



2.5G SFP OC-48 LR-1 / STM-16 L16.1 Transceiver Hot Pluggable, Duplex LC, 1310nm DFB, SMF 40KM, DDM

Part Number: FSFP-E7-S13-40D



Overview

FSFP-E7-S13-40D Small Form Factor Pluggable SFP transceivers are compliant with the current SFP Multi-Source Agreement (MSA) Specification. The high performance uncooled 1310nm DFB transmitter and high sensitivity PIN receiver provide superior performance for SONET OC-48 / SDH STM-16 applications up to SMF 40km optical links.

Applications

- SONET OC-48 / SDH STM-16 @2.5G

Features

- Compatible with SONET OC-48 LR-1 and SDH STM-16 L16.1
- Compliant with INF-8074i SFP MSA
- Hot Pluggable
- 1310nm DFB laser transmitter
- Duplex LC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8472
- Single +3.3V power supply
- Link distance 40km over SM fiber
- RoHS Compliant

Laser Safety

- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous radiation exposure.



Absolute Maximum Ratings

| Parameters | Symbol | Min. | Max. | Unit |
|---------------------------|-----------------|------|------|------|
| Storage Temperature | T _{ST} | -40 | +85 | °C |
| Storage Relative Humidity | RH | 5 | 95 | % |
| Supply Voltage | V _{CC} | -0.5 | +4.0 | V |

Recommended Operating Conditions

| Parameters | Symbol | Min. | Typ. | Max. | Unit |
|---|-----------------|-------|------|-------|------|
| Case Operating Temp. (FSFP-E7-S13-40D) | T _{OP} | 0 | - | +70 | °C |
| Case Operating Temp. (FSFP-E7-S13-40Di) | T _{OP} | -40 | - | +85 | °C |
| Supply Voltage | V _{CC} | +3.13 | +3.3 | +3.47 | V |
| Supply Current (FSFP-E7-S13-40D) | I _{CC} | | | 250 | mA |
| Supply Current (FSFP-E7-S13-40Di) | I _{CC} | | | 280 | mA |

Transmitter Electro-optical Characteristics

V_{CC}= 3.13V to 3.47V, T_{OP} = 0 °C to 70 °C (FSFP-E7-S13-40D); T_{OP} = -40 °C to 85 °C (FSFP-E7-S13-40Di)

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|--------------------|--------------------|------|-----------------|-------|------|
| Operating Data Rate | DR | | 2488 | | Mb/s | |
| Optical Launch Power | P _o | -2 | | +3 | dBm | 1 |
| Optical Center Wavelength | λ _c | 1290 | 1310 | 1335 | nm | |
| Spectral Width (-20dB) | Δλ | | | 1 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Optical Extinction Ratio | ER | 8.2 | | | dB | |
| Optical Eye Mask | | ITU-T G.957 STM-16 | | | | |
| Relative Intensity Noise | RIN | | | -120 | dB/Hz | |
| Differential Data Input Swing | V _{IN} | 180 | | 1200 | mV | |
| Tx Disable Input Voltage-Low (Tx ON) | TDISV _L | GND | | 0.8 | V | |
| Tx Disable Input Voltage-High (Tx OFF) | TDISV _H | 2.0 | | V _{CC} | V | |
| Tx Fault Output Voltage-Low (Tx Normal) | TFLTV _L | GND | | 0.8 | V | |
| Tx Fault Output Voltage-High (Tx Fault) | TFLTV _H | 2.0 | | V _{CC} | V | |

Note1: The optical power is launched into a 9/125μm single mode fiber.



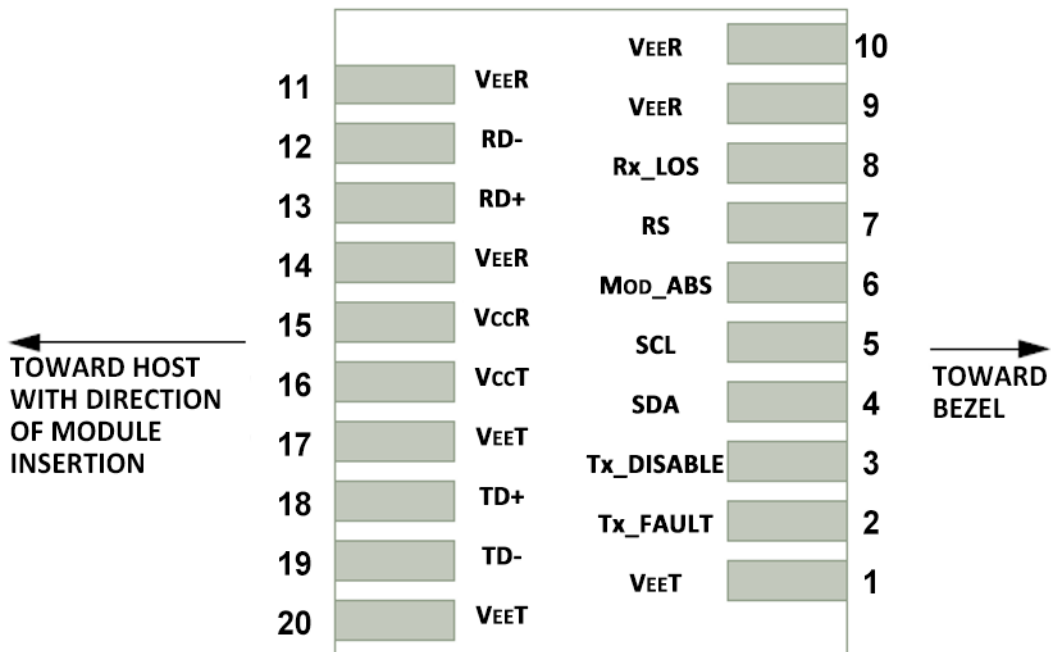
Receiver Electro-optical Characteristics

$V_{CC} = 3.13V$ to $3.47V$, $T_{OP} = 0\text{ }^{\circ}C$ to $70\text{ }^{\circ}C$ (FSFP-E7-S13-40D); $T_{OP} = -40\text{ }^{\circ}C$ to $85\text{ }^{\circ}C$ (FSFP-E7-S13-40Di)

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|----------------------|------|------|-----------------|------|------|
| Operating Data Rate | DR | | 2488 | | Mb/s | |
| Receiver Sensitivity | SEN | | | -20 | dBm | 1 |
| Maximum Receive Power | PR _x -MAX | -3 | | | dBm | 1 |
| Optical Center Wavelength | λ_c | 1260 | | 1610 | nm | |
| LOS De-Assert | LOS _D | | | -21 | dBm | |
| LOS Assert | LOS _A | -35 | | | dBm | |
| LOS Hysteresis | LOS _{HY} | 0.5 | | | dB | |
| Differential Data Output Swing | V _{OUT} | 600 | | 1000 | mV | |
| Receiver LOS Signal Output Voltage-Low | LOS _{VL} | GND | | 0.8 | V | |
| Receiver LOS Signal Output Voltage-High | LOS _{VH} | 2.0 | | V _{CC} | V | |

Note1: Measured with a PRBS 2²³-1 test pattern @2488Mbps BER<10⁻¹⁰.

Pin Assignment



Host PCB SFP Pad Assignment Top View



Pin Description

| Pin | Name | Function / Description |
|-----|------------|--|
| 1 | VEET | Transmitter Ground |
| 2 | Tx_FAULT | Transmitter Fault Indication (1) |
| 3 | Tx_DISABLE | Transmitter Disable – Turns off transmitter laser output (2) |
| 4 | SDA | 2-wire Serial Interface Data Line (SDA: Serial Data Signal) (3) |
| 5 | SCL | 2-wire Serial Interface Clock (SCL: Serial Clock Signal) (3) |
| 6 | MOD_ABS | Module Absent, connected to VEET or VEER in the module (3) |
| 7 | RS | Rate Select, optional (5) |
| 8 | Rx_LOS | Receiver Loss of Signal Indication (4) |
| 9 | VEER | Receiver Ground |
| 10 | VEER | Receiver Ground |
| 11 | VEER | Receiver Ground |
| 12 | RD- | Receiver Inverted Data output, Differential LVPECL, AC coupled |
| 13 | RD+ | Receiver Non-Inverted Data output, Differential LVPECL, AC coupled |
| 14 | VEER | Receiver Ground |
| 15 | VccR | Receiver 3.3V Power Supply |
| 16 | VccT | Transmitter 3.3V Power Supply |
| 17 | VEET | Transmitter Ground |
| 18 | TD+ | Transmitter Non-Inverted Data Input, Differential LVPECL, AC coupled |
| 19 | TD- | Transmitter Inverted Data Input, Differential LVPECL, AC coupled |
| 20 | VEET | Transmitter Ground |

Note1: Tx Fault is open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply $<V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to $<0.8V$.

Note2: Tx Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7K~10KΩ resistor. 1) Low(0~0.8V): Transmitter on; 2) Between(0.8V and 2V): Undefined; 3) High (2.0~ V_{ccT}): Transmitter Disabled; 4) Open: Transmitter Disabled.

Note3: These are the module definition pins. They should be pulled up with a 4.7K~10KΩ resistor on the host board to supply less than $V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. MOD_ABS is grounded by the module to indicate that the module is present.

Note4: Rx_LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply $<V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to $<0.8V$.

Note5: No connect on this module.



Digital Diagnostic Functions

As defined by the SFP MSA (SFF-8472) Ficer's SFP 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

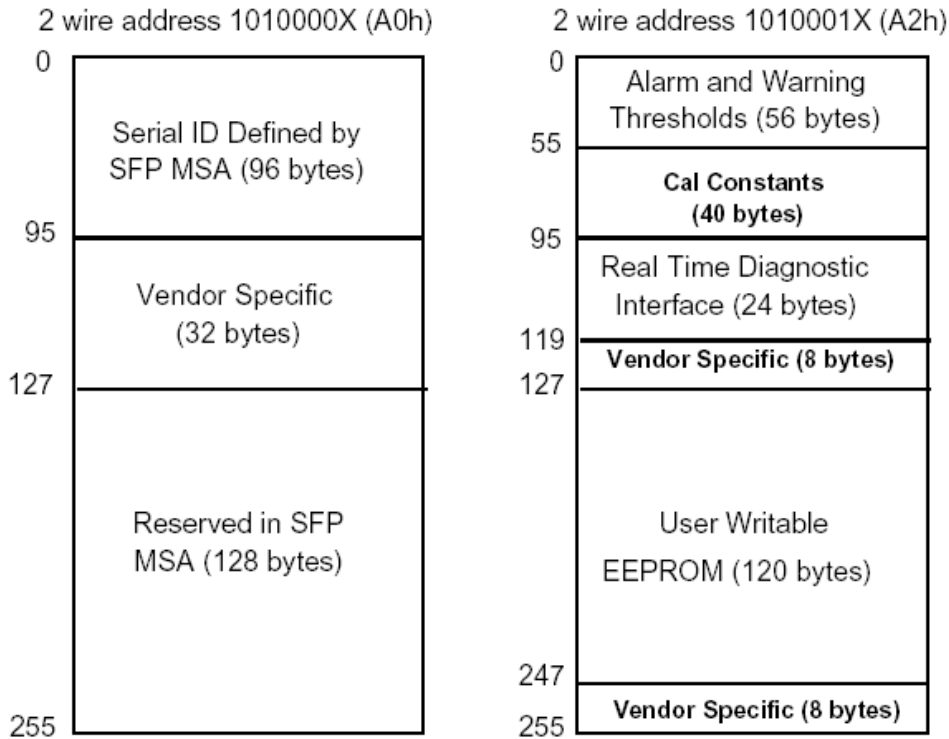
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) 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 SFP transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the SFP 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.

For more detailed information including memory map definitions, please see the SFP MSA (SFF-8472) Specification.



Digital Diagnostic Memory Map

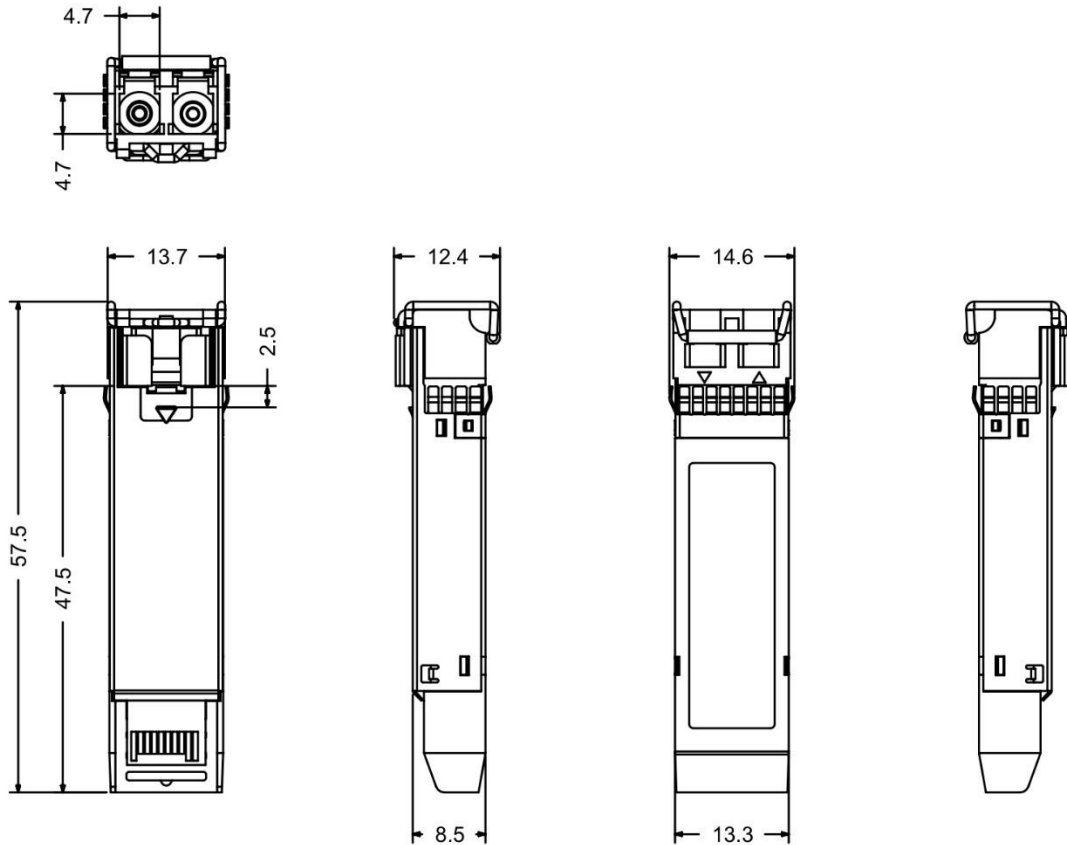


Digital Diagnostic Monitoring Characteristics

| Parameter | Accuracy | Unit | Note |
|---------------------------|----------|------|----------------------|
| Temperature | ±3 | °C | Internal Calibration |
| Supply Voltage | ±0.1 | V | Internal Calibration |
| Tx Bias Current | ±5 | mA | Internal Calibration |
| Tx Output Power | ±3 | dB | Internal Calibration |
| Rx Received Optical Power | ±3 | dB | Internal Calibration |



Mechanical Dimensions



(All Dimensions are $\pm 0.20\text{mm}$ Unless Otherwise Specified, Unit: mm)

Ordering Information

| Part No. | Tx | Rx | Link | DDM | Temp. |
|------------------|--------|-------------|-------------|-----|----------|
| FSFP-E7-S13-40D | 1310nm | 1260nm | SMF 40km | Yes | 0~70°C |
| FSFP-E7-S13-40Di | | ~ 1610nm | | | -40~85°C |

Note: Distances are indicative only. To calculate a more precise link budget based on specific conditions in your application, please refer to the optical characteristics.