

Product Specification

**1.5G SDI Video Optical SFP Transmitter Module
Low Power Single Channel
with 1310 FP Laser**

EP-1TP-1G-31L1

ePHOTON

Ver. A

EP-1TP-1G-31L1
*1.5G SDI Video Optical SFP Transmitter Module
for SMPTE 292M/259M(Low Power)***1 Features**

- 1.1 Transmitter unit with independent laser disable pins and 1310nm FP Laser diode transmitter
- 1.2 SMPTE 297-2006 compatible
- 1.3 -6dBm typical launch power,
- 1.4 Robust error-free transmission of signals from 50Mbps to 1.5Gbps for up to 10Km single mode fiber;
- 1.5 Supports video pathological patterns for SD-SDI,HD-SDI
- 1.6 Diagnose and control via I²C interface including:
Monitoring laser bias current, average output power, supply voltage and temperature;
- 1.7 Industry standard SFP form factor;
- 1.8 Single +3.3V power supply
- 1.9 Low power consumption, typically 400mW
- 1.10 Hot pluggable
- 1.11 RoHS-6 compliant

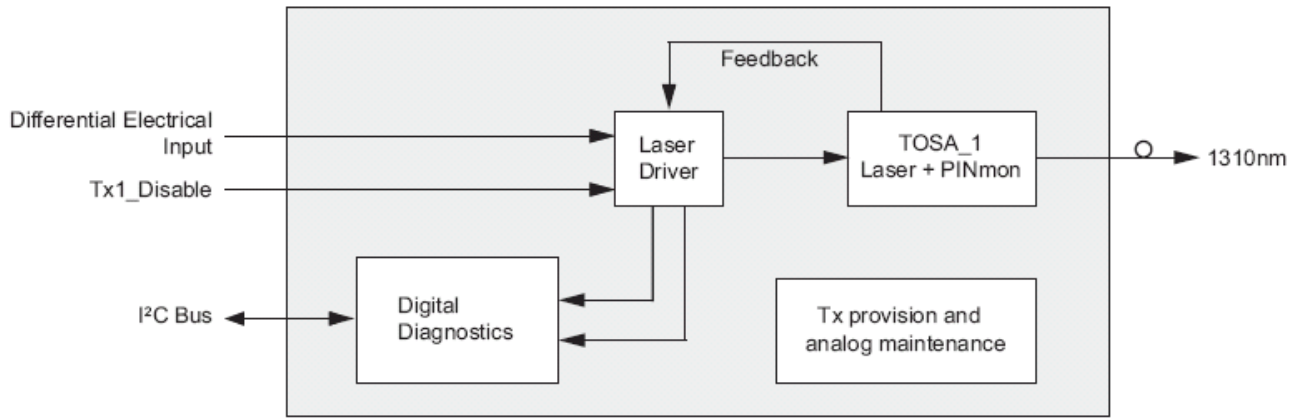
2 Applications

- 2.1 HD SDI 1.5G video application
- 2.2 SMPTE 297-2006 compatible OE interfaces
- 2.3 Broadcast cameras

3 General

The Modules are optical transceiver or transmitter and receiver modules designed to transmit and receive optical and electrical serial digital signals as defined in SMPTE 297-2006. The transceiver or transmitter and receiver are specifically designed for the application with the performance of SDI pathological patterns for SMPTE 259M, 344M, 292M serial rates.

4 Functional Block Diagram



5 Performance Specifications

5.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Storage Temperature (Non-Operating)	Tstg	-40	+85	°C	
Case Temperature (Operating)	Tc	0	+70	°C	1
Input Voltage	-	GND	Vcc	V	
Power Supply Voltage	Vcc-Vee	-0.5	+3.6	V	
Lead Soldering	T/Sec		260/10	°C/Sec	

Note

1. Measured on top side front center of SFP module.

5.2 Operating Environment

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	Vcc	+3.1	+3.3	+3.5	V	-
Power Consumption	Icc	-	400	600	mW	-
Case Temperature (Operating)	Tc	0	-	70	°C	-
Data Rate	-	-	-	1.5	Gb/s	-

5.3 Transmitter Specifications

(Over Operating Case Temperature Range, Vcc = 3.135V to 3.465V)

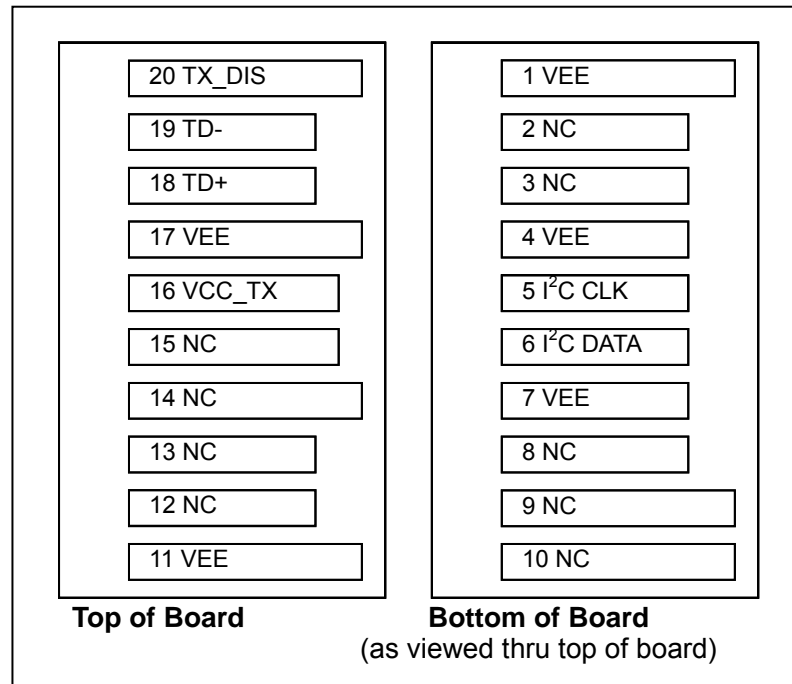
Electrical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Differential Data Input Swing	V _{in,pp}	300	-	1200	mV	-
Differential Input Impedance	R _{in}	95	100	105	ohm	-
Tx Disable Voltage	V _d	2.0	-	V _{cc} +0.3	V	-
Tx Enable Voltage	V _{en}	0	-	0.8	V	-
Optical Characteristics						
Optical Power	P _{out}	-12	-	-3	dBm	1
Optical Extinction Ratio	ER	5	7.5	-	dB	-
Optical Wavelength	λ ₁	1270	1310	1350	nm	
Spectral Width (RMS)	σ	-	-	10	nm	
Optical Rise Time	Tr			270	ps	2,5
				800	ps	3,5
Optical Fall Time	Tf			270	ps	2,5
				800	ps	3,5
Optical Signal Intrinsic Jitter	JTX	-	-	100	ps	5

Notes:

1. Using 9/125 SMF
2. SMPTE 292M, 1.485Gbps;
3. SMPTE 259M, 270Mbps;
4. Measured with PRBS 2²³-1 and color bar test signal at 1.485Gbps, 270Mbps;
5. 20%~80%, Measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency

6 Pin Definitions

6.1 Pin Diagram



6.2 Pin Descriptions

Pin#	Name	Function	Notes
1	VEE	Ground	-
2	NC	Not Connect	-
3	NC	Not Connect	-
4	GND	Ground	-
5	I2C CLK	I2C Clock	Note 2, 2 wire serial ID interface
6	I2C DATA	I2C, Data	Note 2, 2 wire serial ID interface
7	VEE	Ground	-
8	NC	Not Connect	-
9	NC	Not Connect	-
10	NC	Not Connect	-
11	VEE	Ground	-
12	NC	Not Connect	-
13	NC	Not Connect	-
14	NC	Not Connect	-
15	NC	Not Connect	-
16	VCC TX	Transmitter Power Supply	Note 4, 3.3V 5%
17	VEE	Ground	-
18	TD+	Transmitter Data Positive In	Note 5
19	TD-	Transmitter Data Negative In	Note 5
20	TX DIS	Transmitter Disable	Note 1

Notes:

1. TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7–10 K Ω resistor. Its states are:
Low (0–0.8V): Transmitter on
(>0.8, <2.0V): Undefined
High (2.0–3.465V): Transmitter Disabled
Open: Transmitter Disabled
2. These 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 VCC.
3. VEE may be internally connected within the SFP module.
4. VCC_TX is the transmitter power supplies. It is defined as 3.3V \pm 5% at the SFP connector pin. Maximum supply current is 600mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value.
5. TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

6.3 Optical Connector

An LC connector with PC/UPC is required for each port.

7. Serial interface memory map

Module identification and diagnostic information is accessible through the address map shown in the following tables .

7.1 EEPROM serial ID memory contents (A0h)

Addr	Hex	ASCII	Description	Addr	Hex	ASCII	Description	Addr	Hex	ASCII	Description
0	83		Single Transmitter	32	20		Vendor name	64	00		
1	04		SFP function is defined by serial ID only	33	20			65	18		TX_DISABLE, TX_FAULT active; LOS not active
2	07		LC connector	34	20			66	00		BR, Max
3	40		SMPTE259M/344M/292M and 297M	35	20			67	00		BR, Min.
4	00		Reserved(SFP MSA does not specify SMPTE compliance codes)	36	XX		Reserved	68	XX		Vendor Serial number
5	00			37	00		Vendor OUI	69	XX		
6	00			38	00		Vendor part number	70	XX		
7	00			39	00			71	XX		
8	00			40	45	E		72	XX		
9	00			41	50	P		73	XX		
10	00			42	2D	-	74	XX			
11	03			NRZ	43	31	1	75	XX		
12	0F			BR in 100Mbps	44	54	T	76	XX		
13	00			Reserved	45	50	P	77	XX		
14	0A	10	Length(9u)*Km	46	2D	-	78	XX			
15	00		Length(9u)*100m	47	31	1	79	XX			
16	00		Length(50u)*10m	48	47	G	80	XX			
17	00		Length(62.5u)*10m	49	2D	-	81	XX			
18	00		Length(Copper)	50	33	3	82	XX			
19	XX		Reserved	51	31	1	83	XX			
20	65	e	Vendor name	52	52	L	84	XX		Vendor data code: Year	
21	50	P		53	31	1	85	XX		Vendor data code: Month	
22	48	H		54	20		86	XX		Vendor data code: Day	
23	4F	O		55	20		87	XX		Blank	
24	54	T		56	00		88	XX			
25	4F	O		57	00	.	89	XX			
26	4E	N		58	00		90	20			
27	20			59	0A	10	Vendor PN reversion Ver 1.0	91	20		
28	20			60	1F	31	For the two middle digits of channel 1 wavelength: 1310nm	92	20		Calibrated average output power
29	20			61	00		Reserved	93	E0		Enhanced alarm/warning flags
30	20			62	00		Reserved	94	XX		Reserved
31	20		63	XX		CC_BASE(0-62)	95	XX		CC_EXT(64-94)	

96-127: 00, Vendor specific
128-255: 00, Reserved
XX: denotes hex values which varies from module to module

7.2 EEPROM serial ID memory contents (A2h)

7.2.1 Alarm and Warning Thresholds, OM Output Calibration ID Fields

Addr. (DEC)	# Bytes	Name	Value
00-01	2	Temp high alarm	+120°C
02-03	2	Temp low alarm	-13°C
04-05	2	Temp high warning	+110°C
06-07	2	Temp low warning	-8°C
08-09	2	Supply voltage high alarm	+3.6V
10-11	2	Supply voltage low alarm	+3.0V
12-13	2	Supply voltage high warning	+3.47V
14-15	2	Supply voltage low warning	+3.14V
16-17	2	Bias high alarm	100mA
18-19	2	Bias low alarm	0mA
20-21	2	Bias high warning	80mA
22-23	2	Bias low warning	0mA
24-25	2	Tx power high alarm	-1dBm
26-27	2	Tx power low alarm	-13dBm
28-29	2	Tx power high warning	-2dBm
30-31	2	Tx power low warning	-12dBm
32-94	64	Reserved	
95	1	Check sum	Byte 95 contains the low order 8 bits of the sum of bytes 0-94

7.2.2 A/D Values and Status Bits

Addr. (DEC)	Bit	Name	Description
96	All	Temperature MSB	Internally measured module temperature, see table 7.2.3
97	All	Temperature LSB	
98	All	Vcc MSB	Internal measured supply voltage, see table 7.2.3
99	All	Vcc LSB	
100	All	Tx bias MSB	TBD
101	All	Tx bias LSB	
102	All	Tx power MSB	Measured TX output power, see table 7.2.3
103	All	Tx power LSB	
104-109	All	Reserved	
Optional status/control bits			
110	7	N/A	
110	6	N/A	
110	5	Reserved	
110	4	N/A	
110	3	N/A	
110	2	TX fault	Tx fail status: 1=TX fail; 0=TX normal
110	1	N/A	
110	0	Data Ready	
111	7	Temp Update	Goes to high after a temperature update
	6	Vcc Update	Goes to high after a Vcc update
	5	Mon 1 Update	Goes to high after a Tx bias current update
	4	Mon 2 Update	Goes to high after a TX power update
	3	Mon 3 Update	Goes to high after a Tx modulation current update
	2-0	Reserved	

7.2.3 Transmitter only

A2h address	Parameter	Calibration	Accuracy	Range
96-97	Temperature	Internal	+/- 3°C	Note 1
98-99	Vcc	Internal	+/- 3%	3.135 to 3.465
100-101	Bias	TBD	TBD	TBD
102-103	Tx power	External	+/- 3dB	-12 to -3dBm

Notes:

1. Junction temperature of temperature sensing device

7.2.4 Alarm and Warning Flags

Addr. (DEC)	Bit	Name	Description
112	7	Temp high alarm	Set when internal temperature exceeds high alarm level
	6	Temp low alarm	Set when internal temperature below low alarm level
	5	Vcc high alarm	Set when internal supply voltage exceeds high alarm level
	4	Vcc low alarm	Set when internal supply voltage below low alarm level
	3	Tx bias high alarm	Set when internal Tx bias current exceeds high alarm level
	2	Tx bias low alarm	Set when internal Tx bias current below low alarm level
	1	Tx power high alarm	Set when internal Tx output power exceeds high alarm level
	0	Tx power low alarm	Set when internal Tx output power below low alarm level
113-115	All	Reserved	
116	7	Temp high warning	Set when internal temperature exceeds high warning level
	6	Temp low warning	Set when internal temperature below low warning level
	5	Vcc high warning	Set when internal supply voltage exceeds high warning level
	4	Vcc low warning	Set when internal supply voltage below low warning level
	3	Tx bias high warning	Set when internal Tx bias current exceeds high warning level
	2	Tx bias low warning	Set when internal Tx bias current below low warning level
	1	Tx power high warning	Set when internal Tx output power exceeds high warning level
	0	Tx power low warning	Set when internal Tx output power below low warning level
117-119	all	Reserved	

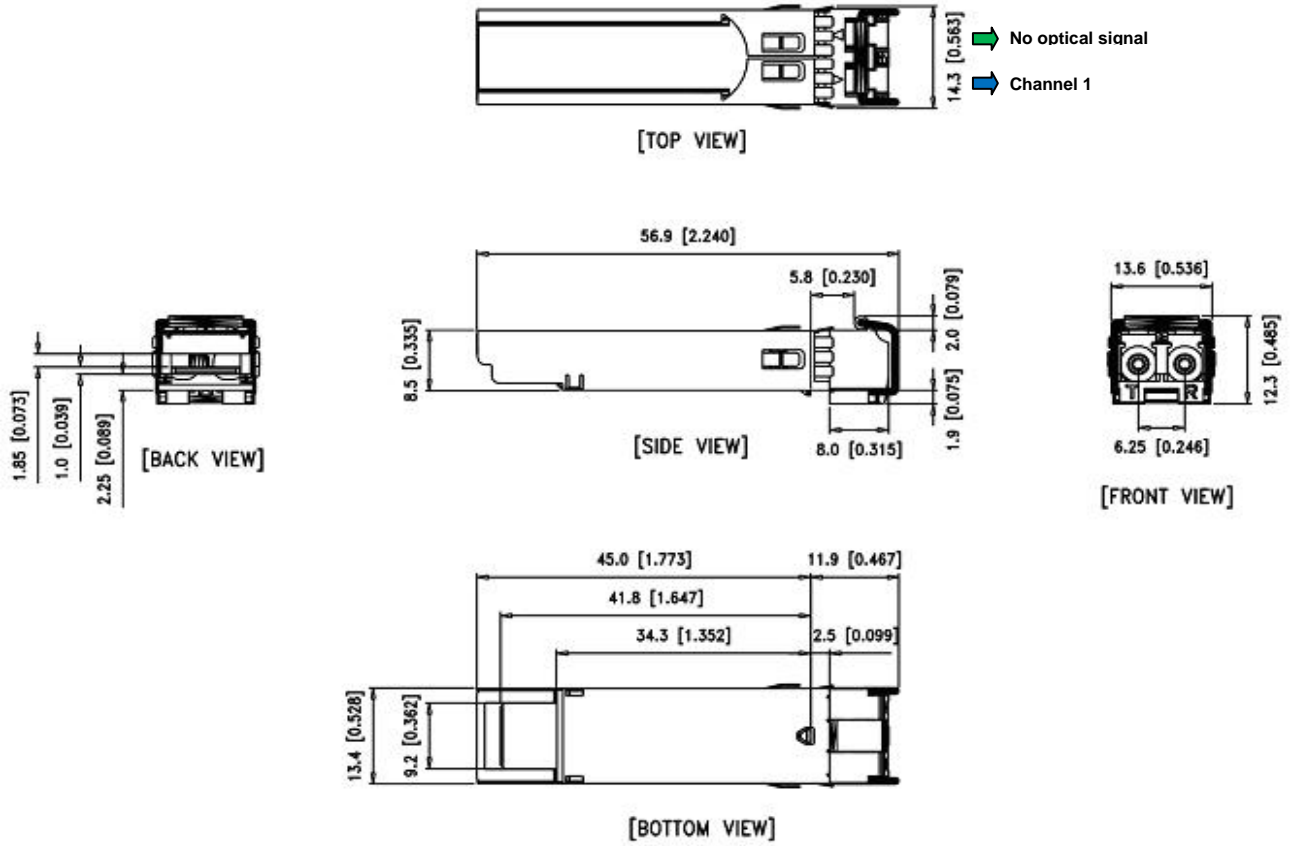
7.2.5 Vendor Specific Memory Addresses

Addr. (DEC)	# Bytes	Name	Description
120-127	8	Vendor specific	Vendor specific

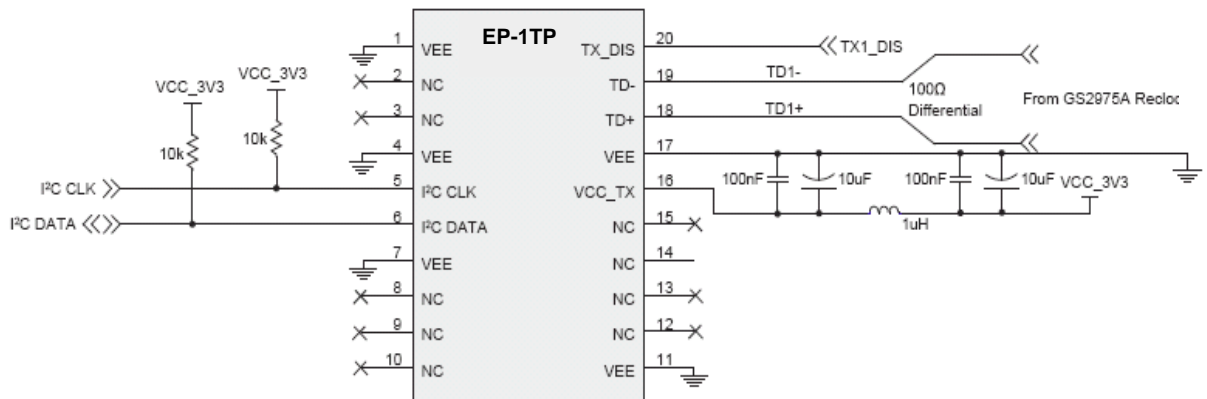
7.2.6 User EEPROM

Addr. (DEC)	# Bytes	Name	Description
128-247	120	Vendor Writable Area	Vendor writable EEPROM
248-255	8	Vendor specific	Vendor specific control functions

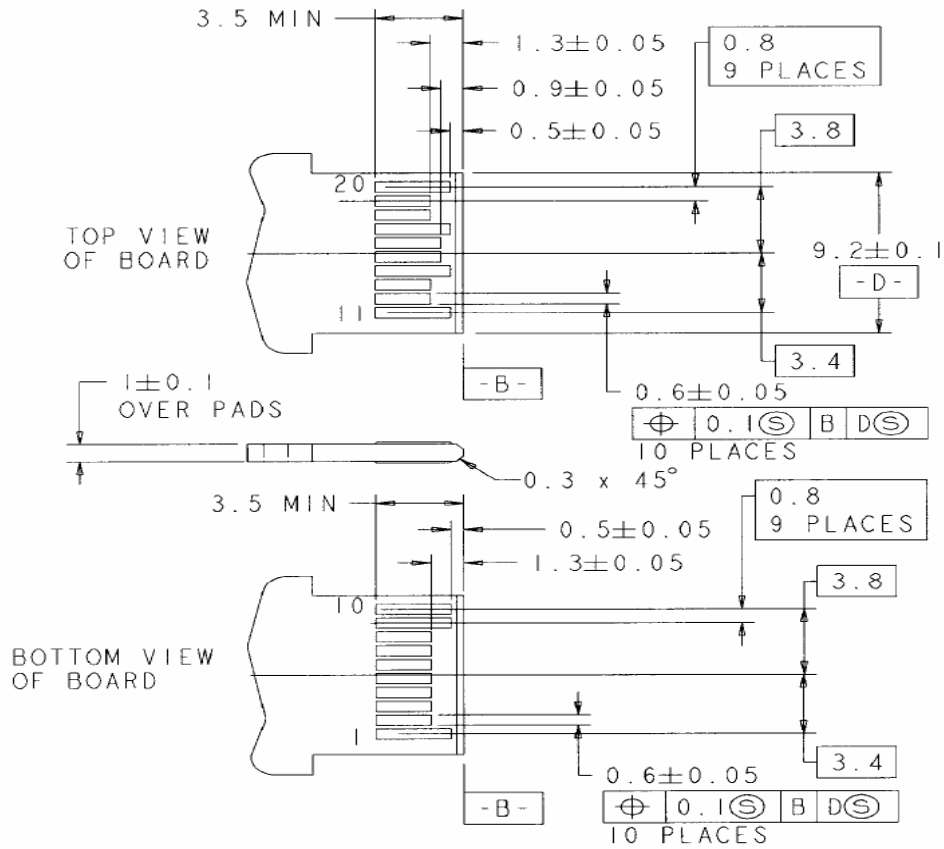
8 Package Information



9 Recommended Circuit



10 Pattern Layout of SFP Printed Circuit Board



(Unit: mm)

