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 APD-TIA Burst-mode receiver
- SFP Package with SC Receptacle
- +3.3V single power supply
- Operating case temperature：

  Standard: 0℃~+70℃

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

2.Applications

- IEEE802.3ah 1000BASE-PX20+/PX20++/PX20+++/PX20++++

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 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-1.1-Order Information (Standard: 0℃~+70℃)

Part Number	Data Rate (TX/RX)	Index level	PO (dBm)	Sens (dBm)	Interface	Temp.Note 1
GELS-4111-20ACS	1.25Gbps/1.25Gbps	PX20++	+5~+8	≤-33	SC	0℃~+70℃
GELS-4111-30CS	1.25Gbps/1.25Gbps	PX20+++	+7~+10	≤-33	SC	0℃~+70℃
GELS-4111-30ACSC	1.25Gbps/1.25Gbps	PX20++++	+9~+13	≤-33	SC	0℃~+70℃

Table-1.2-Order Information (Industrial: -40℃~+85℃)

Part Number	Data Rate (TX/RX)	Index level	PO (dBm)	Sens (dBm)	Interface	Temp.Note 1
GELS-4111-20AIS	1.25Gbps/1.25Gbps	PX20++	+5~+8	≤-33	SC	-40℃~+85℃
GELS-4111-30IS	1.25Gbps/1.25Gbps	PX20+++	+7~+10	≤-33	SC	-40℃~+85℃
GELS-4111-30AISC	1.25Gbps/1.25Gbps	PX20++++	+9~+13	≤-33	SC	-40℃~+85℃

Note:
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	-	+85
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	600	-	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	-	-	
Power-OFF Transmitter Optical Power		dBm	-	-	-39	
Extinction Ratio	ER	dB	9	-	-	2
Optical Return Loss Tolerance		dB	-	-	15	
Maximum reflectance		dB	-	-	-12	
Eye Diagram	Compliant with IEEE Std 802.3ah					3
Receiver						
Data Rate	BR	Mbps	-	1250	-	
Overload Input Optical Power	PSTA	dBm	-6	-	-	4
Center Wavelength Range	λc	nm	1260	1310	1360	
Receiver reflectance		dB	-	-	-12	
LOS	LOSA	dBm	-45	-	-	6
	LOSD	dBm	-	-	-34	6

LOS Hysteresis		dB	0.5	-	6	6
Measurement Accuracy of received burst optical power, range from -10dBm to -30dBm		dB	-3	-	+3	
Trigger width	Tw	us	-	-	1.25	7
I²C Waiting Time	Twait	us			500	8

Note:

1. **Coupled into 9/125 SMF.**
2. **Measured with PRBS 2^7-1 test pattern @1.25Gbps.**
3. **SeeFigure 1.**
4. **Measured with PRBS 2^7-1 test pattern @1.25Gbps with Tx_on, ER=10dB,BER<=10^{-12}.**
5. **See Figure 3.**
6. **Burst optical Power received Detect.**
7. **See Figure 2.**
8. **result can be read out since trigger is High**

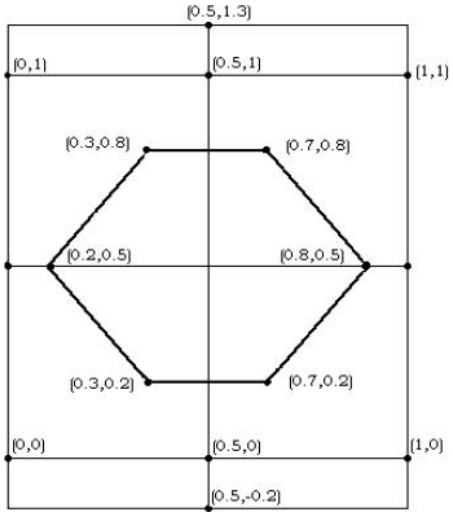

Figure 1, Eye pattern mask

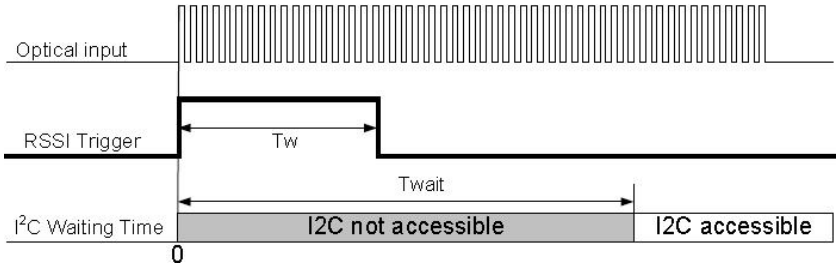

Figure 2, RSSI Trigger Sequence in EPON system

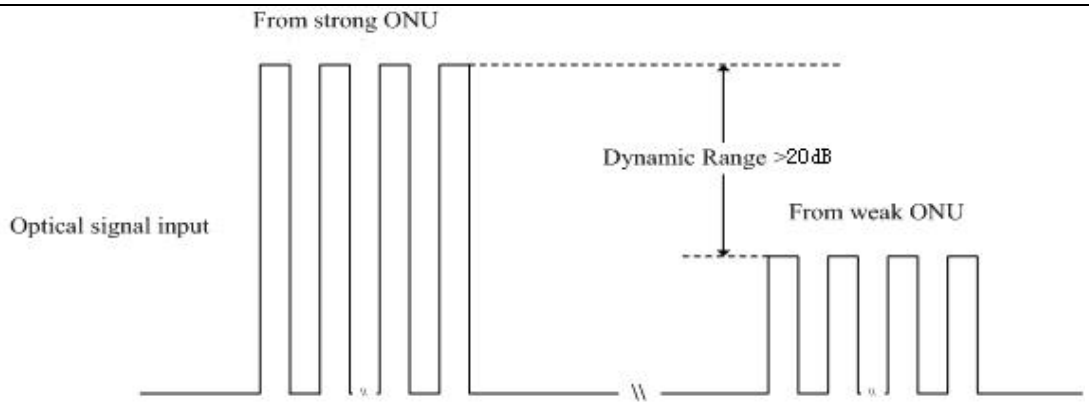

Figure 3, Burst_mode Reciever Dynamic range in EPON system

9. Digital Diagnostic Memory Map

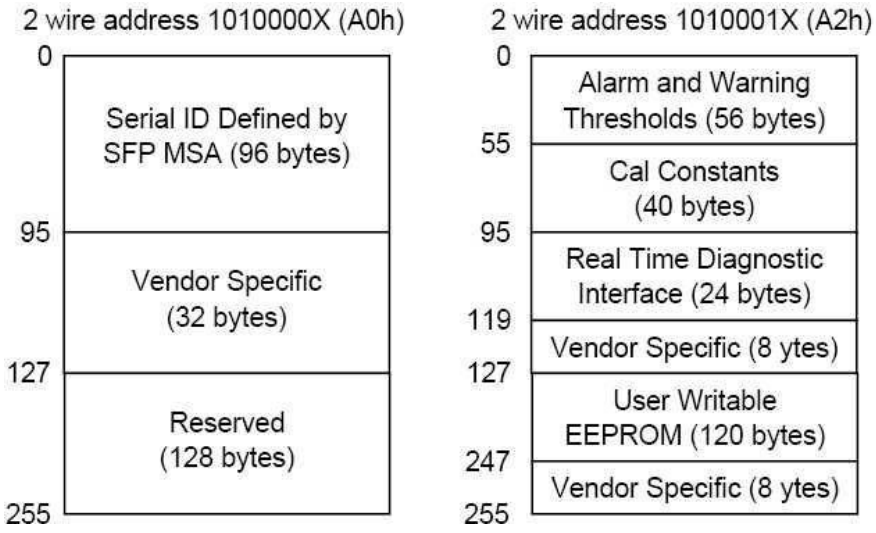

Figure 4, Memory map

10. Pin arrangement

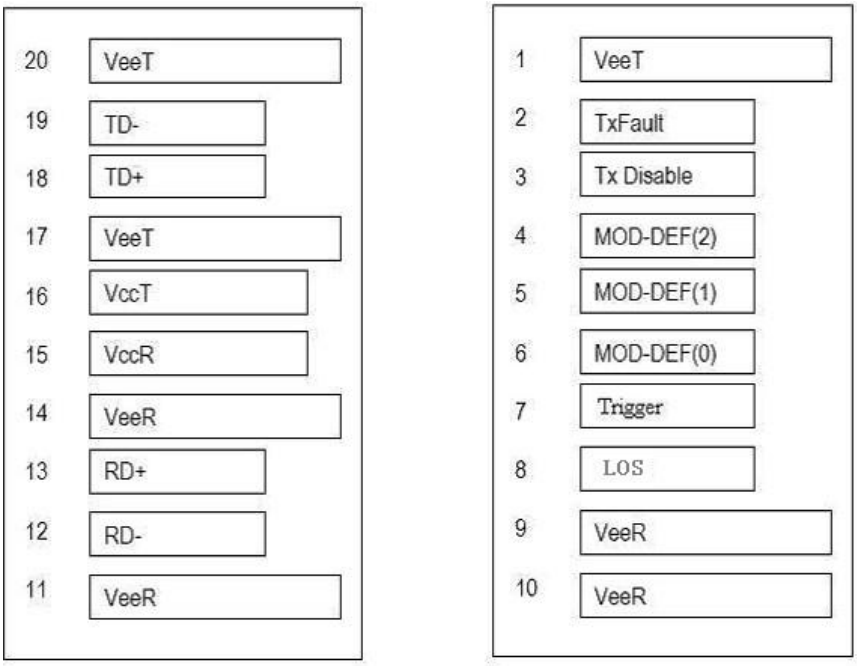

Figure 5, Pin Views

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	I2C data, SDA	3
5	MOD-DEF1	I2C clock, SCL	3
6	MOD-DEF0	Module Definition 0, Grounding in SFP	3
7	Trigger	Trigger input of burst signal packet received	
8	Los	Loss of Burst signal	4
9	VeeR	Receiver Ground	
10	VeeR	Receiver Ground	
11	VeeR	Receiver Ground	
12	RD-	Inverse Received Data out, DC coupled output	
13	RD+	Received Data out, DC coupled output	
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, internally AC coupled with 100ohm terminated.	
19	TD-	Inverse Transmitter Data In, internally AC coupled with 100ohm terminated.	
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 Vcc+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 4.7K~ 10KΩ 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 4.7K~10KΩ 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

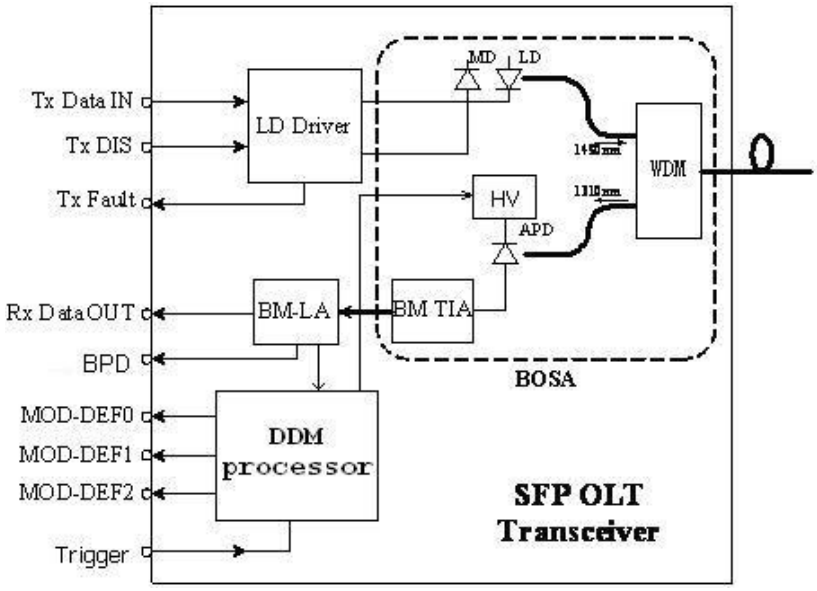

Figure 6, Block Diagram

12.Typical Application Circuit

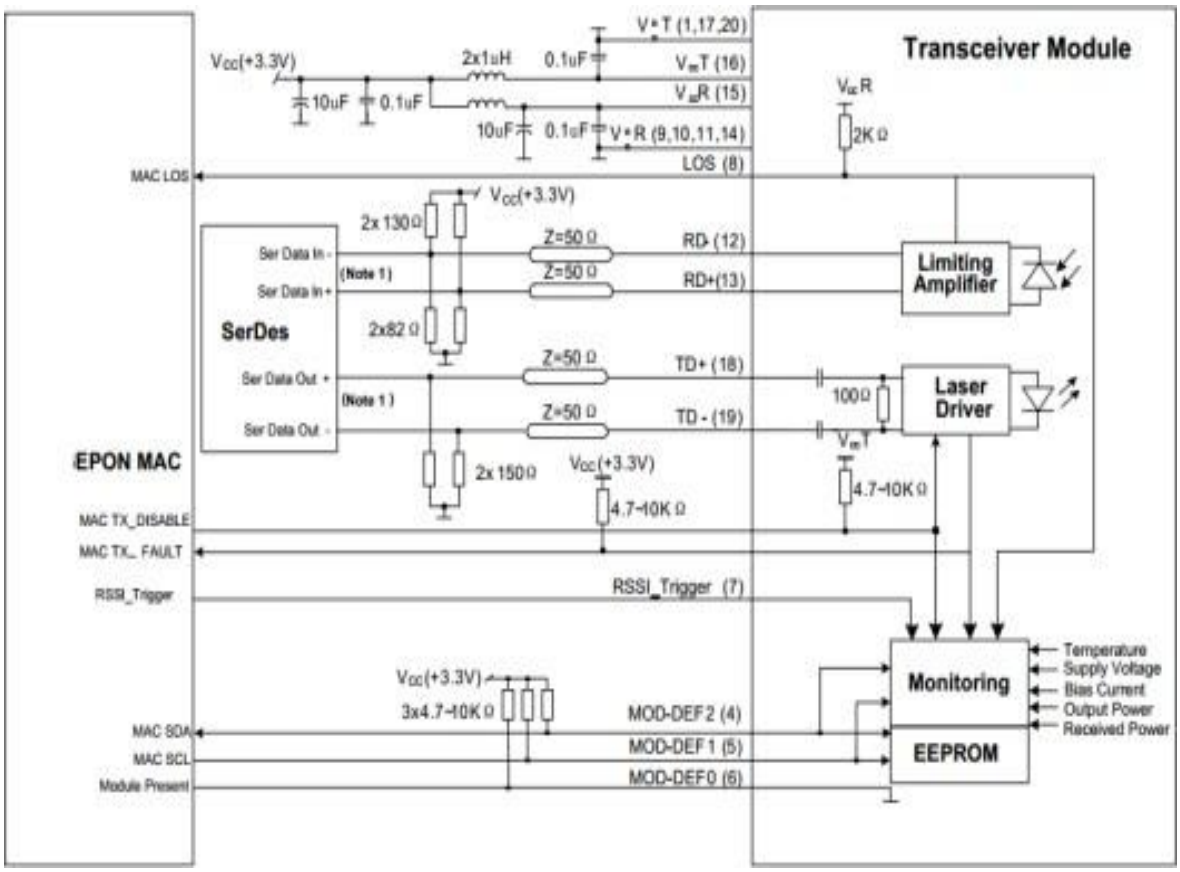

Figure 7,Typical Application Circuit

13.Mechanical Information

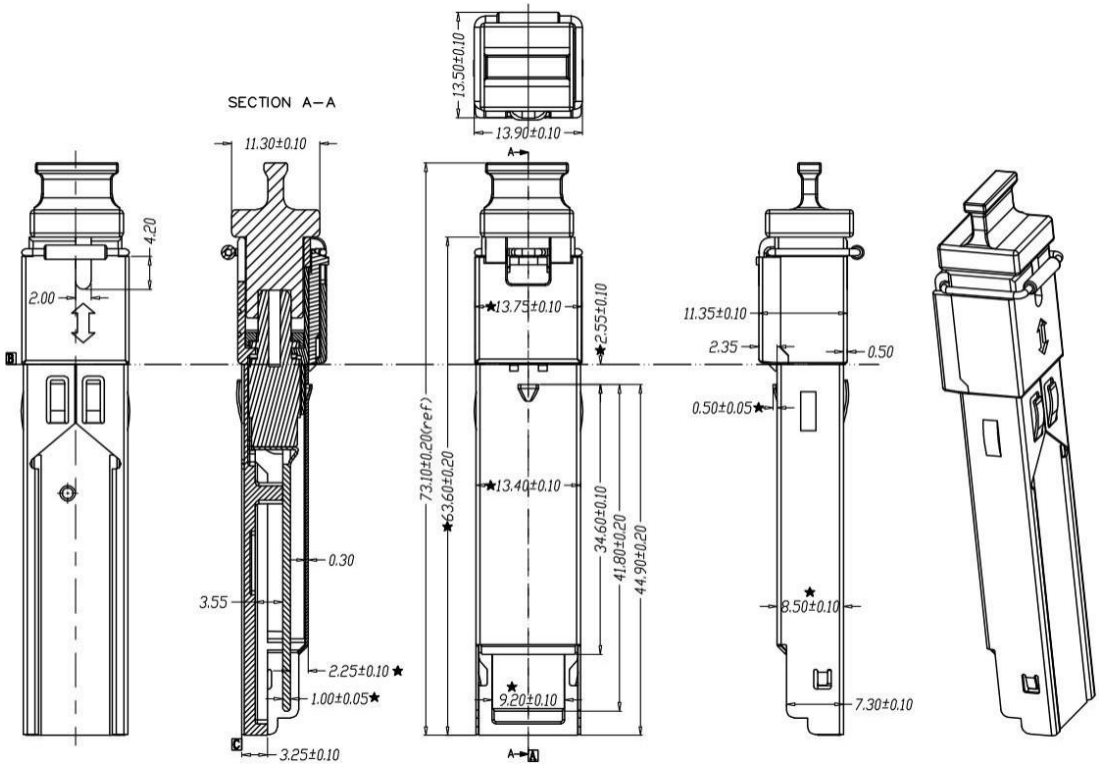

Figure 8, Mechanical Information

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	2018-07-16
A1	Fei.Han	Sean.Lin	PX20++++ Index level series Added	2022-09-01
A2	Fei.Han	Yucheng.Wang	Description Added	2022-11-24
A3	Yucheng.Wang			2022-03-20