

## DF-10GOEO-I

### Industrial 1G/10G SFP+ to SFP+ OEO Converter (3R Repeater)

#### Description

DF-10GOEO-I series Industrial 10G OEO Converter is a connection between fiber to fiber 10Gbps equipment function as fiber media converter, or as fiber repeater for long distance transmission in harsh environment at operating temperature -40~ 75 °C.

It is for network backbone (SAN, LAN, MAN) application. Support SDH/SONET STM-64/OC-192, 10G fiber channel, 10G Ethernet, which can be applied in R&D laboratory, data center, telecommunication room. It supports optical wavelength conversion 1310nm/1550nm/CWDM/DWDM with Loop-back.

When only connecting the copper and fiber port, it can be connection between fiber to copper 1Gbps Ethernet equipment function as fiber-to-copper media converter for long distance transmission up to 120km.



#### Main Features

- Transparent Transport and very low delay
- 3R function (Regeneration, Reshaping, Re-timing)
- Support hot plugging, full state led display, easy installation
- Support ITUT prescribed DWDM/CWDM wavelength, and can also display it's DDM function
- Support Loop-back and Jumbo Frame
- DIP Switch supports 1.25G/10G fiber data rate switching
- Can be as 1G Ethernet Media Converter if using Ethernet

## Industrial Case and Installation

- IP40 Aluminium case, Fanless design
- 12-48V DC redundant power with reverse polarity protection
- DIN-rail and wall mount installation
- -40 to +75°C operating temperature

## Technical Indexes

| Performance Data               | Technical Indexes                                                                                                                                                                                                                                            |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment function             | 3R Repeater                                                                                                                                                                                                                                                  |
| Transmission Speed             | 10G: 8.5Gb/s-11.7Gb/s                                                                                                                                                                                                                                        |
| Protocols                      | 8.5G Fiber Channel<br><br>SONET OC-192, SDH STM-64 (9.95Gbps)<br><br>10G WAN (10Gbps)<br><br>10G LAN (10.31Gbps)<br><br>OTN OTU-2 (G.709) (10.70Gbps)<br><br>10G LAN with 255/237 FEC coding (11.09Gbps)<br><br>10G Fiber Channel (11.32Gbps)<br><br>10G POS |
| Interface Type                 | SFP+ to SFP+                                                                                                                                                                                                                                                 |
| Transmission Distance          | SFP+ module: up to 80km                                                                                                                                                                                                                                      |
| Maximum Packet Forwarding Rate | 14,880,950/S                                                                                                                                                                                                                                                 |
| Operating Temperature          | -40°C to 75°C                                                                                                                                                                                                                                                |
| Storage Temperature            | -40°C to 85°C                                                                                                                                                                                                                                                |
| Relative Humidity              | 5% to 95% non-condensing                                                                                                                                                                                                                                     |

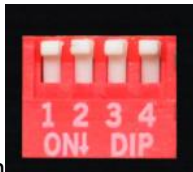


REAL OPTIC

|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MTBF                                           | > 200,000 hrs                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Ethernet Media Converter Specifications</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Standards                                      | IEEE 802.3 10BASE-T<br>IEEE 802.3u 100BASE-TX<br>IEEE 802.3ab 1000BASE-T<br>IEEE 802.3z, 1000BASE-SX/LX<br>IEEE 802.3x Full-duplex flow control                                                                                                                                                                                                                                                                                                       |
| Work Mode                                      | 10/100/1000BASE-T to 1000BASE-SX/LX                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Port Type                                      | SFP to RJ45                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Network Cables                                 | <b>Twisted-pair</b><br><br>10BASE-T: 2-pair UTP Cat. 3,4,5, up to 100m<br>100BASE-TX: 2-pair UTP Cat. 5, up to 100m<br>1000BASE-T: 4-pair STP Cat 5 up to 100m<br><br><b>Fiber-optic Cable</b><br><br><b>1000BASE-SX:</b><br><br>50/125 $\mu$ m or 62.5/125 $\mu$ m multi-mode fiber cable, up to 220/550m/2km.<br><br><b>1000BASE-LX:</b><br><br>9/125 $\mu$ m single-mode cable, providing long distance for 10/20/40/80/120km (vary on SFP module) |
| <b>Electrical and Mechanical</b>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Input Power                                    | 12~48VDC, Redundant Power (4-pin Terminal Block)                                                                                                                                                                                                                                                                                                                                                                                                      |
| Power Consumption                              | 8W Max                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Protection                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Power Input Overload                           | Automatic Resettable                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Reverse Polarity                               | Present                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>DIP Switch</b>                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



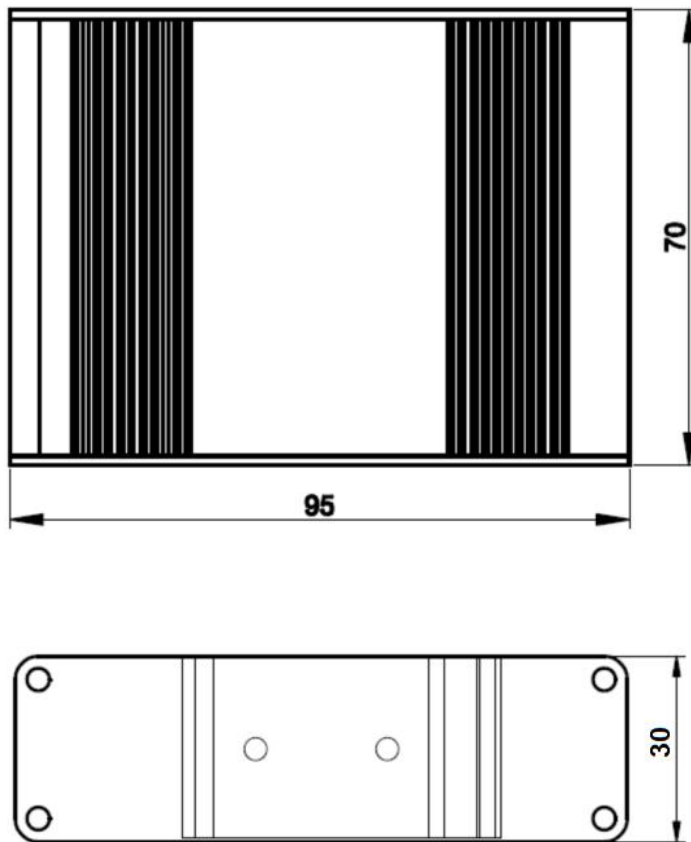
REAL OPTIC

|                                                                                                                                                |                 |           |               |                |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|---------------|----------------|
| <div>4-digit DIP switch</div> <div></div> <div>function</div> | DIP             | Function  | Settings      |                |
|                                                                                                                                                | SW 1            | 1.25G/10G | ON - 1.25G    | OFF - 10.3G    |
|                                                                                                                                                | SW 2            | Reserved  | ON - Reserved | OFF - Reserved |
|                                                                                                                                                | SW 3            | Reserved  | ON - Reserved | OFF - Reserved |
|                                                                                                                                                | SW 4            | Reserved  | ON - Reserved | OFF - Reserved |
| <b>LED Indicators:</b>                                                                                                                         |                 |           |               |                |
| PWR                                                                                                                                            | Power Status    |           |               |                |
| FX1                                                                                                                                            | SFP Port-1      |           |               |                |
| FX2                                                                                                                                            | SFP Port-2      |           |               |                |
| L/A                                                                                                                                            | TP LINK/ACT     |           |               |                |
| Dimensions (WxDxH)                                                                                                                             | 95 x 70 x 30 mm |           |               |                |
| Weight                                                                                                                                         | 0.25Kg          |           |               |                |
| Casing                                                                                                                                         | Aluminum Case   |           |               |                |
| Mounting Options:                                                                                                                              | DIN-Rail mount  |           |               |                |
| <b>Regulatory Approvals</b>                                                                                                                    |                 |           |               |                |
| ISO9001, CE, RoHS, FCC                                                                                                                         |                 |           |               |                |
| EN55022:2010+AC: 2011, Class A                                                                                                                 |                 |           |               |                |
| EN 61000-3-2: 2006+A1: 2009+A2: 2009                                                                                                           |                 |           |               |                |
| EN 61000-3-3: 2013                                                                                                                             |                 |           |               |                |
| EN55024:2010                                                                                                                                   |                 |           |               |                |
| IEC 61000-4-2: 2008 (ESD)                                                                                                                      |                 |           |               |                |
| IEC 61000-4-3: 2010 (RS)                                                                                                                       |                 |           |               |                |
| IEC 61000-4-4: 2012 (EFT)                                                                                                                      |                 |           |               |                |
| IEC 61000-4-5: 2014 (Surge)                                                                                                                    |                 |           |               |                |
| IEC 61000-4-6: 2013 (CS)                                                                                                                       |                 |           |               |                |
| IEC 61000-4-8: 2009 (PFMF)                                                                                                                     |                 |           |               |                |



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## Dimensions (Unit: mm)



## Package List

- 1 x Fiber media converter
- 1 x Rail Mounting Kit
- 1 x Wall Mount Kit
- 1 x Warranty Card

## Order Information

| Model Number | Description                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------|
| DF-10GOEO-I  | Industrial 1G/10G SFP+ to SFP+ OEO Converter (3R Repeater) with 1G Ethernet Media Converter Function |

## TK-1392-3LCD10

### 10Gbps 1310nm 10KM SFP+ Optical Transceiver

#### Features

- Support data rate up to 11.3Gb/s
- Hot-Pluggable SFP Footprint and Single LC Connector
- Up to 10km reach for G.652 SMF
- 1310nm DFB laser and PIN receiver
- Temperature Range:
  - Commercial: 0°C ~70°C
  - Industrial: -40°C ~85°C
- Power consumption <1W
- Compliant with SFP-8431
- Compliant with SFP-8432
- Compliant with SFP-8472
- Compliant with IEEE802.3ae
- RoHS 6 compliance
- Complies with EU Directive 2015/863/EU



TK-1392-3LCD10

#### Applications

- 10GBASE-LR/LW
- OTU2/2e
- Other Optical Links

#### Product description

This 1310nm DFB 10Gbps SFP+ transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km.

The SFP+ 10km module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI.

#### Ordering Information

| Part No.    | Data Rate(optical) | Laser | Fiber Type | Distance | Optical Interface | Temp     | DDMI | Latch Color |
|-------------|--------------------|-------|------------|----------|-------------------|----------|------|-------------|
| ESP31X-10D  | 10.3125Gbps        | DML   | SMF        | 10km     | LC                | 0~70°C   | Y    | Blue        |
| ESP31X-10DI | 10.3125Gbps        | DML   | SMF        | 10km     | LC                | -40~85°C | Y    | Blue        |



## Absolute Maximum Ratings

| Parameter                  | Symbol | Min  | Typ | Max | Unit | Ref. |
|----------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage     | Vcc    | -0.5 |     | 4.7 | V    |      |
| Storage Temperature        | TS     | -40  |     | 85  | °C   |      |
| Case Operating Temperature | Tcase  | -5   |     | 70  | °C   |      |

## Electrical Characteristics

| Parameter                      | Symbol     | Min     | Typ | Max      | Unit | Ref. |
|--------------------------------|------------|---------|-----|----------|------|------|
| Supply Voltage                 | Vcc        | 3.14    | 3.3 | 3.46     | V    |      |
| Supply Current                 | Icc        |         |     | 300      | mA   |      |
| <b>Transmitter</b>             |            |         |     |          |      |      |
| Input differential impedance   | Rin        |         | 100 |          | Ω    | 1    |
| Single ended data input swing  | Vin,pp     | 180     |     | 700      | mV   |      |
| Transmit Disable Voltage       | VD         | Vcc-1.3 |     | Vcc      | V    |      |
| Transmit Enable Voltage        | VEN        | Vee     |     | Vee+ 0.8 | V    | 2    |
| Transmit Disable Assert Time   |            |         |     | 10       | us   |      |
| <b>Receiver</b>                |            |         |     |          |      |      |
| Differential data output swing | Vout,pp    | 300     |     | 850      | mV   | 3    |
| Data output rise time          | tr         | 28      |     |          | ps   | 4    |
| Data output fall time          | tf         | 28      |     |          | ps   | 4    |
| LOS Fault                      | VLOS fault | Vcc-1.3 |     | VccHOST  | V    | 5    |
| LOS Normal                     | VLOS norm  | Vee     |     | Vee+0.8  | V    | 5    |
| Power Supply Rejection         | PSR        | 100     |     |          | mVpp | 6    |

### Notes:

- 1) Connected directly to TX data input pins. AC coupled thereafter.
- 2) Or open circuit.
- 3) Into 100 ohms differential termination.
- 4) 20 – 80 %.
- 5) Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
- 6) Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## Optical Characteristics (T<sub>case</sub> = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

| Parameter          | Symbol | Min | Typ | Max  | Unit | Ref. |
|--------------------|--------|-----|-----|------|------|------|
| <b>Transmitter</b> |        |     |     |      |      |      |
| Output Opt. Pwr    | POUT   | -6  |     | -0.5 | dBm  | 1    |



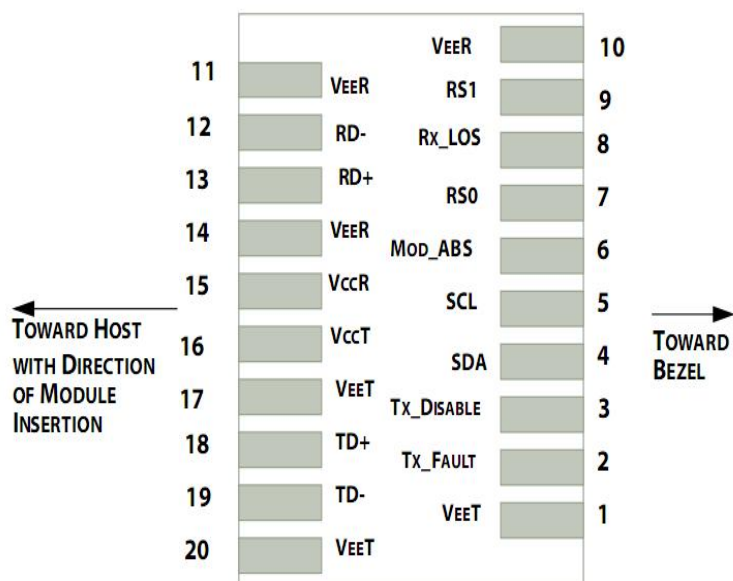
## REAL OPTIC

|                                    |                              |      |      |       |       |   |
|------------------------------------|------------------------------|------|------|-------|-------|---|
| Optical Wavelength                 | $\lambda$                    | 1260 | 1310 | 1355  | nm    |   |
| Wavelength Temperature Dependence  |                              |      | 0.08 | 0.125 | nm/°C |   |
| Spectral Width (-20dB)             | $\sigma$                     |      |      | 1     | nm    |   |
| Optical Extinction Ratio           | ER                           | 3.5  |      |       | dB    |   |
| Transmitter and Dispersion Penalty | TDP                          |      |      | 3.2   | dB    |   |
| Optical Rise/Fall Time             | tr/ tf                       |      | 0.1  | 0.26  | ns    |   |
| RIN                                | RIN                          |      |      | -128  | dB/Hz |   |
| Output Eye Mask                    | Compliant with IEEE 0802.3ae |      |      |       |       |   |
| Receiver                           |                              |      |      |       |       |   |
| Rx Sensitivity                     | RSENS                        |      |      | -15   | dBm   | 2 |
| Input Saturation Power (Overload)  | Psat                         | 0.5  |      |       | dBm   |   |
| Wavelength Range                   | $\lambda_c$                  | 1270 |      | 1610  | nm    |   |
| LOS De -Assert                     | LOSD                         |      |      | -17   | dBm   |   |
| LOS Assert                         | LOSA                         | -30  |      |       | dBm   |   |
| LOS Hysteresis                     |                              | 0.5  | 1.0  |       | dB    |   |

### Notes:

- 1) Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- 2) With worst-case extinction ratio. Measured with a PRBS  $2^{31}-1$  test pattern, @10.325Gb/s, BER< $10^{-12}$ .

## Pin Assignment



Pin out of Connector Block on Host Board





REAL OPTIC

| Pin | Symbol      | Name/Description                                               | Ref. |
|-----|-------------|----------------------------------------------------------------|------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | $T_{FAULT}$ | Transmitter Fault.                                             | 2    |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 4   | SDA         | 2-wire Serial Interface Data Line                              | 4    |
| 5   | SCL         | 2-wire Serial Interface Clock Line                             | 4    |
| 6   | MOD_ABS     | Module Absent. Grounded within the module                      | 4    |
| 7   | RS0         | Rate Select 0                                                  | 5    |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 6    |
| 9   | RS1         | No connection required                                         | 1    |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | $V_{EER}$   | 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  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 15  | $V_{CCR}$   | Receiver Power Supply                                          |      |
| 16  | $V_{CCT}$   | Transmitter Power Supply                                       |      |
| 17  | $V_{EET}$   | 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  | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |

#### Notes:

- 1) Circuit ground is internally isolated from chassis ground.
- 2)  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{CC} + 0.3V$ . 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.
- 3) Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
- 4) Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
- 5) Internally pulled down per SFF-8431 Rev 4.1.
- 6) LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Digital Diagnostic Functions

TAKFLY TK-1392-3LCD10 transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1.

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

Additionally, TAKFLY 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



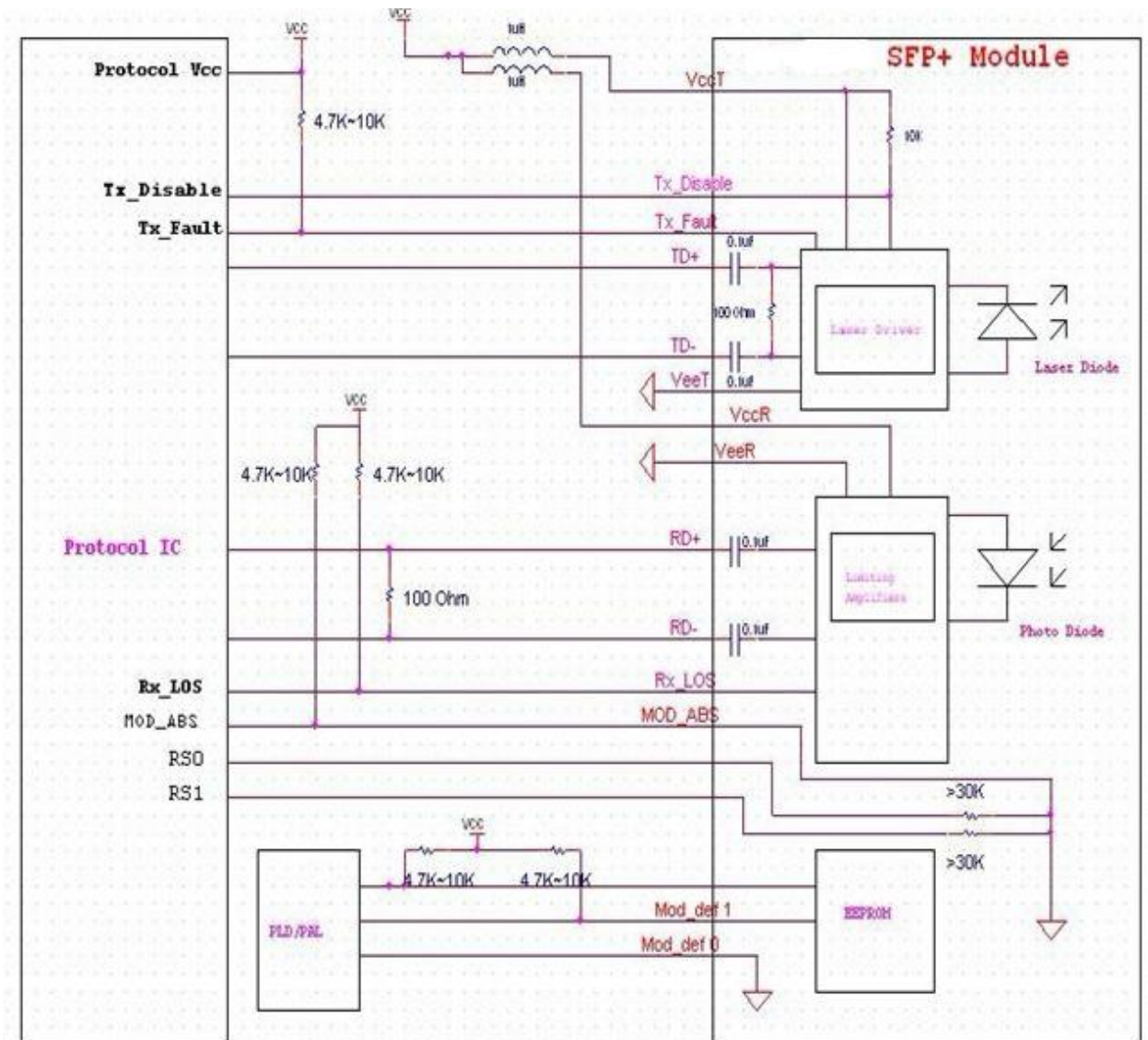
end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM 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 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.

## Host - Transceiver Interface Block Diagram

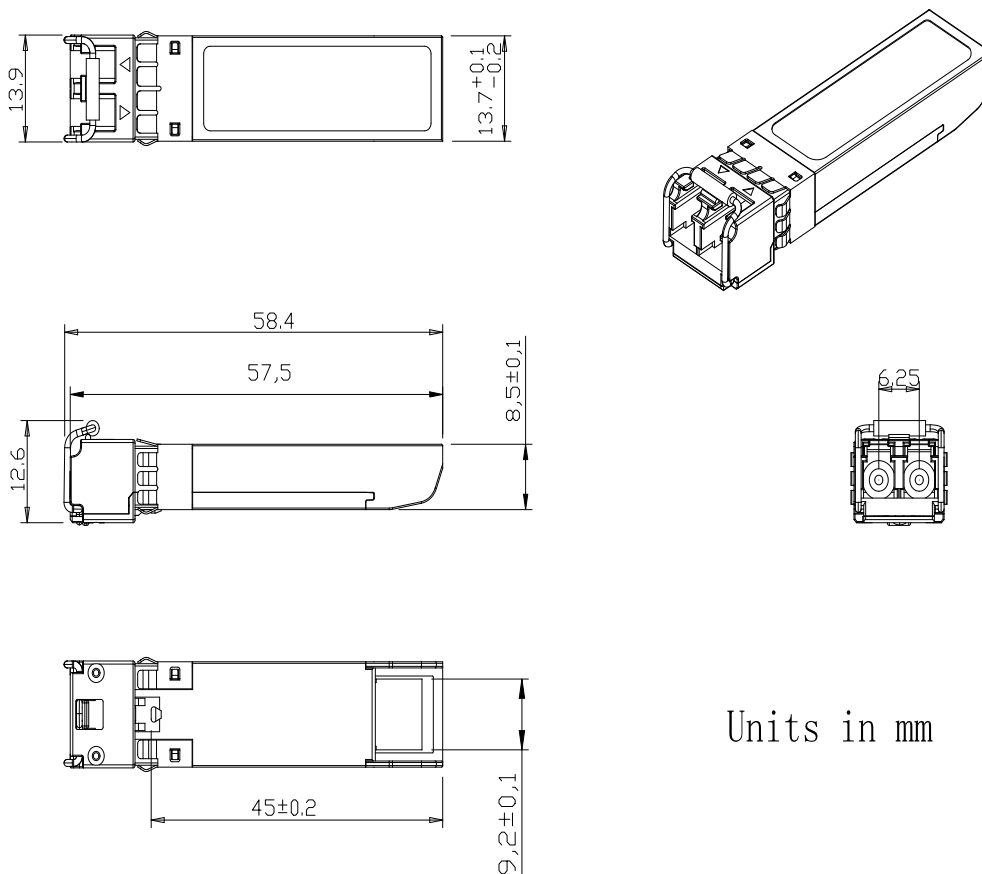




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## Outline Dimensions

Comply to SFF-8432 rev. 5.0, the improved Pluggable form factor specification.



Units in mm

## Regulatory Compliance

| Feature                            | Reference                                        | Performance               |
|------------------------------------|--------------------------------------------------|---------------------------|
| Electrostatic discharge (ESD)      | IEC/EN 61000-4-2                                 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2     | Class 1 laser product     |
| Component Recognition              | IEC/EN 60950, UL                                 | Compatible with standards |
| ROHS                               | 2002/95/EC                                       | Compatible with standards |
| EMC                                | EN61000-3                                        | Compatible with standards |

## TK-8592-3LCD03

### 10Gbps 850nm 300M SFP+ Optical Transceiver

#### Features

- Optical interface compliant to IEEE 802.3ae
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- 850nm VCSEL transmitter, PIN photo-detector
- Maximum link length of 300m on 2000MHz/km MMF
- Operating case temperature: 0 to 70 °C
- Low power consumption
- Maximum link length of 300m on 2000MHz/km MMF
- All-metal housing for superior EMI performance
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS6 compliant (lead free)



**TK-8592-3LCD03**

#### Applications

- 10GBASE-SR at 10.3125Gbps
- 10GBASE-SW at 9.953Gbps
- Other optical links

#### Product description

This 850 nm VCSEL 10Gigabit SFP+ transceiver is designed to transmit and receive optical data over 50/125µm or 62.5/125µm multimode optical fiber (Table 1).

| Fiber type  | Minimum modal bandwidth @ 850 nm<br>(MHz·km) | Operating range (meters) |
|-------------|----------------------------------------------|--------------------------|
| 62.5 µm MMF | 160                                          | 2 to 26                  |
|             | 200                                          | 2 to 33                  |
| 50 µm MMF   | 400                                          | 2 to 66                  |
|             | 500                                          | 2 to 82                  |
|             | 2000                                         | 2 to 300                 |

**Table 1: SFP+ SR Operating Range for each Optical Fiber Type**



## REAL OPTIC

The SFP+ SR module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled.

The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

The transmitter converts 10Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-SR standard. An open collector compatible Transmit Disable (Tx\_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (TFault) is provided. TX\_Fault is a module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX\_Fault output contact is an open drain/collector and shall be pulled up to the Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ. TX\_Disable is a module input contact. When TX\_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx\_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx\_LOS contact is an open drain/collector output and shall be pulled up to Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx\_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

## Absolute Maximum Ratings

| Parameter                  | Symbol | Min  | Typ | Max | Unit | Ref. |
|----------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage     | Vcc    | -0.5 |     | 4.7 | V    |      |
| Storage Temperature        | TS     | -40  |     | 85  | °C   |      |
| Case Operating Temperature | Tcase  | -5   |     | 70  | °C   |      |

## Electrical Characteristics (Tcase = -5 to 70°C, VCC = 3.14 to 3.46Volts)

| Parameter                     | Symbol | Min     | Typ | Max      | Unit | Ref. |
|-------------------------------|--------|---------|-----|----------|------|------|
| Supply Voltage                | Vcc    | 3.14    | 3.3 | 3.46     | V    |      |
| Supply Current                | Icc    |         |     | 250      | mA   |      |
| <b>Transmitter</b>            |        |         |     |          |      |      |
| Input differential impedance  | Rin    |         | 100 |          | Ω    | 1    |
| Single ended data input swing | Vin,pp | 180     |     | 700      | mV   |      |
| Transmit Disable Voltage      | VD     | Vcc-1.3 |     | Vcc      | V    |      |
| Transmit Enable Voltage       | VEN    | Vee     |     | Vee+ 0.8 | V    | 2    |
| Transmit Disable Assert Time  |        |         |     | 10       | us   |      |



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| Receiver                       |            |         |  |         |      |   |
|--------------------------------|------------|---------|--|---------|------|---|
| Differential data output swing | Vout,pp    | 300     |  | 850     | mV   | 3 |
| Data output rise time          | tr         | 28      |  |         | ps   | 4 |
| Data output fall time          | tf         | 28      |  |         | ps   | 4 |
| LOS Fault                      | VLOS fault | Vcc-1.3 |  | VccHOST | V    | 5 |
| LOS Normal                     | VLOS norm  | Vee     |  | Vee+0.8 | V    | 5 |
| Power Supply Rejection         | PSR        | 100     |  |         | mVpp | 6 |

#### Notes:

- 1) Connected directly to TX data input pins. AC coupled thereafter.
- 2) Or open circuit.
- 3) Into 100 ohms differential termination.
- 4) These are unfiltered 20-80% values
- 5) Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
- 6) Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## Optical Characteristics (T<sub>case</sub> = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

| Parameter                         | Symbol                       | Min | Typ | Max  | Unit  | Ref. |
|-----------------------------------|------------------------------|-----|-----|------|-------|------|
| Transmitter                       |                              |     |     |      |       |      |
| Output Opt. Pwr                   | POUT                         | -6  |     | -1   | dBm   | 1    |
| Optical Wavelength                | $\lambda$                    | 840 | 850 | 860  | nm    |      |
| Optical Extinction Ratio          | ER                           | 3.0 |     |      | dB    |      |
| RIN                               | RIN                          |     |     | -128 | dB/Hz |      |
| Output Eye Mask                   | Compliant with IEEE 0802.3ae |     |     |      |       |      |
| Receiver                          |                              |     |     |      |       |      |
| Rx Sensitivity                    | RSENS                        |     |     | -10  | dBm   | 2    |
| Input Saturation Power (Overload) | Psat                         | 0.5 |     |      | dBm   |      |
| Wavelength Range                  | $\lambda_c$                  | 770 | 850 | 860  | nm    |      |
| LOS De -Assert                    | LOSD                         |     |     | -14  | dBm   |      |
| LOS Assert                        | LOSA                         | -30 |     |      | dBm   |      |
| LOS Hysteresis                    |                              | 0.5 |     |      | dB    |      |

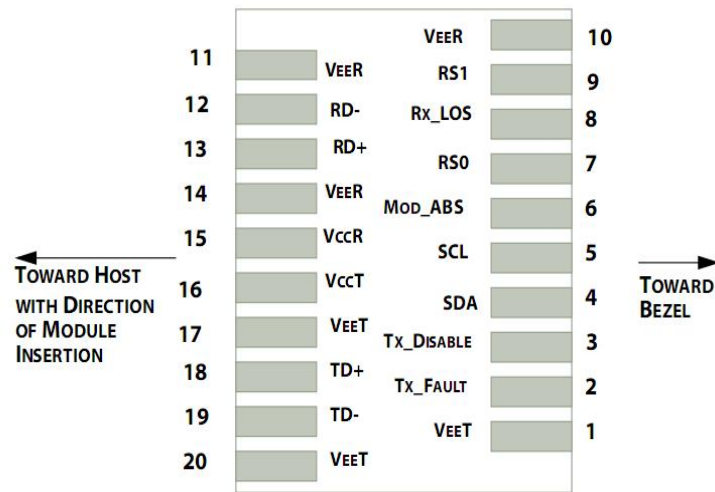
#### Notes:

- 1) Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- 2) With worst-case extinction ratio. Measured with a PRBS  $2^{31}-1$  test pattern, @10.325Gb/s, BER<10<sup>-12</sup>.



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## Pin Descriptions



Pin out of Connector Block on Host Board

| Pin | Symbol      | Name/Description                                               | Ref. |
|-----|-------------|----------------------------------------------------------------|------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | $T_{FAULT}$ | Transmitter Fault.                                             | 2    |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 4   | SDA         | 2-wire Serial Interface Data Line                              | 4    |
| 5   | SCL         | 2-wire Serial Interface Clock Line                             | 4    |
| 6   | MOD_ABS     | Module Absent. Grounded within the module                      | 4    |
| 7   | RS0         | Rate Select 0                                                  | 5    |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 6    |
| 9   | RS1         | No connection required                                         | 1    |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | $V_{EER}$   | 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  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 15  | $V_{CCR}$   | Receiver Power Supply                                          |      |
| 16  | $V_{CCT}$   | Transmitter Power Supply                                       |      |
| 17  | $V_{EET}$   | 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  | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |

### Notes:

- 1) Circuit ground is internally isolated from chassis ground.





- 2)  $T_{\text{FAULT}}$  is an open collector/drain output, which should be pulled up with a 4.7k $\Omega$ – 10 k $\Omega$  resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{\text{cc}} + 0.3\text{V}$ . 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.
- 3) Laser output disabled on  $T_{\text{DIS}} > 2.0\text{V}$  or open, enabled on  $T_{\text{DIS}} < 0.8\text{V}$ .
- 4) Should be pulled up with 4.7k $\Omega$ - 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
- 5) Internally pulled down per SFF-8431 Rev 4.1.
- 6) LOS is open collector output. It should be pulled up with 4.7k $\Omega$  – 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Digital Diagnostic Functions

TAKFLY TK-8592-3LD03 transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1.

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

Additionally, TAKFLY 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 EEPROM 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.

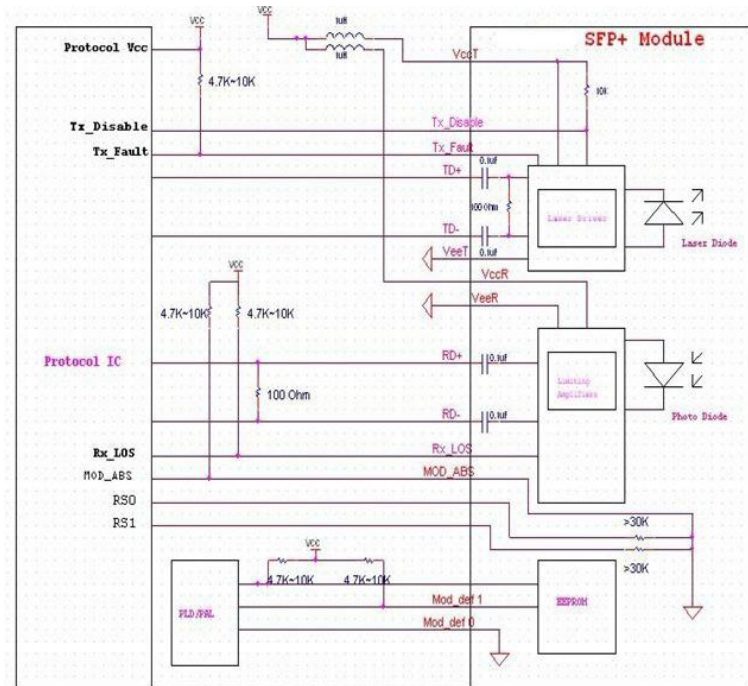
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the EEPROM 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.





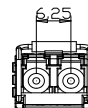
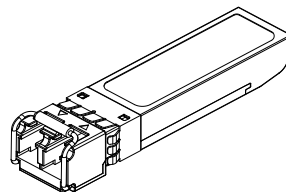
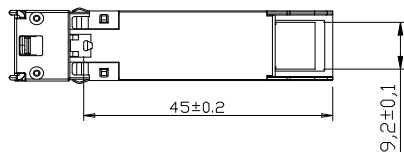
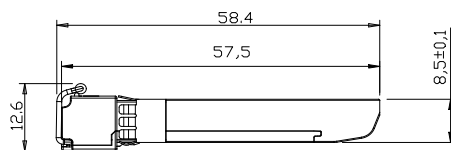
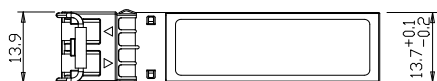
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## Host - Transceiver Interface Block Diagram



## Outline Dimensions

Comply to SFF-8432 rev5.0, the improved Pluggable form factor specification.



Units in mm



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## Regulatory Compliance

| Feature                            | Reference                                        | Performance               |
|------------------------------------|--------------------------------------------------|---------------------------|
| Electrostatic discharge (ESD)      | IEC/EN 61000-4-2                                 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2     | Class 1 laser product     |
| Component Recognition              | IEC/EN 60950, UL                                 | Compatible with standards |
| ROHS                               | 2002/95/EC                                       | Compatible with standards |
| EMC                                | EN61000-3                                        | Compatible with standards |