

EN-QDD-PLR4

400Gb/s 10Km QSFP-DD PLR4 Transceiver module

Product Features

- 4x106.25Gbps PAM4 parallel lanes
- 8 x 53.125 Gbps PAM4 electrical interface (400GAUI-8)
- 4 channels transmitters and PIN receivers
- Maximum power consumption 8 W
- MPO-12 connector
- Up to 10km transmission on single mode fiber
- Operating case temperature: 0°C to 70°C
- Single 3.3 V power supply
- QSFP-DD MSA compliant rev4.0 compliant
- Compliant to IEEE 802.3cu

Applications

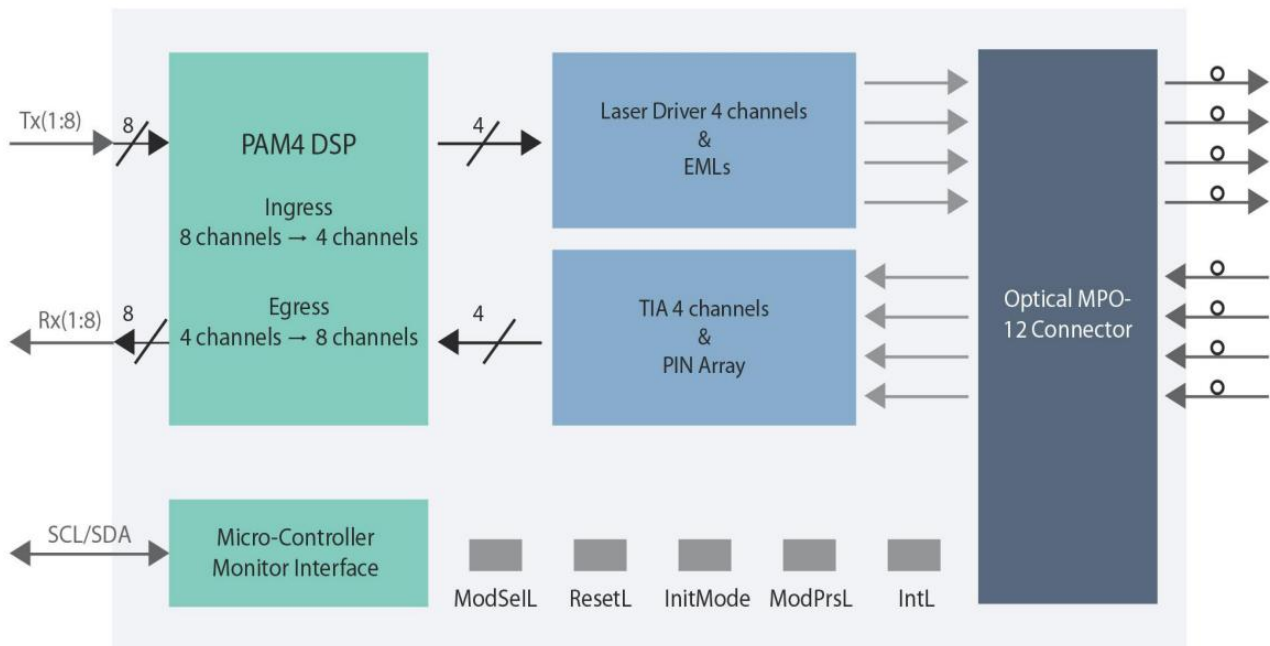
- Data Center 400GE 10km SMF links
- 4:1 breakout with 100GBASE-LR
- Upgrading 100G PSM4 to 400G
- Switch/Router interconnections

Part No.	Specifications									Application
	Package	Data rate	Laser	Optical Power	Detector	Sensitivity	Temp	Reac h	Other	
EN-QDD-PLR4	QSFP-DD	400G	EML	1.1~5dBm (OMA)	PIN	< -6.1dBm (OMA)	0~70°C	10km	DDM	400G Ethernet

Function Description

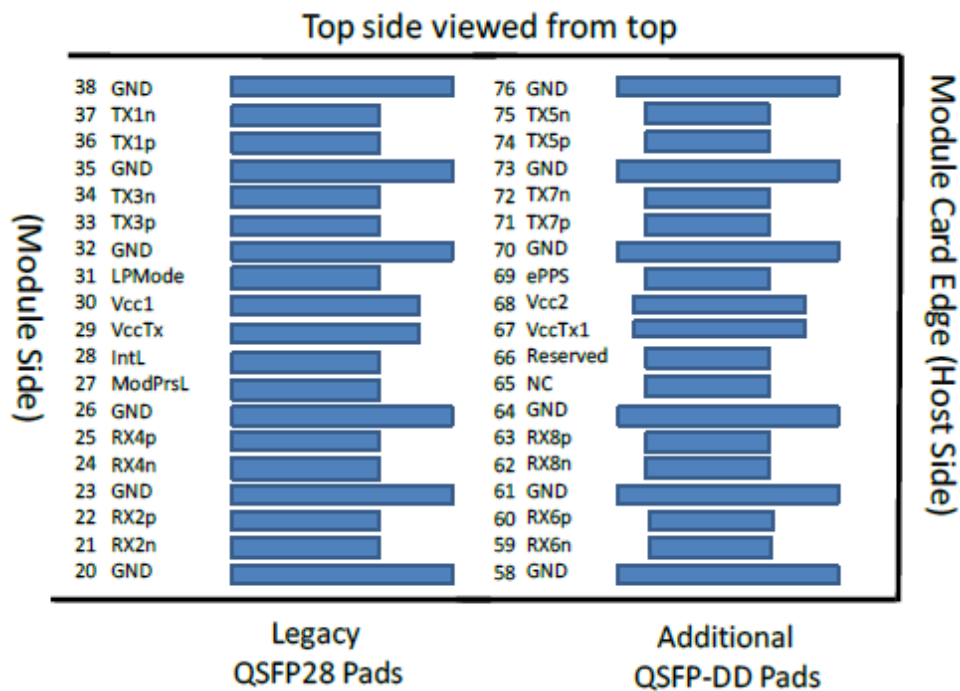
The module is designed for 10km optical communication applications, and it is compliant with 100G Lambda MSA standard. This module can convert 8-channel 53.125 Gbps electrical data to 4-channel 106.25 Gbps optical signals,.

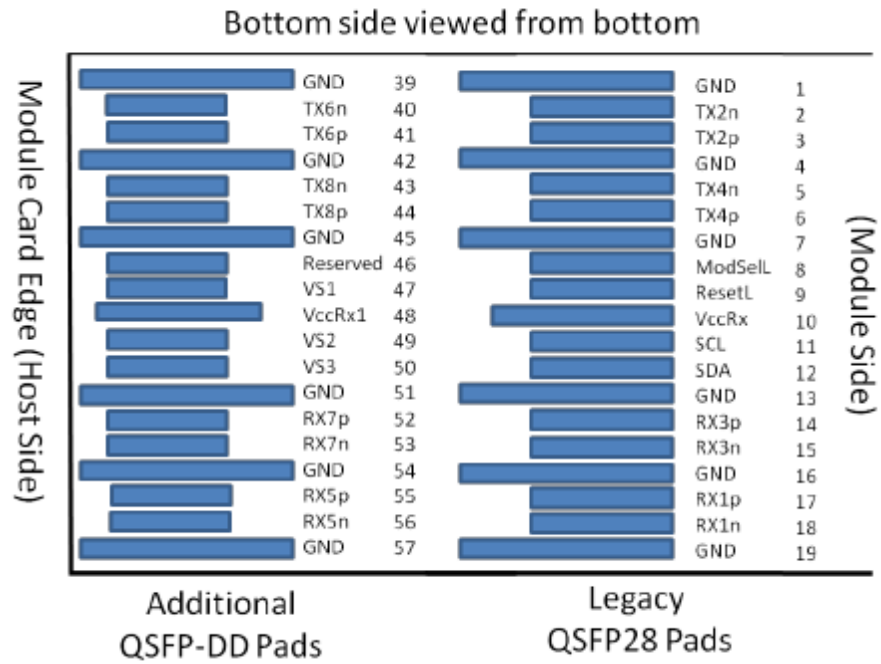
Figure 1-1 Transceiver block diagram



Pin Descriptions

Figure 1-2 MSA compliant connector





Pin	Symbol	Description	Notes
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	



Pin	Symbol	Description	Notes
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	LPMODE	Low Power 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

Pin	Symbol	Description	Notes
67	VccTx1	3.3 V Power Supply	2
68	Vcc2	3.3 V Power Supply	2
69	ePPS	Precision Time Protocol (PTP) reference clock input. It is not used.	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

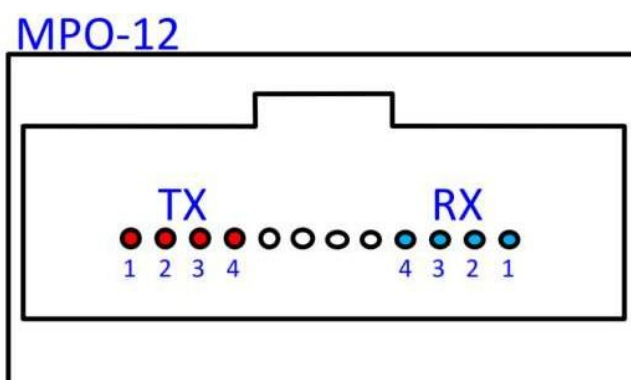
Notes:

- 1.QSFP-DD uses common ground (GND) for all signals and supply (power). All are comon within the QSFP-DD module and all module voltages are referenced to this po-te-nial 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.Requirements defined for the host side of the Host Card Edge Connector. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000 mA.
- 3.All Vendor Specific, Reserved and No Connect pins may be terminated with 50ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and Reserved pads shall have an impedance to GND that is greater than 10K ohms and less than 100pF.

Optical Interface

The MPO-12 connectors for QSFP-DD 400G PLR4.

Figure 1-3 Optical lane assignments



Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Maximum supply voltage	Vcc	-0.5	3.3	3.6	V	
Storage temperature	Ts	-40		85	°C	
Relative humidity	RH	10		85	%	Non-condensing
Damage threshold, each lane	THd	4.5			dBm	

Operating Environments

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	Vcc	3.135	3.3	3.465	V
Case temperature	Top	0		70	°C
Link distance with G.652		0		10	km

Electrical Characteristics

Parameter	Min	Typ	Max	Unit	Notes
Power dissipation			8	W	
Supply current			2.55	A	
Receiver (module input)					
Data rate, each lane	26.5625 ± 100 ppm			GBd	
Overload differential voltage pk-pk	900			mV	
Common mode voltage	−350		2850	mV	
Differential termination resistance mismatch			10	%	At 1 MHz
Differential return loss (SDD11)	Equation (16-1)			dB	OIF-CEI-56G-VSR-PAM4
Common mode to differential mode conversion (SCD11)	Equation (16-2)			dB	OIF-CEI-56G-VSR-PAM4
Stressed input test	See OIF-CEI-56G-VSR-PAM4 Section 16.3.10.3				
Transmitter (module output)					
Data rate, each lane	26.5625 ± 100 ppm			GBd	
Differential voltage, pk-pk			900	mV	
Common mode voltage (Vcm)	−350		2850	mV	
Common mode noise, RMS			17.5	mV	



Parameter	Min	Typ	Max	Unit	Notes
Differential termination resistance mismatch			10	%	At 1 MHz
Differential return loss (SDD22)			Equation (16-1)	dB	
Common mode to differential mode conversion (SDC22)			Equation (16-3)	dB	
Common mode return loss (SCC22)			-2	dB	From 250 MHz to fb GHz
Transition time	9.5			ps	
Near-end eye width at 10^{-6} probability (EW6)	0.265			UI	
Near-end eye height at 10^{-6} probability (EH6)	70			mV	
Far-end eye width at 10^{-6} probability (EW6)	0.20			UI	
Far-end eye height at 10^{-6} probability (EH6)	30			mV	
Near-end eye linearity	0.85				

Optical Characteristics

Parameter	Min	Typ	Max	Unit	Notes
Transmitter					
Data rate, each Lane	53.125 $\pm$ 100 ppm			GBd	
Modulation format	PAM4				
Line wavelengths	1304.5		1317.5	nm	
Side-mode suppression ratio	30			dB	
Average launch power	-1.9		4.8	dBm	Note 1
Outer Optical Modulation Amplitude (OMA _{outer})	1.1		5	dBm	Note 2 Per lane
Launch power in OMA _{outer} minus TDECQ	-0.3			dBm	Per Lane
Transmitter and dispersion eye closure for PAM4			3.4	dB	Per lane
Average Optical Output Power of Off Transmitter			-15	dBm	Per lane
Extinction Ratio	3.5			dB	Per lane
RIN _{21.4OMA}			-136	dB/Hz	
Optical return loss			21.4	dB	

tolerance					
Transmitter reflectance			-26	dB	Note 3
Receiver					
Data rate, each Lane	53.125 ± 100 ppm			GBd	
Modulation format	PAM4				
Line wavelengths	1304.5		1317.5	nm	
Receiver Sensitivity each lane (OMAouter)			-6.1	dBm	Note 4
Average receive power	-8.2		4.8	dBm	
Receive power (OMAouter)			5	dBm	Per lane
Receiver reflectance			-26	dB	
LOS De-Assert	-	-	-12	dBm	
LOS Assert	-18	-	-	dBm	
LOS Hysteresis	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.

Note 2: Even if the TDECQ < 1.4 dB, the OMAouter (min) must exceed these values.

Note 3: Transmitter reflectance is defined looking into the transmitter.

Note 4: For when Pre-FEC BER is 2.4×10^{-4} .

Digital Diagnostic Monitoring Functions

Digital diagnostic management interface (DDMI) is realized by I2C interface in compliance with CMIS 4.0. diagnostic management functions are realized, and the data addresses are listed in the form below.

Performance item	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

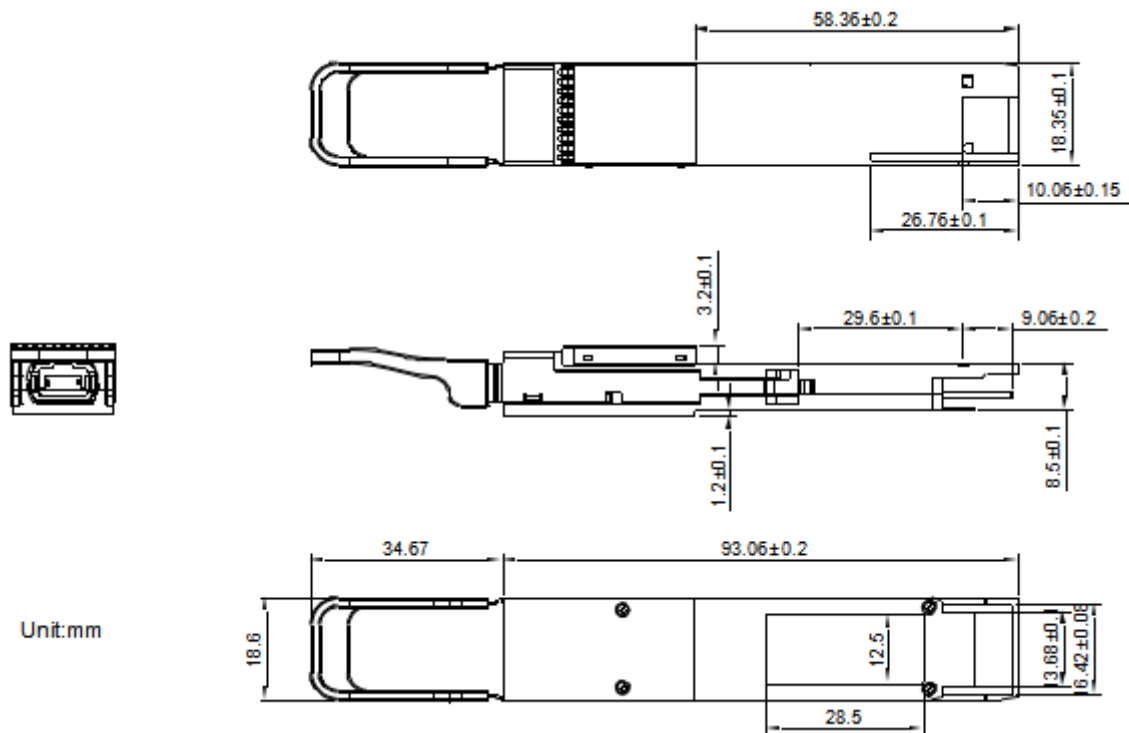


Figure 1-4 Mechanical dimensions

Regulatory Compliance

Feature	Agency	Standard	Performance
Safety	NRTL	UL 62368-1 CAN/CSA C22.2 No. 62368-1 IEC 60825-1 IEC 60825-2	NRTL recognized component for US and CAN
	TUV	EN 62368-1 EN 60825-1 EN 60825-2	TUV certificate

Feature	Agency	Standard	Performance
	FDA	U.S. 21 CFR 1040.10 & 1040.11	FDA/CDRH certified with accession number according to Laser Notice 56
Electromagnetic Compatibility	Radiated emissions	EMC Directive 2014/30/EU EN 55032 CISPR 32 FCC rules 47 CFR Part 15 ICES-003 VCCI-CISPR 32 AS/NZS CISPR 32	Class B digital device with a minimum –6 dB margin to the limit when tested with a metal enclosure. Final margin may vary depending on system application, good system EMI design practice, ie: suitable metal enclosure and well-bonding, is required to achieve Class B margins at the system level. Tested frequency range: 30 MHz to 40 GHz or 5th harmonic (5 times the highest frequency), whichever is less.
	ESD	EMC Directive 2014/30/EU EN 55035 CISPR 35 IEC/EN 61000-4-2	Withstands discharges of ± 8 kV contact, ± 15 kV air.
	Radiated immunity	EMC Directive 2014/30/EU EN 55035 CISPR 35 IEC/EN 61000-4-3	Field strength of 10 V/m from 80 MHz to 6 GHz.
Restriction of Hazardous Substances	RoHS	EU RoHS (2011/65/EU & (EU) 2015/863) & UK RoHS EN IEC 63000:2018 & BS EN IEC 63000:2018	