



## Active Optical Cable Breakout QSFP28 100Gbps to 4x28G SFP28, 10m, MSA Compatible

### Active Optical Cables Technical Data Sheet

**AOCQSP28100-010**

#### Features

- Full-Duplex 4 channel parallel breakout active optical cable, supporting 100 Gbps links
- Up to 28 Gbps Data rate per channel (breakouts)
- Maximum link length of 10m available
- High Reliability 850nm VCSEL technology
- Electrically hot-pluggable

#### Applications

- 100G Ethernet Data Center Intra-Rack and Inter-Rack links
- 25G Ethernet Link Aggregation
- Infiniband QDR
- HPC Interconnects

#### Description

The AOCQSP28100-010 is an active optical breakout cable designed for use in 100Gigabit Ethernet links. The QSFP28 (100Gbps) interface is electrically compliant and mechanically compliant with the SFF-8436. The SFP28 (25Gbps) interface is electrically compliant with SFF-8431 and mechanically compliant with SFF-8432. The AOCQSP28100-010 is utilized in the aggregation of 25Gbps interfaces in a 100Gbps environment.

#### QSFP28+ 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	

#### SFP28+ 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	

#### QSFP28+ 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	-		750	mA	per cable end
Data Rate	BR		25.78125		Gbps	Each channel

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP28 100Gbps to 4x28G SFP28, 10m, MSA Compatible AOCQSP28100-010](#)



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AOCQSP28100-010

SFP28+ 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	-		300	mA	per cable end
Data Rate	BR		25.78		Gbps	

QSFP28+ General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	QSFP28		
Number of Lanes	4 Tx /Rx		
Maximum Aggregate Data Rate	111.8	Gb/s	
Maximum Data Rate per Lane	27.952	Gb/s	
Standard Cable Lengths	3, 5, 7, 10	meters	Other lengths, please contact sales
Protocols Supported	Typical applications include Infiniband, Fiber Channel, 100G Ethernet		
Electrical Interface and Pin-out	38-pin edge connector		Pin-out as defined by the QSFP28 MSA
Standard Optical Cable Type	Multimode ribbon fiber cable assembly, riser-rated		
Maximum Power Consumption per End	2.5	W	
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by the QSFP28 MSA

Note: 100G Ethernet & 100GBASE-SR4 and ITU-T OTU4 has different register setting , not auto-Negotiation

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AOCQSP28100-010

#### SFP28+ General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	SFP+		
Maximum Data Rate	28	Gb/s	
Standard Cable Lengths	3, 5, 7, 10, 50, 100	meters	Other lengths may be available upon request (<= 100m OM3)
Protocols Supported	Typical applications include Infiniband, Fibre Channel, 25G 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

Note:

Low rate is 24~26Gb/s&High rate is 25~28Gb/s, different rate range has different register setting , not auto- Negotiation

#### SFP28+ 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	
<b>Transmitter</b>						
Differential data input swing	V <sub>in,pp</sub>	50		900	mV	1
Single ended input voltage tolerance	V <sub>inT</sub>	-0.3		4.0	V	
<b>Receiver</b>						
Differential data output swing	V <sub>out,pp</sub>	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.

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AOCQSP28100-010

#### QSFP28+ High-speed Electrical Characteristics per Lane

Parameter-Inputs	Symbol	Min	Typ	Max	Unit	NOTE	
<b>Input electrical specifications (per Lane)</b>							
Differential Voltage pk-pk				900	mV		
Common Mode Noise RMS				17.5	mV		
Differential Termination Resistance Mismatch				10	%		
Differential Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 requirements					
Common Mode to Differential conversion and Differential to Common Mode Conversion	SDC22, SCD22					dB	
						dB	
Common Mode Return Loss	SCC22					dB	
Transition Time, 20 to 80%	Tr, Tf	10			ps		
Common Mode Voltage	Vcm	-0.3		2.8	V		
Eye Width at 1E-15 probability	EW15	0.46			UI		
Eye Height at 1E-15 probability	EH15	94			mV		

#### QSFP28+ High-speed Electrical Characteristics per Lane

<b>Output electrical specifications (per Lane)</b>							
Differential Voltage pk-pk				900	mV		
Common Mode Voltage	Vcm	-350		2850	mV		
Common Mode Noise RMS				17.5	mV		
Differential Termination Resistance Mismatch				10	%		
Differential Return Loss	SDD22	Per OIF CEI-28G-VSR and CAUI-4 requirements				dB	
Common Mode to Differential conversion and Differential to Common Mode Conversion	SDC22, SCD22					dB	
						dB	
Common Mode Return Loss	SCC22					dB	
Output Rise and Fall time (20% to 80%)	tRH, tFH	9.5			ps		
Vertical Eye Closure	VEC			5.5	dB		
Eye Width at 1E-15 probability	EW15	0.57			UI		

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AOCQSP28100-010

### Mechanical Specifications

Length 393.7 in [10 m]

### Environmental Specifications

#### QSFP28

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

#### SFP28

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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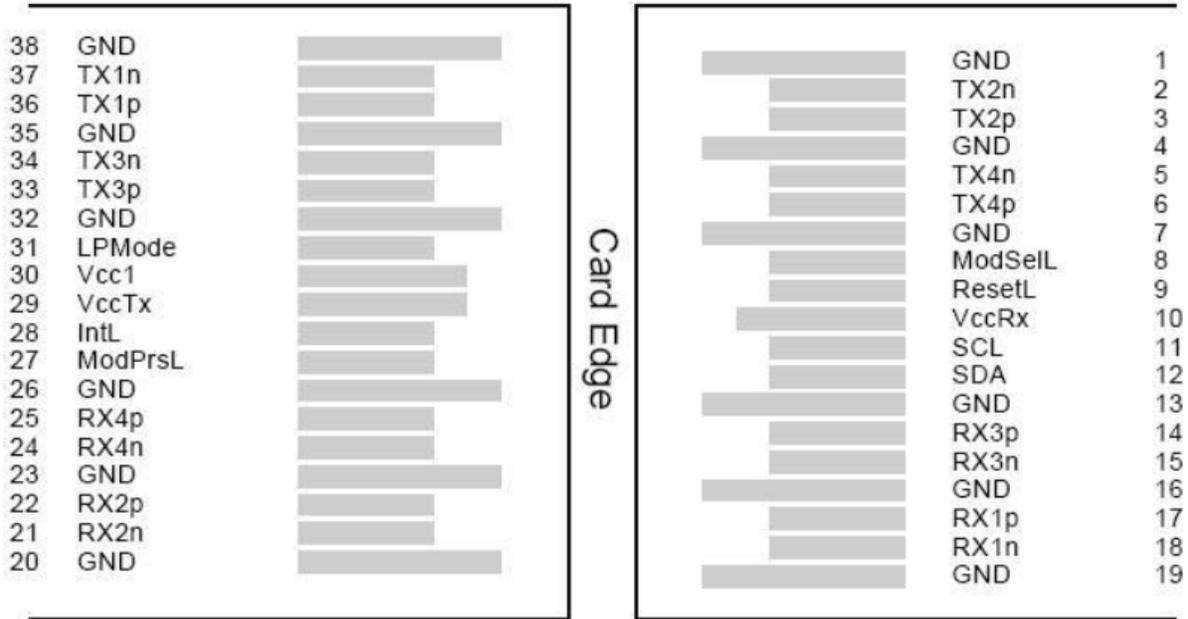


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AOCQSP28100-010

QSFP28+ Pin Assignment



Top Side

Bottom Side

Pin out of Connector Block on Host Board

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### Active Optical Cables Technical Data Sheet

AOCQSP28100-010

#### QSFP28+ 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 QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

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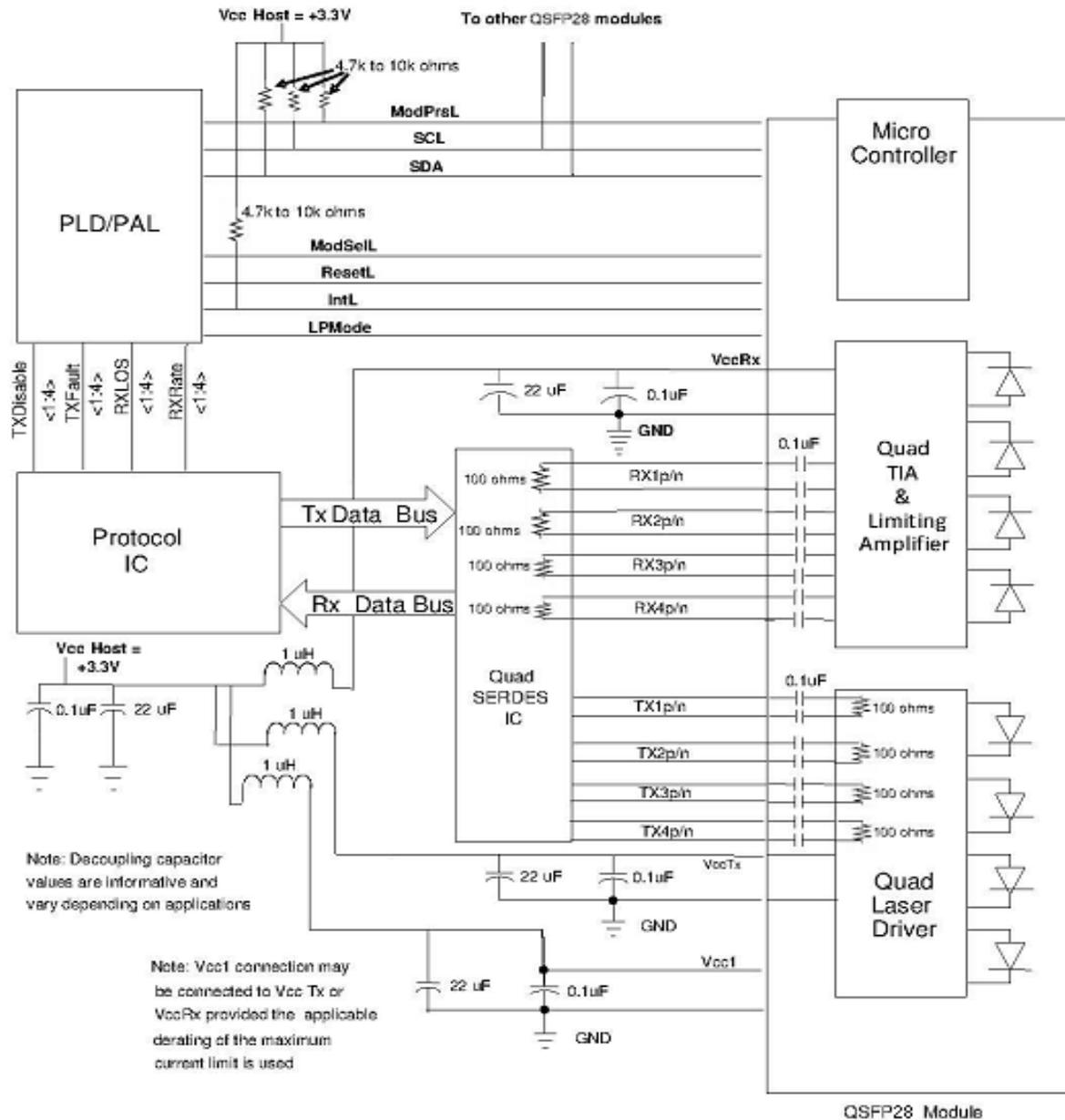


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## QSFP28+ Host - Transceiver Interface Block Diagram



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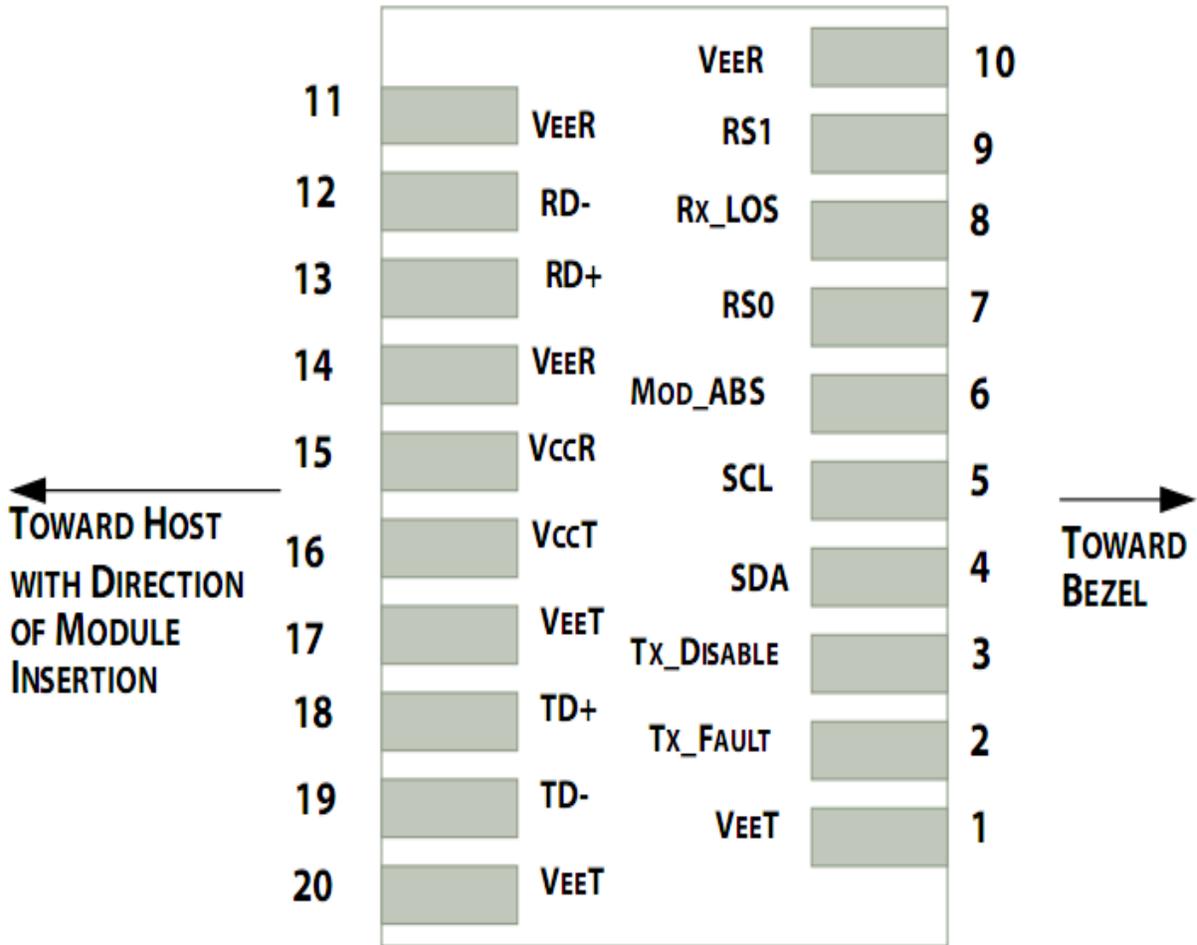


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# SFP28+ Pin Assignment



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AOCQSP28100-010

#### SFP28+ Pin Assignment Table

Pin	Symbol	Name/Description	NOTE
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	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 <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

1. Circuit ground is internally isolated from chassis ground.
2. T<sub>FAULT</sub> 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 V<sub>cc</sub> + 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<sub>DIS</sub> >2.0V or open, enabled on T<sub>DIS</sub> <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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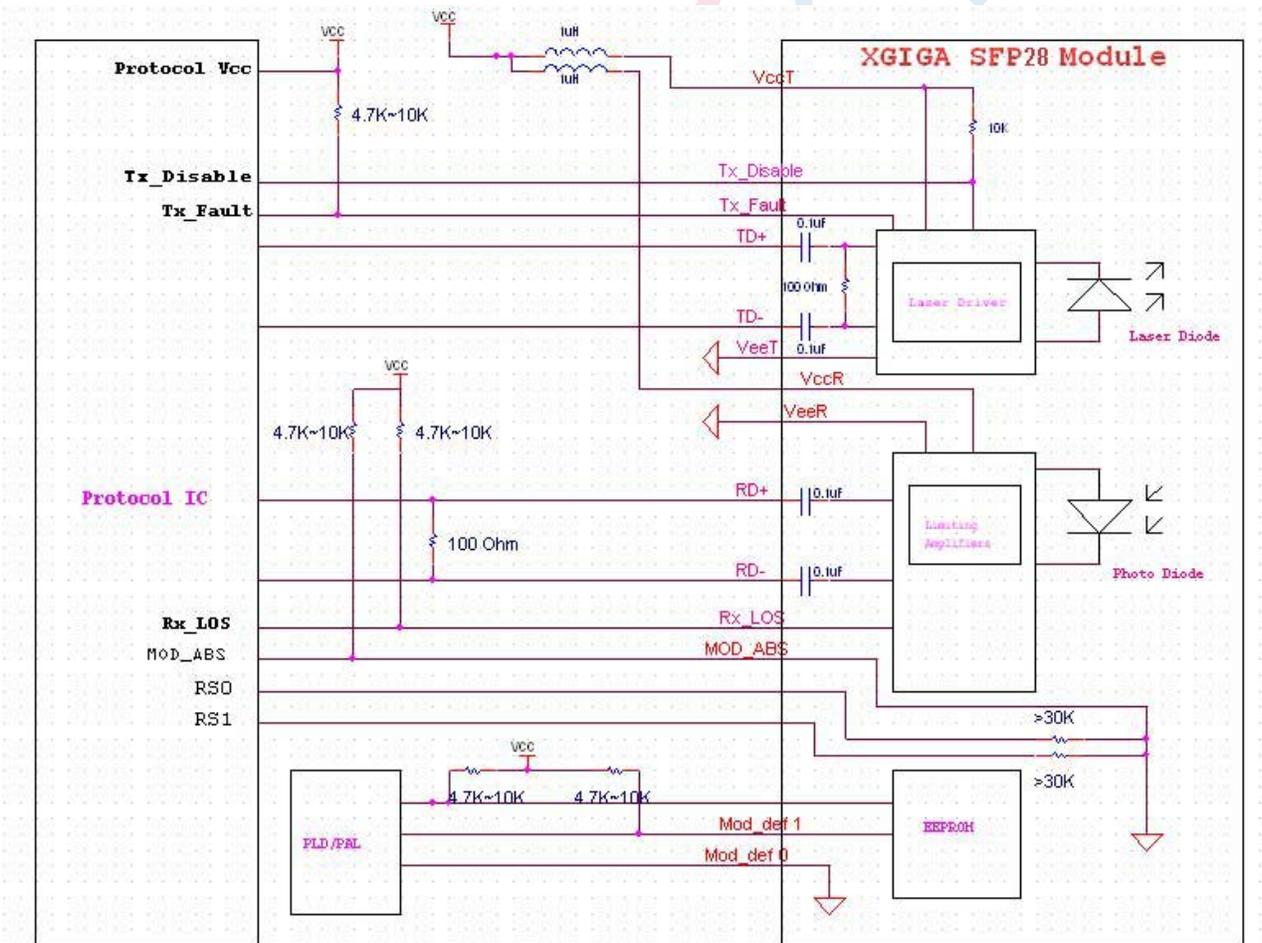


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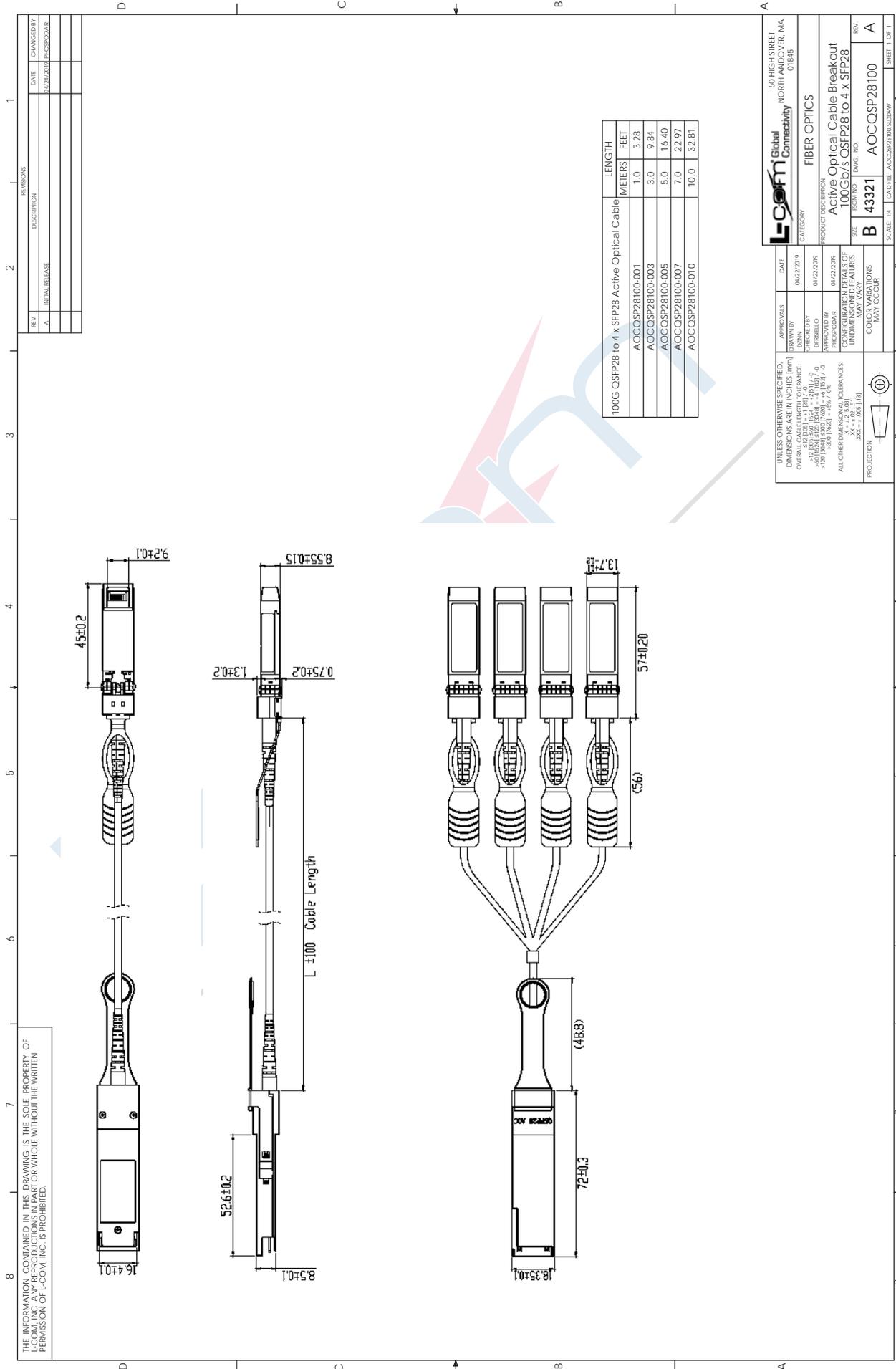
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## SFP28+ Host - Transceiver Interface Block Diagram



# AOCQSP28100-010 CAD Drawing

Active Optical Cable Breakout QSFP28 100Gbps to 4x28G SFP28, 10m, MSA Compatible



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REV. A	INITIAL RELEASE	REVISIONS	DESCRIPTION	DATE	CHANGED BY
				04/22/2019	PHOSPHODAR

APPROVALS	DATE	APPROVALS	DATE
DESIGNED BY	04/22/2019	PHOSPHODAR	04/22/2019
DRAWN BY	04/22/2019	PHOSPHODAR	04/22/2019
CHECKED BY			
ENG'N			
PHOSPHODAR			

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES (mm)	APPROVALS	DATE
OVERALL DIMENSIONS TOLERANCE: ±0.13 (±0.33)	DESIGNED BY	04/22/2019
POSITIONAL DIMENSIONS TOLERANCE: ±0.13 (±0.33)	DRAWN BY	04/22/2019
FORMING DIMENSIONS TOLERANCE: ±0.13 (±0.33)	CHECKED BY	
ALL OTHER DIMENSIONAL TOLERANCES: X ± 0.1 (0.1)	PHOSPHODAR	04/22/2019
Y ± 0.1 (0.1)	PHOSPHODAR	04/22/2019
Z ± 0.1 (0.1)	PHOSPHODAR	04/22/2019
XXX ± 0.1 (0.1)	PHOSPHODAR	04/22/2019

PRODUCT DESCRIPTION	ACTIVE OPTICAL CABLE BREAKOUT 100GB/S QSFP28 TO 4 X SFP28
CATEGORY	FIBER OPTICS
SIZE	B
FIG. NO.	43321
DWG. NO.	AOCQSP28100
REV.	A

50 HIGH STREET  
NORTH ANDOVER, MA 01845

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SCALE 1:1 CAD FILE: AOCQSP28100.DWG SHEET 1 OF 1