

## XSPC-P9T9R-BD1C(I)

SFP+ MPM XGS-PON OLT B+ Transceiver

### 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 RX 1.244Gbps application
- 0 to 70°C operating case temperature
- 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
- Rx\_SD indication
- Low EMI and excellent ESD protection
- Digital diagnostic monitor interface
- RoHS6 compliance



### Applications

- XGS-PON OLT B+
- GPON OLT B+

### Standards

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

## Absolute Maximum Ratings

**Table 1 - Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit	Notes
Storage Ambient Temperature	TSTG	-40	85	°C	
Operating Case Temperature	TA	0	70	°C	
Relative Storage Humidity	RHs	5	85	%	
Relative Operating Humidity	RoHS	5	85	%	
VCC3 Power Supply Voltage	VCC3	3.13	3.47	V	
Total Power			3.3	W	

## Recommended Operating Environment

**Table 2 - Recommended Operating Environment**

Parameter	Symbol	Min	Typical	Max	Unit	Notes	
Operating Case Temperature	Tc	0		70	°C		
Power Supply Voltage	Vcc	3.13	3.3	3.47	V		
RX Date Rate			9.953		Gbps		
			2.488				Gbps
			1.244				Gbps
TX Date Rate			9.953		Gbps		
			2.488		Gbps		

## XGSPON Transmitter Optical Characteristics

**Table 3-XGSPON Transmitter Optical Characteristics**

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Optical Center Wavelength	$\lambda_C$	1575		1580	nm	
Optical Spectrum Width (-20dB)	$\Delta\lambda$	-	-	1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	

Average Launch Optical Power(BOL)	AOP	+1		+4	dBm	25°C, Launched into SMF
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	PRBS2 <sup>31</sup> -1 @9.953Gbps
Optical Waveform Diagram	Compliant with ITU G.9807.1					Figure 1, Mask Margin>5%
Tolerance to Transmitter Incident Light		-15			dB	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF

## XGSPON Transmitter Electrical Characteristics

Table 4-XGSPON Transmitter Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Data Input Differential Swing		180		850	mV	CML input, AC coupled
Input Differential Impedance		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 Procedures

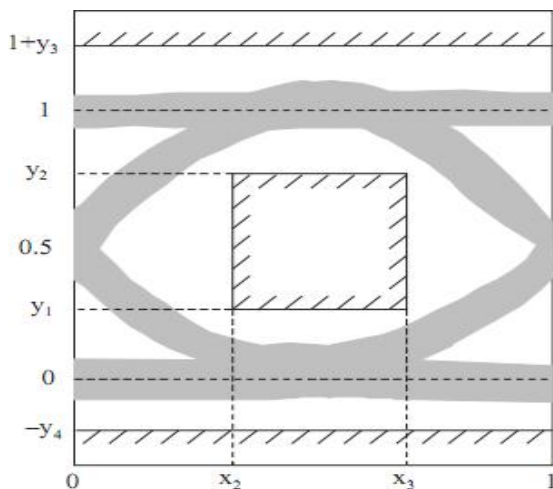


Figure 1 XGPON Transmitter Eye Mask Definitions

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

## GPON Transmitter Optical Characteristics

Table 5- Transmitter Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Optical Center Wavelength	$\lambda_c$	1480		1500	nm	
Optical Spectrum Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power (BOL)	AOP	+1.5		+5	dBm	Launched into SMF
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	PRBS 2 <sup>23</sup> -1+72CID@2.488G
Optical Waveform Diagram	Compliant with ITU-T G.984.2					Figure 2, Mask Margin>5%
Tolerance to Transmitter Incident Light			-15		dB	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF

## GPON Transmitter Electrical Characteristics

Table 6-GPON Transmitter Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Data Input Differential Swing		180		850	mV	CML input, AC coupled
Input Differential Impedance		90	100	110	$\Omega$	
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

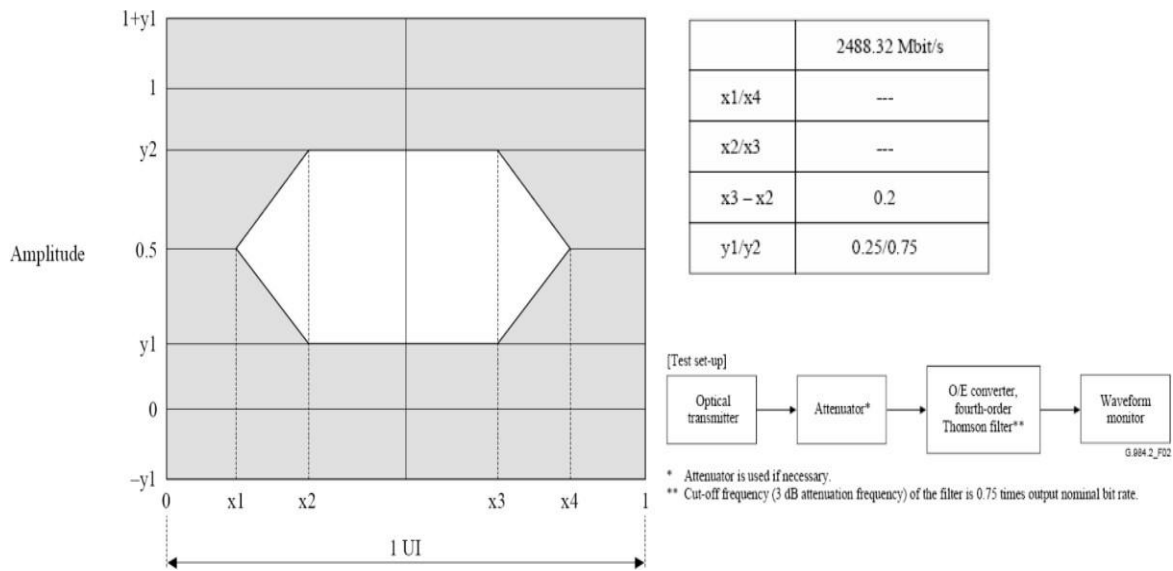


Figure 2 GPON Transmitter Eye Mask Definitions

## XGS PON Receiver Optical Characteristics

Table 7-XGS PON Receiver Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Wavelength		1260		1280	nm	
Sensitivity	SEN			-25	dBm	ER≥6dB, PRBS2 <sup>31</sup> @9.953Gbps BER ≤1×10 <sup>-3</sup>
Minimum Overload		-4			dBm	
Max Optical input				0	dBm	
SD Assert Level				-25.5	dBm	
SD De-Assert Level		-45			dBm	
Hysteresis		0.5		6	dB	
Receiver Reflectance				-12	dB	

## XG PON Receiver Optical Characteristics

Table 8-XG PON Receiver Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Wavelength		1260		1280	nm	
Sensitivity	SEN			-26.5	dBm	ER≥6dB, PRBS2 <sup>23</sup> @2.488Gbps BER ≤1×10 <sup>-4</sup>
Minimum Overload		-6			dBm	
Max Optical input				0	dBm	
SD Assert Level				-27.0	dBm	
SD De-Assert Level		-45			dBm	
Hysteresis		0.5		6	dB	
Receiver Reflectance				-12	dB	

## XGS/XGPON Receiver Electrical Characteristics

Table 9-XGS/XGPON Receiver Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Guard time	Tg	50	100	-	ns	
Reset Pulse Width	Tr	25.6	-	-	ns	
Receiver Threshold Settling Time	TSETTLING			100	ns	Figure 3
Data Output Differential Swing		400		800	mV	DC Coupled, CML output
Input Differential Impedance	Zin	90	100	110	$\Omega$	
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

Table 10-GPON Receiver Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Wavelength		1290	1310	1330	nm	
Sensitivity	SEN			-28.0	dBm	ER $\geq$ 10dB PRBS 2 <sup>23</sup> @1.244Gbps BER $\leq$ 1 $\times$ 10 <sup>-10</sup>
Minimum Overload		-8			dBm	
Max Optical input				0	dBm	
SD Assert Level				-28.5	dBm	
SD De-Assert Level		-45			dBm	
Hysteresis		0.5		6	dB	
CID		72			bit	

## GPON Receiver Electrical Characteristics

Table 11-GPON Receiver Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Guard time	Tg	25.6	50	-	ns	
Reset Pulse Width	Tr	12.8	-	-	ns	
Receiver Threshold Settling Time	TSETTLE		25.6		ns	Figure 4
Data Output Differential Swing		600		1600	mV	LVPECL output, DC coupled
Input Differential Impedance	Zin	90	100	110	$\Omega$	
SD Assert Level Time	Ta			24	ns	Figure 4
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

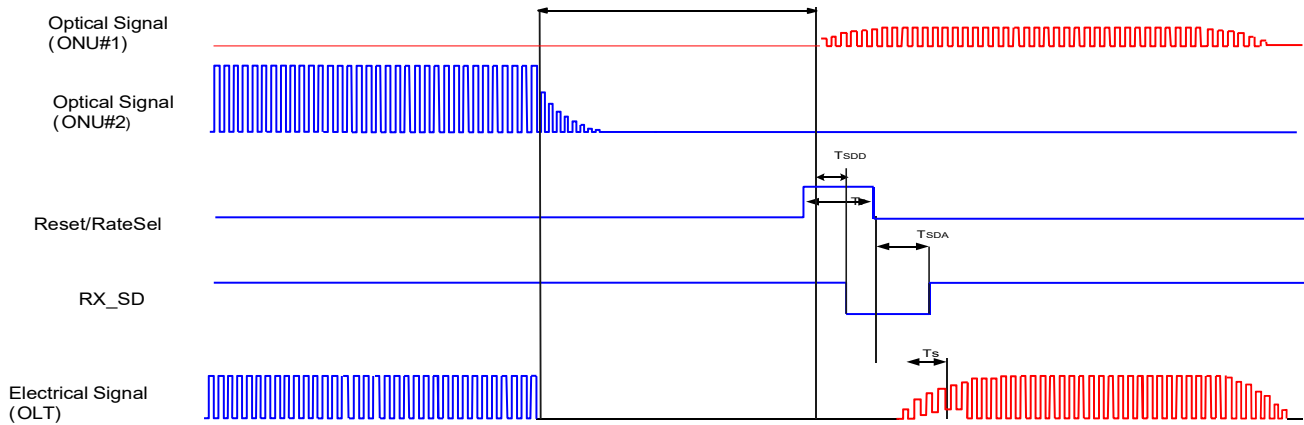


Figure 3 Timing Parameter Definitions in XGS-PON Burst Mode Sequence



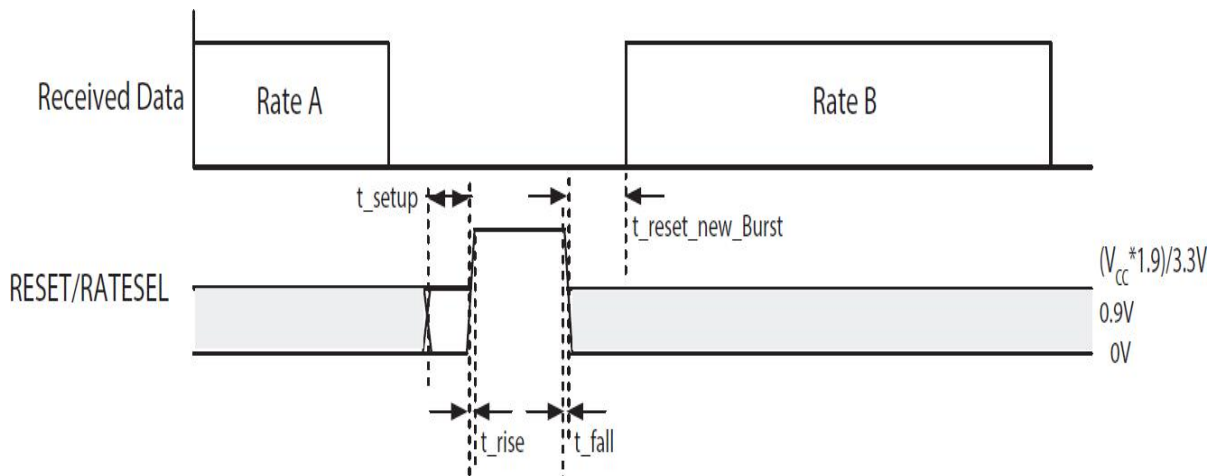


Figure 4 Reset/RateSel Timing Diagram

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

Table 12 - Reset/RateSel Timing Diagram

Parameter	Symbol	Min	Typical	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	

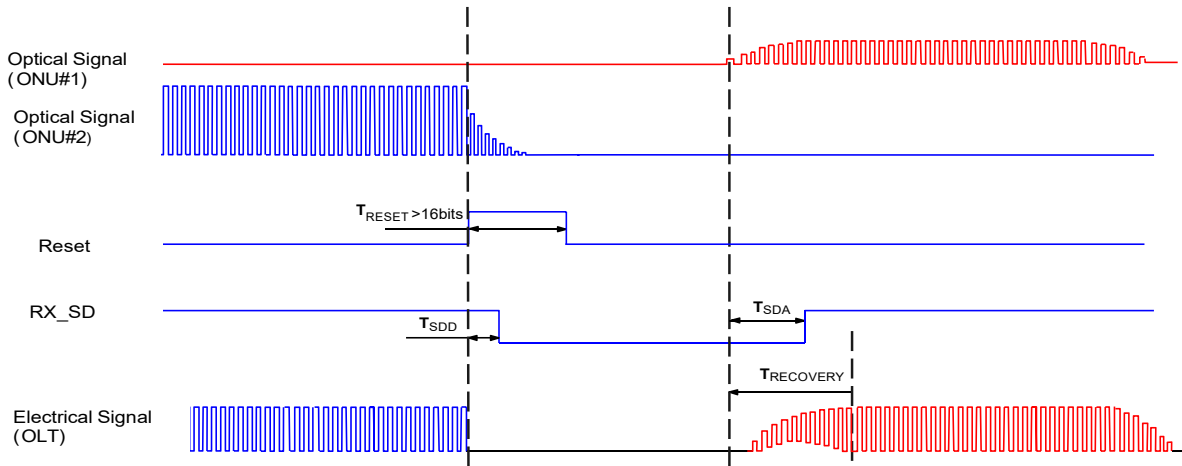


Figure 5 Timing Parameter Definitions in GPON Burst Mode Sequence

## RSSI Timing Sequence

Table 13-RSSI Timing Sequence

Parameter	Symbol	Min	Typical	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		V <sub>cc</sub>	V	
I <sup>2</sup> C Access Prohibited Time	$T_S$	500			μs	
I <sup>2</sup> C Bus Frequency		0	100	200	KHz	
I <sup>2</sup> C - High		2.4		3.6	V	
I <sup>2</sup> C - Low		0		0.4	V	

## Digital RSSI Sample/Hold Timing Specification

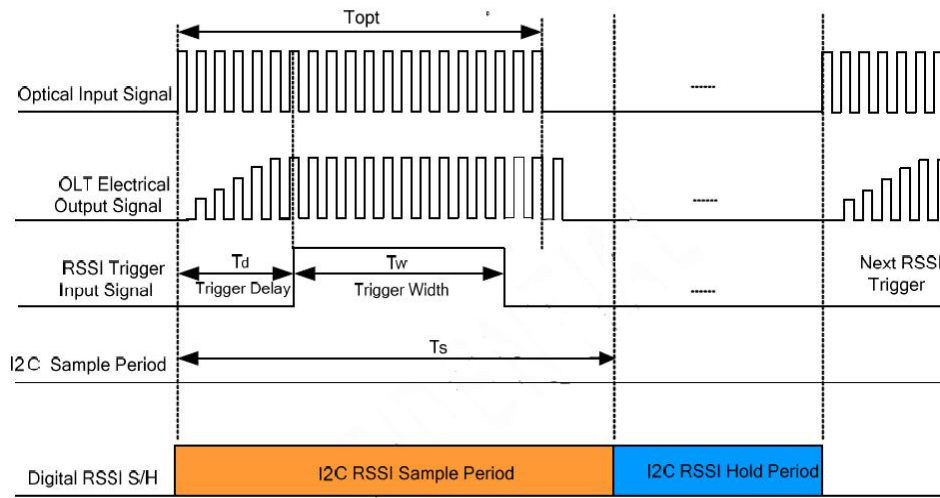
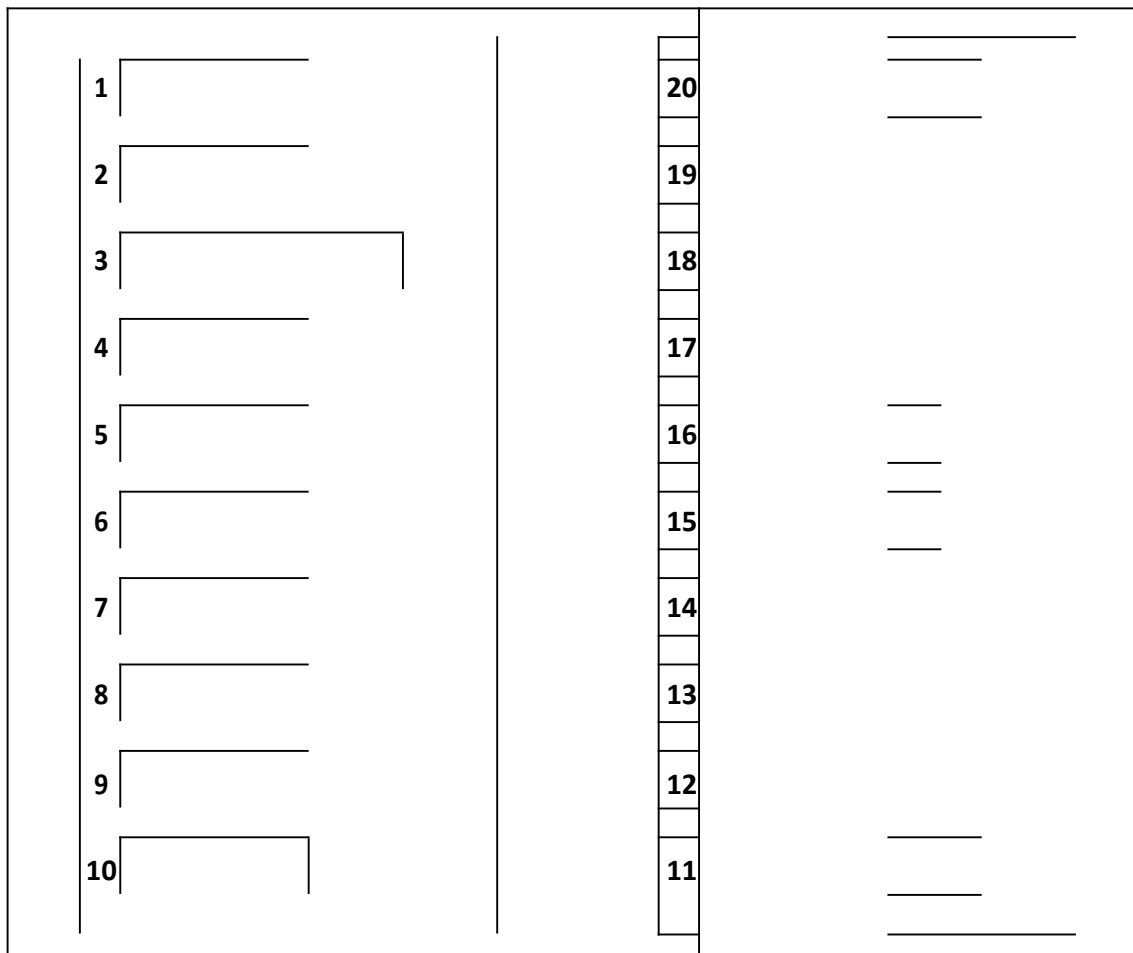


Figure 6 Timing Parameter Definitions in RSSI Trigger

## Pin Out Drawing



## Pin Descriptions

**Table 14-Pin Descriptions**

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 <sup>[1]</sup>
7	Reset& Rate Select	XGSPON Reset& Rate Select	High: Reset, Middle:2.5G, Low:10G <sup>[2]</sup>
8	XGSPON SD	XSGPON SD Indicator	LOW: lost signal
9	Trig/Tx_Dis	Receiver RSSI trigger input /Transmitter Disable	The Mode can be switched <sup>[3]</sup>
10	GPON_RD+	Received 1G Data Out	DC coupled, LVPECL output <sup>[1]</sup>
11	GND	Module Ground	
12	XGSPON_RD-	Inv. Received 10G Data Out	DC coupled, CML output <sup>[5]</sup>
13	XGSPON_RD+	Received 10G Data Out	DC coupled, CML output <sup>[5]</sup>
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;

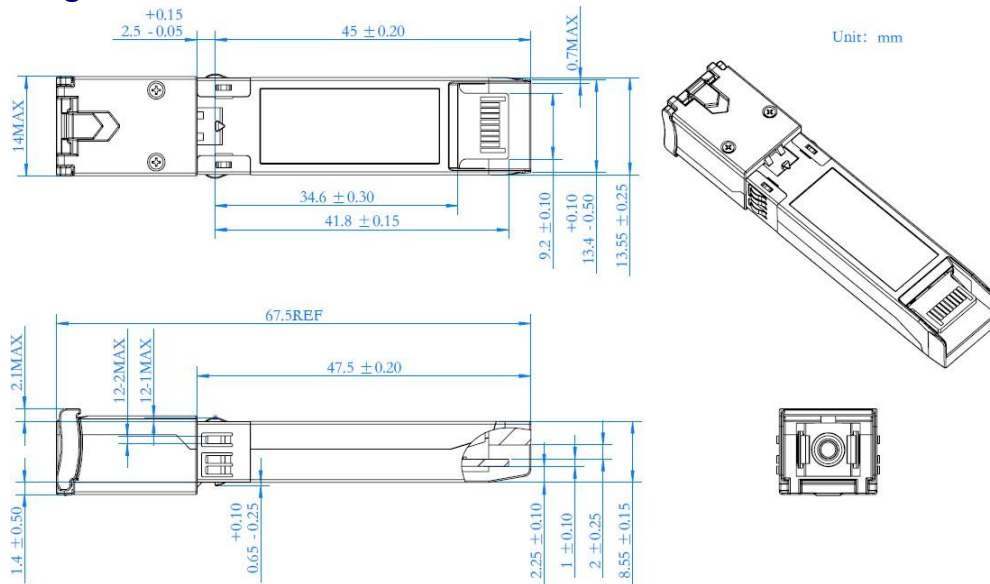
**Note 3:** A2 RSSI/TXDIS SELECTION

Address	Bit	Name	Description
A2 BYTE118	7	RSSI Select	Writing "0" for 10GE PON RSSI Monitor; Writing "1" for EPON 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 10GE PON TXDIS input. Default power-up value: "0". [4]
	4	GPON TXDIS Selection	When set "0", PIN9 as the EPON 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

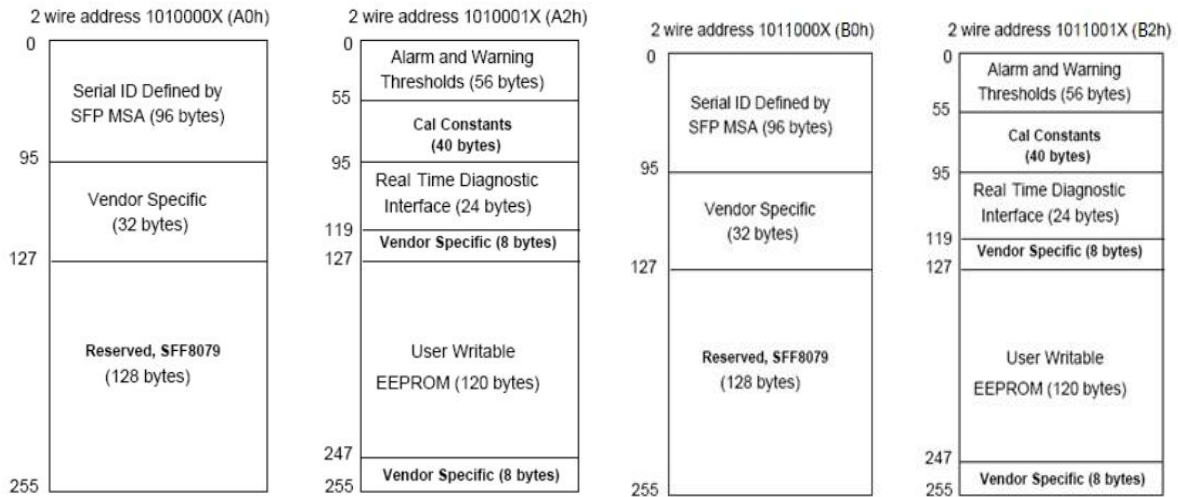


**Figure 8 Package Outline**

## 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.



## XGS Digital Diagnostic Monitoring Interface

Table 15-XGS Digital Diagnostic Monitoring Interface

Parameter	Range	Accuracy	Calibration	Page	Address	Notes
Temperature	0 to 70°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 4dBm	±2dB	Internal	A2	Byte 102~103, Byte102 is MSB	LSB: 0.2uW
XGS-PON RX Power Monitor	-27 to -4dBm	±3dB	Internal	A2	Byte 104~105, Byte104 is MSB	LSB: 0.1uW

## GPON Digital Diagnostic Monitoring Interface

Table 16-GPON Digital Diagnostic Monitoring Interface

Parameter	Range	Accuracy	Calibration	Page	Address	Notes
Temperature	0 to 70°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	1.5 to 5dBm	±2dB	Internal	B2	Byte 102~103, Byte102 is MSB	LSB: 0.2uW
GPON RX Power Monitor	-28 to -8dBm	±3dB	Internal	B2	Byte 104~105, Byte104 is MSB	LSB: 0.1uW

## Ordering information

Table 17- Ordering information

Part Number	Product Description
XSPC-P9T9R-BD1C(I)	XGSPON&GPON Combo OLT SFP+ D1/B+, SC, B+/D1, 0 ~ +70°C, with DDM

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