

# PRODUCT SPECIFICATION



## GLSF-BL5412-FOD(I)

1.25Gb/s BiDi Single LC, SMF, 1550nm DFB-LD, 1490nm Super Tia, 150Km SFP Transceiver

### ■ Features:

- ★ Up to 1.25Gb/s Data Links
- ★ Hot-Pluggable SFP footprint
- ★ Single LC for Bi-directional Transmission
- ★ Built-in 1550nm DFB Laser
- ★ 1490nm Super Tia photo-detector
- ★ Built-in digital diagnostic functions
- ★ Up to 150Km on 9/125μm SMF
- ★ Single +3.3V Power Supply
- ★ Industrial /Extended/ Commercial operating temperature range: -40°C to 85°C/-5°C to 85°C/-0°C to 70°C Version available
- ★ Very low EMI and excellent ESD protection
- ★ RoHS compliant and Lead Free



### ■ Applications:

- ★ Metro/Access Networks
- ★ 1.25 Gb/s 1000Base-LX Ethernet
- ★ 1×Fiber Channel
- ★ Other Optical Link

### ■ Description:

GLight GLSF-BL5412-FOD(I) Bi-Directional transceiver is a high performance, cost effective module, which is compliant with LC Optics interface with built in WDM for Bi-Directional serial optical data communication applications. This module is designed for Single-Mode single fiber, operates at the normal wavelength of 1550/1490nm. The transmitter section incorporates DFB and driver IC with temperature compensation and automatic power control circuit, which makes the transmitter section output power and Extinction ration stabled in operation temperature. The receiver section incorporates an efficient InGaAs photodiode and transimpedance with AGC for wide dynamic range.

## Absolute Maximum Ratings

| Parameter                  | Symbol             | Min. | Typical | Max. | Unit |
|----------------------------|--------------------|------|---------|------|------|
| Case operating Temperature | Industrial         | -40  |         | +85  | °C   |
|                            | Extended           |      |         |      | °C   |
|                            | Commercial         | 0    |         | 70   | °C   |
| Supply Voltage             | V <sub>CCT,R</sub> | -0.5 |         | 4    | V    |
| Relative Humidity          | RH                 | 0    |         | 85   | %    |

## Electrical Characteristics (T<sub>OP</sub> = T<sub>c</sub>, V<sub>CC</sub> = 3.135 to 3.465 Volts)

| Parameter                         | Symbol                | Min.                  | Typical | Max.                  | Unit  | Note |
|-----------------------------------|-----------------------|-----------------------|---------|-----------------------|-------|------|
| Supply Voltage                    | V <sub>cc</sub>       | 3.14                  | 3.30    | 3.47                  | V     |      |
| Supply Current                    | I <sub>cc</sub>       |                       |         | 300                   | mA    |      |
| Inrush Current                    | I <sub>surge</sub>    |                       |         | I <sub>cc</sub> +30   | mA    |      |
| Maximum Power                     | P <sub>max</sub>      |                       |         | 1.0                   | mW    |      |
| <b>Transmitter Section:</b>       |                       |                       |         |                       |       |      |
| Input differential impedance      | R <sub>in</sub>       | 90                    | 100     | 110                   |       |      |
| Single ended data input swing     | V <sub>in PP</sub>    | 200                   |         | 1200                  | mVp-p |      |
| Transmit Disable Voltage          | V <sub>D</sub>        | V <sub>cc</sub> – 1.3 |         | V <sub>cc</sub>       | V     | 2    |
| Transmit Enable Voltage           | V <sub>EN</sub>       | V <sub>ee</sub>       |         | V <sub>ee</sub> + 0.8 | V     |      |
| Transmit Disable Assert Time      | T <sub>dessert</sub>  |                       |         | 10                    | us    |      |
| <b>Receiver Section:</b>          |                       |                       |         |                       |       |      |
| Single ended data output swing    | V <sub>out,pp</sub>   | 300                   |         | 800                   | mv    | 3    |
| Data output rise time             | t <sub>r</sub>        |                       |         | 260                   | ps    | 4    |
| Data output fall time             | t <sub>f</sub>        |                       |         | 260                   | ps    | 4    |
| 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                   |         |                       | mVpp  | 6    |
| Deterministic Jitter Contribution | RXΔDJ                 |                       |         | 51.7                  | ps    | 7    |
| Total Jitter Contribution         | RXΔTJ                 |                       |         | 122.4                 | ps    |      |

Notes:

1. AC coupled.
2. Or open circuit.
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.
7. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and .

DJ.

## ■ Optical Parameters(T<sub>OP</sub> = T<sub>C</sub>, VCC = 3.135 to 3.465 Volts)

| Parameter   | Symbol   | Min. | Typical | Max.              | Unit  | Note |
|---|--|------|---------|-------------------|-------|------|
| <b>Transmitter Section:</b>                           |  |      |         |                   |       |      |
| Center Wavelength                                     | $\lambda_c$  | 1530 | 1550    | 1570              | nm    | 1    |
| Spectral Width  | $\sigma$   |      |         | 1                 | nm    |      |
| Optical Output Power                                  | P <sub>out</sub>                                       | 2    |         | 5                 | dBm   | 2    |
| Optical Rise/Fall Time                                | t <sub>r</sub> / t <sub>f</sub>                        |      |         | 260               | ps    | 3    |
| Extinction Ratio                                      | ER   | 9    |         |                   | dB    |      |
| Deterministic Jitter Contribution                     | TX $\Delta$ DJ   |      |         | 56.5              | ps    | 4    |
| Total Jitter Contribution                             | TX $\Delta$ TJ   |      |         | 119               | ps    | 3    |
| Eye Mask for Optical Output                           | Compliant with Eye Mask Defined in IEEE 802.3 standard |      |         |                   |       |      |
| Relative Intensity Noise                              | RIN  |      |         | -120              | dB/Hz |      |
| <b>Receiver Section:</b>                              |  |      |         |                   |       |      |
| Optical Input Wavelength                              |  | 1470 | 1490    | 1510              | nm    |      |
| Receiver Overload                                     | P <sub>ol</sub>  | -3   |         |                   | dBm   | 5.6  |
| RX Sensitivity  | Sen  |      |         | -30               | dBm   | 5.6  |
| RX_LOS Assert   | LOS <sub>A</sub>                                       | -45  |         |                   | dBm   |      |
| RX_LOS Deassert                                       | LOS <sub>D</sub>                                       |      |         | -32               | dBm   |      |
| RX_LOS Hysteresis                                     | LOS <sub>H</sub>                                       | 0.5  | 2       | 5                 | dB    |      |
| <b>General Specifications</b>                         |  |      |         |                   |       |      |
| 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@1.25G | LMAX   |      | 150     |                   | km    | 7    |
| Total System Budget                                   | LB   | 25   |         |                   | dB    | 8    |

Note:

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 1x10<sup>-12</sup> BER by multiplying the RMS jitter (measured on a single rise or fall edge) from the oscilloscope by 14. Per FC-PI, 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<sup>7</sup>-1 at 10<sup>-12</sup> BER

## Pin Assignment

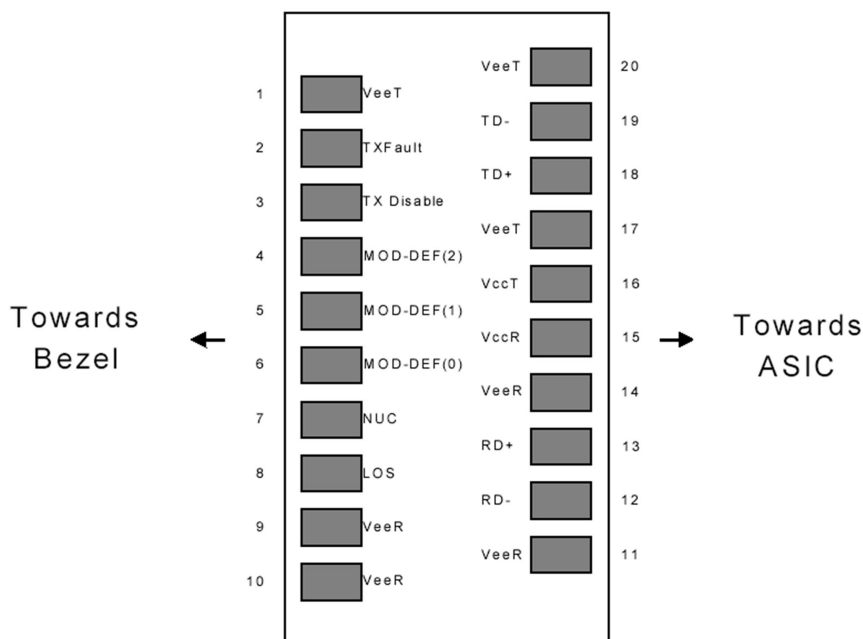


Diagram of Host Board Connector Block Pin Numbers and Names

## Pin Description

| 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     |
| 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 |  |
|----|------|--------------------|---|--|

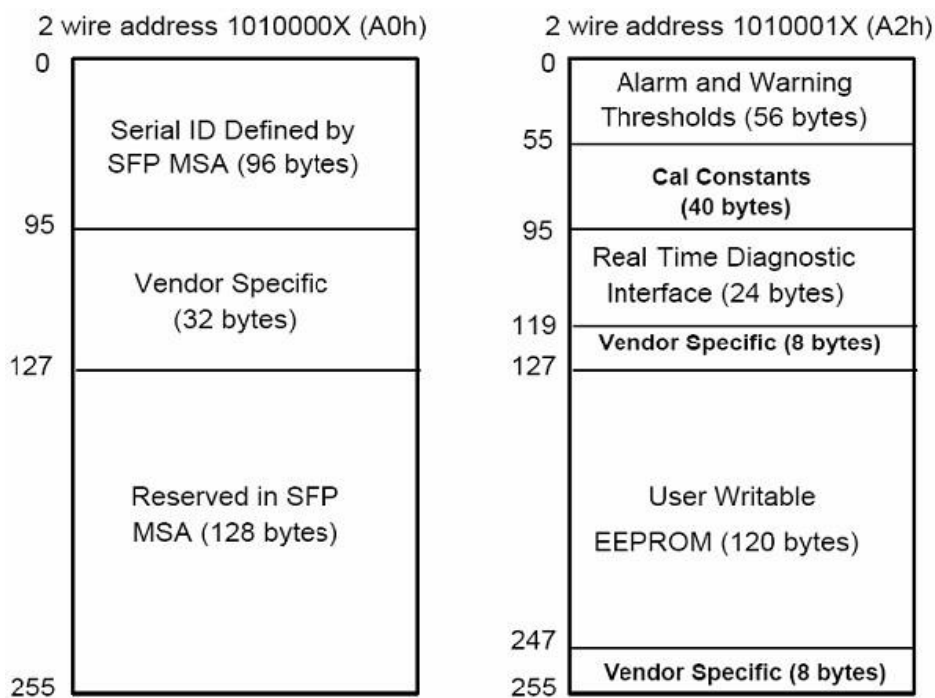
Notes:

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

## ■ 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 I<sup>2</sup>C 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 is 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.

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



**Table 2.** EEPROM Serial ID Memory Contents(A0h)

| Data Address   | Length (Byte) | Name of Length | Description and Contents                                 |
|----------------|---------------|----------------|--|
| Base ID Fields |               |                |  |
| 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             | 1             | Reserved       | (0000h)  |
| 14             | 1             | Length(9um,km) | Link length supported for 9/125um fiber, units of km     |
| 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: "xxxxxxx" (ASCII)                           |
| 56-59          | 4             | Vendor rev     | Revision level for part number                           |
| 60-61          | 2             | Wavelength     | Laser wavelength   |
| 62             | 1             | Reserved       |  |

|                           |     |                  |  |
|---------------------------|-----|------------------|--|
| 63                        | 1   | CCID             | Least significant byte of sum of data in address 0-62  |
| Extended ID Fields        |     |                  |  |
| 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        | Manufacturing date code  |
| 92                        | 1   | Diagnostic Type  | Diagnostics  |
| 93                        | 1   | Enhanced Options | Diagnostics  |
| 94                        | 1   | SFF-8472         | Diagnostics  |
| 95                        | 1   | CCEX             | Check code for the extended ID Fields (addresses 64 to 94)   |
| Vendor Specific ID Fields |     |                  |  |
| 96-127                    | 32  | Readable         | Vendor specific date, read only  |
| 128-255                   | 128 | Reserved         | Reserved for SFF-8079  |

## ■ Digital Diagnostic Monitor Characteristics

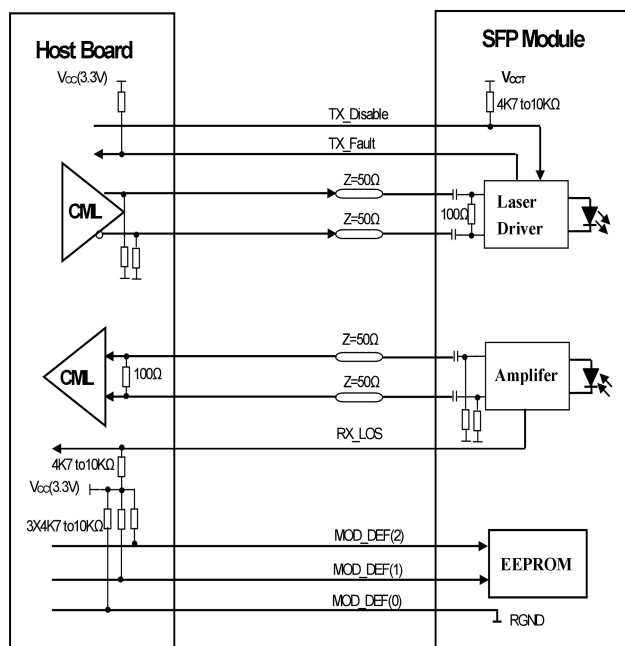
| Data Address | Parameter                        | Accuracy | Unit | Calibration |
|--------------|----------------------------------|----------|------|-------------|
| 96-97        | Transceiver Internal Temperature | ±3.0     | °C   | internal    |
| 98-99        | VCC3 Internal Supply Voltage   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

## ■ Regulatory Compliance

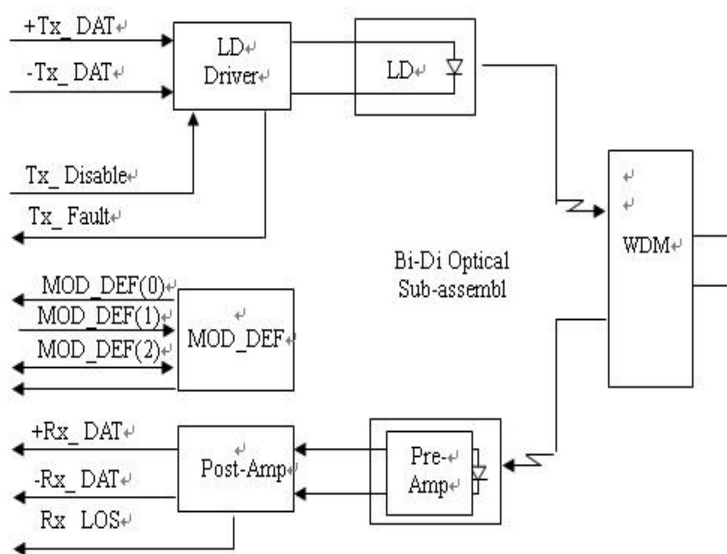
The transceiver complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

|   |  |  |
|---|--|--|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E<br>Method 3015.7                                      | Class 1(>1000 V)                       |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2<br>GR-1089-CORE                                      | Compatible with standards              |
| Electromagnetic Interference (EMI)                        | FCC Part 15 Class B<br>EN55022 Class B (CISPR 22B)<br>VCCI Class B | Compatible with standards              |
| Laser Eye Safety  | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2       | Compatible with Class 1 laser product. |

## ■ Recommended Circuit:

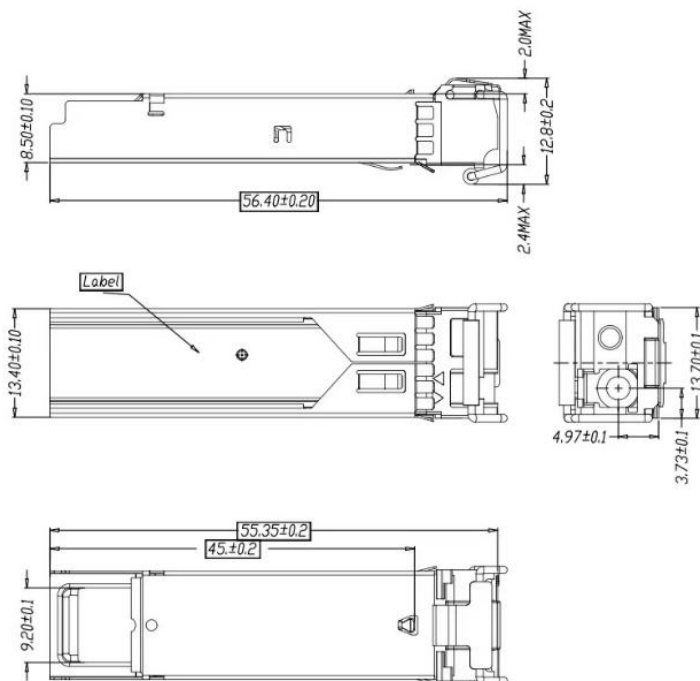


SFP Host Recommended Circuit



Block Diagram

## ■ Mechanical Dimensions



Mechanical Drawing



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