

## PRODUCT SPECIFICATION

### FLXP-85B1-03D

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25Gb/s Duplex LC, MMF, 850nm VCSEL-LD, PIN Receiver, SR 100m SFP+ Transceiver

#### ■ Features:

- ★ Operating data rate support 24.33Gbps and 25.78Gbps with CDR engaged mode
- ★ Hot-Pluggable SFP+ footprint
- ★ TO-CAN 850nm VCSEL laser transmitter
- ★ Duplex LC connector
- ★ Maximum link length of 100m
- ★ Single +3.3V Power Supply
- ★ Power consumption<1W (Standard)
- ★ Compliant with MSA SFP+ Specification SFF-8432
- ★ Commercial operating temperature range: 0C to 70°C  
Industrial operating temperature range: -40C to 85°C
- ★ RoHS compliant (lead-free)



#### ■ Applications:

- ★ CPRI Option 10
- ★ 25GBE
- ★ 10GbE Optical Link

#### ■ Description:

Flowlink FLXP-85B1-01D transceivers are Multi-mode transceiver is SFP28 module for duplex optical data communications supports 24.33Gbps and 25.78Gbps with CDR engaged, while, 25G Ethernet optical data communication can be supported when CDR is bypassed. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I2C. It has built-in clock and data recovery (CDR). This module is designed for Multi-mode fiber and operates at a nominal wavelength of 850nm. Flowlink FLXP-85B1-01D the transmitter section uses a 850nm multiple quantum well VCSEL/PIN Transceivers are RoHS compliant per Directive 2011/65/EU. The high performance 850nm VCSEL transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to Maximum link length of 100m MMF

## ■ Absolute Maximum Ratings

| Parameter                  | Symbol          | Min. | Typical | Max. | Unit |
|----------------------------|-----------------|------|---------|------|------|
| Storage Temperature        | T <sub>S</sub>  | -40  |         | +85  | °C   |
| Case Operating Temperature | T <sub>A</sub>  | 0    |         | 70   | °C   |
| Supply Voltage             | V <sub>CC</sub> | -0.5 |         | 4.0  | V    |
| Relative Humidity          | RH              | 0    |         | 85   | %    |
| Industrial                 | TC              | -40  |         | 85   | °C   |
| Commercial                 | TC              | 0    |         | 70   | °C   |

## ■ General Specification

| Parameter                                       | Symbol          | Min. | Typical | Max.    | Unit |
|-------------------------------------------------|-----------------|------|---------|---------|------|
| Bit Rate                                        | BR              |      | 25.78   |         | Gb/s |
| Bit Error Ratio                                 | BER             |      |         | 5E (-5) |      |
| Supply Voltage                                  | V <sub>CC</sub> | -0.5 |         | 3.6     | V    |
| Maximum Supported Distances<br>(MMF, 50μm OM3 ) |                 |      |         | 70      | m    |
| Maximum Supported Distances<br>(MMF, 50μm OM4)  |                 |      |         | 100     | m    |

## ■ Electrical Characteristics (Condition: T<sub>a</sub>=T<sub>OP</sub>)

| Parameter                                                             | Symbol                 | Min.            | Typical | Max.                 | Unit | Note |
|-----------------------------------------------------------------------|------------------------|-----------------|---------|----------------------|------|------|
| Supply Voltage                                                        | V <sub>CC</sub>        | 3.14            | 3.3     | 3.47                 | V    |      |
| Supply Current                                                        | I <sub>CC</sub>        |                 |         | 290                  | mA   |      |
| <b>Transmitter Section:</b>                                           |                        |                 |         |                      |      |      |
| Input differential impedance                                          | R <sub>in</sub>        |                 | 100     |                      | Ω    | 1    |
| Tx Input Single Ended DC Voltage<br>Tolerance (Ref V <sub>eeT</sub> ) | V                      | -0.3            |         | 4.0                  | V    |      |
| Differential input voltage swing                                      | V <sub>in,pp</sub>     | 150             |         | 1200                 | 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<br>Tolerance                              | V                      | -0.3            |         | 4                    | V    |      |
| Rx Output Diff Voltage                                                | V <sub>O</sub>         | 350             |         | 800                  | mV   |      |
| LOS Fault                                                             | V <sub>LOS fault</sub> | 2               |         | V <sub>CCHOST</sub>  | V    | 4    |
| LOS Normal                                                            | V <sub>LOS norm</sub>  | V <sub>ee</sub> |         | V <sub>ee</sub> +0.8 | V    | 4    |

Note:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Compliant with MSA SFP+ Specification SFF-8432
3. Into 100 ohms differential termination.
4. LOS is an open collector output. Should be pulled up with 4.7k – 10k $\Omega$  on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.

## ■ Optical Characteristics (Condition: Ta=TOP)

| Parameter                              | Symbol                | Min. | Typical | Max.  | Unit  | Note |
|----------------------------------------|-----------------------|------|---------|-------|-------|------|
| <b>Transmitter Section:</b>            |                       |      |         |       |       |      |
| Center Wavelength                      | $\lambda_t$           | 830  | 850     | 870   | nm    |      |
| RMS spectral width                     | $\Delta\lambda_{rms}$ |      |         | 0.60  | nm    |      |
| Average Optical Power                  | Pavg                  | -8   |         | 2.4   | dBm   | 1    |
| Extinction Ratio                       | ER                    | 2    |         |       | dB    |      |
| Transmitter and Dispersion Eye Closure | TDP                   |      |         | 4.3   | dB    | 2    |
| Relative Intensity Noise               | Rin                   |      |         | -128  | dB/Hz | 3    |
| Optical Return Loss Tolerance          |                       | 12   |         |       | dB    |      |
| <b>Receiver Section:</b>               |                       |      |         |       |       |      |
| Center Wavelength                      | $\lambda_r$           | 830  |         | 870   | nm    |      |
| Receiver Sensitivity                   | Sen                   |      |         | -10.3 | dBm   | 5    |
| Los Assert                             | LOS <sub>A</sub>      | -30  |         |       | dBm   |      |
| Los De-assert                          | LOS <sub>D</sub>      |      |         | -12   | dBm   |      |
| Los Hysteresis                         | LOS <sub>H</sub>      | 0.5  |         | 4     | dB    |      |
| Receiver Overload                      | Sat                   | 2.4  |         |       | dBm   | 4    |

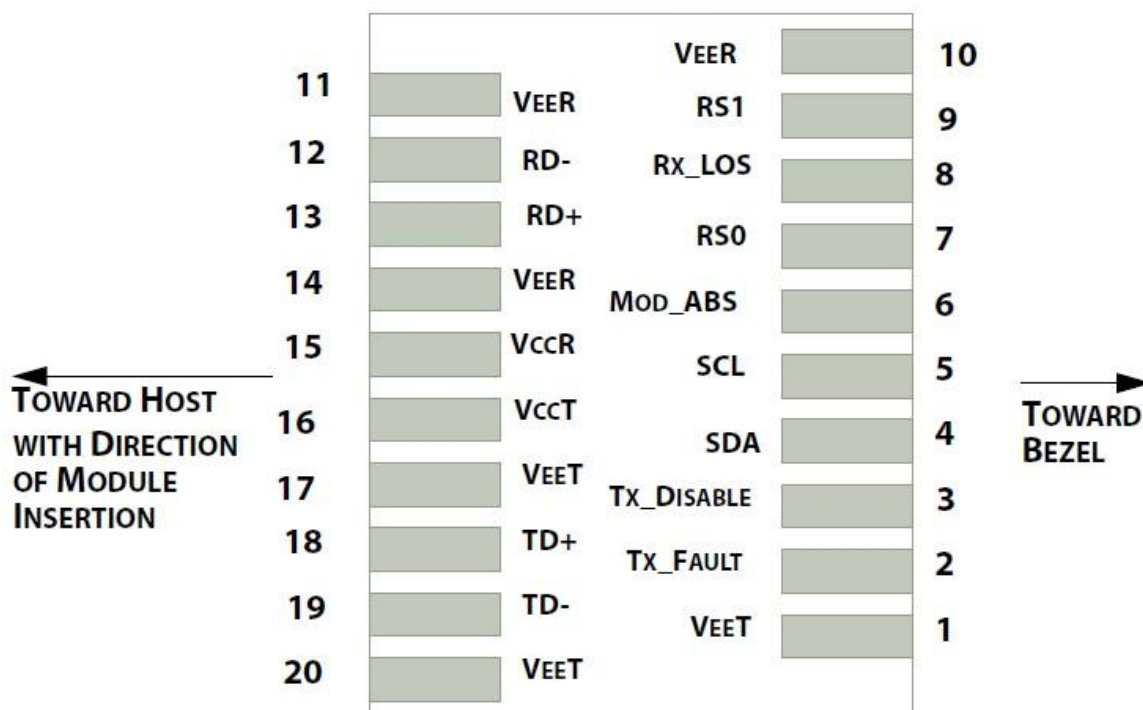
Note:

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. Conditions of stressed receiver tests per IEEE802.3ae. CSRS testing requires the host board to be SFF-8431 compliant.
4. Receiver overload specified in OMA and under the worst comprehensive stressed condition.
5. Test condition: BER < 5E-5 and PRBS 2<sup>31</sup>-1

## ■ Timing Characteristics

| Parameter                                    | Symbol                 | Min. | Typical | Max.            | Unit |
|----------------------------------------------|------------------------|------|---------|-----------------|------|
| TX_Disable Assert Time                       | t_off                  |      |         | 10              | us   |
| TX_Disable Negate Time                       | t_on                   |      |         | 1               | ms   |
| Time to Initialize Include Reset of TX_FAULT | t_int                  |      |         | 300             | ms   |
| TX_FAULT from Fault to Assertion             | t_fault                |      |         | 100             | us   |
| TX_Disable Time to Start Reset               | t_reset                | 10   |         |                 | us   |
| Receiver Loss of Signal Assert Time          | T <sub>A</sub> ,RX_LOS |      |         | 100             | us   |
| Receiver Loss of Signal Deassert Time        | T <sub>d</sub> ,RX_LOS |      |         | 100             | us   |
| Rate-Select Chage Time                       | t_ratesel              |      |         | 10              | us   |
| Serial ID Clock Time                         | t_serial-clock         |      | 100     | 400             | kHz  |
| MOD_DEF (0:2)-High                           | VH                     | 2    |         | V <sub>cc</sub> | V    |
| MOD_DEF (0:2)-Low                            | VL                     |      |         | 0.8             | V    |

## ■ Pin Assignment:



## ■ Pin Function Definitions

| PIN # | Name       | Function                                                                                                                         | Notes |
|-------|------------|----------------------------------------------------------------------------------------------------------------------------------|-------|
| 1     | VeeT       | Module transmitter ground                                                                                                        | 1     |
| 2     | Tx Fault   | Module transmitter fault                                                                                                         | 2     |
| 3     | Tx Disable | Transmitter Disable; Turns off transmitter laser output                                                                          | 3     |
| 4     | SDL        | 2 wire serial interface data input/output (SDA)                                                                                  |       |
| 5     | SCL        | 2 wire serial interface clock input (SCL)                                                                                        |       |
| 6     | MOD-ABS    | Module Absent, connect to VeeR or VeeT in the module                                                                             | 2     |
| 7     | RS0        | Rate select0, optionally control SFP28 receiver. When high, enable CDR for 24.33 or 25.78 Gb/s; when low, input low data rate    | 5     |
| 8     | LOS        | Receiver Loss of Signal Indication                                                                                               | 4     |
| 9     | RS1        | Rate select0, optionally control SFP28 transmitter. When high, enable CDR for 24.33 or 25.78 Gb/s; when low, input low data rate | 5     |
| 10    | VeeR       | Module receiver ground                                                                                                           | 1     |
| 11    | VeeR       | Module receiver ground                                                                                                           | 1     |
| 12    | RD-        | Receiver inverted data out put                                                                                                   |       |
| 13    | RD+        | Receiver non-inverted data out put                                                                                               |       |
| 14    | VeeR       | Module receiver ground                                                                                                           | 1     |
| 15    | VccR       | Module receiver 3.3V supply                                                                                                      |       |
| 16    | VccT       | Module transmitter 3.3V supply                                                                                                   |       |
| 17    | VeeT       | Module transmitter ground                                                                                                        | 1     |
| 18    | TD+        | Transmitter inverted data input                                                                                                  |       |
| 19    | TD-        | Transmitter non-inverted data input                                                                                              |       |
| 20    | VeeT       | Module transmitter ground                                                                                                        | 1     |

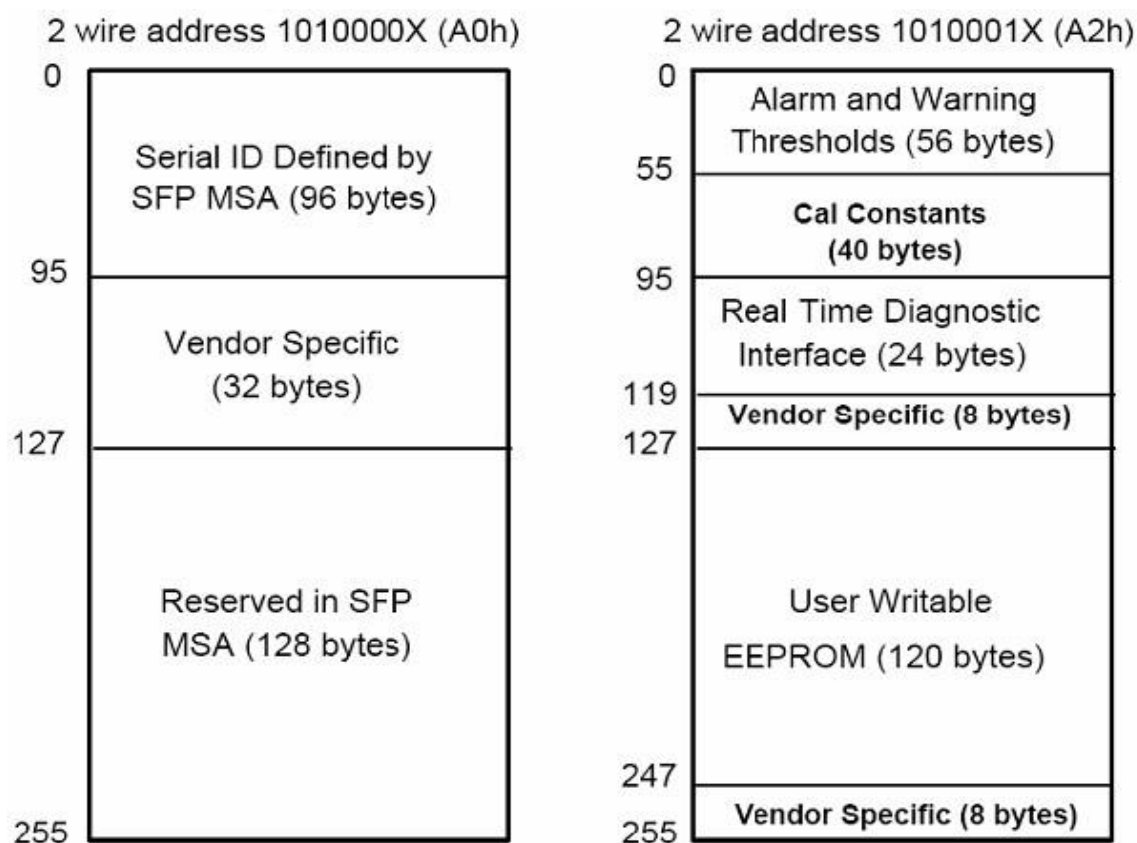
### Note:

1. The module ground pins shall be isolated from the module case.
2. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
3. This pin shall be pulled up with 4.7K-10Kohms to VccT in the module.
4. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
5. Default CDR enable, data rate 25G

## ■ 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. The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (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    | 25G SR                                                                                                |
| 11                        | 1             | Encoding       | 64B/66B                                                                                               |
| 12                        | 1             | BR, Nominal    | Nominal baud rate, unit of 100Mbps                                                                    |
| 13-14                     | 2             | Reserved       | (0000h)                                                                                               |
| 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                                                                                           |
| 56-59                     | 4             | Vendor rev     | Revision level for part number                                                                        |
| 60-62                     | 3             | 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                                                                               |
| 92-94                     | 3             | Reserved       |                                                                                                       |
| 95                        | 1             | CCEX           | Check code for the extended ID Fields (addresses 64 to 94)                                            |
| Vendor Specific ID Fields |               |                |                                                                                                       |
| 96-127                    | 32            | Readable       |                                                                                                       |

|         |     |          |                       |
|---------|-----|----------|-----------------------|
| 128-255 | 128 | Reserved | Reserved for SFF-8079 |
|---------|-----|----------|-----------------------|

## ■ Digital Diagnostic Monitor Characteristics

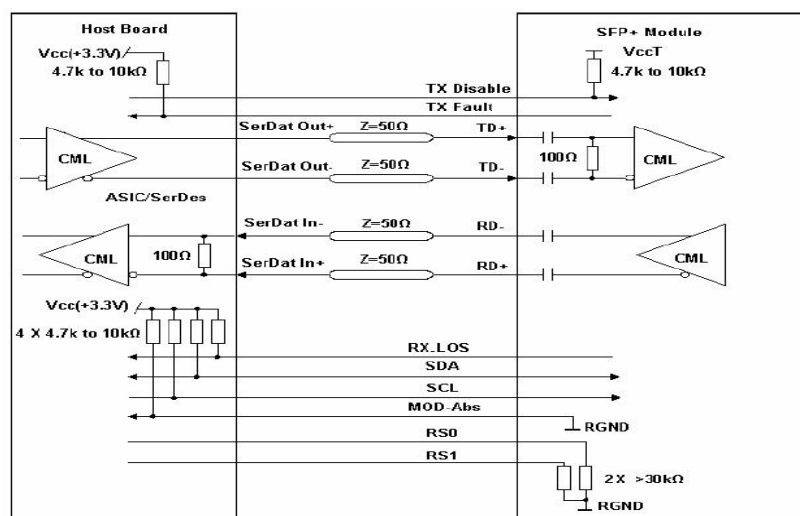
| Parameter                        | Range      | Accuracy | Unit | Calibration |
|----------------------------------|------------|----------|------|-------------|
| Transceiver Internal Temperature | -40 to +85 | ±3.0     | °C   | internal    |
| VCC3 Internal Supply Voltage     | 3.0 to 3.6 | ±5.0%    | mA   | internal    |
| Laser Bias Current               | 0 to 20    | ±10%     | mA   | internal    |
| Tx Output Power                  | -8.0 to 3  | ±3.0     | dBm  | internal    |
| Rx Input Power                   | -14 to 0   | ±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).

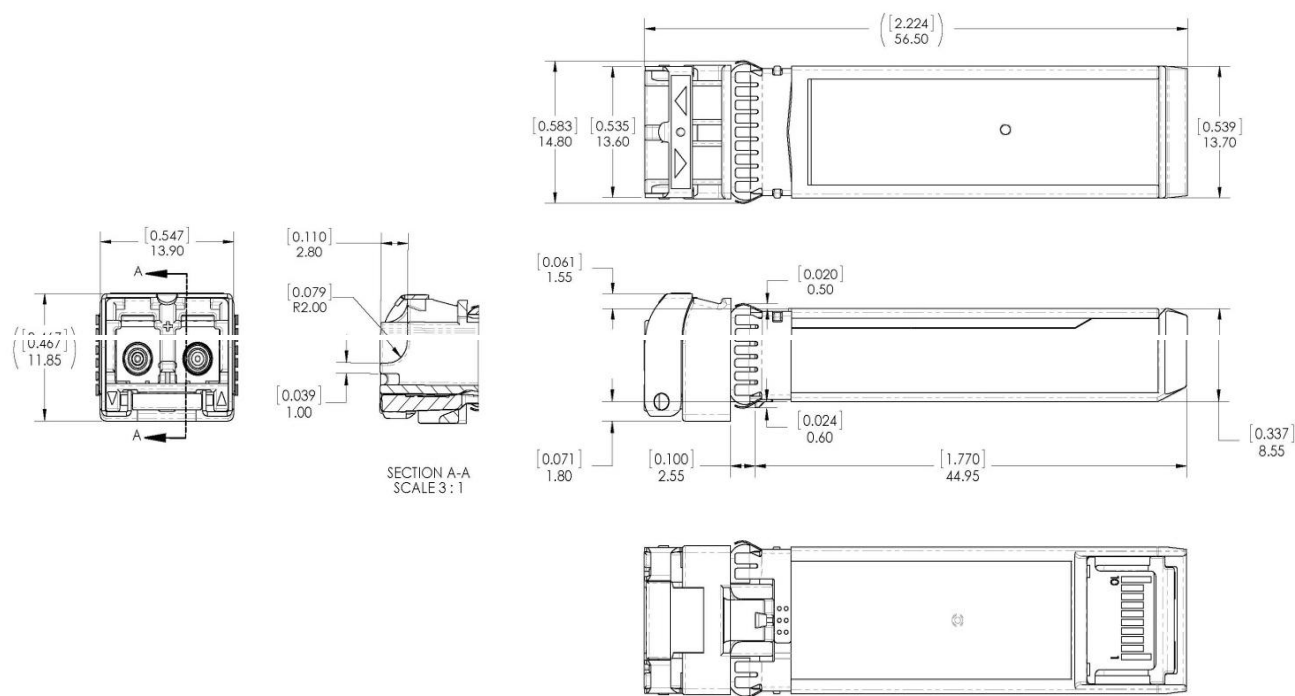
|                                                           |                                                                    |                                        |
|-----------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------|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



## Recommended High-speed Interface Circuit

### ■ Mechanical Dimensions



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