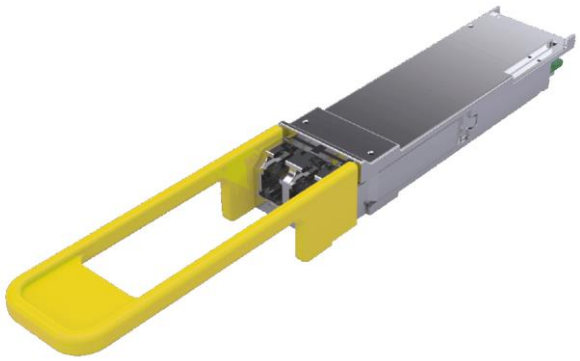
WAVESPLITTER™ TECHNOLOGIES, INC.

Data Sheet

100Gb/s QSFP28 DR Single Lambda Optical Transceiver
P/N: WST-QS28-DR-C



Features:

- 103.125 Gbit/s Single Rate
- Supports 53.125Gbaud
- IEEE 802.3cd 100GBASE-DR Specification compliant
- Up to 500m transmission on single mode fiber (SMF) with FEC
- Operating case temperature: 0 to 70°C
- 4 x 25.78125G channel CAUI-4 Electrical Interface
- 4 x 26.5625G channel 100GAUI-4 Electrical Interface
- light source: Single channel 1310 nm EA-DFB LD
- Receiver: Single channel PIN photo detector
- Maximum power consumption 4.0W
- LC duplex connector
- RoHS compliant

Applications:

- Data Center Interconnect
- 100G Ethernet
- Enterprise networking

Description

WST-QS28-DR-C is a 100GbE QSFP+ 28Gbp/s 4X (QSFP28) optical transceiver that enables a dense-port and high-throughput solution with its compact size and low power consumption. The WST-QS28-DR-C modules can be used in various network applications, such as Internet Protocol switches and routers applications. The maximum transmission distance of WST-QS28-DR-C is 500 m.

WST-QS28-DR-C is a fully integrated optical transceiver module sending and receiving 100Gbit/s data modulated using 4-level pulse amplitude modulation (PAM4) format that consists of a 1310 nm wavelength EA-DFB LD, a Driver IC, a PIN photo-diode, and clock and data recovery (CDR) ICs with a 4 channel x 25.78125 Gbit/s electrical interface.

Mechanical dimensions, connecters and footprint of WST-QS28-DR-C conform to QSFP28 SFF specifications. The module size is 18.4 mm x 72 (122) mm x 8.5 mm and is hot pluggable in Z-direction by 38-pin connector.

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	Max	Units	Notes
Storage Temperature	T_S	-40	85	degC	
Power Supply Voltage	V_{CC}	0	3.6	V	
Optical Receiver Input	TH_d	5		dBm	

Recommended Operating Conditions and Power Supply Requirement

Parameter	Symbol	Min	Typical	Max	nits	Notes
Operating Case Temperature	T_{OP}	0		70	degC	
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Voltage Noise Tolerance	PSNR			66	mV	10 Hz – 10 MHz
Power Consumption				4.0	W	
Supply Current				1154.4	mA	

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Min	Typical	Max	Units	Notes
Transmitter (each lane)					
Differential pk-pk input voltage tolerance (min)	900			mV	At TP1a
Differential termination mismatch			10	%	At TP1
Single-ended input voltage tolerance range	-0.4 to 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	

Notes:

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

Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Units	Notes
Transmitter						
PAM4 Signaling rate (range)		53.125 ± 100 ppm			GBd	
Center Wavelength	λt	1304.5		1317.5	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power	PAVG	-2.9		4	dBm	1
Outer Optical Modulation Amplitude (OMAouter)	POMA	-0.8		4.2	dBm	2
Launch Power in OMAouter minus TDECQ for ER ≥ 5dB for ER < 5dB		-2.2 -1.9			dBm	2
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ)	TDECQ			3.4	dB	
DECQ – 10*log10(Ceq)				3.4	dB	3
Average launch power of OFF transmitter (max)				-15	dBm	
Extinction Ratio	ER	3.5			dB	
RIN15.5OMA	RIN			-136	dB/Hz	
Optical Return Loss Tolerance	TOL			15.5	dB	
Transmitter Reflectance	RT			-26	dB	4
Transmitter Transition Time				17	ps	
Receiver						
Center Wavelength	λr	1304.5		1317.5	nm	
Damage Threshold	THd	5			dBm	6
Average Receive Power		-5.9		4	dBm	7
Receive Power (OMAouter)				4.2	dBm	

Receiver Sensitivity (OMAouter)	SEN			−3.9, *S*ECQ−5.3, (See Figure 1)	dBm	8
Stressed Receiver Sensitivit (OMAouter)	SRS			-1.9	dBm	9
Receiver Reflectance	RR			-26	dB	
Conditions of stressed receiver sensitivity test (note 8)						
Stressed eye closure for PAM4 (SECQ)				3.4	dB	
SECQ – 10*log10(Ceq) (max)				3.4	dB	10
LOS Assert	LOSA	-30		-7.5	dBm	
LOS Deassert	LOSD			-7	dBm	

Notes:

1. 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.
2. Even if the TDECQ < 1.4 dB for an extinction ratio of ≥ 5 dB or TDECQ < 1.1dB for an extinction ratio of < 5 dB, the OMAouter (min) must exceed this value.
3. Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.
4. Transmitter reflectance is defined looking into the transmitter.
5. The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level
6. 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.
7. Receiver sensitivity (OMAouter), (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB.
8. Measured with conformance test signal at TP3 (see IEEE Std 802.3cd clause 140.7.10) for the BER specified in IEEE Std 802.3cd clause 140.1.1.
9. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.
10. Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.

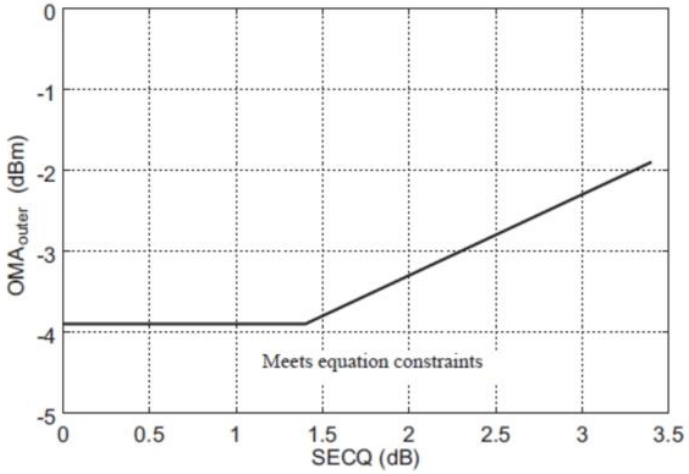
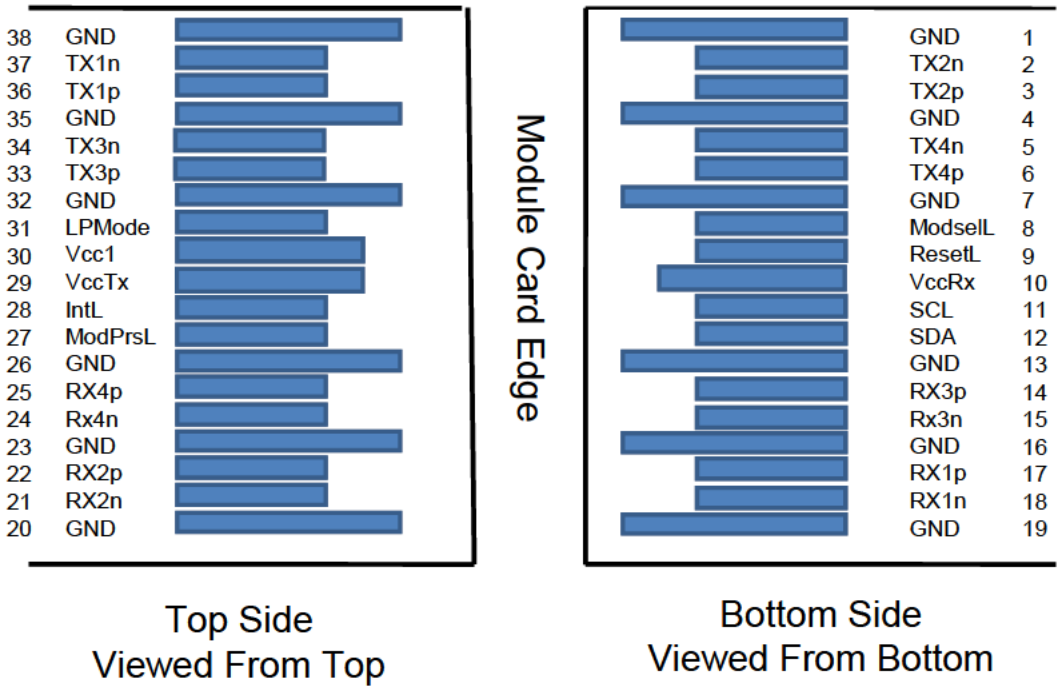


Figure 1. Illustration of Receiver Sensitivity Mask for 100G DR

Pin Assignment



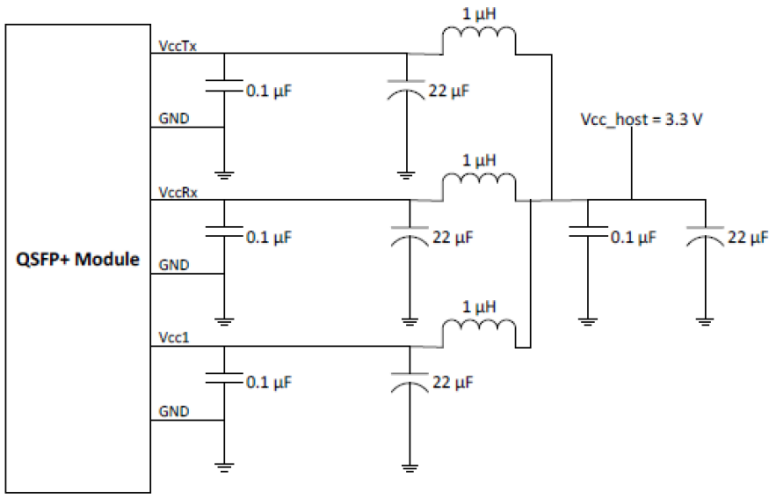
PIN	Logic	Symbol	Name/Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module 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

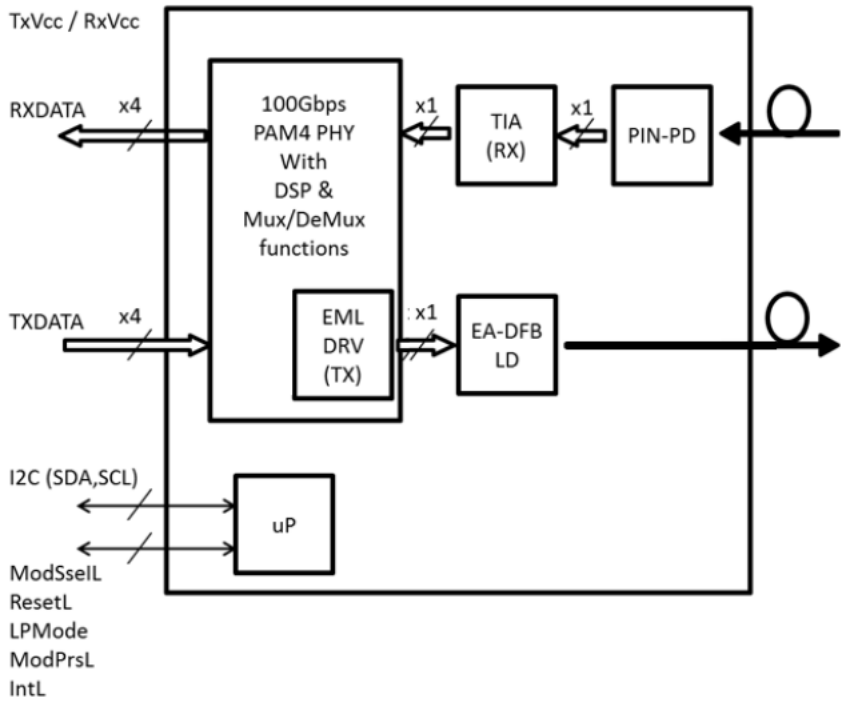
Notes:

1. GND is the symbol for signal and supply (power) common for QSFP28 modules. 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. 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 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

Recommended Power Supply Filter



Recommended Host - Transceiver Interface Block Diagram



Digital Diagnostic Functions

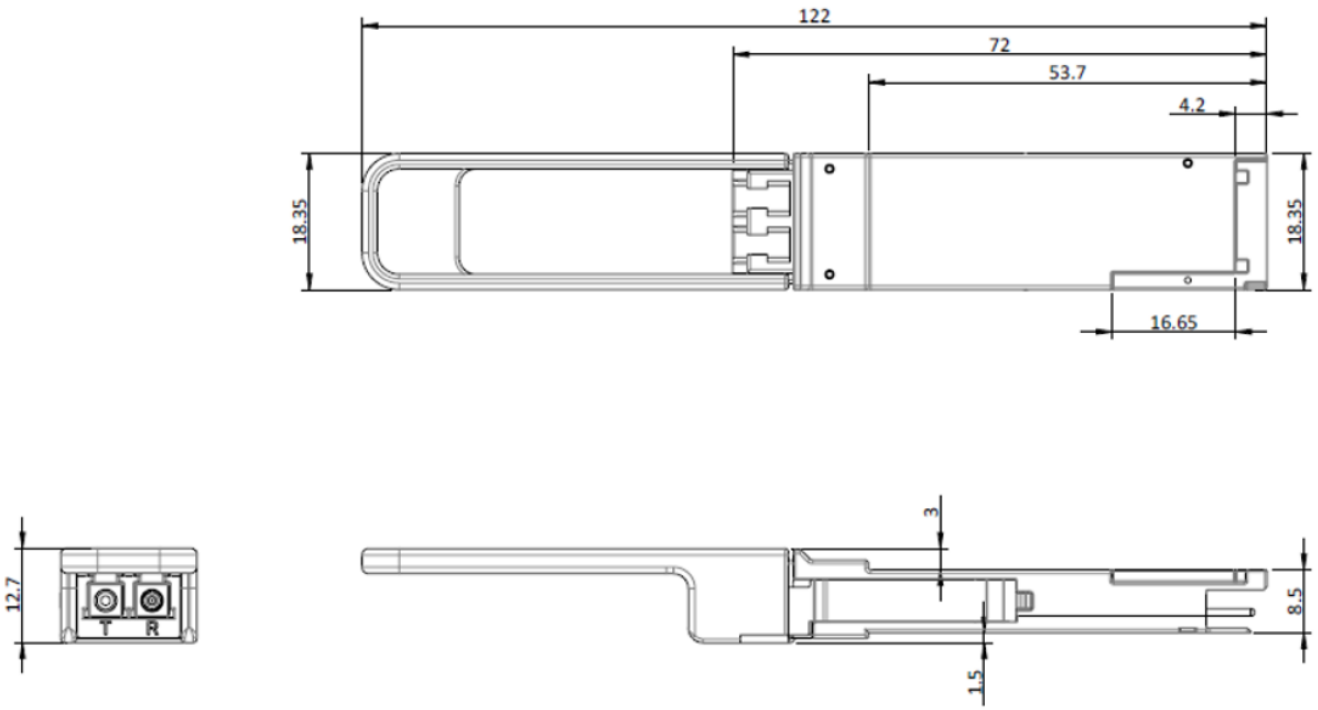
The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified

Parameter	Symbol	Min	Max	Units	Notes
Temperature Monitor Absolute Error	DMI_Temp	-3	3	degC	Over operating temperature range
Supply Voltage Monitor Absolute Error	DMI _VCC	-0.1	0.1	V	Over full operating range
RX Power Monitor Absolute Error	DMI_RX	-2	2	dB	1
Bias Current Monitor	DMI_Ibias	-10%	10%	mA	
TX Power Monitor Absolute Error	DMI_TX	-2	2	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be anadditional +/-1 dB fluctuation, or a +/- 3 dB total accuracy

Mechanical Drawing



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-DR-C	QSFP28	Input 25.78 Gb/s per lane / Optical 53.125 Gbd (PAM4)	1310nm DFB	-2.9~ +4 each Channel	PIN	Refer to Equation (1)	0~70°C	500m with FEC	DDM RoHS	100G Ethernet

Modification History

Revision	Date	Description	Originator	Review	Approved
V1.0	20-Oct-2022	New Issue	Shao Yu Lee	Wayne Liao	Wayne Liao

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