

## DATA SHEET

### MODULETEK: SFP-2FC-SX-C10

2.125Gb/s SFP (Small Form Pluggable) Short Wavelength (850nm) Transceiver

#### SFP-2FC-SX-C10 Overview

ModuleTek's SFP-2FC-SX-C10 SFP optical transceivers, according to Small Form Factor Pluggable Multi-Sourcing Agreement (MSA) SFF-8074i and SFF-8472, revision 9.5, are designed for data communication on multimode fiber up to 500m. They are compliant with ITU-T G.651.1 MMF SDH STM-1/STM-4/1GE/1FC/2FC. SFP-2FC-SX-C10 SFP transceivers offer a wide range of design options, including Digital Diagnostic Monitoring (DDM) features and industrial temperature options. They are compliant with RoHS.

#### Product Features

- Up to 2.125Gb/s bi-directional data links
- Compliant to ITU-T G.651.1 MMF
- Specifications according to SFF-8074i and SFF-8472, revision 9.5
- Hot-pluggable SFP footprint
- 850nm VCSEL laser and PIN photodetector
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 500m on 50/125um MMF, 300m on 62.5/125um MMF
- Single +3.3V DC power supply
- Duplex LC connector compliant
- RoHS Compliant
- Class 1 laser safety certified
- Industrial Operating temperature range: -40°C to 85°C

#### Applications

- FE, STM1, STM4
- 1.25Gb/s Ethernet 1000BASE-SX
- 1.0625Gb/s, 2.125Gb/s Fiber Channel

## Ordering Information

Part Number	Description	Color on Clasp
SFP-2FC-SX-C10	2FC SFP 850nm LC Connectors 500m on MMF, with DOM function.	Black
<b>For More Information:</b> ModuleTek Limited Web: <a href="http://www.moduletek.com">www.moduletek.com</a> Email: <a href="mailto:sales@moduletek.com">sales@moduletek.com</a>		

## General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	0.1		2.125	Gb/s	1
Bit Error Rate	BER			$10^{-12}$		
Operating Temperature	T <sub>C</sub>	-40		85	°C	3
Storage Temperature	T <sub>STO</sub>	-40		85	°C	4
Supply Current	I <sub>CC</sub>		130	180	mA	5
Input Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Maximum Voltage	V <sub>MAX</sub>	-0.5		4	V	5

### Notes:

1. IEEE 802.3
2. FC-PI-2 Rev 5
3. Case temperature
4. Ambient temperature
5. For electrical power interface

## Optical – Characteristics – Transmitter

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Launch Optical Power	$P_{TX}$	-9	-6	-3	dBm	1
Optical Center Wavelength	$\lambda_C$	830	850	860	nm	
Extinction Ratio	ER	8.2			dB	
Spectral Width (RMS)	$\Delta\lambda$			0.85	nm	
Optical Rise/Fall Time (20%-80%)	$t_r/t_f$			150	ps	

### Notes:

1. Class 1 Product

## Optical – Characteristics – Receiver

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Receiver Overload	$P_{OL}$	0			dBm	1
Optical Center Wavelength	$\lambda_C$	770		860	nm	
Receiver Sensitivity	$R_{X\_SEN}$			-17	dBm	1
Optical Return Loss	ORL	27			dB	
LOS Assert	$LOS_A$	-35			dBm	
LOS De-Assert	$LOS_D$			-18	dBm	
LOS Hysteresis	$LOS_H$	0.5	3	5	dB	

### Notes:

1. Measured with PRBS  $2^{23}-1$  test pattern,  $BER < 10^{-12}$

## Electrical – Characteristics – Transmitter

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	$R_{IN}$	80	100	120	$\Omega$	
Single ended data input swing	$V_{IN\_PP}$	250		1200	mV	
Transmit disable voltage	$V_D$	2		$V_{CC}$	V	
Transmit enable voltage	$V_{EN}$	$V_{EE}$		$V_{EE}+0.8$	V	

## Electrical – Characteristics – Receiver

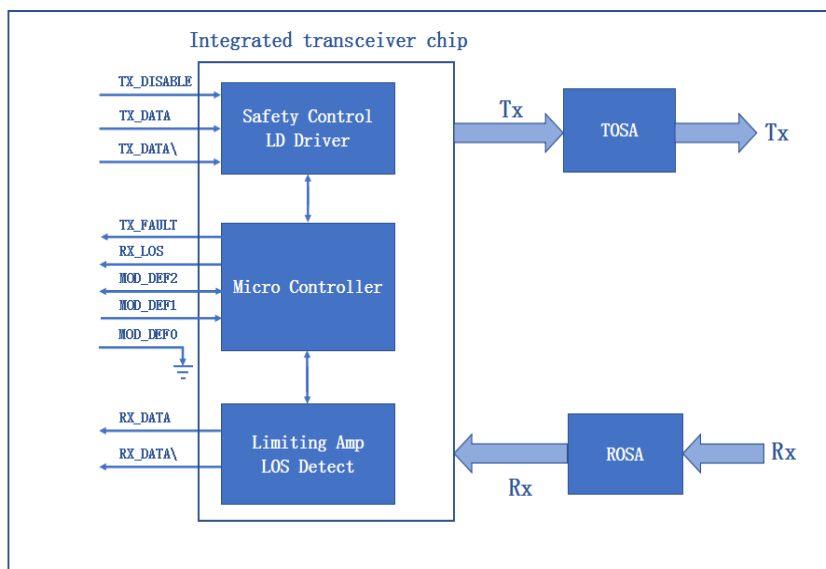
$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	$V_{OUT\_PP}$	250	350	550	mV	
LOS Normal	$V_{LOS\_A}$			$V_{CC\_HOST}$	V	
LOS Fault	$V_{LOS\_D}$	$V_{EE}$		$V_{EE}+0.5$	V	

## Digital Diagnostic Functions

SFP-2FC-SX-C10 supports the 2-wire serial communication protocol as defined in SFF-8472. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for SFP-2FC-SX-C10 are internally calibrated by default. The internal micro control unit accesses the device operating parameters in real time, Such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. The module implements the alarm function of the SFF-8472, alerts the user when a particular operating parameter exceeds the factory-set normal range.

## Block-Diagram-of-Transceiver

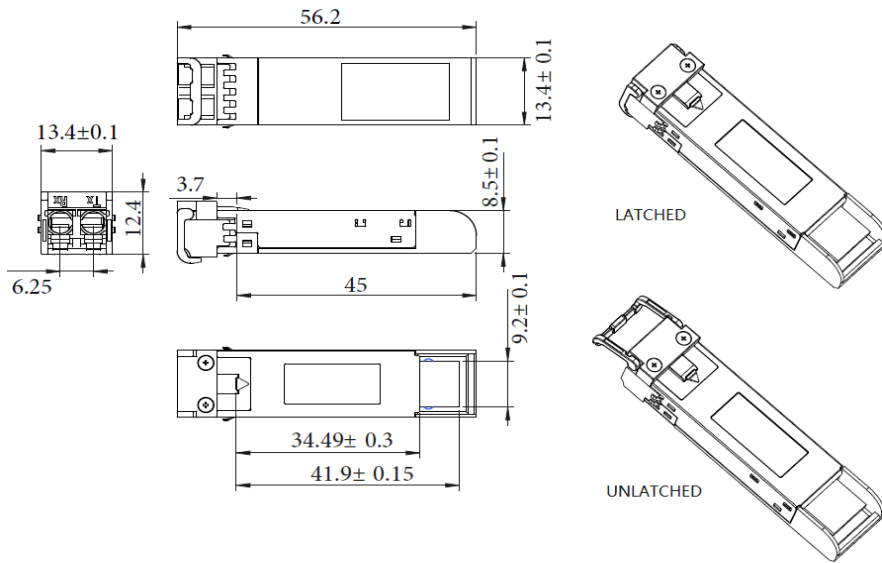


## Functions Description

The transmitter is mainly composed of a laser driver part of the intelligent transceiver chip and a TOSA (light-emitting component), the TOSA includes a 850nm VCSEL laser and a backlight photodetection chip, When the module is working, the input signal is connected to the intelligent transceiver chip, at this time, the laser driver of the intelligent transceiver chip supplies the bias current and the modulation current to the laser. The intelligent transceiver chip simultaneously uses an automatic optical power control (APC) feedback loop to maintain a constant average optical power of the laser output. The purpose is to eliminate the change of the output optical signal due to temperature changes and aging of the light source device. When the transmitter enable pin (TX\_Disable) is high (TTL logic "1"), the laser output is turned off. When TX\_Disable is low (TTL logic "0"), the laser will turn on within 1ms. When the transmitter fault signal (TX\_Fault) is reported as high, indicates a transmitter failure caused by the transmitter's bias current or transmitted optical power or laser tube temperature exceeding a preset alarm threshold. Low indicates normal operation.

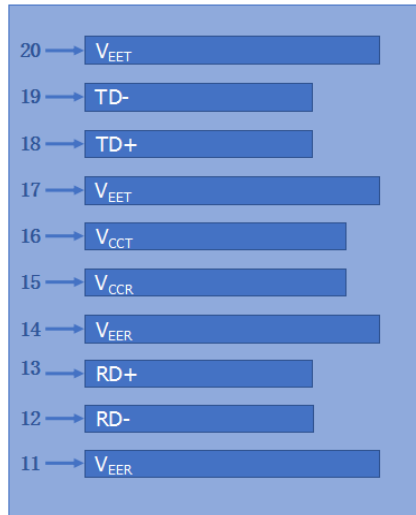
The receiver is mainly composed of a limiting amplifier part of the intelligent transceiver chip and a ROSA (light-receiving component), the ROSA includes a PIN photodetector and a transimpedance amplifier chip. When the ROSA detects the incident light signal, it will be converted into a photo-generated current by the PIN photodetector. The photo-generated current is converted into an electrical signal after passing through the transimpedance amplifier. The electrical signal is further amplified by the limiting amplifier of the intelligent transceiver chip, then outputs a fixed-amplitude electrical signal to the host. When the amplitude of the electrical signal received from the incident light conversion of the opposite optical transceiver module is lower than the set threshold, the module reports that the received signal is lost, the RX\_LOS pin is high (logic "1"), which can be used to diagnose whether the physical signal is normal. The signal is operated in TTL level. The microprocessor inside the module monitors the module's operating voltage, temperature, transmitted optical power, received optical power, and laser bias current value in real time. The host acquires this information over a 2-wire serial bus.

## Dimensions

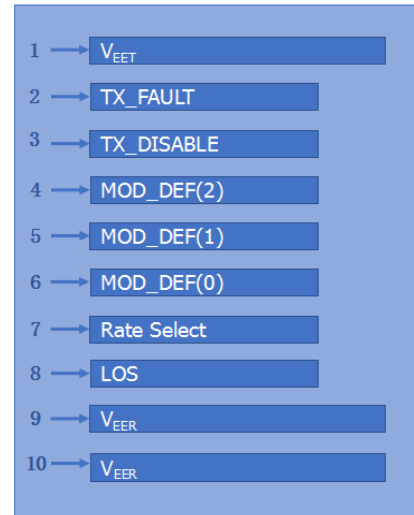


ALL DIMENSIONS ARE  $\pm 0.2$ mm UNLESS OTHERWISE SPECIFIED  
UNIT: mm

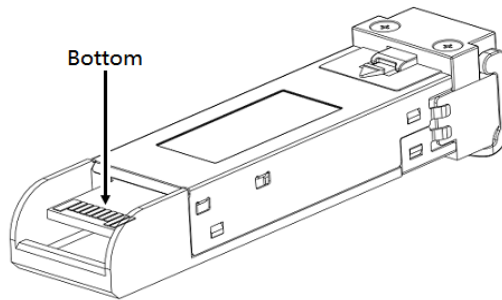
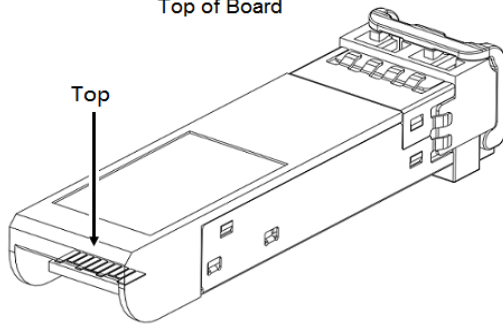
## Electrical Pad Layout



Top of Board



Bottom of Board



## Pin Assignment

PIN #	Symbol	Description	Remarks
1	V <sub>EET</sub>	Transmitter ground (common with receiver ground)	1
2	T_FAULT	Transmitter Fault. Not supported	
3	TX_DISABLE	Transmitter Disable. Laser output disabled on high or open	2
4	MOD_DEF(2)	Module Definition 2. Data line for serial ID	3
5	MOD_DEF(1)	Module Definition 1. Clock line for serial ID	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module	3
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	4
9	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
10	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
11	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
12	RD-	Receiver Inverted DATA out. AC coupled	
13	RD+	Receiver Non-inverted DATA out. AC coupled	
14	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
15	V <sub>CCR</sub>	Receiver power supply	
16	V <sub>CCT</sub>	Transmitter power supply	
17	V <sub>EET</sub>	Transmitter ground (common with receiver ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC coupled	
19	TD-	Transmitter Inverted DATA in. AC coupled	
20	V <sub>EET</sub>	Transmitter ground (common with receiver ground)	1

### Notes:

1. Circuit ground is isolated from chassis ground
2. Disabled: T<sub>DIS</sub> > 2V or open, Enabled: T<sub>DIS</sub> < 0.8V
3. Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V
4. LOS is open collector output

## References

1. IEEE standard 802.3. IEEE Standard Department, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
3. Fiber Channel Draft Physical Interface Specification (FC-PI-2 Rev.5).
4. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.