

## SFP-10GB-DW21-40-FT-OPC

Fortinet® Compatible TAA 10GBase-DWDM SFP+ Transceiver C-Band 100GHz (SMF, 1560.61nm, 40km, LC, DOM)

### Features

- SFF-8432 and SFF-8472 Compliance
- Duplex LC Connector
- Temperature-stabilized EML transmitter and APD receiver
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



### Applications:

- 10x Gigabit Ethernet over DWDM
- 8x/10x Fibre Channel
- Access, Metro and Enterprise

### Product Description

This Fortinet® compatible SFP+ transceiver provides 10GBase-DWDM throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1560.61nm via an LC connector. It can operate at temperatures between 0 and 70C. Our transceiver is built to meet or exceed OEM specifications and is guaranteed to be 100% compatible with Fortinet®. It has been programmed, uniquely serialized, and tested for data-traffic and application to ensure that it will initialize and perform identically. All of our transceivers comply with Multi-Source Agreement (MSA) standards to provide 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.

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

| Channel # | Frequency (THz) | Center Wavelength (nm) |
|-----------|-----------------|------------------------|
| 17        | 191.7           | 1563.86                |
| 18        | 191.8           | 1563.05                |
| 19        | 191.9           | 1562.23                |
| 20        | 192.0           | 1561.42                |
| 21        | 192.1           | 1560.61                |
| 22        | 192.2           | 1559.79                |
| 23        | 192.3           | 1558.98                |
| 24        | 192.4           | 1558.17                |
| 25        | 192.5           | 1557.36                |
| 26        | 192.6           | 1556.55                |
| 27        | 192.7           | 1555.75                |
| 28        | 192.8           | 1554.94                |
| 29        | 192.9           | 1554.13                |
| 30        | 193.0           | 1553.33                |
| 31        | 193.1           | 1552.52                |
| 32        | 193.2           | 1551.72                |
| 33        | 193.3           | 1550.92                |
| 34        | 193.4           | 1550.12                |
| 35        | 193.5           | 1549.32                |
| 36        | 193.6           | 1548.51                |
| 37        | 193.7           | 1547.72                |
| 38        | 193.8           | 1546.92                |
| 39        | 193.9           | 1546.12                |
| 40        | 194.0           | 1545.32                |
| 41        | 194.1           | 1544.53                |
| 42        | 194.2           | 1543.73                |
| 43        | 194.3           | 1542.94                |
| 44        | 194.4           | 1542.14                |
| 45        | 194.5           | 1541.35                |
| 46        | 194.6           | 1540.56                |
| 47        | 194.7           | 1539.77                |
| 48        | 194.8           | 1538.98                |
| 49        | 194.9           | 1538.19                |

|    |       |         |
|----|-------|---------|
| 50 | 195.0 | 1537.40 |
| 51 | 195.1 | 1536.61 |
| 52 | 195.2 | 1535.82 |
| 53 | 195.3 | 1535.04 |
| 54 | 195.4 | 1534.25 |
| 55 | 195.5 | 1533.47 |
| 56 | 195.6 | 1532.68 |
| 57 | 195.7 | 1531.90 |
| 58 | 195.8 | 1531.12 |
| 59 | 195.9 | 1530.33 |
| 60 | 196.0 | 1529.55 |
| 61 | 196.1 | 1528.77 |

#### Absolute Maximum Ratings

| Parameter                  | Symbol | Min. | Typ     | Max. | Unit |
|----------------------------|--------|------|---------|------|------|
| Storage Temperature        | Tstg   | -40  |         | 85   | °C   |
| Supply Voltage             | Vcc    | -0.5 |         | 4.0  | V    |
| Operating Case Temperature | Tc     | 0    | 25      | 70   | °C   |
| Relative Humidity          | RH     | 5    |         | 95   | %    |
| Data Rate                  |        |      | 10.3125 |      | Gbps |

## Electrical Characteristics

| Parameter                        |                      | Symbol                          | Min.  | Typ. | Max.                | Unit              | Notes |
|----------------------------------|----------------------|---------------------------------|-------|------|---------------------|-------------------|-------|
| Supply Voltage                   |                      | V <sub>CC</sub>                 | 3.135 | 3.3  | 3.465               | V                 |       |
| Module Supply Current            |                      | I <sub>CC</sub>                 |       |      | 450                 | mA                |       |
| Power Dissipation                |                      | P <sub>D</sub>                  |       |      | 1500                | mW                |       |
| Transmitter                      |                      |                                 |       |      |                     |                   |       |
| Input Differential Impedance     |                      | Z <sub>in</sub>                 |       | 100  |                     | Ω                 |       |
| Differential Data Input Swing    |                      | V <sub>in,p-p</sub>             | 180   |      | 700                 | mV <sub>p-p</sub> |       |
| TX_FAULT                         | Transmitter Fault    | V <sub>OH</sub>                 | 2.0   |      | V <sub>CCHost</sub> | V                 |       |
|                                  | Normal Operation     | V <sub>OL</sub>                 | 0     |      | 0.8                 | V                 |       |
| TX_DISABLE                       | Transmitter Disable  | V <sub>IH</sub>                 | 2.0   |      | V <sub>CCHost</sub> | V                 |       |
|                                  | Transmitter Enable   | V <sub>IL</sub>                 | 0     |      | 0.8                 | V                 |       |
| Receiver                         |                      |                                 |       |      |                     |                   |       |
| Output Differential Impedance    |                      | Z <sub>o</sub>                  |       | 100  |                     | Ω                 |       |
| Differential Data Output Swing   |                      | V <sub>out,p-p</sub>            | 300   |      | 850                 | mV <sub>p-p</sub> | 1     |
| Data Output Rise Time, Fall Time |                      | t <sub>r</sub> , t <sub>f</sub> | 28    |      |                     | ps                | 2     |
| RX_LOS                           | Loss of Signal (LOS) | V <sub>OH</sub>                 | 2.0   |      | V <sub>CCHost</sub> | V                 | 3     |
|                                  | Normal Operation     | V <sub>OL</sub>                 | 0     |      | 0.8                 | V                 | 3     |

### Notes:

1. Internally AC coupled, but requires an external 100Ω differential load termination.
2. 20-80%.
3. LOS is an open collector output. Should be pulled up with 4.7KΩ on the host board.

## Optical Characteristics

| Parameter                          | Symbol                                                  | Min.    | Typ. | Max.    | Unit  | Notes |
|------------------------------------|---------------------------------------------------------|---------|------|---------|-------|-------|
| Transmitter                        |                                                         |         |      |         |       |       |
| Launch Optical Power               | PO                                                      | -1      |      | 4       | dBm   | 1     |
| Center Wavelength Range            | $\lambda_c$                                             | 1528.77 |      | 1563.86 | nm    |       |
| Center Wavelength Spacing          |                                                         |         | 100  |         | GHZ   |       |
| Center Wavelength Tolerance        | $\Delta\lambda_c$                                       | -100    |      | 100     | pm    |       |
| Extinction Ratio                   | EX                                                      | 8.2     |      |         | dB    |       |
| Side Mode Suppression Ratio        | SMSR                                                    | 30      |      |         | dB    |       |
| Transmitter and Dispersion Penalty | TDP                                                     |         |      | 2.0     | dB    |       |
| Relative Intensity Noise           | RIN                                                     |         |      | -128    | dB/Hz |       |
| Optical Return Loss Tolerance      | ORLT                                                    |         |      | 21      | dB    |       |
| Pout @ TX-Disable Asserted         | Poff                                                    |         |      | -30     | dBm   |       |
| Eye Diagram                        | IEEE Std 802.3-2005 10Gb Ethernet 10GBASE-ER compatible |         |      |         |       |       |
| Receiver                           |                                                         |         |      |         |       |       |
| Center Wavelength                  | $\lambda_c$                                             | 1528    |      | 1565    | nm    |       |
| Receiver Sensitivity (Pavg)        | S                                                       |         |      | -15     | dBm   |       |
| Receiver Overload (Pavg)           | POL                                                     | -1      |      |         | dBm   |       |
| Optical Return Loss                | ORL                                                     | 26      |      |         | dB    |       |
| LOS De-Assert                      | LOSD                                                    |         |      | -16     | dBm   |       |
| LOS Assert                         | LOSA                                                    | -35     |      |         | dBm   |       |
| LOS Hysteresis                     |                                                         | 0.5     |      |         | dB    |       |

### Notes:

1. The optical power is launched into 9/125 $\mu$ m SMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps.
3. Measured with PRBS 2<sup>31</sup>-1 test pattern, 10.3125Gb/s, BER<10<sup>-12</sup>.
4. Comply with IEEE 802.3-2005.

## Pin Descriptions

| Pin | Symbol     | Name/Descriptions                                                       | Ref. |
|-----|------------|-------------------------------------------------------------------------|------|
| 1   | VeeT       | Transmitter Ground.                                                     | 1    |
| 2   | TX_Fault   | Transmitter Fault (LVTTTL-O) - High indicates a fault condition.        | 2    |
| 3   | TX_Disable | Transmitter Disable (LVTTTL-I) – High or open disables the transmitter. | 3    |
| 4   | SDA        | Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2).            | 4    |
| 5   | SCL        | Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1)            | 4    |
| 6   | MOD_ABS    | Module Absent (Output), connected to VeeT or VeeR in the module.        | 5    |
| 7   | RS0        | Rate Select 0 – Not used, Presents high input impedance.                |      |
| 8   | RX_LOS     | Receiver Loss of Signal (LVTTTL-O).                                     | 2    |
| 9   | RS1        | Rate Select 1 – Not used, Presents high input impedance.                |      |
| 10  | VeeR       | Receiver Ground.                                                        | 1    |
| 11  | VeeR       | Receiver Ground.                                                        | 1    |
| 12  | RD-        | Inverse Received Data out (CML-O).                                      |      |
| 13  | RD+        | Received Data out (CML-O).                                              |      |
| 14  | VeeR       | Receiver Ground.                                                        |      |
| 15  | VccR       | Receiver Power - +3.3V.                                                 |      |
| 16  | VccT       | Transmitter Power - +3.3 V.                                             |      |
| 17  | VeeT       | Transmitter Ground.                                                     | 1    |
| 18  | TD+        | Transmitter Data In (CML-I).                                            |      |
| 19  | TD-        | Inverse Transmitter Data In (CML-I).                                    |      |
| 20  | VeeT       | Transmitter Ground.                                                     | 1    |

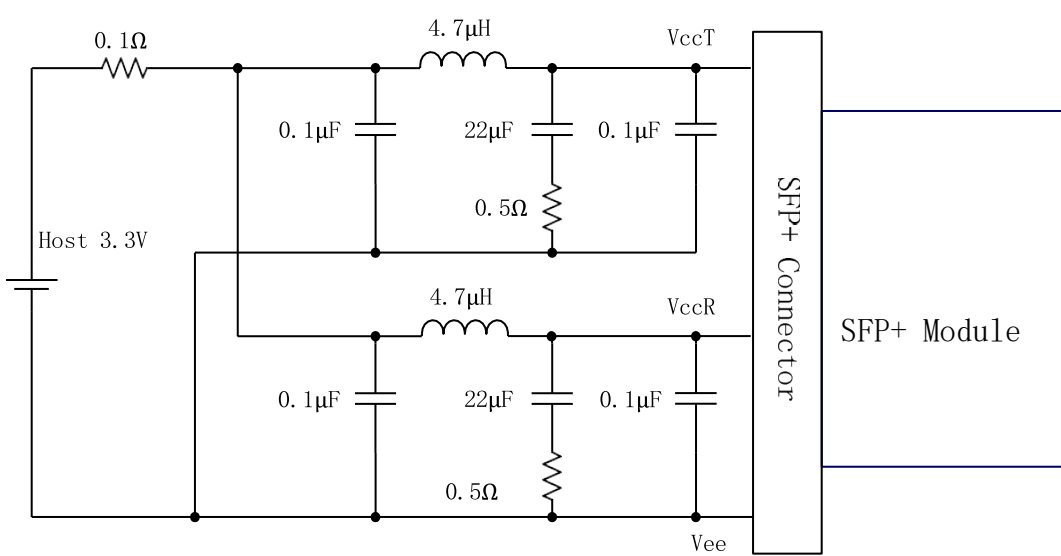
## Notes:

1. The module signal grounds are isolated from the module case.
2. This is an open collector/drain output that on the host board requires a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccHost.
3. This input is internally biased high with a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccT.
4. 2-Wire Serial interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
5. This is the ground return that on the host board requires a 4.7K $\Omega$  to 10K $\Omega$  pull-up resistor to VccHost.

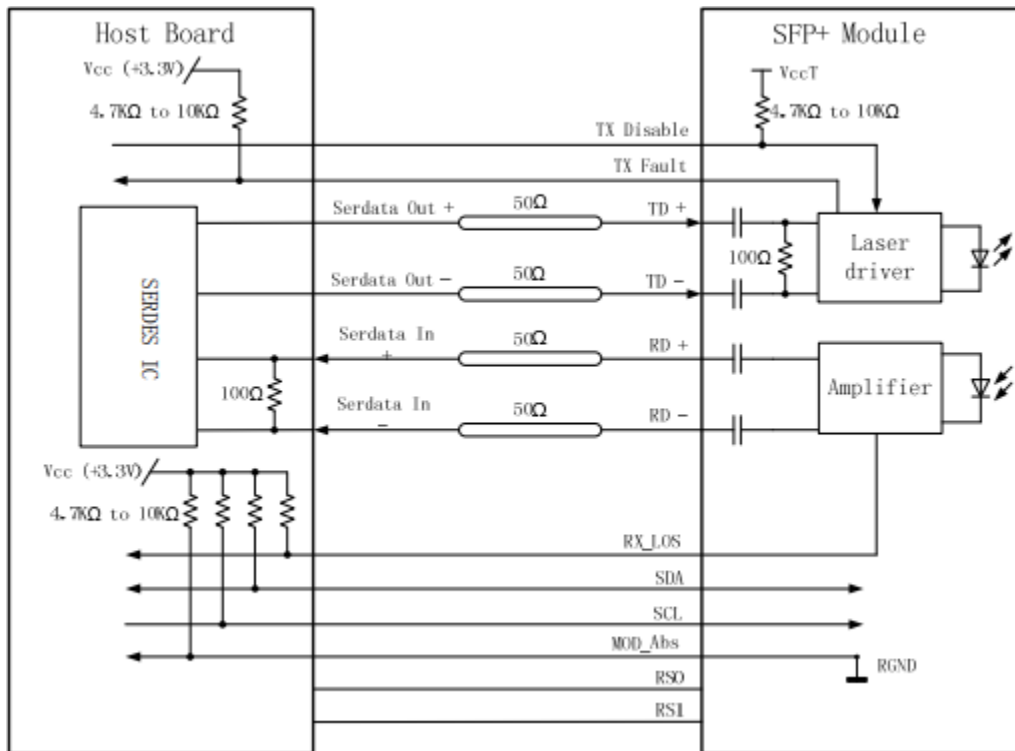
Host PCB SFP+ Pad Assignment Top View



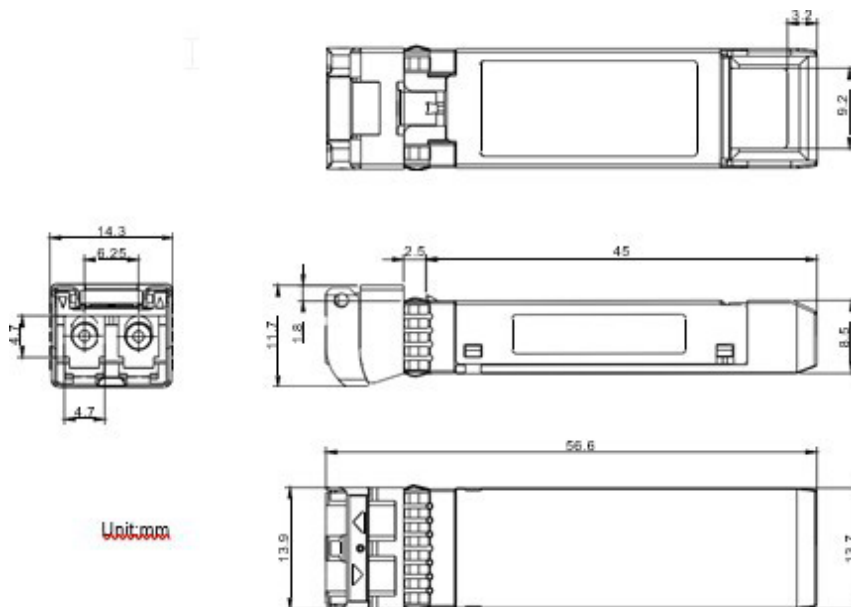
Recommended Host Board Power Supply Filter Network



## Recommended Application Interface Block Diagram



## Mechanical Specifications



## PCB Layout Recommendation

**Notes:**

1. Datum and basic dimensions established by customer
2. Pads and vias are chassis ground, 11 places
3. Thru holes, plating optional

