

## Specification

**Small Form Factor Pluggable**

Duplex LC Receptacle – SFP+

**Optical Transceivers**

10 Gigabit Ethernet

10GBASE-LR



## Ordering Information

**T A S – A 5 N B 1 – F A H**

| Model Name    | Voltage | Category  | Device type | Interface        | LOS   | Temperature | Distance | Latch Color                                                                                   |
|---------------|---------|-----------|-------------|------------------|-------|-------------|----------|-----------------------------------------------------------------------------------------------|
| TAS-A5NB1-FAH | 3.3V    | With DDMI | 1310 nm DFB | AC / AC Coupling | LVTTL | -5°C~+70°C  | 10km     | Blue<br> |

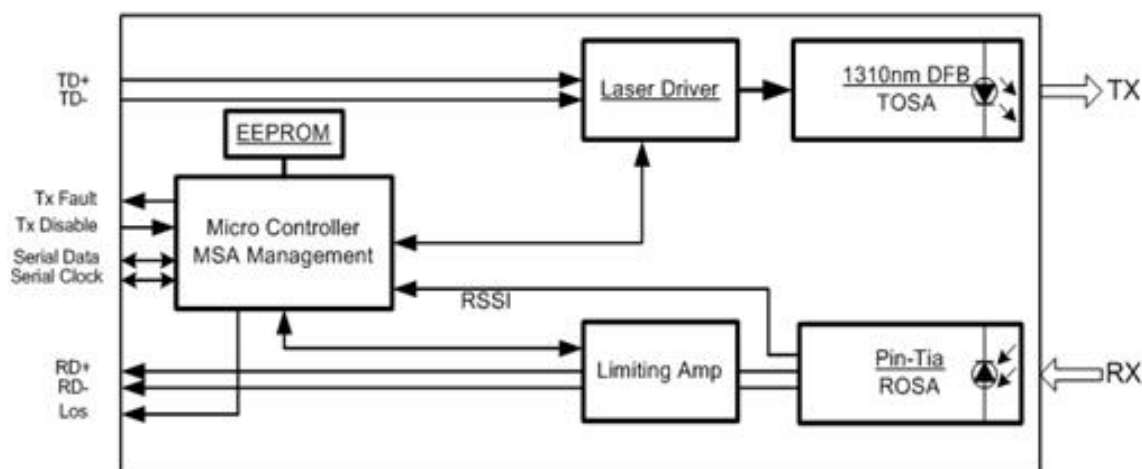
## Features

- Optical Interface compliant to IEEE 802.3ae 10GBASE-LR/LW
- Compliant with SFP+ MSA
- Data Rate 10.3125Gbps
- 1310nm DFB TOSA and PIN ROSA
- Applicable for 10 km SMF connection
- LC duplex receptacle
- Low power dissipation (< 1W)
- Hot Pluggable
- All-metal housing for superior EMI performance
- Built in digital diagnostic Functions
- ROHS Compliant

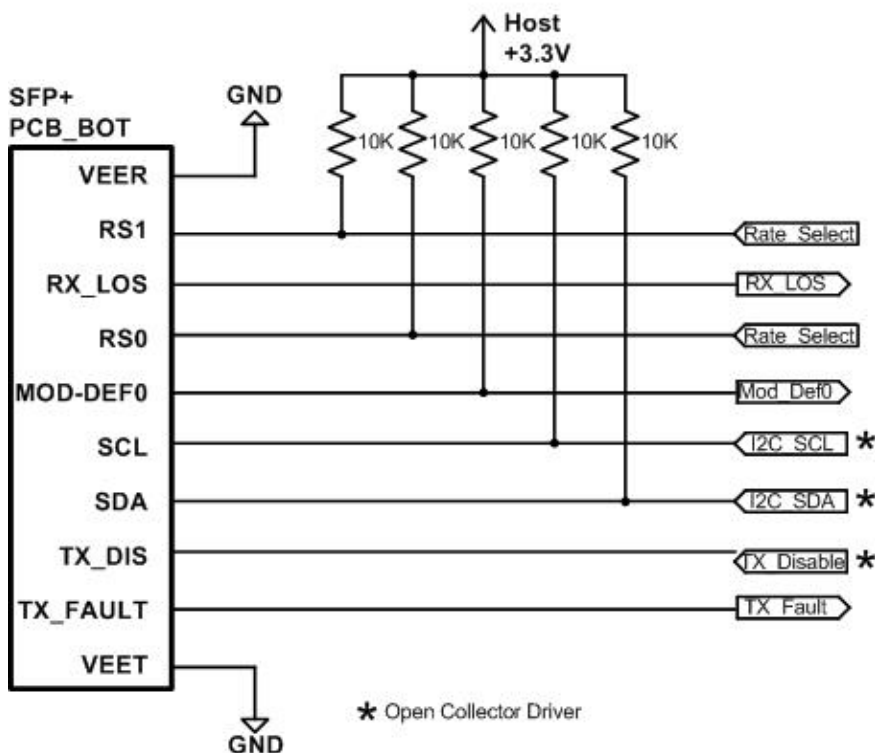
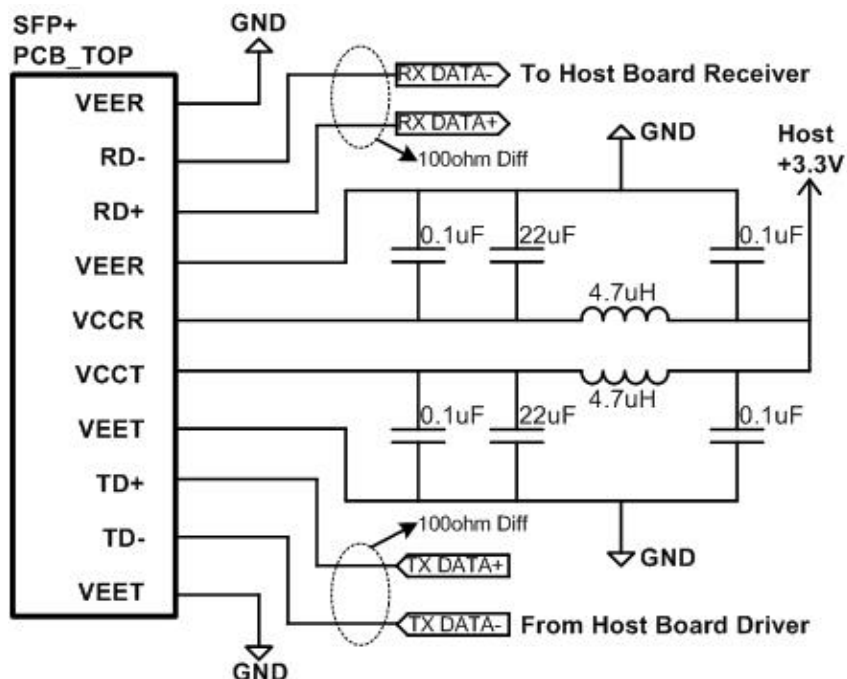
## Applications

- 10GBASE-LR 10Gigabit Ethernet
- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes

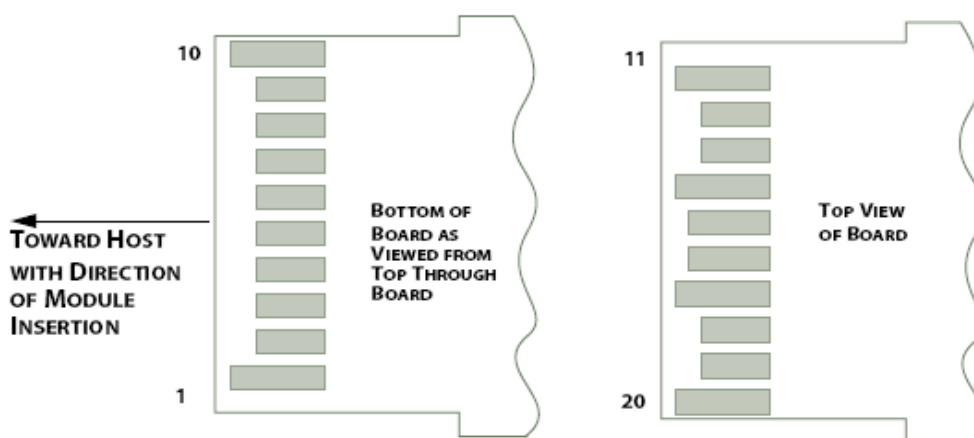
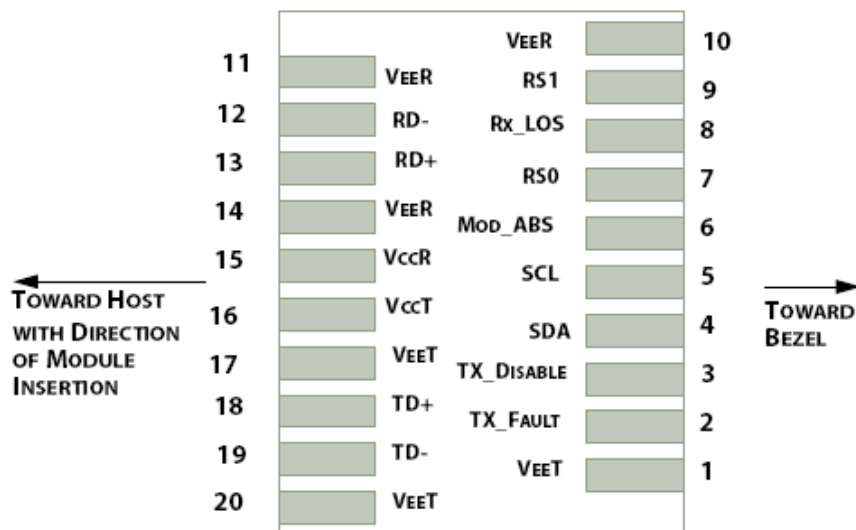
## Transceiver Block Diagram



## Proposed Applications Schematics



## Pin Definition and Descriptions



| PIN | Logic     | Symbol   | Name / Description                                                                                                                                    | Note |
|-----|-----------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1   |           | VeeT     | Module Transmitter Ground                                                                                                                             | 1    |
| 2   | LVTTL-O   | TX_Fault | Module Transmitter Fault                                                                                                                              | 2    |
| 3   | LVTTL-I   | TX_Dis   | Transmitter Disable; Turns off transmitter laser output                                                                                               | 3    |
| 4   | LVTTL-I/O | SDA      | 2-Wire Serial Interface Data Line                                                                                                                     |      |
| 5   | LVTTL-I   | SCL      | 2-Wire Serial Interface Clock                                                                                                                         |      |
| 6   |           | Mod_ABS  | Module Absent, connected to VeeT or VeeR in the module                                                                                                |      |
| 7   | LVTTL-I   | RS0      | Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate > 4.25 GBd and when low input signal rate $\leq$ 4.25 GBd.    |      |
| 8   | LVTTL-O   | RX_LOS   | Receiver Loss of Signal Indication                                                                                                                    |      |
| 9   | LVTTL-I   | RS1      | Rate Select 1, optionally controls SFP+ module transmitter. When high input signaling rate > 4.25 GBd and when low input signal rate $\leq$ 4.25 GBd. |      |
| 10  |           | VeeR     | Module Receiver Ground                                                                                                                                | 1    |
| 11  |           | VeeR     | Module Receiver Ground                                                                                                                                | 1    |
| 12  | CML-O     | RD-      | Receiver Inverted Data Output                                                                                                                         |      |
| 13  | CML-O     | RD+      | Receiver Data Output                                                                                                                                  |      |
| 14  |           | VeeR     | Module Receiver Ground                                                                                                                                | 1    |
| 15  |           | VccR     | Module Receiver 3.3 V Supply                                                                                                                          |      |
| 16  |           | VccT     | Module Transmitter 3.3 V Supply                                                                                                                       |      |
| 17  |           | VeeT     | Module Transmitter Ground                                                                                                                             | 1    |
| 18  | CML-I     | TD+      | Transmitter Non-Inverted Data Input                                                                                                                   |      |
| 19  | CML-I     | TD-      | Transmitter Inverted Data Input                                                                                                                       |      |
| 20  |           | VeeT     | Module Transmitter Ground                                                                                                                             | 1    |

**Note:**

1. Module ground pins are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7k to 10k ohm to a voltage between 3.15V and 3.45V on the host board.
3. Shall be pulled up with 4.7k to 10k ohm to VccT in the module.

### Absolute Maximum Ratings

| Parameters                      | Symbol           | Min. | Max. | Unit |
|---------------------------------|------------------|------|------|------|
| Power Supply Voltage            | V <sub>CC</sub>  | 0    | 3.6  | V    |
| Storage Temperature             | T <sub>c</sub>   | -40  | 85   | °C   |
| Relative Humidity               | RH               | 5    | 95   | %    |
| Optical Receiver Power (Damage) | P <sub>max</sub> |      | 1.5  | dBm  |

### Recommended Operating Environment

| Parameters                 | Symbol          | Min.  | Typical | Max   | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Power Supply Voltage       | V <sub>CC</sub> | 3.135 | 3.3     | 3.465 | V    |
| Operating Case Temperature | T <sub>c</sub>  | -5    |         | 70    | °C   |
| Power Supply Current       | I <sub>cc</sub> |       |         | 300   | mA   |
| Power Consumption          |                 |       | 800     | 1000  | mW   |
| Data rate                  |                 |       | 10.3125 |       | Gbps |

## Optical Characteristics

| Parameter                               |          | Symbol                              | Min.  | Typ. | Max   | Unit  | Notes |
|-----------------------------------------|----------|-------------------------------------|-------|------|-------|-------|-------|
| Transmitter                             |          |                                     |       |      |       |       |       |
| Average Launch Power                    |          | P <sub>o</sub>                      | -8.2  | ---  | 0.5   | dBm   |       |
| Center wavelength                       |          | λ <sub>c</sub>                      | 1260  | ---  | 1355  | nm    |       |
| Side Mode Suppression Ratio             |          | SMSR                                | 30    | ---  | ---   | nm    |       |
| Extinction ratio                        |          | E <sub>R</sub>                      | 3.5   | ---  | ---   | dB    |       |
| Transmitter and dispersion penalty(max) |          | TDP                                 | ---   | ---  | 3.2   | dB    |       |
| Optical power OMA                       |          | P <sub>OMA</sub>                    | -5.2  | ---  | ---   | dBm   |       |
| OMA-TDP                                 |          | P <sub>OMA-TDP</sub>                | -6.2  | ---  | ---   | dBm   |       |
| Average launch power of OFF transmitted |          | P <sub>off</sub>                    | ---   | ---  | -30   | dBm   |       |
| RIN <sub>12</sub> OMA                   |          | RIN                                 | ---   | ---  | -128  | dB/Hz |       |
| Optical Return Loss Tolerance           |          |                                     | 12    | ---  | ---   | dB    |       |
| Output eye                              |          | Compliant with IEEE802.3ae eye mask |       |      |       |       |       |
| Receiver                                |          |                                     |       |      |       |       |       |
| Center wavelength                       |          | λ <sub>c</sub>                      | 1260  |      | 1355  | nm    |       |
| Average receiver power(max)             |          | P <sub>max</sub>                    |       |      | 0.5   | dBm   |       |
| Average receiver power(min)             |          | P <sub>min</sub>                    | -14.4 |      |       | dBm   |       |
| Receiver Reflectance                    |          | R <sub>rx</sub>                     |       |      | -12   | dB    |       |
| Receiver Sensitivity in OMA             |          |                                     |       |      | -12.6 | dBm   |       |
| Stressed Sensitivity in OMA             |          |                                     |       |      | -10.3 | dBm   | 1     |
| Vertical eye closure penalty            |          |                                     | 2.2   |      |       | dB    | 2     |
| Stressed eye jitter                     |          |                                     | 0.3   |      |       | Ulp-p | 1     |
| LOS                                     | Assert   | LOS <sub>A</sub>                    | -30   |      |       | dBm   |       |
|                                         | Deassert | LOS <sub>D</sub>                    |       |      | -12   | dBm   |       |
| LOS Hysteresis                          |          | LOS <sub>H</sub>                    | 0.5   |      |       | dB    |       |

### Note:

1. Receiver sensitivity is informative. Stressed receiver sensitivity shall be measured with conformance test signal for BER =1x 10<sup>-12</sup>.
2. Vertical eye closure penalty and stressed eye jitter are the test conditions for measuring stressed receiver sensitivity. They are not the required characteristic of the receiver.

## Electrical Characteristics

| Parameter                              | Symbol          | Min.            | Typical | Max                  | Unit | Notes      |
|----------------------------------------|-----------------|-----------------|---------|----------------------|------|------------|
| Data Rate                              |                 | -               | 10.3125 | -                    | Gbps |            |
| Transmitter                            |                 |                 |         |                      |      |            |
| Transmitter Differential Input Voltage | V <sub>IN</sub> | 180             | -       | 700                  | mV   |            |
| Transmitter Disable (TX-Disable)       | V <sub>IH</sub> | 2               |         | V <sub>CC</sub>      | V    |            |
|                                        | V <sub>IL</sub> | V <sub>EE</sub> |         | V <sub>EE</sub> +0.8 |      |            |
| Receiver                               |                 |                 |         |                      |      |            |
| Receiver Differential Output Voltage   | V <sub>O</sub>  | 300             | -       | 850                  | mV   |            |
| Loss of Signal (LOS)                   | V <sub>OH</sub> | 2               |         | V <sub>CC</sub>      | V    |            |
|                                        | V <sub>OL</sub> | V <sub>EE</sub> |         | V <sub>EE</sub> +0.8 |      |            |
| Rx Output Rise and Fall Time           | Tr/Tf           | 30              |         |                      | ps   | 20% to 80% |

## Control And Status I/O Timing Characteristics

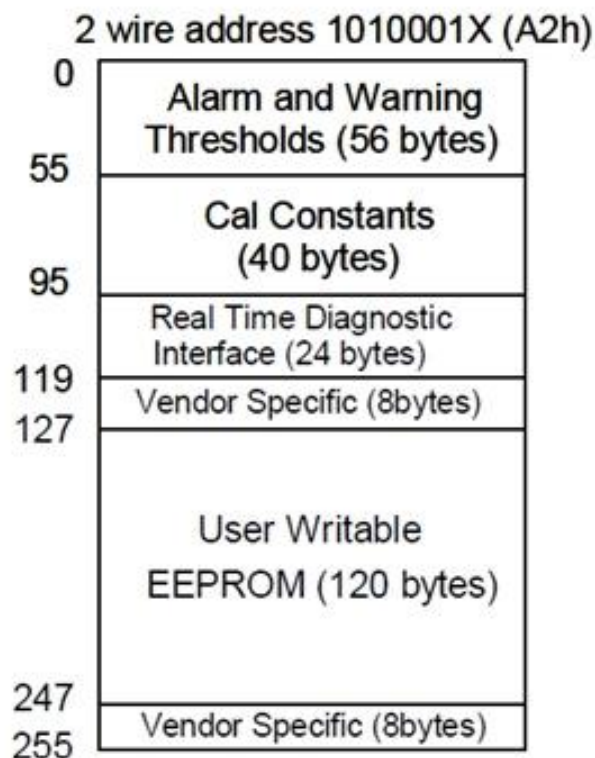
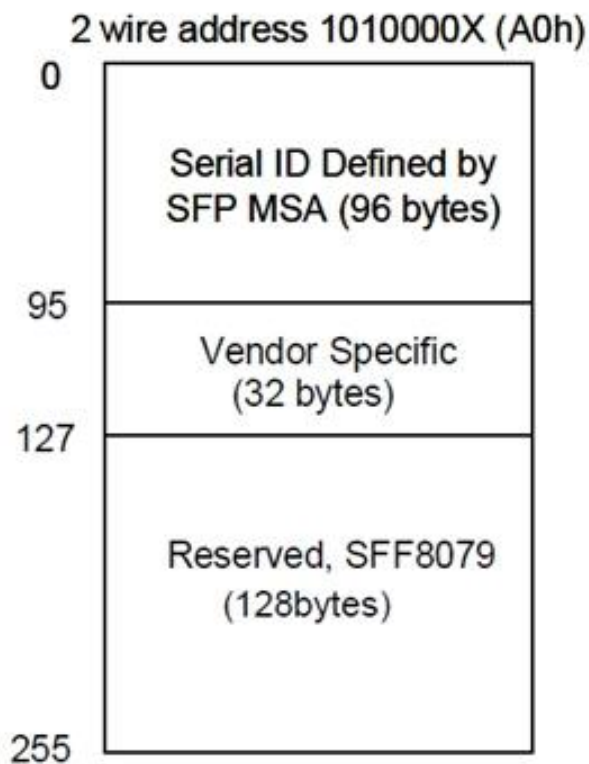
| Parameter                                       | Symbol              | Min | Max | Unit    | Condition                                                                                                                        |
|-------------------------------------------------|---------------------|-----|-----|---------|----------------------------------------------------------------------------------------------------------------------------------|
| TX Disable Assert Time                          | $t_{off}$           |     | 10  | $\mu s$ | Time from rising edge of TX Disable to when the optical output falls below 10% of nominal                                        |
| TX Disable Negate Time                          | $t_{on}$            |     | 1   | ms      | Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal                             |
| Time to initialize, including reset of TX_Fault | $t_{init}$          |     | 300 | ms      | From power on or negation of TX Fault using TX Disable                                                                           |
| TX Fault Assert Time                            | $t_{fault}$         |     | 100 | $\mu s$ | Time from fault to TX fault on.                                                                                                  |
| TX Disable to reset                             | $t_{reset}$         | 10  |     | $\mu s$ | Time TX Disable must be held high to reset TX_fault                                                                              |
| LOS Assert Time                                 | $t_{loss\_on}$      |     | 100 | $\mu s$ | Time from LOS state to RX LOS assert                                                                                             |
| LOS Deassert Time                               | $t_{loss\_off}$     |     | 100 | $\mu s$ | Time from non-LOS state to RX LOS deassert                                                                                       |
| Rate-Select Change Time                         | $t_{ratesel}$       |     | 10  | $\mu s$ | Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification. |
| Serial ID Clock Rate                            | $f_{serial\_clock}$ |     | 100 | kHz     |                                                                                                                                  |



### Digital Diagnostic Functions

| Parameter                             | Symbol    | Min.  | Max  | Unit | Notes                 |
|---------------------------------------|-----------|-------|------|------|-----------------------|
| Temperature monitor absolute error    | DMI_Temp  | -3    | 3    | degC | Over operating temp   |
| Laser power monitor absolute error    | DMI_TX    | -3    | 3    | dB   |                       |
| RX power monitor absolute error       | DMI_RX    | -3    | 3    | dB   | -1dBm to -12dBm range |
| Supply voltage monitor absolute error | DMI_VCC   | -0.08 | 0.08 | V    | Full operating range  |
| Bias current monitor                  | DMI_Ibias | -10%  | 10%  | mA   |                       |

### Digital Diagnostic Memory Map





# 10GbE SFP+ LR Transceiver

## PRODUCT NUMBER: TAS-A5NB1-FAH

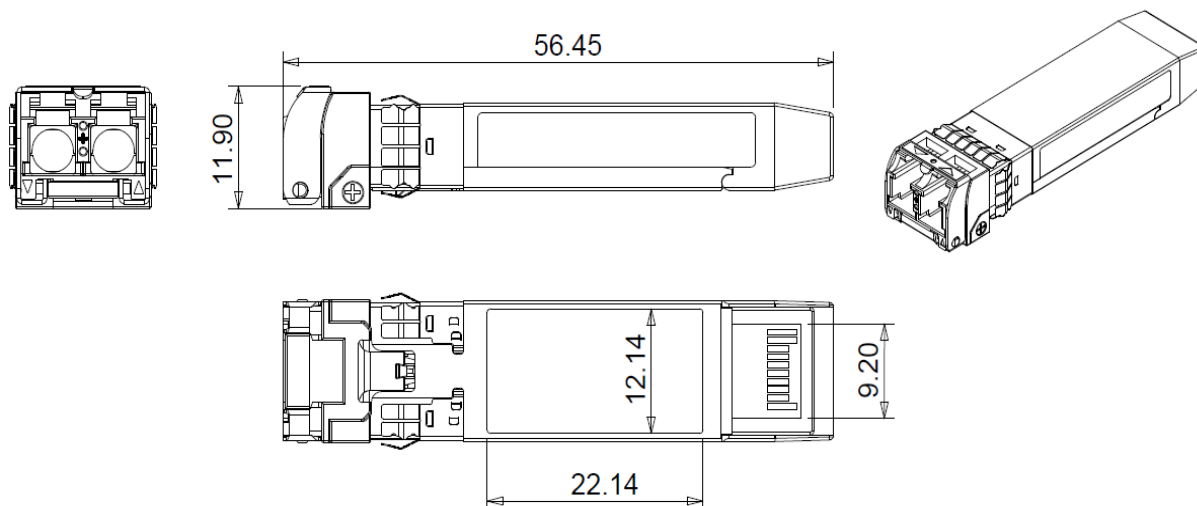
### Content in 2-Wire Address A0H

| Address | HEX                                             | Name of Field                        | Description                                                               |
|---------|-------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------|
| 00      | 03                                              | Identifier                           | SFP                                                                       |
| 01      | 04                                              | Extended Identifier                  | SFP                                                                       |
| 02      | 07                                              | Connector type                       | LC                                                                        |
| 03      | 20                                              | 10G Ethernet Compliance Codes        | 10G Base LR                                                               |
| 04      | 00                                              | SONET Compliance Codes               | Not compliant                                                             |
| 05      | 00                                              | SONET Compliance Codes               | Not compliant                                                             |
| 06      | 00                                              | Ethernet Compliance Codes            | Not compliant                                                             |
| 07      | 00                                              | Fiber Channel link length            | Not compliant                                                             |
| 08      | 00                                              | Fiber Channel transmitter technology | Not compliant                                                             |
| 09      | 00                                              | Fiber Channel transmission media     | Not compliant                                                             |
| 10      | 00                                              | Fiber Channel speed                  | Not compliant                                                             |
| 11      | 06                                              | Encoding codes:                      | 64B/66B                                                                   |
| 12      | 67                                              | Nominal Bit Rate (units of 100Mbps)  | 10.3Gbps                                                                  |
| 13      | 00                                              | Rate identifier                      | Unspecified                                                               |
| 14      | 0A                                              | Link length supported for 9um fiber  | 10km (units of km)                                                        |
| 15      | 64                                              | Link length supported for 9um fiber  | 10km (units of 100m)                                                      |
| 16      | 00                                              | Link length supported for 50um,OM2   | N/A (units of 10m)                                                        |
| 17      | 00                                              | Link length supported for 62.5um,OM1 | N/A (units of 10m)                                                        |
| 18      | 00                                              | Link length supported for copper     | N/A (units of 1m)                                                         |
| 19      | 00                                              | Link length supported for 50um,OM3   | N/A (units of 10m)                                                        |
| 20 ~ 35 | 46,4F,52,4D,45,52,49,43,41,4F,45,20,20,20,20,20 | Vendor Name                          | FORMERICA OE                                                              |
| 36      | 00                                              | Unallocated                          |                                                                           |
| 37 ~ 39 | 00,00,00                                        | Vendor OUI                           | Unspecified                                                               |
| 40 ~ 55 | 54,41,53,2D,41,35,4E,42,31,2D,46,41,48,20,20,20 | Part Number                          | TAS-A5NB1-FAH                                                             |
| 56 ~ 59 | 00,00,00,00                                     | Vendor Revision number               | Unspecified                                                               |
| 60 ~ 61 | 05,1E                                           | Laser Wavelength                     | 1310nm                                                                    |
| 62      | 00                                              | Unallocated                          |                                                                           |
| 63      |                                                 | CC_BASE:                             | Check sum of byte 0 ~ 62                                                  |
| 64      | 00                                              | Options                              |                                                                           |
| 65      | 1A                                              | Options                              | TX-DIS, TX_FAULT, RX-LOS                                                  |
| 66      | 00                                              | Bit Rate, max.                       | Unspecified                                                               |
| 67      | 00                                              | Bit Rate, min.                       | Unspecified                                                               |
| 68 ~ 83 | Serial Number                                   | Serial Number                        |                                                                           |
| 84 ~ 89 | yy/mm/dd                                        | Date Code                            |                                                                           |
| 90 ~ 91 | 20,20                                           | Vendor specific lot code             | Unspecified                                                               |
| 92      | 68                                              | Diagnostic Monitoring Type           | Internal calibration                                                      |
| 93      | F0                                              | Enhanced Options (soft)              | Alarm/Warning flags, Soft TxDisable, Soft TxFault, Soft RxLOS implemented |
| 94      | 03                                              | SFF-8472 Compliance                  | Rev10.2                                                                   |
| 95      |                                                 | CC_EXT                               | Check sum of byte 64 ~ 94                                                 |
| 96~127  |                                                 | Vendor specific                      |                                                                           |

**Content in 2-Wire Address A2H**

| Add   | Bytes | Name                  | Hex      | Real Value |
|-------|-------|-----------------------|----------|------------|
| 00-01 | 2     | Temp High Alarm       | 5500     | 85℃        |
| 02-03 | 2     | Temp Low Alarm        | F100     | -15℃       |
| 04-05 | 2     | Temp High Warning     | 5000     | 80℃        |
| 06-07 | 2     | Temp Low Warning      | F600     | -10℃       |
| 08-09 | 2     | Voltage High Alarm    | 9470     | 3.8V       |
| 10-11 | 2     | Voltage Low Alarm     | 6D60     | 2.8V       |
| 12-13 | 2     | Voltage High Warning  | 9088     | 3.7V       |
| 14-15 | 2     | Voltage Low Warning   | 7148     | 2.9V       |
| 16-17 | 2     | Bias High Alarm       | AFC8     | 90mA       |
| 18-19 | 2     | Bias Low Alarm        | 03E8     | 2mA        |
| 20-21 | 2     | Bias High Warning     | 9C40     | 80mA       |
| 22-23 | 2     | Bias Low Warning      | 05DC     | 3mA        |
| 24-25 | 2     | TX Power High Alarm   | 576C     | 3.5dBm     |
| 26-27 | 2     | TX Power Low Alarm    | 02F8     | -11.2dBm   |
| 28-29 | 2     | TX Power High Warning | 4574     | 2.5dBm     |
| 30-31 | 2     | TX Power Low Warning  | 03B6     | -10.2dBm   |
| 32-33 | 2     | RX Power High Alarm   | 576C     | 3.5dBm     |
| 34-35 | 2     | RX Power Low Alarm    | 00E6     | -16.4dBm   |
| 36-37 | 2     | RX Power High Warning | 4574     | 2.5dBm     |
| 38-39 | 2     | RX Power Low Warning  | 016B     | -14.4dBm   |
| 40-55 | 16    | Reserved              | FF       | -          |
| 56-59 | 4     | RX_PWR(4)             | 00000000 | 0          |
| 60-63 | 4     | RX_PWR(3)             | 00000000 | 0          |
| 64-67 | 4     | RX_PWR(2)             | 00000000 | 0          |
| 68-71 | 4     | RX_PWR(1)             | 3F800000 | 1          |
| 72-75 | 4     | RX_PWR(0)             | 00000000 | 0          |
| 76-77 | 2     | TX_I(Slope)           | 0100     | 1          |
| 78-79 | 2     | TX_I(Offset)          | 0000     | 0          |
| 80-81 | 2     | TX_PWR(Slope)         | 0100     | 1          |
| 82-83 | 2     | TX_PWR(Offset)        | 0000     | 0          |
| 84-85 | 2     | T(Slope)              | 0100     | 1          |
| 86-87 | 2     | T(Offset)             | 0000     | 0          |
| 88-89 | 2     | V(Slope)              | 0100     | 1          |
| 90-91 | 2     | V(Offset)             | 0000     | 0          |
| 92-94 | 3     | Reserved              | 00       | -          |
| 95    | 1     | Checksum              |          | -          |

## Mechanical (mm)



## ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## LASER Safety

This is a Class 1 Laser Product according to IEC 60825-1:1993:+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)