# 产 品 规 格 书

# *Product Specification Sheet*

## TOP-SFP28-25G-LR

**25Gb/s 10km SFP28 Optical Transceiver**

## Features

- Up to 25.78Gb/s bi-directional data links
- 1310nm DFB transmitter, PIN photo-detector
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature: 0 °C to 70°C
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP28 solution, enables higher port densities and greater bandwidth
- RoHS compliant

## Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes

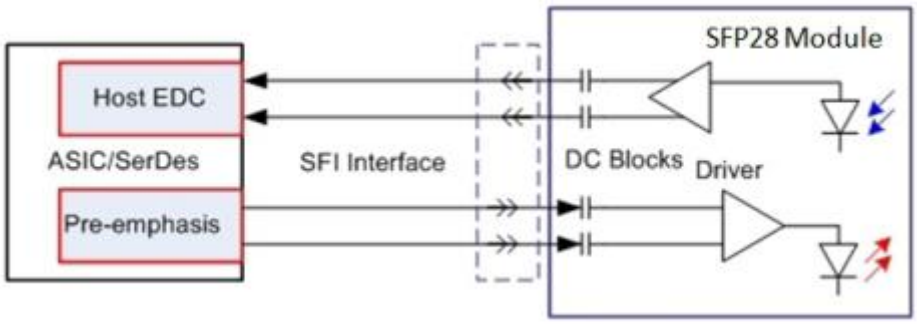



**Figure1: Application in System**

## 1. General Description

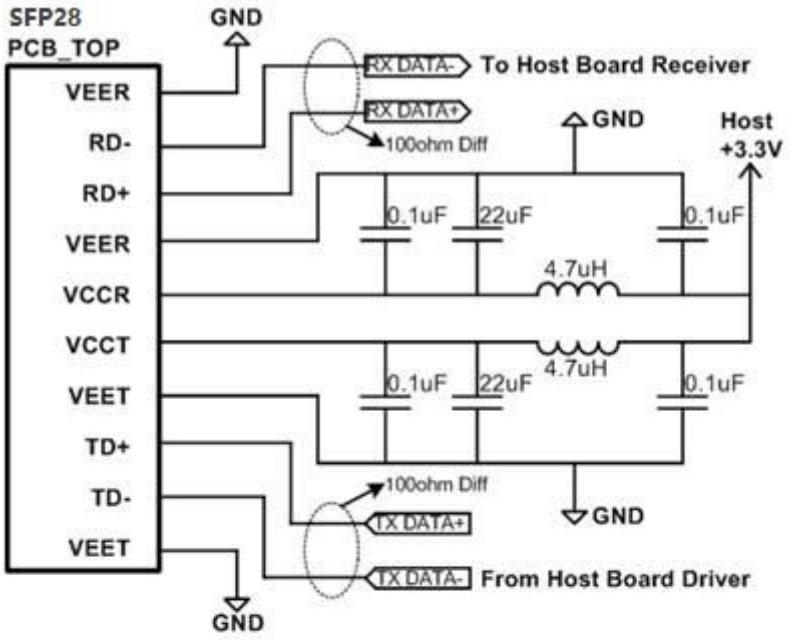
This 1310 nm DFB 25 Gigabit SFP28 transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km.

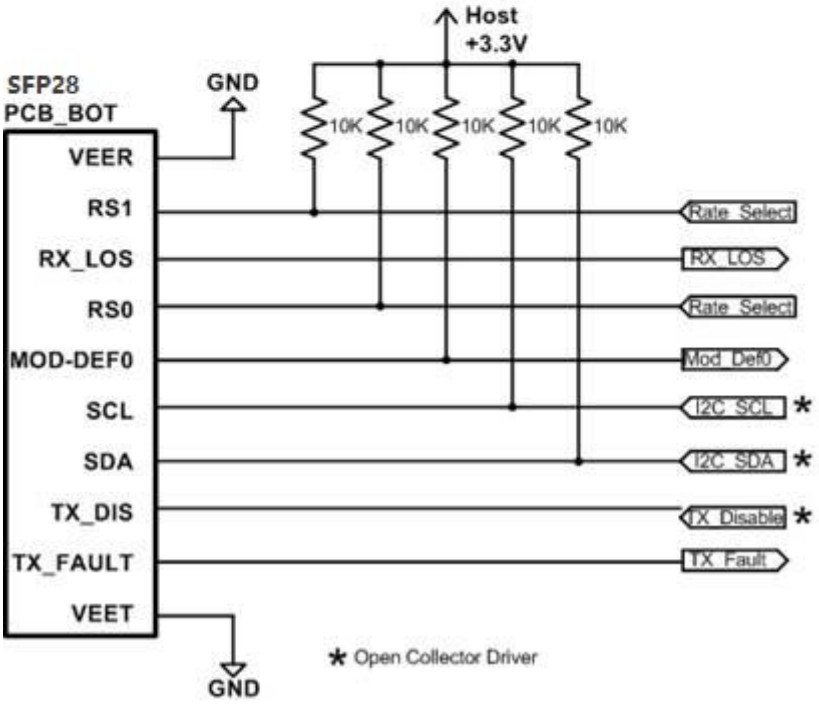
The SFP28 LR module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mmof standard FR4 with one connector.

The transmitter converts 25Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic “1” or no connection on this pin will disable the laser from transmitting. Logic “0” on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

The receiver converts 25Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

## 2. Proposed Application Schematics



### 3. Pin Definition

The SFP28 modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP28 host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 3 and contact definitions are given in the PIN description table. SFP28 module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 4 and the contact sequence order listed in the PIN description table.

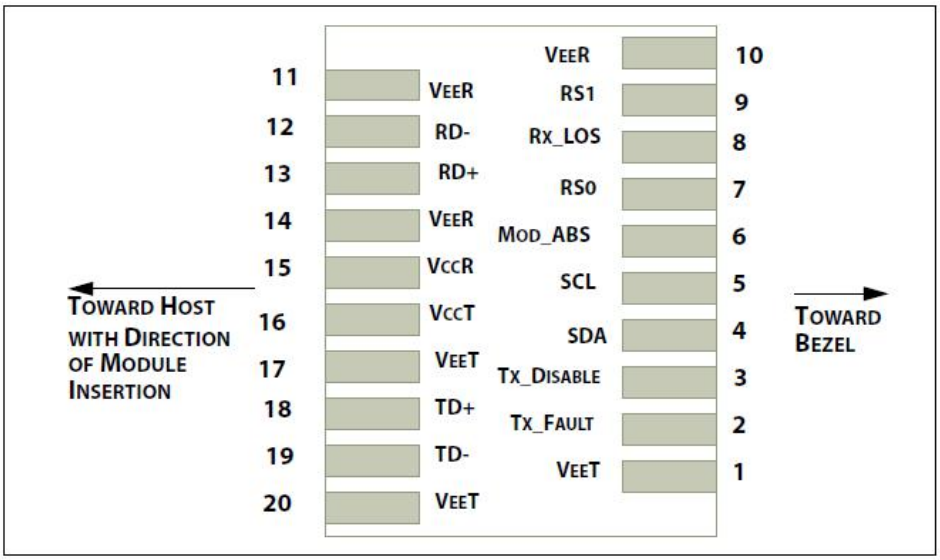



**Figure 3: Module Interface to Host**

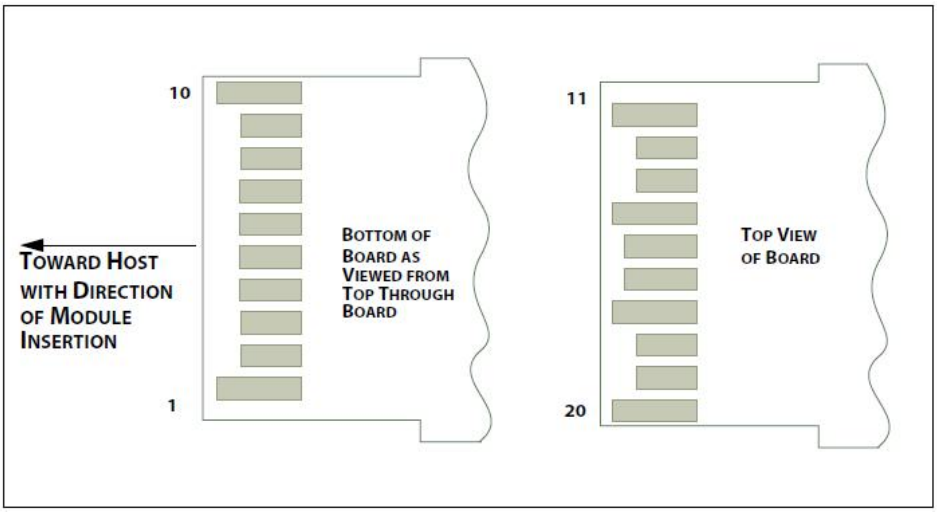



**Figure 4: Module Contact Assignment**

**PIN description**

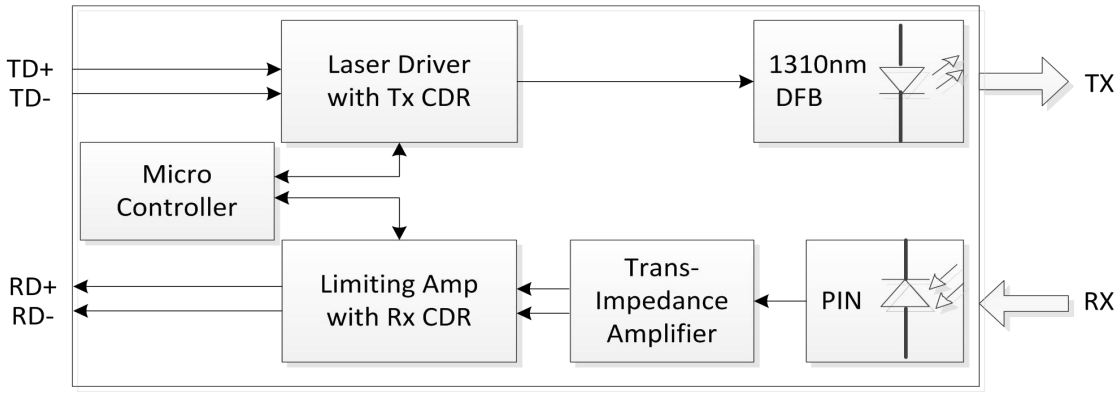
| PIN | Logic | Symbol | Name / Description | Note |
|---|---|---|---|---|
| 1 | | VeeT | Module Transmitter Ground | 1 |
| 2 | LVTTL-O | TX_Fault | Module Transmitter Fault | |
| 3 | LVTTL-I | TX_Dis | Transmitter Disable; Turns off transmitter laser output | |
| 4 | LVTTL-I/O | SDA | 2-Wire Serial Interface Data Line | 2 |
| 5 | LVTTL-I | SCL | 2-Wire Serial Interface Clock | 2 |
| 6 | | MOD_DEF0 | Module Definition, Grounded in the module | |
| 7 | LVTTL-I | RS0 | Receiver Rate Select | |
| 8 | LVTTL-O | RX_LOS | Receiver Loss of Signal Indication Active LOW | |
| 9 | LVTTL-I | RS1 | Transmitter Rate Select (not used) | |
| 10 | | VeeR | Module Receiver Ground | 1 |
| 11 | | VeeR | Module Receiver Ground | 1 |
| 12 | CML-O | RD- | Receiver Inverted Data Output | |
| 13 | CML-O | RD+ | Receiver Data Output | |
| 14 | | VeeR | Module Receiver Ground | 1 |
| 15 | | VccR | Module Receiver 3.3 V Supply | |
| 16 | | VccT | Module Receiver 3.3 V Supply | |
| 17 | | VeeT | Module Transmitter Ground | 1 |
| 18 | CML-I | TD+ | Transmitter Non-Inverted Data Input | |
| 19 | CML-I | TD- | Transmitter Inverted Data Input | |
| 20 | | VeeT | Module Transmitter Ground | 1 |

**Note:**

1. Module ground pins GND are isolated from the module case.

2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

## 4. Transceiver Block Diagram




## 5. Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power Supply Voltage | VCC | 0 | 3.6 | V |
| Storage Temperature | Tc | -40 | 85 | °C |
| Operating Case Temperature | Tc | 0 | 70 | °C |
| Relative Humidity | RH | 5 | 95 | % |
| Damage Threshold | Pmax | 3.4 | | dBm |

## 6. Recommended Operating Environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameters | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | Vcc | 3.135 | 3.3 | 3.465 | V |
| Power Supply Current | Icc | | | 300 | mA |
| Operating Case Temperature | TC | 0 | 25 | 70 | °C |

## 7. Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength | λt | 1295 | | 1325 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Average Optical Power | Pavg | -5 | | 2 | dBm | Note1 |
| Laser Off Power | Poff | | | -30 | dBm | |
| Extinction Ratio | ER | 3.5 | | | dB | |
| Transmitter Dispersion Penalty | TDP | | | 2.7 | dB | |
| Relative Intensity Noise | $RIN_{20}OMA$ | | | -130 | dB/Hz | |
| Optical Modulation Amplitude | OMA | -2 | | | dBm | |
| **Receiver** | | | | | | |
| Center Wavelength | λr | 1260 | | 1350 | nm | |
| Sensitivity (Average power) | Psens | | -11.4 | | dBm | BER = $1x10^{-12}$ |
| Unstressed receiver sensitivity(OMA) | Psens | | | -11.4 | dBm | BER = $1x10^{-6}$ |
| LOS Assert | LOSA | -30 | | | dBm | |
| LOS De-assert | LOSD | | | -13 | dBm | |
| LOS Hysteresis | LOSH | 0.5 | | | dB | |
| Return loss of receiver | | 26 | | | dB | |
| Average received power (overload) | | | | 2 | dBm | Note2 |

**Notes:**

1. Average optical power shall be measured using the methods specified in TIA/EIA-455-95.
2. Maximum average received power is compatible with FC-PI-6-32G while typical BER is less than $1x\ 10^{-12}$.

## 8. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev10.2 with internal

calibration mode. For external calibration mode please contact our sales staff.

| Parameter | Symbol | Min. | Max | Unit | Notes |
|---|---|---|---|---|---|
| Temperature monitor absolute error | DMI_Temp | -3 | 3 | degC | Over operating temp |
| Laser power monitor absolute error | DMI_TX | -3 | 3 | dB | |
| RX power monitor absolute error | DMI_RX | -3 | 3 | dB | 3.5dBm to -10.4dBm range |
| Supply voltage monitor absolute error | DMI_VCC | -0.1 | 0.1 | V | Full operating range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |

**9. Electrical Characteristics**

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Data Rate | | - | 25.78 | - | Gbps | |
| Power Consumption | | - | 900 | 1000 | mW | |
| **Transmitter** | | | | | | |
| Single Ended Input Voltage Tolerance | | -0.3 | | 4 | V | |
| AC Common mode voltage tolerance | | 15 | | | mV | RMS |
| Differential Input Voltage Swing | Vin | 180 | | 700 | mV | |
| Differential Input Impedance | Zin | 90 | 100 | 110 | Ohm | |
| **Receiver** | | | | | | |
| Single-ended Output Voltage | | -0.3 | - | 4 | V | |
| Differential Output Voltage Swing | Vo | 300 | | 850 | mV | |
| AC Common Mode Output Voltage | | | | 7.5 | mV | RMS |
| Differential Output Impedance | Zout | 90 | 100 | 110 | Ohm | |

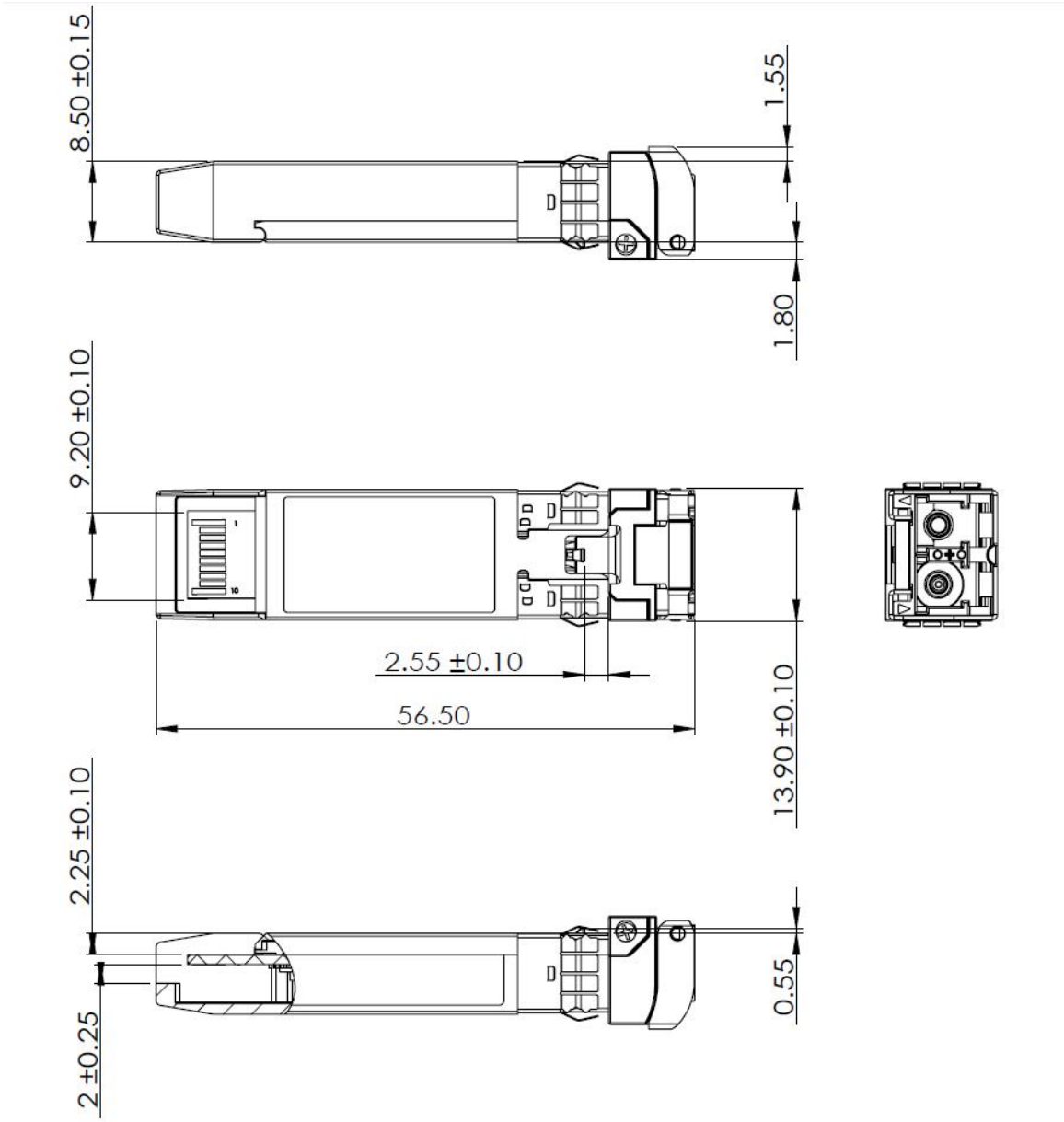
## 10. Control and Status I/O Timing Characteristics

Timing characteristics of control and status I/O are compatible with SFF-8431-MSA.

| Parameter | Symbol | Min. | Max. | Unit | Conditions |
|---|---|---|---|---|---|
| Tx_Disable assert time | t_off | | 100 | µs | Rising edge of Tx_Disable to fall of output signal below 10% of nominal |
| Tx_Disable negate time | t_on | | 2 | ms | Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery. |
| Time to initialize 2-wire interface | t_2w_start_up | | 300 | ms | From power on or hot plug after the supply meeting SFF8431 |
| Time to initialize | t_start_up | | 300 | ms | From power supplies meeting SFF8431 or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational. |
| Time to initialize cooled module and time to power up a cooled module to Power Level II | t_start_up_cooled | | 90 | s | From power supplies meeting SFF8431 or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational. Also, from stop bit low-to-high SDA transition enabling Power Level II until cooled module is fully operational |
| Time to Power Up to Level II | t_power_level2 | | 300 | ms | From stop bit low-to-high SDA transition enabling power level II until non-cooled module is fully operational |
| Time to Power Down from Level II | t_power_down | | 300 | ms | From stop bit low-to-high SDA transition disabling power level II until module is within power level I requirements |
| Tx_Fault assert | Tx_Fault_on | | 1 | ms | From occurrence of fault to assertion of Tx_Fault |
| Tx_Fault assert for cooled module | Tx_Fault_on_cooled | | 50 | ms | From occurrence of fault to assertion of Tx_Fault |
| Tx_Fault Reset | t_reset | 10 | | µs | Time Tx_Disable must be held high to reset Tx_Fault |
| RS0, RS1 rate select timing for FC | t_RS0_FC, t_RS1_FC | | 500 | µs | From assertion till stable output |
| RS0, RS1 rate select timing non FC | t_RS0, t_RS1 | | 24 | ms | From assertion till stable output |
| Rx_LOS assert delay | t_los_on | | 100 | µs | From occurrence of loss of signal to assertion of Rx_LOS |
| Rx_LOS negate delay | t_los_off | | 100 | µs | From occurrence of presence of signal to negation of Rx_LOS |

## 11. Mechanical Dimensions

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



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