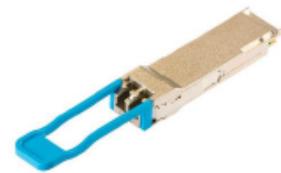

Product Specification

100G CWDM4 QSFP28 Optical Transceiver Module

ECX-QSFP28-CWDM4-GN-03

PRODUCT FEATURES

- QSFP28 MSA compliant
- Compliant to 100G CWDM4 MSA
- 4 CWDM lanes MUX/DEMUX design
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 3.5W
- LC duplex connector
- Supports 103.1Gb/s aggregate bit rate
- Up to 2km transmission on single mode fiber with FEC
- Operating case temperature: 0 to 70°C
- Single 3.3V power supply
- I2C digital management interface
- RoHS 2.0 compliant



APPLICATIONS

- 100G Ethernet
- Data Center Interconnect
- Enterprise networking

DESCRIPTIONS

Enconnex's OM3559CX100 are QSFP28 transceiver modules designed for 2km optical communication applications with single mode fiber. They are compliant to 100G CWDM4 MSA¹, QSFP28 MSA², IEEE 802.3bm Annex 83E³ and OIF CEI-28G-VSR⁴ standards. Digital diagnostic management interface (DDMI) is realized by I2C interface in compliance with SFF-8636. The modules are RoHS 2.0 compliant.

The modules can convert 4-channel 25Gb/s electrical data to 4-channel optical signals, and multiplex them into a single channel for 100Gb/s optical transmission. Similarly, they optically de-multiplex a 100Gb/s input into 4-channel signals, and convert them to 4-channel output electrical data on the receiver side. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Block Diagrams

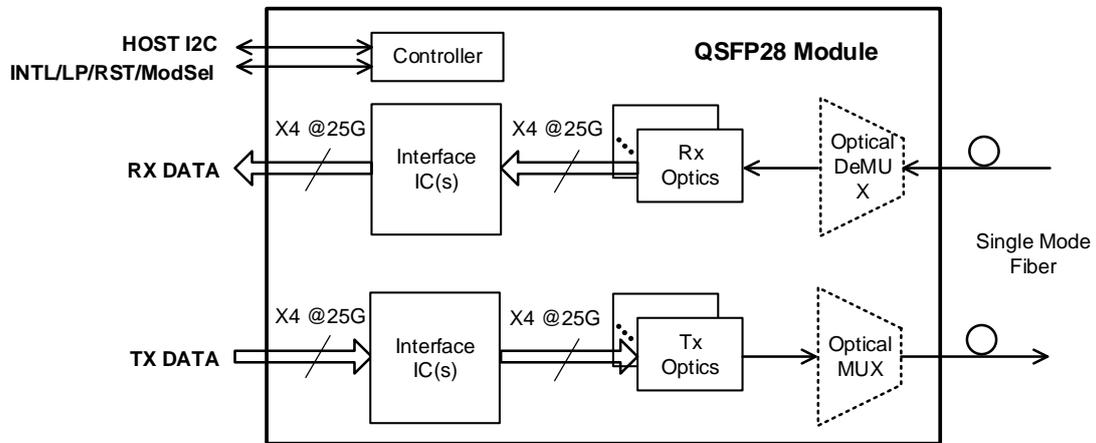


Figure 1. Transceiver Block Diagram

Pin Descriptions

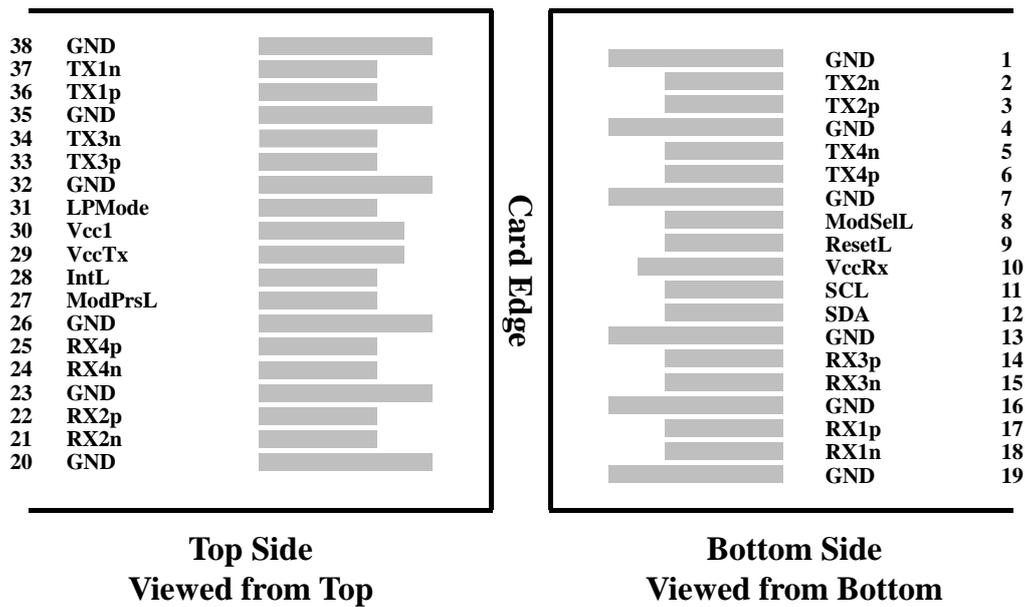


Figure 2. MSA compliant Connector

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	

Pin	Symbol	Description	Notes
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3V Power Supply Receiver	
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 Non-Inverted Data Output	
25	Rx4p	Receiver Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	Vcc Tx	+3.3V Power supply transmitter	
30	Vcc1	+3.3V Power supply	
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

Notes

1. Circuit ground is internally isolated from chassis ground.

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	0		85	%	1
Damage Threshold, each lane	THd	3.5			dBm	

Notes

1. Non-condensing

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
Data Rate, each lane			25.78125		Gbps
Data Rate Accuracy		-100		100	ppm
Link Distance with G.652		0.002		2	km

Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Power dissipation				3.5	W	
Supply Current	Icc			1.06	A	
Transmitter						
Data Rate, each lane			25.78125		Gbps	
Differential Voltage pk-pk	Vpp			900	mV	At 1 MHz
Common Mode Voltage	Vcm	-350		2850	mV	
Transition time	Trise/Tfall	10			ps	20%~80%
Differential Termination Resistance Mismatch				10	%	

Eye width	EW15	0.46			UI	
Eye height	EH15	95			mV	
Receiver						
Data Rate, each lane			25.78125		Gbps	
Differential Termination Resistance Mismatch				10	%	At 1 MHz
Differential Voltage pk-pk	Vpp			900	mV	
Common Mode Voltage	Vcm	-350		2850	mV	
Common Mode Noise, RMS	Vrms			17.5	mV	
Transition time	Trise/Tfall	12			ps	20%~80%
Eye width	EW15	0.57			UI	
Eye height	EH15	228			mV	

Optical Characteristics

Parameters	Unit	min	type	max
Transmitter				
Data Rate, each lane	Gbps		25.78125	
Average launch power, each lane	dBm	-6.5		2.5
Line wavelengths	nm	1264.5		1277.5
		1284.5		1297.5
		1304.5		1317.5
		1324.5		1337.5
Optical Modulation Amplitude (OMA), each lane	dBm	-4.0		2.5
Extinction Ratio (ER)	dB	3.5		
Side-Mode Suppression Ratio (SMSR)	dB	30		
Launch power in OMA minus TDP, each lane	dBm	-5.0		

Transmitter and Dispersion Penalty (TDP), each lane	dB			3.0
Transmitter reflectance	dB			-12
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.31, 0.4, 0.45, 0.34, 0.38, 0.4} (Hit ratio 5×10^{-5})		
Receiver				
Data Rate, each lane	Gbps		25.78125	
Line wavelengths	nm	1264.5		1277.5
		1284.5		1297.5
		1304.5		1317.5
		1324.5		1337.5
Average receiver power, each lane	dBm	-11.5		2.5
Receiver power, each lane (OMA)	dBm			2.5
Damage threshold, each lane	dBm	3.5		
Receiver sensitivity (OMA), each lane	dBm			-10 (BER@5e-5)
Stressed receiver Sensitivity (OMA) , each lane	dBm			-7.3 (BER@5e-5)
LOS Assert	dBm	-30		
LOS Deassert	dBm			-13
LOS Hysteresis	dB	0.5		
Receiver reflectance	dB			-26
Vertical eye closure penalty, each lane	dB		1.9	
Stressed eye J2 Jitter, each lane	UI		0.33	
Stressed eye J4 Jitter, each lane	UI		0.48	
SRS eye mask definition { X1, X2, X3, Y1, Y2, Y3}		{0.39, 0.5, 0.5, 0.39, 0.39, 0.4}		

EEPROM (A0h) Definitions

Data Address	Name	Description	Value (hex)	Read/Write
0	Identifier	Identifier	11	Read-Only
1	Status	Revision Compliance	*	Read-Only
2		Status	*	Read-Only
3	Interrupt Flags	L-Tx/RX LOS, channel 1~4	*	Read-Only
4		L-Tx/RX Adapt EQ Fault, channel 1~4 L-TX Fault, channel 1~4	*	Read-Only
5		L-Tx/RX LOL, channel 1~4	*	Read-Only
6		L-Temp High/Low Alarm/Warning Initialization complete flag	*	Read-Only
7		L-VCC High/Low Alarm/Warning	*	Read-Only
8		Vendor Specific	*	Read-Only
9		L-Rx Power High/Low Alarm/Warning, channel 1~2	*	Read-Only
10		L-RxPower High/Low Alarm/Warning, channel 3~4	*	Read-Only
11		L-Tx Bias High/Low Alarm/Warning, channel 1~2	*	Read-Only
12		L-Tx Bias High/Low Alarm/Warning, channel 3~4	*	Read-Only
13		L-Tx Power High/Low Alarm/Warning, channel 1~2	*	Read-Only
14		L-Tx Power High/Low Alarm/Warning, channel 3~4	*	Read-Only
15-18		Reserved	00	Read-Only
19-21		Vendor Specific	*	Read-Only
22		Free Side Monitors	Internally measured temperature (MSB)	*
23	Internally measured temperature (LSB)		*	Read-Only
24	Reserved		00	Read-Only
25	Reserved		00	Read-Only
26	Internally measured supply voltage (MSB)		*	Read-Only
27	Internally measured supply voltage (LSB)		*	Read-Only
28-29	Reserved		00	Read-Only
30-33	Vendor Specific		*	Read-Only
34	Channel Monitors	Internally measured RX input power, channel 1 (MSB)	*	Read-Only
35		Internally measured RX input power, channel 1 (LSB)	*	Read-Only

Data Address	Name	Description	Value (hex)	Read/Write
36	Channel Monitors	Internally measured RX input power, channel 2 (MSB)	*	Read-Only
37		Internally measured RX input power, channel 2 (LSB)	*	Read-Only
38		Internally measured RX input power, channel 3 (MSB)	*	Read-Only
39		Internally measured RX input power, channel 3 (LSB)	*	Read-Only
40		Internally measured RX input power, channel 4 (MSB)	*	Read-Only
41		Internally measured RX input power, channel 4 (LSB)	*	Read-Only
42		Internally measured TX bias, channel 1 (MSB)	*	Read-Only
43		Internally measured TX bias, channel 1 (LSB)	*	Read-Only
44		Internally measured TX bias, channel 2 (MSB)	*	Read-Only
45		Internally measured TX bias, channel 2 (LSB)	*	Read-Only
46		Internally measured TX bias, channel 3 (MSB)	*	Read-Only
47		Internally measured TX bias, channel 3 (LSB)	*	Read-Only
48		Internally measured TX bias, channel 4 (MSB)	*	Read-Only
49		Internally measured TX bias, channel 4 (LSB)	*	Read-Only
50		Internally measured TX Power, channel 1 (MSB)	*	Read-Only
51		Internally measured TX Power, channel 1 (LSB)	*	Read-Only
52		Internally measured TX Power, channel 2 (MSB)	*	Read-Only
53		Internally measured TX Power, channel 2 (LSB)	*	Read-Only
54		Internally measured TX Power, channel 3 (MSB)	*	Read-Only
55		Internally measured TX Power, channel 3 (LSB)	*	Read-Only

Data Address	Name	Description	Value (hex)	Read/Write
56	Channel Monitors	Internally measured TX Power, channel 4 (MSB)	*	Read-Only
57		Internally measured TX Power, channel 4 (LSB)	*	Read-Only
58-65		Reserved channel monitor	00	Read-Only
66-81		Vendor Specific	*	Read-Only
82-85	Reserved		00	Read-Only
86	Control	Tx Disable, channel 1~4	00	Read/Write
87		Rx_Rate_select, channel 1~4	00	Read/Write
88		Tx_Rate_select, channel 1~4	00	Read/Write
89		Rx4_Application_Select, Rx Channel 4	00	Read/Write
90		Rx3_Application_Select, Rx Channel 3	00	Read/Write
91		Rx2_Application_Select, Rx Channel 2	00	Read/Write
92		Rx1_Application_Select, Rx Channel 1	00	Read/Write
93		Reserved High Power Class Enable Power set Power override	00	Read/Write
94		Tx4_Application_Select, Rx Channel 4	00	Read/Write
95		Tx3_Application_Select, Rx Channel 3	00	Read/Write
96		Tx2_Application_Select, Rx Channel 2	00	Read/Write
97		Tx1_Application_Select, Rx Channel 1	00	Read/Write
98		Tx/Rx_CDR_control, channel 1~4	FF	Read/Write
99		Reserved	00	Read/Write
100	Module and Channel Masks	Masking Bit for TX/RX LOS indicator, channel 1~4	00	Read/Write
101		Masking Bit for TX, Adaptive EQ fault indicator, channel 1~4 Masking Bit for TX Transmitter/Laser indicator, channel 1~4	00	Read/Write
102		Masking Bit for TX/RX CDR Loss of Lock indicator, channel 1~4	00	Read/Write
103		Masking Bit for Temperature alarm/warning	00	Read/Write
104		Masking Bit for Vcc alarm/warning	00	Read/Write
105-106		Vendor Specific	00	Read/Write
107	Reserved		00	Read/Write
108	Free Side Device Properties	Propagation Delay MSB	*	Read-Only
109		Propagation Delay LSB	*	Read-Only

Data Address	Name	Description	Value (hex)	Read/Write
110	Free Side Device Properties	Advanced Low Power Mode	*	Read-Only
111		Far Side Managed		
112		Min Operating Voltage		
113-118	Reserved		00	Read/Write
119-122	Password Change Entry Area		80	Read/Write
123-126	Password Entry Area		00	Read/Write
127	Page Select Byte	Page Select	00	Read/Write
128	Identifier	Identifier Type of serial Module	11	Read-Only
129	Ext. Identifier	Extended Identifier of Serial Module	*	Read-Only
130	Connector	Code for connector type	07	Read-Only
131-138	Specification compliance	Code for electronic compatibility or optical compatibility	80	Read-Only
139	Encoding	Code for serial encoding algorithm	*	Read-Only
140	BR, nominal	Nominal bit rate, units of 100 Mbits/s	FF	Read-Only
141	Extended Rate Select Compliance	Tags for extended rate select compliance	*	Read-Only
142	Length(SMF)	Link length supported for SMF fiber in km (note 1)	02	Read-Only
143	Length(OM3 50 um)	Link length supported for EBW 50/125 um fiber (OM3), units of 2m	00	Read-Only
144	Length(OM2 50 um)	Link length supported for 50/125 um fiber (OM2), units of 1m	00	Read-Only
145	Length(OM1 62.5 um)	Link length supported for 62.5/125 um fiber (OM1), units of 1m	00	Read-Only
146	Length (Copper)	Link length of copper or active cable, units of 1 m (note 1)Link length supported for 50/125 um fiber (OM4), units of 2 m when Byte 147 declares 850nm VCSEL	00	Read-Only
147	Device tech	Device technology	*	Read-Only
148-163	Vendor name	QSFP+ vendor name(ASCII)	*	Read-Only
164	Extended Module	Extended Module codes for InfiniBand	*	Read-Only
165-167	Vendor OUI	QSFP+ vendor IEEE company ID	*	Read-Only
168-183	Vendor PN	Part number provided by QSFP+ vendor(ASCII)	*	Read-Only

Data Address	Name	Description	Value (hex)	Read/Write
184	Vendor rev	Revision level for part number provided by vendor(ASCII)	*	Read-Only
185			*	Read-Only
186	Wave length or Copper cable Attenuation	Nominal laser wavelength (wave-length=value/20 in nm) or copper cable attenuation in dB at 2.5GHz (Adrs 186) and 5.0GHz (Adrs 187)	66	Read-Only
187			58	Read-Only
188	Wavelength tolerance	Guaranteed range of laser wavelength(+/-value) from nominal wavelength.(wave-length Tol.=value/200 in nm)	*	Read-Only
189			*	Read-Only
190	Max case temp.	Maximum case temperature in degrees C	*	Read-Only
191	CC_BASE	Check code for base ID fields (addresses 128-190)	*	Read-Only
192	Link codes	Extended Specification Compliance Codes	06/09	Read-Only
193	Options	Rate Select, TX Disable, TX Fault, LOS, Warning indicators for: Temperature, VCC, RX power, TX Bias	*	Read-Only
194			*	Read-Only
195			*	Read-Only
196-211	Vendor SN	Serial number provided by vendor (ASCII)	*	Read-Only
212-219	Date Code	Vendor's manufacturing date code	*	Read-Only
220	Diagnostic Monitoring Type	Indicates which types of diagnostic monitoring are implemented (if any) in the Module. Bit 1,0 Reserved	*	Read-Only
221	Enhanced Options	Indicates which optional enhanced features are implemented in the Module.	*	Read-Only
222	Extended Bit Rate	Extended Bit Rate	*	Read-Only
223	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)	*	Read-Only
224-255	Vendor Specific EEPROM	Vendor Specific ID	*	Read-Only

Notes

- * represent that the values read from register varied according to module state.

Digital Diagnostics Functions

Digital diagnostic management interface (DDMI) is realized by I2C interface in compliance with SFF-8636. Diagnostic management functions are realized, and the data addresses are listed in the form below.

Performance Item	Data Address	
	Alarm & Warning	Monitor
Module temperature	6	22-23
Module voltage	7	26-27
Bias current	11-12	42-49
Transmitter optical power	13-14	50-57
Receiver optical power	9-10	34-41

Mechanical Specifications

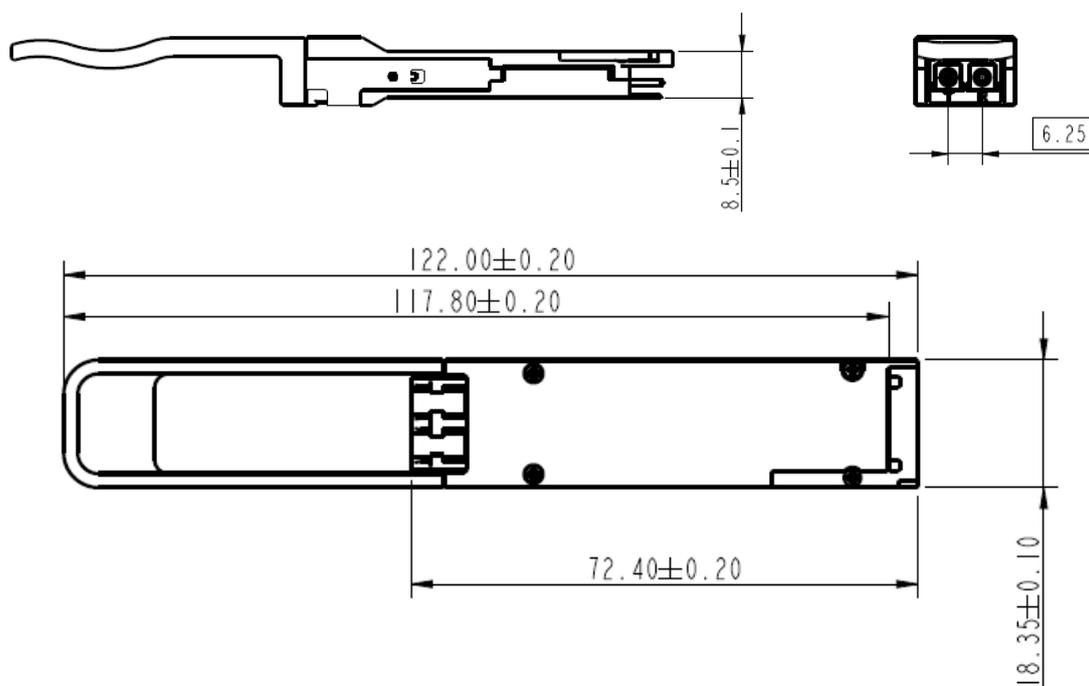


Figure 3. Mechanical Dimensions

Safety Specification Design



Cautions

- 1) Do not look into fiber end faces without eye protection using an optical meter (such as magnifier and microscope) within 100 mm, unless you ensure that the laser output is disabled. When operating an optical meter, observe the operation requirements.

-
- 2) The module and all host contacts with exception of the module and host high speed signal contacts shall withstand 2kV electrostatic discharge. And the module and host high speed signal contacts shall withstand 1kV electrostatic discharge based on Human Body Model per JEDEC JESD22-A114-B.
-

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

References

1. 100G CWDM4 MSA Technical Specifications, 2km Optical Specifications, Rev 1.1, Nov 24, 2015.
2. SFF-8665: “QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28)”, Rev 1.9, June 29, 2015 and associated SFF documents referenced: SFF-8661, SFF-8679, SFF-8636, SFF-8662, SFF-8663, SFF-8672, SFF-8683.
3. IEEE 802.3bm, CAUI-4 Interface.
4. OIF-CEI-03.1, CEI-28G-VSR, Feb 18, 2014.