

## SFP

### ES-T2-R

#### 10/100/1000BASE-T Copper SFP Transceiver

- Up to 1.25Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- TX Disable and RX Los/without Los function
- Fully metallic enclosure for low EMI
- Low power dissipation (1.05 W typical)
- Compact RJ-45 connector assembly
- Access to physical layer IC via 2-wire serial bus
- 10/100/1000Mbps compliant in host systems with SGMII interface
- Operating case temperature range of 0°C to +70°C (Commercial)  
-20°C to +85°C (Extend)



## Applications

- 1.25 Gigabit Ethernet over Cat 5 cable

## Description

ETU-LINK's ES-T2-R Copper Small Form Pluggable (SFP) transceivers is high performance, cost effective module compliant with the Gigabit Ethernet and 10/100/1000BASE-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 module 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.

## Pin Definitions

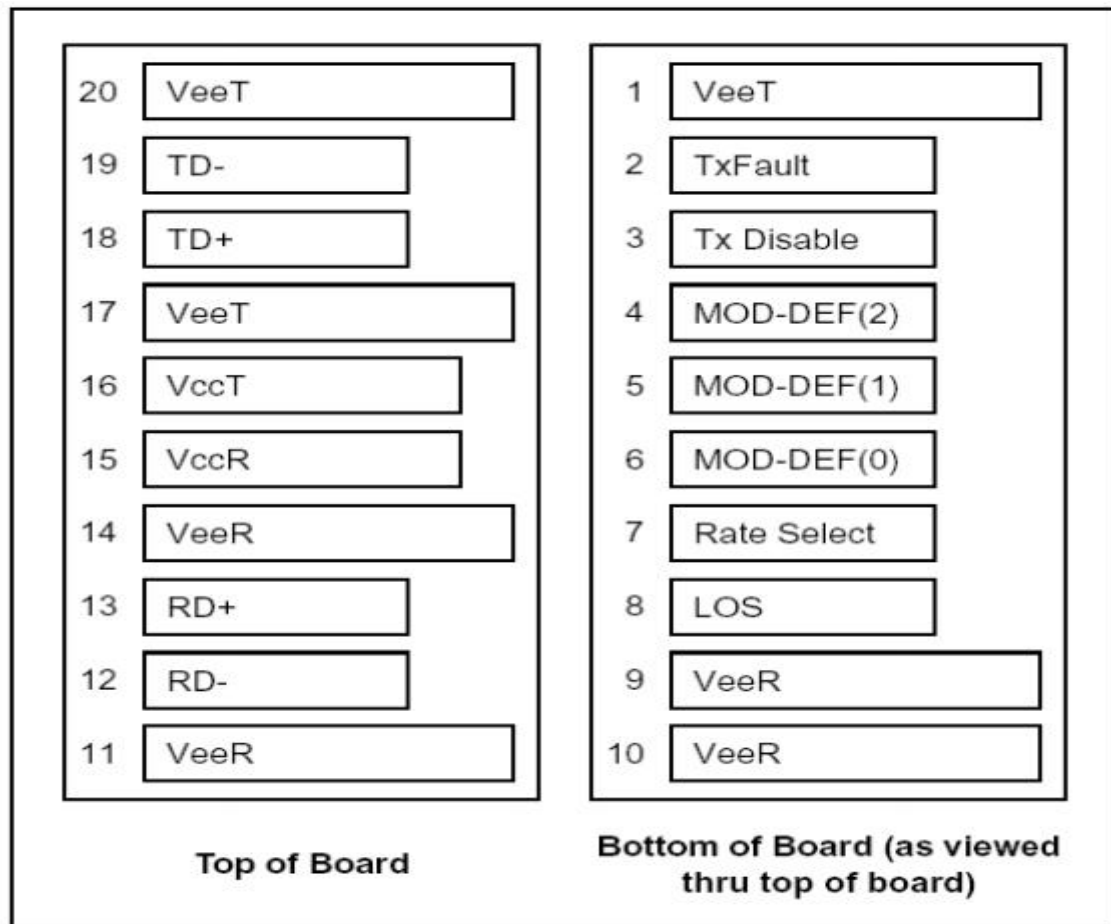


Figure 1. Pin Definitions

## Pin Descriptions

| PIN | NAME        | FUNCTION                     | SEQ. | NOTES                                                         |
|-----|-------------|------------------------------|------|---------------------------------------------------------------|
| 1   | VeeT        | Transmitter Ground           | 1    | VeeT and VeeR are connected in SFP.                           |
| 2   | TX_FAULT    | Transmitter Fault Indication | 3    | Not Implemented. Tied to VeeT in SFP.                         |
| 3   | TX_DISABLE  | Transmitter Disable          | 3    | See TX Disable.                                               |
| 4   | MOD DEF (2) | Module Definition 2          | 3    | Data Line for Serial ID and Bidirectional Data Transfer bus.  |
| 5   | MOD DEF (1) | Module Definition 1          | 3    | Clock Line for Serial ID and Bidirectional Data Transfer bus. |
| 6   | MOD DEF (0) | Module Definition 0          | 3    | Tied to Vee in SFP.                                           |
| 7   | RATE SELECT | Not Implemented              | 3    | Not implemented. 33K pulldown to Vee in SFP.                  |
| 8   | LOS         | Loss of Signal               | 3    | See LOS option.                                               |

|    |      |                                |   |                                                        |
|----|------|--------------------------------|---|--------------------------------------------------------|
| 9  | VeeR | Receiver Ground                | 1 | VeeT and VeeR are connected in SFP.                    |
| 10 | VeeR | Receiver Ground                | 1 | VeeT and VeeR are connected in SFP.                    |
| 11 | VeeR | Receiver Ground                | 1 | VeeT and VeeR are connected in SFP.                    |
| 12 | RD-  | Inverted Received Data out     | 3 | AC coupled 100 ohm differential high speed data lines. |
| 13 | RD+  | Non-Inverted Received Data out | 3 | AC coupled 100 ohm differential high speed data lines. |
| 14 | VeeR | Receiver Ground                | 1 | VeeT and VeeR are connected in SFP.                    |
| 15 | VccR | Receiver Power                 | 2 | VccR and VccT are connected in SFP.                    |
| 16 | VccT | Transmitter Power              | 2 | VccR and VccT are connected in SFP.                    |
| 17 | VeeT | Transmitter Ground             | 1 | VeeT and VeeR are connected in SFP.                    |
| 18 | TD+  | Non-inverted Data In           | 3 | AC coupled 100 ohm differential high speed data lines. |
| 19 | TD-  | Inverted Data In               | 3 | AC coupled 100 ohm differential high speed data lines. |
| 20 | VeeT | Transmitter Ground             | 1 | VeeT and VeeR are connected in SFP.                    |

**Notes:**

Plug Seq.: Pin engagement sequence during hot plugging.

- 1) TX Fault is not supported and is always connected to ground.
- 2) TX disable, an input used to reset the transceiver module, This pin is pulled up within the module with a 4.7 K $\Omega$  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 4.7K~10K resistor on the host board. The pull-up voltage shall be VccT or VccR

Mod-Def 0 is grounded by the module to indicate that the module is present

Mod-Def 1 is the clock line of two wire serial interface for serial ID

Mod-Def 2 is the data line of two wire serial interface for serial ID

- 4) RX\_LOS (Loss of Signal): LVTTTL compatible with a maximum voltage of Host\_Vcc. RX\_LOS can enabled or disabled (Refer to Ordering information),RX\_LOS is not used and is always tied to ground via 100-ohm resistor.

- 5) RD-/+: These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES.

- 6) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential termination inside the module.

## +3.3V Volt Electrical Power Interface

| Parameter       | Symbol           | Min  | Typ | Max  | Units | Notes/Conditions                                                                  |
|-----------------|------------------|------|-----|------|-------|-----------------------------------------------------------------------------------|
| Supply Current  | I <sub>s</sub>   |      | 320 | 375  | mA    | 1.2W max power over full range of voltage and temperature. See caution note below |
| Input Voltage   | V <sub>cc</sub>  | 3.13 | 3.3 | 3.47 | V     | Referenced to GND                                                                 |
| Maximum Voltage | V <sub>max</sub> |      |     | 4    | V     | Maximum                                                                           |

## Low-speed signals, electronic characteristics

| Parameter       | Symbol | Min                          | Max                           | Units | Notes/Conditions                                                                 |
|-----------------|--------|------------------------------|-------------------------------|-------|----------------------------------------------------------------------------------|
| SFP Output LOW  | VOL    | 0                            | 0.5                           | V     | 4.7k to 10k pull-up to host_V <sub>cc</sub> , measured at host side of connector |
| SFP Output HIGH | VOH    | host_V <sub>cc</sub><br>-0.5 | host_V <sub>cc</sub><br>+ 0.3 | V     | 4.7k to 10k pull-up to host_V <sub>cc</sub> , measured at host side of connector |
| SFP Input LOW   | VIL    | 0                            | 0.8                           | V     | 4.7k to 10k pull-up to V <sub>cc</sub> , measured at SFP side of connector       |
| SFP Input HIGH  | VIH    | 2                            | V <sub>cc</sub> +0.3          | V     | 4.7k to 10k pull-up to V <sub>cc</sub> , measured at SFP side of connector       |

## High-speed electrical interface, transmission line-SFP

| Parameter           | Symbol              | Min | Typ | Max | Units | Notes/Conditions                                          |
|---------------------|---------------------|-----|-----|-----|-------|-----------------------------------------------------------|
| Line Frequency      | f <sub>L</sub>      |     | 125 |     | MHz   | 5-level encoding, per IEEE 802.3                          |
| Tx Output Impedance | Z <sub>out,TX</sub> |     | 100 |     | Ohm   | Differential, for all Frequencies between 1MHz and 125MHz |
| Rx Input Impedance  | Z <sub>in,RX</sub>  |     | 100 |     | Ohm   | Differential, for all Frequencies between 1MHz and 125MHz |

## High-speed electrical interface, host-SFP

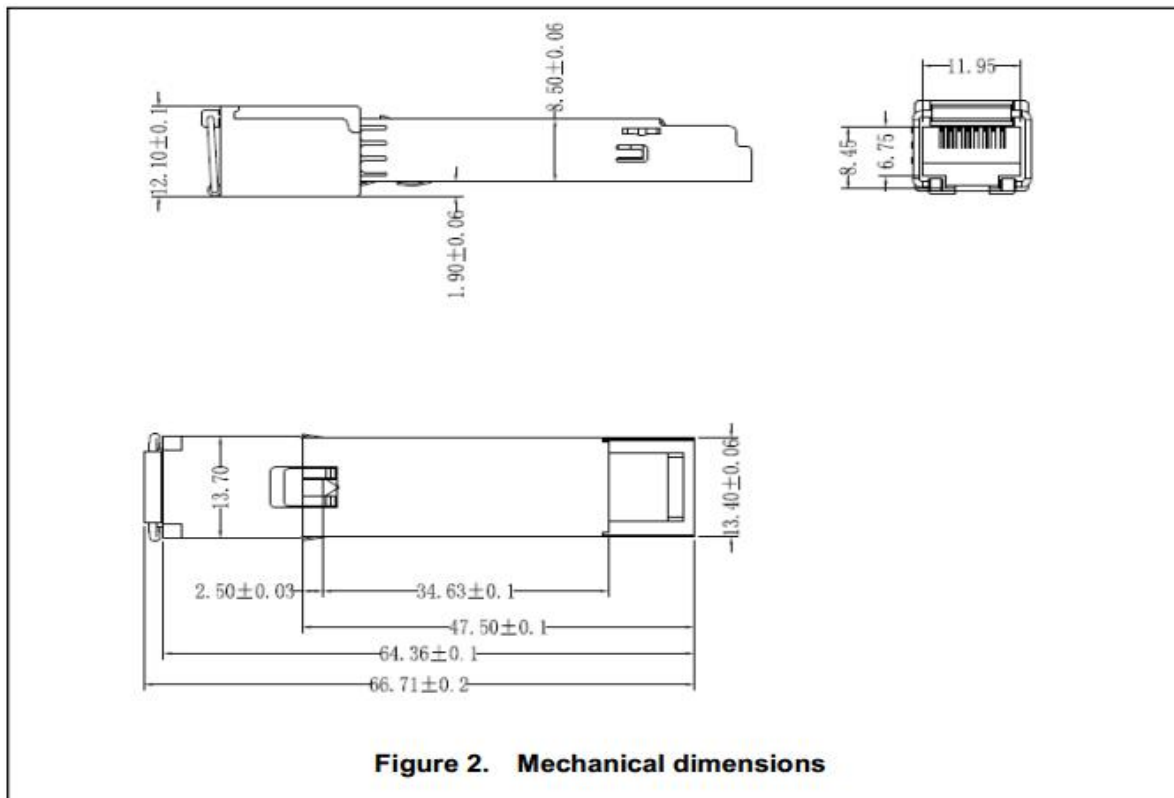
| Parameter                      | Symbol   | Min | Typ | Max  | Units | Notes/Conditions |
|--------------------------------|----------|-----|-----|------|-------|------------------|
| Single ended data input swing  | Vinsing  | 250 |     | 1200 | mV    | Single ended     |
| Single ended data output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

## General specifications

| Parameter                  | Symbol     | Min | Typical | Max | Unit |
|----------------------------|------------|-----|---------|-----|------|
| Operating Case Temperature | Commercial | Tc  |         | 70  | °C   |
|                            | Extend     |     |         |     |      |
|                            |            |     |         |     |      |
| Storage Temperature        |            | -40 |         | 85  | °C   |

## Mechanical Specifications

The host-side of the ES-T2-R conforms to the mechanical specifications outlined in the SFP MSA1. The front portion of the SFP (part extending beyond the face plate of the host) is larger to accommodate the RJ-45 connector



## References

1. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
2. IEEE802.3 – 2002.
3. “AT24C01A/02/04/08/16 2-Wire Serial CMOS E2PROM”, Atmel Corporation.

## Regulatory Compliance

| Feature                            | Reference                                           | Performance               |
|------------------------------------|-----------------------------------------------------|---------------------------|
| Electrostatic discharge (ESD)      | IEC/EN 61000-4-2                                    | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022<br>Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11<br>IEC/EN 60825-1, 2     | Class 1 laser product     |
| Component Recognition              | IEC/EN 60950, UL                                    | Compatible with standards |
| ROHS                               | 2002/95/EC                                          | Compatible with standards |
| EMC                                | EN61000-3                                           | Compatible with standards |

## Ordering information

| Part number | Speed mode       | MAC interface | TX Disable function | Link Indicator on RX_LOS Pin | Temp        |
|-------------|------------------|---------------|---------------------|------------------------------|-------------|
| ES-T1-R     | 1000Mbps         | SERDES        | Yes                 | Yes                          | 0~70°C      |
| ES-T2-R     | 10/100/1000 Mbps | SGMII         | Yes                 | Yes                          | 0~70°C      |
| ES-T3-R     | 10/100M          | SGMII         | Yes                 | Yes                          | 0~70°C      |
| ES-T4-R     | 1000M            | SERDES        | Yes                 | Yes                          | -20°C~+85°C |

## Compatibility Test

In order to ensure the product compatibility, our products will be tested on the switch before shipment. Our modules can be compatible with many mainstream brand switches, such as Cisco, Juniper, Extreme, Brocade, IBM, H3C, HP, Huawei, D-Link, Mikrotik, ZTE, TP-Link...

Our test equipment: VOLKTEK MEN-4110, HP 2530-8G, CRS226-24G-25+RM, Catalyst 2960G Series, Catalyst 3850 XS 10G SFP+, Catalyst 3750-E Series, HUAWEI S5700Series, H3C S3100V2 Series, Juniper-EX4200, etc.



Cisco Catalyst 3850



HUAWEI S5700



H3C S3100V2



HP J9264AR



Juniper EX 4200



Alcatel 6850E-U24X



Mikrotik CR5226-24G-25+RM



Cisco Catalyst 2960G



Volktek MEN-4110



## Quality Assurance

Continuous introduction of new equipment, produced by strict standards, strict quality inspection, to guarantee the high quality standard of each product.



**Standardized  
Production Line**



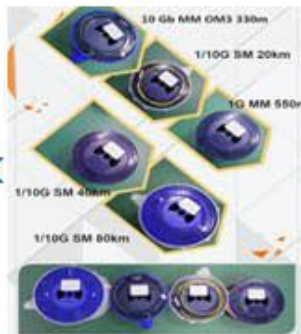
**Professional  
Welding**



**Assembling**



**Aging Testing**



**Distance Testing**



**Cleaning end face**



**Product Initial Test**



**Switch Testing**

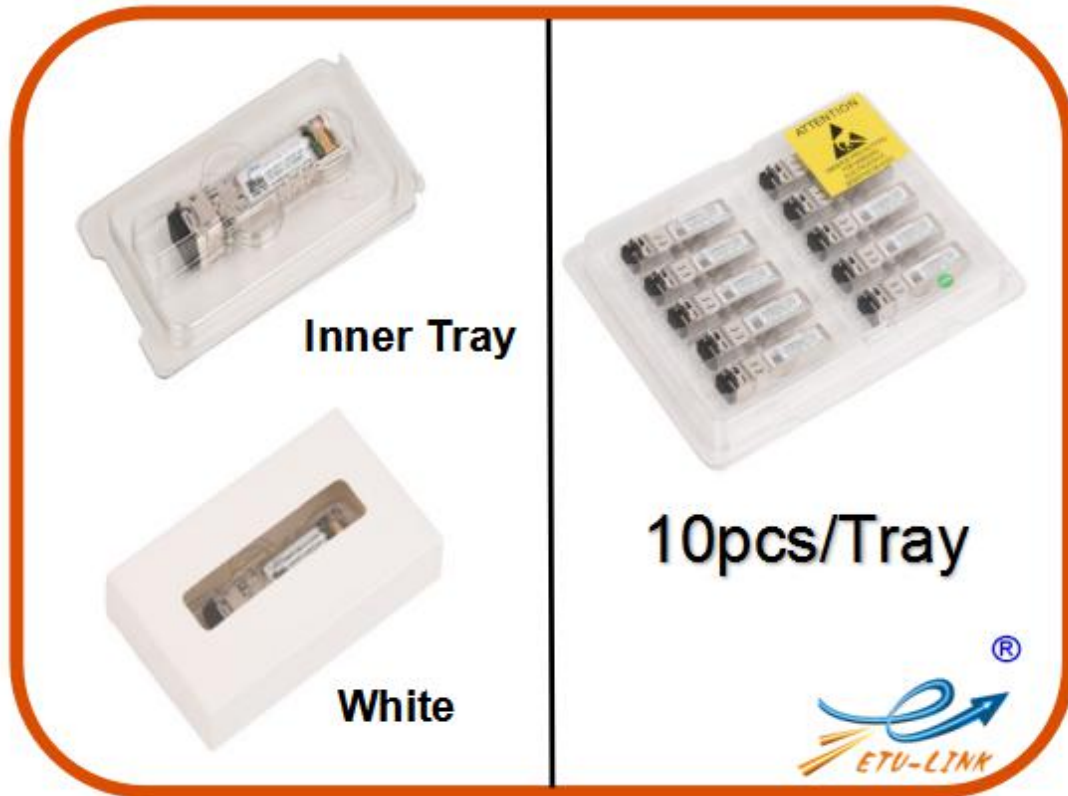


**Product Final Test**



## Packaging

ETU-Link provides two kinds of packaging, 10pcs/Tray and individual package.



Company: ETU-Link Technology Co., LTD

Address: 4th Floor, C Building, JinBoLong Industrial Park, QingQuan Road, LongHua District, Shenzhen city, GuangDong

Tel: +86-755 2328 4603

Addresses and phone number also have been listed at [www.etulinktechnology.com](http://www.etulinktechnology.com).

Please e-mail us at [sales@etulinktechnology.com](mailto:sales@etulinktechnology.com) or call us for assistance.