WAVESPLITTER™ TECHNOLOGIES, INC.

Data Sheet

100G QSFP28 ER4 Lite Dual-rate Transceiver
P/N: WST-QS28-ER4L8C

Standard:

- Compliant to IEEE 802.3ba ,IEEE 802.3bm
- Compliant to SFF 8636

Applications:

- 100GE Ethernet 100GBASE ER4
- ITU-T OTU4

Features:

- Compliant with 100GBASE LR4 and ITU T G.959.1
- Support line rates from 103.125Gbps to 111.81Gbps
- Integrated LAN WDM TOSA/APD ROSA for up to 40km, reach over SMF with FEC 30km without FEC
- Digital Diagnostics Monitoring Interface
- Duplex LC optical receptacle
- No external reference clock
- Electrically hot pluggable
- Compliant with QSFP28 MSA with LC connector
- Case operating temperature range: 0 °C to 70 °C
- Power consumption < 4.5 W

General Description

The WST-QS28-ER4L8C optical Transceiver integrates receiver and transmitter path on one module. In the transmit side, four lanes of serial da ta streams are recovered, retimed, and passed to four laser drivers. The laser drivers control 4 EML with center wavelength of 1296 nm, 1300nm, 1305nm and 1309 nm. The optical signals are multiplexed to a single mode fiber through an industry standard LC connector. In the receive side, the four lanes of optical data streams are optically de multiplexed by the integrated optical de multiplexer. Each data stream is recovered by a APD and trans impedance amplifier, retimed. This module features a hot pluggab le electrical interface, low power consumption and 2 wire serial interface The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi Source Agreement (MSA) and compliant to IEEE 802.3ba.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Note
Storage Temperature	TS	-40	85	ºC	
Power Supply Voltage	V_{CC}	-0.3	4.0	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Signal Input Voltage		Vcc-0.3	Vcc+0.3	V	

Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Units
Operating Case Temperature	T_{OP}	0		70	°C
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V
Supply Current	I_{CC}			1360	mA
Data Rate (Each channel)	BR		25.78125/27.9525		Gbps
Transmission Distance (With FEC)	TD			40	km
Transmission Distance (without FEC)	TD			30	km
Coupled fiber	Single mode fiber		9/125um SMF		

Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.13 to 3.47 Volts)

Parameter	Symbol	Min	Typical	Max	Units	Notes
Transmitter						
Input differential impedance	Rin		100		Ω	1
Differential data input swing	Vin,pp	180		1000	mV	
Transmit Disable Voltage	VD	Vcc–1.3		Vcc	V	
Enable Voltage	VEN	Vee		Vee+ 0.8	V	2
Receiver (each Lane)						
Differential data output swing	Vout,pp	300		850	mV	3
LOS Fault	VLOS fault	Vcc–1.3		VccHOST	V	4
LOS Normal	VLOS norm	Vee		Vee+0.8	V	4

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. Loss Of Signal is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Optical Characteristics (T_{OP} = 0 to 70 °C, V_{CC} = 3.13 to 3.47 Volts)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Transmitter						
Total Average Launch Power	PT			10.5	dBm	
Average Launch Power, each Lane	P_{AVG}	-2.5		6.5	dBm	
Spectral Width (-20dB)	σ			1	dB	
SMSR	SMSR	30			dB	
Extinction Ratio	ER	7			dB	
Average launch Power off per lane	Poff			-30	dBm	
Eye Mask {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					1
Receiver						
Signaling Speed per Lane		25.78125 ± 100 ppm			Gbps	
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Receiver Sensitivity each Lane(OMA) , each Lane (BER = $5x10^{-5}$)	SEN			-18.5	dBm	2
Receiver Sensitivity each Lane(OMA) , each Lane (BER = $1x10^{-12}$)				14	dBm	
Input Saturation Power (Overload)	Psat	-3.5			dBm	
LOS Assert	LOSA	-35			dBm	
LOS De-Assert	LOSD			-18	dBm	

Notes:

1. Hit ratio $5x10^{-5}$.
2. Measured with a PRBS 2^{31}-1 test pattern, @25.78Gb/s, BER<$5x10^{-5}$.

OTU4 Optical Characteristics (T_{OP} = 0 to 70 °C, V_{CC} = 3.13 to 3.47 Volts)

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Signaling Speed per Lane		27.9525 ± 20 ppm			Gb/s	
Transmitter						
Total Average Launch Power	PT			10.5	dBm	
Average Launch Power, each Lane	P_{AVG}	0.6		5.1	dBm	
Spectral Width (-20dB)	σ			1	nm	
SMSR	SMSR	30			dB	
Extinction Ratio	ER	7			dB	
Average launch Power off per lane	Poff			-30	dBm	
Eye Mask {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					1
Receiver						
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Signaling Speed per Lane		27.9525 ± 20 ppm			Gb/s	
Receive Sensitivity (OMA)	R			-17.4	dBm	2
Input Saturation Power (Overload)	Psat	-3.5			dBm	
LOS Assert	LOSA	-35			dBm	
LOS De-Assert	LOSD			-18	dBm	

Notes:

1. Hit ratio $5x10^{-5}$.
2. Measured with a PRBS 2^{31}-1 test pattern, @27.95Gb/s, BER<$5x10^{-5}$.

Pin Assignment

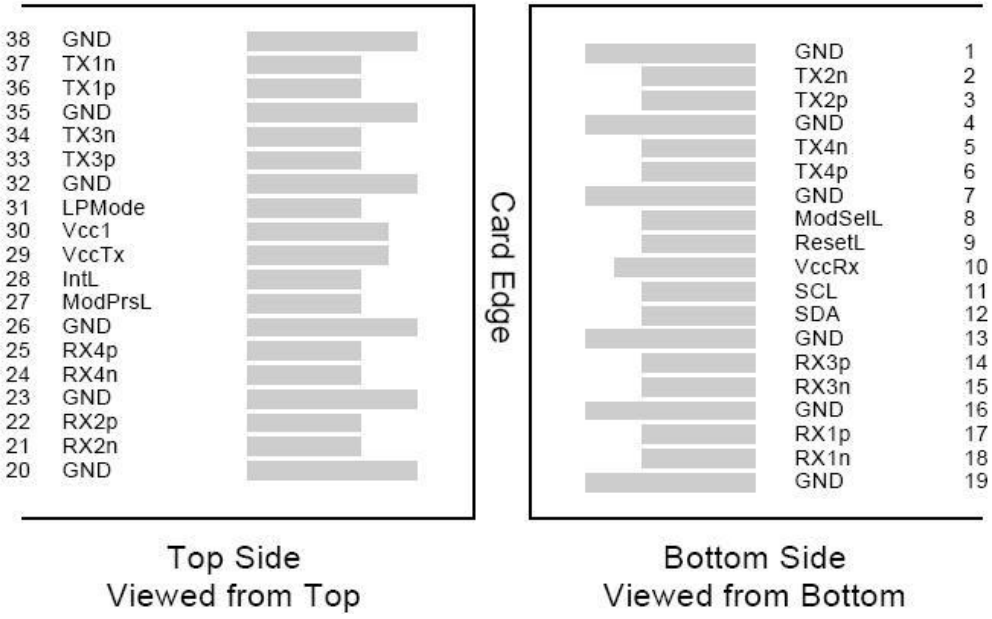


Figure . MSA Compliant Connector

PIN	Logic	Symbol	Name/Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		VccRx	+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	
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	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

1. GND is the symbol for signal and supply (power) common for the QSFP28 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 the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 3 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the module in any combination. The connector pins are each rated for a maximum current of 1000mA.

Recommended Transceiver Block Diagram

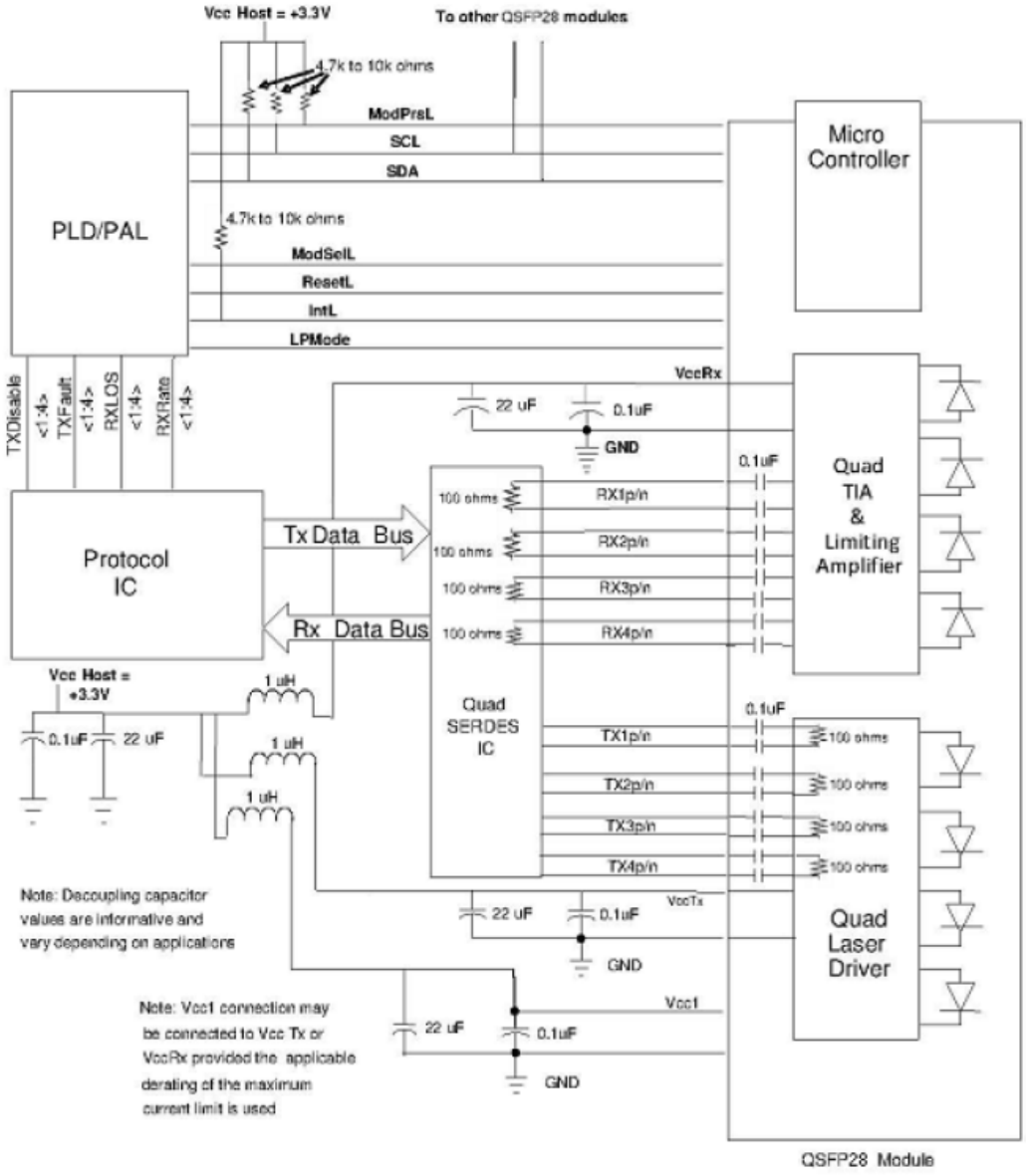
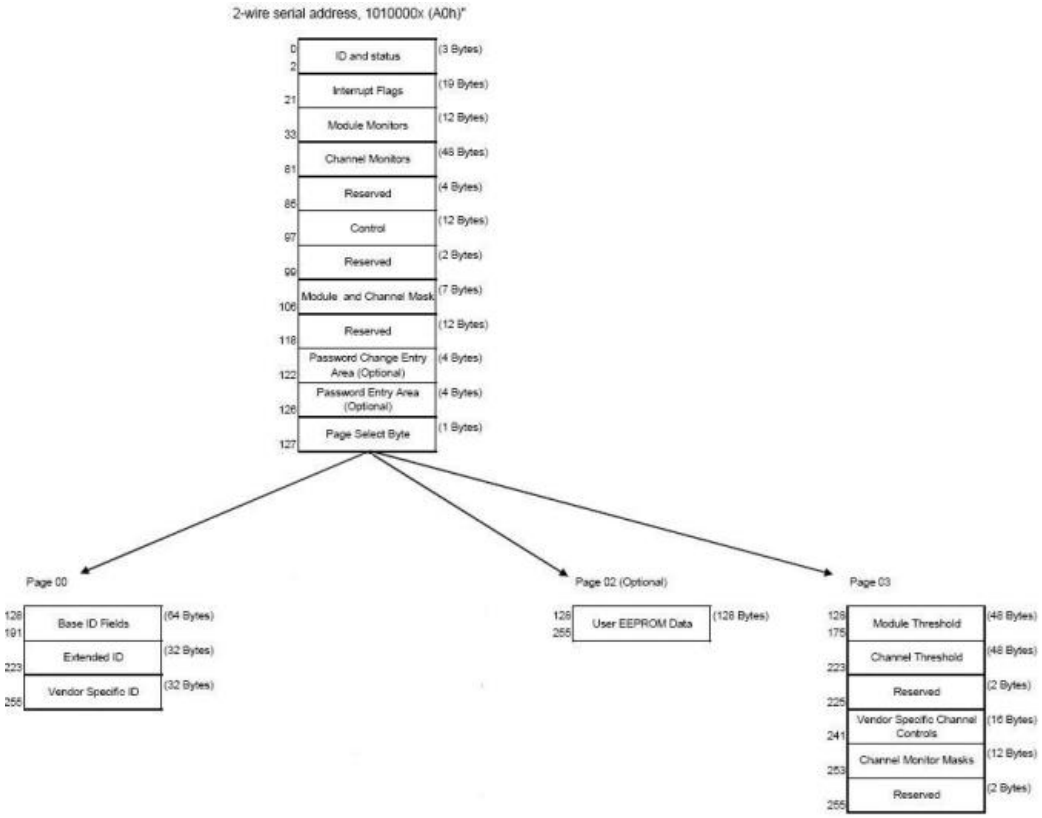


Figure . Transceiver Block Diagram

EEPROM Memory map



Digital Diagnostic Functions

Digital diagnostics monitoring function is available on all QSFP28 ER4. A 2-wire serial interface provides user to contact with module. The structure of the memory is shown in flowing. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages. This structure permits timely access to addresses in the lower page, such as Interrupt Flags and Monitors. Less time critical time entries, such as serial ID information and threshold settings, are available with the Page Select function. The interface address used is A0xh and is mainly used for time critical data like interrupt handling in order to enable a one-time-read for all data related to an interrupt situation. After an interrupt, IntL has been asserted, the host can read out the flag field to determine the affected channel and type of flag.

Mechanical Design Diagram

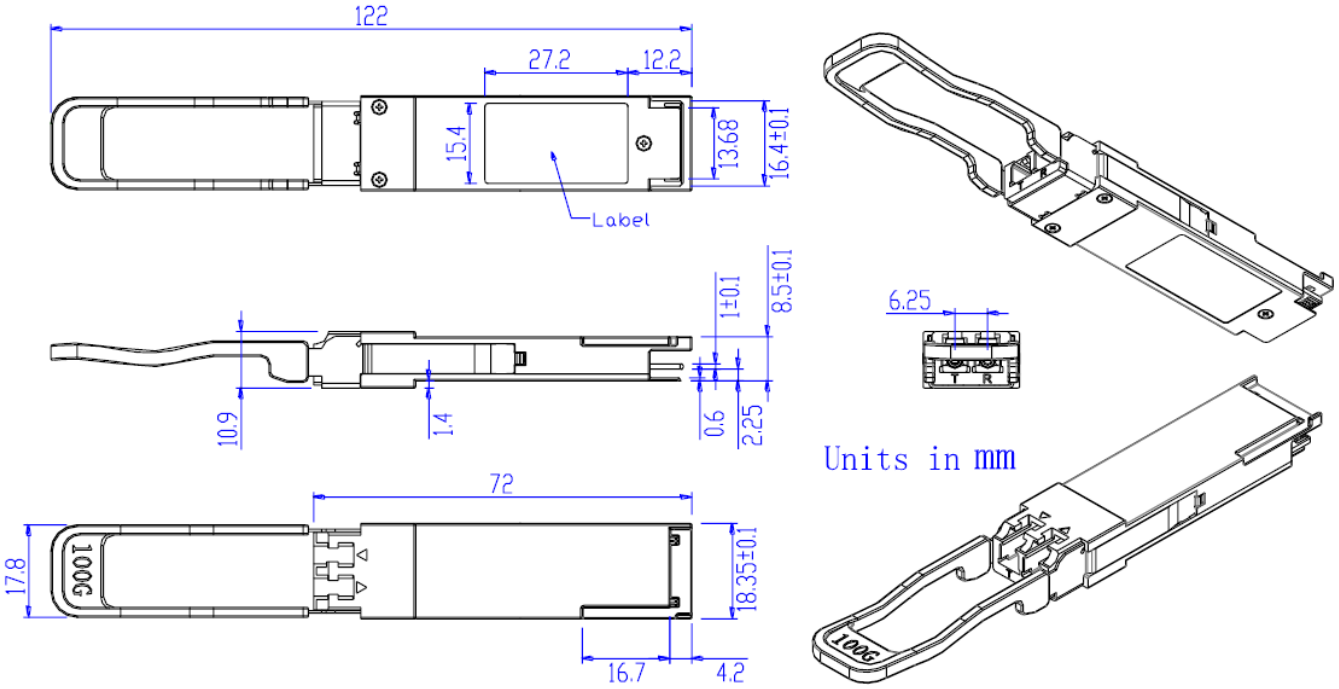


Figure . Mechanical Outline

Unit: mm

Ordering Information

Part No	Specification									
	Package	Data rate per Lane	Laser	Optical Power	Detector	Max. Receive Sensitivity (OMA)	Temp	Reach	Other	Application code
WST-QS28-ER4L8C	QSFP28	25.78 Gb/s 100GE, 27.95 Gb/s OTU4	EML	-2.5~ +6.5 each Channel	APD	-18 dBm each Channel	0~70°C	30km (without FEC) 40km (withFEC)	DDM RoHS	100G-ER4 Ethernet OTU4

Modification History

Revision	Date	Description	Originator	Review	Approved
V1.0	09-Jul-2021	New Issue	ShaoYu Lee	Tom Tang	Wayne Liao
V1.1	17-Mar-2023	Update FW and Format	ShaoYu Lee	Tom Tang	Wayne Liao

Headquarters
16F-5, No. 75, Sec. 1, Xintai 5th Rd., Xizhi Dist.,
New Taipei City 22101, Taiwan
Tel: +886-2-2698-7208
Fax: +886-2-2698-7210
Email: sales@wavesplitter.com
Website: https://wavesplitter.com/