

# QSFP-DD

Development Platform Preliminary Specs

## Summary

The **MultiLane QSFP-DD Development Kit** provides the necessary development tools and reference modules required for the development of QSFP-DD based products. This kit is essential for development, testing and characterization of QSFP-DD based products. It can also be used for testing 400G CDRs, 400G Gearbox devices, 400G QSFP-DD ports on routers and line-cards, electro-optical modules, and QSFP-DD active optical cables.

| QSFP-DD Modules          |                   |                                 |                 |                 |
|--------------------------|-------------------|---------------------------------|-----------------|-----------------|
|                          | MCB               | HCB                             | Loopback Module | Breakout Module |
| 8x50G                    | ML4062-MCB        | ML4062-HCB1                     | ML4062-SLB-V1   | ML4062-BO       |
|                          | ML4062-MCB-MXP    |                                 | ML4062-SLB-V4   |                 |
|                          | ML4062-MCB-LB     | ML4062-HCB2                     | ML4062-SLB-V6   |                 |
|                          | ML4062-MCB-TR     |                                 | ML4062-XLB1     |                 |
| 8x112G                   | ML4062-MCB-112-24 | ML4062-HCB-112-24<br>(set of 2) | ML4062-LB-112   |                 |
|                          | ML4062-MCB-112-18 | ML4062-HCB-112-18<br>(set of 2) |                 |                 |
| QSFP-DD Related Products |                   |                                 |                 |                 |
|                          | Thermal Load      | Controller                      | Adapter         | Analyzer        |
| 8x50G                    | ML4062-TL         | ML4062-CNT                      | ML4066-QDD      | ML4066-QDD-ANA  |
|                          |                   |                                 | ML4054-QDD      |                 |
|                          |                   | <b>Loopback Module</b>          |                 |                 |
|                          |                   | ML4062-TL2a-C-LCD               |                 |                 |
|                          |                   | ML4062-TL2a-C-LED               |                 |                 |
|                          | ML4062-TL2a-C-CON |                                 |                 |                 |

# QSFP-DD

## QSFP-DD Module Compliance Board

### ML4062-MCB

#### Key Features

- Supports 8x50G interfaces
- I2C master driven from both on board microcontroller or external pin headers
- 40 GHz 2.92 mm K Connectors
- Current Sense
- Matched differential trace length
- All 8 channels come with matching trace length
- High performance signal integrity traces from K connectors to QSFP-DD host connector.
- On-board LEDs display MSA output alarm states
- On-board buttons/jumpers for MSA input control signals
- User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- Four corner testing capability
- USB interface

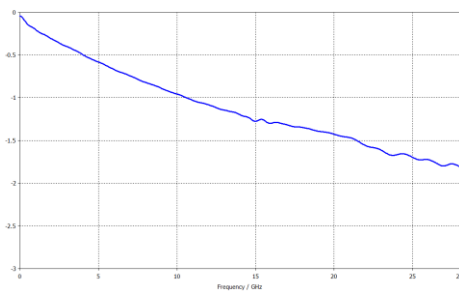


Figure 1: ML4062-MCB Insertion Loss



Figure 2: ML4062-MCB

## QSFP-DD Module Compliance Board

### ML4062-MCB-MXP

#### Key Features

- Supports 8x50G interfaces
- I2C master driven from both on board microcontroller or external pin headers
- 2x8 Huber+Suhner MXP Connector rows
- Current Sense
- Internal noise injection option through a programmable switching regulator
- Power can be fed through an external source
- Power margining between 3.1 V and 3.6 V
- Matched differential trace length
- All 8 channels come with matching trace length
- High performance signal integrity traces from MXP connectors to QSFP-DD host connector.
- On-board LEDs display MSA output alarm states
- On-board buttons/jumpers for MSA input control signals
- User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- Four corner testing capability
- USB interface

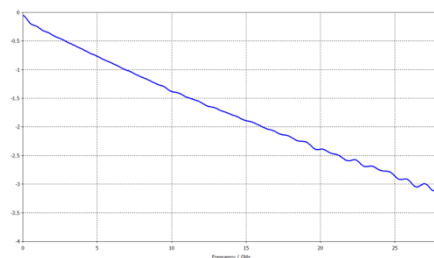


Figure 3: ML4062-MCB-MXP Insertion Loss



Figure 4: ML4062-MCB-MXP

## QSFP-DD Module Compliance Board (Host Loopback)

### ML4062-MCB-LB

#### Key Features

- Supports 8x50G interfaces
- I2C master driven from both on board microcontroller or external pin headers
- Current Sense
- Internal noise injection option through a programmable switching regulator
- All TX channels are looped back to the RX side on host with  $\approx 1$  dB loss
- Power can be fed through an external source
- Power margining between 3.1 V and 3.6 V
- On-board LEDs display MSA output alarm states
- On-board buttons/jumpers for MSA input control signal
- User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- Four corner testing capability
- USB interface



Figure 5: ML4062-MCB-LB

## QSFP-DD Breakout Modules

### ML4062-BO

#### Key Features

- All high-speed signals are connected from the QSFP-DD Plug to the front QSFP-DD host connector with superior SI traces
- High performance signal integrity traces
- QSFP-DD MSA form factor
- Low insertion loss
- Built with high performance PCB material
- Production friendly form factor
- Supports 8x50G TX and RX lanes
- High speed signals accessible through 2x8 Huber+Suhner MXP connector rows
- Maximum trace length 3923 mils
- Minimum trace length 2850 mils

#### Application

- Line card and port characterization



Figure 6: ML4062-BO

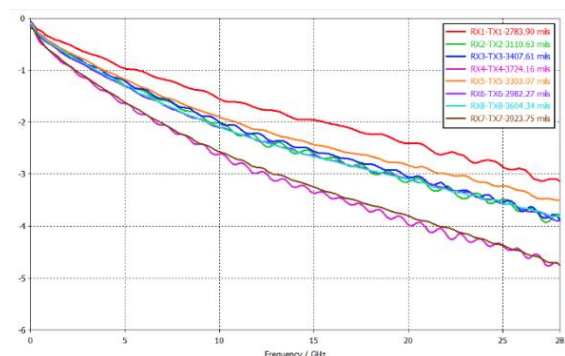


Figure 7: Insertion Loss for all channels

## QSFP-DD Host Compliance Board

### ML4062-HCB1

#### Key Features

- High Performance signal integrity traces
- QSFP-DD MSA Form Factor
- Same low Insertion Loss for all traces
- Built with high performance PCB material
- Production friendly form factor
- Supports 4x50 G
- 4 channels: Ch1, Ch2, Ch3, Ch4

| CH1 |     | CH2 |     | CH3 |     | CH4 |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| TX1 | RX1 | TX2 | RX2 | TX3 | RX3 | TX4 | RX4 |

- Built with high performance PCB material
- High speed signals accessible through K connector rows

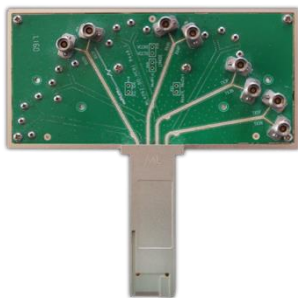


Figure 8: ML4062-HCB1

## QSFP-DD Host Compliance Board

### ML4062-HCB2

#### Key Features

- High Performance signal integrity traces
- QSFP-DD MSA Form Factor
- Same low Insertion Loss for all traces
- Built with high performance PCB material
- Production friendly form factor
- Supports 4x50 G
- 4 channels: Ch5, Ch6, Ch7, Ch8

| CH5 |     | CH6 |     | CH7 |     | CH8 |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| TX5 | RX5 | TX6 | RX6 | TX7 | RX7 | TX8 | RX8 |

- Built with high performance PCB material
- High speed signals accessible through K connector rows

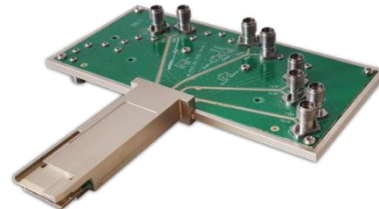


Figure 9: ML4062-HCB2

## QSFP-DD Module Compliance Board

### ML4062-MCB-TR

#### Key Features

- Consumable, low-cost MCB for volume testing to be used in combination with a replaceable multi-channel cable
- I2C master driven from either on-board microcontroller or external pin headers
- Current sensor
- Voltage sensor
- Two temperature sensors
- Matched differential trace length across all channels
- High performance signal integrity traces from TR40 connectors to QSFP-DD host connector
- On-board LEDs display MSA output alarm states
- On-board jumpers for MSA input control signals
- User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- Four corner testing capability
- USB interface
- QSFP-DD analyzer interface for ML4066-ANA I2C CMIS testing
- No components near QSFP-DD cage makes thermal testing easy to achieve



Figure 10: ML4062-MCB-TR

## QSFP-DD Passive Loopback Modules

### ML4062-SLB

#### Summary

The **ML4062-SLB** is packaged in a standard MSA housing compatible with all QSFP-DD ports. Transmit data from the host is electrically routed, (internal to the loopback module), to the receive data outputs and back to the host. It provides an economical way to exercise QSFP-DD ports during R&D validation, production testing, and field testing.

#### Key Features

- Supports 8x50G electrical interface
- QSFP-DD MSA Form Factor
- Microcontroller programmed to maintain user specified PD or constant temperature
- 4 thermistors on PCBA
- 4 independent power heaters, with 0.1 W resolution, up to 14 W
- Temperature Monitor and alarms warning
- Superior SI performance
- MSA Compatible Configuration and EEPROM
- Loops back TX to RX on all 8 ports
- I2C Interface
- Programmable MSA memory pages
- I2C control from edge connectors and from rear pin header
- 2 status LED Indicator
- Insertions counter
- Hot Pluggable module
- Cutoff temperature preventing module overheating
- Cable assemblies for power & I2C Control
- Custom memory maps

#### Application

- 8x50G electrical module testing and characterization
- QSFP-DD port compliant testing

#### Type 1 Modules

##### [ML4062-SLB-V1](#)

Regular QSFP-DD passive loopback module that has shipping available already, compliant with QSFP-DD MSA 2.0 (March 13, 2017).

*Datasheet: "ML4062-SLB\_DS\_V1-rev0.5"*

##### [ML4062-SLB-V4](#)

New QSFP-DD passive loopback module, compliant with CMIS 2.8 (May 3, 2018) and CMIS 3.0.

*Datasheet: "ML4062-SLB\_DS\_V4-rev0.3"*

##### [ML4062-SLB-V6](#)

New QSFP-DD passive loopback module that is newly available, compliant with CMIS 4.0.

*Datasheet: "ML4062-SLB\_DS\_V6-rev0.1"*

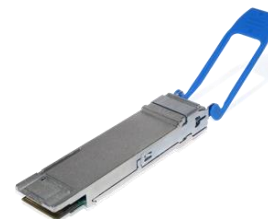


Figure 11: ML4062-SLB

## QSFP-DD Thermal Load

### ML4062-TL

#### Key Features

- QSFP-DD MSA form factor
- Microcontroller can be programmed to maintain user specified PD or constant temperature
- 4 temperature sensors
- 23 independent power spots
- Temperature monitor and alarms warning
- MSA compatible configuration and EEPROM
- I2C interface
- Programmable MSA memory pages
- I2C control rom edge connectors and from rear pin header
- Hot pluggable module
- Cut-off temperature preventing module overheating
- Controller card with I2C Master, supports multiple modules, USB master
- Cable assemblies for power & I2C control
- Custom memory maps



Figure 12: ML4062-TL



Figure 13: ML4062-CNT

## QSFP-DD Controller

### ML4062-CNT

#### Key Features

- The controller is powered using a 24 V external power supply.
- Two thermal loads modes are available: constant temperature and constant power dissipation.
  - Constant Temperature
    - Option 1: Used to fix the total temperature of the module (Enter the temperature value and click Set)
    - Option 2: Used to fix the temperature of a specified spot in the module (Select the spot that you need to fix its temperature, enter the temperature value and click Set).
  - Constant Power Dissipation
    - Used to set the power value of the desired spot using the corresponding slider.
- The user can set the temperature cut-off value using the Cut-off temperature field.
- Module VCC can be set to 3.3 or 3.5 V. The temperature values can be logged. The Interval indicates the time spent between consecutive temperature measurements.
- The total duration indicates the total times of logging temperature values.
- After the logging is done, you can view the graph that shows the temperature in time.

#### Ordering Information

|                   |                                   |
|-------------------|-----------------------------------|
| ML4062-CNT        | Regular controller                |
| ML4062-CNT-Gen2   | Reworked CNT that works with TL2a |
| ML4062-CNT-CBL    | Regular cable for TL1/TL2         |
| ML4062-CNT-CBL-G2 | Cable for TL2a                    |

## 400G QSFP-DD

### Passive Loopback Module

#### **ML4062-XLB1**

#### Key Features

- Crossed, Looped back TX to RX on all 8 ports
- Supports 8x50G electrical interface
- QSFP-DD MSA Form Factor
- Built with advanced PCB material
- 4 Thermistors on PCBA
- 4 independent power heaters, up to 14W
- Temperature Monitor and alarms warning
- Superior SI performance
- MSA Compatible Configuration and EEPROM
- I2C Interface
- Programmable MSA memory pages
- 2 status LED Indicators
- Insertions counter
- Hot Pluggable module
- Cut-off temperature preventing module overheating



**Figure 14: ML4062-XLB1**

## NEW RELEASES

### QSFP-DD Electrical Passive Loopback Module

#### ML4062-TL2a

##### Summary

**ML4062-TL2a** is used for testing QSFP-DD transceiver ports under board level tests, by substituting a full-featured QSFP-DD transceiver with the ML4062-TL2a. The **ML4062-TL2a** covers all QSFP-DD power classes.

The **ML4062-TL2a** is packaged in a standard MSA housing compatible with all QSFP-DD ports. It provides an economical way to exercise QSFP-DD ports during R&D validation, production testing, and field testing.

Note that the ML4062-TL2a follows the **CMIS Rev 4.0** standard.

##### Key Features

- QSFP-DD MSA Form Factor
- MSA Compatible Configuration and EEPROM
- Programmable MSA memory pages
- Custom memory maps
- I2C Interface
- I2C control from edge connectors and from rear pin header
- Controller card with I2C Master, supports multiple modules, USB master
- Hot Pluggable module
- Ten independent power spots dissipating up to 23.4 W
- Four temperature sensors
- Voltage sensor
- Current sensor
- Temperature Monitor and alarms warning
- Cut-off temperature preventing module overheating

#### Ordering Options

| Option             | Part Number       | Description                             |
|--------------------|-------------------|---|
| #1 – LCD Display   | ML4062-TL2a-C-LCD | Temperature and other monitoring values |
| #2 – LED Indicator | ML4062-TL2a-C-LED | Power mode and alarms monitoring        |
| #3 – Pin Header    | ML4062-TL2a-C-CON | Board to board connection               |



#1 LCD Display



#2 LED Indicator



#3 Pin Header



## NEW RELEASES

### 800G QSFP-DD MCB

#### ML4062-MCB-112

##### Key Features

- Supports 8x112G interfaces
- Compliant with CEI-112G-VSR-PAM4 and CEI-56G-VSR-NRZ
- I2C master driven from both on board microcontroller or external pin headers
- 2.4 or 1.85mm connectors
- Current Sense
- Matched differential trace length
- All 8 channels come with matching trace length
- High performance signal integrity traces from 2.4 or 1.85mm connectors to QSFP-DD host connector.
- On-board LEDs display MSA output alarm states
- Built with high performance PCB material
- On-board buttons/jumpers for MSA input control signals
- User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- Four corner testing capability



Figure 15: ML4062-MCB-112

### 800G QSFP-DD HCB

#### ML4062-HCB1-112

##### Key Features

- High performance signal integrity traces
- Compliant with CEI-112G-VSR-PAM4 and CEI-56G-VSR-NRZ
- QSFP-DD MSA Form Factor
- Same low Insertion Loss for all traces
- Supports 4x112G
- Built with high performance PCB Material
- High speed signals accessible through 2.4 or 1.85mm connectors
- 4 channels: 4 TX and the corresponding 4 RX

| CH1 |     | CH2 |     | CH3 |     | CH4 |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| TX1 | RX1 | TX2 | RX2 | TX3 | RX3 | TX4 | RX4 |

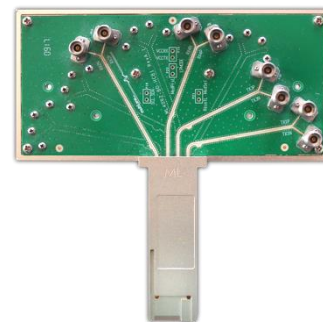


Figure 16: ML4062-HCB1-112

800G QSFP-DD HCB

**ML4062-HCB2-112**

Key Features

- High performance signal integrity traces
- Compliant with CEI-112G-VSR-PAM4 and CEI-56G-VSR-NRZ
- QSFP-DD MSA Form Factor
- Same low Insertion Loss for all traces
- Supports 4x112G
- Built with high performance PCB Material
- High speed signals accessible through 2.4 or 1.85mm connectors
- 4 channels: 4 TX and the corresponding 4 RX

| CH5 |     | CH6 |     | CH7 |     | CH8 |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| TX5 | RX5 | TX6 | RX6 | TX7 | RX7 | TX8 | RX8 |

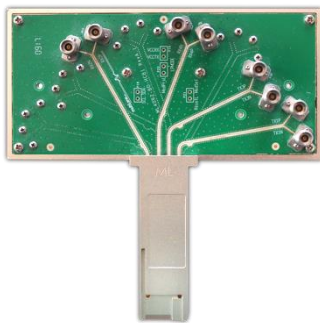


Figure 17: ML4062-HCB2-112

800G QSFP-DD Loopback Module

**ML4062-LB-112**

Key Features

- Loops back TX & RX with good performance SI Traces
- Built with advanced PCB Material
- MSA Compliant Shell with latching mechanism
- Four thermal spots
- Can emulate all QSFP-DD power classes
- Can dissipate up to 16 W via the thermal loads
- Temp sense
- I2C Terminated by microcontroller, I2C slave compliant with MSA
- Implements MSA Memory Map with programmable new pages
- Ability to control/monitor all low speed signals
- Insertion Counter
- Front LED Indicator
- Hot Pluggable
- Cut-off temperature preventing module overheating
- AC-coupled High-Speed Interface



Figure 18: ML4062-LB-112

## RELATED PRODUCT

### QSFP-DD to QSFP-DD Adapter

#### ML4066-QDD

##### Key Features

- All high-speed signals are connected from the QSFP-DD Plug to the front QSFP-DD host connector with superior SI traces
- Low insertion loss PCB traces
- Power pins are accessible via pin headers and can be jumped to connect them to the plugged QSFP-DD transceiver
- All low speed management signals are accessible via pin headers, and can be jumped to connect them to the plugged QSFP-DD transceiver
- I2C SCL and SDA signals accessible via pin headers or can be jumped to connect them to the plugged QSFP-DD transceiver
- Ability to drive I2C from external pin headers, or connect I2C packet analyzer
- Ability to drive 3.3 V from external source for power supply margining
- Ability to break 3.3 V power from Host to module allowing voltage and current measurement
- Signal interface to connect SFF Analyzer board
- ML4066-QDD Pin headers

|    | Host Side | Module Side |
|----|-----------|-------------|
| 1  | VCC       | VCC         |
| 2  | .VCC-TX   | VCC-TX      |
| 3  | VCC-RX    | VCC-RX      |
| 4  | .MODSEL_L | MODSEL_L    |
| 5  | .RESET_L  | RESET_L     |
| 6  | SCL       | SCL         |
| 7  | SDA       | SDA         |
| 8  | MODPRS_L  | MODPRS_L    |
| 9  | INT_L     | INT_L       |
| 10 | LPMODE    | LPMODE      |
| 11 | GND       | GND         |



Figure 20: ML4066-QDD ADP/ANA

### SFF Analyzer

#### ML4066-QDD-ANA

##### Key Features

- USB Interface
- Windows based GUI and API Library
- Detection and measurement of host pull up + pull down resistors on low speed signals
- Host VCC rails sampling measurement
- VCC spectral noise analysis
- I2C Analyzer
  - Bus speed
  - ACK/NACK DETECTION
  - Clock stretching analysis
  - Time event logging
- Functional tests
  - Control signals
  - Configuration registers
  - Ability to emulate optical module by loading identification registers with custom data
  - Built with advanced PCB Material
  - I2C terminated by microcontroller, I2C slave compliant with MSA
  - Implements MSA memory map and programmable new pages
  - Memory map can be loaded to replicate optical module's identification registers
  - Ability to control/monitor all low speed signals
  - Hot pluggable
  - AC coupled high speed interface
  - CMIS state machine testing

##### CMIS State Machine Analyzer

- Analyzer test available on all QSFP-DD modules that are CMIS 4.0 compliant
- Ability to test different state transitions
- Paged memory map and flat memory map show the module's current state and transition signals

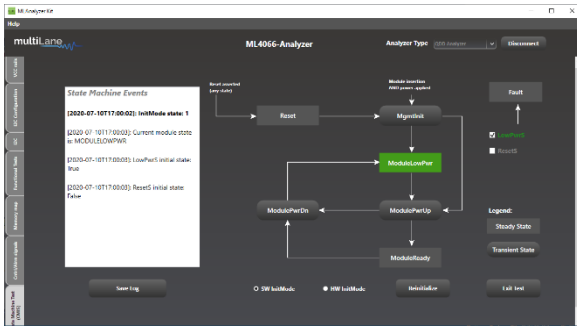


Figure 21: Paged Memory Modules

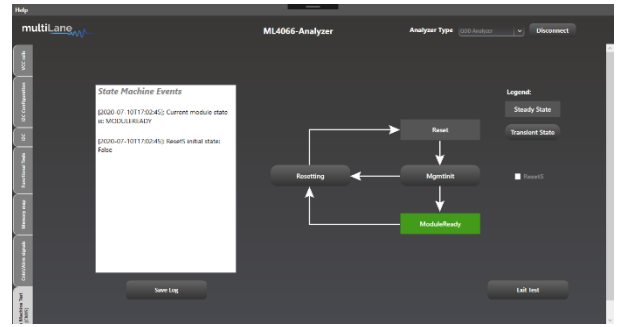


Figure 22: Flat Memory Modules

## CFP8 to QSFP-DD Adapter

### ML4054-QDD

- All high-speed signals are connected from the CFP8 Plug to the front QSFP-DD host connector with superior SI traces.

For more info, please find full datasheet [here](#).



Figure 23: ML4054-QDD