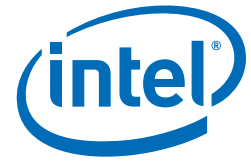


## Product Brief

Intel® Ethernet SFP+ Optics

Network Connectivity



# Intel® Ethernet SFP+ Optics

SR and LR Optics for the Intel® Ethernet Server Adapter X520 Family

- Hot-pluggable SFP+ footprint
- Supports rate selectable 1.25 Gb/s or 9.95 to 10.3 Gb/s bit rates
- Power dissipation < 1 W
- RoHS-6 compliant (lead-free)
- Commercial temperature range 0 °C to 70 °C
- Single 3.3 Vdc power supply
- Max. link length 300 m on 2000 MHZ-km MMF (SR), 10 km (LR)
- Uncooled 850 nm VCSEL laser (SR)
- Uncooled 1310 nm DFB laser (LR)
- Receiver limiting electrical interface
- Duplex LC connector
- Built-in digital diagnostic functions



Intel's family of Intel® Ethernet X520 Server Adapters with SFP+ connectivity are the most flexible and scalable Ethernet adapters for today's demanding data center environments. The escalating deployments of servers with multi-core processors and demanding applications such as High Performance Computing (HPC), database clusters, and video-on-demand are the types of applications driving the need for 10 Gigabit connections. Customers require flexible and scalable I/O solutions to meet the rigorous requirements of running mission-critical applications in virtualized and unified storage environments.

Powered by Intel's third-generation 10 GbE network controller, the Intel® Ethernet 82599 10 Gigabit Ethernet Controller, the X520 server adapter family addresses the demanding needs

of the next-generation data center by providing unmatched features for virtualization, flexibility for LAN and SAN networking, and proven, reliable performance.

To ensure maximum flexibility, Intel supports the ability to mix any combination of the SFP+ optical modules, direct attach copper cables, or 1000BASE-T SFP modules on the Intel Ethernet X520 Adapters. For instance, customers can remove the optical modules that come installed on the adapter and replace them with an Intel® Ethernet SFP+ Optic, an SFP+ Direct Attach Copper Cable, or a 1000BASE-T SFP module. Intel® Ethernet SFP+ Optics are available in both short range (SR) 850 nm and long range (LR) 1310 nm options.

This enables customers to create the configuration that best meets the needs of their data center environment.

## General Specifications

Network Standards Physical Layer Interface	SR <ul style="list-style-type: none"> <li>1000BASE-SX 1G Ethernet</li> <li>10GBASE-SR 10G Ethernet</li> </ul> LR <ul style="list-style-type: none"> <li>1000BASE-LX 1G Ethernet</li> <li>10GBASE-LR 10G Ethernet</li> </ul>
SFP+ Module Specifications	<ul style="list-style-type: none"> <li>Electrical interface: SFF-8431 Rev 4.1</li> <li>I2C Register interface: SFF-8472 Rev 10.4</li> <li>Mechanical: SFF-8432 Rev 5.0</li> </ul>
Product Codes	<ul style="list-style-type: none"> <li>E10GSFPSR – Intel® Ethernet SFP+ SR Optic</li> <li>E10GSFPLR – Intel® Ethernet SFP+ LR Optic</li> </ul>
Compatible Intel® Ethernet Server Adapters	<ul style="list-style-type: none"> <li>E10G42BTDA – Intel® Ethernet Server Adapter X520-DA2</li> <li>E10G41BFPSR – Intel® Ethernet Server Adapter X520-SR1*</li> <li>E10G42BFPSR – Intel® Ethernet Server Adapter X520-SR2*</li> <li>E10G41BFLLR – Intel® Ethernet Server Adapter X520-LR1*</li> </ul> <p>* Ships with pluggable optic installed</p>

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

**Note:** When two Intel® Ethernet Server 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 for RSO = HIGH (10 Gb Operation)

( $T_{OP}$  = 0 °C to 70 °C,  $V_{CC}$  = 3.14 Vdc to 3.46 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 Wavelength	$\lambda$	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	Tx	Per IEEE 802.3-2008 requirements				
Encircled Flux	<4.5 $\mu$ m			30	%	3
	<19 $\mu$ m	86				
Relative Intensity Noise	$RIN_{OMA}$			-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	
LOS Hysteresis		0.5			dB	

Notes:

- Per Tradeoff Table 52.8, IEEE 802.3-2008
- Average Power figures are informative only, per IEEE802.3-2008.
- Measured into Type A1a (50/125  $\mu$ m multimode) fiber per ANSI/TIA/EIA-455-203-2.
- Measured with worst ER; BER<10<sup>-12</sup>; 231 – 1 PRBS.
- Per IEEE 802.3-2008.

SR Optical Characteristics (continued)

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate (RSO = LOW)	BR		1.25		Gb/s	1
Bit Rate (RSO = HIGH)	BR	9.95	10.3		Gb/s	2

Parameter		Symbol	Max. Supported Distance		Units
Distance			@ 1G	@ 10G	
Fiber Type	850nm OFL Bandwidth				
62.5 μm	160 MHz-km	L <sub>max</sub>	220	26	m
	OM1 200 MHz-km		275	33	
50 μm	400 MHz-km	L <sub>max</sub>	500	66	m
	OM2 500 MHz-km		550	82	
	OM3 2000 MHz-km		>550	300	

Notes:

- 1000BASE-SX. 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-SR/SW. Tested with a 2<sup>31</sup> - 1 PRBS. See note above for conditions.

### 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>	0		70	°C
Storage Temperature	T <sub>sto</sub>	-40		85	°C

## LR

Optical Characteristics for RSO = 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 Wavelength	λ	1260		1355	nm	
Side-Mode Suppression Ratio	SMSR	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 Receive Power	P <sub>AVE</sub>	-14.2		0.5	dBm	

## LR Optical Characteristics (continued)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Optical Center Wavelength	$\lambda_c$	1260		1600	nm	
Receiver Reflectance	$R_{rx}$			-12	dB	
LOS De-Assert	$LOS_D$			-17	dBm	
LOS Assert	$LOS_A$	-30	-23		dBm	
LOS 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>; 231 – 1 PRBS.
3. Valid between 1260 and 1355 nm. Per IEEE 802.3-2008.

## General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Note
Bit Rate (RSO = LOW)	BR		1.25		Gb/s	1
Bit Rate (RSO = HIGH)	BR	9.95	10.3		Gb/s	2
Max. Supported Link Length	$L_{MAX}$		10		km	

### Notes:

1. 1000BASE-LX. Tested with a 2<sup>31</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.)
2. 10GBASE-LR/LW. Tested with a 2<sup>31</sup> – 1 PRBS. (See note above for conditions.)

## 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	$T_{op}$	-5		70	°C
Storage Temperature	$T_{sto}$	-40		85	°C

## Regulatory Compliance

Transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by TÜV and CSA 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). Service and availability may vary by country.

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