



## FG-TRAN-QSFP28-LR4-SKY

Fortinet® FG-TRAN-QSFP28-LR4 Compatible 100GBase-LR4 QSFP28 Transceiver (SMF, 1295nm to 1309nm, 10km, LC, DOM)

### Product Description

This Fortinet® FG-TRAN-QSFP28-LR4 compatible QSFP28 transceiver provides 100GBase-LR4 throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1295nm to 1309nm via an LC connector. Our transceiver is built to meet or exceed OEM specifications and is guaranteed to be 100% compatible with Fortinet®. 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:

- SFF-8665 Compliance
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



### Applications:

- 100GBase 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 |
|-------------------------------------|--------|------|------|------|------|
| Maximum Supply Voltage              | Vcc    | -0.5 |      | 3.6  | V    |
| Storage Temperature                 | TS     | -40  |      | 85   | °C   |
| Operating Case Temperature          | Tc     | 0    | 25   | 70   | °C   |
| Operating Humidity                  | RH     | 5    |      | 85   | %    |
| Receiver Damage Threshold, per Lane | Rxdmg  | 5.5  |      |      | dBm  |

## Electrical Characteristics

| Parameter                              | Symbol | Min.                     | Typ. | Max.  | Unit  | Notes   |
|----------------------------------------|--------|--------------------------|------|-------|-------|---------|
| Power Dissipation                      | PD     |                          |      | 3.5   | W     |         |
| Power Supply Voltage                   | Vcc    | 3.135                    | 3.3  | 3.465 | V     |         |
| Transmitter                            |        |                          |      |       |       |         |
| Differential data input swing per lane | Vin    |                          |      | 900   | Mvp-p |         |
| Input Impedance (Differential)         | Zin    |                          |      | 10    | %     |         |
| Stressed Input Parameters              |        |                          |      |       |       |         |
| Eye width                              |        | 0.46                     |      |       | UI    |         |
| Applied pk-pk sinusoidal jitter        |        | IEEE 802.3bm Table 88-13 |      |       |       |         |
| Eye height                             |        | 95                       |      |       | mv    |         |
| DC common mode voltage                 |        | -350                     |      | 2850  | mv    |         |
| Receiver                               |        |                          |      |       |       |         |
| Differential output amplitude          |        | 200                      |      | 900   | Mvp-p |         |
| Output Impedance (Differential)        | Zout   |                          |      | 10    | %     |         |
| Output Rise/Fall Time                  | tr/tf  | 12                       |      |       | ps    | 20%~80% |
| Eye width                              |        | 0.57                     |      |       | UI    |         |
| Eye height differential                |        | 228                      |      |       | mv    |         |
| Vertical eye closure                   |        |                          |      | 5.5   | db    |         |

## Optical Characteristics

| Parameter                                                 | Symbol                           | Min.    | Typ.    | Max.    | Unit  | Notes |
|-----------------------------------------------------------|----------------------------------|---------|---------|---------|-------|-------|
| Transmitter                                               |                                  |         |         |         |       |       |
| Signaling Speed per Lane                                  | Brave                            |         | 25.78   |         | Gbps  |       |
| Data Rate Variation                                       |                                  | -100    |         | +100    |       |       |
| Lane_0 Center Wavelength                                  | $\lambda_{C0}$                   | 1294.53 | 1295.56 | 1296.59 | nm    |       |
| Lane_1 Center Wavelength                                  | $\lambda_{C1}$                   | 1299.02 | 1300.05 | 1301.09 | nm    |       |
| Lane_2 Center Wavelength                                  | $\lambda_{C2}$                   | 1303.54 | 1304.58 | 1305.63 | nm    |       |
| Lane_3 Center Wavelength                                  | $\lambda_{C3}$                   | 1308.09 | 1309.14 | 1310.19 | nm    |       |
| Average Launch Power each Lane                            | P <sub>each</sub>                | -4.3    |         | 4.5     | dBm   | 1     |
| Optical Modulation Amplitude (OMA) each Lane              | TxOMA                            | -1.3    |         | 4.5     | dBm   |       |
| Difference in launch power between any two lanes (OMA)    |                                  |         |         | 5       | dB    |       |
| Launch power in OMA minus TDP, each lane                  |                                  | -2.3    |         |         | dBm   |       |
| Transmitter and dispersion penalty (TDP), each lane       |                                  |         |         | 2.2     | dB    |       |
| Extinction Ratio                                          | ER                               | 4       |         |         | dB    |       |
| Side-mode Suppression ratio                               | SMSR <sub>min</sub>              | 30      |         |         | dB    |       |
| Average launch power of OFF transmitter per lane          |                                  |         |         | -30     | dBm   |       |
| Relative Intensity Noise                                  | RIN                              |         |         | -130    | dB/hz |       |
| Transmitter Reflectance                                   |                                  |         |         | -12     | dB    |       |
| Optical Return Loss Tolerance                             |                                  |         |         | 20      | dB    |       |
| Transmitter eye mask definitions: X1, X2, X3, Y1, Y2, Y3  | 0.25, 0.4, 0.45, 0.25, 0.28, 0.4 |         |         |         |       | 2     |
| Receiver                                                  |                                  |         |         |         |       |       |
| Signaling Speed per Lane                                  | BRAVE                            |         | 25.78   |         | Gbps  |       |
| Data Rate Variation                                       |                                  | -100    |         | +100    | ppm   |       |
| Damage threshold per lane                                 | Rxdmg                            | 5.5     |         |         | dBm   |       |
| Lane_0 Center Wavelength                                  | $\lambda_{C0}$                   | 1294.53 | 1295.56 | 1296.59 | nm    |       |
| Lane_1 Center Wavelength                                  | $\lambda_{C1}$                   | 1299.02 | 1300.05 | 1301.09 | nm    |       |
| Lane_2 Center Wavelength                                  | $\lambda_{C2}$                   | 1303.54 | 1304.58 | 1305.63 | nm    |       |
| Lane_3 Center Wavelength                                  | $\lambda_{C3}$                   | 1308.09 | 1309.14 | 1310.19 | nm    |       |
| Average Receive Power per Lane                            | Rxpow                            | -10.6   |         | 4.5     | dBm   | 3     |
| Receive Power (OMA) per Lane                              | RxOMA                            |         |         | 4.5     | dBm   |       |
| Receive Sensitivity in OMA per Lane                       | Rxsens                           |         |         | -8.6    | dBm   |       |
| Receiver 3 dB electrical upper cutoff frequency, per lane |                                  |         |         | 31      | GHz   |       |
| Stressed Receiver Sensitivity (OMA) per Lane              | RXSRS                            |         |         | -6.8    | dBm   | 4     |

|                                                         |      |     |      |     |     |   |
|---------------------------------------------------------|------|-----|------|-----|-----|---|
| <b>Optical Return Loss</b>                              | ORL  |     |      | -26 | dB  |   |
| <b>LOS Assert</b>                                       | LOSA | -25 |      |     | dBm |   |
| <b>LOS De-Assert</b>                                    | LOSD |     |      | -12 | dBm |   |
| <b>LOS Hysteresis</b>                                   |      | 0.5 |      |     | dB  |   |
| <b>Conditions of stressed receiver sensitivity test</b> |      |     |      |     |     |   |
| <b>Vertical eye closure penalty</b>                     | VECP |     | 1.8  |     | dB  | 5 |
| <b>Stressed eye J2 Jitter</b>                           | J2   |     | 0.3  |     | UI  | 5 |
| <b>Stressed eye J9 Jitter</b>                           | J9   |     | 0.47 |     | UI  | 5 |

**Notes:**

1. Average launch power, each lane (min) 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. Hit ratio  $5 \times 10^{-5}$ .
3. 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.
4. Measured with conformance test signal at TP3 for BER = 10<sup>-12</sup>.
5. Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## Pin Descriptions

| Pin | Logic       | Symbol  | Name/Descriptions                                   | Ref. |
|-----|-------------|---------|-----------------------------------------------------|------|
| 1   |             | GND     | Module Ground                                       | 1    |
| 2   | CML-I       | Tx2-    | Transmitter inverted data input                     |      |
| 3   | CML-I       | Tx2+    | Transmitter non-inverted data input                 |      |
| 4   |             | GND     | Module Ground                                       | 1    |
| 5   | CML-I       | Tx4-    | Transmitter inverted data input                     |      |
| 6   | CML-I       | Tx4+    | Transmitter non-inverted data input                 |      |
| 7   |             | GND     | Module Ground                                       | 1    |
| 8   | LVTTTL-I    | MODSEIL | Module Select                                       | 2    |
| 9   | LVTTTL-I    | ResetL  | Module Reset                                        | 2    |
| 10  |             | VCCRx   | +3.3v Receiver Power Supply                         |      |
| 11  | LVC MOS-I   | SCL     | 2-wire Serial interface clock                       | 2    |
| 12  | LVC MOS-I/O | SDA     | 2-wire Serial interface data                        | 2    |
| 13  |             | GND     | Module Ground                                       | 1    |
| 14  | CML-O       | RX3+    | Receiver non-inverted data output                   |      |
| 15  | CML-O       | RX3-    | Receiver inverted data output                       |      |
| 16  |             | GND     | Module Ground                                       | 1    |
| 17  | CML-O       | RX1+    | Receiver non-inverted data output                   |      |
| 18  | CML-O       | RX1-    | Receiver inverted data output                       |      |
| 19  |             | GND     | Module Ground                                       | 1    |
| 20  |             | GND     | Module Ground                                       | 1    |
| 21  | CML-O       | RX2-    | Receiver inverted data output                       |      |
| 22  | CML-O       | RX2+    | Receiver non-inverted data output                   |      |
| 23  |             | GND     | Module Ground                                       | 1    |
| 24  | CML-O       | RX4-    | Receiver inverted data output                       |      |
| 25  | CML-O       | RX4+    | Receiver non-inverted data output                   |      |
| 26  |             | GND     | Module Ground                                       | 1    |
| 27  | LVTTTL-O    | ModPrsL | Module Present, internal pulled down to GND         |      |
| 28  | LVTTTL-O    | IntL    | Interrupt output, should be pulled up on host board | 2    |
| 29  |             | VCCTx   | +3.3v Transmitter Power Supply                      |      |
| 30  |             | VCC1    | +3.3v Power Supply                                  |      |
| 31  | LVTTTL-I    | LPMode  | Low Power Mode                                      | 2    |
| 32  |             | GND     | Module Ground                                       | 1    |
| 33  | CML-I       | Tx3+    | Transmitter non-inverted data input                 |      |
| 34  | CML-I       | Tx3-    | Transmitter inverted data input                     |      |
| 35  |             | GND     | Module Ground                                       | 1    |
| 36  | CML-I       | Tx1+    | Transmitter non-inverted data input                 |      |
| 37  | CML-I       | Tx1-    | Transmitter inverted data input                     |      |
| 38  |             | GND     | Module Ground                                       | 1    |

**Notes:**

- 1. Module circuit ground is isolated from module chassis ground with in the module.
- 2. Open collector; should be pulled up with 4.7k-10k ohms on host board to a voltage between 3.15V and 3.6V.

**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.

