

## Features

- ◎ Up to 25.78125Gbps Data rate per channel
- ◎ Up to reach 2km for G.652 SMF
- ◎ 4 channels 1310nm DFB
- ◎ 4 channels PIN photo detector array
- ◎ Hot-pluggable QSFP28 form factor
- ◎ Single MPO connector receptacle
- ◎ Internal CDR circuits on both receiver and Transmitter channels
- ◎ Support CDR bypass
- ◎ Built-in digital diagnostic functions
- ◎ Single +3.3V power supply
- ◎ Low power consumption<3.5 W
- ◎ Operating case temperature: 0~+70°C
- ◎ 4 channel full duplex transceiver modules

## Applications

- ◎ 100G PSM4 applications with FEC
- ◎ Datacenter and Enterprise networking
- ◎ Other optical links

## Standard

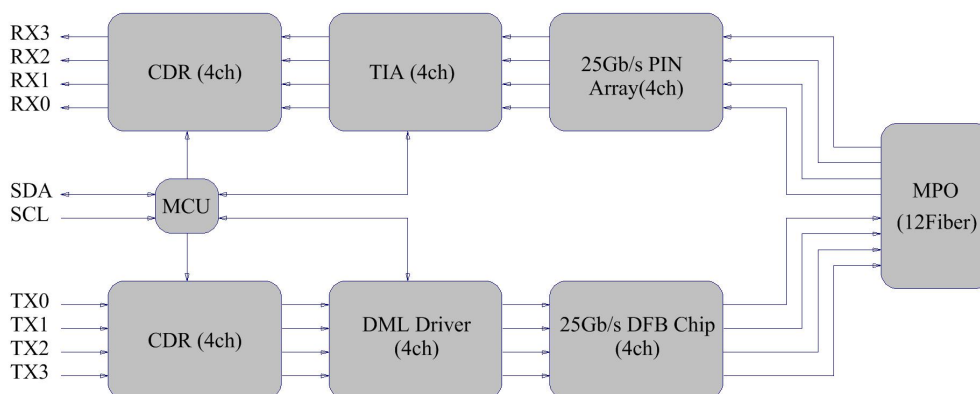
- ◎ Compliant with SFF-8636
- ◎ Compliant with IEEE 802.3bm 100GBASE-PSM4
- ◎ Compliant with Telcordia GR-468-CORE
- ◎ RoHS Compliant

**Table 1. Regulatory Compliance**

| Product Certificate | Certificate Number | Applicable Standard                                                       |
|---------------------|--------------------|---------------------------------------------------------------------------|
| TUV                 | R50135086          | EN 60950-1:2006+A11+A1+A12+A2<br>EN 60825-1:2014<br>EN 60825-2:2004+A1+A2 |
| UL                  | E317337            | UL 60950-1<br>CSA C22.2 No. 60950-1-07                                    |
| EMC CE              | AE 50285865 0001   | EN 55022:2010<br>EN 55024:2010                                            |
| FCC                 | WTF14F0514417E     | 47 CFR PART 15 OCT., 2013                                                 |
| FDA                 | /                  | CDRH 1040.10                                                              |
| ROHS                | /                  | 2011/65/EU                                                                |

## Product Description

The transceiver is a four-channel, pluggable, parallel, fiber-optic QSFP28 PSM4 transceiver module for 100GBASE-PSM4 and 100G Ethernet, InfiniBand DDR, EDR applications. This high performance module is designed for data communication and interconnect applications. It integrates four data lanes in each direction with 100Gb/s bandwidth. Each lane can operate at 25.78125Gb/s Up to reach 2km for G.652 SMF. These modules are designed to operate over single mode fiber systems using a nominal wavelength of 1310nm. The electrical interface uses a 38 pin contact edge type connector. The optical interface uses an 12 fiber MTP(MPO) connector. This module incorporates Technologies proven circuit and Optical technology to provide reliable long life, high performance, and onsistent service.



**Figure 1. Transceiver functional Block Diagram**

## Absolute Maximum Ratings

**Table 2. Absolute Maximum Ratings**

(Exceeding the limits below may damage the transceiver module permanently)

| Parameter                               | Symbol | Min  | Typ | Max  | Unit | Notes |
|-----------------------------------------|--------|------|-----|------|------|-------|
| Maximum Supply Voltage                  | VCC    | -0.5 | -   | +4.0 | V    |       |
| Storage Temperature                     | TS     | -40  | -   | +85  | °C   |       |
| Case Operating Temperature              | TA     | -5   | -   | +75  | °C   |       |
| Relative Humidity                       | RH     | 5    | -   | 95   | %    | 1     |
| Receiver Damage Threshold,<br>each lane | PRdmg  | 3.0  | -   | -    | dBm  |       |

**Notes:**

1. Non-condensing.

## Recommend Operation Environment

**Table 3. Recommend Operation Environment**

| Parameter                  | Symbol | Min  | Typ      | Max  | Unit | Notes |
|----------------------------|--------|------|----------|------|------|-------|
| Data Rate,each lane        | BR     | -    | 25.78125 | -    | Gbps |       |
| Power Supply Voltage       | VCC    | 3.13 | 3.3      | 3.47 | V    |       |
| Power Supply Current       | ICC    | -    | -        | 1060 | mA   |       |
| Power Dissipation          | PD     | -    | -        | 3.5  | W    |       |
| Case Operating Temperature | TA     | 0    | -        | +70  | °C   |       |
| Relative Humidity          | RH     | 5    | -        | 85   | %    | 1     |
| Transmission Distance      | TD     | -    | -        | 2    | km   | 2     |

**Notes:**

1. Non-condensing.

2. Measured with ITU-T G.652 SMF

## Electrical/Optical Characteristics

**Table 4. Electrical Characteristics**(T<sub>OP</sub> = 0 to +70 °C, V<sub>CC</sub> = 3.13 to 3.47 V)

| Parameter                         | Symbol               | Min  | Typ | Max             | Unit | Notes |
|-----------------------------------|----------------------|------|-----|-----------------|------|-------|
| <b>Transmitter</b>                |                      |      |     |                 |      |       |
| Differential Data Input Amplitude | V <sub>IN,P-P</sub>  | 180  | -   | 900             | mVpp |       |
| Input Differential Impedance      | Z <sub>IN</sub>      | 90   | 100 | 110             | Ω    |       |
| Transmitter Fault Output-High     | V <sub>OH</sub>      | 2.4  | -   | V <sub>CC</sub> | V    |       |
| Transmitter Fault Output-Low      | V <sub>OL</sub>      | -0.3 | -   | 0.4             | V    |       |
| Transmitter Disable Voltage- High | V <sub>IH</sub>      | 2.0  | -   | V <sub>CC</sub> | V    |       |
| Transmitter Disable Voltage- low  | V <sub>IL</sub>      | 0    | -   | 0.8             | V    |       |
| <b>Receiver</b>                   |                      |      |     |                 |      |       |
| Differential output voltage swing | V <sub>OUT,P-P</sub> | 300  | -   | 900             | mVpp |       |
| Output Differential Impedance     | Z <sub>OUT</sub>     | 90   | 100 | 110             | Ω    |       |
| LOS Output Voltage-High           | V <sub>LOSH</sub>    | 2.0  | -   | V <sub>CC</sub> | V    |       |
| LOS Output Voltage-Low            | V <sub>LOSL</sub>    | -    | -   | 0.8             | V    |       |

## Optical Characteristics

**Table 5. Optical Characteristics**(T<sub>OP</sub> = 0 to +70 °C, V<sub>CC</sub> = 3.13 to 3.47 V)

| Parameter                                           | Symbol         | Min  | Typ      | Max  | Unit | Notes |
|-----------------------------------------------------|----------------|------|----------|------|------|-------|
| <b>Transmitter</b>                                  |                |      |          |      |      |       |
| Optical Center Wavelength                           | λ <sub>C</sub> | 1290 | 1310     | 1330 | nm   |       |
| RMS Spectral Width (20dB)                           | Δσ             | -    | -        | 1.0  | nm   |       |
| Side Mode Suppression Ratio                         | SMSR           | 30   | -        | -    | dB   |       |
| Data Rate, each lane                                | BR             | -    | 25.78125 | -    | Gbps |       |
| Average Launch Power,each lane                      | P <sub>O</sub> | -6.0 | -        | 2.0  | dBm  | 1     |
| Optical Modulation Amplitude, each lane             | POMA           | -5.0 | -        | 2.2  | dBm  |       |
| Transmitter and dispersion penalty (TDP), each lane | TDP            | -    | -        | 2.9  | dBm  |       |
| Optical Extinction Ratio                            | ER             | 3.5  | -        | -    | dB   |       |

|                                                          |                                                    |        |          |        |       |   |
|----------------------------------------------------------|----------------------------------------------------|--------|----------|--------|-------|---|
| Relative Intensity Noise                                 | RIN                                                | -      | -        | -130   | dB/Hz |   |
| Optical Return Loss Tolerance                            | ORL                                                | -      | -        | 20     | dB    |   |
| Transmitter Reflectance                                  | RT                                                 | -      | -        | -12    | dB    |   |
| Average Launch power of Tx OFF, each lane                | POFF                                               | -      | -        | -30    | dBm   |   |
| Transmitter Eye Mask coordinates: X1, X2, X3, Y1, Y2, Y3 | SPECIFICATION VALUES {0.31,0.4,0.45,0.34,0.38,0.4} |        |          |        |       | 2 |
| Receiver                                                 |                                                    |        |          |        |       |   |
| Center Wavelength Range                                  | λC                                                 | 1290   | 1310     | 1330   | nm    |   |
| Data Rate, each lane                                     | BR                                                 | -      | 25.78125 | -      | Gbps  |   |
| Receiver Power(OMA), each lane                           | ROMA                                               | -      | -        | 2.2    | dBm   |   |
| Average Receive Power, each lane                         | RPO                                                | -12.66 | -        | 2.0    | dBm   | 1 |
| Receiver Sensitivity(OMA), each lane                     | RSENS                                              | -      | -        | -11.35 | dBm   |   |
| Stressed Receiver Sensitivity (OMA) , each lane          | RSRS                                               | -      | -        | -6.8   | dBm   | 3 |
| LOS Assert                                               | LOSA                                               | -30    | -        | -      | dBm   |   |
| LOS De-Assert                                            | LOSD                                               | -      | -        | -14    | dBm   |   |
| LOS Hysteresis                                           | LOSH                                               | 0.5    | -        | 5.0    | dB    |   |
| Receiver Reflectance                                     | RR                                                 | -      | -        | -26    | dB    |   |

## Notes:

1. Average launch/receive power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch/receive power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Hit Ratio  $5 \times 10^{-5}$  hits/sample
3. Measured with worst ER=3.5dB, RPBS  $2^{31}-1$  test pattern @25.78125Gbs BER= $<1 \times 10^{-12}$ .

## Pin Assignment

**Table 6. Pin Descriptions**

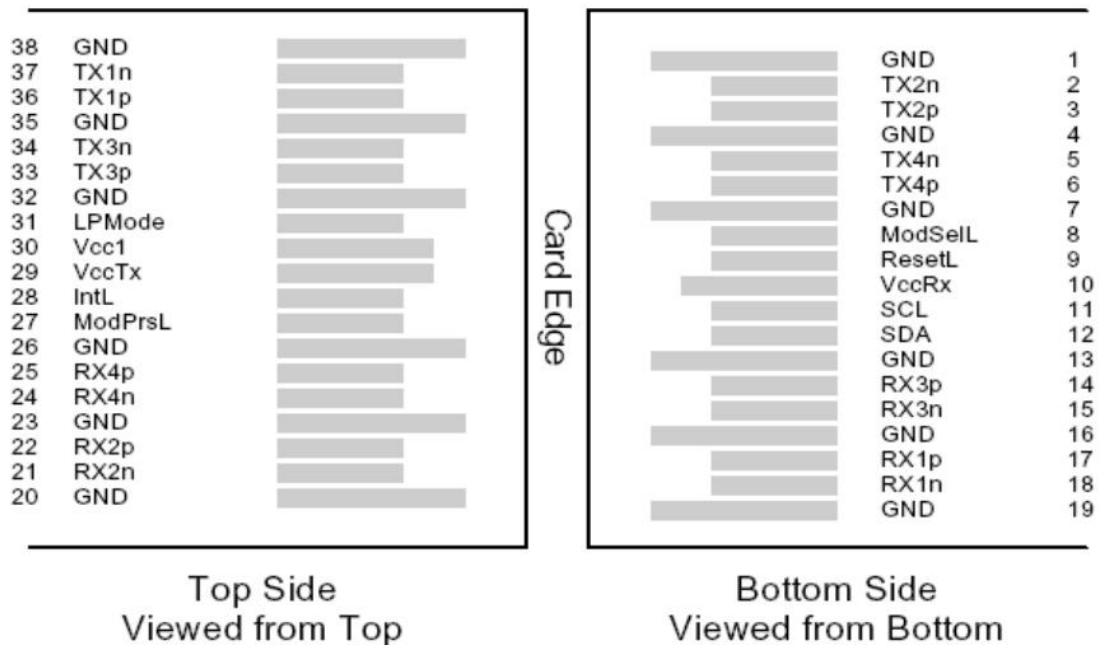
| Pin | Symbol  | Name/Description                    | Notes |
|-----|---------|-------------------------------------|-------|
| 1   | GND     | Ground                              | 1     |
| 2   | Tx2n    | Transmitter Inverted Data Input     |       |
| 3   | Tx2p    | Transmitter Non-Inverted Data Input |       |
| 4   | GND     | Ground                              | 1     |
| 5   | Tx4n    | Transmitter Inverted Data Input     |       |
| 6   | Tx4p    | Transmitter Non-Inverted Data Input |       |
| 7   | GND     | Ground                              | 1     |
| 8   | ModSelL | Module Select                       | 2     |
| 9   | ResetL  | Module Reset                        | 2     |
| 10  | Vcc Rx  | +3.3 V Power supply receiver        |       |
| 11  | SCL     | 2-wire serial interface clock       | 2     |
| 12  | SDA     | 2-wire serial interface data        | 2     |
| 13  | GND     | Ground                              | 1     |
| 14  | Rx3p    | Receiver Non-Inverted Data Output   |       |
| 15  | Rx3n    | Receiver Inverted Data Output       |       |
| 16  | GND     | Ground                              | 1     |
| 17  | Rx1p    | Receiver Non-Inverted Data Output   |       |
| 18  | Rx1n    | Receiver Inverted Data Output       |       |
| 19  | GND     | Ground                              | 1     |
| 20  | GND     | Ground                              |       |
| 21  | Rx2n    | Receiver Inverted Data Output       |       |
| 22  | Rx2p    | Receiver Non-Inverted Data Output   |       |
| 23  | GND     | Ground                              | 1     |
| 24  | Rx4n    | Receiver Inverted Data Output       |       |
| 25  | Rx4p    | Receiver Non-Inverted Data Output   |       |
| 26  | GND     | Ground                              | 1     |
| 27  | ModPrsL | Module Present                      |       |

|    |        |                                     |   |
|----|--------|-------------------------------------|---|
| 28 | IntL   | Interrupt                           | 2 |
| 29 | Vcc Tx | +3.3 V Power supply transmitter     |   |
| 30 | Vcc1   | +3.3 V Power Supply                 |   |
| 31 | LPMODE | Low Power Mode                      | 2 |
| 32 | GND    | Ground                              | 1 |
| 33 | Tx3p   | Transmitter Non-Inverted Data Input |   |
| 34 | Tx3n   | Transmitter Inverted Data Input     |   |
| 35 | GND    | Ground                              | 1 |
| 36 | Tx1p   | Transmitter Non-Inverted Data Input |   |
| 37 | Tx1n   | Transmitter Inverted Data Input     |   |
| 38 | GND    | Ground                              | 1 |

**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. Open collector; should be pulled up with a 4.7kΩ to 10kΩ resistor on host board to a voltage between 3.15V and 3.6V.

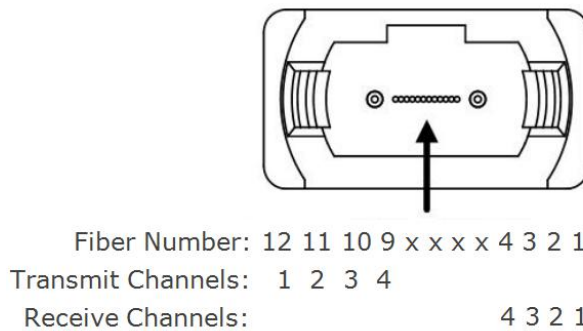
**Pin Assignment (continued)**



**Figure 2. Host PCB QSFP28 pad assignment top view and Names**

## Optical Interface Lanes and Assignment

The optical interface port is a male MPO connector, the keying feature of the MPO receptacle is on the top, then fibers are numbered left to right as 12 through 1 looking into the receptacle. The four fiber positions on the left (fibers 12, 11, 10, 9) are used for the optical transmit signals (Channel 1 through 4). The fiber positions on the right (fibers 4, 3, 2, 1) are used for the optical receive signals (Channel 4 through 1). The central four fibers (5, 6, 7, 8) may be physically present.

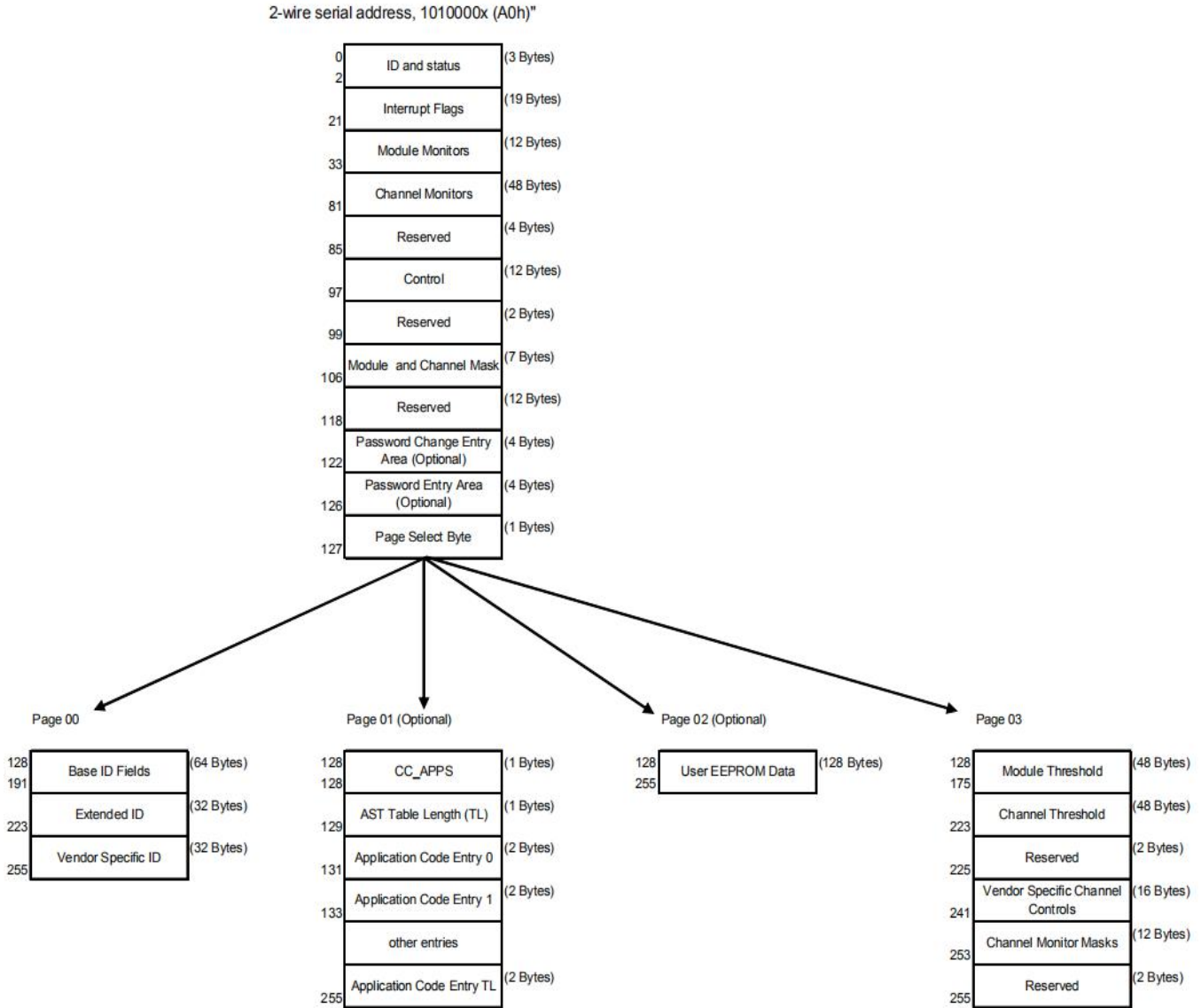


**Figure 3. QSFP28 Optical Receptacle and Channel Orientation**

## Digital Diagnostic Monitoring Interface

Digital diagnostics monitoring function is available on all QSFP28 module. A 2-wire serial interface provides user to contact with module. The structure of the memory is shown in Figure 4. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages. This structure permits timely access to addresses in the lower page, such as Interrupt Flags and Monitors. Less time critical time entries, such as serial ID information and threshold settings, are available with the Page Select function. The interface address used is A0xh and is mainly used for time critical data like interrupt handling in order to enable a one-time-read for all data related to an interrupt situation. After an interrupt, IntL, has been asserted, the host can read out the flag field to determine the affected channel and type of flag.





**Figure 4, QSFP28 Memory Map (Specific Data Field Descriptions)**

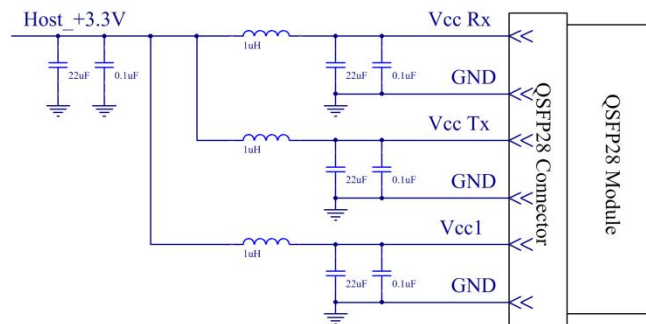
**Table 7. Digital Diagnostic Monitor Characteristics**

| Parameter                        | Calibration | Range          | Accuracy | Unit |
|----------------------------------|-------------|----------------|----------|------|
| Transceiver Internal Temperature | Internal    | 0 to +70°C     | ±3.0     | °C   |
| VCC Internal Supply Voltage      | Internal    | 3.0 to 3.6V    | ±3.0     | %    |
| Laser Bias Current, each lane    | Internal    | 0 to 90mA      | ±10      | %    |
| Tx Output Power, each lane       | Internal    | -5.0 to 2.5dBm | ±3.0     | dBm  |
| Rx Input Power, each lane        | Internal    | -14.0 to 0dBm  | ±3.0     | dBm  |

**Table 8. Timing and Electrical**

| Parameter                                  | Symbol       | Min | Typ | Max  | Unit |
|--------------------------------------------|--------------|-----|-----|------|------|
| Initialization Time                        | t_init       | -   | -   | 2000 | ms   |
| Reset Init Assert Time                     | t_reset_init | -   | -   | 2    | us   |
| Serial Bus Hardware Ready Time             | t_serial     | -   | -   | 2000 | ms   |
| Monitor Data Ready Time                    | t_data       | -   | -   | 2000 | ms   |
| Reset Assert Time                          | t_reset      | -   | -   | 2000 | ms   |
| LPMODE Assert Time                         | ton_LPMODE   | -   | -   | 100  | us   |
| IntL Assert Time                           | ton_IntL     | -   | -   | 200  | ms   |
| IntL Deassert Time                         | toff_IntL    | -   | -   | 500  | us   |
| Rx LOS Assert Time                         | ton_los      | -   | -   | 100  | ms   |
| Tx Fault Assert Time                       | ton_Txfault  | -   | -   | 200  | ms   |
| Flag Assert Time                           | ton_flag     | -   | -   | 200  | ms   |
| Mask Assert Time                           | ton_mask     | -   | -   | 100  | ms   |
| Mask Deassert Time                         | toff_mask    | -   | -   | 100  | ms   |
| ModSelL Assert Time                        | ton_ModSelL  | -   | -   | 100  | us   |
| ModSelL Deassert Time                      | toff_ModSelL | -   | -   | 100  | us   |
| Power_over-ride or Power-set Assert Time   | ton_Pdown    | -   | -   | 100  | ms   |
| Power_over-ride or Power-set Deassert Time | toff_Pdown   | -   | -   | 300  | ms   |

## Recommended Circuit



**Figure 5, Recommended Host Board Power Supply Circuit**

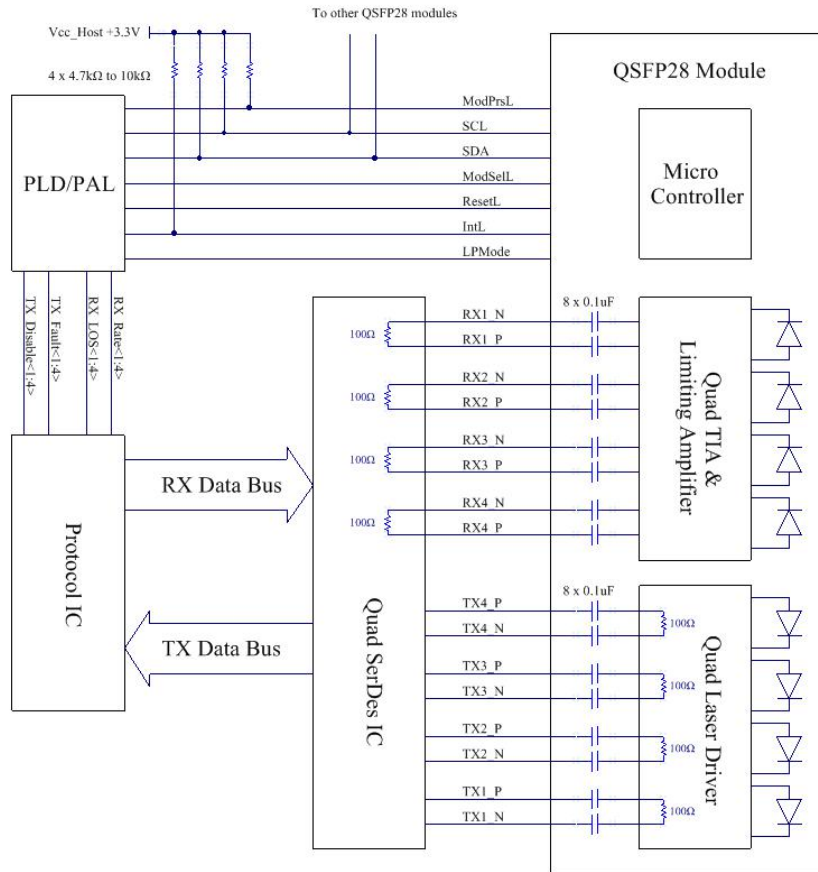


Figure 6, Recommended Interface Circuit

## Mechanical Dimensions

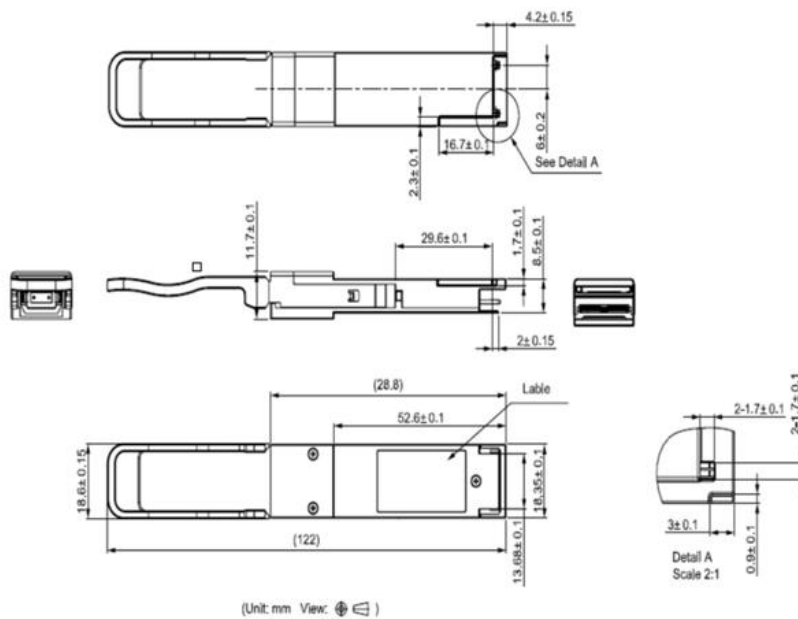


Figure 7, Mechanical Dimensions

## Warnings

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes.  
Avoid eye exposure to direct or indirect radiation.