



# SFP+

## ES31X-3LCD10

### 10Gbps 1310nm 10KM SFP+ Optical Transceiver

- Optical interface compliant to IEEE 802.3ae 10GBASE-LF
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- 1310nm DFB transmitter, PIN photo-detector
- Operating case temperature: 0 to 70 °C
- Low power consumption  $\leq 1.5W$
- Duplex LC receptacle
- Applicable for 10km SMF connection
- All-metal housing for superior EMI performance
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS6 compliant (lead free)
- Compliant with IEEE 802.3ae-2002, SFP+ MSA
- Case operating temperature range: -5°C to 70°C
- Transceiver power monitoring and threshold exceed warning
- Information extraction and retrieval:
  - + Media type
  - + Module Information: Vendor, Part number, Serial number, Wavelength
  - + Voltage, temperature and threshold exceed warning



## Applications

- 10GBASE-LR at 10.3125Gbps
- Other optical links

## Standard

- Compliant with SFF-8472 SFP+ MSA.
- Compliant to SFP+ SFF-8431 and SFF-8432.
- Compliant to 802.3ae 10GBASE-LR.
- RoHS Compliant.

## Product description

This 1310nm DFB 10Gbps SFP+ transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km.

The SFP+ 10km module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

## Absolute Maximum Ratings

| Parameter                  | Symbol | Min  | Typ | Max | Unit | Ref. |
|----------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage     | Vcc    | -0.5 |     | 4.7 | V    |      |
| Storage Temperature        | TS     | -40  |     | 85  | °C   |      |
| Case Operating Temperature | Tcase  | -5   |     | 70  | °C   |      |

## Optical Characteristics

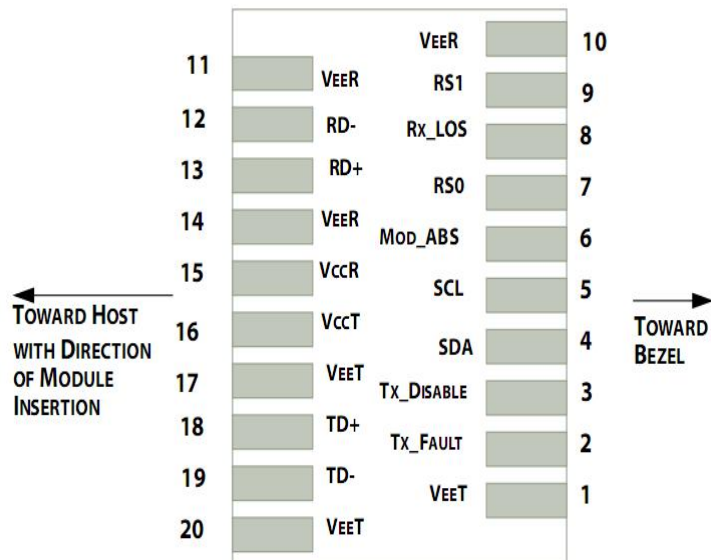
| Parameter                          | Symbol                       | Min  | Typ  | Max   | Unit  | Ref. |
|------------------------------------|------------------------------|------|------|-------|-------|------|
| <b>Transmitter</b>                 |                              |      |      |       |       |      |
| Output Opt. Pwr                    | POUT                         | -8.2 |      | 0.5   | dBm   | 1    |
| Optical Wavelength                 | $\lambda$                    | 1260 | 1310 | 1355  | nm    |      |
| Wavelength Temperature Dependence  |                              |      | 0.08 | 0.125 | nm/°C |      |
| Spectral Width (-20dB)             | $\sigma$                     |      |      | 1     | nm    |      |
| Optical Extinction Ratio           | ER                           | 3.5  |      |       | dB    |      |
| Transmitter and Dispersion Penalty | TDP                          |      |      | 3.2   | dB    |      |
| Optical Rise/Fall Time             | tr/ tf                       |      | 0.1  | 0.26  | ns    |      |
| RIN                                | RIN                          |      |      | -128  | dB/Hz |      |
| Output Eye Mask                    | Compliant with IEEE 0802.3ae |      |      |       |       |      |
| <b>Receiver</b>                    |                              |      |      |       |       |      |
| Rx Sensitivity                     | RSENS                        |      |      | -14.4 | dBm   | 2    |

|                                   |             |      |     |      |     |  |
|-----------------------------------|-------------|------|-----|------|-----|--|
| Input Saturation Power (Overload) | Psat        | 0.5  |     |      | dBm |  |
| Wavelength Range                  | $\lambda_c$ | 1270 |     | 1610 | nm  |  |
| LOS De -Assert                    | LOSD        |      |     | -17  | dBm |  |
| LOS Assert                        | LOSA        | -30  |     |      | dBm |  |
| LOS Hysteresis                    |             | 0.5  | 1.0 |      | dB  |  |

**Notes:**

- 1) Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- 2) With worst-case extinction ratio. Measured with a PRBS  $2^{31}-1$  test pattern, @10.325Gb/s,  $BER \leq 10^{-12}$ .

## Pin Assignment



Pin out of Connector Block on Host Board

| Pin | Symbol      | Name/Description   | Ref. |
|-----|-------------|--|------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | $T_{FAULT}$ | Transmitter Fault.   | 2    |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 4   | SDA         | 2-wire Serial Interface Data Line                              | 4    |
| 5   | SCL         | 2-wire Serial Interface Clock Line                             | 4    |
| 6   | MOD_ABS     | Module Absent. Grounded within the module                      | 4    |
| 7   | RS0         | Rate Select 0  | 5    |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 6    |
| 9   | RS1         | No connection required   | 1    |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | $V_{EER}$   | 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  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |

|    |           |  |   |
|----|-----------|--|---|
| 15 | $V_{CCR}$ | Receiver Power Supply                            |   |
| 16 | $V_{CCT}$ | Transmitter Power Supply                         |   |
| 17 | $V_{EET}$ | 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 | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1 |

**Notes:**

- 1) Circuit ground is internally isolated from chassis ground.
- 2)  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{cc} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- 3) Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
- 4) Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
- 5) Internally pulled down per SFF-8431 Rev 4.1.
- 6) LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Electrical Interface Characteristics

| Parameter                      | Symbol       | Min          | Typ | Max          | Unit | Ref. |
|--------------------------------|--------------|--------------|-----|--------------|------|------|
| Supply Voltage                 | $V_{cc}$     | 3.14         | 3.3 | 3.46         | V    |      |
| Supply Current                 | $I_{cc}$     |              |     | 300          | mA   |      |
| <b>Transmitter</b>             |              |              |     |              |      |      |
| Input differential impedance   | $R_{in}$     |              | 100 |              | Ω    | 1    |
| Single ended data input swing  | $V_{in,pp}$  | 180          |     | 700          | mV   |      |
| Transmit Disable Voltage       | VD           | $V_{cc}-1.3$ |     | $V_{cc}$     | V    |      |
| Transmit Enable Voltage        | VEN          | Vee          |     | $V_{ee}+0.8$ | V    | 2    |
| Transmit Disable Assert Time   |              |              |     | 10           | us   |      |
| <b>Receiver</b>                |              |              |     |              |      |      |
| Differential data output swing | $V_{out,pp}$ | 300          |     | 850          | mV   | 3    |
| Data output rise time          | $t_r$        | 28           |     |              | ps   | 4    |
| Data output fall time          | $t_f$        | 28           |     |              | ps   | 4    |
| LOS Fault                      | VLOS fault   | $V_{cc}-1.3$ |     | $V_{ccHOST}$ | V    | 5    |
| LOS Normal                     | VLOS norm    | Vee          |     | $V_{ee}+0.8$ | V    | 5    |
| Power Supply Rejection         | PSR          | 100          |     |              | mVpp | 6    |

**Notes:**

- 1) Connected directly to TX data input pins. AC coupled thereafter.

- 2) Or open circuit.
- 3) Into 100 ohms differential termination.
- 4) 20 – 80 %.
- 5) Loss of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
- 6) Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## Digital Diagnostic Functions

ETU-LINK's ES31X-3LCD10 transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1.

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

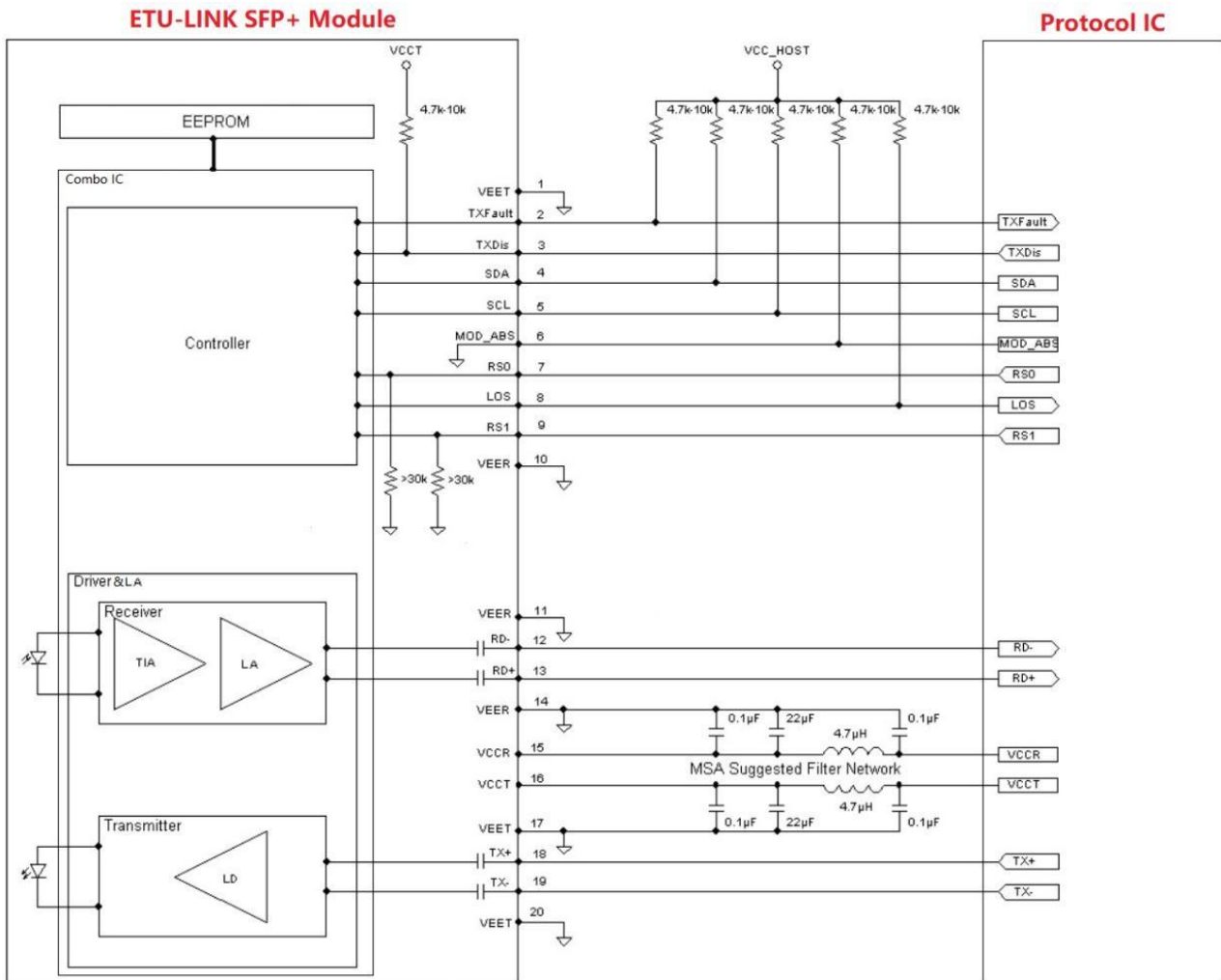
Additionally, ETU-LINK SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver.

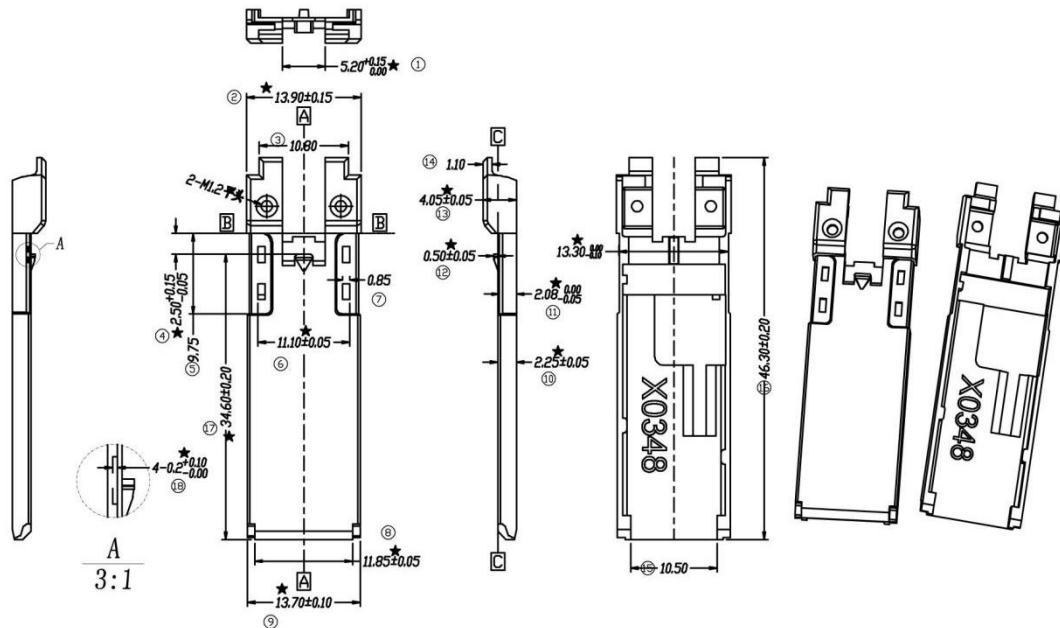
The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

## Host-Transceiver Interface Block Diagram



## Outline Dimensions

Comply with SFF-8432 rev. 5.0, the improved Pluggable form factor specification.



## 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 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11 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 |

## Compatibility Test

In order to ensure the product compatibility, our products will be tested on the switch before shipment. Our modules can 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**



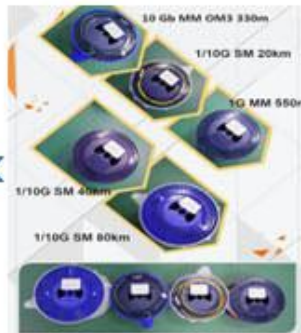
**Professional  
Welding**



**Assembling**



**Aging Testing**



**Distance Testing**



**Cleaning end face**



**Product Initial Test**



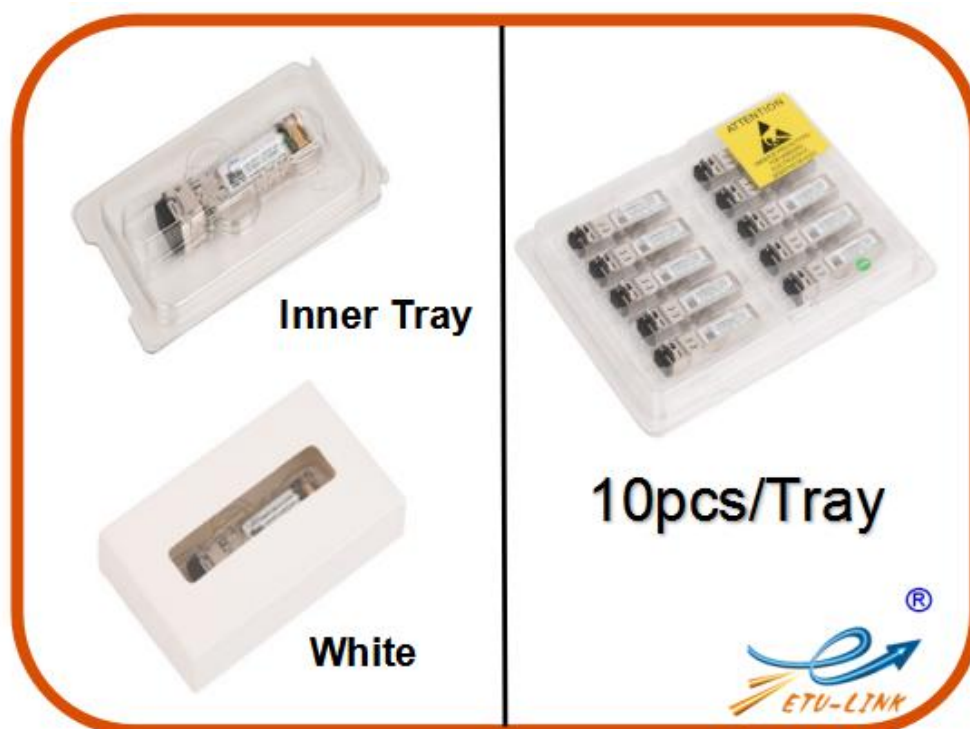
**Switch Testing**



**Product Final Test**

## Packaging

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



Company: ETU-Link Technology Co., LTD

Address: Right side of 3rd floor, No. 102 building, Longguan expressway, Dalang street,  
Longhua District, Shenzhen city, Guangdong Province, China 518109

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.