# FP-CWDM-LL-80KM

# 10Gb/s 80km CWDM XFP Optical Transceiver

## PRODUCT FEATURES




- Hot-pluggable XFP footprint
- Supports 9.95Gb/s to 11.3Gb/s bit rates
- Supports Line-side and XFI loopback
- RoHS-6 Compliant (lead-free)
- Power dissipation <3.0W
- 3.3V &1.8V power supply
- Maximum link length of 80km
- DWDM EML and APD Receiver
- Full Duplex LC connector
- No Reference Clock required
- Built-in digital diagnostic functions
- Standard bail release mechanism
- Case operating temperature range: Commercial: 0°C to +70°C

  Industrial: -40°C to +85°

## APPLICATIONS

- DWDM 10GBASE-ZR/ZW 10G Ethernet
- DWDM 80KM 10G Fiber Channel
- DWDM SONET OC-192&SDH STM-64

# PRODUCT DESCRIPTION

XFP-CWDM-LL-80KM Small Form Factor 10Gb/s (XFP) transceivers are compliant with the current XFP Multi-Source Agreement (MSA) Specification. They comply with 10-Gigabit Ethernet 10GBASE-ZR/ZW per IEEE 802.3ae. Digital diagnostics functions are available via a 2-wire serial interface, as specified in the XFP MSA. The transceiver is RoHS compliant and leads free .

## Ⅰ. Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ | Max | Unit | NOTE |
|---|---|---|---|---|---|---|
| Absolute Supply Voltage | Vcc3 | -0.3 | | 3.6 | V | |
| | Vcc2 | -0.3 | | 2.0 | V | |
| Storage Temperature | TS | -40 | | 85 | °C | |
| Case Operating Temperature | Tcase | 0 | | 70 | °C | |
| | | -40 | - | 85 | ºC | |
| Operating Relative Humidity | RHop | 5 | | 95 | % | |

## II. Electrical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | NOTE |
|---|---|---|---|---|---|---|
| Supply Voltage – 1.8V supply | Vcc2 | 1.71 | | 1.89 | V | |
| Supply Voltage – 3.3V supply | Vcc3 | 3.13 | | 3.47 | V | |
| Supply Current – 1.8V supply | Icc2 | | | 250 | mA | |
| Supply Current – 3.3V supply | Icc3 | | | 760 | mA | |
| Module total power | P | | | 3.0 | W | 1 |
| **Transmitter** | | | | | | |
| Input differential impedance | $R_{in}$ | | 100 | | Ω | 2 |
| Differential data input swing | Vin,pp | 120 | | 820 | mV | |
| Transmit Disable Voltage | $V_D$ | 2.0 | | Vcc | V | 3 |
| Transmit Enable Voltage | $V_{EN}$ | GND | | GND+ 0.8 | V | |
| **Receiver** | | | | | | |
| Differential data output swing | Vout,pp | 340 | 650 | 850 | mV | 4 |
| LOS Fault | $V_{LOS\ fault}$ | Vcc – 0.5 | | $V_{CCHOST}$ | V | 5 |
| LOS Normal | $V_{LOS\ norm}$ | GND | | GND+0.5 | V | 5 |

Notes:

1. Maximum total power value is specified across the full temperature and voltage range.
2. After internal AC coupling.
3. Or open circuit.
4. Into 100 ohms differential termination.
5. Loss Of Signal is open collector to be pulled up with a 4.7k – 10kohm resistor to 3.15 – 3.6V. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

## Ⅲ. Optical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | NOTE |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Average Optical Power | $P_f$ | 0 | | 5 | dBm | |
| Optical Wavelength | λc | λc -0.1 | | λc +0.1 | nm | |
| Center Wavelength Spacing | | | 50 | | GHz | 1 |
| Side mode Suppression ratio | SMSR | 30 | | | dB | |
| Optical Extinction Ratio | ER | 8.2 | | | dB | |
| Transmitter and Dispersion Penalty | TDP | | | 3 | dB | |
| Average Launch power of OFF transmitter | $P_{OFF}$ | | | -30 | dBm | |
| Tx Jitter | $Tx_j$ | Compliant with 802.3ae requirements | | | | |
| **Receiver** | | | | | | |
| Receiver Sensitivity | Psen | | | -24 | dBm | 2 |
| Input Saturation Power (Overload) | Psat | -6 | | | dBm | |
| Wavelength Range | $\lambda_C$ | 1260 | | 1600 | nm | |
| Receiver Reflectance | $R_{rx}$ | | | -27 | dB | |
| LOS De-Assert | $LOS_D$ | | | -27 | dBm | |
| LOS Assert | $LOS_A$ | -37 | | | dBm | |
| LOS Hysteresis | | 0.5 | | | dB | |

Notes:

1. Corresponds to approximately 0.4 nm.
2. Measured with worst ER; BER<$10^{-12}$ with 10.3Gbps, $2^{31}-1$ PRBS.

## Ⅳ. Pin Assignment

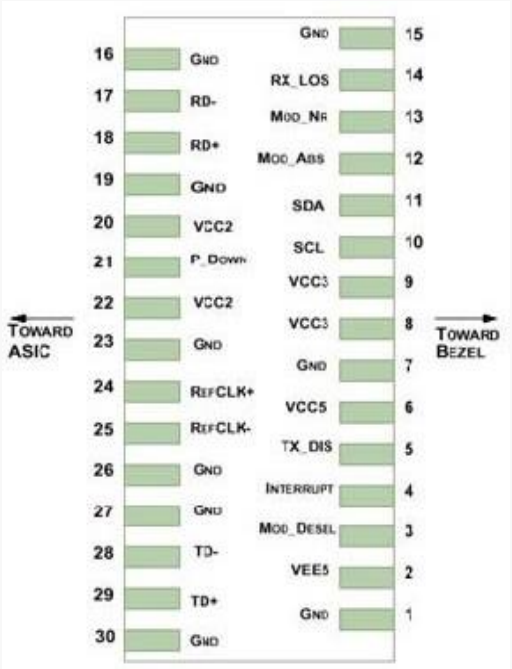



**Diagram of Host Board Connector Block Pin Numbers and Name**

| Pin | Logic | Symbol | Name/Description | NOTE |
|---|---|---|---|---|
| 1 | | GND | Module Ground | 1 |
| 2 | | VEE5 | Optional -5.2 Power Supply – Not required | |
| 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 – Not required | |
| 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 | LVTTLI/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; LONGLINE defines it as a logical OR between RX_LOS and Loss of Lock in TX/RX. | 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 – Not required | 3 |
| 25 | PECL-I | RefCLK- | Reference Clock inverted input, AC coupled on the host board – Not required | 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. 2 Open collector; should be pulled up with 4.7k – 10kohms on host board to a voltage between 3.15V and 3.6V.
3. A Reference Clock input is not required by the XFP-CWDM-LL-80KM. If present, it will be ignored.

## V. General Specifications

| Parameter | Symbol | Min | Typ | Max | Units | NOTE |
|---|---|---|---|---|---|---|
| Bit Rate | BR | 9.95 | | 11.3 | Gb/s | 1 |
| Bit Error Ratio | BER | | | $10^{-12}$ | | 2 |
| Max. Supported Link Length | $L_{MAX}$ | | | 80 | km | 1 |

Notes:

1. 10GBASE-ZR/ZW
2. Tested with $2^{31} - 1$ PRBS

## VI. Digital Diagnostic Functions

As defined by the XFP MSA, LONGLINE 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.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) 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.
For more detailed information including memory map definitions, please see the XFP MSA Specification.

# VII. XFP-CWDM-LL-80KM center wavelength

## C-band λc Wavelength Guide Pin Descriptions

| Channel | Wavelength (nm) | Frequency(THZ) | Channel | Wavelength (nm) | Frequency (THZ) |
|---|---|---|---|---|---|
| C17 | 1563.86 | 191.70 | C39 | 1546.12 | 193.90 |
| H17 | 1563.45 | 191.75 | H39 | 1545.72 | 193.95 |
| C18 | 1563.05 | 191.80 | C40 | 1545.32 | 194.00 |
| H18 | 1562.64 | 191.85 | H40 | 1544.92 | 194.05 |
| C19 | 1562.23 | 191.90 | C41 | 1544.53 | 194.10 |
| H19 | 1561.83 | 191.95 | H41 | 1544.13 | 194.15 |
| C20 | 1561.42 | 192.00 | C42 | 1543.73 | 194.20 |
| H20 | 1561.01 | 192.05 | H42 | 1543.33 | 194.25 |
| C21 | 1560.61 | 192.10 | C43 | 1542.94 | 194.30 |
| H21 | 1560.20 | 192.15 | H43 | 1542.54 | 194.35 |
| C22 | 1559.79 | 192.20 | C44 | 1542.14 | 194.40 |
| H22 | 1559.39 | 192.25 | H44 | 1541.75 | 194.45 |
| C23 | 1558.98 | 192.30 | C45 | 1541.35 | 194.50 |
| H23 | 1558.58 | 192.35 | H45 | 1540.95 | 194.55 |
| C24 | 1558.17 | 192.40 | C46 | 1540.56 | 194.60 |
| H24 | 1557.77 | 192.45 | H46 | 1540.16 | 194.65 |
| C25 | 1557.36 | 192.50 | C47 | 1539.77 | 194.70 |
| H25 | 1556.96 | 192.55 | H47 | 1539.37 | 194.75 |
| C26 | 1556.55 | 192.60 | C48 | 1538.98 | 194.80 |
| H26 | 1556.15 | 192.65 | H48 | 1538.58 | 194.85 |
| C27 | 1555.75 | 192.70 | C49 | 1538.19 | 194.90 |
| H27 | 1555.34 | 192.75 | H49 | 1537.79 | 194.95 |
| C28 | 1554.94 | 192.80 | C50 | 1537.40 | 195.00 |
| H28 | 1554.54 | 192.85 | H50 | 1537.00 | 195.05 |
| C29 | 1554.13 | 192.90 | C51 | 1536.61 | 195.10 |
| H29 | 1553.73 | 192.95 | H51 | 1536.22 | 195.15 |
| C30 | 1553.33 | 193.00 | C52 | 1535.82 | 195.20 |
| H30 | 1552.93 | 193.05 | H52 | 1535.43 | 195.25 |
| C31 | 1552.52 | 193.10 | C53 | 1535.04 | 195.30 |
| H31 | 1552.12 | 193.15 | H53 | 1534.64 | 195.35 |
| C32 | 1551.72 | 193.20 | C54 | 1534.25 | 195.40 |
| H32 | 1551.32 | 193.25 | H54 | 1533.86 | 195.45 |
| C33 | 1550.92 | 193.30 | C55 | 1533.47 | 195.50 |
| H33 | 1550.52 | 193.35 | H55 | 1533.07 | 195.55 |
| C34 | 1550.12 | 193.40 | C56 | 1532.68 | 195.60 |
| H34 | 1549.72 | 193.45 | H56 | 1532.29 | 195.65 |
| C35 | 1549.32 | 193.50 | C57 | 1531.90 | 195.70 |
| H35 | 1548.91 | 193.55 | H57 | 1531.51 | 195.75 |
| C36 | 1548.51 | 193.60 | C58 | 1531.12 | 195.80 |
| H36 | 1548.11 | 193.65 | H58 | 1530.72 | 195.85 |
| C37 | 1547.72 | 193.70 | C59 | 1530.33 | 195.90 |
| H37 | 1547.32 | 193.75 | H59 | 1529.94 | 195.95 |
| C38 | 1546.92 | 193.80 | C60 | 1529.55 | 196.00 |
| H38 | 1546.52 | 193.85 | H60 | 1529.16 | 196.05 |
| Non-ITU | Peak wavelength between 1528.77nm-1563.86 | | C61 | 1528.77 | 196.10 |