



## OSFPRHS-800GB-2XDR4P-SKY

MSA Compliant 800GBase-2xDR4 PAM4 OSFP112 RHS Transceiver (SMF, 1310nm, 2km, 2xMPO, DOM, CMIS 5.0)

### Product Description

This MSA compliant OSFP112 RHS transceiver provides 800GBase-2xDR4 throughput up to 2km over single-mode fiber (SMF) PAM4 using a wavelength of 1310nm via a 2xMPO connector. It can operate at temperatures between 0 and 70C. 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. 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:

- Supports Both Ethernet and InfiniBand
- Dual MPO-12 Connector APC
- OSFP MSA Compliant
- 8 Channels of 100G-PAM4 Electrical and Optical Parallel Lanes
- 2km Maximum Reach via Single-Mode Fiber
- Compliant with CMIS 5.0
- Operating Temperature: 0 to 70 Celsius
- Power Consumption: 14.5W
- RoHS Compliant and Lead-Free
- Class 1 Laser



### Applications:

- 800GBase 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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## CMIS Application Advertisements

| ApSel Code | Host Electrical Interface   | Module Media Interface | Host and Media Lane Count | Host Lane Assignment       |
|------------|-----------------------------|------------------------|---------------------------|----------------------------|
| ApSel 1    | 50 (400GAUI-4-L C2M)        | 1C (400GBASE-DR4)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 2    | 32 (IB NDR)                 | 1C (400GBASE-DR4)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 3    | F (200GAUI-4 C2M)           | 17 (200GBASE-DR4)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 4    | 31 (IB HDR)                 | 17 (200GBASE-DR4)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 5    | 4C (100GAUI-1-L C2M)        | 14 (100GBASE-DR)       | 11 (1:1)                  | FF (lanes 1,2,3,4,5,6,7,8) |
| ApSel 6    | 52 (800GAUI-8-L C2M)        | 0 (Undefined)          | 88 (8:8)                  | 01 (lane 1)                |
| ApSel 7    | 4F (400GAUI-4-S C2M)        | 1C (400GBASE-DR4)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 8    | 4B (100GAUI-1-S C2M)        | 14 (100GBASE-DR)       | 11 (1:1)                  | FF (lanes 1,2,3,4,5,6,7,8) |
| ApSel 9    | 51 (800GAUI-8-S C2M)        | 0 (Undefined)          | 88 (8:8)                  | 01 (lane 1)                |
| ApSel 10   | 42 (CAUI-4 C2M with RS FEC) | F (100G PSM4 MSA)      | 44 (4:4)                  | 11 (lanes 1,5)             |
| ApSel 11   | 30 (IB EDR)                 | F (100G PSM4 MSA)      | 44 (4:4)                  | 11 (lanes 1,5)             |

## Absolute Maximum Ratings

| Parameter                          | Symbol | Min. | Typ.   | Max.                 | Unit | Notes |
|------------------------------------|--------|------|--------|----------------------|------|-------|
| Power Supply Voltage               | Vcc    | -0.5 |        | 3.6                  | V    |       |
| Storage Temperature                | Tstg   | -40  |        | 85                   | °C   |       |
| Operating Case Temperature         | Tc     | 0    |        | 70                   | °C   |       |
| Relative Humidity (Non-Condensing) | RH     | 0    |        | 85                   | %    |       |
| Data Rate Per Lane                 | DRL    |      | 53.125 |                      | GBd  | PAM4  |
| Data Rate Accuracy                 |        | -100 |        | 100                  | ppm  |       |
| Pre-FEC Bit Error Ratio            |        |      |        | $2.4 \times 10^{-4}$ |      |       |
| Post-FEC Bit Error Ratio           |        |      |        | $1 \times 10^{-15}$  |      | 1     |
| Link Distance                      | D      | 100  |        | 2000                 | m    | 2     |

### Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

## Electrical Characteristics

| Parameter                                           |                       | Symbol | Min.                         | Typ. | Max.  | Unit | Notes |
|-----------------------------------------------------|-----------------------|--------|------------------------------|------|-------|------|-------|
| Power Supply Voltage                                |                       | Vcc    | 3.135                        | 3.3  | 3.465 | V    |       |
| Power Consumption                                   |                       |        |                              |      | 14.5  | W    |       |
| Module Input Per Lane                               |                       |        |                              |      |       |      |       |
| Signaling Rate Per Lane                             |                       | TP1    | 53.125 ± 100ppm              |      |       | GBd  |       |
| DC Common-Mode Input Voltage                        |                       | TP1    | -0.35                        |      | 2.85  | V    |       |
| Single-Ended Input Voltage                          |                       | TP1a   | -0.4                         |      | 3.3   | V    |       |
| AC Common-Mode RMS Input Voltage                    | Low-Frequency (VCMLF) | TP1a   | 32                           |      |       | mV   |       |
|                                                     | Full-Band (VCMFB)     |        | 80                           |      |       |      |       |
| Module Stressed Input Test                          |                       |        | IEEE 802.3ck 120G3.4.3       |      |       |      |       |
| Differential Peak-to-Peak Input Voltage Tolerance   |                       | TP1a   | 750                          |      |       | mV   |       |
| Common to Different Mode Input Return Loss          |                       | TP1    | IEEE 802.3ck Equation 120G-2 |      |       |      |       |
| Effective Input Return Loss                         |                       | TP1    | 8.5                          |      |       | dB   |       |
| Differential Input Termination Mismatch             |                       | TP1    |                              |      | 10    | %    |       |
| Module Output Per Lane                              |                       |        |                              |      |       |      |       |
| Signaling Rate Per Lane                             |                       | TP4    | 53.125 ± 100ppm              |      |       | GBd  |       |
| Differential Peak-to-Peak Output Voltage            | Short-Mode            | TP4    |                              |      | 600   | mV   |       |
|                                                     | Long-Mode             |        |                              |      | 845   |      |       |
| AC Common-Mode Output Voltage, RMS                  | Low-Frequency (VCMLF) | TP4    |                              |      | 32    | mV   |       |
|                                                     | Full-Band (VCMFB)     |        |                              |      | 80    |      |       |
| Differential Termination Mismatch                   |                       | TP4    |                              |      | 10    | %    |       |
| Eye Height                                          |                       | TP4    | 15                           |      |       | mV   |       |
| Vertical Eye Closure (VEC)                          |                       | TP4    |                              |      | 12    | dB   |       |
| Common-Mode to Differential-Mode Output Return Loss |                       | TP4    | IEEE 802.3ck Equation 120G-1 |      |       | dB   |       |
| Effective Return Loss                               |                       | TP4    | 8.5                          |      |       | dB   |       |
| Output Transition Time (20-80%)                     |                       | TP4    | 8.5                          |      |       | ps   |       |
| DC Common-Mode Output Voltage                       |                       | TP4    | -350                         |      | 2850  | mV   |       |
| Differential Termination Mismatch                   |                       | TP4    |                              |      | 10    | %    |       |

## Optical Characteristics

| Parameter                                                           | Symbol           | Min.                  | Typ. | Max.       | Unit  | Notes |
|---------------------------------------------------------------------|------------------|-----------------------|------|------------|-------|-------|
| <b>Transmitter</b>                                                  |                  |                       |      |            |       |       |
| Center Wavelength                                                   | $\lambda_C$      | 1304.5                | 1311 | 1317.5     | nm    |       |
| Data Rate Per Lane                                                  |                  | 53.125 $\pm$ 100ppm   |      |            | GBd   |       |
| Modulation Format                                                   |                  | PAM4                  |      |            |       |       |
| Side-Mode Suppression Ratio                                         | SMSR             | 30                    |      |            | dB    |       |
| Average Launch Power Per Lane                                       | Pavg             | -3.1                  |      | 4          | dBm   | 1     |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ) Per Lane | P <sub>oma</sub> | Max. (-0.1-1.5+TDECQ) |      | 4.2        | dBm   | 2     |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ) Per Lane    | TDECQ            |                       |      | 3.4        | dB    |       |
| Transmitter Eye Closure for PAM4 (TECQ) Per Lane                    | TECQ             |                       |      | 3.4        | dB    |       |
| TDECQ – TECQ                                                        |                  |                       |      | 2.5        | dB    |       |
| Over-shoot/Under-shoot                                              |                  |                       |      | 22         | %     |       |
| Transmitter Power Excursion                                         |                  |                       |      | 2          | dBm   |       |
| Extinction Ratio                                                    | 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                                         | Tr               |                       |      | 17         | ps    |       |
| Average Launch Power of Off Transmitter Per Lane                    | Toff             |                       |      | -15        | dBm   |       |
| <b>Receiver</b>                                                     |                  |                       |      |            |       |       |
| Center Wavelength                                                   | $\lambda_C$      | 1304.5                | 1311 | 1317.5     | nm    |       |
| Data Rate Per Lane                                                  |                  | 53.125 $\pm$ 100ppm   |      |            | GBd   |       |
| Modulation Format                                                   |                  | PAM4                  |      |            |       |       |
| Damage Threshold Per Lane                                           | THd              | 5                     |      |            | dBm   | 3     |
| Average Receive Power Per Lane                                      | AOP <sub>R</sub> | -7.1                  |      | 4          | dBm   | 4     |
| Receive Power (OMA <sub>outer</sub> ) Per Lane                      |                  |                       |      | 4.2        | dBm   |       |
| Receiver Sensitivity (OMA <sub>outer</sub> ) Per Lane               | SEN              |                       |      | Equation 1 | dBm   | 5     |
| Stressed Receiver Sensitivity (OMA <sub>outer</sub> ) Per Lane      | SRS              |                       |      | -2.5       | dBm   | 6     |
| Receiver Reflectance                                                | RR               |                       |      | -26        | dB    |       |
| LOS Assert                                                          | LOSA             | -15                   |      | -10.5      | dBm   |       |
| LOS De-Assert                                                       | LOSD             |                       |      | -7.5       | dBm   |       |
| LOS Hysteresis                                                      | LOSH             | 0.5                   |      |            | dBm   |       |
| <b>Conditions of Stress Receiver Sensitivity (Note 7)</b>           |                  |                       |      |            |       |       |
| Stressed Eyer Closure for PAM4 (SECQ) Per Lane Under Test           |                  |                       |      | 3.4        | dB    |       |

**Notes:**

1. Average launch power, per lane (minimum), is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. The values for  $OMA_{outer}(\text{minimum})$  vary with TDECQ. The Illustration of Transmitter  $OMA_{outer}$  and Receiver Sensitivity Mask below illustrates this along with values for  $OMA_{outer}$  (maximum).
3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulation optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
4. Average receiver power, per lane(minimum), is informative and not the principle indicator of signal strength. A receiver power below this value cannot be compliant; however, a value above this does not ensure compliance.
5. Receiver sensitivity ( $OMA_{outer}$ ) is informative and is defined for a transmitter with a value of TECQ up to 3.4 dB. Receiver sensitivity should meet Equation (1), illustrated in the Illustration of Transmitter  $OMA_{outer}$  and Receiver Sensitivity Mask below.

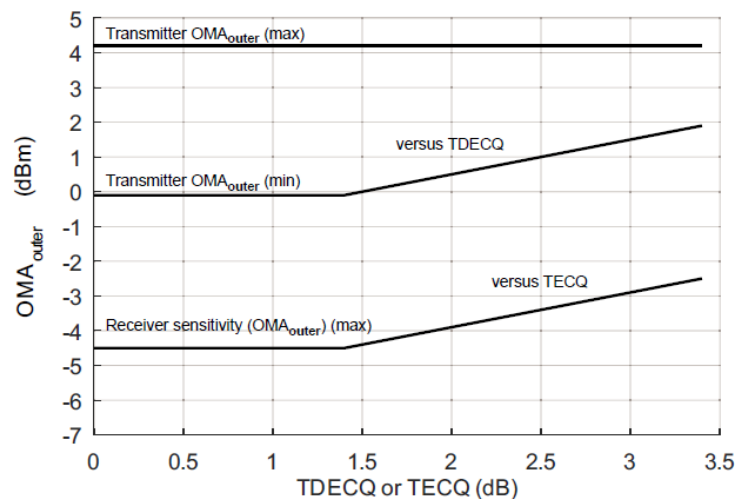
$$RS = \max. (-4.5, \text{TECQ} - 5.9) \text{ dBm}$$

Where:

RS is the receiver sensitivity

TECQ is the TECQ of transmitter used to measure the receiver sensitivity

6. Measured with conformance test signal at TP3 for the  $BER = 2.4 \times 10^{-4}$ .
7. The test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

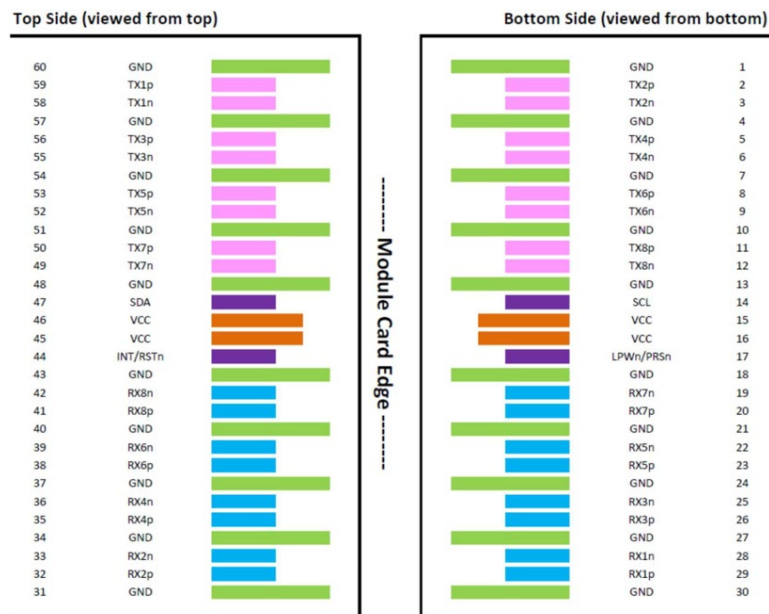
**Illustration of Transmitter  $OMA_{outer}$  and Receiver Sensitivity Mask**

## Pin Descriptions

| Pin | Logic       | Symbol    | Name/Description               | Direction       | Plug Sequence | Notes |
|-----|-------------|-----------|--------------------------------|-----------------|---------------|-------|
| 1   |             | GND       | Module Ground.                 |                 | 1             |       |
| 2   | CML-I       | Tx2+      | Transmitter Data Non-Inverted. | Input from Host | 3             |       |
| 3   | CML-I       | Tx2-      | Transmitter Data Inverted.     | Input from Host | 3             |       |
| 4   |             | GND       | Module Ground.                 |                 | 1             |       |
| 5   | CML-I       | Tx4+      | Transmitter Data Non-Inverted. | Input from Host | 3             |       |
| 6   | CML-I       | Tx4-      | Transmitter Data Inverted.     | Input from Host | 3             |       |
| 7   |             | GND       | Module Ground.                 |                 | 1             |       |
| 8   | CML-I       | Tx6+      | Transmitter Data Non-Inverted. | Input from Host | 3             |       |
| 9   | CML-I       | Tx6-      | Transmitter Data Inverted.     | Input from Host | 3             |       |
| 10  |             | GND       | Module Ground.                 |                 | 1             |       |
| 11  | CML-I       | Tx8+      | Transmitter Data Non-Inverted. | Input from Host | 3             |       |
| 12  | CML-I       | Tx8-      | Transmitter Data Inverted.     | Input from Host | 3             |       |
| 13  |             | GND       | Module Ground.                 |                 | 1             |       |
| 14  | LVC MOS-I/O | SCL       | 2-Wire Serial Interface Clock. | Bi-Directional  | 3             |       |
| 15  |             | Vcc       | +3.3V Power.                   | Power from Host | 2             |       |
| 16  |             | Vcc       | +3.3V Power.                   | Power from Host | 2             |       |
| 17  | Multi-Level | LPWn/PRSn | Low-Power Mode/Module Present. | Bi-Directional  | 3             |       |
| 18  |             | GND       | Module Ground.                 |                 | 1             |       |
| 19  | CML-O       | Rx7-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 20  | CML-O       | Rx7+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 21  |             | GND       | Module Ground.                 |                 | 1             |       |
| 22  | CML-O       | Rx5-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 23  | CML-O       | Rx5+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 24  |             | GND       | Module Ground.                 |                 | 1             |       |
| 25  | CML-O       | Rx3-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 26  | CML-O       | Rx3+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 27  |             | GND       | Module Ground.                 |                 | 1             |       |
| 28  | CML-O       | Rx1-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 29  | CML-O       | Rx1+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 30  |             | GND       | Module Ground.                 |                 | 1             |       |
| 31  |             | GND       | Module Ground.                 |                 | 1             |       |
| 32  | CML-O       | Rx2+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 33  | CML-O       | Rx2-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 34  |             | GND       | Module Ground.                 |                 | 1             |       |
| 35  | CML-O       | Rx4+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 36  | CML-O       | Rx4-      | Receiver Data Inverted.        | Output to Host  | 3             |       |
| 37  |             | GND       | Module Ground.                 |                 | 1             |       |
| 38  | CML-O       | Rx6+      | Receiver Data Non-Inverted.    | Output to Host  | 3             |       |
| 39  | CML-O       | Rx6-      | Receiver Data Inverted.        | Output to Host  | 3             |       |

|    |             |          |                                |                 |   |  |
|----|-------------|----------|--------------------------------|-----------------|---|--|
| 40 |             | GND      | Module Ground.                 |                 | 1 |  |
| 41 | CML-O       | Rx8+     | Receiver Data Non-Inverted.    | Output to Host  | 3 |  |
| 42 | CML-O       | Rx8-     | Receiver Data Inverted.        | Output to Host  | 3 |  |
| 43 |             | GND      | Module Ground.                 |                 | 1 |  |
| 44 | Multi-Level | INT/RSTn | Module Interrupt/Module Reset. | Bi-Directional  | 3 |  |
| 45 |             | Vcc      | +3.3V Power.                   | Power from Host | 2 |  |
| 46 |             | Vcc      | +3.3V Power.                   | Power from Host | 2 |  |
| 47 | LVC MOS-I/O | SDA      | 2-Wire Serial Interface Data.  | Bi-Directional  | 3 |  |
| 48 |             | GND      | Module Ground.                 |                 | 1 |  |
| 49 | CML-I       | Tx7-     | Transmitter Data Inverted.     | Input from Host | 3 |  |
| 50 | CML-I       | Tx7+     | Transmitter Data Non-Inverted. | Input from Host | 3 |  |
| 51 |             | GND      | Module Ground.                 |                 | 1 |  |
| 52 | CML-I       | Tx5-     | Transmitter Data Inverted.     | Input from Host | 3 |  |
| 53 | CML-I       | Tx5+     | Transmitter Data Non-Inverted. | Input from Host | 3 |  |
| 54 |             | GND      | Module Ground.                 |                 | 1 |  |
| 55 | CML-I       | Tx3-     | Transmitter Data Inverted.     | Input from Host | 3 |  |
| 56 | CML-I       | Tx3+     | Transmitter Data Non-Inverted. | Input from Host | 3 |  |
| 57 |             | GND      | Module Ground.                 |                 | 1 |  |
| 58 | CML-I       | Tx1-     | Transmitter Data Inverted.     | Input from Host | 3 |  |
| 59 | CML-I       | Tx1+     | Transmitter Data Non-Inverted. | Input from Host | 3 |  |
| 60 |             | GND      | Module Ground.                 |                 | 1 |  |

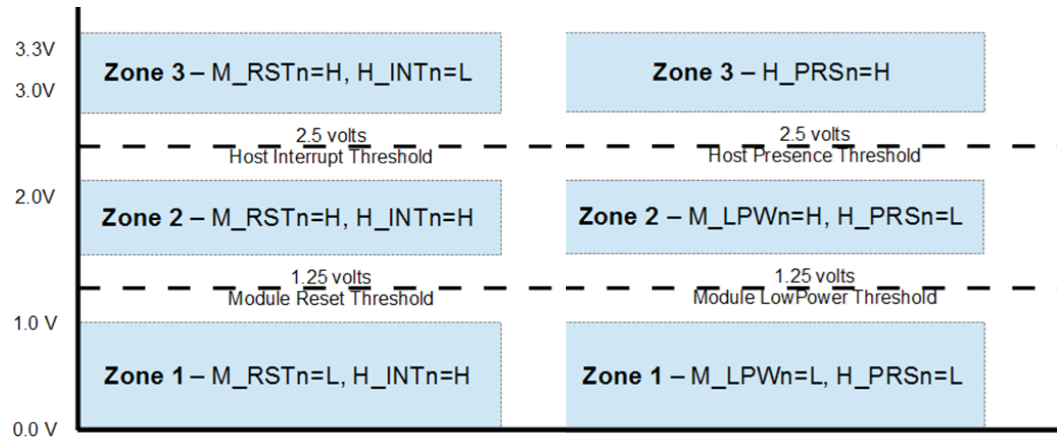
## Electrical Pad Layout



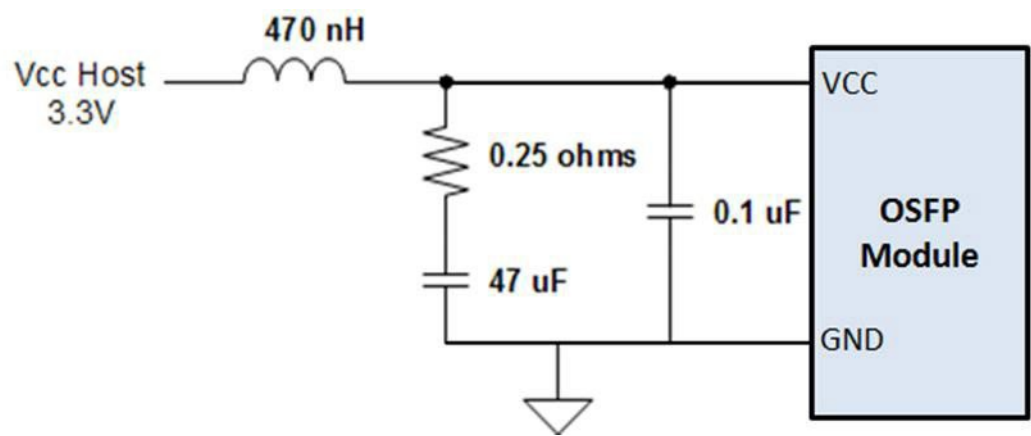
OSFP Control Pins

| Name      | Direction    | Description                                                                                                                                                                                                                                                                                                  |
|-----------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SCL       | BiDir        | 2-wire serial clock signal. Requires pull-up resistor to +3.3V on host.                                                                                                                                                                                                                                      |
| SDA       | BiDir        | 2-wire serial data signal. Requires pull-up resistor to +3.3V on host.                                                                                                                                                                                                                                       |
| LPWn/PRSn | Input/Output | Dual Function Signal <ul style="list-style-type: none"><li>Low-Power Mode is an active-low input signal.</li><li>Module Present is controlled by a pull-down resistor on the module which gets converted to an active-low output logic signal.</li><li>Voltage zones is shown in the figure below.</li></ul> |
| INT/RSTn  | Input/Output | Dual Funtion Signal <ul style="list-style-type: none"><li>Reset is an active-low input signal.</li><li>Interrupt is an active-high output signal voltage zones is shown in the figure below.</li></ul>                                                                                                       |

Voltage Zones



Recommended Power Supply Filter

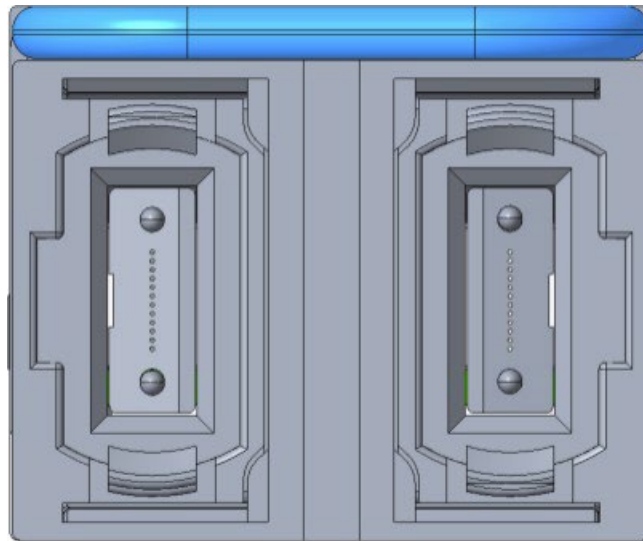


### Optical Port Descriptions

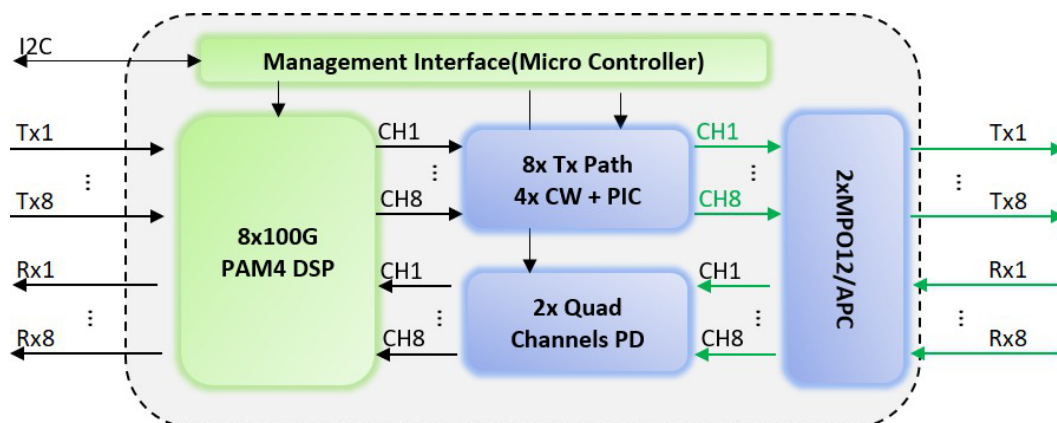
The optical interface port is dual MPO-12 APC receptacle. The transmit and receive optical lanes shall occupy the positions depicted in the figure below when looking into the MDI receptacle with the connector keyway feature on top.

Aligned keys are used to ensure alignment between the modules and the patch cords. The optical connector is orientated such that the keying feature of the MPO receptacle is on the top. **Note:** 2 alignment pins are present in each receptacle.

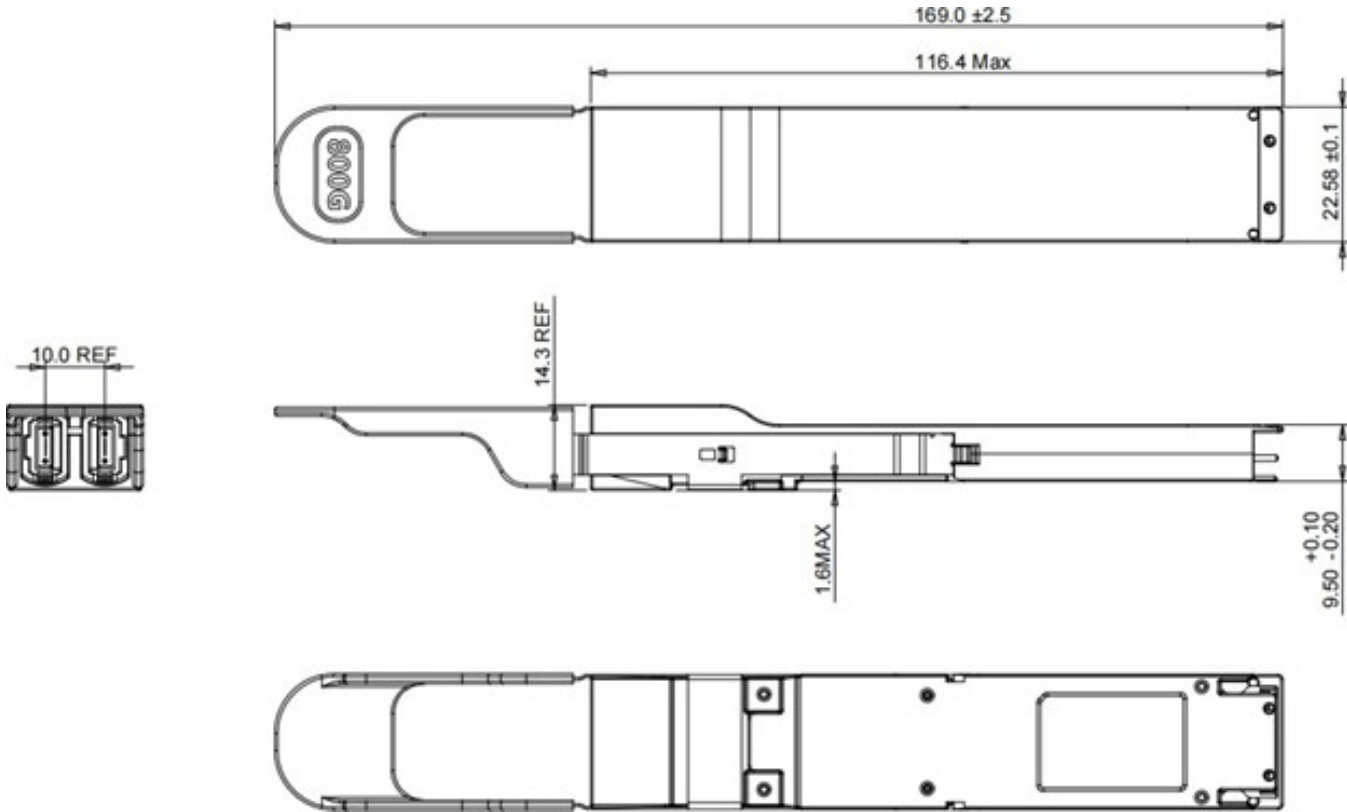
### Optical Media-Dependent Interface Port Assignments



### Transceiver Block Diagram



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.

