PROLABS – AOC-Q-Q-40G-XM-C

40GBd QSFP+ Active Optical Cable Transceiver

AOC-Q-Q-40G-XM-C Overview

PROLABS's AOC-Q-Q-40G-XM-C QSFP+ active optical cable transceivers are 4-channel active optical cable for QSFP+ applications that is designed to meet the QSFP+ 10GBPS X 4 Pluggable Transceiver SFF-8436 specification. This full-duplex optical assembly offers 4 independent transmit and receive channels, each capable of 10Gbps for an aggregate bandwidth of 40Gbps.

The cables use the standard multimode fiber cable carrying a nominal wavelength of 850nm. The electrical interface is standard 38 contact edge type connector and is electrically compliant with the SFI+ and PPI interface supporting Infiniband, Ethernet, Fiber Channel. The connector is hot pluggable and provides I2C serials access via an on-board microcontroller.

QSFP+ AOC can be used as a direct replacement for traditional copper cables with the added benefit of a lighter weight and smaller diameter solution for cable lengths from 1 to 100 meters.

Product Features

- 4 high-speed full duplex channels
- QSFP+ MSA compliant
- Cable lengths from 1 to 100 meters
- Small 3mm diameter fiber cable
- Low Power consumption, less than 1W
- RoHS Compliance
- Operating temperature range: 0℃ to 70℃.

Applications

- 40G Ethernet
- Infiniband interconnects

Ordering Information

Part Number	*Description*
AOC-Q-Q-40G-XM-C	40G QSFP+ Active optical Cable (length from 1m to 100m)

General Specifications

Parameter	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Remarks*
Bit Error Rate	*BER*			10^{-15}		
Operating Temperature	T_{OP}	0		70	℃	Case temperature
Storage Temperature	T_{STO}	– 40		85	℃	Ambient temperature
Input Voltage	V_{CC}	3.14	3.3	3.47	V	
Maximum Voltage	V_{MAX}	– 0.5		3.6	V	For electrical power interface

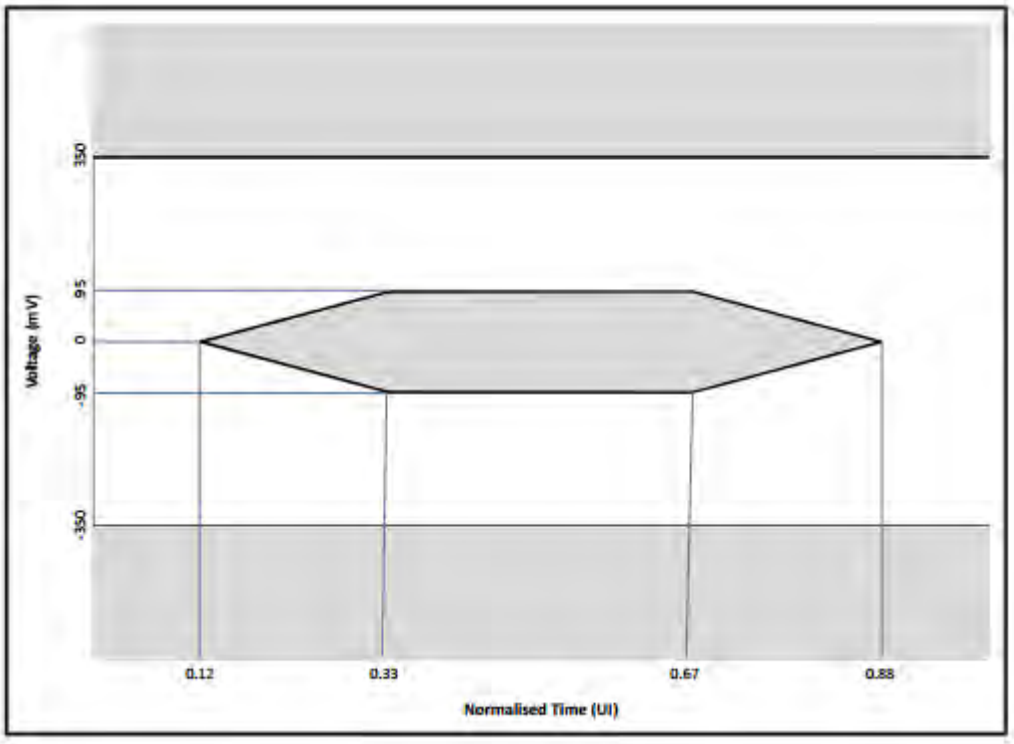
Link Distances

Parameter	*Fiber Type*	*Distance Range (m)*
40 GBd	MMF	Up to 100

AOC Electrical Input Requirements

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate Per Channel	*Dr*		0.001	10.5	GB/s	Non condensing
Differential Input Amplitude	V_{IN_PP}	150		1600	mV	
Single Ended Voltage Tolerance	*V*	-0.3		3.8	V	
AC Common Mode Voltage	*Vcm*	15			mV	
Total Jitter	T_j			0.28	UIp-p	
Data Dependent Jitter	*DDJ*			0.1	UIp-p	
Eye Mask			See note			

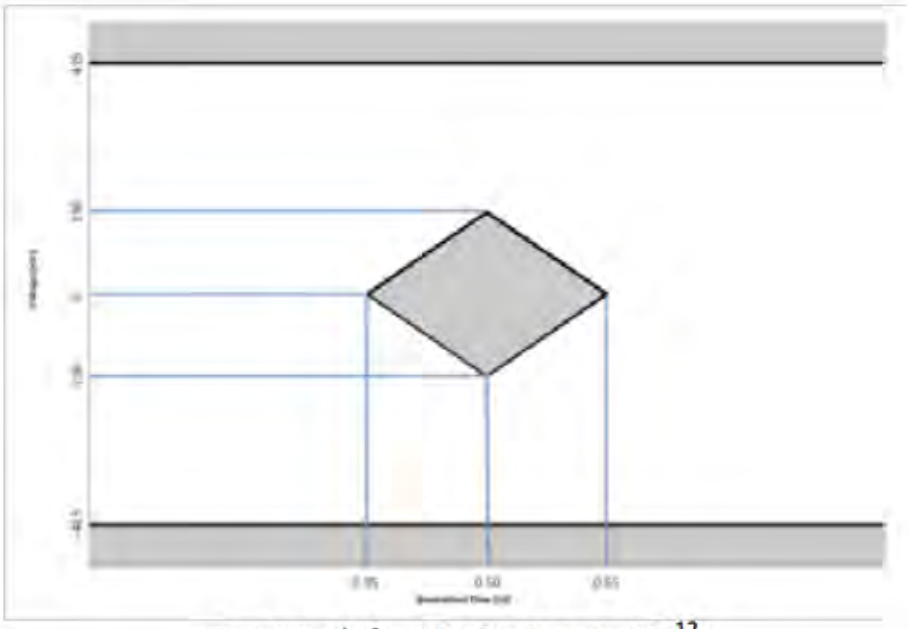
Note: The worst case electrical input is defined by the eye mask:



AOC Electrical Onput Requirments

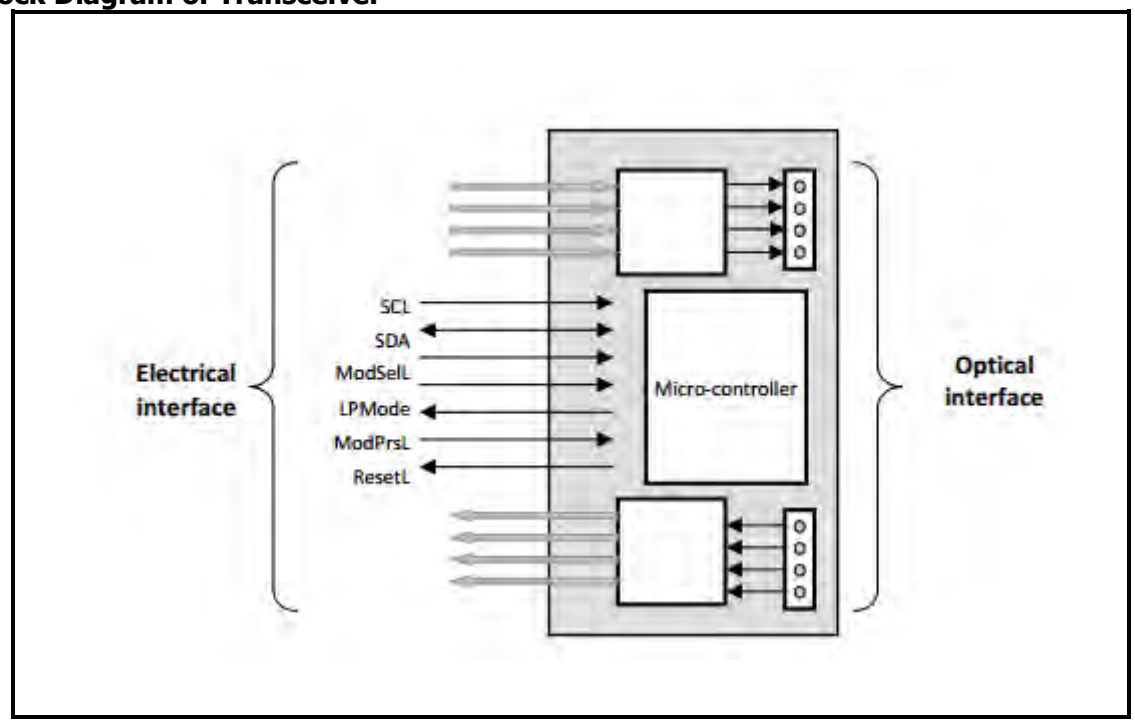
Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate Per Channel	*Dr*		0.001	10.5	GB/s	Non condensing
Differential Output Amplitude	*Vout_PP*	340		700	mV	
Differential Output Amplitude in Squelched state	*Vout_sq*			50	mV	
Single Ended Voltage Tolerance	*V*	-0.3		3.8	V	
Output AC Common Mode Voltage	*Vcm*			7.5	mV	RMS
Output Transition Time	*Tr, Tf*	28			ps	
Total Jitter	*Tj*			0.7	UIp-p	
Deterministic Jitter	*DJ*			0.4	UIp-p	
Eye Mask			See note			

Note:



Eye Mask for Hit Ratio = $1x10^{-12}$

Block Diagram of Transceiver



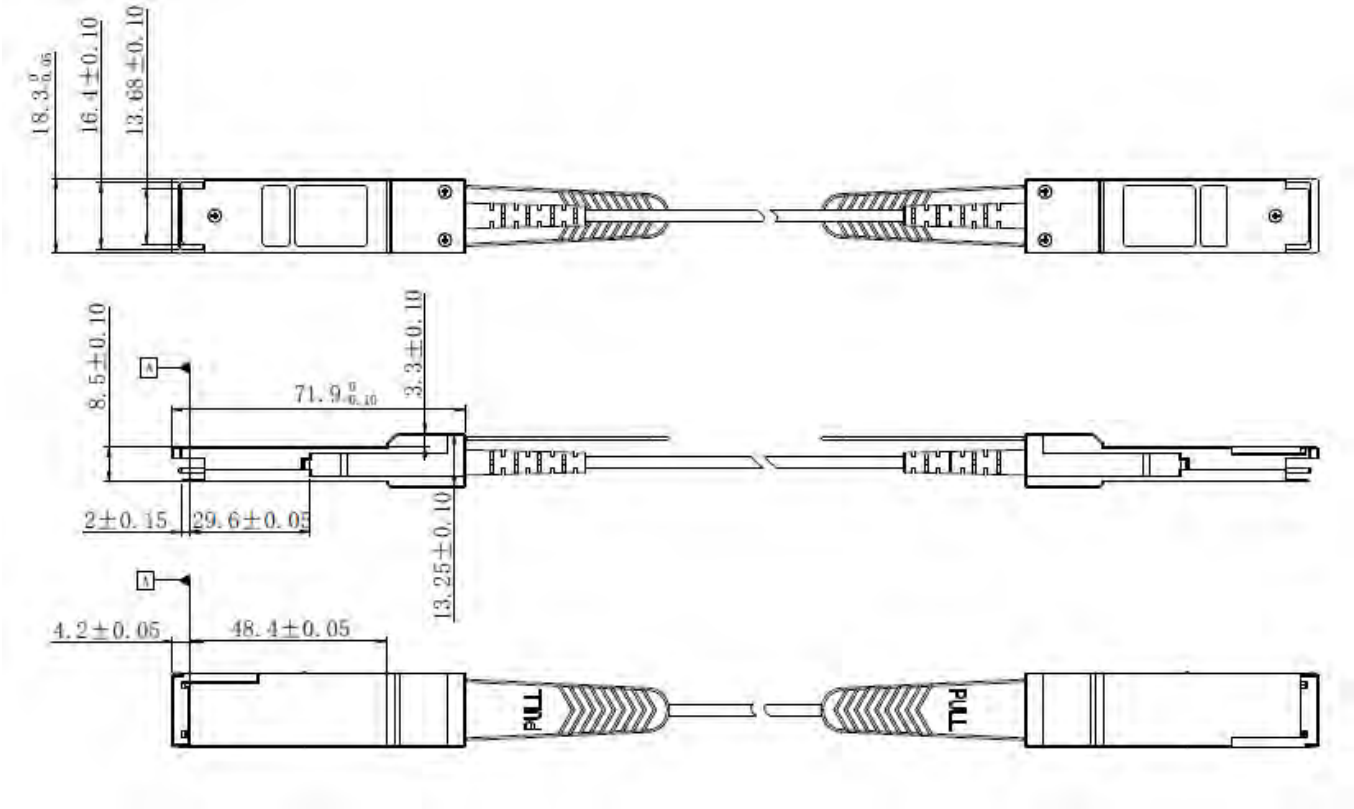
The QSFP AOC has miniature optical engine embedded into each end of the cable assembly. The engines interconnect 4 independent transmit/receive lanes.

A functional block diagram of the engine is shown in the above Figure. The transmitter sections consists of a 4-channel VCSEL array, a 4-channel input buffer and laser driver.

An on board micro-controller provides control, diagnostic and monitoring for the cable functions, as well as the external I2C serial communication interface.

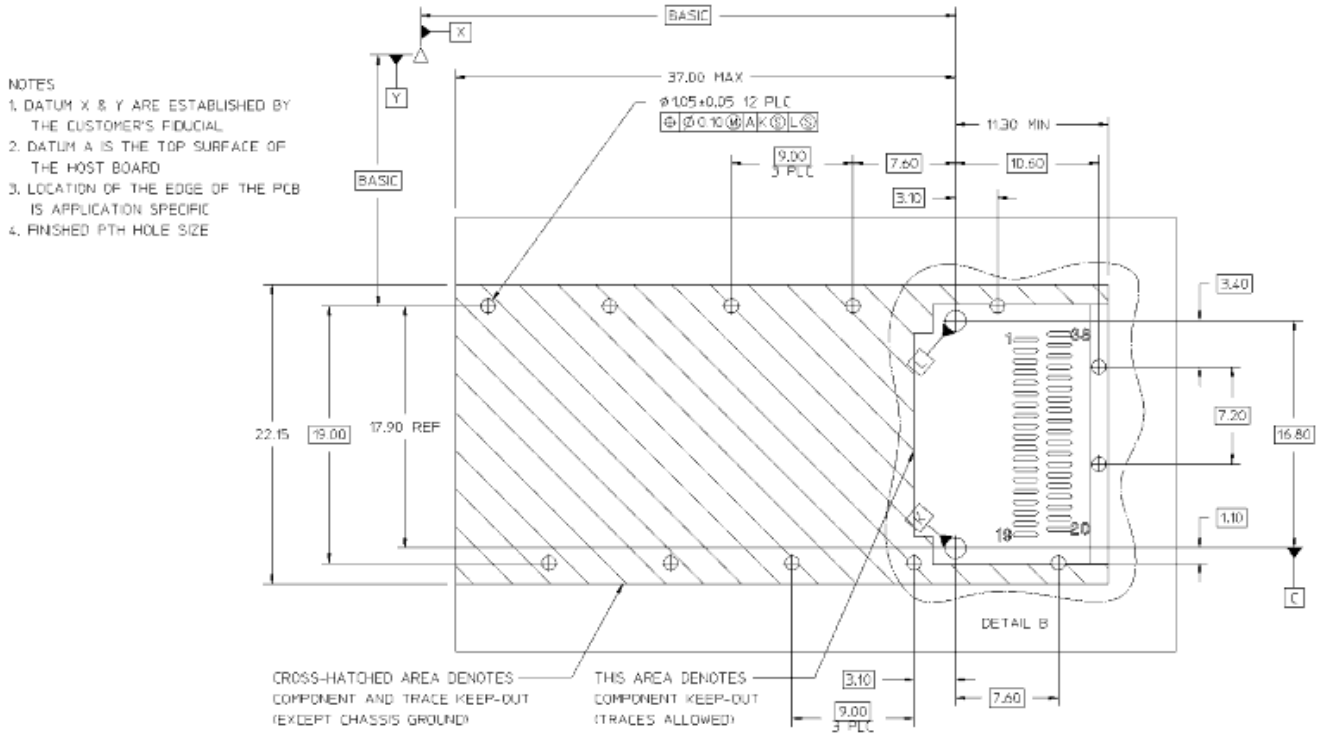
The Receiver section consists of a 4-channel PIN photodiode array, a 4-channel TIA array, and a 4-channel output buffer.

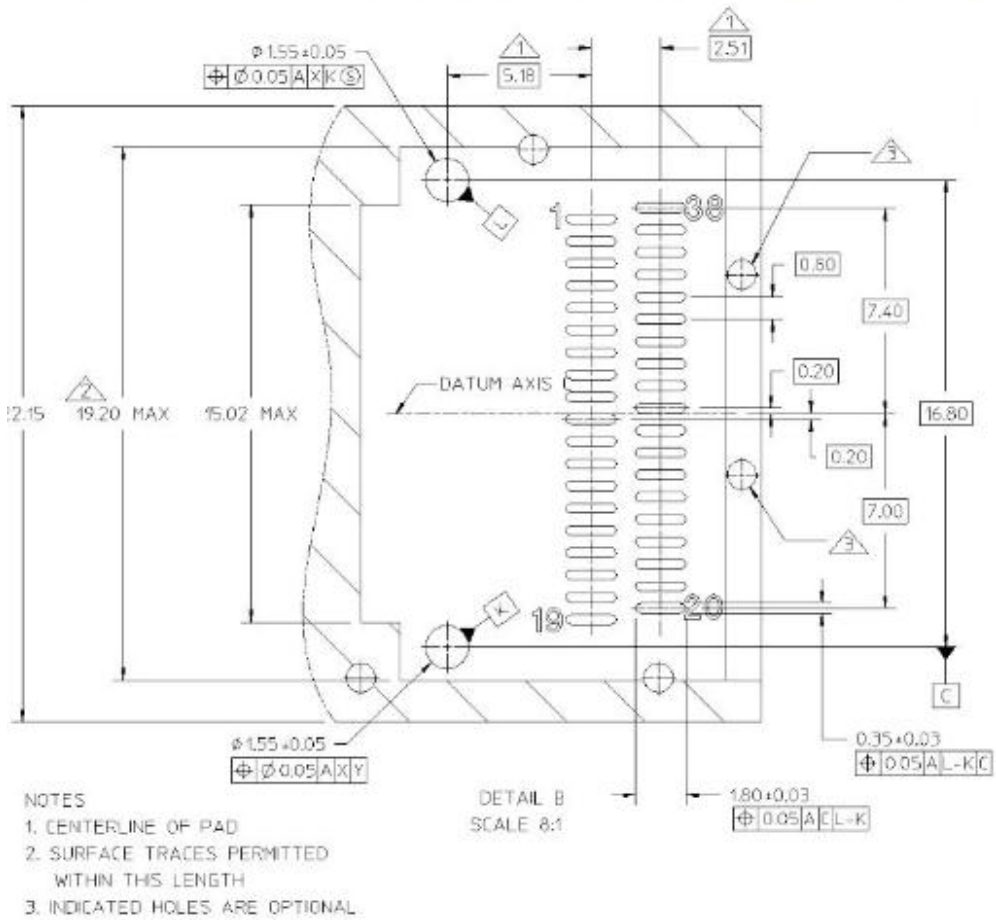
Dimensions



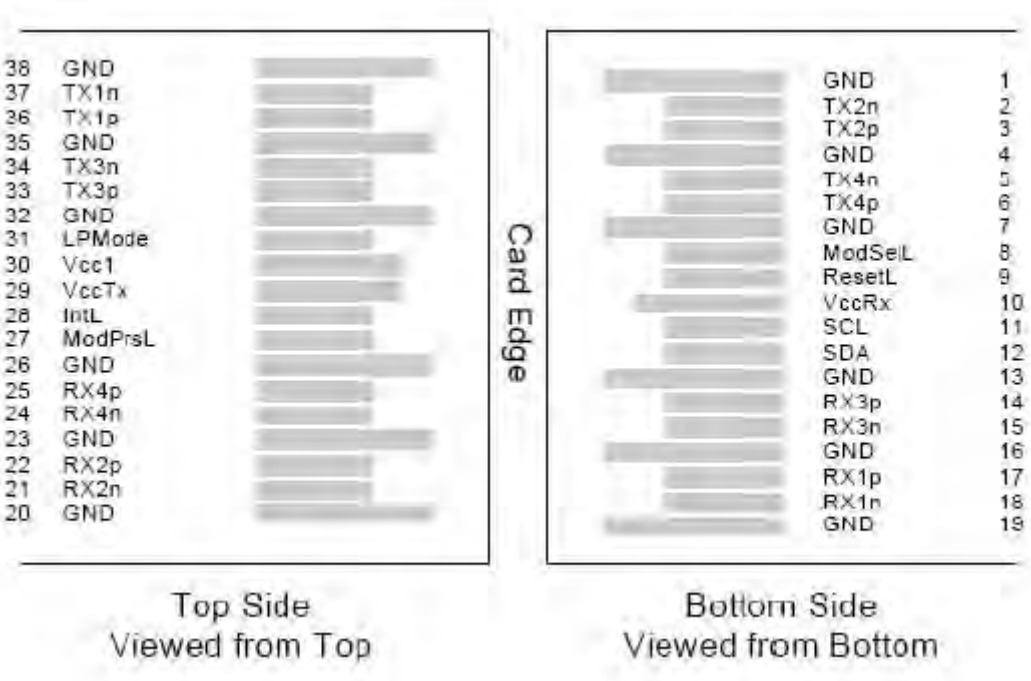
ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

PCB Layout Recommendation





Electrical Pad Layout



Pin Assignment

PIN #	*Symbol*	*Description*	*Remarks*
1	GND	Ground	
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	V_{cc} RX	+3.3V Power Supply Receiver	
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
13	GND	Ground	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	
20	GND	Ground	
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	V_{cc} TX	+3.3V Power Supply transmitter	
30	V_{cc1}	+3.3V Power Supply	
31	LPMode	Low Power Mode	
32	GND	Ground	
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmiiter Inverted Data Input	
35	GND	Ground	
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmiiter Inverted Data Input	
38	GND	Ground	

References

1. IEEE standard 802.3ba. IEEE Standard Department, 2010.
2. QSFP+ 10Gbs 4X PLUGGABLE TRANSCEIVER – SFF-8436