

**T-1G-SM-40KM****1.25Gbps SFP Optical Transceiver, 40km Reach****Features**

Dual data-rate of 1.25Gbps/1.063Gbps operation  
1310nm DFB laser and PIN photodetector for 40km transmission  
Compliant with SFP MSA and SFF-8472 with duplex LC receptacle  
Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration  
Compatible with SONET OC-24-LR-1  
Compatible with RoHS  
+3.3V single power supply  
Operating case temperature range of  
0°C to +70°C (Standard) or -40°C to +85°C (Industrial)

**Applications**

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

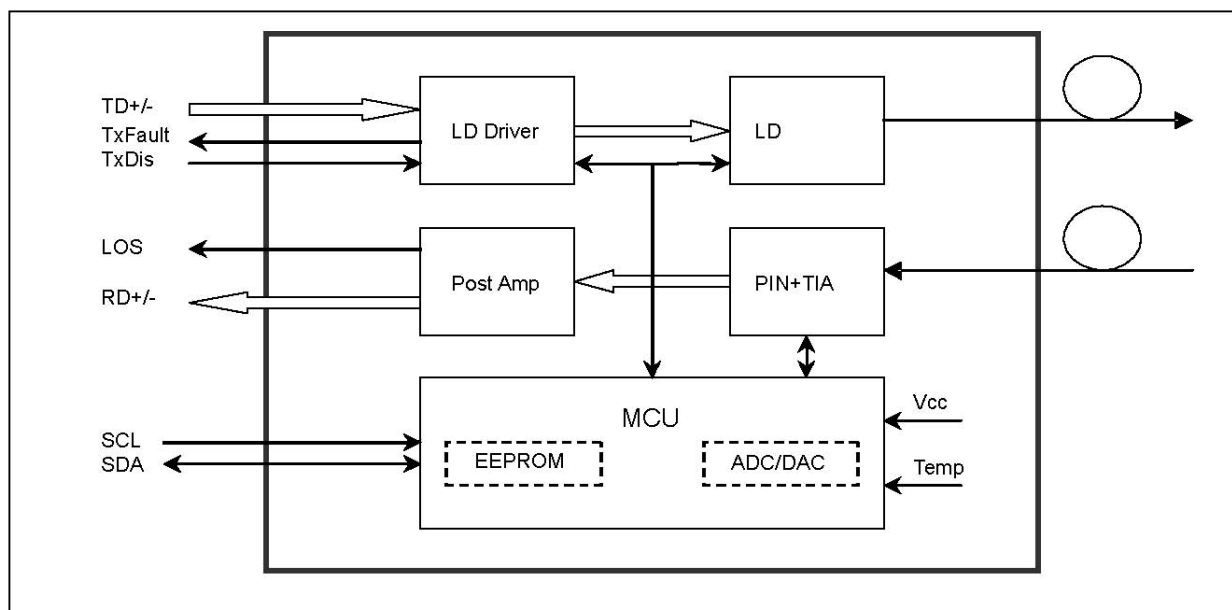
**Description**

The SFP transceivers are high performance, cost effective modules supporting dual data-rate of 1.25Gbps/1.063Gbps and 40km transmission distance with SMF.

The transceiver consists of three sections: a 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

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

## Recommended Operating Conditions

| Parameter                  |                  | Symbol | Min  | Typical | Max  | Unit |
|----------------------------|------------------|--------|------|---------|------|------|
| Operating Case Temperature | Standard         | Tc     | 0    |         | +70  | °C   |
|                            | Industrial       |        | -40  |         | +85  | °C   |
| Power Supply Voltage       |                  | Vcc    | 3.13 | 3.3     | 3.47 | V    |
| Power Supply Current       |                  | Icc    |      |         | 300  | mA   |
| Data Rate                  | Gigabit Ethernet |        |      | 1.25    |      | Gbps |
|                            | Fiber Channel    |        |      | 1,063   |      |      |

## Optical and Electrical Characteristics

| Parameter                      |         | Symbol           | Min  | Typical | Max             | Unit     | Notes |
|--------------------------------|---------|------------------|------|---------|-----------------|----------|-------|
| Transmitter                    |         |                  |      |         |                 |          |       |
| Centre Wavelength              |         | $\lambda_c$      | 1260 | 1310    | 1360            | nm       |       |
| Spectral Width (RMS)           |         | $\Delta\lambda$  |      |         | 4               | nm       |       |
| Average Output Power           |         | P <sub>out</sub> | -18  |         | -10             | dBm      | 1     |
| Extinction Ratio               |         | ER               | 10   |         |                 | dB       |       |
| Data Input Swing Differential  |         | V <sub>IN</sub>  | 400  |         | 1800            | 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        |       |
| Receiver                       |         |                  |      |         |                 |          |       |
| Centre Wavelength              |         | $\lambda_c$      | 1260 |         | 1580            | nm       |       |
| Receiver Sensitivity           |         |                  |      |         | -32             | dBm      | 3     |
| Receiver Overload              |         |                  | -3   |         |                 | dBm      | 3     |
| LOS De-Assert                  |         | LOS <sub>D</sub> |      |         | -33             | dBm      |       |
| LOS Assert                     |         | LOS <sub>A</sub> | -45  |         |                 | dBm      |       |
| LOS Hysteresis                 |         |                  | 1    |         | 4               | dB       |       |
| Data Output Swing Differential |         | V <sub>out</sub> | 400  |         | 1800            | mV       | 4     |
| LOS                            | High    |                  | 2.0  |         | V <sub>cc</sub> | V        |       |
|                                | Low     |                  |      |         | 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>7</sup>-1 test pattern @1250Mbps, BERJ1×10<sup>-12</sup>.
4. Internally AC-coupled.

## Timing and Electrical

| Parameter                                       | Symbol         | Min | Typical | Max             | Unit |
|---|----------------|-----|---------|-----------------|------|
| Tx Disable Negate Time                          | t_on           |     |         | 1               | ms   |
| Tx Disable Assert Time                          | t_off          |     |         | 10              | μs   |
| Time To Initialize, including Reset of Tx Fault | t_init         |     |         | 300             | ms   |
| Tx Fault Assert Time                            | t_fault        |     |         | 100             | μs   |
| Tx Disable To Reset                             | t_reset        | 10  |         |                 | μs   |
| LOS Assert Time                                 | t_loss_on      |     |         | 100             | μs   |
| LOS De-assert Time                              | t_loss_off     |     |         | 100             | μs   |
| Serial ID Clock Rate                            | f_serial_clock |     |         | 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 Specification

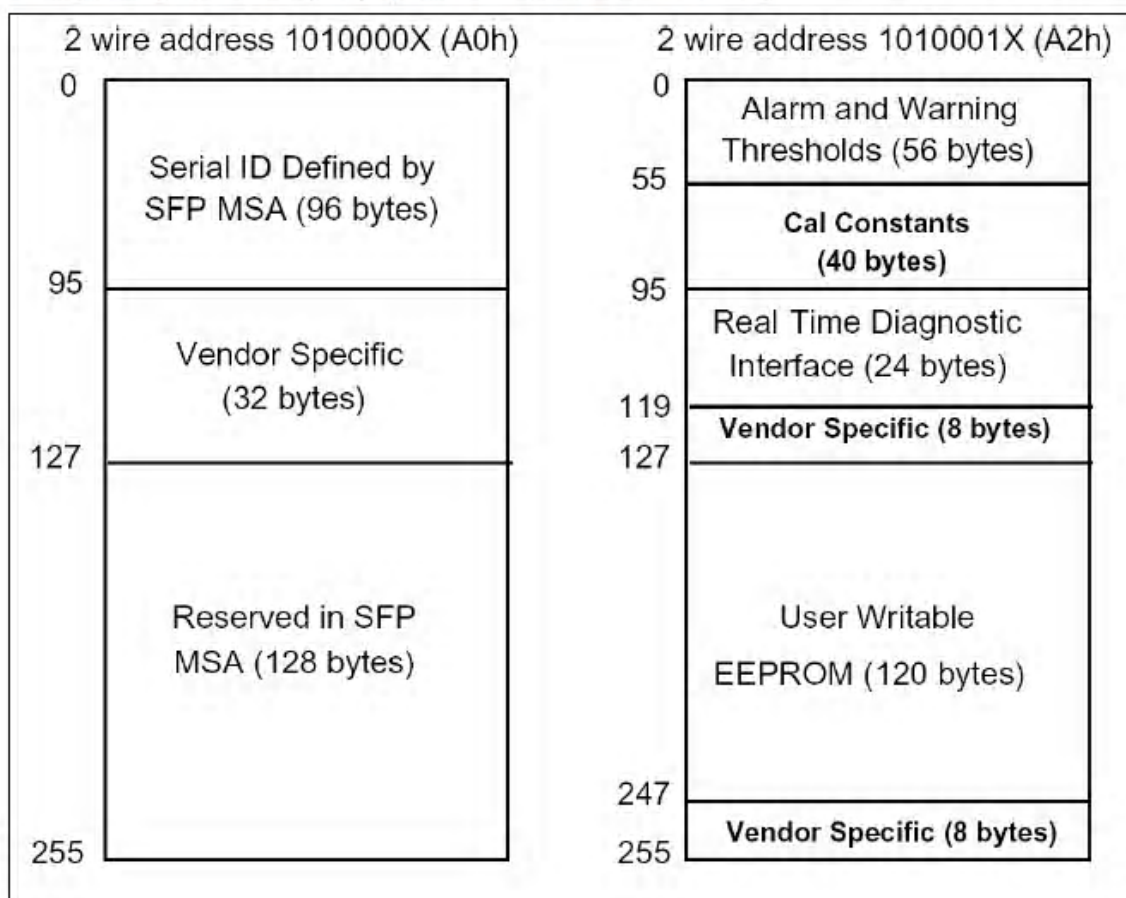
| Parameter    | Range      | Unit | Accuracy | Calibration         |
|--------------|------------|------|----------|---------------------|
| Temperature  | 0 to +70   | °C   | ±3°C     | Internal / External |
|              | -40 to +85 |      |          |                     |
| Voltage      | 3.0 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     | -24 to -3  | dBm  | ±3dB     | Internal / External |

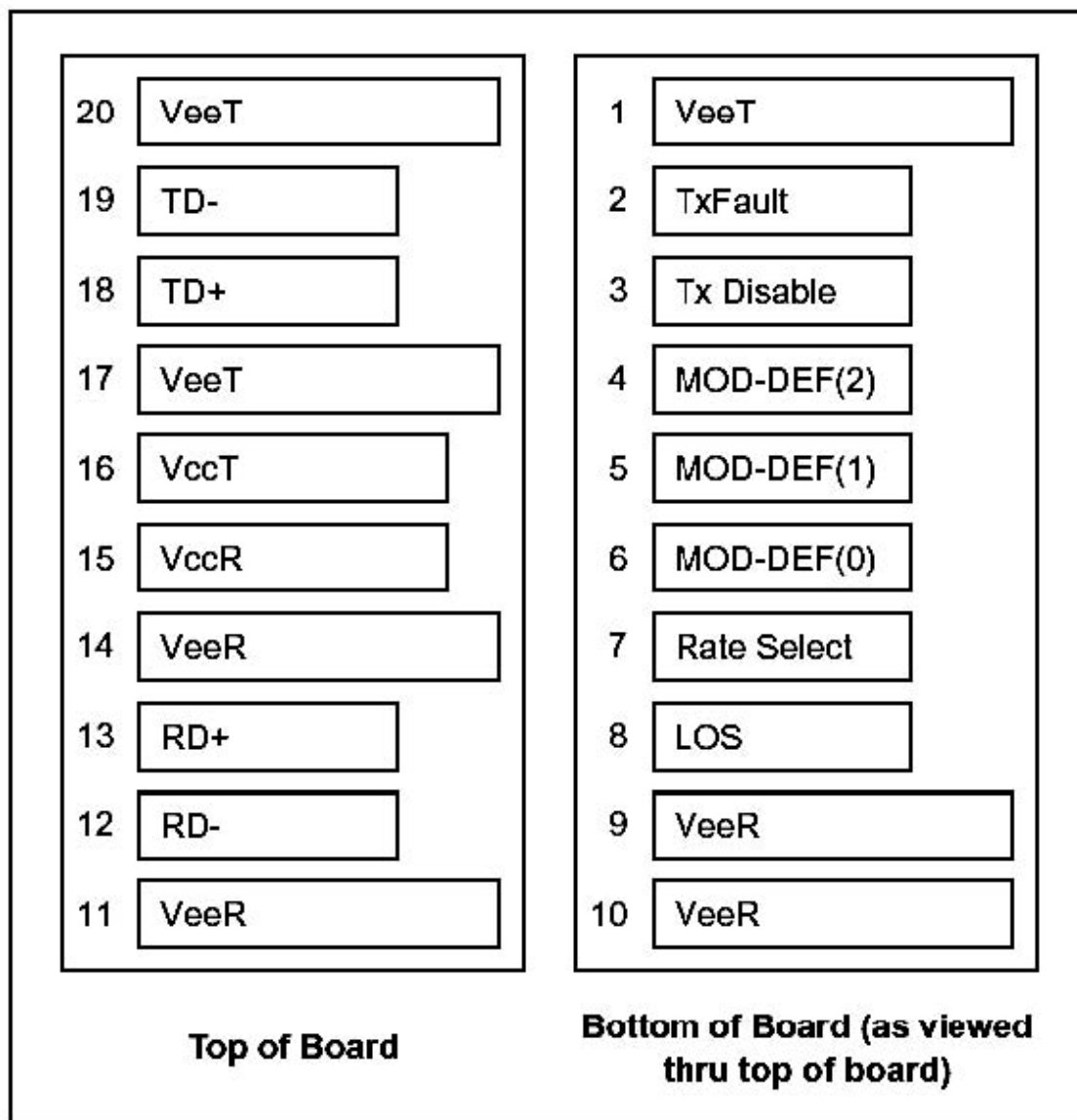
**Digital Diagnostic Memory Map**

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



**SFP Transceiver Electrical Pad Layout**



## Pin Descriptions

| Pin | Signal Name | Description                  | 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_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 Connect                  | 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 Supply        | 2         |        |
| 16  | VccT        | Transmitter Power Supply     | 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:

Plug Seq.: Pin engagement sequence during hot plugging.

1) TX Fault is an open collector output, which should be pulled up with a 4.7k~10k $\Omega$  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.

2) 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~10k $\Omega$  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

3) ModDef 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10k $\Omega$  resistor on the host board. The pullup voltage shall be VccT or VccR

ModDef 0 is grounded by the module to indicate that the module is present

ModDef 1 is the clock line of two wire serial interface for serial ID

ModDef 2 is the data line of two wire serial interface for serial ID

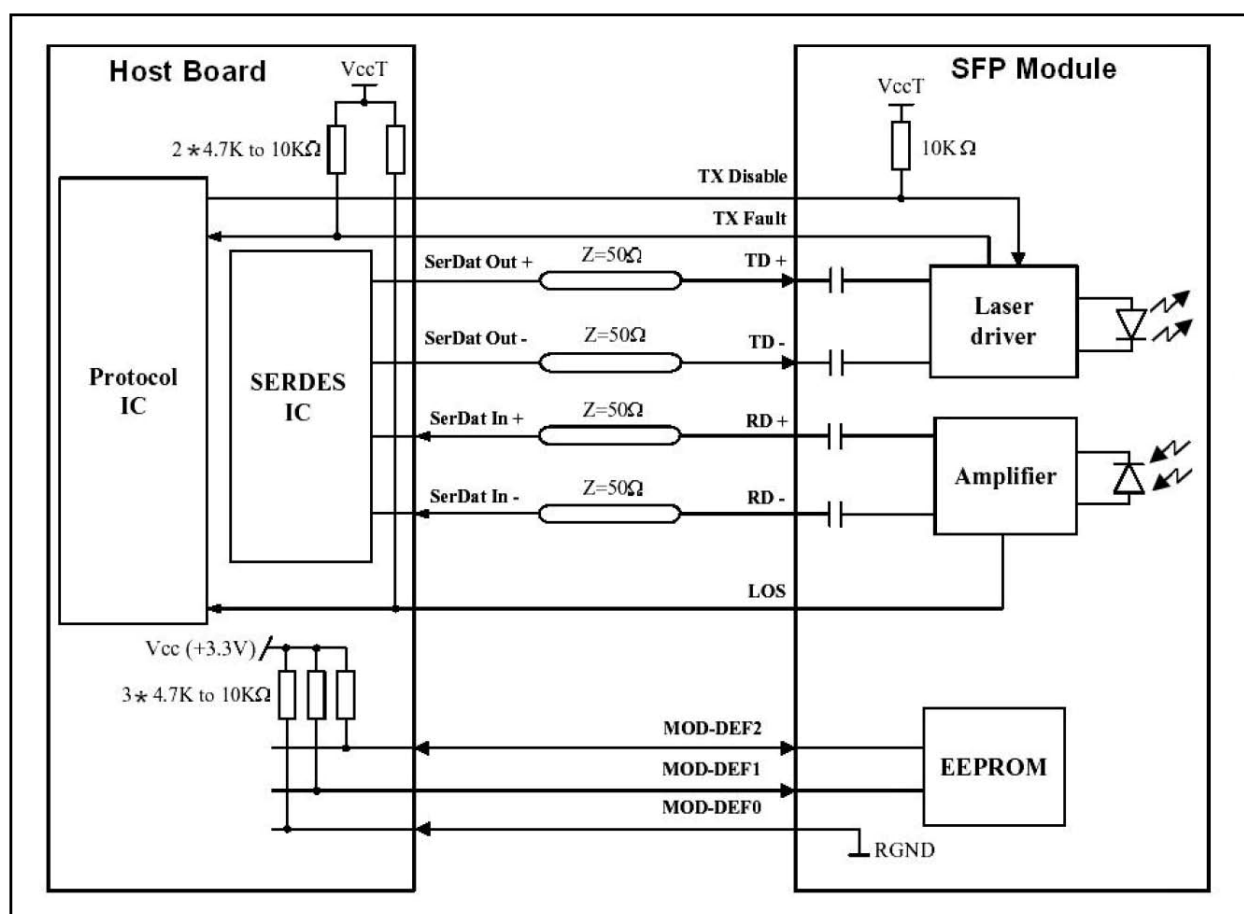
4) LOS is an open collector output, which should be pulled up with a 4.7k~10k $\Omega$  resistor. Pull up voltage between 2.0V and Vcc+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low

state, the output will be pulled to less than 0.8V.

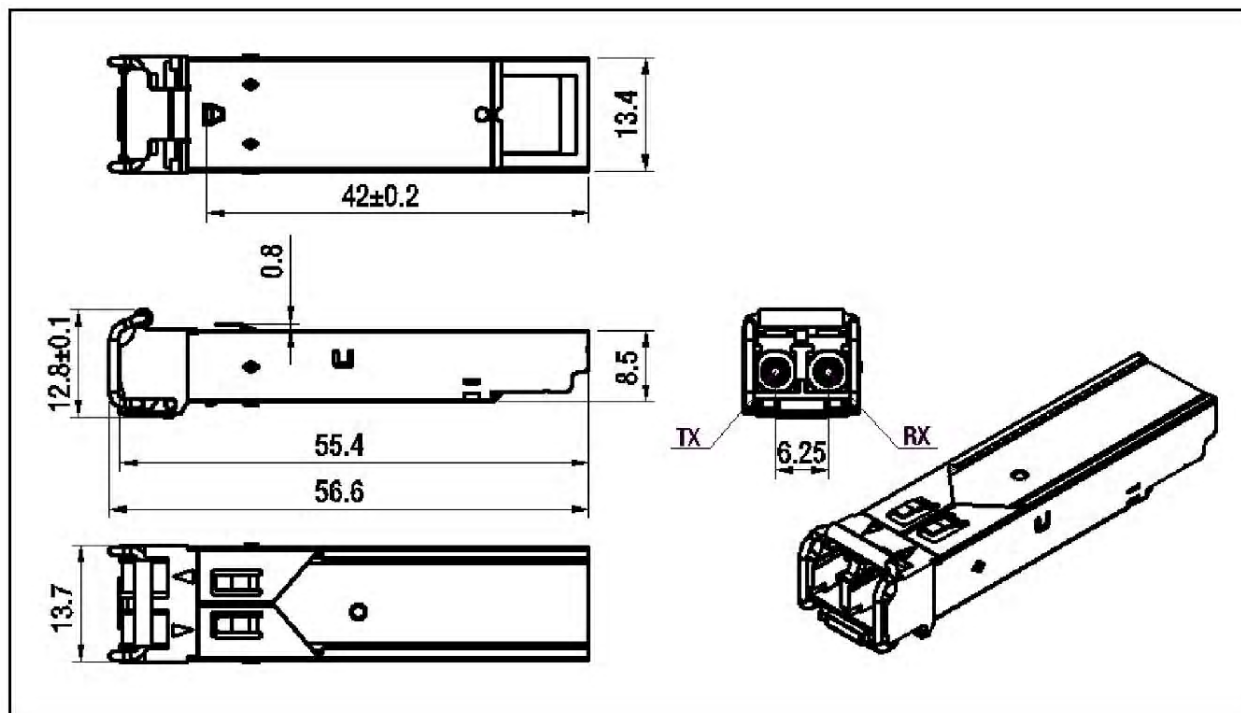
5) RD/+: These are the differential receiver outputs. They are internally ACcoupled 100 differential lines which should be terminated with  $100\Omega$  (differential) at the user

6) TD/+: These are the differential transmitter inputs. They are internally ACcoupled, differential lines with  $100\Omega$  differential termination inside the module.

### Recommended Interface Circuit





**Mechanical Dimensions**

**Regulatory Compliance**

| Feature  | Standard   | Performance   |
|--|--|---|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883E Method 3015.7                                   | Class 1(>500 V)<br>Isolation with the case                              |
| Electromagnetic Interference (EMI)                   | FCC Part 15 Class B  | Compatible with standards   |
| Laser Eye Safety                                     | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2 | Compatible with Class I laser product.<br>Compatible with TÜV standards |
| Component Recognition                                | UL and CUL   | UL file E317337   |
| Green Products                                       | 2002/95/EC<br>2005/618/EC                                    | RoHS6   |

**Ordering information**

|                | Product Description  |
|----------------|--|
| T-1G-SM-40KM   | 1310nm, 1.25Gbps, LC, 40km, 0°C~+70°C                                      |
| T-1G-SMD-40KM  | 1310nm, 1.25Gbps, LC, 40km, 0°C~+70°C, With Digital Diagnostic Monitoring  |
| T-1G-SMI-40KM  | 1310nm, 1.25Gbps, LC, 40km, 40°C~+85°C                                     |
| T-1G-SMDI-40KM | 1310nm, 1.25Gbps, LC, 40km, 40°C~+85°C, With Digital Diagnostic Monitoring |



## 1.25Gbps SFP Module

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### References

Small Form Factor Pluggable (SFP) Transceiver MultiSource Agreement (MSA), September 2000.

Telcordia GR253CORE and ITUT G.957 Specifications.

### Notice

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