

### **X65402-LC-C**

NetAPP® X65402-LC Compatible TAA 40GBase-LX4 QSFP+ Transceiver (SMF/SMF, 1270nm to 1330nm, 150m/2km, LC, DOM)

#### **Features:**

- SFF-8436 Compliance
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### **Applications:**

- 40GBase Ethernet
- Access and Enterprise

#### **Product Description**

This NetAPP® X65402-LC compatible QSFP+ transceiver provides 40GBase-LX4 throughput up to 150m over single-mode fiber (SMF) using a wavelength of 1270nm to 1330nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent NetAPP® 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' 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. | Typ. | Max. | Unit |
|-----------------------------|--------|------|------|------|------|
| Storage Temperature         | TS     | -40  |      | 85   | °C   |
| Operating Temperature       | Top    | 0    |      | 70   | °C   |
| Power Supply Voltage        | Vcc    | -0.5 |      | 3.6  | V    |
| Relative Humidity           | Rh     | 0    |      | 85   | %    |
| Damage Threshold, each Lane | THd    | 4.5  |      |      | dBm  |

### Recommended Operating Conditions

| Parameter                  | Symbol | Min.  | Typ.    | Max.  | Unit |
|----------------------------|--------|-------|---------|-------|------|
| Operating Case Temperature | TOP    | 0     |         | 70    | °C   |
| Power Supply Voltage       | VCC    | 3.135 | 3.3     | 3.465 | V    |
| Data Rate, each Lane       |        |       | 10.3125 | 11.2  | Gb/s |
| Control Input Voltage High |        | 2     |         | Vcc   | V    |
| Control Input Voltage Low  |        | 0     |         | 0.8   | V    |
| Link Distance (OM3 MMF)    | D_MMF  |       |         | 150   | m    |
| Link Distance (SMF)        | D_SMF  |       |         | 2     | km   |

## Electrical Characteristics

| Parameter                                     | Symbol                     | Min. | Typ. | Max. | Unit     | Notes                          |
|---|----------------------------|------|------|------|----------|--------------------------------|
| Power Consumption                             |                            |      |      | 3.5  | W        |                                |
| Supply Current                                | Icc                        |      |      | 1.1  | A        |                                |
| Transceiver Power-on Initialization Time      |                            |      |      | 2000 | ms       | 1                              |
| Transmitter (each lane)                       |                            |      |      |      |          |                                |
| Single-ended Input Voltage Tolerance (Note 2) |                            | -0.3 |      | 4.0  | V        | Referred to TP1 signal common  |
| AC Common mode Voltage Tolerance              |                            | 15   |      |      | mV       | RMS                            |
| Differential Input Voltage Swing Threshold    |                            | 50   |      |      | mVpp     | LOSA Threshold                 |
| Differential Input Voltage Swing              | Vin,pp                     | 190  |      | 700  | mVpp     |                                |
| Differential Input Impedance                  | Zin                        | 90   | 100  | 110  | Ohm      |                                |
| Differential Input Return Loss                | See IEEE 802.3ba 86A.4.11  |      |      |      | dB       | 10MHz-11.1GHz                  |
| J2 Jitter Tolerance                           | Jt2                        | 0.17 |      |      | UI       |                                |
| J9 Jitter Tolerance                           | Jt9                        | 0.29 |      |      | UI       |                                |
| Data Dependent Pulse Width Shrinkage          | DDPWS                      | 0.07 |      |      | UI       |                                |
| Eye Mask Coordinates {X1, X2, Y1, Y2}         | 0.11, 0.31<br>95, 350      |      |      |      | UI<br>mV | Hit Ratio = 5x10 <sup>-5</sup> |
| Receiver (each lane)                          |                            |      |      |      |          |                                |
| Single-ended Output Voltage                   |                            | -0.3 |      | 4.0  | V        | Referred to signal common      |
| AC Common Mode Output Voltage                 |                            |      |      | 7.5  | mV       | RMS                            |
| Differential Output Voltage Swing             | Vout,pp                    | 300  |      | 850  | mVpp     |                                |
| Differential Output Impedance                 | Zout                       | 90   | 100  | 110  | Ohm      |                                |
| Termination Mismatch at 1MHz                  |                            |      |      | 5    | %        |                                |
| Differential Output Return Loss               | See IEEE 802.3ba 86A.4.2.1 |      |      |      | dB       | 10MHz-11.1GHz                  |
| Common-mode Output Return Loss                | See IEEE 802.3ba 86A.4.2.2 |      |      |      | dB       | 10MHz-11.1GHz                  |
| Output Transition Time                        |                            | 28   |      |      | ps       | 20% to 80%                     |
| J2 Jitter Output                              | Jo2                        |      |      | 0.42 | UI       |                                |
| J9 Jitter Output                              | Jo9                        |      |      | 0.65 | UI       |                                |
| Eye Mask Coordinates {X1, X2, Y1, Y2}         | 0.29, 0.5<br>150, 425      |      |      |      | UI<br>mV | Hit Ratio = 5x10 <sup>-5</sup> |

### Notes:

1. Power-on initialization time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.

- The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

## Optical Characteristics

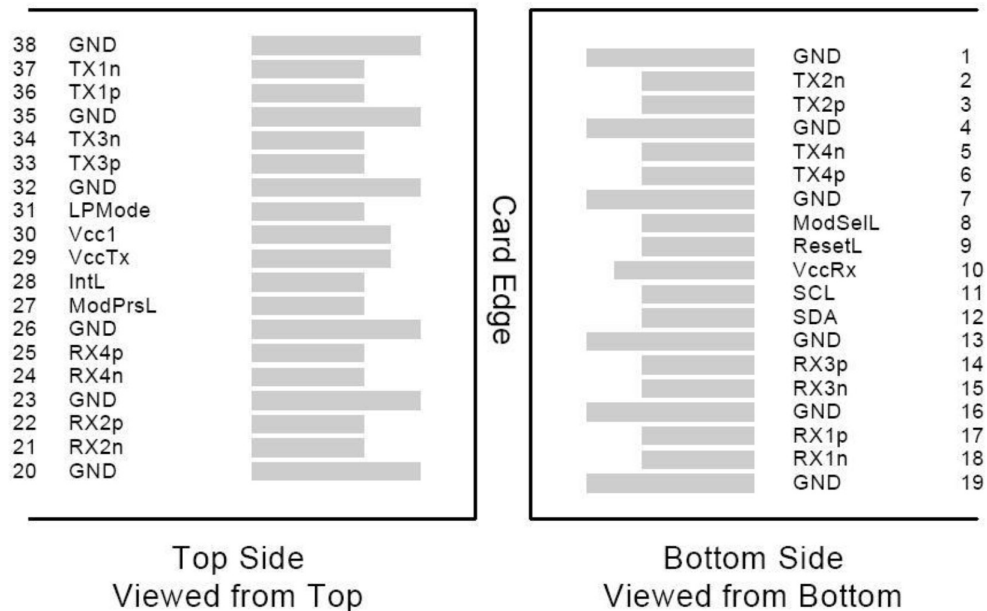
| Parameter   | Symbol                              | Min.   | Typ. | Max.   | Unit  | Notes           |
|---|-------------------------------------|--------|------|--------|-------|-----------------|
| Wavelength  | L0                                  | 1264.5 | 1271 | 1277.5 | nm    |                 |
|   | L1                                  | 1284.5 | 1291 | 1297.5 | nm    |                 |
|   | L2                                  | 1304.5 | 1311 | 1317.5 | nm    |                 |
|   | L3                                  | 1324.5 | 1331 | 1337.5 | nm    |                 |
| Transmitter   |                                     |        |      |        |       |                 |
| Total Average Launch Power (for SMF)  | $P_{T, SMF}$                        |        |      | 8.3    | dBm   |                 |
| Total Average Launch Power (for MMF)  | $P_{T, MMF}$                        |        |      | 9.5    | dBm   |                 |
| Average Launch Power, each Lane (for SMF)                                     | $P_{AVG, SMF}$                      | -7.0   |      | 2.3    | dBm   |                 |
| Average Launch Power, each Lane (for MMF)                                     | $P_{AVG, MMF}$                      | -5.0   |      | 3.5    | dBm   |                 |
| OMA, each Lane (for SMF)  | $P_{OMA, SMF}$                      | -6.0   |      | 3.5    | dBm   | 1               |
| OMA, each Lane (for MMF)  | $P_{OMA, MMF}$                      | -4.0   |      | 4.5    | dBm   |                 |
| Difference in Launch Power between any Two Lanes (OMA)                        | $P_{tx,diff}$                       |        |      | 6.5    | dB    |                 |
| Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane |                                     | -6.8   |      |        | dBm   |                 |
| TDP, each Lane  | TDP                                 |        |      | 2.6    | dB    |                 |
| Extinction Ratio  | ER                                  | 3.5    |      |        | dB    |                 |
| Relative Intensity Noise  | RIN                                 |        |      | -128   | dB/Hz | 12dB reflection |
| Transmitter Reflectance   | $R_T$                               |        |      | -12    | dB    |                 |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}                      | {0.23, 0.34, 0.43, 0.27, 0.35, 0.4} |        |      |        |       |                 |
| Average Launch Power OFF Transmitter, each Lane                               | $P_{off}$                           |        |      | -30    | dBm   |                 |
| Receiver  |                                     |        |      |        |       |                 |
| Damage Threshold, each Lane   | $TH_d$                              | 4.5    |      |        | dBm   | 2               |
| Total Average Receive Power (for SMF)   |                                     |        |      | 8.3    | dBm   |                 |
| Total Average Receive Power (for MMF)   |                                     |        |      | 9.5    | dBm   |                 |
| Average Receive Power, each Lane (for SMF)                                    |                                     | -11.7  |      | 2.3    | dBm   |                 |
| Average Receive Power, each Lane (for MMF)                                    |                                     | -7.0   |      | 3.5    | dBm   |                 |
| Receiver Reflectance  | $R_R$                               |        |      | -26    | dB    |                 |

|  |                    |     |  |       |     |  |
|--|--------------------|-----|--|-------|-----|--|
| Receive Power (OMA), each Lane (for SMF)                   |                    |     |  | 3.5   | dBm |  |
| Receive Power (OMA), each Lane (for MMF)                   |                    |     |  | 4.5   | dBm |  |
| Receiver Sensitivity (OMA), each Lane (for SMF)            | SEN <sub>SMF</sub> |     |  | -11.5 | dBm |  |
| Receiver Sensitivity (OMA), each Lane (for MMF)            | SEN <sub>MMF</sub> |     |  | -10.5 | dBm |  |
| Difference in Receive Power between any Two Lanes (OMA)    | Prx,diff           |     |  | 7.5   | dB  |  |
| LOS Assert   | LOSA               | -28 |  |       | dBm |  |
| LOS Deassert   | LOSD               |     |  | -15   | dBm |  |
| LOS Hysteresis   | LOSH               | 0.5 |  |       | dB  |  |
| Receiver Electrical 3 dB upper Cutoff Frequency, each Lane | Fc                 |     |  | 12.3  | GHz |  |

#### Notes:

1. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

#### Electrical Pin-out Details

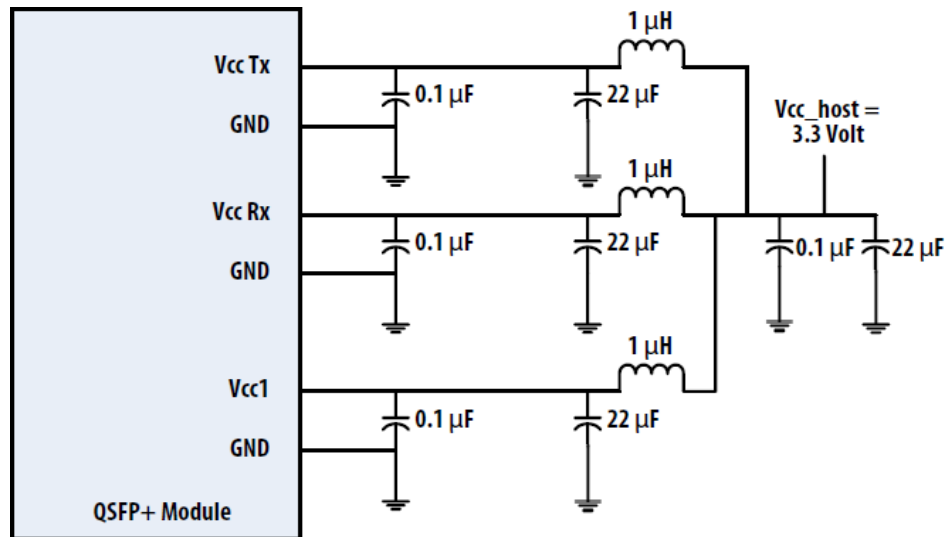
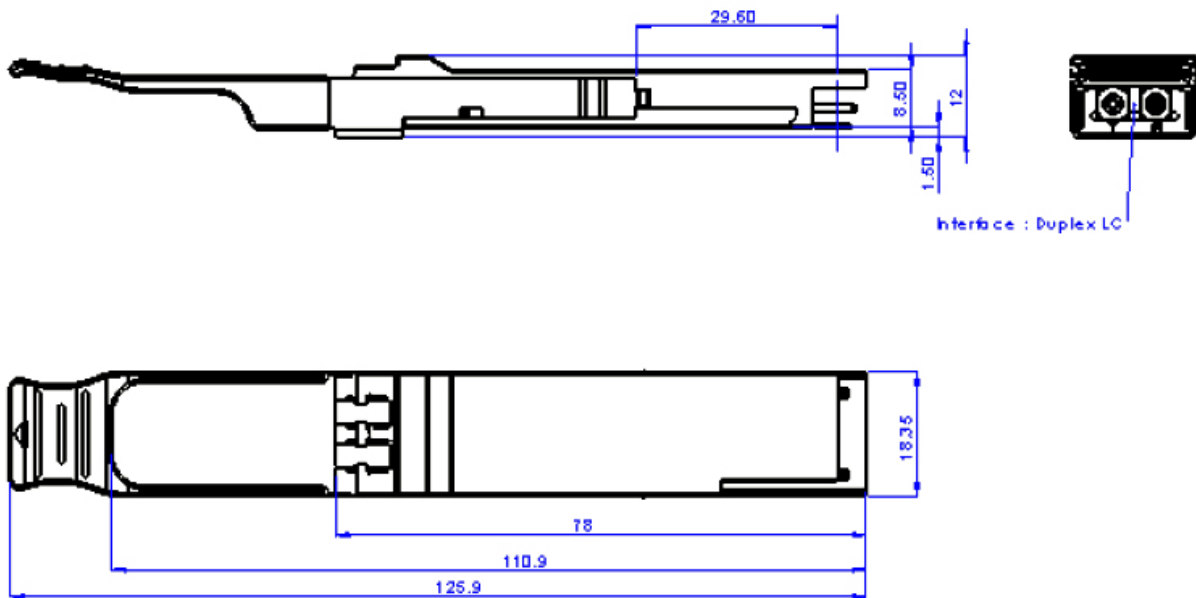


## Pin Descriptions

| 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   | LVTTL-I     | MODSEIL | Module Select                                      | 2    |
| 9   | LVTTL-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  | LVTTL-O     | ModPrsL | Module Present, internal pulled down to GND        |      |
| 28  | LVTTL-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  | LVTTL-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.

**Recommended Power Supply Filter****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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