


## SFP-10G-LR

### 10Gbps SFP+ SMF Optical Transceiver, 1310nm, 10km

#### Features

- ◆ Supports from 1.25 Gb/ to 11.3 Gbps bit rates
- ◆ Electrical interface compliant to SFF-8431
- ◆ Hot Pluggable SFP+ footprint
- ◆ 1310nm DFB transmitter, PIN photo-detector
- ◆ Industrial case operating case temperature: -40 to 85 °C
- ◆ Low power consumption (1.1W typical)
- ◆ Applicable for 10km SMF connection
- ◆ All-metal housing for superior EMI performance
- ◆ Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- ◆ Built-in digital diagnostic functions
- ◆ RoHS6 compliant (lead free) 



#### Applications

- ◆ 10GBASE-LR at 10.3125Gbps
- ◆ Other optical transmission systems

#### Product description

This 1310 nm DFB 10Gbps SFP+ transceiver is a “limiting module”, designed for 10GBASE-LR applications.

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. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

### Absolute maximum rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters                 | Symbol          | Min. | Max. | Unit |
|----------------------------|-----------------|------|------|------|
| Power Supply Voltage       | V <sub>cc</sub> | 0    | +3.6 | V    |
| Storage Temperature        | T <sub>c</sub>  | -40  | +85  | °C   |
| Operating Case Temperature | T <sub>c</sub>  | -40  | +85  | °C   |
| Relative Humidity          | RH              | 5    | 95   | %    |

### Recommended operating environment

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

| Parameter                  | Symbol          | Min.  | Typical | Max   | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Power Supply Voltage       | V <sub>cc</sub> | 3.135 | 3.300   | 3.465 | V    |
|                            | I <sub>cc</sub> |       |         | 500   | mA   |
| Operating Case Temperature | T <sub>c</sub>  | -40   |         | +85   | °C   |
| Power Dissipation          | PD              |       | 1.1     | 1.5   | W    |
| Data Rate                  |                 |       |         | 11    | Gbps |
| Transmission Distance      |                 |       |         | 10    | km   |

### Low Speed Characteristics

| Parameter       | Symbol | Min.         | Typical | Max          | Unit |
|-----------------|--------|--------------|---------|--------------|------|
| TX_Fault,RX_LOS | VOL    | 0            |         | 0.4          | V    |
|                 | VOH    | Host_Vcc-0.5 |         | Host_Vcc+0.3 | V    |
| TX_DIS          | VIL    | -0.3         |         | 0.8          | V    |
|                 | VIH    | 2.0          |         | VCCT+0.3     | V    |
| RS0,RS1         | VIL    | -0.3         |         | 0.8          | V    |
|                 | VIH    | 2.0          |         | VCCT+0.3     | V    |

## Optical characteristics

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

|   | Unit  | Values     |
|---|-------|------------|
| Operating Reach   | km    | 10         |
| <b>Transmitter</b>  |       |            |
| Center wavelength (range)   | nm    | 1260 -1355 |
| Side Mode Suppression Ratio (min)   | dB    | 40         |
| Launched power  |       |            |
| – maximum   | dBm   | 0          |
| – minimum   | dBm   | -6 Note1   |
| Transmitter and dispersion penalty  | dB    | 3.2 Note4  |
| Average launch power of OFF transmitter (max)   | dBm   | -30        |
| Extinction ratio (min)  | dB    | 4 Note2    |
| RIN12 OMA (max)   | dB/Hz | -128       |
| Optical Return Loss Tolerance (min)   | dB    | 12         |
| <b>Receiver</b>   |       |            |
| Center wavelength (range)   | nm    | 1260 -1355 |
| Receive overload (max) in average power <sup>1</sup>                                      | dBm   | -1         |
| Receive sensitivity (min) in average power <sup>1</sup>                                   | dBm   | -17 Notes3 |
| Receiver sensitivity (max) in OMA (footnote 2)  | dBm   | -15 Notes3 |
| Receiver Reflectance (max)  | dB    | -12        |
| Stressed receiver sensitivity (max) in OMA <sup>2</sup>                                   | dBm   | -10.3      |
| Vertical eye closure penalty (min) <sup>3</sup>   | dB    | 2.2        |
| Receiver power (damage, Max)  | dBm   | 0          |
| <b>Notes:</b>   |       |            |
| 1. The optical power is launched into SMF   |       |            |
| 2. Measured with a PRBS 2 <sup>31</sup> -1 test pattern@10.3125Gbps                       |       |            |
| 3. Measured with a PRBS 2 <sup>31</sup> -1 test pattern@10.3125Gbps BER≤10 <sup>-12</sup> |       |            |
| 4. In G.652 and G.655(NDSF)   |       |            |

### Electrical characteristics

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

| Parameter                             | Symbol | Min.  | Typical | Max  | Unit | Notes      |
|---------------------------------------|--------|-------|---------|------|------|------------|
| Data Rate                             |        | 1.250 | 10.3125 | 11.3 | Gbps |            |
| Power Consumption                     |        | -     | 1.1     | 1.5  | W    |            |
| <b>Transmitter</b>                    |        |       |         |      |      |            |
| Single Ended Output Voltage Tolerance |        | -0.3  | -       | 4.0  | V    |            |
| C common mode voltage tolerance       |        | 15    | -       | -    | mV   |            |
| Tx Input Diff Voltage                 | VI     | 400   |         | 1600 | mV   |            |
| Tx Fault                              | VoL    | -0.3  |         | 0.4  | V    | At 0.7mA   |
| Data Dependent Input Jitter           | DDJ    |       |         | 0.10 | UI   |            |
| Data Input Total Jitter               | TJ     |       |         | 0.28 | UI   |            |
| <b>Receiver</b>                       |        |       |         |      |      |            |
| Single Ended Output Voltage Tolerance |        | -0.3  | -       | 4.0  | 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     |       |         | 0.70 | UI   |            |
| Deterministic Jitter                  | DJ     |       |         | 0.42 | UI   |            |

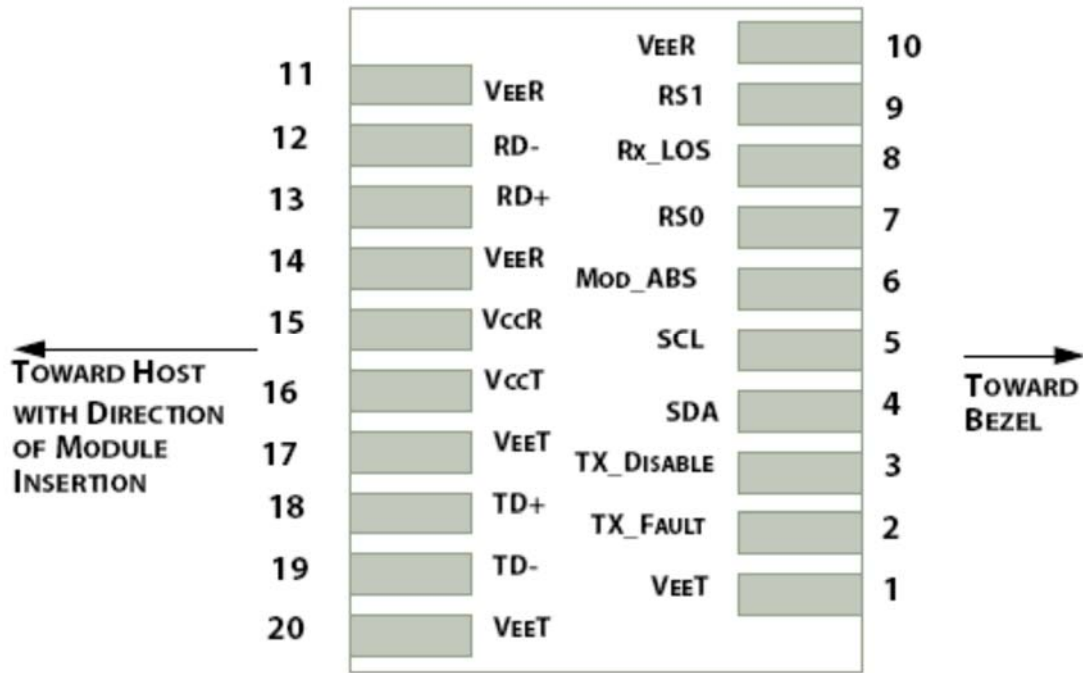


Figure 1: Interface to Host PCB

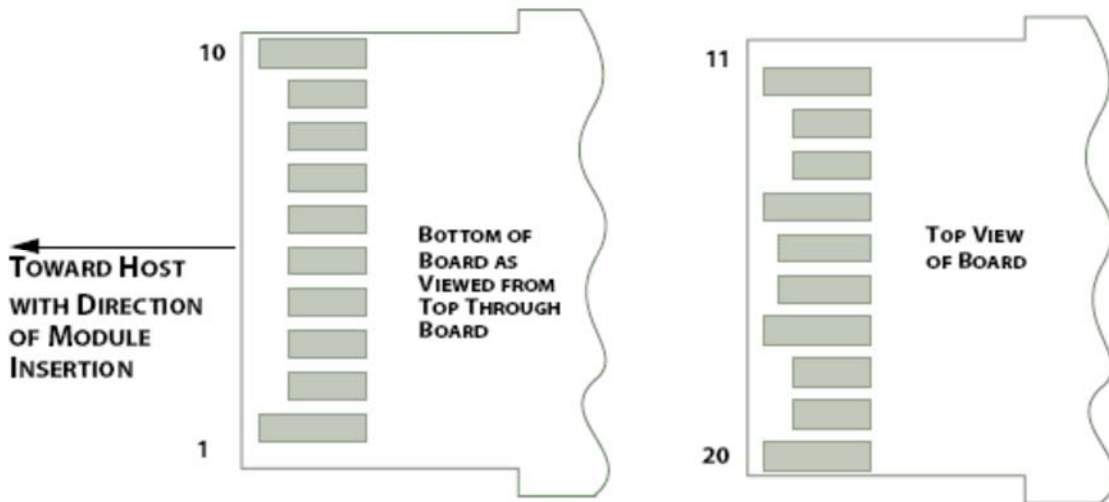


Figure 2: Module Contact Assignment

**Pin definition**

| Pin | Symbol       | Name/Description  |
|-----|--------------|---|
| 1   | VEET [1]     | Transmitter Ground  |
| 2   | Tx_FAULT [2] | Transmitter Fault   |
| 3   | Tx_DIS [3]   | Transmitter Disable. Laser output disabled on high or open    |
| 4   | SDA [2]      | 2-wire Serial Interface Data Line                             |
| 5   | SCL [2]      | 2-wire Serial Interface Clock Line                            |
| 6   | MOD_ABS [4]  | Module Absent. Grounded within the module                     |
| 7   | RS0 [5]      | Rate Select 0   |
| 8   | RX_LOS [2]   | Loss of Signal indication. Logic 0 indicates normal operation |
| 9   | RS1 [5]      | Rate Select 1   |
| 10  | VEER [1]     | Receiver Ground   |
| 11  | VEER [1]     | Receiver Ground   |
| 12  | RD-          | Receiver Inverted DATA out. AC Coupled                        |
| 13  | RD+          | Receiver DATA out. AC Coupled                                 |
| 14  | VEER [1]     | Receiver Ground   |
| 15  | VCCR         | Receiver Power Supply   |
| 16  | VCCT         | Transmitter Power Supply                                      |
| 17  | VEET [1]     | Transmitter Ground  |
| 18  | TD+          | Transmitter DATA in. AC Coupled                               |
| 19  | TD-          | Transmitter Inverted DATA in. AC Coupled                      |
| 20  | VEET [1]     | Transmitter Ground  |

**Notes:**

[1] Module circuit ground is isolated from module chassis ground within the module.

[2].should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

[3]Tx\_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VccT inside the module.

[4]Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7 kΩ to 10 kΩ.Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.

[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.

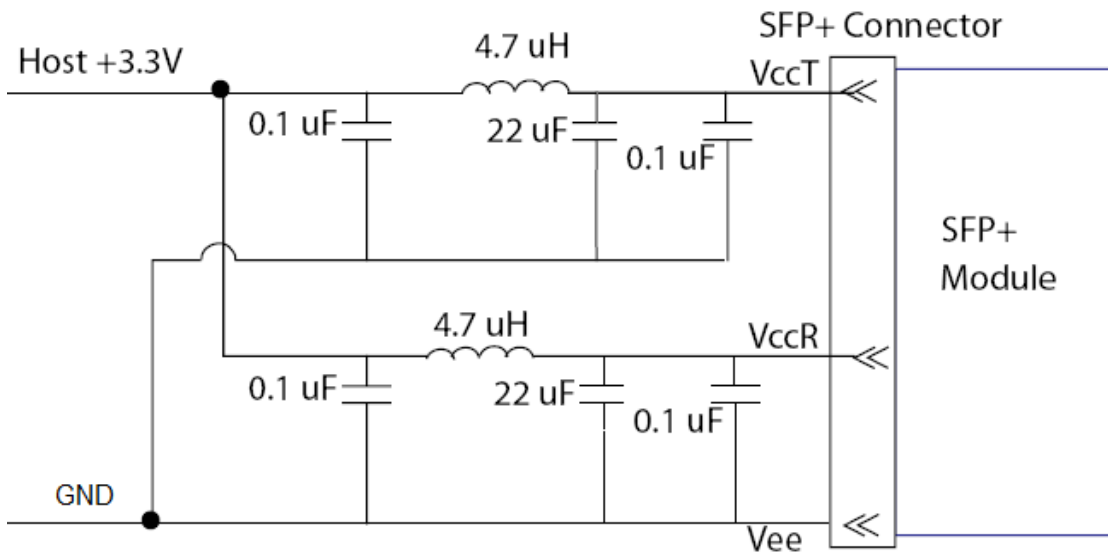


Figure3. Host Board Power Supply Filters Circuit

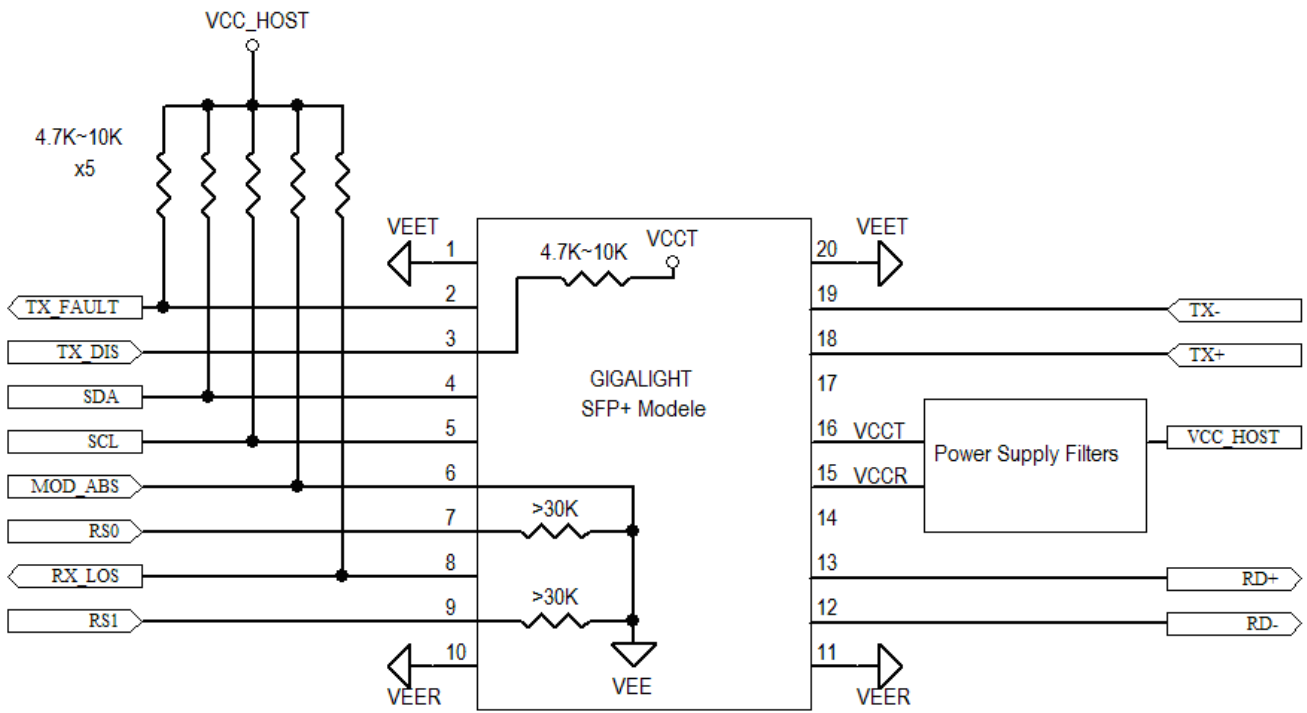
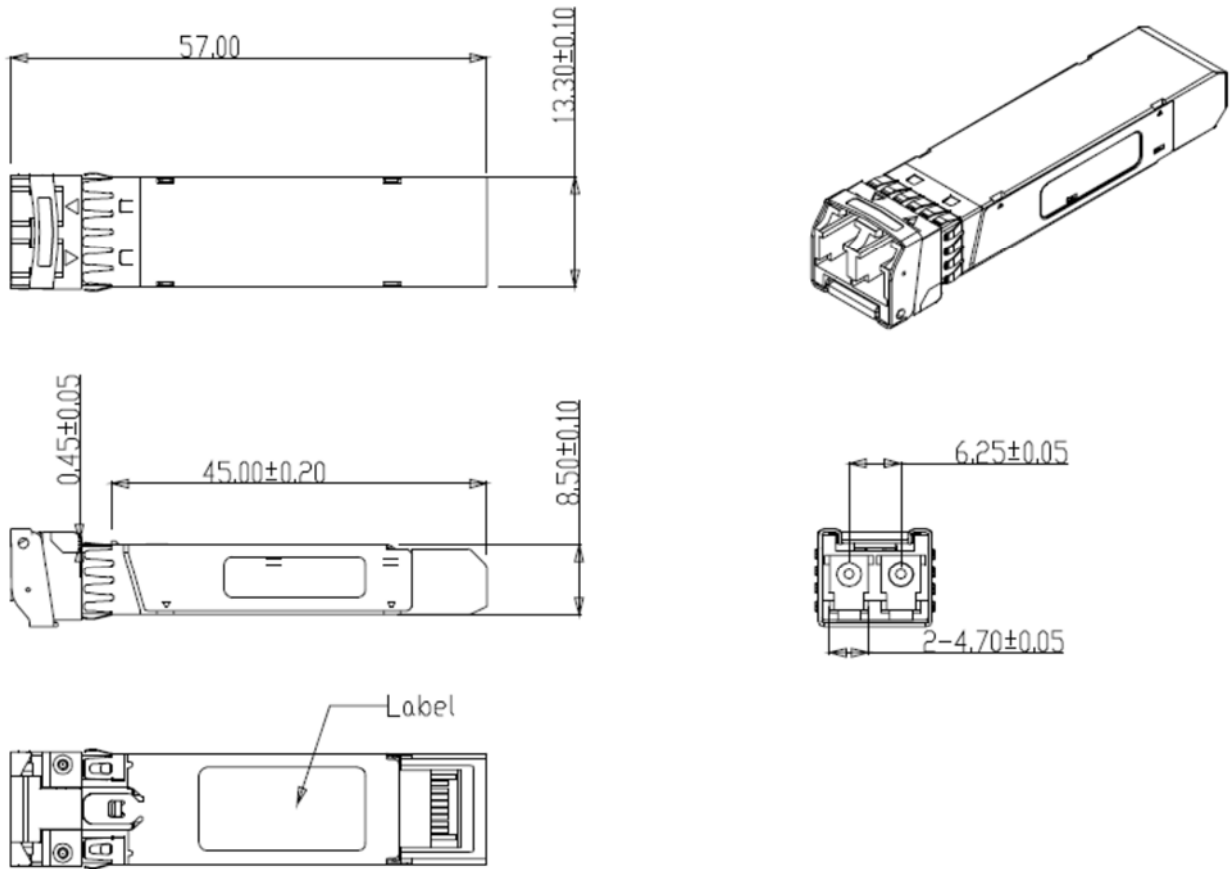


Figure4. Host-Module Interface

**Mechanical Dimensions**



**Figure5. Mechanical Specifications**



## Regulatory Compliance

This SFP+ transceiver is designed to be Class I Laser safety compliant and is certified per the following standards:

| Feature                  | Agency | Standard  | Certificate / Comments |
|--------------------------|--------|---|------------------------|
| Laser Safety             | FDA    | CDRH 21 CFR 1040 annd Laser Notice No. 50         | 1120292-000            |
| Product Safety           | UL     | UL and CUL EN60950-2:2007                         | E347511                |
| Environmental protection | SGS    | RoHS Directive 2002/95/EC                         | GZ1001008918/CHEM      |
| EMC                      | WALTEK | EN 55022:2006+A1:2007<br>EN 55024:1998+A1+A2:2003 | WT10093759-D-E-E       |

## Ordering information

| Part Number | Product Description  |
|-------------|--|
| SFP-10G-LR  | 10G SFP+ SMF LR Optical Transceiver, 1310nm, 10km -45°C to +85°C |

## References

1. "Specifications for Enhanced Small Form Factor Pluggable Module SFP+", SFF-8431, Rev 4.1, July 6, 2009.
2. "Improved Pluggable Formfactor", SFF-8432, Rev 4.2, Apr 18, 2007
3. IEEE802.3ae – 2002
4. "Diagnostic Monitoring Interface for Optical Transceivers" SFF-8472, Rev 10.3, Dec 1, 2007

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