

## Features



- Bi-directional transmission in single fiber
- Built-in PHY supporting SGMII Interface
- Built-in high performance MCU supporting easier configuration
- 100BASE-BX10 operation
- Up to 10km point-to-point transmission
- 1310nm Tx/1550nm Rx for ONU side
- 1550nm Tx/1310nm Rx for OLT side
- Integrated PHY IC with SGMII interface
- 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

The transceivers have been tested according to American and European product safety and electromagnetic compatibility regulations (See Table 1). For further information regarding regulatory certification, please refer to Flexon™ regulatory specification and safety guidelines, or contact with Source Photonics, Inc. America sales office listed at the end of the documentation.

**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	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compliant with standards
Immunity	IEC 61000-4-3	Compliant with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compliant with Class I laser product. TUV Certificate No. 50030043
Component Recognition	UL and CSA	UL file E223705
RoHS	2002/95/EC 4.1&4.2 2005/747/EC	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	
Operating Temperature	$T_c$	-5	-	+70	°C	
Operating Ambient Humidity		0	-	95	%	
Supply Voltage	$V_{CC}$	0	-	+4	V	
Input Voltage	$V_{in}$	0		$V_{CC}$	V	

## 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	3.30	3.50	V	
Power Supply Current	$I_{CC}$			320	mA	
Power Supply Noise Rejection	PSRN	100			mV <sub>pp</sub>	
Date Rate			125		Mbps	

## Optical Characteristics

**Table 4 – Optical Characteristics**

Transmitter							
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
Centre Wavelength	$\lambda_c$	1260	1310	1360	nm		
		1480	1550	1580			
Average Output Power	$P_{out}$	-14		-8	dBm	1	
$P_{out}$ @TX Disable Asserted	$P_{out}$			-45	dBm	1	
Spectral Width (RMS)	$\sigma$			7.7	nm		
				4.6			
Extinction Ratio	ER	9.0			dB		
Total Jitter at TP2	$T_{J-TP2}$			0.40	UI	2	
Deterministic Jitter at TP2	$D_{J-TP2}$			0.305	UI	2	
Return Loss Tolerance		12			dB		
Output Optical Eye	Compliant with eye mask of 100BASE-BX						3

Receiver							
Centre Wavelength	100BASE-BX10-U	$\lambda_C$	1480		1600	nm	
	100BASE-BX10-D		1260		1360		
Receiver Sensitivity		$P_{IN}$			-30	dBm	4
Receiver Overload		$P_{IN}$	-8			dBm	4
LOS De-Assert		$LOS_D$			-31	dBm	
LOS Assert		$LOS_A$	-45			dBm	
LOS Hysteresis			0.5			dB	
Total Jitter at TP4		$T_{J-TP4}$			0.51	UI	2
Deterministic Jitter at TP4		$D_{J-TP4}$			0.305	UI	2

Notes:

1. The optical power is launched into SMF 9/125um.
2. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.
3. Measured with 4B/5B code for 125Mbps, >10% margin.
4. Measured with 4B/5B code for 125Mbps, worst-case extinction ratio, BER  $\leq 1 \times 10^{-10}$ .

## Electrical Characteristics

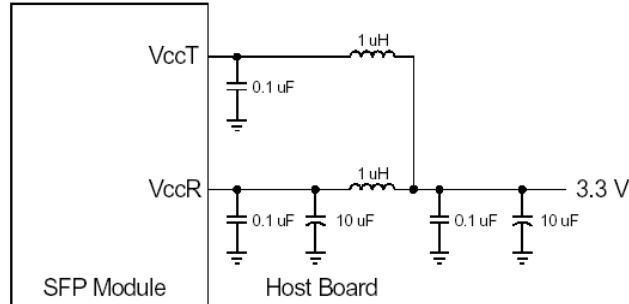
**Table 5 – Electrical Characteristics**

Transmitter							
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
Data Input Swing Differential (SGMII Series interface)	$V_{IN}$	200		2100	mV	1	
Input Differential Impedance	$Z_{IN}$	80	100	120	$\Omega$		
TX Disable	Disable		2.0	$V_{CC}$	V		
	Enable		Vee	Vee+0.8			
TX Fault	Fault		2.0	$V_{CC}$	V		
	Normal		Vee	Vee+0.5			
Receiver							
Data Output Swing Differential (SGMII Series Interface)	$V_{OUT}$	370	420	2000	mV	1	
LOS	High		2.0	$V_{CC}+0.3$	V		
	Low		Vee	Vee+0.5			

Note:

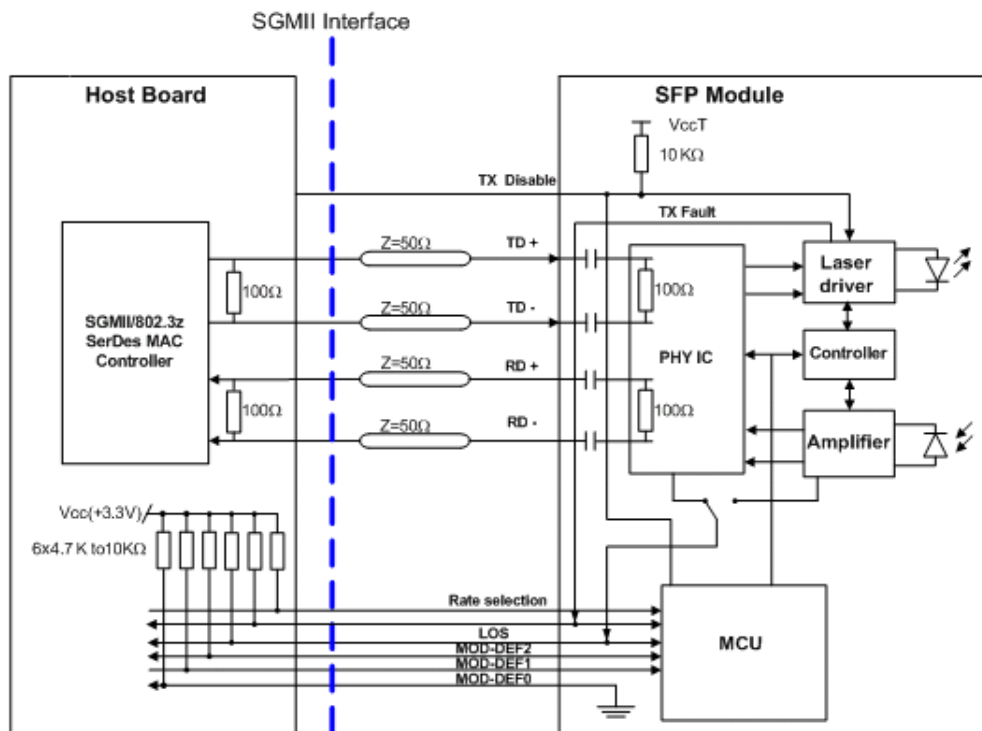
1. Internally AC coupled.

**Recommended Host Board Power Supply Circuit**



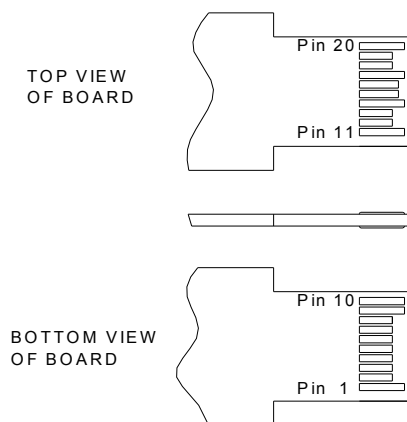
**Figure 1, Recommended Host Board Power Supply Circuit**

**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	Not Connected	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:**

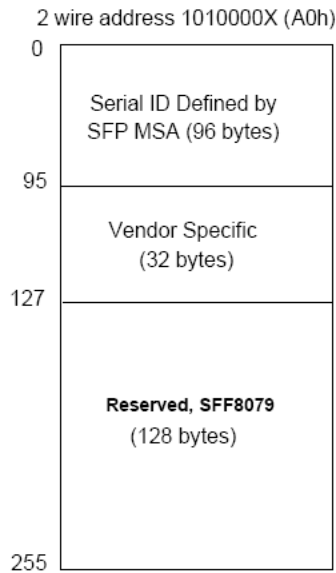
1. TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
2. TX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



**Figure 4, 2-wire Serial Digital Diagnostic 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 40 00 00 00 00	BASE-BX10
11	1	Encoding	02	4B5B
12	1	BR, nominal	01	100Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	0A	10km
15	1	Length (9um)	64	10km
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 46 45 42 58 43 4E 46 xx 20 20 20 20 20	“SPGFEBXCNFx”(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	xx xx	“05 1E” is for 1310nm, “06 0E” is for 1550nm
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—154	58	Vendor specific		
155	1	Reserved		Read only
156-247		Vendor specific		

248	1	Status		Read only
249	1	CFG0		Work mode configuration
250	1	CFG1		Work mode configuration
251	1	CFG2		Work mode configuration
252	1	Status		Module status indication
253	1	Reserved		Read only
254	1	PSWH		Password entry
255	1	PSWL		Password entry

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).

### Easier Configuration

Designing-in a high performance MCU in SPG-FE-BX-CNFC and SPG-FE-BX-CNFD, host can configure Source Photonics’ SGMII series product easily.

Host only need access few registers of A0H via I2C to configure SGMII series module, such as speed-selection, Auto-negotiation, LOS/Link detection, TX disable, FEFI/RFI and CRC counter function support. Host can get inner status via access specific register of the module.

The operation data rate can be configured via hardware pin and I2C bus independently.

For more detailed information, please refer to application note of 100M SGMII SFP.

### Mechanical Diagram

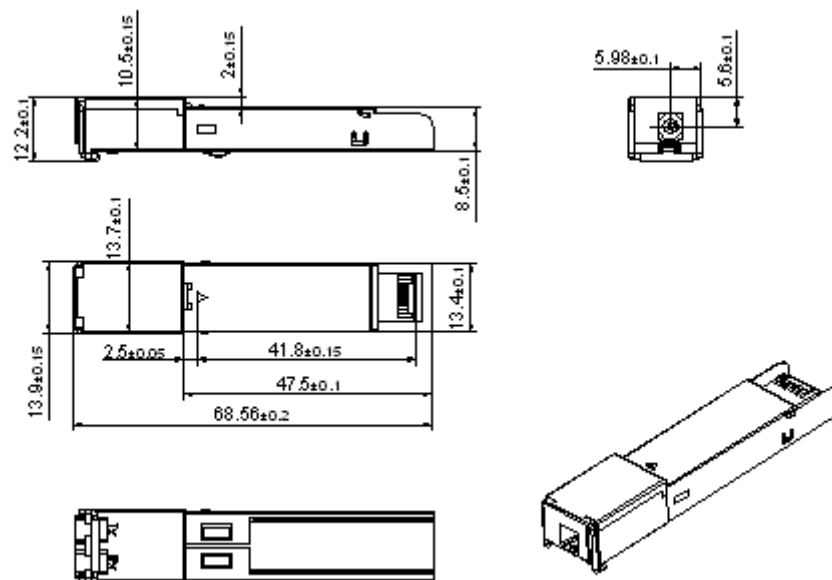


Figure 5, Mechanical Diagram of SFP+

## Order Information

**Table 8 – Order Information**

Part No.	Media	Data Rate(Mbps)	Transmission Distance(km)	Temperature
SPG-FE-BX-CNFC	SMF (1310nm Tx/1550nm Rx for ONU)	125	10	-5~+70°C
SPG-FE-BX-CNFD	SMF (1550nm Tx/1310nm Rx for OLT)	125	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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