



### Features:

- Built-in PHY supporting SGMII Interface
- Built-in high performance MCU supporting easier configuration
- Dual data-rate of 100BASE-LX/1000BASE-LX operation
- 1310nm FP laser and PIN photo-detector
- Up to 2km transmission with MMF at 125Mbps
- Up to 550m transmission with MMF at 1.25Gbps
- Standard serial ID information Compatible with SFP MSA
- SFP MSA package with duplex LC connector
- With Spring-Latch for high density application
- +3.3V single power supply
- Operating case temperature: -40 to +85°C
- Commercial temperature: -5 to +70°C

### Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B	Compliant with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2	Compliant with Class I laser product.
RoHS	EU 2011/65/EU	RoHS With Exemption 7C(I)

## Absolute Maximum Ratings

Table 1 - 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	-	+3.6	V	
Operating Relative Humidity	RH	+5	-	+95	%	

## Recommended Operating Conditions

Table 2 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T <sub>c</sub>	-40		+85	°C	I temp
		-5		+70	°C	C temp
Power Supply Voltage	V <sub>CC</sub>	3.13	3.3	3.47	V	
Power Consumption	P <sub>D</sub>	-	-	1.5	W	
Data Rate	1000BASE-LX		1250		Mbps	
	100BASE-FX		125			

## Optical Characteristics

Table 3 – Optical Characteristics

Transmitter							
Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength		λ <sub>c</sub>	1260	1310	1360	nm	
Average Output Power	1000BASE-LX	P <sub>Out</sub>	-11.5		-3	dBm	1
	100BASE-LX	P <sub>Out</sub>	-20		-14		1
P <sub>Out</sub> @TX Disable Asserted		P <sub>Out</sub>			-45	dBm	1
Spectral Width (RMS)	1000BASE-LX	σ			4	nm	
	100BASE-LX				7.7		
Extinction Ratio		ER	9			dB	
Rise/Fall Time (20%~80%)	1000BASE-LX	t <sub>r</sub> /t <sub>f</sub>			0.26	ns	2
	100BASE-LX				3		
Total Jitter at TP2	1000BASE-LX	J <sub>T</sub>			0.481	UI	3
	100BASE-LX				0.4		
Deterministic Jitter at TP2	1000BASE-LX	J <sub>D</sub>			0.250		3
	100BASE-LX				0.305		

Output Optical Eye		Compatible with IEEE 802.3					4
Receiver							
Centre Wavelength		$\lambda_c$	1260	1310	1570	nm	
Receiver Sensitivity	1000BASE-LX				-22	dBm	5
	100BASE-LX				-28		6
Receiver Overload	1000BASE-LX		-3			dBm	5
	100BASE-LX		-8				6
Return Loss			12			dB	
LOS De-Assert	1000BASE-LX	LOS <sub>D</sub>			-23	dBm	
	100BASE-LX				-23		
LOS Assert	1000BASE-LX	LOS <sub>A</sub>	-45			dBm	
	100BASE-LX		-45				
LOS Hysteresis			0.5		4.5	dB	
Total Jitter at TP4	SGMII	J <sub>T</sub>			0.749	UI	3
Deterministic Jitter at TP4	SGMII	J <sub>D</sub>			0.462	UI	

**Notes:**

1. The optical power is launched into 62.5/125um SMF.
2. Unfiltered, measured with 8B/10B code for 1.25Gbps and 4B/5B code for 125Mbps
3. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.
4. Measured with 8B/10B code for 1.25Gbps and 4B/5B code for 125Mbps.
5. Measured with 8B/10B code for 1.25Gbps, worst-case extinction ratio, and BER  $\leq 1 \times 10^{-12}$ .
6. Measured with 4B/5B code for 125Mbps, worst-case extinction ratio, and BER  $\leq 1 \times 10^{-12}$ .

## Electrical Characteristics

**Table 4 – Electrical Characteristics**

Transmitter							
Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Swing Differential (SGMII Series interface)		V <sub>IN</sub>	200		2100	mV	1
Input Differential Impedance		Z <sub>IN</sub>	80	100	120	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V	
	Enable		V <sub>ee</sub>		V <sub>ee</sub> +0.8		
TX Fault	Fault		2.0		V <sub>cc</sub>	V	
	Normal		V <sub>ee</sub>		V <sub>ee</sub> +0.5		
Receiver							
Data Output Swing Differential (SGMII Series Interface)		V <sub>OUT</sub>	370		2000	mV	1
LOS	High		2.0		V <sub>cc</sub> +0.3	V	

	Low		Vee		Vee+0.5	
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Notes:

1. PECL logic, internally AC coupled.

### Recommended Host Board Power Supply Circuit

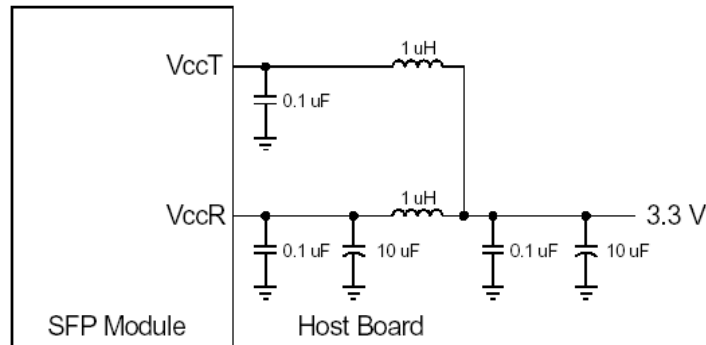


Figure 1, Recommended Host Board Power Supply Circuit

### Recommended Interface Circuit

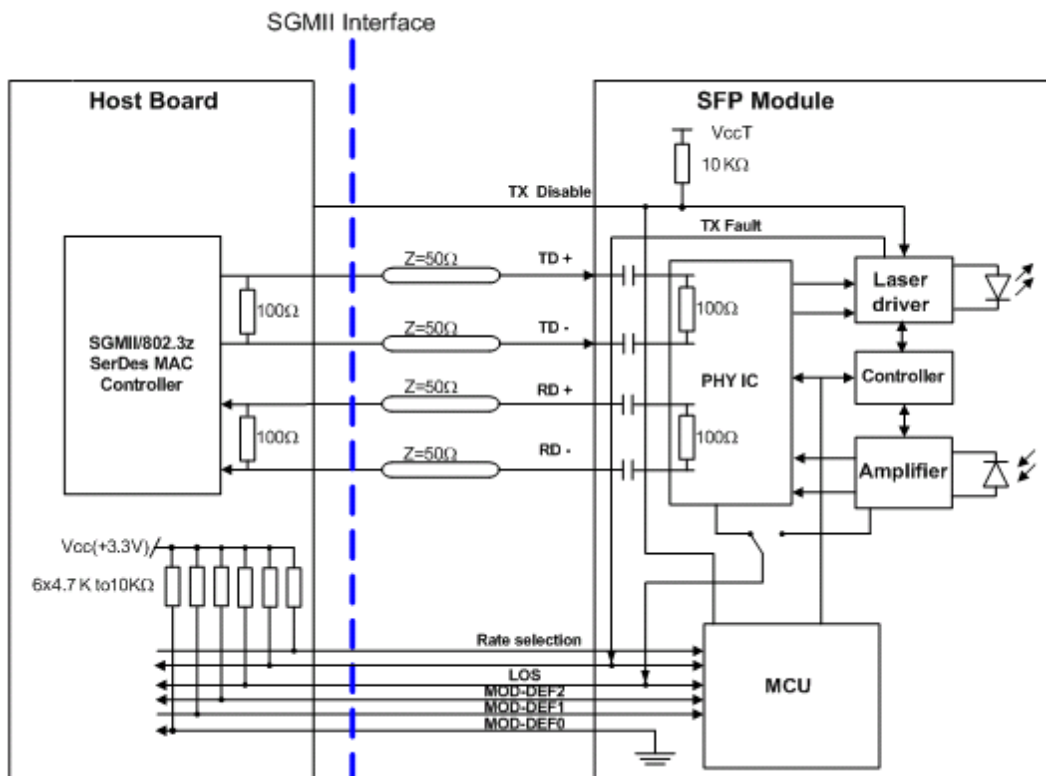


Figure 2, Recommended Interface Circuit

## Pin Definitions

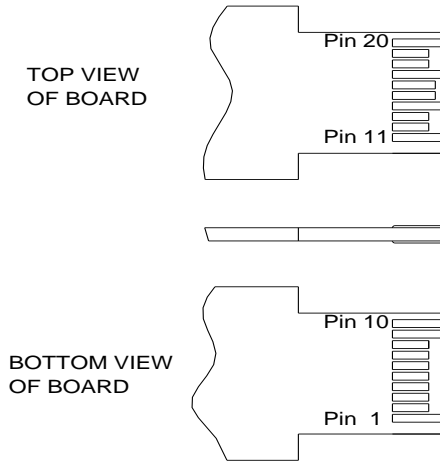


Figure 1, Pin View

Table 6 - Pin Function Definitions

Pin No.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2
4	MOD-DEF2	Module Definition 2	3	Note 3
5	MOD-DEF1	Module Definition 1	3	Note 3
6	MOD-DEF0	Module Definition 0	3	Note 3
7	Rate Select	Not Use	3	
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power	2	
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	VeeT	Transmitter Ground	1	

**Notes:**

- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.

2. TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:
  - Low (0~0.8V): Transmitter on
  - (>0.8V, <2.0V): Undefined
  - High (2.0~3.465V): Transmitter Disabled
  - Open: Transmitter Disabled
3. MOD-DEF 0,1,2 are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
  - MOD-DEF 0 is grounded by the module to indicate that the module is present
  - MOD-DEF 1 is the clock line of two wire serial interface for serial ID
  - MOD-DEF 2 is the data line of two wire serial interface for serial ID
4. LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates loss of signal or link down with partner I. In the low state, the output will be pulled to less than 0.8V.
5. These are the differential receiver output. They are internally AC-coupled 100Ω differential lines which should be terminated with 100Ω (differential) at host with SGMII interface.
6. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module.

## EEPROM Information

Table 7 - EEPROM Serial ID Memory Contents (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3-10	8	Transceiver	00 00 00 22 00 00 00 00	
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25Gb/s
13	1	Reserved	00	
14	1	Length (9um)-km	00	
15	1	Length (9um)m	00	
16	1	Length (50um)	37	550m
17	1	Length (62.5um)	37	550m
18	1	Length (copper)	00	
19	1	Reserved	00	
20-35	16	Vendor name	xx	"SOURCEPHOTONICS "(ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	00 1F 22	

40-55	16	Vendor PN	xx	"SPGDRFXxDFD" (ASCII)
56-59	4	Vendor rev	31 30 20 20	ASCII(1.0 revision)
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	xx	
66	1	BR, max	00	
67	1	BR, min	00	
68-83	16	Vendor SN	xx	ASCII
84-91	8	Vendor date code	xx	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92	1	Diagnostic type	68	Diagnostics(Int.Cal)
93	1	Enhanced option	xx	
94	1	SFF-8472	02	Diagnostics(SFF-8472 Rev 9.4)
95	1	CC_EXT	xx	Check sum of bytes 64 - 94
96-255	160	Vendor specific	xx	

## Recommended Software configuration

### How to configure auto-negotiation, loopback, work speed

The module can support auto-negotiation, loopback configuration.

Please refer the following steps to configure:

Step 1: Access the module at 0xA2 via two-wire serial interface.

Step 2: Configure 0x6Dh/6Eh (Byte 109~110) as below table. Addr.109 default is "1Fh". Addr.110 default is "00h".

Addr. 109	Function	"1"	"0"	Default Value (BIN)
bit7	FEFI Status	FEFI condition detected	FEFI condition not detected	'0'
bit6	Fiber Auto-Negotiation	Disable	Enable	'0'
Bit5	MAC Auto-Negotiation	Disable	Enable	'0'
bit4	FEFI function	Disable	Enable	'1'
bit3	CRC checker	Disable/Reset	Enable	'1'
bit2	Fiber loop back	Disable	Enable	'1'
bit1	MAC loop back	Disable	Enable	'1'
bit0	Reserved	Reserved	Reserved	'1'

Addr. 110	Function	“1”	“0”	Default Value (BIN)
bit7	TX Disable State	TX-Disable	TX-Enable	'0'
bit6	TX-Disable	TX-Disable	TX-Enable	'0'
Bit5~Bit4	Reserved	Reserved	Reserved	'0'
Bit3	Work speed mode	1000Base	100Base	'0'
Bit2	TX fault output status	TX fault indication	No fault	'0'
Bit1	LOS pin output status	LOS asserted (Link down)	LOS de-asserted (Link up)	'0'
Bit0	Data Ready status	Not ready	Ready	'0'

### Electrical Characteristics

Table 8 – Monitoring Specification

Parameter		Range	Accuracy	Calibration
Temperature	I-temp	-40 to 85° C	±3° C	Internal
	C-temp	-5 to 70° C	±3° C	Internal
Voltage		2.97 to 3.63V	±3%	Internal
Bias Current		3 to 80mA	±10%	Internal
TX Power(1000Base-LX)		-11.5 to -3 dBm	±3dB	Internal
TX Power(100Base-LX)		-20 to -14 dBm	±3dB	Internal
RX Power(1000Base-LX)		-26 to -3 dBm	±3dB	Internal
RX Power(100Base-LX)		-32 to -8 dBm	±3dB	Internal

### Mechanical Diagram

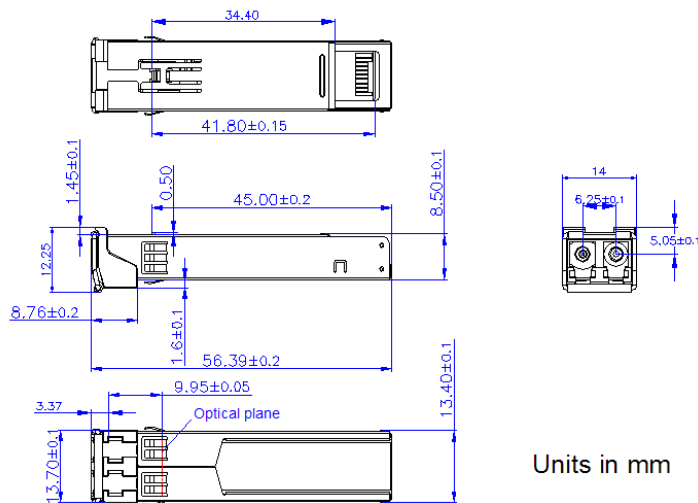


Figure 5, Mechanical Design Diagram of the SFP



**Order Information****Table 9 – Order Information**

Part No.	Media	Data Rate(Mbps)	Transmission Distance	Temperature
SPG-DR-FX-IDFD	MMF	125/1250	2km/550m	-40~+85° C
SPG-DR-FX-CDFD	MMF	125/1250	2km/550m	-5~+70° C

## 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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