

## DATA SHEET

### UN-QSFP+ LR4

#### 40Gb/s QSFP+ LR4 1310nm 10km Optical Transceiver Overview

The UN-QSFP+ LR4 is a parallel 40Gbps Quad Small Form-factor Pluggable (QSFP+) optical module. It provides increased port density and total system cost savings. The QSFP+ full-duplex optical module offers 4 independent transmit and receive channels, each capable of 10Gb/s operation for an aggregate data rate of 40Gb/s on 10km of single mode fiber.

An optical fiber ribbon cable with an UNP/MPO connector can be plugged into the QSFP+ module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through a z-pluggable 38-pin connector per MSA requirement.

The module operates with single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt and Low Power Mode, are available with the modules. A 2-wire serial interface is available to send and receive more complex control signals, and to receive digital diagnostic information. Individual channels can be addressed and unused channels can be shut down for maximum design flexibility.

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. The module can be managed through the I2C two-wire serial interface.

### Product Features

- Transmission data rate up to 11.2Gbps per channel
- Digital Diagnostics Monitoring Interface
- Hot-pluggable QSFP+ form factor
- Aggregate Bandwidth of up to 44.0G
- 4 Parallel lanes design
- Commercial operating case temperature range: -5°C to 70°C
- RoHS-6 Compliant
- Maximum power consumption 3.5W
- Single +3.3V power supply
- Up to 10km transmission on single mode fiber (SMF)

### Applications

- 40GBASE-LR4 40G Ethernet links
- Infiniband QDR, DDR and SDR
- Datacenter and Enterprise networking

**Ordering Information**

Part. No	Specifications (Per Channel)								
	Pack	Rate (Gbps)	Tx (nm)	Po (dBm)	RX	Sen (dBm)	Temp (°C)	Reach (km)	DDM
UTQ40L1L	QSFP+	10.3125	1310	-5.5~1.5	PIN	<-12.5	-5~70	10	Y
<b>For More Information:</b> UNIVISO TECHNOLOGIES& DEVELOP LIMITED Room 608, Yuanzheng Building B, Nanshan District, Shenzhen, China, 518052 Email: bruce.ke@szuniviso.com									

**General Specifications**

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate per Lane	DR		10.3125		Gbps	
Operating Temperature	T <sub>OP</sub>	-5		70	°C	
Storage Temperature	T <sub>STO</sub>	-40		85	°C	
Power Consumption	P <sub>diss</sub>			3.5	W	
Input Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Maximum Voltage	V <sub>MAX</sub>	-0.5		4	V	

**Optical Characteristics – Transmitter**
**V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=-5°C to 70°C**

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P <sub>TX</sub>	-6		-1	dBm	
Optical Center Wavelength	λ <sub>C</sub>	1290	1310	1330	nm	
Extinction Ratio	ER	3.5			dB	
Optical Rise/Fall Time (20% - 80%)	T <sub>RF_IN</sub>			30	ps	
Relative Intensity Noise	RIN			-128	dB/Hz	
Average Launch Power per lane @ TX off state				-30	dBm	
Transmitter Reflectance				-12	dB	
Transmitter Reflectance				-12	dB	
Transmitter and dispersion penalty (TDP), each lane		-5.5			dB	
Average Launch Power per Lane	TxPx	-5.5		1.5	dBm	
Launch Power in OMA minus TDP, each lane		-4.5		2.5	dBm	
Difference in launch power between any two lanes (OMA)				6.5	dB	
Launch power (OMA) minus TDP per		-4		3.5	dBm	

lane					
Total Output Power	Pout			7.5	dBm
Lane center wavelengths (range)	$\lambda_0$	1260	1310	1355	nm
Side Mode Suppression Ratio	SMSR	30			dB
Extinction Ratio	ER	3.5			dB
Transmitter and dispersion penalty (TDP), each lane		-5.5			dB
Transmitter Eye Mask definition: X1,X2, X3, Y1, Y2, Y3		Compliant with 802.3ba standard {0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			

### Optical Characteristics – Receiver

**V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=-5°C to 70°C**

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Receive Power (OMA) per Lane	RxOMA			2.5	dBm	
Average Receive Power per Lane	RXPx	-12.6		1.5		
Receiver Sensitivity (OMA) per Lane	Rxsens			-12.6	dBm	
Receiver Reflectance				-12	dB	
Difference in Receive Power between any two lanes (OMA)	P			7.5	dB	
Receiver Damage Threshold		3.3			dBm	
LOS Assert	P <sub>LOS_A</sub>	-30			dBm	
LOS De-Assert	P <sub>LOS_D</sub>			-16	dBm	
LOS Hysteresis		0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	F <sub>c</sub>			12.3	GHz	

### Electrical Characteristics – Transmitter

**V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=-5°C to 70°C**

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
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			15		mV	RMS
Differential Input Voltage Swing Threshold		50			mVpp	LOSA Threshold
Differential Input Voltage Swing	V <sub>in,pp</sub>	190		700	mVpp	
Differential Input Impedance	Z <sub>in</sub>	90	100	110	Ohm	

Supply Current	I <sub>cc</sub>		1.1	A	
Maximum Power Consumption			3.5	W	
LP Mode			1.5	W	
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>
Signaling Speed Operating Range			± 100	ppm	
Transmitter Differential Input Impedance			100	ohms	
Transmitter Differential Input Voltage		0.2	1.6	V	

### Electrical Characteristics – Receiver

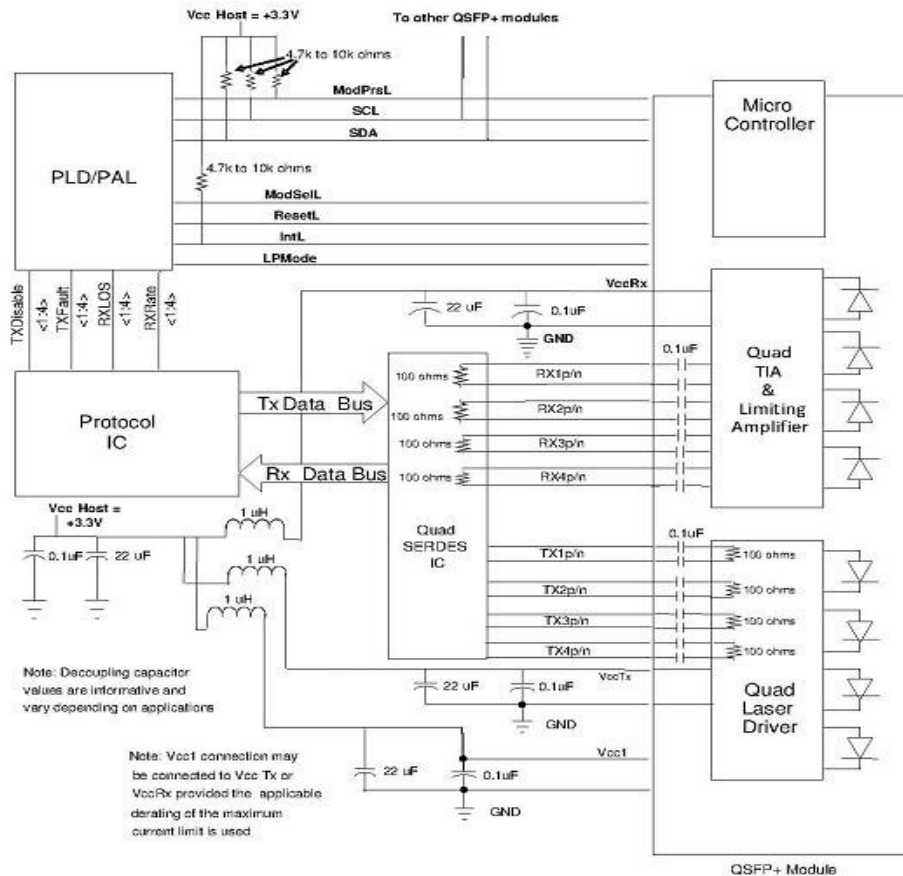
V<sub>CC</sub>=3.14V to 3.46V, T<sub>C</sub>=-5°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single-ended Output Voltage		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage			7.5		V	RMS
Differential Output impedance			100		mVpp	
Differential output voltage		300		850	mV	
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
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 =5x10 <sup>-5</sup>

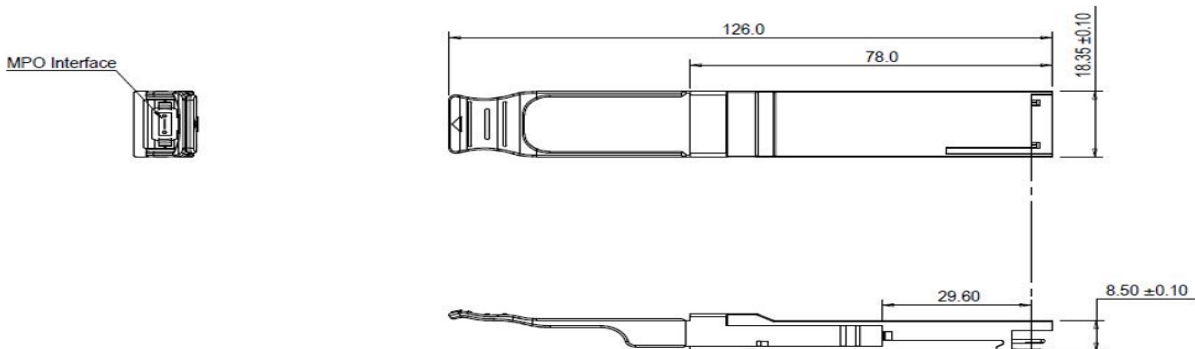
#### Notes:

1. The maximum transmitter average optical power of 1.5 dBm is well within the guardband of receiver overload specifications of commercially available 10GBASE-LR SFP+ transceivers offered by InnoLight and other vendors.
2. Even if the TDP < 1 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.

### Block Diagram



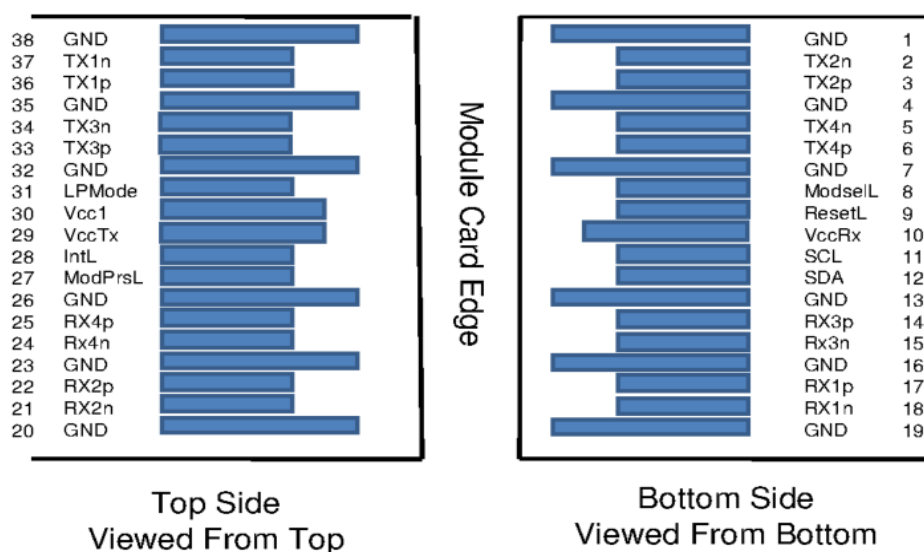
### Dimensions



**ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED**

**UNIT: mm**

### Electrical Pad Layout



Pin	Symbol	Name/Description	Notes
1	GND	Transmitter Ground (Common with Receiver 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	2
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
13	GND	Ground	
14	RX3P	Transmitter Inverted Data Input	
15	RX3N	Transmitter Non-Inverted Data Input	
16	GND	Ground	1

17	RX1P	Transmitter Inverted Data Input	
18	RX1N	Transmitter Non-Inverted Data Input	
19	GND	Ground	1
20	GND	Ground	1
21	RX2N	Transmitter Inverted Data Input	
22	RX2P	Transmitter Non-Inverted Data Input	
23	GND	Ground	1
24	RX4N	Transmitter Inverted Data Input	1
25	RX4P	Transmitter Non-Inverted Data Input	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	Vcc Tx	+3.3 V Power supply transmitter	2
30	Vcc1	+3.3 V Power Supply	2
31	LPMoDe	Low Power Mode	
32	GND	Ground	1
33	TX3P	Transmitter Inverted Data Input	
34	TX3N	Transmitter Non-Inverted Data Input	
35	GND	Ground	1
36	TX1P	Transmitter Inverted Data Input	
37	TX1N	Transmitter Non-Inverted Data Input	
38	GND	Ground	1

**Notes:**

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 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 QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

**References**

1. IEEE standard 802.3. IEEE Standard Department, 2005.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.