# ESDxx12-20D(I)

**1.25Gbps DWDM SFP Optical Transceiver, 20KM Reach**

## PRODUCT FEATURES

- **Wavelength selectable to C-band ITU-T grid wavelengths**
- **Suitable for use in 100GHz channel spacing DWDM systems**
- **DWDM SFP MSA Compliant**
- **Dual data-rate of 1.25Gbps/1.063Gbps operation**
- **Up to 2.67Gb/s data rate**
- **OC-24 Long Reach 20KM**
- **Cold Start up Wavelength Compliance**
- **Low Power Dissipation <1.8W Maximum**
- **Diagnostic Performance Monitoring of module temperature, supply Voltages, laser bias current, transmit optical power, receive optical power, Laser temperature and TEC current**
- **Extended link budget with PIN receiver technology**
  **RoHS compliant and lead free**

**Interface: LC connector**

- 
- **Operating case temperature:**
  **Standard : 0 to +70°C**
  **Industrial : -40 to +85°**

## APPLICATIONS

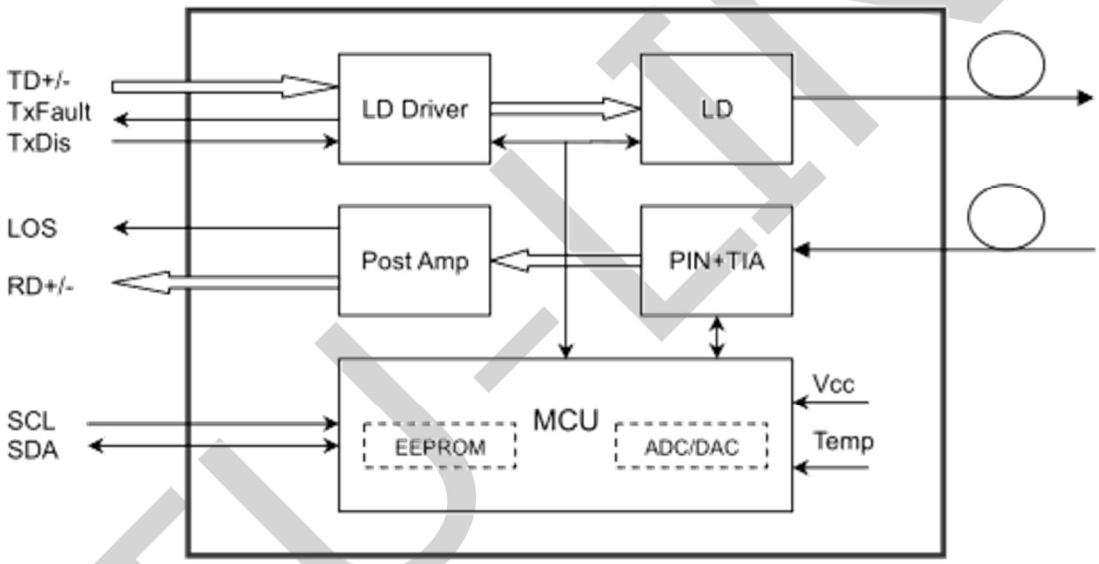
- **SFP Transceivers for DWDM SONET/ SDH**
- **Ethernet IEEE 802.3z**
- **Fiber Channel**

## DESCRIPTIONS

ETU-Link DWDM SFP Transceiver exhibits excellent wavelength stability, supporting operation at 100GHz channel, cost effective module. It is designed for DWDM SONET/ SDH, Gigabit Ethernet and Fiber-Channel applications.

The transceiver consists of two sections: The transmitter section incorporates a colded DFB laser. And the receiver section consists of a PIN photodiode integrated with a TIA. All modules satisfy class I laser safety requirements. ETU-Link DWDM SFP transceiver provides an enhanced monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage, laser temperature and TEC current.

## Module Block Diagram




## Ordering Information

| Part No. | Data Rate(optical) | Laser | Fiber Type | Distance | Optical Interface | Temp | DDMI |
|---|---|---|---|---|---|---|---|
| ESDxx12-20D | 1.25Gbps | EML | SM | 20KM | LC | 0~70℃ | Y |
| ESDxx12-20D(I) | 1.25Gbps | EML | SM | 20KM | LC | -40~85℃ | Y |

## Wavelength Selection

| Code | Frequency (THz) | Center Wavelength(nm) | Code | Frequency (THz) | Center Wavelength(nm) |
|---|---|---|---|---|---|
| C17 | 191.7 | 1563.86 | C40 | 194.0 | 1545.32 |
| C18 | 191.8 | 1563.05 | C41 | 194.1 | 1544.53 |
| C19 | 191.9 | 1562.23 | C42 | 194.2 | 1543.73 |
| C20 | 192.0 | 1561.42 | C43 | 194.3 | 1542.94 |
| C21 | 192.1 | 1560.61 | C44 | 194.4 | 1542.14 |
| C22 | 192.2 | 1559.79 | C45 | 194.5 | 1541.35 |
| C23 | 192.3 | 1558.98 | C46 | 194.6 | 1540.56 |
| C24 | 192.4 | 1558.17 | C47 | 194.7 | 1539.77 |
| C25 | 192.5 | 1557.36 | C48 | 194.8 | 1538.98 |
| C26 | 192.6 | 1556.55 | C49 | 194.9 | 1538.19 |
| C27 | 192.7 | 1555.75 | C50 | 195.0 | 1537.40 |
| C28 | 192.8 | 1554.94 | C51 | 195.1 | 1536.61 |
| C29 | 192.9 | 1554.13 | C52 | 195.2 | 1535.82 |
| C30 | 193.0 | 1553.33 | C53 | 195.3 | 1535.04 |
| C31 | 193.1 | 1552.52 | C54 | 195.4 | 1534.25 |
| C32 | 193.2 | 1551.72 | C55 | 195.5 | 1533.47 |
| C33 | 193.3 | 1550.92 | C56 | 195.6 | 1532.68 |
| C34 | 193.4 | 1550.12 | C57 | 195.7 | 1531.90 |
| C35 | 193.5 | 1549.32 | C58 | 195.8 | 1531.12 |
| C36 | 193.6 | 1548.51 | C59 | 195.9 | 1530.33 |
| C37 | 193.7 | 1547.72 | C60 | 196.0 | 1529.55 |
| C38 | 193.8 | 1546.92 | C61 | 196.1 | 1528.77 |
| C39 | 193.9 | 1546.12 | | | |

## Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|---|---|---|---|---|---|---|
| Storage Temperature | Ts | -40 | | 85 | ºC | |
| Relative Humidity | RH | 5 | | 95 | % | |
| Power Supply Voltage | VCC | -0.5 | | 4 | V | |
| Signal Input Voltage | | -0.3 | | Vcc+0.3 | V | |
| Receiver Damage Threshold | | +5 | | | dBm | |

## Recommended Operating Conditions

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Operating Case Temperature | $T_{OP}$ | 0 | | 70 | °C | Commercial |
| | | -40 | | 85 | | Industrial |
| Power Supply Voltage | $V_{CC}$ | 3.135 | 3.3 | 3.465 | V | |
| Data Rate | | | 1250 | | Mb/s | |
| Control Input Voltage High | | 2 | | Vcc | V | |
| Control Input Voltage Low | | 0 | | 0.8 | V | |
| Link Distance (SMF) | D | | | 20 | km | 9/125um |

## Electrical Characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Power Consumption | P | | | 1.5 | W | commercial |
| | | | | 1.8 | | Industrial |
| Supply Current | Icc | | | 450 | mA | commercial |
| | | | | 545 | | Industrial |
| **Transmitter** | | | | | | |
| Single-ended Input Voltage Tolerance | $V_{CC}$ | -0.3 | | 3.6 | V | |
| Differential Input Voltage Swing | Vin,pp | 200 | | 2400 | mVpp | |
| Differential Input Impedance | Zin | 90 | 100 | 110 | Ohm | |
| Transmit Disable Assert Time | | | | 5 | us | |
| Transmit Disable Voltage | Vdis | Vcc-1.3 | | Vcc | V | |
| Transmit Enable Voltage | Ven | Vee-0.3 | | 0.8 | V | |
| **Receiver** | | | | | | |
| Differential Output Voltage Swing | Vout,pp | 500 | | 900 | mVpp | |
| Differential Output Impedance | Zout | 90 | 100 | 110 | Ohm | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Data output rise/fall time | Tr/Tf | | 100 | 260 | ps | 20% to 80% |
| LOS Assert Voltage | VlosH | Vcc-1.3 | | Vcc | V | |
| LOS De-assert Voltage | VlosL | Vee-0.3 | | 0.8 | V | |

Notes:

Note (1): A (TX) + B (RX) = 500mA (Not include termination circuit)

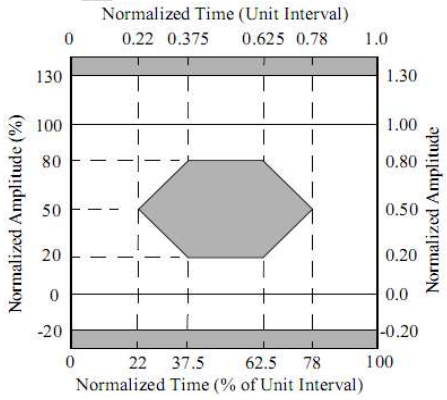
## Optical and Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength Spacing | | | 100 | | GHz | |
| Center Wavelength | λ | X-100 | X | X+100 | pm | Note (1) |
| Average Output Power | POUT | -2 | | 3 | dBm | |
| Extinction Ratio | ER | 9 | | | dB | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Spectrum Bandwidth(-20dB) | σ | | | 1 | nm | |
| Transmitter OFF Output Power | POff | | | -45 | dBm | |
| Differential Line Input Impedance | RIN | 90 | 100 | 110 | Ohm | |
| Output Eye Mask | Compliant with IEEE802.3 z (class 1 laser safety) | | | | | Note (2) |

Notes:

Note (1): X = specified ITU center wavelength. (To See “Ordering Information”)

Note (2): Transmitter eye mask definition.




| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|---|---|---|---|---|---|---|
| **Receiver** | | | | | | |
| Input Optical Wavelength | λIN | 1270 | | 1610 | nm | PIN |
| Receiver Sensitivity | PIN | | -24 | | dBm | Note (1) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Input Saturation Power (Overload) | PSAT | -3 | | | dBm | |
| Los Of Signal Assert | PA | -45 | | | dBm | |
| Los Of Signal De-assert | PD | | | -25 | dBm | Note (2) |
| LOS Hysteresis | PA-PD | 0.5 | 2 | 6 | dB | |

Note:

Note (1): Measured with Light source 1550nm, ER=9dB; BER =<10^-12 @PRBS=2^7-1 NRZ

Note (2): When LOS de-asserted, the RX data+/- output is High-level (fixed)

## Digital Diagnostics

ETU-LINK ESDxx12-20D(I) transceivers support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the E2PROM defined in the GBIC standard, with the same electrical specifications.

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

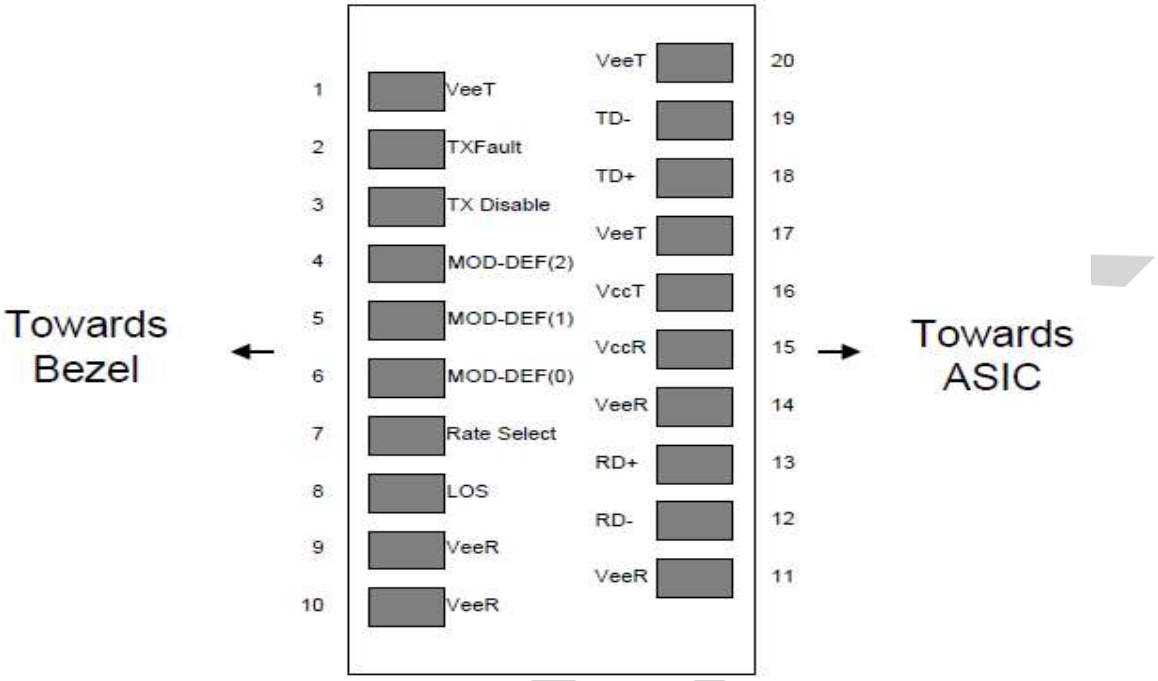
Additionally, ETU-LINK SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage .It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in E2PROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

Digital diagnostics for the ESDxx12-20D are internally calibrated by default.

## Pin Diagram




## Pin Definitions

| Pin | Symbol | Name/Description | Ref. |
|---|---|---|---|
| 1 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | TFAULT | Transmitter Fault. | |
| 3 | TDIS | 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 | 4 |
| 8 | LOS | Loss of Signal indication. Logic 0 indicates normal operation. | 5 |
| 9 | VEER | Receiver Ground (Common with Transmitter Ground) | 1 |
| 10 | VEER | Receiver Ground (Common with Transmitter Ground) | 1 |
| 11 | VEER | 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 | VEER | Receiver Ground (Common with Transmitter Ground) | 1 |
| 15 | VCCR | Receiver Power Supply | |
| 16 | VCCT | Transmitter Power Supply | |
| 17 | VEET | 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 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on $T_{DIS}$ >2.0V or open, enabled on $T_{DIS}$ <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. This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates).If implemented, the input will be internally pulled down with > 30kΩ resistor. The input states are:

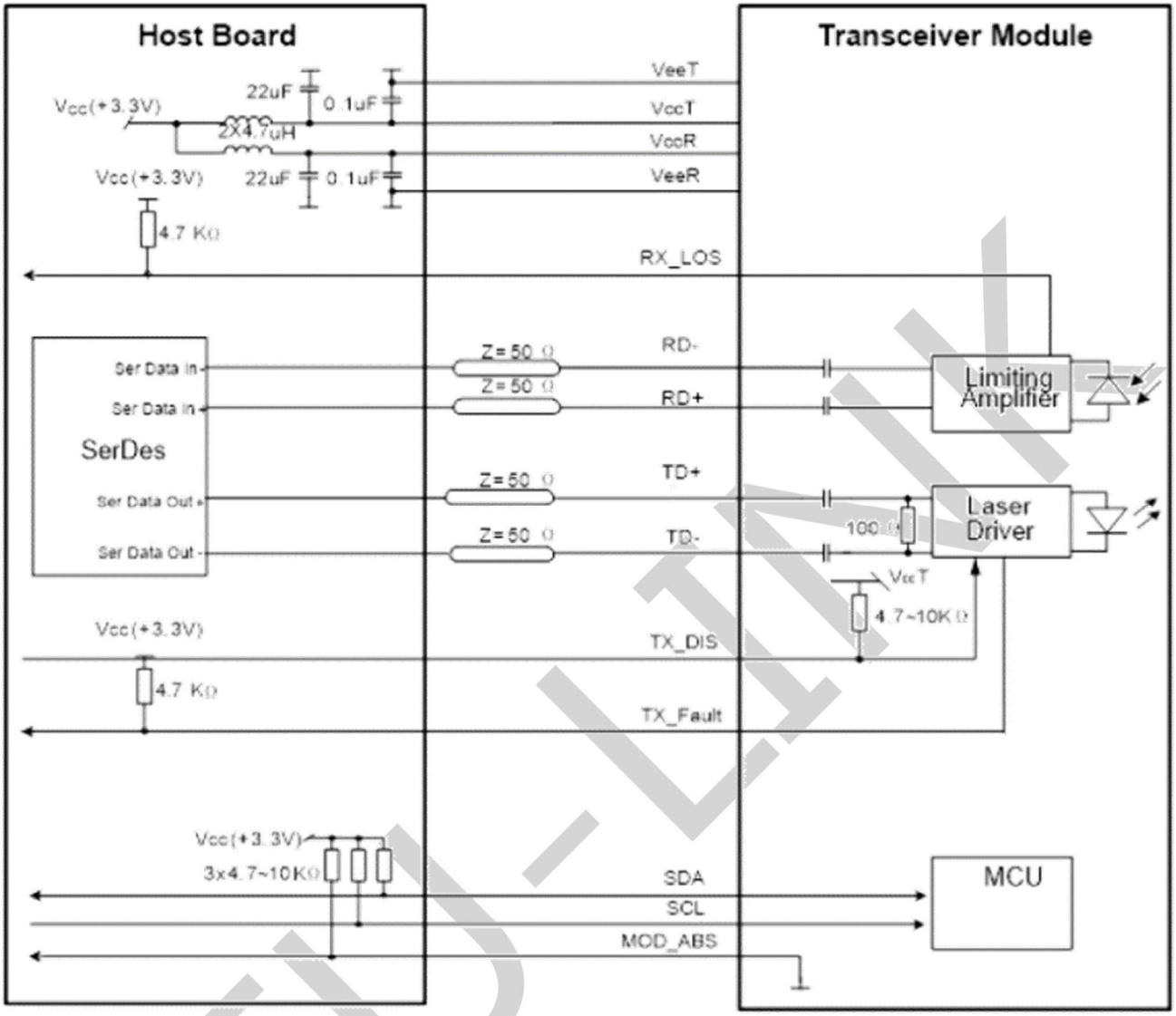
   Low (0 – 0.8V): Reduced Bandwidth

   (>0.8, < 2.0V): Undefined

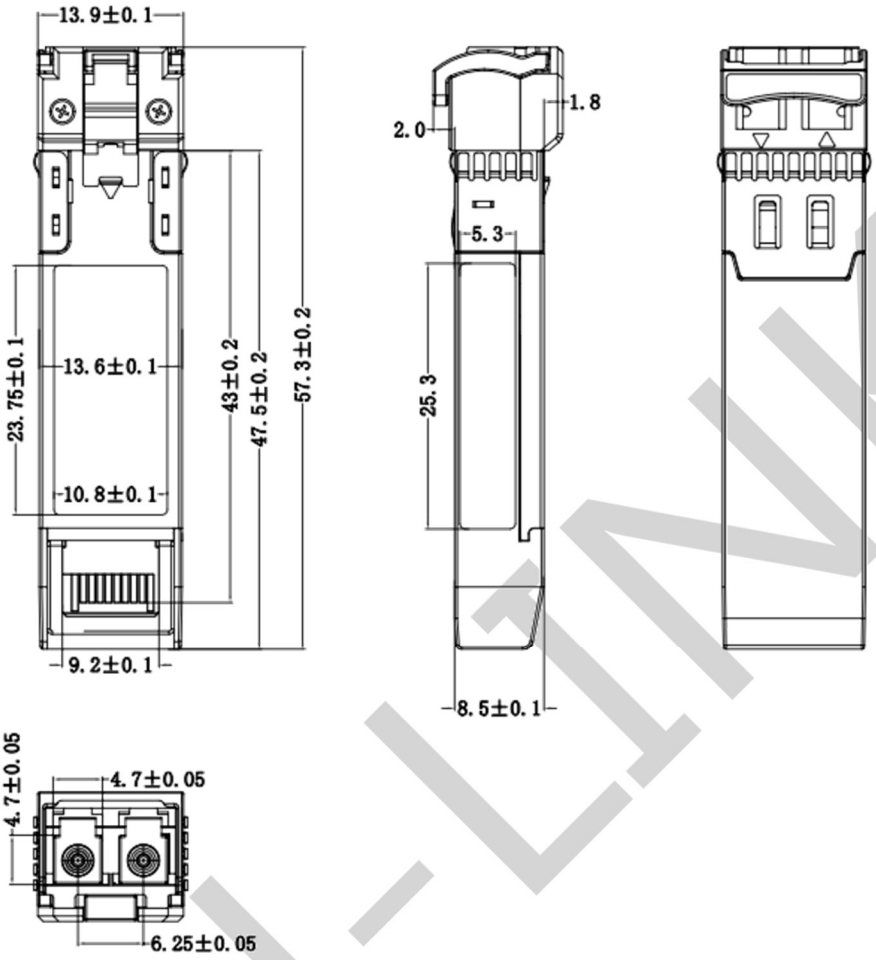
   High (2.0 – 3.465V): Full Bandwidth

   Open: Reduced Bandwidth
5. 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.

## Recommended Interface Circuit



## Mechanical Diagram




## Revision History

| Version No. | Date | Description |
|---|---|---|
| 1.0 | February 18, 2016 | Preliminary datasheet |
| 2.0 | September 28,2023 | Product upgrades |
| 3.0 | July 27, 2024 | Format change |

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