

## PROLABS – 40G-QSFP-LR4-C

### *40GBd SFP+ LR4 Extended Distance Transceiver*

#### **40G-QSFP-LR4-C Overview**

PROLABS's 40G-QSFP-LR4-C QSFP+ LR4 optical transceivers are based on Ethernet IEEE P802.3ba standard and SFF 8436 standard. The QSFP+ transceiver converts 4 inputs channels of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data.

The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid defined in ITU-T G694.2.

#### **Product Features**

- 4 CWDM Lanes MUX/DEMUX design
- Up to 11.2Gbps data rate per wavelength
- QSFP+ MSA compliant
- Up to 10km Transmission
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 10km on SMF
- Maximum 3.5W operation power
- RoHS Compliance
- Class 1 Laser
- Operating temperature range: 0°C to 70°C.

#### **Applications**

- 40G Ethernet
- Infiniband interconnects

#### **Ordering Information**

| <i><b>Part Number</b></i> | <i><b>Description</b></i>                                             |
|---------------------------|-----------------------------------------------------------------------|
| 40G-QSFP-LR4-C            | 40G QSFP+ 1310nm LC Connectors, Up to 10km on SMF, with DOM function. |

## General Specifications

| <i>Parameter</i>      | <i>Symbol</i> | <i>Min</i> | <i>Typ</i> | <i>Max</i> | <i>Unit</i> | <i>Remarks</i>                 |
|-----------------------|---------------|------------|------------|------------|-------------|--------------------------------|
| Bit Error Rate        | $BER$         |            |            | $10^{-12}$ |             |                                |
| Operating Temperature | $T_{OP}$      | 0          |            | 70         | °C          | Case temperature               |
| Storage Temperature   | $T_{STO}$     | - 20       |            | 85         | °C          | Ambient temperature            |
| Input Voltage         | $V_{CC}$      | 3.14       | 3.3        | 3.47       | V           |                                |
| Maximum Voltage       | $V_{MAX}$     | - 0.5      |            | 3.6        | V           | For electrical power interface |

## Link Distances

| <i>Parameter</i> | <i>Fiber Type</i> | <i>Distance Range (Km)</i> |
|------------------|-------------------|----------------------------|
| 40 GBd           | 9/125um SMF       | 10                         |

## Optical Characteristics – Transmitter

| <i>Parameter</i>                        | <i>Symbol</i>   | <i>Min</i>                  | <i>Typ</i> | <i>Max</i> | <i>Unit</i> | <i>Remarks</i> |
|-----------------------------------------|-----------------|-----------------------------|------------|------------|-------------|----------------|
| Total Output Optical Power              | $P_T$           |                             |            | 8.3        | dBm         | Average        |
| Average Launch Power (Each Lane)        | $P$             | -7                          |            | 2.3        | dBm         |                |
| Optical Center Wavelength               | $\lambda_C$     | 1264.5                      | 1271       | 1277.5     | nm          | L0 Lane        |
|                                         |                 | 1284.5                      | 1291       | 1297.5     | nm          | L1 Lane        |
|                                         |                 | 1304.5                      | 1311       | 1317.5     | nm          | L2 Lane        |
|                                         |                 | 1324.5                      | 1331       | 1337.5     | nm          | L3 Lane        |
| Optical Modulation Amplitude, Each Lane | $OMA$           | -4                          |            | 3.5        | dB          |                |
| Extinction Ratio                        | $ER$            | 3.5                         |            |            | dB          |                |
| Spectral Width (- 20 dB)                | $\Delta\lambda$ |                             |            | 0.6        | nm          |                |
| Side Mode Suppression Ratio             | $SMSR$          | 30                          |            |            | dB          |                |
| Relative Intensity Noise                | $RIN$           |                             |            | - 128      | dB/Hz       |                |
| Transmitter Dispersion Penalty          | $TDP$           |                             |            | 2.3        | dB          |                |
| Optical Return Loss Tolerance           |                 |                             |            | 20         | dB          |                |
| Transmitter Eye Mask                    |                 | Compliant with IEEE 802.3ba |            |            |             |                |
| Launch Power of OFF Transmitter         | $P_{OUT\_OFF}$  |                             |            | - 30       | dBm         | Average        |

## Optical Characteristics – Receiver

| <i>Parameter</i>                                | <i>Symbol</i> | <i>Min</i> | <i>Typ</i> | <i>Max</i> | <i>Unit</i> | <i>Remarks</i>       |
|-------------------------------------------------|---------------|------------|------------|------------|-------------|----------------------|
| Optical Center Wavelength                       | $\lambda_C$   | 1264.5     | 1271       | 1277.5     | nm          | L0 Lane              |
|                                                 |               | 1284.5     | 1291       | 1297.5     | nm          | L1 Lane              |
|                                                 |               | 1304.5     | 1311       | 1317.5     | nm          | L2 Lane              |
|                                                 |               | 1324.5     | 1331       | 1337.5     | nm          | L3 Lane              |
| Optical Input Power, each lane                  | $P_{IN}$      | -13.7      |            | 2.3        | dBm         | Average, Informative |
| Damage Threshold                                | $P$           | 3.3dBm     |            |            |             |                      |
| Receiver Sensitivity (OMA), each Lane           | $R_{X\_SEN1}$ |            |            | 3.5        | dBm         |                      |
| Stressed Receiver Sensitivity in OMA, Each Lane |               |            |            | -9.9       | dBm         |                      |
| Receiver Reflectance                            | $TR_{RX}$     |            |            | - 26       | dB          |                      |
| LOS Assert                                      | $LOS_A$       | - 25       |            |            | dBm         |                      |
| LOS De-Assert                                   | $LOS_D$       |            |            | - 16       | dBm         |                      |
| LOS Hysteresis                                  |               | 0.5        |            |            | dB          |                      |

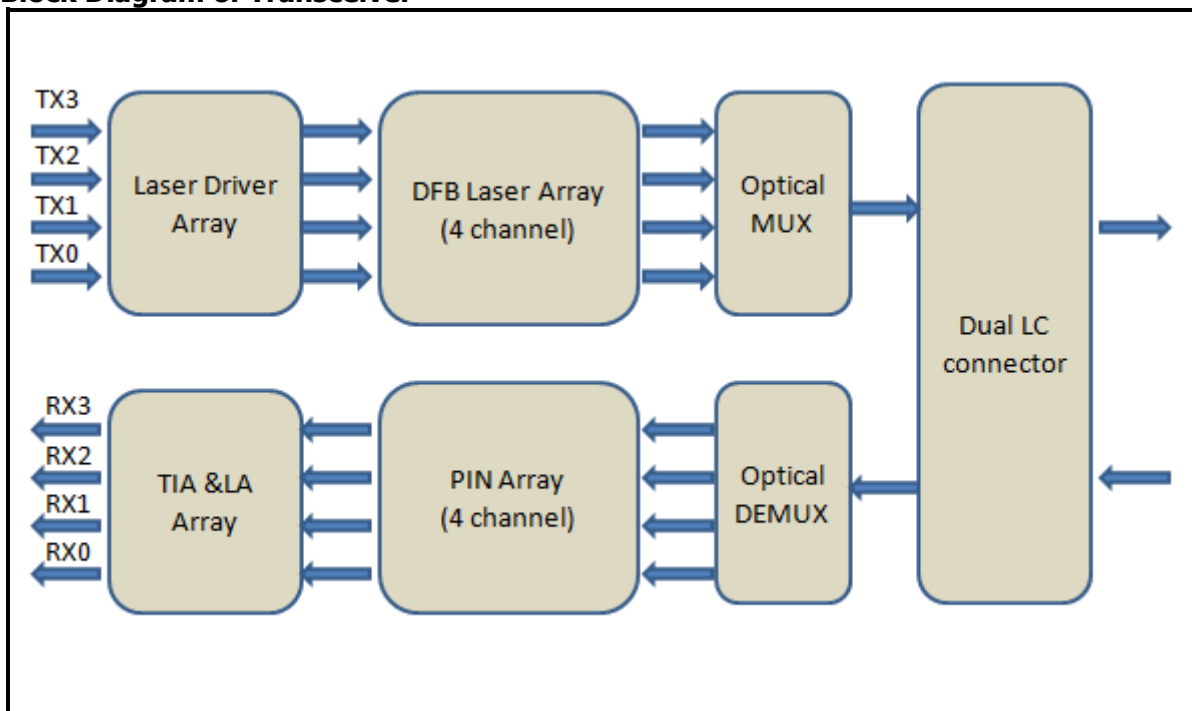
## Electrical Characteristics – Transmitter

| <i>Parameter</i>              | <i>Symbol</i> | <i>Min</i>   | <i>Typ</i> | <i>Max</i>   | <i>Unit</i> | <i>Remarks</i> |
|-------------------------------|---------------|--------------|------------|--------------|-------------|----------------|
| Input differential impedance  | $R_{IN}$      |              | 100        |              | $\Omega$    | Non condensing |
| Single ended data input swing | $V_{IN\_PP}$  | 90           |            | 600          | mV          |                |
| Transmit disable voltage      | $V_D$         | $V_{CC}-1.3$ |            | $V_{CC}$     | V           |                |
| Transmit enable voltage       | $V_{EN}$      | $V_{EE}$     |            | $V_{EE}+0.8$ | V           |                |

## Electrical Characteristics – Receiver

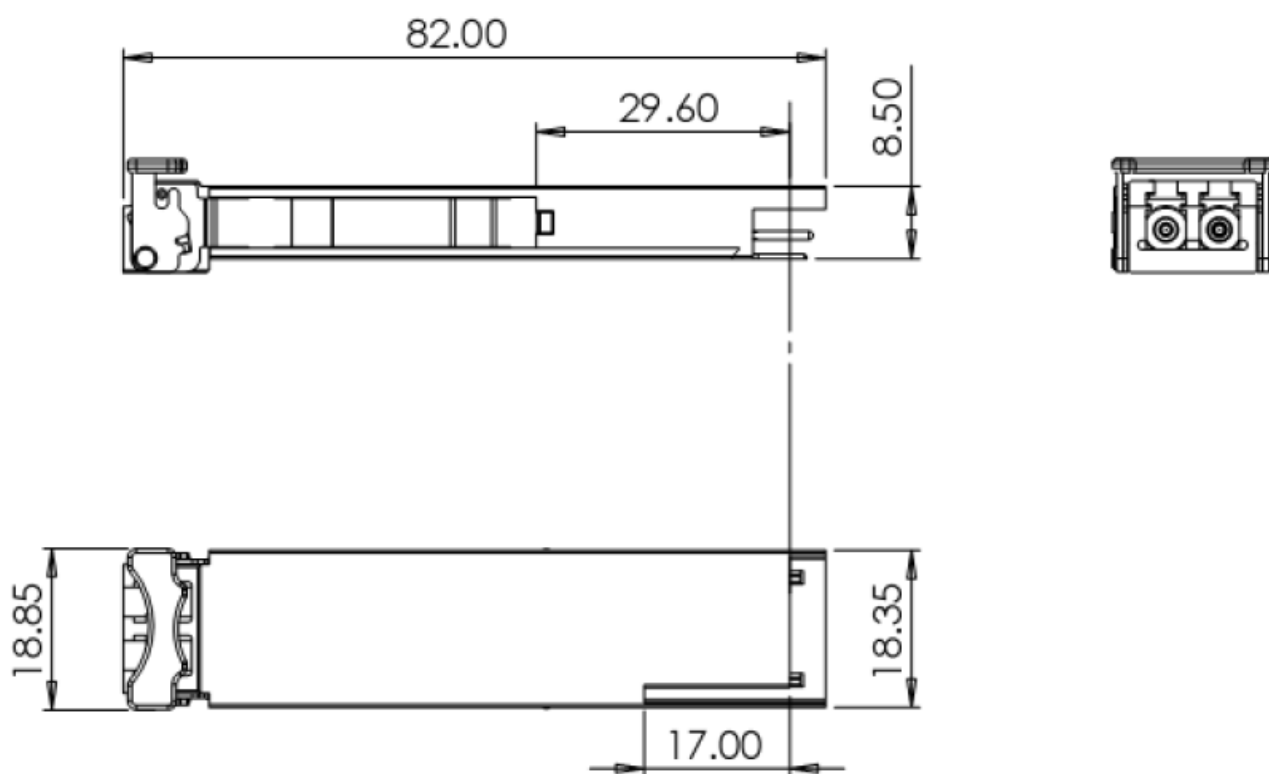
| <i>Parameter</i>                | <i>Symbol</i>     | <i>Min</i>   | <i>Typ</i> | <i>Max</i>     | <i>Unit</i> | <i>Remarks</i> |
|---------------------------------|-------------------|--------------|------------|----------------|-------------|----------------|
| Single ended data output swing  | $V_{OUT\_PP}$     | 150          | 300        | 425            | mV          |                |
| Data output rise time (20%-80%) | $T_R$             |              | 30         |                | ps          |                |
| Data output fall time (20%-80%) | $T_F$             |              | 30         |                | ps          |                |
| LOS Fault                       | $V_{LOS\_Fault}$  | $V_{CC}-1.3$ |            | $V_{CC\_HOST}$ | V           |                |
| LOS Normal                      | $V_{LOS\_normal}$ | $V_{EE}$     |            | $V_{EE}+0.5$   | V           |                |

## Block Diagram of Transceiver



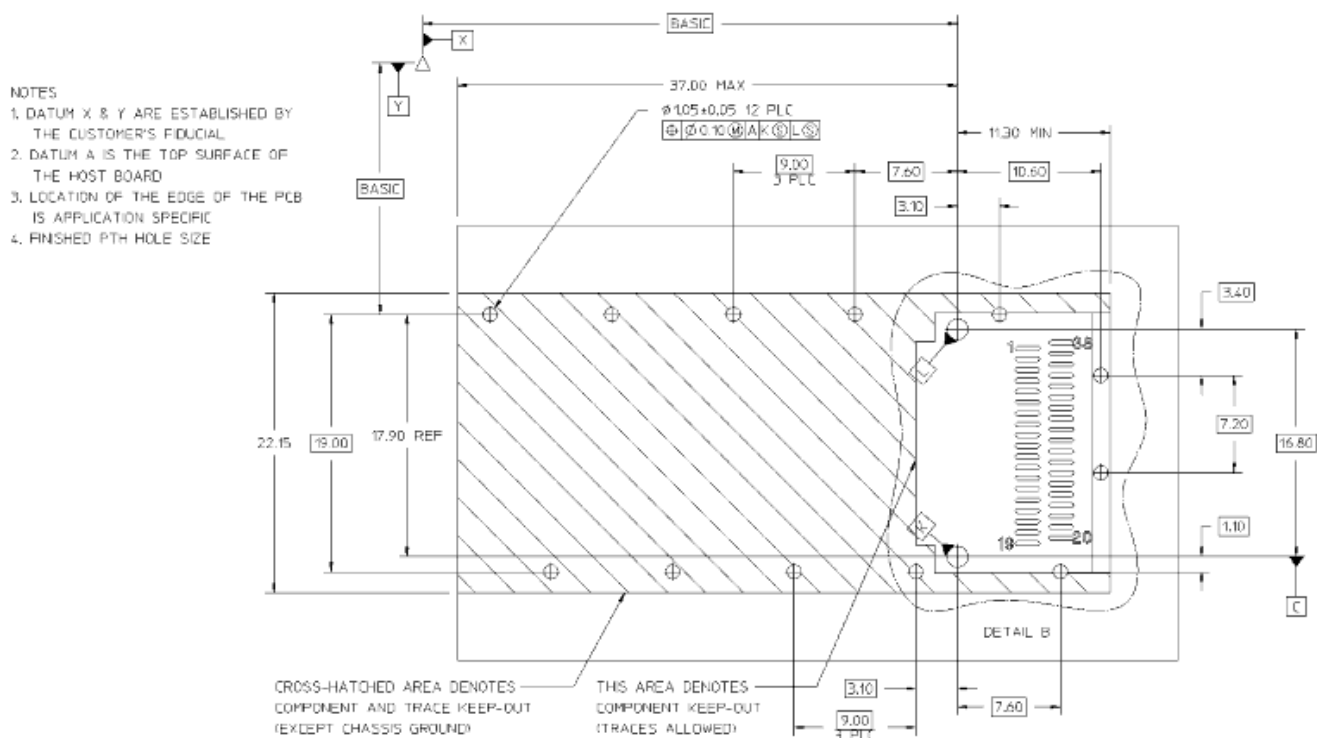
This product converts the 4-channel 10Gb/s electrical input data into CWDM optical signals (light), by a driven 4-wavelength Distributed Feedback Laser (DFB) array. The light is combined by the MUX parts as a 40Gb/s data, propagating out of the transmitter module from the SMF. The receiver module accepts the 40Gb/s CWDM optical signals input, and de-multiplexes it into 4 individual 10Gb/s channels with different wavelength. Each wavelength light is collected by a discrete photo diode, and then outputted as electric data after amplified by a TIA.

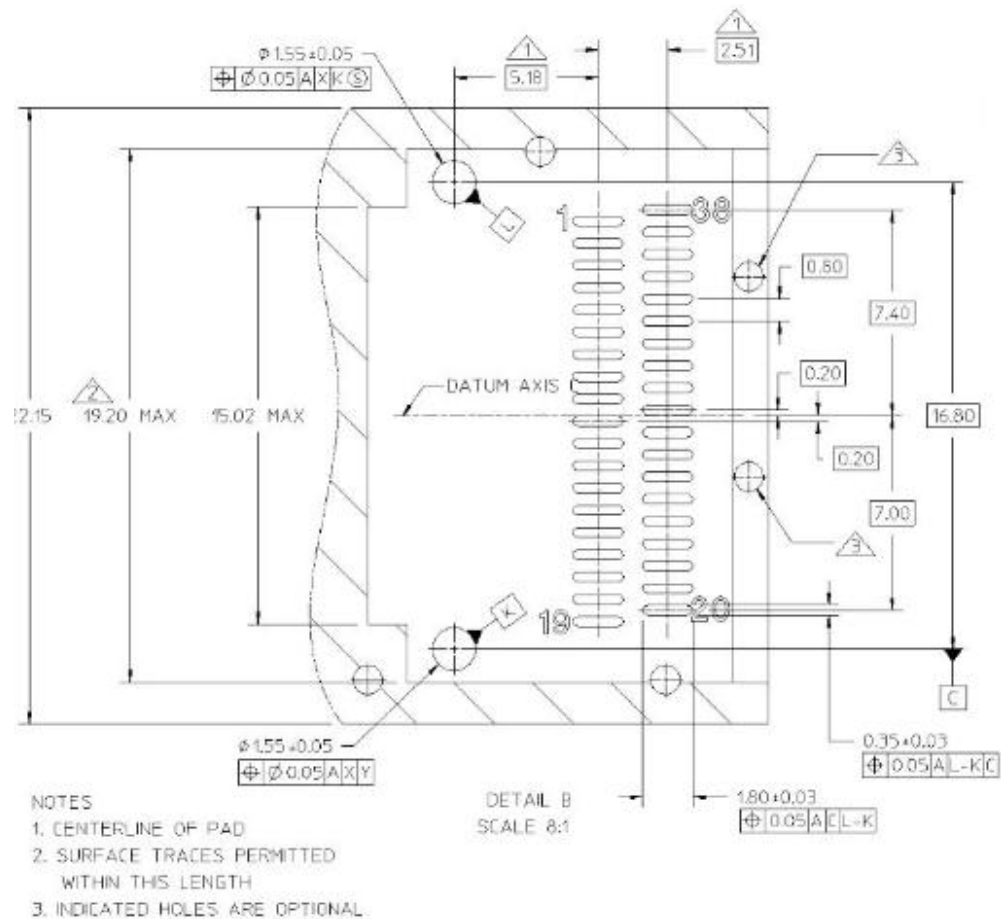
## Dimensions



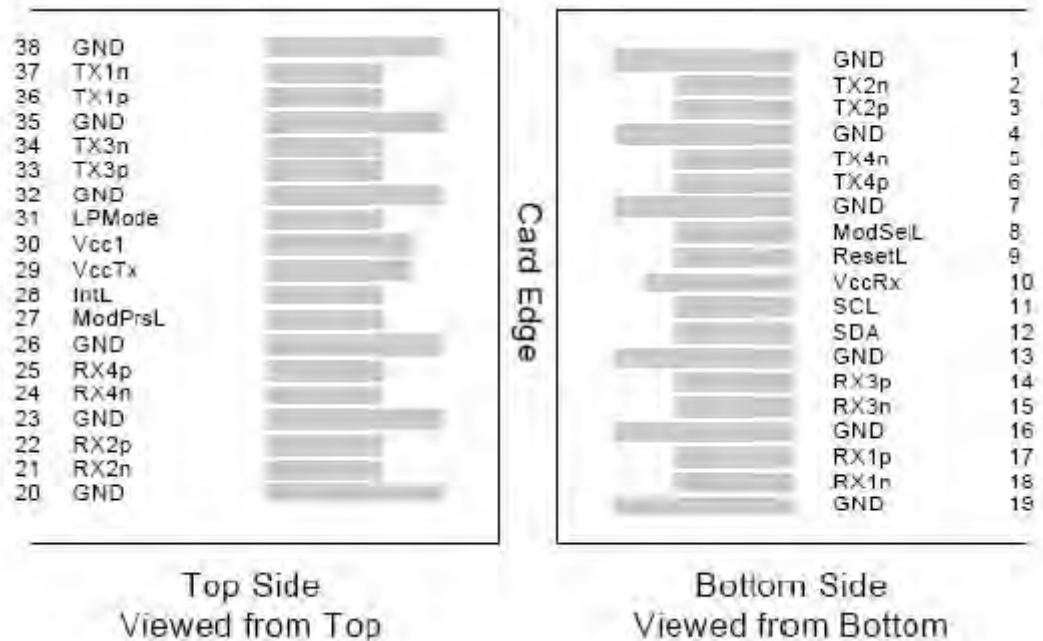
**ALL DIMENSIONS ARE  $\pm 0.2\text{mm}$  UNLESS OTHERWISE SPECIFIED**  
**UNIT: mm**

## PCB Layout Recommendation





## Electrical Pad Layout



## Pin Assignment

| <i><b>PIN #</b></i> | <i><b>Symbol</b></i> | <i><b>Description</b></i>           | <i><b>Remarks</b></i> |
|---------------------|----------------------|-------------------------------------|-----------------------|
| 1                   | GND                  | Ground                              |                       |
| 2                   | Tx2n                 | Transmitter Inverted Data Input     |                       |
| 3                   | Tx2p                 | Transmitter Non-Inverted Data Input |                       |
| 4                   | GND                  | Ground                              |                       |
| 5                   | Tx4n                 | Transmitter Inverted Data Input     |                       |
| 6                   | Tx4p                 | Transmitter Non-Inverted Data Input |                       |
| 7                   | GND                  | Ground                              |                       |
| 8                   | ModSelL              | Module Select                       |                       |
| 9                   | ResetL               | Module Reset                        |                       |
| 10                  | V <sub>cc</sub> RX   | +3.3V Power Supply Receiver         |                       |
| 11                  | SCL                  | 2-wire serial interface clock       |                       |
| 12                  | SDA                  | 2-wire serial interface data        |                       |
| 13                  | GND                  | Ground                              |                       |
| 14                  | Rx3p                 | Receiver Non-Inverted Data Output   |                       |
| 15                  | Rx3n                 | Receiver Inverted Data Output       |                       |
| 16                  | GND                  | Ground                              |                       |
| 17                  | Rx1p                 | Receiver Non-Inverted Data Output   |                       |
| 18                  | Rx1n                 | Receiver Inverted Data Output       |                       |
| 19                  | GND                  | Ground                              |                       |
| 20                  | GND                  | Ground                              |                       |
| 21                  | Rx2n                 | Receiver Inverted Data Output       |                       |
| 22                  | Rx2p                 | Receiver Non-Inverted Data Output   |                       |
| 23                  | GND                  | Ground                              |                       |
| 24                  | Rx4n                 | Receiver Inverted Data Output       |                       |
| 25                  | Rx4p                 | Receiver Non-Inverted Data Output   |                       |
| 26                  | GND                  | Ground                              |                       |
| 27                  | ModPrsL              | Module Present                      |                       |
| 28                  | IntL                 | Interrupt                           |                       |
| 29                  | V <sub>cc</sub> TX   | +3.3V Power Supply transmitter      |                       |
| 30                  | V <sub>cc1</sub>     | +3.3V Power Supply                  |                       |
| 31                  | LPMode               | Low Power Mode                      |                       |
| 32                  | GND                  | Ground                              |                       |
| 33                  | Tx3p                 | Transmitter Non-Inverted Data Input |                       |
| 34                  | Tx3n                 | Transmitter Inverted Data Input     |                       |
| 35                  | GND                  | Ground                              |                       |
| 36                  | Tx1p                 | Transmitter Non-Inverted Data Input |                       |
| 37                  | Tx1n                 | Transmitter Inverted Data Input     |                       |
| 38                  | GND                  | Ground                              |                       |

## References

1. IEEE standard 802.3ba. IEEE Standard Department, 2010.
2. QSFP+ 10Gbs 4X PLUGGABLE TRANSCEIVER – SFF-8436