Features

- 4 Parallel lanes design
- Up to 11.2Gbps data rate per channel
- Aggregate Bandwidth of up to 44.0G
- QSFP+ MSA compliant
- Up to 10km transmission on single mode fiber (SMF)
- Commercial case temperature : 0°C to 70°C
- Maximum power consumption 3.5W
- MTP/MPO duplex connector
- RoHS-6 compliant

Applications

- 40G Ethernet
- Infiniband QDR and DDR and SDR
- Datacenter and Enterprise networking

Description

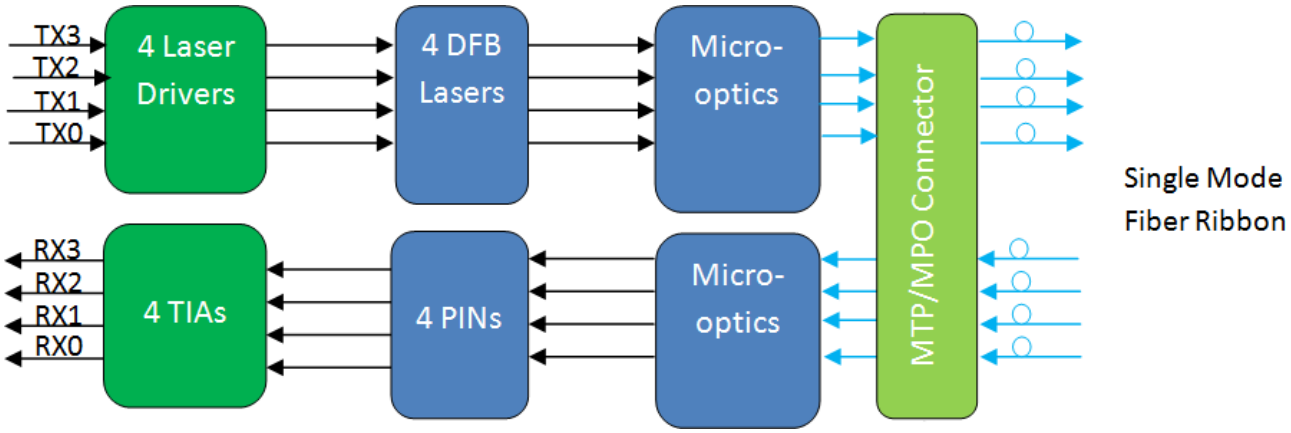
This product is a parallel 40Gb/s Quad Small Form-factor Pluggable (QSFP+) optical module. It provides increased port density and total system cost savings. The QSFP+ full-duplex optical module offers 4 independent transmit and receive channels, each capable of 10Gb/s operation for an aggregate data rate of 40Gb/s on 10km of single mode fiber.

An optical fiber ribbon cable with an MTP/MPO connector can be plugged into the QSFP+ module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through a z-pluggable 38-pin connector per MSA requirement.

The module operates with single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt and Low Power Mode, are available with the modules. A 2-wire serial interface is available to send and receive more complex control signals, and to receive digital diagnostic information. Individual channels can be addressed and unused channels can be shut down for maximum design flexibility.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP+ Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module can be managed through the I2C two-wire serial interface.

Block Diagram of Transceiver



Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Ambient Temperature	T_{STG}	-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	%	
Damaged Threshold , each Lane	*THd*	3.3		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit
Operating Case Temperature	TOP	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 G.652	D	0.002		10	km

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Units	Notes
Temperature monitor absolute error	DMI_Temp	±3	℃	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

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.

Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
		Transmitter				
Center Wavelength	λC	1260	1310	1355	nm	
Side Mode Suppression Ratio	*SMSR*	30			dB	
Total Average Launch Power	P_T			7.5	dBm	
Average Launch Power, each lane	P_{AVG}	-5.5		1.5	dBm	
Optical Modulation Amplitude (OMA) each lane	P_{OMA}	-4.5		2.5	dBm	1
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		-5.5			dBm	
TDP, each lane	*TDP*			3.2	dB	
Extinction Ratio	*ER*	3.5			dB	
Relative Intensity Noise	*RIN*			-128	dB/Hz	12dB reflecton
Optical Return Loss Tolerance	*TOL*			12	dB	
Transmitter Reflectance	R_T			-12	dB	
Transmitter Eye Mask Definition (X1, X2, X3, Y1, Y2, Y3)		{0.25,0.4,0.45,0.25,0.28,0.4}				
Average Launch Power OFF Transmitter each lane	*Poff*			-30	dBm	
		Receiver				
Center Wavelength	λC	1260	1310	1355	nm	2
Damage Threshold, each lane	TH_d	3.3			dBm	
Average Receive Power, each lane		-12.5		1.5	dBm	
Receiver Reflectance	R_R			-12	dB	
Receiver Power (OMA) each lane				2.5	dBm	
Receiver Sensitivity (OMA) each lane	*SEN*			-12.6	dBm	
Difference in Receiver Power between any Two Lanes (OMA)	*Prx,diff*			7.5	dB	
LOS Assert	*LOSA*	-30			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. The maximum transmitter average optical power of 1.5dBm is well within the guardband of receiver overload specifications of commercially available 10GBASE-LR SFP+ transceivers .
2. Even if the TDP<1 dB, the OMA min must exceed the minimum value specified here.
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.

Electronical Characteristics

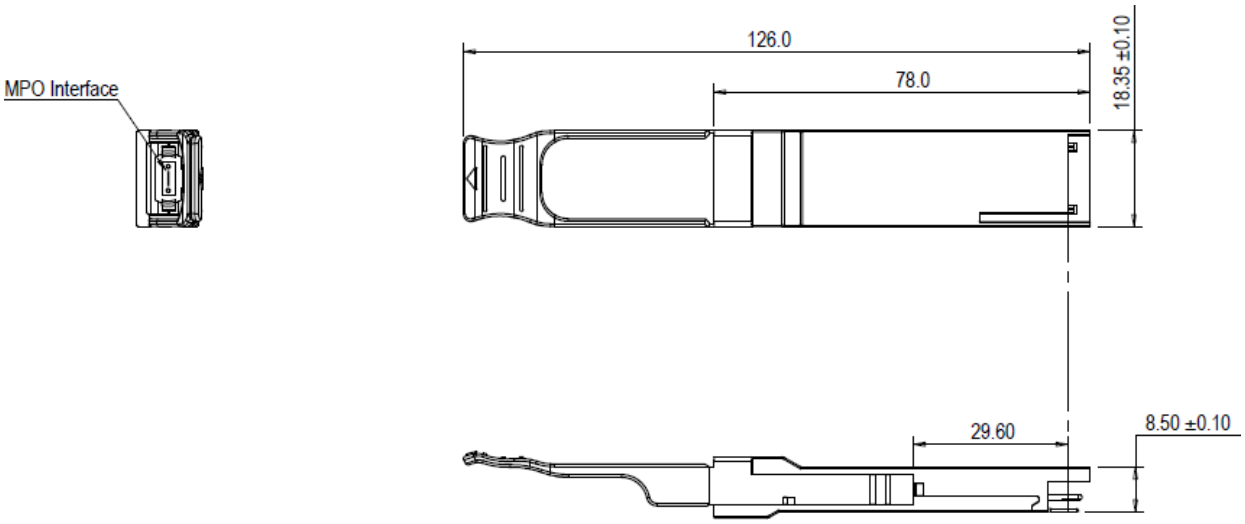
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				3.5	W	
Supply Current	Icc			1.1	A	
Transceiver Power-on Initialization Time				2000	ms	1
Transmitter (each lane)						
Single-ended Input Voltage Tolerance (Note 2)		-0.3		4.0	V	Referred to TP1 signal common
AC Common Mode Input Voltage 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 Ration=5x10-5

Notes:

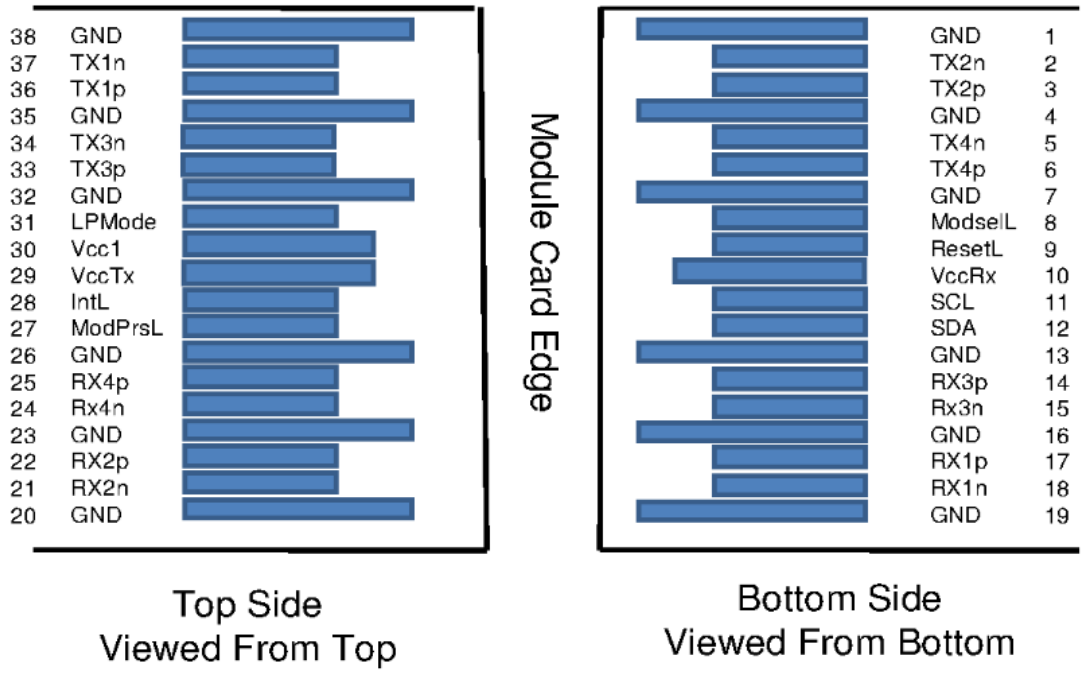
1. Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.
2. The single ended input voltage tolerance is the allowable range of the instantaneous input signals

Dimensions



Pin Assignment and Description

The electrical pinout of the QSFP28 module is shown as below



Pin Descriptions

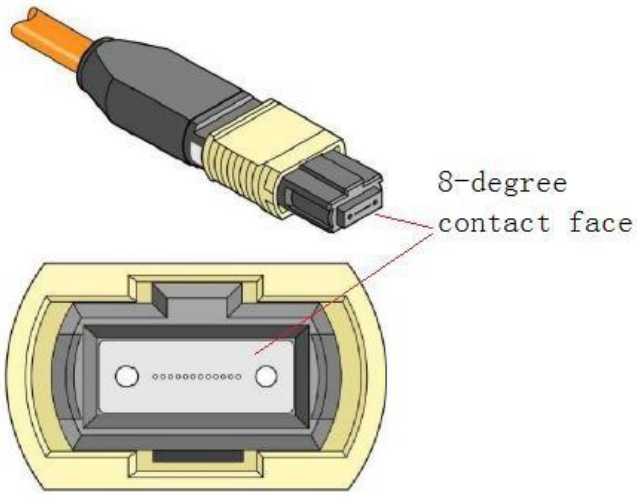
PIN	Logic	Symbol	Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTLL-I	ModSelL	Module 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 the QSFP+ module. 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 receiver and transmitter power supplies and shall be applied concurrently. Recommended host board power supply flitering is shown below. 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.

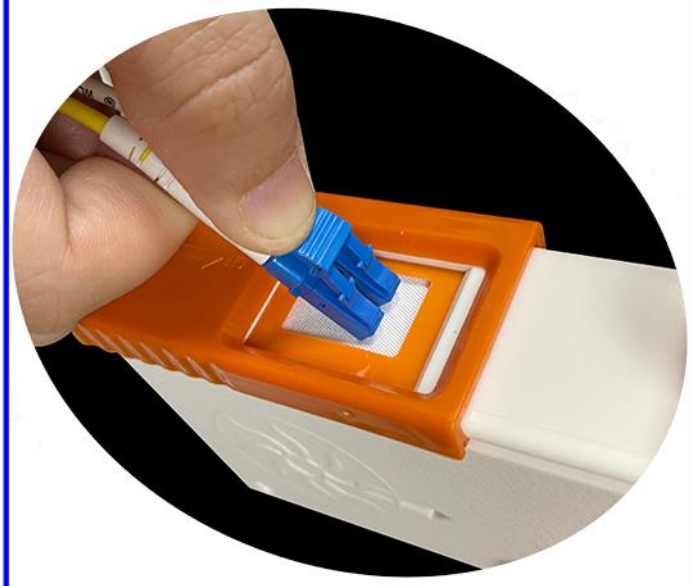
Female MPO Connector with 8-degree End-face



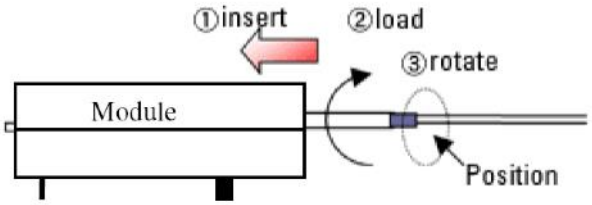
Optical Receptacle Cleaning Recommendations :

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	Reach	Wavelength	Temperature
QSFP 40G LR4-PSM	OPCS-S10-13-CBS	10km	1310nm	0°C to 70°C

Modification History

Revision	Date	Description
A1	Sep. 2014	Initial Release

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