

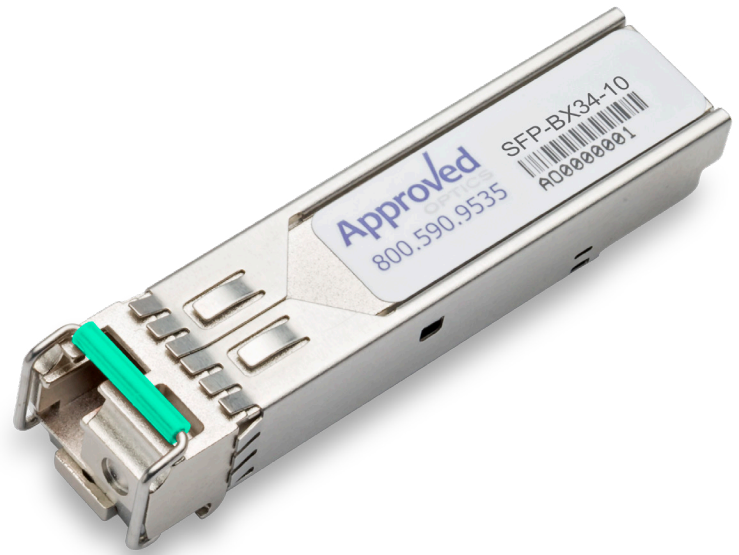
**SFP-GE10KT13R14-A**  
1GBASE, SFP, LX, BIDI Transceiver

## Features

- Up to 1.25Gb/s Data Links
- Hot-Pluggable
- Single LC connector
- Up to 10 km on 9/125µm SMF
- 1310nm FP laser transmitter
- 1490nm PIN photo-detector
- Single +3.3V Power Supply
- Monitoring Interface Compliant with SFF-8472
- Maximum Power <1W
- Commercial operating temperature range:  
-0°C to 70°C
- RoHS compliant and Lead Free

## 1. Description

Approved Networks SFP LX BIDI Transceivers are a high performance, cost effective module which have a single LC optics interface. They are compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA) and Digital diagnostics functions are available via the 2-wire serial bus specified in SFF-8472. The receiver section uses a PIN receiver and the transmitter uses a 1310 nm FP laser, up to 13dB link budget ensure this module 1000Base-LX Ethernet 10km application.



## Applications

- 1000Base-LX Ethernet
- Metro/Access Networks
- 1×Fibre Channel
- Other Optical Links

## 2. Absolute Maximum Ratings

Operation in excess of any absolute maximum ratings might cause permanent damage to this module.

| Parameter            | Symbol | Min  | Typ | Max | Units |
|----------------------|--------|------|-----|-----|-------|
| Storage Temperature  | TS     | -40  |     | +85 | °C    |
| Power Supply Voltage | VCC    | -0.5 |     | 4   | V     |
| Relative Humidity    | RH     | 0    |     | 85  | %     |

## 3. Recommended Operating Environment

| Parameter                               | Symbol             | Min   | Typ | Max                 | Unit |
|---|--------------------|-------|-----|---------------------|------|
| Case operating Temperature (Commercial) | TC                 | 0     |     | 70                  | °C   |
| Supply Voltage                          | VCC                | 3.135 |     | 3.465               | V    |
| Supply Current                          | Icc                |       |     | 300                 | mA   |
| Inrush Current                          | I <sub>surge</sub> |       |     | I <sub>cc</sub> +30 | mA   |
| Maximum Power                           | P <sub>max</sub>   |       |     | 1                   | W    |

## 4. Electrical Characteristics

(TOP = -40 to 85°C, VCC = 3.135 to 3.465 Volts)

| Transmitter Section:           |                       |                      |     |                      |                  |      |
|--------------------------------|-----------------------|----------------------|-----|----------------------|------------------|------|
| Parameter                      | Symbol                | Min                  | Typ | Max                  | Unit             | Note |
| Input differential impedance   | R <sub>in</sub>       | 90                   | 100 | 110                  |                  | 1    |
| Single ended data input swing  | V <sub>in PP</sub>    | 300                  |     | 800                  | mV <sub>pp</sub> |      |
| Transmit Disable Voltage       | VD                    | V <sub>cc</sub> -1.3 |     | V <sub>cc</sub>      | V                | 2    |
| Transmit Enable Voltage        | VEN                   | V <sub>ee</sub>      |     | V <sub>ee</sub> +0.8 | V                |      |
| Transmit Disable Assert Time   | T <sub>desert</sub>   |                      |     | 10                   | us               |      |
| Receiver Section:              |                       |                      |     |                      |                  |      |
| Parameter                      | Symbol                | Min                  | Typ | Max                  | Unit             | Note |
| Single ended data output swing | V <sub>out,pp</sub>   | 300                  |     | 800                  | mv               | 3    |
| LOS Fault                      | V <sub>losfault</sub> | V <sub>cc</sub> -0.5 |     | V <sub>CC_host</sub> | V                | 5    |
| LOS Normal                     | V <sub>los-norm</sub> | V <sub>ee</sub>      |     | V <sub>ee</sub> +0.5 | V                | 5    |
| Power Supply Rejection         | PSR                   | 100                  |     |                      | mV <sub>pp</sub> | 6    |

### Notes:

1. AC coupled.
2. Or open circuit.

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TX 1310 NM / RX 1490 NM, 10 KM REACH, LC

3. Into 100 ohm differential termination.
4. 20 – 80 %
5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

## 5. Optical Parameters

(TOP = -40 to 85°C, VCC = 3.135 to 3.465 Volts)

| Transmitter Section:                                     |   |      |      |                   |       |       |
|--|---|------|------|-------------------|-------|-------|
| Parameter  | Symbol  | Min  | Typ  | Max               | Unit  | Notes |
| Center Wavelength  | $\lambda_c$                                       | 1270 | 1330 | 1600              | nm    |       |
| Spectral Width   | $\sigma$  |      |      | 4                 | nm    |       |
| Optical Output Power                                     | Pout  | -8   |      | -4                | dBm   | 1     |
| Extinction Ratio   | ER  | 9    |      |                   | dB    |       |
| Optical Rise/Fall Time                                   | tr / tf   |      |      | 260               | ps    | 2     |
| Relative Intensity Noise                                 | RIN   |      |      | -120              | dB/Hz |       |
| Total Jitter Contribution                                | TX $\Delta$ TJ                                    |      |      | 0.284             | UI    | 3     |
| Output Eye Mask  | Compliant with IEEE802.3 z (class 1 laser safety) |      |      |                   |       |       |
| Receiver Section:  |   |      |      |                   |       |       |
| Parameter  | Symbol  | Min  | Typ  | Max               | Unit  | Notes |
| Optical Input Wavelength                                 | $\lambda_c$                                       | 1470 | 1490 | 1510              | nm    |       |
| Receiver Overload  | Pol   | -3   |      |                   | dBm   | 4     |
| RX Sensitivity   | Sen   |      |      | -21               | dBm   | 4     |
| RX_LOS Assert  | LOS A   | -40  |      |                   | dBm   |       |
| RX_LOS De-assert   | LOS D   |      |      | -25               | dBm   |       |
| RX_LOS Hysteresis  | LOS H   | 0.5  |      |                   | dB    |       |
| General Specifications:                                  |   |      |      |                   |       |       |
| Parameter  | Symbol  | Min  | Typ  | Max               | Unit  | Notes |
| Data Rate  | BR  |      | 1.25 |                   | Gb/s  |       |
| Bit Error Rate   | BER   |      |      | 10 <sup>-12</sup> |       |       |
| Max. Supported Link Length on 9/125 $\mu$ m SMF@1.25Gb/s | LMAX  |      | 20   |                   | km    |       |
| Total System Budget                                      | LB  | 14   |      |                   | dB    |       |

**Notes:**

1. The optical power is launched into SMF.
2. 20-80%.
3. Contributed total jitter is calculated from DJ and RJ measurements using  $TJ = RJ + DJ$ . Contributed RJ is calculated for  $1 \times 10^{-12}$  BER by multiplying the RMS jitter (measured on a single rise or fall edge) from the oscilloscope by 14. Per FC-PI (Table 9 - SM jitter output, note 1), the actual contributed RJ is allowed to increase above its limit if the actual contributed DJ decreases below its limits, as long as the component output DJ and TJ remain within their specified FC-PI maximum limits with the worst case specified component jitter input.
4. Measured with PRBS  $2^{7-1}$  at  $10^{-12}$  BER

**6. Pin Assignment and Description**

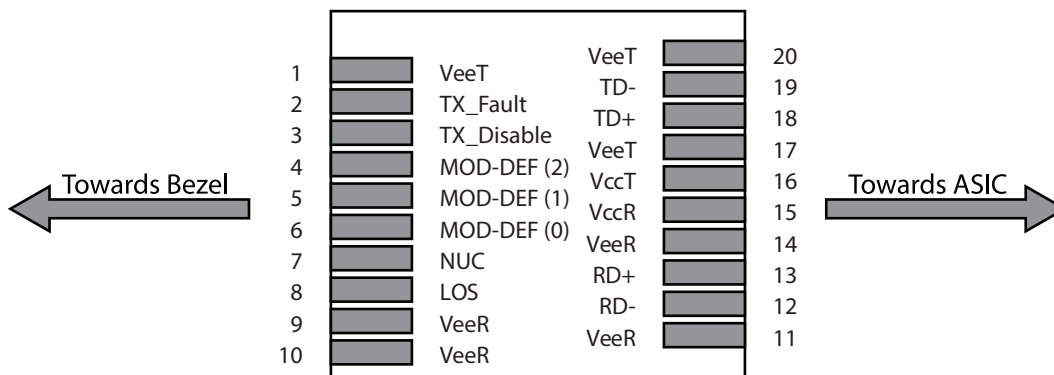


Figure 1. Host Board Connector Block Pin Numbers and Names

**7. Pin Function Definitions**

| Pin No | Name        | Function                     | Plug Seq | Notes |
|--------|-------------|------------------------------|----------|-------|
| 1      | VeeT        | Transmitter Ground           | 1        | 1     |
| 2      | TX Fault    | Transmitter Fault Indication | 3        |       |
| 3      | TX Disable  | Transmitter Disable          | 3        | 2     |
| 4      | MOD-DEF2    | Module Definition            | 2        | 3     |
| 5      | MOD-DEF1    | Module Definition 1          | 3        | 3     |
| 6      | MOD-DEF0    | Module Definition 0          | 3        | 3     |
| 7      | Rate Select | Not Connected                | 3        | 4     |
| 8      | LOS         | Loss of Signal               | 3        | 5     |
| 9      | VeeR        | Receiver Ground              | 1        | 1     |
| 10     | VeeR        | Receiver Ground              | 1        | 1     |
| 11     | VeeR        | Receiver Ground              | 1        | 1     |

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TX 1310 NM / RX 1490 NM, 10 KM REACH, LC

| Pin No | Name | Function               | Plug Seq | Notes |
|--------|------|------------------------|----------|-------|
| 12     | RD-  | Inv. Received Data Out | 3        | 6     |
| 13     | RD+  | Received Data Out      | 3        | 6     |
| 14     | VeeR | Receiver Ground        | 3        | 1     |
| 15     | VccR | Receiver Power         | 2        | 1     |
| 16     | VccT | Transmitter Power      | 2        |       |
| 17     | VeeT | Transmitter Ground     | 1        |       |
| 18     | TD+  | Transmit Data In       | 3        | 6     |
| 19     | TD-  | Inv. Transmit In       | 3        | 6     |
| 20     | VeeT | Transmitter Ground     | 1        |       |

## Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms 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. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled

## 8. SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I2C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in the following table, and the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, "Digital Diagnostic Monitoring Interface for Optical Transceivers". The DDM parameters have been internally calibrated.

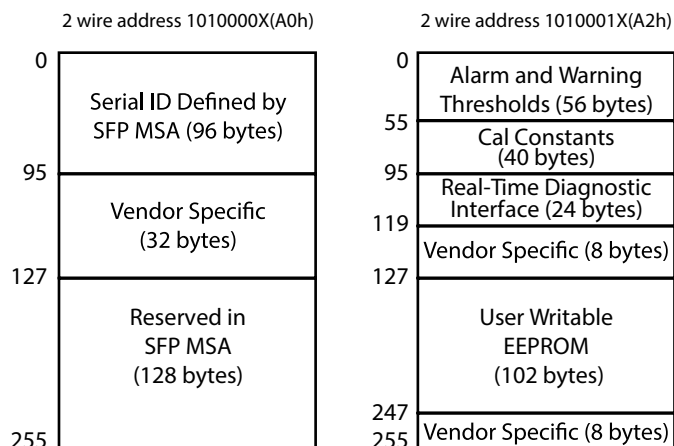


Figure 2. Diagnostic Memory Map (Specific Data Field Descriptions)

| Base ID Fields |               |                       |  |
|----------------|---------------|-----------------------|--|
| Data Address   | Length (Byte) | Name of Length        | Description and Contents                                 |
| 0              | 1             | Identifier            | Type of Serial transceiver (03h=SFP)                     |
| 1              | 1             | Reserved              | Extended identifier of type serial transceiver (04h)     |
| 2              | 1             | Connector             | Code of optical connector type (07=LC)                   |
| 3-10           | 8             | Transceiver           |  |
| 11             | 1             | Encoding              | NRZ(03h)   |
| 12             | 1             | BR, Nominal           | Nominal baud rate, unit of 100Mbps                       |
| 13-14          | 2             | Reserved              | (0000h)  |
| 15             | 1             | Length(9um)           | Link length supported for 9/125um fiber, units of 100m   |
| 16             | 1             | Length(50um)          | Link length supported for 50/125um fiber, units of 10m   |
| 17             | 1             | Length(62.5um)        | Link length supported for 62.5/125um fiber, units of 10m |
| 18             | 1             | Length(Copper)        | Link length supported for copper, units of meters        |
| 19             | 1             | Reserved              |  |
| 20-35          | 16            | Vendor Name           | SFP vendor name  |
| 36             | 1             | Reserved              |  |
| 37-39          | 3             | Vendor OUI            | SFP transceiver vendor OUI ID                            |
| 40-55          | 16            | Vendor PN Part Number | Part Number (ASCII)                                      |
| 56-59          | 4             | Vendor rev            | Revision level for part number                           |
| 60-62          | 3             | Reserved              |  |

| Base ID Fields            |               |                |   |
|---------------------------|---------------|----------------|---|
| Data Address              | Length (Byte) | Name of Length | Description and Contents  |
| 63                        | 1             | CCID           | Least significant byte of sum of data in address 0-62   |
| Extended ID Fields        |               |                |   |
| Data Address              | Length (Byte) | Name of Length | Description and Contents  |
| 64-65                     | 2             | Option         | Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported) |
| 66                        | 1             | BR, max        | Upper bit rate margin, units of %   |
| 67                        | 1             | BR, min        | Lower bit rate margin, units of %   |
| 68-83                     | 16            | Vendor SN      | Serial number (ASCII)   |
| 84-91                     | 8             | Date code      | Vendor Manufacturing date code  |
| 92-94                     | 3             | Reserved       |   |
| 95                        | 1             | CCEX           | Check code for the extended ID Fields (addresses 64 to 94)  |
| Vendor Specific ID Fields |               |                |   |
| Data Address              | Length (Byte) | Name of Length | Description and Contents  |
| 96-127                    | 32            | Readable       | Vendor specific data, read only   |
| 128-255                   | 128           | Reserved       | Reserved for SFF-8079   |

## 9. Digital Diagnostic Monitor Characteristics

| Data Address | Parameter                        | Accuracy | Unit |
|--------------|----------------------------------|----------|------|
| 96-97        | Transceiver Internal Temperature | ±3.0     | °C   |
| 98-99        | VCC3 Internal Supply Voltage     | ±3.0     | %    |
| 100-101      | Laser Bias Current               | ±10      | %    |
| 102-103      | Tx Output Power                  | ±3.0     | dBm  |
| 104-105      | Rx Input Power                   | ±3.0     | dBm  |

### 10. Regulatory Compliance

This transceiver complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

|   |   |  |
|---|---|--|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E Method 3015.7                                  | Class 1(>1000 V)                       |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2 GR-1089-CORE                                  | Compatible with standards              |
| Electromagnetic Interference (EMI)                        | FCC Part 15 Class BEN55022 Class B (CISPR 22B) VCCI Class B | Compatible with standards              |
| Laser Eye Safety  | FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2   | Compatible with Class 1 laser product. |

### 11. Recommended Circuit

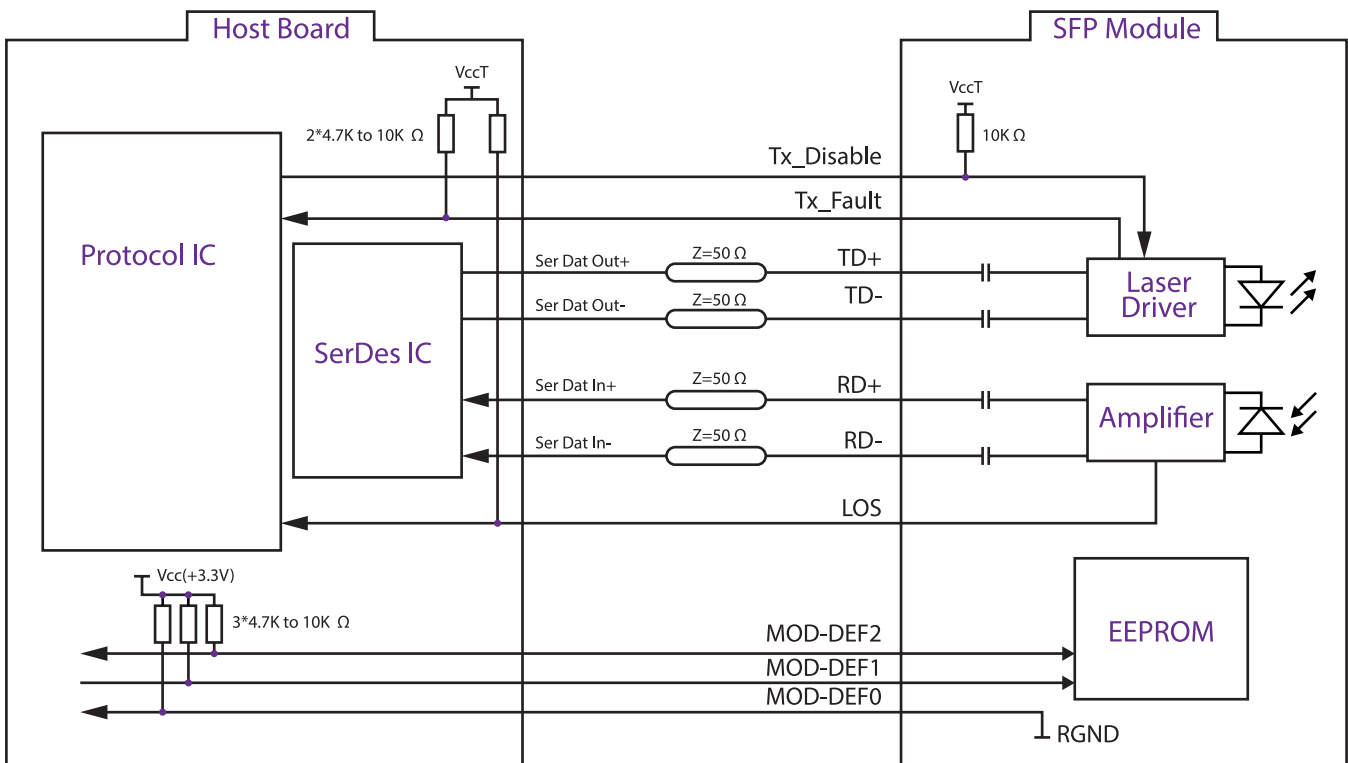


Figure 3. SFP Host Recommended Circuit



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## 12. Mechanical Dimensions

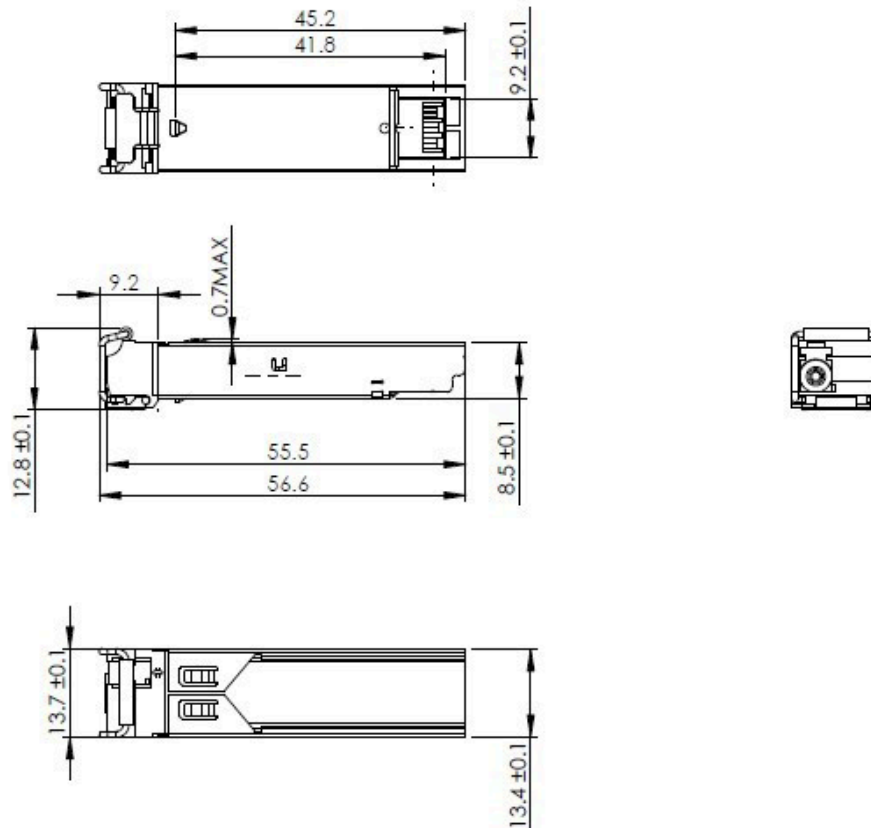


Figure 4. Mechanical Drawing

## 13. Contact Information

Approved Networks is a leading supplier of Network Transceivers and Connectivity products to Channel Partners, Resellers, and OEMs. With more than 9 years of direct industry experience, our products are resident in the most demanding and mission critical functional networks Worldwide. We serve as a Master Distributor to the largest CMs in the world and deploy the most rigorous testing and firmware management programs to bring the highest level of functional product to the market at a cost that makes sense.

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