

### **QDD-400GB-DR4-2-LR4-SIG**

MSA and TAA 400GBase-LR4 QSFP-DD Transceiver (SMF, 1310nm, 2km, MPO, DOM)

#### **Features:**

- Compliant with IEEE 802.3bs Standard: 400GAUI-8 Electrical Interface
- Compliant with IEEE 802.3cu Standard: 4x100GBASE-FR1 Optical Interface
- Compliant with QSFP-DD MSA HW Rev. 5.1 Type 2 Housing with MPO-12 Connector
- Compliant with QSFP-DD CMIS Rev. 4.0
- Maximum Power Consumption: 9W
- 2-Wire Serial Interface with Digital Diagnostic Monitoring
- Complies with EU Directive 2011/65/EU
- Class 1 Laser
- Operating Temperature: 0 to 70 Celsius
- RoHS Compliant and Lead-Free



#### **Applications:**

- 400GBase Ethernet
- Access and Enterprise

#### **Product Description**

This MSA compliant QSFP-DD transceiver provides 400GBase-LR4 throughput up to 2km over single-mode fiber (SMF) using a wavelength of 1310nm via an MPO connector. All of our transceivers are built to comply with Multi-Source Agreement (MSA) standards and are uniquely serialized and tested for data-traffic and application to ensure seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs' transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products.")



## Absolute Maximum Ratings

| Parameter                                  | Symbol | Min. | Typ.   | Max. | Unit | Notes |
|--------------------------------------------|--------|------|--------|------|------|-------|
| Storage Temperature                        | Tstg   | -40  |        | 85   | °C   |       |
| Operating Case Temperature                 | Tc     | 0    |        | 70   | °C   |       |
| Power Supply Voltage                       | Vcc    | -0.5 |        | 3.6  | V    |       |
| Relative Humidity                          | RH     | 5    |        | 95   | %    |       |
| Operating Distance                         | D      | 2    |        | 2000 | m    |       |
| Signaling Rate Per Lane                    | SRL    |      | 53.125 |      | GBd  | 1     |
| Maximum Power Dissipation                  | PD     |      |        | 9    | W    |       |
| Maximum Power Dissipation (Low-Power Mode) | PDLP   |      |        | 1.5  | W    |       |

### Notes:

1. PAM4.

## Electrical Characteristics

| Parameter                                  | Symbol | Min.  | Typ. | Max.    | Unit | Notes |
|--------------------------------------------|--------|-------|------|---------|------|-------|
| Supply Voltage                             | Vcc    | 3.135 | 3.3  | 3.465   | V    |       |
| Control Input Voltage                      | VI     | -0.3  |      | Vcc+0.5 | V    |       |
| Instantaneous Peak Current at Hot Plug     | Icc_IP |       |      | 3600    | mA   |       |
| Sustained Peak Current at Hot Plug         | Icc_SP |       |      | 2970    | mA   |       |
| Power Supply Noise Tolerance (10Hz-10MHz)  |        |       |      | 66      | mV   |       |
| Rx Differential Data Output Load           |        |       | 100  |         | Ω    |       |
| 2-Wire Serial Interface Clock Rate         |        |       |      | 400     | kHz  |       |
| Transmitter (Module Input)                 |        |       |      |         |      |       |
| Differential Pk-Pk Input Voltage Tolerance |        | 900   |      |         | mV   |       |
| Differential Termination Mismatch          |        |       |      | 10      | %    |       |
| Single-Ended Voltage Tolerance Range       |        | -0.4  |      | 3.3     | V    |       |
| DC Common-Mode Voltage                     |        | -350  |      | 2850    | mV   |       |
| Receiver (Module Output)                   |        |       |      |         |      |       |
| AC Common-Mode Output Voltage (RMS)        |        |       |      | 17.5    | mV   |       |
| Differential Output Voltage                |        |       |      | 900     | mV   |       |
| Near-End Eye Height (Differential)         |        | 70    |      |         | mV   |       |
| Far-End Eye Height (Differential)          |        | 30    |      |         | mV   |       |
| Far-End Pre-Cursor Ratio                   |        | -4.5  |      | 2.5     | %    |       |
| Differential Termination Mismatch          |        |       |      | 10      | %    |       |
| Transition Time (Minimum, 20-80%)          |        | 9.5   |      |         | ps   |       |
| DC Common-Mode Voltage                     |        | -350  |      | 2850    | mV   |       |
| Low-Speed Signal                           |        |       |      |         |      |       |
| Module Output SCL and SDA                  | VOL    | 0     |      | 0.4     | V    |       |

|                               |     |         |  |         |   |  |
|-------------------------------|-----|---------|--|---------|---|--|
| Module Input SCL and SDA      | VIL | -0.3    |  | Vcc*0.3 | V |  |
|                               | VIH | Vcc*0.7 |  | Vcc+0.5 | V |  |
| InitMode, ResetL, and ModSelL | VIL | -0.3    |  | 0.8     | V |  |
|                               | VIH | 2       |  | Vcc+0.3 | V |  |
| IntL                          | VOL | 0       |  | 0.4     | V |  |
|                               | VOH | Vcc-0.5 |  | Vcc+0.3 | V |  |

## Optical Characteristics

| Parameter                                                           |                       | Symbol      | Min.       | Typ. | Max.      | Unit  | Notes |
|---------------------------------------------------------------------|-----------------------|-------------|------------|------|-----------|-------|-------|
| Transmitter                                                         |                       |             |            |      |           |       |       |
| Wavelength                                                          |                       | $\lambda_C$ | 1304.5     | 1311 | 1317.5    | nm    |       |
| Side-Mode Suppression Ratio                                         |                       | SMSR        | 30         |      |           | dB    |       |
| Average Launch Power Per Lane                                       |                       | AOPL        | -3.1       |      | 4         | dBm   | 1     |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ) Per Lane |                       | TOMA        |            |      | 4.2       | dBm   |       |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ) Per Lane | TDECQ < 1.4dB         | TOMA        | -0.1       |      |           | dBm   |       |
|                                                                     | 1.4dB ≤ TDECQ ≤ 3.4dB |             | -1.5+TDECQ |      |           |       |       |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ) Per Lane    |                       | TDECQ       |            |      | 3.4       | dB    |       |
| Transmitter Eye Closure for PAM4 (TECQ)                             |                       | TECQ        |            |      | 3.4       | dB    |       |
| TDECQ - TECQ                                                        |                       |             |            |      | 2.5       | dB    |       |
| Over/Under-Shoot                                                    |                       |             |            |      | 22        | %     |       |
| Transmitter Power Excursion                                         |                       |             |            |      | 2         | dBm   |       |
| Average Launch Power of Off Transmitter Per Lane                    |                       | Poff        |            |      | -15       | dBm   |       |
| Extinction Ratio Per Lane                                           |                       | ER          | 3.5        |      |           | dB    |       |
| RIN <sub>17.1</sub> OMA                                             |                       | RIN         |            |      | -136      | dB/Hz |       |
| Optical Return Loss Tolerance                                       |                       | ORL         |            |      | 17.1      | dB    |       |
| Transmitter Reflectance                                             |                       | TR          |            |      | -26       | dB    |       |
| Transmitter Transition Time                                         |                       |             |            |      | 17        | ps    |       |
| Receiver                                                            |                       |             |            |      |           |       |       |
| Wavelength                                                          |                       | $\lambda_C$ | 1304.5     | 1311 | 1317.5    | nm    |       |
| Damage Threshold Per Lane                                           |                       | AOPD        | 5          |      |           | dBm   |       |
| Average Receive Power Per Lane                                      |                       | AOPR        | -7.1       |      | 4         | dBm   | 2     |
| Receive Power (OMA <sub>outer</sub> ) Per Lane                      |                       | OMAR        |            |      | 4.2       | dBm   |       |
| Receiver Reflectance                                                |                       | RR          |            |      | -26       | dB    |       |
| Receiver Sensitivity (OMA <sub>outer</sub> ) Per Lane               | TECQ < 1.4dB          | SOMA        |            |      | -4.5      | dBm   |       |
|                                                                     | 1.4dB ≤ TECQ ≤ 3.4dB  |             |            |      | -5.9+TECQ |       |       |
| Stressed Receiver Sensitivity (OMA <sub>outer</sub> ) Per Lane      |                       | SRS         |            |      | -2.5      | dBm   | 3     |
| Conditions of Stressed Receiver Sensitivity Test                    |                       |             |            |      |           |       |       |
| Stressed Eye Closure for PAM4 (SECQ)                                |                       |             |            | 3.4  |           | dB    |       |

**Notes:**

1. Average launch power, per lane (minimum), is informative and not the principal indicator of signal strength.
2. Average receive power, per lane (minimum), is informative and not the principal indicator of signal strength.
3. Measured with conformance test signal at TP3 for the BER =  $2.4 \times 10^{-4}$ .

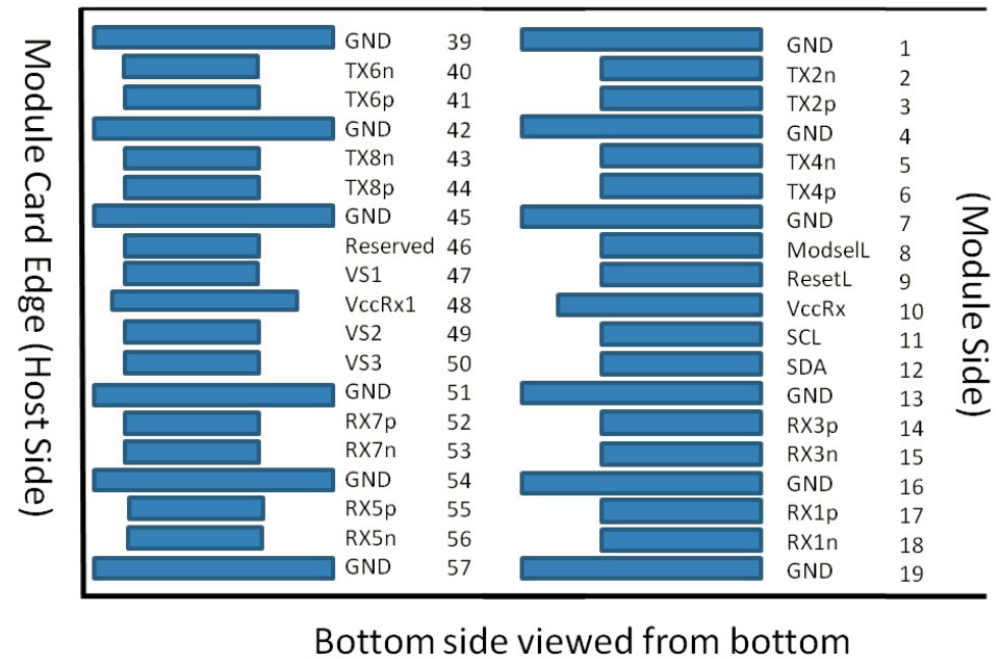
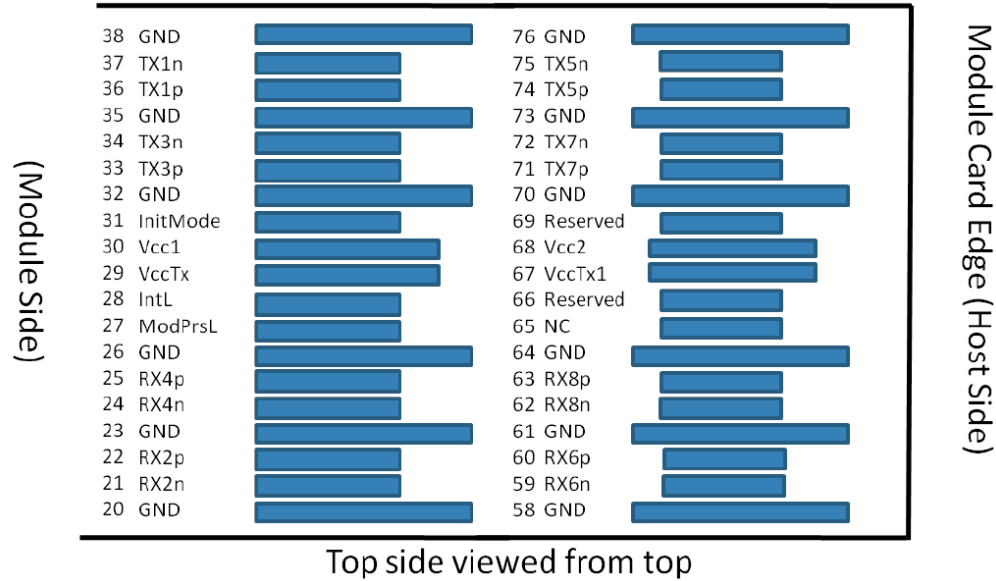
**Pin Description**

| Pin | Logic       | Symbol   | Name/Description                     | Notes |
|-----|-------------|----------|--------------------------------------|-------|
| 1   |             | GND      | Module Ground.                       |       |
| 2   | CML-I       | Tx2n     | Transmitter Inverted Data Input.     |       |
| 3   | CML-I       | Tx2p     | Transmitter Non-Inverted Data Input. |       |
| 4   |             | GND      | Module Ground.                       |       |
| 5   | CML-I       | Tx4n     | Transmitter Inverted Data Input.     |       |
| 6   | CML-I       | Tx4p     | Transmitter Non-Inverted Data Input. |       |
| 7   |             | GND      | Module Ground.                       |       |
| 8   | LVTTL-I     | ModSelL  | Module Select.                       |       |
| 9   | LVTTL-I     | ResetL   | Module Reset.                        |       |
| 10  |             | VccRx    | +3.3V Receiver Power Supply.         |       |
| 11  | LVC MOS-I/O | SCL      | 2-Wire Serial Interface Clock.       |       |
| 12  | LVC MOS-I/O | SDA      | 2-Wire Serial Interface Data.        |       |
| 13  |             | GND      | Module Ground.                       |       |
| 14  | CML-O       | Rx3p     | Receiver Non-Inverted Data Output.   |       |
| 15  | CML-O       | Rx3n     | Receiver Inverted Data Output.       |       |
| 16  |             | GND      | Module Ground.                       |       |
| 17  | CML-O       | Rx1p     | Receiver Non-Inverted Data Output.   |       |
| 18  | CML-O       | Rx1n     | Receiver Inverted Data Output.       |       |
| 19  |             | GND      | Module Ground.                       |       |
| 20  |             | GND      | Module Ground.                       |       |
| 21  | CML-O       | Rx2n     | Receiver Inverted Data Output.       |       |
| 22  | CML-O       | Rx2p     | Receiver Non-Inverted Data Output.   |       |
| 23  |             | GND      | Module Ground.                       |       |
| 24  | CML-O       | Rx4n     | Receiver Inverted Data Output.       |       |
| 25  | CML-O       | Rx4p     | Receiver Non-Inverted Data Output.   |       |
| 26  |             | GND      | Module Ground.                       |       |
| 27  | LVTTL-O     | ModPrsL  | Module Present.                      |       |
| 28  | LVTTL-O     | IntL     | Interrupt.                           |       |
| 29  |             | VccTx    | +3.3V Transmitter Power Supply.      |       |
| 30  |             | Vcc1     | +3.3V Power Supply.                  |       |
| 31  | LVTTL-I     | InitMode | Initialization Mode.                 |       |
| 32  |             | GND      | Module Ground.                       |       |

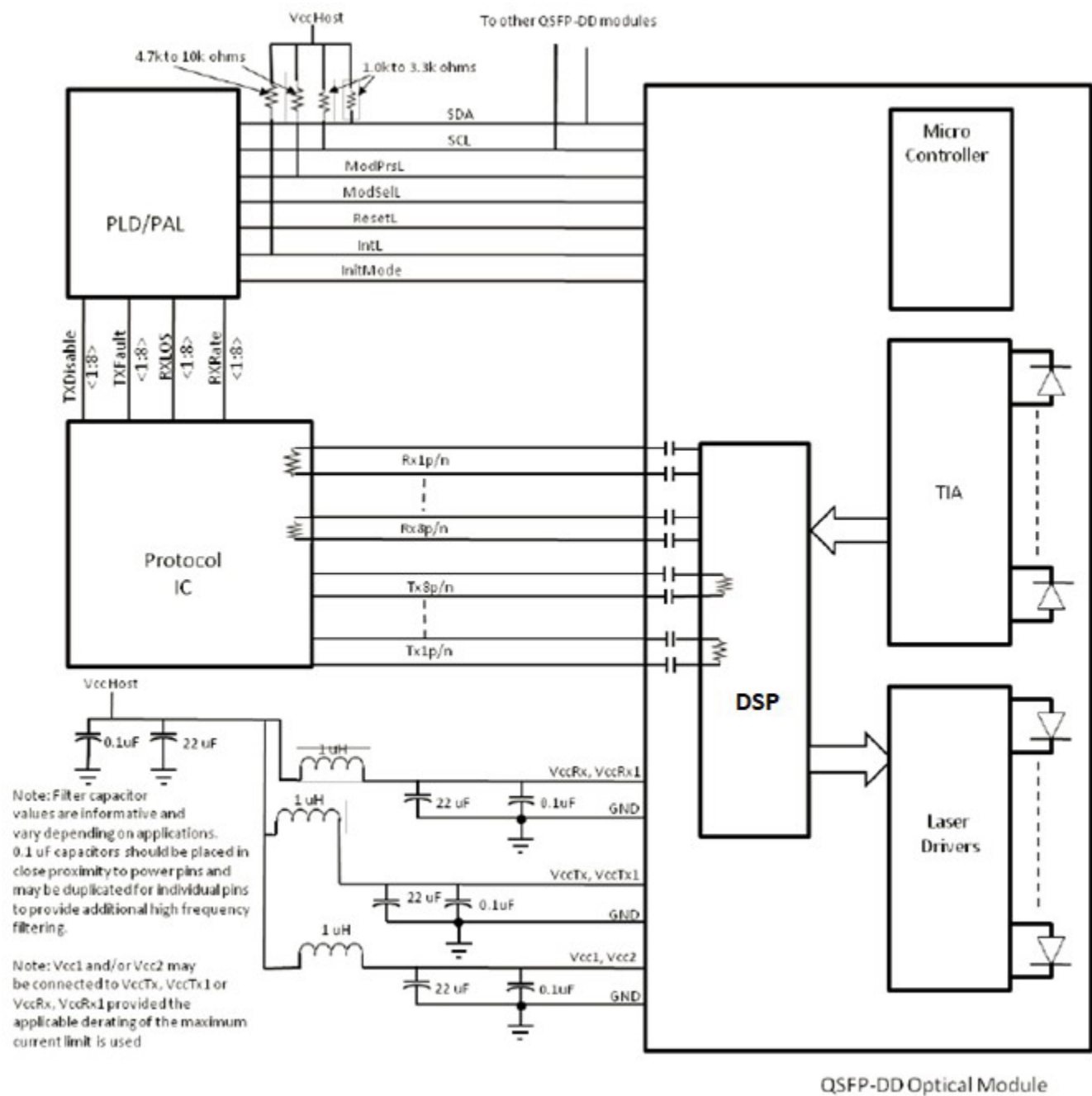
|    |       |          |                                      |  |
|----|-------|----------|--------------------------------------|--|
| 33 | CML-I | Tx3p     | Transmitter Non-Inverted Data Input. |  |
| 34 | CML-I | Tx3n     | Transmitter Inverted Data Input.     |  |
| 35 |       | GND      | Module Ground.                       |  |
| 36 | CML-I | Tx1p     | Transmitter Non-Inverted Data Input. |  |
| 37 | CML-I | Tx1n     | Transmitter Inverted Data Input.     |  |
| 38 |       | GND      | Module Ground.                       |  |
| 39 |       | GND      | Module Ground.                       |  |
| 40 | CML-I | Tx6n     | Transmitter Inverted Data Input.     |  |
| 41 | CML-I | Tx6p     | Transmitter Non-Inverted Data Input. |  |
| 42 |       | GND      | Module Ground.                       |  |
| 43 | CML-I | Tx8n     | Transmitter Inverted Data Input.     |  |
| 44 | CML-I | Tx8p     | Transmitter Non-Inverted Data Input. |  |
| 45 |       | GND      | Module Ground.                       |  |
| 46 |       | Reserved |                                      |  |
| 47 |       | VS1      | Module Vendor-Specific 1.            |  |
| 48 |       | VccRx1   | +3.3V Receiver Power Supply.         |  |
| 49 |       | VS2      | Module Vendor-Specific 2.            |  |
| 50 |       | VS3      | Module Vendor-Specific 3.            |  |
| 51 |       | GND      | Module Ground.                       |  |
| 52 | CML-O | Rx7p     | Receiver Non-Inverted Data Output.   |  |
| 53 | CML-O | Rx7n     | Receiver Inverted Data Output.       |  |
| 54 |       | GND      | Module Ground.                       |  |
| 55 | CML-O | Rx5p     | Receiver Non-Inverted Data Output.   |  |
| 56 | CML-O | Rx5n     | Receiver Inverted Data Output.       |  |
| 57 |       | GND      | Module Ground.                       |  |
| 58 |       | GND      | Module Ground.                       |  |
| 59 | CML-O | Rx6n     | Receiver Inverted Data Output.       |  |
| 60 | CML-O | Rx6p     | Receiver Non-Inverted Data Output.   |  |
| 61 |       | GND      | Module Ground.                       |  |
| 62 | CML-O | Rx8n     | Receiver Inverted Data Output.       |  |
| 63 | CML-O | Rx8p     | Receiver Non-Inverted Data Output.   |  |
| 64 |       | GND      | Module Ground.                       |  |
| 65 |       | NC       | Not Connected.                       |  |
| 66 |       | Reserved |                                      |  |
| 67 |       | VccTx1   | +3.3V Transmitter Power Supply.      |  |
| 68 |       | Vcc2     | +3.3V Power Supply.                  |  |
| 69 |       | Reserved |                                      |  |
| 70 |       | GND      | Module Ground.                       |  |
| 71 | CML-I | Tx7p     | Transmitter Non-Inverted Data Input. |  |
| 72 | CML-I | Tx7n     | Transmitter Inverted Data Input.     |  |
| 73 |       | GND      | Module Ground.                       |  |

|    |       |      |                                      |  |
|----|-------|------|--------------------------------------|--|
| 74 | CML-I | Tx5p | Transmitter Non-Inverted Data Input. |  |
| 75 | CML-I | Tx5n | Transmitter Inverted Data Input.     |  |
| 76 |       | GND  | Module Ground.                       |  |

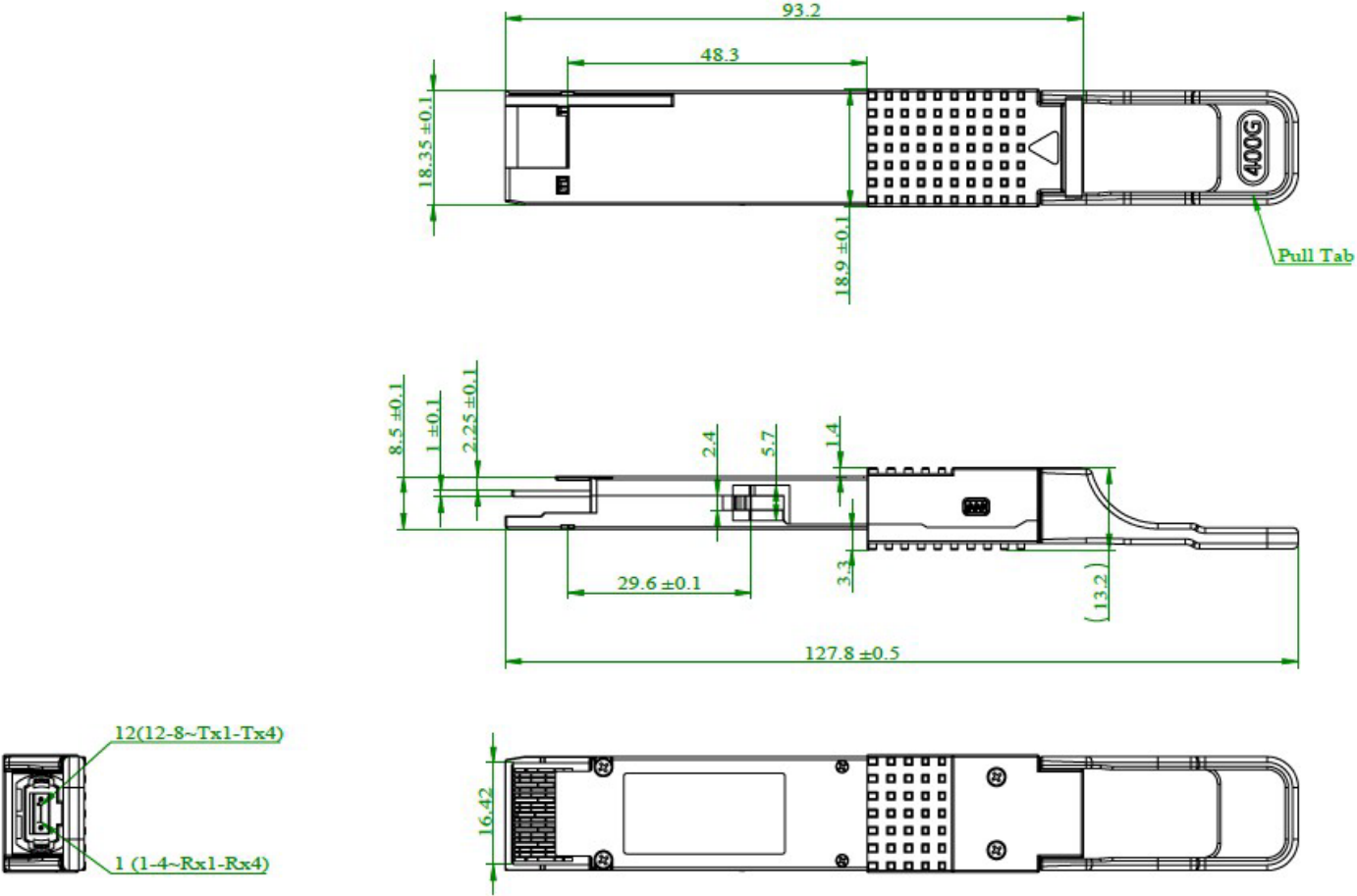
# Electrical Pin-Out Details



Recommended QSFP-DD Host Board Schematic



Mechanical Specifications



## About ProLabs

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## Complete Portfolio of Network Solutions

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.



## Contact Information

ProLabs US

Email: [sales@prolabs.com](mailto:sales@prolabs.com)

Telephone: 952-852-0252

ProLabs UK

Email: [salesupport@prolabs.com](mailto:salesupport@prolabs.com)

Telephone: +44 1285 719 600