# Alpha Bridge SFP AB-XPON-ST-1Datasheet

## Features

- Single fiber bi-directional data links GPON ONU and EPON ONU application with XPON MAC

- SC/UPC receptacle SFP with PON ONU MAC inside, "Plug-and-play" via auto-discovery and configuration

- 1310nm DFB burst mode transmitter, 1490nm TIA continuous mode receiver.

- Single 3.3V power supply

- Digital diagnostic monitor interface compatible with SFF-8472

- SFP MSA compliance

- Low EMI and excellent ESD protection

- Class I laser safety standard IEC-60825 compliant

- RoHS compliance

- XPON stick compatible with GPON and EPON system.

- Complies with SFP Multi-Source Agreement (MSA) SFF-8074i.

- Complies with ITUT-T G.984.2, G.984.2 Amendment 1

- Complies with ITUT G.988 ONU management and control interface (OMCI) specification.

- Complies with IEEE802.3AH

- Complies with SGMII and 1000BASE-X.

## Applications

- Passive Optical Networks (PON)

- The product is an MSA-compliant SFP that incorporates not just the optics for an ONU, but all of the electronics need as well. It is a "PON on a Stick" that an entire FTTH ONU in a slightly oversized SFP. It can be plugged into networking equipment. Allowing the data interfaces on a switch, router, etc. to be customized for different fiber environments and distance requirements.
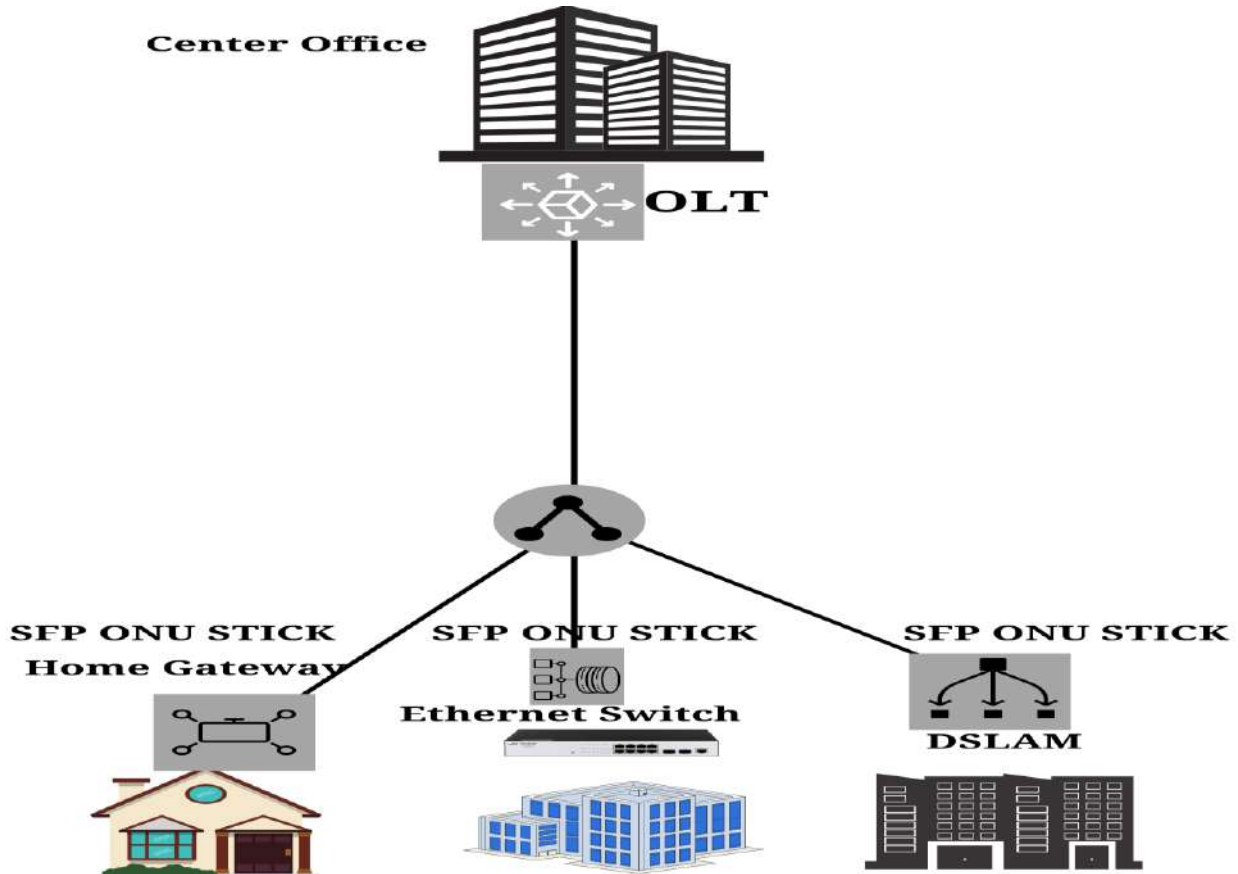
## Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit | Notes |
|-----------|--------|------|------|------|-------|
| Storage Ambient Temperature | TSTG | -40 | 85 | °C | |
| Operating Case Temperature | Tc | 0 | 70 | °C | |
| | Tc | -40 | 85 | °C | |
| Operating Humidity | OH | 5 | 95 | % | |
| Power Supply Voltage | VCC | -0.5 | 3.6 | V | |

## Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|-----------|--------|------|------|------|------|-------|
| Power Supply Voltage | VCC | 3.13 | 3.3 | 3.47 | V | |
| Power Dissipation | PD | - | 2.10 | 2.5 | W | Max value under Hightemp environment |
| Operating Case Temperature | Tc | 0 | | +70 | °C | |
| | Tc | -40 | | +85 | °C | |
| Operating Humidity Range | OH | 5 | | 95 | % | |
| Data Rate | | | TX:1.244 /RX:2.488 | | Gbit/s | GPON MODE |
| | | | TX:1.25 / RX:1.25 | | | EPON MODE |
| Data Rate Drift | | -100 | | +100 | PPM | |

## TRANSMITTER OPTICAL CHARACTERISTICS

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Optical Center Wavelength | $\lambda$C | 1290 | 1310 | 1330 | nm | |
| Spectral Width (-20dB) | $\Delta\lambda$ | | | 1 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Average Launch Optical Power | AOP | 0.5 | | 4 | dBm | Launched into SMF Fiber |
| Burst off Average Output Power | | | | -45 | dBm | |
| Extinction Ratio | ER | 10 | | | dB | |
| Rise/Fall Time (20%-80%) | TR/TF | | | 0.26 | ns | Unfiltered PRBS $2^{23}-1$@1244.16 Mbps |
| RIN15OMA | | | | -115 | dB/Hz | |
| Optical Return Loss Tolerance | | -15 | | | dB | |
| Transmitter Reflectance | | | | -10 | dB | |
| Transmitter and Dispersion Penalty | TDP | | | 1 | dB | Transmit on 20km SMF. |
| Optical Waveform Diagram | Compliant With ITU-T G984.2 | | | | | PRBS $2^{23}-1$ @1244.16Mbps |
| | | | | | | |

## TRANSMITTER ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Data Input Differential Swing | | 300 | | 1800 | mV | CML input, AC coupled |
| Input Differential Impedance | | 90 | 100 | 110 | Ω | |
| Transmitter TxDisable ControlVoltage - | | 0 | | 0.8 | V | |
| Transmitter TxDisable Voltage - High | | 2.0 | | VCC | V | |
| Transmitter Fault Alarm Voltage - Low | | 0 | | 0.4 | V | |
| Transmitter Fault Alarm Voltage –High | | 2.4 | | Vcc | V | |

## RECEIVER OPTICAL CHARACTERISTICS

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|

| Operating Wavelength | $\lambda c$ | 1480 | 1490 | 1500 | nm | |
|---|---|---|---|---|---|---|
| Sensitivity | SEN | | | -28 | dBm | PRBS $2^{23}$ - 1 @1G~2.5Gbps |
| Saturation Optical Power | SAT | -8 | | | dBm | |
| Loss of Signal De-Assert | LOSD | | | -29 | dBm | |
| Loss of Signal Assert | LOSA | -40 | | | dBm | |
| Signal-Detected Hysteresis | | 0.5 | | 6 | dBm | |
| Receiver Reflectance | | | | -12 | dB | $\lambda$=1490nm |
| WDM Filter Isolation | | 38 | | | dB | $\lambda$=1550nm |
| | | 35 | | | dB | $\lambda$=1650nm |

## RECEIVER ELECTRIAL CHARACTERISTICS

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Data Output Differential Swing | | 300 | | 1200 | mV | CML output, AC coupled |
| Loss of Signal - Low | | 0 | | 0.4 | V | |
| Loss of Signal - High | | 2.4 | | VCC | V | |

## PIN DESCRIPTION

| PIN | Name | Description | Notes |
|---|---|---|---|
| 1 | VeeT | Transmitter Ground | Note 5 |
| 2 | TX Fault | Transmitter Fault Indication | Note 1 |
| 3 | TX Disable | NC | |
| 4 | MOD-DEF2 | Module Definition 2 | Note 3,2 wire serial ID Interface |
| 5 | MOD-DEF1 | Module Definition 1 | Note 3,2 wire serial ID Interface |
| 6 | MOD-DEF0 | Module Definition 0 | Note 3 Grounded in Module |
| 7 | Rate | NC | - |
| 8 | LOS | Loss of Signal | Note 4 |
| 9 | VeeR | Receiver Ground | Note 5 |

| 10 | VeeR | Receiver Ground | Note 5 |
|----|------|-----------------|--------|
| 11 | VeeR | Receiver Ground | Note 5 |
| 12 | RD- | Inv. Received DataOut | Note 6 |
| 13 | RD+ | Received Data Out | Note 6 |
| 14 | VeeR | Receiver Ground | Note 5 |
| 15 | VccR | Receiver Power | 3.3 ±5%, Note 7 |
| 16 | VccT | Transmitter Power | 3.3 ±5%, Note |
| 17 | VeeT | Transmitter Ground | Note 5 |
| 18 | TD+ | Transmit Data In | Note 8 |
| 19 | TD- | Inv.Transmit Data In | Note 8 |
| 20 | VeeT | Transmitter Ground | Note 5 |
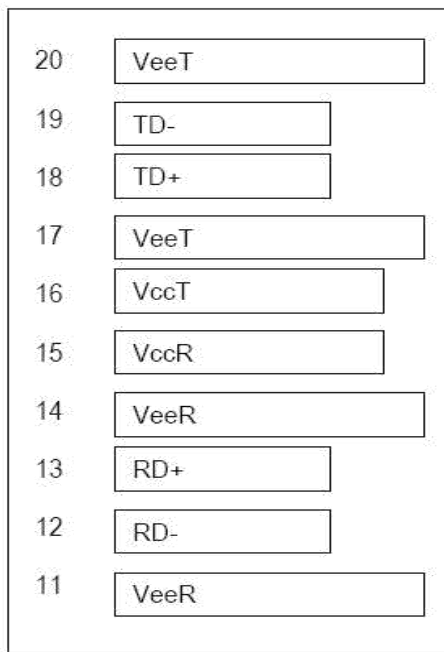


Top of Board
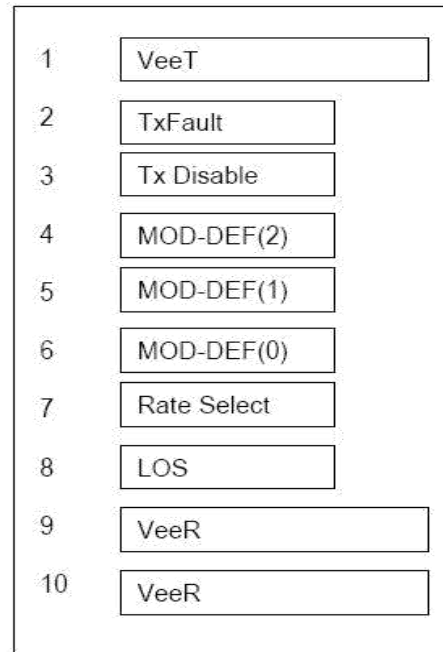
Bottom of Board (as viewed thru top of board)

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ 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: This pin is no function for SFP STICK

3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10KΩ 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 presentMod-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) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low 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 AC coupled 100 Ω differential lines which should be terminated with 100

Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 – 1000 mV single ended) when properly terminated.
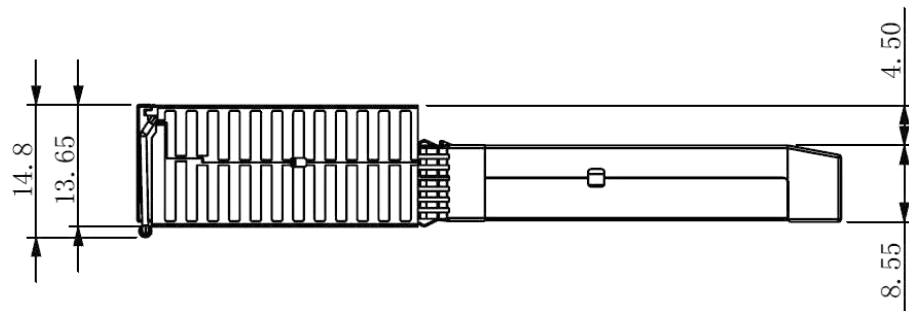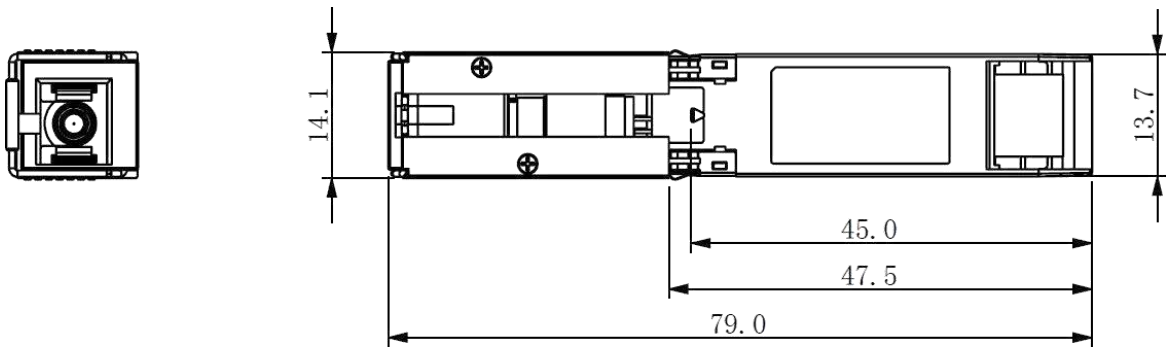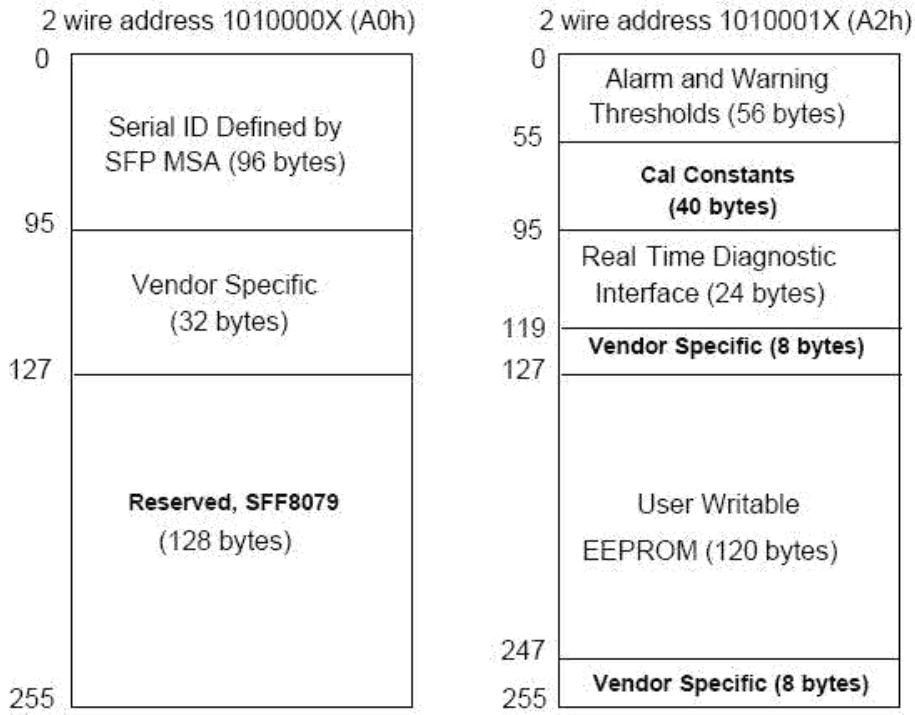
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 300 mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1Ω=should be used in order to maintain the 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 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 500 – 2400 mV (250 – 1200 mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 – 600 mV single-ended) be used for best EMI performance.

### Recommended Host Board Supply Filtering Network
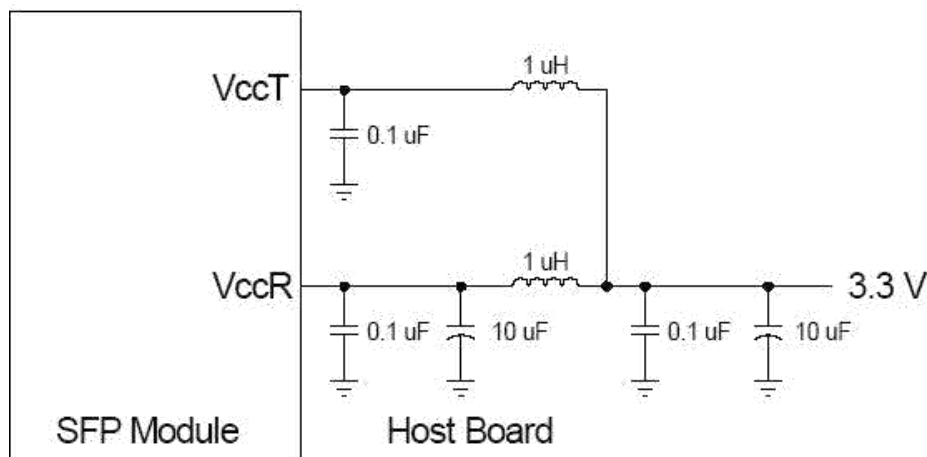


### DESCRIPTION OF EEPROM ADDRESS A0H AND A2H

SFP ONU uses the two-wire serial bus to access two blocks of 256-byte EEPROM address 1010000X (A0h) and 1010001X (A2h), A0h stores static information including product and vendor IDs and A2h provides diagnostic information about the module's present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. The below figure shows the detail descriptions of A0h and A2h. All this information is not only accessible by a local host equipment into which the EPON Stick is plugged, but also can be retrieved by OLT remotely through EPON OAM messages.

## 2 wire address 1010000X (A0h)

| 0 | |
|---|---|
| | Serial ID Defined by SFP MSA (96 bytes) |
| 95 | |
| | Vendor Specific (32 bytes) |
| 127 | |
| | Reserved, SFF8079 (128 bytes) |
| 255 | |

## 2 wire address 1010001X (A2h)

| 0 | |
|---|---|
| | Alarm and Warning Thresholds (56 bytes) |
| 55 | |
| | **Cal Constants (40 bytes)** |
| 95 | |
| | Real Time Diagnostic Interface (24 bytes) |
| 119 | |
| | **Vendor Specific (8 bytes)** |
| 127 | |
| | User Writable EEPROM (120 bytes) |
| 247 | |
| | **Vendor Specific (8 bytes)** |
| 255 | |

## Mechanical Specification

| | | | | |
|---|---|---|---|---|
| 14(0E) | 1 | Length (9m) | 14 | 20(km) |
| 15(0F) | 1 | Length (9m) | C8 | 200(100m |
| 16(10) | 1 | Length (50um) | 00 | |
| 17(11) | 1 | Length (62.5um) | 00 | |
| 18(12) | 1 | Length (Copper) | 00 | |
| 19(13) | 1 | Reserved | 00 | |
| 20(14) | | | -- | -- |
| 21(15) | | | -- | -- |
| 22(16) | | | -- | -- |
| 23(17) | | | -- | -- |
| 24(18) | | | -- | -- |
| 25(19) | | | -- | -- |
| 26(1A) | | | -- | -- |
| 27(1B) | | | -- | -- |
| 28(1C) | 16 | Vendor name | | |
| 29(1D) | | | | |
| 30(1E) | | | | |
| 31(1F) | | | | |

## EEPROM INFORMATION

| Data Addr | Field Size (Byte) | Name Of filed | Hex | Coded value |
|---|---|---|---|---|
| 0(00) | 1 | Identifier | 03 | SFP |
| 1(01) | 1 | Ext. Identifier | 04 | GBIC/SFP function is defined byserial ID |
| 2(02) | 1 | Connector | 01 | SC |
| 3(03) | 8 | Transceiver (Note 3) | 00 | |
| 4(04) | | | 00 | |
| 5(05) | | | 00 | |
| 6(06) | | | 02 | |
| 7(0X07) | | | 00 | |
| 8(0X08) | | | 00 | |
| 9(0X09) | | | 00 | |
| 10(0X0A) | | | 00 | |
| 11(0X0B) | 1 | Encoding | 03 | NRZ |
| 12(0C) | 1 | BR, Nominal | 0C | 1.244GH |
| 13(0D) | 1 | Reserved | 00 | |

| | | | | |
|---|---|---|---|---|
| 32(20) | | | | |
| 33(21) | | | | |
| 34(22) | | | | |
| 35(23) | | | | |
| 36(24) | 1 | Reserved | 00 | |
| 37(25) | | | 00 | |
| 38(26) | 3 | Vendor OUI | 00 | |
| 39(27) | | | 00 | |
| 40(28) | 16 | Vendor | -- | X |
| 41(29) | | | -- | X |
| 42(2A) | | PN(Note) | -- | X |
| 43(2B) | | | -- | X |
| 44(2C) | | | -- | X |
| 45(2D) | | | -- | X |
| 46(2E) | | | -- | X |
| 47(2F) | | | -- | X |
| 48(30) | | | -- | - |
| 49(31) | | | -- | X |
| 50(32) | | | -- | X |
| 51(33) | | | -- | X |
| 52(34) | | | -- | X |
| 53(35) | | | -- | <space> |
| 54(36) | | | -- | <space> |
| 55(37) | | | -- | <space> |
| 56(38) | | | 31 | 1 |
| 57(39) | | Vendor | 30 | 0 |
| 58(3A) | | | 20 | <space> |
| 59(3B) | | | 20 | <space> |
| 60(3C) | 2 | Wavelength | 05 | 1310nm |
| 61(3D) | | | 1E | |
| 62(3E) | 1 | Reserved | 00 | |
| 63(3F) | 1 | CC_BASE | 00 | Note1 |
| 64(40) | 2 | Options | 00 | TX_FAULT, LOS |
| 65(41) | | | 0A | |
| 66(42) | 1 | BR, max | 00 | |
| 67(43) | 1 | BR, min | 00 | |
| 68(44) | | | FF | |
| 69(45) | | | FF | |
| 70(46) | | | FF | |
| 71(47) | | | FF | |

| | | | | |
|---|---|---|---|---|
| 72(48) | | | FF | |
| 73(49) | | | FF | |
| 74(4A) | | | FF | |
| 75(4B) | | | FF | |
| 76(4C) | | | FF | |
| 77(4D) | 16 | VendorSN (Note3) | FF | |
| 78(4E) | | | FF | |
| 79(4F) | | | FF | |
| 80(50) | | | FF | |
| 81(51) | | | FF | |
| 82(52) | | | FF | |
| 83(53) | | | FF | |
| 84(54) | 8 | Datecode (Note3) | xx | Year |
| 85(55) | | | xx | Year |
| 86(56) | | | xx | Month |
| 87(57) | | | xx | Month |
| 88(58) | | | xx | Day |
| 89(59) | | | xx | Day |
| 90(5A) | | | 20 | <Space> |
| 91(5B) | | | 20 | <Space> |
| 92(5C) | 1 | Diagnostic | 68 | DD Implemented; Internally |
| 93(5D) | 1 | Enhanced Options | B0 | Optional Alarm/warningFlags |
| 94(5E) | 1 | SFF-8472 Compliance | 02 | Rev 9.4of SFF-8472. |
| 95(5F) | 1 | CC_EXT | FF | Note 2 |

1) The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte.

2) The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte 64 to byte 94, inclusive.

3) The value is reference date, it will be assigned accord to the module's actual situation A2H

| | | | | |
|---|---|---|---|---|
| | TX_DISABLE_STATE | TX_DISABLE_STATE | | - |
| | SOFT_TX_DISABLE | Enables direct control of the transmitter via I2C | | Disable |
| | ROGUE_ONU | Set this bit to"1" on the occurrence of a rogue ONU condition. Set to "0" to reset. | | - |
| | N/A | | | - |

| 110(6E) | ROGUE_TXP_LO_FLAG | Set to 1 when TXP_LO_FLAG has been set in Rogue_TXP_LO_EN bit enable. | X X | - |
|---|---|---|---|---|
| | TX_FAULT_STATE | TX_FAULT_STATE | | - |
| | RX_LOS_STATE | RX_LOS_STATE | | - |
| | DATA_READY_BAR_STATE | Indicates LDD has achieved power and data is ready. Bit stays high until data is ready at which time the LDD sets this bit low | | - |
| 111(6F) | N/A | | 4 0 | - |
| | TX_FAST_SLEEP | Default "0" means on de-assert of TX_SLEEP, Tx implements a reset start. Set to "1" enable theTx to use the last known bias & mod values. | | Set to "1" enable the Tx to use the lastknown bias & mod values. |
| | RX_SLEEP_ASSERT | Set to 1　　enable RX_SLEEP mode | | disable |
| | RX_SLEEP_STATE | RX_SLEEP_STATE | | - |
| | TX_SLEEP_STATE | TX_SLEEP_STATE | | - |
| | POW_LEV | Sets the GPON power leveling control | | 00=0dB |
| | Alarm_flags1 | alarm & warning flags | | 00 |
| | Alarm_flags2 | alarm & warning flags | | 00 |
| | Rogue　　ONU Timer Setup | Sets the interval time for counters located at 78h and 　　　79h.4 values are avialable.80h=40ms,40h=80ms,20h=160 | | set as 80h=40ms |
| | Reserved | | | |
| | Reserved | | | |
| | Warning_flag1 | alarm & warning flags | | xx |
| | Warning_flag2 | alarm & warning flags | | xx |
| | Reserved | | | |
| | unallocated | | | |
| | Reserved | Reserved for debug information | | |

## DIGITAL DIAGNOSTIC MONITORING INTERFACE

| Parameter | Range | Accuracy | Calibration |
|---|---|---|---|
| Temperature | -40 to 85°C ( I Temp) | ±3°C | Internal |
| | 0 to 70°C(C Temp) | ±3°C | Internal |
| Voltage | 0 to 3.7V | ±3% | Internal |
| Bias Current | 0 to 130mA | ±10% | Internal |
| TX Power | -10 to 8 dBm | ±2dB | Internal |
| RX Power monitor | -30 to -8 dBm | ±2dB | Internal |

| Model Number | Part Number | Reach | Input/Output | Signal Detect | Voltage | Temperature |
|---|---|---|---|---|---|---|
| AB-XPON-ST-1 | OPAX-MX1-85-CT | 100m | AC/AC | TTL | 3.3V | 0°C to 70 °C |

Note: All information contained in this document is subject to change without notice.