EAQP4X-4SPxxx

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

PRODUCT FEATURES



- **Compliant to the 40GBASE-SR4 and XLPPI**
- **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-4SPxxx 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 × 5G IB DDR and 4 × 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 4× 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-OM3	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	℃	
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	ΔDR	-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+40GActive 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	ΔVin	300		1100	mVp-p
Differential output voltage amplitude	ΔVout	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	ΔVin	100		1800	mVp-p
Differential output voltage amplitude	ΔVout	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

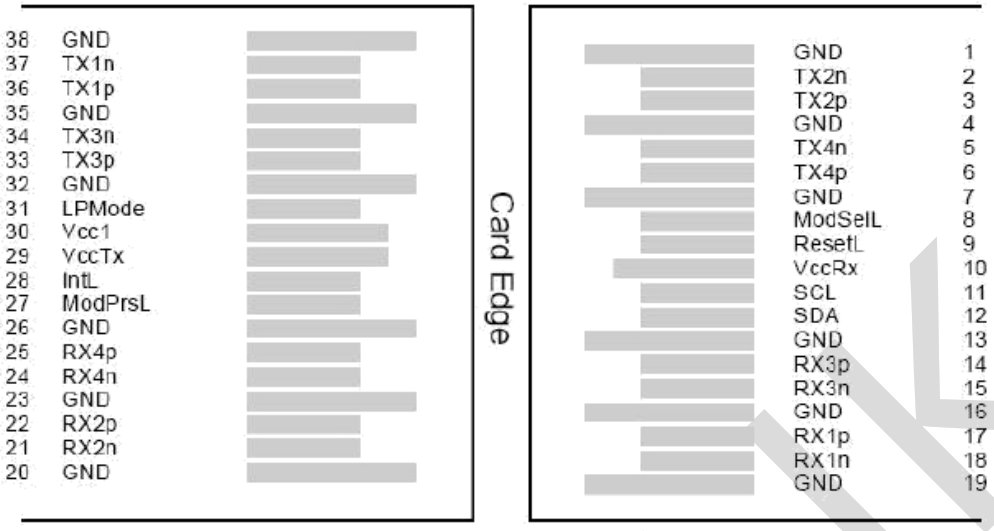
All parameters are specified under the recommended operating conditions with PRBS31 data pattern unless otherwise specified.

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	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-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	

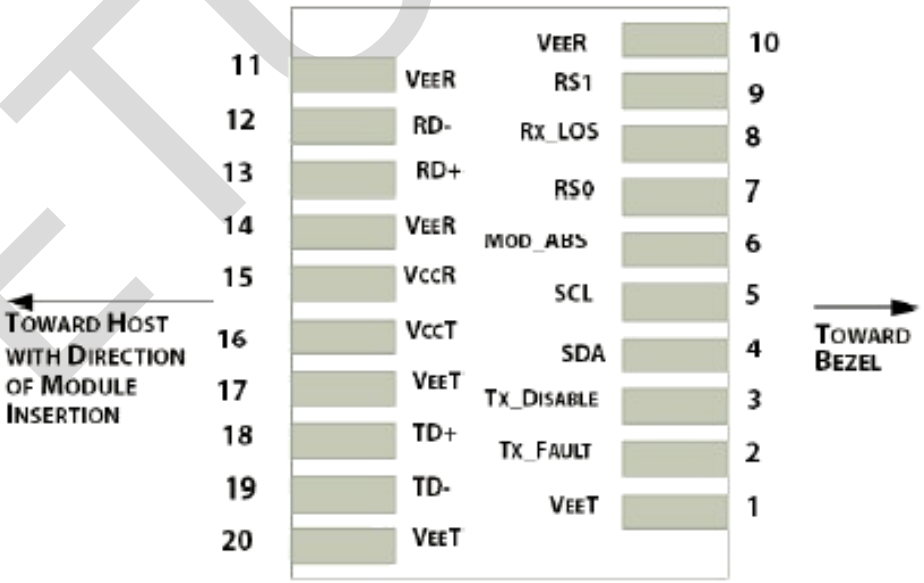
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power 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 (LVTTL-O) – Not used. Grounded inside the module	Note 2
3	TX_DISABLE	Transmitter Disable (LVTTL-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 (LVTTL-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.

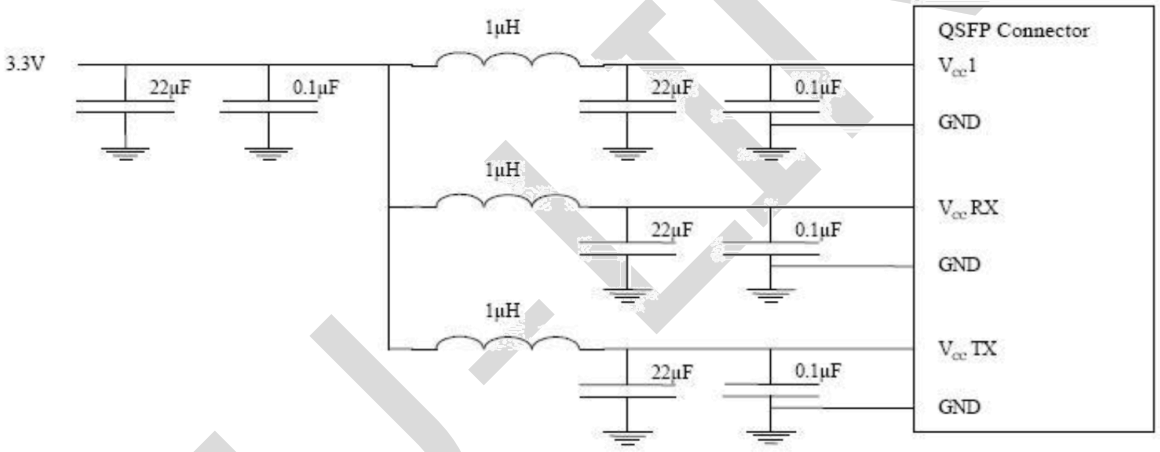
Optical Fiber Specifications

Parameter	Specification
Tight buffer color	Orange
Tight buffer material	PVC

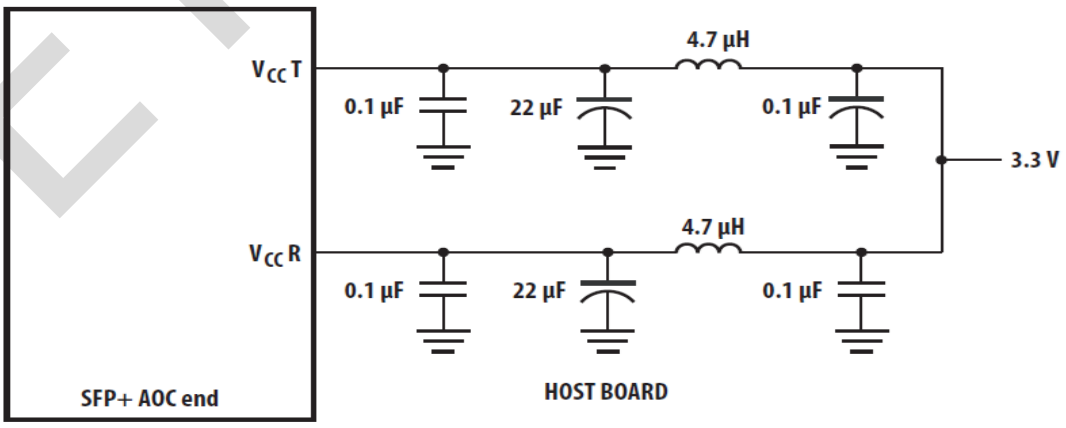
Fiber type	62.5/125 (OFS) Bandwith:160 MHz.km @ 850 nm
Jacket material	PVC
Cable diameter mm	3.0 ± 0.1
Cable weight Kg/km	7.0
Min. bending radius mm	30
Attenuation dB/km	≤ 3.5 at 850 nm ≤ 1.5 at 1300 nm
Short tension N	120
Operation temperature °C	-20~70

Power Supply Filtering

QSFP+ AOC

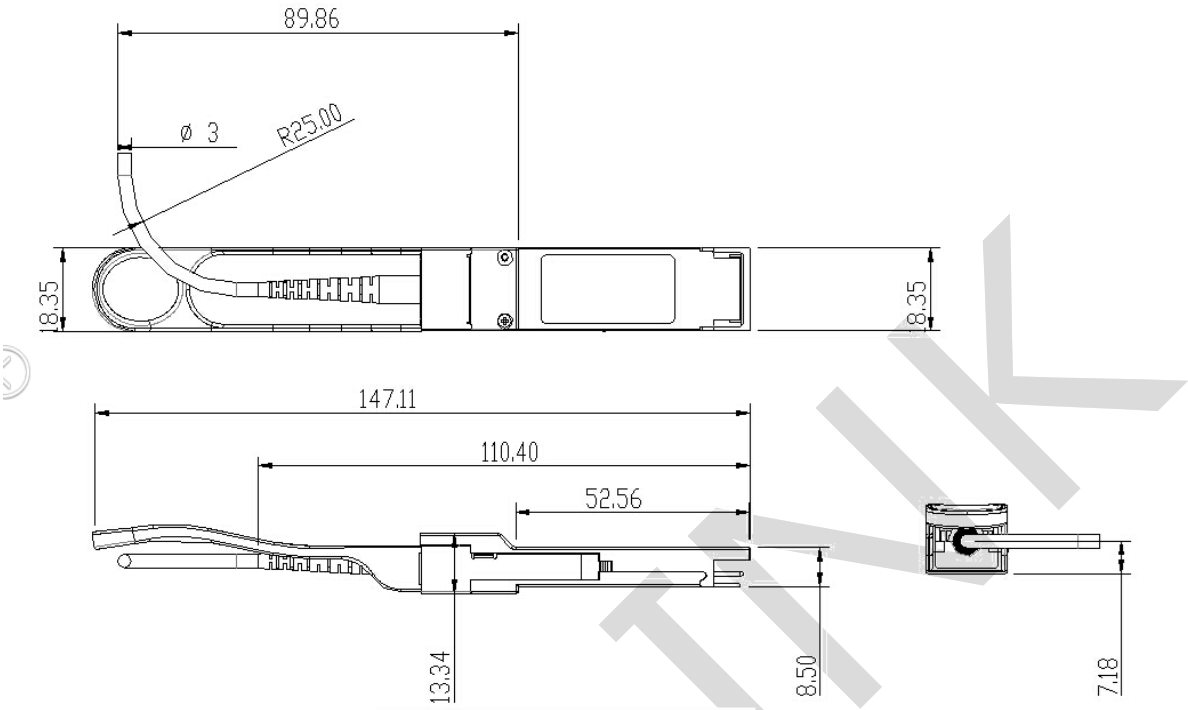


SFP+ AOC

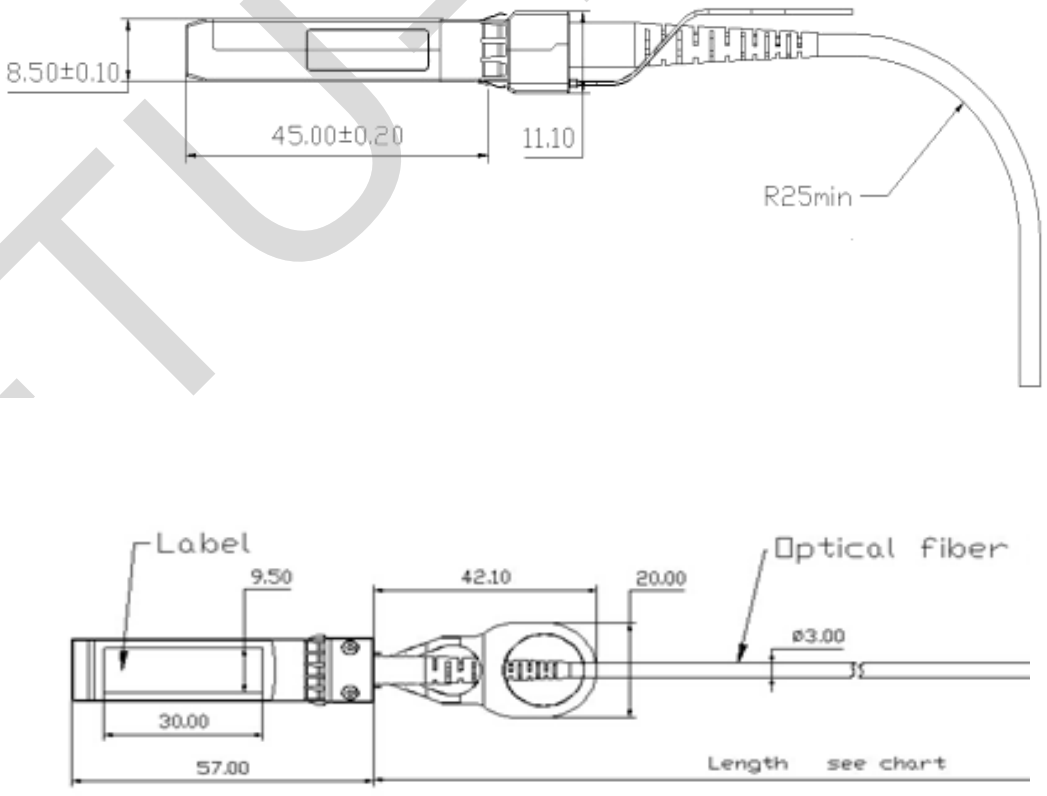


NOTE: INDUCTORS MUST HAVE LESS THAN 1Ω SERIES RESISTANCE TO LIMIT VOLTAGE DROP TO THE SFP MODULE.

QSFP+ AOC end Mechanical Specifications



SFP+ AOC end Mechanical Specifications



ETU-LINK

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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