

### **QSFPDD4-400GB-AOC30M-MX-C**

Mellanox® Compatible TAA 400GBase-AOC QSFP-DD to QSFP-DD Active Optical Cable (850nm, MMF, 30m)

#### **Features:**

- Compliant to QSFP-DD MSA Standards
- 8 Parallel Full-Duplex Channels
- Compliant to IEEE802.3bs
- Up to 100m OM3 MMF Transmission
- Operating Temperature: 0 to 70 Celsius
- 8x53.125Gbps Electrical Interface (400GAUI-8)
- Data Rate 53.125Gbps (PAM4) Per Channel
- Maximum Power Consumption: 10.5W
- RoHS Compliant and Lead-Free



#### **Applications:**

- 400GBase Ethernet

#### **Product Description**

This is a Mellanox® compatible 400GBase-AOC QSFP-DD to QSFP-DD active optical cable that operates over multi-mode fiber with a maximum reach of 30.0m (98.4ft). At a wavelength of 850nm, it has been programmed, uniquely serialized, and data-traffic and application tested to ensure it is 100% compliant and functional. This active optical cable is TAA (Trade Agreements Act) compliant, and is built to comply with MSA (Multi-Source Agreement) standards. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs' transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products.")



## General Specifications

| Parameter                   | Symbol | Min. | Typ.    | Max. | Unit | Notes |
|-----------------------------|--------|------|---------|------|------|-------|
| Storage Temperature         | Tstg   | -40  |         | 85   | °C   |       |
| Operating Case Temperature  | Tc     | 0    |         | 70   | °C   |       |
| Supply Voltage              | Vcc    | -0.5 |         | 3.6  | V    |       |
| Relative Operating Humidity | RH     | 0    |         | 85   | %    |       |
| Data Rate Per Lane          |        |      | 26.5625 |      |      | PAM4  |
| Data Rate Accuracy          |        | -100 |         | 100  | ppm  |       |
| Link Distance with OM3      | D      | 0.5  |         | 100  | M    | 1     |

### Notes:

1. FEC is required on the host system to support the maximum distance.

## Electrical Specifications

| Parameter                                           | Symbol | Min.                             | Typ.  | Max.                 | Unit  | Notes |
|-----------------------------------------------------|--------|----------------------------------|-------|----------------------|-------|-------|
| Power Supply Voltage                                | Vcc    | 3.135                            | 3.3   | 3.465                | V     |       |
| Pre-FEC Bit Error Ratio                             |        |                                  |       | 2.4x10 <sup>-4</sup> |       |       |
| Post-FEC Bit Error Ratio                            |        |                                  |       | 1x10 <sup>-12</sup>  |       | 1     |
| Power Consumption                                   |        |                                  |       | 10.5                 | W     |       |
| Supply Current                                      | Icc    |                                  |       | 3.18                 | A     |       |
| <b>Transmitter</b>                                  |        |                                  |       |                      |       |       |
| Signaling Rate Per Lane                             | TP1    | 26.5625 ± 100ppm                 |       |                      | GBd   |       |
| Differential Pk-Pk Input Voltage Tolerance          | TP1a   | 900                              |       |                      | mVp-p | 2     |
| Differential Termination Mismatch                   | TP1    |                                  |       | 10                   | %     |       |
| Differential Input Return Loss                      | TP1    | IEEE 802.3-2015 Equation (83E-5) |       |                      | dB    |       |
| Differential to Common-Mode Input Return Loss       | TP1    | IEEE 802.3-2015 Equation (83E-6) |       |                      | dB    |       |
| Module Stressed Input Test                          | TP1a   | See IEEE 802.3bs 120E.3.4.1      |       |                      |       | 3     |
| Single-Ended Voltage Tolerance Range (Minimum)      | TP1a   | -0.4 to 3.3                      |       |                      | V     |       |
| DC Common-Mode Input Voltage                        | TP1    | -350                             |       | 2850                 | mV    | 4     |
| <b>Receiver</b>                                     |        |                                  |       |                      |       |       |
| Signaling Rate Per Lane                             | TP4    | 26.5625 ± 100ppm                 |       |                      | GBd   |       |
| Differential Pk-Pk Output Voltage                   | TP4    |                                  |       | 900                  | mVp-p |       |
| AC Common-Mode Output Voltage (RMS)                 | TP4    |                                  |       | 17.5                 | mV    |       |
| Differential Termination Mismatch                   | TP4    |                                  |       | 10                   | %     |       |
| Differential Output Return Loss                     | TP4    | IEEE 802.3-2015 Equation (83E-2) |       |                      |       |       |
| Common- to Differential-Mode Conversion Return Loss | TP4    | IEEE 802.3-2015 Equation (83E-3) |       |                      |       |       |
| Transition Time (20-80%)                            | TP4    | 9.5                              |       |                      | ps    |       |
| Near-End Eye Symmetry Mask Width (ESMW)             | TP4    |                                  | 0.265 |                      | UI    |       |
| Near-End Eye Height (Differential)                  | TP4    | 70                               |       |                      | mV    |       |
| Far-End Eye Symmetry Mask Width (ESMW)              | TP4    |                                  | 0.2   |                      | UI    |       |
| Far-End Eye Height (Differential)                   | TP4    | 30                               |       |                      | mV    |       |
| Far-End Pre-Cursor ISI Ratio                        | TP4    | -4.5                             |       | 2.5                  | %     |       |
| Common-Mode Output Voltage (Vcm)                    | TP4    | -350                             |       | 2850                 | mV    | 4     |

### Notes:

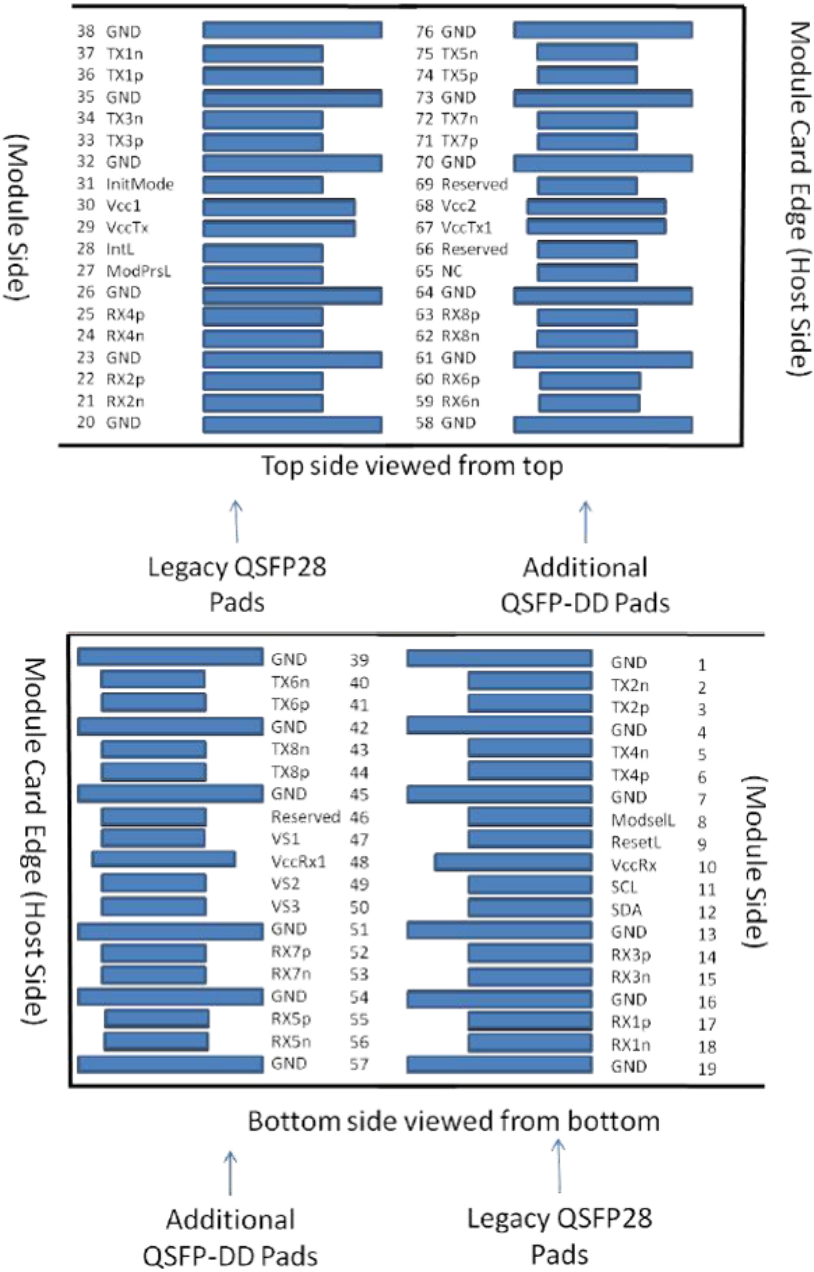
1. FEC is provided by the host system.
2. With the exception to IEEE 802.3bs 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
3. Meets BER specified in IEEE 802.3bs 120E.1.1.
4. DC common-mode voltage generated by the host. Specification includes effects of ground offset voltage.

## Pin Descriptions

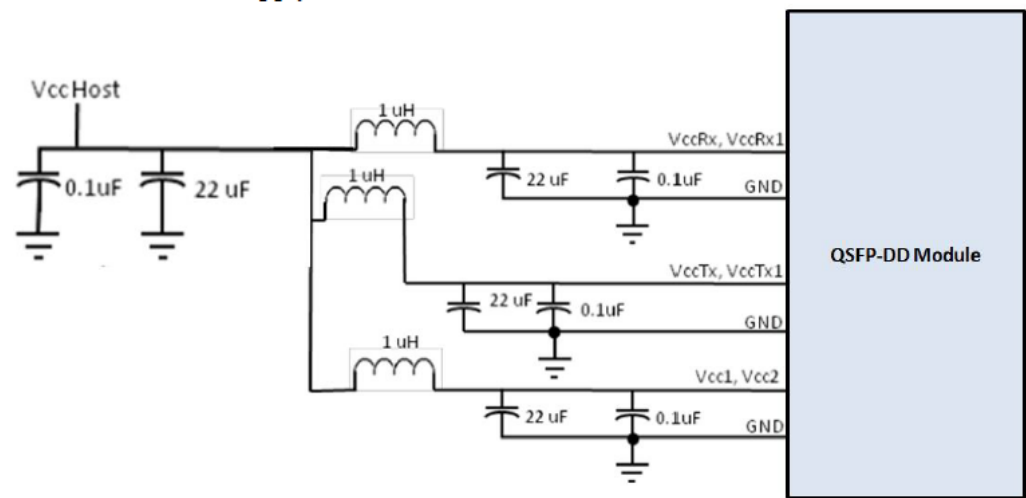
| Pin | Logic       | Symbol   | Name/Description                                                                     | Plug Sequence | Notes |
|-----|-------------|----------|--------------------------------------------------------------------------------------|---------------|-------|
| 1   |             | GND      | Module Ground.                                                                       | 1B            |       |
| 2   | CML-I       | Tx2-     | Transmitter Inverted Data Input.                                                     | 3B            |       |
| 3   | CML-I       | Tx2+     | Transmitter Non-Inverted Data Input.                                                 | 3B            |       |
| 4   |             | GND      | Module Ground.                                                                       | 1B            |       |
| 5   | CML-I       | Tx4-     | Transmitter Inverted Data Input.                                                     | 3B            |       |
| 6   | CML-I       | Tx4+     | Transmitter Non-Inverted Data Input.                                                 | 3B            |       |
| 7   |             | GND      | Module Ground.                                                                       | 1B            |       |
| 8   | LVTTTL-I    | ModSelL  | Module Select.                                                                       | 3B            |       |
| 9   | LVTTTL-I    | ResetL   | Module Reset.                                                                        | 3B            |       |
| 10  |             | VccRx    | +3.3V Receiver Power Supply.                                                         | 2B            |       |
| 11  | LVC MOS-I/O | SCL      | 2-Wire Serial Interface Clock.                                                       | 3B            |       |
| 12  | LVC MOS-I/O | SDA      | 2-Wire Serial Interface Data.                                                        | 3B            |       |
| 13  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 14  | CML-O       | Rx3+     | Receiver Non-Inverted Data Output.                                                   | 3B            |       |
| 15  | CML-O       | Rx3-     | Receiver Inverted Data Output.                                                       | 3B            |       |
| 16  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 17  | CML-O       | Rx1+     | Receiver Non-Inverted Data Output.                                                   | 3B            |       |
| 18  | CML-O       | Rx1-     | Receiver Inverted Data Output.                                                       | 3B            |       |
| 19  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 20  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 21  | CML-O       | Rx2-     | Receiver Inverted Data Output.                                                       | 3B            |       |
| 22  | CML-O       | Rx2+     | Receiver Non-Inverted Data Output.                                                   | 3B            |       |
| 23  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 24  | CML-O       | Rx4-     | Receiver Inverted Data Output.                                                       | 3B            |       |
| 25  | CML-O       | Rx4+     | Receiver Non-Inverted Data Output.                                                   | 3B            |       |
| 26  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 27  | LVTTTL-O    | ModPrsL  | Module Present.                                                                      | 3B            |       |
| 28  | LVTTTL-O    | IntL     | Interrupt.                                                                           | 3B            |       |
| 29  |             | VccTx    | +3.3V Transmitter Power Supply.                                                      | 2B            |       |
| 30  |             | Vcc1     | +3.3V Power Supply.                                                                  | 2B            |       |
| 31  | LVTTTL-I    | InitMode | Initialization Mode. In legacy QSFP applications, the InitMode pad is called LPMODE. | 3B            |       |
| 32  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 33  | CML-I       | Tx3+     | Transmitter Non-Inverted Data Input.                                                 | 3B            |       |
| 34  | CML-I       | Tx3-     | Transmitter Inverted Data Input.                                                     | 3B            |       |
| 35  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 36  | CML-I       | Tx1+     | Transmitter Non-Inverted Data Input.                                                 | 3B            |       |
| 37  | CML-I       | Tx1-     | Transmitter Inverted Data Input.                                                     | 3B            |       |
| 38  |             | GND      | Module Ground.                                                                       | 1B            |       |
| 39  |             | GND      | Module Ground.                                                                       | 1A            |       |
| 40  | CML-I       | Tx6-     | Transmitter Inverted Data Input.                                                     | 3A            |       |

|    |       |          |                                      |    |  |
|----|-------|----------|--------------------------------------|----|--|
| 41 | CML-I | Tx6+     | Transmitter Non-Inverted Data Input. | 3A |  |
| 42 |       | GND      | Module Ground.                       | 1A |  |
| 43 | CML-I | Tx8-     | Transmitter Inverted Data Input.     | 3A |  |
| 44 | CML-I | Tx8+     | Transmitter Non-Inverted Data Input. | 3A |  |
| 45 |       | GND      | Module Ground.                       | 1A |  |
| 46 |       | Reserved | For Future Use.                      | 3A |  |
| 47 |       | VS1      | Module Vendor-Specific 1.            | 3A |  |
| 48 |       | VccRx1   | +3.3V Receiver Power Supply.         | 2A |  |
| 49 |       | VS2      | Module Vendor-Specific 2.            | 3A |  |
| 50 |       | VS3      | Module Vendor-Specific 3.            | 3A |  |
| 51 |       | GND      | Module Ground.                       | 1A |  |
| 52 | CML-O | Rx7+     | Receiver Non-Inverted Data Output.   | 3A |  |
| 53 | CML-O | Rx7-     | Receiver Inverted Data Output.       | 3A |  |
| 54 |       | GND      | Module Ground.                       | 1A |  |
| 55 | CML-O | Rx5+     | Receiver Non-Inverted Data Output.   | 3A |  |
| 56 | CML-O | Rx5-     | Receiver Inverted Data Output.       | 3A |  |
| 57 |       | GND      | Module Ground.                       | 1A |  |
| 58 |       | GND      | Module Ground.                       | 1A |  |
| 59 | CML-O | Rx6-     | Receiver Inverted Data Output.       | 3A |  |
| 60 | CML-O | Rx6+     | Receiver Non-Inverted Data Output.   | 3A |  |
| 61 |       | GND      | Module Ground.                       | 1A |  |
| 62 | CML-O | Rx8-     | Receiver Inverted Data Output.       | 3A |  |
| 63 | CML-O | Rx8+     | Receiver Non-Inverted Data Output.   | 3A |  |
| 64 |       | GND      | Module Ground.                       | 1A |  |
| 65 |       | NC       | Not Connected.                       | 3A |  |
| 66 |       | Reserved | For Future Use.                      | 3A |  |
| 67 |       | VccTx1   | +3.3V Transmitter Power Supply.      | 2A |  |
| 68 |       | Vcc2     | +3.3V Power Supply.                  | 2A |  |
| 69 |       | Reserved | For Future Use.                      | 3A |  |
| 70 |       | GND      | Module Ground.                       | 1A |  |
| 71 | CML-I | Tx7+     | Transmitter Non-Inverted Data Input. | 3A |  |
| 72 | CML-I | Tx7-     | Transmitter Inverted Data Input.     | 3A |  |
| 73 |       | GND      | Module Ground.                       | 1A |  |
| 74 | CML-I | Tx5+     | Transmitter Non-Inverted Data Input. | 3A |  |
| 75 | CML-I | Tx5-     | Transmitter Inverted Data Input.     | 3A |  |
| 76 |       | GND      | Module Ground.                       | 1A |  |

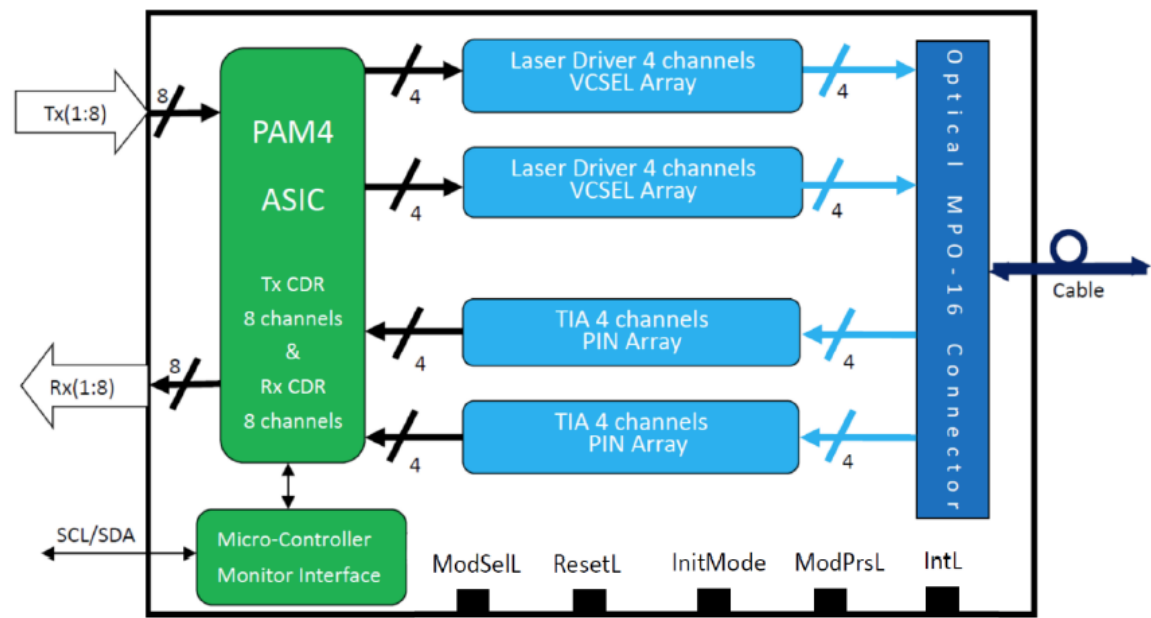
Electrical Pin-Out Details



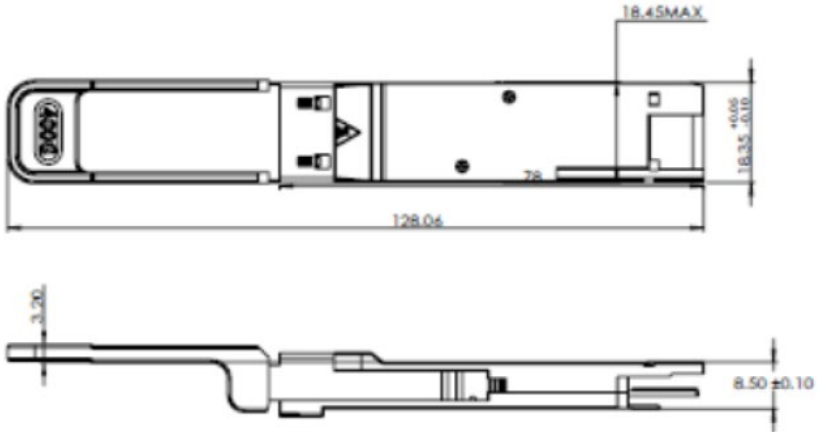
Recommended Power Supply Filter



Block Diagram



Mechanical Specifications



## About ProLabs

Our extensive experience comes as standard. For over 20 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with more than 100 optical switching and transport platforms.

## A Complete Portfolio of Network Solutions

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 1.6T while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## The Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure compatible products, and immediate answers to your questions. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.



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