



## X2-DXX-40

### 10Gbps DWDM X2 ER Transceiver

#### Features

- X2 MSA Compliant
- 70-PIN connector
- SC duplex receptacle package
- XAU1 4x3.125Gb/s and TX/RX 10Gb/s data rate
- Wavelength selectable to C-band ITU-T grid wavelengths
- Cooled EA-DFB/PIN-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
- XAU1 electrical interface 4 x 3.125Gb/s Ethernet
- ≤40km ER (Extended Range) 10GBE
- RoHS compliant and lead free

#### Applications

- 10 Gb/s Ethernet transmission systems

#### Absolute Maximum Ratings

| Parameter                    | Symbol | Min | Max | Unit |
|------------------------------|--------|-----|-----|------|
| Supply Voltage+5V            | Vcc5   |     | 6.0 | V    |
| Supply Voltage_3.3V          | Vcc3   |     | 4   | V    |
| Supply Voltage APS           | Vaps   |     | 2   | V    |
| Storage Temperature          | Tst    | -20 | 85  | °C   |
| Optical Input Received Power | PIN    | -   | -1  | dBm  |



## Operating Conditions

| Parameter                  | Symbol | Min  | Typical | Max  | Unit |
|----------------------------|--------|------|---------|------|------|
| Operating Case temperature | Tca    | 0    | -       | 70   | °C   |
| Supply Voltage+5V          | Vcc5   | 4.75 | 5       | 5.25 | V    |
| Supply Current+5V          | Icc5   |      |         | 500  | mA   |
| Supply Voltage_3.3V        | VCC3   | 3.14 | 3.3     | 3.47 | V    |
| Supply Current+3.3V        | Icc3   |      |         | 1000 | mA   |
| Supply Voltage APS         | Vaps   | 1.14 | 1.2     | 1.26 | V    |
| Supply Current APS         | Iaps   |      |         | 1100 | mA   |
| Module Power Dissipation   | Pm     | -    |         | 4    | W    |

## Transmitter Specifications – Optical

| Parameter                         | Symbol                 | Min              | Typical                | Max              | Unit |
|-----------------------------------|------------------------|------------------|------------------------|------------------|------|
| Center Wavelength (SOL)△          | $\lambda_c$            | $\lambda_c-0.05$ | ITU-T grid Wavelengths | $\lambda_c+0.05$ | nm   |
| Center Wavelength (EOL)▲          | $\lambda_c$            | $\lambda_c-0.1$  | ITU-T grid Wavelengths | $\lambda_c+0.1$  | nm   |
| Optical Transmit Power            | Po                     | -1               |                        | 2                | dBm  |
| Optical Transmit Power (disabled) | Ptx-dis                | -                | -                      | -40              | dBm  |
| Extinction Ratio                  | ER                     | 7                |                        | -                | dB   |
| Side Mode Suppression Ratio       | SMSR                   | 30               | -                      | -                | dB   |
| Eye Mask                          | IEEE 802.3ae Compliant |                  |                        |                  |      |

△Laser- Start of Life

▲Laser End of life

## Transmitter Specifications – Electrical

| Parameter                     | Symbol  | Min | Typical | Max  | Unit     |
|-------------------------------|---------|-----|---------|------|----------|
| 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      |



## Receiver Specifications – Optical

| Parameter                  | Symbol      | Min  | Typical | Max  | Unit |
|----------------------------|-------------|------|---------|------|------|
| Received power             | Rpo         | -15  | -       | -3   | dBm  |
| Maximum Input Power        | RX-overload | -3   | -       | -    | dBm  |
| Input Operating Wavelength | $\lambda$   | 1260 | -       | 1565 | nm   |
| Reflectance                | Rrx         | -    | -       | -27  | dB   |

## Receiver Specifications – Electrical

| Parameter                      | Symbol   | Min  | Typical | Max  | Unit |
|--------------------------------|----------|------|---------|------|------|
| 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  |

## Signal Specifications – Electrical

| Parameter                   | Symbol   | Min  | Typ | Max  | Units |
|-----------------------------|----------|------|-----|------|-------|
| 1.2 V CMOS                  |          |      |     |      |       |
| Input High Voltage          | VIL(MAX) | -    | -   | 0.36 | V     |
| Input Low Voltage           | VIH(MIN) | 0.84 | -   | 1.25 | V     |
| Capacitance                 |          | -    | -   | 320  | pF    |
| Pull Up Resistance          | Rpull    | 10k  | -   | 22k  | ohm   |
| MDIO I/O                    |          |      |     |      |       |
| Output Low Voltage          | VOL      | -0.3 | -   | 0.2  | V     |
| Output Low Current          | IOL      | -    | -   | 4    | mA    |
| Input High Voltage          | VIH      | 0.84 | -   | 1.5  | V     |
| Input Low Voltage           | VIL      | -0.3 | -   | 0.36 | V     |
| Pull-up Supply Voltage      | VPULL    | 1.14 | 1.2 | 1.26 |       |
| Input Capacitance           | CIN      | -    | -   | 10   | Pf    |
| Load Capacitance            | CLOD     | -    | -   | 470  | Pf    |
| External Pull-up Resistance | EPULL    | 200  | -   | -    | Ohm   |



**Table 3: Digital Diagnostic Monitoring Accuracy**

| Parameter    | Accuracy | Unit |
|--------------|----------|------|
| Temperature  | ± 5      | °C   |
| Bias Current | ± 10     | %    |
| TX Power     | ± 3      | DBm  |
| RX Power     | ± 3      | DBm  |

**Pin Definitions**

| Pin No | Name          | Dir | Function   | Notes |
|--------|---------------|-----|--|-------|
| 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. 10K-22K pull up on host.<br>Logic High: Normal Operation<br>Logic Low: LASI Asserted                                  | 4     |
| 10     | RESET         | I   | Open Drain compatible. 10-22K pull-up on transceiver<br>Logic high = Normal operation<br>Logic low = Reset<br>Minimum reset assert time 1 ms | 4     |
| 11     | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.   | 8     |
| 12     | TX ON/OFF     | I   | Open Drain compatible. 10-22K pull-up on transceiver<br>Logic high = Transmitter On (capable)<br>Logic low = Transmitter Off (always)        | 4     |
| 13     | RESERVED      |     | Reserved   | 4     |
| 14     | MOD DETECT    | O   | Pulled low inside module through 1k  |       |
| 15     | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.   | 8     |
| 16     | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.   | 8     |
| 17     | MDIO          | I/O | Management Data IO   | 4, 5  |
| 18     | MDC           | I   | Management Data Clock  | 4, 5  |
| 19     | PRTAD4        | I   | Port Address Bit 4 (Low = 0)   | 4     |
| 20     | PRTAD3        | I   | Port Address Bit 3 (Low = 0)   | 4     |
| 21     | PRTAD2        | I   | Port Address Bit 2 (Low = 0)   | 4     |
| 22     | PRTAD1        | I   | Port Address Bit 1 (Low = 0)   | 4     |
| 23     | PRTAD0        | I   | Port Address Bit 0 (Low = 0)   | 4     |
| 24     | VEND SPECIFIC |     | Vendor Specific Pin.<br>Leave unconnected when not in use.   | 8     |
| 25     | APS SET       |     | Feedback input for APS   |       |
| 26     | RESERVED      |     | Reserved for Avalanche Photodiode use.   | 8     |
| 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+ | 7 |
| 42 | RX LANE0- | O | Module XAUI Output Lane 0- | 7 |
| 43 | GND       |   | Electrical Ground          | 1 |
| 44 | RX LANE1+ | O | Module XAUI Output Lane 1+ | 7 |
| 45 | RX LANE1- | O | Module XAUI Output Lane 1- | 7 |
| 46 | GND       |   | Electrical Ground          | 1 |
| 47 | RX LANE2+ | O | Module XAUI Output Lane 2+ | 7 |
| 48 | RX LANE2- | O | Module XAUI Output Lane 2- | 7 |
| 49 | GND       |   | Electrical Ground          | 1 |
| 50 | RX LANE3+ | O | Module XAUI Output Lane 3+ | 7 |
| 51 | RX LANE3- | O | Module XAUI Output Lane 3- | 7 |
| 52 | GND       |   | Electrical Ground          | 1 |
| 53 | GND       |   | Electrical Ground          | 1 |
| 54 | GND       |   | Electrical Ground          | 1 |
| 55 | TX LANE0+ | I | Module XAUI Input Lane 0+  | 7 |
| 56 | TX LANE0- | I | Module XAUI Input Lane 0-  | 7 |
| 57 | GND       |   | Electrical Ground          | 1 |
| 58 | TX LANE1+ | I | Module XAUI Input Lane 1+  | 7 |
| 59 | TX LANE1- | I | Module XAUI Input Lane 1-  | 7 |
| 60 | GND       |   | Electrical Ground          | 1 |
| 61 | TX LANE2+ | I | Module XAUI Input Lane 2+  | 7 |
| 62 | TX LANE2- | I | Module XAUI Input Lane 2-  | 7 |
| 63 | GND       |   | Electrical Ground          | 1 |
| 64 | TX LANE3+ | I | Module XAUI Input Lane 3+  | 7 |
| 65 | TX LANE3- | I | Module XAUI Input Lane 3-  | 7 |
| 66 | GND       |   | Electrical Ground          | 1 |
| 67 | RESERVED  |   | Reserved                   |   |
| 68 | RESERVED  |   | Reserved                   |   |
| 69 | GND       |   | Electrical Ground          | 1 |
| 70 | GND       |   | Electrical Ground          | 1 |

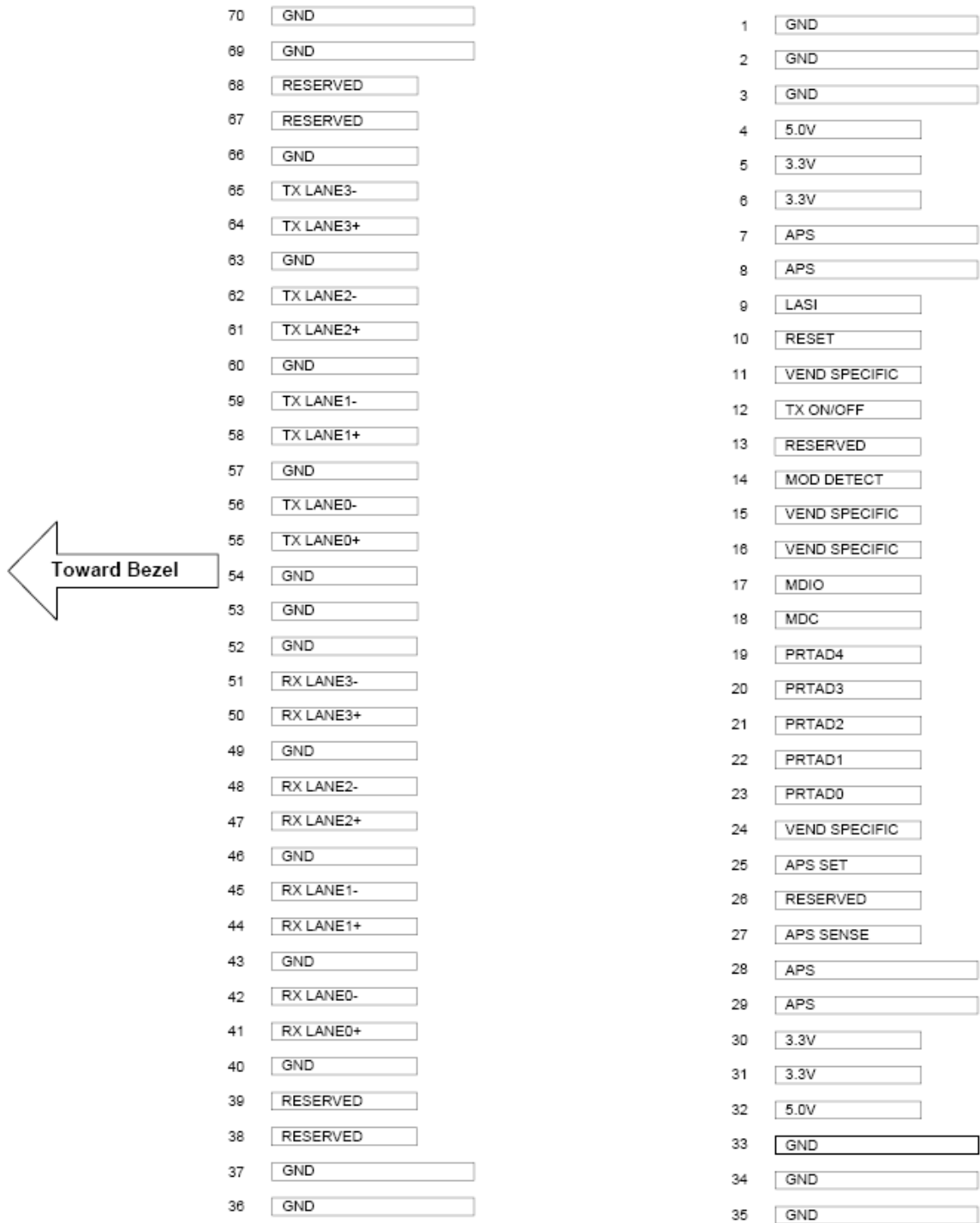
Notes:

- 1) Ground connections are common for TX and RX.
- 2) All connector contacts are rated at 0.5A nominal.
- 4) 1.2V CMOS compatible.
- 5) MDIO and MDC timing must comply with IEEE802.3ae, Clause 45.3
- 7) XAUI output characteristics should comply with IEEE802.3ae Clause 47.
- 8) Transceivers will be MSA compliant when no signals are present on the vendor specific pins.

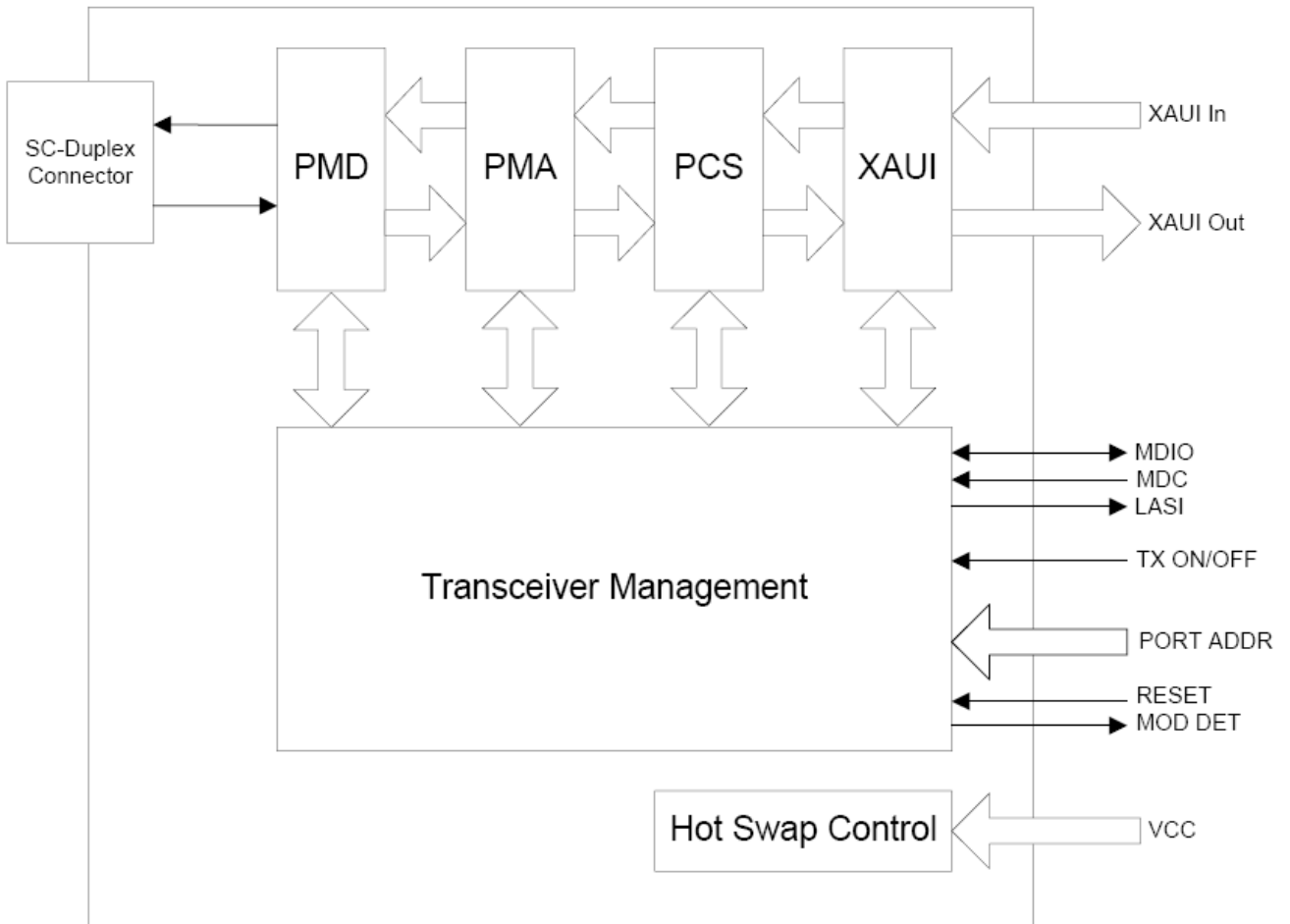


## C-band $\lambda$ c Wavelength Guide

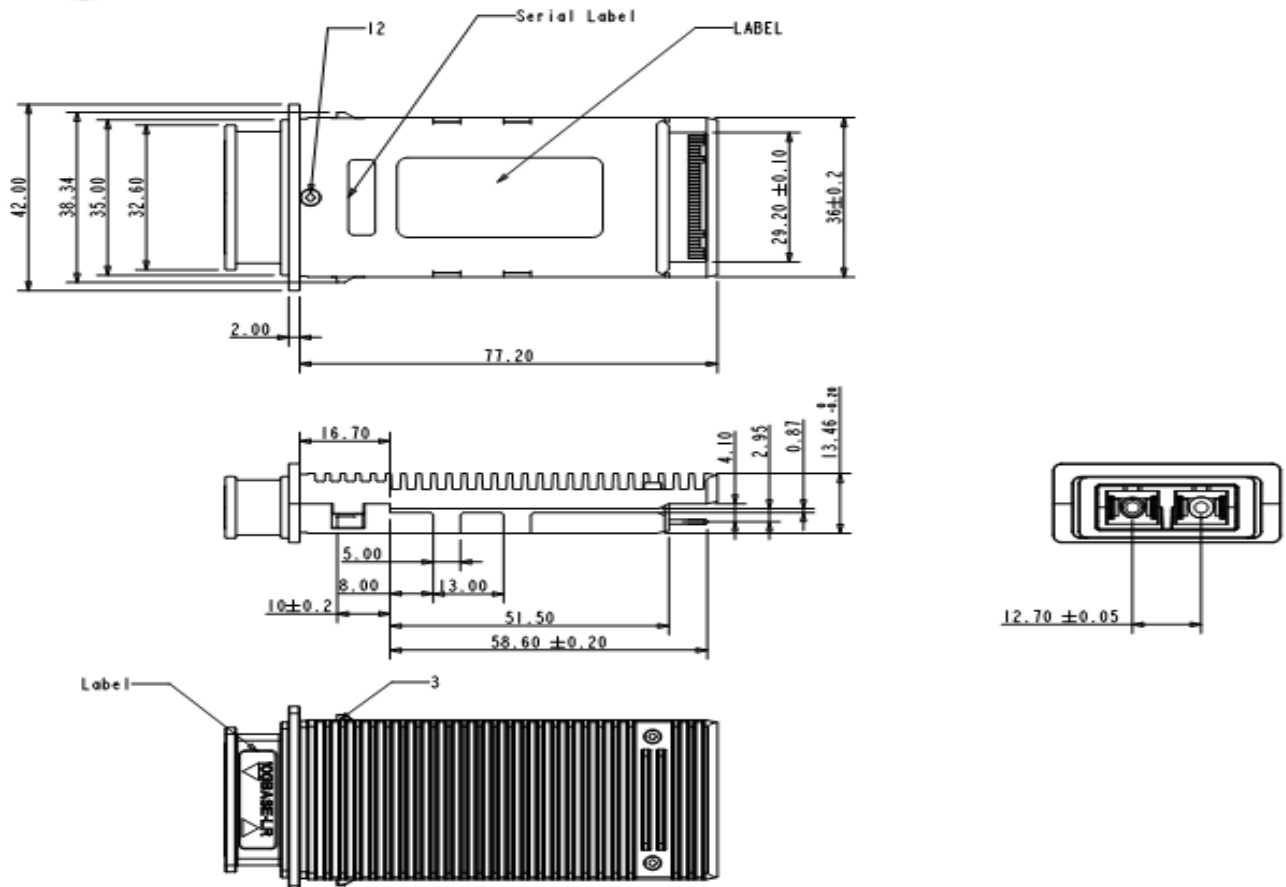
| ITU Channel Product Code | Frequency(THz) | Wavelength | ITU Channel Product Code | Frequency(THz) | Wavelength |
|--------------------------|----------------|------------|--------------------------|----------------|------------|
| 17                       | 191.7          | 1563.86    | 40                       | 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    |                          |                |            |



**Figure1.Electrical Pin-out Details**



**Figure2.** Functional Diagram of Typical X2 Style Transceiver



Dimensions in mm

**Figure3.** Mechanical Dimensions

### Ordering information

| Part Number                   | Product Description                                 |
|-------------------------------|---|
| X2-DXX-40                     | DWDM X2, 40km(ER), 0°C ~ 70°C, Cooled EA-DFB/PIN-PD |
| XX=17~61 (ITU Channel C-band) |   |

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