



## QDD-400G-2QSFP56-PDAC1-5M-SKY

MSA Compliant 400GBase-CU QSFP-DD 400G to 2xQSFP56 200G PAM-4 Direct Attach Cable (Passive Twinax, 1.5m)

### Product Description

This is a MSA Compliant 400GBase-CU QSFP-DD 400G to 2xQSFP56 200G PAM-4 direct attach cable that operates over passive copper with a maximum reach of 1.5m (4.9ft). It has been programmed, uniquely serialized, and data-traffic and application tested to ensure it is 100% compliant and functional. This direct attach cable is built to comply with MSA (Multi-Source Agreement) standards. 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:

- QSFP-DD MSA Compliant
- Transmission Data Rate Up to 53.125Gbps per Channel
- QSFP Module Compliant to SFF-8661
- Built-in EEPROM Functions
- Operating Temperature: 0 to 70 Celsius
- Enable 400Gbps to 2x20Gbps Transmission
- RoHS Compliant and Lead-Free



### Applications:

- 400GBase Ethernet

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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 |
|----------------------------|--------|------|------|------|------|
| Supply Voltage             | Vcc    | 3.13 | 3.3  | 3.47 | V    |
| Storage Temperature        | Tstg   | -40  |      | 85   | °C   |
| Operating Case Temperature | Tc     | 0    |      | 70   | °C   |
| Relative Humidity          | RH     | 5    |      | 85   | %    |
| Data Rate                  |        |      | 400  |      | Gbps |

## Physical Characteristics

| Parameter       | Symbol | Min.       | Typ. | Max. | Unit | Notes |
|-----------------|--------|------------|------|------|------|-------|
| Length          | L      |            |      | 1.5  | M    |       |
| AWG             |        |            | 30   |      | AWG  |       |
| Jacket Material |        | PVC, Black |      |      |      |       |

## Electrical Specifications

| Parameter                                   | Symbol      | Min.                                                                                                                                                                  | Typ. | Max.  | Unit | Notes |
|---------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|------|-------|
| Resistance                                  | Rcon        |                                                                                                                                                                       |      | 3     | Ω    |       |
| Insulation Resistance                       | Rins        |                                                                                                                                                                       |      | 10    | MΩ   |       |
| Raw Cable Impedance                         | Zca         | 95                                                                                                                                                                    | 100  | 110   | Ω    |       |
| Mated Connector Impedance                   | Zmated      | 85                                                                                                                                                                    | 100  | 115   | Ω    |       |
| Insertion Loss @13.28GHz                    | SDD21       | 8                                                                                                                                                                     |      | 17.16 | dB   |       |
| Return Loss                                 | SDD11/22    | $\text{Return\_loss}(f) \geq \begin{cases} 16.5-2vf & 0.05 \leq f < 4.1 \\ 10.66-14\log_{10}(f/5.5) & 4.1/7.5 \leq f \leq 19 \end{cases}$                             |      |       | dB   | 1     |
| Differential to Common-Mode Return Loss     | SCD11/22    | $\text{Return\_loss}(f) \geq \begin{cases} 22-(20/25.78)f & 0.01 \leq f < 12.89 \\ 15+(6/25.78)f & 12.89 \leq f \leq 19 \end{cases}$                                  |      |       | dB   | 1     |
| Differential to Common-Mode Conversion Loss | SCD21-SDD21 | $\text{Conversion\_loss}(f) - \text{IL}(f) \geq \begin{cases} 10 & 0.01 \leq f < 12.89 \\ 27-(29/22)f & 12.89 \leq f < 15.7 \\ 6.3 & 15.7 \leq f \leq 19 \end{cases}$ |      |       | dB   | 1     |
| Minimum COM                                 | COM         | 3                                                                                                                                                                     |      |       | dB   |       |

### Notes:

1. For  $0.05 \leq f \leq \text{GHz}$ , where f is the frequency on GHz.

## Pin Descriptions- QSFP-DD End

| Pin | Logic       | Symbol       | Name/Description                     | Plug Sequence | Notes |
|-----|-------------|--------------|--------------------------------------|---------------|-------|
| 1   |             | GND          | Module Ground.                       | 1B            | 1     |
| 2   | CML-I       | Tx2-         | Transmitter Inverted Data Input.     | 3B            |       |
| 3   | CML-I       | Tx2+         | Transmitter Non-Inverted Data Input. | 3B            |       |
| 4   |             | GND          | Module Ground.                       | 1B            | 1     |
| 5   | CML-I       | Tx4-         | Transmitter Inverted Data Input.     | 3B            |       |
| 6   | CML-I       | Tx4+         | Transmitter Non-Inverted Data Input. | 3B            |       |
| 7   |             | GND          | Module Ground.                       | 1B            | 1     |
| 8   | LVTTL-I     | ModSelL      | Module Select.                       | 3B            |       |
| 9   | LVTTL-I     | ResetL       | Module Reset.                        | 3B            |       |
| 10  |             | VccRx        | +3.3V Receiver Power Supply.         | 2B            | 2     |
| 11  | LVC MOS-I/O | SCL          | 2-Wire Serial Interface Clock.       | 3B            |       |
| 12  | LVC MOS-I/O | SDA          | 2-Wire Serial Interface Data.        | 3B            |       |
| 13  |             | GND          | Module Ground.                       | 1B            | 1     |
| 14  | CML-O       | Rx3+         | Receiver Non-Inverted Data Output.   | 3B            |       |
| 15  | CML-O       | Rx3-         | Receiver Inverted Data Output.       | 3B            |       |
| 16  |             | GND          | Module Ground.                       | 1B            | 1     |
| 17  | CML-O       | Rx1+         | Receiver Non-Inverted Data Output.   | 3B            |       |
| 18  | CML-O       | Rx1-         | Receiver Inverted Data Output.       | 3B            |       |
| 19  |             | GND          | Module Ground.                       | 1B            | 1     |
| 20  |             | GND          | Module Ground.                       | 1B            | 1     |
| 21  | CML-O       | Rx2-         | Receiver Inverted Data Output.       | 3B            |       |
| 22  | CML-O       | Rx2+         | Receiver Non-Inverted Data Output.   | 3B            |       |
| 23  |             | GND          | Module Ground.                       | 1B            | 1     |
| 24  | CML-O       | Rx4-         | Receiver Inverted Data Output.       | 3B            |       |
| 25  | CML-O       | Rx4+         | Receiver Non-Inverted Data Output.   | 3B            |       |
| 26  |             | GND          | Module Ground.                       | 1B            | 1     |
| 27  | LVTTL-O     | ModPrsL      | Module Present.                      | 3B            |       |
| 28  | LVTTL-O     | IntL/RxLOS   | Interrupt. Optio0na RxLOS.           | 3B            |       |
| 29  |             | VccTx        | +3.3V Transmitter Power Supply.      | 2B            | 2     |
| 30  |             | Vcc1         | +3.3V Power Supply.                  | 2B            | 2     |
| 31  | LVTTL-I     | LPMode/TxDis | Low Power Mode. Optional Tx Disable. | 3B            |       |
| 32  |             | GND          | Module Ground.                       | 1B            | 1     |
| 33  | CML-I       | Tx3+         | Transmitter Non-Inverted Data Input. | 3B            |       |
| 34  | CML-I       | Tx3-         | Transmitter Inverted Data Input.     | 3B            |       |
| 35  |             | GND          | Module Ground.                       | 1B            | 1     |
| 36  | CML-I       | Tx1+         | Transmitter Non-Inverted Data Input. | 3B            |       |
| 37  | CML-I       | Tx1-         | Transmitter Inverted Data Input.     | 3B            |       |
| 38  |             | GND          | Module Ground.                       | 1B            | 1     |
| 39  |             | GND          | Module Ground.                       | 1A            | 1     |
| 40  | CML-I       | Tx6-         | Transmitter Inverted Data Input.     | 3A            |       |
| 41  | CML-I       | Tx6+         | Transmitter Non-Inverted Data Input. | 3A            |       |

|    |               |            |                                          |    |   |
|----|---------------|------------|------------------------------------------|----|---|
| 42 |               | GND        | Module Ground.                           | 1A |   |
| 43 | CML-I         | Tx8-       | Transmitter Inverted Data Input.         | 3A |   |
| 44 | CML-I         | Tx8+       | Transmitter Non-Inverted Data Input.     | 3A |   |
| 45 |               | GND        | Module Ground.                           | 1A |   |
| 46 | LVC MOS/CML-I | P/VS4      | Programmable. Module Vendor-Specific 4.  | 3A | 5 |
| 47 | LVC MOS/CML-I | P/VS1      | Programmable. Module Vendor-Specific 1.  | 3A | 5 |
| 48 |               | VccRx1     | +3.3V Receiver Power Supply.             | 2A | 2 |
| 49 | LVC MOS/CML-O | P/VS2      | Programmable. Module Vendor-Specific 2.  | 3A | 5 |
| 50 | LVC MOS/CML-O | P/VS3      | Programmable. Module Vendor-Specific 3.  | 3A | 5 |
| 51 |               | GND        | Module Ground.                           | 1A | 1 |
| 52 | CML-O         | Rx7+       | Receiver Non-Inverted Data Output.       | 3A |   |
| 53 | CML-O         | Rx7-       | Receiver Inverted Data Output.           | 3A |   |
| 54 |               | GND        | Module Ground.                           | 1A | 1 |
| 55 | CML-O         | Rx5+       | Receiver Non-Inverted Data Output.       | 3A |   |
| 56 | CML-O         | Rx5-       | Receiver Inverted Data Output.           | 3A |   |
| 57 |               | GND        | Module Ground.                           | 1A | 1 |
| 58 |               | GND        | Module Ground.                           | 1A | 1 |
| 59 | CML-O         | Rx6-       | Receiver Inverted Data Output.           | 3A |   |
| 60 | CML-O         | Rx6+       | Receiver Non-Inverted Data Output.       | 3A |   |
| 61 |               | GND        | Module Ground.                           | 1A | 1 |
| 62 | CML-O         | Rx8-       | Receiver Inverted Data Output.           | 3A |   |
| 63 | CML-O         | Rx8+       | Receiver Non-Inverted Data Output.       | 3A |   |
| 64 |               | GND        | Module Ground.                           | 1A | 1 |
| 65 |               | NC         | Not Connected.                           | 3A | 3 |
| 66 |               | Reserved   | For Future Use.                          | 3A | 3 |
| 67 |               | VccTx1     | +3.3V Power Supply.                      | 2A | 2 |
| 68 |               | Vcc2       | +3.3V Power Supply.                      | 2A | 2 |
| 69 | LVC MOS-I     | ePPS/Clock | 1PPS PTP Clock or Reference Clock Input. | 3A | 6 |
| 70 |               | GND        | Module Ground.                           | 1A | 1 |
| 71 | CML-I         | Tx7+       | Transmitter Non-Inverted Data Input.     | 3A |   |
| 72 | CML-I         | Tx7-       | Transmitter Inverted Data Input.         | 3A |   |
| 73 |               | GND        | Module Ground.                           | 1A | 1 |
| 74 | CML-I         | Tx5+       | Transmitter Non-Inverted Data Input.     | 3A |   |
| 75 | CML-I         | Tx5-       | Transmitter Inverted Data Input.         | 3A |   |
| 76 |               | GND        | Module Ground.                           | 1A | 1 |

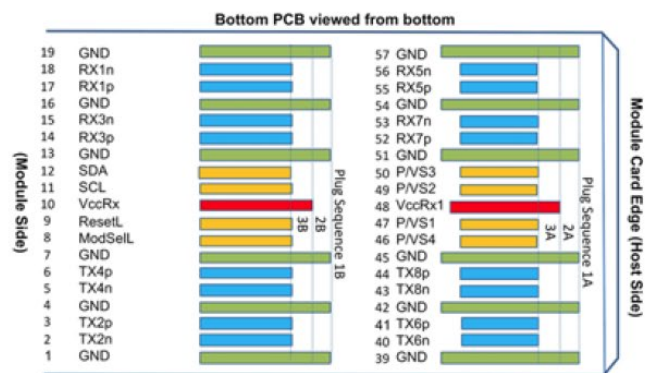
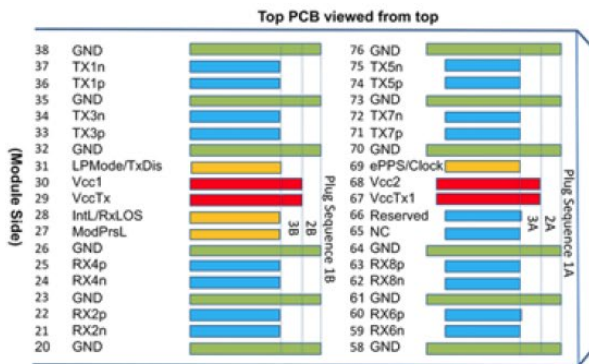
#### Notes:

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. Each connector GND contact is rated for maximum current of 500mA.
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 below. For power classes 4 and above, the

module differential loading of input voltage pads must not result in exceeding contact current limits. Each connector Vcc contact is rated for a maximum current of 1500mA.

3. Reserved and no Connect pads recommended to be terminated with 10k $\Omega$  to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module.
4. Plug sequence specifies the mating sequence of the host connector and module. The sequence is 1A, 2A, 3A, 1B, 2B, and 3B. Contact sequence A will make, then break contact with additional QSFP-DD pads. Sequence 1A and 1B will then occur simultaneously, followed by 2A and 2B, followed by 3A and 3B.
5. Full definitions of P/VSx signals currently under development. On new designs not used P/VSx signals are recommended to be terminated on the host with 10k $\Omega$ .
6. ePPS/Clock if not used recommended to be terminated with 50 $\Omega$  to ground on the host.

### Pin-Out Detail QSFP-DD End



## Pin Descriptions- QSFP End

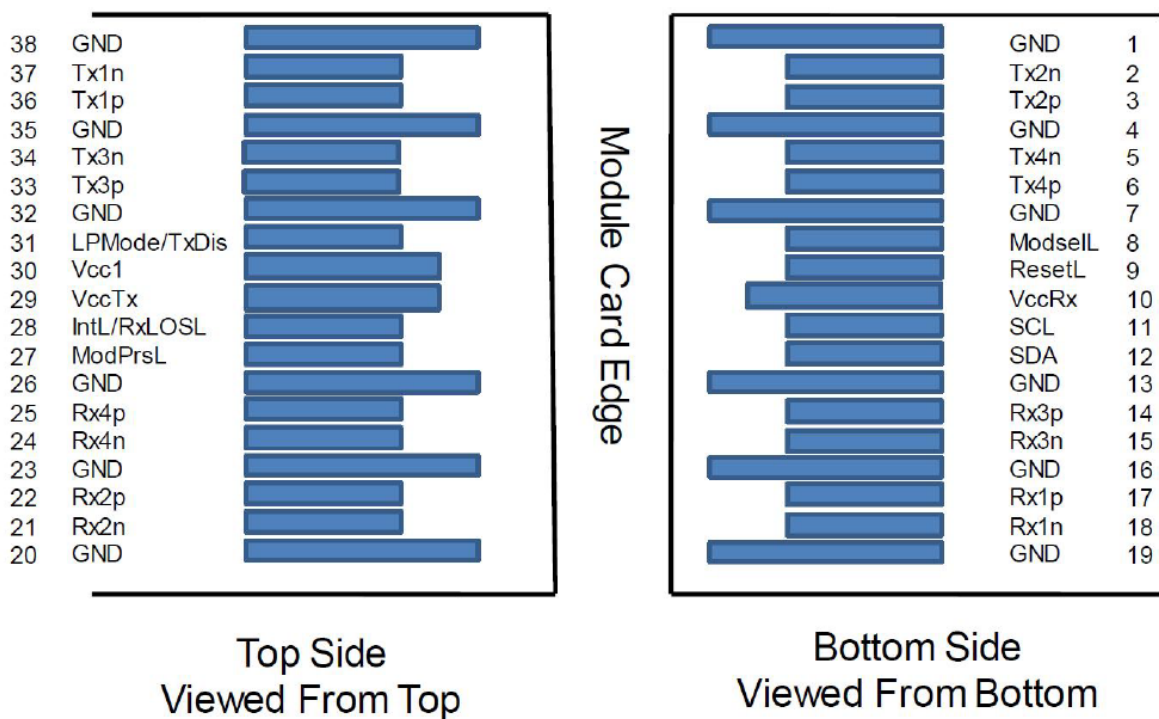
| Pin | Logic       | Symbol  | Name/Description                     | Plug Sequence | Notes |
|-----|-------------|---------|--------------------------------------|---------------|-------|
| 1   |             | GND     | Module Ground.                       | 1             | 1     |
| 2   | CML-I  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

|    |       |      |                                      |   |   |
|----|-------|------|--------------------------------------|---|---|
| 35 |       | GND  | Module Ground.                       | 1 | 1 |
| 36 | CML-I | Tx1+ | Transmitter Non-Inverted Data Input. | 3 |   |
| 37 | CML-I | Tx1- | Transmitter Inverted Data Input.     | 3 |   |
| 38 |       | GND  | Module Ground.                       | 1 | 1 |

#### Notes:

1. GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP 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, Vcc1, and VccTx are the receiver and transmitter power supplies and shall be applied concurrently. VccRx, Vcc1, and VccTx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

#### Electrical Pin-Out Details - QSFP

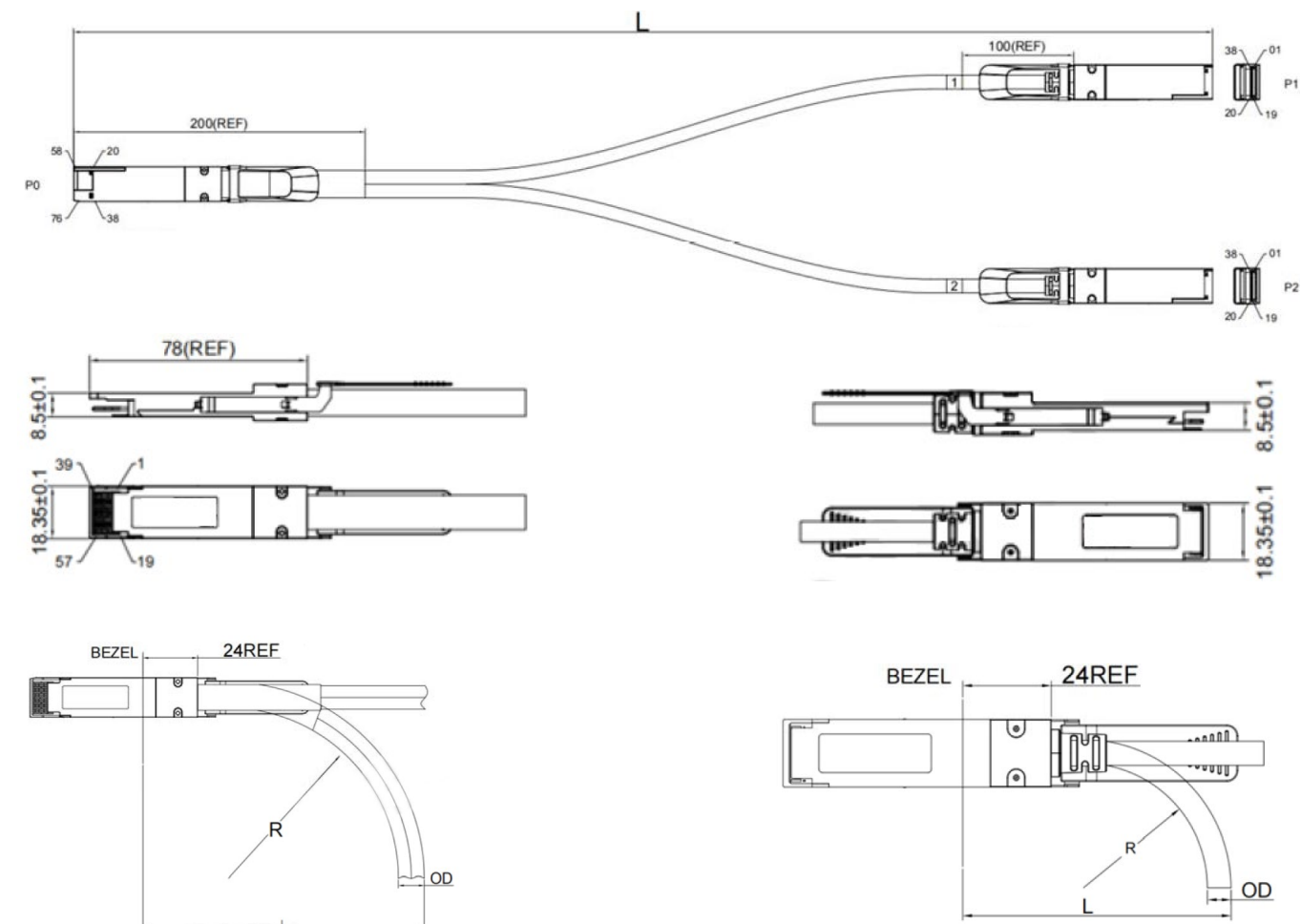


Wiring Table

| WIRING DIAGRAM |        |      |           |        |  |
|----------------|--------|------|-----------|--------|--|
| P0 END         |        |      | P1&P2 END |        |  |
| Pad            | Signal | Px   | Pad       | Signal |  |
| 1              | GND    | —    | 20        | GND    |  |
| 2              | TX2n   | → P1 | 21        | RX2n   |  |
| 3              | TX2p   | →    | 22        | RX2p   |  |
| 4              | GND    | —    | 20        | GND    |  |
| 5              | TX4n   | →    | 21        | RX2n   |  |
| 6              | TX4p   | →    | 22        | RX2p   |  |
| 7              | GND    | —    | 23        | GND    |  |
| 13             | GND    | —    | 35        | GND    |  |
| 14             | RX3p   | ←    | 36        | TX1p   |  |
| 15             | RX3n   | ←    | 37        | TX1n   |  |
| 16             | GND    | —    | 38        | GND    |  |
| 17             | RX1p   | ←    | 36        | TX1p   |  |
| 18             | RX1n   | ←    | 37        | TX1n   |  |
| 19             | GND    | —    | 38        | GND    |  |
| 20             | GND    | —    | 1         | GND    |  |
| 21             | RX2n   | ←    | 2         | TX2n   |  |
| 22             | RX2p   | ←    | 3         | TX2p   |  |
| 23             | GND    | —    | 1         | GND    |  |
| 24             | RX4n   | ←    | 2         | TX2n   |  |
| 25             | RX4p   | ←    | 3         | TX2p   |  |
| 26             | GND    | —    | 4         | GND    |  |
| 32             | GND    | —    | 16        | GND    |  |
| 33             | TX3p   | →    | 17        | RX1p   |  |
| 34             | TX3n   | →    | 18        | RX1n   |  |
| 35             | GND    | —    | 19        | GND    |  |
| 36             | TX1p   | →    | 17        | RX1p   |  |
| 37             | TX1n   | → P1 | 18        | RX1n   |  |
| 38             | GND    | —    | 19        | GND    |  |

| WIRING DIAGRAM |        |      |           |        |  |
|----------------|--------|------|-----------|--------|--|
| P0 END         |        |      | P3&P4 END |        |  |
| Pad            | Signal | Px   | Pad       | Signal |  |
| 39             | GND    | —    | 20        | GND    |  |
| 40             | TX6n   | → P3 | 21        | RX2n   |  |
| 41             | TX6p   | →    | 22        | RX2p   |  |
| 42             | GND    | —    | 20        | GND    |  |
| 43             | TX8n   | →    | 21        | RX2n   |  |
| 44             | TX8p   | →    | 22        | RX2p   |  |
| 45             | GND    | —    | 23        | GND    |  |
| 51             | GND    | —    | 35        | GND    |  |
| 52             | RX7p   | ←    | 36        | TX1p   |  |
| 53             | RX7n   | ←    | 37        | TX1n   |  |
| 54             | GND    | —    | 38        | GND    |  |
| 55             | RX5p   | ←    | 36        | TX1p   |  |
| 56             | RX5n   | ←    | 37        | TX1n   |  |
| 57             | GND    | —    | 38        | GND    |  |
| 58             | GND    | —    | 1         | GND    |  |
| 59             | RX6n   | ←    | 2         | TX2n   |  |
| 60             | RX6p   | ←    | 3         | TX2p   |  |
| 61             | GND    | —    | 1         | GND    |  |
| 62             | RX8n   | ←    | 2         | TX2n   |  |
| 63             | RX8p   | ←    | 3         | TX2p   |  |
| 64             | GND    | —    | 4         | GND    |  |
| 70             | GND    | —    | 16        | GND    |  |
| 71             | TX7p   | →    | 17        | RX1p   |  |
| 72             | TX7n   | →    | 18        | RX1n   |  |
| 73             | GND    | —    | 19        | GND    |  |
| 74             | TX5p   | →    | 17        | RX1p   |  |
| 75             | TX5n   | → P3 | 18        | RX1n   |  |
| 76             | GND    | —    | 19        | GND    |  |

Mechanical Specifications



| QSFP-DD |      |                 |                      | QSFP  |       |                 |                      |
|---------|------|-----------------|----------------------|-------|-------|-----------------|----------------------|
| Gauge   | OD   | Bend Radius "R" | Min. Bend Radius "L" | Gauge | OD    | Bend Radius "R" | Min. Bend Radius "L" |
| 30AWG   | 14MM | 70MM            | 170MM                | 30AWG | 7.0MM | 35MM            | 80MM                 |

# 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.

