

## **TS-EP12-OLT-P20+ GEPON OLT SFP Transceiver**

### **FEATURES**

- Single fiber bi-directional data links symmetric 1.25Gbps application
- 1490nm continuous-mode DFB laser transmitter and 1310nm burst-mode APD-TIA receiver
- Reset-less burst-mode receiver simplify the system design
- More than 24dB wide dynamic range
- 0 to 70°C operating case temperature,
- Single 3.3V power supply
- Digital diagnostic monitoring interface
- Digital burst RSSI function to monitor the input optical power level
- LVPECL compatible data input/output interface
- LVTTTL transmitter disable control
- LVTTTL transmitter laser fault alarm
- LVTTTL receiver loss of signal indication
- Low EMI and excellent ESD protection
- Class I laser safety standard IEC-60825 compliant
- RoHS-6 compliance

### **APPLICATIONS**

- Gigabit Ethernet Passive Optical Networks (GEPON) 20Km 1:32 application or 10Km 1:64 application.

### **STANDARDS**

- Complies with SFP Multi-Source Agreement (MSA) SFF-8074i
- Complies with SFF-8472
- Complies with IEEE 802.3ah™-2004
- Complies with FCC 47 CFR Part 15, Class B
- Complies with FDA 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007

| 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    | 70   | °C    |       |
| Operating Humidity          | OH               | 5    | 90   | %     |       |
| Power Supply Voltage        | V <sub>CC</sub>  | 0    | 3.6  | V     |       |
| Receiver Damaged Threshold  |                  | +4   |      | dBm   |       |

| RECOMMENDED OPERATING CONDITION |                 |      |      |      |        |       |
|---------------------------------|-----------------|------|------|------|--------|-------|
| Parameter                       | Symbol          | Min. | Typ. | Max. | Unit   | Notes |
| Operating Case Temperature      | T <sub>c</sub>  | 0    |      | 70   | °C     |       |
| Power Supply Voltage            | V <sub>CC</sub> | 3.13 | 3.3  | 3.47 | V      |       |
| Operating Humidity Range        | OH              | 5    |      | 90   | %      |       |
| Data Rate                       |                 |      | 1.25 |      | Gbit/s |       |
| Data Rate Drift                 |                 | -100 |      | +100 | PPM    |       |

| TRANSMITTER OPTICAL CHARACTERISTICS |                                       |      |      |      |       |   |
|-------------------------------------|---------------------------------------|------|------|------|-------|---|
| Parameter                           | Symbol                                | Min. | Typ. | Max. | Unit  | Notes   |
| Optical Center Wavelength           | $\lambda_c$                           | 1480 | 1490 | 1500 | nm    |   |
| Optical Spectrum Width (-20dB)      | $\Delta\lambda$                       |      |      | 1    | nm    |   |
| Side Mode Suppression Ratio         | SMSR                                  | 30   |      |      | dB    |   |
| Average Launch Optical Power        | AOP                                   | +2   |      | +7   | dBm   | EOL, Over Temperature                           |
| Power-OFF Transmitter Optical Power |                                       |      |      | -39  | dBm   | Launched into SMF                               |
| Extinction Ratio                    | ER                                    | 9    |      |      | dB    | PRBS 2 <sup>7</sup> -1 test pattern @1.25Gbit/s |
| Total Jitter                        | TJ                                    |      |      | 0.43 | UI    | PRBS 2 <sup>7</sup> -1 test pattern @1.25Gbit/s |
| Rise/Fall Time (20%-80%)            | T <sub>R</sub> /T <sub>F</sub>        |      |      | 260  | ps    | Bessel-Thompson Filter OFF.                     |
| RIN <sub>15</sub> OMA               |                                       |      |      | -115 | dB/Hz |   |
| Optical Return Loss Tolerance       |                                       |      |      | 15   | dB    |   |
| Transmitter Reflectance             |                                       |      |      | -10  | dB    |   |
| Transmitter and Dispersion Penalty  | TDP                                   |      |      | 2.3  | dB    | Transmit on 20km SMF                            |
| Optical Waveform Diagram            | Compliant with IEEE Std 802.3ah™-2004 |      |      |      |       | Figure 1  |

| TRANSMITTER ELECTRICAL CHARACTERISTICS |        |      |      |                 |      |                          |
|--|--------|------|------|-----------------|------|--------------------------|
| Parameter                              | Symbol | Min. | Typ. | Max.            | Unit | Notes                    |
| Data Input Differential Swing          |        | 200  |      | 1600            | mV   | LVPECL input, AC coupled |
| Input Differential Impedance           |        | 90   | 100  | 110             | Ω    |                          |
| Power Supply Current                   |        |      |      | 220             | mA   | Load free                |
| Transmitter Disable Voltage - Low      |        | 0    |      | 0.8             | V    |                          |
| Transmitter Disable Voltage - High     |        | 2.0  |      | V <sub>CC</sub> | V    |                          |
| Transmitter Fault Alarm Voltage - Low  |        | 0    |      | 0.4             | V    |                          |
| Transmitter Fault Alarm Voltage - High |        | 2.4  |      | V <sub>CC</sub> | V    |                          |

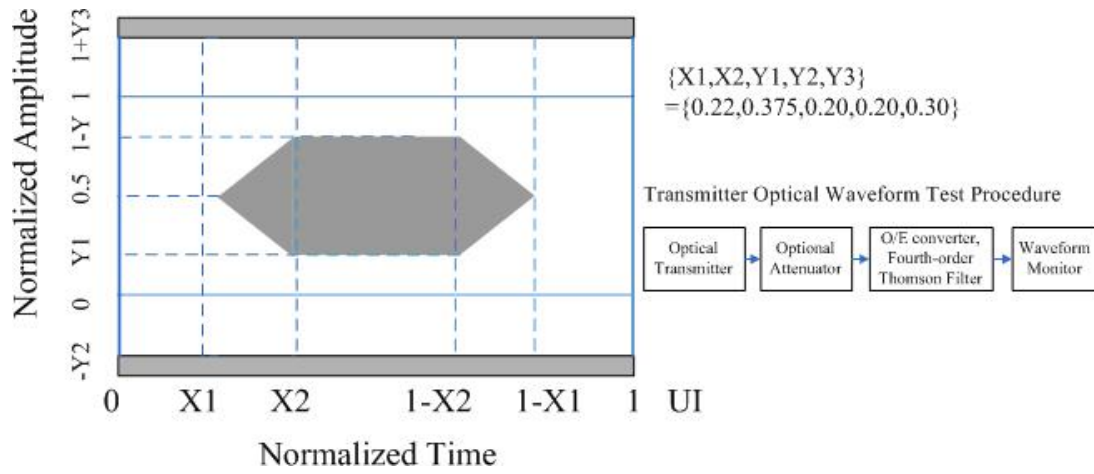
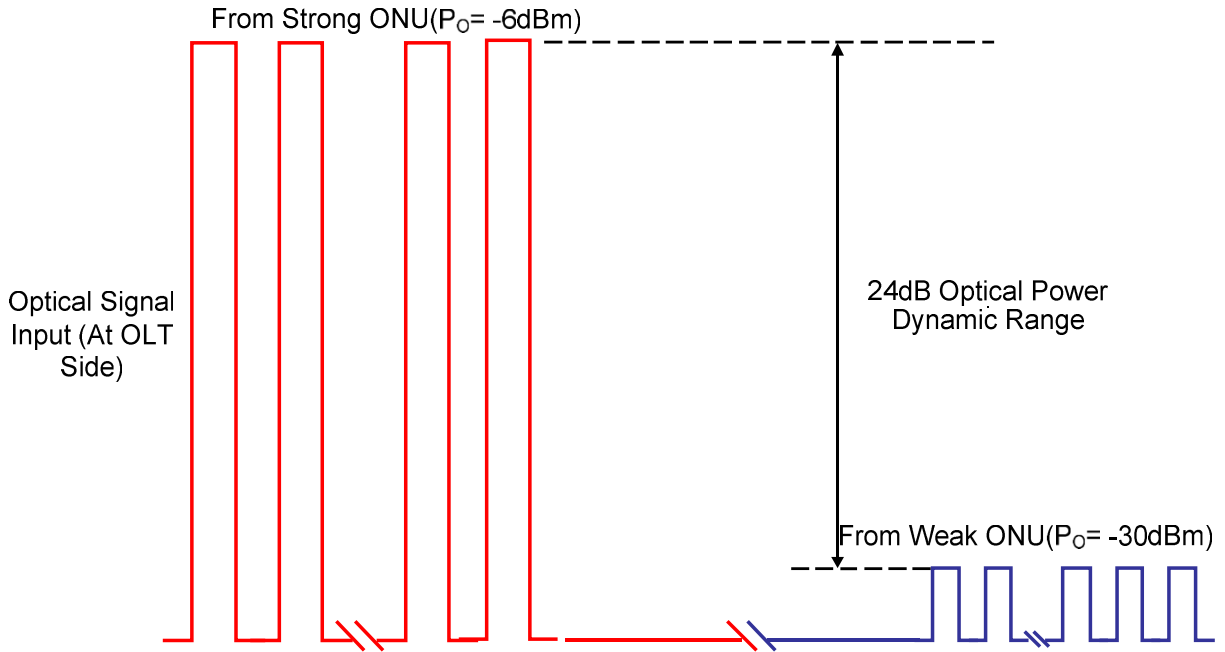


Figure 1 Transmitter Eye Mask Definitions and Test Procedure

| RECEIVER OPTICAL CHARACTERISTICS |        |      |      |      |      |  |
|----------------------------------|--------|------|------|------|------|--|
| Parameter                        | Symbol | Min. | Typ. | Max. | Unit | Notes  |
| Operating Wavelength             |        | 1260 |      | 1360 | nm   |  |
| Sensitivity                      | SEN    |      |      | -30  | dBm  | PRBS 2 <sup>7</sup> -1@1.25Gbps BER ≤1×10 <sup>-12</sup> |
| Saturation Optical Power         | SAT    | -6   |      |      | dBm  | PRBS 2 <sup>7</sup> -1@1.25Gbps BER ≤1×10 <sup>-12</sup> |
| Loss Of Signal De-assert Level   | LOSD   |      |      | -31  | dBm  |  |
| Loss Of Signal Assert Level      | LOSA   | -45  |      |      | dBm  |  |
| Loss Of Signal Hysteresis        |        | 0.5  |      | 6    | dB   |  |
| Receiver Reflectance             |        |      |      | -12  | dB   |  |
| Dynamic Range                    |        | -30  |      | -6   | dBm  | Figure 2   |

**BURST MODE RECEIVER DYNAMIC RANGE IN GEAPON SYSTEM**

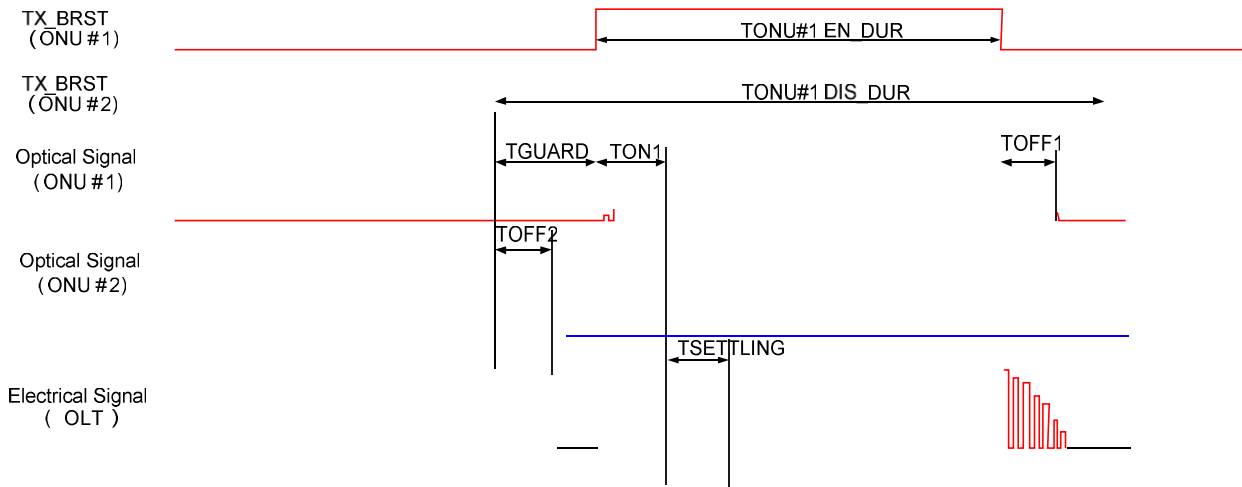


**Figure 2 Burst Mode Receiver Dynamic Range in GEAPON System**

**RECEIVER ELECTRICAL CHARACTERISTICS**

| Parameter                         | Symbol                | Min.  | Typ. | Max.  | Unit. | Notes                     |
|-----------------------------------|-----------------------|-------|------|-------|-------|---------------------------|
| Power Supply Current              |                       |       |      | 160   | mA    | Load free                 |
| Data Output Voltage – Low (-Vcc)  |                       | -1.81 |      | -1.62 | V     |                           |
| Data Output Voltage – High (-Vcc) |                       | -1.02 |      | -0.88 | V     |                           |
| Data Output Differential Swing    |                       | 400   |      | 1600  | mV    | LVPECL output, DC coupled |
| Loss Of Signal Assert Time        |                       |       | 0.5  |       | µs    |                           |
| Loss Of Signal De-assert Time     |                       |       | 0.5  |       | µs    |                           |
| Loss Of Signal Voltage - Low      |                       | 0     |      | 0.4   | V     |                           |
| Loss Of Signal Voltage - High     |                       | 2.4   |      | VCC   | V     |                           |
| Receiver Threshold Settling Time  | T <sub>SETTLING</sub> |       |      | 250   | ns    | Figure 3                  |

**TIMING PARAMETER DEFINITIONS IN BURST MODE SEQUENCE**

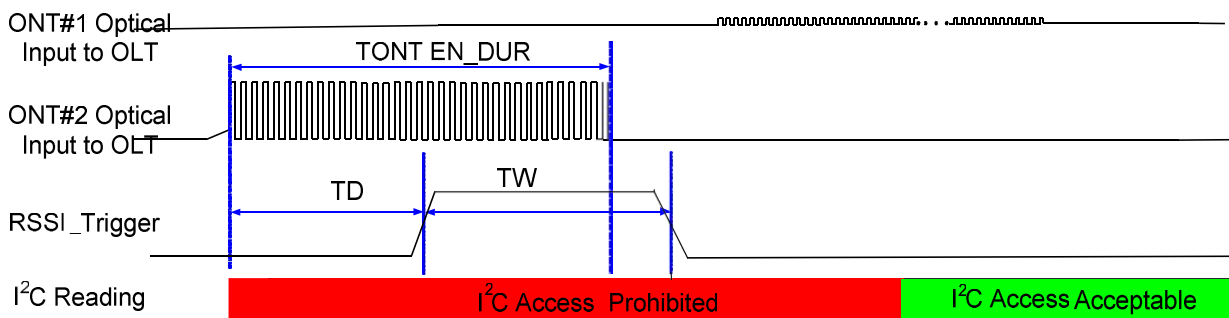


**Figure 3 Timing Parameter Definitions in Burst Mode Sequence**

**RECEIVER ELECTRICAL CHARACTERISTICS**

| Parameter                  | Symbol         | Min. | Typ. | Max. | Unit. | Notes                              |
|----------------------------|----------------|------|------|------|-------|------------------------------------|
| RSSI Trigger-Low           |                | 0    |      | 0.8  | V     |                                    |
| RSSI Trigger-High          |                | 2.0  |      | Vcc  | V     |                                    |
| RSSI Trigger width         | T <sub>w</sub> | 10   |      |      | us    |                                    |
| RSSI Trigger Delay         | T <sub>D</sub> |      | 950  |      | ns    | Refer to first bit of the preamble |
| I2C Access Prohibited Time |                | 150  | 200  |      | μs    |                                    |
| Optical Signal During Time | TONU_EN_DUR    | 1000 | 1200 |      | ns    | 400ns CDR time                     |

**RSSI TIMING SEQUENCE**



**Figure 4 Timing Parameter Definitions in RSSI Trigger**

| PIN DESCRIPTION |                   |                              |  |
|-----------------|-------------------|------------------------------|--|
| PIN             | Name              | Description                  | Notes  |
| 1               | V <sub>EE</sub> T | Transmitter Ground           |  |
| 2               | TX Fault          | Transmitter Fault Indication | High: abnormal; Low: normal                        |
| 3               | TX Disable        | Transmitter Disable          | High: transmitter disable; Low: transmitter enable |
| 4               | MOD-DEF2          | Module Definition 2          | The data line of two wire serial interface         |
| 5               | MOD-DEF1          | Module Definition 1          | The clock line of two wire serial interface        |
| 6               | MOD-DEF0          | Module Definition 0          | Connected to Ground in the transceiver             |
| 7               | RSSI Trigger      | RSSI Trigger for Transceiver | High: enable RSSI A/D conversion                   |
| 8               | LOS               | Loss of Signal               | High: Loss Of Signal; Low: Signal Detected         |
| 9               | V <sub>EE</sub> R | Receiver Ground              |  |
| 10              | V <sub>EE</sub> R | Receiver Ground              |  |
| 11              | V <sub>EE</sub> R | Receiver Ground              |  |
| 12              | RD-               | Inv. Receiver Data Out       | LVPECL logic output, DC coupled                    |
| 13              | RD+               | Receiver Data Out            | LVPECL logic output, DC coupled                    |
| 14              | V <sub>EE</sub> R | Receiver Ground              |  |
| 15              | V <sub>CC</sub> R | Receiver Power               |  |
| 16              | V <sub>CC</sub> T | Transmitter Power            |  |
| 17              | V <sub>EE</sub> T | Transmitter Ground           |  |
| 18              | TD+               | Transmit Data In             | LVPECL logic input, AC coupled                     |
| 19              | TD-               | Inv. Transmit Data In        | LVPECL logic input, AC coupled                     |
| 20              | V <sub>EE</sub> T | Transmitter Ground           |  |

#### SFP RECOMMENDED HOST BOARD POWER SUPPLY FILTERING NETWORK

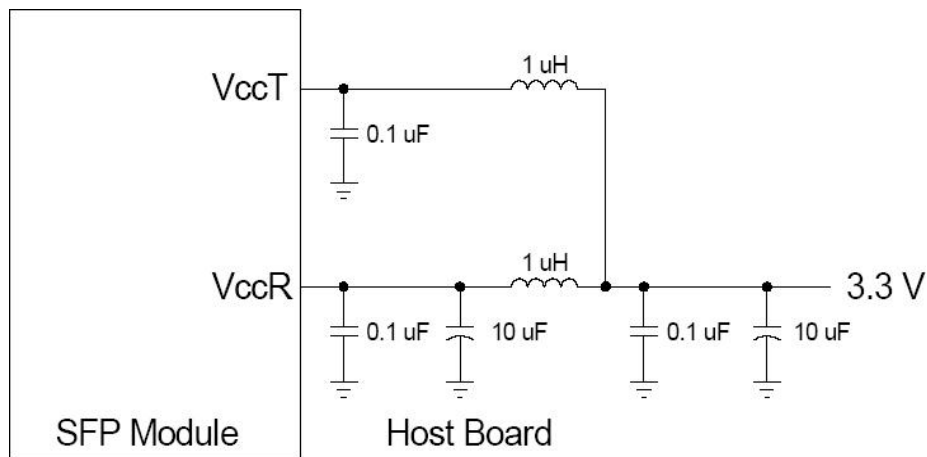
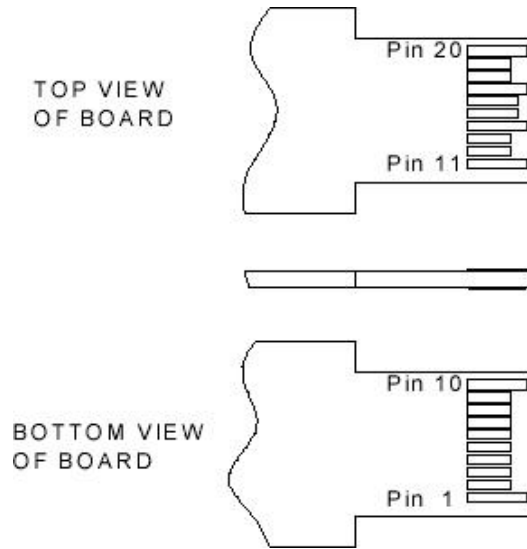
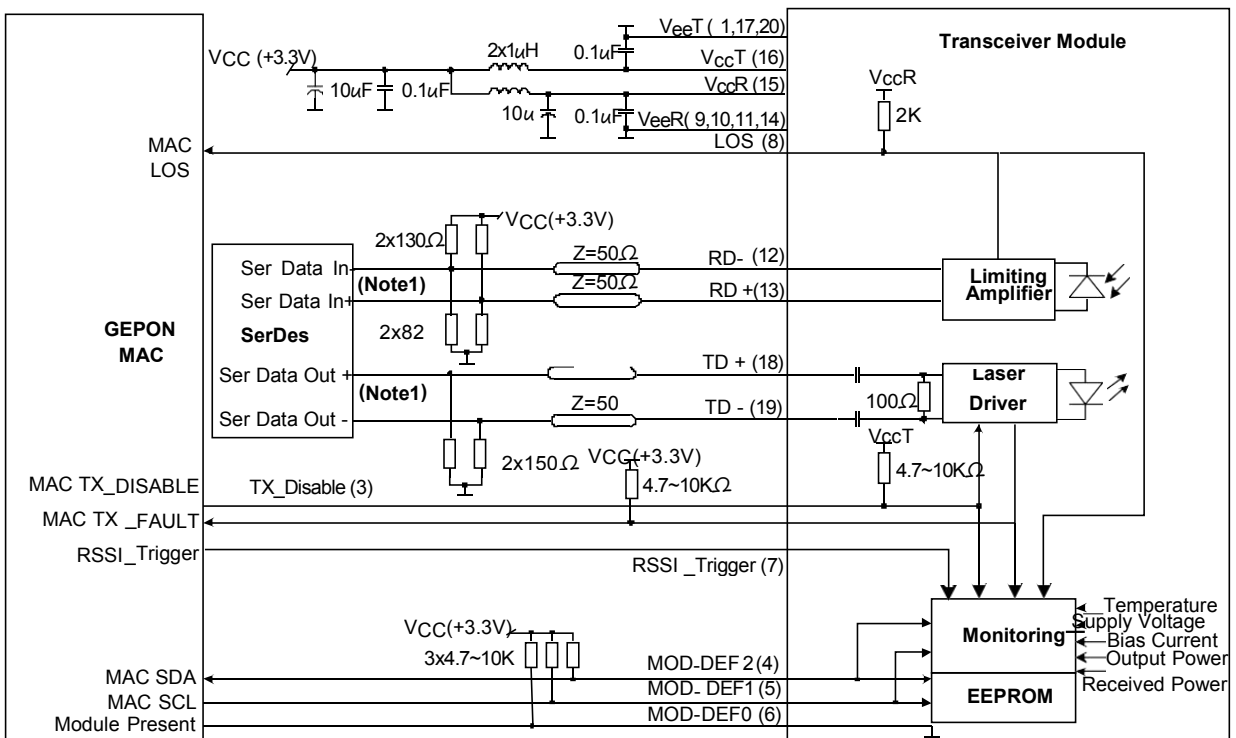


Figure 5 SFP Recommended Host Board Power Supply Filtering Network

**SFP PIN (GOLDEN FINGER) DRAWING**

**Figure 6 SFP Pin (Golden Finger) Drawing**
**TYPICAL INTERFACE CIRCUIT**

**Figure 7 Typical Interface Circuit**

**PACKAGE OUTLINE**

Unit:mm

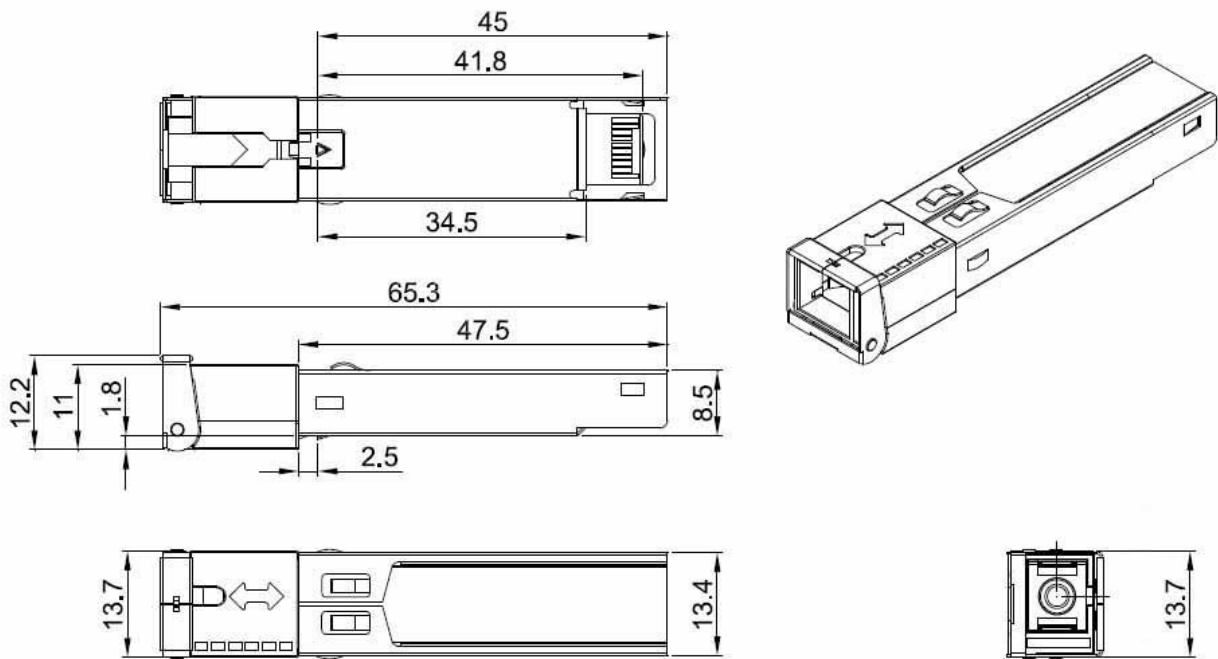


Figure 8 Package Outline

**EEPROM INFORMATION**

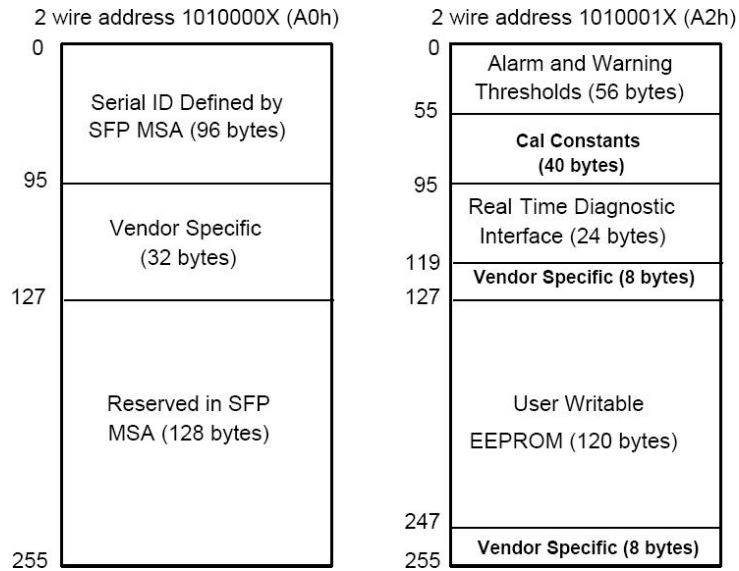


Figure 9 EEPROM Memory Map Specific Data Field Descriptions



**DIGITAL DIAGNOSTIC MONITORING INTERFACE**

| Parameter        | Range         | Accuracy | Calibration | NOTES       |
|------------------|---------------|----------|-------------|-------------|
| Temperature      | 0 to 70°C     | ±3°C     | Internal    | LSB: 1/256C |
| Voltage          | 2.97 to 3.63V | ±3%      | Internal    | LSB: 0.1mV  |
| Bias Current     | 0 to 100mA    | ±10%     | Internal    | LSB: 2uA    |
| TX Power         | -2 to 8dBm    | ±3dB     | Internal    | LSB: 0.1uW  |
| RX Power monitor | -30 to -6dBm  | ±3dB     | Internal    | LSB: 0.1uW  |

**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.