
10Gb/s 1310nm Single-mode SFP+ LR Transceiver

PRODUCT FEATURES

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-LR
- 1310nm DFB transmitter, PIN photo-detector
- Duplex LC connector
- Metal enclosure, for lower EMI
- Electrical interface compliant to SFF-8431 specifications for 10 Gigabit “SFP+”
- 2-wire interface for management specifications compliant with SFF 8472
- Single 3.3V power supply
- Operating temperature range: -5°C to 70°C

APPLICATIONS

- 10GBASE-LR/LW 10G Ethernet

PRODUCT SELECTION

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 | TOP | -5 | | 70 | °C | |

Electrical Characteristics (TOP = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|--------------------------------|---------------------|----------------------|-----|-----------------------|------|------|
| Supply Voltage | V _{cc} | 3.14 | 3.3 | 3.46 | V | |
| Supply Current | I _{cc} | | 200 | 285 | mA | |
| Transmitter | | | | | | |
| 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 | V _{ee} | | V _{ee} + 0.8 | V | 2 |
| Transmit Disable Assert Time | | | | 10 | us | |
| Receiver | | | | | | |
| Differential data output swing | V _{out,pp} | 300 | | 850 | mV | 3 |
| Data output rise time | t _r | 29 | | | ps | 4 |
| Data output fall time | t _f | 29 | | | ps | 4 |
| LOS Fault | VLOS fault | V _{cc} -1.3 | | V _{cc} HOST | V | 5 |
| LOS Normal | VLOS norm | V _{ee} | | 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 % Measured with Module Compliance Test Board and OMA test pattern.
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.

Optical Characteristics (T_{OP} = -5 to 70°C, V_{CC} = 3.14 to 3.46 Volts)

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|-----------------------------------|-------------|----------------------------|------|-------|-------|------|
| Transmitter | | | | | | |
| Output Opt. Pwr | POUT | -6 | | -1 | dBm | 1 |
| Optical Wavelength | λ | 1260 | 1310 | 1355 | nm | |
| Wavelength Temperature Dependance | | | 0.08 | 0.125 | nm/°C | |
| Spectral Width (-20dB) | σ | | | 0.4 | nm | |
| Optical Extinction Ratio | ER | 3.5 | 6 | | dB | |
| Sidemode Supression ratio | SSRmin | 30 | | | dB | |
| Optical Rise/Fall Time | tr/ tf | | 0.1 | 0.26 | ns | |
| RIN | RIN | | | -128 | dB/Hz | |
| Transmitter Jitter (peak to peak) | | IEEE 802.3.ae requirements | | | | |
| Receiver | | | | | | |
| Average Rx Sensitivity @ 10.325G | RSSENS3 | | | -15.0 | dBm | 2 |
| Maximum Input Power | PMAX | 0.5 | | | dBm | |
| Optical Center Wavelength | λ C | 1260 | 1310 | 1600 | nm | |
| LOS De -Assert | LOSD | | | -17 | dBm | |
| LOS Assert | LOSA | -30 | | | dBm | |

| | | | | | | |
|----------------|--|-----|-----|--|----|--|
| LOS Hysteresis | | 0.5 | 1.0 | | dB | |
|----------------|--|-----|-----|--|----|--|

Notes:

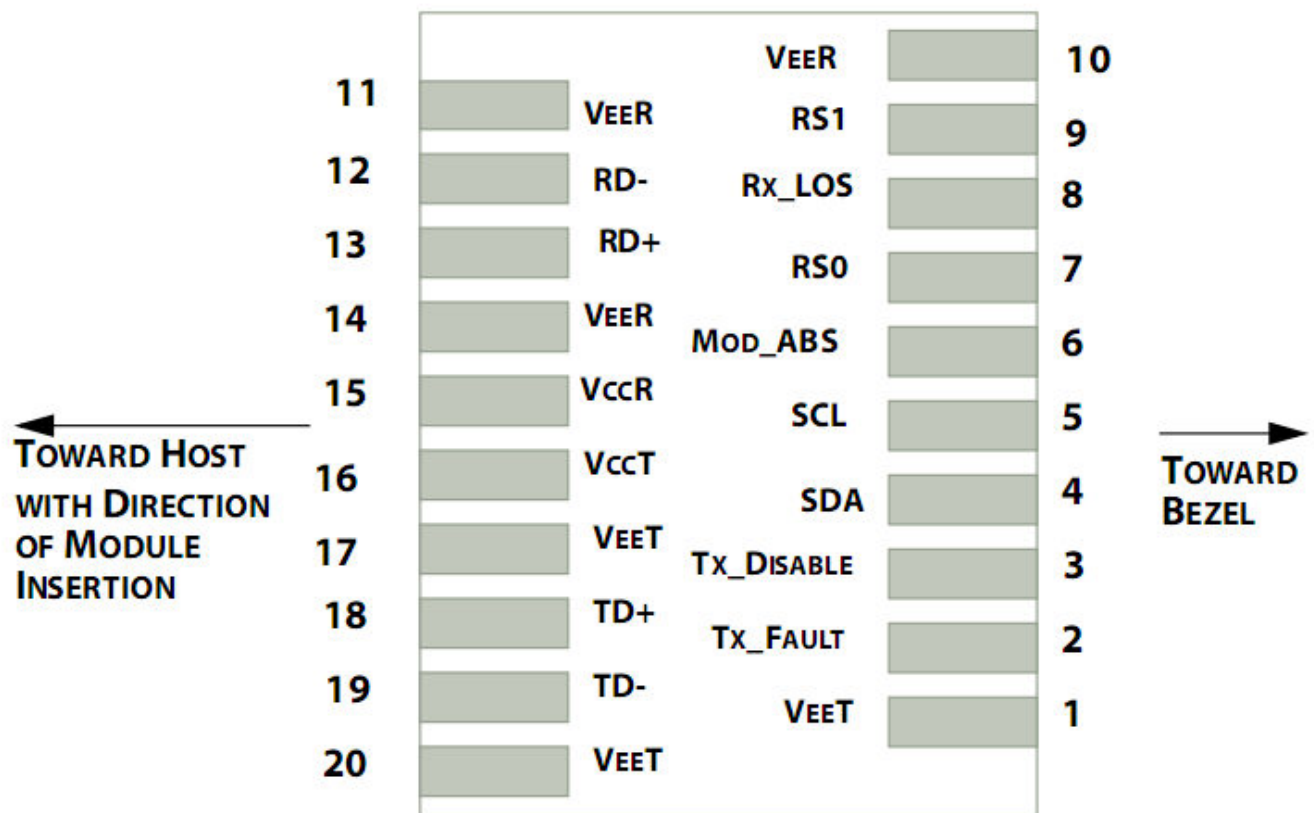
1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. With worst-case extinction ratio. Measured with a PRBS $2^{31}-1$ test pattern, @10.325Gb/s, BER<10⁻¹².

Pin Descriptions

| 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 | RS0 for Rate Select: Open or Low = Module supports 1.25 Gb/s High = Module supports 9.95 Gb/s to 10.3125 Gb/s | 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 Vcc + 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 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.
5. Transceiver data rate selected through the 2-wire bus in accordance with SFF-8472 Rev. 10.5. Soft RS0 is set at Bit3, Byte 110, Address A2h. Soft RS0 default state on power up is '0' LOW, and the state is reset following a power cycle. Writing '1' HIGH selects max. data rate operation. Transceiver data rate is the logic OR of the input state of the RS0 pin and soft RS0 bit. Thus, if either the RS0 pin OR the soft RS0 bit is HIGH then the selected data rate will be 9.95 and 10.3 Gb/s.
6. Loss Of Signal is LVTTTL. 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.



Pinout of Connector Block on Host Board

Digital Diagnostic Functions

This transceiver supports 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, 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, 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.

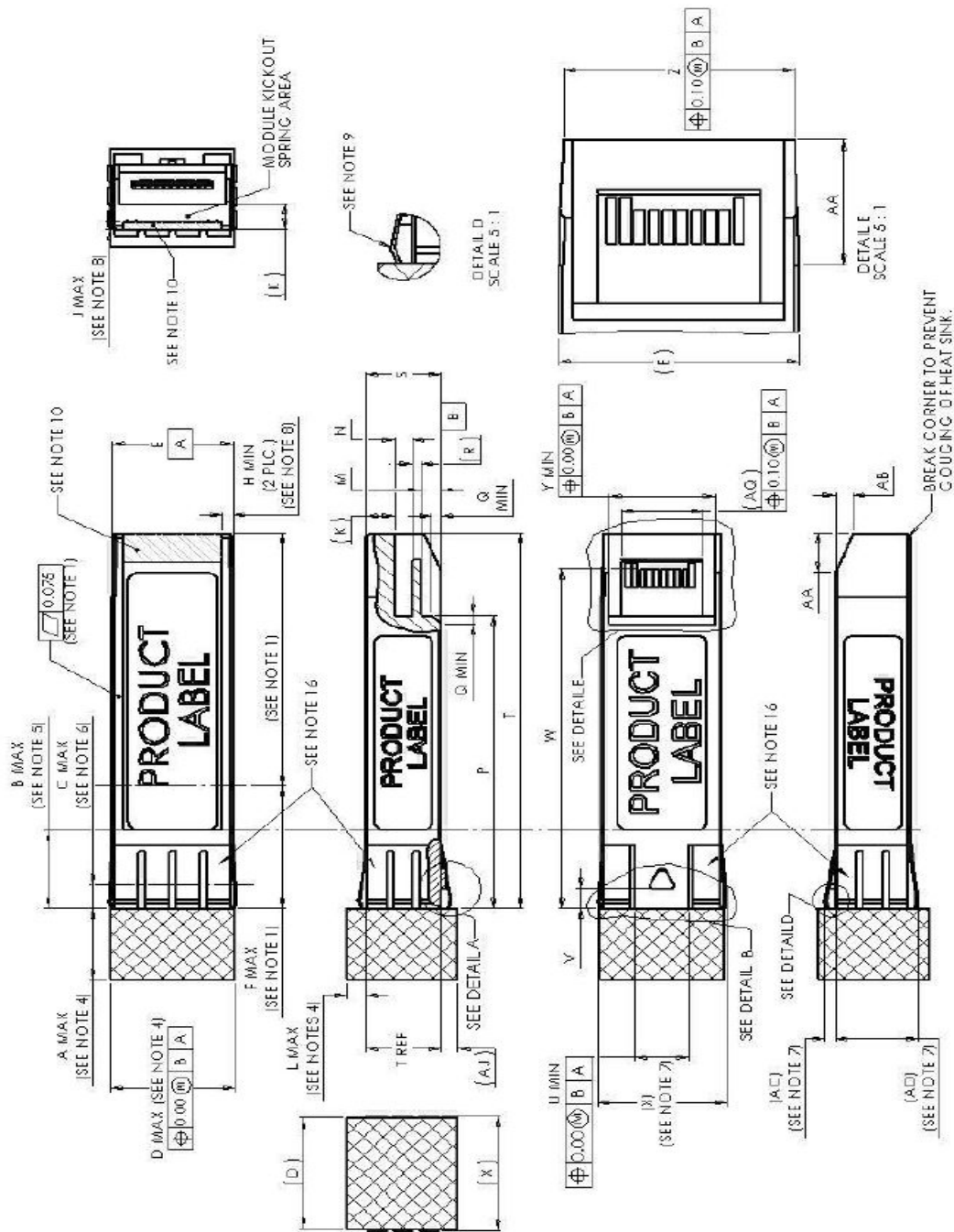
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. 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.

Digital diagnostics are Internally calibrated by default.

MECHANICAL

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



| Designator | Dimension (mm) | Tolerance (mm) | Comments |
|------------|-------------------|------------------------|---|
| A | 10.00 | Recommended Maximum | Module length extending outside of cage, see Note 4. Other lengths are application specific. |
| B | 10.00 | Maximum | Designated EMI ground spring area, see Note 5 |
| C | 3.00 | Maximum | EMI spring/Cage Contact Point, see Note 6 |
| D | 14.00 | Maximum | Module width extending outside of cage, see Note 4 |
| E | 13.55 | ±0.25 | Module width |
| F | 15.50 | Maximum | Distance to front end of optional heat sink area, see Note 1 |
| H | 1.25 | Minimum | Top slot distance from edge, see note 8 |
| J | 1.00 | Maximum | Top slot depth, see note 8 |
| K | 3.25 | Reference | Height of module kick-out spring area |
| L | 2.10 | Maximum | Module top height extending outside of cage see Note 4 |
| M | 2.25 | ±0.10 | Distance from bottom of Module to printed circuit board |
| N | 2.00 | ±0.25 | Distance from rear shoulder to printed circuit board |
| P | 37.10 | ±0.30 | Distance from positive stop to bottom opening of Module and beginning of bottom rear relief |