

## Product Features

- Compliant with IEEE Std 802.3-2005 10Gb Ethernet 10GBase-BX
- XFP MSA Rev. 4.5 compliant
- Full digital diagnostic management interface
- XFP MSA package with Single LC receptacle optical
- Uncooled 1270nm DFB Laser
- Up to 11.3Gb/s bi-directional data links
- Class 1 laser safety certified
- Operating temperature options:
  - (Commercial) 0°C to +70°C
  - (Industrial) -40°C to +85°C
- Up to 10km on 9/125µm SMF
- RoHS Compliant



## Applications

- 10G Ethernet 10GBASE-BX
- Other high speed data connections

## Descriptions

LX3401C(I)DR XFP transceivers, according to 10 Gigabit Small Form Factor Pluggable Module Multi-Sourcing Agreement (XFP-MSA) INF-8077i Revision 4.5, are designed for single fiber bidirectional serial optical data communications up to 10km. They are compatible with IEEE Std 802.3-2005 10G Ethernet 10GBase-BX.

LX3401C(I)DR offer commercial and industrial operating temperature options.

## Ordering Information

Table 1. Ordering Information

| Part Number | Transmitter | Output Power | Receiver   | Sensitivity | Reach | Temp        | DDM       | RoHS      |
|-------------|-------------|--------------|------------|-------------|-------|-------------|-----------|-----------|
| LX3401CDR   | 1270nm DFB  | -6 ~ -1dBm   | 1330nm PIN | < -14dBm    | 10km  | 0 ~ 70 °C   | Available | Compliant |
| LX3401IDR   | 1270nm DFB  | -6 ~ -1dBm   | 1330nm PIN | < -14dBm    | 10km  | -40 ~ 85 °C | Available | Compliant |

## Electrical Pin Description

Table 2. Electrical Pin Description

|   | Logic | Symbol | Name/Description | Note |
|---|-------|--------|------------------|------|
| 1 | -     | GND    | Module Ground    | 1    |

|    |           |                  |   |   |
|----|-----------|------------------|---|---|
| 2  | -         | V <sub>EE5</sub> | Optional -5.2V Power Supply - <b>Not Required</b>   | - |
| 3  | LVTTL-I   | Mod_DeSel        | Module De-select; When held low allows module to respond to 2-wire serial interface   | - |
| 4  | LVTTL-O   | Interrupt        | Interrupt; Indicates presence of an important condition which can be read over the 2-wire serial interface  | 2 |
| 5  | LVTTL-I   | TX_DIS           | Transmitter Disable; Turns off transmitter laser output   | - |
| 6  | -         | V <sub>CC5</sub> | +5V Power Supply- <b>Not Required</b>   | - |
| 7  | -         | GND              | Module Ground   | 1 |
| 8  | -         | V <sub>CC3</sub> | +3.3V Power Supply  | - |
| 9  | -         | V <sub>CC3</sub> | +3.3V Power Supply  | - |
| 10 | LVTTL-I/O | SCL              | 2-Wire Serial Interface Clock   | 2 |
| 11 | LVTTL-I/O | SDA              | 2-Wire Serial Interface Data Line   | 2 |
| 12 | LVTTL-O   | Mod_Abs          | Indicates Module is not present. Grounded in the Module   | 2 |
| 13 | LVTTL-O   | Mod_NR           | Module Not Ready; Indicating Module Operational Fault   | 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 | -         | V <sub>CC2</sub> | +1.8V Power Supply - <b>Not Required</b>  | - |
| 21 | LVTTL-I   | P_Down/RST       | Power down; When high, requires the module to limit power consumption to 1.5W or below. 2-Wire serial interface must be functional in the low power mode.<br>Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle. | - |
| 22 | -         | V <sub>CC2</sub> | +1.8V Power Supply - <b>Not Required</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>  | 3 |
| 25 | PECL-I    | RefCLK-          | Reference Clock Inverted Input, AC coupled on the host board - <b>Not Required</b>  | 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 ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K $\Omega$  to 10K $\Omega$  to a voltage between 3.15V and 3.45V on the host board.
3. Reference Clock is not required. If present, it will be ignored.

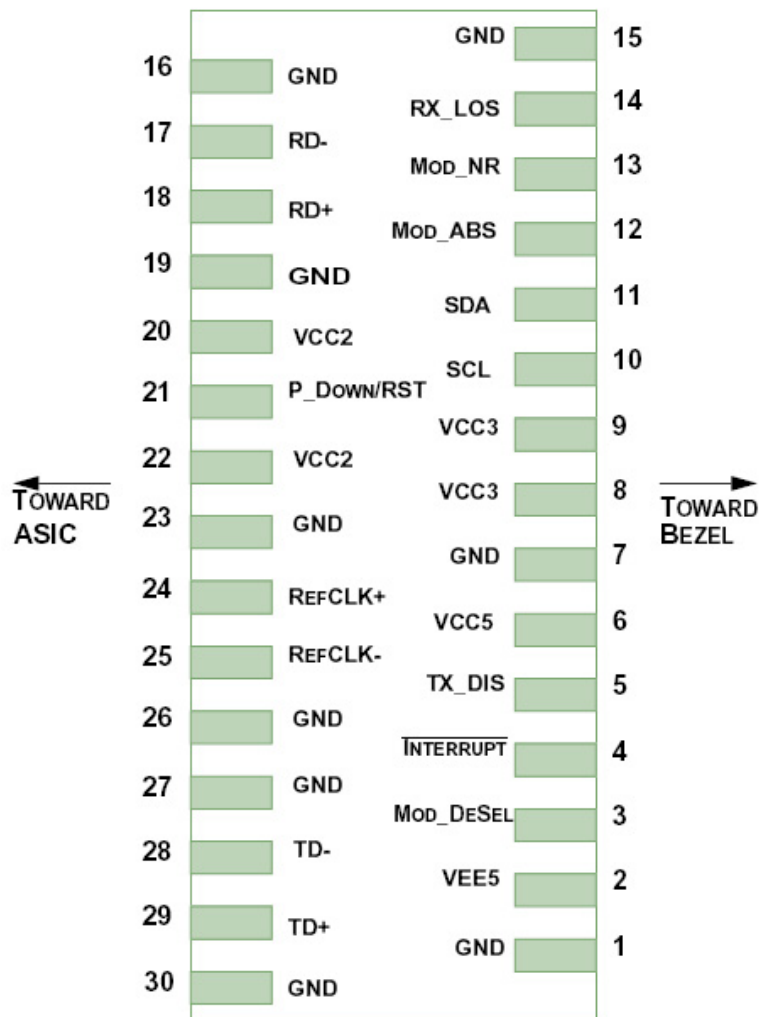


Figure 1. Host PCB XFP Pinout Top View

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Table 3. Absolute Maximum Ratings

| Parameter           | Symbol           | Minimum | Maximum | Unit |
|---------------------|------------------|---------|---------|------|
| Storage Temperature | T <sub>S</sub>   | -40     | 85      | °C   |
| Relative Humidity   | RH               | 5       | 95      | %    |
| Supply Voltage      | V <sub>CC3</sub> | -0.5    | 4.0     | V    |

## Recommended Operating Conditions

Table 4. Recommended Operating Conditions

| Parameter                                | Symbol    | Min   | Typ | Max   | Unit |
|--|-----------|-------|-----|-------|------|
| Operating Case Temperature (Commercial ) | $T_C$     | 0     | -   | 70    | °C   |
| Operating Case Temperature (Industrial ) | $T_C$     | -40   | -   | 85    | °C   |
| Supply Voltage                           | $V_{CC3}$ | 3.135 | 3.3 | 3.465 | V    |
| Data Rate                                | -         | 9.95  | -   | 11.3  | Gb/s |

## Transceiver Electrical Characteristics

Table 5. Transceiver Electrical Characteristics

| Parameter                        | Symbol        | Minimum          | Typical | Maximum          | Unit              | Notes |
|----------------------------------|---------------|------------------|---------|------------------|-------------------|-------|
| Supply Current                   | $I_{CC3}$     | -                | -       | 600              | mA                | -     |
| Power Dissipation                | $P_D$         | -                | 1500    | 2000             | mW                | -     |
| <b>Transmitter</b>               |               |                  |         |                  |                   |       |
| Input Differential Impedance     | $Z_{IN}$      | -                | 100     | -                | $\Omega$          | -     |
| Differential Data Input Swing    | $V_{IN,P-P}$  | 120              | -       | 1000             | mV <sub>P-P</sub> | -     |
| Tx_Disable, P_Down/RST           | $V_{IH}$      | 2.0              | -       | $V_{CC3}+0.3$    | V                 | -     |
|                                  | $V_{IL}$      | -0.3             | -       | 0.8              | V                 | -     |
| Transmit Disable Assert Time     | -             | -                | -       | 10               | us                | -     |
| <b>Receiver</b>                  |               |                  |         |                  |                   |       |
| Output Differential Impedance    | $Z_O$         | -                | 100     | -                | $\Omega$          | -     |
| Differential Data Output Swing   | $V_{OUT,P-P}$ | 340              | -       | 850              | mV <sub>P-P</sub> | 1     |
| Data Output Rise Time, Fall Time | $t_r, t_f$    | 24               | -       | -                | ps                | 2     |
| Rx_LOS, Mod_NR, Interrupt        | $V_{OH}$      | $V_{CCHOST}-0.5$ | -       | $V_{CCHOST}+0.3$ | V                 | 3     |
|                                  | $V_{OL}$      | 0                | -       | 0.4              | V                 | 3     |

**Notes:**

1. Internally AC coupled, but requires a external 100 $\Omega$  differential termination.
2. 20–80%.
3. Loss Of Signal is an open collector output. Should be pulled up with a 4.7k $\Omega$ -10k $\Omega$  resistor on the host board.

## Transmitter Optical Characteristics

Table 6. Transmitter Optical Characteristics

| Parameter                    | Symbol      | Minimum | Typical | Maximum | Unit | Notes |
|------------------------------|-------------|---------|---------|---------|------|-------|
| Launch Average Optical Power | $P_o$       | -6      | -       | -1      | dBm  | 1     |
| Center Wavelength Range      | $\lambda_c$ | 1263    | 1270    | 1277    | nm   | -     |
| Extinction Ratio             | EX          | 4.5     | -       | -       | dB   | 2     |

|                                    |  |    |   |     |     |   |
|------------------------------------|--|----|---|-----|-----|---|
| Spectral Width (-20dB)             | $\Delta\lambda$                          | -  | - | 1   | nm  | - |
| Side Mode Suppression Ratio        | SMSR                                     | 30 | - | -   | dB  | - |
| Transmitter and Dispersion Penalty | TDP                                      | -  | - | 1   | dB  | 3 |
| Average Optical Power (Laser Off)  | $P_{OFF}$                                | -  | - | -30 | dBm | 1 |
| Eye Diagram                        | ITU-T G.691 SDH STM-64 I-64.1 compatible |    |   |     |     | 2 |

**Notes:**

1. The optical power is launched into 9/125 $\mu$ m SMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @ 9.953Gbps.
3. Measured with 10km G.652 SMF.

## Receiver Optical Characteristics

**Table 7. Receiver Optical Characteristics**

| Parameter                          | Symbol      | Minimum | Typical | Maximum | Unit | Notes |
|------------------------------------|-------------|---------|---------|---------|------|-------|
| Center Wavelength                  | $\lambda_c$ | 1323    | 1330    | 1337    | nm   | -     |
| Receiver Sensitivity ( $P_{avg}$ ) | S           | -       | -       | -14     | dBm  | 1     |
| Receiver Overload ( $P_{avg}$ )    | $P_{OL}$    | 0.5     | -       | -       | dBm  | 1     |
| Optical Return Loss                | ORL         | 14      | -       | -       | dB   | -     |
| LOS De-Assert                      | $LOS_D$     | -       | -       | -15     | dBm  | -     |
| LOS Assert                         | $LOS_A$     | -25     | -       | -       | dBm  | -     |
| LOS Hysteresis                     | -           | 0.5     | -       | -       | dB   | -     |

**Notes:**

1. Measured with worst ER; 1330nm; PRBS 2<sup>31</sup>-1 test pattern, BER<10<sup>-12</sup>.

## Recommended Host Board Power Supply Filter Network

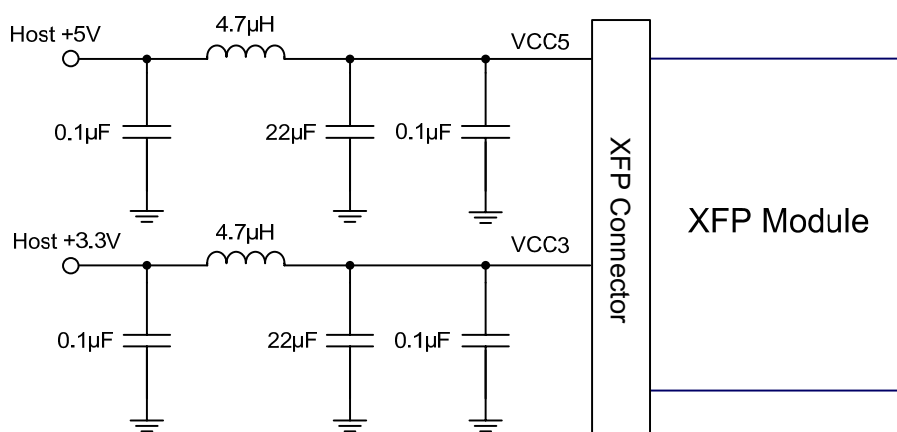


Figure 2. Recommended Host Board Power Supply Filter Network

## Recommended Application Interface Block Diagram

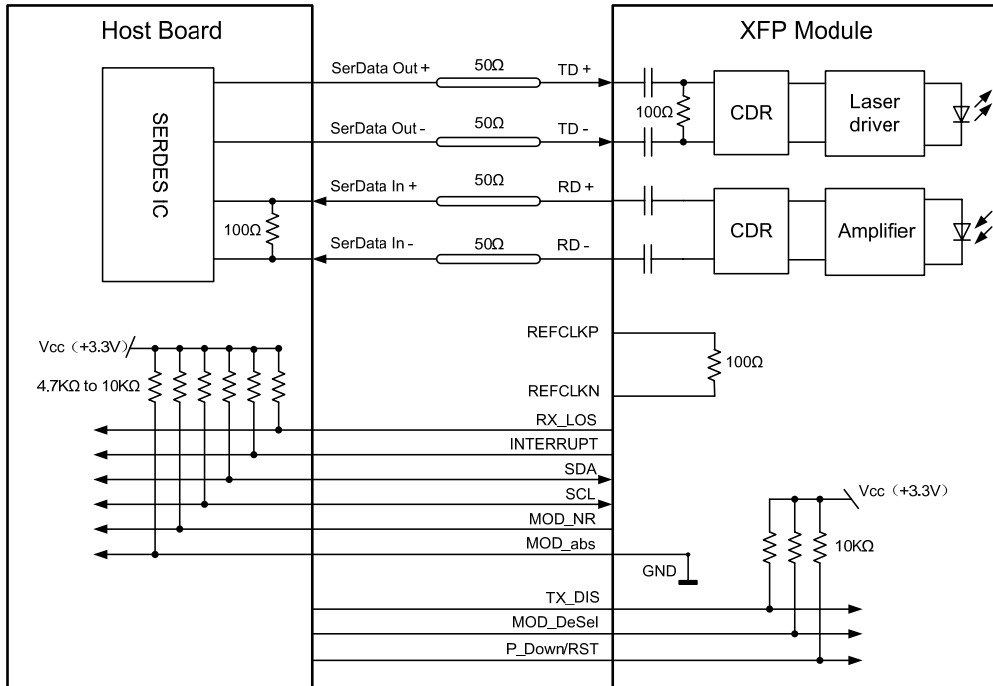


Figure 3. Recommended Application Interface Block Diagram

## Mechanical specifications

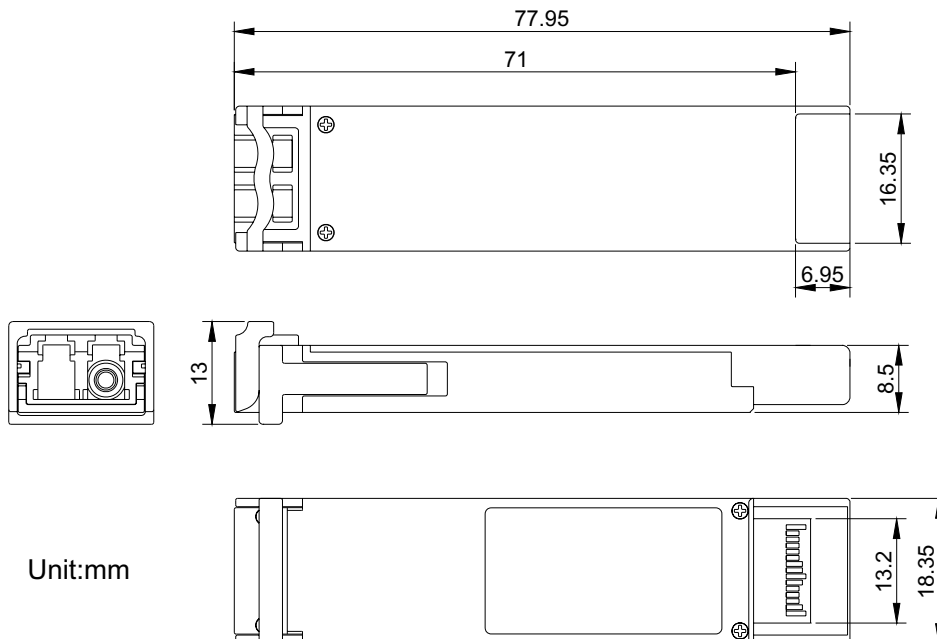


Figure 4. Outline Drawing

## **For More Information**

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