

## GPON OLT SFP Transceiver

### Functional Features

- SC BIDI SFP Single Mode Transceiver
  - 1490nm Continuous Mode 2.488 Gbps DFB Transmitter
  - 1310nm Burst Mode 1.244 Gbps APD-TIA Receiver
- Single +3.3 Power Supply, Hot-pluggable
- LVTTTL receiver Fast Burst Packet Detect indication
- Burst mode received signal strength indication (RSSI) function
- Complies with Telcordia (Bellcore) GR-468-CORE
- Class I laser safety standard IEC-60825 compliant
- Compliant with SFP MSA and SFF-8472
- Complies with ITU-T G.984.2 Class C++++

### Product Applications

- GPON OLT For P2MP Application

### General

The AS60-PG43207-CPSS9 transceiver with supports data rate of typical 2.488 Gbps for GPON OLT application up to 20km transmission distance, it' s designed meeting with ITU-T G.984.2 Class C++++ specifications. SC receptacle is for optical interface.

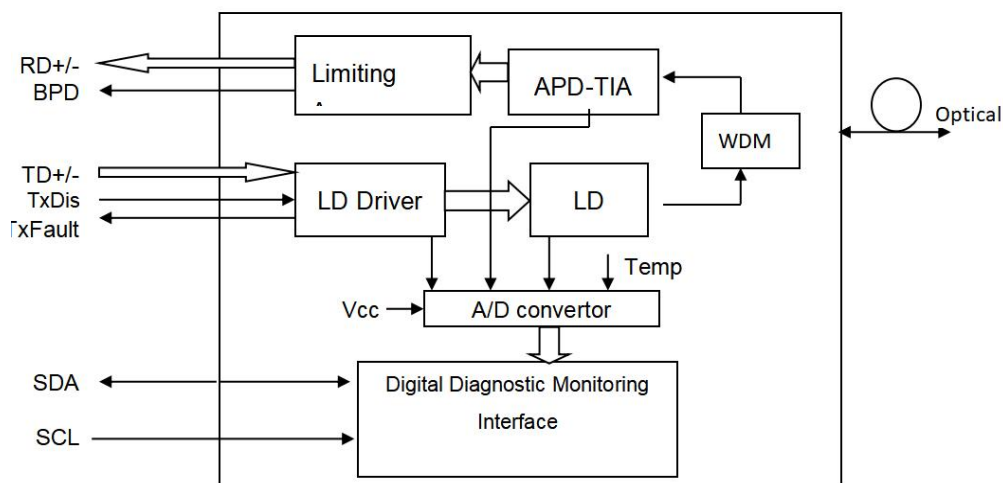


Fig 1 Transceiver Block Diagram

The module provides digital diagnostic information of its operating conditions and status, including transmitting power, laser bias, receiver input optical power, module temperature, and supply voltage. Calibration and alarm/warning threshold data are written and stored in internal memory (EEPROM). The memory map is compatible with SFF-8472, as shown in Fig. 2. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56-95 in A2h.

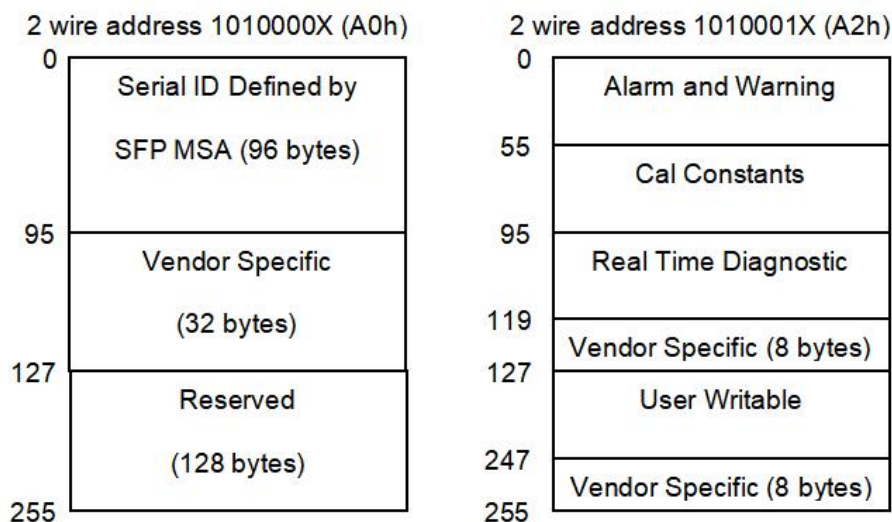


Fig 2 EEPROM Information

## Performance Specification

| Absolute Maximum Ratings         |         |       |         |       |      |      |
|----------------------------------|---------|-------|---------|-------|------|------|
| Parameter                        | Symbol  | Min.  | Max.    | Unit  | Note |      |
| Storage Temperature              | Tst     | -40   | +85     | ° C   |      |      |
| Operating Case Temperature       | Tc      | 0     | 70      | ° C   |      |      |
| Input Voltage                    | -       | GND   | Vcc     | V     |      |      |
| Power Supply Voltage             | Vcc-Vee | -0.5  | +3.6    | V     |      |      |
| Recommended Operating Conditions |         |       |         |       |      |      |
| Parameter                        | Symbol  | Min.  | Typical | Max.  | Unit | Note |
| Power Supply Voltage             | Vcc     | 3.135 | 3.3     | 3.465 | V    |      |
| Operating Case Temperature       | Tc      | 0     | -       | 70    | ° C  |      |
| Data Rate                        | TX      | -     | 2.488   | -     | Gbps |      |
|                                  | RX      | -     | 1.244   | -     |      |      |
| Total Supply Current             | -       | -     | -       | 400   | mA   |      |
| Damage Threshold For Receiver    | -       | -     | -       | 4     | dBm  |      |

| Optical Specification                     |                              |      |      |       |      |      |
|-------------------------------------------|------------------------------|------|------|-------|------|------|
| Transmitter                               |                              |      |      |       |      |      |
| Parameter                                 | Symbol                       | Min. | Typ. | Max.  | Unit | Note |
| Optical Central Wavelength                | $\lambda$                    | 1480 | 1490 | 1500  | nm   | -    |
| Spectral Width (-20dB)                    | $\Delta\lambda$              | -    | -    | 1     | nm   | -    |
| Side Mode Suppression Ratio               | SMSR                         | 30   | -    | -     | dB   | -    |
| Average Optical Output Power              | Po                           | +7.5 | +9   | +10.5 | dBm  |      |
| Extinction Ratio                          | Er                           | 8.2  | -    | -     | dB   | -    |
| Rise/Fall Time                            | Tr/Tf                        | -    | -    | 150   | ps   | -    |
| Transmitter Total Jitter                  | Jp-p                         | -    | -    | 0.1   | UI   |      |
| Transmitter Reflectance                   | RFL                          | -    | -    | -12   | dB   |      |
| Average Launched Power of Off Transmitter | Poff                         | -    | -    | -39   | dBm  | -    |
| Differential Input Voltage                | VIN-DIF                      | 300  | -    | 1600  | mV   | -    |
| Tx Disable Input Voltage-Low              | VIL                          | 0    | -    | 0.8   | V    | -    |
| Tx Disable Input Voltage-High             | VIH                          | 2.0  | -    | Vcc   | V    | -    |
| Output Eye                                | Compliant with ITU-T G.984.2 |      |      |       |      |      |
| Receiver                                  |                              |      |      |       |      |      |
| Parameter                                 | Symbol                       | Min. | Typ. | Max.  | Unit | Note |
| Operate Wavelength                        | -                            | 1260 | 1310 | 1360  | nm   | -    |
| Sensitivity                               | Pr                           | -    | -    | -32   | dBm  |      |
| Saturation                                | Ps                           | -12  | -    | -     | dBm  |      |
| LOS assert Level                          | -                            | -45  | -    | -     | dBm  | -    |
| LOS De-Assert Level                       | -                            | -    | -    | -30   | dBm  | -    |
| LOS Hysteresis                            | -                            | 0.5  | -    | 5     | dB   | -    |
| Receiver Optical Reflectance              | -                            | -    | -    | -12   | dB   | -    |
| Data Output Low                           | Vol                          | -2   | -    | -1.58 | V    | -    |
| Data Output High                          | Voh                          | -1.1 | -    | -0.74 | V    | -    |
| LOOutput Voltage-Low                      | VSD-L                        | 0    | -    | 0.8   | V    | -    |
| LOS Output Voltage-High                   | VSD-H                        | 2.0  | -    | Vcc   | V    |      |

Note:

1. Minimum Sensitivity and saturation levels for an NRZ 2<sup>23</sup>-1 PRBS. BER≤10<sup>-10</sup>, 1.244Gpbs, ER=9dB

## EEPROM Information

| Addr.<br>(decimal) | Field Size<br>(Bytes) | Name of Field      | Content (Hex)                                               | Content<br>(Decimal)                                     | Description                         |
|--------------------|-----------------------|--------------------|-------------------------------------------------------------|----------------------------------------------------------|-------------------------------------|
| 0                  | 1                     | Identifier         | 03                                                          | 3                                                        | SFP                                 |
| 1                  | 1                     | Ext. Identifier    | 04                                                          | 4                                                        | MOD4                                |
| 2                  | 1                     | Connector          | 01                                                          | 1                                                        | SC                                  |
| 3-10               | 8                     | Transceiver        | 00 00 00 80<br>00 00 00 00                                  | 00 00 00 128<br>00 00 00 00                              |                                     |
| 11                 | 1                     | Encoding           | 03                                                          | 3                                                        | NRZ                                 |
| 12                 | 1                     | BR, nominal        | 19                                                          | 25                                                       | 2.488Gbps                           |
| 13                 | 1                     | Reserved           | 00                                                          | 0                                                        | -                                   |
| 14                 | 1                     | Length<br>(9um)-km | 14                                                          | 20                                                       | 20/km                               |
| 15                 | 1                     | Length (9um)       | C8                                                          | 200                                                      | 20km                                |
| 16                 | 1                     | Length<br>(50um)   | 00                                                          | 0                                                        | -                                   |
| 17                 | 1                     | Length<br>(62.5um) | 00                                                          | 0                                                        | -                                   |
| 18                 | 1                     | Length<br>(copper) | 00                                                          | 0                                                        | -                                   |
| 19                 | 1                     | Reserved           | 00                                                          | 0                                                        | -                                   |
| 20-35              | 16                    | Vendor name        | 4F 45 4D 20 20<br>20<br>20 20 20 20 20<br>20<br>20 20 20 20 | 79 69 77 32 32<br>32 32 32 32 32<br>32 32 32 32 32<br>32 |                                     |
| 36                 | 1                     | Reserved           | 00                                                          | 0                                                        | -                                   |
| 37-39              | 3                     | Vendor OUI         | 00 00 00                                                    | 0 0 0                                                    | -                                   |
| 40-55              | 16                    | Vendor PN          | 5A 4C 35 34 33<br>32 30 41 39 2D<br>4B 43 53 51 20<br>20    | 90 76 53 52 51<br>50 48 65 57 45<br>75 67 83 81 32<br>32 | ‘AS60-PG43207-CPS<br>S9’<br>(ASCII) |
| 56-59              | 4                     | Vendor rev         | 30 30 30 20                                                 | 48 48 48 32                                              | “000” (ASCII)                       |
| 60-61              | 2                     | Wavelength         | 05 D2                                                       | 05 210                                                   | 1490                                |
| 62                 | 1                     | Reserved           | 00                                                          | 0                                                        | -                                   |
| 63                 | 1                     | CC BASE            | -                                                           | -                                                        | Check sum of bytes 0<br>- 62        |
| 64                 | 1                     | Reserved           | 00                                                          | 0                                                        |                                     |
| 65                 | 1                     | Options            | 1C                                                          | 28                                                       |                                     |
| 66                 | 1                     | BR, max            | 00                                                          | 0                                                        | -                                   |
| 67                 | 1                     | BR, min            | 00                                                          | 0                                                        | -                                   |
| 68-83              | 16                    | Vendor SN          | -                                                           | -                                                        | ASCII                               |

|        |     |                     |    |     |                                                   |
|--------|-----|---------------------|----|-----|---------------------------------------------------|
| 84-91  | 8   | Vendor date         | -  | -   | Year (2 bytes), Month (2 bytes), Day (2 bytes)    |
| 92     | 1   | DDM Type            | 60 | 96  | Internal Calibrated                               |
| 93     | 1   | Enhanced Option     | 80 | 128 | LOS, TX_FAULT and Alarm/warning flags implemented |
| 94     | 1   | SFF-8472 Compliance | 02 | 2   | SFF-8472 Rev 10.3                                 |
| 95     | 1   | CC EXT              | -  | -   | Check sum of bytes 64 - 94                        |
| 96-255 | 160 | Vendor spec         |    |     |                                                   |

## EEPROM Serial ID Memory Contents (A0h)

## Alarm and Warning Thresholds (Serial ID A2H)

| Parameter(Unit) | C Temp(°C) | Voltage(V) | Bias(mA) | TX Power(dBm) | RX Power(dBm) |
|-----------------|------------|------------|----------|---------------|---------------|
| High Alarm      | 100        | 3.6        | 80       | +8.16         | -12           |
| Low Alarm       | -10        | 3          | 1        | +5            | -32           |
| High Warning    | 95         | 3.5        | 70       | +8.1          | -13           |
| Low Warning     | 0          | 3.1        | 2        | +6            | -31           |

## Digital Diagnostic Monitor Accuracy

| Parameter            | Unit | Accuracy | Range                                                  | Calibration       |
|----------------------|------|----------|--------------------------------------------------------|-------------------|
| Tx Optical Power     | dB   | $\pm 3$  | Po: -Pomin~Pomax dBm, Recommended operation conditions | External/Internal |
| Rx Optical Power     | dB   | $\pm 3$  | Pi: Ps~Pr dBm, Recommended operation conditions        | External/Internal |
| Bias Current         | %    | $\pm 10$ | Id: 1-100mA, Recommended operating conditions          | External/Internal |
| Power Supply Voltage | %    | $\pm 3$  | Recommended operating conditions                       | External/Internal |
| Internal Temperature | °C   | $\pm 3$  | Recommended operating conditions                       | External/Internal |

## PIN Diagram

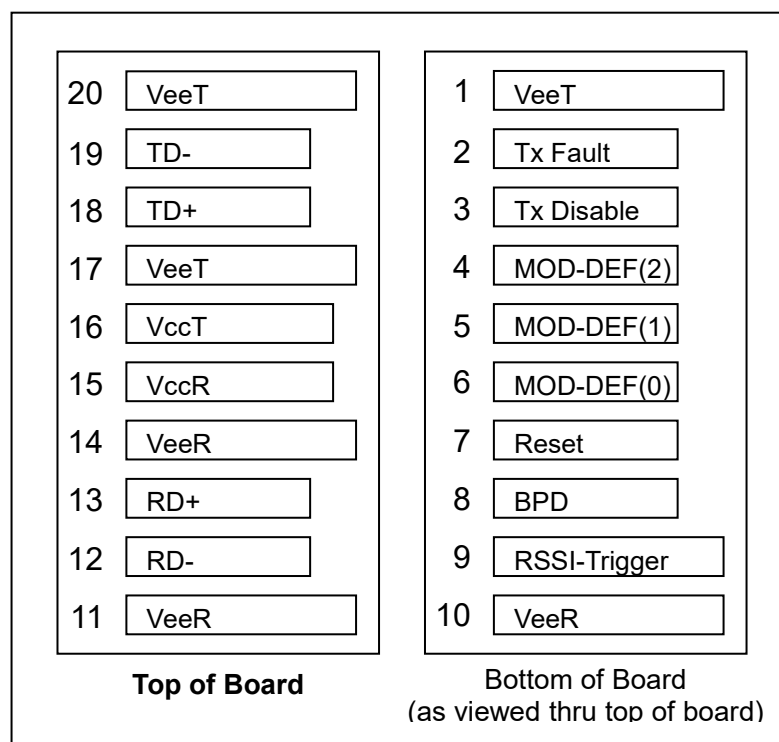


Fig 3

## PIN Description

| Pin No. | Name         | Function                            | Plug Seq. | Notes  |
|---------|--------------|-------------------------------------|-----------|--------|
| 1       | VeeT         | Transmitter Ground                  | 1         |        |
| 2       | Tx Fault     | Transmitter Fault Indication        | 3         | Note 1 |
| 3       | Tx Disable   | Transmitter Disable                 | 3         | Note 2 |
| 4       | MOD-DEF2     | Module Definition 2                 | 3         | Note 3 |
| 5       | MOD-DEF1     | Module Definition 1                 | 3         | Note 3 |
| 6       | MOD-DEF0     | Module Definition 0                 | 3         | Note 3 |
| 7       | Reset        | Reset signal input                  | 3         |        |
| 8       | BPD          | Burst Power Detect (active HIGH)    | 3         | Note 4 |
| 9       | RSSI-Trigger | Receiver Signal Strength Indication | 1         |        |
| 10      | VeeR         | Receiver Ground                     | 1         | Note 5 |
| 11      | VeeR         | Receiver Ground                     | 1         | Note 5 |
| 12      | RD-          | Inv. Receiver Data Out              | 3         | Note 6 |
| 13      | RD+          | Receiver Data Out                   | 3         | Note 6 |

|    |      |                          |   |                  |
|----|------|--------------------------|---|------------------|
| 14 | VeeR | Receiver Ground          | 1 | Note 5           |
| 15 | VccR | Receiver Power Supply    | 2 | Note 7, 3.3V± 5% |
| 16 | VccT | Transmitter Power Supply | 2 | Note 7, 3.3V± 5% |
| 17 | VeeT | Transmitter Ground       | 1 | Note 5           |
| 18 | TD+  | Transmitter Data In      | 3 | Note 8           |
| 19 | TD-  | Inv.Transmitter Data In  | 3 | Note 8           |
| 20 | VeeT | Transmitter Ground       | 1 | Note 5           |

## Notes:

1. TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10K  $\Omega$  resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2. TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 – 10 K  $\Omega$  resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3. Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10K  $\Omega$  resistor on the host board. The pull-up voltage shall be VccT or VccR.

Mod-Def 0 is grounded by the module to indicate that the module is present

Mod-Def 1 is the clock line of two wire serial interface for serial ID

Mod-Def 2 is the data line of two wire serial interface for serial ID

4. BPD is pulled up internally with a 4.7K – 10K  $\Omega$  resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When LOW, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). HIGH indicates normal operation. In the low state, the output will be pulled to < 0.8V.

5. VeeR and VeeT may be internally connected within the SFP module.

6. RD-/+: These are the differential receiver outputs. They are DC coupled 100  $\Omega$  differential lines which should be terminated with 100  $\Omega$  (differential) at the user SERDES.

7. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ± 5% at the SFP connector pin. Maximum supply current is 450mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1  $\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

8. TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100  $\Omega$  differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

## Package Diagram

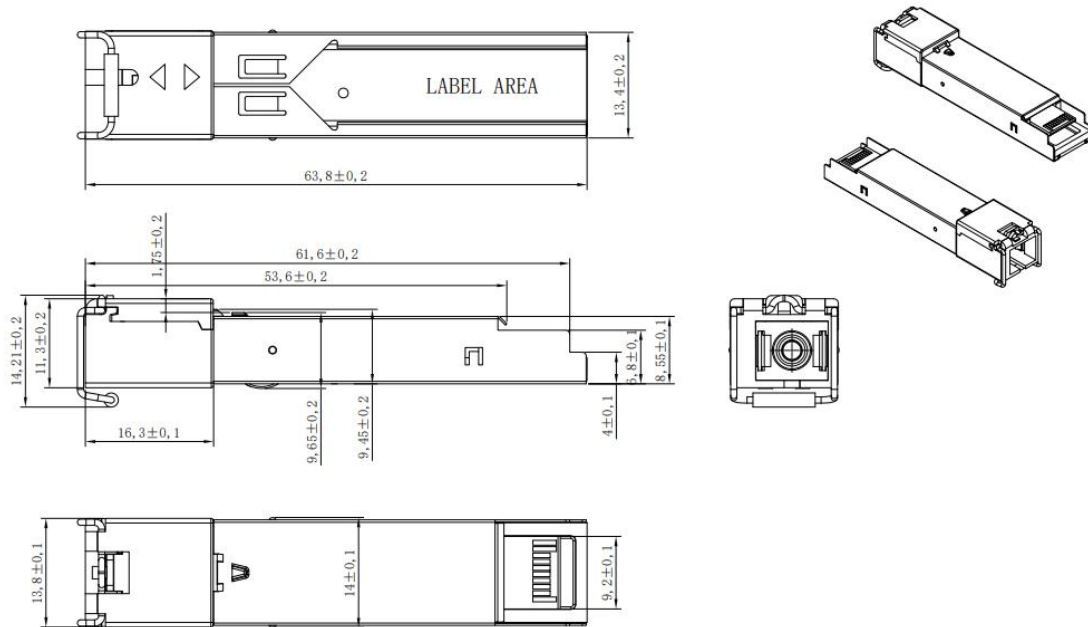


Fig 4

## Recommended Circuit

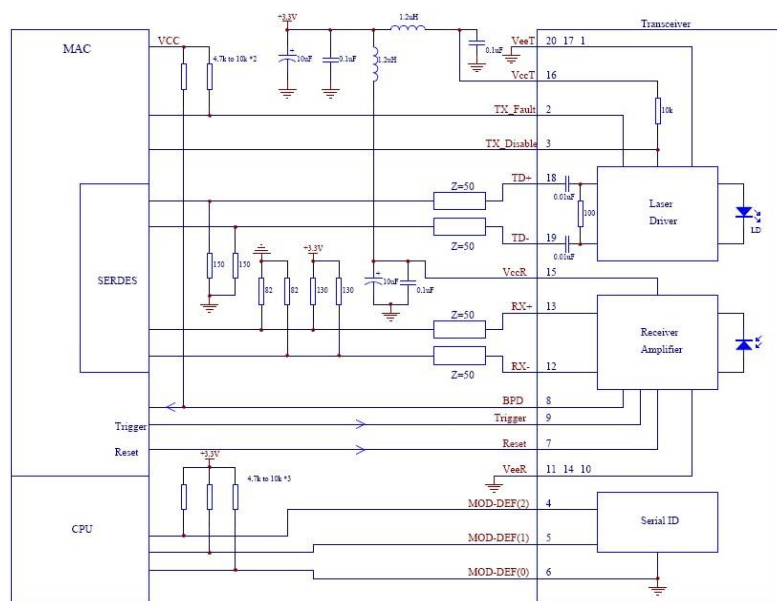


Fig 5

## Timing Parameter Definition

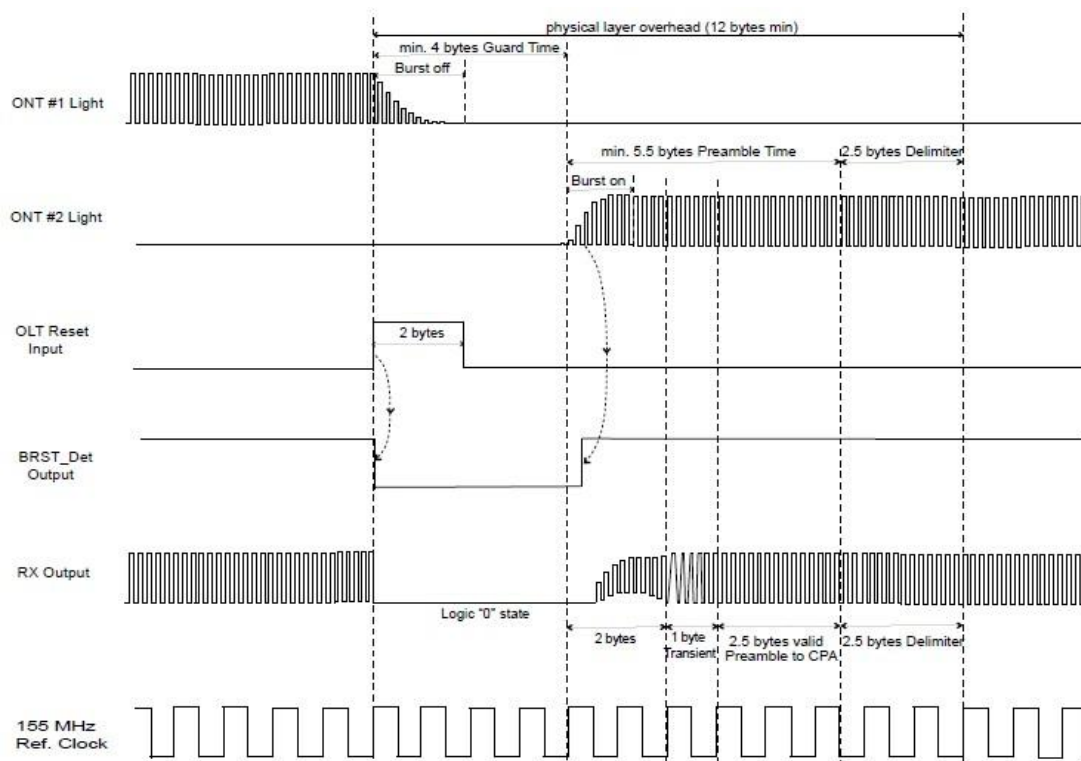
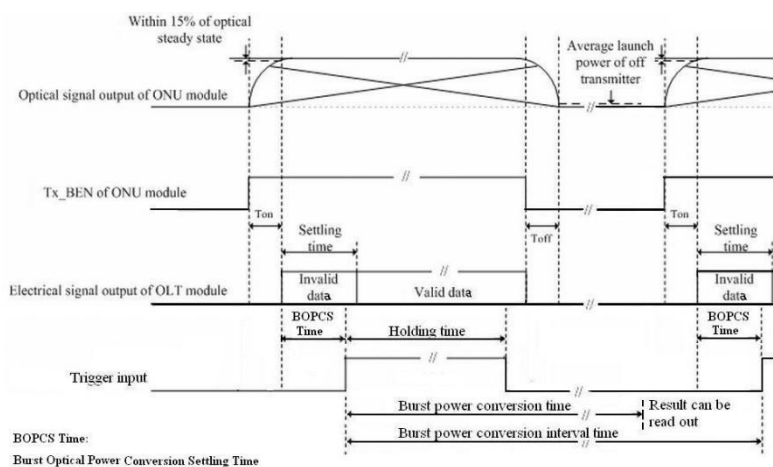


Fig6 Time parameter definition in GPON system

## Timing Of Digital RSSI



Fi7 Trigger sequence definition in GPON system



| PARAMETER                    | SYMBOL          | MIN | TYP | MAX | UNITS |
|------------------------------|-----------------|-----|-----|-----|-------|
| Packet Length                | -               | 600 | -   | -   | ns    |
| Trigger delay                | BOPCS           | 100 | -   | -   | ns    |
| RSSI Trigger and Sample Time | Holding Time    | 400 | -   | -   | ns    |
| Internal delay               | Conversion time | 500 | -   | -   | us    |