

## 98Y2178-AO

IBM® 98Y2178 Compatible TAA 16GBase-LW Fibre Channel SFP+ Transceiver (SMF, 1310nm, 10km, LC)

### Features

- SFF-8432 and SFF-8472 Compliance
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



### Applications

- Fibre Channel
- Access and Enterprise

### Product Description

This IBM® 98Y2178 compatible SFP+ transceiver provides 16GBase-LW Fibre Channel throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent IBM® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. It is built to meet or exceed the specifications of IBM®, as well as to comply with MSA (Multi-Source Agreement) standards to ensure seamless network integration. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

AddOn's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## Absolute Maximum Ratings

| Parameter                  | Symbol           | Min. | Max. | Unit |
|----------------------------|------------------|------|------|------|
| Maximum Supply Voltage     | V <sub>cc</sub>  | -0.5 | 4.0  | V    |
| Storage Temperature        | T <sub>stg</sub> | -40  | 85   | °C   |
| Operating Case Temperature | T <sub>c</sub>   | 0    | 70   | °C   |
| Operating Humidity         | RH               | 5    | 95   | %    |
| Receiver Power             | R <sub>max</sub> |      | 2    | dBm  |
| 9/125μm G.652 SMF          | L <sub>max</sub> |      | 10   | km   |

## Electrical Characteristics

| Parameter                                        | Symbol                | Min.                 | Typ. | Max.                 | Unit | Notes |
|--------------------------------------------------|-----------------------|----------------------|------|----------------------|------|-------|
| Power Supply Voltage                             | V <sub>cc</sub>       | 3.13                 | 3.30 | 3.47                 | V    |       |
| Power Supply Current                             | I <sub>cc</sub>       |                      |      | 350                  | mA   |       |
| Power Consumption                                | P <sub>DISS</sub>     |                      |      | 0.8                  | W    |       |
| Transmitter                                      |                       |                      |      |                      |      |       |
| Differential data input swing                    | V <sub>in</sub> , pp  | 120                  | 600  | 850                  | mV   |       |
| Input differential impedance                     | Z <sub>in</sub>       | 90                   | 100  | 110                  | Ω    |       |
| TX Disable-High                                  |                       | 2.0                  |      | V <sub>cc</sub> +0.3 | V    |       |
| TX Disable-Low                                   |                       | V <sub>ee</sub> -0.3 |      | 0.8                  | V    |       |
| TX Fault-High                                    |                       | 2.0                  |      | V <sub>cc</sub> +0.3 | V    |       |
| TX Fault-Low                                     |                       | V <sub>ee</sub> -0.3 |      | 0.8                  | V    |       |
| Receiver                                         |                       |                      |      |                      |      |       |
| Differential data output swing                   | V <sub>out</sub> , pp | 300                  | 600  | 850                  | mV   |       |
| Output Differential Impedance                    | Z <sub>in</sub>       | 90                   | 100  | 110                  | Ω    |       |
| LOS-High                                         |                       | 2.0                  |      | V <sub>cc</sub> +0.3 | V    |       |
| LOS-Low                                          |                       | V <sub>ee</sub> -0.3 |      | 0.8                  | V    |       |
| Unstressed Receiver OMA Sensitivity, 14.025 Gb/s | R <sub>SENSr</sub>    |                      |      | 0.063                | mW   |       |
| Unstressed Receiver OMA Sensitivity, 8.5 Gb/s    | R <sub>SENSr</sub>    |                      |      | 0.042                | mW   | 1     |
| Unstressed Receiver OMA Sensitivity, 4.25 Gb/s   | R <sub>SENSr</sub>    |                      |      | 0.029                | mW   | 1     |

## Notes:

1. Measured with PRBS 2<sup>7</sup>-1 at 10<sup>-12</sup> BER.

## Optical Characteristics

| Parameter                                      | Symbol                          | Min. | Typ. | Max. | Unit  | Notes |
|------------------------------------------------|---------------------------------|------|------|------|-------|-------|
| Transmitter                                    |                                 |      |      |      |       |       |
| Output Opt. Power @14.025Gbps                  | P <sub>O,RH</sub>               | -5   |      | 2    | dBm   | 1, 2  |
| Output Opt. Power @4.25/8.5Gbps                | P <sub>O,RL</sub>               | -5   |      | -1   | dBm   | 3     |
| Optical Wavelength                             | λ                               | 1295 |      | 1325 | nm    | 4     |
| Spectral Width                                 | σ                               |      |      | 1    | nm    | 4, 5  |
| Optical Modulation Amplitude @ 14.025 Gbps     | OMA                             | 631  |      |      | μW    | 6     |
| Optical Modulation Amplitude @ 4.25/8.5Gbps    | OMA                             | 290  |      |      | μW    | 4, 6  |
| Transmitter and Dispersion Penalty @14.025Gbps | TDP                             |      |      | 4.4  | dB    | 7     |
| Transmitter and Dispersion Penalty @8.5Gbps    | TDP                             |      |      | 3.2  | dB    | 7     |
| Optical Rise/Fall Time @4.25Gbps               | Tr/Tf                           |      |      | 90   | ps    | 8     |
| RIN                                            |                                 |      |      | -130 | dB/Hz |       |
| Eye Diagram                                    | Compatible with IEEE 802.3-2005 |      |      |      |       |       |
| Receiver                                       |                                 |      |      |      |       |       |
| Average Received Power                         | RX <sub>MAX</sub>               |      |      | 2.0  | dBm   |       |
| Optical Center Wavelength                      | λC                              | 1260 |      | 1370 | nm    |       |
| Return Loss                                    |                                 | 12   |      |      | dB    |       |
| LOS De-Assert                                  | LOSD                            |      |      | -19  | dBm   |       |
| LOS Assert                                     | LOSA                            | -30  |      |      | dBm   |       |
| LOS Hysteresis                                 |                                 | 0.5  |      |      | dB    |       |

### Notes:

- Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- High Bandwidth Mode. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- Low Bandwidth Mode. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- Also specified to meet curves in FC-PI-5 Rev 6.10 Figures 23, 24, and 25, which allow trade-off between wavelength, spectral width and OMA for 4.25/8.5Gbps operation.
- 20dB spectral width.
- Equivalent extinction ratio specification for Fiber Channel. Allows smaller ER at higher average power.
- For 14.025/8.5Gbps operation, Jitter values for gamma T and gamma R are controlled by TDP.
- Unfiltered, 20-80%. Complies with IEEE 802.3 (Gig. E), FC 4x eye mask when filtered.

## Pin Descriptions

| Pin | Symbol     | Name/Description                                                           | Notes |
|-----|------------|----------------------------------------------------------------------------|-------|
| 1   | VeeT       | Transmitter Ground (Common with Receiver Ground).                          | 1     |
| 2   | Tx_Fault   | Transmitter Fault. LVTTTL-O.                                               | 2     |
| 3   | Tx_Disable | Transmitter Disable. Laser output disabled on "high" or "open." LVTT-I.    | 3     |
| 4   | SDA        | 2-Wire Serial Interface Data. Same as MOD-DEF2 in INF-8074i. LVTTTL-I/O.   |       |
| 5   | SCL        | 2-Wire Serial Interface Clock. Same as MOD-DEF2 in INF-8074i. LVTTTL-I.    |       |
| 6   | MOD_ABS    | Module Absent. Connect to VeeT or VeeR in the module.                      | 4     |
| 7   | RS0        | Rate Select 0. Optionally controls the SFP+ module receiver. LVTTTL-I.     | 5     |
| 8   | LOS        | Loss of Signal Indication. "Logic 0" indicates normal operation. LVTTTL-O. | 2     |
| 9   | RS1        | Rate Select 1. Optionally controls the SFP+ module transmitter. LVTTTL-I.  | 5     |
| 10  | VeeR       | Receiver Ground (Common with Transmitter Ground).                          | 1     |
| 11  | VeeR       | Receiver Ground (Common with Transmitter Ground).                          | 1     |
| 12  | RD-        | Receiver Inverted Data Out. AC Coupled. CML-O.                             |       |
| 13  | RD+        | Receiver Non-Inverted Data Out. AC Coupled. CML-O.                         |       |
| 14  | VeeR       | Receiver Ground (Common with Transmitter Ground).                          | 1     |
| 15  | VccR       | Receiver Power Supply.                                                     |       |
| 16  | VccT       | Transmitter Power Supply.                                                  |       |
| 17  | VeeT       | Transmitter Ground (Common with Receiver Ground).                          | 1     |
| 18  | TD+        | Transmitter Non-Inverted Data In. AC Coupled. CML-I.                       |       |
| 19  | TD-        | Transmitter Inverted Data In. AC Coupled. CML-O.                           |       |
| 20  | VeeT       | Transmitter Ground (Common with Receiver Ground).                          | 1     |

## Notes:

1. The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
2. This contact is an open collector/drain output and should be pulled up to the Host\_Vcc with resistor in the range 4.7kΩ to 10kΩ. Pull-ups can be connected to one or several power supplies; however, the host board design shall ensure that no module contract has voltage exceeding module VccT/R+0.5V.
3. Tx\_Disable is an input contact with a 4.7kΩ to 10kΩ pull-up resistor to the VccT inside the module.
4. MOD\_ABS is connected to the VeeT or VeeR in the SFP+ module. The host may pull the contract up to Host\_Vcc with a resistor in the range from 4.7kΩ to 10kΩ. MOD\_ABS is asserted "high" when the SFP+ module is physically absent from a host slot.
5. RS0 and RS1 are module inputs and are pulled low to VeeT with >30k resistors in the module. RS0 optionally selects the optical receive signaling rate coverage. RS1 optionally selects the optical transmit signaling rate coverage.

These contacts can also be used for RS0 and RS1 if implementing SFF-8079. See SFF-8079 for details.

RS1 is commonly connected to VeeT or VeeR in the classic SFP modules. The host needs to ensure that

it will not be damaged if this contact is connected to VeeT or VeeR in the module.

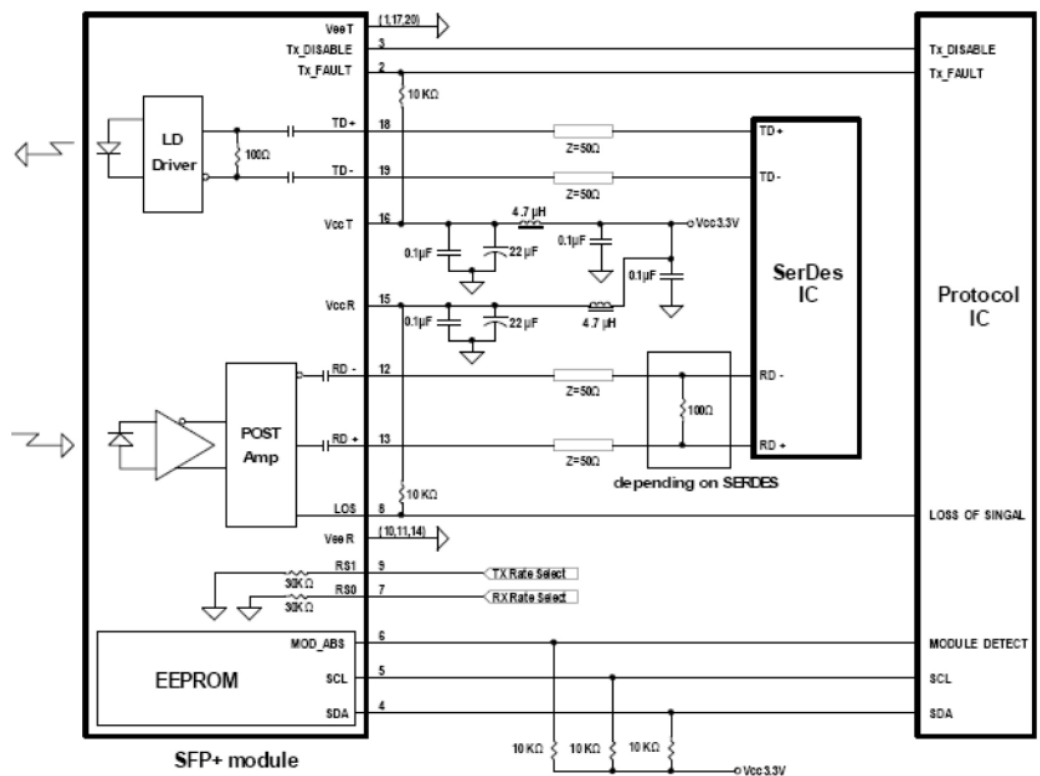
The SFP+ module provides two inputs RS0 and RS1 that can optionally be used for rate selection. RS0 controls the receive path signaling rate compatibility, and RS1 controls the transmit path signaling rate compatibility. The host and module may choose to use either, both, or none of these functions. Because contact 9 in the classic SFP INF-8074i is connected to VeeR, and SFP+ host utilizing RS1 must provide short circuit protection.

This rate select functionality can also be controlled by software as defined by SFF-8472. Optionally the rate select methods of Part 2 SFF-8079 may be used instead of the method described here by setting the management declaration bit (A0h byte 93 bit 2) to 1, see SFF-8472.

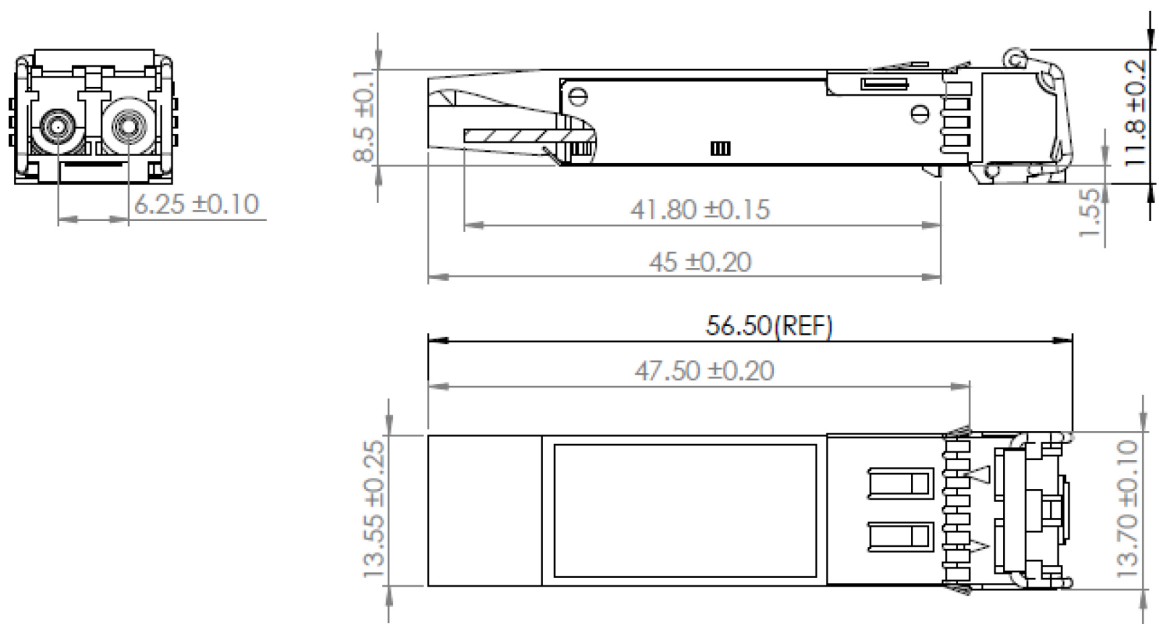


Pin-Out of Connector Block on the Host Board

Recommended Circuit Schematic

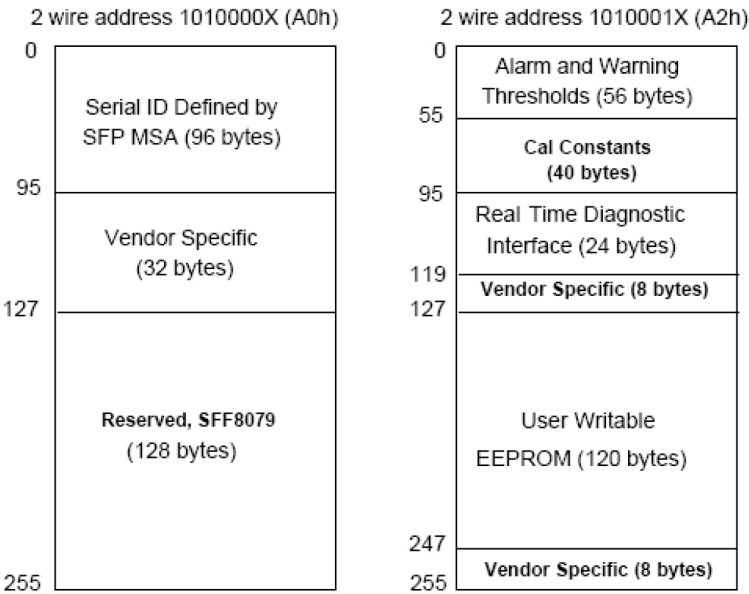


Mechanical Specifications



**EEPROM Information**

EEPROM memory map-specific data field description is as below:



## About AddOn Networks

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is ingrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



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