# SFP+ 10G BIDI ER 60KM Transceiver




## Product Features

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-ER
- Electrical interface compliant to SFF-8431 specifications for enhanced 8.5 and 10 Gigabit small form factor pluggable module "SFP+"
- 1270/1330nm DFB transmitter, APD photo-detector
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface for optical transceivers
- ll-metal housing for superior EMI performance
- Low power consumption
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS compliant
- Operating case temperature range: Commercial: 0 to 70℃; Industrial: -40 to 85℃

## Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes

# Description

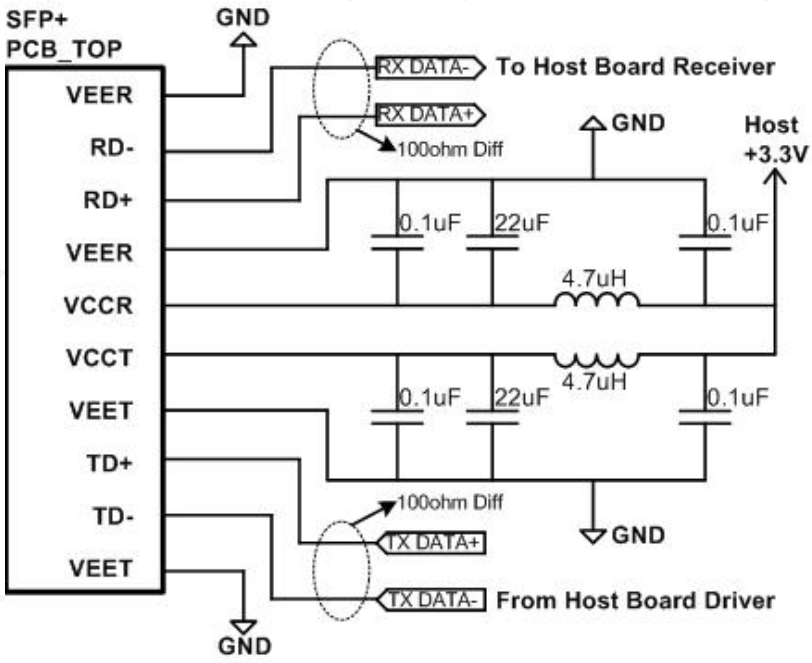
This 1270/1330nm DFB 10Gigabit SFP+ transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 60km.

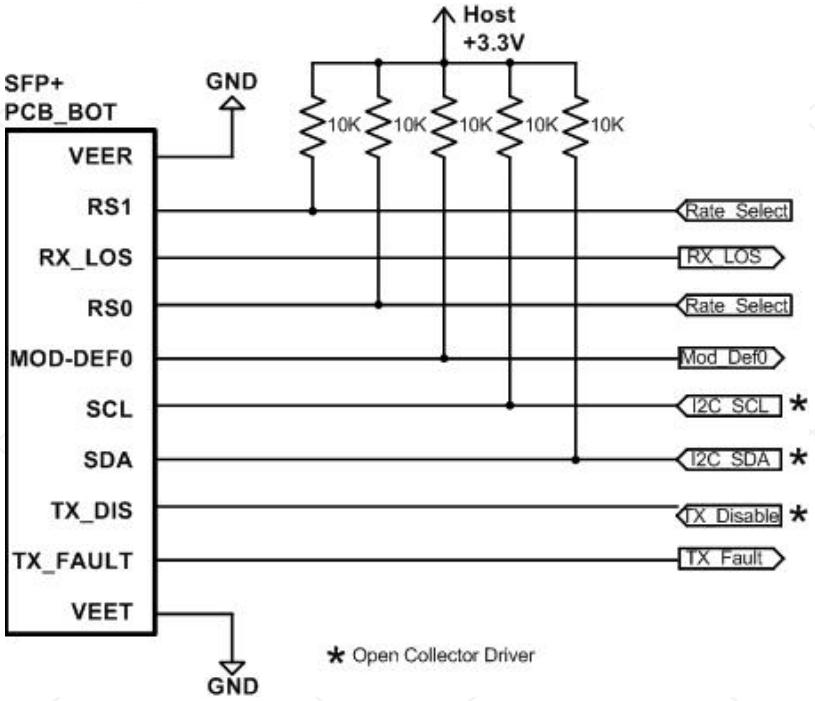
The SFP+ module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality 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 CML electrical data into serial optical data compliant with the 10GBASE-ER 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

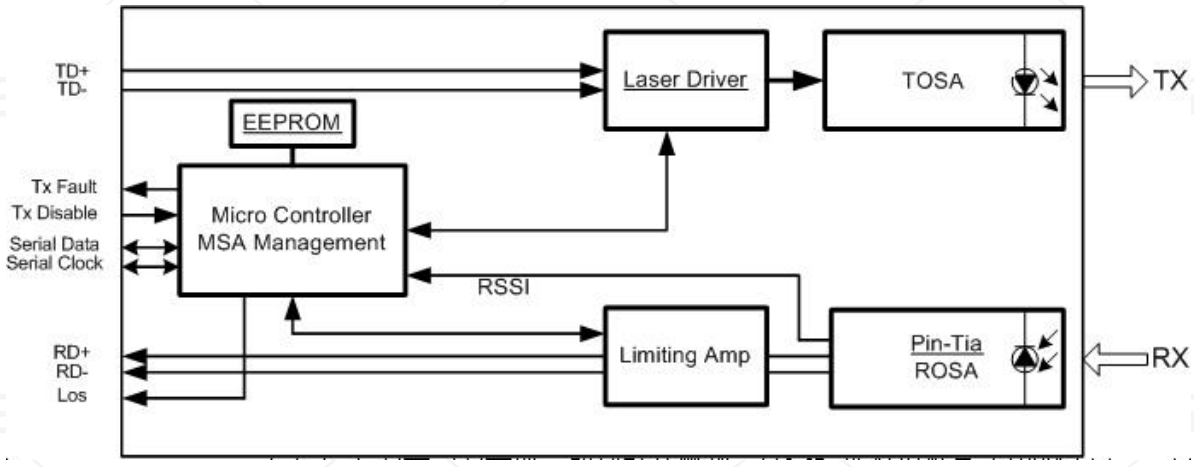
The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and 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.

## (1) PROPOSED APPLICATION SCHEMATICS






## (2) TRANSCEIVER BLOCK DIAGRAM



# Product specifications

## (1) Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| Power Supply Voltage | Vcc | 0 | 3.6 | V |
| Storage Temperature | Tc | -40 | 85 | °C |
| Operating Case Temperature | Tc | 0 | 70 | °C |
| | | -40 | 85 | |
| Relative Humidity | RH | 5 | 95 | % |
| RX Input Average Power | Pmax | | 0 | dBm |

Note:

1、Exceeding any of these values may immediately damage the device.

## (2) Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Power Supply Voltage | Vcc | 3.135 | 3.3 | 3.465 | V |
| Power Supply Current | Icc | | | 350 | mA |
| Operating Case Temperature | Tc | 0 | 25 | 70 | °C |
| | | -40 | 25 | 85 | |

Note:

1、Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

## (3) Optical Characteristics

| Parameters | Unit | Values |
|---|---|---|
| Operating Reach | m | 60K |
| **Transmitter** | | |
| Center wavelength (range) | nm | 1270/1330 |
| Side Mode Suppression Ratio (min) | dB | 30 |
| Launched power | | |
| – maximum (Average) | dBm | 6 |
| – minimum (Average) | dBm | 2 |
| Transmitter and dispersion penalty (max) | dB | 3.2 |
| Average launch power of OFF transmitter (max) | dBm | -30 |
| Extinction ratio (min) | dB | 3.5 |
| RIN12 OMA (max) | dB/Hz | -128 |

| | | |
|---|---|---|
| Optical Return Loss Tolerance (min) | dB | 12 |
| **Receiver** | | |
| Center wavelength (range) | nm | 1270/1330 |
| Receive overload (max) in average power(note 1) | dBm | -8 |
| Receive sensitivity (min) in average power(note 1) | dBm | -20 |
| Receiver Reflectance (max) | dB | -12 |
| Vertical eye closure penalty (min)(note 3) | dB | 2.2 |
| Los Dessert(max) | dBm | -27 |
| Los Hysteresis(min) | dB | 0.5 |
| Stressed eye jitter (min)(note 2) | UIp-p | 0.3 |
| Receive electrical 3dB upper cutoff frequency (max) | GHz | 12.3 |
| Receiver power (damage, Max) | dBm | 6 |

Note:

1、Average optical power shall be measured using the methods specified in TIA/EIA-455-95.

2、Power budget is defined as the different between the Rx sensitivity and the Tx output power of the interface.

3、Path penalty is intended as the power penalty of the interface between back-to-back and the maximum applied dispersion.

## (4) DITITAL DIAGNOSTIC FUNCTIONS

| Parameter | Symbol | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| Temperature monitor absolute error | DMI_Temp | -3 | 3 | ℃ | Over operating temp |
| Laser power monitor absolute error | DMI_TX | -3 | 3 | dB | |
| RX power monitor absolute error | DMI_RX | -3 | 3 | dB | -1dBm to -15dBm range |
| Supply voltage monitor absolute error | DMI_VCC | -0.08 | 0.08 | V | Full operating range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |

Note:

1、The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales stuff.

## (5) Electrical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Data Rate | / | | 10.3125 | | Gbps | |
| Power Consumption | / | | 800 | 1000 | mW | |
| **Transmitter** | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | | 4 | V | |
| C common mode voltage tolerance | | 15 | | | mV | |
| Tx Input Diff Voltage | VI | 180 | | 700 | mV | |
| Tx Fault | VoL | -0.3 | | 0.4 | V | At 0.7mA |
| Data Dependent Input Jitter | DDJ | | | 0.1 | UI | |
| Data Input Total Jitter | TJ | | | 0.28 | UI | |
| **Receiver** | | | | | | |
| Single Ended Output Voltage Tolerance | | -0.3 | | 4 | V | |
| Rx Output Diff Voltage | Vo | 300 | | 850 | mV | |
| Rx Output Rise and Fall Time | Tr/Tf | 30 | | | ps | 20% to 80% |
| Total Jitter | TJ | | | 0.7 | UI | |
| Deterministic Jitter | DJ | | | 0.42 | UI | |

Note:

1.The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

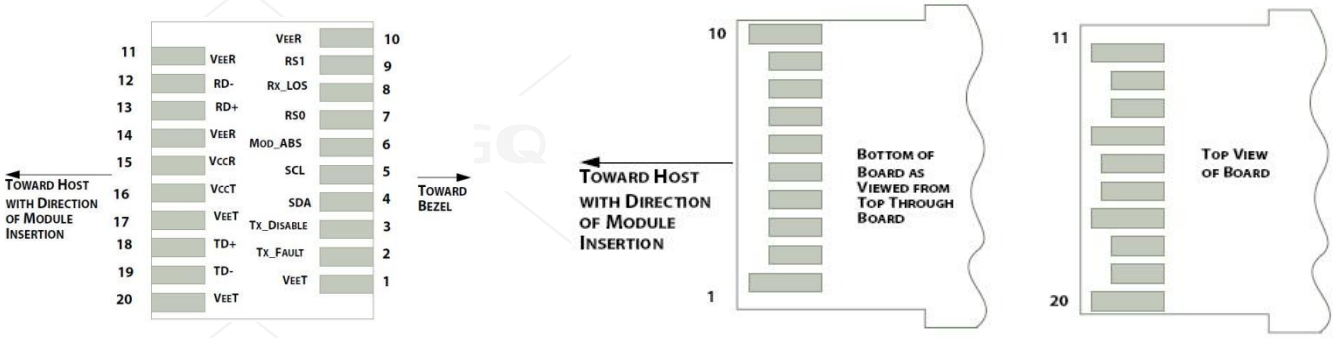
## (6) CONTROL AND STATUS I/O TIMING CHARACTERISTICS

| Parameter | Symbol | Min | Max | Unit | Condition |
|---|---|---|---|---|---|
| TX Disable Assert Time | t_off | | 10 | μs | Time from rising edge of TX Disable to when the optical output falls below 10% of nominal |
| TX Disable Negate Time | t_on | | 1 | ms | Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal |
| Time to initialize,including reset of TX_Fault | t_init | | 300 | ms | From power on or negation of TX Fault using TX Disable |
| TX Fault Assert Time | t_fault | | 100 | μs | Time from fault to TX fault on |
| TX Disable to reset | t_reset | 10 | | μs | Time TX Disable must be held high to reset TX fault |
| LOS Assert Time | t_loss_on | | 100 | μs | Time from LoS state to RX LOS assert |
| LOS Deassert Time | t_loss_off | | 100 | μs | Time from non-LOS state to RX LOS deassert |
| Rate-Select Change Time | t_ratesel | | 10 | μs | Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification |
| Serial ID Clock Rate | t_serial_clock | | 100 | kHz | |

Note:

1、 Timing characteristics of control and status I/O are included in Table 8, which is also defined in SFF-8431.

## (7) Pin Assignment and Description




| PIN Definition | | | | |
|---|---|---|---|---|
| **PIN** | **Logic** | **Symbol** | **Description** | **Notes** |
| 1 | | VeeT | Module Transmitter Ground | 1 |
| 2 | LVTTL-O | TX_Fault | Module Transmitter Fault | |
| 3 | LVTTL-I | TX_Dis | Transmitter Disable; Turns off transmitter laser output | |
| 4 | LVTTL-I/O | SDA | 2-Wire Serial Interface Data Line | 2 |
| 5 | LVTTL-I | SCL | 2-Wire Serial Interface Clock | 2 |
| 6 | | MOD_DEF0 | Module Definition, Grounded in the module | |
| 7 | LVTTL-I | RS0 | Receiver Rate Select | |
| 8 | LVTTL-O | RX_LOS | Receiver Loss of Signal Indication Active LOW | |
| 9 | LVTTL-I | RS1 | Transmitter Rate Select (not used) | |
| 10 | | VeeR | Module Receiver Ground | 1 |
| 11 | | VeeR | Module Receiver Ground | 1 |
| 12 | CML-O | RD- | Receiver Inverted Data Output | |
| 13 | CML-O | RD+ | Receiver Data Output (not used) | |
| 14 | | VeeR | Module Receiver Ground | 1 |
| 15 | | VccR | Module Receiver 3.3 V Supply | |
| 16 | | VccT | Module Receiver 3.3 V Supply | |
| 17 | | VeeT | Module Transmitter Ground | 1 |
| 18 | CML-I | TD+ | Transmitter Non-Inverted Data Input | |
| 19 | CML-I | TD- | Transmitter Inverted Data Input | |
| 20 | | VeeT | Module Transmitter Ground | 1 |

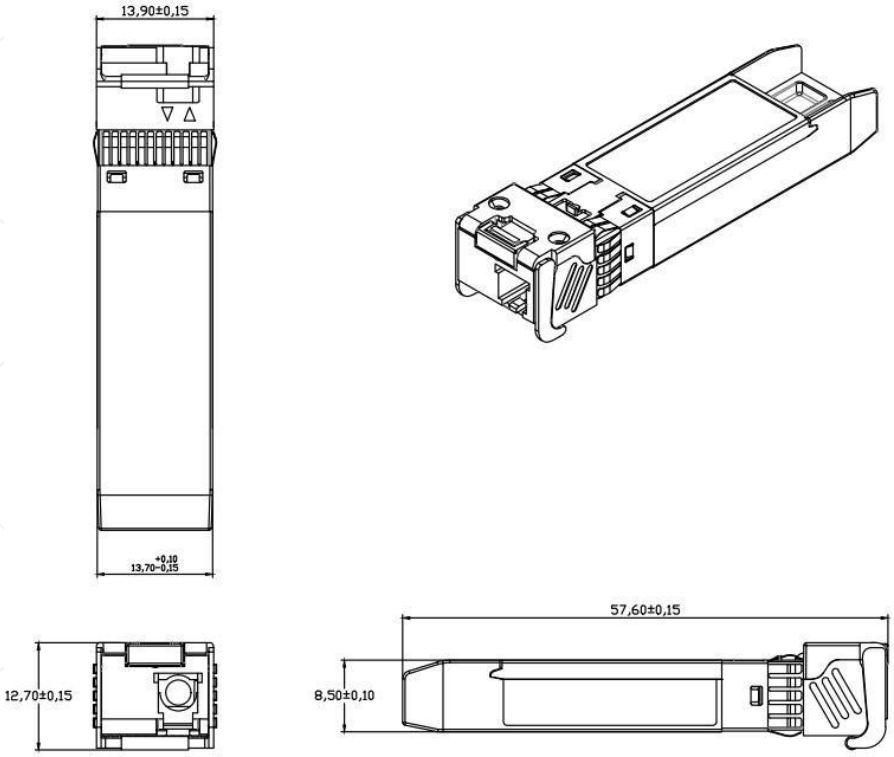
Note:

1、Module ground pins GND are isolated from the module case.

2、Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

## (8) Mechanical Specifications

- **LC Interface**




## (9) ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## (10) LASER SAFTY

This is a Class 1 Laser Product according to IEC 60825-1:1993:+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001).

## Ordering Information

| Model | Specification Description | | | | | | |
|---|---|---|---|---|---|---|---|
| SFP+-10G-20LR-27AS<br>SFP+-10G-20LR-33BS | SFP+ | BIDI/SM | 10.3125G | T1270-R1330nm | 20km | SC | 0 ~ 70℃ |
| SFP+-10G-20LR-27A<br>SFP+-10G-20LR-33B | | | | T1270-R1330nm | 20km | LC | |
| SFP+-10G-40ER-27A<br>SFP+-10G-40ER-33B | | | | T1270-R1330nm | 40km | LC | |
| SFP+-10G-60ER-27A<br>SFP+-10G-60ER-33B | | | | T1270-R1330nm | 60km | LC | |
| SFP+-10G-80ZR-49A<br>SFP+-10G-80ZR-55B | | | | Tx1490-Rx1550nm | 80km | LC | |
| SFP+-10G-100ZR-49A<br>SFP+-10G-100ZR-55B | | | | Tx1490-Rx1550nm | 100km | LC | |

## Contact Information

**Shenzhen HS Fiber Communication Equipment Co.,Ltd**

Tel: 0755-8175 5526

Fax: 0755-8958 2791

E-mail: hsgq@hsgq.com

Website: www.hsgq.com

Address: 5th Floor, Building 2, Zone B, Hongfa Science and Technology Industrial Park, Tangtou Community, Shiyan Street, Baoan District, Shenzhen

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