

## EOLS-BI1624-15X 17X 20X 29X Series

Single-Mode 2.5Gbps SDH /SONET/FC  
 Simplex SC/LC Single-Fiber SFP Transceiver  
 RoHS6 Compliant

### Features

- ◆ Support up to 2.5Gbps data links
- ◆ 18-Wavelength CWDM DFB LD Transmitter from 1270nm to 1610nm, with step 20nm
- ◆ 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°C~+70°C  
 Extended:-20°C~+85°C
- ◆ Compliant with MSA SFP Specification
- ◆ Digital diagnostic monitor interface Compatible with SFF-8472



### Applications

- ◆ Fiber Channel Links
- ◆ WDM OC-48 / STM-16 Links
- ◆ WDM Gigabit Ethernet Links
- ◆ CPRI rate: 2.4576Gb/s
- ◆ Other Optical Links

### Ordering information

Part No.	Data Rate	Power budget	Interface	Temp.	DDMI
EOLS-BI1624-15X*(note1)	2.5Gbps	≥15dB	SC	Standard	NO
EOLS-BI1624-15XI	2.5Gbps	≥15dB	SC	Extended	NO
EOLS-BI1624-15XD	2.5Gbps	≥15dB	SC	Standard	YES
EOLS-BI1624-15XDI	2.5Gbps	≥15dB	SC	Extended	YES
EOLS-BI1624-15XL*(note1)	2.5Gbps	≥15dB	LC	Standard	NO
EOLS-BI1624-15XIL	2.5Gbps	≥15dB	LC	Extended	NO
EOLS-BI1624-15XDL	2.5Gbps	≥15dB	LC	Standard	YES
EOLS-BI1624-15XDIL	2.5Gbps	≥15dB	LC	Extended	YES
Part No.	Data Rate	Power budget	Interface	Temp.	DDMI
EOLS-BI1624-17X*(note1)	2.5Gbps	≥17dB	SC	Standard	NO
EOLS-BI1624-17XI	2.5Gbps	≥17dB	SC	Extended	NO
EOLS-BI1624-17XD	2.5Gbps	≥17dB	SC	Standard	YES

EOLS-BI1624-17XDI	2.5Gbps	$\geq 17\text{dB}$	SC	Extended	YES
EOLS-BI1624-17XL*(note1)	2.5Gbps	$\geq 17\text{dB}$	LC	Standard	NO
EOLS-BI1624-17XIL	2.5Gbps	$\geq 17\text{dB}$	LC	Extended	NO
EOLS-BI1624-17XDL	2.5Gbps	$\geq 17\text{dB}$	LC	Standard	YES
EOLS-BI1624-17XDIL	2.5Gbps	$\geq 17\text{dB}$	LC	Extended	YES
Part No.	Data Rate	Power budget	Interface	Temp.	DDMI
EOLS-BI1624-20X*(note1)	2.5Gbps	$\geq 20\text{dB}$	SC	Standard	NO
EOLS-BI1624-20XI	2.5Gbps	$\geq 20\text{dB}$	SC	Extended	NO
EOLS-BI1624-20XD	2.5Gbps	$\geq 20\text{dB}$	SC	Standard	YES
EOLS-BI1624-20XDI	2.5Gbps	$\geq 20\text{dB}$	SC	Extended	YES
EOLS-BI1624-20XL*(note1)	2.5Gbps	$\geq 20\text{dB}$	LC	Standard	NO
EOLS-BI1624-20XIL	2.5Gbps	$\geq 20\text{dB}$	LC	Extended	NO
EOLS-BI1624-20XDL	2.5Gbps	$\geq 20\text{dB}$	LC	Standard	YES
EOLS-BI1624-20XDIL	2.5Gbps	$\geq 20\text{dB}$	LC	Extended	YES
Part No.	Data Rate	Power budget	Interface	Temp.	DDMI
EOLS-BI1624-29X*(note1)	2.5Gbps	$\geq 29\text{dB}$	SC	Standard	NO
EOLS-BI1624-29XI	2.5Gbps	$\geq 29\text{dB}$	SC	Extended	NO
EOLS-BI1624-29XD	2.5Gbps	$\geq 29\text{dB}$	SC	Standard	YES
EOLS-BI1624-29XDI	2.5Gbps	$\geq 29\text{dB}$	SC	Extended	YES
EOLS-BI1624-29XL*(note1)	2.5Gbps	$\geq 29\text{dB}$	LC	Standard	NO
EOLS-BI1624-29XIL	2.5Gbps	$\geq 29\text{dB}$	LC	Extended	NO
EOLS-BI1624-29XDL	2.5Gbps	$\geq 29\text{dB}$	LC	Standard	YES
EOLS-BI1624-29XDIL	2.5Gbps	$\geq 29\text{dB}$	LC	Extended	YES

Note1: Standard version, X refer to CWDM Wavelength range 1270nm to 1610nm, A=1270, B=1290...Q=1590, R=1610. TX and RX wavelength spacing must  $\geq 60\text{nm}$ . Typical transmitter and receiver wavelength combinations are L/O, M/Q, M/P and etc.

## CWDM\* Wavelength \*Note2

Band	Nomenclature	Wavelength(nm)		
		Min.	Typ.	Max.
O-band Original	A	1264	1270	1277.5
	B	1294	1290	1297.5
	C	1304	1310	1317.5
	D	1324	1330	1337.5
	E	1344	1350	1357.5
E-band Extended	F	1364	1370	1377.5
	G	1384	1390	1397.5
	H	1404	1410	1417.5
	I	1424	1430	1437.5

	J	1444	1450	1457.5
S-band Short Wavelength	K	1464	1470	1477.5
	L	1484	1490	1497.5
	M	1504	1510	1517.5
	N	1524	1530	1537.5
C-band Conventional	O	1544	1550	1557.5
L-band Long Wavelength	P	1564	1570	1577.5
	Q	1584	1590	1597.5
	R	1604	1610	1617.5

Note2: 18 Wavelengths from 1270nm to 1610nm, each step 20nm.

### 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 FDA and ROHS. For the latest certification information, please check with Eoptolink..

### Product Description

The EOLS-BI1624-XX series is small form factor pluggable module for OC-48 / STM-16 and Fiber Channel single fiber communications. It is with the SFP 20-pin connector to allow hot plug capability.

The transmitter section uses a distributed feedback 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 InGaAs Avalanche photo detector preamplifier mounted in an optical header and a limiting post-amplifier IC.

The EOLS-BI1624-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 <sub>s</sub>	-40	+85	°C
Supply Voltage	V <sub>cc</sub>	-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 <sub>c</sub>	EOLS-BI1624-X	0		+70	°C
		EOLS-BI1624-XI	-20		+85	
Power Supply Voltage	V <sub>cc</sub>	3.15	3.3	3.45	V	
Power Supply Current	I <sub>cc</sub>			300	mA	
Data Rate	FC		1.063		Gbps	
	2xFC		2.125			
	CPRI		2.4576			
	OC-48/STM-16		2.5			

**Performance Specifications - Electrical**

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
<b>Transmitter</b>						
LVPECL Compatible Inputs(Differential)	V <sub>in</sub>	400		2000	mVpp	AC coupled inputs*(note5)
Input Impedance (Differential)	Z <sub>in</sub>	85	100	115	ohms	R <sub>in</sub> > 100 kohms @ DC
Tx_Dis	Disable	2		V <sub>cc</sub>	V	
	Enable	0		0.8		
Tx_FAULT	Fault	2		V <sub>cc</sub> +0.3	V	
	normal	0		0.5		
<b>Receiver</b>						
CML Outputs (Differential)	V <sub>out</sub>	370		1200	mVpp	AC coupled outputs*(note5)
Output Impedance (Differential)	Z <sub>out</sub>	85	100	115	ohms	
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	

**Optical and Electrical Characteristics**
**(CWDM DFB and PIN-TIA with 15dB Power Budget)**

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		15			dB
Data Rate		1.063		2.5	Gbps
<b>Transmitter</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power <sup>*(note3)</sup>	P <sub>out</sub>	-5		0	dBm
Extinction Ratio <sup>*(note4)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye <sup>*(note4)</sup>	IUT-T G.957 Compliant <sup>*(note7)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	Us
<b>Receiver</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda-20$	$\lambda$	$\lambda+20$	nm
Receiver Sensitivity <sup>*(note6)</sup>	P <sub>min</sub>			-20	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-21	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis <sup>*(note8)</sup>		0.5			dB

**(CWDM DFB and PIN-TIA with 17dB Power Budget)**

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		17			dB
Data Rate		1.063		2.5	Gbps
<b>Transmitter</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power <sup>*(note3)</sup>	P <sub>out</sub>	-3		+2	dBm
Extinction Ratio <sup>*(note4)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye <sup>*(note4)</sup>	IUT-T G.957 Compliant <sup>*(note7)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	Us
<b>Receiver</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda-20$	$\lambda$	$\lambda+20$	nm
Receiver Sensitivity <sup>*(note6)</sup>	P <sub>min</sub>			-20	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB

Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-21	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis <sup>*(note8)</sup>		0.5			dB

### (CWDM DFB and PIN-TIA with 20dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		20			dB
Data Rate		1.063		2.5	Gbps
<b>Transmitter</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power <sup>*(note3)</sup>	P <sub>out</sub>	0		+5	dBm
Extinction Ratio <sup>*(note4)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye <sup>*(note4)</sup>	IUT-T G.957 Compliant <sup>*(note7)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	Us
<b>Receiver</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda-20$	$\lambda$	$\lambda+20$	nm
Receiver Sensitivity <sup>*(note6)</sup>	P <sub>min</sub>			-20	dBm
Receiver Overload	P <sub>max</sub>	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-21	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis <sup>*(note8)</sup>		0.5			dB

### (CWDM DFB and APD-TIA with 29 Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		29			dB
Data Rate		1.063		2.5	Gbps
<b>Transmitter</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda_c-6$	$\lambda_c$	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power <sup>*(note3)</sup>	P <sub>out</sub>	0		+5	dBm
Extinction Ratio <sup>*(note4)</sup>	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye <sup>*(note4)</sup>	IUT-T G.957 Compliant <sup>*(note7)</sup>				
TX_Disable Assert Time	t <sub>off</sub>			10	Us
<b>Receiver</b>					
Channel Centre Wavelength <sup>*(note9)</sup>		$\lambda-20$	$\lambda$	$\lambda+20$	nm
Receiver Sensitivity <sup>*(note6)</sup>	P <sub>min</sub>			-29	dBm

Receiver Overload	Pmax	-8			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-30	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

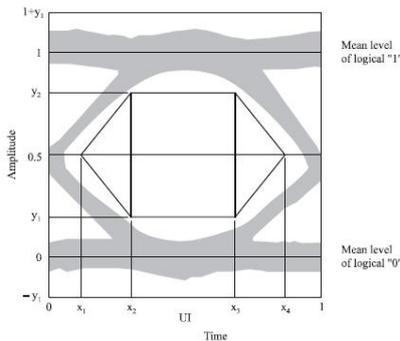
Note3: Output is coupled into a 9/125µm single-mode fiber.

Note4: Filtered, measured with a PRBS 2<sup>23</sup>-1 test pattern @2500Mbps

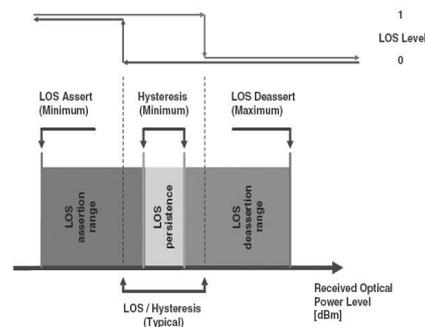
Note5: LVPECL/CML logic, internally AC coupled.

Note6: Measured at all data rates specified in Data Rate table with ER=9 dB, 2<sup>23</sup>-1 PRBS data pattern, BER <1E-10.

Note7: Eye pattern mask

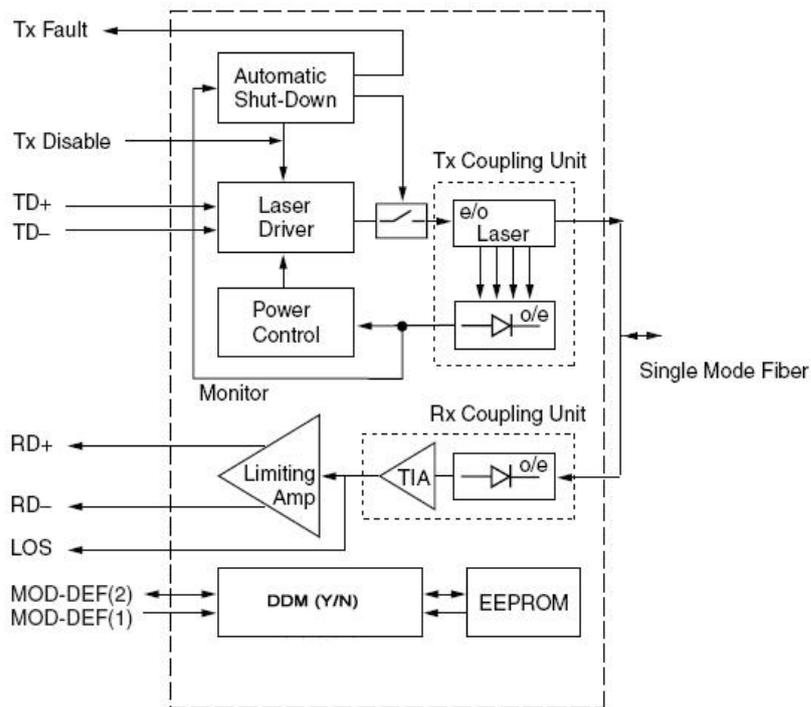


Note8: LOS Hysteresis

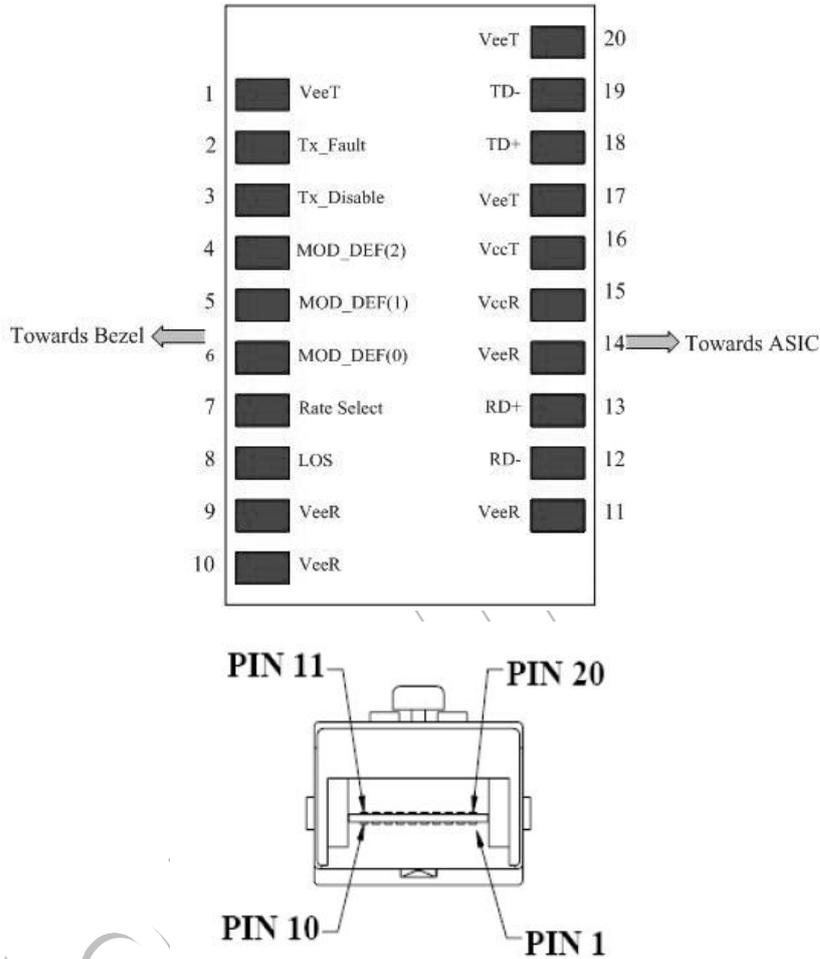


Note9: The channel center wavelength of transmitter side is compliant with table <CWDM\* Wavelength >, and the channel center wavelength of receiver side is the typical wavelength of CWDM channel ±20nm.

## 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

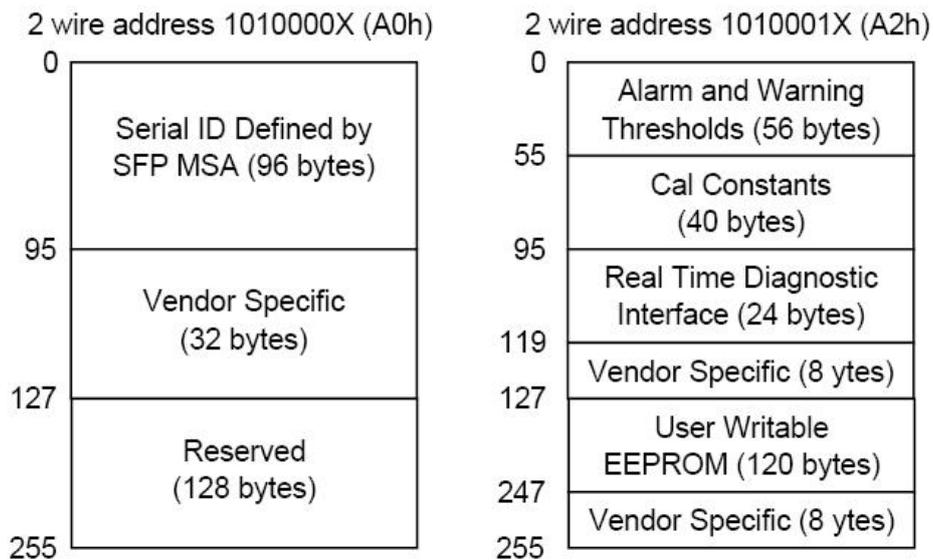
recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

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.

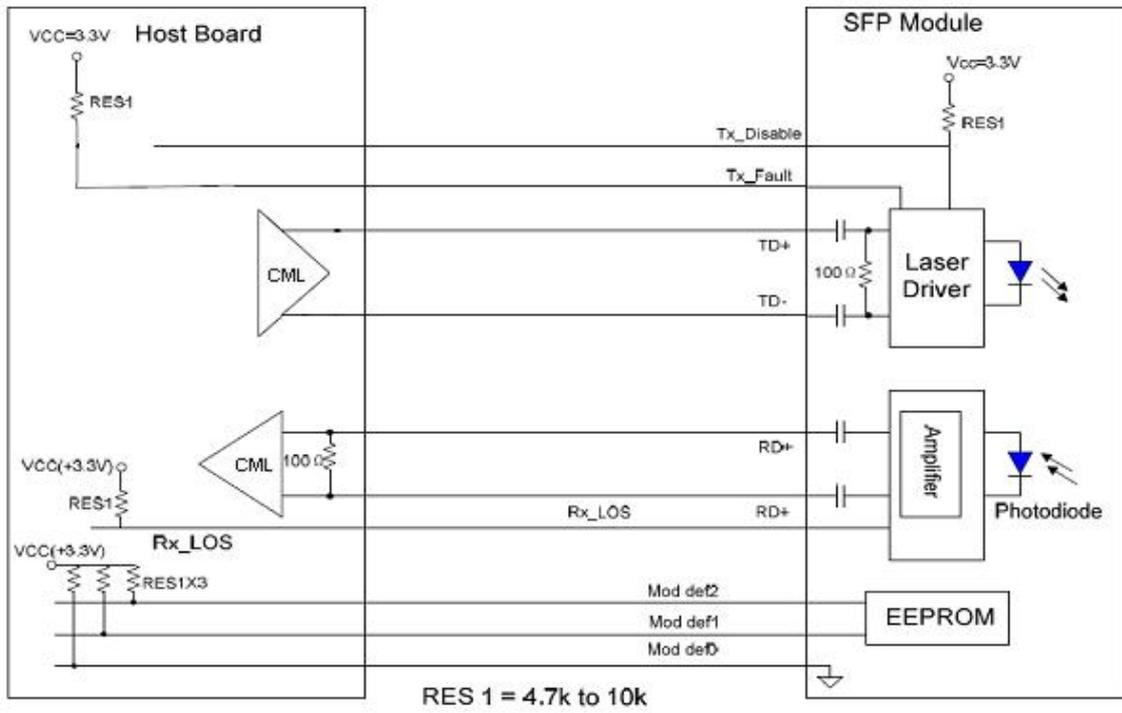
## EEPROM

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.

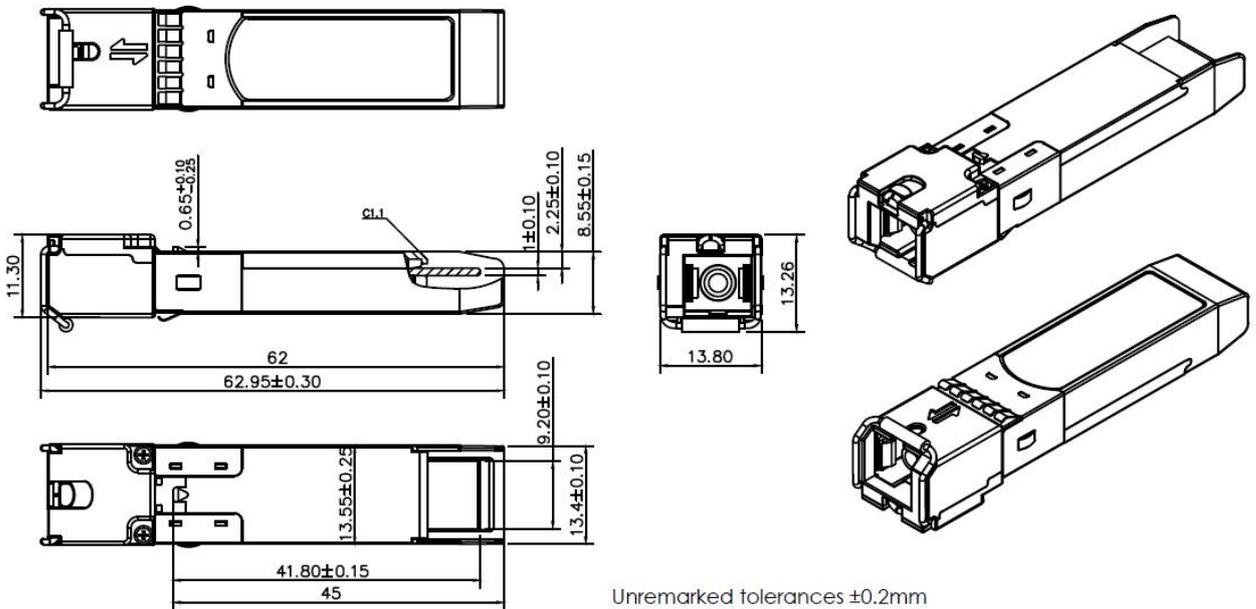
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power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



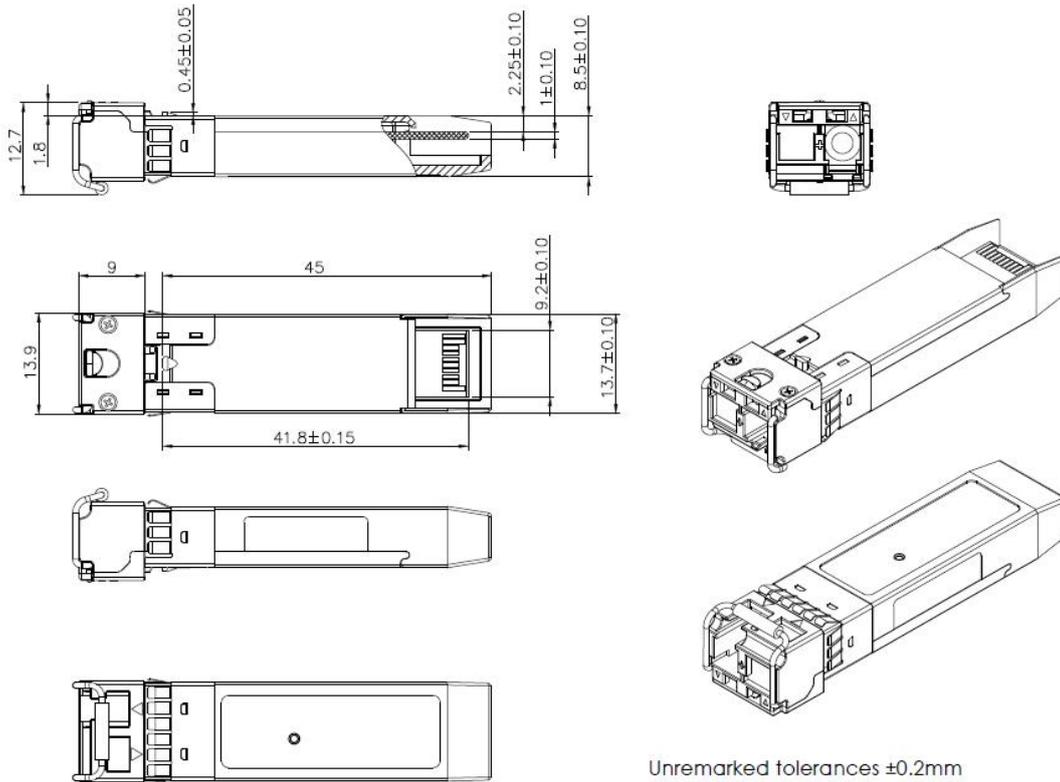
Recommend Circuit Schematic



Mechanical Specifications



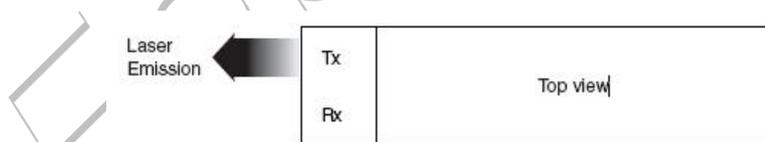
SC



LC

\*This 2D drawing only for reference, please check with Eoptolink before ordering.

**Laser Emission**



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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			Initial datasheet.	Nov 8, 2008
V1.b	Kelly			Update mechanical spec.	Jan 26, 2010
V2.a	Phlio			Update Recommend Circuit Update Link Budget	Aug 10, 2011
V2.b	Phlio	kelly		Remove EEPROM information and integrate	Aug 22, 2011

				17dB,20dB and 29dB series	
V2.c	Kelly			Update photo.	Nov 4, 2011
V2.d	Angela/ Arvin	Lyn/Nygai/ Jason/Walt		Update case temperature range	July 10, 2013
V2.e	Angela	Kelly/ Jason/Wlat /Lyn/Nygai	Phlio	Add CPRI application, update the regulatory compliance and LOSA of 15dB/17 dB/20dB product.	Oct 11,2014
V2.f	Angela	Oliver/Dow ney/Vina/ William/Ch ao.Wang	Phlio	Update the regulatory compliance, LOSA of 29dB, 2D drawing and contact.	May 16, 2018

### Notice:

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