

## SHPP-10G-ER13

### 10Gb/s SFP+ Transceiver Hot Pluggable, Duplex LC, +3.3V, 1310nm DFB/PIN, Single mode, 40km

SHPP-10G-ER13 is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s, inter-converting the 10Gb/s serial electrical data stream with the 10Gb/s optical signal. It complies with SFF-8431, SFF-8432 and IEEE 802.3ae 10GBASE-LR. It provides Digital diagnostics functions via a 2-wire serial interface as specified in SFF-8472. It features hot plug, easy upgrading and low EMI emission. The high-performance 1310nm DFB transmitter and high-sensitivity PIN receiver provide superior performance for Ethernet applications up to link length of 40km on single mode fiber.

#### ■ Features:

- ◇ Supports 9.95 to 11.3Gb/s bit rates
- ◇ Hot-Pluggable
- ◇ Duplex LC connector
- ◇ 1310nm DFB transmitter, PIN photo-detector
- ◇ SMF links up to 40km
- ◇ 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface
- ◇ Power Supply :+3.3V
- ◇ Power consumption<1.5W
- ◇ Commercial Temperature Range: 0~ 70°C
- ◇ Industrial Temperature Range: -40~ +85°C
- ◇ RoHS compliant



#### ■ Applications:

- ◇ 10GBASE-LR/LW Ethernet
- ◇ SONET OC-192 / SDH
- ◇ 10G Fibre Channel

#### ■ Ordering Information:

Part Number	Data Rate	Distance	Wavelength	Laser	Fiber	DDM	Connector	Temperature
SHPP-10G-ER13	10Gb/s	40km	1310nm	DFB/PIN	SM	Yes	Duplex LC	0~ 70°C
SHPP-10G-ER13-i	10Gb/s	40km	1310nm	DFB/PIN	SM	Yes	Duplex LC	-40~ +85°C

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➤ **Absolute Maximum Ratings**

Parameter	Symbol	Min.	Typical	Max.	Unit	
Storage Temperature	T <sub>S</sub>	-40		+85	°C	
Case Operating Temperature	SHPP-10G-ER13 SHPP-10G-ER13-I	T <sub>A</sub>	0		70	°C
			-40		+85	°C
Maximum Supply Voltage	V <sub>CC</sub>	-0.5		4	V	
Relative Humidity	RH	0		85	%	

➤ **Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.135 to 3.465 Volts)**

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Supply Voltage	V <sub>CC</sub>	3.135		3.465	V	
Supply Current	I <sub>CC</sub>			430	mA	
Power Consumption	P			1.5	W	
<b>Transmitter Section:</b>						
Input differential impedance	R <sub>in</sub>		100		Ω	1
Tx Input Single Ended DC Voltage Tolerance (Ref V <sub>ee</sub> T)	V	-0.3		4	V	
Differential input voltage swing	V <sub>in,pp</sub>	180		700	mV	2
Transmit Disable Voltage	V <sub>D</sub>	2		V <sub>CC</sub>	V	3
Transmit Enable Voltage	V <sub>EN</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	
<b>Receiver Section:</b>						
Single Ended Output Voltage Tolerance	V	-0.3		4	V	
Rx Output Diff Voltage	V <sub>o</sub>	300		850	mV	
Rx Output Rise and Fall Time	Tr/Tf	30			ps	4
LOS Fault	V <sub>LOS fault</sub>	2		V <sub>CCHOST</sub>	V	5
LOS Normal	V <sub>LOS norm</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	5

Notes: 1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.

2. Per SFF-8431 Rev 3.0

3. Into 100 ohms differential termination

4. 20%~80%

5. LOS is an open collector output. Should be pulled up with 4.7k – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.

➤ **Optical Parameters (T<sub>OP</sub> = 0 to 70°C, VCC = 3.135 to 3.465 Volts)**

Parameter	Symbol	Min.	Typical	Max.	Unit
<b>Transmitter</b>					
Centre Wavelength	λ <sub>c</sub>	1260	1310	1360	nm
Spectral Width (RMS)	σ			3	nm
Average Output Power	P <sub>out</sub>	-1		4	dBm
Extinction Ratio	ER	3.5			dB
Average Launch Power of Off Transmitter	P <sub>off</sub>			-30	dBm
<b>Receiver</b>					
Centre Wavelength	λ <sub>c</sub>	1200	1310	1600	nm
Receiver Sensitivity	PIN			-16	dBm
Receiver Overload	P <sub>max</sub>	2.5			dBm

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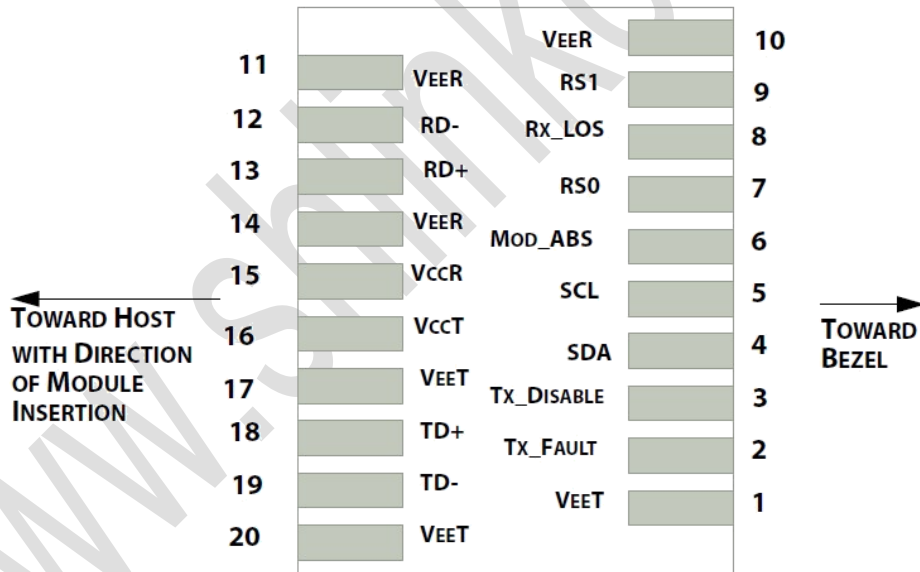
LOS De-Assert	LOSD			-20	dBm
LOS Assert	LOSA	-25			dBm
LOS Hysteresis		0.5		4.5	dB

➤ **Timing Characteristics**

Parameter	Symbol	Min.	Typical	Max.	Unit
TX_Disable Assert Time	t_off			10	us
TX_Disable Negate Time	t_on			1	ms
Time to Initialize Include Reset of TX_FAULT	t_int			300	ms
TX_FAULT from Fault to Assertion	t_fault			100	us
TX_Disable Time to Start Reset	t_reset	10			us
Receiver Loss of Signal Assert Time	T <sub>A</sub> ,RX_LOS			100	us
Receiver Loss of Signal Deassert Time	T <sub>d</sub> ,RX_LOS			100	us
Rate-Select Chage Time	t_ratesel			10	us
Serial ID Clock Time	t_serial-clock			100	kHz

➤ **Pin Assignment**

Diagram of Host Board Connector Block Pin Numbers and Name



➤ **Pin Function Definitions**

PIN	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	
5	SCL	2 wire serial interface clock input (SCL)	
6	MOD-ABS	Module Absent, connect to VeeR or VeeT in the module	2
7	RS0	Rate select0, optionally control SFP+ receiver. When high, input data rate >4.5Gb/ s; when	

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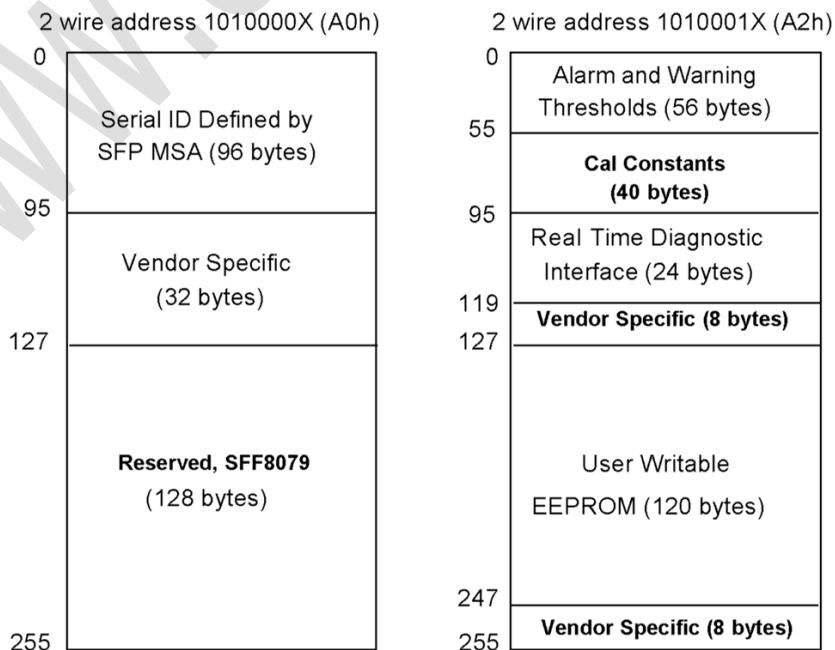
		low, input data rate <=4.5Gb/s	
8	LOS	Receiver Loss of Signal Indication	4
9	RS1	Rate select0, optionally control SFP+ transmitter. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s	
10	VeeR	Module receiver ground	1
11	VeeR	Module receiver ground	1
12	RD-	Receiver inverted data out put	
13	RD+	Receiver non-inverted data out put	
14	VeeR	Module receiver ground	1
15	VccR	Module receiver 3.3V supply	
16	VccT	Module transmitter 3.3V supply	
17	VeeT	Module transmitter ground	1
18	TD+	Transmitter inverted data out put	
19	TD-	Transmitter non-inverted data out put	
20	VeeT	Module transmitter ground	1

- Note:
1. The module ground pins shall be isolated from the module case.
  2. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.
  3. This pin shall be pulled up with 4.7K-10Kohms to VccT in the module.
  4. This pin is an open collector/drain output pin and shall be pulled up with 4.7K-10Kohms to Host\_Vcc on the host board.

➤ **SFP Module EEPROM Information and Management**

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I<sup>2</sup>C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2, and the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, "Digital Diagnostic Monitoring Interface for Optical Transceivers". The DDM parameters have been internally calibrated.

**Table 1.** Digital Diagnostic Memory Map (Specific Data Field Descriptions)



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Table 2 - EEPROM Serial ID Memory Contents (A0h)

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	10G Base-LR
11	1	Encoding	64B/66B
12	1	BR, Nominal	Nominal baud rate, unit of 100Mbps
13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name: SH Link
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "SHPP-10G-ER13" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-62	3	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
Extended ID Fields			
64-65	2	Option	Indicates which optical SFP signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	SH's Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	SH specific date, read only
128-255	128	Reserved	Reserved for SFF-8079

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➤ **Digital Diagnostic Monitor Characteristics**

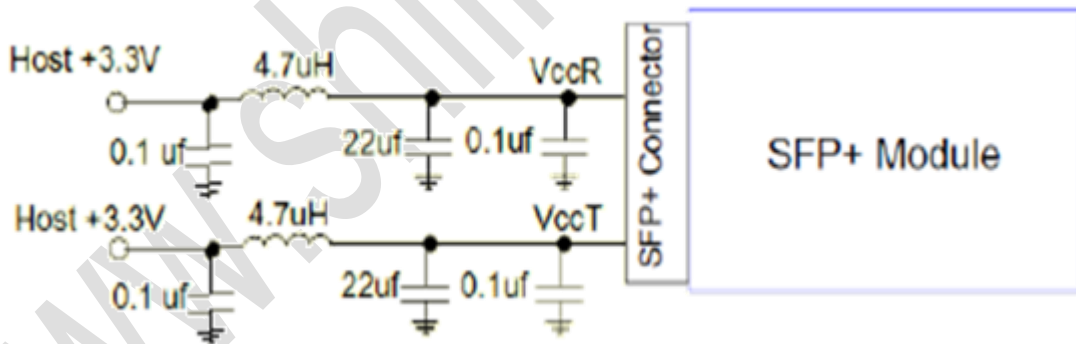
Data Address	Parameter	Accuracy	Unit
96-97	Transceiver Internal Temperature	±3.0	°C
100-101	Laser Bias Current	±10	%
100-101	Tx Output Power	±3.0	dBm
100-101	Rx Input Power	±3.0	dBm
100-101	VCC3 Internal Supply Voltage	±3.0	%

➤ **Regulatory Compliance**

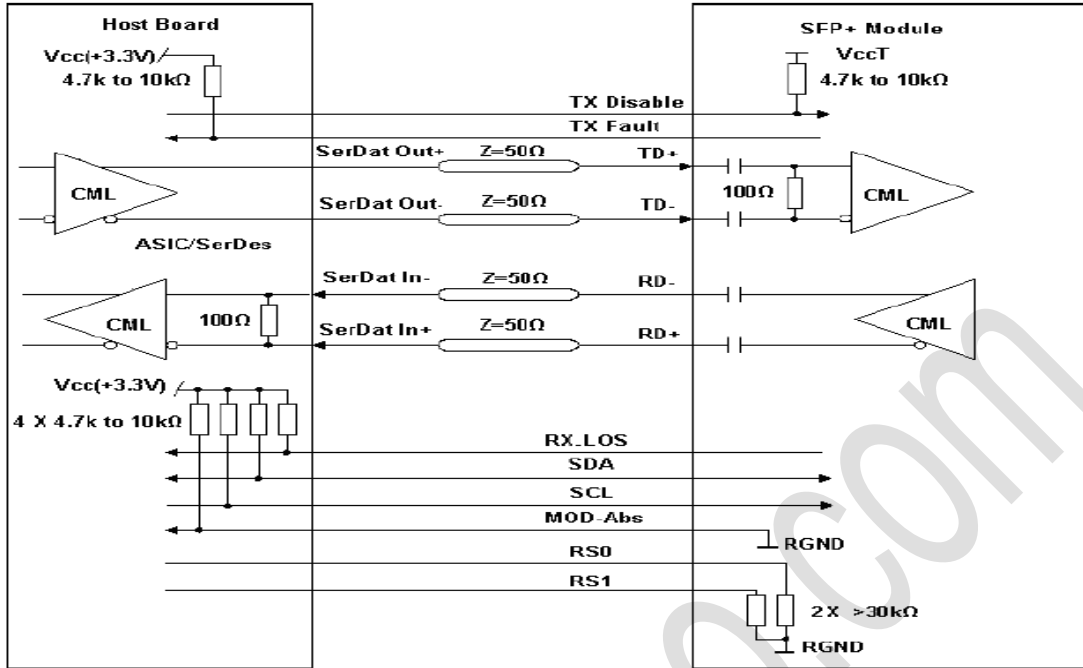
The SHPP-10G-ER13 complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000 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
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class 1 laser product.

➤ **Recommended Circuit**

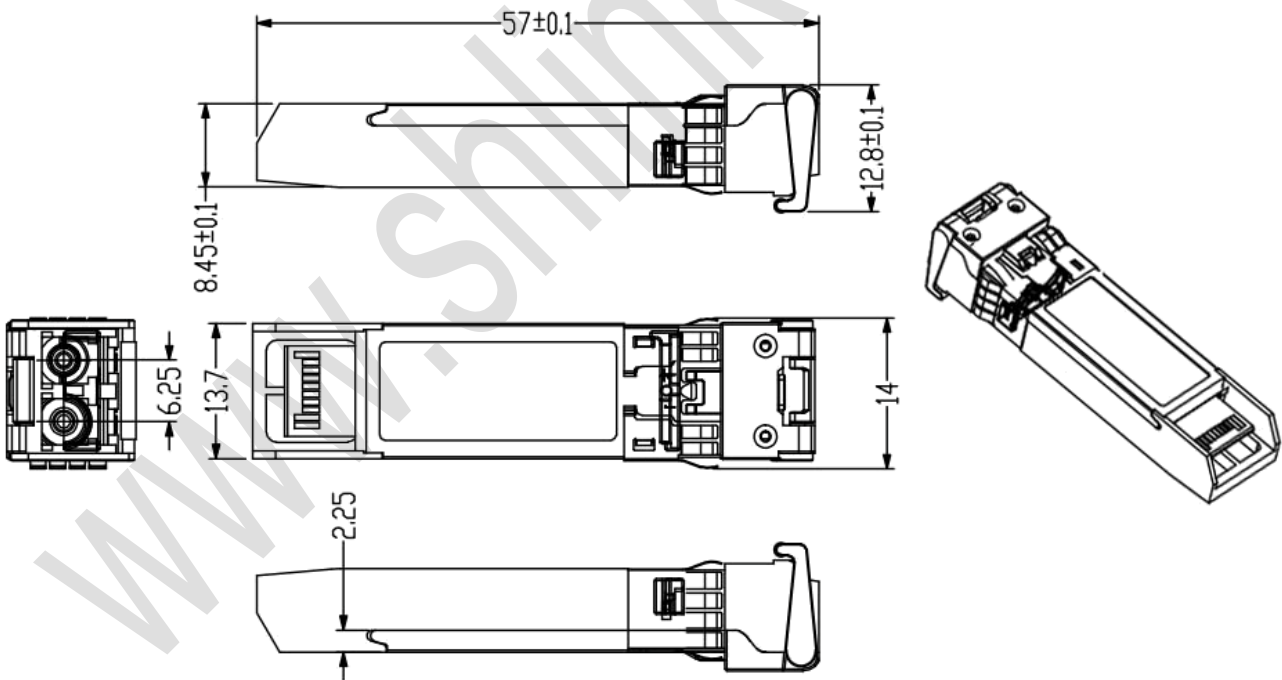


Recommended Host Board Power Supply Circuit



Recommended High-speed Interface Circuit

➤ Mechanical Dimensions



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