# Yeson(HK) Technology Co,.Ltd

## YT-SFP+-LRM
### 10Gbps 220m SFP+ Transceiver

### Features

►Supports 9.95 to 10.3Gbps bit rates

►Transmission distance up to 220m (OM1 fiber)

►Hot Pluggable SFP+ footprint

►1310nm FP transmitter, PIN photo-detector

►Digital Status monitoring Interface

►Duplex LC connector

►RoHS compliant and Lead Free

►Metal enclosure for lower EMI

►Single 3.3V power supply

►Power dissipation < 1W

►Operating case temperature: 0 to 70℃

►Compliant with FC-PI-4 800-Mx-SN-I, SFF-8431 , SFF-8432 and SFF-8472

### Applications

►10GBASE-LRM 10G Ethernet

►Legacy FDDI multimode links

### Product description

SFP+ LRM is an optical transceiver module for transmission at 1310nm over legacy multimode fiber. Supporting 10GBASE-LRM Ethernet standard make it ideally suited for 10G datacom. Its very low power consumption and its excellent EMI performance allow system design with high port density. The small form factor integrates a 1310nm Fabry-Perot (FP) laser in an LC package and a linear multimode PIN receiver.

This module is lead free, RoHS compliant and is designed and tested in accordance with industry safety standards.This SFP+ transceiver is a linear-interface transceiver that enables, in conjunction with an Electronic Dispersion Compensation (EDC) on the host board, an IEEE802.3aq 10GBASE-LRM compliant link. The host board EDC provides correction for the severe modal dispersion that may occur

during propagation through multimode fiber links, including legacy installed FDDI multimode fiber (see IEEE802.3aq for detailed information regarding fiber coverage).

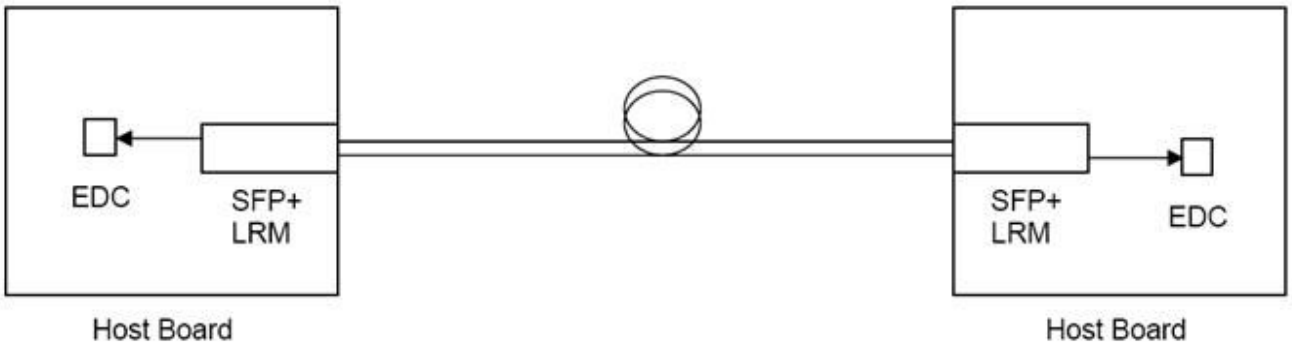


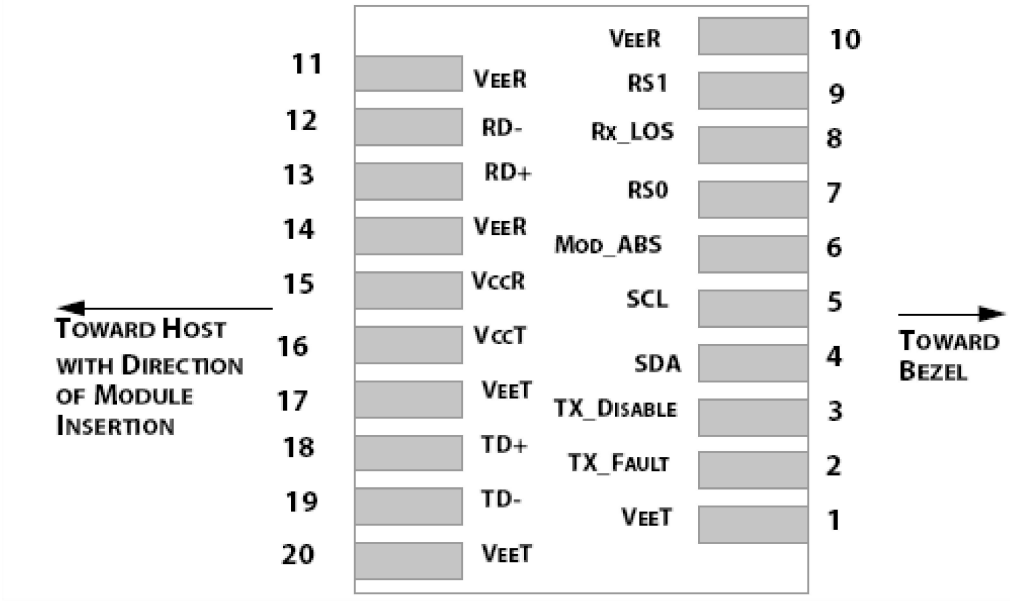

**Figure 1. Block Diagram of SFP+ LRM Module on Host Board with EDC**

Unlike the XFP MSA transceiver requirements, the SFP+ transceiver does not contain internal retiming circuitry, and thus some of the Transmitter Optical Characteristics stated in this data sheet require that the Host Board is compliant to the SFP+ MSA specifications. See Chapter 3 in Reference [1] for further details.

## Pin definition

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance.

Host PCB contact assignment is shown in Figure 2 and contact definitions are given in Table 2. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 3 and the contact sequence order listed in Table 2.



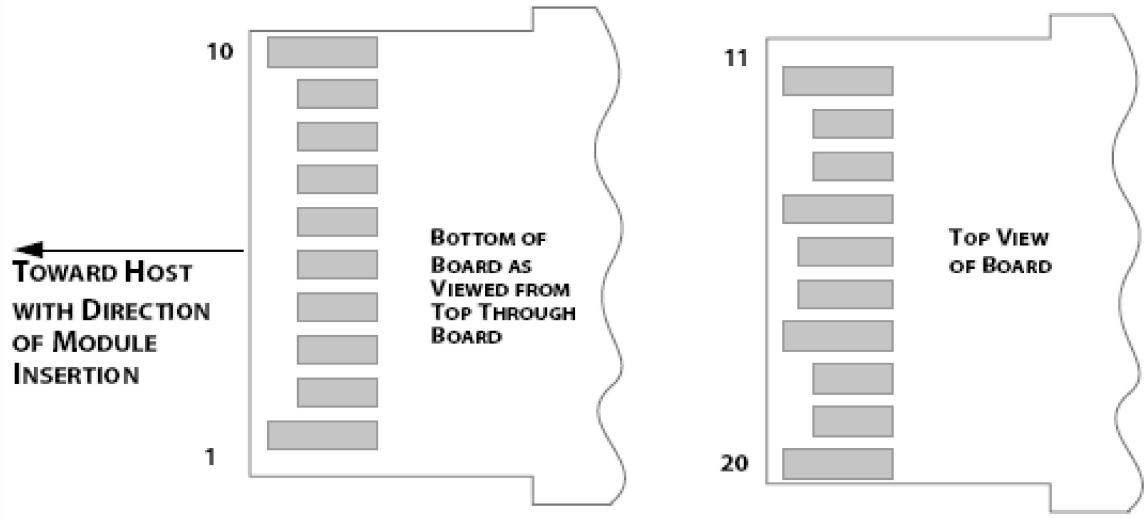




**Figure 3: Module Contact Assignment**

| Contacts | logic | Symbol | Power Sequence Order | Name/Description |
|---|---|---|---|---|
| 1 | | VeeT | 1st | Module Transmitter Ground |
| 2 | LVTTL-O | TX_Fault | 3rd | Module Transmitter Fault |
| 3 | LVTTL-I | TX_Disable | 3rd | Transmitter Disable; Turns off transmitter laser output |
| 4 | LVTTL-I/O | SDA | 3rd | 2-wire Serial Interface Data Line (Same as MOD-DEF2 in the INF-8074i) |
| 5 | LVTTL-I/O | SCL | 3rd | 2-wire Serial Interface Clock (Same as MOD-DEF1 in the INF-8074i) |
| 6 | | Mod_ABS | 3rd | Module Absent, connected to VeeT or VeeR in the module |
| 7 | LVTTL-I | RS0 | 3rd | Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate> 4.25 GBd and when low input signaling rate ≤ 4.25 GBd. |
| 8 | LVTTL-O | Rx_LOS | 3rd | Receiver Loss of Signal Indication (In FC designated as Rx_LOS and in Ethernet designated as Signal Detect) |
| 9 | LVTTL-I | RS1 | 3rd | Rate Select 1, optionally controls SFP+ transmitter. When high input signaling rate> 4.25 GBd and when low input signaling rate ≤ 4.25 GBd. |
| 10 | | VeeR | 1st | Module Receiver Ground |
| 11 | | VeeR | 1st | Module Receiver Ground |
| 12 | CML-O | RD- | 3rd | Receiver Inverted Data Output |
| 13 | CML-O | RD+ | 3rd | Receiver Non-Inverted Data Output |
| 14 | | VeeR | 1st | Module Receiver Ground |
| 15 | | VccR | 2nd | Module Receiver 3.3 V Supply |
| 16 | | VccT | 2nd | Module Transmitter 3.3 V Supply |
| 17 | | VeeT | 1st | Module Transmitter Ground |
| 18 | CML-I | TD+ | 3rd | Transmitter Non-Inverted Data Input |
| 19 | CML-I | TD- | 3rd | Transmitter Inverted Data Input |
| 20 | | VeeT | 1st | Module Transmitter Ground |

**Table 2: SFP+ Module PIN Definition**

## Absolute maximum rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 0 | +3.6 | V |
| Storage Temperature | Tc | -40 | +85 | °C |
| Operating Case Temperature | Tc | 0 | +70 | °C |
| Relative Humidity | RH | 5 | 95 | % |

**Table 3: Absolute Maximum Rating**

## Recommended operating environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameter | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 3.135 | 3.300 | 3.465 | V |
| Operating Case Temperature | $T_C$ | 0 | 25 | 70 | °C |

**Table 4: Recommended Operating Environment**

## LOW Speed Characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|
| Power Consumption | | | 1.2 | 1.2 | W |
| TX_Fault,RX_LOS | VOL | 0 | | 0.4 | V |
| | VOH | Host_Vcc-0.5 | | Host_Vcc+0.3 | V |
| TX_DIS | VIL | -0.3 | | 0.8 | V |
| | VIH | 2.0 | | VCCT+0.3 | V |
| RS0,RS1 | VIL | -0.3 | | 0.8 | V |
| | VIH | 2.0 | | VCCT+0.3 | V |

## Electrical characteristics

| Parameter | Conditions | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Nominal Data Rate | | VID | | 10.3125 | | Gbps |
| Supply Voltage | | Vcc | 3.14 | | 3.46 | V |
| Supply Current | | Icc | | 200 | 300 | mA |
| Power Dissipation | | P | | | 1 | W |
| **Transmitter** | | | | | | |
| Input differential impedance | 2 | $R_{in}$ | | 100 | | Ω |
| Single ended data input swing | 3 | Vin,pp | 90 | | 350 | mV |
| Transmit Disable Voltage | 4 | $V_D$ | 2 | | Vcc | V |
| Transmit Enable Voltage | | $V_{EN}$ | Vee | | Vee+ 0.8 | V |
| **Receiver** | | | | | | |
| Termination Mismatch at 1 MHz | | $\Delta Z_M$ | | | 5 | % |
| Single Ended Output Voltage Tolerance | | | -0.3 | | 4.0 | V |
| Output AC Common Mode Voltage | | | | | 7.5 | mV RMS |

| | | | | | | |
|---|---|---|---|---|---|---|
| Output Rise and Fall time (20% to 80%) | 5 | Tr, Tf | 30 | | | Ps |
| Relative Noise LRM Links with crosstalk | 6 | dRNx | | | TBD equatio | dB/Hz |
| Difference Waveform Distortion Penalty | 7 | dWDP | per SFF-8431 | | | dB |
| Differential Voltage Modulation Amplitude | | VMA | 180 | | 600 | mV |
| LOS Fault | 8 | $V_{LOS\ fault}$ | 2 | | $V_{CCHOST}$ | V |
| LOS Normal | 8 | $V_{LOS\ norm}$ | Vee | | Vee+ 0.8 | V |
| Power Supply Noise Tolerance | 9 | VccT/VccR | per SFF-8431 | | | mVpp |

Notes:
1. Non-condensing.
2. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
3. Per SFF-8431 Rev 3.0
4. Into 100 ohms differential termination.
5. Measured with Module Compliance Test Board and OMA test pattern.
6. Crosstalk source rise/fall time (20%-80%) is 35 ps.
7. Defined with reference receiver with 14 T/2 spaced FFE taps and 5 T spaced DFE taps.
8. LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.
9. As described in Section 2.8.1, SFF-8431 Rev 3.0.

## General Specifications

| Parameter | | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|---|
| Bit Rate | | BR | | 10.3125 | | Gb/sec | 1 |
| Bit Error Ratio | | BER | | | $10^{-12}$ | | 2 |
| **Maximum Supported Distances** | | | | | | | |
| **Fiber Type** | **1310nm OFL Bandwidth** | | | | | | |
| 62.5μm | "FDDI" 160MHz/km | Lmax | | | 220 | m | 3 |
| | OM1 200MHz/km | | | | 220 | | |
| 50μm | 400MHz/km | Lmax | | | 100 | m | 3 |
| | OM2 500MHz/km | | | | 220 | | |
| | OM3 2000MHz/km | | | | 220 | | |

Notes:
1. 10GBASE-LRM
2. Tested with a 231 – 1 PRBS
3. Operating range as defined by IEEE standards. Longer reach possible depending upon link implementation.

## Optical characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength | λt | 1260 | | 1355 | nm | |

| | | | | | | |
|---|---|---|---|---|---|---|
| RMS spectral width | λrms @1260nm | - | - | 2.4 | nm | 2 |
| | λrms @ 1260nm-1300 | | | 2.4 | | |
| | λrms @ 1300nm-1355 | | | 4 | | |
| Average Optical Power | Pavg | -6.5 | - | 0.5 | dBm | 1 |
| Extinction Ratio | ER | 3.5 | - | - | dB | |
| Optical Modulation Amplitude (OMA) | POMA | -4.5 | | +1.5 | dBm | |
| Peak Launch Power | PMAX | | | 3 | dBm | |
| Transmitter Waveform Dispersion Penalty | TWDP | | | 4.7 | dB | 3 |
| Average Launch power of OFF transmitter | POFF | | | -30 | dBm | |
| Uncorrelated Jitter [rms] | $Tx_j$ | | | 0.033 | UI | |
| Encircled Flux | <5μm | 30 | | | % | |
| | <11μm | 81 | | | | |
| Transmitter Reflectance | | | | -12 | dB | |
| Optical Return Loss Tolerance | | 20 | | | dB | |
| Relative Intensity Noise | Rin | | | -128 | dB/Hz | |
| **Receiver** | | | | | | |
| Comprehensive Stressed Receiver Sensitivity (OMA) @ 10.3125Gb/s | Precursor | - | - | -6.5 | dBm | 5 |
| | Symmetrical | | | -6 | dBm | |
| | Postcursor | | | -6.5 | dBm | |
| LOS Assert | LosA | -30 | - | | dBm | |
| LOS De-assert | LosD | | | -11 | dBm | |
| Overload | $P_{MAX}$ | -+1.5 | - | | dBm | 4 |
| Receiver Reflectance | | - | - | -12 | dB | |
| LOS Hysteresis | | 0.5 | | | dB | |

Notes:
1. Average power figures are informative only, per IEEE802.3aq
2. Maximum RMS spectral width as specified by Figure 3
3. Optical Eye Mask requires the host board to be SFF-8431 compliant. Optical eye mask per IEEE802.3aq.
4. TWDP figure requires the host board to be SFF-8431compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3aq
5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.
6. Conditions of stressed receiver tests per IEEE802.3aq. CSRS testing requires the host board to be SFF-8431 compliant.

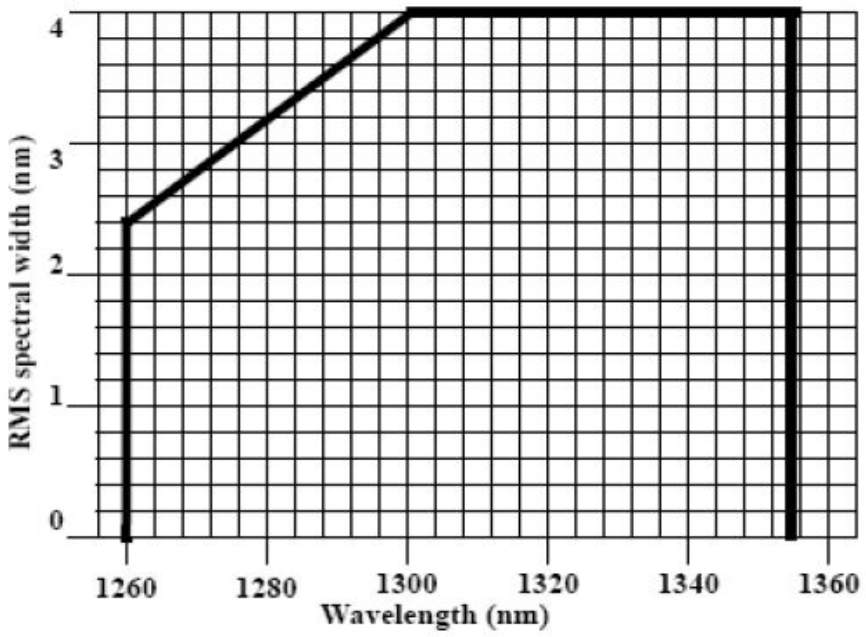



**Figure 3**
**Transmitter Maximum RMS Spectral Width**

## Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev9.2 with internal calibration mode. For external calibration mode please contact our sales stuff.

| Parameter | Symbol | Min. | Max | Unit | Notes |
|---|---|---|---|---|---|
| **Accuracy** | | | | | |
| Transceiver Temperature | DMI_Temp | -3 | +3 | degC | Over operating temp |
| TX Output optical power | DMI_TX | -3 | +3 | dB | |
| RX Input optical power | DMI_RX | -3 | +3 | dB | -3dBm to -12dBm range |
| Transceiver Supply voltage | DMI_VCC | -0.08 | +0.08 | V | Full operating range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |
| **Dynamic Range Accuracy** | | | | | |
| Transceiver Temperature | DMI_Temp | -5 | 70 | degC | |
| TX Output optical power | DMI_TX | -9 | -1 | dBm | |

| | | | | | |
|---|---|---|---|---|---|
| RX Input optical power | DMI_RX | -18 | 0 | dBm | |
| Transceiver Supply voltage | DMI_VCC | 3.0 | 3.6 | V | |
| Bias current monitor | DMI_Ibias | 0 | 16 | mA | |

## Control and status I/O timing characteristics

Timing characteristics of control and status I/O are included in Table 8, which is also defined in SFF-8431.

| *Parameter* | *Symbol* | *Min.* | *Max.* | *Unit* | *Conditions* |
|---|---|---|---|---|---|
| TX_Disable assert time | t_off | | 100 | µs | rising edge of TX_Disable to fall of output signal below 10% of nominal |
| TX_Disable negate time | t_on | | 2 | ms | Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery. |
| Time to initialize 2-wire interface | t_2w_start_up | | 300 | ms | From power on or hot plug after the supply meeting Table 8. |
| Time to initialize | t_start_up | | 300 | ms | From power supplies meeting Table 8 or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational. |
| Time to initialize cooled module | t_start_up_cooled | | 90 | s | From power supplies meeting Table 8 or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational. |
| Time to Power Up to Level II | t_power_level2 | | 300 | ms | From falling edge of stop bit enabling power level II until non-cooled module is fully operational |
| Time to Power Down from Level II | t_power_down | | 300 | ms | From falling edge of stop bit disabling power level II until module is within power level I requirements |
| TX_Fault assert | TX_Fault_on | | 1 | ms | From occurrence of fault to assertion of TX_Fault |
| TX_Fault assert for cooled module | TX_Fault_on_cooled | | 50 | ms | From occurrence of fault to assertion of TX_Fault |
| TX_Fault Reset | t_reset | 10 | | µs | Time TX_Disable must be held high to reset TX_Fault |
| RS0, RS1 rate select timing for FC | t_RS0_FC, RS1_FC | | 500 | µs | From assertion till stable output |
| RS0, RS1 rate select timing non FC | t_RS0, t_RS1 | | 10 | ms | From assertion till stable output |
| Rx_LOS assert delay | t_los_on | | 100 | µs | From occurrence of loss of signal to assertion of Rx_LOS |
| Rx_LOS negate delay | t_los_off | | 100 | µs | From occurrence of presence of signal to negation of Rx_LOS |

**Table 8: Timing Characteristics**

### Mechanical

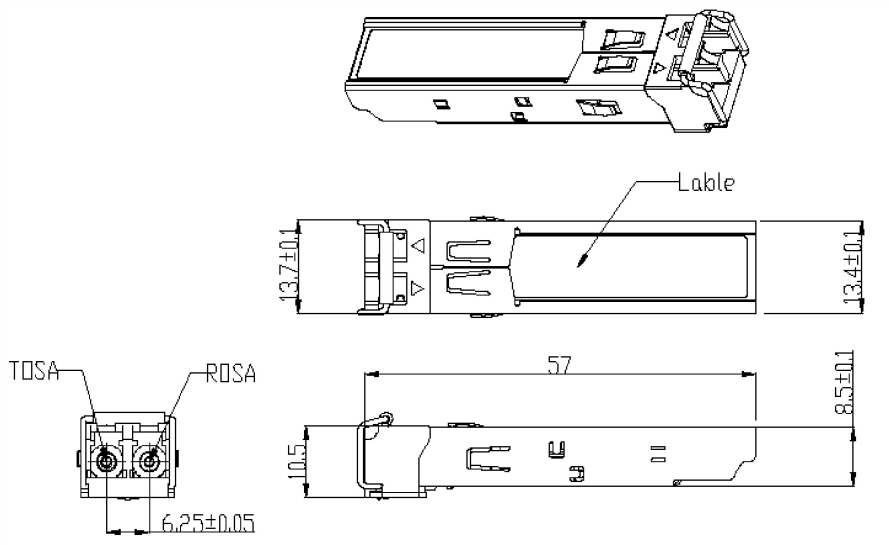



**Table 9: Key Mechanical Dimensions**

### ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

### LASER SAFTY

This is a Class 1 Laser Product according to IEC 60825-1:1993:+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)

## Ordering information

| Part Number | Product Description |
|---|---|
| YT-SFP+-LRM | 1310nm, 10.3125Gpbs, Multi Mode 220m, 0ºC ~ +70ºC |