

## Product Specification

### Multiprotocol 80Km, 10Gb/s DWDM XFP Optical Transceiver FTLX3815M3xx

#### PRODUCT FEATURES

- Supports 8.5Gb/s to 11.35Gb/s
- Hot-pluggable XFP footprint
- RoHS-6 Compliant (lead-free)
- 100GHz ITU Grid, C-Band
- Duplex LC connector
- Power dissipation <3.5W
- Built-in digital diagnostic functions
- Temperature range: 0°C to 70°C
- Point-to-Point & OSNR optimized versions
- Reference Clock Not Required



#### APPLICATIONS

- ITU G.698.1, DW100S-2Dx compliant DWDM 10G SONET/SDH
- ITU G.698.2, DW100C-2Ax compliant DWDM 10G SONET/SDH
- DWDM, IEEE 10GBASE-ZR based Ethernet
- 10GFC (SM-1200-LL-L) & 8GFC (SM-800-LC-L) compliant
- ITU G.709 / OTN FEC applications

Finisar's FTLX3815M3xx Small Form Factor 10Gb/s (XFP) transceiver complies with the XFP Multi-Source Agreement (MSA) Specification<sup>1</sup>. It supports amplified DWDM 10Gb/s SONET/SDH, 10 Gigabit Ethernet, and 10 Gigabit Fibre Channel applications over 80km of fiber without dispersion compensation. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA. The transceiver is RoHS compliant and lead free per Directive 2002/95/EC<sup>3</sup>, and Finisar Application Note AN-2038<sup>4</sup>.

#### PRODUCT SELECTION

**FTLX3815M3xx**

**xx:** 100GHz ITU-T channel

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |              |
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**I. Pin Descriptions****II.**

| Pin | Logic     | Symbol     | Name/Description                                                                                                                     | Ref. |
|-----|-----------|------------|--------------------------------------------------------------------------------------------------------------------------------------|------|
| 1   |           | GND        | Module Ground                                                                                                                        | 1    |
| 2   |           | VEE5       | Optional –5.2 Power Supply – <b>Not used</b>                                                                                         |      |
| 3   | LVTTL-I   | Mod-Desel  | Module De-select; When held low allows the module to respond to 2-wire serial interface commands                                     |      |
| 4   | LVTTL-O   | Interrupt  | Interrupt (bar); Indicates presence of an important condition which can be read over the serial 2-wire interface                     | 2    |
| 5   | LVTTL-I   | TX_DIS     | Transmitter Disable; Transmitter laser source turned off                                                                             |      |
| 6   |           | VCC5       | +5 Power Supply                                                                                                                      |      |
| 7   |           | GND        | Module Ground                                                                                                                        | 1    |
| 8   |           | VCC3       | +3.3V Power Supply                                                                                                                   |      |
| 9   |           | VCC3       | +3.3V Power Supply                                                                                                                   |      |
| 10  | LVTTL-I   | SCL        | Serial 2-wire interface clock                                                                                                        | 2    |
| 11  | LVTTL-I/O | SDA        | Serial 2-wire interface data line                                                                                                    | 2    |
| 12  | LVTTL-O   | Mod_Abs    | Module Absent; Indicates module is not present. Grounded in the module.                                                              | 2    |
| 13  | LVTTL-O   | Mod_NR     | Module Not Ready; Finisar defines it as a logical OR between RX_LOS and Loss of Lock in TX/RX.                                       | 2    |
| 14  | LVTTL-O   | RX_LOS     | Receiver Loss of Signal indicator                                                                                                    | 2    |
| 15  |           | GND        | Module Ground                                                                                                                        | 1    |
| 16  |           | GND        | Module Ground                                                                                                                        | 1    |
| 17  | CML-O     | RD-        | Receiver inverted data output                                                                                                        |      |
| 18  | CML-O     | RD+        | Receiver non-inverted data output                                                                                                    |      |
| 19  |           | GND        | Module Ground                                                                                                                        | 1    |
| 20  |           | VCC2       | +1.8V Power Supply – <b>Not used</b>                                                                                                 |      |
| 21  | LVTTL-I   | P_Down/RST | Power Down; When high, places the module in the low power stand-by mode and on the falling edge of P_Down initiates a module reset   |      |
|     |           |            | Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle. |      |
| 22  |           | VCC2       | +1.8V Power Supply – <b>Not used</b>                                                                                                 |      |
| 23  |           | GND        | Module Ground                                                                                                                        | 1    |
| 24  | PECL-I    | RefCLK+    | Reference Clock non-inverted input, AC coupled on the host board – <b>Not Required</b>                                               |      |
| 25  | PECL-I    | RefCLK-    | Reference Clock inverted input, AC coupled on the host board – <b>Not Required</b>                                                   |      |
| 26  |           | GND        | Module Ground                                                                                                                        | 1    |
| 27  |           | GND        | Module Ground                                                                                                                        | 1    |
| 28  | CML-I     | TD-        | Transmitter inverted data input                                                                                                      |      |
| 29  | CML-I     | TD+        | Transmitter non-inverted data input                                                                                                  |      |
| 30  |           | GND        | Module Ground                                                                                                                        | 1    |

**Notes:**

1. Module circuit ground is isolated from module chassis ground within the module.
2. Open collector; should be pulled up with 4.7k – 10kohms on host board to a voltage between 3.15V and 3.6V.

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |              |
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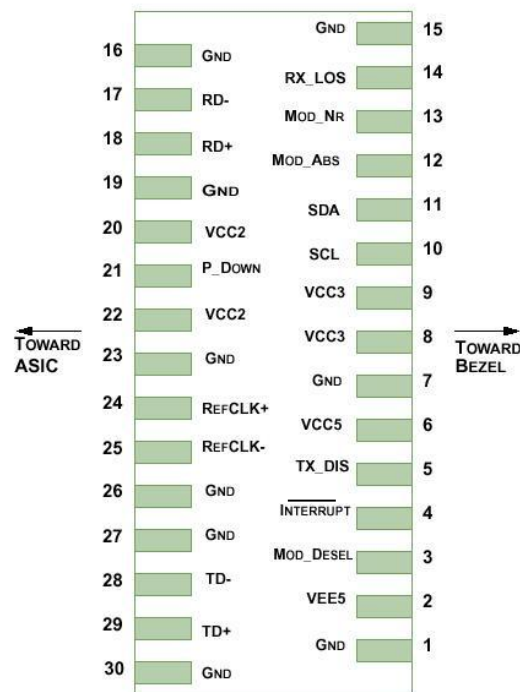


Diagram of Host Board Connector Block Pin Numbers and Names

## II. Absolute Maximum Ratings

| Parameter                  | Symbol            | Min  | Typ | Max | Unit | Ref. |
|----------------------------|-------------------|------|-----|-----|------|------|
| Maximum Supply Voltage #1  | Vcc3              | -0.5 |     | 4.0 | V    |      |
| Maximum Supply Voltage #2  | Vcc2              | -0.5 |     | 6.0 | V    |      |
| Storage Temperature        | T <sub>S</sub>    | -40  |     | 85  | °C   |      |
| Case Operating Temperature | T <sub>OP</sub>   | 0    |     | 70  | °C   |      |
| Receiver Damage Threshold  | P <sub>Rdmg</sub> | +5   |     |     | dBm  |      |

**III. Electrical Characteristics ( $T_{OP} = -5$  to  $70^{\circ}C$ ,  $V_{CC5} = 4.75$  to  $5.25$  Volts)**

| FTLX3815M3xx                            |                        |                       |     |                     |      |      |
|-----------------------------------------|------------------------|-----------------------|-----|---------------------|------|------|
| Parameter                               | Symbol                 | Min                   | Typ | Max                 | Unit | Ref. |
| Supply Voltage #1                       | Vcc3                   | 3.13                  |     | 3.46                | V    |      |
| Supply Voltage #2                       | Vcc5                   | 4.75                  |     | 5.25                | V    |      |
| Supply Current – Vcc5 supply            | Icc5                   |                       |     | 450                 | mA   |      |
| Supply Current – Vcc3 supply            | Icc3                   |                       |     | 750                 | mA   |      |
| Module total power dissipation          | P                      |                       |     | 3.5                 | W    | 1    |
| Transmitter                             |                        |                       |     |                     |      |      |
| Input differential impedance            | R <sub>in</sub>        |                       | 100 |                     | Ω    | 2    |
| Differential data input swing           | V <sub>in,pp</sub>     | 120                   |     | 820                 | mV   |      |
| Transmit Disable Voltage                | V <sub>D</sub>         | 2.0                   |     | V <sub>CC</sub>     | V    | 3    |
| Transmit Enable Voltage                 | V <sub>EN</sub>        | GND                   |     | GND+ 0.8            | V    |      |
| Receiver                                |                        |                       |     |                     |      |      |
| Differential data output swing          | V <sub>out,pp</sub>    |                       | 500 | 850                 | mV   | 4    |
| Data output rise time                   | t <sub>r</sub>         |                       |     | 40                  | ps   | 5    |
| Data output fall time                   | t <sub>f</sub>         |                       |     | 40                  | ps   | 5    |
| LOS Fault                               | V <sub>LOS fault</sub> | V <sub>CC</sub> – 0.5 |     | V <sub>CCHOST</sub> | V    | 6    |
| LOS Normal                              | V <sub>LOS norm</sub>  | GND                   |     | GND+0.5             | V    | 6    |
| Power Supply Rejection                  | PSR                    | See Note 7 below      |     |                     |      | 7    |
| Reference Clock (AC-Coupled)            |                        |                       |     |                     |      |      |
| Single-ended peak to peak voltage swing | V <sub>SEPP</sub>      | 200                   |     | 450                 | mV   |      |
| Single-ended resistance                 | R <sub>L</sub>         | 40                    | 50  | 60                  |      |      |
| Frequency clock tolerance               | Δf                     | -100                  |     | +100                | ppm  |      |
| Duty cycle                              | -                      | 40                    |     | 60                  | %    |      |

Notes:

- Maximum total power value is specified across the full temperature and voltage range.
- After internal AC coupling.
- Or open circuit.
- Into 100 ohms differential termination.
- 20 – 80 %
- Loss Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
- Per Section 2.7.1. in the XFP MSA Specification<sup>1</sup>.

**XII. Optical Characteristics (EOL,  $T_{OP} = -5$  to  $70^{\circ}\text{C}$ ,  $V_{CC5} = 4.75$  to  $5.25$  Volts)**

| Transmitter                                       |             |       |     |       |      |     |
|---------------------------------------------------|-------------|-------|-----|-------|------|-----|
| Parameter                                         | Symbol      | Min   | Typ | Max   | Unit | Ref |
| Output Opt. Pwr: 9/125 SMF                        | $P_{OUT}$   | -1    |     | +3    | dBm  |     |
| Optical Extinction Ratio                          | ER          | 8.2   |     |       | dB   |     |
| Center Wavelength Spacing                         |             |       | 100 |       | GHz  | 1   |
| Transmitter Center Wavelength – End Of Life       | $\lambda_C$ | X-100 | X   | X+100 | pm   | 2   |
| Transmitter Center Wavelength – Beginning Of Life | $\lambda_C$ | X-25  | X   | X+25  | pm   | 2   |
| Sidemode Suppression ratio                        | $SSR_{min}$ | 35    |     |       | dB   |     |
| Tx Jitter Generation (peak-to-peak)               | $Tx_j$      |       |     | 0.1   | UI   | 3   |
| Tx Jitter Generation (RMS)                        | $Tx_{jRMS}$ |       |     | 0.01  | UI   | 4   |
| Tx Locked Eye (Cold Start)                        |             |       |     | 30    | s    |     |

| Receiver                  |             |      |  |      |     |  |
|---------------------------|-------------|------|--|------|-----|--|
| Overload                  | $P_{MAX}$   | -6   |  |      | dBm |  |
| Optical Center Wavelength | $\lambda_C$ | 1270 |  | 1615 | nm  |  |
| Receiver Reflectance      | $R_{rx}$    |      |  | -27  | dB  |  |
| LOS De-Assert             | $LOS_D$     |      |  | -30  | dBm |  |
| LOS Assert                | $LOS_A$     | -37  |  |      | dBm |  |
| LOS Hysteresis            |             | 0.5  |  |      | dB  |  |

| FTLX3815M3xx                      |       |                    |                                             |                                 |                           |
|-----------------------------------|-------|--------------------|---------------------------------------------|---------------------------------|---------------------------|
| Receiver Sensitivity <sup>5</sup> |       |                    |                                             |                                 | 5                         |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Sensitivity back-to-back at OSNR>30dB (dBm) | Power Penalty at OSNR>30dB (dB) | Threshold Adjust Required |
| 8.5                               | 1e-12 | -500 to 1450       | -24                                         | 3                               | No                        |
| 9.95                              | 1e-12 | -500 to 1450       | -24                                         | 3                               | No                        |
| 10.3                              | 1e-12 | -500 to 1450       | -24                                         | 3                               | No                        |
| 10.7                              | 1e-4  | -500 to 1450       | -27                                         | 3                               | Yes                       |
| 11.1                              | 1e-4  | -500 to 1450       | -27                                         | 3                               | Yes                       |
| 11.3                              | 1e-4  | -500 to 1450       | -27                                         | 3                               | Yes                       |

| <b>OSNR Performance<sup>6</sup></b> |       |                    |                                                    | <b>6</b>                    |
|-------------------------------------|-------|--------------------|----------------------------------------------------|-----------------------------|
| Data rate (Gb/s)                    | BER   | Dispersion (ps/nm) | Max OSNR w/ dispersion at Power: -7 to -18dBm (dB) | Threshold Adjustm. Required |
| 8.5                                 | 1e-12 | -500 to 1450       | 28                                                 | No                          |
| 9.95                                | 1e-12 | -500 to 1450       | 28                                                 | No                          |
| 10.3                                | 1e-12 | -500 to 1450       | 28                                                 | No                          |
| 10.7                                | 1e-4  | -500 to 1300       | 22                                                 | Yes                         |
| 11.1                                | 1e-4  | -500 to 1300       | 22                                                 | Yes                         |
| 11.3                                | 1e-4  | -500 to 1100       | 22                                                 | Yes                         |

Notes:

1. Corresponds to approximately 0.8 nm.
2. X = Specified ITU Grid wavelength. Wavelength stability is achieved within 10 seconds of power up.
3. Measured with a host jitter of 50 mUI peak-to-peak.
4. Measured with a host jitter of 7 mUI RMS.
5. Measured at 1528-1600nm with worst ER; PRBS31.
6. All OSNR measurements are performed with 0.1nm resolution.

**Part Numbers for Amplified (OSNR) Applications:**

| Channel # | Product Code | Frequency (THz) | Center Wavelength (nm) |
|-----------|--------------|-----------------|------------------------|
| 17        | FTLX3815M317 | 191.7           | 1563.86                |
| 18        | FTLX3815M318 | 191.8           | 1563.05                |
| 19        | FTLX3815M319 | 191.9           | 1562.23                |
| 20        | FTLX3815M320 | 192.0           | 1561.42                |
| 21        | FTLX3815M321 | 192.1           | 1560.61                |
| 22        | FTLX3815M322 | 192.2           | 1559.79                |
| 23        | FTLX3815M323 | 192.3           | 1558.98                |
| 24        | FTLX3815M324 | 192.4           | 1558.17                |
| 25        | FTLX3815M325 | 192.5           | 1557.36                |
| 26        | FTLX3815M326 | 192.6           | 1556.55                |
| 27        | FTLX3815M327 | 192.7           | 1555.75                |
| 28        | FTLX3815M328 | 192.8           | 1554.94                |
| 29        | FTLX3815M329 | 192.9           | 1554.13                |
| 30        | FTLX3815M330 | 193.0           | 1553.33                |
| 31        | FTLX3815M331 | 193.1           | 1552.52                |
| 32        | FTLX3815M332 | 193.2           | 1551.72                |
| 33        | FTLX3815M333 | 193.3           | 1550.92                |
| 34        | FTLX3815M334 | 193.4           | 1550.12                |
| 35        | FTLX3815M335 | 193.5           | 1549.32                |
| 36        | FTLX3815M336 | 193.6           | 1548.51                |
| 37        | FTLX3815M337 | 193.7           | 1547.72                |
| 38        | FTLX3815M338 | 193.8           | 1546.92                |
| 39        | FTLX3815M339 | 193.9           | 1546.12                |
| 40        | FTLX3815M340 | 194.0           | 1545.32                |
| 41        | FTLX3815M341 | 194.1           | 1544.53                |
| 42        | FTLX3815M342 | 194.2           | 1543.73                |
| 43        | FTLX3815M343 | 194.3           | 1542.94                |
| 44        | FTLX3815M344 | 194.4           | 1542.14                |
| 45        | FTLX3815M345 | 194.5           | 1541.35                |
| 46        | FTLX3815M346 | 194.6           | 1540.56                |
| 47        | FTLX3815M347 | 194.7           | 1539.77                |
| 48        | FTLX3815M348 | 194.8           | 1538.98                |
| 49        | FTLX3815M349 | 194.9           | 1538.19                |
| 50        | FTLX3815M350 | 195.0           | 1537.40                |
| 51        | FTLX3815M351 | 195.1           | 1536.61                |
| 52        | FTLX3815M352 | 195.2           | 1535.82                |
| 53        | FTLX3815M353 | 195.3           | 1535.04                |
| 54        | FTLX3815M354 | 195.4           | 1534.25                |
| 55        | FTLX3815M355 | 195.5           | 1533.47                |
| 56        | FTLX3815M356 | 195.6           | 1532.68                |
| 57        | FTLX3815M357 | 195.7           | 1531.90                |
| 58        | FTLX3815M358 | 195.8           | 1531.12                |
| 59        | FTLX3815M359 | 195.9           | 1530.33                |
| 60        | FTLX3815M360 | 196.0           | 1529.55                |
| 61        | FTLX3815M361 | 196.1           | 1528.77                |

**V. Additional Specifications and Response Timing**

| Parameter                     | Symbol           | Min | Typ | Max   | Units | Ref. |
|-------------------------------|------------------|-----|-----|-------|-------|------|
| Bit Rate                      | BR               | 8.5 |     | 11.35 | Gb/s  | 1    |
| Maximum Supported Link Length | L <sub>MAX</sub> |     | 80  |       | km    | 2    |

Notes:

1. Amplified SONET OC-192, 10G Ethernet, SONET OC-192 with FEC, 10G Ethernet with FEC, 10GFC, and 8GFC
2. Distance indicates dispersion budget. Optical amplification may be required to achieve maximum distance.

## Response timing:

| Parameter                       |           | Min | Typ | Max | Units | Ref. |
|---------------------------------|-----------|-----|-----|-----|-------|------|
| Tx_Dis                          | Assert    |     |     | 10  | us    |      |
|                                 | De-assert |     |     | 2   | ms    |      |
| Rx_LOS                          | Asset     |     |     | 100 | us    |      |
|                                 | De-assert |     |     | 100 | us    |      |
| Mod_NR                          | Asset     |     |     | 1   | ms    |      |
|                                 | De-assert |     |     | 1   | ms    |      |
| Interrupt                       | Asset     |     |     | 200 | ms    |      |
|                                 | De-assert |     |     | 500 | us    |      |
| P_Down/RST Time                 |           | 10  |     |     | us    |      |
| P_Down/RST Asser Delay          |           |     |     | 100 | us    |      |
| Start-up time (Initialize time) |           |     |     | 300 | ms    | 1    |

1. Time required for transponder to be ready to begin I2C communication with host from a cold start or a hardware reset condition.

**VI. Environmental Specifications**

Finisar XFP transceivers have an operating temperature range from 0°C to +70°C case temperature.

| Parameter                  | Symbol           | Min | Typ | Max | Units | Ref. |
|----------------------------|------------------|-----|-----|-----|-------|------|
| Case Operating Temperature | T <sub>op</sub>  | 0   |     | 70  | °C    |      |
| Storage Temperature        | T <sub>sto</sub> | -40 |     | 85  | °C    |      |

**VII. Regulatory Compliance**

Finisar XFP transceivers are Class 1 Laser Products. They are certified per the following standards:

| Feature           | Agency   | Standard                                                                                               | Certificate Number |
|-------------------|----------|--------------------------------------------------------------------------------------------------------|--------------------|
| Laser Eye Safety  | FDA/CDRH | CDRH 21 CFR 1040 and Laser Notice 50                                                                   | TBD                |
| Laser Eye Safety  | TÜV      | EN 60825-1: 1994+A11:1996+A2:2001<br>IEC 60825-1: 1993+A1:1997+A2:2001<br>IEC 60825-2: 2000, Edition 2 | TBD                |
| Electrical Safety | TÜV      | EN 60950                                                                                               | TBD                |
| Electrical Safety | UL/CSA   | CLASS 3862.07<br>CLASS 3862.87                                                                         | TBD                |

Copies of the referenced certificates are available at Finisar Corporation upon request.

## VIII. Digital Diagnostics Functions

As defined by the XFP MSA<sup>1</sup>, Finisar XFP transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage
- TEC Temperature

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the XFP transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the XFP transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 000h to the maximum address of the memory.

For more detailed information, including memory map definitions, please see the XFP MSA documentation<sup>1</sup>.

### Receiver Threshold Adjustment

The FTLX3815M3xx also provide access to receiver decision threshold adjustment via 2-wire serial interface, in order to improve receiver OSNR performance based on specific link conditions. It is implemented as follows:

- Rx Threshold of XFP transceivers will be factory-set for optimized performance in non-FEC applications. This will be the default value during both cold start (power-up) and warm start (module reset).

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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- The transceiver supports adjustment of Rx Threshold value by the host through register 76d, table 01h. This is intended to be used in FEC applications.
- Register 76d, table 01h is a volatile memory. Therefore if the transceiver is power-cycled, the register starts up with a value of 00h which corresponds to the default Rx Threshold value.
- The threshold adjustment input value is 2's complement 7 bit value (-128 to +127). The default Rx threshold value will be approximately 0. Full range of adjustment provides at least a  $\pm 10\%$  change in Rx threshold from the default value.

### **SBS suppression, dither tone**

Set Address 111, bit 1 to "0" to enable tone, "1" to disable dither tone (defaults: frequency = 40kHz , tone is disabled). Please contact your Finisar RSM or PLM if specific amplitudes and frequencies are needed for SBS suppression.

### **8.5Gb/s Fibre-Channel CDR Bypass rate select:**

For 8G FC operation, write "1" to Byte 116, bit 1. Every time that the module is power cycled, this will need to be re-written (bit goes back to "0" and CDR is now set for 10Gb/s operation) in order to operate properly at 8G FC.

Contact your Finisar RSM or PLM for details on the CDR Bypass.

Write "1" to Byte 116, bit 1. Every time that the module is power cycled, this will need to be re-written (bit goes back to "0" and CDR is now set for 10Gb/s operation) in order to operate properly at 8G FC.

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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**Alarm and Warning Threshold Values**

| Address | Parameter             | Threshold Values | UNITS |
|---------|-----------------------|------------------|-------|
| 02-03   | Temp High Alarm       | 78               | C     |
| 04-05   | Temp Low Alarm        | -13              | C     |
| 06-07   | Temp High Warning     | 73               | C     |
| 08-09   | Temp Low Warning      | -8               | C     |
| 10-17   | Reserved              |                  |       |
| 18-19   | Bias High Alarm       | 120              | mA    |
| 20-21   | Bias Low Alarm        | 10               | mA    |
| 22-23   | Bias High Warning     | 100              | mA    |
| 24-25   | Bias Low Warning      | 15               | mA    |
| 26-27   | TX Power High Alarm   | +5               | dBm   |
| 28-29   | TX Power Low Alarm    | -3               | dBm   |
| 30-31   | TX Power High Warning | +4               | dBm   |
| 32-33   | TX Power Low Warning  | -2               | dBm   |
| 34-35   | RX Power High Alarm   | -4               | dBm   |
| 36-37   | RX Power Low Alarm    | -31              | dBm   |
| 38-39   | RX Power High Warning | -5               | dBm   |
| 40-41   | RX Power Low Warning  | -25              | dBm   |
| 42-43   | AUX 1 High Alarm      | 57               | C     |
| 44-45   | AUX 1 Low Alarm       | 20               | C     |
| 46-47   | AUX 1 High Warning    | 54               | C     |
| 48-49   | AUX 1 Low Warning     | 25               | C     |
| 50-51   | AUX 2 High Alarm      | 3.564            | V     |
| 52-53   | AUX 2 Low Alarm       | 3.036            | V     |
| 54-55   | AUX 2 High Warning    | 3.465            | V     |
| 56-57   | AUX 2 Low Warning     | 3.135            | V     |

**A/D Table**

| Address | Parameter            | Accuracy  | Resolution | Units | Note s                   |
|---------|----------------------|-----------|------------|-------|--------------------------|
| 96-97   | Internal module Temp | +/-3      | +/- 0.1    | degC  | PCB mounted thermocouple |
| 98-99   | Reserved             |           |            |       |                          |
| 100-101 | TX bias current      | +/-8      | +/-2       | uA    |                          |
| 102-103 | Transmit Power       | +/-1.5 dB | 0.1        | uW    |                          |
| 104-105 | Receive Power        | +/-1.5 dB | +/-0.1     | uW    |                          |
| 106-107 | Auxiliary monitor1   | +/-3      | +/-0.1     | degC  | Laser Temperature        |
| 108-109 | Auxiliary monitor2   | +/-3      | +/-100     | uV    | 3.3V Supply Voltage      |

## EEPROM (Table A0h)

| Byte Addr | Hex | LSB | Bit Size | Name                           | Description                                             | Value | Hex Value |
|-----------|-----|-----|----------|--------------------------------|---------------------------------------------------------|-------|-----------|
| 0         | 00  | 0   | 8        | Identifier                     | Type of serial transceiver                              | 6     | 6         |
| 1         | 01  | 0   | 8        | Signal Conditioner Control     | Signal Conditioner Control                              | 0     | 0         |
| 2         | 02  | 0   | 16       | Temp High Alarm                | MSB at low address                                      | 78    |           |
| 4         | 04  | 0   | 16       | Temp Low Alarm                 | MSB at low address                                      | -13   |           |
| 6         | 06  | 0   | 16       | Temp High Warning              | MSB at low address                                      | 73    |           |
| 8         | 08  | 0   | 16       | Temp Low Warning               | MSB at low address                                      | -8    |           |
| 10        | 0A  | 0   | 16       | Aux3 High Alarm                | MSB at low address                                      | 0     | 00 00     |
| 12        | 0C  | 0   | 16       | Aux3 Low Alarm                 | MSB at low address                                      | 0     | 00 00     |
| 14        | 0E  | 0   | 16       | Aux3 High Warning              | MSB at low address                                      | 0     | 00 00     |
| 16        | 10  | 0   | 16       | Aux3 Low Warning               | MSB at low address                                      | 0     | 00 00     |
| 18        | 12  | 0   | 16       | Bias High Alarm                | MSB at low address                                      | 120   |           |
| 20        | 14  | 0   | 16       | Bias Low Alarm                 | MSB at low address                                      | 10    |           |
| 22        | 16  | 0   | 16       | Bias High Warning              | MSB at low address                                      | 110   |           |
| 24        | 18  | 0   | 16       | Bias Low Warning               | MSB at low address                                      | 15    |           |
| 26        | 1A  | 0   | 16       | TX Power High Alarm            | MSB at low address                                      | +5    |           |
| 28        | 1C  | 0   | 16       | TX Power Low Alarm             | MSB at low address                                      | -3    |           |
| 30        | 1E  | 0   | 16       | TX Power High Warning          | MSB at low address                                      | +4    |           |
| 32        | 20  | 0   | 16       | TX Power Low Warning           | MSB at low address                                      | -2    |           |
| 34        | 22  | 0   | 16       | RX Power High Alarm            | MSB at low address                                      | -4    |           |
| 36        | 24  | 0   | 16       | RX Power Low Alarm             | MSB at low address                                      | -31   |           |
| 38        | 26  | 0   | 16       | RX Power High Warning          | MSB at low address                                      | -5    |           |
| 40        | 28  | 0   | 16       | RX Power Low Warning           | MSB at low address                                      | -25   |           |
| 42        | 2A  | 0   | 16       | AUX 1 High Alarm               | MSB at low address                                      | 57    |           |
| 44        | 2C  | 0   | 16       | AUX 1 Low Alarm                | MSB at low address                                      | 20    |           |
| 46        | 2E  | 0   | 16       | AUX 1 High Warning             | MSB at low address                                      | 54    |           |
| 48        | 30  | 0   | 16       | AUX 1 Low Warning              | MSB at low address                                      | 25    |           |
| 50        | 32  | 0   | 16       | AUX 2 High Alarm               | MSB at low address                                      | 3.564 |           |
| 52        | 34  | 0   | 16       | AUX 2 Low Alarm                | MSB at low address                                      | 3.036 |           |
| 54        | 36  | 0   | 16       | AUX 2 High Warning             | MSB at low address                                      | 3.465 |           |
| 56        | 38  | 0   | 16       | AUX 2 Low Warning              | MSB at low address                                      | 3.135 |           |
| 58        | 3A  | 0   | 16       | Optional VPS Control Registers | Optional VPS Control Registers                          | 0     |           |
| 60        | 3C  | 0   | 80       | RESERVED                       | RESERVED                                                | NA    | NA        |
| 70        | 46  | 0   | 8        | Acceptable BER                 | Acceptable BER Reported by the FEC to the Module        | 0     | 0         |
| 71        | 47  | 0   | 8        | Actual BER                     | Actual BER Reported by the FEC to the Module            | 0     | 0         |
| 72        | 48  | 0   | 8        | Wavelength Set MSB             | User input of Wavelength setpoint. (Units of 0.05nm)    | 0     | 0         |
| 73        | 49  | 0   | 8        | Wavelength Set LSB             | User input of Wavelength setpoint. (Units of 0.05nm)    | 0     | 0         |
| 74        | 4A  | 0   | 8        | Wavelength Error MSB           | Monitor of Current Wavelength Error. (Units of 0.005nm) | 0     | 0         |
| 75        | 4B  | 0   | 8        | Wavelength Error MSB           | Signed 2's complement value                             | 0     | 0         |
| 76        | 4C  | 0   | 8        | Amplitude Adjustment           | Relative amplitude of receive quantization threshold    | 0     | 0         |
| 77        | 4D  | 0   | 8        | Phase Adjustment               | Phase of receive quantization relative to 0.5 UI        | 0     | 0         |
| 78        | 4E  | 0   | 16       | RESERVED                       | RESERVED                                                | NA    | NA        |
| 80        | 50  | 0   | 1        | L- TX Power Low Alarm          | Latched low TX Power alarm.                             | FALSE | 0         |
| 80        | 50  | 1   | 1        | L- TX Power High Alarm         | Latched high TX Power alarm.                            | FALSE | 0         |
| 80        | 50  | 2   | 1        | L- TX Bias Low Alarm           | Latched low TX Bias alarm.                              | FALSE | 0         |
| 80        | 50  | 3   | 1        | L- TX Bias High Alarm          | Latched high TX Bias alarm.                             | FALSE | 0         |
| 80        | 50  | 4   | 1        | L- Vcc Low Alarm               | Latched low Vcc alarm.                                  | FALSE | 0         |
| 80        | 50  | 5   | 1        | L- Vcc High Alarm              | Latched high Vcc alarm.                                 | FALSE | 0         |
| 80        | 50  | 6   | 1        | L- Temp Low Alarm              | Latched low Temperature alarm.                          | FALSE | 0         |
| 80        | 50  | 7   | 1        | L- Temp High Alarm             | Latched high Temperature alarm                          | FALSE | 0         |
| 81        | 51  | 0   | 1        | RESERVED                       | RESERVED                                                | NA    | NA        |
| 81        | 51  | 1   | 1        | RESERVED                       | RESERVED                                                | NA    | NA        |
| 81        | 51  | 2   | 1        | L- AUX 2 Low Alarm             | Latched low AUX2 monitor alarm.                         | FALSE | 0         |
| 81        | 51  | 3   | 1        | L- AUX 2 High Alarm            | Latched high AUX2 monitor alarm.                        | FALSE | 0         |
| 81        | 51  | 4   | 1        | L- AUX 1 Low Alarm             | Latched low AUX1 monitor alarm.                         | FALSE | 0         |
| 81        | 51  | 5   | 1        | L- AUX 1 High Alarm            | Latched high AUX1 monitor alarm.                        | FALSE | 0         |
| 81        | 51  | 6   | 1        | L- RX Power Low Alarm          | Latched low RX Power alarm.                             | FALSE | 0         |
| 81        | 51  | 7   | 1        | L- RX Power High Alarm         | Latched high RX Power alarm.                            | FALSE | 0         |

## EEPROM (Table A0h) continued

|    |    |   |    |                          |                                                                          |       |    |
|----|----|---|----|--------------------------|--------------------------------------------------------------------------|-------|----|
| 82 | 52 | 0 | 1  | L- TX Power Low Warning  | Latched low TX Power warning.                                            | FALSE | 0  |
| 82 | 52 | 1 | 1  | L- TX Power High Warning | Latched high TX Power warning.                                           | FALSE | 0  |
| 82 | 52 | 2 | 1  | L- TX Bias Low Warning   | Latched low TX Bias warning.                                             | FALSE | 0  |
| 82 | 52 | 3 | 1  | L- TX Bias High Warning  | Latched high TX Bias warning.                                            | FALSE | 0  |
| 82 | 52 | 4 | 1  | L- Vcc Low Warning       | Latched low Vcc warning.                                                 | FALSE | 0  |
| 82 | 52 | 5 | 1  | L- Vcc High Warning      | Latched high Vcc warning.                                                | FALSE | 0  |
| 82 | 52 | 6 | 1  | L- Temp Low Warning      | Latched low Temperature warning.                                         | FALSE | 0  |
| 82 | 52 | 7 | 1  | L- Temp High Warning     | Latched high Temperature warning.                                        | FALSE | 0  |
| 83 | 53 | 0 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 83 | 53 | 1 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 83 | 53 | 2 | 1  | L- AUX 3 Low Warning     | Latched low AUX2 monitor warning.                                        | FALSE | 0  |
| 83 | 53 | 3 | 1  | L- AUX 2 High Warning    | Latched high AUX2 monitor warning.                                       | FALSE | 0  |
| 83 | 53 | 4 | 1  | L- AUX 1 Low Warning     | Latched low AUX1 monitor warning.                                        | FALSE | 0  |
| 83 | 53 | 5 | 1  | L- AUX 1 High Warning    | Latched high AUX1 monitor warning.                                       | FALSE | 0  |
| 83 | 53 | 6 | 1  | L- RX Power Low Warning  | Latched low RX Power warning.                                            | FALSE | 0  |
| 83 | 53 | 7 | 1  | L- RX Power High Warning | Latched high RX Power warning.                                           | FALSE | 0  |
| 84 | 54 | 0 | 1  | L- Reset Complete        | Latched Reset Complete Flag                                              | FALSE | 0  |
| 84 | 54 | 1 | 1  | L- MOD_NR                | Latched Mirror of MOD_NR pin                                             | FALSE | 0  |
| 84 | 54 | 2 | 1  | L- RX CDR not Locked     | Latched RX CDR Loss of Lock                                              | FALSE | 0  |
| 84 | 54 | 3 | 1  | L- LOS                   | Latched mirror of LOS pin (RX optical loss of signal)                    | FALSE | 0  |
| 84 | 54 | 4 | 1  | L- RX_NR                 | Latched RX_NR Status                                                     | FALSE | 0  |
| 84 | 54 | 5 | 1  | L- TX CDR not Locked     | Latched TX CDR Loss of Lock                                              | FALSE | 0  |
| 84 | 54 | 6 | 1  | L- TX_Fault              | Latched Laser Fault condition. Generated by laser safety system.         | FALSE | 0  |
| 84 | 54 | 7 | 1  | L- TX_NR                 | Latched TX_NR Status.                                                    | FALSE | 0  |
| 85 | 55 | 0 | 5  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 85 | 55 | 5 | 1  | L- Wavelength Unlocked   | Latched Wavelength Unlocked Condition                                    | FALSE | 0  |
| 85 | 55 | 6 | 1  | L- TEC Fault             | Latched TEC Fault                                                        | FALSE | 0  |
| 85 | 55 | 7 | 1  | L- APD Supply Fault      | Latched APD Supply Fault                                                 | FALSE | 0  |
| 86 | 56 | 0 | 16 | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 88 | 58 | 0 | 1  | M- TX Power Low Alarm    | Masking bit for low TX Power alarm.                                      | FALSE | 0  |
| 88 | 58 | 1 | 1  | M- TX Power High Alarm   | Masking bit for high TX Power alarm.                                     | FALSE | 0  |
| 88 | 58 | 2 | 1  | M- TX Bias Low Alarm     | Masking bit for low TX Bias alarm.                                       | FALSE | 0  |
| 88 | 58 | 3 | 1  | M- TX Bias High Alarm    | Masking bit for high TX Bias alarm.                                      | FALSE | 0  |
| 88 | 58 | 4 | 1  | M- Vcc Low Alarm         | Masking bit for low Vcc alarm.                                           | FALSE | 0  |
| 88 | 58 | 5 | 1  | M- Vcc High Alarm        | Masking bit for high Vcc alarm.                                          | FALSE | 0  |
| 88 | 58 | 6 | 1  | M- Temp Low Alarm        | Masking bit for low Temperature alarm.                                   | FALSE | 0  |
| 88 | 58 | 7 | 1  | M- Temp High Alarm       | Masking bit for high Temperature alarm.                                  | FALSE | 0  |
| 89 | 59 | 0 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 89 | 59 | 1 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 89 | 59 | 2 | 1  | M- AUX 2 Low Alarm       | Masking bit for low AUX2 monitor alarm.                                  | FALSE | 0  |
| 89 | 59 | 3 | 1  | M- AUX 2 High Alarm      | Masking bit for high AUX2 monitor alarm.                                 | FALSE | 0  |
| 89 | 59 | 4 | 1  | M- AUX 1 Low Alarm       | Masking bit for low AUX1 monitor alarm.                                  | FALSE | 0  |
| 89 | 59 | 5 | 1  | M- AUX 1 High Alarm      | Masking bit for high AUX1 monitor alarm.                                 | FALSE | 0  |
| 89 | 59 | 6 | 1  | M- RX Power Low Alarm    | Masking bit for low RX Power alarm.                                      | FALSE | 0  |
| 89 | 59 | 7 | 1  | M- RX Power High Alarm   | Masking bit for high RX Power alarm.                                     | FALSE | 0  |
| 90 | 5A | 0 | 1  | M- TX Power Low Warning  | Masking bit for low TX Power warning.                                    | FALSE | 0  |
| 90 | 5A | 1 | 1  | M- TX Power High Warning | Masking bit for high TX Power warning.                                   | FALSE | 0  |
| 90 | 5A | 2 | 1  | M- TX Bias Low Warning   | Masking bit for low TX Bias warning.                                     | FALSE | 0  |
| 90 | 5A | 3 | 1  | M- TX Bias High Warning  | Masking bit for high TX Bias warning.                                    | FALSE | 0  |
| 90 | 5A | 4 | 1  | M- Vcc Low Warning       | Masking bit for low Vcc warning.                                         | FALSE | 0  |
| 90 | 5A | 5 | 1  | M- Vcc High Warning      | Masking bit for high Vcc warning.                                        | FALSE | 0  |
| 90 | 5A | 6 | 1  | M- Temp Low Warning      | Masking bit for low Temperature warning.                                 | FALSE | 0  |
| 90 | 5A | 7 | 1  | M- Temp High Warning     | Masking bit for high Temperature warning.                                | FALSE | 0  |
| 91 | 5B | 0 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 91 | 5B | 1 | 1  | RESERVED                 | RESERVED                                                                 | NA    | NA |
| 91 | 5B | 2 | 1  | M- AUX 2 Low Warning     | Masking bit for low AUX2 monitor warning.                                | FALSE | 0  |
| 91 | 5B | 3 | 1  | M- AUX 2 High Warning    | Masking bit for high AUX2 monitor warning.                               | FALSE | 0  |
| 91 | 5B | 4 | 1  | M- AUX 1 Low Warning     | Masking bit for low AUX1 monitor warning.                                | FALSE | 0  |
| 91 | 5B | 5 | 1  | M- AUX 1 High Warning    | Masking bit for high AUX1 monitor warning.                               | FALSE | 0  |
| 91 | 5B | 6 | 1  | M- RX Power Low Warning  | Masking bit for low RX Power warning.                                    | FALSE | 0  |
| 91 | 5B | 7 | 1  | M- RX Power High Warning | Masking bit for high RX Power warning.                                   | FALSE | 0  |
| 92 | 5C | 0 | 1  | M- Reset Complete        | Masking bit for Reset Complete Flag                                      | FALSE | 0  |
| 92 | 5C | 1 | 1  | M- MOD_NR                | Masking bit for Mirror of MOD-NR pin                                     | FALSE | 0  |
| 92 | 5C | 2 | 1  | M- RX CDR not Locked     | Masking bit for RX CDR Loss of Lock                                      | FALSE | 0  |
| 92 | 5C | 3 | 1  | M- LOS                   | Masking bit for mirror of LOS pin (RX optical loss of signal)            | FALSE | 0  |
| 92 | 5C | 4 | 1  | M- RX_NR                 | Masking bit for RX_NR Status                                             | FALSE | 0  |
| 92 | 5C | 5 | 1  | M- TX CDR not Locked     | Masking bit for TX CDR Loss of Lock                                      | FALSE | 0  |
| 92 | 5C | 6 | 1  | M- TX_Fault              | Masking bit for Laser Fault condition. Generated by laser safety system. | FALSE | 0  |
| 92 | 5C | 7 | 1  | M- TX_NR                 | Masking bit for TX_NR Status                                             | FALSE | 0  |

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## EEPROM (Table A0h) continued

|     |    |   |    |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |             |
|-----|----|---|----|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------|
| 93  | 5D | 0 | 5  | RESERVED               | RESERVED                                                                                                                                                                                                                                                                                                                                                                                                                        | NA                                  | NA          |
| 93  | 5D | 5 | 1  | M- Wavelength Unlocked | Masking bit for Wavelength Unlocked Condition                                                                                                                                                                                                                                                                                                                                                                                   | FALSE                               | 0           |
| 93  | 5D | 6 | 1  | M- TEC Fault           | Masking bit for TEC Fault                                                                                                                                                                                                                                                                                                                                                                                                       | FALSE                               | 0           |
| 93  | 5D | 7 | 1  | M- APD Supply Fault    | Masking bit for APD Supply Fault                                                                                                                                                                                                                                                                                                                                                                                                | FALSE                               | 0           |
| 94  | 5E | 0 | 16 | RESERVED               | RESERVED                                                                                                                                                                                                                                                                                                                                                                                                                        | NA                                  | NA          |
| 96  | 60 | 0 | 8  | Temperature MSB        | Internally measured module temperature                                                                                                                                                                                                                                                                                                                                                                                          | 0                                   | 0           |
| 97  | 61 | 0 | 8  | Temperature LSB        | Internally measured module temperature                                                                                                                                                                                                                                                                                                                                                                                          | 0                                   | 0           |
| 98  | 62 | 0 | 8  | Vcc MSB                | Internally measured supply voltage in transceiver                                                                                                                                                                                                                                                                                                                                                                               | 0                                   | 0           |
| 99  | 63 | 0 | 8  | Vcc LSB                | Internally measured supply voltage in transceiver                                                                                                                                                                                                                                                                                                                                                                               | 0                                   | 0           |
| 100 | 64 | 0 | 8  | TX Bias MSB            | Internally measured TX Bias Current                                                                                                                                                                                                                                                                                                                                                                                             | 0                                   | 0           |
| 101 | 65 | 0 | 8  | TX Bias LSB            | Internally measured TX Bias Current                                                                                                                                                                                                                                                                                                                                                                                             | 0                                   | 0           |
| 102 | 66 | 0 | 8  | TX Power MSB           | Measured TX output power                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                   | 0           |
| 103 | 67 | 0 | 8  | TX Power LSB           | Measured TX output power                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                   | 0           |
| 104 | 68 | 0 | 8  | RX Power MSB           | Measured RX output power                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                   | 0           |
| 105 | 69 | 0 | 8  | RX Power LSB           | Measured RX output power                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                   | 0           |
| 106 | 6A | 0 | 8  | AUX 1 MSB              | Auxiliary measurement 1 defined in Byte 222 Page 01h                                                                                                                                                                                                                                                                                                                                                                            | 0                                   | 0           |
| 107 | 6B | 0 | 8  | AUX 1 LSB              | Auxiliary measurement 1 defined in Byte 222 Page 01h                                                                                                                                                                                                                                                                                                                                                                            | 0                                   | 0           |
| 108 | 6C | 0 | 8  | AUX 2 MSB              | Auxiliary measurement 2 defined in Byte 222 Page 01h                                                                                                                                                                                                                                                                                                                                                                            | 0                                   | 0           |
| 109 | 6D | 0 | 8  | AUX 2 LSB              | Auxiliary measurement 2 defined in Byte 222 Page 01h                                                                                                                                                                                                                                                                                                                                                                            | 0                                   | 0           |
| 110 | 6E | 0 | 1  | Data_Not_Ready         | Indicates transceiver has achieved power up and data is ready. Bit remains high until data is ready to be read at which time the device sets the bit low.                                                                                                                                                                                                                                                                       | 0                                   | 0           |
| 110 | 6E | 1 | 1  | LOS                    | Indicates Optical Loss of Signal (per relevant optical link standard). Updated within 100msec of change on pin                                                                                                                                                                                                                                                                                                                  | FALSE                               | 0           |
| 110 | 6E | 2 | 1  | Interrupt              | Digital state of the Interrupt output pin                                                                                                                                                                                                                                                                                                                                                                                       | FALSE                               | 0           |
| 110 | 6E | 3 | 1  | Soft_P_Down            | Read/write bit that allows the module to be placed in the power down mode. This is identical to the P_Down hardware pin function except that it does not initiate a system reset                                                                                                                                                                                                                                                | FALSE                               | 0           |
| 110 | 6E | 4 | 1  | P_Down State           | Digital state of the P_Down Pin. Updated within 100msec of change on pin                                                                                                                                                                                                                                                                                                                                                        | FALSE                               | 0           |
| 110 | 6E | 5 | 1  | MOD_NR State           | Digital state of the MOD_NR Pin. Updated within 100msec of change on pin                                                                                                                                                                                                                                                                                                                                                        | FALSE                               | 0           |
| 110 | 6E | 6 | 1  | Soft TX Disable        | Read/write bit that allows software disable of laser. Writing '1' disables laser. Turn on/off time is 100msec max from acknowledgement of serial byte transmission. This bit is "OR"d with the hard TX_DISABLE pin value. Note, per SFP MSA TX_DISABLE pin is default enabled unless pulled low by hardware. If Soft TX Disable is not implemented, the transceiver ignores the value of this bit. Default power up value is 0. | 0                                   | 0           |
| 110 | 6E | 7 | 1  | TX Disable State       | Digital state of the TX Disable Input Pin. Updated within 100msec of change on pin                                                                                                                                                                                                                                                                                                                                              | FALSE                               | 0           |
| 111 | 6F | 0 | 3  | RESERVED               | RESERVED                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             |
| 111 | 6F | 3 | 1  | RX_CDR not Locked      | Identifies Loss of Lock in RX path CDR                                                                                                                                                                                                                                                                                                                                                                                          | FALSE                               | 0           |
| 111 | 6F | 4 | 1  | RX_NR State            | Identifies Not Ready condition as specific to the TX path                                                                                                                                                                                                                                                                                                                                                                       | FALSE                               | 0           |
| 111 | 6F | 5 | 1  | TX_CDR not Locked      | Identifies Loss of Lock in TX path CDR                                                                                                                                                                                                                                                                                                                                                                                          | FALSE                               | 0           |
| 111 | 6F | 6 | 1  | TX_Fault State         | Identifies Laser fault condition (Generated by laser safety system)                                                                                                                                                                                                                                                                                                                                                             | FALSE                               | 0           |
| 111 | 6F | 7 | 1  | TX_NR State            | Identifies Not Ready condition as specific to the TX path                                                                                                                                                                                                                                                                                                                                                                       | FALSE                               | 0           |
| 112 | 70 | 0 | 48 | RESERVED               | RESERVED                                                                                                                                                                                                                                                                                                                                                                                                                        | NA                                  | NA          |
| 118 | 76 | 0 | 1  | Error Checking         | Error Checking                                                                                                                                                                                                                                                                                                                                                                                                                  | Packet error checking not supported | 0           |
| 118 | 76 | 1 | 7  | RESERVED               | RESERVED                                                                                                                                                                                                                                                                                                                                                                                                                        | NA                                  | NA          |
| 119 | 77 | 0 | 32 | New Password Entry     | Location of Entry of New Optional Password                                                                                                                                                                                                                                                                                                                                                                                      | 0                                   | 00 00 00 00 |
| 123 | 7B | 0 | 32 | Password Entry         | Location for Entry of Optional Password                                                                                                                                                                                                                                                                                                                                                                                         | 0                                   | 00 00 00 00 |
| 127 | 7F | 0 | 8  | Table Select           | Entry Location for Table Select Byte                                                                                                                                                                                                                                                                                                                                                                                            | 1                                   | 1           |

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## EEPROM (Table 01h)

| Byte Addr | Hex | LSB | Bit Size | Name                           | Description                                             | Value                             | Hex Value |
|-----------|-----|-----|----------|--------------------------------|---------------------------------------------------------|-----------------------------------|-----------|
| 128       | 80  | 0   | 8        | Identifier                     | Type of serial transceiver                              | XFP                               | 6         |
| 129       | 81  | 0   | 3        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 129       | 81  | 3   | 1        | CLEI code present in Table 02h | CLEI code present in Table 02h                          | No CLEI code present in Table 02h | 0         |
| 129       | 81  | 4   | 1        | TX Ref Clock Input Required    | TX Ref Clock Input Required                             | Not Required                      | 1         |
| 129       | 81  | 5   | 1        | Module with CDR                | Module with CDR                                         | with CDR                          | 0         |
| 129       | 81  | 6   | 2        | Ext. Identifier                | Defines Module Power Class                              | Power level 3 (< 3.5W)            | 2         |
| 130       | 82  | 0   | 8        | Connector                      | Code for connector type                                 | LC                                | 7         |
| 131       | 83  | 0   | 1        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 131       | 83  | 1   | 1        | 10GBASE-EW                     | 10GBASE-EW                                              | FALSE                             | 0         |
| 131       | 83  | 2   | 1        | 10GBASE-LW                     | 10GBASE-LW                                              | FALSE                             | 0         |
| 131       | 83  | 3   | 1        | 10GBASE-SW                     | 10GBASE-SW                                              | FALSE                             | 0         |
| 131       | 83  | 4   | 1        | 10GBASE-LRM                    | 10GBASE-LRM                                             | FALSE                             | 0         |
| 131       | 83  | 5   | 1        | 10GBASE-ER                     | 10GBASE-ER                                              | FALSE                             | 0         |
| 131       | 83  | 6   | 1        | 10GBASE-LR                     | 10GBASE-LR                                              | FALSE                             | 0         |
| 131       | 83  | 7   | 1        | 10GBASE-SR                     | 10GBASE-SR                                              | FALSE                             | 0         |
| 132       | 84  | 0   | 4        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 132       | 84  | 4   | 1        | Intermediate Reach 1300 nm FP  | Intermediate Reach 1300 nm FP                           | FALSE                             | 0         |
| 132       | 84  | 5   | 1        | Extended Reach 1550 nm         | Extended Reach 1550 nm                                  | FALSE                             | 0         |
| 132       | 84  | 6   | 1        | 1200-SM-LL-L                   | 1200-SM-LL-L                                            | FALSE                             | 0         |
| 132       | 84  | 7   | 1        | 1200-MX-SN-I                   | 1200-MX-SN-I                                            | FALSE                             | 0         |
| 133       | 85  | 0   | 8        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 134       | 86  | 0   | 1        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 134       | 86  | 1   | 1        | OC-48-LR                       | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 2   | 1        | OC-48-IR                       | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 3   | 1        | OC-48-SR                       | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 4   | 1        | 2xFC SMF                       | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 5   | 1        | 2xFC MMF                       | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 6   | 1        | 1000BASE-LX/1xFC SMF           | Lower speed link compliance code                        | FALSE                             | 0         |
| 134       | 86  | 7   | 1        | 1000BASE-SX/1xFC MMF           | Lower speed link compliance code                        | FALSE                             | 0         |
| 135       | 87  | 0   | 2        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 135       | 87  | 2   | 1        | I-64.5                         | Sonet codes                                             | FALSE                             | 0         |
| 135       | 87  | 3   | 1        | I-64.3                         | Sonet codes                                             | FALSE                             | 0         |
| 135       | 87  | 4   | 1        | I-64.2                         | Sonet codes                                             | FALSE                             | 0         |
| 135       | 87  | 5   | 1        | I-64.2r                        | Sonet codes                                             | FALSE                             | 0         |
| 135       | 87  | 6   | 1        | I-64.1                         | Sonet codes                                             | FALSE                             | 0         |
| 135       | 87  | 7   | 1        | I-64.1r                        | Sonet codes                                             | FALSE                             | 0         |
| 136       | 88  | 0   | 1        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 136       | 88  | 1   | 1        | S-64.5b                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 2   | 1        | S-64.5a                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 3   | 1        | S-64.3b                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 4   | 1        | S-64.3a                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 5   | 1        | S-64.2c                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 6   | 1        | S-64.2a                        | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 136       | 88  | 7   | 1        | S-64.1                         | Sonet Short Haul Link codes                             | FALSE                             | 0         |
| 137       | 89  | 0   | 1        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 137       | 89  | 1   | 1        | DWDM                           | DWDM                                                    | FALSE                             | 0         |
| 137       | 89  | 2   | 1        | G.959.1 P1L1-2D2               | Sonet Long Haul Link codes                              | TRUE                              | 1         |
| 137       | 89  | 3   | 1        | L-64.3                         | Sonet Long Haul Link codes                              | FALSE                             | 0         |
| 137       | 89  | 4   | 1        | L-64.2c                        | Sonet Long Haul Link codes                              | FALSE                             | 0         |
| 137       | 89  | 5   | 1        | L-64.2b                        | Sonet Long Haul Link codes                              | FALSE                             | 0         |
| 137       | 89  | 6   | 1        | L-64.2a                        | Sonet Long Haul Link codes                              | FALSE                             | 0         |
| 137       | 89  | 7   | 1        | L-64.1                         | Sonet Long Haul Link codes                              | FALSE                             | 0         |
| 138       | 8A  | 0   | 5        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 138       | 8A  | 5   | 1        | V-64.3                         | Sonet Very Long Haul Link codes                         | FALSE                             | 0         |
| 138       | 8A  | 6   | 1        | V-64.2b                        | Sonet Very Long Haul Link codes                         | FALSE                             | 0         |
| 138       | 8A  | 7   | 1        | V-64.2a                        | Sonet Very Long Haul Link codes                         | FALSE                             | 0         |
| 139       | 8B  | 0   | 2        | RESERVED                       | RESERVED                                                | NA                                | NA        |
| 139       | 8B  | 2   | 1        | Tx Dither Supported            |                                                         | TRUE                              | 1         |
| 139       | 8B  | 3   | 1        | RZ                             | Encoding Support                                        | FALSE                             | 0         |
| 139       | 8B  | 4   | 1        | NRZ                            | Encoding Support                                        | TRUE                              | 1         |
| 139       | 8B  | 5   | 1        | Sonet Scrambled                | Encoding Support                                        | TRUE                              | 1         |
| 139       | 8B  | 6   | 1        | 8B/10B                         | Encoding Support                                        | TRUE                              | 1         |
| 139       | 8B  | 7   | 1        | 64B/66B                        | Encoding Support                                        | TRUE                              | 1         |
| 140       | 8C  | 0   | 8        | BR, minimum                    | Minimum Supported Bitrate (/100Mb)                      | 99                                | 63        |
| 141       | 8D  | 0   | 8        | BR, maximum                    | Maximum Supported Bitrate (/100Mb)                      | 113                               | 71        |
| 142       | 8E  | 0   | 8        | Length(SMF)-km                 | LENGTH (STANDARD SINGLE MODE FIBER)-KM                  | 80                                | 50        |
| 143       | 8F  | 0   | 8        | Length(EMM-50um)-meter         | LENGTH (EXTENDED BANDWIDTH 50 um MULTIMODE FIBER) (/2m) | 0                                 | 0         |

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## EEPROM (Table 01h) continued

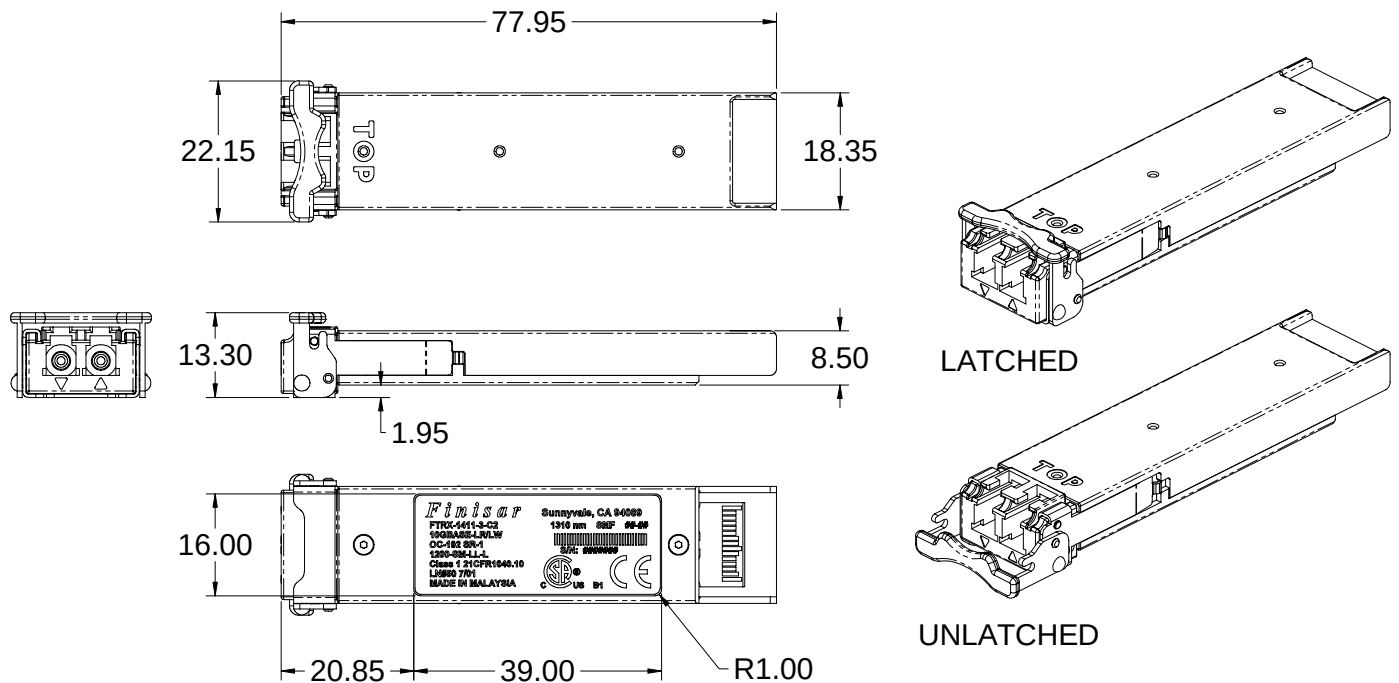
|     |    |   |     |                                         |                                                                                                               |                           |                                                                                      |
|-----|----|---|-----|-----------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------|
| 144 | 90 | 0 | 8   | Length(50)-meter                        | LENGTH (50 UM MULTIMODE FIBER) (/1meter)                                                                      | 0                         | 0                                                                                    |
| 145 | 91 | 0 | 8   | Length(62.5)-meter                      | LENGTH (62.5 UM MULTIMODE FIBER)(/1meter)                                                                     | 0                         | 0                                                                                    |
| 146 | 92 | 0 | 8   | Length(Copper)-km                       | LENGTH (COPPER) (/1meter)                                                                                     | 0                         | 0                                                                                    |
| 147 | 93 | 0 | 1   | Tunable Transmitter                     | Device Technology                                                                                             | FALSE                     | 0                                                                                    |
| 147 | 93 | 1 | 1   | Detector Type                           | Device Technology                                                                                             | APD                       | 1                                                                                    |
| 147 | 93 | 2 | 1   | Cooled Transmitter                      | Device Technology                                                                                             | TRUE                      | 1                                                                                    |
| 147 | 93 | 3 | 1   | Wavelength Control                      | Device Technology                                                                                             | FALSE                     | 0                                                                                    |
| 147 | 93 | 4 | 4   | Transmitter Technology                  | Device Technology                                                                                             | 1550 nm EML               | 7                                                                                    |
| 148 | 94 | 0 | 128 | Vendor Name                             | Vendor Name (ascii)                                                                                           | Finisar                   | 46 69 6E 69 73 61 72 20 20 20 20 20 20 20 20                                         |
| 164 | A4 | 0 | 1   | XFI Loopback Supported                  | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 164 | A4 | 1 | 1   | Uneside Loopback Mode Supported         | CDR support                                                                                                   | FALSE                     | 0                                                                                    |
| 164 | A4 | 2 | 1   | RESERVED                                | RESERVED                                                                                                      | NA                        | NA                                                                                   |
| 164 | A4 | 3 | 1   | CDR support for 11.1 Gb/s               | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 164 | A4 | 4 | 1   | CDR support for 10.7 Gb/s               | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 164 | A4 | 5 | 1   | CDR support for 10.5 Gb/s               | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 164 | A4 | 6 | 1   | CDR support for 10.3 Gb/s               | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 164 | A4 | 7 | 1   | CDR support for 9.95 Gb/s               | CDR support                                                                                                   | TRUE                      | 1                                                                                    |
| 165 | A5 | 0 | 24  | Vendor OUI                              | SFP vendor IEEE company ID                                                                                    | 00 90 65h (36965 Decimal) | 00 90 65                                                                             |
| 168 | A8 | 0 | 128 | Vendor PN                               | Part number provided by vendor (ASCII)                                                                        | FTLX3815M3xx              | Variable                                                                             |
| 184 | B8 | 0 | 16  | Vendor Rev                              | Revision level for part number provided by vendor (ASCII)                                                     | 0                         | Variable                                                                             |
| 186 | BA | 0 | 16  | Wavelength                              | Nominal laser wavelength (Wavelength=value/20 in nm)                                                          | Variable                  | Variable                                                                             |
| 188 | BC | 0 | 16  | Wavelength Tolerance                    | Guaranteed range of laser wavelength (+/- value) from Nominal wavelength. (Wavelength Tol. = value/200 in nm) | 04                        | 00 04                                                                                |
| 190 | BE | 0 | 8   | Max Case Temp                           | MAXIMUM CASE TEMPERATURE                                                                                      | 70                        | 46                                                                                   |
| 191 | BF | 0 | 8   | CC_BASE                                 | Checksum (128 to 190)                                                                                         |                           | Variable                                                                             |
| 192 | C0 | 0 | 8   | Maximum Power                           | Maximum Power Dissipation, Max power is 8 bit value * 20 mW.                                                  | 175                       | AF                                                                                   |
| 193 | C1 | 0 | 8   | Max Power in Power Down Mode            | Maximum Total Power Dissipation in Power Down Mode, Max Power is 8 bit value * 10 mW.                         | 100                       | 64                                                                                   |
| 194 | C2 | 0 | 4   | Max Current +3.3v                       | Maximum current required by +3.3V Supply. Max current is 4 bit value * 100 mA.                                | 8                         | 8                                                                                    |
| 194 | C2 | 4 | 4   | Max Current +5v                         | Maximum current required by +5V Supply. Max current is 4 bit value * 50 mA. [500 mA max]                      | 9                         | 9                                                                                    |
| 195 | C3 | 0 | 4   | Max Current -5v                         | Maximum current required by -5.2V Supply. Max current is 4 bit value * 50 mA. [500 mA max]                    | 0                         | 0                                                                                    |
| 195 | C3 | 4 | 4   | Max Current +1.8v                       | Maximum current required by +1.8V Supply. Max current is 4 bit value * 100 mA.                                | 0                         | 0                                                                                    |
| 196 | C4 | 0 | 128 | Vendor SN                               | Serial number provided by vendor (ASCII)                                                                      | Variable                  | Variable                                                                             |
| 212 | D4 | 0 | 16  | Date Code - Year                        | Two low order digits of year (00 = 2000) - ASCII code                                                         | Variable                  | Variable                                                                             |
| 214 | D6 | 0 | 16  | Date Code - Month                       | Digits of month (01=JAN ~ 12=DEC) - ASCII code                                                                | Variable                  | Variable                                                                             |
| 216 | D8 | 0 | 16  | Date Code - Day                         | Digits of day (01-31) - ASCII code                                                                            | Variable                  | Variable                                                                             |
| 218 | DA | 0 | 16  | Date Code - Vendor specific lot code    | Vendor specific lot code, may be left blank - ASCII code                                                      | 0                         | 0                                                                                    |
| 220 | DC | 0 | 3   | RESERVED                                | RESERVED                                                                                                      | NA                        | NA                                                                                   |
| 220 | DC | 3 | 1   | Received power meas. Type               | Special functions                                                                                             | Average power             | 1                                                                                    |
| 220 | DC | 4 | 1   | FEC BER support                         | Special functions                                                                                             | FALSE                     | 0                                                                                    |
| 220 | DC | 5 | 3   | AUX3 (Finisar)                          | Aux3 minitor (1612 only)                                                                                      | RESERVED                  | 0                                                                                    |
| 221 | DD | 0 | 1   | Optional CMU support mode               | Enhanced Options                                                                                              | FALSE                     | 0                                                                                    |
| 221 | DD | 1 | 1   | Wavelength Tunability implemented       | Enhanced Options                                                                                              | FALSE                     | 0                                                                                    |
| 221 | DD | 2 | 1   | Active FEC control function implemented | Enhanced Options                                                                                              | TRUE                      | 1                                                                                    |
| 221 | DD | 3 | 1   | Support VPS bypass regulator mode       | Enhanced Options                                                                                              | FALSE                     | 0                                                                                    |
| 221 | DD | 4 | 1   | Support VPS LV regulator mode           | Enhanced Options                                                                                              | FALSE                     | 0                                                                                    |
| 221 | DD | 5 | 1   | Soft P_Down                             | Enhanced Options                                                                                              | TRUE                      | 1                                                                                    |
| 221 | DD | 6 | 1   | Soft TX_DISABLE                         | Enhanced Options                                                                                              | TRUE                      | 1                                                                                    |
| 221 | DD | 7 | 1   | Variable Power Supply Support           | Enhanced Options                                                                                              | FALSE                     | 0                                                                                    |
| 222 | DE | 0 | 4   | Aux A/D Input 2                         | Enhanced Options                                                                                              | +3.3V Supply Voltage      | 7                                                                                    |
| 222 | DE | 4 | 4   | Aux A/D Input 1                         | Enhanced Options                                                                                              | Laser Temperature         | 4                                                                                    |
| 223 | DF | 0 | 8   | CC_EXT                                  | Check code for bytes 192 to 222                                                                               |                           | Variable                                                                             |
| 224 | E0 | 0 | 256 | Vendor Specific                         | Vendor Specific EEPROM                                                                                        | 0                         | 0000000000000000<br>0000000000000000<br>0000000000000000<br>0000000000000000<br>0000 |

**EEPROM (Table 02h)**

All Bytes except 128 and 129 filled with “00” unless otherwise specified by customer requirements. Addresses 128 and 129 are filled with “FF”.

**IX. Mechanical Specifications**

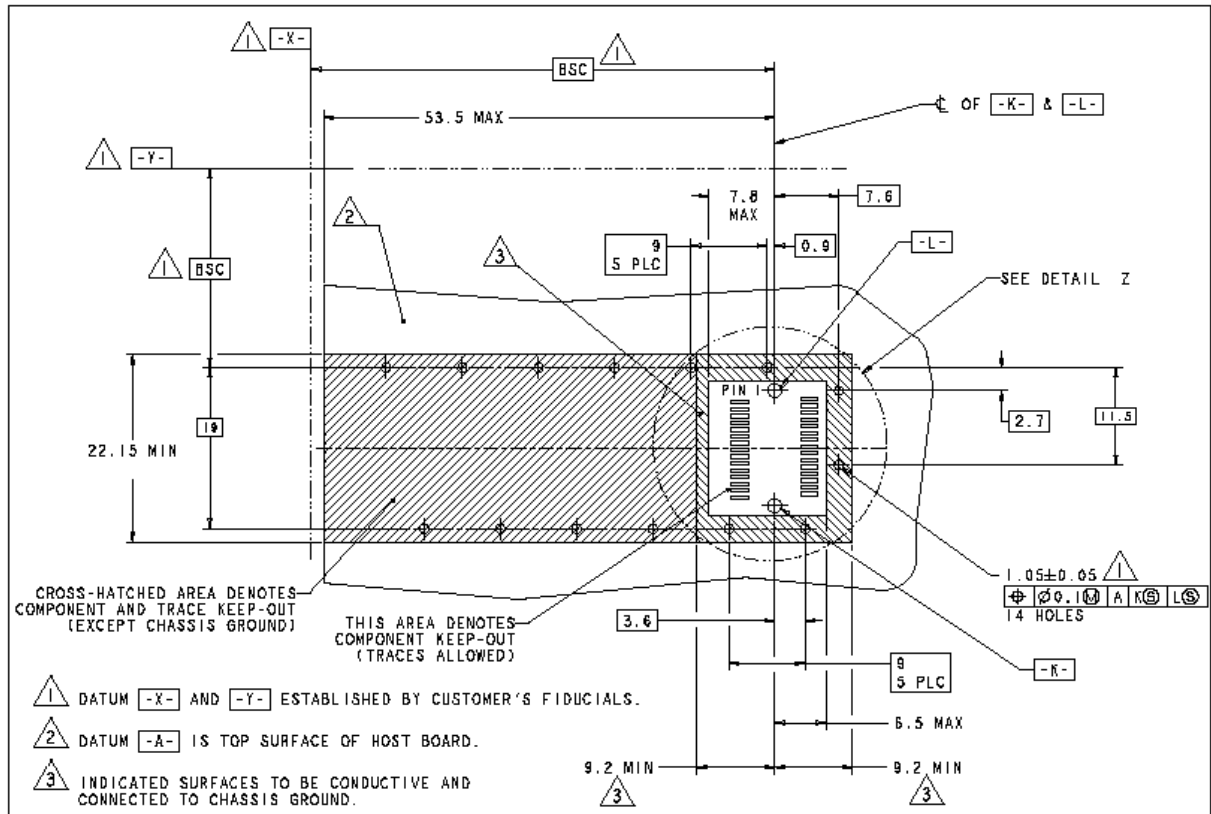
Finisar’s XFP transceivers are compliant with the dimensions defined by the XFP Multi-Sourcing Agreement (MSA).



**XFP Transceiver (dimensions are in mm)**

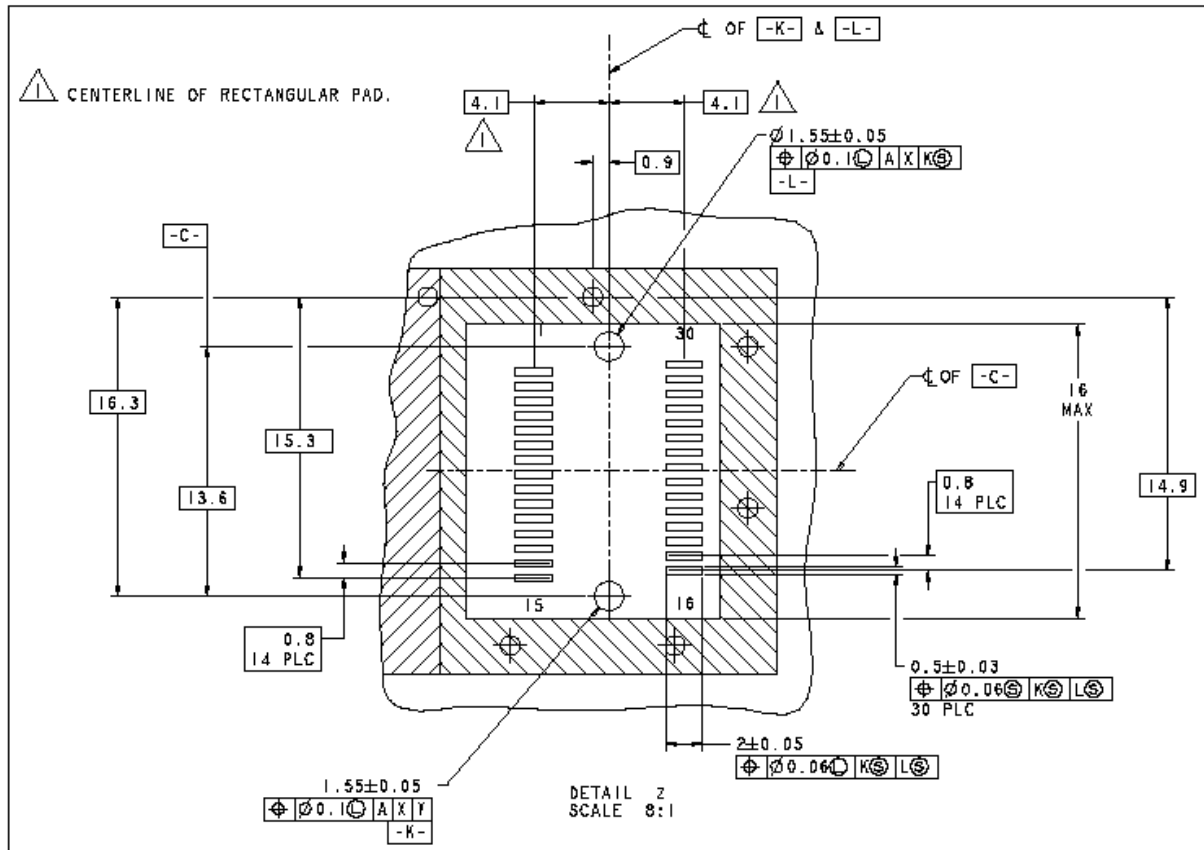
|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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## X. PCB Layout and Bezel Recommendations



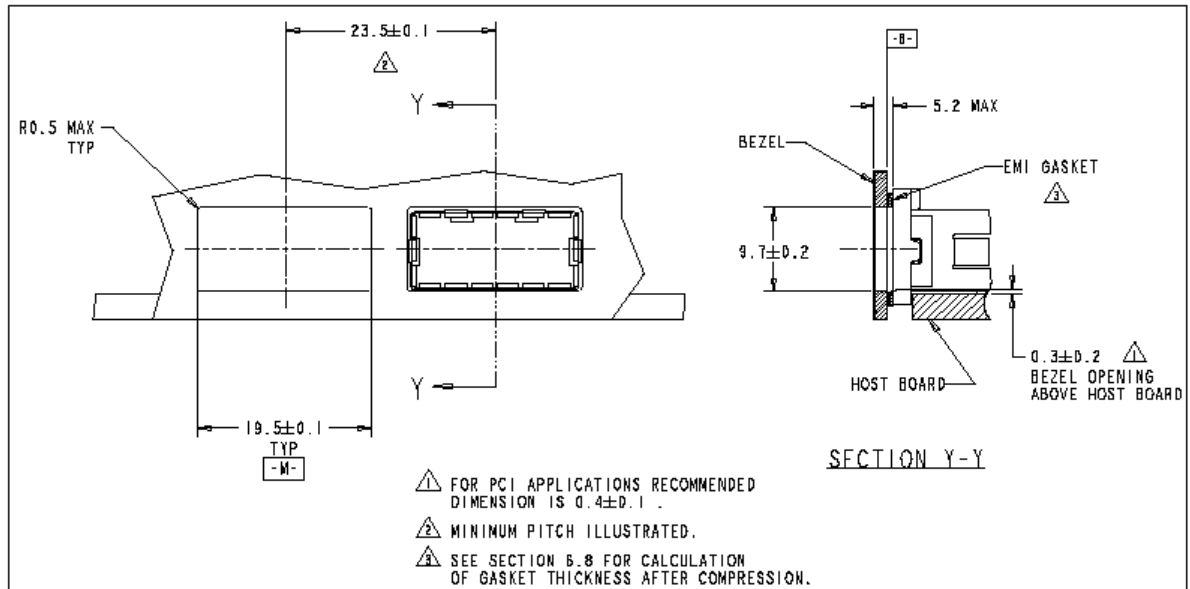
**XFP Host Board Mechanical Layout (dimensions are in mm)**

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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XFP Detail Host Board Mechanical Layout (dimensions are in mm)

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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**XFP Recommended Bezel Design (dimensions are in mm)**

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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**XI. Notes & Exceptions**

- The FTLX3815 product family has the following exceptions to the XFP MSA;
  - Initialize time of 2 sec maximum (MSA requires 300ms).
- XFI loopback operation:
  - When XFI Loopback is enabled, the Transmitter output is disabled.
  - When Line Loopback is enabled, the Receiver input is disabled.
- 8.5Gb/s operation requires configuration change via I2C vendor reserved command.

**XIII. References**

2. 10 Gigabit Small Form Factor Pluggable Module (XFP) Multi-Source Agreement (MSA), Rev 4.5 – August 2005. Documentation is currently available at <http://www.xfpmsa.org/>
3. Application Note AN-2035: “Digital Diagnostic Monitoring Interface for XFP Optical Transceivers” – Finisar Corporation, December 2003
4. Directive 2002/95/EC of the European Council Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”. January 27, 2003.
5. “Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers”, Finisar Corporation, January 21, 2005.

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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**XIII. Product Selection Details**

FTLX3815M3xx

FT: FT Series

L: RoHS-6

X: 10G Bit Rate Class

38: 80km (asymmetric chirp)

1: XFP form factor

5: Standard Performance Class

M: Multiprotocol

3: Commercial temperature range

xx: Sub-Band start channel (please refer to page 6 for channel definition)

**XIV. Revision History**

| Revision | Date       | Description                                                                                                                             |
|----------|------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| A00      | 8/15/2012  | Preliminary document created                                                                                                            |
| A01      | 10/22/2012 | Update EEPROM Table A0h and 01h                                                                                                         |
| A02      | 10/31/2012 | Include cold start timing, correct initialization timing, SBS/Dither Byte                                                               |
| A03      | 6/11/2014  | Update TX Bias High Warning; EEPROM: update values for Bytes 188, 189, 193 in Table 01h, and values for Bytes 128 and 129 in Table 02h. |
| A04      | 11/1/2014  | Data output Rise and Fall times adjusted to 40ps max.                                                                                   |

**XV. For more information**

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|                                                                                        |                                                                                                                                                                                                                                                                                                                                                           |           |               |
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