Features

- 4 CWDM lanes MUX/DEMUX design
- Up to 11.2Gb/s data rate per wavelength
- QSFP+ MSA compliant
- IEEE 802.3ba Electrical Interface
- Digital diagnostic capabilities
- Compliant with QDR/DDR Infiniband data rates
- Up to 150m transmission on OM3 multimode fiber (MMF) or 2km transmission on single mode fiber (SMF)
- Operating case temperature: 0 to 70℃
- Maximum power consumption 3.5W
- LC duplex connector

Applications

- 40GBASE-LX4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 40G datacom connections

Description

This product converts the 4-channel 10Gb/s electrical input data into CWDM optical signals (light), by a driven 4-wavelength Distributed Feedback Laser (DFB) array. The light is combined by the MUX parts as a 40Gb/s data, propagating out of the transmitter module from the MMF.

The receiver module accepts the 40Gb/s CWDM optical signals input, and de-multiplexes it into 4 individual 10Gb/s channels with different wavelength. Each wavelength light is collected by a discrete photo diode, and then outputted as electric data after amplified by a TIA and a post amplifier.

Figures 1 and 2 show the functional block diagram of this product.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	Ts	-40	85	°C
Operating Case Temperature	T_{OP}	0	70	°C
Power Supply Voltage	Vcc	-0.5	3.6	V
Relative Humidity (non-condensation)	RH	0	85	%
Damage Threshold, each Lane	TH_d	4.5		dBm

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T_{OP}	0		+70	°C
Power Supply Voltage	Vcc	3.135	3.3	3.465	V
Data Rate, each Lane			10.3125	11.2	Gb/s
Control Input Voltage High		2		Vcc	V
Control Input Voltage Low		0		0.8	V
Link Distance with (OM3 MMF)	$D_{\_MMF}$			150	m
Link Distance (SMF)	$D_{\_SMF}$			2	km

Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Power Consumption				3.5	W	
Supply Current	Icc			1.1	A	
Transceiver Power-on Initialization Time				2000	ms	1

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.

Optical Characteristics

Parameter	Symbol	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	

Digital Diagnostic Functions

Parameter	Symbol	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	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:

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

Transmitter Electro-optical Characteristics (each Lane)

Vcc = 3.135 V to 3.465 V, T_C = 0 °C to 70 °C

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Single-ended Input Voltage Tolerance (Note 1)		-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 = $5x10^{-5}$
Total Average Launch Power (for SMF)	$P_{T,SMF}$			8.3	dBm	
Total Average Launch Power (for MMF)	$P_{T,MMF}$			9.5	dBm	
Average Launch Power, each Lane (for SMF)	$P_{AVG, SMF}$	-7.0		2.3	dBm	
Average Launch Power, each Lane (for MMF)	$P_{AVG, MMF}$	-5.0		3.5	dBm	
OMA, each Lane (for SMF)	$P_{OMA, SMF}$	-6.0		3.5	dBm	2
OMA, each Lane (for MMF)	$P_{OMA, MMF}$	-4.0		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	R_T			-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.23,0.34,0.43,0.27,0.35, 0.4}				

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	

Notes:

1. The single ended input voltage tolerance is the allowable range of the instantaneous input signals.
2. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.

Receiver Electro-optical Characteristics (each Lane)

Vcc = 3.135 V to 3.465 V, T_C = 0 °C to 70 °C

Parameter	Symbol	Min	Typical	Max	Unit	Notes
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 = $5x10^{-5}$
Damage Threshold, each Lane	THd	4.5			dBm	1
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)		-11.7		2.3	dBm	
Average Receive Power, each Lane (for MMF)		-7.0		3.5	dBm	
Receiver Reflectance	R_R			-26	dB	
Receive Power (OMA), each Lane (for SMF)				3.5	dBm	
Receiver Power (OMA), each Lane (for MMF)				4.5	dBm	
Receiver Sensitivity (OMA), each Lane (for SMF)	SEN_{SMF}			-11.5	dBm	
Receiver Sensitivity (OMA), each Lane (for MMF)	SEN_{MMF}			-10.5	dBm	
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	

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			12.3	GHz	

Notes:

1. 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.

Block Diagram of Transceiver

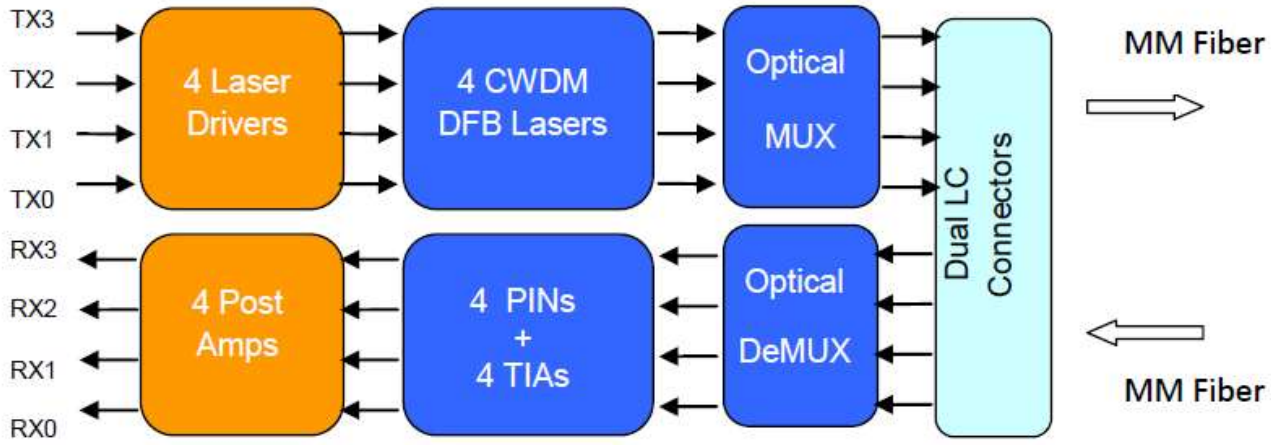


Figure 1. Transceiver Block Diagram for Applications over Multimode Fiber

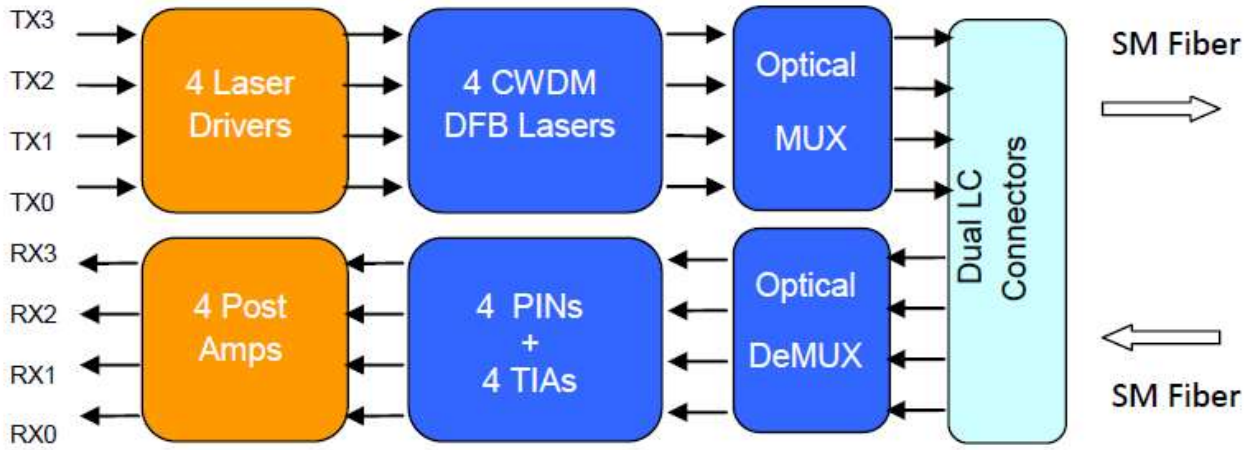


Figure 2. Transceiver Block Diagram for Applications over Single Mode Fiber

Pin Assignment

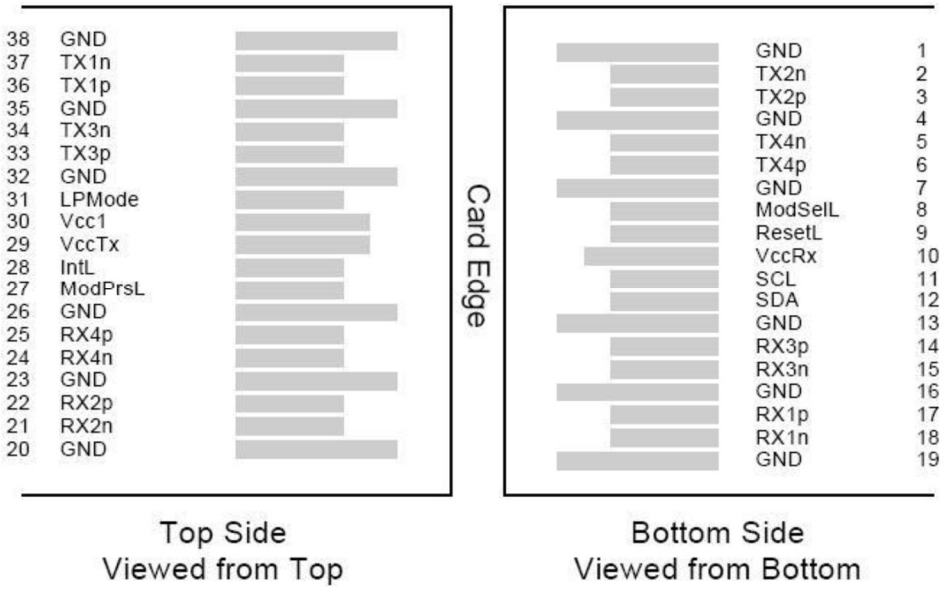


Figure 3. MSA compliant Connector

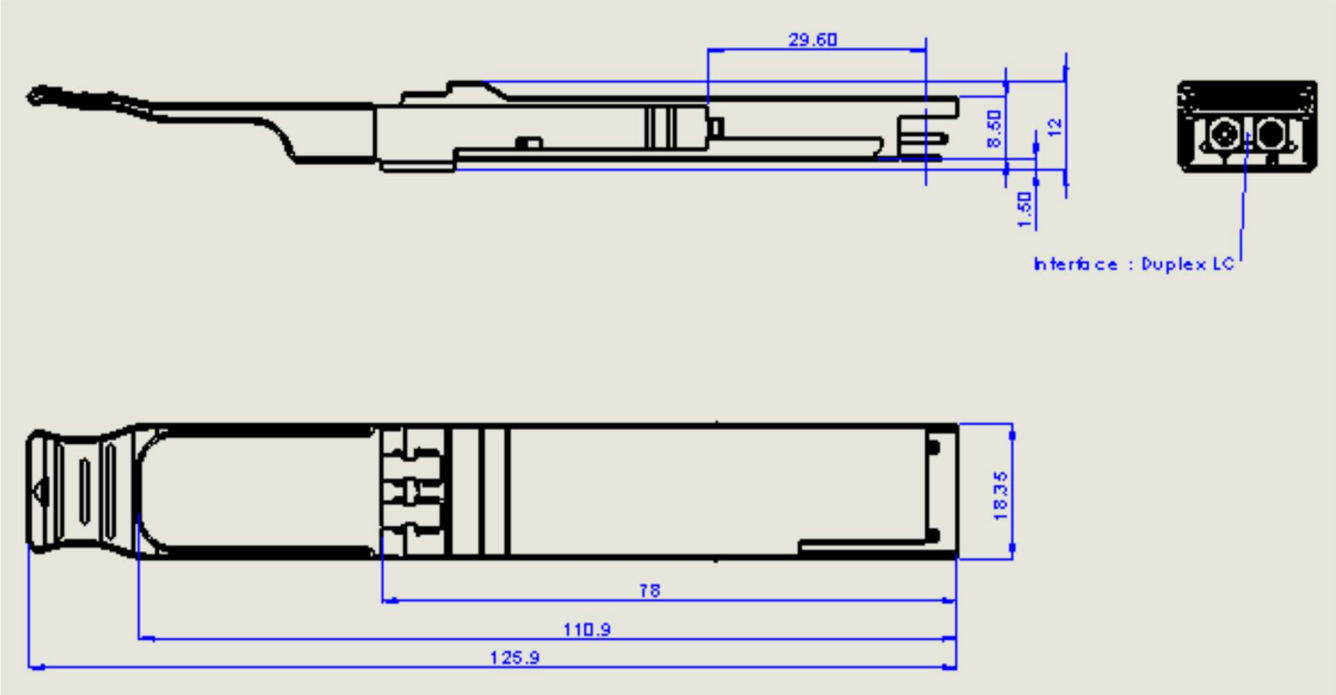
PIN	Logic	Symbol	Name/Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module 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		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	
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 QSFP+ modules. All are common within the QSFP+ 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 QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

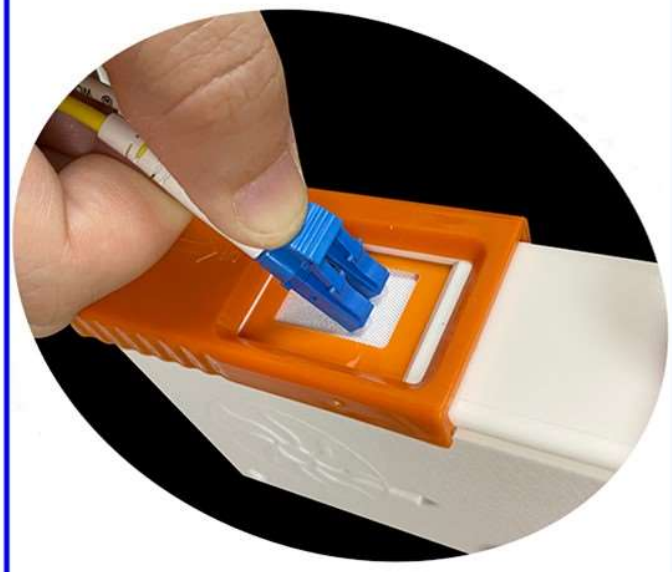
Dimensions



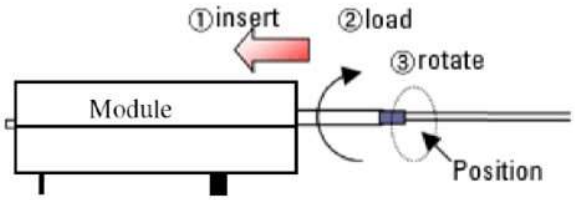
Optical Receptacle Cleaning Recommendations:

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.

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	Voltage	Temperature
QSFP-40G-LX4	OPCS-X02-13-CB	3.3V	0°C to 70 °C

Modification History

Revision	Date	Description
A1	Dec.2023	Initial Release

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