

## **QDD4-400GB-ER4-N-OPC**

Alcatel-Lucent Nokia® Compatible TAA 400GBase-ER4 PAM4 QSFP-DD Transceiver (SMF, 1310nm, 40km, LC, DOM, CMIS 4.0)

### **Features**

- Compliant with IEEE Std 802.3cd
- Compliant with QSFP-DD MSA
- Compliant with QSFP-DD Management Interface

### **Specifications**

- Duplex LC
- 53.125GBd PAM4x4 Cooled EML
- 26.5625GBd PAM4x8 Electrical Connector
- Single 3.3V Power Supply
- Up to 40km on SMF
- Operating Temperature: 0 to 70 Celsius
- RoHS Compliant and Lead-Free



### **Applications:**

- 400GBase Ethernet
- Access and Enterprise

### **Product Description**

This Alcatel-Lucent Nokia® compatible QSFP-DD transceiver provides 400GBase-ER4 throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1310nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Alcatel-Lucent Nokia® 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. It is built to meet or exceed the specifications of Alcatel-Lucent Nokia® to ensure seamless network integration. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

## Absolute Maximum Ratings

| Parameter                  | Symbol | Min. | Typ.   | Max. | Unit | Notes |
|----------------------------|--------|------|--------|------|------|-------|
| Storage Temperature        | Tstg   | -40  |        | 85   | °C   |       |
| Operating Case Temperature | Tc     | 0    | 25     | 70   | °C   |       |
| Relative Humidity          | RH     | 15   |        | 85   | %    |       |
| Supply Voltage             | Vcc    | -0.5 |        | 4.0  | V    |       |
| Data Rate Per Channel      |        |      | 53.125 |      | Gbps |       |
| Modulation Format          |        |      | PAM4   |      |      |       |

## Electrical Characteristics

| Parameter                     | Symbol            | Min.  | Typ. | Max.  | Unit  | Notes |
|-------------------------------|-------------------|-------|------|-------|-------|-------|
| Power Supply Voltage          | Vcc               | 3.135 | 3.3  | 3.465 | V     |       |
| Power Supply Current          | Icc               |       |      | 3.8   | A     |       |
| Power Dissipation             | P <sub>DISS</sub> |       |      | 12    | W     |       |
| Transmitter                   |                   |       |      |       |       |       |
| Input Differential Impedance  | ZIN               |       | 100  |       | Ω     |       |
| Differential Data Input Swing | VIN,pp            | 180   |      | 900   | mVp-p |       |
| Receiver                      |                   |       |      |       |       |       |
| Output Differential Impedance | ZOUT              |       | 100  |       | Ω     |       |
| Differential Data Input Swing | VOOUT,pp          | 300   |      | 850   | mVp-p | 1     |

### Notes:

1. Internally AC coupled but requires an external 100Ω differential load termination.

## Optical Characteristics

| Parameter                                                        | Symbol               | Min.    | Typ. | Max.    | Unit | Notes |
|------------------------------------------------------------------|----------------------|---------|------|---------|------|-------|
| Transmitter                                                      |                      |         |      |         |      |       |
| Center Wavelength                                                | $\lambda_C$          | 1304.06 |      | 1305.1  | nm   | 1     |
|                                                                  |                      | 1306.33 |      | 1307.38 |      |       |
|                                                                  |                      | 1308.61 |      | 1309.66 |      |       |
|                                                                  |                      | 1310.9  |      | 1311.96 |      |       |
| Side-Mode Suppression Ratio                                      | SMSR                 | 30      |      |         | dB   |       |
| Total Average Launch Power                                       | PT                   |         |      | 10      | dBm  |       |
| Average Launch Power Per Lane                                    | P                    | 1.5     |      | 7.1     | dBm  |       |
| Outer Optical Modulation Amplitude Per Lane (Min.)               | OMA <sub>outer</sub> | 4.5     |      | 7.9     | dBm  |       |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ) Per Lane | TDECQ                |         |      | 3.9     | dB   |       |
| Transmitter Eye Closure for PAM4 (TECQ) Per Lane                 | TECQ                 |         |      | 3.9     | dB   |       |
| TDECQ-TECQ                                                       |                      |         |      | 2.7     | dB   |       |
| Extinction Ratio                                                 | ER                   | 6       |      |         | dB   |       |
| Average Launch Power of Off Transmitter Per Lane                 | P <sub>off</sub>     |         |      | -30     | dBm  |       |
| Optical Return Loss Tolerance                                    | ORLT                 |         |      | 15      | dB   |       |
| Transmitter Reflectance                                          |                      |         |      | -26     | dB   |       |
| Receiver                                                         |                      |         |      |         |      |       |
| Center Wavelength                                                | $\lambda_C$          | 1304.06 |      | 1305.1  | nm   |       |
|                                                                  |                      | 1306.33 |      | 1307.38 |      |       |
|                                                                  |                      | 1308.61 |      | 1309.66 |      |       |
|                                                                  |                      | 1310.9  |      | 1311.96 |      |       |
| Average Receiver Power Per Lane (P <sub>avg</sub> )              |                      | -16.2   |      | -3.4    | dBm  |       |
| Receiver Overload (Average Power) Per Lane                       |                      | -3.4    |      |         | dBm  |       |
| Damage Threshold                                                 |                      | -2.4    |      |         | dBm  |       |
| Receive Power Per Lane (OMA <sub>outer</sub> )                   |                      |         |      | -2.6    | dBm  | 2     |
| Receiver Sensitivity Per Lane (OMA <sub>outer</sub> )            |                      |         |      | -14     | dBm  | 2     |
| Stressed Receiver Sensitivity Per Lane (OMA <sub>outer</sub> )   |                      |         |      | -11.5   | dBm  |       |
| LOS Assert                                                       | LOSA                 |         |      | -20     | dBm  |       |
| LOS De-Assert                                                    | LOSD                 |         |      | -17     | dBm  |       |
| LOS Hysteresis                                                   |                      | 0.5     |      |         | dB   |       |

### Notes:

1. The typical wavelengths compliant with 1310nm nLWDM wavelength grids.
2. Measured with PRBS31Q test pattern @53.125Gbps, PAM4, and BER<2.4E<sup>-4</sup>.

## Pin Descriptions

| Pin | Symbol  | Name/Description                      | Notes |
|-----|---------|---------------------------------------|-------|
| 1   | GND     | Module Ground.                        | 1     |
| 2   | Tx2-    | Transmitter Inverted Data Input.      |       |
| 3   | Tx2+    | Transmitter Non-Inverted Data Output. |       |
| 4   | GND     | Module Ground.                        | 1     |
| 5   | Tx4-    | Transmitter Inverted Data Input.      |       |
| 6   | Tx4+    | Transmitter Non-Inverted Data Output. |       |
| 7   | GND     | Module Ground.                        | 1     |
| 8   | ModSelL | Module Select.                        |       |
| 9   | ResetL  | Module Reset.                         |       |
| 10  | VccRx   | +3.3V Receiver Power Supply.          | 2     |
| 11  | SCL     | 2-Wire Serial Interface Clock.        |       |
| 12  | SDA     | 2-Wire Serial Interface Data.         |       |
| 13  | GND     | Module Ground.                        | 1     |
| 14  | Rx3+    | Receiver Non-Inverted Data Output.    |       |
| 15  | Rx3-    | Receiver Inverted Data Output.        |       |
| 16  | GND     | Module Ground.                        | 1     |
| 17  | Rx1+    | Receiver Non-Inverted Data Output.    |       |
| 18  | Rx1-    | Receiver Inverted Data Output.        |       |
| 19  | GND     | Module Ground.                        | 1     |
| 20  | GND     | Module Ground.                        | 1     |
| 21  | Rx2-    | Receiver Inverted Data Output.        |       |
| 22  | Rx2+    | Receiver Non-Inverted Data Output.    |       |
| 23  | GND     | Module Ground.                        | 1     |
| 24  | Rx4-    | Receiver Inverted Data Output.        |       |
| 25  | Rx4+    | Receiver Non-Inverted Data Output.    |       |
| 26  | GND     | Module Ground.                        | 1     |
| 27  | ModPrsL | Module Present.                       |       |
| 28  | IntL    | Interrupt.                            |       |
| 29  | VccTx   | +3.3V Transmitter Power Supply.       | 2     |
| 30  | Vcc1    | +3.3V Power Supply.                   | 2     |
| 31  | LPMODE  | Low-Power Mode.                       |       |
| 32  | GND     | Module Ground.                        | 1     |
| 33  | Tx3+    | Transmitter Non-Inverted Data Input.  |       |
| 34  | Tx3-    | Transmitter Inverted Data Output.     |       |
| 35  | GND     | Module Ground.                        | 1     |
| 36  | Tx1+    | Transmitter Non-Inverted Data Input.  |       |
| 37  | Tx1-    | Transmitter Inverted Data Output.     |       |
| 38  | GND     | Module Ground.                        | 1     |
| 39  | GND     | Module Ground.                        | 1     |

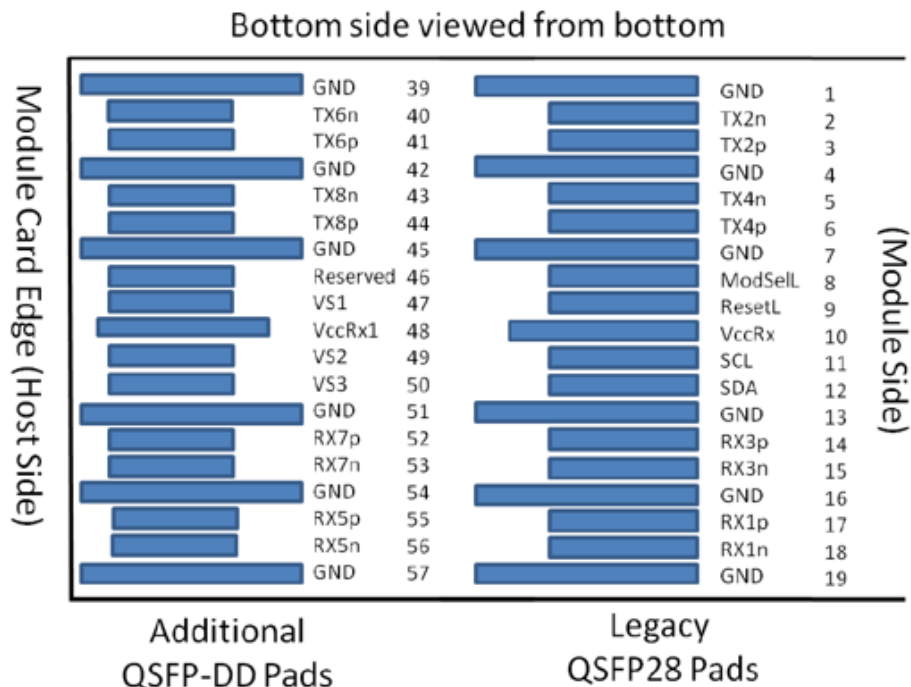
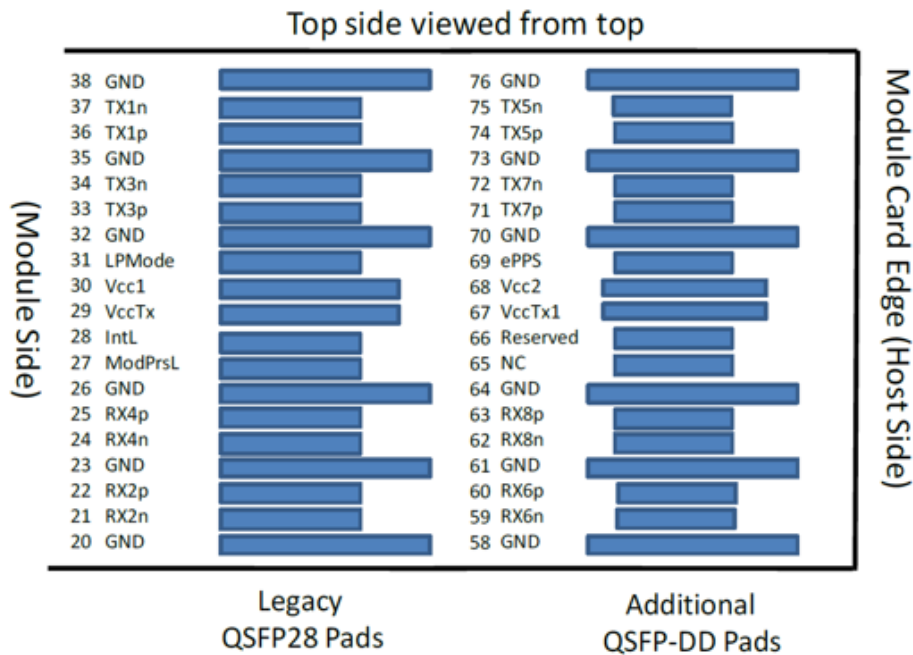
|    |          |                                                      |   |
|----|----------|------------------------------------------------------|---|
| 40 | Tx6-     | Transmitter Inverted Data Input.                     |   |
| 41 | Tx6+     | Transmitter Non-Inverted Data Output.                |   |
| 42 | GND      | Module Ground.                                       | 1 |
| 43 | Tx8-     | Transmitter Inverted Data Input.                     |   |
| 44 | Tx8+     | Transmitter Non-Inverted Data Output.                |   |
| 45 | GND      | Module Ground.                                       | 1 |
| 46 | Reserved | For Future Use.                                      | 3 |
| 47 | VS1      | Module Vendor-Specific 1.                            | 3 |
| 48 | VccRx1   | +3.3V Receiver Power Supply.                         | 2 |
| 49 | VS2      | Module Vendor-Specific 2.                            | 3 |
| 50 | VS3      | Module Vendor-Specific 3.                            | 3 |
| 51 | GND      | Module Ground.                                       | 1 |
| 52 | Rx7+     | Receiver Non-Inverted Data Output.                   |   |
| 53 | Rx7-     | Receiver Inverted Data Output.                       |   |
| 54 | GND      | Module Ground.                                       | 1 |
| 55 | Rx5+     | Receiver Non-Inverted Data Output.                   |   |
| 56 | Rx5-     | Receiver Inverted Data Output.                       |   |
| 57 | GND      | Module Ground.                                       | 1 |
| 58 | GND      | Module Ground.                                       | 1 |
| 59 | Rx6-     | Receiver Inverted Data Output.                       |   |
| 60 | Rx6+     | Receiver Non-Inverted Data Output.                   |   |
| 61 | GND      | Module Ground.                                       | 1 |
| 62 | Rx8-     | Receiver Inverted Data Output.                       |   |
| 63 | Rx8+     | Receiver Non-Inverted Data Output.                   |   |
| 64 | GND      | Module Ground.                                       | 1 |
| 65 | NC       | Not Connected.                                       | 3 |
| 66 | Reserved | For Future Use.                                      | 3 |
| 67 | VccTx1   | +3.3V Transmitter Power Supply.                      | 2 |
| 68 | Vcc2     | +3.3V Power Supply.                                  | 2 |
| 69 | ePPS     | Precision Time Protocol (PTP) Reference Clock Input. | 3 |
| 70 | GND      | Module Ground.                                       | 1 |
| 71 | Tx7+     | Transmitter Non-Inverted Data Input.                 |   |
| 72 | Tx7-     | Transmitter Inverted Data Output.                    |   |
| 73 | GND      | Module Ground.                                       | 1 |
| 74 | Tx5+     | Transmitter Non-Inverted Data Input.                 |   |
| 75 | Tx5-     | Transmitter Inverted Data Output.                    |   |
| 76 | GND      | Module Ground.                                       | 1 |

**Notes:**

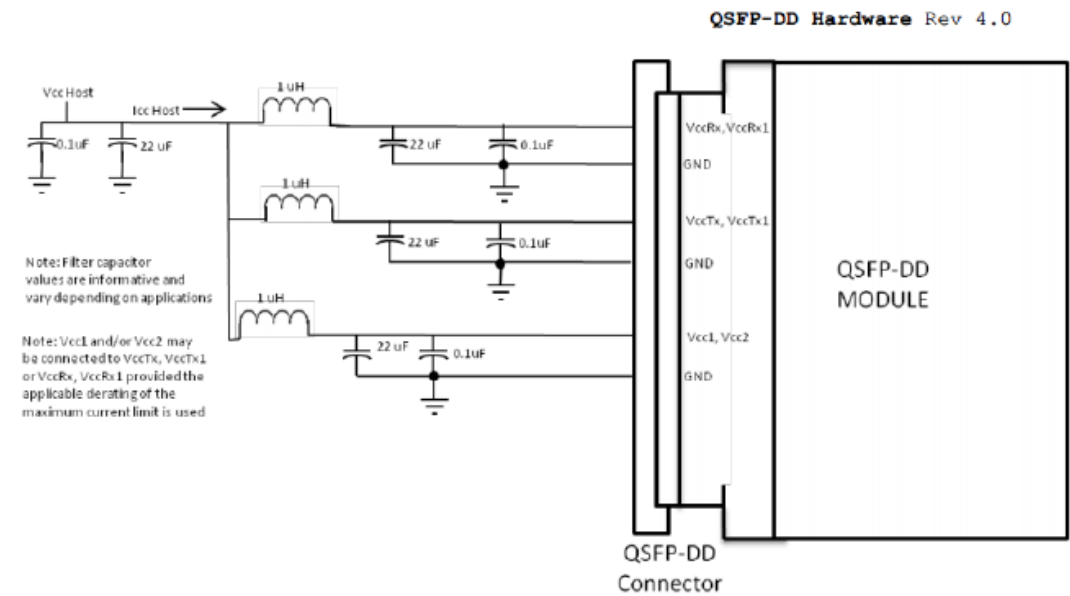
1. QSFP-DD uses common ground (GND) for all signals and power supplies. All are common within the QSFP-DD module, and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.

2. VccRx, VccRx1, Vcc1, Vcc2, VccTx, and VccTx1 shall be applied concurrently. VccRx, VccRx1, Vcc1, Vcc2, VccTx, and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000mA.
3. All Vendor-Specific, Reserved, Not Connected, and ePPS (if not used) pins may be terminated with 50Ω to ground on the host. Pad 65 (Not Connected) shall be left unconnected within the module. Vendor-Specific and Reserved pads shall have an impedance to GND that is greater than 10kΩ and less than 100pF.

## Module Pad Layout



Host Board Power Supply Filter Network



Mechanical Specifications

