

## XFPG-L



### Features

- XFP MSA Rev.3.0 compliant
- Low cost 10G solution leveraged off Luminent's in house foundry
- Reach up to 10Km
- Supports 10Gig Fibre Channel and 10Gig Ethernet
- IEEE 802.3ae compliant transceiver
- Advanced Digital Diagnostics
- Monitor TX and RX Power
- Monitor Device Temperature and Voltage
- Stable output power over temperature (low tracking error)
- 10G base 1310 nm DFB laser with isolator
- Low power consumption
- 0 to 70 C temperature range
- SIO Management Interface
- Die cast metal housing for low EMI
- TUV certificate number B 02 11 43429 027
- UL File Number E231834
- XFI loop back
- PCB equalizing
- No reference clock required

### Absolute Maximum Rating

| Parameter                     | Symbol           | Min  | Typical | Max | Unit |
|-------------------------------|------------------|------|---------|-----|------|
| Maximum Supply Voltage (3.3V) | V <sub>cc3</sub> | -0.3 | -       | 3.6 | V    |
| Maximum Supply Voltage (5.0V) | V <sub>cc5</sub> | -0.3 | -       | 5.5 | V    |
| Storage Temperature           | T <sub>st</sub>  | -40  | -       | 85  | °C   |

### General Operations

| Parameter                                 | Symbol               | Min  | Typical | Max  | Unit |
|-------------------------------------------|----------------------|------|---------|------|------|
| Supply Voltage (3.3v)                     | V <sub>cc3</sub>     | 3.14 | 3.3     | 3.47 | V    |
| Supply Voltage (5v)                       | V <sub>cc5</sub>     | 4.75 | 5       | 5.25 | V    |
| Total Current on any Pin                  | I <sub>cc</sub>      | -    | -       | 500  | mA   |
| Inrush Current (3.3v)                     | I <sub>inrush3</sub> | -    | -       | 0.75 | A    |
| Inrush Current (5v)                       | I <sub>inrush5</sub> | -    | -       | 0.5  | A    |
| Power on 3.3V Rail                        | P <sub>3rail</sub>   | -    | -       | 2.5  | W    |
| Power on 5V Rail                          | P <sub>5rail</sub>   | -    | -       | 2.5  | W    |
| Module Total Power Consumption            | P <sub>t</sub>       | -    | -       | 2.5  | W    |
| Power Consumption-P_Down mode             | P <sub>p_d</sub>     | -    | -       | 1.5  | W    |
| Host Bulk Bypass Capacitance for Module   |                      | -    | -       | 22   | μF   |
| Power Supply Noise Rejection <sup>a</sup> |                      | -    | -       | 2    | %    |
| Power Supply Noise Rejection <sup>b</sup> |                      | -    | -       | 3    | %    |
| Operating Temperature (case)              | T <sub>op</sub>      | -5   | -       | 70   | °C   |

a) Peak to peak noise when measured with a 1 MHz low pass filter

b) Peak to peak noise when measured with 1MHz-10MHz low pass filter

## XFPG-L

### Transmitter Requirements

| Parameter                                  | Symbol               | Min  | Typical | Max   | Unit   |
|--------------------------------------------|----------------------|------|---------|-------|--------|
| Bit Rate                                   | BR                   | 9.95 | -       | 11.09 | Gbit/s |
| Center Wavelength                          | $\lambda$            | 1260 | -       | 1355  | nm     |
| Side Mode Suppression Ratio                | SMSR                 | 30   | -       | -     | dB     |
| Spectral Linewidth                         | $\Delta\lambda_{20}$ | -    | -       | 0.1   | nm     |
| Electrical Signal to Noise Ratio           | ESNR                 | 26   | -       | -     | dB     |
| Average Launch Power                       | $P_{ave}$            | -6   | -3      | -1    | dBm    |
| OMA-TDP                                    | OMA-TDP              | -6.2 | -       | -     | dBm    |
| OMA                                        | OMA                  | -5.2 | -       | -     | dBm    |
| Chromatic Dispersion Penalty (at 10km SMF) | PP                   | -    | -       | 3.2   | dB     |
| OFF Transmit Power                         | $P_{off}$            | -    | -       | -30   | dBm    |
| ER                                         | ER                   | 3.5  | 4       | -     | dB     |
| RIN                                        | RIN                  | -    | -       | -128  | dB/Hz  |
| Reflectance Tolerance                      | $ref_T$              | -    | -       | -27   | dB     |
| Transmit Eye Mask Margin                   |                      | 10   | -       | -     | %      |

### Receiver Requirements

| Parameter                            | Symbol          | Min   | Typical | Max       | Unit   |
|--------------------------------------|-----------------|-------|---------|-----------|--------|
| Bit Rate                             | BR              | 9.95  | -       | 11.09     | Gbit/s |
| Bit Rate Variation                   |                 | -     | -       | $\pm 100$ | ppm    |
| Center Wavelength <sup>c</sup>       | $\lambda$       | 1260  | -       | 1355      | nm     |
| Receive Power, Overload              | $Rx_{OL}$       | 0.5   | -       | -         | dB     |
| Receive Power, Sensitivity           | $Rx_{sens}$     | -     | -       | -14.4     | dBm    |
| Differential Group Delay             | DGD             | -     | -       | 30        | ps     |
| Receiver Power, Overload Damage      | $RxOL_{damage}$ | 4     | -       | -         | dBm    |
| Receiver sensitivity in OMA          |                 | -     | -       | -12.6     | dBm    |
| Receiver Reflectance                 | $Rx_r$          | -     | -       | -12       | dB     |
| Stressed receiver sensitivity in OMA |                 | -     | -       | -10.3     | dBm    |
| Stressed eye jitter                  |                 | 0.3   | -       | -         | UI, pp |
| Rx 3 dB upper cutoff frequency       | $f_{cutoff}$    | -     | -       | 12.3      | GHz    |
| LOS Assert                           | -               | -24.4 | -       | -         | dBm    |
| LOS De-assert                        | -               | -     | -       | -14.4     | dBm    |
| LOS Hysteresis                       | -               | 1     | -       | -         | dB     |

c) Operational over 1200-1625nm range

## XFPG-L

### Hardware Timing

| Parameter               | Symbol                | Min | Typical | Max | Unit |
|-------------------------|-----------------------|-----|---------|-----|------|
| Tx Disable Negate Time  | t <sub>on</sub>       | -   | -       | 2   | ms   |
| Tx Disable Assert Time  | t <sub>off</sub>      | -   | -       | 10  | µs   |
| Time to Initialize      | t <sub>init</sub>     | -   | -       | 300 | ms   |
| Interrupt Assert Delay  | interrupt_on          | -   | -       | 200 | ms   |
| Interrupt Negate Delay  | interrupt_off         | -   | -       | 500 | µs   |
| P_Down/RST Assert Delay | P_Down/RST_on         | -   | -       | 100 | µs   |
| MOD NR Assert Delay     | Mod_nr_on             | -   | -       | 1   | ms   |
| MOD NR Negate Delay     | Mod_nr_off            | -   | -       | 1   | ms   |
| P_Down Reset Time       | -                     | 10  | -       | -   | µs   |
| RX_LOS Assert Delay     | t <sub>loss_on</sub>  | -   | -       | 100 | µs   |
| RX_LOS Negate Delay     | t <sub>loss_off</sub> | -   | -       | 100 | µs   |

### Software Timing

| Parameter                   | Symbol                | Min | Typical | Max  | Unit |
|-----------------------------|-----------------------|-----|---------|------|------|
| Tx Disable Negate Time      | t <sub>on</sub>       | -   | -       | 100  | ms   |
| Tx Disable Assert Time      | t <sub>off</sub>      | -   | -       | 100  | ms   |
| P_Down Assert Time          | T_P_Down              | -   | -       | 100  | ms   |
| P_Down Deassert Time        | T_P_Up                | -   | -       | 300  | ms   |
| RX_LOS Assert Time          | t <sub>loss_on</sub>  | -   | -       | 100  | ms   |
| RX_LOS Deassert Time        | t <sub>loss_off</sub> | -   | -       | 100  | ms   |
| MOD NR Assert Delay         | T_nr_on               | -   | -       | 100  | ms   |
| MOD NR Negate Delay         | T_nr_off              | -   | -       | 100  | ms   |
| Analog Parameter Data Ready | T_data                | -   | -       | 1000 | ms   |

### Low Speed Electrical-Pin Out and Definitions

| Parameter                                 | Symbol                     | Min                        | Typical              | Max                        | Unit |
|-------------------------------------------|----------------------------|----------------------------|----------------------|----------------------------|------|
| Mod_NR                                    | Mod_NR                     | -                          | Host_V <sub>cc</sub> | -                          | -    |
| Module Deselect Pin                       | Mod_DeSel                  | -                          | V <sub>cc3</sub>     | -                          | -    |
| XFP Interrupt, Mod_NR, Rx_LOS             | V <sub>OL</sub>            | 0                          | -                    | 0.4                        | V    |
|                                           | V <sub>OH</sub>            | host_V <sub>cc</sub> - 0.5 | -                    | host_V <sub>cc</sub> - 0.3 | V    |
| XFP Tx_Dis, P_Dwn/RST                     | V <sub>IL</sub>            | - 0.3                      | -                    | 0.8                        | V    |
|                                           | V <sub>IH</sub>            | 2                          | -                    | V <sub>cc3</sub> + 0.3     | V    |
| XFP SCL and SDA                           | V <sub>OL</sub>            | 0                          | -                    | 0.4                        | V    |
|                                           | V <sub>OH</sub>            | host_V <sub>cc</sub> - 0.5 | -                    | host_V <sub>cc</sub> - 0.3 | V    |
| XFP SCL and SDA                           | V <sub>IL</sub>            | - 0.3                      | -                    | V <sub>cc3</sub> *0.3      | V    |
|                                           | V <sub>IH</sub>            | V <sub>cc3</sub> *0.7      | -                    | V <sub>cc3</sub> + 0.5     | V    |
| Leakage Current                           | I <sub>L</sub>             | -10                        | -                    | 10                         | µA   |
| Capacitance for XFP SCL and SDA I/O Pin   | C <sub>i</sub>             | -                          | -                    | 14                         | pF   |
| Total Bus Capacitive Load for SCL and SDA | C <sub>b<sup>c</sup></sub> | -                          | -                    | 100                        | pF   |
|                                           | C <sub>b<sup>d</sup></sub> | -                          | -                    | 400                        | pF   |

c) at 400 KHz, 3.0 Kohms R<sub>p</sub> max, at 100 KHz, 8.0 Kohm R<sub>p</sub> max

d) at 400 KHz, 0.8 Kohms R<sub>p</sub> max, at 100 KHz, 2.0 Kohm R<sub>p</sub> max

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**XFI High Speed Electrical (XFI Transmitter, B')**

| Parameter                              | Symbol       | Min | Typical | Max  | Unit     |
|----------------------------------------|--------------|-----|---------|------|----------|
| Reference Differential Impedence       | $Z_d$        | -   | 100     | -    | $\Omega$ |
| Termination Mismatch                   | $\Delta R_M$ | -5% | -       | 5%   |          |
| Source to Sink DC Potential Difference | $V_{cm}$     | 0   | -       | 3.6  | V        |
| Input AC Common Mode Voltage           | $V_{AC}$     | -   | -       | 25   | mV (RMS) |
| Single Ended Input Amplitude, min      |              | -   | -       | 65   | mVpp     |
| Single Ended Input Amplitude, max      |              | 400 | -       | -    | mVpp     |
| Total Jitter                           | $T_j$        | -   | -       | 0.61 | UI       |
| Total Non DDJ Jitter                   |              | -   | -       | 0.41 | UI       |

**XFI High Speed Electrical (XFI Receiver, C')**

| Parameter                               | Symbol       | Min  | Typical | Max  | Unit     |
|-----------------------------------------|--------------|------|---------|------|----------|
| Reference Differential Output Impedence | $Z_d$        | -    | 100     | -    | $\Omega$ |
| Termination Mismatch                    | $\Delta R_M$ | -5%  | -       | 5%   |          |
| DC Common Mode Potential                | $V_{cm}$     | 0    | -       | 3.6  | V        |
| Output AC Common Mode Voltage           | $V_{AC}$     | -    | -       | 15   | mV (RMS) |
| Output Rise Time, 20-80%                | $t_r$        | 24   | -       | -    | ps       |
| Output Fall Time, 20-80%                | $t_f$        | 24   | -       | -    | ps       |
| Deterministic Jitter                    | $D_j$        | -    | -       | 0.18 | UI, pp   |
| Total Jitter                            | $T_j$        | -    | -       | 0.34 | UI       |
| Reference Clock, BitRate/64             |              | -100 |         | 100  | ppm      |

## XFPG-L

### Signal Conditioner (Module Transmitter- Telecom & Datacom)

| Parameter                           | Symbol | Min    | Typical | Max                                 | Unit                 |
|-------------------------------------|--------|--------|---------|-------------------------------------|----------------------|
| Jitter Transfer Bandwidth           | BW     | -      | -       | 8                                   | MHz                  |
| Jitter Generation at Optical Output | JG     | -<br>- | -<br>-  | 10<br>100                           | mUI(RMS)<br>mUI(p-p) |
| Jitter Peaking (telecom)            | JP     | -      | -       | 0.03 <sup>i</sup><br>1 <sup>j</sup> | dB<br>dB             |
| Jitter Peaking (datacom)            | JP     | -      | -       | 1                                   | dB                   |

i) <120 KHz

j) >120 KHz

### Signal Conditioner (Module Receiver)

| Parameter                 | Symbol | Min | Typical | Max                                 | Unit     |
|---------------------------|--------|-----|---------|-------------------------------------|----------|
| Jitter Transfer Bandwidth | BW     | -   | -       | 8                                   | MHz      |
| Jitter Peaking (telecom)  | JP     | -   | -       | 0.03 <sup>k</sup><br>1 <sup>L</sup> | dB<br>dB |
| Jitter Peaking (datacom)  | JP     | -   | -       | 1                                   | dB       |

k) <120 KHz

L) >120 KHz

### XFP 2 Wire Interface Protocol

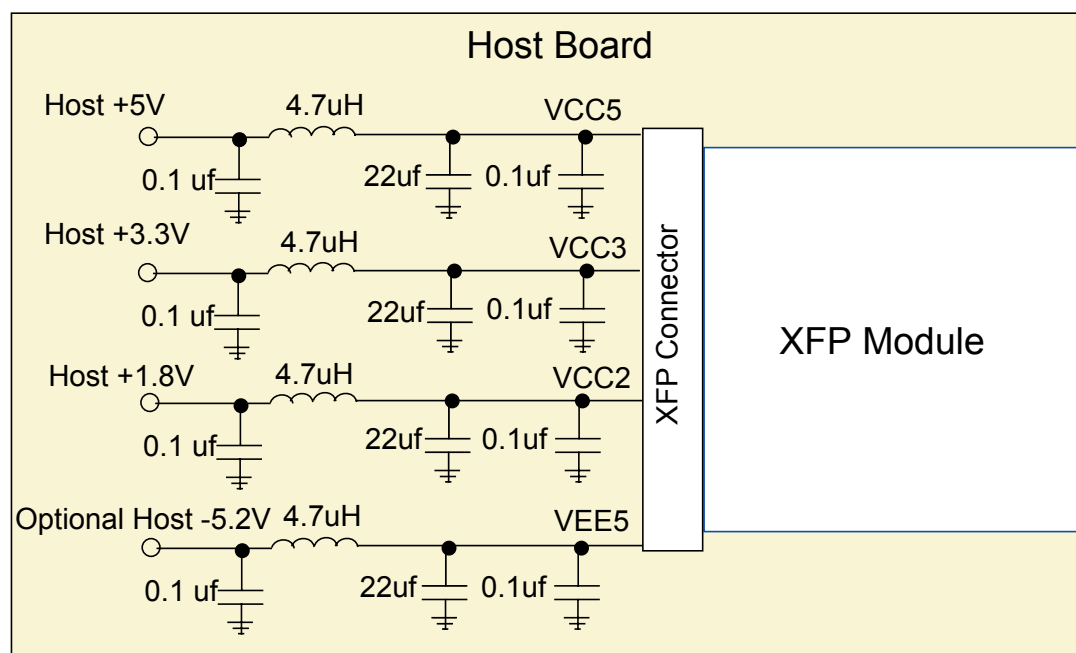
| Parameter                                       | Symbol                  | Min | Typical | Max  | Unit   |
|-------------------------------------------------|-------------------------|-----|---------|------|--------|
| Clock Frequency                                 | f <sub>SCL</sub>        | 0   | -       | 400  | KHz    |
| Clock Pulse Width Low                           | t <sub>LOW</sub>        | 1.3 | -       | -    | µs     |
| Clock Pulse Width High                          | t <sub>HIGH</sub>       | 0.6 | -       | -    | µs     |
| Time Bus Free Before new Transmission can Start | t <sub>BUF</sub>        | 1.3 | -       | -    | µs     |
| START Hold Time                                 | t <sub>HD, STA</sub>    | 0.6 | -       | -    | µs     |
| START Set-Up Time                               | t <sub>SU, STA</sub>    | 0.6 | -       | -    | µs     |
| Data in Hold Time                               | t <sub>HD, DAT</sub>    | 0   | -       | -    | µs     |
| Data in Set-Up Time                             | t <sub>SU, DAT</sub>    | 0.1 | -       | -    | µs     |
| Input Rise Time (100KHz)                        | t <sub>R, 100</sub>     | -   | -       | 1000 | ns     |
| Input Rise Time (400 KHz)                       | t <sub>R, 400</sub>     | -   | -       | 300  | ns     |
| Input Fall Time (100 KHz)                       | t <sub>F, 100</sub>     | -   | -       | 300  | ns     |
| Input Fall Time (400 KHz)                       | t <sub>F, 400</sub>     | -   | -       | 300  | ns     |
| STOP Set-Up Time                                | t <sub>SU, STO</sub>    | 0.6 | -       | -    | µs     |
| Host Supplied Module Deselect Set-Up Time       | Host_select_setup       | 2   | -       | -    | ms     |
| Host Supplied Module Deselect Hold Time         | Host_select_hold        | 10  | -       | -    | µs     |
| Aborted Sequence-Bus Release                    | Deselect_Abort          | 2   | -       | -    | ms     |
| Clock Stretching                                | T <sub>clock_hold</sub> | -   | -       | 500  | µs     |
| Complete Single or Sequential Byte              | t <sub>WR</sub>         | -   | -       | 10   | ms     |
| Endurance                                       |                         | 50K | -       | -    | cycles |

**XFPG-L**

**Diagnostics**

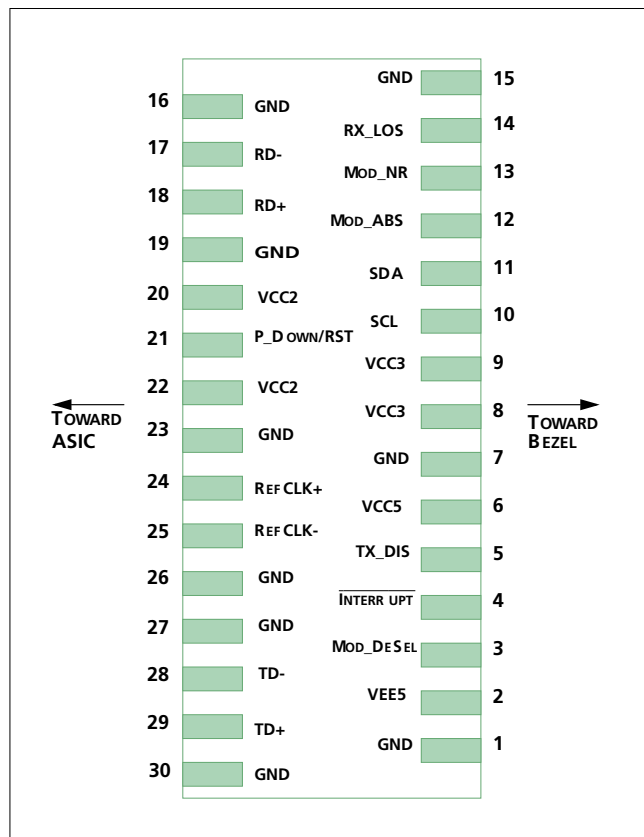
| Parameter         | Range               | Units | Accuracy           |
|-------------------|---------------------|-------|--------------------|
| Temperature       | -5 to 70            | C     | ±3°C               |
| Bias Current      | 0 to 131            | mA    | 3.5 (±10% nominal) |
| Tx Power-absolute | 0 to 6.5535         | mW    | ± 2 dB             |
| Tx Power-relative | 0 to 6.5535         | mW    | ± 1 dB             |
| Rx Power-absolute | -1 dBm to -20.4 dBm | mW    | ± 2 dB             |
| Rx Power-relative | -1 dBm to -20.4dBm  | mW    | ±1 dB              |
| Voltage           | 0 to 6.5535         | V     | ± 3%               |

**Recommended host Filtering circuit**



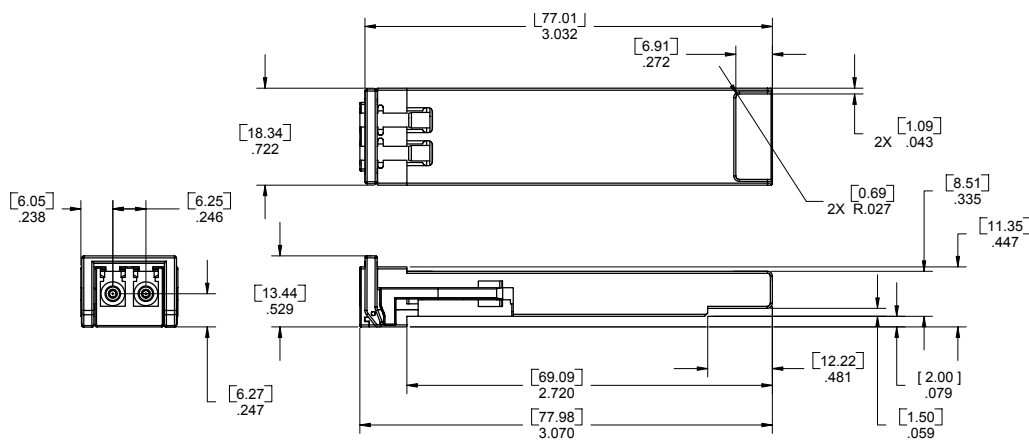
## XFPG-L

### Pinout Diagram



Host PCB XFP Pinout Top View

### Mechanical Drawing



Dimensions in inches [mm]  
tolerance = ±0.005 in.

1. CUSTOMER MAKES EXTERNAL CONNECTIONS  
TO COMPONENT FIBER, WIRING, AND CONNECTIONS.  
NOTES: UNLESS OTHERWISE SPECIFIED:

## Host Board Mechanical Layout





## XFPG-L

### Warnings

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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