

# 8G Fiber Channel SFP+ 1310nm 10km DOM LC MMF Transceiver Module

22R4902-LL



## Application

- 10GBASE-SR/SW Ethernet
- SONET OC-192 / SDH STM-64
- 10G Fibre Channel

## Features

- Supports 8.5 to 11.3Gb/s bit rates
- Hot-Pluggable
- Duplex LC connector
- 1310nm VCSEL transmitter, PIN photo-detector
- Maximum link length of 300m on 2000 MHZ-km MMF
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface
- Power Supply :+3.3V
- Power consumption<1W
- Temperature Range: 0~ 70° C RoHS compliant

## Description

The SFP+ Module is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with SFI specification.

The high performance 1310nmVCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 300m links.

The SFP+ Module compliants with SFF-8431, SFF-8432 and IEEE 802.3ae 10GBASE-SR. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The fully SFP compliant form factor provides hot pluggability, easy optical port upgrades and low EMI emission.

## I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
StorageTemperature	TS	-40		+85	° C
CaseOperatingTemperature	TA	0		70	° C
MaximumSupplyVoltage	Vcc	-0.5		4	V
RelativeHumidity	RH	0		85	%

## II. Electrical Characteristics (TOP = 0 to 70 ° C, VCC = 3.0 to 3.60 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	Vcc	3.135		3.465	V	
SupplyCurrent	Icc			250	mA	
PowerConsumption	P			1	W	
<b>Transmitter Section</b>						
Inputdifferentialimpedance	Rin		100		Ω	1
TxInputSingleEndedDCVoltageTolerance(RefVeeT)	V	-0.3		4	V	
Differentialinputvoltageswing	Vin,pp	180		700	mV	2
TransmitDisableVoltage	VD	2		Vcc	V	3
TransmitEnableVoltage	VEN	Vee		Vee+0.8	V	
<b>Receiver Section</b>						
SingleEndedOutputVoltageTolerance	V	-0.3		4	V	
RxOutputDiffVoltage	Vo	300		850	mV	

<b>RxOutputRiseandFallTime</b>	Tr/Tf	30		ps	4
<b>LOS Fault</b>	VLOS fault	2		VccHOST V	5
<b>LOSNormal</b>	VLOSnorm	Vee		Vee+0.8 V	5

**Note:**

- 1.Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
- 2.Per SFF-8431 Rev 3.0
- 3.Into 100 ohms differential termination.
- 4.20%~80%
- 5.LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.

**III. Optical Parameters(TOP = 0 to 70° C, VCC = 3.00 to 3.60 Volts)**

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Transmitter Section</b>						
<b>CenterWavelength</b>	$\lambda_t$	840	850	860	nm	
<b>RMSspectralwidth</b>	$\lambda_{RMS}$			4	nm	
<b>AverageOpticalPower</b>	Pavg	-6		-1	dBm	1
<b>OpticalPowerOMA</b>	Poma		-1.5		dBm	
<b>LaserOffPower</b>	Poff			-30	dBm	
<b>ExtinctionRatio</b>	ER	3.5			dB	
<b>TransmitterDispersionPenalty</b>	TDP			3.9	dB	2
<b>RelativeIntensityNoise</b>	Rin			-128	dB/Hz	3
<b>OpticalReturnLossTolerance</b>		20			dB	
<b>Receiver Section</b>						
<b>CenterWavelength</b>	$\lambda_r$	790		870	nm	
<b>ReceiverSensitivity(OMA)</b>	Sen			-11.1	dBm	4
<b>StressedSensitivity(OMA)</b>	SenST			-7.5	dBm	4
<b>LosAssert</b>	LOSA	-30		-	dBm	
<b>LosDessert</b>	LOSD			-12	dBm	
<b>LosHysteresis</b>	LOSH	0.5			dB	
<b>Overload</b>	Sat	0			dBm	5
<b>ReceiverReflectance</b>	Rrx			-12	dB	

**Note:**

- 1.Average power figures are informative only, per IEEE802.3ae.
- 2.TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3ae.
- 3.12dB reflection.
- 4.Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
- 5.Receiver overload specified in OMA and under the worst comprehensive stressed condition.

#### IV. Timing Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
<b>TX_DisableAssertTime</b>	t_off			10	us
<b>TX_DisableNegateTime</b>	t_on			1	ms
<b>TimeToInitializeIncludeResetofTX_FAULT</b>	t_int			300	ms
<b>TX_FAULTfromFaulttoAssertion</b>	t_fault			100	us
<b>TX_DisableTimetoStartReset</b>	t_reset	10			us
<b>ReceiverLossofSignalAssertTime</b>	TA,RX_LOS			100	us
<b>ReceiverLossofSignalDeassertTime</b>	Td,RX_LOS			100	us
<b>Rate-SelectChageTime</b>	t_ratesel			10	us
<b>SerialIDClockTime</b>	t_serial-clock			100	kHz

#### V. General Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>BitRate</b>	BR	9.95		11.3	Gb/s	
<b>BitErrorRatio</b>	BER			10-12		

#### Maximum Supported Distances

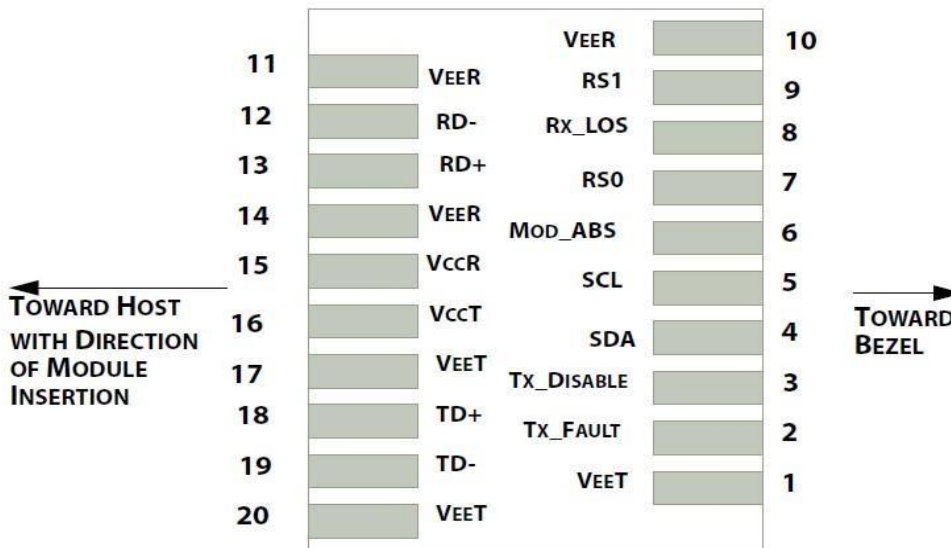
FiberType	1310nm OFLBandwidth	Min.	Typical	Max.	Unit	Note
<b>62.5µm</b>	160MHz-km			26	m	
	OM1200 MHz-km			33	m	
	400MHz-km			66	m	
<b>50µm</b>	OM2500 MHz-km			82	m	
	OM32000 MHz-km			300	m	
	OM34700 MHz-km			500	m	

## VI. Timing Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
<b>TX_DisableAssertTime</b>	t_off			10	us
<b>TX_DisableNegateTime</b>	t_on			1	ms
<b>Time to Initialize Include Reset ofTX_FAULT</b>	t_int			300	ms
<b>TX_FAULTfromFaulttoAssertion</b>	t_fault			100	us
<b>TX_DisableTimetoStartReset</b>	t_reset	10			us
<b>ReceiverLossofSignalAssertTime</b>	TA,RX_LOS			100	us
<b>ReceiverLossofSignalDeassertTime</b>	Td,RX_LOS			100	us
<b>Rate-SelectChageTime</b>	t_ratesel			10	us
<b>SerialIDClockTime</b>	t_serial-clock			100	kHz

## VII. Pin Assignment

Diagram of Host Board Connector Block Pin Numbers and Name



## VIII. Pin Function Definitions

PIN	Logic	Symbol	Name/ Description	Note
<b>1</b>		VeeT	ModuleTransmitterGround	1
<b>2</b>	LVTTTL-O	TX_Fault	ModuleTransmitterFault	2
<b>3</b>	LVTTTL-I	TX_Dis	TransmitterDisable;Turnsofftransmitterlaseroutput	3
<b>4</b>	LVTTTL-I/O	SDA	2-WireSerialInterfaceDataLine	
<b>5</b>	LVTTTL-I	SCL	2-WireSerialInterfaceClock	
<b>6</b>		MOD_DEF0	ModuleDefinition,Groundedinth module	2

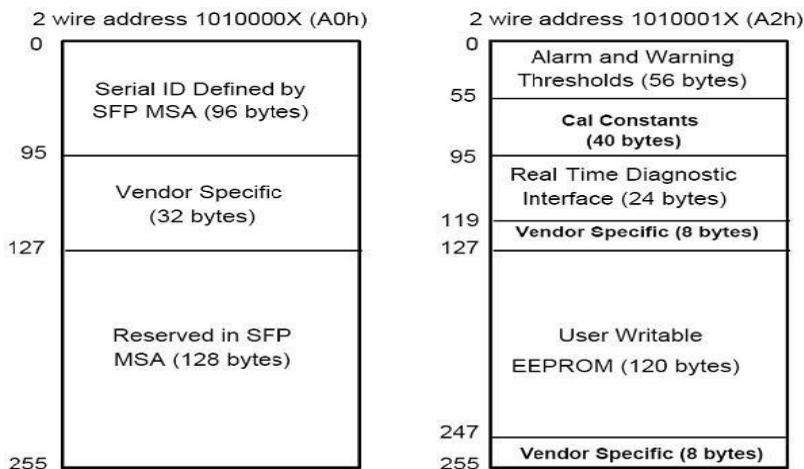
<b>7</b>	LVTTTL-I	RS0	ReceiverRateSelect	
<b>8</b>	LVTTTL-O	RX_LOS	Receiver LossofSignalIndicationActiveLOW	4
<b>9</b>	LVTTTL-I	RS1	TransmitterRateSelect(notused)	
<b>10</b>		VeeR	ModuleReceiver Ground	1
<b>11</b>		VeeR	ModuleReceiver Ground	1
<b>12</b>	CML-O	RD-	ReceiverInvertedDataOutput	
<b>13</b>	CML-O	RD+	ReceiverDataOutput(notused)	
<b>14</b>		VeeR	ModuleReceiver Ground	1
<b>15</b>		VccR	ModuleReceiver 3.3VSupply	
<b>16</b>		VccT	ModuleReceiver 3.3VSupply	
<b>17</b>		VeeT	ModuleTransmitterGround	1
<b>18</b>	CML-I	TD+	TransmitterNon-InvertedDataInput	
<b>19</b>	CML-I	TD-	TransmitterInvertedDataInput	
<b>20</b>		VeeT	ModuleTransmitterGround	1

**Notes:**

- 1.The module ground pins shall be isolated from the module case.
- 2.This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
- 3.This pin shall be pulled up with 4.7K-10Kohms to VccT in the module.
- 4.This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.

## IX. SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I2C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, "Digital Diagnostic Monitoring Interface for Optical Transceivers". The DDM parameters have been internally calibrated.

**Table 1.** Digital Diagnostic Memory Map (Specific Data Field Descriptions)


**Table 2 - EEPROM Serial ID Memory Contents (A0h)**

DataAddress	Length(Byte)	Name ofLength	DescriptionandContents
<b>Base ID Fields</b>			
<b>0</b>	1	Identifier	TypeofSerialtransceiver(03h=SFP)
<b>1</b>	1	Reserved	Extendedidentifieroftypeserialtransceiver(04h)
<b>2</b>	1	Connector	Codeof optical connectortype(07=LC)
<b>3-10</b>	8	Transceiver	10GBase-SR
<b>11</b>	1	Encoding	64B/66B
<b>12</b>	1	BR,Nominal	Nominal baudrate, unitof10km bps
<b>13-14</b>	2	Reserved	(0000h)
<b>15</b>	1	Length(9um)	Linklengthsupportedfor9/125umfiber,unitsof10 km
<b>16</b>	1	Length(50um)	Linklengthsupportedfor50/125umfiber,unitsof10m
<b>17</b>	1	Length(62.5um)	Linklengthsupportedfor62.5/125umfiber,unitsof10m
<b>18</b>	1	Length(Copper)	Linklengthsupportedforcopper,unitsofmeters
<b>19</b>	1	Reserved	
<b>20-35</b>	16	VendorName	SFPvendorname:FS
<b>36</b>	1	Reserved	
<b>37-39</b>	3	VendorOUI	SFPtransceivervendorOUIID
<b>40-55</b>	16	VendorPN	PartNumber:""(ASCII)
<b>56-59</b>	4	Vendorrev	Revisionlevelforpartnumber
<b>60-62</b>	3	Reserved	
<b>63</b>	1	CCID	Leastsignificant byteof sumofdata inaddress0-62
<b>Extended ID Fields</b>			
<b>64-65</b>	2	Option	IndicateswhichopticalSFPsignalsareimplemented(001Ah=LOS,TX_FAULT,TX_DISABLEallsupported)
<b>66</b>	1	BR,max	Upperbitratemargin,unitsof%
<b>67</b>	1	BR,min	Lowerbitratemargin,unitsof%
<b>68-83</b>	16	VendorSN	Serialnumber(ASCII)
<b>84-91</b>	8	Date code	Longline's Manufacturingdatecode
<b>92-94</b>	3	Reserved	
<b>95</b>	1	CCEX	Checkcode fortheextended IDFields (addresses64to 94)
<b>Vendor Specific ID Fields</b>			
<b>96-127</b>	32	Readable	Longline specificdate,readonly
<b>128-255</b>	128	Reserved	ReservedforSFF-8079

## X. Digital Diagnostic Monitor Characteristics)

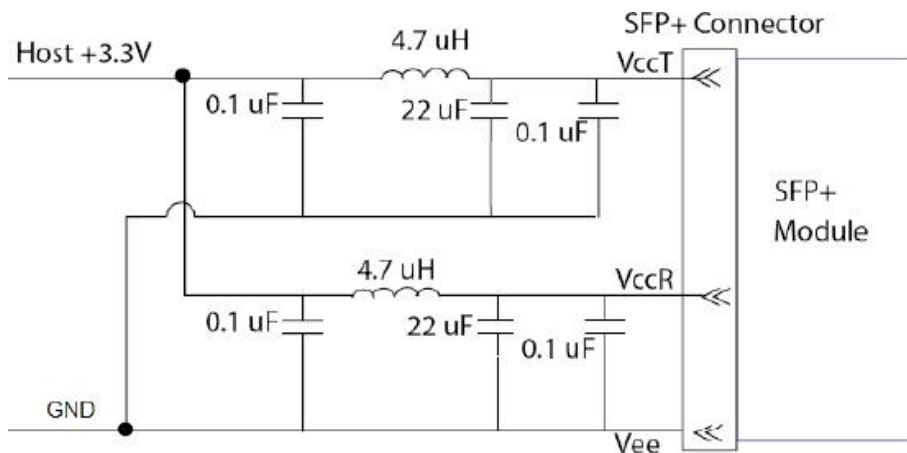
DataAddress	Parameter	Accuracy	Unit
96-97	TransceiverInternalTemperature	± 3.0	° C
98-99	VCC3Internal SupplyVoltage	± 5.0	%
100-101	LaserBias Current	± 10	%
102-103	TxOutput Power	± 3.0	dBm
104-105	RxInput Power	± 3.0	dBm

## XI. Regulatory Compliance

The complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

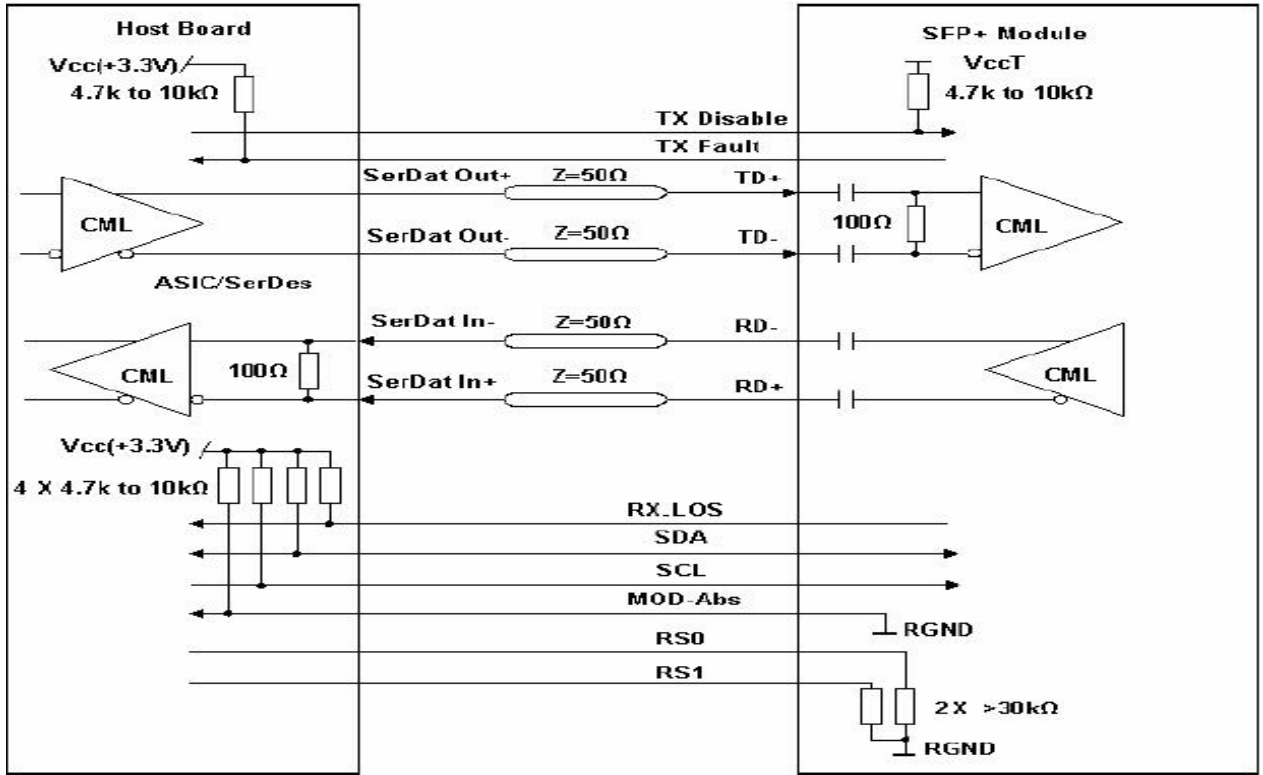
ElectrostaticDischarge(ESD)totheElectricalPin s	MIL-STD-883EMethod3015.7	Class1(>1000V)
ElectrostaticDischarge(ESD)totheDuplexLCRe ceptacle	IEC61000-4-2GR-1089-CORE	Compatiblewithstandards
ElectromagneticInterference(EMI)	FCCPart15ClassBEN55022Class B(CISPR 22B)VCCIClassB	Compatiblewithstandards
LaserEye Safety	FDA21CFR1040.10and 1040.11EN60950,EN(IEC)60825-1,2	CompatiblewithClass1laserproduct.

## XII. Recommended Circuit



Recommended Host Board Power Supply Circuit





Recommended High-speed Interface Circuit

### XIII. Mechanical Dimensions

