

40Gbps QSFP+ ER4 40km Transceiver

CLQSFP40GER4

PRODUCT FEATURES

- Hot-pluggable QSFP+ form factor
- Supports 41.3 Gb/s aggregate bit rate
- Power dissipation < 3.5W
- 18.5 dB link insertion loss budget
- RoHS-6 compliant
- Commercial case temperature range 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 40km on Single Mode Fiber (SMF)
- Uncooled 4x10Gb/s CWDM transmitter
- XLPPI electrical interface
- Duplex LC receptacles
- Built-in digital diagnostic functions, including Tx/Rx power monitoring



APPLICATIONS

- 40GBASE-ER4 40G Ethernet

General Description

C-LIGHT's CLQSFP40GER4 is designed for use in 40 Gigabit Ethernet links over single mode fiber. They are compliant with the QSFP+ MSA¹ and IEEE 802.3bm 40GBASE-ER4². Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The optical transceiver is compliant per the RoHS Directive 2011/65/EU⁵.

1. Pin Descriptions

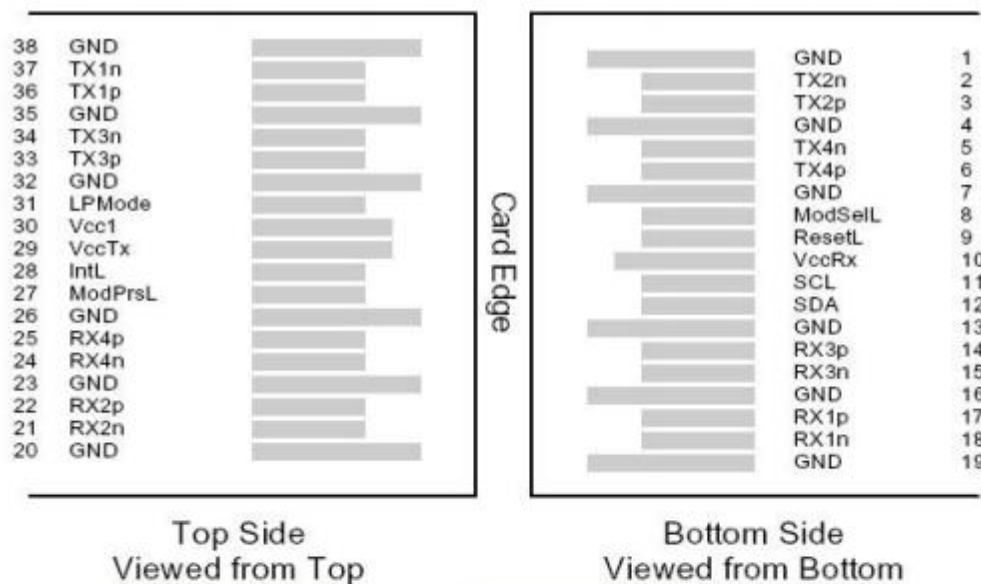


Figure 1 – QSFP+ MSA-compliant 38-pin connector

Pin	Symbol	Name/Description	Notes
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	
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.General Product Characteristics

Parameter	Value	Unit	Notes
Module Form Factor	QSFP+		
Maximum Aggregate Data Rate	41.2500	Gb/s	
Maximum Data Rate per Lane	10.3125	Gb/s	
Protocols Supported	40G Ethernet		
Electrical Interface and Pin-out	38-pin edge connector		Pin-out as defined by the QSFP+ MSA
Maximum Power Consumption	3.5	Watts	
Management Interface	Serial, I2C-based, 400 kHz maximum frequency		As defined by the QSFP+ MSA

Data Rate Specifications	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate per Lane	BR		10.3125		Gb/sec	1
Bit Error Ratio	BER			10 ⁻¹²		2
Link distance on SMF-28	d	0.002		40	kilometers	3

Notes :

1. ± 100 ppm , compliant with 40GBASE-ER4 and XLPP1 per IEEE 802.3bm.
2. Tested with a PRBS 2³¹-1 test pattern.
3. Per 40GBASE-ER4, IEEE 802.3bm. Links longer than 30km are considered to be engineered links, with losses less than the worst case specified for the fiber type.

3. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc1, VccTx, VccRx	-0.5		3.6	V	
Storage Temperature	T _S	-40		85	°C	
Case Operating Temperature	T _{OP}	0		70	°C	
Relative Humidity	RH	0		85	%	1
Damage Threshold, per Lane	DT	3.8			dBm	
Operating Range				40	km	

Notes :

1. Non-condensing.

4. Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc1, VccTx, VccRx	3.1		3.47	V	
Supply Current	I _{cc}			1.13	A	
Link turn-on time						
Transmit turn-on time				2000	ms	2
Transmitter (per Lane)						
Single ended input voltage tolerance	V _{inT}	-0.3		4.0	V	
Differential data input swing	V _{in,pp}	120		1200	mV _{pp}	3
Differential input threshold			50		mV	
AC common mode input voltage tolerance (RMS)		15			mV	
Differential input return loss		Per IEEE P802.3ba, Section 86A.4.1.1			dB	4
J2 Jitter Tolerance	J _{t2}	0.17			UI	
J9 Jitter Tolerance	J _{t9}	0.29			UI	
Data Dependent Pulse Width Shrinkage	DDPWS	0.07			UI	
Eye mask coordinates {X1, X2 Y1, Y2}			0.11, 0.31 95, 350		UI mV	5
Receiver (per Lane)						
Single-ended output voltage		-0.3		4.0	V	
Differential data output swing	V _{out,pp}	0		800	mV _{pp}	6
AC common mode output voltage (RMS)				7.5	mV	
Termination mismatch at 1 MHz				5	%	
Differential output return loss		Per IEEE P802.3ba, Section 86A.4.2.1			dB	4
Common mode output return loss		Per IEEE P802.3ba, Section 86A.4.2.2			dB	4
Output transition time, 20% to 80%		28			ps	
J2 Jitter output	J _{o2}			0.42	UI	

J9 Jitter output	Jo9		0.65	UI	
Eye mask coordinates #1 {X1, X2 Y1, Y2}		0.29, 0.5 150, 425		UI mV	5
Power Supply Ripple Tolerance	PSR	50		mVpp	

Notes :

- Maximum total power value is specified across the full temperature and voltage range.
- From power-on and end of any fault conditions.
- After internal AC coupling. Self-biasing 100Ω differential input.
- 10 MHz to 11.1 GHz range.
- Hit ratio = 5 x 10E-5.
- AC coupled with 100Ω differential output impedance.

5. Optical Characteristics (TOP = 0 to 70 °C, VCC = 3.1 to 3.3 V)

Parameter	Symbol	Min	Typ
Transmitter			
Signaling Speed per Lane	10.3125		GBd
Lane center wavelengths (range)	1264.5 – 1277.5 1284.5 – 1297.5 1304.5 – 1317.5 1324.5 – 1337.5		nm
Total Average Launch Power	P _{OUT}	10.5	dBm
Transmit OMA per Lane	TxOMA	0.3	dBm
Average Launch Power per Lane	TXP _x	-2.7	dBm
Difference in launch power between any two lanes (OMA)		4.7	dB
Transmitter Dispersion Penalty	TDP	2.6	dB
Launch power (OMA) minus TDP per lane	-0.5		dBm
Optical Extinction Ratio	ER	5.5	dB
Sidemode Suppression ratio	SSR _{min}	30	dB
Average launch power of OFF transmitter, per lane		-30	dBm
Relative Intensity Noise	RIN	-128	dB/Hz
Optical Return Loss Tolerance		20	dB
Transmitter Reflectance		-12	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}		
Receiver			
Signaling Speed per Lane	10.3125		GBd
Lane center wavelengths (range)	1264.5 – 1277.5 1284.5 – 1297.5 1304.5 – 1317.5 1324.5 – 1337.5		nm
Receive Power (OMA) per Lane	RxOMA	-4.0	dBm
Average Receive Power per Lane	RXP _x	-21.2	dBm
Receiver Sensitivity (OMA) per Lane	Rxsens	-19	dBm
Stressed Receiver Sensitivity (OMA) per Lane	SRS	-16.8	dBm

Damage Threshold per Lane	P_{MAX}			3.8	dBm	
Return Loss	RL			-26	dB	
Vertical eye closure penalty, per lane				2.2	dB	
Receive electrical 3 dB upper cutoff frequency, per lane				12.3	GHz	
LOS De-Assert	LOS_D			-19	dBm	
LOS Assert	LOS_A	-35			dBm	
LOS Hysteresis			1		dB	

Notes :

1. Transmitter consists of 4 lasers operating at up to 10.3 Gb/s each, $\pm$ 100ppm
2. Minimum value is informative.
3. RIN is scaled by $10 \cdot \log(10/4)$ to maintain SNR outside of transmitter.
4. Receiver consists of 4 photodetectors operating at up to 10.3125 Gb/s each, $\pm$ 100ppm
5. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.
6. Maximum value is based on a min. of 9dB loss. Additional attenuation may be required when connected in loopback or short fiber link.

6.Memory Map and Control Registers

Compatible with SFF-8636 (QSFP+ MSA)¹.

7.Environmental Specifications

The transceivers have an operating temperature range from 0°C to +70°C case temperature.

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	0		70	°C	
Storage Temperature	T_{sto}	-40		85	°C	

8.Regulatory Compliance

the transceivers are RoHS-6 Compliant.

the transceiver modules are Class 1 laser eye safety compliant per IEC 60825-1.

9. Mechanical Specifications

The mechanical specifications are compliant to the QSFP+ MSA transceiver module specifications.

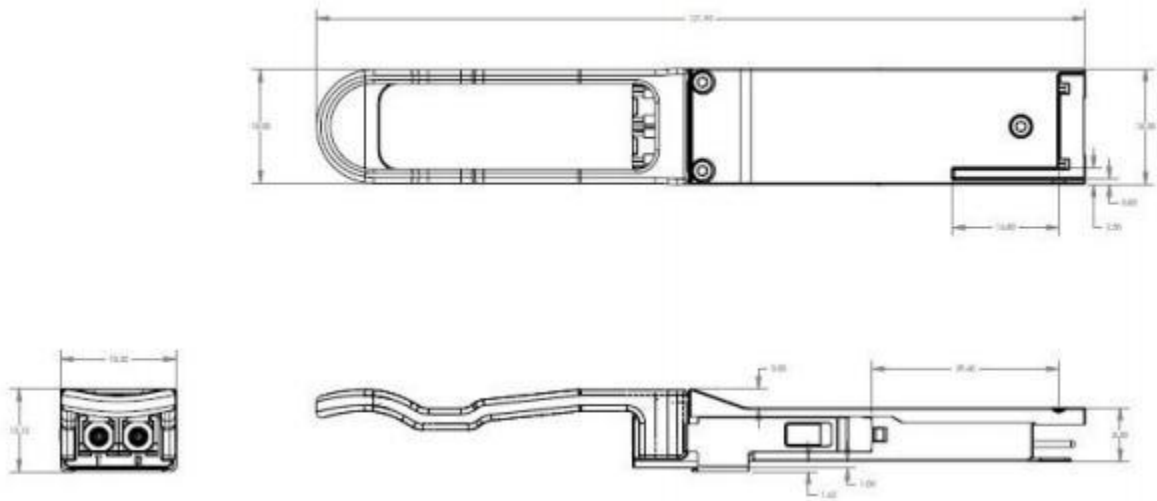


Figure 2 – the mechanical drawing

Ordering Information

Part No.	Data Rate	DDM	Wave	Fiber Type	Dist.	Temp.	Optical Interface
CLQSFP40GER4	40Gbps	yes	1310nm	SMF	40Km	0~70℃	LC

VERSION UPDATE:

VERSION NO.	DATE	UPDATED INFORMATION
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V20151101	20151101	1. NEW PUBLISHED

NOTICE:

C-LIGHT reserves the right to make changes to this product in this specification without notice, in order to improve product performance.

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