



#### FEATURES

- Single fiber bi-directional data links TX 9.953 Gbps, Burst Mode RX 9.953G/2.488 Gbps application
- Single fiber bi-directional data links TX 2.488 Gbps, Burst Mode RX 1.244 Gbps application
- 3.3V power supply
- SFP-DD package with SC Receptacle connector
- Hot-pluggable capability
- High power 1577nm EML LD and 1490nm DFB LD
- High sensitivity 1270nm APD & 1310nm APD
- Support 20km transmission distance with SMF
- XGSPON RX\_SD indication
- GPON RX\_LOS 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 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 RATING**

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Ambient Temperature	T <sub>STG</sub>	-40	85	°C	
Operating Case Temperature	T <sub>C</sub>	0 -40	70 85	°C	Commercial Industrial
Relative Storage Humidity	RHs	5	85	%	
VCC3 Power Supply Voltage	VCC3	0	3.6	V	

**RECOMMENDED OPERATING CONDITION**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	T <sub>C</sub>	0 -40		70 85	°C	Commercial Industrial
Power Supply Voltage	V <sub>CC</sub>	3.13	3.3	3.47	V	
Power Supply Consumption	P			3.3	W	
TX Data Rate			9.953		Gbps	
			2.488		Gbps	
RX Data Rate			9.953/2.488		Gbps	
			1.244		Gbps	
Operating current				1000	mA	

**XGS-PON TRANSMITTER OPTICAL CHARACTERISTICS**

Parameter	Symbol	Min.	Typ.	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	
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF
Average Launch Optical Power	AOP	1		4	dBm	B+ C+
		5		8		
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	PRBS <sup>231</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	

**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	-0.3		0.8	V	

**XGS-PON TRANSMITTER EYE MASK DEFINITIONS AND TEST PROCEDURE**

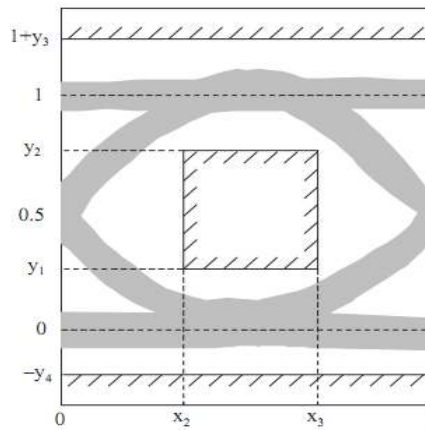


Figure 1 XGPON Transmitter Eye Mask Definitions

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	$\lambda_c$	1480		1500	nm	
Optical Spectrum Width (-20dB)	$\Delta\lambda$			0.9	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power	AOP	1.5		5	dBm	B+
		3		7		C+
Transmitter and Dispersion Penalty	TDP			1	dB	Transmit on 20km SMF
Power-OFF Transmitter Optical Power				-39	dBm	Launched into SMF
Extinction Ratio	ER	8.2			dB	PRBS 2 <sup>23</sup> -1+72CID@2.488Gbps
Optical Waveform Diagram	Compliant with ITU-T G.984.2					Figure 2, Mask Margin > 5%
Tolerance to Transmitter Incident Light		-15			dB	
Total Jitter	TJ p-p			0.2	UI	

**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	$\Omega$	
TX Disable	Disable	2		VCC+0.3	V	
	Enable	-0.3		0.8	V	

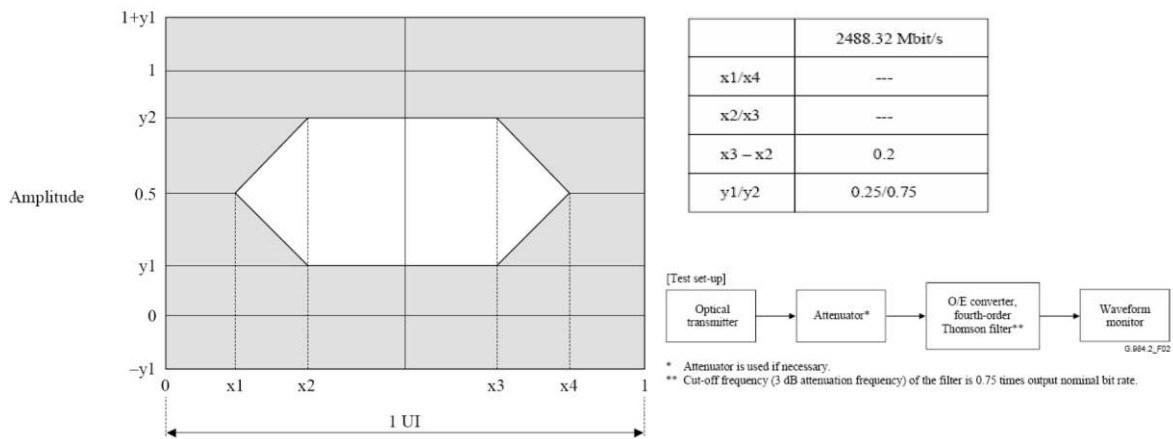
**GPON TRANSMITTER EYE MASK DEFINITIONS AND TEST PROCEDURE**


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	dBm	PRBS2 <sup>31</sup> -1@9.953Gbps BER $\leq 1 \times 10^{-3}$ , ER $\geq 6$ dB
Overload	OL	B+: -4 C+: -8			dBm	PRBS2 <sup>31</sup> -1@9.953Gbps BER $\leq 1 \times 10^{-3}$ , ER $\geq 6$ dB
Max Input power		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5			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	dBm	PRBS 2 <sup>23</sup> -1@2.488Gbps BER ≤1×10 <sup>-4</sup> , ER≥8.2dB
Saturation Optical Power	SAT	B+: -6 C+: -10			dBm	PRBS 2 <sup>23</sup> -1@2.488Gbps BER ≤1×10 <sup>-4</sup> , ER≥8.2dB
Max Input power		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5			dB	
Receiver reflectance				-12	dB	

XGS/XG-PON RECEIVER ELECTRICAL CHARACTERISTICS						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Output Differential Swing		300		800	mV	DC coupled, CML output
Output Differential Impedance	Zout	90	100	110	Ω	
SD Voltage - Low		-0.3		0.4	V	
SD Voltage - High		2.4		VCC+0.3	V	
RSSI Trigger-Low		-0.3		0.8	V	
RSSI Trigger-High		2.0		VCC+0.3	V	
CID		72			Bit	

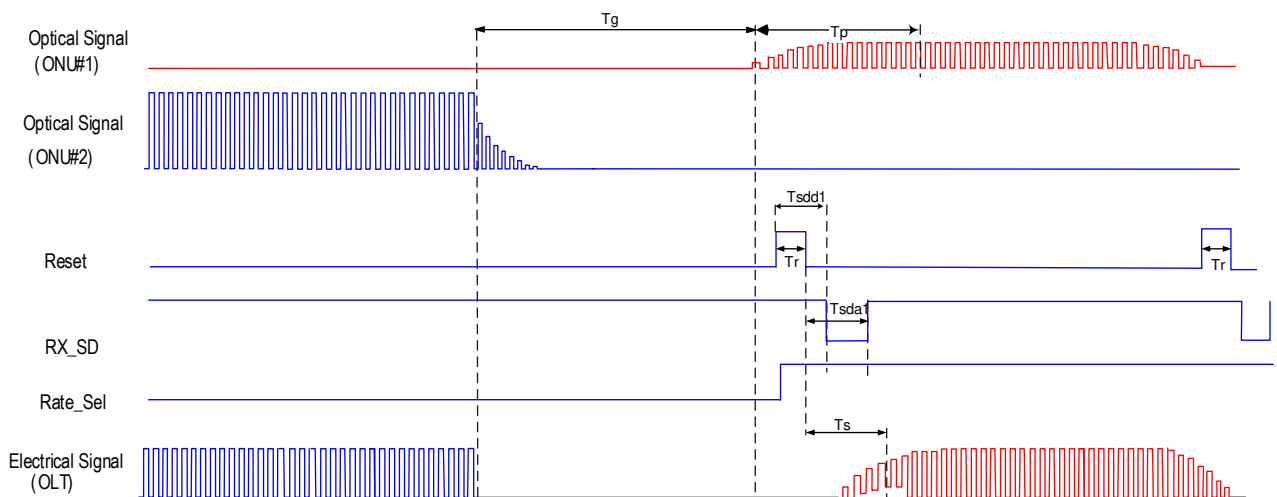
GPON RECEIVER OPTICAL CHARACTERISTICS						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength		1290	1310	1330	nm	
Sensitivity	SEN			B+: -28 C+: -32	dBm	ER≥10dB, PRBS 2 <sup>23</sup> -1@1.244Gbps BER ≤1×10 <sup>-10</sup> for B+, BER ≤1×10 <sup>-4</sup> for C+
Saturation Optical Power	SAT	B+: -8 C+: -12			dBm	ER≥10dB, PRBS 2 <sup>23</sup> -1@1.244Gbps BER ≤1×10 <sup>-10</sup> for B+, BER ≤1×10 <sup>-4</sup> for C+
Max Input power		0			dBm	
SD Assert Level				SEN-0.5	dBm	
SD De-Assert Level		-43			dBm	
Hysteresis		0.5			dB	
Receiver reflectance				-12	dB	

GPON RECEIVER ELECTRICAL CHARACTERISTICS						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Data Output Differential Swing		600		1000	mV	DC coupled, CML output
Output Differential Impedance	Zout	90	100	110	$\Omega$	
SD Voltage - Low		-0.3		0.4	V	
SD Voltage - High		2.4		VCC+0.3	V	
RSSI Trigger-Low		-0.3		0.8	V	
RSSI Trigger-High		2.0		VCC+0.3	V	
CID		72			Bit	

RECOMMENDED XGS/XGPON Receiver Timing Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Guard time	Tg	25	50		ns	Figure 3
Reset Pulse Width	Tr		25.6		ns	
Data Recovery Time	Ts		50	100	ns	
Preamble time	Tp	100	150		ns	
SD De-Assert Time	T <sub>SDD</sub>			50	ns	
SD Assert Time	T <sub>SDA</sub>			50	ns	

**Note:** Vendor recommends providing a Reset signal at the end of the optional packet

**XGSPON TIMING PARAMETER DEFINITIONS IN BURST MODE SEQUENCE**



**Figure 3 Timing Parameter Definitions of Normal Mode & Ranging Mode**

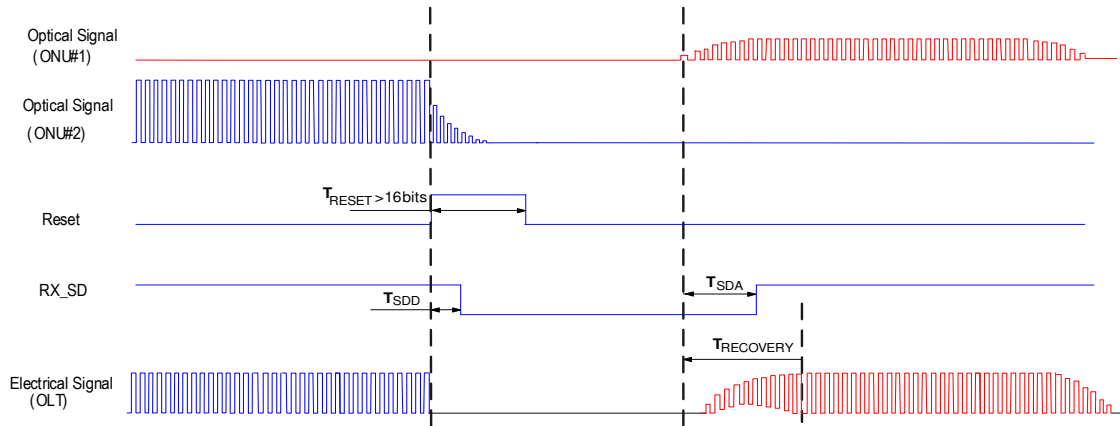
**Note:** Rate selection completes switching between the end of the previous frame and the end of reset

**RECOMMENDED GPONReceiver Timing Characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Notes
Guard time	Tg	25	50		ns	Figure 4
Reset Pulse Width	Tr		25.6		ns	
Data Recovery Time	Ts			100	ns	
Preamble time	Tp	100	150		ns	
SD De-Assert Time	T <sub>SDD</sub>			150	ns	
SD Assert Time	T <sub>SDA</sub>			50	ns	
Time to Un-squelch	T <sub>RN</sub>			200	ns	

*Note: Vendor recommends providing a Reset signal at the end of the optional packet*

**GPON TIMING PARAMETER DEFINITIONS IN BURST MODE SEQUENCE**



**Figure 4 Timing Parameter Definitions of Normal Mode & Range Mode**

**RSSI TIMING SEQUENCE**

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Notes
Optical Signal Duration Time	T <sub>opt</sub>	1200			ns	
RSSI Trigger width	T <sub>w</sub>	500			ns	
RSSI Trigger Delay	T <sub>D</sub>	150			ns	
FC Access Prohibited Time	T <sub>s</sub>	500			μs	
FC Bus Frequency			100	400	KHz	

Digital RSSI Sample/Hold Timing Specification

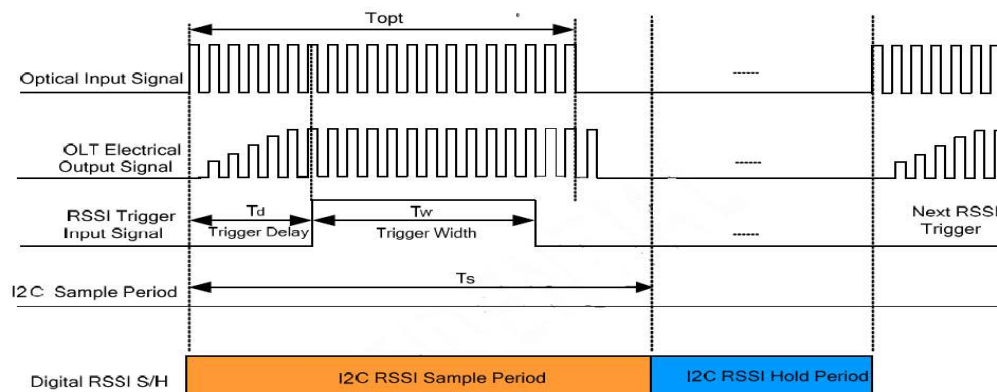


Figure 5 Timing Parameter Definitions in RSSI Trigger

PIN OUT DRAWING

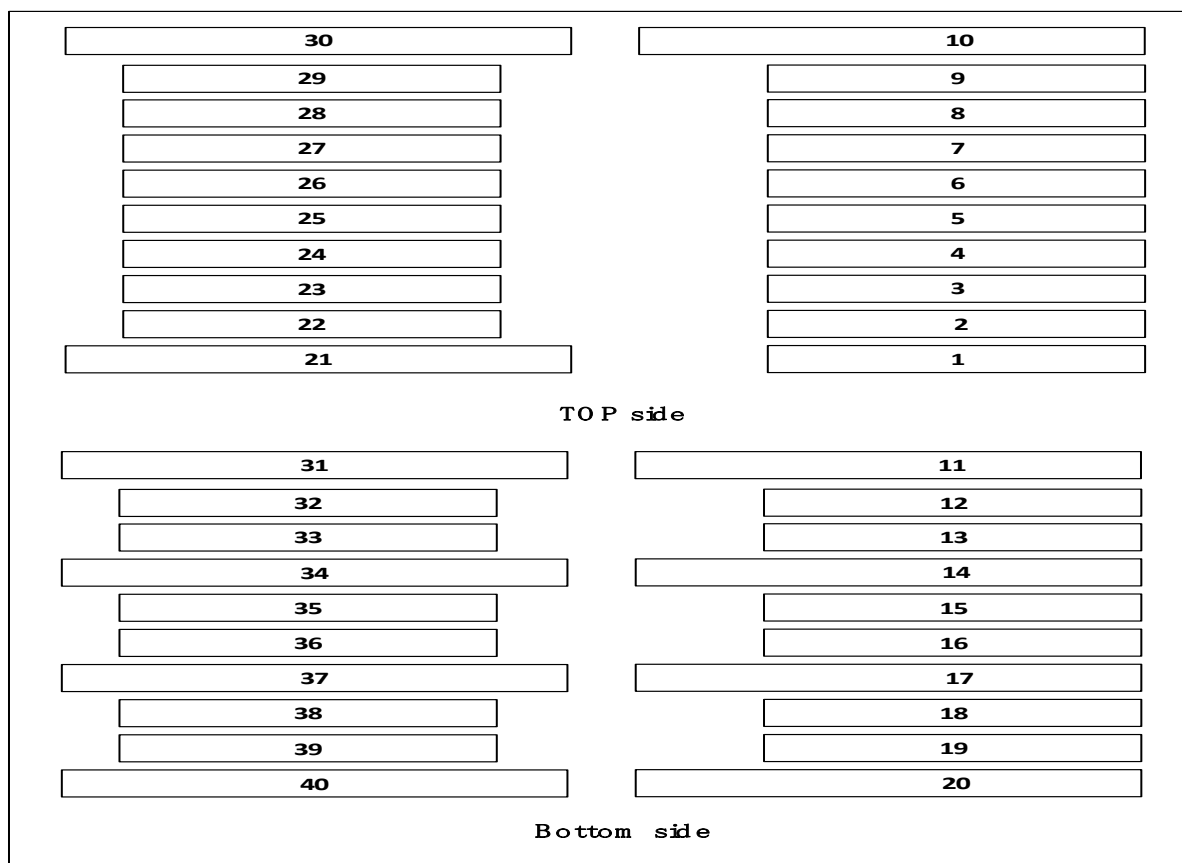


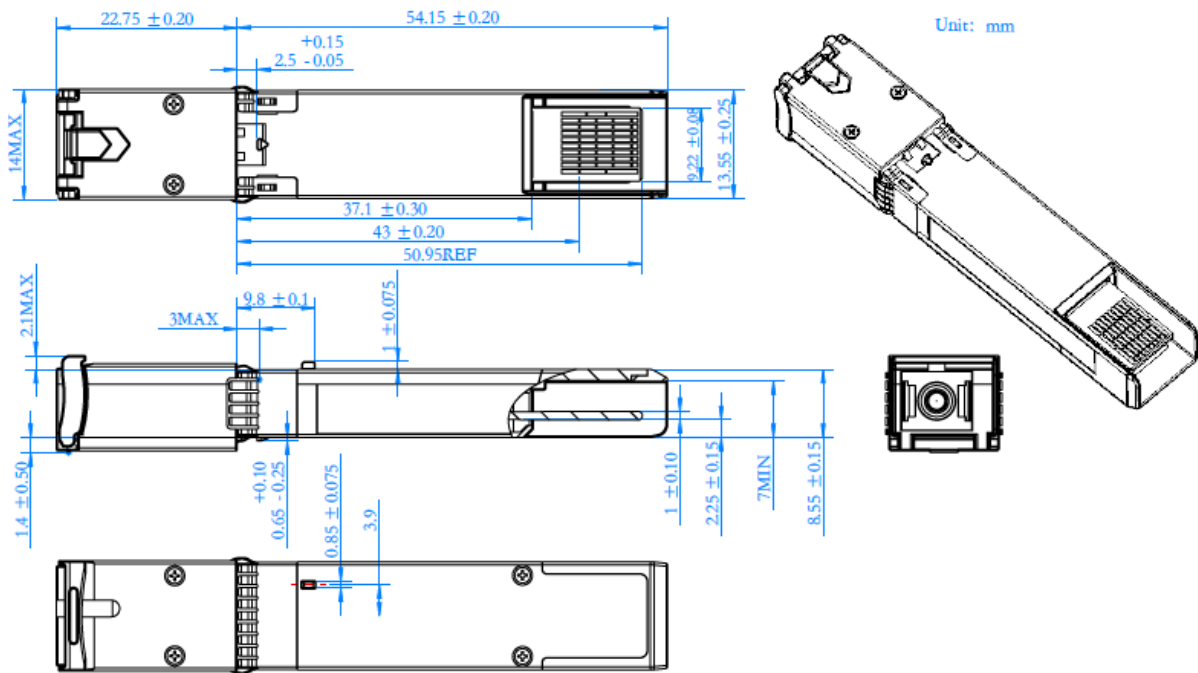
Figure 6 Pin Out Drawing



PIN DESCRIPTION				
PIN	Name	Type	Description	Notes
1	Ratesel		Rate select	Low :9.953Gbps,High:2.488Gbps
2	NC		NC	
3	Tx_DIS1	LVTTTL-I	Transmit Disable Channel 1	Low = Normal, High = Disable
4	SDA	LVTTTL-IO	I2C data	
5	SCL	LVTTTL-I	I2C clock	
6	MOD_ABS	Ground	Module absent indication	Pull-up on host PCB, internally pulled to GND
7	Rst1	LVTTTL-1	Optical Reset (XGS)	Active High
8	SD	LVTTTL-O	Signal Detect Channel 1	Low : Lost Signal, High: Signal Detected
9	RSSI1	LVTTTL-I	Receive strength Trigger Channel 1	Active High
10	GND		Module Ground	
11	GND		Module Ground	
12	RX1n	LVCML-O	Receive Channel 1 DC coupled.	Coupling caps are placed on host PCB, Common mode muting
13	RX1p	LVCML-O	Receive Channel 1 DC coupled.	
14	GND		Module Ground	
15	VCC	+3.3v	Power	
16	VCC	+3.3v	Power	
17	GND		Module Ground	
18	TX1p	LVCML-I	Transmit Channel 1 AC coupled	Internally AC coupled
19	TX1n	LVCML-I	Transmit Channel 1 AC coupled	Internally AC coupled
20	GND		Module Ground	
21	GND		Module Ground	
22	NC		NC	
23	Tx_DIS2	LVTTTL-I	Transmit Disable Channel 2	Active High
24	NC		NC	
25	NC		NC	
26	NC		NC	
27	RST2	LVTTTL-I	Optical Reset channel 2	Active High
28	LOS	LVTTTL-O	Signal Detect Channel 2	High: Lost Signal , Low : Signal Detected
29	RSSI2	LVTTTL-I	Receive strength Trigger Channel 2	Active High
30	GND		Module Ground	
31	GND		Module Ground	
32	RX2n	LVCML-O	Receive Channel 2 DC coupled.	Coupling caps are placed on host PCB, Un-squelch
33	RX2p	LVCML-O	Receive Channel 2 DC coupled.	
34	GND		Module Ground	
35	VCC	+3.3v	Power	
36	VCC	+3.3v	Power	

37	GND		Module Ground	
38	TX2p	LVCML-I	Transmit Channel 2 AC coupled	Internally AC coupled
39	TX2n	LVCML-I	Transmit Channel 2 AC coupled	Internally AC coupled
40	GND		Module Ground	

**PACKAGE OUTLINE**



**Figure 7 Package Outline**

**Note: The SFP-DD 10G OLT package is version.**

**XGS: DIGITAL DIAGNOSTIC MONITORING INTERFACE**

Parameter	Range	Accuracy	Calibration	Address	NOTES
Temperature	0 to 70°C	±3°C	Internal	Byte 96~97, Byte96 is MSB	LSB: 1/256C
Voltage	2.97 to 3.63V	±5%	Internal	Byte 98~99, Byte98 is MSB	LSB: 0.1mV
Bias Current_XGS	0 to 262mA	±10%	Internal	Byte 100~101, Byte100 is MSB	LSB: 4uA
TX Power_XGS	1 to 8dBm	±3dB	Internal	Byte 102~103, Byte102 is MSB	LSB:0.2uW
XGS-PON RX Power Monitor	Sensitivity to Overload	±3dB	Internal	Byte 104~105, Byte104 is MSB	LSB:0.1uW

**GPON: DIGITAL DIAGNOSTIC MONITORING INTERFACE**

Parameter	Range	Accuracy	Calibration	Address	NOTES
Temperature	0 to 70°C	±3°C	Internal	Byte 96~97, Byte96 is MSB	LSB: 1/256C
Voltage	2.97 to 3.63V	±5%	Internal	Byte 98~99, Byte98 is MSB	LSB: 0.1mV
Bias Current_GPON	0 to 262mA	±10%	Internal	Byte 100~101, Byte100 is MSB	LSB: 4uA
TX Power_GPON	1 to 8dBm	±3dB	Internal	Byte 102~103, Byte102 is MSB	LSB:0.2uW
GPON RX Power Monitor	Sensitivity to Overload	±3dB	Internal	Byte 104~105, Byte104 is MSB	LSB:0.1uW

**ORDERING INFORMATION**

PN	Temperature Rating°C	ODN Class	Fiber Termination
SOGX6299-ISGE	0~70°C	B+	SC UPC
SOGX6299-ISIGE	-40~85°C	B+	SC UPC
SOGX6299-ISGF	0~70°C	C+	SC UPC
SOGX6299-ISIGF	-40~85°C	C+	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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