



## SPD40100102DC2I

Juniper Networks® EX-SFP-10GE-ZR-45.32-100-I Compatible 10GBase-DWDM SFP+ Transceiver (SMF, 1545.32nm, 100km, LC, DOM, -40 to 85C)

### Product Description

This Juniper Networks® EX-SFP-10GE-ZR-45.32-100-I compatible SFP+ transceiver provides 10GBase-DWDM throughput up to 100km over single-mode fiber (SMF) using a wavelength of 1545.32nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Juniper Networks® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. 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-8432 and SFF-8472 Compliance
- Duplex LC Connector
- Industrial Temperature -40 to 85 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



### Applications:

- 10x Gigabit Ethernet over DWDM
- Access, Metro and Enterprise
- 8x/10x Fibre Channel

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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 (THz) | Center Wavelength (nm) |
|-----------|-----------------|------------------------|
| 34        | 193.4           | 1550.12                |
| 35        | 193.5           | 1549.32                |
| 36        | 193.6           | 1548.51                |
| 37        | 193.7           | 1547.72                |
| 38        | 193.8           | 1546.92                |
| 39        | 193.9           | 1546.12                |
| 40        | 194.0           | 1545.32                |
| 41        | 194.1           | 1544.53                |
| 42        | 194.2           | 1543.73                |
| 43        | 194.3           | 1542.94                |
| 44        | 194.4           | 1542.14                |
| 45        | 194.5           | 1541.35                |
| 46        | 194.6           | 1540.56                |
| 47        | 194.7           | 1539.77                |
| 48        | 194.8           | 1538.98                |
| 49        | 194.9           | 1538.19                |
| 50        | 195.0           | 1537.40                |
| 51        | 195.1           | 1536.61                |
| 52        | 195.2           | 1535.82                |
| 53        | 195.3           | 1535.04                |
| 54        | 195.4           | 1534.25                |
| 55        | 195.5           | 1533.47                |
| 56        | 195.6           | 1532.68                |
| 57        | 195.7           | 1531.90                |
| 58        | 195.8           | 1531.12                |
| 59        | 195.9           | 1530.33                |
| 60        | 196.0           | 1529.55                |
| 61        | 196.1           | 1528.77                |

## Absolute Maximum Ratings

| Parameter                  | Symbol | Min. | Typ.    | Max. | Unit |
|----------------------------|--------|------|---------|------|------|
| Storage Temperature        | TS     | -40  |         | 85   | °C   |
| Operating Case Temperature | Tc     | -40  | 25      | 85   | °C   |
| Supply Voltage             | Vcc    | -0.5 |         | 4.0  | V    |
| Relative Humidity          | RH     | 5    |         | 95   | %    |
| Data Rate                  |        |      | 10.3125 |      | Gb/s |

## Electrical Characteristics

| Parameter                        | Symbol                          | Min.            | Typ. | Max.                | Unit              | Notes |
|----------------------------------|---------------------------------|-----------------|------|---------------------|-------------------|-------|
| Supply Voltage                   | Vcc                             | 3.135           | 3.3  | 3.465               | V                 |       |
| Module Supply Current            | Icc                             |                 |      | 550                 | mA                |       |
| Power Dissipation                | P <sub>D</sub>                  |                 |      | 1.8                 | W                 |       |
| Transmitter                      |                                 |                 |      |                     |                   |       |
| Input Differential Impedance     | Z <sub>IN</sub>                 |                 | 100  |                     | Ω                 |       |
| Differential Data Input Swing    | V <sub>IN, P-P</sub>            | 180             |      | 700                 | mV <sub>P-P</sub> |       |
| TX_FAULT                         | Transmitter Fault               | V <sub>OH</sub> | 2.0  | V <sub>CCHOST</sub> | V                 |       |
|                                  | Normal Operation                | V <sub>OL</sub> | 0    | 0.8                 | V                 |       |
| TX_DISABLE                       | Transmitter Disable             | V <sub>IH</sub> | 2.0  | V <sub>CCHOST</sub> | V                 |       |
|                                  | Transmitter Enable              | V <sub>IL</sub> | 0    | 0.8                 | V                 |       |
| Receiver                         |                                 |                 |      |                     |                   |       |
| Output Differential Impedance    | Z <sub>O</sub>                  |                 | 100  |                     | Ω                 |       |
| Differential Data Output Swing   | V <sub>OUT, P-P</sub>           | 300             |      | 850                 | mV <sub>P-P</sub> | 1     |
| Data Output Rise Time, Fall Time | t <sub>r</sub> , t <sub>f</sub> | 28              |      |                     | ps                | 2     |
| RX_LOS                           | Loss of signal (LOS)            | V <sub>OH</sub> | 2.0  | V <sub>CCHOST</sub> | V                 | 3     |
|                                  | Normal Operation                | V <sub>OL</sub> | 0    | 0.8                 | V                 | 3     |

## Notes:

1. Internally AC coupled, but requires a external 100Ω differential load termination.
2. 20–80%.
3. LOS is an open collector output. Should be pulled up with 4.7KΩ on the host board.

## Optical Characteristics

| Parameter                                | Symbol                                                  | Minimum | Typical | Maximum | Unit  | Notes |
|------------------------------------------|---------------------------------------------------------|---------|---------|---------|-------|-------|
| Transmitter                              |                                                         |         |         |         |       |       |
| Launch Optical Power                     | P <sub>o</sub>                                          | +1.0    |         | +4.0    | dBm   | 1     |
| Center Wavelength Range                  | λ <sub>c</sub>                                          | 1528.77 |         | 1550.22 | nm    |       |
| Center Wavelength Spacing                |                                                         |         | 100     |         | GHz   |       |
| Center Wavelength Tolerance              | Δλ <sub>c</sub>                                         | -100    |         | 100     | pm    |       |
| Extinction Ratio                         | EX                                                      | 9.0     |         |         | dB    | 2     |
| Side Mode Suppression Ratio              | SMSR                                                    | 30      |         |         | dB    |       |
| Spectral Width (-20dB)                   |                                                         |         |         | 1       | nm    |       |
| Transmitter and Dispersion Penalty       | TDP                                                     |         |         | 4.0     | dB    |       |
| Relative Intensity Noise                 | RIN                                                     |         |         | -128    | dB/Hz |       |
| Optical Return Loss Tolerance            | ORLT                                                    |         |         | 21      | dB    |       |
| P <sub>out</sub> @TX-Disable Asserted    | P <sub>off</sub>                                        |         |         | -30     | dBm   | 1     |
| Eye Diagram                              | IEEE Std 802.3-2005 10Gb Ethernet 10GBASE-ZR compatible |         |         |         |       |       |
| Receiver                                 |                                                         |         |         |         |       |       |
| Center Wavelength                        | λ <sub>c</sub>                                          | 1528    |         | 1565    | nm    |       |
| Receiver Sensitivity (P <sub>avg</sub> ) | S                                                       |         |         | -26     | dBm   | 3     |
| Receiver Overload (P <sub>avg</sub> )    | P <sub>OL</sub>                                         | -7.0    |         |         | dBm   | 3     |
| Optical Return Loss                      | ORL                                                     |         |         | -27     | dB    |       |
| OSNR                                     |                                                         | 27      |         |         | dB    | 4     |
| Max OSNR Path Penalty                    |                                                         |         |         | 4       | dB    | 4     |
| Dispersion Limited Distance              |                                                         |         |         | 100     | Km    |       |
| LOS De-Assert                            | LOS <sub>D</sub>                                        |         |         | -26     | dBm   |       |
| LOS Assert                               | LOS <sub>A</sub>                                        | -35     |         |         | dBm   |       |
| LOS Hysteresis                           |                                                         | 0.5     |         |         | dB    |       |

### Notes:

1. The optical power is launched into 9/125 $\mu$ m SMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps.
3. Measured with PRBS 2<sup>31</sup>-1 test pattern, 10.3125Gb/s, BER<10<sup>-12</sup>.
4. Receiver power@ -7~-18dBm, 10.3125Gb/s, BER<10<sup>-12</sup>.

## Pin Descriptions

| Pin | Symbol     | Name/Descriptions                                                              | Ref. |
|-----|------------|--------------------------------------------------------------------------------|------|
| 1   | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |
| 2   | TX Fault   | Transmitter Fault. LVTTTL-O                                                    | 2    |
| 3   | TX Disable | Transmitter Disable. Laser output disabled on high or open. LVTT-I.            | 3    |
| 4   | SDA        | 2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i). LVTTTL-I/O. |      |
| 5   | SCL        | 2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i). LVTTTL-I.   |      |
| 6   | MOD_ABS    | Module Absent, Connect to VeeT or VeeR in Module.                              | 4    |
| 7   | RS0        | Rate Select 0. Not used                                                        | 5    |
| 8   | LOS        | Loss of Signal indication. Logic 0 indicates normal operation. LVTTTL-O.       | 2    |
| 9   | RS1        | Rate Select 1. Not used                                                        | 5    |
| 10  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 11  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 12  | RD-        | Receiver Inverted DATA out. AC Coupled. CML-O.                                 |      |
| 13  | RD+        | Receiver Non-inverted DATA out. AC Coupled. CML-O.                             |      |
| 14  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 15  | VccR       | Receiver Power Supply.                                                         |      |
| 16  | VccT       | Transmitter Power Supply.                                                      |      |
| 17  | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |
| 18  | TD+        | Transmitter Non-Inverted DATA in. AC Coupled. CML-I.                           |      |
| 19  | TD-        | Transmitter Inverted DATA in. AC Coupled. CML-O.                               |      |
| 20  | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |

## Notes:

1. The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
2. This contact is an open collector/drain output and should be pulled up to the Vcc\_Host with resistor in the range 4.7KΩ to 10KΩ. Pull ups can be connected to one or several power supplies, however the host board design shall ensure that no module contract has voltage exceeding module VccT/R +0.5.V.
3. Tx\_Disable is an input contact with a 4.7KΩ to 10KΩ pull-up resistor to VccT inside module.
4. Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull the contract up to Vcc\_Host with a resistor in the range from 4.7KΩ to 10KΩ. Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.
5. Internally pulled down per SFF-8431



Pin-out of connector Block on Host board

### Recommended Application Interface Block Diagram



Mechanical Specifications

Small Form Factor Pluggable (SFP) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).



EEPROM Information

EEPROM memory map specific data field description is as below:

| 2 wire address 1010000X (A0h)           | 2 wire address 1010001X (A2h)             |
|-----------------------------------------|-------------------------------------------|
| 0                                       | 0                                         |
| Serial ID Defined by SFP MSA (96 bytes) | Alarm and Warning Thresholds (56 bytes)   |
| 95                                      | 55                                        |
| Vendor Specific (32 bytes)              | Cal Constants (40 bytes)                  |
| 127                                     | 95                                        |
| Reserved, SFF8079 (128 bytes)           | Real Time Diagnostic Interface (24 bytes) |
|                                         | 119                                       |
|                                         | 127                                       |
|                                         | Vendor Specific (8 bytes)                 |
|                                         | User Writable EEPROM (120 bytes)          |
|                                         | 247                                       |
| 255                                     | 255                                       |
|                                         | Vendor Specific (8 bytes)                 |

# 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.

