

EAQP4X-4SPx

40G QSFP+ to 4X 10G SFP+ Active Optical Cables

PRODUCT FEATURES

- Compliant to the 40GBASE-SR4 and XLPP1
- Specification per IEEE 802.3ba-2010 and supporting
- 40G-IB-QDR / 20G-IB-DDR / 10G-IB-SDR applications
- Compliant to the industry standard SFF-8436
- QSFP+ Specification
- Power Level 1: Max Power < 1.5 W
- Operate at 10.3125Gbps per channel with 64b/66b
- encoded data for 40GbE application and at 10Gbps
- with 8b/10b compatible encoded data for 40G-IB-QDR application



APPLICATIONS

- 40GbE and 10GbE break-out applications for Datacom switch and router connections
- 40G to 4×10G density applications for Datacom and Proprietary protocol applications
- Datacenter
- Utilizes optical fiber for high density and thin, lightweight cable m

DESCRIPTIONS

The ETU-LINK Technologies EAQP4X-4SPx is a Four-Channel, Pluggable, Parallel, and Fiber-Optic QSFP+ Active Optical Cable (AOC) to 4× SFP+ Active Optical Cable break-out solution. This Breakout cable is intended for 40G to 4× 10G applications.

This AOC is a high performance cable for short-range multi-lane data communication and interconnect applications. It integrates four data lanes in each direction with 40Gbps aggregate bandwidth. Each lane can operate at 10.3125Gbps. These cables also support 4 x 10G InfiniBand QDR applications and are backwards compatible to the 4 x 5G IB DDR and 4 x 2.5G IB single IB SDR applications.

This product is leveraged from ETU-LINK Technologies QSFP+ to QSFP+ Active Optical Cable product and SFP+ Active Optical Cable product. Where applicable, consult these respective datasheets

This AOC incorporates ETU-LINK Technologies proven integrated circuit and VCSEL technology to provide reliable long life, high performance, and consistent service.

Active Optical Cable Assembly

- 0 to 70 C degree case temperature operating range
- Proven High Reliability 850 nm technology: VCSEL transmitter and PIN receiver
- Hot pluggable for ease of servicing and installation
- Two Wire Serial interface

Each 4x SFP+ end

- Compliant to the electrical specifications per SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module
- Mechanical specifications per SFF Committee SFF-8432 Improved Pluggable Form factor "IPF"
- Maximum power dissipation 0.35W per end.

Ordering Information

| Part No. | Description |
|---------------|---|
| EAQP4X-4SPxxx | 40G QSFP+ to 4X 10G SFP+ Active Optical Cables (AOC) OM3 0~100M |

Notes:

1. where "x" denotes cable length in meters. Examples are as follows:
2. x = 1 for 1m, xx=10 for 10m, xx=100 for 100m

Absolute Maximum Ratings

The operation in excess of any absolute maximum ratings might cause permanent damage to this module.

| Parameter | Symbol | Min | Max | Unit | Note |
|-----------------------------------|--------|-----|-----|------|------|
| Storage Temperature | TST | -40 | 85 | °C | |
| Relative Humidity(non-condensing) | RH | 0 | 85 | % | |

| | | | | | |
|----------------------------|------|------|---------|------|--|
| Operating Case Temperature | TOPC | 0 | 70 | degC | |
| Supply Voltage | VCC | -0.3 | 3.6 | V | |
| Input Voltage | Vin | -0.3 | Vcc+0.3 | V | |

Recommended Operating Conditions

| Parameter | Symbol | Min | Typical | Max | Unit |
|--|-------------|------|---------|---------|------|
| Operating Case Temperature | TOPC | 0 | | 70 | degC |
| Power Supply Voltage | VCC | 3.13 | 3.3 | 3.47 | V |
| Data Rate | DR | | 10.3 | 11.3 | Gbps |
| Data Speed Tolerance | Δ DR | -100 | | +100 | ppm |
| Link Distance with OM3 fiber | D | 0 | | 100 | m |
| Control* Input Voltage High | Vih | 2 | | VCC+0.3 | V |
| Control* Input Voltage Low | Vil | -0.3 | | 0.8 | V |
| I2C Serial Interface frequency | fs | | | 400k | Hz |
| Power Supply Noise | | | | 50 | mVpp |
| Receiver Differential Data Output Load | | | | 100 | mVpp |

Active Cable-End Electrical Characteristics

The following characteristics are defined over the Recommended Operating Conditions unless otherwise noted. Typical values are for Tc = 40 °C, Vcc = 3.3 V

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|--------|-----|---------|------|------|
| QSFP+40G Active Cable-End Power Consumption | | | | 1.5 | W |
| QSFP+ 40G Active Cable-End Power Supply Current | | | | 300 | mA |
| SFP+ 10G Active Cable-End Power Consumption | | | | 0.35 | W |
| SFP+ 10G Active Cable-End Power Supply Current | | | | 100 | mA |

QSFP+ AOC-end Electrical Specifications

| Parameter | Symbol | Min | Typical | Max | Unit |
|---------------------------------------|---------------|-----|---------|------|-------|
| Differential input impedance | Zin | 90 | 100 | 110 | ohm |
| Differential Output impedance | Zout | 90 | 100 | 110 | ohm |
| Differential input voltage amplitude | Δ Vin | 300 | | 1100 | mVp-p |
| Differential output voltage amplitude | Δ Vout | 400 | | 800 | mVp-p |
| Bit Error Rate | BR | | | E-12 | |
| Input Logic Level High | VIH | 2.0 | | VCC | V |
| Input Logic Level Low | VIL | 0 | | 0.8 | V |

| | | | | | |
|-------------------------|-----|---------|--|-----|---|
| Output Logic Level High | VOH | VCC-0.5 | | VCC | V |
| Output Logic Level Low | VOL | 0 | | 0.4 | V |

SFP+ AOC-end Electrical Specifications

| Parameter | Symbol | Min | Typical | Max | Unit |
|--|------------------|-----|---------|------|-------|
| Differential input impedance | Zin | 90 | 100 | 110 | ohm |
| Differential Output impedance | Zout | 90 | 100 | 110 | ohm |
| Differential input voltage amplitude a Amplitude | ΔV_{in} | 100 | | 1800 | mVp-p |
| Differential output voltage amplitude | ΔV_{out} | 400 | | 800 | mVp-p |
| Bit Error Rate | BR | | | | E-12 |
| Input Logic Level High | VIH | 2.0 | | VCC | V |
| Input Logic Level Low | VIL | 0 | | 0.8 | V |

Optical and Characteristics

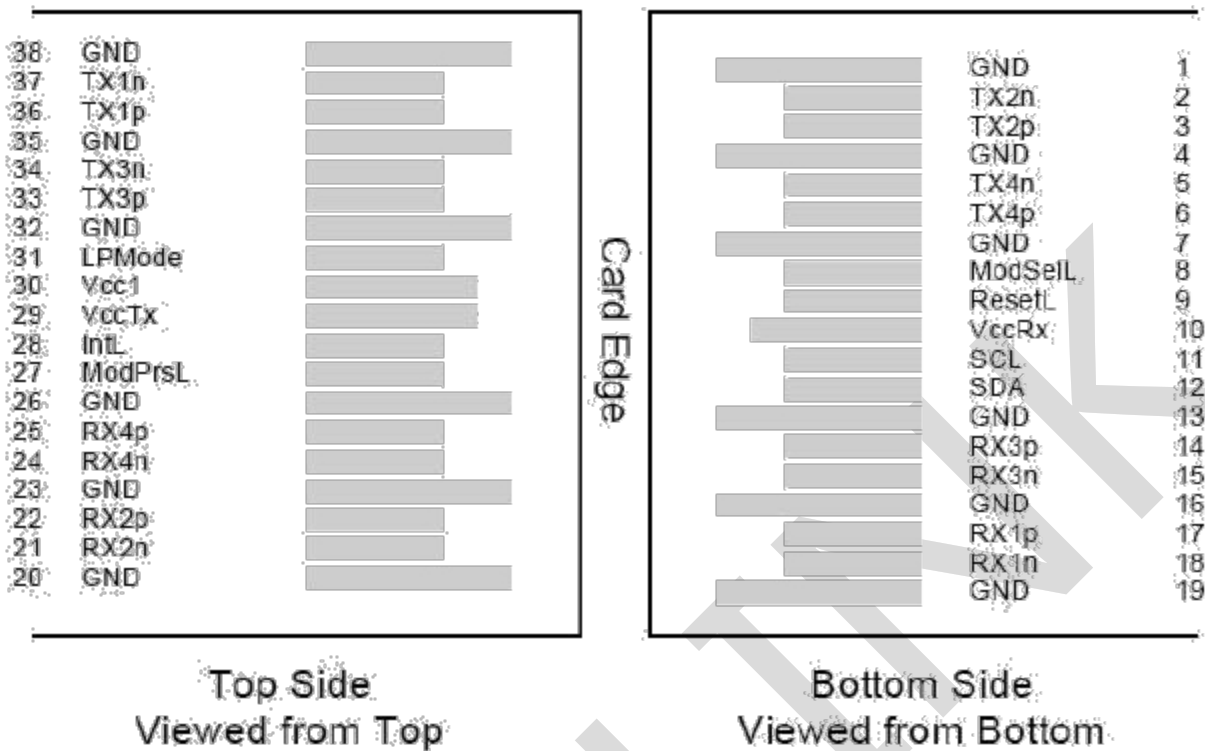
All parameters are specified under the recommended operating conditions with PRBS31 data pattern unless otherwise specified.

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|-----------------------------------|------------------------------|------|-----|------|-------|------|
| Transmitter | | | | | | |
| Output Opt. Pwr | POUT | -6 | | -1 | dBm | 1 |
| Optical Wavelength | λ | 840 | 850 | 860 | nm | |
| Optical Extinction Ratio | ER | 3.0 | | | dB | |
| RIN | RIN | | | -128 | dB/Hz | |
| Output Eye Mask | Compliant with IEEE 0802.3ae | | | | | |
| Receiver | | | | | | |
| Input Saturation Power (Overload) | Psat | -3 | | | dBm | |
| Wavelength Range | λ_c | 770 | 850 | 860 | nm | |
| Bit Error Rate | BER | E-12 | | | | |
| Receiver Overload | PinMAX | 2.5 | | | dBm | |
| Output Differential Impedance | Zout | 90 | 100 | 110 | ohm | |

Notes:

1. The optical power is launched into SMF.
2. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

QSFP+ AOC-end Pin Diagram



QSFP+ AOC-end Pin Descriptions

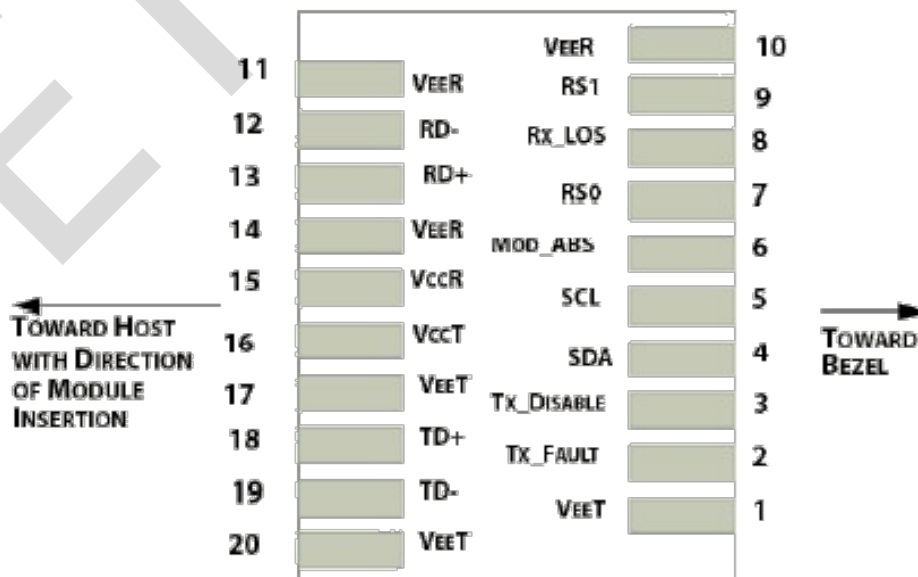
| PIN | Logic | Symbol | Name/Description | Note |
|-----|-------------|---------|--------------------------------------|------|
| 1 | | GND | Ground | 1 |
| 2 | CML-I | Tx2n | Transmitter Inverted Data Input | |
| 3 | CML-I | Tx2p | Transmitter Non-Inverted Data output | |
| 4 | | GND | Ground | 1 |
| 5 | CML-I | Tx4n | Transmitter Inverted Data Input | |
| 6 | CML-I | Tx4p | Transmitter Non-Inverted Data output | |
| 7 | | GND | Ground | 1 |
| 8 | LVTLL-I | ModSelL | Module Select | |
| 9 | LVTLL-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 | |
| 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 | 1 |
| 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 | +3.3 V Power Supply transmitter | 2 |
| 30 | | Vcc1 | +3.3 V Power Supply | 2 |
| 31 | LVTTL-I | LPMode | Low Power Mode | |
| 32 | | GND | Ground | 1 |
| 33 | CML-I | Tx3p | Transmitter Non-Inverted Data Input | |
| 34 | CML-I | Tx3n | Transmitter Inverted Data Output | |
| 35 | | GND | Ground | 1 |
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input | |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Output | |
| 38 | | GND | Ground | 1 |

Notes:

- 1) Module circuit ground is isolated from module chassis ground within the module. GND is the symbol for signal and supply (power) common for QSFP modules.
- 2) The connector pins are each rated for a maximum current of 500mA.

SFP+ AOC-end Pin Diagram



SFP+ AOC-end Pin Descriptions

| PIN | Symbol | Name/Description | Note |
|-----|------------|---|--------|
| 1 | VeeT | Transmitter Signal Ground | Note 1 |
| 2 | TX_FAULT | Transmitter Fault (LVTTTL-O) – Not used. Grounded inside the module | Note 2 |
| 3 | TX_DISABLE | Transmitter Disable (LVTTTL-I) – High or open disables the transmitter | Note 3 |
| 4 | SDA | Two Wire Serial Interface Data Line (LVCMOS – I/O) (same as MOD-DEF2 in INF-8074) | Note 4 |
| 5 | SCL | Two Wire Serial Interface Clock Line (LVCMOS – I/O) (same as MOD-DEF1 in INF-8074) | Note 4 |
| 6 | MOD_ABS | Module Absent (Output), connected to VeeT or VeeR in the module | Note 5 |
| 7 | RS0 | Rate Select 0 - Not used, Presents high input impedance. | |
| 8 | RX_LOS | Receiver Loss of Signal (LVTTTL-O) | Note 2 |
| 9 | RS1 | Rate Select 1 - Not used, Presents high input impedance. | |
| 10 | VeeR | Receiver Signal Ground | Note 1 |
| 11 | VeeR | Receiver Signal Ground | Note 1 |
| 12 | RD- | Receiver Data Out Inverted (CML-O) | |
| 13 | RD+ | Receiver Data Out (CML-O) | |
| 14 | VeeR | Receiver Signal Ground | |
| 15 | VccR | Receiver Power + 3.3 V | |
| 16 | VccT | Transmitter Power + 3.3 V | |
| 17 | VeeT | Transmitter Signal Ground | Note 1 |
| 18 | TD+ | Transmitter Data In (CML-I) | |
| 19 | TD- | Transmitter Data In Inverted (CML-I) | |
| 20 | VeeT | Transmitter Signal Ground | Note 1 |

Notes:

- 1) Module circuit ground is isolated from module chassis ground within the module. GND is the symbol for signal and supply (power) common for SFP modules.
- 2) This is an open collector/drain output that on the host board requires a 4.7 kΩ to 10 kΩ pullup resistor to VccHost. See Figure 2.
- 3) This input is internally biased high with a 4.7 kΩ to 10 kΩ pullup resistor to VccT.
- 4) Two-Wire Serial interface clock and data lines require an external pullup resistor dependent on the capacitance load.
- 5) This is a ground return that on the host board requires a 4.7 kΩ to 10 kΩ pullup resistor to VccHost.

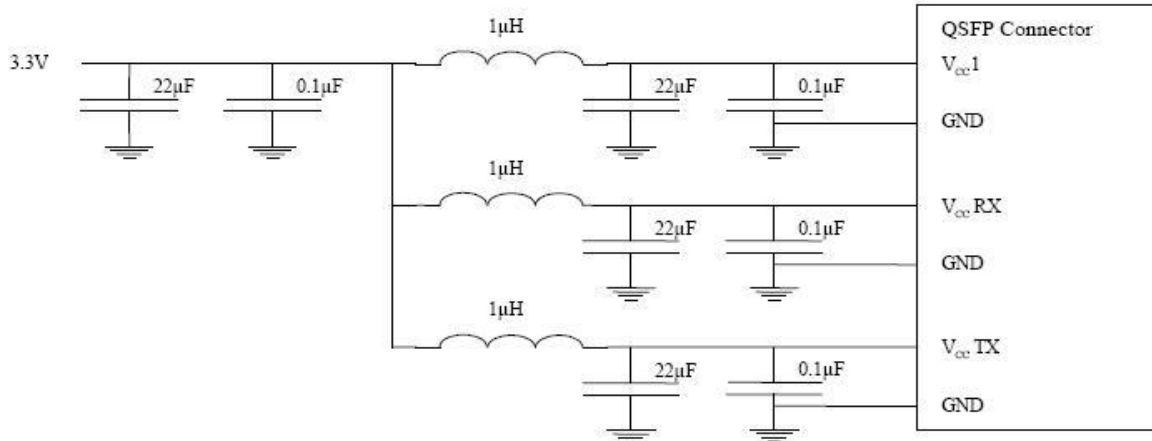
Optical Fiber Specifications

| Parameter | Specification |
|-----------------------|---------------|
| Tight buffer color | Orange |
| Tight buffer material | PVC |

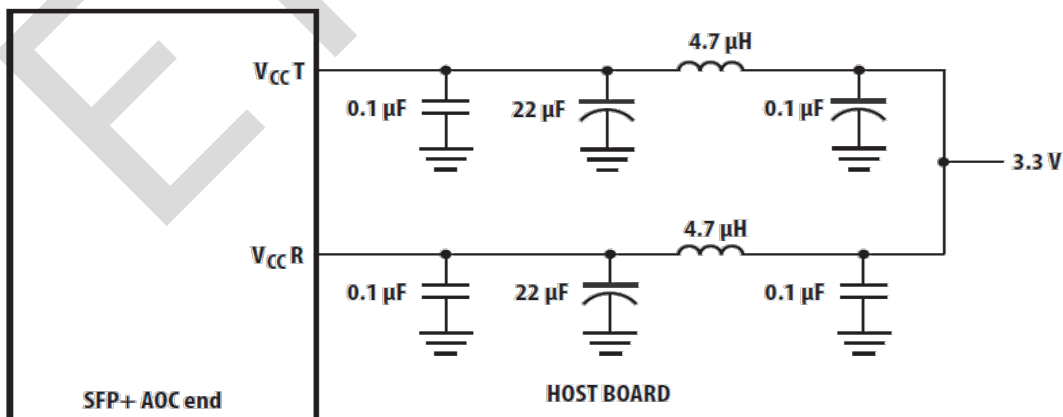
| | |
|--------------------------|--|
| Fiber type | 62.5/125 (OFS) Bandwith:160 MHz.km @ 850 nm |
| Jacket material | PVC |
| Cable diameter mm | 3.0 ± 0.1 |
| Cable weight Kg/km | 7.0 |
| Min. bending radius mm | 30 |
| Attenuation dB/km | ≤ 3.5 at 850 nm ≤ 1.5 at 1300 nm |
| Short tension N | 120 |
| Operation temperature °C | -20~70 |

Power Supply Filtering

QSFP+ AOC

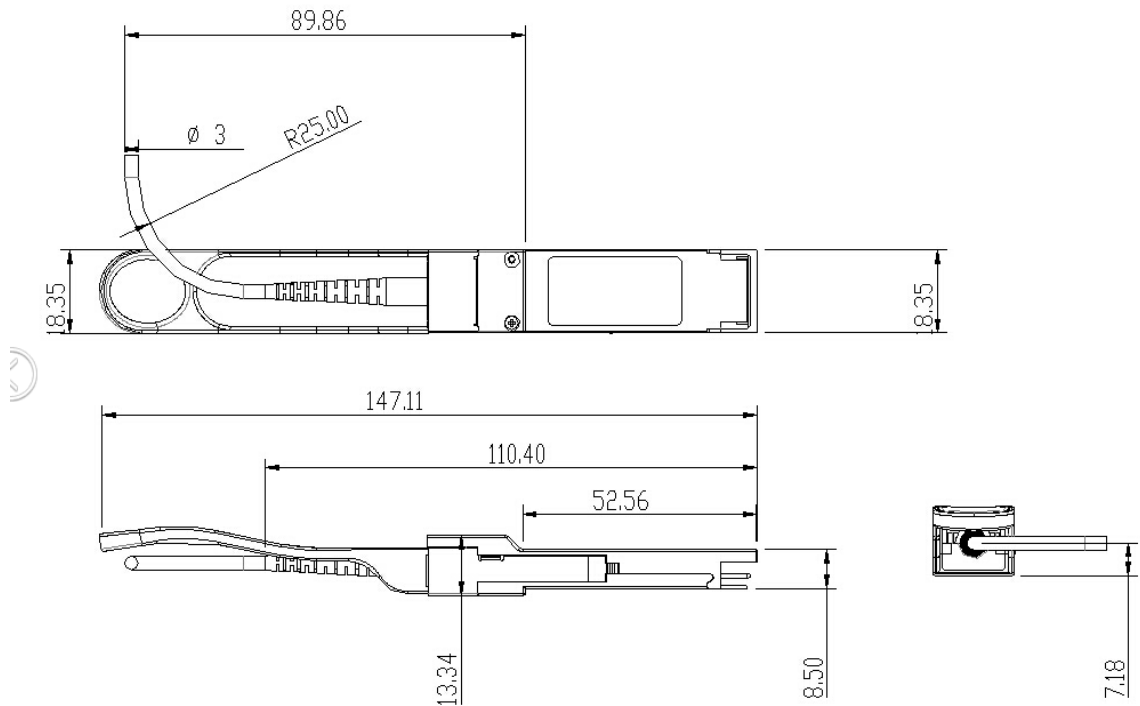


SFP+ AOC

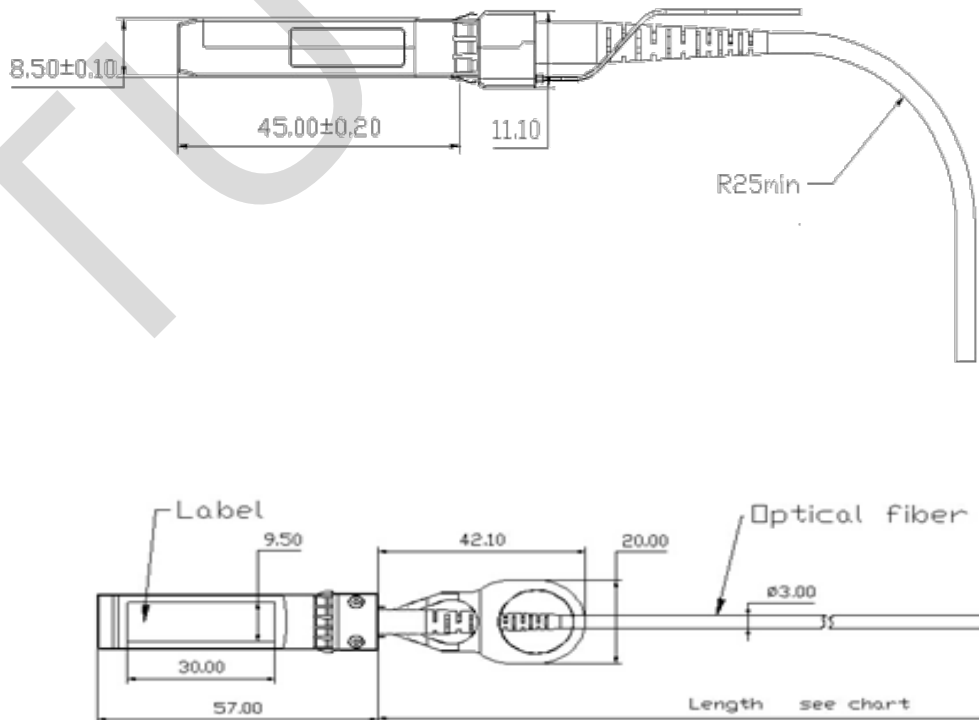


NOTE: INDUCTORS MUST HAVE LESS THAN 1Ω SERIES RESISTANCE TO LIMIT VOLTAGE DROP TO THE SFP MODULE.

QSFP+ AOC end Mechanical Specifications



SFP+ AOC end Mechanical Specifications



Revision History

| Version No. | Date | Description |
|-------------|------------------|-----------------------|
| 1.0 | February 8, 2018 | Preliminary datasheet |
| 2.0 | October 11,2021 | Product upgrades |
| 2.1 | Aug 12,2024 | Product upgrades |

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