EOLS-1506-XX Series

**Single-Mode 1550nm 100~622Mbps SDH/SONET
Duplex SFP Transceiver
RoHS6 Compliant**

Features

◆ Operating Data Rate up to 100~622Mbps

◆ 1550nm DFB Laser Transmitter

◆ 40km with 9/125 μm SMF

   80km with 9/125 μm SMF

   100km with 9/125 μm SMF

   120km with 9/125 μm SMF

   160km with 9/125 μm SMF

◆ Single 3.3V Power Supply and LVTTL Control

   Logic Interface

◆ Hot-Pluggable SFP Footprint Duplex LC

   Connector Interface

◆ Class 1 FDA and IEC60825-1 Laser Safety
Compliant

◆ Operating Case Temperature

   Standard: 0℃~+70℃

   Industrial: -40℃~85℃

Applications

◆ Fast Ethernet

◆ SDH/SONET

◆ ATM Switches and Other Optical

   Links

◆ Other Optical Links

Ordering Information

Part No.	Data Rate	Fiber	Distance*(note2)	Interface	Temp.	DDMI
EOLS-1506-40*(note1)	100~622Mbps	SMF	40km	LC	Standard	NO
EOLS-1506-40-I	100~622Mbps	SMF	40km	LC	Industrial	NO
EOLS-1506-40-D	100~622Mbps	SMF	40km	LC	Standard	YES
EOLS-1506-40-DI	100~622Mbps	SMF	40km	LC	Industrial	YES
EOLS-1506-80*(note1)	100~622Mbps	SMF	80km	LC	Standard	NO
EOLS-1506-80-I	100~622Mbps	SMF	80km	LC	Industrial	NO
EOLS-1506-80-D	100~622Mbps	SMF	80km	LC	Standard	YES
EOLS-1506-80-DI	100~622Mbps	SMF	80km	LC	Industrial	YES

EOLS-1506-A *(note1)	100~622Mbps	SMF	100km	LC	Standard	NO
EOLS-1506-A-I	100~622Mbps	SMF	100km	LC	Industrial	NO
EOLS-1506-A-D	100~622Mbps	SMF	100km	LC	Standard	YES
EOLS-1506-A-DI	100~622Mbps	SMF	100km	LC	Industrial	YES
EOLS-1506-B-D	100~622Mbps	SMF	120km	LC	Standard	YES
EOLS-1506-B-DI	100~622Mbps	SMF	120km	LC	Industrial	YES
EOLS-1506-C-D	100~622Mbps	SMF	160km	LC	Standard	YES
EOLS-1506-C-DI	100~622Mbps	SMF	160km	LC	Industrial	YES

Note1: Standard version

Note2: With 9/125μm SMF

Regulatory Compliance[*]

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12+A2
		EN 60825-1:2014
		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
FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	/	CDRH 1040.10
ROHS	/	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 EOLS-1506-X series single-mode transceivers are small form factor pluggable module for bi-directional serial optical data communications such as Fast Ethernet and OC-3, OC-12/STM-4 SDH/SONET. 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 1550nm.

The transmitter section uses a multiple quantum well 1550nm laser which 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.

The EOLS-1506-X-D series are designed to be compliant with SFF-8472 MSA.

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		-	95	%

*Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	EOLS-1506-X	0		+70	°C
		EOLS-1506-XI	-40		+85	
Power Supply Voltage	Vcc		3.15	3.3	3.45	V
Power Supply Current	Icc				300	mA
Date Rate				100~622		Mbps

Performance Specifications - Electrical

Parameter		Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter							
LVPECL Inputs(Differential)		Vin	400		2000	mVpp	AC coupled inputs*(note5)
Input Impedance (Differential)		Zin	85	100	115	ohms	Rin > 100 kohms @ DC
TX Disable	Disable		2		Vcc+0.3	V	
	Enable		0		0.8		
TX FAULT	Fault		2		Vcc+0.3	V	
	Normal		0		0.5		
Receiver							
LVPECL Outputs (Differential)		Vout	400		2000	mVpp	AC coupled outputs*(note5)
Output Impedance (Differential)		Zout	85	100	115	ohms	
RX_LOS	LOS		2		Vcc+0.3	V	
	Normal		0		0.8	V	
MOD_DEF (2:0)	VoH	2.5				V	With Serial ID
	VoL	0			0.5	V	

Optical and Electrical Characteristics

(1550nm DFB and PIN, 40km)

Parameter		Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF		L		40		km
Data Rate				100~622		Mbps
Transmitter						
Center Wavelength		λC	1520	1550	1580	nm
Spectral Width (-20dB)		Δλ			1	nm
Average Output Power*[note3]		Pout	-5		0	dBm
Extinction Ratio*[note4]		ER	10			dB
Rise/Fall Time(20%～80%)		tr/tf			1.2	ns
Output Optical Eye*[note4]		IUT-T G.957 Compliant*[note7]				
TX Disable Assert Time		t_off			10	us
Receiver						
Centre Wavelength		λC	1260		1600	nm
Receiver Sensitivity*[note6]	100M	Pmin			-35	dBm
	OC-3				-34	dBm
	OC-12				-28	dBm
Receiver Overload		Pmax	-8			dBm
LOS De-Assert		LOSD			-29	dBm
LOS Assert		LOSA	-42			dBm
LOS Hysteresis*[note8]			0.5			dB

(1550nm DFB and PIN, 80km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L		80		km
Data Rate			100~622		Mbps
Transmitter					
Center Wavelength	λC	1520	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Average Output Power*[note3]	Pout	-3		2	dBm
Extinction Ratio*[note4]	ER	10			dB
Rise/Fall Time(20%～80%)	tr/tf			1.2	ns
Output Optical Eye*[note4]	IUT-T G.957 Compliant*[note7]				
TX Disable Assert Time	t_off			10	us
Receiver					
Centre Wavelength	λC	1260		1600	nm

Receiver Sensitivity*(note6)	100M	Pmin			-35	dBm
	OC-3				-34	dBm
	OC-12				-28	dBm
Receiver Overload		Pmax	-8			dBm
LOS De-Assert		LOSD			-29	dBm
LOS Assert		LOSA	-42			dBm
LOS Hysteresis*(note8)			0.5			dB

(1550nm DFB and PIN, 100km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		100		km
Data Rate			100~622		Mbps
Transmitter					
Center Wavelength	λC	1520	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Average Output Power*(note3)	Pout	0		5	dBm
Extinction Ratio*(note4)	ER	10			dB
Rise/Fall Time(20%～80%)	tr/tf			1.2	ns
Output Optical Eye*(note4)	IUT-T G.957 Compliant*(note7)				
TX Disable Assert Time	t_off			10	us
Receiver					
Centre Wavelength	λC	1260		1600	nm

Receiver Sensitivity*(note6)	100M	Pmin			-36	dBm
	OC-3				-35	dBm
	OC-12				-30	dBm
Receiver Overload		Pmax	-8			dBm
LOS De-Assert		LOSD			-31	dBm
LOS Assert		LOSA	-45			dBm
LOS Hysteresis*(note8)			0.5			dB

(1550nm DFB and PIN, 120km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		120		km
Data Rate			100~622		Mbps
Transmitter					
Center Wavelength	λC	1520	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Average Output Power*(note3)	Pout	2		7	dBm
Extinction Ratio*(note4)	ER	10			dB

Rise/Fall Time(20%～80%)	tr/tf			1.2	ns
Output Optical Eye*(note4)	IUT-T G.957 Compliant*(note7)				
TX Disable Assert Time	t_off			10	us
Receiver					
Centre Wavelength	λC	1260		1600	nm
Receiver Sensitivity*(note6) 100M	Pmin			-34	dBm
Receiver Sensitivity*(note6) OC-3	Pmin			-33	dBm
Receiver Sensitivity*(note6) OC-12				-32	dBm
Receiver Overload	Pmax	-10			dBm
LOS De-Assert	LOSD			-33	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis*(note8)		0.5			dB

(1550nm DFB and APD, 160km)

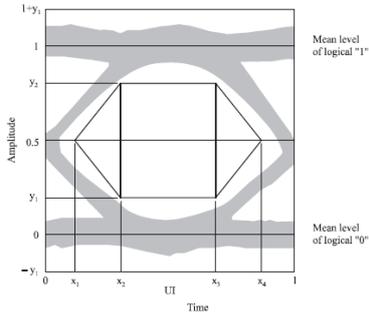| Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF	L		160		km
Data Rate			100~622		Mbps
Transmitter					
Center Wavelength	λC	1520	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Average Output Power*(note3)	Pout	1		5	dBm
Extinction Ratio*(note4)	ER	10			dB
Rise/Fall Time(20%～80%)	tr/tf			1.2	ns
Output Optical Eye*(note4)	IUT-T G.957 Compliant*(note7)				
TX Disable Assert Time	t_off			10	us
Receiver					
Centre Wavelength	λC	1260		1600	nm
Receiver Sensitivity*(note6) 100M	Pmin			-39	dBm
Receiver Sensitivity*(note6) OC-3	Pmin			-38	dBm
Receiver Sensitivity*(note6) OC-12				-37	dBm
Receiver Overload	Pmax	-10			dBm
LOS De-Assert	LOSD			-38	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis*(note8)		0.5			dB

Note3: Output is coupled into a 9/125µm single-mode fiber.

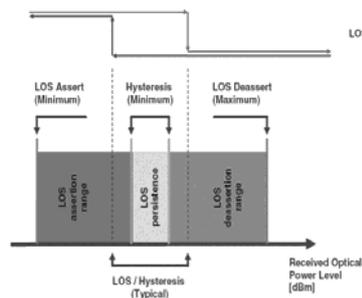Note4: Filtered, measured with a PRBS 2^{23}-1 test pattern @622Mbps

Note5: LVPECL logic, internally AC coupled.

Note6: Minimum average optical power measured at BER less than 1E-10, with a 2^{23}-1 PRBS and ER=9 dB.
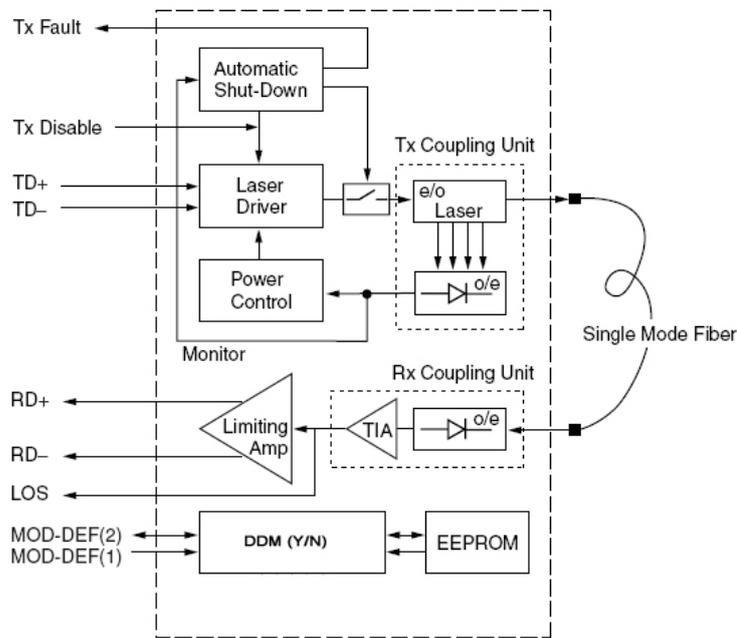
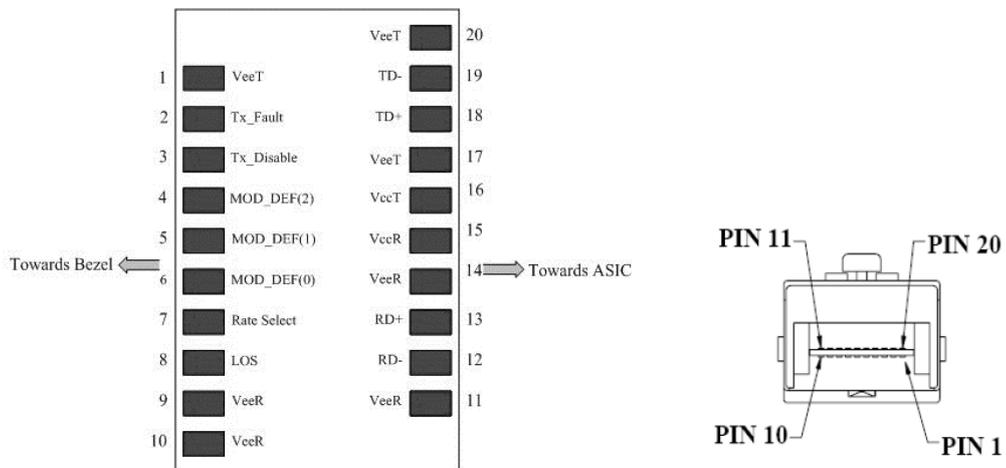Note7: Eye Pattern Mask   Note8: LOS Hysteresis

Functional Description of Transceiver

SFP Transceiver Electrical Pad Layout

Pin Function Definitions

Pin Num.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	2) Module disables on high or open
4	MOD-DEF2	SDA	3	2 Wire Serial Interface Data Line only with DDMI.
5	MOD-DEF1	SCL	3	2 Wire Serial Interface Clock Line only with DDMI.
6	MOD-DEF0	MOD_ABS	3	3) Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	4)
9	VeeR	Receiver Ground	1	5)
10	VeeR	Receiver Ground	1	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	6)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	7) 3.3V ± 5%
16	VccT	Transmitter Power	2	7) 3.3V ± 5%
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	VeeT	Transmitter Ground	1	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 kinds. 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 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 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. The voltage swing on these lines will be between 400 and 2000mV differential (200 –1000mV single ended) when properly terminated.

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. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1ohm 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. The inputs will accept differential swings of 400 – 2000mV (200 – 1000mV single-ended).

EEPROM

The serial interface uses the 2-wire serial I^{2}Cprotocol. 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 9.3.
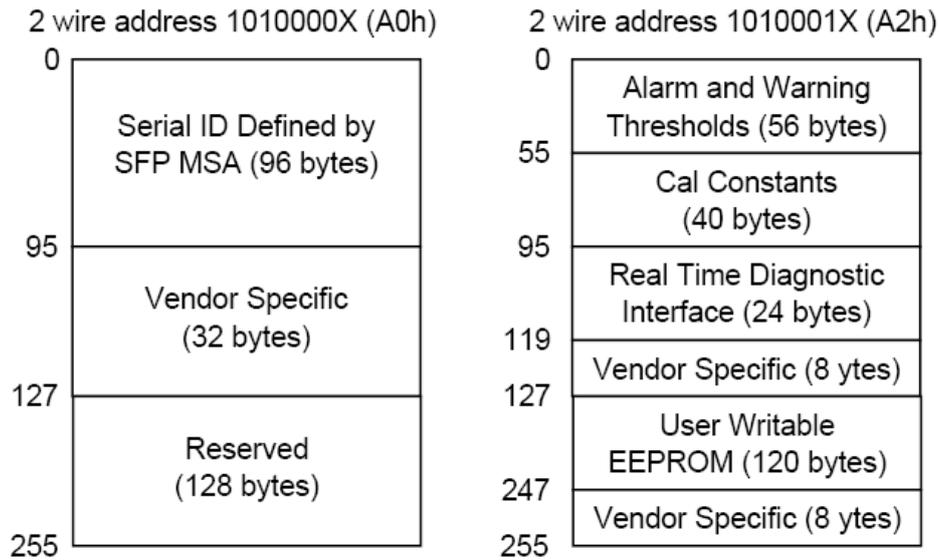
EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0h). Memory Contents of Serial ID are shown in Table 1.

Table 1 Serial ID Memory Contents

Addr.	Size (Bytes)	Name of Field	Hex	Description
BASE ID FIELDS				
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	XX XX XX XX XX XX XX XX[note9]	OC 12, Single mode inter. or long reach
11	1	Encoding	03	NRZ
12	1	BR, Nominal	06	622Mbps
13	1	Reserved	00	
14	1	Length (9µm)km	XX[note9]	Transceiver transmit distance
15	1	Length(9µm)100m	FF	
16	1	Length (50µm) 10m	00	
17	1	Length(62.5µm)10m	00	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	XX XX XX XX XX XX XX XX[note9]20 20 20 20 20 20 20 20	Vendor name (ASCII)
36	1	Reserved	00	

37-39	3	Vendor OUI	XX XX XX(note9)	
40-55	16	Vendor PN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX(note9)	Part Number
56-59	4	Vendor rev	XX XX XX XX(note9)	
60-61	2	Wavelength	06 0E	1550nm
62	1	Reserved	00	
63	1	CC_BASE	Checksum	Check code for Base ID Fields
EXTENDED ID FIELDS				
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(note9)	Serial Number of transceiver (ASCII). For example "B000822".
84-91	8	Date code	XX XX XX XX XX XX XX XX(note9)	Manufactory date code. For example "080405".
92	1	Diagnostic Monitoring Type	XX(note9)	Digital diagnostic monitoring implemented
93	1	Enhanced Options	XX(note9)	Optional flags
94	1	SFF_8472 Compliance	XX(note9)	01 for diagnostics (Rev9.3 SFF-8472).
95	1	CC_EXT	Checksum	Checksum for Extended ID Field.
VENDOR SPECIFIC ID FIELDS				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	

Note9: 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
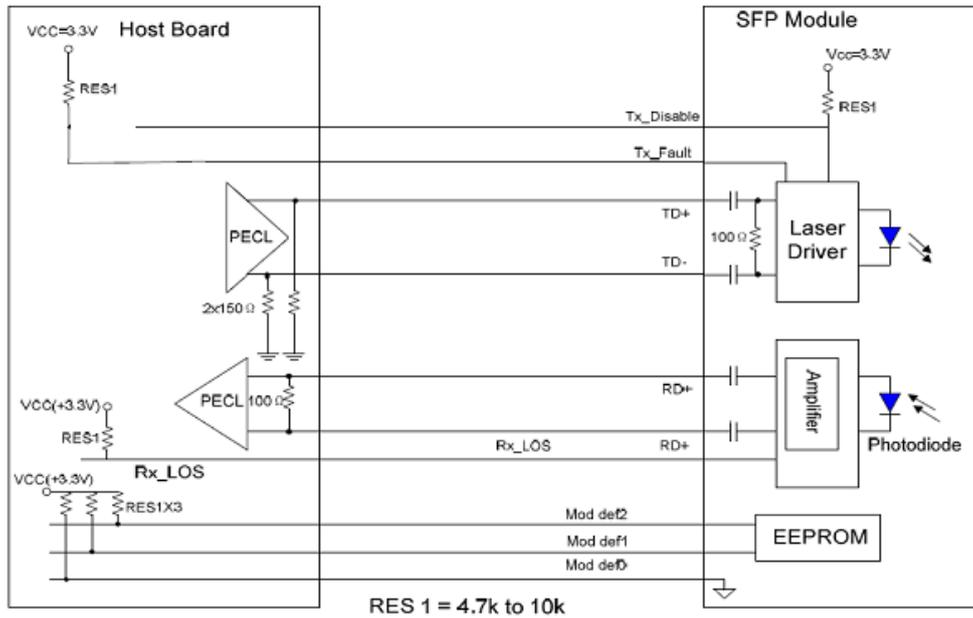
Mechanical Specifications
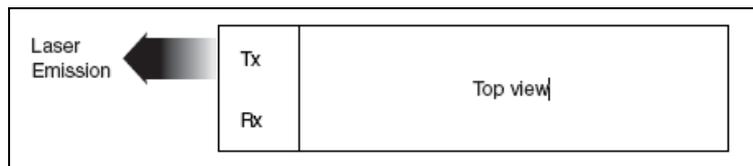

Unremarked tolerances±0.2mm
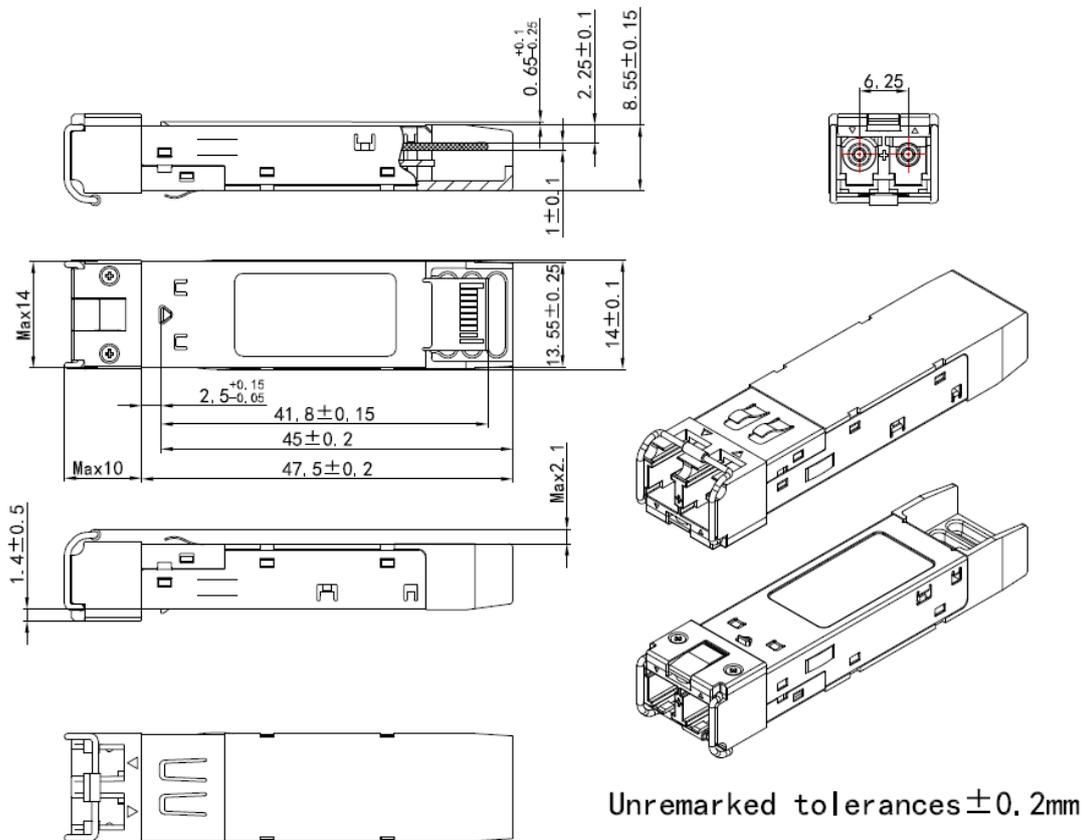
This 2D drawing only for reference, please check with Eoptolink before ordering.

Laser Emission Data

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

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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
V3.a	Cathy	Kelly	Richard. Huang	Released.	Feb 8, 2010
V3.b	Cathy			Updated PN and mechanical spec.	November 9, 2010
V4.a	Townie	Kelly		Update circuit schematic.	July 11, 2011
V4.b	Jans	Kelly		Integrate 4 products.	Sep 22, 2011
V4.c	Jans	Kelly		Add the new product EOLS-1506-A-X.	Oct 26,2012
V4.d	Jans	Jason, Walt,Lyn	Phlio	Update the ROSA type of 120KM.	Apr 7,2013
V4.e	Angela	Vina		Update the regulatory compliance, LOSA and 2D drawing.	Oct 27,2015
V4.f	Angela	Kelly/William /Chao.Wang		Updated the product image and 2D drawing.	April 20, 2018

Notice:

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