Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 30m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-030

Features

- Full-Duplex 4 Channel parallel breakout active optical cable, supporting 42 Gbps links
- Up to 10.5 Gbps Data rate per channel (breakouts)
- Maximum link length of 30m availalble
- High Reliability 850nm VCSEL technology
- Electrically hot-pluggable

- Electrical interface compliant to SFF8436 (QSFP+) and SFF-8431 (SFP+)
- Case operating temperature range: 0°C to 70°C
- Power dissipation < 1.5W per QSFP+ end
- Power dissipation < 1.0W per SFP+ end

Applications

- 40G Ethernet Data Center Intra-Rack and Inter-Rack links
- Infiniband QDR

- 10G Fibre Channel
- HPC Interconnections

Description

The AOCQSP40-030 is an active optical breakout cable designed for use in 40Gigabit Ethernet links. The QSFP+ (40Gbps) interface is electrically compliant and mechanically compliant with the SFF-8436. The SFP+ (10Gbps) interface is electrically compliant with SFF-8431 and mechanically compliant with SFF-8432. The AOCQSP40-030 is utilized in the aggregation of 10Gbps interfaces in a 40Gbps environment.

QSFP+ Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40	-	85	°C	
Relative Humidity	RH	5	-	95	%	
Power Supply Voltage	VCC	-0.3	-	4	V	
Signal Input Voltage		Vcc-0.3	-	Vcc+0.3	V	

SFP+ Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40	-	85	°C	
Relative Humidity	RH	5	-	95	%	
Power Supply Voltage	VCC	-0.3	-	4	V	
Signal Input Voltage		Vcc-0.3	-	Vcc+0.3	V	

QSFP+ Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operating Temperature	Tcase	0	-	70	°C	Without air flow
Power Supply Voltage	VCC	3.14	3.3	3.46	V	
Power Supply Current	ICC	-		450	mA	per cable end
Data Rate	BR		10.3125		Gbps	Each channel

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SFP+ Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operating Temperature	Tcase	0	-	70	℃	Without air flow
Power Supply Voltage	VCC	3.14	3.3	3.46	V	
Power Supply Current	ICC	-		300	mA	per cable end
Data Rate	BR		10.3125		Gbps	

QSFP+ General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	QSFP+		
Number of Lanes	4 Tx /Rx		
Maximum Aggregate Data Rate	42.0	Gb/s	
Maximum Data Rate per Lane	10.5	Gb/s	
Standard Cable Lengths	3, 5, 7, 10, 50, 100	meters	Other lengths, please contact sales
Protocols Supported	Typical applications include Infiniband, Fiber Channel, 40G Ethernet		
Electrical Interface and Pin-out	38-pin edge connector		Pin-out as defined by the QSFP+ MSA
Standard Optical Cable Type	Multimode ribbon fiber cable assembly, riser-rated		
Maximum Power Consumption per End	1.5	W	
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by the QSFP+ MSA

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Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 30m, MSA Compatible

SFP+ General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	SFP+		
Maximum Data Rate	11.1	Gb/s	
Standard Cable Lengths	3, 5, 7, 10, 50, 100	meters	Other lengths may be available upon request (<= 300m)
Protocols Supported	Typical applications include Infiniband, Fibre Channel, 10G Ethernet		
Electrical Interface and Pin-out	20-pin edge connector		Pin-out as defined by the SFP+ MSA
Standard Optical Cable Type	Multimode ribbon fiber cable assembly		
Maximum Power Consumption per End	1.0	W	per cable end
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by the SFP+ MSA

QSFP+ Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	NOTE
Supply Voltage	Vcc1,VccTx,VccRx	3.14	3.3	3.46	V	
Supply Current	Icc			450	mA	
Transmitter						
Differential data input swing	Vin,pp	180		1000	mV	1
Single ended input voltage tolerance	VinT	-0.3		4.0	V	
Receiver						
Differential data output swing	Vout,pp	300		850	mV	2
Single-ended output voltage		-0.3		4.0	V	

Notes:

1. AC coupled internally. See Figure 1 for input eye mask requirements. Self-biasing 100Ω differential input.
2. AC coupled with 100Ω differential output impedance. See Figure 2 for output eye mask.

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Active Optical Cables Technical Data Sheet   **AOCQSP40-030**

SFP+ Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	NOTE
Supply Voltage	VccT,VccR	3.14	3.3	3.46	V	
Supply Current	Icc			300	mA	
Transmitter						
Differential data input swing	Vin,pp	180		1000	mV	1
Single ended input voltage tolerance	VinT	-0.3		4.0	V	
Receiver						
Differential data output swing	Vout,pp	300		850	mV	2
Single-ended output voltage		-0.3		4.0	V	

Notes:

1. AC coupled internally. Self-biasing 100Ω differential   input.
2. AC coupled with 100Ω differential output impedance.

QSFP+ High-speed Electrical Characteristics per Lane

Parameter-Inputs	Symbol	Min	Typ	Max	Unit	NOTE
Reference Differential Input Impedance	Zd		100		Ω	
Termination Mismatch	ΔZM			5	%	1
Input AC Common Mode Voltage				25	mV (RMS)	
Differential Input Return Loss	SDD11				dB	2，0.01-4.1 GHz
					dB	3，4.1 – 11.1 GHz
Differential to Common Mode Loss	SCD11			-10	dB	0.01-11.1 GHz
Jitter Tolerance (Total)	TJ			0.40	UI	
Jitter Tolerance (Deterministic)	DJ			0.15	UI	

Notes:

1. See SFF-8431 section D.15 Termination Mismatch for definition & test recommendations
2. Reflection coefficient given by equation $SDD11(dB) < -12 + 2 \cdot SQRT(f)$, with f in GHz. See Figure 3.
3. Reflection coefficient given by equation $SDD11(dB) < -6.3 + 13 Log10(f/5.5)$, with f in GHz. See Figure 3

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Active Optical Cables Technical Data Sheet　　　　　　　**AOCQSP40-030**

QSFP+ High-speed Electrical Characteristics per Lane

Parameter-Outputs	Symbol	Min	Typ	Max	Unit	NOTE
Reference Differential Output Impedance	Zd		100		Ω	
Termination Mismatch	ΔZM			5	%	
Output AC Common Mode Voltage				15	mV (RMS)	
Differential Output Return Loss	SDD22				dB	4 ，0.01-4.1 GHz
					dB	5 ，4.1 – 11.1 GHz
Common Mode Output Return Loss	SCC22				dB	6，0.01-2.5 GHz
				-3	dB	2.5-11.1 GHz
Output Rise and Fall time (20% to 80%)	tRH, tFH	24			ps	
Deterministic Jitter	DJOUT			0.38	UI	7
Total Jitter	TJOUT			0.64	UI	7

Notes:

4. Reflection coefficient given by equation SDD22(dB)< -12+2*SQRT(f), with f in GHz. See Figure 3.

5. Reflection coefficient given by equation SDD22(dB)< -6.3+13Log10(f/5.5), with f in GHz. See Figure 3.

6. Reflection coefficient given by equation SCC22(dB)< -7+1.6*f, with f in GHz.

7. When transmitter input jitter specs are met.

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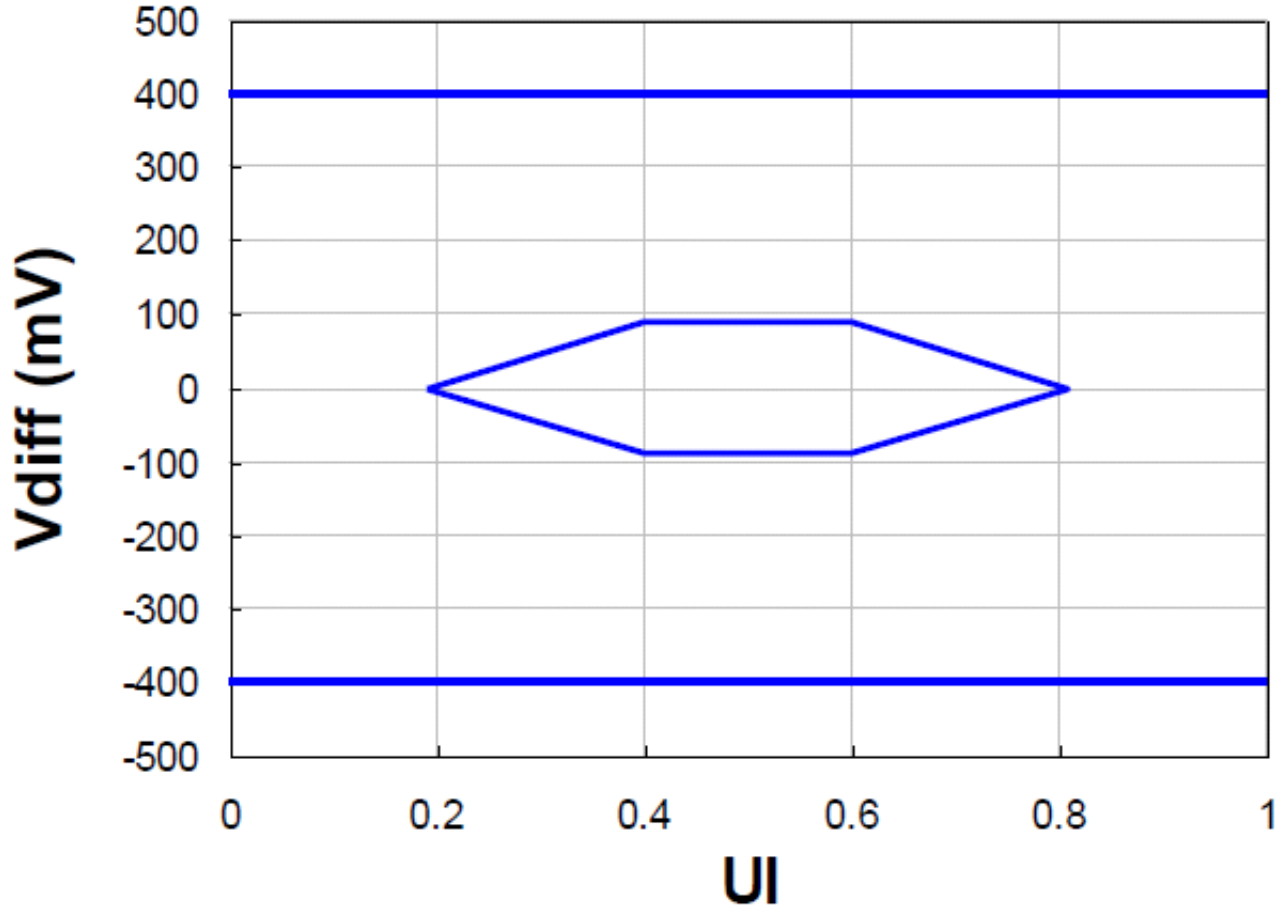
Figure 1 – QSFP+ Transmitter Input Differential Signal Mask
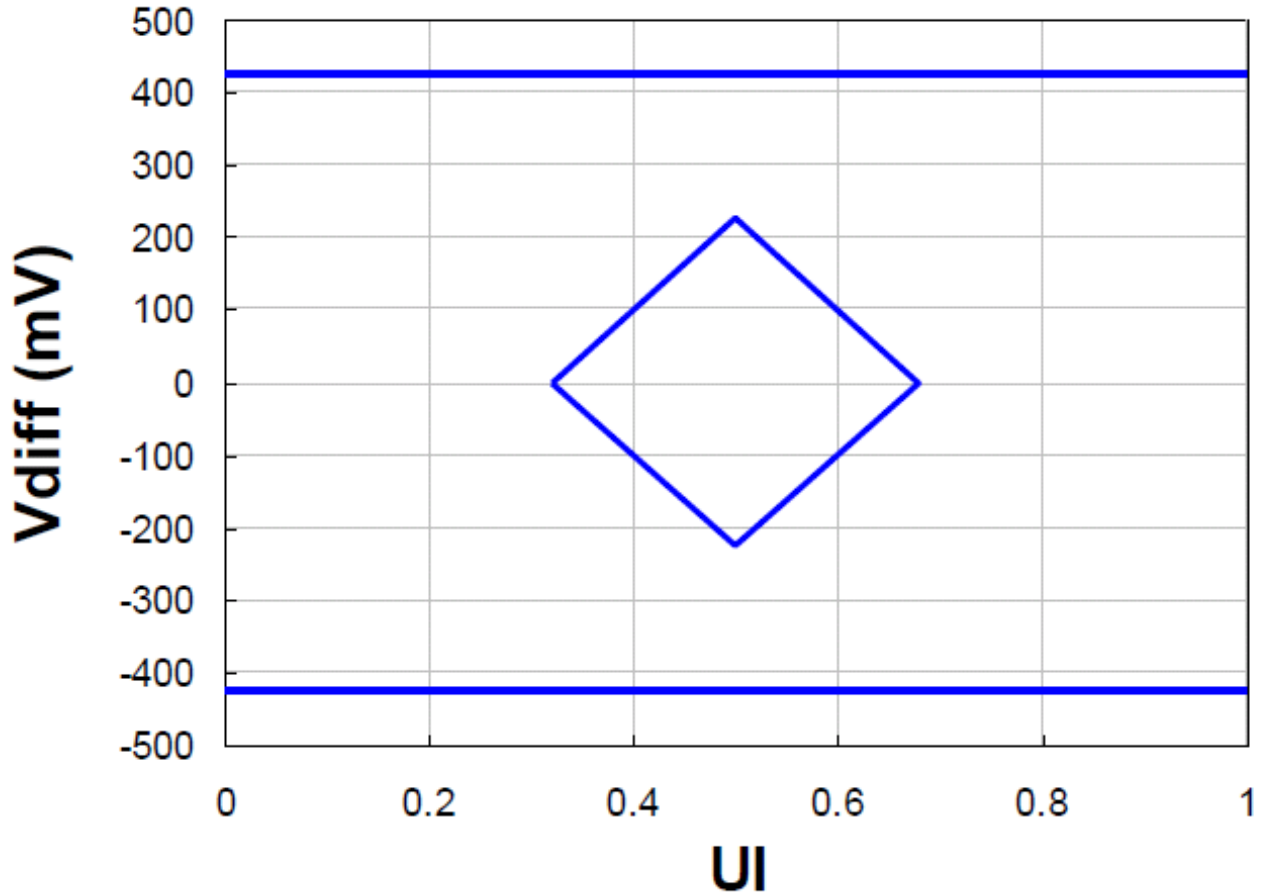
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Figure 2 – QSFP+ Receiver Output Differential Signal Mask

Mechanical Specifications

Length   1,181.1 in [30 m]

Environmental Specifications

QSFP+

  Temperature (Operational)   +0C to +70C

  Temperature (Storage)   -40C to +85C

  Relative Humidity   5% to 95%

SFP+

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Temperature (Operational)	+0C to +70C
Temperature (Storage)	-40C to +85 C
Relative Humidity	5% to 95%

Compliance Certifications

RoHS Compliant	Yes

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Our portfolio includes cable assemblies, connectors, adapters and custom products, as well as their wireless product line which includes antennas, RF amplifiers, coaxial lightning and surge protectors, and NEMA rated enclosures.

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URL: https://www.l-com.com/active-optical-cable-breakout-qsfp-40-30m-msa-compatible-aocqsp40-030-p.aspx

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mid

QSFP+ Pin Assignment

Top Side		Bottom Side	
38	GND	GND	1
37	TX1n	TX2n	2
36	TX1p	TX2p	3
35	GND	GND	4
34	TX3n	TX4n	5
33	TX3p	TX4p	6
32	GND	GND	7
31	LPMode	ModSelL	8
30	Vcc1	ResetL	9
29	VccTx	VccRx	10
28	IntL	SCL	11
27	ModPrsL	SDA	12
26	GND	GND	13
25	RX4p	RX3p	14
24	RX4n	RX3n	15
23	GND	GND	16
22	RX2p	RX1p	17
21	RX2n	RX1n	18
20	GND	GND	19

Card Edge
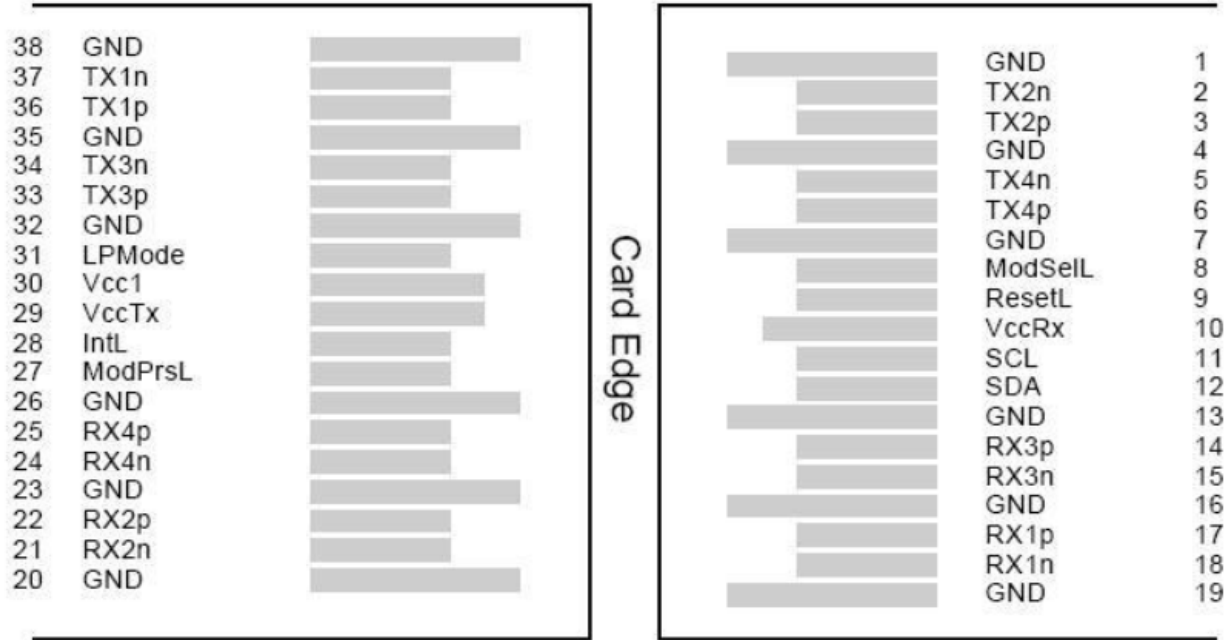
Pin out of Connector Block on Host Board

Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 30m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-030

QSFP+ Pin Assignment Table

Pin	Symbol	Name/Description	NOTE
1	GND	Transmitter Ground (Common with Receiver Ground)	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data output	
4	GND	Transmitter Ground (Common with Receiver Ground)	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data output	
7	GND	Transmitter Ground (Common with Receiver Ground)	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	3.3V Power Supply Receiver	2
11	SCL	2-Wire serial Interface Clock	
12	SDA	2-Wire serial Interface Data	
13	GND	Transmitter Ground (Common with Receiver Ground)	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Transmitter Ground (Common with Receiver Ground)	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Transmitter Ground (Common with Receiver Ground)	1
20	GND	Transmitter Ground (Common with Receiver Ground)	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Transmitter Ground (Common with Receiver Ground)	1
24	Rx4n	Receiver Inverted Data Output	1
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Transmitter Ground (Common with Receiver Ground)	1
27	ModPrsl	Module Present	
28	IntL	Interrupt	
29	VccTx	3.3V power supply transmitter	2
30	Vcc1	3.3V power supply	2
31	LPMode	Low Power Mode，not connect	
32	GND	Transmitter Ground (Common with Receiver Ground)	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Output	
35	GND	Transmitter Ground (Common with Receiver Ground)	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Output	
38	GND	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.

2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

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QSFP+ Host - Transceiver Interface Block Diagram

SFP+ Pin Assignment

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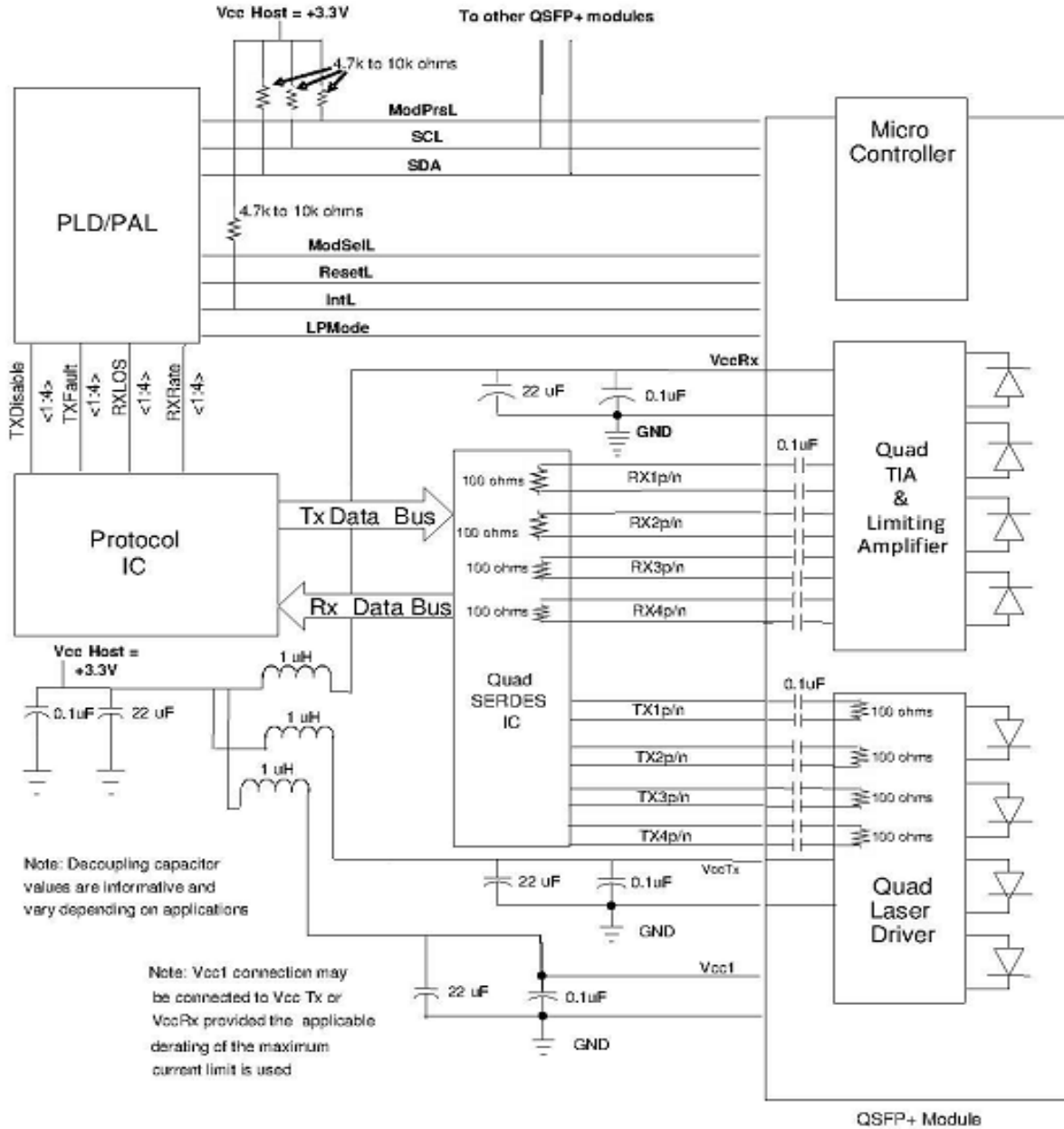
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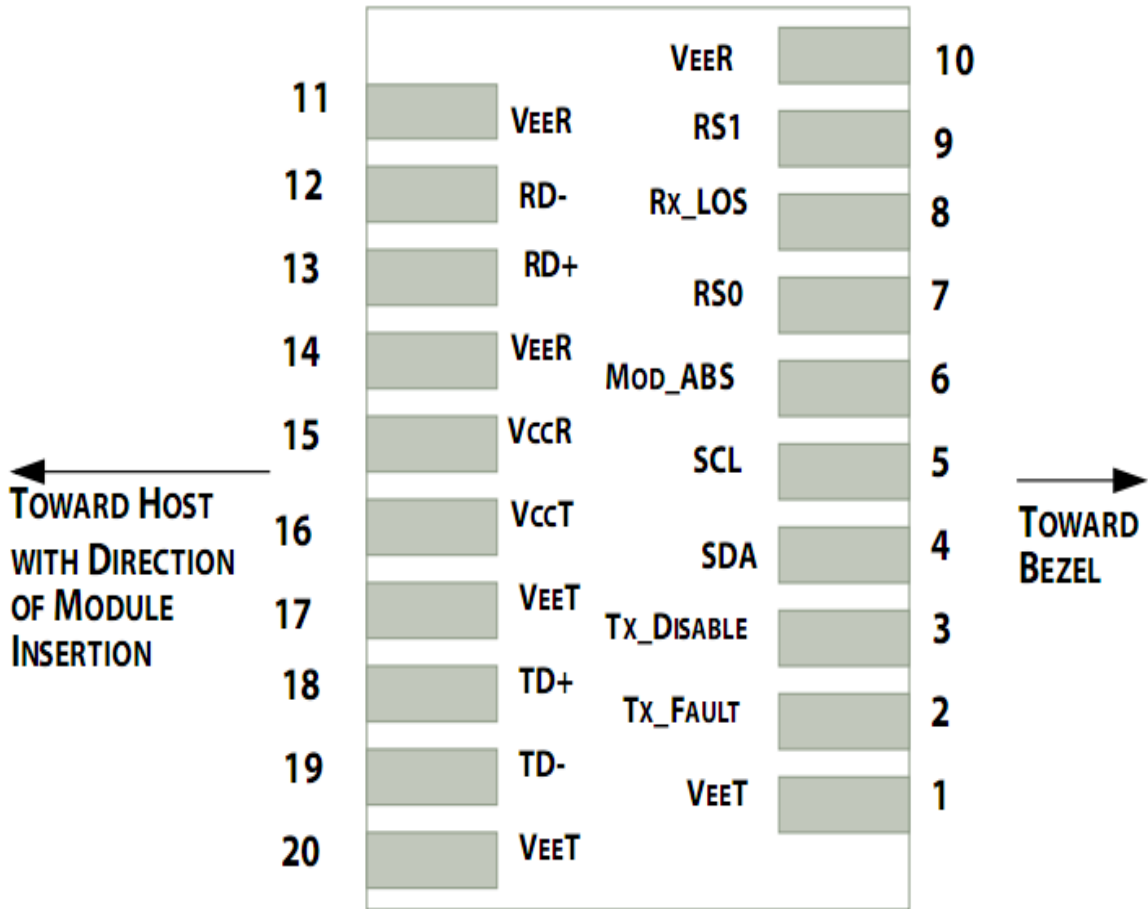
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SFP+ Pin Assignment Table

Pin	Symbol	Name/Description	NOTE
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault.	2
3	T_{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	1
10	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
11	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
15	V_{CCR}	Receiver Power Supply	
16	V_{CCT}	Transmitter Power Supply	
17	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.

2. T_{FAULT} is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V.A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.

3. Laser output disabled on T_{DIS} >2.0V or open, enabled on T_{DIS} <0.8V.

4. Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.

5. Internally pulled down per SFF-8431 Rev 4.1.

6. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

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SFP+ Host - Transceiver Interface Block Diagram

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REVISIONS

REV	DESCRIPTION	DATE	CHANGED BY
A	INITIAL RELEASE	04/24/2019	PHOSPODAR

40G QSFP+ to 4x10G SFP+ Active Optical Cable

	LENGTH	
	METERS	FEET
AOCQSP40-001	1.0	3.28
AOCQSP40-003	3.0	9.84
AOCQSP40-005	5.0	16.40
AOCQSP40-007	7.0	22.97
AOCQSP40-010	10.0	32.81
AOCQSP40-020	20.0	65.62
AOCQSP40-030	30.0	98.43

L-com Global Connectivity
50 HIGH STREET NORTH ANDOVER, MA 01845

CATEGORY
FIBER OPTICS

PRODUCT DESCRIPTION
Active Optical Cable Breakout QSFP+ 40Gb/s to 4x10G SFP+

PSCM NO. 43321

DWG NO. AOCQSP40

SIZE B

REV A

SCALE 1:4 CAD FILE: AOCQSP40-5LDDRW

SHEET 1 OF 1

APPROVALS

		DATE
DRAWN BY	DJINN	04/22/2019
CHECKED BY	DFRISIELLO	
APPROVED BY	PHOSPODAR	04/22/2019

CONFIGURATION DETAILS OF UNDIMENSIONED FEATURES MAY VARY

COLOR VARIATIONS MAY OCCUR

UNLESS OTHERWISE SPECIFIED,
DIMENSIONS ARE IN INCHES [mm]
OVERALL CABLE LENGTH TOLERANCE

ALL OTHER DIMENSIONAL TOLERANCES:
X = ± .25 [6]
XX = ± .02 [.51]
XXX = ± .005 [.13]

PROJECTION

45±0.2
9.2±0.1
16.4±0.1

57±0.20
47.5±0.20
8.55±0.15
8.5±0.1
52.6±0.2

L ±100 Cable Length

13.7 -0.2

(37.8)

(48.8)

QSFP28 AOC

72±0.3
18.35±0.1