EOLS-BI1306-15 40 Series

EOLS-BI1506-15 40 Series

Single-Mode 622Mbps SDH /SONET
Simplex SC/LC Single-Fiber SFP Transceiver
RoHS6 Compliant

Features

- Support 622Mbps data links
- A type: 1310nm FP Tx/1550nmRx
  B type: 1550nm DFB TX/1310nmRx
- 15km with 9/125 μm SMF for EOLS-BI1X06-15 Series
  40km with 9/125 μm SMF for EOLS-BI1X06-40 Series
- Single 3.3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex SC/LC Connector Interface
- Class 1 FDA and IEC60825-1 laser safety compliant
- Operating Case Temperature
  Standard: 0℃~+70℃
  Industrial:-40℃~+85℃
- Compliant with SFP MSA

Applications

- SONET OC-12 / SDH STM-4
- WDM Fast Ethernet Links

Ordering information

Part No.	Data Rate	Distance	Wavelength	Interface	Temp.	DDMI
EOLS-BI1306-15*(note1)	622Mbps	15km	1310nm	SC	Standard	NO
EOLS-BI1506-15*(note1)	622Mbps	15km	1550nm	SC	Standard	NO
EOLS-BI1306-15-I	622Mbps	15km	1310nm	SC	Industrial	NO
EOLS-BI1506-15-I	622Mbps	15km	1550nm	SC	Industrial	NO
EOLS-BI1306-15-D	622Mbps	15km	1310nm	SC	Standard	YES
EOLS-BI1506-15-D	622Mbps	15km	1550nm	SC	Standard	YES
EOLS-BI1306-15-DI	622Mbps	15km	1310nm	SC	Industrial	YES
EOLS-BI1506-15-DI	622Mbps	15km	1550nm	SC	Industrial	YES
EOLS-BI1306-15-L*(note1)	622Mbps	15km	1310nm	LC	Standard	NO
EOLS-BI1506-15-L*(note1)	622Mbps	15km	1550nm	LC	Standard	NO

EOLS-BI1306-15-IL	622Mbps	15km	1310nm	LC	Industrial	NO
EOLS-BI1506-15-IL	622Mbps	15km	1550nm	LC	Industrial	NO
EOLS-BI1306-15-DL	622Mbps	15km	1310nm	LC	Standard	YES
EOLS-BI1506-15-DL	622Mbps	15km	1550nm	LC	Standard	YES
EOLS-BI1306-15-DIL	622Mbps	15km	1310nm	LC	Industrial	YES
EOLS-BI1506-15-DIL	622Mbps	15km	1550nm	LC	Industrial	YES
EOLS-BI1306-40*(note1)	622Mbps	40km	1310nm	SC	Standard	NO
EOLS-BI1506-40*(note1)	622Mbps	40km	1550nm	SC	Standard	NO
EOLS-BI1306-40-I	622Mbps	40km	1310nm	SC	Industrial	NO
EOLS-BI1506-40-I	622Mbps	40km	1550nm	SC	Industrial	NO
EOLS-BI1306-40-D	622Mbps	40km	1310nm	SC	Standard	YES
EOLS-BI1506-40-D	622Mbps	40km	1550nm	SC	Standard	YES
EOLS-BI1306-40-DI	622Mbps	40km	1310nm	SC	Industrial	YES
EOLS-BI1506-40-DI	622Mbps	40km	1550nm	SC	Industrial	YES
EOLS-BI1306-40-L*(note1)	622Mbps	40km	1310nm	LC	Standard	NO
EOLS-BI1506-40-L*(note1)	622Mbps	40km	1550nm	LC	Standard	NO
EOLS-BI1306-40-IL	622Mbps	40km	1310nm	LC	Industrial	NO
EOLS-BI1506-40-IL	622Mbps	40km	1550nm	LC	Industrial	NO
EOLS-BI1306-40-DL	622Mbps	40km	1310nm	LC	Standard	YES
EOLS-BI1506-40-DL	622Mbps	40km	1550nm	LC	Standard	YES
EOLS-BI1306-40-DIL	622Mbps	40km	1310nm	LC	Industrial	YES
EOLS-BI1506-40-DIL	622Mbps	40km	1550nm	LC	Industrial	YES

Note1: Standard version

Regulatory Compliance*Note2

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 EOLS-BI1X06-X series is small form factor pluggable module for OC-3/STM-1 OC-12/STM-4 SONET/SDH and Fibre Channel single fiber communications by using 1310nm/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 B type/ A type detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

The EOLS-BI1X06-XD series are designed to be compliant with SFF-8472 SFP Multi-source Agreement (MSA).

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	℃
Supply Voltage	V_{CC}	-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-1X06-X	0		+70	℃
			EOLS-1X06-XI	-40		+85	
Power Supply Voltage		V_{CC}		3.15	3.3	3.45	V
Power Supply Current		I_{CC}				300	mA
Date Rate	OC-12/STM-4				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_Dis	Disable		2		Vcc	V	
	Enable		0		0.8		
Tx_FAULT	Fault		2		Vcc+0.3	V	
	Normal		0		0.5		
Receiver							
LVPECL Outputs (Differential)		Vout	370		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 (0:2)		VoH	2.5			V	With Serial ID
		VoL	0		0.5	V	

Optical and Electrical Characteristics

(EOLS-BI1306-15, 1310nmFP and PIN, 15km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		15		km
Data Rate			622		Mbps
Transmitter					
Centre Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ			4	nm
Average Output Power*(note3)	Pout	-15		-8	dBm
Extinction Ratio*(note4)	ER	8.2			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
P_{Out}@TX Disable Asserted	Pout			-45	dBm
Receiver					
Centre Wavelength	λ	1480	1550	1580	nm
Receiver Sensitivity*(note6)	Pmin			-28	dBm
Receiver Overload	Pmax	-3			dBm
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

(EOLS-BI1506-15, 1550nm DFB and PIN, 15km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		15		km
Data Rate			622		Mbps
Transmitter					
Centre Wavelength	λ_C	1480	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	-15		-8	dBm
Extinction Ratio*(note4)	ER	8.2			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	λ	1260		1600	nm
Receiver Sensitivity*(note6)	Pmin			-28	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

(EOLS-BI1306-40, 1310nmFP and PIN, 40km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		40		km
Data Rate			622		Mbps
Transmitter					
Centre Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ			4	nm
Average Output Power*(note3)	Pout	-3		+2	dBm
Extinction Ratio*(note4)	ER	8.2			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
P_{Out}@TX Disable Asserted	Pout			-45	dBm
Receiver					
Centre Wavelength	λ	1500	1550	1580	nm
Receiver Sensitivity*(note6)	Pmin			-28	dBm
Receiver Overload	Pmax	-3			dBm
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

(EOLS-BI1506-40, 1550nm DFB and PIN, 40km)

Parameter	Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF	L		40		km
Data Rate			622		Mbps
Transmitter					
Centre Wavelength	λ_C	1480	1550	1580	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	-5		0	dBm
Extinction Ratio*(note4)	ER	8.2			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	λ	1260		1600	nm
Receiver Sensitivity*(note6)	Pmin			-28	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

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

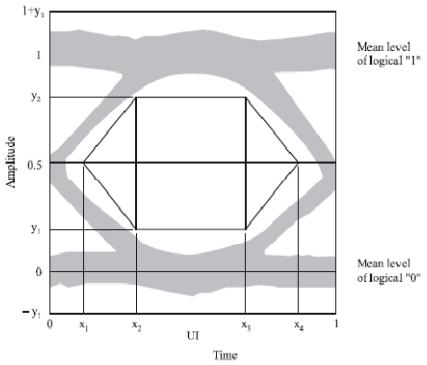
Note4: Filtered, measured with a PRBS 2^{23}-1 test pattern @622Mbps

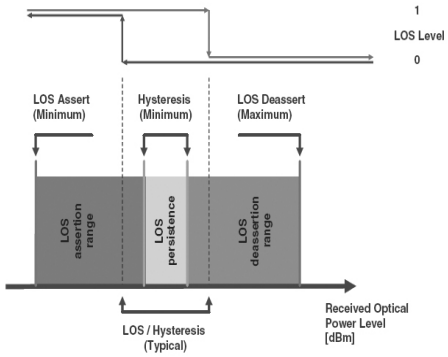
Note5: LVPECL logic, internally AC coupled.

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

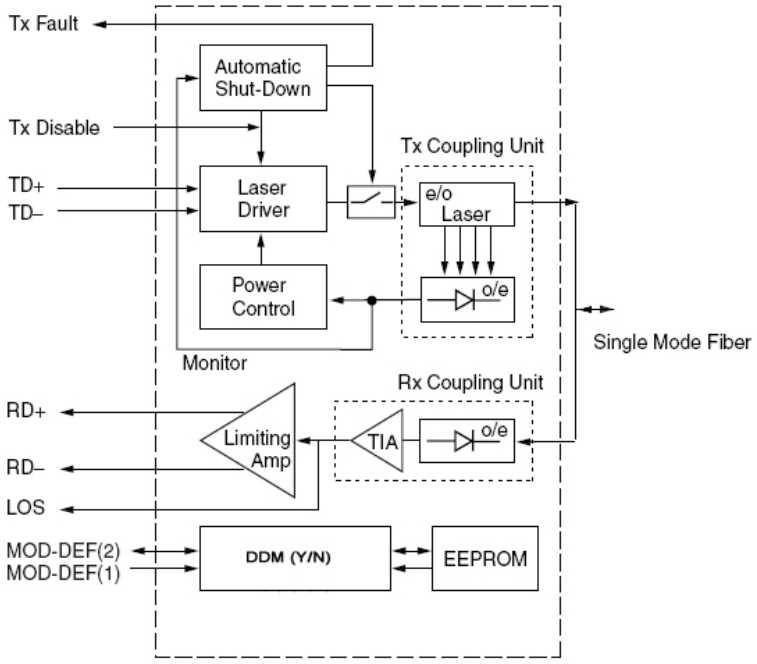
Note7: Eye pattern mask

Note8: LOS Hysteresis

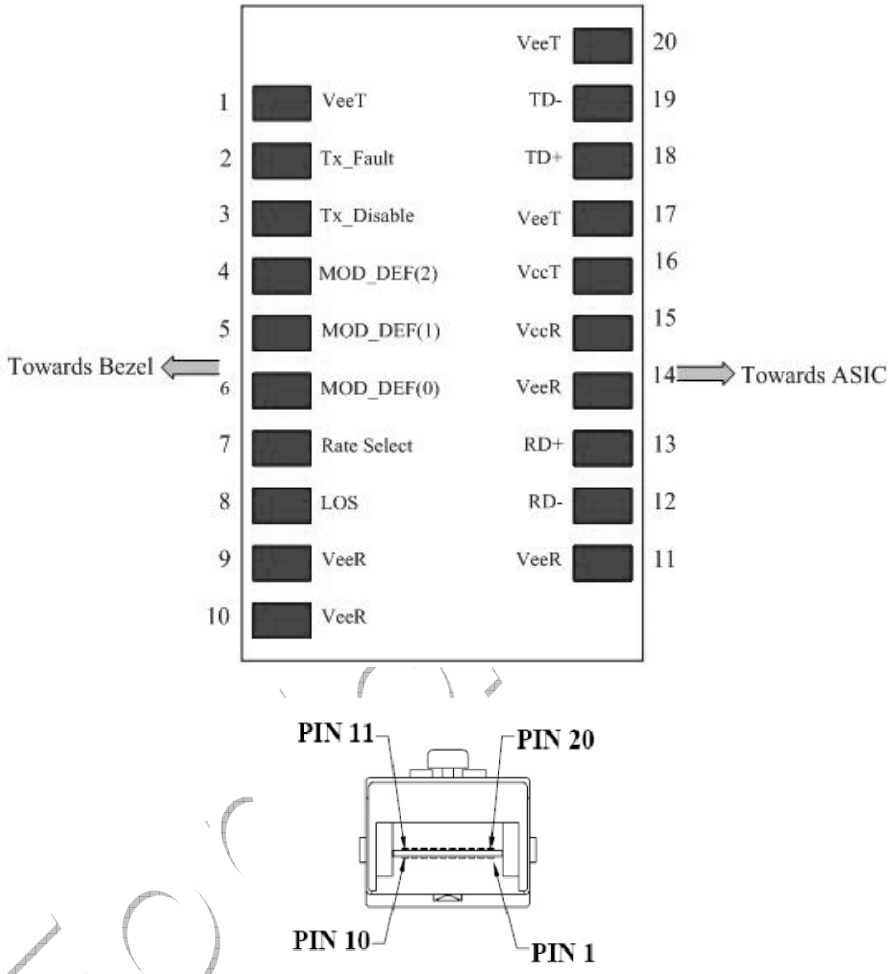




Functional Description of Transceiver



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	Module Definition 2	3	3), Data line for Serial ID.
5	MOD-DEF1	Module Definition 1	3	3), Clock line for Serial ID.
6	MOD-DEF0	Module Definition 0	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	7)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	3.3 ± 5%, 7)
16	VccT	Transmitter Power	2	3.3 ± 5%, 7)
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 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 – 10 K Ω 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) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10KΩ resistor 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 – 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 and is thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 –1000 mV 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 1 ohm should be used in

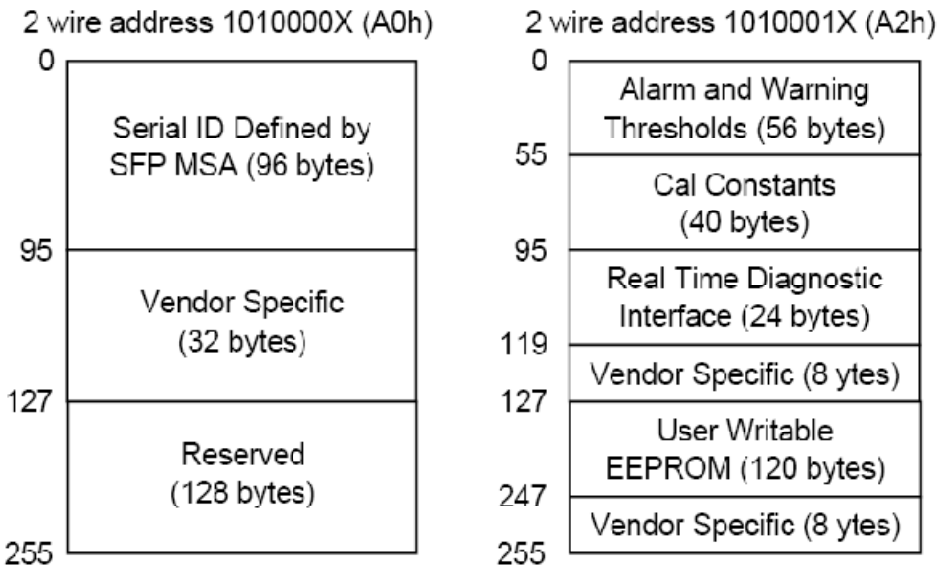
order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally 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. The inputs will accept differential swings of 500 – 2400 mV (250 – 1200mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 – 600mV single-ended) be used for best EMI performance.

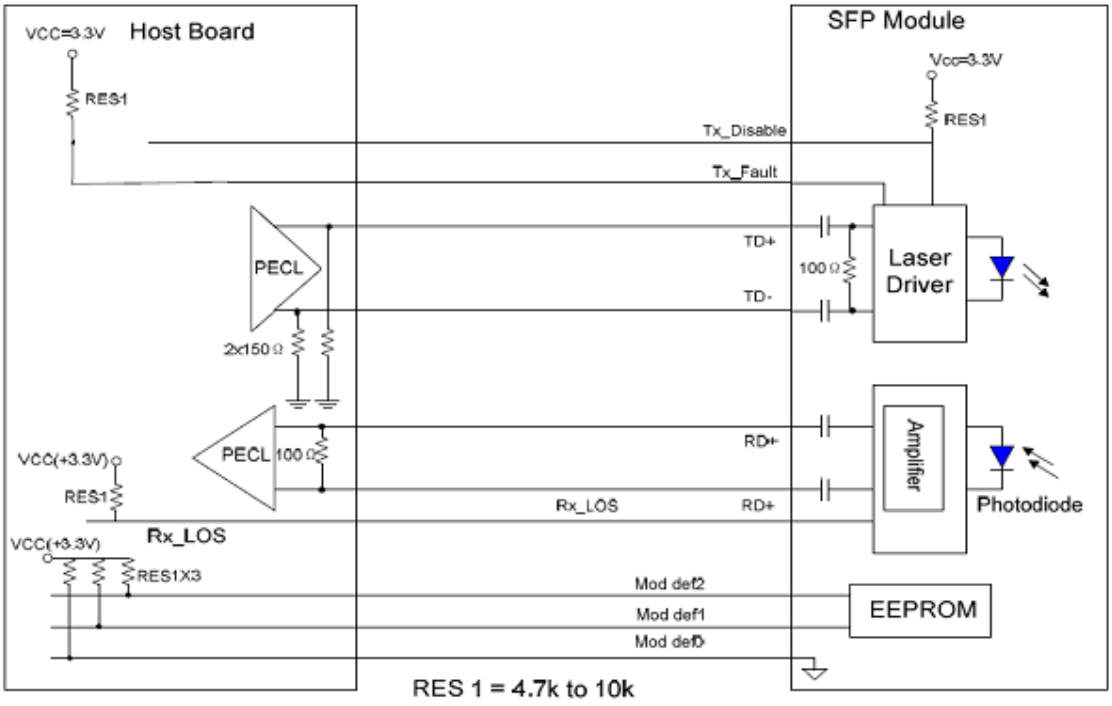
EEPROM

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.

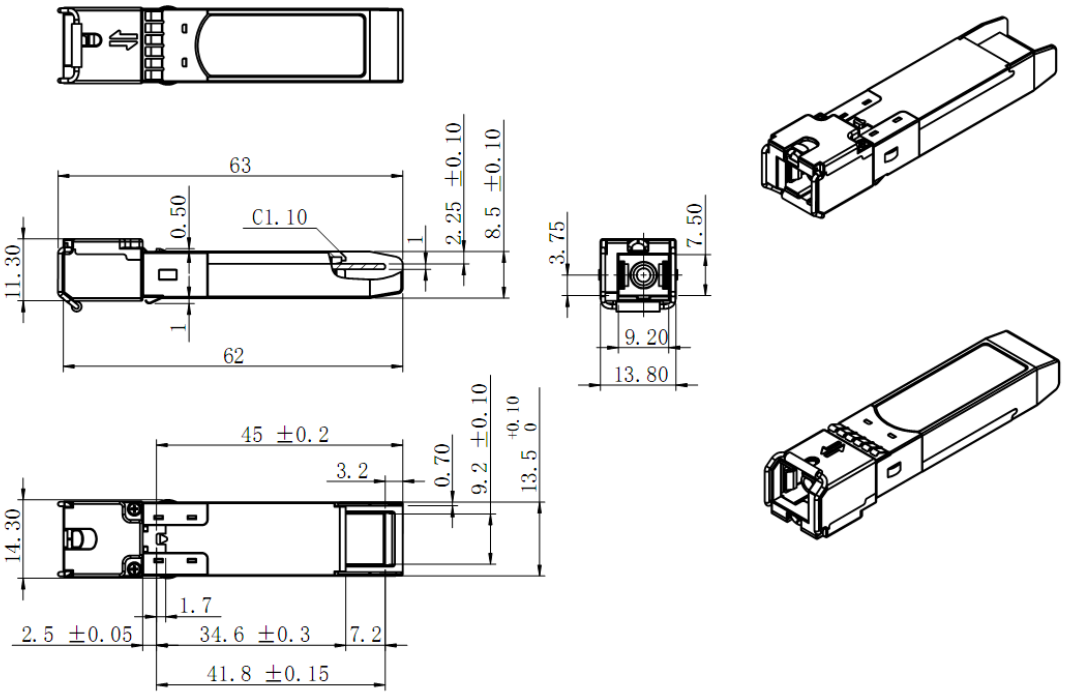
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. 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



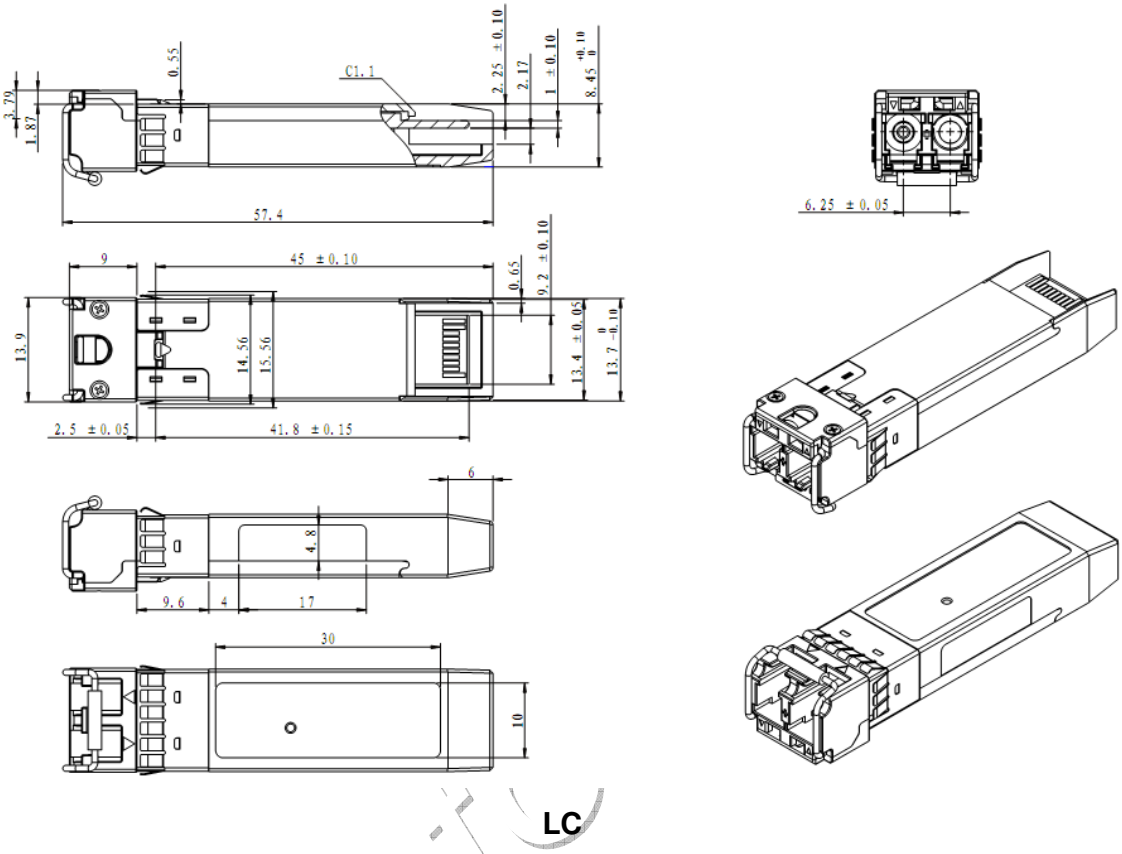
Recommend Circuit Schematic



Mechanical Specifications



SC



LC

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	Initiate	Review	Approve	Subject	Last printed
V1.a	Tim	Kelly		Initial datasheet	Apr 2, 2007
V1.b	Kelly			Update mechanical spec.	Jan 23, 2010
V2.a	Phlio			Update Recommend Circuit Update Link Budget	Aug 10, 2011

V2.b	Phlio			Integrate 40km product series	Aug 22, 2011
V2.c	Kelly			Update photo.	Nov 4, 2011
V2.d	Angela	Kelly		Update PN.	Nov 14,2012
V2.e	Angela	Daquan.Dong/ Kelly/Yi,Wan	Phlio	Update regulatory compliance and LOSA.	July 23, 2014

Notice:

Eoptolink reserves the right to make changes to or discontinue any optical link product or service identified in this publication, without notice, in order to improve design and/or performance. Applications that are described herein for any of the optical link products are for illustrative purposes only. Eoptolink makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Contact:

Add: Floor 5 Building 2 No. 21 Gaopeng Avenue High-Tech District CHENGDU, SICHUAN 610041 P.R. CHINA
Tel: (+86) 028-85122709 ext 816 & 809
Fax: (+86) 028-85121912
Postal: 610041
E-mail:sales@eoptolink.com
http://www.eoptolink.com