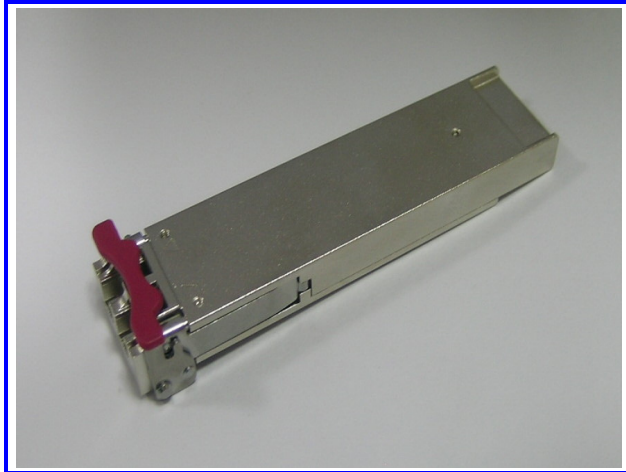




RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH



Features

- Compliant with IEEE802.3ae 10GBASE-EW/ER
- Compliant with SONET OC-192/SDH STM-64
- Compliant with ITU-T G.709
- Compliant with 40km 10G Fiber Channel
- Compliant with XFP MSA INF-8077i
- Differential CML inputs and outputs
- Hot Pluggable
- Power consumption<3.5W
- Class 1 laser product complies with EN 60825-1
- Support XFI loopback mode

Ordering Information

| Channel | PART NUMBER | Frequency(THz) | Center Wavelength(nm) |
|---------|------------------|----------------|-----------------------|
| 17 | LS47-H3L-TC-ND17 | 191.7 | 1563.86 |
| 18 | LS47-H3L-TC-ND18 | 191.8 | 1563.05 |
| 19 | LS47-H3L-TC-ND19 | 191.9 | 1562.23 |
| 20 | LS47-H3L-TC-ND20 | 192.0 | 1561.42 |
| 21 | LS47-H3L-TC-ND21 | 192.1 | 1560.61 |
| 22 | LS47-H3L-TC-ND22 | 192.2 | 1559.79 |
| 23 | LS47-H3L-TC-ND23 | 192.3 | 1558.98 |
| 24 | LS47-H3L-TC-ND24 | 192.4 | 1558.17 |
| 25 | LS47-H3L-TC-ND25 | 192.5 | 1557.36 |
| 26 | LS47-H3L-TC-ND26 | 192.6 | 1556.55 |
| 27 | LS47-H3L-TC-ND27 | 192.7 | 1555.75 |
| 28 | LS47-H3L-TC-ND28 | 192.8 | 1554.94 |
| 29 | LS47-H3L-TC-ND29 | 192.9 | 1554.13 |



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

| Channel | PART NUMBER | Frequency(THz) | Center Wavelength(nm) |
|---------|------------------|----------------|-----------------------|
| 30 | LS47-H3L-TC-ND30 | 193.0 | 1553.33 |
| 31 | LS47-H3L-TC-ND31 | 193.1 | 1552.52 |
| 32 | LS47-H3L-TC-ND32 | 193.2 | 1551.72 |
| 33 | LS47-H3L-TC-ND33 | 193.3 | 1550.92 |
| 34 | LS47-H3L-TC-ND34 | 193.4 | 1550.12 |
| 35 | LS47-H3L-TC-ND35 | 193.5 | 1549.32 |
| 36 | LS47-H3L-TC-ND36 | 193.6 | 1548.51 |
| 37 | LS47-H3L-TC-ND37 | 193.7 | 1547.72 |
| 38 | LS47-H3L-TC-ND38 | 193.8 | 1546.92 |
| 39 | LS47-H3L-TC-ND39 | 193.9 | 1546.12 |
| 40 | LS47-H3L-TC-ND40 | 194.0 | 1545.32 |
| 41 | LS47-H3L-TC-ND41 | 194.1 | 1544.53 |
| 42 | LS47-H3L-TC-ND42 | 194.2 | 1543.73 |
| 43 | LS47-H3L-TC-ND43 | 194.3 | 1542.94 |
| 44 | LS47-H3L-TC-ND44 | 194.4 | 1542.14 |
| 45 | LS47-H3L-TC-ND45 | 194.5 | 1541.35 |
| 46 | LS47-H3L-TC-ND46 | 194.6 | 1540.56 |
| 47 | LS47-H3L-TC-ND47 | 194.7 | 1539.77 |
| 48 | LS47-H3L-TC-ND48 | 194.8 | 1538.98 |
| 49 | LS47-H3L-TC-ND49 | 194.9 | 1538.19 |
| 50 | LS47-H3L-TC-ND50 | 195.0 | 1537.40 |
| 51 | LS47-H3L-TC-ND51 | 195.1 | 1536.61 |
| 52 | LS47-H3L-TC-ND52 | 195.2 | 1535.82 |
| 53 | LS47-H3L-TC-ND53 | 195.3 | 1535.04 |
| 54 | LS47-H3L-TC-ND54 | 195.4 | 1534.25 |
| 55 | LS47-H3L-TC-ND55 | 195.5 | 1533.47 |
| 56 | LS47-H3L-TC-ND56 | 195.6 | 1532.68 |
| 57 | LS47-H3L-TC-ND57 | 195.7 | 1531.90 |
| 58 | LS47-H3L-TC-ND58 | 195.8 | 1531.12 |



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

| Channel | PART NUMBER | Frequency(THz) | Center Wavelength(nm) |
|---------|------------------|----------------|-----------------------|
| 59 | LS47-H3L-TC-ND59 | 195.9 | 1530.33 |
| 60 | LS47-H3L-TC-ND60 | 196.0 | 1529.55 |
| 61 | LS47-H3L-TC-ND61 | 196.1 | 1528.77 |

Absolute Maximum Ratings

| PARAMETER | SYMBOL | MIN | MAX | UNITS | NOTE |
|---------------------|-----------|------|-----|-------|------|
| Storage Temperature | T_s | -40 | 85 | °C | |
| Supply Voltage | V_{cc3} | -0.5 | 3.6 | V | |
| | V_{cc5} | -0.5 | 6.0 | V | |

Recommended Operating Conditions

| PARAMETER | SYMBOL | MIN | MAX | UNITS | NOTE |
|----------------------------|-----------|------|------|-------|------|
| Case operating Temperature | T_C | -5 | 70 | °C | |
| Supply Voltage | V_{cc3} | 3.1 | 3.5 | V | |
| Supply Current | I_{cc3} | --- | 500 | mA | |
| Supply Voltage | V_{cc5} | 4.75 | 5.25 | V | |
| Supply Current | I_{cc5} | --- | 380 | mA | |

Diagnostics

| Data Address | PARAMETER | RANGE | ACCURACY |
|--------------|--------------|--------------|----------|
| 96-97 | Temperature | -10 to 75°C | ±3°C |
| 100-101 | Bias Current | 0 to 120mA | ±10% |
| 102-103 | TX Power | -1 to +2dBm | ±2dB |
| 104-105 | RX Power | -16 to -1dBm | ±2dB |
| 106-107 | Vcc3 Voltage | 3.0~3.6Volts | ±3% |
| 108-109 | Vcc5 Voltage | 4.7~5.3Volts | ±3% |



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

Transmitter Electro-optical Characteristics

$V_{cc3} = 3.1\text{ V to }3.5\text{ V}$, $V_{cc5} = 4.75\text{ V to }5.25\text{ V}$, $T_C = -5^\circ\text{C to }70^\circ\text{C}$

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNITS | NOTE |
|--|-------------------------------------|----------------------------|------|----------|---------|------|
| Operating Data Rate | | 9.95 | | 11.3 | Gbps | |
| Input Reference Clock Rate | | Not Required | | | | |
| Output power | POUT | -1 | | +2 | dBm | |
| Extinction Ratio | ER | 8.2 | | | dB | |
| Center Wavelength Spacing | | | 100 | | G | |
| Optical Wavelength-EOL | λ_c | X-100 | X | X+100 | pm | 1 |
| Optical Wavelength-BOL | λ_c | X-25 | X | X+25 | pm | 1 |
| Transmitter Dispersion Penalty (@ 800 ps/nm) | TDP | | | 2 | dB | |
| Sidemode Supression ratio | SSRmin | 30 | | | dB | |
| Relative Intensity Noise | RIN | --- | --- | -130 | dB/Hz | |
| Output Eye | | Compliant with IEEE802.3ae | | | | |
| Differential Input Voltage | V_{DIFF} | 0.12 | --- | 1.0 | V | |
| Transmit Fault Output-Low | TX_FAULT_L | 0.0 | --- | 0.5 | V | |
| Transmit Fault Output-High | TX_FAULT_H | 2.4 | --- | V_{CC} | V | |
| TX_DISABLE Assert Time | t_{off} | --- | --- | 10 | μs | |
| TX_DISABLE Negate Time | t_{on} | --- | --- | 2 | ms | |
| Time to initialize | t_{init} | --- | --- | 300 | ms | |
| Interrupt assert delay | $\overline{\text{Interrupt}}_{on}$ | --- | --- | 200 | ms | |
| Interrupt negate delay | $\overline{\text{Interrupt}}_{off}$ | --- | --- | 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_{loss_on} | | | 100 | μs | |
| RX_LOS negate delay | t_{loss_off} | | | 100 | μs | |



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

Note 1:X = Specified ITU Grid wavelength.

Receiver Electro-optical Characteristics

$V_{cc3} = 3.1\text{ V to }3.5\text{ V}$, $V_{cc5} = 4.75\text{ V to }5.25\text{ V}$, $T_C = -5\text{ }^\circ\text{C to }70\text{ }^\circ\text{C}$

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNITS | NOTE |
|---|-----------------|------|------|----------|---------|------------------|
| Optical Input Power-maximum | P_{IN} | -1 | | | | BER < 10^{-12} |
| Receiver Sensitivity | P_{IN} | | | -16 | dBm | BER < 10^{-12} |
| Operating Center Wavelength | λ_C | 1270 | --- | 1570 | nm | |
| Receiver Reflectance | R_{RX} | --- | --- | -27 | dB | |
| Loss of Signal-Asserted | P_A | -28 | --- | --- | dBm | |
| Loss of Signal-Deasserted | P_D | --- | --- | -16 | dBm | |
| Differential Output Voltage | V_{DIFF} | 0.6 | | 0.8 | V | |
| TTL Input High Voltage | | 2 | | V_{cc} | V | |
| TTL Input Low Voltage | | 0 | | 0.8 | V | |
| TTL Output High Voltage | | 2.4 | --- | V_{cc} | V | |
| TTL Output Low Voltage | | 0 | --- | 0.4 | V | |
| Receiver Loss of Signal Assert Time (off to on) | t_{A,RX_LOS} | --- | --- | 100 | μs | |
| Receiver Loss of Signal Assert Time (on to off) | t_{D,RX_LOS} | --- | --- | 100 | μs | |



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

Serial ID Memory Contents (Table 01h)

| <i>Address</i> | <i>Size</i> | <i>Name</i> | <i>Hex</i> | <i>Description</i> |
|----------------|-------------|------------------------|--|---|
| 128 | 1 | Identifier | 06 | XFP |
| 129 | 1 | Ext. Identifier | B0 | Power consumption<3.5W Tx reference clock not required |
| 130 | 1 | Connector | 07 | LC Connector |
| 131-138 | 8 | Transceiver | 22 00 00 00 00 00 00 00 | 10G BASE-ER/EW |
| 139 | 1 | Encoding | 80 | 64B/66B |
| 140 | 1 | BR-Min | 63 | 9.95Gbps |
| 141 | 1 | BR-Max | 71 | 11.3Gbps |
| 142 | 1 | Length(SMF)-km | 28 | 40km |
| 143 | 1 | Length(E-50um) | 00 | 0 |
| 144 | 1 | Length(50um) | 00 | 0 |
| 145 | 1 | Length(62.5um) | 00 | 0 |
| 146 | 1 | Length(copper) | 00 | 0 |
| 147 | 1 | Device Tech | 74 | Cooled 1550 EML, PIN |
| 148-163 | 16 | Vendor name | 4F 45 4D 20 20 20 20 20 20 20 20 20 20 20 20 20 | OEM |
| 164 | 1 | CDR support | F9 | XFI Loopback Mode , 9.95~11.3Gbps |
| 165-167 | 3 | Vender OUI | 00 00 00 | |
| 168-183 | 16 | Vendor PN | 4C 53 34 37 2D 48 33 4C 2D 54 43 2D 4E 44 xx xx | LS47-H3L-TC-NDxx |
| 184-185 | 2 | Vender rev | 30 41 | 0A |
| 186-187 | 2 | Wavelength | 7A 2D | 1563.86nm(Ex :CH17) |
| 188-189 | 2 | Tolerance Tolerance | 00 50 | +/- 25pm |



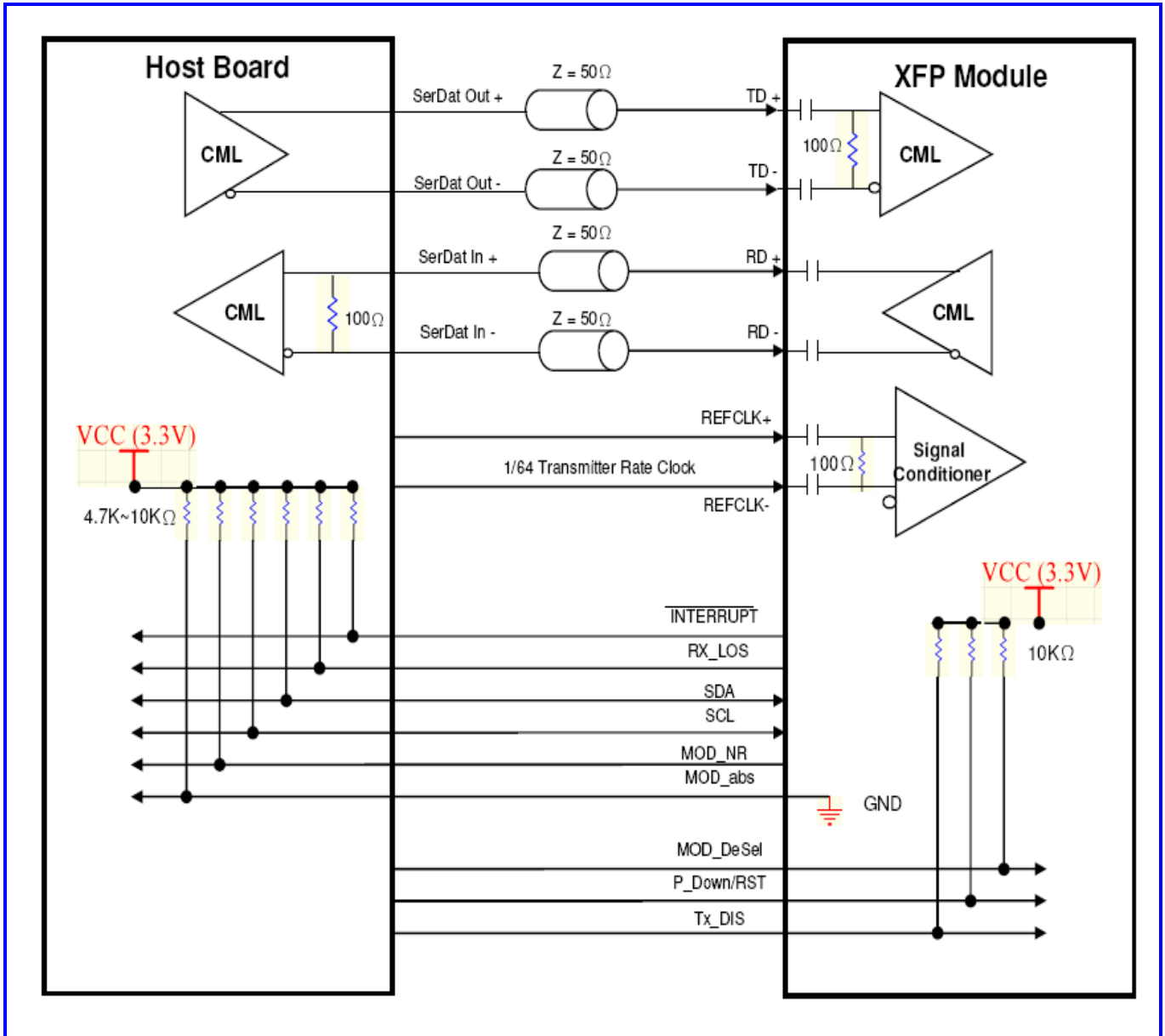
RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

| | | | | |
|---------|----|----------------------------|-------------------------|--|
| 190 | 1 | Max Case Temp | 46 | 70degC |
| 191 | 1 | CC_BASE | | Check code(128~190) |
| 192-195 | 4 | Power Supply | AF FA 66 00 | 3.5W (power consumption) 2.5W (power down mode) 300mA (5V) 600mA (3.3V) |
| 196-211 | 16 | Vender SN | | ASCII |
| 212-219 | 8 | Vender date code | xx xx xx xx xx xx 20 20 | ASCII Year(2bytes) , Month(2bytes) , Day(2bytes) |
| 220 | 1 | Diagnostic Monitoring Type | 08 | No BER support; Average Power |
| 221 | 1 | Enhanced Options | 60 | Optional soft Tx_disable and P_down |
| 222 | 1 | Aux Monitoring | 76 | AUX1:+3.3V power supply AUX2:+5V power supply |
| 223 | 1 | CC_EXT | | Check code(192~222) |
| 224-255 | 32 | Vendor specific | | Reserved |

Block Diagram of Transceiver



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH



MOD_NR

The Mod_NR is an output pin that when High, indicates that the module has detected a condition that renders



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

transmitter and or receiver data invalid, shall consist of logical OR of the following signals:

- Transmit Signal Conditioner Loss of Lock
- Transmitter Laser Fault
- Receiver Signal Conditioner Loss of Lock

MOD_DESEL

The Mod_DeSel is an input pin. When held Low by the host, the module responds to 2-wire serial communication commands. The Mod_DeSel allows the use of multiple XFP modules on a single 2-wire interface bus.

When the Mod_DeSel pin is “High”, the module shall not respond to or acknowledge any 2-wire interface communication from the host.

INTERRUPT

Interrupt is an output pin. When “Low”, indicates possible module operational fault or a status critical to the host system.

TX_DIS

TX_DIS is an input pin. When TX_DIS is asserted High, the XFP module transmitter output must be turned off.

MOD_ABS

Mod_ABS is pulled up to Host_Vcc on the host board and grounded in the XFP module. Mod_ABS is then asserted “High” when the XFP module is physically absent from a host slot.

RX_LOS

The RX_LOS when High indicates insufficient optical power for reliable signal reception.

P_DOWN/RST

This is a multifunction pin for module Power Down and Reset. The P_Down/RST pin must be pulled up to VCC3 in the XFP module.

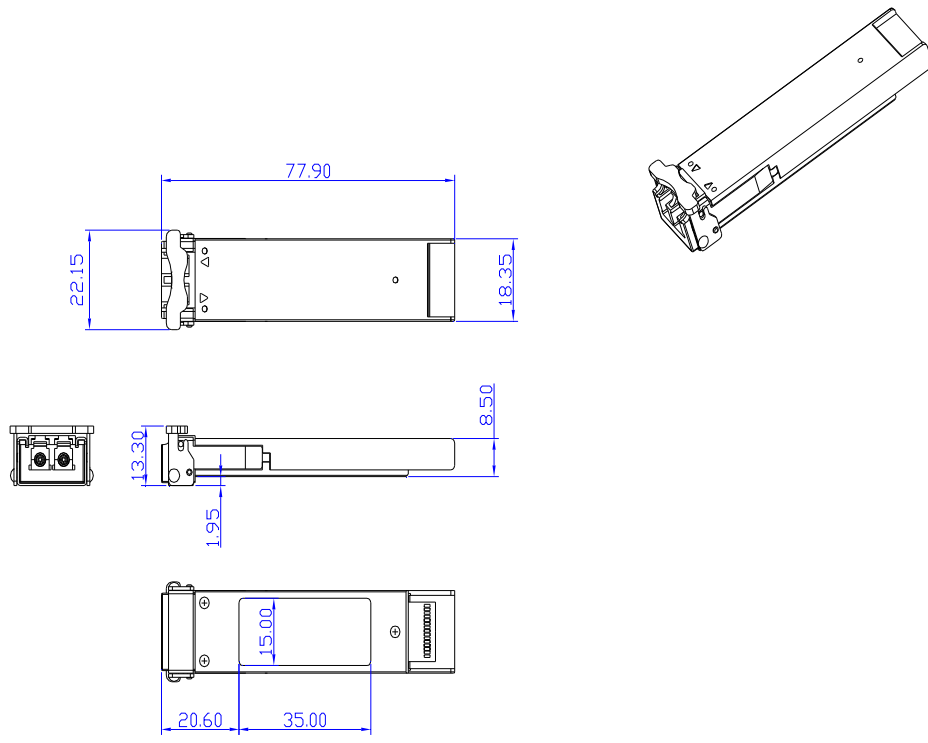
POWER DOWN FUNCTION

The P_Down pin, when held High by the host, places the module in the standby (Low Power) mode with a maximum power dissipation of 1.5W. This protects hosts which are not capable of cooling higher power modules which may be accidentally inserted.



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

Dimensions



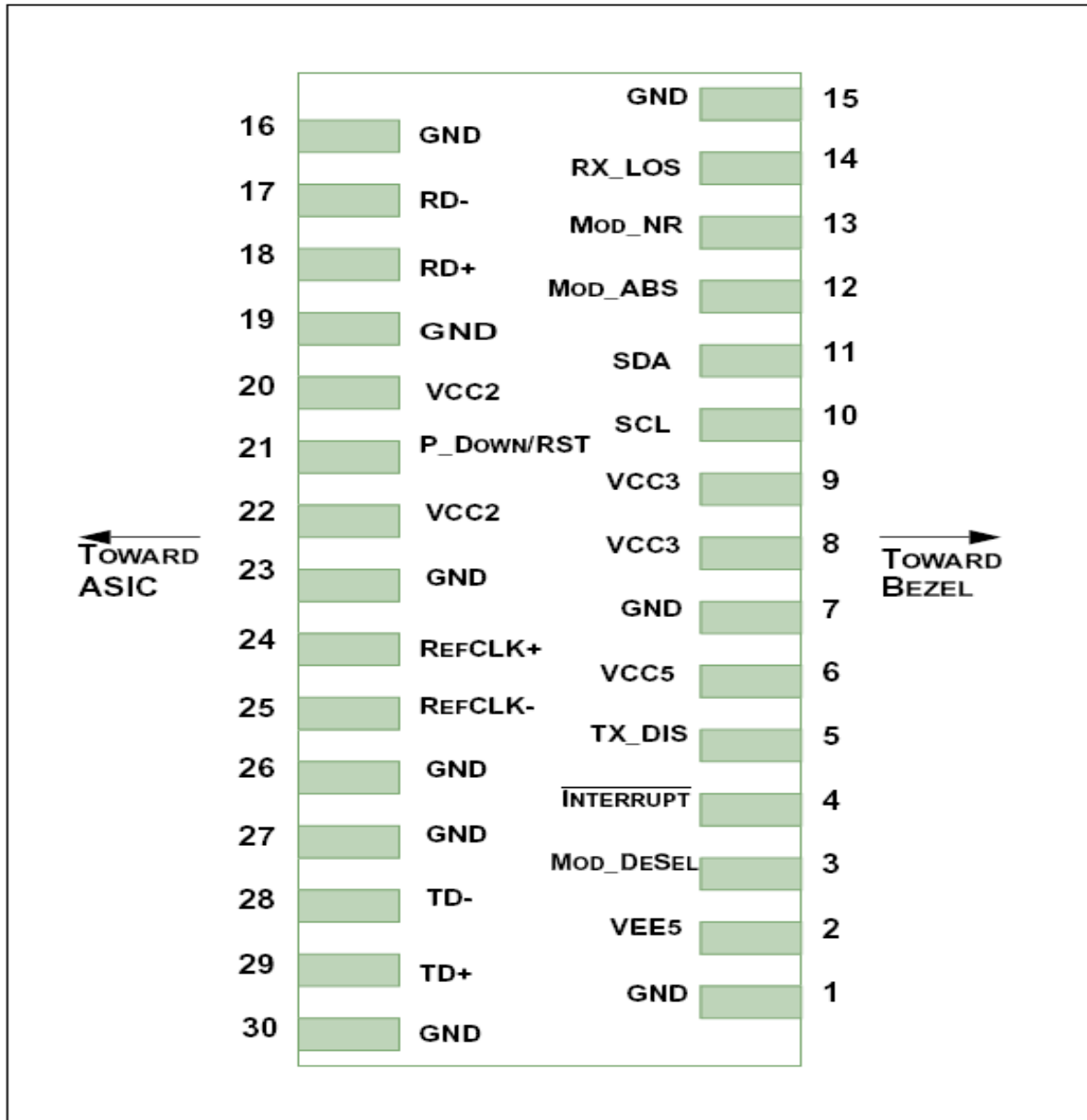
DIMENSIONS ARE IN MILLIMETERS

ALL DIMENSIONS ARE $\pm 0.2\text{mm}$ UNLESS OTHERWISE SPECIFIED



RoHS Compliant
 DWDM XFP Transceiver up to 40km link length
 10GBASE-EW/ER
 10G Fiber Channel
 10G SONET/SDH

Pin Assignment





**RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH**

| <i>Pin</i> | <i>Logic</i> | <i>Symbol</i> | <i>Name/Description</i> | <i>Note</i> |
|------------|--------------|-------------------------------|---|-------------|
| 1 | | GND | Module Ground | 1 |
| 2 | | VEE5 | Optional -5.2V Power Supply | |
| 3 | LVTTL-I | Mod_DeSel | Module De-select; When held low allows module to respond to 2-wire serial interface | |
| 4 | LVTTL-O | $\overline{\text{Interrupt}}$ | $\overline{\text{Interrupt}}$; 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 | | VCC5 | +5V Power Supply | |
| 7 | | GND | Module Ground | 1 |
| 8 | | VCC3 | +3.3V Power Supply | |
| 9 | | VCC3 | +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 | | VCC2 | +1.8V Power Supply | 3 |
| 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. 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 | 3 |
| 23 | | GND | Module Ground | 1 |
| 24 | PECL-I | RefCLK+ | Reference Clock Non-Inverted Input, AC coupled on the host board | |
| 25 | PECL-I | RefCLK- | Reference Clock Inverted Input, AC coupled on the host board | |
| 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 |

1. Module ground pins Gnd are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
3. The 1.8 V power supply can be optionally programmed to voltages lower than 1.8 V in modules supporting the variable power supply.



RoHS Compliant
DWDM XFP Transceiver up to 40km link length
10GBASE-EW/ER
10G Fiber Channel
10G SONET/SDH

Eye Safety Mark

The LS4 series single-mode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

Caution

All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.

Required Mark

**Class 1 Laser Product
Complies with
21 CFR 1040.10 and 1040.11**

Note : All information contained in this document is subject to change without notice.