

## 100BASE-T Copper SFP Transceiver

(For 100m reach over Cat 5 UTP cable)

Members of Flexon™ Family



### Features

- ◆ 100Mbps bi-direction data links
- ◆ 100m transmission over unshielded twisted-pair (UTP) Category 5 Cable
- ◆ Perform any necessary scrambling / descrambling between the 100Base-TX and 100Base-FX formats.
- ◆ Support intelligent auto-negotiation 100BASE-T operation in host systems
- ◆ Hot-pluggable capability
- ◆ SFP form with compact RJ-45 connector
- ◆ With spring latch for high density application
- ◆ Very low EMI and excellent ESD protection
- ◆ +3.3V single power supply
- ◆ Low power dissipation
- ◆ Operating case temperature: 0 to +70°C
- ◆ Detailed product information in EEPROM

### Applications

- ◆ LAN 100Base-T
- ◆ Switch to Switch interface
- ◆ Switched backplane applications
- ◆ Router/Server interface

### Standard

- ◆ Compliant with SFP MSA
- ◆ Compliant with IEEE Std 802.3™-2002
- ◆ Compliant with FCC 47 CFR Part 15, Class B
- ◆ RoHS compliance and lead free assembly process compatibility

### Description

Fiberxon FTM-C001R-LG 100BASE-T copper SFP transceiver is high performance, cost effective module compliant with the 100BASE-T standards as specified in IEEE 802.3-2002 and IEEE 802.3ab, which supporting 100Mbps up to 100 meters reach over unshielded twisted-pair category-5 cable. FTM-C001R-LG is a “Hot-Pluggable” 100Base-TX Ethernet electrical interface SFP module.

The FTM-C001R-LG provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the two-wire serial CMOS EEPROM protocol.

The FTM-C001R-LG is RoHS compatible.

## 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 2(>2000 V)          |
| Electrostatic Discharge (ESD) to the RJ-45 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 |
| Component Recognition                                 | UL and CSA   | Compatible with standards |

## 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         | $T_S$    | 0    | +70  | °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 | Notes |
|----------------------------|----------|------|---------|------|------|-------|
| Operating Case Temperature | $T_C$    | 0    |         | +70  | °C   |       |
| Power Supply Voltage       | $V_{CC}$ | 3.13 | 3.30    | 3.47 | V    |       |
| Power Supply Current       | $I_{CC}$ |      | 170     | 300  | mA   |       |
| Data Rate                  |          |      | 100     |      | Mbps |       |

## Host Side Electrical Interface

**Table 4 - Electrical Characteristics**

| Parameter                      | Symbol    | Min. | Typical | Max. | Unit     | Notes |
|--------------------------------|-----------|------|---------|------|----------|-------|
| Data Input Swing Differential  | $V_{IN}$  | 500  |         | 2400 | mV       | 1     |
| Input Differential Impedance   | $Z_{IN}$  |      | 100     |      | $\Omega$ |       |
| Data Output Swing Differential | $V_{OUT}$ | 370  |         | 2000 | mV       | 2     |
| Output Differential Impedance  | $Z_{OUT}$ |      | 100     |      | $\Omega$ |       |
| Output Data Rise/Fall Time     | Tr/Tf     |      |         | 3    | ns       |       |

Notes:

1. Internally AC coupled and terminated.
2. Internally AC coupled.

## Line Side Electrical Interface

**Table 5 - Electrical Characteristics**

| Parameter                | Symbol    | Min. | Typical | Max.       | Unit     | Notes |
|--------------------------|-----------|------|---------|------------|----------|-------|
| Line Baud Rate           |           |      | 125     |            | MBaud    |       |
| Bit Error Rate           | BER       |      |         | $10^{-12}$ |          | 1     |
| Line Rx Input Impedance  | $Z_{IN}$  |      | 100     |            | $\Omega$ |       |
| Line Tx Output Impedance | $Z_{OUT}$ |      | 100     |            | $\Omega$ |       |

Notes:

1. Measured over 100m Cat-5 UTP cable.

## 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       | 00                      |                       |
| 3—10  | 8                  | Transceiver     | 00 00 00 30 00 00 00 00 | 100BASE-FX/100BASE-LX |
| 11    | 1                  | Encoding        | 02                      | 4B5B                  |
| 12    | 1                  | BR, nominal     | 01                      | 100M                  |
| 13    | 1                  | Reserved        | 00                      |                       |
| 14    | 1                  | Length (9um)-km | 00                      |                       |
| 15    | 1                  | Length (9um)    | 00                      |                       |

|        |     |                  |  |  |
|--------|-----|------------------|--|--|
| 16     | 1   | Length (50um)    | 00   |  |
| 17     | 1   | Length (62.5um)  | 00   |  |
| 18     | 1   | Length (copper)  | 64   | 100m   |
| 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 43 30 30 31<br>52 2D 4C 47 20 20 20 20 | "FTM-C001R-LG" (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       | 00 00  |  |
| 62     | 1   | Reserved         | 00   |  |
| 63     | 1   | CC BASE          | xx   | Check sum of bytes 0 - 62                      |
| 64—65  | 2   | Options          | 00 00  |  |
| 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 MSA.

### Recommended Host Board Power Supply Circuit

Figure 1 shows the recommended host board power supply circuit.

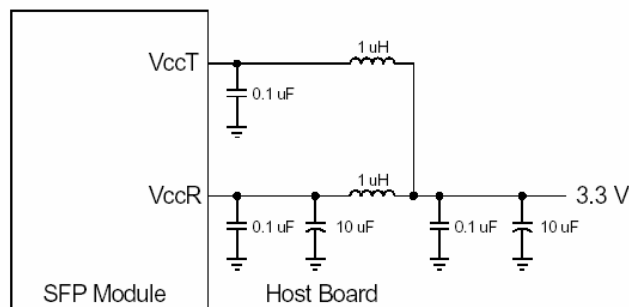


Figure 1, Recommended Host Board Power Supply Circuit

## 20-Pin Definitions

Figure 2 below shows the 20-pin numbering of SFP to Host electrical interface. The pin functions are described in Table 7 with some accompanying notes.

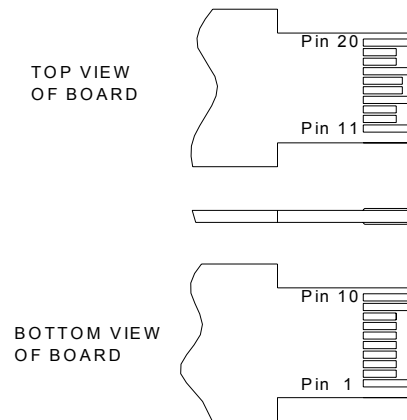


Figure 2, Pin View

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 not used and tied to ground within the module.
2. TX Disable is not used and is not connected within the module.
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  $V_{ccT}$  or  $V_{ccR}$ .

MOD-DEF 0 is tied to ground within the module.

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

4. LOS is not used and tied to ground within the module.
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.

### Mechanical Design Diagram

The mechanical design diagram is shown in Figure 3.

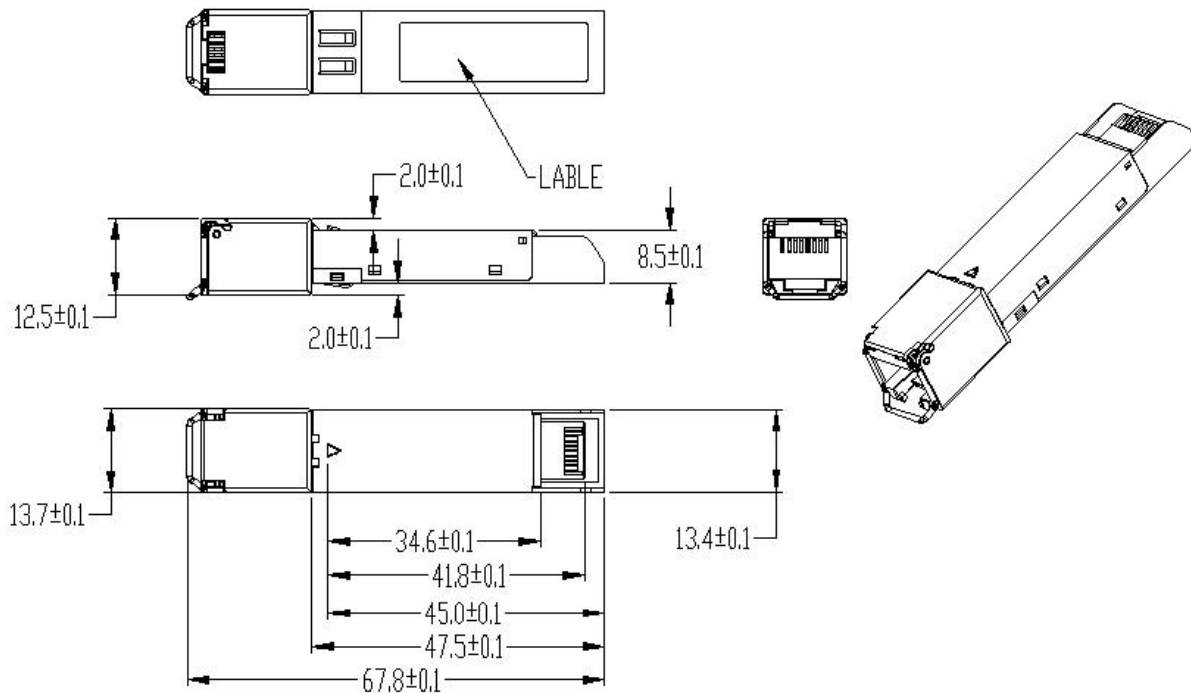
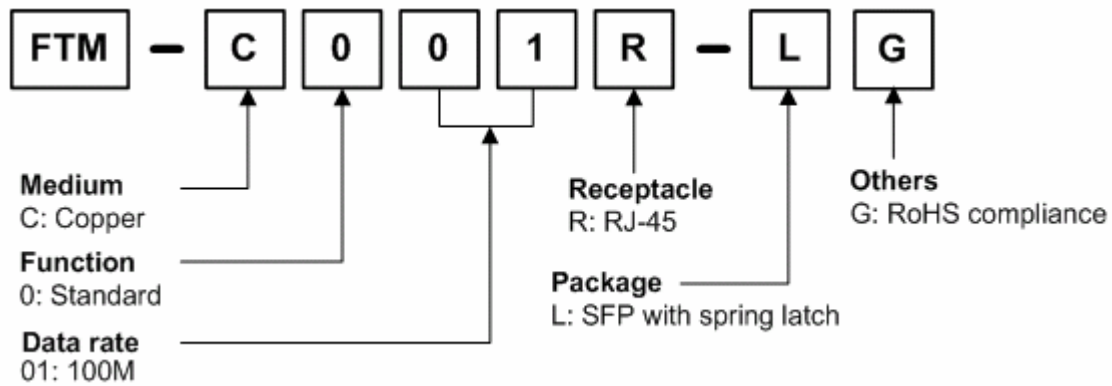


Figure 3, Mechanical Design Diagram

### Ordering information



| Part No.     | Product Description   |
|--------------|---|
| FTM-C001R-LG | 100Mbps, 100base-TX convert to 100base-FX, Copper SFP with spring latch, 0°C~+70°C, ROHS compliance |

### Related Documents

For further information, please refer to the following documents:

- *Fiberxon SFP Application Notes*
- *Fiberxon 100BASE-T Copper SFP Application Note*
- *SFP Multi-Source Agreement (MSA)*

### Obtaining Document

You can visit our website:

<http://www.fiberxon.com>

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

### Revision History

| Revision | Initiate    | Review         | Approve       | Subject           | Release Date  |
|----------|-------------|----------------|---------------|-------------------|---------------|
| Rev. 1a  | Unvier.Yang | Armstrong.tian | Tripper.huang | Initial datasheet | July 24, 2007 |
|          |             |                |               |                   |               |
|          |             |                |               |                   |               |

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**Contact**

U.S.A. Headquarter:

5201 Great America Parkway, Suite 340

Santa Clara, CA 95054

U. S. A.

Tel: 408-562-6288

Fax: 408-562-6289

Or visit our website: <http://www.fiberxon.com>