

# SFP Transceiver

(XSFP-LD13-1.25G-20-XX)

(XSFP-LD15-1.25G-20-XX)



## Features

Dual data-rate of 1.25Gbps/1.0625Gbps operation

LD13 series: MQW FP Laser, 1310nm TX, PIN RX

LD15 series: MQW FP Structure Laser, 1550nm TX, PIN RX (<5km)

DFB Laser, 1550nm TX, PIN RX ( 5~20km)

LVTTL logic level RX LOS

20km transmission with SMF

Standard serial ID information compatible with SFP MSA

SFP MSA package with SC Single fiber Bi-direction connector

Very low EMI and excellent ESD protection

+3.3V single power supply

Operating case temperature:

Standard:0 to +70°C

Industrial: -40 to +85°C

## **Applications**

Switch to Switch interface  
Switched backplane applications  
Router/Server interfac  
ATM  
SONT/SDH/PDH  
FDDI  
Fiber Channel  
Other optical transmission systems

## **Standard**

Compatible with SFP MSA  
Compatible with IEEE 802.3z  
Compatible with ANSI specifications for Fibre Channel  
Compatible with FCC 47 CFR Part 15, Class B  
Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I  
Compatible with Telcordia GR-468-CORE  
RoHS compliance

## **Description**

The SFP transceiver is high performance, cost effective module supporting dual data-rate of 1.25Gbps/1.0625Gbps and from 10km to 20km transmission distance with SMF.

The transceiver consists of two sections: The transmitter section incorporates a FP laser. And the receiver section consists of a PIN photodiode integrated with a trans-impedance preamplifier (TIA). All modules satisfy class I laser safety requirements.

The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver.

The standard serial ID information compatible with SFP MSA describes the transceiver's capabilities, standard interfaces, manufacturer and other information. The host equipment can access this information via the 2-wire serial CMOS EEPROM protocol. For further information, please refer to SFP Multi-Source Agreement (MSA).

The SFP transceivers are compatible with RoHS.

## Regulatory Compliance

The transceivers have been tested according to American and European product safety and electromagnetic compatibility regulations (See Table 1). For further information regarding regulatory certification, please refer to Howfflink regulatory specification and safety guidelines, or contact with Howfflink, Inc.

**Table 1 - Regulatory Compliance**

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>500 V)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B	Compatible with standards
Immunity	IEC 61000-4-3	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class I laser product.
Component Recognition	UL and CSA	Compatible with standards

RoHS	2002/95/EC 4.1&4.2	Compatible with standards
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## Absolute Maximum Ratings

**Table 2 - Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	V <sub>CC</sub>	-0.5	3.6	V
Operating Relative Humidity	-	5	95	%

## Recommended Operating Conditions

**Table 3- Recommended Operating Conditions**

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Standard	T <sub>c</sub>	0		+70	°C
	Industrial		-40		+85	
Power Supply Voltage		V <sub>CC</sub>	3.13	3.3	3.47	V
Power Supply Current		I <sub>CC</sub>		200	300	mA
Data Rate	Gigabit Ethernet			1.25		Gbps
	Fibre Channel			1.0625		

**Table 4 – Transmitter Optical and Electrical Characteristics**

Parameter	Symbol	Min	Typical	Max	Unit
Optical output	P <sub>o</sub>	-8	-	-3	dBm
Extinction ratio	ER	8.2	-	-	dB
Optical wavelength	$\lambda$	1270	1310	1340	nm
		-	1550	-	nm
Spectral width	$\Delta$	-	-	4	nm
	$\lambda$			1	
Rise time	Tr	-	300	-	ps
Fall time	Tf	-	300	-	ps

Transmitter outout eye	compliant with Eye Mask Defined in 802.3z standard				
Data rate (NRZ)	B	100	-	1250	Mb/s
Supply voltage	V <sub>CCT</sub>	+3.1	+3.3	+3.6	V
Supply current	I <sub>CCT</sub>	-	70	130	mA
Input HIGH Voltage	V <sub>IH</sub>	V <sub>CCT</sub> -1.165	-	V <sub>CCT</sub> -0.700	V
Input LOW Voltage	V <sub>IL</sub>	V <sub>CCT</sub> -1.890	-	V <sub>CCT</sub> -1.475	V
Transmitter Enable voltage	V <sub>EN</sub>	-	-	0.8	V
Transmitter Disable voltage	V <sub>D</sub>	2	-	-	V

**Table 5 – Receiver Optical and Electrical Characteristics**

Parameter	Symbol	Min	Typical	Max	Unit
Sensitivity	Sen	-	-25	-23	dBm
Saturation	-	-3	-	-	dBm
Optical wavelength	$\lambda$	1100	-	1600	nm
Signal detect asserted	P <sub>A</sub>	-	-	-22	dBm
Signal detect deasserted	P <sub>D</sub>	-35	-	-	dBm
Optical Return Loss	RL	-	-	-27	dB
Data rate (NRZ)	B	100	-	1250	Mb/s
Supply voltage	V <sub>CCR</sub>	+3.1	+3.3	+3.6	V
Suplly current	I <sub>CCR</sub>	-	80	150	mA
Data Output High	V <sub>OH</sub>	V <sub>CCR</sub> -1.025	-	V <sub>CCR</sub> -0.880	V
Data Output LOW	V <sub>OL</sub>	V <sub>CCR</sub> -1.810	-	V <sub>CCR</sub> -1.620	V
LOS Low Voltage	V <sub>LOUT</sub>	-	-	0.8	V
LOS High Voltage	V <sub>HOUT</sub>	2	-	-	V

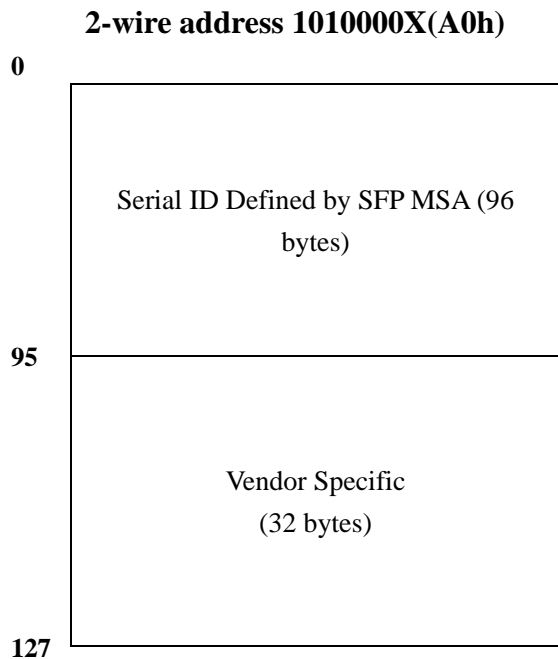
(Sensitivity and saturation levels for a  $2^{23}-1$  PRBS with 72 ones and 72 zeros inserted over temperature)

### **EEPROM Information:**

The serial SFP module contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver's capabilities, standard interfaces, manufacturer. 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\_DEF1). 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\_DEF2) is bi-directional for serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The module provide diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold 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 using calibration constants stored in EEPROM locations 56-95 at wire serial bus address A2h. The diital diagnostic memory map specific data field define ad following.



### **Recommended Host Board Power Supply Circuit**

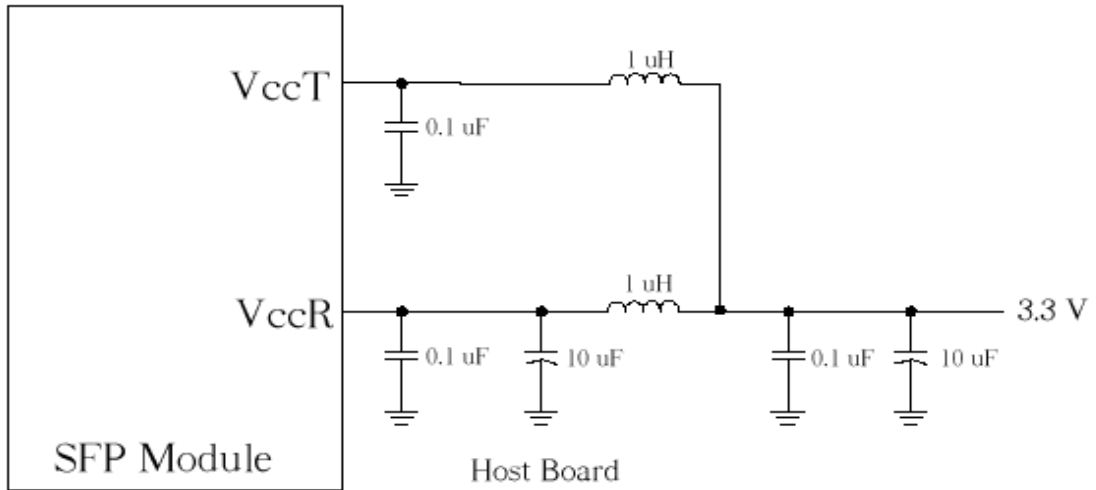


Figure 1, Recommended Host Board Power Supply Circuit

**Recommended Interface Circuit**

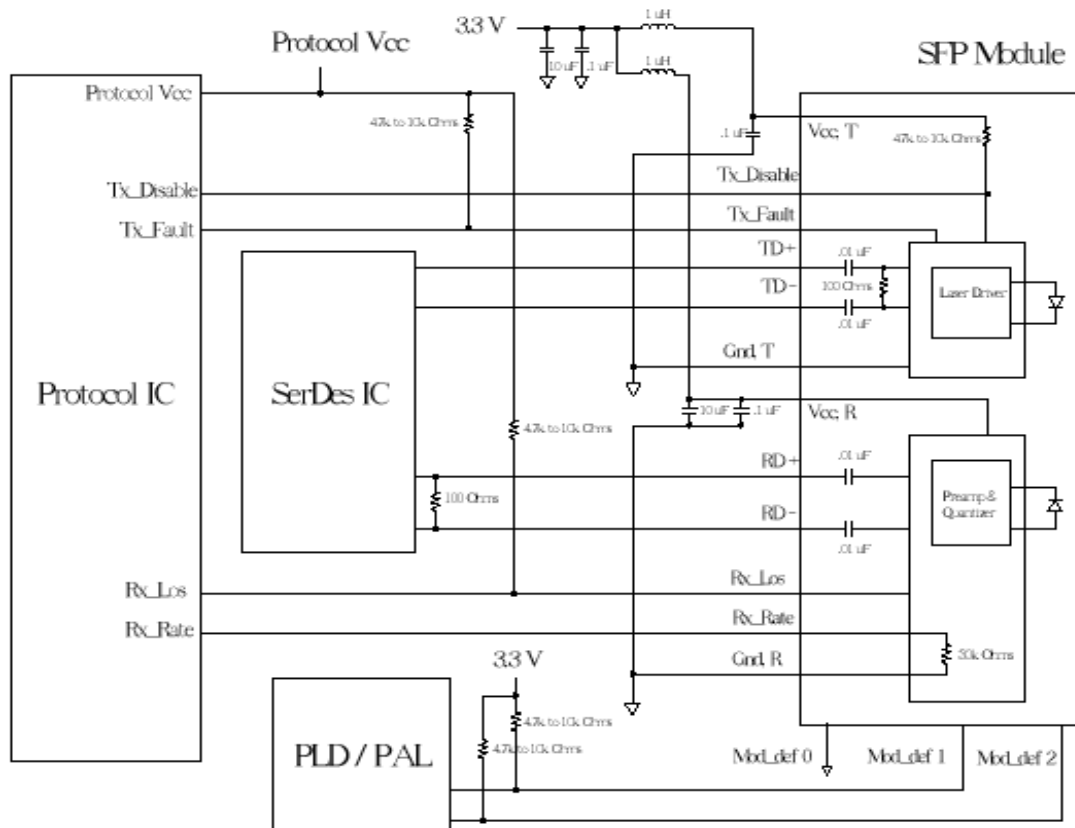


Figure 2 shows the recommended interface circuit.

**Pin Definitions**

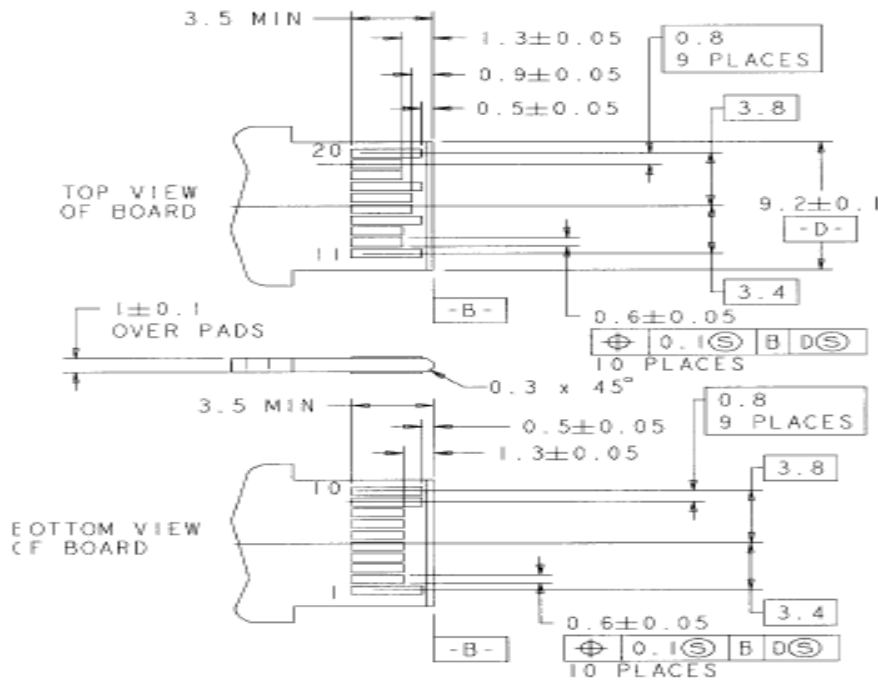


Figure 3, Pin View

Table 6 – Pin Function Definitions

Pin Name	PIN	Name/Function
GNDR	9、10、11、14	Receiver Ground
VCCR	15	Receiver Supply Voltage. They are defined as $+3.3V \pm 5\%$ at the SFP connector pin. Recommended host board power supply filtering is shown below. The DC resistance of inductor is less than $1\Omega$ , which result in maintaining the required voltage at the SFP input pin with $+3.3V$ supply voltage.
RD-	12	Receiver Data, Differential Output. They are AC coupled $100\Omega$ differential lines which should be terminated with $100\Omega$ 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 $370mV$ and $2000mV$ differential when properly terminated.
RD+	13	Receiver Data, Differential Output. They are AC coupled $100\Omega$ differential lines which should be terminated with $100\Omega$ 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 $370mV$ and $2000mV$ differential when properly terminated.
LOS	8	Receiver Loss of Signal, logic high, open collector compatible, $4.7K$ to $10K$ Ohm pull up to VCCR on host
Rate Select	7	NC.
GNDT	1、17、20	Transmitter Ground
VCCT	16	Transmitter Supply Voltage. They are defined as $+3.3V \pm 5\%$ at the SFP connector pin. Recommended host board power supply filtering is shown below. The DC resistance of inductor is less than $1\Omega$ , which result in maintaining the required voltage at the SFP input pin with $+3.3V$ supply voltage.



TD+	18	Transmit Data, Differential Input. They are AC coupled 100Ω differential lines which should be terminated with 100Ω inside the module. The AC coupling is done inside the module and is thus not required on the host board.
TD-	19	Transmit Data, Differential Input. They are AC coupled 100Ω differential lines which should be terminated with 100Ω inside the module. The AC coupling is done inside the module and is thus not required on the host board.
TX_Disable	3	Transmitter Disable, logic high, open collector compatible, 4.7K to 10K Ohm pull up to VCCT on SFP. The pin is used to shut down the transmitter optical output. High is transmitter Disabled, Low is transmitter on.
TX_Fault	2	Transmitter Fault, logic high, open collector compatible, 4.7K to 10K Ohm pull up to VCCT on host. When high, output indicates a laser fault of some kind. Low indicates normal operation.
MOD_DEF0	6	SFP module definition and presence, bit 0, 4.7K to 10K Ohm pull up to VCCT on host. The pin is grounded by the module to indicate that the module is present.
MOD_DEF1	5	SFP module definition and presence, bit 1, 4.7K to 10K Ohm pull up to VCCT on host. The pin is the clock line of two wire serial interface for serial ID
MOD_DER2	4	SFP module definition and presence, bit 2, 4.7K to 10K Ohm pull up to VCCT on host. The pin is the data line of two wire serial interface for serial ID.

### Mechanical Design Diagram

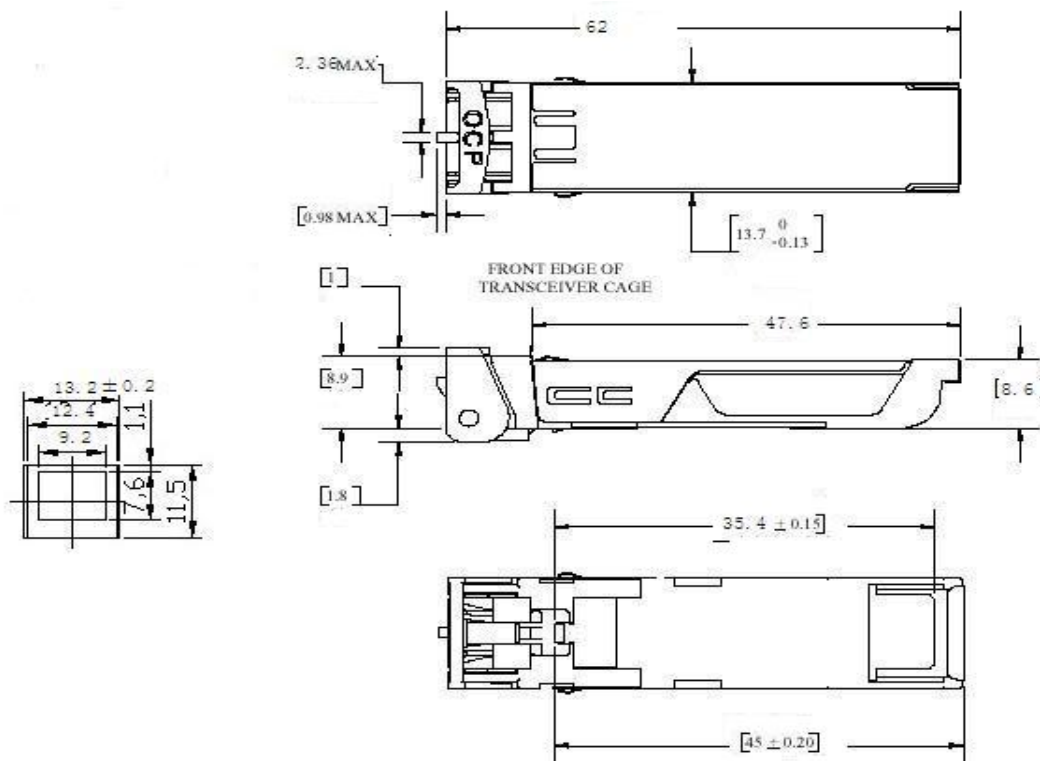


Figure 4, Mechanical Design Diagram of the SFP with Spring-Latch

## Ordering information

