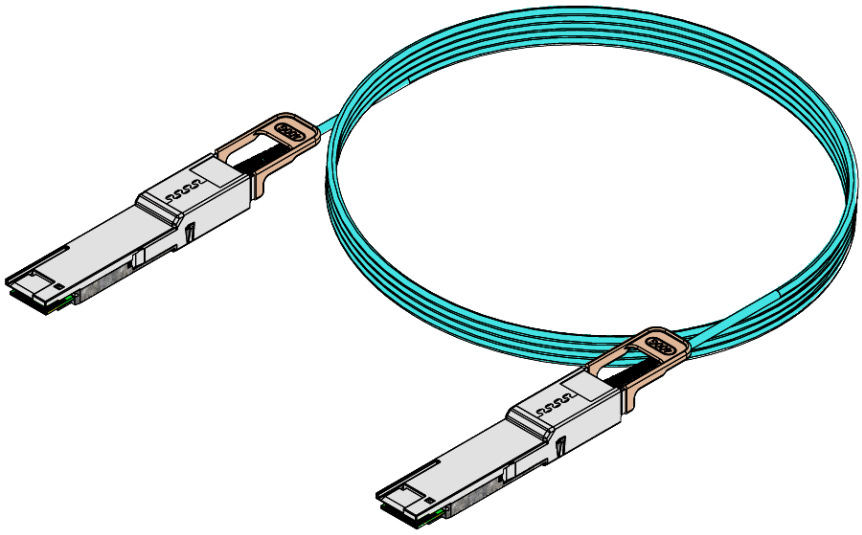
Specification

Quad Small Form-factor Pluggable Double Density
Immersion Active Optical Cable
400G



TQS-R16H8-P8M##

Length (meter)

Ordering Information:

Model Name	TQS-R16H8-P8M##	Note
Voltage	3.3V	
Device type	850nm VCSEL	
Interface	CML/CML	
Temperature	0°C ~+70°C	
Latch Color	Beige	

Features

- Hot-pluggable QSFP-DD form factor
- Transmission data rate up to 53Gbps per channel
- 8 channels full-duplex active optical cable
- 8x53Gbps PAM4 transmitter and receiver
- 8 channels 850nm VCSEL array, PIN photo-detector array
- Max power consumption of 10W per end
- Pre-terminated fiber cable length up to 100m (OM4)
- Built-in digital diagnostic functions, Compliant with CMIS-4
- 0 to 70°C case temperature operating range
- RoHS compliant
- Compatible with immersion cooling liquid

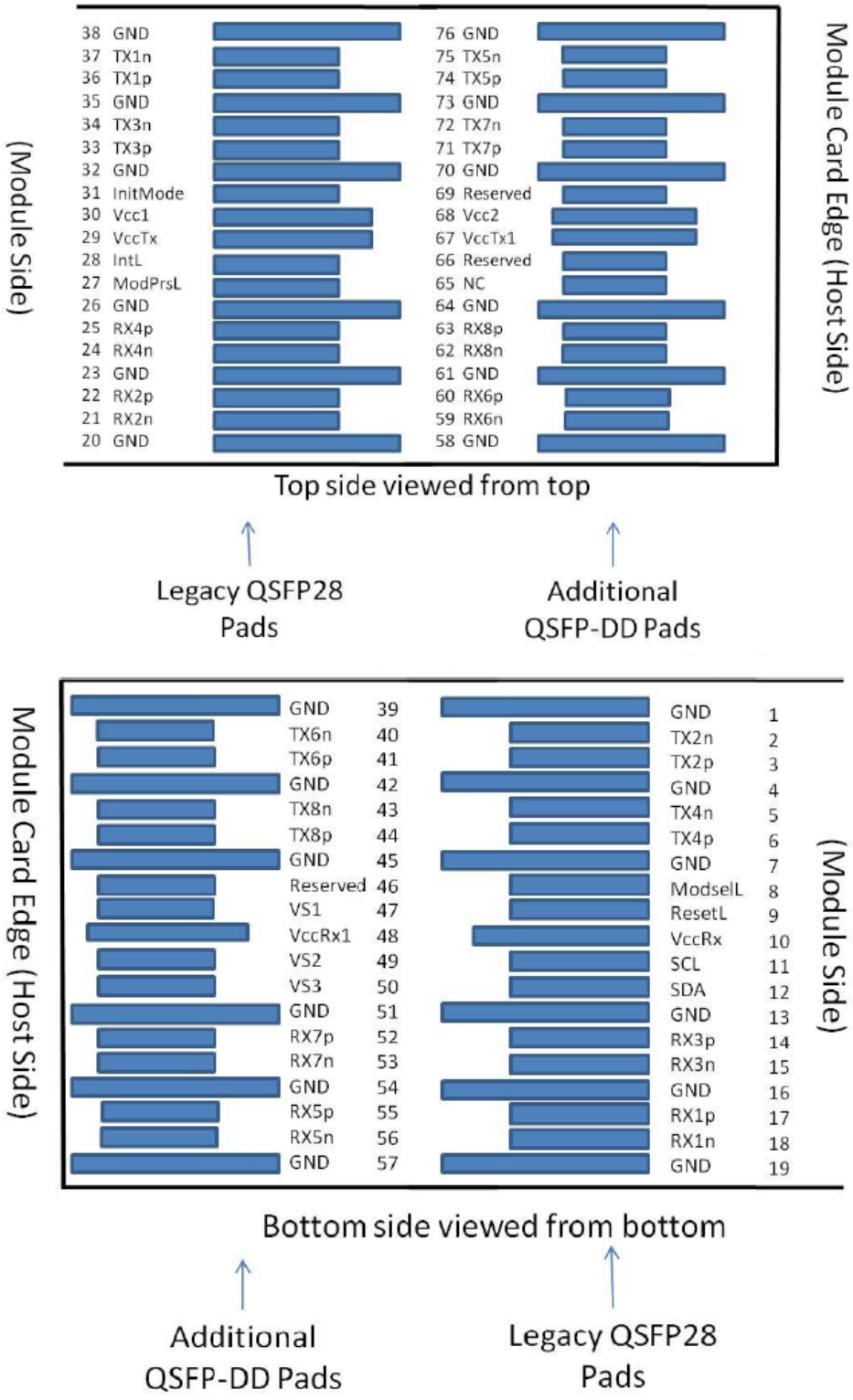
Applications

- 400G Ethernet
- Other Optical Link

Description

TQS-R16H8-P8M## is a hot-pluggable QSFP-DD AOC for 400G links over multimode fiber. It is high performance module for short-range data communication and interconnect application which operate at 400 Gbps. This AOC is designed to operate over multimode fiber systems using a nominal wavelength of 850nm. The electrical interface uses a 76 pins connector

QSFP-DD Module Pad Assignments and Descriptions



Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1B	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3B	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3B	
4		GND	Ground	1B	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3B	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3B	
7		GND	Ground	1B	1
8	LVTTL-I	ModSelL	Module Select	3B	
9	LVTTL-I	ResetL	Module Reset	3B	
10		VccRx	+3.3V Power Supply Receiver	2B	2
11	LVCMOS-I/O	SCL	2-wire serial interface clock	3B	
12	LVCMOS-I/O	SDA	2-wire serial interface data	3B	
13		GND	Ground	1B	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3B	
15	CML-O	Rx3n	Receiver Inverted Data Output	3B	
16		GND	Ground	1B	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3B	
18	CML-O	Rx1n	Receiver Inverted Data Output	3B	
19		GND	Ground	1B	1
20		GND	Ground	1B	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3B	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3B	
23		GND	Ground	1B	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3B	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3B	
26		GND	Ground	1B	1
27	LVTTL-O	ModPrsL	Module Present	3B	
28	LVTTL-O	IntL	Interrupt	3B	
29		VccTx	+3.3V Power supply transmitter	2B	2
30		Vcc1	+3.3V Power supply	2B	2

31	LVTTL-I	InitMode	Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE	3B	
32		GND	Ground	1B	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3B	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3B	
35		GND	Ground	1B	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3B	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3B	
38		GND	Ground	1B	1
39		GND	Ground	1A	1
40	CML-I	Tx6n	Transmitter Inverted Data Input	3A	
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	3A	
42		GND	Ground	1A	1
43	CML-I	Tx8n	Transmitter Inverted Data Input	3A	
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	3A	
45		GND	Ground	1A	1
46		Reserved	For future use	3A	3
47		VS1	Module Vendor Specific 1	3A	3
48		VccRx1	3.3V Power Supply	2A	2
49		VS2	Module Vendor Specific 2	3A	3
50		VS3	Module Vendor Specific 3	3A	3
51		GND	Ground	1A	1
52	CML-O	Rx7p	Receiver Non-Inverted Data Output	3A	
53	CML-O	Rx7n	Receiver Inverted Data Output	3A	
54		GND	Ground	1A	1
55	CML-O	Rx5p	Receiver Non-Inverted Data Output	3A	
56	CML-O	Rx5n	Receiver Inverted Data Output	3A	
57		GND	Ground	1A	1
58		GND	Ground	1A	1
59	CML-O	Rx6n	Receiver Inverted Data Output	3A	
60	CML-O	Rx6p	Receiver Non-Inverted Data Output	3A	
61		GND	Ground	1A	1

62	CML-O	Rx8n	Receiver Inverted Data Output	3A	
63	CML-O	Rx8p	Receiver Non-Inverted Data Output	3A	
64		GND	Ground	1A	1
65		NC	No Connect	3A	3
66		Reserved	For future use	3A	3
67		VccTx1	3.3V Power Supply	2A	2
68		Vcc2	3.3V Power Supply	2A	2
69		Reserved	For Future Use	3A	3
70		GND	Ground	1A	1
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input	3A	
72	CML-I	Tx7n	Transmitter Inverted Data Input	3A	
73		GND	Ground	1A	1
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input	3A	
75	CML-I	Tx5n	Transmitter Inverted Data Input	3A	
76		GND	Ground	1A	1

Notes:

1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common within the QSFP-DD 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, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 shall be applied concurrently. Requirements defined for the host side of the Host Card Edge Connector are listed in Table 6. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000 mA.

3. All Vendor Specific, Reserved and No Connect pins may be terminated with 50 ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and Reserved pads shall have an impedance to GND that is greater than 10 kOhms and less than 100 pF.

4. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 1A, 2A, 3A, 1B, 2B, 3B. (see above Figure for pad locations) Contact sequence A will make, then break contact with additional QSFP-DD pads. Sequence 1A, 1B will t

Absolute Maximum Ratings

Not necessarily be applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

Parameter	Min	Typical	Max	Unit	Note
Storage Temperature	-40		85	ºC	
Supply Voltage	-0.4		3.6	V	
Humidity (Non-condensing)	5		85	%	
Storage Humidity	5		85	%	

Recommended Operating Conditions

Parameter	Min	Typical	Max	Unit	Note
Supply Voltage	3.135	3.3	3.465	V	
Operating Case temperature	0	55	70	ºC	
Total Power Consumption per end			10	W	
Supply Current per end			2750	mA	
Bit Rate	425			Gbps	

Electrical Specifications

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

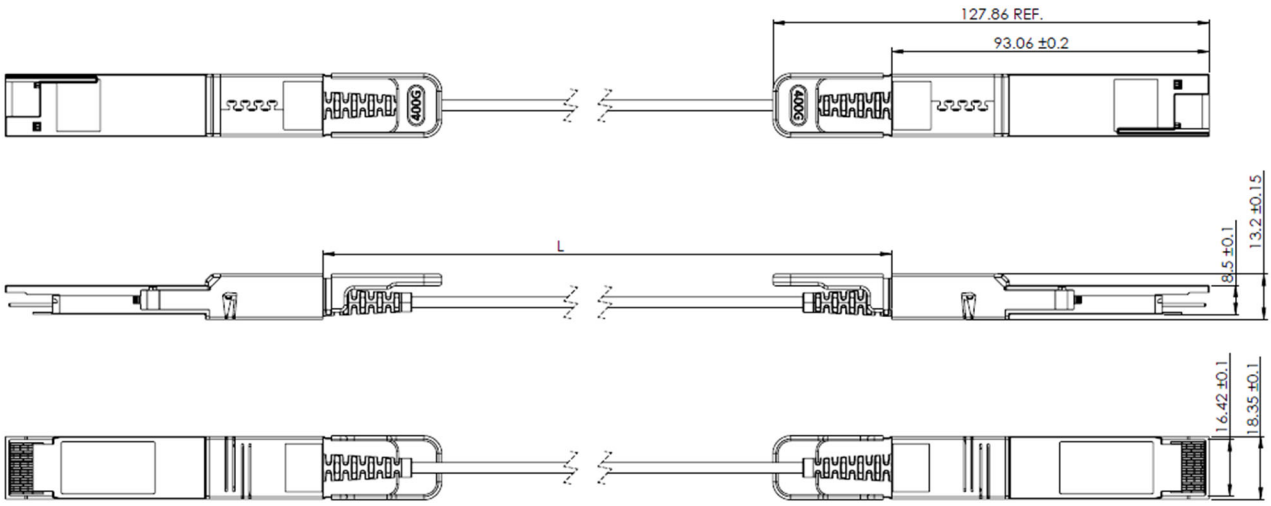
Parameter	Min	Typical	Max	Unit	Note
Pre FEC Bit Error Ratio			2.4E-4		
Post FEC Bit Error Ratio			1E-12		
Transmitter (each lane)					
Differential pk-pk Input Voltage tolerance	400		900	mV	
Differential Termination Mismatch			10	%	
Eye height	10			mV	
Common-mode to differential-mode return loss	IEEE802.3ck Equation (120G–1)			dB	
Vertical eye closure			12	dB	
Effective return loss	7.3			dB	
Transition Time	10			ps	
Receiver (each Lane)					
Differential data output swing			900	mVpp	
Differential termination mismatch			10	%	
Eye height	15			mV	
Vertical eye closure			12	dB	
Common-mode to differential-mode return loss	IEEE802.3ck Equation (120G–1)			dB	
Effective return loss	8.5			dB	
Transition time	8.5			ps	

Note:

1. RMS spectral width is the standard deviation of the spectrum.
2. Even if the TDECQ < 1.5 dB, the OMA (min) must exceed this value.

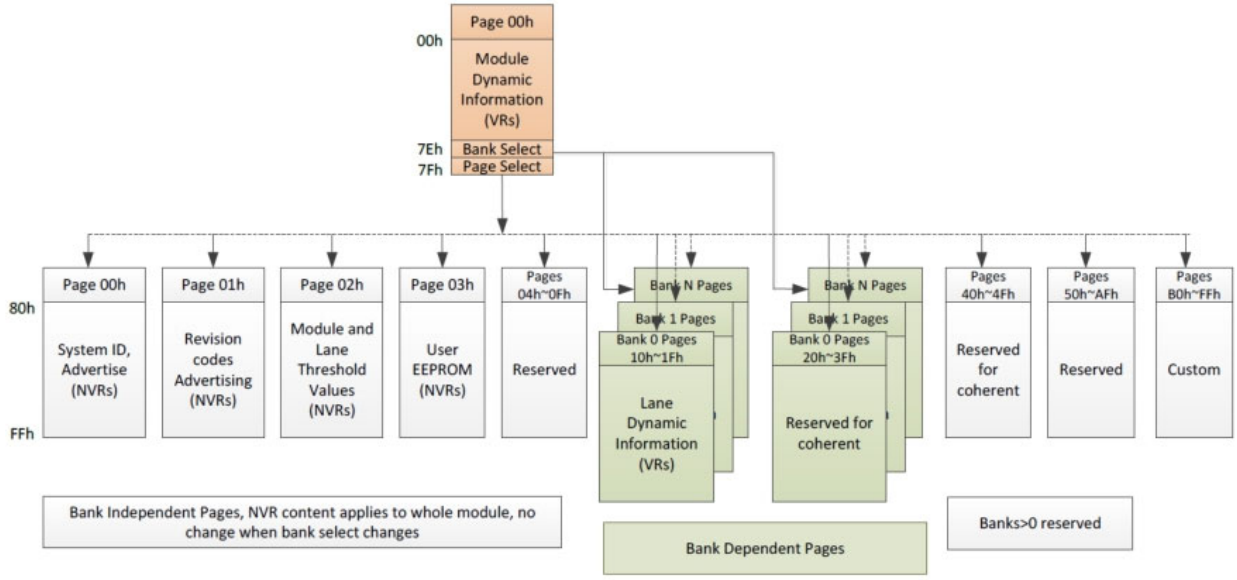
Module Outline

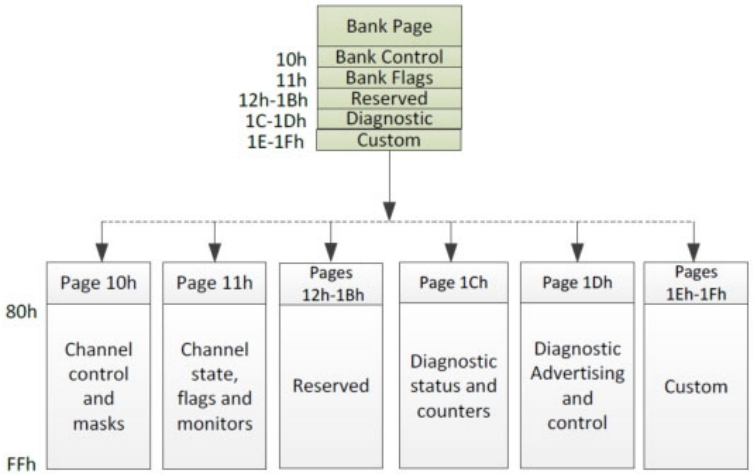
(Unit: mm)



Memory Map

The memory map is structured as a single address and multiple page approaches, according to the QSFP DD rev.3.0 specification as shown in the below (CMIS-4). For more detailed description of this memory map or lower pages, please see our Memory Map document with flexible customization settings.





ESD

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

Laser Safety

This is a Class 1M Laser Product according to IEC/EN60825-1:2014 (Third Edition). This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 56, MAY 8, 2019

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Attention: L'utilisation de commandes ou de réglages ou l'exécution de procédures autres que celles spécifiées dans le document peut entraîner une exposition à des radiations dangereuses.

Contact Information

Formerica OptoElectronics Inc.
5F-11, No.38, Taiyuan St., Zhubei City,
Hsinchu County 30265, Taiwan
Tel: +886-3-5600286 Fax: +886-3-5600239

inquiry@formericaoe.com
www.formericaoe.com

Revision History

Date	Version	Description
03/20/2024	1.0	Initial Release