

## 155Mbps SFP Transceiver with Spring Latch

(For 15km~80km transmission)

### Members of Flexon™ Family



- ◆ Compatible with FCC 47 CFR Part 15, Class B
- ◆ Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I
- ◆ Compliant with RoHS

### Description

Fiberxon 155Mbps spring-latch SFP transceiver is high performance, cost effective modules that supports data-rate of 155Mbps and transmission distance from 15km to 80km.

The transceiver consists of two sections: The transmitter section incorporates a FP or uncooled DFB laser. And the receiver section consists of a PIN photodiode integrated with a trans-impedance preamplifier (TIA). All modules satisfy class I laser safety requirements.

The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is provided to indicate degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

The standard serial ID information Compatible with SFP MSA describes the transceiver's capabilities, standard interfaces, manufacturer and other information. The host equipment can access this information via the two-wire serial CMOS EEPROM protocol. For further information, please refer to SFP Multi-Source Agreement (MSA).

### Features

- ◆ Up to 155Mbps data-rate
- ◆ 1310nm FP laser and PIN photodetector for 15km and 40km transmission
- ◆ 1550nm uncooled DFB laser and PIN photodetector for 80km transmission
- ◆ Standard serial ID information Compatible with SFP MSA
- ◆ SFP MSA package with duplex LC connector
- ◆ With spring latch for easily removing
- ◆ Very low EMI and excellent ESD protection
- ◆ +3.3V single power supply
- ◆ Operating case temperature:  
Standard : 0 to +70°C  
Industrial : -40 to +85°C

### Applications

- ◆ SDH STM-1, S-1.1, L-1.1, L-1.2
- ◆ SONET OC-3 IR1, LR1, LR2
- ◆ Other optical links

### Standard

- ◆ Compatible with SFP MSA
- ◆ Compatible with ITU-T G.957 and G.958
- ◆ Compatible with Telcordia GR-253-CORE

## 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 Fiberxon regulatory specification and safety guidelines, or contact with Fiberxon, Inc. America sales office listed at the end of the documentation.

**Table 1 - Regulatory Compliance**

| Feature                                                   | Standard                                                           | Performance                                                            |
|-----------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E<br>Method 3015.7                                      | Class 1(>500 V)                                                        |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2<br>GR-1089-CORE                                      | Compatible with standards                                              |
| Electromagnetic Interference (EMI)                        | FCC Part 15 Class B<br>EN55022 Class B (CISPR 22B)<br>VCCI Class B | Compatible with standards                                              |
| Immunity                                                  | IEC 61000-4-3                                                      | Compatible with standards                                              |
| Laser Eye Safety                                          | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2       | Compatible with Class 1 laser product.<br>TUV Certificate No. 50030043 |
| Component Recognition                                     | UL and CSA                                                         | UL file E223705                                                        |

## Absolute Maximum Ratings

Stress in excess of the maximum absolute ratings can cause permanent damage to the module.

**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 Relative Humidity | -        | 5    | 95   | %    |

## Recommended Operating Conditions

**Table 3- Recommended Operating Conditions**

| Parameter                  |            | Symbol   | Min. | Typical | Max. | Unit |
|----------------------------|------------|----------|------|---------|------|------|
| Operating Case Temperature | Standard   | $T_C$    | 0    |         | +70  | °C   |
|                            | Industrial |          | -40  |         | +85  |      |
| Power Supply Voltage       |            | $V_{CC}$ | 3.13 | 3.3     | 3.47 | V    |
| Power Supply Current       |            | $I_{CC}$ |      |         | 300  | mA   |
| Data Rate                  |            |          |      | 155     |      | Mbps |

**FTM-3001C-SL15G, FTM-3001C-SL15iG (1310nm FP and PIN, 15km)****Table 4 - Optical and Electrical Characteristics**

| Parameter                      |         | Symbol                                                | Min. | Typical | Max.         | Unit     | Notes |
|--------------------------------|---------|-------------------------------------------------------|------|---------|--------------|----------|-------|
| Transmitter                    |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1261 |         | 1360         | nm       |       |
| Average Output Power           |         | $P_{Out}$                                             | -15  |         | -8           | dBm      | 1     |
| Spectral Width (RMS)           |         | $\sigma$                                              |      |         | 4            | nm       |       |
| Extinction Ratio               |         | EX                                                    | 8.2  |         |              | dB       |       |
| Jitter Generation (RMS)        |         |                                                       |      |         | 0.01         | UI       |       |
| Jitter Generation (pk-pk)      |         |                                                       |      |         | 0.1          | UI       |       |
| Output Optical Eye             |         | Compatible with Telcordia GR-253-CORE and ITU-T G.957 |      |         |              |          | 2     |
| Data Input Swing Differential  |         | $V_{IN}$                                              | 300  |         | 1860         | mV       | 3     |
| Input Differential Impedance   |         | $Z_{IN}$                                              | 90   | 100     | 110          | $\Omega$ |       |
| TX Disable                     | Disable |                                                       | 2.0  |         | $V_{CC}$     | V        |       |
|                                | Enable  |                                                       | 0    |         | 0.8          | V        |       |
| TX Fault                       | Fault   |                                                       | 2.0  |         | $V_{CC}+0.3$ | V        |       |
|                                | Normal  |                                                       | 0    |         | 0.8          | V        |       |
| Receiver                       |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1260 |         | 1580         | nm       |       |
| Receiver Sensitivity           |         |                                                       |      |         | -34          | dBm      | 4     |
| Receiver Overload              |         |                                                       | -8   |         |              | dBm      | 4     |
| Optical Path Penalty           |         |                                                       |      |         | 1            | dB       | 5     |
| LOS De-Assert                  |         | $LOS_D$                                               |      |         | -37          | dBm      |       |
| LOS Assert                     |         | $LOS_A$                                               | -45  |         |              | dBm      |       |
| LOS Hysteresis                 |         |                                                       | 1    |         | 4            | dB       |       |
| Data Output Swing Differential |         | $V_{OUT}$                                             | 370  |         | 1800         | mV       | 6     |
| LOS                            | High    |                                                       | 2.0  |         | $V_{CC}+0.3$ | V        |       |
|                                | Low     |                                                       | 0    |         | 0.8          | V        |       |

**Notes:**

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps,  $BER \leq 1 \times 10^{-10}$ .
5. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, over 15km G.652 SMF,  $BER \leq 1 \times 10^{-10}$ .
6. Internally AC coupled.

**FTM-3001C-SL40G, FTM-3001C-SL40iG (1310nm FP and PIN, 40km)****Table 5 - Optical and Electrical Characteristics**

| Parameter                      |         | Symbol                                                | Min. | Typical | Max.         | Unit     | Notes |
|--------------------------------|---------|-------------------------------------------------------|------|---------|--------------|----------|-------|
| <b>Transmitter</b>             |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1263 |         | 1360         | nm       |       |
| Average Output Power           |         | $P_{out}$                                             | -5   |         | 0            | dBm      | 1     |
| Spectral Width (RMS)           |         | $\sigma$                                              |      |         | 3            | nm       |       |
| Extinction Ratio               |         | EX                                                    | 10   |         |              | dB       |       |
| Jitter Generation (RMS)        |         |                                                       |      |         | 0.01         | UI       |       |
| Jitter Generation (pk-pk)      |         |                                                       |      |         | 0.1          | UI       |       |
| Output Optical Eye             |         | Compatible with Telcordia GR-253-CORE and ITU-T G.957 |      |         |              |          | 2     |
| Data Input Swing Differential  |         | $V_{IN}$                                              | 300  |         | 1860         | mV       | 3     |
| Input Differential Impedance   |         | $Z_{IN}$                                              | 90   | 100     | 110          | $\Omega$ |       |
| TX Disable                     | Disable |                                                       | 2.0  |         | $V_{cc}$     | V        |       |
|                                | Enable  |                                                       | 0    |         | 0.8          | V        |       |
| TX Fault                       | Fault   |                                                       | 2.0  |         | $V_{cc}+0.3$ | V        |       |
|                                | Normal  |                                                       | 0    |         | 0.8          | V        |       |
| <b>Receiver</b>                |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1260 |         | 1580         | nm       |       |
| Receiver Sensitivity           |         |                                                       |      |         | -34          | dBm      | 4     |
| Receiver Overload              |         |                                                       | -8   |         |              | dBm      | 4     |
| Optical Path Penalty           |         |                                                       |      |         | 1            | dB       | 5     |
| LOS De-Assert                  |         | $LOS_D$                                               |      |         | -37          | dBm      |       |
| LOS Assert                     |         | $LOS_A$                                               | -45  |         |              | dBm      |       |
| LOS Hysteresis                 |         |                                                       | 1    |         | 4            | dB       |       |
| Data Output Swing Differential |         | $V_{OUT}$                                             | 370  |         | 1800         | mV       | 6     |
| LOS                            | High    |                                                       | 2.0  |         | $V_{cc}+0.3$ | V        |       |
|                                | Low     |                                                       | 0    |         | 0.8          | V        |       |

**Notes:**

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, extinction ratio ER=10dB, BER  $\leq 1 \times 10^{-10}$ .
5. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, over 40km G.652 SMF, BER  $\leq 1 \times 10^{-10}$ .
6. Internally AC coupled.

**FTM-5001C-SL80G (1550nm DFB and PIN, 80km)****Table 6 - Optical and Electrical Characteristics**

| Parameter                      |         | Symbol                                                | Min. | Typical | Max.         | Unit     | Notes |
|--------------------------------|---------|-------------------------------------------------------|------|---------|--------------|----------|-------|
| Transmitter                    |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1480 |         | 1580         | nm       |       |
| Average Output Power           |         | $P_{Out}$                                             | -5   |         | 0            | 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       |       |
| Output Optical Eye             |         | Compatible with Telcordia GR-253-CORE and ITU-T G.957 |      |         |              |          | 2     |
| Data Input Swing Differential  |         | $V_{IN}$                                              | 300  |         | 1860         | mV       | 3     |
| Input Differential Impedance   |         | $Z_{IN}$                                              | 90   | 100     | 110          | $\Omega$ |       |
| TX Disable                     | Disable |                                                       | 2.0  |         | $V_{CC}$     | V        |       |
|                                | Enable  |                                                       | 0    |         | 0.8          | V        |       |
| TX Fault                       | Fault   |                                                       | 2.0  |         | $V_{CC}+0.3$ | V        |       |
|                                | Normal  |                                                       | 0    |         | 0.8          | V        |       |
| Receiver                       |         |                                                       |      |         |              |          |       |
| Centre Wavelength              |         | $\lambda_C$                                           | 1260 |         | 1580         | nm       |       |
| Receiver Sensitivity           |         |                                                       |      |         | -34          | dBm      | 4     |
| Receiver Overload              |         |                                                       | -8   |         |              | dBm      | 4     |
| Optical Path Penalty           |         |                                                       |      |         | 1            | dB       | 5     |
| LOS De-Assert                  |         | $LOS_D$                                               |      |         | -37          | dBm      |       |
| LOS Assert                     |         | $LOS_A$                                               | -45  |         |              | dBm      |       |
| LOS Hysteresis                 |         |                                                       | 1    |         | 4            | dB       |       |
| Data Output Swing Differential |         | $V_{OUT}$                                             | 370  |         | 1800         | mV       | 6     |
| LOS                            | High    |                                                       | 2.0  |         | $V_{CC}+0.3$ | V        |       |
|                                | Low     |                                                       | 0    |         | 0.8          | V        |       |

**Notes:**

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps.
3. PECL input, internally AC coupled and terminated.
4. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, extinction ratio ER=10dB,  $BER \leq 1 \times 10^{-10}$ .
5. Measured with a PRBS  $2^{23}-1$  test pattern @155Mbps, over 80km G.652 SMF,  $BER \leq 1 \times 10^{-10}$ .
6. Internally AC coupled.

## 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 two-wire serial interface at the 8-bit address 1010000X (A0h). For memory contents please 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 xx 00 00 00 00 00                            | OC 3, Single mode inter. or long reach        |
| 11     | 1                  | Encoding         | 03                                                 | NRZ                                           |
| 12     | 1                  | BR, nominal      | 01                                                 | 155Mbps                                       |
| 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      | 46 49 42 45 52 58 4F 4E<br>20 49 4E 43 2E 20 20 20 | "FIBERXON INC. "(ASC II )                     |
| 36     | 1                  | Reserved         | 00                                                 |                                               |
| 37—39  | 3                  | Vendor OUI       | 00 00 00                                           |                                               |
| 40—55  | 16                 | Vendor PN        | 46 54 4D 2D xx 30 30 31<br>43 2D 53 4C xx xx xx 47 | "FTM-x001C-SLxx(i)G" (ASC II )                |
| 56—59  | 4                  | Vendor rev       | xx xx 00 00                                        | ASC II ( "31 30 00 00" means 1.0 revision)    |
| 60—62  | 3                  | Reserved         | 00 00 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—94  | 3                  | Reserved         | 00 00 00                                           |                                               |
| 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 *SFP Multi-Source Agreement (MSA)*.

## Recommended Host Board Power Supply Circuit

Figure 1 shows the recommended host board power supply circuit.

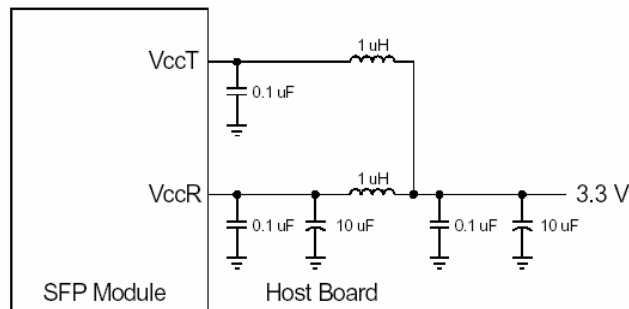


Figure 1, Recommended Host Board Power Supply Circuit

## Recommended Interface Circuit

Figure 2 shows the recommended interface circuit.

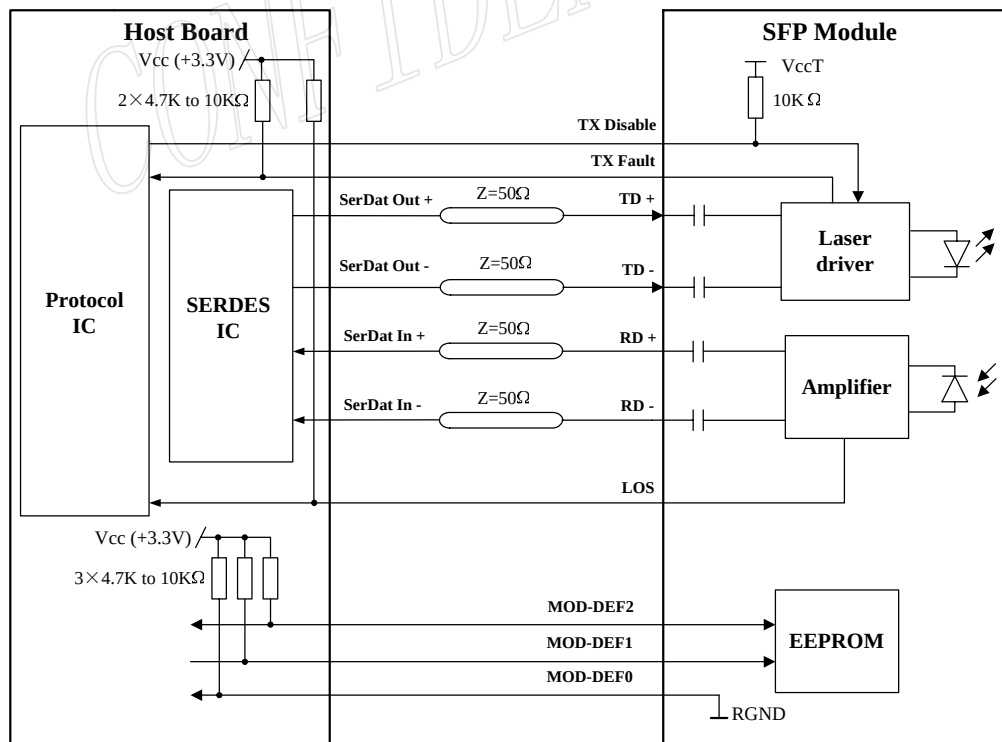


Figure 2, Recommended Interface Circuit

## 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.

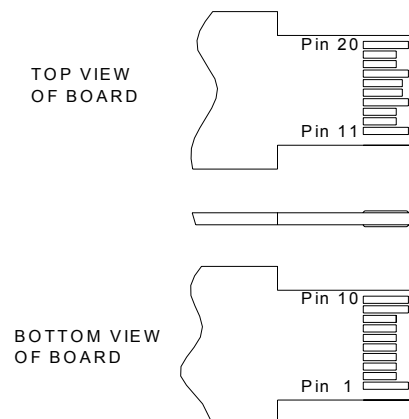


Figure 3, Pin View

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:**

- 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 ( $2.0\sim3.465V$ ): Transmitter Disabled
- Open: Transmitter Disabled
- MOD-DEF 0,1,2 are the module definition pins. They should be pulled up with a  $4.7k\sim10k\Omega$  resistor on the host board. The pull-up voltage shall be  $V_{ccT}$  or  $V_{ccR}$ .  
MOD-DEF 0 grounded by the module indicates 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  $4.7k\sim10k\Omega$  resistor on the host board to a voltage between  $2.0V$  and  $V_{cc}+0.3V$ . 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 internally AC-coupled  $100\Omega$  differential lines which should be terminated with  $100\Omega$  (differential) at the user SERDES.
  - These are the differential transmitter inputs. They are AC-coupled, differential lines with  $100\Omega$  differential termination inside the module.

### Mechanical Design Diagram

The mechanical design diagram is shown in Figure 4.

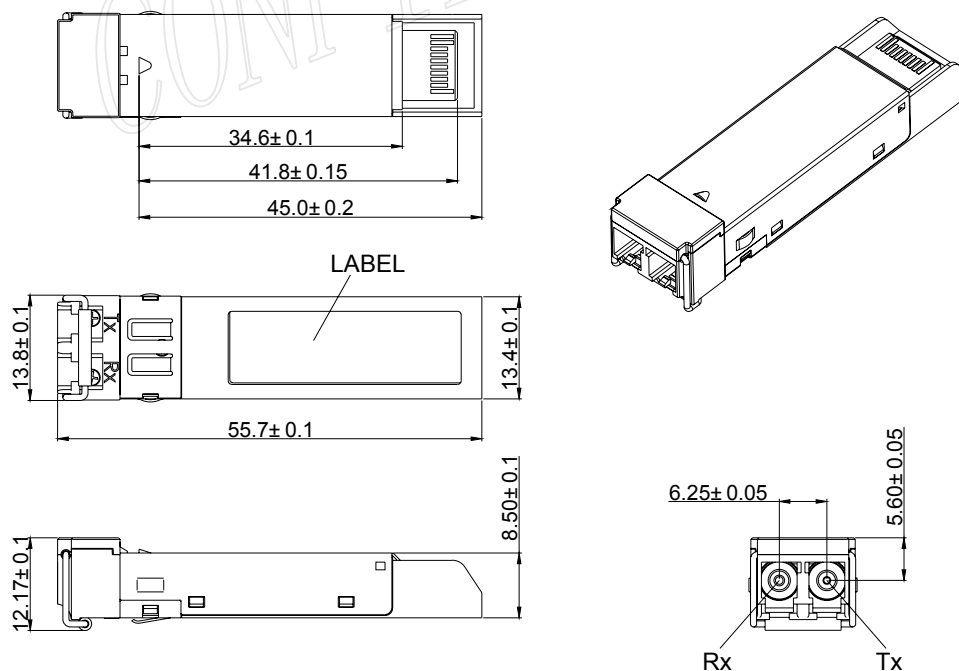
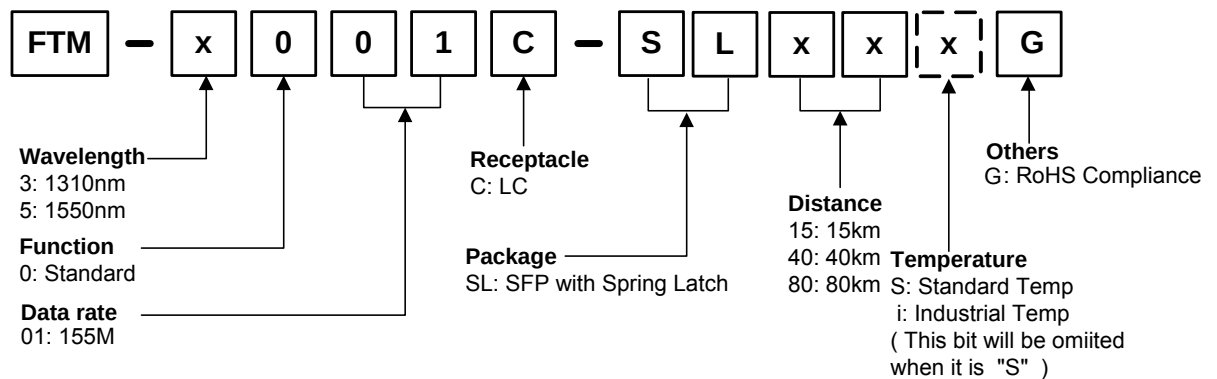


Figure 4, Mechanical Design Diagram of the SFP with Spring-Latch

### Ordering information



| Part No.         | Product Description                                                       |
|------------------|---------------------------------------------------------------------------|
| FTM-3001C-SL15G  | 1310nm, 155Mbps, 15km, SFP with spring latch, 0°C~+70°C,RoHS compliance   |
| FTM-3001C-SL15iG | 1310nm, 155Mbps, 15km, SFP with spring latch, -40°C~+85°C,RoHS compliance |
| FTM-3001C-SL40G  | 1310nm, 155Mbps, 40km, SFP with spring latch, 0°C~+70°C,RoHS compliance   |
| FTM-3001C-SL40iG | 1310nm, 155Mbps, 40km, SFP with spring latch, -40°C~+85°C,RoHS compliance |
| FTM-5001C-SL80G  | 1550nm, 155Mbps, 80km, SFP with spring latch, 0°C~+70°C,RoHS compliance   |

## Related Documents

For further information, please refer to the following documents:

- *Fiberxon Spring-Latch SFP Installation Guide*
- *Fiberxon SFP Application Notes*
- *SFP Multi-Source Agreement (MSA)*

## Obtaining Document

You can visit our website:

<http://www.fiberxon.com>

Or contact Fiberxon, Inc. America Sales Office listed at the end of the documentation to get the latest documents.

## Revision History

| Revision | Initiate    | Review     | Approve   | Subject                                                           | Release Date |
|----------|-------------|------------|-----------|-------------------------------------------------------------------|--------------|
| Rev. 1a  | Solaris Zhu | Monica Wei | Walker.We | Initial datasheet                                                 | Dec 23, 2005 |
| Rev. 1b  | Solaris Zhu | Monica Wei | Walker.We | Modified the recommended circuit; Updated overload value to -8dBm | Mar 15, 2006 |
| Rev. 1c  | Solaris Zhu | Monica Wei | Walker.We | Deleted FTM-5001C-SL80iG                                          | May 12, 2006 |

|  |  |  |  |                                                                  |  |
|--|--|--|--|------------------------------------------------------------------|--|
|  |  |  |  | and updated datasheet from preliminary version to formal version |  |
|--|--|--|--|------------------------------------------------------------------|--|

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