

40Gbps QSFP+ SMF 2KM IR4

SLQS-40G-IR4



Overview

This product is a transceiver module designed for 2km optical communication applications. The design is compliant to 40GBASE-LR4 of the IEEE P802.3ba standard. The module converts 4 inputs channels (ch) of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically demultiplexes a 40Gb/s 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. To minimize the optical

dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module.

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.

Features

- ◆ 4 CWDM lanes MUX/DEMUX design
- ◆ Up to 11.2Gb/s data rate per wavelength
- ◆ QSFP+ MSA compliant
- ◆ IEEE 802.3ba Electrical Interface
- ◆ Up to 2km transmission on single mode fiber (SMF)
- ◆ Operating case temperature: 0 to 70°C
- ◆ Maximum power consumption 3.5W
- ◆ LC duplex connector
- ◆ RoHS compliant

Applications

- ◆ 40G Ethernet
- ◆ Data Center Interconnect
- ◆ Infiniband QDR
- ◆ 40G Campus Link

Ordering Information

Part Number	Product Description
SLQS-40G-IR4	40G QSFP+ SMF IR4 for 2KM LC Duplex Connector

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Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Input Voltage	Vin	-0.3	Vcc+0.3	V
Storage Temperature	Tst	-40	85	°C
Case Operating Temperature	Top	0	70	°C
Humidity(non-condensing)	Rh	0	85	%

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Supply Voltage	Vcc	3.13	3.3	3.47	V
Operating Case temperature	Tca	0		70	°C
Data Rate Per Lane	fd		10.3125	11.2	Gbps
Humidity	Rh	5		85	%

Electrical Specifications

Parameter	Symbol	Min	Typical	Max	Unit	Notes
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
AC Common Mode Input Voltage Tolerance		15			mV	RMS
Differential Input Voltage		50			mVpp	LOSA
Swing Threshold						Threshold
Differential Input Voltage Swing	Zin, pp	190	-	700	mVpp	-
Differential Input Impedance	Zin	90	100	110	ohm	-
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	Zout, pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	ohm	

Note:

1. Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended

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operating supply voltages to the time when the module is fully functional.

- The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Lane Wavelength	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	
Transmitter						
SMSR	SMSR	30			dB	
Total Average Launch Power	P_T			8.3	dBm	
Average Launch Power,each Lane	P_{AVG}	-7.0		2.3	dBm	
OMA, each Lane	P_{OMA}	-6.0		3.5	dBm	1
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	
TDP, each Lane	TDP			2.6	dB	
Extinction Ratio	ER	3.5			dB	
RIN_{20OMA}	RIN			-128	dB/Hz	
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	R_T			-12	dB	
Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				2
Average Launch Power OFF Transmitter, each Lane	P_{off}			-30	dBm	
Receiver						
Damage Threshold, each Lane	TH_d	4.5			dBm	3
Total Average Receive Power				8.3	dBm	
Average Receive Power, each Lane		-11.6		2.3	dBm	
Receive Power (OMA), each Lane				3.5	dBm	
Receiver Sensitivity (OMA), each Lane	SEN			-11.5	dBm	
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	F_c			12.3	GHz	

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Note:

1. Even if the TDP < 1 dB, the OMA min must exceed the minimum value specified here.
2. See Figure 2 below.
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 = 1×10^{-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.

Module Block Diagram

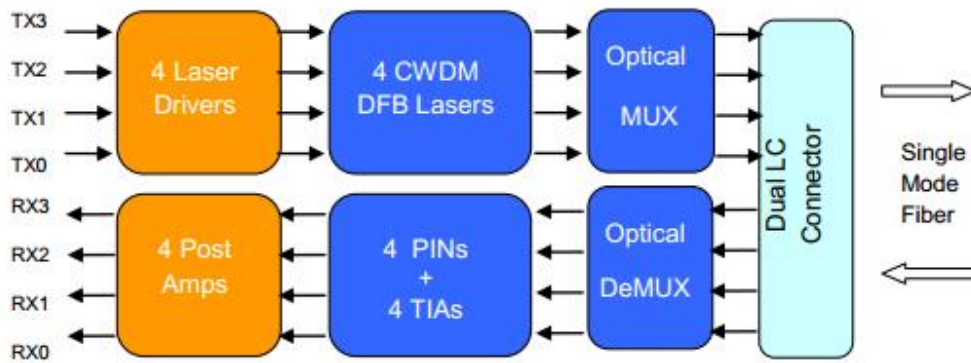


Figure1. Module Block Diagram

Pin Assignment

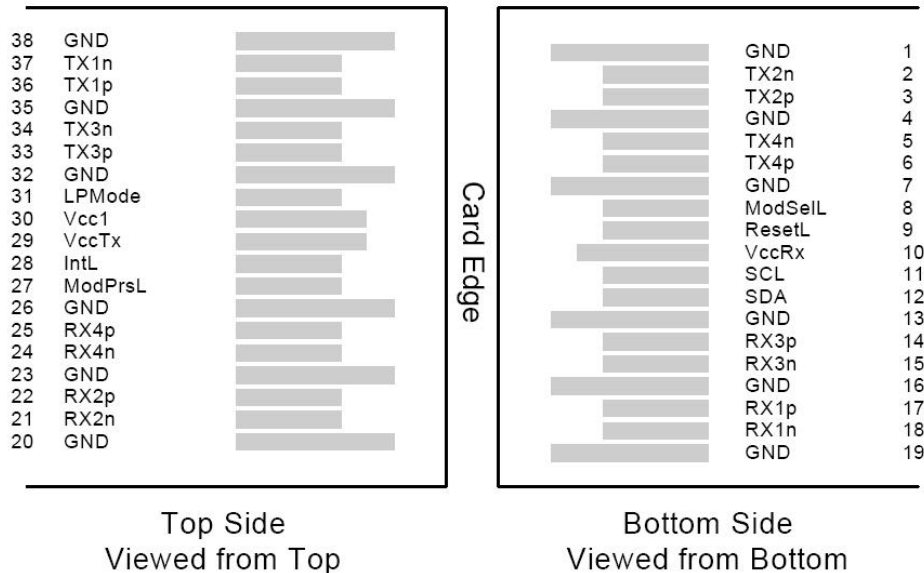


Figure2. Electrical Pin-out Details

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	LVTTLL-O	ModPrsL	Module Present	
28	LVTTLL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTLL-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	

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 1000mA.

Power Supply Filtering

The host board should use the power supply filtering shown in Figure3.

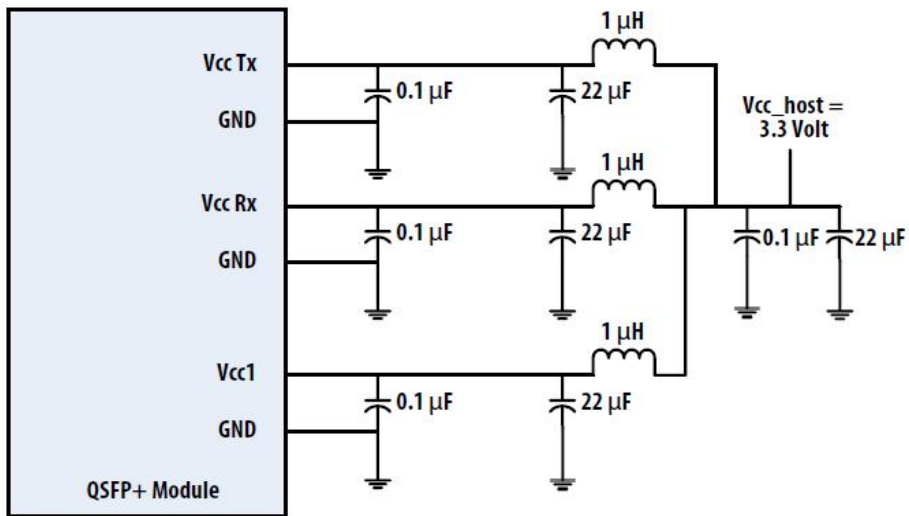


Figure3. Host Board Power Supply Filtering

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

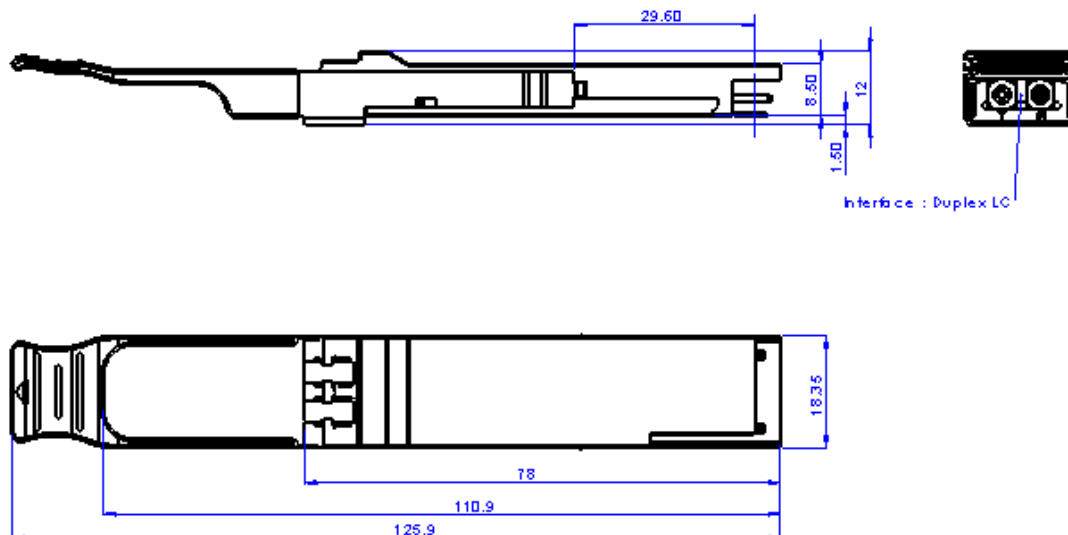


Figure4. Mechanical Specifications

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).

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