

### Features

- 1.25Gb/s bi-directional data links
- Up to 40km point-point transmission
- 1310nm DFB transmitter and 1550nm PIN receiver for SPL-35-GB-BD-xDFM
- 1550nm DFB transmitter and 1310nm PIN receiver for SPL-53-GB-BD-xDFM
- Digital diagnostic monitor interface compatible with SFF-8472
- SFP MSA package with single LC receptacle
- +3.3V single power supply
- Operating case temperature:  
Industrial: -40~+85°C; Standard: -5~+70°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	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2	Compatible 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 <sub>s</sub>	-40	-	+85	°C	
Supply Voltage	V <sub>CC</sub>	0	-	+4	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	Industrial	T <sub>C</sub>	-40	-	+85	°C	
	Standard		-5		+70	°C	
Power Supply Voltage		V <sub>CC</sub>	3.13	3.3	3.47	V	
Power Supply Current		I <sub>CC</sub>	-	-	300	mA	
Data Rate				1.25		Gbps	

## Optical Characteristics

Table 4 – Optical Characteristics: SPL-35-GB-BD-xDFM

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	λ <sub>C</sub>	1260	1310	1360	nm	
Average Output Power	P <sub>OUT</sub>	-5	-2.5	0	dBm	1
Average Launch Power of OFF Transmitter				-45	dBm	
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	EX	9			dB	
Optical Eye Mask	ITU-T G.957 Compatible					2
Receiver						
Centre Wavelength	λ <sub>C</sub>	1500	1550	1600	nm	
Receiver Sensitivity	P <sub>IN</sub>			-24	dBm	3
Receiver Overload	P <sub>IN</sub>	-3			dBm	3
LOS Assert	LOS <sub>A</sub>	-45			dBm	
LOS Deassert	LOS <sub>D</sub>			-24	dBm	
LOS Hysteresis		0.5		4	dB	

Notes:

1. The optical power is launched into SMF
2. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1.25Gbps.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern@1.25Gbps, BER ≤ 1 × 10<sup>-12</sup>

**Table 5 – Optical Characteristics: SPL-53-GB-BD-xDFM**

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	$\lambda_C$	1500	1550	1600	nm	
Average Output Power	$P_{OUT}$	-5	-2.5	0	dBm	1
Average Launch Power of OFF Transmitter				-45	dBm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	EX	9			dB	
Rise/Fall Time (20%~80%)	$t_r / t_f$			0.18	ns	
Relative Intensity Noise	$RIN_{12OMA}$			-117	dB/Hz	
Jitter Generation (RMS)				0.007	UI	
Jitter Generation (pk-pk)				0.07	UI	
Optical Eye Mask	ITU-T G.957 Compatible					2
Receiver						
Centre Wavelength	$\lambda_C$	1260	1310	1360	nm	
Receiver Sensitivity	$P_{IN}$			-24	dBm	3
Receiver Overload	$P_{IN}$	-3			dBm	3
LOS Assert	$LOS_A$	-45			dBm	
LOS Deassert	$LOS_D$			-24	dBm	
LOS Hysteresis		0.5		4	dB	

Notes:

1. The optical power is launched into SMF
2. Measured with a PRBS  $2^7-1$  test pattern @1.25Gbps.
3. Measured with a PRBS  $2^7-1$  test pattern@1.25Gbps,  $BER \leq 1 \times 10^{-12}$

## Electrical Characteristics

**Table 6 – Electrical Characteristics**

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Swing Differential	$V_{IN}$	500		2400	mV	1
T_init time				300	ms	
Input Differential Impedance	$Z_{IN}$	80	100	120	$\Omega$	
Tx_DIS Disable	$V_D$	2.4		$V_{CC}$	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 <sub>OUT</sub>	370		1600	mV	1
Rx_LOS Fault	V <sub>LOS-Fault</sub>	2.0		Vcc+0.3	V	
Rx_LOS Normal	V <sub>LOS-Normal</sub>	GND		GND+0.8	V	

Notes:

- Internally AC coupled

### Recommended Host Board Power Supply Circuit

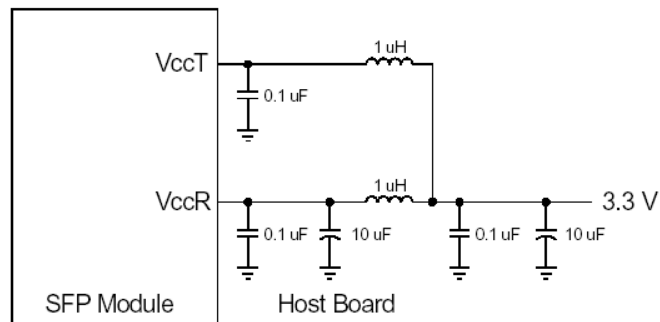


Figure 1, Recommended Host Board Power Supply Circuit

### Recommended Interface Circuit

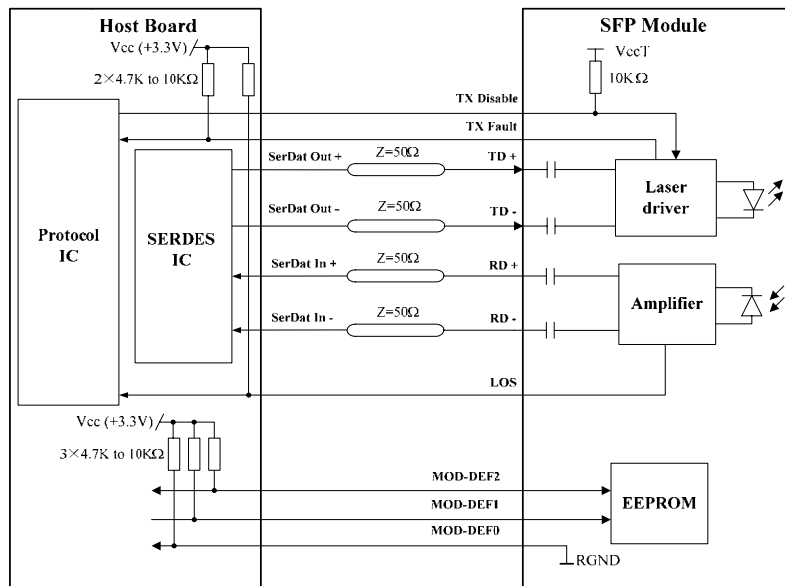


Figure 2, Recommended Interface Circuit

### Pin Definitions

Figure 3 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table 7 with some accompanying notes.

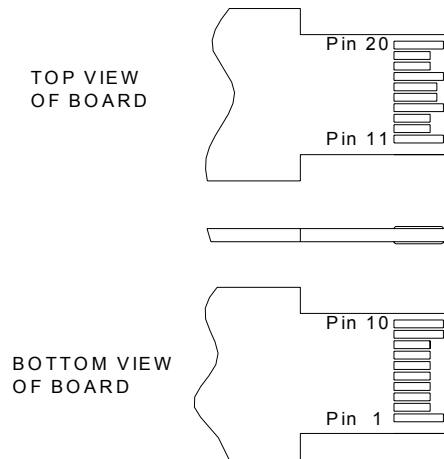


Figure 3, Pin View

Table 7 - 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	
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**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 8.

**Table 8 - 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 40 00 00 00 00	1.25 Gbps
11	1	Encoding	01	
12	1	BR, nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	28	40km

15	1	Length (9um)	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	xx	“SPL-35/53-GB-BD-xDFM” (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	05 1E/06 0E	1310/1550nm
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 30 31	Year(2 bytes), Month(2 bytes), Day (2 bytes)
92	1	Diagnostic type	58	Diagnostics(External Calibration)
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 9.5)
95	1	CC EXT	xx	Check sum of bytes 64 - 94
96-127	32	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.

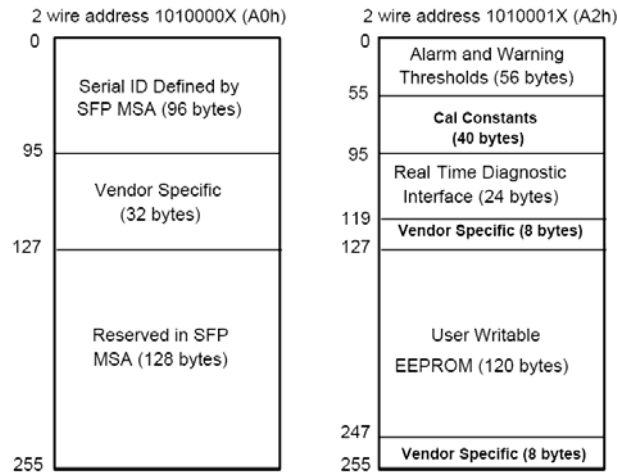


Figure 4, EEPROM Memory Map Specific Data Field Descriptions

Table 10- Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	Industrial	-40 to + 90°C	±3°C
	Standard	-10 to 80°C	±3°C
Voltage	2.97 to 3.63V	±3%	External
Bias Current	3mA to 80mA	±10%	External
TX Power	-5 to 0dBm	±3dB	External
RX Power	-24to -3dBm	±3dB	External

### Mechanical Diagram

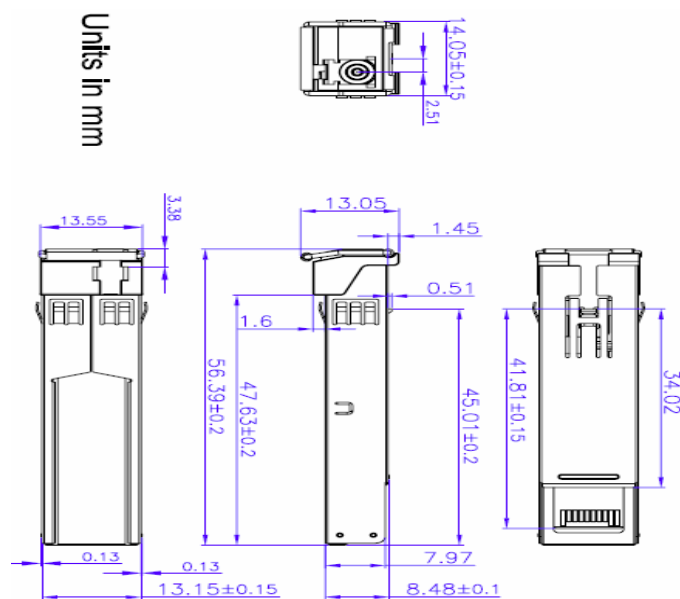


Figure 5, Mechanical Design Diagram of the SFP with Spring-Latch

## Order Information

**Table 11 – Order Information**

Part No.	Data Rate	Laser Source	Fiber Type
SPL-35-GB-BD-xDFM	1.25G	1310nm DFB Tx/1550nm PIN Rx	SMF
SPL-53-GB-BD-xDFM	1.25G	1550nm DFB Tx/1310nm PIN Rx	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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