

EW3C0000235-A

1000BASE, SFP-T Transceiver

Features

- Up to 1.25Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- Commercial case temperature range (0°C to +70°C)
- Fully metallic enclosure for low EMI
- Low power dissipation
- Compact RJ-45 connector assembly
- Detailed product information in EEPROM
- +3.3V single power supply
- Access to physical layer IC via 2-wire serial bus
- Compliant with SFP MSA
- Compliant with IEEE Std 802.3TM-2002
- Compliant with FCC 47 CFR Part 15, Class B
- RoHS Compliant

1. Description

Approved Networks' 1000BASE-T copper SFP transceiver is a high performance, cost effective module compliant with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE 802.3-2002 and IEEE 802.3ab, which supporting 1000Mbps data rate up to 100 meters reach over unshielded twisted-pair category 5 cable. The module supports 1000 Mbps full duplex data-links with 5-level Pulse Amplitude Modulation (PAM) signals. All four pairs in the cable are used with symbol rate at 250Mbps on each pair. The 1000BASE-T copper SFP provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the 2-wire serial CMOS EEPROM protocol. The physical IC can also be accessed via 2-wire serial bus at address ACh.

**Applications**

- 1.25 Gigabit Ethernet over Cat 5 cable
- Switch/Router to Switch/Router Link
- High speed I/O for file servers

2. Pin Assignment and Description

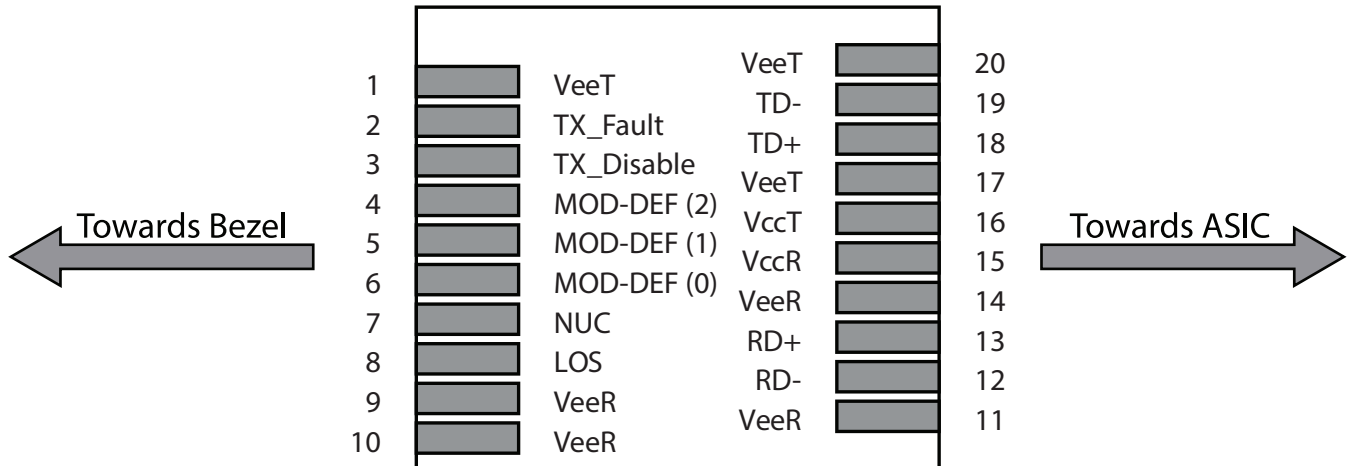


Figure 1. Host Board Connector Block Pin Numbers and Names

3. Pin Function Definitions

| Pin No | Name | Function | Plug Seq | Notes |
|--------|-------------|------------------------------|----------|-------|
| 1 | VeeT | Transmitter Ground | 1 | |
| 2 | TX Fault | Transmitter Fault Indication | 3 | 1 |
| 3 | TX Disable | Transmitter Disable | 3 | 2 |
| 4 | MOD-DEF2 | Module Definition | 2 | 3 |
| 5 | MOD-DEF1 | Module Definition 1 | 3 | 3 |
| 6 | MOD-DEF0 | Module Definition 0 | 3 | 3 |
| 7 | Rate Select | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | 4 |
| 9 | VeeR | Receiver Ground | 1 | |
| 10 | VeeR | Receiver Ground | 1 | |
| 11 | VeeR | Receiver Ground | 1 | |
| 12 | RD- | Inv. Received Data Out | 3 | 5 |
| 13 | RD+ | Received Data Out | 3 | 5 |
| 14 | VeeR | Receiver Ground | 3 | |
| 15 | VccR | Receiver Power | 2 | 6 |
| 16 | VccT | Transmitter Power | 2 | 6 |
| 17 | VeeT | Transmitter Ground | 1 | |
| 18 | TD+ | Transmit Data In | 3 | 7 |
| 19 | TD- | Inv. Transmit In | 3 | 7 |
| 20 | VeeT | Transmitter Ground | 1 | |

Notes:

1. TX Fault is not used and is always tied to ground through a 100 ohm resistor.
2. TX Disable as described in the MSA is not applicable to the 1000BASE-T module, but is used for convenience as an input to reset the internal ASIC. This pin is pulled up within the module with a 4.7 KW resistor.
Low (0 – 0.8 V): Transceiver on Between (0.8 V and 2.0 V): Undefined
High (2.0 – 3.465 V): Transceiver in reset state
Open: Transceiver in reset state
3. Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7-10 KW resistor on the host board to a supply less than $VCCT + 0.3\text{ V}$ or $VCCR + 0.3\text{ V}$.
Mod Def 0 is tied to ground through a 100 ohm resistor to indicate that the module is present.
Mod-Def 1 is clock line of two wire serial interface for optional serial ID
Mod-Def 2 is data line of two wire serial interface for optional serial ID
4. LVTTTL compatible with a maximum voltage of 2.5V. Not supported on HTSFP-24-111X
5. RD-/+: These are the differential receiver outputs. They are ac coupled 100 ohm differential lines which should be terminated with 100 ohm 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. These levels are compatible with CML and LVPECL voltage swings.
6. VCCR and VCCT are the receiver and transmitter power supplies. They are defined as $3.3\text{ V} \pm 5\%$ at the SFP connector pin. The maximum supply current is about 300mA and the associated in-rush current will typically be no more than 30 mA above steady state after 500 nanoseconds.
7. TD-/+: These are the differential transmitter inputs. They are ac coupled differential lines with 100 W 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. These levels are compatible with CML and LVPECL voltage swings.

4. +3.3V Volt Electrical Power Interface

This Transceiver has an input voltage range of 3.3 V +/- 5%. The 4 V maximum voltage is not allowed for continuous operation.

| Parameter | Symbol | Min | Typ | Max | Units | Notes/Conditions |
|-----------------------|--------------------|------|-----|------|-------|---|
| Supply Current | I _s | | 320 | 375 | mA | 1.2W max power over full range of voltage and temperature. See caution note below |
| Input | V _{cc} | 3.13 | 3.3 | 3.47 | V | Referenced to GND |
| Voltage Surge Current | I _{surge} | | 30 | | mA | Hot plug above steady state current. See caution note |

Caution:

Power consumption and surge current are higher than the specified values in the SFP MSA

5. Low-Speed Signals

MOD_DEF(1) (SCL) and MOD_DEF(2) (SDA), are open drain CMOS signals. Both MOD_DEF(1) and MOD_DEF(2) must be pulled up to host_Vcc.

| Parameter | Symbol | Min | Max | Units | Notes/Conditions |
|-----------------|--------|---------------|----------------|-------|----------------------------------|
| SFP Output LOW | VOL | 0 | 0.5 | V | 4.7k to 10k pull-up to host_Vcc. |
| SFP Output HIGH | VOH | host_Vcc -0.5 | host_Vcc + 0.3 | V | 4.7k to 10k pull-up to host_Vcc. |
| SFP Input LOW | VIL | 0 | 0.8 | V | 4.7k to 10k pull-up to Vcc. |
| SFP Input HIGH | | 2 | Vcc + 0.3 V | V | 4.7k to 10k pull-up to Vcc. |

6. High-Speed Electrical Interface

All high-speed signals are AC-coupled internally.

| Parameter | Symbol | Min | Typical | Max | Units | Notes/Conditions |
|------------------------------|---------------------|-----|---------|-----|-------|----------------------------------|
| Transmission Line-SFP | | | | | | |
| Line Frequency | f _L | | 125 | | MHz | 5-level encoding, per IEEE 802.3 |
| Tx Output Impedance | Z _{out,TX} | | 100 | | Ohm | Differential |
| Rx Input Impedance | Z _{in,RX} | | 100 | | Ohm | Differential |

| Parameter | Symbol | Min | Typical | Max | Units | Notes/Conditions |
|--------------------------------|----------|-----|---------|------|-------|------------------|
| Host-SFP | | | | | | |
| Single ended data input swing | Vinsing | 250 | | 1200 | mV | Single ended |
| Single ended data output swing | Voutsing | 350 | 100 | 800 | mV | Single ended |
| Rise/Fall Time | Tr,Tf | | 175 | | psec | 20%-80% |
| Tx Input Impedance | Zin | | 50 | | Ohm | Single ended |
| Rx Output Impedance | Zout | | 50 | | Ohm | Single ended |

7. General Specifications

| Parameter | Symbol | Min | Typical | Max | Units | Notes/Conditions |
|--------------|--------|-----|---------|-------|-------|----------------------------|
| Data Rate | BR | 100 | | 1,000 | Mb/s | IEEE 802.3 compatible. |
| Cable Length | L | | | 100 | m | Category 5 UTP. BER <10-12 |

8. Environmental Specifications

This transceiver has an extended range from 0°C to +85°C case temperature as specified below.

| Parameter | Symbol | Min | Typ | Max | Units |
|-----------------------|--------|-----|-----|-----|-------|
| Operating Temperature | Top | -0 | | +70 | °C |
| Storage Temperature | Tsto | -40 | | 100 | °C |

9. SFP Module EEPROM Information and Management

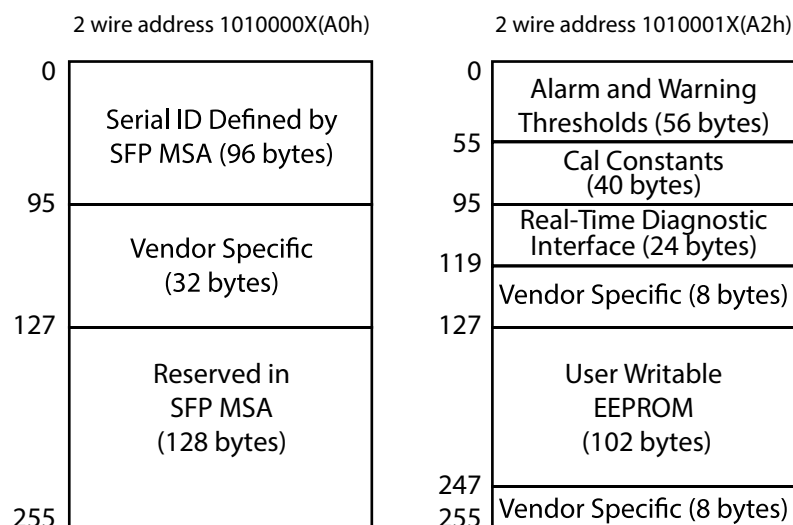


Figure 2. Diagnostic Memory Map (Specific Data Field Descriptions)

10. Serial ID Memory Contents

| Base ID Fields | | | |
|--------------------|---------------|-----------------------|---|
| Data Address | Length (Byte) | Name of Length | Description and Contents |
| 0 | 1 | Identifier | Type of Serial transceiver (03h=SFP) |
| 1 | 1 | Reserved | Extended identifier of type serial transceiver (04h) |
| 2 | 1 | Connector | Code of optical connector type (22=RJ45) |
| 3-10 | 8 | Transceiver | 1000BASE - T |
| 11 | 1 | Encoding | 8B10B (01h) |
| 12 | 1 | BR, Nominal | Nominal baud rate, unit of 100Mbps |
| 13-14 | 2 | Reserved | (0000h) |
| 15 | 1 | Length(9um) | Link length supported for 9/125um fiber, units of 100m |
| 16 | 1 | Length(50um) | Link length supported for 50/125um fiber, units of 10m |
| 17 | 1 | Length(62.5um) | Link length supported for 62.5/125um fiber, units of 10m |
| 18 | 1 | Length(Copper) | Link length supported for copper, units of meters |
| 19 | 1 | Reserved | |
| 20-35 | 16 | Vendor Name | SFP vendor name |
| 36 | 1 | Reserved | |
| 37-39 | 3 | Vendor OUI | SFP transceiver vendor OUI ID |
| 40-55 | 16 | Vendor PN Part Number | Part Number (ASCII) |
| 56-59 | 4 | Vendor rev | Revision level for part number |
| 60-62 | 3 | Reserved | |
| 63 | 1 | CCID | Least significant byte of sum of data in address 0-62 |
| Extended ID Fields | | | |
| Data Address | Length (Byte) | Name of Length | Description and Contents |
| 64-65 | 2 | Option | Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported) |
| 66 | 1 | BR, max | Upper bit rate margin, units of % |
| 67 | 1 | BR, min | Lower bit rate margin, units of % |
| 68-83 | 16 | Vendor SN | Serial number (ASCII) |
| 84-91 | 8 | Date code | Vendor Manufacturing date code |

| Extended ID Fields | | | |
|---------------------------|---------------|----------------|--|
| Data Address | Length (Byte) | Name of Length | Description and Contents |
| 92-94 | 3 | Reserved | |
| 95 | 1 | CCEX | Check code for the extended ID Fields (addresses 64 to 94) |
| Vendor Specific ID Fields | | | |
| Data Address | Length (Byte) | Name of Length | Description and Contents |
| 96-127 | 32 | Readable | Vendor specific data, read only |
| 128-255 | 128 | Reserved | Reserved for SFF-8079 |

11. Mechanical Dimentionions

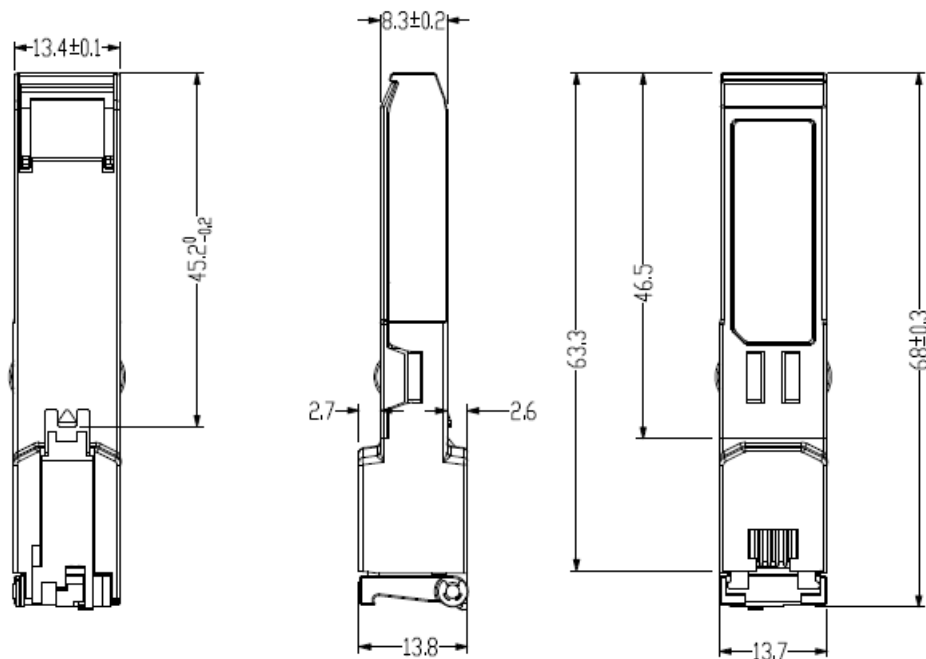


Figure 3. Mechanical outline

12. Contact Information

Approved Networks is a leading supplier of Network Transceivers and Connectivity products to Channel Partners, Resellers, and OEMs. With more than 9 years of direct industry experience, our products are resident in the most demanding and mission critical functional networks Worldwide. We serve as a Master Distributor to the largest CMs in the world and deploy the most rigorous testing and firmware management programs to bring the highest level of functional product to the market at a cost that makes sense.

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