



### Features

- Support 10GBASE-LRM application
- Up to 220m transmission in MMF
- 1310nm FP laser and PIN receiver with linear amplifier
- 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 1.5 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 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 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class I laser product.
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	Compliant with standards <sup>note</sup>

Note:

In light of item 5 in Annex of 2002/95/EC, "Pb in the glass of cathode ray tubes, electronic components and fluorescent tubes." and item 13 in Annex of 2005/747/EC, "Lead and cadmium in optical and filter glass.", the two exemptions are being concerned for Source Photonics transceivers, because Source Photonics transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

## Absolute Maximum Ratings

Table 2 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T <sub>S</sub>	-40	-	+85	°C	
Supply Voltage	V <sub>CC</sub>	-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 <sub>C</sub>	-5	-	+70	°C	
Power Supply Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Power Supply Current	I <sub>CC</sub>	-	-	430	mA	
Power Dissipation	P <sub>D</sub>	-	-	1.5	W	
Bit Rate	BR	-	10.3125	-	Gbps	
Transmission Distance	TD	2	-	220	m	1

Note 1: Measured with MMF.

## 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	$P_{OUT}$	-6.5	-	0.5	dBm	1
Optical Modulation Amplitude	OMA	-4.5	-	1.5	dBm	1
Average Output Power (Laser Off)	$P_{OUT-OFF}$	-	-	-30	dBm	1
Extinction Ratio	ER	3.5	-	-	dB	2
RMS spectral width	$\triangle\lambda$	-	-	4	nm	
Transmitter Waveform and Dispersion Penalty	TWDP	-	-	4.7	dB	
Optical Return Loss Tolerance	ORLT	-	-	20	dB	
Optical Eye Mask	Compliant with IEEE 802.3aq-2006					2
Receiver						
Center Wavelength Range	$\lambda_C$	1260	-	1355	nm	
Stress Sensitivity in OMA	$P_{IN-OMA}$			-6.5	dBm	3

Stressed sensitivity in OMA for symmetrical test	$P_{IN-OMA}$			-6	dBm	3
Overload in OMA	$P_{IN-OMA}$	1.5			dBm	3
Received average power for damage	$P_{IN-damage}$	1.5			dBm	
Receiver Reflectance				-12	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	Notes
Differential Data Input Amplitude		V <sub>IN,P-P</sub>	180	-	700	mVpp	
Input Differential Impedance		Z <sub>IN</sub>	85	100	115	Ω	
Tx_Fault	Normal Operation	V <sub>OL</sub>	-0.3	-	0.4	V	
	Transmitter Fault	V <sub>OH</sub>	2.4	-	V <sub>CC</sub>	V	
Tx_Disable	Normal Operation	V <sub>IL</sub>	-0.3	-	0.8	V	
	Laser Disable	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	
Receiver							
Differential Data Output Amplitude		V <sub>OUT,P-P</sub>	120	-	600	mVpp	
Output Differential Impedance		Z <sub>O</sub>	80	100	120	Ω	
Output Rise Time, 20%~80%		T <sub>R</sub>	28	-	-	ps	
Output Fall Time, 20%~80%		T <sub>F</sub>	28	-	-	ps	

## Recommended Host Board Power Supply Circuit

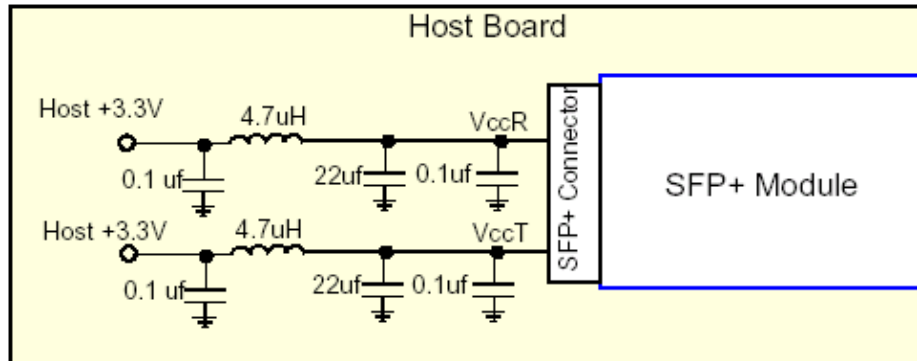


Figure 1, Recommended Host Board Power Supply Circuit

## Recommended Interface Circuit

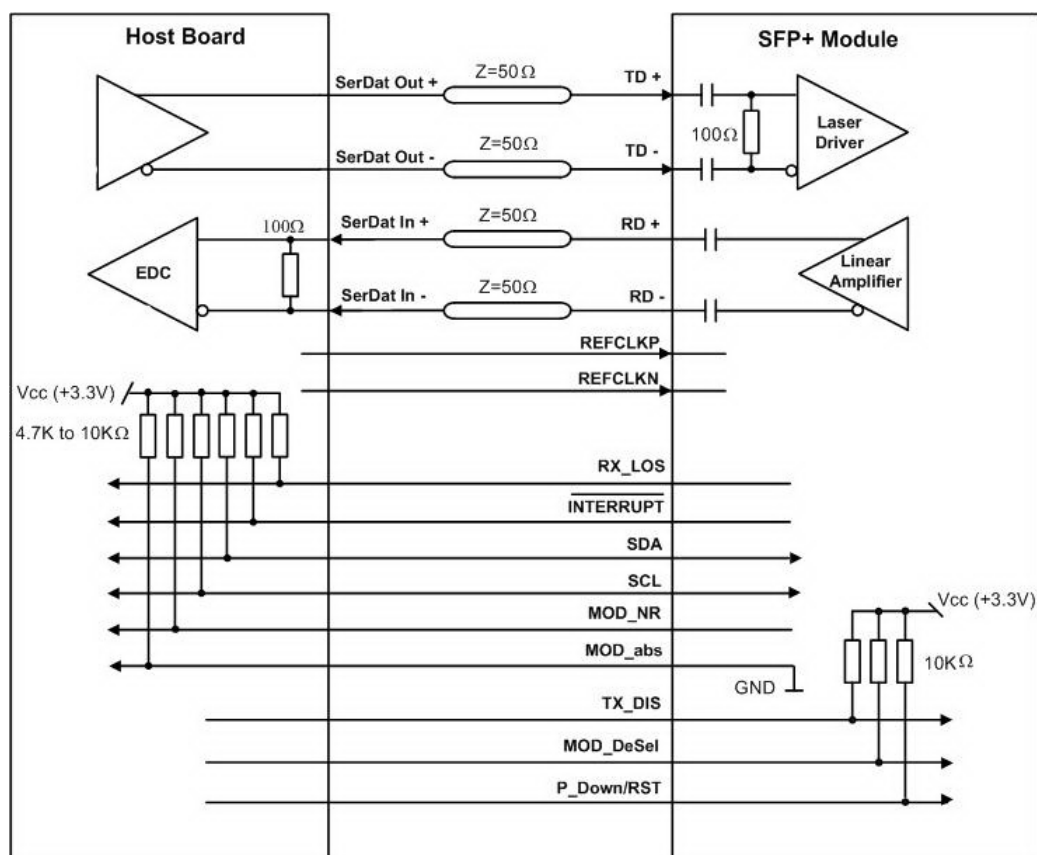


Figure 2, Recommended Interface Circuit

## Pin Definitions

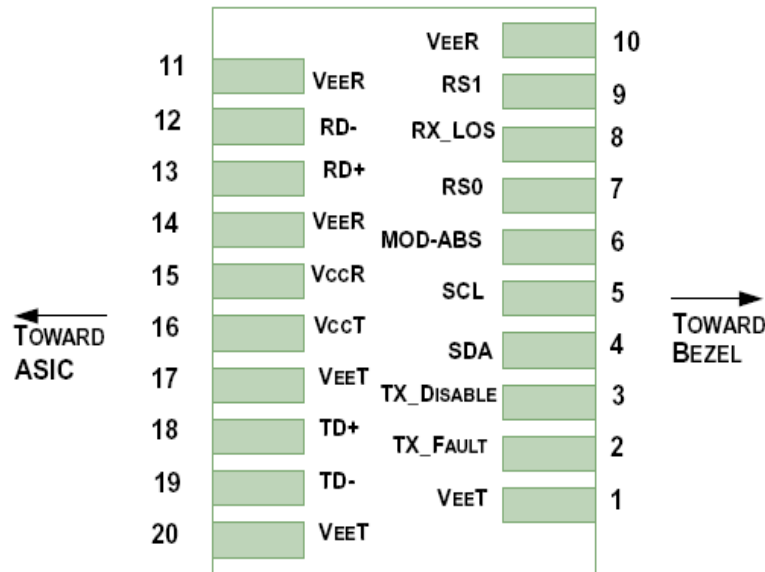


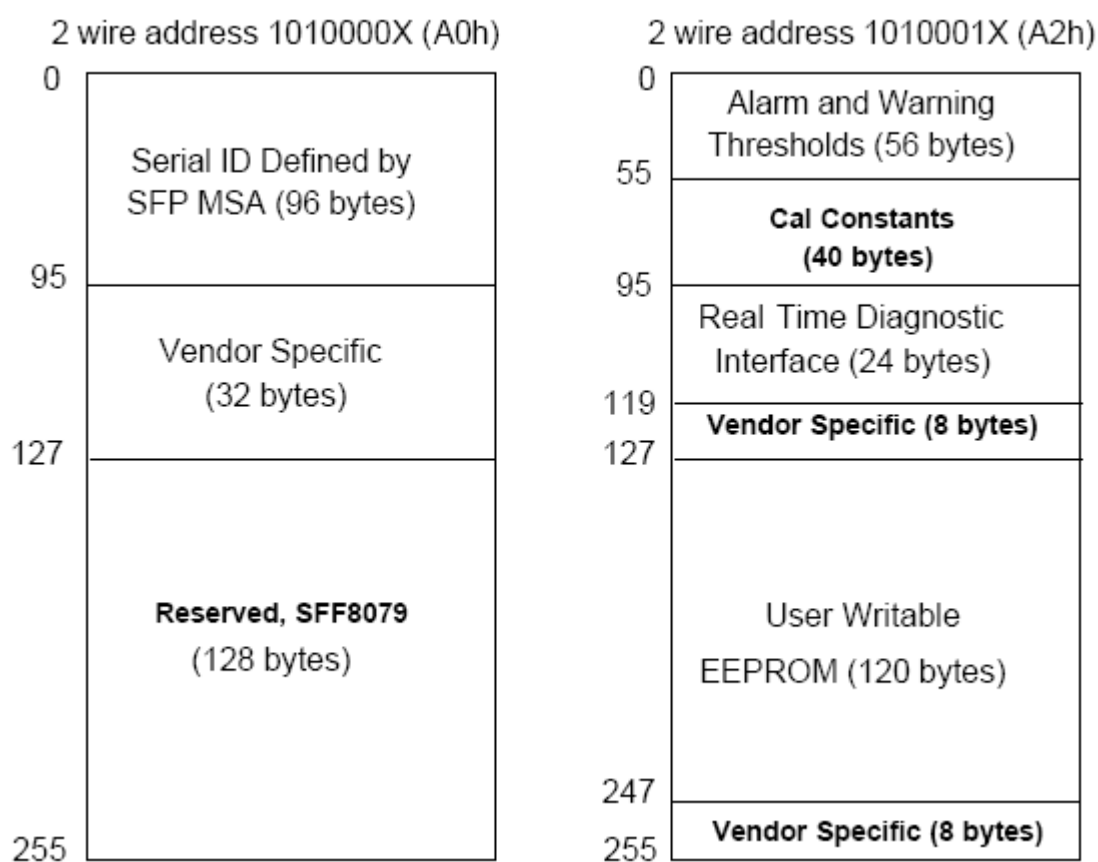
Figure 3, Pin View

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  $V_{EET}$  with a >30k $\Omega$  resistor in the module.

**EEPROM Information**

**Figure 4, 2-wire Serial Digital Diagnostic Memory Map**
**Table 7 – Digital Diagnostic Specification (A2h)**

Data Address	Parameter	Range	Accuracy
96-97	Temperature	-10 to +80°C	±3°C
98-99	$V_{CC}$ Voltage	+3.0V to +3.7V	±3%
100-101	Tx Bias Current	0 to 100mA	±10%
102-103	TX Output Power	-7 to +1dBm	±3dB
104-105	RX Input Power	-15 to +1dBm	±3dB

**Table 8 –EEPROM Serial ID Memory Contents (A0h)**

Addr.	Bytes	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	SFP with Serial ID
2	1	Connector	07	LC
3-10	8	Transceiver	40 00 00 00 00 00 00 00	10GBASE-LRM
11	1	Encoding	03	NRZ
12	1	BR, nominal	67	10.3G
13	1	Rate identifier	00	Not specified
14	1	Length (9um)-km	00	
15	1	Length (9um)	00	
16	1	Length (50um, OM2)	16	220m
17	1	Length (62.5um,OM1)	16	220m
18	1	Length (copper)	00	
19	1	Length (50um, OM3)	16	220m
20-35	16	Vendor name	53 4F 55 52 43 45 50 48 4F 54 4F 4E 49 43 53 20	“SOURCEPHOTONICS “(ASC II )
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	Not specified
40-55	16	Vendor PN	53 50 50 31 30 45 4C 4D 43 44 46 41 20 20 20 20	“SPP10ELMCDFA” (ASC II )
56-59	4	Vendor rev	xx xx xx xx	ASC II
60-61	2	Wavelength	05 1E	1310nm
62	1	Reserved	00	
63	1	CC BASE	xx	Check sum of bytes 0-62
64-65	2	Options	02 3A	Table 3.7 of SFF-8472, rev 10.3
66	1	BR, max	00	Not specified
67	1	BR, min	00	Not specified
68-83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASC II
84-91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92	1	Diagnostic type	68	Diagnostics (internally calibrated)
93	1	Enhanced option	FA	Table 3.10 of SFF-8472, rev 10.3
94	1	SFF-8472 Compliance	03	SFF-8472 Rev 10 compliant
95	1	CC_EXT	xx	Check sum of bytes 64-94
96-255	160	Vendor specific		Reserved by vendor



## Mechanical Diagram

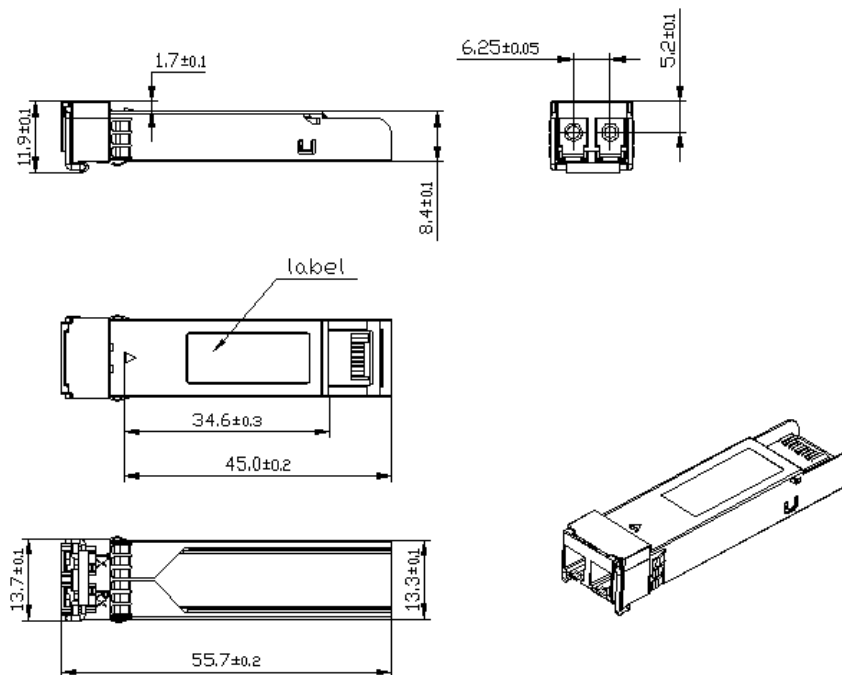


Figure 5, Mechanical Diagram of SFP+

## Order Information

Table 9 – Order Information

Part No.	Application	Data Rate	Laser Source	Fiber Type
SPP-10E-LM-CDFA	10GBASE-LRM	10.3125G	1310nm FP	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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