

### **Q400G-4Q56G-AOC45M-AO**

MSA and TAA Compliant 400GBase-AOC QSFP-DD to 4xQSFP56 PAM-4 Active Optical Cable (850nm, MMF, 45m) CMIS 3.0

#### **Features**

- Low latency DSP-free electronics-based CDR
- PAM4 modulation
- Multi-data rate up to 56.15 Gb/s per lane
- Low power consumption: 7.6W on 400G end, 2.3W on 100G end with all CDRs enabled
- QSFP-DD MSA compliant
- Single 3.3 V power supply
- Commercial temperature 0 to 70 Celsius
- CMIS 4.0 compliant
- RoHS compliant and lead-free
- Hot pluggable
- LSZH-rated cable
- IEEE 802.3cm



#### **Applications**

- Data center: Switches, servers, storages and NIC adapters
- 400GBase Ethernet

#### **Product Description**

This is a MSA Compliant 400GBase-AOC QSFP-DD to 4xQSFP56 active optical cable that operates over active fiber with a maximum reach of 45m. It has been programmed, uniquely serialized, and data-traffic and application tested to ensure it is 100% compliant and functional. We stand behind the quality of our products and proudly offer a limited lifetime warranty. This cable is TAA (Trade Agreements Act) compliant and is built to comply with MSA (Multi-Source Agreement) standards.

AddOn's 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."



### Absolute Maximum Ratings

| Parameter                  | Symbol  | Min. | Typ. | Max. | Unit | Notes   |
|----------------------------|---------|------|------|------|------|---------|
| Supply Voltage             | VIN     | 0    |      | 4.0  | V    |         |
| Input Swing                | VIN-MAX |      |      | 1500 | mVpp |         |
| Storage Temperature        | TSTG    | −40  |      | 85   | °C   | Ambient |
| Operating Case Temperature | Top     | 0    |      | 70   | °C   |         |
| Relative Humidity          | RH      | 5    |      | 85   | %    |         |

### Electrical Specifications

| Parameter                        | Symbol   | Min. | Typ.    | Max.                 | Unit | Notes |
|----------------------------------|----------|------|---------|----------------------|------|-------|
| Data Rate (Per Channel)          | BR       |      | 26.5625 |                      | GBd  |       |
| Power Supply Voltage             | VCC      | 3.15 | 3.30    | 3.47                 | V    |       |
| Power Supply Current             | 400G End | ICC  | 2300    | 2500                 | mA   | 1     |
|                                  | 100G End | ICC  | 680     | 750                  | mA   | 1     |
| Power Consumption                | 400G End | P    | 7.6     | 8.0                  | W    | 1     |
|                                  | 100G End | P    | 2.3     | 2.5                  | W    | 1     |
| Transmitter                      |          |      |         |                      |      |       |
| Input Differential Impedance     | RIN      |      | 100     |                      | Ω    |       |
| Diff. Pk-Pk Input Vol. Tolerance | VINP-P   | 900  |         |                      | mV   |       |
| Receiver                         |          |      |         |                      |      |       |
| Output Differential Impedance    | ROUT     |      | 100     |                      | Ω    |       |
| Differential Data Output Swing   | VOU TP-P | 700  | 800     | 900                  | mV   |       |
| Bit Error Ratio (at 26.5625 GBd) |          |      |         | 2.4×10 <sup>-4</sup> |      | 3     |

#### Notes:

1. Per end, all channel CDRs are enabled.
2. Pre-FEC Bit Error Ratio with a PRBS 231 – 1 test pattern over a normal operating temperature range.

## Pin Descriptions (QSFP-DD 400G End)

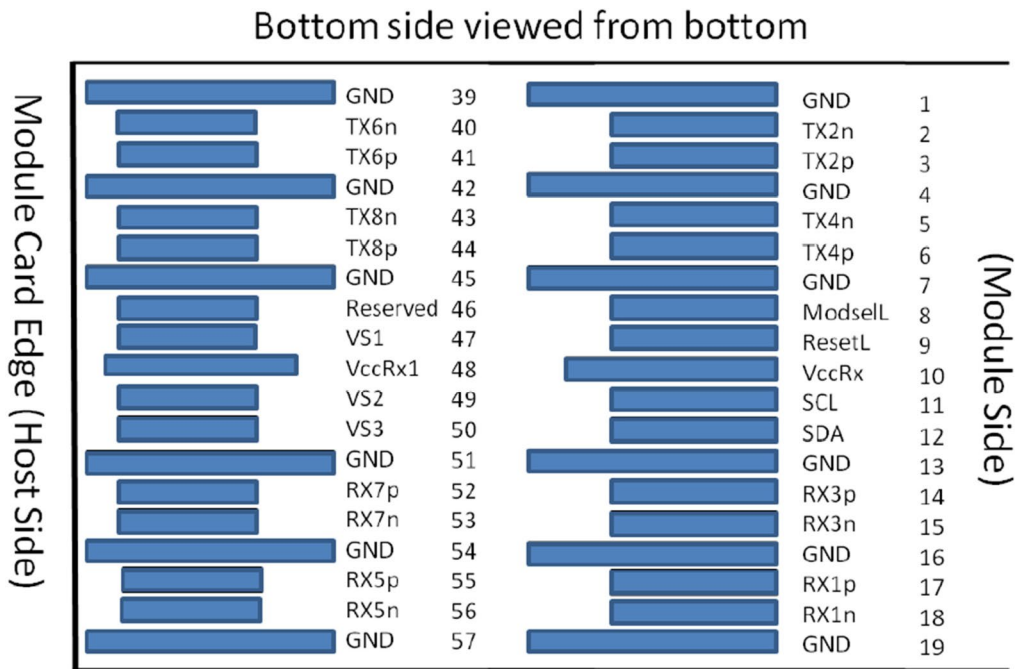
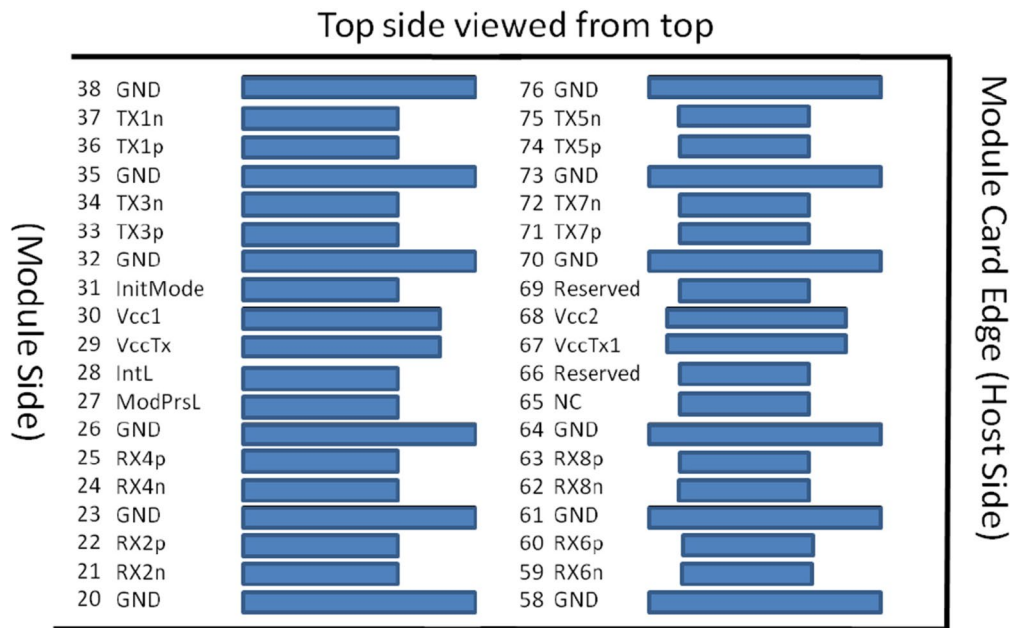
| PIN | Logic       | Symbol   | Description                                                                         | Notes |
|-----|-------------|----------|-------------------------------------------------------------------------------------|-------|
| 1   |             | GND      | Ground                                                                              | 1     |
| 2   | CML-I       | Tx2n     | Transmitter Inverted Data Input                                                     |       |
| 3   | CML-I       | Tx2p     | Transmitter Non-Inverted Data Input                                                 |       |
| 4   |             | GND      | Ground                                                                              | 1     |
| 5   | CML-I       | Tx4n     | Transmitter Inverted Data Input                                                     |       |
| 6   | CML-I       | Tx4p     | Transmitter Non-Inverted Data Input                                                 |       |
| 7   |             | GND      | Ground                                                                              | 1     |
| 8   | LVTTL-I     | ModSelL  | Module Select                                                                       |       |
| 9   | LVTTL-I     | ResetL   | Module Reset                                                                        |       |
| 10  |             | VccRx    | +3.3V Power Supply Receiver                                                         | 2     |
| 11  | LVC MOS-I/O | SCL      | 2-wire serial interface clock                                                       |       |
| 12  | LVC MOS-I/O | SDA      | 2-wire serial interface data                                                        |       |
| 13  |             | GND      | Ground                                                                              | 1     |
| 14  | CML-O       | Rx3p     | Receiver Non-Inverted Data Output                                                   |       |
| 15  | CML-O       | Rx3n     | Receiver Inverted Data Output                                                       |       |
| 16  |             | GND      | Ground                                                                              | 1     |
| 17  | CML-O       | Rx1p     | Receiver Non-Inverted Data Output                                                   |       |
| 18  | CML-O       | Rx1n     | Receiver Inverted Data Output                                                       |       |
| 19  |             | GND      | Ground                                                                              | 1     |
| 20  |             | GND      | Ground                                                                              | 1     |
| 21  | CML-O       | Rx2n     | Receiver Inverted Data Output                                                       |       |
| 22  | CML-O       | Rx2p     | Receiver Non-Inverted Data Output                                                   |       |
| 23  |             | GND      | Ground                                                                              | 1     |
| 24  | CML-O       | Rx4n     | Receiver Inverted Data Output                                                       |       |
| 25  | CML-O       | Rx4p     | Receiver Non-Inverted Data Output                                                   |       |
| 26  |             | GND      | Ground                                                                              | 1     |
| 27  | LVTTL-O     | ModPrsL  | Module Present                                                                      |       |
| 28  | LVTTL-O     | IntL     | Interrupt                                                                           |       |
| 29  |             | VccTx    | +3.3V Power Supply Transmitter                                                      | 2     |
| 30  |             | VccI     | +3.3V Power Supply                                                                  | 2     |
| 31  | LVTTL-I     | InitMode | Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE |       |
| 32  |             | GND      | Ground                                                                              | 1     |
| 33  | CML-I       | Tx3p     | Transmitter Non-Inverted Data Input                                                 |       |
| 34  | CML-I       | Tx3n     | Transmitter Inverted Data Input                                                     |       |
| 35  |             | GND      | Ground                                                                              | 1     |
| 36  | CML-I       | Tx1p     | Transmitter Non-Inverted Data Input                                                 |       |
| 37  | CML-I       | Tx1n     | Transmitter Inverted Data Input                                                     |       |
| 38  |             | GND      | Ground                                                                              | 1     |

| PIN |       | Symbol   | Description                         | Notes |
|-----|-------|----------|-------------------------------------|-------|
| 39  |       | GND      | Ground                              | 1     |
| 40  | CML-I | Tx6n     | Transmitter Inverted Data Input     |       |
| 41  | CML-I | Tx6p     | Transmitter Non-Inverted Data Input |       |
| 42  |       | GND      | Ground                              | 1     |
| 43  | CML-I | Tx8n     | Transmitter Inverted Data Input     |       |
| 44  | CML-I | Tx8p     | Transmitter Non-Inverted Data Input |       |
| 45  |       | GND      | Ground                              | 1     |
| 46  |       | Reserved | For future use                      | 3     |
| 47  |       | VSI      | Module Vendor Specific 1            | 3     |
| 48  |       | VccRx1   | 3.3V Power Supply                   | 2     |
| 49  |       | VS2      | Module Vendor Specific 2            | 3     |
| 50  |       | VS3      | Module Vendor Specific 3            | 3     |
| 51  |       | GND      | Ground                              | 1     |
| 52  | CML-O | Rx7p     | Receiver Non-Inverted Data Output   |       |
| 53  | CML-O | Rx7n     | Receiver Inverted Data Output       |       |
| 54  |       | GND      | Ground                              | 1     |
| 55  | CML-O | Rx5p     | Receiver Non-Inverted Data Output   |       |
| 56  | CML-O | Rx5n     | Receiver Inverted Data Output       |       |
| 57  |       | GND      | Ground                              | 1     |
| 58  |       | GND      | Ground                              | 1     |
| 59  | CML-O | Rx6n     | Receiver Inverted Data Output       |       |
| 60  | CML-O | Rx6p     | Receiver Non-Inverted Data Output   |       |
| 61  |       | GND      | Ground                              | 1     |
| 62  | CML-O | Rx8n     | Receiver Inverted Data Output       |       |
| 63  | CML-O | Rx8p     | Receiver Non-Inverted Data Output   |       |
| 64  |       | GND      | Ground                              | 1     |
| 65  |       | NC       | No Connect                          | 3     |
| 66  |       | Reserved | For future use                      | 3     |
| 67  |       | VccTx1   | 3.3V Power Supply                   | 2     |
| 68  |       | Vcc2     | 3.3V Power Supply                   | 2     |
| 69  |       | Reserved | For future use                      | 3     |
| 70  |       | GND      | Ground                              | 1     |
| 71  | CML-I | Tx7p     | Transmitter Non-Inverted Data Input |       |
| 72  | CML-I | Tx7n     | Transmitter Inverted Data Input     |       |
| 73  |       | GND      | Ground                              | 1     |
| 74  | CML-I | Tx5p     | Transmitter Non-Inverted Data Input |       |
| 75  | CML-I | Tx5n     | Transmitter Inverted Data Input     |       |
| 76  |       | GND      | Ground                              | 1     |

**Notes:**

1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common within the QSFP-DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 shall be applied concurrently. Requirements defined for the host side of the Host Card Edge Connector are listed in Table 6. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000 mA.
3. All Vendor Specific, Reserved and No Connect pins may be terminated with 50 ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and Reserved pads shall have an impedance to GND that is greater than 10 kOhms and less than 100 pF.
4. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 1A, 2A, 3A, 1B, 2B, 3B. (see Figure 2 for pad locations) Contact sequence A will make, then break contact with additional QSFP-DD pads. Sequence 1A, 1B will then occur simultaneously, followed by 2A, 2B, followed by 3A, 3B.

Electrical Pin-out Details (QSFP-DD 400G End)



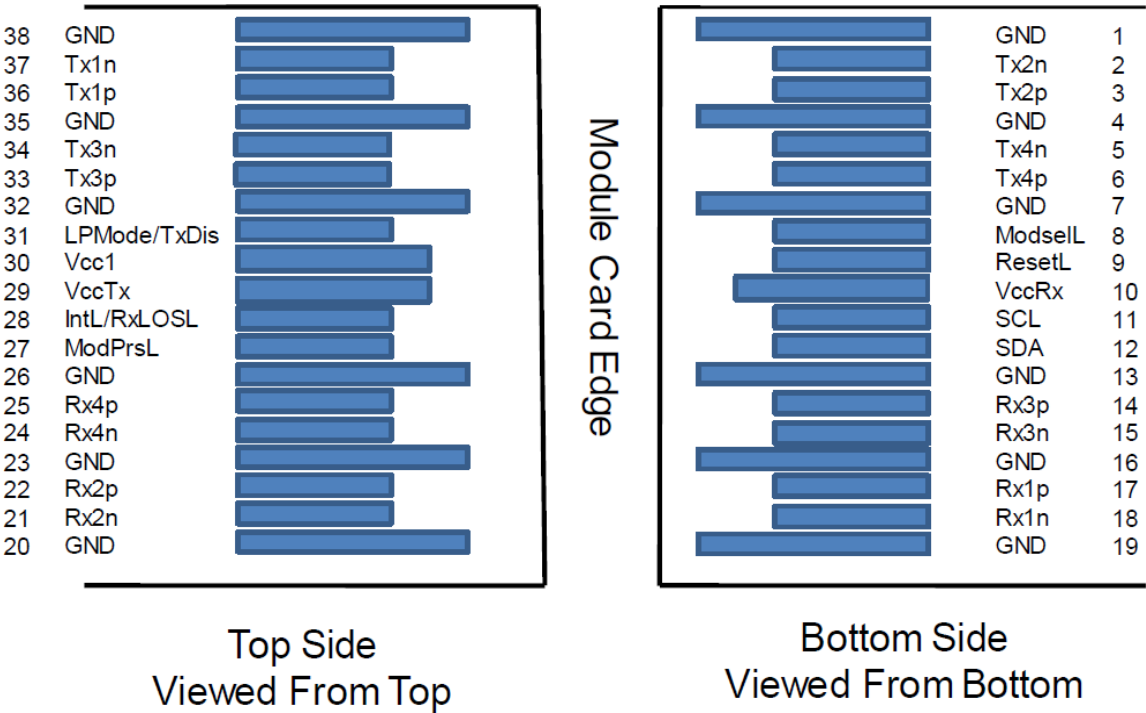
## Pin Descriptions (QSFP56 100G End)

| PIN | Logic       | Symbol  | Description                         | Notes |
|-----|-------------|---------|-------------------------------------|-------|
| 1   |             | GND     | Ground                              | 1     |
| 2   | CML-I       | Tx2n    | Transmitter Inverted Data Input     |       |
| 3   | CML-I       | Tx2p    | Transmitter Non-Inverted Data Input |       |
| 4   |             | GND     | Ground                              | 1     |
| 5   | CML-I       | Tx4n    | Transmitter Inverted Data Input     | 3     |
| 6   | CML-I       | Tx4p    | Transmitter Non-Inverted Data Input | 3     |
| 7   |             | GND     | Ground                              | 1     |
| 8   | LVTTL-I     | ModSelL | Module Select                       |       |
| 9   | LVTTL-I     | ResetL  | Module Reset                        |       |
| 10  |             | Vcc Rx  | +3.3V Power supply receiver         | 2     |
| 11  | LVC MOS-I/O | SCL     | 2-wire serial interface clock       |       |
| 12  | LVC MOS-I/O | SDA     | 2-wire serial interface data        |       |
| 13  |             | GND     | Ground                              | 1     |
| 14  | CML-O       | Rx3p    | Receiver Non-Inverted Data Output   | 3     |
| 15  | CML-O       | Rx3n    | Receiver Inverted Data Output       | 3     |
| 16  |             | GND     | Ground                              | 1     |
| 17  | CML-O       | Rx1p    | Receiver Non-Inverted Data Output   |       |
| 18  | CML-O       | Rx1n    | Receiver Inverted Data Output       |       |
| 19  |             | GND     | Ground                              | 1     |
| 20  |             | GND     | Ground                              | 1     |
| 21  | CML-O       | Rx2n    | Receiver Inverted Data Output       |       |
| 22  | CML-O       | Rx2p    | Receiver Non-Inverted Data Output   |       |
| 23  |             | GND     | Ground                              | 1     |
| 24  | CML-O       | Rx4n    | Receiver Inverted Data Output       | 3     |
| 25  | CML-O       | Rx4p    | Receiver Non-Inverted Data Output   | 3     |
| 26  |             | GND     | Ground                              | 1     |
| 27  | LVTTL-O     | ModPrsL | Module Present                      |       |
| 28  | LVTTL-O     | IntL    | Interrupt                           |       |
| 29  |             | Vcc Tx  | +3.3V Power supply transmitter      | 2     |
| 30  |             | Vcc 1   | +3.3V Power Supply                  | 2     |
| 31  | LVTTL-I     | LPMode  | Low Power Mode                      |       |
| 32  |             | GND     | Ground                              | 1     |
| 33  | CML-I       | Tx3p    | Transmitter Non-Inverted Data Input | 3     |
| 34  | CML-I       | Tx3n    | Transmitter Inverted Data Input     | 3     |
| 35  |             | GND     | Ground                              | 1     |
| 36  | CML-I       | Tx1p    | Transmitter Non-Inverted Data Input |       |
| 37  | CML-I       | Tx1n    | Transmitter Inverted Data Input     |       |
| 38  |             | GND     | Ground                              | 1     |

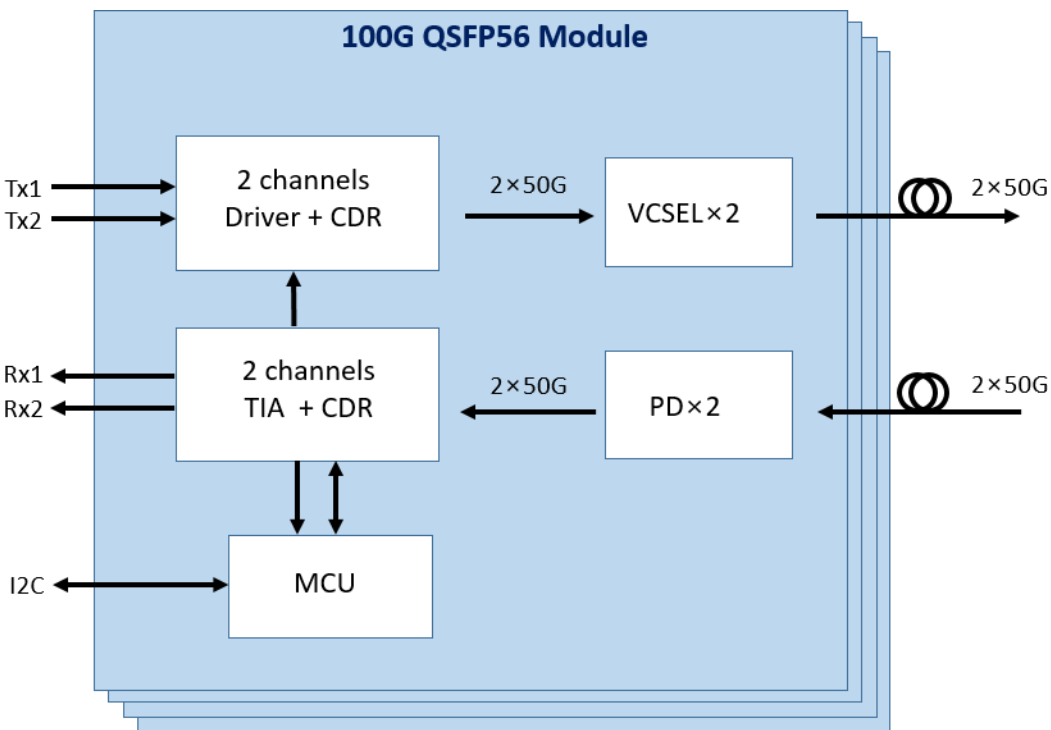
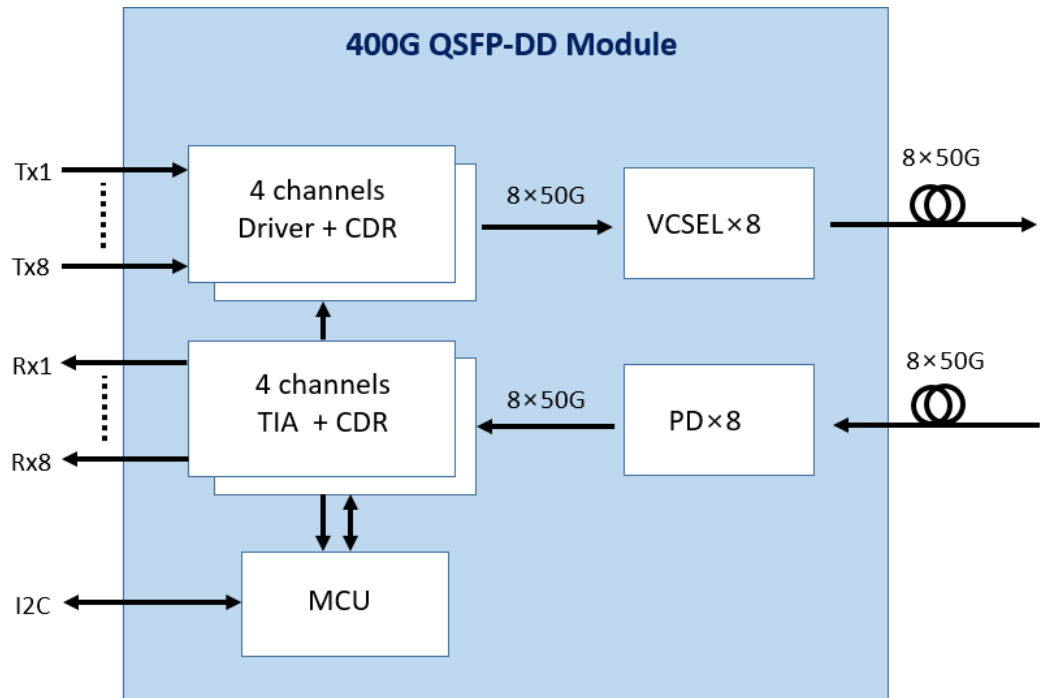
**Notes:**

1. GND is the symbol for signal and supply (power) common for the QSFP module. All are common within the QSFP module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for a maximum current of 500 mA.
3. Not used

**Electrical Pin-out Details (QSFP56 100G End)**



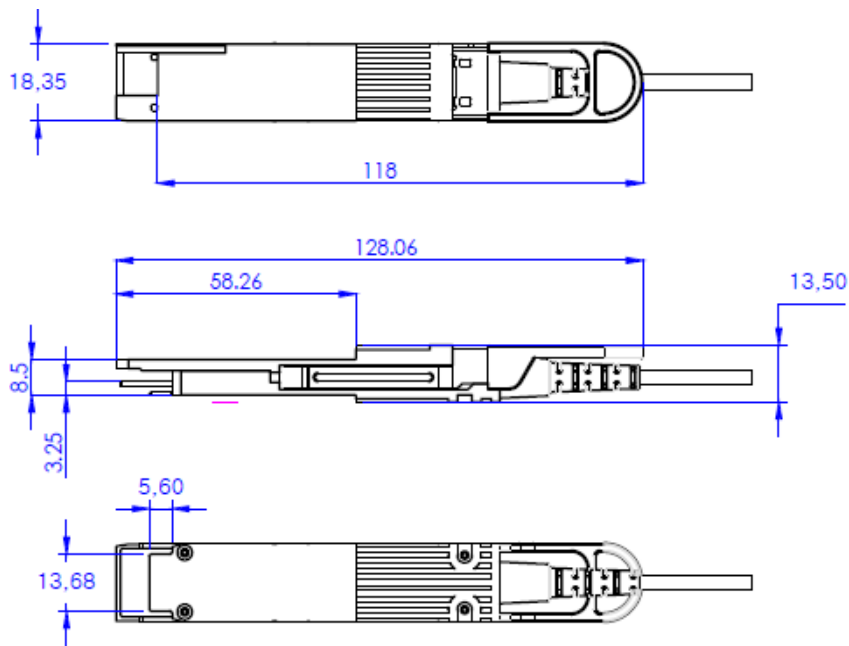
**Block Diagram**



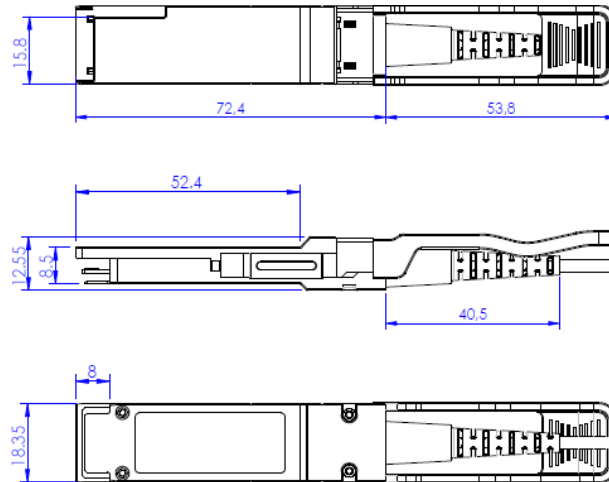
Active Optical Cable Specifications

| Parameter           | Value                            | Unit | Note            |
|---------------------|----------------------------------|------|-----------------|
| Cable Diameter      | LSZH: $\varnothing 3.0 \pm 0.15$ | mm   |                 |
| Minimum Bend Radius | 30                               | mm   | Without tension |
| Length Tolerance    | +300 / -0                        | mm   |                 |
| Cable Jacket        | LSZH, Aqua                       |      |                 |

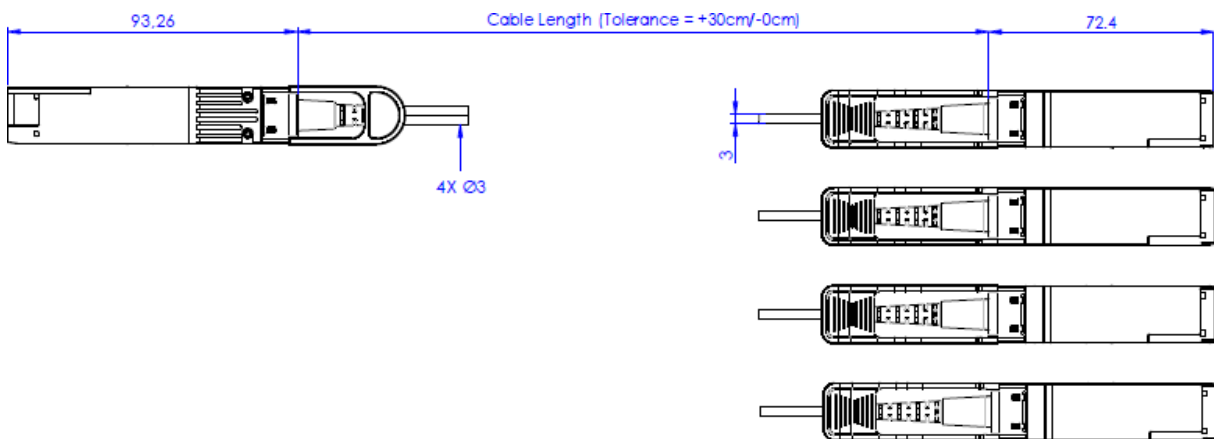
Mechanical Specifications



QSFP-DD 400G End



**QSFP56 100G End**



## About AddOn Networks

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is ingrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



## U.S. Headquarters

Email: [sales@addonnetworks.com](mailto:sales@addonnetworks.com)

Telephone: +1 877.292.1701

Fax: 949.266.9273

## Europe Headquarters

Email: [salesupportemea@addonnetworks.com](mailto:salesupportemea@addonnetworks.com)

Telephone: +44 1285 842070