



Features

- Single Fiber, Integrated Diplexer Transceiver
- 2x10 SFF pinout supports I²C digital diagnostics
- Voice/Data FTTx ONT/ONU Applications
- Compliant to FSAN G.984.5 Specifications
- 1244 Mbps Tx, 2488 Mbps Rx Asymmetric Data Rate
- 1310 nm Tx, 1490 nm Rx
- Burst Mode Transmission
- Commercial temperature versions available
- 28 dB link budget; 20 km reach
- TX Burst Mode Detection, TX_SD
- Compliant to IEC-60825 Class 1 laser diode
- SC/APC fiber connector
- RoHS compliant
- Internal Calibration

Regulatory Compliance

Table 1 – Regulatory Compliance

| Feature | Standard | Performance |
|---|--|---|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883E Method 3015.7 | Class 1(>500V for XFI pins, >2000V for other pins.) |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2 GR-1089-CORE | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B | Compatible with standards |
| Immunity | IEC 61000-4-3 | Compatible with standards |
| Laser Eye Safety | FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2 | Compatible with Class I laser product. |
| RoHS | 2002/95/EC 4.1&4.2 2005/747/EC | Compliant with standards ^{note} |

Note:

In light of item 5 in Annex of 2002/95/EC, “Pb in the glass of cathode ray tubes, electronic components and fluorescent tubes.” and item 13 in Annex of 2005/747/EC, “Lead and cadmium in optical and filter glass.”, the two exemptions are being concerned for Source Photonics transceivers, because Source Photonics transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

Absolute Maximum Ratings

Table 2 – Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|-----------------------------|--------------------|------|---------|-----------------------|------|-------|
| Storage Temperature | T _s | -40 | - | +85 | °C | |
| Supply Voltage | V _{CC_Rx} | -0.4 | - | +4.2 | V | |
| | V _{CC_Tx} | -0.4 | - | V _{CC_Rx} +1 | V | |
| Operating Relative Humidity | RH | 5 | - | 95 | % | |

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|--------------------------------|-----------------|------|---------|--------|------|-------|
| Operating Case Temperature | T _C | 0 | - | 70 | °C | |
| Operating Voltage | V _{CC} | 3.14 | 3.30 | 3.46 | V | |
| Total TX and RX Supply Current | I _{CC} | - | - | 400 | mA | |
| Power Dissipation | P _D | - | - | 1.5 | W | |
| Bit Rate(Tx) | BR | - | 1244.16 | - | Mbps | |
| Bit Rate(Rx) | BR | - | 2488.32 | - | Mbps | |
| Transmission Distance | TD | - | - | 20,000 | m | |

Optical Characteristics

Table 4 – Optical Characteristics

| Transmitter | | | | | | |
|-------------------------------------|---------------------------------|------|---------|------|------|-------|
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Center Wavelength Range | λ _C | 1290 | - | 1330 | nm | |
| Average Output Power | P _{OUT} | 0.5 | - | 5 | dBm | |
| Average Output Power (Laser Off) | P _{OUT-OFF} | - | - | -45 | dBm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Spectral Width (-20dB) | λ ₂₀ | - | - | 1 | nm | |
| Extinction Ratio | ER | 10 | - | - | dB | 1 |
| Optical Rise and Fall Time(20%-80%) | T _R /T _F | - | 250 | - | ps | |
| Jitter Generation | JG | - | - | 0.2 | UI | 2 |
| Transmitter Output Eye | Compliant with G.984.2 Figure 3 | | | | | |
| Receiver | | | | | | |
| Center Wavelength Range | λ _C | 1480 | - | 1500 | nm | |

| | | | | | | |
|--|---------------|-----|-----|-----|-----|---|
| Received Optical Power | P_{in} | -28 | - | -8 | dBm | 3 |
| Data Output Rise and Fall Time (20% to 80%) | T_R/T_F | - | 160 | - | ps | |
| Signal Detect Assertion Level | SDA | - | - | -31 | dBm | |
| Signal Detect De-Assertion Level | SDD | -45 | - | - | dBm | |
| Hysteresis | $P_{SDA-SDD}$ | 0.5 | - | 6 | dB | |
| RSSI Accuracy | RSSI | -3 | - | +3 | dB | |
| 1310nm Tx to 1490nm Rx Crosstalk | | - | - | -47 | dB | |
| 1555nm Rx to 1490nm Isolation | | 30 | - | - | dB | |
| G.984.5 Wavelength Blocking Filter Isolation | | 30 | - | - | dB | |

Notes:

1. Measured with a PRBS $2^{23}-1$, NRZ, 50% duty cycle.
2. 4kHz to 10MHz
3. Measured with a PRBS $2^{31}-1$, 50% duty cycle.

Electrical Characteristics

Table 5 – Electrical Characteristics

| Transmitter | | | | | | |
|-----------------------------------|-----------------------|------|---------|-------|----------|-------|
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Differential Data Input Amplitude | $V_{IN,P-P}$ | 200 | - | 2400 | mVpp | 4 |
| Input Differential Impedance | Z_{IN} | - | 100 | - | Ω | 5 |
| Tx Burst Enable Time | T_{BURST_EN} | - | - | 12.86 | ns | 6 |
| Tx Burst Disable Time | T_{BURST_DIS} | - | - | 12.86 | ns | 6 |
| Tx_BRST Voltage - Low | $V_{TX_ENB_Low}$ | 0 | - | 0.8 | V | |
| Tx_BRST Voltage – High | $V_{TX_ENB_Hith}$ | 2.0 | - | Vcc | V | |
| Tx_SD timing “D” | T_{TX_SD-D} | - | - | 1000 | nS | 7 |
| Tx_SD timing “X” | T_{TX_SD-X} | - | - | 350 | nS | 7 |
| Tx_SD Startup Time | $T_{TX_SD_Startup}$ | - | - | 3 | S | 7 |
| Receiver | | | | | | |
| Differential Output Voltage | | 300 | - | 1200 | mV | 8 |
| Signal Detect Output HIGH Voltage | V_{SD_High} | 2.4 | - | - | V | 9 |
| Signal Detect Output LOW Voltage | V_{SD_Low} | - | - | 0.6 | V | 10 |
| Data Output Rise and Fall Time | T_R/T_F | - | 160 | - | ps | |

Notes:

4. TxD+/- DC-coupled.
5. TxD+/-
6. 16 bits data @1244Mbps
7. Tx_SD:

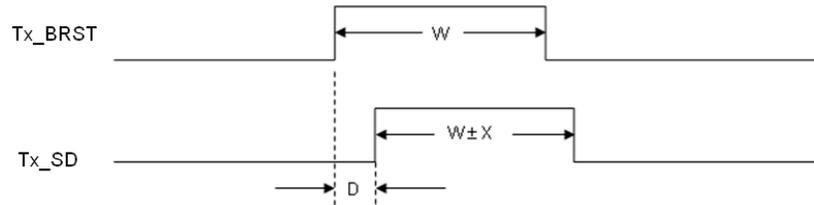


Figure 1, Tx_SD Timing diagram

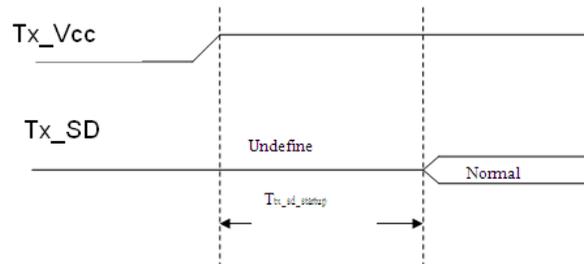


Figure 2, Tx_SD Startup Timing diagram

8. CML output, AC coupled(0.1μF)
9. LVTTTL with internal 10kΩ pull up resistor. Asserts HIGH when input data amplitude is above threshold.
10. LVTTTL. De-asserts LOW when input data amplitude is below threshold.

Recommended Interface Circuit

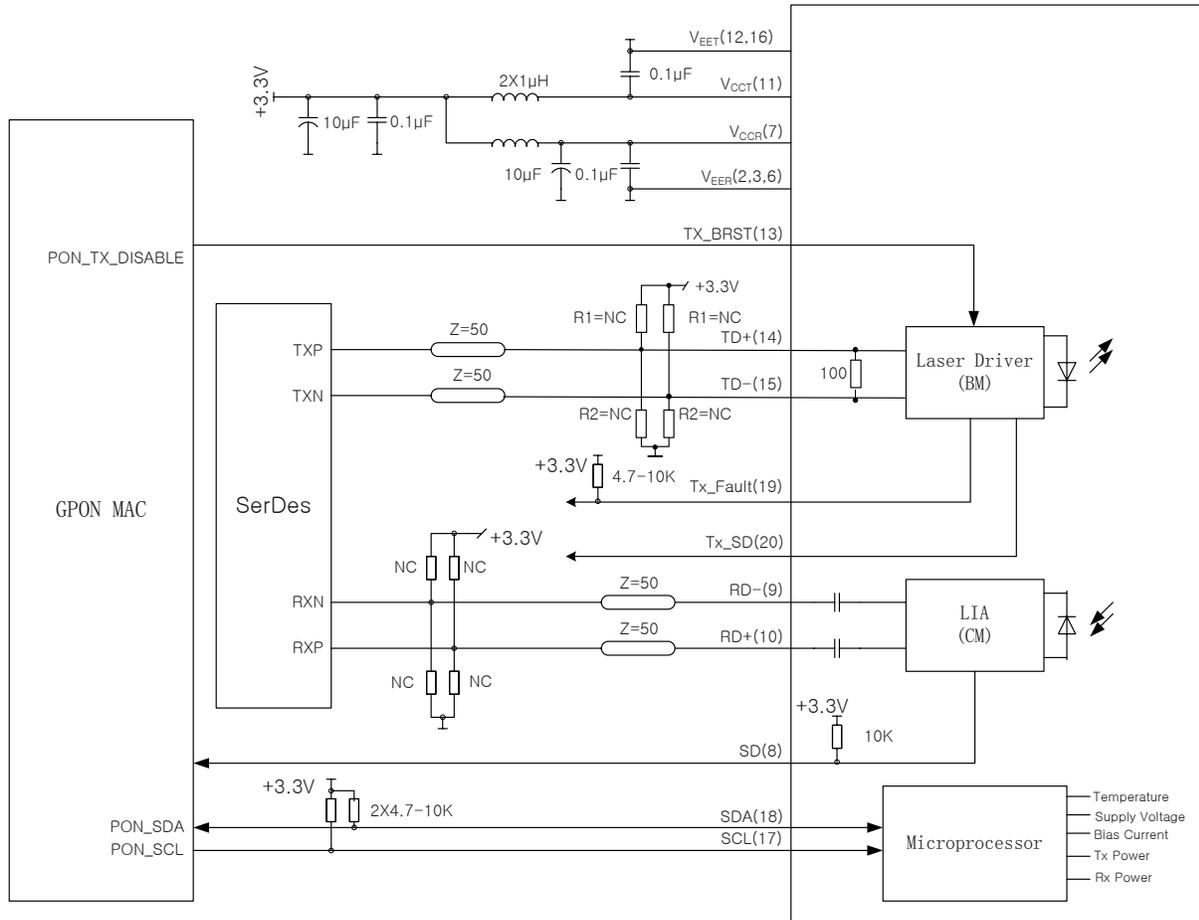


Figure 3, Recommended Interface Circuit

Pin Definitions

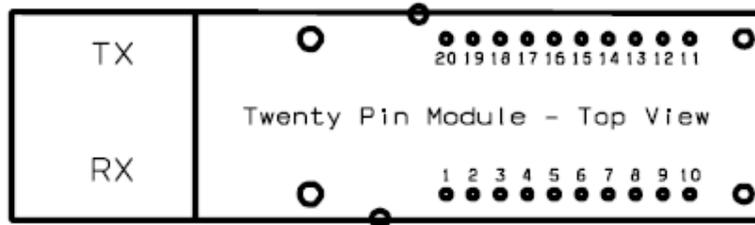


Figure 4, Pin View

Table 6 – Pin definitions

| Pin | Logic | Symbol | Name/Description | Note |
|-----|-----------|----------|--|------|
| 1 | NA | NC | No User Connection | |
| 2 | NA | GND_Rx | Digital Rx ground | |
| 3 | NA | GND_Rx | Digital Rx ground | |
| 4 | NA | NC | Reserved, No User Connection | |
| 5 | NA | NC | Reserved, No User Connection | |
| 6 | NA | GND_Rx | Digital Rx Ground | |
| 7 | NA | Vcc_Rx | Digital Rx Vcc | |
| 8 | LVTTL-O | SD | Signal Detect output, pull up internally (4.7kΩ). Asserts high when input optical power level is above threshold | |
| 9 | CML-O | RxD- | RX data bar output, CML. 50Ω terminated to Vcc and AC coupled to module output (0.1μF) | |
| 10 | CML-O | RxD+ | RX data output, CML. 50Ω terminated to Vcc and AC coupled to module output (0.1μF) | |
| 11 | NA | Vcc_Tx | Digital Tx Vcc | |
| 12 | NA | GND_Tx | Digital Tx Ground | |
| 13 | LVTTL-I | Tx_BRST | Tx Burst Enable. LVTTL Input (1=TX on, 0=TX off) | |
| 14 | CML-I | TxD+ | Tx data input, CML. Internally DC coupled. 100Ω differential termination. | |
| 15 | CML-I | TxD- | Tx data bar input, CML. Internally DC coupled. 100Ω differential termination. | |
| 16 | NA | GND_Tx | Digital Tx Ground | |
| 17 | LVTTL-I | SCL | I ² C Clock input | 1 |
| 18 | LVTTL-I/O | SDA | I ² C Data input/output | 1 |
| 19 | LVTTL-O | Tx_Fault | Module Transmitter Fault | |
| 20 | LVTTL-O | Tx_SD | Tx signal detect | |

Note

1. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10K ohms to a Host_Vcc on the host board.

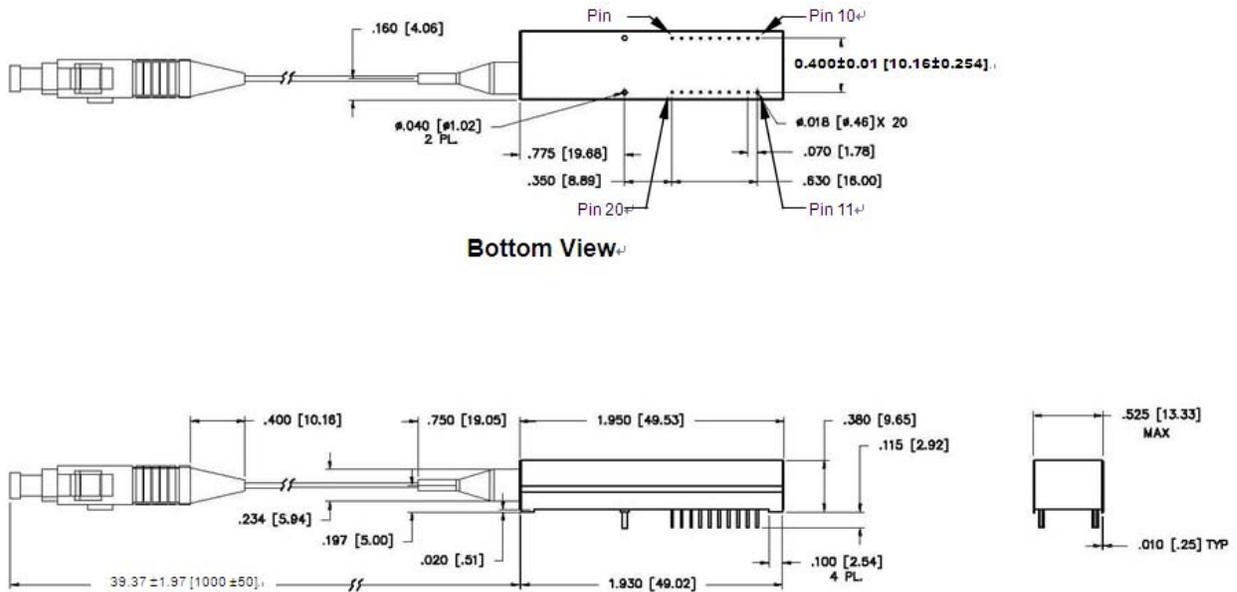
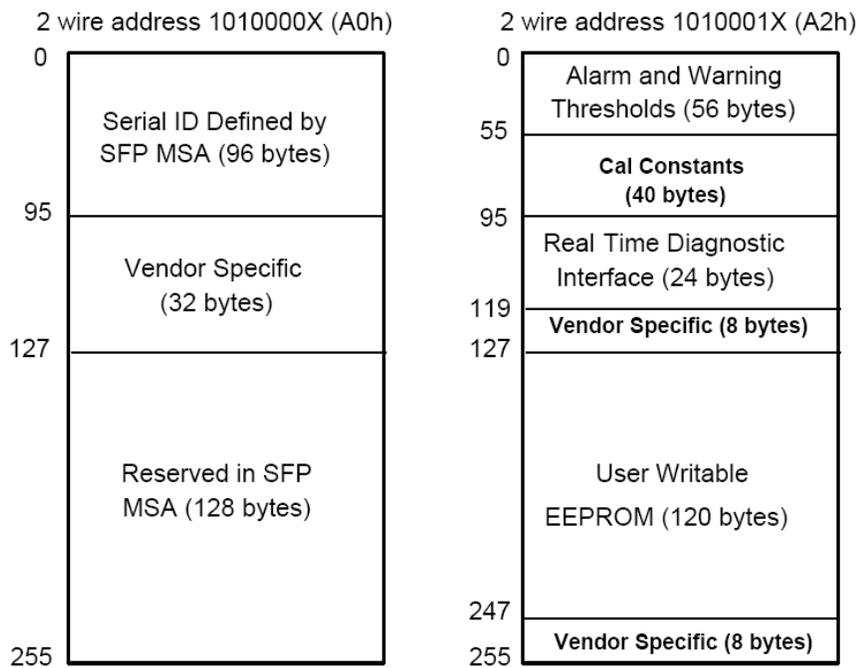
Mechanical Diagram

Figure 5, Mechanical Diagram
EEPROM Information

Figure 6, EEPROM Diagram

Table 7 –EEPROM Memory Content (A0h)

| Addr. | Field Size (Bytes) | Name of Field | Hex | Description |
|-------|--------------------|----------------------------|--|--|
| 0 | 1 | Identifier | 02 | Module/connector soldered to motherboard |
| 1 | 1 | Ext. Identifier | 04 | MOD4 |
| 2 | 1 | Connector | 0B | Optical Pigtail |
| 3-10 | 8 | Transceiver | 00 00 00 00 00 00 00 00 | |
| 11 | 1 | Encoding | 03 | NRZ |
| 12 | 1 | BR, Nominal | 0C | 1.244Gbps |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9um)-km | 14 | 20(km) |
| 15 | 1 | Length (9um) | C8 | 200(100m) |
| 16 | 1 | Length (50um) | 00 | Not Support MMF |
| 17 | 1 | Length (62.5um) | 00 | Not Support MMF |
| 18 | 1 | Length (Copper) | 00 | Not Support Copper |
| 19 | 1 | Reserved | 00 | |
| 20-35 | 16 | Vendor name | 53 4F 55 52 43 45 50 48 4F 54 4F 4E 49 43 53 20 | "SOURCEPHOTONICS"(ASC II) |
| 36 | 1 | Reserved | 00 | |
| 37-39 | 3 | Vendor OUI | 00 00 00 | |
| 40-55 | 16 | Vendor PN | 53 46 41 33 34 32 34 54 48 50 43 44 46 49 20 20 | "SFA3424THPCDFI" (ASCII) |
| 56-59 | 4 | Vendor Rev | xx xx 20 20 | ASCII("31 30 20 20" means 1.0 Revision) |
| 60-61 | 2 | Wavelength | 05 1E | 1310nm Laser Wavelength |
| 62 | 1 | Reserved | 00 | |
| 63 | 1 | CC_BASE | xx | Check sum of byte 0-62 |
| 64-65 | 2 | Options | 00 0C | Rx_SD, Tx_Fault |
| 66 | 1 | BR, max | 00 | |
| 67 | 1 | BR, min | 00 | |
| 68-83 | 16 | Vendor SN | xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx | ASCII |
| 84-91 | 8 | Date code | xx xx xx xx xx xx 20 20 | Year(2 bytes),Month(2 bytes), Day(2 bytes) |
| 92 | 1 | Diagnostic Monitoring Type | 68 | Compliant with SFF-8472 V9.5 Internally Calibrated Received power measurement type -Average Power |
| 93 | 1 | Enhanced Options | B0 | Optional Alarm/warning Flags Implemented; Tx_Fault; Rx_Los |
| 94 | 1 | SFF-8472 Compliance | 02 | Diagnostics Compliance(SFF-8472 V9.5) |

| | | | | |
|--------|----|-----------------|----|-------------------------|
| 95 | 1 | CC_EXT | xx | Check sum of byte 64-94 |
| 96-255 | 64 | Vendor Specific | | |

Table 8 –EEPROM Memory Content (A2h)

| Addr. | Field Size (Bytes) | Name of Field | Hex | Description |
|-------|--------------------|----------------------------|-------------|--|
| 0 | 00 | Temp High Alarm | 50 00 | 80 °C |
| 2 | 02 | Temp Low Alarm | F3 00 | -13 °C |
| 4 | 04 | Temp High Warning | 4B 00 | 75 °C |
| 6 | 06 | Temp Low Warning | F8 00 | -8 °C |
| 8 | 08 | Voltage High Alarm | 8C A0 | 3.6V |
| 10 | 0A | Voltage Low Alarm | 75 30 | 3.0V |
| 12 | 0C | Voltage High Warning | 88 B8 | 3.5V |
| 14 | 0E | Voltage Low Warning | 79 18 | 3.1V |
| 16 | 10 | Bias High Alarm | AF C8 | 90mA |
| 18 | 12 | Bias Low Alarm | 00 00 | 0mA |
| 20 | 14 | Bias High Warning | 88 B8 | 70mA |
| 22 | 16 | Bias Low Warning | 00 00 | 0mA |
| 24 | 18 | TX Power High Alarm | 9B 82 | 6dBm |
| 26 | 1A | TX Power Low Alarm | 22 D0 | -0.5dBm |
| 28 | 1C | TX Power High Warning | 7B 86 | 5dBm |
| 30 | 1E | TX Power Low Warning | 2B D4 | 0.5dBm |
| 32 | 20 | RX Power High Alarm | 07 CB | -7dBm |
| 34 | 22 | RX Power Low Alarm | 00 0F | -28dBm |
| 36 | 24 | RX Power High Warning | 06 30 | -8dBm |
| 38 | 26 | RX Power Low Warning | 00 14 | -27dBm |
| 40 | 28 | Reserved | 00...000 | Reserved |
| 56 | 38 | RX_PWR(4) Calibration | 00 00 00 00 | 4th order RSSI calibration coefficient |
| 60 | 3C | RX_PWR(3) Calibration | 00 00 00 00 | 3rd order RSSI calibration coefficient |
| 64 | 40 | RX_PWR(2) Calibration | 00 00 00 00 | 2nd order RSSI calibration coefficient |
| 68 | 44 | RX_PWR(1) Calibration | 3F 80 00 00 | 1st order RSSI calibration coefficient |
| 72 | 48 | RX_PWR(0) Calibration | 00 00 00 00 | 0th order RSSI calibration coefficient |
| 76 | 4C | TX_I(Slope) Calibration | 01 00 | Slope for Bias calibration |
| 78 | 4E | TX_I(Offset) Calibration | 00 00 | Offset for Bias calibration |
| 80 | 50 | TX_PWR(Slope) Calibration | 01 00 | Slope for TX Power calibration |
| 82 | 52 | TX_PWR(Offset) Calibration | 00 00 | Offset for TX Power calibration |
| 84 | 54 | T(Slope) Calibration | 01 00 | Slope for Temperature calibration |
| 86 | 56 | T(Offset) Calibration | 00 00 | Offset for Temperature calibration, in units of 256ths C |
| 88 | 58 | V(Slope) Calibration | 01 00 | Slope for VCC calibration |

| | | | | | |
|-----|------|------|-------------------------------|----------|--|
| 90 | 5A | 2 | V(Offset) Calibration | 00 00 | Offset for VCC calibration |
| 92 | 5C | 3 | Reserved | 00 00 00 | Reserved |
| 95 | 5F | 1 | Checksum | xx | Checksum |
| 96 | 60 | 2 | Transceiver Temperature | xx xx | Temperature in C/256 |
| 98 | 62 | 2 | Supply Voltage | xx xx | Vcc |
| 100 | 64 | 2 | TX Bias Current | xx xx | BIASMON |
| 102 | 66 | 2 | TX Optical Output Power | xx xx | Back facet monitor |
| 104 | 68 | 2 | RX Optical Input Power | xx xx | RSSI |
| 106 | 6A | 2 | Reserved | 00 00 | Reserved |
| 108 | 6C | 2 | Reserved | 00 00 | Reserved |
| 110 | 6E.7 | 1bit | TX_DIS State | x | Soft TX disable state |
| | 6E.6 | 1bit | Soft TX Disable | x | Write bit that allows software disable laser output. |
| | 6E.5 | 1bit | Reserved. | 0 | Reserved |
| | 6E.4 | 1bit | Rate Select State | 0 | NOT SUPPORTED. |
| | 6E.3 | 1bit | Rate Select | 0 | NOT SUPPORTED. |
| | 6E.2 | 1bit | TX_FAULT | x | Digital state of the TX Fault Output |
| | 6E.1 | 1bit | Rx LOS | x | Digital state of the Rx LOS Output |
| | 6E.0 | 1bit | Data Ready Bar | x | Indicates transceiver has achieved power up and data is ready. |
| 111 | 6F.7 | 1bit | Reserved | 0 | Reserved |
| | 6F.6 | 1bit | Reserved | 0 | Reserved |
| | 6F.5 | 1bit | Reserved | 0 | Reserved |
| | 6F.4 | 1bit | Reserved | 0 | Reserved |
| | 6F.3 | 1bit | Reserved | 0 | Reserved |
| | 6F.2 | 1bit | Reserved | x | Reserved |
| | 6F.1 | 1bit | Reserved | 0 | Reserved |
| | 6F.0 | 1bit | Reserved | x | Reserved |
| 112 | 70.7 | 1bit | Temperature too high alarm | x | Temperature too high alarm |
| | 70.6 | 1bit | Temperature too low alarm | x | Temperature too low alarm |
| | 70.5 | 1bit | VCC too high alarm | x | VCC too high alarm |
| | 70.4 | 1bit | VCC too low alarm | x | VCC too low alarm |
| | 70.3 | 1bit | BIASMON too high alarm | x | BIASMON too high alarm |
| | 70.2 | 1bit | BIASMON too low alarm | x | BIASMON too low alarm |
| | 70.1 | 1bit | TX Power too high alarm | x | TX Power too high alarm |
| | 70.0 | 1bit | TX Power too low alarm | x | TX Power too low alarm |
| 113 | 71.7 | 1bit | RX Power too high alarm | x | RX Power too high alarm |
| | 71.6 | 1bit | RX Power too low alarm | x | RX Power too low alarm |
| | 71.5 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |
| | 71.4 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |
| | 71.3 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |
| | 71.2 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |

| | | | | | |
|-----|------|------|-------------------------------|-------------------------|-------------------------------|
| | 71.1 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |
| | 71.0 | 1bit | Reserved interrupt status bit | x | Reserved interrupt status bit |
| 114 | 72 | 1 | Reserved | 00 | Reserved |
| 115 | 73 | 1 | Reserved | 00 | Reserved |
| 116 | 74.7 | 1bit | Temperature too high warning | x | Temperature too high warning |
| | 74.6 | 1bit | Temperature too low warning | x | Temperature too low warning |
| | 74.5 | 1bit | VCC too high warning | x | VCC too high warning |
| | 74.4 | 1bit | VCC too low warning | x | VCC too low warning |
| | 74.3 | 1bit | BIASMON too high warning | x | BIASMON too high warning |
| | 74.2 | 1bit | BIASMON too low warning | x | BIASMON too low warning |
| | 74.1 | 1bit | TX Power too high warning | x | TX Power too high warning |
| | 74.0 | 1bit | TX Power too low warning | x | TX Power too low warning |
| 117 | 75.7 | 1bit | RX Power too high warning | x | RX Power too high warning |
| | 75.6 | 1bit | RX Power too low warning | x | RX Power too low warning |
| | 75.5 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| | 75.4 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| | 75.3 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| | 75.2 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| | 75.1 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| | 75.0 | 1bit | Reserved interrupt status bit | 0 | Reserved interrupt status bit |
| 118 | 76 | 1 | Reserved | 00 | Reserved |
| 119 | 77 | 1 | Reserved | 00 | Reserved |
| 120 | 78 | 8 | Vendor Specific | 00 00 00 00 00 00 00 00 | Vendor Specific |

Table 9 – Digital Diagnostic Specification (A2h)

| Data Address | Parameter | Range | Accuracy |
|--------------|--------------|--------------|----------|
| 96-97 | Temperature | -5 to 70°C | ±3°C |
| 98-99 | Vcc Voltage | 0 to Vcc | ±3% |
| 100-101 | Bias Current | 0 to 100mA | ±10% |
| 102-103 | TX Power | -1 to 5dBm | ±2dB |
| 104-105 | RX Power | -28 to -8dBm | ±3dB |

Order Information

Table 10 – Order Information

| Part No. | Application | Data Rate | Laser Source | Fiber Type | Temp Range |
|--------------------|-------------|----------------------------------|---------------|------------|------------|
| SFA-34-24T-HP-CDFI | GPON ONT | TX:1244.16Mb/s RX:2488.32Mb/s | 1310nm DFB | SMF | 0 to 70°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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