PeakOptical®

DATASHEET

DESCRIPTION:

PHOLT-24-24-2211S43HF is Optical Line Terminal (OLT) compliant with 1000BASE-PX20 application.
The transceiver is the high performance module for 1.25Gbps data link in single fiber by using 1490nm continuous- mode transmitter and 1310nm burst-mode receiver.It provides digital diagnostic information of its operating conditions and status, including transmitting power, laser bias current, module temperature, and supply voltage. Calibration and alarm/warning threshold data are written and stored in the internal memory (EEPROM). The memory map is compatible with SFF-8472.
The transmitter section uses a multiple quantum well 1490nm DFB laser and is Class I laser compliant product according to international safety standard IEC-60825.
The receiver has a hermetically packaged APD-TIA (trans-impedance amplifier) pre-amplifier and a limiting amplifier with LVPECL compatible differential outputs. It features a Loss of Signal (LOS) output which is LVTTL compatible.
The receiver offers bust-mode RSSI outputs, which is I2C accessible digitized data stored in the internal flash memory.
The optical output can be disabled by a LVTTL logic high-level input of TX_DIS. LAS_nFAIL is provided to indicate that degradation of the laser.

FEATURES:

- Single fiber bi-directional data links with symmetric1.25Gbps upstream and 1.25Gbps downstream
- Integrated with micro-optics WDM filter for dual wavelength Tx/Rx operation at 1490/ 1310nm
- Continuous 1490nm DFB laser transmitter
- 1310nm burst-mode receiver with APD-TIA
- Support more than 24dB dynamic range
- Burst mode received signal strength indication (RSSI) output
- Digital Diagnostic Monitoring (DDM) with external calibration
- 0 to 75℃ operating temperature
- SFP package with SC receptacle
- Single 3.3V power supply
- LVPECL compatible data input/output interface
- LVTTL transmitter disable control
- LVTTL transmitter laser failure alarm
- LVTTL receiver signal-detected indication
- Low EMI and excellent ESD protection
- RoHS Compliance
- Compliant with SFF MSA and SFF-8472
- Compliant with IEEE 802.3ah™-2004

APPLICATIONS:

- Gigabit Ethernet Passive Optical Networks (GE-PON) – OLT side

SPECIFICATIONS:

Absolute Maximum Ratings

Absolute Maximum Ratings are those values, beyond which, some damages may occur to the devices. Exposure to conditions above the Absolute Maximum Ratings listed in Table 1 may negatively impact the reliability of the products.

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Storage Ambient Temperature	TSTG	-40	85	°C	
Operating Humidity	HOP	5	90	%	
Power Supply Voltage	VCC	0	4.0	V	
Input Voltage		GND	Vcc	V	
Soldering Temperature			400	°C	1

Note 1: Only for soldering by iron and 10 seconds on leads only.

Recommended Operating Conditions

Table 2 - Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	VCC	3.13	3.3	3.47	V	3.3V±5%
Operating Ambient Temperature	TOPR	0		70	°C	
Data Rate (Upstream/Downstream)			1.25/ 1.25		Gbit/s	
Data Rate Drift -		-100		100	PPM	

Optical and Electrical Characteristics

Table 3 - Transmitter Optical and Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Optical Center Wavelength	λC	1480		1500	nm	
Optical Spectrum Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Power (BOL)	P BOUT	+2		+7	dBm	1
Average Launch Power-OFF Transmitter	P EOFF			-45	dBm	
Extinction Ratio	ER	9			dB	2
Rise/Fall Time (20%-80%)	TR/TF			260	ps	3
Optical Return Loss Tolerance				12	dB	
Transmitter Reflectance				-10	dB	
Optical Eye Diagram	Compliant With IEEE Std 802.3ah™-2004					4
Data Input Differential Swing	V_{IN}	200		1600	mV	5
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Power Supply Current	ICC_TX			180	mA	
Transmitter Disable Voltage - Low	VTDIS L	0		0.8	V	6
Transmitter Disable Voltage - High	VTDIS,H	2		Vcc	V	
Laser Failure Alarm Voltage - Low	VLFA,L	0		0.8	V	7
Laser Failure Alarm Voltage - High	VLFA,H	2.4		Vcc	V	

Note 1: Launched into 9/125um Single Mode Fiber.
Note 2: Measured with PRBS 27-1 test pattern @1.25 Gbit/s.
Note 3: Measured with the Bessel-Thompson filter OFF.
Note 4: Transmitter eye mask definition {0.22UI, 0.375UI, 0.20UI, 0.20UI, 0.30UI}.
Note 5: Compatible with LVPECL input, AC coupled internally.
Note 6: TX_DISABLE (See Pin Function Definitions)
Note7: TX Fault (See Pin Function Definitions)

Table 4 - Receiver Optical and Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Operating Wavelength		1270	1310	1350	nm	
Sensitivity	PSEN			-30	dBm	1
Saturation	Pov	-6			dBm	
Receiver Threshold Settling Time	TSET			400	ns	
Dynamic Range		24				2
LOS Assert Level	PLOSA			-32	dBm	3
LOS Deassert Level	PLOSD	-45			dBm	4
LOS Hysteresis	PLOSA- PLOSD	0.5		5	dB	
Receiver Reflectance				-12	dB	
Power Supply Current	ICC_RX			120	mA	
Data Output Differential Swing	VOUT	400		1000	mV	5
LOS Voltage - Low	VSD, L	0		0.8	V	
LOS Voltage - High	VSD, H	2.4		VCC	V	
LOS Assert Time	TASS			500	ns	
LOS Deassert Time	TDAS			500	ns	

Note 1: Measured with a PRBS 2^{7-1} test pattern @1.25Gbit/s and ER=10dB, BER =$10^{-12.}$
Note 2: See Figure 3.
Note 3: An increase in optical power above the specified level will cause Loss of Single (LOS) output to switch from a high state to a low state.
Note 4: A decrease in optical power below the specified level will cause Loss of Single (LOS) output to switch from a low state to a high state.
Note 5: LVPECL output, DC coupled internally, guaranteed in the full range of input optical power (-6dBm to -30dBm) (See Recommended Interface Circuit)

Table5- Digital Diagnostic Monitor Accuracy

| Parameter	Unit	Accuracy	Range	Calibration
Tx Optical Power	dB	±3	Full temperature range	External
		±2	Room temperature	
Rx Optical Power	dB	±3	-6dBm to -30dBm	External
Bias Current	%	±10	Id: 1-100mA, Recommended operating conditions	External
Power Supply Voltage	%	±3	Vcc: 3.0-3.6V, Recommended operating conditions	External
Internal Temperature	°C	±3	Recommended operating conditions	External
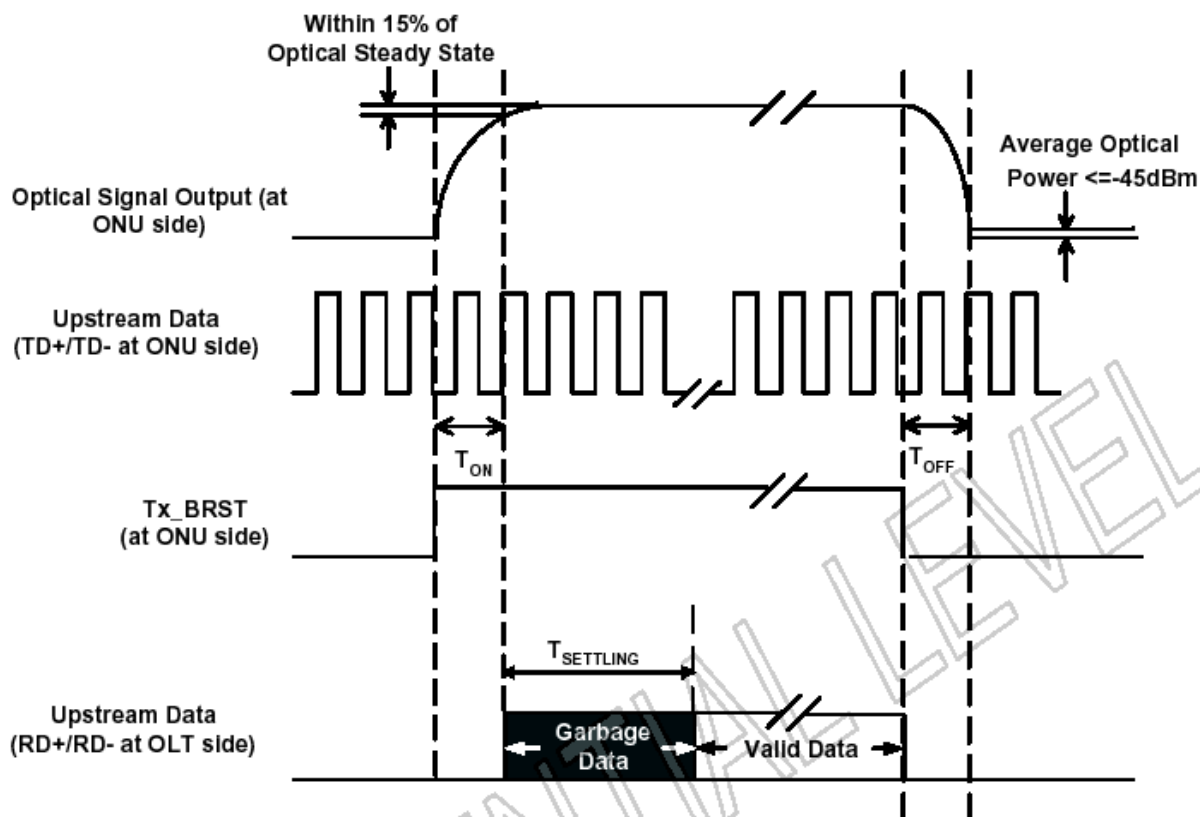
Figure 1 Timing Parameter Definition in Burst Mode Sequence (only one)
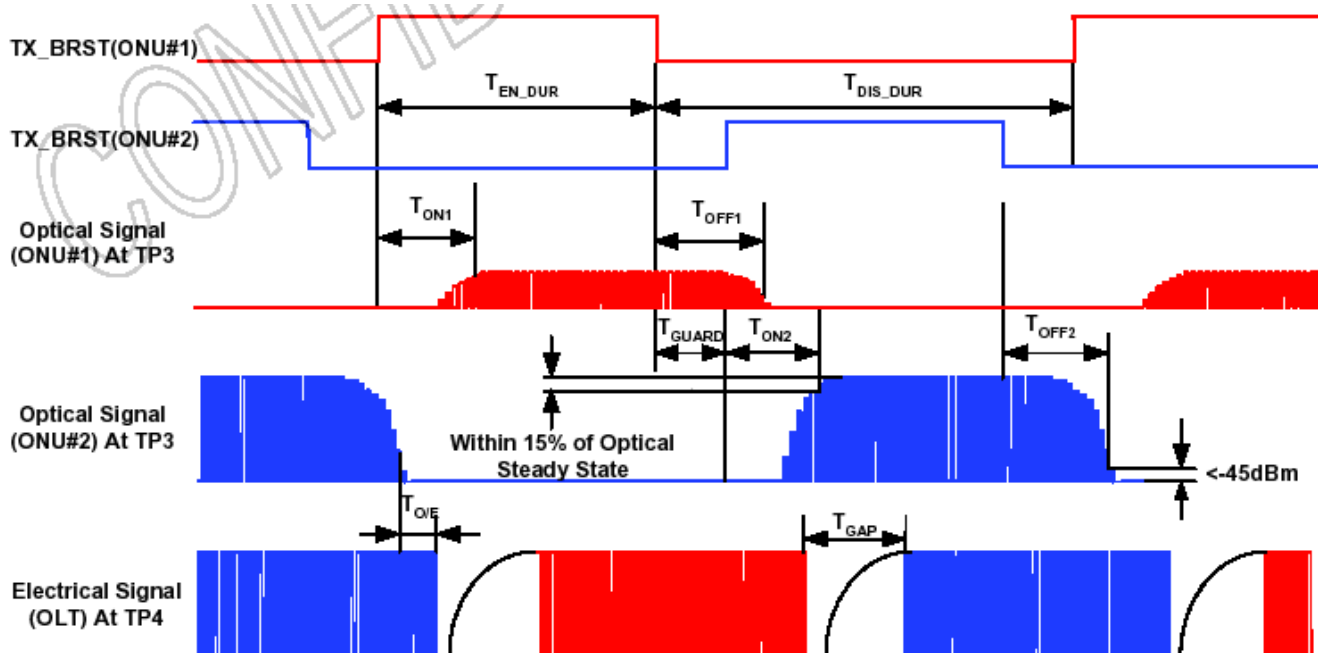

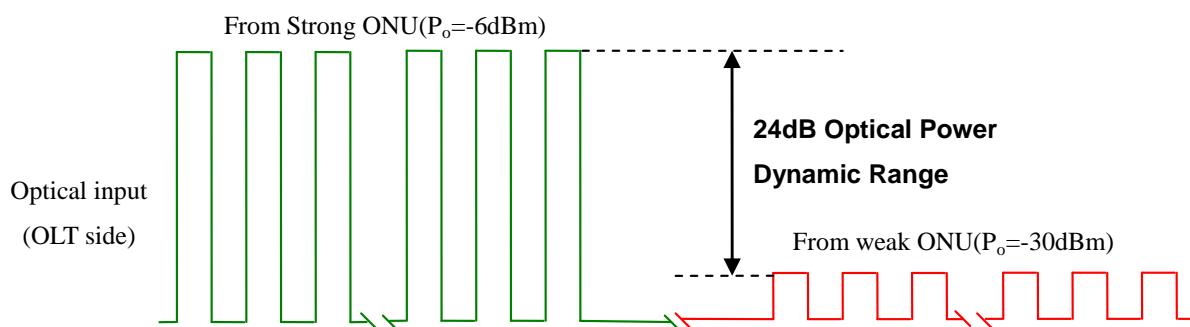**Figure 2 Timing Parameter Definitions in Burst Mode Sequence (Dual ONUs)**

From Strong ONU(P_o=-6dBm)

24dB Optical Power

Dynamic Range

Optical input

(OLT side)

From weak ONU(P_o=-30dBm)

Figure 3 Burst Mode Receiver Dynamic Range in GEPON System

Table 6-Timing Characteristics for Digital RSSI

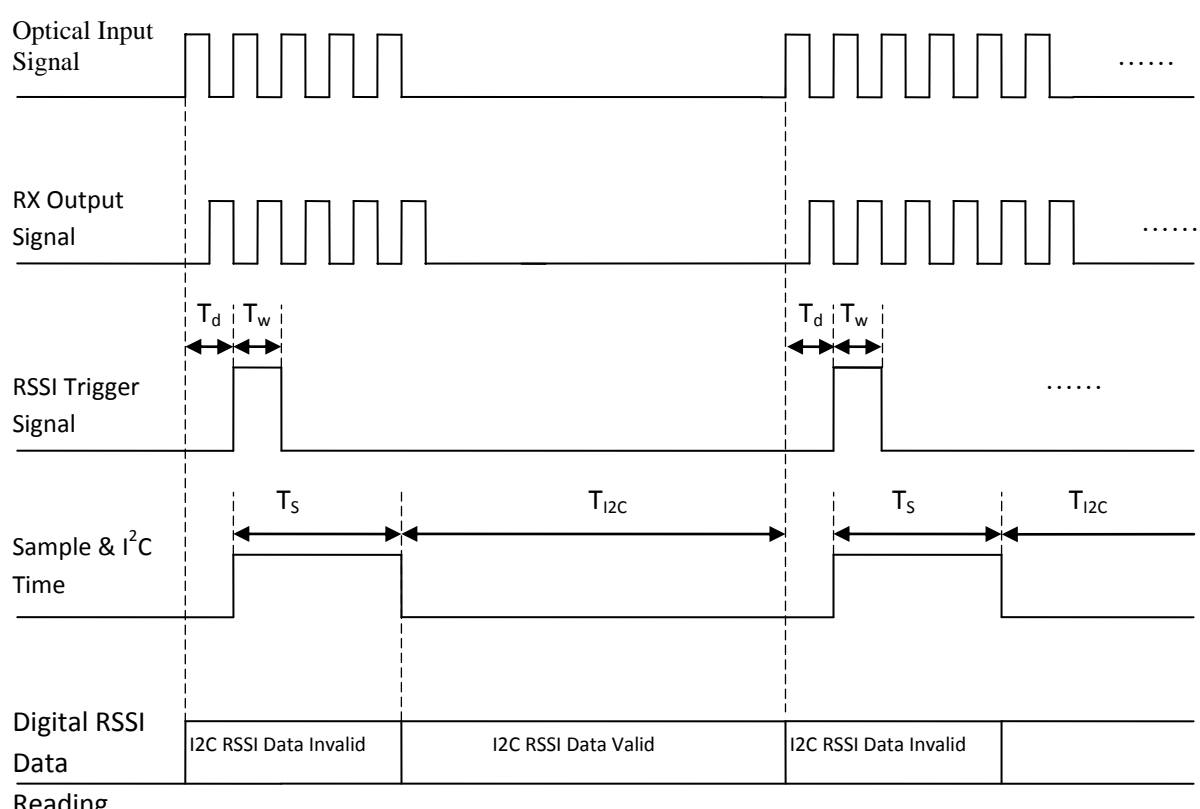| PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Trigger delay	T_d	2	-	-	us
Trigger width	T_w	2	4	-	us
Sample time	Ts	6	-	-	us
I2C read time	T_{I2C}	150	200	-	us

Figure 4 RSSI timing Characteristics
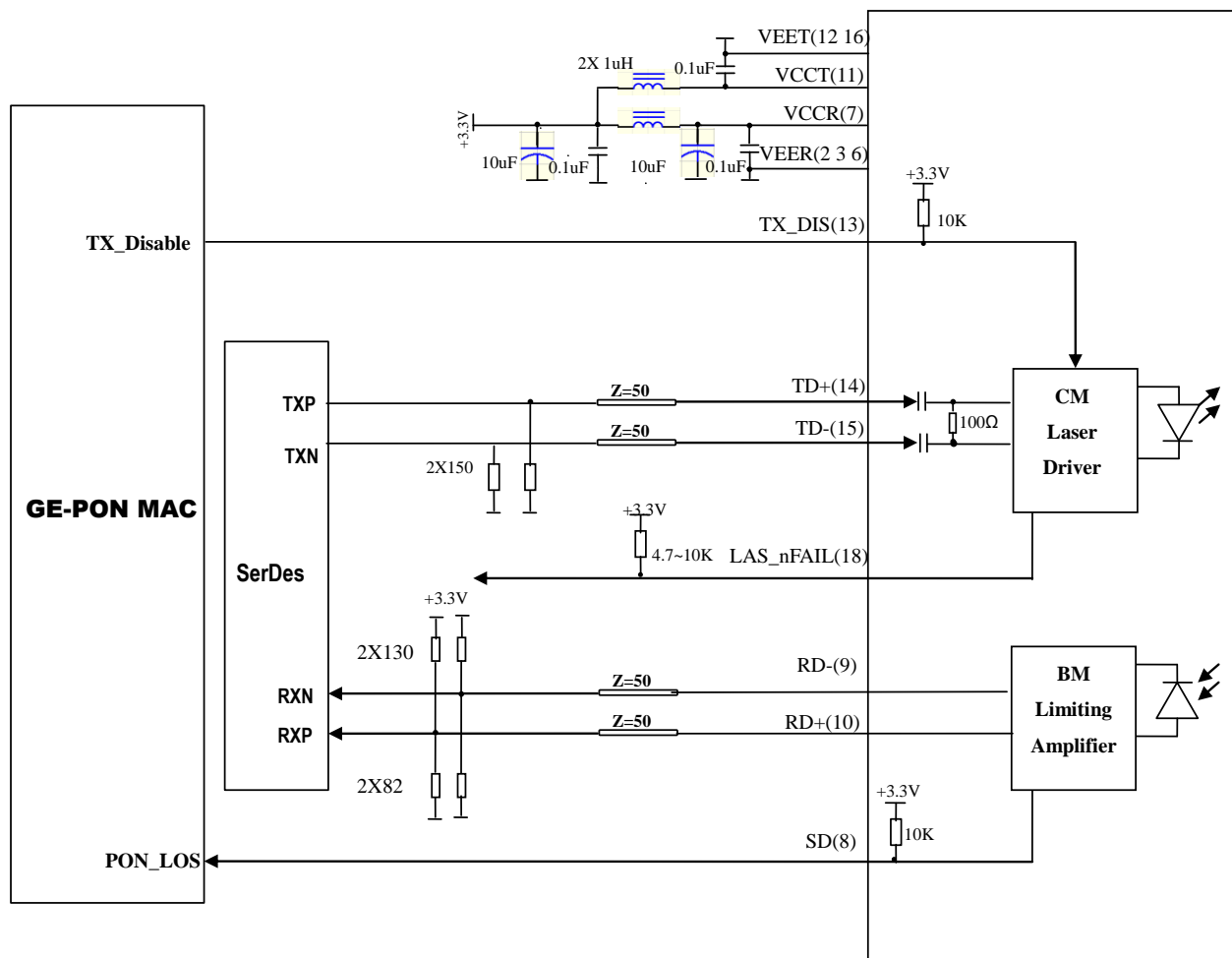
Recommended Interface Circuit:

Figure 5 shows the recommended interface scheme

Pin Definitions:

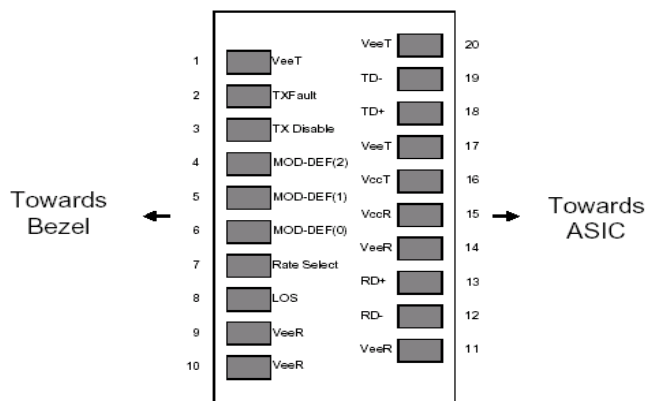Table 7 show the SFP pin information of electrical interface and mounting studs.

Figure 6 SFP Outline

Table 7 - Pin Function Definitions (EPON OLT SFP)

Pin#	Name	Function	Notes
1	VeeT	Transmitter Ground	-
2	TX Fault	Transmitter Fault Indication	Note 1
3	TX Disable	Transmitter Disable	Note 2, Module disables on high or open
4	MOD-DEF2	Module Definition 2	Note 3, 2 wire serial ID interface
5	MOD-DEF1	Module Definition 1	Note 3, 2 wire serial ID interface
6	MOD-DEF0	Module Definition 0	Note 3, Grounded in Module
7	RSSI_Trigger		
8	LOS	Loss of Signal	Note 4
9	VeeR	Receiver Ground	Note 5
10	VeeR	Receiver Ground	Note 5
11	VeeR	Receiver Ground	Note 5
12	RD-	Inv. Received Data Out	Note 6
13	RD+	Received Data Out	Note 6
14	VeeR	Receiver Ground	Note 5
15	VccR	Receiver Power	Note 7, 3.3V± 5%
16	VccT	Transmitter Power	Note 7, 3.3V± 5%
17	VeeT	Transmitter Ground	Note 5
18	TD+	Transmit Data In	Note 8
19	TD-	Inv. Transmit Data In	Note 8
20	VeeT	Transmitter Ground	Note 5

Notes:

1. TX Fault is an open collector/drain output, which should be pulled up with a 4.7K–10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 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 4.7–10 KΩ 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.
3. Mod-Def 0,1,2. These 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 (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
5. VeeR and VeeT may be internally connected within the SFP module.
6. RD-/+: These are the differential receiver outputs. They are DC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES.
7. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 400mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1Ω 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. VccR and VccT may be internally connected within the SFP transceiver module.
8. TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

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 (01h=SC)
3-10	8	Transceiver	Gigabit Ethernet 1000Base-BX
11	1	Encoding	8B10B (01h)
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: PeakOptical
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "HOLT-xxxxxx" (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	PeakOptical'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	PeakOptical specific date, read only

Serial ID Memory Contents: (A2H)

Address	# Bytes	Name	Description
00-01	2	Temp High Alarm	MSB at low address
02-03	2	Temp Low Alarm	MSB at low address
04-05	2	Temp High Warning	MSB at low address
06-07	2	Temp Low Warning	MSB at low address
08-09	2	Voltage High Alarm	MSB at low address
10-11	2	Voltage Low Alarm	MSB at low address
12-13	2	Voltage High Warning	MSB at low address
14-15	2	Voltage Low Warning	MSB at low address
16-17	2	Bias High Alarm	MSB at low address
18-19	2	Bias Low Alarm	MSB at low address
20-21	2	Bias High Warning	MSB at low address
22-23	2	Bias Low Warning	MSB at low address
24-25	2	TX Power High Alarm	MSB at low address
26-27	2	TX Power Low Alarm	MSB at low address
28-29	2	TX Power High Warning	MSB at low address
30-31	2	TX Power Low Warning	MSB at low address
32-33	2	RX Power High Alarm	MSB at low address
34-35	2	RX Power Low Alarm	MSB at low address
36-37	2	RX Power High Warning	MSB at low address
38-39	2	RX Power Low Warning	MSB at low address
40-55	16	Reserved	Reserved for future monitored quantities

Address	# Bytes	Name	Description
56-59	4	Rx_PWR(4)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 56 is MSB. Bit 0 of byte 59 is LSB.
60-63	4	Rx_PWR(3)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 60 is MSB. Bit 0 of byte 63 is LSB.
64-67	4	Rx_PWR(2)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 64 is MSB, bit 0 of byte 67 is LSB.
68-71	4	Rx_PWR(1)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 68 is MSB, bit 0 of byte 71 is LSB.
72-75	4	Rx_PWR(0)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 72 is MSB, bit 0 of byte 75 is LSB.
76-77	2	Tx_I(Slope)	Fixed decimal (unsigned) calibration data, laser bias current. Bit 7 of byte 76 is MSB, bit 0 of byte 77 is LSB.
78-79	2	Tx_I(Offset)	Fixed decimal (signed two's complement) calibration data, laser bias current. Bit 7 of byte 78 is MSB, bit 0 of byte 79 is LSB
80-81	2	Tx_PWR(Slope)	Fixed decimal (unsigned) calibration data, transmittercoupled output power. Bit 7 of byte 80 is MSB, bit 0 of byte81 is LSB.
82-83	2	Tx_PWR(Offset)	Fixed decimal (signed two's complement) calibration data, transmitter coupled output power. Bit 7 of byte 82 is MSB, bit 0 of byte 83 is LSB.
84-85	2	T(Slope)	Fixed decimal (unsigned) calibration data, internal module temperature. Bit 7 of byte 84 is MSB, bit 0 of byte 85 is LSB.
86-87	2	T(Offset)	Fixed decimal (signed two's complement) calibration data, internal module temperature. Bit 7 of byte 86 is MSB, bit 0 of byte 87 is LSB.
88-89	2	V(Slope)	Fixed decimal (unsigned) calibration data, internal module supply voltage. Bit 7 of byte 88 is MSB, bit 0 of byte 89 is LSB.
90-91	2	V(Offset)	Fixed decimal (signed two's complement) calibration data, internal module supply voltage. Bit 7 of byte 90 is MSB. Bit 0 of byte 91 is LSB.
92-95	4	Reserved	Reserved

Byte	Bit	Name	Description
Converted analog values. Calibrated 16 bit data			
96	All	Temperature MSB	Internally measured module temperature.
97	All	Temperature LSB	
98	All	Vcc MSB	Internally measured supply voltage in transceiver.
99	All	Vcc LSB	
100	All	TX Bias MSB	Internally measured TX Bias Current.
101	All	TX Bias LSB	
102	All	TX Power MSB	Measured TX output power.
103	All	TX Power LSB	
104	All	RX Power MSB	Measured RX input power.
105	All	RX Power LSB	
106	All	Reserved MSB	Reserved for 1st future definition of digitized analog input
107	All	Reserved LSB	Reserved for 1st future definition of digitized analog input
108	All	Reserved MSB	Reserved for 2nd future definition of digitized analog input
109	All	Reserved LSB	Reserved for 2nd future definition of digitized analog input
Optional Status/Control Bits			
110	7	TX Disable State	Digital state of the TX Disable Input Pin. Not supported.
110	6	Soft TX Disable	Read/write bit that allows software disable of laser. Not supported.
110	5	Reserved	
110	4	RX Rate Select State	Digital state of the SFP RX Rate Select Input Pin. Not supported.
110	3	Soft RX Rate Select	Read/write bit that allows software RX rate select. Not supported.
110	2	TX Fault	Digital state of the TX Fault Output Pin.
110	1	LOS	Digital state of the LOS Output Pin.
110	0	Data Ready	Indicates transceiver has achieved power up and data is ready
111	7-0	Reserved	Reserved.

Byte	Bit	Name	Description
Reserved Optional Alarm and Warning Flag Bits			
112	7	Temp High Alarm	Set when internal temperature exceeds high alarm level.
112	6	Temp Low Alarm	Set when internal temperature is below low alarm level.
112	5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level.
112	4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level.
112	3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level.
112	2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level.
112	1	TX Power High Alarm	Set when TX output power exceeds high alarm level.
112	0	TX Power Low Alarm	Set when TX output power is below low alarm level.
113	7	RX Power High Alarm	Set when Received Power exceeds high alarm level.
113	6	RX Power Low Alarm	Set when Received Power is below low alarm level.
113	5	Reserved Alarm	
113	4	Reserved Alarm	
113	3	Reserved Alarm	
113	2	Reserved Alarm	
113	1	Reserved Alarm	
113	0	Reserved Alarm	
114	All	Reserved	
115	All	Reserved	
116	7	Temp High Warning	Set when internal temperature exceeds high warning level.
116	6	Temp Low Warning	Set when internal temperature is below low warning level.
116	5	Vcc High Warning	Set when internal supply voltage exceeds high warning level.
116	4	Vcc Low Warning	Set when internal supply voltage is below low warning level.
116	3	TX Bias High Warning	Set when TX Bias current exceeds high warning level.
116	2	TX Bias Low Warning	Set when TX Bias current is below low warning level.
116	1	TX Power High Warning	Set when TX output power exceeds high warning level.
116	0	TX Power Low Warning	Set when TX output power is below low warning level.
117	7	RX Power High Warning	Set when Received Power exceeds high warning level.
117	6	RX Power Low Warning	Set when Received Power is below low warning level.
117	5	Reserved Warning	
117	4	Reserved Warning	
117	3	Reserved Warning	
117	2	Reserved Warning	
117	1	Reserved Warning	
117	0	Reserved Warning	
118	All	Reserved	
119	All	Reserved	

Byte	# Byte	Name	Description
120-127	8	Vendor Specific	00h.
128-255	128		Writable Memory

Mechanical Design Diagram

The mechanical design diagram of the SFP form factor with SC receptacle is shown in Figure 7. (Dimension in mm)
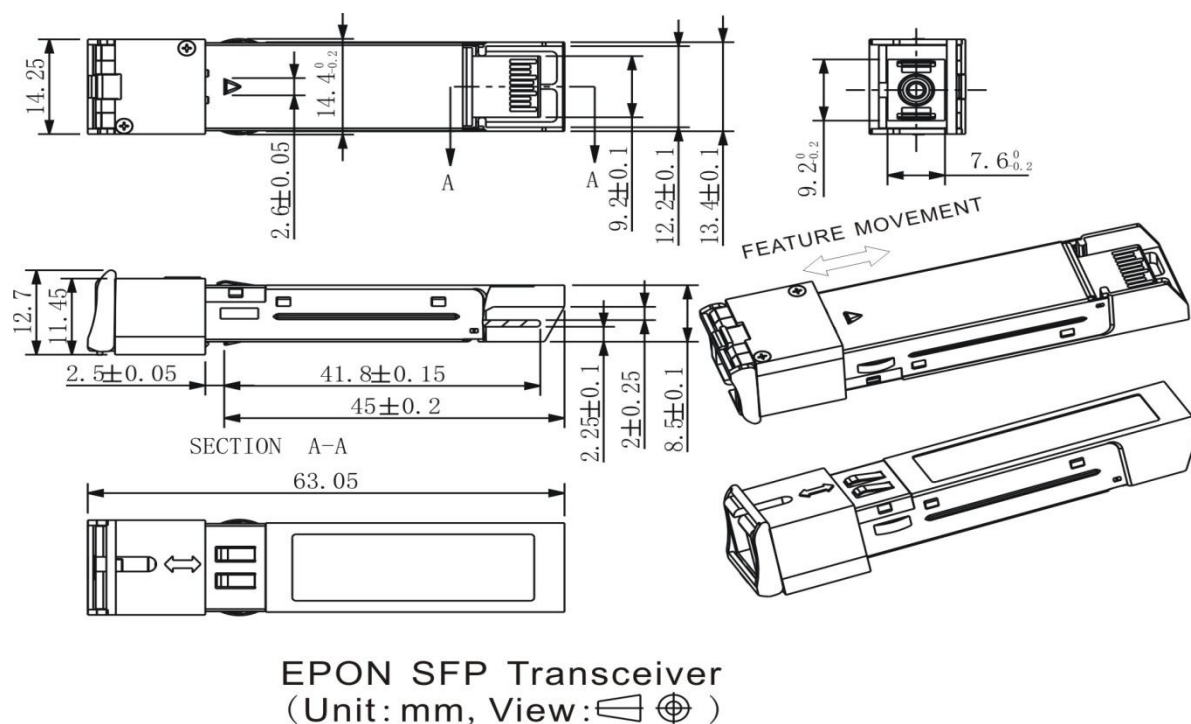

Figure7: Mechanical Diagram

Ordering Information:

PHOLT-AA-BB-CDEFGHIJK

A	Downstream Data Rate	24 = 1.25Gb/s	48 = 2.5Gb/s	
B	Upstream Data Rate	24 = 1.25Gb/s	48 = 2.5Gb/s	
C	Transmission Distance	1 = 10KM	2 = 20KM	
D	Wavelength	1 = 1490Tx/1550Rx	2 =1490Tx/1310Rx	
E	LD/PD Type	1 = DFB-LD/APD	2 = DFB-LD/PINTIA	
F	Connector	1 = SC/PC Receptacle	2 = LC/PC Receptacle	3 = SC/PC with Pigtail
		4 = LC/PC with Pigtail		
G	Operating Temperature	S = 0~70℃	E= -20~70℃	I=-40~85℃
H	Package Type	2 = SFF 2X5Pin	3 = SFF 2X10 Pin	4 = SFP
I	Interface	1 = TD AC coupled/RD AC coupled	2 = TD DC coupled/RD DC coupled	3 = TD AC coupled/RD DC coupled
		4= TD DC coupled/RD AC coupled		
J	TX Disabled	L= Low Level	H= High Level	
K	RoHS Compliance	Blank= RoHS5	F= RoHS6	