

CSMQDDQGC3110**400 Gbps QSFP-DD LR4 10 km Optical Transceiver Module****Description**

This product is a 400 Gbps QSFP-DD optical module designed for 10 km optical communication applications. The module converts 8 channels of 50Gb/s (PAM4) electrical input data to 4 channels of CWDM optical signals and multiplexes them into a single channel for 400 Gbps optical transmission. On the receiver side, the module optically de-multiplexes a 400 Gbps optical input into 4 channels of CWDM optical signals and converts them to 8 channels of 50 Gbps (PAM4) electrical output data.

The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid defined in ITU-T G.694.2. Host FEC is required to support up to 10 km fiber transmission.

Features

- Compliant with QSFP-DD MSA
- Compliant with 100G Lambda MSA 400G-LR4 Specification
- Compliant with CMIS 5.0
- Compliant with IEEE Std 802.3bs
- 8 × 53.125 Gbps Electrical Interface (400GAUI-8)
- Cooled EML laser with CWDM wavelength
- Up to 10 km Transmission over Single-Mode Fiber (SMF) with FEC
- Single +3.3 V Power Supply
- Case Temperature Range: 0 °C to +70 °C
- Maximum Power Consumption 12 W
- Duplex LC connector
- RoHS Compliant

Applications

- 400GBASE-LR4 Ethernet
- Data Center Interconnect
- Enterprise Networking

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature Range	Tstg	-40	+85	°C
Supply Voltage	V _{CC}	0	+4	V
Relative Humidity	RH	10 to 90 Non-Condensing		%

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating Case Temperature	T _{case}	0	+70	°C
Supply Voltage	V _{CC}	3.14	3.46	V
Power Consumption	PDISS		12	W
Pre-FEC Bit Error Ratio			2.4 x 10 ⁻⁴	
Link Distance	2		10,000	m

Electrical Specifications

Parameter	Min	Typical	Max	Unit	Notes
Receiver Electrical Output Characteristics at TP4					
Signaling Rate per Lane		26.5625		GBd	
AC common-mode output voltage(RMS)			17.5	mV	
Differential peak-to-peak output voltage			900	mV	
Near-end ESMW (Eye symmetry mask width)		0.265		UI	
Near-end Eye height, differential	70			mV	
Near-end vertical eye closure			7.5	dB	
Far-end ESMW (Eye symmetry mask width)		0.2		UI	
Far-end Eye height, differential	30			mV	
Far-end vertical eye closure			7.5	dB	
Far-end pre-cursor ISI ratio	-4.5		2.5	%	
Common mode to differential conversion return loss	IEEE 802.3 Equation (83E-3)			dB	
Differential Output Return Loss	IEEE 802.3 Equation (83E-2)			dB	
Differential Termination Mismatch			10	%	
Transition Time (Min., 20% to 80%)		9.5		ps	
DC Common-Mode Voltage	-350		2850	mV	

Transmitter Electrical Input Characteristics at TP1					
Signaling rate, per lane		26.5625		GBd	
Differential peak-to-peak input voltage tolerance	900			mV	
Differential input return loss	IEEE 802.3 Equation (83E-5)				
Common-Mode to Differential-Mode Conversion Return Loss	IEEE 802.3 Equation (83E-6)			dB	
AC common-mode output voltage(RMS)			17.5	mV	
Single-ended voltage tolerance range	-0.4		3.3	V	
Module stressed input	IEEE 802.3 Section 120E.3.4.1				
Differential Termination Mismatch			10	%	
DC common mode voltage	-350		2850	mV	

Optical Specifications

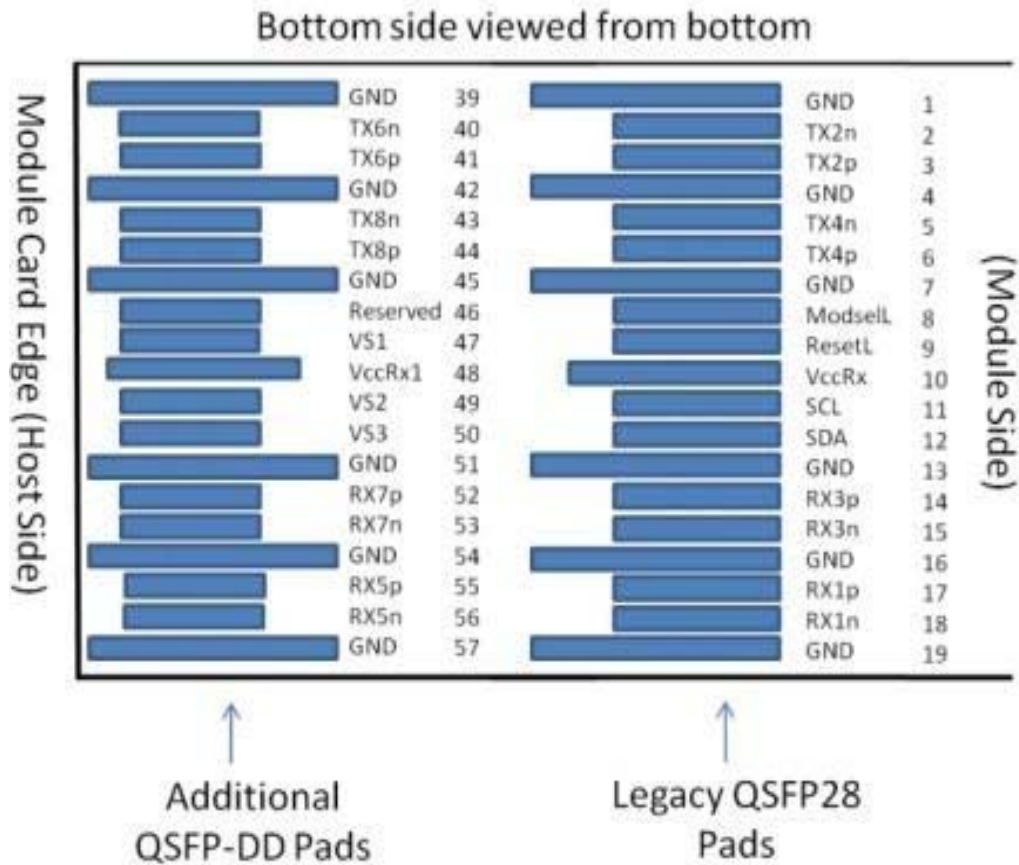
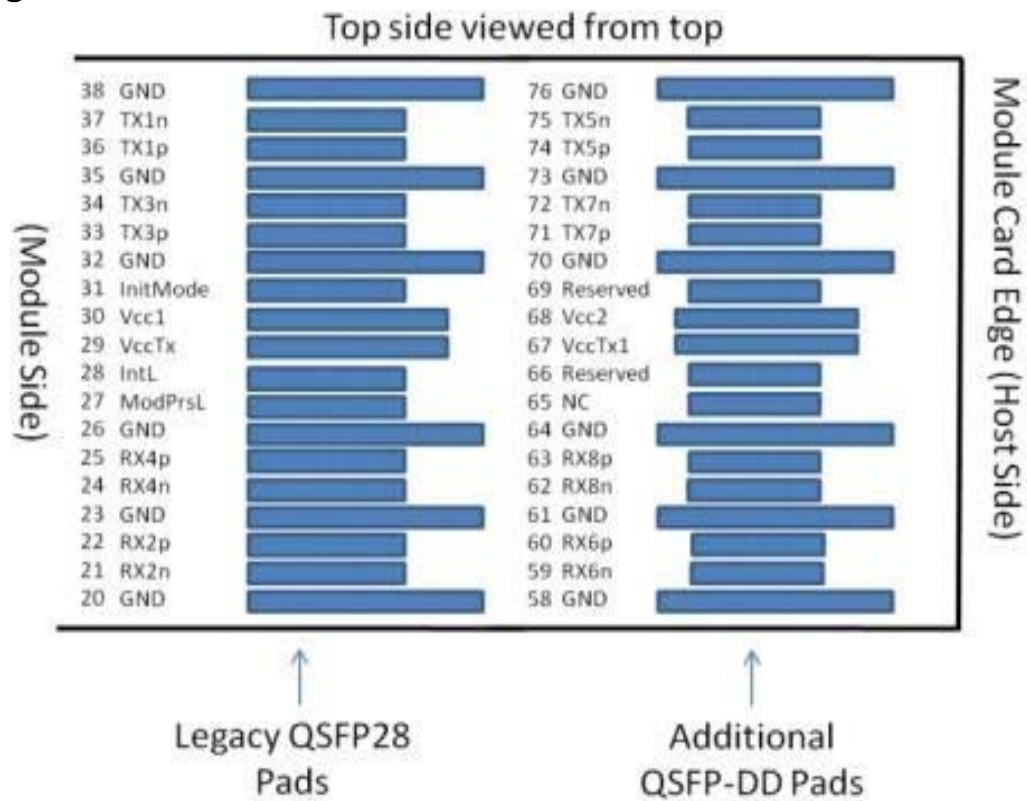
Parameter	Lane	Min	Typical	Max	Unit
Transmitter					
Lane Wavelength Range	Lane 0	1264.5	1271	1277.5	nm
	Lane 1	1284.5	1291	1297.5	nm
	Lane 2	1304.5	1311	1317.5	nm
	Lane 3	1324.5	1331	1337.5	nm
Signaling Rate per Lane			53.125		GBd
Average Launch Power per Lane		-2.7		5.1	dBm
Total Average Launch Power				11.1	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane for TDECQ<1.4 dB		0.3		4.4	
for 1.4 dB ≤ TDECQ ≤ 3.9 dB		-1.1 + TDECQ			
Difference in launch power between any two lanes (OMA _{outer})				4	dB
Average Launch Power per Lane at TX Off State				-16	dBm
Transmitter Eye Closure for PAM4 (TECQ), Each Lane				3.9	dB
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), Each Lane				3.9	dB
TDECQ - TECQ				2.5	dB
Extinction Ratio		3.5			dB
Relative Intensity Noise (OMA)				-136	dB/Hz
Side-Mode Suppression Ratio (SMSR)		30			dB
Optical Return Loss Tolerance				15.6	dB
Transmitter Reflectance				-26	dB
Transmitter Over/Undershoot				25	%
Transmitter Peak-to-Peak Power				5.2	dBm
Transmitter Transition Time				17	ps

Receiver					
Lane Wavelength Range	Lane 0	1264.5	1271	1277.5	nm
	Lane 1	1284.5	1291	1297.5	nm
	Lane 2	1304.5	1311	1317.5	nm
	Lane 3	1324.5	1331	1337.5	nm
Signaling Rate per Lane			53.125		GBd
Damage Threshold		6.1			dBm
Average Receive Power, Each Lane		-9		5.1	dBm
Receiver Power, each lane (OMA)				4.4	dBm
Receiver Reflectance				-26	dB
Difference in Receive Power between Any Two Lanes (OMOuter)				4.3	dBm
Receiver Sensitivity, Each Lane (OMOuter)					
for TECQ < 1.4 dB				-6.8	dBm
for 1.4 dB ≤ TECQ ≤ 3.9 dB				- 8. 2 +TECQ	
Stressed Receiver Sensitivity (OMOuter), each				-4.3	dBm
Stressed Conditions for Stressed Receiver Sensitivity					
Stressed Eye Closure for PAM4 (SECQ), Lane under Test			3.9		dB
OMOuter of each Aggressor Lane			-0.4		dBm
RX_LOS_Assert Min/Max		-20			dBm
RX_LOS_De-Assert Min/Max				-12.2	dBm
RX_LOS_Hysteresis		0.5			dB

Digital Diagnostic Specifications

Parameters	Specification	Unit
Temperature Monitor Absolute Error	± 3	°C
Supply Voltage Monitor absolute error	± 5	%
I_bias Monitor absolute error	± 10	%
Received Power (Rx) Monitor absolute error	± 3.0	dB
Transmit Power (Tx) Monitor absolute error	± 3.0	dB

Pin Diagram



QSFP-DD Pad Assignment Top View

Pin Definitions

Pin	Symbol	Description	Note
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	+3.3 V Power Supply Receiver	2
11	SCL	2-Wire Serial Interface Clock	
12	SDA	2-Wire Serial Interface Data	
13	GND	Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	VccTx	+3.3 V power supply transmitter	2
30	Vcc1	+3.3 V power supply	2
31	InitMode	Initialization Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

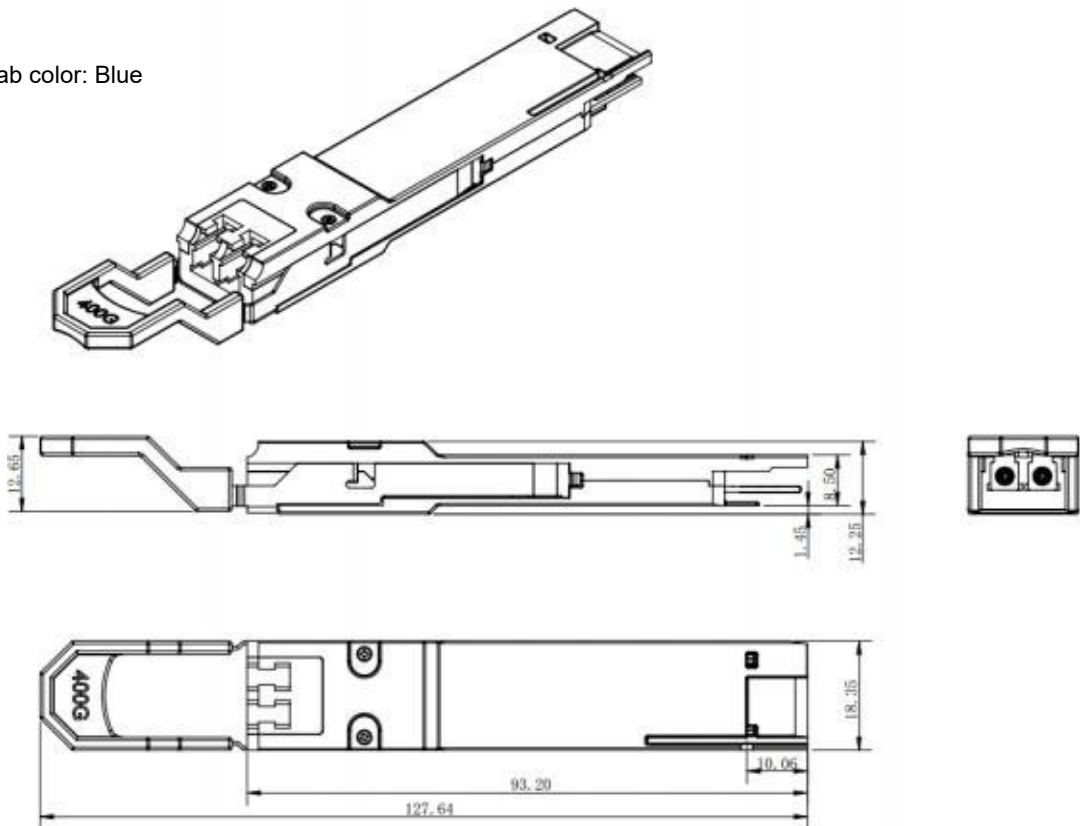
39	GND	Ground	1
40	Tx6n	Transmitter Inverted Data Input	
41	Tx6p	Transmitter Non-Inverted Data Input	
42	GND	Ground	1
43	Tx8n	Transmitter Inverted Data Input	
44	Tx8p	Transmitter Non-Inverted Data Input	
45	GND	Ground	1
46	Reserved	For Future Use	3
47	VS1	Module Vendor Specific 1	3
48	VccRx1	+3.3 V Power Supply	2
49	VS2	Module Vendor Specific 2	3
50	VS3	Module Vendor Specific 3	3
51	GND	Ground	1
52	Rx7p	Receiver Non-Inverted Data Output	
53	Rx7n	Receiver Inverted Data Output	
54	GND	Ground	1
55	Rx5p	Receiver Non-Inverted Data Output	
56	Rx5n	Receiver Inverted Data Output	
57	GND	Ground	1
58	GND	Ground	1
59	Rx6n	Receiver Inverted Data Output	
60	Rx6p	Receiver Non-Inverted Data Output	
61	GND	Ground	1
62	Rx8n	Receiver Inverted Data Output	
63	Rx8p	Receiver Non-Inverted Data Output	
64	GND	Ground	1
65	NC	No Connect	3
66	Reserved	For Future Use	3
67	VccTx1	+3.3 V power supply	2
68	Vcc2	+3.3 V power supply	2
69	Reserved	For Future Use	3
70	GND	Ground	1
71	Tx7p	Transmitter Non-Inverted Data Input	
72	Tx7n	Transmitter Inverted Data Input	
73	GND	Ground	1
74	Tx5p	Transmitter Non-Inverted Data Input	
75	Tx5n	Transmitter Inverted Data Input	
76	GND	Ground	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. Vcc contacts may be internally connected within the module in any combination. Each connector Vcc contact is rated for a steady-state current of 1000 mA.
3. Vendor Specific, Reserved, and No Connect pins are reserved for future use or vendor-specific functions. Pad 65 (No Connect) shall be left unconnected within the module.

Mechanical Specifications

Pull tab color: Blue



Unit: mm

Ordering Information

Part Number	Product Description
CSMQDDQGC3110	QSFP-DD, 400G, LR4, 10 km, 0 °C to +70 °C, with FEC

For More Information

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