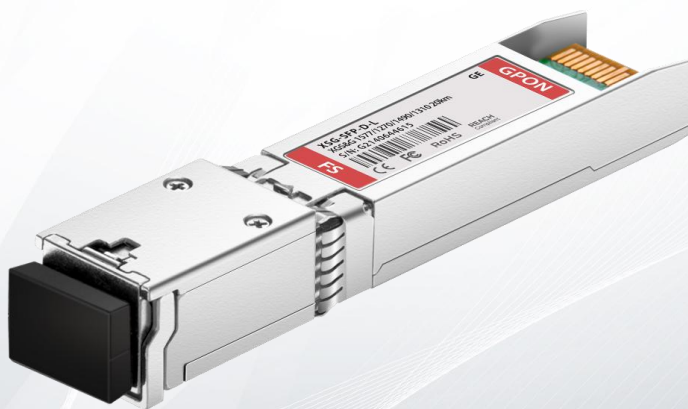


XGS-PON&GPON Combo OLT SFP+ 1577nm-TX/1270nm-RX and 1490nm- TX/1310nm-RX Class D 20km DOM SC SMF Optical Transceiver Module

XSG-SFP-D-L



Application

- FTTx
- XGS-PON&XG-PON&GPON Access network

Features

- Combination of XGS-PON OLT and GPON OLT optical transceiver in a SFP+ package
- Comply ITU-T G.984.5 (2014)/Amd.2 (10/2020) GPON & XGS-PON OPL Class D
- Single fiber bi-directional data links with:
Tx1: 9.953Gbps, Rx1: 9.953Gbps/2.488Gbps
Tx2: 2.488Gbps, Rx2: 1.244Gbps
- 1577nm continuous-mode transmitter with EML laser
- 1490nm continuous-mode transmitter with DFB laser
- 1270nm burst-mode receiver with APD-TIA
- 1310nm burst-mode receiver with APD-TIA
- +3.3V power supply
- 2-wire interface for integrated digital diagnostic Monitoring
- RoHS With Exemptions 7C(I)
- 20Km Reach
- Operating temp: 0~70° C

Description

The 10G-TX/10G(2.5G)-RX & 2.5G-TX/1.25G-RX transceiver module is specifically designed for 10-Gigabit-capable Symmetric Passive Optical Network (XGSPON&GPON) system. It integrates bidirectional data transmission over one single-mode optical fiber. The XGSPON Combo OLT Small Form-Factor Pluggable Plus (SFP+) transceiver provides a symmetric 9.953Gbps, 2.488Gbps & 1.244Gbps upstream and 9.953Gbps & 2.488Gbps downstream data rate, reaching a link up to 20km via an SC/UPC connector. Digital diagnostic monitoring (DOM) allows access to real-time operating parameters. It is fully compliant with ITU-T G.9807. 1, ITU-T G.984.5, ITU-T G.984.2, ITU-T G.987.2 and SFP+ MSA.

Product Specifications

I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Ambient Temperature	Ts	-40	-	+85	°C	
Operating Case Temperature	Tc	0		70	°C	C-Temp
Supply Voltage	Vcc	0	-	3.6	V	
Operating Relative Humidity	RH	5	-	+85	%	

II. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Case Temperature	Tc	0		70	°C	
Power Supply Voltage	Vcc3	3.14	3.3	3.47	V	
Power Consumption			3.5		W	
XGS Rx Optical Isolation (From External 1290- 1650nm)	ISO	-30			dB	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Reflectance of XGS Rx (1260- 1280nm)				-12	dB	
GPON Rx Optical Isolation (From External 1260-1280nm)	ISO	-30			dB	
GPON Rx Optical Isolation (From External 1342-1650nm)	ISO	-30			dB	
Reflectance of GPON Rx (1290-1330nm)				-20	dB	
Differential Power Range				20	dB	1

Notes:
1. Power differential between sequential ONU bursts

III. Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter (9.953G)						
Centre Wavelength	λ_C	1575	1577	1580	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power	Aop	8		11	dBm	
Average Launch Power-OFF	POFF			-40	dBm	
Extinction Ratio	ER	8.2			dB	
Transmitter Tolerance to Reflected Power		- 15			dB	
Eye Diagram		ITU-T G.9807.1 Compliant				

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter (2.488G)						
Centre Wavelength	λ_C	1480	1490	1500	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power	Aop	6		10	dBm	
Average Launch Power-OFF	POFF			-40	dBm	
Extinction Ratio	ER	8.2			dB	
Transmitter Tolerance to Reflected Power		-15			dB	
Eye Diagram	ITU-T G.984.2 Compliant					
Receiver (9.953G)						
Operating Wavelength	λ_C	1260	1270	1280	nm	
Sensitivity	PSEN			-32	dBm	1
Saturation	PSAT	- 11			dBm	1
Signal Detected De-assert Level	Psdd	-45			dBm	
Signal Detected Assert Level	Psda			-33	dBm	
Max Optical input	Pdamage			0	dBm	
Receiver (2.488G)						
Operating Wavelength	λ_C	1290	1310	1330	nm	
Sensitivity	PSEN			-33.5	dBm	2
Saturation	PSAT	- 13			dBm	2

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Signal Detected De-assert Level	Psdd	-45			dBm	
Signal Detected Assert Level	Psda			-34	dBm	
Max Optical input	Pdamage			0	dBm	
Receiver (1.244G)						
Operating Wavelength	λC	1290	1310	1330	nm	
Sensitivity	PSEN			-35	dBm	3
Saturation	PSAT	- 15			dBm	3
Signal Detected De-assert Level	Psdd	-45			dBm	
Signal Detected Assert Level	Psda			-33	dBm	
Max Optical input	Pdamage			0	dBm	

- Notes:
- 1. Measured with PRBS 2^31- 1 test pattern @9.953Gbps and ER=6dB BER =10^-3
 - 2. Measured with PRBS 2^23- 1 test pattern @2.488Gbps and ER=8.2dB, BER =10^-4
 - 3. Measured with PRBS 2^23- 1 test pattern @1.244Gbps and ER=8.2dB, BER =10^-4

IV. Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter (9.953G)						
Data Input Differential Swing	VIN	200		850	mVp-p	
Input Differential Impedance	ZIN		100		Q	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Tx_Disable Voltage	VIL	0	-	0.8	V	
	VIH	2		3.3	V	
TransmitterFault Voltage -Low	VTFI,L	0		0.4	V	
TransmitterFault Voltage -High	VTFI,H	2.4		Vcc	V	
Transmitter (2.488G)						
Data Input Differential Swing	VIN	200		850	mVp-p	
Input Differential Impedance	ZIN		100		Q	
Tx_Disable Voltage	VIL	0		0.8	V	
	VIH	2		3.3	V	
Transmitter Fault Voltage - Low	VTFI, L	0		0.4	V	
TransmitterFault Voltage -High	VTFI,H	2.4		Vcc	V	
Receiver (9.953G)						
Data Output Differential Swing	VOUT	300		800	mVP-P	
Signal Detected Voltage_low	VSD,L	0		0.4	V	
Signal Detected Voltage_high	VSD,H	2.4		Vcc	V	
Receiver (2.488G)						
Data Output Differential Swing	VOUT	300		800	mVP-P	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Signal Detected Voltage_low	VSD, L	0		0.4	V	
Signal Detected Voltage_high	VSD, H	2.4		Vcc	V	
Receiver (1.244G)						
Data Output Differential Swing	VOUT	600		1600	mVP-P	
Signal Detected Voltage_low	VSD, L	0		0.4	V	
Signal Detected Voltage_high	VSD, H	2.4		Vcc	V	

V. RSSI Timing

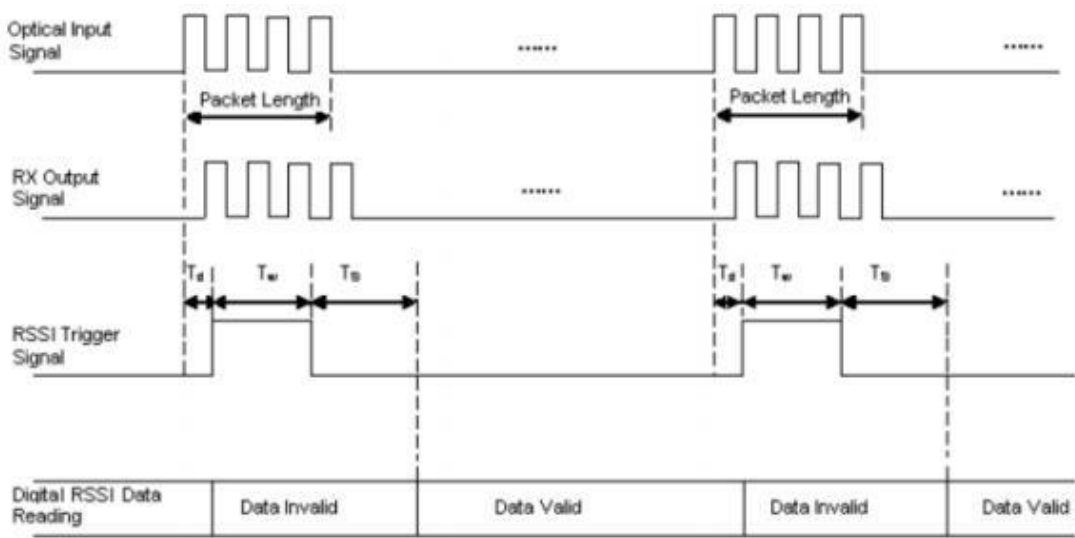


Figure 1, RSSI Timing Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Packet Length		575			ns	
RSSI Trigger Delay	Td	100			ns	
RSSI Trigger Width	Tw	500			ns	
RSSI Sampling Time	TSAMPLE	500			ns	
Delay Before Read	Ts	500			us	

VI. Recommended Host Board Power Supply Circuit

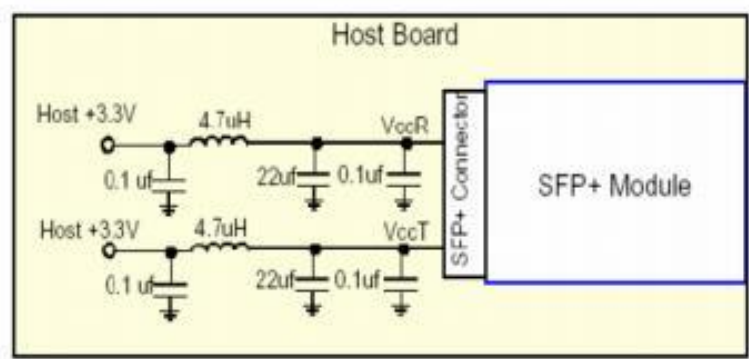


Figure 2, Recommended Host Board Power Supply Filtering

VII. XGSPON Rx Burst Timing (22pins)

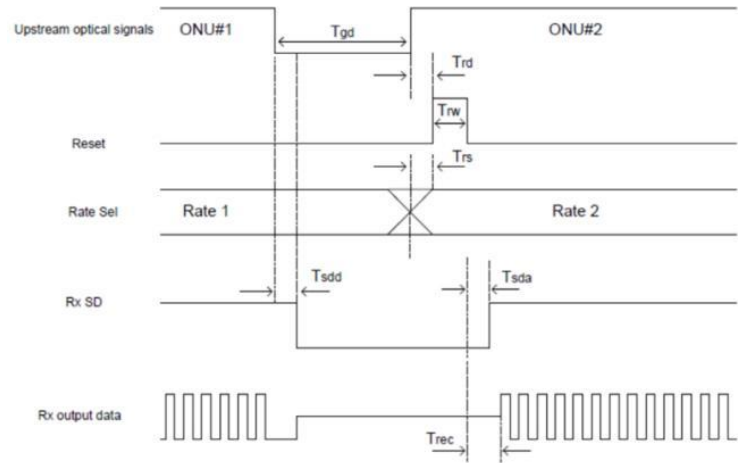


Figure 3, XGSPON RX Burst Timing(22pins)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Guard Time	Tgd	51.2			ns	
Reset Delay	Trd	0			ns	1
Reset Width	Trw	25.6			ns	
Rate Sel Setup Time	Trs	5			ns	2
SD Assert Time	Tsda	0		51.2	ns	
SD De-assert Time	Tsdd		100		ns	3
Data Recovery Time	Trec	0	51.2	100	ns	

- Notes:
- 1. Reset pulse is suggested to be fully inside the preamble.
 - 2. The polarity of RateSel signal could be customized, high = 10G rate, low = 2.5G rate by default.
 - 3. Signal detect auto reset function is applied. The signal detect de-assert time forced by auto reset is typically 100ns, and could short to about 12.8ns with additional reset pulse.

VIII. XGSPON Rx Burst Timing (20pins)

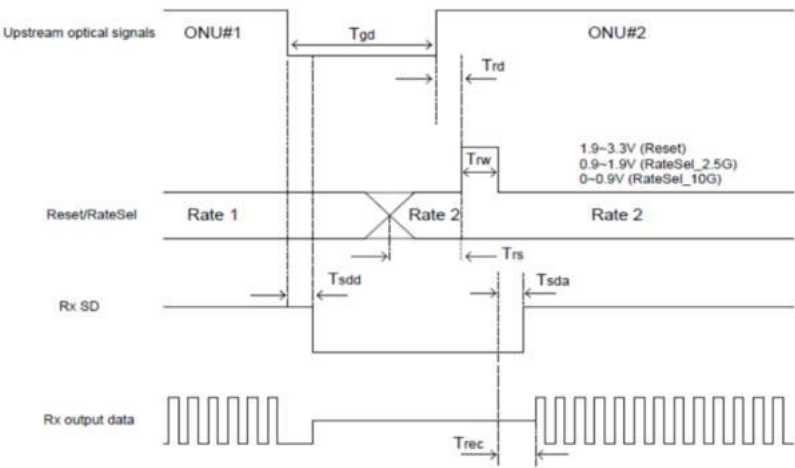


Figure 4, XGSPON Rx Burst Timing (20pins)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Guard Time	Tgd	51.2			ns	
Reset Delay	Trd	0			ns	1
Reset Width	Trw	25.6			ns	
Rate Sel Setup Time	Trs	5			ns	2
SD Assert Time	Tsda	0		51.2	ns	
SD De-assert Time	Tsdd		100		ns	3
Data Recovery Time	Trec	0	51.2	100	ns	

Notes:

- 1. Reset pulse is suggested to be fully inside the preamble.
- 2. Middle voltage 0.9~1.9V = 2.5G rate, low voltage 0~0.9V = 10G rate by default.
- 3. Signal detect auto reset function is applied. The signal detect de-assert time forced by auto reset is typically 100ns, and could short to about 12.8ns with additional reset pulse.

IX. GPON Rx Burst Timing (22pins or 20pins)

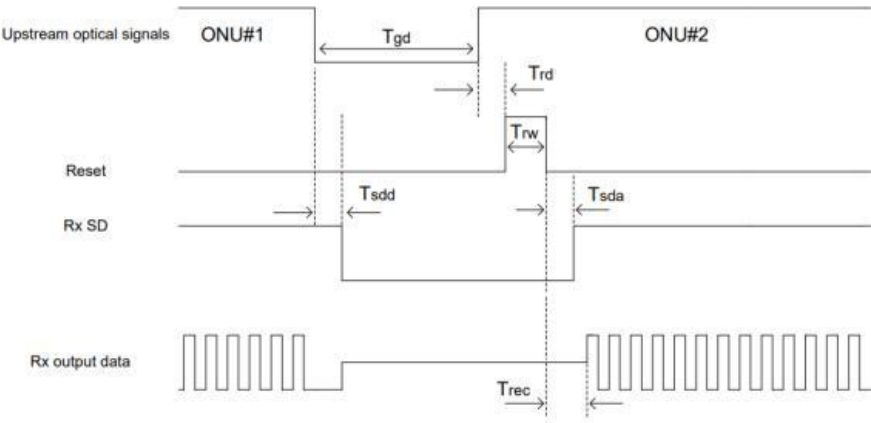


Figure 5, GPON Rx Burst Timing (22pins or 20pins)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Guard Time	Tgd	25.6			ns	
Reset Delay	Trd	0			ns	1
Reset Width	Trw	12.8			ns	
SD Assert Time	Tsda	0	25.6	51.2	ns	
SD De-assert Time	Tsdd		100		ns	2
Data Recovery Time	Trec	0	25.6	100	ns	

- Notes:
- 1. Reset pulse is suggested to be fully inside the preamble.
 - 2. Signal detect auto reset function is applied. The SD De-assert time forced by auto reset is typically 100ns, and could short to about 12.8ns with additional reset pulse.

X. Recommended Interface Circuit

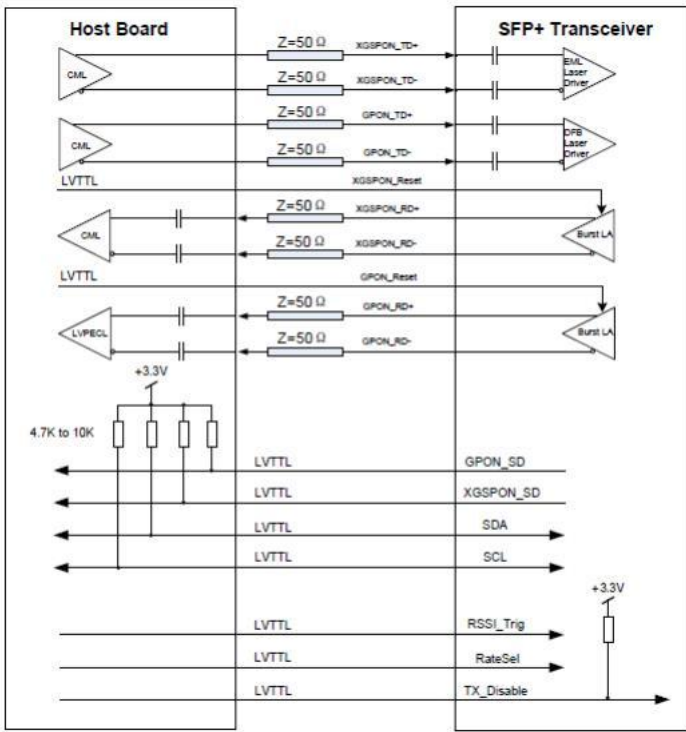


Figure 6, Recommended interface Circuit

XI. Diagnostics

Parameter	Range	Accuracy	Unit	Notes	Calibration
Temperature	0 to 70	± 3	$^{\circ}\text{C}$	LSB Equal to 1/256c	Internal
Voltage	3.15 to 3.47	$\pm 3\%$	V	LSB Equal to 100uV	Internal
Bias Current	0 to 130	$\pm 10\%$	mA	LSB Equal to 8uA	Internal
Tx Power (9.953G)	8 to 11	$\pm 2\text{dB}$	dBm	LSB Equal to 0.4uW	Internal
Tx Power (2.488G)	6 to 10	$\pm 2\text{dB}$	dBm	LSB Equal to 0.4uW	Internal
Rx Power (9.953/2.488G)	-33.5 to - 13	$\pm 3\text{dB}$	dBm	LSB Equal to 0.1uW	Internal
Rx Power (1.244G)	-35 to - 15	$\pm 3\text{dB}$	dBm	LSB Equal to 0.1uW	Internal

XII. Pin Function Definitions (22 PINs)

Pin	Logic	Name	Description
1	CML-I	GPON_TD+	GPON transmit data input, AC coupling
2	CML-I	GPON_TD-	Inverted GPON transmit data input, ACcoupling
3		GND	Ground
4	LVTTL-I	TX Disable	Active high, TX Disable control both XGS-PON and GPON transmitter, and can be separately disable GPON or XGS-PON by IIC programming
5	LVTTL-I/O	SDA	2-Wire serial interface SDA
6	LVTTL-I	SCL	2-Wire serial interface SCL
7	LVPECL-O	GPON_RD-	Inverted GPON received data output, DCcoupling



Pin	Logic	Name	Description
8	LVTTL-I	XGS-PON Reset	Reset for XGSPON LA, active high
9	LVTTL-O	XGS-PON SD	XGS Receiver signal detect, logic 1 indicates normal operation
10	LVTTL-I	RSSI_Trigger	RSSI trigger input, active high. RSSI trigger control both XGS-PON and GPON receiver, and select GPON or XGS-PON channel by IIC programming
11	LVPECL-O	GPON_RD+	GPON received data output, DCcoupling
12	LVTTL-I	Rate_Sel	2.488G =Low, 9.953G=High
13		GND	Ground
14	CML-O	XGS-PON RD-	Inverted XGSPON received data output, DC coupling
15	CML-O	XGS-PON RD+	XGSPON received data output, DCcoupling
16	LVTTL-O	GPON SD	GPON Receiver signal detect, logic 1 indicates normal operation
17		VCC	+3.3V Power supply
18		VCC	+3.3V Power supply
19	LVTTL-I	GPON Reset	Reset for GPON LA, active high
20	CML-I	XGS-PON TD+	XGS transmit data input, AC coupling
21	CML-I	XGS-PON TD-	Inverted XGS transmit data input, AC coupling
22		GND	Module Ground

XIII. Pin Function Definitions (20 PINs)

Pin	Logic	Name	Description
1	CML-I	GPON_TD+	GPON transmit data input, AC coupling



Pin	Logic	Name	Description
2	CML-I	GPON_TD-	Inverted GPON transmit data input, ACcoupling
3		GND	Ground
4	LVTTL	SDA	2-Wire serial interface SDA
5	LVTTL	SCL	2-Wire serial interface SCL
6	LVPECL-O	GPON_RD-	Inverted GPON received data output, DC coupling
7	LVTTL	XGSPON_Reset/ Rate_select	High level (>1.9V) for the RESET function, Low level (<0.9V) for 10G Rate selection signal, Intermediate level (0.9V ~1.9V) for 2.5g Rate select signal
8	LVTTL-O	XGSPON_SD	XGS Receiver signal detect, logic 1 indicates normal operation
9	LVTTL	Trig/Tx_disable	Signal pins are multiplexed through register, when use as Tx disable, active high.
10	LVPECL-O	GPON_RD+	GPON received data output, DCcoupling
11		GND	Ground
12	CML-O	XGS-PON RD-	Inverted XGSPON received data output, DCcoupling
13	CML-O	XGS-PON RD+	XGSPON received data output, DC coupling
14	LVTTL-O	GPON SD	GPON Receiver signal detect, logic 1 indicates normal operation
15		VCC Rx	+3.3V Power supply
16		VCC Tx	+3.3V Power supply
17	LVTTL-I	GPON Reset	Reset for GPON LA, active high
18	CML-I	XGS-PON TD+	XGS transmit datainput, AC coupling
19	CML-I	XGS-PON TD-	Inverted XGS transmit data input, AC coupling

Pin	Logic	Name	Description
20		GND	Module Ground

XIV. Outline Drawing

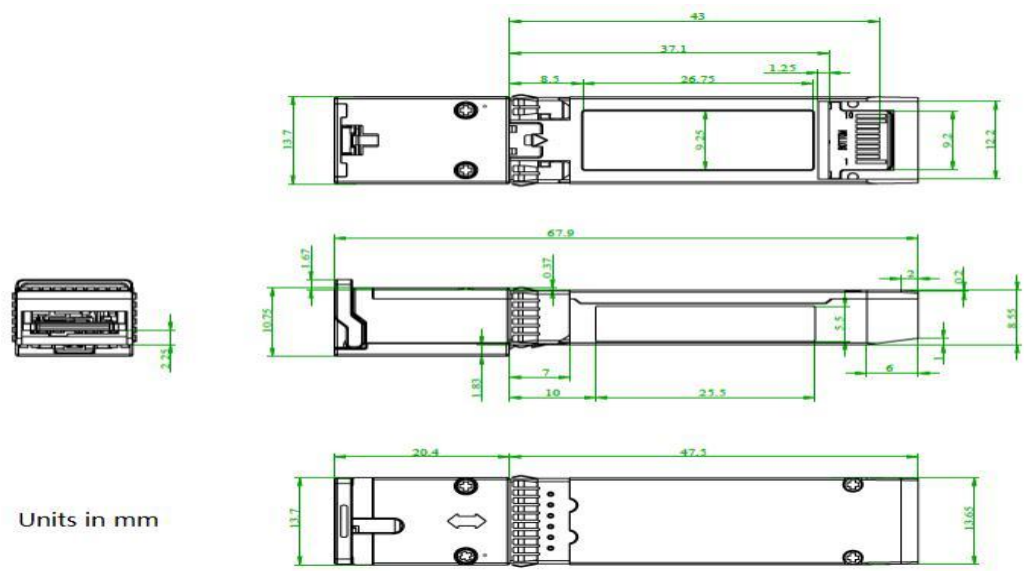


Figure 7, Outline Drawing

Order Information

Part Number	Description
XSG-SFP-B+L-I	XGS-PON&GPON Combo OLT SFP+ 1577nm-Tx/1270nm-Rx and 1490nm-Tx/1310nm-Rx Class B+ 20km DOM SC/UPC SMF Optical Transceiver Module (Industrial)
XSG-SDD-C+N-I	XGS-PON&GPON Combo OLT SFP-DD 1577nm-TX/1270nm-RX and 1490nm-TX/1310nm-RX Class C+ 20km DOM SC SMF Optical Transceiver Module (Industrial)
XSG-SFP-C+L-I	XGS-PON&GPON Combo OLT SFP+ 1577nm-Tx/1270nm-Rx and 1490nm-Tx/1310nm-Rx Class C+ 20km DOM SC/UPC SMF Optical Transceiver Module (Industrial)
XSG-SFP-D-L	XGS-PON&GPON Combo OLT SFP+ 1577nm-TX/1270nm-RX and 1490nm-TX/1310nm-RX Class D 20km DOM SC SMF Optical Transceiver Module