

100G QSFP28 LR4 Transceiver

Current Document Version V2.0



Key Feature

- Supports 103.125Gb/s and 111.81Gb/s aggregate bit rates
- Hot-pluggable QSFP28 MSA form factor
- Duplex LC receptacle optical interface
- Transmitter: cooled 4x28Gb/s DML laser
- Receiver: 4x28Gb/s PIN receiver
- Compliant with CEI-28G-VSR
- Single +3.3V power supply
- Low power dissipation (Max:4.0W)
- Built in digital diagnostic function
- Operating case temperature range 0°C to 70°C

Applications

- 100GBASE-LR4 & OTU4
- Infiniband EDR
- Client-side 100G Telecom connections

Ordering Information - 100G QSFP28 LR4

Part No.	Data Rate	Distance	Wavelength	Media	Connector	Temp.
LLQ0-YLR04LC	103G/112G	10km	LWDM 1295.56/1300.05/1304.5 8/1309.14nm	SMF	Duplex LC	C

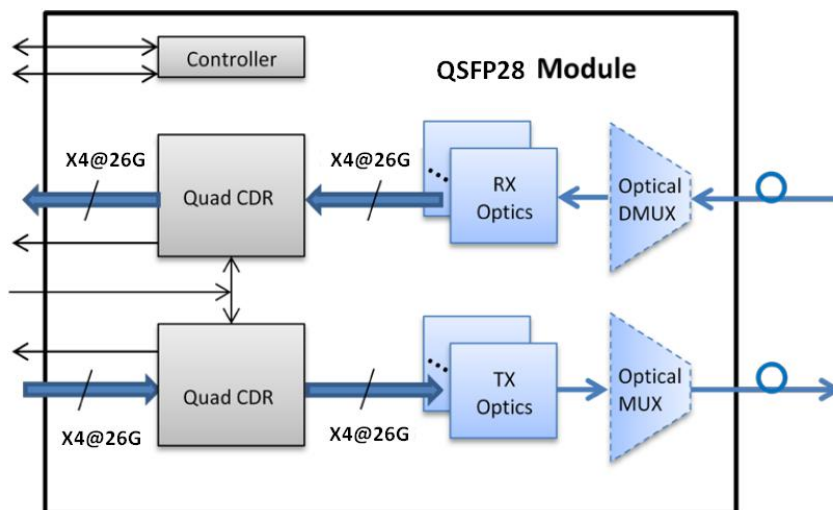
Product Description

The 100G QSFP28 LR4 optical transceiver integrates the transmit and receive path onto one module. On the transmit side, four lanes of serial data streams are recovered, retimed, and passed on to four laser drivers, which control four lasers with 1295.5, 1300.0, 1304.5, and 1309.1nm center wavelengths.

The optical signals are then multiplexed into a single-mode fiber through an industry-standard LC connector. On the receive side, four lanes of optical data streams are optically demultiplexed by an integrated optical demultiplexer. Each data stream is recovered by a photodetector and transimpedance amplifier, retimed, and passed on to an output driver. This module features a hot-pluggable electrical interface, low power consumption, and 2-wire serial interface



Functional Diagram



Absolute Maximum Rating

Parameter	Symbol	Min.	Max.	Unit	Note
Supply Voltage	VCC	-0.5	3.6	V	
Storage Temperature	TS	-40	85	°C	
Relative Humidity	RH	0	85	%	
Rx Damage Threshold, each lane	PRdmg	5.5		dBm	

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the transceiver.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
Data Rate (100GE)	DR		103.125		Gb/s	
Data Rate (OTU4)	DR		111.81		Gb/s	
Supply Voltage	VCC	3.135	3.3	3.465	V	
Operating Case Temp.	TC	0		70	°C	
Power Consumption	PC			4.0	W	
Transmission Distance (without FEC)	TD			10	km	SMF



Electrical Characteristics

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
Transmitter						
Signaling rate per lane		25.78125±100ppm			Gb/s	
Differential data input swing per lane	Vin,pp,dif			900	mV	
DC common mode voltage		-350		2850	mV	1
Differential termination mismatch				10	%	
Differential input return loss		Per Section 83E.3.3.1, IEEE 802.3bm				
Differential to common mode input returnloss		Per Section 83E.3.3.1, IEEE 802.3bm				
Module stressed input test		Per Section 83E.3.4.1, IEEE 802.3bm				
Receiver						
Signaling rate per lane		25.78125±100ppm			Gb/s	
Differential data output swing	Vout,pp			900	mV	
DC common mode voltage		-350		2850	mV	1
Common Mode Noise, RMS				17.5	mV	
Differential termination mismatch				10	%	
Eye width		0.57			UI	
Eye height, differential		228			mV	
Vertical eye closure	VEC			5.5	dB	
Transition time (20% to 80%)	tr, tf	12			ps	
Differential output return loss		Per Section 83E.3.1.3, IEEE 802.3bm				
Common to differential mode conversion return loss		Per Section 83E.3.1.3, IEEE 802.3bm				

Note: 1. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.


Optical Characteristics (Under Recommended Operating Conditions) **IEEE802.3ba 100GBASE-LR4**

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter						
Transmit Rate for Each Lane	DRPL	25.78125 ± 100		ppm	Gb/s	
Four Lane Wavelength Range	λ1	1294.53	1295.56	1296.59	nm	
	λ2	1299.02	1300.05	1301.09	nm	
	λ3	1303.54	1304.58	1305.63	nm	
	λ4	1308.09	1309.14	1310.19	nm	
Total launch power	Pout			10.5	dBm	
Average launch power, each lane	Pavg	-4.3			4.5	dBm
Optical Modulation Amplitude (OMA), each lane	POMA	-1.3			4.5	dBm
Extinction ratio	ER	4				dB
Side-mode suppression ratio	SMSR	30				dB
Average launch power of OFF transmitter, per lane	POFF			-30	dBm	
Relative Intensity Noise	RIN			-130	dB/Hz	
Transmitter reflectance	TR			-12	dB	
Transmitter eye mask {X1,X2,X3,Y1,Y2,Y3}	Mt	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				1
Receiver						
Receive Rate for Each Lane	DRPL	25.78125 ± 100		ppm	Gb/s	
Four Lane Wavelength Range	λ1	1294.53	1295.56	1296.59	nm	
	λ2	1299.02	1300.05	1301.09	nm	
	λ3	1303.54	1304.58	1305.63	nm	
	λ4	1308.09	1309.14	1310.19	nm	
Damage threshold for Each Lane	Pmax	5.5			dBm	
Average Receive Power for Each Lane	Pin	-10.6	-	4.5	dBm	
Receive power, each lane (OMA)					4.5	dBm
Difference in receive power between any two lanes (OMA)					5.5	dB
Receiver sensitivity (OMA), each lane	Psens			-8.6	dBm	2
Stressed receiver sensitivity (OMA), each lane					-6.8	dBm 3
Receiver reflectance	Rref			-26	dB	
Los De-Assert	LOSD			-11.6	dBm	
Los Assert	LOSA	-23.6			dBm	
Loss Hysteresis	LOSH	0.5	6		dBm	
Conditions of stressed receiver sensitivity test:						4
Vertical eye closure penalty,each lane	Vecp	1.8				dB
Stressed eye J2 Jitter, each lane	J2	0.3				UI
Stressed eye J9 Jitter, each lane	J9	0.47				UI

Note:

1. Hit ratio 5×10^{-5} .
2. Measured with a PRBS 231 -1 test pattern, BER = 1×10^{-12} @25.78Gb/s.



3. Measured with conformance test signal at receiver input for BER = 1×10^{-12} .
4. Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

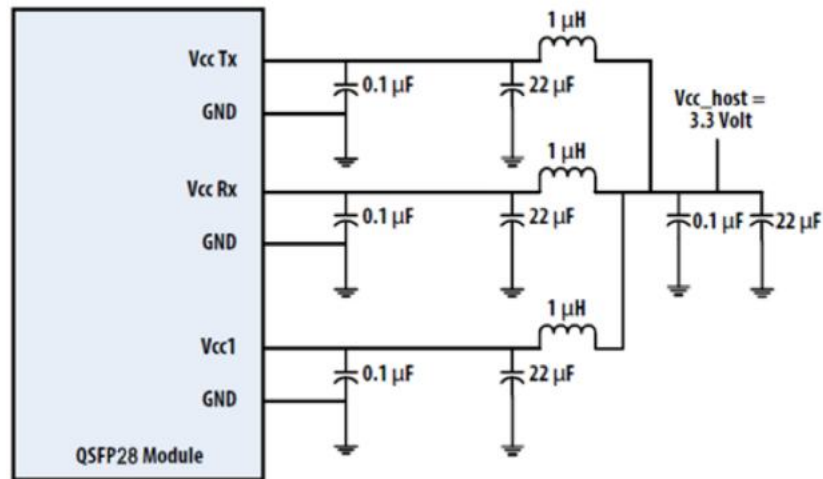
Optical Characteristics (Under Recommended Operating Conditions) **ITU-T G.959.1 OTU4 4I1-9D1F**

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter						
Transmit Rate for Each Lane	DRPL	27.95249 ± 20 ppm			Gb/s	
Four Lane Wavelength Range	λ1	1294.53	1295.56	1296.59	nm	
	λ2	1299.02	1300.05	1301.09	nm	
	λ3	1303.54	1304.58	1305.63	nm	
	λ4	1308.09	1309.14	1310.19	nm	
Total launch power	Pout	10			dBm	
Average launch power, each lane	Pavg	-0.6	4		dBm	
Extinction ratio	ER	4	7		dB	
Side-mode suppression ratio	SMSR	30			dB	
Average launch power of OFF	PoFF	-30			dBm	
Optical return loss tolerance	ORLT	20			dB	
Transmitter reflectance	TR	-12			dB	
Transmitter eye mask {X1,X2,X3,Y1,Y2,Y3}	Mt	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				1
Receiver						
Receive Rate for Each Lane	DRPL	27.95249 ± 20 ppm			Gb/s	
Four Lane Wavelength Range	λ1	1294.53	1295.56	1296.59	nm	
	λ2	1299.02	1300.05	1301.09	nm	
	λ3	1303.54	1304.58	1305.63	nm	
	λ4	1308.09	1309.14	1310.19	nm	
Damage threshold for Each	Pmax	4.5			dBm	
Average Receive Power for Each Lane	Pin	-6.9	-	4	dBm	
Difference in receive power between any two lanes				5.5	dB	2
Equivalent Sensitivity, each lane	Psens			-8.4	dBm	3
Receiver reflectance	Rref	-26			dB	
Los De-Assert	LOSD	-11.6			dBm	
Los Assert	LOSA	-25			dBm	
Loss Hysteresis	LOSH	0.5	6		dBm	

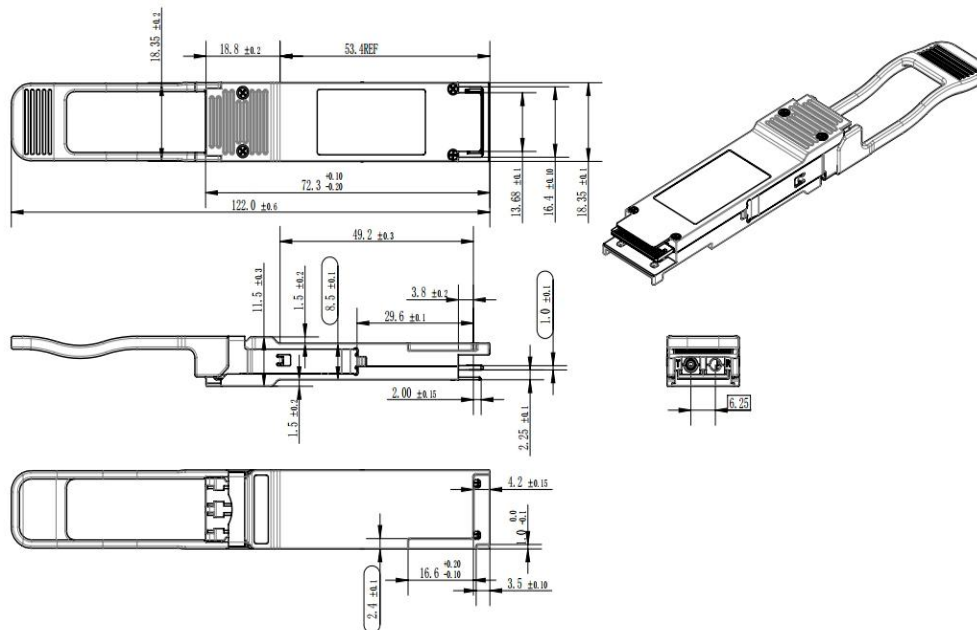
Notes:

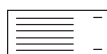
1. Hit ratio 5×10^{-5} .
2. Specified at a BER of 10^{-6} (pre-FEC), per ITU-T G.sup39.

Recommended Power Supply Filter



Mechanical Dimension





QSFP28 PIN Function Definitions

Pin	Logic	Symbol	Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-wire serial interface clock	
12	LVCMOS-I/O	SDA	2-wire serial interface data	
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	



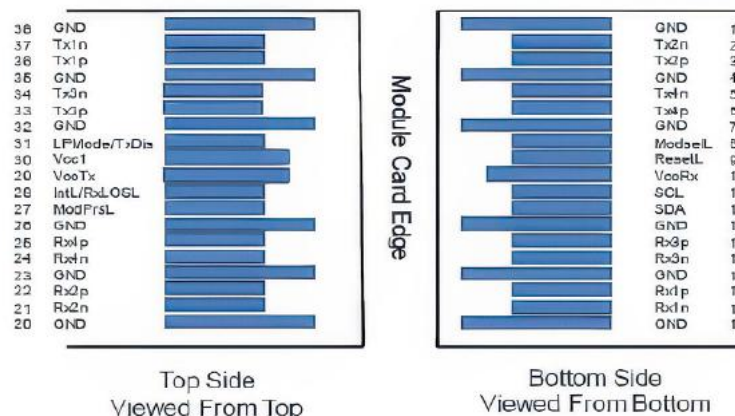
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Present	
28	LVTTL-O	IntL/RxLOSL	Interrupt/optional RxLOS	
29		Vcc Tx	+3.3 V Power supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMode/TxDis	Low Power Mode/optional TX Disable	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	1

Notes:

1. GND is the symbol for signal and supply (power) common for the module. All are common within the 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. VccRx, Vcc1 and VccTx are applied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A.

QSFP28 Electrical Pad Layout

For detail mechanical information, please refer to the related document of QSFP MSA.





Laser Safety Warning

This product is classified as a Class 1 Laser Product according to IEC 60825-1.
It complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Caution: Use of optical instruments with this product will increase eye hazard. Do not view the laser beam directly with optical instruments or naked eyes.

Disclaimer

Images are for illustrative purposes only and may not accurately represent the actual product. Specifications and appearances are subject to change without prior notice.

The information provided in this datasheet is subject to change without notice. Lumulus Technologies assumes no responsibility for any errors or omissions. Performance may vary depending on application and operating conditions. Product specifications are provided for reference only and do not constitute a warranty.

For assistance and more information, please contact your sales representative or write to sales@lumulus.com

Lumulus Technologies, Inc. USA

Headquarters

9685 Via Excelencia Suite 106
San Diego, CA 92126
USA

 (+1) 858-397-2228

 www.lumulus.com

Lumulus Technologies, Inc. Thailand

Production site

Sri Ayutthaya - Thailand