

VER A / 022208

PT745F-81-1D(+)*10Gb/s XFP Optical Transceiver Module***1 Features**

- Supports 9.95Gb/s~10.7Gb/s bit rates
- Transceiver unit with independent
Uncooled 1310nm DFB laser diode transmitter
PIN photodiode receiver
- Meet XFP MSA completely
- Digital diagnostic monitoring
- Hot-pluggable
- Metal enclosure for lower EMI
- Duplex LC receptacle
- XFP Mechanical Interface with bail latch for easy removal
- LVTTTL logic level Tx_Disable and Rx_LOS functions
- Qualified to meet the intent of Bellcore reliability practices
- 3.3V power supply only
- XFI loopback
- Power consumption less than 2.0W, 1.5W typical
- Links of 2~10 km with 9/125 μ m SMF
- Complies with RoHS directive(2002/95/EC)

**Applications**

- 10GBASE-LR/LW (10G Ethernet)
- VSR-2000-2R1,I-64.1 (STM-64) / SR-1 (OC-192)
- 1200-SM-LL-L(10G Fiber Channel)

I. General

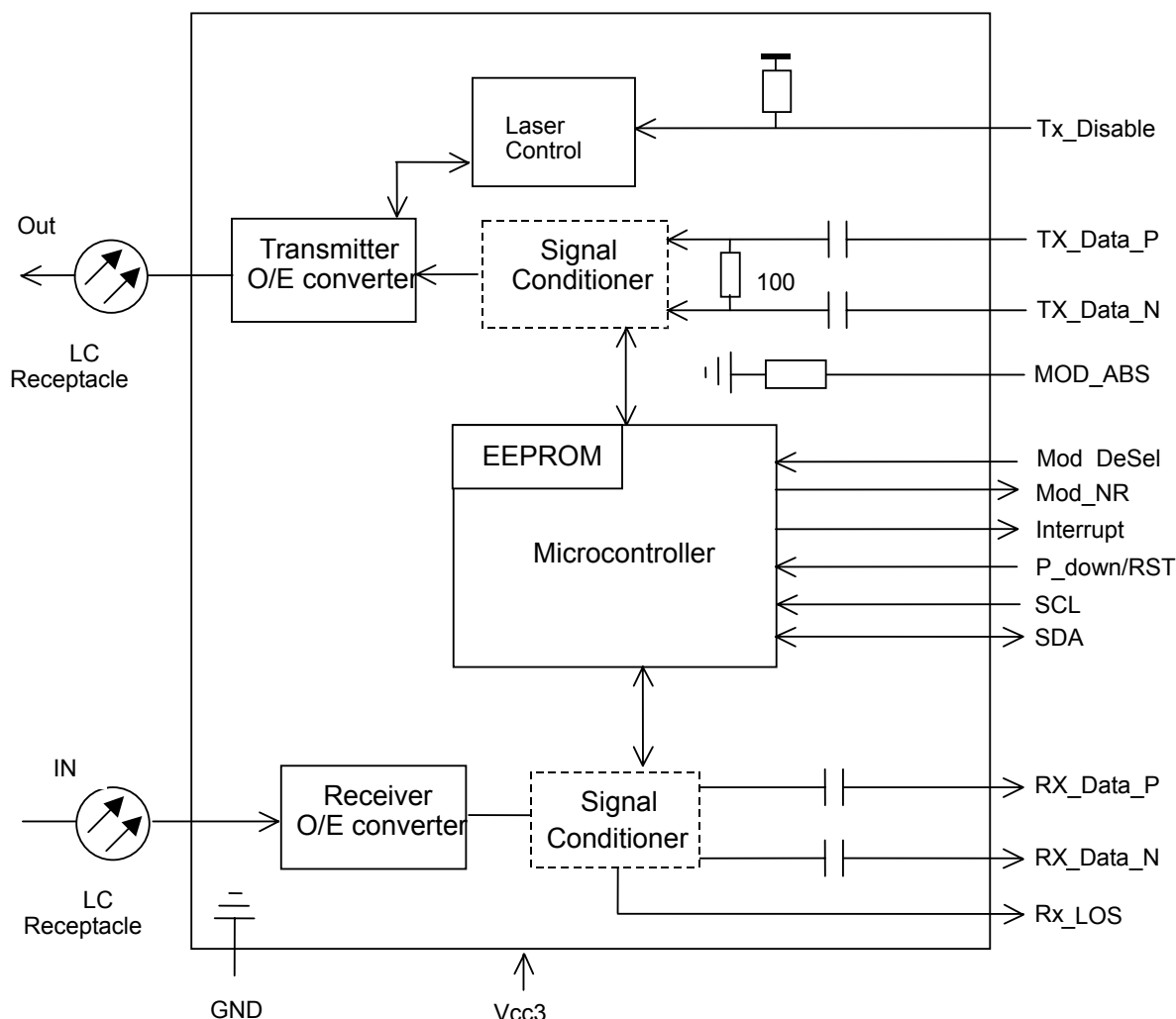
The PT745F-81-1D+ is compliant with the 10G Small Form-Factor Pluggable (XFP) Multi-Source Agreement (MSA). It offers previously unavailable system cost, upgrade, and reliability benefits by virtue of being hot-pluggable.

The PT745F-81-1D+ is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The PT745F-81-1D+ converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with XFI specification and allows FR4 host PCB trace up to 200mm.

The PT745F-81-1D+ is designed for use in a variety of 10Gb/s SONET/SDH equipment including FEC

(9.95Gb/s to 10.7Gb/s) and Ethernet LAN (10.3Gb/s) and WAN (9.95Gb/s) applications.

The high performance uncooled 1310nm DFB-LD transmitter and high sensitivity PIN receiver provide superior performance for SONET /SDH and Ethernet applications at up to 10km links.



Transmitter Section

The transmitter contains a Clock Data Recovery (CDR) circuit that reduces the jitter of received signal and reshapes the electrical signal before the electrical to optical (E-O) conversion. The optical output power is maintained constant by a power control circuit. Transmitter is designed for single mode fiber and operates at a nominal wavelength of 1310nm. The transmitter module uses a DFB laser diode. The output power can be turned off by the single TxDis pin. Logic LVTTTL HIGH level disables the transmitter.

Receiver Section

The receiver section uses a hermetic packaged front end receiver (PIN and preamplifier). The optical receiver contains a CDR circuits that reshapes and retimes an electrical signal before sending out to the XFI channel. As the input optical is decreased, LOS will switch from low to high. As the input optical power is increased from very low levels, LOS will switch back from high to low.

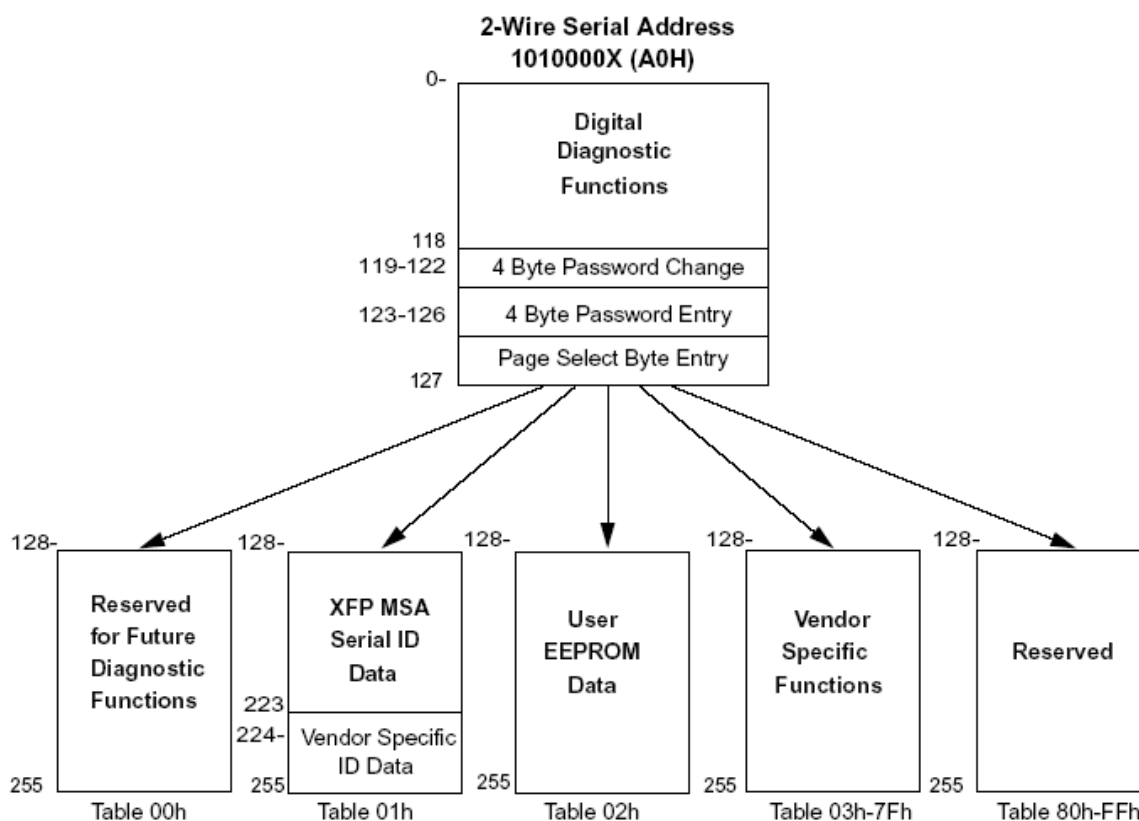
Management Interface

The optical transceiver contains an EEPROM. It provides access to sophisticated identification

information that describes the transceiver’s capabilities, standard interfaces, manufacturer, and other information.

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C01A/02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units. The digital diagnostic memory map specific data field defines as following.



II. Regulatory Compliance

NeoPhotonics XFP transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Standard	Performance
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN 60825-1,-2	Class I
Immunity	IEC 61000-4-3	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B	Compliant with standards
Electrostatic Discharge(ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 2(>2000 V)

III. Performance Specifications

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Tst	-40	+85	°C
Power Supply Voltage	VCC3	-0.5	4	V
Receiver Input Optical Power	Mip	-	3	dBm

Recommend Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Case Temperature	Top	-5	-	70	°C
Relative Humidity (non-condensing)	Rhop	5	-	85	%
Power Supply Voltage	VCC3	3.1	3.3	3.5	V
Power Supply Current	ICC3	-	450	600	mA
Total Power Consumption	Pd	-	-	2	W

Transmitter E-O Characteristics(Top=-5~70°C, VCC3=3.1~3.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	-	9.95	-	10.7	Gb/s	-
Center Wavelength	λ	1290	-	1330	nm	-
Spectral Width (-20dB)	$\Delta\lambda$	-	-	1.0	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Average Optical Output Power	Po	-6	-	-1	dBm	1
Extinction Ratio	Er	6	-	-	dB	-
Optical path penalty	OPP	-	-	1	dB	-

Transmitter Enable Voltage	VEN	GND	-	0.8	V	-
Transmitter Disable Voltage	VD	2.0	-	VCC3	V	-
Differential data Inputs swing	Vinpp	120	-	1000	mV	2
Output Power After Disabled	-	-	-	-30	dBm	-
Output Eye Diagram	Compliant with ITUT and IEEE recommendation MASK					

Notes:

1. The optical power is launched into SMF.
2. Internally AC coupled.

Receiver O-E Characteristics(Top=-5~70°C, VCC3=3.1~3.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	-	9.95	-	10.7	Gb/s	-
Operate Wavelength	-	1260	-	1620	nm	-
Sensitivity	Sen1	-	-17	-14.4	dBm	1
Sensitivity in OMA	Sen2	-	-	-12.6	dBm	1
Stressed Receiver Sensitivity(OMA)	SRS	-	-	-10.3	dBm	-
Saturation	Ps	+0.5	-	-	dBm	1
LOS Asserted	-	-30	-	-	dBm	High level: Alarm
LOS De-Asserted	-	-	-	-15	dBm	
LOS Hysteresis	-	0.5	-	-	dB	
Differential data outputs swing	Voutpp	500	-	800	mV	2
LOS Low Voltage	VLout	GND	-	0.4	V	-
LOS High Voltage	VHout	2.0	-	VCC3	V	-
Receiver Optical Return Loss	-	-	-	-27	dB	-

Notes

1. Measured at 9.953Gbps, PRBS 2³¹-1, NRZ, BER≤10⁻¹²
2. Internally AC coupled

IV. EEPROM Section

Table1 Digital Diagnostic Monitoring A/D Accuracy

Data Address	Parameter	Accuracy	Note
96-97	Temperature	±3°C	1
100-101	Tx Bias	±10%	2
102-103	Tx Power	±2dB@BOL (-6 to -1dBm)	-
104-105	Rx Power	±2dB@BOL (-16to +0.5dBm)	-
106-107	VCC3	±3%	3

Notes:

1. Junction temperature of monitoring IC, Range from -10 to +80°C.
2. Over specified temperature and voltage range over the life of the product into a fixed measurement

system

3. VCC3 ranges from +2.97V to +3.63V.

Table2 Serial ID Memory Contents (Page 01h)

Addr.	Size(byte)	Name of field	Hex	Description
128	1	Identifier	06	XFP
129	1	Ext. Identifier	50	2.5W Max, with CDR
130	1	Connector	07	LC connector
131	8	Transceiver	44	10GASE-LR/LW
132			40	1200-SM-LL-L
133			00	-
134			00	-
135			40	I-64.1
136			00	-
137			00	-
138			00	-
139	1	Encoding	F0	64B/66B; 8B10B; SONET Scrambled; NRZ
140	1	BR-Min	63	9.953Gbps
141	1	BR-Max	6C	10.7Gbps
142	1	Length(SMF)-km	0A	10 km
143	1	Length (E-50µm)	00	-
144	1	Length (50 µm)	00	-
145	1	Length (62.5 µm)	00	-
146	1	Length (Copper)	00	-
147	1	Device Tech	40	1310nm DFB; PIN detector
148-163	16	Vendor name	4E 45 4F 50 50 48 4F 54 4F 4E 49 43 53 20 20 20	"NEOPHOTONICS"
164	1	CDR	F0	Support 9.95-10.7Gb/s
165-167	3	Vendor OUI	00 00 00	-
168	1	Vendor PN	50	P
169	1		54	T
170	1		37	7
171	1		34	4
172	1		35	5
173	1		46	F

174	1		2D	-
175	1		38	8
176	1		31	1
177	1		2D	-
178	1		31	1
179	1		44	D
180	1		2B	+ (Optional)
181	1		20	
182	1		20	
183	1		20	
184-185	2		Vendor rev	31 31
186-187	2	wavelength	66	1310nm
			58	
188-189	2	Wavelength Tolerance	0F	±20nm(Note1)
			A0	
190	1	Max Case Temp	46	70°C
191	1	CC_BASE	Note2	-
192	4	Power Supply	64	Max total power consumption 2W
193			96	1.5W
194			06	Note3
195			00	Note4
196-211	16	Vendor SN	-	-
212-219	8	vendor's date code	-	-
220	1	Diagnostic Monitoring Type	08	No BER Support
				Average Power
221	1	Enhanced Options	00	
222	1	Aux Monitoring	70	3.3V Supply Voltage
223	1	CC_EXT	00	-
224-255	32	Vendor Specific	--	Vendor Specific EEPROM

Note1: The guaranteed +/- range of transmitter output wavelength under all normal operating conditions.

Note2: Address 191 is check sum of bytes 128 to 190.

Note3:+5V is not in use.

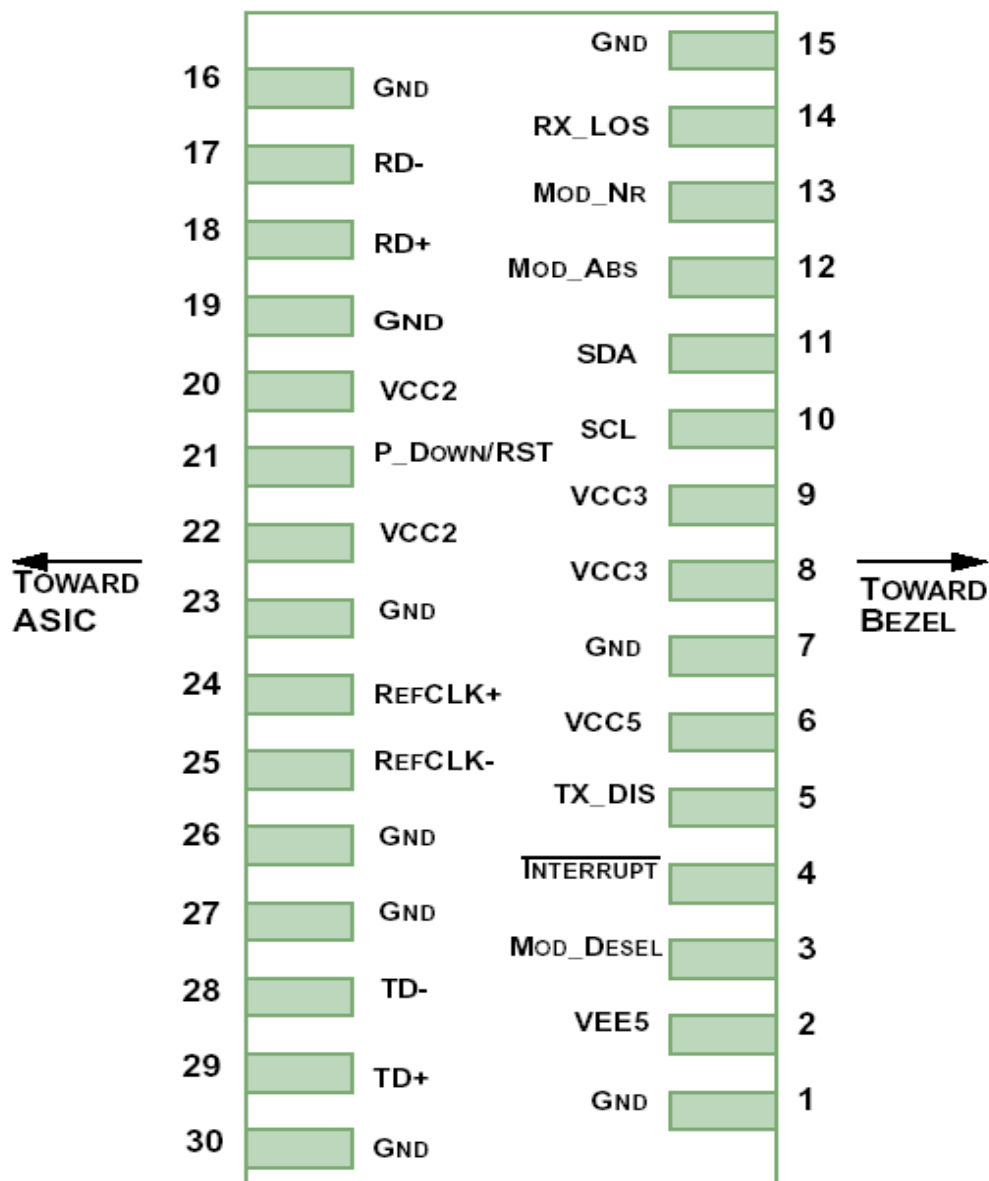
Note4:+1.8V/-5.2V is not in use

Table3 Alarm and Warning thresholds Setting

Parameter(Unit)	High Alarm	Low Alarm	High Warning	Low Warning
Temp(°C)	95	-10	90	0
Voltage(V)	3.5	3.1	3.45	3.15
Bias(mA)	100	10	90	20
TX Power(dBm)	-1	-6	-1.5	-5.5
RX Power(dBm)	-1	-14.5	-1.5	-14

V. Pin Definitions

Pin Diagram



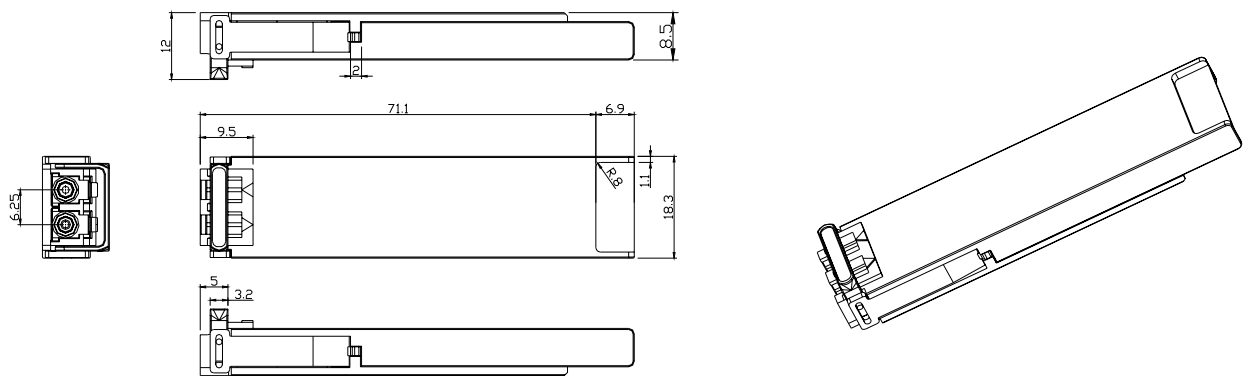
Pin Descriptions

Pin	Logic	Name	Description	Note
1		GND	Module common ground	1
2		VEE5	Optional -5.2V power supply, not in use	3
3	LVTTL-I	Mod_DeSel	Module Deselect; when held low allows module to respond 2-wire serial interface	-
4	LVTTL-O	$\overline{\text{Interrupt}}$	Indicates presence of an important condition which can be read over the 2-wire serial interface	2
5	LVTTL-I	TX_DIS	Transmitter Disable; turn off transmitter laser output	-
6		VCC5	+5V power supply, not in use	3
7		GND	Module common ground	1
8		VCC3	+3.3V power supply	-
9		VCC3	+3.3V power supply	-
10	LVTTL-I/O	SCL	2-wire serial interface clock.	2
11	LVTTL-I/O	SDA	2-wire serial interface data.	2
12	LVTTL-O	Mod_Abs	Indicates module is not present. ground in the module	2
13	LVTTL-O	Mod_NR	Module not ready, indicating module operational fault	2
14	LVTTL-O	RX_LOS	Receiver loss of signal indicator	2
15		GND	Module common ground	1
16		GND	Module common ground	1
17	CML-O	RD-	Receiver inverted data output	-
18	CML-O	RD+	Receiver non-inverted data output	-
19		GND	Module common ground	1
20		VCC2	+1.8V power supply, not in use	3
21	LVTTL-I	P_Down/RST	Power down; when high, requires the module to limit power consumption to 1.5w or below ,2-wire serial interface must be functional in the low power mode	-
			Reset; the falling edge initiates a complete reset of the module including the 2-wire Serial interface, equivalent to a power cycle	-
22		VCC2	+1.8V power supply, not in use	3
23		GND	Module Common ground	1
24	PECL-I	RefCLK+	Reference clock non-inverted input, ac coupled on the host board, not in use	3
25	PECL-I	RefCLK-	Reference clock inverted input, ac coupled on the host board, not in use	3
26		GND	Module common ground	1
27		GND	Module common ground	1
28	CML-I	TD-	Transmitter inverted data input	-
29	CML-I	TD+	Transmitter non-inverted data input	-
30		GND	Module common ground	1

Notes:

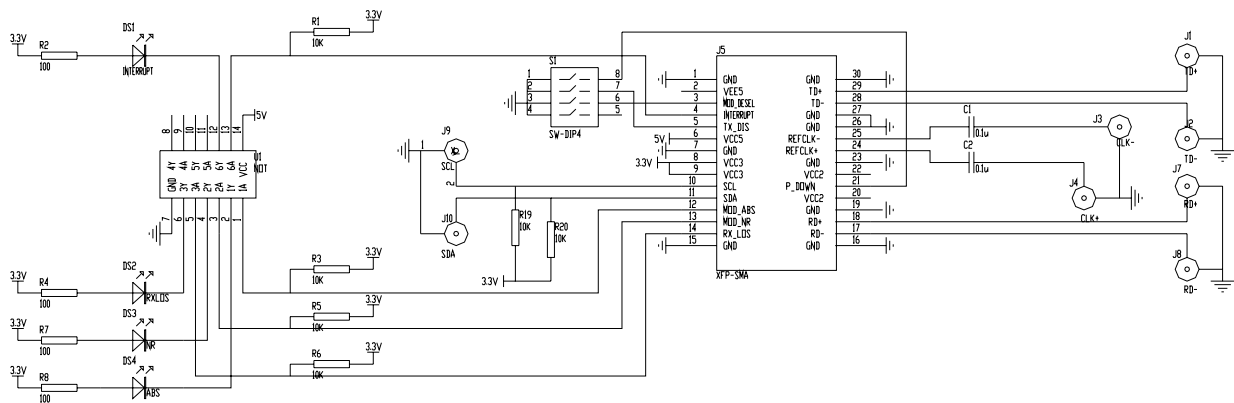
1. Module ground pins GND are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
3. Not connected internally.

VI. Package Information



UNIT: mm

VII. Recommended Circuit



VIII. Specification for environmental protection

1. RoHS-5 compliant product:

Qualified as RoHS compliant product for network application based on the lead(Pb) RoHS exemption clause of “lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission as well as network management for telecommunications”.

RoHS-5 compliant products 2nd level interconnect material contained lead (Pb) and Pb concentration > 1000ppm, e.g. soldering material, or the terminals, Pins of electronic components, or

pads of printed circuit board, exempted by RoHS(2002/95/EC) directive.

Other materials (excluded exempted material) comply with threshold value of RoHS banned substance in homogenous material.

2. RoHS-6 compliant product:

Qualified as RoHS compliant and lead-free product based on lead-free soldering process, all materials (excluded exempted material) comply with threshold value of RoHS banned substance in homogenous material.

IX. Ordering Information

Part Number	RoHS Compliant
PT745F-81-1D	RoHS-5
PT745F-81-1D+	RoHS-6

X. Revision History

Rev.	Date	Modification	Note
1.1	2006-5-18	Initial datasheet	-
1.2	2007-2-1	Modify Sen1,Sen2	-
A	2008-2-22	Add EEPROM,DDM IFO and change test rate from 10.31 Gbps to 9.953 Gbps	-

XI. References

10 Gigabit Small Form Factor Pluggable Module (XFP) Multi-Source Agreement (MSA), Rev 4.5 - Aug 2005. Documentation is currently available at <http://www.xfpmsa.org/>