

## EOLS-BI1X03-2MXX Series

**Multi-Mode 155Mbps**

**SC/LC Single-Fiber SFP Transceiver**

**RoHS6 Compliant**

### Features

- ◆ Operating data rate up to 155Mbps
- ◆ A type: 1310nm FP Tx/1550nm Rx  
B type: 1550nm FP Tx/1310nm Rx
- ◆ Distance Up to 2 km
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Hot Pluggable
- ◆ Operating Case Temperature  
Standard: 0~+70  
Industrial: -40~+85
- ◆ Compliant with MSA SFP Specification
- ◆ Digital diagnostic monitor interface
- ◆ Compatible with SFF-8472



### Applications

- ◆ WDM Fast Ethernet Links
- ◆ SONET/SDH Equipment Interconnect
- ◆ Fiber Channel Links
- ◆ Other Optical Transmission Systems

### Ordering Information

Part No.	Data Rate	Fiber	Distance <sup>*(note2)</sup>	Temperature	DDM
EOLS-BI1303-2M <sup>*(note1)</sup>	155Mbps	MMF	2km	Standard	NO
EOLS-BI1303-2MI	155Mbps	MMF	2km	Industrial	NO
EOLS-BI1503-2MD <sup>*(note1)</sup>	155Mbps	MMF	2km	Standard	Yes
EOLS-BI1503-2MDI	155Mbps	MMF	2km	Industrial	Yes

Note1: Standard version

Note2: 2km with 50/125μm MMF.

## Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme )
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards <sup>*note3</sup>

Note3: For update of the equipments and strict control of raw materials, EOPTOLINK has the ability to supply the customized products since Jan 1<sup>st</sup>, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Eoptolink's transceivers, because Eoptolink's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other components.

## Product Description

The EOLS-BI1X03-2MX series is small form factor pluggable module for IEEE 802.3ah 100BASE-BX10 and OC-3/STM-1 SONET/SDH single fiber communications by using 1310

nm/1550nm transmitter and 1550nm/1310nm receiver. It is with the SFP 20-pin connector to allow hot plug capability.

The transmitter section uses a multiple quantum well A type/ B type laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated A type/ B type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

The EOLS-BI1X03-2MXD series are designed to be compliant with SFF-8472 SFP.

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	5	95	%

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	
Operating Case Temperature	T <sub>A</sub>	EOLS-BI1303-2MD	0		+70	°C
		EOLS-BI1303-2MDI	-40		+85	
		EOLS-BI1503-2MD	0		+70	
		EOLS-BI1503-2MDI	-40		+85	
Power Supply Voltage	Vcc	3.15	3.3	3.45	V	
Power Supply Current	Icc			360	mA	
Date Rate			155		Mbps	

## Performance Specifications - Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
LVPECL Inputs(Differential)	Vin	400		2000	mVpp	AC coupled inputs <sup>*(note4)</sup>
Input Impedance (Differential)	Zin	85	100	115	ohm	Rin > 100 kohm @ DC
TX_Dis	Disable	2		Vcc+0.3	V	
	Enable	0		0.8		
TX_FAULT	Fault	Vcc-0.5		Vcc+0.3	V	
	Normal	0		0.8		
<b>Receiver</b>						
LVPECL Outputs (Differential)	Vout	400	800	2000	mVpp	AC coupled outputs <sup>*(note4)</sup>
Output Impedance (Differential)	Zout	85	100	115	ohm	

RX_LOS	LOS		2		V <sub>cc</sub> +0.3	V	
	Normal		0		0.8	V	
MOD_DEF ( 0:2 )		VoH	2.5			V	With Serial ID
		VoL	0		0.5	V	

## Performance Specifications – Optical

### (1310nm FP and PIN, 2km)

Parameter	Symbol	Min.	Typical	Max.	Unit
MMF	L		2		km
Data Rate			155		Mbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_C$	1260	1310	1360	nm
Spectral Width (RMS)	$\Delta\lambda$			4	nm
Average Output Power <sup>*(note5)</sup>	P <sub>out</sub>	-15		-8	dBm
Extinction Ratio <sup>*(note6)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Total Jitter	TJ			1.0	ns
Output Optical Eye <sup>*(note6)</sup>	IUT-T G.957 Compliant <sup>*(note8)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	us
TX Disable Asserted	P <sub>out</sub>			-45	dBm
<b>Receiver</b>					
Center Wavelength	$\lambda$	1500	1550	1580	nm
Receiver Sensitivity <sup>*(note7)</sup>	P <sub>min</sub>			-30	dBm
Return Loss		12			dB
LOS De-Assert	LOSD			-32	dBm
LOS Assert	LOSA	-40			dBm
LOS Hysteresis <sup>*(note9)</sup>		1		3	dB
Overload	P <sub>max</sub>	-8			dBm

### (1550nm FP and PIN, 2km)

Parameter	Symbol	Min.	Typical	Max.	Unit
MMF	L		2		km
Data Rate			125		Mbps
<b>Transmitter</b>					
Center Wavelength	$\lambda_C$	1500	1550	1580	nm
Spectral Width (RMS)	$\Delta\lambda$			4	nm
Average Output Power <sup>*(note5)</sup>	P <sub>out</sub>	-15		-8	dBm
Extinction Ratio <sup>*(note6)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Total Jitter	TJ			1.0	ns
Output Optical Eye <sup>*(note6)</sup>	IUT-T G.957 Compliant <sup>*(note8)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	us
TX Disable Asserted	P <sub>out</sub>			-45	dBm

Receiver				
Center Wavelength	$\lambda$	1260	1360	nm
Receiver Sensitivity <sup>*(note7)</sup>	Pmin		-30	dBm
Return Loss		12		dB
LOS De-Assert	LOSD		-32	dBm
LOS Assert	LOSA	-40		dBm
LOS Hysteresis <sup>*(note9)</sup>		1	3	dB
Overload	Pmax	-8		dBm

Note4: LVPECL logic, internally AC coupled.

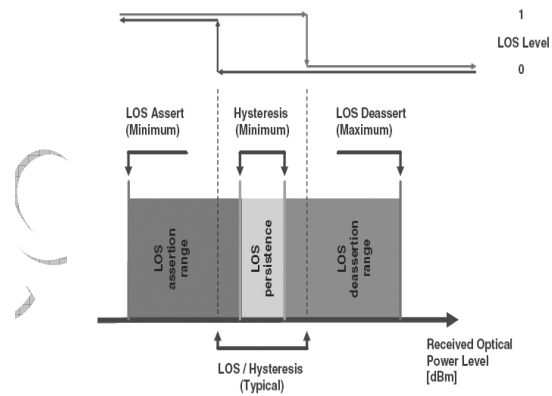
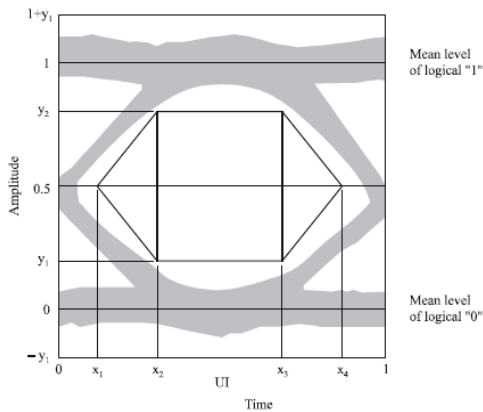
Note5: Output power is measured by coupling into a 62.5/125 mm multi-mode fiber.

Note6: Filtered, measured with a PRBS  $2^{23}-1$  test pattern @155Mbps.

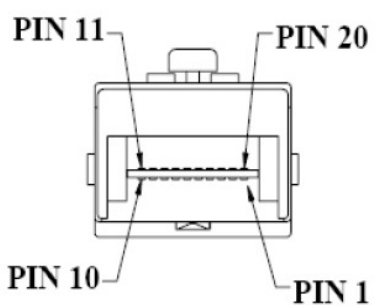
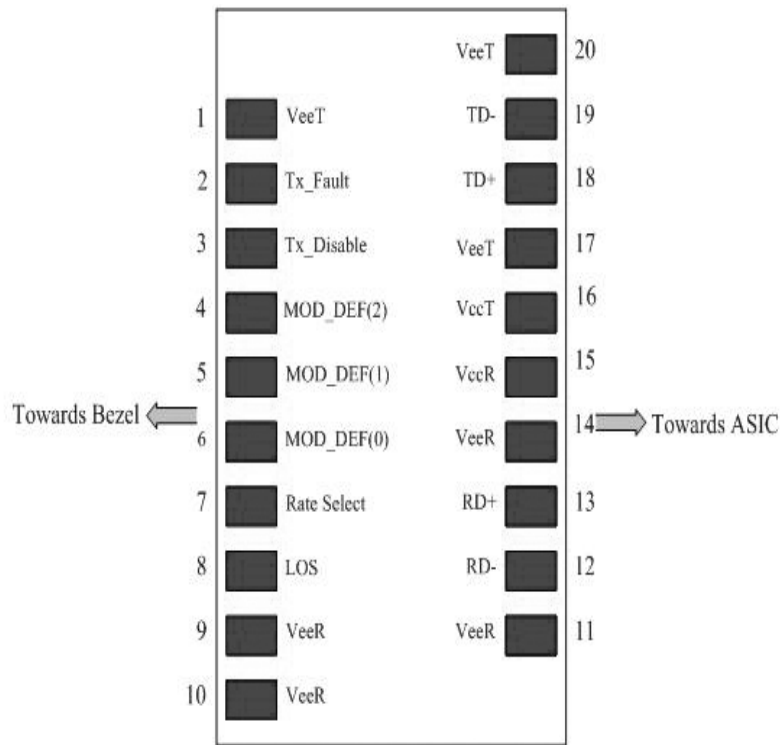
Note7: Minimum average optical power is measured by coupling into a 62.5/125 mm multi-mode fiber; the BER is less than  $1E-10$ , measured with a  $2^{23}-1$  PRBS and ER=9 dB.

Note8: Eye Pattern Mask

Note9: LOS Hysteresis



## 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	MOD-DEF2	Module Definition 2	3	Note 3, Data line for Serial ID.
5	MOD-DEF1	Module Definition 1	3	Note 3, Clock line for Serial ID.

6	MOD-DEF0	Module Definition 0	3	Note 3, Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	Note 5
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	3.3 ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3 ± 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 — 10K2 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 4.7 — 10K2 resistors. 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) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K — 10K2resistor on the host board. The pull-up voltage shall be VccT or VccR (see Section IV for further details). Mod-Def 0 is grounded by the module to indicate that the module is present Mod-Def 1 is the clock line of two wire serial interface for serial ID Mod-Def 2 is the data line of two wire serial interface for serial ID
- 4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K — 10K2 resistor. Pull up voltage between 2.0V and VccT, 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 SEP module.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 1002 differential lines which should be terminated with 1002 (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  $\pm 5\%$  at the SEP 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 SEP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SEP 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 SEP transceiver module.

8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 1002 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 writing 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.

## EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X(A0H). Memory Contents of Serial ID are shown in Table 1. The following information is according to EOLS-BI1303-2MI.

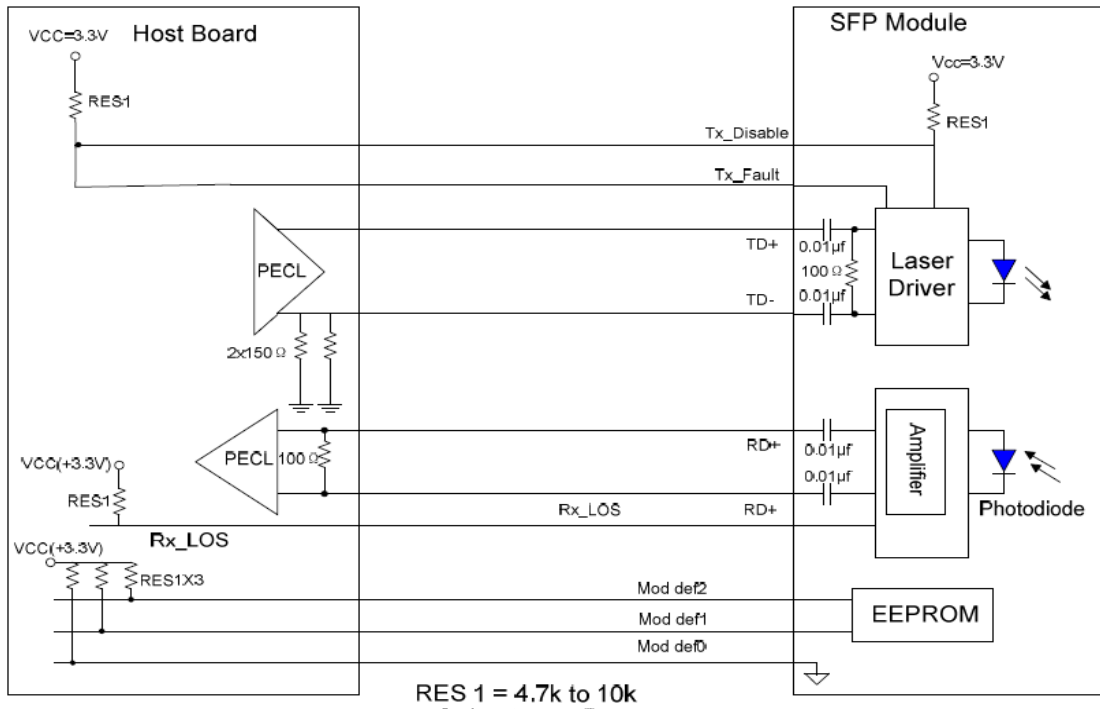
**Table 1 Serial ID Memory Contents**

Addr.	Size (Bytes)	Name of Field	Hex	Description
<b>BASE ID FIELDS</b>				
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	SFP function is defined by serial ID only
2	1	Connector	07	LC Connector
3-10	8	Transceiver	00 00 00 20 00 00 00 00	Transmitter Code
11	1	Encoding	02	4B5B
12	1	BR, Nominal	01	100Mbps
13	1	Reserved	00	
14	1	Length (9 $\mu$ m)km	00	Transceiver transmit

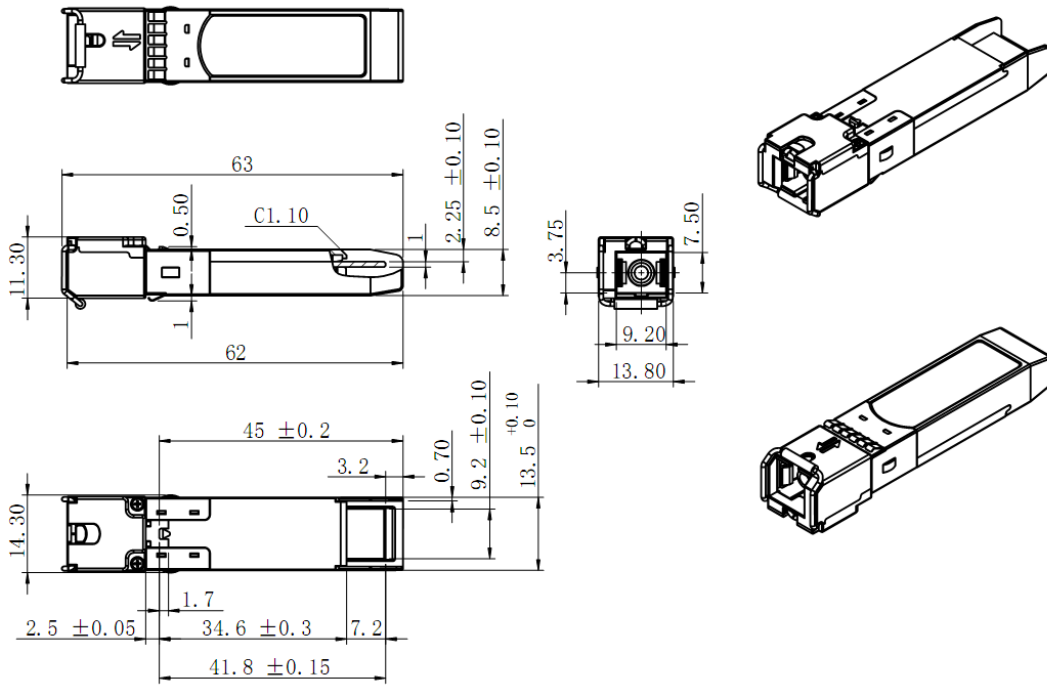
15	1	Length(9μm)100m	00	distance
16	1	Length (50μm) 10m	C8	
17	1	Length(62.5μm)10m	37	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	45 4F 50 54 4F 4C 49 4E 4B 20 49 4E 43 20 20 20	ELOPTOLINK INC (ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	45 4F 4C 53 2D 42 49 31 33 30 33 2D 32 4D 49 20	EOLS-BI1303-2MI
56-59	4	Vendor rev	31 2E 30 20	1.0
60-61	2	Wavelength	05 1E	1310nm
62	1	Reserved	00	
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
<b>EXTENDED ID FIELDS</b>				
64-65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR,max	00	
67	1	BR,min	00	
68-83	16	Vendor SN	XX XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example "B000822".
84-91	8	Date code	XX XX XX XX XX XX XX XX	Manufactory date code. For example "080405".
92	1	Diagnostic Monitoring Type	00	Digital diagnostic monitoring implemented
93	1	Enhanced Options	00	Optional flags
94	1	SFF_8472 Compliance	00	01 for diagnostics (Rev9.3 SFF-8472).
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field.
<b>VENDOR SPECIFIC ID FIELDS</b>				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	

The "XX" byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

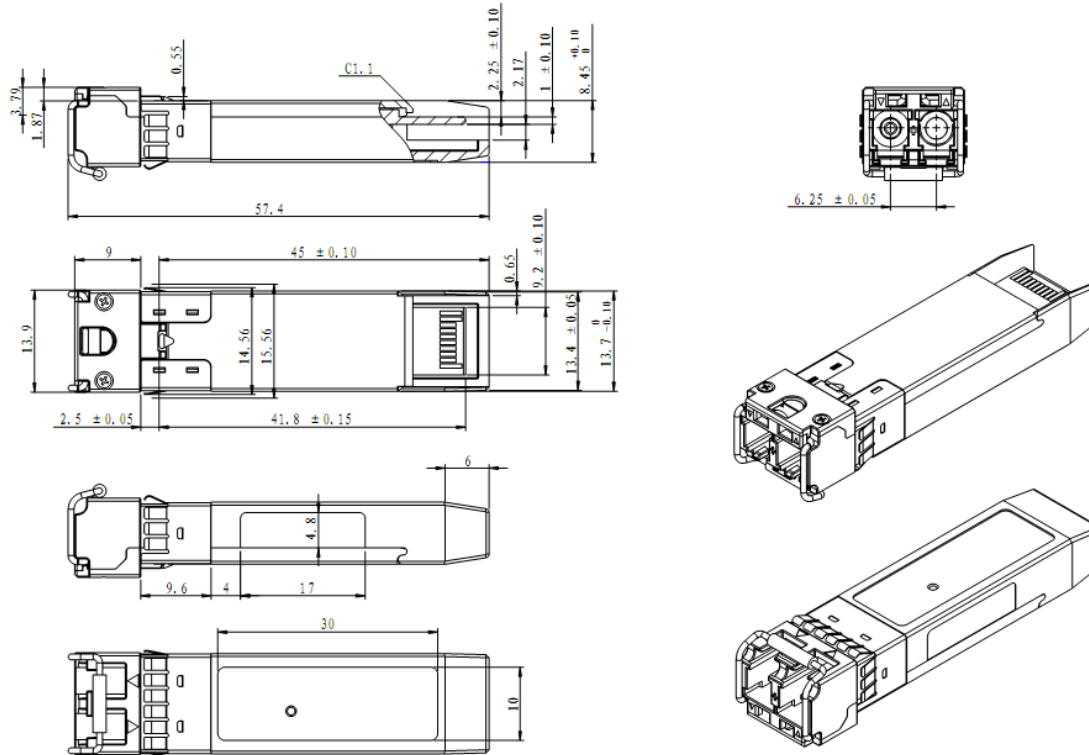
## Recommend Circuit Schematic



## Mechanical Specifications

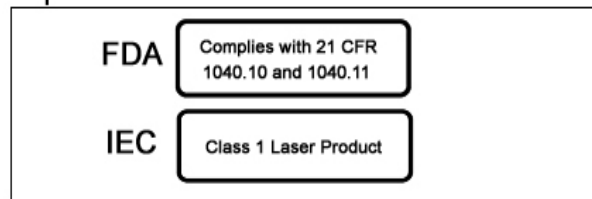


SC Connector



LC Connector

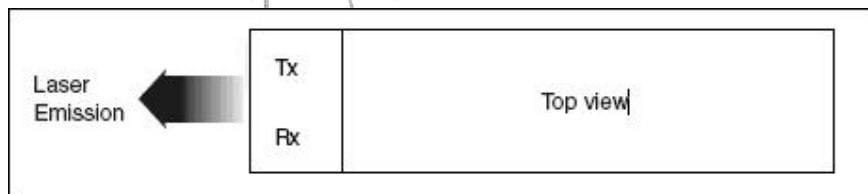
## Class 1 Labels



## Laser Emission Data

Wavelength	1310nm
Total output power (as defined by FDA: 7mm aperture at 20cm distance)	<0.195mW
Total output power (as defined by IEC: 7mm aperture at 10cm distance)	<15.6mW
Beam divergence	12.5°
Wavelength	1550nm
Total output power (as defined by FDA: 7mm aperture at 20cm distance)	<0.195mW
Total output power (as defined by IEC: 7mm aperture at 10cm distance)	<15.6mW
Beam divergence	12.5°

## Laser Emission



## 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 documents.

## Revision History

Revision	Initiated	Reviewed	Approved	Revision History	Release Date
V2.a	Jacky.Cheng	Philo.Chen		Released.	July 14, 2009
V2.b	Kelly			Update the mechanical	Jan 23, 2010

				spec.	
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