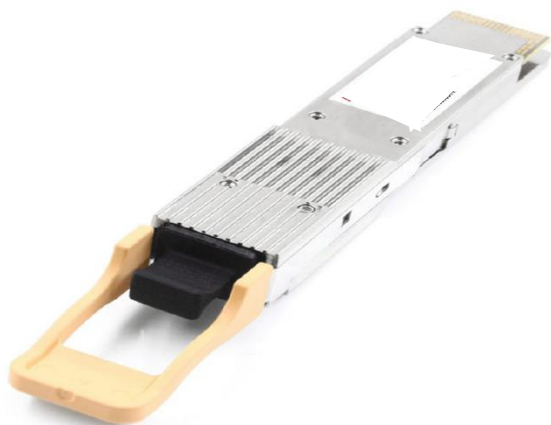


Data Sheet

## 100Gbps QSFP28 Bi-Directional Transceiver, 100m P/N: WST-QS28-SRB-MD



### Features:

- Support 100GE aggregate bit rates
- Support KP4 FEC @ 100G data rate
- Two independent full-duplex channels
- Up to 100m OM4 MMF transmission
- Operating case temperature: -10 to 60 °C
- Single 3.3V power supply
- Maximum power consumption 4W
- LC optical connector

### Applications:

- 100G Ethernet
- Data Center
- Infiniband HDR

### Standard:

- RoHS-6 compliant
- QSFP28 MSA compliant

### Description

This product can support 100Gb/s bit rates. It is a parallel Quad Small Form-factor Pluggable (QSFP28) Bi-Directional optical module. The module integrates four host electrical data into two optical lanes (by Dual Wavelength VCSEL Bi-Directional Optical Interface, 850nm and 900nm) to allow optical communication over a 2-fiber duplex LC optical multi-mode fiber. Reversely, on the receiver side, the module de-multiplexes 2 sets of optical input signal and converts them to 4 channels of electrical data.

An optical fiber ribbon cable with an LC connector can be plugged into the QSFP28 module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through an MSA- compliant 38-pin edge type connector.

The module operates by a single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt and Low Power Mode, are available with the modules. A 2-wire serial interface is available to send and

receive more complex control signals, and to receive digital diagnostic information. Individual channels can be addressed and unused channels can be shut down for maximum design flexibility.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

### ***Functional Description***

This product can support 100Gb/s bit rates. It is a parallel Quad Small Form-factor Pluggable (QSFP28) Bi-Direction optical module. The module integrates four host electrical data into two optical lanes (by Dual Wavelength VCSEL Bi-Directional Optical Interface, 850nm and 900nm) to allow optical communication over a 2-fiber duplex LC optical multi-mode fiber. Reversely, on the receiver side, the module de-multiplexes 2 sets of optical input signal and converts them to 4 channels of electrical data. The receiver module outputs electrical signals are also voltage compatible with Common Mode Logic (CML) levels. Figure 1 shows the functional block diagram of this product.

A single +3.3V power supply is required to power up the module. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As per MSA specifications the module offers 7 low speed hardware control pins (including the 2-wire serial interface): ModSelL, SCL, SDA, ResetL, LPMODE, ModPrsL and IntL.

Module Select (ModSelL) is an input pin. When held low by the host, the module responds to 2-wire serial communication commands. The ModSelL allows the use of multiple QSFP28 modules on a single 2-wire interface bus –individual ModSelL lines for each QSFP28 module must be used.

Serial Clock (SCL) and Serial Data (SDA) are required for the 2-wire serial bus communication interface and enable the host to access the QSFP28 memory map.

The ResetL pin enables a complete module reset, returning module settings to their default state, when a low level on the ResetL pin is held for longer than the minimum pulse length. During the execution of a reset the host shall disregard all status bits until the module indicates a completion of the reset interrupt. The module indicates this by posting an IntL (Interrupt) signal with the Data\_Not\_Ready bit negated in the memory map. Note that on power up (including hot insertion) the module should post this completion of reset interrupt without requiring a reset.

Low Power Mode (LPMODE) pin is used to set the maximum power consumption for the module in order to protect hosts that

are not capable of cooling higher power modules, should such modules be accidentally inserted.

Module Present (ModPrsL) is a signal local to the host board which, in the absence of a module, is normally pulled up to the host Vcc. When a module is inserted into the connector, it completes the path to ground through a resistor on the host board and asserts the signal. ModPrsL then indicates a module is present by setting ModPrsL to a “Low” state.

Interrupt (IntL) is an output pin. Low indicates a possible module operational fault or a status critical to the host system. The host identifies the source of the interrupt using the 2-wire serial interface. The IntL pin is an open collector output and must be pulled to the Host Vcc voltage on the Host board.

### ***Absolute Maximum Ratings***

Data Rate Specifications	Symbol	Min	Typ.	Max	Unit
Storage Temperature	TS	-40		+85	°C
Supply Voltage	VCCT, R	-0.5		3.6	V
Relative Humidity	RH	0		85	%
Operating Case Temperature	TOP	-10		60	degC
Damage Threshold	THd	5			dBm

### ***Recommended Operating Conditions***

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
Case operating Temperature	TC	-10		+60	°C	
Supply Voltage	VCCT	+3.135	3.3	+3.465	V	
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4 \times 10^{-4}$		
Post-FEC Bit Error Ratio				$1 \times 10^{-12}$		1
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance	OM3	D1		70	m	2
	OM4	D2		100	m	2
	OM5	D3		150	m	2

**Notes:**

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

**Electrical Characteristics (TOP= 0 to 70 °C,  $V_{CC} = 3.135$  to  $3.465$  Volts)**

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Power Consumption				4	W	
Supply Current	I <sub>cc</sub>			1.21	A	
<b>Transmitter</b>						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (V <sub>cm</sub> )	TP1	-350		2850	mV	1
Differential Termination Resistance Mismatch	TP1			10	%	At 1MHz
Differential Return Loss (SDD11)	TP1			See CEI- 28G VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	TP1			See CEI- 28G- VSR Equation 13-20	dB	
Stressed Input Test	TP1a	See CEI- 28G-VSR Section 13.3.11. 2.1				
<b>Receiver</b>						
Differential Voltage pk-pk	TP4			900	mV	
Common Mode Voltage (V <sub>cm</sub> )	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI- 28G- VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	TP4			See CEI- 28G- VSR Equation 13-21	dB	
Common Mode Return Loss (SCC22)	TP4			-2	dB	2
Transition Time, 20 to 80%	TP4	9.5			ps	
Vertical Eye Closure (VEC)	TP4			5.5	dB	

Eye Width at 10-15 Probability (EW15)	TP4	0.57			UI	
Eye Width at 10-15 Probability (EH15)	TP4	228			mV	

**Notes:**

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. From 250MHz to 30GHz.

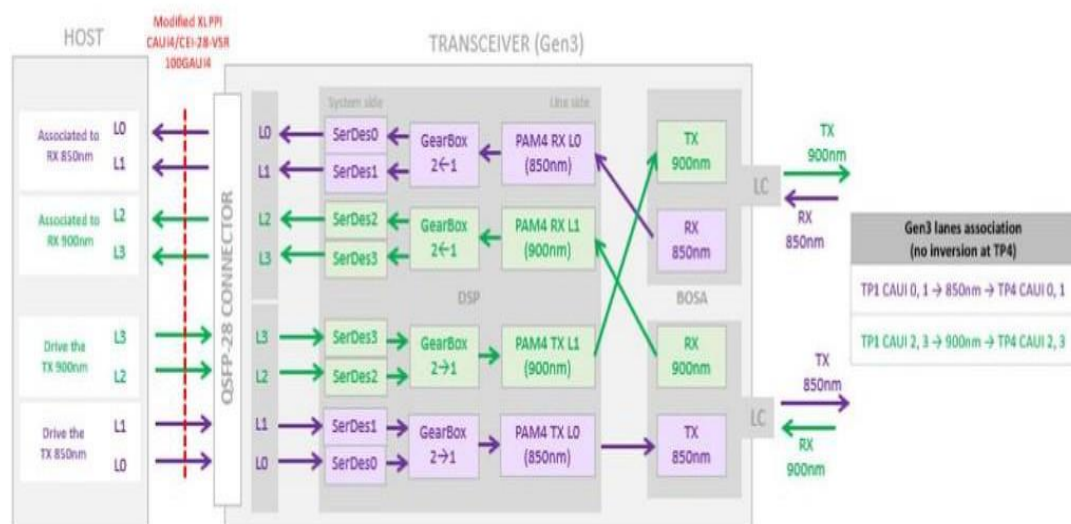
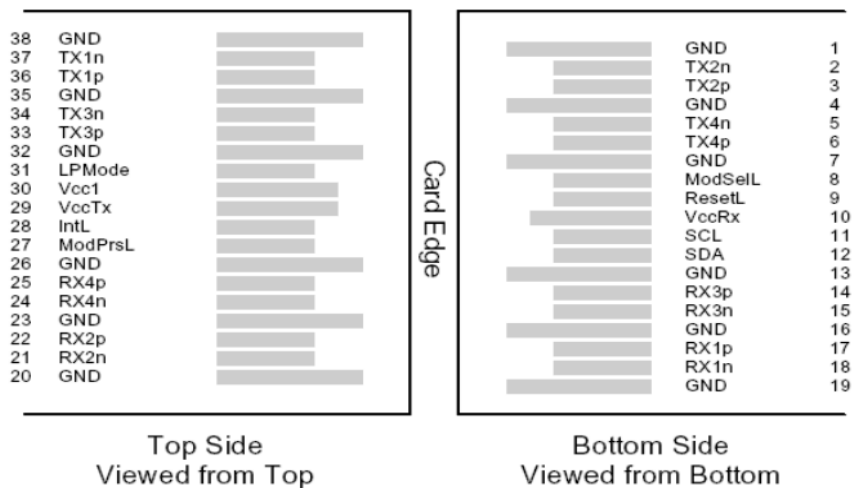
**Optical Characteristics (TOP = 0 to 70 °C, VCC = 3.135 to 3.465 Volts)**

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Transmitter						
Optical Wavelength Line0	$\lambda$	844		863	nm	
Optical Wavelength Line1	$\lambda$	900		918	nm	
RMS Spectral Width	Pm			$\lambda$ 1: 0.6 $\lambda$ 2: 0.65	nm	
Average Optical Power per Channel	Pavg	-6.2		+4.0	dBm	
Optical Modulation Amplitude (OMA), each Lane	POMA	-4.2		3	dBm	1
Peak Power, each lane					dBm	
Launch power in OMA minus TDP, each lane		-5.6			dBm	
TDECQ, each lane				4.5	dB	
Extinction Ratio	ER	3.0			dB	
Transmitter Transition Time, each lane (max)				31	ps	
RIN12 OMA				-128	dB/Hz	
Optical Return Loss Tolerance	TOL			12	dB	
Average Launch	Poff			-30	dBm	
Power OFF Transmitter, each Lane						
Encircled Flux		$\geq 86\%$ at 19 $\mu\text{m}$ $\leq 30\%$ at 4.5 $\mu\text{m}$				2
Signaling rate, each lane		26.5625± 100ppm			Gbps	
Receiver						
Optical Center Wavelength Line0	$\lambda$	844	850	863	nm	
Optical Center Wavelength Line1	$\lambda$	900	910	918	nm	
Damage Threshold, each Lane	THd	5			dBm	3

Average Receive Power, each lane		-8.2			dBm	4
Average power at Receiver Input, each lane (overload)				4	dBm	
Receiver Reflectance	RR			-12	dB	
Stressed Receiver Sensitivity in OMA, Lane2				-3.5	dBm	5
Receiver Sensitivity (OMA outer), each lane				Max (-6.6, SECQ-8) as per IEEE cl 150	dBm	
LOS Assert	LOSA	-30		-14.2	dBm	
LOS Deassert	LOSD			-11.2	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Stressed eye closure (SECq), each lane	4.5	dB				
OMA of each aggressor, each lane	3	dBm				

**Notes:**

1. Even if the mTDEC<0.9 dB, the OMA (min) must exceed this value.
2. If measured into type A1a.2 50um fiber in accordance with IEC 61280-1-4.
3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
4. 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.
5. Measured with conformance test signal at TP3 as per following

**Transceiver Block Diagram****Pin Assignment****Diagram of Host Board Connector Block Pin Numbers and Name**

Pin	Logic	Symbol	Name/Description	Ref.
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 Output	

6	CML-I	Tx4p	Transmitter Non-Inverted Data Output	
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		VccRx	+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	Ground	1
14	CML-O	Rx3p	Receiver Inverted Data Output	
15	CML-O	Rx3n	Receiver Non-Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Inverted Data Output	
18	CML-O	Rx1n	Receiver Non-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	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3V Power Supply Transmitter	2
30		Vcc1	+3.3V Power Supply	2
31	LVTTL-I	LPMODE	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Inverted Data Output	
34	CML-I	Tx3n	Transmitter Non-Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Inverted Data Output	
37	CML-I	Tx1n	Transmitter Non-Inverted Data Output	
38		GND	Ground	1

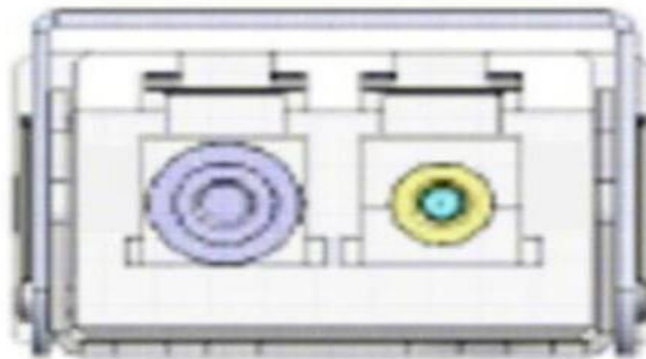


**Notes:**

1. GND is the symbol for single and supply(power) common for QSFP modules, All are common within the QSFP module and all module voltages are referenced to this potential otherwise noted. Connect these directly to the host board signal common ground plane. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
2. VccRx, Vcc1 and VccTx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. VccRx, Vcc1 and VccTx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for maximum current of 500mA.

***Optical Interface Lanes and Assignment***

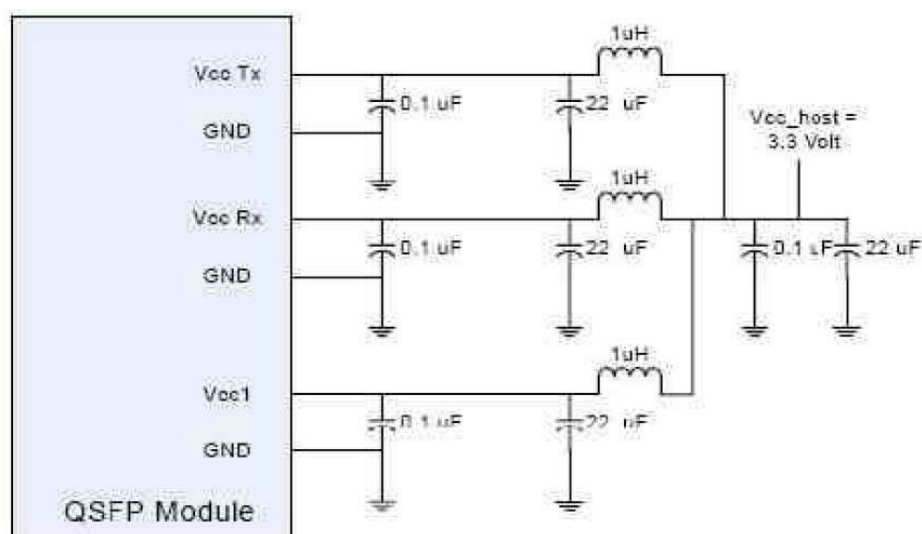
The following figure shows the orientation of the multi-mode fiber facets of the optical connector. Table 1 provides the lane assignment.



**Outside View of the QSFP28 Module LC Receptacle**

**Recommended Circuit**

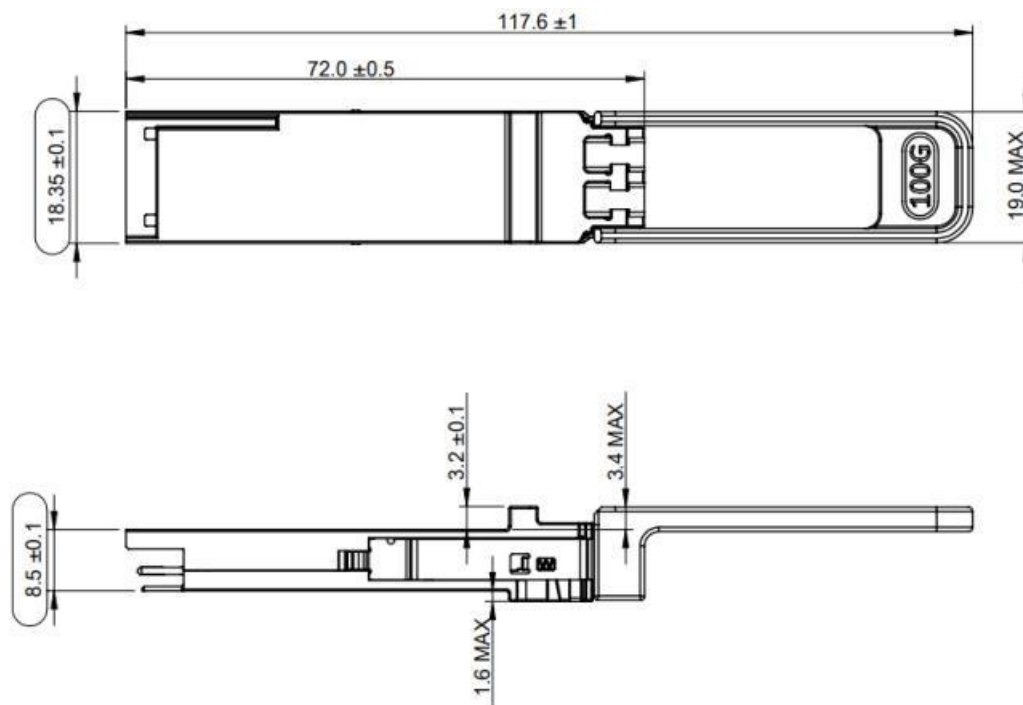
The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8436.

**Digital Diagnostic Functions**

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	1
Supply voltage monitor absolute error	DMI_VCC	-5%	5%	V	2
Channel RX power monitor absolute error	DMI_RX_Ch	-3	3	dB	3
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	4
Channel TX power monitor absolute error	DMI_TX_Ch	-3	3	dB	1

**Notes:**

1. Over operating temperature range
2. Over full operating temperature range
3. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.
4. Ch1~Ch4

***Mechanical Drawing***

Unit: mm

**Ordering Information**

Part No	Specification									
	Package	Data rate per Lane	Laser	Optical Power	Detector	Receiver Sensitivity (OMA)	Temp	Reach	Other	Application
WST-QS28-SRB-MD	QSFP28	26.5625 Gbps each lane	VCSEL	-6.2~ +4 dBm per Channel	PIN	(-6.6, SECQ-8) as per IEEE cl 150	-10 ~ +60°C	70m OM3 100m OM4 150m OM5	RoHS	100G Ethernet

**Modification History**

Revision	Date	Description	Originator	Review	Approved
V1.0	30-Apr-2024	New Issue	Ken Cheng	Joanne Ni	Tom Tang

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