

### **SFP-1GB-HD1-55U-20-C**

MSA and TAA 1000Base-CWDM HD1 SFP Transceiver (SMF, 1550nm LTx/HRx, 20km, LC, DOM)

#### **Features:**

- INF-8074 and SFF-8472 Compliance
- Simplex 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:**

- Gigabit Ethernet over CWDM
- 1x Fibre Channel
- Access, Metro and Enterprise

#### **Product Description**

This MSA compliant SFP transceiver provides 1000Base-CWDM HD1 throughput up to 20km over single-mode fiber (SMF) at a bidirectional wavelength of 1550nm LTx/HRx via an LC connector. It can operate at temperatures between 0 and 70C. The listed reach has been determined using a link budget calculation and tested in a standard environment. Actual link distances achieved will be dependent upon the deployed environment. 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.")



### CWDM Available Wavelengths

| Wavelength | Min.   | Typ. | Max.   |
|------------|--------|------|--------|
| 27         | 1264.5 | 1271 | 1277.5 |
| 29         | 1284.5 | 1291 | 1297.5 |
| 31         | 1304.5 | 1311 | 1317.5 |
| 33         | 1324.5 | 1331 | 1337.5 |
| 35         | 1344.5 | 1351 | 1357.5 |
| 37         | 1364.5 | 1371 | 1377.5 |
| 39         | 1384.5 | 1391 | 1397.5 |
| 41         | 1404.5 | 1411 | 1417.5 |
| 43         | 1424.5 | 1431 | 1437.5 |
| 45         | 1444.5 | 1451 | 1457.5 |
| 47         | 1464.5 | 1471 | 1477.5 |
| 49         | 1484.5 | 1491 | 1497.5 |
| 51         | 1504.5 | 1511 | 1517.5 |
| 53         | 1524.5 | 1531 | 1537.5 |
| 55         | 1544.5 | 1551 | 1557.5 |
| 57         | 1564.5 | 1571 | 1577.5 |
| 59         | 1584.5 | 1591 | 1597.5 |
| 61         | 1604.5 | 1611 | 1617.5 |

### Absolute Maximum Ratings

| Parameter                    | Symbol | Min.   | Typ.   | Max.   | Unit  | Notes |
|------------------------------|--------|--------|--------|--------|-------|-------|
| Power Supply Voltage         | Vcc    | +3.135 | +3.30  | +3.465 | V     |       |
| Power Supply Current         | Icc    |        |        | 500    | mA    | 1     |
| Power Supply Noise Rejection | PSNR   |        |        | 100    | mVp-p | 2     |
| Operating Temperature        | Tc     | -40    |        | +85    | °C    | 3     |
| Storage Temperature          | Tstg   | -40    |        | +85    | °C    | 4     |
| Power Supply Storage         | Vcc    |        | < +4.0 |        | V     |       |
| Ambient Humidity             | AH     | 5      |        | 95     | %     | 5     |

#### Notes:

1. Cooled type.
2. From 100Hz to 1MHz.
3. Case with airflow.
4. Ambient.

- Without dew.

## Electrical Characteristics

| Parameter                                               |                | Symbol       | Min.   | Typ. | Max.    | Unit | Notes |
|---------------------------------------------------------|----------------|--------------|--------|------|---------|------|-------|
| Transmitter                                             |                |              |        |      |         |      |       |
| Data Rate                                               |                | DRT          | 1.0625 |      | 1.25    | Gbps |       |
| Differential Input Voltage                              |                | VIN,pp       | 150    |      | 1000    | mV   |       |
| Differential Input Impedance                            |                | ZIN          | 90     | 100  | 110     | Ω    |       |
| Tx_Disable                                              | Input_Low      | VIL          | 0      |      | 0.8     | V    | 1     |
|                                                         | Input_High     | VIH          | 2.0    |      | 3.465   | V    |       |
|                                                         | Assert Time    | tOFF         |        |      | 10      | us   | 2     |
|                                                         | Negate Time    | tON          |        |      | 1       | ms   | 3     |
| Tx_Disable to Reset                                     |                | treset       | 10     |      |         | us   | 4     |
| Time to Initialize_Cooled (Including Reset of Tx_Fault) |                | tInit_cooled |        |      | 10      | sec  | 5     |
| Tx_Fault                                                | Output_Low     | VFOL         | 0      |      | 0.8     | V    | 6     |
|                                                         | Output_High    | VFOH         | 2.0    |      | Vcc+0.3 | V    |       |
| Receiver                                                |                |              |        |      |         |      |       |
| Data Rate                                               |                | DR           | 1.0625 |      | 1.25    | Gbps |       |
| Differential Output Voltage                             |                | VOUT         | 300    |      | 850     | mV   | -     |
| Differential Output Impedance                           |                | ZOUT         | 90     | 100  | 110     | Ω    | -     |
| Rx_LOS<br>(Loss of Signal)                              | Output_Low     | VLOSL        | 0      |      | 0.8     | V    | 6     |
|                                                         | Output_High    | VLOSH        | 2      |      | Vcc+0.3 | V    |       |
|                                                         | Assert Time    | tLOS-ON      |        |      | 100     | us   | 7     |
|                                                         | De-Assert Time | tLOS-OFF     |        |      | 100     | us   | 8     |

### Notes:

- LVTTTL, normal at low, high is shutdown (Poff).
- Assert time tOFF: high.
- Negate time tON: low.
- Tx\_Disable to reset treset: high.
- Cooled version, for wavelength stabilization at worst-case (low & high temperatures).
- LVTTTL, low is normal.
- Assert time tLOS-ON: low → high.
- De-assert time tLOS-OFF: high → low.

## Optical Characteristics

| Parameter                       |            | Symbol                               | Min.                                | Typ. | Max.  | Unit  | Notes |
|---------------------------------|------------|--------------------------------------|-------------------------------------|------|-------|-------|-------|
| Transmitter                     |            |                                      |                                     |      |       |       |       |
| Optical Transmit Power          |            | Pf                                   | -2.5                                |      | 2.0   | dBm   |       |
| Transmitter Disable (Off) Power |            | Poff                                 |                                     |      | -35   | dBm   | 2     |
| Peak Wavelength                 |            | $\lambda_P$                          | $\lambda_C$ -6.5 ~ $\lambda_C$ -1.5 |      |       | nm    | 1     |
| Spectral Width                  |            | $\Delta\lambda$                      |                                     |      | 1.0   | nm    | 3     |
| Side-Mode Suppression Ratio     |            | SMSR                                 | 30                                  |      |       | dB    |       |
| RIN <sub>12</sub> OMA           |            | RIN                                  |                                     |      | -117  | dB/Hz |       |
| Dispersion Penalty              |            | DP                                   |                                     |      | 1.5   | dB    |       |
| Extinction Ratio                |            | ER                                   | 8.2                                 |      |       | dB    | 4     |
| Eye Pattern Mask                |            | IEEE802.3/2008 Section 3 Figure 38-2 |                                     |      |       |       |       |
| Receiver                        |            |                                      |                                     |      |       |       |       |
| Optical Sensitivity             |            | S                                    |                                     |      | -26.5 | dBm   | 5     |
| Optical Overload                |            | OL                                   | 2.0                                 |      |       | dBm   | 5     |
| Operating Wavelength            |            | $\lambda_o$                          | $\lambda_C$ +2.0 ~ $\lambda_C$ +6.5 |      |       | nm    | 1     |
| Rx_LOS<br>(Loss of Signal)      | Assert     | PA                                   | -38.0                               |      |       | dBm   | 6     |
|                                 | De-Assert  | PD                                   |                                     |      | -26.5 | dBm   |       |
|                                 | Hysteresis | PA-PD                                | 0.5                                 | 2.0  | 5.0   | dB    |       |
| Receiver Reflectance            |            |                                      |                                     |      | -27   | dB    | 7     |
| RSSI Calibration                |            | RCAL                                 | Internally Calibrated               |      |       |       |       |

### Notes:

1. CWDM, DFB-LD,  $\lambda_C = 1271, 1291, 1311, 1331, 1351, 1371, 1391, 1411, 1431, 1451, 1471, 1491, 1511, 1531, 1551, 1571, 1591, \text{ and } 1611\text{nm}$ .
2. At Tx\_Disable = high.
3. At -20dB.
4. At 1.25Gbps, PRBS 2<sup>7</sup>-1, Figure 1.
5. PRBS2<sup>7</sup>-1, BER1x10<sup>-12</sup>, and ER=8.2dB.
6. Squelch function enabled.
7. At  $\lambda_O$ .

## Pin Descriptions

| Pin | Symbol      | Name/Description                                           | Plug Sequence | Notes |
|-----|-------------|------------------------------------------------------------|---------------|-------|
| 1   | VeeT        | Module Ground.                                             | 1             |       |
| 2   | Tx_Fault    | Status Out.                                                | 3             |       |
| 3   | Tx_Disable  | Control In.                                                | 3             |       |
| 4   | MOD_DEF(2)  | Input/Output (SDA, I <sup>2</sup> C Data).                 | 3             |       |
| 5   | MOD_DEF(1)  | Input/Output (SCL, I <sup>2</sup> C Clock).                | 3             |       |
| 6   | MOD_DEF(0)  | Indicates that the module is present. Grounded internally. | 3             |       |
| 7   | Rate Select | Rate Select In. Not Used.                                  | 3             | 1     |
| 8   | Rx_LOS      | Status Out.                                                | 3             |       |
| 9   | VeeR        | Module Ground.                                             | 3             |       |
| 10  | VeeR        | Module Ground.                                             | 1             |       |
| 11  | VeeR        | Module Ground.                                             | 1             |       |
| 12  | Rx_Data-    | Data Out Negative.                                         | 3             |       |
| 13  | Rx_Data+    | Data Out Positive.                                         | 3             |       |
| 14  | VeeR        | Module Ground.                                             | 1             |       |
| 15  | Rx_Vcc      | Power.                                                     | 2             |       |
| 16  | Tx_Vcc      | Power.                                                     | 2             |       |
| 17  | VeeT        | Module Ground.                                             | 1             |       |
| 18  | Tx_Data+    | Data In Positive.                                          | 3             |       |
| 19  | Tx_Data-    | Data In Negative.                                          | 3             |       |
| 20  | VeeT        | Module Ground.                                             | 1             |       |

### Notes:

1. Internally pulled down with >51k $\Omega$  resistor.

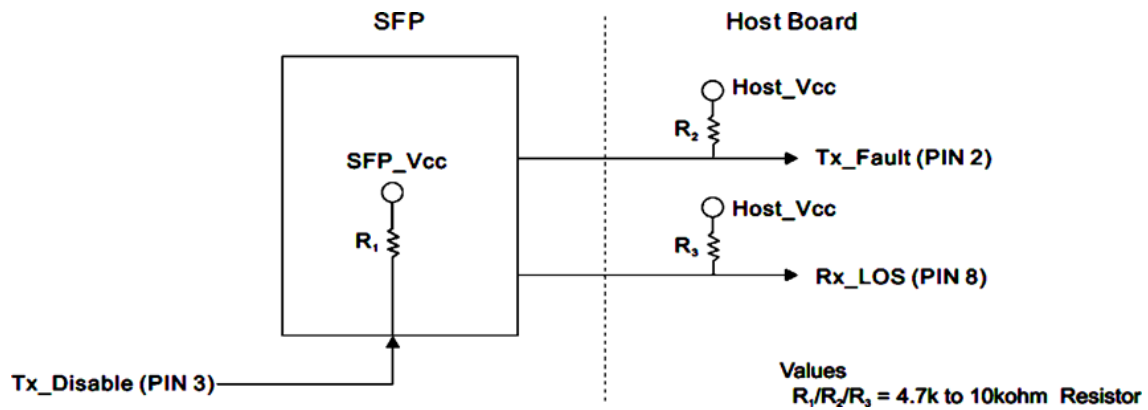
### Recommended Circuit Schematic

Tx\_Disable: Transmitter Disable, logic high, 4.7k to 10kΩ pull-up to the Vcc on the SFP.

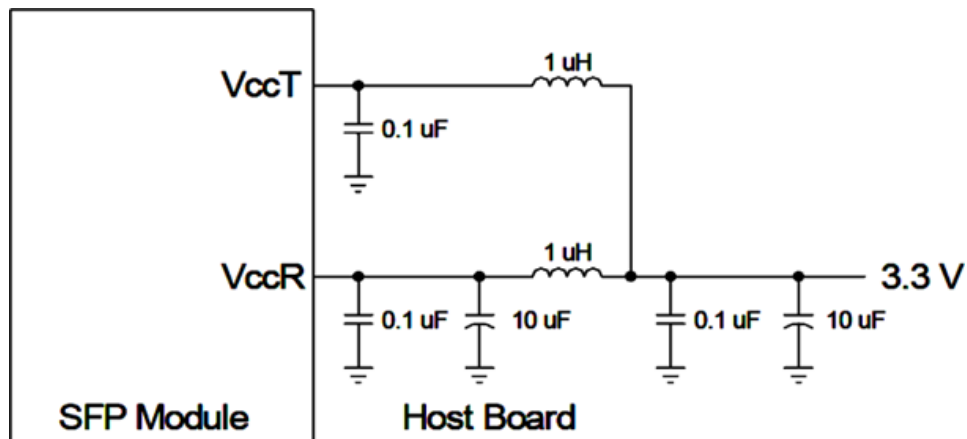
Tx\_Fault: Transmitter Fault, logic high, 4.7k to 10kΩ pull-up to the Vcc on the host.

Rx\_LOS: Receiver Loss of Signal, logic high, 4.7k to 10kΩ pull-up to the Vcc on the host.

### Signal Definitions



### Power Coupling



The diagram illustrates the internal wiring of an SFP module. Key components and connections include:

- Protocol IC:** Provides control signals like `Tx_Disable`, `Tx_Fault`, `Rx_LOS`, and `Rx_Rate`. It is connected to `Protocol Vcc` and has a `4.7k to 10k Ohms` pull-up resistor on its `Protocol Vcc` line.
- SerDes IC:** Interfaces with the Protocol IC and the SFP Module. It has a `100 Ohms` termination resistor on its input line and is connected to `4.7k to 10k Ohms` pull-up resistors on both its `Protocol Vcc` and `3.3V` lines.
- 3.3V Power Supply:** Provided by a 3.3V source with a `10 uF` capacitor and a `.1uF` capacitor. It is connected to the `3.3V` pin of the SerDes IC and the `3.3V` pin of the SFP Module.
- SFP Module:** Contains the `Laser Driver` and `Preamp & Quantizer`. It has pins for `Vcc,T`, `Tx_Disable`, `Tx_Fault`, `TD+`, `TD-`, `Gnd,T`, `Vcc,R`, `RD+`, `RD-`, `Rx_LOS`, `Rx_Rate`, `Gnd,R`, and `Mod_def 0`, `Mod_def 1`, `Mod_def 2`. It also has a `30k Ohms` resistor connected to `Vcc,R`.
- PLD / PAL:** Provides `Mod_def 0`, `Mod_def 1`, and `Mod_def 2` signals. It has a `3.3V` supply and is connected to `4.7k to 10k Ohms` pull-up resistors on its `3.3V` line.

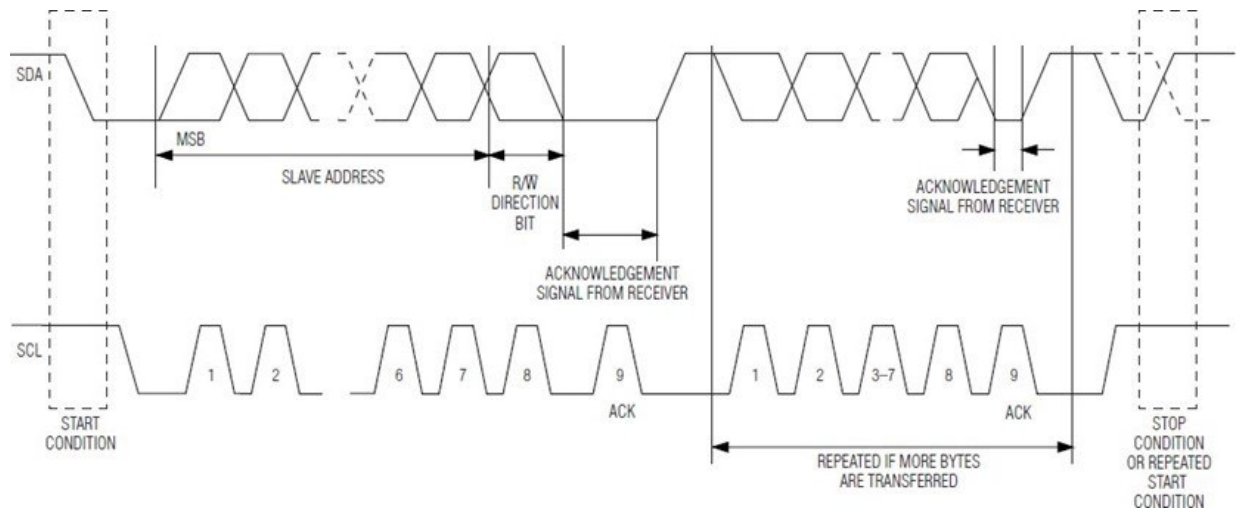
**Top of Board**

|    |      |
|----|------|
| 20 | VeeT |
| 19 | TD-  |
| 18 | TD+  |
| 17 | VeeT |
| 16 | VccT |
| 15 | VccR |
| 14 | VeeR |
| 13 | RD+  |
| 12 | RD-  |
| 11 | VeeR |

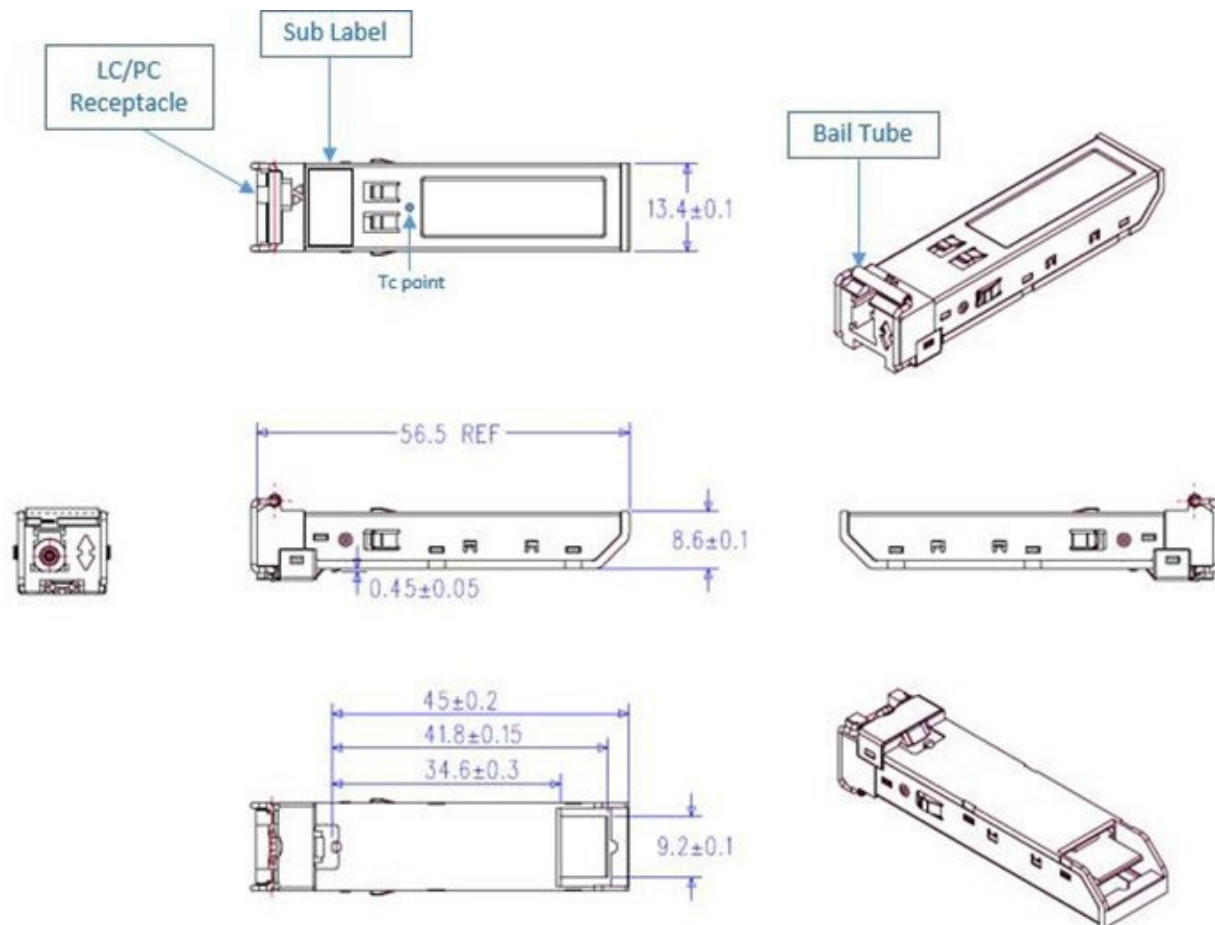
**Bottom of Board (as viewed thru top of board)**

|    |             |
|----|-------------|
| 1  | VeeT        |
| 2  | TxFault     |
| 3  | Tx Disable  |
| 4  | MOD-DEF(2)  |
| 5  | MOD-DEF(1)  |
| 6  | MOD-DEF(0)  |
| 7  | Rate Select |
| 8  | LOS         |
| 9  | VeeR        |
| 10 | VeeR        |

## 2-Wire Data Transfer Protocol



## 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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