

Features

- QSFP28 MSA compliant
- Compliant to IEEE 802.3bm 100GBASE PSM4
- Four independent full-duplex channels
- Supports 103.1Gb/s aggregate bit rate
- Up to 2km reach for G.652 SMF
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 3.5W
- Single +3.3V power supply
- Operating case temperature: 0 to 70°C
- RoHS-6 compliant



Applications

- 100G Ethernet links
- Infiniband QDR and DDR interconnects
- Datacenter and Enterprise networking

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 2km of single 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.

Absolute Maximum Ratings

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
Storage Temperature	T _s	-40	85	°C	
Operating Case Temperature	T _{op}	0	70	°C	
Supply Voltage	V _{cc}	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	TH _d	3.0		dBm	

Recommended Operating Conditions

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
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		Gb/s
Data Rate Accuracy		-100		100	ppm
Control Input Voltage High		2		V _{cc}	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	D	0.002		2	km

Diagnostics Monitoring

<i>Parameter</i>	<i>Symbol</i>	<i>Accuracy</i>	<i>Unit</i>	<i>Notes</i>
Temperature monitor absolute error	DMI_Temp	± 3	°C	Over operating temperature range
Supply voltage monitor absolute error	DMI_VCC	± 0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	± 2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	± 10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	± 2	dB	1

Notes:

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

Transmitter Electro-optical Characteristics (each Lane)

Parameter	Test Point	Min	Typical	Max	Units	Notes
Power Consumption				3.5	W	
Supply Current	I _{cc}			1.06	A	
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (V _{cm})	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			
Center Wavelength	TP2 (λ _c)	1295	1310	1325	nm	
Side Mode Suppression Ratio	TP2 (SMSR)	30			dB	
Total Average Launch Power	TP2 (P _T)			8	dBm	
Average Launch Power, each Lane	TP2 (P _{AVG})	-5.5		2	dBm	
Optical Modulation Amplitude (OMA), each Lane	TP2 (P _{OMA})	-3.5		2.2	dBm	2
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane	TP2	-4.3			dBm	
TDP, each Lane	TP2 (TDP)			2.9	dB	
Extinction Ratio	TP2 (ER)	3.5			dB	
Optical Return Loss Tolerance	TP2 (TOL)			20	dB	
Transmitter Reflectance	TP2 (R _T)			-12	dB	
Average Launch Power OFF Transmitter, each Lane	TP2 (P _{off})			-30	dBm	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	TP2	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				

Notes:

- V_{cm} is generated by the host. Specification includes effects of ground offset voltage.
1. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.

Receiver Electro-optical Characteristics (each Lane)

Parameter	Test Point	Min	Typ	Max	Units	Notes
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- 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 Height at 10 ⁻¹⁵ probability (EH15)	TP4	228			mV	
Center Wavelength	TP3 (λ_c)	1295	1310	1325	nm	
Damage Threshold, each Lane	TP3 (TH _d)	3			dBm	3
Average Receive Power, each Lane	TP3	-10.2		2	dBm	
Receive Power (OMA), each Lane	TP3			2.2	dBm	
Receiver Sensitivity (OMA), each Lane	TP3 (SEN1)			-9	dBm	for BER = 1x10 ⁻¹²
Stressed Receiver Sensitivity (OMA), each Lane	TP3			-6.44	dBm	for BER = 1x10 ⁻¹²
Receiver Sensitivity (OMA), each Lane	TP3 (SEN2)			-11.35	dBm	for BER = 5x10 ⁻⁵
Stressed Receiver Sensitivity (OMA), each Lane	TP3			-8.79	dBm	for BER = 5x10 ⁻⁵
Receiver Reflectance	TP3 (R _R)			-26	dB	
LOS Assert	TP3 (LOSA)	-30			dBm	
LOS Deassert	TP3 (LOSD)			-15	dBm	
LOS Hysteresis	TP3 (LOSH)	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	TP3 (F _c)			31	GHz	

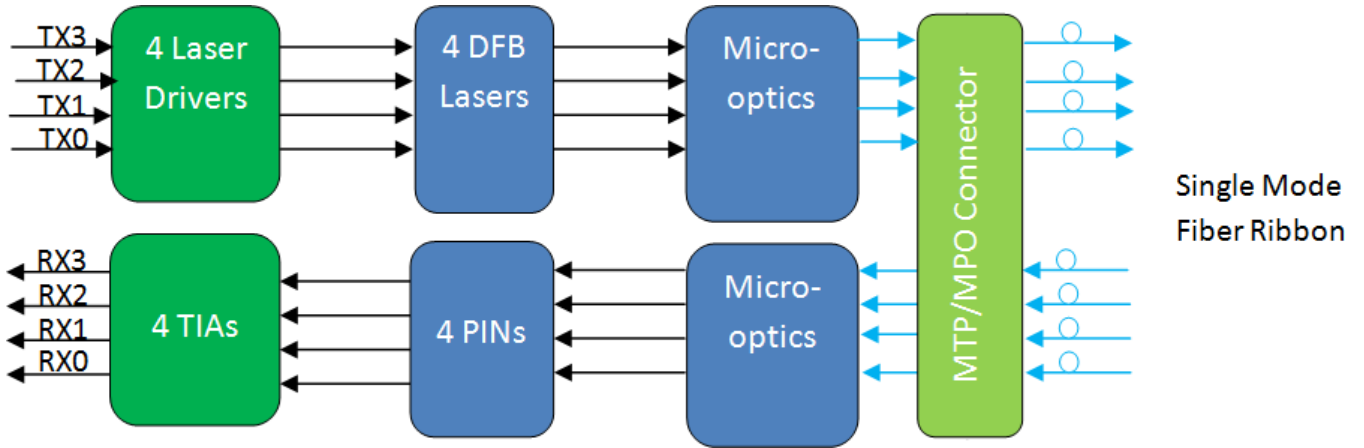
Conditions of Stress Receiver Sensitivity Test (Note 4)

Vertical Eye Closure Penalty, each Lane	1.9	dB
Stressed Eye J2 Jitter, each Lane	0.27	UI
Stressed Eye J4 Jitter, each Lane	0.39	UI
Stressed Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.24, 0.5, 0.5, 0.24, 0.24, 0.4}	

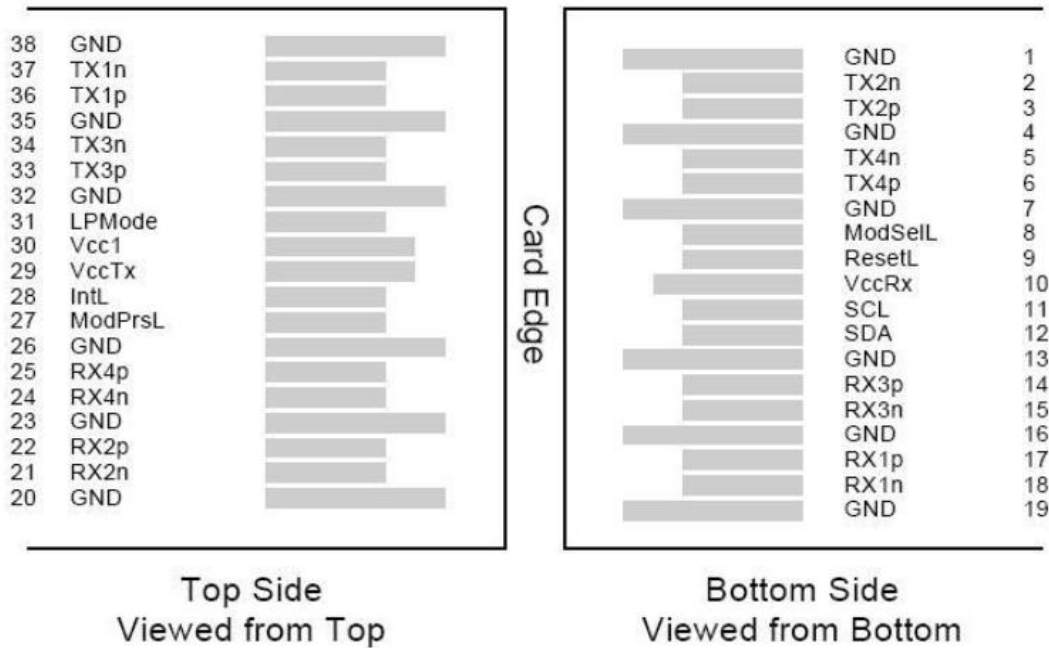
Notes:

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

Block Diagram of Transceiver



Pin Assignment



MSA compliant Connector

Pin Description

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 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	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data	
13		GNC	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	

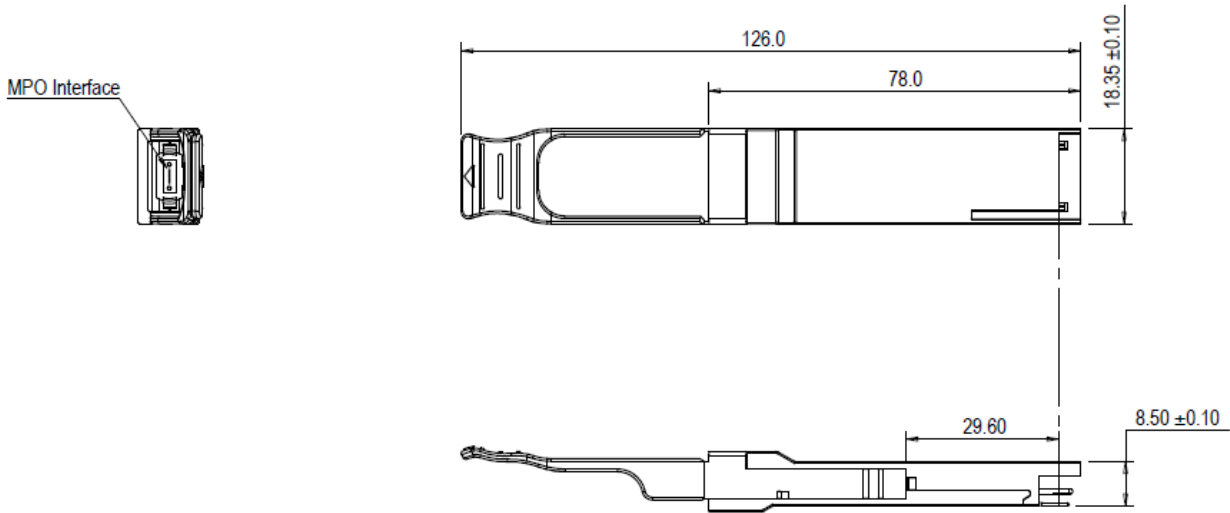
PIN	Logic	Symbol	Name/Description	Note
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data output	
22	CML-O	Rx2p	Receiver Non-Inverted Data output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3V 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 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

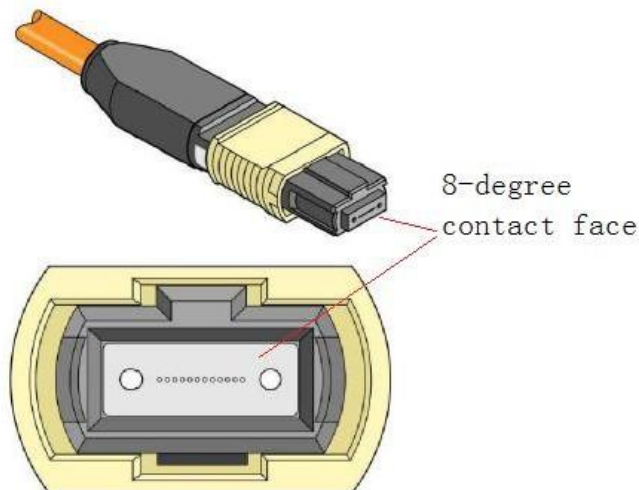
Notes:

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 receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 3 below. Vcc Rx, Vcc1 and VccTx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

Dimensions


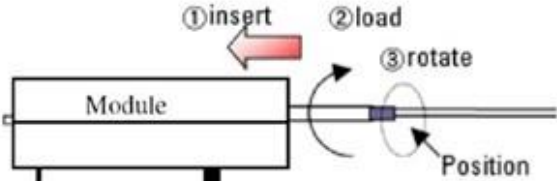


Attention: To minimize MPO connection induced reflections, an MPO receptacle with 8-degree angled end-face is utilized for this product. A female MPO connector with 8-degree end-face should be used with this product as illustrated in below figure.



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.

<p>Cleaning of patch-cord</p> 	<p>Cleaning of fiber stub</p>  <ol style="list-style-type: none"> 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. <p><i>Notice: Number of possible wipes: Maintenance (repair) ~1 use / piece Equipment construction: 4 uses / piece (max.)</i></p>
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Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

<i>Model Number</i>	<i>Part Number</i>	<i>Voltage</i>	<i>Temperature</i>
QSFP28-IR4-PSM	OPCW-S02-13-CBS	3.3V	0°C to 70 °C

Modification History

<i>Revision</i>	<i>Date</i>	<i>Description</i>
A1	Dec. 2016	Initial Release

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