1.Features

- IEEE 802.3-2008 1000BASE-PX20 EPON OLT side application
- bi-directional transmission with symmetric 1.25-Gbps upstream/downstream
- 1490nm DFB laser Continuous Transmitter and 1310nm PIN Burst-mode receiver
- SFP Package with SC Receptacle
- +3.3V single power supply
- Low power consumption
- operating case temperature：

  Standard: 0℃~+70℃

  Industrial :-40℃~+85℃
- Excellent EMI and EMC characteristics
- Digital diagnostic interface compliant with SFF-8472 Rev 9.5
- Compliant with RoHs2.0

2.Applications

- IEEE802.3ah 1000BASE-PX20-D

3.General

The EPON OLT Transceiver module is designed for Gigabit Ethernet Passive Optical Network （EPON） 20km transmission. The module incorporates 1490nm continuous-mode transmitter and 1310nm burst-mode receiver. The transmitter section uses a 1490nm DFB laser and an integrated laser driver which is designed to be class-1 eye safe under any single fault. The laser driver includes APC and temperature compensation functions, which are used for keeping the launch optical power and extinction ratio constant over temperature and aging.

The receiver section uses an integrated APD and BM-preamplifier mounted together. The burst-mode receiver is restless and wide dynamic range is 32.5~42dB that can be obtained under whole operating conditions. The module has the function that indicates receiver burst-power-detect signal. The receiver includes digitalized burst mode optical power monitoring function, which converses any of a received ONU optical power directly in digital, with a Trigger input from system. When rising edge of Trigger detected, the DDM processor starts a burst optical power conversion, the digital result is available via DDM interface after Burst Optical Power Conversion Time. Trigger pulse width should be more than Burst Optical Power Conversion Holding Time. An integrated WDM coupler can distinguish 1310nm input light from 1490nm output light. The metallic package guarantees excellent EMI and EMC characteristics.

4.Order Information

Table-1-Order Information

Part Number	Data Rate (TX/RX)	Wavelength (TX/RX)	Index level	Interface	Temp.(1)
GELS-4111-20CS	1.25G/1.25G	1490nm/1310nm	PX20+	SC	0~+70℃
GELS-4111-20IS	1.25G/1.25G	1490nm/1310nm	PX20+	SC	-40~+85℃
GELS-4111-20ACS	1.25G/1.25G	1490nm/1310nm	PX20++	SC	0~+70℃
GELS-4111-20AIS	1.25G/1.25G	1490nm/1310nm	PX20++	SC	-40~+85℃
GELS-4111-30CS	1.25G/1.25G	1490nm/1310nm	PX20+++	SC	0~+70℃
GELS-4111-30IS	1.25G/1.25G	1490nm/1310nm	PX20+++	SC	-40~+85℃
GELS-4111-30ACSC	1.25G/1.25G	1490nm/1310nm	PX30	SC	0~+70℃
GELS-4111-30AISC	1.25G/1.25G	1490nm/1310nm	PX30	SC	-40~+85℃

(1)The Temp is Operating Case Temperature Range.

5. Absolute Maximum Ratings

Table 2-Absolute Maximum Ratings

Parameter	Condition	Unit	Min.	Typ.	Max.

Supply Voltage		V	-0.5	-	3.6
Storage Temperature	Case Temperature	℃	-45	-	90
Relative Humidity, Storage	None Condensing	%	5	-	95
Rx Total Optical Power	Damage Threshold	dBm	-	-	-4

6. Operating Environment

Table 3-Operating Environment

Parameter	Condition	Unit	Min.	Typ.	Max.
Power Supply Voltage		V	3.13	3.3	3.47
Operating Case Temperature	Standard	℃	0	-	70
	Industrial	℃	-45	-	85

*Exceeding any one of these values may destroy the device immediately.

7. Electrical Characteristics

Table 4-Electrical Characteristics

Parameter		Symbol	Min	Type	Max	Units	Notes
Transmitter							
Differential Data Input Swing		Vin	200	-	2400	mVpp	1
Input Differential Impedance		Zin	90	100	110	ohm	
Tx_Disable	Disable	VD	2.0	-	VCC+0.5	V	
	Enable	VEN	GND	-	GND+0.8	V	
TX_ Fault	Fault	VF	2.0	-	VCC+0.5	V	
	Normal	VNO	GND	-	GND+0.8	V	
Receiver							
Differential Date Output Swing		Vout	800	-	1500	mVpp	2
Output Differential Impedance		Zout	90	100	110	ohm	
Rx_Los	Los Signal	VOH	2.0	-	VCC	V	
	Normal Operation	VOL	GND	-	GND+0.8	V	

Note:

1.Internally AC coupled, input termination may be required for LVPECL/CML applications.

2.Internally DC coupled, LVPECL/CML differential output stage.

8. Specifications

Table 5-Optical Characteristics

Parameter	Symbol	Unit	Min	Typ.	Max	Notes
Transmitter						
Data Rate	BR	Mbps	-	1250	-	
Center Wavelength Range	λC	nm	1480	1490	1500	
Optical Spectrum Width (-20dB)	Δλ	nm	-	-	1	
Side Mode Suppression Ratio	SMSR	dB	30	-	-	
Launch Optical Power (PX20+)	AOP_1	dBm	+2.5	-	+7	1
Launch Optical Power (PX20++)	AOP_2	dBm	+5.0	-	+8	1
Launch Optical Power (PX20+++)	AOP_3	dBm	+7.0	-	+10	1
Launch Optical Power (PX30)	AOP_4	dBm	+9.0	-	+13	1
Power-OFF Transmitter Optical Power		dBm	-	-	-39	
Extinction Ratio	ER	dB	9	-	-	2
Total Jitter	J_{total}	UI	-	-	0.44	
Rise/Fall time (20%~80%)	Tr/Tf	ps	-	-	260	3
Optical Return Loss Tolerance		dB	-	-	15	
Maximum reflectance		dB	-	-	-12	

Eye Diagram	Compliant with IEEE Std 802.3ah					4
Receiver						
Data Rate	BR	Mbps	-	1250	-	
Burst-Mode Sensitivity (PX20+)	$Sens_1$	dBm	-	-	-30	5
Burst-Mode Sensitivity (PX20++/PX20+++/PX30)	$Sens_2$	dBm	-	-	-33	5
Overload Input Optical Power	P_{STA}	dBm	-6	-	-	5
Center Wavelength Range	λc	nm	1260	1310	1360	
Receiver reflectance		dB	-	-	-12	
LOS(PX20+)	LOSA	dBm	-45	-	-	8
	LOSD	dBm	-	-	-31	8
LOS(PX20++/PX20+++/PX30)	LOSA	dBm	-45	-	-	8
	LOSD	dBm	-	-	-34	8
LOS Hysteresis		dB	0.5	-	6	8
Measurement Accuracy of received burst optical power, range from -10dBm to -30dBm		dB	-3	-	+3	
Receiver Threshold Settling Time	$T_{SETTLING}$	ns	-	-	250	9
Burst optical power conversion holding time	Holding Time	ns	400	-	-	9
Burst optical power conversion time		us			500	10
Burst optical power conversion interval time		Ms	1.0			11

Note:

1.Coupled into 9/125 SMF.

2.Measured with PRBS 27-1 test pattern @1.25Gbps.

3.Measured with the Bessel-Thompson filter ON .

4.SeeFigure 1.

5.Measured with PRBS 2^7-1 test pattern @1.25Gbps with Tx_on, ER=10dB,BER<=10E-12.

6.Define Tsettling as the time from the Tx_BEN assertion, minus the Ton time to the time the electrical signal the Receiver output reaches within 15% of its steady state conditions. It is shown in the Figure 2.

7.See Figure 3.

8.Burst optical Power received Detect.

9.See Figure 2.

10.result can be read out since trigger is High

11.Means 1000 conversions/s max.

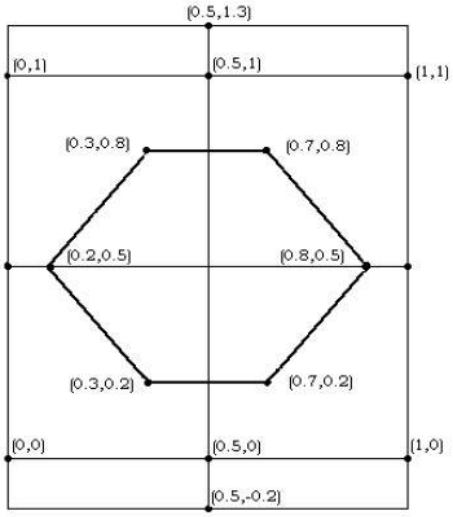

Figure 1, Eye pattern mask

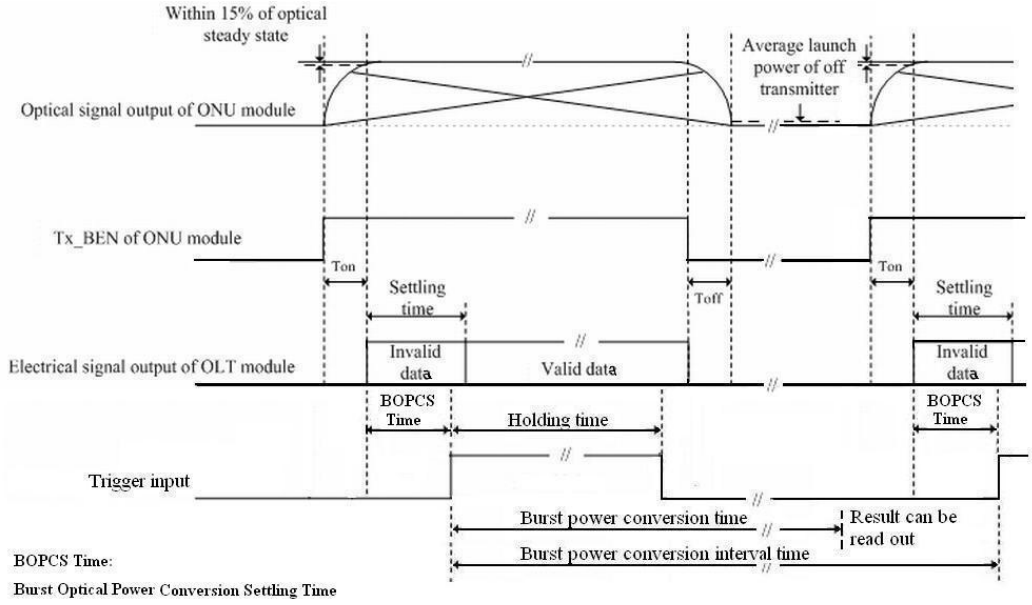

Figure 2, Time parameter definition in EPON system

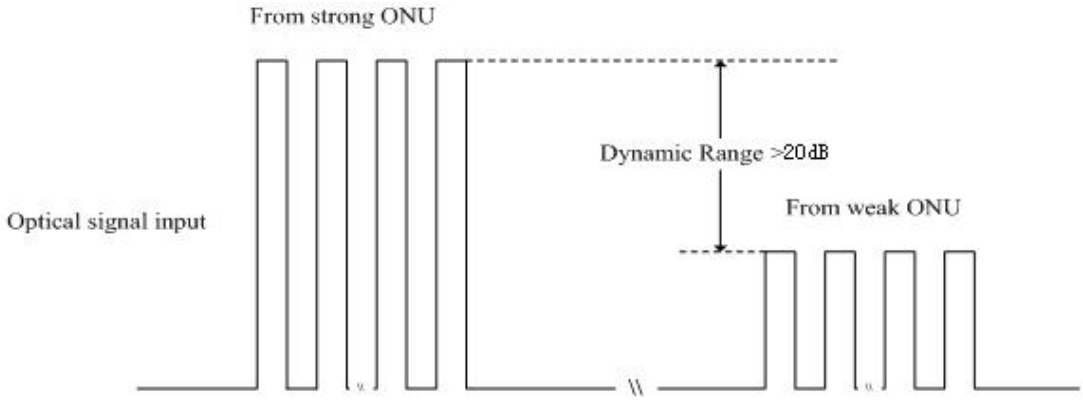

Figure 3, Burst_mode Reciever Dynamic range in EPON system

9. Digital Diagnostic Memory Map

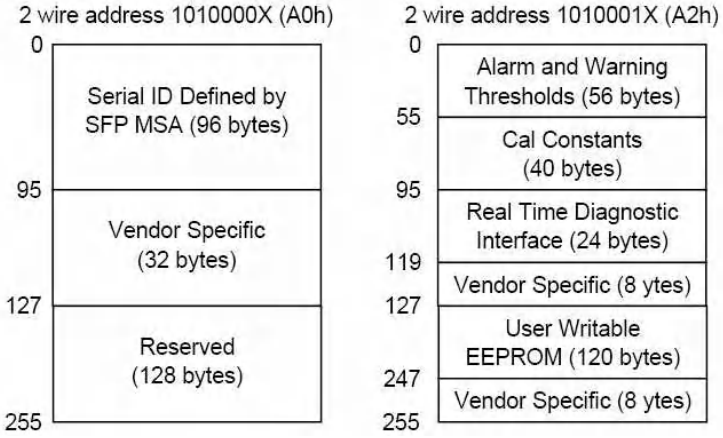

Figure 4, Memory map

10. Pin arrangement

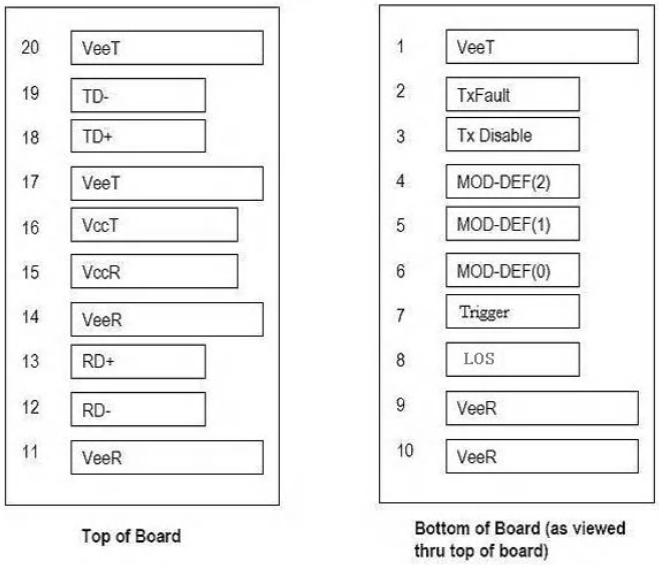

Figure 5, Pin Views

Table 6-Connector Pin Assignment

Pin	Name	Description	Notes
1	VeeT	Transmitter Ground	
2	TX Fault	Transmitter Fault Indication	1
3	TX Disable	Transmitter Disable	2
4	MOD-DEF2	Module Definition 2-Two wire serial ID interface	3
5	MOD-DEF1	Module Definition 1-Two wire serial ID interface	3
6	MOD-DEF0	Module Definition 0-Two wire serial ID interface	3
7	Trigger	Trigger input of burst signal packet received	
8	Los	Los of Burst signal	4
9	VeeR	Receiver Ground	
10	VeeR	Receiver Ground	
11	VeeR	Receiver Ground	
12	RD-	Inverse Received Data out	
13	RD+	Received Data out	
14	VeeR	Receiver Ground	
15	VccR	Receiver Power —— +3.3V±5%	
16	VccT	Transmitter Power —— +3.3 V±5%	
17	VeeT	Transmitter Ground	
18	TD+	Transmitter Data In	
19	TD-	Inverse Transmitter Data In .	
20	VeeT	Transmitter Ground	

Note:

1.TX Fault is open collector output which should be pulled up externally with a 4.7K ~10KΩ resistor on the host board to voltage between 2.0V and V_{CC}+0.3V. Logic 0 indicates normal operation; logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.

2.TX Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7~10K resistor.

Low (0- 0.8V):	**Transmitter on**
Between (0.8V and 2V):	**Undefined**
High (2.0 – VccT):	**Transmitter Disabled**
Open:	**Transmitter Disabled**

3.MOD-DEF 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7~10K resistor on the host board to supply less than VccT+0.3V or VccR+0.3V.

MOD-DEF 0 is grounded by the module to indicate that the module is present.

MOD-DEF 1 is clock line of two wire serial interface for optional serial ID.

MOD-DEF 2 is data line of two wire serial interface for optional serial ID.

4.LOS (Loss of signal) is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates loss of signal. In the low state, the output will be pulled to less than 0.8V.

11.Block Diagram

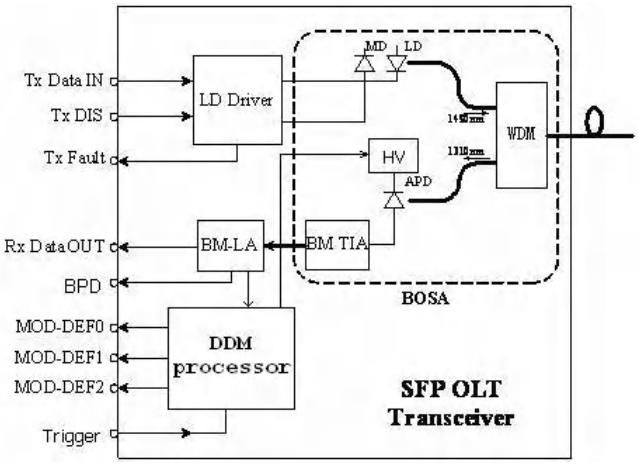

Figure 6, Block Diagram

12.Typical Application Circuit

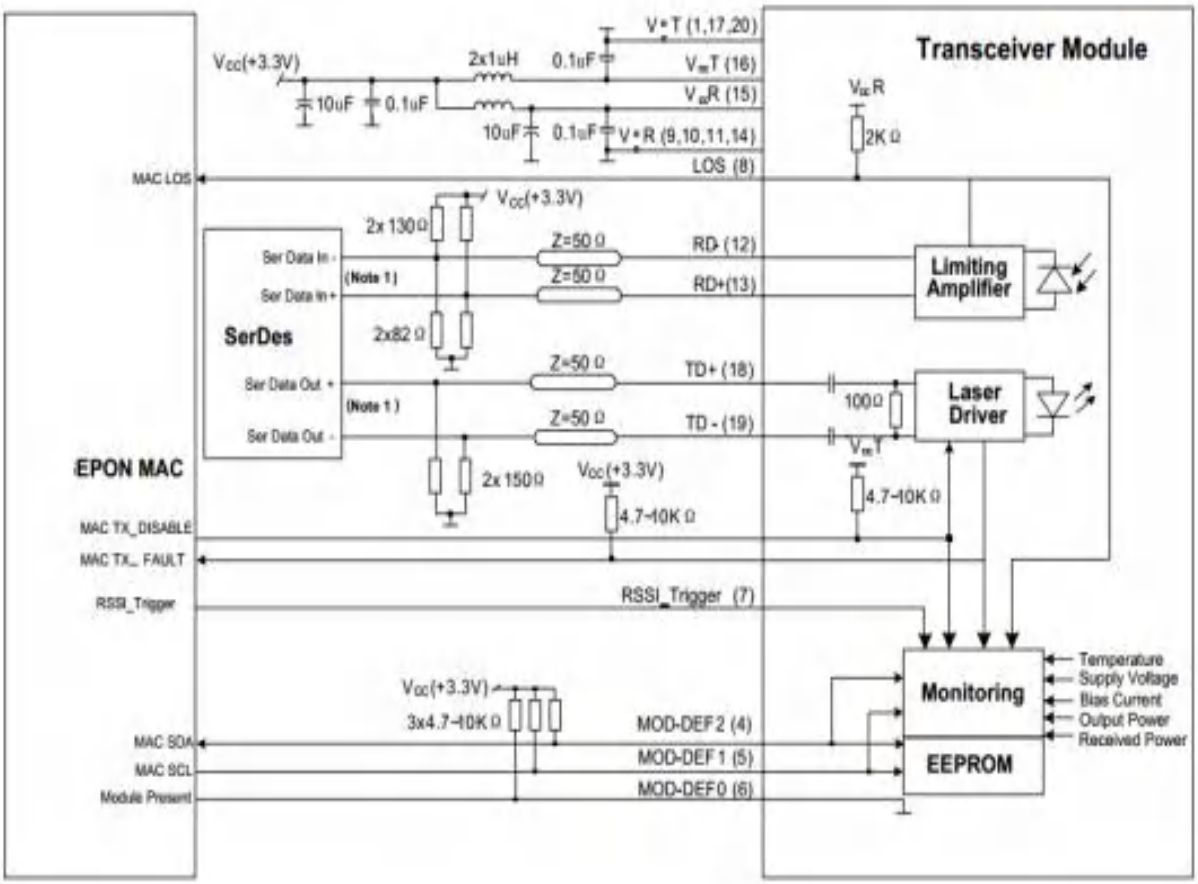

Figure 7,Typical Application Circuit

13.Mechanical Information

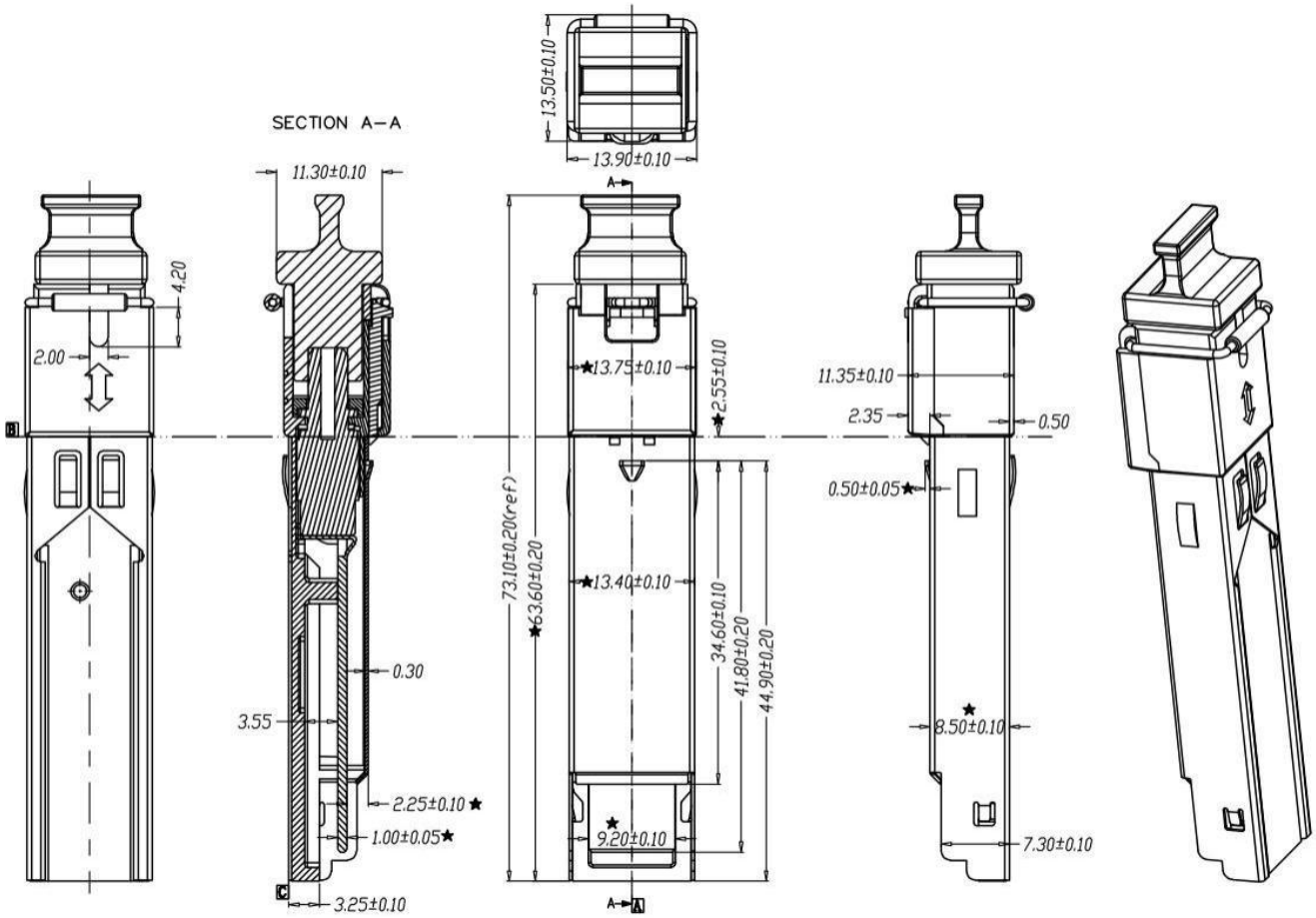

Figure 8, Mechanical Information

14. Regulatory Information

Table 7-List of Regulatory/Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883H Method 3015.8	Based on HBM
	IEC61000-4-2	8kV Contact Discharge 15kV Air Discharge
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compatible 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	Compatible 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.
RoHS 2.0	2011/65/EU	Compliant with standards

15.Notice

Gigac 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. Gigac makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

16.Revision History

Version	Initiated	Reviewed	Revision History	Release Date
A0	Fei.Han	Smith.Xu	Initialization	2022-07-16
A1	Fei.Han	Sean.Lin	PX30 Index level series Added	2022-11-01