

Features

- QSFP28 MSA compliant
- 4 CWDM lanes MUX/DEMUX design
- Supports 103.1Gb/s aggregate bit rate
- Compliant to 100G CWDM4 MSA Technical Spec Rev1.1
- Bidirectional optical data transmission/receiving
- Up to 2km transmission on single mode fiber (SMF) with FEC
- Operating case temperature: 0 to 70°C
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 3.5W
- Optical connector: SMF angled polished APC LC simplex connector
- Hot pluggable: the module needs to be hot pluggable for ease of installation and service
- RoHS compliant



Applications

- Data Center Interconnect
- 100G Ethernet
- 100G Campus Link

Description

This product is designed for 2km optical communication applications. The design is compliant to 100GBASE CWDM4 MSA standard. The module converts 4 inputs channels (ch) of 25Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 100Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 100Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331nm as members of the CWDM wavelength grid defined in ITU-T G.694.2. It contains an LC/APC simplex connector for the optical interface and a 38-pin connector for the electrical interface. To minimize the optical dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module. Host FEC is required to support up to 2km fiber transmission.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It have been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
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	3.5		dBm	

Recommended Operating Conditions and Power Supply Requirement

Parameter	Symbol	Min.	Typ.	Max.	Units
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		10	km

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Unit	Notes
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	Typ.	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			
Lane Wavelength	TP2	L0	1264.5	1271	1277.5	nm
		L1	1284.5	1291	1297.5	nm
		L2	1304.5	1311	1317.5	nm
		L3	1324.5	1331	1337.5	nm
Side Mode Suppression Ratio	TP2 (SMSR)	30			dB	
Total Average Launch Power	TP2 (P _T)			8.5	dBm	
Average Launch Power, each Lane	TP2 (P _{AVG})	-6.5		2.5	dBm	
Optical Modulation Amplitude (OMA), each Lane	TP2 (P _{OMA})	-4		2.5	dBm	2
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane	TP2	-5			dBm	
TDP, each Lane	TP2 (TDP)			3.0	dB	
Extinction Ratio	TP2 (ER)	3.5			dB	

<i>Parameter</i>	<i>Test Point</i>	<i>Min</i>	<i>Typ.</i>	<i>Max</i>	<i>Units</i>	<i>Notes</i>
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}				3

Notes:

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. Even if the TDP < 1.0 dB, the OMA min must exceed the minimum value specified here.
3. Hit ratio 5x10⁻⁵.

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	
Damage Threshold, each Lane	TP3 (TH _d)	3.5			dBm	3
Average Receive Power, each Lane	TP3	-11.5		2.5	dBm	
Receive Power (OMA), each Lane	TP3			2.5	dBm	
Receiver Sensitivity (OMA), each Lane	TP3 (SEN)			-10	dBm	For BER = 5x10 ⁻⁵
Stressed Receiver Sensitivity (OMA), each Lane	TP3			-7.3	dBm	4
Receiver Reflectance	TP3 (R _R)			-26	dB	
LOS Assert	TP3 (LOSA)	-30			dBm	

Parameter	Test Point	Min	Typ.	Max	Units	Notes
LOS Deassert	TP3 (LOSD)			-15	dBm	
LOS Hysteresis	TP3 (LOSH)	0.5			dB	
Receiver Electrical 3dB upper Cutoff Frequency, each Lane	TP3 (Fc)			31	GHz	

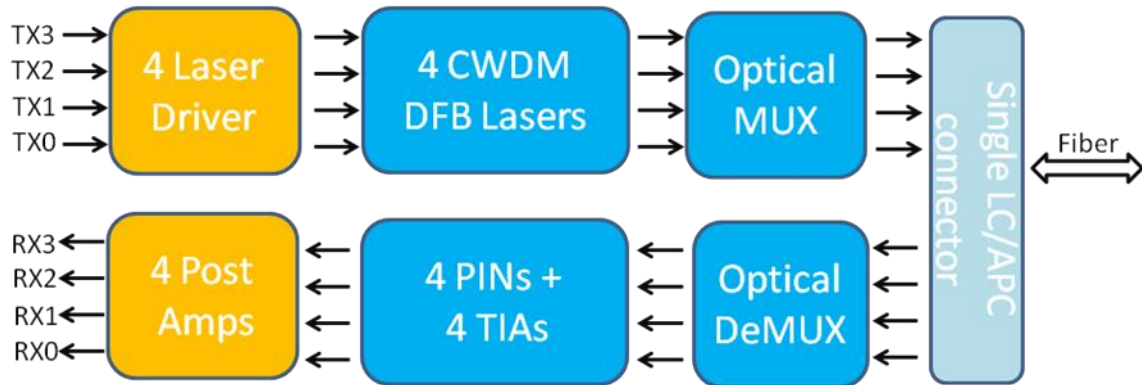
Conditions of Stress Receiver Sensitivity Test (Note 5)

Vertical Eye Closure Penalty, each Lane			1.9		dB	
Stressed Eye J2 Jitter, each Lane			0.33		UI	
Stressed Eye J4 Jitter, each Lane			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}			

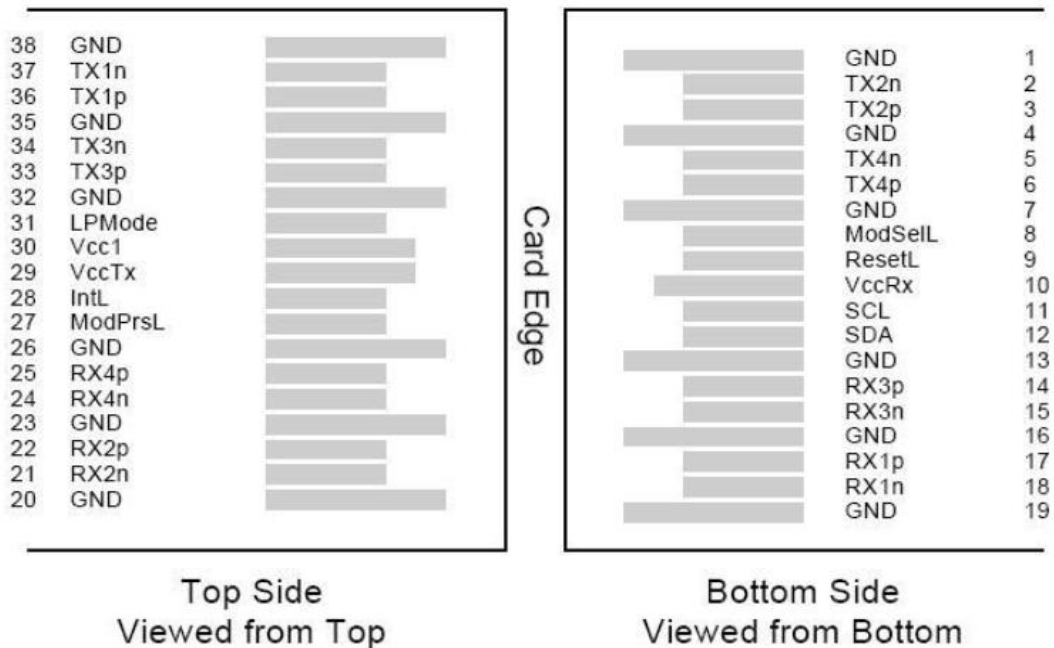
Notes:

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. Measured with conformance test signal for BER = 5×10^{-5} .
5. 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.

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	

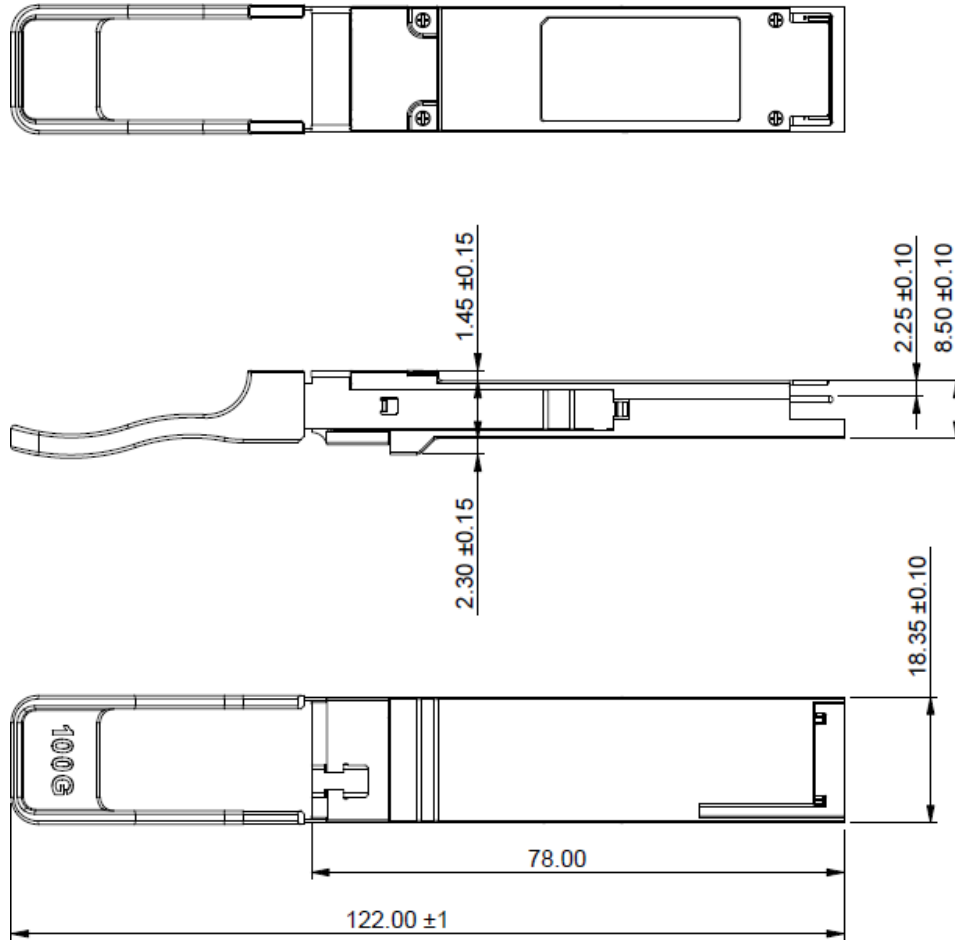
PIN	Logic	Symbol	Name/Description	Note
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data output	
22	CML-O	Rx2p	Receiver Non-Inverted Data output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data output	1
25	CML-O	Rx4p	Receiver Non-Inverted 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

Note:

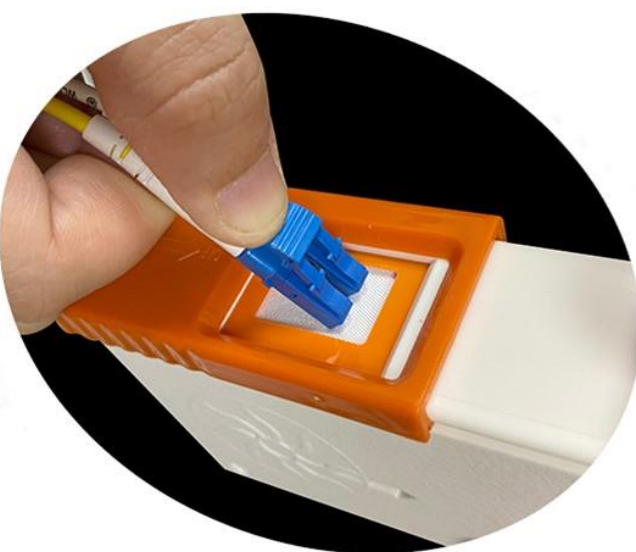
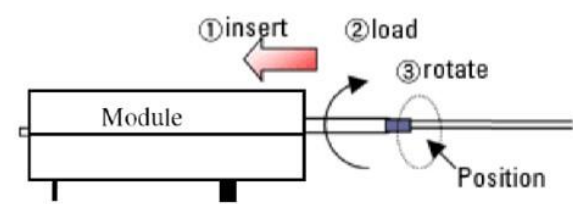
1. GND is the symbol for signal and supply (power) common for QSFP28 modules. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. 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 500mA.

Dimensions



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>
QSFP28-100G-BWDM-CWDM4	OPCW-W02-13-CB	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.