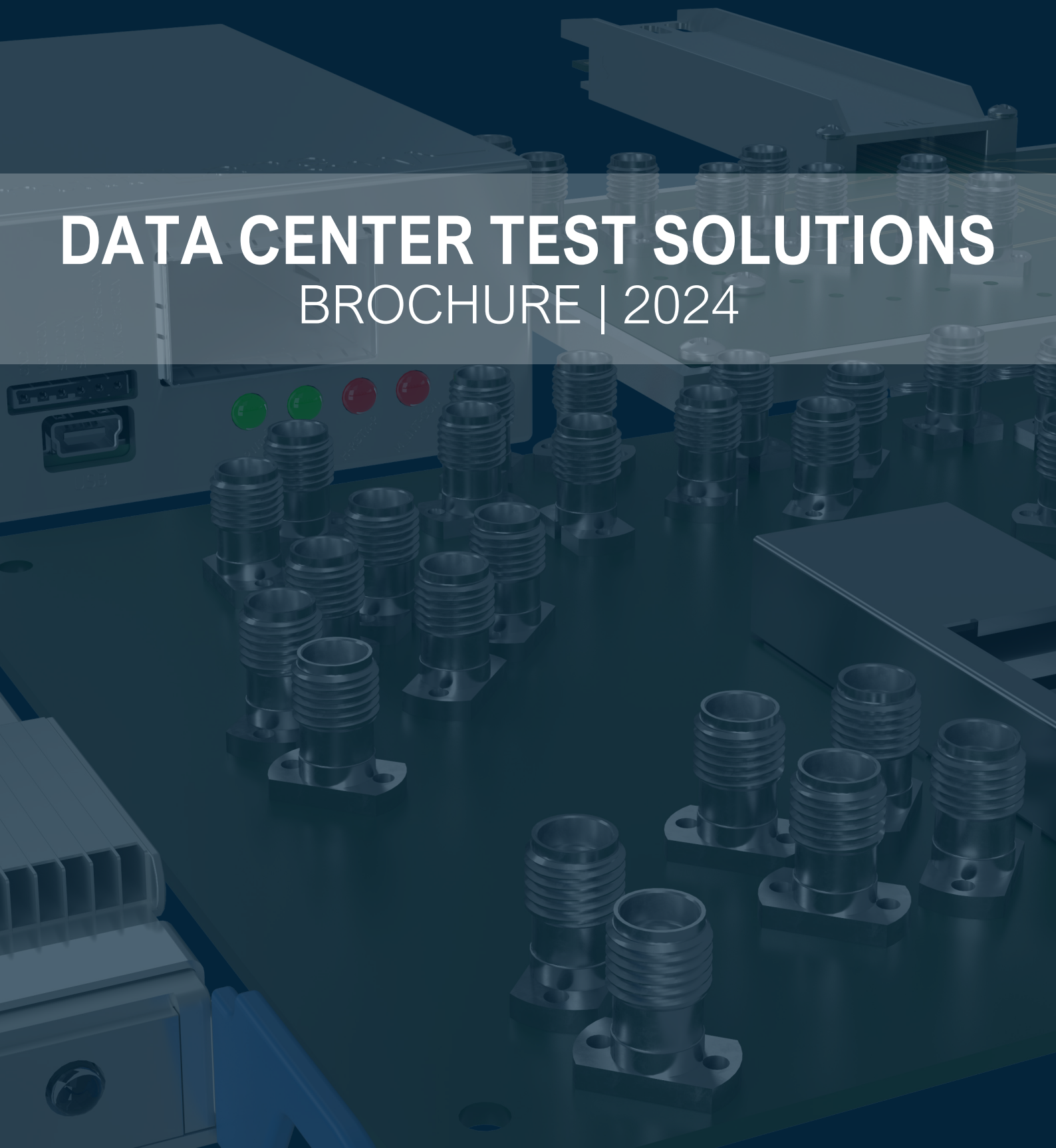
multiLane

DATA CENTER TEST SOLUTIONS

BROCHURE | 2024



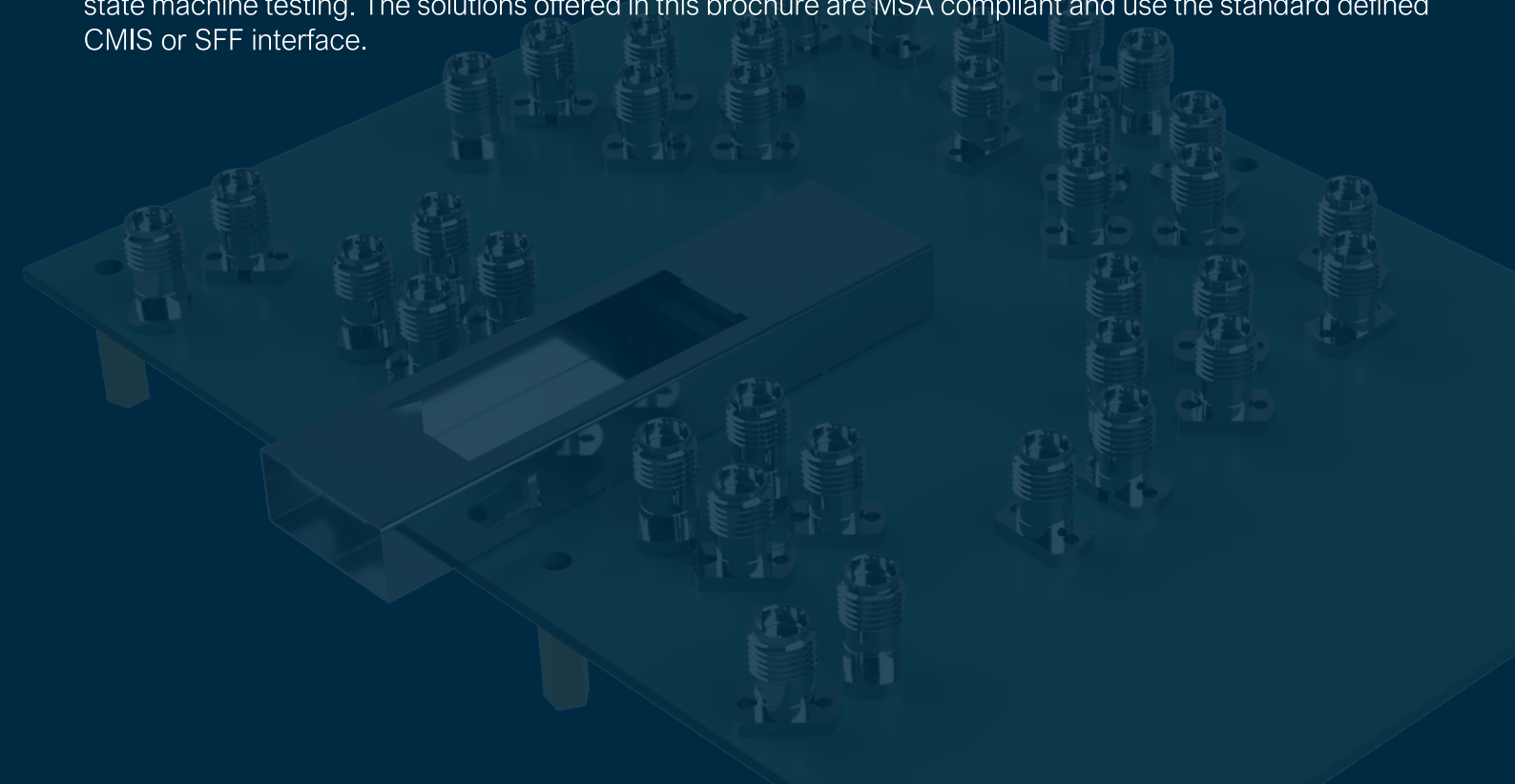
ABOUT US

Since 2006, Multilane has been offering high speed test and measurement equipment for data communications. We help chart industry evolution and accelerate the adoption of new technologies with a complete cycle support of data center test solutions encompassing IC and transceiver characterization, host line card testing, and link testing. We provide a range of form factors and architectures, from portable instruments, to stand-alone bench top instruments to automated test platforms. We also assist our customer base with compliance and interoperability test services. We serve developers, module vendors, network installers, and data center operators with high-performance, reliable equipment at an attractive price-point. Multilane provides leading-edge solutions for the latest data center technologies and well-established techologies, from 800G at 112Gbps/lane to industry-first 1.6T thermal testing solutions, with a comprehensive set of development solutions for MSAs ranging from SFP, DSFP, QSFP, QSFP-DD, QSFP-OO800, and OSFP800.

The Multi Lane portfolio encompasses optical and electrical oscilloscopes, bit error rate testers, time domain reflectometers (TOR) for TIA and cable testing, interconnect products, as well as fully automated DAC and transceiver test solutions, and compliance test services for 1 00G and 800G technologies. Developers, manufacturers, and installers of these new technologies all need the wide portfolio of solutions to be able to do their jobs successfully.

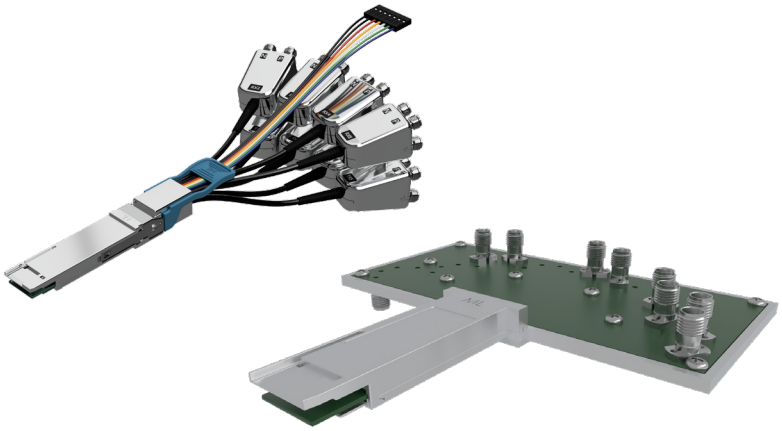
DATA CENTER TEST SOLUTIONS ENABLE NETWORK EVOLUTION

The ever-increasing faceplate densities and data rates bring with them a proliferation of many different MSA form factors and standards. As such, the need for tools to ensure compliance to the relevant standards is essential. As part of MultiLane's commitment to supporting the evolution of the data center, we provide a comprehensive selection of these data center test solutions for a wide variety of standards including Module and Host Compliance Boards, Passive and Active Loopback Modules, and Analyzers for I2C CMIS and SFF state machine testing. The solutions offered in this brochure are MSA compliant and use the standard defined CMIS or SFF interface.

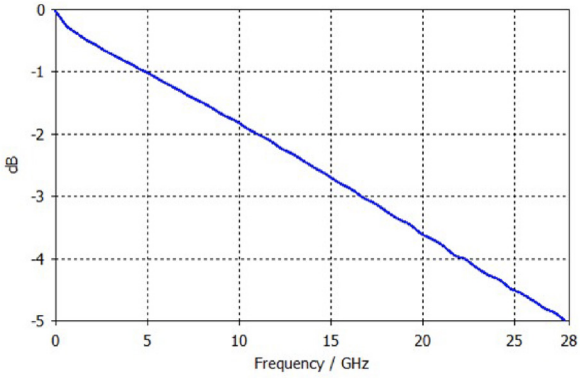


HOST COMPLIANCE BOARDS

A host compliance board is a breakout fixture that can be plugged into the system host side and provides access to the host electrical input and output signal (TP1a, TP4a compliance test points). It is a passive structure for optimum signal integrity. See graph for typical insertion loss performance.



Left to Right: The ML4062-CHCB-112 QSFP-DD 112 cable based HCB and the ML4064-HCB-112 OSFP 112 HCB



Insertion loss OSFP HCB ML4064-HCB

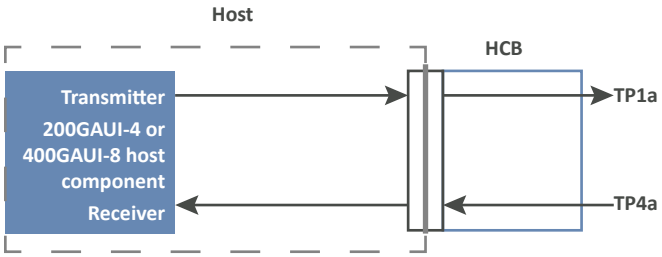
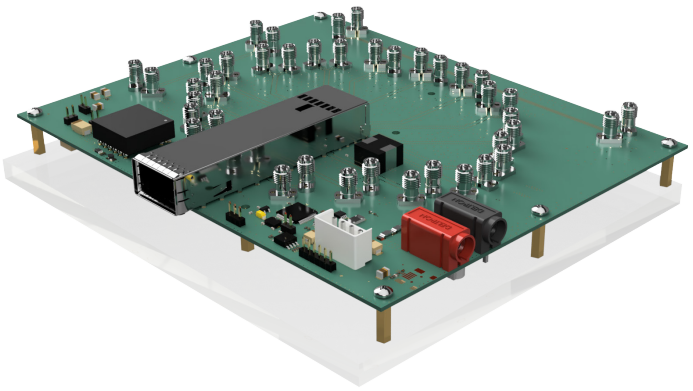


Figure 120E-5--Host 200AUI-4 or 400GAUI-8 C2M compliance points

Reference: 802.3bs spec, section Annex 120E, p253

MODULE COMPLIANCE BOARDS

MultiLane's Module Compliance Boards (MCBs) can be used with any form of pluggable in their respective form factor. They serve to validate the compliance, signal transmission, and any other feature the pluggable has. They can also test and monitor module thermal capability, as well as provide stress testing.
The Module Compliance Boards are accompanied with a comprehensive CMIS or sff user interface.
The UI includes, but is not limited to:
- I2C Access and R/W
- Customizable memory maps and access to module EEPROM
- Temperature, voltage, and current monitoring



ML4064-MCB-112

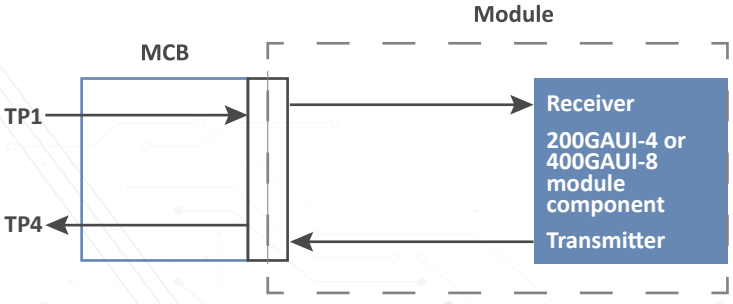
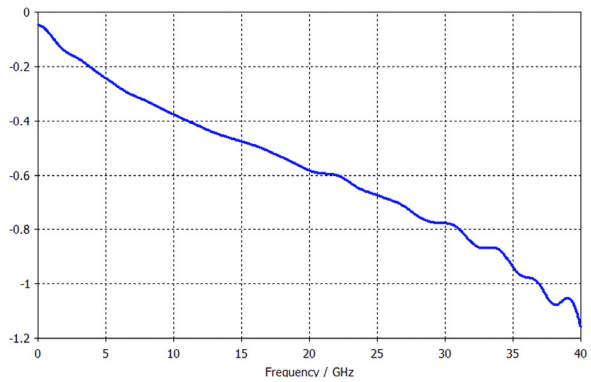


Figure 120E-6--Module 200AUI-4 or 400GAUI-8 C2M compliance points

Reference: 802.3bs spec, section Annex 120E, p253

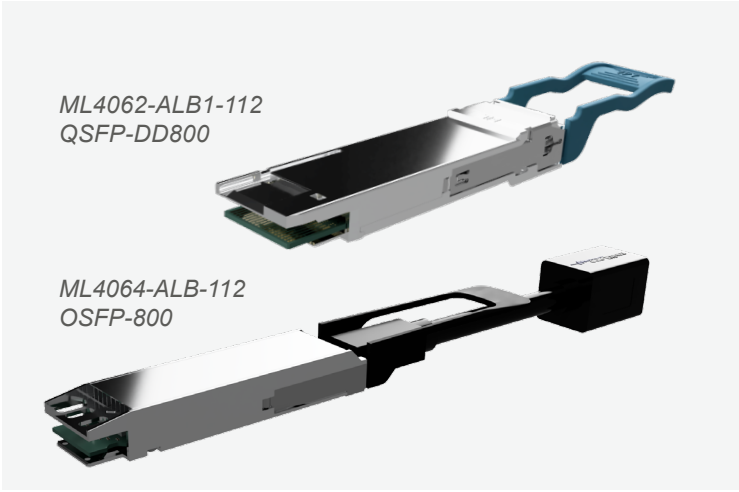


ML4041K-56 Insertion Loss

LOOPBACK MODULES

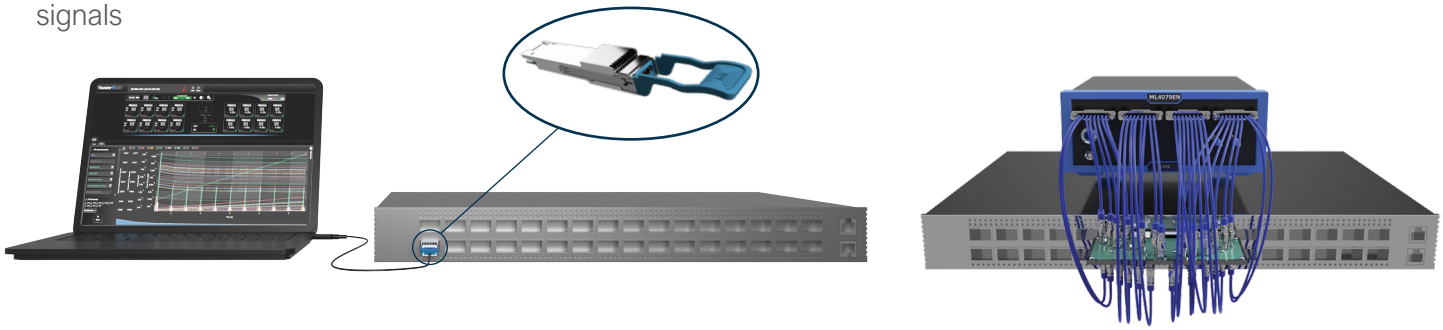
Active Loopbacks

The move to 800G brings with it a paradigm shift in loopback design. The complex characterization techniques required for host ports at 8x112Gbps necessitate the advent of a new generation of loopbacks to address these challenges. MultiLane's Active Loopbacks are DSP-based modules designed specifically to account for these complex characterization techniques, while also covering established requirement – loopback capabilities, CMIS interoperability, and thermal management – for host port testing.



Key Features

- Available for QSFP-DD (ML4062-ALB-112) and OSFP (ML4064-ALB-112)
- Multi-Vendor DSP support
- VSR Support
- PRBS Generator
- BER/ SNR Diagnostics
- Gray Mapping supported
- FIR taps supported
- 800G DSP enables retiming and equalization of host signals
- CMIS Compatible Configuration and EEPROM
- Communication via USB-C, I2C or ethernet
- Programmable MSA memory pages and custom memory maps
- Separate daughter card for configurable power spots, dissipating up to 19W
- DSP dissipates 10W
- Two temperature sensors, voltage sensor
- Additional feature: ThunderBERT GUI



ML4062-ALB-112-TB (right) characterizing a host port with ThunderBERT GUI. Equivalent to a full BERT benchtop setup (right)

While all Active Loopbacks are CMIS 5.0 compliant, they can also be enhanced with MultiLane's signature ThunderBERT GUI, resulting in a first-of-its-kind combination of instrument and module that can take the place of a full benchtop setup for host port testing. These ThunderBERT enabled ALBs – ALB-TBs – allow for distinct, separate Tx and Rx checking, making use of the ALB's full BER/SNR diagnostics and a PRBS generator through a much faster and more detailed GUI. With instrument-grade measurements packaged in a module's casing – a change in form factor akin to going from a desktop to a laptop – MultiLane's ALB-TBs can serve as benchtop replacements in development, speed up testing during production, and can even act as a field debugging tool post deployment.

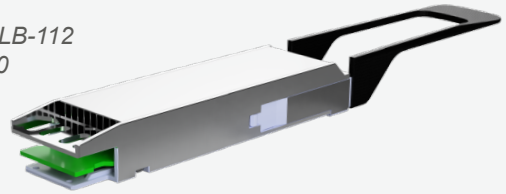
Watch video

LOOPBACK MODULES

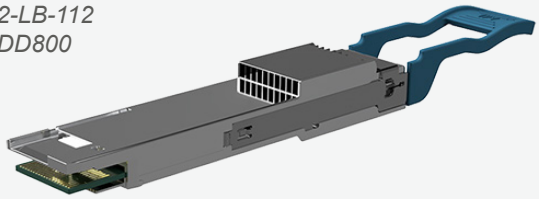
Passive/Thermal loads

Loopback modules are packaged in a standard MSA housing compatible with its respective ports. Transmit data from the host is electrically routed - internal to the loopback module - to the receive data outputs and back to the host. These modules act as thermal loads and have programmable power dissipation. This provides a cost-effective means to exercise system ports during R&D validation, production testing, and field testing. Some modules are thermal load only and do not have the high-speed loopback routing of signals and are used to solely test the thermal and power loading of a system.

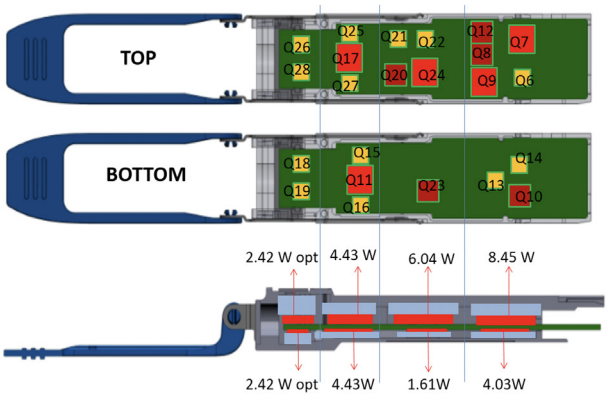
ML4064-LB-112
OSFP800



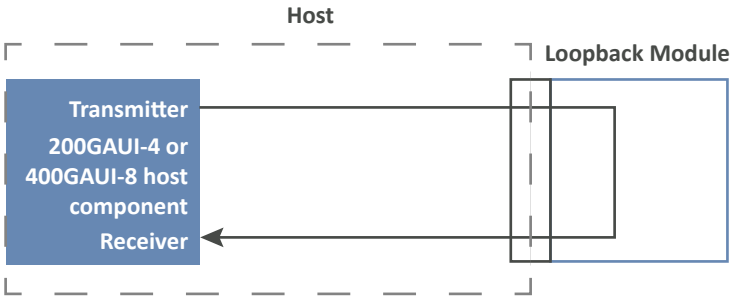
ML4062-LB-112
QSFP-DD800



The power dissipation of the loopbacks is programmable, and the thermal loads emulate the costlier optical transceivers' thermal profiles. Below is an example of the power dissipation elements inside the loopback.



ML4062-S-TL QSFP-DD 400G power dissipation elements

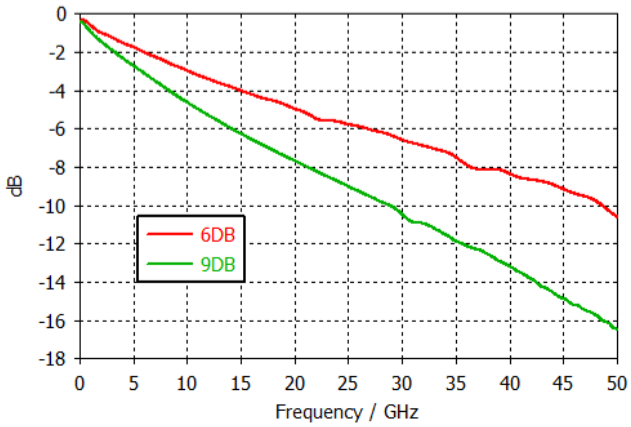


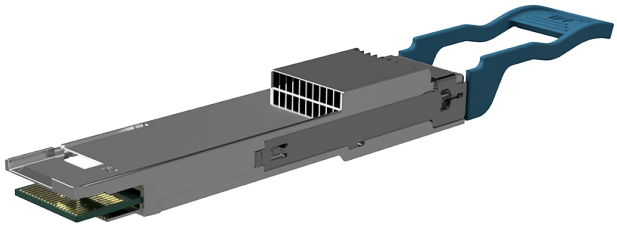
Watch video

LOOPBACK MODULES

Loss Target Loopbacks

MultiLane provides Loss Target Loopbacks with an attenuation of 9 dB.



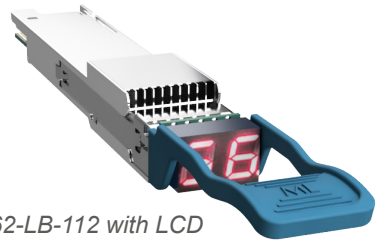


ML4062-LB2a-9dB

Smart Loopbacks

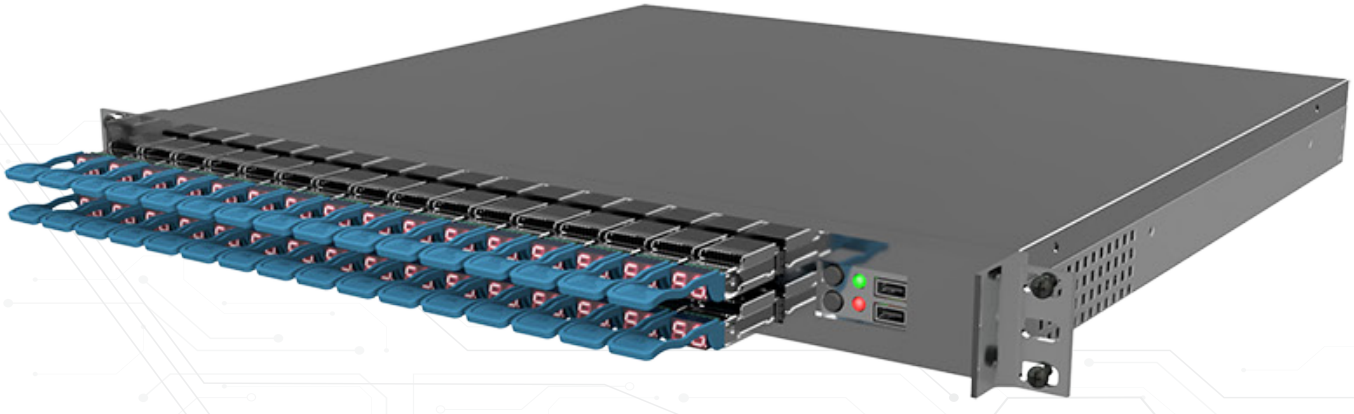
As the global leader in Data Center test solutions, we have adopted the term ‘smart loopbacks’ to emphasize the rich and powerful feature set that is being offered in these loopbacks. Smart loopbacks enable testing beyond the regular thermal loading and signal integrity validation, and support a variety of features crucial for firmware validation of new host designs:

- Fully programmable MSA memory pages
- Low speed signal status indicators
- Edge detection of control signals
- Raising alarm signals to any desired state
- LCD monitor to report real-time diagnostics



ML4062-LB-112 with LCD

MultiLane offers full customization of loopbacks to meet your specific testing needs. This includes setting the location and magnitude of thermal loads on the PCB itself, defining specific register content across memory map pages, and even forcing precise insertion loss/return loss impairments along the loopback traces.



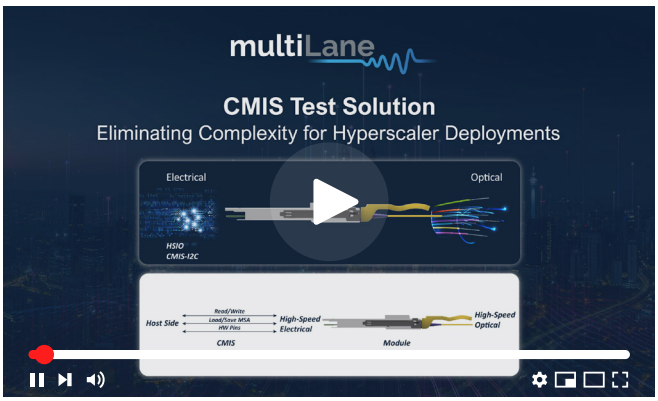
Switch with all ports being tested at once

ADAPTERS AND ANALYZERS

The new Common Management Interface Specification in 3.0, 4.0, and 5.0 versions is a unified protocol to ensure device interoperability and is adopted for most form factors.
MultiLane's ML4066 analyzers ensure both module and host properly conform to this vital standard or SFF specifications no matter the manufacturer.
Available in: QSFP-DD800, OSFP800, OSFP, QSFP-DD, QSFP, SFP-DD, and SFP.

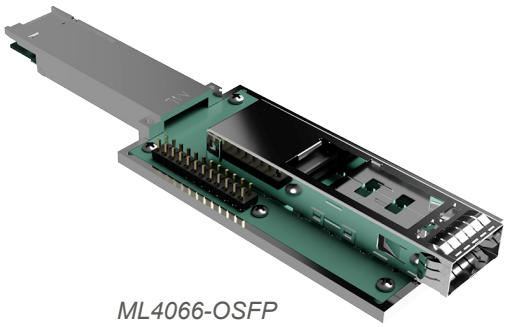
Read the full specifications here.

Watch video



Adapters

An adapter is either a port extender that keeps the same form factor while providing signal access for diagnostics, or a media converter that transforms one MSA compliant form factor into another. The port extender provides access to low-speed control signal, or power supply lines, and can be used in conjunction with an analyzer board for CMIS state machine analysis. This also enables the debug of a host-to-module connection.



ML4066-OSFP

Analyzers

The analyzer mates onto the adapter with a set of pin headers, and are accompanied with their own CMIS UI, which enables the user to:
- Analyze I2C communication in 3 different modes
- State Machine Testing
- Access to the low speed and control signals
- VCC monitoring
- Access to module EEPROM, as well as customizable memory maps
- Monitor and visualize I2C transactions and operations

Read more.

ML4066-ANA-OSFP CMIS analyzer mated on to the ML4066-OSFP CMIS adapter

Cables

MultiLane offers a wide variety of cables to provide test instrumentation connectivity.

For more information click here.

NEXUS ANALYZER

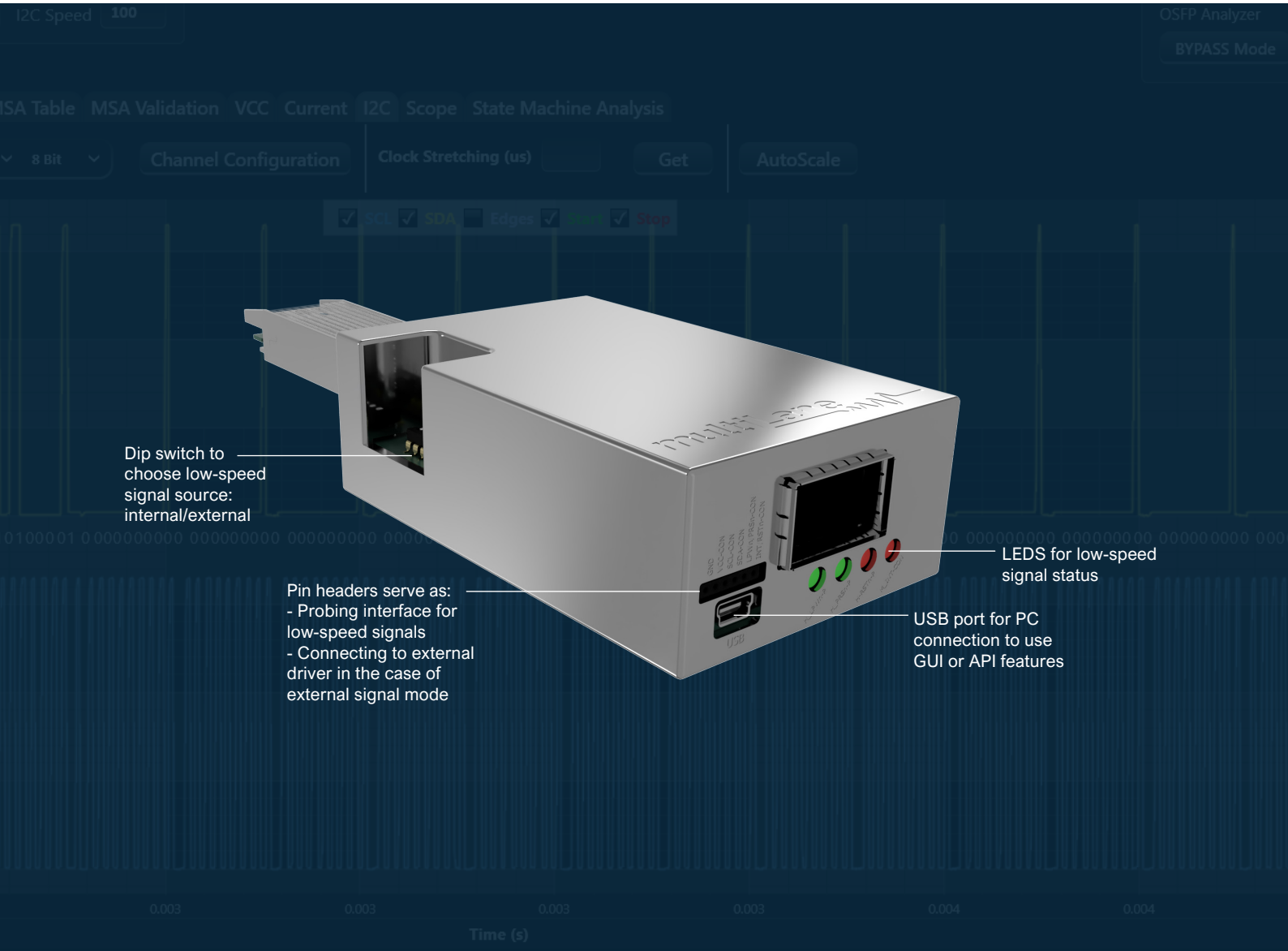
As new CMIS standards are developed and adopted, with a wide variety of SFF and CMIS specs available, CMIS testing becomes increasingly complex and time consuming. The MultiLane Nexus Analyzer is a direct response to this complexity, designed with speed and simplicity at its core. A CMIS/SFF debug tool for interoperability testing and CMIS/SFF failures, the Nexus Analyzer is equipped with a full feature sweep implemented in its GUI.

The Nexus Analyzer is used as a verification tool to validate the CMIS/SFF implementation, with a CMIS/SFF register sweep, state machine and data path state machine testing, I2C R/W commands and packet analysis, included in the product's features.

Capable of running a full system debug in minutes, with pinpoint accuracy on interoperability issues from either the module or host side, the Nexus Analyzer acts as a dramatic accelerant to CMIS adoption across the industry.

The product includes a port extender which connects low speed signals from the host to the plugged module while providing a probing interface at the same time. It also implements SI traces capable of 112G/lane, to connect the TX and RX paths from the host port to the plugged transceiver in the adapter.

Mating onto the adapter through a set of pin headers, the Analyzer gives access to the Nexus GUI with the capabilities to troubleshoot the interoperability between the system and the pluggable. Features include data path state machine testing, a full CMIS/SFF register sweep, I2C communication packets capturing and measurement of voltage and inrush current.



Adapter

800G Adapter Key Features:
- SI traces and connector support 112G rates
- Support up to 30W modules
- Current and temperature sensor
- Module power ripples and inrush current measurement
- Detection of power spikes during module state transitions
- Probing interface for Vcc and GND pins
- External I2C
- Dip switch to choose low-speed signal source: internal/external
- Available in all SFF/CMIS form factors

Analyzer

800G Analyzer Key Features:
- Voltage sensor
- ePPS signal validation
- 1 MHz I2C
- Probing interface for low-speed signals
- External control for any low-speed signal:
  -INT/RST
  -LPW/PRS
  -SDA
  -SCL
- LEDs for control/alarm signal status
- USB port for PC connection to use GUI or API features
- Available in all SFF/CMIS form factors

OSFP-XD

As the first Terabit generation approaches, the race is on to determine what form factors and speeds will come to define the move to 1.6T. MultiLane stands ready to supply our customers with first-to-market solutions to accelerate the industry's capacity to serve its insatiable demand. MultiLane also offers OSFP-XD Host and Module Compliance Boards.

Thermal Emulation | ML4064-XD-CNT & ML4064-XD-TL

MultiLane's Thermal Load and Controller Board – the ML4064-XD-TL and ML4064-XD-CNT – provide a versatile tool for testing the anticipated 45 W heat dissipation required by the 1.6T generation. Configurable power spots on the thermal load allows for a variety of internal combinations to be tested for both transceiver emulation and cooling solutions. Up to 4 Thermal Loads can be controlled using the ML4064-XD-CNT Controller Board, allowing for multiple configurations to be tested at once for a total of 176 W.

ML4064-XD-TL Key Features

- Total heat dissipation of 44 W using 11 power spots
- 16 power spots of 4 W each for flexible thermal configurations
- 7 temperature sensors to help monitor the
- Available with 2A, 2B, 2C, or 2D heatsinks

ML4064-XD-CNT Key Features

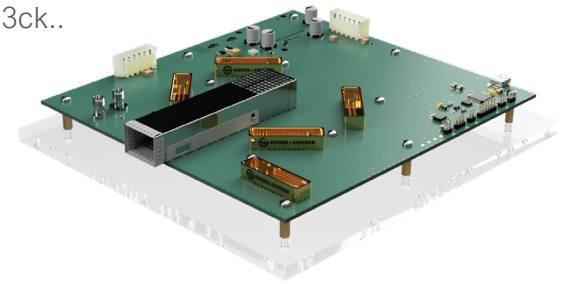
- Tests up to 4 Thermal Loads simultaneously
- Supports 176 W of dissipation at once
- Power configuration setting through GUI
- Exportable temperature monitoring on all attached modules
- I2C R/W Tab to read/write to the TL EEPROM
- Load/Save MSA for full access to TL EEPROM

Four ML4064-XD-TL thermal loads plugged into the ML4064-XD-CNT thermal controller board

OSFP-XD Module Compliance Board

MultiLane's work to accelerate the OSFP-XD ecosystem goes beyond just thermal management. Module Compliance Boards, Host Compliance Boards, and Loopbacks are all already in development.

MultiLane's upcoming OSFP-XD MCBs, the ML4064-XD-MCB-112-MXPM70, offer a means of testing 16x112Gbps OSFP-XD pluggables. The board is already compliant with the insertion loss requirements of CEI-56G-VSR-NRZ and IEEE 802.3ck..

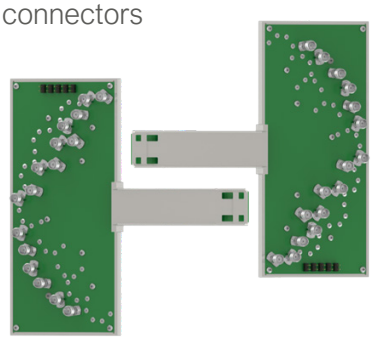


ML4064-XD-MCB-112-MXPM70

OSFP-XD Host Compliance Board

ML4064-XD-HCB1/2-112 Key Features

- Compliant with IEEE802.3ck and CEI-56G-VSR-NRZ
- Built with high performance PCB Material
- High performance signal integrity traces
- Same low Insertion Loss for all channels
- HCB1 supports 8x112G TX and RX lanes
- HCB2 supports 8x112G TX and RX lanes
- High speed signals accessible through 2.4-mm or 1.85-mm connectors



ML4064-XD-HCB1-112 ML4064-XD-HCB2-112

CHANNEL EMULATION BOARDS

Multilane's Channel Emulation Boards simulate lossy signals allowing vendors to characterize their designs for a variety of real-world environments. The ML4067 features a variety of carefully designed differential test traces, this passive test accessory adds precise ISI (inter-symbol interference) in order to calibrate or stress test DSPs, modules, gearboxes or other relevant systems in real-life environments. The channel emulation board is available to support 112Gbps/lane and 224Gbps/lane, ML4067-112 and ML4067-224, respectively.

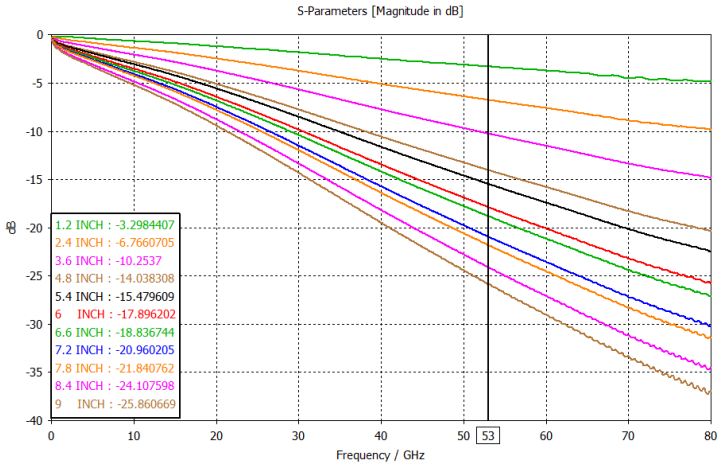
ML4067-112-18/24 Key Features

- 13 trace paths
- Loss from 2 dB to 24 dB with a 2 dB increment
- Target Nyquist frequency of 26 GHz
- 100 ohms and 93 ohms differential traces
- Available in 1.85-mm or 2.4-mm connectors

ML4067-224 Key Feautures

- 11 trace paths
- Loss from 3 dB to 25 dB
- Target Nyquist frequency of 53 GHz
- 100 ohms and 93 ohms differential traces
- Available in 1-mm or 1.85-mm connectors

ML4067-112-24/18



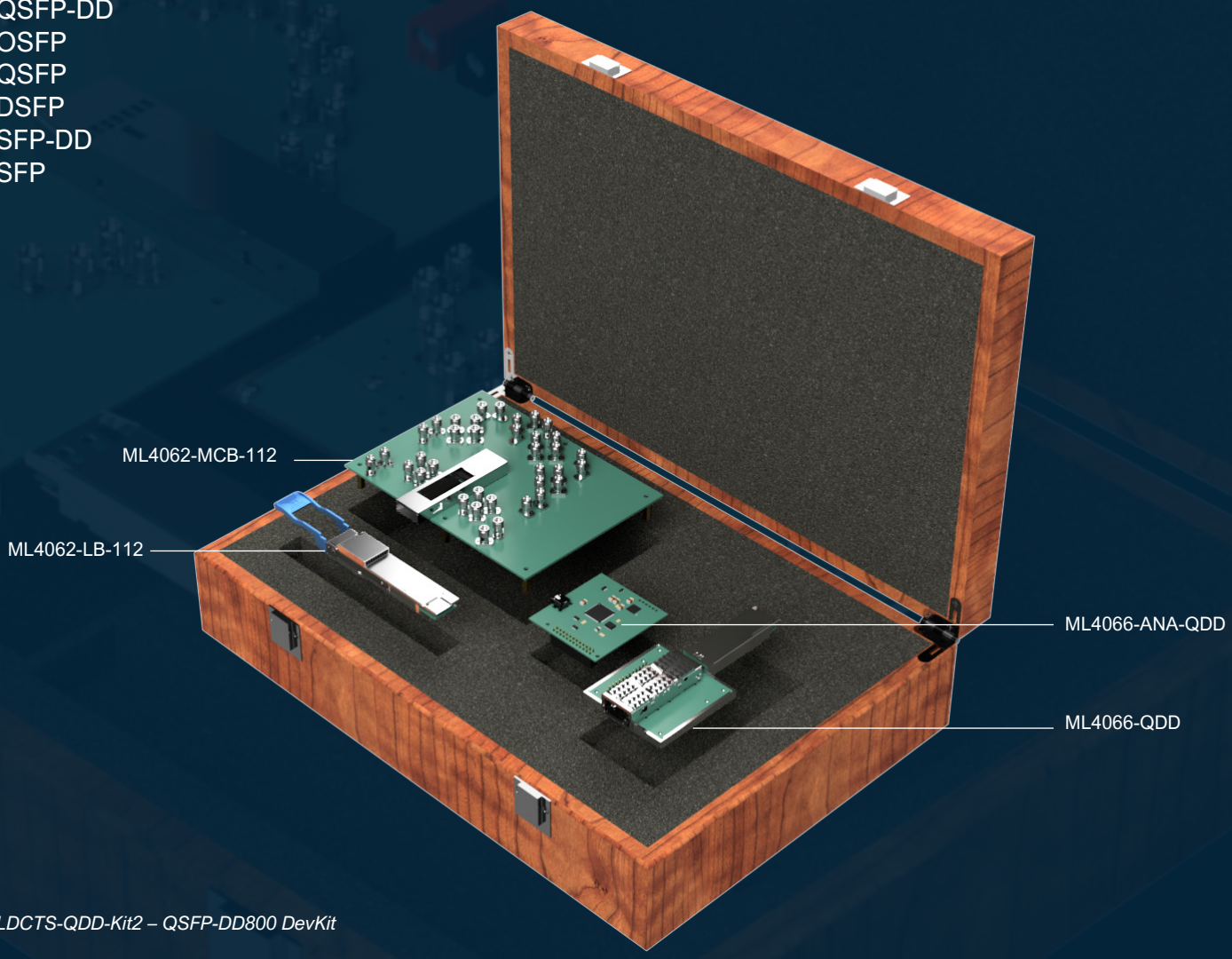
Insertion loss of the ML4067-224

MULTILANE DATA CENTER DEVKITS

MultiLane's Data Center DevKits provide an all-in-one solution for network testing and design. Each kit contains the appropriate module/host compliance board, loopbacks, and CMIS analyzers for Module, Host, or Compliance testing across 6 form factors supporting speeds from 50 to 800G.

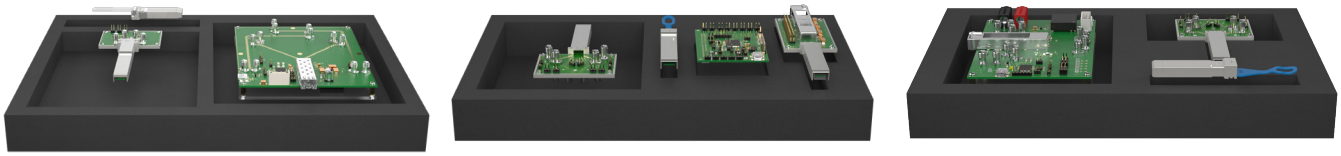
Supported Form Factors:

- QSFP-DD
- OSFP
- QSFP
- DSFP
- SFP-DD
- SFP



MLDCTS-QDD-Kit2 – QSFP-DD800 DevKit

A full list of each DevKit's contents can be found in their dedicated catalog .



Solutions by MSA

The following tables list all the Interconnect Test Solutions that are available per MSA standard. In the appendix more information can be found about the respective MSAs.

Channel Emulation Board

	Part Number	Description	Connector Type	Details
Channel Emulation Board	**ML4067-112**	112G Channel Emulation Board	2.4 mm	112G Channel Emulation Board with 2.4 mm connectors. 13 traces, 100 Ohm: 2,4,8,10,12,14,16,18,20,22,24 dB, 93 Ohm: 2,4 dB. A USB drive containing real measured S-parameters for each channel is included. 2.4 mm available, ML4067-112-24 1.85 mm available, ML4067-112-18
			1.85 mm	
	ML4067-112-QDD	112G QDD Channel Emulation Board	MXPM70	112G Channel Emulation Board, 4 QDD112 ports to MXPM70 connectors with 4 loss profiles Cable : 2x8 Huber Suhner MXPM70 Cable Assembly, 6 inch length, 1.85mm Male connector.
	ML4067-112-OSFP	112G OSFP Channel Emulation Board	MXPM70	112G Channel Emulation Board, 4 OSFP112 ports to MXPM70 connectors with 4 loss profiles Cable : 2x8 Huber Suhner MXPM70 Cable Assembly, 6 inch length, 1.85mm Male connector.

QSFP-DD

	Part Number	Description	Connector Type	Details
MCB	**ML4062-MCB**	QSFP-DD MCB 8x50G	2.92 mm	8x50G, MSA-compliant, low IL module compliance board with current and temperature monitoring. Windows GUI. Option CDB: Enables Command Data Block messaging, and issuing of commands from the MCB to the Module, as per CMIS 4.0 and 5.0. 2.4 mm (option 24) available
	ML4062-MCB-MXP	QSFP-DD MCB, 8x50 Gb, with MXP connector	MXP	8x50G, dual 2x8 MXP40 connector, MSA-compliant, low IL module compliance board with current and temperature monitoring. Windows GUI. Requires 2 MXP40 cables. Option CDB: Enables Command Data Block
	ML4062-MCB-MXP-ETH	QSFP-DD MCB, 8x50 Gb, with Ethernet connector	MXP	8x50G, dual 2x8 MXP40 connector, MSA-compliant, low IL module compliance board with current and temperature monitoring, with an additional Ethernet connector. Windows GUI. Requires 2 MXP40 cables. Option CDB: Enables Command Data Block messaging.
	ML4062-MCB-TR	QSFP-DD MCB for Volume and Production Testing, with Ardent TR cable footprint	Ardent TR40	8x50G, dual TR40-16X2 connector, high volume QSFP-DD module production test board. Windows GUI. Requires two (2) TR40-16X2 cables. Option CDB: Enables Command Data Block messaging.
	ML4062-MCB-TR-BC	QSFP-DD MCB for Volume and Production Testing, with Ardent TR cable footprint. Connector cage on bottom side of PCB	Ardent TR40	8x50G, dual TR40-16X2 connector, high volume QSFP-DD module production test board. Connector cage on bottom side of PCB. Windows GUI. Requires two (2) TR40-16X2 cables. Option CDB: Enables Command Data Block messaging.

MCB	**ML4062-MCB-LPBK**	QSFP-DD MCB, 8x50G, Dual Loopback Board	NA	8x50G, Loopback Board. Internal noise injection option. On-board LEDs display MSA output alarm states. Windows GUI. Option CDB: Enables Command Data Block messaging, and issuing of commands from the MCB to the Module, as per CMIS 4.0 and 5.0.
HCB	**ML4062-HCB (Set of 2)**	QSFP-DD HCB set ML4062-HCB1 & ML4062-HCB2	2.92 mm	4x50G HCB1, Channels 1, 2, 3, 4 Tx & Rx 4x50G HCB2, Channels 5, 6, 7, 8 Tx & Rx 2.4 mm (option 24) available
	ML4062-BO	QSFP-DD Break-Out Board	MXP	QSFP-DD Break-Out Board. For MSA compliant Insertion loss, use ML4062-HCB. Requires 2 MXP40 cables.
Auxiliary Parts	**ML4062-CNT-Gen2**	QSFP-DD Controller Board for ML4062-TL2a		Host board to supply power to the QSFP-DD Thermal loads (ML4062-TL2a), and an I2C master that allows to read/write the registers. Windows GUI for temperature and power monitoring.
	ML4066-QDD	QSFP-DD Low Speed Signal Analyzer		QSFP-DD to QSFP-DD Diagnostic adapter
	ML4066-ANA-QDD	ML4066-QDD Analyzer Daughter Card + CMIS Analysis and Compliance		QSFP-DD Analyzer module that plugs on the ML4066-QDD, with USB interface and windows GUI v2.0, which supports timing measurements and transactional data logging across multiple operational modes with a refreshed look and feel.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4062-SLB-V#**	QSFP-DD Loopback, Passive, MSA Compliant	14 W	0 dB	8x50G, programmable power dissipation up to 14 W. MSA compliant. Industrial temperature range -40 to 85 °C available. Part number ML4062-SLB-V#-IND, Option IND, add 10%
	ML3062-SLB-V#	QSFP-DD Loopback, Passive, MSA Compliant, Fixed power	14 W	0 dB	8x50G, fixed power dissipation of 14 W. MSA compliant. Industrial temperature range -40 to 85 °C available. Part number ML3062-SLB-56-14W-IND, Option IND, add 10%
	ML4062-TL1	QSFP-DD Thermal Load	16 W	0 dB	Programmable power dissipation up to 16 W. Thermal Load with six heaters. No loop back function. Suggest ML4062-CNT-Gen2 with this thermal load module.

Loopbacks	**ML4062-TL2a**	QSFP-DD Type 2a Loopback for QSFP-DD ZR/ZR+ with LED ML4062-TL2a-LED	23.4 W	0 dB	QSFP-DD ZR/ZR+ emulator with programmable power dissipation up to 23.4 W. Type 2a extended shell Loopback + Thermal Load with LED status indicator. Part number ML4062-TL2a-LED Type 2a extended shell Loopback + Thermal Load with dual 7 segment display status. Part number ML4062-TL2a-LCD indicator. Type 2a extended shell Loopback + Thermal Load with external power connector. Part number ML4062-TL2a-CON
		QSFP-DD Type 2a Loopback for QSFP-DD ZR/ZR+ with LCD ML4062-TL2a-LCD			
		QSFP-DD Type 2a Loopback for QSFP-DD ZR/ZR+ with LED ML4062-TL2a-LED			

QSFP-DD800

	Part Number	Description	Connector Type	Details
MCB	**ML4062-MCB-112**	QSFP-DD800 MCB	2.4 mm ML4062-MCB-112-24	8x112G, current-sense monitor, Windows GUI and API. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. Option CDB: Enables Command Data Block messaging, and issuing of commands from the MCB to the Module,as per CMIS 4.0 and 5.0. Available with 2.4 mm or 1.85 mm connectors
			1.85 mm ML4062-MCB-112-18	
	ML4062-MCB-112-MXPM70	QSFP-DD800 MCB	MXPM70	8x112G, MXPM70 connectors, current-sense monitor, Windows GUI and API. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. Option CDB: Enables Command Data Block messaging.
HCB	**ML4062-HCB-112 (set of 2)**	QSFP-DD800 HCB set ML4062-HCB1/2-112	2.4 mm ML4062-HCB-112-24	4x112G HCB1: CH1-4, HCB2: CH5-8. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification Available with 2.4 mm or 1.85 mm connectors
			1.85 mm ML4062-HCB-112-18	
	ML4062-HCB-112-MXPM70	QSFP-DD800 HCB	MXPM70	8x112 Gbps, MXPM70 connectors 8 channels. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification

Auxiliary Parts	**ML4062-CNT-Gen2-V2**	QSFP-DD Low Speed Signal Analyzer	NA	Host board to supply power to the QSFP-DD800 30 W Thermal loads (ML4062-LB2a/b-112), and an I2C master that allows to read/write the registers. Windows GUI for temperature and power monitoring.

	Part Number	Description	Power Dissipation	Details
Loopbacks	**ML4062-LB-112**	QSFP-DD800 Loopback type 1	16 W	8x112G, programmable power dissipation up to 16 W. I2C terminated by microcontroller. Implements MSA memory map with programmable new pages. Industrial temperature range -40 to 85 °C available. Part number ML4062-LB-112-IND
	ML4062-LB2a-112	QSFP-DD800 Loopback type 2A with LED ML4062-LB2a-112-LED	30 W	8x112G, programmable power dissipation up to 30 W. Option with LED status indicator. Part number ML4062-LB2a-112-LED Option with dual 7 segment LCD display status indicator. Part number ML4062-LB2a-112-LCD Option with external power connector. Part number ML4062-LB2a-112-CON
		QSFP-DD800 Loopback type 2A with LCD ML4062-LB2a-112-LCD		
		QSFP-DD800 Loopback type 2A with connector ML4062-LB2a-112-CON		
	ML4062-LB2a-9dB	QSFP-DD800 Loopback, Passive, MSA Compliant, Loss-Target	30 W	8x112G, programmable power dissipation up to 30 W, Loss Target Loopback with 9 dB attenuation, with LED status indicator.

	Part Number	Description	Power Consumption	Details
Loopbacks	ML4062-LB2b-112	QSFP-DD800 Loopback type 2B with connector ML4062-LB2b-112-	30 W	8x112G, programmable power dissipation up to 30 W. I2C terminated by microcontroller. Implements MSA memory map with programmable new pages. Option with LED status indicator. Part number ML4062-LB2b-112-LED Option with dual 7 segment LCD display status indicator. Part number ML4062-LB2b-112-LCD Option with external power connector. Part number ML4062-LB2b-112-CON
		QSFP-DD800 Loopback type 2B with LED ML4062 - LB2b-112-		
		QSFP-DD800 Loopback type 2B with LCD ML4062-LB2b-112-LCD		
		QSFP-DD800 Loopback type 2B, Passive, MSA Compliant ML4062-LB2b-112		

	Part Number	Description	Power Consumption	Details
Active Loopbacks	**ML4062-ALB1-112**	QSFP-DD800 Loopback type 2A, Passive, MSA Compliant ML4062-ALB1-2A-112	19 W	8x112G, programmable power dissipation up to 19 W. I2C interface. Industrial temperature range -40 to 85 °C available. Part number ML4062-ALB1-112-IND. Option type 2A. Part number ML4062-ALB1-2A-112. Option type 2B. Part number ML4062-ALB1-2B-112.
		QSFP-DD800 Loopback type 2B, Passive, MSA Compliant ML4062-ALB1-2B-112		
	ML4062-ALB2-112	QSFP-DD 800G Active Loopback, Shell Type 2A, CMIS programmability, Chipset is optical DSP 2	25 W	8x112G, programmable power dissipation up to 19 W. I2C interface. Industrial temperature range -40 to 85 °C available. Part number ML4062-ALB1-112-IND. Option type 2A. Part number ML4062-ALB1-2A-112. Option type 2B. Part number ML4062-ALB1-2B-112.
		QSFP-DD 800G Active Loopback, Shell Type 2B, CMIS programmability, Chipset is optical DSP 2		
		QSFP-DD 800G Active Loopback, Shell Type 2B, CMIS programmability, Chipset is optical DSP 2, ML4062-ALB2-2B-112 - NPI		
	ML4062-112-ALB-TB	QSFP-DD 800G Active Loopback, Shell Type 2A, Chipset is optical DSP 2, ThunderBERT Version	25 W	8x112G, active loopback module, programmable power dissipation, I2C terminated by microcontroller. Implements CMIS memory map. Ethernet interface connects to a PC with full ThunderBERT support
		QSFP-DD 800G Active Loopback, Shell Type 2B, Chipset is optical DSP 2, ThunderBERT Version		

QSFP28

	Part Number	Description	Connector Type	Details
MCB	**ML4041-K-RevG/RevD+**	QSFP28 MCB, 4x28G, connector on top RevG QSFP28 MCB, 4x28G, connector on bottom of PCB	QSFP28	4x28G Module Compliance Board. Matched differential trace length, low insertion loss, current-sense monitor, Windows GUI and API. USB controlled. Standard ML4041-K is RevG. ML4041-K RevD+ has QSFP28 connector on bottom of PCB for TEC testing.
HCB	**ML4020-N-MSMPM** **ML4020-N-MXP**	QSFP28 Narrow HCB, 4x28G	MSMPM or MXP	4x28G, narrow Host Compliance Board, uses 2 high-density Huber+Suhner MXP or MSMPM connectors. Order as ML4020-N-MSMPM or ML4020-N-MXP. MultiLane sells the two 1x8 MSMPM cables.

	Part Number	Description	Connector Type	Details
HCB	**ML4020-MSMPM** **ML4020-MXP**	QSFP28 HCB, 4x28G	MSMPM or MXP	4x28G, Host Compliance Board, uses 2 high-density Huber+Suhner MXP or MSMPM connectors. All TX and RX channels have matching trace length. Order as ML4020-MSMPM or ML4020-MXP. MultiLane sells the two 1x8 MSMPM cables.
Auxiliary Parts	**ML4066-QSFP**	QSFP28 Low Speed Signal Analyzer		QSFP to QSFP Diagnostic adapter
	ML4066-ANA-QSFP	ML4066-QSFP Analyzer Daughter Card + CMIS Analysis and Compliance software		QSFP Analyzer module that plugs on the ML4066-QSFP, with USB interface and windows GUI v2.0, which supports timing measurements and transactional data logging across multiple operational modes with a refreshed look and feel.
	ML4086	CFP2 to QSFP28 Adapter, Passive		CFP2 to QSFP28, MSA-compliant passive adapter

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4002-28**	QSFP28 Loopback Module	3.5 W	0 dB	4x28G. Programmable power dissipation up to 3.5 W. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-IND
	ML4002-28-C5	QSFP28 Loopback Module	5 W	0 dB	4x28G. Programmable power dissipation up to 5 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-C5-IND.
	ML4002-28-C5-V2	QSFP28 Loopback Module	5 W	0 dB	4x28G. Programmable power dissipation up to 5 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-C5-V2-IND. CMIS 4.0 compliant.
	ML4002-28-8W	QSFP28 Loopback Module	8 W	0 dB	4x28G. Programmable power dissipation up to 8 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-8W-IND.
	ML4002-28-13W	QSFP28 Loopback Module	13 W	0 dB	4x28G. Programmable power dissipation up to 13 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-13W-IND.
	ML4002-28-3dB	QSFP28 Loopback Module	5.5 W	3 dB	4x28G. Programmable power dissipation up to 5.5 W with 3 dB attenuation. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-28-3dB-IND.
	ML4012-28	QSFP28 Loopback Module, Fixed Power	4.5 W	0 dB	4x28G. Fixed power dissipation of 4.5 W. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4012-28-IND.

QSFP56

	Part Number	Description	Connector Type	Details
MCB	**ML4041-K-56**	QSFP56 MCB, 4x56G	2.92 mm	QSFP56, 4x56G Module Compliance board, MSA Compliant. Matched differential trace length, low insertion loss, current-sense monitor. Supports 4x56G interfaces. USB controlled. User Friendly GUI, API.
HCB	**ML4020-K-56**	QSFP56 HCB, 4x56G	2.92 mm	QSFP56, 4x56G Host Compliance Board, MSA Compliant.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4002-56-0dB**	QSFP56 Loopback Module	5 W	0 dB	QSFP56, 4x56G Loopback module. Programmable power dissipation up to 5 W. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-56-0dB-IND
	ML4002-56-5dB	QSFP56 Loopback Module	5 W	5 dB	QSFP56, 4x56G Loopback module. Programmable power dissipation up to 5 W. 5 dB attenuation. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-56-5dB-IND
	ML4002-56-15W-0dB	QSFP56 Loopback Module	15 W	0 dB	QSFP56, 4x56G Loopback module. Programmable power dissipation up to 15 W. 0 dB attenuation. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-56-15W-0dB -IND

QSFP 400G

	Part Number	Description	Connector Type	Details
MCB	**ML4041-112**	QSFP 112G MCB	2.4 mm (Option 18, 1.85 mm connector)	QSFP 4x112G Module Compliance Board, compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. 1.85 mm (option 18) available
HCB	**ML4020-112**	QSFP 112G HCB	2.4 mm (Option 18, 1.85 mm connector)	QSFP 4x112G Host Compliance Board, compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. 1.85 mm (option 18) available

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4002-112**	QSFP 112G Loopback	7 W	NA	QSFP112, 4x112G Loopback module. Dual LED indicator. Temperature range from 0° to 80 °C. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-112-IND.

OSFP

	Part Number	Description	Connector Type	Details
MCB	**ML4064-MCB**	OSFP 400G MCB	2.92 mm	OSFP 8x50G Module Compliance Board. Low insertion loss, current sense monitor. Windows GUI and API. 2.4 mm (option 24) available
	ML4064-MCB-TR	OSFP 400G MCB, with Ardent connector footprint	TR40-16X2	OSFP 8x50G, dual TR40-16X2 connector, high volume module production test board. Low insertion loss, current-sense monitor. Windows GUI and API. Requires two TR40-16X2 cables.
HCB	**ML4064-HCB**	OSFP 400G HCB	2.92 mm	OSFP 8x50G Host Compliance Board. 2.4 mm (option 24) available
Auxiliary Parts	**ML4066-OSFP**	OSFP Low Speed Signal Analyzer		OSFP to OSFP Diagnostic adapter
	ML4066-ANA-OSFP	ML4066-OSFP Analyzer Daughter Card + CMIS Analysis and Compliance software		OSFP Analyzer module that plugs on the ML4066-OSFP, with USB interface and windows GUI v2.0, which supports timing measurements and transactional data logging across multiple operational modes with a refreshed look and feel.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4064-LB**	OSFP Loopback Module	18 W	NA	OSFP 8x50G Loopback module. Programmable power dissipation up to 18 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-LB-IND.
	ML4064-LB-20W	OSFP Loopback Module	20 W	NA	OSFP 8x50G Loopback module. Programmable power dissipation up to 20 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-LB-20W-IND.
	ML4064-LB-30W	OSFP Loopback Module	30 W	NA	OSFP 8x50G Loopback module. Programmable power dissipation up to 30 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-LB-30W-IND.

OSFP 800G

	Part Number	Description	Connector Type	Details
MCB	ML4064-MCB-112	OSFP 800G MCB	2.4 mm ML4062-MCB-112-24	800G OSFP MCB, 8x112 Gbps, current-sense monitor, Windows GUI and API. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. Available with 2.4 mm or 1.85 mm connectors
			1.85 mm ML4062-MCB-112-18	
HCB	ML4064-HCB-112	OSFP 800G HCB	2.4 mm ML4064-HCB-112-24	800G OSFP HCB, 8x112 Gbps. Compliant to OIF-CEI-112G-VSR-PAM4 and OIF-CEI-56G-VSR-NRZ specification. Available with 2.4 mm or 1.85 mm connectors
			1.85 mm ML4064-HCB-112-18	

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	ML4064-LB-112	OSFP 800 Loopback	17.5 W	NA	8x112G OSFP800 Loopback module, programmable power dissipation up to 17.5 W. I2C terminated by microcontroller, MSA memory map with programmable new pages. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-112-17.5W-IND.
	ML4064-LB-112-24W	OSFP 800 Loopback	24 W	NA	8x112G OSFP800 Loopback module, programmable power dissipation up to 24 W. I2C terminated by microcontroller, MSA memory map with programmable new pages. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-LB-112-24W-IND.
	ML4064-LB-112-30W	OSFP 800 Loopback	30 W	NA	8x112G OSFP800 Loopback module, programmable power dissipation up to 30 W. I2C terminated by microcontroller, MSA memory map with programmable new pages. Industrial temperature range -40 to 85 °C available upon request. Part number ML4064-LB-112-30W-IND.

	Part Number	Description	Power Consumption	Attenuation	Details
Active Loopbacks	**ML4064-ALB2-112**	OSFP 800G Active Loopback, CMIS programmability, Chipset is optical DSP 2	30 W	NA	8x112G, active loopback module, programmable power dissipation, I2C terminated by microcontroller. Implements MSA memory map with programmable new pages. Production. Lead Time5-9 months
	ML4064-ALB2-112 – NPI	OSFP 800G Active Loopback, CMIS programmability, Chipset is optical DSP 2	30 W	NA	8x112G, active loopback module, programmable power dissipation, I2C terminated by microcontroller. Implements MSA memory map with programmable new pages Lead Time 0-5 months
	ML4064-ALB2-112-TB	OSFP 800G Active Loopback, Chipset is optical DSP 2, ThunderBERT Version	30 W	NA	8x112G, active loopback module, programmable power dissipation, I2C terminated by microcontroller. Implements CMIS memory map. Ethernet interface connects to a PC with full ThunderBERT support

OSFP-XD

	Part Number	Description	Connector Type	Details
MCB	**ML4064-XD-MCB-112-MXPM70**	OSFP-XD MCB	MXMPM70	16x112G, Uses 4 Huber+Suhner MXPM70 connectors, current-sense monitor, Windows GUI and API. Compliant to OIF-CEI-56G-VSR-NRZ specification and IEEE802.3ck when MXPM70 cable is de-embedded
Auxiliary Parts	**ML4064-XD-CNT**	OSFP-XD thermal controller board	NA	Controller board to supply power to the OSFP-XD Thermal loads (ML4064-XD-TL2), and an I2C master that allows to read/write the registers. Windows GUI for temperature and power monitoring.
	ML4064-XD-CBL	Cable for OSFP-XD thermal controller board	NA	Cable to connect ML4064-XD-CNT to ML4064-XD-TL2 modules, cable length 1 m
	ML4064-XD-TL	OSFP-XD Thermal Load Type 2 shell option A ML4064-XD-TL2A	NA	OSFP-XD thermal load, supports 45W power dissipation, shell and PCBA temperature sensors, Type 2,
		OSFP-XD Thermal Load Type 2 shell option B ML4064-XD-TL2B		
		OSFP-XD Thermal Load Type 2 shell option C ML4064-XD-TL2C		
		OSFP-XD Thermal Load Type 2 shell option D ML4064-XD-TL2D		

SFP28/56

	Part Number	Description	Connector Type	Details
MCB	**ML4024**	SFP28/56 MCB	2.92 mm	SFP28/56, 1x28/56G Module Compliance board. On-board buttons/jumpers for MSA input control signals. Current sense, limit monitor with low insertion loss, Windows GUI and API
HCB	**ML4023**	SFP28/56 HCB	2.92 mm	SFP28/56, 1x28/56G Host Compliance Board.
	ML4023-N	SFP28/56 Narrow HCB	2.92 mm	SFP28/56, 1x28/56G Narrow Host Compliance Board
Auxiliary Parts	**ML4066-SFP**	ML4066-SFP Low Speed Signal Analyzer		SFP to SFP Diagnostic adapter
	ML4066-ANA-SFP	ML4066-SFP Analyzer Daughter Card + CMIS Analysis and Compliance software		SFP Analyzer module that plugs on the ML4066-SFP, with USB interface and windows GUI v2.0, which supports timing measurements and transactional data logging across multiple operational modes with a refreshed look and feel.

SFP28

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4026-28-0dB**	SFP28 Loopback Module	2 W	0 dB	SFP28, 1x28G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 2 W, spread over 6 spots. Industrial temperature range -40 to 85 °C available. Part number ML4026-28-0dB-IND.
	ML4026-28-3.5W	SFP28 Loopback Module	3.5 W	0 dB	SFP28, 1x28G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 3.5 W, spread over 6 spots. Industrial temperature range -40 to 85 °C available. Part number ML4026-28-3.5W-IND.
	ML4026-28-5dB	SFP28 Loopback Module, 5 dB Attenuation	2 W	5 dB	SFP28, 1x28G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 2 W, spread over 6 spots. 5 dB attenuation. Industrial temperature range -40 to 85 °C available. Part number ML4026-28-5dB-IND
	ML4026-28-5dB-3.5W	SFP28 Loopback Module, 5 dB Attenuation	3.5 W	5 dB	SFP28, 1x28G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 3.5 W, spread over 6 spots. 5 dB attenuation. Industrial temperature range -40 to 85 °C available. Part number ML4026-28-5dB-3.5W-IND

SFP56

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4026-56-0dB**	SFP56 Loopback Module	2 W	0 dB	SFP56, 1x56G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 2 W, spread over 6 spots. Industrial temperature range -40 to 85 °C available. Part number ML4026-56-0dB-IND
	ML4026-56-5dB	SFP56 Loopback Module	2 W	5 dB	SFP56, 1x56G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 2 W, spread over 6 spots. 5 dB attenuation. Industrial temperature range -40 to 85 °C available. Part number ML4026-56-5dB-IND
	ML4026-56-3.5W-0dB	SFP56 Loopback Module	3.5 W	0 dB	SFP56, 1x56G Passive Loopback. SFF-8472 Compliant EEPROM. Programmable power dissipation up to 3.5 W, spread over 6 spots. Industrial temperature range -40 to 85°C available. Part number ML4026-56-3.5W-0dB-IND

DSFP

	Part Number	Description	Connector Type	Details
MCB	**ML4019-MCB**	DSFP Module Compliance Board	2.92 mm	DSFP 2x50G Module Compliance Board. MSA-compliant, low insertion loss module compliance board with current and temperature monitoring. Windows GUI and API.
HCB	**ML4019-HCB**	DSFP Host Compliance Board	2.92 mm	DSFP 2x50G Host Compliance Board. MSA-compliant, low insertion loss.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4019-LB-56-3.5W**	DSFP Loopback Module	3.5 W	0 dB	DSFP, 2x56G Loopback module. Programmable power dissipation up to 3.5W. Temperature range from 0° to 80 °C. Industrial temperature range -40 to 85 °C available upon request. Part number ML4019-LB-56-3.5W-IND.

SFP-DD

	Part Number	Description	Connector Type	Details
MCB	**ML4022-MCB**	SFP-DD Module Compliance Board	2.92 mm	SFP-DD 2x50G Module Compliance Board. MSA-compliant, low insertion loss module compliance board with current and temperature monitoring. Windows GUI and API.
HCB	**ML4022-HCB**	SFP-DD Host Compliance Board	2.92 mm	SFP-DD 2x50G Host Compliance Board. MSA-compliant, low insertion loss.
Auxiliary Parts	ML4066-SFPDD	**Low Speed Signal Analyzer**		**SFP-DD to SFP-DD Diagnostic adapter**
	ML4066-ANA-SFPDD	Analyzer Daughter Card + CMIS		SFP-DD Analyzer module that plugs on the ML4066-SFPDD, with USB interface and windows GUI v2.0, which supports timing measurements and transactional data

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4022-LB-V#**	SFP-DD Passive Loopback Module	4.5 W ML4022-LB-V#		SFP-DD 2x50G Loopback module, programmable power dissipation up to 4.5 W. Industrial temperature range -40 to 85 °C available. Part number ML4022-LB-IND. 5W version available, part number ML4022-LB-5W
		SFP-DD Passive Loopback Module	5 W ML4022-LB-5W		

QSFP+

	Part Number	Description	Connector Type	Details
MCB	**ML4021**	QSFP+ MCB	SMA	QSFP+, 4x14G Module Compliance board. Current/ Power supply monitoring. Low insertion loss, current-sense monitor. User Friendly GUI, API. USB controlled.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4002**	QSFP+ Loopback Module	3.5 W	NA	QSFP+, 4x14G Loopback module. Programmable power dissipation up to 3.5 W. Dual LED indicator. Industrial temperature range -40 to 85 °C available upon request. Part number ML4002-IND.

CFP2-ACO

	Part Number	Description	Connector Type	Details
MCB	**ML4027-ACO**	CFP2-ACO MCB	2.92 mm	CFP2-ACO 4x32G MSA compliant Module Compliance board. High performance signal integrity traces with current sense.
	ML4027-ACO-2X	CFP2-ACO MCB, 2x trace length	2.92 mm	CFP2-ACO 4x32G MSA compliant Module Compliance board with trace length 3.785 inch (2X trace length of ML4027-ACO, can be used for In-situ De-Embedding). Current sense.
HCB	**ML4028-ACO-MSMPM** **ML4028-ACO-MXP**	CFP2-ACO HCB	MXP or MSMPM	CFP2-ACO 4x32G MSA compliant Host Compliance board. Uses 2 Huber+Suhner MXP or MSMPM connectors. Order as ML4028-ACO-MSMPM or ML4028-ACO-MXP. MultiLane sells the two 1x8 MSMPM cables.
HCB	**ML2028-ACO-MSMPM** **ML2028-ACO-MXP**	CFP2-ACO Narrow HCB	MXP or MSMPM	CFP2-ACO 4x32G MSA compliant narrow Host Compliance board. Uses 2 Huber+Suhner MXP or MSMPM connectors. Order as ML2028-ACO-MSMPM or ML2028-ACO-MXP. MultiLane can sell the two 1x8 MSMPM cables.
	ML2028K-ACO	CFP2-ACO HCB	2.92 mm	CFP2-ACO 4x32G MSA compliant Host Compliance board, with trace length of 5.618 inch
	ML2028K-ACO-2X	CFP2-ACO HCB, 2x Trace Length	2.92 mm	CFP2-ACO 4x32G MSA compliant Host Compliance board, with trace length of 11.85 inch (2X trace length of ML2028K-ACO, can be used for In-situ De-Embedding).
Auxiliary Part	**ML4086**	CFP2 to QSFP28 Adapter, Passive		CFP2 to QSFP28, MSA-compliant passive adapter

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4030-ACO**	CFP2-ACO Loopback Module	12 W	NA	4x32G CFP2-ACO Passive Loopback Module, with programmable heat dissipation up to 12 W. MSA compliant MDIO. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-ACO-IND.
	ML4030-ACO-Cal1	CFP2-ACO Loopback, 1.2 ps matched Tx Rx	12 W	NA	ML4030-ACO for self-calibration, used in conjunction with cross laned Loopback modules. Programmable heat dissipation up to 12 W. TX and RX lanes matched to 1.2 ps. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-ACO-Cal1-IND.
	ML4030-ACO-Cal2	CFP2-ACO Loopback, Crossed YQ & YI, XQ & XI	12 W	NA	ML4030-ACO-Cal1 with crossed lanes YQ and YI, as well as XQ and XI. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-ACO-Cal2-IND.
	ML4030-ACO-Cal3	CFP2-ACO Loopback, Crossed YI & XQ	12 W	NA	ML4030-ACO-Cal1 with crossed lanes YI and XQ. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-ACO-Cal3-IND.
	ML4030-ACO-Cal4	CFP2-ACO Loopback, Crossed YQ & XQ	12 W	NA	ML4030-ACO-Cal1 with crossed lanes YQ and XQ. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-ACO-Cal4-IND.
	ML4030-LR4	CFP2 Loopback Module	12 W	NA	4x25G Passive Loopback module, matched TX and RX traces. Programmable power dissipation up to 12 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-LR4-IND.
	ML4030-LR4-15W	CFP2 Loopback Module	15 W	NA	4x25G Passive Loopback module, matched TX and RX traces. Programmable power dissipation up to 15 W. Industrial temperature range -40 to 85 °C available upon request. Part number ML4030-LR4-15W-IND.

CFP2-DCO

	Part Number	Description	Connector Type	Details
MCB	**ML4027-DCO**	CFP2 DCO MCB	2.92 mm	8x32G CFP2-DCO MSA compliant Module Compliance Board. High performance signal integrity traces, current sense, Windows GUI and API.
	ML4027-DCO-64	CFP2 DCO MCB w/64G Connector	2.92 mm	8x64G CFP2-DCO MSA compliant Module Compliance Board with 64G high speed host connector. High performance signal integrity traces, current sense, Windows GUI and API.
HCB	**ML4027-DCO-HLB-X**	CFP2-DCO Host side Loopback	NA	CFP2-DCO Host side Loopback Module, power-up using single supply 3.3 V and power-up using dual supply (5 V AND 3.3 V) available. MDIO interface, FTDI Chip accessible through USB connector, access to Control/Alarm signals provided through pin headers, Current, Voltage, Temperature Sense. Does not provide access to the high-speed Tx/Rx Channels, but acts as a host side Loopback connecting Tx and Rx.
	ML4028-DCO-MSMPM ML4028-DCO-MXP	CFP2 DCO HCB	MXP or MSMPM	8x32G CFP2-DCO Host Compliance Board. High Performance signal integrity traces. Uses 4 Huber+Suhner MXP or MSMPM connectors. Order as ML4028-DCO-MSMPM or ML4028-DCO-MXP. MultiLane sells the four 1x8 MSMPM cables.
	ML4028-DCO-64-MSMPM ML4028-DCO-64-MXP	CFP2 DCO HCB w/ 64Gb	MXP or MSMPM	8x64G CFP2-DCO Host Compliance Board with 64G high speed connector. High Performance signal integrity traces. Uses 4 Huber+Suhner MXP or MSMPM connectors. Order as ML4028-DCO-64-MSMPM or ML4028-DCO-64-MXP. MultiLane sells the four 1x8 MSMPM cables.
Auxiliary Part	**ML4086**	CFP2 to QSFP28 Adapter, Passive		CFP2 to QSFP28, MSA-compliant passive adapter

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4030-DCO**	CFP2 DCO Passive Loopback	24 W	NA	8x32G CFP2-DCO Passive Loopback Module, programmable heat dissipation up to 24 W. MSA compliant MDIO.
	ML4030-DCO-32W	CFP2 DCO Passive Loopback	32 W	NA	8x32G CFP2-DCO Passive Loopback Module, programmable heat dissipation up to 32 W. MSA compliant MDIO.
	ML4030-DCO-36W	CFP2 DCO Passive Loopback	36 W	NA	8x32G CFP2-DCO Passive Loopback Module, programmable heat dissipation up to 36 W. MSA compliant MDIO.

CFP2

	Part Number	Description	Connector Type	Details
MCB	**ML4042**	CFP2 MCB, 10x10G	SMA	10x10G CFP2 MSA compliant Module Compliance Board. User friendly GUI for MDIO control and loading custom MSA Memory Maps, and API. USB controlled.
HCB	**ML4028-MSMPM ML4028-MXP**	CFP2 HCB, 10x10G	MSMPM or MXP	10x10G CFP2 MSA compliant Host Compliance Board. High Performance signal integrity traces. MDIO Access via Pin headers. Order as ML4028-MSMPM or ML4028-MXP. MultiLane sells the two 1x8 MSMPM cables

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4030-SR10**	CFP2 Loopback Module, Passive, 10x10G	12 W	NA	CFP2 Passive Loopback Module. Supports 10x10G. CFP2 MSA Form Factor. MDIO interface compliant with IEEE 802.3 Clause 45. Programmable power dissipation up to 12 W, insertion counter, custom memory maps.
	ML4029	CFP2 Retimed Loop Back Module	NA	NA	CFP2 Retimed Loopback Module. PRBS generator & detector supports all pattern lengths, temperature monitor, customized memory maps, input & DFE adaptation to optimize eye opening, insertion counter, wide range CRU. CFP2 MSA Form Factor. Retimed Loop back mode at 100GbE 25G and OTU4 28G rates.
	ML4043-SR10	CFP2 Retimed Loop Back Module	NA	NA	CFP2 Retimed Loopback Module. Retimed Loop back mode at 100GbE 10x10.3125G rates. MDIO MSA compliant interface. Input and DFE adaptation to optimize eye opening, customized memory maps, insertion counter, wide range CRU.

CFP

	Part Number	Description	Connector Type	Details
MCB	**ML4018**	CFP MCB		10x10G CFP Module Compliance Board. High performance signal integrity traces, current sense/limit monitor with low insertion loss. User friendly GUI for MDIO control. MSA compliant. Digital Diagnostic and Monitoring Interface, API.
HCB	**ML4014**	CFP HCB	Coax cables	10x10G CFP Host Compliance Board. Low insertion loss.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4013**	CFP Loopback Module, 10x10G, Passive	24 W	NA	10x10G Passive CFP loopback module. High performance signal integrity traces. Programmable power dissipation up to 24 W.
	ML4013-HP	CFP Loopback Module, 10x10G, Passive	40 W	NA	10x10G Passive CFP loopback module. High performance signal integrity traces. Programmable power dissipation up to 40 W, temperature sensing, customized memory maps

CFP4

	Part Number	Description	Connector Type	Details
MCB	**ML4049**	CFP4 MCB	2.92 mm	4x28G CFP4 MSA compliant Module Compliance Board. High Performance signal integrity traces. Windows GUI and API. MSA compliant MDIO.
HCB	**ML4052-MSMPM** **ML4052-MXP**	CFP4 HCB	MSMPM or MXP	4x28G CFP4 MSA compliant Host Compliance Board. High Performance signal integrity traces. Reference clock accessible via SMA connector. Order as ML4052-MSMPM or ML4052-MXP. MultiLane sells the two 1x8 MSMPM cables.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4050**	CFP4 Loopback Module, Passive	6.5 W		4x28G CFP4 Passive Loopback Module. Customized memory map, MSA compliant, programmable power dissipation up to 6.5 W. MDIO interface compliant with IEEE 802.3 Clause 45. Industrial temperature range -40 to 85 °C available upon request. Part number ML4050-IND.
	ML4050-7.5W	CFP4 Loopback Module, Passive	7.5 W		4x28G CFP4 Passive Loopback Module. Customized memory map, MSA compliant, programmable power dissipation up to 7.5 W. MDIO interface compliant with IEEE 802.3 Clause 45. Industrial temperature range -40 to 85 °C available upon request. Part number ML4050-7.5W-IND.
	ML4050-9.5W	CFP4 Loopback Module, Passive	9.5 W		4x28G CFP4 Passive Loopback Module. Customized memory map, MSA compliant, programmable power dissipation up to 9.5 W. MDIO interface compliant with IEEE 802.3 Clause 45. Industrial temperature range -40 to 85 °C available upon request. Part number ML4050-9.5W-IND.

CFP8

	Part Number	Description	Connector Type	Details
MCB	**ML4057**	CFP8 MCB	MXP	CFP8 Passive Module Compliance Board. Supports 16x25G, 8x50G PAM and CFP8-ACO. MSA compliant MDIO. Uses 2x8 40 GHz Huber & Suhner _2x8A_81_MXP-S50-0-3-111_N Connectors. Low insertion loss, Windows GUI and API.
HCB	**ML4058-MSMPM ML4058-MXP**	CFP8 HCB (Break-Out) Module	MSMPM or MXP	CFP8 Host Compliance Board. OIF compliant. Supports 16x25G, 8x50G PAM and CFP8-ACO. Extends MDIO and control interface to SMA Connector. Order as ML4058-MSMPM or ML4058-MXP. MultiLane sells the eight 1x8 MSMPM cables.
	ML4058-N-MSMPM ML4058-N-MXP	CFP8 Narrow HCB	MSMPM or MXP	CFP8 narrow Host Compliance Board. OIF compliant HCB. Supports 16x25G, 8x50G PAM and CFP8-ACO. Extends MDIO and control interface to SMA Connector. Order as ML4058-N-MSMPM or ML4058-N-MXP. MultiLane sells the eight 1x8 MSMPM cables.

	Part Number	Description	Power Consumption	Attenuation	Details
Loopbacks	**ML4059**	CFP8 Loopback Module, Passive	21 W	NA	CFP8 Passive Loopback Module. Supports 16x25G, 8x50G PAM and CFP8-ACO. Superior SI performance, programmable power dissipation up to 21 W. Supports 28G Analog Coherent. Industrial temperature range -40 to 85 °C available upon request. Part number ML4059-IND.

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