

400G QSFP-DD DR4 Optical Transceiver

Product Specifications

This product is a 400Gb/s QSFP-DD optical module designed for 0.5Km optical communication applications. The module converts 8 channels of 50Gb/s (PAM4) electrical input data to 4 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 400Gb/s.

On the receiver side, the module converts 4 channels of parallel optical signals of 100Gb/s each channel for an aggregate data rate of 400Gb/s into 8 channels of 50Gb/s (PAM4) electrical output data.

An optical fiber cable with an MTP/MPO-12 connector can be plugged into the QSFP-DD DR4 module receptacle. Host FEC is required to support up to 0.5Km fiber transmission.

The transceiver is using surface mounted opto-electronic devices with no free space elements. The unique design of the optical engine facilitates unparalleled compactness while maintaining Telcordia robustness.

Features

- Compliant to QSFP-DD MSA
- Parallel 4 Optical Lanes
- IEEE 802.3bs 400GBASE-DR4 Specification compliant
- Maximum power consumption 9.5W

Applications

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

General Description

- Compliant with IEEE Std 802.3bs
- Compliant with 400G-DR4 optical specifications
- Compliant with QSFP-DD MSA
- Compliant with CMIS4.0 Management interface specifications
- 8x53.125Gb/s electrical interface (400GAUI-8)
- Up to 0.5km transmission on single mode fiber (SMF) with FEC
- Single +3.3V power supply
- Case temperature range: 0 ~ +70°C
- Maximum power consumption 9.5W
- RoHS compliant

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units
Storage Temperature Range	T_{STG}	-40	+85	°C
Supply Voltage	V_{CC}	0	4	V
Relative Humidity	RH	10% to 90% non-condensing		

Operating Conditions

Parameter	Symbol	Min	Max	Units
Case Temperature- Operating	T_{CASE}	0	70	°C
Supply Voltage	V_{CC}	3.14	3.46	V
Power Consumption	P_{DISS}		9.5	W
Pre-FEC Bit Error Ratio			2.4×10^{-4}	
Post-FEC Bit Error Ratio			1×10^{-12}	
Link Distance		2	500	M

Wavelength Lane Assignments

Transmitter Parameter	Min	Typical	Max	Units
Lane Wavelength Range	1304.5	1311	1317.5	nm

Transmitter Optical Specifications

Transmitter Parameter	Min	Typical	Max	Units
Lane Wavelength Range	1304.5		1317.5	nm
Modulation Format	PAM4			
Average Optical Power per lane	-2.9		4	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane	-0.8		4.2	dBm
Average Launch Power per Lane @ TX Off State			-15	dBm
Launch Power in OMA _{outer} minus TDECQ, each Lane	-2.2			dB
Transmitter and Dispersion Eye Closure for PAM4, each Lane			3.4	dB
Extinction Ratio	3.5			dB
Relative Intensity Noise (OMA)			-136	dB/Hz
Side-Mode Suppression Ration (SMSR)	30			dB
Optical Return Loss Tolerance			21.4	dB
Transmitter Reflectance			-26	dB

Receiver Optical Specifications

Receiver Parameter	Min	Typical	Max	Units
Lane Wavelength Range	1304.5		1317.5	nm
Modulation Format	PAM4			
Damage Threshold	5.0			dBm
Average Receive Power, each lane	-5.9		4.0	dBm
Receiver Power, each lane (OMA)			4.2	dBm
Receiver Reflectance			-26.0	dB
Receiver Sensitivity each lane (OMA _{outer})			-4.4	dBm
Stressed Receiver Sensitivity (OMA _{outer}), each			-1.9	dBm
Stressed Conditions for Stress Receiver Sensitivity				
Stressed Eye Closure for PAM4 (SECQ), Lane under Test		3.4		dB
OMA _{outer} of each Aggressor Lane		4.2		dBm

High Speed Electrical Specifications

Parameter	Min	Typical	Max	Units	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	
Far-end ESMW (Eye symmetry mask width)		0.2		UI	
Far-end Eye height, differential	30			mV	
Far-end pre-cursor ISI ratio	-4.5		2.5	%	
Differential output return loss	9.5 - 0.37f			dB	0.01 – 8 GHz
	4.75 -7.4log 10 (f/14)			dB	8 – 19 GHz
Common to differential mode conversion return loss	22-20(f/25.78)			dB	0.01 -12.89GHz
	15 -6log 10 (f/25.78)			dB	12.89 – 19 GHz
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 pk-pk input voltage tolerance	900			mV	
Differential input return loss	9.5 - 0.37f			dB	0.01 – 8 GHz
	4.75 -7.4log 10 (f/14)			dB	8 – 19 GHz
Differential to common mode input return loss	22-20(f/25.78)			dB	0.01 -12.89GHz
	15 -6log 10 (f/25.78)			dB	12.89 – 19 GHz
Differential termination mismatch			10	%	
Module stressed input test	Per Section 120E.3.4.1, IEEE802.3bs				
Single-ended voltage tolerance range	-0.4		3.3	V	
Common-mode voltage	-350		2850	mV	

Receiver Output Power Thresholds for Loss of Signal (LOS)

Parameter	Min	Typical	Max	Units
RX_LOS Assert Min/Max	-15.0			dBm
RX_LOS De-Assert Min/Max			-8.9	dBm
RX_LOS Hysteresis		1.5		dB

Digital Diagnostic Monitoring Specifications

Parameters	Unit	Specification
Temperature Monitor absolute error	degC	± 3
Voltage Monitor absolute error	%	± 5
I_bias Monitor absolute error	%	± 10
Received Power (Rx) Monitor absolute error	dB	± 3.0
Transmit Power (Tx) Monitor absolute error	dB	± 3.0

QSFP-DD Edge Connector and Pinout Description

The electrical pinout of the QSFP-DD module is shown in Figure 2 below.

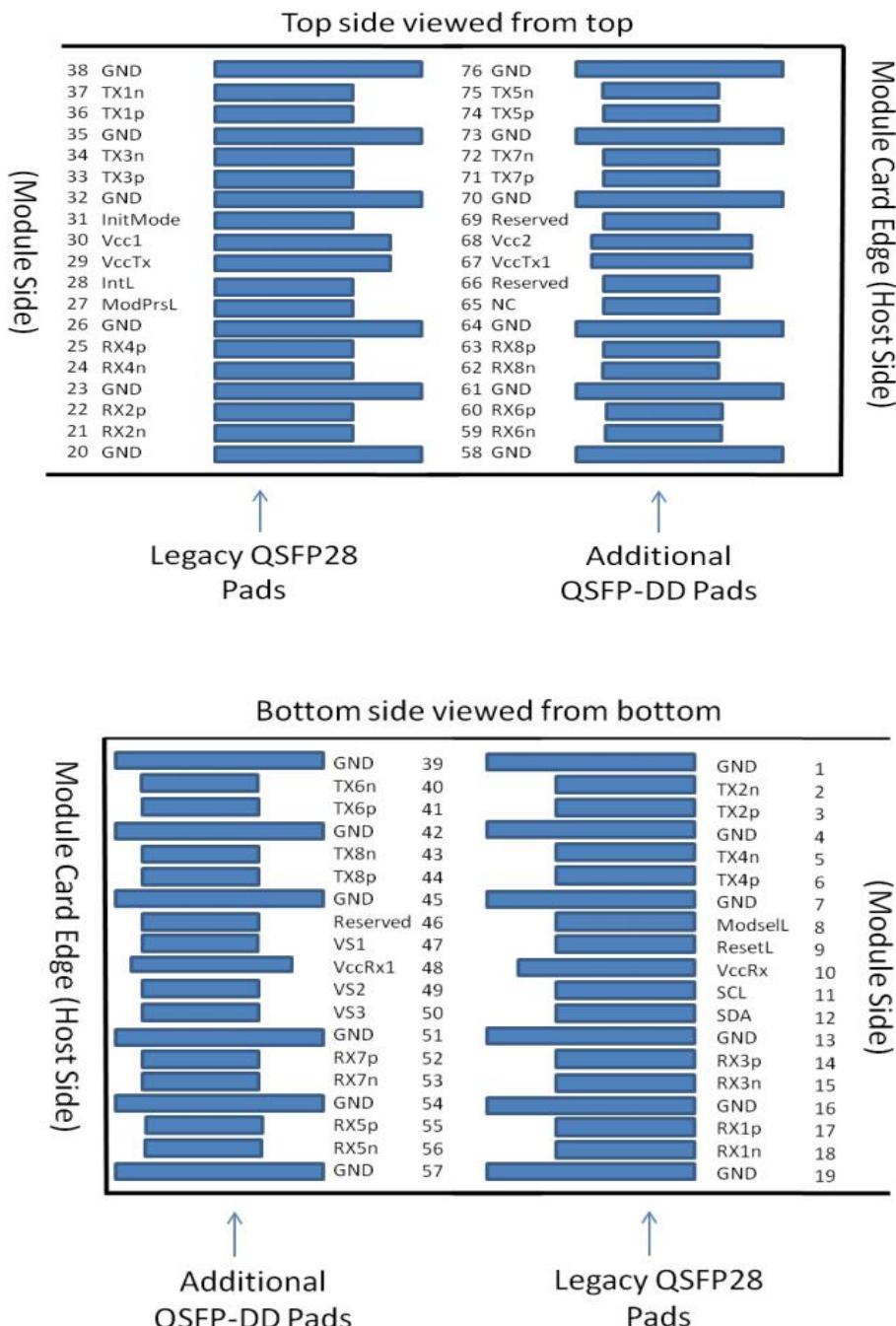


Figure 1. Host PCB QSFP-DD pad assignment top view

Pin No.	Symbol	Description	Note
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data output	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data output	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	3.3V 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	3.3V power supply transmitter	2
30	Vcc1	3.3V power supply	2
31	Init Mode	Initialization mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Output	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Output	
38	GND	Ground	1

39	GND	Ground	1
40	Tx6n	Transmitter Inverted Data Input	
41	Tx6p	Transmitter Non-Inverted Data output	
42	GND	Ground	1
43	Tx8n	Transmitter Inverted Data Input	
44	Tx8p	Transmitter Non-Inverted Data output	
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	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	3.3V power supply	2
68	Vcc2	3.3V 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 Output	
73	GND	Ground	1
74	Tx5p	Transmitter Non-Inverted Data Input	
75	Tx5n	Transmitter Inverted Data Output	
76	GND	Ground	1

Module Block Diagram

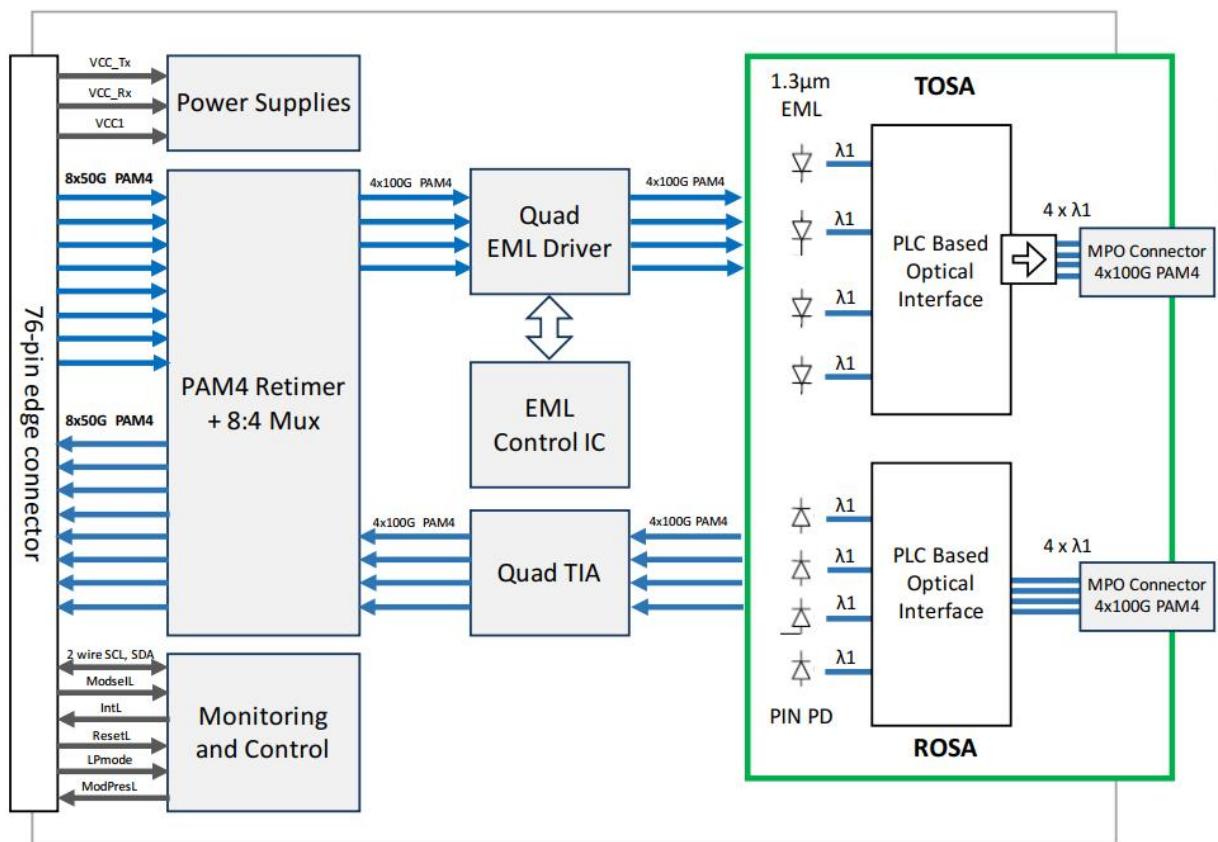


Figure 2. Module Block Diagram

Mechanical Specifications

Pull tab color: Blue

Pantone: 300U

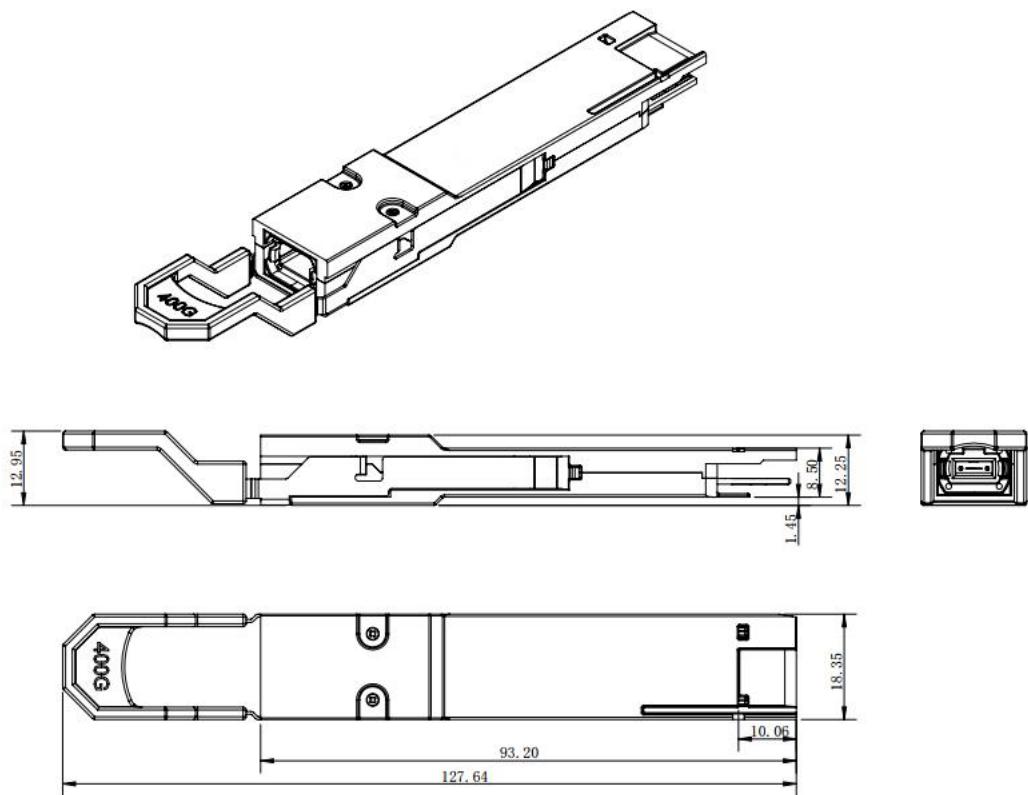


Figure 3. Mechanical Dimensions