400Gb/s QSFP-DD 1310nm DR4 500m Optical Transceiver

Features

- QSFP-DD MSA compliant
- Four Parallel 1310nm Optical Lanes
- IEEE 802.3bs 400GBASE-DR4 Specification Compliant
- Compliant with RoHS Requirement
- Up to 500m Transmission on Single Mode Fiber (SMF) with FEC
- 8x53.125Gb/s Electrical Interface (400GAUI-8)
- Data Rate 4*106.25Gbps(PAM4) Optical Interface
- Case Temperature Range: 0 to70°C
- Maximum Power Consumption10.5W
- MPO-12 Connector
- Built-in Digital Diagnostic Functions
- Laser Safety Class 1

Applications

- 400G Ethernet
- Data center Enterprise networking

Absolute Maximum Ratings

Table1-Absolute Maximum Ratings

Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Storage Temperature	TSTG	-40		85	ºC	
Operating Relative Humidity (non-condensing)	RH	0		85	%	
Supply Voltage	VCC	-0.5		3.6	V	
Damage Threshold,each Lane	TH_d	5.5			dBm	

Recommended Operating Conditions

Table2-Recommended Operating Conditions

Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Case temperature	T_{case}	0		70	℃	
Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate Accuracy		-100		100	ppm	
Data Rate, each lane			26.5625		GBd	PAM4
Pre-FEC Bit Error Ratio				2.4E-4		
Post-FEC Bit Error Ratio				1E-12		1
Link Distance	D	2		500	m	2

Notes:

[1] EC provided by host system.

[2] FEC required on host system to support maximum transmission distance.

Electrical Characteristic

Table3-Electrical Characteristic

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply current	I_{cc}			3.18	A	
Power Consumption				10.5	W	
Transmitter						
Signaling Rate, each Lane	TP1	26.5625 ± 100 ppm			GBd	
Data Input Swing Differential/TX	mV	85		1600		
Data Differential Impedance	Ω	90	100	110	%	
Receiver						
Signaling Rate, each lane	TP4	26.5625 ± 100 ppm			GBd	

Data Output Swing Differential/RX	mV			900	mVpp	
Data Differential Impedance	Ω	90	100	110		

Optical Characteristics

Table4- Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Center Wavelength	λc	1304.5	1310	1317.5	nm	
Transmitter						
Data Rate, each Lane		53.125±100ppm			GBd	
Modulation Format		PAM4				
Side-mode Suppression Ratio	SMSR	30			dB	
Average Launch Power, each Lane	P_{AVG}	-2.4		4	dBm	1
Outer Optical Modulation Amplitude (OMA_{outer}), each Lane	P_{OMA}	-0.8		4.2	dBm	2
Launch Power in OMA_{outer} minus TDECQ, each Lane(min)	dBm	-2.2				
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each lane (max)	TDECQ			3.4	dB	3
Average Launch Power of OFF Transmitter, each lane (max)				-15	dBm	
Extinction Ratio, each lane (min)	ER	3.5			dB	
Optical Return Loss Tolerance (max)				21.4	dB	
RIN21.40MA(max)	RIN			-136	dB/Hz	
Transmitter Reflectance (max)				26	dB	
Receiver						
Data Rate, each Lane		53.125 ± 100 ppm			GBd	
Modulation Format		PAM4				
Damage Threshold, each	TH_d	5			dBm	4

Lane						
Average Receive Power, each Lane		-6.4		4.0	dBm	5
Receive Power (OMA_{outer}), each Lane				4.2	dBm	
Receiver Reflectance (max)				-26	dB	
Receiver Sensitivity (OMA_{outer}), each Lane	SEN			Equation(1)	dBm	6
Stressed Receiver Sensitivity (OMA_{outer}), each Lane	SRS			-1.9	dBm	7
Conditions of Stress Receiver Sensitivity Test						
Stressed Eye Closure for PAM4 (SECQ), lane under test			3.4		dB	8
OMA_{outer} of each aggressor lane				4.2	dBm	
LOS Assert		-15			dBm	
LOS De-Assert				-8.9	dBm	
LOS Hysteresis		0.5			dB	

Notes:

[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] Even if the TDECQ ＜1.4dB for an extinction ratio of ≥5dB or TDECQ ＜1.1dB for an extinction ratio of ＜5dB, the OMA_{outer} (min) must exceed the minimum value specified here.

[3] Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.

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

[5] The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

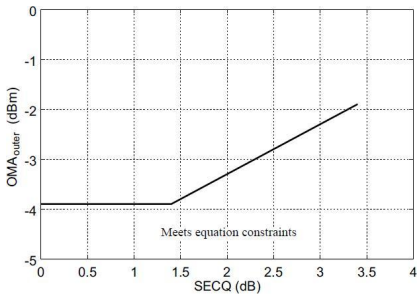
[6] Receiver sensitivity (OMA_{outer}) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. Receiver sensitivity should meet Equation (1), which is illustrated in Figure 4.

$RS = \max(-3.9, SECQ - 5.3)dBm$ (1)

Where:

RS is the receiver sensitivity, and

SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.



[7] Measured with conformance test signal at TP3 for the BER equal to 2.4x10-4.

[8] These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Pin Description

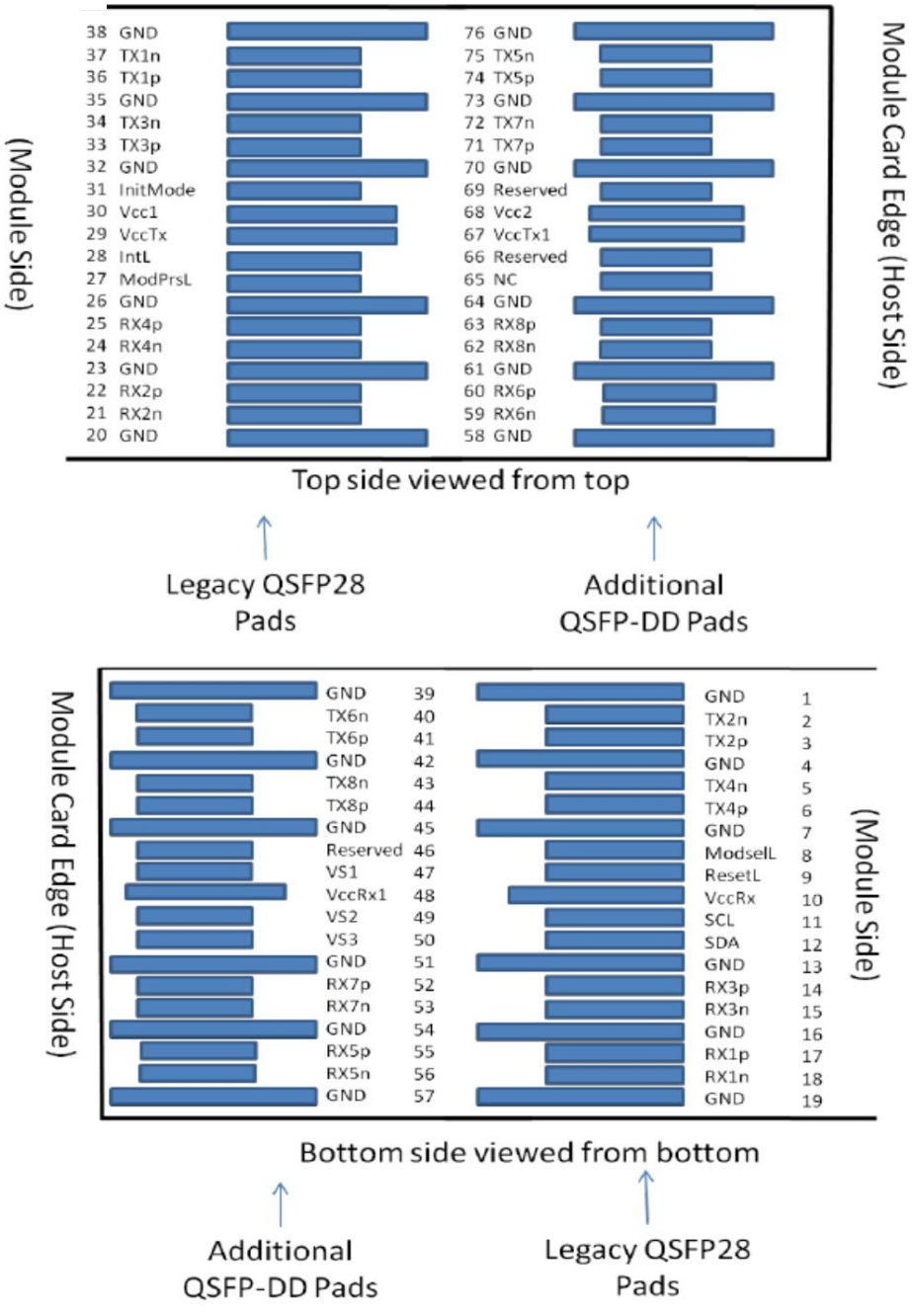


Figure 1 Pin view

Pin Function Definitions

Table5-Pin Function Definitions

Pin	Name	Symbol	Description	Notes
1		GND	Ground	1B
2	CML-I	Tx2n	Transmitter Inverted Data Input	3B
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3B
4		GND	Ground	1B
5	CML-I	Tx4n	Transmitter Inverted Data Input	3B
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3B
7		GND	Ground	1B
8	LVTTL-I	ModSelL	Module Select	3B
9	LVTTL-I	ResetL	Module Reset	3B
10		Vcc Rx	+3.3V Power Supply Receiver	2B
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
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3B
15	CML-O	Rx3n	Receiver Inverted Data Output	3B
16	GND	GND	Ground	1B
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3B
18	CML-O	Rx1n	Receiver Inverted Data Output	3B
19		GND	Ground	1B
20		GND	Ground	1B
21	CML-O	Rx2n	Receiver Inverted Data Output	3B
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3B
23		GND	Ground	1B
24	CML-O	Rx4n	Receiver Inverted Data Output	3B
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3B
26		GND	Ground	1B
27	LVTTL-O	ModPrsL	Module Present	3B

28	LVTTL-O	IntL/RxLOSL	Interrupt. Optionally configurable as RxLOSL via the management interface (SFF-8636)	3B
29		VccTx	+3.3V Power supply transmitter	2B
30		Vcc1	+3.3V Power supply	2B
31	LVTTL-I	InitMode	Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE	3B
32		GND	Ground	1B
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3B
34	CML-I	Tx3n	Transmitter Inverted Data Input	3B
35		GND	Ground	1B
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3B
37	CML-I	Tx1n	Transmitter Inverted Data Input	3B
38		GND	Ground	1B
39		GND	Ground	1A
40	CML-I	Tx6n	Transmitter Inverted Data Input	3A
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	3A
42		GND	Ground	1A
43	CML-I	Tx8n	Transmitter Inverted Data Input	3A
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	3A
45		GND	Ground	1A
46		Reserved	For future use	3A
47		VS1	Module Vendor Specific 1	3A
48		VccRx1	3.3V Power Supply	2A
49		VS2	Module Vendor Specific 2	3A
50		VS3	Module Vendor Specific 3	3A
51		GND	Ground	1A
52	CML-O	Rx7p	Receiver Non-Inverted Data Output	3A
53	CML-O	Rx7n	Receiver Inverted Data Output	3A
54		GND	Ground	1A
55	CML-O	Rx5p	Receiver Non-Inverted Data Output	3A
56	CML-O	Rx5n	Receiver Inverted Data Output	3A
57		GND	Ground	1A
58		GND	Ground	1A
59	CML-O	Rx6n	Receiver Inverted Data Output	3A
60	CML-O	Rx6p	Receiver Non-Inverted Data Output	3A
61		GND	Ground	1A

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

Recommended Power Supply Filter

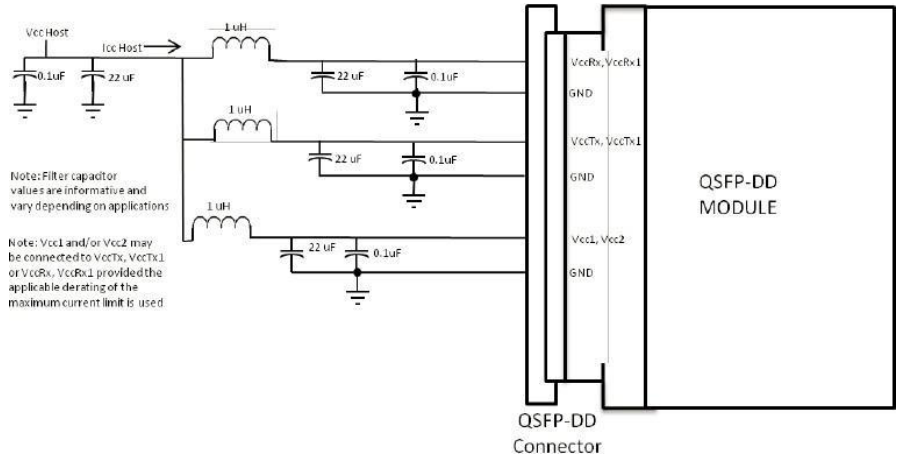


Figure 2 Recommended Power Supply Filter

Mechanical Dimensions

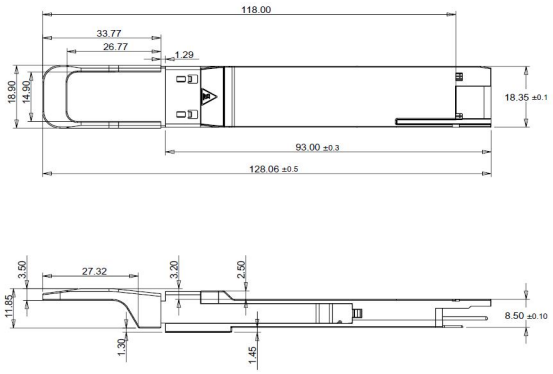


Figure3 Mechanical Outline

ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still 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 1 Laser Product according to EN 60825-1:2014. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

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

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Disclaimer

1. We are committed to continuous product improvement and feature upgrades, and the contents contained in this manual are subject to change without notice.

2. Nothing herein should be construed as constituting an additional warranty.

3. NADDOD assumes no responsibility for the use or reliability of equipment or software not provided by NADDOD.