# XFP-10MM31-2HC

## 10Gb/s XFP LRM Optical Transceiver Module

## Features

- 10Gb/s serial optical transceiver in compliance with IEEE 802.3ae, ITU-T G709, and 10G FC.

- Uncooled 1310nm DFB transmitter and PIN photodiode receiver

- XFP mechanical interface with bail latch and hot pluggable

- XFI High Speed Electrical Interface

- 2-wire interface for management and digital diagnostic monitor

- Low power consumption < 1.8W.  Single +3.3V power supply

- advanced firmware allowing customer specific information to be stored in transceiver

- RoHS compliant

- All-metal housing for superior EMI performance

- no reference clock needed

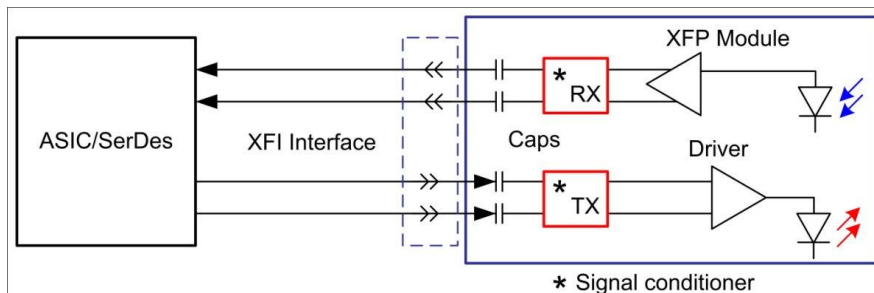## Applications

- 10GBASE- LRM  (10.3125Gbps)

- 10GE Storage



**Figure 1 Application in System**

---

# GENERAL DESCRIPTION

The XFP-10MM31-2HC is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The XFP-10MM31-2HC converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with XFI specification and allows FR4 host PCB trace up to 220mm.

The XFP-10MM31-2HC is designed for use in Ethernet LAN (10.3Gb/s) and WAN (9.95Gb/s) applications. The high performance uncooled 1310nm DFB-LD transmitter and high sensitivity PIN receiver provide superior performance for Ethernet applications at up to 220M links over OM2 MMF fiber. The fully XFP compliant form factor provides hot plug ability, easy optical port upgrades and low EMI emission.

## Functional Description

The XFP-10MM31-2HC contains a duplex LC connector for the optical interface and a 30-pin connector for the electrical interface. Chart of Section 3 shows the functional block diagram of XFP-10MM31-2HC XFP Transceiver.

### Transmitter Operation

The transceiver module receives 10Gb/s electrical data and transmits the data as an optical signal. The transmitter contains a Clock Data Recovery (CDR) circuit that reduces the jitter of received signal and reshapes the electrical signal before the electrical to optical (E-O) conversion. The optical output power is maintained constant by an automatic power control (APC) circuit. The transmitter output can be turned off by TX disable signal at TX_DIS pin. When TX_DIS is asserted high, the transmitter is turned off.

### Receiver Operation

The received optical signal is converted to serial electrical data signal. The optical receiver contains a CDR circuit that reshapes and retimes an electrical signal before sending out to the XFI channel (i.e. XFP connector and high speed signal traces). The RX_LOS signal indicates insufficient optical power for reliable signal reception at the receiver.

### Management Interface

A 2-wire interface (SCL, SDA) is used for serial ID, digital diagnostics and other control/monitor functions. The address of XFP transceiver is 1010000x. MOD_DESEL signal can be used to support

multiple XFP modules on the same 2-wire interface bus. Management interface is compliant with XFP MSA.

## Absolute Maximum Ratings

**Table 1- Absolute Maximum Ratings**

| Parameter | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Storage Temperature | Tst | -40 | 85 | degC | |
| Relative Humidity (non-condensation) | RH | - | 85 | % | |
| Supply Voltage | VCC3 | -0.5 | 3.6 | V | |
| Voltage on LVTTL Input | Vilvttl | -0.5 | VCC3+0.5 | V | |
| LVTTL Output Current | Iolvttl | - | 15 | mA | |
| Voltage on Open Collector Output | Voco | 0 | 6 | V | |
| Receiver Input Optical Power(Average) | Mip | - | 3 | dBm | 2 |

**Notes:**
1.Ta: -10 to 60degC with 1.5m/s airflow with an additional heat sink.
2.PIN Receiver.

## Recommended Operating Conditions and Power Supply Requirements
**Table 2- Recommended Operating Conditions and Power Supply Requirements**

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Operating Case Temperature | Topc | 0 | 70 | degC |
| Relative Humidity (non-condensing) | Rhop | - | 85 | % |
| Power Supply Voltage | VCC3 | 3.135 | 3.465 | V |
| Power Supply Current | ICC3 | - | 500  (0-70C) | mA |
| Total Power Consumption | Pd | - | 1.8   (0-70C) | W |

## Low Speed Control and Alarm Signals Electrical Interface
### Table 3- Low Speed Control and Alarm Signals Electrical Interface

| Parameter | Symbol | Min | Max | Units | Note |
|---|---|---|---|---|---|
| XFP Interrupt, Mod_NR, RX_LOS | Vol | 0.0 | 0.4 | V | 1 |
| | Voh | Vcc-0.5 | Vcc+0.3 | | 2 |
| XFP TX_DIS, P_DOWN/RST | Vil | -0.3 | 0.8 | V | 3 |
| | Vih | 2.0 | VCC3+0.3 | | 4 |
| XFP SCL and SDA Output | Vol | 0.0 | 0.4 | V | 1 |
| | Voh | Vcc-0.5 | Vcc+0.3 | | 2 |
| XFP SCL and SDA Input | Vil | -0.3 | VCC3*0.3 | V | 5 |
| | Vih | VCC3*0.7 | VCC3+0.5 | | 6 |
| Capacitance for XFP SCL and SDA I/O pin | Ci | - | 14 | pF | |
| Total bus capacitive load for SCL and SDA | Cb | - | 100 | pF | 7 |
| | | | 400 | pF | 8 |

**Notes:**
1. Pull-up resistor must be connected to host_Vcc on the host board.Iol(max)=3mA
2. Pull-up resistor must be connected to host_Vcc on the host board.
3. Pull-up resistor connected to VCC3 within XFP module. Iil(max)= -10µA.
4. Pull-up resistor connected to VCC3 within XFP module. Iih(max)= 10µA.
5. Pull-up resistor must be connected to host_Vcc on the host board. Iol(max)= -10µA.
6. Pull-up resistor must be connected to host_Vcc on the host board. Iol(max)= 10µA.
7. At 400KHz, 3.0kohms pull-up resister, at 100kHz 8.0kohms pull-up resister max.
8. At 400KHz, 0.8kohms pull-up resister, at 100kHz 2.0kohms pull-up resister max.

## Optical Interface
### Table 4- Optical Interface

| Transmitter Optical Interface | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Min | Typical | Max | Unit | Note |
| Operating Data Rate | - | 9.95 | | 11.30 | Gb/s | 1 |
| Output Center Wavelength | ltc | 1290 | 1310 | 1330 | nm | |
| Spectral Width | dl | - | | 1 | nm | |
| SMSR | SMSR | 30 | | - | dB | |
| Average Output Power | Po | -6 | | -1 | dBm | 2 |
| Disabled Power | Poff | - | | -30 | dBm | 2 |
| Extinction Ratio | ER | 3.5 | | - | dB | 2 |
| Minimum OMA-TDP | OMAtdp | -5.2 | | - | dBm | 3 |

| (10G Ethernet) | | | | | | |
|---|---|---|---|---|---|---|
| Eye Mask 1(SONET/SDH) | | GR-253-CORE/ITU-T G.691 | | | | 2 |
| Eye Mask 2 (10G Ethernet) | | IEEE802.3ae | | | | 3 |
| Generation Jitter 1 (20kHz - 80MHz) | | | | 0.15 | UIp-p | 2,4 |
| Generation Jitter 2 (4MHz - 80MHz) | | | | 0.1 | UIp-p | 2,4 |
| RIN | RIN | - | | -128 | dB/Hz | |

| Optical Path | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Min** | **Typical** | **Max** | **Unit** | **Note** |
| Chromatic Dispersion (SONET/SDH) | CD | | | 6.6 | ps/nm | |
| Operating Distance (10G Ethernet) | | | | 220 | m | |
| Attenuation (SONET/SDH) | | 0 | | 4 | dB | |
| Channel Insertion Loss (10G Ethernet) | | 0 | | 6 | dB | |
| Maximum DGD (SONET/SDH) | DGD | - | | 30 | ps | |

| Receiver Optical Interface | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Min** | **Typical** | **Max** | **Unit** | **Note** |
| Operating Data Rate | | 9.95 | | 11.30 | Gb/s | 1 |
| Input Center Wavelength | lrc | 1260 | | 1565 | nm | |
| Overload | Rovl | 0.5 | | - | dBm | |
| Minimum Sensitivity | Pmin | - | - | -14.6 | dBm | 2 |
| Sensitivity in OMA | OMA0 | - | | -12.6 | dBm | 3 |
| Stressed Sensitivity in OMA | OMAst | - | | -10.3 | dBm | 3 |
| RX_LOS Assert Level | RLOSa | -29 | | | dBm | |
| RX_LOS Deassert Level | RLOSd | | | -15 | dBm | |
| RX_LOS Hysteresis | RLOSh | 0.5 | | 5 | dB | |
| Optical Path Penalty | PN | - | | 1 | dB | 1 |
| Optical Return Loss | ORL | 14 | | - | dB | |
| Jitter Tolerance | JTL | GR-253-CORE/ITU-T G.783 | | | | |

Notes:
1.Data rate tolerance -10GBASE-LR/LW: typ.+/-100ppm
2.Measured at 10.3125Gbps,Non-framed PRBS2^31-1,NRZ
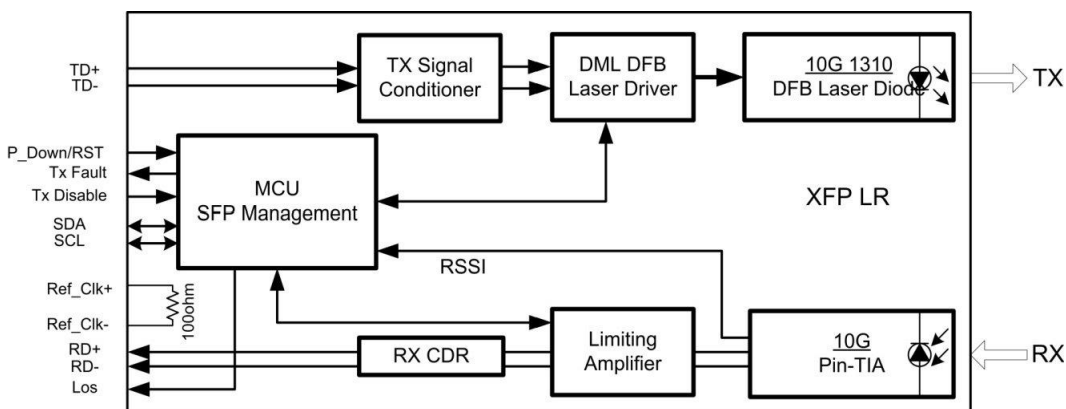3.Measured by using Ascent Optics XFP evaluation board.

## Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant with SFF8472 Rev9.2 with internal calibration mode. For external calibration mode, please contact our sales stuff.
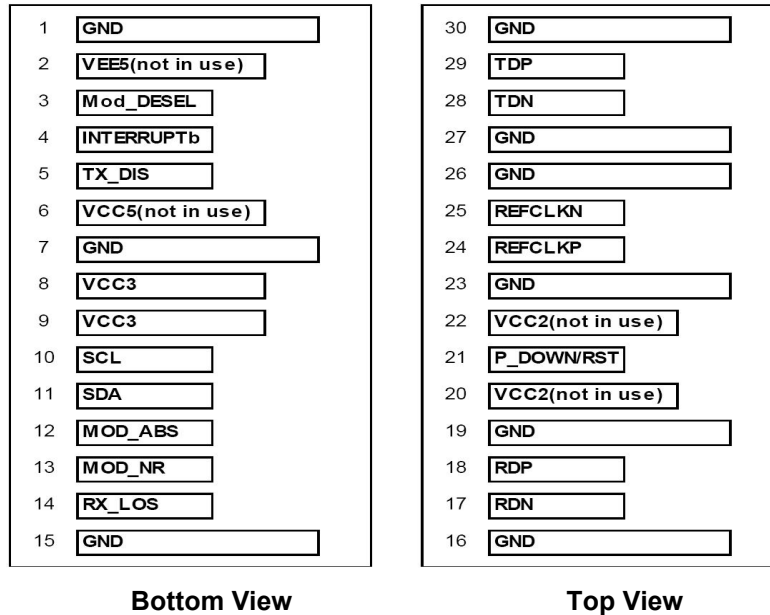
**Table 5- Digital Diagnostic Functions**

| Parameter | Symbol | Min. | Max | Unit | Notes |
|---|---|---|---|---|---|
| Temperature monitor absolute error | DMI_Temp | -3 | 3 | degC | Over operating temp |
| Laser power monitor absolute error | DMI_TX | -3 | 3 | dB | |
| RX power monitor absolute error | DMI_RX | -3 | 3 | dB | -1dBm to -15dBm range |
| Supply voltage monitor absolute error | DMI_VCC | -0.08 | 0.08 | V | Full operating range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |

## Transceiver Block Diagram

## Pin Assignment

**XFP Transceiver Electrical Pad Layout**

| 1 | GND |
| 2 | VEE5(not in use) |
| 3 | Mod_DESEL |
| 4 | INTERRUPTb |
| 5 | TX_DIS |
| 6 | VCC5(not in use) |
| 7 | GND |
| 8 | VCC3 |
| 9 | VCC3 |
| 10 | SCL |
| 11 | SDA |
| 12 | MOD_ABS |
| 13 | MOD_NR |
| 14 | RX_LOS |
| 15 | GND |

| 30 | GND |
| 29 | TDP |
| 28 | TDN |
| 27 | GND |
| 26 | GND |
| 25 | REFCLKN |
| 24 | REFCLKP |
| 23 | GND |
| 22 | VCC2(not in use) |
| 21 | P_DOWN/RST |
| 20 | VCC2(not in use) |
| 19 | GND |
| 18 | RDP |
| 17 | RDN |
| 16 | GND |

**Bottom View**          **Top View**

## Pin Descriptions
### Table 6- Pin Descriptions

| Pin# | Name | Logic | Description | Note |
|------|------|-------|-------------|------|
| 1 | GND | | Module Ground | 1 |
| 2 | VEE5 | | 0.2V Power Supply , not in use | 3 |
| 3 | MOD_DESEL | LVTTL-I | Module De-select; When held Low allows module to respond to 2-wire serial interface | |
| 4 | INTERRUPT | LVTTL-O | Indicates presence of an important condition, which can be read over the 2-wire serial interface. This pin is an open collector output and must be pulled up to host_Vcc on the host board. | 2 |
| 5 | TX_DIS | LVTTL-I | Transmitter Disable; When asserted High, transmitter output is turned off. This pin is pulled up to VCC3 in the module | |
| 6 | VCC5 | | +5V Power Supply, not in use | 3 |
| 7 | GND | | Module Ground | 1 |
| 8 | VCC3 | | +3.3V Power Supply | |
| 9 | VCC3 | | +3.3V Power Supply | |
| 10 | SCL | I/O | 2-wire serial interface clock. Host shall resistor connected to host_Vcc of +3.3V. | 2 |
| 11 | SDA | I/O | 2-wire serial interface data. Host shall use a pull-up resistor connected to host_Vcc of +3.3V. | 2 |

| 12 | MOD_ABS | LVTTL-O | Indicates Module is not present. Host shall pull up this pin, and grounded in the module. "High" when the XFP module is absent from a host board. | 2 |
|---|---|---|---|---|
| 13 | MOD_NR | LVTTL-O | Module not ready; When High, Indicates Module Operational Fault. This pin is an open collector and must be pulled to host_Vcc on the host board. | |
| 14 | RX_LOS | LVTTL-O | Receiver Loss of Signal; When high, indicates insufficient optical input power to the module. This pin is an open collector and must be pulled to host_Vcc on the host board. | 2 |
| 15 | GND | | Module Ground | |
| 16 | GND | | Module Ground | |
| 17 | RDN | CML-O | Receiver Inverted Data Output; AC coupled inside the module. | |
| 18 | RDP | CML-O | Receiver Non-Inverted Data Output; AC coupled in side the module. | |
| 19 | GND | | Module Ground | 1 |
| 20 | VCC2 | | +1.8V Power Supply; not in use | 3 |
| 21 | P_DOWN/RST | LVTTL-I | Power down; When High, module is limited power mode. Low for normal operation. Reset; The falling edge indicates complete reset of the module. This pin is pulled up to VCC3 in the module. (Power Down function support upon request) | |
| 22 | VCC2 | | +1.8V Power Supply; not in use | 3 |
| 23 | GND | | Module Ground | 1 |
| 24 | REFCLKP | PECL-I | Reference clock Non-Inverted Input; not in use | |
| 25 | REFCLKN | PECL-I | Reference clock Inverted Input; not in use | |
| 26 | GND | | Module Ground | 1 |
| 27 | GND | | Module Ground | 1 |
| 28 | TDN | CML-I | Transmitter Inverted Data Input; AC coupled inside the module. | |
| 29 | TDP | CML-I | Transmitter Non-Inverted Data Input; AC coupled inside the module. | |
| 30 | GND | | Module Ground | 1 |

**Notes:**
1.Module ground pins are isolated from the module case and chassis ground within the module.
2.Shall be pulled up with 4.7k to 10k ohm to a voltage between 3.15V and 3.45V on the host board.
3.Not connected internally.
4.Response time: typ. 20msec ( XFP MSA Rev. 4.5≦1msec).
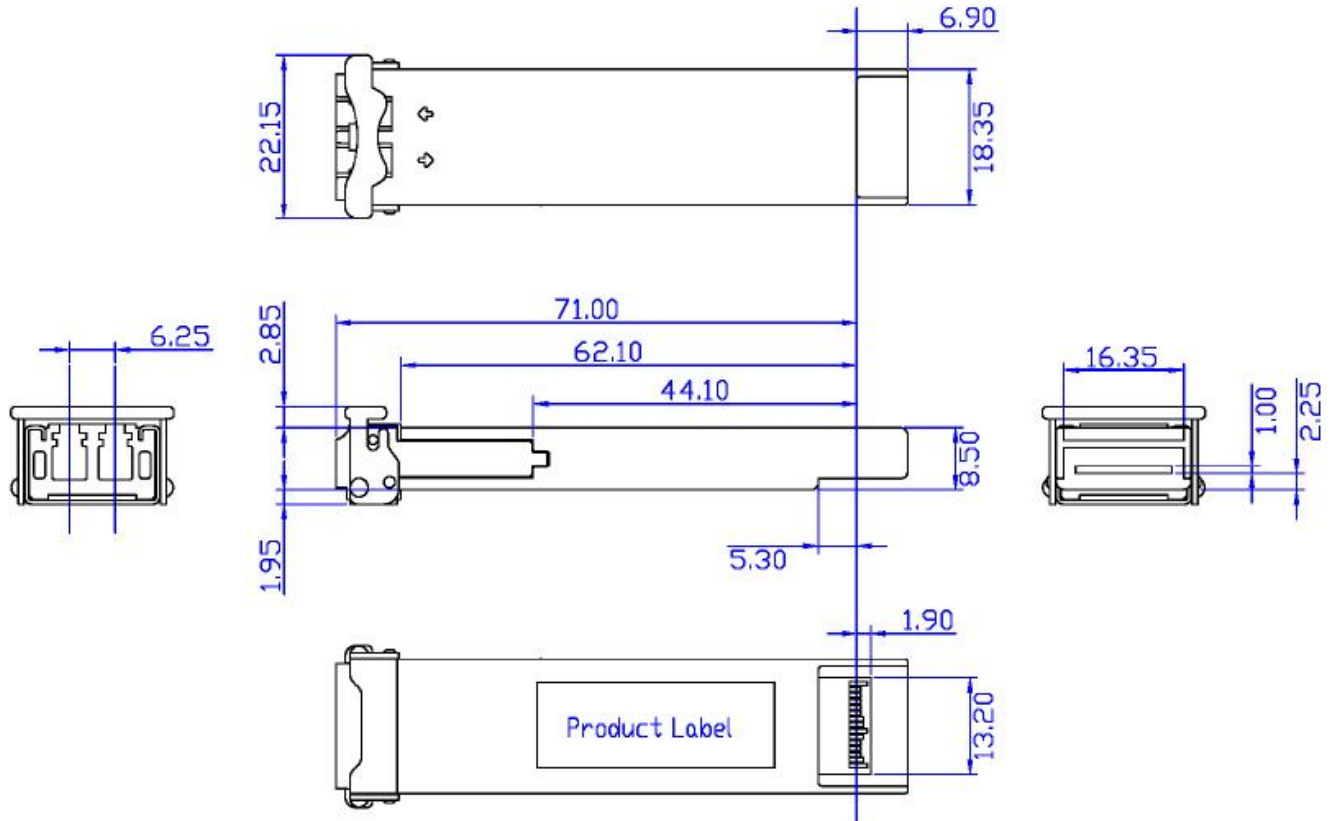5.MOD_NR = (TX LOL) OR (RX LOL ).

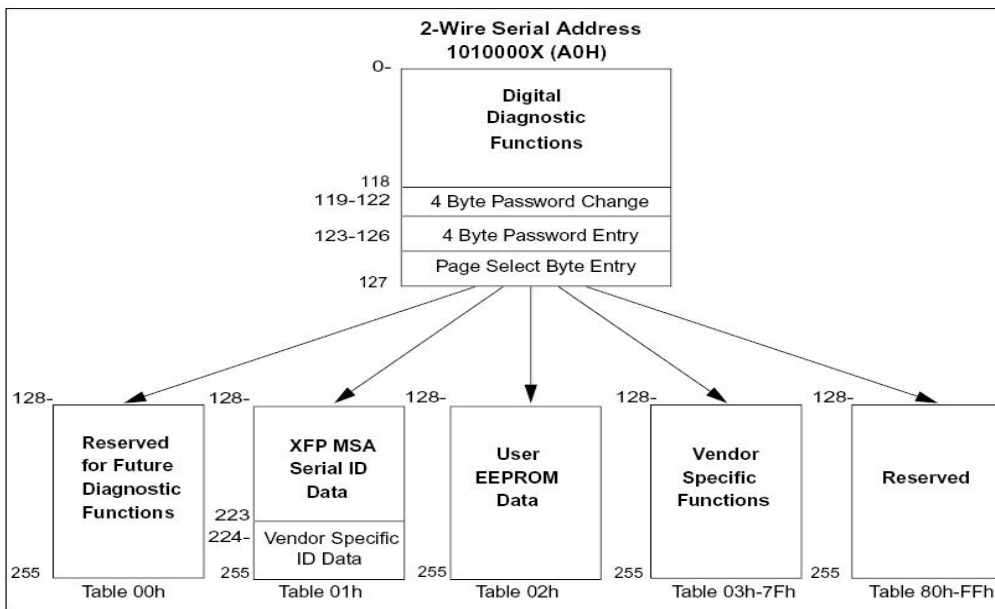## Recommended Power Supply Filter
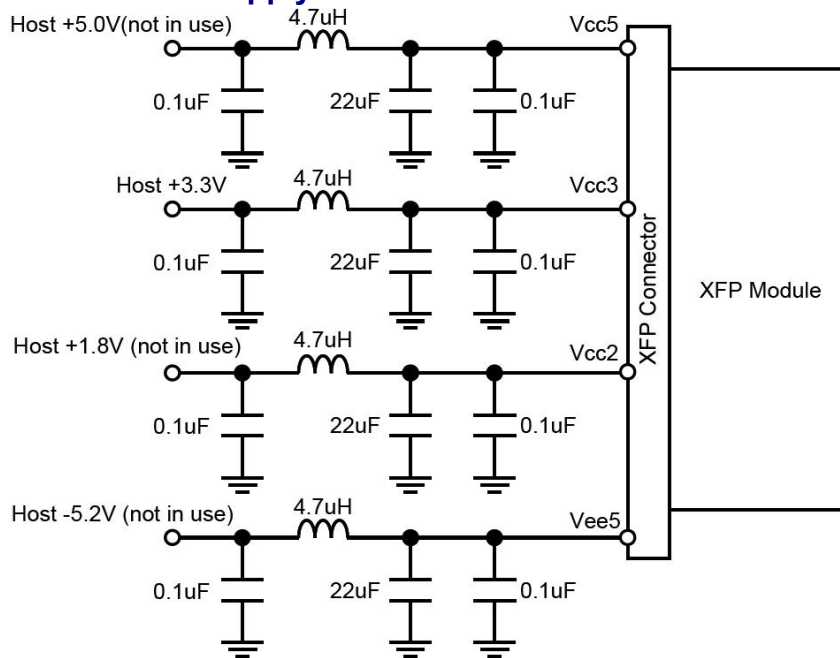


## Recommended Electrical Interface to Host
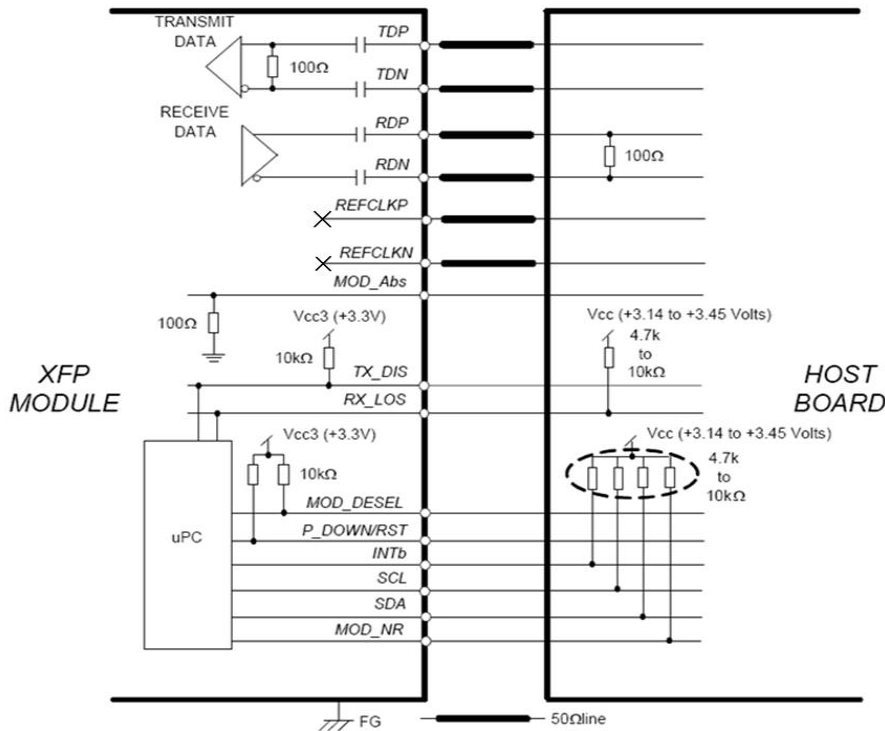
## Mechanical Dimensions



## MSA Compliant EEPROM Structure



## ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM).  However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## Laser Safety

This is a Class 1 Laser Product according to IEC 60825-1:1993:+A1:1997+A2:2001.  This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)

## Ordering information

**Table 7- Ordering information**

| Part Number | Product Description |
|---|---|
| XFP-10MM31-2HC | 10Gbps, XFP 1310nm  MMF 220M  -5ºC ~ +70ºC |

E-mail: sales@ascentoptics.com

Web : http://www.ascentoptics.com