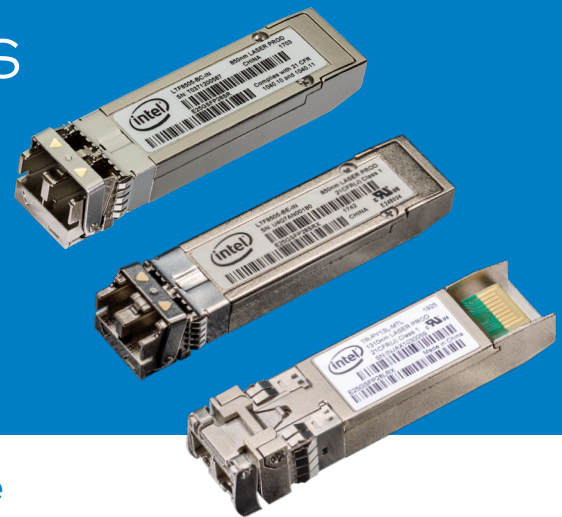


Intel® Ethernet SFP28 Optics



Intel® Ethernet SFP28 Optics deliver a proven reliable solution for deployments of high-density Ethernet

Key Features

- Hot-pluggable SFP28 optical transceivers
- Support for commercial and extended temperature ranges
- RoHS 6 compliant (lead-free)

Overview

Intel® Ethernet SFP28 Optics are an excellent choice for high-speed communications equipment where extraordinary performance and reliability are essential. These hot-pluggable optical modules consume low-power and are offered in the extended temperature range.

When used with Intel® Ethernet Network Adapters with SFP28 connectivity, these optics provide more secure connections for virtualization, flexibility for LAN and SAN networking, and consistently reliable performance.

Fiber optics are 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. Also, light has a superior signal strength that is near impervious to unwanted network taps.

General Specifications

Module Form Factor	Network Standards Physical Layer Interface	Product Order Code
SFP28 - short range	10G/25GBASE-SR (Commercial)	E25GSFP28SR
SFP28 - short range	25GBASE-SR (Extended Temp)	E25GSFP28SRX
SFP28 - long range	25GBASE-LR (Extended Temp)	E25GSFP28LRX

Airflow and Module Specifications

SFP28 Module Specifications	Electrical: SFF-8402, SFF-8431 I2C Register Interface: SFF-8472 Rev 12.0
Airflow	Refer to the Ethernet network adapter product brief for specific airflow and temperature recommendations

SR Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter						
Average Output Power: 50 or 62.5 MMF	P_{OUT}	-8.4		2.4	dBm	1
Optical Wave Length	λ	840		860	nm	
Spectral Width (RMS)	$\Delta\lambda_{rms}$			0.60	nm	
Optical Modulation amplitude (OMA)	OMA	-6.4		3	dBm	
Transmitter and Dispersion Penalty 25.78 Gb/s	TDP			5	dBm	2
10.3 Gb/s				2.5		3
Relative Intensity Noise	RIN			-128	dB/Hz	
Extinction Ratio	ER	2				
Receiver						
Stressed Receiver Sensitivity OMA Sensitivity @ 25.78 Gb/s	RxSENS			5.6	dBm	
Average Receiver Power	RX_{MAX}	-11		3	dBm	
Unstressed Receiver OMA Sensitivity @ 10.3 Gb/s	RxSENS			-11.1	dBm	
Stressed Receiver Sensitivity (OMA) 10.3 Gb/s	RxSENS2			-7.5	dBm	
Optical Center Wavelength	λ_C	840		860	nm	
Optical Return Loss		12			dB	
LOS Assert	LOS _A	-30			dBm	
LOS De-Assert	LOS _D			-13	dBm	
Loss Hysteresis		0.5			dB	

Notes:

- Class 1 Laser Safety limit per FDA/CDRH, and EN (IEC) 60825 laser safety standards.
- Informative Only.
- The TDP transversal filter should be scaled from SR: for 100m OM3 and 0.65nm spectral bandwidth, the TDP filter should have tap separation of 21ps. This would introduce ~0.3dB eye closure penalty.

SR Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply Voltage	V _{CC}	3.15		3.46	V	
Supply Current	I _{CC}			350	mA	1
Transmitter						
Input Differential Impedance	R _{in}		100	2.4	Ω	2
Single-ended Data Input Swing	V _{in,pp}	90		800	mV	
Transmit Disable Voltage	V _D	2		V _{CC}	VA	3
Transmit Enable Voltage	V _{EN}	V _{EE}		V _{CC} +0.8	V	
Transmitter and Dispersion Penalty	TDP				dBm	
25.78 Gb/s				5		2
10.3 Gb/s				2.5		3

Receiver

Single-ended Data Output Swing	V _{out,pp}	185		425	mV	4
LOS Fault	V _{LOS fault}	2		V _{CC HOST}	V	5
LOS Normal	V _{LOS norm}	V _{EE}		V _{EE} +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:

1. With established link. The total power dissipation can exceed 1 W when the module is attempting to establish link at operating case temperature below 25 °C.
2. Connected directly to Tx data input pins. AC coupling from pins into laser driver IC.
3. Or open circuit.
4. Into 100 Ω differential termination.
5. LOS is an open collector output. Should be pulled up with 4.7 K – 10 KΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

SR Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Note
Maximum Supply Voltage	V _{CC}	-0.5		4.0	V	
Storage Temperature	T _s	-40		85	°C	
Case Operating Temperature	T _{case}	0		70	°C	
Relative Humidity (non-condensing)	RH	0		85	%	

SR Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Bit Rate	BR		25.78			Gb/s
	BR		10.3125			Gb/s
Bit Rate Error Ratio	BER			10^{-12}		1,4
				10^{-8}		2
				5E(-5)		3
Fiber Length on 50/125µm high-bandwidth (OM3/M5E) MMF	L			30	m	1
				50	m	2
				70	m	3
				100	m	4
Fiber Length on 50/125µm high-bandwidth (OM4/M5F) MMF	L			40	m	1
				70	m	2
				100	m	3

Notes:

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

SR Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units	Note
Case Operating Temperature	T _{op}	0		70	°C	
Storage Temperature	T _{sto}	-40		85	°C	

SRX Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter						
850nm VCSEL						
Average Launch Power	P_{OUT}	-8.4		2.4	dBm	
Average Launch Power (Laser Off)	P_{OFF}			-30	dBm	
Optical Center Wave Length	λ	840	850	860	nm	
Spectral Width (RMS)	$\Delta\lambda$			0.60	nm	
Dispersion Penalty	DP			4.3	dB	
Optical Return Loss Tolerance	ORL			12	dB	
Extinction Ratio	ER	2			dB	
Receiver						
850nm PIN/TIA CW Mode						
Optical Center Wave Length	λ	840	850	860	nm	
Receiver Sensitivity OMA 25Gb	P_{IN}	-10.3		2.4	dBm	1
Stressed Receiver Sensitivity (OMA) 25Gb	$P_{IN(OMA)}$			-5.2	dBm	1
Receiver Optical Overload	$P_{IN(SAT)}$			3	dBm	
Receiver Reflectance	RFL			-12	dB	
LOS Assert	P_A	-30			dBm	
LOS De-Assert	P_D			-12	dBm	
LOS Hysteresis	P_{Hy}	0.5			dB	
Notes:						
1. BER5×10^{-5}, PRBS 2 ³¹ -1						

SRX Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply Voltage	V _{CC}	3.14	3.3	3.46	V	
Supply Current	I _{IN}			300	mA	
Transmitter						
Input Differential Impedance	Z _{IN}		100		Ω	
Differential Data Input Swing	V _{IN}	200		1000	mV	
Transmit Disable Voltage	V _D	2.0		V _{CC} +0.3	V	
Transmit Enable Voltage	V _{EN}	-0.3		0.8	V	
Receiver						
Output Differential Impedance	Z _{OUT}	300		850	Ω	
Differential Data Output Swing	V _{OUT}		100		mV	
LOS Assert Voltage	V _{LOSA}	2.0		V _{CC} +0.3	V	
LOS De-Assert Voltage	V _{LOSD}	-0.3		0.4	V	

SRX Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Bit Rate	BR		25.78		Gb/s	
25Gb Effective Reach/50µm (OM3) MMF	L			30	m	1
				70	m	2
25Gb Effective Reach/50µm (OM4) MMF	L			70	m	3
				100	m	4

Notes:

1. 2000MHz-km BER $<1 \times 10^{-12}$, PRBS 2³¹-1
2. 2000MHz-km BER $<5 \times 10^{-5}$, PRBS 2³¹-1
3. 4700MHz-km BER $<1 \times 10^{-12}$, PRBS 2³¹-1
4. 4700MHz-km BER $<5 \times 10^{-5}$, PRBS 2³¹-1

SRX Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Note
Maximum Supply Voltage	V _{cc}	0		3.6	V	
Storage Temperature	T _{stg}	-40		85	°C	
Relative Humidity - Storage	RH _s	0		95	%	
Relative Humidity - Operating	RH _o	0		85	%	

SRX Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units	Note
Case Operating Temperature	T _{case}	0	25	85	°C	1
Storage Temperature	T _{stg}	-40		85	°C	

Notes:

1. Temperature Range = E

LRX Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter			1310nm DML			
Average Launch Power	P_{OUT}	-7		2	dBm	
Average Launch Power (Laser Off)	P_{OFF}			-30	dBm	
Optical Center Wave Length	λ	1295		1325	nm	
Spectral Width (RMS)	$\Delta\lambda$			1	nm	
Dispersion Penalty	DP			2.7	dB	
Optical Return Loss Tolerance	ORL			20	dB	
Extinction Ratio	ER	3.5			dB	
Transmitter Output Eye			IEEE802.3bm			
Receiver			PIN/TIA			
Optical Center Wave Length	λ	1260		1355	nm	
Receiver Sensitivity OMA 25Gb	$P_{IN(OMA)}$			-12	dBm	1
Receiver Optical Overload	$P_{IN(SAT)}$	2			dBm	
Receiver Reflectance	RFL			-26	dB	
LOS Assert	P_A	-30			dBm	
LOS De-Assert	P_D			-17	dBm	
LOS Hysteresis	P_{Hy}	0.5		5	dB	

Notes:

1. BER < 5×10^{-5} , PRBS $2^{31}-1$

LRX Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply Voltage	V _{CC}	3.14	3.3	3.46	V	
Supply Current	I _{IN}			410	mA	
Transmitter						
Input Differential Impedance	Z _{IN}		100		Ω	
Differential Data Input Swing	V _{IN}	200		800	mV	
Transmit Disable Voltage	V _D	2.0		V _{CC} +0.3	V	
Transmit Enable Voltage	V _{EN}	0		0.8	V	
Receiver						
Differential Data Output Swing	V _{OUT}	200		800	mV	
Rx Differential Output Impedance	Z _{OUT}		100		Ω	
LOS Assert Voltage	V _{LOSA}	2.0		V _{CC} +0.3	V	
LOS De-Assert Voltage	V _{LOSD}	VEE		VEE+0.4	V	

LRX Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Data Rate	BR		25.78		Gb/s	

LRX Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Note
Storage Ambient Temperature	T _{stg}	-40		+85	°C	1
Relative Humidity - Storage	RH _s	0		95	%	1
Relative Humidity - Operating	RH _o	0		85	%	1
Module Supply Voltage	V _{cc}	0		3.6	V	1

Notes:

1. Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device. The device is not intended to be operated under the condition of simultaneous Absolute Maximum Ratings, a condition which may cause irreversible damage to the device.

LRX Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units	Note
Case Operating Temperature	T _{case}	0	25	85	°C	1
Storage Temperature	T _{stg}	-40		85	°C	

Notes:

1. Temperature Range = E

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

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

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