



## QDD4-400GB-ER4-SKY

MSA Compliant 400GBase-ER4 PAM4 QSFP-DD Transceiver (SMF, 1310nm, 40km, LC, DOM, CMIS 4.0)

### Product Description

This MSA compliant QSFP-DD transceiver provides 400GBase-ER4 throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. Digital optical monitoring (DOM) support is also present to allow 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:

- Compliant with IEEE Std 802.3cd
- Compliant with QSFP-DD Management Interface Specifications
- Compliant with QSFP-DD MSA
- 53.125GBd PAM4x4 Cooled EML
- 26.5625GBd PAM4x8 Electrical Connector
- Duplex LC
- Up to 40km on SMF
- Single 3.3V Power Supply
- RoHS Compliant and Lead-Free
- Operating Temperature: 0 to 70 Celsius



### Applications:

- 400GBase Ethernet
- Access and Enterprise

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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 |
|----------------------------|--------|------|--------|------|------|-------|
| Storage Temperature        | Tstg   | -40  |        | 85   | °C   |       |
| Operating Case Temperature | Tc     | 0    | 25     | 70   | °C   |       |
| Relative Humidity          | RH     | 15   |        | 85   | %    |       |
| Supply Voltage             | Vcc    | -0.5 |        | 4.0  | V    |       |
| Data Rate Per Channel      |        |      | 53.125 |      | Gbps |       |
| Modulation Format          |        |      | PAM4   |      |      |       |

## Electrical Characteristics

| Parameter                     | Symbol            | Min.  | Typ. | Max.  | Unit  | Notes |
|-------------------------------|-------------------|-------|------|-------|-------|-------|
| Power Supply Voltage          | Vcc               | 3.135 | 3.3  | 3.465 | V     |       |
| Power Supply Current          | Icc               |       |      | 3.8   | A     |       |
| Power Dissipation             | P <sub>DISS</sub> |       |      | 12    | W     |       |
| Transmitter                   |                   |       |      |       |       |       |
| Input Differential Impedance  | ZIN               |       | 100  |       | Ω     |       |
| Differential Data Input Swing | VIN,pp            | 180   |      | 900   | mVp-p |       |
| Receiver                      |                   |       |      |       |       |       |
| Output Differential Impedance | ZOUT              |       | 100  |       | Ω     |       |
| Differential Data Input Swing | VOOUT,pp          | 300   |      | 850   | mVp-p | 1     |

## Notes:

1. Internally AC coupled but requires an external 100Ω differential load termination.

## Optical Characteristics

| Parameter                                                        | Symbol               | Min.    | Typ. | Max.    | Unit | Notes |
|------------------------------------------------------------------|----------------------|---------|------|---------|------|-------|
| Transmitter                                                      |                      |         |      |         |      |       |
| Center Wavelength                                                | $\lambda_C$          | 1304.06 |      | 1305.1  | nm   | 1     |
|                                                                  |                      | 1306.33 |      | 1307.38 |      |       |
|                                                                  |                      | 1308.61 |      | 1309.66 |      |       |
|                                                                  |                      | 1310.9  |      | 1311.96 |      |       |
| Side-Mode Suppression Ratio                                      | SMSR                 | 30      |      |         | dB   |       |
| Total Average Launch Power                                       | PT                   |         |      | 10      | dBm  |       |
| Average Launch Power Per Lane                                    | P                    | 1.5     |      | 7.1     | dBm  |       |
| Outer Optical Modulation Amplitude Per Lane (Min.)               | OMA <sub>outer</sub> | 4.5     |      | 7.9     | dBm  |       |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ) Per Lane | TDECQ                |         |      | 3.9     | dB   |       |
| Transmitter Eye Closure for PAM4 (TECQ) Per Lane                 | TECQ                 |         |      | 3.9     | dB   |       |
| TDECQ-TECQ                                                       |                      |         |      | 2.7     | dB   |       |
| Extinction Ratio                                                 | ER                   | 6       |      |         | dB   |       |
| Average Launch Power of Off Transmitter Per Lane                 | P <sub>off</sub>     |         |      | -30     | dBm  |       |
| Optical Return Loss Tolerance                                    | ORLT                 |         |      | 15      | dB   |       |
| Transmitter Reflectance                                          |                      |         |      | -26     | dB   |       |
| Receiver                                                         |                      |         |      |         |      |       |
| Center Wavelength                                                | $\lambda_C$          | 1304.06 |      | 1305.1  | nm   |       |
|                                                                  |                      | 1306.33 |      | 1307.38 |      |       |
|                                                                  |                      | 1308.61 |      | 1309.66 |      |       |
|                                                                  |                      | 1310.9  |      | 1311.96 |      |       |
| Average Receiver Power Per Lane (P <sub>avg</sub> )              |                      | -16.2   |      | -3.4    | dBm  |       |
| Receiver Overload (Average Power) Per Lane                       |                      | -3.4    |      |         | dBm  |       |
| Damage Threshold                                                 |                      | -2.4    |      |         | dBm  |       |
| Receive Power Per Lane (OMA <sub>outer</sub> )                   |                      |         |      | -2.6    | dBm  | 2     |
| Receiver Sensitivity Per Lane (OMA <sub>outer</sub> )            |                      |         |      | -14     | dBm  | 2     |
| Stressed Receiver Sensitivity Per Lane (OMA <sub>outer</sub> )   |                      |         |      | -11.5   | dBm  |       |
| LOS Assert                                                       | LOSA                 |         |      | -20     | dBm  |       |
| LOS De-Assert                                                    | LOSD                 |         |      | -17     | dBm  |       |
| LOS Hysteresis                                                   |                      | 0.5     |      |         | dB   |       |

### Notes:

1. The typical wavelengths compliant with 1310nm nLWDM wavelength grids.
2. Measured with PRBS31Q test pattern @53.125Gbps, PAM4, and BER<2.4E<sup>-4</sup>.

## Pin Descriptions

| Pin | Symbol  | Name/Description                      | Notes |
|-----|---------|---------------------------------------|-------|
| 1   | GND     | Module Ground.                        | 1     |
| 2   | Tx2-    | Transmitter Inverted Data Input.      |       |
| 3   | Tx2+    | Transmitter Non-Inverted Data Output. |       |
| 4   | GND     | Module Ground.                        | 1     |
| 5   | Tx4-    | Transmitter Inverted Data Input.      |       |
| 6   | Tx4+    | Transmitter Non-Inverted Data Output. |       |
| 7   | GND     | Module Ground.                        | 1     |
| 8   | ModSelL | Module Select.                        |       |
| 9   | ResetL  | Module Reset.                         |       |
| 10  | VccRx   | +3.3V Receiver Power Supply.          | 2     |
| 11  | SCL     | 2-Wire Serial Interface Clock.        |       |
| 12  | SDA     | 2-Wire Serial Interface Data.         |       |
| 13  | GND     | Module Ground.                        | 1     |
| 14  | Rx3+    | Receiver Non-Inverted Data Output.    |       |
| 15  | Rx3-    | Receiver Inverted Data Output.        |       |
| 16  | GND     | Module Ground.                        | 1     |
| 17  | Rx1+    | Receiver Non-Inverted Data Output.    |       |
| 18  | Rx1-    | Receiver Inverted Data Output.        |       |
| 19  | GND     | Module Ground.                        | 1     |
| 20  | GND     | Module Ground.                        | 1     |
| 21  | Rx2-    | Receiver Inverted Data Output.        |       |
| 22  | Rx2+    | Receiver Non-Inverted Data Output.    |       |
| 23  | GND     | Module Ground.                        | 1     |
| 24  | Rx4-    | Receiver Inverted Data Output.        |       |
| 25  | Rx4+    | Receiver Non-Inverted Data Output.    |       |
| 26  | GND     | Module Ground.                        | 1     |
| 27  | ModPrsL | Module Present.                       |       |
| 28  | IntL    | Interrupt.                            |       |
| 29  | VccTx   | +3.3V Transmitter Power Supply.       | 2     |
| 30  | Vcc1    | +3.3V Power Supply.                   | 2     |
| 31  | LPMODE  | Low-Power Mode.                       |       |
| 32  | GND     | Module Ground.                        | 1     |
| 33  | Tx3+    | Transmitter Non-Inverted Data Input.  |       |
| 34  | Tx3-    | Transmitter Inverted Data Output.     |       |
| 35  | GND     | Module Ground.                        | 1     |
| 36  | Tx1+    | Transmitter Non-Inverted Data Input.  |       |
| 37  | Tx1-    | Transmitter Inverted Data Output.     |       |
| 38  | GND     | Module Ground.                        | 1     |
| 39  | GND     | Module Ground.                        | 1     |

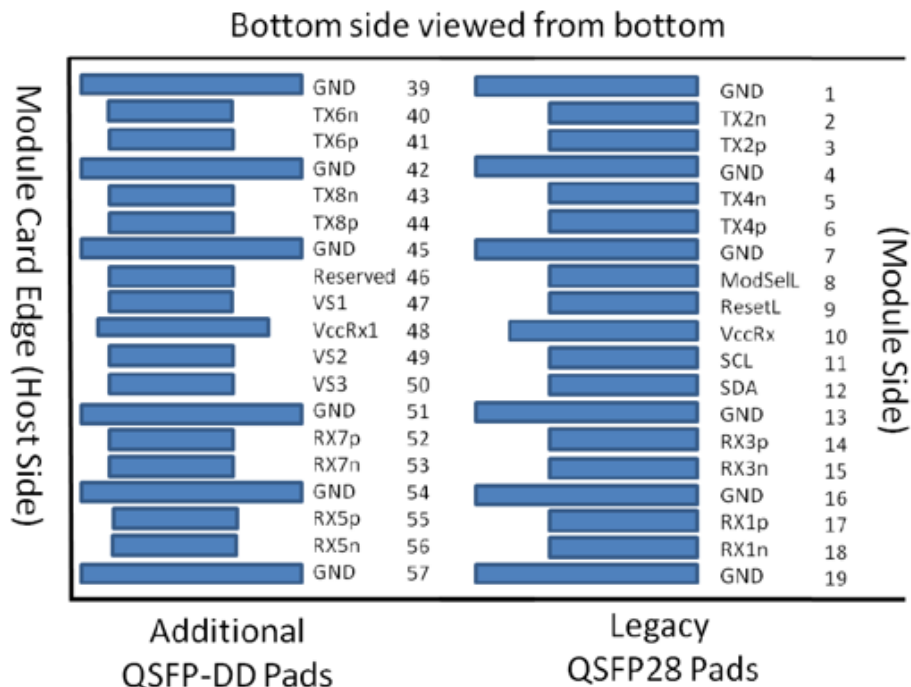
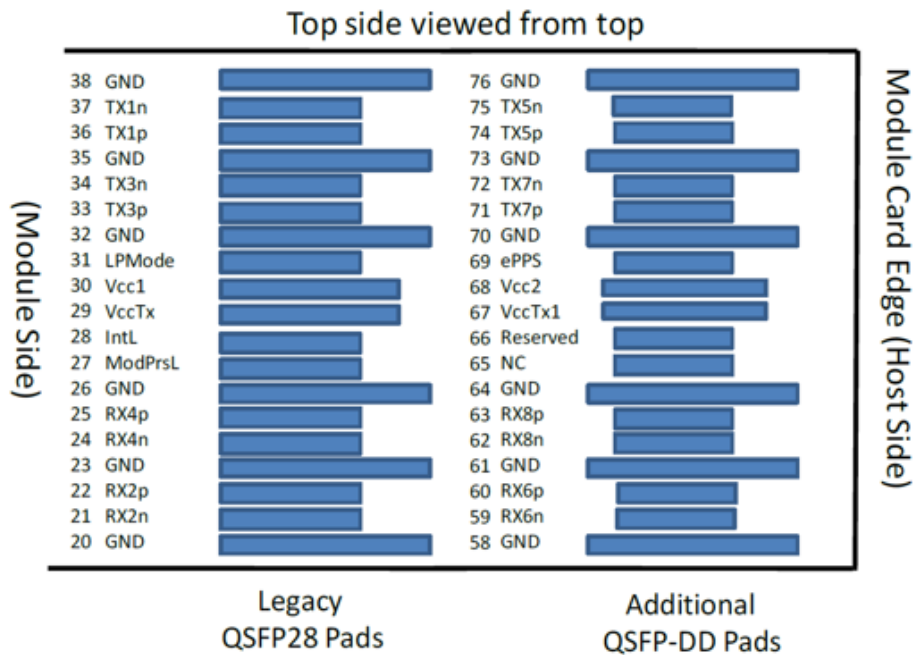
|    |          |                                                      |   |
|----|----------|------------------------------------------------------|---|
| 40 | Tx6-     | Transmitter Inverted Data Input.                     |   |
| 41 | Tx6+     | Transmitter Non-Inverted Data Output.                |   |
| 42 | GND      | Module Ground.                                       | 1 |
| 43 | Tx8-     | Transmitter Inverted Data Input.                     |   |
| 44 | Tx8+     | Transmitter Non-Inverted Data Output.                |   |
| 45 | GND      | Module Ground.                                       | 1 |
| 46 | Reserved | For Future Use.                                      | 3 |
| 47 | VS1      | Module Vendor-Specific 1.                            | 3 |
| 48 | VccRx1   | +3.3V Receiver Power Supply.                         | 2 |
| 49 | VS2      | Module Vendor-Specific 2.                            | 3 |
| 50 | VS3      | Module Vendor-Specific 3.                            | 3 |
| 51 | GND      | Module Ground.                                       | 1 |
| 52 | Rx7+     | Receiver Non-Inverted Data Output.                   |   |
| 53 | Rx7-     | Receiver Inverted Data Output.                       |   |
| 54 | GND      | Module Ground.                                       | 1 |
| 55 | Rx5+     | Receiver Non-Inverted Data Output.                   |   |
| 56 | Rx5-     | Receiver Inverted Data Output.                       |   |
| 57 | GND      | Module Ground.                                       | 1 |
| 58 | GND      | Module Ground.                                       | 1 |
| 59 | Rx6-     | Receiver Inverted Data Output.                       |   |
| 60 | Rx6+     | Receiver Non-Inverted Data Output.                   |   |
| 61 | GND      | Module Ground.                                       | 1 |
| 62 | Rx8-     | Receiver Inverted Data Output.                       |   |
| 63 | Rx8+     | Receiver Non-Inverted Data Output.                   |   |
| 64 | GND      | Module Ground.                                       | 1 |
| 65 | NC       | Not Connected.                                       | 3 |
| 66 | Reserved | For Future Use.                                      | 3 |
| 67 | VccTx1   | +3.3V Transmitter Power Supply.                      | 2 |
| 68 | Vcc2     | +3.3V Power Supply.                                  | 2 |
| 69 | ePPS     | Precision Time Protocol (PTP) Reference Clock Input. | 3 |
| 70 | GND      | Module Ground.                                       | 1 |
| 71 | Tx7+     | Transmitter Non-Inverted Data Input.                 |   |
| 72 | Tx7-     | Transmitter Inverted Data Output.                    |   |
| 73 | GND      | Module Ground.                                       | 1 |
| 74 | Tx5+     | Transmitter Non-Inverted Data Input.                 |   |
| 75 | Tx5-     | Transmitter Inverted Data Output.                    |   |
| 76 | GND      | Module Ground.                                       | 1 |

**Notes:**

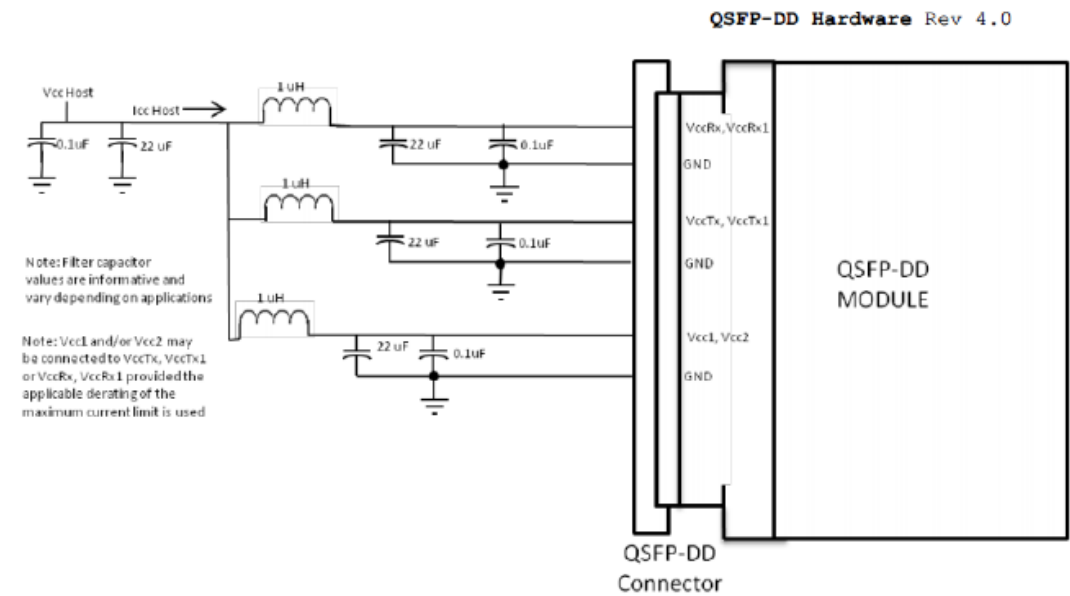
1. QSFP-DD uses common ground (GND) for all signals and power supplies. All are common within the QSFP-DD module, and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.

2. VccRx, VccRx1, Vcc1, Vcc2, VccTx, and VccTx1 shall be applied concurrently. 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, Not Connected, and ePPS (if not used) pins may be terminated with 50Ω to ground on the host. Pad 65 (Not Connected) 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.

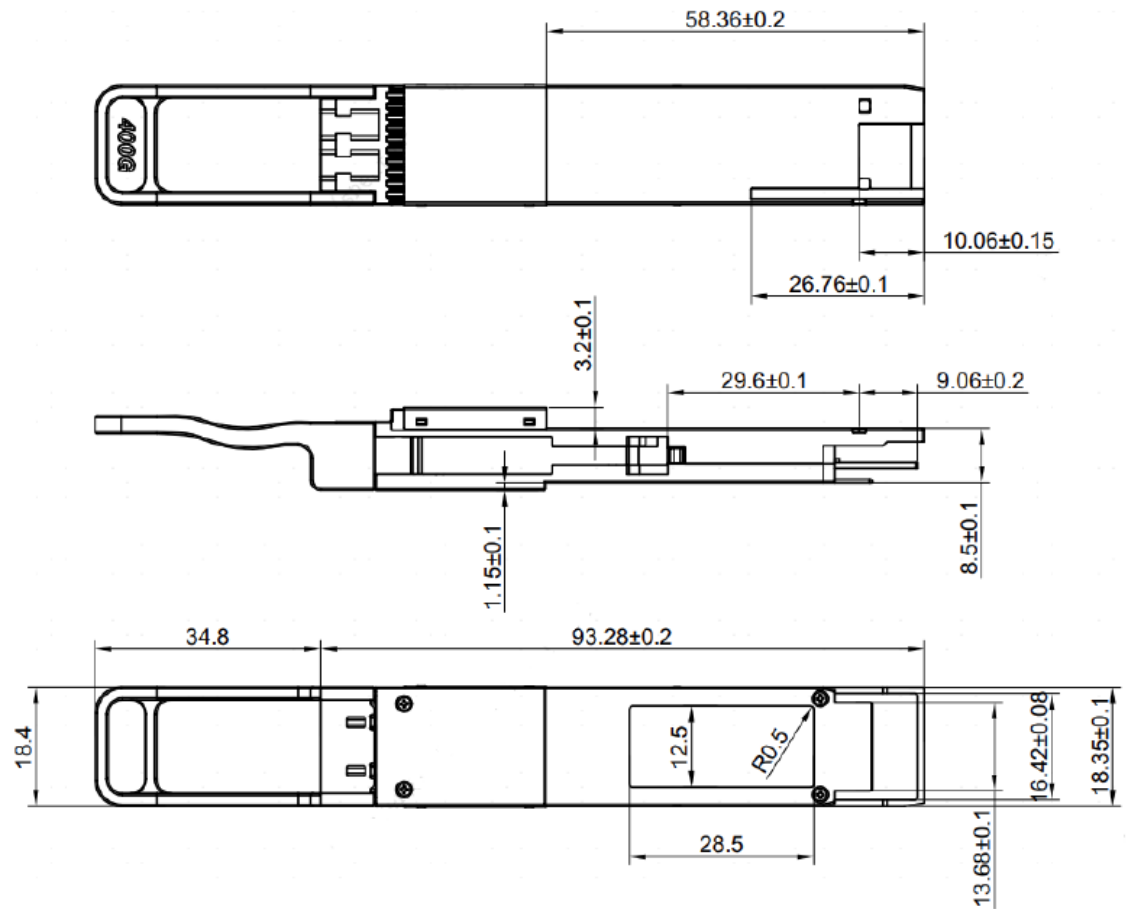
## Module Pad Layout



Host Board Power Supply Filter Network



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.

