Features:

- ✧ Hot pluggable QSFP56 MSA form factor
- ✧ Compliant to IEEE 802.3bs 200GBASE-LR4
- ✧ Up to 10km reach for G.652 SMF with FEC
- ✧ Single +3.3V power supply
- ✧ Operating case temperature: 0~70℃
- ✧ Transmitter: cooled 4x26.5625 GBaud/s LAN WDM TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- ✧ Receiver: 4x26.5625 GBaud/s PIN ROSA
- ✧ 26.5625 GBaud/s Channel Electrical Serial Interface (200GAUI-8)
- ✧ Maximum power consumption 7.5W
- ✧ Duplex LC receptacle
- ✧ RoHS compliant

Applications:

- ✧ 200GBASE-LR4 Ethernet Links

Part Number Ordering Information

OPQH10	QSFP56 LR4 10km optical transceiver with full real-time digital diagnostic monitoring and pull tab

1. General Description

OPQH10 200GE QSFP56 Optical Transceiver modules are designed for use in 200 Gigabit Ethernet links over SMF28 single-mode fiber. They are compliant with the QSFP MSA and with IEEE 802.3bs 200GBASE-LR4 specification. Digital diagnostics functions are available via the I2C interface as specified by ACMIS4.0. The transceiver is RoHS 2.0 compliant and lead-free per Directive 2011/65/EU.

2. Transceiver Block Diagram

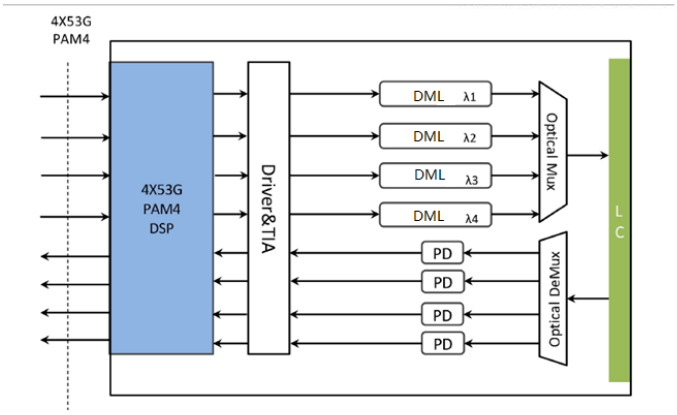

Figure 1. Transceiver Block Diagram

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3. Pin Assignment and Description

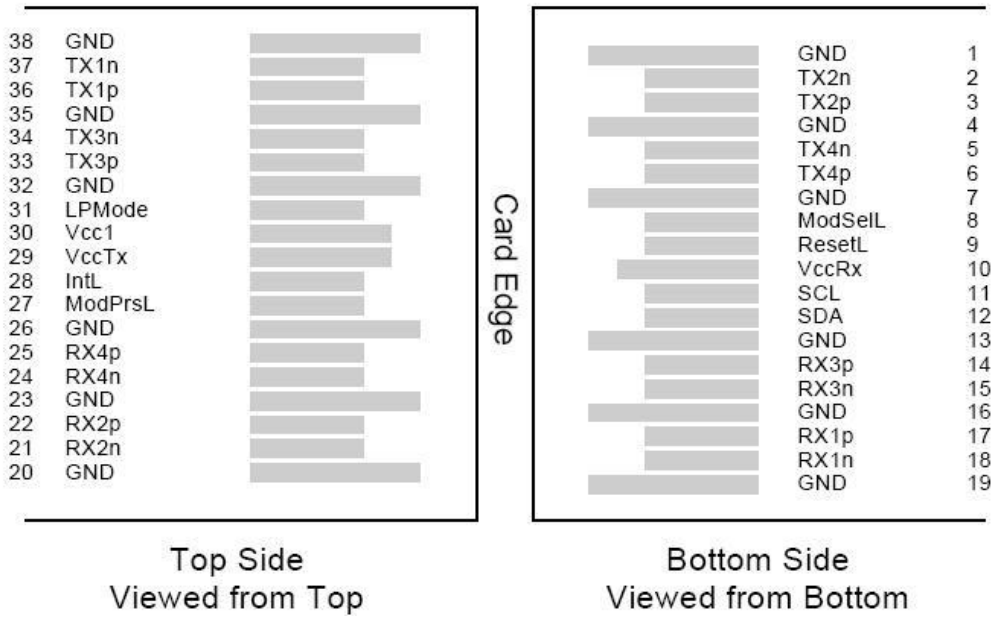

Figure 2. MSA Compliant Connector

Pin Definition

PIN	Logic	Symbol	Name/Description	Notes
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	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V 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

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Notes:

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 in Figure 3 below. 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.

5. Recommended Power Supply Filter

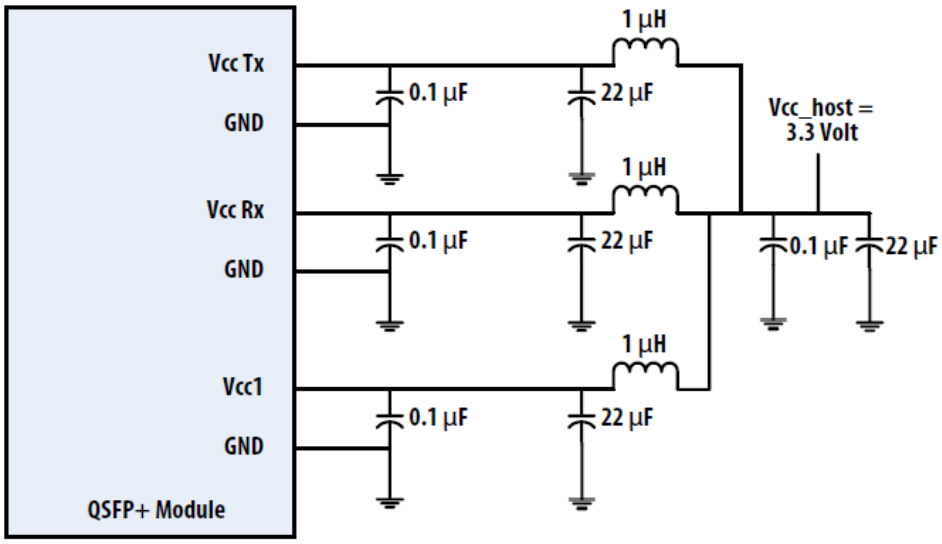

Figure 3. Recommended Power Supply Filter

6. Absolute Maximum Ratings

It must be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Units	Note
Storage Temperature	TS	-40	85	degC	
Operating Case Temperature	TOP	0	70	degC	
Power Supply Voltage	VCC	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	THd	-3.0		dBm	

7. Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Units
Operating Case Temperature	TOP	0		70	degC
Power Supply Voltage	VCC	3.135	3.3	3.465	V

Data Rate, each Lane (PAM4)			26.5625		GBaud/s
Control Input Voltage High		2		Vcc	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	D			10	km

8. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min	Typical	Max	Units	Notes
Power Consumption				7.5	W	
Supply Current	Icc			2.28	A	
Transceiver Power-on Initialization Time				2000	ms	
Transmitter (each Lane)						
Overload Differential Voltage pk-pk	TP1a	900			mV	1
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	2
Differential Termination Resistance Mismatch	TP1			10	%	
Differential Return Loss (SDD11)	TP1	200GAUI-4 83E.3.1.3Equation (83E–3)			dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	TP1	200GAUI-4 83E.3.1.3Equation (83E–3)			dB	
Receiver (each Lane)						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	2
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	
Differential Return Loss (SDD22)	TP4	200GAUI-4 83E.3.1.3Equation (83E–3)			dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	TP4	200GAUI-4 83E.3.1.3Equation (83E–3)			dB	
Transition Time, 20 to 80%	TP4	9.5			ps	
Far-end ESMW (Eye symmetry mask width)	TP4	0.2			UI	
Near-end ESMW (Eye symmetry mask width)	TP4	0.22			UI	

Near-end Eye height, differential (min)	TP4	70			mV	
Far-end Eye height, differential (min)	TP4	30			mV	

Notes:

1. With the exception to 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
2. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

9. Optical Characteristics

QSFP56 200GBASE-LR4						
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**	**Notes**
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Transmitter						
SMSR	SMSR	30			dB	
Total Average Launch Power	PT			11.3	dBm	
Average Launch Power, each Lane	P_{AVG}	-3.4		5.3	dBm	
Outer Optical Modulation Amplitude (OMAouter), each lane	P_{OMA}	-0.4		5.1	dBm	1
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			4	dB	
Launch power in OMAouter minus TDECQ, each lane (min):		-1.8			dBm	
Transmitter and dispersion eye closure for PAM4 (TDECQ),each lane	TDECQ			3.4	dB	
Extinction Ratio	ER	3.5			dB	
$RIN_{15.6}OMA$	RIN			-132	dB/Hz	
Optical Return Loss Tolerance	TOL			15.6	dB	
Transmitter Reflectance	R_T			-26	dB	
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Receiver						
Damage Threshold, each Lane	THd	6.3			dBm	2
Total Average Receive Power				2.0	dBm	
Average Receive Power, each Lane		-9.7		5.3	dBm	
Receiver sensitivity (OMAouter), each lane	SEN			EQ122-2	dBm	3,4
Receiver reflectance				-26	dB	

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Difference in Receive Power between any Two Lanes (Average and OMA)	Prx,diff			5.1	dB	
LOS Assert	LOSA	-30			dBm	
LOS Deassert	LOSD			-9	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Stressed receiver sensitivity (OMAouter), each laned (max)				-5.2	dBm	4

Notes:

1. Even if the TDECQ < 1.4 dB, the OMAouter (min) must exceed this value
2. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level on one lane. The receiver does not have to operate correctly at this input power.
3. Receiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB for 200GBASE-LR4.

   For 200GBASE-LR4, receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. Receiver sensitivity should meet Equation (122–2), which is illustrated in Figure 4

$$RS = \max(-5.5, SECQ - 6.9) \quad \text{(dB)} \qquad (122\text{–}1)$$

$$RS = \max(-7.2, SECQ - 8.6) \quad \text{(dB)} \qquad (122\text{–}2)$$

where
RS is the receiver sensitivity
SECQ is the SECQ of the transmitter used to measure the receiver sensitivity

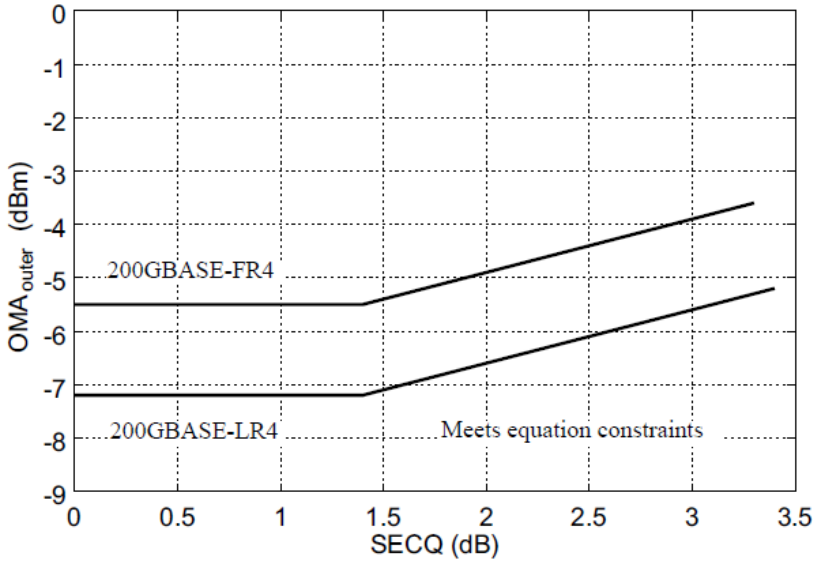

Figure 4. Eye Mask Definition

4. Measured with conformance test signal at TP3 (see IEEE 802.3cd 138.8.10) for the BER of 2.4E-4.

10. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise

specified.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	+3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI _VCC	-5%	5%	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

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.

11.Mechanical Dimensions

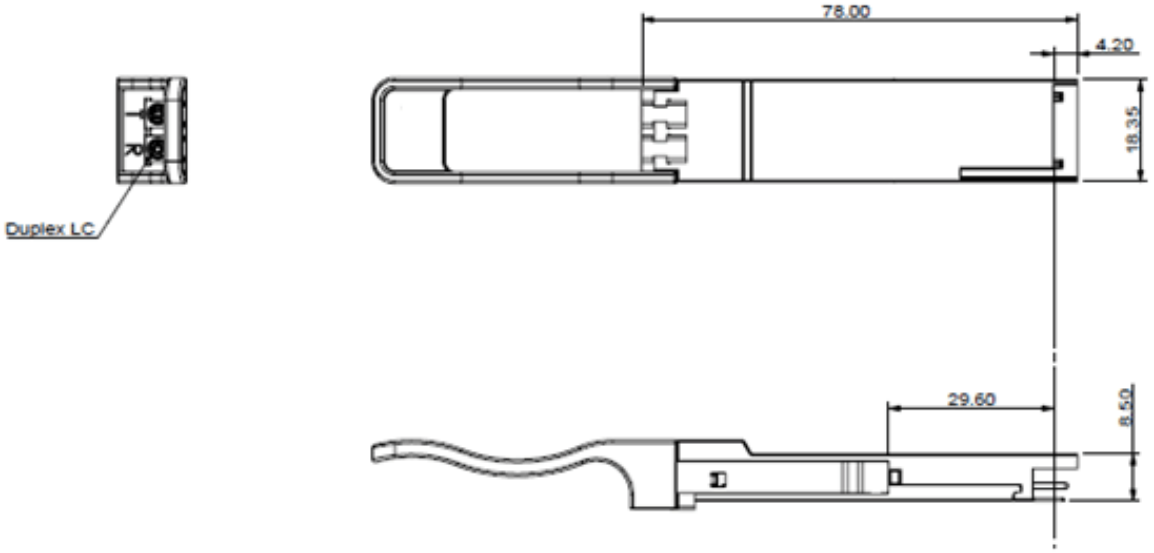

Figure 5. Mechanical Outline

12. ESD

This transceiver is specified as ESD threshold 1kV for SFI 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.

13. 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 here in may result in hazardous radiation exposure.

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