

100Gb/s QSFP28 LX4 MMF/SMF 1310nm 100m/2km Optical Transceiver

Features

- Four-channel full-duplex transceiver modules
- Transmission data rate up to 26Gbit/s per channel
- Up to 100m transmission on OM3 multimode fiber (MMF)
or 2km transmission on single mode fiber (SMF)
- Low power consumption <4W
- Operating case temperature 0°C to +70°C
- 3.3V power supply voltage
- RoHS compliant
- Hot Pluggable QSFP28 form factor
- LC connector receptacle
- Built-in digital diagnostic function

Applications

- 100G Ethernet
- Proprietary High Speed Interconnections
- Data center
- 100G LX4 application with FEC

Description

This product is a transceiver module designed for optical transmission applications over both MMF and SMF with transmission distances of up to 100m on MMF (OM3) and 2km on SMF. 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 a duplex LC connector for the optical interface and a 38-pin connector for the electrical interface.

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.

For applications over OM3/OM4 MMF, MMF cables are directly connected to the LC connectors of QSFP28 LX4 module and optical signal is directly launched from the transmitter into the MMF cable as shown in Figure 2. For applications over SMF, the module is used as a QSFP28 CWDM4 module and SMF cables are directly connected to the LC connectors of the module as shown in Figure 3.

Absolute Maximum Ratings

Table1-Absolute Maximum Ratings					
Parameter	Symbols	Min.	Max.	Unit	Notes
Storage Temperature	TS	-40	85	°C	
Operating Case Temperature	TOP	0	70	°C	
Power Supply Voltage	VCC	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	THd	4.5		dBm	

Recommended Operating Conditions and Power Supply Requirements

Table2-Recommended Operating Conditions and Power Supply Requirements						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	TOP	0		70	°C	
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Data Rate, each Lane			25.78125		Gb/s	
Control Input Voltage High		2		VCC	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (OM3 MMF)	D_MMF			100	m	

Link Distance (SMF)	D_SMF			2	km	
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Electrical Characteristic

Table3-Electrical Characteristics

Parameter	Test Point	Min.	Typical	Max.	Unit	Notes
Power Consumption				4	W	
Supply Current	ICC			1.22	A	
Transceiver Power-on Initialization Time				2000	ms	1
Transmitter (each Lane)						
Single-ended Input Voltage Tolerance (Note 2)		-0.3		4.0	V	Referred to TP1 signal common
AC Common Mode Input Voltage Tolerance		15			mV	RMS
Differential Input Voltage Swing Threshold		50			mVpp	LOSA Threshold
Differential Input Voltage Swing	Vin,pp	190		700	mVpp	
Differential Input Impedance	Zin	90	100	110	ohm	
Differential Input Return Loss		See IEEE 802.3ba 86A.4.11			dB	10MHz-11.1GHz
J2 Jitter Tolerance	Jt2	0.17			UI	
J9 Jitter Tolerance	Jt9	0.29			UI	
Data Dependent Pulse Width Shrinkage (DDPWS) Tolerance		0.07			UI	
Eye Mask Coordinates {X1, X2, Y1, Y2}		0.11, 0.31 95, 350			UI mV	Hit Ratio = 5x10 ⁻⁵
Receiver (each Lane)						
Single-ended Output Voltage		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage				7.5	mV	RMS
Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	ohm	
Termination Mismatch at 1MHz				5	%	
Differential Output Return Loss		See IEEE 802.3ba 86A.4.2.1			dB	10MHz-

						11.1GHz
Common Mode Output Return Loss		See IEEE 802.3ba 86A.4.2.2			dB	10MHz-11.1GHz
Output Transition Time		28			Ps	20% to 80%
J2 Jitter Output	Jo2			0.42	UI	
J9 Jitter Output	Jo9			0.65	UI	
Eye Mask Coordinates {X1, X2, Y1, Y2}		0.29, 0.5, 150, 425			UI mV	Hit Ratio = 5x10-5

Notes:

[1] Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.

[2] The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

Optical Characteristics

Table4-Optical Characteristics						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Wavelength Assignment	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	
Transmitter						
Total Average Launch Power(for SMF)	PT,SMF			8.3	dBm	
Total Average Launch Power(for MMF)	PT,MMF			9.5	dBm	
Average Launch Power, each Lane(for SMF)	PAVG,SMF	-6.5		2.5	dBm	
Average Launch Power, each Lane(for MMF)	PAVG,MMF	-4.5		4.5	dBm	
Optical Modulation Amplitude (OMA), each Lane(for SMF)	POMA,SMF	-4.5		2.5	dBm	1
Optical Modulation Amplitude (OMA), each Lane(for MMF)	POMA,MMF	-3		4.5	dBm	
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			6.5	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-6.8			dBm	
TDP, each Lane	TDP			2.6	dB	
Extinction Ratio	ER	3.5			dB	

Relative Intensity Noise	RIN			-128	dB/Hz	12dB reflection
Transmitter Reflectance	RT			-12	dB	
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Receiver						
Overload power, each Lane(AVG)		4.5			dBm	2
Total Average Receive Power(for SMF)				8.3	dBm	
Total Average Receive Power(for MMF)				9.5	dBm	
Average Receive Power, each Lane(for SMF)		-11.5		4.5	dBm	
Average Receive Power, each Lane(for MMF)		-8		3.5	dBm	
Receiver Reflectance	RR			-26	dB	
Receiver Sensitivity (OMA), each Lane(for SMF)	SEN,SMF			-11.5	dBm	3
Receiver Sensitivity (OMA), each Lane(for MMF)	SEN, MMF			-8	dBm	3
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			7.5	dB	
LOS Assert	LOSA	-28			dBm	
LOS Deassert	LOSD			-15	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	FC			12.3	GHz	

Notes:

- [1] Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.
- [2] 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.
- [3] Sensitivity is specified at 5x10⁻⁵ BER.

Digital Diagnostic Functions

Table5-Digital Diagnostic Functions

Parameter	Symbols	Min.	Max.	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	+3	°C	Over operating temperature range
Supply voltage monitor absolute error	DMI_VCC	-0.1	+0.1	V	Over full operating range

Channel RX power monitor absolute error	DMI_RX_Ch	-3	+3	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	+10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-3	+3	dB	1

Pin Description

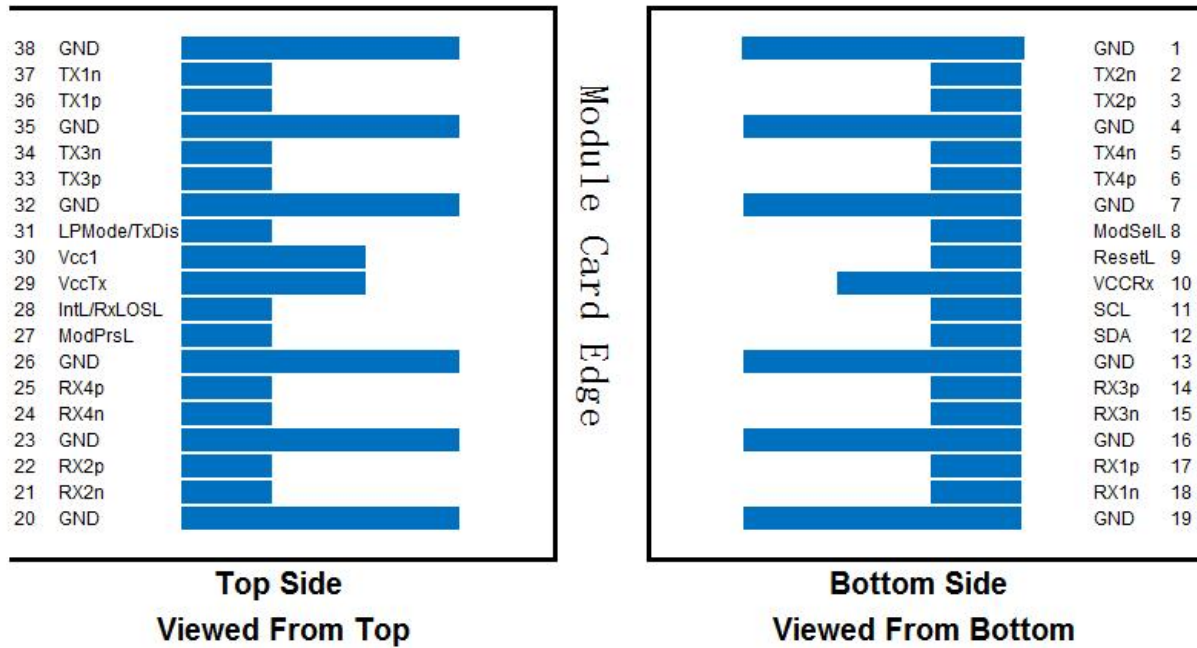


Figure 1 Pin view

Pin Function Definitions

Pin	Symbols	Description	Notes
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3V Power Supply Receiver	2
11	SCL	2-wire serial interface clock	

12	SDA	2-wire serial interface data	
13	GND	Ground	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	1
19	GND	Ground	1
20	GND	Ground	
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	VccTx	+3.3V Power supply transmitter	2
30	Vcc1	+3.3V Power supply	2
31	LPMODE	Low Power Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Notes:

[1] GND is the symbol for signal and supply (power) common for the 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] Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure2. 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 1000 mA.

Block Diagram of Transceiver

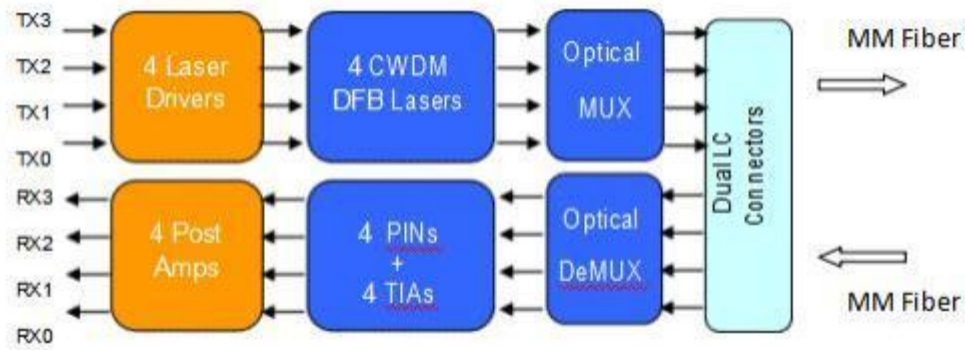


Figure 2 TransceiverBlockDiagramforApplicationsoverMultimode

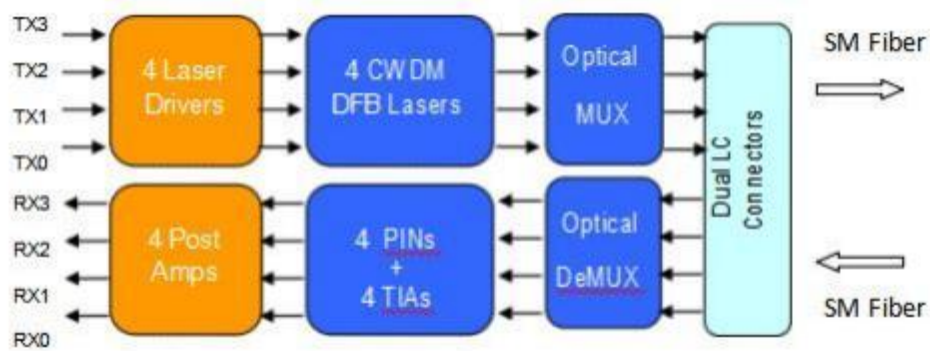
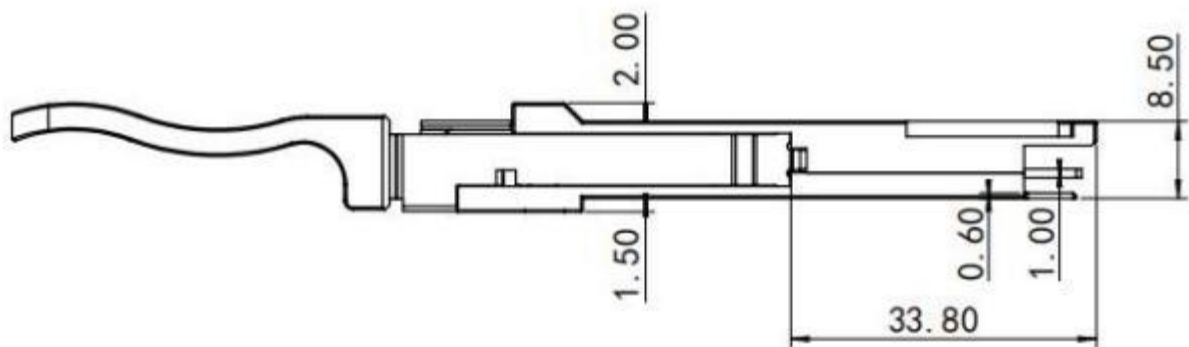


Figure 3 Transceiver Block Diagram for Applications over Single Mode Fiber

Mechanical Dimensions



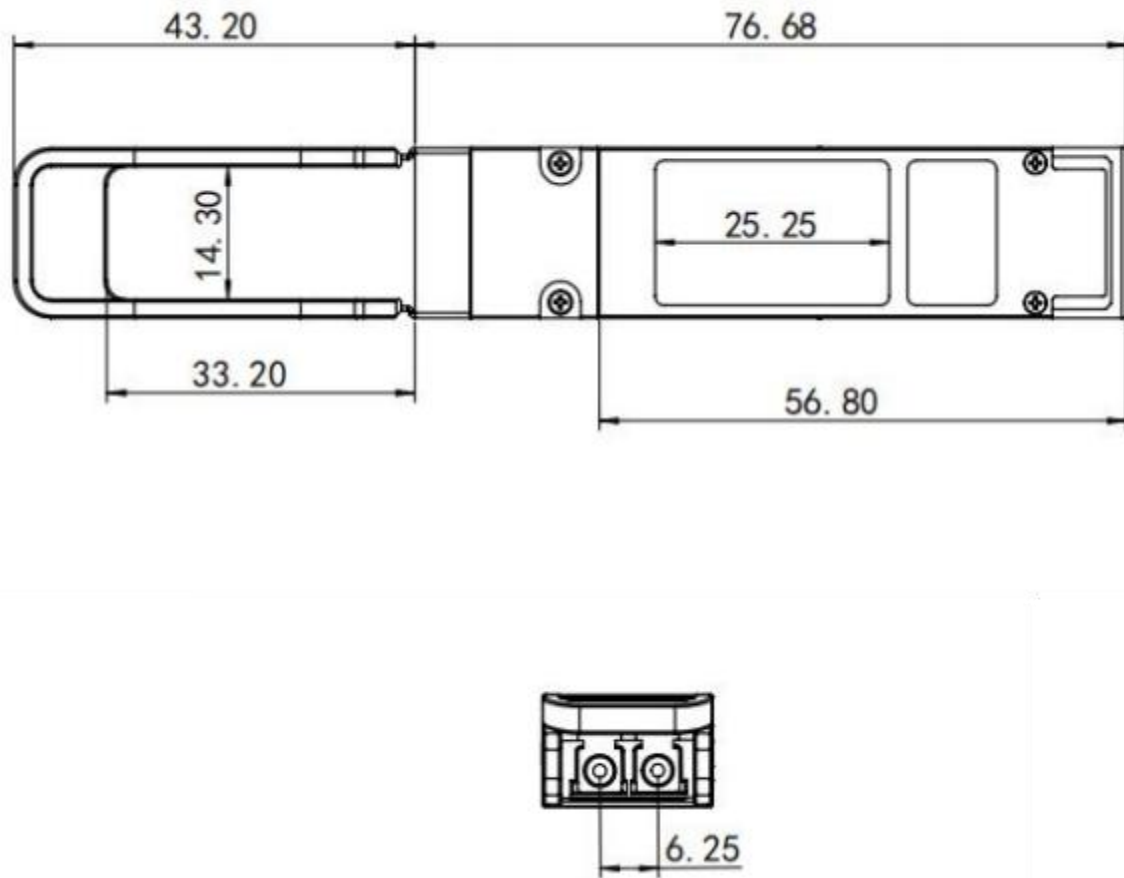


Figure4 Mechanical Outline

ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

Laser Safety

This is a Class 1 Laser Product according to EN 60825-1:2014. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007)

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Further Information:

Web www.naddod.com

Email For order requirements: sales@naddod.com
For customer service: support@naddod.com
For technical support: tech@naddod.com

For cooperation: agency@naddod.com

For other informations: info@naddod.com

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