

### Features



- 1.25Gbps bi-directional data links
- 80km transmission distance with 9/125  $\mu\text{m}$  SMF
- 1550nm un-cooled DFB laser
- PIN photodiode receiver
- Class I laser product
- Digital diagnostic monitor interface Compatible with SFF-8472
- SFP MSA package with duplex LC receptacle
- Very low EMI and excellent ESD protection
- Single 3.3V power supply
- Operating case temperature:  
Standard: -5 to +70°C  
Industrial: -40 to +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 standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B	Compliant with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2	Compliant with Class I laser product.
RoHS	2011/65/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	SP-GB-ZX-CDFC	$T_c$	-5		+70	°C	
	SP-GB-ZX-IDFC		-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				1.25		Gbps	

## Optical Characteristics

**Table 4 – Optical Characteristics**

Transmitter							
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
Centre Wavelength	$\lambda_c$	1500	1550	1580	nm		
Average Output Power	$P_{Out}$	0		+5	dBm	1	
$P_{Out}$ @TX Disable Asserted	$P_{Out}$			-45	dBm	1	
Spectral Width (-20dB)	$\sigma$			1	nm		
Side Mode Suppression Ratio	SMSR	30			dB		
Extinction Ratio	EX	9			dB		
Rise/Fall Time (20%~80%)	$t_r/t_f$			0.26	ns	2	
Total Jitter	TJ			0.481	UI	3	
Deterministic Jitter	DJ			0.25	UI	3	
Output Optical Eye	IEEE 802.3z and ANSI Fibre Channel Compatible						4
Receiver							
Centre Wavelength	$\lambda_c$	1260		1580	nm		
Receiver Sensitivity				-23	dBm	5	
Receiver Overload		-3			dBm		
Return Loss		12			dB		
LOS De-Assert	$LOS_D$			-23	dBm		
LOS Assert	$LOS_A$	-37			dBm		
LOS Hysteresis		0.5		5	dB		

Notes:

1. The optical power is launched into SMF.
2. Unfiltered, measured with a PRBS  $2^7-1$  test pattern @1.25Gbps
3. Measured with a PRBS  $2^7-1$  test pattern@1.25Gbps, meet the specified maximum output jitter requirements if the specified maximum input jitter is present.
4. Measured with a PRBS  $2^7-1$  test pattern @1.25Gbps.
5. Measured with a PRBS  $2^7-1$  test pattern @1.25Gbps, extinction ratio ER=9dB, BER  $\leq 1 \times 10^{-12}$

## Electrical Characteristics

Table 5 – 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	$\Omega$	
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:

- Internally AC coupled

## Recommended Host Board Power Supply Circuit

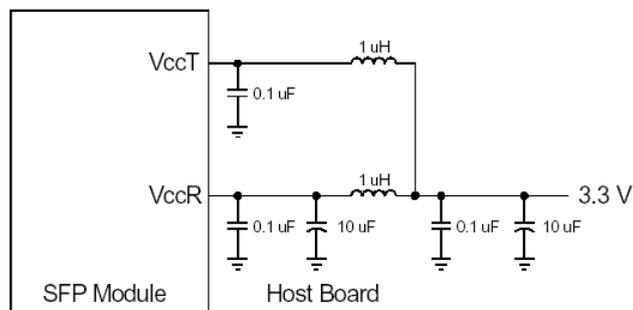


Figure 1, Recommended Host Board Power Supply Circuit

### Recommended Interface Circuit

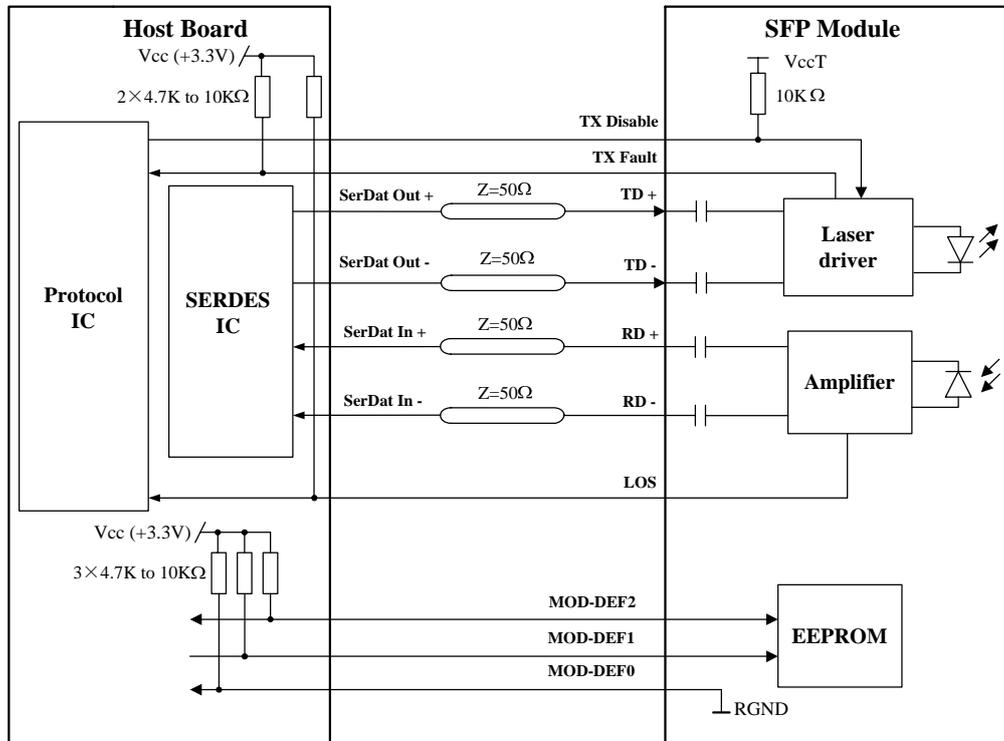


Figure 2, Recommended Interface Circuit

### Pin Definitions

Figure 3 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 6 with some accompanying notes.

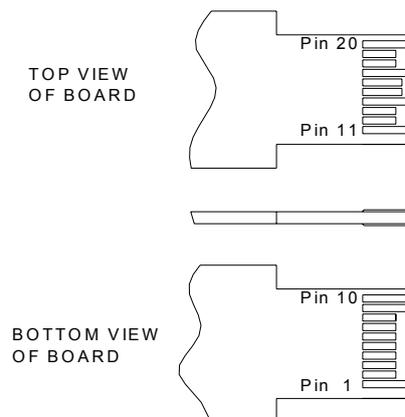


Figure 3, Pin View

Table 6 - 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
- 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
- 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.
- 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.
- 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 7.

Table 7 - 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 00 00 02 12 00 01 01	1000BASE-LX, long distance (L); Longwave laser (LC)
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	50	80km
15	1	Length (9um)	FF	80km
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 47 42 5A 58 xx 44 46 43 20 20 20 20 20 20	"SPGBZXxDFC" (ASC II)
56—59	4	Vendor rev	31 30 20 20	ASC II ("31 30 20 20" means 1.0 revision)
60-61	2	Wavelength	06 0E	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 (External. Cal)
93	1	Enhanced	B0	Diagnostics(Optional Alarm/warning flags,

		option		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 8.

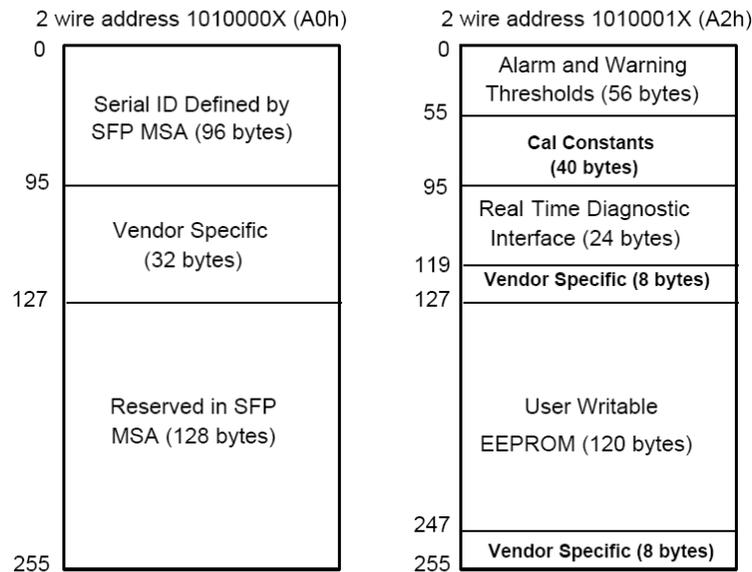


Figure 4, EEPROM Memory Map Specific Data Field Descriptions

Table 8 - Monitoring Specification

Parameter		Range	Accuracy	Calibration
Temperature	SP-GB-ZX-CDFC	-10 to +80°C	±3°C	External
	SP-GB-ZX-IDFC	-40 to +95°C	±3°C	External
Voltage		3.135 to 3.465V	±3%	External
Bias Current		3 to 60mA	±10%	External
TX Power		0 to +5dBm	±3dB	External
RX Power		-23 to -3dBm	±3dB	External

## Mechanical Diagram

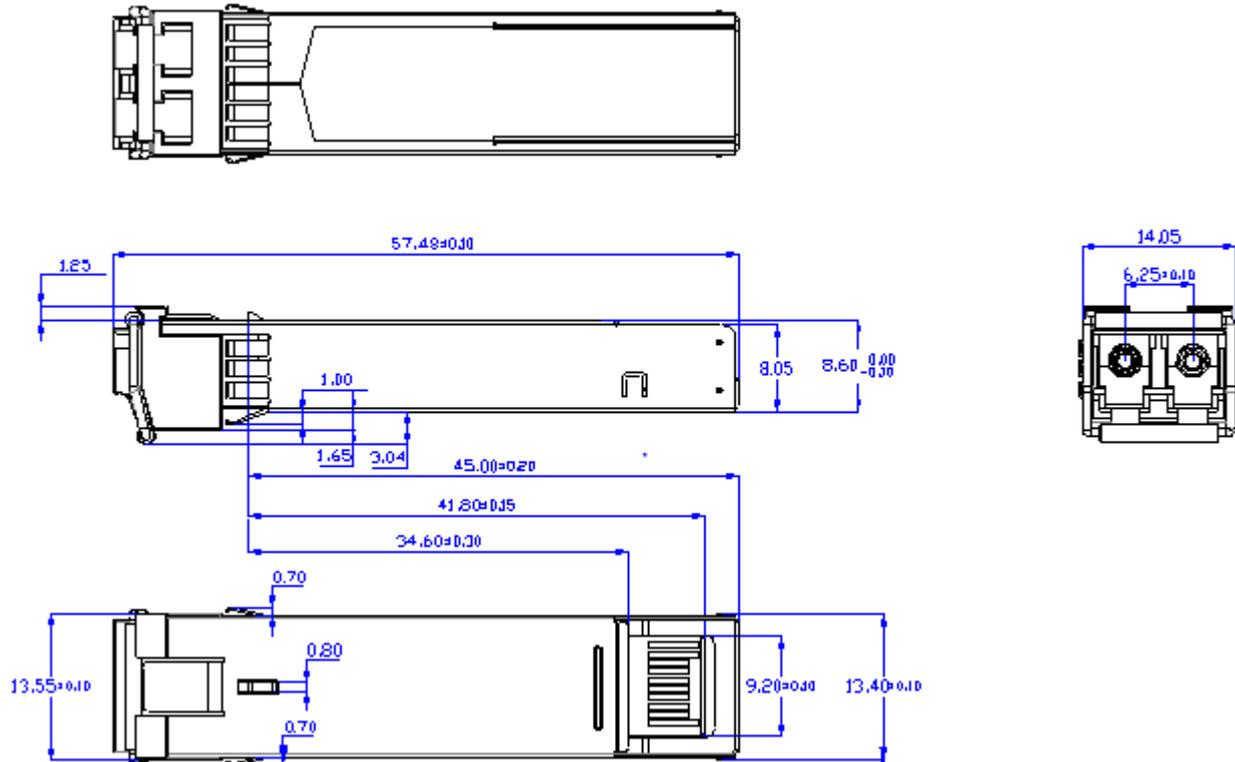


Figure 5, Mechanical Design Diagram of the SFP

## Order Information

Table 9 – Order Information

Part No.	Case Temperature	Application	Data Rate	Laser Source	Fiber Type
SP-GB-ZX-CDFC	-5 to 70°C	1000BASE-ZX	1.25Gbps	1550nm DFB	SMF
SP-GB-ZX-IDFC	-40 to 85°C	1000BASE-ZX	1.25Gbps	1550nm DFB	SMF

## 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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