

40GBASE-ER4 and OTU3 QSFP+ 1310nm 40km LC Transceiver for SMF

QSFP-ER4-40G



Application

- 40GBASE-ER4 40G Ethernet
- OTU3, OTU3e1, OTU3e2

Features

- Hot Pluggable QSFP+ form factor
- Supports 39.8Gb/s to 44.6 Gb/s aggregate bit rates
- Power dissipation <3.5W
- 18.5dB link insertion loss budget
- RoHS-6 compliant
- Single 3.3V power supply
- Maximum link length of 40km on Single Mode Fiber (SMF)
- Commercial operating case temperature range: 0°C to 70°C
- Uncooled 4x10Gb/s CWDM transmitter
- XLPP electrical interface
- Duplex LC receptacles
- Built-in digital diagnostic functions, including optical power monitoring

Description

QSFP+ transceiver modules are designed for use in 40 Gigabit Ethernet links and 4x10G OTN client interfaces over single mode fiber. They are compliant with the QSFP+ MSA , IEEE 802.3bm 40GBASE-ER4 and OTU3 requirements specified in ITU-T Recommendation G.695 as adapted to a 40km interface. Digital diagnostics functions are available via an I2C interface, as specified by the QSFP+ MSA. The optical transceiver is RoHS compliant per Directive 2011/65/EU.

Product Specifications

I.General Product Characteristics

Parameter	Value	Unit	Notes			
Module Form Factor	QSFP+					
Number of Lanes	4 Tx and 4 Rx					
Maximum Aggregate Data Rate	44.6	Gb/s				
Maximum Data Rate per Lane	11.2	Gb/s				
Protocols Supported	Typical applications include OTN OTU3, 40G Ethernet, Infiniband, SATA/SAS3					
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	9.95		11.15	Gb/sec	1
Bit Error Ratio	BER			10 ⁻¹²		2
Link distance on SMF-28	d	0.002		40	kilometers	3

Notes:

- Compliant with 40GBASE-ER4 and XLPP1 per IEEE 802.3bm, OTU3 C4S1-2D1 per ITU-T Rec.
- G.695 and OTU3e1/OTU3e2 per ITU-T G-Series Rec. Supplement 43. Compatible with
- 1/10 Gigabit Ethernet and 1/2/4/8/10G Fibre Channel.
- Tested with a PRBS 231-1 test pattern.
- 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.

II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Maximum Supply Voltage	Vcc1, VccTx, VccRx	-0.5		3.6	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:

1. Non-condensing..

III. 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	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 coordinates {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	V _{out,pp}	0		800	mV _{pp}	5
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	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			mV _{pp}	

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°C, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Transmitter (per Lane)						
Signaling Speed per Lane		9.95		11.15	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 LaunchPower	P _{out}			10.5	dBm	
Average Launch Power per Lane	TXP _x	-2.7		4.5	dBm	2
Transmit OMA per Lane	TxOMA	0.3		5.0	dBm	
Difference in Power between any two lanes (OMA)	DP _x			4.7	dB	
Transmitter Dispersion Penalty	TDP			2.6	dB	
Launch Power (OMA) minus TDP per Lane	P-TDP	-0.5			dBm	
Optical Extinction Ratio	ER	5.5				
Sidemode Suppression ratio	SS _{Rmin}	30			dB	
Average launch power of OFF transmitter, per lane				-30	dBm	
Relative Intensity Tolerance	RIN			-128	dB/Hz	3
Optical Return Loss Tolerance	ORL			20		
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)			
Jitter Generation			Per OTL3.4 section 4.14.1			

Receiver (per Lane)

Signaling Speed per Lane		9.95		11.15	GBd	4
Lane Center wavelengths (range)					nm	
Receive Power (OMA) per Lane	RxOMA			-4.0	dBm	
Average Receive Power per Lane	RXP _x	-21.2		-4.5	dBm	5
Receiver Sensitivity (OMA) per Lane	Rxsens			-19	dBm	
Stressed Receiver	SRS			-16.8	dBm	
Damage Threshold per Lane	P _{MAX}			3.8	dBm	
Return Loss	RL			-26	dB	
Jitter Tolerance				Per OTL3.4, G.8251		
Vertical eye closure penalty, per lane				2.2		
Receive electrical 3dB upper cutoff frequency, per lane				12.3	GHz	
LOS De-Assert	LOS _D			TBD	dBm	
LOS Assert	LOS _A	TBD			dBm	
LOS Hysteresis			1		dB	

Notes:

1. Transmitter consists of 4 lasers operating at up to 11.2 Gb/s each, +/- 20ppm
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 11.15 Gb/s each, +/- 100ppm
5. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.

V. Pin Description

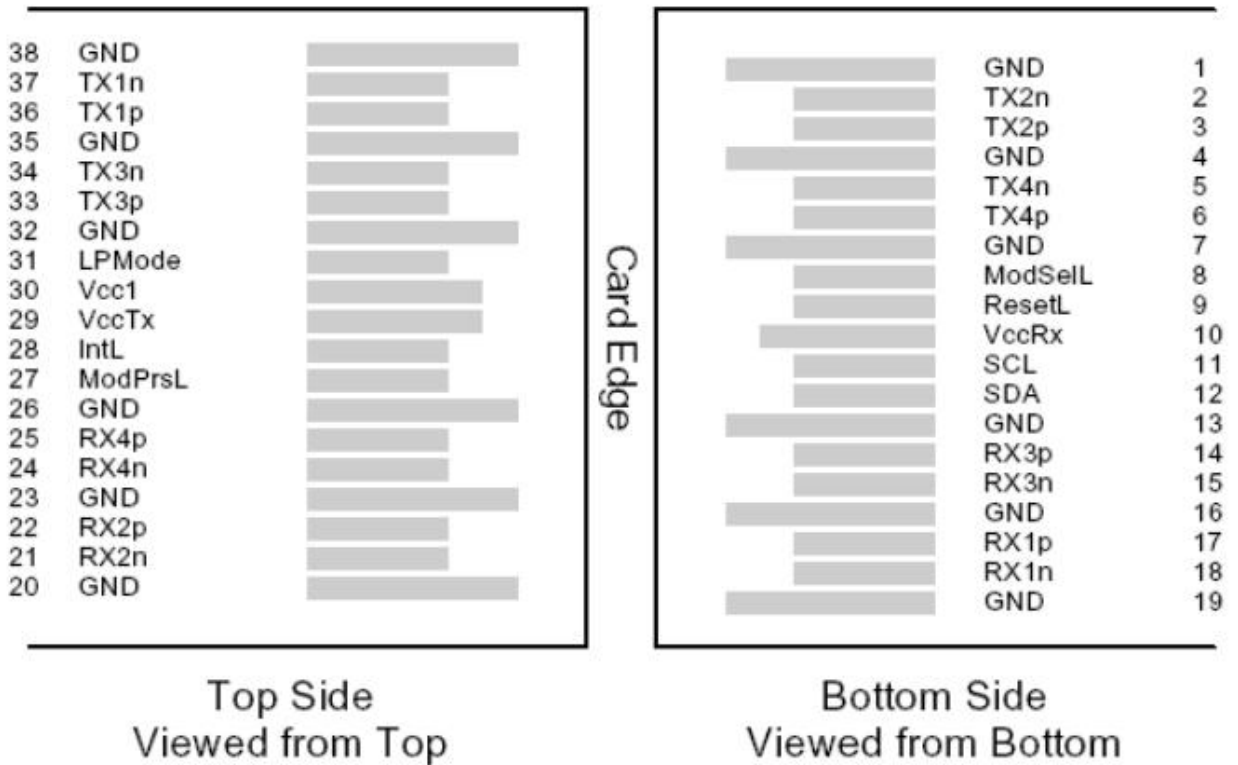


Figure 1 – QSFP+ MSA-compliant 38-pin connector

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	

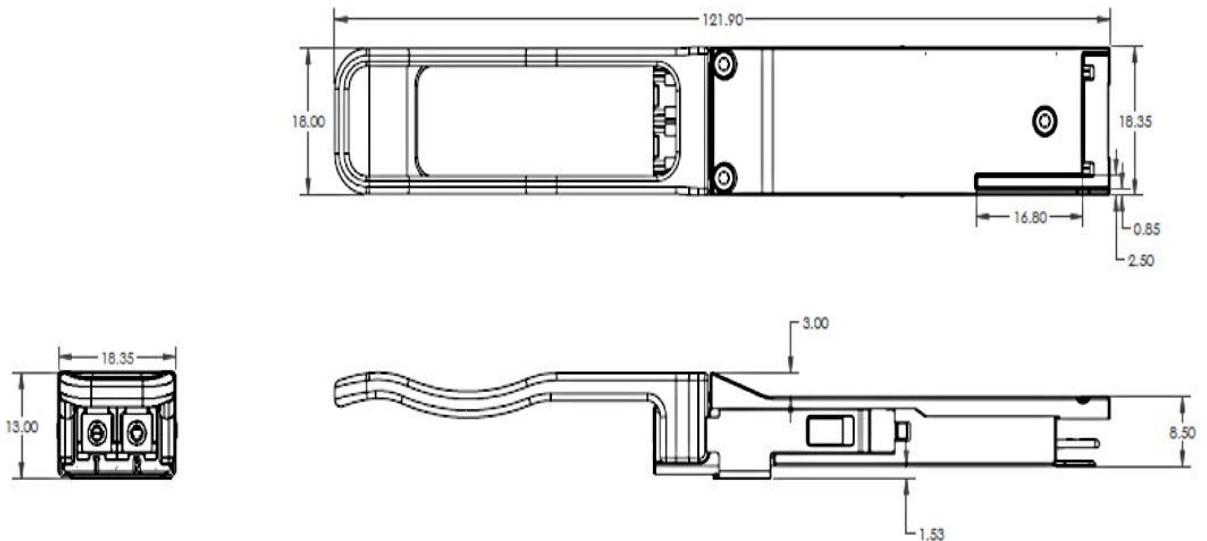
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Note:

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

FS.COM transceivers are tested to ensure connectivity and compatibility in our test center before shipped out. FS.COM test center is supported by a variety of mainstream original brand switches and groups of professional staff, helping our customers make the most efficient use of our products in their systems, network designs and deployments.

The original switches could be found nowhere but at FS.COM test center, eg: Juniper MX960 & EX 4300 series, Cisco Nexus 9396PX & Cisco ASR 9000 Series, HP 5900 Series & HP 5406R ZL2 V3(J9996A), Arista 7050S-64, Brocade ICX7750-26Q & ICX6610-48, Avaya VSP 7000 MDA 2, etc.



Cisco ASR 9000 Series(A9K-MPA-1X40GE)



ARISTA 7050S-64(DCS-7050S-64)



Juniper MX960



Brocade ICX 7750-26Q



Extreme Networks X670V VIM-40G4X



Mellanox M3601Q



Dell N4032F



HP 5406R ZL2 V3(J9996A)



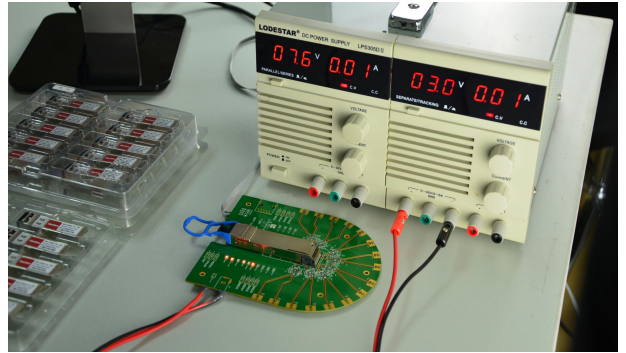
AVAYA 7024XLS(7002QQ-MDA)

Test Assured Program

FS.COM truly understands the value of compatibility and interoperability to each optics. Every module FS.COM provides must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In our test center, we care of every detail from staff to facilities—professionally trained staff, advanced test facilities and comprehensive original-brand switches, to ensure our customers to receive the optics with superior quality.



Our smart data system allows effective product management and quality control according to the unique serial number, properly tracking the order, shipment and every part.



Our in-house coding facility programs all of our parts to standard OEM specs for compatibility on all major vendors and systems such as Cisco, Juniper, Brocade, HP, Dell, Arista and so on.



With a comprehensive line of original-brand switches, we can recreate an environment and test each optics in practical application to ensure quality and distance.



The last test assured step to ensure our products to be shipped with perfect package.

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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