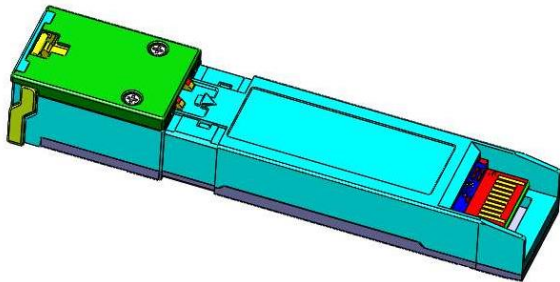


### Features:

- Combination of XG-PON OLT and GPON OLT optical transceiver in a SFP+ package
- Comply ITU-T G.984.5 (2014)/Amd.2 (10/2020) GPON & XG-PON OPL Class C+
- Single fiber bi-directional data links with  
 Tx1: 9.953Gbps, Rx1: 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
- 2-wire interface for integrated digital diagnostic Monitoring
- +3.3V power supply, 4W power consumption
- RoHS With Exemptions 7C(I)
- 20Km Reach
- Operating case temp: 0~70°C or -40~85°C
- Support Pin-out :  
 22 Pins : SPPS-ST-XG-CP-C(I)DFA  
 20 Pins: SPPS-ST-XG-CP-C(I)DFB



### Absolute Maximum Ratings

Table 1 - Absolute Maximum Ratings

| Parameter                   | Symbol | Min. | Typical | Max. | Unit | Note   |
|-----------------------------|--------|------|---------|------|------|--------|
| Storage Ambient Temperature | TS     | -40  | -       | +85  | °C   |        |
| Operating Case Temperature  | Tc     | 0    |         | 70   | °C   | C-Temp |
|                             |        | -40  |         | 85   |      | I-Temp |
| Supply Voltage              | VCC3   | 0    | -       | 3.6  | V    |        |
| Operating Relative Humidity | RH     | 5    | -       | +85  | %    |        |

## Recommended Operating Conditions

Table 2 – Recommended Operating Conditions

| Parameter  | Symbol | Min. | Typical | Max. | Unit | Note   |
|--|--------|------|---------|------|------|--------|
| Operating Case Temperature                               | Tc     | 0    |         | 70   | °C   | C-Temp |
|  |        | -40  |         | 85   |      | I-Temp |
| Power Supply Voltage                                     | VCC3   | 3.14 | 3.3     | 3.47 | V    |        |
| Power Consumption  |        |      |         | 4    | W    |        |
| XGS Rx Optical Isolation<br>(From external 1290-1650nm)  | ISO    | -30  |         |      | dB   |        |
| GPON Rx Optical Isolation<br>(From external 1260-1280nm) | ISO    | -30  |         |      | dB   |        |
| GPON Rx Optical Isolation<br>(From external 1342-1650nm) | ISO    | -30  |         |      | dB   |        |
| Differential Power Range                                 |        |      |         | 20   | dB   | 2      |

Notes:

1. Power differential between sequential ONU bursts

## Optical Characteristics

Table 3 – Optical Characteristics

| Transmitter (9.953G)                     |             |                         |         |      |      |      |
|--|-------------|-------------------------|---------|------|------|------|
| Parameter                                | Symbol      | Min.                    | Typical | Max. | Unit | Note |
| Centre Wavelength                        | $\lambda C$ | 1575                    | 1577    | 1580 | nm   |      |
| Side Mode Suppression Ratio              | SMSR        | 30                      |         |      | dB   |      |
| Average Launch Power                     | Aop         | 5                       |         | 9    | dBm  |      |
| Average Launch Power-OFF                 | POFF        |                         |         | -39  | dBm  |      |
| Extinction Ratio                         | ER          | 8.2                     |         |      | dB   |      |
| Transmitter tolerance to reflected power |             | -15                     |         |      | dB   |      |
| Eye Diagram                              |             | ITU-T G.987.2 Compliant |         |      |      |      |
| Transmitter (2.488G)                     |             |                         |         |      |      |      |
| Centre Wavelength                        | $\lambda C$ | 1480                    | 1490    | 1500 | nm   |      |
| Side Mode Suppression Ratio              | SMSR        | 30                      |         |      | dB   |      |
| Average Launch Power                     | Aop         | 3                       |         | 7    | 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 |      |       |     |   |
| <b>Receiver(2.488G)</b>                  |             |                         |      |       |     |   |
| Operating Wavelength                     | $\lambda$ C | 1260                    | 1270 | 1280  | nm  |   |
| Sensitivity                              | PSEN        |                         |      | -30.5 | dBm | 1 |
| Saturation                               | PSAT        | -10                     |      |       | dBm |   |
| Signal Detected De-assert Level          | Psdd        | -45                     |      |       | dBm |   |
| Signal Detected Assert Level             | Psda        |                         |      | -31   | dBm |   |
| Max Optical input                        | Pdamage     |                         |      | 0     | dBm |   |
| <b>Receiver(1.244G)</b>                  |             |                         |      |       |     |   |
| Operating Wavelength                     | $\lambda$ C | 1290                    | 1310 | 1330  | nm  |   |
| Sensitivity                              | PSEN        |                         |      | -32   | dBm | 2 |
| Saturation                               | PSAT        | -12                     |      |       | dBm |   |
| 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<sup>23</sup>-1 test pattern @2.488Gbps and ER=8.2dB, BER =10<sup>-4</sup>
2. Measured with PRBS 2<sup>23</sup>-1 test pattern @1.244Gbps and ER=8.2dB, BER =10<sup>-4</sup>

## Electrical Characteristics

Table 4 – Electrical Characteristics

| Parameter                        | Symbol  | Min. | Typical | Max. | Unit     | Notes |
|----------------------------------|---------|------|---------|------|----------|-------|
| <b>Transmitter (9.953G)</b>      |         |      |         |      |          |       |
| Data Input Differential Swing    | VIN     | 200  | -       | 850  | mVp-p    |       |
| Input Differential Impedance     | ZIN     |      | 100     |      | $\Omega$ |       |
| Tx_Disable Voltage               | VIL     | 0    | -       | 0.8  | V        |       |
|                                  | VIH     | 2    |         | Vcc  | V        |       |
| Transmitter Fault Voltage - Low  | VTFI, L | 0    |         | 0.4  | V        |       |
| Transmitter Fault Voltage - High | VTFI, H | 2.4  |         | Vcc  | V        |       |
| <b>Transmitter (2.488G)</b>      |         |      |         |      |          |       |
| Data Input Differential Swing    | VIN     | 200  | -       | 850  | mVp-p    |       |

|                                  |         |     |     |      |          |  |
|----------------------------------|---------|-----|-----|------|----------|--|
| Input Differential Impedance     | ZIN     |     | 100 |      | $\Omega$ |  |
| Tx_Disable Voltage               | VIL     | 0   | -   | 0.8  | V        |  |
|                                  | VIH     | 2   |     | Vcc  | V        |  |
| Transmitter Fault Voltage - Low  | VTFI, L | 0   |     | 0.4  | V        |  |
| Transmitter Fault Voltage - High | VTFI, H | 2.4 |     | VCC  | V        |  |
| <b>Receiver (2.488G)</b>         |         |     |     |      |          |  |
| 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        |  |
| Signal Detected Assert Time      | TSDA    |     |     | 50   | ns       |  |
| Signal Detected Deassert Time    | TSDD    |     |     | 12.8 | ns       |  |
| Data Recovery Time               | Trec    |     |     | 25.6 | ns       |  |
| <b>Receiver (1.244G)</b>         |         |     |     |      |          |  |
| 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        |  |
| Signal Detected Assert Time      | TSDA    |     |     | 50   | ns       |  |
| Signal Detected Deassert Time    | TSDD    |     |     | 12.8 | ns       |  |
| Data Recovery Time               | Trec    |     |     | 25.6 | ns       |  |

## RSSI Timing

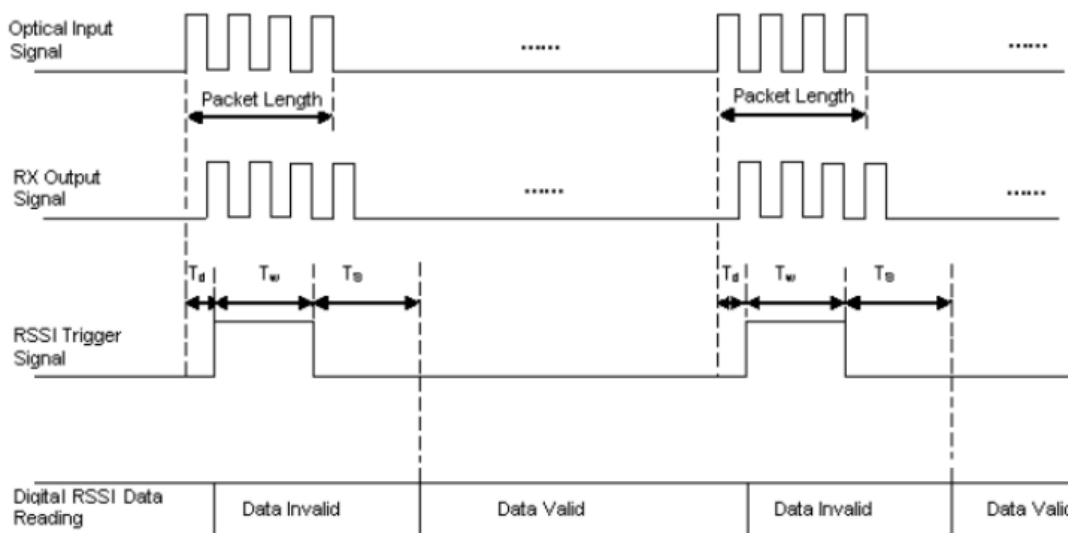
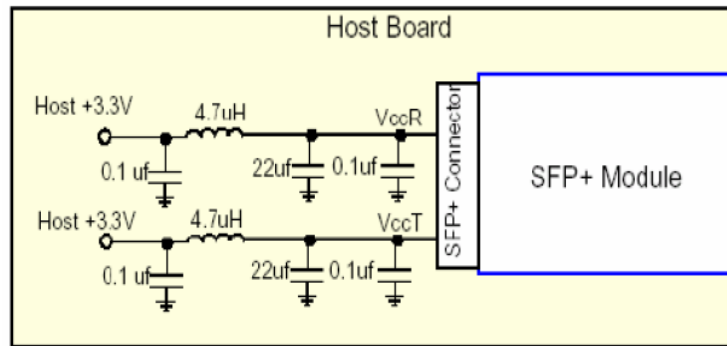


Figure 1, RSSI Timing Specification

**Table 6 – RSSI Timing Spec**

| Parameter          | Symbol       | Min. | Typical | Max. | Unit | Notes |
|--------------------|--------------|------|---------|------|------|-------|
| Packet Length      |              | 575  |         |      | ns   |       |
| RSSI Trigger Delay | $T_d$        | 100  |         |      | ns   |       |
| RSSI Trigger Width | $T_w$        | 500  |         |      | ns   |       |
| RSSI Sampling Time | $T_{SAMPLE}$ | 500  |         |      | ns   |       |
| Delay before Read  | $T_s$        | 500  |         |      | us   |       |

**Recommended Host Board Power Supply Circuit**



**Figure 2, Recommended Host Board Power Supply Filtering**

### Recommended Interface Circuit

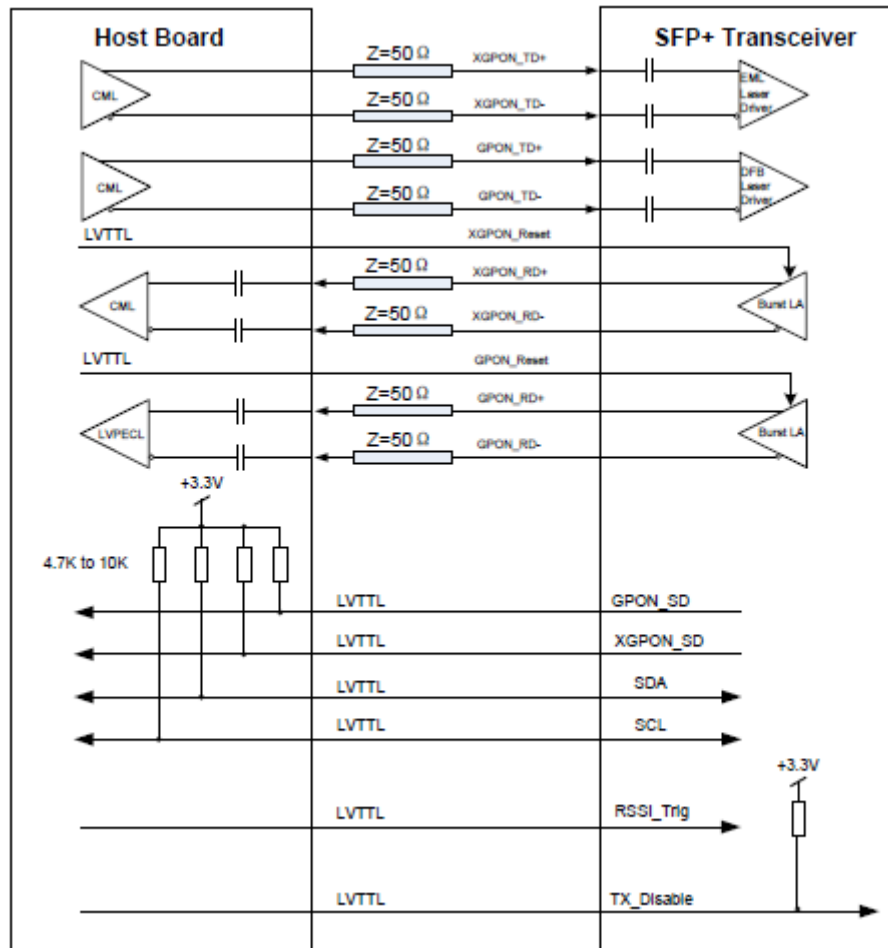


Figure 3, Recommended Interface Circuit

### Diagnostics

Table 7– Diagnostics

| Parameter        | Range        | Accuracy | Unit | Notes               | Calibration |
|------------------|--------------|----------|------|---------------------|-------------|
| Temperature      | 0 to 70      | ±3       | °C   | LSB equal to 1/256c | Internal    |
| Voltage          | 3.15 to 3.45 | ±3%      | V    | LSB equal to 100uV  | Internal    |
| Bias Current     | 0 to 130     | ±10%     | mA   | LSB equal to 4uA    | Internal    |
| Tx Power(9.953G) | 5 to 9       | ±2dB     | dBm  | LSB equal to 0.2uW  | Internal    |
| Tx Power(2.488G) | 3 to 7       | ±2dB     | dBm  | LSB equal to 0.2uW  | Internal    |
| Rx Power(9.953G) | -31 to -10   | ±3dB     | dBm  | LSB equal to 0.1uW  | Internal    |
| Rx Power(1.244G) | -32 to -12   | ±3dB     | dBm  | LSB equal to 0.1uW  | Internal    |

## Pin Function Definitions

Table 8– Pin Definitions (22Pins)

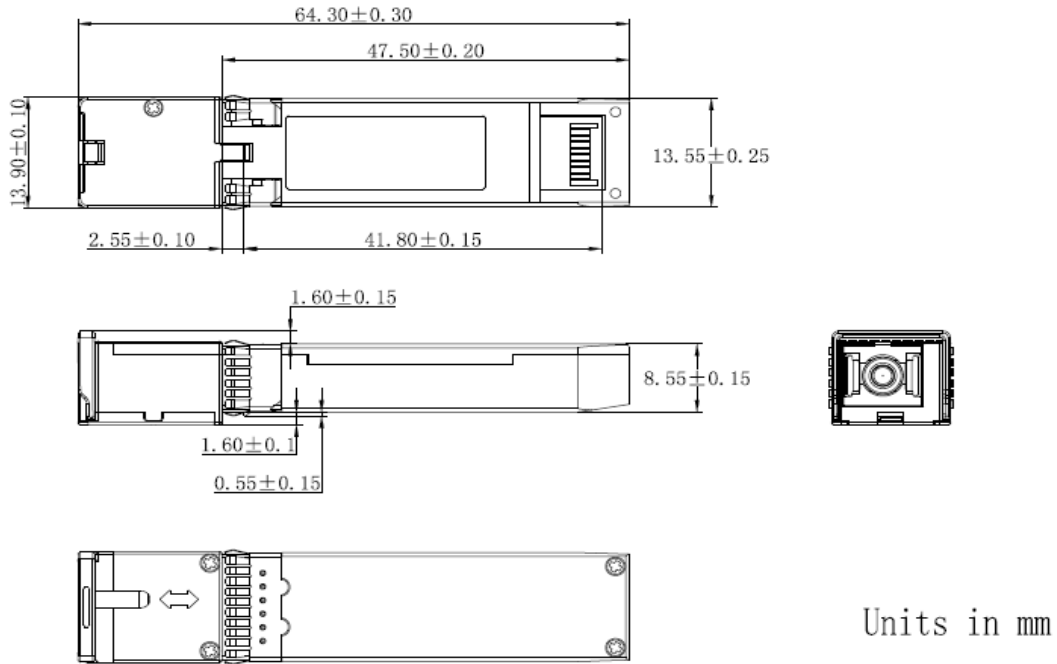
| Pin | Logic    | Name         | Description  | Notes |
|-----|----------|--------------|--|-------|
| 1   | CML      | GPON_TD+     | AC-coupled,  |       |
| 2   | CML      | GPON_TD-     | AC-coupled,  |       |
| 3   |          | GND          | Ground   |       |
| 4   | LVTTTL-I | TX Disable   | Active High, TX Disable control both XG-PON and GPON transmitter, and can be separately disable GPON or XG-PON by IIC programming.           |       |
| 5   | LVTTTL   | SDA          | 2-Wire serial interface SDA  |       |
| 6   | LVTTTL   | SCL          | 2-Wire serial interface SCL  |       |
| 7   | LVPECL   | GPON_RD-     | DC-coupling  |       |
| 8   | CML      | XG-PON Rest  | Reset input, Active High,  |       |
| 9   | CML      | XG-PON SD    | RX SD output. Logic 1 : normal operation   |       |
| 10  | LVTTTL-I | RSSI_Trigger | RSSI trigger input, active high.<br>RSSI trigger control both XG-PON and GPON receiver, and select GPON or XG-PON channel by IIC programming |       |
| 11  | LVPECL   | GPON_RD+     | DC-coupling  |       |
| 12  |          | NC           | Not connection   |       |
| 13  |          | GND          | Ground   |       |
| 14  | CML      | XG-PON RD-   | DC-coupling  |       |
| 15  | CML      | XG-PON RD+   | DC-coupling  |       |
| 16  | LVTTTL   | GPON SD      | RX SD output. Logic 1 : normal operation   |       |
| 17  |          | VCC          | +3.3V Power supply   |       |
| 18  |          | VCC          | +3.3V Power supply   |       |
| 19  | LVTTTL   | GPON Reset   | Reset for GPON receiver, Reset input, Active High,   |       |
| 20  | CML      | XG-PON TD+   | AC-coupled   |       |
| 21  | CML      | XG-PON TD-   | AC-coupled   |       |
| 22  |          | GND          | Module Ground  |       |

**Table 9– Pin Definitions (20 PINs)**

| Pin | Logic    | Name            | Description  | Notes |
|-----|----------|-----------------|--|-------|
| 1   | CML-I    | GPON_TD+        | GPON transmit data input, AC coupling  |       |
| 2   | CML-I    | GPON_TD-        | Inverted GPON transmit data input, AC coupling                                     |       |
| 3   |          | GND             | Ground   |       |
| 4   | LVTTTL   | SDA             | 2-Wire serial interface SDA  |       |
| 5   | LVTTTL   | SCL             | 2-Wire serial interface SCL  |       |
| 6   | LVPECL-O | GPON_RD-        | Inverted GPON received data output, DC coupling                                    |       |
| 7   | LVTTTL   | XGPON_Reset     | RESET, active High   |       |
| 8   | LVTTTL-O | XGPON_SD        | XG Receiver signal detect, logic 1 indicates normal operation                      |       |
| 9   | LVTTTL   | 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, DC coupling   |       |
| 11  |          | GND             | Ground   |       |
| 12  | CML-O    | XGS-PON RD-     | Inverted XGSPON received data output, DC coupling                                  |       |
| 13  | CML-O    | XGS-PON RD+     | XGSPON received data output, DC coupling   |       |
| 14  | LVTTTL-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  | LVTTTL-I | GPON Reset      | Reset for GPON LA, active high   |       |
| 18  | CML-I    | XGS-PON TD+     | XGS transmit data input, AC coupling   |       |
| 10  | CML-I    | XGS-PON TD-     | Inverted XGS transmit data input, AC coupling                                      |       |
| 20  |          | GND             | Module Ground  |       |



**Outline Drawing**



**Figure 4, Draft outline drawing, not a final version**

**Ordering Information**

**Table 10 - Ordering Information**

| Part No.           | Application                                    | Data Rate  | Laser Source                       | Fiber |
|--------------------|--|--|------------------------------------|-------|
| SPPS-ST-XG-CP-CDFA | XGPON&GPON Combo OLT C+,SFP+,22 Pins, 0~70°C   | Tx1: 9.95328G<br>Tx2: 2.488G<br>Rx1: 2.488G<br>Rx2: 1.244G | Tx1: 1577nm EML<br>Tx2: 1490nm DFB | SMF   |
| SPPS-ST-XG-CP-IDFA | XGPON&GPON Combo OLT C+,SFP+,22 Pins, -40~85°C |  |                                    |       |
| SPPS-ST-XG-CP-CDFB | XGPON&GPON Combo OLT C+,SFP+,20 Pins, 0~70°C   |  |                                    |       |
| SPPS-ST-XG-CP-IDFB | XGPON&GPON Combo OLT C+,SFP+,20 Pins, -40~85°C |  |                                    |       |

## 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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