

EOLS-1603-XXXD Series

SFP Single-Mode for DWDM Application
Duplex SFP Transceiver
Digital Diagnostic Function
RoHS6 Compliant

Features

- ◆ Operating Data Rate up to 155Mbps
- ◆ Available in all C-Band Wavelengths on the 50GHz DWDM ITU Grid
- ◆ Single 3.3V Power Supply and TTL Logic Interface
- ◆ Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- ◆ Compliant with Class 1 FDA and IEC60825-1 Laser Safety
- ◆ Compliant with SFP MSA
- ◆ Compliant with SFF-8472
- ◆ Operating Case Temperature:
 - Standard: 0°C to 70°C
 - Industrial: -40°C to 85°C



Applications

- ◆ Amplified DWDM networks
- ◆ Ring topologies with fixed and reconfigurable OADMs
- ◆ Fast Ethernet, Giga Ethernet
- ◆ Fiber Channel

Ordering Information

Part No.	Data Rate	Laser	Power budget ^{*(note2)}	Interface	Temp.
EOLS-1603-45XXX ^{*(note1)} D	155Mbps	DWDM EML	45dB	LC	Standard
EOLS-1603-45XXX ^{*(note1)} DI	155Mbps	DWDM EML	45dB	LC	Industrial

Note1: XXX refers to DWDM Wavelength range as ITU-T specified, please refer the following table for detailed center wavelength information.

Note2: The power budget which is guaranteed.

*The product image only for reference purpose.

XXX- Channel refers to the following table:

Channel (XXX)	Part NO.	Frequency (THz)	Center Wavelength (nm)
200	EOLS-1603-X*200D EOLS-1603-X*200DI	192.00	1561.42

205	EOLS-1603-X*205D EOLS-1603-X*205DI	192.05	1561.01
210	EOLS-1603-X*210D EOLS-1603-X*210DI	192.10	1560.61
215	EOLS-1603-X*215D EOLS-1603-X*215DI	192.15	1560.20
220	EOLS-1603-X*220D EOLS-1603-X*220DI	192.20	1559.79
225	EOLS-1603-X*225D EOLS-1603-X*225DI	192.25	1559.39
230	EOLS-1603-X*230D EOLS-1603-X*230DI	192.30	1558.98
235	EOLS-1603-X*235D EOLS-1603-X*235DI	192.35	1558.58
240	EOLS-1603-X*240D EOLS-1603-X*240DI	192.40	1558.17
245	EOLS-1603-X*245D EOLS-1603-X*245DI	192.45	1557.77
250	EOLS-1603-X*250D EOLS-1603-X*250DI	192.50	1557.36
255	EOLS-1603-X*255D EOLS-1603-X*255DI	192.55	1556.96
260	EOLS-1603-X*260D EOLS-1603-X*260DI	192.60	1556.55
265	EOLS-1603-X*265D EOLS-1603-X*265DI	192.65	1556.15
270	EOLS-1603-X*270D EOLS-1603-X*270DI	192.70	1555.75
275	EOLS-1603-X*275D EOLS-1603-X*275DI	192.75	1555.34
280	EOLS-1603-X*280D EOLS-1603-X*280DI	192.80	1554.94
285	EOLS-1603-X*285D EOLS-1603-X*285DI	192.85	1554.54
290	EOLS-1603-X*290D EOLS-1603-X*290DI	192.90	1554.13
295	EOLS-1603-X*295D EOLS-1603-X*295DI	192.95	1553.73
300	EOLS-1603-X*300D EOLS-1603-X*300DI	193.00	1553.33
305	EOLS-1603-X*305D EOLS-1603-X*305DI	193.05	1552.93
310	EOLS-1603-X*310D	193.10	1552.52

	EOLS-1603-X*310DI		
315	EOLS-1603-X*315D EOLS-1603-X*315DI	193.15	1552.12
320	EOLS-1603-X*320D EOLS-1603-X*320DI	193.20	1551.72
325	EOLS-1603-X*325D EOLS-1603-X*325DI	193.25	1551.32
330	EOLS-1603-X*330D EOLS-1603-X*330DI	193.30	1550.92
335	EOLS-1603-X*335D EOLS-1603-X*335DI	193.35	1550.52
340	EOLS-1603-X*340D EOLS-1603-X*340DI	193.40	1550.12
345	EOLS-1603-X*345D EOLS-1603-X*345DI	193.45	1549.72
350	EOLS-1603-X*350D EOLS-1603-X*350DI	193.50	1549.32
355	EOLS-1603-X*355D EOLS-1603-X*355DI	193.55	1548.91
360	EOLS-1603-X*360D EOLS-1603-X*360DI	193.60	1548.51
365	EOLS-1603-X*365D EOLS-1603-X*365DI	193.65	1548.11
370	EOLS-1603-X*370D EOLS-1603-X*370DI	193.70	1547.72
375	EOLS-1603-X*375D EOLS-1603-X*375DI	193.75	1547.32
380	EOLS-1603-X*380D EOLS-1603-X*380DI	193.80	1546.92
385	EOLS-1603-X*385D EOLS-1603-X*385DI	193.85	1546.52
390	EOLS-1603-X*390D EOLS-1603-X*390DI	193.90	1546.12
395	EOLS-1603-X*395D EOLS-1603-X*395DI	193.95	1545.72
400	EOLS-1603-X*400D EOLS-1603-X*400DI	194.00	1545.32
405	EOLS-1603-X*405D EOLS-1603-X*405DI	194.05	1544.92
410	EOLS-1603-X*410D EOLS-1603-X*410DI	194.10	1544.53
415	EOLS-1603-X*415D EOLS-1603-X*415DI	194.15	1544.13

420	EOLS-1603-X*420D EOLS-1603-X*420DI	194.20	1543.73
425	EOLS-1603-X*425D EOLS-1603-X*425DI	194.25	1543.33
430	EOLS-1603-X*430D EOLS-1603-X*430DI	194.30	1542.94
435	EOLS-1603-X*435D EOLS-1603-X*435DI	194.35	1542.54
440	EOLS-1603-X*440D EOLS-1603-X*440DI	194.40	1542.14
445	EOLS-1603-X*445D EOLS-1603-X*445DI	194.45	1541.75
450	EOLS-1603-X*450D EOLS-1603-X*450DI	194.50	1541.35
455	EOLS-1603-X*455D EOLS-1603-X*455DI	194.55	1540.95
460	EOLS-1603-X*460D EOLS-1603-X*460DI	194.60	1540.56
465	EOLS-1603-X*465D EOLS-1603-X*465DI	194.65	1540.16
470	EOLS-1603-X*470D EOLS-1603-X*470DI	194.70	1539.77
475	EOLS-1603-X*475D EOLS-1603-X*475DI	194.75	1539.37
480	EOLS-1603-X*480D EOLS-1603-X*480DI	194.80	1538.98
485	EOLS-1603-X*485D EOLS-1603-X*485DI	194.85	1538.58
490	EOLS-1603-X*490D EOLS-1603-X*490DI	194.90	1538.19
495	EOLS-1603-X*495D EOLS-1603-X*495DI	194.95	1537.79
500	EOLS-1603-X*500D EOLS-1603-X*500DI	195.00	1537.40
505	EOLS-1603-X*505D EOLS-1603-X*505DI	195.05	1537.00
510	EOLS-1603-X*510D EOLS-1603-X*510DI	195.10	1536.61
515	EOLS-1603-X*515D EOLS-1603-X*515DI	195.15	1536.22
520	EOLS-1603-X*520D EOLS-1603-X*520DI	195.20	1535.82
525	EOLS-1603-X*525D	195.25	1535.43

	EOLS-1603-X*525DI		
530	EOLS-1603-X*530D EOLS-1603-X*530DI	195.30	1535.04
535	EOLS-1603-X*535D EOLS-1603-X*535DI	195.35	1534.64
540	EOLS-1603-X*540D EOLS-1603-X*540DI	195.40	1534.25
545	EOLS-1603-X*545D EOLS-1603-X*545DI	195.45	1533.86
550	EOLS-1603-X*550D EOLS-1603-X*550DI	195.50	1533.47
555	EOLS-1603-X*555D EOLS-1603-X*555DI	195.55	1533.07
560	EOLS-1603-X*560D EOLS-1603-X*560DI	195.60	1532.68
565	EOLS-1603-X*565D EOLS-1603-X*565DI	195.65	1532.29
570	EOLS-1603-X*570D EOLS-1603-X*570DI	195.70	1531.90
575	EOLS-1603-X*575D EOLS-1603-X*575DI	195.75	1531.51
580	EOLS-1603-X*580D EOLS-1603-X*580DI	195.80	1531.12
585	EOLS-1603-X*585D EOLS-1603-X*585DI	195.85	1530.72
590	EOLS-1603-X*590D EOLS-1603-X*590DI	195.90	1530.33
595	EOLS-1603-X*595D EOLS-1603-X*595DI	195.95	1529.94

*: X refers to the DWDM Power budget (45), please contact EOPTOLINK to confirm whether the wavelength is available.

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
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*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-1603-XXXD series single mode transceiver is small form factor pluggable module for duplex optical data communications. This module is designed for single mode fiber and operates at a nominal DWDM wavelength from 1529.94nm to 1561.42nm as specified by the ITU-T. It is designed to deploy in the DWDM networking equipment in metropolitan access and core networks.

It is with the SFP 20-pin connector to allow hot plug capability. The transmitter section uses a DWDM multiple quantum well EML laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

The EOLS-1603-XXXD series are designed to be compliant with SFF-8472 Multi-Source Agreement (MSA).

Absolute Maximum Ratings^{*note3}

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T _S	-40	+85	°C
Operating Case Temperature	T _{case}	-40	85	°C
Supply Voltage	V _{CC}	-0.5	3.6	V
Operating Relative Humidity		-	95	%

Note3: Exceeding any one of these values may destroy the device permanently.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	
Operating Case Temperature	T _C	EOLS-1603-XXD	0	-	+70	°C
		EOLS-1603-XXDI	-40	-	+85	
Power Supply Voltage	V _{CC}	3.15	3.3	3.45	V	
Power Supply Current	I _{CC}	-	-	450	mA	
Power Supply Current	I _{CC}	-	-	540*	mA	
Date Rate				155M	bps	

*540mA only for Industrial operating case temperature

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter						
LVPECL Inputs(Differential)	V _{in}	400		2000	mVpp	AC coupled inputs ^{*(note4)}
Input Impedance (Differential)	Z _{in}	85	100	115	ohm	R _{in} > 100 kohm @ DC

TX_Dis	Disable		2		Vcc	V	
	Enable		0		0.8		
TX_FAULT	Fault		2		Vcc	V	
	Normal		0		0.8		
Receiver							
LVPECL Outputs (Differential)		Vout	370		2000	mVpp	AC coupled outputs*(note4)
Output Impedance (Differential)		Zout	85	100	115	ohm	
RX_LOS	LOS		2		Vcc	V	
	Normal		0		0.8	V	
MOD_DEF (0:2)		VoH	2.5			V	
		VoL	0		0.8	V	

Performance Specifications – Optical

(DWDM EML and APD, 45dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate			155M		bps
Transmitter					
Center Wavelength	λ	1528		1564	nm
Spectral Width (-20dB)	$\Delta\lambda$			0.3	nm
Side Mode Suppression Ratio	SMSR	30			dB
Channel Spacing	Δf		50		GHz
Deviation From Central Frequency@EOL		-6		6	GHz
Average Output Power*(note5)	Pout	2		5	dBm
Average Launch Power (Tx: OFF)	Poff			-45	dBm
Extinction Ratio*(note6)	ER	8.2			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye*(note6)	Compatible with IEEE 802.3*(note8)				
TX_Disable Assert Time	t_off			10	us
Pout@TX Disable Asserted	Pout			-45	dBm
Relative Intensity Noise	RIN			-135	dB/Hz
Receiver					
Center Wavelength	λ	1528		1664	nm
Receiver Sensitivity*(note7)	Pmin			-43	dBm
Receiver Overload	Pmax	-10			dBm
LOS De-Assert	LOSD			-44	dBm
LOS Assert	LOSA	-55			dBm
LOS Hysteresis*(note9)		0.5			dB

Note4: LVPECL logic, internally AC coupled.

Note5: Output is coupled into a 9/125 μ m single-mode fiber.

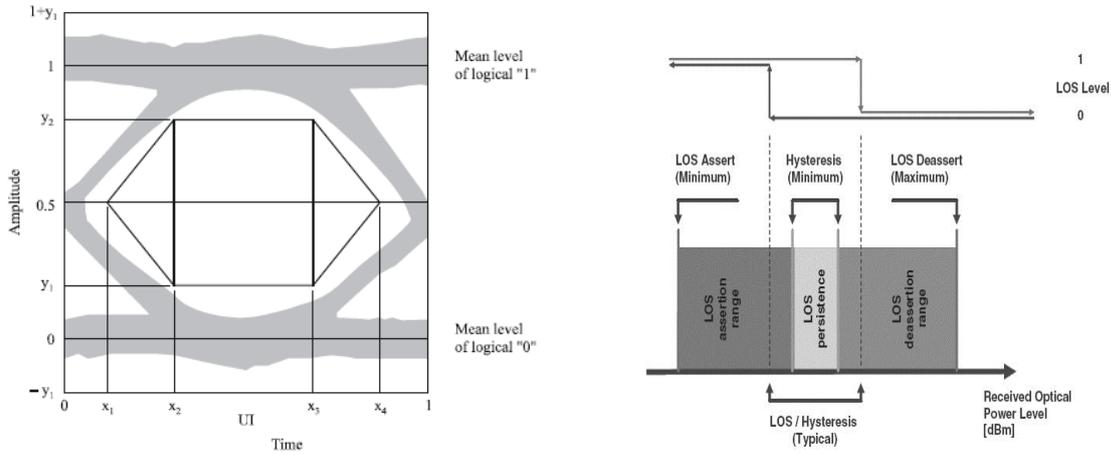
Note6: Filtered, measured with a PRBS 2²³-1 test pattern @155Mbps

Note7: Minimum average optical power measured at BER less than $1E-10$, with a $2^{23}-1$ PRBS and $ER=10\text{Db}$.

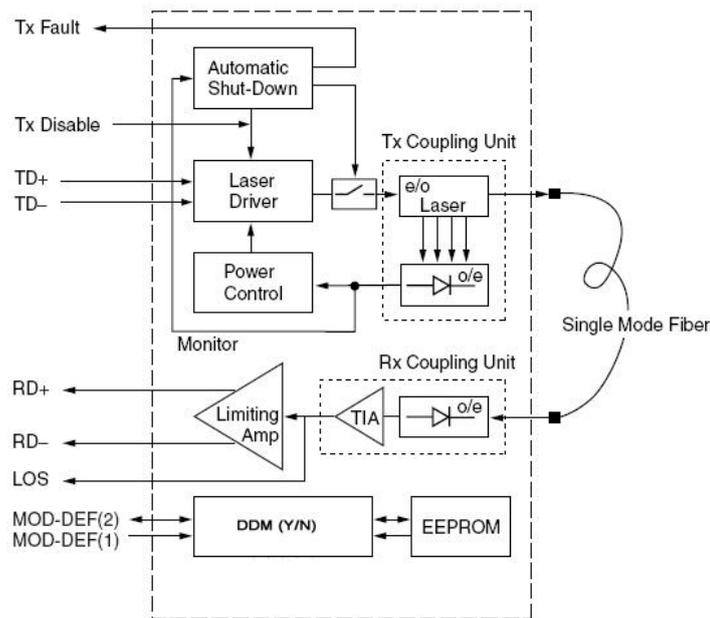
Note8: Measured with a PRBS $2^{23}-1$ test pattern @155Mbps, $BER \leq 1 \times 10^{-10}$.

Note9: Eye Pattern Mask

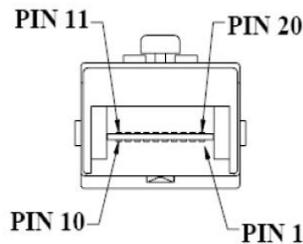
Note10: LOS Hysteresis

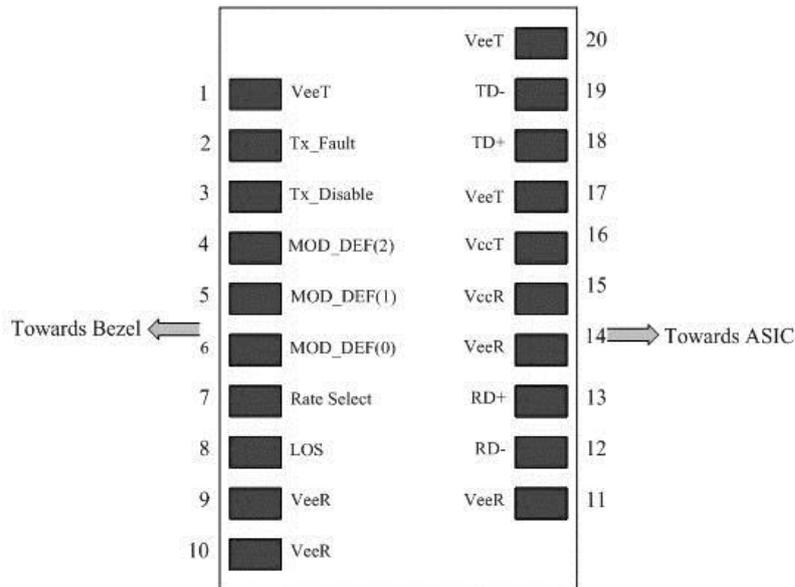


Functional Description of Transceiver



SFP Transceiver Electrical Pad Layout





Pin Function Definitions

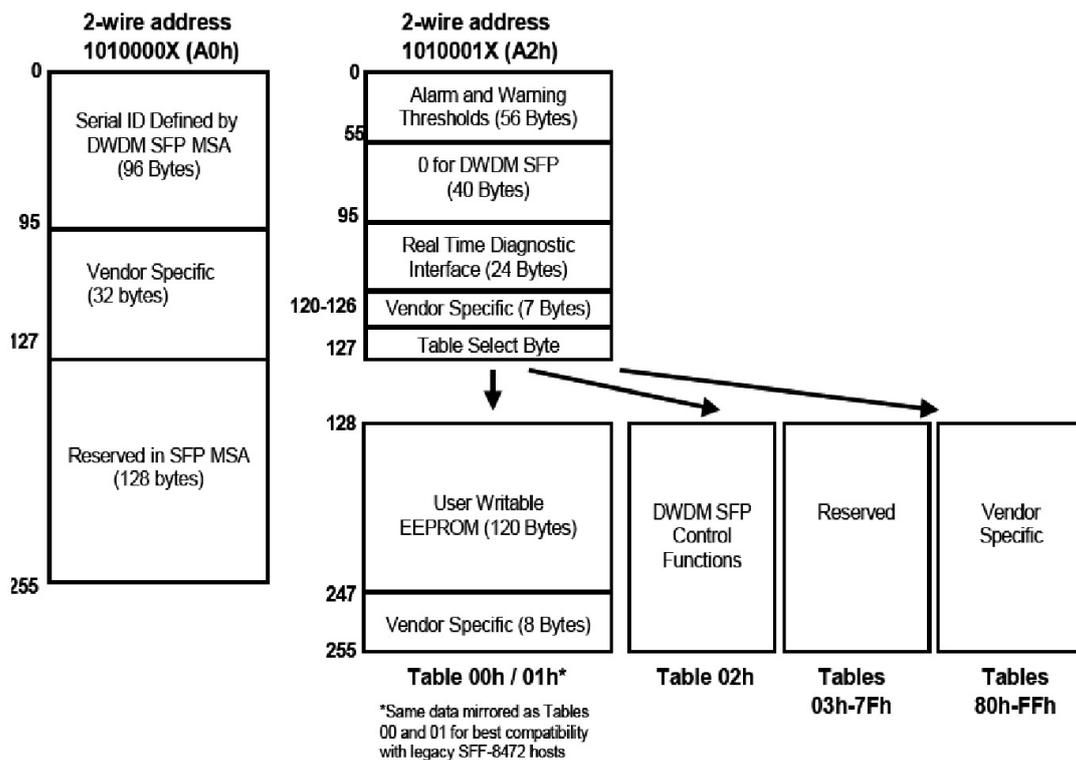
Pin Num.	Name	Function Description
1	VeeT	Transmitter Ground
2	TX Fault	Transmitter Fault Indication, open collector/drain output
3	TX Disable	Transmitter Disable
4	MOD-DEF2	Module Definition 2, Data line for Serial ID.
5	MOD-DEF1	Module Definition 1, Clock line for Serial ID.
6	MOD-DEF0	Module Definition 0, Grounded within the module.
7	Rate Select	Not Connect, Function not available
8	LOS	Loss of Signal, open collector/drain output
9	VeeR	Receiver Ground
10	VeeR	Receiver Ground
11	VeeR	Receiver Ground
12	RD-	Inv. Received Data Out
13	RD+	Received Data Out
14	VeeR	Receiver Ground
15	VccR	Receiver Power, 3.3 ± 5%
16	VccT	Transmitter Power, 3.3 ± 5%
17	VeeT	Transmitter Ground
18	TD+	Transmit Data In
19	TD-	Inv. Transmit Data In
20	VeeT	Transmitter Ground

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. 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

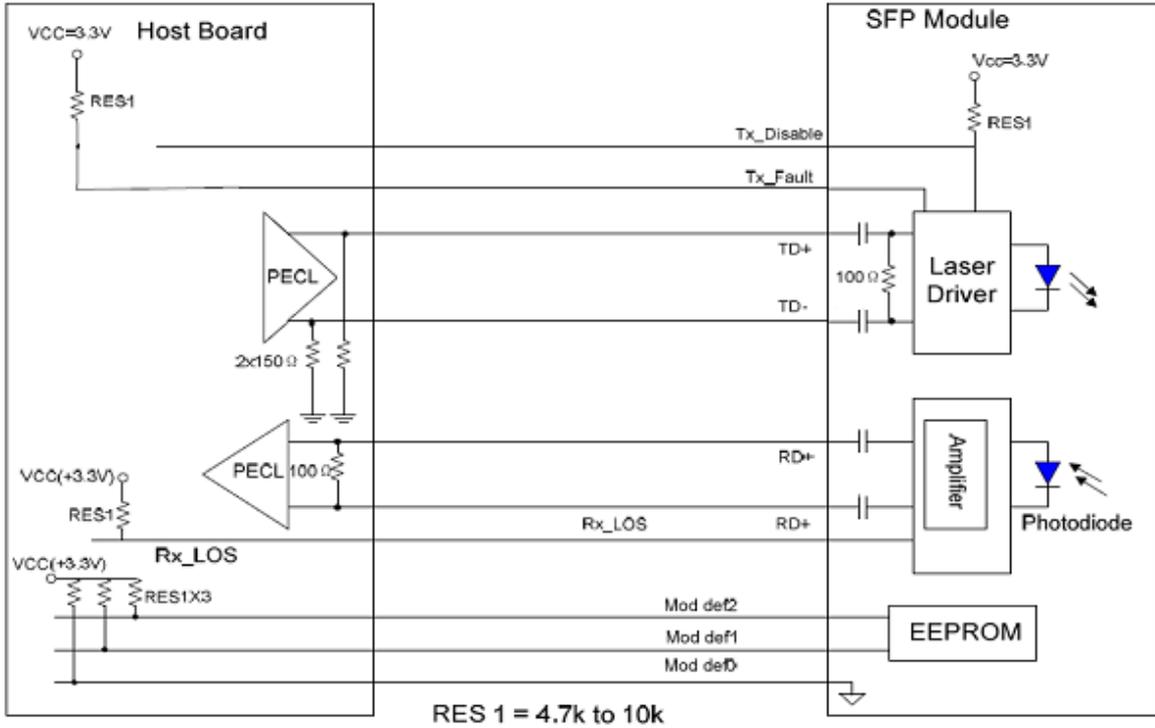
Addr.	Size(bytes)	Name of field	Vaule(Hex)	Description
0	1	Identifier	0B	DWDM SFP
1	1	Ext. Identifier	XX	

2	1	Connector	07	LC connector
3-10	8	Transceiver Codes	00	Reserved
			00	-
			00	-
			XX	
			XX	
			XX	
			01	Single mode
			01	100Mbytes/sec compliant
11	1	Encoding	XX	
12	1	BR, Nominal	01	155Mbps
13	1	Reserved	00	-
14	1	Length (9μm)km	XX	
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 XX XX XX XX XX XX XX XX ^(note11)	Vendor name
36	1	Implemented Optional DWDM Features	00	-
37-39	3	Vendor OUI	00 00 00	-
40-55	16	Vendor PN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX ^(note11)	PN
56-59	4	Vendor Rev	XX XX XX XX ^(note11)	
60-62	3	Wavelength	XX	Laser Wavelength
63	1	CC-BASE	XX	CC for Base ID fields implemented (addresses 0 to62)
64~65	2	Options	00	Reserved
			1A	1.TX_DISABLE is implemented and disables the serial output; 2.TX_FAULT signal implemented; 3.Loss of Signal implemented
66	1	BR, max	00	-

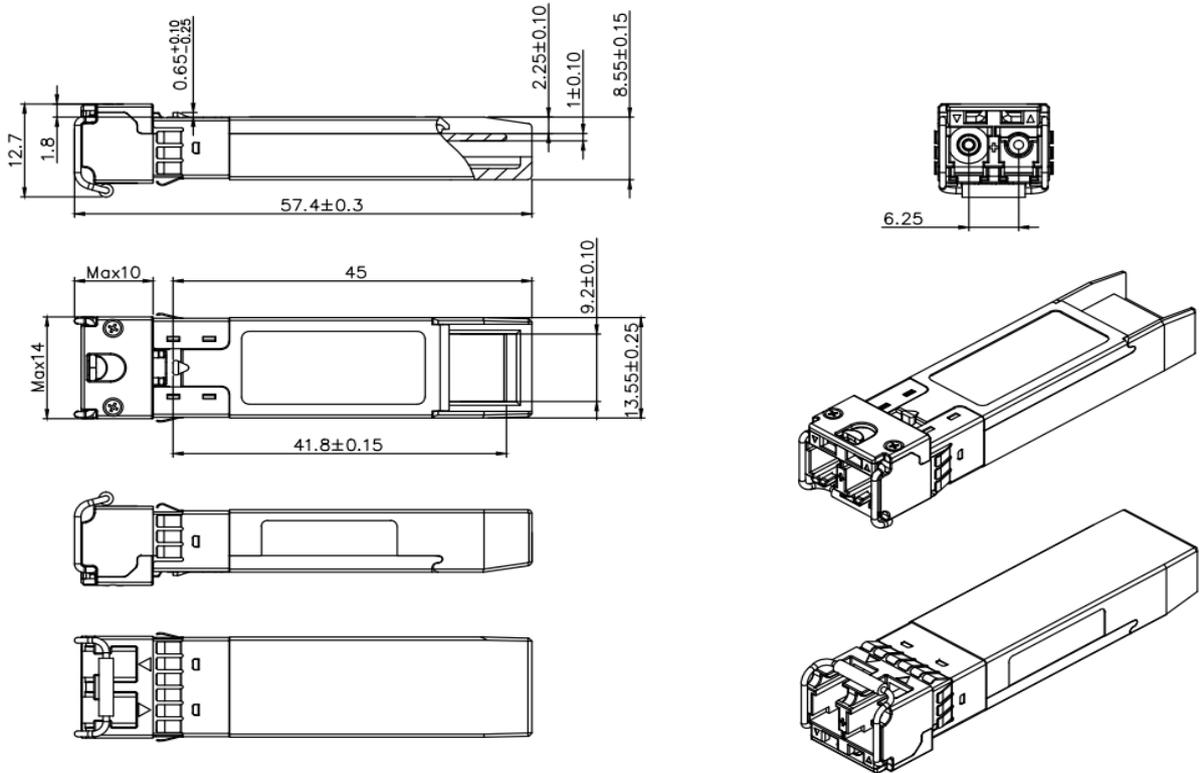
67	1	BR, max	00	-
68~83	16	Vendor SN	XX	Serial number of Transceiver (ASCII)
84~89	6	Date code	XX	The vendor's date code (ASCII)
90~91	2	Vendor specific lot code	XX XX	-
92	1	Diagnostic Monitoring Type	XX	1. Digital diagnostic monitoring implemented 2. Internally/Externally Calibrated; 3. Received power measurement type is Average Power
93	1	Enhanced Options	F0	1. Optional Alarm/warning flags implemented for all monitored quantities 2. Optional Soft TX_DISABLE control and monitoring implemented 3. Optional Soft TX_FAULT monitoring Implemented 4. Optional Soft RX_LOS monitoring Implemented
94	1	SFF-8472 Compliance	01	Includes functionality described in Rev 9.3 of SFF-8472.
95	1	CC_EXT	XX	CC for the extended ID Fields (addresses 64 to 94) implemented.
96~127	32	Vendor Specific	XX	Read only memory
128-255	128	Reserved	Read only	

Note11: 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.

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	Tim.Liang	Kelly.Cao		Released.	Oct 24, 2009
V2.b	Kelly			Revise the A2H.	Nov 24, 2009
V2.c	Kelly			Complete the DWDM wavelength.	Jan 18, 2010
V2.d	Kelly			Correct Rx λ range.	Apr 8, 2010
V3.a	Kelly			Update PN&LOGO.	July 18, 2011
V3.b	Jans	Kelly		Update EEPROM map, integrate 3 products.	Sep 20, 2011
V3.c	Angela	Lyn/Jason/ Walt/Nygai		Update regulatory compliance, lcc, Tr/Toff and the Pout of 37Db and 45Db products.	Sep 25,2013
V3.d	Angela	Lyn/Jason/ Nygai		Add 29Db series PN. Update the regulatory compliance and 2D drawing.	Aug 10,2015
V3.e	Oliver	Abby/Chao/Downey/Phlio /Picard/Marvin/Kelly/Lyn/ Elaine/Nico/Jp/John/Flagon		Add the industrial temperature range, delete the 29Db 34Db 37Db link budget, update the laser type, the label picture, the regulatory compliance and 2D drawing.	Feb 9,2017
V3.f	Elaine	Kelly/Daquan.Dong		Update the note7	Jul 28, 2017

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.

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