40GBASE-UNIV QSFP+ 1310nm 2km DOM Optical Transceiver Module for SMF/MMF

QSFP-LX4-40G

Application

- 40G Ethernet over MMF and SMF
- Infiniband QDR and DDR interconnects

Features

- Hot-pluggable QSFP+ form factor
- Operates over duplex multimode and single mode fiber with dual LC receptacles
- Supports 41.2 Gb/s aggregate bit rate
- Power dissipation <3.5W
- Commercial case temperature range 0° C to 70° C
- Maximum link length of 150m on OM3, and 2km on SMF
- Uncooled 4x10Gb/s CWDM transmitter
- XLPPI electrical interface
- Built-in digital diagnostic functions, including Tx/Rx power monitoring
- RoHS-6 Compliant

Description

The QSFP-LX4-40G is a transceiver module designed for 2km (SMF) / 150m (MMF) optical communication applications. They are compliant with the IEEE 802.3ba 40GBASE-LR4 refered to as LM4. 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 de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

Product Specifications

I.General Specifications

Parameter	Value	Unit	Notes
Module Form Factor	QSFP+		
Maximum Aggregate Data Rate	41.2	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			10,313	Mb/sec	1
Bit Error Ratio	BER			10-12		2
Link distance on OM3	d			150	meters	
Link distance on OM4	d			160	meters	
Link distance on SMF	d			2000	meters	

Notes:

1. Adapted from 40GBASE-LR4, IEEE 802.3ba
2. Tested with a PRBS 231-1 test pattern.

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Maximum Supply Voltage	Vcc1, VccTx, VccRx	-0.5		4	V	
Storage Temperature	Ts	-40		85	° C	
Case Operating Temperature	Top	0		70	° C	
Relative Humidity	RH	0		85	%	1
Damage Threshold, per Lane	DT	3.4			dBm	

Notes:

Non-condensing.

III. Electrical Characteristics (TOP= 0 to 70℃, 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	Icc			1.13	A	
Transmit turn-on time				2000	ms	1
			Transmitter (per Lane)			
Single ended input voltage tolerance	VinT	-0.3		4.0	V	
Differential data input swing	Vin,pp	120		1200	mVpp	2
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	3
J2 Jitter Tolerance	Jt2	0.17			UI	
J9 Jitter Tolerance	Jt9	0.29			UI	
Data Dependent Pulse Width Shrinkage	DDPWS	0.07			UI	
Eye mask colordinates {X1, X2 ,Y1, Y2}			0.11, 0.31 95, 350		UI mV	4

Receiver (per Lane)

Single-ended output voltage		-0.3		4.0	V	
Differential data output swing	Vout,pp	0		800	mVpp	5
AC common mode output voltage (RMS)				7.5	mV	
Termination mismatch at 1 MHx				5	%	
Differential output return loss		Per IEEE P802.3ba,Section 86A.4.2.1			dB	3
Common mode output return loss		Per IEEE P802.3ba,Section 86A.4.2.2			dB	3
Output transition time, 20% to 80%		28			ps	
J2 Jitter output	Jo2			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	4
Power Supply Ripple Tolerance	PSR	50			mVpp	

Notes:

1. From power-on and end of any fault conditions.
2. After internal AC coupling. Self-biasing 100Ω differential input.
3. 10 MHz to 11.1 GHz range
4. Hit ratio = 5 x 10E-5.
5. AC coupled with 100Ω differential output impedance.

IV. Optical Characteristics (TOP = 0 to 70℃, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Transmitter (per Lane)						
Signaling Speed per Lane				11.2	GBd	1
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	POUT			8.3	dBm	
Average Launch Power per Lane, MMF	TXPx	-7.0		4.3	dBm	
Average Launch Power per Lane, SMF		-10.0		2.3		2
Transmit OMA per Lane, MMF	TxOMA	-3.0		4.8	dBm	
Transmit OMA per Lane, SMF		-6.0		3.5	dBm	
Transmitter Dispersion Penalty, MMF	TXP-TDP			4.7	dBm	
Transmitter Dispersion Penalty, SMF				2.6		3
Average launch power of OFF transmitter, per Lane				-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	4
Sidemode Suppression ratio	SSRmin	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
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)				

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Receiver(per Lane)						
Signaling Speed per Lane				11.2	GBd	5
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, MMF	RXOMA			4.8	dBm	
Receive Power (OMA) per Lane, SMF				3.3		
Damage Threshold per Lane	PMAX			5.5	dBm	
Average Receive Power per Lane, MMF	RXPx	-10.0		4.3	dBm	
Average Receive Power per Lane, SMF		-13.7		2.3		6
Receiver Sensitivity (OMA) per Lane, MMF	Rxsens			-10.5	dBm	
Receiver Sensitivity (OMA) per Lane, SMF				-10.5		7
Stressed Receiver Sensitivity (OMA) per Lane, MMF	SRS			-5.0	dBm	
Stressed Receiver Sensitivity (OMA) per Lane, SMF				-8.5		

Return Loss	RL			-20	dB	
Vertical eye closure penalty, per lane				3.6	dB	
Receive electrical 3 dB upper cutoff frequency, per lane				12.3	dB	
LOS De-Assert	LOSD			-12	dBm	8
LOS Assert	LOSA	-28			dBm	8
LOS Hysteresis			1		dB	

Notes:

1.Transmitter consists of 4 lasers operating at 10.3Gb/s each.

2.Minimum value is informative.

3.Even if TDP < 0.5 dB (MMF) or TDP < 0.8 dB (SMF), TxP – TDP must be geater than this value.

4.RIN is scaled by 10*log(10/4) to maintain SNR outside of transmitter.

5.Receiver consists of 4 photodetectors operating at 10.3Gb/s each.

6.Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.

7.SMF receiver sensitivity guaranteed by design, but nots measured in production.

8.LOS Assert and De-Assert values are informative and may vary between MMF and SMF uses.

V. Pin Description

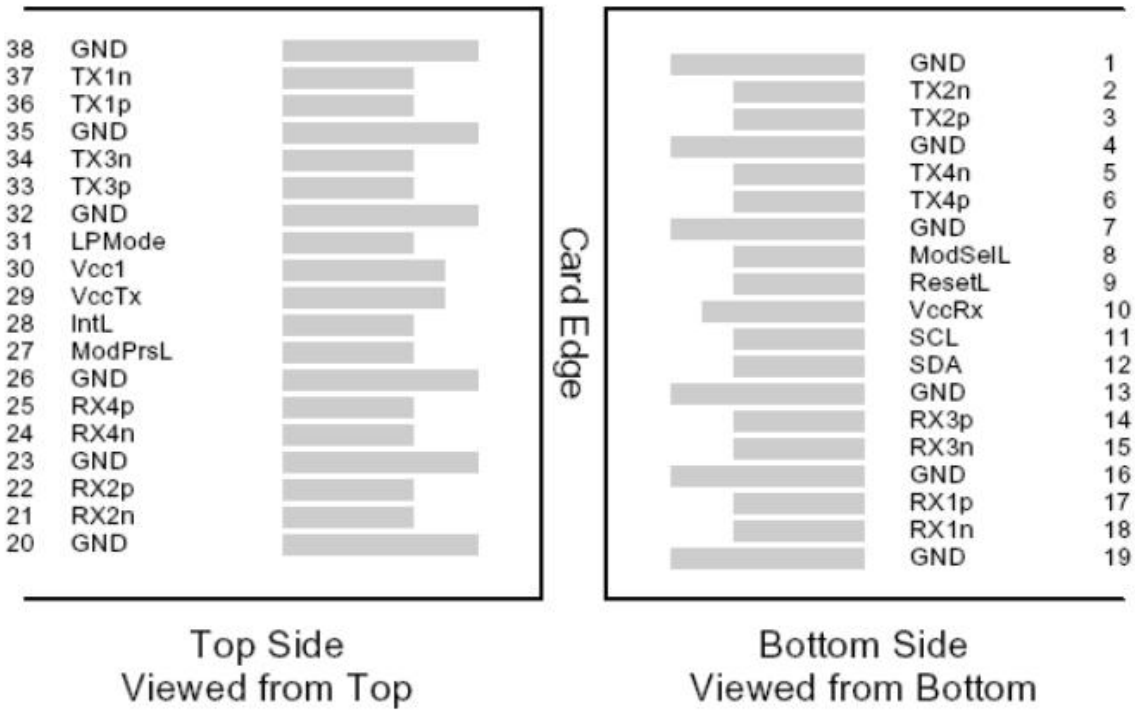


Figure 1 – QSFP+ MSA-compliant 38-pin connector

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	

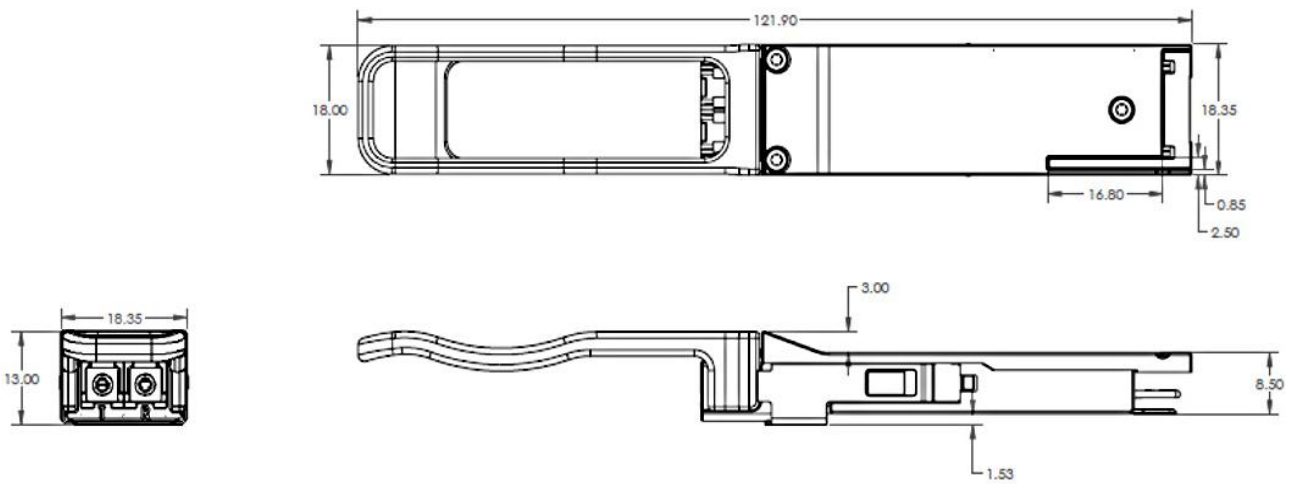
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Note:

1. Circuit ground is internally isolated from chassis ground.

VI. Mechanical Specifications

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

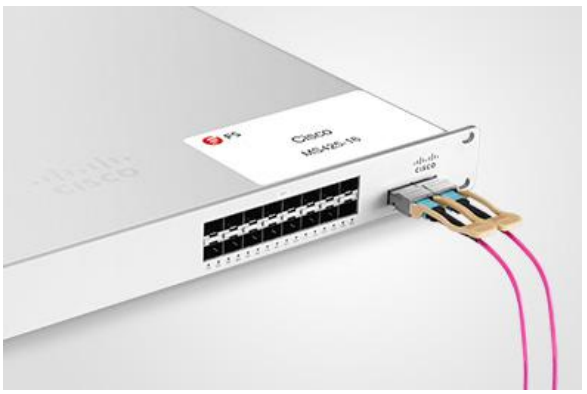


Test Center

I. Compatibility Testing

Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.

Cisco Catalyst C9500-24Y4C



Cisco MS425-16

Brocade VDX 6940-144S

Dell EMC Networking Z9100-ON

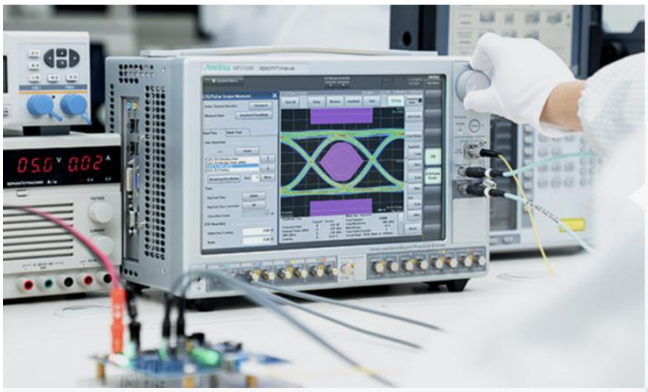
Force⑩tm S60-44T

HUAWEI S6720-30L-HI-24S

Above is part of our test bed network equipment. For more information, please click the Test Bed PDF. It will be updated in real time as we expand our portfolio.

II. Performance Testing

Each fiber optical transceiver has been fully tested in FS Assured Program equipped with world's most advanced analytical equipment to ensure that our transceivers work perfectly on your device.



1. TX/RX Single Quality Testing

Equipped with the all-in-one tester integrated 4ch BERT & sampling oscilloscope, and variable optical attenuator the input and output signal quality.

- Eye Pattern Measurements: Jitter, Mask Margin, etc
- Average Output Power
- OMA
- Extinction Ratio
- Receiver Sensitivity
- BER Curve

2. Reliability and Stability Testing

Subject the transceivers to dramatic in temperature on the thermal shock chamber to ensure reliability and stability of the transceivers.

- Commercial: 0℃ to 70℃
- Extended: -5℃ to 85℃
- Industrial: -40℃ to 85℃

3. Transfer Rate and Protocol Testing

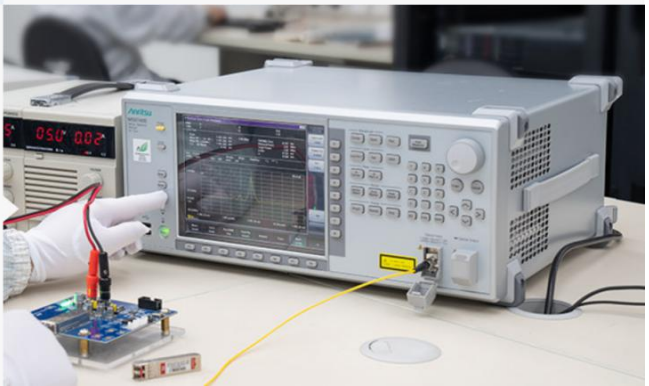
Test the actual transfer data rate and the transmission ability under different protocols with Networks Master Pro.

- Ethernet
- Fiber Channel
- SDH/SONET
- CPRI

4. Optical Spectrum Evaluation

Evaluate various important parameters with the Optical Spectrum Analyzer to meet the industry standards.

- Center Wavelength, Level
- OSNR
- SMSR
- Spectrum Width



Order Information

Part Number	Description
QSFP-SR4-40G	40GBASE-SR4 QSFP+ 850nm 150m MTP/MPO Transceiver for MMF
QSFP-CSR4-40G	40GBASE-CSR4 QSFP+ 850nm 400m MTP/MPO Transceiver for MMF
QSFP-PIR4-40G	40GBASE-PLRL4 QSFP+ 1310nm 1.4km MTP/MPO Transceiver for SMF
QSFP-LX4-40G	40GBASE-UNIV QSFP+ 1310nm 2km LC Transceiver for SMF&MMF
QSFP-IR4-40G	40GBASE-LR4L QSFP+ 1310nm 2km LC Transceiver for SMF
QSFP-LR4-40G	40GBASE-LR4 and OTU3 QSFP+ 1310nm 10km LC Transceiver for SMF
QSFP-PLR4-40G	40GBASE-PLR4 QSFP+ 1310nm 10km MTP/MPO Transceiver for SMF
QSFP-ER4-40G	40GBASE-ER4 and OTU3 QSFP+ 1310nm 40km LC Transceiver for SMF
QSFP-BD-40G	40GBASE-SR Bi-Directional QSFP LC Duplex Transceiver for MMF

Notes:

40G QSFP+ transceiver module is individually tested on corresponding equipment such as Cisco, Arista, Juniper, Dell, Brocade and other brands, and passes the monitoring of FS.COM intelligent quality control system.

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