# Product Features

- Compliant with IEEE Std 802.3-2005
  10G Ethernet 10GBase-ZR/ZW

- Electrical interface specifications per SFF-8431

- Management interface specifications per
  SFF-8431 and SFF-8472

- SFP+ MSA package with duplex LC connector

- Cooled 1550nm EML Laser

- Up to 10.3Gb/s bi-directional data links

- Single +3.3V power supply

- Class 1 laser safety certified

- Operating temperature Options:

  - (Commercial) 0ºC to +70ºC

- Up to 100km on 9/125µm SMF

- RoHS Compliant

# Applications

- 10G Ethernet 10GBASE-ZR/ZW

# Descriptions

LX4004CDL SFP+ transceivers, according to Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable "SFP+" Multi-Sourcing Agreement (MSA) SFF-8431 and SFF-8472, revision 10.4, are designed for 10G Ethernet serial optical data communication up to 100km on single mode fiber. They are compliant with IEEE Std 802.3-2005 10Gb Ethernet 10GBase-ZR/ZW.

# Ordering Information

**Table 1. Ordering Information**

| Part Number | Transmitter | Output Power | Receiver | Sensitivity | Reach | Temp | DDM | RoHS |
|---|---|---|---|---|---|---|---|---|
| LX4004CDL | 1550nm EML | 1 ~ +4dBm | APD | < -25dBm | 100km | 0 ~ 70 ºC | Available | Compliant |

# Pin Description

**Table 2. Pin Description**

| Pin | Name | Function/Description | Notes |
|---|---|---|---|
| 1 | VeeT | Transmitter Ground | 1 |
| 2 | TX_Fault | Transmitter Fault (LVTTL-O) - High indicates a fault condition | 2 |
| 3 | TX_Disable | Transmitter Disable (LVTTL-I) – High or open disables the transmitter | 3 |
| 4 | SDA | Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2) | 4 |

| 5 | SCL | Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1) | 4 |
|---|---|---|---|
| 6 | MOD_ABS | Module Absent (Output), connected to VeeT or VeeR in the module | 5 |
| 7 | RS0 | Rate Select 0 – Not used, Presents high input impedance | - |
| 8 | RX_LOS | Receiver Loss of Signal (LVTTL-O) | 2 |
| 9 | RS1 | Rate Select 1 – Not used, Presents high input impedance | - |
| 10 | VeeR | Receiver Ground | 1 |
| 11 | VeeR | Receiver Ground | 1 |
| 12 | RD- | Inverse Received Data out (CML-O) | - |
| 13 | RD+ | Received Data out (CML-O) | - |
| 14 | VeeR | Receiver Ground | - |
| 15 | VccR | Receiver Power - +3.3V | - |
| 16 | VccT | Transmitter Power - +3.3 V | - |
| 17 | VeeT | Transmitter Ground | 1 |
| 18 | TD+ | Transmitter Data In (CML-I) | - |
| 19 | TD- | Inverse Transmitter Data In (CML-I) | - |
| 20 | VeeT | Transmitter Ground | 1 |

**Notes:**

1. The module signal grounds are isolated from the module case.

2. This is an open collector/drain output that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

3. This input is internally biased high with a 4.7KΩ to 10KΩ pull-up resistor to VccT.

4. Two-Wire Serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.

5. This is a ground return that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.
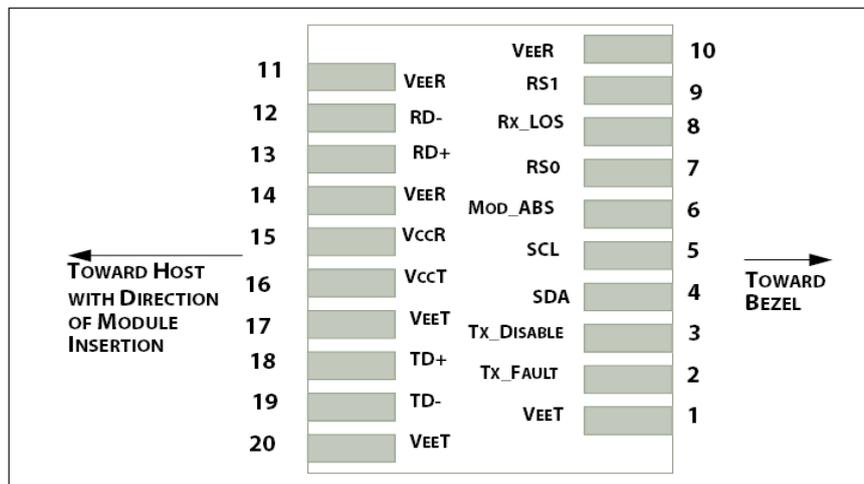


Figure 1. Host PCB SFP+ pad assignment top view

# Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

**Table 3. Absolute Maximum Ratings**

| Parameter | Symbol | Minimum | Maximum | Unit |
|---|---|---|---|---|
| Storage Temperature | $T_S$ | -40 | 85 | ºC |
| Relative Humidity | RH | 5 | 95 | % |
| Supply Voltage | $V_{CC}$ | -0.5 | 4.0 | V |

# Recommended Operating Conditions

**Table 4. Recommended Operating Conditions**

| Parameter | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Temperature | LX4004CDL | $T_C$ | 0 | 25 | 70 | ºC |
| Supply Voltage | | $V_{CC}$ | 3.135 | 3.3 | 3.465 | V |
| Data Rate | | - | - | 10.3125 | - | Gb/s |

# Transceiver Electrical Characteristics

**Table 5. Transceiver Electrical Characteristics**

| Parameter | | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|---|---|---|---|---|---|---|---|
| Power Dissipation (C-temp) | | $P_D$ | - | - | 1500 | mW | - |
| **Transmitter** | | | | | | | |
| Input Differential Impedance | | $Z_{IN}$ | - | 100 | - | Ω | - |
| Differential Data Input Swing | | $V_{IN, P-P}$ | 180 | - | 700 | mV$_{P-P}$ | - |
| TX_FAULT | Transmitter Fault | $V_{OH}$ | 2.0 | - | $V_{CCHOST}$ | V | - |
| | Normal Operation | $V_{OL}$ | 0 | - | 0.8 | V | - |
| TX_DISABLE | Transmitter Disable | $V_{IH}$ | 2.0 | - | $V_{CCHOST}$ | V | - |
| | Transmitter Enable | $V_{IL}$ | 0 | - | 0.8 | V | - |
| **Receiver** | | | | | | | |
| Output Differential Impedance | | $Z_O$ | - | 100 | - | Ω | - |
| Differential Data Output Swing | | $V_{OUT, P-P}$ | 300 | - | 850 | mV$_{P-P}$ | 1 |
| Data Output Rise Time, Fall Time | | $t_r, t_f$ | 28 | - | - | ps | 2 |
| RX_LOS | Loss of signal (LOS) | $V_{OH}$ | 2.0 | - | $V_{CCHOST}$ | V | 3 |
| | Normal Operation | $V_{OL}$ | 0 | - | 0.8 | V | 3 |

**Notes:**
1. Internally AC coupled, but requires a external 100Ω differential load termination.
2. 20–80%.

3.  LOS is an open collector output. Should be pulled up with 4.7KΩ on the host board.

# Transmitter Optical Characteristics

**Table 6. Transmitter Optical Characteristics**

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|---|---|---|---|---|---|---|
| Launch Optical Power | Po | 1 | - | +4.0 | dBm | 1 |
| Center Wavelength Range | λc | 1530 | 1550 | 1565 | nm | - |
| Extinction Ratio | EX | 9.0 | - | - | dB | 2 |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | - |
| Transmitter and Dispersion Penalty | TDP | - | - | 3.0 | dB | - |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | |
| Optical Return Loss Tolerance | ORLT | - | - | 21 | dB | - |
| Pout @TX-Disable Asserted | $P_{off}$ | - | - | -30 | dBm | 1 |
| Eye Diagram | IEEE Std 802.3-2005 10Gb Ethernet 10GBASE-ZR compatible | | | | | |

**Notes:**
1.  The optical power is launched into 9/125µm SMF.
2.  Measured with a PRBS $2^{31}$-1 test pattern @10.3125Gbps.

# Receiver Optical Characteristics

**Table 7. Receiver Optical Characteristics**

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|---|---|---|---|---|---|---|
| Center Wavelength | λc | 1530 | - | 1565 | nm | - |
| Receiver Sensitivity ($P_{avg}$) | S | - | - | -25 | dBm | 1 |
| Receiver Overload ($P_{avg}$) | $P_{OL}$ | -7.0 | - | - | dBm | 1 |
| Optical Return Loss | ORL | 26 | - | - | dB | - |
| LOS De-Assert | $LOS_D$ | - | - | -26 | dBm | - |
| LOS Assert | $LOS_A$ | -38 | - | - | dBm | - |
| LOS Hysteresis | - | 0.5 | - | - | dB | - |

**Notes:**
1.  Measured with PRBS $2^{31}$-1 test pattern, 10.3125Gb/s, BER<$10^{-12}$.
2.  Comply with IEEE 802.3-2005.

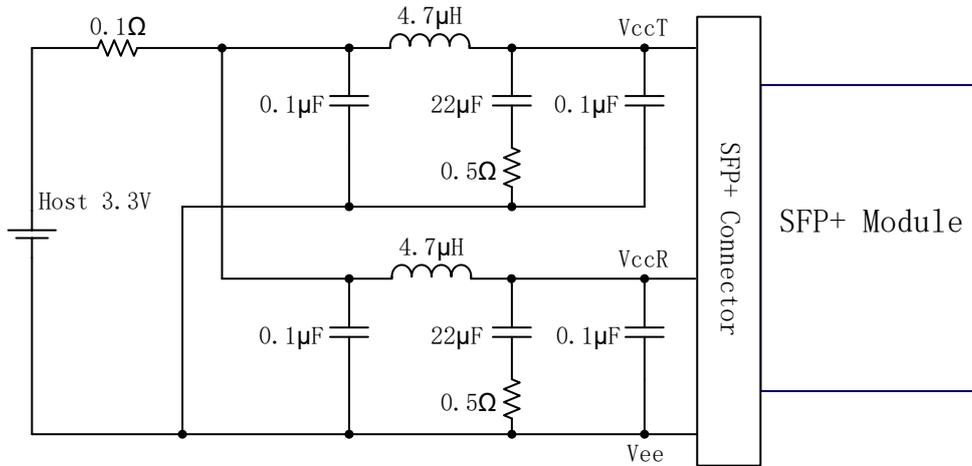# Recommended Host Board Power Supply Filter Network



Figure 2. Recommended Host Board Power Supply Filter Network

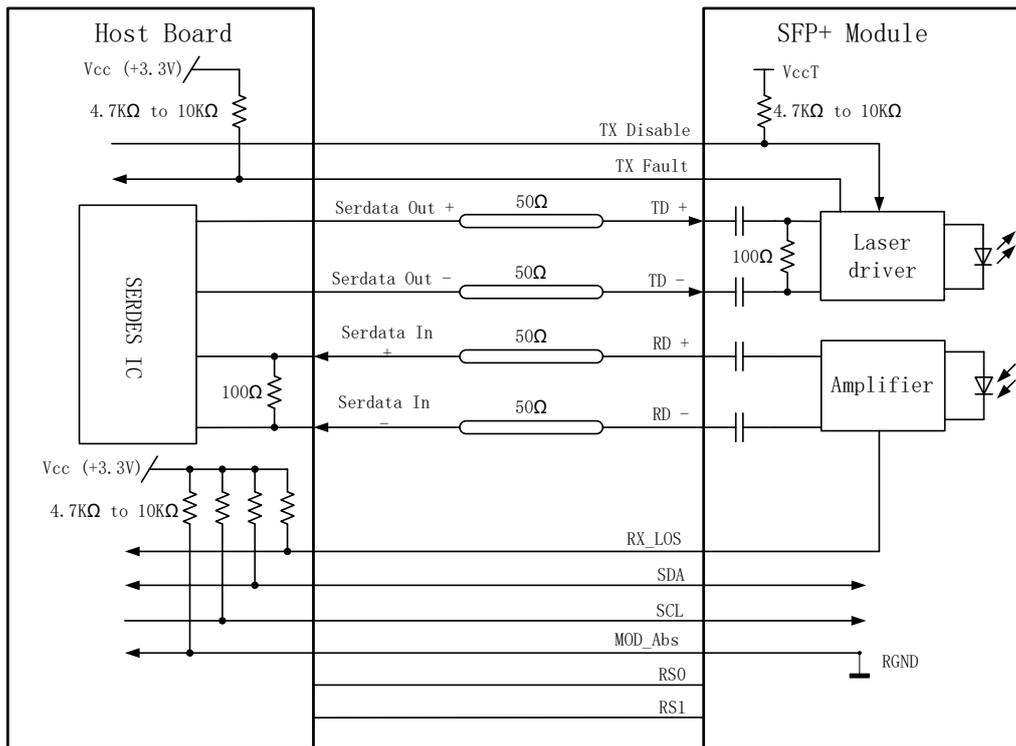# Recommended Application Interface Block Diagram



Figure 3. Recommended Application Interface Block Diagram
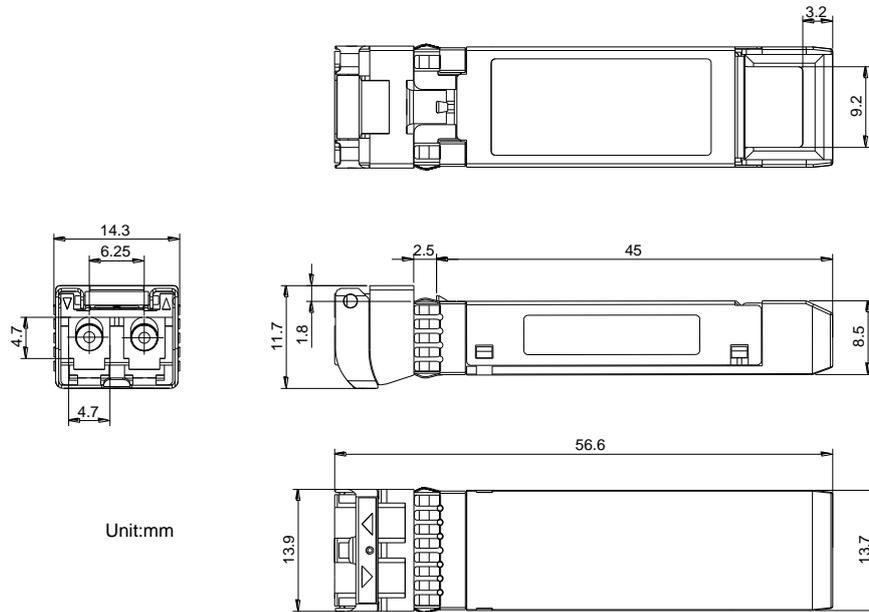
## Mechanical specifications



Unit:mm

Figure 4. Outline Drawing

# PCB layout recommendation



Figure 5. PCB layout recommendation

# Revision History

| Date | Rev. # | Description | Modified By |
|---|---|---|---|
| 11/18/2020 | V1.0 | Initial Version | Pei Zhang |

# For More Information

**Linktel Technologies Co., Ltd**

info@linkteltech.com

www.linkteltech.com

**Linktel USA**

1601 McCarthy Blvd #9, Milpitas, CA 95035, USA

Tel: +1 408 807 0482

Email: linktelus@linkteltech.com

jimli@linkteltech.com

**Linktel International** (Except USA)

E12, No. 52 Liufang Road, East-Lake Hi-tech Development Zone, Wuhan, China

Tel: +86 27 8792 9207

Email: ailsagong@linkteltech.com

**Linktel China**

E12, No. 52 Liufang Road, East-Lake Hi-tech Development Zone, Wuhan, China

Tel: +86 27 8792 9213

Email: lifan@linkteltech.com