

VER C/ 111109

## PT765F-81-2TD(+)

### *10Gb/s XFP Optical Transceiver Module*

#### **1 Features**

- 1.1 Supports 9.95Gb/s to 11.1Gb/s bit rates
- 1.2 Transceiver unit with independent
  - 1550nm DFB laser diode transmitter
  - PIN photodiode receiver
- 1.3 Meet XFP MSA
- 1.4 Digital diagnostic monitoring
- 1.5 Hot-pluggable
- 1.6 Metal enclosure for lower EMI
- 1.7 Duplex LC Receptacle
- 1.8 XFP mechanical interface with bail latch for easy removal
- 1.9 LVTTTL logic level Tx\_Disable and Rx\_LOS functions
- 1.10 Qualified to meet the intent of Bellcore reliability practices
- 1.11 3.3V and 5.0V power supply
- 1.12 Power consumption less than 3.5W
- 1.13 Links of 40 km with 9/125  $\mu\text{m}$  single mode fiber (SMF) of maximum interconnect distances
- 1.14 Complies with RoHS directive (2002/95/EC)

#### **2 Application**

- 2.1 SONET OC-192 /SDH STM-64
- 2.2 10G Ethernet
- 2.3 10G Fiber Channel

#### **3 General**

The PT765F-81-2TD(+) 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.

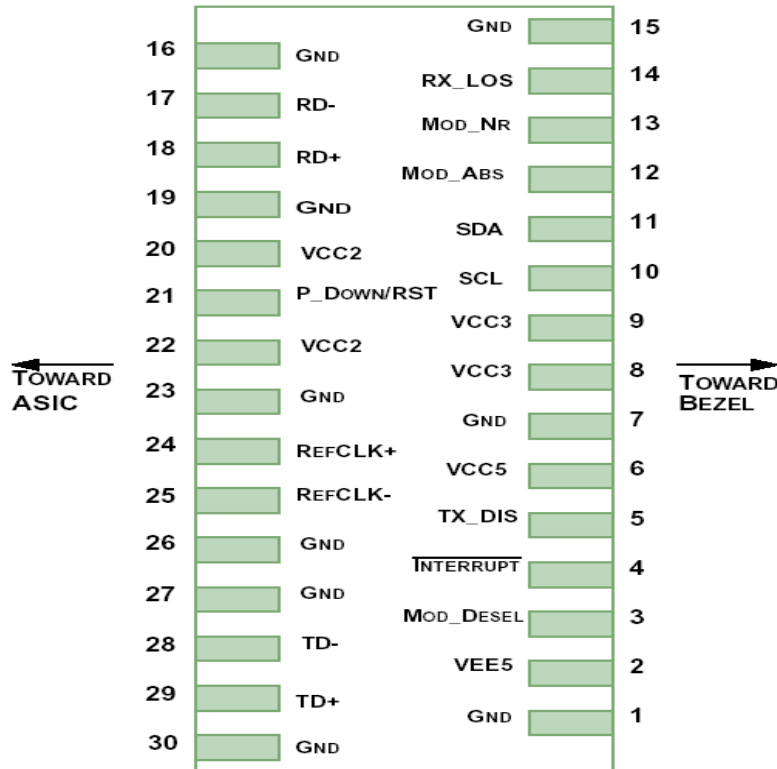
The PT765F-81-2TD(+) is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The PT765F-81-2TD(+) converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with XFI specification and allows FR4 host PCB trace up to 200mm.

The PT765F-81-2TD(+) is designed for use in a variety of 10Gb/s SONET/SDH equipment including FEC (9.95Gb/s to 11.1Gb/s) and Ethernet LAN (10.3Gb/s) and WAN (9.95Gb/s) applications.

The high performance cooled 1550nm DFB-LD transmitter and high sensitivity PIN receiver provide superior performance for SONET /SDH and Ethernet applications at up to 40km links.

## 4 Pin Definitions

### 4.1 Pin Diagram



### 4.2 Pin Descriptions

Pin	logic	name	description	note
1		GND	Module Common ground	1
2		VEE5	Optional -5.2V power supply	-
3	LVTTL-I	Mod_DeSel	Module Deselect; when held low allows module to respond 2-wire serial interface	-
4	LVTTL-O	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	-
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	-
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	-
23		GND	Module Common ground	1
24	PECL-I	RefCLK+	Reference clock non-inverted input, ac coupled on the host board	-
25	PECL-I	RefCLK-	Reference clock inverted input, ac coupled on the host board	-
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

Note:

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.

## 5 Performance Specifications

### 5.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Tst	-40	+85	°C
Case Temperature ( Operating )	To	-5	+70	°C
Power Supply Voltage	VCC3	-0.5	4	V
Power Supply Voltage	VCC5	-0.5	6	V
Receiver Input Optical Power	Mip	-	3	dBm

### 5.2 Recommended Operating Conditions and Supply Requirements

Parameter	Symbol	Min.	Max.	Unit	Note
Case Temperature ( Operating )	Topc	-5	70	°C	-

Relative Humidity (non-condensing)	Rhop	5	85	%	-
Power Supply Voltage	VCC3	3.1	3.5	V	-
Power Supply Voltage	VCC5	4.75	5.25	V	-
Power Supply Current	ICC3	-	700	mA	-
Power Supply Current	ICC5	-	400	mA	-
Total Power Consumption	Pd	-	3.5	W	-

### 5.3 Transmitter E-O characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating data rate	-	9.95	-	11.1	Gb/s	-
Center Wavelength	$\lambda$	1530		1565	nm	-
Spectral Width(-20dB)	$\Delta\lambda$	-	-	1.0	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Average Optical Output Power	Po	-1	-	+2	dBm	1
Extinction Ratio	ER	8.2	-	-	dB	-
Transmitter Enable Voltage	VEN	GND	-	0.8	V	-
Transmitter disable Voltage	VD	2.0	-	VCC3	V	-
Differential data Input Swing	Vpp	120	-	820	mVpp	-
Max.mean launched power in case Tx_Dis	Poff	-	-	-30	dBm	-
Dispersion Tolerance	-	-	-	800	Ps/nm	-
Optical path penalty	-	-	-	2	dB	-
Jitter Generation	B1	-	-	0.3	UI	20K-80M Hz
Jitter Generation	B2	-	-	0.1	UI	4MHZ-80 MHz
Output Eye Diagram	Compliant with ITUT and IEEE recommendation MASK					

Note 1: Measured at 9.95328Gbps, Framed PRBS2^31-1, NRZ

### 5.4 Receiver O-E Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating data rate	-	9.95	-	11.1	Gb/s	-
Operate wavelength	-	1260	-	1620	nm	-
Sensitivity	Pr	-	-	-16	dBm	1
Saturation	Ps	-1	-	-	dBm	1
LOS Asserted	-	-30	-	-	dBm	High level: Alarm
LOS De-Asserted	-	-	-	-16	dBm	
LOS Hysteresis	-	0.5	-	5	dB	
Differential data output swing	VPP	340	-	850	mV	-
Data Output Rise Time	t <sub>r</sub>	-	-	40	ps	-
Data Output Fall Time	t <sub>f</sub>	-	-	40	ps	-
LOS Low Voltage	VLout	GND	-	0.4	V	-

LOS High Voltage	VHout	2.0	-	VCC3	V	-
Receiver Optical Return Loss	-	-	-	-27	dB	-

Note 1: Measured at 9.95328Gbps, Framed PRBS2^31-1, NRZ, BER≤10<sup>-12</sup>

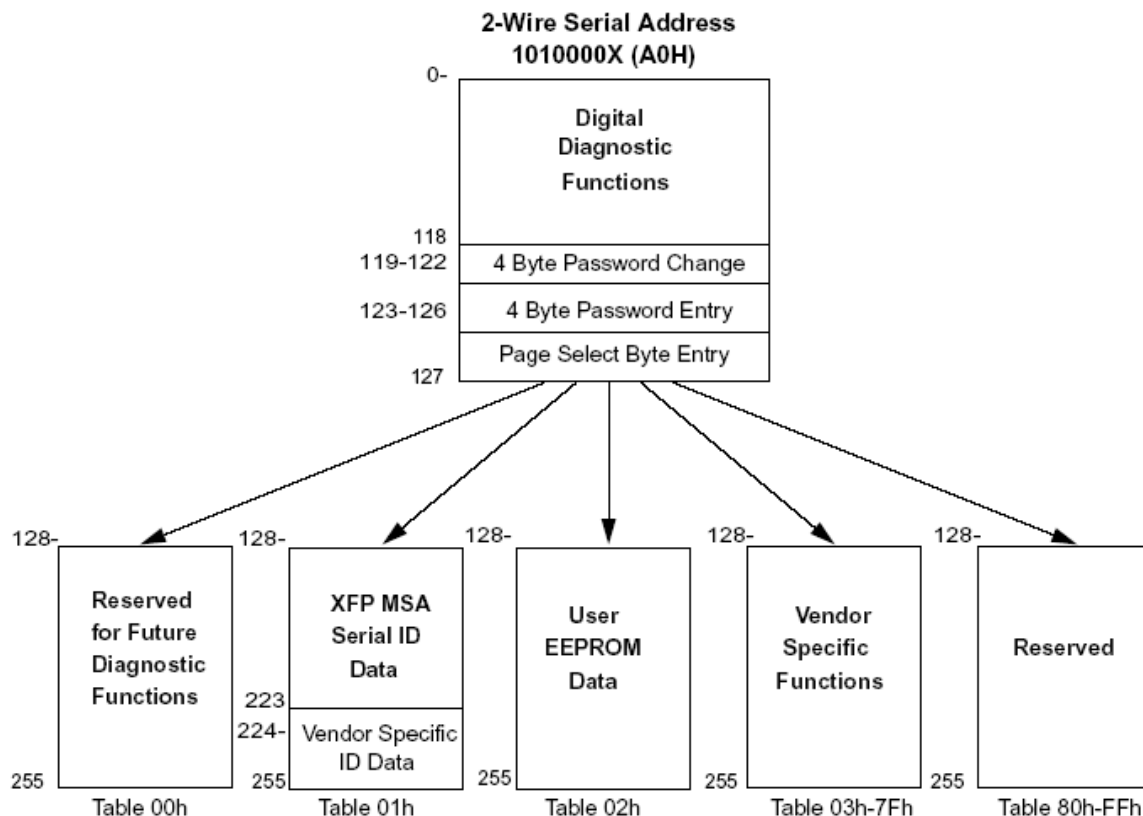
## 6 EEPROM Section

### 6.1 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 fields define as following.



6.2 Serial ID Memory Contents (Table 01h)

Addr.	Size(byte)	Name of field	Dec	Description
128	1	Identifier	6	XFP
129	1	Ext. Identifier	144	3.5W Max power dissipation , with CDR , TX Ref Clock Input not Required
130	1	Connector	7	LC connector
131	8	Transceiver	34	10GBASE-ER/EW
132			32	Extended Reach 1550 nm
133			0	-
134			0	-
135			0	-
136			32	S-64.2b
137			0	-
138			0	-
139	1	Encoding	176	64B/66B; SONET Scrambled; NRZ
140	1	BR-Min	99	9.95Gbps
141	1	BR-Max	111	11.1Gbps
142	1	Length(SMF)-km	40	40km
143	1	Length (E-50µm)	0	-
144	1	Length (50 µm)	0	-
145	1	Length (62.5 µm)	0	-
146	1	Length (Copper)	0	-
147	1	Device Tech	116	1550nm EML, Cooled transmitter ,Transmitter not Tunable; PIN detector
148-163	16	Vendor name	78 69 79 80 72 79 84 79 78 73 67 83 32 32 32 32	"NEOPHOTONICS"
164	1	CDR	248	CDR Support 9.95-11.1Gb/s
165-167	3	Vendor OUI	0	-
168	1	Vendor PN	80	P
169	1		84	T
170	1		55	7
171	1		54	6
172	1		53	5
173	1		70	F
174	1		45	-
175	1		56	8
176	1		49	1
177	1		45	-

178	1		50	2
179	1		84	T
180	1		68	D
181	1		43/32	(If RoHS6 Compliant, set "+", otherwise this bit set 32.)
182	1		32	
183	1		32	
184-185	2	Vendor rev	0 0	Unspecified
186-187	2	Wavelength	121	1550nm
			24	
188-189	2	Wavelength Tolerance	11	+/-15nm
			184	
190	1	Max Case Temp	70	70°C
191	1	CC_BASE	-	Note2
192	4	Power Supply	175	Maximum Power Dissipation
193			150	Maximum Total Power Dissipation in Power Down Mode
194			135	Maximum current required by +5V Supply is 400mA Maximum current required by +3.3V Supply is 700mA
195			0	+1.8V Supply and -5.2V Supply are not in use.
196-211	16	Vendor SN	-	-
212-219	8	vendor's date code	-	-
220	1	Diagnostic Monitoring Type	8	Module Respond to FEC BER: No BER Support
				Received power measurement type: Average Power
221	1	Enhanced Options	0	-
222	1	Aux Monitoring	116	+3.3V Supply Voltage; Laser Temperature
223	1	CC_EXT	-	Note3
224-255	32	Vendor Specific	-	-

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

Note2: Address 191 is checksum of bytes from128 to 190.

Note3: Address 222 is checksum of bytes from192 to 222.

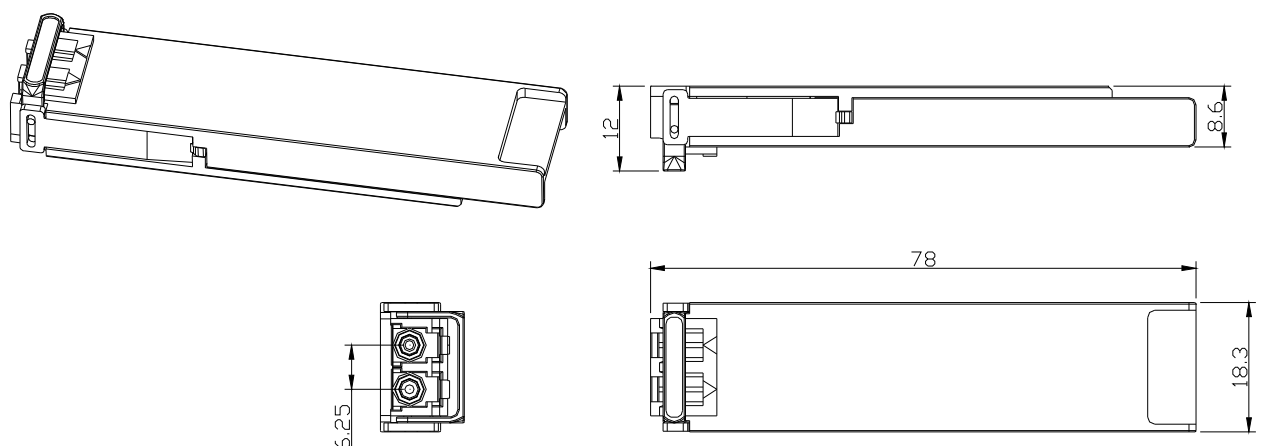
### 6.3 Digital Diagnostic Monitoring Accuracy

Digital Diagnostic Monitor	Accuracy Limit
XFP Case Temperature	±3°C
Laser Bias Current	±10%
TX Power	±2.0dB@EOL(-1~+2dBm)
Optical Rx Power	±2.0dB@EOL(-16~0.5dBm)
VCC3	±3%

### 6.4 Alarm and Warning thresholds Setting

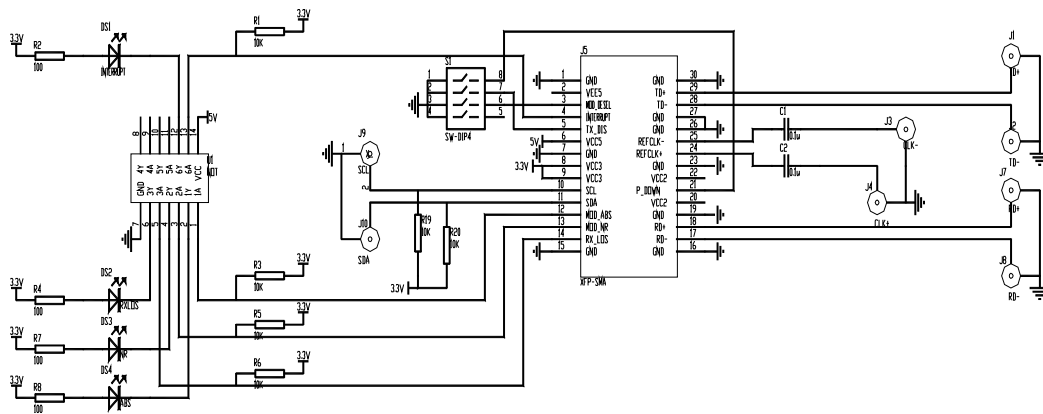
Parameter(Unit)	High Alarm	Low Alarm	High Warning	Low Warning
Temp(°C)	95	-10	90	0
Voltage(V)	3.5	3.1	3.45	3.15
Bias(mA)	110	10	100	20
TX Power(dBm)	2.5	-1.5	+2	-1
RX Power(dBm)	-1	-16.5	-1.5	-16

## 7 Package information





### 8 Recommended Circuit



### 9 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 2<sup>nd</sup> 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.

### 10 Ordering information

Part Number	RoHS Compliant
PT765F-81-2TD	RoHS-5
PT765F-81-2TD+	RoHS-6

### 11 Release History

Version	Change Description	Changed by	Date
A	Initial release	Xiaobao Yang	2008-05-12
B	1. change operating data rate from 9.953~10.7Gbps to 9.953~11.1Gbps	Xiaobao Yang	2009-08-26

	<p>and EEPROM definition updated correspondingly</p> <ol style="list-style-type: none"> <li>2. change contents of byte184~185<sup>th</sup>, table 01 from 49,49 to 0,0;</li> <li>3. Correct Differential data Input Swing from 240mV~2V to 120mV~820mV;</li> <li>4. Correct Differential data output swing from 500mV~800mV to 340mV~850mV</li> <li>5. Correct Digital Diagnostic Monitoring Accuracy requirement from BOL to EOL according to XFP MSA</li> </ol>		
C	<ol style="list-style-type: none"> <li>1. Correct wavelength in byte186,187 table 01 from 120 , 230 to 121,24,means from 1547.5nm to 1550nm;</li> <li>2. Correct wavelength tolerance in byte 188,189 table 01 from 13,172 to 11,184,means from +/-17.5nm to +/-15nm</li> </ol>	Xiaobao Yang	2009-11-10

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