

# SO-SFP-16GFC-LD

SFP+, 16/8/4 Gbps FC/FICON, 1310nm, MM, DDM, 8.9dB, 10km

## OVERVIEW

The SO-SFP-16GFC-LD series single-mode transceiver is small-form-factor pluggable module for bi-directional serial optical data communications such as 16x/8x/4x Fibre Channel. It is with the SFP+ 20-pin connector to allow hot plug capability. This module is designed for single-mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310 nm multiple quantum-well DFB laser and is a Class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and post amplifier IC. The module has a duplex LC optical interface and all mechanical characteristics are compliant with the current SFP+ specification (SFF-8431 and SFF-8432). All SFP modules fulfill the content of the serial EEPROM described in the SFP MSA, Appendix B4, table 3.1, at base data fields (defined as addresses 0 to 63) and extended data fields (defined as addresses 64 to 95). The nominal transmitter output wavelength is stated at the reserved addresses 60-61 according to SFF document SFF-8472 rev 10.5, "Digital Diagnostics Monitoring Interface". Wavelengths stated in the specification are measured in vacuum. All requirements in this specification are valid throughout the specified lifetime and operational environmental temperature range unless otherwise stated. The transceiver modules are compliant to RoHS-6/6

## PRODUCT FEATURES

- Up to 14.025 Gbps data-rates
- Compliant with 16G FC 1600-SM-LC-L
- Compliant with 8G, 4G fibre channel
- 2m up to 10km on 9/125µm SMF
- Duplex LC connector
- Compliant with SFP+ MSA
- Built-in digital diagnostic functions
- Single power supply 3.3V
- RoHS6 compliant
- Class 1 laser product complies with EN 60825-1
- Operating temperature range:
  - Standard: 0°C to 70°C
  - Industrial: -40°C to 85°C
- Power consumption <1.5W

## ORDERING INFORMATION

Part Number	Description
SO-SFP-16GFC-LD	SFP+, 16/8/4 Gbps FC/FICON, 1310nm, MM, DDM, 8.9dB, 10km

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## APPLICATIONS

- 16G/8G/4G Fibre Channel

## GENERAL SPECIFICATIONS

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Data Rate	<i>DR</i>	4.25		14.025+100ppm	Gbps	
Bit Error Rate	<i>BER</i>			10 <sup>-12</sup>		
Operating Temperature	<i>TOP</i>	0		70	°C	Case temperature
		-40		85	°C	Case temperature ind. Temp.
Storage Temperature	<i>TSTO</i>	-40		85	°C	Ambient temperature
Supply Current	<i>IS</i>		350	550	mA	For electrical power interface
Input Voltage	<i>VCC</i>	3.13	3.3	3.45	V	
Maximum Voltage	<i>VMAX</i>	-0.5		3.6	V	For electrical power interface
Total Power Dissipation			1.2	1.5	W/1	

## OPTICAL CHARACTERISTICS – TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Output Optical Power	<i>P<sub>O,AVG</sub></i>	-4		+2	dBm	9/125 μm SMF
Extinction Ratio	<i>ER</i>	3.5			dB	
Optical Modulation Amplitude	<i>P<sub>O,OMA</sub></i>	-2		+2	dBm	
Optical Center Wavelength	<i>λ<sub>c</sub></i>	1295		1325	nm	
Optical Spectrum Width				1	nm	-20 dB width
Side Mode Suppression Ratio	<i>SMSR</i>	30			dB	
Transmitter and dispersion penalty	<i>TDP</i>			4.4	dB	
Relative Intensity noise	<i>RIN</i>			-128	dB/Hz	Peak-to-Peak
Average Launch Power OFF				-30	dBm	

## OPTICAL CHARACTERISTICS – RECEIVER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Optical Receiver Power	<i>P<sub>MAX</sub></i>			2	dBm	Average
Optical Center Wavelength	<i>λ</i>	1260		1565	nm	
Receiver Sensitivity @ 14.25GBps	<i>RX_SENS1</i>			-10.9	dBm	Average Power
Unstressed & average power						BER<10 <sup>-12</sup> , PRBS 27-1
Receiver Sensitivity @ 14.25GBps	<i>RX_SENS2</i>			-12	dBm	OMA
Unstressed & OMA						BER<10 <sup>-12</sup> , PRBS 27-1
Receiver Sensitivity @ 14.25GBps	<i>RX_SENS3</i>			-10.2	μW	BER<10 <sup>-12</sup> , PRBS 2 <sup>7</sup> -1
Stressed						
Loss of Signal-Asserted	<i>PLOS_A</i>			-12	dBm	
Loss of Signal-Deasserted	<i>PLOS_D</i>	-22			dBm	
Loss of Signal-Hysteresis	<i>PLOS_H</i>	1		4	dB	

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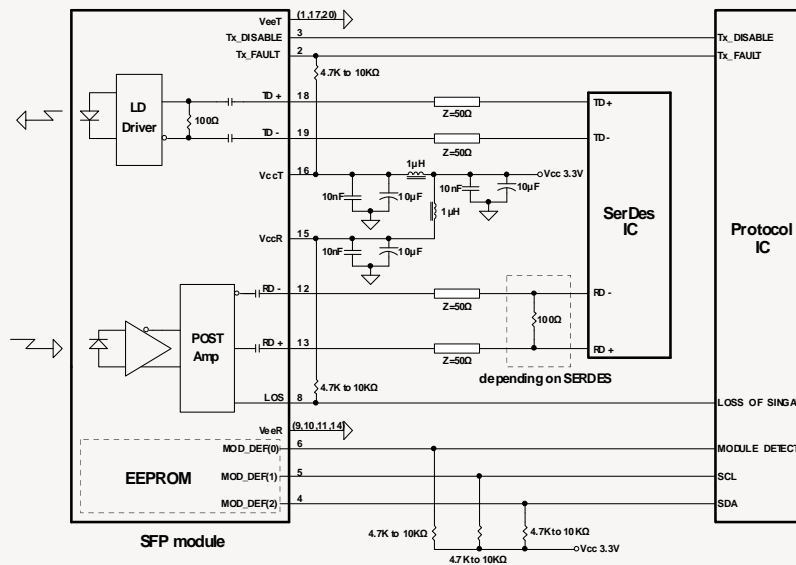
## ELECTRICAL CHARACTERISTICS – HIGH-SPEED SIGNAL INTERFACE (CML)

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input Data Rate		4.25	14.025		Gb/s	
TX Clock Tolerance				±100	ppm	
Differential Input Impedance	<i>RIN</i>		100		Ω	
Differential data input amplitude		150		1200	mVpp	Internally AC coupled
Output Data Rate		4.25	14.025		Gb/s	
RX Clock Tolerance				±100	ppm	
Differential Output Impedance	<i>ROUT</i>		100		Ω	
Differential data output amplitude		350	600	700	mVpp	Internally AC coupled

## ELECTRICAL CHARACTERISTICS – LOW-SPEED SIGNAL INTERFACE (LVTTTL)

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input High Voltage		2.0		VCC+0.3	V	TX-DIS, TX-FAULT
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		Vcc	V	RX-LOS
Output Low Voltage		GND		0.5	V	

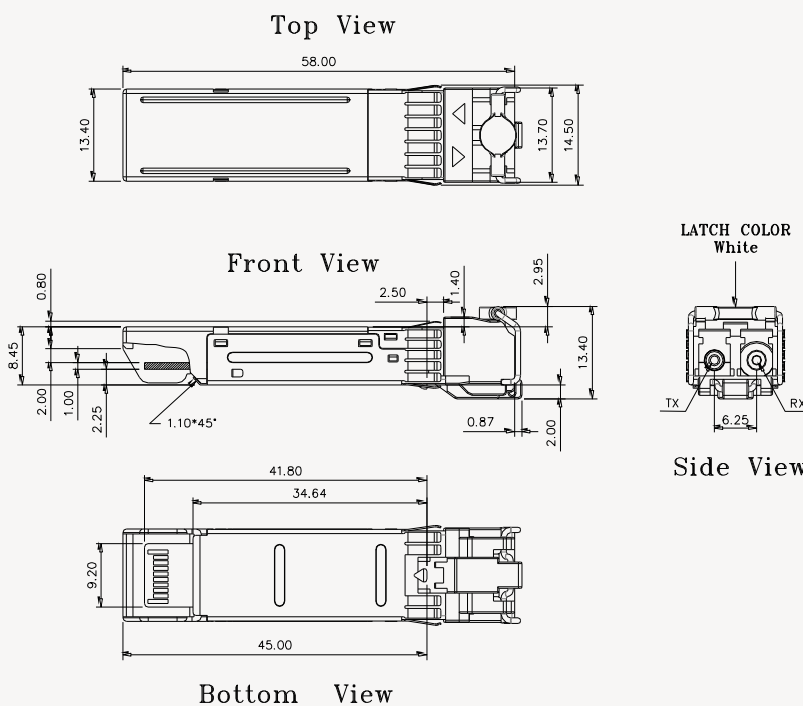
## RECOMMENDED CIRCUIT SCHEMATIC



### PIN FUNCTION DEFINITIONS

PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic "1" Output = Laser Fault. Logic "0" Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic "1" Input (or no connection) = Laser off, Logic "0" = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	V <sub>EE</sub> R	Receiver Signal Ground
5	SDL	Modulation Definition 1 – Two wires serial ID Interface	15	V <sub>CC</sub> R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V <sub>CC</sub> T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	17	V <sub>EE</sub> T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	V <sub>EE</sub> R	Receiver Signal Ground	20	V <sub>EE</sub> T	Transmitter Signal Ground

### MECHANICAL DRAWING



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