

Features

- ◎ Supports 10Gb/s serial optical interface
- ◎ Up to 60km transmission on SMF
- ◎ Un-cooled DFB laser and APD receiver
- ◎ Hot-pluggable SFP+ footprint
- ◎ SFI high speed electrical interface
- ◎ Built-in digital diagnostic functions
- ◎ Single +3.3V power supply
- ◎ Power consumption less than 1.0 W
- ◎ Operating case temperature: -5~+70°C
- ◎ SFP+ MSA package with simplex LC connector, Bi-directional



Applications

- ◎ 10GBASE-BX 10G Ethernet
- ◎ Other optical links

Standard

- ◎ Compliant with SFF-8472 and SFP+ MSA
- ◎ Compliant to SFF-8431 and SFF-8432
- ◎ Compliant with IEEE 802.3ae 10GBASE-ZR/ZW
- ◎ Compliant with FCC 47 CFR Part 15, Class B
- ◎ Compliant with Telcordia GR-468-CORE
- ◎ RoHS Compliant

Table 1. Regulatory Compliance

| Feature | Standard | Performance |
|---|-------------------------------|--|
| Electrostatic Discharge(ESD) to the Electrical Pins | MIL-STD-883E Method 3015.7 | Class 1(>1000V for SFI pins, >2000V for other pins.) |

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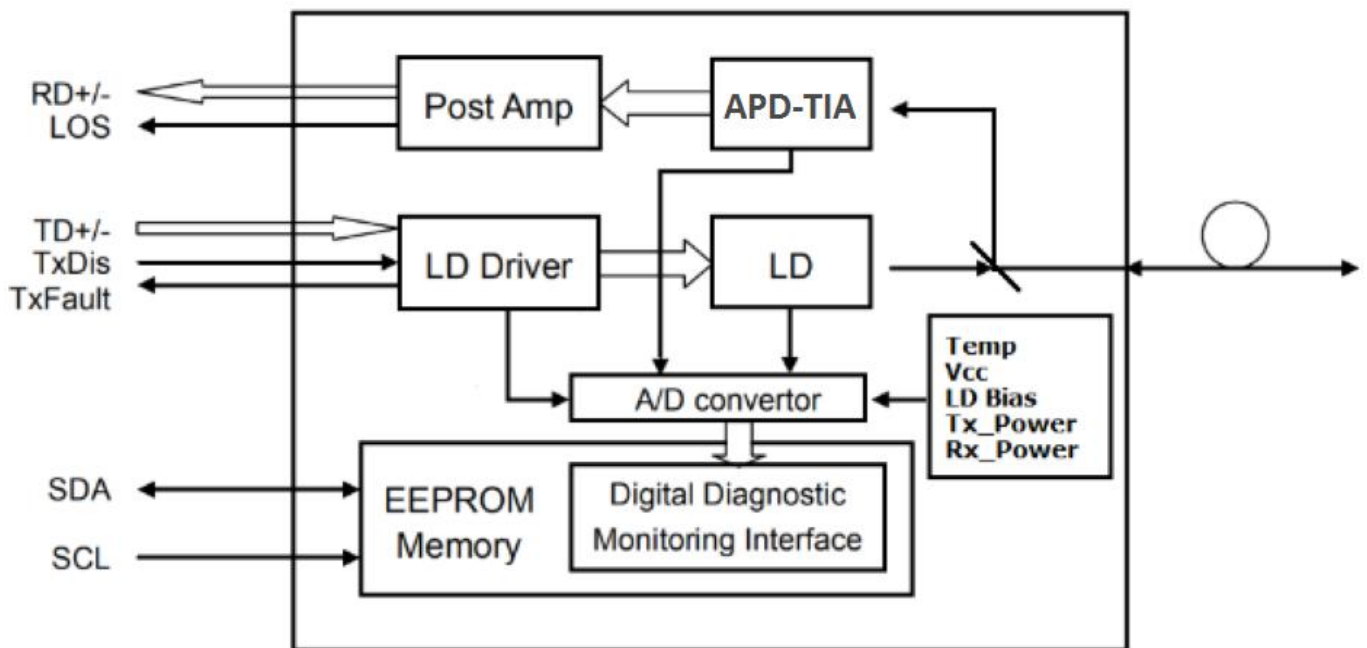
| | | |
|---|--|---------------------------------------|
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2 GR-1089-CORE | Compatible with standards |
| Electromagnetic nterference (EMI) | FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B | Compatible with standards |
| Immunity | IEC 61000-4-3 | Compatible with standards |
| Laser Eye Safety | FDA 21CFR 1040.10 and 1040.11 | Compatible with Class I laser product |
| RoHS | 2002/95/EC 4.1&4.2 2011/65/EU | Compatible with standards |

Product Description

The SFP+ transceivers are high performance, cost effective modules supporting data rate of 10Gbps and 60km transmission distance with SMF.

The transceiver consists of three sections: a Un-cooled DFB laser transmitter, a APD 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 and SFF-8472 digital diagnostics functions.



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Figure 1. Transceiver functional Block Diagram

Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

(Exceeding the limits below may damage the transceiver module permanently)

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|----------------------------|-----------------|------|-----|------|------|-------|
| Maximum Supply Voltage | V _{CC} | -0.5 | - | +4.0 | V | |
| Storage Temperature | T _S | -40 | - | +85 | °C | |
| Case Operating Temperature | T _A | -10 | - | +75 | °C | |
| Relative Humidity | RH | 5 | - | 85 | % | 1 |

Notes:

1. Non-condensing.

Recommend Operation Environment

Table 3. Recommend Operation Environment

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|----------------------------|-----------------|--------|---------|---------|------|-------|
| Data Rate | BR | 9.9528 | 10.3125 | 11.3168 | Gbps | |
| Power Supply Voltage | V _{CC} | 3.13 | 3.3 | 3.47 | V | |
| Power Supply Current | I _{CC} | - | - | 300 | mA | |
| Power Dissipation | P _D | - | - | 1.0 | W | |
| Case Operating Temperature | T _A | -5 | - | +70 | °C | |
| Transmission Distance | T _D | - | - | 60 | km | 1 |

Notes:

1. Measured with ITU-T G.652 SMF

Optical Characteristics

Table 4. Optical Characteristics(T_{OP} = -5 to +70 °C, V_{CC} = 3.13 to 3.47 V)**HuangShan Optoray Communication Corp.,Ltd.****No.4PiYun Road,Huangshan Economic Development Zone,Huangshan City,Anhui,China 245000****Tel:+86 559 5290615 Fax:+86 559 2585516****Http://www.optoray.com**

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|------------------------------------|--|--------|---------|---------|------|-------|
| Transmitter | | | | | | |
| Optical Center Wavelength(202733) | λ_c | 1260 | 1270 | 1280 | nm | |
| Optical Center Wavelength(203327) | λ_c | 1320 | 1330 | 1340 | nm | |
| Data Rate | BR | 9.9528 | 10.3125 | 11.3168 | Gbps | |
| Average Output Power | P _o | 1 | - | +6 | dBm | 1 |
| Optical Extinction Ratio | ER | 4.5 | 6.5 | - | dB | 2 |
| RMS Spectral Width (-20dB) | $\Delta\lambda$ | - | - | 1 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Data Dependent Jitter | DDJ | - | - | 0.10 | UI | |
| Total Jitter | TJ | - | - | 0.28 | UI | |
| Transmitter and Dispersion Penalty | TDP | - | - | 3.2 | dB | |
| Average Launch power of Tx OFF | P _{OFF} | - | - | -30 | dBm | |
| Optical Eye Mask | Compliant with IEEE 802.3ae-2005 and ITU-T G.691 | | | | | |
| Receiver | | | | | | |
| Center Wavelength Range(203327) | λ_c | 1320 | - | 1340 | nm | |
| Center Wavelength Range(202733) | λ_c | 1260 | - | 1280 | nm | |
| Data Rate | BR | 9.9528 | 10.3125 | 11.3168 | Gbps | |
| Receiver Sensitivity | R _{SEN} | - | - | -20 | dBm | 3 |
| Maximum Input Power | P _{MAX} | -7 | - | - | dB | 3 |
| LOS Assert | LOS _A | -35 | - | - | dBm | |
| LOS De-Assert | LOS _D | - | - | -22 | dBm | |
| LOS Hysteresis | LOS _H | 0.5 | - | 5 | dB | |
| Receiver Reflectance | R _R | - | - | -27 | dB | |

Notes:

1. The optical power is launched into SMF.
2. Measured with worst ER=4.5dB, RPBS 2³¹-1 test pattern @10.3125Gbs.
3. Measured with worst ER=4.5dB, RPBS 2³¹-1 test pattern @10.3125Gbs BER=<10⁻¹².

ElectricalOptical Characteristics

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Table 5. Electrical Characteristics(Top = -5 to +70 °C, Vcc = 3.13 to 3.47 V)

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|---------------------------------------|--------------------------------|------|-----|-----------------|------|-------|
| Transmitter | | | | | | |
| Differential Data Input Amplitude | V _{IN,P-P} | 180 | - | 850 | mVpp | 1 |
| Input Differential Impedance | Z _{IN} | 80 | 100 | 120 | Ω | |
| Transmitter Fault Output-High | V _{OH} | 2.4 | - | V _{CC} | V | |
| Transmitter Fault Output-Low | V _{OL} | -0.3 | - | 0.4 | V | |
| Transmitter Disable Voltage- High | V _{IH} | 2.0 | - | V _{CC} | V | |
| Transmitter Disable Voltage- low | V _{IL} | 0 | - | 0.8 | V | |
| Receiver | | | | | | |
| Differential output voltage swing | V _{OUT,P-P} | 300 | - | 850 | mVpp | 1 |
| Output Differential Impedance | Z _{OUT} | 80 | 100 | 120 | Ω | |
| Data Output Rise/Fall time 20%~80% | T _r /T _f | - | - | 28 | ps | 2 |
| Deterministic Jitter | DJ | - | - | 0.42 | UI | |
| Total Jitte | TJ | - | - | 0.70 | UI | |
| LOS Output Voltage-High | V _{LOSH} | 2.0 | - | V _{CC} | V | 3 |
| LOS Output Voltage-Low | V _{LOSL} | - | - | 0.8 | V | 3 |

Notes:

1. CML input/output, internally AC-coupled and terminated.
2. Measured with Module Compliance Test Board and OMA test pattern.
3. LOS is an open collector output. Should be pulled up with 4.7kΩ to 10kΩ on the host board.
Normal operation is logic 0; loss of signal is logic 1.

Table 6. Timing and Electrical

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| Parameter | Symbol | Min | Typ | 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 Fault 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 |
| SDA, SCL, MOD_ABS High Level | V _H | 2 | - | V _{cc} | V |
| SDA, SCL, MOD_ABS Low Level | V _L | - | - | 0.8 | V |

Pin Assignment

Table 7. Pin Descriptions

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| Pin | Symbol | Name/Description | Notes |
|-----|------------|---|-------|
| 1 | VEET | Module Transmitter Ground | |
| 2 | Tx_Fault | Module Transmitter Fault | 1 |
| 3 | Tx_Disable | Transmitter Disable, Turns off transmitter laser output | 2 |
| 4 | SDA | 2 wire serial interface data input/output (SDA) | 1 |
| 5 | SCL | 2 wire serial interface clock input (SCL) | 1 |
| 6 | MOD_ABS | Module Absent, connected to VeeT or VeeR in the module | 1 |
| 7 | RS0 | Receiver Rate Select | |
| 8 | Rx_LOS | Loss of Signal indication, Logic 0 indicates normal operation | 3 |
| 9 | RS1 | Transmitter Rate Select, Not Used for this product | |
| 10 | VEER | Module Receiver Ground | |
| 11 | VEER | Module Receiver Ground | |
| 12 | RD- | Receiver Inverted Data Output, AC Coupled | 4 |
| 13 | RD+ | Receiver Non-Inverted Data Output, AC Coupled | 4 |
| 14 | VEER | Module Receiver Ground | |
| 15 | VccR | Module Receiver 3.3 V Supply | |
| 16 | VccT | Module Transmitter 3.3 V Supply | |
| 17 | VEET | Module Transmitter Ground | |
| 18 | TD+ | Transmitter Non-Inverted Data Input, AC Coupled | 5 |
| 19 | TD- | Transmitter Inverted Data Input, AC Coupled | 5 |
| 20 | VEET | Module Transmitter Ground | |

Notes:

1. Open collector/drain output, which should be pulled up with a 4.7k Ω to 10k Ω resistor on the host board if intended for use. Pull up voltage should be between 2.0V to 3.6V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
2. Laser output disabled on Tx_Disable >2.0V or open, enabled on Tx_Disable <0.8V.
3. LOS is open collector output. Should be pulled up with 4.7k Ω to 10k Ω on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
4. RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 Ω

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differential lines which should be terminated with 100Ω (differential) at the user SERDES.

5. TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

Pin Assignment (continued)

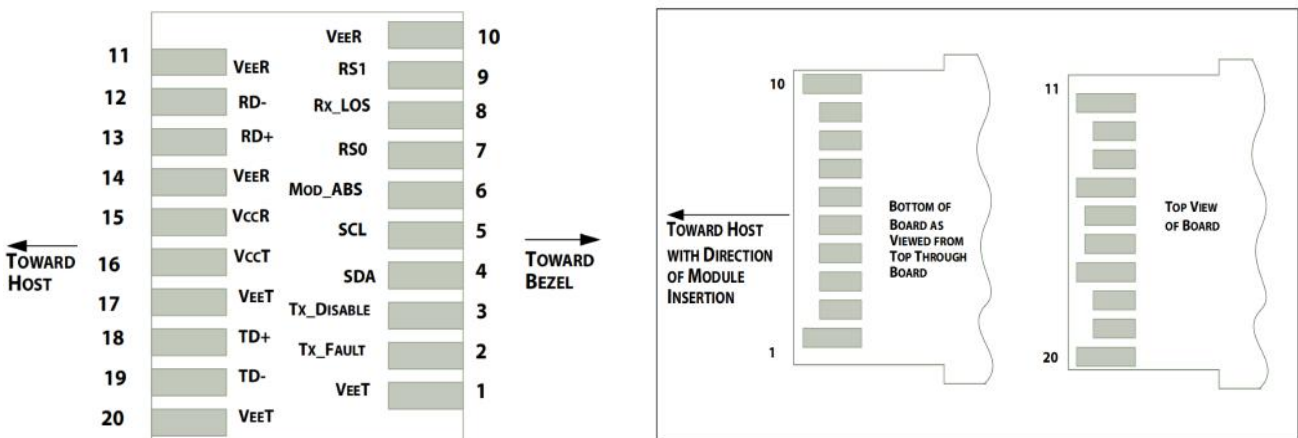


Figure 2. Host PCB SFP+ pad assignment top view and Names.

Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire 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.

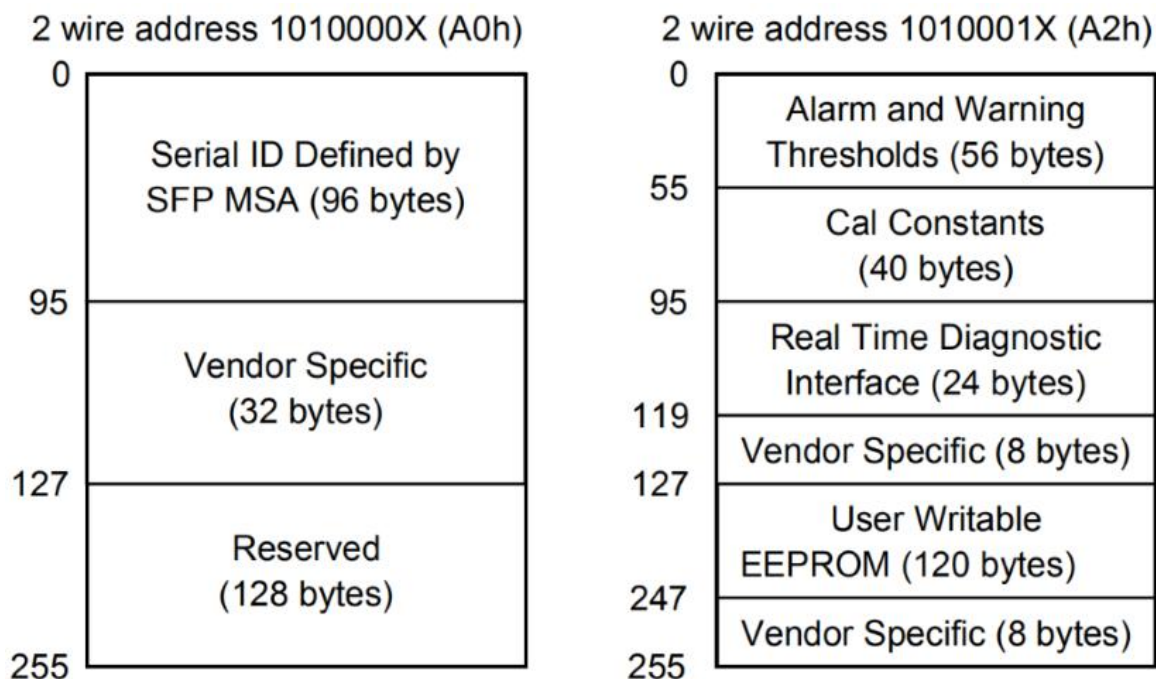
Table 8. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

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Table 9. Digital Diagnostic Monitor Characteristics

| Parameter | Calibration | Range | Accuracy | Unit |
|----------------------------------|-------------|--------------|----------|------|
| Transceiver Internal Temperature | Internal | -5 to +70°C | ±3.0 | °C |
| Vcc3 Internal Supply Voltage | Internal | 3.0 to 3.6V | ±3.0 | % |
| Laser Bias Current | Internal | 0 to 90mA | ±10 | % |
| Tx Output Power | Internal | 0 to +6dBm | ±3.0 | dBm |
| Rx Input Power | Internal | -26 to -6dBm | ±3.0 | dBm |

Recommended Circuit

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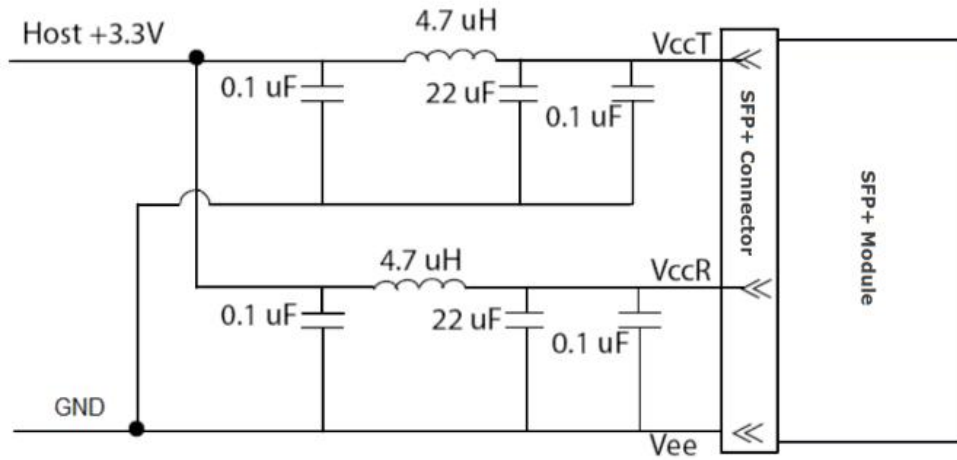


Figure 3, Recommended Host Board Power Supply Circuit

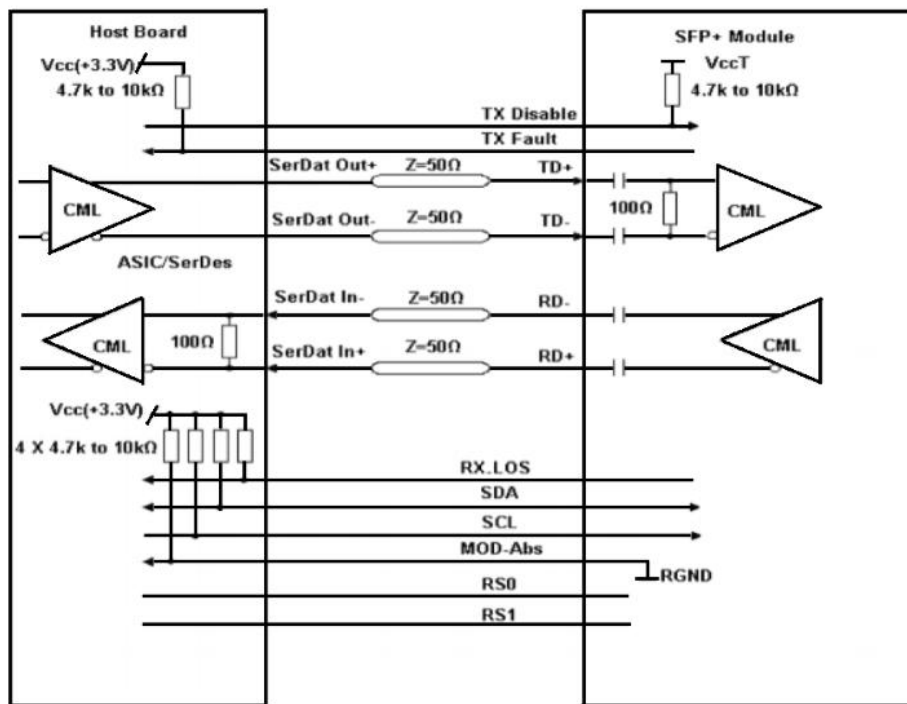


Figure 4, Recommended Interface Circuit

Mechanical Dimensions

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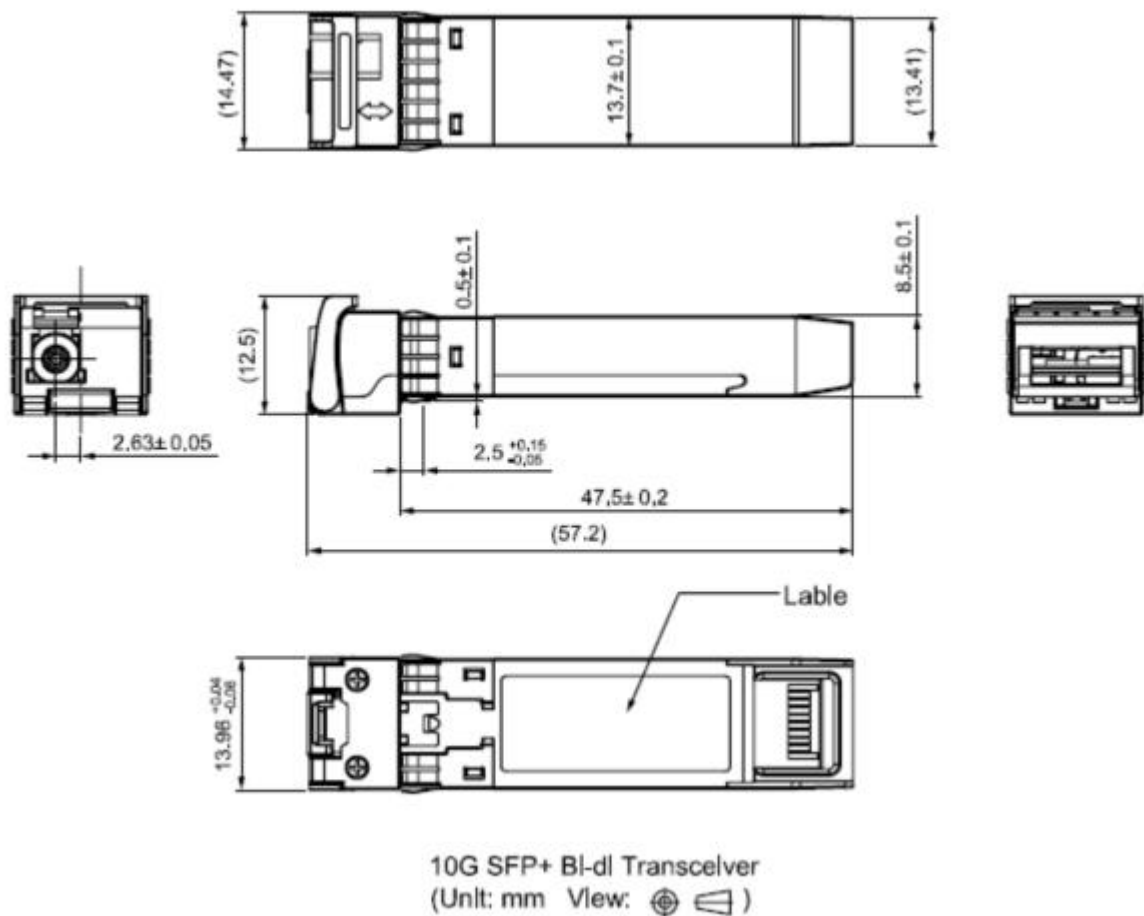


Figure 5, Mechanical Dimensions

Ordering information

Table 10. Ordering information

| Part Number | Product Description |
|------------------|--|
| OBS-10G-27-33-60 | TX:1270nm DFB & RX:1330nm, 10.3125Gbps, SMF 60km, -5°C ~ +70°C |

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| | |
|-------------------|---|
| OBS-10G-33-27-60 | TX:1330nm DFB & RX:1270nm, 10.3125Gbps, SMF 60km, -5°C ~ +70°C |
| OBS-10G-27-33-60E | TX:1270nm DFB & RX:1330nm, 10.3125Gbps, SMF 60km, -20°C ~ +85°C |
| OBS-10G-33-27-60E | TX:1330nm DFB & RX:1270nm, 10.3125Gbps, SMF 60km, -20°C ~ +85°C |
| OBS-10G-27-33-60I | TX:1270nm DFB & RX:1330nm, 10.3125Gbps, SMF 60km, -40°C ~ +85°C |
| OBS-10G-33-27-60I | TX:1330nm DFB & RX:1270nm, 10.3125Gbps, SMF 60km, -40°C ~ +85°C |

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.