



25Gb/s SFP28 DWDM 15km Transceiver HXSD-FLxx15x

Features

- Up to 25.78Gb/s data links
- DWDM EML transmitter and APD receiver
- 100 GHz ITU channel spacing with integrated wavelength locker
- Up to 15km on 9/125um SMF
- Hot-pluggable SFP28 footprint
- Support Digital Monitoring interface
- Duplex LC/UPC type pluggable optical interface
- RoHS-10 compliant and lead-free
- With CDR function
- Single +3.3V power supply
- Compliant with SFF+MSA and SFF-8472
- Metal enclosure, for lower EMI
- Meet ESD requirements, resist 8KV direct contact voltage
- Case operating temperature
Commercial: 0 ~ +70°C
Extended: -10 ~ +80°C
Industrial: -40 ~ +85°C



Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes
- Inter Rack Connection
- Other Optical Links

Part Number Ordering Information

| Part Number | Data Rate (Gb/s) | Wavelength (nm) | Transmission Distance(km) | Temperature (°C) (Operating Case) |
|--------------|---------------------|--------------------|------------------------------|--------------------------------------|
| HXSD-FLxx15C | 25.78 | CH17~CH61 | 15 | 0~70 commercial |
| HXSD-FLxx15E | 25.78 | CH17~CH61 | 15 | -10~80 Extended |
| HXSD-FLxx15I | 25.78 | CH17~CH61 | 15 | -40~85 Industrial |



Wavelength Selection: C-band λ_c Wavelength Guide Pin Descriptions

| Channel (xx) | Wavelength (nm) | Frequency (THZ) | Channel (xx) | Wavelength (nm) | Frequency (THZ) |
|-----------------|--|--------------------|-----------------|--------------------|--------------------|
| C17 | 1563.86 | 191.70 | C39 | 1546.12 | 193.90 |
| C18 | 1563.05 | 191.80 | C40 | 1545.32 | 194.00 |
| C19 | 1562.23 | 191.90 | C41 | 1544.53 | 194.10 |
| C20 | 1561.42 | 192.00 | C42 | 1543.73 | 194.20 |
| C21 | 1560.61 | 192.10 | C43 | 1542.94 | 194.30 |
| C22 | 1559.79 | 192.20 | C44 | 1542.14 | 194.40 |
| C23 | 1558.98 | 192.30 | C45 | 1541.35 | 194.50 |
| C24 | 1558.17 | 192.40 | C46 | 1540.56 | 194.60 |
| C25 | 1557.36 | 192.50 | C47 | 1539.77 | 194.70 |
| C26 | 1556.55 | 192.60 | C48 | 1538.98 | 194.80 |
| C27 | 1555.75 | 192.70 | C49 | 1538.19 | 194.90 |
| C28 | 1554.94 | 192.80 | C50 | 1537.40 | 195.00 |
| C29 | 1554.13 | 192.90 | C51 | 1536.61 | 195.10 |
| C30 | 1553.33 | 193.00 | C52 | 1535.82 | 195.20 |
| C31 | 1552.52 | 193.10 | C53 | 1535.04 | 195.30 |
| C32 | 1551.72 | 193.20 | C54 | 1534.25 | 195.40 |
| C33 | 1550.92 | 193.30 | C55 | 1533.47 | 195.50 |
| C34 | 1550.12 | 193.40 | C56 | 1532.68 | 195.60 |
| C35 | 1549.32 | 193.50 | C57 | 1531.90 | 195.70 |
| C36 | 1548.51 | 193.60 | C58 | 1531.12 | 195.80 |
| C37 | 1547.72 | 193.70 | C59 | 1530.33 | 195.90 |
| C38 | 1546.92 | 193.80 | C60 | 1529.55 | 196.00 |
| Non-ITU | Peak wavelength between 1528.77nm-1563.86 | | C61 | 1528.77 | 196.10 |



I. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

| Parameter | Symbol | Min | Max | Unit | Notes |
|--------------------------------------|-----------------|------|-----|------|-------|
| Storage Temperature | T _s | -40 | 85 | °C | |
| Power Supply Voltage | V _{CC} | -0.5 | 3.6 | V | |
| Relative Humidity (non-condensation) | RH | 5 | 95 | % | |
| Damage Threshold | TH _d | -3 | | dBm | |

II. Recommended Operating Conditions

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|----------------------------|-----------------|-------|---------|-----------------|------|------------|
| Operating Case Temperature | T _{OP} | 0 | | 70 | °C | commercial |
| | | -10 | | 80 | | extended |
| | | -40 | | 85 | | Industrial |
| Power Supply Voltage | V _{CC} | 3.135 | 3.3 | 3.465 | V | |
| Data Rate | | | 25.78 | | Gb/s | |
| Control Input Voltage High | | 2 | | V _{CC} | V | |
| Control Input Voltage Low | | 0 | | 0.8 | V | |
| Link Distance (SMF) | D | | | 15 | km | 9/125um |

III. General Description

HXSD-FLxx15x SFP28 transceiver is designed for use in 25-Gigabit Ethernet links up to 15km over single mode fiber. The module consists of DWDM EML Laser, APD and Preamplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. This module is designed for single mode fiber and operates at a nominal wavelength of 100GHz ITU Grid, C Band DWDM wavelength.

The module optical connection is duplex LC and shall be compatible with SFP+ 28Gbps and backward compatible with legacy 10G SFP+ pluggable. The SFP28 DWDM LR module is a dual directional device with a transmitter and receiver plus a control management interface (2-wire interface) in the same physical package. 2-wire interface is used for serial ID, digital diagnostics and module control function.

The transmitter converts 25Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic “1” or no connection on this pin will disable the laser from transmitting. Logic “0” on this pin provides normal operation. The transmitter has an internal



automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor.

The receiver converts 25Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

IV. Pin Assignment and Pin Description

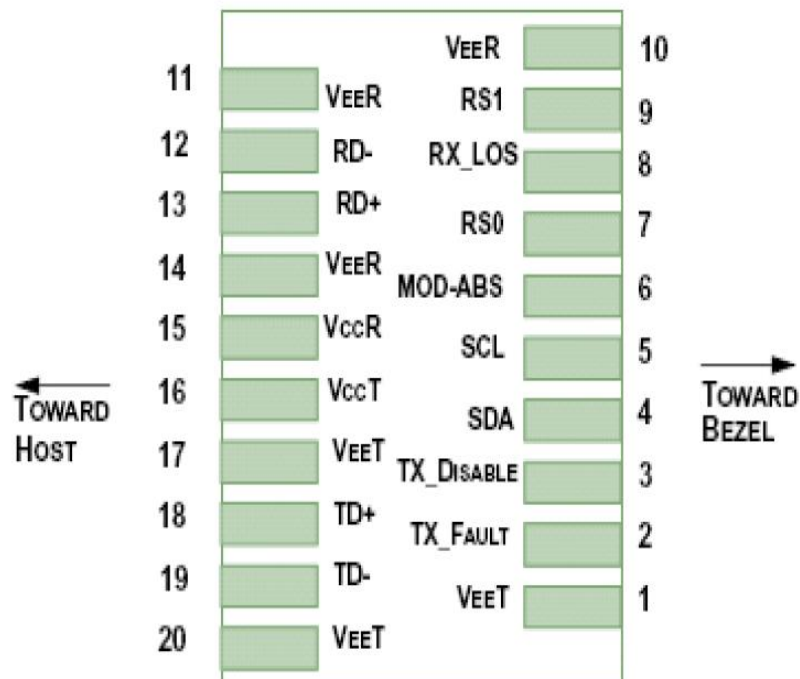


Figure1. Diagram of host board connector block pin numbers and names

| PIN | Name | Name/Description | Notes |
|-----|------|------------------|-------|
|-----|------|------------------|-------|



| | | | |
|----|------------|---|---|
| 1 | VeeT | Transmitter Ground | 1 |
| 2 | TX_Fault | Transmitter Fault | |
| 3 | TX_Disable | Transmitter Disable; Turns off transmitter laser output | |
| 4 | SDA | Two wire serial interface Data Line (LVCMOS-I/O) (MOD-DEF2) | 2 |
| 5 | SCL | Two wire serial interface Clock Line (LVCMOS-I/O) (MOD-DEF1) | 2 |
| 6 | MOD_ABS | Module Definition, Grounded in the module | |
| 7 | RS0 | Rx Rate Select: | |
| 8 | RX_LOS | Receiver Loss of Signal Indication Active LOW | |
| 9 | RS1 | Transmitter Rate Select (not used) | |
| 10 | VeeR | Receiver Ground | 1 |
| 11 | VeeR | Receiver Ground | 1 |
| 12 | RD- | Receiver Inverted Data Output | |
| 13 | RD+ | Receiver Data Output | |
| 14 | VeeR | Receiver Ground | 1 |
| 15 | VccR | Receiver Power - +3.3V | |
| 16 | VccT | Transmitter Power - +3.3 V | |
| 17 | VeeT | Transmitter Ground | 1 |
| 18 | TD+ | Transmitter Non-Inverted Data Input | |
| 19 | TD- | Transmitter Inverted Data Input | |
| 20 | VeeT | Transmitter Ground | 1 |

Notes:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.47V on the host board.



V. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|--------------------------------------|---------|---------|------|----------|------|--------------|
| Power Consumption | p | | | 1.75 | W | |
| Supply Current | Icc | | | 520 | mA | 瞬 态 650mA |
| Transmitter | | | | | | |
| Single-ended Input Voltage Tolerance | Vcc | -0.3 | | 4.0 | V | |
| Common mode voltage tolerance | | 15 | | | mV | |
| Differential Input Voltage Swing | Vin,pp | 180 | | 700 | mVpp | |
| Differential Input Impedance | Zin | 90 | 100 | 110 | Ohm | 1 |
| Transmit Disable Assert Time | | | | 10 | us | |
| Transmit Disable Voltage | Vdis | Vcc-1.3 | | Vcc | V | |
| Transmit Enable Voltage | Ven | Vee | | Vee +0.8 | V | 2 |
| Receiver | | | | | | |
| Single-ended Input Voltage Tolerance | Vcc | -0.3 | | 4.0 | V | |
| Differential Output Voltage Swing | Vout,pp | 300 | | 900 | mVpp | |
| Differential Output Impedance | Zout | 90 | 100 | 110 | Ohm | 3 |
| Data output rise/fall time | Tr/Tf | 9.5 | | | ps | 4 |
| LOS Assert Voltage | VlosH | Vcc-1.3 | | Vcc | V | 5 |
| LOS De-assert Voltage | VlosL | Vee | | Vee +0.8 | V | 5 |

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Input 100 ohms differential termination.
4. These are unfiltered 20-80% values.
5. Loss of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.



VI. Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|------------------------------------|----------------------------|-------------------|---------|-------------------|------|-------|
| Transmitter | | | | | | |
| Optical Wavelength | λ_c | $\lambda_c - 0.1$ | | $\lambda_c + 0.1$ | nm | 1 |
| Center Wavelength Spacing | | | 100 | | GHz | |
| Optical Spectral Width | $\Delta\lambda$ | | | 1 | nm | |
| Average Optical Power | P _{AVG} | 0 | | 5 | dBm | 2 |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Optical Extinction Ratio | ER | 6 | | | dB | |
| Transmitter OFF Output Power | P _{off} | | | -30 | dBm | |
| Transmitter and Dispersion Penalty | TDP | | | 2.7 | dB | |
| Optical Return Loss Tolerance | ORLT | | | 20 | dB | |
| Transmitter Eye Mask | Compliant with IEEE802.3ae | | | | | |
| Receiver | | | | | | |
| Center Wavelength | λ_c | 1270 | | 1610 | nm | |
| Receiver Sensitivity | Sen. | | | -14 | dBm | 3 |
| Average Receive Power | | -20 | | -5 | dBm | |
| Input Saturation Power (overload) | P _{sat} | -8 | | | dBm | |
| LOS Assert | LOSA | -30 | | | dBm | |
| LOS De-assert | LOSD | | | -21 | dBm | |
| LOS Hysteresis | LOSH | 0.5 | | | dB | |
| Damage Threshold | TH _d | 3 | | | dBm | |

Notes:

1. λ_c refer to wavelength selection, and corresponds to approximately 0.8 nm.
2. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
3. Measured with Light source 1528.77~1563.86nm, ER=6dB; BER = $<10^{-12}$ @ PRBS=2³¹-1 NRZ.



VII. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

| Parameter | Symbol | Min. | Max | Unit | Notes |
|---------------------------------------|----------|-------|------|------|----------------------|
| Temperature monitor absolute error | DMI_Temp | -3 | 3 | °C | Over operating temp |
| Supply voltage monitor absolute error | DMI_VCC | -0.15 | 0.15 | V | Full operating range |
| RX power monitor absolute error | DMI_RX | -3 | 3 | dB | |
| Bias current monitor | DMI_bias | -10% | 10% | mA | |
| TX power monitor absolute error | DMI_TX | -3 | 3 | dB | |

VIII. Mechanical Dimensions

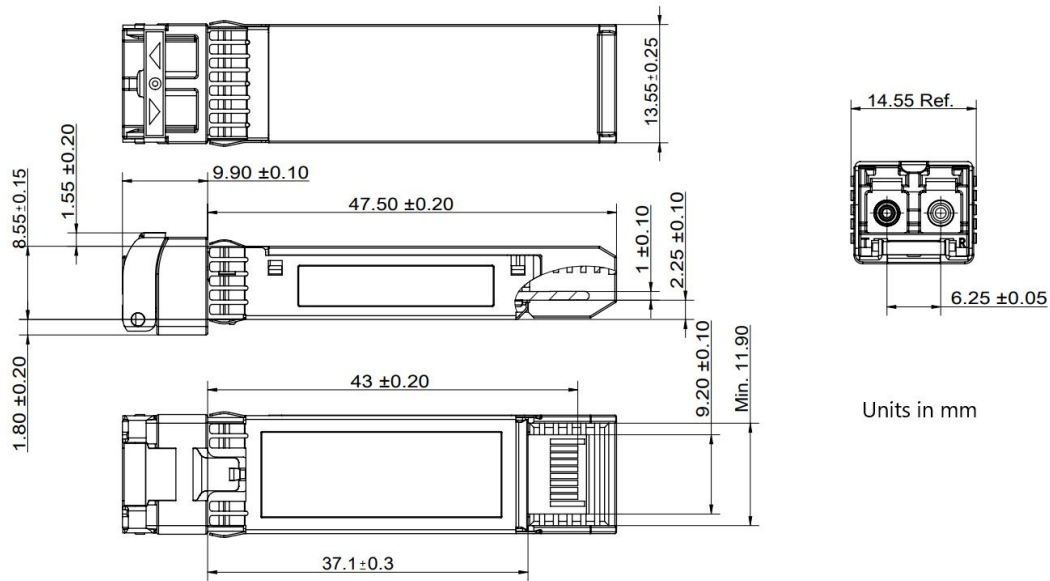


Figure2. Mechanical Outline