

### **QSFP-100GB-DW56-OPC**

MSA and TAA 100GBase-DWDM PAM4 QSFP28 Transceiver Single Lambda C-Band 100GHz w/EDFA/DCM (SMF, 1532.68nm, 80km w/EDFA/DCM, LC, DOM)

#### **Features**

- SFF-8636 MSA Compliance
- Duplex LC Connector
- 100GHz DWDM ITU Grid
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- PAM4 optical signal with integrated FEC
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



#### **Applications:**

- 100GBase Ethernet
- Access, Metro and Enterprise

#### **Product Description**

This MSA compliant QSFP28 transceiver provides 100GBase-DWDM throughput up to 80km over single-mode fiber (SMF) PAM4 using a wavelength of 1532.68nm 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)

| Channel # | Frequency (GHz) | Center Wavelength (nm) | Channel # | Frequency (GHz) | Center Wavelength (nm) |
|-----------|-----------------|------------------------|-----------|-----------------|------------------------|
| 21        | 192.1           | 1560.61                | 41        | 194.1           | 1544.53                |
| 22        | 192.2           | 1559.79                | 42        | 194.2           | 1543.73                |
| 23        | 192.3           | 1558.98                | 43        | 194.3           | 1542.94                |
| 24        | 192.4           | 1558.17                | 44        | 194.4           | 1542.14                |
| 25        | 192.5           | 1557.36                | 45        | 194.5           | 1541.35                |
| 26        | 192.6           | 1556.55                | 46        | 194.6           | 1540.56                |
| 27        | 192.7           | 1555.75                | 47        | 194.7           | 1539.77                |
| 28        | 192.8           | 1554.94                | 48        | 194.8           | 1538.98                |
| 29        | 192.9           | 1554.13                | 49        | 194.9           | 1538.19                |
| 30        | 193.0           | 1553.33                | 50        | 195.0           | 1537.40                |
| 31        | 193.1           | 1552.52                | 51        | 195.1           | 1536.61                |
| 32        | 193.2           | 1551.72                | 52        | 195.2           | 1535.82                |
| 33        | 193.3           | 1550.92                | 53        | 195.3           | 1535.04                |
| 34        | 193.4           | 1550.12                | 54        | 195.4           | 1534.25                |
| 35        | 193.5           | 1549.32                | 55        | 195.5           | 1533.47                |
| 36        | 193.6           | 1548.51                | 56        | 195.6           | 1532.68                |
| 37        | 193.7           | 1547.72                | 57        | 195.7           | 1531.90                |
| 38        | 193.8           | 1546.92                | 58        | 195.8           | 1531.12                |
| 39        | 193.9           | 1546.12                | 59        | 195.9           | 1530.33                |
| 40        | 194.0           | 1545.32                | 60        | 196.0           | 1529.55                |

## Absolute Maximum Ratings

| Parameter                          | Symbol             | Min. | Typical | Max. | Unit |
|------------------------------------|--------------------|------|---------|------|------|
| Storage Temperature (case)         | T <sub>s</sub>     | -40  |         | 85   | °C   |
| Operating Case Temperature         | T <sub>op</sub>    | 0    | 25      | 70   | V    |
| Supply Voltage                     | V <sub>cc</sub>    | 0    |         | 3.6  | V    |
| Relative Humidity (non-condensing) | RH                 | 5    |         | 85   | %    |
| Optical Receiver Damage Threshold  | R <sub>x</sub> dmg | 5    |         |      | dBm  |
| ESD Sensitivity                    |                    | 500  |         |      | V    |

## Electrical Characteristics

The host 4x25.78 Gbps electrical interface complies with the CAUI-4 standard.

| Parameter                       | Symbol            | Min.                 | Typ.     | Max.                 | Unit | Notes                      |
|---------------------------------|-------------------|----------------------|----------|----------------------|------|----------------------------|
| Data Rate per Lane (host side)  | BR <sub>avg</sub> |                      | 25.78125 |                      | Gbps |                            |
| Data Rate Variation             |                   | -100                 |          | 100                  | ppm  |                            |
| Power Supply Voltage            | V <sub>CC</sub>   | 3.135                | 3.3      | 3.47                 | V    |                            |
| Power Consumption               | PD                |                      | 4.7      | 5.5                  | W    |                            |
| Transmitter                     |                   |                      |          |                      |      |                            |
| Input Swing (Differential)      | V <sub>in</sub>   |                      |          | 900                  | mVpp | AC coupled                 |
| Input Impedance (Differential)  | Z <sub>in</sub>   | 90                   | 100      | 110                  | Ohm  |                            |
| Receiver                        |                   |                      |          |                      |      |                            |
| Output Swing (Differential)     | V <sub>out</sub>  |                      |          | 900                  | mVpp | AC coupled                 |
| Output Impedance (Differential) | Z <sub>out</sub>  | 90                   | 100      | 110                  | Ohm  |                            |
| Low Speed Signals               |                   |                      |          |                      |      |                            |
| LPMode, Reset, ModSel           | V <sub>IL</sub>   | -0.3                 |          | 0.8                  | V    |                            |
|                                 | V <sub>IH</sub>   | 2                    |          | V <sub>CC</sub> +0.3 | V    |                            |
| ModPrs, Int                     | V <sub>OL</sub>   | 0                    |          | 0.4                  | V    | IOL = 2.0mA                |
|                                 | V <sub>OH</sub>   | V <sub>CC</sub> -0.5 |          | V <sub>CC</sub> +0.3 | V    |                            |
| SCL, SDA                        | V <sub>IL</sub>   | -0.3                 |          | 0.3*V <sub>CC</sub>  | V    |                            |
|                                 | V <sub>IH</sub>   | 0.7*V <sub>CC</sub>  |          | V <sub>CC</sub> +0.5 | V    |                            |
| SCL, SDA                        | V <sub>OL</sub>   | 0                    |          | 0.4                  | V    | IOL <sub>max</sub> = 3.0mA |
|                                 | V <sub>OH</sub>   | V <sub>CC</sub> -0.5 |          | V <sub>CC</sub> +0.3 | V    |                            |

## Optical Characteristics

| Parameter                                    | Symbol             | Min.            | Typ.      | Max.            | Unit  | Notes |
|----------------------------------------------|--------------------|-----------------|-----------|-----------------|-------|-------|
| Data Rate                                    | BR                 | 103.125         |           |                 | Gbps  | 1     |
| Data Rate Variation                          |                    | -100            |           | 100             | ppm   |       |
| Transmitter                                  |                    |                 |           |                 |       |       |
| Central Wavelength                           | $\lambda_C$        | 1527            | $\lambda$ | 1567            | nm    |       |
| Central Wavelength Stability                 |                    | $\lambda_C-0.1$ |           | $\lambda_C+0.1$ | nm    |       |
| Average Output Optical Power                 | P <sub>O</sub>     | -2              | -0.5      | 2               | dBm   | 5     |
| Optical Extinction Ratio (outer)             | ER                 | 6               |           |                 | dB    |       |
| Optical Output Power, TX: OFF                | P <sub>off</sub>   |                 |           | -30             | dBm   |       |
| TX Reflectance                               |                    |                 |           | -26             | dB    |       |
| Receiver                                     |                    |                 |           |                 |       |       |
| Operating Wavelength                         |                    | 1527            |           | 1567            | nm    |       |
| RX Sensitivity, Avg Power                    | RX <sub>sens</sub> |                 | -9        | -8              | dBm   | 2, 5  |
| RX Overload, Avg Power                       | RX <sub>sat</sub>  | 4               |           |                 | dBm   | 2     |
| RX Damage Threshold                          | RX <sub>dmg</sub>  | 4               |           |                 | dBm   |       |
| RX Sensitivity, Avg Power at OSNR 32dB/0.1nm |                    |                 |           | -7              | dBm   | 3, 5  |
| Dispersion Tolerance                         |                    | -30             |           | +30             | ps/nm | 4, 5  |
| RX Reflectance                               |                    |                 |           | -26             | dB    |       |
| LOS Assert                                   | LOSA               | -15             |           |                 | dBm   |       |
| LOS De-Assert                                | LOSD               |                 |           | -10.5           | dBm   |       |
| LOS Hysteresis                               |                    |                 | 1         |                 | dB    |       |

### Notes:

1. The raw data rate is minimum 103.125 Gbps, when FEC code is added, the actual optical signal data rate is higher.
2. Rx average power sensitivity and overload are for post-FEC BER < 1E-15 with integrated FEC without dispersion and noise load at BOL.
3. Rx average power sensitivity at OSNR 32dB is for post-FEC BER < 1E-15 with integrated FEC without dispersion at OSNR 32dB/0.1nm at BOL. A 100GHz spacing DWDM filter with enough bandwidth should be used to remove the extra noises of the optical signal with noises for the RX test.
4. Dispersion tolerance is for dispersion values that cause Rx OSNR penalty less than 2 dB when compared with no dispersion at RX power -6 dBm and PRBS15 signal at BER 2e-3 at the operating data rate at BOL. A 100GHz spacing DWDM filter with enough bandwidth should be used to remove the extra noises of the optical signal with noises for the RX BER test.
5. The Average output optical power, RX sensitivity, RX sensitivity at OSNR 32dB/0.1nm, and Dispersion tolerance parameters are specified for beginning of life (BOL) over the operating temperature with clean fiber connectors.

## Pin Descriptions

| Pin | Logic        | Symbol         | Name/Descriptions                   | Plug Sequence | Ref. |
|-----|--------------|----------------|-------------------------------------|---------------|------|
| 1   |              | GND            | Ground                              | 1             | 1    |
| 2   | CML-I        | Tx2n           | Transmitter Inverted Data Input     | 3             |      |
| 3   | CML-I        | Tx2p           | Transmitter Non-Inverted Data Input | 3             |      |
| 4   |              | GND            | Ground                              | 1             | 1    |
| 5   | CML-I        | Tx4n           | Transmitter Inverted Data Input     | 3             |      |
| 6   | CML-I        | Tx4p           | Transmitter Non-Inverted Data Input | 3             |      |
| 7   |              | GND            | Ground                              | 1             | 1    |
| 8   | LVTTL-I      | ModSelL        | Module Select                       | 3             |      |
| 9   | LVTTL-I      | ResetL         | Module Reset                        | 3             |      |
| 10  |              | VccRx          | +3.3V Power Supply Receiver         | 2             | 2    |
| 11  | LVC MOS- I/O | SCL            | 2-wire serial interface clock       | 3             |      |
| 12  | LVC MOS- I/O | SDA            | 2-wire serial interface data        | 3             |      |
| 13  |              | GND            | Ground                              | 1             | 1    |
| 14  | CML-O        | Rx3p           | Receiver Non-Inverted Data Output   | 3             |      |
| 15  | CML-O        | Rx3n           | Receiver Inverted Data Output       | 3             |      |
| 16  |              | GND            | Ground                              | 1             | 1    |
| 17  | CML-O        | Rx1p           | Receiver Non-Inverted Data Output   | 3             |      |
| 18  | CML-O        | Rx1n           | Receiver Inverted Data Output       | 3             |      |
| 19  |              | GND            | Ground                              | 1             | 1    |
| 20  |              | GND            | Ground                              | 1             | 1    |
| 21  | CML-O        | Rx2n           | Receiver Inverted Data Output       | 3             |      |
| 22  | CML-O        | Rx2p           | Receiver Non-Inverted Data Output   | 3             |      |
| 23  |              | GND            | Ground                              | 1             | 1    |
| 24  | CML-O        | Rx4n           | Receiver Inverted Data Output       | 3             |      |
| 25  | CML-O        | Rx4p           | Receiver Non-Inverted Data Output   | 3             |      |
| 26  |              | GND            | Ground                              | 1             | 1    |
| 27  | LVTTL-O      | ModPrsL        | Module Present                      | 3             |      |
| 28  | LVTTL-O      | IntL/RX_LOS    | Interrupt                           | 3             | 3    |
| 29  |              | VccTx          | +3.3V Power supply transmitter      | 2             | 2    |
| 30  |              | Vcc1           | +3.3V Power supply                  | 2             | 2    |
| 31  | LVTTL-I      | LPMMode/TX_DIS | Low Power Mode                      | 3             | 3    |
| 32  |              | GND            | Ground                              | 1             | 1    |
| 33  | CML-I        | Tx3p           | Transmitter Non-Inverted Data Input | 3             |      |
| 34  | CML-I        | Tx3n           | Transmitter Inverted Data Input     | 3             |      |
| 35  |              | GND            | Ground                              | 1             | 1    |
| 36  | CML-I        | Tx1p           | Transmitter Non-Inverted Data Input | 3             |      |
| 37  | CML-I        | Tx1n           | Transmitter Inverted Data Input     | 3             |      |
| 38  |              | GND            | Ground                              | 1             | 1    |

**Notes:**

- 1. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module and all module voltages are referenced to this potential unless otherwise noted.
- 2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently

**Electrical Pin-out Details**



Mechanical Specifications

