



## Features

- 1.25Gbps bi-directional data links
- Up to 10km point-point transmission
- 1310nm FP transmitter and 1490nm PIN receiver for SPL-34-GB-BX-CDFM
- 1490nm DFB transmitter and 1310nm PIN receiver for SPL-43-GB-BX-CDFM
- Digital diagnostic monitor interface compatible with SFF-8472
- SFP MSA package with single LC receptacle
- +3.3V single power supply
- Power consumption less than 1W
- Operating case temperature: -5~+70°C
- RoHS compliant

## Regulatory Compliance

Table 1 - Regulatory Compliance

| Feature   | Standard  | Performance                            |
|---|---|--|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E<br>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<br>EN (IEC) 60825-1,2 | Compatible 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 <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 | $T_C$    | -5   | -       | +70  | °C   |       |
| Power Supply Voltage       | $V_{CC}$ | 3.13 | 3.3     | 3.47 | V    |       |
| Power Supply Current       | $I_{CC}$ | -    | -       | 300  | mA   |       |
| Data Rate                  |          |      | 1.25    |      | Gbps |       |

## Optical Characteristics

**Table 4 – Optical Characteristics: SPL-34-GB-BX-CDFM**

| Transmitter              |                         |                 |         |       |      |       |
|--------------------------|-------------------------|-----------------|---------|-------|------|-------|
| Parameter                | Symbol                  | Min.            | Typical | Max.  | Unit | Notes |
| Centre Wavelength        | $\lambda_C$             | 1260            | 1310    | 1360  | nm   |       |
| Average Output Power     | $P_{OUT}$               | -9              | -6      | -3    | dBm  | 1     |
| Spectral Width (RMS)     | 1260nm                  | $\Delta\lambda$ |         | 2.09  | nm   |       |
|                          | 1270nm                  |                 |         | 2.52  |      |       |
|                          | 1280nm                  |                 |         | 3.13  |      |       |
|                          | 1286nm                  |                 |         | 3.50  |      |       |
|                          | 1343nm                  |                 |         | 3.06  |      |       |
|                          | 1350nm                  |                 |         | 2.58  |      |       |
|                          | 1360nm                  |                 |         |       |      |       |
| Extinction Ratio         | EX                      | 6               |         |       | dB   |       |
| Rise/Fall Time (20%~80%) | $t_r / t_f$             |                 |         | 0.26  | ns   |       |
| Deterministic Jitter     | DJ                      |                 |         | 200   | ps   |       |
| Total Jitter             | TJ                      |                 |         | 385   | ps   |       |
| Optical Eye Mask         | IEEE 802.3ah Compatible |                 |         |       |      | 2     |
| Receiver                 |                         |                 |         |       |      |       |
| Centre Wavelength        | $\lambda_C$             | 1480            | 1490    | 1500  | nm   |       |
| Receiver Sensitivity     | $P_{IN}$                |                 |         | -19.5 | dBm  | 3     |
| Receiver Overload        | $P_{IN}$                | -3              |         |       | dBm  | 3     |
| LOS Assert               | $LOS_A$                 | -35             |         |       | dBm  |       |
| LOS Deassert             | $LOS_D$                 |                 |         | -20   | dBm  |       |
| LOS Hysteresis           |                         | 0.5             |         | 5     | 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,  $BER \leq 1 \times 10^{-12}$

**Table 5 – Optical Characteristics: SPL-43-GB-BX-CDFM**

| Transmitter                 |                         |      |         |       |      |       |
|-----------------------------|-------------------------|------|---------|-------|------|-------|
| Parameter                   | Symbol                  | Min. | Typical | Max.  | Unit | Notes |
| Centre Wavelength           | $\lambda_C$             | 1480 | 1490    | 1500  | nm   |       |
| Average Output Power        | $P_{OUT}$               | -9   | -6      | -3    | dBm  | 1     |
| Spectral Width (-20dB)      | $\Delta\lambda$         |      |         | 0.88  | nm   |       |
| Side Mode Suppression Ratio | SMSR                    | 30   |         |       | dB   |       |
| Extinction Ratio            | EX                      | 6    |         |       | dB   |       |
| Rise/Fall Time (20%~80%)    | $t_r / t_f$             |      |         | 0.26  | ns   |       |
| Deterministic Jitter        | DJ                      |      |         | 200   | ps   |       |
| Total Jitter                | TJ                      |      |         | 385   | ps   |       |
| Optical Eye Mask            | IEEE 802.3ah Compatible |      |         |       |      | 2     |
| Receiver                    |                         |      |         |       |      |       |
| Centre Wavelength           | $\lambda_C$             | 1260 | 1310    | 1360  | nm   |       |
| Receiver Sensitivity        | $P_{IN}$                |      |         | -19.5 | dBm  | 3     |
| Receiver Overload           | $P_{IN}$                | -3   |         |       | dBm  | 3     |
| LOS Assert                  | $LOS_A$                 | -35  |         |       | dBm  |       |
| LOS Deassert                | $LOS_D$                 |      |         | -20   | dBm  |       |
| LOS Hysteresis              |                         | 0.5  |         | 5     | 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     |
| Input Differential Impedance   | $Z_{IN}$  | 80   | 100     | 120      | $\Omega$ |       |
| 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  |         | Vcc+0.3  | V        |       |
| TX_ Fault (Normal)             |           | 0    |         | 0.8      | V        |       |
| Receiver                       |           |      |         |          |          |       |
| Data Output Swing Differential | $V_{OUT}$ | 370  |         | 1600     | mV       | 1     |

|               |                         |     |  |                      |   |  |
|---------------|-------------------------|-----|--|----------------------|---|--|
| Rx_LOS Fault  | V <sub>LOS-Fault</sub>  | 2.0 |  | V <sub>cc</sub> +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

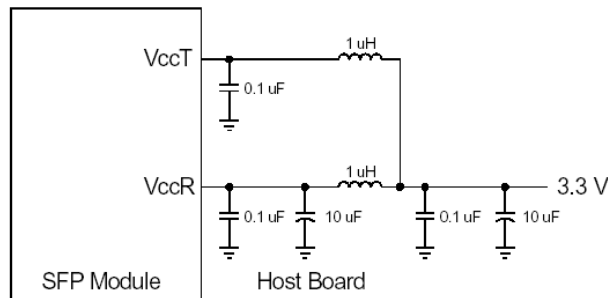


Figure 1, Recommended Host Board Power Supply Circuit

### Recommended Interface Circuit

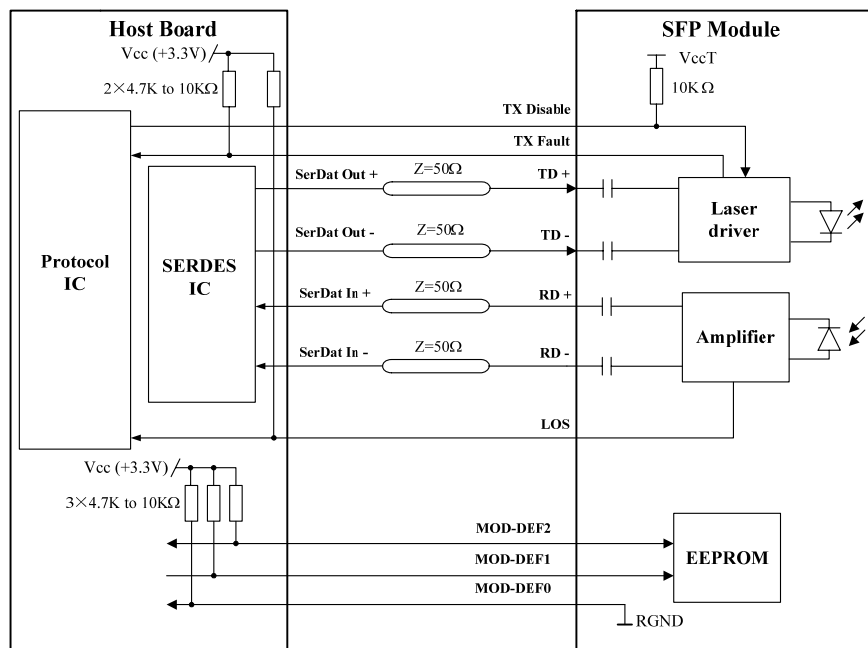


Figure 2, Recommended Interface Circuit

### 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.

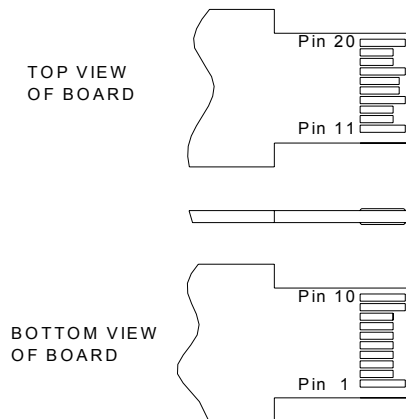


Figure 3, Pin View

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         |        |

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 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 | Transmitter Code |
| 11    | 1                  | Encoding        | 01                      | 8B10B            |
| 12    | 1                  | BR, nominal     | 0D                      | 1.25Gbps         |
| 13    | 1                  | Reserved        | 00                      |                  |
| 14    | 1                  | Length (9um)-km | 0A                      | 10km             |
| 15    | 1                  | Length (9um)    | 64                      | 10 km            |
| 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<br>4F 54 4F 4E49 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 4C xx xx 47 42 42<br>58 43 44 46 4D 20 20 20 | SPL34GBBXCDFM<br>SPL43GBBXCDFM   |
| 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/05 D2  | 1310/1490nm  |
| 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<br>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 9.



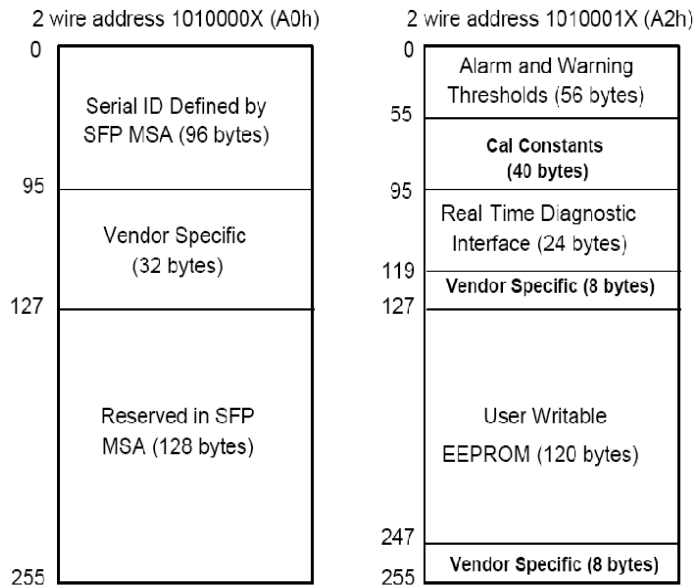


Figure 4, EEPROM Memory Map Specific Data Field Descriptions

**Table 9- Monitoring Specification**

| Parameter    | Range          | Accuracy | Calibration |
|--------------|----------------|----------|-------------|
| Temperature  | -10 to + 80°C  | ±3°C     | External    |
| Voltage      | 2.97 to 3.63V  | ±3%      | External    |
| Bias Current | 3mA to 80mA    | ±10%     | External    |
| TX Power     | -9 to -3dBm    | ±3dB     | External    |
| RX Power     | -19.5 to -3dBm | ±3dB     | External    |

### Mechanical Diagram

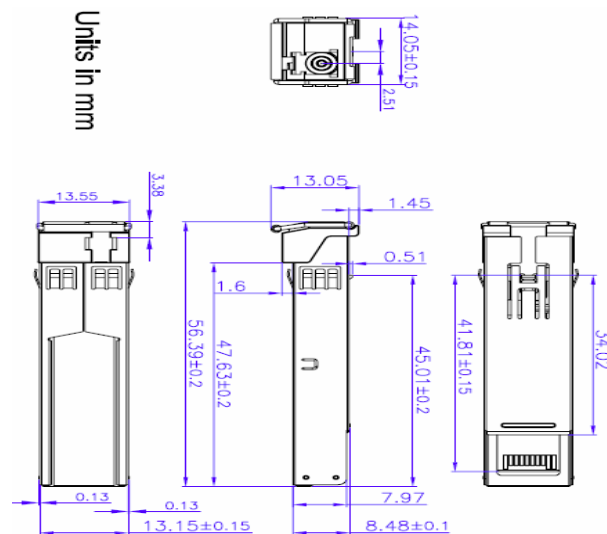


Figure 5, Mechanical Design Diagram of the SFP with Spring-Latch



## Order Information

**Table 10 – Order Information**

| Part No.          | Application   | Data Rate | Laser Source                | Fiber Type |
|-------------------|---------------|-----------|-----------------------------|------------|
| SPL-34-GB-BX-CDFM | 1000BASE-BX10 | 1.25G     | 1310nm FP Tx/1490nm PIN Rx  | SMF        |
| SPL-43-GB-BX-CDFM | 1000BASE-BX10 | 1.25G     | 1490nm 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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