

## Features



- Support 10GBASE-LR/LW and CPRI wireless application
- Up to 10km transmission on SMF
- 1310nm DFB laser and PIN receiver
- SFI high speed electrical interface
- 2-wire interface with integrated Digital Diagnostic monitoring
- SFP+ MSA package with duplex LC connector
- Single +3.3V power supply
- Power consumption less than 1.0 W
- Operating case temperature: -5~+70 °C

## Regulatory Compliance

**Table 1 - Regulatory Compliance**

| Feature                                                   | Standard                                                           | Performance                                          |
|-----------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883E<br>Method 3015.7                                      | Class 1(>1000V for SFI pins, >2000V for other pins.) |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | IEC 61000-4-2<br>GR-1089-CORE                                      | Compatible with standards                            |
| Electromagnetic Interference (EMI)                        | FCC Part 15 Class B<br>EN55022 Class B (CISPR 22B)<br>VCCI Class B | Compatible with standards                            |
| Immunity                                                  | IEC 61000-4-3                                                      | Compatible with standards                            |
| Laser Eye Safety                                          | FDA 21CFR 1040.10 and 1040.11<br>EN60950, EN (IEC) 60825-1,2       | Compatible with Class I laser product.               |
| RoHS                                                      | 2011/65/EU                                                         | Compliant with standards                             |

## Absolute Maximum Ratings

**Table 2 - Absolute Maximum Ratings**

| Parameter                   | Symbol   | Min. | Typical | Max. | Unit | Notes |
|-----------------------------|----------|------|---------|------|------|-------|
| Storage Temperature         | $T_s$    | -40  | -       | +85  | °C   |       |
| Supply Voltage              | $V_{CC}$ | -0.5 | -       | +4.0 | V    |       |
| Operating Relative Humidity | RH       | -    | -       | +85  | %    |       |

## Recommended Operating Conditions

**Table 3 – Recommended Operating Conditions**

| Parameter                  | Symbol   | Min. | Typical | Max.   | Unit | Notes |
|----------------------------|----------|------|---------|--------|------|-------|
| Operating Case Temperature | $T_C$    | -5   | -       | +70    | °C   |       |
| Power Supply Voltage       | $V_{CC}$ | 3.14 | 3.3     | 3.47   | V    |       |
| Power Supply Current       | $I_{CC}$ | -    | -       | 290    | mA   |       |
| Power Dissipation          | $P_D$    | -    | -       | 1.0    | W    |       |
| Bit Rate                   | BR       | -    | 10.3125 | -      | Gbps |       |
| Transmission Distance      | TD       | 2    | -       | 10,000 | m    | 1     |

Note 1: Measured with SMF.

## Optical Characteristics

**Table 4 – Optical Characteristics**

| Transmitter                        |                                |      |         |       |      |       |
|------------------------------------|--------------------------------|------|---------|-------|------|-------|
| Parameter                          | Symbol                         | Min. | Typical | Max.  | Unit | Notes |
| Center Wavelength Range            | $\lambda_C$                    | 1260 | -       | 1355  | nm   |       |
| Average Output Power               | $P_{OUT}$                      | -8.2 | -       | 0.5   | dBm  | 1     |
| Optical Modulation Amplitude       | OMA                            | -5.2 | -       | -     | dBm  | 1     |
| Average Output Power (Laser Off)   | $P_{OUT-OFF}$                  | -    | -       | -30   | dBm  | 1     |
| Side Mode Suppression Ratio        | SMSR                           | 30   | -       | -     | dB   |       |
| Extinction Ratio                   | ER                             | 3.5  | -       | -     | dB   | 2     |
| Transmitter and Dispersion Penalty | TDP                            | -    | -       | 3.2   | dB   |       |
| Optical Return Loss Tolerance      | ORLT                           | -    | -       | 12    | dB   |       |
| Optical Eye Mask                   | Compliant with IEEE 802.3-2008 |      |         |       |      | 2     |
| Receiver                           |                                |      |         |       |      |       |
| Center Wavelength Range            | $\lambda_C$                    | 1260 | -       | 1355  | nm   |       |
| Receiver Sensitivity               | $P_{IN-SENS}$                  | -    | -       | -14.4 | dBm  | 3     |
| Receiver Sensitivity in OMA        | $P_{IN-SENS(OMA)}$             | -    | -       | -12.6 | dBm  | 3     |

|                      |             |     |   |     |     |   |
|----------------------|-------------|-----|---|-----|-----|---|
| Receiver Overload    | $P_{IN-OL}$ | 0.5 | - | -   | dBm | 3 |
| Receiver Reflectance | Ref         | -   | - | -12 | dB  |   |
| LOS Assert           | $LOS_A$     | -25 | - | -   | dBm |   |
| LOS Deassert         | $LOS_D$     | -   | - | -15 | dBm |   |
| LOS Hysteresis       | $LOS_H$     | 0.5 | - | -   | dB  |   |

Notes:

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{31}-1$  test pattern @10.3125Gbps.
3. Measured with a PRBS  $2^{31}-1$  test pattern @10.3125Gbps,  $BER \leq 10^{-12}$ .

## Electrical Characteristics

**Table 5 – Electrical Characteristics**

| Transmitter                        |                   |               |      |         |              |          |
|------------------------------------|-------------------|---------------|------|---------|--------------|----------|
| Parameter                          |                   | Symbol        | Min. | Typical | Max.         | Unit     |
| Differential Data Input Amplitude  |                   | $V_{IN,P-P}$  | 180  | -       | 700          | mVpp     |
| Input Differential Impedance       |                   | $Z_{IN}$      | 85   | 100     | 115          | $\Omega$ |
| Tx_Fault                           | Normal Operation  | $V_{OL}$      | -0.3 | -       | 0.4          | V        |
|                                    | Transmitter Fault | $V_{OH}$      | 2.4  | -       | $V_{CC}$     | V        |
| Tx_Disable                         | Normal Operation  | $V_{IL}$      | -0.3 | -       | 0.8          | V        |
|                                    | Laser Disable     | $V_{IH}$      | 2.0  | -       | $V_{CC}+0.3$ | V        |
| Receiver                           |                   |               |      |         |              |          |
| Differential Data Output Amplitude |                   | $V_{OUT,P-P}$ | 300  | -       | 850          | mVpp     |
| Output Differential Impedance      |                   | $Z_O$         | 80   | 100     | 120          | $\Omega$ |
| Rx_LOS                             | Normal Operation  | $V_{OL}$      | -0.3 | -       | 0.4          | V        |
|                                    | Lose Signal       | $V_{OH}$      | 2.4  | -       | $V_{CC}$     | V        |

## Recommended Host Board Power Supply Circuit

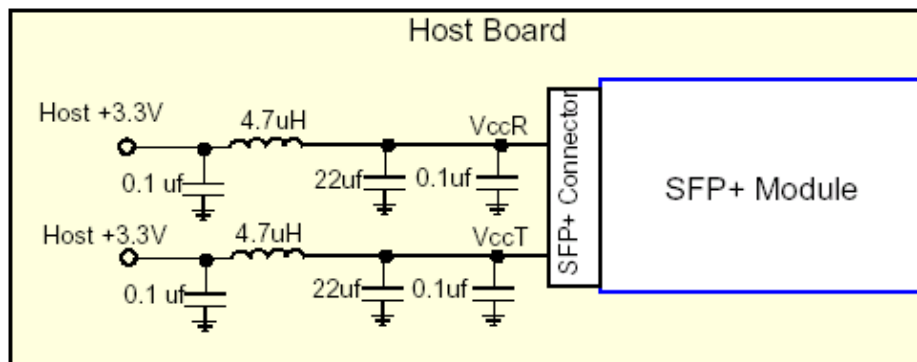


Figure 1, Recommended Host Board Power Supply Circuit

## Recommended Interface Circuit

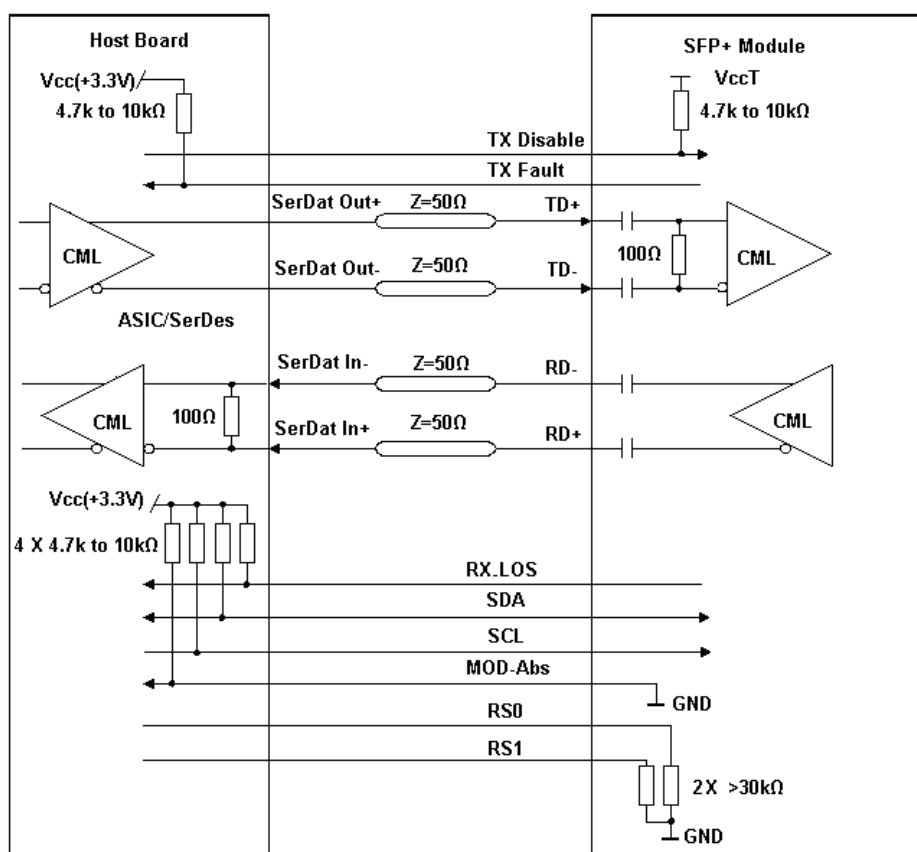
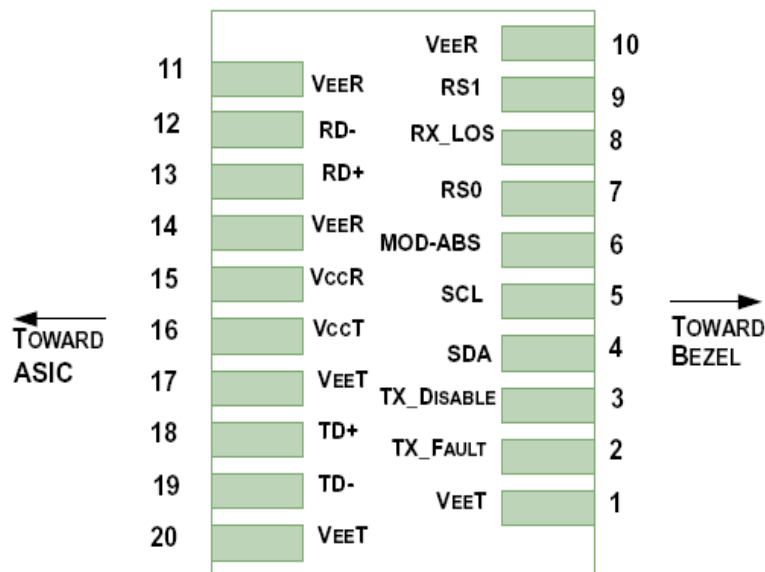


Figure 2, Recommended Interface Circuit

## Pin Definitions



**Figure 3, Pin View**

**Table 6–Pin Function Definitions**

| Pin | Logic     | Symbol        | Name/Description                                                                                                                                 | Note |
|-----|-----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1   |           | $V_{EE}T$     | Module Transmitter Ground                                                                                                                        | 1    |
| 2   | LVTTL-O   | $TX\_FAULT$   | Module Transmitter Fault                                                                                                                         | 2    |
| 3   | LVTTL-I   | $TX\_DISABLE$ | Transmitter Disable; Turns off transmitter laser output                                                                                          | 3    |
| 4   | LVTTL-I/O | SDL           | 2-Wire Serial Interface Data Line (MOD-DEF2)                                                                                                     |      |
| 5   | LVTTL-I/O | SCL           | 2-Wire Serial Interface Clock (MOD-DEF1)                                                                                                         |      |
| 6   |           | MOD_ABS       | Module Absent, connected to $V_{EE}T$ or $V_{EE}R$ in the module                                                                                 | 2    |
| 7   | LVTTL-I   | RS0           | Rate Select 0, NOT implement                                                                                                                     | 4    |
| 8   | LVTTL-O   | $RX\_LOS$     | Receiver Loss of Signal Indication (in FC designated as $RX\_LOS$ , in SONET designated as LOS, and in Ethernet designated as NOT Signal Detect) | 2    |
| 9   | LVTTL-I   | RS1           | Rate Select 1, NOT implement                                                                                                                     | 4    |
| 10  |           | $V_{EE}R$     | Module Receiver Ground                                                                                                                           | 1    |
| 11  |           | $V_{EE}R$     | Module Receiver Ground                                                                                                                           | 1    |
| 12  | CML-O     | RD-           | Receiver Inverted Data Output                                                                                                                    |      |
| 13  | CML-O     | RD+           | Receiver Non-Inverted Data Output                                                                                                                |      |
| 14  |           | $V_{EE}R$     | Module Receiver Ground                                                                                                                           | 1    |
| 15  |           | $V_{CC}R$     | Module Receiver 3.3 V Supply                                                                                                                     |      |
| 16  |           | $V_{CC}T$     | Module Transmitter 3.3 V Supply                                                                                                                  |      |
| 17  |           | $V_{EE}T$     | Module Transmitter Ground                                                                                                                        | 1    |
| 18  | CML-I     | TD+           | Transmitter Non-Inverted Data Input                                                                                                              |      |
| 19  | CML-I     | TD-           | Transmitter Inverted Data Input                                                                                                                  |      |
| 20  |           | $V_{EE}T$     | Module Transmitter Ground                                                                                                                        | 1    |

## Notes:

1. The module ground pins are isolated from the module case.
2. The pins shall be pulled up with 4.7K-10Kohms to a voltage between 3.14V and 3.46V on host board.
3. The pin is pulled up to  $V_{CCT}$  with a 4.7K-10K $\Omega$  resistor in the module.
4. The pins are pulled low to  $V_{EE}$  with a >30k $\Omega$  resistor in the module.

## Mechanical Diagram

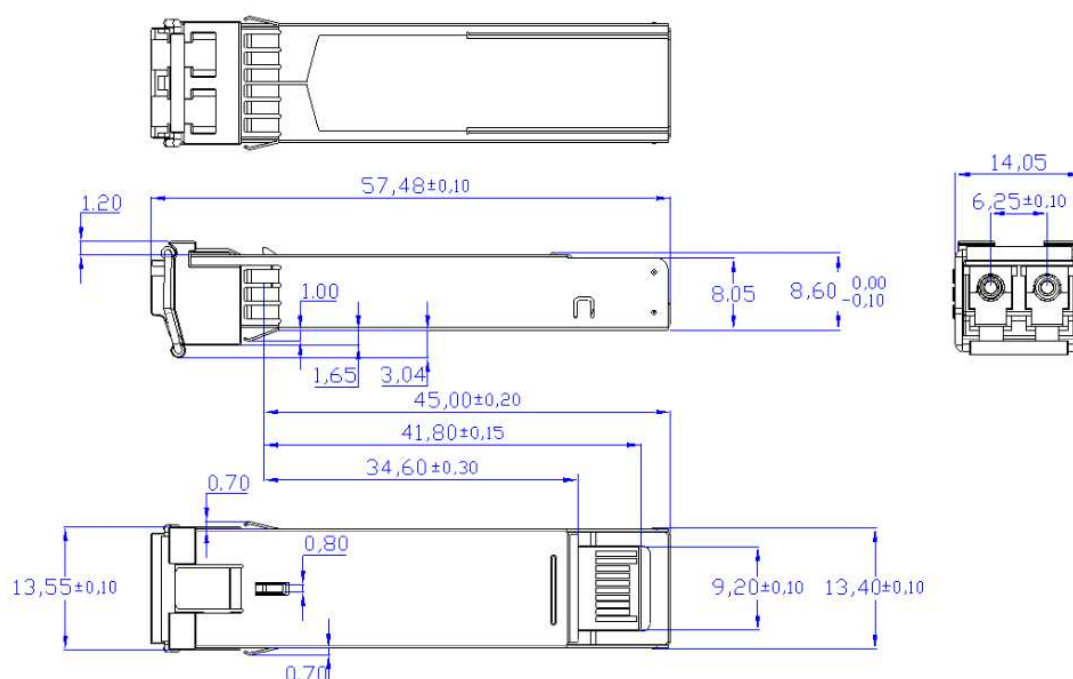


Figure 4, Mechanical Diagram of SFP+

## Order Information

Table 7 – Order Information

| Part No.        | Application           | Data Rate | Laser Source | Fiber Type |
|-----------------|-----------------------|-----------|--------------|------------|
| SPP-10E-LR-CDFF | CPRI<br>10GBASE-LR/LW | 10.3125G  | 1310nm DFB   | SMF        |

## Warnings

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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