

### FTLC1154RDPL4-C

Finisar® Compatible TAA 100GBase-LR4 QSFP28 Transceiver (SMF, 1295nm to 1309nm, 10km, LC, DOM, -40 to 85C)

#### Features:

- SFF-8665 Compliance
- Duplex LC Connector
- Single-mode Fiber
- Industrial Temperature -40 to 85 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### Applications:

- 100Gbase Ethernet

#### Product Description

This Finisar® compatible QSFP28 transceiver provides 100GBase-LR4 throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1295nm to 1309nm via an LC connector. It is capable of withstanding rugged environments and can operate at temperatures between -40 and 85C. Our transceiver is built to meet or exceed OEM specifications and is guaranteed to be 100% compatible with Finisar®. It has been programmed, uniquely serialized, and tested for data-traffic and application to ensure that it will initialize and perform identically. All of our transceivers comply with Multi-Source Agreement (MSA) standards to provide seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows 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."



## 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

## Absolute Maximum Ratings

| Parameter                           | Symbol | Min. | Typ. | Max. | Unit |
|-------------------------------------|--------|------|------|------|------|
| Maximum Supply Voltage              | Vcc    | -0.5 |      | 3.6  | V    |
| Storage Temperature                 | TS     | -40  |      | 85   | °C   |
| Operating Case Temperature          | Tc     | -40  | 25   | 85   | °C   |
| Operating Humidity                  | RH     | 5    |      | 85   | %    |
| Receiver Damage Threshold, per Lane | Rxdmg  | 5.5  |      |      | dBm  |

## Electrical Characteristics

| Parameter                              | Symbol | Min.                     | Typ. | Max.  | Unit  | Notes   |
|--|--------|--------------------------|------|-------|-------|---------|
| Power Dissipation                      | PD     |                          |      | 4.0   | W     |         |
| Power Supply Voltage                   | Vcc    | 3.135                    | 3.3  | 3.465 | V     |         |
| <b>Transmitter</b>                     |        |                          |      |       |       |         |
| Differential data input swing per lane | Vin    |                          |      | 900   | Mvp-p |         |
| Input Impedance (Differential)         | Zin    |                          |      | 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   | Mvp-p |         |
| Output Impedance (Differential)        | Zout   |                          |      | 10    | %     |         |
| Output Rise/Fall Time                  | tr/tf  | 12                       |      |       | ps    | 20%~80% |
| 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    |       |       |
| 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 Launch Power each Lane                            | $P_{each}$     | -4.3                             |         | 4.5     | dBm   | 1     |
| Optical Modulation Amplitude (OMA) each Lane              | TxOMA          | -1.3                             |         | 4.5     | dBm   |       |
| Difference in launch power between any two lanes (OMA)    |                |                                  |         | 5       | dB    |       |
| Launch power in OMA minus TDP, each lane                  |                | -2.3                             |         |         | dBm   |       |
| Transmitter and dispersion penalty (TDP), each lane       |                |                                  |         | 2.2     | dB    |       |
| Extinction Ratio  | ER             | 4                                |         |         | dB    |       |
| Side-mode Suppression ratio                               | SMSRmin        | 30                               |         |         | dB    |       |
| Average launch power of OFF transmitter per lane          |                |                                  |         | -30     | dBm   |       |
| Relative Intensity Noise                                  | RIN            |                                  |         | -130    | dB/hz |       |
| Transmitter Reflectance                                   |                |                                  |         | -12     | dB    |       |
| Optical Return Loss Tolerance                             |                |                                  |         | 20      | dB    |       |
| Transmitter eye mask definitions: X1, X2, X3, Y1, Y2, Y3  |                | 0.25, 0.4, 0.45, 0.25, 0.28, 0.4 |         |         |       | 2     |
| <b>Receiver</b>   |                |                                  |         |         |       |       |
| Signaling Speed per Lane                                  | BRAVE          |                                  | 25.78   |         | Gbps  |       |
| Data Rate Variation                                       |                | -100                             |         | +100    | ppm   |       |
| Damage threshold per lane                                 | Rxdmg          | 5.5                              |         |         | 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                            | Rxpow          | -10.6                            |         | 4.5     | dBm   | 3     |
| Receive Power (OMA) per Lane                              | RxOMA          |                                  |         | 4.5     | dBm   |       |
| Receive Sensitivity in OMA per Lane                       | Rxsens         |                                  |         | -8.6    | dBm   |       |
| Receiver 3 dB electrical upper cutoff frequency, per lane |                |                                  |         | 31      | GHz   |       |
| Stressed Receiver Sensitivity (OMA) per Lane              | RXSRS          |                                  |         | -6.8    | dBm   | 4     |
| Optical Return Loss                                       | ORL            |                                  |         | -26     | dB    |       |
| LOS Assert  | LOSA           | -25                              |         |         | dBm   |       |

|   |      |     |      |     |     |   |
|---|------|-----|------|-----|-----|---|
| LOS De-Assert   | LOSD |     |      | -12 | dBm |   |
| LOS Hysteresis  |      | 0.5 |      |     | dB  |   |
| <b>Conditions of stressed receiver sensitivity test</b> |      |     |      |     |     |   |
| Vertical eye closure penalty                            | VECP |     | 1.8  |     | dB  | 5 |
| Stressed eye J2 Jitter                                  | J2   |     | 0.3  |     | UI  | 5 |
| Stressed eye J9 Jitter                                  | J9   |     | 0.47 |     | UI  | 5 |

**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. Hit ratio  $5 \times 10^{-5}$ .
3. 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.
4. Measured with conformance test signal at TP3 for BER =  $10^{-12}$ .
5. Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## 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   | LVTTTL-I   | MODSEIL | Module Select                                       | 2    |
| 9   | LVTTTL-I   | ResetL  | Module Reset  | 2    |
| 10  |            | VCCRx   | +3.3v Receiver Power Supply                         |      |
| 11  | LVCNOS-I   | SCL     | 2-wire Serial interface clock                       | 2    |
| 12  | LVCNOS-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  | LVTTTL-O   | ModPrsL | Module Present, internal pulled down to GND         |      |
| 28  | LVTTTL-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  | LVTTTL-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    |

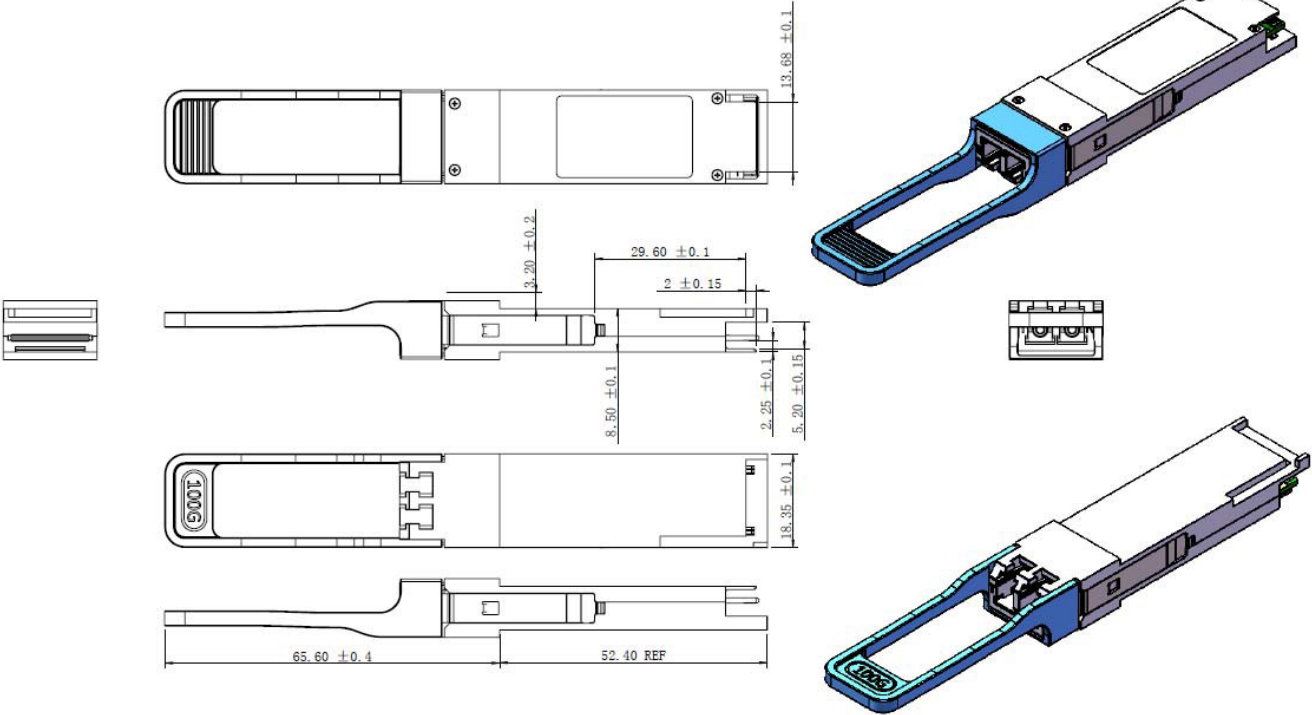
**Notes:**

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.

**Electrical Pin-out Details**



**Mechanical Specifications**



## About ProLabs

Our extensive experience comes as standard. For over 20 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 more than 100 optical switching and transport platforms.

## A 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 1.6T 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.

## The Trusted Partner

Customer service is our number one value. ProLabs has invested in people, labs and manufacturing capacity to ensure compatible products, and immediate answers to your questions. 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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