

## Product Specification

### +1600 ps/nm (80km) Tunable XFP Optical Transceiver

#### FTLX6811MCC-xx and FTLX6814MCC-xx

#### PRODUCT FEATURES

- Supports 8.5Gb/s to 11.35Gb/s
- -300 to +1600 ps/nm Dispersion Tolerance
- Supports 50GHz ITU-based channel spacing (C-Band) with a wavelength locker
- Monolithic MZM Tunable TOSA
- Temperature range: -5°C to 70°C
- RoHS-6 Compliant (lead-free)
- Power dissipation <3.5W
- Built-in digital diagnostic functions
- High performance APD Receiver
- Adjustable receiver threshold with option for automatic optimization through FEC feedback



#### APPLICATIONS

- DWDM 10Gb/s SONET/SDH
- DWDM 10Gb/s Ethernet & 10Gb/s Fibre Channel
- DWDM 10Gb/s SONET/SDH w/FEC
- DWDM 10Gb/s Ethernet and 10Gb/s Fibre Channel w/FEC

Finisar's FTLX6811MCC-xx 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

|                              |                       |
|------------------------------|-----------------------|
| <b>Standard Performance:</b> | <b>FTLX6811MCC-xx</b> |
| <b>High Performance:</b>     | <b>FTLX6814MCC-xx</b> |

**xx:** Customer specific

**I. Pin Descriptions**

| 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 - Required                                                          | 3    |
| 25  | PECL-I    | RefCLK-    | Reference Clock inverted input, AC coupled on the host board - Recommended                                                           | 3    |
| 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.
3. Reference clock is single ended and requires a non-inverted input on PIN 24. Finisar recommends also using the inverted input on PIN 25 for noise considerations. Version not requiring Host board Reference Clock is also available upon request.

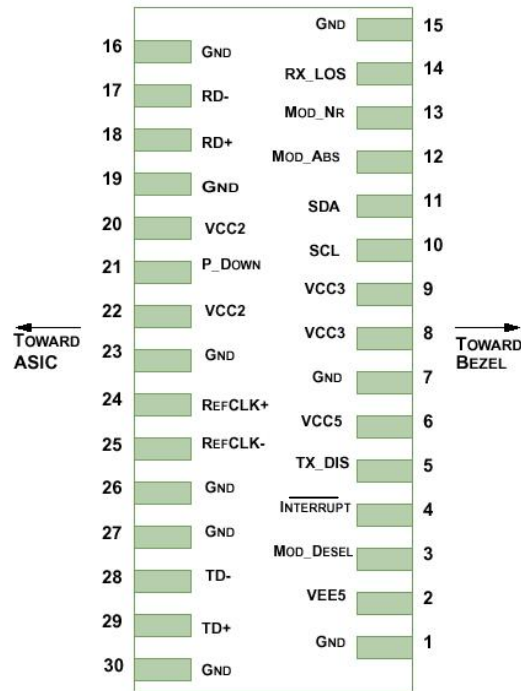


Diagram of Host Board Connector Block Pin Numbers and Names

## 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>   | -5   |     | 70  | °C   |      |
| Receiver Damage Threshold  | P <sub>Rdmg</sub> | +3   |     |     | dBm  |      |

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

| FTLX6811MCC / FLTX6814MCC               |                        |                  |     |                     |      |      |
|-----------------------------------------|------------------------|------------------|-----|---------------------|------|------|
| 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                   |                  |     | 500                 | 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              |     | Vcc                 | 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>         |                  |     | 35                  | ps   | 5    |
| Data output fall time                   | t <sub>f</sub>         |                  |     | 35                  | ps   | 5    |
| LOS Fault                               | V <sub>LOS fault</sub> | Vcc – 0.5        |     | Vcc <sub>HOST</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              |     | 900                 | 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>.

**IV. Optical Characteristics (EOL, T<sub>OP</sub> = -5 to 70°C, V<sub>CC5</sub> = 4.75 to 5.25 Volts)**

| Transmitter                                              |                  | FTLX6811MCC       |             |                   | FTLX6814MCC       |             |                   | Unit  | Ref |
|----------------------------------------------------------|------------------|-------------------|-------------|-------------------|-------------------|-------------|-------------------|-------|-----|
| Parameter                                                | Symbol           | Min               | Typ         | Max               | Min               | Typ         | Max               |       |     |
| Output Opt. Pwr: 9/125 SMF                               | P <sub>OUT</sub> | -1                |             | +3.0              | -1                |             | +3.0              | dBm   |     |
| Optical Extinction Ratio                                 | ER               | 8.2               | 9.5         |                   | 10                | 11          |                   | dB    |     |
| Wavelength range (ITU Grid)                              | $\Lambda$        | 1528.77           |             | 1563.86           | 1528.77           |             | 1563.86           | nm    |     |
| Crossing Ratio                                           |                  | 40                |             | 60                | 40                |             | 60                | %     |     |
| Center Wavelength Spacing                                |                  |                   | 50          |                   |                   | 50          |                   | GHz   | 1   |
| Transmitter Center Wavelength – End Of Life              | $\Lambda_c$      | $\lambda_c - 2.5$ | $\lambda_c$ | $\lambda_c + 2.5$ | $\lambda_c - 2.5$ | $\lambda_c$ | $\lambda_c + 2.5$ | GHz   | 2   |
| Side Mode Suppression Ratio                              | SMSR             | 35                |             |                   | 35                |             |                   | dB    |     |
| Wavelength tuning (Cold Start)                           |                  |                   |             | 30                |                   |             | 30                | s     |     |
| Wavelength tuning (Warm)                                 |                  |                   | 0.5         | 2                 |                   | 0.5         | 2                 | s     |     |
| Tx Jitter (SONET) 20kHz-80MHz                            | T <sub>xj1</sub> |                   |             | 0.3               |                   |             | 0.3               | UI    | 3   |
| Tx Jitter (SONET) 4MHz – 80MHz                           | T <sub>xj2</sub> |                   |             | 0.1               |                   |             | 0.1               | UI    | 4   |
| Relative Intensity Noise                                 | RIN              |                   |             | -135              |                   |             | -135              | dB/Hz |     |
| SBS threshold (1% of launch power reflected) – Dither On |                  | +16               |             |                   | +16               |             |                   | dBm   |     |
| Receiver                                                 |                  |                   |             |                   |                   |             |                   | Unit  | Ref |
| Parameter                                                | Symbol           | Min               | Typ         | Max               | Min               | Typ         | Max               |       |     |
| Overload                                                 | P <sub>MAX</sub> | -6                |             |                   | -6                |             |                   | dBm   |     |
| Optical Center Wavelength                                | $\lambda_c$      | 1270              |             | 1615              | 1270              |             | 1615              | nm    |     |
| Receiver Reflectance                                     | R <sub>rx</sub>  |                   |             | -27               |                   |             | -27               | dB    |     |
| LOS De-Assert                                            | LOS <sub>D</sub> |                   |             | -30               |                   |             | -30               | dBm   |     |
| LOS Assert                                               | LOS <sub>A</sub> | -37               |             |                   | -37               |             |                   | dBm   |     |
| LOS Hysteresis                                           |                  | 0.5               |             |                   | 0.5               |             |                   | dB    |     |

| FTLX6811MCC                       |       |                    |                                                      |                                              |                           |
|-----------------------------------|-------|--------------------|------------------------------------------------------|----------------------------------------------|---------------------------|
| Receiver Sensitivity <sup>5</sup> |       |                    |                                                      |                                              |                           |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Sensitivity back-to-back at OSNR>30dB (dBm)          | Dispersion Penalty at OSNR>30dB (dB)         | Threshold Adjust Required |
| 9.95                              | 1e-12 | -300 to 1450       | -23                                                  | 2                                            | No                        |
| 10.3                              | 1e-12 | -300 to 1450       | -23                                                  | 2.5                                          | No                        |
| 10.7                              | 1e-4  | -300 to 1300       | -27                                                  | 3                                            | Yes                       |
| 11.1                              | 1e-4  | -300 to 1300       | -27                                                  | 3                                            | Yes                       |
| OSNR Performance <sup>6</sup>     |       |                    |                                                      |                                              |                           |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Min OSNR Back-to-back at Power: -18dBm to -7dBm (dB) | Max OSNR Penalty at Power: -18 to -7dBm (dB) | Threshold Adjust Required |
| 9.95                              | 1e-12 | -300 to 1450       | 24                                                   | 4                                            | Yes                       |
| 10.3                              | 1e-12 | -300 to 1450       | 24                                                   | 4                                            | Yes                       |
| 10.7                              | 1e-4  | -300 to 1300       | 16                                                   | 4                                            | Yes                       |
| 11.1                              | 1e-4  | -300 to 1300       | 16                                                   | 4                                            | Yes                       |

| FTLX6814MCC                       |       |                    |                                                   |                                              |                           |
|-----------------------------------|-------|--------------------|---------------------------------------------------|----------------------------------------------|---------------------------|
| Receiver Sensitivity <sup>5</sup> |       |                    |                                                   |                                              |                           |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Sensitivity through Fiber at OSNR >30dB (dBm)     |                                              | Threshold Adjust Required |
| 10.7                              | 1E-4  | -300 to 1600       | -25.5                                             |                                              | Yes                       |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Sensitivity back-to-back at OSNR>30dB (dBm)       | Dispersion Penalty at OSNR>30dB (dB)         | Threshold Adjust Required |
| 9.95                              | 1e-12 | -300 to 1450       | -24                                               | 2                                            | No                        |
| 10.3                              | 1e-12 | -300 to 1450       | -24                                               | 2                                            | No                        |
| 10.7                              | 1e-4  | -300 to 1450       | -28                                               | 2.5                                          | Yes                       |
| 11.1                              | 1e-4  | -300 to 1450       | -28                                               | 3                                            | Yes                       |
| 11.3                              | 1e-4  | -300 to 1450       | -27                                               | 3                                            | Yes                       |
| OSNR Performance <sup>6</sup>     |       |                    |                                                   |                                              |                           |
| Data rate (Gb/s)                  | BER   | Dispersion (ps/nm) | Min OSNR Back-to-back at Power: -18 to -7dBm (dB) | Max OSNR Penalty at Power: -18 to -7dBm (dB) | Threshold Adjust Required |
| 9.95                              | 1e-12 | -300 to 1450       | 22                                                | 3                                            | Yes                       |
| 10.3                              | 1e-12 | -300 to 1450       | 22                                                | 3                                            | Yes                       |
| 10.7                              | 1e-4  | -300 to 1450       | 14.5                                              | 3                                            | Yes                       |
| 11.1                              | 1e-4  | -300 to 1450       | 14.5                                              | 3                                            | Yes                       |
| 11.3                              | 1e-4  | -300 to 1450       | 15                                                | 3                                            | Yes                       |

**Notes:**

1. Corresponds to approximately 0.4 nm.
2.  $\lambda_c$  = Specified ITU Grid wavelength. Wavelength stability is achieved within 30 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.

**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 | $L_{MAX}$ |     | 80  |       | km    | 2    |
| PMD Penalty (30ps of DGD)     |           |     |     | 1     | dB    |      |

**Notes:**

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

**Transmitter Power Monitor Accuracy**

Initial accuracy at 25C:

+/- 1.5dB.

Relative accuracy over temperature, voltage and aging:

+/- 2dB.

Received Optical Power Monitor Accuracy (applicable measurement range defined from -24dBm to -6dBm)

Initial accuracy at 25C: +/- 1.5dB.

Relative accuracy over temperature, voltage and aging: +/- 2dB.

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 FTLX6811MCC and FTLX6814MCC XFP transceivers have an operating temperature range from -5°C to +70°C case temperature.

| Parameter                  | Symbol           | Min | Typ | Max | Units | Ref. |
|----------------------------|------------------|-----|-----|-----|-------|------|
| Case Operating Temperature | T <sub>op</sub>  | -5  |     | 70  | °C    |      |
| Storage Temperature        | T <sub>sto</sub> | -40 |     | 85  | °C    |      |

## VII. Regulatory Compliance

Finisar Tunable XFP transceivers are Class 1 Laser Products and are certified per the following standards:

| Feature           | Agency   | Standard                                                                                               | Certificate Number     |
|-------------------|----------|--------------------------------------------------------------------------------------------------------|------------------------|
| Laser Eye Safety  | FDA/CDRH | CDRH 21 CFR 1040 and Laser Notice 50                                                                   | 9210176                |
| 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 | R72101686              |
| Electrical Safety | TÜV      | EN 60950                                                                                               | R72101686              |
| Electrical Safety | UL/CSA   | CLASS 3862.07<br>CLASS 3862.87                                                                         | 2283290<br>(LR 115314) |

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.

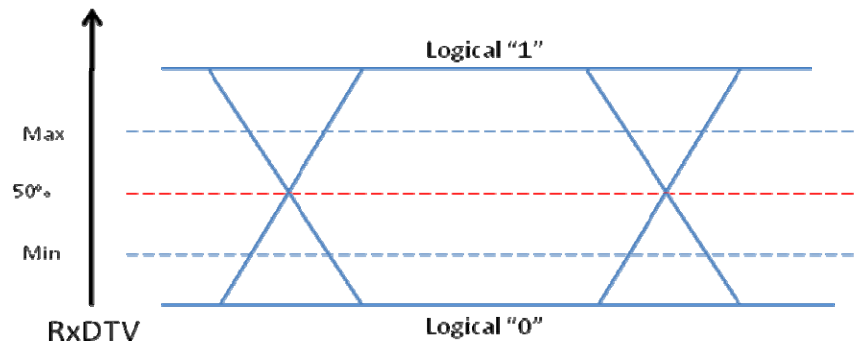
For more detailed information, including memory map definitions, please see the XFP MSA documentation<sup>1</sup>.

### **Receiver Threshold Adjustment**

The FTLX6811MCC and FTLX6814MCC 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).
- 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), with 0 corresponding to default Rx threshold value. Full range of adjustment provides at least a  $\pm 10\%$  change in Rx threshold from the default value.
- An increase in RxDTV value sets the threshold closer to the "1" value of the eye. The Default setting is the factory tuned optimized set point and is not necessarily the 50% RxDTV 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.

### Tuning Management Interface for ITU Frequency Grid Applications

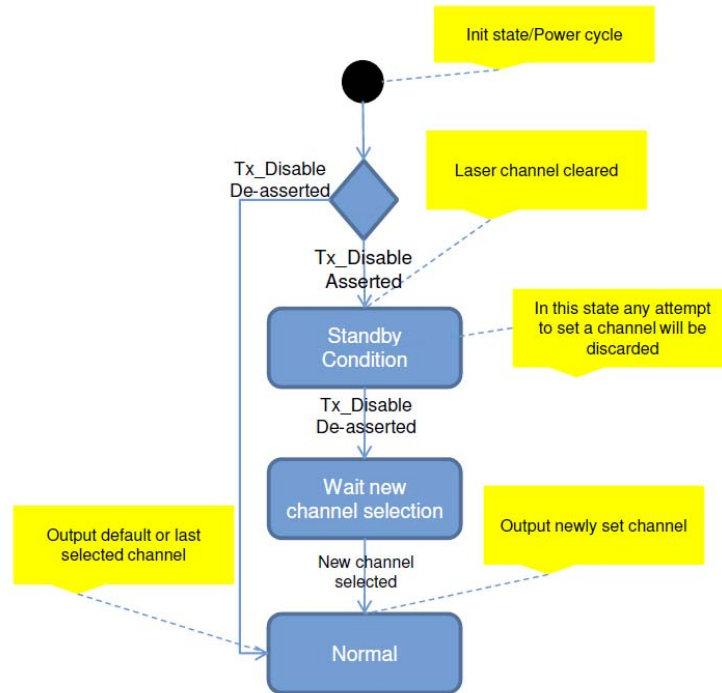
Implementation of wavelength or frequency tuning is indicated in Serial ID Byte 221 (Table 01h) bit 1.

| Data Address    | Bit | Description                                    |
|-----------------|-----|------------------------------------------------|
| 221 (Table 01h) | 1   | Wavelength or frequency tunability implemented |

The Finisar tunable XFP supports both wavelength and frequency tuning (as specified in INF-8077i), the wavelength tuning support is indicated by the transceiver description encoded in Serial ID Byte 138 bits 2 and 3.

| Address | Bit | Description of transceiver                                |
|---------|-----|-----------------------------------------------------------|
| 138     | 3   | Tunable DWDM (selection by channel number, bytes 112-113) |
| 138     | 2   | Tunable DWDM (selection in 50 pm steps, bytes 72-73)      |
| 138     | 1-0 | Reserved                                                  |

Upon a power up, the module will go to a default wavelength (Finisar default channel is 1549.716nm) or the last channel set by the host. If Tx\_DIS is asserted upon power up, the laser will be disabled and the set wavelength will be cleared. Once the Tx\_DIS is de-asserted, the firmware will maintain the laser in an off state until the host sets the desired ITU channel. If the module is powered-down before the ITU channel was set and TX\_DIS de-asserted, the module will re-start at the default channel. See the following startup channel flowchart.



**Flow Chart of Startup Channel**

A desired wavelength can be commanded by the user by writing into Bytes 72 (MSB) and 73 (LSB). Wavelength control command:

| Address             | Bit | Name             | Description                                            |
|---------------------|-----|------------------|--------------------------------------------------------|
| 72 (MSB) & 73 (LSB) | All | Wavelength Set   | User input of Wavelength set point (in units of 50 pm) |
| 74 (MSB) & 75 (LSB) | All | Wavelength Error | Monitor of Current Wavelength Error (in units of 5 pm) |

Thus for instance a target wavelength of 1556.55 nm would correspond to 79h (MSB) written to Byte address 72 and 9Bh (LSB) written to Byte address 73. Alternatively a desired frequency channel can be commanded by the user by writing into Bytes 112 (MSB) and 113 (LSB).

| Address               | Bit | Name               | Description                                                                     |
|-----------------------|-----|--------------------|---------------------------------------------------------------------------------|
| 112 (MSB) & 113 (LSB) | All | Channel Number Set | User input of channel number, which is an integer 1 to N (N=Number of Channels) |
| 114 (MSB) & 115 (LSB) | All | Frequency Error    | Frequency error reported in 16 bit signed integer with LSB=0.1 GHz              |
| 116-117               | All | Reserved           | Reserved                                                                        |

The channel number is derived from the following equation using parameters found in Module capabilities as listed in Byte Addresses 60-69:

Channel number = 1 + (Desired Frequency – First Frequency) / Grid Spacing

### Alarm and Warning Threshold Values

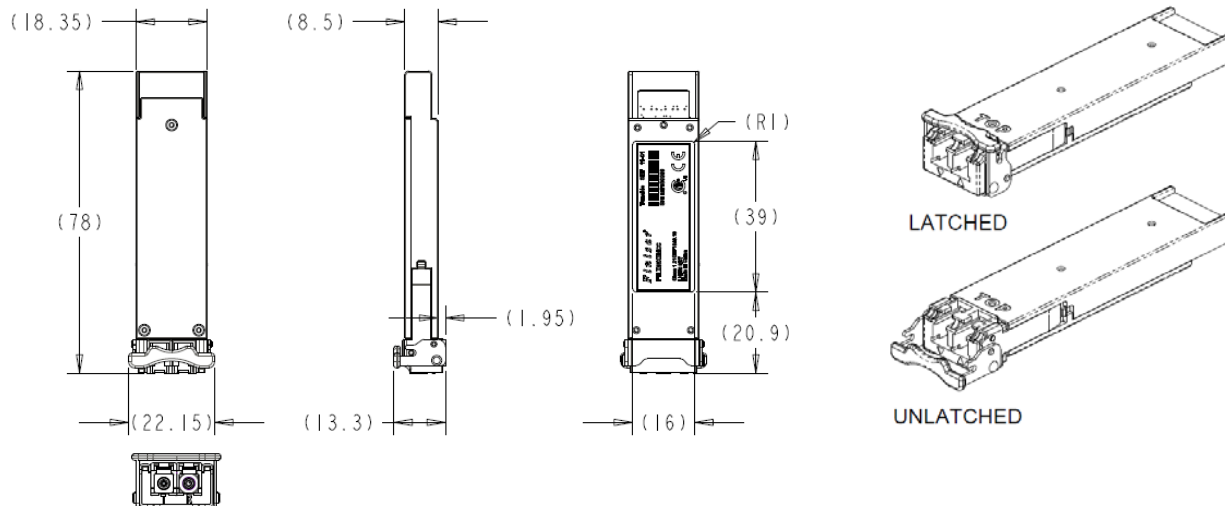
| Address | Parameter             | Threshold Values | UNITS |
|---------|-----------------------|------------------|-------|
| 02-03   | Temp High Alarm       | 78               | C     |
| 04-05   | Temp Low Alarm        | -13              | C     |
| 06-07   | Temp High Warning     | 73               | 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     | 110              | 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 | Notes                    |
|---------|--------------------|-----------|------------|-------|--------------------------|
| 96-97   | Module Case 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      |

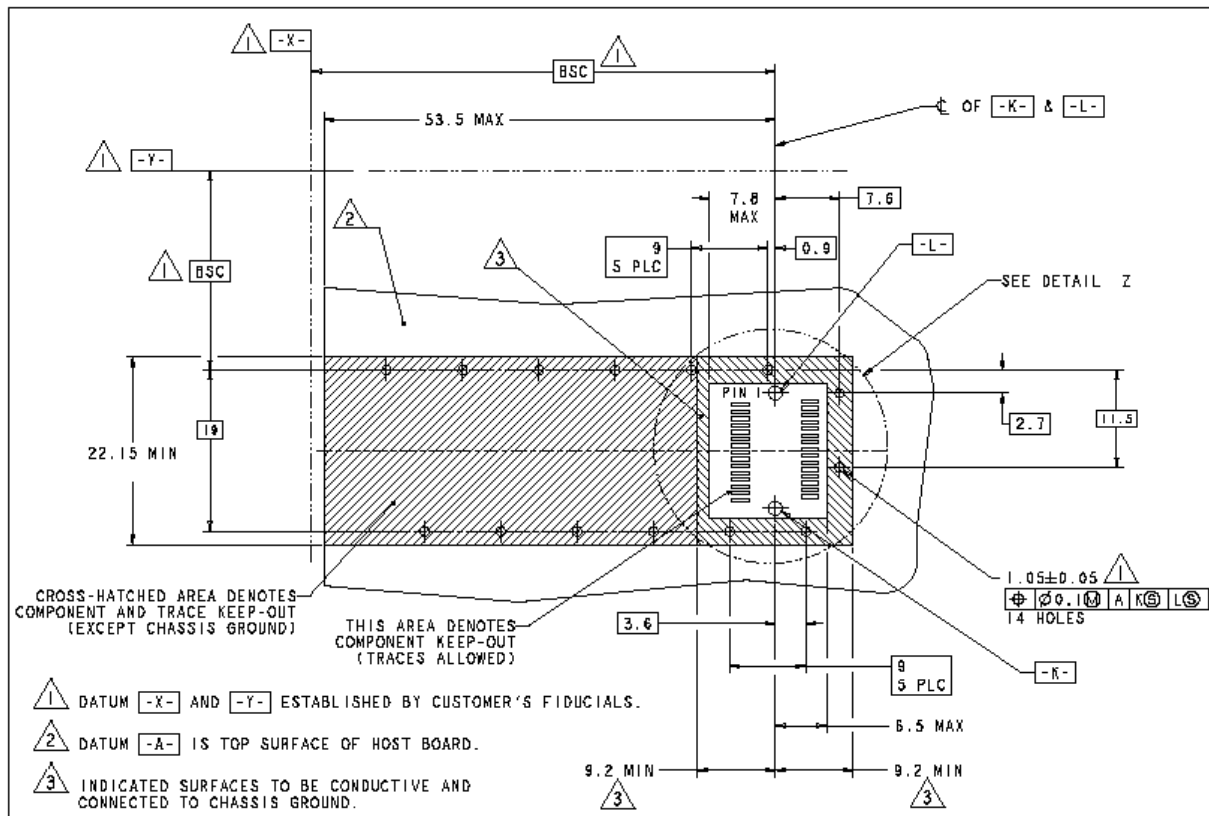
**IX. Mechanical Specifications**

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

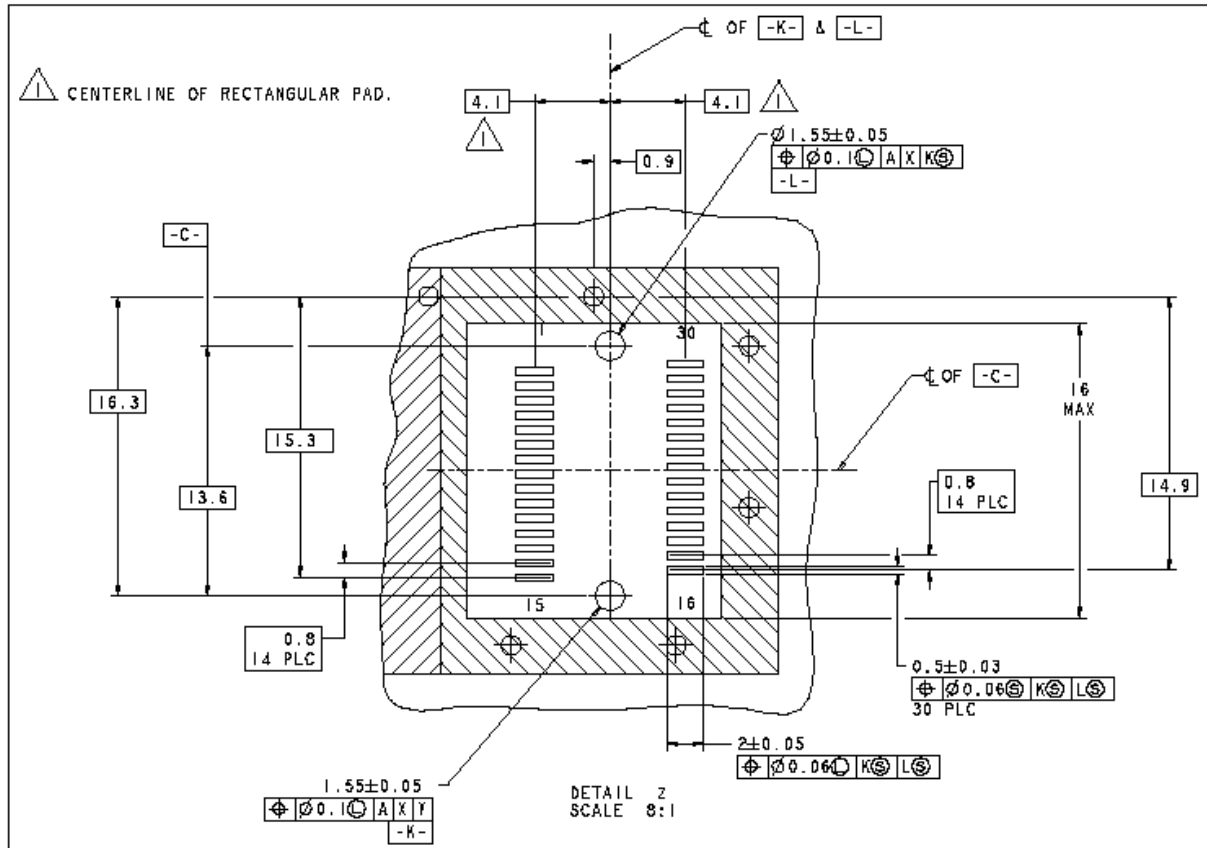


**XFP Transceiver (dimensions are in mm)**

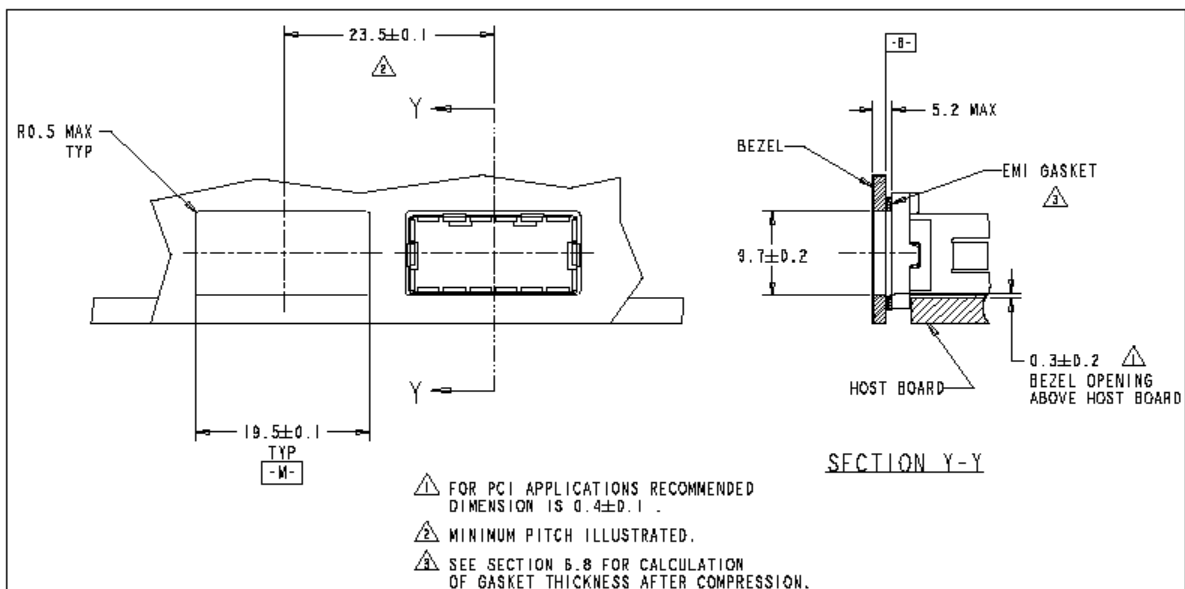
## X. PCB Layout and Bezel Recommendations



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



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



### XFP Recommended Bezel Design (dimensions are in mm)

**XI. Notes & Exceptions**

- XFI and Line Loopback operation:
  - o When XFI Loopback is enabled, the Transmitter output is disabled.
  - o When Line Loopback is enabled, the CDR output is disabled.
- 8.5Gb/s operation requires configuration change via I2C vendor reserved command.

**XII. References**

1. 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/>
2. Application Note AN-2035: “Digital Diagnostic Monitoring Interface for XFP Optical Transceivers” – Finisar Corporation, December 2003
3. 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.
4. “Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers”, Finisar Corporation, January 21, 2005.
5. SFF-8477 Revision 1.3: “Specification for Tunable XFP for ITU Frequency Grid Applications”. October 20<sup>th</sup>, 2008. Documentation is currently available at <ftp://ftp.seagate.com/sff>

**XIII. Product Selection Details**

FTLX6811MCC-xx/ FTLX6814MCC-xx

FT: FT Series

L: RoHS-6

X: 10G Bit Rate Class

68: 80km (asymmetric chirp) widely tunable with APD Receiver

1: XFP form factor

1: Gen 1 (Standard Performance), 4: Gen 1 (High-Performance)

M: Multiprotocol, 8.5Gb/s supported with I2C command

C: Commercial temperature range

C: ITU-T C-Band 50GHz spacing

xx: customer specific (not required for standard configuration)

**XIV. Revision History**

| <b>Revision</b> | <b>Date</b> | <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A00             | 4/11/2010   | Preliminary document created                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| A01             | 6/18/2010   | Initial Release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| A02             | 1/25/2011   | Minor updates to alarm and warning limits and corrected typos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A03             | 7/21/2011   | Updates as follows: new T-XFP photo on front page (green bail latch); clarify reference clock single ended specs; improve min. SBS to +16dBm; add +1600ps/nm sensitivity performance; update Path Penalty specs to -300 to 1450ps/nm range; update initialization time to MSA requirement of 300ms max; clarify RxDTV slope direction; correct Set Dither Address to Byte 111, bit 1 and default frequency to 40kHz and “0” to enable; clarify default and startup channel behavior (add flowchart); correct Byte 138 to call out bits 2&3 for WL tuning support (mistake in INF-8077i); clarify addresses 96-97 for module case temp; new mechanical picture with standard label; removed exception to MSA initialization time; clarified XFI and Line Loopback details. |

**XV. For more information**

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