



Datasheet: Transceivers

QSFP-40G-SR

40GB/s QSFP+ Short wavelength (850nm) Optical Transceiver

Key Features

- Supports 41.2 Gb/s aggregate bit rates
- Compliant with QSFP+ MSA
- Compliant with SFF-8436
- Four independent transmit and receive channels
- Uncooled 4x10Gb/s 850nm transmitter
- Differential, internally AC-coupled data I/Os
- Electrically hot-pluggable
- Single 3.3V power supply
- Built-in Digital Diagnostic functions TxPower, TxBias RxPower, Vcc & Temperature
- Optical connectivity via industry standard MPO/MTP terminated fiber ribbon
- Operating temperature range: 0°C to 70°C

Application

- High-speed interconnects within and between switches, routers and transport equipment
- Server-Server Clusters, Super-computing interconnections
- 10GBASE-SR & 40GBASE-SR4 applications
- Infiniband SDR, DDR and QDR applications

Introduction

ProLabs SR4-QSFP-40G-C QSFP+ optical transceiver is a parallel fiber optical module with four independent optical transmit and receive channels. The QSFP+ transceiver converts 4 inputs channels of 10Gb/s electrical data to 4 optical signals and transmits them on separate multimode fibers. Reversely, on the receiver side, the module optically receives the optical signals on 4 separate fibers and converts them to 4 channel electrical data.

Specifications

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Operating Case Temperature	T _{OP}	0	-	70	°C	-
Power Supply Voltage	V _{CC}	3.135	3.3	3.465	V	-
Data Rate, each lane	-	-	10.3125	11.2	Gb/s	-
Control Input Voltage High	-	2	-	V _{CC}	V	-
Control Input Voltage Low	-	0	-	0.8	V	-
Link Distance (OM3)	D	-	-	100	m	-

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Ambient Storage Temperature	T _S	-40	-	85	°C	-
Operating Case Temperature	T _{OP}	0	-	70	°C	-
Supply Voltage	V _{CC}	-0.5	-	3.6	V	-
Relative Humidity (non-condensation)	RH	0	-	85	%	-
Damage Threshold, each lane	TH _d	3.4	-	-	dBm	-

Optical Characteristics – Transmitter

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Center Wavelength	λ _C	840	850	860	nm	-
RMS Spectral Width	Δλ _{rms}		0.5	0.65	nm	-
Average Optical Power, each Lane	P _{AVG}	-7.6		1.0	dBm	1
Optical Modulation Amplitude (OMA), each Lane	P _{OMA}	-5.6	-	3.0	dBm	2
Difference in Launch Power between any Two Lanes (OMA)	P _{tx,diff}	-	-	4.0	dB	-
Peak Power, each Lane	PP _T		-	4.0	dBm	-
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane	OMA-TDP	-6.5	-	-	dBm	-
TDP, each Lane	-	-	-	3.5	dB	-
Extinction Ratio	ER	3.0	-	-	dB	-
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	12dB reflection
Optical Return Loss Tolerance	TOL	-	-	12	dB	-
Encircled Flux	-	>86% at 19um <30% at 4.5um			-	-
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	-	0.23, 0.34, 0.43, 0.27, 0.35, 0.4			-	-
Average Launch Power OFF Transmitter, each Lane	P _{off}	-	-	-30	dBm	-

Optical Characteristics – Receiver

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Center Wavelength Range	λ_c	840	850	860	nm	-
Damage Threshold, each lane	TH _d	3.4	-	-	dBm	3
Average Power at Receiver Input, each lane	-	-9.5	-	2.4	dBm	-
Receiver Reflectance	R _R	-	-	-12	dB	-
Receiver Power (OMA), each Lane	-	-	-	3.0	dBm	-
Stressed Receiver Sensitivity (OMA), each lane	-	-	--	-5.4	dBm	4
Receiver Sensitivity (OMA), Each Lane	SEN	-	-	7.5	dBm	-
Peak Power, each Lane	PP _R	-	-	4.0	dBm	-
LOS Assert	LOSA	-30	-	-	dBm	-
LOS Deassert	LOSD	-	-	-12	dBm	-
LOS Hysteresis	LOSH	0.5	-	-	dB	-
Conditions of Stress Receiver Sensitivity Test (Note 5)						
Vertical Eye Closure Penalty, each Lane	-	-	1.9	-	dB	-
Stressed Eye J2 Jitter, each Lane	-	-	0.3	-	UI	-
Stressed Eye J9 Jitter, each Lane	-	-	0.47	-	UI	-
OMA of each aggressor Lane	-	-	-0.4	-	dBm	-

Electrical Characteristics – Transmitter

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Power Consumption	-	-	-	1.5	W	-
Supply Current	I _{CC}	-	-	450	mA	-
Transceiver Power-on Initialization Time	-	-	-	2000	ms	1
Single-ended Input Voltage Tolerance (Note 2)	-	-0.3	-	4.0	V	Referred to TP1 signal common
AC Common Mode Input Voltage Tolerance (RMS)	-	15	-	-	mV	-
Differential Input Voltage Swing Threshold	-	50	-	-	mVpp	LOSA Threshold
Differential Input Voltage Swing	V _{in,pp}	180	-	1200	mVpp	-
Differential Input Impedance	Z _{in}	90	100	110	Ohm	-
Differential input Return Loss	-	See IEE 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	-

1. The maximum transmitter average optical power of 1.0 dBm is well within the guard band of receiver overload specifications of commercially available 10GBASE-SR SFP+ transceivers offered by Prolabs' and other vendors.
2. Even if the TDP < 0.9 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.
4. Measured with conformance test signal at receiver input for BER = 1x10⁻¹².
5. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical Characteristics – Receiver

Parameter	Symbol	Min.	Typ	Max	Unit	Notes
Single-ended Output Voltage		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage (RMS)				7.5	mV	
Differential Output Voltage Swing	$V_{out,pp}$	600		800	mVpp	
Differential Output Impedance	Z_{out}	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 = 5×10^{-5}

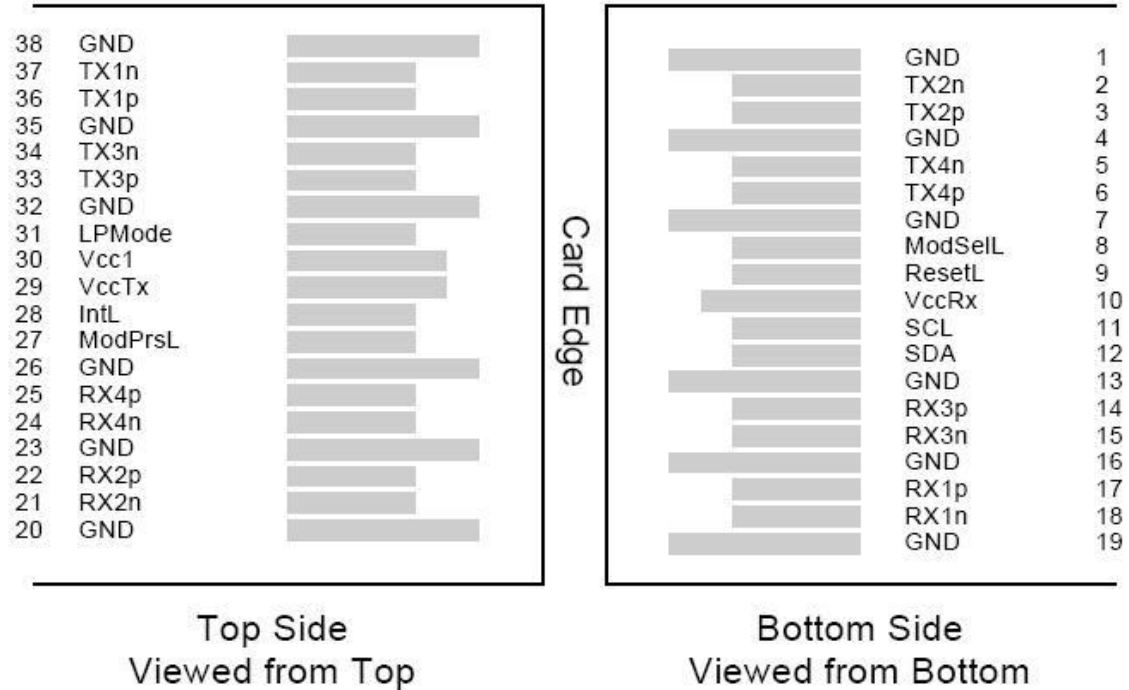
Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8436.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	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	Ch1~Ch4
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.



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	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-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

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 receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 4 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.

Optical Interface Lanes and Assignment

Figure 3 shows the orientation of the multi-mode fiber facets of the optical connector. Table 1 provides the lane assignment.

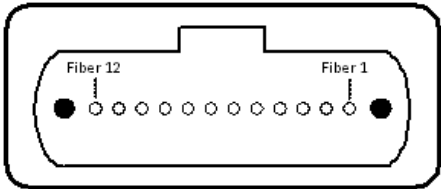
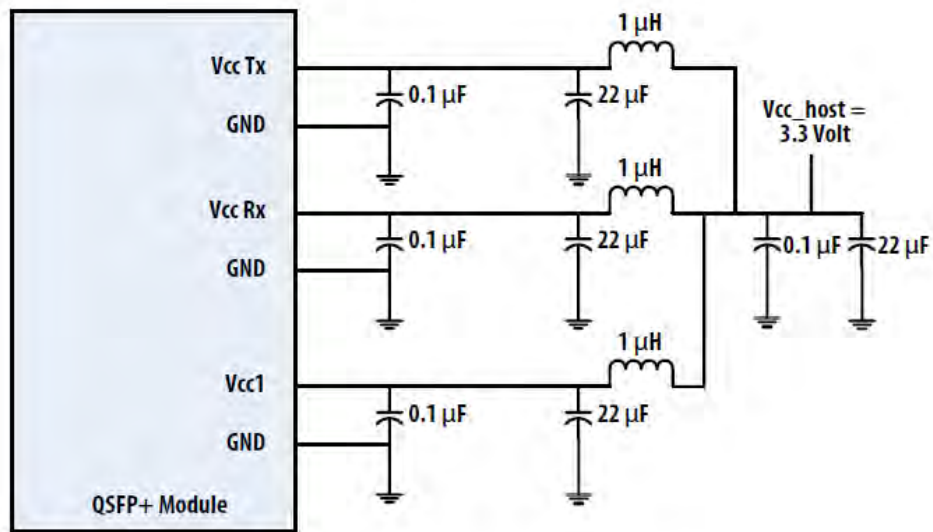


Figure 3. Outside View of the QSFP+ Module MPO

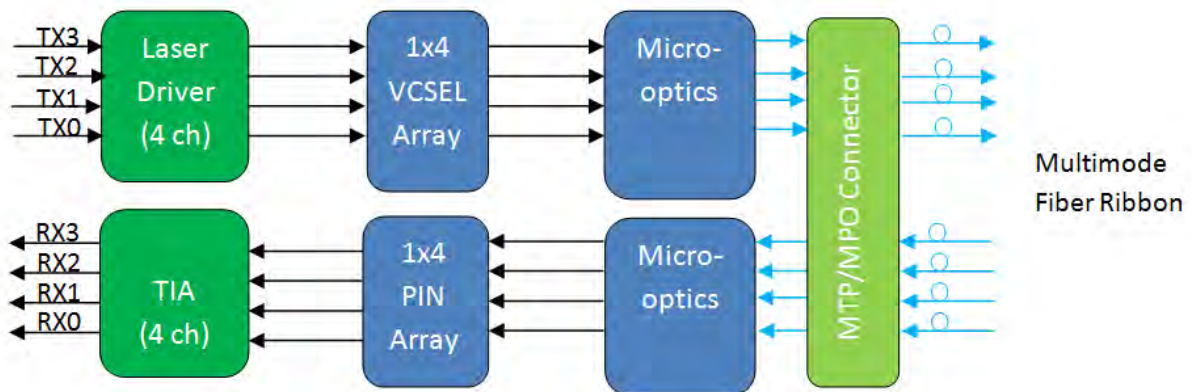
Table 1: Lane Assignment

Fiber #	Lane Assignment
1	RX0
2	RX1
3	RX2
4	RX3
5,6,7,8	Not used
9	TX3
10	TX2
11	TX1
12	TX0

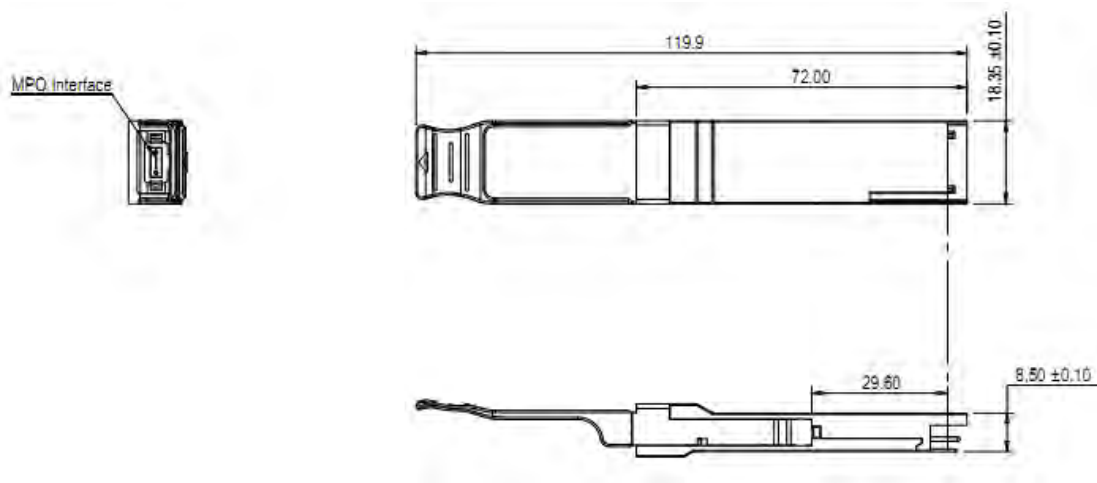
Recommended Power Supply Filter



Block Diagram of Transceiver



Mechanical Dimensions



ESD

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

Laser Safety

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