

## 40Gbps QSFP+ LX4

SLQS-40G-LX4



### Overview

SLQS-40G-LX4 is a transceiver module designed for optical transmission applications over both MMF and SMF with transmission distances of up to 150m on MMF (OM3) and 2km on SMF. The module converts 4 inputs channels (CH) of 10Gbps electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gbps optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gbps input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid defined in ITU-T G.694.2. It contains a duplex LC connector for the optical interface and a 148-pin connector for the electrical interface.

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.

For applications over OM3/OM4 MMF, MMF cables are directly connected to the LC connectors of QSFP+ LX4 module and optical signal is directly launched from the transmitter into the MMF cable as shown in Figure 1. For applications over SMF, the module is used as a QSFP+ IR4 module and SMF cables are directly connected to the LC connectors of the module as shown in Figure 2.

### 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
- ◆ 150m transmission on OM3 multimode fiber (MMF) or 2km transmission on single mode fiber (SMF)
- ◆ Operating case temperature: 0 to 70oC
- ◆ Maximum power consumption 3.5W
- ◆ LC duplex connector
- ◆ RoHS compliant

### Applications

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

### Ordering Information

Part Number	Product Description
SLQS-40G-LX4	QSFP+ 40Gbps LX4 with full real-time DDM and pull tab, LC Duplex Connector

### Module Block Diagram

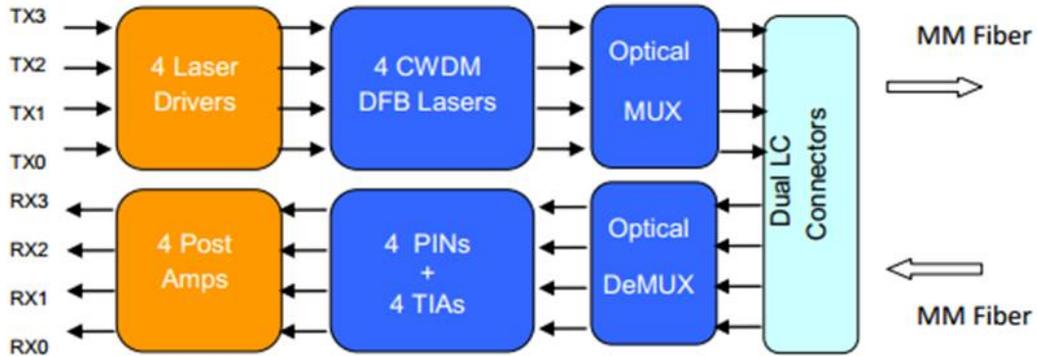


Figure1. Module Block Diagram for Applications over Multimode Fiber

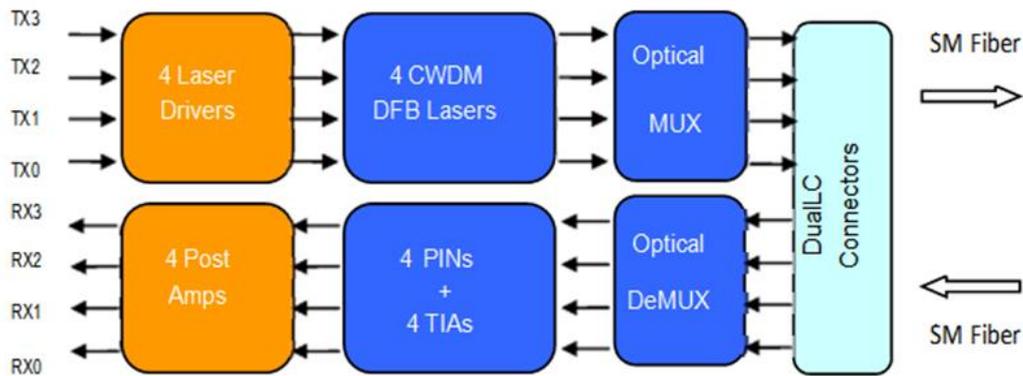


Figure2. Module Block Diagram for Applications over Single Mode Fiber

### Absolute Maximum Ratings

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

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	Tst	-40	85	°C
Case Operating Temperature	Top	0	70	°C
Humidity(non-condensing)	Rh	0	85	%
Damage Threshold, each Lane	TH <sub>d</sub>	4.5		dBm

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### Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V
Operating Case temperature	T <sub>OP</sub>	0		70	°C
Data Rate Per Lane	fd		10.3125	11.2	Gb/s
Control Input Voltage High		2		V <sub>CC</sub>	V
Control Input Voltage Low		0		0.8	V
Link Distance (OM3 MMF)	D <sub>MMF</sub>			150	m
Link Distance (SMF)	D <sub>MMF</sub>			2	Km

### Electrical Specifications

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Power Consumption				3.5	W	
Supply Current	I <sub>CC</sub>			1.1	A	
Transceiver Power-on Initialization Time				2000	ms	1
<b>Transmitter (Each Lane)</b>						
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			mV <sub>pp</sub>	LOSA Threshold
Differential Input Voltage Swing	Z <sub>in, pp</sub>	190		700	mV <sub>pp</sub>	
Differential Input Impedance	Z <sub>in</sub>	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 <sup>-5</sup>
<b>Receiver (Each Lane)</b>						
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	V <sub>out, pp</sub>	300		850	mV <sub>pp</sub>	

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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 = $5 \times 10^{-5}$

**Note:**

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.

**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	
<b>Transmitter</b>						
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	1
OMA, each Lane (for MMF)	$P_{OMA, MMF}$	-4.0		4.5	dBm	
Difference in Launch Power between any Two Lanes (OMA)	$P_{tx, diff}$			6.5	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-6.8			dBm	

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TDP, each Lane	TDP			2.6	dB	
Extinction Ratio	ER	3.5			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	12dB reflection
Transmitter Reflectance	RT			-12	dB	
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	Poff			-30	dBm	
<b>Receiver</b>						
Damage Threshold, each Lane	TH <sub>d</sub>	4.5			dBm	2
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	RR			-26	dB	
Receive Power (OMA), each Lane (for SMF)				3.5	dBm	
Receive Power (OMA), each Lane (for MMF)				4.5	dBm	
Receiver Sensitivity (OMA), each Lane (for SMF)	SEN <sub>SMF</sub>			-11.5	dBm	
Receiver Sensitivity (OMA), each Lane (for MMF)	SEN <sub>MMF</sub>			-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	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			12.3	GHz	

**Note:**

1. Even if the TDP < 1 dB, the OMA min must exceed the minimum value specified here.
2. 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.

## Pin Descriptions

Pin	Logic	Symbol	Name/Description	Ref.
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	LVTTLL-I	ModSelL	Module Select	
9	LVTTLL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVCNOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCNOS-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	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTTL-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 Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
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 4 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 500mA.

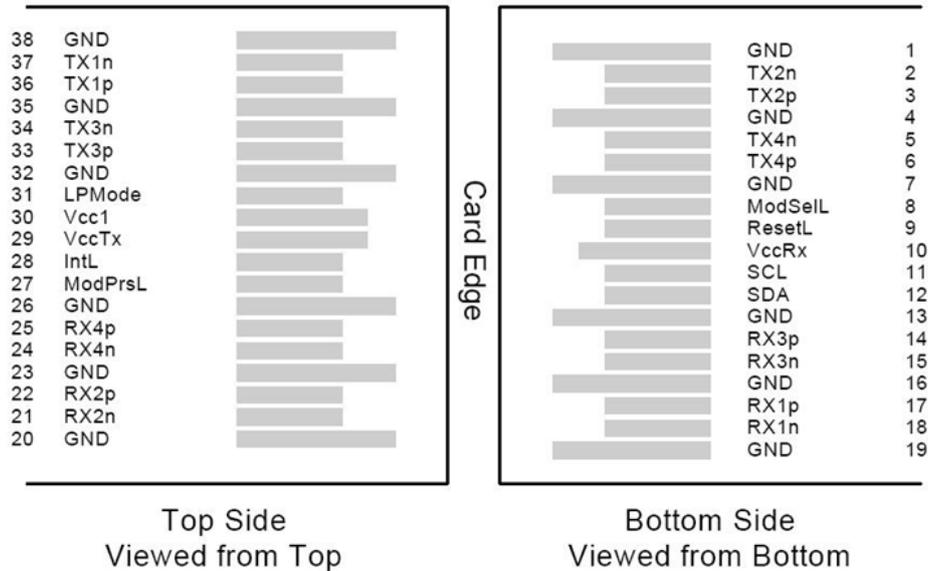


Figure3. Electrical Pin-out Details

Recommended Power Supply Filter

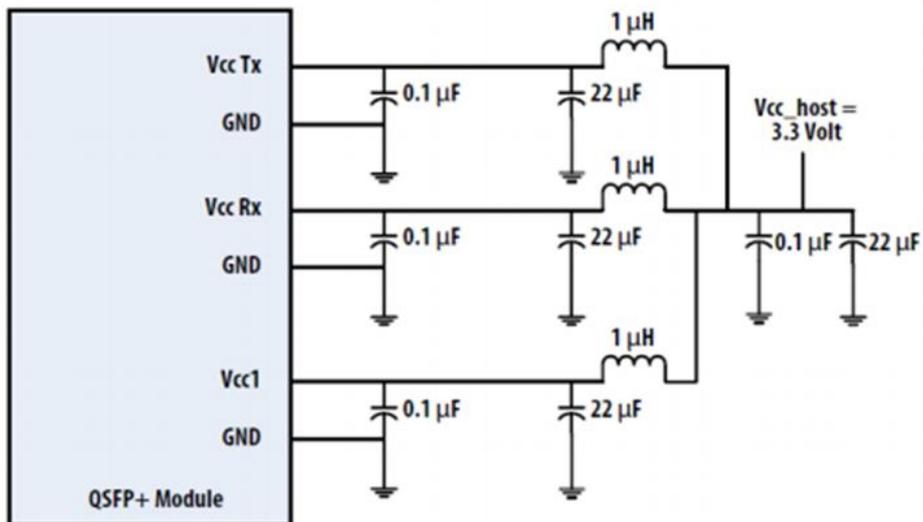


Figure4. Recommended Power Supply Filter

### Digital Diagnostic Functions

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

Parameter	Symbol	Min	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	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 single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

### Mechanical Dimensions

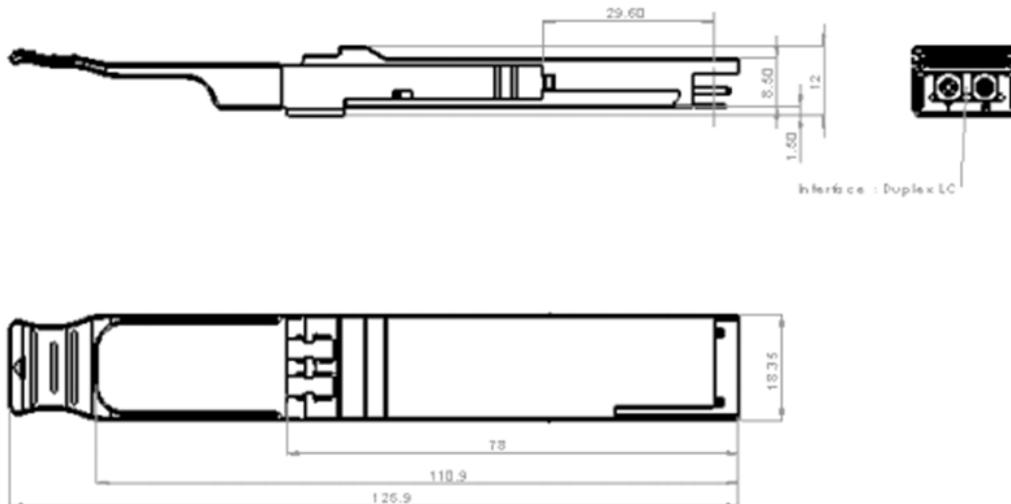


Figure5. Mechanical Specifications

## 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.

## 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).

### Shenzhen Sourcelight Technology Co., Ltd

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