

#### FEATURES

- Hot-pluggable QSFP28 form factor
- 4 CWDM lanes MUX/DEMUX design
- 4x25Gb/s electrical interface
- Supports 103.1Gb/s aggregate bit rate
- Up to 10km transmission on single mode fiber (SMF) with FEC
- LC duplex connector
- Operating case temperature: 0 to 70°C
- Single 3.3V power supply
- Maximum power consumption 3.5W
- RoHS compliant

#### APPLICATIONS

- Data Center Interconnect
- 100G Ethernet
- 100G 4WDM-10 applications with FEC

#### STANDARDS

- Compliant with 100G 4WDM-10 MSA Technical Spec Rev1.0
- Complies with SFF-8661
- Complies with SFF-8636
- IEEE 802.3bm Annex 83E Interface

**Absolute Maximum Ratings**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Maximum Supply Voltage	$V_{cc}$	-0.5		3.6	V	
Storage Temperature	$T_s$	-40		+85	°C	
Case Operating Temperature	$T_{op}$	0		+70	°C	
Relative Humidity	RH			85	%	1
Receiver Damage Threshold, each Lane	$TH_{dmg}$	3.5			dBm	

Note1: Non-condensing.

**Recommended Operating Conditions and Power Supply Requirements**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	$T_{op}$	0		+70	°C	
Power Supply Voltage	$V_{cc}$	3.135	3.3	3.465	V	
Data Rate, each Lane		25.78125 ± 100 ppm			Gb/s	
Link Distance with G.652	D			10	Km	
Supply Current	$I_{cc}$			1.12	A	
Module total power	P			3.5	W	

**Electrical Characteristics**

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

Parameter	Symbol	Min	Max	Unit	Notes
LPMoDe, ResetL and ModSelL	VIL	-0.3	0.8	V	
	VIH	2	VCC+0.3	V	
ModPrsL and IntL	VOL	0	0.4	V	
	VOH	VCC-0.5	VCC+0.3	V	
<b>Transmitter (each Lane)</b>					
Overload Differential Voltage pk-pk	$V_{pp}$	900		mV	
Common Mode Voltage	$V_{cm}$	-350	2850	mV	1
Differential Termination Mismatch			10	%	
<b>Receiver (each Lane)</b>					
Differential Voltage, pk-pk			900	mV	
Transition Time, 20 to 80%		12		ps	
Differential Termination Mismatch			10	%	

 Note1:  $V_{cm}$  is generated by the host. Specification includes effects of ground offset voltage.

Optical Characteristics						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Wavelength Assignment	L0	1264.5	1271	1277.5	nm	1
	L1	1284.5	1291	1297.5	nm	
	L2	1304.5	1311	1317.5	nm	
	L3	1324.5	1331	1337.5	nm	1
Transmitter						
Total Average Launch Power	$P_T$			8.5	dBm	
Transmit Average Power, each lane	$P_{AVG}$	-6.5		2.5	dBm	
Optical Modulation Amplitude (OMA), each lane	$P_{OMA}$	-4.0		2.5	dBm	1
Optical Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty, each lane	TDP			3.0	dB	
Launch power in OMA minus TDP, each lane		-5.0			dBm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average launch power of OFF transmitter, each lane	$P_{OFF}$			-30	dBm	
Optical Return Loss Tolerance				20	dB	
Transmitter Reflectance				-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				2
Receiver						
Receive Saturation (OMA), each lane	$R_{max}$	2.5			dBm	
Damage threshold, , each lane	$TH_{dmg}$	3.5			dBm	3
Average Receive Power, each lane		-13		2.5	dBm	
Unstressed Receiver Sensitivity (OMA), each lane	SEN			-11.5	dBm	4
Stressed Receiver Sensitivity (OMA), each lane	SRS			-8.6	dBm	5
Receiver Reflectance	$R_r$			-26	dB	
LOS Assert	LOSA	-30			dBm	
LOS De-Assert	LOSD			-15	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Conditions of Stress Receiver Sensitivity Test (Note 6)						
Vertical Eye Closure Penalty, each lane	VECP		2.6		dB	
Stressed J2 Jitter, each lane	J2		0.33		UI	

Stressed J4 Jitter, each lane	J4	0.48	UI
SRS eye mask definition { X1, X2, X3, Y1, Y2, Y3}	{0.39, 0.5, 0.5, 0.39, 0.39, 0.4}		

Note1: Even if the TDP < 1.0 dB, the OMA( min) must exceed the minimum value.

Note2: Hit ratio of  $5 \times 10^{-5}$ .

Note3: The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level.

Note4: For BER =  $5 \times 10^{-5}$ .

Note5: Measured with conformance test signal for BER =  $5 \times 10^{-5}$ .

Note6: Vertical eye closure penalty, stressed eye J2 jitter, stressed eye J4 jitter, and SRS eye mask definition are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Pin Description				
pin	Logic	Symbol	Description	Notes
1		GND	Ground	1
	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	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		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 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-0	ModPrsL	Module Present	
28	LVTTL-0	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 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

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: VccRx, Vcc1 and VccTx shall be applied concurrently. The connector pins are each rated for a maximum current of 1000 mA.

Pin Out Drawing

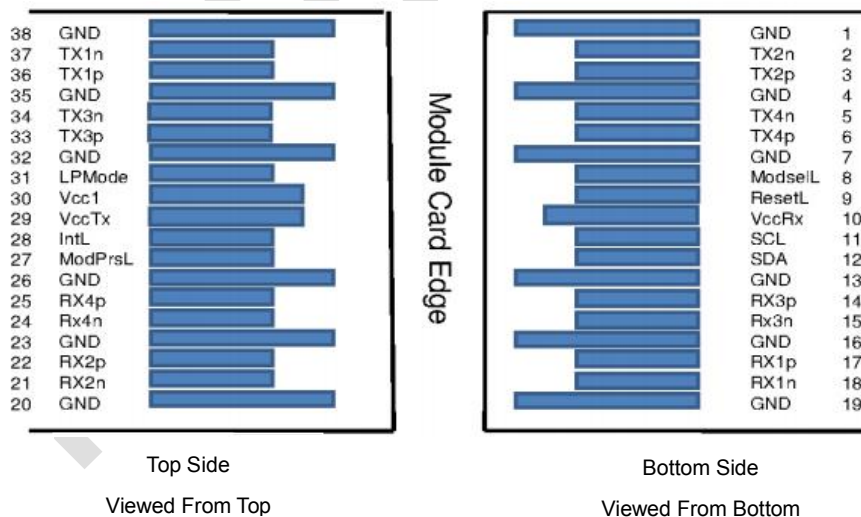


Figure 1. MSA Compliant Connector

## Transceiver Block Diagram

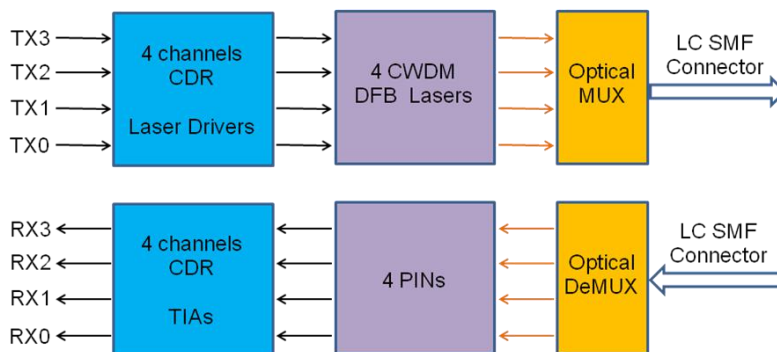


Figure 2. Transceiver Block Diagram

## Host Board Supply Filtering Network

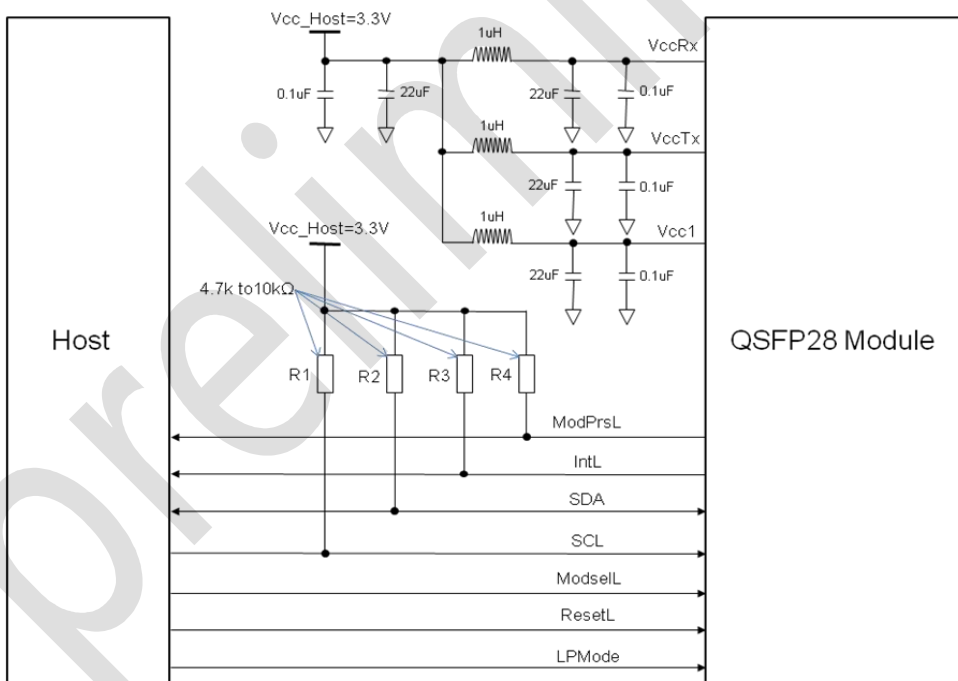


Figure 3. Typical Interface Circuit

## Mechanical Dimensions

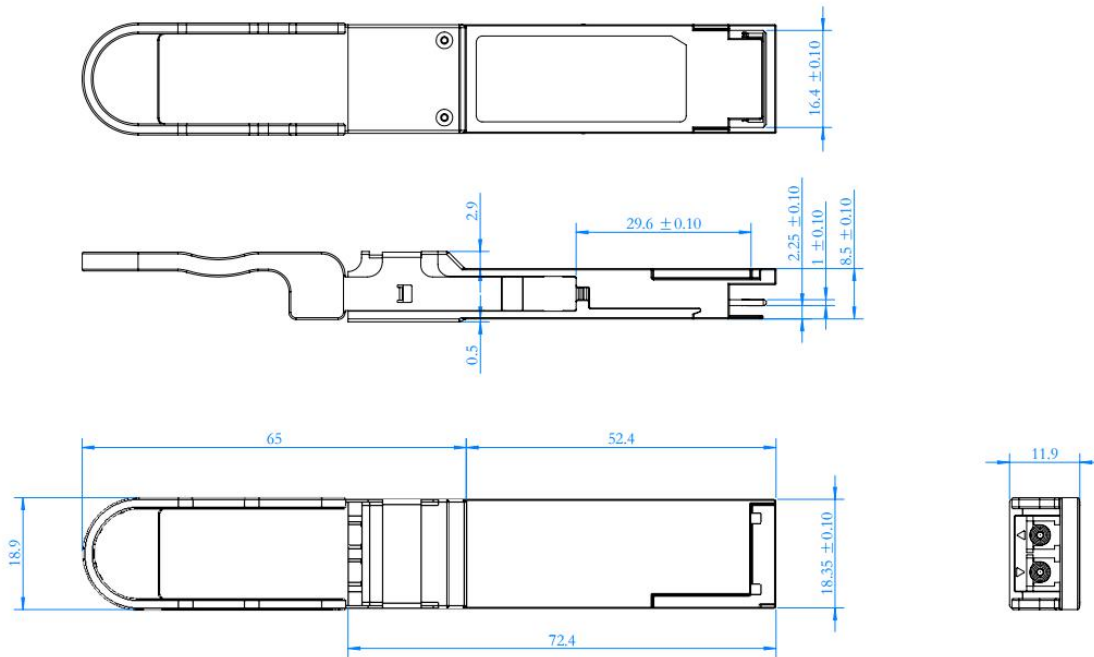


Figure 4. Mechanical Outline

## Digital Diagnostics Functions

The transceivers support the I2C-based diagnostics interface specified by the SFF Committee. 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	DDM_Temp	-3	3	°C	
Supply voltage monitor absolute error	DDM_VCC	-3%	3%	V	
Channel RX power monitor absolute error	DDM_Ch_RX	-3	3	dB	
Channel Bias current monitor absolute	DDM_Ch_Ibias	-10%	10%	mA	
Channel TX power monitor absolute error	DDM_Ch_TX	-3	3	dB	

## Version History

Version	Description of Change	Date
A. 1. 1	New document	2018-03-01

## Warnings

- Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
- Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Legal Notes

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