

### **SFP-2-5GB-DW28-120-C**

MSA and TAA 2.5GBase-DWDM SFP Transceiver 100GHz (SMF, 1554.94nm, 120km, LC, DOM, 0 to 70C)

#### **Features:**

- INF-8074 and SFF-8472 Compliance
- Duplex LC Connector
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### **Applications:**

- Ethernet over DWDM
- Access, Metro and Enterprise

#### **Product Description**

This MSA compliant SFP transceiver provides 2.5GBase-DWDM throughput up to 120km over single-mode fiber (SMF) using a wavelength of 1554.94nm via an LC connector. It can operate at temperatures between 0 and 70C. All of our transceivers are built to comply with Multi-Source Agreement (MSA) standards and are uniquely serialized and tested for data-traffic and application to ensure 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.")



## DWDM Wavelengths

| ITU Channel | Frequency (THz) | Center Wavelength (nm) | ITU Channel | Frequency (THz) | Center Wavelength (nm) |
|-------------|-----------------|------------------------|-------------|-----------------|------------------------|
| 16          | 191.60          | 1564.68                | 42          | 194.20          | 1543.73                |
| 17          | 191.70          | 1563.86                | 43          | 194.30          | 1542.94                |
| 18          | 191.80          | 1563.05                | 44          | 194.40          | 1542.14                |
| 19          | 191.90          | 1562.23                | 45          | 194.50          | 1541.35                |
| 20          | 192.00          | 1561.42                | 46          | 194.60          | 1540.56                |
| 21          | 192.10          | 1560.61                | 47          | 194.70          | 1539.77                |
| 22          | 192.20          | 1559.79                | 48          | 194.80          | 1538.98                |
| 23          | 192.30          | 1558.98                | 49          | 194.90          | 1538.19                |
| 24          | 192.40          | 1558.17                | 50          | 195.00          | 1537.40                |
| 25          | 192.50          | 1557.36                | 51          | 195.10          | 1536.61                |
| 26          | 192.60          | 1556.55                | 52          | 195.20          | 1535.82                |
| 27          | 192.70          | 1555.75                | 53          | 195.30          | 1535.04                |
| 28          | 192.80          | 1554.94                | 54          | 195.40          | 1534.25                |
| 29          | 192.90          | 1554.13                | 55          | 195.50          | 1533.47                |
| 30          | 193.00          | 1553.33                | 56          | 195.60          | 1532.68                |
| 31          | 193.10          | 1552.52                | 57          | 195.70          | 1531.90                |
| 32          | 193.20          | 1551.72                | 58          | 195.80          | 1531.12                |
| 33          | 193.30          | 1550.92                | 59          | 195.90          | 1530.33                |
| 34          | 193.40          | 1550.12                | 60          | 196.00          | 1529.55                |
| 35          | 193.50          | 1549.32                | 61          | 196.10          | 1528.77                |
| 36          | 193.60          | 1548.51                | 62          | 196.20          | 1527.99                |
| 37          | 193.70          | 1547.72                | 63          | 196.30          | 1527.22                |
| 38          | 193.80          | 1546.92                | 64          | 196.40          | 1526.44                |
| 39          | 193.90          | 1546.12                | 65          | 196.50          | 1525.66                |
| 40          | 194.00          | 1545.32                | 66          | 196.60          | 1524.89                |
| 41          | 194.10          | 1544.53                |             |                 |                        |

## Absolute Maximum Ratings

| Parameter                          | Symbol           | Min. | Typ. | Max. | Unit | Notes |
|------------------------------------|------------------|------|------|------|------|-------|
| Data Rate                          |                  |      |      | 1.25 | Gbps |       |
| Link Budget                        |                  | 32   |      |      | dB   |       |
| Operating Case Temperature         | T <sub>c</sub>   | 0    |      | 70   | °C   |       |
| Storage Temperature                | T <sub>stg</sub> | -40  |      | 85   | °C   |       |
| Maximum Voltage                    | V <sub>cc</sub>  | -0.5 |      | 3.6  | V    |       |
| Relative Humidity (Non-Condensing) | RH               | 5    |      | 85   | %    |       |

### Notes:

1. Exceeding any one of these values may destroy the device permanently.

## Electrical Characteristics

| Parameter                       |         | Symbol | Min. | Typ. | Max.    | Unit  | Notes |
|---------------------------------|---------|--------|------|------|---------|-------|-------|
| Power Supply Voltage            |         | Vcc    | 3.14 | 3.3  | 3.47    | V     |       |
| Power Supply Current            |         | Icc    |      |      | 450     | mA    |       |
| Transmitter                     |         |        |      |      |         |       |       |
| LVPECL Inputs (Differential)    |         | VIN    | 400  |      | 2000    | mVp-p | 1     |
| Input Impedance (Differential)  |         | ZIN    | 85   | 100  | 115     | Ω     | 2     |
| Tx_Disable                      | Disable |        | 2    |      | Vcc     | V     |       |
|                                 | Enable  |        | 0    |      | 0.8     |       |       |
| Tx_Fault                        | Fault   |        | 2    |      | Vcc+0.3 | V     |       |
|                                 | Normal  |        | 0    |      | 0.5     |       |       |
| Receiver                        |         |        |      |      |         |       |       |
| LVPECL Outputs (Differential)   |         | VOUT   | 370  |      | 700     | mVp-p | 3     |
| Output Impedance (Differential) |         | ZOUT   | 85   | 100  | 115     | Ω     |       |
| Tx_Disable Assert Time          |         | t_off  |      |      | 10      | us    |       |
| Rx_LOS                          | High    |        | 2    |      | Vcc+0.3 | V     |       |
|                                 | Low     |        | 0    |      | 0.8     |       |       |
| MOD_DEF (0.2)                   |         | VOH    | 2.5  |      |         | V     | 4     |
|                                 |         | VOL    | 0    |      | 0.5     |       |       |

### Notes:

1. LVPECL logic. Internally AC coupled inputs.
2. R<sub>IN</sub> > 100kΩ @ DC.
3. After internal AC coupling.
4. With serial ID.

## Optical Characteristics

| Parameter                        | Symbol                    | Min.                         | Typ. | Max. | Unit | Notes |
|----------------------------------|---------------------------|------------------------------|------|------|------|-------|
| Transmitter                      |                           |                              |      |      |      |       |
| Center Wavelength                | $\lambda_C$               | ITU-T DWDM Center Wavelength |      |      | nm   |       |
| Center Wavelength Variation      |                           | -0.1                         |      | 0.1  | nm   |       |
| Center Frequency Spacing         | $\Delta f$                |                              | 100  |      | GHz  |       |
| Spectral Width (-20dB)           | $\Delta \lambda$          |                              |      | 1    | nm   |       |
| Side-Mode Suppression Ratio      | SMSR                      | 30                           |      |      | dB   |       |
| Average Output Power             | POUT                      | 0                            |      | 5    | dBm  | 1     |
| Optical Extinction Ratio         | ER                        | 9                            |      |      | dB   |       |
| Transmitter Dispersion Penalty   | TDP                       |                              |      | 3.0  | dB   |       |
| Average Power of Off Transmitter | Poff                      |                              |      | -45  | dBm  |       |
| Rise/Fall Time (20-80%)          | Tr/Tf                     |                              |      | 260  | ps   |       |
| Output Optical Eye               | Compliant with IEEE 802.3 |                              |      |      |      | 2     |
| Receiver                         |                           |                              |      |      |      |       |
| Center Wavelength                | $\lambda_C$               | 1528                         |      | 1620 | nm   |       |
| Receiver Sensitivity             | PSEN                      |                              |      | -32  | dBm  | 3, 4  |
| Receiver Overload                | POVER                     | -10                          |      |      | dBm  | 4     |
| LOS De-Assert                    | LOSD                      |                              |      | -33  | dBm  |       |
| LOS Assert                       | LOSA                      | -45                          |      |      | dBm  |       |
| LOS Hysteresis                   | LOSH                      | 0.5                          |      | 6    | dB   |       |

### Notes:

1. Output power is measured by coupling into a 9/125 $\mu$ m single-mode fiber.
2. Filtered, measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps.
3. Minimum average optical power, measured at BER less than 1E<sup>-12</sup> with 2<sup>7</sup>-1 PRBS and ER=9dB.
4. Measured with receiving wavelength in the range of 1524nm to 1620nm.

## Pin Descriptions

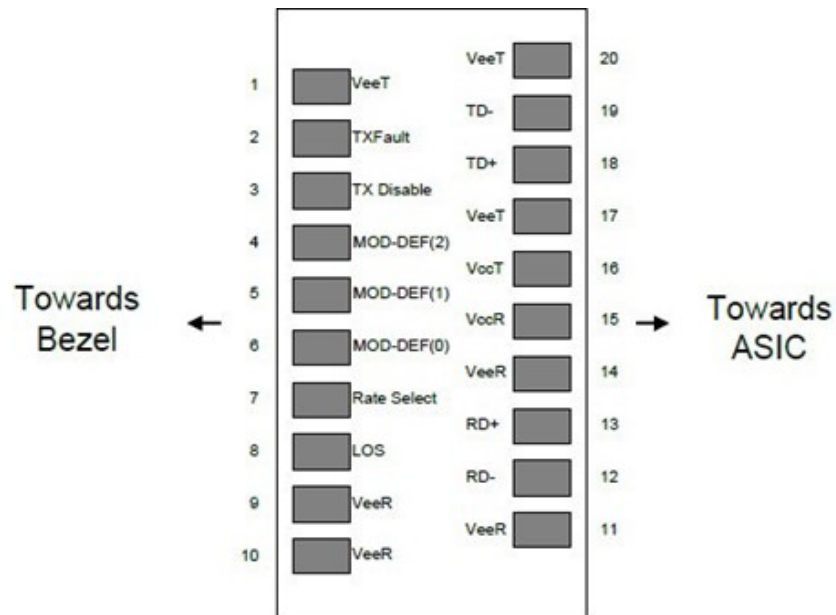
| Pin | Symbol      | Name/Description                                          | Plug Sequence | Notes |
|-----|-------------|-----------------------------------------------------------|---------------|-------|
| 1   | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 2   | Tx_Fault    | Transmitter Fault Indication.                             | 3             | 1     |
| 3   | Tx_Disable  | Transmitter Disable. Module disables on “high” or “open.” | 3             | 2     |
| 4   | MOD_DEF2    | Module Definition 2. 2-wire serial ID interface.          | 3             | 3     |
| 5   | MOD_DEF1    | Module Definition 1. 2-wire serial ID interface.          | 3             | 3     |
| 6   | MOD_DEF0    | Module Definition 0. Grounded within the module.          | 3             | 3     |
| 7   | Rate Select | Not Connected. Function not available.                    | 3             |       |
| 8   | LOS         | Loss of Signal.                                           | 3             | 4     |
| 9   | VeeR        | Receiver Ground.                                          | 1             |       |
| 10  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 11  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 12  | RD-         | Inverted Received Data Out.                               | 3             | 6     |
| 13  | RD+         | Received Data Out.                                        | 3             | 6     |
| 14  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 15  | VccR        | 3.3 ± 5% Receiver Power.                                  | 2             | 7     |
| 16  | VccT        | 3.3 ± 5% Transmitter Power.                               | 2             | 7     |
| 17  | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 18  | TD+         | Transmit Data In.                                         | 3             | 8     |
| 19  | TD-         | Inverted Transmit Data In.                                | 3             | 8     |
| 20  | VeeT        | Transmitter Ground.                                       | 1             | 5     |

## Notes

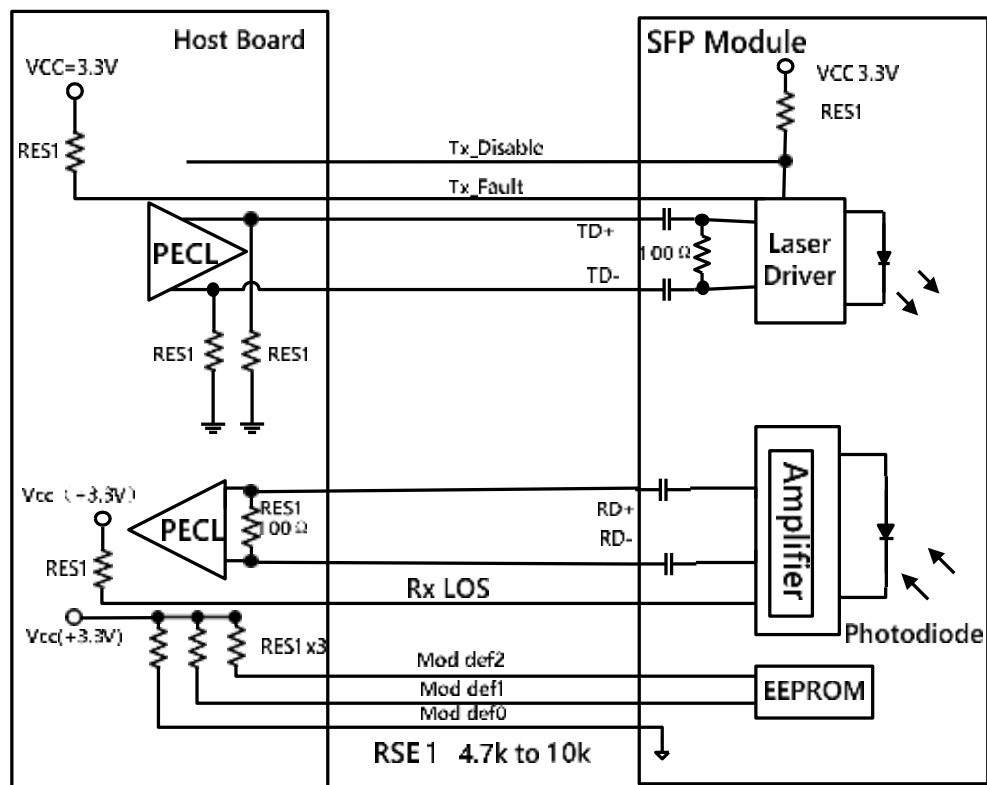
1. Tx\_Fault is an open collector/drain output that should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. When “high,” the output indicates a laser fault of some kind. “Low” indicates normal operation. In the “low” state, the output will be pulled to <0.8V.
2. Tx\_Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7kΩ to 10kΩ resistor. Its states are :  
Low (0V-0.8V): Transmitter On  
(>0.8V, <2.0V): Undefined  
High (2.0V–3.465V): Transmitter Disabled  
Open: Transmitter Disabled.
3. MOD\_DEF0, 1, & 2. These are the module definition pins. They should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board.  
MOD\_DEF0 is grounded by the module to indicate that the module is present.  
MOD\_DEF1 is the clock line of the 2-wire serial interface for serial ID.  
MOD\_DEF2 is the data line of the 2-wire serial interface for serial ID.
4. LOS (Loss of Signal) is an open collector/drain output that should be pulled up with a 4.7kΩ to 10kΩ resistor. When “high,” this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). “Low” indicates normal operation in the “low” state. The output will be pulled to <0.8V.
5. VeeR and VeeT may be internally connected within the SFP module.
6. RD-/+. These are the differential receiver outputs. They are AC-coupled, 100Ω differential lines that should be terminated with 100Ω (differential) at the user SERDES.

7. VccR and VccT are the receiver and transmitter power supplies. They are defined as  $3.3V \pm 5\%$  at the SFP connector pin. VccR and VccT may be internally connected within the SFP transceiver.
8. TD-/+. These are the differential transmitter inputs. They are AC-coupled, differential lines with  $100\Omega$  differential termination inside the module.

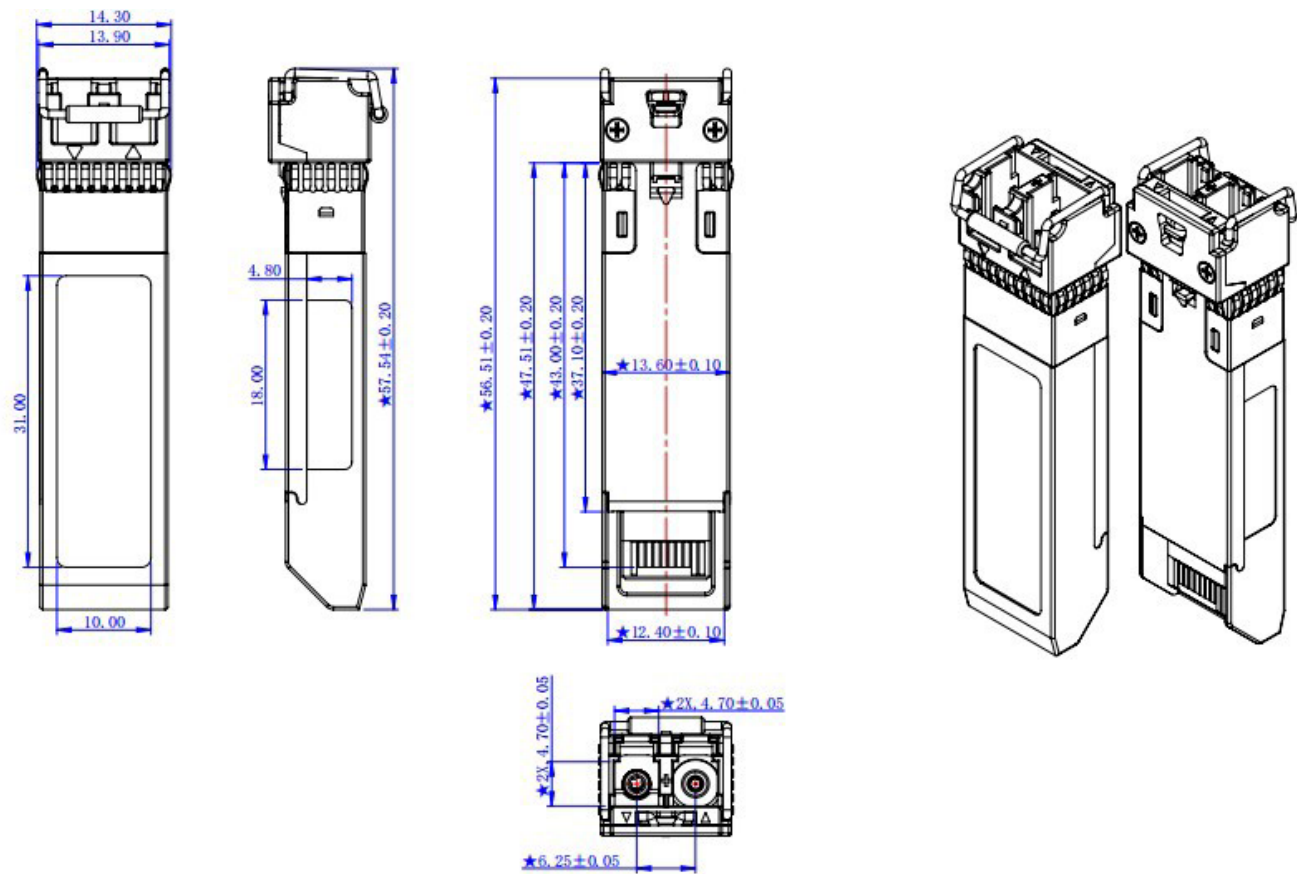
## Pin-Out Details



## Recommended Circuit Schematic



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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