Keysight Technologies

U7238A MIPI D-PHY Compliance Test Software for Infiniium Oscilloscopes

Data Sheet

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Validate and debug your embedded D-PHY data links quickly and easily

The Keysight Technologies, Inc. U7238A MIPI D-PHY compliance test software for Infiniium oscilloscopes gives you a fast, easy way to validate and debug your embedded D-PHY data links. The D-PHY electrical test software allows you to automatically execute D-PHY electrical checklist tests for CSI and DSI architectures, and displays the results in a flexible report format. In addition to the measurement data, the report provides margin analysis that shows how closely your product passed or failed each test.

The U7238A MIPI D-PHY compliance test software performs a wide range of tests required to meet the physical layer requirements per Section 8 of the MIPI Alliance Specification for D-PHY v1.00.00. The U7238A MIPI D-PHY compliance test software helps you execute the most difficult physical layer tests for transmitters (TX tests only) that can be measured with a 4-GHz or higher-bandwidth real-time oscilloscope. Although there are not currently any requirements for physical layer compliance verification, it is highly recommended that every MIPI D-PHY link be tested against the limits of the physical layer specification to ensure that it is compliant to the specification and to minimize concerns with protocol level interoperability.

Features

The U7238A MIPI D-PHY compliance test software offers several features to simplify design validation:

- Complete MIPI Alliance Specification for D-PHY v1.00.00, section 8
- User selection of tests and configuration of data rate
- Automated scope measurement setup and programming for increased accuracy, time-savings and repeatability
- Advanced debug modes for troubleshooting
- Automated margin analysis and pass/fail conformance reporting

With the D-PHY compliance test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the MIPI Alliance Specification for D-PHY v1.00.00, section 8 requirements.

U7238A saves you time

The U7238A compliance test software saves you time by setting the stage for automatic execution of required electrical tests. The primary difficulty of performing electrical tests for D-PHY is connecting the oscilloscope to the target device, correctly configuring the scope's measurement system for ultimate accuracy, issuing the proper commands to perform the tests and then analyzing the measured results by comparing them to limits published in the specification. The D-PHY compliance test software automates this work to provide rapid, accurate and repeatable test execution. In addition, if you discover a problem with your product, debug tools in the scope are available to aid in root-cause analysis.

See Table 1 for a complete list of the measurements you can make with the U7238A MIPI D-PHY compliance test software.

Easy test definition

The U7238A MIPI D-PHY compliance test software extends the ease-of-use advantages of Keysight's Infiniium oscilloscopes to testing D-PHY designs. The Keysight automated test engine walks you quickly through the steps required to define and configure the tests, execute the tests, and view the test results. You can select a category of tests all at once or specify individual tests. The user interface is oriented to minimize unnecessary reconnections, which saves time and ensures accuracy and repeatability of tests. You can save tests and configurations as project files and recall them later for quick re-testing or review of previous test. Straightforward menus let you perform tests with a minimum of mouse clicks.
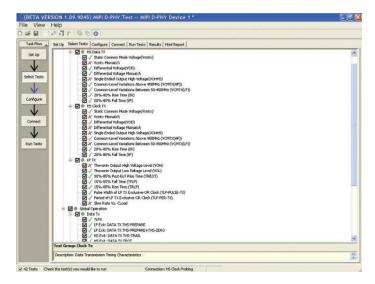

Figure 1. You can easily select individual tests or groups of test with a mouse-click and customize your output report based on the test results you want to see.

Configurability and guided connections

The U7238A MIPI D-PHY compliance test software provides flexibility in your test setup. The D-PHY compliance test software provides you with user-defined controls for critical test parameters such as channel probe configurations, number of measurement observations for tests and the low-power trigger threshold.

After you configure the tests to meet your needs, the U7238A user interface will present you the connection screen that is specific to the configuration data you have selected. This includes the oscilloscope channels used for the test and the routing of any necessary probing needed to perform the tests. In some cases, a configuration change may be necessary to properly make a new set of measurements. Guided configuration diagrams will be presented when each change is needed to ensure proper configuration for the tests. The software is designed to minimize connection changes to increase the efficiency of test operation and save you time.
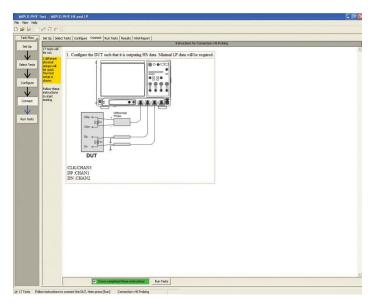

Figure 2. Guided configuration diagrams provide you with channel and probe configurations needed to properly connect to your product and accurately perform tests.

Results reports with margin analysis

In addition to providing you with measurement results, the U7238A MIPI D-PHY test software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test assertion. You select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to the electrical tests where your product is operating close to the official test limit defined by the specification for a given test assertion.
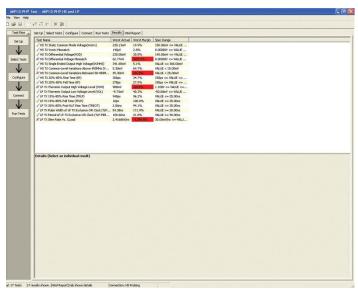

Figure 3. Results reports quickly highlight test margins versus specified limits and a summary of measurements that pass/fail or violate the margin warnings you have set.

Configurability and guided connections

The U7238A D-PHY compliance software generates thorough reports that not only capture the performance and status of the device under test, but capture the screen shots of your most significant measurements for your documentation and evaluation.
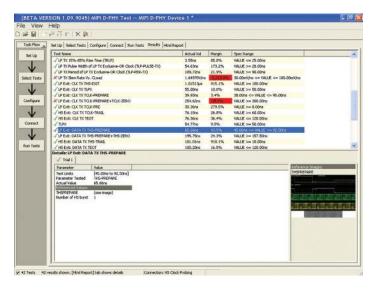

Figure 4. A complete HTML-formatted report provides a results summary for documentation and archiving with full detail on measurement definitions referenced to the specification and screen images from the oscilloscope during test.

Extensibility

You may add additional custom tests or steps to your application using the N5467A User Defined Application (UDA) development tool (www.keysight.com/find/uda). Use UDA to develop functional "Add-Ins" that you can plug into your application.

Add-ins may be designed as:

– Complete custom tests (with configuration variables and connection prompts)
– Any custom steps such as pre or post processing scripts, external instrument control and your own device control
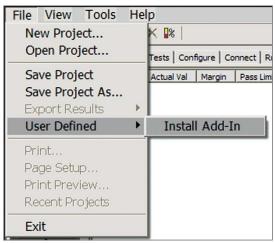

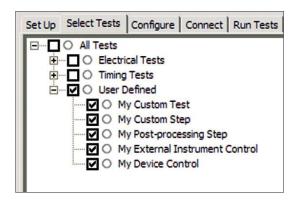Figure 5. Importing a UDA Add-In into your test application.

Figure 6. UDA Add-In tests and utilities in your test application.

Automation

You can completely automate execution of your application's tests and Add-Ins from a separate PC using the included N5452A Remote Interface feature (download free toolkit from www.keysight.com/find/scope-apps-sw). You can even create and execute automation scripts right inside the application using a convenient built-in client.

The commands required for each task may be created using a command wizard or from "remote hints" accessible throughout the user interface.

Using automation, you can accelerate complex testing scenarios and even automate manual tasks such as:

– Opening projects, executing tests and saving results
– Executing tests repeatedly while changing configurations
– Sending commands to external instruments
– Executing tests out of order

Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive:

– Interact with your device controller to place it into desired states or test modes before test execution.
– Configure additional instruments used in your test suite such as a pattern generator and probe switch matrix.
– Export data generated by your tests and post-process it using your favorite environment, such as MATLAB, Python, LabVIEW, C, C++, Visual Basic etc.
– Sequence or repeat the tests and "Add-In" custom steps execution in any order for complete test coverage of the test plan.
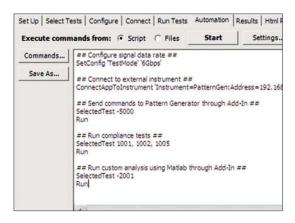

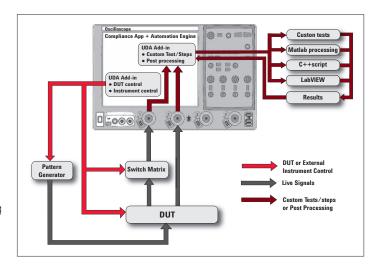Figure 7. Remote Programming script in the Automation tab.

Figure 8. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

Measurement requirements

To use the U7238A D-PHY compliance software you will need a Keysight 9000, 90000 or 90000 X Series Infiniium oscilloscope with at least 4 GHz of analog, real-time bandwidth. You will also need the N5414B or N5415B InfiniiScan software option (Option 009 on new scopes) and a license for the U7238A. In order to use the U7238A compliance test software, your product will need to be able to source the necessary low-power (LP) to high-speed (HS) data transitions needed to perform the testing.

Section 8, Electrical Characteristics

High-speed data and clock measurements

- HS data and clock TX static common-mode voltage (VCMTX)
- HS data and clock TX VCMTX mismatch (ΔVCMTX(1,0)
- HS data and clock TX differential voltage (VOD)
- HS data and clock TX differential voltage mismatch (ΔVOD)
- HS data and clock TX single-ended output high voltage (VOHHS)
- HS data and clock TX common-level variations above 450 MHz (VCMTX(HF))
- HS data and clock TX common-level variations between 50-450 MHz (VCMTX(LF))
- HS data and clock TX 20%–80% rise time (tR)
- HS data and clock TX 20%–80% fall time (tF)

Low-power data measurements

- LP TX Thevenin output high voltage level (VOH)
- LP TX Thevenin output low voltage (VOL)
- LP TX 15%-85% rise time (tRLP)
- LP TX 15%-85% fall time (tFLP)
- LP TX 30%-85% post-EoT rise time (tREOT)
- LP TX pulse width of LP TX exclusive-OR clock (TLP-PULSE-TX)
- LP TX period of LP TX exclusive-OR clock (TLP-PER-TX)
- LP TX slew rate vs. CLOAD

Table 1. MIPI D-PHY electrical conformance tests performed by the U7238A software

Date rate	Recommended Oscilloscopes	Bandwidth Requirements
Up to 800 Mbps	DSO/DSA90404A DSO9404A	4 GHz

Also compatible with the following scope models

Scope Model	Scope Bandwidth
DSO/DSA90604A	6 GHz
DSO/DSA90804A	8 GHz
DSO/DSA91204A	12 GHz
DSO/DSA91304A	13 GHz
DSO/DSAX91604A	16 GHz
DSO/DSAX92004A	20 GHz
DSO/DSAX92504A	25 GHz
DSO/DSAX92804A	28 GHz
DSO/DSAX93204A	32 GHz

Global operation data and clock TX measurements

- TLPX
- LP exit: data TX THS-prepare
- LP exit: data TX THS-prepare+THS-zero
- HS exit: data TX THS-trail
- HS exit: data TX TEOT
- HS exit: data TX THS-exit
- LP exit: clock TX THS-exit
- LP exit: clock TX TLPX
- LP exit: clock TX TCLK-prepare
- LP exit: clock TX TCLK-prepare+TCLK-zero
- LP exit: clock TX TCLK-PRE
- LP exit: clock TX TCLK-trail
- LP exit: clock TC TX TEOT

HS data-clock timing

- HS clock instantaneous
- HS clock rising edge alignment to first payload bit
- Data-to-clock skew (TSKEW(TX))

Ordering information

To purchase the U7238A MIPI D-PHY compliance software with a
new or existing Keysight Infiniium 9000, 90000 and 90000
X-Series oscilloscope, order the model numbers shown:

Model Number	Description	Quantity
DSO/DSA90404[1] or DSO9404A	Infiniium Series oscilloscope Infiniium Series oscilloscope	1
N5414B or N5415B	InfiniiScan event identification software, (Option 009 on new oscilloscopes or N5414B for 90000 series, N5415B for 9000 Series or N5435A-004 for server based license)	1
U7238A	MIPI D-PHY compliance test software for Infiniium Oscilloscopes (option 035 on new oscilloscopes or option N5435A-022 for server based licence)	1
1132A	InfiniiMax 5-GHz differential probe amplifier	3
E2669A	Differential probe connectivity kit (contains needed probe heads)	1

1. * U7238A also supports higher bandwidth Infiniium Series oscilloscopes

Related Literature

Publication title	Publication type	Publicationnumber
Infiniium DSO/DSA 90000A Series Oscilloscopes	Data sheet	5989-7819EN
N5414B/N5415B InfiniiScan Event Identification	Data sheet	5989-4605EN
MIPI D-PHY Protocol Test Solutions	Data sheet	5989-7921EN
N5990A Test Automation Software Platform	Data sheet	5989-5483EN
Infiniium DSO/MSO9000A Series Oscilloscope	Data sheet	5990-3746EN
Keysight Technologies Infiniium 90000 X-Series Oscilloscopes	Data sheet	59990-5271EN

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