

## 200Gb/s QSFP56 SR4 MPO Pigtail Transceiver for liquid immersion environment

P/N POQP2001LI-XX

### FEATURES

Data rate up to 212.5Gbps (4x 53Gbps PAM4);  
 Reach up to 70m on MMF(OM3);  
 Reach up to 100m on MMF(OM4);  
 850nm VCSEL laser and PIN receiver;  
 High speed I/O electrical interface (200GAUI-4);  
 I2C interface with integrated Digital Diagnostic monitoring;  
 Single MPO-12 APC cable pigtail;  
 Single +3.3V power supply;  
 Power consumption <4 W;  
 Operating case temperature: 0 to +70°C;  
 Compliant to RoHS-10



### APPLICATION

200G BASE-SR4  
 Especially design for liquid immersion environment

The 200G QSFP56 SR4 MPO Pigtail Liquid cooling transceiver is designed for Ethernet 200G BASE- SR4 applications. The module integrates four parallel lanes with baud rate at 26.5625GBd each lane. It can transmit up to 70 m on fiber OM3 fiber or 100 m on OM4 fiber with FEC. It is compliant to IEEE802.3bs, IEEE802.3cd and Common Management Interface Specification Rev4.0.

### ABSOLUTE MAXIMUM RATINGS (TC=25°C, UNLESS OTHERWISE NOTED)

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings will cause permanent damage and/or adversely affect device reliability.

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Storage Temperature	TS	-40	-	+85	°C	-
Maximum Supply Voltage	Vcc	-0.5	-	4.0	V	-
Operating Relative Humidity	RH	-	-	-	%	-

### GENERAL SPECIFICATIONS

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	Tc	0	-	70	°C	-
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	-
Power Supply Current	Icc	-	-	1.2	A	-
Maximum Power Dissipation	P <sub>D</sub>	-	-	4	W	-
Lane Baud Rate	BR <sub>LANE</sub>	-	26.5625	-	GBd	-
Transmission Distance	TD	-	-	70	m	Over MMF OM3
Transmission Distance	TD	-	-	100	m	Over MMF OM4

## PIN DESCRIPTIONS

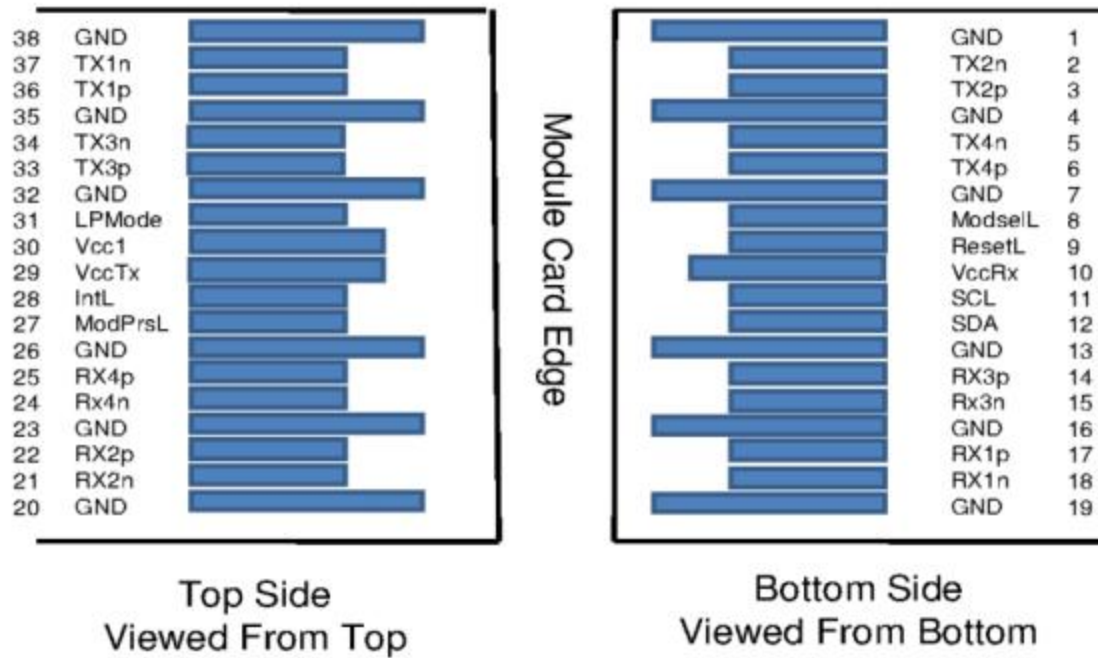


Figure 1 – Pin Definitions

## PIN DESCRIPTIONS

Pin	Symbol	Name/Description	Ref.
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	1

8	ModSelL	Module Select	-
9	ResetL	Module Reset	-
10	Vcc Rx	+3.3 V Power supply receiver	-
11	SCL	2-wire serial interface clock	-
12	SDA	2-wire serial interface data	-
13	GND	Ground	1
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	-
19	GND	Ground	1
20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	-
22	Rx2p	Receiver Non-Inverted Data Output	-
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	-
25	Rx4p	Receiver Non-Inverted Data Output	-
26	GND	Ground	1
27	ModPrsL	Module Present	-
28	IntL	Interrupt	2
29	Vcc Tx	+3.3 V Power supply transmitter	-
30	Vcc1	+3.3 V Power Supply	-
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] Circuit ground is internally isolated from chassis ground.

[2] IntL is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board. The INTL pin is deasserted "High" after all set interrupt flags are read.

## ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typical	Max	Units	Notes	
<b>Receiver electrical output characteristics at TP4</b>							
Signaling rate per lane		-	26.5625		GBd	-	
Common Mode Voltage(V <sub>cm</sub> )		-350	-	2850	mV	-	
AC common-mode output voltage(RMS)		-	-	17.5	mV	-	
Differential peak-to-peak output voltage		-	-	900	mV	-	
Near-end ESMW (Eye symmetry mask width)		0.265	-	-	UI	-	
Near-end Eye height, differential		70	-	-	mV	-	
Far-end ESMW (Eye symmetry mask width)		0.2	-	-	UI	-	
Far-end Eye height, differential		30	-	-	mV	-	
Far-end pre-cursor ISI ratio		-4.5	-	2.5	%	-	
Differential output return loss(SDD22)		-	-	-11	dB	0.05 – 7.5GHz	
		-	-	$6+9.2*\log_{10}(15f/7f_b)$	dB	$f_b / 7.5-f_b$ GHz	
Differential to common mode conversion return loss (SDC22)		-	-	$25+20*(f/f_b)$	dB	0.05 – $f_b/2$ GHz	
		-	-	$18+6*(f/f_b)$	dB	$f_b/2 -f_b$ GHz	
Common Mode Return Loss(SCC22)		-	-	-2	dB	-	
Differential termination mismatch		-	-	10	%	-	
Transition time (min, 20% to 80%)		9.5	-	-	ps	-	
Near-end Eye Linearity		0.85	-	-	-	-	
<b>Transmitter electrical input characteristics at TP1</b>							
Signaling rate, per lane		--	26.5625	-	GBd	-	
Differential pk-pk input voltage tolerance		900	-	-	mV	-	
Differential input return loss(SDD22)		-	-	-11	dB	0.05 – 7.5GHz	
		-	-	$6+9.2*\log_{10}(15f/7f_b)$	dB	$f_b / 7.5-f_b$ GHz	
Common to differential mode conversion return loss (SCD11)		-	-	$22+14*(f/f_b)$	dB	0.05 – $f_b/2$ GHz	
		-	-	$18+6*(f/f_b)$	dB	$f_b/2 -f_b$ GHz	
Differential termination mismatch		-	-	10	%	-	
Module stressed input test		Per OIF-CEI-04.0 16.3.1 Table 16-1					-
Single-ended voltage tolerance range		-0.4	-	3.3	V	-	
Common-mode voltage		-350	-	2850	mV	-	

## LOW SPEED CONTROL AND SENSE SIGNALS

Parameter	Symbol	Min	Max	Unit	Notes/Conditions
SCL and SDA	VOL	0	0.4	V	IOL(max)=3.0 mA
	VOH	Vcc-0.5	Vcc+0.3	V	
SCL and SDA	VIL	-0.3	Vcc*0.3	V	
	VIH	Vcc*0.7	Vcc + 0.5	V	
Capacitance on SCL and SDA I/O contact.	Ci		14	pF	Looking into the module SCL and SDA contacts.
Total bus capacitive load for SCL and SDA for up to 400 kHz SCL rate (includes capacitance of all elements on the bus).	Cb		100	pF	3.0 kΩ pullup resistor
			200	pF	1.6 kΩ pullup resistor
LPMode/TxDis, ResetL and ModSelL	VIL	-0.3	0.8	V	
	VIH	2	Vcc+0.3	V	
	Iin	-365	125	μA	0 V ≤ Vin ≤ Vcc
ModPrsL and IntL/RxLOSL	VOL	0	0.4	V	IOL=2.0mA
	VOH	Vcc-0.5	Vcc+0.3	V	

Parameter	Symbol	Min	Nom	Max	Unit
Power supply voltages VccTx, VccRx and Vcc1 including ripple, droop and noise below 100 kHz (Note 1)		3.135	3.3	3.465	V
Host RMS noise output 10 Hz to 10 MHz				25	mV
Module RMS noise output 10 Hz to 10 MHz (Note 2)				15	mV
Module power supply noise tolerance 10 Hz to 10 MHz (peak-to-peak)	PSNR_Mod			66	mV
Module inrush - instantaneous peak duration	T <sub>ip</sub>	-	-	50	μs
Module inrush - initialization time	T <sub>init</sub>	-	-	500	ms
<b>Power Class 1 module and Low Power Mode for other modules</b>					
Power consumption	P <sub>1</sub>	-	-	1.5	W
Instantaneous peak current at hot plug	I <sub>cc_ip_1</sub>	-	-	600	mA
Sustained peak current at hot plug	I <sub>cc_sp_1</sub>	-	-	495	mA
Steady state current (Note 3)	I <sub>cc_1</sub>	-	-	432.9	mA

<b>High Power Mode Power Class 5 module</b>					
Power consumption	P <sub>5</sub>	-	-	4	W
Instantaneous peak current at hot plug	I <sub>cc_ip_5</sub>	-	-	1600	mA
Sustained peak current at hot plug	I <sub>cc_sp_5</sub>	-	-	1320	mA
Steady state current (Note 3)	I <sub>cc_5</sub>	-	-	1154.4	mA

## OPTICAL CHARACTERISTICS

Parameter	Symbol	Min	Typical	Max	Units	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda_c$	840	850	860	nm	-
RMS Spectral width	$\Delta\lambda$	-	-	0.6	nm	-
Average Launch Power, each lane		-6.5	-	4	dBm	-
Optical Modulation Amplitude	OMA	-4.5	-	3	dBm	-
Launch power in OMA minus TDEC		-5.9	-	-	dBm	-
Average Output Power (Laser Turn off)		-	-	-30	dBm	-
Extinction Ratio	ER	3	-	-	dB	-
Transmitter and dispersion eye closure	TDEC	-	-	4.5	dB	-
TDECQ – $10\log_{10}(C_{eq})$ , each lane		-	-	4.5	dB	-
Optical Return Loss Tolerance	ORLT	-	-	12	dB	-
RIN <sub>12</sub> OMA		-	-	-128	dB/Hz	-
Encircled flux at 4.5 $\mu$ m		-	-	30	%	-
Encircled flux at 19 $\mu$ m		86	-	-	%	-
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	840	850	860	nm	-
Damage threshold		5	-	-	dBm	-
Average receive power, each lane		-8.4	-	4	dBm	-
Receive power, each lane (OMA <sub>outer</sub> )		-	-	3	dBm	1
Receiver sensitivity (OMA <sub>outer</sub> ), each lane	Rx <sub>sen</sub>	-	-	-5.5	dBm	1
Stressed receiver sensitivity (OMA <sub>outer</sub> ), each lane		-	-	-3.4	dBm	2
Reflectance	Ref	-	-	-12	dB	-
LOS Assert	LOS <sub>A</sub>	-	-	-9	dBm	-
LOS De-Assert	LOS <sub>D</sub>	-	-	-	dBm	-
LOS Hysteresis	LOS <sub>H</sub>	0.5	-	-	dB	-

Notes:

[1] Measured at TP3 for BER 1E-6 Pre-FEC

[2] Conditions of stressed receiver sensitivity test:

Stressed eye closure for PAM4 (SECQ), lane under test=4.5dB

SECQ –  $10\log_{10}(C_{eq})$  (max), lane under test =4.5dB

OMA of each aggressor lane =3dBm

## Module Memory Map

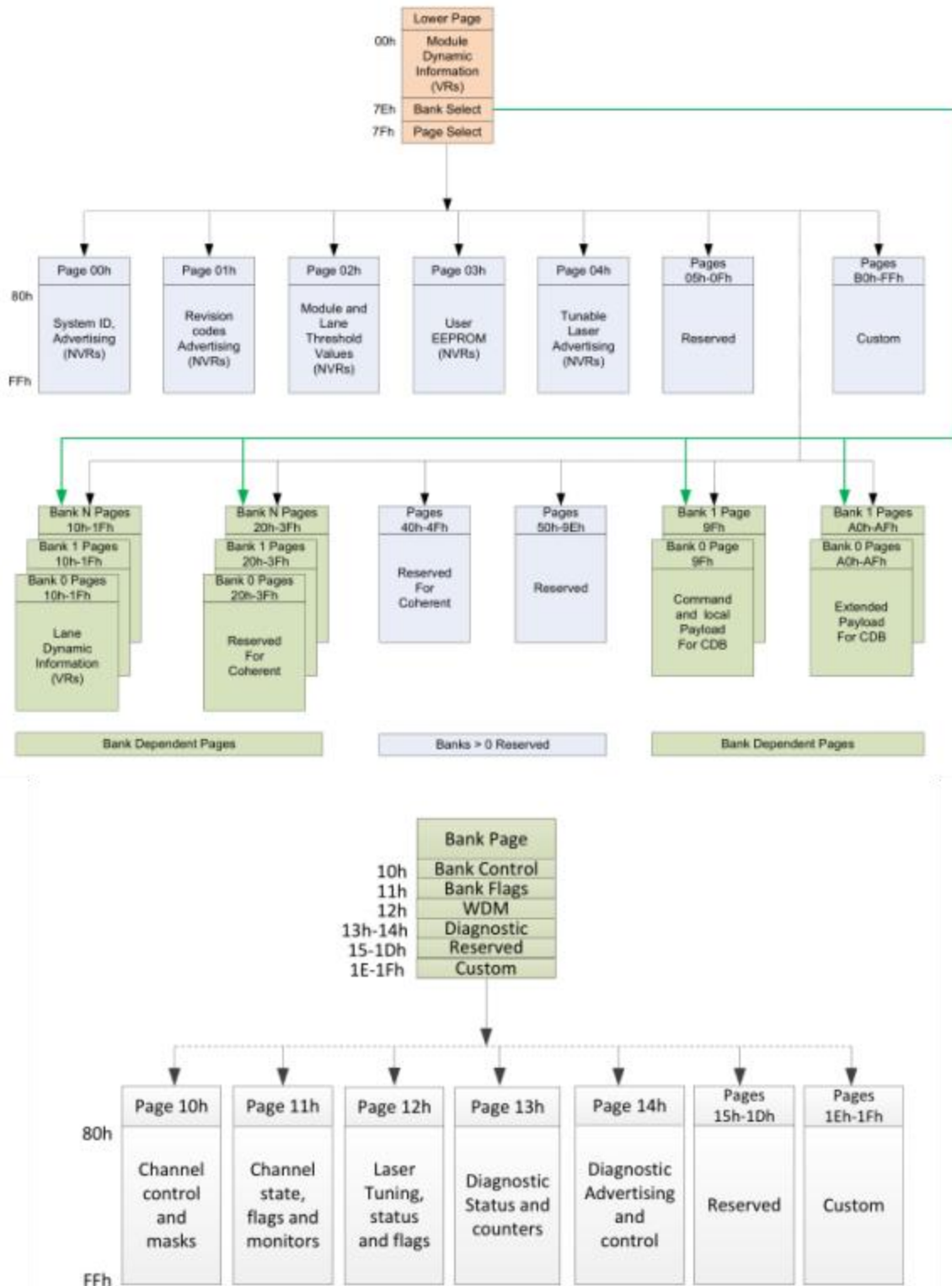
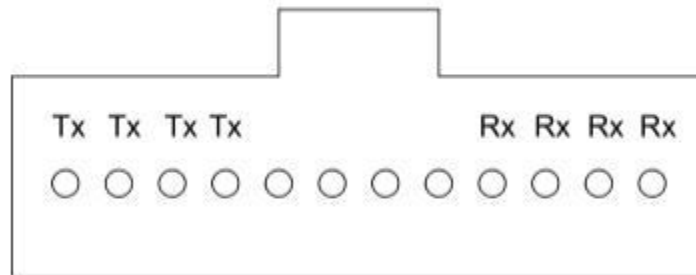


Figure 2 – Memory Map

## DIGITAL DIAGNOSTIC SPECIFICATION

Parameter	Symbol	Accuracy	Units	Notes
Transceiver Case Temperature	DMI_TEMP	±3	°C	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	±3%	V	Full operating range
Channel Bias current monitor	DMI_IBIAS	±10%	mA	Per channel
Channel RX power monitor absolute error	DMI_RX	±3	dB	Per channel
Channel TX power monitor absolute error	DMI_TX	±3	dB	Per channel

## OPTICAL INTERFACE LANES AND ASSIGNMENT



**Figure 3 –Optical lanes Assignment**

To minimize MPO connection induced reflections, cable with MPO connector for 8-degree angled end-face is utilized for this product.



## MECHANICAL SPECIFICATIONS

unit: mm

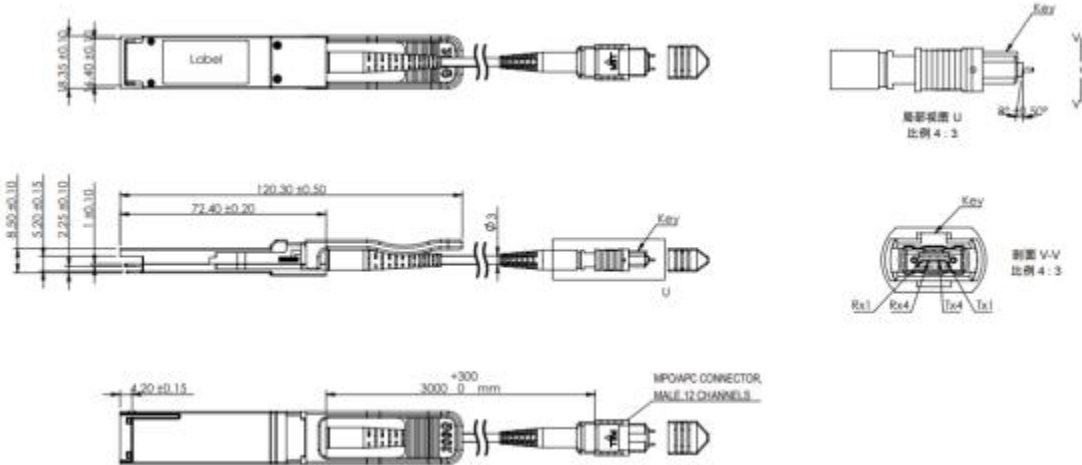


Figure 4 – QSFP56 Mechanical Specifications

## ESD SAFETY CAUTIONS

This transceiver is specified as ESD threshold 1KV for high speed data pins and 2KV for all others 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.