Keysight Technologies
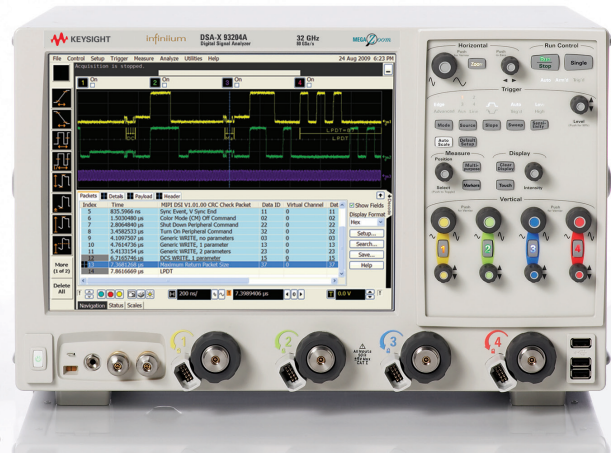
MIPI D-PHY Multilane Protocol Triggering and Decode

For Infiniium Series Oscilloscopes

Data Sheet

KEYSIGHT TECHNOLOGIES

MIPI D-PHY

MIPI (Mobile Industry Processor Interface) serial buses are the backbone for communication in mobile products. The serial bus interface provides content-rich points for debug and test. However, since these protocols transfer bits serially, using a traditional oscilloscope has limitations. Manually converting captured 1's and 0's to protocol requires significant effort, can't be done in real-time, and includes potential for human error. As well, traditional scope triggers are not sufficient for specifying protocol-level conditions.

Extend your scope capability with the Keysight Technologies, Inc. MIPI D-PHY triggering and decode application. This application makes it easy to debug and test designs that include MIPI D-PHY buses using your Infiniium Series oscilloscope.

- Perform MIPI D-PHY multilane protocol decode which includes 1, 2, 3 and 4 lane design implementation
- Set up your scope to show MIPI D-PHY protocol decode in less than 30 seconds.
- Get access to a rich set of integrated protocol-level triggers.
- Save time and eliminate errors by viewing packets at the protocol level.
- Use time-correlated views to quickly troubleshoot serial protocol problems back to their timing or signal integrity root cause.

The following are the MIPI D-PHY protocols and features that will be supported by the application.

1. DSI specification v1.02 and v1.01 decode and triggering of short and long packets
2. CSI specification v1.00 decode and triggering of short and long packets
3. Low Power Data Transmission (LPDT) decode and triggering for DSI and CSI specifications
4. CSI and DSI packets with and without Cyclical Redundancy Check (CRC) support
5. DCS specification v1.02 decode and triggering
6. Full decode Bus turnaround including direction
7. Full decode of Escape entry commands including Ultra-Low Power State, Reset-Trigger, Tearing Effect, Acknowledge and others


Easy to find

Turn decode on/off via the "Serial Decode" button on the front of 9000 Series scopes or in the "Setup" menu. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4–5.)
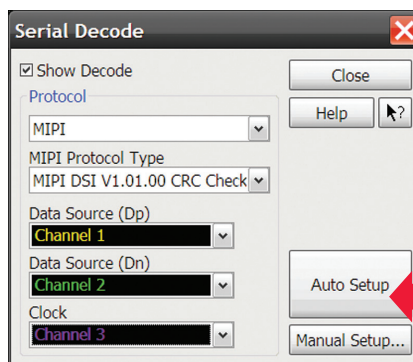
30 Second MIPI Setup

Configure your oscilloscope to display protocol decode in under 30 seconds. Use "Auto Setup" to automatically configure sample rate, memory depth, threshold and trigger levels.
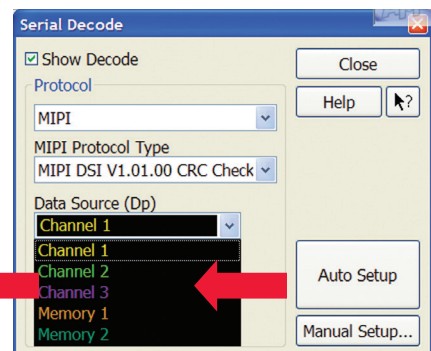
### Support for live and saved waveforms

Perform and view decode information on both live and saved waveforms. Decode up to any combination of 4 live or saved waveforms.

MIPI D-PHY Setup, Protocol Triggering, and Search Capabilities
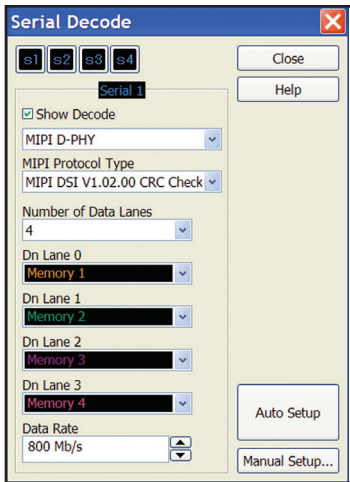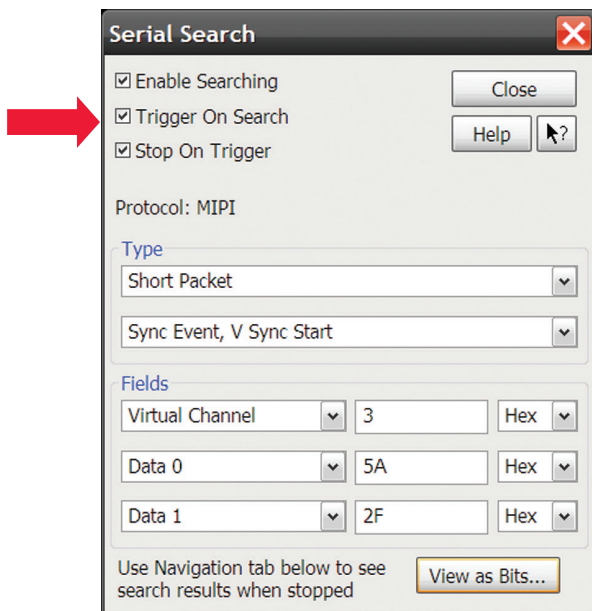

MIPI D-PHY Multilane Setup

The MIPI D-PHY setup allows you to select the number of data lanes to decode. Then, specify the Dn waveforms, whether from the scope live channels or saved waveforms as well as the data rate.
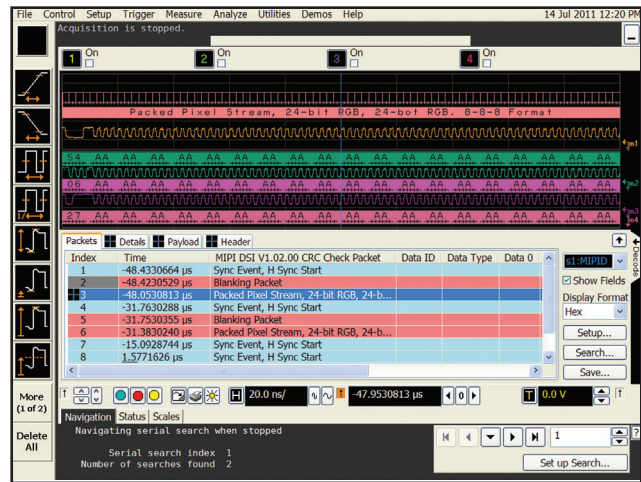
Multilane Packet Decode

The MIPI D-PHY multilane can decode up to 4-lane design implementation. The packet content information can be viewed on the waveform available at the top display as well as the compact listing format at the bottom display. Different color coding to indicate generic and protocol specific packets.

Get access to a rich set of integrated protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to MIPI D-PHY. When serial triggering is selected, the application uses software-based triggering.

With software-based protocol triggering, the oscilloscope takes signals acquired using either scope or digital channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.


## MIPI trigger and search setup

Quickly access the software-based trigger via the trigger or search menus. Software-based triggering enables quick setup of data, remote, or error frames.

3

MIPI D-PHY multilane protocol decode

Get access to a rich set of integrated protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to MIPI D-PHY. When serial triggering is selected, the application uses software-based triggering.

With software-based protocol triggering, the oscilloscope takes signals acquired using scope channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.
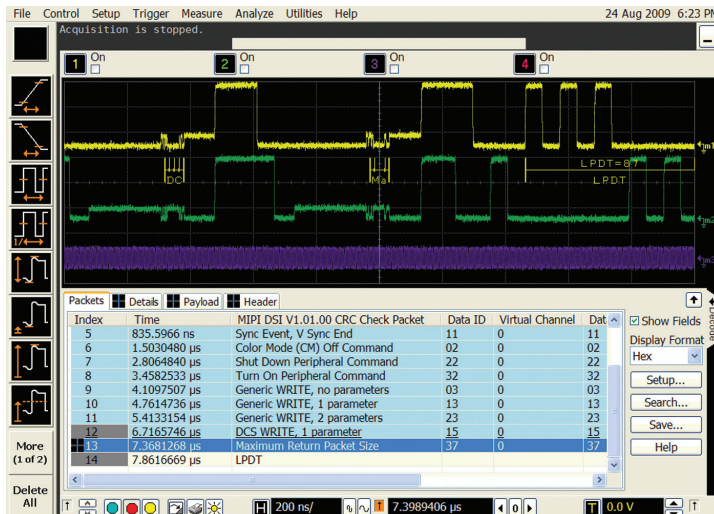

Quickly move between physical and MIPI D-PHY protocol layer information using the time-correlated tracing marker. Display protocol content using embedded decode in the waveform area, Or, see protocol events in a compact listing format. Minor tick marks indicate clock transitions. Major tick marks indicate segments of the serial packet MIPI D-PHY measurements are automatically time-correlated with measurement on other scope channels.
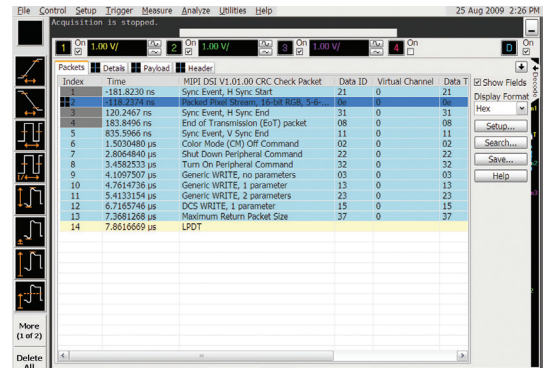

Compact protocol using the full screen listing.

The protocol viewer window shows the index number, time stamp value identifier, packet type, and data values for each MIPI D-PHY packet. Data in the listing window can be saved to a .csv or .txt file for off-line.
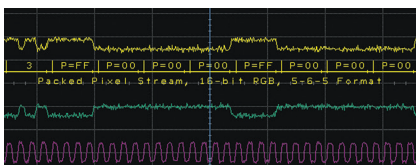
MIPI D-PHY decode embedded in waveform area

Utilize the oscilloscope waveform area to display decode information. Minor ticks indicate clock transitions and major ticks show segments within each MIPI D-PHY packet.
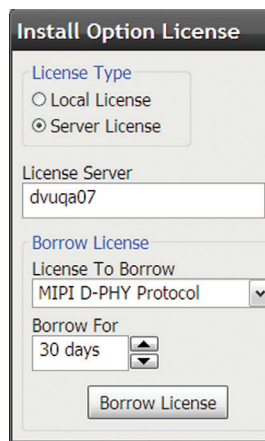
Using multiple scopes?

Server-based licensing allows users to borrow an application for a specified period of time.
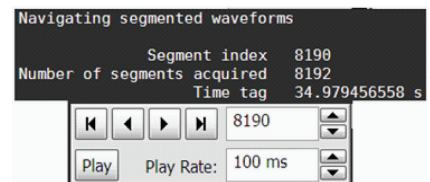
Long time captures using segmented memory

In this example, MIPI D-PHY traffic was captured for near 35 seconds. Segmented memory uses time tags to track time between segment acquisitions.

MIPI D-PHY multilane protocol decode

Time correlation with other system activity

Protocol measurements are automatically time-correlated with measurements taken on other analog or digital (on MSO models) channels.
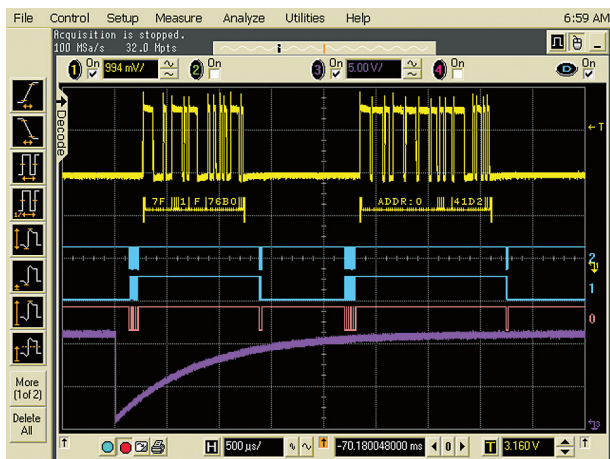
Precise MSO triggering and display

Mixed-signal oscilloscope measurement in a mobile system using both digital and analog acquisition channels..
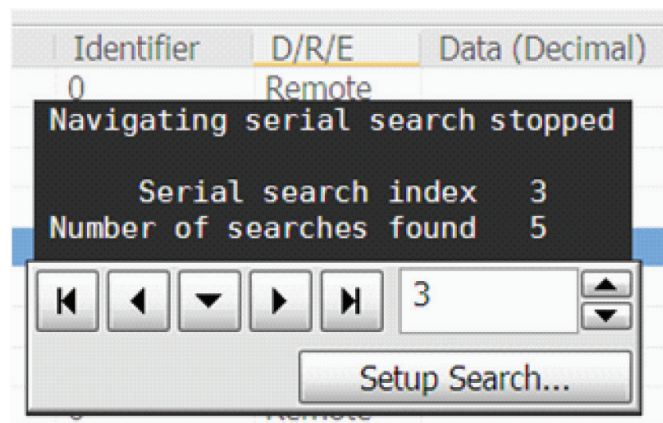
Post-acquisition searching

Search acquired protocol listings using a menu that is identical to the trigger menu. Quickly move to next occurrence of a specified event.

MIPI D-PHY Application Specifications and Characteristics

MIPI	
MIPI sources	Analog channels 1, 2, 3, or 4 Any waveform memories The application relies on probing and trigger/measurement thresholds to properly condition the signal for triggering and decode. Differential probing may be required.
Data rate	Up to 2500 Mb/s
Protocol type	CSI-2 v1.00, DSI v1.01, DSI v1.02, DCS v1.02
Auto setup	Automatically configures scope settings for proper MIPI D-PHY decode and SW-based protocol triggering including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds
Decoded fields	All including extended frame format

Triggering (software-based)	Short Packet
	Long Packet
	Low-Power Data Transmission
	Errors
	  Any Error
	  Bad 166 CRC
	  Bad 86 ECC

Recommended Oscilloscopes

The D-PHY protocol decoder is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 4.20 or higher. For oscilloscopes with earlier revisions, free upgrade software is available here: www.keysight.com/find/scope-apps-sw.

Data rate	Minimum bandwidth	Minimum channels	Recommended oscilloscopes
Up to 1 Gbps	4 GHz	3	Infiniium 9000, S-Series, 90000 and Z-Series
Up to 1.5 Gbps	6 GHz	3	Infiniium 90000 and Z-Series
Up to 2.5 Gbps	12 GHz	3	Infiniium 90000 and Z-Series

Ordering Information

To purchase the D-PHY protocol decoder with a new or existing Infiniium Series oscilloscope, order the following options.

Software options

Application	License type		Infiniium Z-Series	Infiniium S-Series	Infiniium 90000 Series	Infiniium 9000 Series
D-PHY protocol decoder	Fixed	Factory-installed	N8802A-1FP	N8802B-1FP	Option 019	Option 019
		User-installed	N8802A-1FP	N8802B-1FP	N8802A-1NL	N8802B-1NL
	Floating	Transportable	N8802A-1TP	N8802B-1TP	N8802A-1TP[1,2]	N8802B-1TP[1,2]
		Server-based	N5435A-022	N5435A-022	N5435A-022	N5435A-022

1   Requires software 5.00 and above.
2   Software 4.30 or above requires Windows 7. N2753A Infiniium Windows XP to 7 OS upgrade kit (oscilloscope already has M890 motherboard). N2754A Infiniium Windows XP to 7 OS and M890 motherboard upgrade kit (oscilloscope without M890 motherboard). Verify the M890 motherboard using the procedure found in the Windows 7 upgrade kit data sheet with the publication number 5990-8569EN.
3   For full switch configuration, refer to www.keysight.com/find/switching or the brochure Automated Switching Solution for Oscilloscopes with the publication number 5991-2413EN.

Other hardware, probes and accessories

Model number	Description	Quantity
1132A[4]	InfiniiMax 5-GHz differential probe amplifier (quantity 4 recommended for 4 data lane decode)	3
E2669A	Differential probe connectivity kit (contains needed probe heads)	1
RTB	MIPI D-PHY reference termination board from UNH-IOL https://www.iol.unh.edu/services/testing/mipi/fixtures.php	1

4   InfiniiMax I and II probes are suitable for D-PHY probing but not InfiniiMax III probes.

Related Literature

Publication title	Publication type	Publication number
Infiniium 9000 Series Oscilloscopes	Data sheet	5990-3746EN
Infiniium 90000 X-Series Oscilloscopes	Data sheet	5990-5271EN
Infiniium 90000 Series Oscilloscopes	Data sheet	5989-7819EN
Infiniium S-Series Oscilloscopes	Data sheet	5991-3904EN
Infiniium Z-Series Oscilloscopes	Data sheet	5991-3868EN
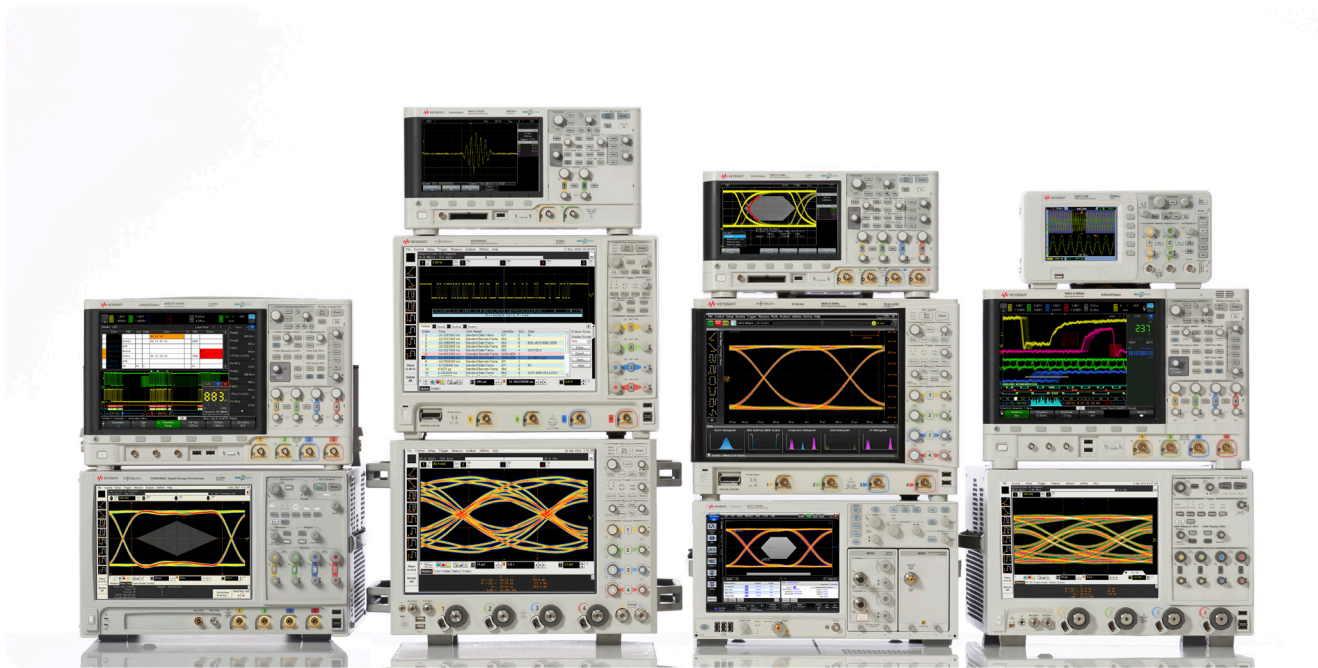
Keysight Technologies Oscilloscopes

Multiple form factors from 20 MHz to > 90 GHz | Industry leading specs | Powerful applications

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.

www.keysight.com/find/N8802A

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-07-10-14)

KEYSIGHT
TECHNOLOGIES