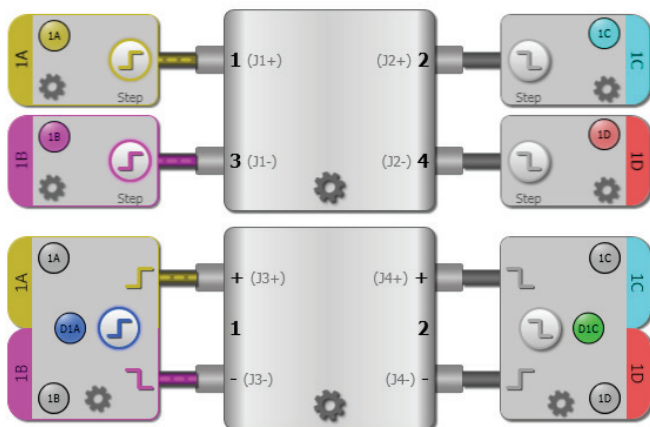
Single-ended and differential stimulus

The TDR/TDT remote heads may be configured for single-ended (SE), differential- or common-mode measurements. Step polarity, skew, amplitude and repetition rate can be independently configured for each remote head.

Additionally, the N1055A may be configured for True-Mode stimulus (simultaneous positive and negative going steps), which allows a device to be tested using the conditions under which it normally operates.

An easy-to-use graphical user interface simplifies single-ended and differential device setup.

Ultra-slim remote heads optimize signal fidelity

The industry's lightest and smallest remote TDR heads allow direct connection to the device under test using a TDR/TDT step generator and low-noise sampler located at the end of a flexible 1.6-meter phase-stable cable. This ensures optimal step fidelity and minimizes signal degradation due to adapters or cables. Remote heads can be configured with male or female connectors to further minimize the number of adapters used in the system.
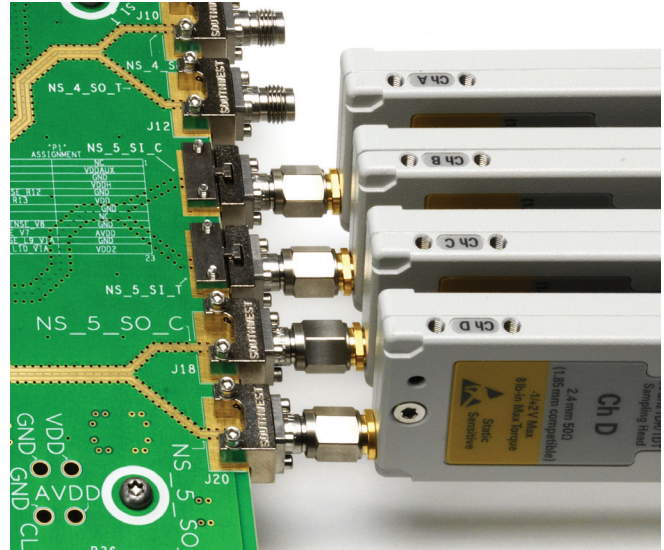
The industry's smallest TDR/TDT remote heads optimize signal fidelity.

Connector options:

– 35 GHz 2.92 mm: male or female

– 50 GHz 1.85 mm: male or female

  *Note - All remote heads within a single module must be equipped with the same connector type.

Two remote heads form a differential pair; heads may be held together using a remote head clamp (two clamps are shipped with each module). When clamped, pin-to-pin spacing is 10 mm.

The ultra-thin remote head has also been designed so it can be directly connected to most high-bandwidth TDR probes on the market today, thereby minimizing signal degradation due to cables.

Ultra-thin remote heads connect directly to TDR probes or may be clamped together to form a differential pair (clamp included).

Fast and accurate multi-port S-parameters (86100D-202)

Scattering parameters (S-parameters) are generated in real-time within the oscilloscope for simultaneous display with time domain results. They are mathematically derived from TDR and TDT measurements using the 86100D Option 202 enhanced impedance and S-parameter analysis software. The N1055A's fast rise time enables calibrated S-parameter measurements to more than 50 GHz.
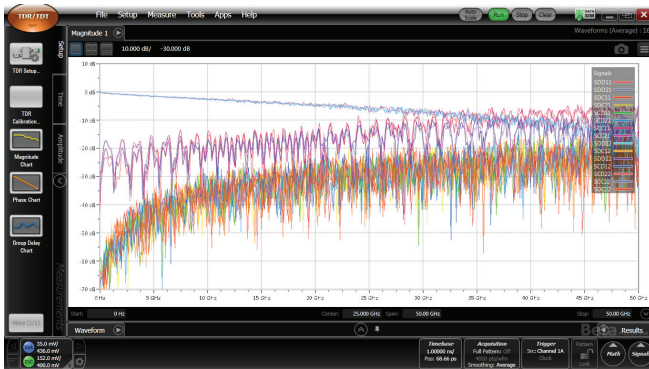
Measure and display (in real-time) calibrated S-parameters to >50 GHz.

86100D Option 202 performs single-ended and mixed-mode S-parameter measurements on up to 16 ports (4-port device shown in screen capture). The software automatically controls the sequencing of TDR steps so a full set of S-parameters can be generated by the touch of a button.
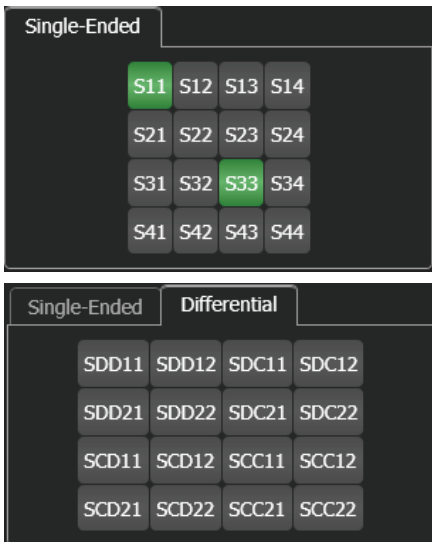
*Select S-parameter measurements quickly and easily.*

Magnitude, phase and group delay plots can be configured at the touch of a button.

FlexDCA displays accurate S-parameter magnitude, phase and group delay plots simultaneously.

Minimize re-connections, maximize productivity

With up to 16 TDR/TDT channels, the DCA-TDR solution also helps to minimize cable re-connections and facilitate more efficient near end crosstalk (NEXT) and far end crosstalk (FEXT) measurements both in R&D as well as high-volume test applications. For example, a 16-port system can measure NEXT and FEXT on up to four differential lanes simultaneously.
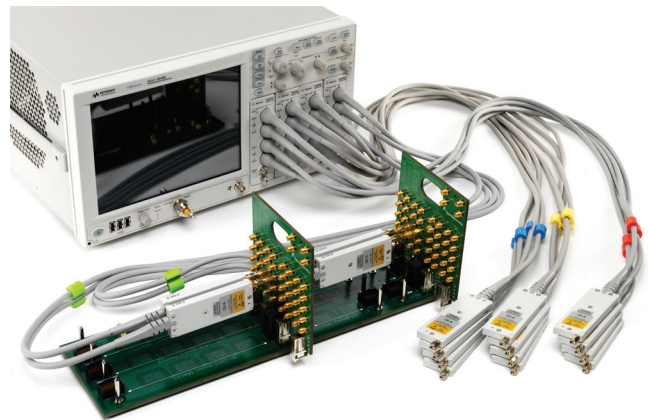

Perform efficient near-end crosstalk (NEXT) and far-end crosstalk (FEXT) measurements on differential designs that have up to four lanes.

World's easiest-to-use solution on devices that have up to 16 ports

The 86100D-based system combines its powerful FlexDCA graphical user interface with the world's only TDR/TDT solution that leverages accurate, easy-to-use electronic calibration (ECal) technology. This combination provides calibrated impedance and S-parameter results that are displayed in real-time within the FlexDCA user interface – no external application, monitor or computer is required.

TDR/TDT calibration

For users who do not need precision measurements and prefer to perform simple, quick impedance and S-parameter measurements on a device, a TDR/TDT calibration is not required thanks to the high-fidelity performance of the raw hardware.
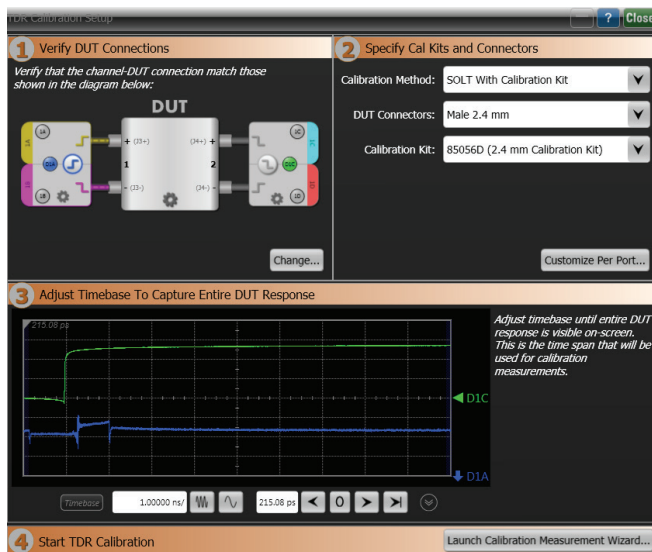
A built-in wizard supports calibration methods using mechanical and electronic calibration standards.

Traditional mechanical Short-Open-Load-Thru (SOLT) calibration standards are supported, but a significant breakthrough for both accuracy and ease-of-use is achieved through the support of Electronic Calibration (ECal) modules, an advanced calibration technique originally developed for the "gold standard" in S-parameter measurements, the Vector Network Analyzer (VNA). A special Keysight N4694A DC-67 GHz ECal module was developed for the DCA-TDR that enables fast and accurate calibration and de-skew of TDR modules.

N4694A DC-67 GHz electronic calibration (ECal) modules make TDR calibration and de-skew fast and easy.

The built-in calibration wizard also supports a variety of other calibration methods that include:

– ECal-based

– SOLT with calibration kit

– SLT with calibration kit
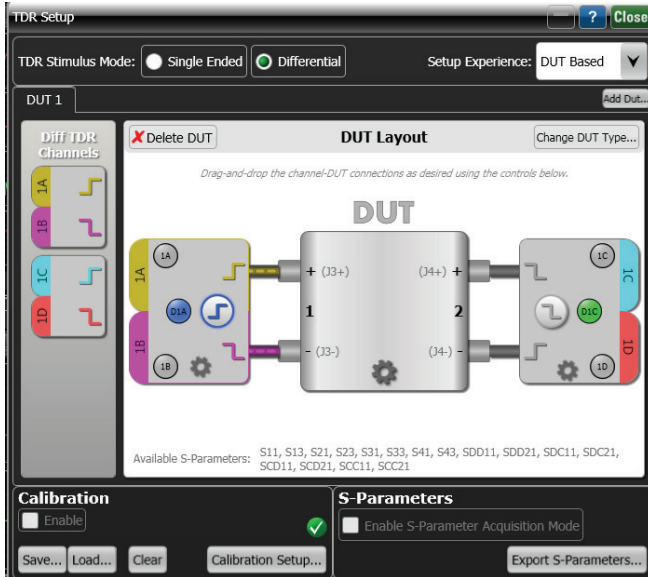
– SLT with generic standards
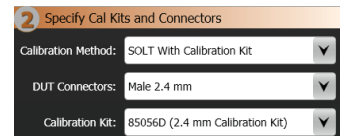
SOLT = Short, Open, Load and Thru

Easy set-up using graphical user interface

A graphical user interface makes it easy to configure the instrument. Port names may also be customized using meaningful names that relate to the device being tested (Example: TX1+, TX1- or J1+, J1-). FlexDCA uses the custom names when displaying signals and saving waveforms.

Configure the setup and customize connector/port names using the graphical user interface.

Customizable displays

With the click of a button, FlexDCA can be configured to display impedance and S-parameter waveforms the way you want using overlapped, tiled or zoom-tiled displays.

Built-in ESD/EOS protection

Each remote head integrates a high-performance TDR step generator and high-bandwidth sampling into a microcircuit located behind the connector. To protect these high-performance components against electrostatic discharge (ESD) and electrical overstress (EOS), each microcircuit also integrates multiple 67-GHz diode limiters into the design. While the user must still follow safe ESD and EOS practices, the diode limiters offer additional protection and help protect your investment.
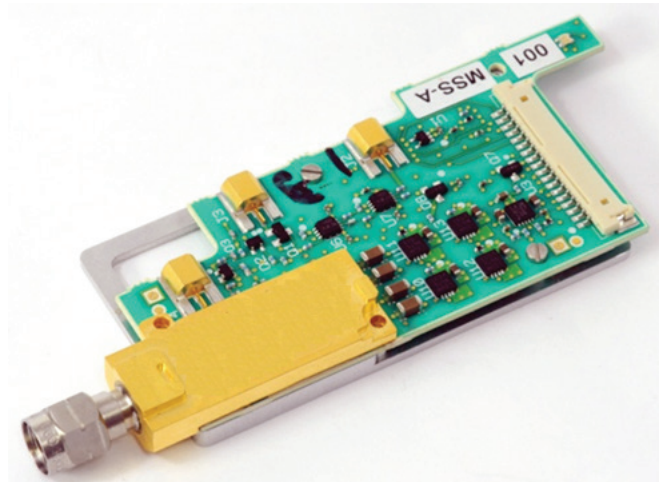
A high-speed step generator, sampler, and diode limiter are integrated into a proprietary microcircuit design housed in the remote head.
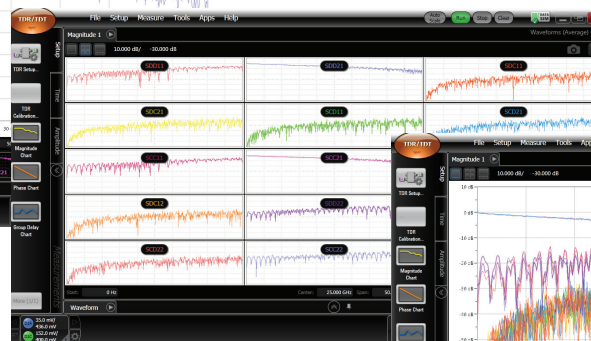
Zoom-tiled

Tiled

Overlapped waveform

N1055A receiver–only operation

The N1055A TDR/TDT module, equipped with 16 bit low-noise samplers, can also be used as a receiver only and perform accurate oscilloscope, eye/mask and jitter/noise (86100D-200/300) measurements. When used with the 86107A or 86100D-PTB precision timebase circuits, the N1055A provides a high-bandwidth measurement system with < 100 fs rms intrinsic random jitter.
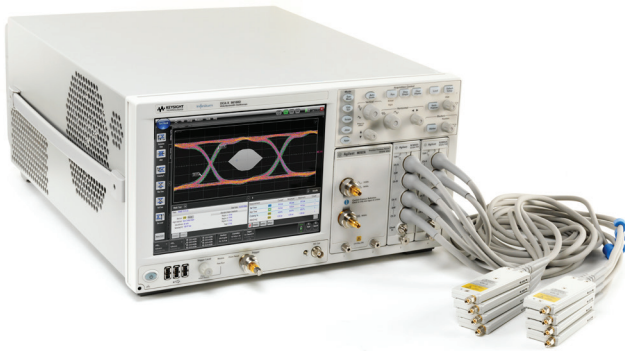
The N1055A remote head modules also perform high-performance oscilloscope, eye/mask, and jitter/noise measurements.

Easy channel and eye diagram simulations (86100D Option SIM)

Generate waveform and eye diagram simulations without using an external pattern generator. 86100D Option SIM provides integrated embedding and de-embedding channel simulations using S-parameters generated using the DCA (or imported from other tools).
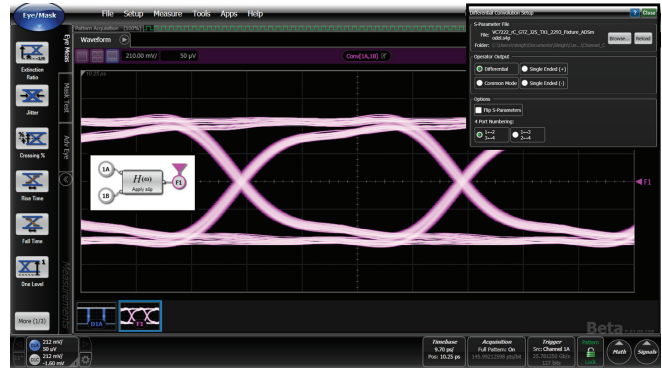
FlexDCA may be used to generate waveform and eye diagram simulations using S-parameters generated by the TDR/TDT system.

One application, FlexDCA, provides comprehensive measurement capability

FlexDCA software integrates impedance (TDR/TDT), S-parameter (86100D-202), oscilloscope, eye/mask, jitter/noise (Option 200/300), equalization (Option 201), channel simulation (Option SIM) and other powerful features into a single application that runs on the 86100D mainframe or on a PC (using N1010A FlexDCA). For more information, refer to www.keysight.com/find/flexdca.

The N1055A module is supported by all 86100D DCA-X DCA modes of operation.

Specifications table

Dual/quad electrical channel modules				
Channel options (number of channels; F = female; M = male	32F/32M	34F/34M	52F/52M	54F/54M
Number of channels [2]	2	4	2	4
Electrical channel bandwidth	35 GHz [4]	35 GHz [4]	35/50 GHz	
Transition time (10% to 90% calculated from TR = 0.35/BW)	10 ps		10/7 ps	
Channel-to-channel skew range	± 100 ps			
RMS noise				
Characteristic	550 µV		550/950 µV	
Scale factor (per division)				
Minimum	1 mV / division			
Maximum	100 mV / division			
DC accuracy (single marker)	±0.4% of full scale ±2 mV ±4% of (reading-channel offset), (50 GHz)			
DC offset range (referenced from center of screen)	±500 mV			
Input dynamic range (relative to channel offset)	±400 mV			
Maximum input signal	+2 V / -1 V			
Nominal impedance	50 ohm			
Electrical input [3]	2.92 mm (female or male option)		1.85 mm (female or male option)	

1. Module is supported by 86100D DCA-X mainframe and later.

2. Upgradable from 2 channel to 4 channel after purchase (return to Keysight).

3. Connector style in the same on all channels and is selected at time of order.

4. Upgradable from 35 GHz to 50 GHz after purchase (return to Keysight).

	N1055A - 3xx (35 GHz bandwidth)		N1055A - 5xx (50 GHz bandwidth)	
	Without TDR calibration	With TDR calibration	Without TDR calibration	With TDR calibration
Step rise/fall time (Transmitted, typical)	18 ps	Adjustable from 18 ps	9 ps	Adjustable from 8 ps

1. "Transmitted" edge speed is the TDR edge speed at the output of the remote head. Step speed is validated using a connector-to-connector measurement using a high-bandwidth receiver (>+ 60 GHz).

Ordering options

N1055A 35/50 GHz 2/4 Port TDR/TDT remote head

Choose ONE option:
- N1055A-32F   35 GHz, 2 channel, 2.92 mm, female
- N1055A-32M   35 GHz, 2 channel, 2.92 mm, male
- N1055A-34F   35 GHz, 4 channel, 2.92 mm, female
- N1055A-34M   35 GHz, 4 channel, 2.92 mm, male
- N1055A-52F   50 GHz, 2 channel, 1.85 mm, female
- N1055A-52M   50 GHz, 2 channel, 1.85 mm, male
- N1055A-54F   50 GHz, 4 channel, 1.85 mm, female
- N1055A-54M   50 GHz, 4 channel, 1.85 mm, male

N1055A included accessories
- N1027A-1CL   Cable management clips (6 at yellow, pink, blue, green)
- N1027A-2CL   2 remote head clips
- 8710-1765   Torque wrench 8 lb-in, 5/16 in
- N1027A-1CF   Protective cap for 1.85 mm, female
- N1027A-1CM   Protective cap for 1.85 mm, male
- N1027A-3CF   Protective cap for 2.92 mm, female
- N1027A-3CM   Protective cap for 2.92 mm, male

N1055A optional accessories
- N1027A-3MC   Storage case for N1055A module
- N1027A-3AC   Accessory case for N1055A module
- N1027A-1C1   Coaxial cable 1.85 mm, M/M, 67 GHz, 10 cm

Multiple module configurations require 86100D-ETR

86100D-ETR is required if using an N1055A module to perform a TDT measurement using a separate DCA module (for example N1045A, N1055A, 86117A, etc.) as the receiver. In this configuration, 86100D Option ETR provides internal cabling for module synchronization.

Calibration kits

Electronic calibration (ECal) modules
- N4694A-HMM   ECal module, DC-67 GHz, 1.85 mm, male-male
- N4694A-HFF   ECal module, DCA-67 GHz, 1.85 mm, female-female
- N4694A-HMF   ECal module, DCA-67 GHz, 1.85 mm, male-female

Mechanical calibration kits
- 85033D 3.5mm calibration kit, 30 kHz to 6 GHz
- 85033E Standard mechanical calibration kit, DC to 9 GHz, 3.5 mm
- 85052B Standard mechanical calibration kit, DC to 26.5 GHz, 3.5 mm
- 85052C Precision mechanical calibration kit, DC to 26.5 GHz, 3.5 mm
- 85052D Economy mechanical calibration kit, DC to 26.5 GHz, 3.5 mm

- 85056A Standard mechanical calibration kit, DC to 50 GHz, 2.4 mm
- 85056D Economy mechanical calibration kit, DC to 50 GHz, 2.4 mm
- 85056K Mechanical calibration kit, DC to 50 GHz, 2.4 mm and 2.92 mm
- 85058B Standard mechanical calibration kit, DC to 67 GHz, 1.85 mm
- 85058E Economy mechanical calibration kit, DC to 67 GHz, 1.85 mm
- Generic calibration kits

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.axiestandard.org
AdvancedTCA® Extensions for Instrumentation and Test (AXIe) is an
open standard that extends the AdvancedTCA for general purpose and
semiconductor test. Keysight is a founding member of the AXIe consortium.
ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of
the PCI Industrial Computer Manufacturers Group.

www.lxistandard.org
LAN eXtensions for Instruments puts the power of Ethernet and the
Web inside your test systems. Keysight is a founding member of the LXI
consortium.

www.pxisa.org
PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a
rugged, PC-based high-performance measurement and automation system.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's commitment to superior product quality and lower total cost
of ownership. The only test and measurement company with three-year
warranty standard on all instruments, worldwide.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your
instruments are operating to specification so you can rely on accurate
measurements.

www.keysight.com/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product
breadth, combined with channel partner convenience.

ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of the
PCI Industrial Computer Manufacturers Group.

www.keysight.com/find/N1055A

For more information on Keysight
Technologies' products, applications or
services, please contact your local Keysight
office. The complete list is available at:
www.keysight.com/find/contactus

Americas
Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific
Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East
Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-07-01-14)

KEYSIGHT
TECHNOLOGIES