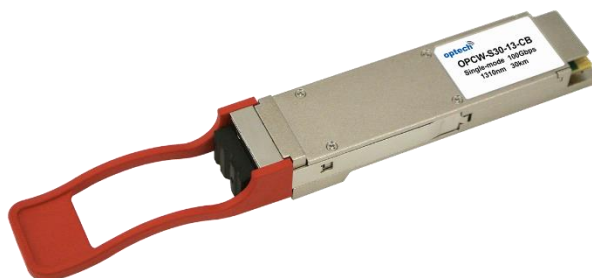


Features

- Hot pluggable QSFP28 MSA form factor
- Compliant to 100G 4WDM-40 MSA
- Supports 103.1Gb/s aggregate bit rate
- Up to 30km reach for G.652 SMF without FEC
- Up to 40km reach for G.652 SMF with FEC
- Single +3.3V power supply
- Operating case temperature: 0~70°C
- Transmitter: cooled 4x25Gb/s LAN WDM EML
- TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- Receiver: 4x25Gb/s APD ROSA
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 5W
- Duplex LC receptacle
- RoHS-6 compliant



Applications

- 100GBASE- ER4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 100G Telecom connections

Description

This product is a 100Gb/s transceiver module designed for optical communication applications compliant to Ethernet 100G 4WDM-40 MSA. The module converts 4 input channels of 25Gb/s electrical data to 4 channels of LAN WDM optical signals and then multiplexes them into a single channel for 100Gb/s optical transmission. Reversely on the receiver side, the module de-multiplexes a 100Gb/s optical input into 4 channels of LAN WDM optical signals and then converts them to 4 output channels of electrical data.

The central wavelengths of the 4 LAN WDM channels are 1295.56, 1300.05, 1304.58 and 1309.14 nm as members of the LAN WDM wavelength grid defined in IEEE 802.3ba. The high performance cooled LAN WDM EA-DFB transmitters and high sensitivity APD receivers provide superior performance for 100Gigabit Ethernet applications up to 30km links without FEC and 40km links with FEC.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_S	-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	%	
Damage Threshold, each Lane	TH_d	-2.5		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
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 (without FEC)	$D1$			30	km	1
Link Distance with G.652 (with FEC)	$D2$			40	km	1

Notes:

1. Depending on actual fiber loss/km (link distance specified is for fiber insertion loss of 0.4dB/km)

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Units	Note
Temperature monitor absolute error	<i>DMI_Temp</i>	± 3	°C	Over operating temperature range
Supply voltage monitor absolute error	<i>DMI_VCC</i>	± 0.1	V	Over full operating range
Channel RX power monitor absolute error	<i>DMI_RX_Ch</i>	- 2	dB	1
Channel Bias current monitor	<i>DMI_Ibias_Ch</i>	- 10%	mA	
Channel TX power monitor absolute error	<i>DMI_TX_Ch</i>	- 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	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				5	W	
Supply Current	<i>I_{cc}</i>			1.52	A	
Overload Differential Voltage pk-pk	<i>TP1a</i>	900			mV	
Common Mode Voltage (V _{cm})	<i>TP1</i>	-350		2850	mV	1
Differential Termination Resistance Mismatch	<i>TP1</i>			10	%	At 1MHz
Differential Return Loss (SDD11)	<i>TP1</i>			See CEI- 28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	<i>TP1</i>			See CEI- 28G-VSR Equation 13-20	dB	
Stressed Input Test	<i>TP1a</i>		See CEI- 28G-VSR section 13.3.11.2.1			
Lane Wavelength	<i>L0</i>	1294.53	1295.56	1296.59	nm	
	<i>L1</i>	1299.02	1300.05	1301.09	nm	
	<i>L2</i>	1303.54	1304.58	1305.63	nm	

	<i>L3</i>	1308.09	1309.14	1310.19	nm	
SMSR	<i>SMSR</i>	30			dB	
Total Average Launch Power	<i>P_T</i>			12.5	dBm	
Average Launch Power, each Lane	<i>P_{AVG}</i>	-2.5		6.5	dBm	2
OMA, each Lane	<i>P_{OMA}</i>	0.5		6.5	dBm	3
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-0.65			dBm	
TDP, each Lane	<i>TDP</i>			3.0	dB	
Extinction Ratio	<i>ER</i>	7.0			dB	
Difference in Launch Power between any Two Lanes (Average and OMA)	<i>P_{tx,diff}</i>			4.0	dB	
RIN _{20OMA}	<i>RIN</i>			-130	dB/Hz	
Optical Return Loss Tolerance	<i>TOL</i>			20	dB	
Transmitter Reflectance	<i>R_T</i>			-26	dB	

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
Average Launch Power OFF Transmitter, each Lane	<i>P_{off}</i>			-30	dBm	
Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				4

Notes:

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
3. Even if the TDP < 1.0dB, the OMA min must exceed the minimum value specified here.
4. Hit ratio 5x10⁻⁵

Receiver Electro-optical Characteristics (each Lane)

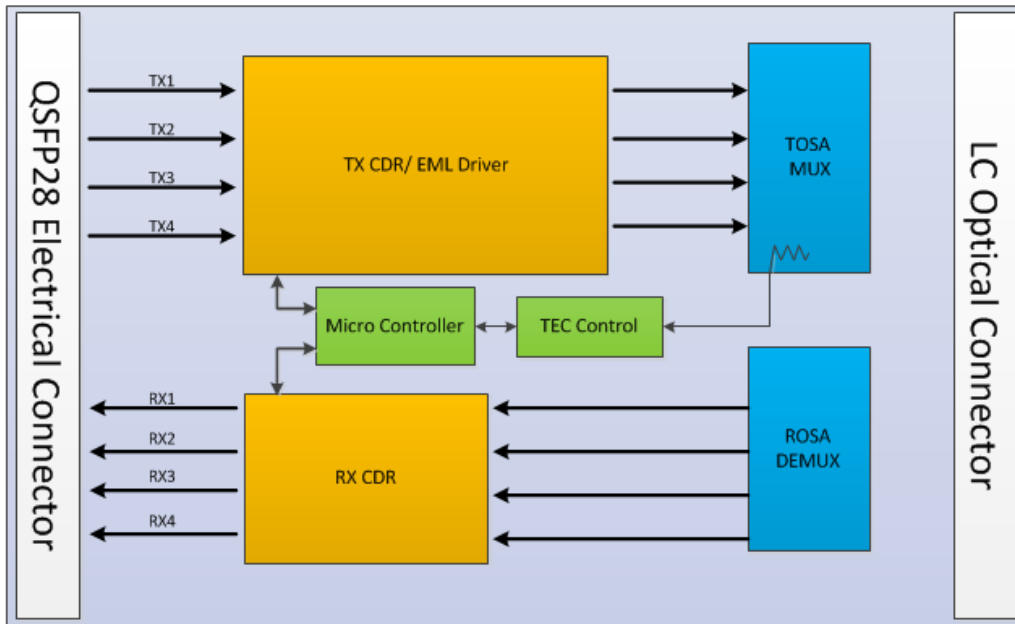
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI- 28G-VSR Equation 13-19	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	TH _d	-2.5			dBm	3
Average Receive Power, each Lane		-16.65		-3.5	dBm	for 30km Link Distance
Average Receive Power, each Lane		-20.5		-3.5	dBm	for 40km Link Distance
Receive Power (OMA), each Lane				-1.9	dBm	
Receiver Sensitivity (OMA), each Lane	SEN1			-14.65	dBm	for BER = 1x10 ⁻¹²
Stressed Receiver Sensitivity (OMA), each Lane				-12.65	dBm	for BER = 1x10 ⁻¹²
Receiver Sensitivity (OMA), each Lane	SEN2			-18.5	dBm	for BER = 5x10 ⁻⁵
Stressed Receiver Sensitivity (OMA), each Lane				-16.6	dBm	for BER = 5x10 ⁻⁵
Receiver reflectance				-26	dB	

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
LOS Assert	LOSA		-26		dBm	
LOS Deassert	LOSD		-24		dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			31	GHz	
Conditions of Stress Receiver Sensitivity Test (Note 4)						
Vertical Eye Closure Penalty, each Lane			2.5		dB	
Stressed Eye J2 Jitter, each Lane			0.33		UI	
Stressed Eye J9 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}			

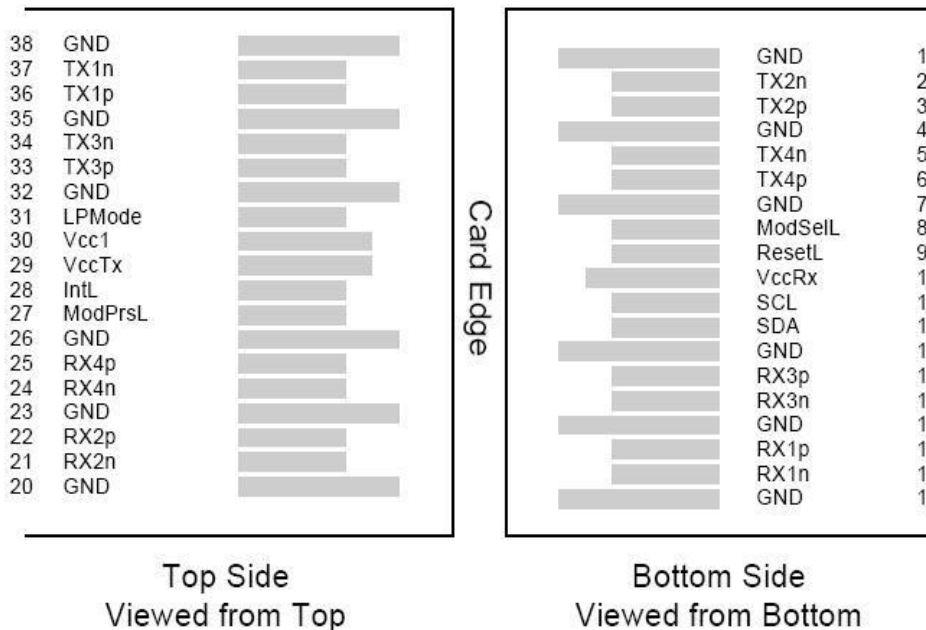
Notes:

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. Vertical eye closure penalty, stressed eye J2 jitter, and stressed eye J9 jitter 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

<i>PIN</i>	<i>Logic</i>	<i>Symbol</i>	<i>Name/Description</i>	<i>Note</i>
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	

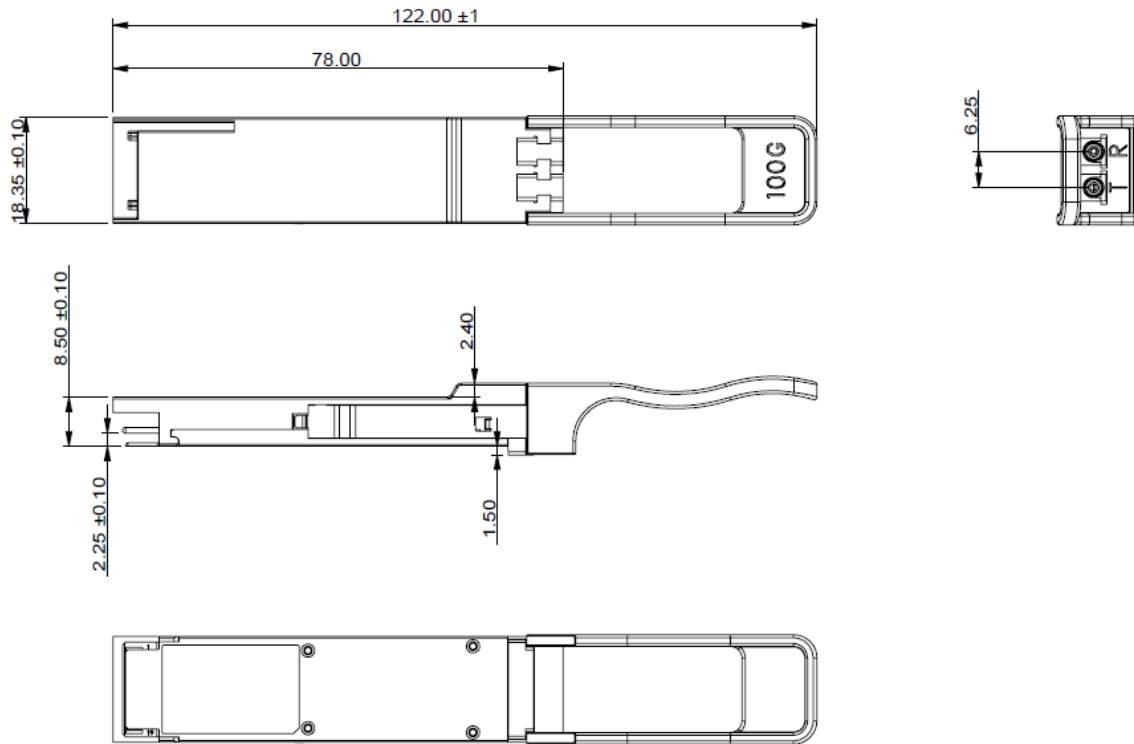
<i>PIN</i>	<i>Logic</i>	<i>Symbol</i>	<i>Name/Description</i>	<i>Note</i>
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data output	
22	CML-O	Rx2p	Receiver Non-Inverted Data output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data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


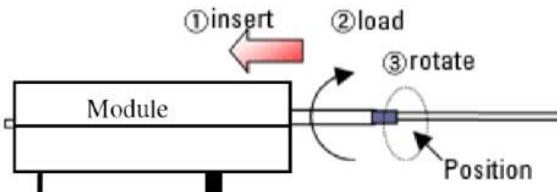
1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below Figure. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the module in any combination. The connector pins are each rated for a maximum current of 1000mA.

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.

Cleaning of patch-cord	Cleaning of fiber stub
	 <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>

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-ER4-Lite	OPCW-S30-13-CB	3.3V	0°C to 70 °C

Modification History

<i>Revision</i>	<i>Date</i>	<i>Description</i>
A1	Mar. 2018	Initial Release

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