ZISA OP151X
2.488G/9.953G XG-PON1 ONU SFP+ Transceiver

Description

OP151X is a high performance transceiver module for single fiber communications using a 1270nm burst-mode transmitter and a1577nm continuous-mode receiver. It is designed to meet ITU-T G987.2 N1 class and N2a class requirements for optical network unit (ONU) applications.

The transmitter has burst-mode automatic power control (APC) function and temperature compensation circuitry to ensure stable optical power output and extinction ratio over all operating temperature range. The transmitter meets Class 1 eye safety per IEC825 and CDRH standards. The optical output can be enabled by a LVTTL logic low-level input of TX_Ben.

The receiver has a hermetically packaged APD-TIA (trans-impedance amplifier) pre-amplifier and a limiting amplifier with CML compatible differential outputs. It features a Loss of Signal (LOS) output which is LVTTL compatible. The receiver offers continuous-mode RSSI output, which is I2C accessible digitized data stored in the internal flash memory.

The module provides digital diagnostic information of its operating conditions and status, including burst-mode transmitting power, continuous-mode receiving 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 SFP-8472.

Features

- Single fiber bi-directional data links application with 2.488Gbps upstream and 9.953Gbps downstream.
- 1270nm burst-mode DFB transmitter
- 1577nm continuous-mode APD-TIA receiver
- 0 to 70°C and -40 to 85°C operating case temperature
- SFP package with SC/UPC receptacle
- Single +3.3V power supply
- LVPECL interface logic level for TX data input
- CML interface logic level for RX data output
- LVTTL transmitter optical signal detect
- LVTTL transmitter disable control
- LVTTL transmitter laser failure alarm
- LVTTL receiver Loss Of Signal(LOS) indication

- Low EMI and excellent ESD protection
- Classlaser safety standard IECⅠ-60825 compliant
- Complies with RoHS-6

Applications

- 10G Gigabit Passive Optical Networks(XG-PON1) – ONT side

Standard

- Compliant with SFP MSA - 2000
- Compliant with SFF-8472 Rev.11.0
- Compliant with ITU-T G987.2 N1 class and N2a class
- Compliant with FCC 47 CFR Part 15, Class B
- Compliant with FDA 21 CFR 1040.10 and 1040.11, ClassⅠ

Absolute Maximum Ratings

Parameter	Symbol	Minim	Maxim	Unit	Note
Storage Ambient Temperature	TSTG	-40	85	°C	
Operating Case Temperature	Tc	-10	75	°C	
Operating Humidity	OH	5	95	%	
Power Supply Voltage	VCC	0	4	V	
Receiver Damaged Threshold			5	dBm	
Soldering Temperature			260/10	°C/S	

Recommended Operating Conditions

Parameter	Symbol	Minim	Typical	Maxim	Unit	Note
Power Supply Voltage	VCC	3.13	3.3	3.47	V	3.3V±5%
Operating Current	Icc			400	mA	
Operating Case Temperature	Tc	0		70	°C	
Operating Humidity Range	OH			85	%	
Data Rate upstream			2.488		Gbit/s	
Data Rate downstream			9.953		Gbit/s	
Data Rate Drift		-100		+100	PPM	

Transmitter Optical and Electrical Characteristics

Parameter	Symbol	Minim	Typical	Maxim	Unit	Note
Optical Center Wavelength	λC	1260	1270	1280	nm	
Optical Spectrum Width	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Launch Optical Power	Po	2		7	dBm	1
Power-OFF Transmitter Optical Power	Poff			-45	dBm	
Extinction Ratio	ER	8.2			dB	2
Rise/Fall Time (20%-80%)	TR/TF			130	ps	2,3
Turn On Time at Burst mode	Ton			12.8	ns	5
Turn Off Time at Burst mode	Toff			12.8	ns	
Optical Return Loss Tolerance				15	dB	
Transmitter Reflectance				-10	dB	
Transmitter and Dispersion Penalty	TDP			0.5	dB	
Optical Waveform Diagram	Compliant With ITU-T G987.2 Figure 9-3					
Data Input Differential Swing	Vinp-p	200		1600	mV	4
Input Differential Impedance	Zin	90	100	110	Ω	
Transmitter burst on Voltage - Low	Vben_on	0		0.8	V	
Transmitter burst off Voltage - High	Vben_off	2.0		VCC	V	
transmitter optical power signal-detected indication		2.0		VCC	V	
TX-SD dealy time when TX-Burst	D1			200	ns	6
Width difference between TX-SD and TX-Burst	|W1-W2|			200	ns	6
TX-SD invalid time when VCC_TX on	D2			3	s	6

Note 1: Launched into 9/125um Single Mode Fiber.

Note 2: Measured with PRBS 223-1 test pattern @2.488Gbit/s.

Note 3: Measured with the Bessel-Thompson filter OFF.

Note 4: Compatible with LVPECL input,DC coupled internally.
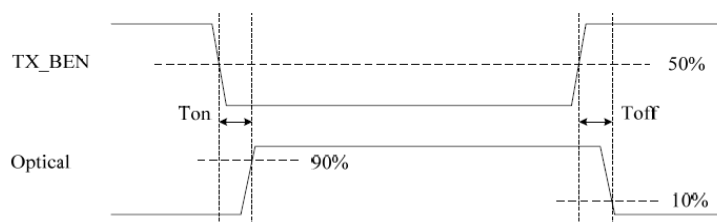
Note 5: Ton and Toff timing at burst mode

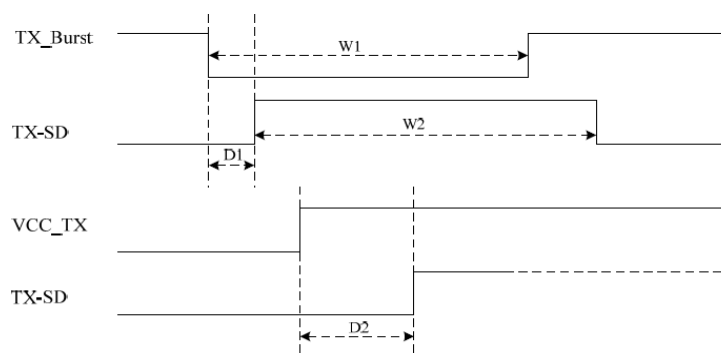Figure 1 Ton and Toff timing at burst mode

Note 6: TX-SD timing

Figure 2 TX-SD timing

Receiver Optical and Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Wavelength	λC	1575	1577	1580	nm	
Sensitivity	SEN	-28		-28	dBm	1
Saturation Optical Power	SAT	-8			dBm	
LOS De-assert Level	LOSH-L			-29	dBm	
LOS Assert Level	LOSL-H	-40			dBm	
LOS Hysteresis		0.5		5	dB	
Data Output Differential Swing	Voutp-p	600		800	mV	2
Receiver reflectance (max)				-12	dB	
WDM Filter Isolation	ISO1	35			dB	1310nm
	ISO2	35			dB	1490nm
Loss of Signal Voltage - Low	LOS_L	0		0.4	V	
Loss of Signal Voltage - High	LOS_H	2.4		VCC	V	
LOS Assert time	TLOSA			100	us	
LOS Deassert time	TLOSD			100	us	
Received Signal Strength Indication	RSSI	±3		±3	dBm	3

Note 1: Measured with a PRBS 2^{31}-1 test pattern @9.953Gbit/s and ER=9dB, BER =10^{-3}.

Note 2: LVCML output, AC coupled internally, guaranteed in the full range of input optical power (-8dBm to -28dBm)

Note 3: Receiving optical signal power is limited between -8 dBm and -28dBm for ±3dBm

accuracy.

Digital Diagnostic Monitor Accuracy

Parameter	Accuracy	Calibration	Notes
Temp report	±3℃	Internal	Case Temp ±3℃
Voltage report	±3%	Internal	Vcc=3.13~3.47V
Ibias report	±10%	Internal	
Optical power output report	±2dB	Internal	Average power
RSSI	±3dB	Internal	Average power,-8 ~ -28dBm

Pin Description

PIN	Name	Description	Notes
1	VeeT	Transmitter Ground	
2	TX Fault	Transmitter Fault indication	Note 1
3	TX BEN	Transmitter Burst Enable	Note 2
4	MOD-DEF2	Module Definition2,	Note 3, used as I2C data line
5	MOD-DEF1	Module Definition1	Note 3, used as I2C clock line
6	MOD-DEF0	Module Definition0	Note 3, internal grounded
7	TX-SD	Transmitter optical power signal - detected indication	Note 4
8	LOS	Loss of signal	Note 5
9	VeeR	Receiver Ground	
10	VeeR	Receiver Ground	
11	VeeR	Receiver Ground	
12	RD-	Inv.Receiver Data Out	Note 6
13	RD+	Receiver Data Out	
14	VeeR	Receiver Ground	
15	VccR	Receiver Power	Note 7, Supply 3.3V±5%
16	VccT	Transmitter Power	Note 7, Supply 3.3V±5%
17	VeeT	Transmitter Ground	
18	TD+	Transmitter Data Input	Note 8
19	TD-	Transmitter Inv. Data Input	
20	VeeT	Transmitter Ground	

Note:

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 to

VccT+0.3V or VccR+0.3V. High output indicates a laser fault of some kinds. Low indicates normal operation. In the low state, the output voltage will be

below 0.8V.

2. TX BEN is an LVTTL input that is used to control the transmitter power output. Here it is defined for TX enable logic, when it is low (0 ~ 0.8V), transmitter is on; when it is high (2 ~ 3.3V), it is off.

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 I2C clock line; Mod-Def 2 is the I2C data line.

4. TX-SD is an LVTTL output that detects the transmitter optical power signal.Logic"1" means optical power on; logic"0" means optical power off.

5. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K –

10KΩ resistor to VccT +0.3V or VccR+0.3V. High 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 voltage will be below 0.8V.

6. RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential line which should be terminated with 100Ω (differential) at the user SER.DES.

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 interface circuit. Inductors with DC resistance of less than 1Ω, in order to insure the voltage at the SFP input pin with 3.3V. 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 with100Ω differential termination inside the module.
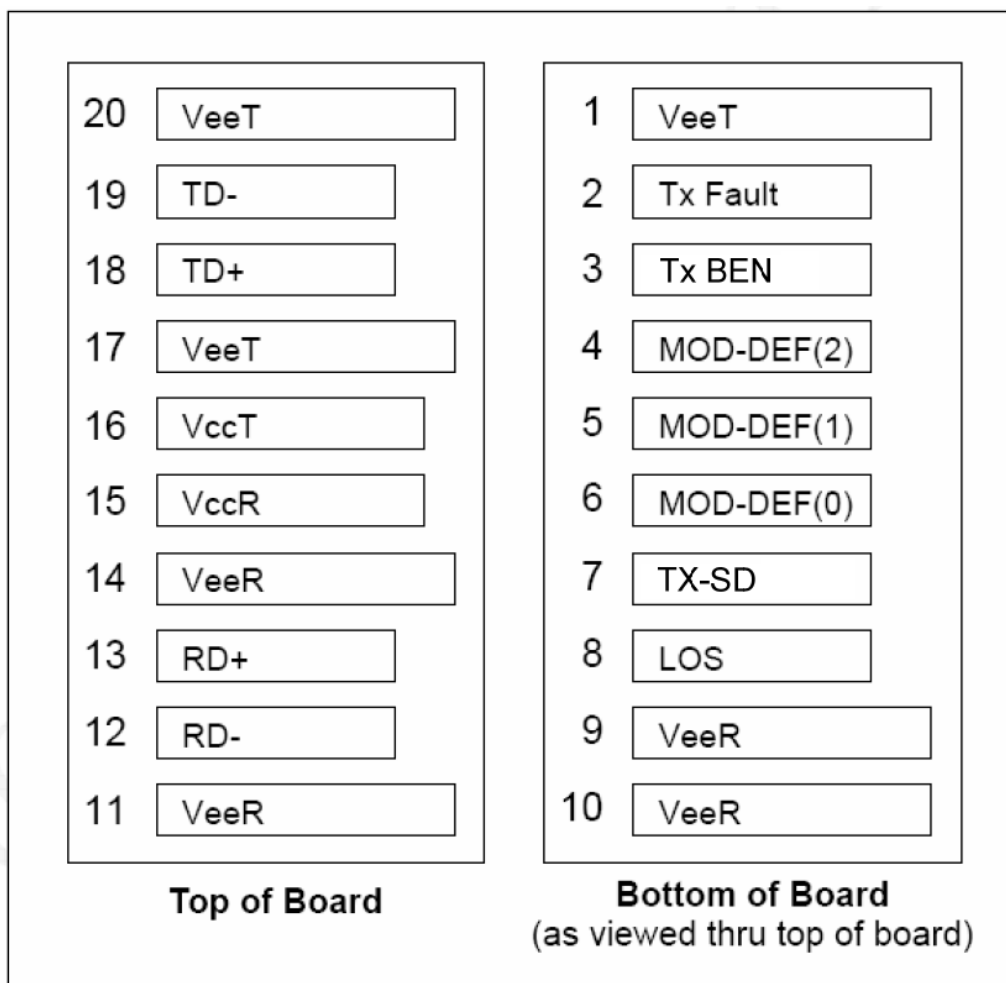
20	VeeT		1	VeeT
19	TD-		2	Tx Fault
18	TD+		3	Tx BEN
17	VeeT		4	MOD-DEF(2)
16	VccT		5	MOD-DEF(1)
15	VccR		6	MOD-DEF(0)
14	VeeR		7	TX-SD
13	RD+		8	LOS
12	RD-		9	VeeR
11	VeeR		10	VeeR

Top of Board **Bottom of Board**
(as viewed thru top of board)

Figure 3　Pin Out Drawing (Top view)
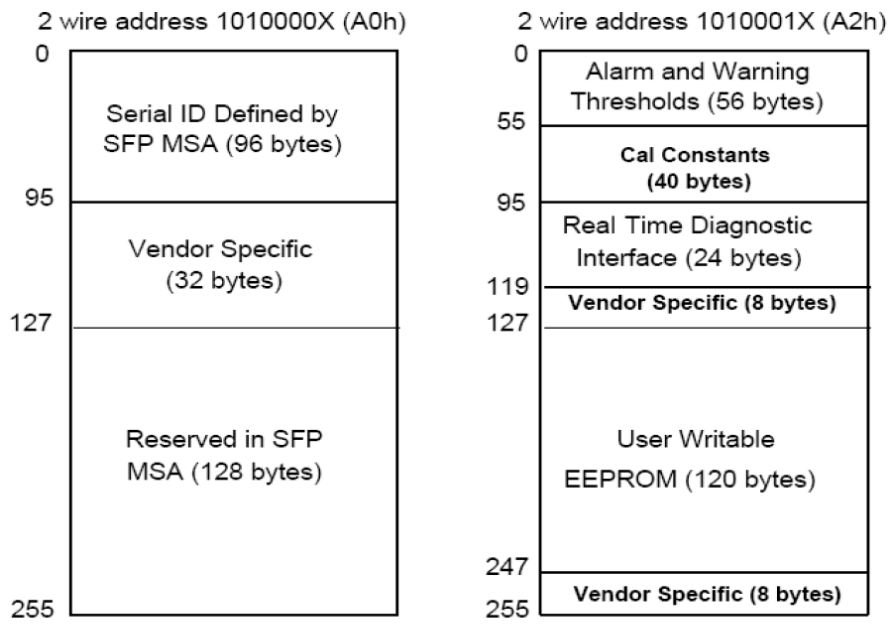
EEPROM Information

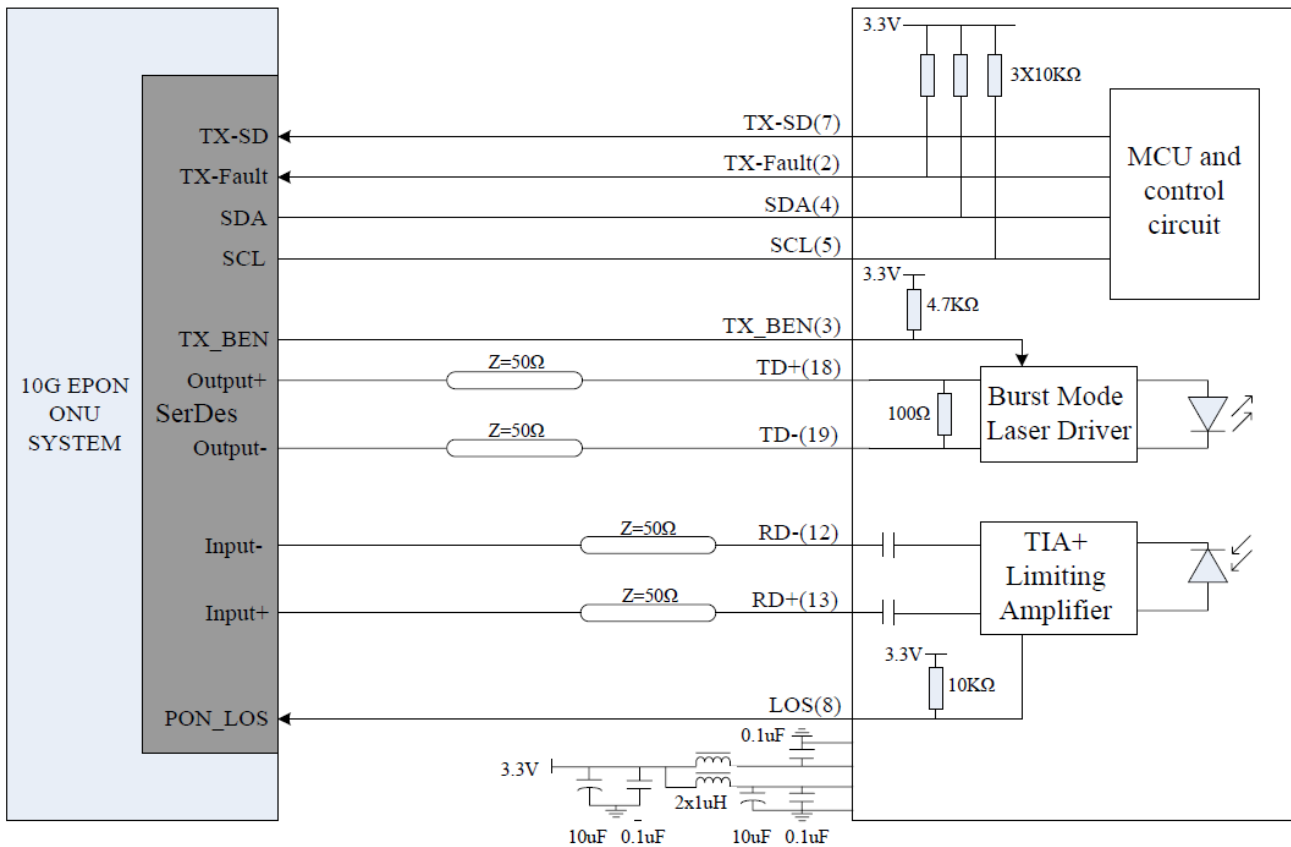**Figure 4   EEPROM Information**

Typical Interface Circuit

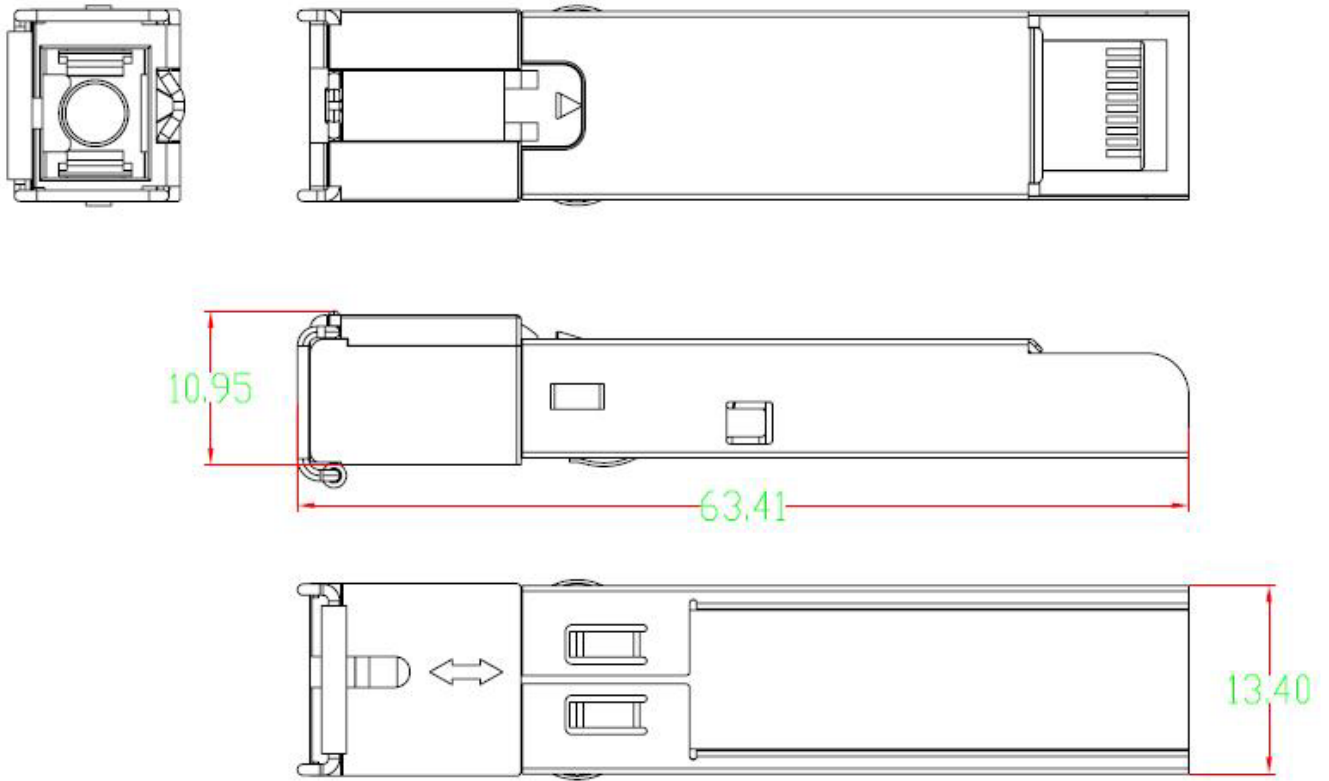**Figure 5   Typical Interface Circuit**

Mechanical Dimensions and Pin Definition
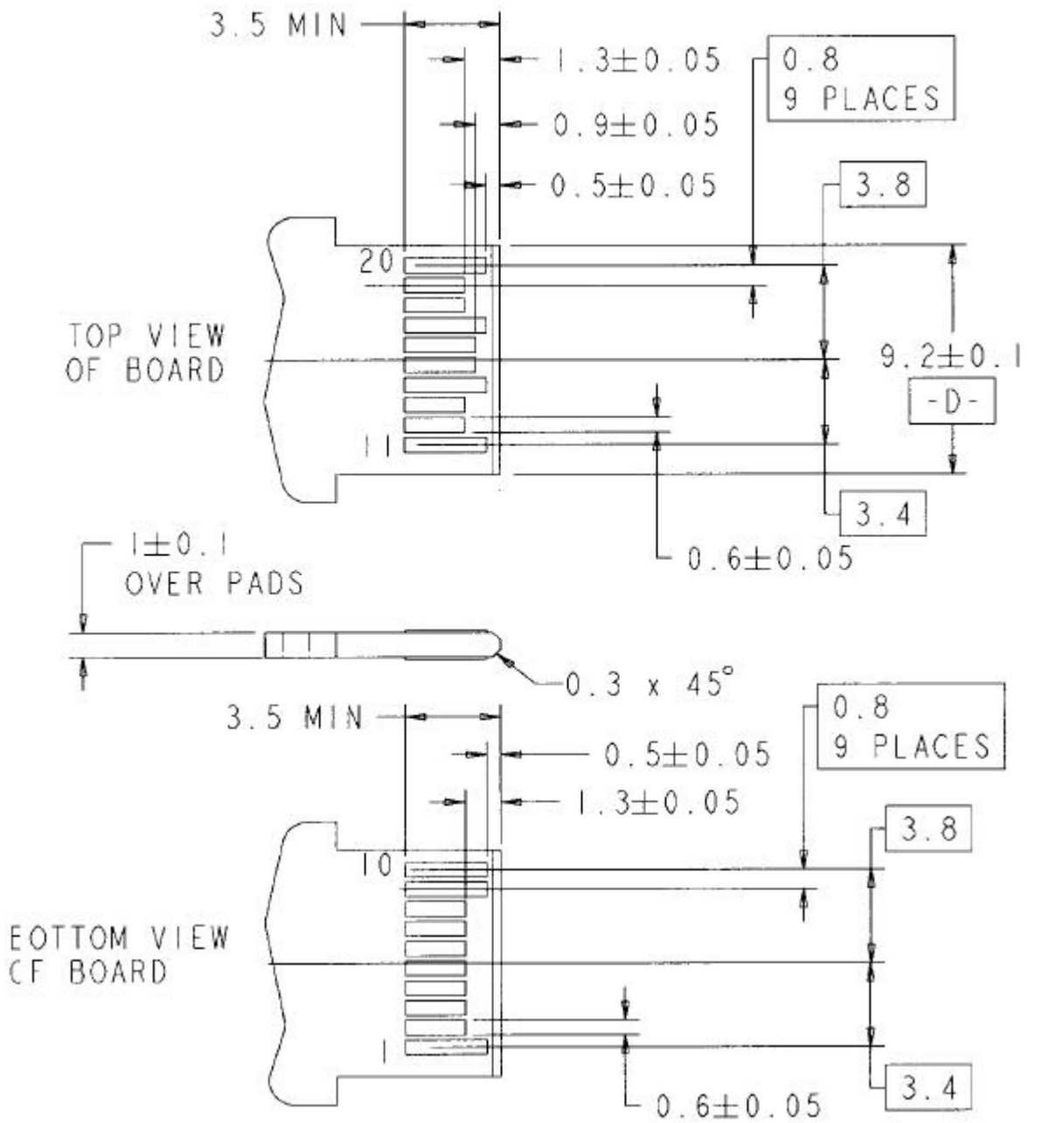

Figure 6 Package Outline

Recommended Board Layout

Unit: mm

Figure 7 Recommended Board Layout Hole Pattern and Panel Mounting

Ordering Information

Part No.	Product Specification				
Package	Package	Data-Rate	Temp.	RoHS	Application
OP151X-C	SFP		0 - 70℃	RoHS 6	XG-PON1 N1 class and N2 class
TW91A6H-HGEL	OP151X-H	2.488Gb/s/9.953Gb/s	-40 - 85℃		

Revision History

Revision	Initiator	Reviewed By	Approved By	Revision Description	Issue Date
V1.0	Hang Zhou	Yanwei Wang	Terry Deng	New Release	20-Jul.-2013
V1.1	Kan Wang	Yanwei Wang	Terry Deng	Add I-temp product	20-Sep.-2013

Related Documents

- SFP MSA - 2000
- ITU-T G987.2 N1 class and N2a class
- SFF- 8472 Rev.11.0

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