

## OS-SP96-3110D

### SMF 1310nm 10G SFP+ Transceiver Data Sheet

## Features

- Operating Data Rate up to 10.31 Gbps
- 1310nm DFB-LD Transmitter
- Distance up to 10km
- Single 3.3V Power Supply and TTL Logic Interface
- Hot-Pluggable Duplex LC Connector Interface
- Power Dissipation<1.0W
- Operating Temperature
  - Standard: 0°C~+70°C
  - Industrial:-40°C~+85°C
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE802.3ae 10GBASE-LR/LW
- Fully ROHS 2.0 compliant



## Applications

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 10.138Gb/s , 9.830 Gb/s, 7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	TS	-40	+85	°C
Maximum Supply Voltage	VCC	-0.5	3.6	V
Operating Relative Humidity	RH		95	%

\*Exceeding any one of these values may destroy the device immediately

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Case Temperature	Tc	OS-SP96-3110D	0	+70	°C
		OS-SP96-3110DI	-40	+85	°C
Power Supply Voltage	Vcc	3.15	3.3	3.45	V
Power Supply Current	Icc			300	mA

Surge Current	I <sub>surge</sub>		+30	mA
Baud Rate	10GBASE-LR		10.31	Gbps
	10GBASE-LW		9.95	

## Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter						
LVPECL Inputs(Differential)	V <sub>in</sub>	150		1200	mVpp	AC Coupled Inputs*(note1)
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	Z <sub>in</sub>	85	100	115	ohms	R <sub>in</sub> > 100 kohms @ DC
Differential Input S-parameter	SDD11	-	-	-10	dB	
Differential to Common Mode Conversion	SCD11	-	-	-10	dB	
TX_Disable Assert Time	t <sub>off</sub>		10		us	
TX_Disable Negate Time	t <sub>on</sub>	-	1		ms	
TX_DIS	High	2		V <sub>cc</sub>	V	
	Low	0		0.8		
TX_FAULT	High	2		V <sub>cc</sub> +0.3	V	Io=400uA ,host Vcc
	Low	0		0.8		Io=-4.0mA
Receiver						
CML Outputs (Differential)	V <sub>out</sub>	350		700	mVpp	AC Coupled Outputs*(Note1)
Output AC Common Mode Voltage		0		15	mV	RMS
Output Impedance(Differential)	Z <sub>out</sub>	90	100	110	ohms	
Differential Output S-parameter	SD22	-	-	-10	dB	
RX_LOS	LOS	VoH	2	V <sub>cc</sub> +0.3		
	Normal	VoL	0	0.8		
MOD_DEF(0.2)		VoH	2		V	With Serial ID
		VoL	0	0.5		

Note1: LVPECL logic, internally AC coupled

## Optical and Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
9μm Core Diameter SMF	L		10		km
Data Rate		0.6	10.31		Gbps
Transmitter					
Center Wavelength	λ <sub>C</sub>	1270	1310	1355	nm
Spectral Width (RMS)	Δλ			1	nm
Average Output Power*(Note2)	P <sub>out</sub>	-8.2		0.5	dBm
Extinction Ratio	ER	3.5			dB

Average Power of OFF Transmitter	Poff			-30	dBm
Side Mode Suppression Ratio	SMSR	30			dB
Transmitter Dispersion Penalty	TDP			3.2	dB
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
Receiver					
Center Wavelength	$\lambda_C$	1260		1600	nm
Receiver Sensitivity*(Note3)	Pmin			-14.4	dBm
Receiver Overload	Pmax	0.5			dBm
Return Loss	ORL			-12	
LOS De-Assert	LOSD			-16	dBm
LOS Assert	LOSA	-28			dBm
LOS-Hysteresis	Phys	0.5			dB

Note2: Output is coupled into a 9/125um SMF. The -4.7dBm is reference IEEE 802.3ae, the typical value is -1dBm.

Note3: Minimum average optical power measured at the BER less than 1E-12, back to back. The measure pattern is PRBS 231-1.

## Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000V)
Electrostatic Discharge to the enclosure	EN 55024:2010+A1:2015 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC 47CFR Part 15 Class B EN55032:2015 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 0.15MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TÜV Certificate No. 50135086(CB scheme)
RoHS6	2002/95/EC 4.1&4.2 5&7&13 2005/747/EC	Compliant with standards*(Note4)

Note4: For update of the equipments and strict control of raw materials, OUSENT has the ability to supply the customized products since Jan 1, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union. In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes. In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Ousent's transceivers, because Ousent's transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

### Laser Safety:

All transceivers are Class 1 Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions

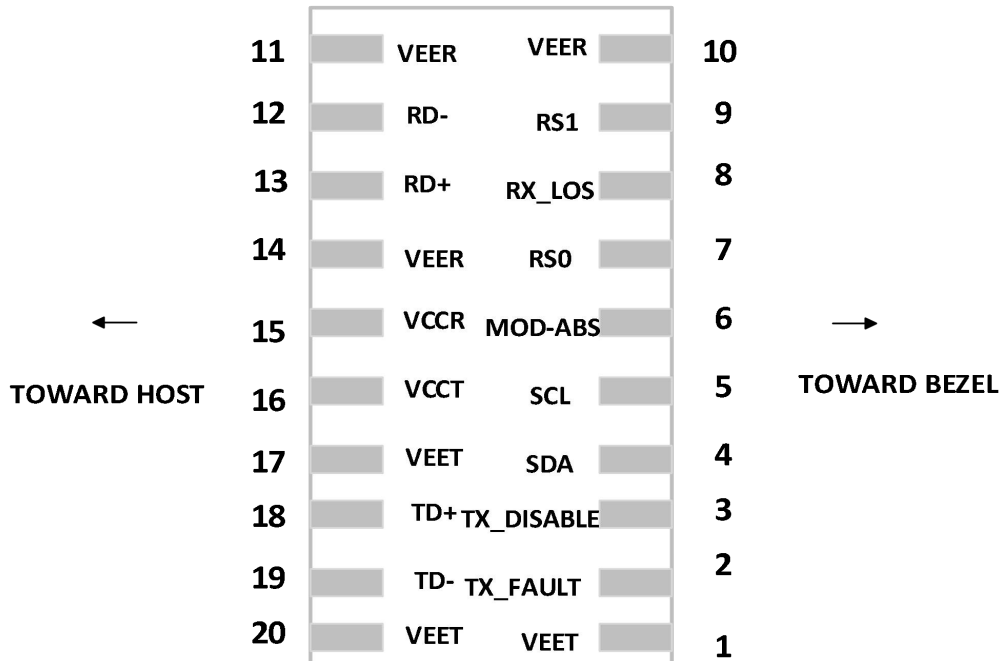
**Ousent Technologies Co., Ltd**

NAME OF MANUFACTURE:

This product complies with  
21 CFR 1040. 10 and 1040. 11  
Meet Class 1 Laser Safety Requirements



### Electrical Pin-out Details



### Pin Function Definitions

Pin	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	2) Module disables on high or open
4	SDA	Transmitter Disable	3	3) 2 wire serial ID interface.
5	SCL	Module Definition 2	3	3) 2 wire serial ID interface.
6	MOD-ABS	Module Definition 1	3	3)
7	RS0	RX Rate Select(LVTTL).	3	Rate Select 0, optionally controls SFP+module receiver. This pin is pulled low to VeeT with a >30K resistor..
8	LOS	Loss of Signal	3	4)
9	RS1	TX Rate Select(LVTTL).	1	Rate Select 1, optionally controls SFP+Module transmitter. This pin is pulled low toVeeT with a >30K resistor.

10	VeeR	Receiver Ground	1	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	6)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	7) 3.3V ± 5%
16	VccT	Transmitter Power	2	7) 3.3V ± 5%
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	VeeT	Transmitter Ground	1	5)

#### NOTES:

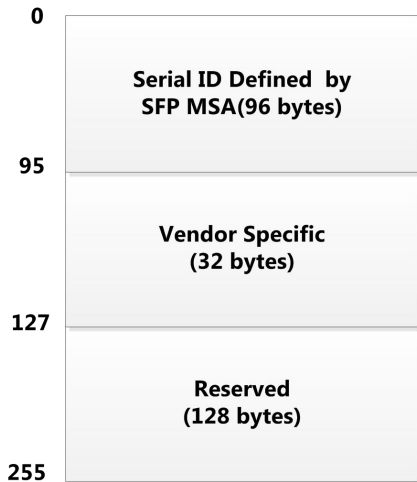
- 1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K-10K resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 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 K 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) Modulation Absent, connected to VEET or VEER in the module
- 4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K 10K 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 AC coupled 100 differential Lines which should be terminated with 100 (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400 and 2000 mV differential (200 –1000 mV single ended) when properly terminated.
- 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 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm 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 30mA 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 100 differential termination inside the module.

#### EEPROM

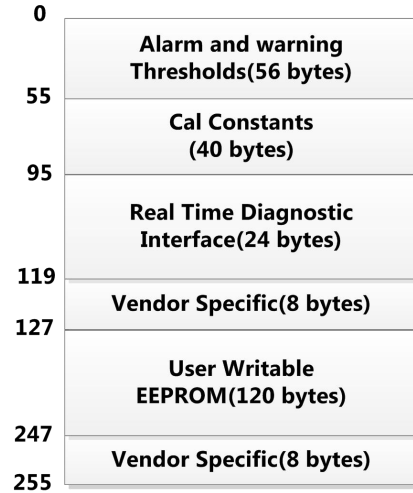
The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) 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. Calibration and 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. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following. For detail EEPROM information please refer to the related document of SFF8472 Rev 10.2.

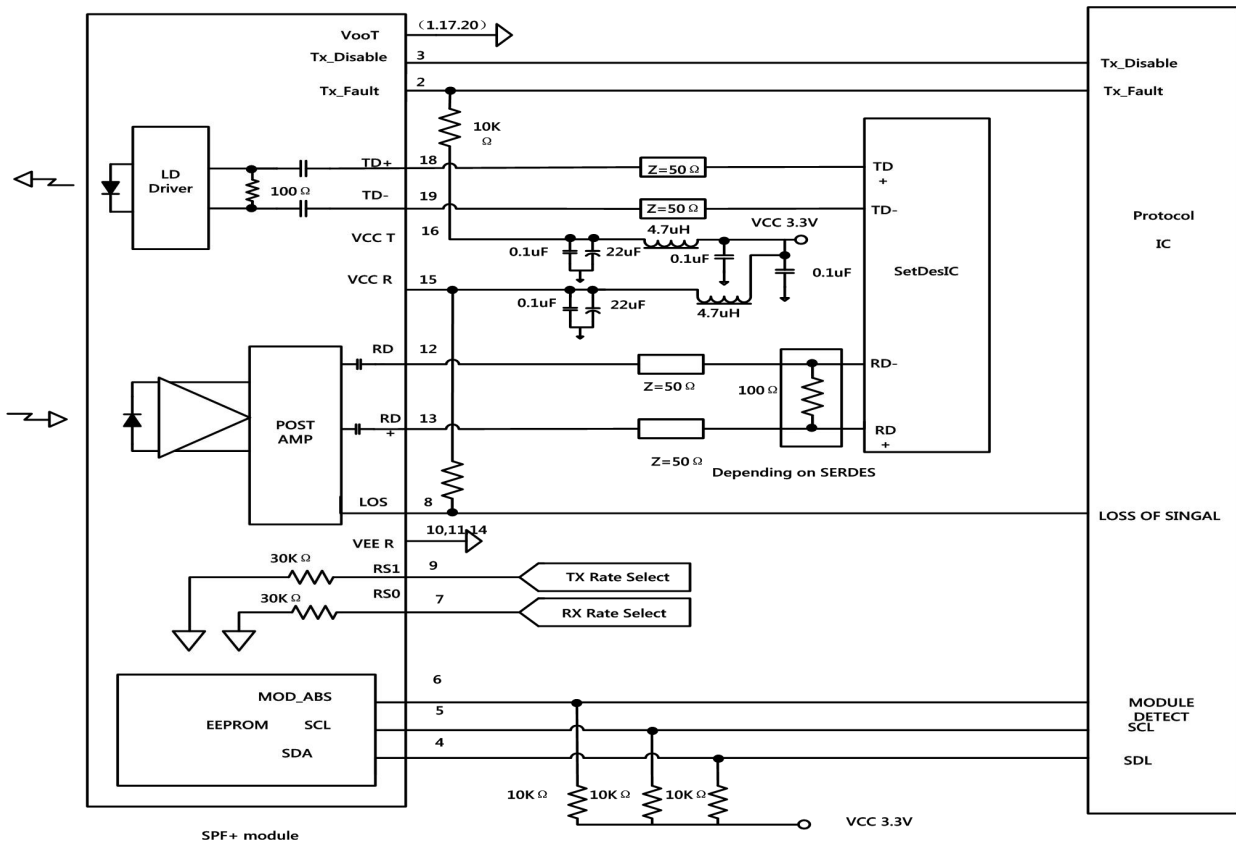
2 wire address 1010000X(A0h)



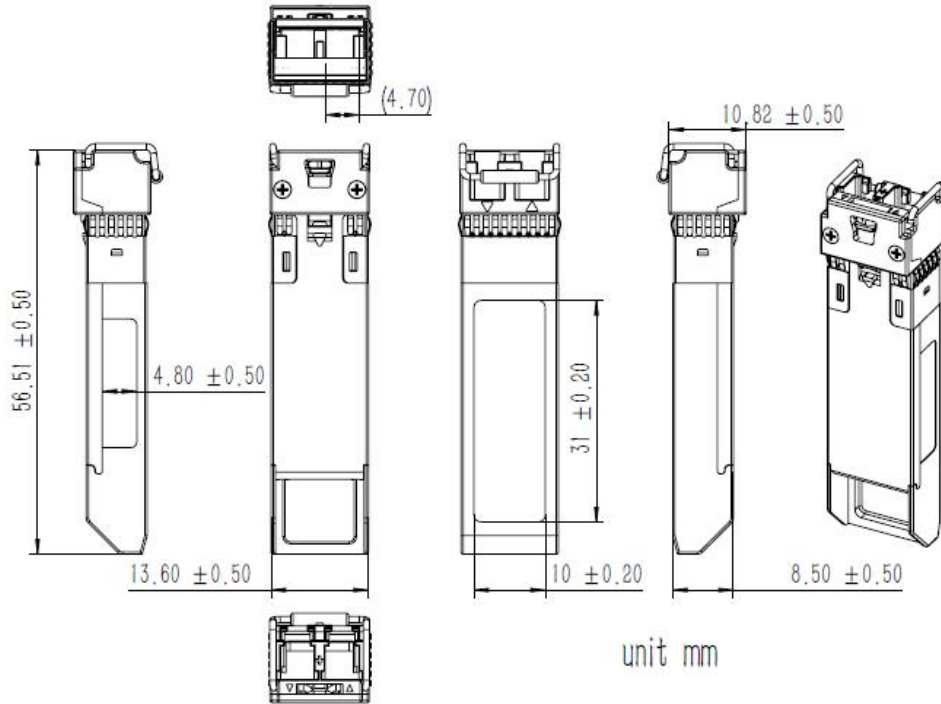
2 wire address 1010000X (A2h)



### Recommend Circuit Schematic



## Mechanical Specifications



## Order Information

Part No.	Data Rate	Fiber	Distance	Interface	Temp.	DDMI
OS-SP96-3110D	10.31Gbps	SMF	10km	LC	0~70°C	Yes
OS-SP96-3110DI	10.31Gbps	SMF	10km	LC	-40~85°C	Yes

### Notice:

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