

EOLS-1606-XX Series

**Single-Mode CWDM 622M SDH/SONET
Duplex SFP Transceiver
RoHS6 Compliant**



Features

- ◆ Operating Data Rate up to 622Mbps
- ◆ 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 Duplex LC Connector Interface
- ◆ Compliant with Class 1 FDA and IEC60825-1 Laser Safety
- ◆ Operating Case Temperature
Standard: 0°C~+70
Extended: -20°C~+85°C
- ◆ Compliant with SFP MSA
- ◆ Compliant with SFF-8472

Applications

- ◆ SDH/SONET
- ◆ ATM Switches and Routers
- ◆ Fast Ethernet
- ◆ Other Optical Link

Ordering Information

Part No.	Data Rate	Fibre	Link Budget	Interface	Temperature	DDMI
EOLS-1606-23X ^{*(note1)}	622Mbps	SMF	23dB	LC	Standard	NO
EOLS-1606-23XI	622Mbps	SMF	23dB	LC	Extended	NO
EOLS-1606-23XD	622Mbps	SMF	23dB	LC	Standard	YES
EOLS-1606-23XDI	622Mbps	SMF	23dB	LC	Extended	YES
EOLS-1606-28X	622Mbps	SMF	28dB	LC	Standard	NO
EOLS-1606-28XI	622Mbps	SMF	28dB	LC	Extended	NO
EOLS-1606-28XD	622Mbps	SMF	28dB	LC	Standard	YES
EOLS-1606-28XDI	622Mbps	SMF	28dB	LC	Extended	YES
EOLS-1606-34XD	622Mbps	SMF	34dB	LC	Standard	YES
EOLS-1606-34XDI	622Mbps	SMF	34dB	LC	Extended	YES

EOLS-1606-39XD	622Mbps	SMF	39dB	LC	Standard	YES
EOLS-1606-39XDI	622Mbps	SMF	39dB	LC	Extended	YES
EOLS-1606-41XD	622Mbps	SMF	41dB	LC	Standard	YES
EOLS-1606-41XDI	622Mbps	SMF	41dB	LC	Extended	YES

Note1: X refers to CWDM Wavelength range 1270nm to 1610nm, A=1270~R=1610.

CWDM^{*Note2} Wavelength

Band	Nomenclature	Wavelength(nm)		
		Min.	Typ.	Max.
O-band Original	A	1264	1270	1277.5
	B	1284	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 1270 nm to 1610 nm, with 20 nm span. Please contact EOPTOLINK to confirm the wavelength availability.

Regulatory Compliance^{*Note3}

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

Note3: 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-1606-XX series single mode transceiver is small form factor pluggable module for serial optical data communications such as SONET OC-12/SDH STM-4 and Fast Ethernet. 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 CWDM. There are eighteen center wavelengths available from 1270nm to 1610nm, with each step 20nm.

The transmitter section uses a multiple quantum well CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs avalanche detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

The EOLS-1606-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 permanently.

Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature		T_c EOLS-1606-XX	0	-	+70	°C
		EOLS-1606-XXI	-20	-	+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
	OC-3/STM-1			155		
	100M			100		

Performance Specifications - Electrical

Parameter		Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter							
LVPECL Inputs(Differential)		V_{in}	400		2000	mVpp	AC coupled inputs
Input Impedance (Differential)		Z_{in}	85	100	115	ohm	$R_{in} > 100 \text{ kohm @ DC}$
TX_Dis	Disable		2		V_{CC}	V	
	Enable		0		0.8		
TX_FAULT	Fault		2		V_{CC}	V	
	Normal		0		0.8		

Receiver						
LVPECL Outputs (Differential)	Vout	370		2000	mVpp	AC coupled outputs
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

(CWDM DFB and PIN/TIA, 23dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		100	622		Mbps
Transmitter					
Center Wavelength	λ_c	λ_c-6	λ_c	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note4)}	Pout	-5		0	dBm
Extinction Ratio ^{*(note4)}	ER	8.2			dB
Side Mode Suppression Ratio	SMSR	30			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye ^{*(note5)}	IUT-T G.957 Compliant ^{*(note8)}				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_c	1100		1650	nm
Receiver Sensitivity ^{*(note6)}	OC-12/STM-4	Pmin		-28	dBm
	OC-3/STM-1			-29	dBm
	100M			-30	dBm
Receiver Overload	Pmax	-8			dBm
Return Loss		14			dB
Optical Path Penalty ^{*(note7)}				1	dB
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis ^{*(note9)}		0.5			dB

(CWDM DFB and PIN/TIA, 28dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		100	622		Mbps
Transmitter					
Center Wavelength	λ_c	λ_c-6	λ_c	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note4)}	Pout	0		+5	dBm
Extinction Ratio ^{*(note4)}	ER	8.2			dB
Side Mode Suppression Ratio	SMSR	30			dB

Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye ^{*(note5)}	IUT-T G.957 Compliant ^{*(note8)}				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_c	1100		1650	nm
Receiver Sensitivity ^{*(note6)}	OC-12/STM-4	Pmin		-28	dBm
	OC-3/STM-1			-29	dBm
	100M			-30	dBm
Receiver Overload	Pmax	-8			dBm
Return Loss		14			dB
Optical Path Penalty ^{*(note7)}				1	dB
LOS De-Assert	LOSD			-29	dBm
LOS Assert	LOSA	-42			dBm
LOS Hysteresis ^{*(note9)}		0.5			dB

(CWDM DFB and PIN, 34dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		100	622		Mbps
Transmitter					
Center Wavelength	λ_c	λ_c-6	λ_c	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note4)}	Pout	2		7	dBm
Extinction Ratio ^{*(note4)}	ER	8.2			dB
Side Mode Suppression Ratio	SMSR	30			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye ^{*(note5)}	IUT-T G.957 Compliant ^{*(note8)}				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_c	1100		1650	nm
Receiver Sensitivity ^{*(note6)}	OC-12/STM-4	Pmin		-32	dBm
	OC-3/STM-1			-33	dBm
	100M			-34	dBm
Receiver Overload	Pmax	-8			dBm
Return Loss		14			dB
Optical Path Penalty ^{*(note7)}				1	dB
LOS De-Assert	LOSD			-33	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis ^{*(note9)}		0.5			dB

(CWDM DFB and APD, 39dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		100	622		Mbps
Transmitter					
Center Wavelength	λ_c	λ_c-6	λ_c	$\lambda_c+7.5$	nm

Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note4)}	Pout	2		7	dBm
Extinction Ratio ^{*(note4)}	ER	8.2			dB
Side Mode Suppression Ratio	SMSR	30			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye ^{*(note5)}	IUT-T G.957 Compliant ^{*(note8)}				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_c	1100		1650	nm
Receiver Sensitivity ^{*(note6)}	OC-12/STM-4	Pmin		-37	dBm
	OC-3/STM-1			-38	dBm
	100M			-39	dBm
Receiver Overload	Pmax	-10			dBm
Return Loss		14			dB
Optical Path Penalty ^{*(note7)}				1	dB
LOS De-Assert	LOSD			-38	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis ^{*(note9)}		0.5			dB

(CWDM DFB and APD, 41dB Power Budget at Least)

Parameter	Symbol	Min.	Typical	Max.	Unit
Data Rate		100	622		Mbps
Transmitter					
Center Wavelength	λ_c	λ_c-6	λ_c	$\lambda_c+7.5$	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note4)}	Pout	4		7	dBm
Extinction Ratio ^{*(note4)}	ER	8.2			dB
Side Mode Suppression Ratio	SMSR	30			dB
Rise/Fall Time(20%~80%)	tr/tf			2	ns
Output Optical Eye ^{*(note5)}	IUT-T G.957 Compliant ^{*(note8)}				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_c	1100		1650	nm
Receiver Sensitivity ^{*(note6)}	OC-12/STM-4	Pmin		-37	dBm
	OC-3/STM-1			-38	dBm
	100M			-39	dBm
Receiver Overload	Pmax	-10			dBm
Return Loss		14			dB
Optical Path Penalty ^{*(note7)}				1	dB
LOS De-Assert	LOSD			-38	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis ^{*(note9)}		0.5			dB

Note4: Output is coupled into a 9/125 μ m single-mode fiber.

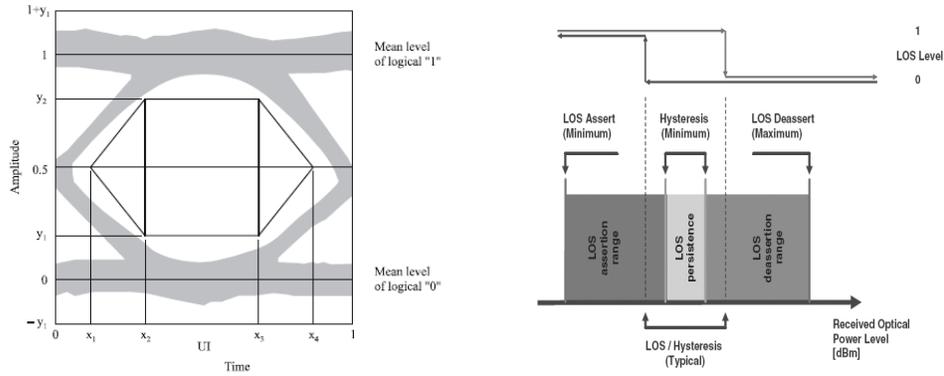
Note5: Filtered, measured with a PRBS 2²³-1 test pattern @622Mbps

Note6: Minimum average optical power measured at BER less than 1E-10 with a $2^{23}-1$ PRBS.

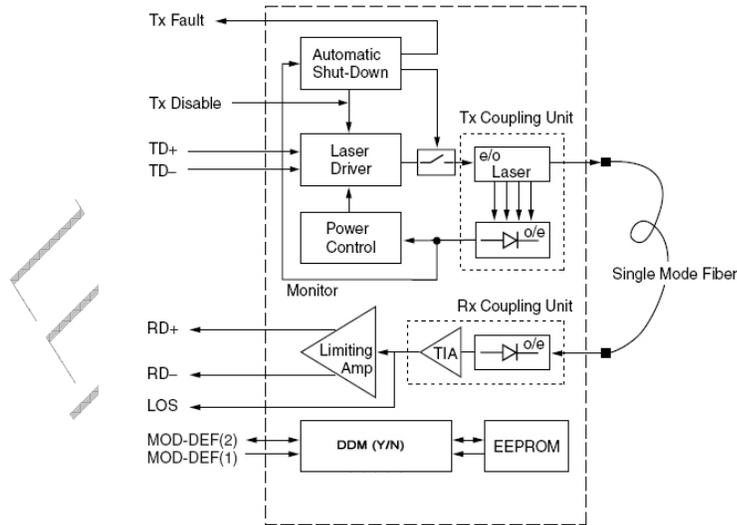
Note7: Measured with a PRBS $2^{23}-1$ test pattern @622Mbps, BER $\leq 1 \times 10^{-10}$.

Note8: Eye Pattern Mask

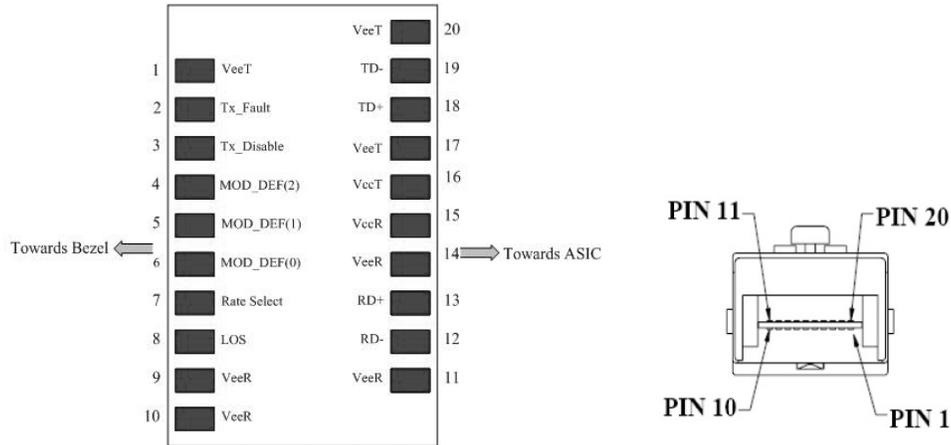
Note9: LOS Hysteresis



Functional Description of Transceiver



SFP Transceiver Electrical Pad Layout



Pin Function Definitions

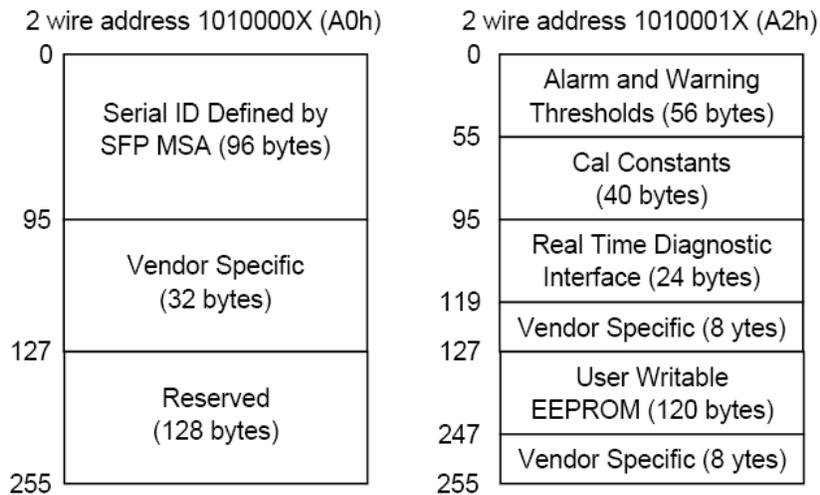
Pin Num.	Name	Function Description
1	VeeT	Transmitter Ground
2	TX Fault	Transmitter Fault Indication, open collector/drain output
3	TX Disable	Transmitter Disable
4	MOD-DEF2	Module Definition 2, Data line for Serial ID.
5	MOD-DEF1	Module Definition 1, Clock line for Serial ID.
6	MOD-DEF0	Module Definition 0, Grounded within the module.
7	Rate Select	Function is implemented.
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.

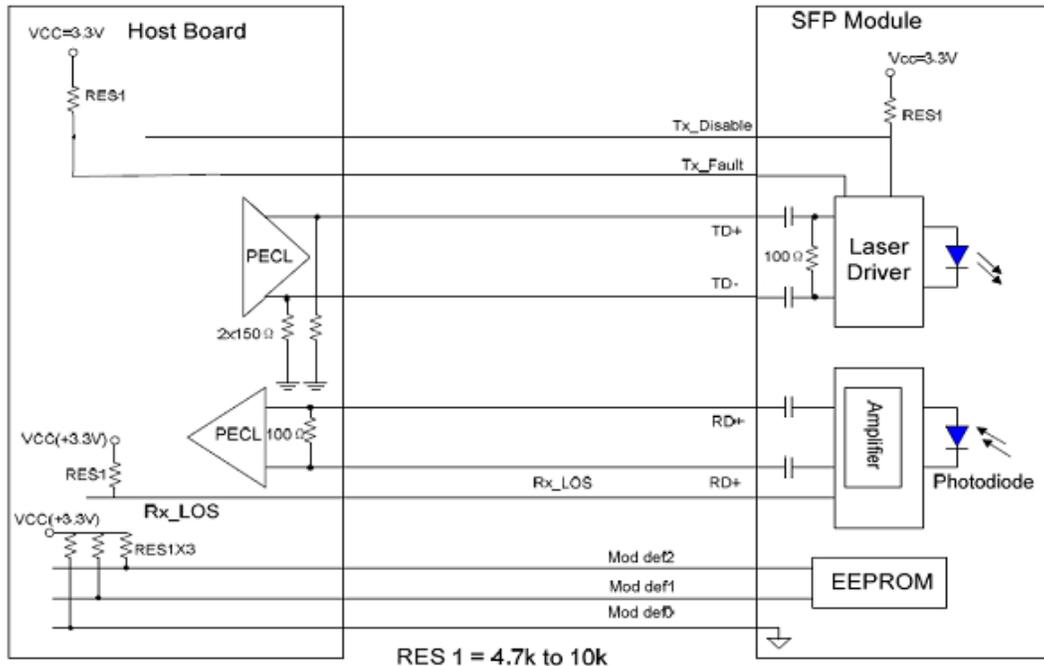
Table 1 Serial ID Memory Contents

Addr.	Size (Bytes)	Name of Field	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	Transceiver transmit distance
15	1	Length(9µm)100m	XX	
16	1	Length (50µm) 10m	XX	

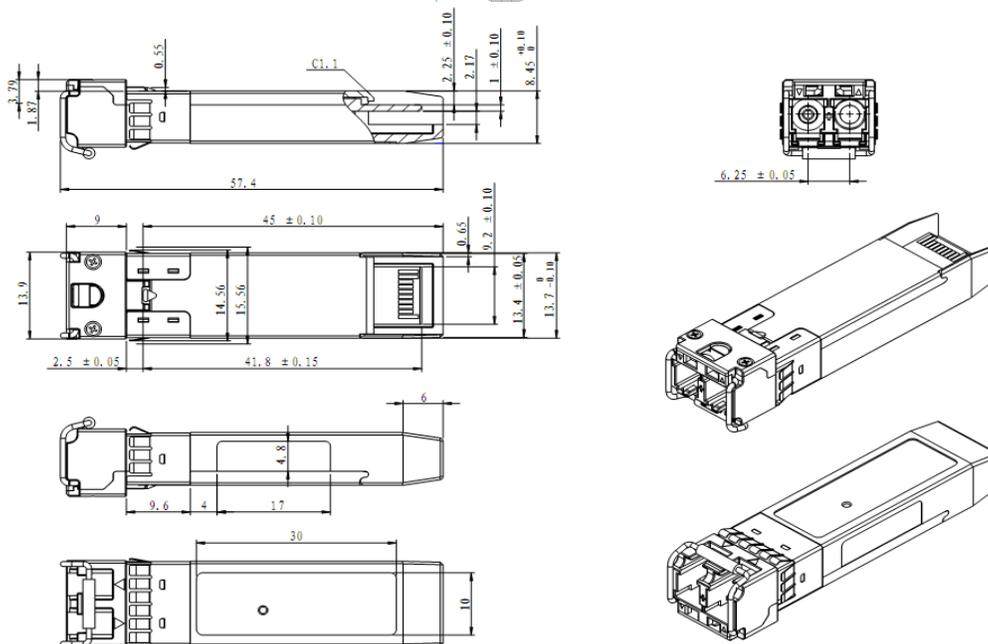
17	1	Length(62.5μm)10m	XX	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX ^(note9)	Vendor name (ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	XX XX XX ^(note10)	
40-55	16	Vendor PN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX ^(note9)	Part Number
56-59	4	Vendor rev	XX XX XX XX ^(note10)	
60-61	2	Wavelength	XX XX ^(note10)	WDM
62	1	Reserved	00	
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
EXTENDED ID FIELDS				
64-65	2	Options	00 1A	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 ^(note10)	Serial Number of transceiver (ASCII). For example "B000822".
84-91	8	Date code	XX XX XX XX XX XX XX XX ^(note10)	Manufactory date code. For example "080405".
92	1	Diagnostic Monitoring Type	XX ^(note10)	Digital diagnostic monitoring implemented
93	1	Enhanced Options	XX ^(note10)	Optional flags
94	1	SFF_8472Compliance	XX ^(note10)	01 for diagnostics (Rev9.3 SFF-8472).
95	1	CC_EXT	Check Sum (Variable)	Check sum 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	

Note10: 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



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.b	Tim.Liang	Mary.Wang Kelly.Cao		Released.	May 9, 2009
V2.c	Kelly			Complete CWDM wavelength & A2H.	Jan 18, 2010
V2.d	Kelly			Correct Rx λ range.	Apr 8, 2010
V2.e	Kelly			Correct overload.	May 4, 2010
V3.a	Jans			Update LOGO.	August 13, 2011
V3.b	Jans	Kelly		Integrate 4 products, update temp. range.	Sep 21, 2011
V3.c	Jans	Kelly		Update temp. range .	June 18,2012
V3.d	Jans	Kelly		Add 41dB budget.	July 23,2012
V3.e	Jans	Kelly		Update the reveiver type of 39dB and 41dB budget.	August 6,2012
V3.f	Jans	Jason, Walt,Lyn	Phlio	Update the ROSA type of 34dB budget.	Apr 7,2013
V3.g	Angela	Kelly/Lyn/ Oliver/Walt	Phlio	Update the Pmax of 34dB budget product.	Oct 10,2014

Notice:

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