

## 16094029004WDM40I-AO

Ciena® 160-9402-900-4WDM-40-I Compatible TAA 100GBase-4WDM-40 QSFP28 Transceiver (SMF, 1295nm to 1309nm, 40km, LC, DOM, -40 to 85C)

### Features

- QSFP28 MSA compliant
- Single 3.3V Power Supply and Power dissipation < 5W
- Supports 103Gbps
- Operating case temperature: -40C to 85C
- Four 25Gbps Cooled DFB-based LAN-WDM lasers on transmitter side
- Up to 40km over SMF with FEC on host
- 4x25G electrical interface
- APD and TIA array on the receiver side
- I2C interface with integrated Digital Diagnostic Monitoring
- Duplex LC receptacles
- RoHS compliant



### Applications

- 100GBase Ethernet
- Access and Enterprise

### Product Description

This Ciena® 160-9402-900-4WDM-40-I compatible QSFP28 transceiver provides 100GBase-4WDM-40 throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1295nm to 1309nm 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.

AddOn'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."



## Absolute Maximum Ratings

| Parameter                   | Symbol          | Min. | Max. | Unit |
|-----------------------------|-----------------|------|------|------|
| Maximum Supply Voltage      | V <sub>cc</sub> | -0.5 | 3.6  | V    |
| Storage Temperature         | T <sub>S</sub>  | -40  | 85   | °C   |
| Operating Case Temperature  | T <sub>c</sub>  | -40  | 85   | °C   |
| Operating Relative Humidity | RH              | 5    | 85   | %    |

## Electrical Characteristics

| Parameter                              | Symbol           | Min.                     | Typ. | Max.  | Unit              | Notes |
|--|------------------|--------------------------|------|-------|-------------------|-------|
| Power Supply Voltage                   | V <sub>cc</sub>  | 3.135                    | 3.3  | 3.465 | V                 |       |
| Power Dissipation                      | PD               |                          |      | 5     | W                 |       |
| <b>Transmitter</b>                     |                  |                          |      |       |                   |       |
| Differential data input swing per lane |                  |                          |      | 900   | mV <sub>p-p</sub> |       |
| Input Impedance (Differential)         | Z <sub>in</sub>  |                          |      | 10    | %                 |       |
| <b>Stressed Input Parameters</b>       |                  |                          |      |       |                   |       |
| 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                |       |
| <b>Receiver</b>                        |                  |                          |      |       |                   |       |
| Differential output amplitude          |                  | 200                      |      | 900   | mV <sub>p-p</sub> |       |
| Output Impedance (Differential)        | Z <sub>out</sub> |                          |      | 10    | %                 |       |
| Eye width                              |                  | 0.57                     |      |       | UI                |       |
| Eye height differential                |                  | 228                      |      |       | mv                |       |
| Vertical eye closure                   |                  |                          |      | 5.5   | dB                |       |

## Optical Characteristics

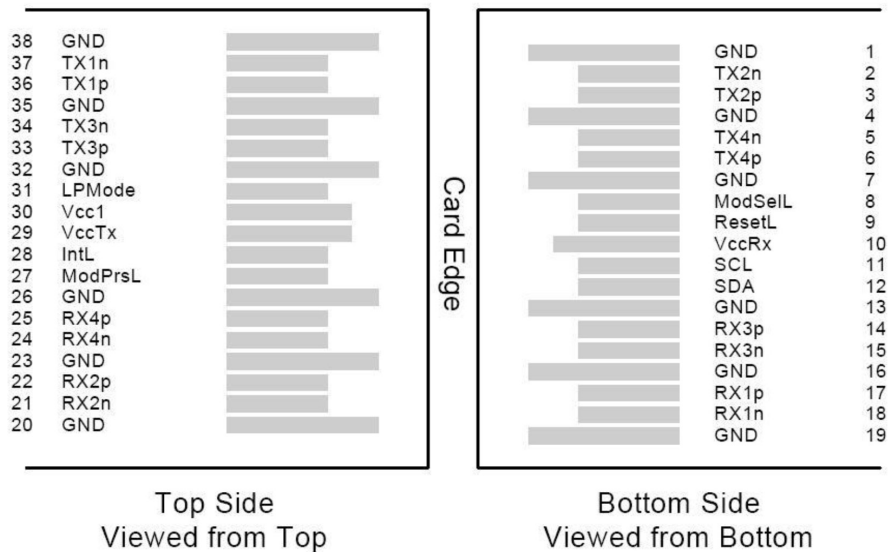
| Parameter  | Symbol              | Min.                               | Typ.    | Max.    | Unit | Notes |
|--|---------------------|------------------------------------|---------|---------|------|-------|
| <b>Transmitter</b>                                       |                     |                                    |         |         |      |       |
| Signaling Speed per Lane                                 | BRAVE               |                                    | 25.78   |         | Gbps |       |
| Data Rate Variation                                      |                     | -100                               |         | +100    | ppm  |       |
| 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   |       |
| Total Average Launch Power                               | PT                  |                                    |         | 12.5    | dBm  |       |
| Average Launch Power per Lane                            | Peach               | -2.5                               |         | 6.5     | dBm  | 1     |
| Optical Modulation Amplitude (OMA) each Lane (max)       | OMAm <sub>ax</sub>  |                                    |         | 6.5     | dBm  |       |
| Optical Modulation Amplitude (OMA), each lane (min)      | OMAm <sub>in</sub>  | 0.5                                |         |         | dBm  | 2     |
| Launch power in OMA minus TDP, each lane (min)           | OMA-TDP             | -0.5                               |         |         | dBm  |       |
| Average launch Power of OFF Transmitter per Lane         |                     |                                    |         | -30     | dBm  |       |
| Side-mode suppression ratio                              | SMSR <sub>min</sub> | 30                                 |         |         | dB   |       |
| Difference in Launch Power Between Any Two Lanes (OMA)   |                     |                                    |         | 4       | dB   |       |
| Optical Return Loss Tolerance                            |                     | 20                                 |         |         | dB   |       |
| Transmitter Reflectance                                  |                     |                                    |         | -26     | dB   | 3     |
| Extinction Ratio   | ER                  | 4.5                                |         |         | dB   | 4     |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3} |                     | {0.25, 0.4, 0.45, 0.25, 0.28, 0.4} |         |         |      | 4     |
| <b>Receiver</b>  |                     |                                    |         |         |      |       |
| Signaling Speed per Lane                                 | BRAVE               |                                    | 25.78   |         | Gbps |       |
| Data Rate Variation                                      |                     | -100                               |         | +100    | ppm  |       |
| Receiver Overload per Lane                               | Psat                | -3                                 |         |         | 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                           | Rxp <sub>ow</sub>   | -20.5                              |         | -3.5    | dBm  | 5     |
| Damage threshold per lane (min)                          | Pd <sub>amage</sub> |                                    |         | -2.5    | dBm  | 6     |
| Receive Sensitivity in (OMA) per Lane                    | Rxs <sub>ens</sub>  |                                    |         | -18.5   | dBm  | 7     |
| Stressed Receiver Sensitivity (OMA) per Lane             | RXSRS               |                                    |         | -16     | dBm  | 8     |
| Optical Return Loss                                      | ORL                 |                                    |         | -26     | dB   |       |
| LOS Assert   | LOSA                | -30                                |         |         | dBm  |       |

|  |      |     |                                   |     |     |   |
|--|------|-----|-----------------------------------|-----|-----|---|
| LOS De-Assert                                    | LOSD |     |                                   | -21 | dBm |   |
| LOS Hysteresis                                   |      | 0.5 |                                   |     | dB  |   |
| <b>Conditions of Receiver Sensitivity Test</b>   |      |     |                                   |     |     |   |
| Vertical Eye Closure Penalty per lane            |      |     | 2.5                               |     | dB  | 9 |
| Stressed Eye J2 Jitter per lane                  |      |     | 0.33                              |     | UI  | 9 |
| Stressed Eye J4 Jitter per lane                  |      |     | 0.48                              |     | UI  | 9 |
| SRS eye mask definition {X1, X2, X3, Y1, Y2, Y3} |      |     | {0.39, 0.5, 0.5, 0.39, 0.39, 0.4} |     |     | 9 |

**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. Even if the TDP < 1.0dB, the OMA (min) must exceed this value.
3. Transmitter reflectance is defined looking into the transmitter.
4. Eye mask hit ratio is 5E-5.
5. 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.
6. The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level.
7. Receiver sensitivity (OMA), each lane (max) at 5E-5 BER is a normative specification.
8. Measured with conformance test signal at TP3 for BER = 5\*10<sup>-5</sup>.
9. Vertical eye closure penalty, stressed eye J2 Jitter, stressed eye J4 Jitter, and SRS eye mask definition are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

**Electrical Pin-out Details**



## Pin Descriptions

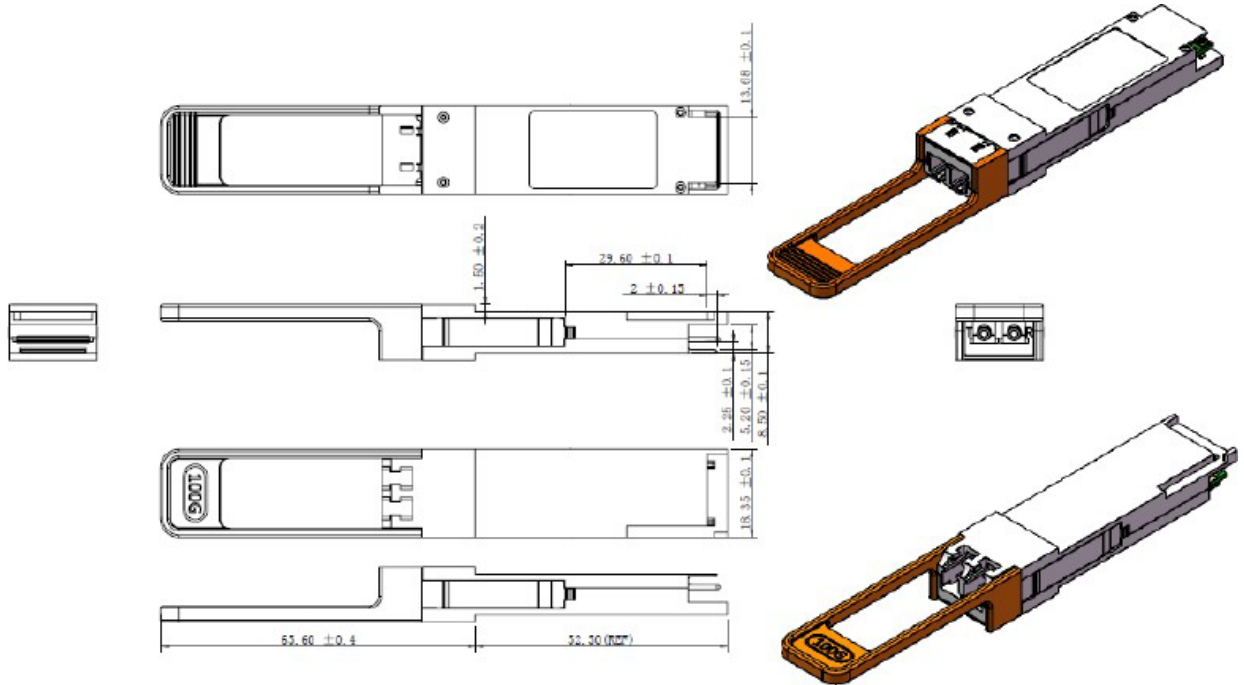
| Pin | Logic       | Symbol  | Name/Descriptions                    | Plug Sequence | Ref. |
|-----|-------------|---------|--------------------------------------|---------------|------|
| 1   |             | GND     | Ground                               | 1             | 1    |
| 2   | CML-I       | 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 output | 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  | LVCMOS- I/O | SCL     | 2-Wire Serial Interface Clock        | 3             |      |
| 12  | LVCMOS- 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    | Interrupt                            | 3             |      |
| 29  |             | VccTx   | +3.3V Power Supply Transmitter       | 2             | 2    |
| 30  |             | Vccl    | +3.3V Power Supply                   | 2             | 2    |
| 31  | LVTTTL-I    | LPMode  | Low Power Mode                       | 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. Connect these directly to the host board signal-common ground plane.
2. VccRx, Vcc1 and VccTx are the receiver and transmitter power supplies and shall be applied concurrently. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP28 Module in any combination. The connector pins are each rated for a maximum current of 1000mA.

**Mechanical Specifications**



## **About AddOn Networks**

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is engrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



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