FEATURES

- Single fiber bi-directional data links TX 9.953Gbps, Burst Mode RX 9.953G/2.488Gbps application
- Single fiber bi-directional data links TX 2.488Gbps, Burst Mode RX1.244Gbps application
- 3.3V power supply
- SFP+ package with SC Receptacle connector
- Hot-pluggable capability
- High power 1577nm EML LD and High power 1490nm DFB LD
- High sensitivity 1270nm/1310nm APD
- Support 20km transmission distance with SMF
- SD indication
- Low EMI and excellent ESD protection
- Digital diagnostic monitor interface
- RoHS10 compliance

APPLICATIONS

- XGS-PON OLT
- GPON OLT

STANDARDS

- Complies with SFF-8472
- Complies with ITU-T G.9807.1 and ITU-T G.987.2
- Complies with FCC 47 CFR Part 15, Class B
- Complies with FDA 21 CFR 1040.10 and 1040.11

ABSOLUTE MAXIMUM RATING

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Ambient Temperature	T_{STG}	-40	85	°C	
Operating Case Temperature	Tc	0 -40	70 85	°C	Commercial Industrial
Relative Storage Humidity	RHs	5	85	%	
Relative Operating Humidity	RoHS	5	85	%	
VCC3 Power Supply Voltage	VCC3	3.13	3.47	V	
Total Power			3.5	W	

RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	Tc	0 -40		70 85	°C	Commercial Industrial
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	
RX Data Rate			9.953/2.488 1.244		Gbps	
TX Data Rate			9.953 2.488		Gbps	

XGS PON TRANSMITTER OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Optical Center Wavelength	λC	1575		1580	nm	
Optical Spectrum Width (-20dB)	Δλ	-	-	1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power	AOP	1 5 6 8		4 8 9 11	dBm	Class B+ Class C+ Class E1 Class D
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	$PRBS2^{31}$ -1@9.953Gbps
Optical Waveform Diagram	Compliant with ITU-T G.9807.1					Figure 1, Mask Margin>5%
Tolerance to Transmitter Incident Light power		-15			dB	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF

XGS PON TRANSMITTER ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Data Input Differential Swing			100		850	mV	CML input, AC coupled
Input Differential Impedance		Zin	90	100	110	Ω	
TX Disable	Disable		2		VCC+0.3	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.4		VCC+0.3	V	
	Normal		0		0.4	V	

XGS PON TRANSMITTER EYE MASK DEFINITIONS AND TEST PROCEDURE

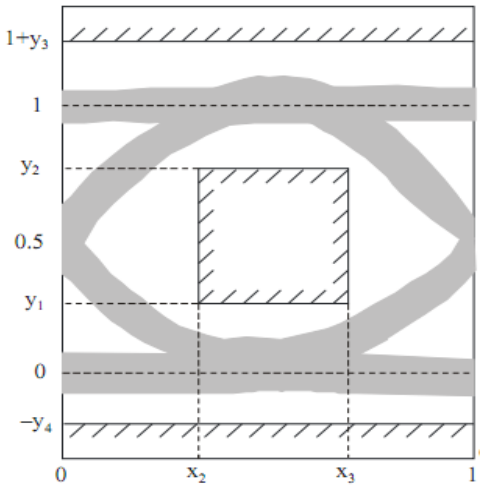


Figure 1 XGPON Transmitter Eye Mask Definitions

X3-X2	Y1	Y2	Y3	Y4	Unit
0.2	0.25	0.75	0.25	0.25	UI

GPON TRANSMITTER OPTICAL CHARACTERISTICS

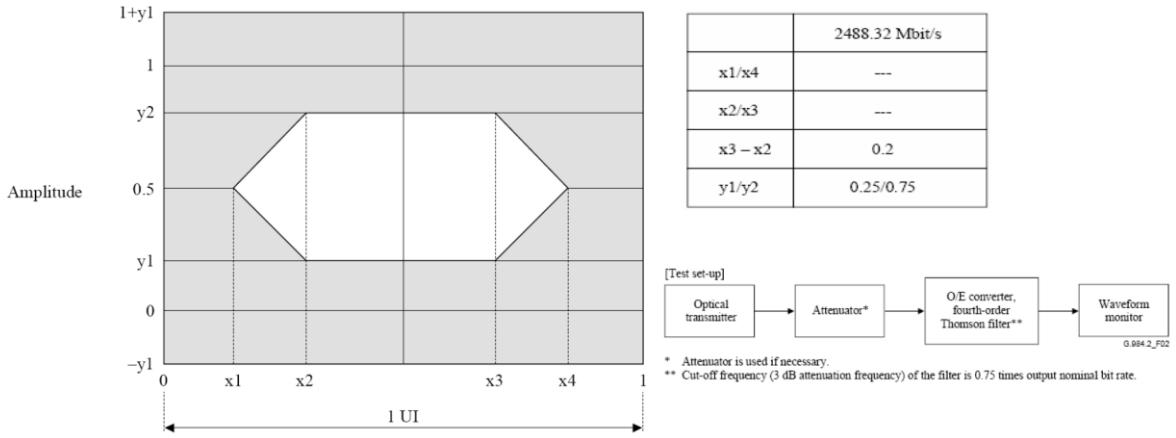
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Optical Center Wavelength	λ_C	1480		1500	nm	
Optical Spectrum Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power	AOP	1.5 3 5 6		5 7 9 10	dBm	Class B+ Class C+ Class E1 Class D
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	PRBS 2^{23} -1@2.488G
Optical Waveform Diagram	Compliant with ITU-T G.984.2					Figure 2, Mask Margin>5%

Tolerance to Transmitter Incident Light power		-15			dB	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF

GPON TRANSMITTER ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Data Input Differential Swing			100		850	mV	CML input, AC coupled
Input Differential Impedance		Zin	90	100	110	Ω	
TX Disable	Disable		2		VCC+0.3	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.4		VCC+0.3	V	
	Normal		0		0.4	V	

GPON TRANSMITTER EYE MASK DEFINITIONS AND TEST PROCEDURE



	2488.32 Mbit/s
x1/x4	---
x2/x3	---
x3 – x2	0.2
y1/y2	0.25/0.75

* Attenuator is used if necessary.
** Cut-off frequency (3 dB attenuation frequency) of the filter is 0.75 times output nominal bit rate.

Figure 2 GPON Transmitter Eye Mask Definitions

XGS PON RECEIVER OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1260		1280	nm	
Sensitivity	SEN			B+: -25 C+: -29 E1: -30 D: -32	dBm	ER≥6dB, PRBS2^{31}-1@9.953Gbps BER ≤1×10-3
Overload	OL	B+: -4 C+: -8 E1: -9			dBm	ER≥6dB, PRBS2^{31}-1@9.953Gbps BER ≤1×10-3

		D: -11				
Max Optical input		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5		6	dB	
Receiver Reflectance				-12	dB	

XG PON RECEIVER OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1260		1280	nm	
Sensitivity	SEN			B+: -26.5 C+: -30.5 E1: -31 D: -33.5	dBm	E≥8.2dB, PRBS2^{23}-1@2.488Gbps BER ≤1×10-4
Overload	OL	B+: -6 C+: -10 E1: -11 D: -13			dBm	ER≥8.2dB, PRBS2^{23}-1@2.488Gbps BER ≤1×10-4
Max Optical input		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5		6	dB	
Receiver Reflectance				-12	dB	

XGS/XGPON RECEIVER ELECTRIAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Notes
Guard time	Tg	50	100	-	ns	
Reset Pulse Width	Tr	25.6	-	-	ns	
Receiver Threshold Settling Time	$T_{SETTLING}$			100	ns	Figure 3
Data Output Differential Swing		400		800	mV	DC Coupled, CML output
Output Differential Impedance	Zout	90	100	110	Ω	
SD Assert Level Time				100	ns	
SD De-Assert Level Time				100	ns	
SD Voltage - Low		0		0.4	V	
SD Voltage - High		2.4		VCC+0.3	V	

GPON RECEIVER OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1290	1310	1330	nm	
Sensitivity	SEN			B+: -28 C+: -32 E1: -33 D: -35	dBm	ER≥10dB PRBS 2^{23}-1@1.244Gbps, BER ≤1×10^{-10} for B+, BER ≤1×10^{-4} for C+, E1, D
Overload	OL	B+: -8 C+: -12 E1: -13 D: -15			dBm	ER≥10dB PRBS 2^{23}-1@1.244Gbps, BER ≤1×10^{-10} for B+, BER ≤1×10^{-4} for C+, E1, D
Max Optical input		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5		6	dB	
CID		72			bit	

GPON RECEIVER ELECTRIAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Notes
Guard time	Tg	25.6	50	-	ns	
Reset Pulse Width	Tr	12.8	-	-	ns	
Receiver Threshold Settling Time	T_{SETTLE}		25.6		ns	Figure 5
Data Output Differential Swing		600		1600	mV	LVPECL output, DC coupled
Output Differential Impedance	Zout	90	100	110	Ω	
SD Assert Level Time	Ta			24	ns	Figure 5
SD De-Assert Level Time				25.6	ns	
SD Voltage - Low		0		0.4	V	
SD Voltage - High		2.4		VCC+0.3	V	

TIMING PARAMETER DEFINITIONS IN BURST MODE SEQUENCE

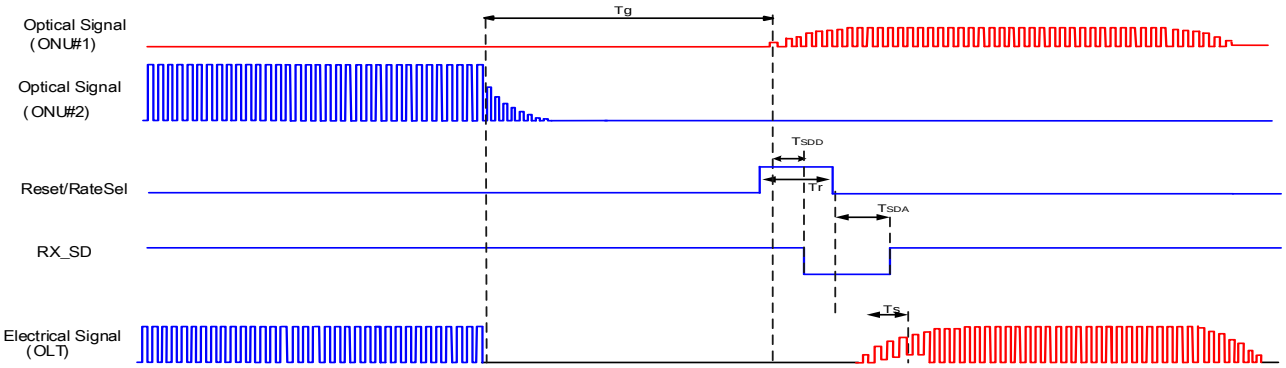


Figure 3 Timing Parameter Definitions in XGS PON Burst Mode Sequence

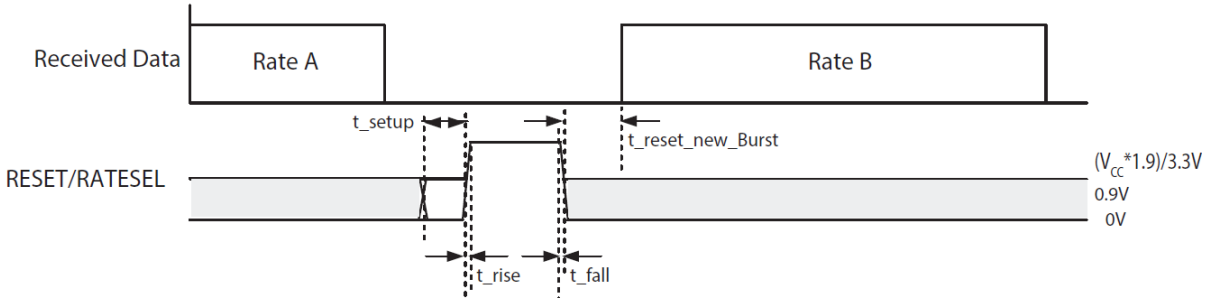


Figure 4 Reset/RateSel Timing Diagram

Reset/RateSel Function		
Reset/Ratesel	Voltage V	Function
High	1.9~3.3V	Reset
Middle	1.2~1.6V	Rate=2.488G
Low	0~0.9V	Rate=9.953G

Reset/RateSel Timing Diagram						
Parameter	Symbol	Min.	Typ.	Max.	Unit.	Notes
Setup Time	T_{Setup}	5			ns	
Reset Rise Time	T_{Rise}			3	ns	
Reset Fall Time	T_{fall}			3	ns	
Reset New Burst Time	$T_{Reset\ new\ burst}$			0	ns	

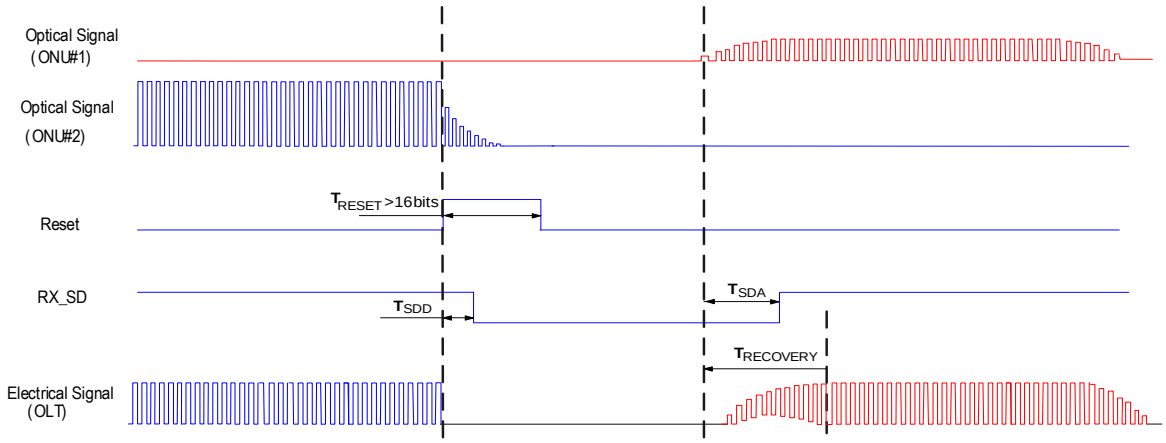


Figure 5 Timing Parameter Definitions in GPON Burst Mode Sequence

RSSI TIMING SEQUENCE						
Parameter	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit.**	**Notes**
Optical Signal Duration time	T_{opt}	1200			ns	
RSSI Trigger width	T_W	550			ns	
RSSI Trigger Delay	T_D	150			ns	
RSSI Trigger-Low		0		0.8	V	
RSSI Trigger-High		2.0		Vcc	V	
I^2C Access Prohibited Time	T_S			500	μs	
I^2C Bus Frequency		0	100	200	KHz	
I^2C - High		2.4		3.6	V	
I^2C - Low		0		0.4	V	

Digital RSSI Sample/Hold Timing Specification

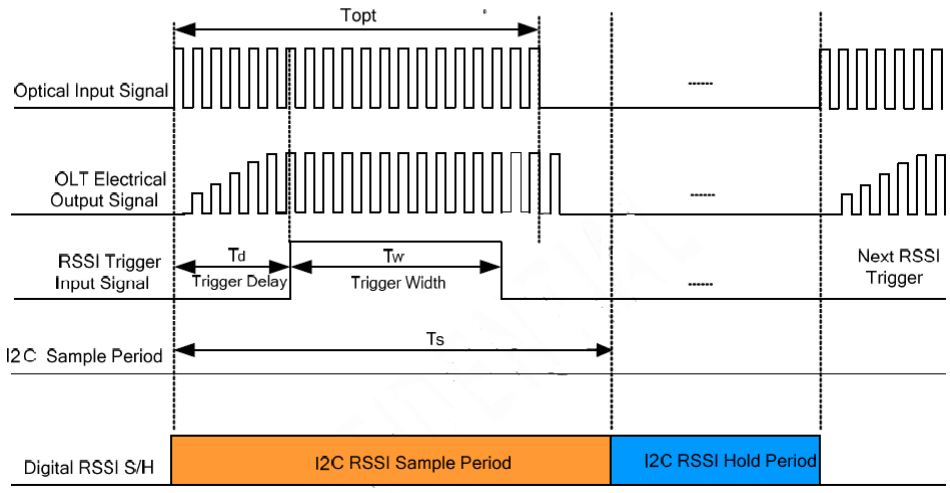


Figure 6 Timing Parameter Definitions in RSSI Trigger

PIN OUT DRAWING

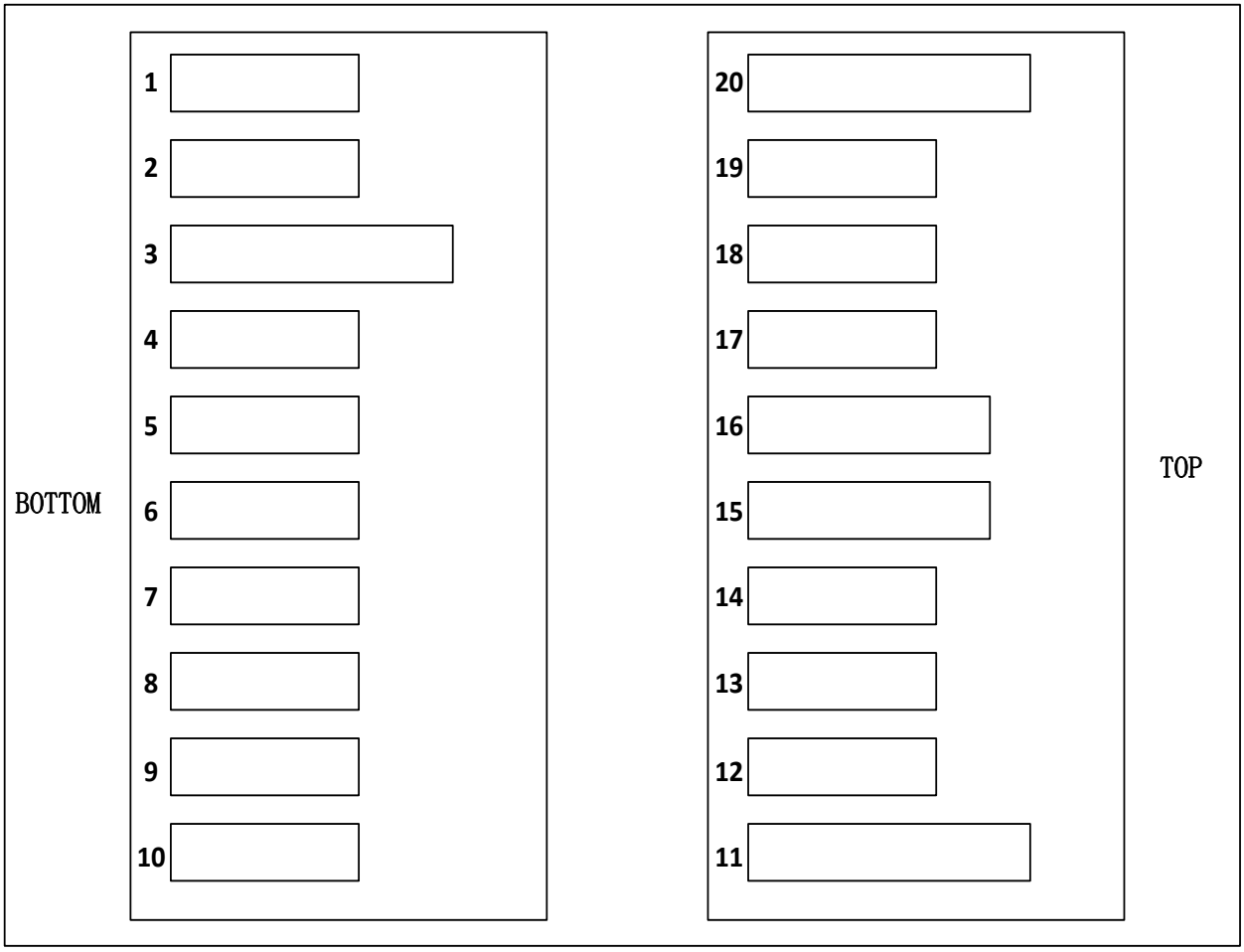


Figure 7 Pin Out Drawing

PIN DESCRIPTION

PIN	Name	Description	Notes
1	GPON_TD+	2.5G Transmit Data In	AC coupled, CML input
2	GPON_TD-	Inv. 2.5G Transmit Data In	AC coupled, CML input
3	GND	Module Ground	
4	SDA	2-Wire Serial Interface Data	The data line of two wire serial interface
5	SCL	2-Wire Serial Interface Clock	The clock line of two wire serial interface
6	GPON_RD-	Inv. Received 1G Data Out	DC coupled, LVPECL output [1]
7	Reset& Rate Select	XGSPON Reset& Rate Select	High: Reset, Middle:2.5G, Low:10G [2]
8	XGSPON SD	XSGPON SD Indicator	LOW: lost signal
9	Trig/Tx_Dis	Receiver RSSI trigger input /Transmitter Disable	The Mode can be switched [3]
10	GPON_RD+	Received 1G Data Out	DC coupled, LVPECL output [1]
11	GND	Module Ground	
12	XGSPON_RD-	Inv. Received 10G Data Out	DC coupled, CML output [5]

13	XGSPON_RD+	Received 10G Data Out	DC coupled, CML output [5]
14	GPON SD	GPON SD Indicator	
15	VCCR	3.3V DC Power Input	
16	VCCT	3.3V DC Power Input	
17	GPON RESET	GPON RESET	
18	XGSPON_TD+	differential 10G Transmit Data In	AC coupled, CML input
19	XGSPON_TD-	Inv. differential 10G Transmit Data In	AC coupled, CML input
20	GND	Module Ground	

Note 1: This contact shall be pulled down with LVPECL output in the host;

Note 2: High voltage is greater than 1.9V, intermediate voltage is 1.2V ~ 1.6V, low voltage is lower than 0.9V;

Note 3: A2 RSSI/TXDIS SELECTION

Address	Bit	Name	Description
A2 BYTE118	7	RSSI Select	Writing "0" for XGS-PON RSSI Monitor; Writing "1" for GPON RSSI Monitor. Default power up value is "0".
	6	RSSI/ TXDIS Select	When set "0", PIN9 input as TXDIS input; When set "1", PIN9 as RSSI input. Default power up value is "0".
	5	XGSPON TXDIS Selection	When set "0", PIN9 as the XGS-PON TXDIS input. Default power-up value: "0". [4].
	4	GPON TXDIS Selection	When set "0", PIN9 as the GPON TXDIS input. Default power-up value: "0". [4]

Note 4: The value is not "0", which represents keep the previous status;

Note 5: While XGS SD is low level, squelch function makes XGS LA output muting;

PACKAGE OUTLINE

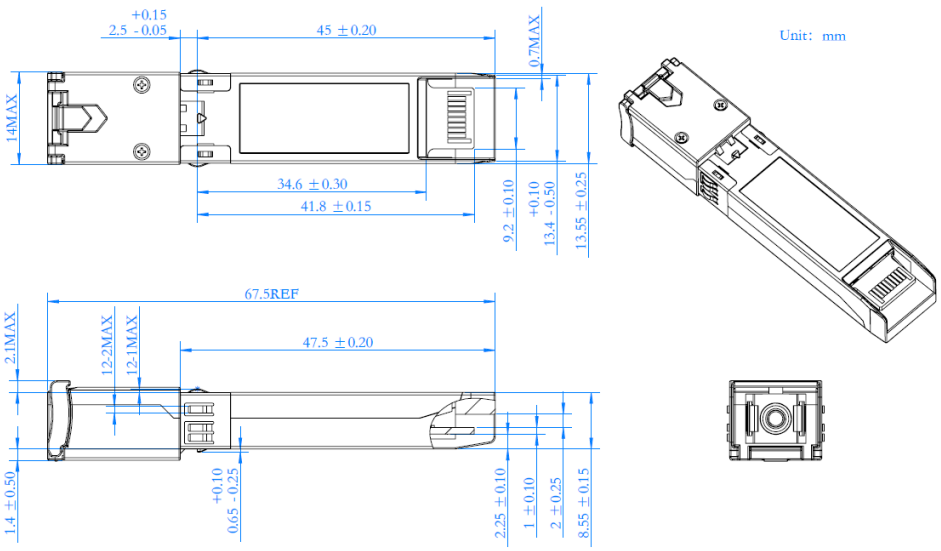


Figure 8 Package Outline

EEPROM INFORMATION

A0h(1010000X) and B0h(1011000X) are the Serial ID addresses for XGSPON/XGPON and GPON OLT, respectively.

A2h(1010001X) and B2h(1011001X) are the Digital Diagnostic addresses for XGSPON/XGPON and GPON OLT, respectively.

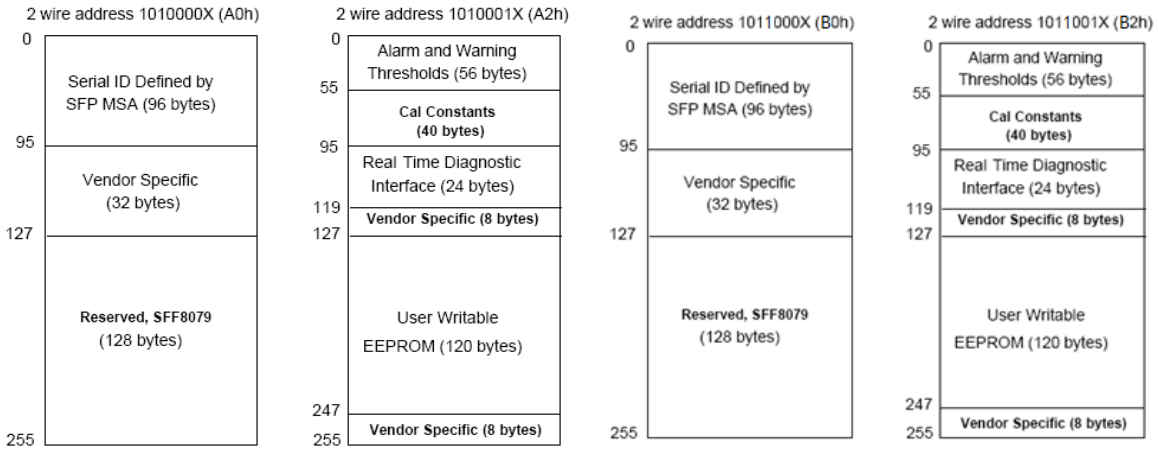


Figure 17 EEPROM Memory Map Specific Data Field Descriptions

XGS: DIGITAL DIAGNOSTIC MONITORING INTERFACE

Parameter	Range	Accuracy	Calibration	Page	Address	NOTES
Temperature	0 to 70°C -40 to 85°C	±3°C	Internal	A2	Byte 96~97, Byte96 is MSB	LSB: 1/256C
Voltage	2.97 to 3.63V	±5%	Internal	A2	Byte 98~99, Byte98 is MSB	LSB: 0.1mV
Bias Current_XGS	0 to 262mA	±10%	Internal	A2	Byte 100~101, Byte100 is MSB	LSB: 4uA
TX Power_XGS	1 to 11dBm	±3dB	Internal	A2	Byte 102~103, Byte102 is MSB	LSB: 0.2uW
RX Power_XGS	Sensitivity to Overload	±3dB	Internal	A2	Byte 104~105, Byte104 is MSB	LSB: 0.1uW

GPON: DIGITAL DIAGNOSTIC MONITORING INTERFACE

Parameter	Range	Accuracy	Calibration	Page	Address	NOTES
Temperature	0 to 70°C -40 to 85°C	±3°C	Internal	B2	Byte 96~97, Byte96 is MSB	LSB: 1/256C
Voltage	2.97 to 3.63V	±5%	Internal	B2	Byte 98~99, Byte98 is MSB	LSB: 0.1mV
Bias Current_GPON	0 to 262mA	±10%	Internal	B2	Byte 100~101, Byte100 is MSB	LSB: 4uA
TX Power_GPON	1 to 10dBm	±3dB	Internal	B2	Byte 102~103, Byte102 is MSB	LSB: 0.2uW
RX Power_GPON	Sensitivity to Overload	±3dB	Internal	B2	Byte 104~105, Byte104 is MSB	LSB: 0.1uW

ORDERING INFORMATION

PN	Temperature Rating ℃	ODN Class	Fiber Termination
SOGX6299-PSGE SOGX6299-PSIGE	0 to 70°C -40 to 85°C	B+	SC UPC
SOGX6299-PSGF SOGX6299-PSIGF	0 to 70°C -40 to 85°C	C+	SC UPC
SOGX6299-PSGN	0 ~ 70	E1	SC UPC
SOGX6299-PSGO	0 ~ 70	D	SC UPC

WARNINGS

- Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
- Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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