

## TS-X2-DWDM-80

### 10Gbps DWDM X2 Optical Transceiver, 80km Reach

#### Features

- X2 MSA Compliant
- 70-PIN connector
- SC duplex receptacle package
- Wavelength selectable to C-band ITU-T grid wavelengths
- Cooled EA-DFB/APD-PD
- Power supply: +5.0 V, +3.3 V, APS:+1.2 V
- Power Dissipation 4W Maximum
- 0°C to 70°C Operating Case Temperature
- Digital Diagnostic Monitoring
- Management and control with MDIO 2-wire bus
- XAUI electrical interface 4 x 3.125 Gb/s Ethernet
- Complaint with the EU RoHS 6 Environmental requirements



#### Applications

- 10 Gb/s Ethernet transmission systems

#### Description

The X2-DWDMxx-80D Series is highly integrated, serial optical transponder module for high-speed, 10Gbit/s data transmission applications. The module is fully compliant to IEEE 802.3ae standard for Ethernet, making it ideally suited for 10GbE datacom (rack to-rack, client interconnection) applications. The transponder module comprises a transmitter with DWDM cooled EML laser, a receiver with a APD photodiode, a XAUI-Attachment Interface, an integrated Coder /Decoder and multiplexer / de-multiplexer (SERDES: Serializer/Deserializer).

The transponder operates within a wide case temperature range of -5°C to +70°C and offers optimum heat dissipation and excellent electromagnetic shielding which enables high port densities for 10GbE systems. A 70 pin electrical connector and a duplex SC connector optical interface assure that connectivity is compliant to the X2 and XENPAK MSA. The transmitter section uses a DWDM multiple quantum well EML laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Digital diagnostic monitoring (DDM) is implemented and fully compliant with X2 DDM architecture. The unit monitors temperature, receive optical power, transmit optical power, and laser bias current.

**Absolute Maximum Ratings** <sup>\*Note</sup>

| Parameter                    | Symbol           | Min | Max | Unit |
|------------------------------|------------------|-----|-----|------|
| Supply Voltage Range @ 3.3V  | V <sub>cc3</sub> |     | 4.0 | V    |
| Supply Voltage Range @ 5V    | V <sub>cc5</sub> |     | 6.0 | V    |
| Adaptable Power Supply (APS) | V <sub>APS</sub> | 0   | 2   | V    |
| Storage Temperature          | T <sub>s</sub>   | -20 | +85 | °C   |

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

**Recommended Operating Conditions**

| Parameter                  | Symbol           | Min  | Typical | Max  | Unit |
|----------------------------|------------------|------|---------|------|------|
| Operating Case Temperature | T <sub>c</sub>   | 0    |         | +70  | °C   |
| Supply Voltage @ 3.3V      | V <sub>cc3</sub> | 3.14 | 3.3     | 3.47 | V    |
| Supply Current @ 3.3V      | I <sub>cc3</sub> |      |         | 1000 | mA   |
| Supply Voltage @ 5V        | V <sub>cc5</sub> | 4.75 | 5       | 5.25 | V    |
| Supply Current @ 5V        | I <sub>cc5</sub> |      |         | 500  | mA   |
| Supply Voltage APS         | V <sub>aps</sub> | 1.14 | 1.2     | 1.26 | V    |
| Supply Current APS         | I <sub>aps</sub> |      |         | 1100 | mA   |
| Module Power Dissipation   | P <sub>m</sub>   |      |         | 4    | W    |

**Optical Interface**

| Parameter                                | Symbol                 | Min               | Typical                | Max               | Unit |
|------------------------------------------|------------------------|-------------------|------------------------|-------------------|------|
| Transmitter Characteristics              |                        |                   |                        |                   |      |
| Center Wavelength (SOL) <sup>Note1</sup> | $\lambda_c$            | $\lambda_c -0.05$ | ITU-T grid Wavelengths | $\lambda_c +0.05$ | nm   |
| Center Wavelength (EOL) <sup>Note2</sup> | $\lambda_c$            | $\lambda_c -0.1$  | ITU-T grid Wavelengths | $\lambda_c +0.1$  | nm   |
| Center wavelength stability              | $\Delta\lambda_D$      | -6.5              | $\lambda_c$            | 6.5               | nm   |
| Optical Transmit Power                   | Po                     | 0                 |                        | 5                 | dBm  |
| Optical Transmit Power (disabled)        | Ptx-dis                |                   |                        | -40               | dBm  |
| Extinction Ratio                         | ER                     | 9                 |                        |                   | dB   |
| Side Mode Suppression Ratio              | SMSR                   | 30                |                        |                   | dB   |
| Eye Mask                                 | IEEE 802.3ae Compliant |                   |                        |                   |      |
| Receiver Characteristics                 |                        |                   |                        |                   |      |
| Input Operating Wavelength               | $\lambda$              | 1260              |                        | 1600              | nm   |
| Received power 1                         | Rpo                    | -24               |                        | -7                | dBm  |
| Maximum Input Power                      | RX-overload            | -7                |                        |                   | dBm  |
| Reflectance                              | Rrx                    |                   |                        | -27               | dB   |

Note1: Laser- Start of Life

Note2: Laser End of life

**Electrical Characteristics**

| Parameter                      | Symbol   | Min  | Typical | Max  | Unit     |
|--------------------------------|----------|------|---------|------|----------|
| <b>Transmitter</b>             |          |      |         |      |          |
| Data Rate ( TXLINE0-3)         | TX-xaui  |      | 3125    |      | Mbps     |
| Differential impedance         | Zo       | 80   | 100     | 120  | $\Omega$ |
| Differential Input Amplitude   | Vin P-P  | 160  |         | 2000 | mVpp     |
| Input Rise/Fall                | TR / TF  | 60   |         | 130  | ps       |
| Differential Impedance of Zin  | Zin      |      | 100     |      | ohm      |
| <b>Receiver</b>                |          |      |         |      |          |
| Data Rate ( TXLINE0-3)         | RX-xaui  |      | 3125    |      | Mbps     |
| Supply Voltage                 | VccRX    | 3.13 | 3.3     | 3.47 | V        |
| Differential Output Amplitude  | Vout P-P | 800  |         | 1600 | mV       |
| Rise/Fall Time                 | Tr / Tf  | 50   |         | 90   | ps       |
| Differential Impedance of Zout | Zout     |      | 100     |      | ohm      |

**MDIO Interface**
**DC Characteristics**

| Characteristic         | Condition                                               | Symbol            | Minimum | Maximum | Unit |
|------------------------|---------------------------------------------------------|-------------------|---------|---------|------|
| Input high voltage     |                                                         | V <sub>H</sub>    | 0.84    | 1.5     | V    |
| Input low voltage      |                                                         | V <sub>L</sub>    | -0.3    | 0.36    | V    |
| MDIO Input current     | MMD Driver in tri-state                                 | I <sub>MDIO</sub> | -10     | 8       | pA   |
| MDC Input current      |                                                         | I <sub>MDC</sub>  | -5      | 5       | pA   |
| Output low voltage     | IOL= 100pA                                              | V <sub>QL</sub>   | -0.3    |         | V    |
|                        | IOL= 4mA                                                | V <sub>QL</sub>   |         | 0.2     | V    |
| Output high voltage    | RPULL-Up = 357 $\Omega$ $\pm$ 1%<br>VPULL-Up =1.14~1.5V | V <sub>QH</sub>   | 1.136   | 1.5     | V    |
| Output low current     | VI = 0.2V                                               | I <sub>QL</sub>   | 4       |         | mA   |
| MDIO Input capacitance | VI = 0~1.5V                                             | Cin               |         | 10      | pF   |

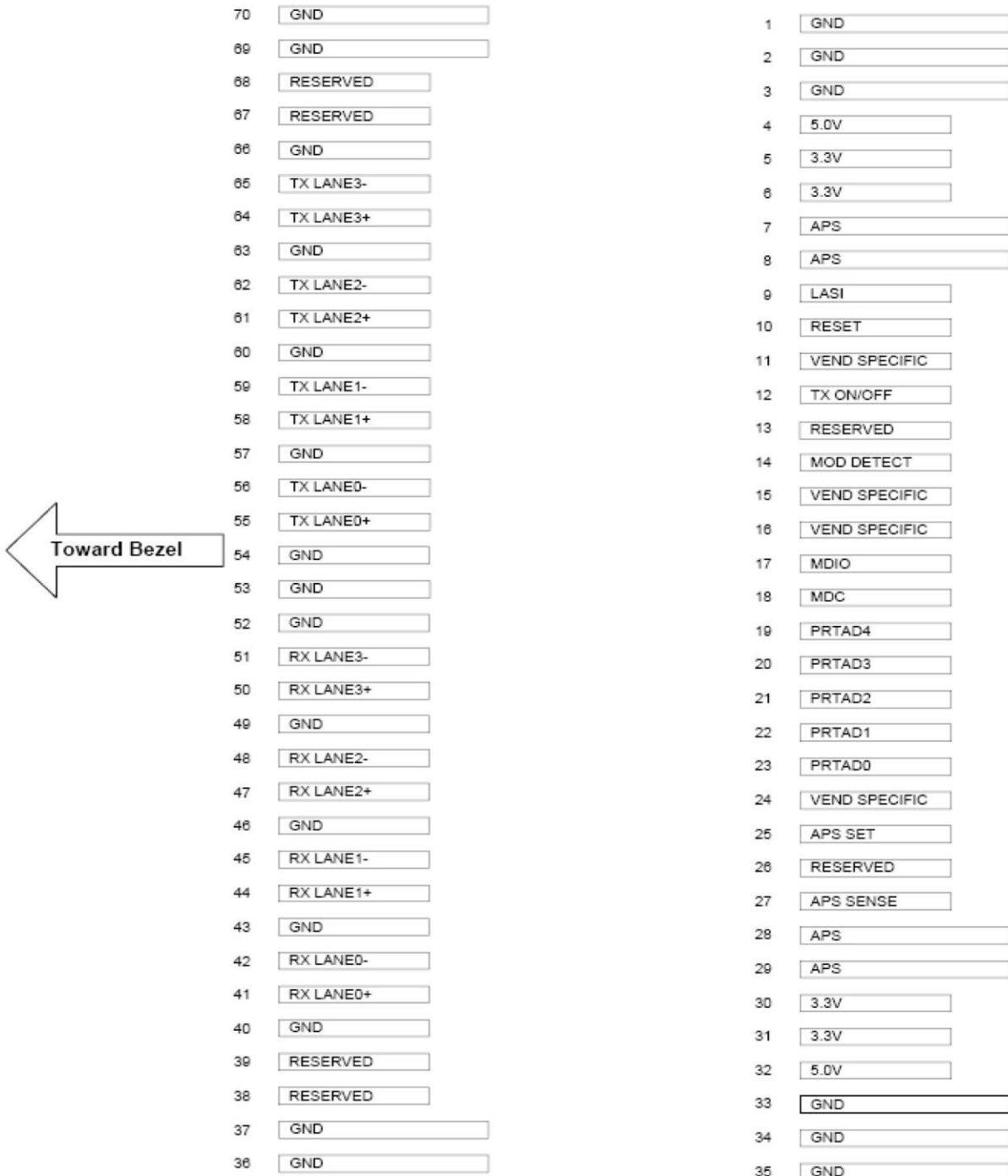
## DWDM Wavelength Guide

*Table 1- DWDM Wavelength Guide*

| ITU Channel<br>Product Code | Frequency<br>(THz) | Wavelength<br>(nm) | ITU Channel<br>Product Code | Frequency<br>(THz) | Wavelength<br>(nm) |
|-----------------------------|--------------------|--------------------|-----------------------------|--------------------|--------------------|
| 17                          | 191.7              | 1563.86            | 40                          | 194.0              | 1545.32            |
| 18                          | 191.8              | 1563.05            | 41                          | 194.1              | 1544.53            |
| 19                          | 191.9              | 1562.23            | 42                          | 194.2              | 1543.73            |
| 20                          | 192.0              | 1561.42            | 43                          | 194.3              | 1542.94            |
| 21                          | 192.1              | 1560.61            | 44                          | 194.4              | 1542.14            |
| 22                          | 192.2              | 1559.79            | 45                          | 194.5              | 1541.35            |
| 23                          | 192.3              | 1558.98            | 46                          | 194.6              | 1540.56            |
| 24                          | 192.4              | 1558.17            | 47                          | 194.7              | 1539.77            |
| 25                          | 192.5              | 1557.36            | 48                          | 194.8              | 1538.98            |
| 26                          | 192.6              | 1556.55            | 49                          | 194.9              | 1538.19            |
| 27                          | 192.7              | 1555.75            | 50                          | 195.0              | 1537.40            |
| 28                          | 192.8              | 1554.94            | 51                          | 195.1              | 1536.61            |
| 29                          | 192.9              | 1554.13            | 52                          | 195.2              | 1535.82            |
| 30                          | 193.0              | 1553.33            | 53                          | 195.3              | 1535.04            |
| 31                          | 193.1              | 1552.52            | 54                          | 195.4              | 1534.25            |
| 32                          | 193.2              | 1551.72            | 55                          | 195.5              | 1533.47            |
| 33                          | 193.3              | 1550.92            | 56                          | 195.6              | 1532.68            |
| 34                          | 193.4              | 1550.12            | 57                          | 195.7              | 1531.90            |
| 35                          | 193.5              | 1549.32            | 58                          | 195.8              | 1531.12            |
| 36                          | 193.6              | 1548.51            | 59                          | 195.9              | 1530.33            |
| 37                          | 193.7              | 1547.72            | 60                          | 196.0              | 1529.55            |
| 38                          | 193.8              | 1546.92            | 61                          | 196.1              | 1528.77            |
| 39                          | 193.9              | 1546.12            |                             |                    |                    |

Note: Please contact with TONGSION for the channel availability.

## Electrical Pad Layout



**Figure2.Electrical Pin-out Details**

**Pin Descriptions**

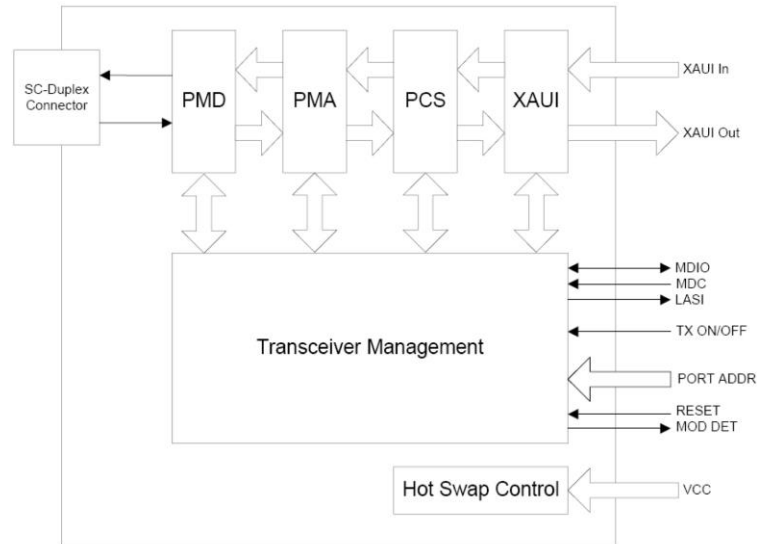
| Pin No. | Name          | Dir | Function                                                                                                                                        | Note |
|---------|---------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1       | GND           |     | Electrical Ground                                                                                                                               | 1    |
| 2       | GND           |     | Electrical Ground                                                                                                                               | 1    |
| 3       | GND           |     | Electrical Ground                                                                                                                               | 1    |
| 4       | 5.0V          |     | Power                                                                                                                                           | 2    |
| 5       | 3.3V          |     | Power                                                                                                                                           | 2    |
| 6       | 3.3V          |     | Power                                                                                                                                           | 2    |
| 7       | APS =1.2V     |     | Adaptive Power Supply                                                                                                                           | 2    |
| 8       | APS =1.2V     |     | Adaptive Power Supply                                                                                                                           | 2    |
| 9       | LASI          |     | Open Drain Compatible<br>10K-22K pull up on host.<br>Logic High: Normal Operation<br>Logic Low : LASIAsserted                                   | 3    |
| 10      | RESET         | I   | Open Drain compatible.<br>10-22K pull-up on transceiver<br>Logic high = Normal operation<br>Logic low = Reset<br>Minimum reset assert time 1 ms | 3    |
| 11      | VEND SPECIFIC |     | Vendor Specific Pin. Leave unconnected when not in use.                                                                                         | 6    |
| 12      | TX ON/OFF     | I   | Open Drain compatible.<br>10-22K pull-up on transceiver<br>Logic high = Transmitter On (capable)<br>Logic low = Transmitter Off (always)        | 3    |
| 13      | RESERVED      |     | Reserved                                                                                                                                        | 3    |
| 14      | MOD DETECT    | O   | Pulled low inside module through 1k                                                                                                             |      |
| 15      | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.                                                                                      | 6    |
| 16      | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.                                                                                      | 6    |
| 17      | MDIO          | I/O | Management Data IO                                                                                                                              | 3,4  |
| 18      | MDC           | I   | Management Data Clock                                                                                                                           | 3,4  |
| 19      | PRTAD4        | I   | Port Address Bit 4 (Low = 0)                                                                                                                    | 3    |
| 20      | PRTAD3        | I   | Port Address Bit 3 (Low = 0)                                                                                                                    | 3    |
| 21      | PRTAD2        | I   | Port Address Bit 2 (Low = 0)                                                                                                                    | 3    |
| 22      | PRTAD1        | I   | Port Address Bit 1 (Low = 0)                                                                                                                    | 3    |
| 23      | PRTAD0        | I   | Port Address Bit 0 (Low = 0)                                                                                                                    | 3    |
| 24      | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.                                                                                      | 6    |
| 25      | APS SET       |     | Feedback input for APS                                                                                                                          |      |
| 26      | RESERVED      |     | Reserved for Avalanche Photodiode use.                                                                                                          | 6    |
| 27      | APS SENSE     |     | APS Sense Connection                                                                                                                            |      |
| 28      | APS =1.2V     |     | Adaptive Power Supply                                                                                                                           | 2    |
| 29      | APS =1.2V     |     | Adaptive Power Supply                                                                                                                           | 2    |
| 30      | 3.3V          |     | Power                                                                                                                                           | 2    |

|    |           |   |                            |   |
|----|-----------|---|----------------------------|---|
| 31 | 3.3V      |   | Power                      | 2 |
| 32 | 5.0V      |   | Power                      | 2 |
| 33 | GND       |   | Electrical Ground          | 1 |
| 34 | GND       |   | Electrical Ground          | 1 |
| 35 | GND       |   | Electrical Ground          | 1 |
| 36 | GND       |   | Electrical Ground          | 1 |
| 37 | GND       |   | Electrical Ground          | 1 |
| 38 | RESERVED  |   | Reserved                   |   |
| 39 | RESERVED  |   | Reserved                   |   |
| 40 | GND       |   | Electrical Ground          | 1 |
| 41 | RX LANE0+ | O | Module XAUI Output Lane 0+ | 5 |
| 42 | RX LANE0- | O | Module XAUI Output Lane 0- | 5 |
| 43 | GND       |   | Electrical Ground          | 1 |
| 44 | RX LANE1+ | O | Module XAUI Output Lane 1+ | 5 |
| 45 | RX LANE1- | O | Module XAUI Output Lane 1- | 5 |
| 46 | GND       |   | Electrical Ground          | 1 |
| 47 | RX LANE2+ | O | Module XAUI Output Lane 2+ | 5 |
| 48 | RX LANE2- | O | Module XAUI Output Lane 2- | 5 |
| 49 | GND       |   | Electrical Ground          | 1 |
| 50 | RX LANE3+ | O | Module XAUI Output Lane 3+ | 5 |
| 51 | RX LANE3- | O | Module XAUI Output Lane 3- | 5 |
| 52 | GND       |   | Electrical Ground          | 1 |
| 53 | GND       |   | Electrical Ground          | 1 |
| 54 | GND       |   | Electrical Ground          | 1 |
| 55 | TX LANE0+ | I | Module XAUI Output Lane 0+ | 5 |
| 56 | TX LANE0- | I | Module XAUI Output Lane 0- | 5 |
| 57 | GND       |   | Electrical Ground          | 1 |
| 58 | TX LANE1+ | I | Module XAUI Output Lane 1+ | 5 |
| 59 | TX LANE1- | I | Module XAUI Output Lane 1- | 5 |
| 60 | GND       |   | Electrical Ground          | 1 |
| 61 | TX LANE2+ | I | Module XAUI Output Lane 2+ | 5 |
| 62 | TX LANE2- | I | Module XAUI Output Lane 2- | 5 |
| 63 | GND       |   | Electrical Ground          | 1 |
| 64 | TX LANE3+ | I | Module XAUI Output Lane 3+ | 5 |
| 65 | TX LANE3- | I | Module XAUI Output Lane 3- | 5 |
| 66 | GND       |   | Electrical Ground          | 1 |
| 67 | RESERVED  |   | Reserved                   |   |
| 68 | RESERVED  |   | Reserved                   |   |
| 69 | GND       |   | Electrical Ground          | 1 |
| 70 | GND       |   | Electrical Ground          | 1 |

Notes:

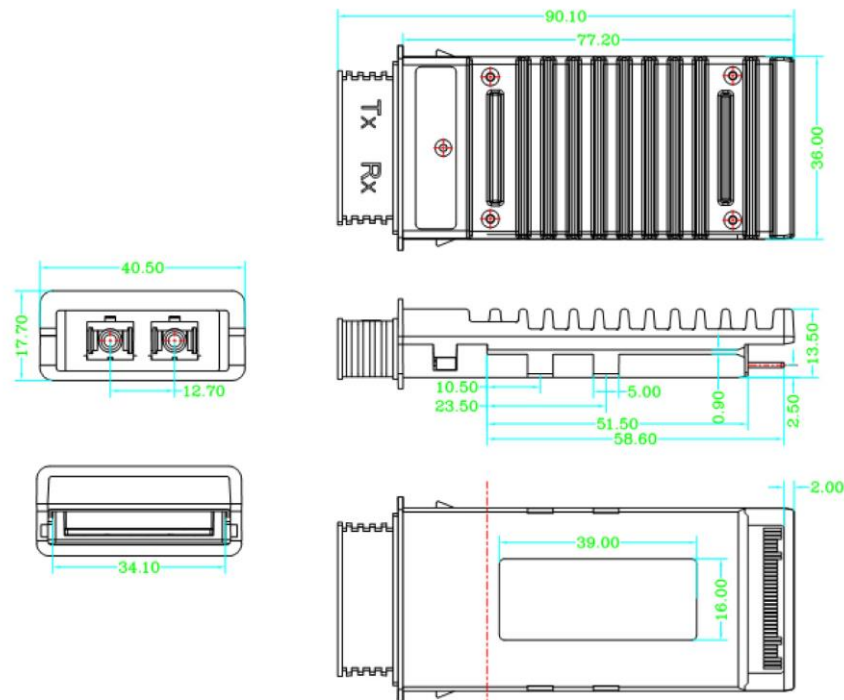
- 1) Ground connections are common for TX and RX.
- 2) All connector contacts are rated at 0.5A nominal.
- 3) 1.2V CMOS compatible.
- 4) MDIO and MDC timing must comply with IEEE802.3ae, Clause 45.3
- 5) XAUI output characteristics should comply with IEEE802.3ae Clause 47.

6) Transceivers will be MSA compliant when no signals are present on the vendor specific pins.



**Figure1.** Functional Diagram of Typical X2 Style Transceiver

## Package Dimensions



## Regulatory Compliance

| Feature                                              | Standard                                                                           | Performance                                                                                                                                                                                            |
|------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883G<br>Method 3015.7                                                      | Class 1C (>1000 V)                                                                                                                                                                                     |
| Electrostatic Discharge to the enclosure             | EN 55024:1998+A1+A2<br>IEC-61000-4-2<br>GR-1089-CORE                               | Compliant with standards                                                                                                                                                                               |
| Electromagnetic Interference (EMI)                   | FCC Part 15 Class B<br>EN55022:2006<br>CISPR 22B :2006<br>VCCI Class B             | Compliant with standards Noise frequency range: 30 MHz to 6 GHz. Good system EMI design practice required to achieve Class B margins. System margins depend on customer host board and chassis design. |
| Immunity                                             | EN 55024:1998+A1+A2<br>IEC 61000-4-3                                               | Compliant with standards. 1kHz sine-wave, 80% AM, from 80 MHz to 1 GHz. No effect on transmitter/receiver performance is detectable between these limits.                                              |
| Laser Eye Safety                                     | FDA 21CFR 1040.10 and 1040.11<br>EN (IEC) 60825-1:2007<br>EN (IEC) 60825-2:2004+A1 | CDRH compliant and Class I laser product.<br>TüV Certificate No. 50135086                                                                                                                              |
| Component Recognition                                | UL and CUL<br>EN60950-1:2006                                                       | UL file E317337<br>TüV Certificate No. 50135086 (CB scheme )                                                                                                                                           |
| RoHS6                                                | 2002/95/EC 4.1&4.2<br>2005/747/EC 5&7&13                                           | Compliant with standards <sup>*note</sup>                                                                                                                                                              |

### Note:

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item 13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for TONGSION's transceivers, because TONGSION's transceivers use glass, which may contain Pb, for components such as lenses, isolators, and other electronic components.

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**Ordering information**

| Part Number   | Product Description                         |
|---------------|---------------------------------------------|
| TS-X2-DWDM-80 | DWDM, 10Gbps, SC, 80km, 0°C~+70°C, With DDM |

Note: XX refers to DWDM Wavelength channel as ITU-T specified, please refer the Table 1- DWDM Wavelength Guide for detailed center wavelength information.

**Important Notice**

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