



Features

- Data rate 622Mbps
- 1310nm FP laser and PIN photodetector for 15km transmission
- 1310nm DFB laser and PIN photodetector for 40km transmission
- 1550nm uncooled DFB laser and PIN photodetector for 80km transmission
- Digital diagnostic monitor interface compliant with SFF-8472
- SFP MSA package with duplex LC connector
- +3.3V single power supply
- Operating case temperature:
Standard: -5 to +70°C; Industrial -40~+85°C
- RoHS compliant

Regulatory Compliance

Table 1 - Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2	Compliant with standard
Electromagnetic Interference (EMI)	FCC Part 15 Class B	Compliant with standard
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2	Compliant with Class I laser product.
RoHS	2011/65/EU	Compliant with RoHS

Absolute Maximum Ratings

Table 2 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T _s	-40	-	+85	°C	
Supply Voltage	V _{CC}	-0.5	-	+3.6	V	
Operating Relative Humidity	RH	+5	-	+95	%	

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	Standard	T _C	-5	-	+70	°C	
	Industrial		-40	-	+85		
Power Supply Voltage		V _{CC}	3.13	3.3	3.47	V	
Power Supply Current		I _{CC}	-	-	300	mA	
Power Dissipation		P _D	-	-	1	W	
Data Rate				622		Mbps	

Optical Characteristics

Table 4 – Optical Characteristics
SP-12-IR1-CDFM SP-12-IR1-IDFM (1310nm FP and PIN, 15km, Monitoring function)

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	λ _C	1293		1334	nm	
Average Output Power	P _{OUT}	-15		-8	dBm	1
Spectral Width (RMS)	Δλ			4	nm	
Extinction Ratio	EX	8.2			dB	
Jitter Generation (RMS)				0.01	UI	
Jitter Generation (pk-pk)				0.1	UI	
Optical Eye Mask	Compliant with Telcordia GR-253-CORE and ITU-T G.957					2
Receiver						
Centre Wavelength	λ _C	1260		1580	nm	
Receiver Sensitivity	P _{IN}			-28	dBm	3
Receiver Overload	P _{IN}	-8			dBm	3
Optical Path Penalty				1	dB	4
LOS Assert	LOS _A	-42			dBm	
LOS Deassert	LOS _D			-31	dBm	
LOS Hysteresis		0.5		4	dB	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2²³-1 test pattern @622Mbps.
3. Measured with a PRBS 2²³-1 test pattern @622Mbps, BER ≤ 1 × 10⁻¹⁰.
4. Measured with a PRBS 2²³-1 test pattern @622Mbps, over 15km G.652 SMF, BER ≤ 1 × 10⁻¹⁰.

Table 5 – Optical Characteristics
SP-12-LR1-CDFM SP-12-LR1-IDFM (1310nm DFB and PIN, 40km, Monitoring function)

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	λ_C	1280		1335	nm	
Average Output Power	P_{OUT}	-3		+2	dBm	1
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	EX	10			dB	
Jitter Generation (RMS)				0.01	UI	
Jitter Generation (pk-pk)				0.1	UI	
Optical Eye Mask	Compliant with Telcordia GR-253-CORE and ITU-T G.957					2
Receiver						
Centre Wavelength	λ_C	1260		1580	nm	
Receiver Sensitivity	P_{IN}			-28	dBm	3
Receiver Overload	P_{IN}	-8			dBm	3
Optical Path Penalty				1	dB	4
LOS Assert	LOS_A	-42			dBm	
LOS Deassert	LOS_D			-31	dBm	
LOS Hysteresis		0.5		4	dB	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps.
3. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps, BER $\leq 1 \times 10^{-10}$.
4. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps, over 40km G.652 SMF, BER $\leq 1 \times 10^{-10}$.

Table 6 – Optical Characteristics
SP-12-LR2-CDFM SP-12-LR2-IDFM (1550nm DFB and PIN, 80km, Monitoring function)

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	λ_C	1480		1580	nm	
Average Output Power	P_{OUT}	-3		+2	dBm	1
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	EX	10			dB	
Jitter Generation (RMS)				0.01	UI	
Jitter Generation (pk-pk)				0.1	UI	
Optical Eye Mask	Compliant with Telcordia GR-253-CORE and ITU-T G.957					2

Receiver						
Centre Wavelength	λ_C	1260		1580	nm	
Receiver Sensitivity	P_{IN}			-28	dBm	3
Receiver Overload	P_{IN}	-8			dBm	3
Optical Path Penalty				1	dB	4
LOS Assert	LOS_A	-42			dBm	
LOS Deassert	LOS_D			-31	dBm	
LOS Hysteresis		0.5		4	dB	

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps.
3. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps, BER $\leq 1 \times 10^{-10}$.
4. Measured with a PRBS $2^{23}-1$ test pattern @622Mbps, over 80km G.652 SMF, BER $\leq 1 \times 10^{-10}$.

Electrical Characteristics

Table 7 – Electrical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Swing Differential	V_{IN}	500		2400	mV	1
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Tx_DIS Disable	V_D	2.0		V_{CC}	V	
Tx_DIS Enable	V_{EN}	GND		GND+0.8	V	
TX_ Fault (Fault)		2.0		$V_{CC}+0.3$	V	
TX_ Fault (Normal)		0		0.8	V	
Receiver						
Data Output Swing Differential	V_{OUT}	370		2000	mV	1
Rx_LOS Fault	$V_{LOS-Fault}$	2.0		$V_{CC}+0.3$	V	
Rx_LOS Normal	$V_{LOS-Normal}$	GND		GND+0.8	V	

Notes:

1. Internally AC coupled

Recommended Host Board Power Supply Circuit

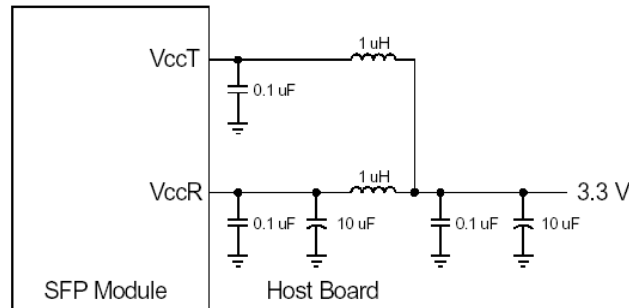


Figure 1, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

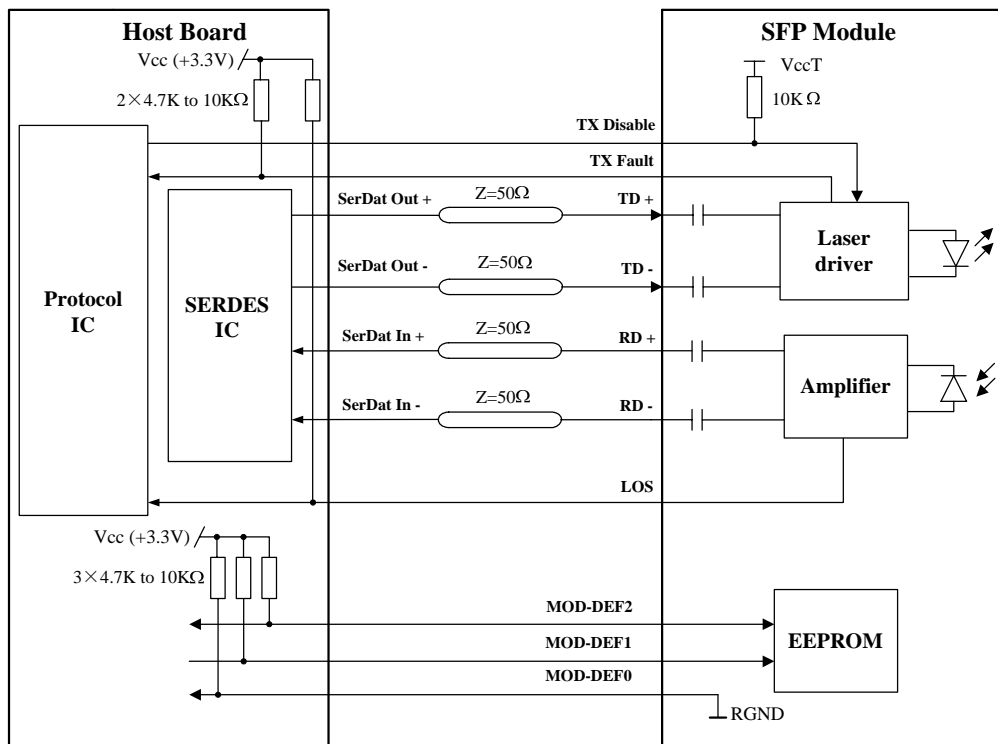


Figure 2, Recommended Interface Circuit

Pin Definitions

Figure 3 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 8 with some accompanying notes.

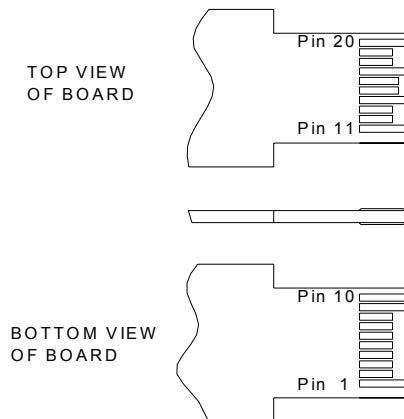


Figure 3, Pin View

Table 8- Pin Function Definitions

Pin No.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2
4	MOD-DEF2	Module Definition 2	3	Note 3
5	MOD-DEF1	Module Definition 1	3	Note 3
6	MOD-DEF0	Module Definition 0	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power	2	
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	VeeT	Transmitter Ground	1	

Notes:

- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:
 Low (0~0.8V): Transmitter on
 (>0.8V, <2.0V): Undefined

- High (2.0~3.465V): Transmitter Disabled
 Open: Transmitter Disabled
3. MOD-DEF 0,1,2 are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
 MOD-DEF 0 is grounded by the module to indicate that the module is present
 MOD-DEF 1 is the clock line of two wires serial interface for serial ID
 MOD-DEF 2 is the data line of two wires serial interface for serial ID
 4. LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates loss of signal. In the low state, the output will be pulled to less than 0.8V.
 5. These are the differential receiver output. They are internally AC-coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES.
 6. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module.

EEPROM Information

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver’s capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 9.

Table 9 - EEPROM Serial ID Memory Contents (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3—10	8	Transceiver	00 xx xx 00 00 00 00 00	OC 12, Single mode inter. or long reach
11	1	Encoding	03	NRZ
12	1	BR, nominal	06	622Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	xx	15km/40km/80km(0F/28/50)
15	1	Length (9um)	xx	15km/40km/80km(96/FF/FF)
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
20—35	16	Vendor name	53 4F 55 52 43 45 50 48 4F 54 4F 4E 49 43 53 20	“SOURCEPHOTONICS”(ASC II)
36	1	Reserved	00	
37—39	3	Vendor OUI	00 1F 22	

40—55	16	Vendor PN	53 50 31 32 xx xx xx xx 44 46 4D 20 20 20 20 20	“SP12xxxxDFM” (ASC II)
56—59	4	Vendor rev	xx xx 20 20	ASC II (“31 30 20 20” means 1.0 revision)
60-61	2	Wavelength	05 1E/06 0E	1310nm/1550nm
62	1	Reserved	00	
63	1	CC BASE	xx	Check sum of bytes 0 - 62
64—65	2	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
66	1	BR, max	00	
67	1	BR, min	00	
68—83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASC II ,
84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92	1	Diagnostic type	58	Diagnostics(Ext.Cal)
93	1	Enhanced option	B0	Diagnostics (Optional Alarm/warning flags, Soft TX_FAULT and Soft TX_LOS monitoring)
94	1	SFF-8472	02	Diagnostics(SFF-8472 Rev 9.4)
95	1	CC EXT	xx	Check sum of bytes 64 - 94
96—255	160	Vendor specific		

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFF-8472 Rev 9.5.

Monitoring Specification

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X (A2h). Please see Figure 4. For detail EEPROM information, please refer to the related document of SFF-8472 Rev 9.5. The monitoring specification of this product is described in Table 10.

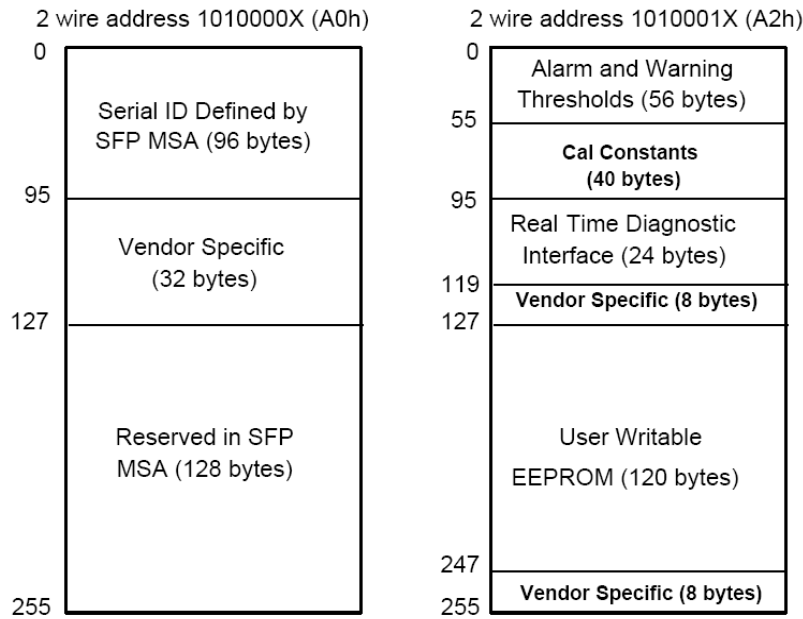


Figure 4, EEPROM Memory Map Specific Data Field Descriptions

Table 10- Monitoring Specification

Parameter		Range	Accuracy	Calibration
Temperature	Standard Temp.	-10 to 80°C	±3°C	External
	Industrial Temp.	-40 to 95°C		
Voltage		3.0 to 3.6V	±3%	External
Bias Current		0 to 100mA	±10%	External
TX Power	SP-12-IR1-CDFM SP-12-IR1-IDFM	-16 to -7 dBm	±3dB	External
	SP-12-LR1-CDFM SP-12-LR1-IDFM	-4 to +3 dBm		
	SP-12-LR2-CDFM SP-12-LR2-IDFM	-4 to +3 dBm		
RX Power	SP-12-IR1-CDFM SP-12-IR1-IDFM	-30 to -7 dBm	±3dB	External
	SP-12-LR1-CDFM SP-12-LR1-IDFM	-30 to -7 dBm		
	SP-12-LR2-CDFM SP-12-LR2-IDFM	-30 to -7 dBm		

Mechanical Diagram

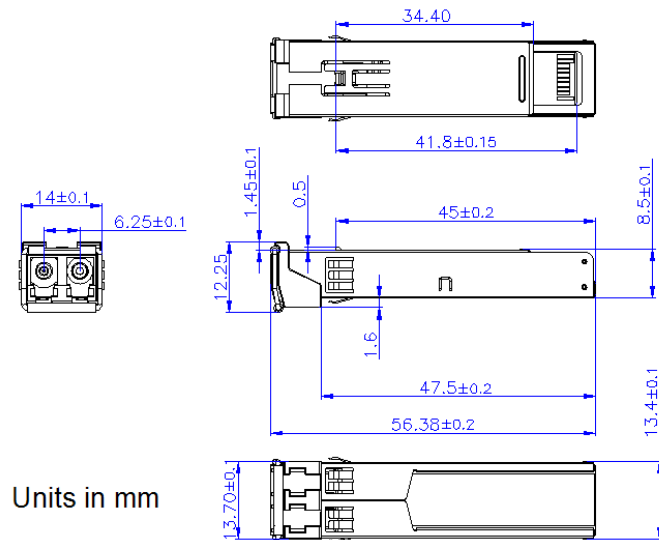


Figure 5, Mechanical Design Diagram of the SFP

Order Information

Table 11 – Order Information

Part No.	Temperature	Application	Data Rate	Laser Source	Fiber Type
SP-12-IR1-CDFM	-5 to +70°C	SDH STM-4, S-4.1	622Mbps	1310nm FP	SMF
SP-12-IR1-IDFM	-40~+85°C	SONET OC-12 IR1			
SP-12-LR1-CDFM	-5 to +70°C	SDH STM-4, L-4.1	622Mbps	1310nm DFB	SMF
SP-12-LR1-IDFM	-40~+85°C	SONET OC-12 LR1			
SP-12-LR2-CDFM	-5 to +70°C	SDH STM-4, L-4.2	622Mbps	1550nm DFB	SMF
SP-12-LR2-IDFM	-40~+85°C	SONET OC-12 LR2			

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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