

### QSFP28-100GB-SWDM4-IN-C

Intel® Compatible 100GBase-SWDM4 QSFP28 Transceiver (MMF, 850nm, 100m, LC, DOM)

#### Features:

- SFF-8665 Compliance
- Duplex LC Connector
- Multi-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### Applications:

- 100GBase Ethernet
- Access and Enterprise

#### Product Description

This Intel® QSFP28 transceiver provides 100GBase-SWDM4 throughput up to 100m over OM4 multi-mode fiber (MMF) using a wavelength of 850nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Intel® 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 | Notes |
|-------------------------------------|-------------------|------|-----|-----|------|-------|
| Maximum Supply Voltage              | V <sub>cc</sub>   | -0.5 |     | 3.6 | V    |       |
| Storage Temperature                 | T <sub>S</sub>    | -40  |     | 85  | °C   |       |
| Case Operating Temperature          | T <sub>OP</sub>   | 0    |     | 70  | °C   | 1     |
| Relative Humidity                   | RH                | 15   |     | 85  | %    | 2     |
| Receiver Damage Threshold, per Lane | PR <sub>dmg</sub> | 3.8  |     |     | dBm  |       |

### Notes:

1. Temporary excursions case operating temperature of -5 to -75 °C not exceeding 72 hours.
2. Non-condensing.

### Electrical Characteristics

| Parameter                                  | Symbol                              | Min               | Typ | Max   | Unit | Notes |
|--|-------------------------------------|-------------------|-----|-------|------|-------|
| Supply Voltage                             | Vcc                                 | 3.135             |     | 3.465 | V    |       |
| Supply Current                             | Icc                                 |                   |     | 1.5   | A    |       |
| Module total power                         | P                                   |                   |     | 3.5   | W    | 1     |
| Transmitter                                |                                     |                   |     |       |      |       |
| Signaling rate per lane                    |                                     | 25.78125 ± 100ppm |     |       | Gb/s |       |
| Differential pk-pk input voltage tolerance | Vin,pp,diff                         |                   |     | 900   | mV   |       |
| Single-ended voltage tolerance             | Vin,pp                              | -0.35             |     | +3.3  | V    |       |
| Module stress input test                   | Per Section 83E.3.4.1, IEEE 802.3bm |                   |     |       |      |       |
| Receiver                                   |                                     |                   |     |       |      |       |
| Signaling rate per lane                    |                                     | 25.78125 ± 100ppm |     |       | Gb/s |       |
| Differential data output swing             | Vout,pp                             | 100               |     | 400   | mVpp | 2     |
|  |                                     | 300               |     | 600   |      |       |
|  |                                     | 400               | 600 | 800   |      |       |
|  |                                     | 600               |     | 1200  |      |       |
| Eye width                                  |                                     | 0.57              |     |       | UI   |       |
| Eye height, differential                   |                                     | 228               |     |       | mV   |       |
| Vertical eye closure                       | VEC                                 | 5.5               |     |       | dB   |       |
| Transition time (20% to 80%)               | tr, tf                              | 12                |     |       | ps   |       |

### Notes:

1. Maximum total power value is specified across the full temperature and voltage range.
2. Output voltage is settable in 4 discrete ranges via I2C. Default range is Range 2 (400 – 800 mV).

## Optical Characteristics

| Parameter  | Symbol | λ1   | λ2                            | λ3   | λ4   | Unit  | Notes |
|--|--------|------|-------------------------------|------|------|-------|-------|
| Transmitter  |        |      |                               |      |      |       |       |
| Signaling Speed per Lane                                       |        |      | 25.78125 ± 100ppm             |      |      | Gb/s  | 1     |
| Lane center wavelengths (range)                                | λ      | 850  | 880                           | 910  | 940  | nm    |       |
| RMS Spectral Width   | SW     | 0.59 | 0.59                          | 0.59 | 0.59 | nm    |       |
| Tx <sub>OMA</sub> min at max TDEC                              |        | -3   | -3                            | -3   | -2.9 | dBm   |       |
| TDEC (OM3)   | TDEC   | 3.3  | 3.5                           | 3.7  | 4.2  | dB    |       |
| Tx <sub>OMA</sub> - TDEC                                       | P-TDEC | -6.3 | -6.5                          | -6.7 | -7.1 | dBm   |       |
| Tx <sub>OMA</sub> min  | TxOMA  | -5.5 | -5.5                          | -5.5 | -5.5 | dBm   |       |
| Relative Intensity Noise                                       | RIN    |      | -130                          |      |      | dB/Hz | 2     |
| Optical Extinction Ratio                                       | ER     | 2    | 2                             | 2    | 2    | dB    |       |
| Optical Return Loss Tolerance                                  | ORL    |      | 12                            |      |      | dB    |       |
| Average launch power of OFF transmitter, per lane              |        |      | -30                           |      |      | dBm   |       |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}       |        |      | {0.3,0.38,0.45,0.35,0.41,0.5} |      |      |       | 3     |
| Receiver   |        |      |                               |      |      |       |       |
| Signaling Speed per Lane                                       |        |      | 25.78125 ± 100ppm             |      |      | GBd   | 4     |
| Lane center wavelengths (range)                                | λ      | 850  | 880                           | 910  | 940  | nm    |       |
| Damage Threshold   | DT     | 3.8  | 3.8                           | 3.8  | 3.8  | dBm   |       |
| Average Receive Power per Lane (min)                           | RXPmin | -9.5 | -9.4                          | -9.4 | -9.4 | dBm   |       |
| Average Receive Power per Lane (max)                           | RXPmax | 3.4  | 3.4                           | 3.4  | 3.4  | dBm   |       |
| Receiver Reflectance (max)                                     | Rfl    |      | -12                           |      |      | dB    |       |
| Stressed Receiver Sensitivity (OMA) per Lane                   | SRS    | -5.2 | -5.2                          | -5.2 | -5.2 | dBm   | 5     |
| Back to Back Receiver Sensitivity (OMA) per Lane               | RxSens | -8.2 | -8.4                          | -8.6 | -8.8 | dBm   | 6     |
| Stressed Conditions:   |        |      |                               |      |      |       |       |
| Stressed eye closure   | SEC    | 3.3  | 3.5                           | 3.7  | 4.2  | dB    |       |
| Stressed eye J2 jitter   | J2     |      | 0.39                          |      |      | UI    |       |
| Stressed eye J4 jitter   | J4     |      | 0.53                          |      |      | UI    |       |
| Stressed Receiver Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3} |        |      | {0.28,0.5,0.5,0.33,0.33,0.4}  |      |      |       | 7     |
| LOS De-Assert (max)  | LOSD   |      | -11                           |      |      | dBm   | 8     |
| LOS Assert (min)   | LOSA   |      | -30                           |      |      | dBm   | 8     |
| LOS Hysteresis   |        |      | 0.5                           |      |      | dB    |       |

**Notes:**

1. Transmitter consists of 4 lasers and a 4:1 optical multiplexer.
2. Informative, link controlled by TDEC
3. Hit Ratio  $1.5 \times 10^{-3}$  hits/sample.
4. Receiver consists of a 1:4 optical de-multiplexer and 4 photodetectors.
5.  $5 \times 10^{-5}$  BER (pre-FEC).
6. Unstressed receiver sensitivity is information and assumes  $5 \times 10^{-5}$  BER (pre-FEC).
7. Hit Ratio  $5 \times 10^{-5}$  hits/sample.
8. DC values.

**Link Budget**

| Parameter                           | Symbol | Min | Typ    | Max                | Units | Notes |
|-------------------------------------|--------|-----|--------|--------------------|-------|-------|
| Bit Rate (all wavelengths combined) | BR     |     | 103.10 |                    | Gb/s  |       |
| Bit Error Rate                      | BER    |     |        | $5 \times 10^{-5}$ |       | 1     |
| Insertion Loss                      | IL     |     |        | 1.8                | dB    | 2     |
| Maximum Supported Distances         |        |     |        |                    |       |       |
| Fiber Type                          |        |     |        |                    |       |       |
| OM3 MMF                             | Lmax1  |     |        | 75                 | m     | 3     |
| OM4 MMF                             | Lmax2  |     |        | 100                | m     | 3     |
| OM5 MMF                             | Lmax3  |     |        | 150                | m     | 3     |

**Notes:**

1. Tested with a  $2^{31} - 1$  PRBS at 25.78125 Gb/s
2. 850 nm channel can tolerate 1.9 dB insertion loss
3. Specified at 103.1Gb/s. Requires RS-FEC on the host to support maximum distance.

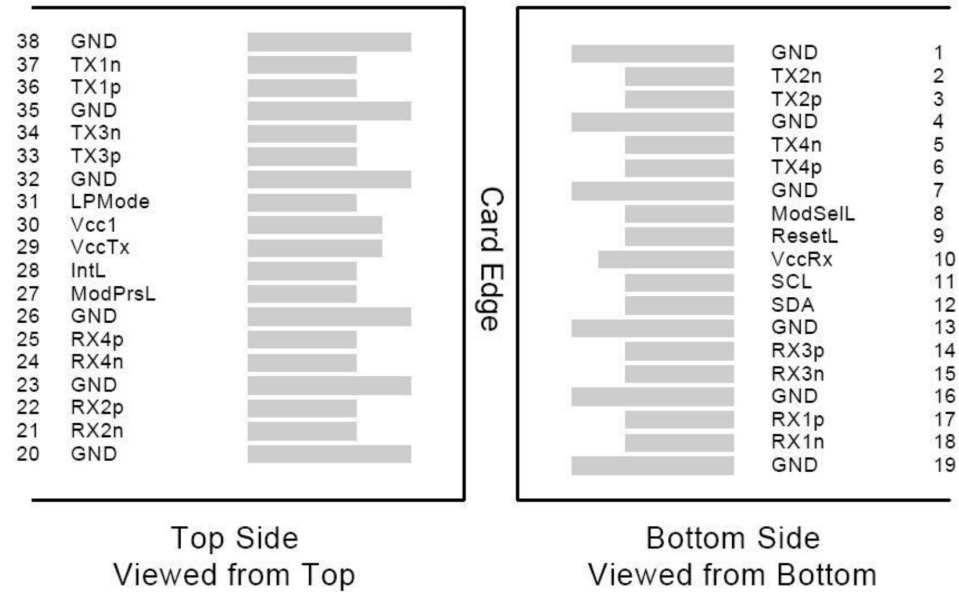
## Pin Descriptions

| 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  |                         | VCCR <sub>x</sub> | +3.3v Receiver Power Supply                        |      |
| 11  | LVC <sub>MOS</sub> -I   | SCL               | 2-wire Serial interface clock                      | 2    |
| 12  | LVC <sub>MOS</sub> -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  |                         | VCCT <sub>x</sub> | +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    |

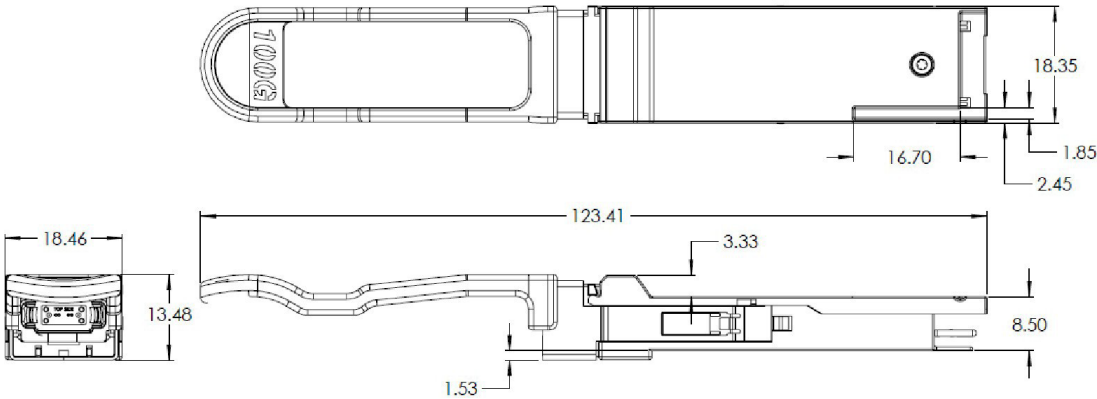
**Notes:**

- 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.

**Electrical Pin-out Details**



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.



## Contact Information

ProLabs US

Email: [sales@prolabs.com](mailto:sales@prolabs.com)

Telephone: 952-852-0252

ProLabs UK

Email: [salesupport@prolabs.com](mailto:salesupport@prolabs.com)

Telephone: +44 1285 719 600