



## Q2D28080C005000

MSA 100GBase-DWDM PAM4 QSFP28 Transceiver Single Lambda C-Band 100GHz w/EDFA/DCM (SMF, 1554.94nm, 80km w/EDFA/DCM, LC, DOM)

### Product Description

This MSA Compliant QSFP28 transceiver provides 100GBase-DWDM throughput up to 80km over single-mode fiber (SMF) using a wavelength of 1554.94nm 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:

- SFF-8636 MSA Compliance
- 100GHz DWDM ITU Grid
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- PAM4 optical signal with integrated FEC
- Single-mode Fiber
- Metal with Lower EMI
- Hot Pluggable
- RoHS Compliant and Lead Free
- Excellent ESD Protection



### Applications:

- 100GBase Ethernet
- Access, Metro 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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## Regulatory Compliance

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ESD to the LC Receptacle: compatible with IEC 61000-4-3
- EMI/EMC compatible with FCC Part 15 Subpart B Rules, EN55022:2010
- Laser Eye Safety compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1,2
- RoHS compliant with EU RoHS 2.0 directive 2015/863/EU

## Wavelength Guide (100GHz ITU-T Channel)

| Channel # | Frequency (GHz) | Center Wavelength (nm) | Channel # | Frequency (GHz) | Center Wavelength (nm) |
|-----------|-----------------|------------------------|-----------|-----------------|------------------------|
| 21        | 192.1           | 1560.61                | 41        | 194.1           | 1544.53                |
| 22        | 192.2           | 1559.79                | 42        | 194.2           | 1543.73                |
| 23        | 192.3           | 1558.98                | 43        | 194.3           | 1542.94                |
| 24        | 192.4           | 1558.17                | 44        | 194.4           | 1542.14                |
| 25        | 192.5           | 1557.36                | 45        | 194.5           | 1541.35                |
| 26        | 192.6           | 1556.55                | 46        | 194.6           | 1540.56                |
| 27        | 192.7           | 1555.75                | 47        | 194.7           | 1539.77                |
| 28        | 192.8           | 1554.94                | 48        | 194.8           | 1538.98                |
| 29        | 192.9           | 1554.13                | 49        | 194.9           | 1538.19                |
| 30        | 193.0           | 1553.33                | 50        | 195.0           | 1537.40                |
| 31        | 193.1           | 1552.52                | 51        | 195.1           | 1536.61                |
| 32        | 193.2           | 1551.72                | 52        | 195.2           | 1535.82                |
| 33        | 193.3           | 1550.92                | 53        | 195.3           | 1535.04                |
| 34        | 193.4           | 1550.12                | 54        | 195.4           | 1534.25                |
| 35        | 193.5           | 1549.32                | 55        | 195.5           | 1533.47                |
| 36        | 193.6           | 1548.51                | 56        | 195.6           | 1532.68                |
| 37        | 193.7           | 1547.72                | 57        | 195.7           | 1531.90                |
| 38        | 193.8           | 1546.92                | 58        | 195.8           | 1531.12                |
| 39        | 193.9           | 1546.12                | 59        | 195.9           | 1530.33                |
| 40        | 194.0           | 1545.32                | 60        | 196.0           | 1529.55                |

## Absolute Maximum Ratings

| Parameter                          | Symbol             | Min. | Typical | Max. | Unit |
|------------------------------------|--------------------|------|---------|------|------|
| Storage Temperature (case)         | T <sub>s</sub>     | -40  |         | 85   | °C   |
| Operating Case Temperature         | T <sub>op</sub>    | 0    | 25      | 70   | V    |
| Supply Voltage                     | V <sub>cc</sub>    | 0    |         | 3.6  | V    |
| Relative Humidity (non-condensing) | RH                 | 5    |         | 85   | %    |
| Optical Receiver Damage Threshold  | R <sub>x</sub> dmg | 5    |         |      | dBm  |
| ESD Sensitivity                    |                    | 500  |         |      | V    |

## Electrical Characteristics

The host 4x25.78 Gbps electrical interface complies with the CAUI-4 standard.

| Parameter                       | Symbol            | Min.                 | Typ.     | Max.                 | Unit | Notes                      |
|---------------------------------|-------------------|----------------------|----------|----------------------|------|----------------------------|
| Data Rate per Lane (host side)  | BR <sub>avg</sub> |                      | 25.78125 |                      | Gbps |                            |
| Data Rate Variation             |                   | -100                 |          | 100                  | ppm  |                            |
| Power Supply Voltage            | V <sub>CC</sub>   | 3.135                | 3.3      | 3.47                 | V    |                            |
| Power Consumption               | PD                |                      | 4.7      | 5.5                  | W    |                            |
| Transmitter                     |                   |                      |          |                      |      |                            |
| Input Swing (Differential)      | V <sub>in</sub>   |                      |          | 900                  | mVpp | AC coupled                 |
| Input Impedance (Differential)  | Z <sub>in</sub>   | 90                   | 100      | 110                  | Ohm  |                            |
| Receiver                        |                   |                      |          |                      |      |                            |
| Output Swing (Differential)     | V <sub>out</sub>  |                      |          | 900                  | mVpp | AC coupled                 |
| Output Impedance (Differential) | Z <sub>out</sub>  | 90                   | 100      | 110                  | Ohm  |                            |
| Low Speed Signals               |                   |                      |          |                      |      |                            |
| LPMode, Reset, ModSel           | V <sub>IL</sub>   | -0.3                 |          | 0.8                  | V    |                            |
|                                 | V <sub>IH</sub>   | 2                    |          | V <sub>CC</sub> +0.3 | V    |                            |
| ModPrs, Int                     | V <sub>OL</sub>   | 0                    |          | 0.4                  | V    | IOL = 2.0mA                |
|                                 | V <sub>OH</sub>   | V <sub>CC</sub> -0.5 |          | V <sub>CC</sub> +0.3 | V    |                            |
| SCL, SDA                        | V <sub>IL</sub>   | -0.3                 |          | 0.3*V <sub>CC</sub>  | V    |                            |
|                                 | V <sub>IH</sub>   | 0.7*V <sub>CC</sub>  |          | V <sub>CC</sub> +0.5 | V    |                            |
| SCL, SDA                        | V <sub>OL</sub>   | 0                    |          | 0.4                  | V    | IOL <sub>max</sub> = 3.0mA |
|                                 | V <sub>OH</sub>   | V <sub>CC</sub> -0.5 |          | V <sub>CC</sub> +0.3 | V    |                            |

## Optical Characteristics

| Parameter                                    | Symbol             | Min.            | Typ.      | Max.            | Unit  | Notes |
|----------------------------------------------|--------------------|-----------------|-----------|-----------------|-------|-------|
| Data Rate                                    | BR                 | 103.125         |           |                 | Gbps  | 1     |
| Data Rate Variation                          |                    | -100            |           | 100             | ppm   |       |
| <b>Transmitter</b>                           |                    |                 |           |                 |       |       |
| Central Wavelength                           | $\lambda_C$        | 1527            | $\lambda$ | 1567            | nm    |       |
| Central Wavelength Stability                 |                    | $\lambda_C-0.1$ |           | $\lambda_C+0.1$ | nm    |       |
| Average Output Optical Power                 | P <sub>O</sub>     | -2              | -0.5      | 2               | dBm   | 5     |
| Optical Extinction Ratio (outer)             | ER                 | 6               |           |                 | dB    |       |
| Optical Output Power, TX: OFF                | P <sub>off</sub>   |                 |           | -30             | dBm   |       |
| TX Reflectance                               |                    |                 |           | -26             | dB    |       |
| <b>Receiver</b>                              |                    |                 |           |                 |       |       |
| Operating Wavelength                         |                    | 1527            |           | 1567            | nm    |       |
| RX Sensitivity, Avg Power                    | RX <sub>sens</sub> |                 | -9        | -8              | dBm   | 2, 5  |
| RX Overload, Avg Power                       | RX <sub>sat</sub>  | 4               |           |                 | dBm   | 2     |
| RX Damage Threshold                          | RX <sub>dmg</sub>  | 4               |           |                 | dBm   |       |
| RX Sensitivity, Avg Power at OSNR 32dB/0.1nm |                    |                 |           | -7              | dBm   | 3, 5  |
| Dispersion Tolerance                         |                    | -30             |           | +30             | ps/nm | 4, 5  |
| RX Reflectance                               |                    |                 |           | -26             | dB    |       |
| LOS Assert                                   | LOSA               | -15             |           |                 | dBm   |       |
| LOS De-Assert                                | LOSD               |                 |           | -10.5           | dBm   |       |
| LOS Hysteresis                               |                    |                 | 1         |                 | dB    |       |

### Notes:

1. The raw data rate is minimum 103.125 Gbps, when FEC code is added, the actual optical signal data rate is higher.
2. Rx average power sensitivity and overload are for post-FEC BER < 1E-15 with integrated FEC without dispersion and noise load at BOL.
3. Rx average power sensitivity at OSNR 32dB is for post-FEC BER < 1E-15 with integrated FEC without dispersion at OSNR 32dB/0.1nm at BOL. A 100GHz spacing DWDM filter with enough bandwidth should be used to remove the extra noises of the optical signal with noises for the RX test.
4. Dispersion tolerance is for dispersion values that cause Rx OSNR penalty less than 2 dB when compared with no dispersion at RX power -6 dBm and PRBS15 signal at BER 2e-3 at the operating data rate at BOL. A 100GHz spacing DWDM filter with enough bandwidth should be used to remove the extra noises of the optical signal with noises for the RX BER test.
5. The Average output optical power, RX sensitivity, RX sensitivity at OSNR 32dB/0.1nm, and Dispersion tolerance parameters are specified for beginning of life (BOL) over the operating temperature with clean fiber connectors.

## Pin Descriptions

| Pin | Logic        | Symbol         | Name/Descriptions                   | Plug Sequence | Ref. |
|-----|--------------|----------------|-------------------------------------|---------------|------|
| 1   |              | GND            | Ground                              | 1             | 1    |
| 2   | CML-I        | Tx2n           | Transmitter Inverted Data Input     | 3             |      |
| 3   | CML-I        | Tx2p           | Transmitter Non-Inverted Data Input | 3             |      |
| 4   |              | GND            | Ground                              | 1             | 1    |
| 5   | CML-I        | Tx4n           | Transmitter Inverted Data Input     | 3             |      |
| 6   | CML-I        | Tx4p           | Transmitter Non-Inverted Data Input | 3             |      |
| 7   |              | GND            | Ground                              | 1             | 1    |
| 8   | LVTTL-I      | ModSelL        | Module Select                       | 3             |      |
| 9   | LVTTL-I      | ResetL         | Module Reset                        | 3             |      |
| 10  |              | VccRx          | +3.3V Power Supply Receiver         | 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            | Ground                              | 1             | 1    |
| 14  | CML-O        | Rx3p           | Receiver Non-Inverted Data Output   | 3             |      |
| 15  | CML-O        | Rx3n           | Receiver Inverted Data Output       | 3             |      |
| 16  |              | GND            | Ground                              | 1             | 1    |
| 17  | CML-O        | Rx1p           | Receiver Non-Inverted Data Output   | 3             |      |
| 18  | CML-O        | Rx1n           | Receiver Inverted Data Output       | 3             |      |
| 19  |              | GND            | Ground                              | 1             | 1    |
| 20  |              | GND            | Ground                              | 1             | 1    |
| 21  | CML-O        | Rx2n           | Receiver Inverted Data Output       | 3             |      |
| 22  | CML-O        | Rx2p           | Receiver Non-Inverted Data Output   | 3             |      |
| 23  |              | GND            | Ground                              | 1             | 1    |
| 24  | CML-O        | Rx4n           | Receiver Inverted Data Output       | 3             |      |
| 25  | CML-O        | Rx4p           | Receiver Non-Inverted Data Output   | 3             |      |
| 26  |              | GND            | Ground                              | 1             | 1    |
| 27  | LVTTL-O      | ModPrsL        | Module Present                      | 3             |      |
| 28  | LVTTL-O      | IntL/RX_LOS    | Interrupt                           | 3             | 3    |
| 29  |              | VccTx          | +3.3V Power supply transmitter      | 2             | 2    |
| 30  |              | Vcc1           | +3.3V Power supply                  | 2             | 2    |
| 31  | LVTTL-I      | LPMMode/TX_DIS | Low Power Mode                      | 3             | 3    |
| 32  |              | GND            | Ground                              | 1             | 1    |
| 33  | CML-I        | Tx3p           | Transmitter Non-Inverted Data Input | 3             |      |
| 34  | CML-I        | Tx3n           | Transmitter Inverted Data Input     | 3             |      |
| 35  |              | GND            | Ground                              | 1             | 1    |
| 36  | CML-I        | Tx1p           | Transmitter Non-Inverted Data Input | 3             |      |
| 37  | CML-I        | Tx1n           | Transmitter Inverted Data Input     | 3             |      |
| 38  |              | GND            | Ground                              | 1             | 1    |

**Notes:**

- 1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted.
- 2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently

**Electrical Pin-out Details**



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.

