EOLS-BI1612-19XX 21XX 24XX 26XX 34XX Series

Single-Mode 100Mbps to1.25Gbps FE/GBE /FC
SC/LC Single-Fiber SFP Transceiver
RoHS Compliant

Features

- Up to 1.25Gbps Data Links
- 19/21/24/26/34dB power budget optional
- Tx/Rx Wavelength are compliant with ITU-T G.694.2, with wavelength spacing more than 60nm
- Single 3.3V Power supply and TTL Logic Interface
- Hot-Pluggable SFP Footprint Simplex LC Connector Interface
- Class 1 FDA and IEC60825-1 laser safety compliant
- Operating Case Temperature
  Standard: 0℃~+70℃
  Extended: -20℃~+85℃
- Compliant with SFP MSA
- Compliant with SFF-8472
- Safety Certification: TUV/UL/FDA*Note1
- RoHS Compliant

Applications

- Fiber Channel Links
- Gigabit Ethernet
- Fast Ethernet
- WDM Gigabit Ethernet Links
- Other Optical Links

Ordering information

Part No.	Data Rate	Power budget	Interface	Temp.	DDMI
EOLS-BI1612-19XX*(Note2)	125~1250Mbps	≥19dB	SC	Standard	NO
EOLS-BI1612-19XXI	125~1250Mbps	≥19dB	SC	Extended	NO
EOLS-BI1612-19XXD	125~1250Mbps	≥19dB	SC	Standard	YES
EOLS-BI1612-19XXDI	125~1250Mbps	≥19dB	SC	Extended	YES

EOLS-BI1612-19XXL*(Note2)	125~1250Mbps	≥19dB	LC	Standard	NO
EOLS-BI1612-19XXIL	125~1250Mbps	≥19dB	LC	Extended	NO
EOLS-BI1612-19XXDL	125~1250Mbps	≥19dB	LC	Standard	YES
EOLS-BI1612-19XXDIL	125~1250Mbps	≥19dB	LC	Extended	YES
EOLS-BI1612-21XX*(Note2)	125~1250Mbps	≥21dB	SC	Standard	NO
EOLS-BI1612-21XXI	125~1250Mbps	≥21dB	SC	Extended	NO
EOLS-BI1612-21XXD	125~1250Mbps	≥21dB	SC	Standard	YES
EOLS-BI1612-21XXDI	125~1250Mbps	≥21dB	SC	Extended	YES
EOLS-BI1612-21XXL*(Note2)	125~1250Mbps	≥21dB	LC	Standard	NO
EOLS-BI1612-21XXIL	125~1250Mbps	≥21dB	LC	Extended	NO
EOLS-BI1612-21XXDL	125~1250Mbps	≥21dB	LC	Standard	YES
EOLS-BI1612-21XXDIL	125~1250Mbps	≥21dB	LC	Extended	YES
EOLS-BI1612-24XX*(Note2)	125~1250Mbps	≥24dB	SC	Standard	NO
EOLS-BI1612-24XXI	125~1250Mbps	≥24dB	SC	Extended	NO
EOLS-BI1612-24XXD	125~1250Mbps	≥24dB	SC	Standard	YES
EOLS-BI1612-24XXDI	125~1250Mbps	≥24dB	SC	Extended	YES
EOLS-BI1612-24XXL*(Note2)	125~1250Mbps	≥24dB	LC	Standard	NO
EOLS-BI1612-24XXIL	125~1250Mbps	≥24dB	LC	Extended	NO
EOLS-BI1612-24XXDL	125~1250Mbps	≥24dB	LC	Standard	YES
EOLS-BI1612-24XXDIL	125~1250Mbps	≥24dB	LC	Extended	YES
EOLS-BI1612-26XX*(Note2)	125~1250Mbps	≥26dB	SC	Standard	NO
EOLS-BI1612-26XXI	125~1250Mbps	≥26dB	SC	Extended	NO
EOLS-BI1612-26XXD	125~1250Mbps	≥26dB	SC	Standard	YES
EOLS-BI1612-26XXDI	125~1250Mbps	≥26dB	SC	Extended	YES
EOLS-BI1612-26XXL*(Note2)	125~1250Mbps	≥26dB	LC	Standard	NO
EOLS-BI1612-26XXIL	125~1250Mbps	≥26dB	LC	Extended	NO
EOLS-BI1612-26XXDL	125~1250Mbps	≥26dB	LC	Standard	YES
EOLS-BI1612-26XXDIL	125~1250Mbps	≥26dB	LC	Extended	YES
EOLS-BI1612-34XX*(Note2)	125~1250Mbps	≥34dB	SC	Standard	NO
EOLS-BI1612-34XXI	125~1250Mbps	≥34dB	SC	Extended	NO
EOLS-BI1612-34XXD	125~1250Mbps	≥34dB	SC	Standard	YES
EOLS-BI1612-34XXDI	125~1250Mbps	≥34dB	SC	Extended	YES
EOLS-BI1612-34XXL*(Note2)	125~1250Mbps	≥34dB	LC	Standard	NO
EOLS-BI1612-34XXIL	125~1250Mbps	≥34dB	LC	Extended	NO
EOLS-BI1612-34XXDL	125~1250Mbps	≥34dB	LC	Standard	YES
EOLS-BI1612-34XXDIL	125~1250Mbps	≥34dB	LC	Extended	YES

Note1: For the latest certification information, please check with Eoptolink.

Note2: 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 ≥60nm. Typical transmitter and receiver wavelength combinations of 19dB power budget list in the following table. For the relation between transmission distance and power budget, it is related to the power penalty, the value is about 0.40~0.45dB/km under 1270~1450nm and 0.30~0.35dB/km under 1470~1610nm.

*The product image only for reference purpose.

Typical Tx/Rx Combinations and PN of 19dB budget Illustration:

Standard Version PN	Tx	Rx
EOLS-BI1612-19CL	1310nm	1490nm
EOLS-BI1612-19LC	1490nm	1310nm
EOLS-BI1612-19LO	1490nm	1550nm
EOLS-BI1612-19OL	1550nm	1490nm
EOLS-BI1612-19MP	1510nm	1570nm
EOLS-BI1612-19PM	1570nm	1510nm
EOLS-BI1612-19MQ	1510nm	1590nm
EOLS-BI1612-19QM	1590nm	1510nm

CWDM* Wavelength

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

CWDM*: 18 Wavelengths from 1270nm to 1610nm, each step 20nm. Please contact EOPTOLINK to confirm the wavelength availability.

Product Description

The EOLS-BI1612-XX series is small form factor pluggable module for GBE/FC single fiber communications. It is with the SFP 20-pin connector to allow hot plug capability. The EOLS-BI1X12-XXD series are designed to be compliant with SFF-8472.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
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-BI1612-X	0		+70	°C
			EOLS-BI1612-XI	-20		+85	
Power Supply Voltage		V_{CC}		3.15	3.3	3.45	V
Power Supply Current		I_{CC}				300	mA
Date Rate	FE				100		Mbps
	FC				1.063		Gbps
	GBE				1.25		Gbps

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	

Performance Specifications - Optical

(CWDM DFB and PIN-TIA with 19dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		19			dB
Data Rate		100		1250	Mbps
Transmitter					
Channel Centre Wavelength*(note9)		λ_C-6	λ_C	λ_C+7.5	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	9			dB
Rise/Fall Time(20%～80%)	tr/tf			2	ns
Output Optical Eye*(note4)	Compliant with IEEE 802.3ah-2004*(note7)				
TX_Disable Assert Time	t_off			10	Us
Receiver					
Channel Centre Wavelength*(note9)		λ-20	λ	λ+20	nm
Receiver Sensitivity*(note6)	Pmin			-24	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-25	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis*(note8)		0.5			dB

(CWDM DFB and PIN-TIA with 21dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		21			dB
Data Rate		100		1250	Mbps
Transmitter					
Channel Centre Wavelength*(note9)		λ_C-6	λ_C	λ_C+7.5	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	-3		+2	dBm
Extinction Ratio*(note4)	ER	9			dB
Rise/Fall Time(20%～80%)	tr/tf			2	ns
Output Optical Eye*(note4)	Compliant with IEEE 802.3ah-2004*(note7)				
TX_Disable Assert Time	t_off			10	Us
Receiver					

Channel Centre Wavelength*(note9)		λ-20	λ	λ+20	nm
Receiver Sensitivity*(note6)	Pmin			-24	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-25	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis*(note8)		0.5			dB

(CWDM DFB and PIN-TIA with 24dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		24			dB
Data Rate		100		1250	Mbps
Transmitter					
Channel Centre Wavelength*(note9)		λ_C-6	λ_C	λ_C+7.5	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	0		+5	dBm
Extinction Ratio*(note4)	ER	9			dB
Rise/Fall Time(20%～80%)	tr/tf			2	ns
Output Optical Eye*(note4)	Compliant with IEEE 802.3ah-2004*(note7)				
TX_Disable Assert Time	t_off			10	Us
Receiver					
Channel Centre Wavelength*(note9)		λ-20	λ	λ+20	nm
Receiver Sensitivity*(note6)	Pmin			-24	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-25	dBm
LOS Assert	LOSA	-35			dBm
LOS Hysteresis*(note8)		0.5			dB

(CWDM DFB and PIN-TIA with 26dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		26			dB
Data Rate		100		1250	Mbps
Transmitter					
Channel Centre Wavelength*(note9)		λ_C-6	λ_C	λ_C+7.5	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	0		+5	dBm
Extinction Ratio*(note4)	ER	9			dB

Rise/Fall Time(20%～80%)	tr/tf			2	ns
Output Optical Eye*(note4)	Compliant with IEEE 802.3ah-2004*(note7)				
TX_Disable Assert Time	t_off			10	Us
Receiver					
Channel Centre Wavelength*(note9)		λ-20	λ	λ+20	nm
Receiver Sensitivity*(note6)	Pmin			-26	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-27	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis*(note8)		0.5			dB

(CWDM DFB and APD-TIA with 34dB Power Budget)

Parameter	Symbol	Min.	Typical	Max.	Unit
Power budget		34			dB
Data Rate		100		1250	Mbps
Transmitter					
Channel Centre Wavelength*(note9)		λ_C-6	λ_C	λ_C+7.5	nm
Spectral Width (-20dB)	Δλ			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*(note3)	Pout	+1		+5	dBm
Extinction Ratio*(note4)	ER	9			dB
Rise/Fall Time(20%～80%)	tr/tf			2	ns
Output Optical Eye*(note4)	I Compliant with IEEE 802.3ah-2004*(note7)				
TX_Disable Assert Time	t_off			10	Us
Receiver					
Channel Centre Wavelength*(note9)		λ-20	λ	λ+20	nm
Receiver Sensitivity*(note6)	Pmin			-33	dBm
Receiver Overload	Pmax	-8			dBm
Return Loss		12			dB
Optical Path Penalty				1	dB
LOS De-Assert	LOSD			-34	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis*(note8)		0.5			dB

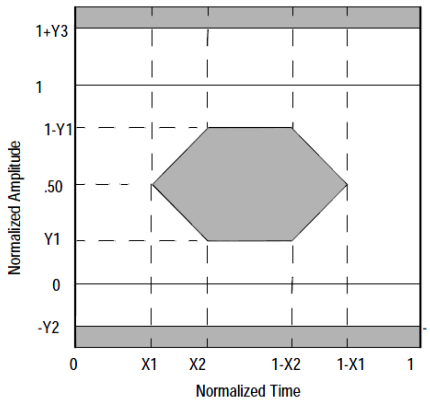
Note3: Output is coupled into a 9/125μm single-mode fiber.

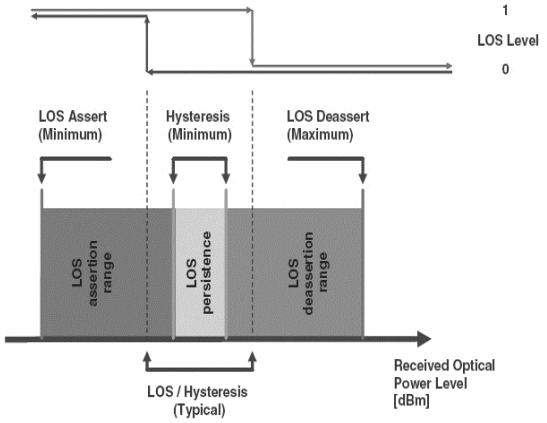
Note4: Filtered, measured with a PRBS 2^7-1 test pattern @1250Mbps.

Note5: LVPECL logic, internally AC coupled.

Note6: Measured at all data rates specified in Data Rate table with ER=9 dB, 2^7-1 PRBS data pattern, BER <1E-12.

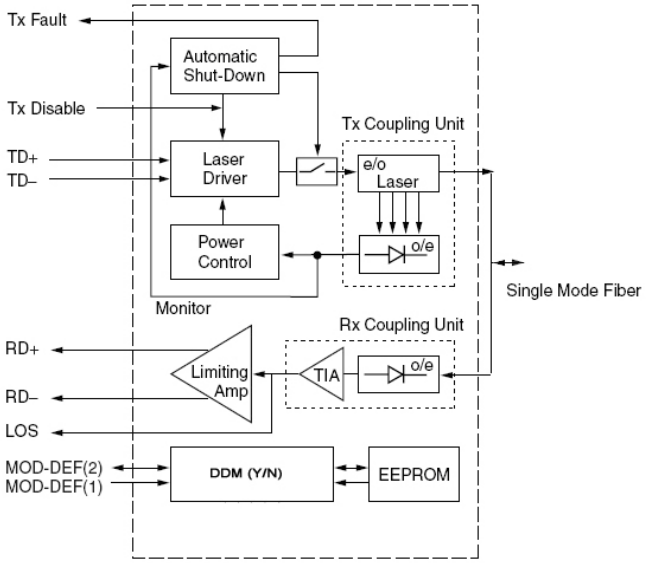
Note7: Eye pattern mask Note8: LOS Hysteresis



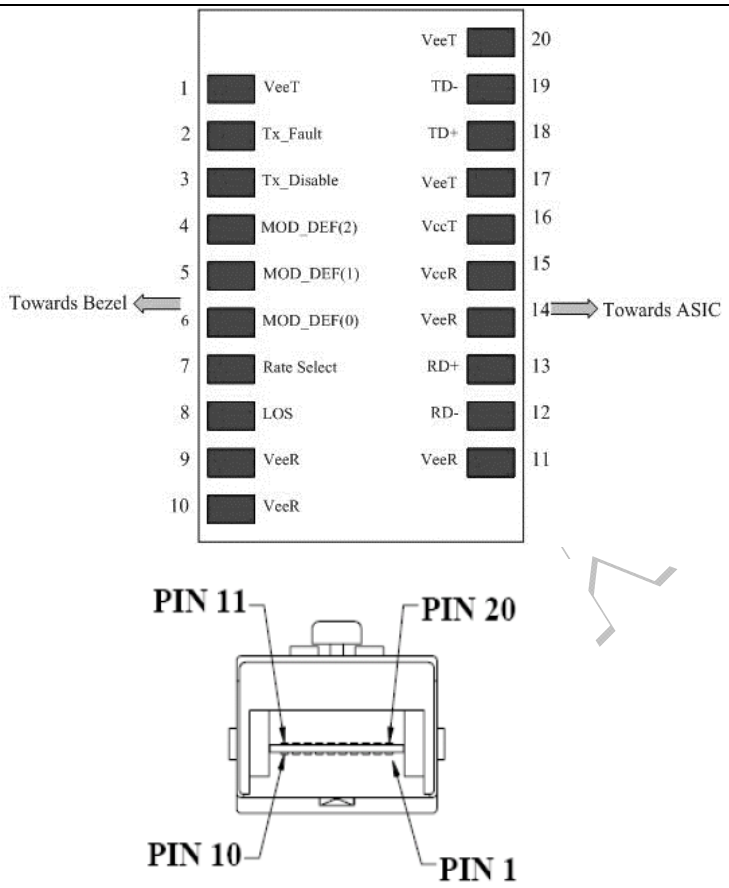


Note9: The channel center wavelength of transmitter side is compliant with table <CWDM* Wavelength (0~70C)>, and the channel center wavelength of receiver side is the typical wavelength of CWDM channel ±20nm

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) 2 wire serial ID interface.
5	MOD-DEF1	Module Definition 1	3	3) 2 wire serial ID interface.
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 – 10KΩresistor on the host board. The pull-up voltage shall be VccT or VccR. 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.

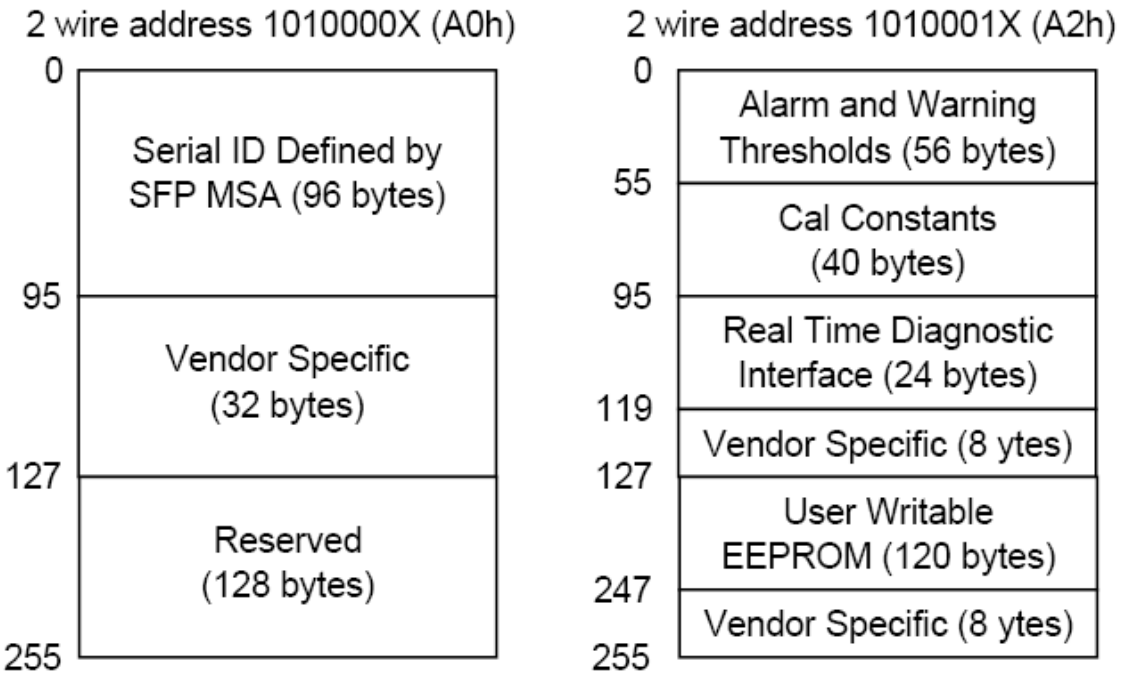
8) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with

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 400 – 2000 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.

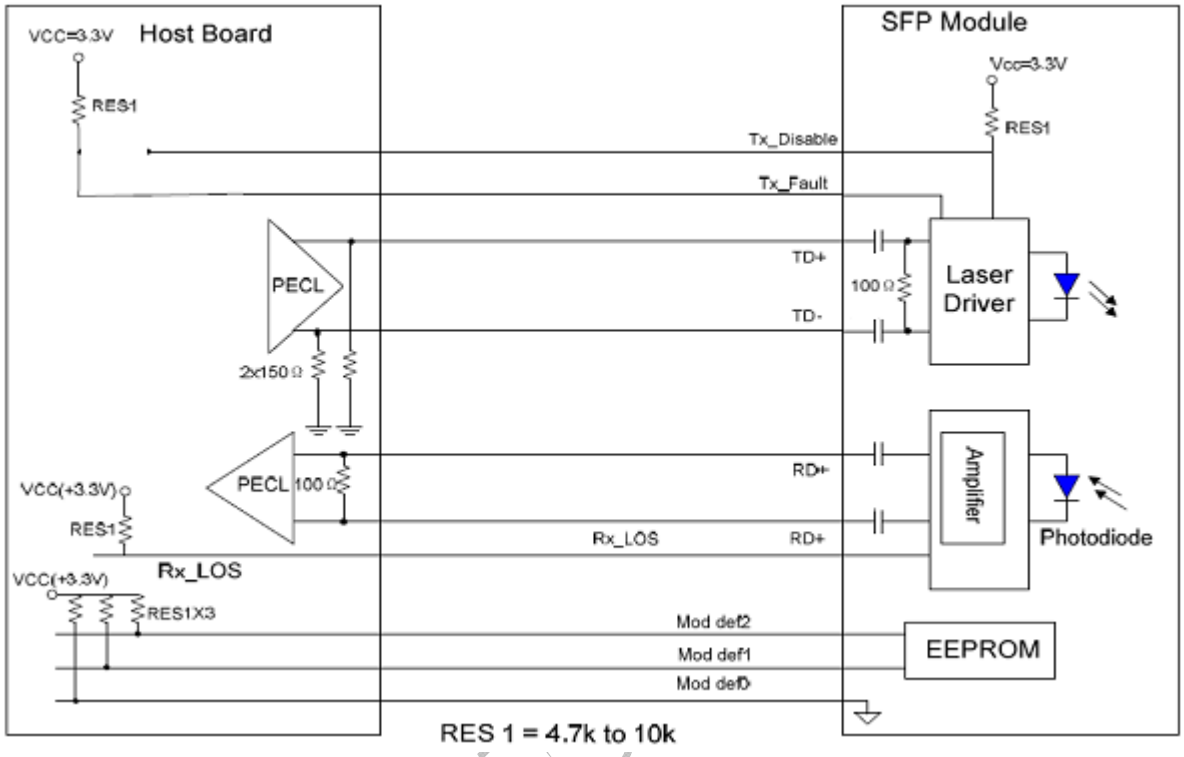
EEPROM

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.

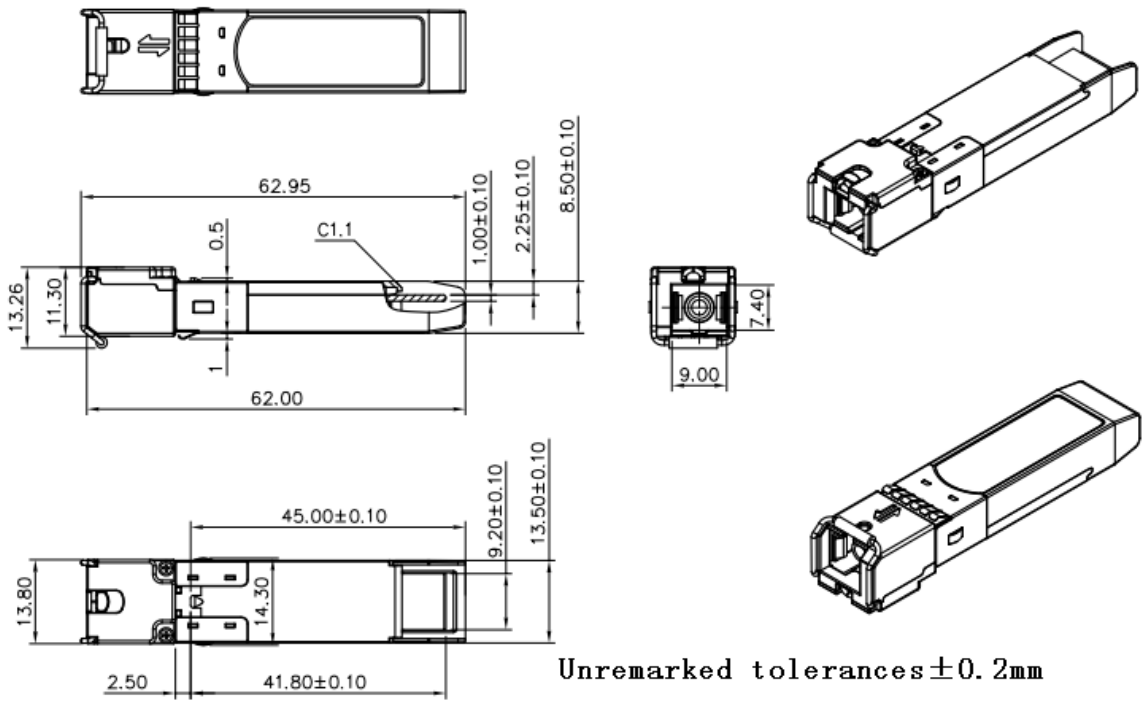
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power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



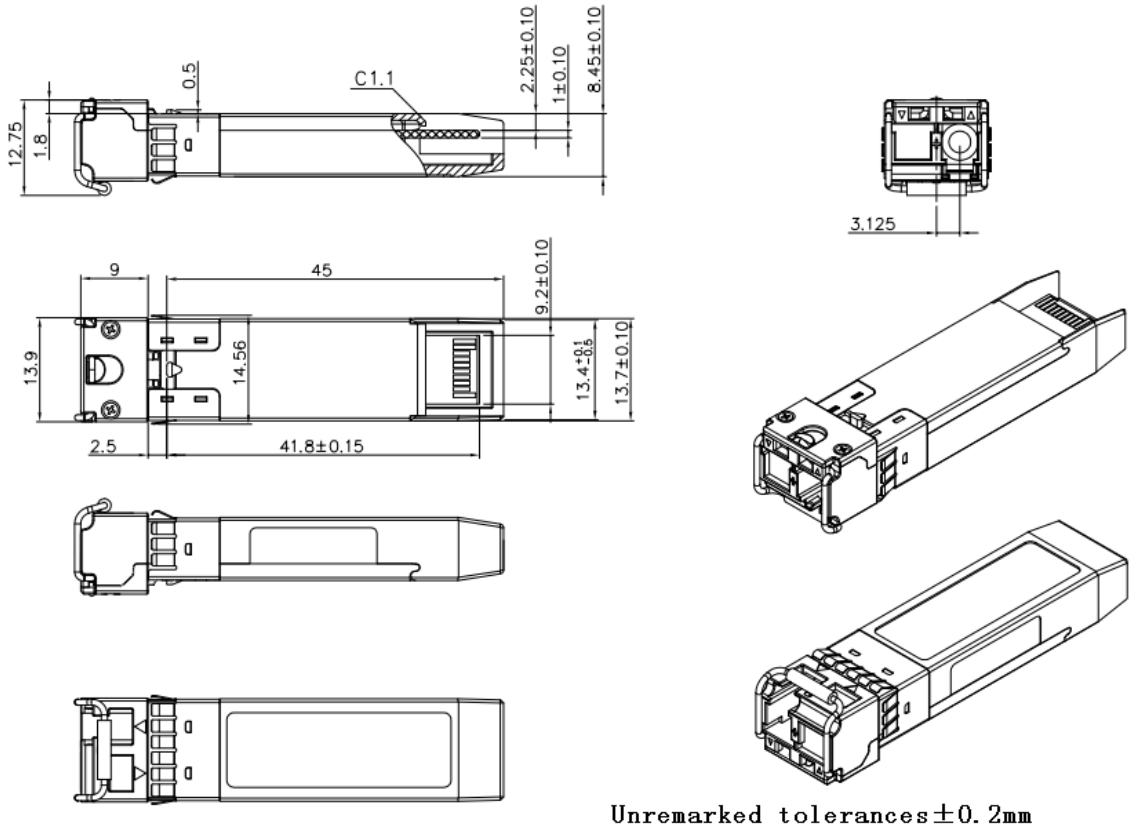
Recommend Circuit Schematic



Mechanical Specifications



SC



LC

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

Laser Emission

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	Revision History	Date
V1.a	Cathy	Kelly		Released.	2009.09.10
V1.b	Cathy	Kelly		Update the mechanical specl	2010.1.23
V1.c	Cathy			Updated EEPROM.	2011.3.11
V2.a	Phlio			Update Recommend Circuit	Aug 10, 2011

V2.b	Phlio			Remove EEPROM Detail Information Change Power Link Budget	Aug 22, 2011
V2.c	Phlio	Kelly		Add 21db link budget items	Sep. 26, 2011
V2.d	Kelly			Add 36Db budget product and PN illustration, update SFP BIDI SC photo.	Oct 8, 2011
V2.e	Kelly			Update photo.	Nov 4, 2011
V2.f	Angela, Jans	Kelly		Update power budget, delete 36Db product.	Dec 8,2012
V2.g	Angela	Kelly		Correct slip of a pen	Jan 18,2013
V2.h	Angela, Jans	Kelly		Update pin definition notes	Jan 23,2013
V2.i	Angela	Kelly/Vina		Update the regulatory compliance, LOSA, optical output eye pattern mask and the 2D drawing.	Feb 17,2016
V2.j	Angela	Kelly		Update the contact.	June 14, 2018
V2.k	Angela	Kelly/Yiwei.Chen		Updated the regulatory compliance and some typo error.	Mar. 27,2019

Notice:

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