

## Features:

- ☞ Single Mode fiber transmission
- ☞ SFP Multi-source Package with LC Receptacle
- ☞ Up to 6.144Gb/s Data Links
- ☞ 1310nm FP laser and PIN photodetector
- ☞ Hot-Pluggable Capability
- ☞ Single +3.3V Power Supply
- ☞ Compliant with Specifications for IEEE802.3Z
- ☞ Eye Safety Designed to Meet Laser Class1, Compliant with IEC60825-1

## Applications:

- ☞ Metro/Access Networks
- ☞ Fiber Channel
- ☞ CPRI

## Specification:

### ● Electrical and Optical Characteristics: (Condition: $T_a=T_{OP}$ )

| Parameter                              | Symbol          | Min. | Typical | Max.            | Unit   |
|--|-----------------|------|---------|-----------------|--------|
| Transmitter Differential Input Voltage | +/-TX_DAT       | 200  |         | 2400            | mV p-p |
| Supply Current                         | I <sub>CC</sub> |      | 150     | 300             | mA     |
| Tx_Disable Input Voltage – Low         | V <sub>IL</sub> | 0    |         | 0.8             | V      |
| Tx_Disable Input Voltage – High        | V <sub>IH</sub> | 2.0  |         | V <sub>CC</sub> | V      |
| Tx_Fault Output Voltage – Low          | V <sub>OL</sub> | 0    |         | 0.8             | V      |
| Tx_Fault Output Voltage – High         | V <sub>OH</sub> | 2.0  |         | V <sub>CC</sub> | V      |
| Receiver Differential Output Voltage   | +/-RX_DAT       | 600  |         | 1400            | mV p-p |
| Rx_LOS Output Voltage- Low             | V <sub>OL</sub> | 0    |         | 0.8             | V      |
| Rx_LOS Output Voltage- High            | V <sub>OH</sub> | 2.0  |         | V <sub>CC</sub> | V      |

### ● Characteristics of Transmitter

| Transmitter :         |                             |      |         |      |      |
|-----------------------|-----------------------------|------|---------|------|------|
| Parameter             | Symbol                      | Min. | Typical | Max. | Unit |
| Data Rate             | B                           | -    | 6.144   | -    | Gb/s |
| Centre Wavelength     | $\lambda_c$                 | 1280 | 1310    | 1330 | nm   |
| Output Spectral Width | $\Delta\lambda(\text{RMS})$ | -    | -       | 4    | nm   |
| Average Output Power  | P <sub>o</sub>              | -9   | -       | -3   | dBm  |

|                           |                           |                       |                |                       |             |
|---------------------------|---------------------------|-----------------------|----------------|-----------------------|-------------|
| Extinction Ratio          | EXT                       | 3.5                   | -              | -                     | dB          |
| Data Input Voltage-High   | V <sub>IHS</sub>          | V <sub>cc</sub> -1.16 | -              | V <sub>cc</sub> -0.89 | V           |
| Data Input Voltage -Low   | V <sub>ILS</sub>          | V <sub>cc</sub> -1.82 | -              | V <sub>cc</sub> -1.48 | V           |
| Supply Current            | I <sub>CC</sub>           | -                     | 80             | 150                   | mA          |
| Output Optical Eye        | Compliant with IEEE802.3Z |                       |                |                       |             |
| <b>Receiver :</b>         |                           |                       |                |                       |             |
| <b>Parameter</b>          | <b>Symbol</b>             | <b>Min.</b>           | <b>Typical</b> | <b>Max.</b>           | <b>Unit</b> |
| Receive Sensitivity       | P <sub>min</sub>          | -                     | -              | -14                   | dBm         |
| Operating Wavelength      | λ <sub>c</sub>            | 1260                  |                | 1620                  | nm          |
| Maximum Input Power       | P <sub>MAX</sub>          | -3                    | -              | -                     | dBm         |
| Signal Detection-Asserted | SD <sub>HIGH</sub>        | -                     | -              | -30                   | dBm         |
| Signal Detection-Deserted | SD <sub>LOW</sub>         | -40                   | -              | -                     | dBm         |
| Hysteresis                | -                         | -                     | 3.0            | -                     | dBm         |
| Output High Voltage       | V <sub>OH</sub>           | V <sub>cc</sub> -1.03 | -              | V <sub>cc</sub> -0.89 | V           |
| Output Low Voltage        | V <sub>OL</sub>           | V <sub>cc</sub> -1.82 | -              | V <sub>cc</sub> -1.63 | V           |
| Supply Current            | I <sub>CC</sub>           | -                     | 80             | 150                   | mA          |

● **Absolute Maximum Ratings: (T<sub>C</sub>=25°C)**

| Parameter             | Symbol          | Min.   | Max.     | Unit |
|-----------------------|-----------------|--------|----------|------|
| Storage Temperature   | T <sub>ST</sub> | -40    | +85      | °C   |
| Operating Temperature | T <sub>IP</sub> | 0(-40) | +70(+85) | °C   |
| Input Voltage         | T <sub>CC</sub> | 0      | +5       | V    |

● **Recommended Operating Environment:**

| Parameter             | Symbol          | Min.   | Typical | Max.     | Unit |
|-----------------------|-----------------|--------|---------|----------|------|
| Supply Voltage        | V <sub>CC</sub> | +3.0   | +3.3    | +3.6     | V    |
| Operating Temperature | T <sub>OP</sub> | 0(-40) | -       | +70(+85) | °C   |

● **Timing Characteristics:**

| Parameter                                    | Symbol             | Min. | Typical | Max. | Unit |
|--|--------------------|------|---------|------|------|
| TX_DISABLE Assert Time                       | t <sub>off</sub>   |      | 3       | 10   | usec |
| TX_DISABLE Negate Time                       | t <sub>on</sub>    |      | 0.5     | 1    | msec |
| Time to Initialize Include Reset of TX_FAULT | t <sub>int</sub>   |      | 30      | 300  | msec |
| TX_FAULT from Fault to Assertion             | t <sub>fault</sub> |      | 20      | 100  | usec |

|   |                        |    |  |     |      |
|---|------------------------|----|--|-----|------|
| TX_DISBEL Time to Start Reset                   | t_reset                | 10 |  |     | usec |
| Receiver Loss of Signal Assert Time (Off to On) | T <sub>A</sub> ,RX_LOS |    |  | 100 | usec |
| Receiver Loss of Signal Assert Time (On to Off) | T <sub>d</sub> ,RX_LOS |    |  | 100 | usec |

● **Serial ID Memory Contents:**

| Data Address                     | Length (Byte) | Name of Length | Description and Contents  |
|----------------------------------|---------------|----------------|---|
| <b>Base ID Fields</b>            |               |                |   |
| 0                                | 1             | Identifier     | Type of Serial transceiver (03h=SFP)  |
| 1                                | 1             | Reserved       | Extended identifier of type serial transceiver (04h)  |
| 2                                | 1             | Connector      | Code of optical connector type (07=LC)  |
| 3-10                             | 8             | Transceiver    | Gigabit Ethernet 1000Base-SX & Fiber Channel  |
| 11                               | 1             | Encoding       | 8B10B (01h)   |
| 12                               | 1             | BR,Nominal     | Nominal baud rate, unit of 100Mbps  |
| 13-14                            | 2             | Reserved       | (0000h)   |
| 15                               | 1             | Length(9um)    | Link length supported for 9/125um fiber, units of 100m  |
| 16                               | 1             | Length(50um)   | Link length supported for 50/125um fiber, units of 10m  |
| 17                               | 1             | Length(62.5um) | Link length supported for 62.5/125um fiber, units of 10m  |
| 18                               | 1             | Length(Copper) | Link length supported for copper, units of meters   |
| 19                               | 1             | Reserved       |   |
| 20-35                            | 16            | Vendor Name    | SFP vendor name   |
| 36                               | 1             | Reserved       |   |
| 37-39                            | 3             | Vendor OUI     | SFP transceiver vendor OUI ID   |
| 40-55                            | 16            | Vendor PN      | Part Number   |
| 56-59                            | 4             | Vendor rev     | Revision level for part number  |
| 60-62                            | 3             | Reserved       |   |
| 63                               | 1             | CCID           | Least significant byte of sum of data in address 0-62   |
| <b>Extended ID Fields</b>        |               |                |   |
| 64-65                            | 2             | Option         | Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported) |
| 66                               | 1             | BR, max        | Upper bit rate margin, units of %   |
| 67                               | 1             | BR, min        | Lower bit rate margin, units of %   |
| 68-83                            | 16            | Vendor SN      | Serial number (ASCII)   |
| 84-91                            | 8             | Date code      | Manufacturing date code   |
| 92-94                            | 3             | Reserved       |   |
| 95                               | 1             | CCEX           | Check code for the extended ID Fields (addresses 64 to 94)  |
| <b>Vendor Specific ID Fields</b> |               |                |   |
| 96-127                           | 32            | Readable       | specific date, read only  |

## ● Digital Diagnostic Monitoring Functions

2-wire serial bus address 1010001X (A2h) is used to access measurement of transceiver temperature, internally measured supply voltage, TX bias current, TX optical output power and RX optical input power which are shown in table 1. Each diagnostic parameter has a corresponding high alarm, low alarm, high warning and low warning threshold which are shown in table 2.

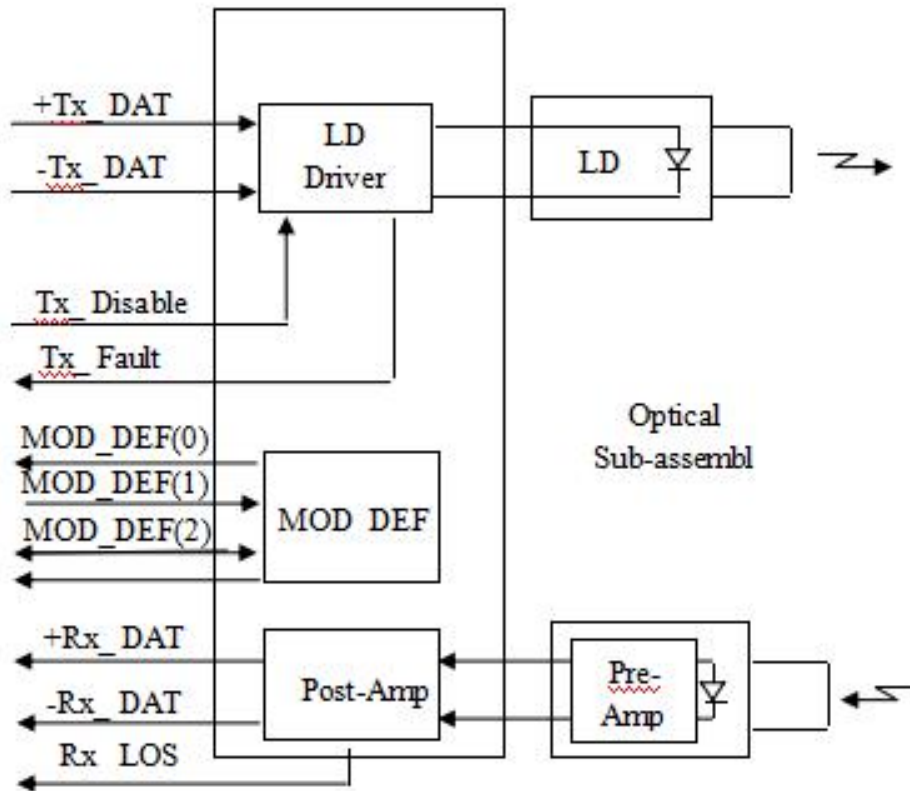
Table 1. Diagnostic Parameters

| Diagnostic Parameter               | Range    |         | LSB           | Accuracy | Address | Note                                  |
|------------------------------------|----------|---------|---------------|----------|---------|---------------------------------------|
|                                    | Min      | Max     |               |          |         |                                       |
| Transceiver Temperature (Temp)     | -50[°C]  | +80[°C] | 1/256[°C]     | ±3[°C]   | 96-97   | A 16bit signed two's complement value |
| Supply Voltage (Voltage)           | +3.0[V]  | +3.6[V] | 100[ $\mu$ V] | ±3[%]    | 98-99   | A 16bit unsigned integer              |
| TX Bias Current (Bias)             | 3[mA]    | 95[mA]  | 2.0[ $\mu$ A] | ±10[%]   | 100-101 | A 16bit unsigned integer              |
| TX Optical Output Power (TX Power) | -10[dBm] | -4[dBm] | 0.1[ $\mu$ W] | ±3 [dB]  | 102-103 | A 16bit unsigned integer              |
| RX Optical Input Power (RX Power)  | -14[dBm] | +0[dBm] | 0.1[ $\mu$ W] | ±3 [dB]  | 104-105 | A 16bit unsigned integer              |

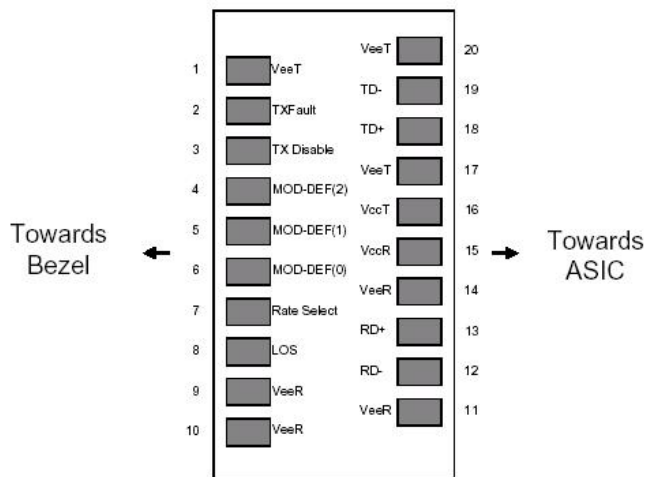
Table 2. Alarm and Warning Thresholds

| Parameter                          | Warning |       | Alarm |      | Unit |
|------------------------------------|---------|-------|-------|------|------|
|                                    | Low     | High  | Low   | High |      |
| Transceiver Temperature (Temp)     | -10     | +80   | -20   | +90  | °C   |
| Supply Voltage (Voltage)           | +3.13   | +3.47 | +3.0  | +3.6 | V    |
| TX Bias Current (Bias)             | 5       | 85    | 3     | 95   | mA   |
| TX Optical Output Power (TX Power) | -9      | -3    | -10   | -2   | dBm  |
| RX Optical Input Power (RX Power)  | -13.5   | +1    | -14.5 | +2   | dBm  |

### Block Diagram of Transceiver:



### Pin Assignment:



### Pin out of Connector Block on Host Board

#### Pin Description:

| Pin | Symbol             | Name/Description   | Ref. |
|-----|--------------------|--|------|
| 1   | V <sub>EET</sub>   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | T <sub>FAULT</sub> | Transmitter Fault. Not supported.                              |      |
| 3   | T <sub>DIS</sub>   | Transmitter Disable. Laser output disabled on high or open.    | 2    |
| 4   | MOD_DEF(2)         | Module Definition 2. Data line for Serial ID.                  | 3    |
| 5   | MOD_DEF(1)         | Module Definition 1. Clock line for Serial ID.                 | 3    |
| 6   | MOD_DEF(0)         | Module Definition 0. Grounded within the module.               | 3    |
| 7   | Rate Select        | No connection required   |      |
| 8   | LOS                | Loss of Signal indication. Logic 0 indicates normal operation. | 4    |
| 9   | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 10  | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 12  | RD-                | Receiver Inverted DATA out. AC Coupled                         |      |
| 13  | RD+                | Receiver Non-inverted DATA out. AC Coupled                     |      |
| 14  | V <sub>EER</sub>   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 15  | V <sub>CCR</sub>   | Receiver Power Supply  |      |
| 16  | V <sub>CCT</sub>   | Transmitter Power Supply                                       |      |
| 17  | V <sub>EET</sub>   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 18  | TD+                | Transmitter Non-Inverted DATA in. AC Coupled.                  |      |
| 19  | TD-                | Transmitter Inverted DATA in. AC Coupled.                      |      |
| 20  | V <sub>EET</sub>   | Transmitter Ground (Common with Receiver Ground)               | 1    |

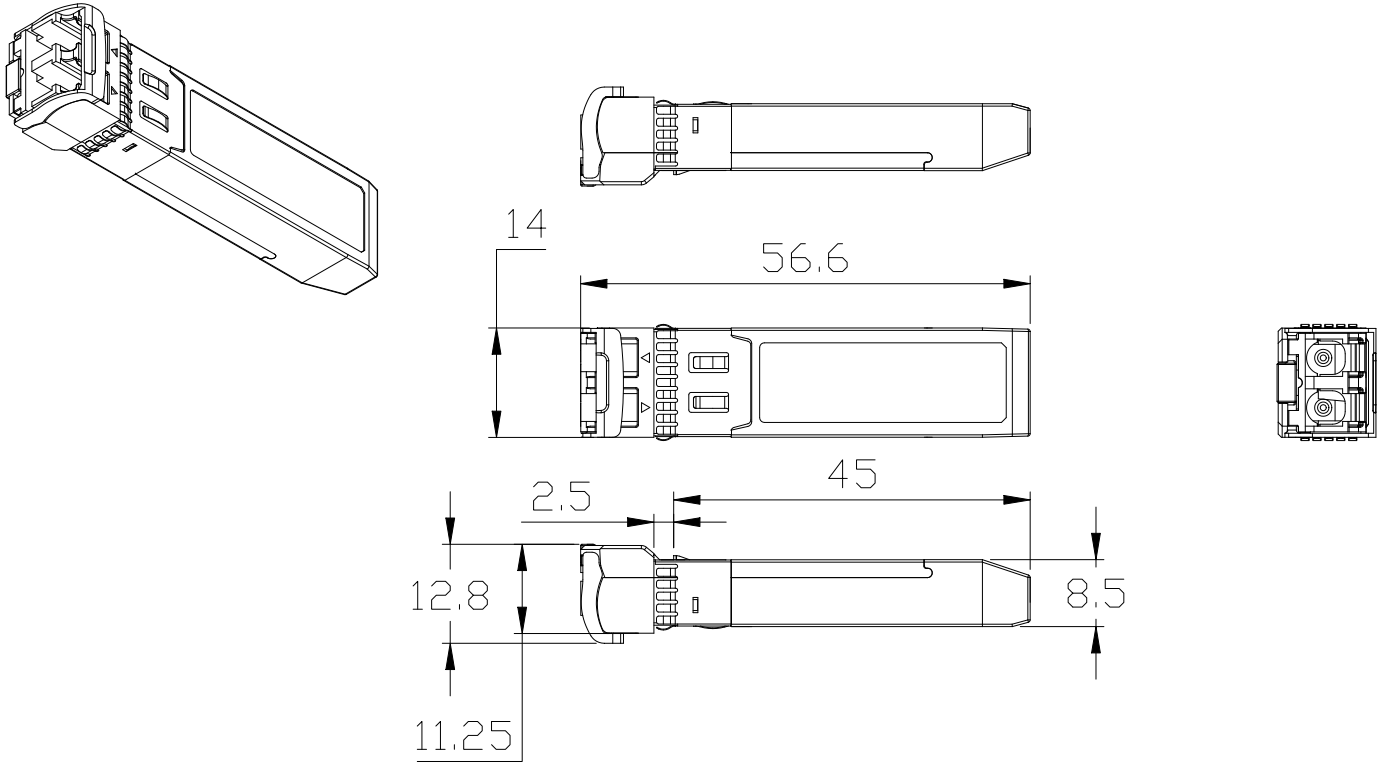
#### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V.  
MOD\_DEF(0) pulls line low to indicate module is plugged in.
4. LOS is open collector output. Should be pulled up with 4.7k – 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

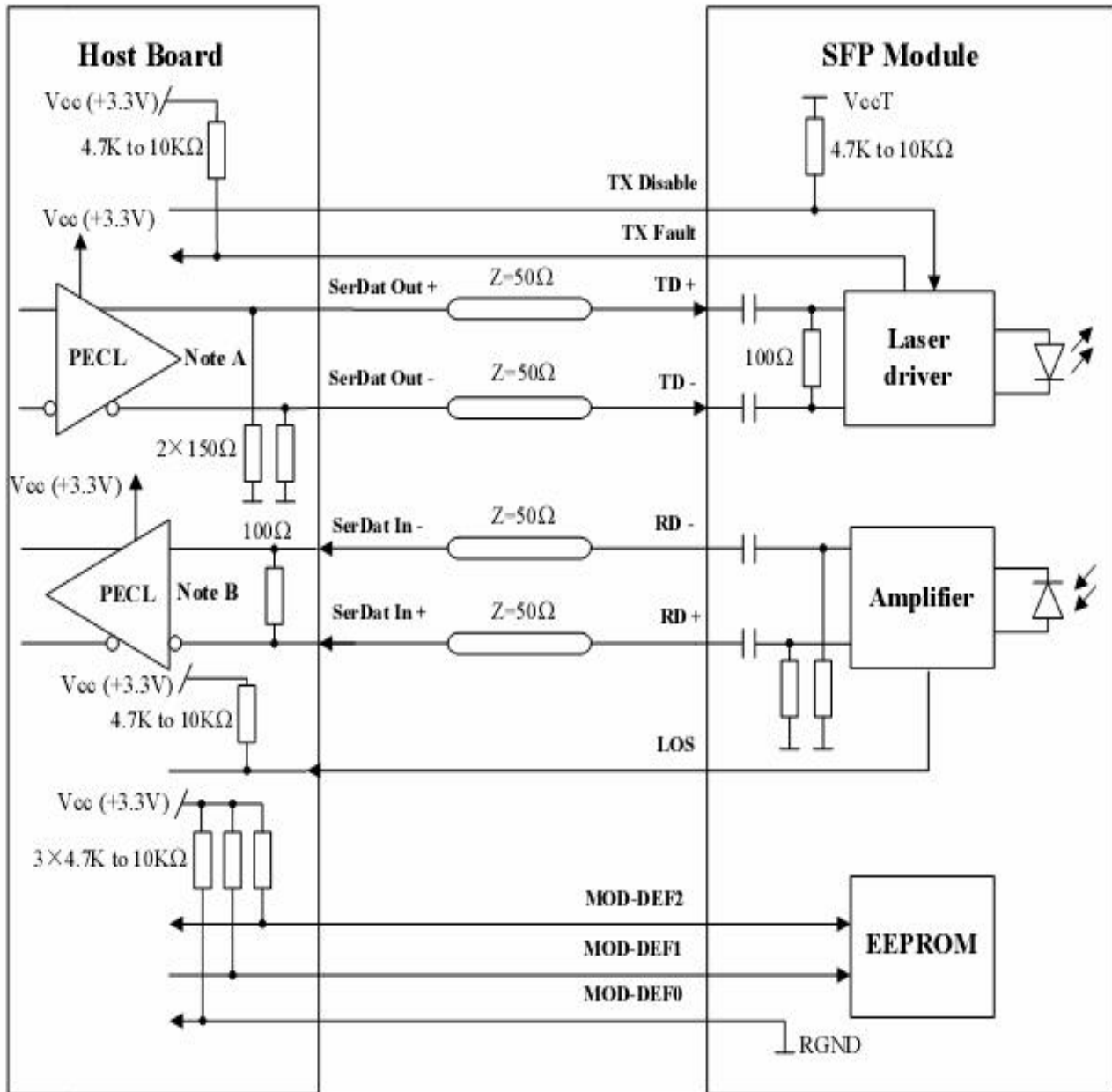
#### Ordering information:

| Part Number   | Package | Rate      | Fiber type | Distance | Wavelength (nm) | Temperature (°C) |
|---------------|---------|-----------|------------|----------|-----------------|------------------|
| TM-EBB3x-233E | SFP     | 6.144Gbps | SMF        | 2km      | 1310            | 0/+70            |
| TM-EBB3x-233I | SFP     | 6.144Gbps | SMF        | 2km      | 1310            | -40/+85          |

**Mechanical Dimensions:**



### Recommended Circuit:



Note A: Circuit assumes open emitter output

Note B: Circuit assumes high impedance internal bias @ $V_{cc}-1.3V$