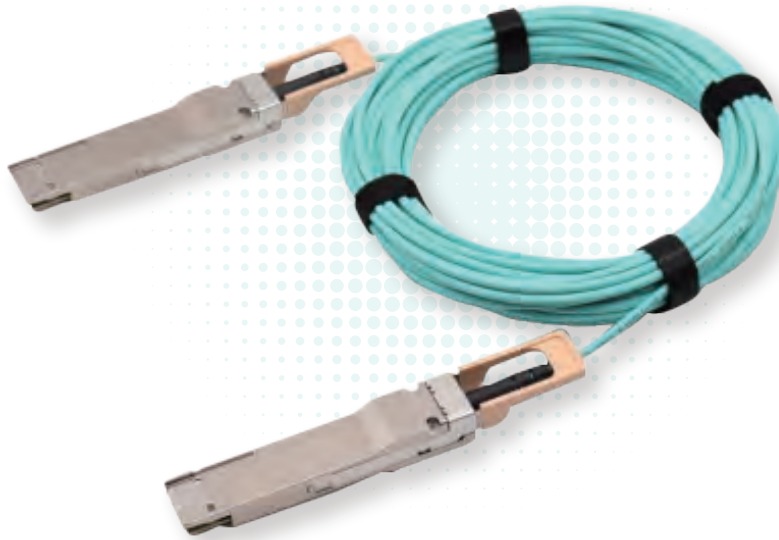


## 400G QSFP-DD Active Optical Cable P/N HSD1-1D1-F5M



### Product Features

Hot-pluggable QSFP-DD form factor

Compliant with electrical interface IEEE 802.3bs

8x53.125Gbps PAM4 400GAUI-8

Up to 50m cable length

Power consumption  $\leq 10W$  at each end

Operating case temperature: 0°C to 70°C

Built-in digital diagnostic functions

3.3V power supply voltage

RoHS compliant

### Applications

- ◆ 400GAUI-8
- ◆ Data center networks

### Cable Specifications

Parameter	Value	Units
Diameter	30±0.2	mm
Minimum bend radius	30	mm
Length tolerance	1m ≤ Length < 5m	+15 / -0 cm
	5m ≤ Length < 15m	+30 / -0 cm
	Length ≥ 15m	+2% / -0 m
Cable color	Aqua(OM3 MMF)	

## Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Supply Voltage	$V_{CC}$	-0.5		3.6	V	
Storage Temperature	$T_s$	-5		75	°C	
Operating Humidity	RH	+5		85	%	Non-condensing

## Recommended Operations Conditions

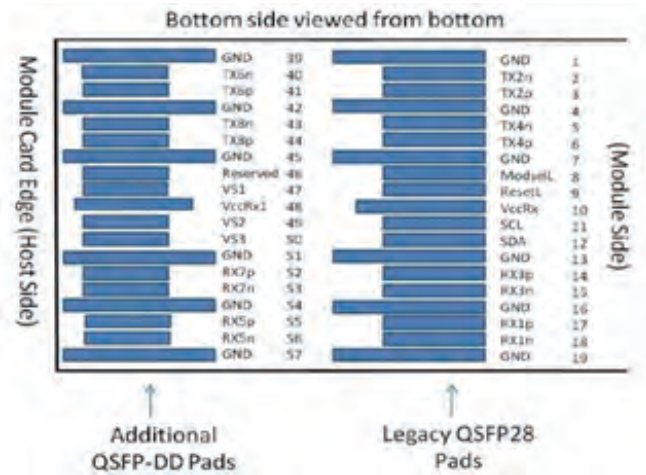
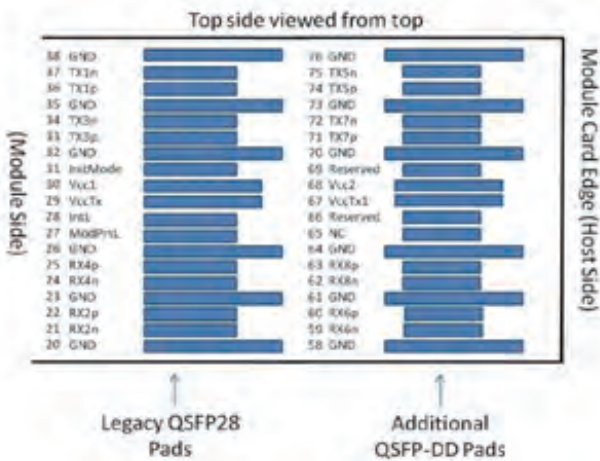
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	$T_{op}$	0		70	°C	
Power Supply Voltage	$V_{CC}$	3.14	3.3	3.47	V	
Power Dissipation	$P_d$			10	W	Each end

## Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>Transmitter</b>						
Differential Data Input Swing	$V_{out,pp}$	900			mV	
Bit Rate (each lane)	BR	26.5625 ± 100ppm			GBd	
Differential termination mismatch				10	%	
Single-ended voltage tolerance range		-0.4		3.3	V	
DC common mode voltage		-350		2850	mV	
<b>Receiver</b>						
Differential Data Output Swing	$V_{in,pp}$			900	mV	
Bit Rate (each lane)	BR	26.5625 ± 100ppm			GBd	1
Differential termination mismatch				10	%	
Near-end ESMW (Eye symmetry mask width)		0.265			UI	
Near-end Eye height, differential (min)		70			mV	
Far-end ESMW (Eye symmetry mask width)		0.2			UI	
Far-end Eye height, differential (min)		30			mV	
Transition time (min, 20% to 80%)		9.5			ps	
DC common mode voltage		-350		2850	mV	
Bit Error Rate	BER			2.4E-4		1

1. PRBS31Q @ 26.5625 GBd PAM4

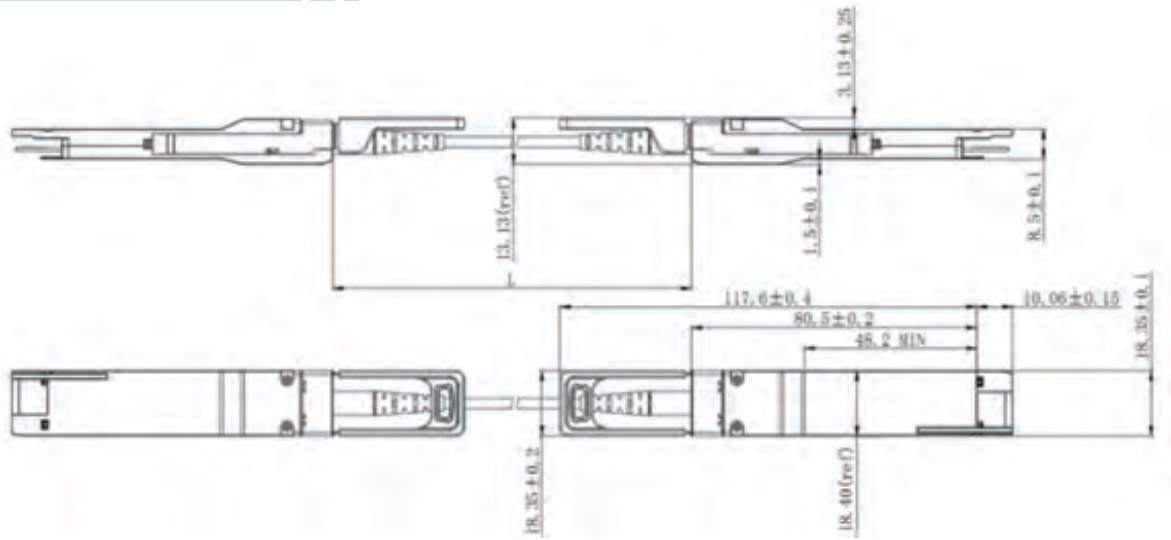
## Electrical Input/Output



PIN	Logic	Symbol	Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Ground	1
8	LVTTTL-I	ModSelL	Module Select	
9	LVTTTL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVCOMS-I/O	SCL	2-wire serial interface clock	
12	LVCOMS-I/O	SDA	2-wire serial interface data	
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Input	
15	CML-O	Rx3n	Receiver Inverted Data Input	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Input	
18	CML-O	Rx1n	Receiver Inverted Data Input	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Input	
22	CML-O	Rx2p	Receiver Non-Inverted Data Input	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Input	
25	CML-O	Rx4p	Receiver Non-Inverted Data Input	
26		GND	Ground	1
27	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		VccTx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTTL-I	InitMode	Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	1

39		GND	Ground	1
40	CML-I	Tx6n	Transmitter Inverted Data Input	
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	
42		GND	Ground	1
43	CML-I	Tx8n	Transmitter Inverted Data Input	
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	
45		GND	Ground	1
46		Reserved	For future use	3
47		VS1	Module Vendor Specific 1	3
48		VccRx1	3.3V Power Supply	2
49		VS2	Module Vendor Specific 2	3
50		VS3	Module Vendor Specific 3	3
51		GND	Ground	1
52	CML-O	Rx7p	Receiver Non-Inverted Data Input	
53	CML-O	Rx7n	Receiver Inverted Data Input	
54		GND	Ground	1
55	CML-O	Rx5p	Receiver Non-Inverted Data Input	
56	CML-O	Rx5n	Receiver Inverted Data Input	
57		GND	Ground	1
58		GND	Ground	1
59	CML-O	Rx6n	Receiver Inverted Data Input	
60	CML-O	Rx6p	Receiver Non-Inverted Data Input	
61		GND	Ground	1
62	CML-O	Rx8n	Receiver Inverted Data Input	
63	CML-O	Rx8p	Receiver Non-Inverted Data Input	
64		GND	Ground	1
65		NC	No Connect	3
66		Reserved	For future use	3
67		VccTx1	3.3V Power Supply	2
68		Vcc2	3.3V Power Supply	2
69		Reserved	For future use	3
70		GND	Ground	1
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input	
72	CML-I	Tx7n	Transmitter Inverted Data Input	
73		GND	Ground	1
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input	
75	CML-I	Tx5n	Transmitter Inverted Data Input	
76		GND	Ground	1

1. Circuit ground is internally isolated from the chassis ground.

**Mechanical Specifications**


Units= mm

**ESD Warning**

This device is susceptible to damage from electrostatic discharge (ESD). A static-free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety**

This is a Class 1 Laser Product as defined by IEC 60825-1:2014. When operated within the limits of this specification, it is considered non-hazardous. Using this product in a manner inconsistent with the specifications and intended usage may result in hazardous radiation exposure.



## Product Label



## Regulatory Certifications

Category	Standard
Radiated Emissions	EMC Directive 2014/30/EU EN 55032 CISPR 32 FCC rules 47 CFR Part 15 ICES-003 VCCI-CISPR 32 AS/NZS CISPR 32
Radiated Immunity	EMC Directive 2014/30/EU EN 55035 CISPR 35 IEC/EN 61000-4-3
RoHS	EU RoHS (2011/65/EU & (EU) 2015/863) & UK RoHS EN IEC 63000:2018 & BS EN IEC 63000:2018
Flammability (PCB)	UL Class 94 V-0

## Ordering Information

Part No.	Data Rate	Wavelength	Cable Length	Case Temperature Range
HSD1-1D1-F5M	425Gbps	850	1m to 50m	0°C to 70°C

*Please specify the cable length when ordering.*

## Notice

SiPhx reserves the right to change product specifications identified in this datasheet without prior notice. The applications described herein are for illustrative purposes only, and SiPhx does not guarantee that the identified products will be suitable for the described applications without further testing and/or modification.

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