

The GigaTech Products **SFP-1000-BIDIR-60KM-1310-GT** is programmed to be fully compatible and functional with all intended ACCEDIAN NETWORKS GIGE switching devices. This SFP optical transceiver is designed for IEEE 802.3 Gigabit Ethernet interconnects and is designed to be compliant with SFF-8472 SFP Multi-source Agreement (MSA). This module is designed for single mode simplex fiber and operates at a nominal transmit wavelength of 1310nm and nominal receive wavelength of 1490nm.

## Features:

- Up to 1.25GBd bi-directional data links
- Hot-pluggable SFP footprint
- 1310nm DFB laser transmitter
- Simplex LC Connectors
- Built in Digital Diagnostics
- Up to 60km over 9/125 SMF
- Single power supply 3.3V
- Operating temperature range  
C-Temp: 0°C to 70°C



## Compliance:

- IEEE 802.3z Gigabit Ethernet
- SFP MSA SFF-8472
- RoHS
- Class 1 laser product EN 60825

## Applications

- 1.25GBd Gigabit Ethernet

## Warranty:

GigaTech Branded Optical Transceivers- Lifetime Warranty

## General Specifications

| Parameter           | Symbol           | Min  | Typ  | Max               | Unit | Remarks                  |
|---------------------|------------------|------|------|-------------------|------|--------------------------|
| Data Rate           | DR               |      | 1.25 |                   | GBd  | IEEE 802.3               |
| Bit Error Rate      | BER              |      |      | 10 <sup>-12</sup> |      |                          |
| Input Voltage       | V <sub>CC</sub>  | 3    | 3.3  | 3.6               | V    |                          |
| Maximum Voltage     | V <sub>max</sub> | -0.5 |      | 4                 | V    | Electric Power Interface |
| Supply Current      | I <sub>s</sub>   |      | 230  | 300               | mA   | Electric Power Interface |
| Storage Temperature | T <sub>sto</sub> | -40  |      | 85                | °C   | Ambient Temperature      |

## Optical Characteristics - Transmitter

| Parameter                       | Symbol             | Min  | Typ  | Max  | Unit  | Remarks         |
|---------------------------------|--------------------|------|------|------|-------|-----------------|
| Optical Center Wavelength       | $\lambda$          | 1290 | 1310 | 1330 | nm    |                 |
| Output Optical Power            | P <sub>tx</sub>    | 0    |      | 5    | dBm   | Class 1 Product |
| Optical Modulation Amp          | OMA                | 174  |      |      | uW    |                 |
| Extinction Ratio @ 1.25GBd      | ER                 | 9    |      |      | dB    |                 |
| Spectral Width (-20dB)          | $\Delta\lambda$    |      |      | 1    | nm    |                 |
| Relative Intensity Noise        | RIN                |      |      | -120 | dB/Hz |                 |
| Optical Rise/Fall Time          | T <sub>RF_IN</sub> |      | 150  | 260  | ps    |                 |
| Deterministic Jitter Contribute | TX_ΔDJ             |      | 30   | 60   | ps    |                 |
| Total Jitter Contribution       | TX_ΔTJ             |      | 60   | 120  | ps    |                 |

## Optical Characteristics - Receiver

| Parameter                      | Symbol             | Min  | Typ  | Max  | Unit | Remarks    |
|--------------------------------|--------------------|------|------|------|------|------------|
| Optical Center Wavelength      | $\lambda_C$        | 1450 | 1490 | 1530 | nm   |            |
| Optical Receive Power          | P <sub>RX</sub>    |      |      | 0    | dBm  | Average    |
| Receiver Sensitivity @ 1.25GBd | P <sub>SENS1</sub> |      |      | -23  | dBm  | IEEE 802.3 |
| Optical Return Loss            | ORL                | 14   |      |      | dB   |            |
| Optical Isolation              | ISO                |      |      | -40  | dB   |            |
| LOS Assert                     | LOS <sub>A</sub>   | -30  |      |      | dBm  |            |
| LOS De-Assert                  | LOS <sub>D</sub>   |      |      | -23  | dBm  |            |
| LOS Hysteresis                 |                    | 0.5  |      |      | dB   |            |

## Electrical Characteristics – Transmitter

| Parameter                     | Symbol             | Min                  | Typ | Max                  | Unit | Remarks        |
|-------------------------------|--------------------|----------------------|-----|----------------------|------|----------------|
| Input differential impedance  | R <sub>in</sub>    |                      | 100 |                      | Ω    | Non Condensing |
| Single ended data input swing | V <sub>IN_PP</sub> | 250                  |     | 1200                 | mV   |                |
| Transmit Disable Voltage      | V <sub>D</sub>     | V <sub>CC</sub> -1.3 |     | V <sub>CC</sub>      | V    |                |
| Transmit Enable Voltage       | V <sub>EN</sub>    | V <sub>EE</sub>      |     | V <sub>EE</sub> +0.8 | V    |                |
| Transmit Disable Assert Time  |                    |                      |     | 10                   | us   |                |

## Electrical Characteristics – Receiver

| Parameter                      | Symbol              | Min                  | Typ | Max                  | Unit | Remarks |
|--------------------------------|---------------------|----------------------|-----|----------------------|------|---------|
| Single ended data output swing | V <sub>OUT_PP</sub> | 300                  | 400 | 800                  | mV   |         |
| Data output rise/fall time     | T <sub>R</sub>      |                      |     | 300                  | ps   | 20%-80% |
| LOS Fault                      | V <sub>LOS_F</sub>  | V <sub>CC</sub> -0.5 |     | V <sub>CC_HOST</sub> | V    |         |
| LOS Normal                     | V <sub>LOS_N</sub>  | V <sub>EE</sub>      |     | V <sub>EE</sub> +0.5 | V    |         |

## Digital Diagnostic Functions

The SFP support the 2-wire serial communication protocol as defined in the SFF 8472. Digital diagnostic information are accessible over the 2-wire interface at the address 0xA2. Digital Diagnostics are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver.

**Transceiver Temperature-** Internally measured, represented as a 16 bit signed twos complement value in increments of 1/256 degrees Celsius, Temperature accuracy is better than  $\pm 3$  degrees Celsius over specified operating temperature and voltage.

**Transceiver Supply Power-** Internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100  $\mu$ Volt, yielding a total range of 0 to +6.55 Volts.

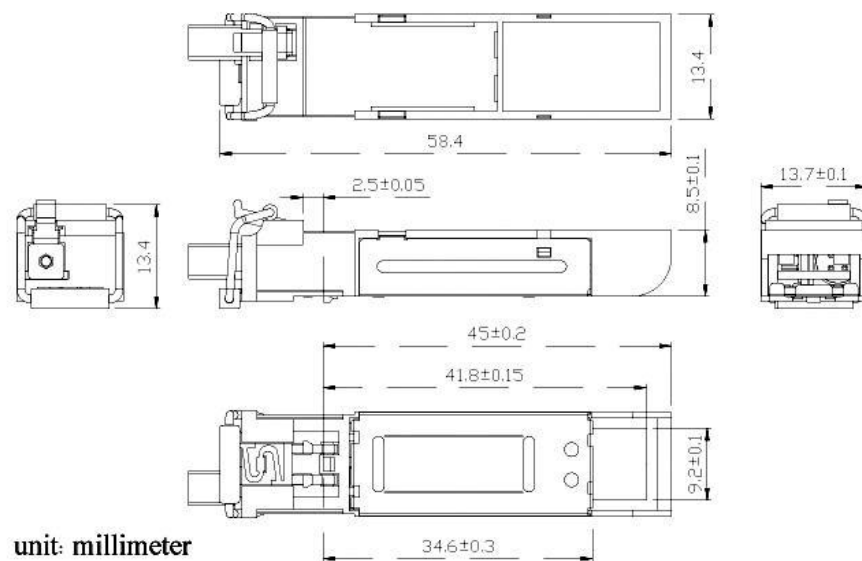
**Transceiver TX bias current-** Internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2  $\mu$ A, yielding a total range of 0 to 131mA. Accuracy is better than  $\pm 10\%$  over specified operating temperature and voltage.

**Transceiver TX output power-** Internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit value (0 – 65535) with LSB equal to 0.1  $\mu$ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage. Data is not valid when the transmitter is disabled.

**Transceiver RX received optical power-** Internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit 35 value (0 – 65535) with LSB equal to 0.1  $\mu$ W. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage.

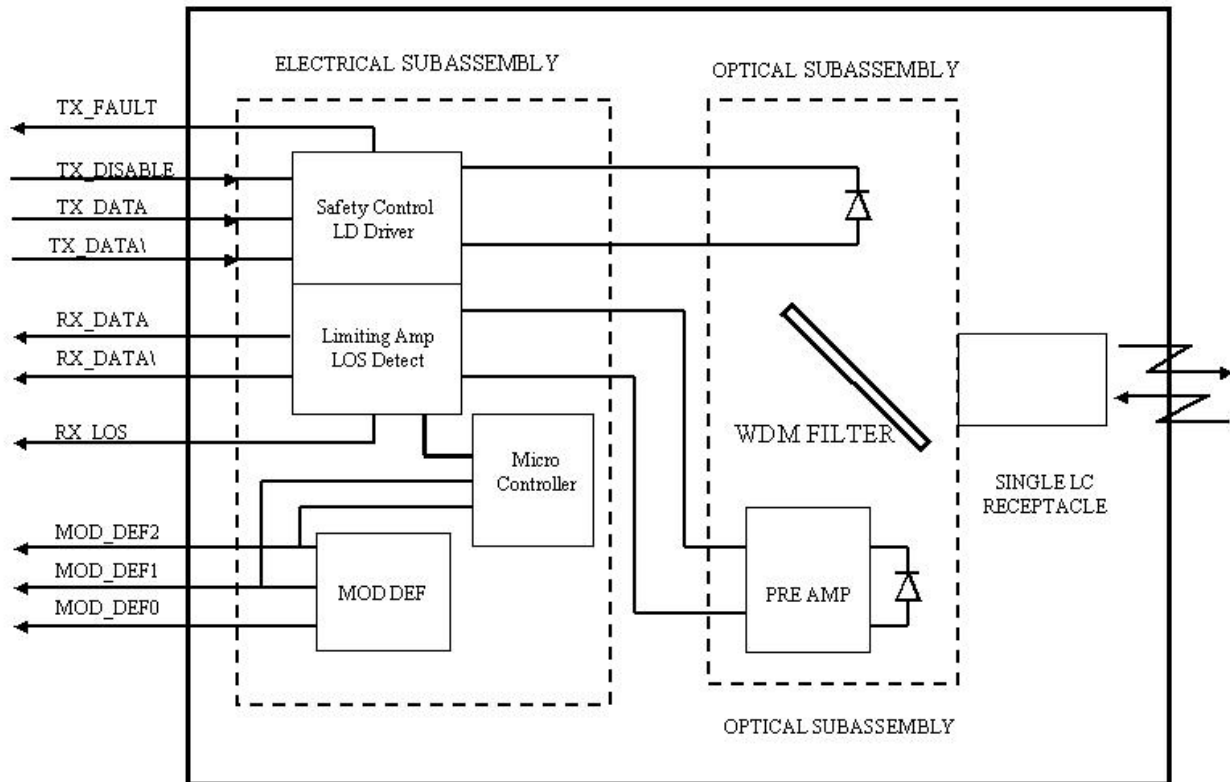
| Parameter    | Symbol       | Accuracy  | Units              | Report Range | Unit               | Remarks |
|--------------|--------------|-----------|--------------------|--------------|--------------------|---------|
| Temperature  | $T_{mon}$    | $\pm 3$   | $^{\circ}\text{C}$ | -40 - +95    | $^{\circ}\text{C}$ |         |
| Voltage      | $V_{mon}$    | $\pm 0.1$ | V                  | 2.9 - 3.7    | V                  |         |
| Bias Current | $T_F$        | $\pm 10$  | %                  | 1 – 80       | mA                 |         |
| Tx Power     | $V_{LOS\_F}$ | $\pm 3$   | dB                 | -10 - +5     | dBm                |         |
| Rx Power     | $V_{LOS\_N}$ | $\pm 3$   | dB                 | -30 - 0      | dBm                |         |

## Dimensions



ALL DIMENSIONS ARE  $\pm 0.2$ mm UNLESS OTHERWISE SPECIFIED

## Block Diagram of Transceiver



### Transmitter Section

The DFB driver accept differential input data and provide bias and modulation currents for driving a laser. An automatic power-control (APC) feedback loop is incorporated to maintain a constant average optical power. 1310nm DFB laser in an eye safe optical subassembly (OSA) mates to the fiber cable.

**TX\_DISABLE-** The TX\_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on within 1ms when TX\_DISABLE is low (TTL logic "0").

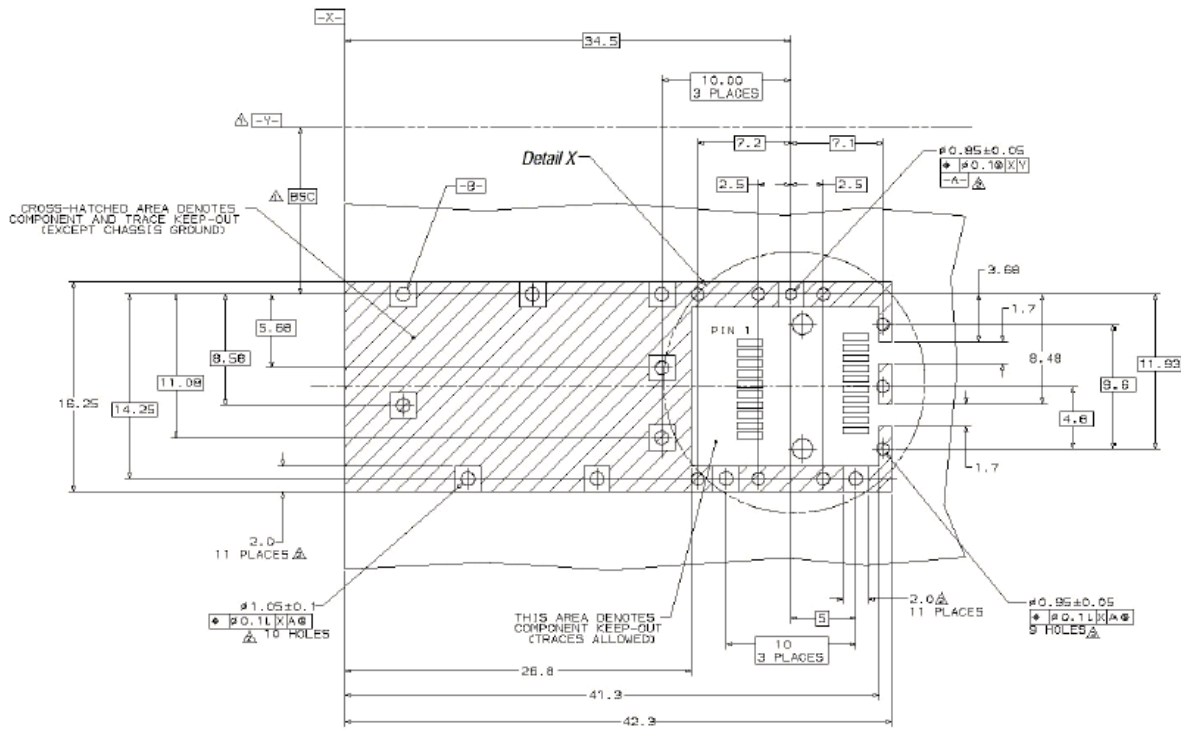
**TX\_FAULT-** When the TX\_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

**Receiver Section-** The receiver utilizes a PIN detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a Limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting Amplifier is AC-coupled to the transimpedance amplifier, with internal 100Ω differential termination.

**Receive Loss (RX\_LOS)-** The RX\_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.

**Controller Section-** The micro controller unit monitors the operation information of LD driver and Limiting Amplifier and report these status to the customer.

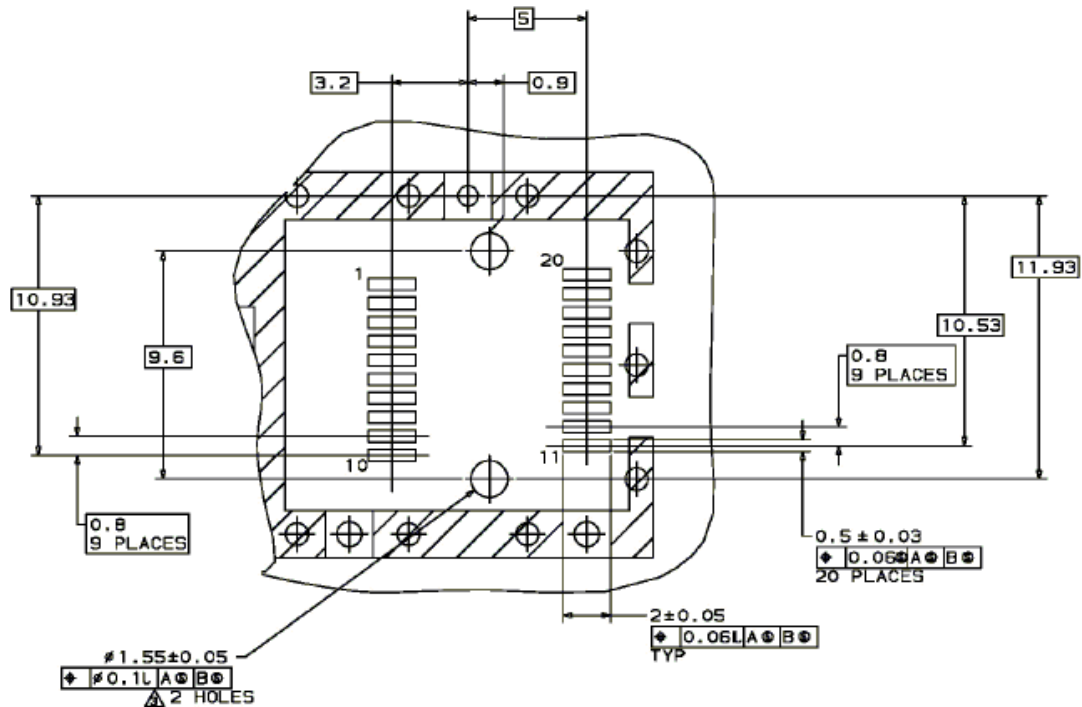
## PCB Layout Recommendation



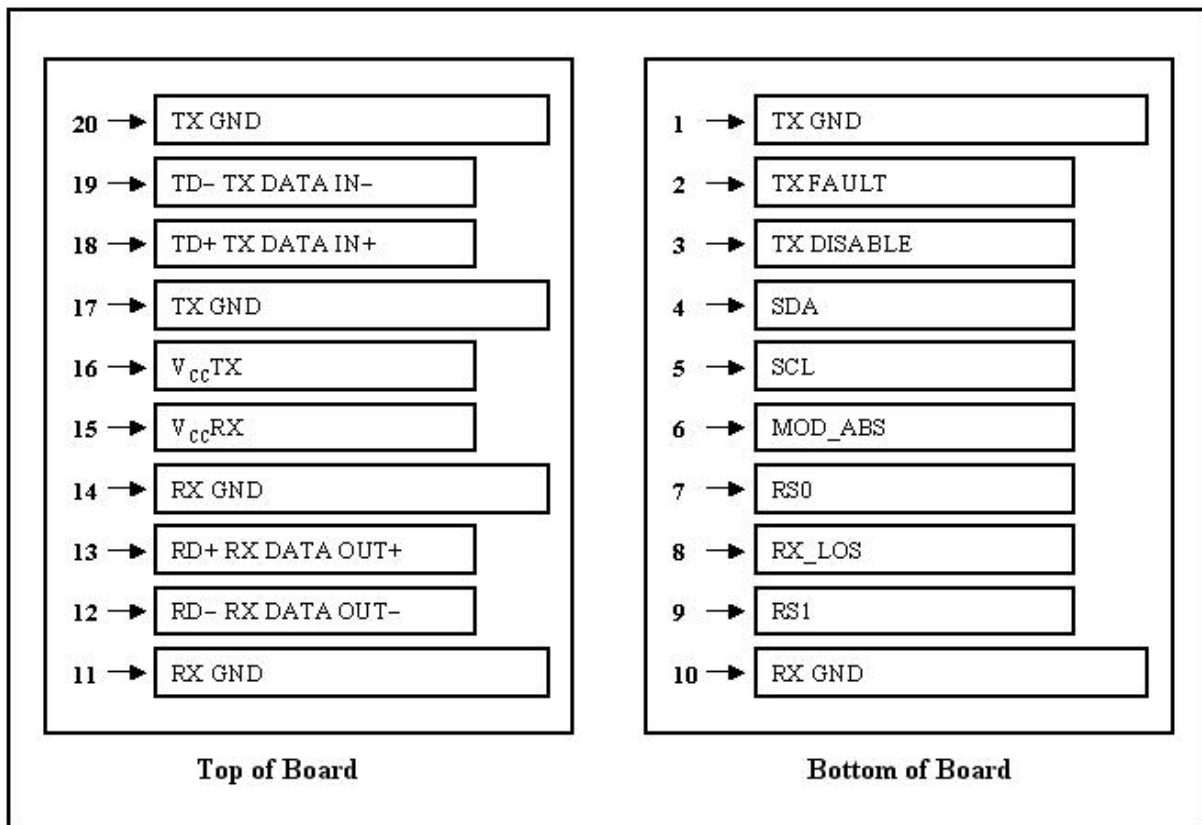
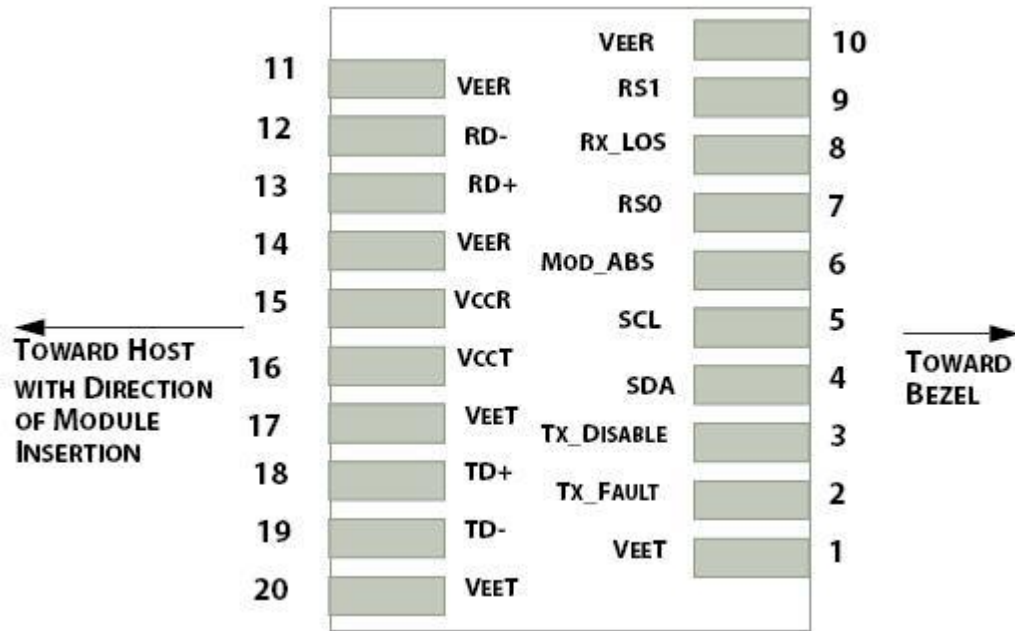
△ Datum and Basic Dimension Established by Customer

△ Pads and Vias are Chassis Ground, 11 Places

△ Through Holes are Unplated



## Electrical Pad Layout



## Pin Assignment

| <i><b>PIN #</b></i> | <i><b>Symbol</b></i> | <i><b>Description</b></i>                                     | <i><b>Remarks</b></i>                                                                  |
|---------------------|----------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1                   | VEET                 | Transmitter ground (common with receiver ground)              | Circuit ground is isolated from chassis ground                                         |
| 2                   | TFAULT               | Transmitter Fault                                             |                                                                                        |
| 3                   | TDIS                 | Transmitter Disable. Laser output disable on high or open     | Disabled: TDIS>2V or open<br>Enabled: TDIS<0.8V                                        |
| 4                   | SDA                  | Data line for serial ID                                       | Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V |
| 5                   | SCL                  | Clock line for serial ID                                      |                                                                                        |
| 6                   | MOD_ABS              | Module Absent. Ground within the module                       |                                                                                        |
| 7                   | RS0                  | No Connection required                                        |                                                                                        |
| 8                   | LOS                  | Loss of Signal indication. Logic 0 indicates normal operation | LOS is open collector output                                                           |
| 9                   | RS1                  | +3.3V Power Supply                                            | Circuit ground is isolated from chassis ground                                         |
| 10                  | VEER                 | Receiver ground (common with transmitter ground)              |                                                                                        |
| 11                  | VEER                 | Receiver ground (common with transmitter ground)              |                                                                                        |
| 12                  | RD-                  | Receiver Inverted DATA out. AC coupled                        |                                                                                        |
| 13                  | RD+                  | Receiver Non-inverted DATA out. AC coupled                    |                                                                                        |
| 14                  | VEER                 | Receiver ground (common with transmitter ground)              | Circuit ground is isolated from chassis ground                                         |
| 15                  | VCCR                 | Receiver power supply                                         |                                                                                        |
| 16                  | VCCT                 | Transmitter power supply                                      | Same as Pin# 1                                                                         |
| 17                  | VEET                 | Transmitter ground (common with receiver ground)              | Circuit ground is connected to chassis ground                                          |
| 18                  | TD+                  | Transmitter Non-inverted DATA out. AC coupled                 |                                                                                        |
| 19                  | TD-                  | Transmitter Inverted DATA out. AC coupled                     |                                                                                        |
| 20                  | VEET                 | Transmitter ground (common with receiver ground)              | Circuit ground is connected to chassis ground                                          |

## References

1. IEEE standard 802.3. IEEE Standard Department, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
3. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.