

## Features

- Support rate selectable 1.25Gb/s or 9.83Gb/s to 11.3Gb/s bit rates
- Compliant with IEEE 802.3-2012 10GBASE-LR/LW and 1000BASE-LX
- Compliant with SFF-8431
- Hot-pluggable SFP+ footprint
- 1310nm DFB laser transmitter
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 10km on SMF
- Single power supply 3.3V
- RoHS Compliant
- Operating case temperature: 0°C ~70°C



## Applications

- 10GBASE-LR/LW Ethernet
- 1000BASE-LX Ethernet

## Description

This SFP-LX / SFP+ LR dual rate SFP+ optical transceivers are based on 1G and 10G Ethernet standard, which are compliant with SFF-8431, IEEE 802.3-2012 10GBASE-LR/LW and 1000BASE-LX and provide a quick and reliable interface for the 1G and 10G Ethernet application. The digital diagnostics functions are available via the 2-wire serial bus, as specified in SFF-8472.

### Absolute Maximum Ratings

| Parameter             | Symbol           | Min. | Typ.    | Max.              | Units | Note |
|-----------------------|------------------|------|---------|-------------------|-------|------|
| Data Rate (RS0=LOW)   | DR               |      | 1.25G   |                   | Gb/s  | 1    |
| Data Rate (RS0=HIGH)  | DR               | 9.83 | 10.3125 | 11.3              | Gb/s  | 1    |
| Bit Error Rate        | BER              |      |         | 10 <sup>-12</sup> |       |      |
| Storage Temperature   | T <sub>c</sub>   | -40  |         | 85                | °C    | 3    |
| Operating Temperature | T <sub>c</sub>   | 0    |         | 70                | °C    | 2    |
| Supply Current        | V <sub>cc</sub>  |      | 250     | 360               | mA    | 4    |
| Input Voltage         | I <sub>cc</sub>  | 3.14 | 3.3     | 3.46              | V     |      |
| Maximum Voltage       | V <sub>MAX</sub> | -0.5 |         | 4                 | V     | 4    |

Notes:

1. IEEE 802.3-2012
2. Case Temperature
3. Ambient Temperature
4. For Electrical power interface

### Digital Diagnostic Functions

| Parameter                             | Symbol    | Accuracy | Unit | Notes                |
|---------------------------------------|-----------|----------|------|----------------------|
| Temperature monitor absolute error    | DMI_Temp  | ± 3      | °C   | Over operating Temp  |
| Supply voltage monitor absolute error | DMI_VCC   | ±0.1     | V    | Full operating range |
| RX power monitor absolute error       | DMI_RX    | ± 2 dB   | dB   | 1                    |
| Bias Current monitor                  | DMI_Ibias | ± 10%    | mA   |                      |
| Laser power monitor absolute error    | DMI_TX    | ± 2 dB   | dB   | 1                    |

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

## Optical Characteristics

| Parameter                       | Symbol           | Min. | Typ. | Max.  | Units | Note |
|---------------------------------|------------------|------|------|-------|-------|------|
| <b>Transmitter</b>              |                  |      |      |       |       |      |
| Output Optical Power@1.25Gb/s   | $P_{TX1}$        | -9.5 |      | -3    | dBm   | 1    |
| Output Optical Power@10.3Gb/s   | $P_{TX2}$        | -8.2 |      | 0.5   | dBm   | 1    |
| Center wavelength               | $\lambda_t$      | 1260 |      | 1355  | nm    |      |
| Optical Modulation Amplitude    | OMA              | -5.2 |      |       | dBm   | 2    |
| Side Mode Suppression Ratio     | SMSR             | 30   |      |       | dB    |      |
| Extinction Ratio@1.25Gb/s       | ER1              | 9    |      |       | dB    |      |
| Extinction Ratio@10.3Gb/s       | ER2              | 3.5  |      |       | dB    |      |
| Spectral Width (-20dB)          | $\Delta\lambda$  |      |      | 1     | nm    |      |
| Relative Intensity Noise        | RIN              |      |      | -128  | dB/Hz |      |
| Transmitter Dispersion Penalty  | TDP              |      |      | 3.2   | dB    |      |
| Launch Power of OFF Transmitter | $P_{OUT\_OFF}$   |      |      | -30   | dBm   | 1    |
| Transmitter Jitter              |                  |      |      |       |       | 2    |
| <b>Receiver</b>                 |                  |      |      |       |       |      |
| Center wavelength               | $\lambda_r$      | 1260 |      | 1600  | nm    |      |
| Receiver Overload               | P <sub>OL</sub>  | 0.5  |      |       | dBm   |      |
| Receiver Sensitivity @1.25Gb/s  | $R_{X\_SEN1}$    |      |      | -19   | dBm   | 3    |
| Receiver Sensitivity @10.3Gb/s  | $R_{X\_SEN2}$    |      |      | -14.4 | dBm   | 4    |
| Receiver Reflectance            | TR <sub>RX</sub> |      |      | -12   | dB    |      |
| LOS Assert                      | LOSA             | -30  |      |       | dBm   |      |
| LOS De-assert@1.25Gb/s          | LOSD             |      |      | -23   | dBm   |      |
| LOS De-assert@10.3Gb/s          | LOSD             |      |      | -17   | dBm   |      |
| LOS Hysteresis                  | LOSH             | 0.5  |      |       | dB    |      |

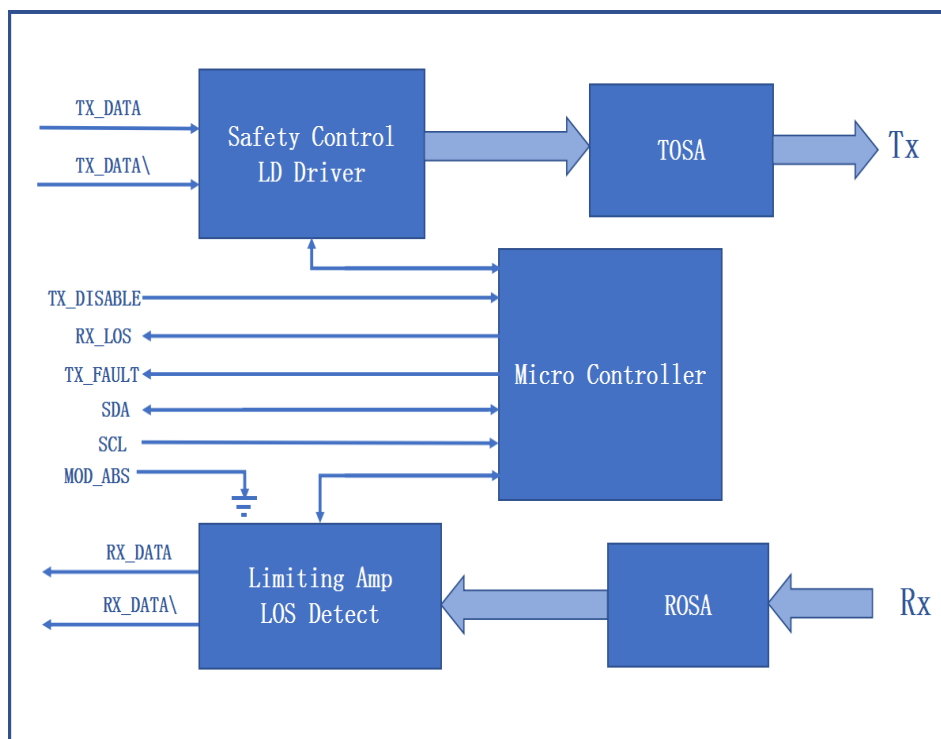
Note:

1. Average
2. According to IEE802.3ae requirement
3. Average test the resulting value the minimum ER value within the defined range BER<10<sup>-12</sup>, 2<sup>7</sup>-1 PRBS
4. Average test the resulting value the minimum ER value within the defined range BER<10<sup>-12</sup>, 2<sup>31</sup>-1 PRBS

## Electro Characteristics

| Parameter                              | Symbol       | Min.     | Typ. | Max.          | Units    | Note |
|----------------------------------------|--------------|----------|------|---------------|----------|------|
| <b>Transmitter</b>                     |              |          |      |               |          |      |
| Input Differential Impedance           | $R_{IN}$     |          | 100  |               | $\Omega$ |      |
| Differential Data Input Swing          | $V_{IN.PP}$  | 180      |      | 700           | mV       |      |
| Transmit Disable Voltage               | $V_D$        | 2        |      | $V_{CC}$      | V        |      |
| Transmit Enable Voltage                | $V_{EN}$     | $V_{EE}$ |      | $V_{EE}+0.8$  | V        |      |
| <b>Receiver</b>                        |              |          |      |               |          |      |
| Differential Data Output Swing         | $V_{OUT.PP}$ | 300      |      | 850           | mV       |      |
| Output Rise and Fall time (20% to 80%) | $T_r, T_f$   | 28       |      |               | ps       |      |
| LOS Assert                             | $V_{LOS.A}$  | 2        |      | $V_{CC.HOST}$ | V        |      |
| LOS De-Assert                          | $V_{LOS.D}$  | $V_{EE}$ |      | $V_{EE}+0.5$  | V        |      |

## Block Diagram of Transceiver



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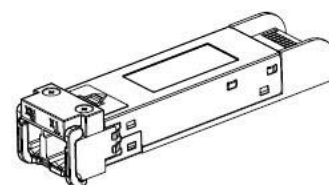
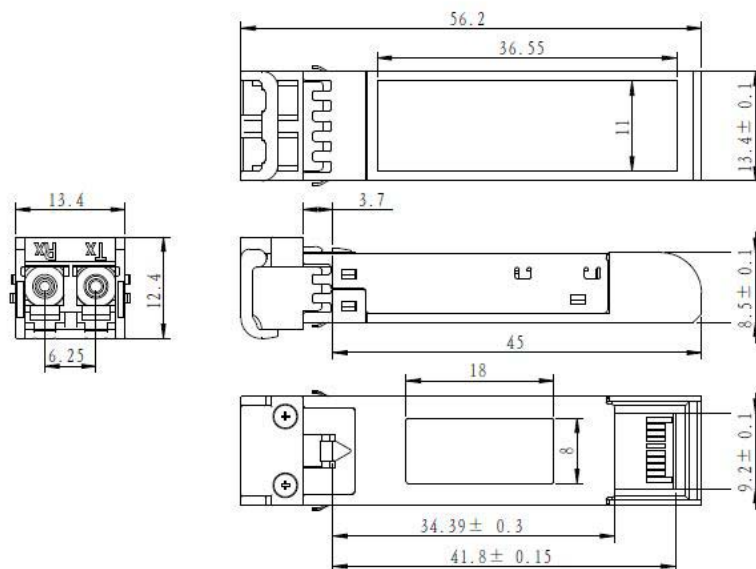
## Pin Assignment

| Pin | Symbol     | Function/Description                                          | Notes |
|-----|------------|---------------------------------------------------------------|-------|
| 1   | VEET       | Transmitter ground (common with receiver ground)              | 1     |
| 2   | TX_FAULT   | Transmitter Fault                                             | 2     |
| 3   | TX DISABLE | 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        | No connection required                                        |       |
| 8   | LOS        | Loss of Signal indication. Logic 0 indicates normal operation | 5     |
| 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     |

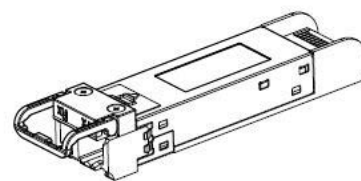
### Notes:

1. Circuit ground is isolated from chassis ground
2. TX\_FAULT is the open collector output and should be pulled up with 4.7k-10k ohm on host board to a voltage between 2V and  $V_{cc}+0.3V$
3. Disable  $T_{DIS} > 2V$  or open Enable:  $T_{DIS} < 0.8V$
4. Should be pulled up with 4.7k-10k ohm on host board to a voltage between 2V and  $V_{cc} + 0.3V$
5. LOS is open collector output and should be pulled up with 4.7k-10k ohm on host board to a voltage between 2V and  $V_{cc} 0.3V$ , the logic "0" indicates normal operation, and the logic "1" indicates that the receiver signal is lost

## Dimensions



LATCHED



UNLATCHED

**ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED UNIT: mm**

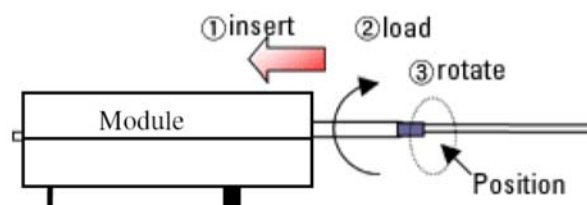
### Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

#### Cleaning of patch-cord



#### Cleaning of fiber stub



1. Insert  
Ensure that stick is held straight when inserting into sleeve.
2. Load  
Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate  
Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

*Notice: Number of possible wipes:  
Maintenance (repair) ~1 use / piece  
Equipment construction: 4 uses / piece (max.)*

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

### Ordering Information

| <i>Model Number</i>      | <i>Part Number</i> | <i>Wavelength</i> | <i>Temperature</i> |
|--------------------------|--------------------|-------------------|--------------------|
| SFP-1G/10G-LR(dual rate) | OPAT-S10-13-CD     | 1310nm            | 0~70 °C            |

### Modification History

| <i>Revision</i> | <i>Date</i> | <i>Description</i> |
|-----------------|-------------|--------------------|
| A1              | Nov. 2020   | Initial Release    |

**Note:** All information contained in this document is subject to change without notice.