

DATA SHEET

MODULETEK: SFP10-BIDI-T1270/R1330-60KM-APD-C10

10Gb/s SFP+ Tx1270nm/Rx1330nm 60km Bi-directional Transceiver

SFP10-BIDI-T1270/R1330-60KM-APD-C10 Overview

ModuleTek's SFP10-BIDI-T1270/R1330-60KM-APD-C10 SFP+ optical transceivers are based on 10G Ethernet IEEE 802.3ae standard and SFF-8431 standard, providing a fast and reliable interface for 10G Ethernet applications. The product implements digital diagnostics via a 2-wire serial bus, compliant with the SFF-8472 standard.

Product Features

- Up to 10.7 Gb/s bi-directional data links
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Compliant with 10GFC
- Compliant with SFF-8431
- Hot-pluggable SFP+ footprint
- 1270nm DFB laser transmitter and 1330nm APD Receiver
- Simplex LC connector
- Built-in digital diagnostic functions
- Up to 60km on SMF
- Single power supply 3.3V
- RoHS Compliant
- Operating temperature range: 0°C to 70°C

Applications

- 10GBASE-LR/LW Ethernet
- 10G FC

Ordering Information

| Part Number | Description | Color on Clasp |
|---|---|----------------|
| SFP10-BIDI-T1270/R1330-60KM-APD-C10 | 10G SFP+ BIDI, TX1270nm/RX1330nm, LC Connectors 60km on SMF, with DOM function. | Yellow |
| For More Information: ModuleTek Limited Web: www.moduletek.com Email: sales@moduletek.com | | |

General Specifications

| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|-----------------------|------------------|------|---------|------------|------|---------|
| Data Rate | DR | | 10.3125 | | Gb/s | 1 |
| Bit Error Rate | BER | | | 10^{-12} | | |
| Operating Temperature | T _C | 0 | | 70 | °C | 2 |
| Storage Temperature | T _{STO} | -40 | | 85 | °C | 3 |
| Supply Current | I _{CC} | | 260 | 280 | mA | 4 |
| Input Voltage | V _{CC} | 3.14 | 3.3 | 3.46 | V | |
| Maximum Voltage | V _{MAX} | -0.5 | | 4 | V | 4 |

Notes:

1. IEEE 802.3ae
2. Case temperature
3. Ambient temperature
4. For electrical power interface

Link Distances

| Data Rate | Fiber Type | Distance Range (km) |
|--------------|------------|---------------------|
| 10.3125 Gb/s | 9/125umSMF | 60 |

Optical – Characteristics – Transmitter

$V_{CC}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|---------------------------------|---------------------------------------|------|------|------|-------|---------|
| Output Optical Power | P_{TX} | 1 | | 5 | dBm | 1 |
| Optical Center Wavelength | λ_C | 1260 | 1270 | 1280 | nm | |
| Extinction Ratio | ER | 3 | 5.5 | | dB | |
| Spectral Width (-20dB) | $\Delta\lambda$ | | | 0.6 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Relative Intensity Noise | RIN | | | -128 | dB/Hz | |
| Transmitter Dispersion Penalty | TDP | | | 3.2 | dB | |
| Launch Power of OFF Transmitter | P_{OUT_OFF} | | | -30 | dBm | 1 |
| Transmitter Jitter | According to IEEE 802.3ae requirement | | | | | |

Notes:

1. Average

Optical – Characteristics – Receiver

$V_{CC}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|-------------------------------|--------------|-------|------|-------|------|---------|
| Optical Center Wavelength | λ_C | 1320 | 1330 | 1340 | nm | |
| Average Receive Power | P_{RX} | -21.2 | | -9 | dBm | |
| Receiver Sensitivity@10.3Gb/s | R_{X_SEN} | | | -19.2 | dBm | 1 |
| Receiver Reflectance | TR_{RX} | | | -12 | dB | |
| LOS Assert | LOS_A | -40 | | | dBm | |
| LOS De-Assert | LOS_D | | | -22 | dBm | |
| LOS Hysteresis | LOS_H | 0.5 | | | dB | |

Notes:

1. Measured with the PRBS $2^{31}-1$ test mode, $BER < 10^{-12}$;

Electrical – Characteristics – Transmitter

$V_{CC}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|-------------------------------|--------------|----------|-----|--------------|----------|---------|
| Input differential impedance | R_{IN} | | 100 | | Ω | |
| Differential data input swing | V_{IN_PP} | 180 | | 700 | 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

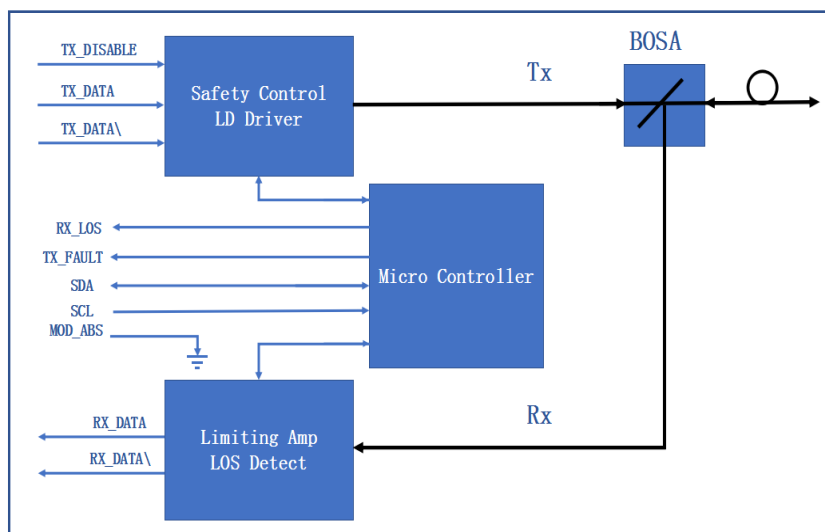
$V_{CC}=3.14V$ to $3.46V$, $T_C=0^{\circ}C$ to $70^{\circ}C$

| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|--------------------------------------|---------------|----------|-----|----------------|------|---------|
| Differential data output swing | V_{OUT_PP} | 300 | | 850 | mV | |
| Data output rise/fall time (20%-80%) | t_r/t_f | 28 | | | ps | |
| LOS Assert | V_{LOS_A} | 2 | | V_{CC_HOST} | V | |
| LOS De-Assert | V_{LOS_D} | V_{EE} | | $V_{EE}+0.5$ | V | |

Digital Diagnostic Functions

SFP10-BIDI-T1270/R1330-60KM-APD-C10 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 SFP10-BIDI-T1270/R1330-60KM-APD-C10 are internally calibrated by default. The internal micro control unit accesses the device operating parameters in real time, Such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. The module implements the alarm function of the SFF-8472, alerts the user when a particular operating parameter exceeds the factory-set normal range.

Block-Diagram-of-Transceiver

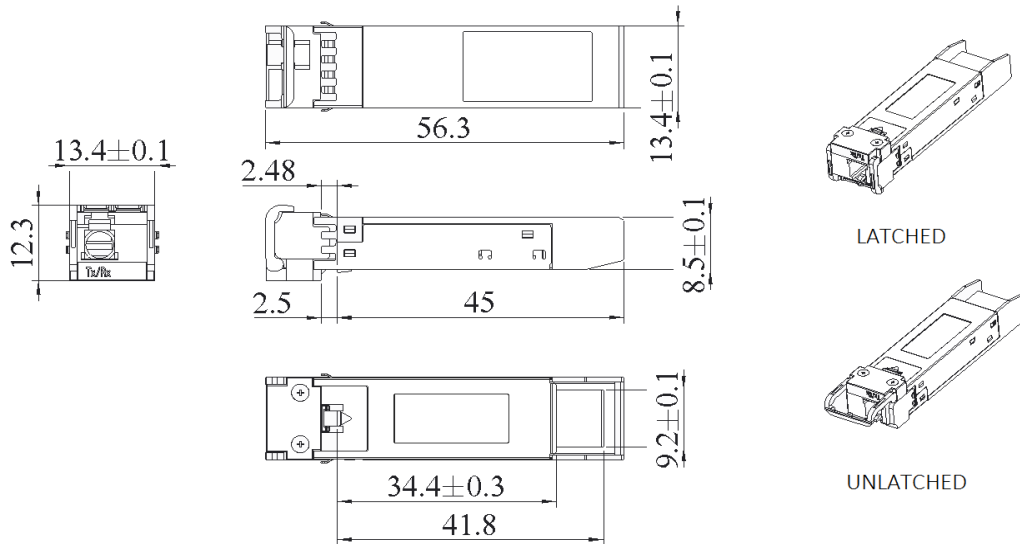


Functions Description

The transmitter is mainly composed of a laser driver and a light emitting component in a BOSA (Bidirectional Optical Transceiver Assembly). The light-emitting component of BOSA includes a 1270nm DFB laser and a backlight photodetection chip. When the module is working, the electrical signal enters the module from the serial electrical interface, then input to the laser driver chip, at this time, the laser driver chip supplies the bias current and the modulation current to the laser. The laser driver chip simultaneously uses an automatic optical power control (APC) feedback loop to maintain a constant average optical power of the laser output. The purpose is to eliminate the change of the output optical signal due to temperature changes and aging of the light source device. When the transmitter enable pin (TX_Disable) is high (TTL logic "1"), the laser output is turned off. When TX_Disable is low (TTL logic "0"), the laser will turn on within 1ms. When the transmitter fault signal (TX_Fault) is reported as high, indicates a transmitter failure caused by the transmitter's bias current or transmitted optical power or laser tube temperature exceeding a preset alarm threshold. Low indicates normal operation.

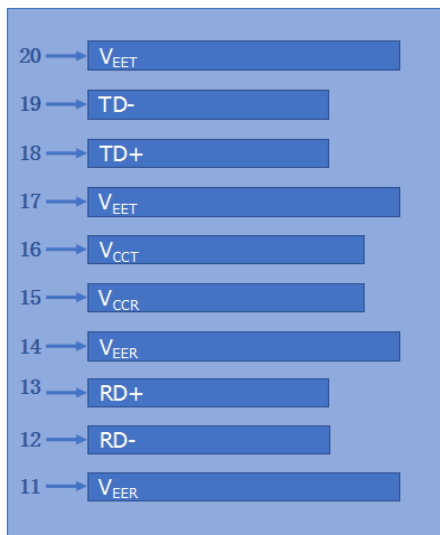
The receiver is mainly composed of a limiting amplifier chip and a light receiving component part in a BOSA. The light receiving components of BOSA includes a APD photodetector and a transimpedance amplifier chip. When the BOSA detects the incident light signal, it will be converted into a photo-generated current by the APD photodetector. The photo-generated current is converted into an electrical signal after passing through the transimpedance amplifier. The electrical signal is further amplified by the limiting amplifier, then outputs a fixed-amplitude electrical signal to the host. When the amplitude of the electrical signal received from the incident light conversion of the opposite optical transceiver module is lower than the set threshold, the module reports that the received signal is lost, the RX_LOS pin is high (logic "1"), which can be used to diagnose whether the physical signal is normal. The signal is operated in TTL level. The microprocessor inside the module monitors the module's operating voltage, temperature, transmitted optical power, received optical power, and laser bias current value in real time. The host acquires this information over a 2-wire serial bus.

Dimensions

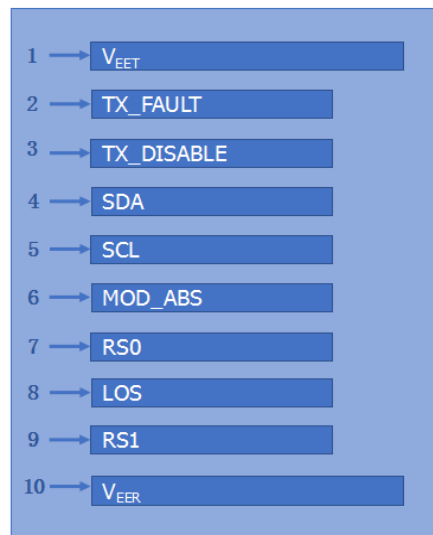
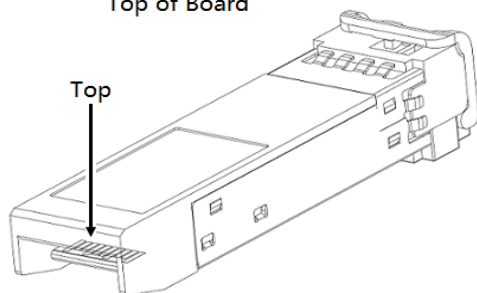


ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

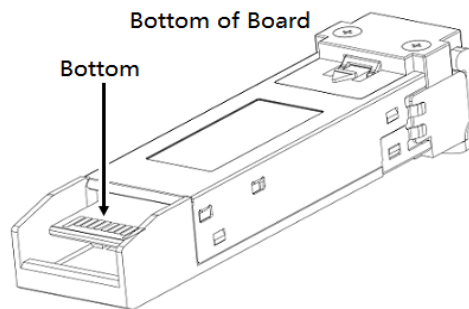
Electrical Pad Layout



Top of Board



Bottom of Board



Pin Assignment

| PIN # | Symbol | Description | Remarks |
|-------|------------------|---|---------|
| 1 | V _{EET} | Transmitter ground (common with receiver ground) | 1 |
| 2 | TX_FAULT | Transmitter Fault | |
| 3 | TX_DISABLE | Transmitter Disable. Laser output disabled on high or open | 2 |
| 4 | SDA | 2-wire Serial Interface Data Line | 3 |
| 5 | SCL | 2-wire Serial Interface Clock Line | 3 |
| 6 | MOD_ABS | Module Absent. Grounded within the module | 3 |
| 7 | RS0 | No connection required | |
| 8 | LOS | Loss of Signal indication. Logic 0 indicates normal operation | 4 |
| 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 isolated from chassis ground
2. Disabled: T_{DIS}>2V or open, Enabled: T_{DIS}<0.8V
3. Should Be pulled up with 4.7k –10k ohm on host board to a voltage between 2V and 3.6V
4. LOS is open collector output

References

1. IEEE standard 802.3ae. IEEE Standard Department, 2005.
2. Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module “SFP+” –SFF-8431
3. Digital Diagnostics Monitoring Interface for Optical Transceivers –SFF-8472.