



# Product Specification

of

## 10Gbps SFP+ 850nm SR Optical Transceiver

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## **1. General Description**

Lasermate's SFP+ SR optical transceivers are designed for 10 Gbps serial optical interfaces for data communications with multimode fiber (MMF). The transceiver can support 1.25 Gbps to 11.1 Gbps. The transceiver designs are optimized for high performance and cost effective to supply customers the best solutions for datacom and storage applications.

## **2. Features**

- Hot pluggable
- VCSEL 850nm LD for the transmitter and PIN for the receiver
- Up to 300 m on 50/125um MMF (2000MHZ.KM)
- SFP MSA package with duplex LC connector
- Digital Diagnostic Monitor Interface internally calibrated
- Very low EMI and excellent ESD protection
- High transmission margin
- +3.3V single power supply
- Below <1W power consumption
- SFP mechanical interface
- Wide data-rate range
- SFP+ MSA Compliant
- SFF-8472 reversion 9.5 compliant
- IEEE802.3-2005 compliant
- Telcordia GR-468-CORE compliant
- FCC 47 CFR Part 15,Class B compliant
- FDA 21 CFR 1040.10 and 1040.11,class1 compliant
- RoHS compliant

## **3. Applications**

- 10G Base-SR/SW
- 10G Fiber Channel
- Other optical links



## 4. Absolute Ratings

| Absolute Maximum Ratings |        |      |      |      |      |
|--------------------------|--------|------|------|------|------|
| Parameter                | Symbol | Min. | Max. | Unit | Note |
| Supply Voltage           | Vcc    | -0.5 | 4.0  | V    |      |
| Storage Temperature      |        | -40  | 85   | °C   |      |
| Relative Humidity        |        |      | 85   | %    |      |

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the module.

## 5. Specification

| Recommended Operating Conditions |               |      |         |      |      |      |
|----------------------------------|---------------|------|---------|------|------|------|
| Parameter                        | Symbol        | Min. | Typical | Max. | Unit | Note |
| Data Rate                        | Ethernet      |      | 10.3125 |      | Gbps |      |
|                                  | Fiber Channel |      | 10.518  |      |      |      |
| Supply Voltage                   | Vcc           | 3.13 | 3.3     | 3.45 | V    |      |
| Supply Current                   | Icc           |      |         | 250  | mA   |      |
| Operating Case Temp.             | Tc            | 0    |         | 70   | °C   |      |

| Optical Characteristics     |                           |      |      |       |      |      |
|-----------------------------|---------------------------|------|------|-------|------|------|
| Transmitter                 |                           |      |      |       |      |      |
| Parameter                   | Symbol                    | Min. | Typ. | Max.  | Unit | Note |
| Operating Wavelength        | $\lambda_c$               | 840  | 850  | 860   | nm   |      |
| Ave. output power (Enabled) | Po                        | -7.3 |      | -1    | dBm  | 1    |
| Extinction Ratio            | ER                        | 3.5  |      |       | dB   | 1    |
| RMS spectral width          | $\Delta\lambda$           |      |      | 4     | nm   |      |
| Output Optical Eye          | IEEE 802.3-2005 Compliant |      |      |       |      |      |
| Optical Characteristics     |                           |      |      |       |      |      |
| Receiver                    |                           |      |      |       |      |      |
| Parameter                   | Symbol                    | Min. | Typ. | Max.  | Unit | Note |
| Operating Wavelength        | $\lambda$                 | 840  |      | 860   | nm   |      |
| Receiver Sensitivity (OMA)  | Psen                      |      |      | -11.1 | dBm  | 4    |
| Stressed Sensitivity (OMA)  | Pimax                     |      |      | -7.5  | dBm  | 4    |
| LOS Assert                  | Pa                        | -30  |      |       | dBm  |      |
| LOS De-assert               | Pd                        |      |      | -12   | dBm  |      |



|                      |       |     |  |     |     |   |
|----------------------|-------|-----|--|-----|-----|---|
| LOS Hysteresis       | Pd-Pa | 0.5 |  | 4   | dB  |   |
| Overload             | Sat   | 0   |  |     | dBm | 5 |
| Receiver Reflectance | Rrx   |     |  | -12 | dB  |   |

Note:

1. Average power figures are informative only, per IEEE802.3ae.
2. TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3ae.
3. 12dB reflection.
4. Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.

| Electrical Characteristics (T <sub>OP</sub> = 0 to 70 °C, VCC = 3.135 to 3.465 Volts) |                        |                 |         |                      |      |      |
|---|------------------------|-----------------|---------|----------------------|------|------|
| Parameter   | Symbol                 | Min.            | Typical | Max.                 | Unit | Note |
| Supply Voltage  | V <sub>CC</sub>        | 3.135           |         | 3.465                | V    |      |
| Supply Current  | I <sub>CC</sub>        |                 |         | 250                  | mA   |      |
| Power Consumption   | P                      |                 |         | 1                    | W    |      |
| <b>Transmitter Section:</b>   |                        |                 |         |                      |      |      |
| Input differential impedance  | R <sub>in</sub>        |                 | 100     |                      | Ω    | 1    |
| Tx Input Single Ended DC Voltage Tolerance (Ref V <sub>eeT</sub> )                    | V                      | -0.3            |         | 4                    | V    |      |
| Differential input voltage swing  | V <sub>in,pp</sub>     | 180             |         | 700                  | mV   | 2    |
| Transmit Disable Voltage  | V <sub>D</sub>         | 2               |         | V <sub>CC</sub>      | V    | 3    |
| Transmit Enable Voltage   | V <sub>EN</sub>        | V <sub>ee</sub> |         | V <sub>ee</sub> +0.8 | V    |      |
| <b>Receiver Section:</b>  |                        |                 |         |                      |      |      |
| Single Ended Output Voltage Tolerance   | V                      | -0.3            |         | 4                    | V    |      |
| Rx Output Diff Voltage  | V <sub>o</sub>         | 300             |         | 850                  | mV   |      |
| Rx Output Rise and Fall Time  | Tr/Tf                  | 30              |         |                      | ps   | 4    |
| LOS Fault   | V <sub>LOS fault</sub> | 2               |         | V <sub>CCHOST</sub>  | V    | 5    |
| LOS Normal  | V <sub>LOS norm</sub>  | V <sub>ee</sub> |         | V <sub>ee</sub> +0.8 | V    | 5    |



Note:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Per SFF-8431 Rev 3.0
3. Into 100 ohms differential termination.
4. 20%~80%
5. LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board.  
Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V

### Serial Interface for ID and DDM

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP MSA. 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 Table 2. And the DDM specification (A2h) is described in Table 3. For more details of the memory map and byte definitions, please refer to the SFF-8472 (Rev 9.3, Aug. 2002), "Digital Diagnostic Monitoring Interface for Optical Transceivers". **The DDM parameters have been internally calibrated.**

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

| 2 wire address 1010000X ( <b>A0h</b> ) |   | 2 wire address 1010001X ( <b>A2h</b> ) |   |
|--|---|--|---|
| Address                                | Information                             | Address                                | Information                               |
| 0~95                                   | Serial ID Defined by SFP MSA (96 bytes) | 0~55                                   | Alarm and Warning Thresholds (56 bytes)   |
|  |   | 56~95                                  | Calibration Constants (40 bytes)          |
| 96~127                                 | Vendor Specific (32 bytes)              | 96~119                                 | Real Time Diagnostic Interface (24 bytes) |
|  |   | 120~127                                | Vender Specific (8 bytes)                 |
| 128~255                                | Reserved,SFF8079 (128 bytes)            | 128~247                                | User Writable EEPROM (120 bytes)          |
|  |   | 248~255                                | Vender Specific (8 bytes)]                |

Note: Specifications subject to change without notice.



## 6. PIN Assignment

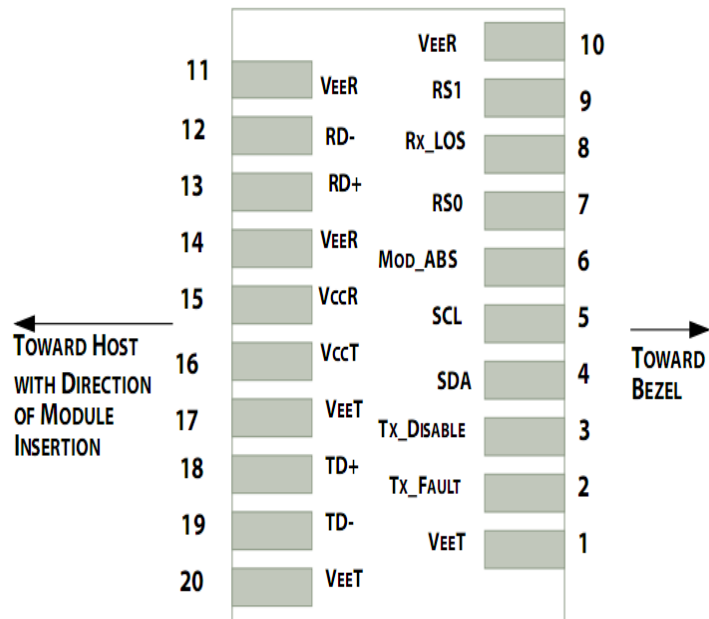
| Pin | Symbol  | Name/Description   | Note |
|-----|---------|--|------|
| 1   | VEET    | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | TFAULT  | Transmitter Fault.   | 2    |
| 3   | TDIS    | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 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  | VEER    | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | VEER    | 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  | VEER    | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 15  | VCCR    | Receiver Power Supply  |      |
| 16  | VCCT    | Transmitter Power Supply                                       |      |
| 17  | VEET    | 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  | VEET    | Transmitter Ground (Common with Receiver Ground)               | 1    |

### **Notes:**

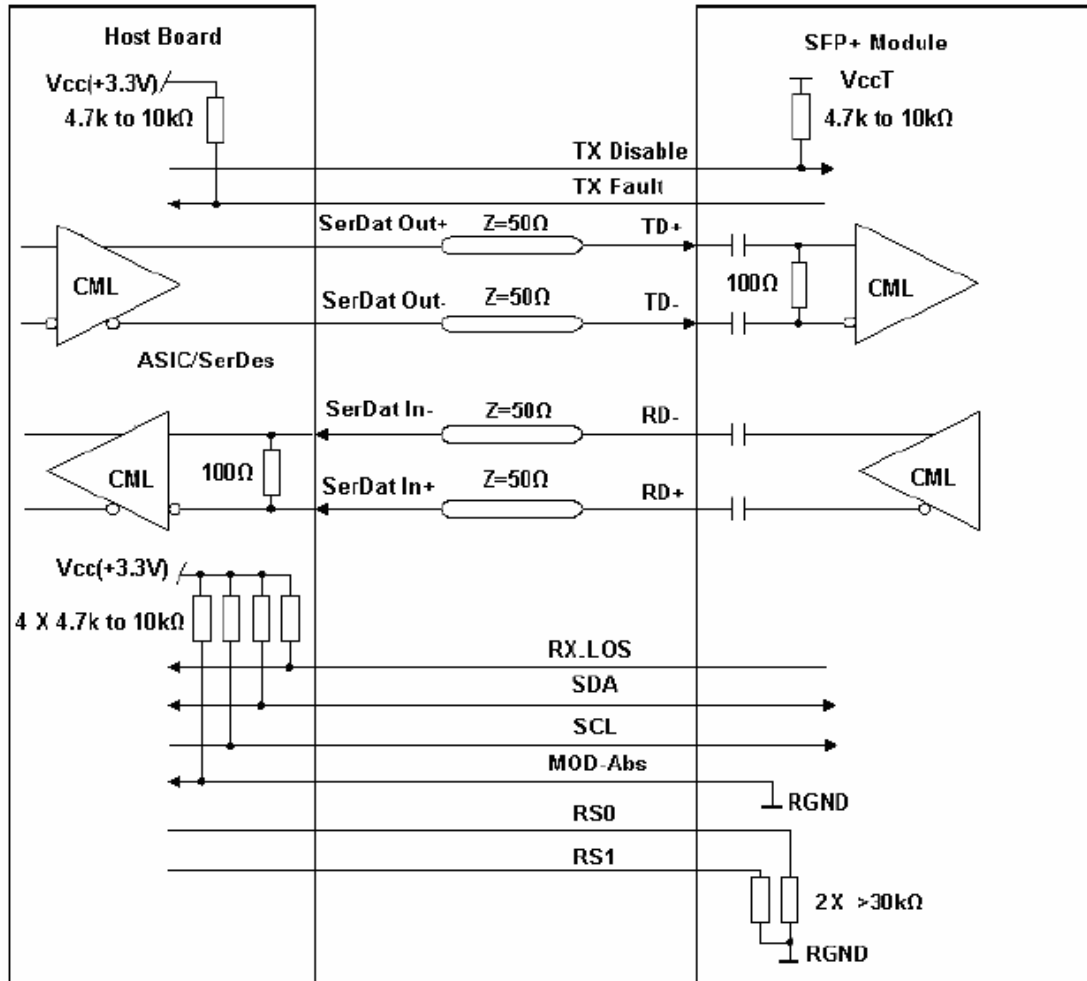
1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7kΩ– 10 kΩ resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 0.3V. A high output indicates a transmitter fault caused 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 TDIS >2.0V or open, enabled on TDIS <0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.



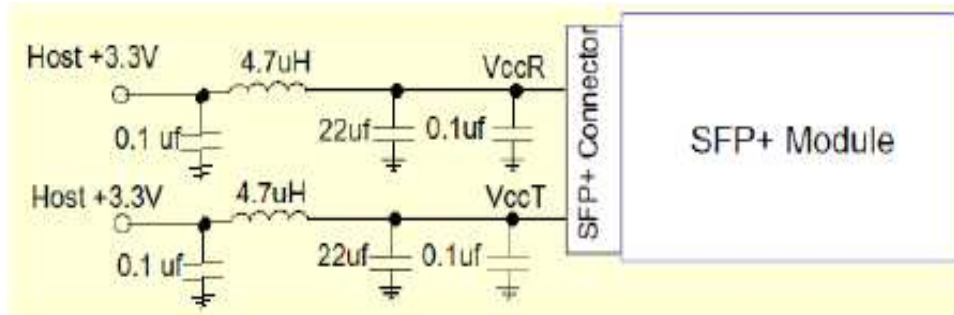
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.



## 7. Recommend Circuit



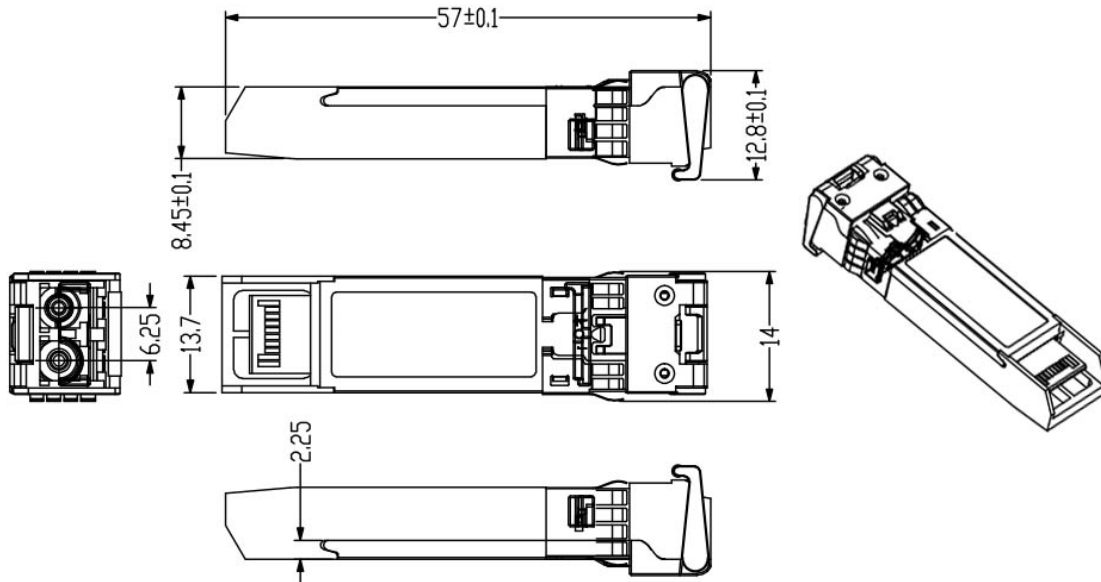
### Recommended power supply filter



Note: Inductors with DC resistance of less than 1Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value



## 8. Dimension ( in mm )



## 9. Ordering Information

| P/N        | Description   | Temp. °C | Connector |
|------------|---|----------|-----------|
| 10GSR SFP+ | 10Gbps SFP+ 850 nm MM 0.3 Km DDM internally calibrated. | 0 ~ +70  | LC Duplex |

## 10. Caution

### Laser Safety

This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1 Ed.2: 2007 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

### ESD

This transceiver is specified as ESD threshold 1kV for SFI pin and 2kV for all others 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.



When the ambient is reaching 85C max as declared, the internal case is hot surface please don't touch.