EOLP-1612G-14XRN Series

12G Video SFP+ Transceiver
(Not Compliant With SFP+ MSA)
RoHS6 Compliant

Features

- Operating Data Rate up to 11.88Gbps
- 14dB Guaranteed Link Budget
- 18 CWDM Center Wavelengths for Choice
- Integrated CDR Locks to SMPTE Rate: 11.88Gbps, 5.94Gbps, 2.97Gbps, 1.485Gbps, or Divide-by-1.001 Sub-Rates, and 270Mbps
- Single 3.3V Power Supply and TTL Logic Interface
- Hot-Pluggable SFP+ Footprint LC Connector Interface
- Support 4K and 8K UHDTV
- Class 1 FDA and IEC60825-1 Laser Safety Compliant
- SMPTE ST 2082-1, SMPTE ST 2081-1, SMPTE 424M, SMPTE 292M and SMPTE 259M Compliant
- Operating Case Temperature:
  Standard: 0°C~+70°C
- Digital Diagnostic Function

Applications

- UHDTV 4K/8K Video
- SMPTE ST 2082-1, SMPTE ST 2081-1, SMPTE 424M, SMPTE 292M and SMPTE 259M Compliant Electrical-to-Optical Interfaces
- Other Optical Links

Ordering Information

Part No.	Data Rate	λ	Link Budget	Laser	Temp.	DDMI
EOLP-1612G-14XRN*Note1	270Mbps~11.88Gbps	CWDM	14dB	DFB	0~+70°C	YES

Note1: X refers to the CWDM wavelength, range from 1270nm to 1610nm, A=1270nm, B=1290nm…Q=1590nm, R=1610nm, refer the suffix at following CWDM wavelength table.

*The product image only for reference purpose.

CWDM Wavelength (0~70°C)

Band	Suffix	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

Regulatory Compliance*Note2

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

Note2: 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 EOLP-1612G-14XRN series transceivers are high performance modules for duplex video transmission application over single mode fiber. These transceivers are designed to transmit/receive data rates from 270Mbps to 11.88Gbps, which are compliant with the following standards:

- SMPTE ST 2082-1 (UHDTV – 11.88Gbps/11.868Gbps)
- SMPTE ST 2081-1 (UHDTV – 5.94Gbps/5.934Gbps)
- SMPTE 424M (1080P – 2.97Gbps/2.967Gbps)
- SMPTE 292M (HDTV – 1.485Gbps/1.4835Gbps)
- SMPTE 259M (SDTV – 270Mbps)

The transmitter section of EOLP-1612G-14XRN is a Class 1 Laser compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J, which is also Class 1 Laser compliant according to International Safety Standard IEC60825. With an internal facing angle polished fiber stub, standard single mode optical patch cord with Standard Polished Connector (SPC) is required.

The receiver section of EOLP-1612G-14XRN is provided with an internal facing angle polished fiber stub. Standard single mode optical patch cord with Standard Polished Connector (SPC) is required.

The EOLP-1612G-14XRN transceiver is hot pluggable with the SFP+ 20-pin connector.

The EOLP-1612G-14XRN transceiver provides extensive operational status monitoring through an I^2C interface as defined by the SFF-8472 MSA specification.

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 Temp.	T_C	0	-	+70	°C
Power Supply Voltage	V_{CC}	3.15	3.3	3.45	V
Power Supply Current	I_{CC}	-	-	550	mA
Data Rate		0.27	-	11.88	Gbps

Performance Specifications – Electrical

PARAMETER		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
I^2C CLK, I^2C DATA		VoH	2.5	-	Vcc	V	-
		VoL	0	-	0.5	V	-
TRANSMITTER							
CML Inputs (Differential)		Vin	200	-	1200	mVpp	AC coupled inputs*(Note3)
Input Impedance (Differential)		Zin	80	100	120	ohm	Rin > 100 kohm @ DC
TX_DIS	Disable		2	-	Vcc	V	-
	Enable		0	-	0.8	V	-
RECEIVER							
CML Outputs (Differential)		Vout	600	-	1300	mVpp	AC Coupled Outputs*(Note3)
Output Impedance (Differential)		Zout	-	100	-	ohm	-

Performance Specifications – Optical

Parameter		Symbol	Min.	Typ.	Max.	Unit
Link Budget @9/125μm SMF			-	13	-	dB
Data Rate			0.27	-	11.88	Gbps
TRANSMITTER						
Center Wavelength @25°C		λ_C	λ_C -6	λ_C	λ_C +7.5	nm
Spectral Width (-20dB)		Δλ	-	-	1	nm
Average Output Power*(Note4)		Pout	0	-	5	dBm
Extinction Ratio*(Note5)		ER	5	-	-	dB
RECEIVER						
Center Wavelength		λ_C	1260	-	1620	nm
Sensitivity*(Note6)	SMPTE ST 2082-1	Pmin	-	-	-14	dBm
	SMPTE ST 2081-1					
Receiver Overload		Pmax	0.5	-	-	dBm
Maximum Back Reflection			-	-	-14	dB
LOS De-Assert		LOS_D	-	-	-17	dBm
LOS Assert		LOS_A	-30	-	-20	dBm
LOS Hysteresis		HY	0.5	-	-	dB

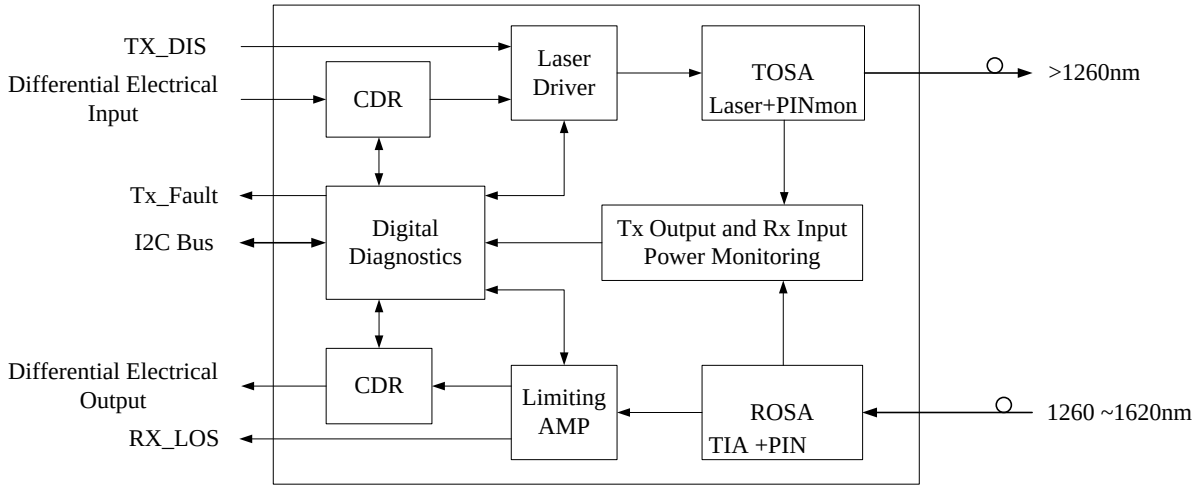
Note3: CML logic, internally AC coupled.

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

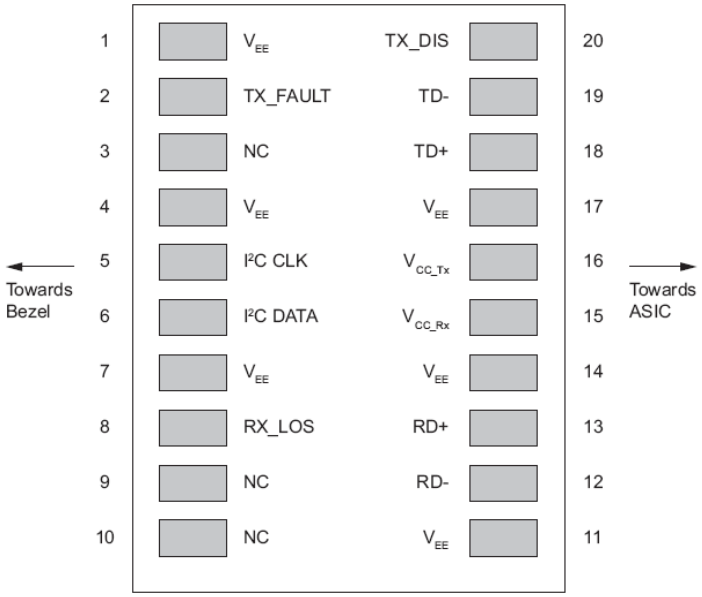
Note5: Filtered, measured with a PRBS 2^{31}-1 test pattern @10.3125Gbps.

Note6: Minimum average optical power measured at the BER less than 1E-12, back to back. The measure pattern is 12G-SDI color bar standard @11.88Gbps and 6G-SDI color bar standard @5.94Gbps.

Functional Description of Transceiver



SFP+ Transceiver Electrical Pad Layout



Pin Function Definitions

Pin Num.	Name	Function	Plug Seq.	Notes
1	V_{EE}	Ground	1	5)
2	TX_FAULT	Transmitter Fault Indication	3	1)
3	NC	No Connect	3	No Connection.
4	V_{EE}	Ground	1	5)
5	I^2C CLK	I2C clock	3	3), I2C Clock line.
6	I^2C DATA	I2C data	3	3), I2C Data line.

7	V_{EE}	Ground	1	5)
8	RX_LOS	Loss of Signal	3	4)
9	NC	No Connect	1	No Connection.
10	NC	No Connect	1	No Connection.
11	V_{EE}	Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	6)
14	V_{EE}	Ground	1	5)
15	V_{CC_Rx}	Power	2	7)
16	V_{CC_Tx}	Power	2	7)
17	V_{EE}	Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	TX_DIS	Transmitter Disable.	3	2)

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 V_{CC_Rx}, V_{CC_Tx} +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_DIS 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) I^2C CLK and I^2C DATA: These are the module definition pins. They should be pulled up with a 4.7K – 10KΩ resistor on the host board. The pull-up voltage shall be V_{CC_Rx} or V_{CC_Tx}. I^2C CLK is the clock line of two wire serial interface for serial ID; I^2C DATA is the data line of two wire serial interface for serial ID.

4) RX_LOS is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and V_{CC_Rx}, V_{CC_Tx}+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) V_{EE} 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) V_{CC_Rx} and V_{CC_Tx} are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 550mA. Inductors with DC resistance

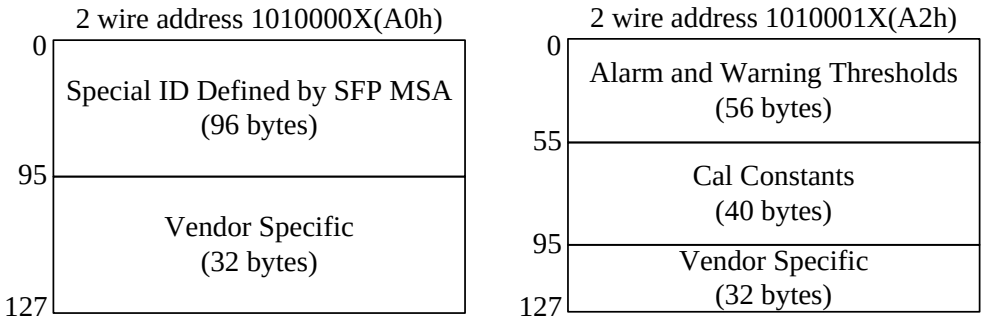
of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. V_{CC_Rx} and V_{CC_Tx} 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.

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol. 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.

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 are all implemented. The digital diagnostic memory map specific data field is defined as following.



EEPROM Serial ID Memory Contents (2-Wire Address A0H)

The diagnostic information is as defined in SFF-8472 MSA.

EEPROM Serial ID Memory Contents (2-Wire Address A2H)

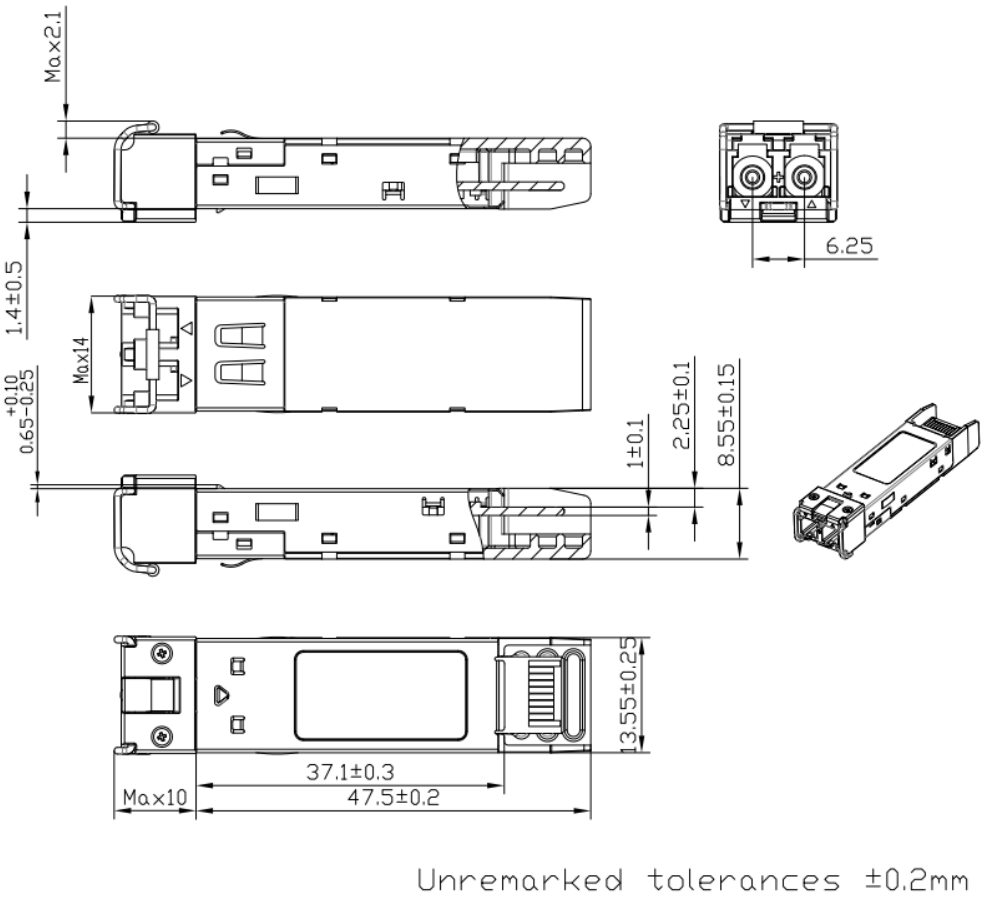
The interface uses the two wire serial bus address 1010001X (A2H) to provide diagnostic monitoring information about the module's present operating conditions as defined in SFF-8472 MSA, the monitoring range, accuracy and calibration method is as following table.

(The following diagnostic information is according to the EOLP-1612G-14XRN Series.)

Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	0 to 70℃	± 3℃	Internal
Voltage	3.0 to 3.6V	± 3%	Internal
Bias Current	0 to 100mA	±10%	Internal
TX Power	-2 to +7dBm	± 3dB	Internal
RX Power	-18.2 to +2dBm	± 3dB	Internal

Mechanical Specifications



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

Obtaining Document

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Revision History

Revision	Initiated	Reviewed	Approved	DCN	Release Date
V1.a	Nico/Leon	Marvin/Lyn/ Jason/Kelly		Preliminary	Mar 15, 2017

V1.b	Nico	Marvin		Update features and applications; Update pin function definitions; Delete CDR data rate configuration	Jul 6, 2017
V1.c	Nico	Marvin/William		Update pin definitions	Jul 19, 2017
V1.d	Nico	Marvin		Update the link budget, the address and the contact information	Aug 31, 2017
V1.e	Nico	Marvin		Update the ER, SEN, link budget and overload.	Oct 23, 2017

Notice:

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