

PROLABS – QSFP-H40G-AOCXM

40GBd QSFP+ Active Optical Cable Transceiver

Key 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°C to 70°C.

Applications

- 40G Ethernet
- Infiniband interconnects



Ordering Information

Part Number	Description
QSFP-H40G-AOCXM	40G QSFP+ Active optical Cable (length from 1m to 100m)

Introduction

PROLABS's QSFP-H40G-AOCXM 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.

Compatible Ordering Information

OEM Manufacturer	Prolabs SKU	Product Description
Alcatel	QSFP-H40G-AOC1M-ALC-C	40G QSFP Active Optical Cable 1m
Allied	QSFP-H40G-AOC1M-ALLIED-C	40G QSFP Active Optical Cable 1m
Arista	AOC-Q-Q-40G-1M-C	40G QSFP Active Optical Cable 1m
Avaya	AA1404028-1M-C	40G QSFP Active Optical Cable 1m
Brocade	40G-QSFP-QSFP-AOC-0101-C	40G QSFP Active Optical Cable 1m
BTN/IBM	90Y3519-AOC1M-C	40G QSFP Active Optical Cable 1m
Cisco	QSFP-H40G-AOC1M-C	40G QSFP Active Optical Cable 1m
Dell Force10	CBL-QSFP-40GE-1M-C	40G QSFP Active Optical Cable 1m
Emulex	OC40-QSFP-AOC-1M-C	40G QSFP Active Optical Cable 1m
Enterasys	40GB-F01-QSFP-C	40G QSFP Active Optical Cable 1m
Extreme	10315-AOC-1M-C	40G QSFP Active Optical Cable 1m
F5 Networks	F5-UPG-QSFP+AOC1M-C	40G QSFP Active Optical Cable 1m
Generic	AOC1M-QSFP-40G-C	40G QSFP Active Optical Cable 1m
Intel	XLAOCBL1-C	40G QSFP Active Optical Cable 1m
Juniper	QFX-QSFP-AOC-1M-C	40G QSFP Active Optical Cable 1m
Alcatel	QSFP-H40G-AOC2M-ALC-C	40G QSFP Active Optical Cable 2m
Allied	QSFP-H40G-AOC2M-ALLIED-C	40G QSFP Active Optical Cable 2m
Arista	AOC-Q-Q-40G-2M-C	40G QSFP Active Optical Cable 2m
Avaya	AA1404028-2M-C	40G QSFP Active Optical Cable 2m
Brocade	40G-QSFP-QSFP-AOC-0201-C	40G QSFP Active Optical Cable 2m
BTN/IBM	90Y3519-AOC2M-C	40G QSFP Active Optical Cable 2m
Cisco	QSFP-H40G-AOC2M-C	40G QSFP Active Optical Cable 2m
Dell Force10	CBL-QSFP-40GE-2M-C	40G QSFP Active Optical Cable 2m
Emulex	OC40-QSFP-AOC-2M-C	40G QSFP Active Optical Cable 2m
Enterasys	40GB-F02-QSFP-C	40G QSFP Active Optical Cable 2m
Extreme	10315-AOC-2M-C	40G QSFP Active Optical Cable 2m
F5 Networks	F5-UPG-QSFP+AOC2M-C	40G QSFP Active Optical Cable 2m
Generic	AOC2M-QSFP-40G-C	40G QSFP Active Optical Cable 2m
Intel	XLAOCBL2-C	40G QSFP Active Optical Cable 2m
Juniper	QFX-QSFP-AOC-2M-C	40G QSFP Active Optical Cable 2m
Alcatel	QSFP-H40G-AOC3M-ALC-C	40G QSFP Active Optical Cable 3m
Allied	QSFP-H40G-AOC3M-ALLIED-C	40G QSFP Active Optical Cable 3m
Arista	AOC-Q-Q-40G-3M-C	40G QSFP Active Optical Cable 3m
Avaya	AA1404028-3M-C	40G QSFP Active Optical Cable 3m
Brocade	40G-QSFP-QSFP-AOC-0301-C	40G QSFP Active Optical Cable 3m
BTN/IBM	90Y3519-AOC3M-C	40G QSFP Active Optical Cable 3m
Cisco	QSFP-H40G-AOC3M-C	40G QSFP Active Optical Cable 3m
Dell Force10	CBL-QSFP-40GE-3M-C	40G QSFP Active Optical Cable 3m
Emulex	OC40-QSFP-AOC-3M-C	40G QSFP Active Optical Cable 3m
Enterasys	40GB-F03-QSFP-C	40G QSFP Active Optical Cable 3m
Extreme	10315-AOC-3M-C	40G QSFP Active Optical Cable 3m
F5 Networks	F5-UPG-QSFP+AOC3M-C	40G QSFP Active Optical Cable 3m
Generic	AOC3M-QSFP-40G-C	40G QSFP Active Optical Cable 3m
Intel	XLAOCBL3-C	40G QSFP Active Optical Cable 3m
Juniper	QFX-QSFP-AOC-3M-C	40G QSFP Active Optical Cable 3m

Note:

This Datasheet covers Dual and Multi coded AOC's for all cable lengths that ProLabs provide.

Compatible Ordering Information

OEM Manufacturer	Prolabs SKU	Product Description
Alcatel	QSFP-H40G-AOC5M-ALC-C	40G QSFP Active Optical Cable 5m
Allied	QSFP-H40G-AOC5M-ALLIED-C	40G QSFP Active Optical Cable 5m
Arista	AOC-Q-Q-40G-5M-C	40G QSFP Active Optical Cable 5m
Avaya	AA1404028-5M-C	40G QSFP Active Optical Cable 5m
Brocade	40G-QSFP-QSFP-AOC-0501-C	40G QSFP Active Optical Cable 5m
BTN/IBM	90Y3519-AOC5M-C	40G QSFP Active Optical Cable 5m
Cisco	QSFP-H40G-AOC5M-C	40G QSFP Active Optical Cable 5m
Dell Force10	CBL-QSFP-40GE-5M-C	40G QSFP Active Optical Cable 5m
Emulex	OC40-QSFP-AOC-5M-C	40G QSFP Active Optical Cable 5m
Enterasys	40GB-F05-QSFP-C	40G QSFP Active Optical Cable 5m
Extreme	10315-AOC-5M-C	40G QSFP Active Optical Cable 5m
F5 Networks	F5-UPG-QSFP+AOC5M-C	40G QSFP Active Optical Cable 5m
Generic	AOC5M-QSFP-40G-C	40G QSFP Active Optical Cable 5m
Intel	XLAOCBL5-C	40G QSFP Active Optical Cable 5m
Juniper	QFX-QSFP-AOC-5M-C	40G QSFP Active Optical Cable 5m
Alcatel	QSFP-H40G-AOC7M-ALC-C	40G QSFP Active Optical Cable 7m
Allied	QSFP-H40G-AOC7M-ALLIED-C	40G QSFP Active Optical Cable 7m
Arista	AOC-Q-Q-40G-7M-C	40G QSFP Active Optical Cable 7m
Avaya	AA1404028-7M-C	40G QSFP Active Optical Cable 7m
Brocade	40G-QSFP-QSFP-AOC-0701-C	40G QSFP Active Optical Cable 7m
BTN/IBM	90Y3519-AOC7M-C	40G QSFP Active Optical Cable 7m
Cisco	QSFP-H40G-AOC7M-C	40G QSFP Active Optical Cable 7m
Dell Force10	CBL-QSFP-40GE-7M-C	40G QSFP Active Optical Cable 7m
Emulex	OC40-QSFP-AOC-7M-C	40G QSFP Active Optical Cable 7m
Enterasys	40GB-F07-QSFP-C	40G QSFP Active Optical Cable 7m
Extreme	10315-AOC-7M-C	40G QSFP Active Optical Cable 7m
F5 Networks	F5-UPG-QSFP+AOC7M-C	40G QSFP Active Optical Cable 7m
Generic	AOC7M-QSFP-40G-C	40G QSFP Active Optical Cable 7m
Intel	XLAOCBL7-C	40G QSFP Active Optical Cable 7m
Juniper	QFX-QSFP-AOC-7M-C	40G QSFP Active Optical Cable 7m
Alcatel	QSFP-H40G-AOC10M-ALC-C	40G QSFP Active Optical Cable 10m
Allied	QSFP-H40G-AOC10M-ALLIED-C	40G QSFP Active Optical Cable 10m
Arista	AOC-Q-Q-40G-10M-C	40G QSFP Active Optical Cable 10m
Avaya	AA1404028-10M-C	40G QSFP Active Optical Cable 10m
Brocade	40G-QSFP-QSFP-AOC-1001-C	40G QSFP Active Optical Cable 10m
BTN/IBM	90Y3519-AOC10M-C	40G QSFP Active Optical Cable 10m
Cisco	QSFP-H40G-AOC10M-C	40G QSFP Active Optical Cable 10m
Dell Force10	CBL-QSFP-40GE-10M-C	40G QSFP Active Optical Cable 10m
Emulex	OC40-QSFP-AOC-10M-C	40G QSFP Active Optical Cable 10m
Enterasys	40GB-F10-QSFP-C	40G QSFP Active Optical Cable 10m
Extreme	10315-AOC-10M-C	40G QSFP Active Optical Cable 10m
F5 Networks	F5-UPG-QSFP+AOC10M-C	40G QSFP Active Optical Cable 10m
Generic	AOC10M-QSFP-40G-C	40G QSFP Active Optical Cable 10m
Intel	XLAOCBL10-C	40G QSFP Active Optical Cable 10m
Juniper	QFX-QSFP-AOC-10M-C	40G QSFP Active Optical Cable 10m

Compatible Ordering Information

OEM Manufacturer	Prolabs SKU	Product Description
Alcatel	QSFP-H40G-AOC15M-ALC-C	40G QSFP Active Optical Cable 15m
Allied	QSFP-H40G-AOC15M-ALLIED-C	40G QSFP Active Optical Cable 15m
Arista	AOC-Q-Q-40G-15M-C	40G QSFP Active Optical Cable 15m
Avaya	AA1404028-15M-C	40G QSFP Active Optical Cable 15m
Brocade	40G-QSFP-QSFP-AOC-1501-C	40G QSFP Active Optical Cable 15m
BTN/IBM	90Y3519-AOC15M-C	40G QSFP Active Optical Cable 15m
Cisco	QSFP-H40G-AOC15M-C	40G QSFP Active Optical Cable 15m
Dell Force10	CBL-QSFP-40GE-15M-C	40G QSFP Active Optical Cable 15m
Emulex	OC40-QSFP-AOC-15M-C	40G QSFP Active Optical Cable 15m
Enterasys	40GB-F15-QSFP-C	40G QSFP Active Optical Cable 15m
Extreme	10315-AOC-15M-C	40G QSFP Active Optical Cable 15m
F5 Networks	F5-UPG-QSFP+AOC15M-C	40G QSFP Active Optical Cable 15m
Generic	AOC15M-QSFP-40G-C	40G QSFP Active Optical Cable 15m
Intel	XLAOCBL15-C	40G QSFP Active Optical Cable 15m
Juniper	QFX-QSFP-AOC-15M-C	40G QSFP Active Optical Cable 15m
Alcatel	QSFP-H40G-AOC20M-ALC-C	40G QSFP Active Optical Cable 20m
Allied	QSFP-H40G-AOC20M-ALLIED-C	40G QSFP Active Optical Cable 20m
Arista	AOC-Q-Q-40G-20M-C	40G QSFP Active Optical Cable 20m
Avaya	AA1404028-20M-C	40G QSFP Active Optical Cable 20m
Brocade	40G-QSFP-QSFP-AOC-2001-C	40G QSFP Active Optical Cable 20m
BTN/IBM	90Y3519-AOC20M-C	40G QSFP Active Optical Cable 20m
Cisco	QSFP-H40G-AOC20M-C	40G QSFP Active Optical Cable 20m
Dell Force10	CBL-QSFP-40GE-20M-C	40G QSFP Active Optical Cable 20m
Emulex	OC40-QSFP-AOC-20M-C	40G QSFP Active Optical Cable 20m
Enterasys	40GB-F20-QSFP-C	40G QSFP Active Optical Cable 20m
Extreme	10316-AOC-20M-C	40G QSFP Active Optical Cable 20m
F5 Networks	F5-UPG-QSFP+AOC20M-C	40G QSFP Active Optical Cable 20m
Generic	AOC20M-QSFP-40G-C	40G QSFP Active Optical Cable 20m
Intel	XLAOCBL20-C	40G QSFP Active Optical Cable 20m
Juniper	QFX-QSFP-AOC-20M-C	40G QSFP Active Optical Cable 20m
Alcatel	QSFP-H40G-AOC50M-ALC-C	40G QSFP Active Optical Cable 50m
Allied	QSFP-H40G-AOC50M-ALLIED-C	40G QSFP Active Optical Cable 50m
Arista	AOC-Q-Q-40G-50M-C	40G QSFP Active Optical Cable 50m
Avaya	AA1404028-50M-C	40G QSFP Active Optical Cable 50m
Brocade	40G-QSFP-QSFP-AOC-5001-C	40G QSFP Active Optical Cable 50m
BTN/IBM	90Y3519-AOC50M-C	40G QSFP Active Optical Cable 50m
Cisco	QSFP-H40G-AOC50M-C	40G QSFP Active Optical Cable 50m
Dell Force10	CBL-QSFP-40GE-50M-C	40G QSFP Active Optical Cable 50m
Emulex	OC40-QSFP-AOC-50M-C	40G QSFP Active Optical Cable 50m
Enterasys	40GB-F50-QSFP-C	40G QSFP Active Optical Cable 50m
Extreme	10317-AOC-50M-C	40G QSFP Active Optical Cable 50m
F5 Networks	F5-UPG-QSFP+AOC50M-C	40G QSFP Active Optical Cable 50m
Generic	AOC50M-QSFP-40G-C	40G QSFP Active Optical Cable 50m
Intel	XLAOCBL50-C	40G QSFP Active Optical Cable 50m
Juniper	QFX-QSFP-AOC-50M-C	40G QSFP Active Optical Cable 50m

Compatible Ordering Information

OEM Manufacturer	Prolabs SKU	Product Description
Alcatel	QSFP-H40G-AOC100M-ALC-C	40G QSFP Active Optical Cable 100m
Allied	QSFP-H40G-AOC100M-ALLIED-	40G QSFP Active Optical Cable 100m
Arista	AOC-Q-Q-40G-100M-C	40G QSFP Active Optical Cable 100m
Avaya	AA1404028-100M-C	40G QSFP Active Optical Cable 100m
Brocade	40G-QSFP-QSFP-AOC-10001-C	40G QSFP Active Optical Cable 100m
BTN/IBM	90Y3519-AOC100M-C	40G QSFP Active Optical Cable 100m
Cisco	QSFP-H40G-AOC100M-C	40G QSFP Active Optical Cable 100m
Dell Force10	CBL-QSFP-40GE-100M-C	40G QSFP Active Optical Cable 100m
Emulex	OC40-QSFP-AOC-100M-C	40G QSFP Active Optical Cable 100m
Enterasys	40GB-F100-QSFP-C	40G QSFP Active Optical Cable 100m
Extreme	10318-AOC-100M-C	40G QSFP Active Optical Cable 100m
F5 Networks	F5-UPG-QSFP+AOC100M-C	40G QSFP Active Optical Cable 100m
Generic	AOC100M-QSFP-40G-C	40G QSFP Active Optical Cable 100m
Intel	XLAOCBL100-C	40G QSFP Active Optical Cable 100m
Juniper	QFX-QSFP-AOC-100M-C	40G QSFP Active Optical Cable 100m

Specification

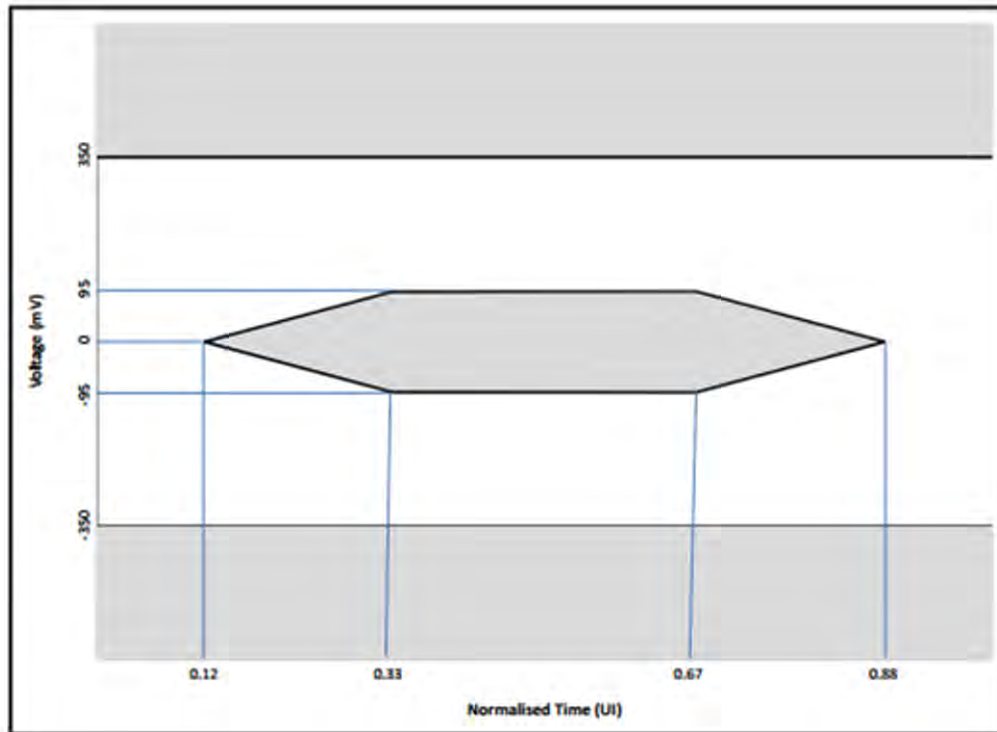
General Specifications						
Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Bit Error Rate	BER			10^{-15}		
Operating Temperature	T_{OP}	0		70	°C	Case temperature
Storage Temperature	T_{STO}	-40		85	°C	Ambient temperature
Input Voltage	V_{CC}	3.14	3.3	3.47	V	
Maximum Voltage	V_{MAX}	0.5		3.6	V	For electrical 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	V_{cm}	15			mV	
Total Jitter	T_j			0.28	Ulp-p	
Data Dependent Jitter	DDJ			0.1	Ulp-p	
Eye mask	see note next page					

Specification

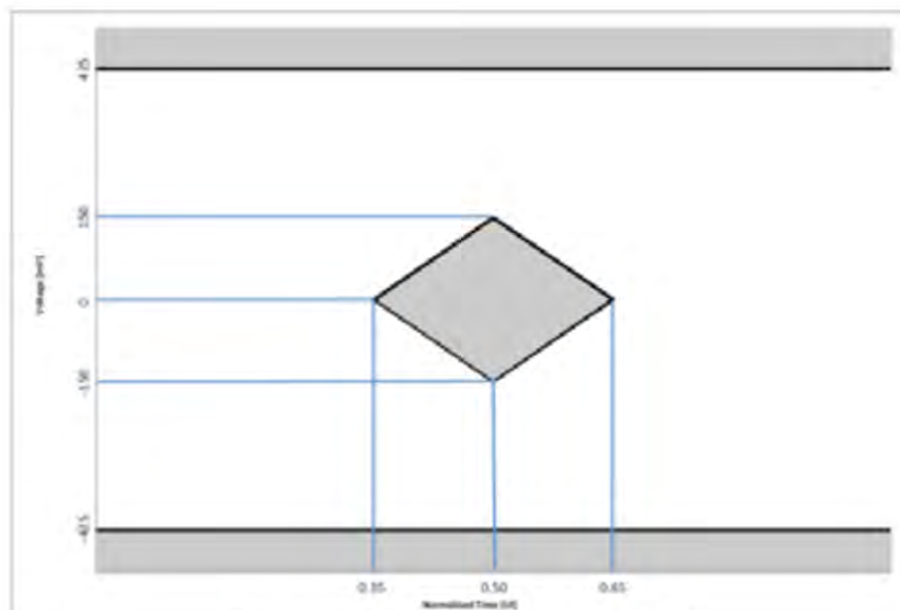
Note: The worst case electrical input is defined by the eye mask:

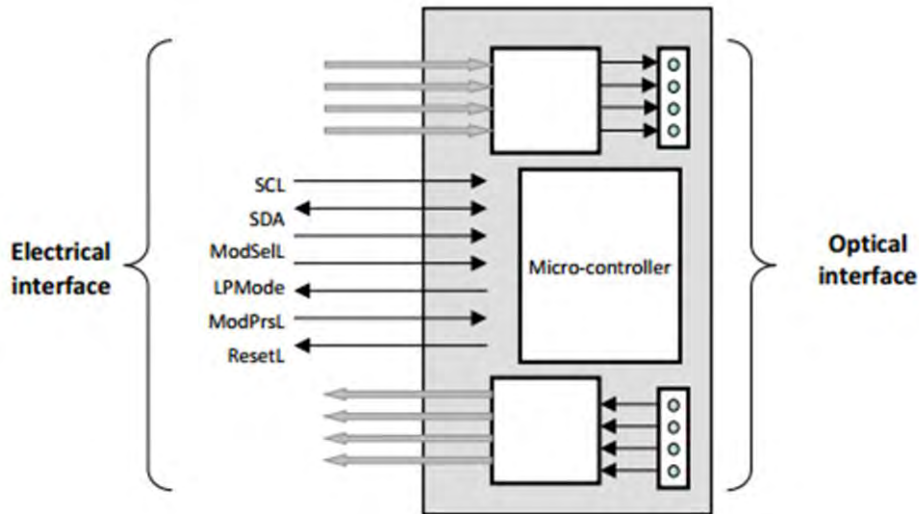


Specification

AOC ELECTRICAL OUTPUT REQUIRMENTS

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate Per Channel	D_r		0.001	10.5	GB/s	Non condensing
Differential Output Amplitude	V_{out_PP}	340		700	mV	
Differential Output Amplitude in Squelched state	V_{out_sq}			50	mV	
Single Ended Voltage Tolerance	V	-0.3		3.8	V	
Output AC Common Mode Voltage	V_{cm}			7.5	mV	RMS
Output Transition Time	T_r, T_f	28			ps	
Total Jitter	T_j			0.7	Ulp-p	
Deterministic Jitter	DJ			0.4	Ulp-p	
Eye Mask			See note			


 Eye Mask for Hit Ratio = 1×10^{-12}

Specification
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.

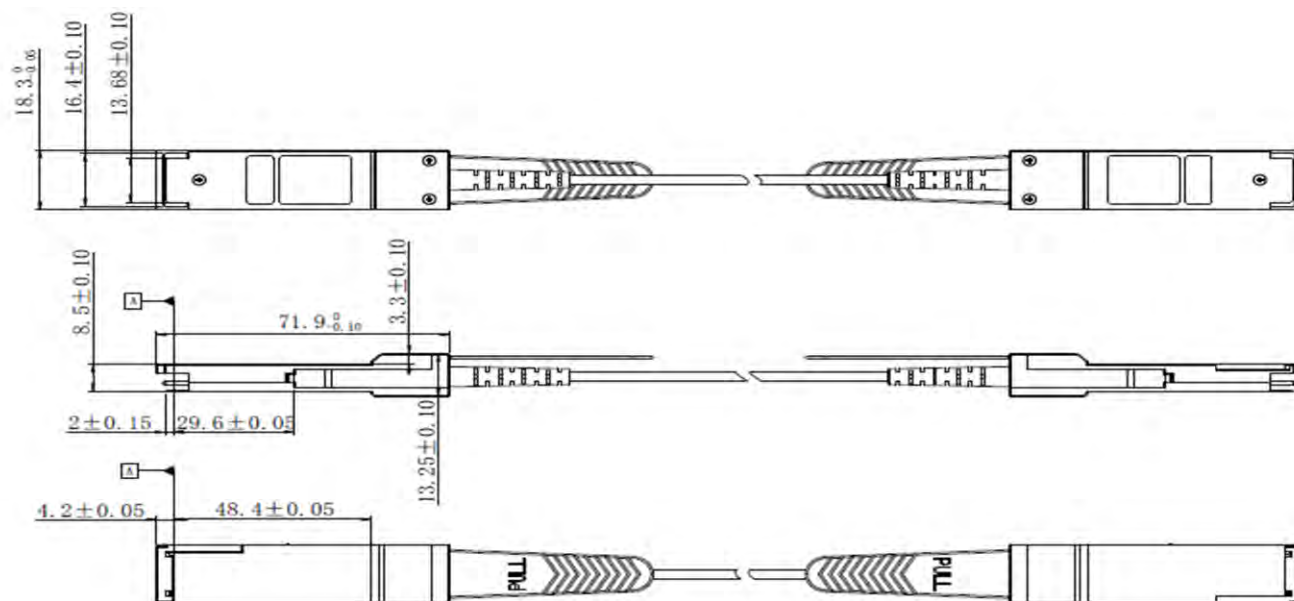
A functional block diagram of the engine is shown in the above Figure. The transmitter sections consists of a 4-channel VCSEL array, a 4-channel input buffer and laser driver.

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.

Specification

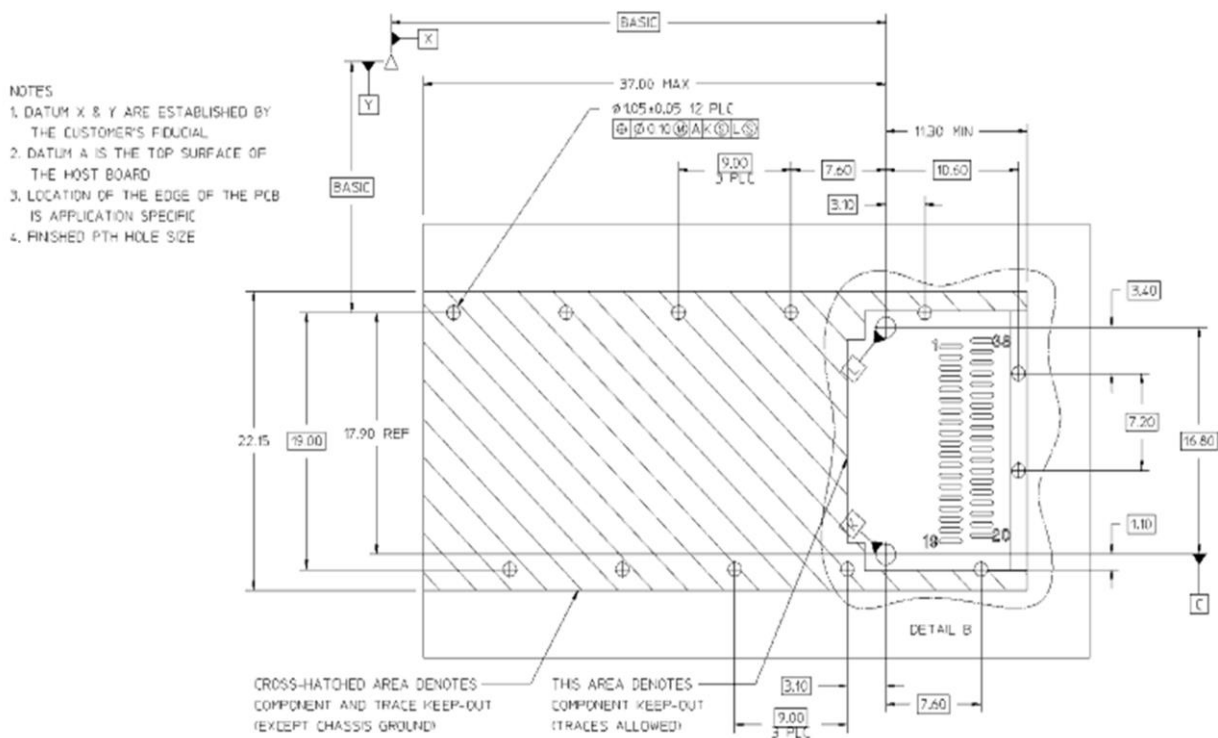
Dimensions



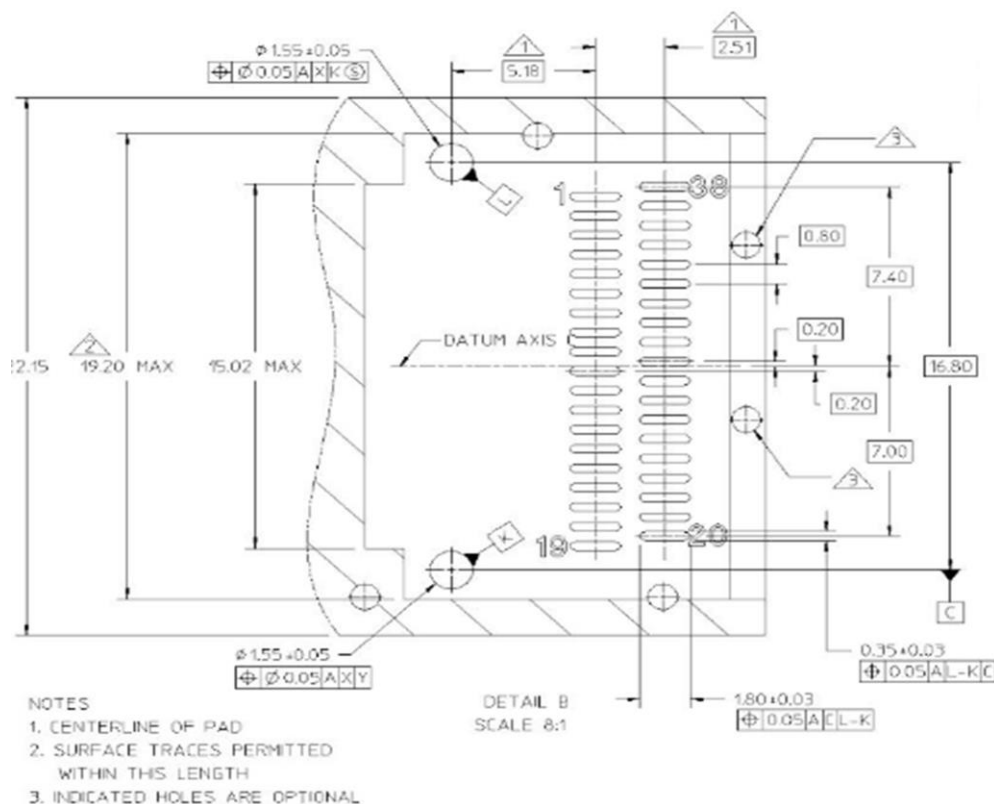
DIMENSIONS ARE $\pm 0.2\text{mm}$ UNLESS OTHERWISE SPECIFIED

UNIT: mm

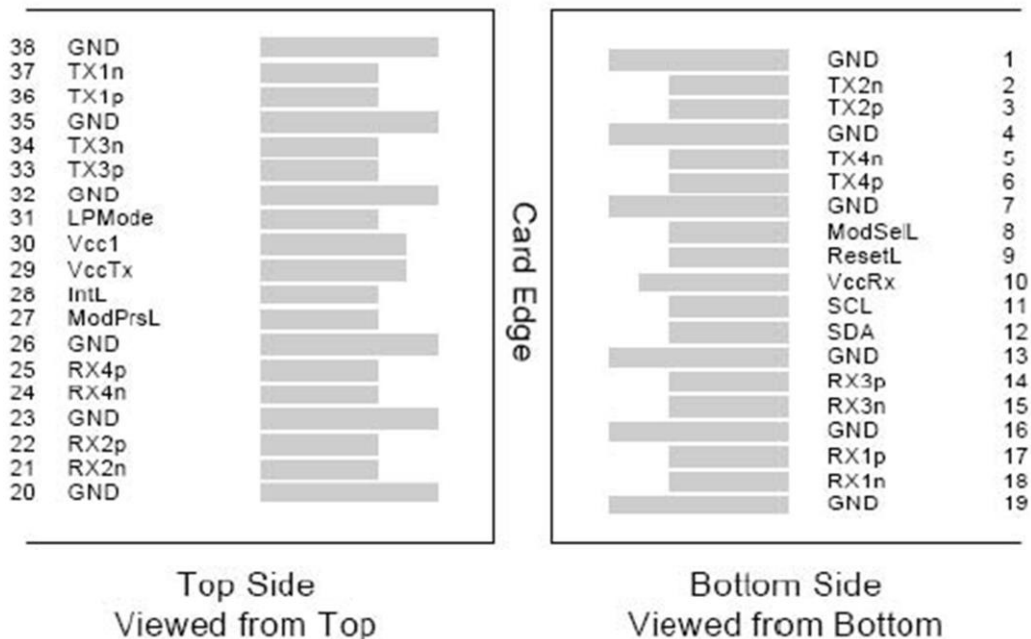
PCB Layout Recommendation



Specification



Electrical Pad Layout



Specification

Pin Assignment (QSFP+ END)			
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	Transmitter Inverted Data Input	
35	GND	Ground	
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	

References

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