

# 100Gb/s QSFP28 ER4 1310nm 40km Extended Temperature Optical Transceiver

## Features

- Maximum Link Length: 40km(with Host FEC), 30km(without Host FEC)
- 103.125Gbps(4x 25.78125 Gb/s) CAUI-4 Compliant
- Single 3.3V Power Supply
- Supports KR4 FEC
- Operating Case Temperature Range: -20 to +85°C
- Transmitter: Cooled 4x LAN-WDM EML-based TOSA
- Receiver: 4x APD-based ROSA
- Hot Pluggable QSFP28 MSA Compliant
- SFF-8636 Management Interface
- Class 1 Laser Safety

## Applications

- Data Center

## Description

The QSFP-100GE-ER4 Optical Transceiver Module is designed for use in 100GBASE Ethernet throughput up to 40km over LC duplex SMF using a wavelength of 1310nm. Full 40km reach requires the use of FEC on the host platform. Without FEC, the reach is 30km. Designed for outside plant applications with an extended temperature range [-20° C to +85° C], this transceiver is compliant with SFF-8636 and 4WDM MSA standards. The built-in digital diagnostics monitoring (DDM) allows access to real-time operating parameters. With these features, this easy to install, hot swappable transceiver is suitable for Data Center applications.

## Absolute Maximum Ratings

Table1-Absolute Maximum Ratings						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Storage Temperature Range	TS	-40		85	°C	
Supply Voltage	VCC	0		+3.6	V	+3.3 V
Optical Receiver Input				-2.5	dBm	Average

## Recommended Operating Conditions

Table2-Recommended Operating Conditions						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	TOPR	-20	25	85	°C	Cold start - 40degC
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Supply Current				1754	mA	Steady State
Supply Voltage Noise Tolerance	PSNR			66	mV	10Hz- 10MHz
Power Consumption				5.5	W	Target

## Optical Characteristics

Table3-Optical Characteristics						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Channel Data Rate	fDC	25.78125			Gb/s	Note 1
Aggregate Data Rate	fD	103.125			Gb/s	
Signal Speed Variation from Nominal	ΔfD	- 100		100	ppm	
Transmitter(Each Lane)						
Wavelength L0	λ 1	1294.53		1296.59	nm	
Wavelength L1	λ 2	1299.02		1301.09	nm	
Wavelength L2	λ 3	1303.54		1305.63	nm	
Wavelength L3	λ 4	1308.09		1310.19	nm	
Optical Output Power in OMA	OMA	0.5		6.5	dBm	Note 2
Average Launch Power		-2.5		6.5	dBm	Note4
Launch Power in OMA Minus TDP,	OMA	-0.5				

each Lane						
Average Launch Power Tx_Off	$P_{OFF}$			-30	dBm	
Transmitter and Dispersion Penalty (TDP), each Lane				3.0	dB	
Extinction Ratio	ER	4.5			dB	
Receiver(Each Lane)						
Receiver Sensitivity(OMA), each Lane at $5 \times 10^{-5}$ BER	$P_{min} OMA$			- 18.5	dBm	Note3
Max. Receive Power in OMA				-3.5	dBm	
Average Receive Power		-20.5		-3.5	dBm	Note5
Stressed Receiver Sensitivity(OMA), each Lane at $5 \times 10^{-5}$ BER	$P_{min} SOMA$			- 16.0	dBm	
Vertical Eye Closure Penalty, each Lane			2.5		dB	Condition for SRS
Receive Reflectance	RF			-26		

Note1: Data Rate; NRZ, Mark Ratio 50%, PRBS=231- 1 unless otherwise specified.

Note2:  $OMA = 10 \log_{10} [2P \{ (A - 1) / (A + 1) \}]$ ,  $A = 10(ER / 10)$ ,  $P = 10(Pf / 10)$

Note3: Receiver sensitivity, which is defined for an ideal input signal, is informative and compliance is not required. If measured, the test signal should have negligible impairments such as inter- symbol interference (ISI), rise/fall times, jitter and RIN.

Note4: 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.

Note5: 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.

## RX LOS Alarm Characteristics

Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Receiver Loss of Signal Indicator Assert Level	RX_LOS			-20.5	dBm	OMA
Receiver Loss of Signal Indicator De-assert Level				- 19.0	dBm	OMA
LOS Hysteresis		0.5			dB	

## Electrical Characteristics

Table4-Electrical Characteristics					
Parameter	Min.	Typical	Max.	Unit	Notes
Transmitter(Each Lane)					
Differential Pk-Pk Input Voltage Tolerance	900			mV	at TP1a
Differential Termination Mismatch			10	%	at TP1
Single-ended Input Voltage Tolerance Range	-0.4		3.3	V	at TP1a

DC Common Mode Voltage	-350	2850	mV	at TP1
Receiver (Each Lane, at TP4)				
AC Common Mode Output Voltage (RMS)		17.5	mV	
Differential Output Voltage		900	mV	
Eye Width	0.57		UI	
Eye Height, Differential	228		mV	
Vertical Eye Closure		5.5	dB	
Differential Termination Mismatch		10	%	
Transition Time(20% to 80%)	12		ps	
DC Common Mode Voltage	-350	2850	mV	

Note: Electrical Rx output is squelched for loss of optical input signal.

## Pin Description

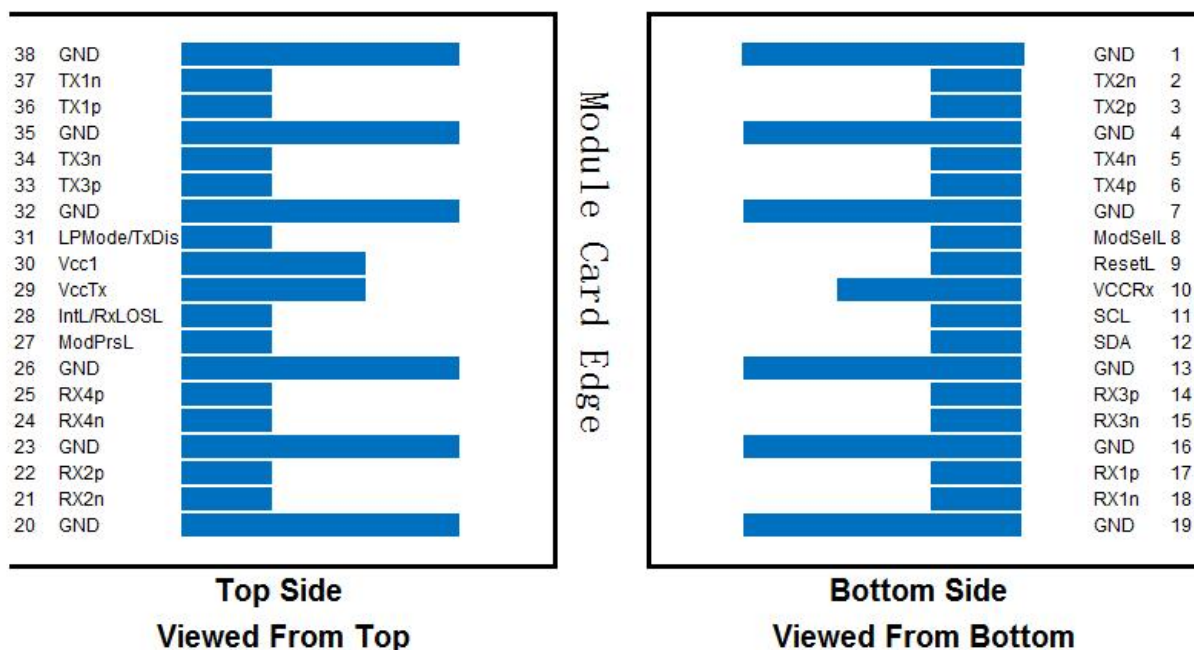


Figure 1 Pin view

## Pin Function Definitions

Table5-Pin Function Definitions				
Pin	Logic	Name	Description	Notes
1		GND	Module Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Module Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Module Ground	

8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVC MOS-I/O	SCL	2-wire serial interface clock	
12	LVC MOS-I/O	SDA	2-wire serial interface data	
13		GND	Module Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Module Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	1
19		GND	Module Ground	1
20		GND	Module Ground	
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Module Ground	
24	CML-O	Rx4n	Receiver Inverted Data Output	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Module Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL/RxLOSL	Interrupt	
29		VccTx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTL-I	LPMODE/TxDis	Low Power Mode	
32		GND	Module Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Module Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Module Ground	1

Note1: 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.

Note2: Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently.

## Mechanical Dimensions

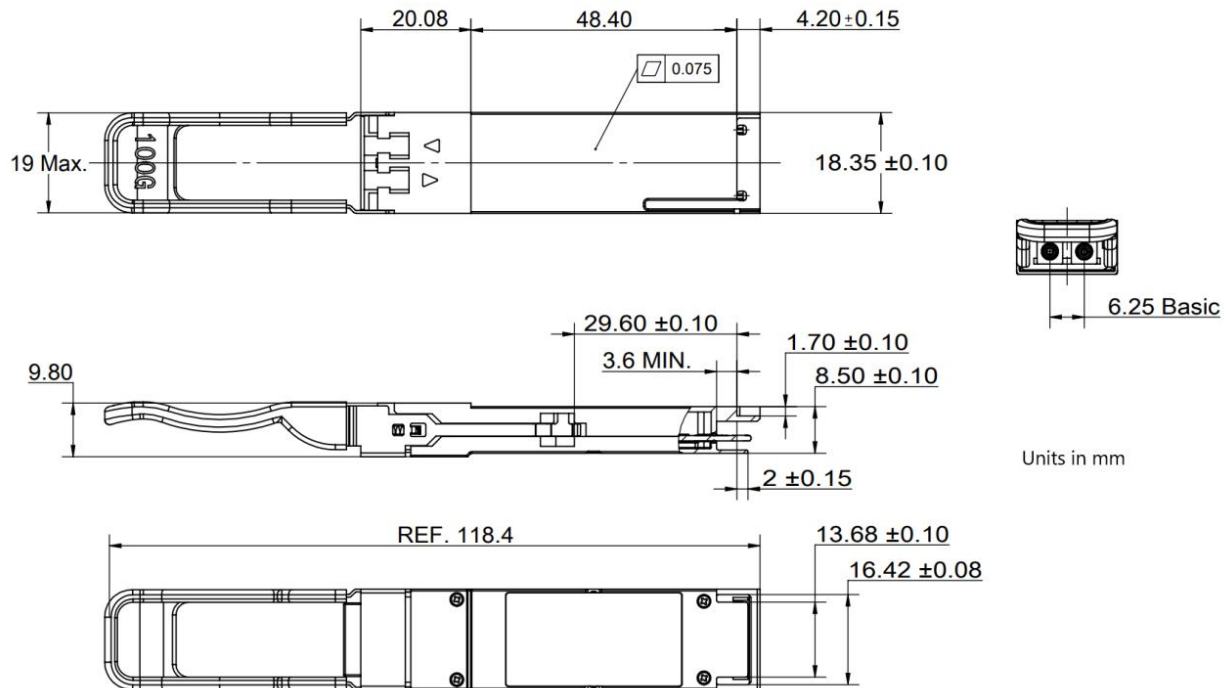


Figure 2 Mechanical Outline

## Regulatory Compliance

Parameter	Standard
EMC/EMI	FCC Part 15, Subpart B (Class B) EN55032 (Class B)
ESD	EN61000-4-2, criterion B JEDEC JESD22-A114-B Human Body Model
Laser Safety	Complies with 21 CFR 1040. 10 and 1040. 1 1 Except for Conformance with IEC 60825- 1 Ed. 3. Described in Laser Notice No. 56, Dated May 8, 2019.
Environmental	RoHS 10 (2011/65/EU + 2015/863) ISA S71.04 G2

## Further Information:

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