EOLS-1312-M Series

Multi-Mode 1310nm GBE/FC/FE
Duplex SFP Transceiver
RoHS6 Compliant

Features

- Operating data rate up to 1.25Gbps
- 1310nm FP laser transmitter
- 550m Reach for 62.5/125um(550MHz.km)
- 1km Reach for 50/125um(800MHz.km)
- Single 3.3V power supply and TTL Logic Interface
- Hot-pluggable SFP footprint duplex LC connector interface
- Class 1 FDA and IEC60825-1 laser safety compliant
- Operating case temperature

  Standard: 0℃~+70℃

  Industrial:-40℃~+85℃
- Compliant with SFP MSA
- Compliant with SFF-8472

Applications

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

Ordering Information

Part No.	Data Rate	Fiber	Distance*(note2)	Interface	Temp.	DDMI
EOLS-1312-M*(note1)	≤1.25Gbps	MMF	550m/1km	LC	Standard	NO
EOLS-1312-M-I	≤1.25Gbps	MMF	550m/1km	LC	Industrial	NO
EOLS-1312-M-D	≤1.25Gbps	MMF	550m/1km	LC	Standard	YES
EOLS-1312-M-DI	≤1.25Gbps	MMF	550m/1km	LC	Industrial	YES

Note1: Standard version

Note2: 550m with 62.5/125μm MMF (550MHz.km),

1km with 50/125μm MMF (800MHz.km).

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-1312-M-X series multi-mode transceiver is small form factor pluggable module for bi-directional serial optical data communications such as Ethernet and SDH/SONET. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for multi-mode fiber and operates at a nominal wavelength of 1310nm.

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

The EOLS-1312-M-DX series are designed to be compliant with SFF-8472 MSA.

Absolute Maximum Ratings

	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	℃
Supply Voltage	V_{CC}	-0.5	3.6	V
Operating Relative Humidity		-	95	%

Note3: 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-1312-M	0		+70	℃
		EOLS-1312-M-I	-40		+85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	I_{CC}				300	mA
Date Rate					1250	Mbps

Performance Specifications - Electrical

Parameter		Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter							
LVPECL Inputs(Differential)		Vin	500		2400	mVpp	AC coupled inputs*(Note4)
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*(Note4)
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

Parameter	Symbol	Min.	Typical	Max.	Unit
50µm Core Diameter MMF(800MHz.km)	L		1000		m
62.5µm Core Diameter MMF(550MHz.km)	L		550		m
			1.25		Gbps
Transmitter					
Center Wavelength	λ_C	1260	1310	1360	nm
Spectral Width (RMS)	Δλ			5	nm
Average Output Power*(Note5)	Pout	-9		-3	dBm
Extinction Ratio*(Note6)	ER	9			dB
Rise/Fall Time(20%～80%)	tr/tf			0.26	ns
Total Jitter*(Note6)	TJ			0.43	UI
Output Optical Eye*(Note6)	IEEE802.3ah-2004 Compliant*(Note8)				
TX_Disable Assert Time	t_off			10	us
Receiver					
Center Wavelength	λ_C	1260		1600	nm
Receiver Sensitivity*(Note7)	Pmin			-21	dBm
Receiver Overload	Pmax	-3			dBm
Return Loss		12			dB
LOS De-Assert	LOSD			-22	dBm

LOS Assert	LOSA	-35			dBm
LOS Hysteresis*(Note9)		0.5			dB

Note4: LVPECL logic, internally AC coupled.

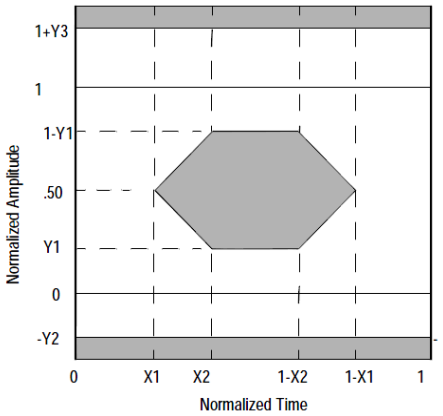
Note5: Output is coupled into a 62.5/125 mm multi-mode fiber.

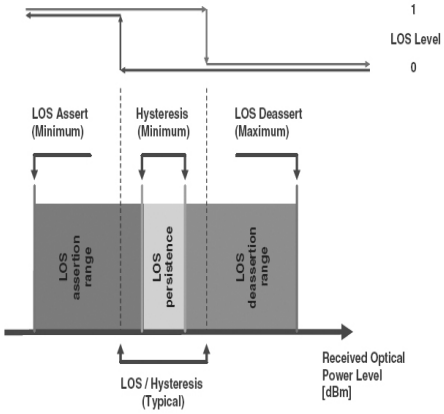
Note6: Filtered, measured with a PRBS 2^7-1 test pattern @1.25Gbps

Note7: Minimum average optical power measured at BER less than 1E-12, with a 2^7-1 PRBS and ER=9 dB.

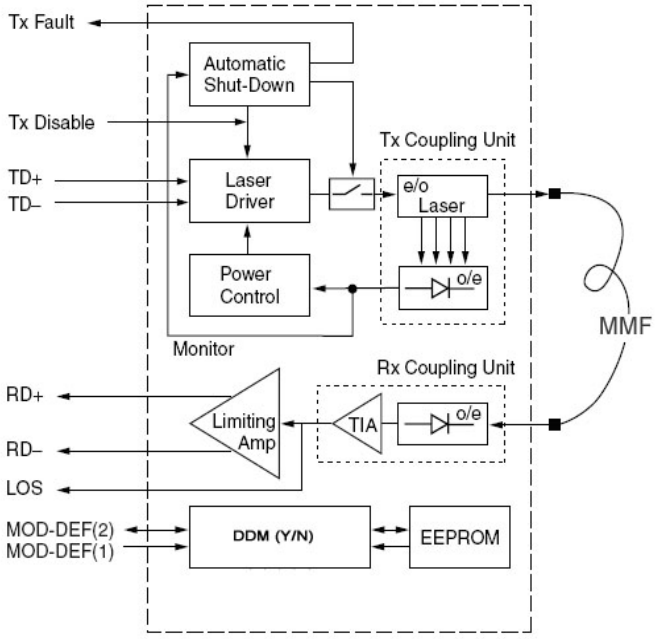
Note8: Eye pattern mask

Note9: LOS Hysteresis

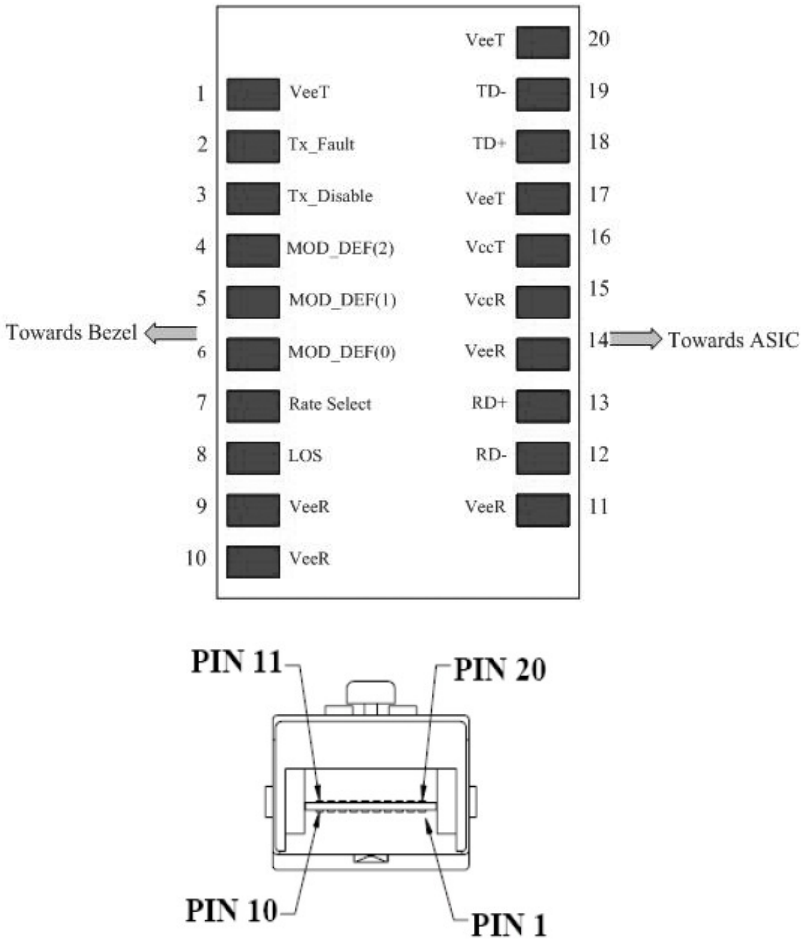




Functional Description of Transceiver



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	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) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10K□□resistor 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 400 and 2000Mv differential (200 –1000Mv single ended) when properly terminated.

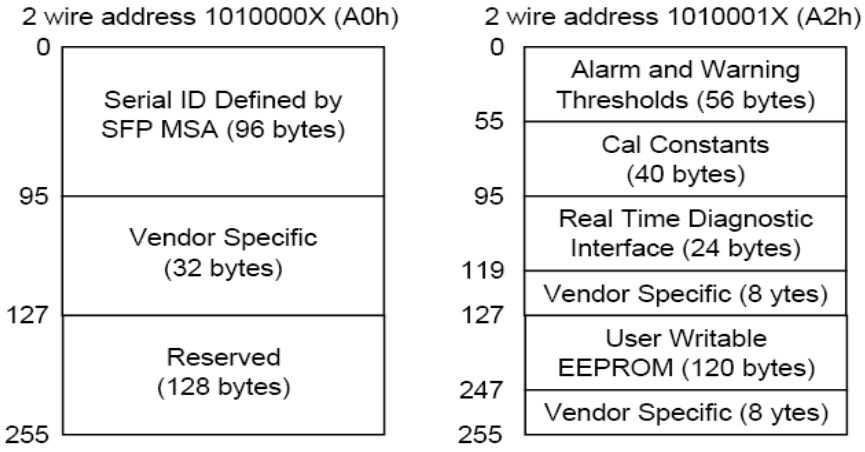
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 300Ma. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1ohm should be used in order to maintain the 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 inputs will accept differential swings of 400 – 2000 Mv (200 – 1000Mv single-ended).

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(A0). Memory Contents of Serial ID are shown in Table 1.

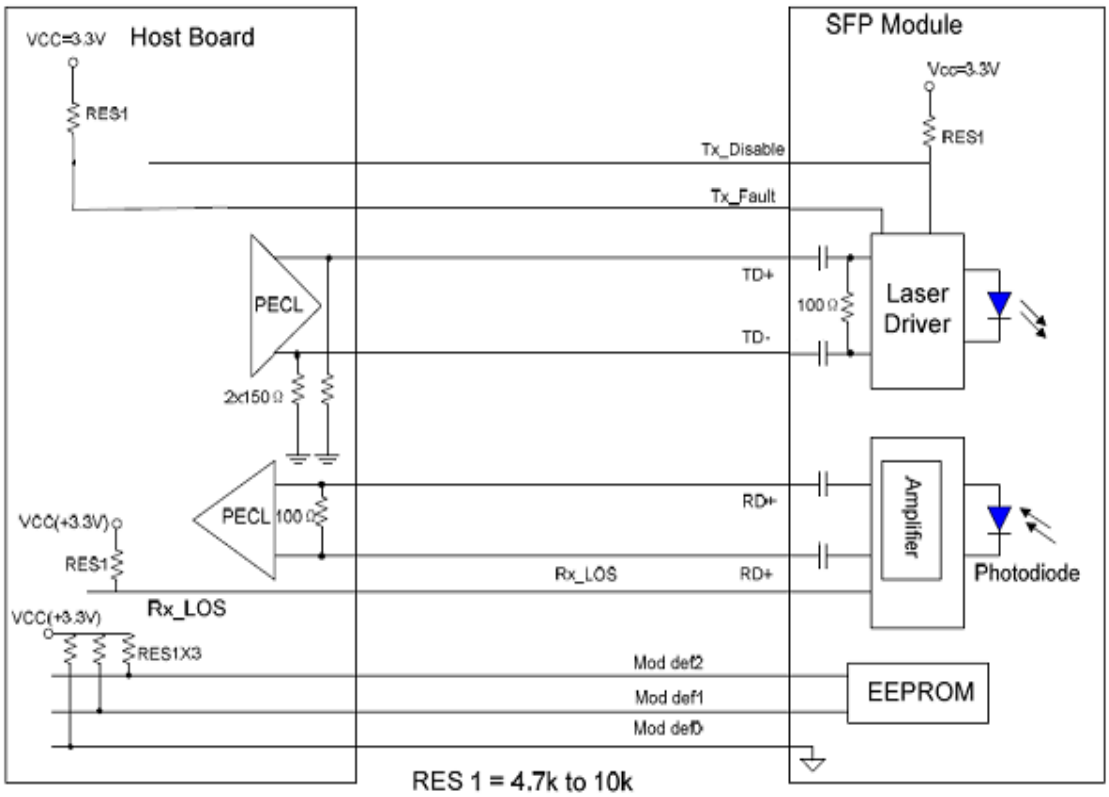
Table 1 Serial ID Memory Contents

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(Note10)	Transmitter Code
11	1	Encoding	01	8B10B
12	1	BR, Nominal	0D	1.25Gbps
13	1	Reserved	00	
14	1	Length (9μm)km	00	Transceiver transmit distance
15	1	Length(9μm)100m	00	
16	1	Length (50μm) 10m	64	
17	1	Length(62.5μm)10m	37	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	XX XX XX XX XX XX XX XX(Note10)20 20 20 20 20 20 20 20	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	Transceiver part number
56-59	4	Vendor rev	XX XX XX XX(Note10)	
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	

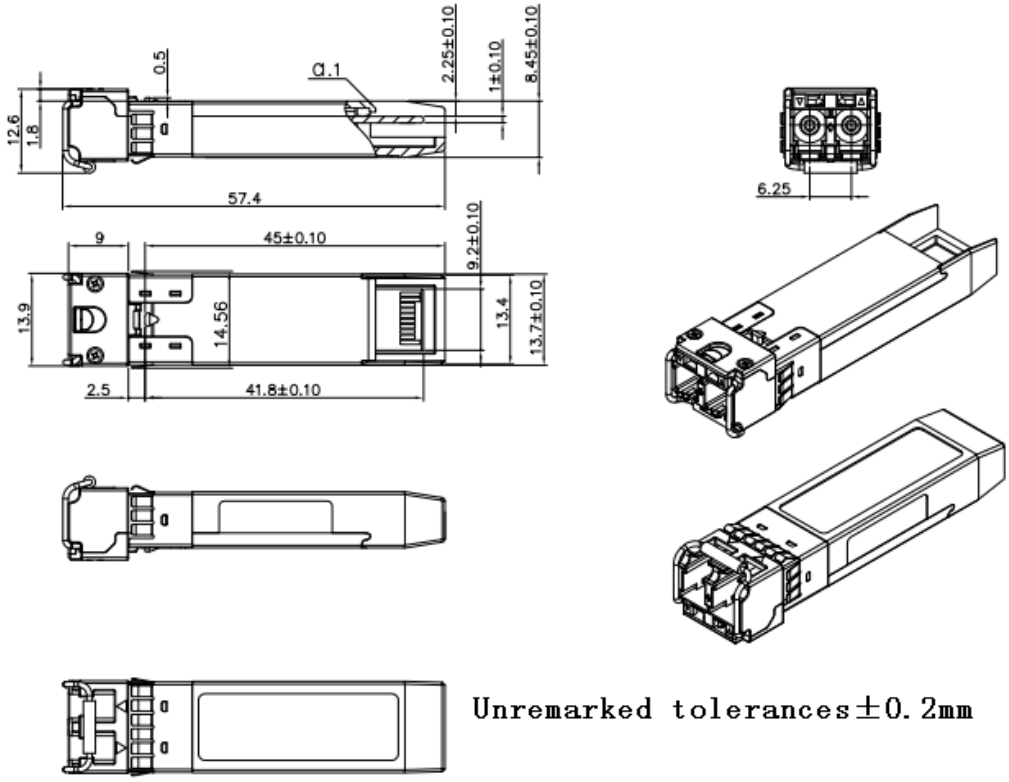
67	1	BR,min	00	
68-83	16	Vendor SN	XX XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20[(Note10)]	Serial Number of transceiver (ASCII). For example “B000822”.
84-91	8	Date code	XX XX XX XX XX XX XX XX[(Note10)]	Manufactory date code. For example “080405”.
92	1	Diagnostic Monitoring Type	XX[(Note10)]	Digital diagnostic monitoring implemented
93	1	Enhanced Options	XX[(Note10)]	Optional flags
94	1	SFF_8472 Compliance	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).

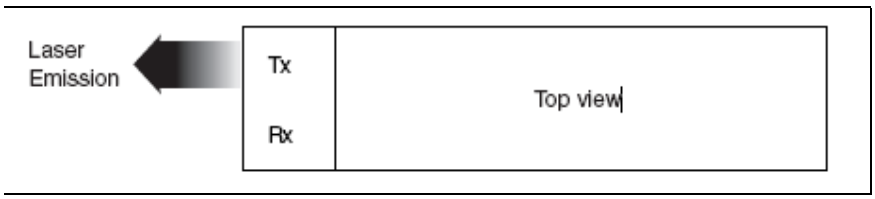
Recommend Circuit Schematic



Mechanical Specifications



Laser Emission



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Revision History

Revision	Initiated	Reviewed	Approved	Revision History	Release Date
V2.a	Tim.Liang	Kelly.Cao		Released.	August 7, 2009
V2.b	Cathy			Updated PN.	December 17, 2010
V2.c	Cathy			Updated LVPECL Inputs and output.	May 4, 2011
V3.a	Jans			Updated LOGO.	August 10, 2011
V4.a	Jans	Kelly		Update photo.	Sep 22, 2011
V4.b	Angela	Kelly		Update transmit distance, PN and pin definition note3. Delete Class 1 labels and laser emission date	Feb 4, 2013
V4.c	Angela	Lyn/Jason/ Nygai		Update the regulatory compliance and ER, LOSA.	Nov 03, 2014
V4..d	Angela	Lyn/Jason/ Nygai	Phlio	Update the distance, regulatory compliance and 2D drawing.	Nov 09,2015

Notice:

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