# 1000BASE-LH SFP 1310nm 20KM DDM SMF Transceiver

# P/N: AE-SFP-LH

## Features

- Dual data-rate of 1.25Gbps/1.063Gbps operation
- 1310nm FP laser and PIN photodetector for 20km transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring: Internal Calibration or External Calibration
- Compatible with SONET OC-24-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature: Standard: 0 to +70°C Industrial: -40 to +85°C

## Applications

- Gigabit Ethernet
- Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

## I. Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | Vcc | -0.5 | 4.5 | V |
| Storage Temperature | Ts | -40 | +85 | °C |
| Operating Humidity | - | 5 | 85 | % |

## II. Recommended Operating Conditions

| Parameter | | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Case Temperature | Standard | Tc | 0 | | +70 | °C |
| | Industrial | | -40 | | +85 | °C |
| Power Supply Voltage | | Vcc | 3.13 | 3.3 | 3.47 | V |
| Power Supply Current | | Icc | | | 300 | mA |
| Data Rate | Gigabit Ethernet | | | 1.25 | | Gbps |
| | Fiber Channel | | | 1.063 | | |

## III. Optical and Electrical Characteristics

| Parameter | | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | | |
| Centre Wavelength | | λc | 1260 | 1310 | 1360 | nm | |
| Spectral Width (RMS) | | Δλ | | | 4 | nm | |
| Average Output Power | | Pout | -9.5 | | -3 | dBm | 1 |
| Extinction Ratio | | ER | 9 | | | dB | |
| Optical Rise/Fall Time (20%~80%) | | tr/tf | | | 0.26 | ns | |
| Data Input Swing Differential | | $V_{IN}$ | 400 | | 1800 | mV | 2 |
| Input Differential Impedance | | $Z_{IN}$ | 90 | 100 | 110 | Ω | |
| TX Disable | Disable | | 2.0 | | Vcc | V | |
| | Enable | | 0 | | 0.8 | V | |
| TX Fault | Fault | | 2.0 | | Vcc | V | |
| | Normal | | 0 | | 0.8 | V | |
| **Receiver** | | | | | | | |
| Centre Wavelength | | λc | 1260 | | 1580 | nm | |
| Receiver Sensitivity | | | | | -23 | dBm | 3 |
| Receiver Overload | | | -3 | | | dBm | 3 |
| LOS De-Assert | | $LOS_D$ | | | -22 | dBm | |
| LOS Assert | | $LOS_A$ | -35 | | | dBm | |
| LOS Hysteresis | | | 1 | | 4 | dB | |
| Data Output Swing Differential | | Vout | 400 | | 1800 | mV | 4 |
| LOS | | High | 2.0 | | Vcc | V | |
| | | Low | | | 0.8 | V | |

***Notes:***

*1. The optical power is launched into SMF.*

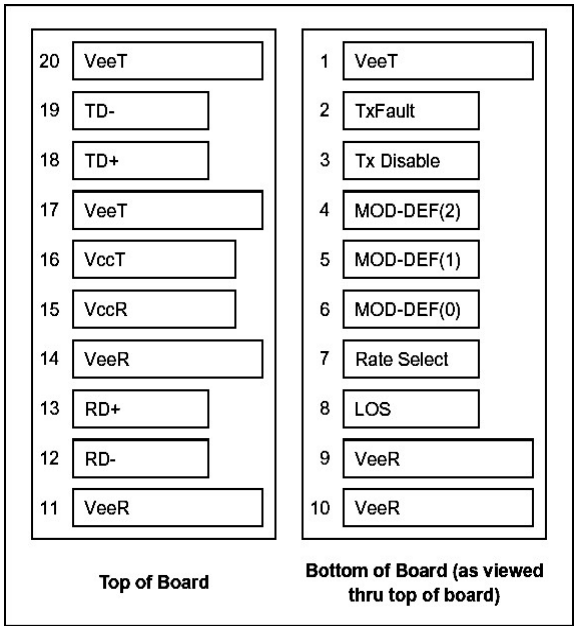
*2. PECL input, internally AC-coupled and terminated.*

*3. Measured with a PRBS 27-1 test pattern @1250Mbps, BER ≤1×10-12. 4. Internally AC-coupled.*

## IV. Timing and Electrical

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Tx Disable Negate Time | t_on | | | 1 | ms |
| Tx Disable Assert Time | t_off | | | 10 | μs |
| Time To Initialize, including Reset of Tx Fault | t_init | | | 300 | ms |
| Tx Fault Assert Time | t_fault | | | 100 | μs |
| Tx Disable To Reset | t_reset | 10 | | | μs |
| LOS Assert Time | t_loss_on | | | 100 | μs |
| LOS De-assert Time | t_loss_off | | | 100 | μs |
| Serial ID Clock Rate | f_serial_clock | | | 400 | KHz |
| MOD_DEF (0:2)-High | $V_H$ | 2 | | Vcc | V |
| MOD_DEF (0:2)-Low | $V_L$ | | | 0.8 | V |

## V. Pin Definitions




## VI. 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.*

*1) 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 Vcc+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.*

*2) 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*

*3) 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 VccT or VccR.*
*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*

*4) LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and Vcc+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.*

*5) 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.*

*6) TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.*

## VII. Ordering information

| Part Number | Product Description |
|---|---|
| AE-SFP-LH | SFP, 1.25Gb/s, 1310nm, SMF, 20KM, DDM, LC connector, 0°C to +70°C |
| AE-SFP-LHI | SFP, 1.25Gb/s, 1310nm, SMF, 20KM, DDM, LC connector, -40°C to +85°C |