Features

- QSFP DD MSA compliant
- CMIS 4.0 Fully compliant
- Parallel 8 Optical Lanes
- 100G Lambda MSA 100G-FR specification compliant
- Maximum power consumption 16W
- Electrical interface: compliant with 800GAUI-8 (8X106.25Gb/s) Interface defined in IEEE802.3ck.
- Up to 2km transmission on single mode fiber (SMF) with FEC
- Rate date operation at 106.25Gbps (PAM4) per Channel.
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- RoHS compliant

Applications

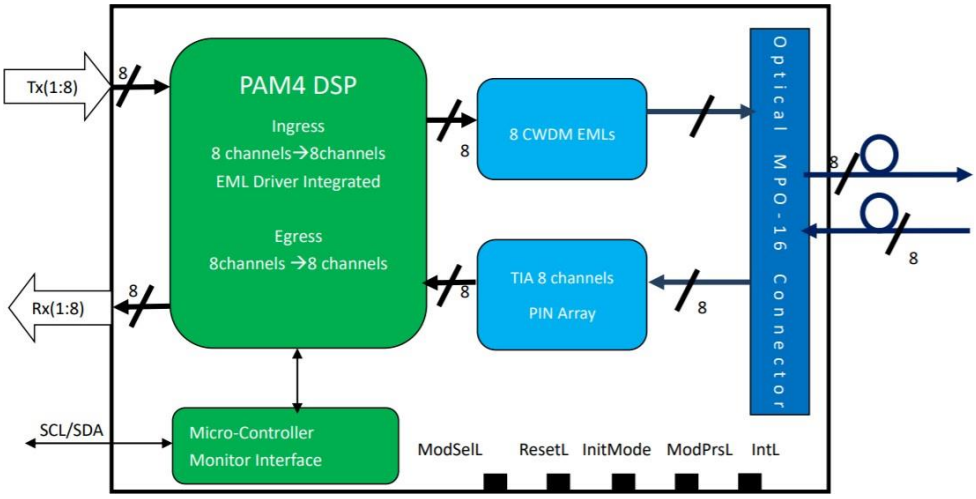
- 800G Ethernet
- Infiniband interconnects
- Datacenter Enterprise networking

This product is a 800Gb/s Quad Small Form Factor Pluggable-double density (QSFP-DD) optical module designed for 2km optical communication applications. The module converts 8 channels of 100Gb/s (PAM4) electrical input data to 8 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 800Gb/s. Reversely, on the receiver side, the module converts 8 channels of parallel optical signals of 100Gb/s each channel for an aggregate data rate of 800Gb/s into 8 channels of 100Gb/s (PAM4) electrical output data.

An optical fiber cable with an APC/MPO-16 connector can be plugged into the QSFP-DD DR8+ module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through a QSFP-DD MSA-compliant edge type connector.

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

Block Diagram of Transceiver



Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_S	-40	85	°C	
Operating Case Temperature	T_{OP}	0	70	°C	
Power Supply Voltage	V_{cc}	-0.5	3.6	V	
Relative Humidity (non-condensation)	*RH*	0	85	%	
Damaged Threshold , each Lane	*THd*	5.5		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Case Temperature	T_{op}	0		70	°C	
Power Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Data Rate, each Lane			26.5625		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4x10^{-4}$		
Post-FEC Bit Error Ratio				$1x10^{-12}$		1
Link Distance	*D*	0.2		2000	m	2

Notes:

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

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Unit	Notes
Temperature monitor absolute error	*DMI_Temp*	± 3	°C	Over operating temperature range
Supply voltage monitor absolute error	*DMI_VCC*	± 0.1	V	Over full operating range
Channel RX power monitor absolute error	*DMI_RX_Ch*	± 2	dB	1
Channel Bias current monitor	*DMI_Ibias_Ch*	± 10%	mA	
Channel TX power monitor absolute error	*DMI_TX_Ch*	± 2	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Center Wavelength	λc	1304.5	1310	1317.5	nm	
Transmitter						
Date Rate, each Lane			53.125 ± 100 ppm		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}	-0.2		4.2	dBm	2
Launch Power in OMA_{outer} minus TDECQ, each Lane					dB	
for ER ≥ 4.5dB		-1.6				
for ER < 4.5dB		-1.5				
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each Lan	TDECQ			3.4	dB	
TDECQ – 10*log_{10}(Ceq), each Lane				3.4	dB	3
Extinction Ratio	ER	3.5			dB	
$RIN_{17.1}$ OMA	RIN			-136	dB/Hz	
Optical Return Loss Tolerance	TOL			17.1	dB	
Transmitter Reflectance	R_T			-26	dB	
Transmitter Transition Time				17	ps	
Average Launch Power of OFF Transmitter, each Lane	P_{off}			-15	dBm	
Receiver						
Data Rate, each Lane			53.125 ± 100 ppm		GBd	
Modulation Format			PAM4			
Damage Threshold, each Lane	TH_d	5.5			dBm	4
Average Receiver Power, each Lane		-6.4		4.5	dBm	5
Receive Power (OMA_{outer}), each Lane				4.7	dBm	
Receiver Sensitivity (OMA_{outer}), each Lane	SEN			Equation (1)	dBm	6
Stressed Receiver Sensitivity (OMA_{outer}), each Lane	SRS			-2.5	dBm	7
Receiver Reflectance	R_R			-26	dB	

LOS Assert	*LOSA*	-15			dBm
LOS De-assert	*LOSD*			-9.4	dBm
LOS Hysteresis	*LOSH*	0.5			dB
Stressed Eye Closure for PAM4 (SECQ), Lane under Test			3.4		**dB**
SECQ – $10*\log_{10}$(Ceq), Lane under Test				3.4	dB
OMA_{outer} of each Aggressor Lane			4.7		dBm

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 ≥ 4.5dB or TDECQ < 1.3dB for an extinction ratio of < 4.5dB, 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.

$$RS = \max(-4.5, SECQ - 5.9)\ dBm \quad (1)$$

Where:

RS is the receiver sensitivity, and

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

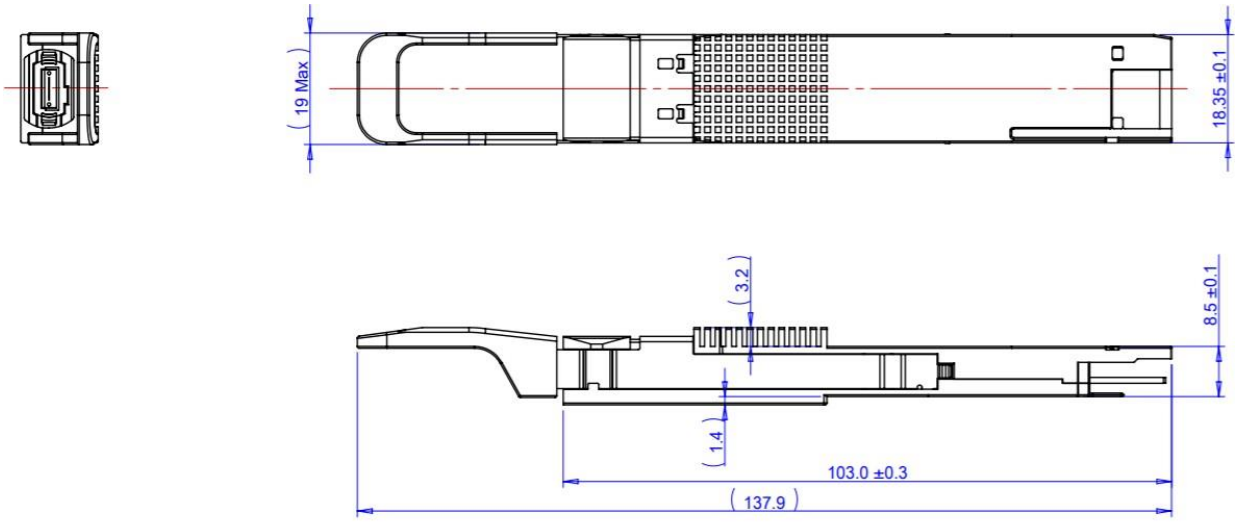
7. Measured with conformance test signal at TP3 for the BER equal to 2.4×10^{-4}.
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electronical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				16	W	
Supply Current	Icc			4.84	A	
Transmitter (each Lane)						
Signaling Rate, each Lane	TP1		53.125 ± 100 ppm		GBd	
DC Common-mode input Voltage	TP1	-0.3		2.8	V	
Single-ended input Voltage	TP1	-0.4		3.3	V	
AC Common-mode RMS input Voltage	TP1			17.5	mV	
Differential Peak-to-Peak input Voltage	TP1			870	mV	
Eye Symmetry Mask Width(ESMW)	TP1		TBD		UI	
Differential input Eye Height	TP1	15			mV	
Differential input Vertical Eye Closure	TP1			9	dB	
Common to Different Mode input Return Loss	TP1		See IEEE 802.3ck Equation 120G-1			
Effective input Return Loss	TP1		TBD			
Differential input Termination Mismatch	TP1			10	%	
Input Transition time (20% to 80%)	TP1		TBD		ps	
Receiver (each Lane)						
Signaling Rate, each lane	TP4		53.125± 100 ppm		GBd	
Differential Peak-to-Peak Output Voltage	TP4			900	mV	
AC Common Mode Output Voltage, RMS	TP4			17.5	mV	
Differential Termination Mismatch	TP4			10	%	
Output Transition Time 20% to 80%	TP4		TBD		ps	
Near-end output Eye Symmetry Mask Width (ESMW)	TP4		IEEE802.3ck 120E.4.2		UI	
Differential Near-end Eye output Eye Height	TP4		IEEE802.3ck 120E.4.2		mV	
Far-end output Eye Symmetry Mask Width (ESMW)	TP4		IEEE802.3ck 120E.4.2		UI	
Differential Far-end output Eye Height	TP4		IEEE802.3ck 120E.3.3.2.1		mV	

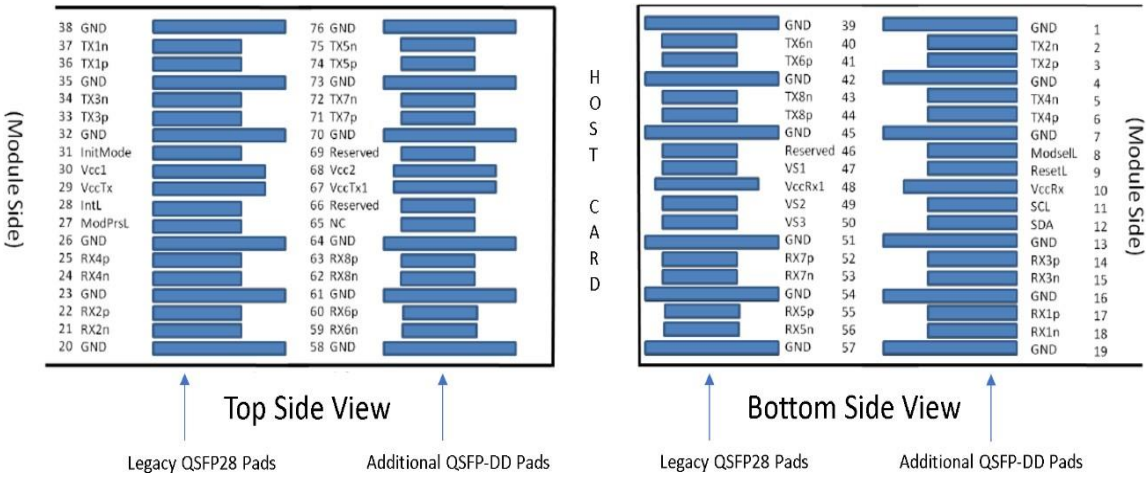
Far-end output Pre0cursor ISI Ratio	*TP4*	IEEE802.3ck 120E.3.3.1.2		
Common Mode to differential mode output Return Loss	*TP4*	IEEE802.3ck Equation 120G-1		dB
Effective output Return Loss	*TP4*	TBD		dB
Output Transition time (20% to 80%)	*TP4*	TBD		ps
DC Common Mode Output Voltage	*TP4*	-350	2850	mV

Dimensions



Pin Assignment and Description

The electrical pinout of the QSFP-DD module is shown as below



Pin Descriptions

Pin	Symbol	Name/Description	Notes
1	GND	Ground	
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	+3.3V Power Supply Receiver	
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
13	GND	Ground	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	Ground	1B	
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	
20	GND	Ground	
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	
27	ModPrsL	Module Present	

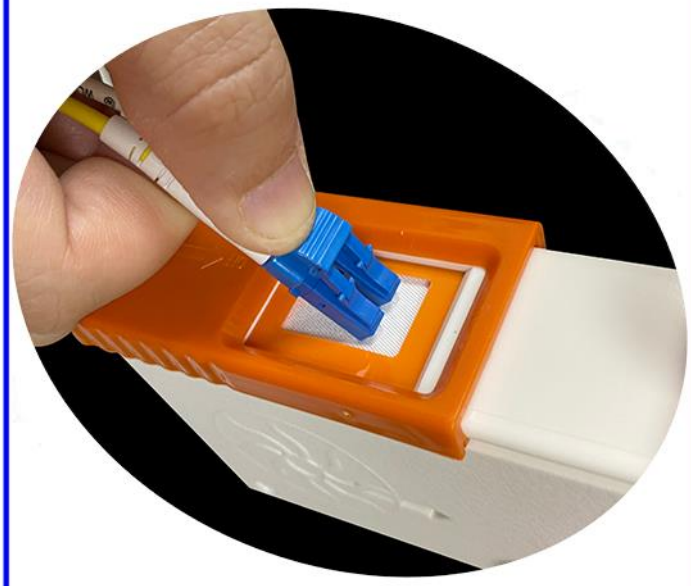
28	IntL	Interrupt	
29	VccTx	+3.3V Power supply transmitter	
30	Vcc1	+3.3V Power supply	
31	InitMode	Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE	
32	GND	Ground	
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	
39	GND	Ground	
40	Tx6n	Transmitter Inverted Data Input	
41	Tx6p	Transmitter Non-Inverted Data Input	
42	GND	Ground	
43	Tx8n	Transmitter Inverted Data Input	
44	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	Rx7p	Receiver Non-Inverted Data Output	
53	Rx7n	Receiver Inverted Data Output	
54	GND	Ground	
55	Rx5p	Receiver Non-Inverted Data Output	
56	Rx5n	Receiver Inverted Data Output	

57	GND	Ground	
58	GND	Ground	
59	Rx6n	Receiver Inverted Data Output	
60	Rx6p	Receiver Non-Inverted Data Output	
61	GND	Ground	
62	Rx8n	Receiver Inverted Data Output	
63	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	Tx7p	Transmitter Non-Inverted Data Input	
72	Tx7n	Transmitter Inverted Data Input	
73	GND	Ground	
74	Tx5p	Transmitter Non-Inverted Data Input	
75	Tx5n	Transmitter Inverted Data Input	
76	GND	Ground	

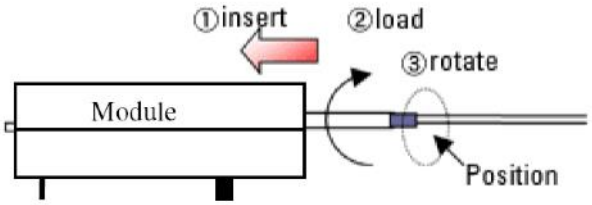
Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord



Cleaning of fiber stub



1. Insert
   Ensure that stick is held straight when inserting into sleeve.
2. Load
   Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate
   Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

Notice: Number of possible wipes:
Maintenance (repair) ~1 use / piece
Equipment construction: 4 uses / piece (max.)

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

Model Number	Part Number	Voltage	Temperature
800G QSFP-DD800 DR8	OPDZ-S02-13-CBS	3.3V	0°C to 70 °C

Modification History

Revision	Date	Description
A1	Dec. 2020	Initial Release

Note: All information contained in this document is subject to change without notice.