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## GPON OLT Class C+ SFP Transceiver

### FEATURES

- Single fiber bi-directional data links asymmetric TX 2488Mbps/RX 1244Mbps application
- Small Form Factor Pluggable package with SC/UPC connector
- Single 3.3V power supply
- 1490nm continuous-mode DFB laser transmitter and 1310nm Burst-mode APD/TIA receiver
- Class C+ Optical Line Terminal (OLT) for ITU-T G.984.2 Gigabit-capable Passive Optical Networks (GPON)
- Reset burst-mode receiver design support more than 15dB dynamic range.
- Burst Digital Receiving Signal Strength Indication (RSSI)
- 0 to 70°C for commercial Case Operating Temperature Range
- -40 to 85°C for industrial Case Operating Temperature Range
- Digital burst RSSI function to monitor the input optical power level
- LVPECL compatible data input/output interface
- LVTTTL transmitter disable control and transmitter laser fault alarm
- LVTTTL fast receiver Signal Detect (SD) indication response
- Low EMI and excellent ESD protection
- Class 1 Laser safety standard IEC-60825 compliant

### APPLICATIONS

- Gigabit-Capable Passive Optical Networks Class C+ 20km 17~32dB attenuation range

### STANDARDS

- Complies with SFP Multi-Source Agreement (MSA) SFF-8074i
- Complies with ITU-T G.984.2 Amendment 2
- Complies with SFF 8472 V9.5
- Complies with FCC 47 CFR Part 15, Class B
- Complies with FDA 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007

ABSOLUTE MAXIMUM RATINGS						
Parameter	Symbol	Min	Max	Units	Notes	
Storage Temperature	$T_{stg}$	-40	+85	°C	Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device. The device is not intended to be operated under the condition of simultaneous Absolute Maximum Ratings, a condition which may cause irreversible damage to the device.	
Commercial Case Operating Temperature Range	$T_{case}$	0	+70	°C		
Industrial Case Operating Temperature Range		-40	85			
DC Supply Voltage	$V_{cc}$	0	4.2	V		
Relative Humidity - Operating	$RH_o$	5	95	%		
Receiver Damaged Threshold		5		dBm		

RECOMMENDED OPERATING CONDITION						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operating Case Temperature	$T_c$	0		70	°C	Commercial
		-40		85		Industrial
Power Supply Voltage	$V_{cc}$	3.13	3.3	3.47	V	
Power Supply Current				450	mA	
Operating Relative Humidity		5		95	%	
Data Rate(TX/RX)	TX		2488.32		Mbit/s	
	RX		1244.16			
Data Rate Drift		-100		+100	PPM	

TRANSMITTER OPTICAL SEPCIFICATION						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter Type		1490nm DFB Continuous Mode				
Data Rate	$S_{tx}$		2488.32		Mbit/s	
Centre Wavelength	$\lambda_c$	1480	1490	1500	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launched Power	$P_{out}$	3		7	dBm	
Mean Launched Power (TX Off)	$P_{out}$			-39	dBm	
Extinction Ratio	ER	8.2			dB	Note 1
Transmitter dispersion Penalty	TDP			1	dB	Transmit on 20km SMF
Eye Diagram		Compliant With ITU-T G.984.2				Note 2

Note 1: Measured with PRBS 2<sup>23</sup>-1 test pattern @2488.32Mbit/s, Low Pass Filter is on.

Note 2: Transmitter eye mask definition

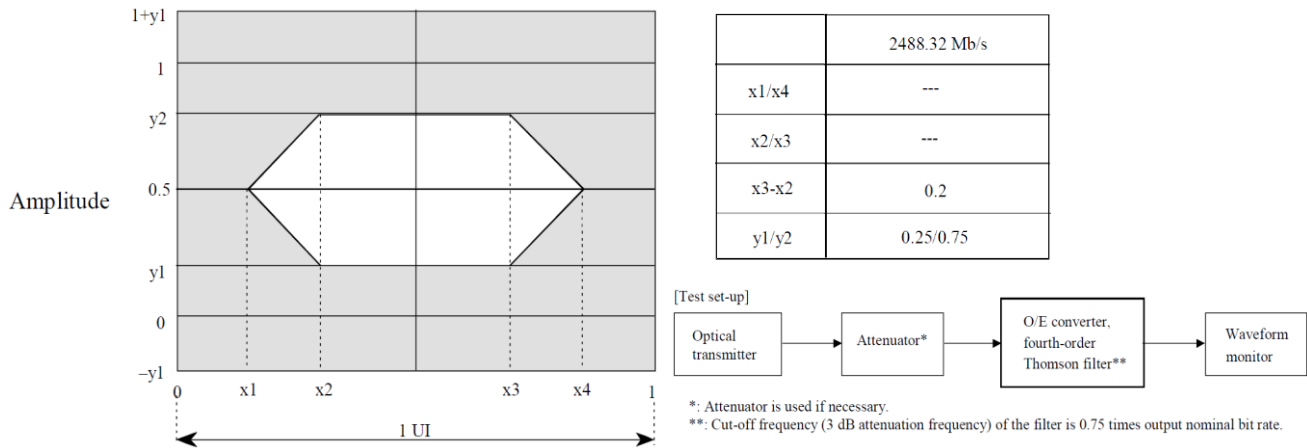


Figure 1 Transmitter Eye Mask Definitions and Test Procedure

TRANSMITTER ELECTRICAL CHARACTERISTICS						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
TX_Data Differential Input Voltage	$V_{IH}-V_{IL}$	200		1600	mV	LVPECL, AC coupled
Input Differential Impedance	$R_{in}$	90	100	110	$\Omega$	
Transmitter Disable control Voltage - Low	$V_{IL}$	0		0.8	V	LVTTTL
Transmitter Disable control Voltage - High	$V_{IH}$	2.0		$V_{cc}$	V	
TX_Fault indicate voltage - Low	$V_{OL}$	0		0.4	V	
TX_Fault indicate voltage - High	$V_{OH}$	2.4		$V_{cc}$	V	

RECEIVER OPTICAL SPECIFICATIONS						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
Receiver Type		1310nm Burst-mode APD/TIA				
Data Rate	Stx		1244.16		Mbit/s	
Receive Wavelength	$\lambda_c$	1260	1310	1360	nm	
Sensitivity	SEN			-30	dBm	Note 1
Overload	SAT	-12			dBm	
RX Dynamic Range		15			dB	Note 2
Signal Detect Assert level				-31	dBm	
Signal Detect De-assert level		-45			dBm	
SD Hysteresis		0.5		6	dB	

Note 1: Measured with a PRBS 2<sup>23</sup>-1 test pattern @1244.16Mbit/s and ER=10dB, BER <=10<sup>-12</sup>

Note 2: RX Dynamic Range Definition

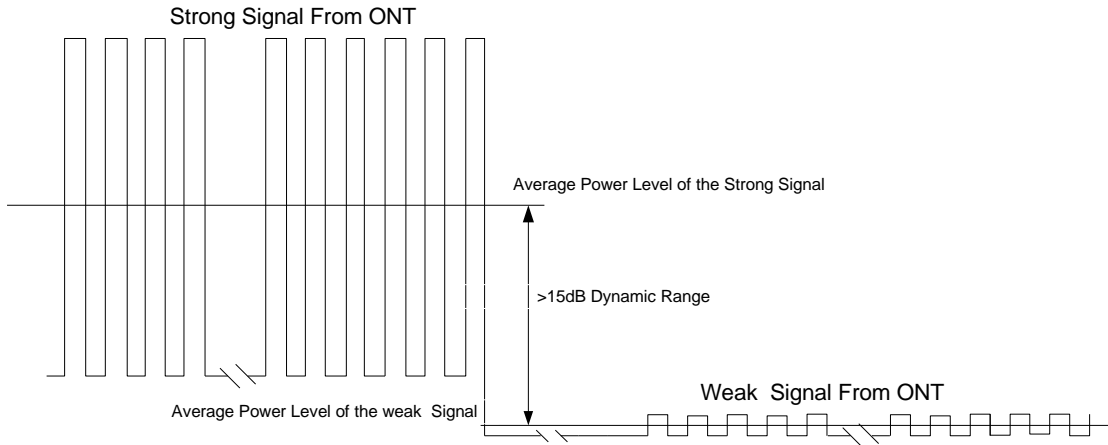


Figure 2 Burst Mode Receiver Dynamic Range in GPON System

RECEIVER ELECTRICAL CHARACTERISTICS						
Parameter	Symbol	Min	Typ	Max	Unit	Notes
RX_Data Differential Output Voltage	$V_{IH}-V_{IL}$	400		1600	mV	
Reset width	$T_{RESET}$	12.8			ns	
Receiver Amplitude Recovery Time	$T_{RECOVERY}$			25.6	ns	Refer to the reset signal falling edge
Signal Detect Assert Time	$T_{SDA}$			50	ns	
Signal Detect De-assert Time	$T_{SDD}$			12.8	ns	
Signal Detect indicate voltage - Low	$V_{OL}$	0		0.4	V	LVTTTL
Signal Detect indicate voltage - High	$V_{OH}$	2.4		$V_{CC}$	V	

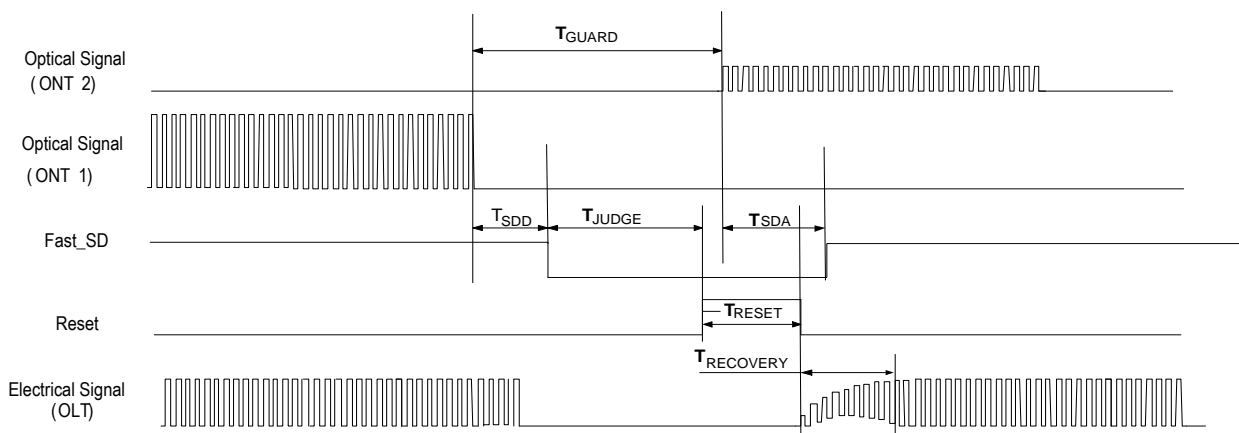


Figure 3 Burst Receiver Timing Sequence

**Digital RSSI Timing Characteristics**

Parameter	Symbol	Min	Typ	Max	Unit	Notes
RSSI Trigger-Low		0		0.8	V	
RSSI Trigger-High		12		VCC	V	
RSSI Trigger Delay	$T_D$	25			ns	Refer to first bit of the preamble
RSSI Trigger width	$T_W$	500		$T_{ONT} - T_D$	ns	
Optical Signal During Time	$T_{ONT\_EN\_DUR}$	525			ns	For RSSI Measurement
I2C Access Prohibited Time	$V_{OL}$	500			$\mu s$	

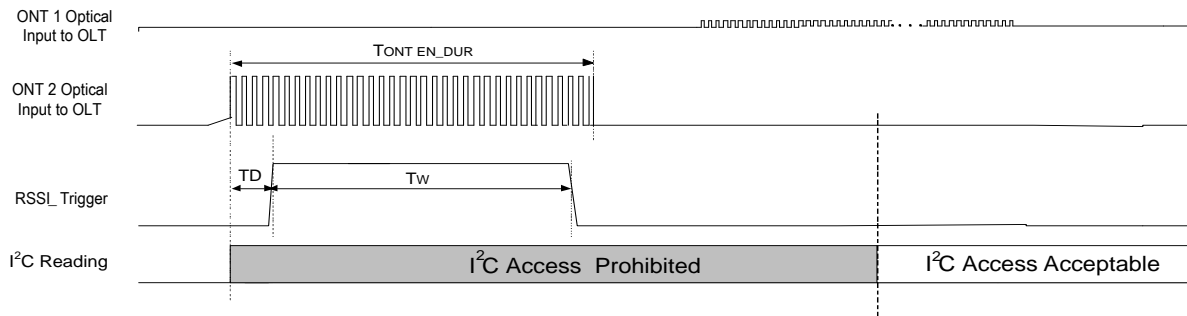
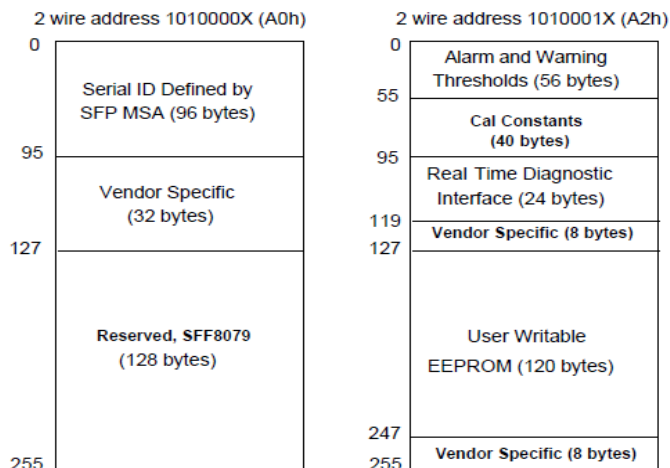


Figure 4 RSSI Timing Sequence

**I2C SERIAL LOGIC**

Parameter	Symbol	State	Min	Typ	Max	Unit
I2C Serial Data	$SDA_H$	HIGH	2.0		Vcc	V
	$SDA_L$	LOW	0		0.8	V
I2C Serial Clock	$SCL_H$	HIGH	2.0		Vcc	V
	$SCL_L$	LOW	0		0.8	V

**EEPROM INFORMATION**



## I2C MEMORY MAP(Page A0 HEX, Unlisted Fields are Blank / Empty)

Address		Memory Contents		Description	Name of Field
Decimal	HEX	HEX			
0	00	03		SFP transceiver	Identifier
1	01	04		MOD4	Extended Identifier
2	02	01		SC	Connector Values
3-10	03 to 0A	00 00 00 00 00 00 00 00		Not Defined	Transceiver Codes
11	0B	03		NRZ	Encoding Codes
12	0C	19		2.488Gbps	Nominal Bit Rate
14	0E	14		20(km)	9 micron fiber length
15	0F	C8		200(100m)	9 micron fiber length
20 to 35	14 to 23	XX		Vendor Name	"TSUHAN LTD."
40 to 48	28 to 30	XX		Vendor Part Number	"THMPRS-4343-GDA(I)"
56 to 59	37 to 3B	01		Vendor Revision Number	Revision 1.0
60 to 61	3C to 3E	05 D2		Wavelength = 1490 nm	Laser Wavelength
65	41	1C		SD,TX_FAULT and TX_DISABLE	Option Values
68 to 83	44 to 53	XX		Vendor Serial Number	Serial Number
84 to 91	54 to 5B	XX		Vendor Date Code	Date Code
92	5C	58		Type of Diagnostics	Average Power, External Calibration, 8472 DDMI
93	5D	F0		Enhanced Options	Optional Alarm/warning Flags Implemented; RX_LOS;TX_FAULT;TX_DISABLE Implemented
94	5E	02		8472 Compatibility	Rev 9.5 of SFF-8472.

## SFF-8472 Rev 9.4 A2 (HEX) ADDRESS TABLE FOR ALARM AND WARNING DATA

8472 Parameter	Alarm Threshold Data				Warning Threshold Data				Measured Values		Alarm Bit Address + Position		Warning Bit Address + Position	
	High Value		Low Value		High Value		Low Value				HIGH	Low	HIGH	Low
	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	HIGH	Low	HIGH	Low
Temperature	00	01	02	03	04	05	06	07	96	97	112 (7)	112 (6)	116 (7)	116 (6)
Vcc	08	09	10	11	12	13	14	15	98	99	112 (5)	112 (4)	116 (5)	116 (4)
TX Bias	16	17	18	19	20	21	22	23	100	101	112 (3)	112 (2)	116 (3)	116 (2)
TX Power	24	25	26	27	28	29	30	31	102	103	112 (1)	112 (0)	116 (1)	116 (0)
RX Power	32	33	34	35	36	37	38	39	104	105	113 (7)	113 (6)	117 (7)	117 (6)

## DIGITAL DIAGNOSTIC MONITORING INTERFACE

Parameter	Range	Accuracy	Calibration
Temperature	-40 to 85 °C	±3°C	Internal
Voltage	2.9 to 3.6V	±3%	Internal
Bias Current	0 to 100mA	±10%	Internal
TX Power	3 to 7dBm	±3dB	Internal
RX Power monitor	-12 to -30dBm	±3dB	Internal

## PIN ASSIGNMENT

Pin	Name	Level/Logic	Function	Description
1	NC	NA	NA	Not connect inside the transceiver
2	TX_Fault	LVTTTL	TX Fault	TX Fault Alarm, TX Fault State: High; TX Normal State: Low
3	TX_Dis	LVTTTL	Transmitter Enable/Disable	Active High
4	MOD-DEF2	LVTTTL	SDA	I2C data
5	MOD-DEF1	LVTTTL	SCL	I2C clock
6	MOD-DEF0	MOD-DEF0		Module Definition 0, Grounding in SFP
7	Reset	LVTTTL	Receiver Reset	Active High
8	SD	LVTTTL	Signal Detect	High: signal detected; Low: loss of signal;
9	RSSI Trigger	LVTTTL	RSSI Trigger for Transceiver A/D Conversion	High: enable RSSI A/D conversion
10	GNDR	NA	Ground	Receiver Ground
11	GNDR	NA	Ground	Receiver Ground
12	RD-	LVPECL	RX Data-	Inv. RX data output, DC coupled output
13	RD+	LVPECL	RX Data+	RX data output, DC coupled output
14	GNDR	NA	Ground	Receiver Ground
15	V <sub>cc</sub> R	NA	Receiver Power Supply	RX Power
16	V <sub>cc</sub> T	NA	Transmitter Power Supply	TX Power
17	GNDT	GNDT	Ground	Transmitter Ground
18	TD+	LVPECL	TX Data+	TX data input, internally AC coupled with 100ohm terminated
19	TD-	LVPECL	TX Data-	Inv. TX data input, internally AC coupled with 100ohm terminated
20	GNDT	NA	Ground	Transmitter Ground

PIN OUT DRAWING

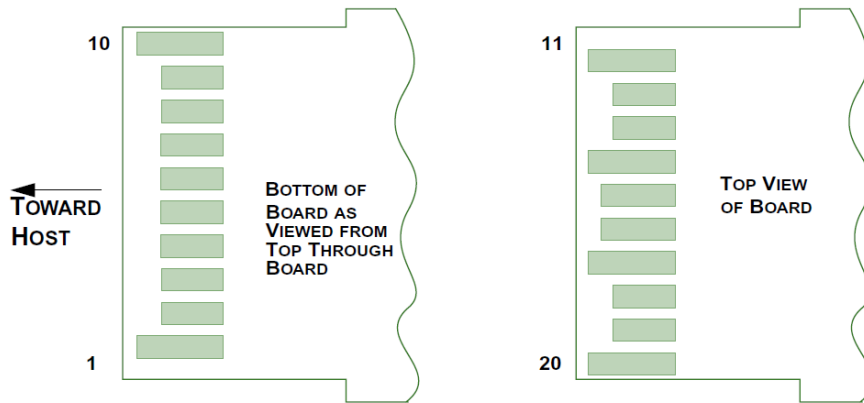


Figure 6 Pin Out Drawing (Top view)

MECHANICAL SPECIFICATIONS(Unit: mm)

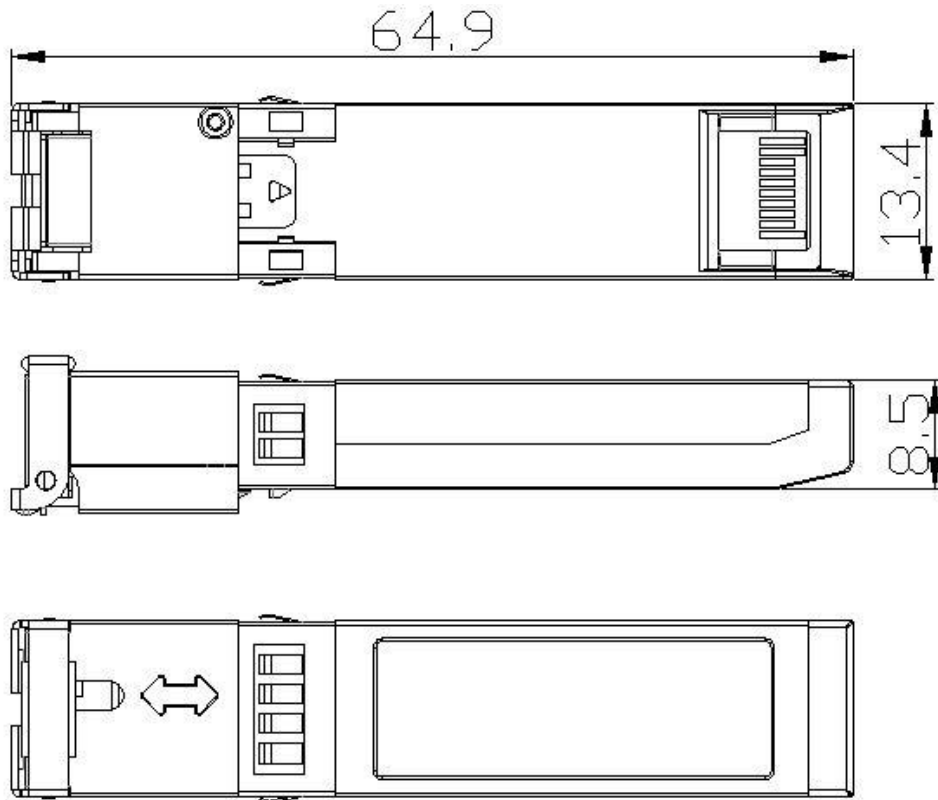


Figure 7 Mechanical Outline Drawing