Features

- Date 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℃; 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	2002/95/EC 4.1&4.2 2005/747/EC	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_{0UT}	-15		-8	dBm	1
Spectral Width (RMS)	$\Delta\lambda$			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 2^{23}-1 test pattern @622Mbps.
3. Measured with a PRBS 2^{23}-1 test pattern @622Mbps, BER $\leqslant 1\times10^{-10}$.
4. Measured with a PRBS 2^{23}-1 test pattern @622Mbps, over 15km G.652 SMF, BER $\leqslant 1\times10^{-10}$.

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_{0UT}	-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 $\leqslant 1\times10^{-10}$.
4. Measured with a PRBS 2^{23}-1 test pattern @622Mbps, over 40km G.652 SMF, BER $\leqslant 1\times10^{-10}$.

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_{0UT}	-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 $\leqslant 1\times10^{-10}$.
4. Measured with a PRBS 2^{23}-1 test pattern @622Mbps, over 80km G.652 SMF, BER $\leqslant 1\times10^{-10}$.

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		Vcc+0.3	V	
TX_ Fault (Normal)		0		0.8	V	
Receiver						
Data Output Swing Differential	V_{OUT}	370		2000	mV	1
Rx_LOS Fault	$V_{LOS\text{-}Fault}$	2.0		Vcc+0.3	V	
Rx_LOS Normal	$V_{LOS\text{-}Normal}$	GND		GND+0.8	V	

Notes:

1. Internally AC coupled

Recommended Host Board Power Supply Circuit

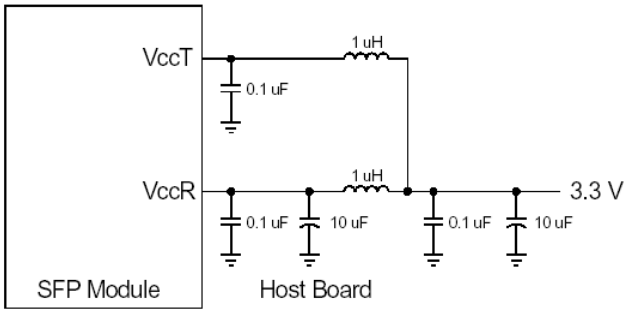

Figure 1, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

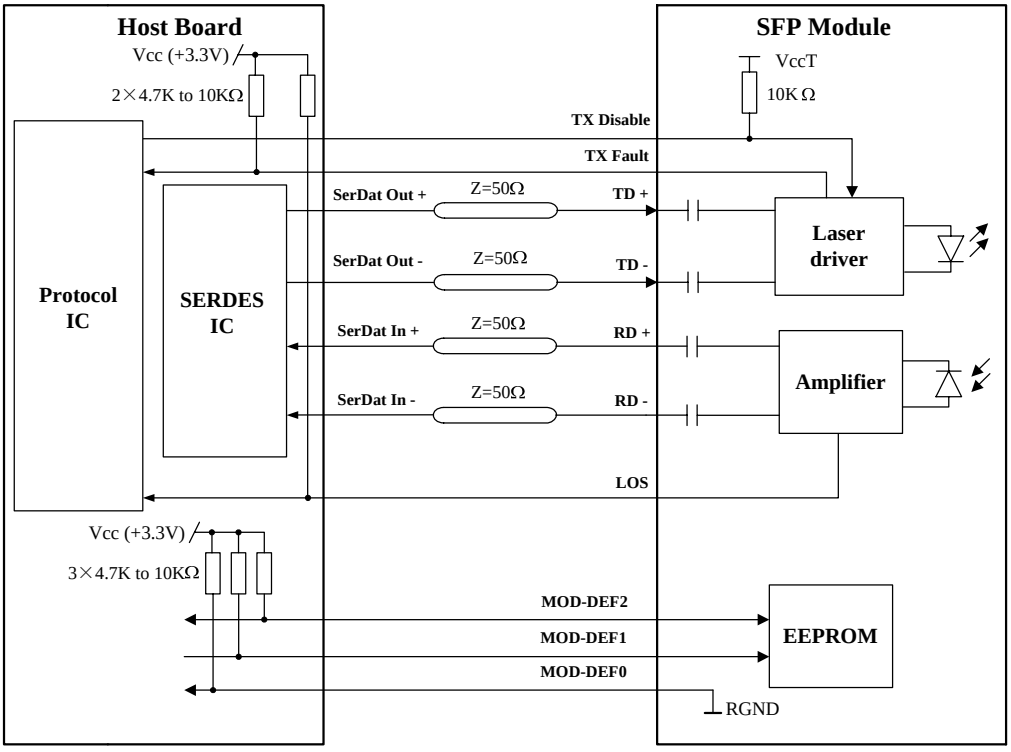

Figure 2, Recommended Interface Circuit

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.

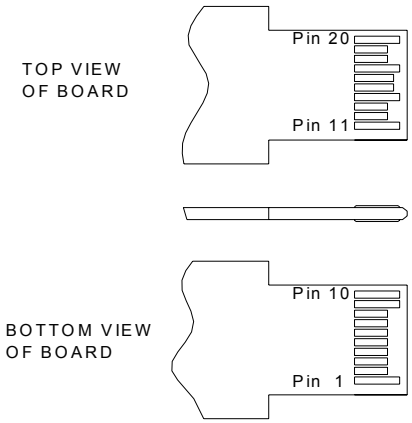

Figure 3, Pin View

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:

1. 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.
2. 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"(ASCⅡ)
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” (ASCⅡ)
56—59	4	Vendor rev	xx xx 20 20	ASCⅡ(“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	ASCⅡ,
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.

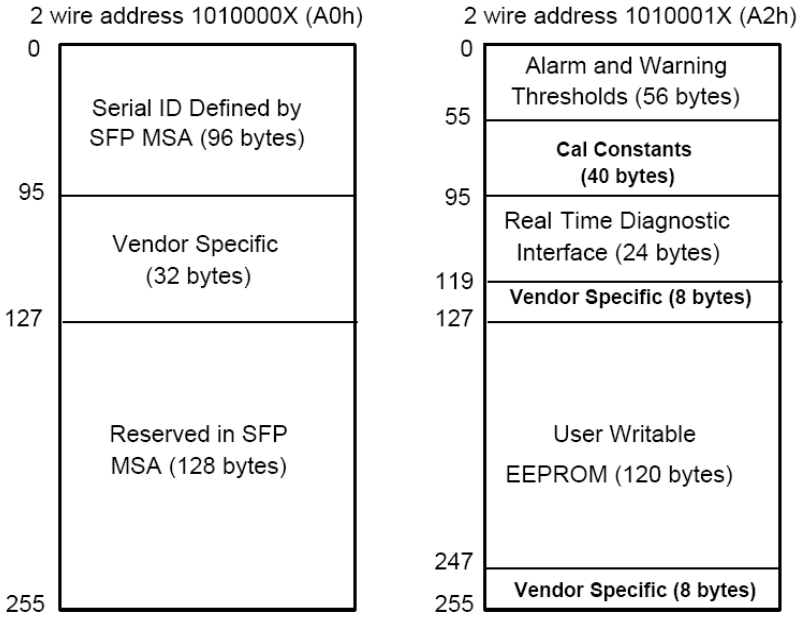

Figure 4, EEPROM Memory Map Specific Data Field Descriptions

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

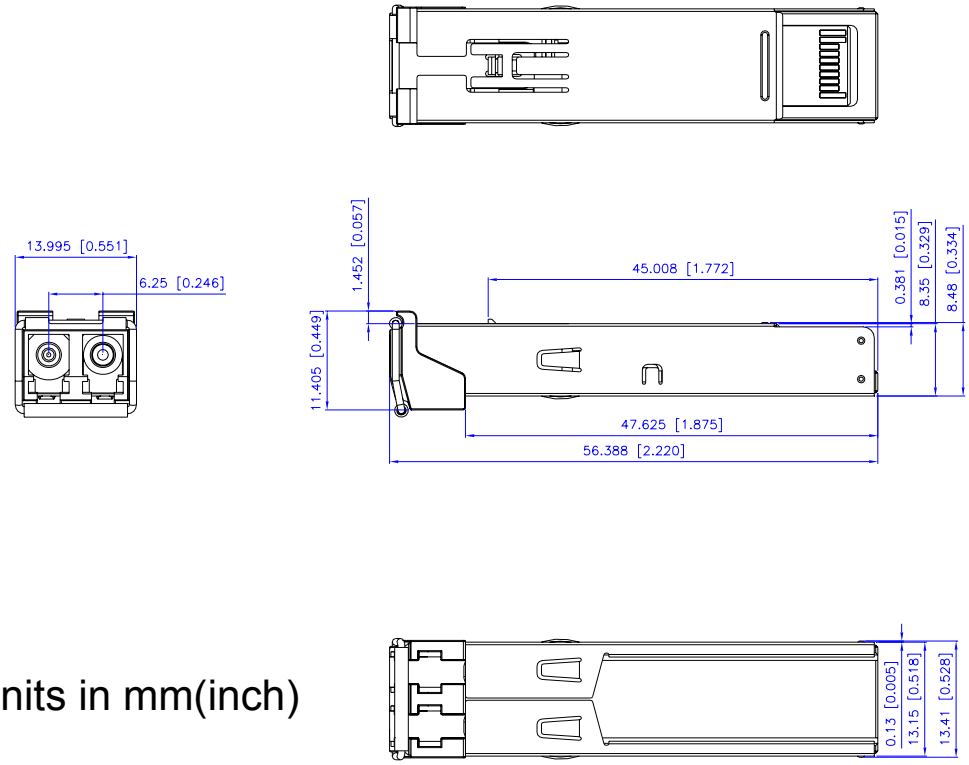

Figure 5, Mechanical Design Diagram of the SFP

Order Information

Table 11 – Order Information

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

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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