Features

- Built-in PHY supporting SGMII Interface
- Built-in high performance MCU supporting easier configuration
- Dual data-rate of 100BASE-ZX/1000BASE-ZX operation
- 1550nm DFB laser and PIN photo-detector
- Up to 80km 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
- +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
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	2011/65/EU	Compliant with RoHS

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}	3.13	3.3	3.47	V	
Power Supply Current		I_{CC}	-	-	350	mA	1
Power Dissipation		P_D	-	-	1.5	W	
Date Rate	1000BASE-ZX			1250		Mbps	
	100BASE-ZX			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	1480	1550	1580	nm	
Average Output Power	1000BASE-ZX	P_{0ut}	0		5	dBm	1
	100BASE-ZX	P_{0ut}	0		5		1
P_{0ut}@TX Disable Asserted		P_{0ut}			-45	dBm	1
Spectral Width (-20dB)	1000BASE-ZX	σ			1	nm	
	100BASE-ZX				3		
Extinction Ratio		EX	9			dB	
Side mode suppression Ratio		SMSR	30				
Rise/Fall Time (20%～80%)	1000BASE-ZX	t_r/t_f			0.26	ns	2
	100BASE-ZX				3		
Total Jitterat TP2	1000BASE-ZX	J_T			0.481	UI	3
	100BASE-ZX				0.4		
Deterministic Jitter at TP2	1000BASE-ZX	J_D			0.250		3
	100BASE-ZX				0.305		
Output Optical Eye		Compatible with IEEE 802.3ah-2004					4
Receiver							
Centre Wavelength		λ_C	1260	1550	1580	nm	
Receiver Sensitivity	1000BASE-ZX				-23	dBm	5
	100BASE-ZX				-23		6
Receiver	1000BASE-ZX		0			dBm	5

Overload	100BASE-ZX		0				6
Return Loss			12			dB	
LOS De-Assert	1000BASE-ZX	LOS_D			-24	dBm	
	100BASE-ZX				-24		
LOS Assert	1000BASE-ZX	LOS_A	-45			dBm	
	100BASE-ZX		-45				
LOS Hysteresis			0.5		4.5	dB	
Total Jitter at TP4	SGMII	J_T			0.749	UI	3
Deterministic Jitter at TP4	SGMII	J_D			0.462	UI	

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, and BER ≤1 × 10^{-12}.
6. Measured with 4B/5B code for 125Mbps, worst-case extinction ratio, and BER ≤1 × 10^{-12}.

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	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		Vcc+0.3	V	
	Low		Vee		Vee+0.5		

Notes:

1. PECL logic, internally AC coupled.

Recommended Host Board Power Supply Circuit

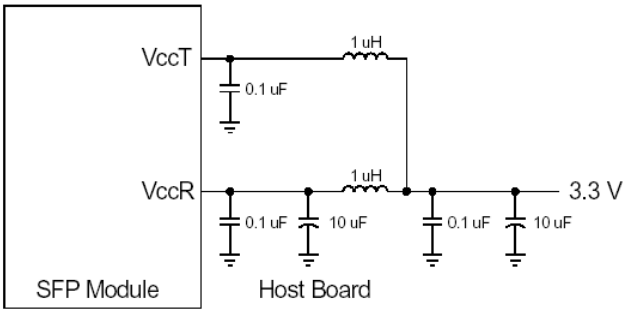

Figure 1, Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

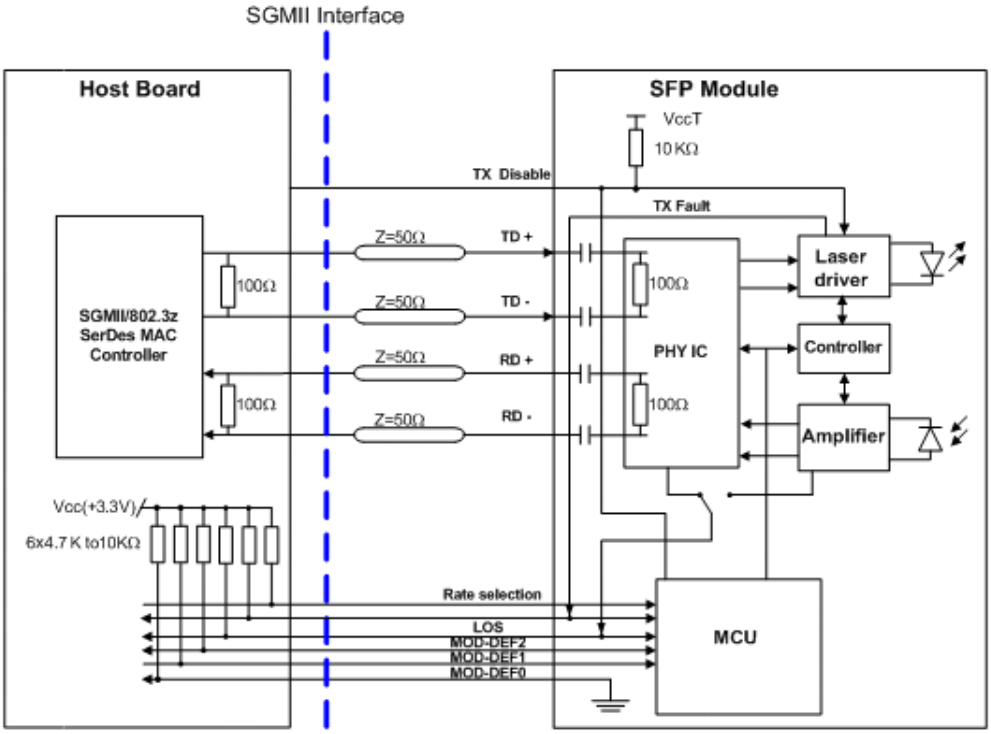

Figure 2, Recommended Interface Circuit

Pin Definitions

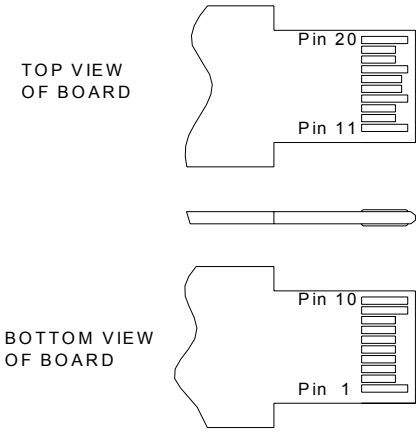

Figure 3, Pin View

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	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:

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 l. 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

The SFP MSA defines a 256-byte memory map in EEPROM describing the transceiver's capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 7.

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	
11	1	Encoding	01	8B10B
12	1	BR, nominal	0D	1.25GHz
13	1	Reserved	00	
14	1	Length (9um)-km	50	80km
15	1	Length (9um)	FF	80000m
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 "(ASCⅡ)

36	1	Reserved	00	
37—39	3	Vendor OUI	00 1F 22	
40—55	16	Vendor PN	53 50 47 44 52 5A 58 43 44 46 43 20 20 20 20 20	“SPGDRZXCDFC” (ASCⅡ)
56—59	4	Vendor rev	31 30 20 20	ASCⅡ(“31 30 20 20” means 1.0 revision)
60-61	2	Wavelength	06 0E	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	ASCⅡ.
84—91	8	Vendor date code	xx xx xx xx xx xx xx xx	Year (2 bytes), Month (2 bytes), Day (2 bytes)
92	1	Diagnostic type	68	Diagnostics(Int.Cal)
93	1	Enhanced option	B0	Diagnostics(Optional Alarm/warning flags, Soft TX_FAULT and Soft TX_LOS monitoring)
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		

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFF-8472 Rev 9.5.

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’

Monitoring Specification

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X (A2h). Please see Figure 4. For detail EEPROM information, please refer to the related document of SFF-8472 Rev 9.5. The monitoring specification of this product is described in Table 8.

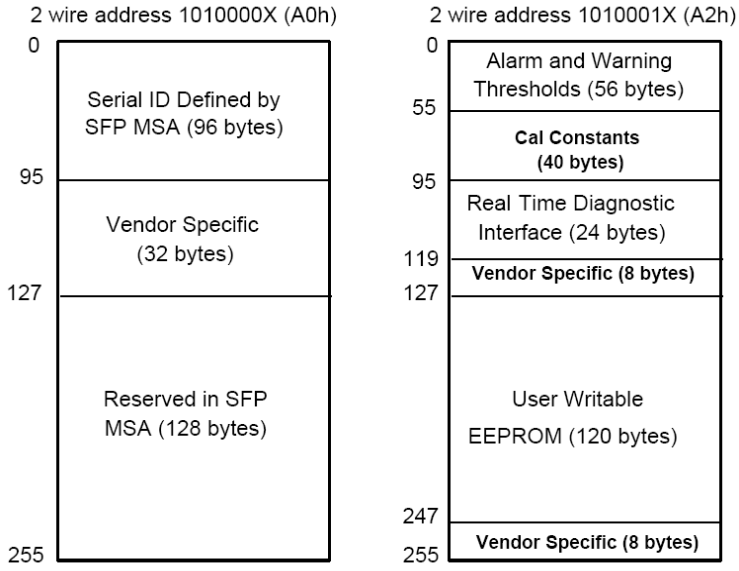

Figure 4, EEPROM Memory Map Specific Data Field Descriptions

Table 8- Monitoring Specification

Parameter	Range	Accuracy	Calibration
Temperature	-10 to 80°C	±3°C	Internal
Voltage	2.97 to 3.63V	±3%	Internal
Bias Current	3 to 80mA	±10%	Internal
TX Power(1000Base-ZX)	0 to 5 dBm	±3dB	Internal
TX Power(100Base-ZX)	0 to 5 dBm	±3dB	Internal
RX Power(1000Base-ZX)	-24 to -3 dBm	±3dB	Internal
RX Power(100Base-ZX)	-24 to -3 dBm	±3dB	Internal

Mechanical Diagram

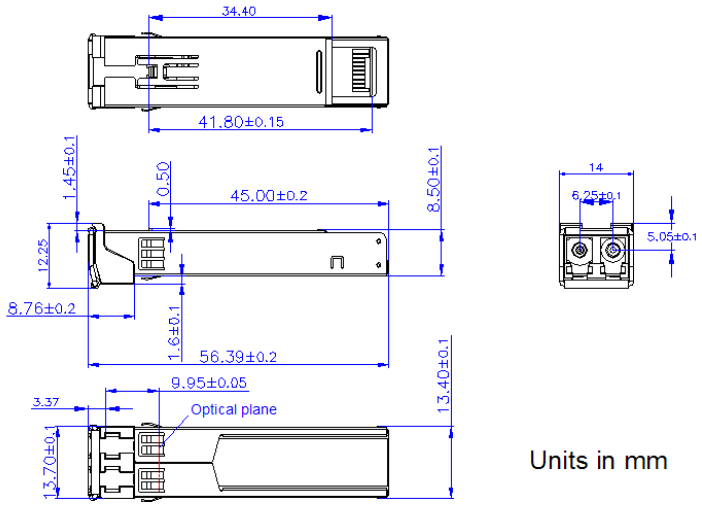

Figure 4, Mechanical Diagram of SFP

Order Information

Table 9 – Order Information

Part No.	Media	Data Rate(Mbps)	Transmission Distance(km)	Temperature
SPG-DR-ZX-CDFC	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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