

### **SFP-1GB-DW41-40-OPC**

MSA and TAA 1000Base-DWDM SFP Transceiver 100GHz (SMF, 1544.53nm, 40km, LC, DOM)

#### **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:**

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

#### **Product Description**

This MSA compliant SFP transceiver provides 1000Base-DWDM throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1544.53nm 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.

## 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

## Wavelength Guide (100GHz ITU-T Channel)

| ITU Channel # | Frequency (THZ) | Center Wavelength (nm) |
|---------------|-----------------|------------------------|
| 61            | 196.1           | 1528.77                |
| 60            | 196.0           | 1529.55                |
| 59            | 195.9           | 1530.33                |
| 58            | 195.8           | 1531.12                |
| 57            | 195.7           | 1531.90                |
| 56            | 195.6           | 1532.68                |
| 55            | 195.5           | 1533.47                |
| 54            | 195.4           | 1534.25                |
| 53            | 195.3           | 1535.04                |
| 52            | 195.2           | 1535.82                |
| 51            | 195.1           | 1536.61                |
| 50            | 195.0           | 1537.40                |
| 49            | 194.9           | 1538.19                |
| 48            | 194.8           | 1538.98                |
| 47            | 194.7           | 1539.77                |
| 46            | 194.6           | 1540.56                |
| 45            | 194.5           | 1541.35                |
| 44            | 194.4           | 1542.14                |
| 43            | 194.3           | 1542.94                |
| 42            | 194.2           | 1543.73                |
| 41            | 194.1           | 1544.53                |
| 40            | 194.0           | 1545.32                |
| 39            | 193.9           | 1546.12                |
| 38            | 193.8           | 1546.92                |
| 37            | 193.7           | 1547.72                |
| 36            | 193.6           | 1548.51                |
| 35            | 193.5           | 1549.32                |
| 34            | 193.4           | 1550.12                |
| 33            | 193.3           | 1550.92                |
| 32            | 193.2           | 1551.72                |
| 31            | 193.1           | 1552.52                |
| 30            | 193.0           | 1553.33                |
| 29            | 192.9           | 1554.13                |
| 28            | 192.8           | 1554.94                |
| 27            | 192.7           | 1555.75                |
| 26            | 192.6           | 1556.55                |

|    |       |         |
|----|-------|---------|
| 25 | 192.5 | 1557.36 |
| 24 | 192.4 | 1558.17 |
| 23 | 192.3 | 1558.98 |
| 22 | 192.2 | 1559.79 |
| 21 | 192.1 | 1560.61 |
| 20 | 192.0 | 1561.42 |
| 19 | 191.9 | 1562.23 |
| 18 | 191.8 | 1563.05 |
| 17 | 191.7 | 1563.86 |

### Absolute Maximum Ratings

| Parameter                  | Symbol          | Min. | Max. | Unit |
|----------------------------|-----------------|------|------|------|
| Maximum Supply Voltage     | V <sub>CC</sub> | -0.5 | 4.0  | V    |
| Storage Temperature        | T <sub>S</sub>  | -40  | 85   | °C   |
| Operating Case Temperature | T <sub>C</sub>  | 0    | 70   | °C   |
| Operating Humidity         | RH              | 5    | 85   | %    |

### Electrical Characteristics (TOP=25°C, V<sub>CC</sub>=3.3Volts)

| Parameter                                          | Symbol           | Min. | Typ. | Max.            | Unit  | Notes |
|----------------------------------------------------|------------------|------|------|-----------------|-------|-------|
| Power Supply Voltage                               | V <sub>CC</sub>  | 3.14 | 3.30 | 3.46            | V     |       |
| Power Supply Current                               | I <sub>CC</sub>  |      |      | 450             | mA    |       |
| Supply Voltage                                     | V <sub>MAX</sub> | -0.5 |      | 4               | V     |       |
| <b>Transmitter</b>                                 |                  |      |      |                 |       |       |
| Differential data input voltage (TD +/-)           |                  | 200  |      | 1200            | mVp-p | 1     |
| Low speed output: Tx Fault/ Loss of Signal (LOS)   | VOH              | 2.0  |      | V <sub>CC</sub> | V     | 2     |
|                                                    | VOL              | 0    |      | 0.8             | V     |       |
| Low speed output: Tx Disable / MOD_DEF1, MOD_DEF 2 | VOH              | 2.0  |      | V <sub>CC</sub> | V     | 3     |
|                                                    | VOL              | 0    |      | 0.8             | V     |       |
| <b>Receiver</b>                                    |                  |      |      |                 |       |       |
| Differential data output voltage                   |                  | 600  |      | 1200            | mVp-p | 4     |

### Notes

1. Internally AC coupled and terminated to 100Ω differential load.
2. Pulled up externally with a 4.7KΩ-10KΩ resistor on the host board to VCCT,R.
3. Mod\_Def1 and Mod\_Def2 must be pulled up externally with a 4.7KΩ-10KΩ resistor on the host board to VCCT,R.

- Internally AC coupled, but requires a 100Ω differential termination or internal to Serializer/Deserializer.

#### Optical Characteristics

| Parameter                          | Symbol                         | Min.                       | Typ. | Max.  | Unit | Notes |
|------------------------------------|--------------------------------|----------------------------|------|-------|------|-------|
| Transmitter                        |                                |                            |      |       |      |       |
| Wavelength Spacing                 |                                |                            | 100  |       | GHz  |       |
| Optical Wavelength                 | T <sub>λ</sub>                 | x-0.1                      | x    | X+0.1 | nm   |       |
| Optical Power (average)            | P <sub>AVE</sub>               | 0                          |      | 4     | dBm  | 1     |
| Transmitter and Dispersion Penalty | TDP                            |                            |      | 3     | dB   |       |
| Optical Extinction Ratio           | ER                             | 8.0                        |      |       | dB   |       |
| Spectral Width                     | Δλ                             |                            |      | 0.3   | nm   |       |
| Sidemode Suppression Ratio         | SMSR                           | 30                         |      |       | dB   |       |
| Optical Rise/Fall Time (20%-80%)   | t <sub>r</sub> /t <sub>f</sub> |                            |      | 260   | ps   |       |
| Eye Diagram                        |                                | Compatible with IEEE 802.3 |      |       |      |       |
| Receiver                           |                                |                            |      |       |      |       |
| Receiver Wavelength                | λ <sub>C</sub>                 | 1528                       |      | 1566  | nm   |       |
| Receiver Sensitivity (average)     | R <sub>AVE</sub>               |                            |      | -20   | dBm  | 2     |
| Receiver overload                  | P <sub>max</sub>               | -1                         |      |       | dBm  | 3     |
| LOS Assert                         | LOS <sub>A</sub>               | -35                        |      |       | dBm  |       |
| LOS De-Assert                      | LOS <sub>D</sub>               |                            |      | -22   | dBm  |       |
| LOS Hysteresis                     | LOS <sub>H</sub>               | 0.5                        |      |       | dBm  |       |

#### Notes:

- Coupled into a Single-mode fibre
- Average power, back-to-back, @1.25Gbps, BER  $1E^{-12}$ , PRBS  $2^{31}-1$ .
- Exceeding the Receiver overload can physically damage the module. Please use appropriate attenuation.

## Pin Descriptions

| Pin | Symbol     | Name/Descriptions                                                              | Ref. |
|-----|------------|--------------------------------------------------------------------------------|------|
| 1   | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |
| 2   | TX Fault   | Transmitter Fault. LVTTTL-O                                                    | 2    |
| 3   | TX Disable | Transmitter Disable. Laser output disabled on high or open. LVTT-I.            | 3    |
| 4   | SDA        | 2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i). LVTTTL-I/O. |      |
| 5   | SCL        | 2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i). LVTTTL-I.   |      |
| 6   | MOD_ABS    | Module Absent, Connect to VeeT or VeeR in Module.                              | 4    |
| 7   | RS0        | Rate Select 0. Not used                                                        | 5    |
| 8   | LOS        | Loss of Signal indication. Logic 0 indicates normal operation. LVTTTL-O.       | 2    |
| 9   | RS1        | Rate Select 1. Not used                                                        | 5    |
| 10  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 11  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 12  | RD-        | Receiver Inverted DATA out. AC Coupled. CML-O.                                 |      |
| 13  | RD+        | Receiver Non-inverted DATA out. AC Coupled. CML-O.                             |      |
| 14  | VeeR       | Receiver Ground (Common with Transmitter Ground).                              | 1    |
| 15  | VccR       | Receiver Power Supply.                                                         |      |
| 16  | VccT       | Transmitter Power Supply.                                                      |      |
| 17  | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |
| 18  | TD+        | Transmitter Non-Inverted DATA in. AC Coupled. CML-I.                           |      |
| 19  | TD-        | Transmitter Inverted DATA in. AC Coupled. CML-O.                               |      |
| 20  | VeeT       | Transmitter Ground (Common with Receiver Ground).                              | 1    |

## Notes:

1. The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
2. This contact is an open collector/drain output and should be pulled up to the Vcc\_Host with resistor in the range 4.7KΩ to 10KΩ. Pull ups can be connected to one or several power supplies, however the host board design shall ensure that no module contract has voltage exceeding module VccT/R +0.5.V.
3. Tx\_Disable is an input contact with a 4.7KΩ to 10KΩ pull-up resistor to VccT inside module.
4. Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull the contract up to Vcc\_Host with a resistor in the range from 4.7KΩ to 10KΩ. Mod\_ABS is asserted "High" when the SFP+ module is physically absent from a host slot.
5. Internally pulled down per SFF-8431



Pin-out of connector Block on Host board

### Recommended Circuit Schematic



**Mechanical Specifications**

Small Form Factor Pluggable (SFP) transceivers are compatible with the dimensions defined by the SFP Multi-Sourcing Agreement (MSA).



**EEPROM Information**

EEPROM memory map specific data field description is as below:

| 2 wire address 1010000X (A0h)           | 2 wire address 1010001X (A2h)             |
|-----------------------------------------|-------------------------------------------|
| 0                                       | 0                                         |
| Serial ID Defined by SFP MSA (96 bytes) | Alarm and Warning Thresholds (56 bytes)   |
| 95                                      | 55                                        |
| Vendor Specific (32 bytes)              | Cal Constants (40 bytes)                  |
| 127                                     | 95                                        |
| Reserved, SFF8079 (128 bytes)           | Real Time Diagnostic Interface (24 bytes) |
| 255                                     | 119                                       |
|                                         | Vendor Specific (8 bytes)                 |
|                                         | 127                                       |
|                                         | User Writable EEPROM (120 bytes)          |
|                                         | 247                                       |
|                                         | Vendor Specific (8 bytes)                 |
|                                         | 255                                       |