

# Technical Datasheet

## QSFP-4X10G-D-AOC-15M-C

H3C® Compatible 40Gb/s QSFP+ to 4SFP+

Active Optical Breakout Cable, 15m

### FEATURES

- Available lengths 15m to 100m
- Compliant with SFF-8436 for QSFP+ and standard SFF-8431 for SFP+
- High speed, high density. Supports up to 4X10Gb/s bi-directional operation
- Reliable VCSEL and PIN photonic devices
- I2C standard management interface
- Excellent high speed signal integrity
- Operating temperature: 0 to 70°C
- RoHS6 Compliant

### APPLICATIONS

10G/40G Ethernet  
Proprietary high speed, high density data  
High performance computing, server and data storage

### DESCRIPTION

ATGBICS QSFP-4X10G-D-AOC-15M-C is a 40Gb/s QSFP+ to 4x 10G SFP+ hot pluggable Active Optical Cable for Infiniband and Ethernet data transmission. It provides parallel interconnects: 4 transmitting / 4 receiving data lanes and supports distance up to 100 meters.

It is composed of optical transceivers on both ends with multimode fiber cable in between. This integrated optical module solution removes the complicated optical fiber interface and brings friendly and intuitive electrical-to-electrical interface to users.

This product is designed to meet the requirements of high speed, high density and low power consumption for applications in today's data centers.

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## Absolute Maximum Ratings

| Parameter                  | Symbol          | Min. | Typical | Max. | Unit |
|----------------------------|-----------------|------|---------|------|------|
| Storage Temperature        | T <sub>s</sub>  | -40  |         | +85  | °C   |
| Case Operating Temperature | T <sub>A</sub>  | 0    |         | 70   | °C   |
| Maximum Supply Voltage     | V <sub>cc</sub> | 0    |         | 3.6  | V    |
| Relative Humidity          | RH              | 5    |         | 85   | %    |

## Recommended Operating Conditions

| Parameter                  | Symbol          | Min.  | Typical | Max.  | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Operating Case Temperature | TC              | 0     | 25      | 70    | °C   |
| Supply Voltage             | V <sub>cc</sub> | 3.135 | 3.3     | 3.465 | V    |
| Data Rate                  | -               | -     | 4*10.3  | -     | Gb/s |

## Transceiver Electrical Characteristics

| Parameter                                                               | Symbol | Min. | Typical | Max.            | Unit | Note |
|-------------------------------------------------------------------------|--------|------|---------|-----------------|------|------|
| Low speed output: Transmitter Fault(TX_FAULT) /Loss of Signal (LOS)     | VOH    | 2.0  | -       | V <sub>cc</sub> | V    | 1    |
|                                                                         | VOL    | 0    |         | 0.8             | V    | 1    |
| Low speed input: Transmitter Disable (TX_DISABLE), MOD_DEF 1, MOD_DEF 2 | VIH    | 2.0  |         | V <sub>cc</sub> | V    | 2    |
|                                                                         | VIL    | -    | -       | 0.8             | V    | 2    |
| Clock Rate-I2C                                                          | f      | -    | -       | 400             | kHz  | 3    |
| Module Turn-on time                                                     | -      | -    | -       | 2000            | ms   | 4    |

### Notes:

1. For all control input pins: LPMode, Reset and ModSelL.
2. For all status output pins: ModPrsL, IntL.
3. For management interface.
4. Time from module power-on / insertion/ ResetL deassert to module full functional.

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## Transmitter Optical Characteristics

| Parameter                              | Symbol | Min. | Typical | Max. | Unit |
|----------------------------------------|--------|------|---------|------|------|
| Reference Differential Input Impedance | Zd     | -    | 100     | -    | Ω    |
| Optical Return Loss Tolerance          | -      | -    | 12      | -    | dB   |
| Differential Data Input Swing          | Vin_pp | 180  | -       | 700  | mV   |
| Differential Data Input Threshold      | -      | -    | 50      | -    | mV   |

Notes:

1. AC coupled inside AOC module.
2. Input swing to trigger TX-squelch.

## Receiver Optical Characteristics

| Parameter                                        | Symbol | Min. | Typical | Max. | Unit | Notes |
|--------------------------------------------------|--------|------|---------|------|------|-------|
| Reference Differential Input Impedance           | Zd     | -    | 100     | -    | Ω    | 1     |
| Pre-emphasis Pulse Amplitude Percentage          | -      | 0    | -       | -    | %    | 2     |
|                                                  | -      | 10   | -       | -    | %    |       |
|                                                  | -      | 20   | -       | -    | %    |       |
|                                                  | -      | 40   | -       | -    | %    |       |
| Pre-emphasis Pulse Duration                      | -      | -    | 30      | -    | ps   |       |
| Signal Speed                                     | -      | -    | 10.3    | -    | Gb/s | -     |
| Differential Data Input Swing                    | -      | 150  | -       | 850  | mV   | -     |
| Differential Data Output Swing<br>When Squelched | -      | -    | -       | 50   | mV   | -     |
| Rise / Fall Time (20% ~80%)                      | -      | 24   |         |      | Ps   | -     |

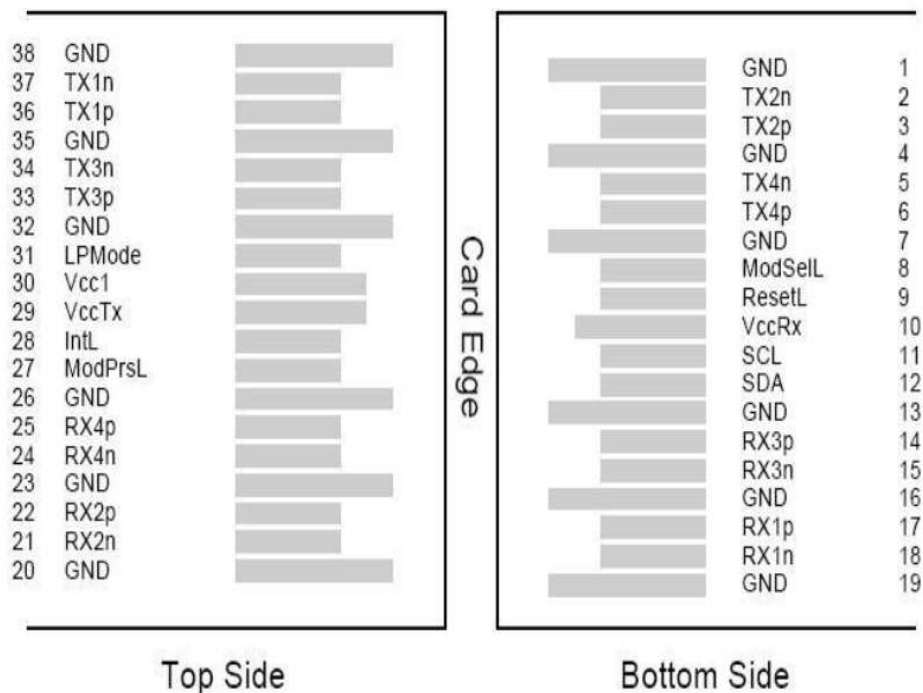
Notes:

1. AC coupled inside AOC module.
2. User selectable. Percentage is the ratio of pre-emphasis amplitude to output swing. Users could change by writing to page 3 address 237, default value is "10"

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## Pin Assignment

Host PCB QSFP+ pad assignment top view



## Pin Description for QSFP+

| Pin | Logic       | Symbol  | Name/Description                     | Ref. |
|-----|-------------|---------|--------------------------------------|------|
| 1   |             | GND     | Ground                               | 1    |
| 2   | CML-I       | Tx2n    | Transmitter Inverted Data Input      |      |
| 3   | CML-I       | Tx2p    | Transmitter Non-Inverted Data output |      |
| 4   |             | GND     | Ground                               | 1    |
| 5   | CML-I       | Tx4n    | Transmitter Inverted Data Output     |      |
| 6   | CML-I       | Tx4p    | Transmitter Non-Inverted Data Output |      |
| 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         |      |

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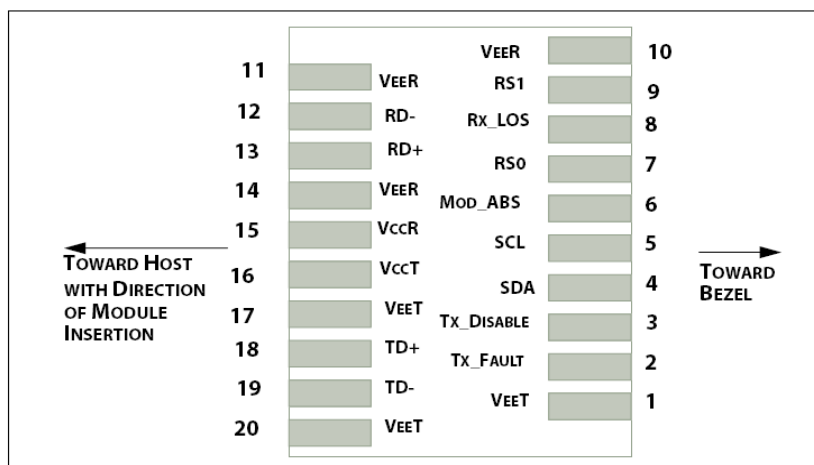
|    |         |         |                                      |   |
|----|---------|---------|--------------------------------------|---|
| 13 |         | GND     | Ground                               | 1 |
| 14 | CML-O   | Rx3p    | Receiver Inverted Data Output        |   |
| 15 | CML-O   | Rx3n    | Receiver Non-Inverted Data Output    |   |
| 16 |         | GND     | Ground                               | 1 |
| 17 | CML-O   | Rx1p    | Receiver Inverted Data Output        |   |
| 18 | CML-O   | Rx1n    | Receiver Non-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 |         | Vcc1    | +3.3V Power Supply                   | 2 |
| 31 | LVTTL-I | LPMODE  | Low Power Mode                       |   |
| 32 |         | GND     | Ground                               | 1 |
| 33 | CML-I   | Tx3p    | Transmitter Inverted Data Output     |   |
| 34 | CML-I   | Tx3n    | Transmitter Non-Inverted Data Output |   |
| 35 |         | GND     | Ground                               | 1 |
| 36 | CML-I   | Tx1p    | Transmitter Inverted Data Output     |   |
| 37 | CML-I   | Tx1n    | Transmitter Non-Inverted Data Output |   |
| 38 |         | GND     | Ground                               | 1 |

Notes:

1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

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## Host PCB SFP+ pad assignment top view



## Pin Description for SFP+

| PIN # | Name       | Function                                                                                                                    | Notes |
|-------|------------|-----------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | VeeT       | Module transmitter ground                                                                                                   | 1     |
| 2     | Tx Fault   | Module transmitter fault                                                                                                    | 2     |
| 3     | Tx Disable | Transmitter Disable; Turns off transmitter laser output                                                                     | 3     |
| 4     | SDL        | 2 wire serial interface data input/output (SDA)                                                                             |       |
| 5     | SCL        | 2 wire serial interface clock input (SCL)                                                                                   |       |
| 6     | MOD-ABS    | Module Absent, connect to VeeR or VeeT in the module                                                                        | 2     |
| 7     | RS0        | Rate select0, optionally control SFP+ receiver. When high, input data rate >4.5Gb/ s; when low, input data rate <=4.5Gb/s   |       |
| 8     | LOS        | Receiver Loss of Signal Indication                                                                                          | 4     |
| 9     | RS1        | Rate select0, optionally control SFP+ transmitter. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s |       |
| 10    | VeeR       | Module receiver ground                                                                                                      | 1     |
| 11    | VeeR       | Module receiver ground                                                                                                      | 1     |
| 12    | RD-        | Receiver inverted data out put                                                                                              |       |
| 13    | RD+        | Receiver non-inverted data out put                                                                                          |       |
| 14    | VeeR       | Module receiver ground                                                                                                      | 1     |
| 15    | VccR       | Module receiver 3.3V supply                                                                                                 |       |
| 16    | VccT       | Module transmitter 3.3V supply                                                                                              |       |

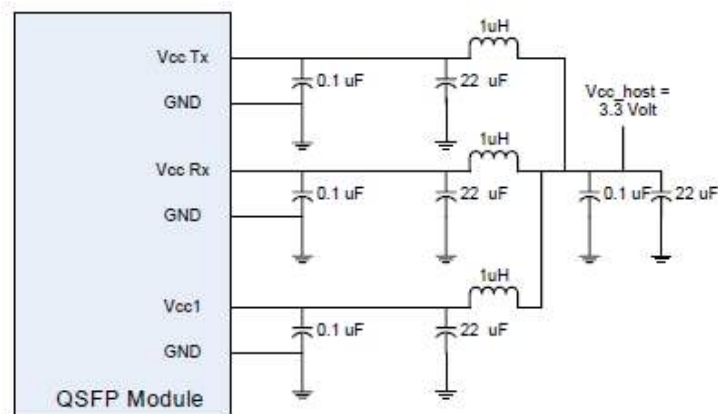
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|    |      |                                       |   |
|----|------|---------------------------------------|---|
| 17 | VeeT | Module transmitter ground             | 1 |
| 18 | TD+  | Transmitter inverted data out put     |   |
| 19 | TD-  | Transmitter non-inverted data out put |   |
| 20 | VeeT | Module transmitter ground             | 1 |

## Notes:

1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.
3. This input is internally biased high with a 4.7KΩ to 10KΩ pull-up resistor to VccT.
4. Two-Wire Serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
5. This is a ground return that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

## Recommended Application Interface Circuit



Recommended Host Board Power Supply Filter Network

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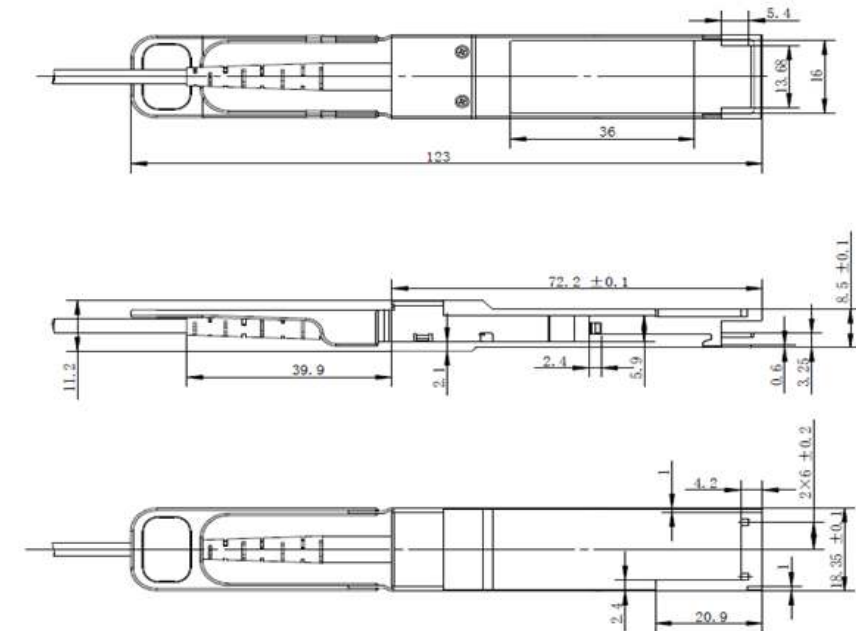
## Mechanical specifications

| Parameter                               | Symbol | Min.           | Typical | Max.       | Unit   | Notes |
|-----------------------------------------|--------|----------------|---------|------------|--------|-------|
| AOC cable length (L ≤ 15m)              | L      | L-0.06         | L       | L+0.06     | M      | -     |
| AOC cable length (L > 15m)              | L      | L-<br>(L*1.1%) | L       | L+(L*1.1%) | M      | -     |
| Module Retention                        | -      | 90             | -       | 170        | N      | -     |
| Module Insertion                        | -      | 0              | -       | 18         | N      | -     |
| Module Extraction                       | -      | 0              | -       | 25         | N      | -     |
| Cable Pull Strength – Apply Load at 0°  | -      | 44             | -       | -          | N      | -     |
| Cable Pull Strength – Apply Load at 90° | -      | 33             | -       | -          | N      | -     |
| Clearance Out of IO Bezel               | -      | 75             | -       | -          | nm     | -     |
| Cable Bending Radius                    | -      | 30             | -       | -          | nm     | -     |
| Insertion / Removal Cycles              | -      | 50             | -       | -          | cycles | -     |



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## Outline Drawing for QSFP



## Outline Drawing for SFP+

