

## DWDM XFP Optical Transceiver

### Features

- Wavelength selectable to C-band ITU-T grid wavelengths Suitable for use in 100GHz channel spacing DWDM systems XFP MSA Compliant
- Data rate from 9.95 Gbps to 11.3Gbps No Reference Clock required
- Cold Start up Wavelength Compliance
- DWDM-rated EML transmitter and PIN receiver link length up to 40km
- Low Power Dissipation 3.5W Maximum
- -5°C to 70°C Operating Case Temperature
- Diagnostic Performance Monitoring of module temperature, supply Voltages, laser bias current, transmit optical power, receive optical power RoHS compliant and lead free



### Description

NewNets DWDM XFP Transceiver exhibits excellent wavelength stability, supporting operation at 100 GHz channel, cost effective module. It is designed for 10G DWDM SDH, 10GBASE-ER/EW and 10G Fiber-Channel applications.

The transceiver consists of two sections: The transmitter section incorporates a colded EML laser. And the receiver section consists of a PIN photodiode integrated with a TIA. All modules satisfy class I laser safety requirements. NewNets DWDM XFP transceiver provides an enhanced monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage.

### Absolute Maximum Ratings

| Parameter                    | Symbol | Min  | Max | Unit |
|------------------------------|--------|------|-----|------|
| Supply Voltage 1             | Vcc1.8 | -0.5 | 2.0 | V    |
| Supply Voltage 2             | Vcc3.3 | -0.5 | 4.0 | V    |
| Supply Voltage 3             | Vcc5.0 | -0.5 | 6.0 | V    |
| Storage Temperature          | Tst    | -40  | 85  | °C   |
| Optical Input Received Power | PIN    | -    | +4  | dBm  |

### Operating Conditions

| Parameter                  | Symbol | Min  | Typical | Max  | Unit |
|----------------------------|--------|------|---------|------|------|
| Supply Voltage 1           | Vcc1.8 | 1.71 | 1.8     | 1.89 | V    |
| Supply current 1           | Icc1.8 |      |         | 350  | mA   |
| Supply Voltage 2           | Vcc3.3 | 3.13 | 3.3     | 3.47 | V    |
| Supply current 2           | Icc3.3 |      |         | 450  | mA   |
| Supply Voltage 3           | Vcc5.0 | 4.75 | 5       | 5.25 | V    |
| Supply current 3           | Icc5.0 |      |         | 100  | mA   |
| Operating Case temperature | Tca    | -5   | -       | 70   | °C   |
| Module Power Dissipation   | Pm     | -    |         | 3.5  | W    |

### Transmitter Specifications – Optical

| Parameter                                | Symbol                                     | Min               | Typical     | Max               | Unit |
|--|--|-------------------|-------------|-------------------|------|
| Data Rate Multirate                      | Mra  | 9.95              | -           | 11.3              | Gbps |
| Center Wavelength (SOL) $\Delta$         | $\lambda_c$                                | $\lambda_c - 25$  | $\lambda_c$ | $\lambda_c + 25$  | pm   |
| Center Wavelength (EOL) $\blacktriangle$ | $\lambda_c$                                | $\lambda_c - 100$ | $\lambda_c$ | $\lambda_c + 100$ | pm   |
| Optical Transmit Power                   | Po   | -1                | -           | +2                | dBm  |
| Optical Transmit Power (disabled)        | PTX_DISABLE                                | -                 | -           | -40               | dBm  |
| Extinction Ratio                         | ER   | 8.2               |             | -                 | dB   |
| Channel Spacing                          | $\Delta f$                                 | -                 | 100         | -                 | GHz  |
| Jitter Generation                        | TJP-P                                      | -                 | -           | 0.1               | UI   |
| Spectral Width (-20dB)                   | DI20                                       | -                 | 0.1         | 0.3               | nm   |
| Side Mode Suppression Ratio              | SMSR                                       | 30                | -           | -                 | dB   |
| Dispersion penalty(800ps/nm)             | DP   |                   |             | 2                 | dB   |
| Eye Mask                                 | Compliant with ITU-T G.691 STM-64 eye mask |                   |             |                   |      |

$\Delta$ Laser- Start of Life

$\blacktriangle$ Laser End of life

### Transmitter Specifications – Electrical

| Parameter                    | Symbol  | Min | Typical | Max      | Unit     |
|------------------------------|---------|-----|---------|----------|----------|
| Input differential impedance | Rim     | -   | 100     | -        | $\Omega$ |
| Differential data Input      | VtxDIFF | 120 | -       | 1000     | mV       |
| Transmit Disable Voltage     | VD      | 2.0 | -       | Vcc3+0.3 | V        |
| Transmit Enable Voltage      | Ven     | 0   | -       | +0.8     | V        |
| Transmit Disable Assert Time | Vn      | -   | -       | 10       | us       |

### PIN Receiver Specifications – Optical

| Parameter                          | Symbol      | Min  | Typical | Max  | Unit |
|------------------------------------|-------------|------|---------|------|------|
| Data Rate Multirate                | Mra         | 9.95 | -       | 11.3 | Gbps |
| Receiver Sensitivity               | Rsens       | -    | -       | -15  | dBm  |
| Receiver Sensitivity (OSNR = 20dB) | Rsens-2     | -    | -       | -24  | dBm  |
| Maximum Input Power                | RX-overload | -    | -       | -1   | dBm  |
| Input Operating Wavelength         | $\lambda$   | 1528 | -       | 1564 | nm   |
| Reflectance                        | Rrx         | -    | -       | -27  | dB   |
| Loss of Signal Asserted            |             | -28  | -       | -    | dBm  |
| LOS De-Asserted                    |             | -    | -       | -22  | dBm  |
| LOS Hysteresis                     |             | 0.5  | -       | -    | dB   |

### PIN Receiver Specifications – Electrical

| Parameter                 | Symbol   | Min | Typical | Max       | Unit |
|---------------------------|----------|-----|---------|-----------|------|
| Differential Output Swing | Vout P-P | 400 | -       | 800       | mV   |
| Rise/Fall Time            | Tr / Tf  | 24  | -       | -         | ps   |
| Loss of Signal -Asserted  | VOH      | 2   | -       | Vcc3+0.3- | V    |
| Loss of Signal -Negated   | VOL      | 0   | -       | +0.8      | V    |

### Low Speed Electrical Signal Timings

| Parameter                  | Symbol | Min      | Typical | Max      | Unit |
|----------------------------|--------|----------|---------|----------|------|
| TX Disable, Power_Down/RST | VIH    | 2.0      |         | Vcc3+0.3 | V    |
|                            | VIL    | -0.3     |         | 0.8      | V    |
| Interrupt, Mod_NR, Rx_Los  | VOH    | Vdd3-0.5 |         | Vdd3+0.3 | V    |
|                            | VOL    | 0        |         | 0.4      | V    |
| SCL,SDA(IN)                | VIH    | Vdd3*0.7 |         | Vdd3+0.5 | V    |
|                            | VIL    | -0.3     |         | Vdd3*0.3 | V    |
| SCL,SDA(OUT)               | VOH    | Vdd3-0.5 |         | Vdd3+0.3 | V    |
|                            | VOL    | 0        |         | 0.4      | V    |

### C-band $\lambda$ c Wavelength Guide

| ITU Channel Product Code | Frequency (THz) | Wavelength | ITU Channel Product Code | Frequency (THz) | Wavelength |
|--------------------------|-----------------|------------|--------------------------|-----------------|------------|
| 17                       | 191.7           | 1563.86    | 40                       | 194.0           | 1545.32    |
| 18                       | 191.8           | 1563.05    | 41                       | 194.1           | 1544.53    |
| 19                       | 191.9           | 1562.23    | 42                       | 194.2           | 1543.73    |
| 20                       | 192.0           | 1561.42    | 43                       | 194.3           | 1542.94    |
| 21                       | 192.1           | 1560.61    | 44                       | 194.4           | 1542.14    |
| 22                       | 192.2           | 1559.79    | 45                       | 194.5           | 1541.35    |
| 23                       | 192.3           | 1558.98    | 46                       | 194.6           | 1540.56    |
| 24                       | 192.4           | 1558.17    | 47                       | 194.7           | 1539.77    |
| 25                       | 192.5           | 1557.36    | 48                       | 194.8           | 1538.98    |
| 26                       | 192.6           | 1556.55    | 49                       | 194.9           | 1538.19    |
| 27                       | 192.7           | 1555.75    | 50                       | 195.0           | 1537.40    |
| 28                       | 192.8           | 1554.94    | 51                       | 195.1           | 1536.61    |
| 29                       | 192.9           | 1554.13    | 52                       | 195.2           | 1535.82    |
| 30                       | 193.0           | 1553.33    | 53                       | 195.3           | 1535.04    |
| 31                       | 193.1           | 1552.52    | 54                       | 195.4           | 1534.25    |
| 32                       | 193.2           | 1551.72    | 55                       | 195.5           | 1533.47    |
| 33                       | 193.3           | 1550.92    | 56                       | 195.6           | 1532.68    |
| 34                       | 193.4           | 1550.12    | 57                       | 195.7           | 1531.90    |
| 35                       | 193.5           | 1549.32    | 58                       | 195.8           | 1531.12    |
| 36                       | 193.6           | 1548.51    | 59                       | 195.9           | 1530.33    |
| 37                       | 193.7           | 1547.72    | 60                       | 196.0           | 1529.55    |
| 38                       | 193.8           | 1546.92    | 61                       | 196.1           | 1528.77    |
| 39                       | 193.9           | 1546.12    |                          |                 |            |

### Pin Descriptions

| Pin | Logic   | Symbol    | Name/Description   | Ref. |
|-----|---------|-----------|--|------|
| 1   |         | GND       | Module Ground  | 1    |
| 2   |         | VEE5      | Optional -5.2 Power Supply - <b>Not required</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;  | 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   |   |
| 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   |   |
| 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 circuit ground is isolated from module chassis ground within the module.
2. Open collector; should be pulled up with 4.7k - 10k ohms on host board to a voltage between 3.15V and 3.6V.
3. A Reference Clock input is not required.

Figure1.Electrical Pin-out Details

Figure2. Recommended Host Board Power Supply Circuit

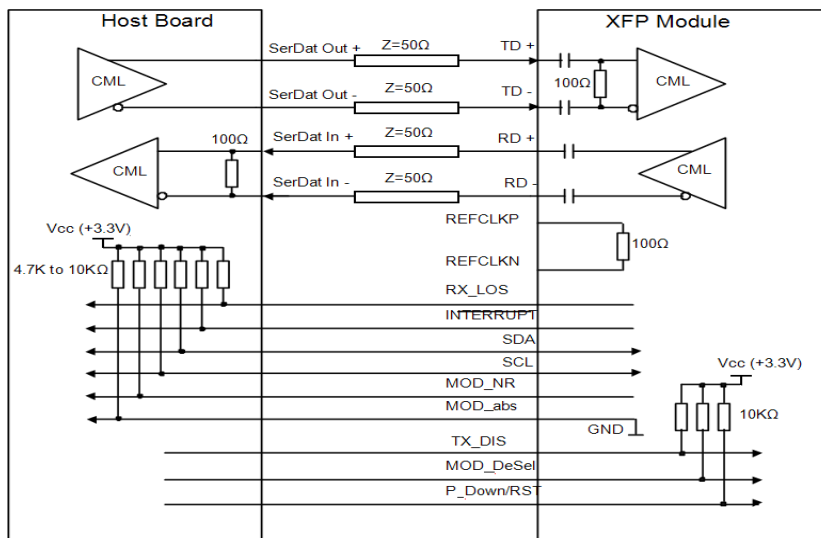


Figure3. Recommended High-speed Interface Circuit

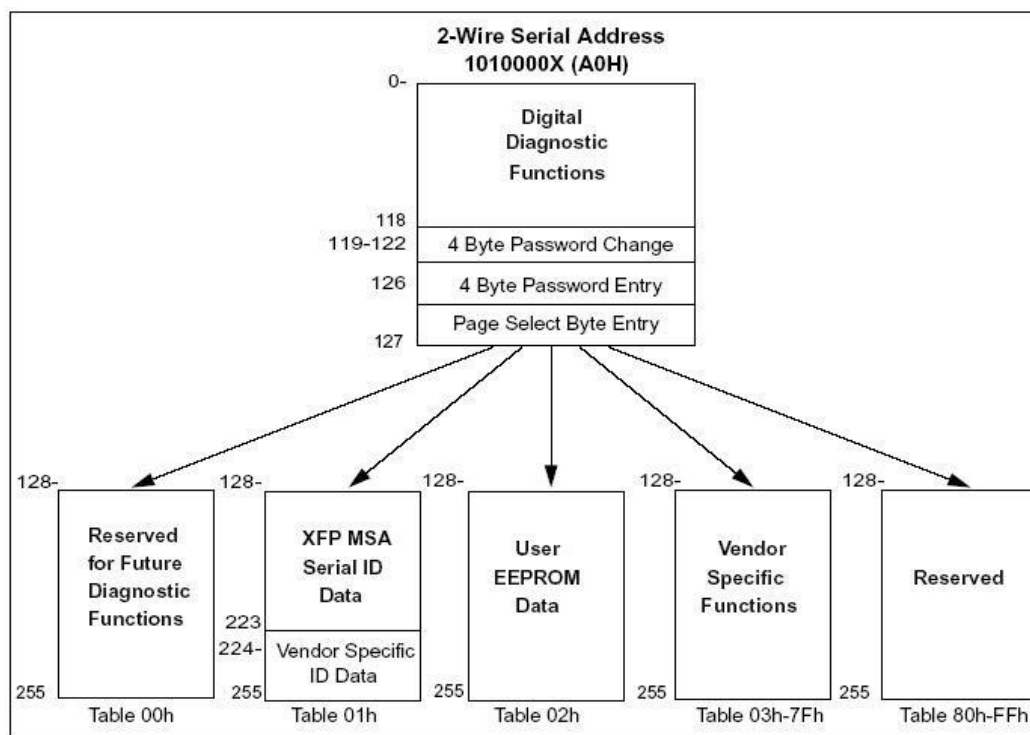
## Digital Diagnostic Functions

Small Form Factor 10Gb/s (XFP) transceivers are compliant with the current XFP Multi-Source Agreement (MSA) Specification Rev 4.5.

As defined by the XFP MSA, 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

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.



**Figure4. 2-wire Serial Digital Diagnostic Memory Map**

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller 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.

**EEPROM Serial ID Memory Contents(Table 01h):**

| Data Address                     | Field Size (Bytes) | Name of Field        | Description and Contents                     |
|----------------------------------|--------------------|----------------------|--|
| <b>Base ID Fields</b>            |                    |                      |  |
| 128                              | 1                  | Identifier           | Type of Serial transceiver (06h=XFP)         |
| 129                              | 1                  | Ext. Identifier      | TX Ref Clock Input not Required (90h)        |
| 130                              | 1                  | Connector            | Code of optical connector type (07h=LC)      |
| 131-138                          | 8                  | Transceiver          | 10GBASE-ER/W(22 00 00 00 20 00 00 00)        |
| 139                              | 1                  | Encoding             | NRZ(10h)                                     |
| 140                              | 1                  | BR-MIN               | 9.953Gbps(63h)                               |
| 141                              | 1                  | BR-MAX               | 11.3Gbps(71h)                                |
| 142                              | 1                  | Length(SMF)-km       | 40KM(28h)                                    |
| 143                              | 1                  | Length(E-50um)       | (00h)  |
| 144                              | 1                  | Length(50um)         | (00h)  |
| 145                              | 1                  | Length(62.5um)       | (00h)  |
| 146                              | 1                  | Length(Copper)       | (00h)  |
| 147                              | 1                  | Device Tech          | Cooled1550nm EML, PIN Detector(74h)          |
| 148-163                          | 16                 | Vendor Name          | XFP vendor name: "PRONETS" (ASCII)           |
| 164                              | 1                  | CDR Support          | CDR supports 9.953Gbps~11.1Gbps(F8h)         |
| 165-167                          | 3                  | Vendor OUI           | XFP transceiver vendor OUI ID                |
| 168-183                          | 16                 | Vendor PN            | Part Number: "PXD-xx192-04" (ASCII)          |
| 184-185                          | 2                  | Vendor rev           | "32 61" means 2a revision (ASCII)            |
| 186-187                          | 2                  | Wavelength           | Specified ITU Grid Wavelength                |
| 188-189                          | 2                  | Wavelength Tolerance | +/-0.025nm                                   |
| 190                              | 1                  | Max Case Temp        | 70°C(46h)                                    |
| 191                              | 1                  | CC_BASE              | Check sum of bytes 128~190                   |
| 192-195                          | 4                  | Power Supply         | 3.5W(MAX) (AF 96 A7 01)                      |
| 196-211                          | 16                 | Vendor SN            | Serial number (ASCII)                        |
| 212-219                          | 8                  | Date code            | Year(2 bytes), Month(2 bytes), Day (2 bytes) |
| 220                              | 1                  | Diagnostic type      | No BER Support, Average Power(08h)           |
| 221                              | 1                  | Enhanced option      | Optional Soft Tx_Disable and P_Down(60h)     |
| 222                              | 1                  | Aux Monitoring       | +5.0V and +3.3V Supply Voltage(67h)          |
| 223                              | 1                  | CC_EXT               | Check sum of bytes 192~222                   |
| <b>Vendor Specific ID fields</b> |                    |                      |  |
| 224-255                          | 32                 | Vendor specific      | Vendor specific                              |



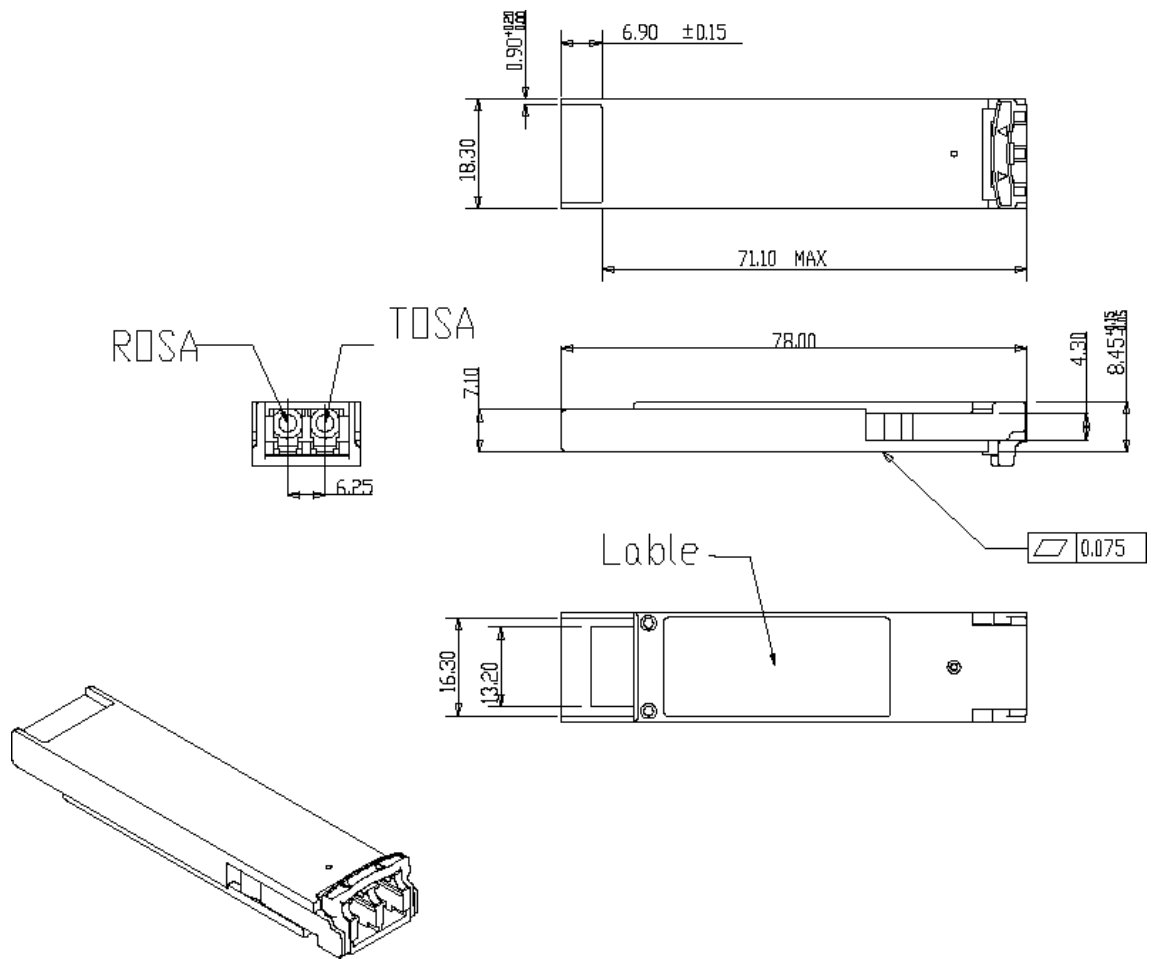


Figure5. Mechanical Specifications