

Innovation for the next generation

ML4079ELN



800G BERT | 8 Channel | 68 GBaud PAM4 & 68 Gbit NRZ | PRBS13Q & PRBS31Q | IEEE802.3ck specs for Long Reach | Real Hardware FEC Analysis | Linear Optics Testing | PCIe Gen 3.0, 5.0 and 6.0 and 7.0 Applications | Up to 34dB Equalization | Compatible with the MWTP

Summary

The ML4079ELN is an 8-channel, 800G BERT purpose built for long reach applications including PCIe- Gen 3, 5, 6 and 7, automotive, transceiver and data center interconnect testing. The ML4079ELN features a wide range of line rate coverage, up to 34dB equalization, built-in AWGN noise injection, and ratio level mismatch (RLM), control, providing a single platform for testing up to 8x68 GBaud.

The ML4079ELN is compatible with the MWTP, the user can fit up to 2 ML4079ELN, to test up to 16 channels

The ML4079ELN includes transmitter equalization (3 or 7 taps FFE), and receiver equalization. The ML4079ELN can provide measurements for Signal-to-Noise Ratio (SNR), histogram measurements, and Real Time BER Measurements and FEC Measurements.

ML4079ELN

8 x 68 GBaud PAM4 BERT

Introduction

The ML4079ELN is a fully featured 800G BERT that can be configured for eight channels of 1-1.5Gbps; 2.55-5.9Gbps; 7.3-11Gbps; 24-32Gbps and 41-66Gbps NRZ and 21.25-21.75GBaud; 26.5625-36GBaud and 44-66GBaud PAM4.

The transmitters support all standard test patterns mandated by IEEE802.3ck stress testing and OIF such as PRBS13Q, PRBS31Q, etc. Tx can also be programmed to output a user-defined pattern.

The ML4079ELN supports transmitter and receiver equalization up to 34dB to overcome signal integrity impairments due to channel losses or reflections.

Additionally, users can opt to programmatically add an ISI channel equivalent to a frequency-dependent attenuator with 1 to 9dB loss at Nyquist.

The ML4079ELN is specifically for linear optic, PCIe Gen 3.0, 5.0 and 6.0, and Active and Passive Cable stress testing, with unique AWGN injection and high Rx equalization capabilities.

Key Features

Transmit

Data Rates: 1-1.5Gbps; 2.55-5.9Gbps; 7.3-11Gbps; 24-32Gbps and 41-68Gbps NRZ and 21.25-21.75GBaud; 26.5625-36GBaud and 44-68GBaud PAM4.

- Ability to tune the bit rate in steps of 100kbps and find the RX PLL locking margin
- DFE and CTLE Equalization
- Independent control of inner eye levels
- Up to 800mVpp controllable Tx Amplitude swing
- Supports Gray coding

Real hardware FEC. SER and FEC measurements and margin available on channels individually as well as on 100G, 400G and 800G blocks.

- Available patterns:
 - PRBS7/9/11/13/15/16/23/31/58
 - PRBS13Q, PRBS31Q
 - Square wave
- Error injection.

Receive

- SNR monitoring over time.
- PAM histogram monitor.
- Error-detection on following patterns:
 - PRBS 7/9/11/15/16/23/31
 - PRBS13Q and PRBS31Q
- Automatic pattern detection.
- LOS indicators.
- Up to 34dB Equalization Capabilities.

General

- LabView driver and Python wrapper available.
- Shallow Loopback testing.
- API libraries with documentation.

Target Applications

- Pluggable and Linear Pluggable Optics Stress testing.
- PCIe Gen 3.0, 5.0, 6.0 and 7.0 testing.
- Testing of copper and fiber-optic transmission lines.
- Active and Passive Cable Testing.

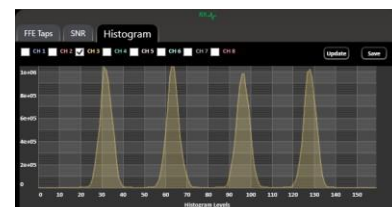


Figure 1: PAM4 eye histogram

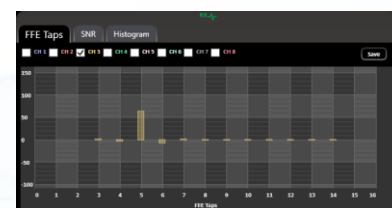


Figure 2: RX FFE Taps

Using ThunderBERT GUI, both instant and accumulated BER, FEC, and SER measurements can be displayed and monitored:

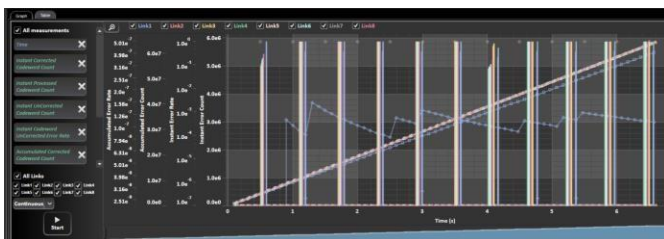


Figure 3: ThunderBERT GUI Screenshots Showing BER Measurements

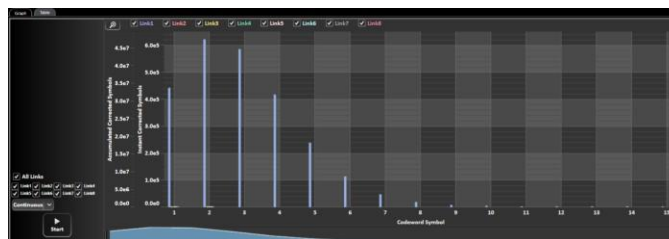


Figure 4: ThunderBERT GUI Screenshots Showing SER

Shallow Loopback mode

Figure 5 depicts a ML4079ELN accepting traffic from an external 800GE switch, looping the traffic internally and re-transmitting it back to the RX side of the host. This can be used to test the robustness of the host port.

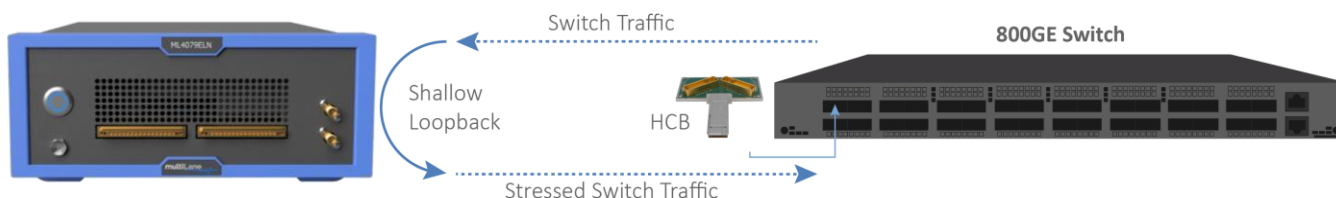


Figure 5: Shallow Loopback Using ML4079ELN and 800G Switch

RLM Stress Test: Inner/Outer Eye Control on PAM4 Mode:

ML4079ELN supports a full Inner and Outer Eye Control Range using the ThunderBERT GUI.

This feature enables the robustness testing of the transmitted signal by changing the Inner/Outer Eye settings and measuring the Level Separation Mismatch Ratio (RLM). The obtained value is compared to the IEEE 802.3 Transmitter Characteristics Value for Compliance Evaluation.

Figure 6 illustrates 3 different Inner/Outer Eye settings using the ML4079ELN.

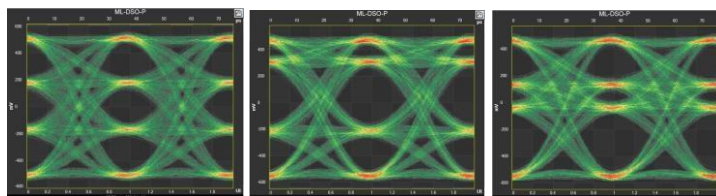


Figure 6: Inner/Outer Eye Control Using ML4079ELN

Specifications

Parameter		Specifications
Bit Rates		NRZ: 1G to 1.5G; 2.55G to 5.9G; 7.3G to 11G; 24G to 32G and 41G to 68G PAM4: 21.25G to 21.75G; 26.5625G to 36G and 44G to 68G
TX Amplitude Differential		0 – 800 mVpp
Patterns		PRBS 7/9/11/13/15/16/23/31/58/9_4 SQ2, SQ4, SQ8, SQ16, SQ32
TX Amplitude Adjustment		Steps of 1 mV
Pre-emphasis resolution		1000 steps
Pre- / Post-emphasis		6 dB
Equalizing Filter Spacing		1 UI
Random Jitter RMS ¹		< 250 fs
Rise/ Fall Time (20–80%) ¹		< 10 ps
Coding		Gray coding supported
FEC (up to 800G)		8x100G and 2x400G in KP Mode
		50G KR Mode
Output Return Loss up to 10 GHz		< -15 dB
Output Return Loss (16-25 GHz)		< -10 dB
Error Detector input range		50 – 800 mV differential
TX/RX connectors		1X16 SMPS footprint on front channel
Reference clock Output	Reference clock	156.25 MHz
	Monitor clock	High Frequency Clock: Multiplier of 1 to 30 of the reference clock
Diff. Input Return Loss		Better than 10 dB
Eye monitor resolution		8 bits horizontal across 2 UI / 9 bits vertical
Clock Input Range		Up to 4.4 GHz
Clock Input Amplitude		800 – 1600 mV
Input Impedance		50 Ω
Ambient Temperature		0 – 75 °C
Power		110 V, 1.4 A or 220 V, 0.9 A – 50/60 Hz

¹ With appropriate pre and post emphasis settings and 50 GHz scope with CDR. Trigger from adjacent data channel rate/8

Mechanical Dimensions

The ML4079ELN is a benchtop instrument that fits in a 19-inch 2U rack. Two ML4079ELNs arranged side by side take up one 2U slot in a rack. MultiLane also supplies the needed brackets.

The ML4079ELN is also compatible with the MWTP platform

Up to 2x ML4079ELN can fit in the MWTP chassis:



Figure 7: ML4079ELN Dimensions in benchtop

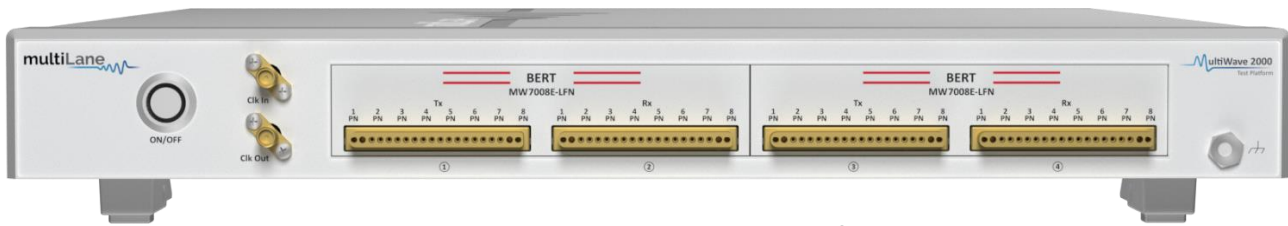


Figure 8: 2x ML4079ELN in MWTP platform

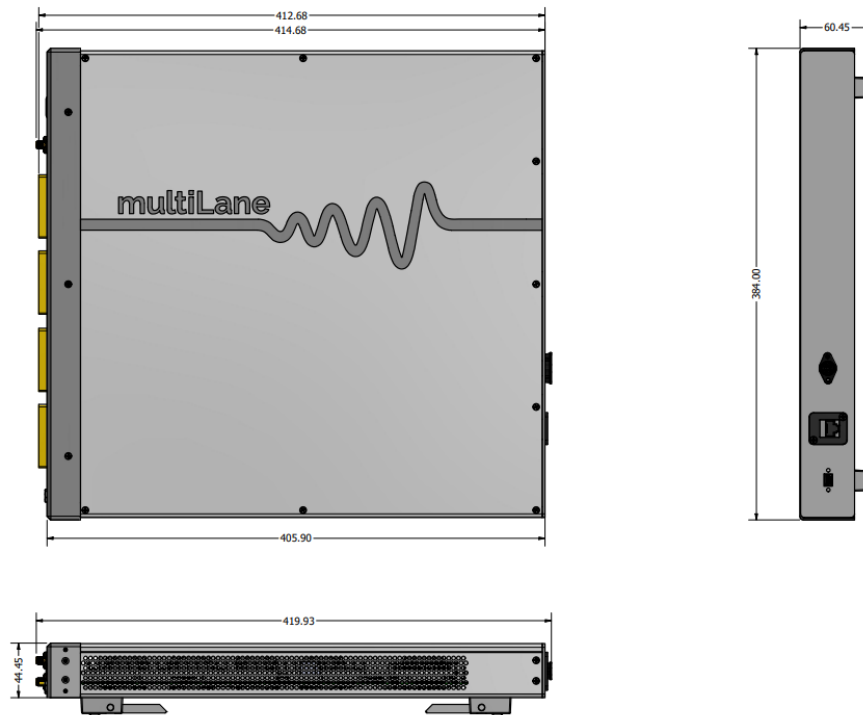


Figure 9: MWTP outline

Ordering Information

Option	Description
ML4079ELN-Lite	Bit Rate Support up to 29GBd NRZ/PAM4 and 32.5Gbps NRZ only per differential channel Supports PCIe gen5
MWTP packaging option	Up to 2x MW7004E-LFN can be added in an MWTP
PCIe 6-7	License Package added to the ML4079ELN-Lite base product, to enable PCIe Gen 6 and PCIe Gen 7 rates
800G	License Package added to the ML4079ELN-Lite base product to enable full 8x112 Gbit rate range support
FEC	License Package added in addition to the 800G option to enable real Hardware FEC encoding and decoding
3YW	Total 3-year warranty
CAL	Single calibration
3YWC	Total 3-year warranty with 3 annual calibrations

Recommended Accessories

Part number	Description
MLCC-SMPSBFC116-F047075-185MST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (M), Flexible 047, 7.5 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04715-185MST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (M), Flexible 047, 15 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04730-185MST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (M), Flexible 047, 30 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04760-185MST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (M), Flexible 047, 60 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F047075-185MST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (M), Flexible 047, 7.5 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04725-SMPSBFC116	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1X16 SMPS Blind-Mate (F), Flexible 047, 25 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F047075-185FST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (F), Flexible 047, 7.5 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04715-185FST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (F), Flexible 047, 15 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04730-185FST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (F), Flexible 047, 30 cm, phase matched to +/-0.5 ps.
MLCC-SMPSBFC116-F04760-185FST	Coax Cable Assembly, 1X16 SMPS Blind-Mate (F) to 1.85 mm (F), Flexible 047, 60 cm, phase matched to +/-0.5 ps.

Please contact us at sales@multilaneinc.com