



155M Bi-directional SFP Transceiver

(For 20km Point to Point Transmission)

Members of Flexon™ Family



Description

SPL-35-03-EBX-IDFF/SPL-53-03-EBX-IDFF is high performance, cost effective transceiver. It is designed point-point FTTH applications at data rates of 155Mbps for 20km transmission.

SPL-35-03-EBX-IDFF is normally used in the client (ONU), which transmits 1310nm and receives 1550nm optical signal; while SPL-53-03-EBX-IDFF is used in the central office (OLT), which transmits 1550nm and receives 1310nm optical signal.

SPL-35-03-EBX-IDFF and SPL-53-03-EBX-IDFF feature an EEPROM that contains the detailed product information stored for retrieval by host equipment. This information is accessed via the 2-wire serial CMOS EEPROM protocol. For further information, please refer to SFP Multi-Source Agreement (MSA).

An enhanced Digital Diagnostic Monitoring Interface compatible with SFF-8472 has been incorporated into the transceivers. It allows real time access to the transceiver operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage by reading a built-in memory with I2C interface.

SPL-35-03-EBX-IDFF and SPL-53-03-EBX-IDFF are compliant with RoHS.

Features

- ◆ 125~155Mbps data links
- ◆ 20km point-point transmission
- ◆ 1310nm FP Tx/1550nm PIN Rx for SPL-35-03-EBX-IDFF
- ◆ 1550nm FP Tx/1310nm PIN Rx for SPL-53-03-EBX-IDFF
- ◆ Class I laser product
- ◆ SFP MSA package with LC receptacle
- ◆ Operation case temperature:-40 to +85°C
- ◆ Detailed product information in EEPROM

Applications

- ◆ Fast Ethernet
- ◆ Point to Point FTTH Application

Standard

- ◆ Compatible with SFP MSA
- ◆ Compatible with IEEE 802.3ah
- ◆ Compliant with RoHS

Regulatory Compliance

The transceivers have been tested according to American and European product safety and electromagnetic compatibility regulations (See Table 1). For further information regarding regulatory certification, please refer to Source Photonics regulatory specification and safety guidelines, or contact with Source Photonics, Inc. America sales office listed at the end of documentation.

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 LC Receptacle | IEC 61000-4-2 | Compatible with standard |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B | Compatible with standard |
| Laser Eye Safety | FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2 | Compatible with Class 1 laser product. |
| RoHS | 2002/95/EC 4.1&4.2 2005/747/EC | Compliant with RoHS |

Absolute Maximum Ratings

Absolute Maximum Ratings are those values beyond which damage to the devices may occur.

Table 2– Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|---------------------|----------|------|------|------|
| Storage Temperature | T_s | -40 | +85 | °C |
| Supply Voltage | V_{CC} | -0.5 | 3.6 | V |
| Operating Humidity | - | 5 | 95 | % |

Recommended Operating Conditions

Table 3 - Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|----------------------------|----------|------|---------|------|------|
| Operating Case Temperature | T_c | -40 | | +85 | °C |
| Power Supply Voltage | V_{CC} | 3.13 | 3.3 | 3.47 | V |
| Power Supply Current | I_{CC} | | | 300 | mA |
| Power Dissipation | P | | 0.65 | 0.8 | W |
| Data Rate | | | 125/155 | | Mbps |

Optical and Electrical Characteristics (SPL-35-03-EBX-IDFF)

Table 4– Optical and Electrical Characteristics (TC=-40 to 85°C, V_{CC}=3.13 to 3.47V)

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|--------------------------------|------------------------|------|---------|----------------------|----------|-------|
| Transmitter | | | | | | |
| Centre Wavelength | λ_C | 1260 | | 1360 | nm | |
| Average Output Power | P_{Out} | -14 | | -8 | dBm | 1 |
| Spectral Width (RMS) | $\Delta\lambda$ | | 2.5 | 7 | nm | |
| Extinction Ration | EX | 10 | | | dB | |
| Optical Isolation | | 30 | | | dB | |
| Output Optical Eye | ITU-T G.957 Compatible | | | | | 2 |
| Data Input Swing Differential | V_{IN} | 500 | | 2400 | mV | 3 |
| Input Differential Impedance | Z_{IN} | 90 | 100 | 110 | Ω | |
| TX Disable | Disable | 2.0 | | V _{CC} +0.3 | V | |
| | Enable | 0 | | 0.8 | V | |
| TX Fault | Fault | 2.0 | | V _{CC} +0.3 | V | |
| | Normal | 0 | | 0.8 | V | |
| Receiver | | | | | | |
| Centre Wavelength | λ_C | 1450 | | 1580 | nm | |
| Receiver Sensitivity | | | | -32 | dBm | 4 |
| Receiver Overload | | -8 | | | dBm | 4 |
| Return Loss | | 14 | | | dB | |
| LOS De-Assert | LOS _D | | | -34 | dBm | |
| LOS Assert | LOS _A | -45 | | | dBm | |
| LOS Hysteresis | | 0.5 | | 4 | dB | |
| Data Output Swing Differential | V_{OUT} | 400 | | 800 | mV | 5 |
| LOS | High | 2.0 | | V _{CC} +0.3 | V | |
| | Low | 0 | | 0.8 | V | |

Note:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2²³-1 test pattern @155Mbps.
3. Internally AC coupled and terminated.
4. Measured with PRBS 2²³-1 test pattern@155Mbps, BER ≤ 1 × 10⁻¹⁰.
5. Internally AC coupled.

Optical and Electrical Characteristics (SPL-53-03-EBX-IDFF)

Table 5 –Optical and Electrical Characteristics (TC=-40 to 85°C, V_{CC}=3.13 to 3.47V)

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|----------------------|-----------------|------|---------|------|------|-------|
| Transmitter | | | | | | |
| Centre Wavelength | λ_C | 1480 | | 1580 | nm | 6 |
| Average Output Power | P_{Out} | -14 | | -8 | dBm | 1 |
| Spectral Width (RMS) | $\Delta\lambda$ | | 2.5 | 4.6 | nm | |

| | | | | | | |
|--------------------------------|------------------------|------|-----|----------------------|-----|---|
| Extinction Ration | EX | 10 | | | dB | |
| Optical Isolation | | 30 | | | dB | |
| Output Optical Eye | ITU-T G.957 Compatible | | | | | 2 |
| Data Input Swing Differential | V _{IN} | 500 | | 2400 | mV | 3 |
| Input Differential Impedance | Z _{IN} | 90 | 100 | 110 | Ω | |
| TX Disable | Disable | 2.0 | | V _{cc} +0.3 | V | |
| | Enable | 0 | | 0.8 | V | |
| TX Fault | Fault | 2.0 | | V _{cc} +0.3 | V | |
| | Normal | 0 | | 0.8 | V | |
| Receiver | | | | | | |
| Centre Wavelength | λ _C | 1260 | | 1360 | nm | |
| Receiver Sensitivity | | | | -32 | dBm | 4 |
| Receiver Overload | | -8 | | | dBm | 4 |
| Return Loss | | 14 | | | dB | |
| LOS De-Assert | LOS _D | | | -34 | dBm | |
| LOS Assert | LOS _A | -45 | | | dBm | |
| LOS Hysteresis | | 0.5 | | 4 | dB | |
| Data Output Swing Differential | V _{OUT} | 400 | | 800 | mV | 5 |
| LOS | High | 2.0 | | V _{cc} +0.3 | V | |
| | Low | 0 | | 0.8 | V | |

Note:

1. The optical power is launched into SMF.
2. Measured with a PRBS 2²³-1 test pattern @155Mbps.
3. Internally AC coupled and terminated.
4. Measured with PRBS 2²³-1 test pattern@155Mbps, BER ≤ 1 × 10⁻¹⁰.
5. Internally AC coupled.
6. Transmitter Central Wavelength can guarantee 1480nm~1580nm within -20 to 85°C.

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 6.

Table 6 - 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 02 00 00 00 00 00 | Transmitter Code xx:10 for SPL-35-03-EBX-IDFF and 08 for SPL-53-03-EBX-IDFF |

| | | | | |
|--------|-----|------------------|--|--|
| 11 | 1 | Encoding | 03 | NRZ |
| 12 | 1 | BR, nominal | 02 | 155Mbps |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9um)-km | 14 | 20km |
| 15 | 1 | Length (9um) | C8 | 20km |
| 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 00 00 | |
| 40—55 | 16 | Vendor PN | 53 50 4C 33 35(35 33) 30 33 45 42 58 49 44 46 46 20 20 | "SPL3503EBXIDFF" or "SPL5303EBXIDFF" (ASC II) |
| 56—59 | 4 | Vendor rev | xx xx xx xx | 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 1. 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 7.

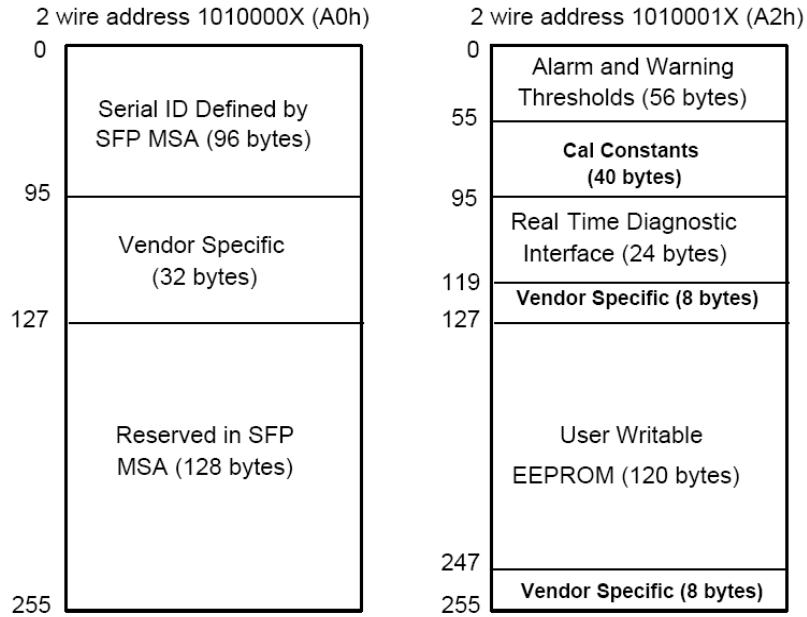


Figure 1, EEPROM Memory Map Specific Data Field Description

Table 7 - SPL-35-03-EBX-IDFF / SPL-53-03-EBX-IDFF Monitoring Specification

| Parameter | Range | Accuracy | Calibration * |
|--------------|---------------|----------|---------------|
| Temperature | -40 to +100°C | ±3°C | External |
| Voltage | 2.97 to 3.63V | ±3% | External |
| Bias Current | 3mA to 80mA | ±10% | External |
| TX Power | -8 to -14dBm | ±3dB | External |
| RX Power | -8 to -32dBm | ±3dB | External |

Recommended Host Board Power Supply Circuit

Figure 2 shows the recommended host board power supply circuit.

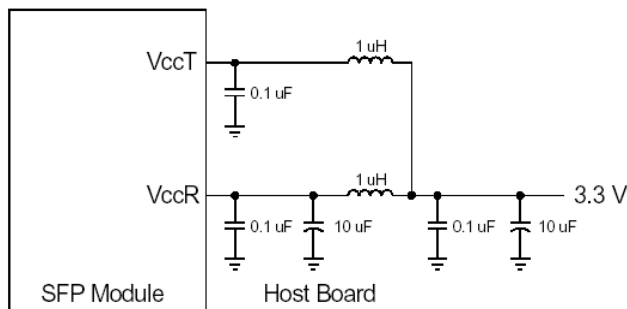


Figure 2, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

Figure 3 shows the recommended interface circuit.

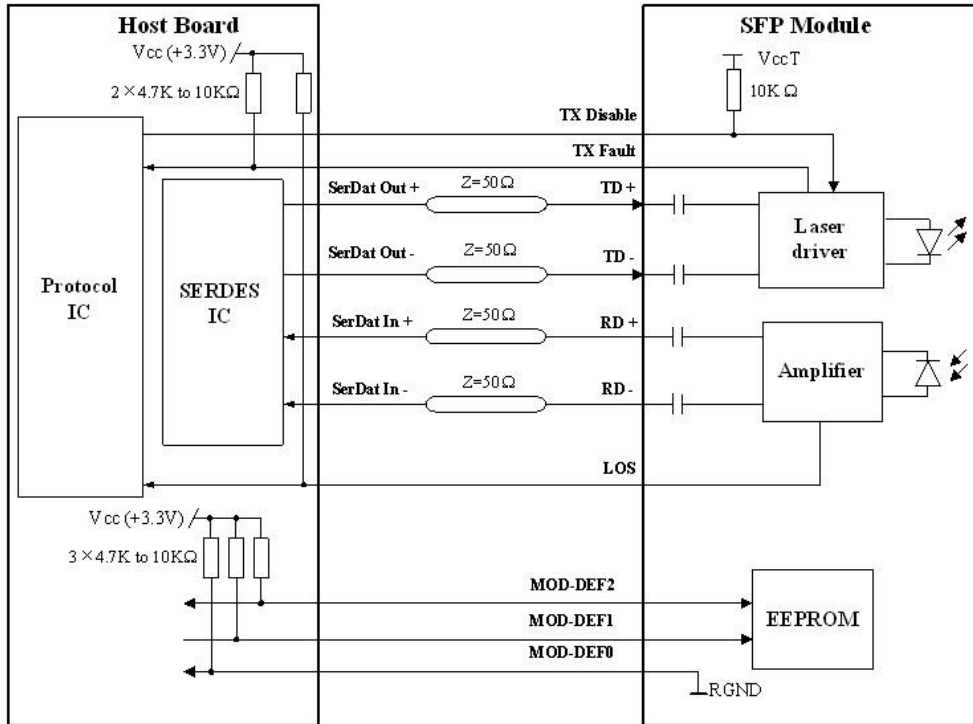


Figure 3, Recommended Interface Circuit

Pin Definitions

Figure 4 below shows the pin numbering of SFP electrical interface. The pin functions are described in Table and the accompanying notes.

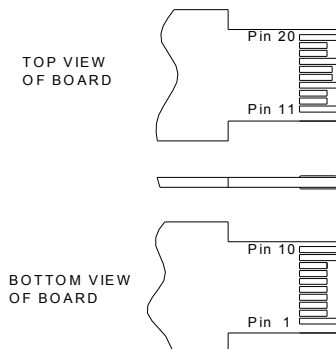


Figure 4, Pin View

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
- 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 wire serial interface for serial ID
MOD-DEF 2 is the data line of two wire 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 outputs. They are 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.

Mechanical Design Diagram

The mechanical design diagram is shown in Figure 5.

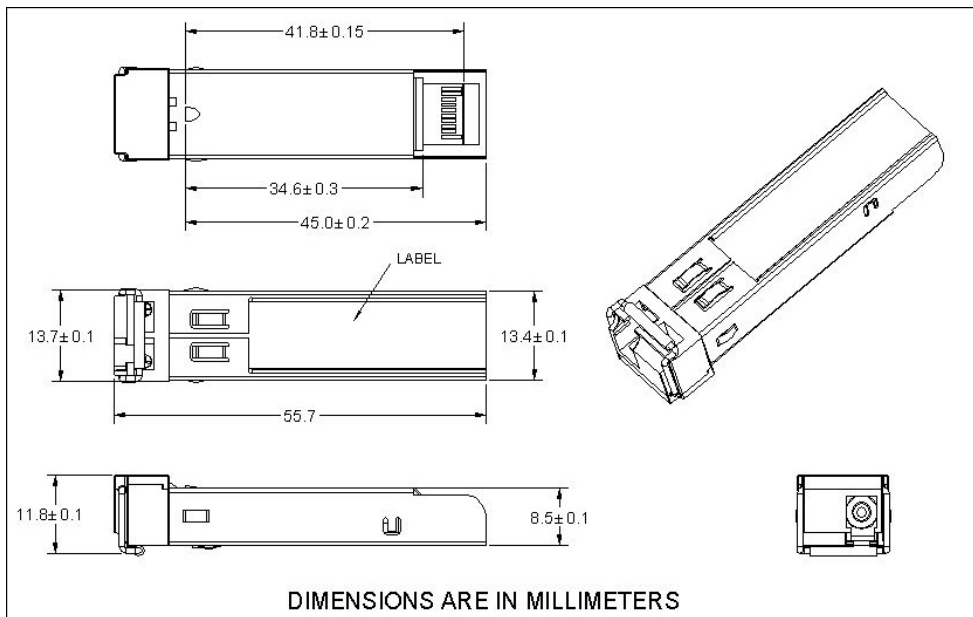
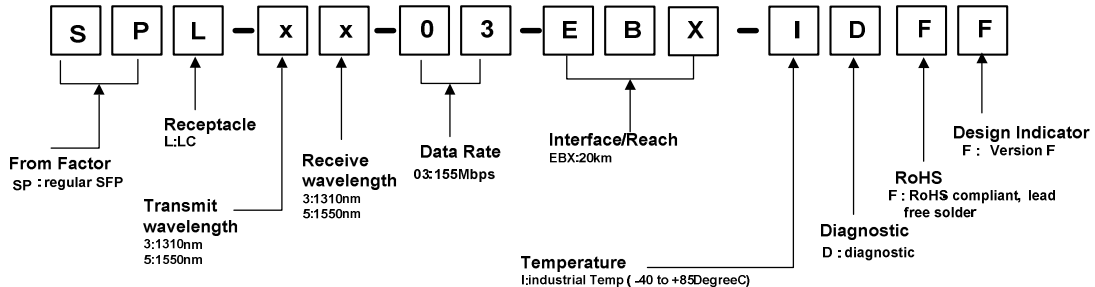


Figure 5, Mechanical Design Diagram of the SFP with Spring Latch

Ordering information



| Part No. | Product Description |
|--------------------|---|
| SPL-35-03-EBX-IDFF | 1310nm(TX)/1550nm(RX), 125~155Mbps, bi-directional SFP for ONU, Compliant with RoHS; -40 to 85 ⁰ C |
| SPL-53-03-EBX-IDFF | 1550nm(TX)/1310nm(RX), 125~155Mbps, bi-directional SFP for OLT, Compliant with RoHS; -40 to 85 ⁰ C |

Related Documents

For further information, please refer to the following documents:

- ◆ Flexon™ SFP Installation Guide
- ◆ Flexon™ SFP Application Notes
- ◆ SFP Multi-Source Agreement (MSA)

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Contact

U.S.A. Headquarter:

20550 Nordhoff Street

Chatsworth, CA91311

U. S. A.

Tel: 818.773.9044

Fax: 818.773.0261

M-S@sourcephotonics.com.cn