

Product Features

- QSFP-DD MSA compliant
- Compliant with IEEE 802.3bs Standard: 400GAUI-8 Electrical Interface
- 8 x 53.125 Gbps PAM4 electrical interface (400GAUI-8)
- Maximum power consumption 8 W
- Single MPO-12 APC Connector
- Maximum Link Length of 100m on OM4 Fiber with FEC
- Single 3.3 V power supply
- Operating Case Temp Commercial: 0°C to +70 °C
- RoHS compliant

Application

- Data Centers Network
- 400G Ethernet

Standards

- IEEE 802.3cu
- QSFP-DD MSA
- CMIS4.0

Description

The 400G QSFP-DD SR4 module, MTP/MPO-12 connector, up to 100m over parallel OM4 multi-mode fiber. It is compliant to IEEE802.3bs protocol and 400GAUI-8 standard. The 400 Gigabit Ethernet signal is carried over four parallel lanes by one wavelength per lane. And it can Support 2 x 200G-SR and 4 x 100G-SR.

Absolute Maximum Ratings:

Module performance is not guaranteed and reliability is not implied for any condition that beyond the operating range. Exceeding the limits below may damage the transceiver module permanently.

Parameter	Unit	Min	Max
Case Operating Temperature	°C	0	+70
Storage Temperature Range	°C	-40	+85
Relative Humidity	%	0	85
Power Supply Voltage	V	-0.3	+3.6

Recommended Operating Conditions:

Parameter	Min	Typ	Max	Unit
Operating Case Temperature Range	0		70	°C
Power Supply Voltage	3.135	3.3	3.465	V
Supply Current			2550	mA
Pre-FEC Bit Error Ratio				2.4x10 ⁻⁴
Post-FEC Bit Error Ratio ¹				1x10 ⁻¹²
Link Distance (OM4) ²	2		100	m
Link Distance (OM3) ²	2		60	m

Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

Electrical Specifications

Parameter	Unit	Min	Typ	Max	Notes
Supply Current	A			3.64	
Power Consumption	W			8	
Receiver					
Data rate, each lane	GBd	26.5625 ± 100 ppm			
Overload differential voltage pk-pk	mV	900			

Common mode voltage	mV	-350		2850	
Differential termination resistance mismatch	%			10	At 1 MHz
Differential return loss (SDD11)	dB	Equation(16-1)			OIF-CEI-56G-VSR PAM4
Common mode to differential mode conversion (SCD11)	dB	Equation(16-2)			OIF-CEI-56G-VSR PAM4
Transmitter					
Data rate, each lane	GBd	26.5625 ± 100 ppm			
Differential voltage, pk-pk	mV			900	
Common mode voltage (Vcm)	mV	-300		2850	
Common mode noise, RMS	mV			17.5	
Differential termination resistance mismatch	%			10	At 1 MHz
Differential return loss (SDD22)	dB			Equation(16-1)	
Common mode to differential mode conversion (SCD22)	dB			Equation(16-3)	
Common mode return loss(SCC22)	dB			-2	From 250 MHz to 19 GHz
Transition time	ps	9.5			
Near-end eye width at 10-6 probability (EW6)	UI	0.265			
Near-end eye height at 10-6 probability (EH6)	mV	70			
Far-end eye width at 10-6 probability (EW6)	UI	0.2			
Far-end eye height at 10-6 probability (EH6)	mV	30			
Near-end eye linearity		0.85			

Optical Characteristics:

Parameter	Unit	Min	Typ	Max	Notes
Transmitter					
Data rate, each Lane	GBd	53.125 ± 100 ppm			
Modulation format		PAM4			
RMS Spectral Width ¹	dBm			0.65	
Center wavelengths	nm	842		948	
Total average launch power	dBm			9.5	
Average launch power, each lane	dBm	-4.6		4	
Optical modulation amplitude (OMA), each lane	dBm	-0.2		3.7	
Extinction ratio (ER)	dB	3.5			
Side-mode suppression ratio (SMSR)	dB	30			
Launch power in OMA minus TDECQ, each lane	dBm	-1.6			
Transmitter and dispersion eye closure for PAM4, each Lane (TDECQ)	dB			4.4	
Difference in launch power between any two lanes (OMA outer)	dB			4	
Overshoot/Undershoot	%			29	
RIN _{17.1OMA}	dB/Hz			-136	
Optical return loss tolerance	dB			17.1	
Transmitter reflectance	dB			-26	
Transition Time	ps			17	
Average Launch Power of OFF Transmitter, Each Lane	dBm			-30	
Encircled Flux ²	dBm	≥86% at 19μm ≤30% at 4.5μm			
Receiver					
Data rate, each Lane	dB	53.125 ± 100 ppm			
Modulation format		PAM4			
Center wavelengths	nm	845		942	

Damage threshold, each lane ³	dBm	5			
Average receiver power, each lane	dBm	-6.3		4	
Receiver power, each lane (OMA)	dBm			3.5	
Difference in receiver power between any two lanes (OMA)	dB			4.1	
Receiver sensitivity (OMA outer), each lane (max)	dBm	-4.4			
LOS assert	dBm	-15			
LOS de-assert	dBm			-9.2	
LOS hysteresis	dB	0.5			
Receiver reflectance	dB			-26	

Notes:

- 1.RMS spectral width is the standard deviation of the spectrum.
- 2.If measured into type A1a.2 or type A1a.3, or A1a.4, 50 μm fiber, in accordance with IEC 61280-1-4.
- 3.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.
4. Measured with conformance test signal for BER = 2.4 x 10⁻⁴.

Pin Definition and Description

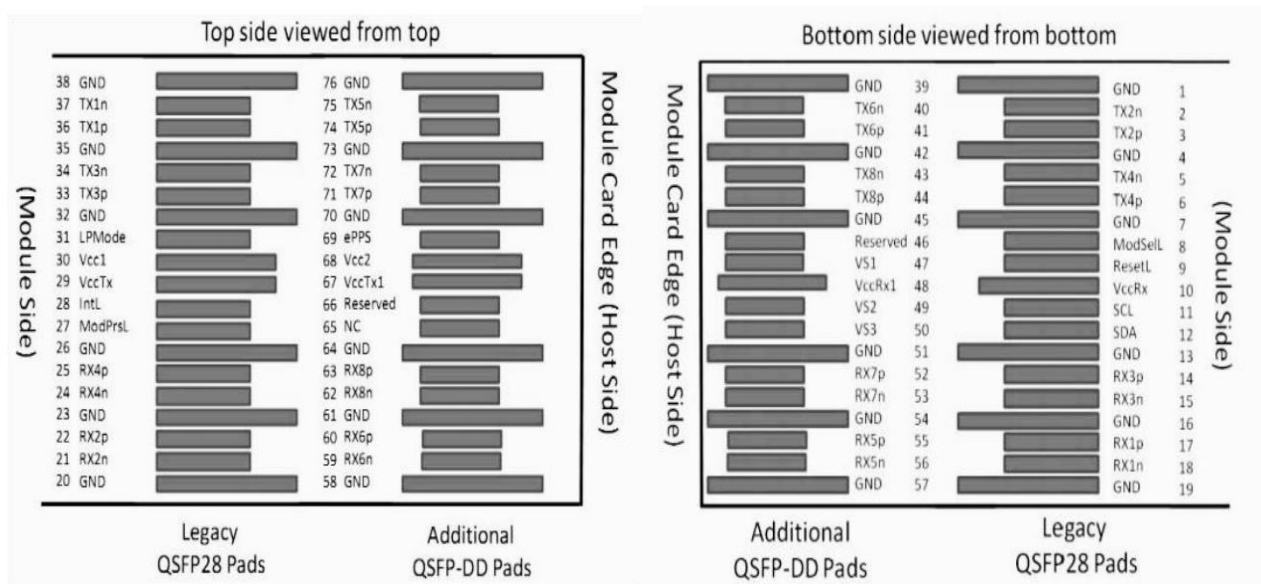


Table 1. Pin definition and descriptions

Pin	Logic	Symbol	Name/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	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock
12	LVC MOS-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
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
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	
47		VS1	Module Vendor Specific1
48		VccRx1	+3.3V Power Supply Receiver
49		VS2	Module Vendor Specific2
50		VS3	Module Vendor Specific3
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	Not connected
66		Reserved	
67		VccTx1	+3.3V Power Supply Transmitter
68		Vcc2	+3.3V Power Supply
69		Reserved	
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

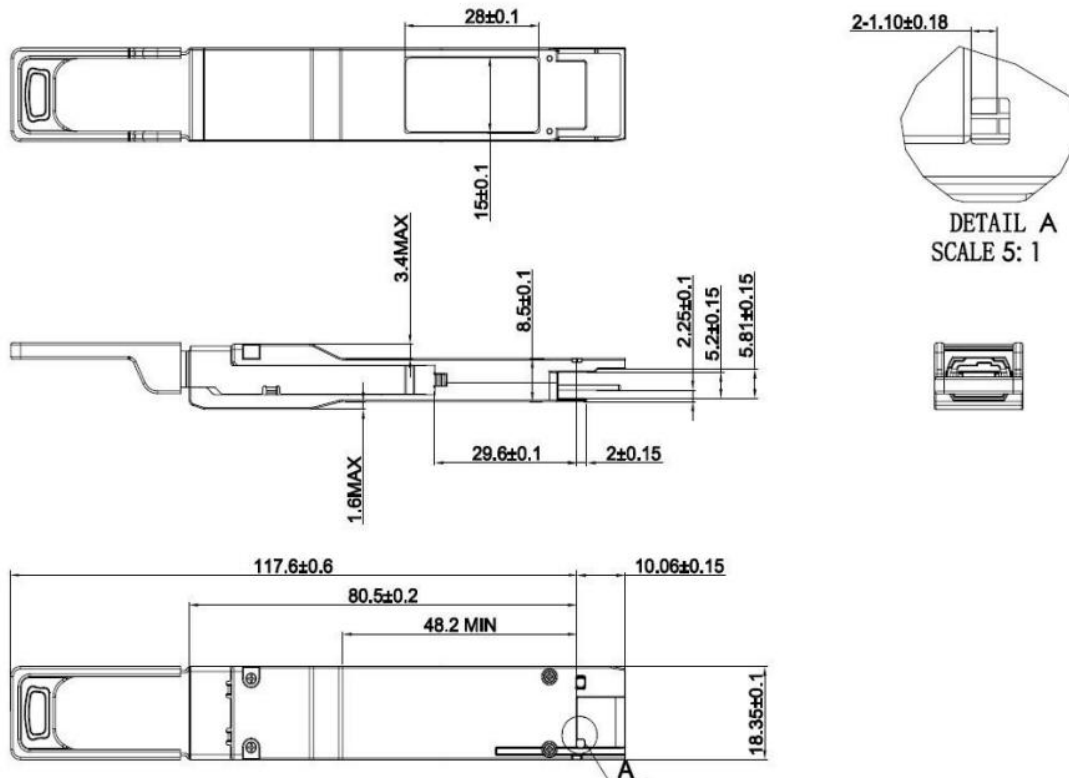
Digital Diagnostic Monitoring Functions

400G QSFP-DD SR4 supports the I2C-based Diagnostic Monitoring Interface (DMI) defined in document QSFP-DD-CMIS-rev4p0. The host can access real-time performance of transmitter and receiver optical power, temperature, supply voltage and bias current.

Parameter	Data address		
	Alarm & Warning	Alarm & Warning thresholds	Monitor
Module temperature	Lower page 9	Page2h (128-135)	Lower page (14-15)
Module Voltage	Lower page 9	Page2h (136-143)	Lower page (16-17)
Bias current	Page11h(143-146)	Page2h (184-191)	Page11h (170-177)
Transmitter optical power	Page11h(139-142)	Page2h (176-183)	Page11h (154-161)
Receiver optical power	Page11h(149-152)	Page2h (192-199)	Page11h (186-193)

Mechanical Specifications

Compatible with the QSFP-DD Type 2 Specification for pluggable form factor modules.



ESD Information

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 otherwise handled in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

Parameter	Threshold	Note
ESD of high-speed pins	1kV	Human body model
ESD of low-speed pins	2kV	Human body model
Air discharge during operation	15kV	
Direct contact discharges to the case	8kV	