



# Intel® Ethernet QSFP+ Optics

QSFP+ 40GBASE-SR4 Optics for Intel® Ethernet Converged Network Adapters



## Key Features

- Support for 40GBASE Ethernet
- Hot-swappable 40 Gb I/O transceiver that plugs into a QSFP+ port
- Supports the 4x10 GbE mode to connect to four 10GBASE-SR optical interfaces
- Four channel, full duplex transceiver module
- Single 1x12 MPO receptacle
- Maximum power dissipation < 1.5 W
- RoHS-6 compliant (lead-free)
- Commercial temperature range 0-70 °C
- Maximum link length 100m on OM3 MMF and 150m OM4 MMF
- 1.06 Gb/s to 10.5 Gb/s per channel multi-rate capability
- Compatible with Intel® Ethernet Converged Network Adapters

## Overview

The Intel® Ethernet 40GBASE-SR4 QSFP+ Optics are available for customers who would like to deploy Intel® Ethernet Converged Network Adapters with a QSFP+ SR optic. Intel® Ethernet Converged Network Adapters with QSFP+ connectivity

deliver proven, reliable solutions for deployments of high density Ethernet for unified 10GbE and 40GbE network connections. Customers can move efficiently to 40GbE for high bandwidth application requirements such as content distribution, high-end virtualization using multiple CPUs, network appliances, and Applications Delivery Controllers (ACD) used for content caching, load balancing,

and compression. To ensure maximum flexibility, Intel supports the ability to use any combination of Intel® Ethernet QSFP+ Optic, Intel® Ethernet QSFP+ Twinaxial Cable, or Intel® Ethernet QSFP+ Breakout Cable. This enables customers to create the configuration that best meets the needs of their data center environment, while ensuring compatibility between adapter and accessories.

## General Specifications

Module Form Factor	QSFP+
Network Standards Physical Layer Interface	▪ 40GBASE-SR4 (4x10GbE and 1x40GbE)
QSFP+ Module Specifications	▪ INF-8438i Specification for QSFP (Quad Small Form factor Pluggable) Transceiver ▪ SFF-8436 - Specification for QSFP+ Copper and Optical Transceiver ▪ IEEE 802.3ba - PMD Type 40GBASE-SR4
Number of Lanes	4 Tx and 4 Rx
Product Code	E40GQSFP4SR
Compatible Intel® Ethernet Converged Network Adapters*	Intel® Ethernet Converged Network Adapter X520-QDA1 Intel® Ethernet Converged Network Adapter XL710-QDA1 Intel® Ethernet Converged Network Adapter XL710-QDA2

NOTE: Other brands of QSFP+ SR optical modules will not work with the Intel® Ethernet Converged Network Adapters.

NOTE: When two Intel® Ethernet Converged Network Adapter X520 and XL 710 Series QSFP+ devices are connected back to back, they should be configured with the same Speed/Duplex setting. Results may vary if speed settings are mixed.

## Compatible Intel® Ethernet Converged Network Adapter Product Codes

Configuration	No. of Ports	Single Pack	Bulk 5 Pack
Intel® Ethernet Converged Network Adapter X520-QDA1	1	X520QDA1	
Intel® Ethernet Converged Network Adapter XL710-QDA1	1	XL710QDA1	XL710QDA1BLK
Intel® Ethernet Converged Network Adapter XL710-QDA2	2	XL710QDA2	XL710QDA2BLK

## Optical Characteristics

(T<sub>OP</sub> = 0 °C to 70 °C, VCC=3.15 to 3.45 V)

Parameter	Symbol	Min	Typ	Max	Unit	Note
<b>Transmitter (per Lane)</b>						
Signaling Speed per Lane			10.5		Gb/s	1
Center Wavelength		840		860	nm	
RMS Spectral Width	SW			0.65	nm	
Average Launch Power per Lane	TXP <sub>x</sub>	-7.6		-1.0	dBm	
Transmit OMA per Lane	TxOMA	-5.6		3.0	dBm	2
Difference in Power between any two lanes (OMA)	DP <sub>x</sub>			4.0	dB	
Peek Power per Lane	PP <sub>x</sub>			4.0	dBm	
Launch Power (OMA) minus TDP per Lane	P-TDP	-6.5			dBm	
TDP per Lane	TDP			3.5	dBm	
Optical Extinction Ratio	ER	3.0			dB	
Optical Return Loss Tolerance	ORL			12	dB	
Encircled Flux	FLX		> 86% at 19 um < 30% at 4.5 um		dBm	
Average launch power of OFF transmitter per lane				-30	dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter eye mask definition	(X1, X2, X3) (Y1, Y2, Y3)		0.23, 0.34, 0.43 0.27, 0.35, 0.4			
<b>Receiver (per Lane)</b>						
Signaling Speed per Lane			10.5		GBd	3
Center Wavelength		840		860	nm	
Damage Threshold	DT	3.4			dBm	
Average Receive Power per Lane	RXP <sub>x</sub>	-9.5		2.4	dBm	
Receive Power (OMA) per Lane	RxOMA			3.0	dBm	
Stressed Receiver Sensitivity (OMA) per Lane	SRS			-5.4	dBm	
Peak Power per Lane	PP <sub>x</sub>			4	dBm	
Receiver Reflectance	Rfl			-12	dB	
Conditions of stressed receiver sensitivity test:						
Vertical Eye Closure Penalty (VECP) per lane				1.9	dB	
Stressed eye J2 jitter per lane				0.3	UI	
Stressed eye J9 jitter per lane				0.47	UI	
OMA of each aggressor lane				-0.4	dBm	
Rx jitter tolerance in OMA per lane			Max	-5.4	dBm	
Conditions of receiver jitter tolerance test:						
Jitter frequency and peak-to-peak amplitude				(75, 5)	KHz, UI	
Jitter frequency and peak-to-peak amplitude				(357, 1)	KHz, UI	
OMA of each aggressor lane				-0.4	dBm	
Loss of Optic Signal (LOS) De-Assert	LOS <sub>D</sub>			-12	dBm	
Loss of Optic Signal (LOS) Assert	LOS <sub>A</sub>	-30			dBm	
Loss of Optic Signal (LOS) Hysteresis		0.5			dBm	

### Notes:

1. Transmitter consists of four lasers operating at a maximum rate of 10.5 Gb/s each.
2. Even if TDP is < 0.9 dB, the OMA min must exceed this value.
3. Receiver consists of four photodetectors operating at a maximum rate of 10.5 Gb/s each.

## Electrical Characteristics

(T<sub>OP</sub> = 0 °C to 70 °C, VCC=3.15 to 3.45 V)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply Voltage	Vcc1 VccTx VccRx	3.15		3.45	V	
Supply Current	Icc			350	mA	
<b>Link Turn-On Time</b>						
Transmit turn-on time				2000	ms	2
<b>Transmitter (per Lane)</b>						
Single-ended input voltage tolerance	VinT	-0.3		4.0	V	
Differential data input swing	Vin,pp	180		1200	mVpp	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	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	5
<b>Receiver (per Lane)</b>						
Single-ended output voltage		-0.3		4.0	V	
Differential data output swing	Vout,pp	0		800	mVpp	7, 8
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	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	6
Eye mask coordinates #2	(X1, X2) (Y1, Y2)		0.29, 0.5 125, 500		UI mV	5
Power Supply Ripple Tolerance	PSR	50			mVpp	

**Notes:**

1. Maximum total power value is specified across the full temperature and voltage range.
2. From power-on and end of any fault conditions.
3. After internal AC coupling. Self-biasing 100 Ω differential input.
4. 10 MHz to 11.1 GHz range.
5. Hit ratio = 5 x 10E-5. Valid for all settings in Figure 1.
6. Hit ratio = 5 x 10E-5. Valid only for the shaded setting in Figure 1.
7. AC coupled with 100 Ω differential output impedance.
8. Settable in four discrete steps via the I<sup>2</sup>C interface. See Figure 1 for Vout setting.

Power (mW)		Pre-Emphasis into 100 Ohms (mV)			
		0	125	175	325
Volt (mV)	0	599			
	317	751	935	971	1075
	422	787	971	1007	1111
	739	883	1055	1103	1190

Figure 1 - Power Dissipation (mW, maximum) vs. Rx Output Conditions

## Regulatory Compliance

Transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950. Copies of certificates are available from Intel Corporation upon request.

## Customer Support

Intel® Customer Support Services offers a broad selection of programs including phone support and warranty service. For more information, contact us at [www.intel.com/support](http://www.intel.com/support).

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## For Product Information

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