

### 160-9401-900-DW40-C

Ciena® 160-9401-900-DW40 Compatible TAA 100GBase-DWDM PAM4 Single Lambda QSFP28 Transceiver (SMF, 1545.32nm, 80km w/EDFA/DCM, LC, DOM)

#### Features:

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



#### Applications:

- 100GBase Ethernet
- Access, Metro and Enterprise

#### Product Description

This Ciena® 160-9401-900-DW40 compatible QSFP28 transceiver provides 100GBase-DWDM throughput up to 80km 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 Ciena® 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. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

ProLabs's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## 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  | Rxdmg           | 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    |                            |
| <b>Transmitter</b>              |                   |                      |          |                      |      |                            |
| Input Swing (Differential)      | V <sub>in</sub>   |                      |          | 900                  | mVpp | AC coupled                 |
| Input Impedance (Differential)  | Z <sub>in</sub>   | 90                   | 100      | 110                  | Ohm  |                            |
| <b>Receiver</b>                 |                   |                      |          |                      |      |                            |
| Output Swing (Differential)     | V <sub>out</sub>  |                      |          | 900                  | mVpp | AC coupled                 |
| Output Impedance (Differential) | Z <sub>out</sub>  | 90                   | 100      | 110                  | Ohm  |                            |
| <b>Low Speed Signals</b>        |                   |                      |          |                      |      |                            |
| 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   | LVTTTL-I    | ModSelL       | Module Select                       | 3             |      |
| 9   | LVTTTL-I    | ResetL        | Module Reset                        | 3             |      |
| 10  |             | VccRx         | +3.3V Power Supply Receiver         | 2             | 2    |
| 11  | LVCNOS- I/O | SCL           | 2-wire serial interface clock       | 3             |      |
| 12  | LVCNOS- 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  | LVTTTL-O    | ModPrsL       | Module Present                      | 3             |      |
| 28  | LVTTTL-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  | LVTTTL-I    | LPMODE/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 ProLabs**

Our experience comes as standard; for over 15 years ProLabs has delivered optical connectivity solutions that give our customers freedom and choice through our ability to provide seamless interoperability. At the heart of our company is the ability to provide state-of-the-art optical transport and connectivity solutions that are compatible with over 90 optical switching and transport platforms.

## **Complete Portfolio of Network Solutions**

ProLabs is focused on innovations in optical transport and connectivity. The combination of our knowledge of optics and networking equipment enables ProLabs to be your single source for optical transport and connectivity solutions from 100Mb to 400G while providing innovative solutions that increase network efficiency. We provide the optical connectivity expertise that is compatible with and enhances your switching and transport equipment.

## **Trusted Partner**

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure that you get immediate answers to your questions and compatible product when needed. With Engineering and Manufacturing offices in the U.K. and U.S. augmented by field offices throughout the U.S., U.K. and Asia, ProLabs is able to be our customers best advocate 24 hours a day.

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