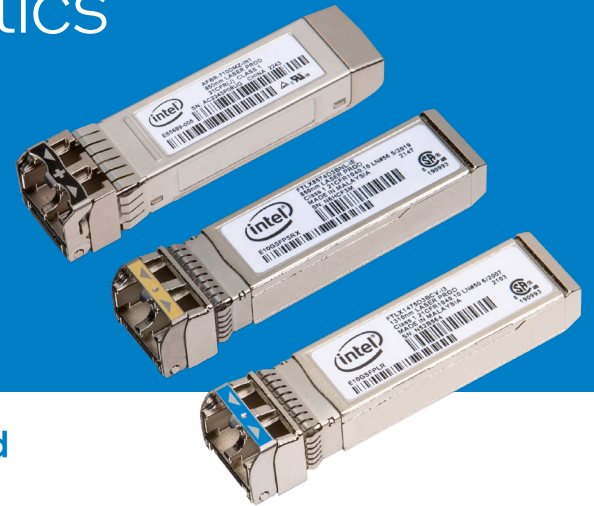


# Intel® Ethernet SFP+ Optics



**Intel® Ethernet SFP+ SR, SRX (extended temp), and LR Optics, offer dependable interoperability and consistent performance across the network when used with Intel® Ethernet 500 and 700 Series Network Adapters**

## Key Features

- Hot-pluggable SFP+ MSA compliant module
- SR and LR support 1GbE and 10GbE
- SRX (extended temperature) supports 10GbE only
- Duplex LC connector
- Built-in digital diagnostic functions
- RoHS-6 compliant (lead-free)

## Overview

For customers looking for Ethernet connections over 15 meters, Intel® Ethernet SFP+ Optics can extend the reach to 300 meters or longer. These optical modules support both short range and long range distances with 10 Gigabit Intel® Ethernet Network Adapters.

The flexibility provided through reach and range enables customers to create networking configurations that best meet the needs of their data center environment. Other installation benefits include: Smaller physical dimensions, use less power, tighter bend radius, lighter weight, and have a longer reach compared to copper media options.

Fiber optics are also more immune to harsh environmental factors. The light used for data transmission does not carry an electrical current so it cannot be impacted by electrical transmissions or radio frequency interference. And, light has a superior signal strength that is near impervious to unwanted network taps.

10 Gigabit Intel® Ethernet Network Adapters with SFP+ connectivity are also the most scalable – providing more secure connections for virtualization, flexibility for LAN and SAN networking, and proven reliable performance. Other use cases include connecting servers to End of Row (EoR) and Top of Rack (ToR) switches.

## General Specifications

Module Form Factor	SFP+
Network Standards Physical Layer Interface	SR <ul style="list-style-type: none"> <li>▪ 1000BASE-SX1GbE</li> <li>▪ 10GBASE-SR10GbE</li> </ul>
	SRX <ul style="list-style-type: none"> <li>▪ 10GBASE-SR10GbE</li> </ul>
	SRX <ul style="list-style-type: none"> <li>▪ 1000BASE-LX1GbE</li> <li>▪ 10GBASE-LR10GbE</li> </ul>
SFP+ Module Specifications	<ul style="list-style-type: none"> <li>▪ Electrical interface: SFF-8431 Rev 4.1</li> <li>▪ I<sup>2</sup>C Register interface: SFF-8472 Rev 10.4</li> <li>▪ Mechanical: SFF-8432 Rev 5.0</li> </ul>

## Product Order Codes

Configuration	Product Code	Intel Order Numbers (Retail / OEM Generic)	MM #
SR Optic	E10GSFPSR	903239/909923	
SRX Optic <sup>1</sup>	E10GSFPSRX	954746	
LR Optic	E10GSFPLR	903240/903240	

<sup>1</sup>Extended temp

Note: Other brands of SFP+ optical modules will not work with the Intel® Ethernet Converged Network Adapter X520 Series.

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

## SR Optical Characteristics

Optical Characteristics for RS0 = HIGH  
(10 Gb Operation) (T<sub>OP</sub> = 0 °C to 70 °C, V<sub>CC</sub> = 3.14 Vdc to 3.46 Vdc)

Parameter	Symbol	Min	Typ	Max	Unit	Note
<b>Transmitter</b>						
Optical Modulation amplitude (OMA)	P <sub>OMA</sub>		-1.5		dBm	1
Average Launch Power	P <sub>AVE</sub>	-5		-1	dBm	2
Optical Wave Length	λ	840	850	860	nm	1
RMS Spectral Width	Δλ <sub>rms</sub>			0.45	dB	1
Optical Extinction Ratio	ER	3.0	5.5		dB	
Transmitter and Dispersion Penalty	TDP			3.9	dB	
Average Launch Power of OFF Transmitter	P <sub>OFF</sub>			-30	dBm	
Tx Jitter	T <sub>x</sub>		Per IEEE 802.3-2008 Requirements			
Encircled Flux	<4.5 μm			30		3
	<19 μm	86			%	
Relative Intensity Noise	RIN <sub>12</sub> OMA			-128	dB/Hz	

Notes:

1. Per Tradeoff Table 52.8, IEEE 802.3-2008.

2. Average Power figures are informative only, per IEEE802.3-2008.

3. Measured into Type A1a (50/125 μm multimode) fiber per ANSI/TIA/EIA-455-203-2.

## SR Optical Characteristics (Continued)

Parameter	Symbol	Min	Typ	Max	Unit	Note
<b>Receiver</b>						
Receiver Sensitivity (OMA) @ 10.3 Gb/s	R <sub>SENS1</sub>			-11.1	dBm	1
Stressed Receiver Sensitivity (OMA) 10.3 Gb/s	R <sub>SENS2</sub>			-7.5	dBm	2
Maximum Input Power	P <sub>MAX</sub>	+0.5			dBm	
Wavelength Range	λ <sub>C</sub>	840		860	nm	
Receiver Reflectance	R <sub>rx</sub>			-12	dB	
LOS De-Assert	LOS <sub>D</sub>			-14	dBm	
LOS Assert	LOS <sub>A</sub>	-30	-23		dBm	
Loss Hysteresis		0.5			dB	

Notes:

1. Measured with worst ER; BER < 10<sup>-12</sup>; 2<sup>31</sup> – 1 PRBS.
2. Per IEEE 802.3-2008.

Bit Rate	BR	9.95		10.5	Gb/s	3
Bit Rate Error Ratio	BER			10 <sup>-12</sup>	Gb/s	4

Notes:

3. 10GBASE-SR/SW.
4. Tested with a 2<sup>31</sup> – 1 PRBS.

## SR Optical Characteristics

Parameter	Symbol	Maximum Supported Distance		Units	
		@1Gb/s	@10Gb/s		
Distance					
Fiber Type	850 nm OFL Band-width				
6.25 μm	160 MHz-km	220	26	m	
	OM1 200 MHz-Km	L <sub>max</sub>	275		33
50 μm	400 MHz-Km	500	66	m	
	OM2 500 MHz-Km	L <sub>max</sub>	550		82
	OM3 2000 MHz-Km		>550		300

## SR Environmental Specifications

850 nm SFP transceivers have a commercial operating temperature range from 0 °C to +70 °C case temperature

Parameter	Symbol	Min	Typ	Max	Units
Case Operating Temperature	T <sub>op</sub>			70	°C
Storage Temperature	T <sub>sto</sub>	-40		85	°C

## SRX Optical Characteristics

Optical Characteristics for RSO = HIGH  
(10 Gb Operation) ( $T_{OP} = -5^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $V_{CC} = 3.14\text{ Vdc}$  to  $3.46\text{ Vdc}$ )

Parameter	Symbol	Min	Typ	Max	Unit	Note
<b>Transmitter</b>						
Optical Modulation amplitude (OMA)	$P_{OMA}$		-1.5		dBm	1
Average Launch Power	$P_{AVE}$	-5		-1	dBm	2
Optical Wave Length	$\lambda$	840	850	860	nm	1
RMS Spectral Width	$\Delta\lambda_{rms}$			-0.45	dB	1
Optical Extinction Ratio	ER	3.0	5.5		dB	
Transmitter and Dispersion Penalty	TDP			3.9	dB	
Average Launch Power of OFF Transmitter	$P_{OFF}$			-30	dBm	
Tx Jitter	$T_{xj}$		Per IEEE 802.3-2012 Requirements			
Encircled Flux	$<4.5\ \mu\text{m}$			30	%	3
	$<19\ \mu\text{m}$	86				
Relative Intensity Noise	$RIN_{12OMA}$			-128	dB/Hz	
<b>Receiver</b>						
Receiver Sensitivity (OMA) @ 10.3 Gb/s	$R_{SENS1}$			-11.1	dBm	4
Stressed Receiver Sensitivity (OMA) 10.3 Gb/s	$R_{SENS2}$			-7.5	dBm	5
Maximum Input Power	$P_{MAX}$	+0.5			dBm	
Wavelength Range	$\lambda_C$	840		860	nm	
Receiver Reflectance	$R_{rx}$			-12	dB	
LOS De-Assert	$LOS_D$			-14	dBm	
LOS Assert	$LOS_A$	-30	-23		dBm	
Loss Hysteresis		0.5			dB	

Notes:

1. Per Tradeoff Table 52.8, IEEE 802.3-2012.
2. Average Power figures are informative only, per IEEE802.3-2012.
3. Measured into Type A1a (50/125  $\mu\text{m}$  multimode) fiber per ANSI/TIA/EIA-455-203-2.
4. Measured with worst ER; BER  $< 10^{-12}$ ;  $2^{31} - 1$  PRBS.
5. Per IEEE 802.3-2012.

## SRX Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Bit Rate (RSO = LOW)	BR	9.95		10.5	Gb/s	1
Bit Rate (RSO = HIGH)	BER			$10^{-12}$	Gb/s	2

Notes:

1. 10GBASE-SR/SW. Contact your Intel Representative for higher data-rate support.
2. Tested Tested with a  $2^{31} - 1$  PRBS. See note above for conditions.

## SRx Optical Characteristics (Continued)

Parameter	Symbol	Maximum Supported Distance	Units
Fiber Type	850 nm OFL Band-width		
6.25 μm	160 MHz-km	26	m
	OM1 200 MHz-Km	33	
50 μm	400 MHz-Km	66	m
	OM2 500 MHz-Km	82	
	OM3 2000 MHz-Km	300	
	OM4 4700 MHz-Km	400	

## SRX Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units
Case Operating Temperature	T <sub>op</sub>	-5		85	°C
Storage Temperature	T <sub>sto</sub>	-40		85	°C

## LR Optical Characteristics

Optical Characteristics for RS0 = HIGH  
(10 Gb Operation) (T<sub>OP</sub> = 0 °C to 70 °C, V<sub>CC</sub> = 3.14 Vdc to 3.46 Vdc)

Parameter	Symbol	Min	Typ	Max	Unit	Note
<b>Transmitter</b>						
Optical Modulation amplitude (OMA)	P <sub>OMA</sub>	-5.2			dBm	
Average Launch Power	P <sub>AVE</sub>	-8.2		0.5	dBm	1
Optical Wave Length	λ	1260		1355	nm	
Side-mode Suppression Ratio	RIN	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.2.	dB	
Average Launch Power of OFF Transmitter	P <sub>OFF</sub>			-30.	dBm	
Tx Jitter	T <sub>x</sub>		Per IEEE 802.3-2008 Requirements			
Relative Intensity Noise	RIN			-128	dB/Hz	
<b>Receiver</b>						
Receiver Sensitivity (OMA) @ 10.3 Gb/s	R <sub>SENS1</sub>			-12.6	dBm	2
Stressed Receiver Sensitivity (OMA) 10.3 Gb/s	R <sub>SENS2</sub>			-10.3	dBm	3
Average Receiver Power	P <sub>AVE</sub>	-14.2		0.5	dB	
Optical Center Wavelength	λ <sub>C</sub>	1260		1600	nm	
Receiver Reflectance	R <sub>rx</sub>			-12	dB	
LOS De-Assert	LOS <sub>D</sub>			-17	dBm	
LOS Assert	LOS <sub>A</sub>	-30			dBm	
Loss Hysteresis		0.5			dB	

Notes:

1. Average power figures are informative only, per IEEE 802.3-2008.
2. Valid between 1260 and 1355 nm. Measured with worst ER; BER < 10<sup>-12</sup>; 2<sup>31</sup> - 1 PRBS.
3. Valid between 1260 and 1355 nm. Per IEEE 802.3-2008.

## LR General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Bit Rate (RSO = LOW)	BR		1.25		Gb/s	1
Bit Rate (RSO = HIGH)	BR	9.95	10.3		Gb/s	2
Maximum Supported Link Length	L <sub>MAX</sub>		10		Km	

### Notes:

- 1000BASE-LX. Tested with a 2<sup>7</sup> – 1 PRBS. (Transceiver data rate selected through the 2-wire bus in accordance with SFF-8472 Rev. 10.3. Soft RSO is set at Bit3, Byte 110, Address A2h. Soft RSO default state on power up is 0 LOW, and the state is reset following a power cycle. Writing 1 HIGH selects max. data rate operation. Transceiver data rate is the logic OR of the input state of the RSO pin and soft RSO bit. Thus, if either the RSO pin OR the soft RSO bit is HIGH, then the selected data rate will be 9.95 and 10.3 Gb/s. Conversely, to select data rate 1.25 Gb/s, both the RSO pin and the soft RSO bit are set LOW.)
- 10GBASE-LR/LW. Tested with a 2<sup>31</sup> – 1 PRBS. (See note above for conditions.)

## LR Environmental Specifications

Transceivers have an operating temperature range from -5 °C to +70 °C case temperature

Parameter	Symbol	Min	Typ	Max	Units
Case Operating Temperature	T <sub>op</sub>	-5		70	°C
Storage Temperature	T <sub>sto</sub>	-40		85	°C

## 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.

## For Product Information

For information about all Intel® Ethernet Products, visit: [intel.com/ethernet](http://intel.com/ethernet)

## Warranty

Intel® Ethernet Optics have a **limited warranty** of three years from the date of shipment.

## Customer Support

For customer support options in North America visit: [intel.com/content/www/us/en/support/contact-support.html](http://intel.com/content/www/us/en/support/contact-support.html)

No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document. Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

This document contains information on products, services and/or processes in development. All information provided here is subject to change without notice. Contact your Intel representative to obtain the latest forecast, schedule, specifications and roadmaps.

The products and services described may contain defects or errors which may cause deviations from published specifications.

© Intel Corporation. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others.