# Specification

## Small Form Factor Pluggable

Duplex LC Receptacle – SFP

## Optical Transceivers

STM-1 / OC-3 / 100BASE
155.52Mbit/s



## Ordering Information

**T S P - S x A A 1 - M 1 1**

**Voltage / Temperature**
1 : 3.3V / +0℃~ +70℃
2 : 3.3V / -40 ℃~ +85℃

| Model Name | Voltage | Category | Device type | Interface | SD/LOS | Temperature | Distance | Latch Color |
|---|---|---|---|---|---|---|---|---|
| TSP-S1AA1-M11 | 3.3V | W/O DDMI | FP / PIN | AC / AC Coupling | LVTTL | +0°C~+70°C | 60km | Blue |
| TSP-S2AA1-M11 | | | | | | -40°C~+85°C | | |

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## Features

- ROHS Compliant
- Standard Small Form Factor Pluggable Package – SFP MSA Compliant
- SONET/SDH Standard Compliant
- Fast Ethernet Standard Compliant
- Laser Class 1 Product – IEC60825-1 Compliant
- Standard Duplex LC Receptacle Optical Interface
- Single + 3.3 V Power Supply
- Differential LVPECL Data Input and Output
- LVTTL Loss of Signal
- Serial ID through $I^2C$ Interface
- Low Power Consumption

## Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Storage temperature | $T_S$ | -40 | -- | 85 | °C |
| Supply voltage | $V_{CC}$ | 0 | -- | 4 | V |
| Operating Relative Humidity | -- | 5 | -- | 95 | % |
| Input voltage | $V_{IN}$ | 0 | -- | $V_{CC}$ | V |

## Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 3.1 | 3.3 | 3.5 | V |
| Operating Case temperature ( TSP-S1AA1-M11 ) | Tc | 0 | -- | 70 | °C |
| Operating Case temperature ( TSP-S2AA1-M11 ) | | -40 | -- | 85 | |
| Total Current ( Transmitter + Receiver ) | Icc | -- | -- | 250 | mA |

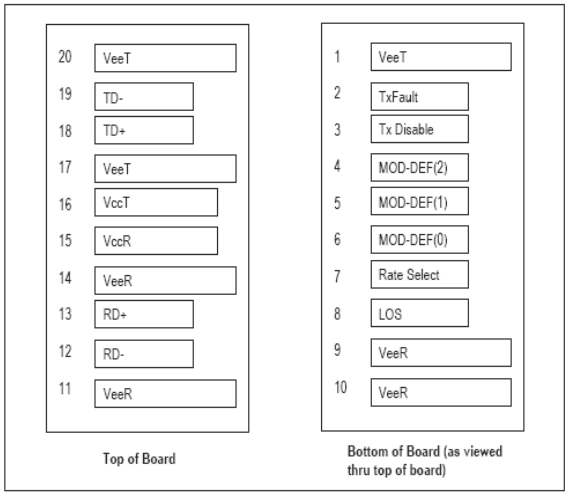
## Transmitter Specifications ( $V_{CC}$=3.1V~3.5V ; Tc= 0°C~70°C / Tc= -40°C~85°C )

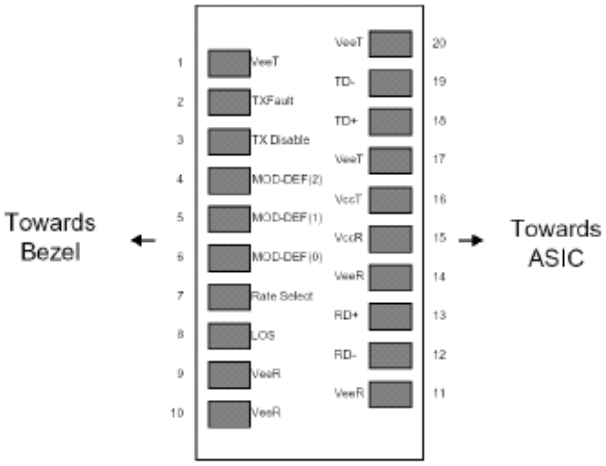
| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Optical Characteristics** | | | | | |
| Output Optical Power | $P_{out}$ | -5 | -- | 0 | dBm |
| Extinction Ratio | ER | 9 | -- | -- | dB |
| Center Wavelength | $\lambda_C$ | 1270 | 1310 | 1355 | nm |
| Spectral Width (RMS) | $\sigma$ | -- | -- | 2.5 | nm |
| Rise/Fall time (10-90%) | $T_{r,f}$ | -- | -- | 2 | ns |
| Relative Intensity Noise | RIN | -- | -- | -120 | dB/Hz |
| Output Eye | Compliant with ITU-T G.957 | | | | |
| Max. $P_{out}$ TX-DISABLE Asserted | $P_{OFF}$ | -- | -- | -45 | dBm |
| **Electrical Characteristics** | | | | | |
| Differential Input Voltage | $V_{DIFF}$ | 0.4 | -- | 2.0 | V |
| Tx_Disable_Input_High | $V_{DISH}$ | 2.0 | -- | $V_{CC}$+0.3 | V |
| Tx_Disable_Input_Low | $V_{DISL}$ | 0 | -- | 0.8 | V |
| Tx_Fault_Output_High | $V_{FH}$ | 2.0 | -- | $V_{CC}$+0.3 | V |
| Tx_Fault_Output_Low | $V_{FL}$ | 0 | -- | 0.8 | V |

## Receiver Specifications ( $V_{CC}$=3.1V~3.5V ; Tc= 0°C~70°C / Tc= -40°C~85°C )

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Optical Characteristics** | | | | | |
| Optical Input Power-maximum | $P_{SATIN}$ | -3 | -- | -- | dBm |
| Receiver Sensitivity ( PRBS=$2^{23}$-1 ; BER≦$10^{-10}$ ) | $P_{SAN}$ | -- | -- | -35 | dBm |
| Operating Center Wavelength | $\lambda_c$ | 1260 | -- | 1610 | nm |
| Optical Return Loss | ORL | 12 | -- | -- | dB |
| Loss of Signal – De-asserted | $P_{LD}$ | -- | -- | -35 | dBm |
| Loss of Signal - Asserted | $P_{LA}$ | -45 | -- | -- | dBm |
| Loss of Signal - Hysteresis | $P_{LH}$ | 0.5 | -- | 6 | dB |
| **Electrical Characteristics** | | | | | |
| Differential Output Voltage | $V_{DIFF}$ | 0.4 | -- | 2.0 | V |
| Receiver Loss of Signal Output Voltage -Low | $V_{LOSL}$ | 0 | -- | 0.8 | V |
| Receiver Loss of Signal Output Voltage -High | $V_{LOSH}$ | 2 | -- | $V_{CC}$+0.3 | V |

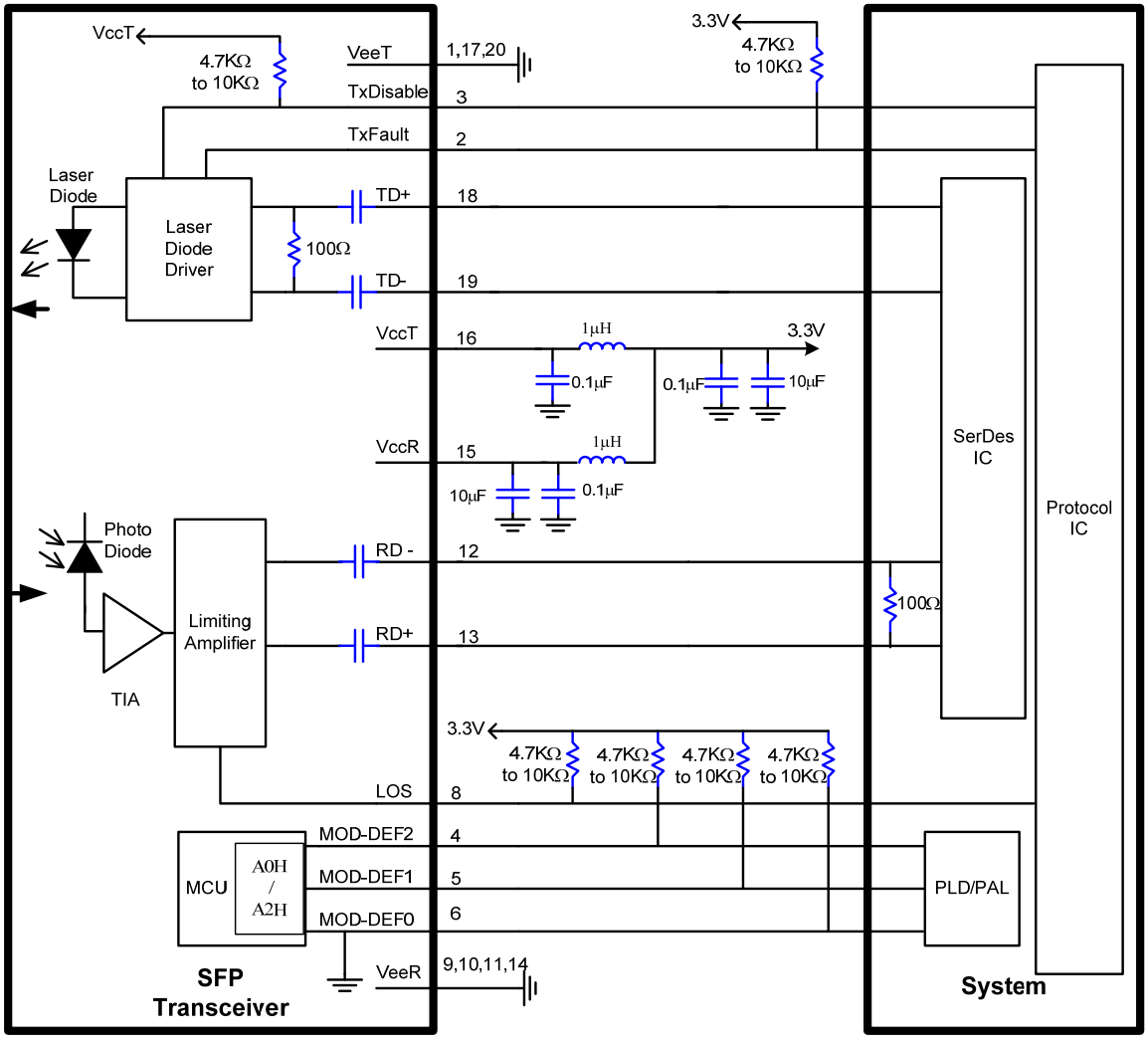
## Pin Definition and Descriptions




| Pin | Name | Input/Output Level | Description |
|---|---|---|---|
| 1 | VeeT | Input | Transmitter ground |
| 2 | TXFault | Output/LVTTL | Laser failure indication. High level indicates “laser failure”. Externally pulled up |
| 3 | TXDisable | Input/LVTTL | Transmitter disable, High signal/open disables TX laser output. Low level enables TX output, internally pulled up. |
| 4 | MOD-DEF(2) | Input/output | Module definition 2, SDA, Data line for I2C bus. Externally pulled up |
| 5 | MOD-DEF(1) | Input | Module definition 1, SCL, Clock for I2C bus. Externally pulled up |
| 6 | MOD-DEF(0) | Output | Module definition 0, Module present. Ground inside module. |
| 7 | Rate Select | - | No connection. |
| 8 | LOS | Output/LVTTL | Receiver loss of signal indication. Low signal indicates optical signal is present at RX input. Should be Externally pulled up. |
| 9 | VeeR | Input | Receiver ground |
| 10 | VeeR | Input | Receiver ground |
| 11 | VeeR | Input | Receiver ground |
| 12 | RD - | Output/CML | Inverted receiver data output (AC coupled) |
| 13 | RD + | Output/CML | Non-inverted receiver data output (AC coupled) |
| 14 | VeeR | Input | Receiver ground |
| 15 | VccR | Input | Receiver power supply |
| 16 | VccT | Input | Transmitter power supply |
| 17 | VeeT | Input | Transmitter ground |
| 18 | TD + | Input/LVPECL | Non-inverted transmitter data input (AC coupled) |
| 19 | TD - | Input/LVPECL | Inverted transmitter data input (AC coupled) |
| 20 | VeeT | Input | Transmitter ground |

## Recommended Circuit Diagram



## Content in 2-Wire Address A0H

| Address | HEX | Name of Field | Description |
|---|---|---|---|
| 00 | 03 | Identifier | SFP |
| 01 | 04 | Extended Identifier | SFP |
| 02 | 07 | Connector type | LC |
| 03 | 00 | Infiniband Compliance Codes | Not compliant |
| 04 | 10 | SONET Compliance Codes | SONET LR-1 compliant |
| 05 | 04 | SONET Compliance Codes | OC-3, single mode, long reach |
| 06 | 00 | Ethernet Compliance Codes | Not compliant |
| 07 | 00 | Fiber Channel link length | Not compliant |
| 08 | 00 | Fiber Channel transmitter technology | Not compliant |
| 09 | 00 | Fiber Channel transmission media | Not compliant |
| 10 | 00 | Fiber Channel speed | Not compliant |
| 11 | 03 | Encoding codes: | NRZ |
| 12 | 02 | Nominal Bit Rate (units of 100Mbps) | 200Mbps |
| 13 | 00 | Rate identifier | Unspecified |
| 14 | 3C | Link length supported for 9um fiber | 60 (units of km) |
| 15 | FF | Link length supported for 9um fiber | 600 (units of 100m) |
| 16 | 00 | Link length supported for 50um,OM2 | N/A (units of 10m) |
| 17 | 00 | Link length supported for 62.5um,OM1 | N/A(units of 10m) |
| 18 | 00 | Link length supported for copper | N/A (units of 1m) |
| 19 | 00 | Link length supported for 50um,OM3 | N/A (units of 10m) |
| 20 ~ 35 | 46,4F,52,4D,45,52,49,43 ,41,4F,45,20,20,20,20,20 | Vendor Name | FORMERICAOE |
| 36 | 00 | Unallocated | |
| 37 ~ 39 | 00,00,00 | Vendor OUI | Unspecified |
| 40 ~ 55 | 54,53,50,2D,53,31(32),41,41 ,31,2D,4D,31,31,20,20,20 | Part Number | TSP-S1(2)AA1-M11 |
| 56 ~ 59 | 00,00,00,00 | Vendor Revision number | Unspecified |
| 60 ~ 61 | 05,1E | Laser Wavelength | 1310nm |
| 62 | 00 | Unallocated | |
| 63 | | CC_BASE: | Check sum of byte 0 ~ 62 |
| 64 | 00 | Options | |
| 65 | 1A | Options | TX-DIS, TX_FAULT, RX-LOS |
| 66 | 00 | Bit Rate, max. | Unspecified |
| 67 | 00 | Bit Rate, min. | Unspecified |
| 68 ~ 83 | Serial Number | Serial Number | |
| 84 ~ 89 | yy/mm/dd | Date Code | |
| 90 ~ 91 | 20,20 | Vendor specific lot code | Unspecified |
| 92 | 00 | Diagnostic Monitoring Type | W/O DDMI |
| 93 | 00 | Enhanced Options (soft) | Unallocated |
| 94 | 00 | SFF-8472 Compliance | Not Included |
| 95 | | CC_EXT | Check sum of byte 64 ~ 94 |
| 96~127 | | Vendor specific | |

## Mechanical Outlines

**( Unit : mm)**

