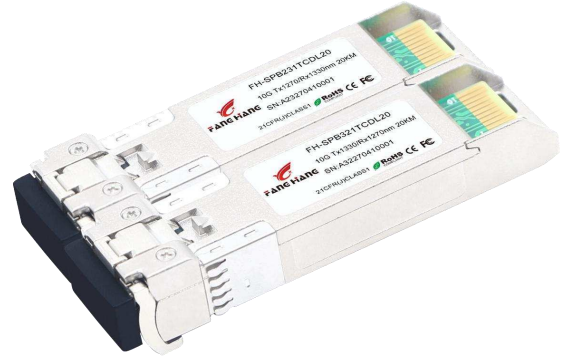


## Product Features

- ✧ Supports 9.95Gb/s to 10.3Gb/s data rates
- ✧ Simplex LC Connector Bi-Directional SFP+ Optical Transceiver
- ✧ Digital Diagnostic SFF-8472 Compliant
- ✧ Hot pluggable
- ✧ 1270(1330) nm DFB Laser transmitter, 1330(1270) nm PIN receiver
- ✧ Up to 40km on 9/125um SMF
- ✧ Compliant with IEEE 802.3ae 10GBASE-LR and 10GBASE-LW
- ✧ SFP+ MSA SFF-8431 Compliant
- ✧ Operating case temperature: 0 to 70 °C



## Applications

- ✧ 10GBASE-ER at 10.3125Gbps
- ✧ 10GBASE-EW at 9.953Gbps
- ✧ Other optical links

## Ordering Information

| Part Number     | Output Power | Rec. Sens | Data Rate | Wavelength      | Distance |
|-----------------|--------------|-----------|-----------|-----------------|----------|
| FH-SPB231TCDL40 | 0 ~ 5 db     | -15 db    | 10.3125G  | TX1270/RX1330nm | 40km     |
| FH-SPB321TCDL40 | 0 ~ 5 db     | -15 db    | 10.3125G  | TX1330/RX1270nm | 40km     |

## General Descriptions

FH-SPB23(32)1TCDL40 Series single mode transceiver is small form factor pluggable module for duplex optical data communications such as 10GBASE-ER/EW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. Module is designed for single mode fiber and operates at a nominal wavelength of 1270 (1330) nm. The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

## Absolute Maximum Ratings

| Parameter           | Symbol | Min. | Max. | Unit | Note |
|---------------------|--------|------|------|------|------|
| Supply Voltage      | Vcc    | -0.5 | 4.0  | V    |      |
| Storage Temperature |        | -40  | 85   | °C   |      |
| Relative Humidity   |        |      | 85   | %    |      |

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the module

## General Operating Characteristics

| Parameter            |               | Symbol | Min. | Typ     | Max. | Unit | Note |
|----------------------|---------------|--------|------|---------|------|------|------|
| Data Rate            | Ethernet      |        |      | 10.3125 |      | Gb/s |      |
|                      | Fiber Channel |        |      | 10.518  |      |      |      |
| Supply Voltage       |               | Vcc    | 3.13 | 3.3     | 3.47 | V    |      |
|                      |               | Vcc    |      |         |      | V    |      |
| Supply Current       |               | Icc5   |      |         |      | mA   |      |
|                      |               | Icc3   |      |         | 400  | mA   |      |
| Operating Case Temp. |               | Tc     | 0    |         | 70   | °C   |      |

## Electrical Input/Output Characteristics

| Parameter                  | Symbol          | Min.            | Typ | Max.                 | Unit | Note |
|----------------------------|-----------------|-----------------|-----|----------------------|------|------|
| <b>Transmitter</b>         |                 |                 |     |                      |      |      |
| Diff. input voltage swing  |                 | 120             |     | 820                  | mVpp | 1    |
| Tx Disable input           | H               | V <sub>IH</sub> | 2.0 | V <sub>CC</sub> +0.3 | V    |      |
|                            | L               | V <sub>IL</sub> | 0   | 0.8                  |      |      |
| Tx Fault output            | H               | V <sub>OH</sub> | 2.0 | V <sub>CC</sub> +0.3 | V    | 2    |
|                            | L               | V <sub>OL</sub> | 0   | 0.8                  |      |      |
| Input Diff. Impedance      | Z <sub>in</sub> |                 | 100 |                      | Ω    |      |
| <b>Receiver</b>            |                 |                 |     |                      |      |      |
| Diff. output voltage swing |                 | 340             | 650 | 800                  | mVpp | 3    |
| Rx LOS Output              | H               | V <sub>OH</sub> | 2.0 | V <sub>CC</sub> +0.3 | V    | 2    |
|                            | L               | V <sub>OL</sub> | 0   | 0.8                  |      |      |

Note 1) TD+/- are internally AC coupled with 100Ω differential termination inside the module.

Note 2) Tx Fault and Rx LOS are open collector outputs, which should be pulled up with 4.7k to 10kΩ resistors on the host board. Pull up voltage between 2.0V and V<sub>CC</sub>+0.3V.

Note 3) RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES.

## Optical Characteristics

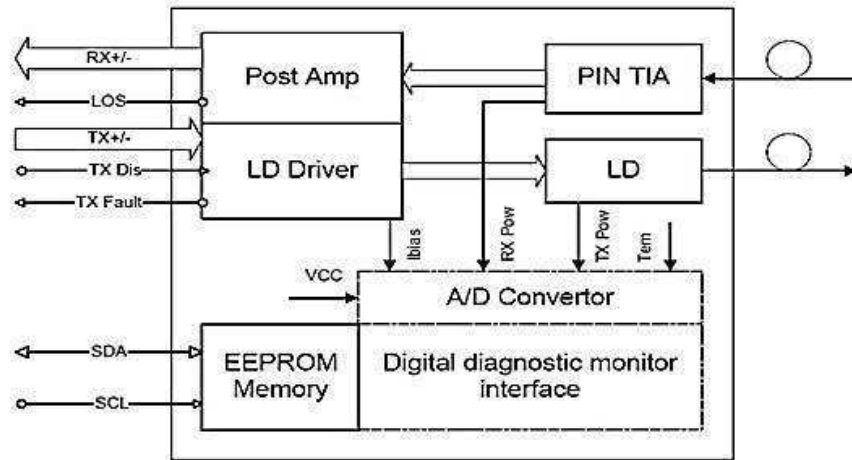
| Parameter                    | Symbol                      | Min.        | Typ         | Max.        | Unit | Note |
|------------------------------|-----------------------------|-------------|-------------|-------------|------|------|
| <b>Transmitter</b>           |                             |             |             |             |      |      |
| Operating Wavelength         |                             | 1260 (1320) | 1270 (1330) | 1280 (1340) | nm   |      |
| Ave. output power (Enabled)  | Po                          | 0           |             | 5           | dBm  | 1    |
| Extinction Ratio             | ER                          | 5           |             |             | dB   | 1    |
| RMS spectral width           | $\Delta\lambda$             |             |             | 1           | nm   |      |
| Rise/Fall time (20%~80%)     | Tr/Tf                       |             |             | 50          | ps   | 2    |
| Optical modulation amplitude | OMA                         | -6.2        |             |             | dBm  |      |
| Dispersion penalty           |                             |             |             | 1           | dB   |      |
| Output Optical Eye           | Compliant with IEEE 802.3ae |             |             |             |      |      |
| <b>Receiver</b>              |                             |             |             |             |      |      |
| Operating Wavelength         |                             | 1320 (1260) | 1330 (1270) | 1340 (1280) | nm   |      |
| Sensitivity                  | Psen                        |             |             | -15         | dBm  | 3    |
| Min. overload                | Pimax                       | 0.5         |             |             | dBm  |      |
| LOS Assert                   | Pa                          | -30         |             |             | dBm  |      |
| LOS De-assert                | Pd                          |             |             | -16         | dBm  |      |
| LOS Hysteresis               | Pd-Pa                       | 0.5         |             | 4           | dB   |      |

Note 1) Measured at 10.3125b/s with PRBS  $2^{31} - 1$  NRZ test pattern.

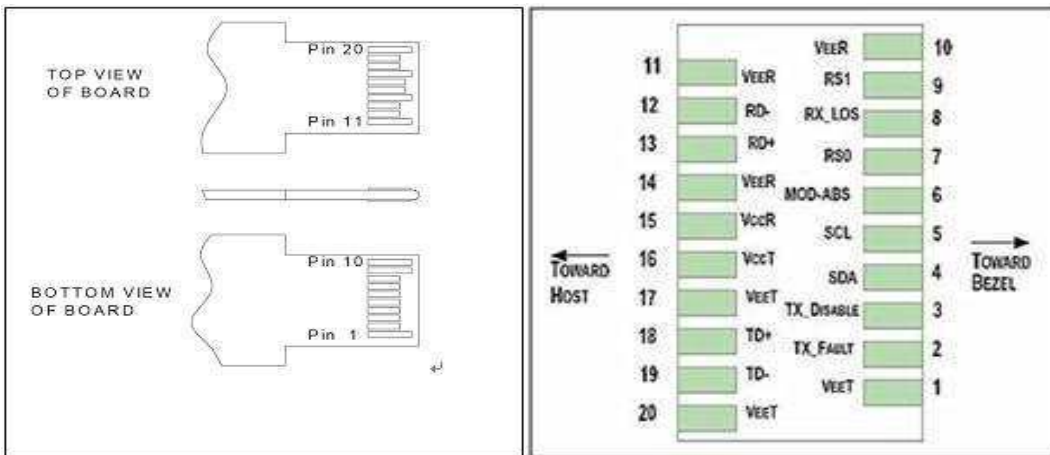
Note 2) 20%~80%

Note 3) Under the ER worst case, measured at 10.3125 Gb/s with PRBS  $2^{31} - 1$  NRZ test pattern for BER <  $1 \times 10^{-12}$

## Functional Diagram



## Pin Definitions And Functions



| Pin | Symbol       | Name/Description   |
|-----|--------------|--|
| 1   | VEET [1]     | Transmitter Ground   |
| 2   | Tx_FAULT [2] | Transmitter Fault  |
| 3   | Tx_DIS [3]   | Transmitter Disable. Laser output disabled on high or open |
| 4   | SDA [2]      | 2-wire Serial Interface Data Line                          |
| 5   | SCL [2]      | 2-wire Serial Interface Clock Line                         |
| 6   | MOD_ABS [4]  | Module Absent. Grounded within the module                  |
| 7   | RS0 [5]      | Rate Select 0  |

|    |            |   |
|----|------------|---|
| 8  | RX_LOS [2] | Loss of Signal indication. Logic 0 indicates normal operation |
| 9  | RS1 [5]    | Rate Select 1   |
| 10 | VEER [1]   | Receiver Ground   |
| 11 | VEER [1]   | Receiver Ground   |
| 12 | RD-        | Receiver Inverted DATA out. AC Coupled                        |
| 13 | RD+        | Receiver DATA out. AC Coupled                                 |
| 14 | VEER [1]   | Receiver Ground   |
| 15 | VCCR       | Receiver Power Supply   |
| 16 | VCCT       | Transmitter Power Supply                                      |
| 17 | VEET [1]   | Transmitter Ground  |
| 18 | TD+        | Transmitter DATA in. AC Coupled                               |
| 19 | TD-        | Transmitter Inverted DATA in. AC Coupled                      |
| 20 | VEET [1]   | Transmitter Ground  |

Notes: [1] Module circuit ground is isolated from module chassis ground within the module.

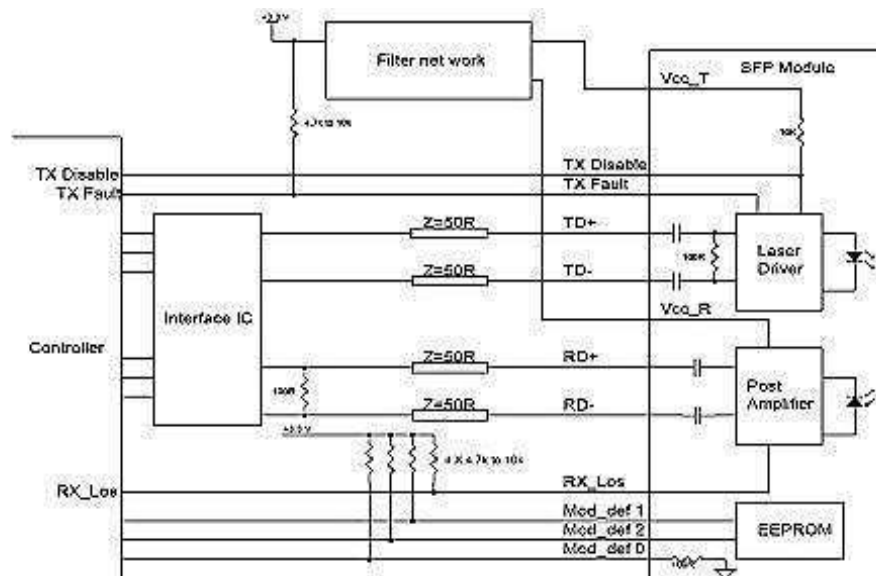
[2].should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

[3]Tx\_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VccT inside the module.

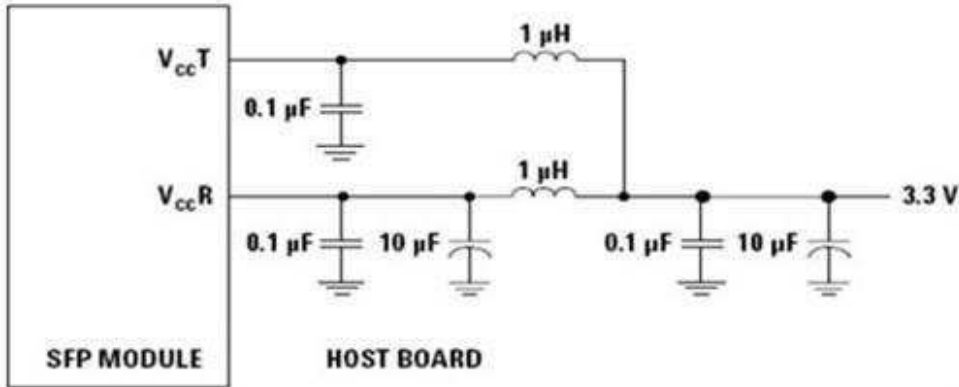
[4]Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7 kΩ to 10 kΩ.Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.

[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.

## Typical Interface Circuit

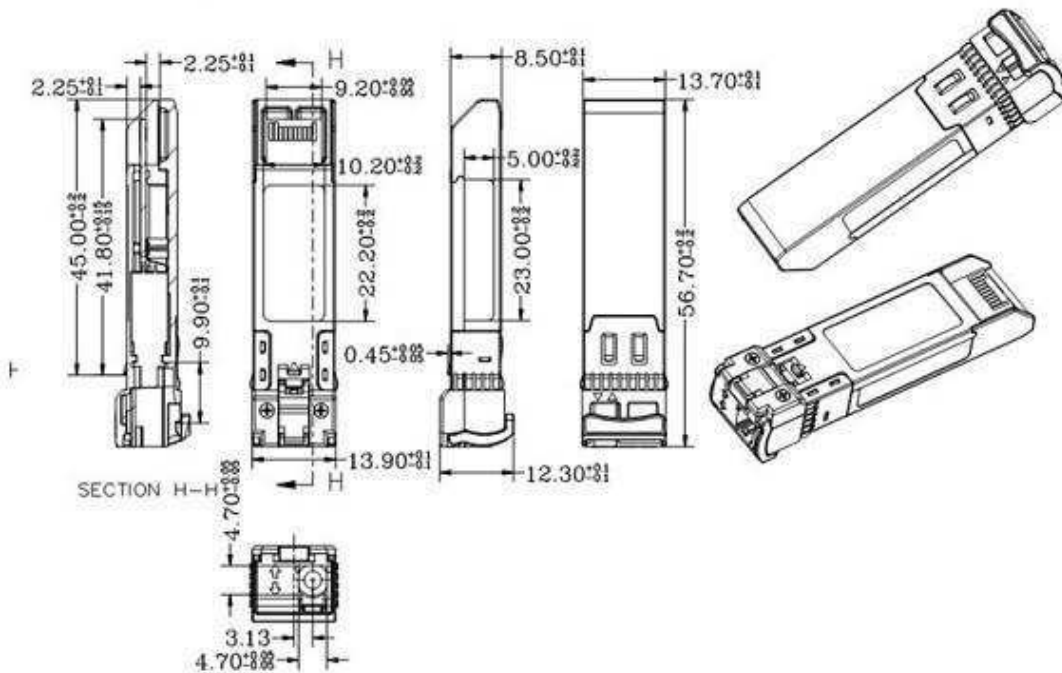


## Recommended power supply filter



Note: Inductors with DC resistance of less than  $1\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value

## Package Dimensions



## **For More Information**

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