Features

- QSFP28 MSA compliant
- Compliant to IEEE 802.3bm 100GBASE-SR4
- Four independent full-duplex channels
- Support 103.1Gb/s aggregate bit rate
- Up to 100m OM4 MMF transmission
- Single 3.3V power supply
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 2.5W
- MTP/MPO optical connector
- Operating case temperature range of 0°C to 70°C
- RoHS 6.0 compliant

Applications

- Rack to Rack
- Data Center
- Infiniband QDR, DDR and SDR
- 100G Ethernet

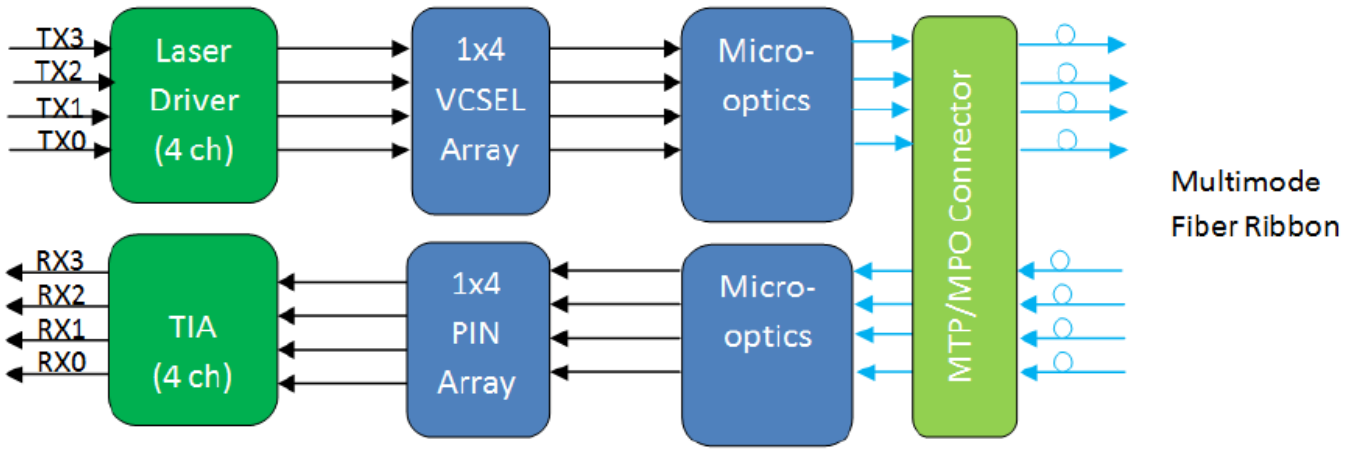
Description

This product is a parallel 100Gb/s Quad Small Form-factor Pluggable (QSFP28) optical module. It provides increased port density and total system cost savings. The QSFP28 full-duplex optical module offers 4 independent transmit and receive channels, each capable of 25Gb/s operation for an aggregate data rate of 100Gb/s on 100 meters of OM4 multi-mode fiber.

An optical fiber ribbon cable with an MTP/MPO 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.

Block Diagram of Transceiver



Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Storage Temperature	*TS*	-40		85	°C	
Operating Case Temperature	T_{OP}	0		70	°C	
Power Supply Voltage	V_{CC}	-0.5		3.6	V	
Relative Humidity (non-condensation)	*RH*	0		85	%	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Case Temperature	T_{OP}	0		70	°C	
Power Supply Voltage	*VCC*	3.135	3.3	3.465	V	
Data Rate, each Lane	*DR*		25.78125		Gb/s	
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$5x10^{-5}$		
Post-FEC Bit Error Ratio				$1x10^{-12}$		1
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (OM3 MMF)	*D1*			70	m	2
Link Distance (OM4 MMF)	*D2*			100	m	2

Notes:

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

Digital Diagnostic Functions

Parameter	Symbol	Accuracy	Unit	Notes
Temperature monitor absolute error	DMI_Temp	±3	°C	
Supply voltage monitor absolute error	DMI_VCC	± 0.15	V	
Channel RX power monitor absolute error	DMI_RX_Ch	± 2	dB	
Channel TX power monitor absolute error	DMI_TX_Ch	± 2	dB	
Channel Bias current monitor	DMI_Ibias_Ch	± 10%	mA	

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
			Transmitter			
Center Wavelength	λ_C	840	850	860	nm	
RMS Spectral Width	$\triangle\lambda$			0.6	nm	
Average Launch Power, each Lane	P_{AVG}	-8.4		2.4	dBm	
Optical Modulation Amplitude (OMA), each Lane	P_{OMA}	-6.4		3.0	dBm	1
Launch Power in OMA minus TDEC, each Lane		-7.3			dBm	
Transmitter and Dispersion Eye Closure (TDEC), each Lane				4.3	dB	
Extinction ratio	*ER*	2			dB	
Optical Return Loss Tolerance	*TOL*			12	dB	
Average Launch Power OFF Transmitter, each Lane	*Poff*			-30	dBm	
Encircled Flux			≧86% at 19μm ≦30% at 4.5μm			
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}			{0.3, 0.38, 0.45, 0.35, 0.41, 0.5}			2
			Receiver			
Damage Threshold, each Lane	*THd*	3.4			dBm	3
Average Receive Power, each Lane		-10.3		2.4	dBm	
Receiver Power (OMA), each Lane				3.0	dBm	
Receiver Sensitivity (OMA), each Lane	*SEN*			-9.2	dBm	For BER =$5x10^{-5}$
Stressed Receiver Sensitivity (OMA), each Lane				-5.2	dBm	4
Receiver Reflectance	R_R			-12	dBm	
LOS Assert	*LOSA*	-30			dBm	
LOS De-assert	*LOSD*			-12	dBm	
LOS Hysteresis	*LOSH*	0.5			dB	
			Conditions of Stress Receiver Sensitivity Test (Note 5)			
Stressed Eye Closure (SEC), Lane under Test			4.3		dB	

Stressed Eye J2 Jitter, Lane under Test		0.39	UI
Stressed Eye J4 Jitter, Lane under Test		0.53	UI
OMA of each Aggressor Lane	3		dBm
Stressed Receiver Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.28, 0.5, 0.5, 0.33,0.33, 0.4}		

Notes:

1. Even if the TDP< 0.9 dB, the OMA min must exceed the minimum value specified here.
2. Hit ratio $1.5x10^{-3}$ hits per sample.
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. Measured with conformance test signal at receiver input for BER=$5x10^{-5}$
5. Vertical eye closure penalty, stressed eye J2 jitter, stressed eye J4 jitter, and stressed receiver eye mask definition are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electro Characteristics

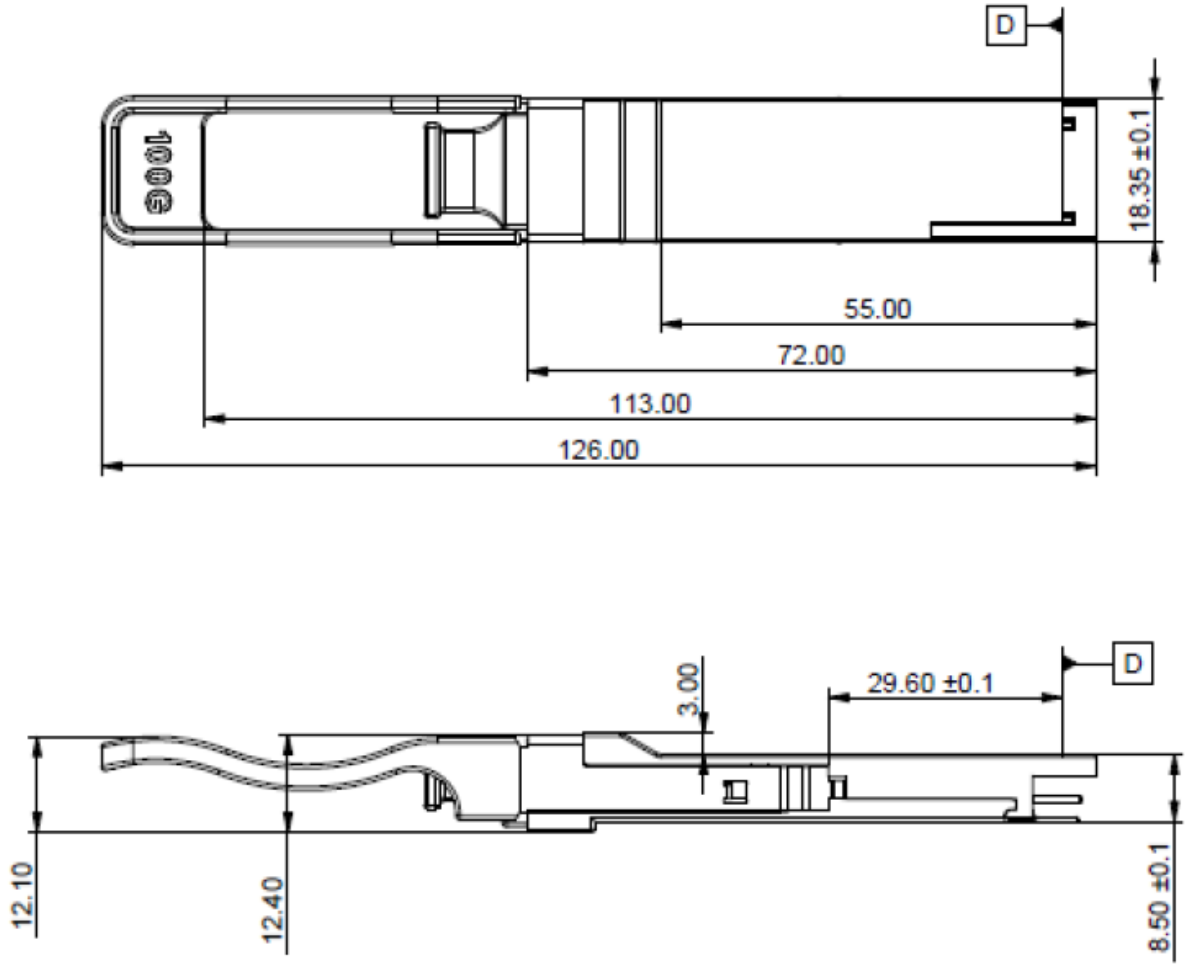
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				2.5	W	
Supply Current	*Icc*			757	mA	
Transmitter (each Lane)						
Overload Differential Voltage pk-pk	*TP1a*	900			mV	
Common Mode Voltage (Vcm)	*TP1*	-350		2850	mV	1
Differential Termination Resistance Mismatch	*TP1*			10	%	At 1MHz
Differential 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				
Receiver (each Lane)						
Differential Voltage pk-pk	*TP4*			900	mV	
Common Mode Voltage (Vcm)	*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-28GVSR Equation 13-21	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 Height at 10^{-15} probability (EH15)	*TP4*	228		mV	

Note:

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

Dimensions



Pin Assignment and Description

Pin Descriptions

PIN	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Ground	1
8	LVTTL-I	ModSe lL	Module Select	
9	LVTTL-I	Reset L	Module Reset	
10		Vcc Rx	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	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-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 Non-Inverted Data Input	

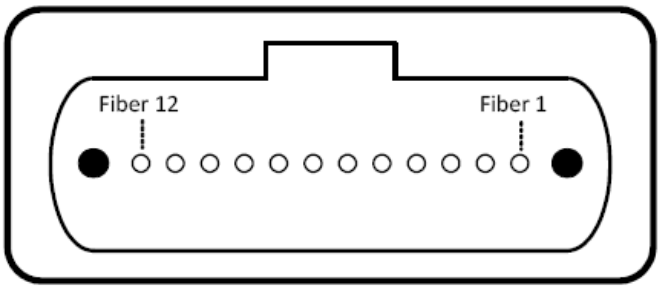
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	

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 receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 4 below. VccRx, 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.

Optical Interface Lanes and Assignment

Figure below shows the orientation of the multi-mode fiber facets of the optical connector. Table below provides the lane assignment.

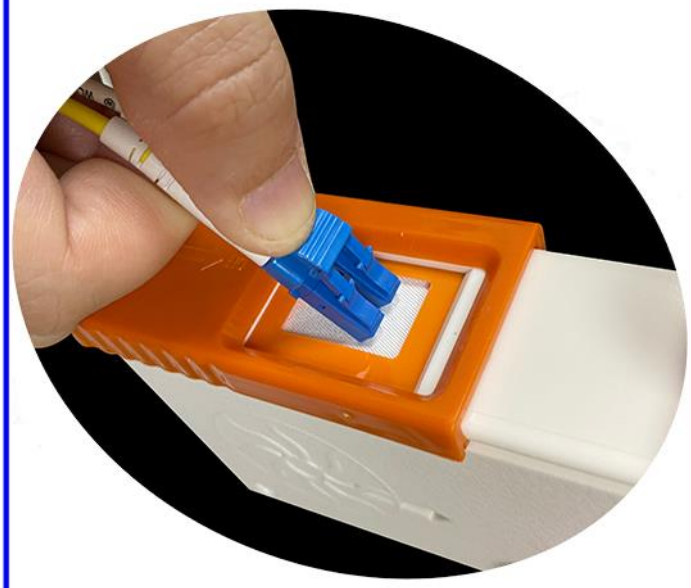


Outside View of the QSFP28 module MPO Receptacle

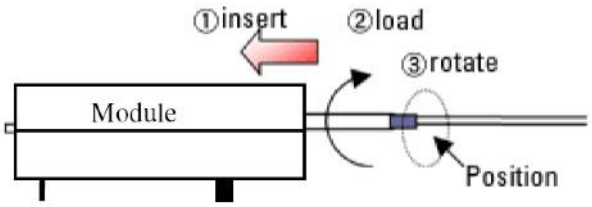
Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord



Cleaning of fiber stub



1. Insert
   Ensure that stick is held straight when inserting into sleeve.
2. Load
   Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate
   Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

Notice: Number of possible wipes:
Maintenance (repair) ~1 use / piece
Equipment construction: 4 uses / piece (max.)

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

Model Number	Part Number	Voltage	Temperature
100G QSFP28 SR4	OPCW-MX1 -85-CB	3.3V	0°C to 70 °C

Modification History

Revision	Date	Description
A1	July 2017	Initial Release

Note: All information contained in this document is subject to change without notice.