

Product Specification

10 Gigabit DWDM X2 40km Transceiver

FEATURES

- XAUI Electrical Interface: 4 Lanes @ 3.125Gbit/s
- DWDM EML laser
- Hot Z-Pluggable
- SC-Duplex Optical Receptacle
- MDIO, DOM Support
- Pin Photo-detector
- Compliant to X2 MSA
- Compliant to IEEE 802.3ae 10GBASE-ER Application
- Case operating temperature: 0 to 70 °C

REFERENCE

IEEE 802.3ae as 10GBASE-ER, X2 MSA Release1.0B

GENERAL DESCRIPTION

FIBERLAND 10Gb/s X2 transceiver module FLD-DWDM-X2-40 is a hot pluggable in the Z-direction module that is usable in typical router line card applications, Storage,IP network and LAN and compliant to X2 MSA.The FLD-DWDM-X2-40 is a fully integrated 10.3Gbit/s optical transceiver module that consists of a 10.3Gbit/s optical transmitter and receiver, XAUI interface, Mux and De-mux with clock and data recovery(CDR).This version of Fiberland Technology Co.,Ltd. transceiver line uses an cooled DWDM EML Laser Diode to achieve 40km over standard single mode fiber as 10GBASE-ER of the IEEE 802.3ae.

PRODUCT SELECTION**C-band λ_c Wavelength Guide Pin Descriptions**

| ITU Channel Product Code XX | Frequency(THz) | Wavelength | ITU Channel Product Code XX | 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 | | | |

PERFORMANCE SPECIFICATIONS**I .Optical Characteristics**

Table 1. Optical Characteristics

| No. | Parameters | Symbols | Min. | Typ. | Max. | Unit | NOTE |
|-----|--|-------------|------------------|-------------|------------------|--------|------|
| 1 | Center Wavelength (BOL) | λ_c | $\lambda_c -25$ | λ_c | $\lambda_c +25$ | pm | |
| 2 | Center Wavelength (EOL) | λ_c | $\lambda_c -100$ | λ_c | $\lambda_c +100$ | pm | |
| 3 | Signaling speed | | - | 10.3125 | - | Gbit/s | |
| 4 | Signaling speed variation from nominal | | -100 | - | +100 | ppm | |
| 5 | Optical modulation amplitude | OMA | -2.1 | - | - | dBm | |
| 6 | Optical Output Power | Pf | -1 | - | +4 | dBm | |
| 7 | Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| 8 | Extinction Ratio | ER | 8.2 | - | - | dB | |
| 9 | Off Transmit Power | Poff | - | - | -30 | dBm | |
| 10 | Receiver Sensitivity | Rsense | - | | -16.5 | dBm | |
| 11 | Receiver Overload | Rro | +0.5 | - | - | dBm | |
| 12 | Receiver Return Loss | RL | 12 | - | - | dB | |

II .Electrical Performance

Table2. Power Supply Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|--------------------------------------|--------|-------|-------|-------|------|------|
| 1 | Supply Voltage | VCC1 | 3.135 | 3.300 | 3.465 | V | |
| 2 | Supply Voltage | VCC2 | 1.152 | 1.200 | 1.248 | V | |
| 3 | Supply Current | ICC1 | - | - | 1.2 | A | |
| 4 | Supply Current | ICC2 | - | - | 1.7 | A | |
| 5 | Power Consumption | PDS | - | - | 4.0 | W | |
| 6 | Power supply stabilization time | TDF | - | - | 500 | ms | |
| 7 | Initialization Time | TINIT | - | - | 5 | s | |
| 8 | RESET Assert Time | TRESET | 1 | - | - | ms | |
| 9 | Hold Time after rising edge of RESET | THOLD | 500 | - | - | ms | |

Table 3. XAUI Driver Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|------------------------|--------|------|-------|------|--------|--------------------|
| 1 | Baud Rate | | - | 3.125 | - | Gbit/s | |
| 2 | Baud Rate Tolerance | | -100 | - | +100 | ppm | |
| 3 | Differential Amplitude | | 800 | - | 1600 | mVPP | AC, near-end value |

Table4. 1.2V CMOS Interface Characteristics

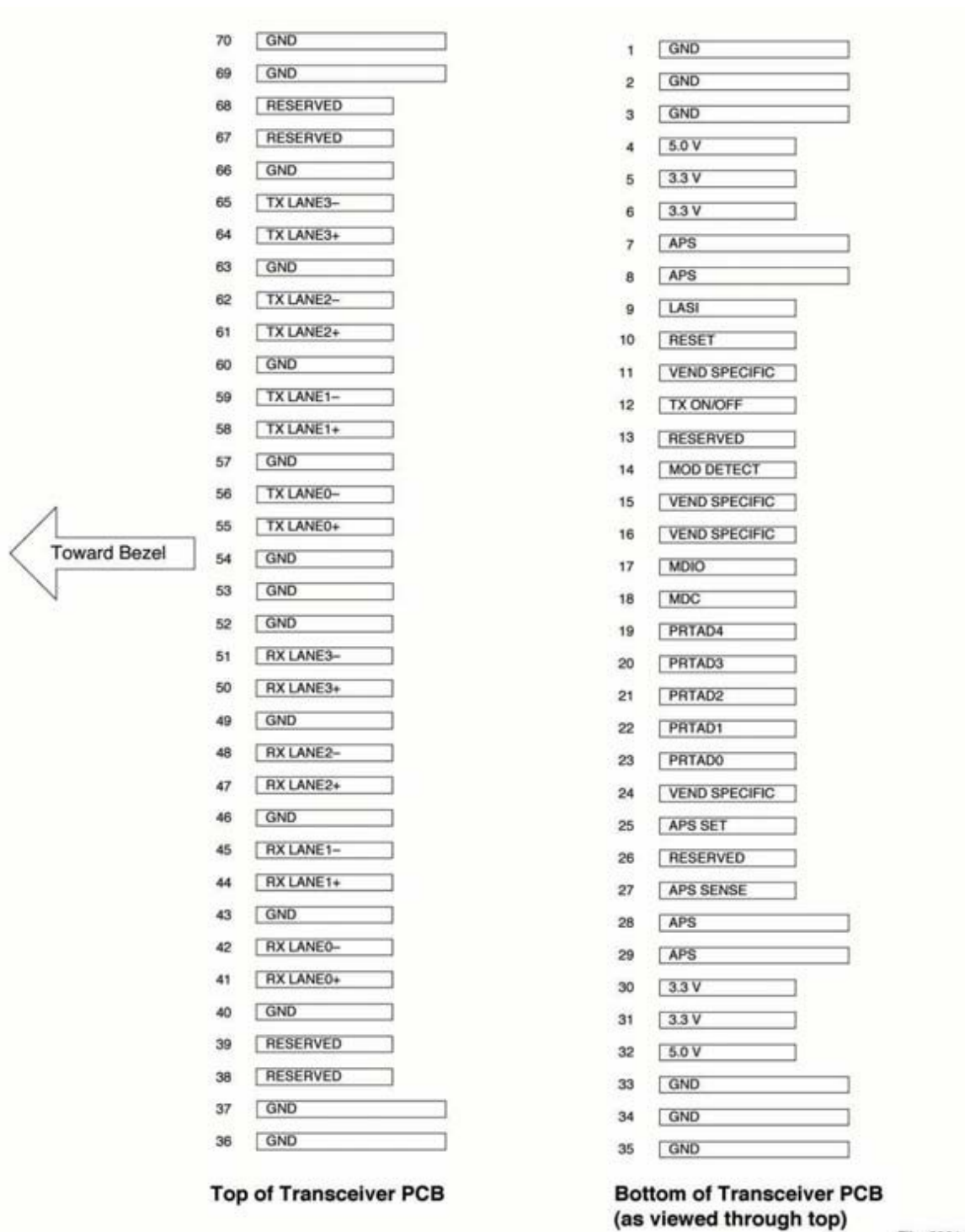
| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|-------------------------|--------|------|------|------|-------|-------------------------|
| 1 | Input High Voltage | VIH | 0.84 | - | 1.5 | V | |
| 2 | Input Low Voltage | VIL | -0.3 | - | 0.36 | V | |
| 3 | Input Pull-down Current | IIn | 20 | 40 | 120 | μA | Vih=1.2V |
| 4 | Output High Voltage | VOH | 1.0 | - | - | V | Pull-up=10k ohm to 1.2V |
| 5 | Output Low Voltage | VOL | - | - | 0.2 | V | |
| 6 | Pull up Resistance | RLASI | 10 | - | 22 | k ohm | |
| 7 | Capacitance | CLASI | - | - | 10 | pF | |
| 8 | Load Capacitance | CLoad | - | - | 320 | pF | |

Table5. MDIO Bidirectional Interface Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|--|---------|------|------|------|------|------|
| 1 | Input High Voltage | VIHM | 0.84 | - | 1.5 | V | |
| 2 | Input Low Voltage | VILM | -0.3 | - | 0.36 | V | |
| 3 | Output High Voltage | VOHM | 1.0 | - | 1.5 | V | |
| 4 | Output Low Voltage | VOLM | -0.3 | - | 0.2 | V | |
| 5 | Pull up Resistance | RMDIO | 200 | - | | Ohm | 1 |
| 6 | MDC min high/low time | THM,TLM | 160 | - | - | ns | |
| 7 | MDC Frequency | 1/TCK | TBD | - | 2.5 | MHz | |
| 8 | Setup time | TDIS | 10 | - | - | ns | |
| 9 | Hold time | TDIH | 10 | - | - | ns | |
| 10 | MDIO output delay after rising edge of MDC | TPD | 0 | - | 300 | ns | |
| 12 | Input Capacitance | Ci | - | - | 10 | pF | |
| 13 | Bus Loading | CL | - | - | 470 | pF | |

Note:1 The maximum value of RMDIO depends on bus loading(CL),input capacitance(Ci), and MDC frequency(1/TCK).

III. Electrical Pad Layout



File: 2301

Fig 1-X2 Transponder Electrical Pad Layout

Table6. X2 Pin Configuration

| Pin # | Symbol | I/O | Logic | Description |
|-------|---------------|-----|------------|--|
| 1 | GND | I | Supply | Electrical ground |
| 2 | GND | I | Supply | Electrical ground |
| 3 | GND | I | Supply | Electrical ground |
| 4 | RESERVED | - | - | Reserved |
| 5 | 3.3 V | I | Supply | Power |
| 6 | 3.3 V | I | Supply | Power |
| 7 | APS | I | Supply | Adaptive Power Supply |
| 8 | APS | I | Supply | Adaptive Power Supply |
| 9 | LASI | O | Open Drain | Link Alarm Status Interrupt. 10-22k ohm pull up on host. |
| 10 | RESET | I | 1.2V CMOS | TX OFF when MDIO RESET |
| 11 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 12 | TX ON/OFF | I | 1.2V CMOS | Transmitter ON/OFF |
| 13 | RESERVED | - | - | Reserved |
| 14 | MOD DETECT | O | - | Pulled low inside module through 1k ohm. |
| 15 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 16 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 17 | MDIO | I/O | Open Drain | Management Data IO |
| 18 | MDC | I | 1.2V CMOS | Management Data Clock |
| 19 | PRTAD4 | I | 1.2V CMOS | Port Address bit 4 (Low=0) |
| 20 | PRTAD3 | I | 1.2V CMOS | Port Address bit 3 (Low=0) |
| 21 | PRTAD2 | I | 1.2V CMOS | Port Address bit 2 (Low=0) |
| 22 | PRTAD1 | I | 1.2V CMOS | Port Address bit 1 (Low=0) |
| 23 | PRTAD0 | I | 1.2V CMOS | Port Address bit 0 (Low=0) |
| 24 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 25 | APS SET | O | - | Feedback output for APS |
| 26 | RESERVED | - | - | Reserved for Avalanche Photodiode use. |
| 27 | APS SENSE | O | Analog | APS Sense Connection |
| 28 | APS | I | Supply | Adaptive Power Supply |
| 29 | APS | I | Supply | Adaptive Power Supply |
| 30 | 3.3 V | I | Supply | Power |
| 31 | 3.3 V | I | Supply | Power |
| 32 | RESERVED | - | - | Reserved |
| 33 | GND | I | Supply | Electrical Ground |
| 34 | GND | I | Supply | Electrical Ground |
| 35 | GND | I | Supply | Electrical Ground |
| 36 | GND | I | Supply | Electrical Ground |
| 37 | GND | I | Supply | Electrical Ground |
| 38 | RESERVED | - | - | Reserved |
| 39 | RESERVED | - | - | Reserved |
| 40 | GND | I | Supply | Electrical Ground |

FIBERLAND

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| | | | | |
|----|------------|---|--------|----------------------------|
| 41 | RX LANE 0+ | O | AC | Module XAUI Output Lane 0+ |
| 42 | RX LANE 0- | O | AC | Module XAUI Output Lane 0- |
| 43 | GND | I | Supply | Electrical Ground |
| 44 | RX LANE 1+ | O | AC | Module XAUI Output Lane 1+ |
| 45 | RX LANE 1- | O | AC | Module XAUI Output Lane 1- |
| 46 | GND | I | Supply | Electrical Ground |
| 47 | RX LANE 2+ | O | AC | Module XAUI Output Lane 2+ |
| 48 | RX LANE 2- | O | AC | Module XAUI Output Lane 2- |
| 49 | GND | I | Supply | Electrical Ground |
| 50 | RX LANE 3+ | O | AC | Module XAUI Output Lane 3+ |
| 51 | RX LANE 3- | O | AC | Module XAUI Output Lane 3- |
| 52 | GND | I | Supply | Electrical Ground |
| 53 | GND | I | Supply | Electrical Ground |
| 54 | GND | I | Supply | Electrical Ground |
| 55 | TX LANE 0+ | I | AC | Module XAUI Input Lane 0+ |
| 56 | TX LANE 0- | I | AC | Module XAUI Input Lane 0- |
| 57 | GND | I | Supply | Electrical Ground |
| 58 | TX LANE 1+ | I | AC | Module XAUI Input Lane 1+ |
| 59 | TX LANE 1- | I | AC | Module XAUI Input Lane 1- |
| 60 | GND | I | Supply | Electrical Ground |
| 61 | TX LANE 2+ | I | AC | Module XAUI Input Lane 2+ |
| 62 | TX LANE 2- | I | AC | Module XAUI Input Lane 2- |
| 63 | GND | I | Supply | Electrical Ground |
| 64 | TX LANE 3+ | I | AC | Module XAUI Input Lane 3+ |
| 65 | TX LANE 3- | I | AC | Module XAUI Input Lane 3- |
| 66 | GND | I | Supply | Electrical Ground |
| 67 | RESERVED | - | - | Reserved |
| 68 | RESERVED | - | - | Reserved |
| 69 | GND | I | Supply | Electrical Ground |
| 70 | GND | I | Supply | Electrical Ground |

Note: Case is connected to electrical ground in the module.

IV.Package Outline

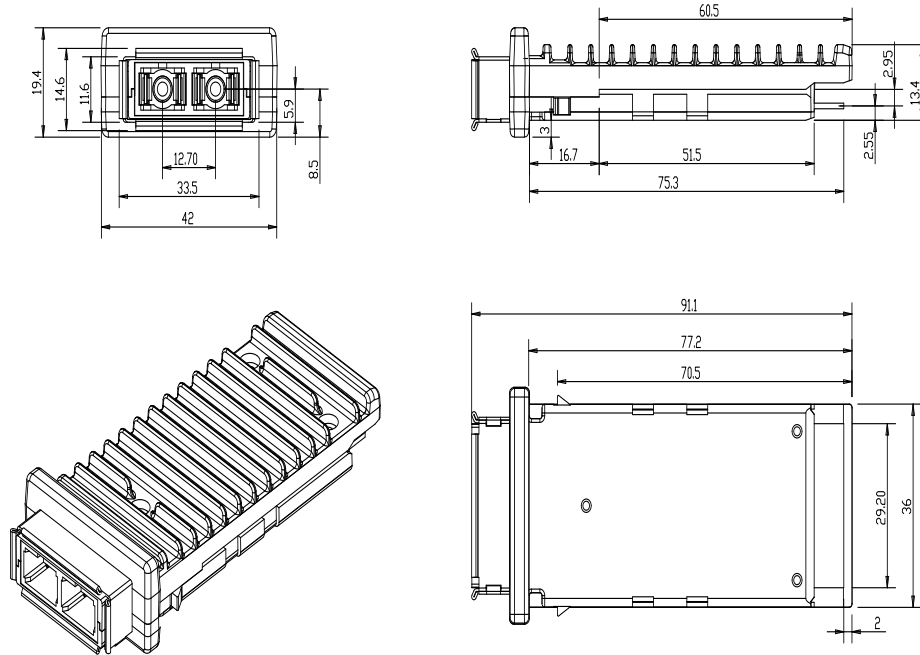


Figure 1 Mechanical dimensions

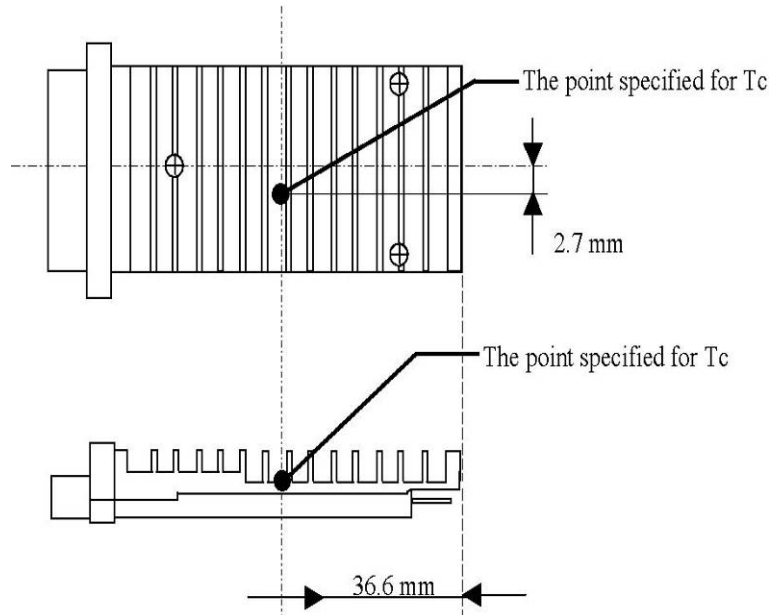


Figure 2 The Point Specified for Case Temperature (Tc)

V. Register Definition

| Device Address (Dec) Register Address (Hex) | PMA/PMD 1 | PCS 3 | PHY XS 4 |
|---|----------------------------------|--|---------------------------|
| 0x0000 | PMA/PMD Control1 | PCS Control1 | PHY XS Control1 |
| 0x0001 | PMA/PMD Status1 | PCS Status1 | PHY XS Status1 |
| 0x0002 | PMA/PMD Device Identifier0 | PCS Device Identifier0 | PHY XS Device Identifier0 |
| 0x0003 | PMA/PMD Device Identifier1 | PCS Device Identifier1 | PHY XS Device Identifier1 |
| 0x0004 | PMA/PMD Speed Ability | PCS Speed Ability | PHY XS Speed Ability |
| 0x0005 | PMA/PMD Device in Package1 | PCS Device in Package1 | PHY XS Device in Package1 |
| 0x0006 | PMA/PMD Device in Package2 | PCS Device in Package2 | PHY XS Device in Package2 |
| 0x0007 | 10G PMA/PMD Control2 | PCS Control2 | Reserved |
| 0x0008 | 10G PMA/PMD Status2 | PCS Status2 | PHY XS Status2 |
| 0x0009 | 10G PMD Transmit Disable | Reserved | Reserved |
| 0x000A | 10G PMD Receive Signal O.K. | Reserved | Reserved |
| 0x000E | Package Identifier0 | Reserved | Reserved |
| 0x000F | Package Identifier1 | Reserved | Reserved |
| 0x0018 | Reserved | Reserved | 10G PHY XGXS Lane Status |
| 0x0019 | Reserved | Reserved | 10G PHY XGXS Test Control |
| 0x0020 | Reserved | 10GBASE-R PCS Status1 | Reserved |
| 0x0021 | Reserved | 10GBASE-R PCS Status2 | Reserved |
| 0x0022 | Reserved | 10GBASE-R PCS Test pattern Seed A0 | Reserved |
| 0x0023 | Reserved | 10GBASE-R PCS Test pattern Seed A1 | Reserved |
| 0x0024 | Reserved | 10GBASE-R PCS Test pattern Seed A2 | Reserved |
| 0x0025 | Reserved | 10GBASE-R PCS Test pattern Seed A3 | Reserved |
| 0x0026 | Reserved | 10GBASE-R PCS Test pattern Seed B0 | Reserved |
| 0x0027 | Reserved | 10GBASE-R PCS Test pattern Seed B1 | Reserved |
| 0x0028 | Reserved | 10GBASE-R PCS Test pattern Seed B2 | Reserved |
| 0x0029 | Reserved | 10GBASE-R PCS Test pattern Seed B3 | Reserved |
| 0x002A | Reserved | 10GBASE-R PCS Test pattern Control | Reserved |
| 0x002B | Reserved | 10GBASE-R PCS Test pattern Error counter | Reserved |
| 0x8000 | NVR Control/Status (X2 Register) | Reserved | |
| 0x8007 - 0x807D | NVR (X2 Register) | Reserved | |

| | | |
|-----------------|--|----------|
| 0x807E-0x80AD | Customer AREA | Reserved |
| 0x80AE - 0x8106 | FIBERLAND Specific Area(X2 Register) | Reserved |
| 0x9000 | RX_ALARM Control (X2 Register) | Reserved |
| 0x9001 | TX_ALARM Control (X2 Register) | Reserved |
| 0x9002 | LASI Control (X2 Register) | Reserved |
| 0x9003 | RX_ALARM Status (X2 Register) | Reserved |
| 0x9004 | TX_ALARM Status (X2 Register) | Reserved |
| 0x9005 | LASI Status (X2 Register) | Reserved |
| 0x9006 | TX_FLAG Control Bits | Reserved |
| 0x9007 | RX_FLAG Control Bits | Reserved |
| 0xA000 - 0xA027 | Alarm and Warning Thresholds | Reserved |
| 0xA060 - 0xA069 | Digital Optical Monitoring Interface | Reserved |
| 0xA06F | DOM Capability - Extended | Reserved |
| 0xA070 | TX_ALARM_FLAG Bits | Reserved |
| 0xA071 | RX_ALARM_FLAG Bits | Reserved |
| 0xA074 | TX_WARNING_FLAG Bits | Reserved |
| 0xA075 | RX_WARNING_FLAG Bits | Reserved |
| 0xA100 | Optional Digital Optical Monitoring (DOM) Control/Status | Reserved |

VI. Regulatory Compliance

| Feature | Reference | Performance |
|------------------------------------|--|---------------------------|
| Electrostatic discharge (ESD) | IEC/EN 61000-4-2 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety | FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2 | Class 1 laser product |
| ROHS | 2002/95/EC | Compatible with standards |
| EMC | EN61000-3 | Compatible with standards |

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