

## QSFP-DD-800G-2SR4

### 800G QSFP-DD 2xSR4 Transceiver

Hot Pluggable, +3.3V, MPO-12, 850nm, MMF, 50m, Commercial Temperature

#### FEATURES

- Hot-pluggable QSFP-DD form factor
- VCSEL transmitter and PIN PD receiver
- Support 850Gbps aggregate bit rate
- Compliant with IEEE 802.3-2022: 8x100GBASE-SR1 optical interface
- Compliant with IEEE 802.3ck-2022: 8x100GAUI-1 C2M electrical interface
- Compliant with QSFP-DD HW Specification Rev 6.3 type 2A housing with MPO-12
- Compliant with CMIS Rev 5.0
- Two wire serial Interface with digital diagnostic monitoring
- Complies with EU Directive 2011/65/EU (RoHS compliant)
- Class 1 Laser
- Commercial Operating Temperature Range: 0 to 70°C

#### ABSOLUTE MAXIMUM RATINGS

| Parameter                          | Symbol                                | Min. | Max.                 | Unit |
|------------------------------------|---------------------------------------|------|----------------------|------|
| Storage Temperature                | T <sub>s</sub>                        | -40  | 85                   | °C   |
| Supply Voltage                     | V <sub>CC</sub>                       | -    | 3.6                  | V    |
| Relative Humidity (non-condensing) | RH                                    | 5    | 85                   | %    |
| Data Input Voltage Differential    | I <sub>V</sub> DIP-V <sub>DIN</sub> I | -    | 1                    | V    |
| Control Input Voltage              | V <sub>I</sub>                        | -0.3 | V <sub>CC</sub> +0.3 | V    |
| Control Output Current             | I <sub>O</sub>                        | -20  | 20                   | mA   |

## RECOMMENDED OPERATING ENVIRONMENT

| Parameter                                 | Symbol             | Min.                 | Typical | Max.                 | Unit | Note |
|-------------------------------------------|--------------------|----------------------|---------|----------------------|------|------|
| Operating Case Temperature                | T <sub>OPR</sub>   | 0                    | -       | 70                   | °C   |      |
| Power Supply Voltage                      | V <sub>CC</sub>    | 3.135                | 3.3     | 3.465                | V    |      |
| Instantaneous peak current at hot plug    | I <sub>CC_IP</sub> | -                    | -       | TBD                  | mA   |      |
| Sustained peak current at hot plug        | I <sub>CC_SP</sub> | -                    | -       | TBD                  | mA   |      |
| Maximum Power Dissipation                 | P <sub>D</sub>     | -                    | -       | TBD                  | W    |      |
| Maximum Power Dissipation, Low Power Mode | P <sub>DLP</sub>   | -                    | -       | 1.5                  | W    |      |
| Signalling Speed per Lane                 | DRL                | -                    | 53.125  | -                    | GBd  |      |
| Control Input Voltage High                | V <sub>IH</sub>    | V <sub>CC</sub> *0.7 | -       | V <sub>CC</sub> +0.3 | V    |      |
| Control Input Voltage Low                 | V <sub>IL</sub>    | -0.3                 | -       | V <sub>CC</sub> *0.3 | V    |      |
| Two Wire Serial Interface Clock Rate      | -                  | -                    | -       | 400                  | kHz  |      |
| Power Supply Noise 1 kHz - 1 MHz (p-p)    | -                  | -                    | -       | 66                   | mVpp |      |
| Operating Distance                        | -                  | 2                    | -       | 50                   | m    | 1    |

Note:

1. 0.5m to 30m for OM3, 0.5m to 50m for OM4 and OM5, with FEC.

## OPTICAL PARAMETERS

| Parameter                                                                                                                                         | Symbol               | Min                                  | Typical | Max               | Unit  | Notes |
|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|---------|-------------------|-------|-------|
| TRANSMITTER                                                                                                                                       |                      |                                      |         |                   |       |       |
| Signalling rate, each lane (range)                                                                                                                |                      | 53.125 ± 100 ppm                     |         |                   | GBd   |       |
| Wavelength                                                                                                                                        | $\lambda_c$          | 840                                  | 850     | 860               | nm    |       |
| RMS spectral width                                                                                                                                | RMS                  | -                                    | -       | 0.6               | dB    | 1     |
| Average Launch Power, each lane                                                                                                                   | AOP <sub>L</sub>     | -4.6                                 | -       | 4                 | dBm   |       |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane<br>for max (TECQ, TDECQ) <= 1.8 dB<br>for 1.8 < max (TECQ, TDECQ) <= 4.4 dB | OMA <sub>outer</sub> | -2.6<br>-4.4+max<br>(TECQ,<br>TDECQ) | -       | 3.5               | dBm   |       |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each lane                                                                                | TDECQ                | -                                    | -       | TBD               | dB    |       |
| Transmitter eye closure for PAM4 (TECQ), each lane                                                                                                | TECQ                 | -                                    | -       | TBD               | dB    |       |
| Over/under-shoot                                                                                                                                  |                      | -                                    |         | 29                | %     |       |
| Transmitter power excursion, each lane                                                                                                            |                      | -                                    |         | 2.3               | dBm   |       |
| Average Launch Power of OFF Transmitter, each lane                                                                                                | T <sub>OFF</sub>     | -                                    | -       | -30               | dBm   |       |
| Extinction Ratio, each lane                                                                                                                       | ER                   | 2.5                                  | -       | -                 | dB    |       |
| Transmitter transition time, each lane                                                                                                            | Tr                   | -                                    | -       | 17                | ps    |       |
| RIN <sub>14</sub> OMA                                                                                                                             | RIN                  |                                      |         | -132              | dB/Hz |       |
| Optical return loss tolerance                                                                                                                     | ORL                  |                                      |         | 14                | dB    |       |
| Encircled flux                                                                                                                                    |                      | >=86% at 19μm <=30% at 4.5μm         |         |                   |       |       |
| RECEIVER                                                                                                                                          |                      |                                      |         |                   |       |       |
| Signalling rate, each lane (range)                                                                                                                |                      | 53.125 ± 100 ppm                     |         |                   | GBd   |       |
| Wavelength                                                                                                                                        | $\lambda_c$          | 840                                  | -       | 860               | nm    |       |
| Damage Threshold, each Lane                                                                                                                       | AOP <sub>D</sub>     | 5                                    | -       | -                 | dBm   |       |
| Average Receive Power, each Lane                                                                                                                  | AOP <sub>R</sub>     | -6.4                                 | -       | 4                 | dBm   |       |
| Receive Power (OMA <sub>outer</sub> ), each Lane                                                                                                  | OMA <sub>R</sub>     | -                                    | -       | 3.5               | dBm   |       |
| Receiver Reflectance                                                                                                                              | RR                   | -                                    | -       | -15               | dB    |       |
| Receiver sensitivity (OMA <sub>outer</sub> )<br>for TECQ < 1.4 dB<br>for 1.4 dB <=TECQ<=3.4 dB                                                    | S <sub>OMA</sub>     | -                                    | -       | -4.6<br>-6.4+TECQ | dBm   |       |
| Stressed Receiver Sensitivity (OMA <sub>outer</sub> ), each Lane                                                                                  | SRS                  | -                                    | -       | -2                | dBm   | 2     |
| CONDITIONS OF STRESSED RECEIVER SENSITIVITY TEST                                                                                                  |                      |                                      |         |                   |       |       |
| Stressed eye closure for PAM4 (SECQ), lane under test                                                                                             |                      | -                                    | 4.4     | -                 | dB    |       |
| OMA <sub>outer</sub> of each aggressor lane                                                                                                       |                      | -                                    | 3.5     | -                 | dBm   |       |

Note:

1. RMS spectral width is the standard deviation of the spectrum.
2. Measured with conformance test signal at TP3 for the BER = 2.4x10<sup>-4</sup>

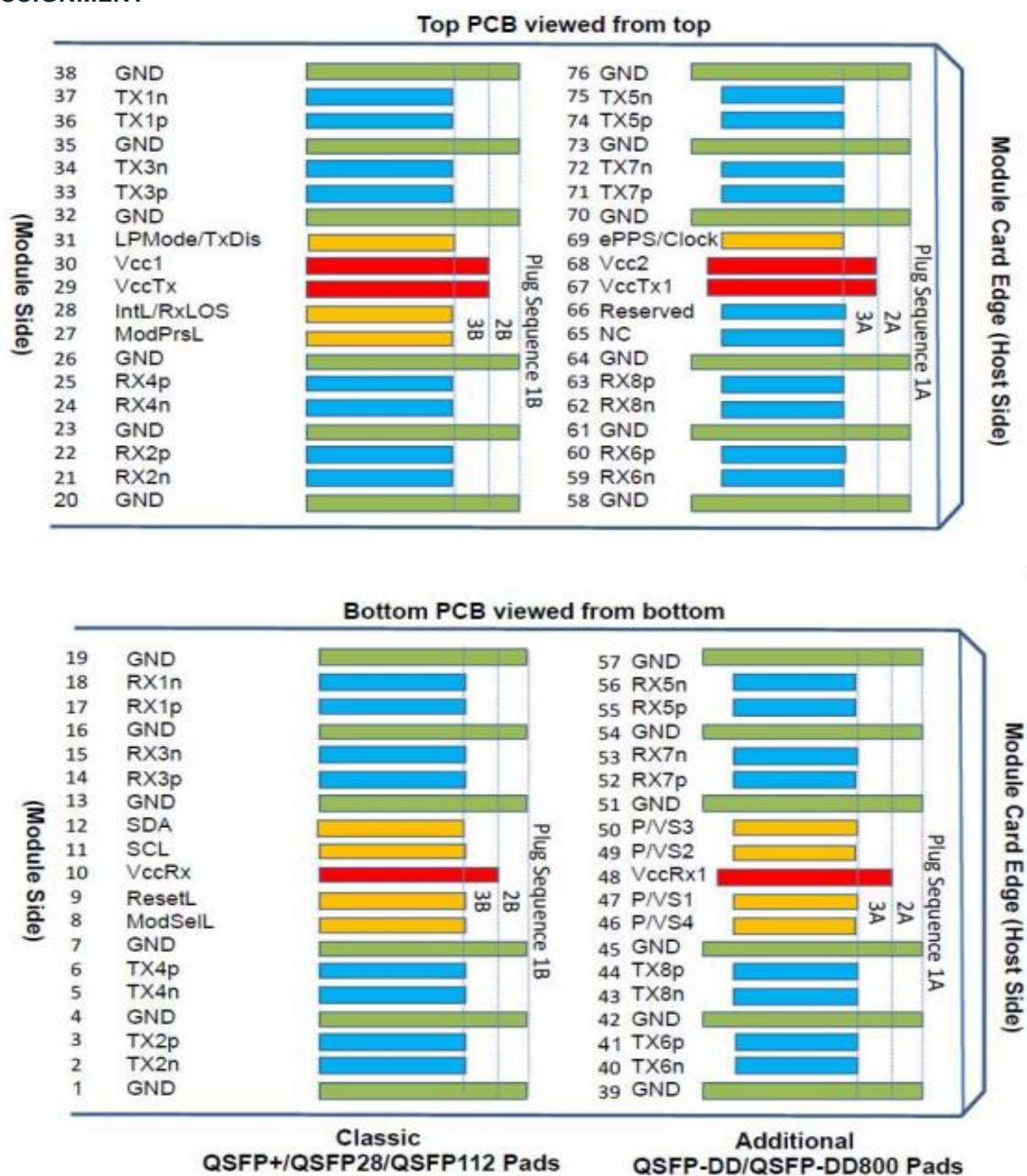
# ELECTRICAL CHARACTERISTICS (High Speed Signal - Compliant with IEEE802.3ck C2M)

| Parameter                                                                                 | Symbol | Min            | Typical | Max        | Unit | Note |
|-------------------------------------------------------------------------------------------|--------|----------------|---------|------------|------|------|
| <b>TRANSMITTER (Module Input, TP1)</b>                                                    |        |                |         |            |      |      |
| Differential pk-pk input Voltage tolerance (TP1a)                                         |        | 750            | -       | -          | mV   |      |
| Peak-to-peak AC common-mode voltage tolerance<br>Low-frequency, VCMLF<br>Full-band, VCMFB |        | 32<br>80       | -       | -          | mV   |      |
| Differential-mode to common-mode return loss                                              | RLcd   | 802.3ck 120G-2 |         |            | dB   |      |
| Effective return loss                                                                     | ERL    | 8.5            | -       | -          | dB   |      |
| Differential termination mismatch                                                         |        | -              | -       | 10         | %    |      |
| Single-ended voltage tolerance range                                                      |        | -0.4           | -       | 3.3        | V    |      |
| DC common-mode voltage tolerance                                                          |        | -0.35          | -       | 2.85       | V    |      |
| <b>RECEIVER (Module Input, TP4)</b>                                                       |        |                |         |            |      |      |
| Peak-to-peak AC common-mode voltage<br>Low-frequency, VCMLF<br>Full-band, VCMFB           |        | -              | -       | 32<br>80   | mV   |      |
| Differential peak-to-peak output voltage:<br>Short mode<br>Long mode                      |        | -              | -       | 600<br>845 | mV   |      |
| Eye height                                                                                | EH     | 15             | -       | -          | mV   |      |
| Vertical eye closure                                                                      | VEC    | -              | -       | 12         | dB   |      |
| Common-mode to differential-mode return loss                                              | RLDc   | 802.3ck 120G-1 |         |            | dB   |      |
| Effective return loss                                                                     | ERL    | 8.5            | -       | -          | dB   |      |
| Differential termination mismatch                                                         |        | -              | -       | 10         | %    |      |
| Transition time                                                                           |        | 8.5            | -       | -          | ps   |      |
| DC common-mode voltage tolerance                                                          |        | -0.35          | -       | 2.85       | V    |      |

**ELECTRICAL CHARACTERISTICS (Low Speed Control and Sense Signals - Compliant with QSFP-DD HW Rev6.01 Table 14)**

| Parameter                    | Symbol          | Min.                 | Max.                 | Unit |
|------------------------------|-----------------|----------------------|----------------------|------|
| Module output SCL and SDA    | V <sub>OL</sub> | 0                    | 0.4                  | V    |
| Module Input SCL and SDA     | V <sub>IL</sub> | -0.3                 | V <sub>CC</sub> *0.3 | V    |
|                              | V <sub>IH</sub> | V <sub>CC</sub> *0.7 | V <sub>CC</sub> +0.5 | V    |
| InitMode, ResetL and ModSelL | V <sub>IL</sub> | -0.3                 | 0.8                  | V    |
|                              | V <sub>IH</sub> | 2                    | V <sub>CC</sub> +0.3 | V    |
| IntL                         | V <sub>OL</sub> | 0                    | 0.4                  | V    |
|                              | V <sub>OH</sub> | V <sub>CC</sub> -0.5 | V <sub>CC</sub> +0.3 | V    |

**PIN ASSIGNMENT**



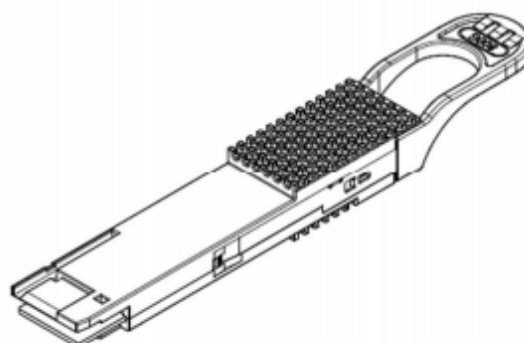
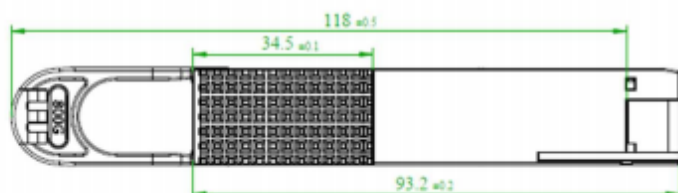
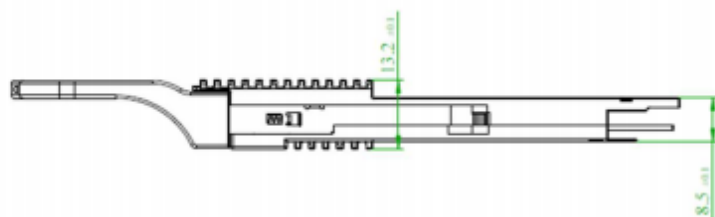
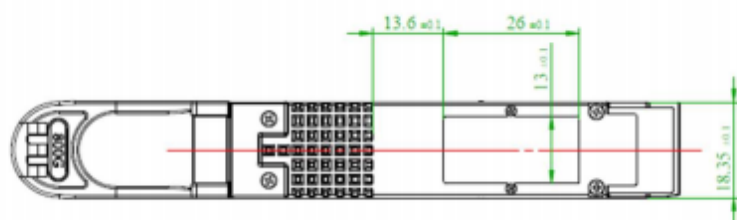
Pin definitions of the module high speed inputs/outputs

| Pin | Logic        | Symbol      | Description                         | Pin | Logic           | Symbol   | Description                           |
|-----|--------------|-------------|-------------------------------------|-----|-----------------|----------|---------------------------------------|
| 1   |              | GND         | Ground                              | 39  |                 | GND      | Ground                                |
| 2   | CML-I        | Tx2n        | Transmitter Inverted Data Input     | 40  | CML-I           | Tx6n     | Transmitter Inverted Data Input       |
| 3   | CML-I        | Tx2p        | Transmitter Non-inverted Data Input | 41  | CML-I           | Tx6p     | Transmitter Non-inverted Data Input   |
| 4   |              | GND         | Ground                              | 42  |                 | GND      | Ground                                |
| 5   | CML-I        | Tx4n        | Transmitter Inverted Data Input     | 43  | CML-I           | Tx8n     | Transmitter Inverted Data Input       |
| 6   | CML-I        | Tx4p        | Transmitter Non-inverted Data Input | 44  | CML-I           | Tx8p     | Transmitter Non-inverted Data Input   |
| 7   |              | GND         | Ground                              | 45  |                 | GND      | Ground                                |
| 8   | LVTTL-I      | ModSelL     | Module Select                       | 46  | LVC MOS / CML-I | P/VS4    | Programmable/Module Vendor Specific 4 |
| 9   | LVTTL-I      | ResetL      | Module Reset                        | 47  | LVC MOS / CML-I | P/VS1    | Programmable/Module Vendor Specific 1 |
| 10  |              | VccRx       | +3.3V Power Supply Receiver         | 48  |                 | VccRx1   | 3.3V Power Supply                     |
| 11  | LVC MOS -I/O | SCL         | TWI serial interface clock          | 49  | LVC MOS / CML-O | P/VS2    | Programmable/Module Vendor Specific 2 |
| 12  | LVC MOS -I/O | SDA         | TWI serial interface data           | 50  | LVC MOS / CML-O | P/VS3    | Programmable/Module Vendor Specific 3 |
| 13  |              | GND         | Ground                              | 51  |                 | GND      | Ground                                |
| 14  | CML-O        | Rx3p        | Receiver Non-inverted Data Output   | 52  | CML-O           | Rx7p     | Receiver Non-inverted Data Output     |
| 15  | CML-O        | Rx3n        | Receiver Inverted Data Output       | 53  | CML-O           | Rx7n     | Receiver Inverted Data Output         |
| 16  |              | GND         | Ground                              | 54  |                 | GND      | Ground                                |
| 17  | CML-O        | Rx1p        | Receiver Non-inverted Data Output   | 55  | CML-O           | Rx5p     | Receiver Non-inverted Data Output     |
| 18  | CML-O        | Rx1n        | Receiver Inverted Data Output       | 56  | CML-O           | Rx5n     | Receiver Inverted Data Output         |
| 19  |              | GND         | Ground                              | 57  |                 | GND      | Ground                                |
| 20  |              | GND         | Ground                              | 58  |                 | GND      | Ground                                |
| 21  | CML-O        | Rx2n        | Receiver Inverted Data Output       | 59  | CML-O           | Rx6n     | Receiver Inverted Data Output         |
| 22  | CML-O        | Rx2p        | Receiver Non-inverted Data Output   | 60  | CML-O           | Rx6p     | Receiver Non-inverted Data Output     |
| 23  |              | GND         | Ground                              | 61  |                 | GND      | Ground                                |
| 24  | CML-O        | Rx4n        | Receiver Inverted Data Output       | 62  | CML-O           | Rx8n     | Receiver Inverted Data Output         |
| 25  | CML-O        | Rx4p        | Receiver Non-inverted Data Output   | 63  | CML-O           | Rx8p     | Receiver Non-inverted Data Output     |
| 26  |              | GND         | Ground                              | 64  |                 | GND      | Ground                                |
| 27  | LVTTL-O      | ModPrsL     | Module Present                      | 65  |                 | NC       | Not connected                         |
| 28  | LVTTL-O      | IntL/ RxLOS | Interrupt/optional RxLOS            | 66  |                 | Reserved |                                       |

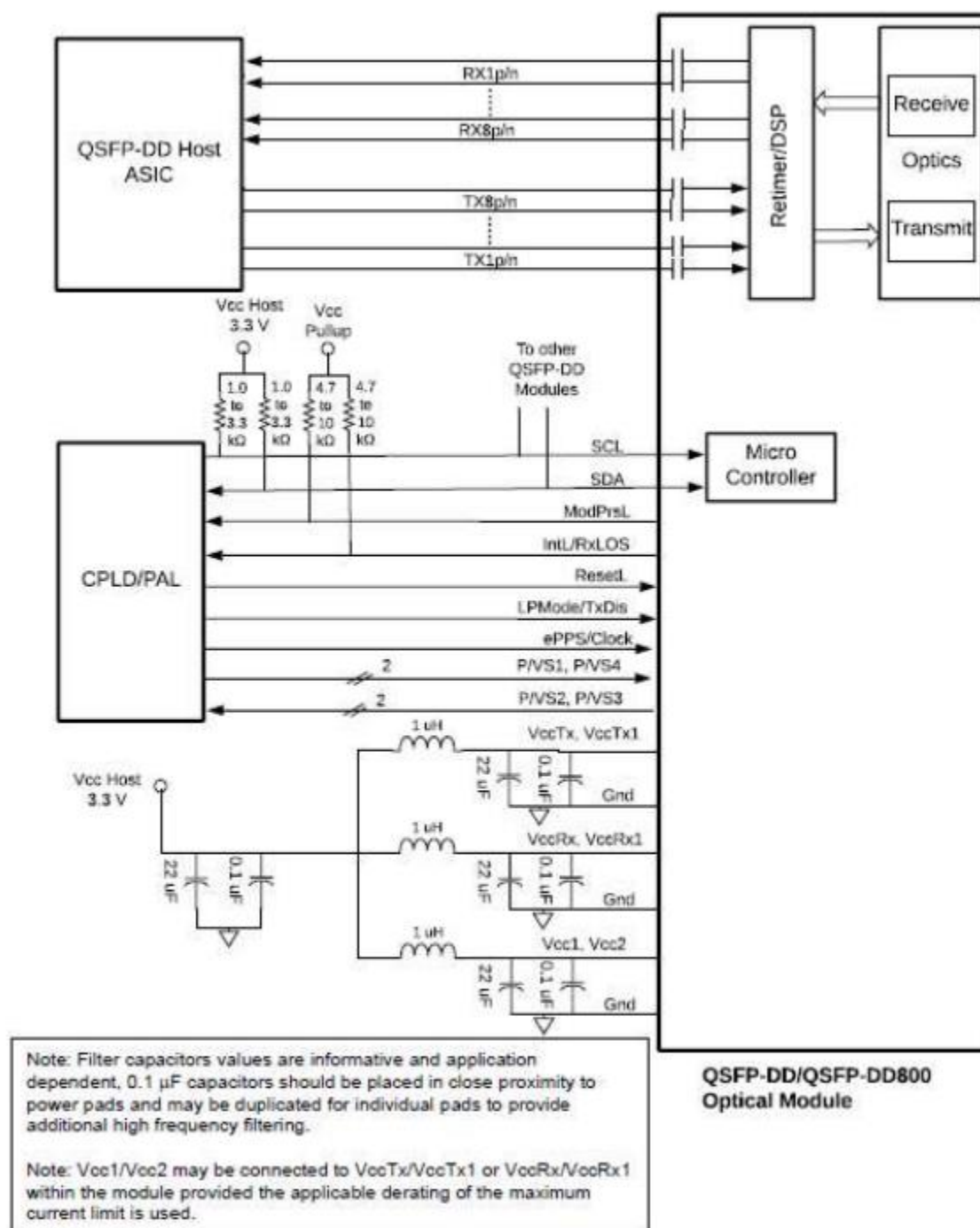
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|    |         |               |                                     |    |           |             |                                         |
|----|---------|---------------|-------------------------------------|----|-----------|-------------|-----------------------------------------|
| 29 |         | VccTx         | +3.3V Power Supply Transmitter      | 67 |           | VccTx1      | 3.3V Power Supply                       |
| 30 |         | Vcc1          | +3.3V Power Supply                  | 68 |           | Vcc2        | 3.3V Power Supply                       |
| 31 | LVTTL-I | LPMode /TxDis | Low Power mode/optional TX Disable  | 69 | LVCMO S-I | ePPS/ Clock | 1PPS PTP clock or reference clock input |
| 32 |         | GND           | Ground                              | 70 |           | GND         | Ground                                  |
| 33 | CML-I   | Tx3p          | Transmitter Non-inverted Data Input | 71 | CML-I     | Tx7p        | Transmitter Non-inverted Data Input     |
| 34 | CML-I   | Tx3n          | Transmitter Inverted Data Input     | 72 | CML-I     | Tx7n        | Transmitter Inverted Data Input         |
| 35 |         | GND           | Ground                              | 73 |           | GND         | Ground                                  |
| 36 | CML-I   | Tx1p          | Transmitter Non-inverted Data Input | 74 | CML-I     | Tx5p        | Transmitter Non-inverted Data Input     |
| 37 | CML-I   | Tx1n          | Transmitter Inverted Data Input     | 75 | CML-I     | Tx5n        | Transmitter Inverted Data Input         |
| 38 |         | GND           | Ground                              | 76 |           | GND         | Ground                                  |

## MECHANICAL DIMENSIONS (UNIT: mm)



## RECOMMENDED HOST BOARD



Recommended QSFP-DD/QSFP-DD800 Host Board Schematic

## DIGITAL DIAGNOSTICS

| Parameter                    | Range                | Accuracy | Unit | Calibration |
|------------------------------|----------------------|----------|------|-------------|
| Temperature                  | 0 to 70              | ±3       | °C   | Internal    |
| Voltage                      | 0 to V <sub>CC</sub> | 0.1      | V    | Internal    |
| Tx Bias Current (Each Lane)  | 0 to 15              | 10%      | mA   | Internal    |
| Tx Output Power (Each Lane)  | -4.6 to +4           | ±3       | dB   | Internal    |
| Rx Receive Power (Each Lane) | -6.4 to +4           | ±3       | dB   | Internal    |