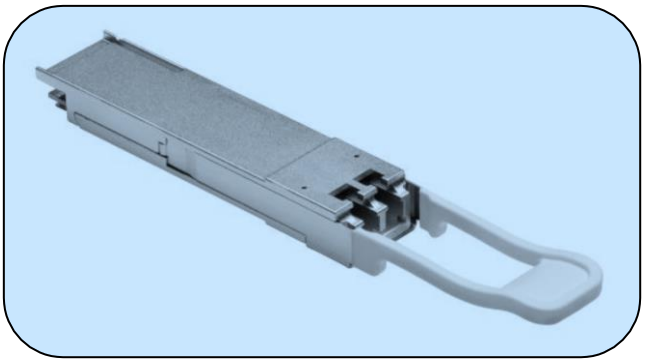
XQDxx9-80LM

DWDM PAM4 QSFP28
100 G Ethernet Transceiver



Features

- 100 Gb/s on a 2 wavelengths with 50 GHz DWDM grid
- PAM4 modulation format enabling 56 Gb/s on a single wavelength
- 80 km reach over duplex, SMF
- Integrated, high-gain FEC encode/decode
- Advanced DSP receiver technology
- Compatible with the QSFP28 MSA as specified in SFF-8665
- Optical and host loopback functionality
- CAUI4 electrical interface
- Adjustable de-emphasis and adaptive equalization in transmit path to compensate for losses on receiver
- Typical power consumption of 4.5 W
- Standard 2-wire DDM
- RoHS 6/6 compliant

Applications

- Multi-channel Data Center Interconnections (DCI)

Description

The XQDxx9-80LM QSFP28 is a DWDM, fiber-optic transceiver for cost effective 100 Gigabit Ethernet (100GbE) communication on extended distances. It's is designed for data center interconnect systems, that require multiple 100Gb connections. Using external amplification, CD compensation and DWDM multiplexing high-capacity links with up to 4Tb throughput and 80 km reach can be constructed.

The optical interface utilizes two, DWDM wave-lengths on a 50 GHz grid. Using PAM4 modulation format 50 Gb/s is transferred on each of two wavelengths. Integrated Forward Error Correction (FEC) and Receiver ADC/DSP technology enable communication over amplified optical paths with distances of up to 80km. The optical signals are transmitted and received from the module through standard duplex SMF and LC receptacles.

Electrical signals are transmitted and received from the host via a standard, 38-pin connector described in the QSFP28 MSA (SFF-8679). The electrical interface is CAUI-4 compliant (IEEE P802.3bm Annex 83E), splitting the 100 Gb/s signals into four, parallel, 25 Gb/s NRZ streams.

Xenopt XQDxx9-80LM provides high performance using innovative, silicon photonics circuit, arrayed modulation driver, arrayed TIA and advanced DSP technology.

Absolute Maximum Ratings

- Stresses beyond those listed here may cause permanent damage to the device.
- These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the "Operating Conditions" and "Electrical Specifications" of this datasheet is not implied.
- Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameter	Symbol	Min	Max	Unit
Storage Temperature[2]	Tstore	-40	+85	°C
3.3V Power Supply[1]	Vcc	-0.5	3.6	V
Data Input Voltage, Single-Ended	Vin	-0.5	Vcc+0.5	V
I2C Controls	SDA, SCL	-0.3	3.9	V
ESD: All Pins[4]		---	1000	V
Storage Humidity[2]	RH	5	85	%
ESD Resistance[3,4]	VESD		1	kW

Notes:

1. Less than 10 seconds for the absolute maximum ratings of the supply voltage
2. Non-condensing environment
3. Standard ESD protected workspace is required
4. Human Body Model

Operating Conditions

Operating conditions specify parameters for which the optical and electrical specifications apply. Optical and electrical characteristics are not defined for operation outside the recommend operating conditions. Reduced reliability or damage to the module may occur for such operation over an extended period of time.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
3.3V Supply Range	Vcc	±5%	3.135	3.3	3.465	V
Power Supply Noise		f = 0 to 5 MHz	---	---	50	mVpp
Control Input Voltage High			2	---	Vcc+0.3	V
Control Input Voltage Low			-0.3	---	0.8	V
Rx Diff Data Output Load			---	100	---	Ω
Case Temperature[1]	TC	Measured at center of heat sink contact area	20	---	70	ºC
Power Dissipation	PD	Tc = 70 °C, Vcc=3.465V, End of Life	---	---	5.0 (MSA class 7)	W
Instantaneous Peak Current at Hot Plug	Icc_ip_8	Instantaneous peak duration < 50 µs	---	---	2000 (MSA class 7)	mA

Notes:

1. Operating environment of the module must be controlled in order to prevent condensation on Peltier-cooled photonics. Ambient temperature and humidity must be within limits defined in GR-63 (see Figure 4-1).

Transmitter Optical Characteristics

Parameter	Min	Typ	Max	Unit
Signaling Rate, each lane[1]	Typ -100 ppm	56.25	Typ +100 ppm	Gb/s
Wavelength	See Product Selection Guide			nm
Frequency Control[2]	λc - 12	---	λc + 12	GHz
Center Wavelength Spacing[3]	---	50	---	GHz
Extinction Ratio	---	6	---	dB
Side Mode Suppression Ratio (SMRS)	30	---	---	dB
Average Launch Power, per lane	-11	-10	-8	dBm
Dispersion Tolerance[4]	-100	---	+100	ps/nm
Average Launch Power when Transmitter OFF, each lane	---	---	-30	dBm
Optical Return Loss Tolerance	---	---	20	dB
Transmitter Reflectance[5]	---	---	-12	dB

Notes:

1. Rate = (25.7813Gb/s + FEC OH (~9%)) * 2 (PAM4)
2. Frequency control loop used to optimize link performance. Min/max limits indicate control loop range.
3. Wavelength difference between both optical lanes
4. Residual dispersion after DCM
5. Measured with signal emitted into the transmitter

Receiver Optical Characteristics

Parameter	Min	Typ	Max	Unit
Signaling Rate, each lane[1]	Typ-100 ppm	56.25	Typ+100 ppm	Gb/s
Wavelength	See Product Selection Guide			nm
Damage Threshold[2]	10	---	---	dBm
Receiver Power, each lane	-2.0	---	6.0	dBm
Receiver Reflectance	---	---	-20	dB
Required OSNR	31	---	---	dB
LOS asserted threshold - OMA	-10	---	---	dBm
LOS de-asserted threshold - OMA	---	---	-3	dBm
LOS Hysteresis	---	1.0	---	dB

Notes:

1. Rate = (25.7813Gb/s + FEC OH (~9%)) * 2 (PAM4)
2. Receiver is capable to tolerate without damage continuous optical signal below or equal to this average power level.
3. Module receiver LOS characteristics are realized by monitoring the DC current of the high-speed photodiodes. Preliminary LOS threshold limits are shown in the table below.

Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

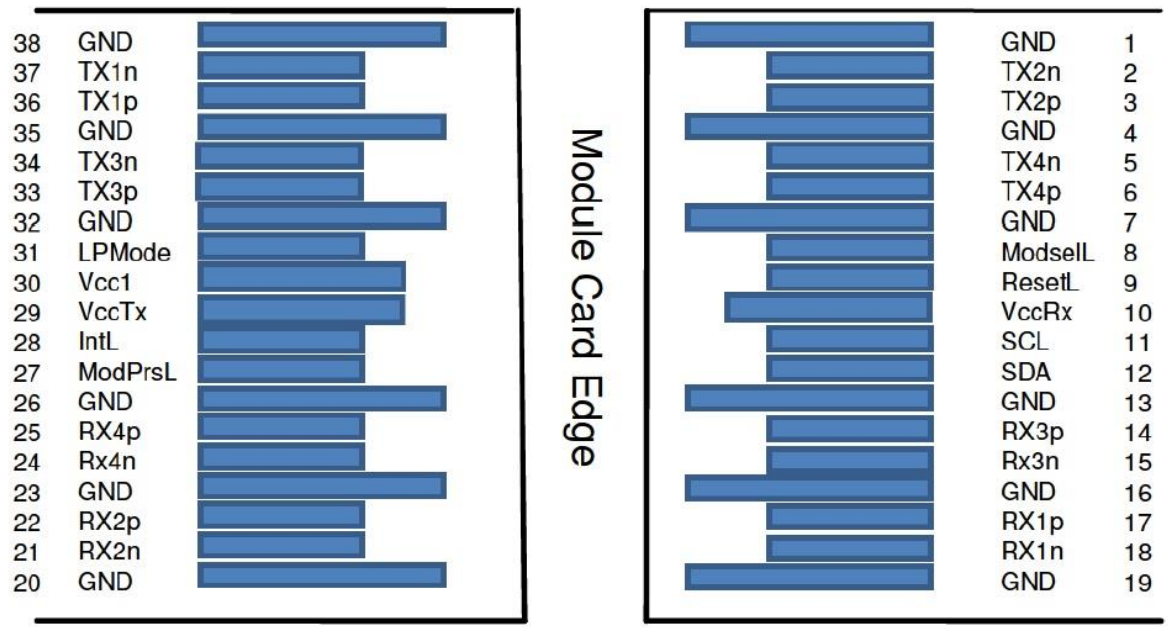
Parameter	Symbol	Min	Typ	Max	Unit
Temperature monitor absolute error[1]	DMI_{TEMP}	-5	---	5	Deg. C
Supply voltage monitor absolute error[2]	DMI_{VCC}	-0.1	---	0.1	V
Channel RX power monitor absolute error	DMI_{RX_CH}	-2	---	2	dB
Channel Bias current monitor	DMI_{Ibias_CH}	-10%	---	10%	mA
Channel TX power monitor absolute error	DMI_{TX_CH}	-2	---	2	dB

Notes:

1. Over operating temperature range
2. Over Full operating range

Electrical Connector

The host side electrical interface is compliant to the QSFP28 MSA (SFF-8679) including pin layout and electrical specifications. See figure below for 38-pin connector layout.



Top View Bottom Veiw

Figure 1: 38-pin Connection Layout

Pin Assignment

See table below for pin assignments and descriptions. In standard/default operation, mapping is defined by the MAC and direct CAUI-to-optical-lane mapping does not exist. When the module's FEC is bypassed, CAUI lanes 1 and 2 are mapped to optical lane 1 and CAUI lanes 3 and 4 are mapped to optical lane 2.

Pin Assignment

Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTL-I	ModSelL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power supply receiver	2	2
11	LVCMOS-I/O	SCL	2-wire serial interface clock	3	
12	LVCMOS-I/O	SDA	2-wire serial interface data	3	
13		GND	Ground	1	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Input	3	
15	CML-O	Rx3n	Receiver Inverted Data Input	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Input	3	
18	CML-O	Rx1n	Receiver Inverted Data Input	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Input	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Input	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Input	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Input	3	
26		GND	Ground	1	
27	LVTTL-O	ModPrsL	Module Present	3	
28	LVTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power Supply	2	2
31	LVTTL-I	LPMode	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

Notes:

1. GND is the symbol for signal supply (power) common for the QSFP module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane

2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. The connector pins are each rated for a maximum of 1000 mA

Mechanical Outline

The mechanical outline design of the module as well as the physical PCB layout of the connector should be compliant to SFF-8661, Specification for QSFP+ 28 Gb/s 4X Pluggable Module. Basic module dimensions are shown below.

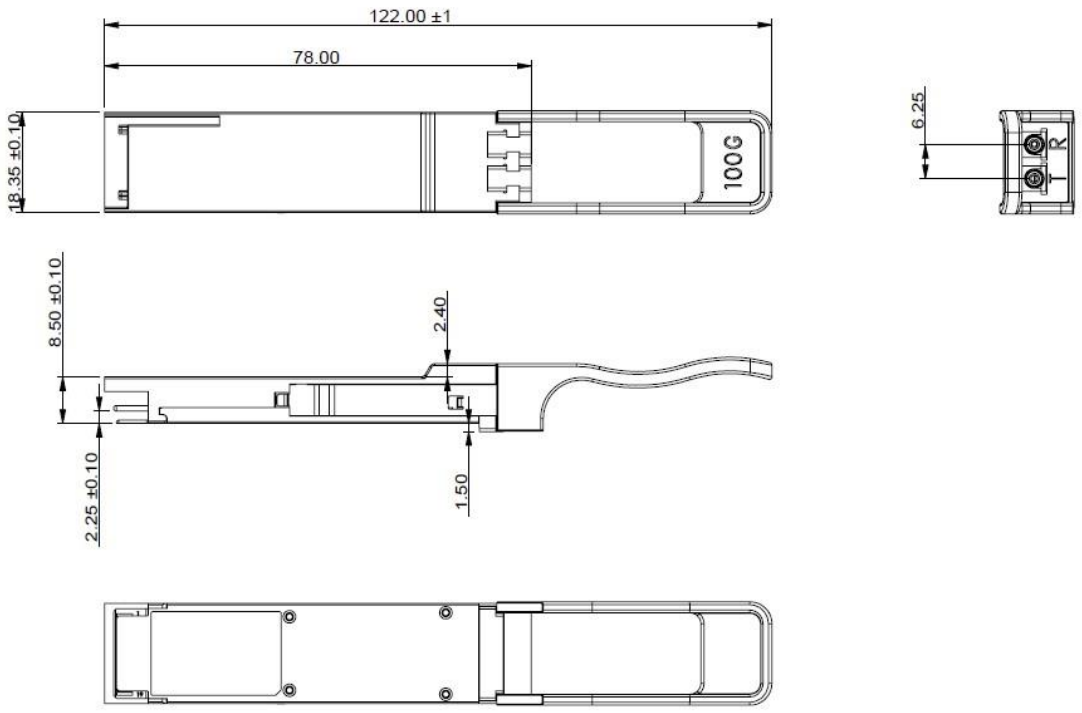


Figure 2: Module Dimensions in mm

ESD Ratings

The transceiver should be handled in an ESD-protected environment utilizing grounded benches, floor mats, ionizers, and wrist straps. It should be shipped in ESD-protective packaging. ESD limit for all pins is 1 kV HBM.

Ordering information[1]

PN	Description
XQDxx9-80LM	DWDM PAM 4 QSFP28 100G Ethernet Pluggable Transceiver, 80 km, LC, DDM, -40°C ~ +85°C, xx=20 ~ 59 (ITU grid channel C-band ID)

Notes:
[1] Specification may change without notice. For accurate specification please contact XenOpt reseller before placing an order. The content of this document is subject to change without notice. Please specify any compatibility requirements at time of ordering. Standard MSA compatible pluggable components may not work or some function of these components may not be available in devices that require customized compatible devices. Pluggable components compatible with one type of communications equipment may not work in other type of communications equipment.

Important Notice

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