

EOLP-1380-10/20

**1310nm SFP+ single-Mode Transceiver, With Diagnostic Monitoring
Fiber Channel /CPRI/OBSAI
Duplex SFP+ Transceiver, RoHS 6 Compliant**

Features

- ◆ Operating data rate up to 8.5Gbps
- ◆ 1310nm DFB-LD Transmitter
- ◆ Distance up to 20km
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Duplex LC Connector Interface
- ◆ Hot Pluggable
- ◆ Compliant with MSA SFP+ Specification SFF-8431
- ◆ Compliant with 8.5G FC-PI-4 800-SM-LC-L FC standard
- ◆ Compliant with 4.25G FC-PI-4 400-SM-LC-L FC standard
- ◆ Compliant with 2.125G FC-PI-4 200-SM-LC-L FC standard
- ◆ Compliant with 1.0625G FC-PI-4 100-SM-LC-L FC standard
- ◆ Operating Case Temperature
Standard: 0°C~+70°C
Industrial:-40°C~+85°C



Applications

- ◆ 1000 Base-LX Ethernet
- ◆ 8XFC at 8.5Gbps
- ◆ 4XFC at 4.25Gbps
- ◆ 2XFC at 2.125Gbps
- ◆ 1xFC at 1.0625Gbps
- ◆ OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- ◆ CPRI rates 7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- ◆ Other optical links

Ordering information

| Part No. | Data Rate | Laser | Fiber Type | Distance | Optical Interface | Temp. | DDMI |
|---------------------------------|----------------------|------------|------------|----------|-------------------|------------|------|
| EOLP-1380-10* ^{Note1} | 0.614Gbps to 8.5Gbps | 1310nm DFB | SMF | 10km | LC | Standard | YES |
| EOLP-1380-10-I | 0.614Gbps to 8.5Gbps | 1310nm DFB | SMF | 10km | LC | Industrial | YES |
| 'EOLP-1380-20* ^{Note1} | 0.614Gbps to 8.5Gbps | 1310nm DFB | SMF | 20km | LC | Standard | YES |
| 'EOLP-1380-20-I | 0.614Gbps to 8.5Gbps | 1310nm DFB | SMF | 20km | LC | Industrial | YES |

Note1: Standard version.

Regulatory Compliance*

| Product Certificate | Certificate Number | Applicable Standard |
|---------------------|--------------------|----------------------------|
| TUV | R50135086 | EN 60950-1:2006+A11+A1+A12 |
| | | EN 60825-1:2007 |
| | | EN 60825-2:2004+A1+A2 |
| UL | E317337 | UL 60950-1 |
| | | CSA C22.2 No. 60950-1-07 |
| EMC CE | AE 50285865 0001 | EN 55022:2010 |
| | | EN 55024:2010 |
| CB | JPTUV-049251 | IEC 60825-1 |
| | | IEC 60950-1 |
| FCC | WTF14F0514437E | 47 CFR PART 15 OCT., 2013 |
| FDA | 1331340-000 | CDRH 1040.10 |
| ROHS | RHS01G006464 | 2011/65/EU |

*The above certificate number updated to June 2014, because some certificate will be updated every year, such as FCC, FDA and ROHS. For the latest certification information, please check with Eoptolink.

Product Description

The EOLP-1380-XX series single mode transceiver is small form factor pluggable module for serial optical data communications such as X1/X2/X4/X8 Fiber Channel. It is with the SFP+ 20-pin connector to allow hot plug capability.

This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|---------------------|----------|------|----------|------|
| Storage Temperature | T_S | -40 | +85 | °C |
| Supply Voltage | V_{CC} | -0.5 | 3.6 | V |
| Input Voltage | V_{in} | -0.5 | V_{CC} | V |
| Output Current | I_o | - | 50 | mA |

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|----------------------------|----------|------------|---------|------|------|
| Operating Case Temperature | T_C | Standard | 0 | +70 | °C |
| | | Industrial | -40 | +85 | |
| Power Supply Voltage | V_{CC} | 3.15 | 3.3 | 3.45 | V |

| | | | | | |
|----------------------|-------------|-------|--|-----|------|
| Power Supply Current | I_{CC} | | | 300 | mA |
| Surge Current | I_{Surge} | | | +30 | mA |
| Baud Rate | | 0.614 | | 8.5 | Gbps |

Performance Specifications – Electrical

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|----------------------------------------|------------|------|------|--------------|------|---------------------------------------------|
| Transmitter | | | | | | |
| CML Inputs(Differential) | V_{in} | 150 | | 1200 | mVpp | AC coupled inputs |
| Input AC Common Mode Voltage | | 0 | | 25 | mV | RMS |
| Input Impedance (Differential) | Z_{in} | 85 | 100 | 115 | ohm | $R_{in} > 100 \text{ kohms @ DC}$ |
| Differential Input S-parameter | S_{DD11} | - | - | -10 | dB | |
| Differential to Common Mode Conversion | S_{CD11} | - | - | -10 | dB | |
| Tx_DISABLE Input Voltage – High | | 2.0 | | $V_{CC}+0.3$ | V | |
| Tx_DISABLE Input Voltage – Low | | 0 | | 0.8 | V | |
| Tx_FAULT Output Voltage – High | | 2.0 | | V_{CC} | V | $I_o = 400\mu\text{A}; \text{Host } V_{CC}$ |
| Tx_FAULT Output Voltage – Low | | 0 | | 0.5 | V | $I_o = -4.0\text{mA}$ |
| Receiver | | | | | | |
| CML Outputs (Differential) | V_{out} | 350 | | 700 | mVpp | AC coupled outputs |
| Output AC Common Mode Voltage | | 0 | | 15 | mV | RMS |
| Output Impedance (Differential) | Z_{out} | 90 | 100 | 110 | ohm | |
| Differential Output S-parameter | S_{D22} | - | - | -10 | dB | |
| Rx_LOS Output Voltage – High | | 2.0 | | $V_{CC}+0.3$ | V | $I_o = 400\mu\text{A}; \text{Host } V_{CC}$ |
| Rx_LOS Output Voltage – Low | | 0 | | 0.8 | V | $I_o = -4.0\text{mA}$ |
| MOD_DEF (2:0) | VoH | 2.5 | | | V | With Serial ID |
| | VoL | 0 | | 0.5 | V | |

Performance Specifications – Optical
EOLP-1380-10/ EOLP-1380-10-I

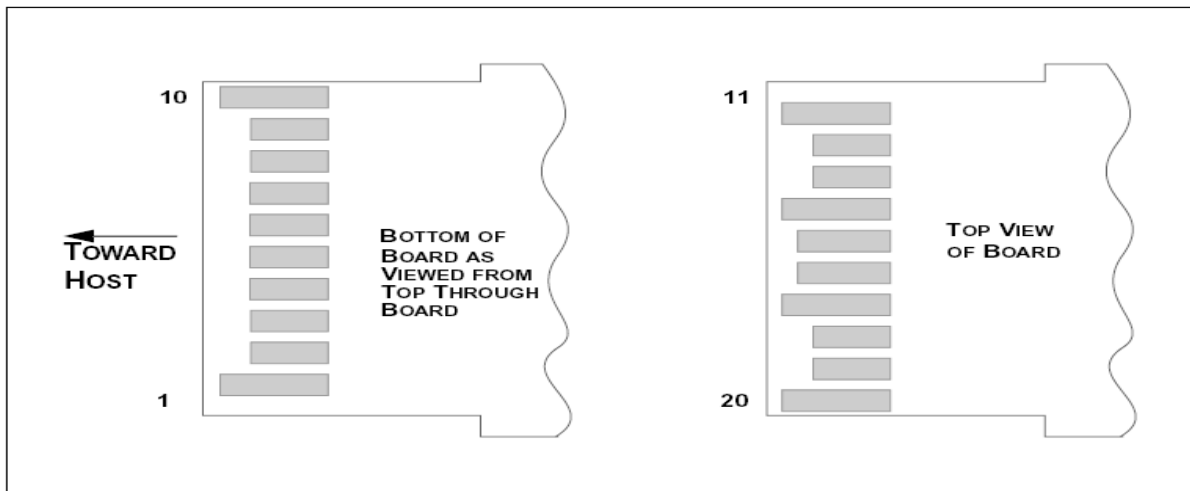
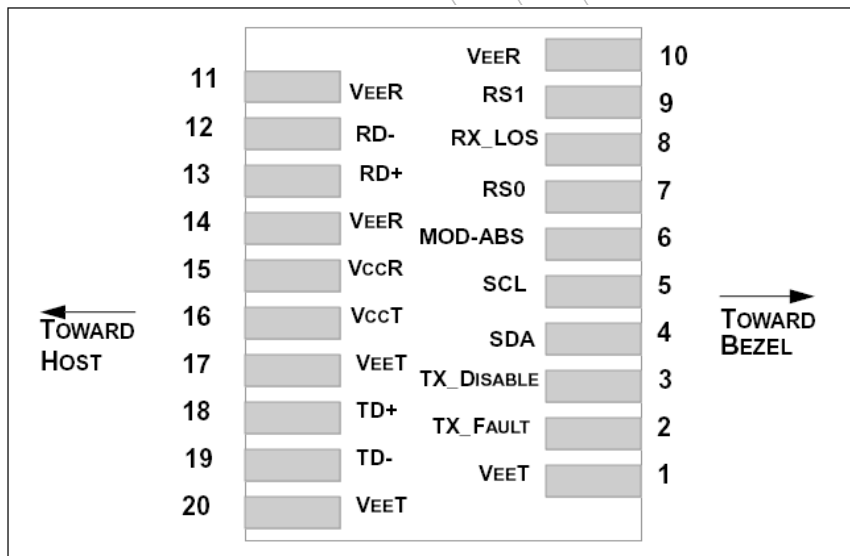
| Parameter | Symbol | Min. | Typical | Max. | Unit |
|-----------------------------------------------|-----------------|-------|---------|-------|---------|
| 9µm Core Diameter SMF Supported Distance | | | | 10 | km |
| Data Rate | | 0.614 | | 8.5 | Gbps |
| Transmitter | | | | | |
| Centre Wavelength | λ_C | 1270 | 1310 | 1355 | nm |
| Spectral Width (-20dB) | $\Delta\lambda$ | | | 1 | nm |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB |
| Average Output Power | P_{out} | -8.2 | | +0.5 | dBm |
| Extinction Ratio | ER | 3.5 | | | dB |
| Average Power of OFF Transmitter | P_{off} | | | -30 | dBm |
| TX Disable Assert Time | t_{off} | - | - | 10 | us |
| TX_DISABLE Negate Time | t_{on} | - | - | 1 | ms |
| TX_BISABLE time to start reset | t_{reset} | 10 | - | - | us |
| Time to initialize, include reset of TX_FAULT | t_{init} | - | - | 300 | ms |
| TX_FAULT from fault to assertion | t_{fault} | - | - | 100 | us |
| Total Jitter | TJ | - | - | 0.28 | UI(p-p) |
| Data Dependant Jitter | DDJ | - | - | 0.1 | UI(p-p) |
| Uncorrelated Jitter | UJ | - | - | 0.023 | RMS |
| Receiver | | | | | |
| Centre Wavelength | λ | 1260 | | 1565 | nm |
| Sensitivity | P_{min} | | | -15 | dBm |
| Receiver Overload | P_{max} | 0.5 | | | dBm |
| Optical Return Loss | ORL | | | -12 | dB |
| LOS De-Assert | LOS_D | | | -17 | dBm |
| LOS Assert | LOS_A | -29 | | | dBm |

EOLP-1380-20/ EOLP-1380-20-I

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|------------------------------------------|-----------------|-------|---------|------|------|
| 9µm Core Diameter SMF Supported Distance | | | | 20 | km |
| Data Rate | | 0.614 | | 8.5 | Gbps |
| Transmitter | | | | | |
| Centre Wavelength | λ_C | 1270 | 1310 | 1355 | nm |
| Spectral Width (-20dB) | $\Delta\lambda$ | | | 1 | nm |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB |
| Average Output Power | P_{out} | -4 | | 0 | dBm |
| Extinction Ratio | ER | 3.5 | | | dB |
| Average Power of OFF Transmitter | P_{off} | | | -30 | dBm |
| TX Disable Assert Time | t_{off} | - | - | 10 | us |
| TX_DISABLE Negate Time | t_{on} | - | - | 1 | ms |

| | | | | | |
|-----------------------------------------------|------------------|------|---|-------|---------|
| TX_BISABLE time to start reset | t_reset | 10 | - | - | us |
| Time to initialize, include reset of TX_FAULT | t_init | - | - | 300 | ms |
| TX_FAULT from fault to assertion | t_fault | - | - | 100 | us |
| Total Jitter | TJ | - | - | 0.28 | UI(p-p) |
| Data Dependant Jitter | DDJ | - | - | 0.1 | UI(p-p) |
| Uncorrelated Jitter | UJ | - | - | 0.023 | RMS |
| Receiver | | | | | |
| Centre Wavelength | λ | 1260 | | 1565 | nm |
| Sensitivity | P _{min} | | | -15 | dBm |
| Receiver Overload | P _{max} | 0.5 | | | dBm |
| Optical Return Loss | ORL | | | -12 | dB |
| LOS De-Assert | LOS _D | | | -17 | dBm |
| LOS Assert | LOS _A | -29 | | | dBm |

SFP+ Transceiver Electrical Pad Layout



Pin Function Definitions

| Pin Num. | Name | FUNCTION | Plug Seq. | Notes |
|----------|------------|------------------------------|-----------|------------------------------------------------------------------------------------------------------------|
| 1 | VeeT | Transmitter Ground | 1 | Note 5 |
| 2 | TX Fault | Transmitter Fault Indication | 3 | Note 1 |
| 3 | TX Disable | Transmitter Disable | 3 | Note 2, Module disables on high or open |
| 4 | SDA | Module Definition 2 | 3 | Data line for Serial ID. |
| 5 | SCL | Module Definition 1 | 3 | Clock line for Serial ID. |
| 6 | MOD-ABS | Module Definition 0 | 3 | Note 3 |
| 7 | RS0 | RX Rate Select (LVTTTL). | 3 | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 8 | LOS | Loss of Signal | 3 | Note 4 |
| 9 | RS1 | TX Rate Select (LVTTTL). | 1 | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 10 | VeeR | Receiver Ground | 1 | Note 5 |
| 11 | VeeR | Receiver Ground | 1 | Note 5 |
| 12 | RD- | Inv. Received Data Out | 3 | Note 6 |
| 13 | RD+ | Received Data Out | 3 | Note 7 |
| 14 | VeeR | Receiver Ground | 1 | Note 5 |
| 15 | VccR | Receiver Power | 2 | 3.3V ± 5%, Note 7 |
| 16 | VccT | Transmitter Power | 2 | 3.3V ± 5%, Note 7 |
| 17 | VeeT | Transmitter Ground | 1 | Note 5 |
| 18 | TD+ | Transmit Data In | 3 | Note 8 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 8 |
| 20 | VeeT | Transmitter Ground | 1 | Note 5 |

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7K – 10 KΩ resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3) Module Absent, connected to VeeT or VeeR in the module.

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and $V_{ccT/R}+0.3V$. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

5) VeeR and VeeT may be internally connected within the SFP+ module.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 300mA. Inductors with DC resistance of less than 1 ohm 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 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.

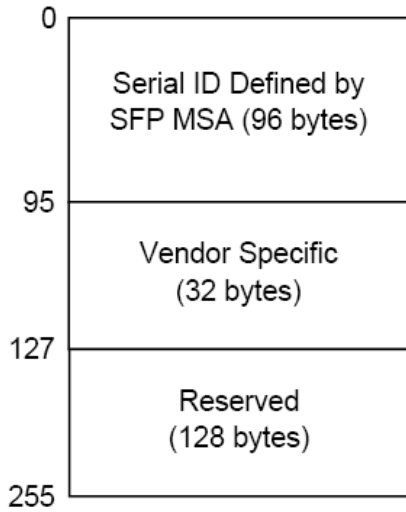
8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

EEPROM

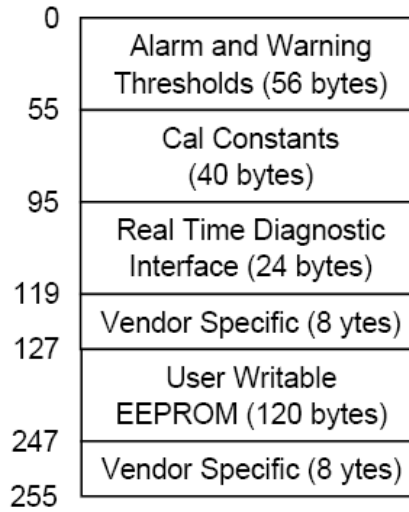
The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 10.2.

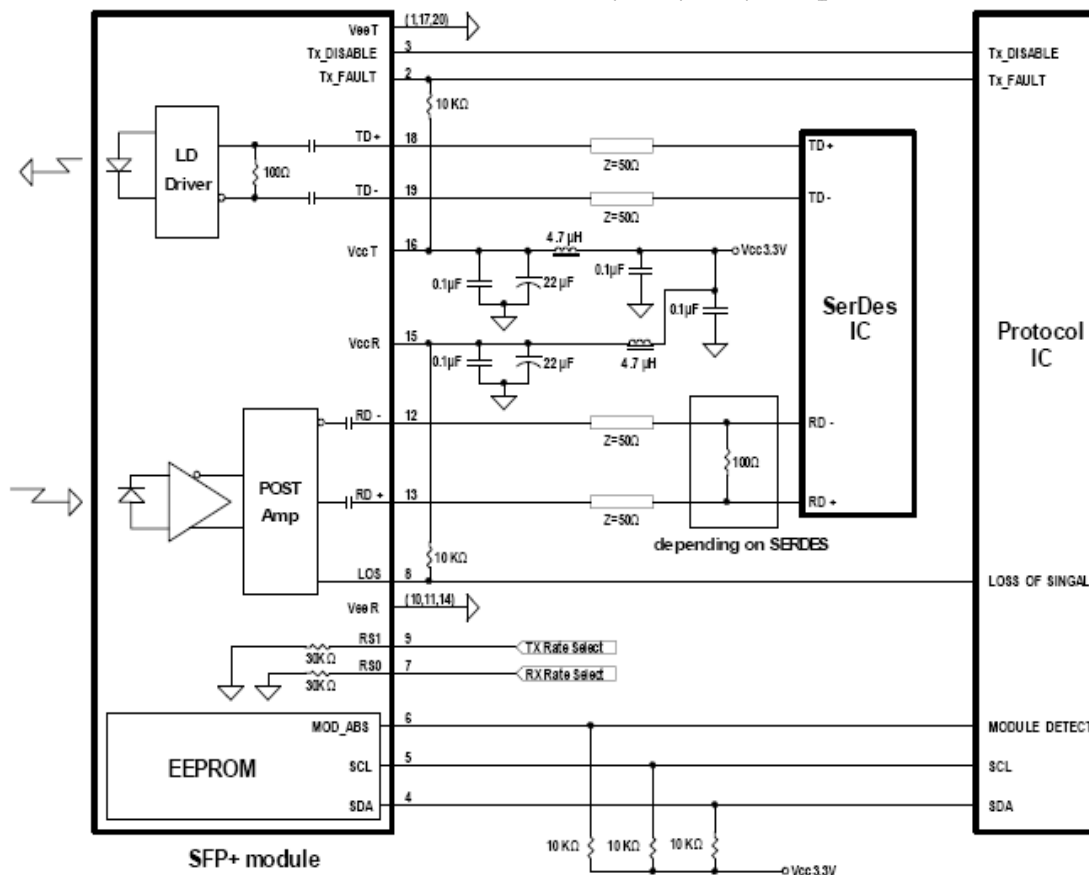
2 wire address 1010000X (A0h)



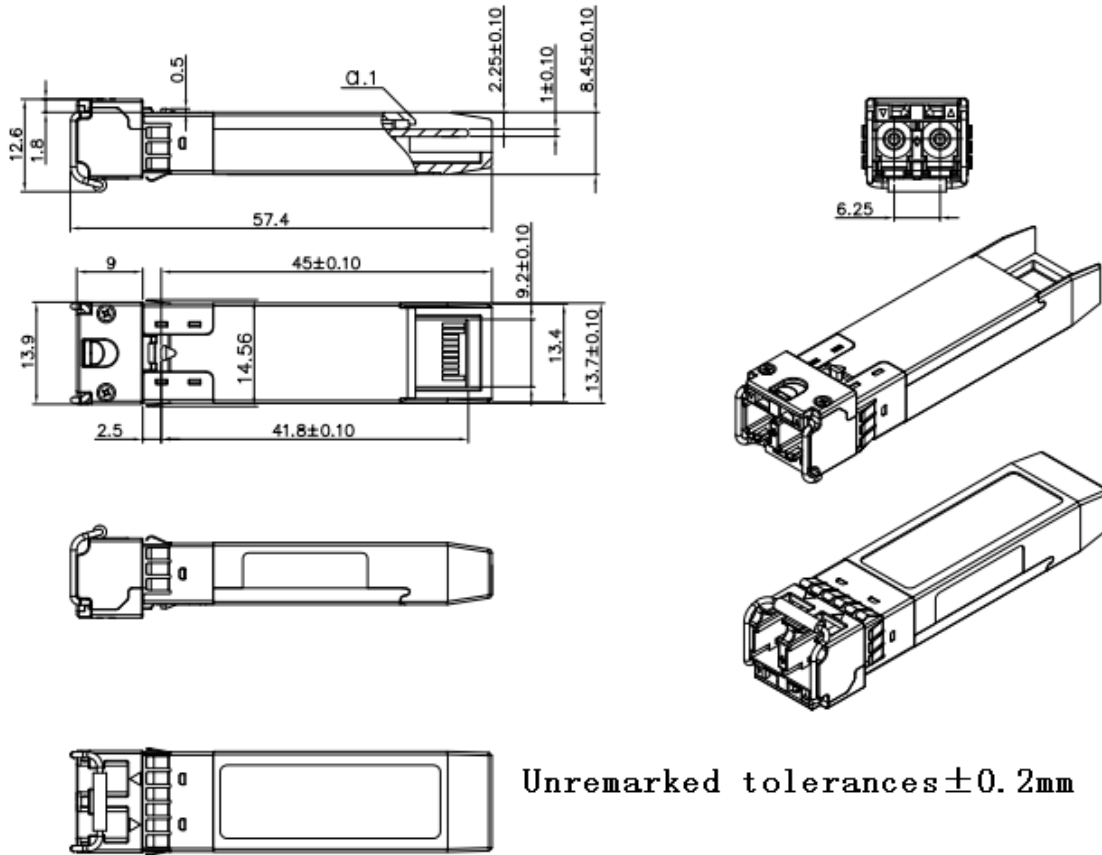
2 wire address 1010001X (A2h)



Recommend Circuit Schematic



Mechanical Specifications



Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

Obtaining Document

You can visit our website:

<http://www.eoptolink.com>

Or contact Eoptolink Technology Inc., Ltd. Listed at the end of the documentation to get the latest document.

Revision History

| Revision | Initiated | Reviewed | Approved | Revision History | Release Date |
|----------|-------------|----------|----------|-------------------------|--------------|
| V2.a | Arvin | Kelly | | Released. | 2011-8-2 |
| V3.a | Alex/Townie | Kelly | | Update spelling mistake | 2011-8-15 |

| | | | | | |
|------|------------|------------|--|-----------------------------------------------------------------------------------------------------------------------------------|---------------|
| V3.b | Eason/Abby | Kelly/Fing | | Update Pout of EOLP-1680-10 and LOSA&LOSD | Jan 6, 2014 |
| V3.c | Angela | Kelly/Fing | | Add CPRI/OBSAI application and extended temperature -20~85°C. Update regulatory compliance and the tolerances of mechanical spec. | Mar 02,2015 |
| V3.d | Angela | Kelly/Vina | | Update the tolerances of mechanical spec. | April 09,2015 |
| V3.e | Angela | Kelly/Fing | | Update temperature to industrial. | July 06,2015 |

Notice:

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