TSDL4-E11MD4C Optical Transceiver

QSFP-DD 400G FR4 Transceiver, With Diagnostic Monitoring
Duplex QSFP-DD 2km Transceiver

Features

- Hot-pluggable QSFP-DD form factor
- 4 CWDM lanes MUX/DEMUX design
- Duplex LC connector
- Compliant to QSFP-DD MSA
- 100G Lambda MSA 400G-FR4 Specification compliant
- Data Rate 106.25Gbps PAM4 per lane
- 8x53.125Gb/s electrical interface (400GAUI-8)
- Up to 2km transmission on single mode fiber (SMF) with FEC
- Digital diagnostics functions are available via the I2C interface
- Single 3.3V Power Supply and Power Dissipation < 10W
- Operating Case Temperature: 0°C~+70°C
- RoHS compliant

Applications

- 400G Ethernet
- Infiniband Interconnect
- Data center
- Enterprise Networking

Production Description

This product is a 400Gb/s Quad Small Form Factor Pluggable-double density (QSFP-DD) optical module designed for 2km 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 400Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 400Gb/s optical input into 4 channels of CWDM optical signals, and converts them to 8 channels of 50Gb/s (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. It contains a duplex LC connector for the optical interface and a 76-pin connector for the electrical interface. To minimize the optical dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module. Host FEC is required to support up to 2km fiber transmission

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The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP-DD Multi- Source Agreement (MSA) Type 2. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Absolute Maximum Rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	VCC	-0.5	+3.6	V
Storage Temperature	Tc	-40	+85	°C
Relative Humidity	RH	0	85	%

Recommended Operating Environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameter	Symbol	Min.	Typical	Max	Unit
Power Supply Voltage	VCC	3.135	3.30	3.465	V
Operating Case Temperature	T_{Ca}	0		70	°C

Electrical Characteristics

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

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Data Rate per lane	DR	53.125±100ppm			Gbd	
Transmitter						
Input differential impedance	Rin	90	100	110	Ω	
Differential Input Voltage swing	Vin	900	-	1100	mVp-p	
Receiver						
Differential Output Swing	Vout	-	-	900	mVp-p	
Output differential impedance	Rout	90	100	110	Ω	

Optical Characteristics

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

Parameter		Symbol	Min.	Typical	Max	Unit	Notes
Transmitter							
Center Wavelength	Ch0	λ0	1264.5	1271	1277.5	nm	
	Ch1	λ1	1284.5	1291	1297.5		
	Ch2	λ2	1304.5	1311	1317.5		
	Ch3	λ3	1324.5	1331	1337.5		
Data rate, each lane			53.125±100ppm			GBd	
Side-mode Suppression Ratio		SMSR	30			dB	
Average Optical Power, per lane		Po	-3.3	-	3.5	dBm	1
Extinction Ratio		ER	3.5	-	-	dBm	
Transmitter and Dispersion Eye Closure		TDECQ			3.4	dB	
Optical Return Loss Tolerance		ORL	-	-	17.1	dB	
Receiver							
Center Wavelength	Ch0	λ0	1264.5	1271	1277.5	nm	
	Ch1	λ1	1284.5	1291	1297.5		
	Ch2	λ2	1304.5	1311	1317.5		
	Ch3	λ3	1324.5	1331	1337.5		
Data rate, each lane			53.125±100ppm			GBd	
Average Receive power ,each lane			-7.3		3.5	dBm	
Receive power (OMAouter), each lane					3.7	dBm	
Receiver sensitivity (OMAouter), each lane					-4.6	dBm	2
LOS Asserted		Lsa	-20	-	-	dBm	
LOS De-Asserted		Lda	-	-	-10.3	dBm	
LOS Hysteresis		Lh	0.5	-	-	dB	

Note:

[1] Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.

[2] Measured with conformance test signal at TP3 for BER = 2.4E-4 Pre-FEC

Qsfp-Dd Transceiver Electrical Pad Layout

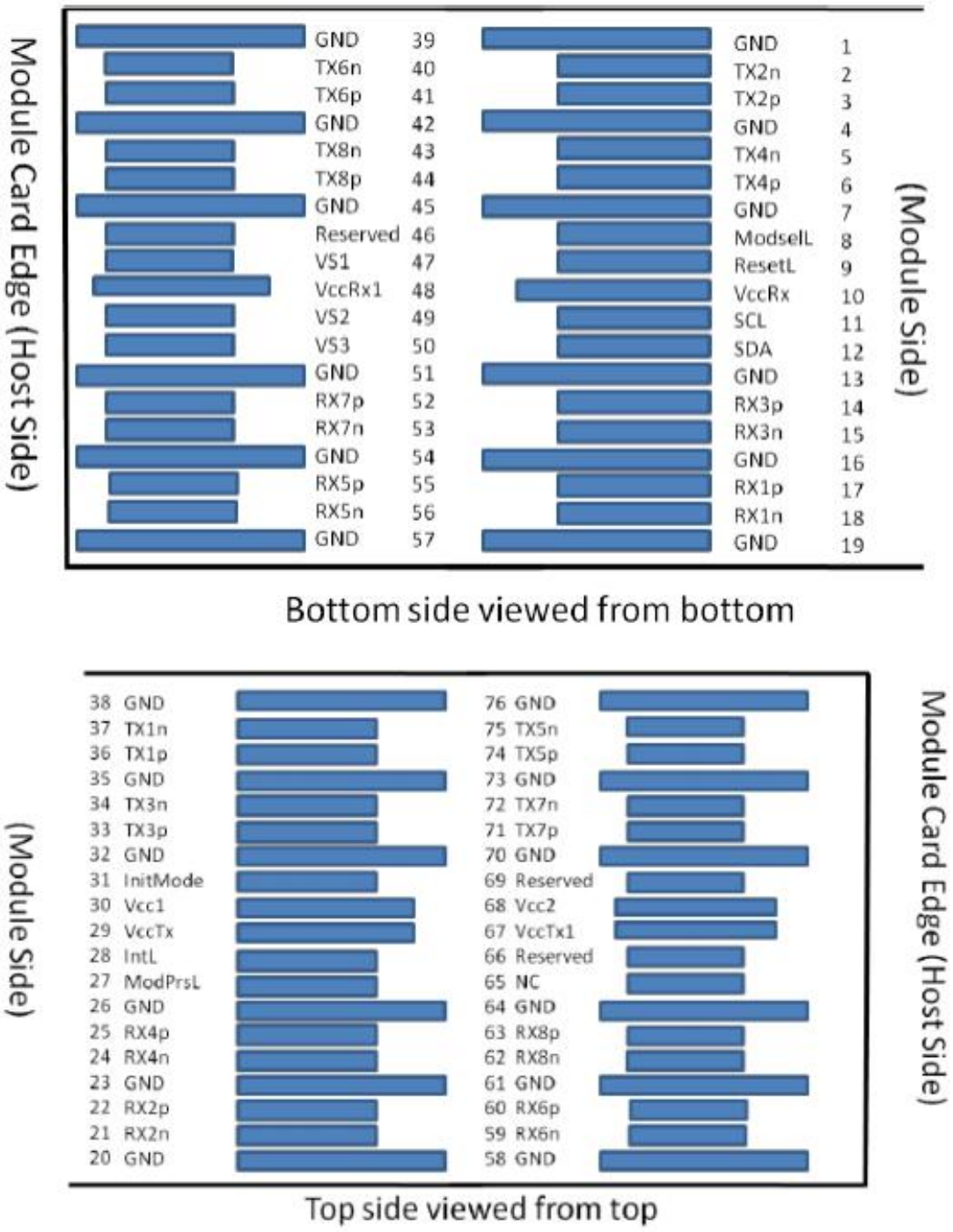

Figure 1 – QSFP-DD -compliant 76-pin connector (per QSFP-DD MSA)

Pin Definition

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

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

Ordering Information

Part Number	Product Description
TSDL4-E11MD4C	400Gbps QSFP-DD FR4 Transceiver, Up to 2Km transmission on single mode fiber (SMF) with FEC, 0°C ~ +70°C

Important Notice

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