

EOLS-1303-10DG & EOLS-1503-10DG & EOLS-4903-10DG Series

100BASE-FX SGMII SFP Transceiver

(With MCU Version)

Features

- ◆ Types available:
 - ✓ 1310nm Laser and PIN Photo-Detector
 - ✓ 1490nm Laser and PIN Photo-Detector
 - ✓ 1550nm Laser and PIN Photo-Detector
- ◆ 10km distance over SMF at least
- ◆ Build-in PHY supporting SGMII Interface
- ◆ Support More Link Status Monitor, Such as CRC, Package Counter and Far End Fault Indication(FEFL)
- ◆ Single 3.3V Power Supply and TTL Logic Interface
- ◆ Compliant with SFP MSA package with duplex LC Connector
- ◆ Standard Serial ID information Compliant with SFP MSA
- ◆ Operating Case Temperature
 - Standard: 0C~+70C
 - Industrial: -40C~+85C



Applications

- ◆ 100BASE-FX
- ◆ Switched Backplane Applications
- ◆ Switch to Switch Interface
- ◆ Other Optical Transmission Systems

Ordering Information

Part No.	Data Rate	Fiber	Distance ^{*(note2)}	Temperature	MCU
EOLS-1303-10DG ^{*(note1)}	125Mbps	SMF	10km	Standard	Yes
EOLS-1303-10DIG	125Mbps	SMF	10km	Industrial	Yes
EOLS-4903-10DG	125Mbps	SMF	10km	Standard	Yes
EOLS-4903-10DIG	125Mbps	SMF	10km	Industrial	Yes
EOLS-1503-10DG	125Mbps	SMF	10km	Standard	Yes
EOLS-1503-10DIG	125Mbps	SMF	10km	Industrial	Yes

Note1: Standard version.

Note2: With 9/125 μm SMF. For other distance, please contact EOPTOLINK to customize.

Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme)
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards ^{*note3}

Note3: For update of the equipments and strict control of raw materials, EOPTOLINK has the ability to supply the customized products since Jan 1st, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Eoptolink's transceivers, because Eoptolink's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other components.

Product Description

The EOLS-XX03-10DG series is small form factor pluggable module for single-mode fiber 100BASE-FX application, with a build-in PHY device supporting SGMII interface. And integrating

a build-in high performance MCU in EOLS-1303-10DG, EOLS-1303-10DIG, EOLS-4903-10DG, EOLS-4903-10DIG, EOLS-1503-10DG and EOLS-1503-10DIG. Host can more easily configure all functions for this module. It is with the SFP 20-pin connector to allow hot plug capability.

The transmitter section uses a multiple quantum well 1310nm/1490nm/1550nm laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	-	5	95	%

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T _A	EOLS-XX03-10DG	0	+70	°C
		EOLS-XX03-10DIG	-40	+85	
Power Supply Voltage	Vcc	3.15	3.3	3.45	V
Power Supply Current	Icc			360	mA
Data Rate			125		Mbps

Performance Specifications - Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter						
LVPECL Inputs(Differential)	Vin	400		2000	mVpp	AC coupled inputs ^{*(note4)}
Input Impedance (Differential)	Zin	85	100	115	ohm	Rin > 100 kohm @ DC
TX_Dis	Disable	2		Vcc+0.3	V	
	Enable	0		0.8		
TX_FAULT	Fault	2		Vcc+0.3	V	
	Normal	0		0.8		
Receiver						
LVPECL Outputs (Differential)	Vout	400		2000	mVpp	AC coupled outputs ^{*(note4)}
Output Impedance (Differential)	Zout	85	100	115	ohm	
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	
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Performance Specifications – Optical

(EOLS-1303-10DG with FP and PIN/TIA)

Parameter	Symbol	Min.	Typical	Max.	Unit
SMF	L		10		km
Data Rate			125		Mbps
Transmitter					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	$\Delta\lambda$			4	nm
Average Output Power ^{*(note5)}	Pout	-15		-8	dBm
Extinction Ratio	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			3	ns
Total Jitter	TJ			1.0	ns
Output Optical Eye ^{*(note6)}	Compliant with IEEE 802.3-2002				
TX_Disable Assert Time	t_off			10	us
TX Disable Asserted	Pout			-45	dBm
Receiver					
Center Wavelength	λ	1200		1600	nm
Receiver Sensitivity ^{*(note7)}	Pmin			-32	dBm
Return Loss		12			dB
LOS De-Assert	LOSD			-33	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis		1		3	dB
Overload ^{*(note7)}	Pmax	0			dBm

(EOLS-4903-10DG with DFB and PIN/TIA)

Parameter	Symbol	Min.	Typical	Max.	Unit
SMF	L		10		km
Data Rate			125		Mbps
Transmitter					
Center Wavelength	λ_C	1480	1490	1500	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power ^{*(note5)}	Pout	-15		-8	dBm
Extinction Ratio	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			3	ns
Total Jitter	TJ			1.0	ns
Output Optical Eye ^{*(note6)}	Compliant with IEEE 802.3-2002				
TX_Disable Assert Time	t_off			10	us
TX Disable Asserted	Pout			-45	dBm
Receiver					
Center Wavelength	λ	1200		1600	nm
Receiver Sensitivity ^{*(note7)}	Pmin			-32	dBm

Return Loss		12			dB
LOS De-Assert	LOSD			-33	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis		1		3	dB
Overload ^{*(note7)}	Pmax	0			dBm

(EOLS-1503-10DG with FP and PIN/TIA)

Parameter	Symbol	Min.	Typical	Max.	Unit
SMF	L		10		km
Data Rate			125		Mbps
Transmitter					
Center Wavelength	λ_c	1500	1550	1600	nm
Spectral Width (RMS)	$\Delta\lambda$			4	nm
Average Output Power ^{*(note5)}	Pout	-15		-8	dBm
Extinction Ratio	ER	9			dB
Rise/Fall Time(20%~80%)	tr/tf			3	ns
Total Jitter	TJ			1.0	ns
Output Optical Eye ^{*(note6)}	Compliant with IEEE 802.3-2002				
TX_Disable Assert Time	t_off			10	us
TX Disable Asserted	Pout			-45	dBm
Receiver					
Center Wavelength	λ	1200		1600	nm
Receiver Sensitivity ^{*(note7)}	Pmin			-32	dBm
Return Loss		12			dB
LOS De-Assert	LOSD			-33	dBm
LOS Assert	LOSA	-45			dBm
LOS Hysteresis		1		3	dB
Overload ^{*(note7)}	Pmax	0			dBm

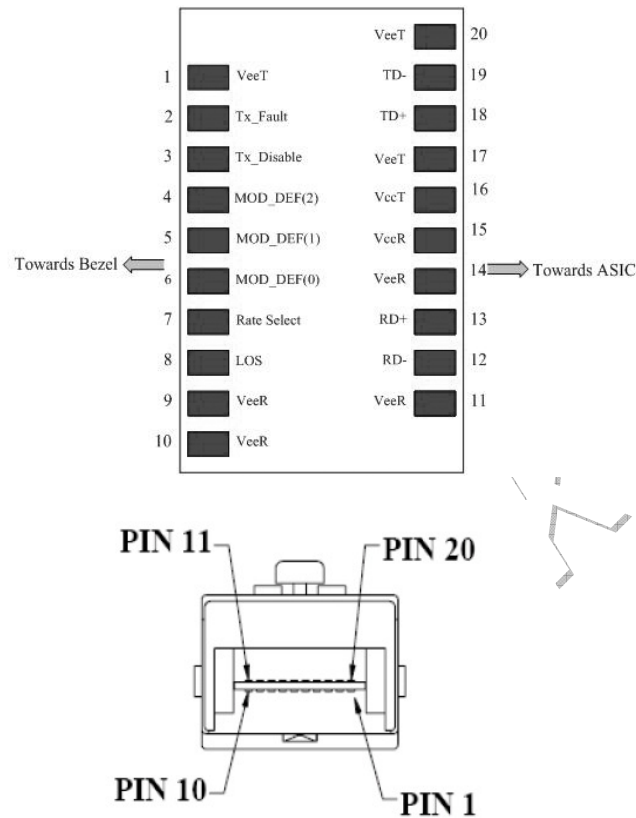
Note4: PECL logic, internally AC coupled.

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

Note6: Measured with 4B/5B code for 125Mbps.

Note7: Measured with 4B/5B code for 125Mbps, worst-case extinction ratio, and BER 1E-12.

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	6)
14	VeeR	Receiver Ground	1	5)

15	VccR	Receiver Power	2	7) 3.3 ± 5%
16	VccT	Transmitter Power	2	7) 3.3 ± 5%
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 KΩ 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) Modulation Absent, connected to VEET or VEER in the module.

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.

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 1ohm 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 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 writing 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.

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. The following information is according to EOLS-1303-10DG.

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	00 00 00 20 00 00 00 00	Transmitter Code
11	1	Encoding	02	4B5B
12	1	BR, Nominal	01	100Mbps
13	1	Reserved	00	
14	1	Length (9μm)km	0A	Transceiver transmit distance
15	1	Length(9μm)100m	64	
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	45 4F 50 54 4F 4C 49 4E 4B 20 49 4E 43 20 20 20	ELOPTOLINK INC (ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	45 4F 4C 53 2D 31 33 30 33 2D 31 30 44 47 20 20	EOLS-1303-10DG
56-59	4	Vendor rev	31 2E 30 20	1.0

60-61	2	Wavelength	05 1E	1310nm
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_DISABLE, 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	Serial Number of transceiver (ASCII). For example "B000822".
84-91	8	Date code	XX XX XX XX XX XX XX XX	Manufactory date code. For example "080405".
92	1	Diagnostic Monitoring Type	00	Digital diagnostic monitoring implemented
93	1	Enhanced Options	00	Optional flags
94	1	SFF_8472 Compliance	00	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	

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).

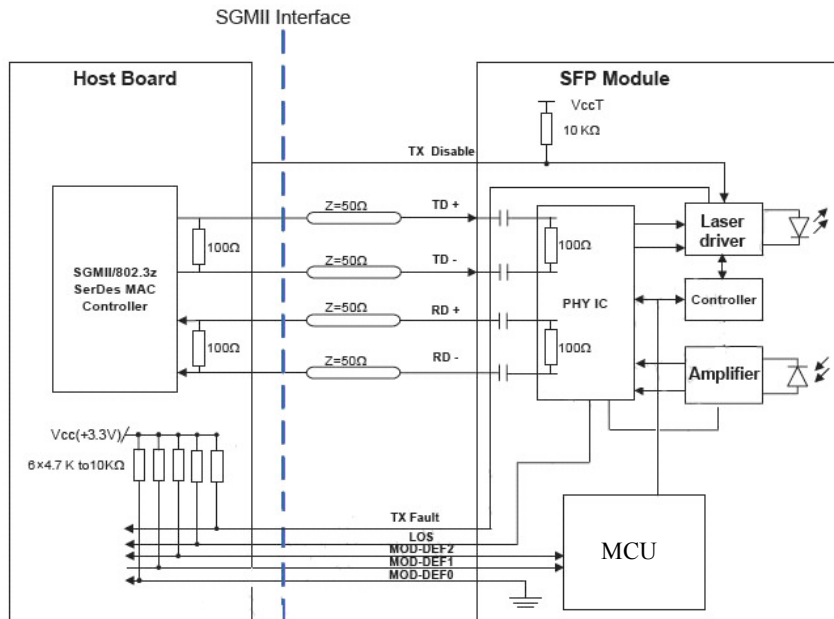
Easier Configuration

Designing-in a high performance MCU in EOLS-XX03-10DG and EOLS-XX03-10DIG, host can configure Eoptolink's SGMII series product easily.

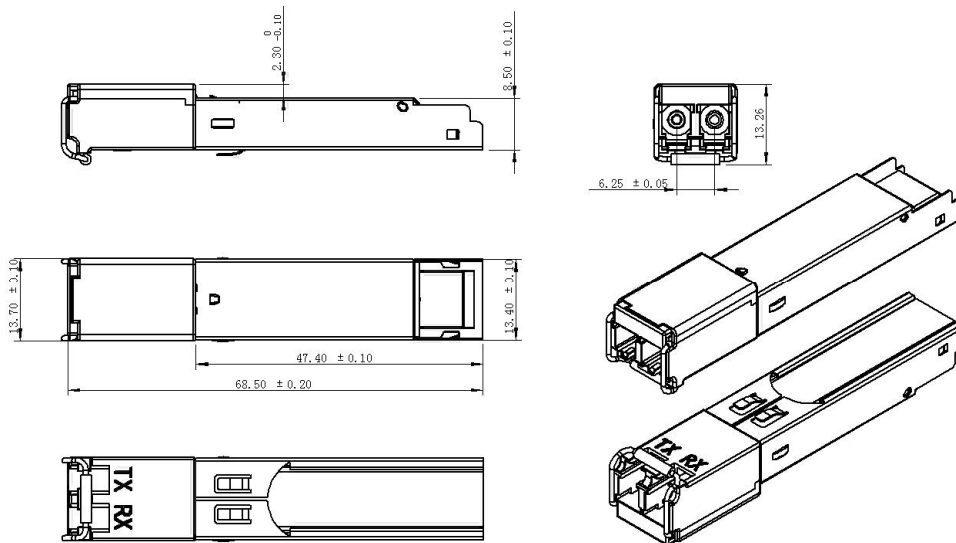
For EOLS-XX03-10DG and EOLS-XX03-10DIG, host only need access specific registers of A0H via I²C serial interface to configure SGMII module, such as speed-selection, Auto-negotiation, LOS/Link detection, TX disable, FEFI/RFI and CRC counter function support.

For more detailed information, please refer to application note of EOLS-XX03-10DG and EOLS-XX03-10DIG.

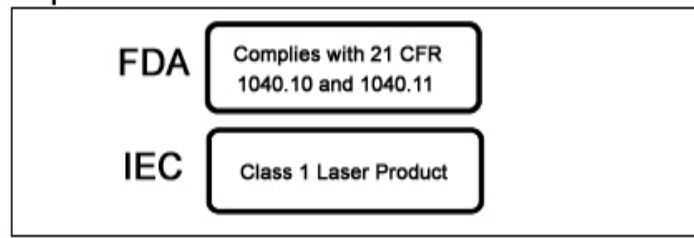
Recommend Circuit Schematic



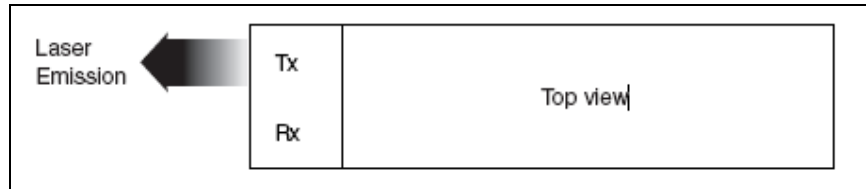
Mechanical Specifications



Class 1 Labels



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	Initiated	Reviewed	Approved	Revision History	Release Date
V1.b	Kelly.Cao	Tim		Released.	Sep 29, 2008
V1.c	Aries	Kelly.Cao		Adding 1550/1490nm product.	July 3, 2009

Notice:

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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>

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