

Features



- Built-in PHY supporting SGMII Interface
- Dual data-rate of 100BASE-LX/1000BASE-LX operation
- 1310nm FP laser and PIN photo-detector
- 0.5m~10km transmission with SMF
- Standard serial ID information Compatible with SFP MSA
- SFP MSA package with duplex LC connector
- With Spring-Latch for high density application
- Very low EMI and excellent ESD protection
- +3.3V single power supply
- Operating case temperature: -5 to +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(>500 V)
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.
Component Recognition	UL and CSA	Compatible with standards
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	Compliant with standards ^{note}

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_s	-40	-	+85	°C	
Supply Voltage	V_{CC}	-0.5	-	+3.6	V	
Operating Relative Humidity	RH	5	-	+95	%	

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}	3.10	3.3	3.50	V	
Power Supply Current	I_{CC}	-	-	350	mA	1
Power Dissipation	P_D	-	-	1.5	W	
Data Rate	1000BASE-LX		1250		Mbps	
	100BASE-FX		125			

Note 1: The max. power supply current after module work stable.

Optical Characteristics

Table 4 – Optical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Centre Wavelength	λ_C	1270	1310	1355	nm	
Average Output Power	1000BASE-LX	P_{Out}	-9.5	-3	dBm	1
	100BASE-LX	P_{Out}	-15	-8		1
$P_{Out}@TX$ Disable Asserted	P_{Out}			-45	dBm	1
Spectral Width (RMS)	1000BASE-LX	σ		4	nm	
	100BASE-LX			7.7		
Extinction Ratio	EX	9			dB	
Rise/Fall Time (20%~80%)	1000BASE-LX	t_r/t_f		0.26	ns	2
	100BASE-LX			3		
Total Jitterat TP2	1000BASE-LX	J_T		0.481	UI	3
	100BASE-LX			0.4		

Deterministic Jitter at TP2	1000BASE-LX	J_D			0.250		3
	100BASE-LX				0.305		
Output Optical Eye		Compatible with IEEE 802.3ah-2004					4
Receiver							
Centre Wavelength		λ_C	1260	1310	1570	nm	
Receiver Sensitivity	1000BASE-LX	LOS_D			-22	dBm	5
	100BASE-LX				-28		6
Receiver Overload	1000BASE-LX	LOS_A	-3			dBm	5
	100BASE-LX		-8				6
Return Loss			12			dB	
LOS De-Assert	1000BASE-LX	LOS_D			-23	dBm	
	100BASE-LX				-29		
LOS Assert	1000BASE-LX	LOS_A	-35			dBm	
	100BASE-LX		-45				
LOS Hysteresis			0.5		4.5	dB	
Total Jitter at TP4	1000BASE-LX	J_T			0.749	UI	3
	100BASE-LX				0.51		3
Deterministic Jitter at TP4	1000BASE-LX	J_D			0.462	UI	
	100BASE-LX				0.305		

Notes:

1. The optical power is launched into 9/125um 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, BER $\leq 1 \times 10^{-12}$.
6. Measured with 4B/5B code for 125Mbps, worst-case extinction ratio, BER $\leq 1 \times 10^{-10}$.

Electrical Characteristics

Table 5 – Electrical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Data Input Swing Differential (SGMII Series interface)	V_{IN}	500		1200	mV	1
Input Differential Impedance	Z_{IN}	80	100	120	Ω	
TX Disable	Disable	2.0		Vcc	V	
	Enable	Vee		Vee+0.8		
TX Fault	Fault	2.0		Vcc	V	
	Normal	Vee		Vee+0.5		

Receiver							
Data Output Swing Differential (SGMII Series Interface)		V_{OUT}	370		2000	mV	1
LOS	High		2.0		$V_{cc}+0.3$	V	
	Low		Vee		$V_{ee}+0.5$		

Notes:

1. PECL logic, internally AC coupled.

Recommended Host Board Power Supply Circuit

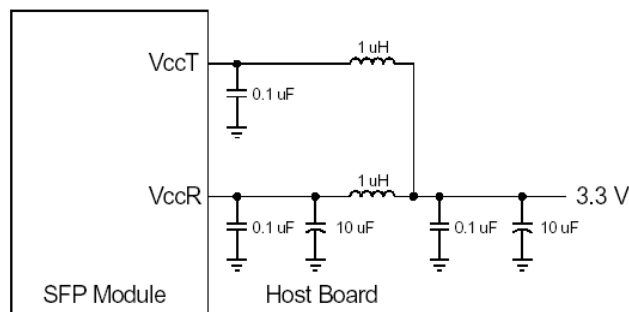


Figure 1, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

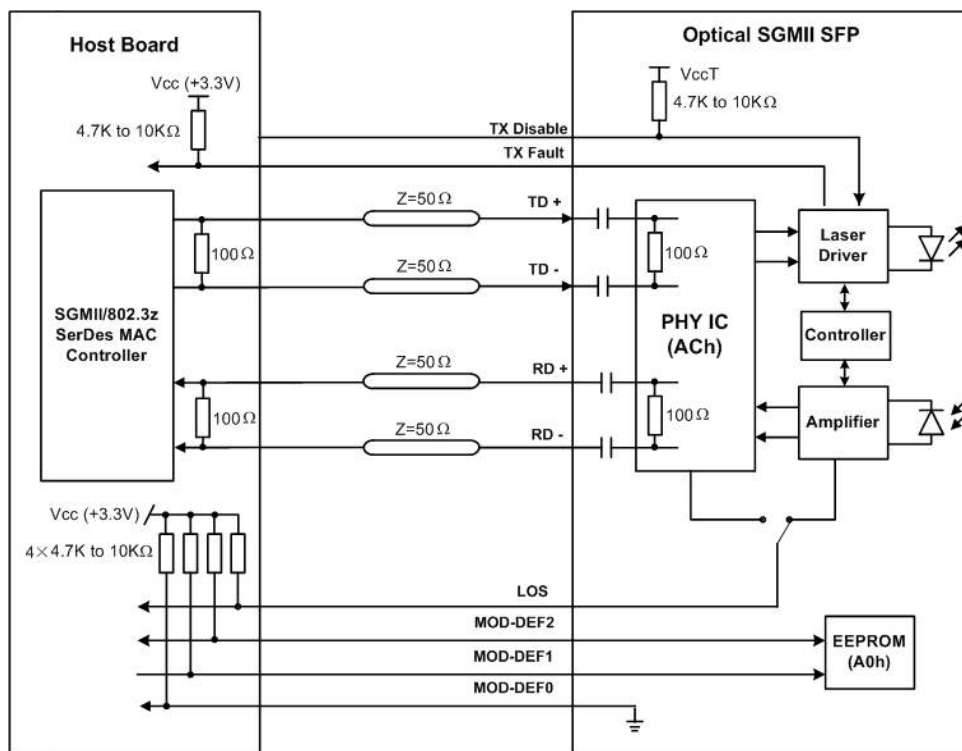


Figure 2, Recommended Interface Circuit

Pin Definitions

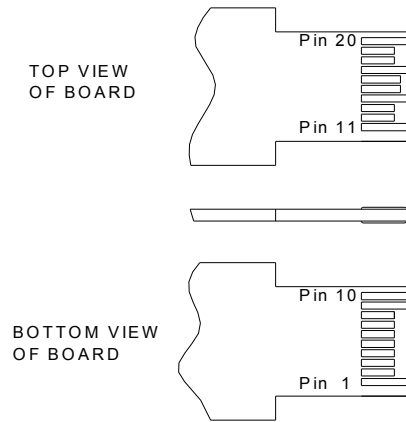


Figure 3, Pin View

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	100Base-FX/1000Base-LX selection	3	Note 7
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~10k Ω 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~10k Ω 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~10k Ω 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 100 Ω differential lines which should be terminated with 100 Ω (differential) at host with SGMII interface.
6. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 Ω differential termination inside the module.
7. When hardware rate selection has higher priority than software configuration via I2C, this pin can be used to select bit rate by host hardware.

SGMII Interface

SGMII uses two data signals and two clock signals to convey frame data and link rate information between a 100/1000 PHY and an Ethernet MAC. The data signals operate at 1.25 Gbaud and the clocks operate at 625 MHz (a DDR interface). Due to the speed of operation, each of these signals is realized as a differential pair thus providing signal integrity while minimizing system noise.

However, specific implementations may desire to recover clock from the data rather than use the supplied clock, such as in our transceiver design. This operation is allowed.

Clearly, SGMII's 1.25 Gbaud transfer rate is excessive for interfaces operating at 100 Mbps. When these situations occur, the interface "elongates" the frame by replicating each frame byte 10 times for 100 Mbps. This frame elongation takes place "above" the 802.3z PCS layer, thus the start frame delimiter only appears once per frame. The 802.3z PCS layer may remove the first byte of the "elongated" frame. For further information about how to use transceivers with SGMII interface, please refer to the application note.

EEPROM Information

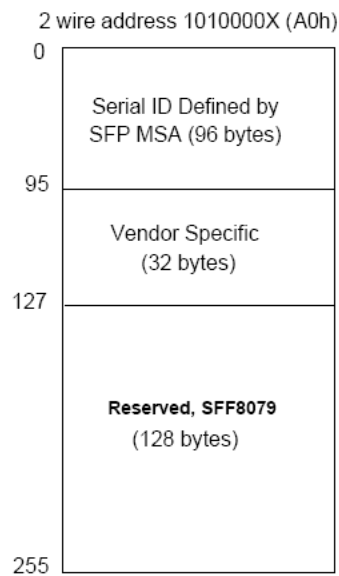


Figure 4, 2-wire Serial Memory Map

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 12 00 00 00 00	100BASE-LX/LX10/1000BASE-LX
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25GHz
13	1	Reserved	00	
14	1	Length (9um)-km	0A	10km
15	1	Length (9um)	64	10000m
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
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	

40—55	16	Vendor PN	53 50 47 44 52 4C 58 43 4E 46 42 20 20 20 20 20	“SPGDRLXCNFB” (ASC II)
56—59	4	Vendor rev	31 30 20 20	ASC II (“31 30 20 20” means 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	00 1A	LOS, TX_FAULT and TX_DISABLE
66	1	BR, max	00	
67	1	BR, min	00	
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	Reserved	00	
93	1	Reserved	00	
94	1	Reserved	00	
95	1	CC_EXT	xx	Check sum of bytes 64 - 94
96—255	160	Vendor specific		

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

Mechanical Diagram

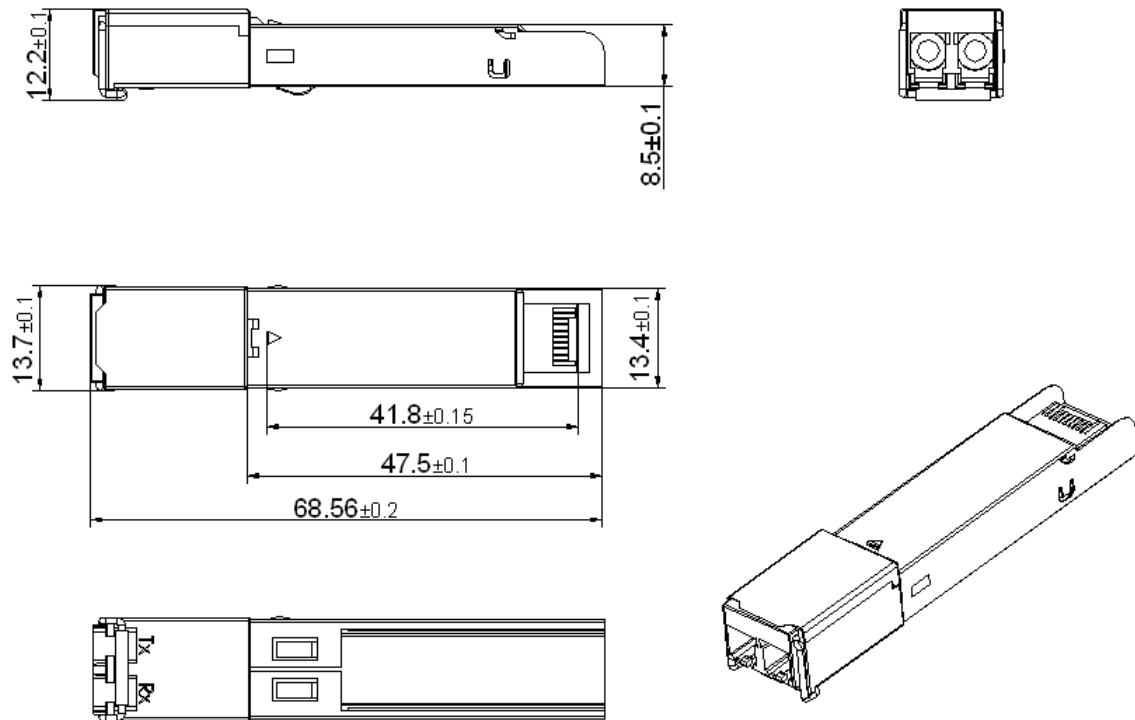


Figure 5, Mechanical Diagram

Order Information

Table 8 – Order Information

Part No.	Media	Data Rate(Mbps)	Transmission Distance(km)	Temperature
SPG-DR-LX-CNFB	SMF	125/1250	10	-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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