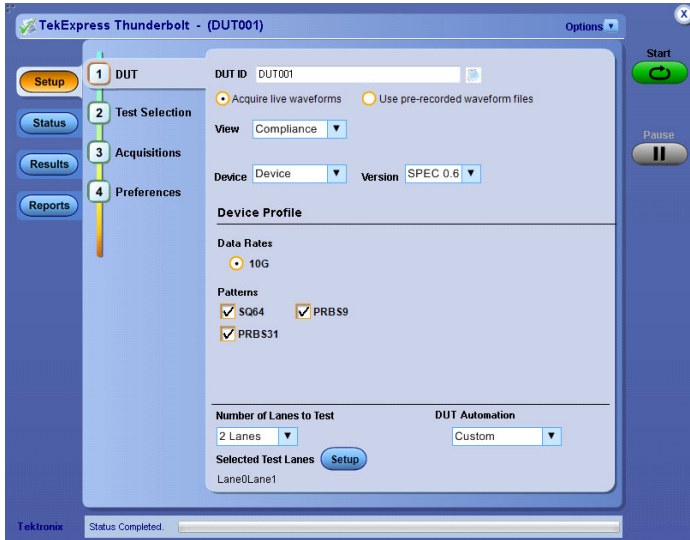


# Thunderbolt™ Application Software

## TBT-TX Data Sheet



## Features & Benefits

### TBT-TX Thunderbolt Transmitter Characterization, Debug, and Compliance Testing

- Automated Transmitter Validation for Thunderbolt Interconnect Specification Revision 0.6
- Simultaneous Two-lane Testing with Device Test Mode Automation
- Easily Reconfigure Existing Measurements to Create User-specified Test Parameters or Test Limits
- Support for Test Fixture De-embedding to Provide More Measurement Margin
- Jitter Decomposition of Random from Deterministic Jitter to Give Better Insight into Critical Thunderbolt Design Challenges
- Quickly Recalculate Test Results using Saved Waveforms with Offline Mode
- Detailed Test Reports with Margin and Statistical Information Aid Analysis

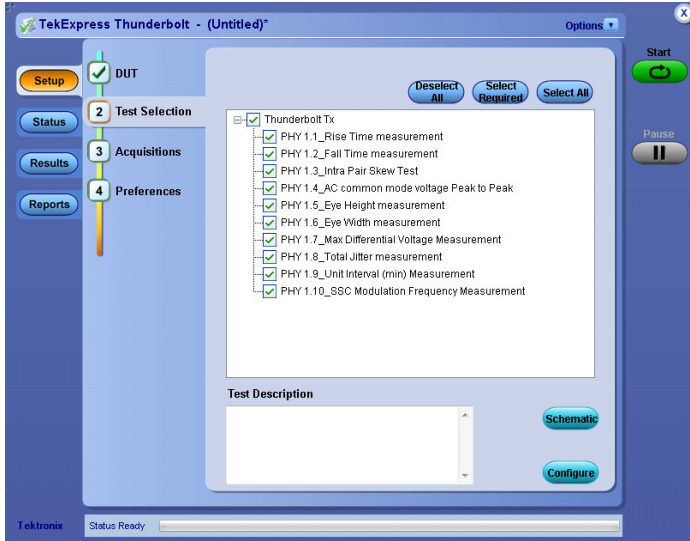
## Applications

- Thunderbolt Electrical Testing for:
  - Thunderbolt Silicon
  - Storage and Display Systems
  - Add-in Expansion Cards
  - Motherboards
  - Embedded Systems
  - Dongles
  - Manufacturing Test

Tektronix provides the most comprehensive solutions to serve the needs of engineers designing Thunderbolt silicon and host systems as well as those validating the physical-layer compliance of Thunderbolt devices to the Thunderbolt Interconnect Specification.

The Tektronix TBT-TX applications and selected Tektronix oscilloscopes provide one-button testing for Thunderbolt measurements as specified by the Thunderbolt specification. TBT-TX automates the measurements allowing engineers to perform the required tests efficiently and reliably right on their bench.

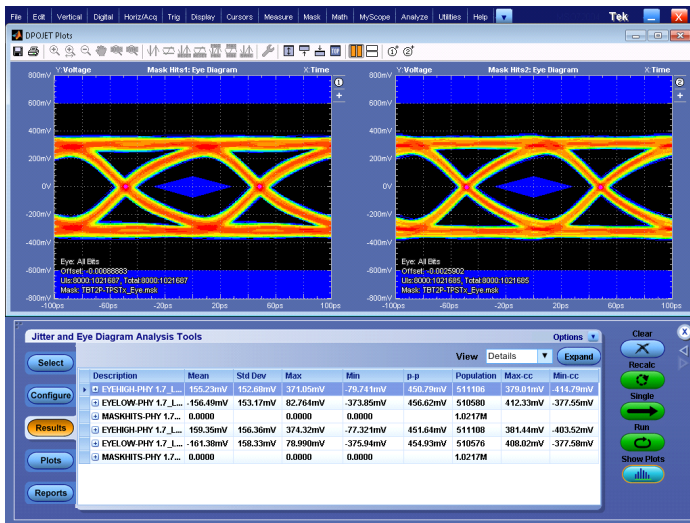
The DPO/DSA/MSO70000 Series oscilloscopes are designed to meet the challenges of the next generation of serial data standards such as Thunderbolt. These oscilloscopes provide the industry's leading vertical noise performance with the highest number of effective bits (ENOB) and flattest frequency response among oscilloscopes in their class.



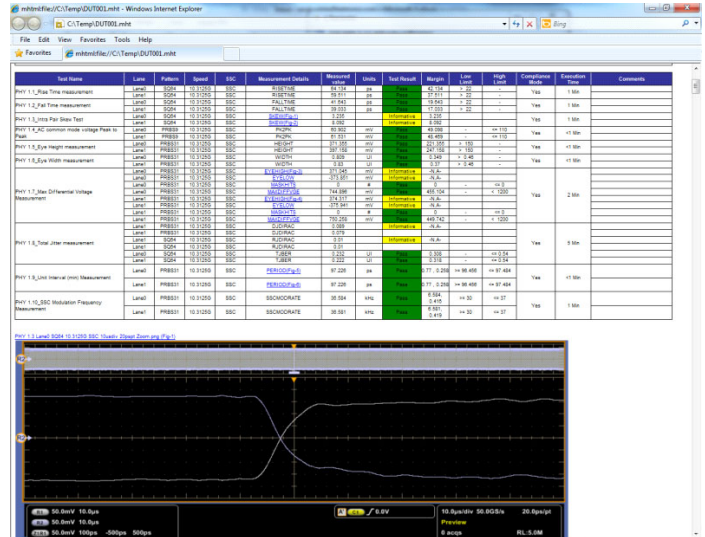
Thunderbolt Physical-layer Tx Compliance Measurements.



Custom Measurement Settings with User-defined Mode.



Simultaneous Multi-lane Analysis with Automated Device State Control.



Detailed Test Report with Measurement Results, Limits, Setup Details, and Screenshots.

## TBT-TX – Thunderbolt Physical Layer Testing

With its fast data rate and multi-lane topology Thunderbolt will present a number of test and measurement challenges, including fixture effects and the need to isolate crosstalk. Coupling of energy from adjacent signaling lanes adds noise and jitter that can affect system interoperability. Effective debug requires jitter analysis tools that can properly separate and classify the jitter components of a signal, including those stemming from crosstalk. Before the measurements are computed the test channel must be de-embedded. De-embed filters can be easily created using Serial Data Link Analysis software (SDLA) and then quickly entered into the TBT-TX measurement setup and saved for future use. In addition to jitter, TBT-TX also provides voltage, spread spectrum clocking (SSC), and other AC parametric measurements.

For compliance testing, TBT-TX automates the instrument setup as required by the Thunderbolt Specification including adequate time window for SSC analysis and PLL settings for jitter/eye analysis. The port microcontroller enables automated device automation through test pattern initiation. TBT-TX allows the user to automate test modes while integrating the required scripts or step through the test modes with manual device control. A test status window indicates current status of waveform acquisitions, signal analysis, and results documentation. The TBT-TX software can be run in Offline mode which allows the user to quickly recalculate test results using saved waveforms. A detailed test report provides color-coded Pass/Fail indications along with test margins. TBT-TX can be run in User-defined mode to debug test failures with custom settings and test limits.

## Characteristics

### Supported Thunderbolt Specification Measurements

#### Differential 10.3125 Gb/s Transmitter (Tx) Output Measurements

Test	Pattern	Description
PHY 1.1	SQ64	TP1_OUT_RISE
PHY 1.2		TP1_OUT_FALL
PHY 1.3		LSOUT-SKEW-INSTR_PAIR
PHY 1.4	PRBS9	VSOUT-AC-CM_pk_pk
PHY 1.5	PRBS31	Eye Height
PHY 1.6		Eye Width
PHY 1.7		Max Diff Voltage
PHY 1.8		TJ at 10-13 BER
PHY 1.9		Unit Interval (min)
PHY 1.10		SSC Modulation Frequency

### Ordering Information

Recommended DPO/DSA/MSO70000 Series oscilloscopes:

- DPO/DSA/MSO70000 Series  
(20 GHz or higher bandwidth models recommended, minimum of 16 GHz is required)

### TBT-TX\*1, 2 – Thunderbolt Tx Physical Layer Test Application

Model	New Instrument Orders	Product Upgrades	Floating Licenses
DPO/DSA/MSO70000 Series	Opt. TBT-TX	Opt. DPO-UP TBT-TX	Opt. DPOFL-TBT-TX

\*1 Requires Option DJA (DPOJET Jitter and Eye Diagram Analysis) and Option 2XL or higher.

\*2 Requires Microsoft Excel 2002 or above for report generation.

### Recommended Accessories

Order	Description
Opt. SLA	Serial Data Link Analysis – Advanced (includes Equalization)
BSA125C with Opt. STR	12.5 Gb/s Bit Error Rate Analyzer (crosstalk generator)
P7500 Series	TriMode™ Differential Probe

### Recommended Test Fixtures

Order	Description
TF-TB-TPA-P	Thunderbolt Plug Adapter
TF-TB-TPA-R	Thunderbolt Receptacle Adapter
TF-TB-TPA-PR2XC	Thunderbolt Plug, Receptacle, Dual 2X Calibration Fixtures
TBT-TPA-UH*2	Thunderbolt Port Microcontroller (Host/Device Testing)
TBT-TPA-UC*2	Thunderbolt Port Microcontroller (Cable Testing)
TBT-TPA-PU*2	Thunderbolt Plug Adapter and Port Microcontroller (Host/Device Testing)
174-4944-xx	Matched SMA Cables

\*2 Available from Wilder Technologies (<http://www.wilder-tech.com>).

### Additional Information

Tektronix offers a range of solutions for Thunderbolt testing. To see a comprehensive listing, including the BERTScope BSA Series for Receiver and Cable Testing and the DSA8300 for Channel De-embedding and Interconnect Analysis, visit [www.tek.com/technology/thunderbolt](http://www.tek.com/technology/thunderbolt). TBT-TX solution updates and up-to-date instrument software upgrades are available at [www.tek.com/downloads](http://www.tek.com/downloads).

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**USA** 1 800 833 9200

\* European toll-free number. If not accessible, call: +41 52 675 3777

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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com)



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