

EOLF-BI1303-X Series

EOLF-BI1503-X Series

**Single-Mode 100M/155M SDH/SONET
Simplex SFF Transceiver
RoHS6 Compliant**



Features

- ◆ Single-Mode Transceiver
- ◆ Operating data rate up to 155Mbps
- ◆ 20km with 9/125μm SMF
40km with 9/125μm SMF
60km with 9/125μm SMF
80km with 9/125μm SMF
- ◆ Single 3.3V Power supply
- ◆ LVPECL Signal Input / Output
- ◆ LVTTTL Transmitter Disable Input
- ◆ LVPECL Signal Detect Output
- ◆ Small Form Factor 2X5 pin Package
- ◆ Class 1 FDA and IEC60825-1 Laser Safety Compliant
- ◆ Operating Case Temperature
Standard: 0°C~+70°C
Industrial: -40°C~+85°C

Applications

- ◆ Fast Ethernet
- ◆ SONET/SDH Equipment Interconnect
- ◆ Fiber Channel Links
- ◆ Other Optical Link

Ordering information^{*(note1)}

| Part No. | Data Rate | λ(nm) | Interface | Distance | Form | Temp. | DDMI |
|----------------|--------------|-------|-----------|----------|------|----------|------|
| EOLF-BI1303-20 | 100M~155Mbps | 1310 | SC | 20km | 2x5 | Standard | NO |
| EOLF-BI1503-20 | 100M~155Mbps | 1550 | SC | 20km | 2x5 | Standard | NO |
| EOLF-BI1303-40 | 100M~155Mbps | 1310 | SC | 40km | 2x5 | Standard | NO |
| EOLF-BI1503-40 | 100M~155Mbps | 1550 | SC | 40km | 2x5 | Standard | NO |
| EOLF-BI1303-60 | 100M~155Mbps | 1310 | SC | 60km | 2x5 | Standard | NO |

| | | | | | | | |
|----------------|--------------|------|----|------|-----|----------|----|
| EOLF-BI1503-60 | 100M~155Mbps | 1550 | SC | 60km | 2x5 | Standard | NO |
| EOLF-BI1303-80 | 100M~155Mbps | 1310 | SC | 80km | 2x5 | Standard | NO |
| EOLF-BI1503-80 | 100M~155Mbps | 1550 | SC | 80km | 2x5 | Standard | NO |

Note1: The above table lists the standard version only. For other order information, please refer the following nomenclature and consult EOPTOLINK.

Nomenclature

EOL□- □□□-□□□□□□□□
A B C D E F G H I J K L

| Code | Parameter | Detailed description | | | | | |
|------|-------------------|--|--|--|--------------|---------|--|
| A | F | SFF | | | | | |
| B | Blank | BI | | | | | |
| C | λ | 13=1310nm | 15=1550nm | | | 16=CWDM | |
| D | Data Rate | 03=155M, 06=622M, 10=100M~1000M, 12=1.25G, 24=2.5G, 26=2.67G, 30=3.125G, 48=4.25G, R=request | | | | | |
| E | Distance | 02=850nm, MMF | XM=Blank~9Km, FP, MM F, (Blank=1Km, X=2~9) | XX=XX Km (SMF, X=0~9) | A=100Km | B=120Km | |
| F | DDM | Blank=Without DDM | | | D=With DDM | | |
| G | CWDM TX λ | A=1270, B=1290,, R=1610 | | | | | |
| H | CWDM RX λ | A=1270, B=1290,, R=1610 | | | | | |
| I | Form | Blank=2x5 | A=2x10 | 6=2x6 | | 7=2x7 | |
| J | Temperature | Blank=0~70 | | | I=-40~85 | | |
| K | Connector | Blank=SC | L=LC | | P=Pigtail/SC | | |
| L | Input/output & SD | Blank=Input: DC; Output: DC; SD-TTL (FC/GBE/2FC/OC48) | | Blank=Input: DC; Output: DC; SD-PECL(OC-3/STM-4) | | | |
| | | 1=Input: AC; Output: AC; SD-TTL (FC/GBE/2FC/OC48) | | 1=Input: AC; Output: AC; SD-PECL (OC-3/STM-4) | | | |
| | | 2=Input: AC; Output: DC; SD-TTL (FC/GBE/2FC/OC48) | | 2=Input: AC; Output: DC; SD-PECL (OC-3/STM-4) | | | |
| | | 3=Input: DC; Output: AC; SD-TTL (FC/GBE/2FC/OC48) | | 3=Input: DC; Output: AC; SD-PECL (OC-3/STM-4) | | | |

Regulatory Compliance

| Feature | Standard | Performance |
|--------------------------------------|----------------------------|--------------------|
| Electrostatic Discharge (ESD) to the | MIL-STD-883G Method 3015.7 | Class 1C (>1000 V) |

| | | |
|--|--|--|
| Electrical Pins | | |
| Electrostatic Discharge to the enclosure | EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE | Compliant with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B | Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design. |
| Immunity | EN 55024:1998+A1+A2 IEC 61000-4-3 | Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits. |
| Laser Eye Safety | FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1 | CDRH compliant and Class I laser product. TüV Certificate No. 50135086 |
| Component Recognition | UL and CUL EN60950-1:2006 | UL File E317337 TüV Certificate No. 50135086 (CB scheme) |
| RoHS6 | 2002/95/EC 4.1&4.2 2005/747/EC 5&7&13 | Compliant with standards ^{*note2} |

Note2: For update of the equipments and strict control of raw materials, EOPTOLINK has the ability to supply the customized products since Jan 1st, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Eoptolink's transceivers, because Eoptolink's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other components.

Product Description

The EOLF-BI1X03-X series Single-mode transceivers is small form factor, low power, and high performance module for bi-directional optical data communications such as Fast Ethernet and SONET OC-3 / SDH STM-1. This module is designed for single-mode fiber and operates at a nominal wavelength of 1310nm and 1550nm.

The transmitter section uses a multiple quantum well laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated

InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC. A LVPECL logic interface simplifies interface to external circuitry.

Interface information

The Signal Detect (SD, active high), normal optical input of receiver represents to a logic “1” level, which means asserted.

The following versions are available:

1. AC/AC Transceiver

Tx and Rx are AC coupling. Tx has differential 100Ω load.

2. DC/DC Transceiver

Standard PECL inputs and outputs, Tx and Rx are DC coupling.

3. AC/DC Transceiver

Tx is AC coupled, Differential 100Ω load, Rx has standard PECL output and is DC coupling.

Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|-----------------------------|-----------------|------|------|------|
| Storage Temperature | T _s | -40 | +85 | °C |
| Supply Voltage | V _{cc} | -0.5 | 3.6 | V |
| Operating Relative Humidity | | - | 95 | % |

*Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit | |
|----------------------------|-----------------|----------------|---------|------|------|----|
| Operating Case Temperature | T _A | EOLF-BI1X03-X | 0 | | +70 | °C |
| | | EOLF-BI1X03-XI | -40 | | +85 | |
| Power Supply Voltage | V _{cc} | 3.15 | 3.3 | 3.45 | V | |
| Power Supply Current | I _{cc} | | | 300 | mA | |
| Date Rate | OC-3/STM-1 | | 155 | | Mbps | |
| | Fast Ethernet | | 100 | | | |

Performance Specifications - Electrical

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|--------------------------------|-----------------|------|------|----------------------|------|---------------------------------------|
| Transmitter | | | | | | |
| LVPECL Inputs(Differential) | V _{in} | 400 | | 2000 | mVpp | AC Coupled Inputs ^{*(note3)} |
| Input Impedance (Differential) | Z _{in} | 85 | 100 | 115 | ohm | R _{in} > 100 kohm @ DC |
| TX_Dis | Disable | 2 | | V _{cc} +0.3 | V | |
| | Enable | 0 | | 0.8 | | |
| TX_FAULT | Fault | 2 | | V _{cc} +0.3 | V | |
| | Normal | 0 | | 0.5 | | |
| Receiver | | | | | | |

| | | | | | | |
|---------------------------------|--------|------|-----|-------|------|--|
| LVPECL Outputs (Differential) | Vout | 400 | | 2000 | mVpp | AC Coupled Outputs ^{*(note3)} |
| Output Impedance (Differential) | Zout | 85 | 100 | 115 | ohm | |
| RX_SD | Normal | -1.1 | | -0.74 | V | |
| | SD | -2.0 | | -1.58 | V | |

Optical and Electrical Characteristics

(EOLF-BI1X03-20 Series, FP and PIN)

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--|---|------|---------|------|------|
| 9µm Core Diameter SMF | | | 20 | | km |
| Data Rate | | | 155 | | Mbps |
| Transmitter | | | | | |
| Centre Wavelength, EOLF-BI1303-20 | λ_c | 1270 | 1310 | 1350 | nm |
| Centre Wavelength, EOLF-BI1503-20 | | 1500 | 1550 | 1600 | |
| Spectral Width (RMS) | $\Delta\lambda$ | | | 4 | nm |
| Average Output Power ^{*(note4)} | Pout | -14 | | -8 | dBm |
| Extinction Ratio ^{*(note5)} | ER | 10 | | | dB |
| Rise/Fall Time(20%~80%) | tr/tf | | | 2 | ns |
| Total Jitter ^{*(note5)} | TJ | | | 1 | ns |
| Output Optical Eye | Telcordia GR-253-CORE and IUT-T G.957 Compliant ^{*(note7)} | | | | |
| TX_Disable Assert Time | t_off | | | 10 | us |
| Receiver | | | | | |
| Center Wavelength, EOLF-BI1303-20 | λ_c | 1480 | 1550 | 1600 | nm |
| Center Wavelength, EOLF-BI1503-20 | | 1260 | 1310 | 1360 | |
| Receiver Sensitivity ^{*(note6)} | Pmin | | -35 | -33 | dBm |
| Receiver Overload | Pmax | -8 | | | dBm |
| SD De-Assert | SDD | | | -34 | dBm |
| SD Assert | SDA | -45 | | | dBm |
| LOS Hysteresis ^{*(note8)} | | 0.5 | | | dB |

(EOLF-BI1X03-40 Series, 1310nm FP / PIN & 1550nm DFB / PIN)

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--|-----------------|------|---------|------|------|
| 9µm Core Diameter SMF | | | 40 | | km |
| Data Rate | | | 155 | | Mbps |
| Transmitter | | | | | |
| Centre Wavelength, EOLF-BI1303-40 | λ_c | 1270 | 1310 | 1350 | nm |
| Centre Wavelength, EOLF-BI1503-40 | | 1530 | 1550 | 1570 | |
| Spectral Width (RMS), EOLF-BI1303-40 | $\Delta\lambda$ | | | 4 | nm |
| Spectral Width (-20dB), EOLF-BI1503-40 | | | | 1 | |
| Average Output Power ^{*(note4)} | Pout | -8 | | -3 | dBm |
| Extinction Ratio ^{*(note5)} | ER | 10 | | | dB |

| | | | | | |
|-----------------------------------|---|------|------|------|-----|
| Rise/Fall Time(20%~80%) | tr/tf | | | 2 | ns |
| Total Jitter*(note5) | TJ | | | 1 | ns |
| Output Optical Eye | Telcordia GR-253-CORE and IUT-T G.957 Compliant*(note7) | | | | |
| TX_Disable Assert Time | t_off | | | 10 | us |
| Receiver | | | | | |
| Center Wavelength, EOLF-BI1303-40 | λ_c | 1480 | 1550 | 1600 | nm |
| Center Wavelength, EOLF-BI1503-40 | | 1260 | 1310 | 1360 | |
| Receiver Sensitivity*(note6) | Pmin | | -35 | -33 | dBm |
| Receiver Overload | Pmax | -10 | | | dBm |
| SD De-Assert | SDD | | | -34 | dBm |
| SD Assert | SDA | -45 | | | dBm |
| LOS Hysteresis*(note8) | | 0.5 | | | dB |

(EOLF-BI1X03-60 Series, 1310nm FP / PIN & 1550nm DFB / PIN)

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--|---|------|---------|------|------|
| 9 μ m Core Diameter SMF | | | 60 | | km |
| Data Rate | | | 155 | | Mbps |
| Transmitter | | | | | |
| Centre Wavelength, EOLF-BI1303-60 | λ_c | 1270 | 1310 | 1350 | nm |
| Centre Wavelength, EOLF-BI1503-60 | | 1530 | 1550 | 1570 | |
| Spectral Width (RMS), EOLF-BI1303-60 | $\Delta\lambda$ | | | 4 | nm |
| Spectral Width (-20dB), EOLF-BI1503-60 | | | | 1 | |
| Average Output Power*(note4) | Pout | -5 | | 0 | dBm |
| Extinction Ratio*(note5) | ER | 10 | | | dB |
| Rise/Fall Time(20%~80%) | tr/tf | | | 2 | ns |
| Total Jitter*(note5) | TJ | | | 1 | ns |
| Output Optical Eye | Telcordia GR-253-CORE and IUT-T G.957 Compliant*(note7) | | | | |
| TX_Disable Assert Time | t_off | | | 10 | us |
| Receiver | | | | | |
| Center Wavelength, EOLF-BI1303-60 | λ_c | 1480 | 1550 | 1600 | nm |
| Center Wavelength, EOLF-BI1503-60 | | 1260 | 1310 | 1360 | |
| Receiver Sensitivity*(note6) | Pmin | | -36 | -34 | dBm |
| Receiver Overload | Pmax | -10 | | | dBm |
| SD De-Assert | SDD | | | -35 | dBm |
| SD Assert | SDA | -45 | | | dBm |
| LOS Hysteresis*(note8) | | 0.5 | | | dB |

(EOLF-BI1X03-80 Series, 1310nm FP / PIN & 1550nm DFB / PIN)

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|-----------------------------|--------|------|---------|------|------|
| 9 μ m Core Diameter SMF | | | 80 | | km |
| Data Rate | | | 155 | | Mbps |
| Transmitter | | | | | |

| | | | | | |
|--|--|------|------|------|-----|
| Centre Wavelength, EOLF-BI1303-80 | λ_c | 1270 | 1310 | 1350 | nm |
| Centre Wavelength, EOLF-BI1503-80 | | 1530 | 1550 | 1570 | |
| Spectral Width (RMS), EOLF-BI1303-80 | $\Delta\lambda$ | | | 4 | nm |
| Spectral Width (-20dB), EOLF-BI1503-80 | | | | 1 | |
| Average Output Power ^{*(note4)} , EOLF-BI1303-80 | Pout | -2 | | 3 | dBm |
| Average Output Power ^{*(note4)} , EOLF-BI1503-80 | | -3 | | 2 | |
| Extinction Ratio ^{*(note5)} | ER | 10 | | | dB |
| Rise/Fall Time(20%~80%) | tr/tf | | | 2 | ns |
| Total Jitter ^{*(note5)} | TJ | | | 1 | ns |
| Output Optical Eye | Telcordia GR-253-CORE and IUT-T G.957 Compliant ^{*(note7)} | | | | |
| TX_Disable Assert Time | t_off | | | 10 | us |
| Receiver | | | | | |
| Center Wavelength, EOLF-BI1303-80 | λ_c | 1480 | 1550 | 1600 | nm |
| Center Wavelength, EOLF-BI1503-80 | | 1260 | 1310 | 1360 | |
| Receiver Sensitivity ^{*(note6)} | Pmin | | -36 | -34 | dBm |
| Receiver Overload | Pmax | -10 | | | dBm |
| SD De-Assert | SDD | | | -35 | dBm |
| SD Assert | SDA | -45 | | | dBm |
| LOS Hysteresis ^{*(note8)} | | 0.5 | | | dB |

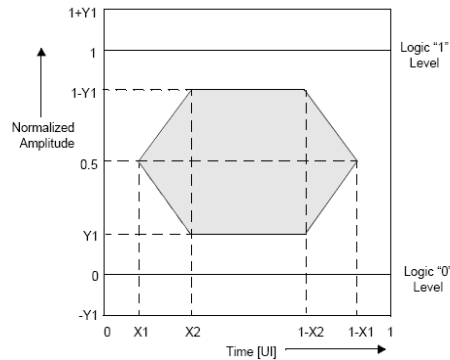
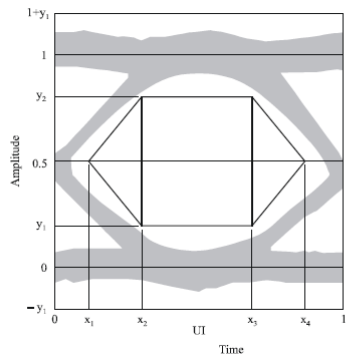
Note3: LVPECL logic, internally AC coupled.

Note4: Output power is measured by coupling into a 9/125 μm Single-mode fiber.

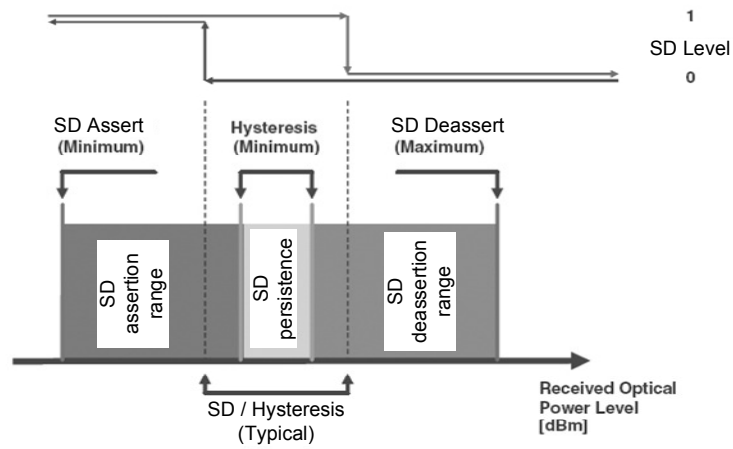
Note5: Filtered, measured with a PRBS $2^{23}-1$ test pattern @155Mbps.

Note6: Minimum average optical power measured at BER less than $1\text{E}-10$, with a $2^{23}-1$ PRBS and ER=9 dB.

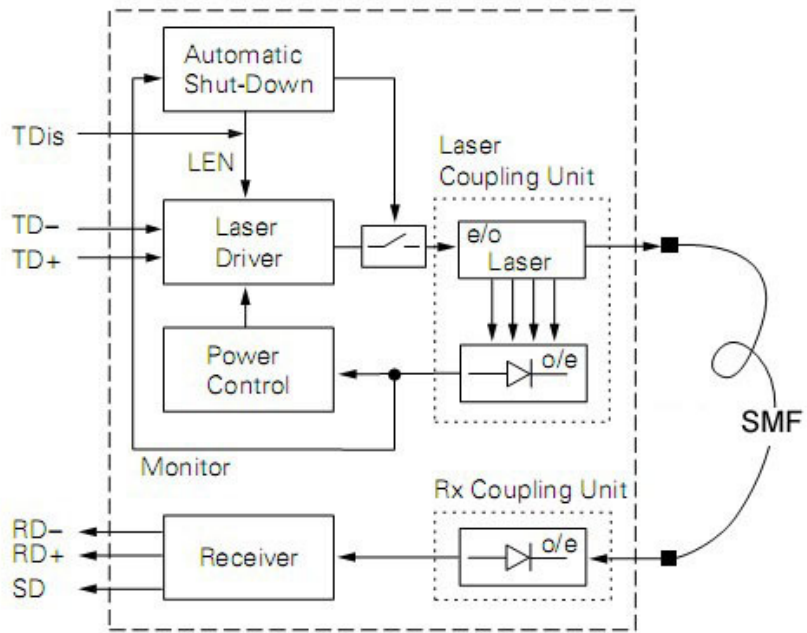
Note7: Eye Pattern Mask



Note8: SD Hysteresis



Functional Description of Transceiver



SFF Transceiver Electrical Pad Layout



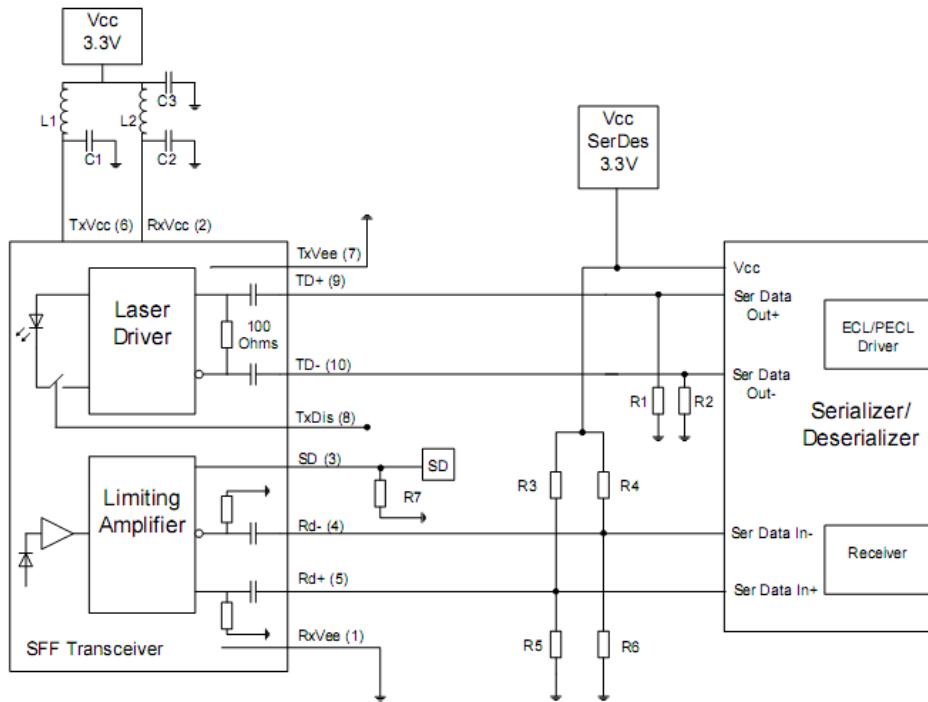
Case isolated from circuit ground.

Pin Function Definitions

| Pin No. | Name | Function |
|---------|-------|--|
| | MS | Mounting Studs, Case isolated from circuit ground |
| 1 | VeeR | Receiver Signal Ground |
| 2 | VccR | 3.3V DC power for receiver section |
| 3 | SD | Signal Detect Output (LVPECL) “1” - “Signal valid”, “0” – “Lose of signal” |
| 4 | RD- | Received Data Out Bar (LVPECL), without termination inside |
| 5 | RD+ | Received Data Out (LVPECL), without termination inside |
| 6 | VccT | 3.3V DC power for transmitter section |
| 7 | VeeT | Transmitter Signal Ground |
| 8 | TXDIS | Transmitter Disable (LVTTL), “1” – Disable, “0” – Enable |
| 9 | TD+ | Transmitter Data In (LVPECL), without termination inside |
| 10 | TD- | Transmitter Data In Bar (LVPECL), without termination inside |

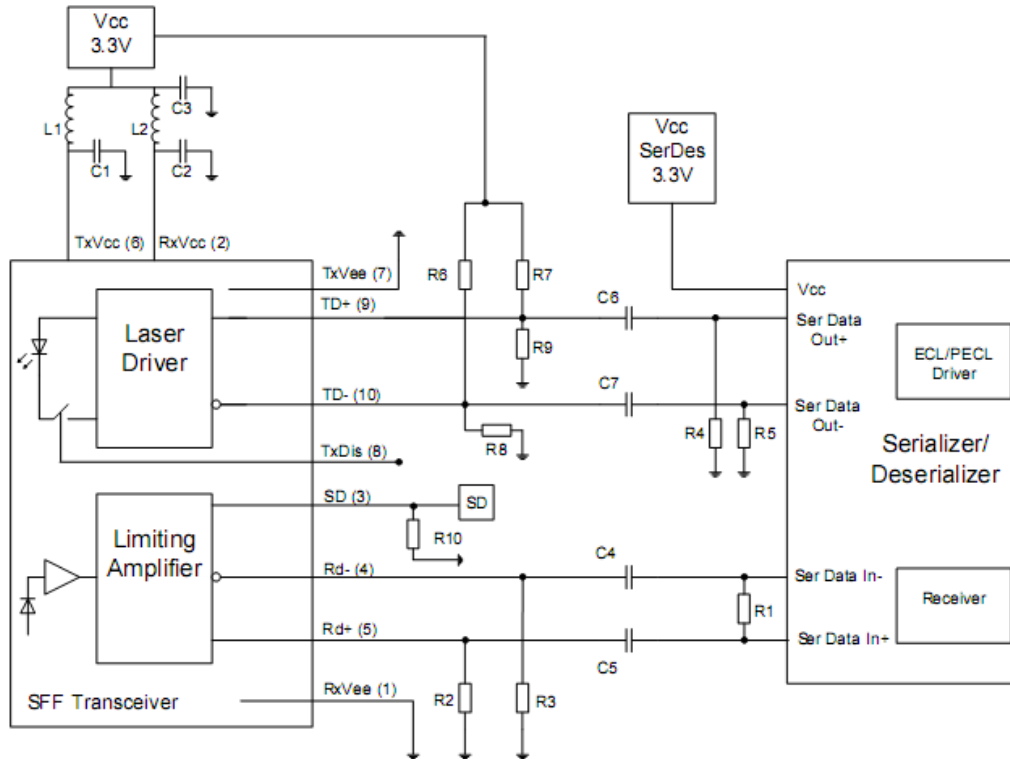
Recommend Circuit Schematic

AC/AC coupling



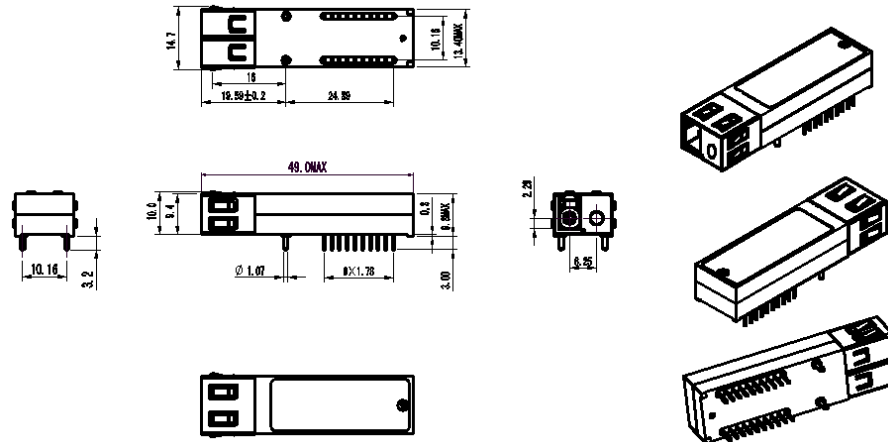
- L1, L2: 1...4.7 μ H
 - C1, C2, C3: 4.7...10 μ F
 - R1, R2: biasing of outputs depending on Serializer
 - R3, R4: 127 Ohms
 - R5, R6: 80 Ohms
 - R7: 510 Ohms for PECL signal detect, open for TTL
- Place R1/2/3/4/5/6 as close to SerDes chip as possible

DC/DC coupling

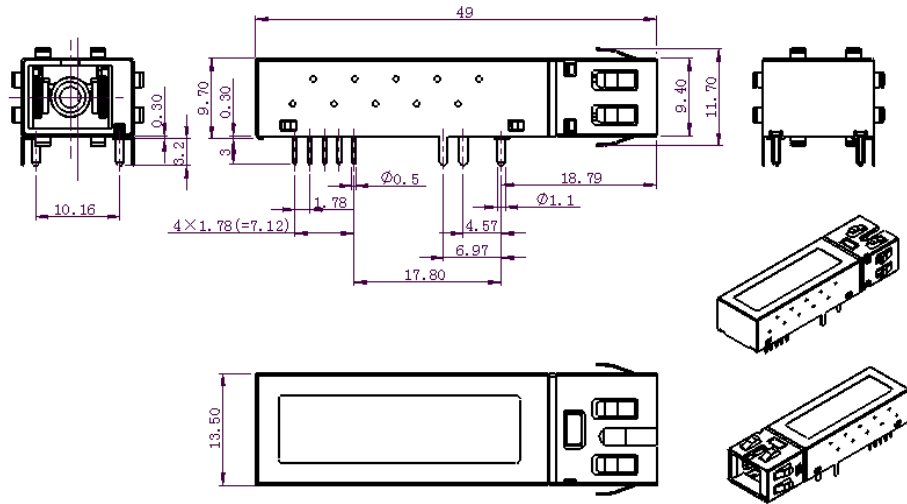


- L1, L2: 1...4.7 μ H
 - C1, C2, C3: 4.7...10 μ F
 - C4, C5, C6, C7: 100 nF
 - R1: 100 Ohms
 - R2, R3: 150 Ohms
 - R4, R5: biasing of outputs depending on Serializer
 - R6, R7: 127 Ohms
 - R8, R9: 80 Ohms
 - R10: 510 Ohms for PECL signal detect, open for TTL
- Place R1/4/5 as close to SerDes as possible
Place R2/3 as close to transceiver as possible

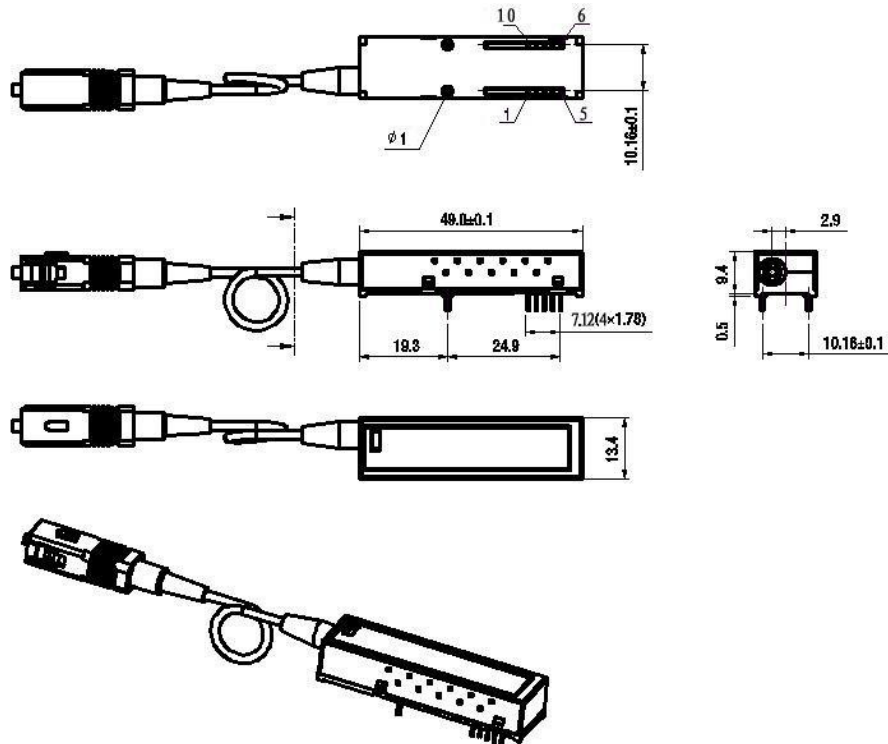
Mechanical Specifications*



LC



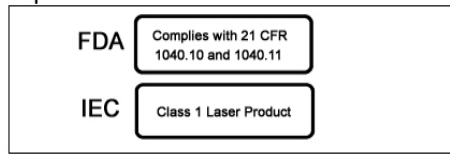
SC



Pigtail

*The pins on the three graphs are only for demonstrate, the dimension for pins is compliant to SFF MSA.

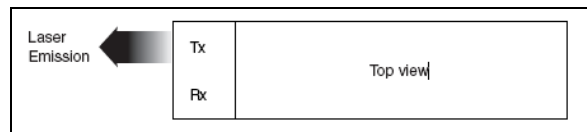
Class 1 Labels



Laser Emission Data

| | |
|---|----------|
| Wavelength | 1310nm |
| Total output power (as defined by FDA: 7mm aperture at 20cm distance) | <0.195mW |
| Total output power (as defined by IEC: 7mm aperture at 10cm distance) | <15.6mW |
| Beam divergence | 12.5° |
| Wavelength | 1550nm |
| Total output power (as defined by FDA: 7mm aperture at 20cm distance) | <0.79mW |
| Total output power (as defined by IEC: 7mm aperture at 10cm distance) | <10mW |
| Beam divergence | 12.5° |

Laser Emission



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Revision History

| Revision | Initiated | Reviewed | Approved | DCN | Release Date |
|----------|-----------|----------|----------|-----------|--------------|
| V3.a | Cathy | Kelly | | Released. | Mar 25, 2008 |

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