

## 155Mbps CWDM SFP Optical Transceiver, 80km Reach EPC-XX03-08CD

### Features

- ◆ Data-rate of 155Mbps operation
- ◆ 9 CWDM DFB wavelengths laser and PIN photodetector for 80km transmission
- ◆ Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- ◆ Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration
- ◆ Compatible with RoHS
- ◆ +3.3V single power supply
- ◆ Operating case temperature:  
Standard : 0 to +70°C



### Applications

- ◆ Gigabit Ethernet
- ◆ Fiber Channel
- ◆ Switch to Switch interface
- ◆ Switched backplane applications
- ◆ Router/Server interface
- ◆ Other optical transmission systems

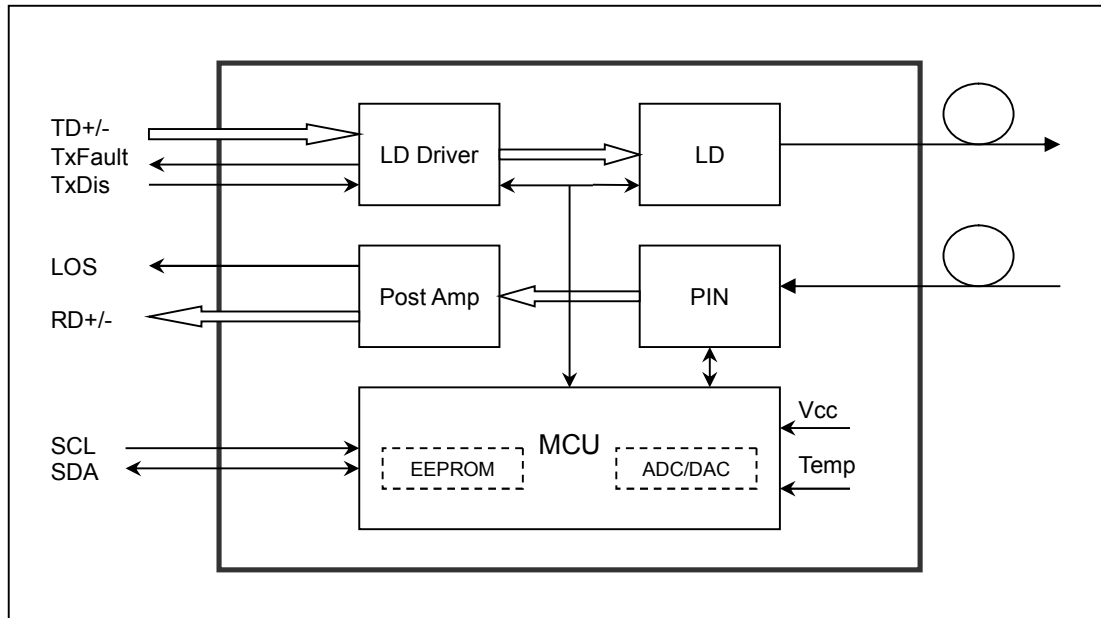
### Description

The SFP transceivers are high performance, cost effective modules supporting data-rate of 155Mbps and 80km transmission distance with SMF.

The transceiver consists of three sections: an uncooled CWDM DFB laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.

### Module Block Diagram



### Absolute Maximum Ratings

Table 1 - Absolute Maximum Ratings

| Parameter           | Symbol | Min  | Max | Unit |
|---------------------|--------|------|-----|------|
| Supply Voltage      | Vcc    | -0.5 | 4.5 | V    |
| Storage Temperature | Ts     | -40  | +85 | °C   |
| Operating Humidity  | -      | 5    | 95  | %    |

### Recommended Operating Conditions

Table 2 - Recommended Operating Conditions

| Parameter                  | Symbol | Min  | Typical | Max  | Unit |
|----------------------------|--------|------|---------|------|------|
| Operating Case Temperature | Tc     | 0    |         | +70  | °C   |
| Power Supply Voltage       | Vcc    | 3.13 | 3.3     | 3.47 | V    |
| Power Supply Current       | Icc    |      |         | 300  | mA   |
| Data Rate                  |        |      | 155     |      | Mbps |

**EPC-XX03-08CD**

See table3 below for “xx” values

**Table3 - $\lambda$ C Wavelength Guide**

| $\lambda$ C Wavelength Guide |             |      |      |             |      |
|------------------------------|-------------|------|------|-------------|------|
| Code                         | $\lambda$ C | Unit | Code | $\lambda$ C | Unit |
| 45                           | 1450        | nm   | 55   | 1550        | nm   |
| 47                           | 1470        | nm   | 57   | 1570        | nm   |
| 49                           | 1490        | nm   | 59   | 1590        | nm   |
| 51                           | 1510        | nm   | 61   | 1610        | nm   |
| 53                           | 1530        | nm   |      |             |      |

**Optical and Electrical Characteristics**
**EPC-XX03-08CD: (CWDM and PIN, 80km Reach)**
**Table 4 - Optical and Electrical Characteristics**

| Parameter                        | Symbol  | Min             | Typical     | Max             | Unit     | Notes |
|----------------------------------|---|-----------------|-------------|-----------------|----------|-------|
| <b>Transmitter</b>               |   |                 |             |                 |          |       |
| Centre Wavelength                | $\lambda$ c                                     | $\lambda$ c-6.5 | $\lambda$ c | $\lambda$ c+6.5 | nm       |       |
| Spectral Width (-20dB)           | $\Delta\lambda$                                 |                 |             | 1               | nm       |       |
| Side Mode Suppression Ratio      | SMSR  | 30              |             |                 | dB       |       |
| Average Output Power             | P <sub>out</sub>                                | -5              |             | 0               | dBm      | 1     |
| Extinction Ratio                 | ER  | 10              |             |                 | dB       |       |
| Jitter Generation (RMS)          |   |                 |             | 0.01            | UI       |       |
| Jitter Generation (PK-PK)        |   |                 |             | 0.1             | UI       |       |
| Output Optical Eye               | Compliant Telcordia GR-253-CORE and ITU-T G.957 |                 |             |                 |          |       |
| Optical Rise/Fall Time (20%~80%) | tr/tf   |                 |             | 0.26            | ns       |       |
| Data Input Swing Differential    | V <sub>IN</sub>                                 | 300             |             | 1860            | mV       | 2     |
| Input Differential Impedance     | Z <sub>IN</sub>                                 | 90              | 100         | 110             | $\Omega$ |       |
| TX Disable                       | Disable   | 2.0             |             | V <sub>cc</sub> | V        |       |
|                                  | Enable  | 0               |             | 0.8             | V        |       |
| TX Fault                         | Fault   | 2.0             |             | V <sub>cc</sub> | V        |       |
|                                  | Normal  | 0               |             | 0.8             | V        |       |
| <b>Receiver</b>                  |   |                 |             |                 |          |       |

|                                |                  |      |  |                 |     |   |
|--------------------------------|------------------|------|--|-----------------|-----|---|
| Centre Wavelength              | $\lambda_c$      | 1260 |  | 1620            | nm  |   |
| Receiver Sensitivity           |                  |      |  | -34             | dBm | 3 |
| Receiver Overload              |                  | -3   |  |                 | dBm | 3 |
| LOS De-Assert                  | LOS <sub>D</sub> |      |  | -38             | dBm |   |
| LOS Assert                     | LOS <sub>A</sub> | -45  |  |                 | dBm |   |
| LOS Hysteresis                 |                  | 1    |  | 4               | dB  |   |
| Data Output Swing Differential | V <sub>out</sub> | 370  |  | 1800            | mV  | 4 |
| LOS                            | High             | 2.0  |  | V <sub>cc</sub> | V   |   |
|                                | Low              | 0    |  | 0.8             | V   |   |

**Notes:**

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>23</sup>-1 test pattern @155Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.

## Timing and Electrical

**Table 5 - Timing and Electrical**

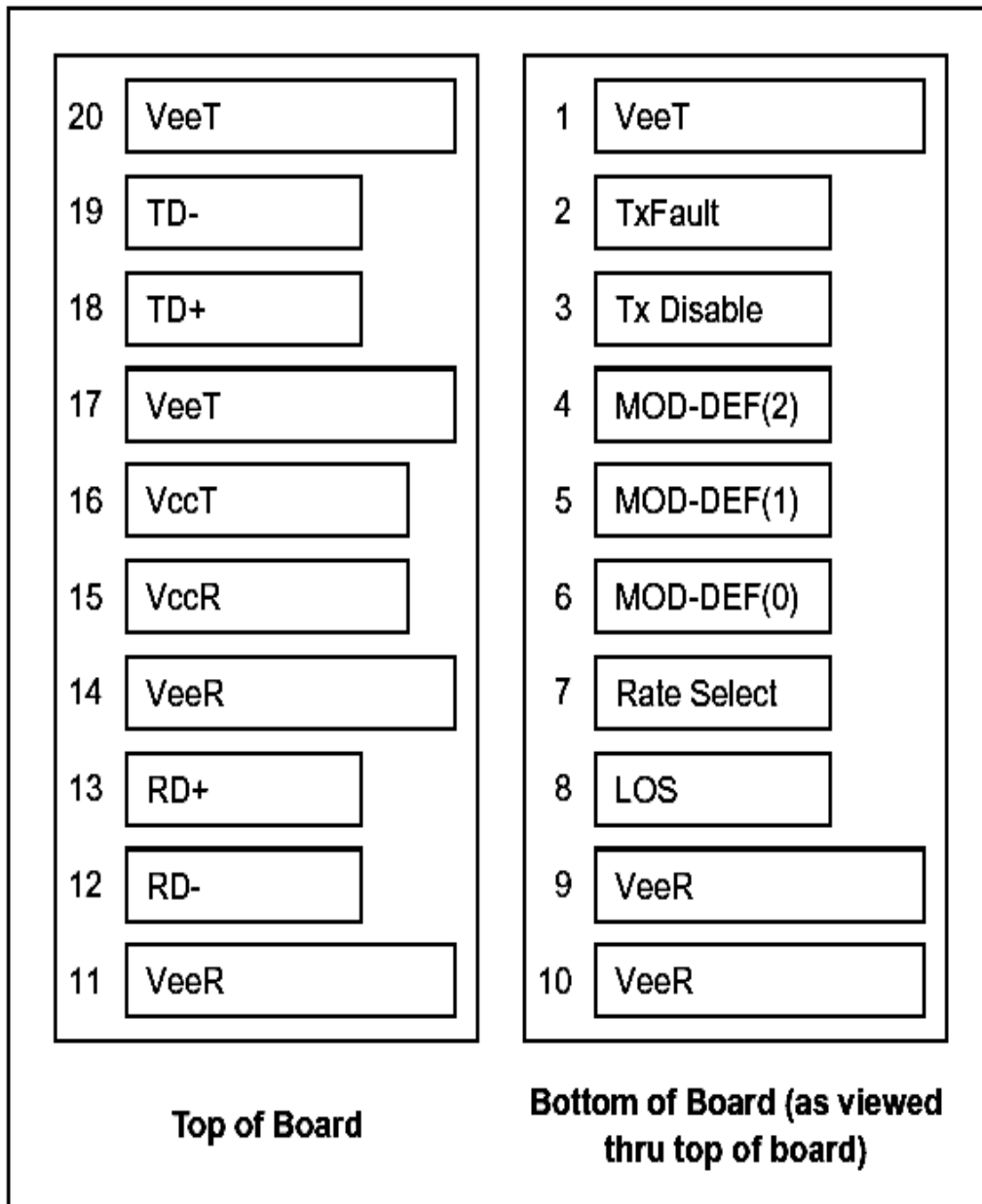
| Parameter                                       | Symbol                    | Min | Typical | Max             | Unit    |
|---|---------------------------|-----|---------|-----------------|---------|
| Tx Disable Negate Time                          | t <sub>on</sub>           |     |         | 1               | ms      |
| Tx Disable Assert Time                          | t <sub>off</sub>          |     |         | 10              | $\mu$ s |
| Time To Initialize, including Reset of Tx Fault | t <sub>init</sub>         |     |         | 300             | ms      |
| Tx Fault Assert Time                            | t <sub>fault</sub>        |     |         | 100             | $\mu$ s |
| Tx Disable To Reset                             | t <sub>reset</sub>        | 10  |         |                 | $\mu$ s |
| LOS Assert Time                                 | t <sub>loss_on</sub>      |     |         | 100             | $\mu$ s |
| LOS De-assert Time                              | t <sub>loss_off</sub>     |     |         | 100             | $\mu$ s |
| Serial ID Clock Rate                            | f <sub>serial_clock</sub> |     |         | 400             | KHz     |
| MOD_DEF (0:2)-High                              | V <sub>H</sub>            | 2   |         | V <sub>cc</sub> | V       |
| MOD_DEF (0:2)-Low                               | V <sub>L</sub>            |     |         | 0.8             | V       |

## Diagnostics

**Table 6 – Diagnostics Specification**

| Parameter    | Range      | Unit | Accuracy | Calibration         |
|--------------|------------|------|----------|---------------------|
| Temperature  | 0 to +70   | °C   | ±3°C     | Internal / External |
| Voltage      | 3.0 to 3.6 | V    | ±3%      | Internal / External |
| Bias Current | 0 to 100   | mA   | ±10%     | Internal / External |
| TX Power     | -5 to 0    | dBm  | ±3dB     | Internal / External |
| RX Power     | -33 to -9  | dBm  | ±3dB     | Internal / External |

## Pin Definitions



## Pin Descriptions

| Pin | Signal Name      | Description                  | Plug Seq. | Notes  |
|-----|------------------|------------------------------|-----------|--------|
| 1   | V <sub>EET</sub> | Transmitter Ground           | 1         |        |
| 2   | TX FAULT         | Transmitter Fault Indication | 3         | Note 1 |
| 3   | TXDISABLE        | Transmitter Disable          | 3         | Note 2 |
| 4   | MOD_DEF(2)       | SDA Serial Data Signal       | 3         | Note 3 |
| 5   | MOD_DEF(1)       | SCL Serial Clock Signal      | 3         | Note 3 |
| 6   | MOD_DEF(0)       | TTL Low                      | 3         | Note 3 |
| 7   | Rate Select      | Not Connected                | 3         |        |
| 8   | LOS              | Loss of Signal               | 3         | Note 4 |
| 9   | V <sub>EER</sub> | Receiver ground              | 1         |        |
| 10  | V <sub>EER</sub> | Receiver ground              | 1         |        |
| 11  | V <sub>EER</sub> | Receiver ground              | 1         |        |
| 12  | RD-              | Inv. Received Data Out       | 3         | Note 5 |
| 13  | RD+              | Received Data Out            | 3         | Note 5 |
| 14  | V <sub>EER</sub> | Receiver ground              | 1         |        |
| 15  | V <sub>CCR</sub> | Receiver Power Supply        | 2         |        |
| 16  | V <sub>CCT</sub> | Transmitter Power Supply     | 2         |        |
| 17  | V <sub>EET</sub> | Transmitter Ground           | 1         |        |
| 18  | TD+              | Transmit Data In             | 3         | Note 6 |
| 19  | TD-              | Inv. Transmit Data In        | 3         | Note 6 |
| 20  | V <sub>EET</sub> | Transmitter Ground           | 1         |        |

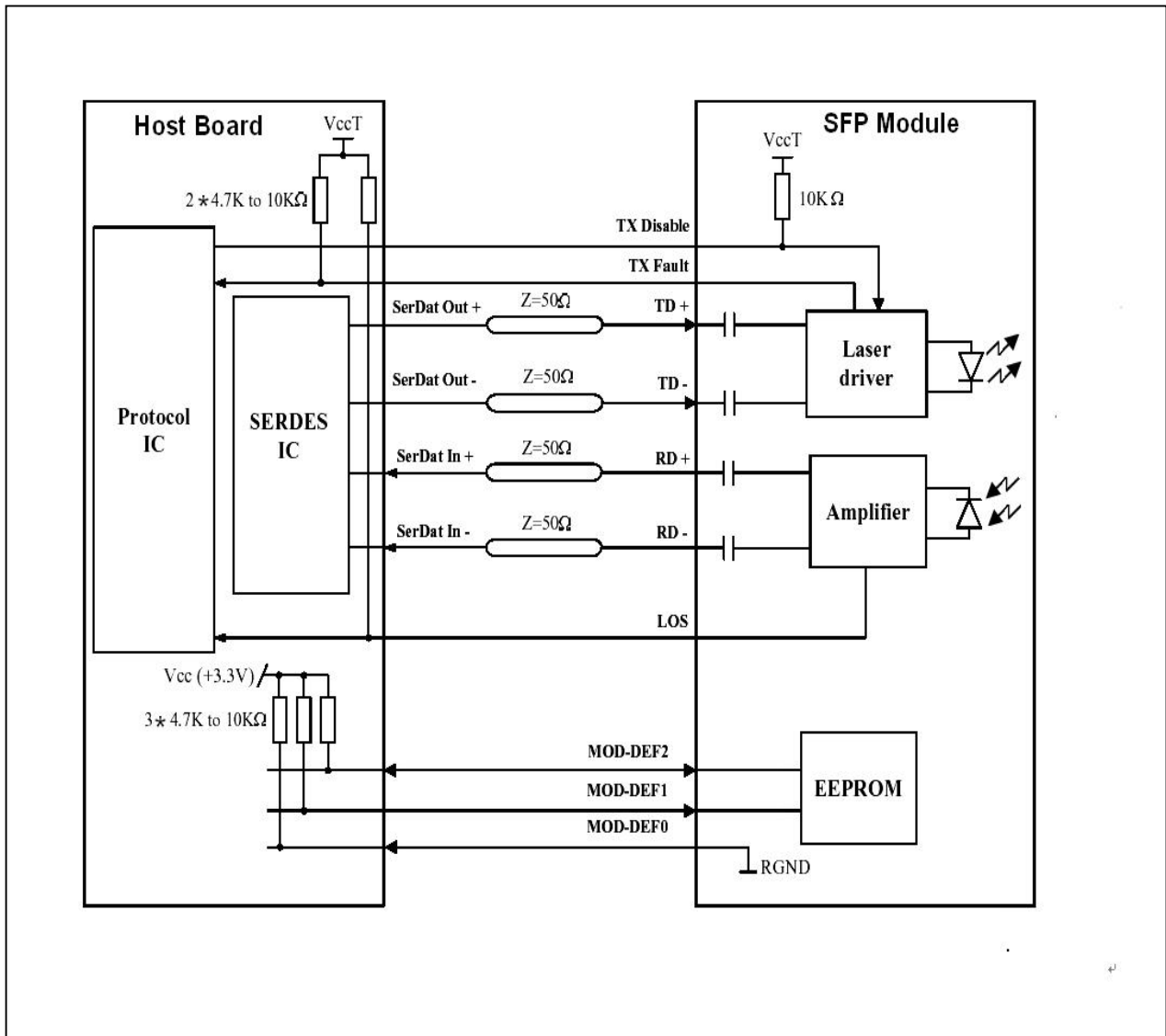
### Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

- 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 V<sub>cc</sub>+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:
 

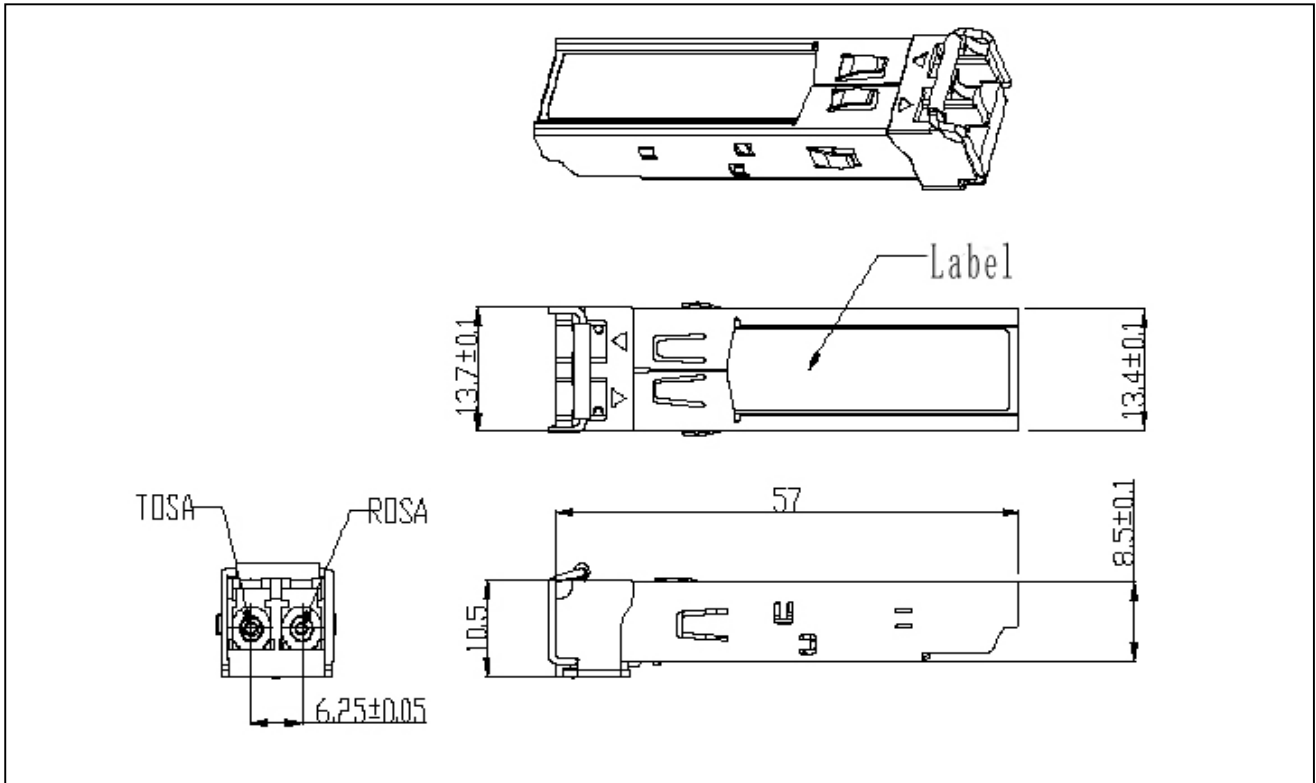
|                       |                      |
|-----------------------|----------------------|
| Low (0 to 0.8V):      | Transmitter on       |
| (>0.8V, < 2.0V):      | Undefined            |
| High (2.0 to 3.465V): | Transmitter Disabled |
| Open:                 | Transmitter Disabled |
- Mod-Def 0,1,2. These 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<sub>ccT</sub> or V<sub>ccR</sub>.  
 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. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

### Recommended Interface Circuit





### Mechanical Dimensions



### Regulatory Compliance

Empowerfiber SFP transceiver is designed to be Class I Laser safety compliant and is certified per the following standards

| Feature                  | Agency | Standard  | Certificate / Comments |
|--------------------------|--------|---|------------------------|
| Laser Safety             | FDA    | CDRH 21 CFR 1040 and Laser Notice No. 50                    | 1120294-000            |
| Product Safety           | BST    | EN 60825-1: 2007<br>EN 60825-2: 2004<br>EN 60950-1: 2006    | BT0905142002           |
| Environmental protection | SGS    | RoHS Directive 2002/95/EC                                   | GZ0902008346/CHEM      |
| EMC                      | CCIC   | EN 55022: 2006+A1: 2007<br>EN 55024: 1998+A1: 2001+A2: 2003 | CTE09050018            |



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OPTICAL NETWORK TRANSCEIVER INNOVATOR

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E-mail: [sales@empowerfiber.com](mailto:sales@empowerfiber.com)

Web : <http://www.empowerfiber.com>