



## FTCD9613E1PCM-SKY

Finisar® FTCD9613E1PCM Compatible 400GBase-SR4 PAM4 112G QSFP-DD Transceiver (MMF, 850nm, 100m, MPO-12, DOM, CMIS 4.0)

### Product Description

This Finisar® FTCD9613E1PCM compatible QSFP-DD transceiver provides 400GBase-SR4 throughput up to 50m over multi-mode fiber (MMF) PAM4 112G using a wavelength of 850nm via an MPO-12 connector. It can operate at temperatures between 0 and 70C. It has been programmed, uniquely serialized, and tested for data-traffic and application to ensure that it will initialize and perform identically. All of our transceivers comply with Multi-Source Agreement (MSA) standards to provide seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows access to real-time operating parameters. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

Skylane's transceivers are RoHS compliant and lead-free.

### Features:

- 53.125 GBd PAM4 4 channel 400G-SR4 Optical interface
- Compliant with IEEE 802.3ck and IEEE 802.3db
- 26.5625 GBd PAM4 8 channel 400G AU1-8 C2M Electrical interface
- Multi-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- QSFP-DD MSA package with MPO-12 APC
- Metal with Lower EMI
- Hot Pluggable
- CMIS Rev4.0
- Excellent ESD Protection
- RoHS Compliant and Lead Free



### Applications:

- 400GBase Ethernet
- Datacenter switch

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*For your product safety, please read the following information carefully before any manipulation of the transceiver:*



#### **ESD**

This transceiver is specified as ESD threshold 1kV for SFI pins and 2kV for all others electrical input pins, tested per MIL-STD-883G, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module.



#### **LASER SAFETY**

This is a Class1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

*The optical ports of the module need to be terminated with an optical connector or with a dust plug in order to avoid contamination.*

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## Absolute Maximum Ratings

| Parameter                   | Symbol | Min. | Typ. | Max. | Unit | Notes |
|-----------------------------|--------|------|------|------|------|-------|
| Maximum Supply Voltage      | Vcc    | 3.1  | 3.3  | 3.5  | V    |       |
| Storage Temperature         | Tstg   | -40  |      | 85   | °C   |       |
| Operating Case Temperature  | Tc     | 0    |      | 70   | °C   |       |
| Operating Relative Humidity | RH     | 5    |      | 85   | %    | 1     |
| Optical Input Power         | PIN    |      |      | 5    | dBm  |       |

### Notes:

1. Non-condensing.

## Electrical Characteristics

| Parameter                                    | Symbol | Min.   | Typ. | Max.  | Unit | Notes |
|----------------------------------------------|--------|--------|------|-------|------|-------|
| Module Supply Voltage                        | VCC    | 3.135  | 3.3  | 3.465 | V    |       |
| Supply Current                               | ICC    |        |      | 2640  | mA   |       |
| Module Power Dissipation                     | P      |        |      | 8     | W    |       |
| Transmitter                                  |        |        |      |       |      |       |
| Differential Input Impedance                 | ZIN    |        | 100  |       | Ω    |       |
| Receiver                                     |        |        |      |       |      |       |
| Differential output Impedance                | Zos    | 90     | 100  | 110   | Ω    |       |
| Common-Mode to Differential-Mode Return Loss | RLdc   | Note 1 |      |       | dB   |       |
| Transition Time, 20 to 80%                   | Tr, Tf | 8.5    |      |       | ps   |       |

### Notes:

1. 
$$RLdc(f) \geq \begin{cases} 25 - 22(f/53.125) & 0.05 \leq f \leq 26.56 \\ 19 - 10(f/53.125) & 26.56 < f \leq 50 \end{cases}$$

## Optical Characteristics

| Parameter                                                                                                                          | Symbol      | Min.                                                          | Typ.    | Max.              | Unit       | Notes |
|------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------|---------|-------------------|------------|-------|
| <b>Transmitter</b>                                                                                                                 |             |                                                               |         |                   |            |       |
| Optical Data Rate per channel (PAM4)                                                                                               | DR          |                                                               | 53.125  |                   | GBd        |       |
| Frequency Tracking                                                                                                                 | Ft          | -100                                                          |         | 100               | ppm        |       |
| Center Wavelength                                                                                                                  | $\lambda_C$ | 844                                                           | 850     | 863               | nm         |       |
| RMS Spectral Width                                                                                                                 |             |                                                               |         | 0.6               | nm         | 1     |
| Laser Off Power                                                                                                                    | Poff        |                                                               |         | -30               | dBm        |       |
| Average Optical Power                                                                                                              | Pavg        | -4.6                                                          |         | 4                 | dBm        |       |
| Extinction Ratio                                                                                                                   | ER          | 2.5                                                           |         |                   | dB         |       |
| Transmitter and Dispersion Eye Closure                                                                                             | TDECQ       |                                                               |         | 4.4               | dB         |       |
| Outer Optical Modulation Amplitude                                                                                                 | OMAouter    | -2.6                                                          |         | 3.5               | dBm        | 2     |
| Encircled Flux, Each Lane                                                                                                          |             | $\geq 86\% @ 19 \mu\text{m}$<br>$\leq 30\% @ 4.5 \mu\text{m}$ |         |                   | dB         | 3     |
| Optical Return Loss Tolerance                                                                                                      | ORLT        |                                                               |         | 14                | dB         |       |
| <b>Receiver</b>                                                                                                                    |             |                                                               |         |                   |            |       |
| Electrical Data Rate Per Channel (PAM4)                                                                                            | DR          |                                                               | 26.5625 |                   | GBd        |       |
| Frequency Tracking                                                                                                                 | Ft          | -100                                                          |         | 100               | ppm        |       |
| Center Wavelength                                                                                                                  | $\lambda_r$ | 842                                                           | 850     | 948               | nm         |       |
| Damage Threshold                                                                                                                   |             | 5                                                             |         |                   | dBm        |       |
| Average Receive Power                                                                                                              |             | -6.4                                                          |         | 4                 | dBm        | 4     |
| Receiver Reflectance                                                                                                               |             |                                                               |         | -15               | dB         |       |
| Differential Data Output Voltage Peak to Peak Swing                                                                                | Vopp        | 600                                                           |         | 845               | mV         |       |
| Receiver Sensitivity (OMAouter) (max)<br>For $\text{TECQ} \leq 1.8\text{dB}$<br>For $1.8\text{dB} < \text{TECQ} \leq 4.4\text{dB}$ | RS          |                                                               |         | -4.6<br>-6.4+TECQ | dBm<br>dBm |       |
| Eye Height                                                                                                                         | EH          | 15                                                            |         |                   | mV         |       |
| Vertical Eye Closure                                                                                                               | VEC         |                                                               |         | 12                | dB         |       |

### Notes:

1. RMS spectral width is the standard deviation of the spectrum.
2. Even if the TDECQ<1.8dB, the OMA (min) must exceed this value.
3. If measured into type A1a.2, type A1a.3 or type A1a.4, 50  $\mu\text{m}$  fiber, in accordance with IEC 61280-1-4.
4. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.  
Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.6dB.

## Pin Descriptions

| Pin | Logic       | Symbol   | Name/Descriptions                                                                    | Notes |
|-----|-------------|----------|--------------------------------------------------------------------------------------|-------|
| 1   |             | GND      | Ground                                                                               |       |
| 2   | CML-I       | Tx2n     | Transmitter Inverted Data Input                                                      |       |
| 3   | CML-I       | Tx2p     | Transmitter Non-Inverted Data Input                                                  |       |
| 4   |             | GND      | Ground                                                                               | 1     |
| 5   | CML-I       | Tx4n     | Transmitter Inverted Data Input                                                      |       |
| 6   | CML-I       | Tx4p     | Transmitter Non-Inverted Data Input                                                  |       |
| 7   |             | GND      | Ground                                                                               | 1     |
| 8   | LVTTTL-I    | ModSelL  | Module Select                                                                        |       |
| 9   | LVTTTL-I    | ResetL   | Module Reset                                                                         |       |
| 10  |             | VccRx    | 3.3V Power Supply Receiver                                                           | 2     |
| 11  | LVC MOS-I/O | SCL      | 2 Wire Serial Interface Clock                                                        |       |
| 12  | LVC MOS-I/O | SDA      | 2 Wire Serial Interface Data                                                         |       |
| 13  |             | GND      | Ground                                                                               | 1     |
| 14  | CML-O       | Rx3n     | Transmitter Inverted Data Output                                                     |       |
| 15  | CML-O       | Rx3p     | Transmitter Non-Inverted Data Output                                                 |       |
| 16  |             | GND      | Ground                                                                               | 1     |
| 17  | CML-O       | Rx1n     | Transmitter Inverted Data Output                                                     |       |
| 18  | CML-O       | Rx1p     | Transmitter Non-Inverted Data Output                                                 |       |
| 19  |             | GND      | Ground                                                                               | 1     |
| 20  |             | GND      | Ground                                                                               | 1     |
| 21  | CML-O       | Rx2n     | Transmitter Inverted Data Output                                                     |       |
| 22  | CML-O       | Rx2p     | Transmitter Non-Inverted Data Output                                                 |       |
| 23  |             | GND      | Ground                                                                               | 1     |
| 24  | CML-O       | Rx4n     | Transmitter Inverted Data Output                                                     |       |
| 25  | CML-O       | Rx4p     | Transmitter Non-Inverted Data Output                                                 |       |
| 26  |             | GND      | Ground                                                                               | 1     |
| 27  | LVTTTL-O    | ModPrsL  | Module Present                                                                       |       |
| 28  | LVTTTL-O    | IntL     | Interrupt                                                                            |       |
| 29  |             | VccRx    | 3.3V Power Supply Transmitter                                                        | 2     |
| 30  |             | Vcc I    | 3.3V Power Supply                                                                    | 2     |
| 31  | LVTTTL-I    | InitMode | Initialization mode. In legacy QSFP applications, the InitMode pad is called LPMODE. |       |
| 32  |             | GND      | Ground                                                                               | 1     |
| 33  | CML-I       | Tx1n     | Transmitter Inverted Data Input                                                      |       |
| 34  | CML-I       | Tx1p     | Transmitter Non-Inverted Data Input                                                  |       |
| 35  |             | GND      | Ground                                                                               | 1     |
| 36  | CML-I       | Tx1n     | Transmitter Inverted Data Input                                                      |       |

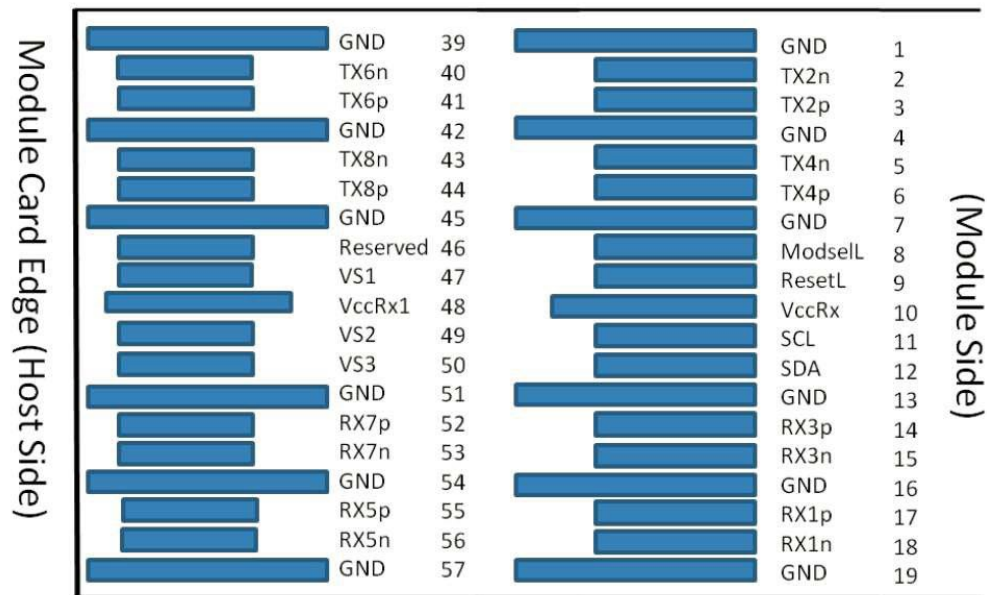
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|----|-------|----------|--------------------------------------|---|
| 37 | CML-I | Tx1p     | Transmitter Non-Inverted Data Input  |   |
| 38 |       | GND      | Ground                               | 1 |
| 39 |       | GND      | Ground                               | 1 |
| 40 | CML-I | Tx6n     | Transmitter Inverted Data Input      |   |
| 41 | CML-I | Tx6p     | Transmitter Non-Inverted Data Input  |   |
| 42 |       | GND      | Ground                               | 1 |
| 43 | CML-I | Tx8n     | Transmitter Inverted Data Input      |   |
| 44 | CML-I | Tx8p     | Transmitter Non-Inverted Data Input  |   |
| 45 |       | GND      | Ground                               | 1 |
| 46 |       | Reserved | NC                                   | 3 |
| 47 |       | VS1      | NC                                   | 3 |
| 48 |       | VccRx1   | 3.3V Power Supply                    | 2 |
| 49 |       | VS2      | NC                                   | 3 |
| 50 |       | VS3      | NC                                   | 3 |
| 51 |       | GND      | Ground                               | 1 |
| 52 | CML-O | Rx7n     | Transmitter Inverted Data Output     |   |
| 53 | CML-O | Rx7p     | Transmitter Non-Inverted Data Output |   |
| 54 |       | GND      | Ground                               | 1 |
| 55 | CML-O | Rx5n     | Transmitter Inverted Data Output     |   |
| 56 | CML-O | Rx5p     | Transmitter Non-Inverted Data Output |   |
| 57 |       | GND      | Ground                               | 1 |
| 58 |       | GND      | Ground                               | 1 |
| 59 | CML-O | Rx6n     | Transmitter Inverted Data Output     |   |
| 60 | CML-O | Rx6p     | Transmitter Non-Inverted Data Output |   |
| 61 |       | GND      | Ground                               | 1 |
| 62 | CML-O | Rx8n     | Transmitter Inverted Data Output     |   |
| 63 | CML-O | Rx8p     | Transmitter Non-Inverted Data Output |   |
| 64 |       | GND      | Ground                               | 1 |
| 65 |       | NC       | NC                                   | 3 |
| 66 |       | Reserved | NC                                   | 3 |
| 67 |       | VccTx1   | 3.3V Power Supply                    | 2 |
| 68 |       | Vcc2     | 3.3V Power Supply                    | 2 |
| 69 |       | Reserved | NC                                   | 3 |
| 70 |       | GND      | Ground                               | 1 |
| 71 | CML-I | Tx7n     | Transmitter Inverted Data Input      |   |
| 72 | CML-I | Tx7p     | Transmitter Non-Inverted Data Input  |   |
| 73 |       | GND      | Ground                               | 1 |
| 74 | CML-I | Tx5n     | Transmitter Inverted Data Input      |   |
| 75 | CML-I | Tx5p     | Transmitter Non-Inverted Data Input  |   |

|    |  |     |        |   |
|----|--|-----|--------|---|
| 76 |  | GND | Ground | 1 |
|----|--|-----|--------|---|

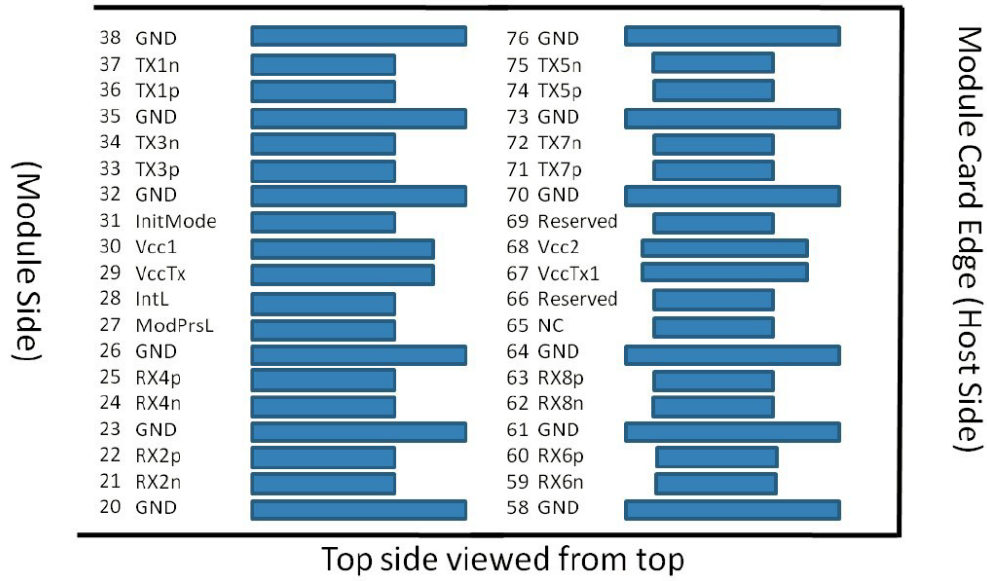
#### Notes:

1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common within the QSFP-DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 shall be applied concurrently. Requirements defined for the host side of the Host Card Edge Connector are listed in Table 6. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000mA.
3. All Vendor Specific, Reserved and No Connect pins may be terminated with 50 ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and reserved pads shall have an impedance to GND that is greater than 10kΩ and less than 100pF.
4. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 1A, 2A, 3A, 1B, 2B, 3B. (see Figure 2 for pad locations) Contact sequence A will make, then break contact with additional QSFP-DD pads. Sequence 1A, 1B will then occur simultaneously, followed by 2A, 2B, followed by 3A, 3B.

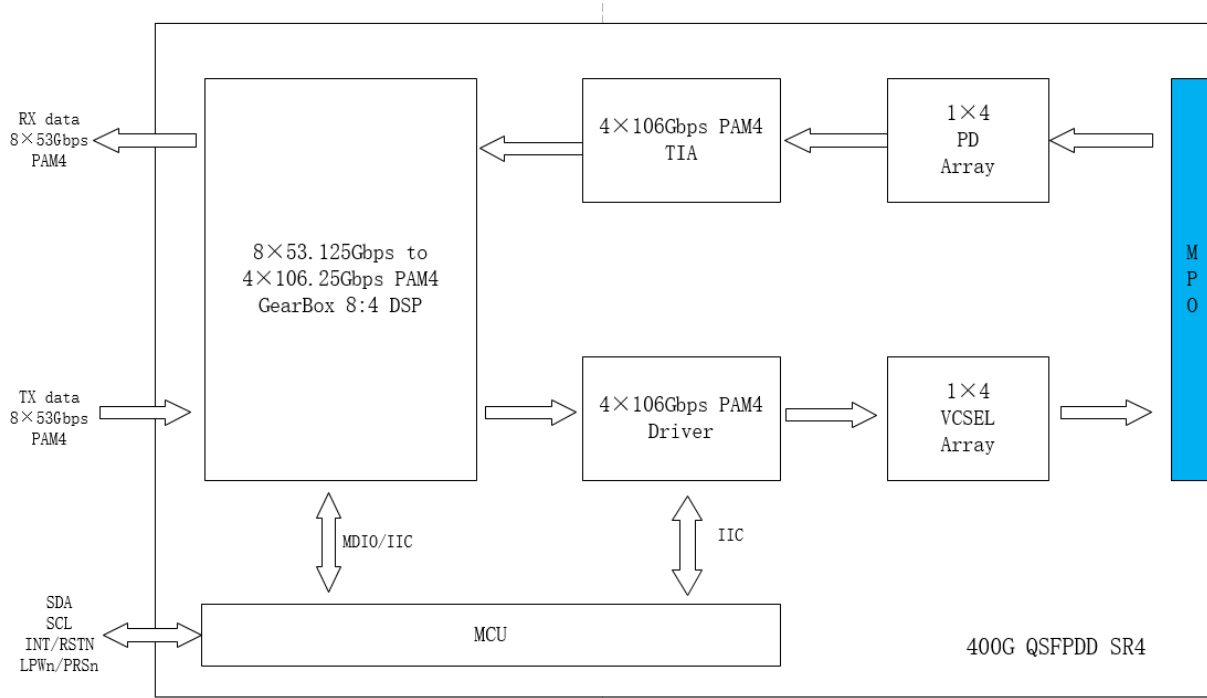
#### Electrical Pin-Out Details



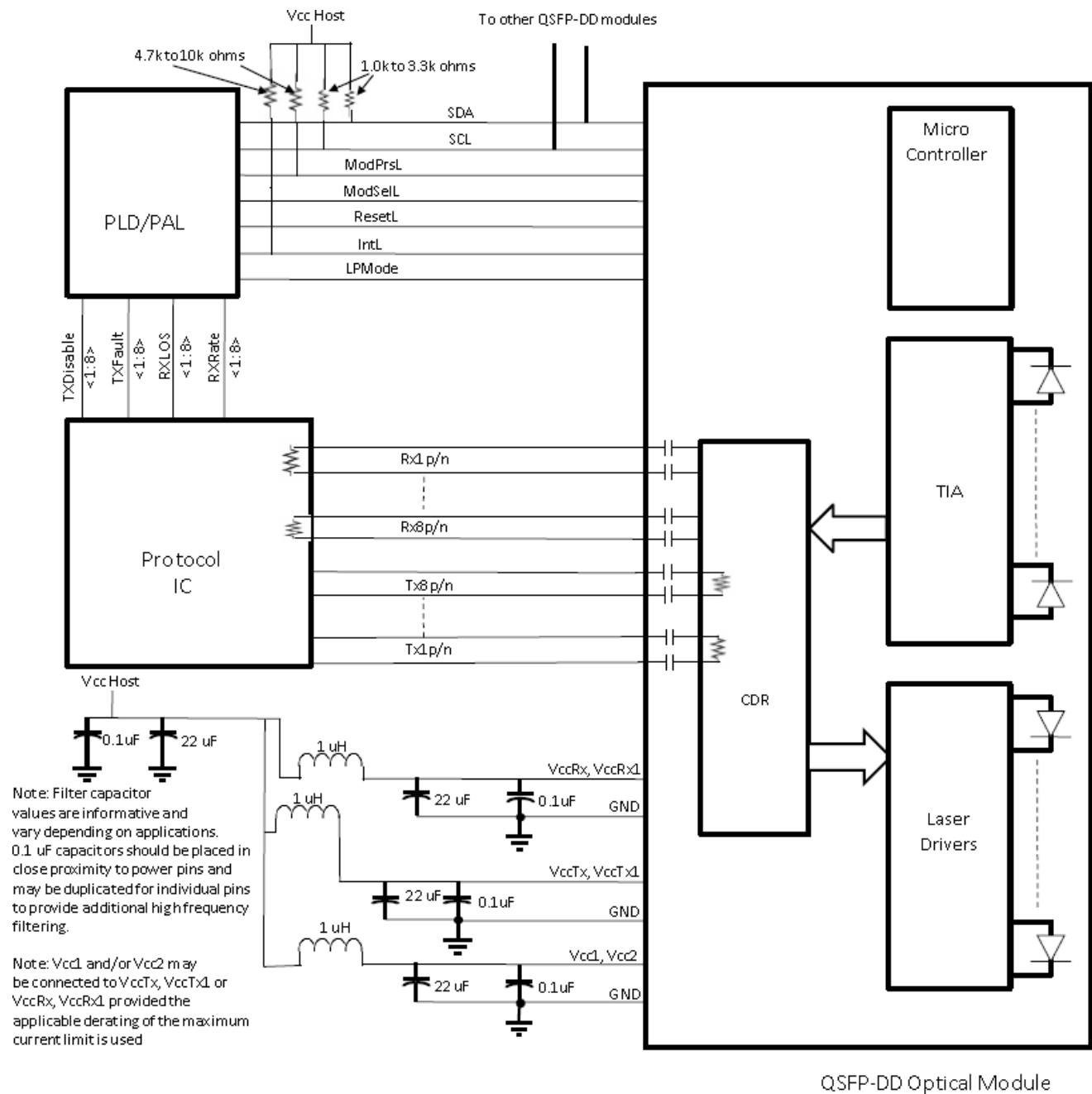
Bottom side viewed from bottom



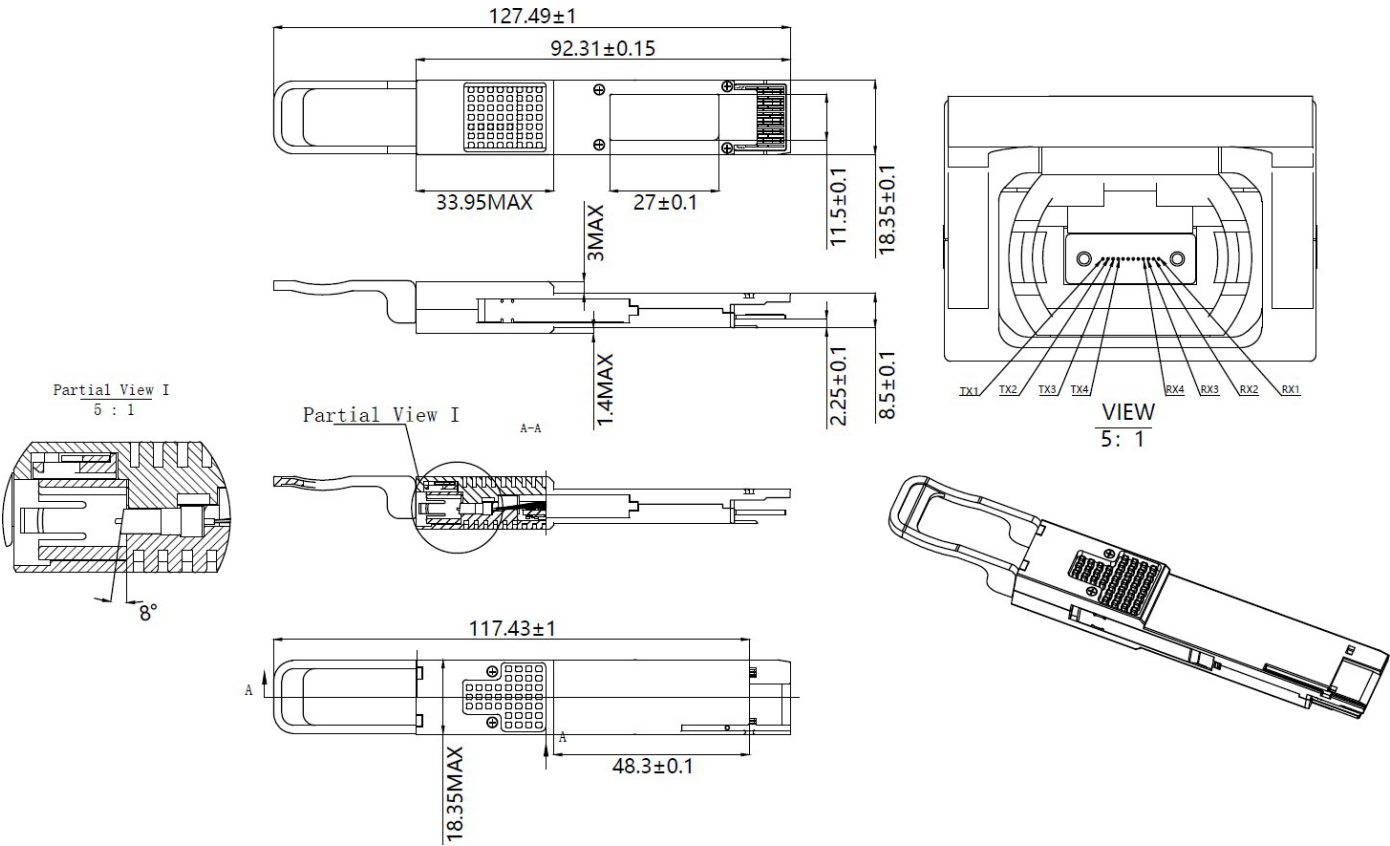
### Transceiver Block Diagram



Recommended Interface Circuit



Mechanical Specifications



# About Skylane Optics

Skylane is a leading provider of transceivers for optical communication.

We offer an extensive portfolio for the enterprise, access, datacenter and metropolitan fiber optical market as well as for smart home applications and home networks.

We cover the European, South American and North American market with a strong partner network and have offices in Belgium, Brazil, Sweden and USA.

Our offerings are characterized by high quality and performance. In combination with our strong technical support, we enable our customers to build cost optimized network solutions.

We offer an extensive range of high-quality products including transceivers (Optical and copper), Active Optical Cable (AOC), Direct Attach Cable (DAC), Mux/Demux, Coding Box.

