100Gbps QSFP28 BIDI TX1304/RX1309 30km Optical Transceiver OPCW-W30-A4-CB Datasheet

Features

- Supports 53.125Gbaud PAM4 Data Rate
- QSFP28 MSA compliant
- 100G Lambda MSA 100G-ER1-30 specification compliant
- Up to 30km transmission on SMF with KP4 FEC
- 1304nm (Upstream)/1309nm (Downstream) EML Laser and APD Receiver
- 4x25G NRZ electrical interface (OIF CEI-28G-VSR)
- Single LC Connector for Bi-Directional application
- Maximum power consumption 4.5W
- Operating case temperature: 0~70°C
- RoHS compliant

Applications

- Data Center Interface
- 100G Ethernet
- Enterprise Networking

Description

This product is transceiver module designed for 30km optical communication applications. The module incorporates one channel optical signal, on 1304/1309nm center wavelength, operating at 50Gband PAM4 data rate. The transmitter path incorporates an EML Driver and a cooled EML together. On the receiver path, the input optical signal is coupled to a APD photodiode detector. A DSP based gearbox is used to convert 4x25Gbps NRZ single to 1x50Gband PAM4 signal. Also a 4-channel retimer and FEC block are integrated in the DSP. The electrical interface is compliant with IEEE 802.3-2022 and QSFP28 MSA in the transmitting and receiving directions, and optical interface is compliant to IEEE 802.3cd and 100G-ER1 -30 in 100G Lambda MSA standard. The module has a maximum power consumption of 4.5W.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP28 Multi-Source Agreement (MSA). It has 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	*Ts*	-40	85	°C	
Operating Case Temperature	T_{op}	0	70	°C	
Power Supply Voltage	V_{cc}	-0.5	4.0	V	
Relative Humidity (non-condensation)	*RH*	0	85	%	
Damage Threshold	*THd*	-2.4		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	
Electrical Data Rate, each Lane			25.78125		Gb/s	NRZ
Optical Data Rate (PAM4)			53.125		GBd	
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4x10^{-4}$		
Pre-FEC Bit Error Ratio				$1x10^{-12}$		1
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance with G.652	*D*	0.002		30	Km	2

Notes:

1. FEC feature is embedded in the module.
2. FEC required to be turned on to support maximum transmission distance.

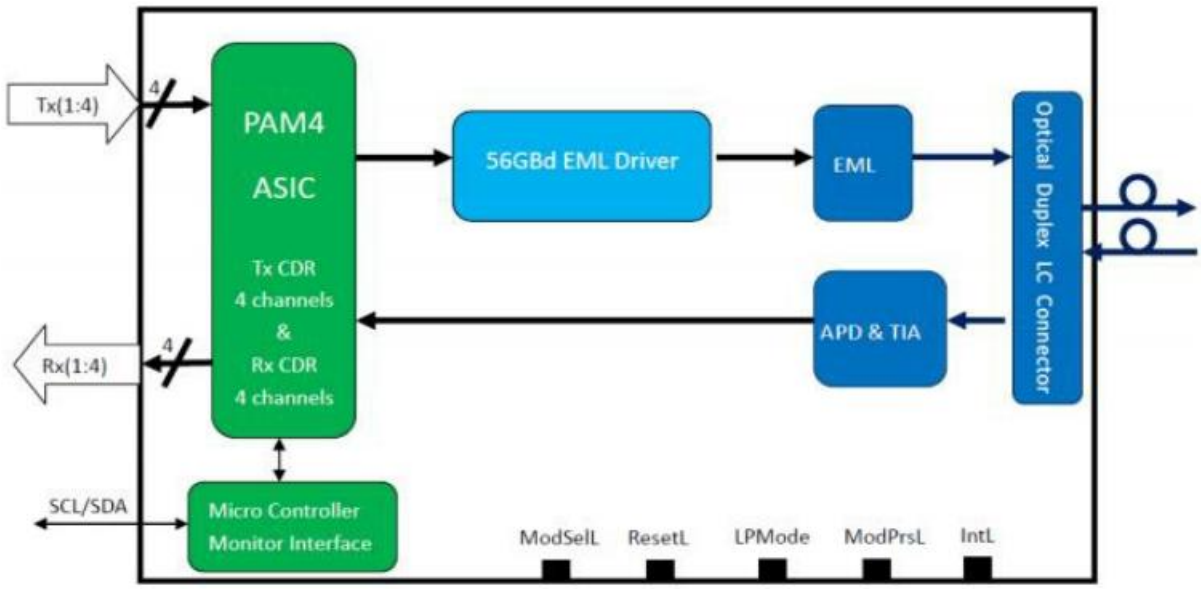
Diagnostics Monitoring

Parameter	Symbol	Accuracy	Unit	Notes
Temperature Monitor Absolute Error	DMI_Temp	± 3	°C	
Supply Voltage Monitor Absolute Error	DMI_VCC	± 0.1	V	
Channel RX Power Monitor Absolute Error	DMI_RX	± 2	dB	1
Channel Bias Current Monitor	DMI_Ibias	± 10%	mA	
Channel TX Power Monitor Absolute Error	DMI_TX	± 2	dB	1

Note:

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

Block Diagram of Transceiver



Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Center Wavelength	λc	1304.06	1304.58	1305.1	nm	
Transmitter						
Side-mode Suppression Ratio	*SMSR*	30			dB	
Average Launch Power	P_{AVG}	0		5.6	dBm	1
Outer Optical Modulation Amplitude (OMAouter) For TDECQ≦ 1.4dB For TDECQ> 1.4dB	*OMA*	3.0 1.6+TDECQ		6.4	dBm	
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ)	*TDECQ*			3.9	dB	
TECQ	*TECQ*			3.9	dB	
| TDECQ-TECQ |				2.7	dB	
Extinction Ratio	*ER*	5			dB	
RIN15 OMA	*RIN*			-136	dB/Hz	
Optical Return Loss Tolerance	*TOL*			15	dB	
Transmitter Reflectance	*RT*			-26	dB	2
Transmitter Transition Time				17	ps	
Average Output Power (Laser Turn off)	*Poff*			-15	dBm	
Receiver						
Center Wavelength	*WL*	1308.61	1309.14	1309.66	nm	
Damage Threshold	*THd*	-2.4			dBm	3
Average Rx Power	P_{RX}	-14.7		-3.4	dBm	4
Receiver Power (OMAouter)				-2.6	dBm	
Receiver Sensitivity (OMAouter)				Equation (2)		5
Stressed Receiver Sensitivity (OMA_{outer})	*SRS*			-10	dBm	6
Receiver Reflectance	R_R			-26	dB	
Los Assert	*LOSA*	-26			dB	
Los De-Assert	*LOSD*			-15	dB	
Los Hysteresis	*LOSH*	0.5			dB	

Conditions of Stress Receiver Sensitivity Test (Note 7)		
Stressed Eye Closure for PAM4 (SECQ)	3.9	dB

Notes:

1. 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.
2. Transmitter reflectance is defined looking into the transmitter.
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. Average receiver power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
5. Receiver sensitivity (OMAouter) (max) is informative and is defined for a transmitter with a value of SECQ up to 3.9dB. It should meet Equation (2), which is illustrated in Figure 4.

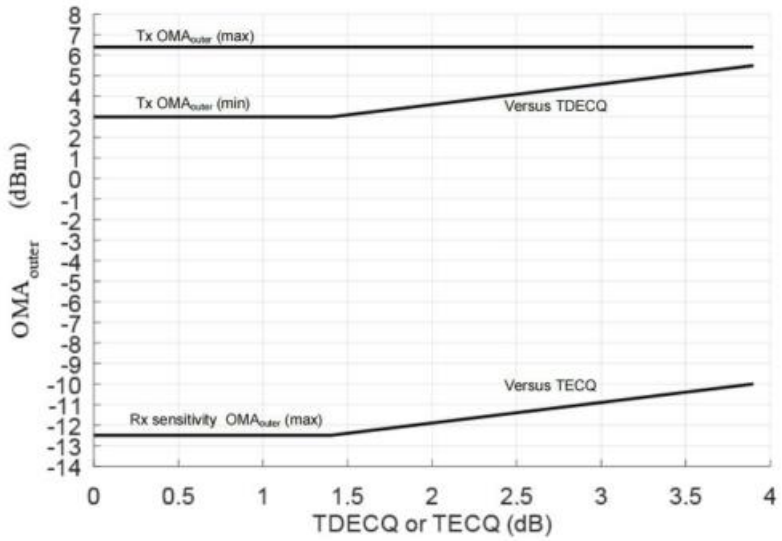
   RS=max (-12.5, SECQ-13.9) dBm

   Where:

   RS is the receiver sensitivity, and

   SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.

6. Measured with conformance test signal at TP3 using test pattern PRBS31Q or scrambled idle for the stress receiver sensitivity for BER equal to 2.4×10^{-4}
7. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.



Electronical Characteristics

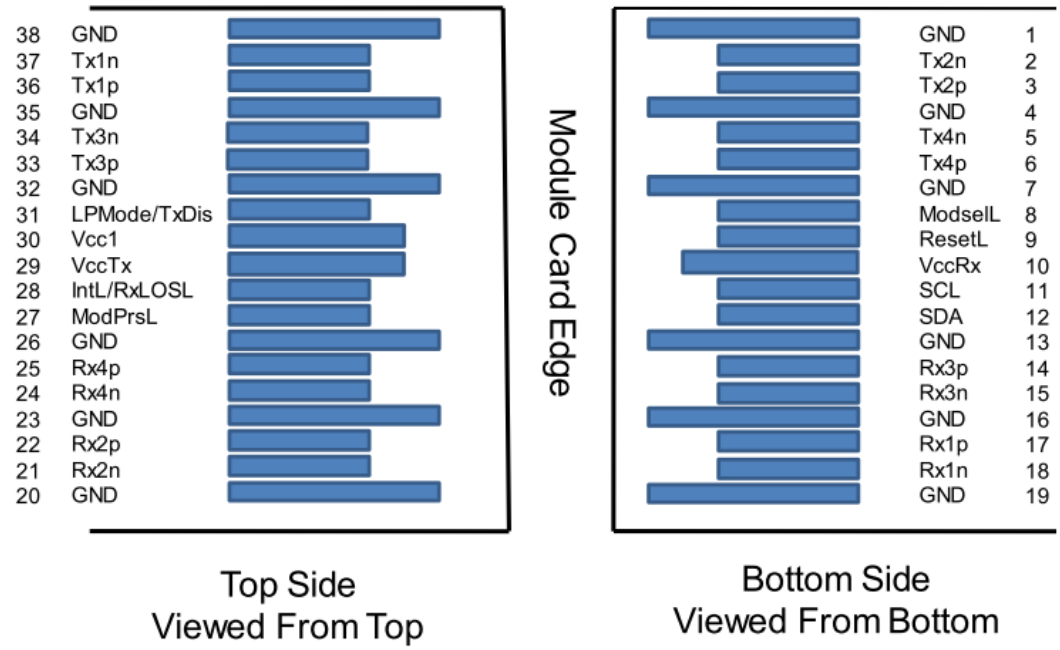
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				4.5	W	
Supply Current	Icc			1.36	A	
Transmitter (each Lane)						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	1
Different Termination Resistance Mismatch	TP1			10	%	At 1MHz
Differential 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-28G-VSR Equation	dB	

			13-19		
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	

Notes:

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

Pin Assignment and Description



Pin Descriptions

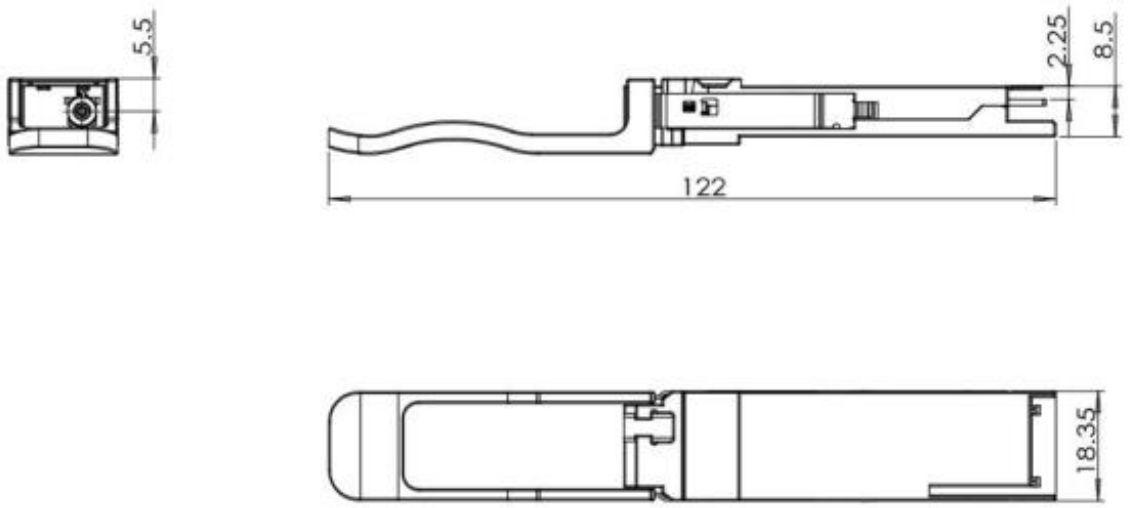
PIN	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module Select	
9	LVTLL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	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	
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 Input	
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 the QSFP28 module. 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. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in MSA. The connector pins are each rated for a maximum current of 1000 mA.

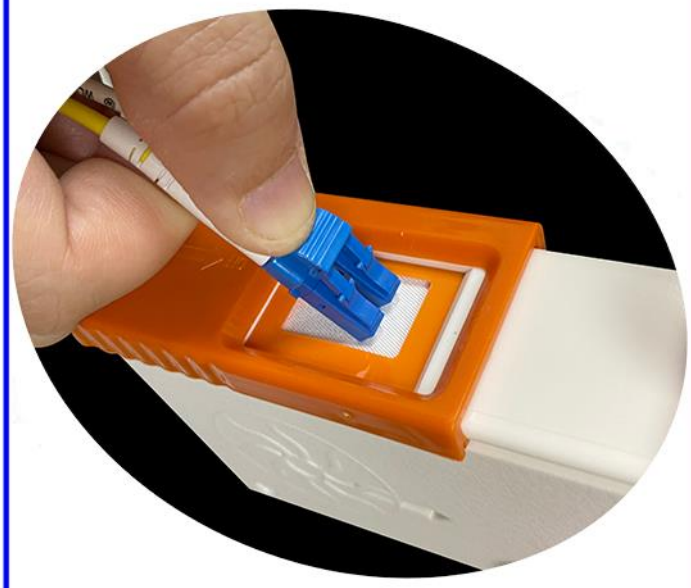
Dimensions



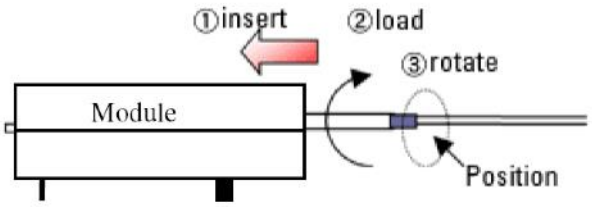
Optical Receptacle Cleaning Recommendations :

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



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	Wavelenth	Temperature
100G QSFP28-BIDI-30U	OPCW-W30-A4-CB	TX1304/RX1309	0°C to 70 °C

Modification History

Revision	Date	Description
A1	Apr. 2023	Initial Release

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