multiLane

DATASHEET

Innovation for the next generation

ML7004F-L

224G/Lane BERT | 4 Channels | 35dB Equalization Capabilities | PAM4 & NRZ Modulations |CEI-224G, LR/MR/VSR | 21 Tx FFE Taps| Rx Equalizer with digital FFE and dual DFE PRBS Generator and checker

Summary

The early adoption of 1.6T brings new considerations for companies on the cutting edge. The exponential increase in data transfer speeds has resulted in higher Bit Error Rates, and a keen understanding of system functionality is crucial. From validating fiber optic and copper wire digital data transmission lines to testing transceiver signal integrity, these instruments ensure smooth operation of the devices at the heart of data centers around the world.

The ML7004F-L is a 224G/Lane, 4-channel BERT is tailored to the needs of those looking to develop the 1.6T ecosystem.

Up to 4 MW7004F-L slots can fit in 1 MWTP, to test up to 16 channels at a time

The ML7004F-L, is features over 35dB of loss equalization to support long reach applications, signal to noise ratio (SNR) and histogram measurements and allows the user to implement transmitter and receiver equalizers. The ML7004F-L can also be used to optimize link performance to be able to minimize the ever-more important power consumption of high-speed connections.

ML7004F-L

4 x 224G BERT

Introduction

The ML7004F-L is a fully featured BERT that can be configured for four channels of 224G, 112G and 56G PAM4 and 25G NRZ and their derivative dynamic rates.

The ML7004F-L is compliant with the IEEE 802.3ck C2M, OIF CEI 112G VSR, MR and LR.

The transmitters support all standard test patterns mandated by the specs such as PRBS13Q, SSPRQ, PRBS31Q, etc. Tx can also be programed to output a user-defined pattern.

The ML7004F-L supports transmitter and receiver equalization up to 35dB 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 9 dB loss at Nyquist.

The ML7004F-L is a general purpose 224G/Lane BERT to test interconnects and data center DUT.

Key Features

Transmit

- Data Rates: NRZ: 25.5625 to 27Gbit/s; 30Gbit/s; 50Gbit/s to 56Gbit/s and 100Gbit/s to 120Gbit/s
  PAM4: 25.5625 to 27Gbaud; 30Gbaud; 50Gbaud to 56Gbaud and 100Gbaud to 120Gbaud
- Ability to tune the bit rate in steps of 100kbps and find the RX PLL locking margin.
- Independent control of inner eye levels.
- Supports Gray coding.
- 21-tap Pre- and Post-emphasis linear FFE.
- Independent PLL per Lane.
- Available patterns:
  - PRBS9/11/13/15/16/23/31
  - PRBS13Q
  - SSPRQ

Receive

- SNR monitoring over time.
- 15-FFE Taps monitor.
- Decision Feedback Equalization (DFE); Reflection canceller (RC).
- Independent CDR on each lane.
- Independent PLL per lane.
- PAM histogram monitor.
- Error-detection on following rates:
  - From 100Gbaud to 120Gbaud
- Error-detection on following patterns:
  - PRBS 11/15/16/23/31/31Q
- Automatic pattern detection.
- LOS indicators.
- Up to 35dB Equalization Capabilities.

General

- LabView driver and Python wrapper available.
- API libraries with documentation.
- Compatible with ThunderBERT Interface.
- Compatible with Lane Control for IP Changing, FW Update and DHCP.

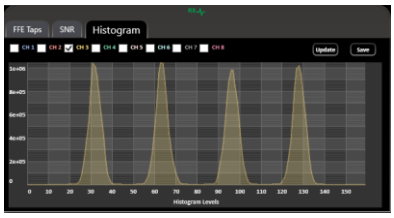


Figure 1: PAM4 eye histogram

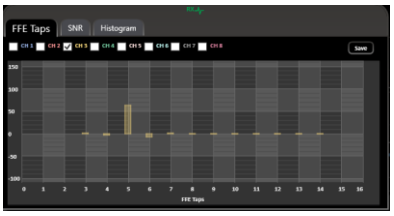


Figure 2: RX FFE Taps

Target Applications

- General Purpose 224G/Lane tester.
- Pluggable and Linear Pluggable Optics.
- Testing of copper and fiber-optic transmission lines.
- Active and Passive Cables Testing.

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

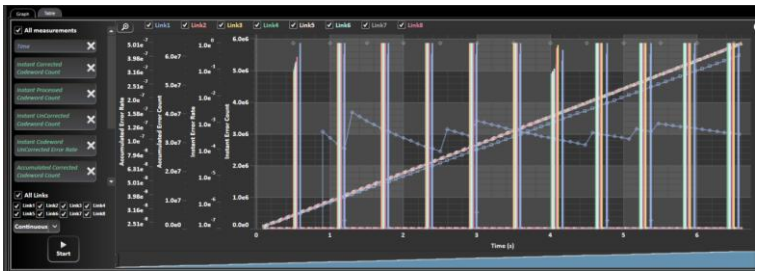
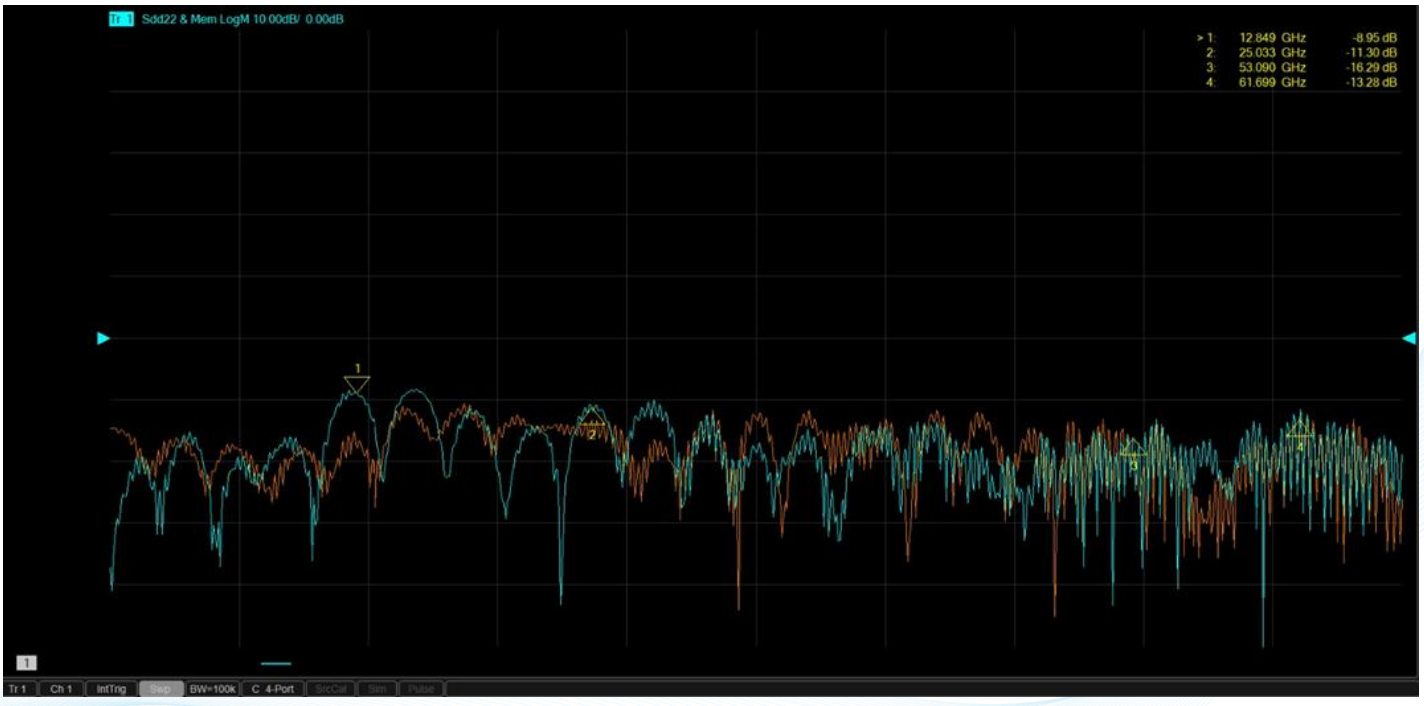


Figure 3: ThunderBERT GUI Screenshots Showing BER Measurements

Differential return loss:



Specifications

Parameter		Specifications
Bit Rates		NRZ: 24 to 28Gbit/s; 50Gbit/s to 56Gbit/s and 100Gbit/s to 120Gbit/s PAM4: 24 to 28Gbaud; 50Gbaud to 56Gbaud and 100Gbaud to 120Gbaud
TX Amplitude Differential		0 – 800mVpp
Patterns		PRBS 9/11/13/15/16/23/31/13Q, SSPRQ, User Defined
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]		< 300 fs
Rise/ Fall Time (20–80%) [1]		TBD
Coding		Gray coding supported
Output Return Loss up to 10 GHz		TBD
Output Return Loss (16-25 GHz)		TBD
Error Detector input range		50 – 800 mV differential
TX/RX connectors		1x 16 SMPS Connector
clock Output	**Reference clock**	156.25 MHz
	Monitor clock	A divider by 16, 32, 64 and 128
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		External Power Supply 110 V, 1.4 A or 220 V, 0.9 A – 50/60 Hz

[1] With appropriate pre and post emphasis settings and 70 GHz scope. Trigger from adjacent data channel rate/64

Mechanical Dimensions

The ML7004F-L is available in 4 channels in following mechanical form.

Figure 4: ML7004F-L Dimensions

MW7004F-L is compatible with the MWTP platform, the user can choose any configuration to fit up to 4x MW7004F-L in 1 MWTP

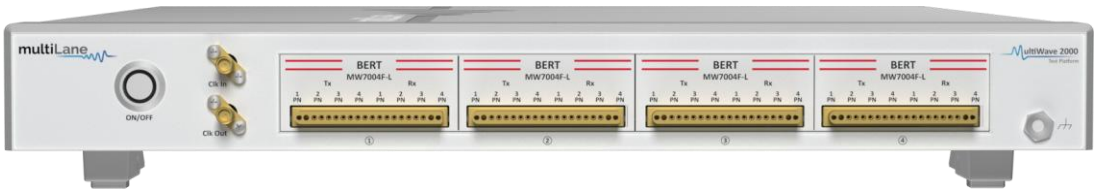


Figure 5: 4x MW7004F-L in the MWTP Platform

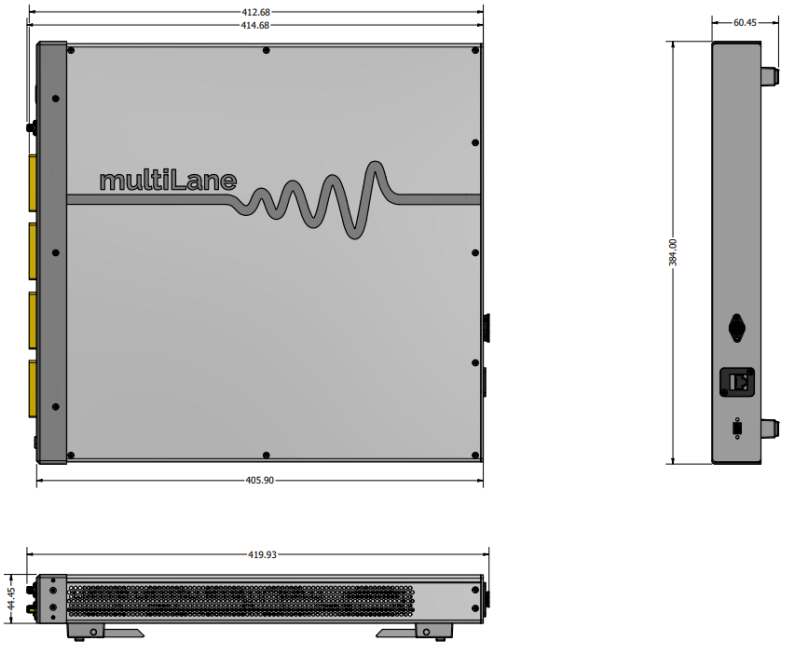


Figure 6: MWTP Outline

Ordering Information

Option	Description
ML7004F-L	224G/Lane BERT 4 Channels
MW7004F-L	224G/Lane BERT 4 Channels Module in the MWTP Form Factor, 1 MWTP can fit up to 4x modules
3YW	Total 3-year warranty
CAL	Single calibration
3YWC	Total 3-year warranty with 3 annual calibrations

Recommended Accessories

Instruments	Recommended	Comments
ML7004F-L	1X 1X16 SMPS cable (M) or (F)	1x16 SMPS Cable, M or F connector (1.85mm)

Please contact us at sales@multilaneinc.com