

## **TS-GP2512-OLT-B+**

### **GPON OLT Class B+ SFP Transceiver**

#### **FEATURES**

- Single fiber bi-directional data links asymmetric TX 2488Mbps/RX1244Mbps application
- 1490nm continuous-mode DFB laser transmitter and 1310nm burst-mode APD-TIA receiver
- Small Form Factor Pluggable package with SC/UPC Connector
- Reset burst-mode receiver design support more than 15dB 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 Signal Detect (SD) indication
- Low EMI and excellent ESD protection
- Class I laser safety standard IEC-60825 compliant
- RoHS-6 compliance

#### **APPLICATIONS**

- Gigabit-capable Passive Optical Networks (GPON) 20Km 13~28dB attenuation range.

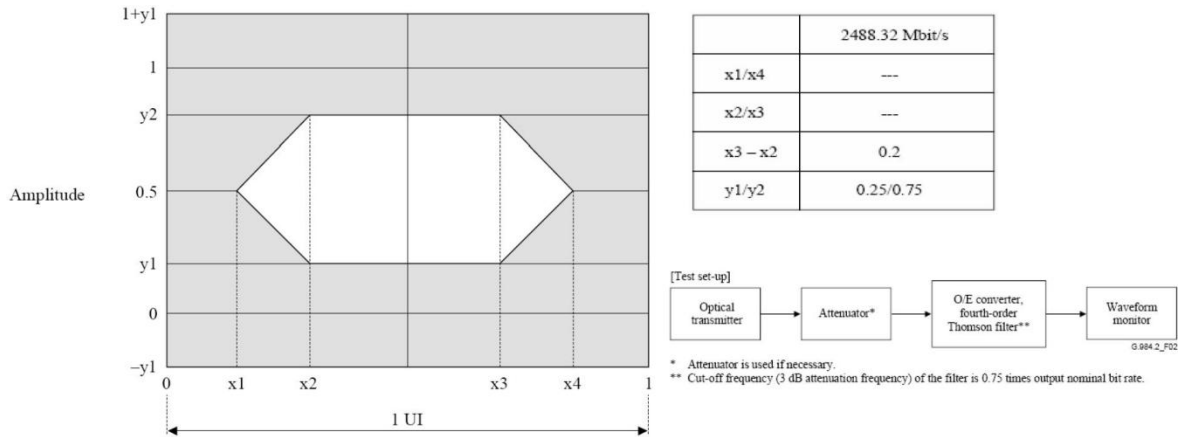
#### **STANDARDS**

- Complies with SFP Multi-Source Agreement (MSA) SFF-8074i
- Complies with ITU-T G.984.2 Amendment 1
- Complies with SFF-8472 Rev 9.5
- 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   | 70   | °C   |       |
| Operating Humidity          | OH               | 5   | 95   | %    |       |
| Power Supply Voltage        | V <sub>CC</sub>  | 0   | 3.6  | V    |       |
| Receiver Damaged Threshold  |                  | +4  |      | dBm  |       |

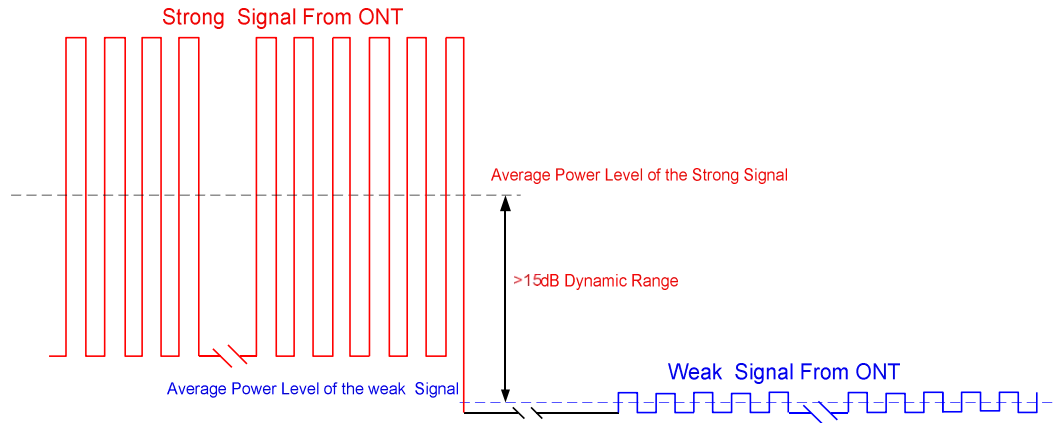
| RECOMMENDED OPERATING CONDITION |                 |      |                          |      |        |       |
|---------------------------------|-----------------|------|--------------------------|------|--------|-------|
| Parameter                       | Symbol          | Min  | Typ.                     | Max. | Unit   | Notes |
| Power Supply Voltage            | V <sub>CC</sub> | 3.13 | 3.3                      | 3.47 | V      |       |
| Operating Case Temperature      | T <sub>c</sub>  | 0    |                          | 70   | °C     |       |
| Operating Humidity Range        | OH              | 5    |                          | 95   | %      |       |
| Data Rate                       |                 |      | Tx 2488.32<br>Rx 1244.16 |      | Mbit/s |       |

| TRANSMITTER OPTICAL CHARACTERISTICS     |                 |      |      |      |          |  |
|---|-----------------|------|------|------|----------|--|
| Parameter                               | Symbol          | Min. | Typ. | 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            | AOP             | +2.5 |      | +5   | dBm      | BOL, Room Temperature                      |
|   |                 | +1.5 |      | +5   | dBm      | EOL, 0~70°C                                |
| Power-OFF Transmitter Optical Power     |                 |      |      | -39  | dBm      | Launched into SMF                          |
| Extinction Ratio                        | ER              | 8.2  |      |      | dB       | PRBS 2 <sup>23</sup> -1+72CID @2.488Gbit/s |
| Tolerance to Transmitter Incident Light |                 | -15  |      |      | dB       |  |
| Transmitter Reflectance                 |                 |      |      | -10  | dB       |  |
| Transmitter and Dispersion Penalty      | TDP             |      |      | 1    | dB       | Transmit on 20km SMF                       |
| Optical Waveform Diagram                | ITU-T G.984.2   |      |      |      | Figure 1 |  |

**TRANSMITTER EYE MASK DEFINITIONS AND TEST PROCEDURE**

**Figure 1 Transmitter Eye Mask Definitions and Test Procedure**

| 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             | $\Omega$ |                          |
| 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        |                          |

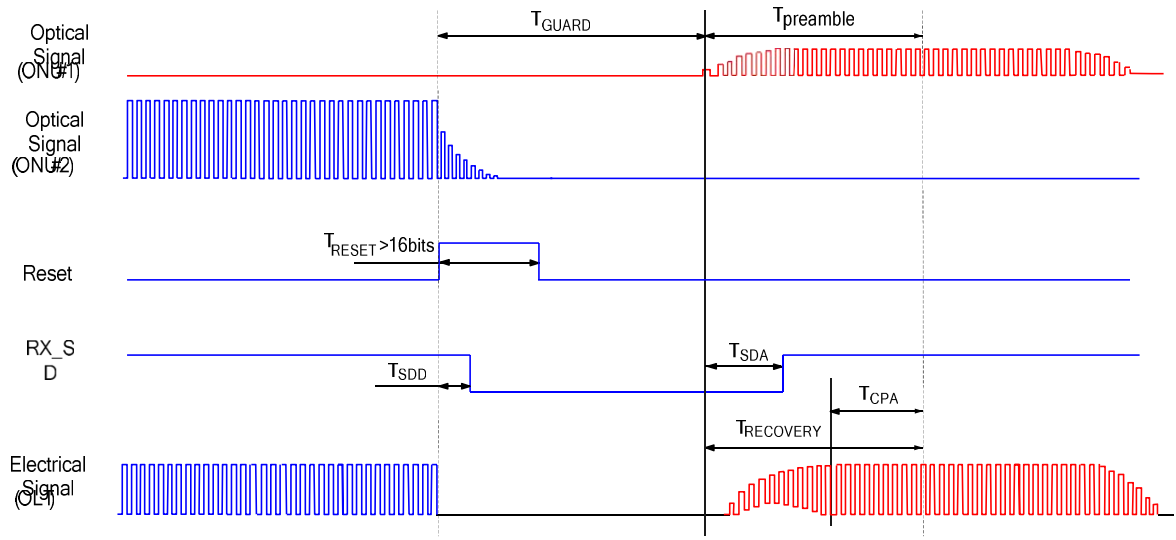
| RECEIVER OPTICAL CHARACTERISTICS |        |      |      |      |      |  |
|----------------------------------|--------|------|------|------|------|--|
| Parameter                        | Symbol | Min. | Typ. | Max. | Unit | Notes                                  |
| Operating Wavelength             |        | 1260 |      | 1360 | nm   |  |
| Sensitivity                      | SEN    |      |      | -28  | dBm  | PRBS 2 <sup>23</sup> -1+72CID@1244Mbps |
| Saturation Optical Power         | SAT    | -8   |      |      | dBm  | BER ≤ 1 × 10 <sup>-10</sup>            |
| Dynamic Range                    |        | 15   |      |      | dB   | Figure 2                               |
| Signal Detect Assert Level       |        |      |      | -30  | dBm  |  |
| Signal Detect De-Assert Level    |        | -45  |      |      | dBm  |  |
| Signal Detect Hysteresis         |        | 0.5  |      | 6    | dB   |  |
| Receiver Reflectance             |        |      |      | -12  | dB   |  |

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

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

| RECEIVER ELECTRICAL CHARACTERISTICS |                       |       |      |                 |      |  |
|-------------------------------------|-----------------------|-------|------|-----------------|------|--|
| Parameter                           | Symbol                | Min.  | Typ. | Max.            | Unit | Notes  |
| Power Supply Current                |                       |       |      | 350             | 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  |
| Reset width                         | T <sub>RESET</sub>    | 16    |      |                 | bits |  |
| Reset-Low                           |                       | 0     |      | 0.4             | V    |  |
| Reset-High                          |                       | 2.4   |      | V <sub>cc</sub> | V    |  |
| Receiver Amplitude Recovery Time    | T <sub>RECOVERY</sub> |       |      | 32              | bits | Refer to the Reset signal falling edge                             |
| Signal Detect Assert Time           |                       |       |      | 50              | ns   |  |
| Signal Detect De-assert Time        |                       |       |      | 12.8            | ns   | Refer to the Reset signal rising edge                              |
| Signal Detect Voltage-Low           |                       | 0     |      | 0.4             | V    |  |
| Signal Detect Voltage-High          |                       | 2.4   |      | V <sub>cc</sub> | V    |  |
| RSSI Trigger-Low                    |                       | 0     |      | 0.8             | V    |  |
| RSSI Trigger-High                   |                       | 2.0   |      | V <sub>cc</sub> | V    |  |
| RSSI Trigger width                  | T <sub>w</sub>        | 350   | 375  | 400             | ns   |  |
| RSSI Trigger Delay                  | T <sub>D</sub>        |       | 500  |                 | ns   | Refer to first bit of the preamble                                 |
| Optical Signal During Time          | TONT EN_DUR<br>EN_DUR |       | 2600 |                 | ns   | TONT EN_DUR ≥ T <sub>D</sub> + T <sub>w</sub> For RSSI Measurement |
| I2C Access Prohibited Time          |                       | 100   |      | 500             | μs   |  |
| RX Power Monitor Range              |                       | -30   |      | -8              | dBm  | Note 1   |

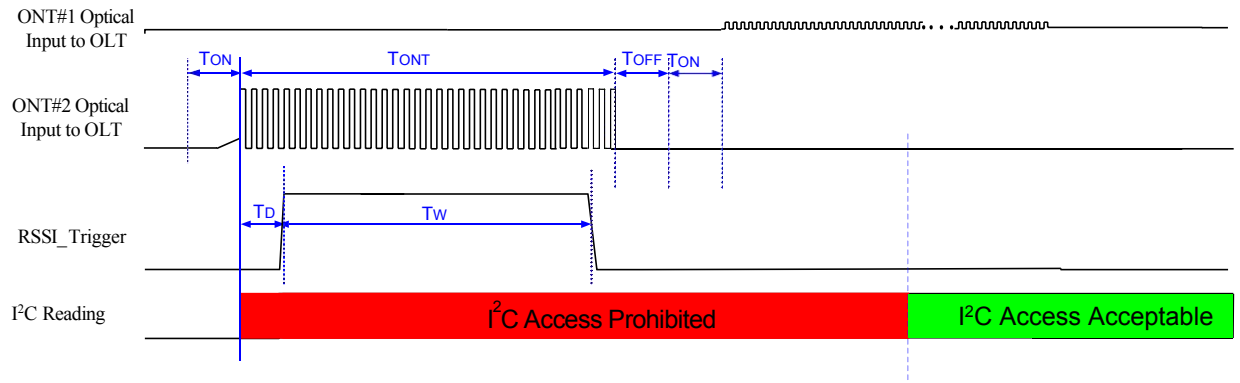
Note 1: RSSI result is provided by access to EEPROM A2H 104~105Byte the unit is 0.1uW. Please refer to the SFF-8472 V9.5 for the detail information.

**TIMING PARAMETER DEFINITIONS IN BURST MODE SEQUENCE**



**Figure 3 Burst Receiver Timing Sequence**

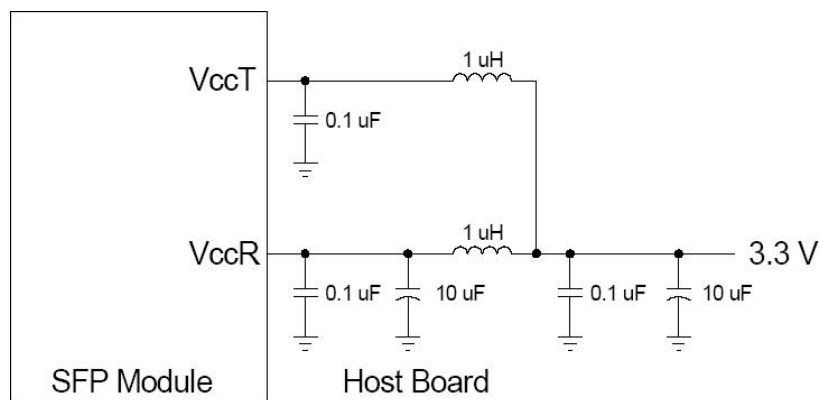
**RSSI TIMING SEQUENCE**



**Figure 4 RSSI TIMING SEQUENCE**

**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   | Reset             | Receiver Reset                   | High: reset the receiver                           |
| 8   | SD                | Signal Detect                    | High: signal detected; Low: loss of signal;        |
| 9   | RSSI Trigger      | RSSI Trigger for Transceiver A/D | High: enable RSSI A/D conversion                   |
| 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 | Received 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

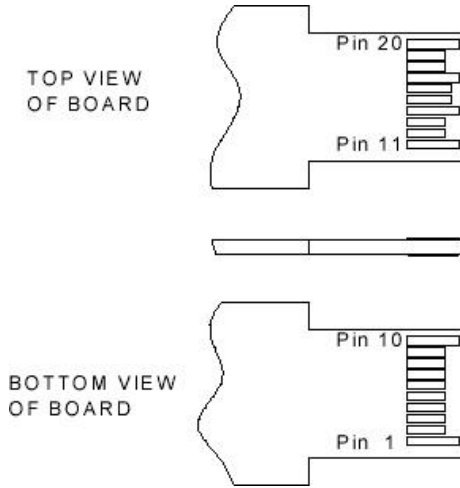


Figure 6 SFP Pin (Golden Finger) Drawing

TYPICAL INTERFACE CIRCUIT

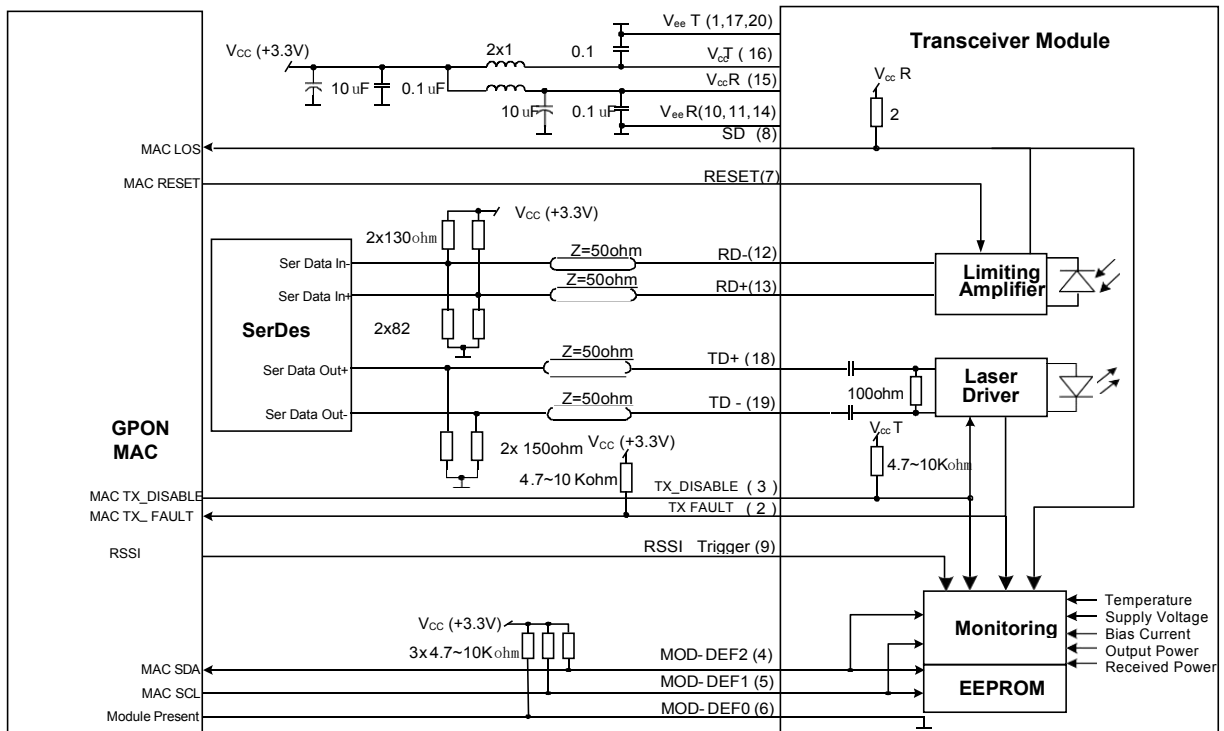
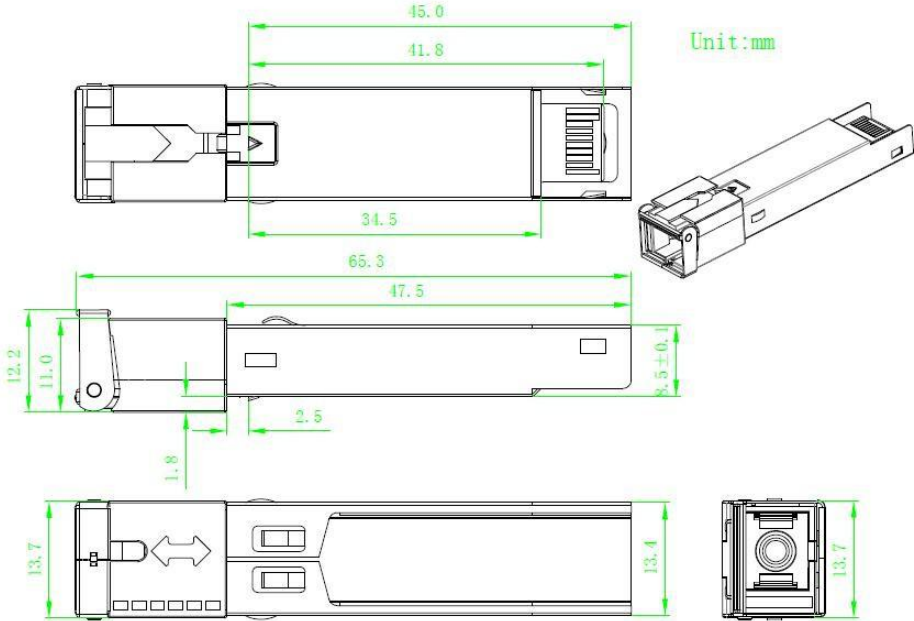


Figure 7 Typical Interface Circuit

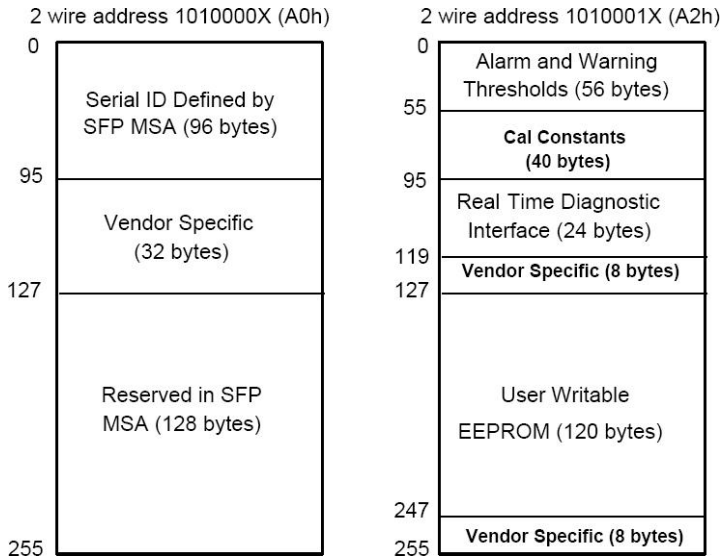
**PACKAGE OUTLINE**

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 | Note           |
|------------------|--------------|----------|-------------|----------------|
| Temperature      | 0 to 70°C    | ±3°C     | Internal    | 1LSB = 1/256°C |
| Voltage          | 3.0 to 3.7V  | ±3%      | Internal    | 1LSB = 0.1mV   |
| Bias Current     | 0 to 100mA   | ±10%     | Internal    | 1LSB = 2uA     |
| TX Power         | 1.5 to 5dBm  | ±2dB     | Internal    | 1LSB = 0.1uW   |
| RX Power Monitor | -30 to -8dBm | ±3dB     | External    | 1LSB = 0.1uW   |

Note : The digital diagnostic monitoring interface defines 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X(A2h). Please refer to the SFF-8472 Rev 9.5 for the detail information.

**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.