



### Features

- Support 10GBASE-ZR/W and SONET/SDH application
- Support multi-rate from 9.953G to 11.1G
- Up to 80km transmission on SMF
- 1550nm EML laser and APD receiver
- Dual CDR integrated
- 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 2W
- Operating case temperature: -5~+85°C

### Regulatory Compliance

**Table 1 - Regulatory Compliance**

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E 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 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Immunity	IEC 61000-4-3	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 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	-	+85	°C	
Power Supply Voltage	$V_{CC}$	3.14	3.3	3.47	V	
Power Supply Current	$I_{CC}$	-	450	575	mA	
Power Dissipation	$P_D$	-	1.5	2.0	W	
Bit Rate	BR	9.953	-	11.1	Gbps	
Transmission Distance	TD	2	-	80,000	m	1

Note 1: Measured with G.652 SMF.

## Optical Characteristics

**Table 4 – Optical Characteristics**

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Center Wavelength Range	$\lambda_C$	1530	-	1565	nm	
Average Output Power	$P_{OUT}$	0	2	4	dBm	1
Average Output Power (Laser Off)	$P_{OUT-OFF}$	-	-	-35	dBm	1
Extinction Ratio	ER	9	-	-	dB	2
Side Mode Suppression Ratio	SMSR	35	-	-	dB	
Dispersion Penalty @ 9.95/10.7Gbps	$DP_1$	-	-	2	dB	3, 4
Dispersion Penalty @ 11.1Gbps	$DP_2$	-	-	3	dB	3, 5
Jitter Generation (peak-to-peak)	$J_{P-P}$	-	-	0.1	UI	
Jitter Generation (RMS)	$J_{RMS}$	-	-	0.01	UI	
Optical Eye Mask	Compatible with IEEE 802.3-2008 and ITU-T G.691-2006					2
Receiver						
Center Wavelength Range	$\lambda_C$	1530	-	1565	nm	
Receiver Sensitivity @ 9.95/10.7Gbps	$P_{IN-SENS1}$	-	-25	-24	dBm	3

Receiver Sensitivity @ 11.1Gbps	$P_{IN-SENS2}$	-	-24	-23	dBm	3
Receiver Overload	$P_{IN-OL}$	-7	-	-	dBm	3
Receiver Reflectance	Ref	-	-	-27	dB	
LOS Assert	$LOS_A$	-34	-		dBm	
LOS De-assert	$LOS_D$	-	-	-24	dBm	
LOS Hysteresis	$LOS_H$	0.5	-	4	dB	

**Notes:**

1. The optical power is launched into SMF.
2. Measured with a PRBS  $2^{31}-1$  test pattern @9.953Gbps.
3. Measured with a PRBS  $2^{31}-1$  test pattern,  $BER \leq 10^{-12}$ .
4. At 1600 ps/nm.
5. At 1450 ps/nm

## Electrical Characteristics

**Table 5 – Electrical Characteristics**

Transmitter							
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
Differential Data Input Amplitude	$V_{IN,P-P}$	190	-	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

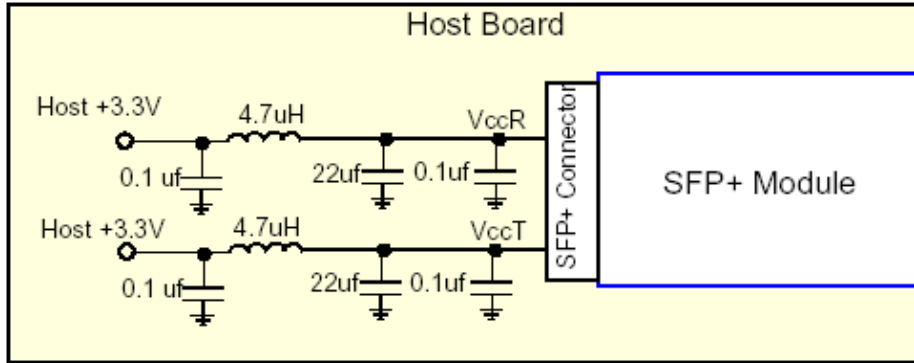


Figure 1, Recommended Host Board Power Supply Circuit

## Recommended Interface Circuit

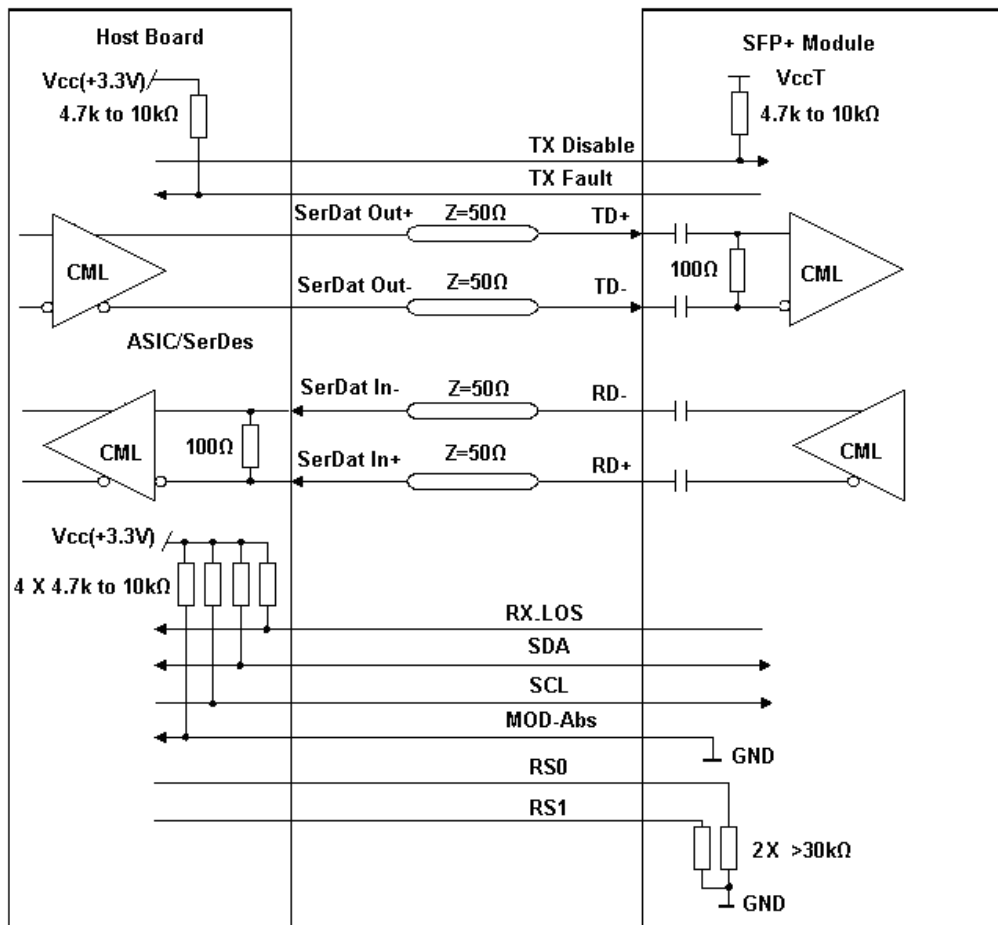


Figure 2, Recommended Interface Circuit

## Pin Definitions

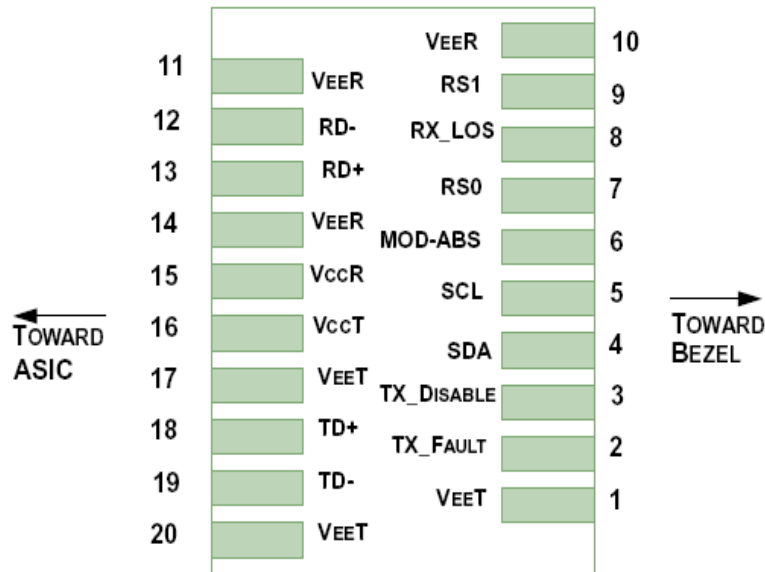


Figure 3, Pin View

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 3.47V on host board.
3. The pin is pulled up to  $V_{CC}T$  with a 4.7K-10K $\Omega$  resistor in the module.
4. The pins are pulled low to  $V_{EE}T$  with a >30k $\Omega$  resistor in the module.

**Mechanical Diagram**

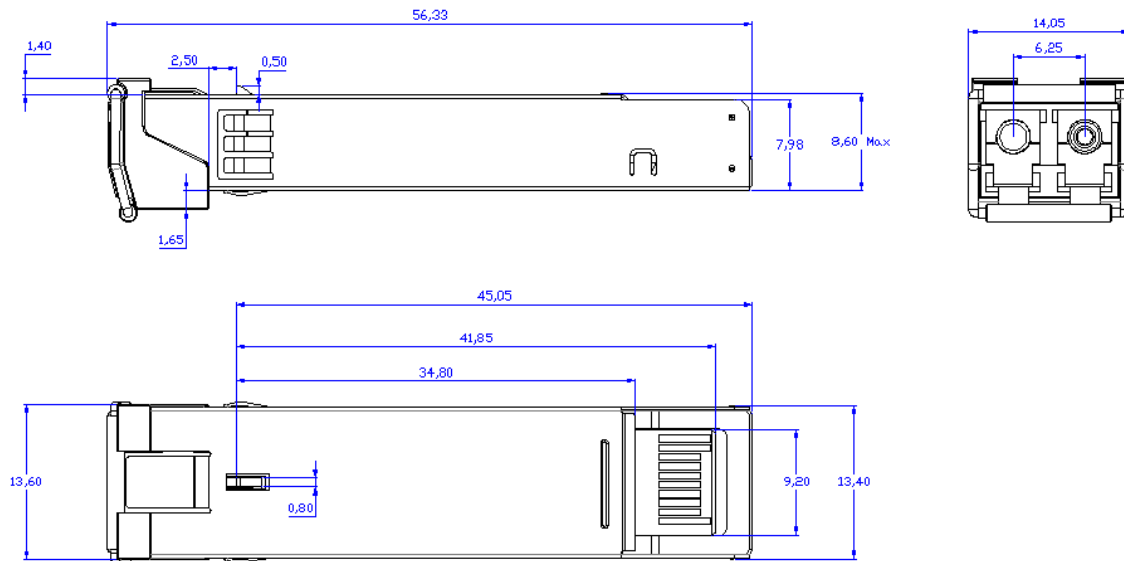


Figure 4, Mechanical Diagram of SFP+

**Order Information**

Table 7 – Order Information

Part No.	Application	Data Rate	Laser Source	Fiber Type	Latch Color
SPP-10S-ZR-EDFB	P1L1-2D2 10GBASE-ZR/W	9.953~11.1G	1550nm EML	SMF	White

**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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