Alpha Bridge® Technologies

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# Alpha Bridge ASFP28-25G-LR Datasheet

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## Features

- Compliant to IEEE802.3by 25GBASE-LR
- Up to 25.78Gb/s data links
- 25G 1310nm DFB transmitter
- 25G PIN photo-detector
- 2-wire interface for management specifications compliantwith SFF-8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature: 0 to 70°C
- All-metal housing for superior EMI performance
- 25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 1.5W
- Advanced firmware allows customer system encryption information to be stored in the transceiver
- RoHS compliant

## Applications

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

## Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit | Notes |
|---|---|---|---|---|---|
| Storage Temperature | Tc | -40 | 85 | °C | |
| Operating Case Temperature | Tc | 0 | 70 | °C | |
| Supply Voltage | Vcc | 0 | 3.6 | V | |
| Relative Humidity | RH | 5 | 85 | % | |
| Damage Threshold | THd | 3.5 | | dBm | |

## Recommended Operating Conditions

| Parameter | Symbol | Min | Type | Max | Unit |
|---|---|---|---|---|---|
| Case Operating Temperature | Tc | 0 | | 70 | °C |
| Power Supply Voltage | Vcc | 3.135 | 3.3 | 3.465 | V |
| Data Rate, each Lane | | | 25.78125 | | Gb/s |
| Data Rate Accuracy | | -100 | | 100 | ppm |
| Control Input Voltage High | | 2 | | Vcc | V |
| Control Input Voltage Low | | 0 | | 0.8 | V |
| Link Distance with G.652 | D | 0.002 | | 10 | km |

## Digital Diagnostics Functions

| Parameter | Symbol | Accuracy | Unit | Notes |
|---|---|---|---|---|
| Temperature monitor absolute error | DMI_Temp | ± 3 | °C | Over operating Temp |
| Supply voltage monitor absolute error | DMI_VCC | ±0.1 | V | Full operating range |
| RX power monitor absolute error | DMI_RX | ± 2 dB | dB | 1 |
| Bias Current monitor | DMI_Ibias | ± 10% | mA | |
| Laser power monitor absolute error | DMI_TX | ± 2 dB | dB | 1 |

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

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## Transmitter Electro-optical Characteristics

| Parameter | Symbol | Min | Typ. | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Power Consumption | | | | 1.5 | W | |
| Supply Current | Icc | | | 450 | mA | |
| Overload Differential Voltage pk-pk | TP1a | 900 | | | mV | |
| Common Mode Voltage (Vcm) | TP1 | -350 | | 2850 | mV | 1 |
| Differential Termination Resistance Mismatch | TP1 | | | 10 | % | At 1MHz |
| Differential Return Loss (SDD11) | TP1 | See CEI-28G-VSR Equation 13-19 VSR Equation | | | dB | |
| Common Mode to Differential Conversion and Differential to Common Mode Convention  (SDC11, SDC11) | TP1 | See CEI-28G-VSR Equation 13-20 | | | dB | |
| Stressed Input Test | TP1a | See CEI-28G-VSR Section 13.3.11.2.1 | | | | |
| Center Wavelength | $\lambda t$ | 1295 | | 1325 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB | |
| Average Optical Power | Pavg | -7 | --- | 2 | dBm | |
| OMA | POMA | -4 | | 2.2 | dBm | 2 |
| Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP) | | -5 | | | dBm | |
| Transmitter Dispersion Penalty | TDP | | | 2.7 | dB | |
| Extinction Ratio | ER | 3 | --- | --- | dB | |
| Relative Intensity Noise | RIN20OMA | | | -130 | dB/Hz | |
| Optical Return Loss Tolerance | TOL | --- | --- | 20 | dB | |
| Transmitter Reflectance | RT | | | -26 | dB | |
| Average Launch Power OFF Transmitter | Poff | | | -30 | dBm | |
| Eye Mask {X1, X2, X3, Y1, Y2, Y3} | | {0.31, 0.4, 0.45, 0.34, 0.38, 0.4} | | | | 3 |

Notes:

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. Even if the TDP < 1 dB, the OMA min must exceed the minimum value specified here.
3. Hit ratio $5 \times 10^{-5}$ per sample.

## Receiver Electro-optical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Differential Voltage, pk-pk | TP4 | | | 900 | mV | |
| Common Mode Voltage (Vcm) | TP4 | -350 | | 2850 | mV | 1 |
| Common Mode Noise, RMS | TP4 | | | 17.5 | mV | |
| Differential Termination Resistance Mismatch | TP4 | | | 10 | % | At 1MHz |
| Differential Return Loss (SDD22) | TP4 | See CEI-28G- VSR Equation 13-19 | | | dB | |
| Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22) | TP4 | See CEI-28G- VSR Equation 13-21 | | | dB | |
| Common Mode Return Loss (SCC22) | TP4 | | | -2 | dB | 2 |
| Transition Time, 20 to 80% | TP4 | 9.5 | | | ps | |
| Vertical Eye Closure (VEC) | TP4 | | | 5.5 | dB | |
| Eye Width at 10-15 probability (EW15) | TP4 | 0.57 | | | UI | |
| Eye Height at 10-15 probability (EH15) | TP4 | 228 | | | mV | |
| Center Wavelength | $\lambda r$ | 1295 | | 1325 | nm | |
| Damage Threshold | THd | 3 | | | dBm | 3 |
| Average Receive Power | | -14 | | 2 | dBm | |

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| Parameter | Symbol | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|
| Receive Power (OMA) | | | | 2.2 | dBm | |
| Receiver Sensitivity (OMA) | SEN | | | -12.1 | dBm | for BER =5x10-5 |
| Stressed Receiver Sensitivity (OMA) | | | | -9.5 | dBm | 4 |
| Receiver Reflectance | RR | | | -26 | dB | |
| LOS Assert | LOSA | -30 | | | dBm | |
| LOS Deassert | LOSD | | | -14 | dBm | |
| LOS Hysteresis | LOSH | 0.5 | | | dB | |
| Receiver Electrical 3 dB upper Cutoff | | | | | | |
| Frequency | Fc | | | 31 | G/Hz | |
| **Conditions of Stressed Receiver Sensitivity Test (Note 5)** | | | | | | |
| Vertical Eye Closure Penalty, each Lane | | | 2.5 | | dB | |
| Stressed Eye J2 Jitter | | | 0.27 | | UI | |
| Stressed Eye J4 Jitter | | | 0.39 | | UI | |
| SRS Eye Mask Definition {$X_1$, $X_2$, $X_3$, $Y_1$, $Y_2$, $Y_3$} Hit ratio 5x10$^{-5}$ per sample | {0.31, 0.4, 0.45, 0.34, 0.38, 0.4} | | | | | |

Notes

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.

2. From 250MHz to 30GHz.

3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signalhaving this power level on one lane. The receiver does not have to operate correctly at this input power.

4. Measured with conformance test signal at receiver input for BER = 5x10-5.

5. Vertical eye closure penalty, stressed eye J2 jitter, stressed eye J4 jitter, and SRS eye mask definition are testconditions for measuring stressed receiver sensitivity. They are not the required characteristics of the receiver.

## Block Diagram of Transceiver
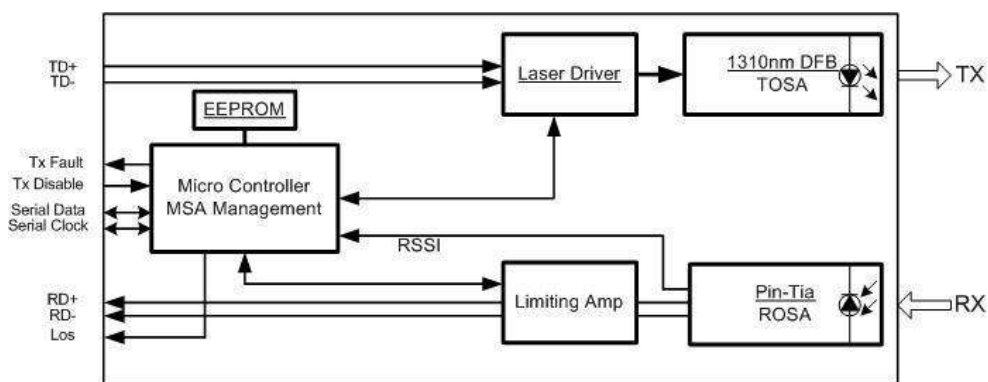


This 1310 nm DFB 25Gb/s SFP28 LR transceiver is designed to transmit and receive optical data over single modeoptical fiber for link length up to 10km.

The module optical connection is duplex LC and shall be compatible with SFP+ 28Gbps and backward compatible with legacy 10G SFP+ pluggable. The SFP28 LR module is a dual directional device with a transmitter and receiverplus 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 module operates by a single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt

and Low Power Mode, are available with the modules. The SFP28 LR module electricalinterface is compliant to OFI CEI-VSR-28G-VSR. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

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 supplyvoltage 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 SFP28is 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.

## Pin Assignment
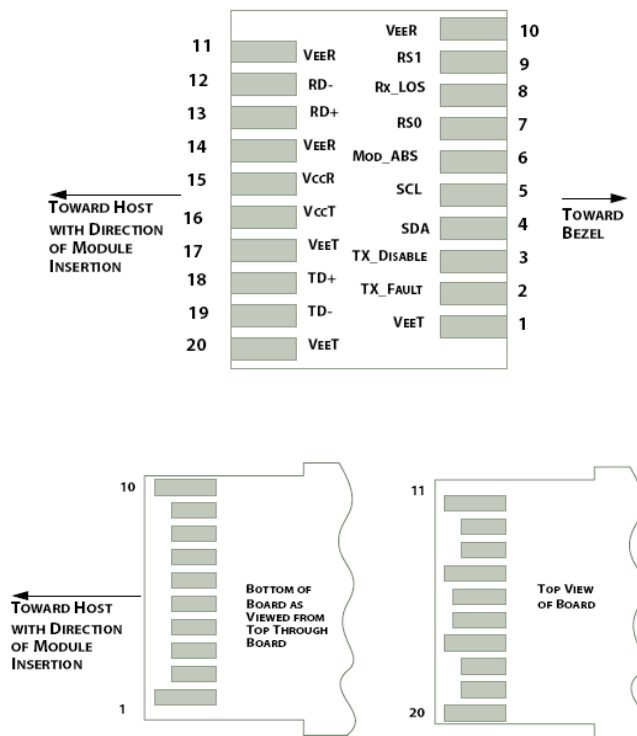
## Pin Descriptions

| Pin | Logic | Symbol | Name/Description | Notes |
|---|---|---|---|---|
| 1 | | VeeT | Module Transmitter Ground | 1 |
| 2 | LVTTL-O | TX_Fault | Module Transmitter Fault | |
| 3 | LVTTL-I | TX_Dis | Transmitter Disable; Turns off transmitter laser output | |
| 4 | LVTTL-I/O | SDA | 2-Wire Serial Interface Data Line | 2 |
| 5 | LVTTL-I | SCL | 2-Wire Serial Interface Clock | 2 |
| 6 | | MOD_DEF0 | Module Definition, Grounded in the module | |
| 7 | LVTTL-I | RS0 | Receiver Rate Select | |
| 8 | LVTTL-O | RX_LOS | Receiver Loss of Signal Indication Active LOW | |
| 9 | LVTTL-I | RS1 | Transmitter Rate Select (not used) | |
| 10 | | VeeR | Module Receiver Ground | 1 |
| 11 | | VeeR | Module Receiver Ground | 1 |
| 12 | CML-O | RD- | Receiver Inverted Data Output | |
| 13 | CML-O | RD+ | Receiver Data Output | |
| 14 | | VeeR | Module Receiver Ground | 1 |
| 15 | | VccR | Module Receiver 3.3 V Supply | |
| 16 | | VccT | Module Receiver 3.3 V Supply | |
| 17 | | VeeT | Module Transmitter Ground | 1 |
| 18 | CML-I | TD+ | Transmitter Non-Inverted Data Input | |
| 19 | CML-I | TD- | Transmitter Inverted Data Input | |
| 20 | | VeeT | Module Transmitter Ground | 1 |

## Dimensions

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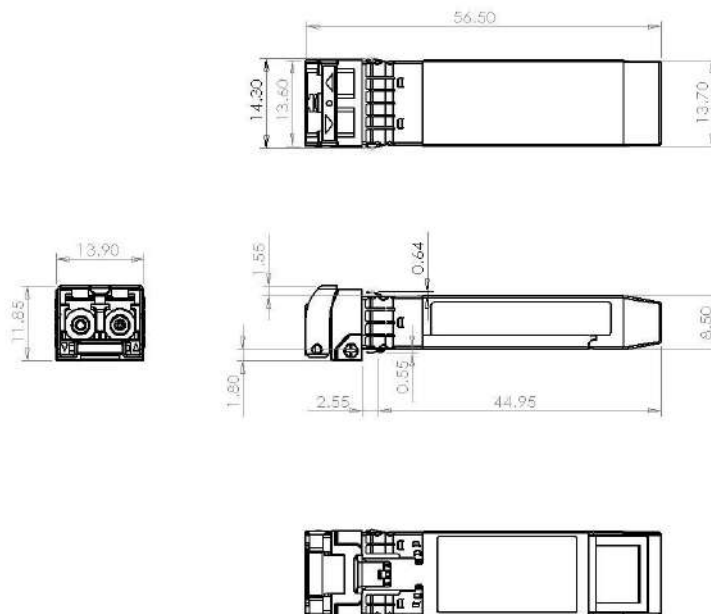
## Optical Receptacle Cleaning Recommendations:

All fiber stubs inside the receptacle portions were cleaned before shipment.  In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen.   If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid.   Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.
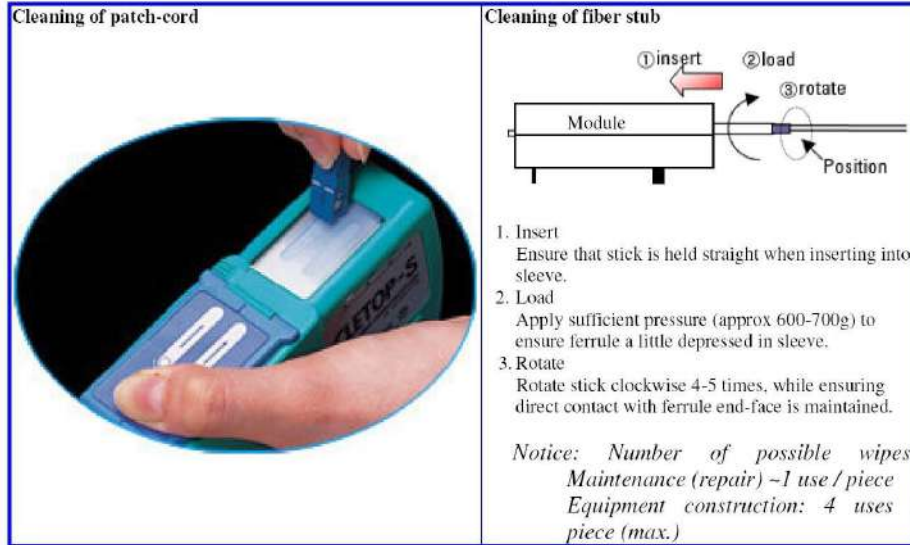


Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

## Ordering Information

| Model Number | Part Number | Reach | Input/Output | Signal Detect | Voltage | Temperature |
|---|---|---|---|---|---|---|
| SFP28-25G-LR | OPAX-S10-13-CB | 10km | AC/AC | TTL | 3.3V | 0°C to 70 °C |
| SFP28-25G-LR-I | OPAX-S10-13-CB | 10km | AC/AC | TTL | 3.3V | -40°C to 85 °C |

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