

## DATA SHEET

### ZCables: ZFTDBBD2733A2xx / ZFTDBBD3327A2xx

- 25Gb/s SFP28 Tx1270nm/Rx1330nm 15km Bi-directional Transceiver
- 25Gb/s SFP28 Tx1330nm/Rx1270nm 15km Bi-directional Transceiver

### ZFTDBBD2733A2xx / ZFTDBBD3327A2xx

ZCables' ZFTDBBD2733A2xx / ZFTDBBD3327A2xx optical transceivers are based on 25G Ethernet IEEE 802.3cc standard. They are compliant with SFF-8402, SFF-8432 and SFF-8472, providing a fast and reliable interface for 25G Ethernet applications. The product implements digital diagnostics via a 2-wire serial bus and is compliant with the SFF-8472 standard.

## Product Features

- Operating data rate support 24.3Gbps to 26.5Gbps
- Compliant with IEEE 802.3cc
- Compliant with SFF-8402
- Compliant with SFF-8432
- Compliant with SFF-8472
- Internal CDR on both Transmitter and Receiver channel
- Hot-pluggable SFP28 footprint
- DFB laser transmitter and PIN PD Receiver
- Simplex LC connector
- Built-in digital diagnostic functions
- Up to 15km on SMF
- Single power supply 3.3V
- RoHS Compliant
- Operating temperature range (Case Temperature) : C Grade 0°C to 70°C  
I Grade -40°C to 85°C



## Applications

- 25GBASE-LR Ethernet
- CPRI and eCPRI Wireless Networks

## Ordering Information

| Part Number   | Description  | Bail Color |
|---|--|------------|
| ZFTDBBD2733A2xx   | 25GBASE SFP28 BIDI,<br>TX1270nm/RX1330nm LC Connector<br>15km on SMF, Commercial Temperature | Yellow     |
| ZFTDBBD3327A2xx   | 25GBASE SFP28 BIDI,<br>TX1330nm/RX1270nm LC Connector<br>15km on SMF, Commercial Temperature | Blue       |
| <b>For More Information:</b><br>ZCables.com<br>Web: <a href="https://www.zcables.com/">https://www.zcables.com/</a> |  |            |

## General Specifications

| Parameter                                     | Symbol    | Min  | Typ | Max                | Unit | Remarks |
|---|-----------|------|-----|--------------------|------|---------|
| Data Rate                                     | DR        | 24.3 |     | 26.5               | Gb/s | 1       |
| Bit Error Rate                                | BER       |      |     | $5 \times 10^{-5}$ |      | 2       |
| Operating Temperature                         | $T_C$     | 0    |     | 70                 | °C   | 3       |
|   |           | -40  |     | 85                 | °C   | 3       |
| Storage Temperature                           | $T_{STO}$ | -40  |     | 85                 | °C   | 4       |
| Supply Current<br>(Commercial Temperature)    | $I_{CC}$  |      | 220 | 420                | mA   | 5       |
| Supply Current<br>(Industrial Temperature)    | $I_{CC}$  |      | 220 | 450                | mA   | 5       |
| Input Voltage                                 | $V_{CC}$  | 3.14 | 3.3 | 3.46               | V    |         |
| Power Dissipation<br>(Commercial Temperature) | $P_C$     |      | 0.9 | 1.3                | W    |         |
| Power Dissipation<br>(Industrial Temperature) | $P_I$     |      | 0.9 | 1.4                | W    |         |
| Maximum Voltage                               | $V_{MAX}$ | -0.5 |     | 4                  | V    | 5       |

**Notes:**

1. IEEE 802.3cc
2. Measured with data rate at 25.78Gb/s, PRBS  $2^{31}-1$
3. Case temperature
4. Ambient temperature
5. For electrical power interface

## Link Distances

| Data Rate  | Fiber Type  | Distance Range (km) | Remarks |
|------------|-------------|---------------------|---------|
| 25.78 Gb/s | 9/125um SMF | 15                  | 1       |

**Notes:**

1. This module requires RS-FEC on the host ports for operation at 25G

## Optical Characteristics – Transmitter

$V_{CC}=3.14V$  to  $3.46V, T_C$

| Parameter                              | Symbol         | Min  | Typ  | Max  | Unit | Remarks |
|--|----------------|------|------|------|------|---------|
| Output Optical Power                   | $P_{TX}$       | 0    | 3.5  | 6    | dBm  | 1       |
| Optical Center Wavelength(T1270/R1330) | $\lambda_{C1}$ | 1260 | 1270 | 1280 | nm   |         |
| Optical Center Wavelength(T1330/R1270) | $\lambda_{C2}$ | 1320 | 1330 | 1340 | nm   |         |
| Transmitter and Dispersion Penalty     | TDP            |      |      | 2.7  | dB   |         |
| Extinction Ratio                       | ER             | 4.0  |      |      | dB   |         |
| Side Mode Suppression Ratio            | SMSR           | 30   |      |      | dB   |         |
| Transmitter Reflectance                |                |      |      | -12  | dB   |         |
| Launch Power of OFF Transmitter        | $P_{OUT\_OFF}$ |      |      | -30  | dBm  | 1       |

**Notes:**

1. Average

## Optical – Characteristics – Receiver

$V_{CC}=3.14V$  to  $3.46V, T_C$

| Parameter                              | Symbol         | Min  | Typ  | Max   | Unit | Remarks |
|--|----------------|------|------|-------|------|---------|
| Optical Center Wavelength(T1270/R1330) | $\lambda_{C1}$ | 1310 | 1330 | 1350  | nm   |         |
| Optical Center Wavelength(T1330/R1270) | $\lambda_{C2}$ | 1250 | 1270 | 1290  | nm   |         |
| Receive Overload                       | $P_{OL}$       | 2    |      |       | dBm  |         |
| Receiver Sensitivity@ 25.78Gb/s        | $R_{X\_SEN1}$  |      |      | -13.9 | dBm  | 1       |
| OMA Receiver Sensitivity@ 25.78Gb/s    | $R_{X\_SEN2}$  |      |      | -14.5 | dBm  | 2       |
| Receiver Reflectance                   | $TR_{RX}$      |      |      | -26   | dB   |         |
| LOS Assert                             | $LOS_A$        | -30  |      |       | dBm  |         |
| LOS De-Assert                          | $LOS_D$        |      |      | -17   | dBm  |         |
| LOS Hysteresis                         | $LOS_H$        | 0.5  |      |       | dB   |         |

**Notes:**

1. Average, measured with Tx signal of 3.5dB ER, data rate at 25.78Gb/s and PRBS  $2^{31}-1$ , BER  $5 \times 10^{-5}$ ;
2. OMA, measured with Tx signal of 3.5dB ER, data rate at 25.78Gb/s and PRBS  $2^{31}-1$ , BER  $5 \times 10^{-5}$ ;

## Electrical Characteristics – Transmitter

$V_{CC}=3.14V$  to  $3.46V, T_C$

| Parameter                     | Symbol       | Min      | Typ | Max          | Unit     | Remarks |
|-------------------------------|--------------|----------|-----|--------------|----------|---------|
| Input differential impedance  | $R_{IN}$     |          | 100 |              | $\Omega$ |         |
| Differential data input swing | $V_{IN\_PP}$ | 200      |     | 900          | mV       |         |
| Transmit Disable Voltage      | $V_D$        | 2        |     | $V_{CC}$     | V        |         |
| Transmit Enable Voltage       | $V_{EN}$     | $V_{EE}$ |     | $V_{EE}+0.8$ | V        |         |

## Electrical – Characteristics – Receiver

$V_{CC}=3.14V$  to  $3.46V, T_C$

| Parameter                      | Symbol        | Min      | Typ | Max            | Unit | Remarks |
|--------------------------------|---------------|----------|-----|----------------|------|---------|
| Differential data output swing | $V_{OUT\_PP}$ | 300      |     | 850            | mV   |         |
| LOS Assert                     | $V_{LOS\_A}$  | 2        |     | $V_{CC\_HOST}$ | V    |         |
| LOS De-Assert                  | $V_{LOS\_D}$  | $V_{EE}$ |     | $V_{EE}+0.8$   | V    |         |

## A0H Register Description

| IIC Addr | Size | Name                   | Description  | Values(HEX)   |
|----------|------|------------------------|--|---|
| 0        | 1    | Identifier             | SFP/SFP+/SFP28   | 03  |
| 1        | 1    | Extended Identifier    | Use IIC interface  | 04  |
| 2        | 1    | Connector              | Connector Type = LC  | 07  |
| 3-10     | 8    | Transceiver            | 25G Base LR  | 00 00 00 00 00 00<br>00 00                            |
| 11       | 1    | Encoding               | Encoding Type = NRZ  | 03  |
| 12       | 1    | BR, Nominal            | Nominal Bit Rate 25.78Gb/s   | FF  |
| 13       | 1    | Rate Identifier        | Without rate selection function  | 00  |
| 14       | 1    | Length(9µm)-km         | Link Length / SMF = 15km   | 0F  |
| 15       | 1    | Length (9µm)-100m      | Link Length / SMF = 15km   | 96  |
| 16       | 1    | Length (50µm)-10m      | 50µm MMF Link Length = N/A   | 00  |
| 17       | 1    | Length (62.5µm)-10m    | 62.5µm MMF Link Length = N/A   | 00  |
| 18       | 1    | Length (Copper)        | Copper Link Length = N/A   | 00  |
| 19       | 1    | Reserved               | Reserved   | 00  |
| 20-35    | 16   | Vendor name            | ZCABLES.COM  | 4D 4F 44 55 4C 45<br>54 45 4B 20 20 20<br>20 20 20 20 |
| 36       | 1    | Transceiver            | 25G Base LR  | 03  |
| 37-39    | 3    | Vendor OUI             | Without vendor OUI   | 00 00 00  |
| 40-55    | 16   | Vendor PN              | Part number in the Ordering Information  | Programmed by Factory                                 |
| 56-59    | 4    | Vendor Revision Number | Manufacturer product version number  | Programmed by Factory                                 |
| 60-61    | 2    | Wavelength             | Laser Wavelength   | Programmed by Factory                                 |
| 62       | 1    | Reserved               | Reserved   | 00  |
| 63       | 1    | CC_BASE                | Checksum of bytes 0-62   | Programmed by Factory                                 |
| 64-65    | 2    | Transceiver Options    | 1.Internal CDR 2.Rx_LOS<br>3.Tx_FAULT 4.Tx_DIS   | 08 1A   |
| 66       | 1    | BR, max                | 103% for 25.78Gbit/s   | 67  |
| 67       | 1    | BR, min                | NA   | 00  |
| 68-83    | 16   | Vendor SN              | Manufacturer serial number   | Programmed by Factory                                 |
| 84-91    | 8    | Date code              | Date code  | Programmed by Factory                                 |
| 92       | 1    | Monitoring Type        | Internal calibration of DOM RxPower measurement using average optical power  | 68  |
| 93       | 1    | Enhanced Options       | 1.Monitor Alarm and Warning of TxPower and RxPower<br>2.Tx_DIS Monitor and Control<br>3.Rx_LOS Monitor<br>4.Tx_FAULT Monitor | F0  |
| 94       | 1    | Compliance             | Revision Implemented   | 08  |
| 95       | 1    | CC_EXT                 | Check sum of bytes 64-94   | Programmed by Factory                                 |
| 96-127   | 32   | Vendor Specific        | Vendor Specific Area   | Programmed by Factory                                 |
| 128-255  | 128  | Vendor Specific        | Vendor Specific Area   | Programmed by Factory                                 |

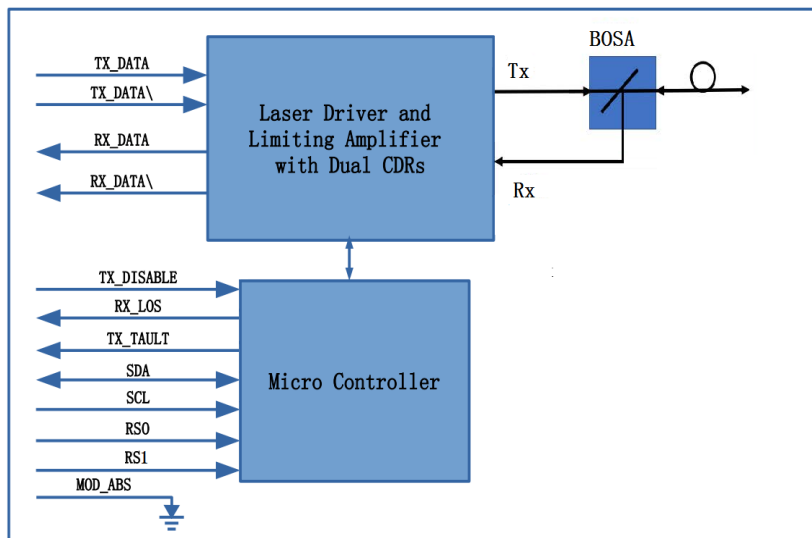
## Digital Diagnostic Functions

ZFTDBBD2733A2xx / ZFTDBBD3327A2xx supports the 2-wire serial communication protocol as defined in SFF-8472. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for the transceiver are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver, such as Transceiver Temperature, Supply Power, TX bias current, TX output power and RX received optical power.

## DDM Threshold Information

| Parameter        |   | Alarm Threshold |               | Warning Threshold |               |
|------------------|---|-----------------|---------------|-------------------|---------------|
|                  |   | High Value      | Low Value     | High Value        | Low Value     |
| Temperature (°C) | C | 90 (5A 00)      | -10 (F6 00)   | 85 (55 00)        | -5 (FB 00)    |
|                  | I | 90 (5A 00)      | -45 (D3 00)   | 85 (55 00)        | -40 (D8 00)   |
| Vcc (V)          |   | 3.63(8D CC)     | 2.97 (74 04)  | 3.46 (87 28)      | 3.13 (7A 44)  |
| Bias (mA)        |   | 100 (C3 50)     | 2 (03 E8)     | 80 (9C 40)        | 4 (07 D0)     |
| TxPower (dBm)    |   | 6.8 (BA 9C)     | -0.97 (1F 40) | 6.0 (9B 82)       | 0.0 (27 10)   |
| RxPower (dBm)    |   | 5.0 (7B 86)     | -18.0 (00 9E) | 4.0 (62 1E)       | -15.0 (01 3C) |

## Block-Diagram-of-Transceiver



## Functions Description

ZCables' ZFTDBBD2733A2xx / ZFTDBBD3327A2xx module consists of a microcontroller, integrated dual-clock data recovery function (CDR) laser drive and limiting amplifier, and a Transmitter and a Receiver.

The microcontroller communicates with the host via a 2-wire serial communication interface, providing module control, status reporting and monitoring functions (DOM). This product Compliant with SFF-8472.

The laser driver amplifies the high-speed differential signal recovered from the TX CDR, and drives the laser to generate an optical signal, and maintains the stability of the transmitted optical power through an automatic optical power control feedback loop.

The limiting amplifier amplifies the electrical signal converted by the light receiving component, and outputs the fixed frequency signal to the RX CDR. The receiver judges and reports the RX-LOS status through OMA, when the limiting amplifier detects the amplitude of the electrical signal converted by the light receiving component, and if it is lower than the set threshold, it reports that the received signal is lost, and raise the RX\_LOS pin level on the gold finger. LOS signal is only related to the amplitude of the electrical signal, not to the signal rate and whether the CDR is locked or not. The module does not enable the suppression function of the receiver.

The transmitter of the transceiver adopts a TO-CAN structure within a BOSA, and is composed of a DFB laser and a monitoring photodiode (MPD). The laser generates a corresponding optical signal according to a bias current and a modulation current provided by the laser driver, and the MPD will continuously monitor the TX power. The transmitter optical power is different when there is signal and when there is no signal. When there is no signal, the transmitter optical power is lower than that with signal. In addition, the suppression function is not turned on on the transmitter.

The Receiver of the transceiver also uses a TO-CAN structure within a BOSA, including a PIN photodetector (PIN PD) and a trans-impedance amplifier (TIA). When ROSA detects the incident light signal, it will be converted into photo-generated current by the PIN PD. The photo-generated current is converted into an electrical signal through the TIA and input to the limiting amplifier.

After the module is powered on, the read value of the security level access registers 7BH ~ 7EH of A2H is replaced with 0x00. After the content of this group of registers is updated, the read value is the last written value. The security level 1 password of this module is 0x00001011. The method to enter the security level 1 working state is to convert and write the security level 1 password in the A2H 7BH ~ 7EH registers of the module, namely 0x00, 0x00, 0x10, 0x11. After entering the security level 1 working state, the user can directly write to the content of the A0H device address, or modify the content of the A2H 7FH table selection register to write to the contents of Table 00 or Table 01. And this version supports the user to modify the security level 1 password. The modification method is: the module is in the security level 1 state, write 0x10 in the A2H 7FH register, and then write the password to be set in the A2H 88H-8BH register in order. The size of password is four bytes.

The transceiver only supports high data rates 24.33G/25.78G (CPRI options 10/25GbE). At this rate, the transmitter and receiver CDRs will lock, beyond this rate, the CDRs will loss of lock and the link will not work.

We can provide different CDR configurations for different applications, such as 10G/25G dual-rate



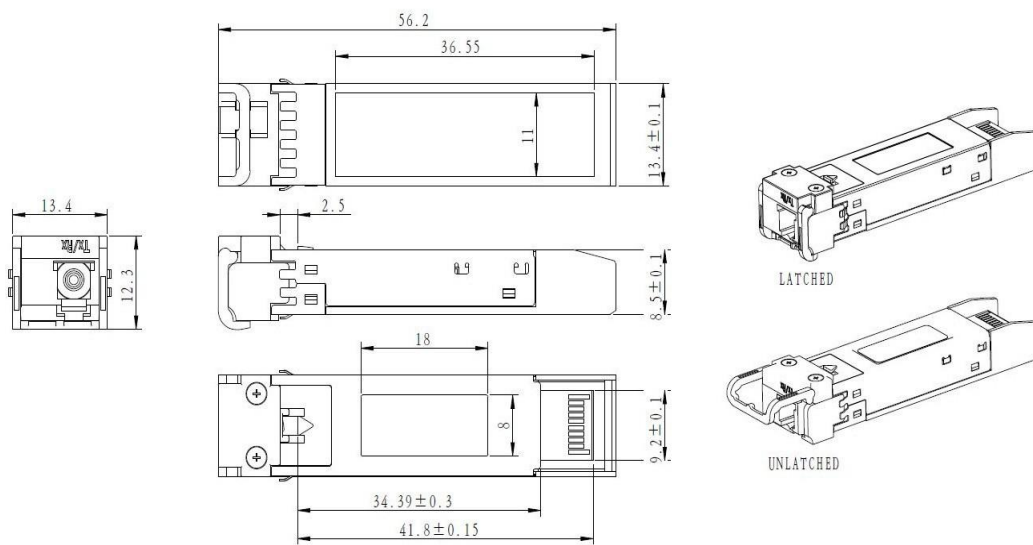
application,full-rate CDR bypass application and so on.For more details, please contact our sales.

## Product Weight

Net weight of module : 19.5g/pcs

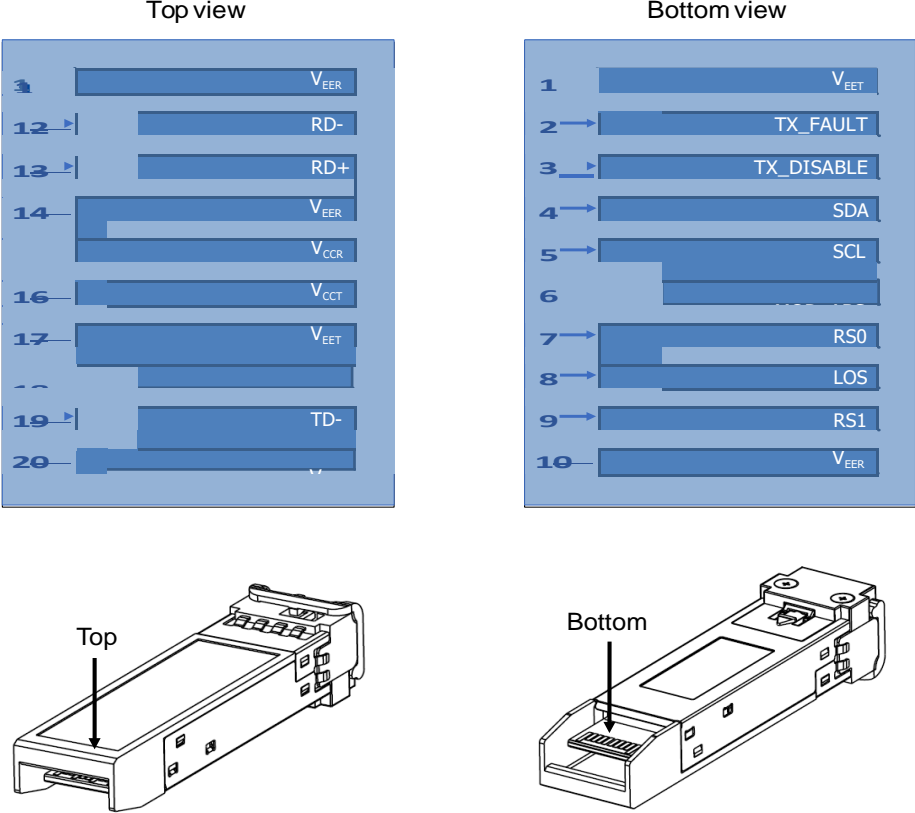
Net weight of dust cap: 0.60g/pcs

## Dimensions

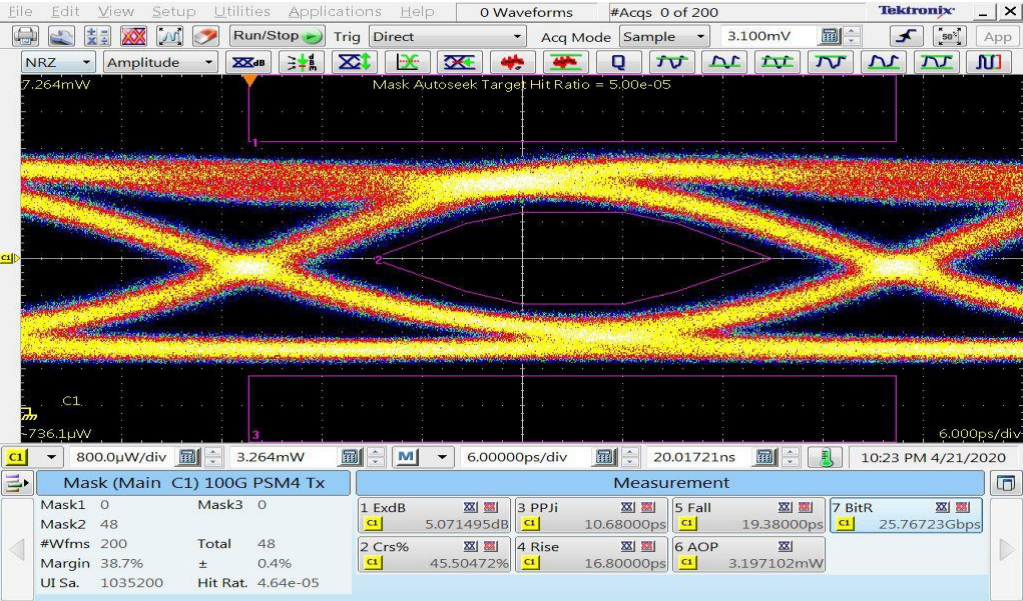


ALL DIMENSIONS ARE  $\pm 0.2$ mm UNLESS OTHERWISE SPECIFIED  
UNIT: mm

## Electrical Pad Layout



## Typical Eye Diagram



## Pin Assignment

| PIN # | Symbol           | Description   | Remarks |
|-------|------------------|---|---------|
| 1     | V <sub>EET</sub> | Transmitter ground (common with receiver ground)              | 1       |
| 2     | TX_FAULT         | Transmitter Fault   | 2       |
| 3     | TX_DISABLE       | 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              | No connection required  |         |
| 8     | LOS              | Loss of Signal indication. Logic 0 indicates normal operation | 5       |
| 9     | RS1              | No connection required  | 1       |
| 10    | V <sub>EER</sub> | Receiver ground (common with transmitter ground)              | 1       |
| 11    | V <sub>EER</sub> | 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 <sub>EER</sub> | Receiver ground (common with transmitter ground)              | 1       |
| 15    | V <sub>CCR</sub> | Receiver power supply   |         |
| 16    | V <sub>CCT</sub> | Transmitter power supply                                      |         |
| 17    | V <sub>EET</sub> | 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 <sub>EET</sub> | Transmitter ground (common with receiver ground)              | 1       |

### Notes:

1. Circuit ground is isolated from chassis ground
2. TX\_FAULT is the open collector output and should be pulled up with 4.7k–10k ohm on host board to a voltage between 2V and V<sub>cc</sub>+0.3V
3. Disabled: T<sub>DIS</sub>>2V or open, Enabled: T<sub>DIS</sub><0.8V
4. Should be pulled up with 4.7k -10k ohm on host board to a voltage between 2V and V<sub>cc</sub> + 0.3V
5. LOS is open collector output and should be pulled up with 4.7k -10k ohm on host board to a voltage between 2V and V<sub>cc</sub>+0.3V, the logic "0" indicates normal operation, and the logic "1" indicates that the receiver signal is lost.