# TS-SF-T12-02-3
# 1000BASE-T Copper SFP Transceiver

## PRODUCT FEATURES

- Up to 1.25 Gb/s bi-directional data links

- Hot-pluggable SFP footprint

- Low power dissipation(1.05W typical)

- Compact RJ-45 connector assembly

- Fully metal enclosure, for lower EMI

- RoHS compliant and lead-free

- Single +3.3V power supply

- 1.25 Gigabit Ethernet over Cat 5 cable

- Case operating temperature：

    Commercial: 0 ℃ to +70 ℃

    Extended: -10 ℃ to +80 ℃

    Industrial: -40 ℃ to +85 ℃

## PRODUCT DESCRIPTION

TRANSCOM'S TS-SF-T12-02-3 1000BASE-T Copper Small Form Pluggable (SFP) transceivers are based on the SFP Multi Source Agreement (MSA).They are compatible with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE Std 802.3 . The 1000BASE-T physical layer IC (PHY) can be accessed via I2C, allowing access to all PHY settings and features.

The TS-SF-T12-02-3 is compatible with 1000BASE-X auto-negotiation and support a SERDES, but does not have a link indication feature.
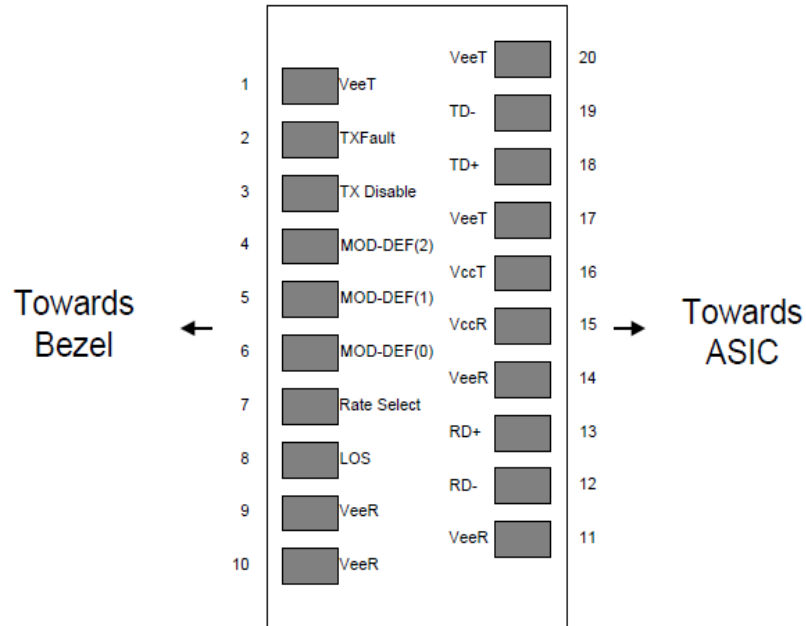
# I. SFP to Host Connector Pin Out



**Figure 1. Diagram of host board connector block pin numbers and names**

| Pin | Symbol | Name/Description | Ref. |
|---|---|---|---|
| 1 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | TFAULT | Transmitter Fault. Not supported. | |
| 3 | TDIS | Transmitter Disable. Not supported. | |
| 4 | MOD_DEF(2) | Module Definition 2. Data line for Serial ID. | 2 |
| 5 | MOD_DEF(1) | Module Definition 1. Clock line for Serial ID. | 2 |
| 6 | MOD_DEF(0) | Module Definition 0. Grounded within the module. | 2 |
| 7 | Rate Select | No connection required | |
| 8 | LOS | Loss of Signal indication. Logic 0 indicates normal operation. | 3 |
| 9 | VEER | Receiver Ground (Common with Transmitter Ground) | 1 |
| 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 | |
| 13 | RD+ | Receiver Non-inverted DATA out. AC Coupled | |
| 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. | |
| 19 | TD- | Transmitter Inverted DATA in. AC Coupled. | |
| 20 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |

Notes:

1. Circuit ground is connected to chassis ground

2. Should be pulled up with 4.7k - 10k Ohms on host board to a voltage between 2.0 V and 3.6 V. MOD_DEF(0) pulls line low to indicate module is plugged in.

3. LVTTL compatible with a maximum voltage of 2.5V.

## II.    +3.3V Volt Electrical Power Interface

The TS-SF-T12-02-3 has an input voltage range of 3.3 V +/- 5%. The 4V maximum voltage is not allowed for continuous operation.

| +3.3 Volt Electrical Power Interface | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| Supply Current | Is | | 320 | 375 | mA | 1.2W max power over full range of voltage and temperature. See caution note below |
| Input Voltage | Vcc | 3.13 | 3.3 | 3.47 | V | Referenced to GND |
| Maximum Voltage | Vmax | | | 4 | V | |
| Surge Current | Isurge | | | 30 | mA | Hot plug above steady state current.   See caution note below |

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

## III.    Low-Speed Signals

MOD_DEF(1) (SCL) and MOD_DEF(2) (SDA), are open drain CMOS signals (see section VII, "Serial Communication Protocol").    Both MOD_DEF(1) and MOD_DEF(2) must be pulled up to host_Vcc

| Low-Speed Signals, Electronic Characteristics | | | | | |
|---|---|---|---|---|---|
| Parameter | Symbol | Min | Max | unit | Notes/Conditions |
| SFP Output LOW | VOL | 0 | 0.5 | V | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| SFP Output HIGH | VOH | host_Vcc -0.5 | host_Vcc + 0.3 | V | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| SFP Input LOW | VIL | 0 | 0.8 | V | 4.7k to 10k pull-up to Vcc, measured at SFP side of connector |
| SFP Input HIGH | VIH | 2 | Vcc + 0.3 | V | 4.7k to 10k pull-up to Vcc, measured at SFP side of connector |

## IV. High-Speed Electrical Interface

All high-speed signals are AC-coupled internally.

| High-Speed Electrical Interface, Transmission Line-SFP | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| Line Frequency | fL | | 125 | | MHz | 5-level encoding, per IEEE 802.3 |
| Tx Output Impedance | Zout,TX | | 100 | | Ohm | Differential, for all frequencies between 1MHz and 125MHz |
| Rx Input Impedance | Zin,RX | | 100 | | Ohm | Differential, for all frequencies between 1MHz and 125MHz |

| High-Speed Electrical Interface, Host-SFP | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| Single ended data input swing | Vinsing | 250 | | 1200 | mV | Single ended |
| Single ended data output swing | Voutsing | 350 | | 800 | mV | Single ended |
| Rise/Fall Time | $T_r, T_f$ | | 175 | | psec | 20%-80% |
| Tx Input Impedance | Zin | | 50 | | Ohm | Single ended |
| Rx Output Impedance | Zout | | 50 | | Ohm | Single ended |

## V. General Specifications

| General | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| Data Rate | BR | 10 | | 1000 | Mb/sec | IEEE 802.3 compatible. See Notes 2 through 4 below |
| Cable Length | L | | | 100 | m | Category 5 UTP. |

**Notes:**

1. Clock tolerance is +/- 50 ppm

2. By default, the TS-SF-T12-02-3 is a full duplex device in preferred master mode

3. Automatic crossover detection is enabled.    External crossover cable is not required

4. TS-SF-T12-02-3 does not support SGMII .With a SERDES the module will operate at 1000BASE-T.

## VI. Environmental Specifications

| Environmental Specifications | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| Case Operating Temperature | Tcase | 0 | | 70 | ℃ | TS-SF-T12-02-3 |
| | | -10 | | 80 | ℃ | TS-SF-T12-02-3E |
| | | -40 | | 85 | ℃ | TS-SF-T12-02-3A |
| Storage Temperature | Tsto | -40 | | 85 | ℃ | Ambient temperature |

## VII. Serial Communication Protocol

TS-SF-T12-02-3 support the 2-wire serial communication protocol outlined in the SFP MSA. It uses use an Atmel AT24C02B 256 byte EEPROM with an address of A0h.

| Serial Bus Timing Requirements | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typ | Max | unit | Notes/Conditions |
| I $^2$C Clock Rate | | 0 | | 100,000 | Hz | |

## VIII. Mechanical Specifications (Unit:mm)
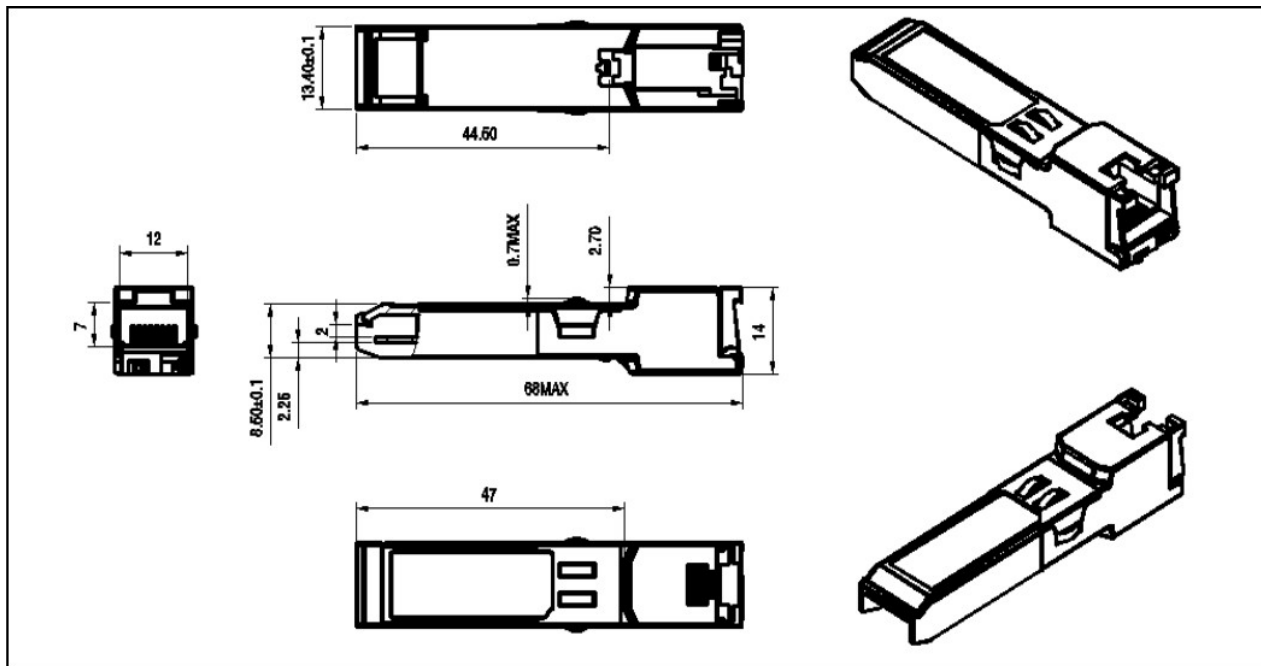


## Appendix A. Document Revision

| Version No. | Date | Description |
|---|---|---|
| 1.0 | 2011-4-22 | Preliminary datasheet |
| 2.0 | 2011-9-10 | Update format and company's logo |
| 3.0 | 2012-02-02 | Add industrial temperature type |