

NPD-XX48-12C(D)**2.67Gbps DWDM SFP Transceiver, 120km Reach****Features**

Wavelength selectable to C-band ITU-T grid wavelengths

Suitable for use in 100GHz channel spacing DWDM systems

DWDM SFP MSA Compliant

Up to 2.67Gb/s data rate

OC48 Long Reach 120km

Cold Start up Wavelength Compliance

Low Power Dissipation <1.3W 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,

Laser temperature and TEC current

Extended link budget with APD receiver technology

RoHS compliant and lead free 

**Applications**

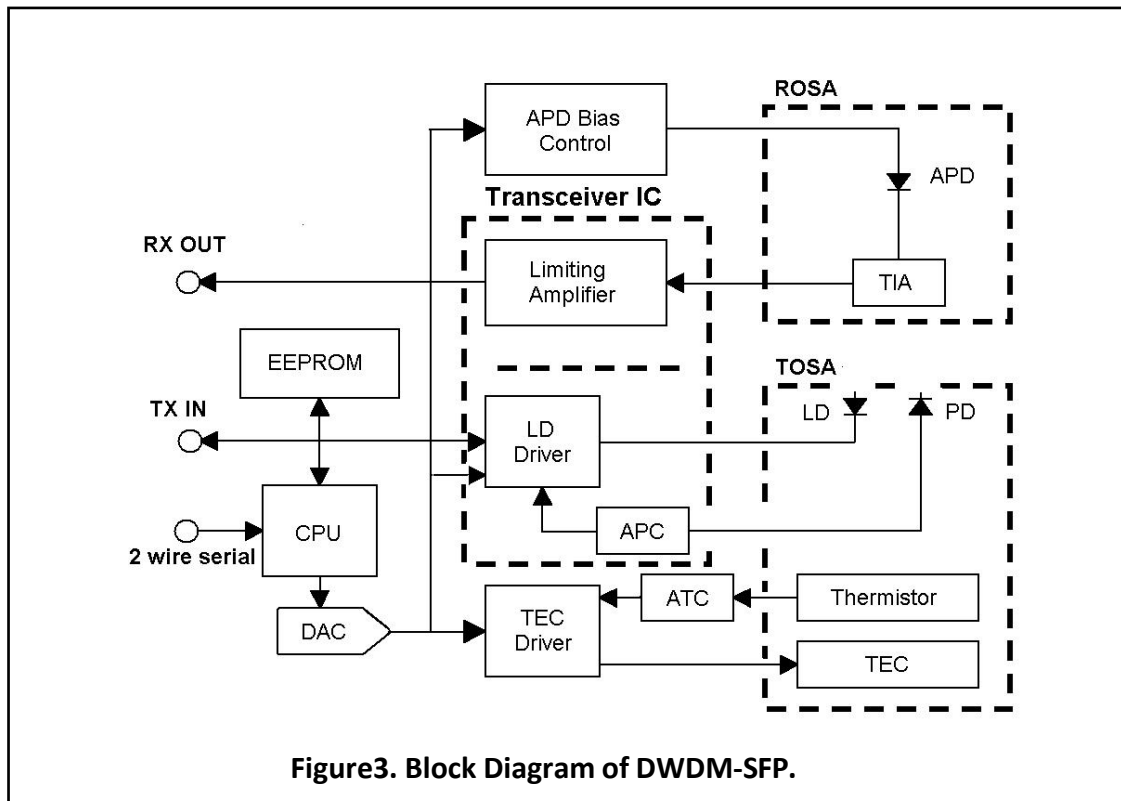
SFP Transceivers for DWDM SONET/ SDH

Ethernet IEEE 802.3ae

Fiber Channel

Description

DWDM SFP Transceiver exhibits excellent wavelength stability, supporting operation at 100 GHz channel, cost effective module. It is designed for DWDM SONET/ SDH, Gigabit Ethernet and Fiber- Channel applications. The transceiver consists of two sections: The transmitter section incorporates a cooled DFB laser. And the receiver section consists of a APD photodiode integrated with a TIA. All modules satisfy class I laser safety requirements. DWDM SFP 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, laser temperature and TEC current.



Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|------------------------------|--------|------|-----|------|
| Supply Voltage | Vcc | -0.3 | 4.0 | V |
| Storage Temperature | Tst | -40 | 85 | °C |
| Data AC Voltage | TX+-AC | - | 2.4 | Vpp |
| Data DC Voltage | TX+-DC | -0.5 | 2.5 | V |
| Optical Input Received Power | PIN | - | +5 | dBm |

Operating Conditions

| Parameter | Symbol | Min | Typical | Max | Unit |
|----------------------------|--------|------|---------|------|------|
| Supply Voltage | Vcc | 3.13 | 3.3 | 3.47 | V |
| Operating Case temperature | Tca | -5 | - | 70 | °C |
| Total Current | Icc | - | - | 380 | mA |
| Module Power Dissipation | Pm | - | 0.8 | 1.3 | W |

C-band λ_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 | | | |

Transmitter Specifications – Optical

| Parameter | Symbol | Min | Typical | Max | Unit |
|--|---|-------------------|-------------|-------------------|------|
| Data Rate Multirate | Mra | 155 | | 2667 | Mbps |
| Center Wavelength (SOL) Δ | λ_c | $\lambda_c - 25$ | λ_c | $\lambda_c + 25$ | pm |
| Center Wavelength (EOL) \blacktriangle | λ_c | $\lambda_c - 100$ | λ_c | $\lambda_c + 100$ | pm |
| Optical Transmit Power | Po | 0 | 2 | 5 | dBm |
| Optical Transmit Power (disabled) | PTX_DISABLE | - | - | -40 | dBm |
| Extinction Ratio | ER | 8.2 | | - | dB |
| Channel Spacing | Δf | - | 100 | - | GHz |
| Jitter Generation | TJP-P | - | - | 70 | mUI |
| Spectral Width (-20dB) | DI20 | - | 0.1 | 0.3 | nm |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB |
| Eye Mask | Compliant with Bell core GR-253-CORE & ITU G.957 for SONET/SDH and with IEEE 802.3ae for Ethernet and Fibre Channel | | | | |

Δ Laser- Start of Life

\blacktriangle Laser End of life

Transmitter Specifications – Electrical

| Parameter | Symbol | Min | Typical | Max | Unit |
|-----------------------|---------|------|---------|---------|------|
| Supply Voltage | VccTX | 3.13 | 3.3 | 3.47 | V |
| PECL/CML Input | VtxDIFF | 500 | - | 1600 | mV |
| Input Rise/Fall | TR / TF | - | - | 160 | ps |
| TX-Fault Fault | Vf | 2 | - | Vcc | V |
| TX-Fault Normal | Vn | Vee | - | Vee+0.5 | V |
| TX_DISABLE (asserted) | VDH | 2 | - | Vcc | V |
| TX_DISABLE (negated) | VDL | Vee | - | Vee+0.8 | V |

APD Receiver Specifications – Optical

| Parameter | Symbol | Min | Typical | Max | Unit |
|-----------------------------|-------------|------|---------|------|------|
| Receiver Sensitivity (OC48) | | - | - | -30 | dBm |
| Maximum Input Power | RX-overload | -9 | - | - | dBm |
| Input Operating Wavelength | λ | 1528 | - | 1564 | nm |
| Reflectance | Rrx | - | - | -34 | dB |
| Loss of Signal Asserted | | -40 | - | - | dBm |
| LOS De-Asserted | | - | - | -34 | dBm |
| LOS Hysteresis | | 0.5 | - | - | dB |

APD Receiver Specifications – Electrical

| Parameter | Symbol | Min | Typical | Max | Unit |
|---------------------------|----------|------|---------|---------|------|
| Supply Voltage | VccRX | 3.13 | 3.3 | 3.47 | V |
| Differential Output Swing | Vout P-P | 370 | - | 2000 | mV |
| Rise/Fall Time | Tr / Tf | - | - | 175 | ps |
| Loss of Signal –Asserted | VOH | 2 | - | Vcc | V |
| Loss of Signal –Negated | VOL | Vee | - | Vee+0.5 | V |

Low Speed Electrical Signal Timings

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|----------------|-----|---------|-----|------|
| TX Disable Negate Time | t-on | - | - | 20 | ms |
| TX Disable Assert Time | t-off | - | - | 20 | ms |
| Time to initialize, including reset of TX_FAULT | t_init | - | - | 300 | ms |
| Start-up Time | t_startup | - | - | 90 | s |
| TX_FAULT/INT Assert Time | t_fault | - | - | 50 | ms |
| TX_DISABLE to Reset | t_reset | 10 | - | - | ms |
| LOS Assert Time | t_los_on | - | - | 100 | us |
| LOS Negate Time | t_los_off | - | - | 100 | us |
| Serial ID Clock Rate | f_serial_clock | - | - | 100 | kHz |

EEPROM Serial ID Memory Contents (A0h):

| Data Address | Field Size (Bytes) | Value | Name of Field | Description and Contents |
|----------------------------------|--------------------|---------------------------------|----------------------------|--|
| Base ID Fields | | | | |
| 0 | 1 | 0Bh | Identifier | Type of Serial transceiver |
| 1 | 1 | 24h | Ext. Identifier | Extended identifier of type serial transceiver |
| 2 | 1 | 07h | Connector | Code of optical connector type |
| 3-10 | 8 | 00h,0Ch,44h,00h,80h,10h,01h,00h | Transceiver | Code for electronic compatibility or optical compatibility |
| 11 | 1 | 03h | Encoding | Code for serial encoding algorithm |
| 12 | 1 | 19h | BR,Nominal | Nominal baud rate, unit of 100Mbps |
| 13-14 | 2 | 78h(120km) | Length (9µm) – km | Link length supported for 9/125µm fiber, units in km |
| 15 | 1 | 46h | Max Temp | Maximum operating case temperature in °C |
| 16 | 1 | FBh | Min Temp | Minimum operating case temperature in °C |
| 17 | 1 | 5Fh | Max Supply Current | Maximum supply current in units of 4mA |
| 18 | 1 | 00h | Reserved | - |
| 19 | 1 | 41h | Channel spacing and number | Channel spacing compatibility and number and tuning of ITU channels supported |
| 20-35 | 16 | Module dependent | Vendor Name | SFP vendor name: "Gigalight" (ASCII) |
| 36 | 1 | 02h | Reserved | Optional DWDM features |
| 37-39 | 3 | - | Vendor OUI | SFP transceiver vendor IEEE company ID |
| 40-55 | 16 | GPD-XXXX-XX | Vendor PN | Part number provided by SFP transceiver vendor (ASCII) |
| 56-59 | 4 | Module dependent | Vendor rev | Revision level for part number provided by vendor (ASCII) |
| 60-61 | 2 | Module dependent | wavelength | Laser wavelength (in nm) |
| 62 | 1 | Module dependent | wavelength | Laser wavelength (fractional part in units of 10pm) |
| 63 | 1 | Module dependent | CC_BASE | Check sum of bytes 0 - 62 |
| Extended ID Fields | | | | |
| 64-65 | 2 | 1Ah | Option | Indicates which optical SFP signals are implemented |
| 66 | 1 | 00h | BR, max | Upper bit rate margin, units of % |
| 67 | 1 | 00h | BR, min | Lower bit rate margin, units of % |
| 68-83 | 16 | Module dependent | Vendor SN | Serial number (ASCII) |
| 84-91 | 8 | Module dependent | Date code | Year(2 bytes), Month(2 bytes), Day (2 bytes) |
| 92 | 1 | 68h | Diagnostic type | Indicates the type of diagnostics implemented in Monitoring Type the transceiver |
| 93 | 1 | F0h | Enhanced option | Indicates which optional enhanced features Options are implemented |
| 94 | 1 | 01h | SFF-8472 | "01" Diagnostics(SFF-8472 Rev 9.3) |
| 95 | 1 | Module dependent | CC_EX | Check sum of bytes 64 - 94 |
| Vendor Specific ID fields | | | | |
| 96-127 | 32 | - | Vendor Specific | Vendor Specific EEPROM (Vendor specific data; Specific read only) |
| 128-255 | 128 | - | Reserved | Reserved for future use |

Serial ID Memory Contents: (A2H)

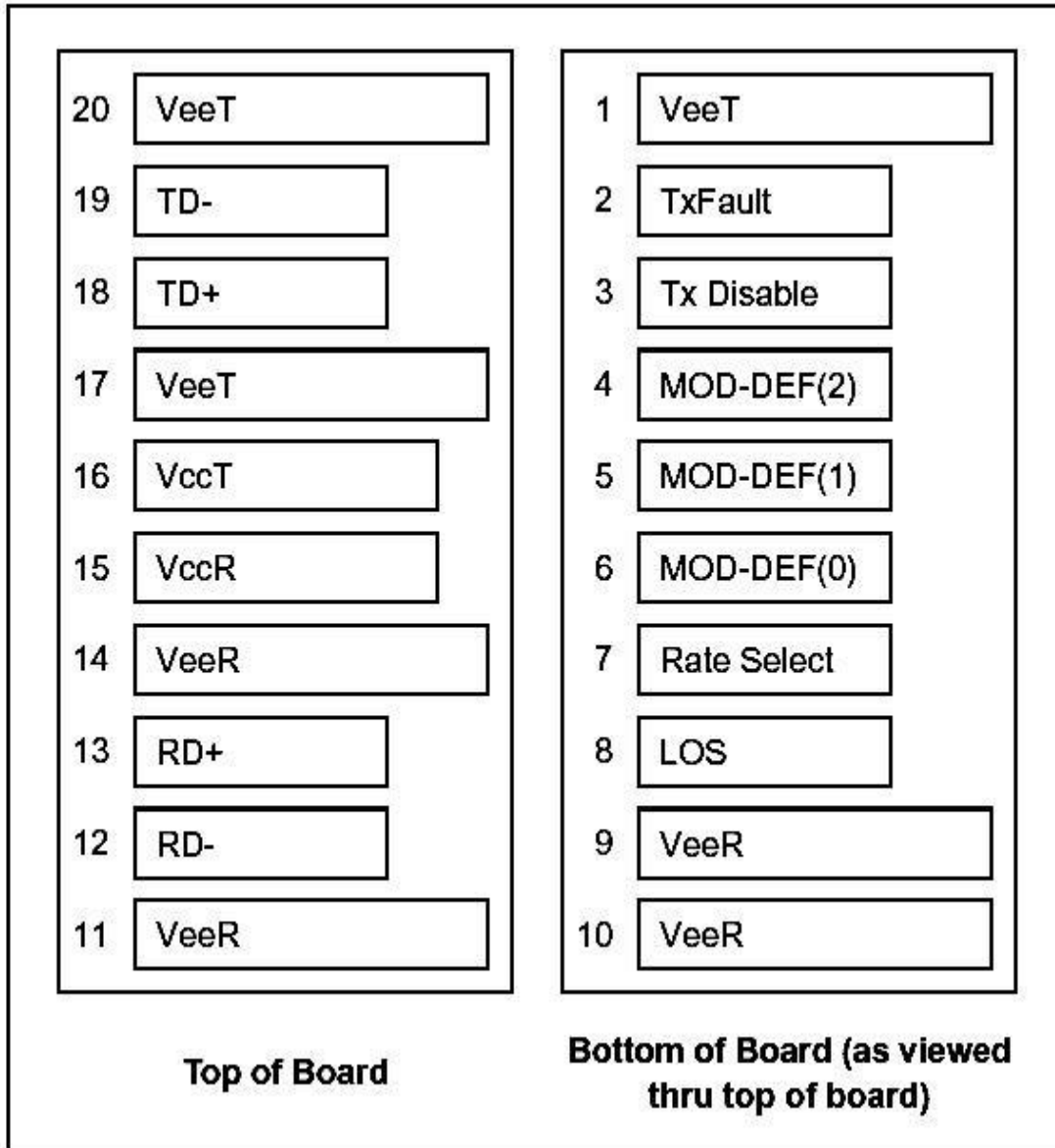
| Address | # Bytes | Name | Description |
|---------|---------|--------------------------|---|
| 00-55 | 56 | Alarm and Warning Levels | Temp/ Vcc/ Bias Current /TX Power/ RX Power/ LD Temp/ TEC Current, High/Low Alarm and Warning Levels |
| 56-94 | 39 | | Not used in DWDM devices. All Bytes Set to 0. |
| 95 | 1 | Checksum | Low order 8 bits of the sum of bytes 0-94 |
| 96-109 | 8 | A/D Values | A/D binary values of the following enhanced diagnostics(Real-time): module temperature, supply voltage, laser bias current, transmit optical power, receive optical power, laser temperature and TEC current. These values are Internally calibrated absolute measurements. All diagnostic parameters implemented in these address locations have a corresponding high and low, alarm and warning thresholds assigned in address locations 00-55. |
| 110 | 1 | Soft Control Signals | Soft control signals monitored over the 2-wire access port. can updated real-time status of the following control signals: TX_FAULT, TX_DISABLE, Rate Select, and LOS. |
| 111 | 1 | Reserved | Reserved |
| 112-117 | 5 | Alarm/Warning Flags | Optional Alarm and Warning Flag and Mask Bits Corresponding to levels detailed in addresses 00-39 above. |
| 118-119 | 2 | Warning Mask | Masking bits corresponding to Warning bits of bytes 116 and 117 respectively |
| 120-126 | 8 | Vendor Specific | Vendor specific data |
| 127 | 1 | Table Select | The byte value defines the Table location for subsequent reads and writes to bytes locations 128-255 |
| 128-247 | 120 | User EEPROM | User writable EEPROM |
| 248-255 | 8 | Vendor Specific | Vendor specific control functions |

Digital Diagnostic Monitoring A/D Accuracy

| Parameter | Range | Accuracy | Unit |
|----------------|------------|------------|--------------------|
| Temperature | -40~100 | ± 3 | $^{\circ}\text{C}$ |
| Voltage | 0~Vcc | 0.1 | V |
| Bias Current | 0~120 | 5 | mA |
| TX Power | 0~5 | ± 2 | dBm |
| RX Power | -30~-9 | ± 2 | dBm |
| TEC Current | -1200~1200 | ± 65 | mA |
| LD Temperature | 20~70 | ± 0.25 | $^{\circ}\text{C}$ |

Pin Definitions

Pin Diagram



Pin Descriptions

| Pin | Signal Name | Description | Plug Seq. | Notes |
|-----|------------------|------------------------------|-----------|--------|
| 1 | V _{EET} | Transmitter Ground | 1 | |
| 2 | TX FAULT | Transmitter Fault Indication | 3 | Note 1 |
| 3 | TX DISABLE | Transmitter Disable | 3 | Note 2 |
| 4 | MOD_DEF(2) | SDA Serial Data Signal | 3 | Note 3 |
| 5 | MOD_DEF(1) | SCL Serial Clock Signal | 3 | Note 3 |
| 6 | MOD_DEF(0) | TTL Low | 3 | Note 3 |
| 7 | Rate Select | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | Note 4 |
| 9 | V _{EER} | Receiver ground | 1 | |
| 10 | V _{EER} | Receiver ground | 1 | |
| 11 | V _{EER} | Receiver ground | 1 | |
| 12 | RD- | Inv. Received Data Out | 3 | Note 5 |
| 13 | RD+ | Received Data Out | 3 | Note 5 |
| 14 | V _{EER} | Receiver ground | 1 | |
| 15 | V _{CCR} | Receiver Power Supply | 2 | |
| 16 | V _{CCT} | Transmitter Power Supply | 2 | |
| 17 | V _{EET} | Transmitter Ground | 1 | |
| 18 | TD+ | Transmit Data In | 3 | Note 6 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 6 |
| 20 | V _{EET} | Transmitter Ground | 1 | |

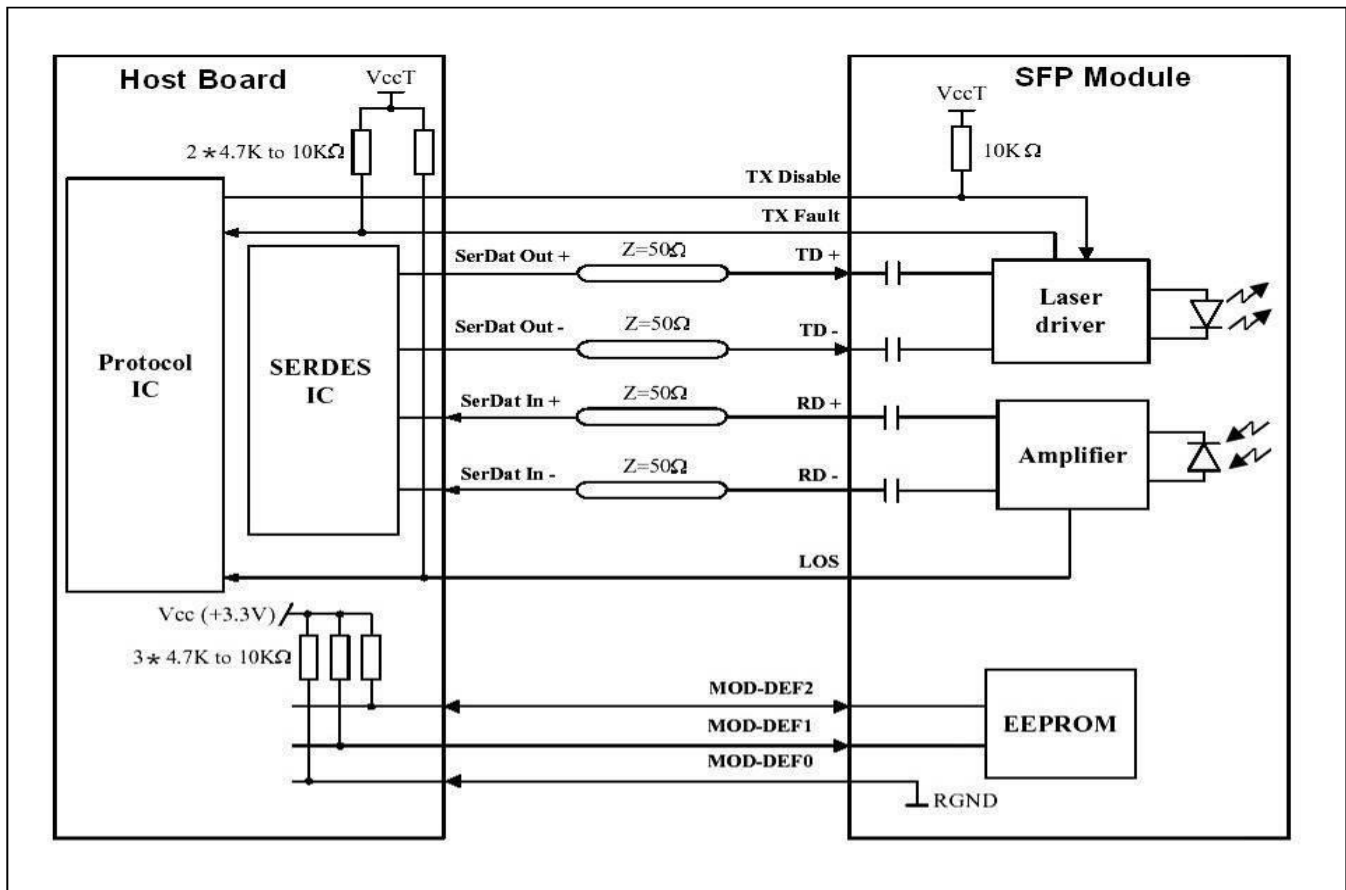
Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

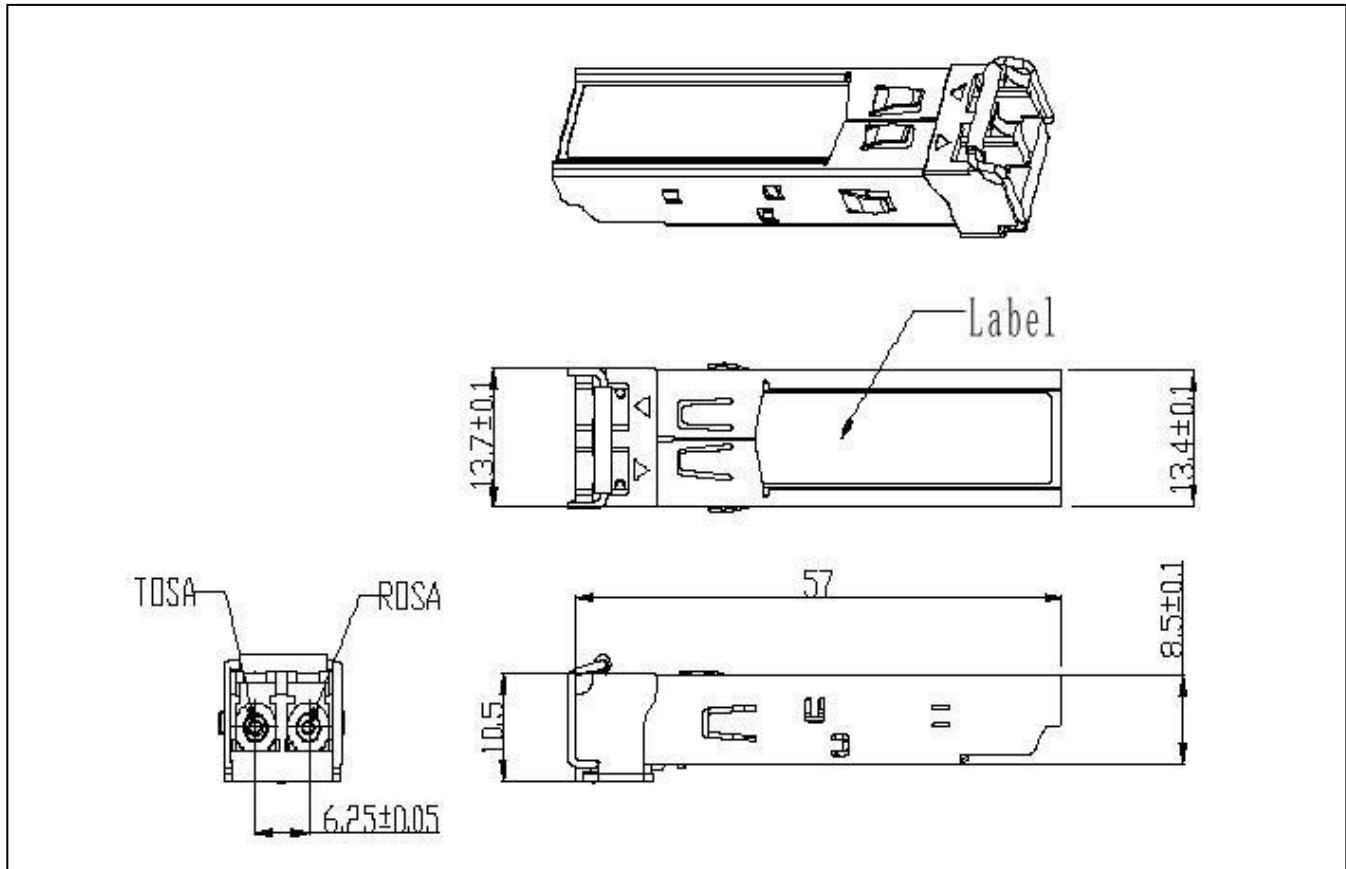
- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V_{cc}+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:

| | |
|-----------------------|----------------------|
| Low (0 to 0.8V): | Transmitter on |
| (>0.8V, < 2.0V): | Undefined |
| High (2.0 to 3.465V): | Transmitter Disabled |
| Open: | Transmitter Disabled |
- Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be V_{ccT} or V_{ccR}.
 Mod-Def 0 is grounded by the module to indicate that the module is present
 Mod-Def 1 is the clock line of two wire serial interface for serial ID
 Mod-Def 2 is the data line of two wire serial interface for serial ID
- LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and V_{cc}+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

Recommended Interface Circuit



Mechanical Dimensions



Regulatory Compliance

SFP transceiver is designed to be Class I Laser safety compliant and is certified per the following standards

| Feature | Agency | Standard | Certificate / Comments |
|--------------------------|--------|---|------------------------|
| Laser Safety | FDA | CDRH 21 CFR 1040 and Laser Notice No. 50 | 1120294-000 |
| Product Safety | BST | EN 60825-1: 2007 EN 60825-2: 2004 EN 60950-1: 2006 | BT0905142002 |
| Environmental protection | SGS | RoHS Directive 2002/95/EC | GZ0902008346/CHEM |
| EMC | CCIC | EN 55022: 2006+A1: 2007 EN 55024: 1998+A1: 2001+A2: 2003 | CTE09050018 |

Ordering information

| Part Number | Product Description |
|---------------|---|
| NPD-xx48-12CD | DWDM SFP, xx=17~61 (ITU Channel C-band), 2.67Gbps, 120km, -5°C ~ +70°C, Digital Diagnostic Monitoring |