

DATA SHEET

MODULETEK – SFP-OC12-SR/IR1-C10

OC-12 SR/IR-1 SFP (Small Form Pluggable) Transceiver with Digital Diagnostics

SFP-OC12-SR/IR1-C10 Overview

ModuleTek's SFP-OC12-SR/IR1-C10 optical transceivers are designed to comply with ATM/SDH/SONET standards at OC-12 IR-1/STM-4 S-4.1 and OC-12 SR/SDH STM I-4 (622Mb/s) data rate. The SFP-OC12-SR/IR1-C10 SFP optical transceivers with digital diagnostics monitoring functionality provide a quick and reliable interface for OC-12/STM-4 single mode applications. The digital diagnostics functions are available via the 2-wire serial bus. In addition, they comply with the Small Form Pluggable Multi-Source Agreement (MSA).

Product Features

- Up to 622 Mb/s bi-directional data links
- Compliant with ANSI-T1.646, ATM and SONET and SDH for OC-12/STM-4 (622Mb/s)
- Comply to SFP MSA
- Built-in digital diagnostics functions
- Hot-pluggable SFP footprint
- Uncooled 1310nm FP laser transmitter
- Duplex LC connector
- Up to 15km on SMF
- Single power supply 3.3V
- RoHS Compliance
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0°C to 70°C.

Applications

- SONET OC-12 IR-1/SDH STM S-4.1
- SONET OC-12 SR/SDH STM I-4

Ordering Information

Part Number	Description
SFP-OC12-SR/IR1-C10	OC-12 SR/IR-1 SFP LC Connectors 1310nm SingleMode 15km, with DOM function

For More Information:

ModuleTek Limited

Unit 4A, B Building, Shenfubao S&T Industrial Park, No. 3 Huang Huai Road, Futian Free Trade Zone, Shenzhen, China. 518038.

Email: sales@moduletek.com

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR		622		Mb/s	
Bit Error Rate	BER			10 ⁻¹²		
Operating Temperature	T _{OP}	0		70	°C	1
Storage Temperature	T _{STO}	- 40		85	°C	2
Supply Current	I _S		165	300	mA	3
Input Voltage	V _{CC}	3.14	3.3	3.46	V	
Maximum Voltage	V _{MAX}	- 0.5		4.5	V	3

Notes:

1. Case temperature
2. Ambient temperature
3. For electrical power interface

Optical Characteristics – Transmitter

V_{CC}=3.14V to 3.46V, T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P _{TX}	- 15		- 8	dBm	1
Optical Center Wavelength	λ _C	1260		1360	nm	
Extinction Ratio	ER	8.2			dB	
Spectral Width (RMS)	Δλ			3	nm	
Optical Rise/Fall Time (20% - 80%)	T _{RF_IN}			300	ps	
Relative Intensity Noise	RIN			- 120	dB/Hz	
Generated Jitter (peak to peak)	GJ _T			0.07	UI	
Generated Jitter (RMS)	GJ _{RMS}			0.007	UI	
Output Eye		Compliant with SONET OC-12/SDH STM-4 standard				

Notes:

1. Class 1 Product

Optical Characteristics – Receiver

V_{CC}=3.14V to 3.46V, T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	λ _C	1260		1600	nm	
Optical Input Power	P _{IN}			- 8	dBm	
Average Rx Sensitivity @ OC12	R _{X_SEN}			- 28	dBm	1
LOS Assert	LOS_A	- 45			dBm	
LOS De-Assert	LOS_D			- 28	dBm	
LOS Hysteresis	LOS_H	0.5			dB	

Notes:

1. PRBS 2²³-1

Electrical Characteristics – Transmitter

V_{CC}=3.14V to 3.46V, T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R _{IN}		100		Ω	
Single ended data input swing	V _{IN_PP}	250		1200	mV	
Transmit disable voltage	V _D	V _{CC} -1.3		V _{CC}	V	
Transmit enable voltage	V _{EN}	V _{EE}		V _{EE} +0.8	V	
Transmit Disable Assert Time				10	us	

Electrical Characteristics – Receiver

V_{CC}=3.14V to 3.46V, T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	V _{OUT_PP}	300	400	800	mV	
Data output rise time (20%-80%)	T _R		150	300	ps	
LOS Fault	V _{LOS_Fault}	V _{CC} -0.5		V _{CC_HOST}	V	
LOS Normal	V _{LOS_Normal}	V _{EE}		V _{EE} +0.5	V	

Digital Diagnostic Functions

SFP-OC12-SR/IR1-C10 supports the 2-wire serial communication protocol as defined in the SFP MSA. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for SFP-OC12-SR/IR1-C10 are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver.

Transceiver Temperature, internally measured, represented as a 16 bit signed twos complement value in increments of 1/256 degrees Celsius, Temperature accuracy is better than ±3 degrees Celsius over specified operating temperature and voltage.

Transceiver Supply Power, internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100 μVolt, yielding a total range of 0 to +6.55 Volts.

Transceiver TX bias current, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2 μA, yielding a total range of 0 to 131mA. Accuracy is better than ±10% over specified operating temperature and voltage.

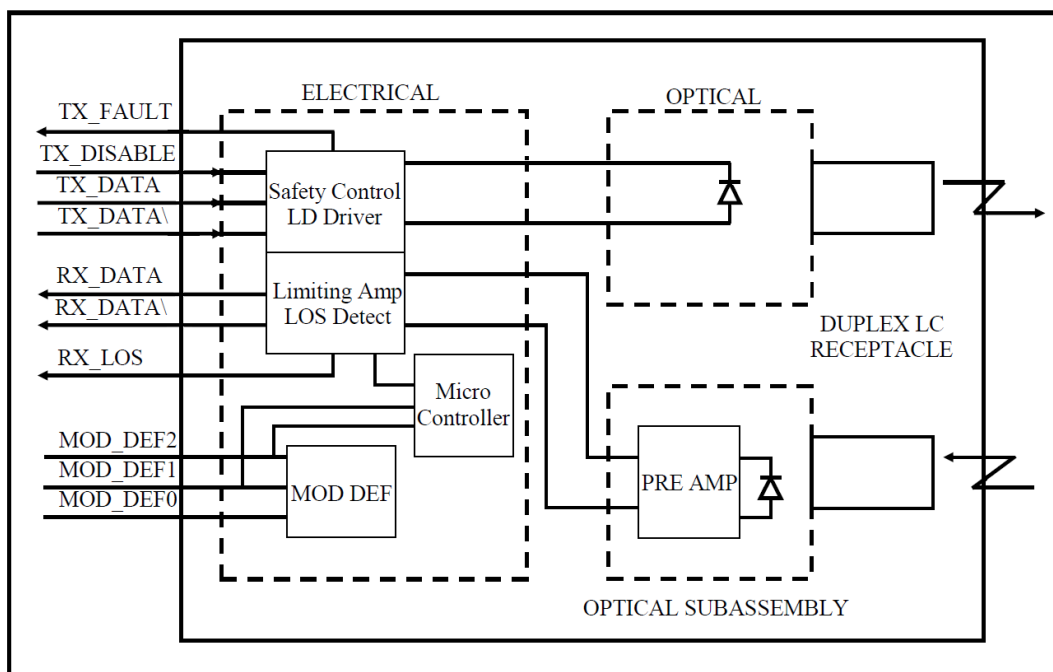
Transceiver TX output power, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit value (0 – 65535) with LSB equal to 0.1 μW. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ±3dB over specified temperature and voltage. Data is not valid when the transmitter is disabled.

Transceiver RX received optical power, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit 35 value (0 – 65535) with LSB equal to 0.1 μW. Accuracy is better than ±3dB over specified temperature

and voltage.

Parameter	Symbol	Accuracy	Units	Report Range	Unit	Remarks
Internal Calibration						
Temperature	T _{MON}	±3	°C	- 40	95	°C
Voltage	V _{MON}	±0.1	V	2.7	3.9	V
Bias Current	I _{MON}	±10	%	1	80	mA
Tx Power	P _{MON}	±3	dB	- 18	- 5	dBm
Rx Power	P _{MON}	±3	dB	- 30	0	dBm

Block Diagram of Transceiver



Transmitter Section

The FP driver accepts differential input data and provide bias and modulation currents for driving a laser. An automatic power-control (APC) feedback loop is incorporated to maintain a constant average optical power. 1310 nm in an eye safe optical subassembly (OSA) mates to the fiber cable.

TX_DISABLE

The TX_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on within 1ms when TX_DISABLE is low (TTL logic "0").

TX_FAULT

When the TX_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

Receiver Section

The receiver utilizes a PIN detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a Limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting Amplifier is AC-coupled to the

transimpedance amplifier, with internal 100Ω differential termination.

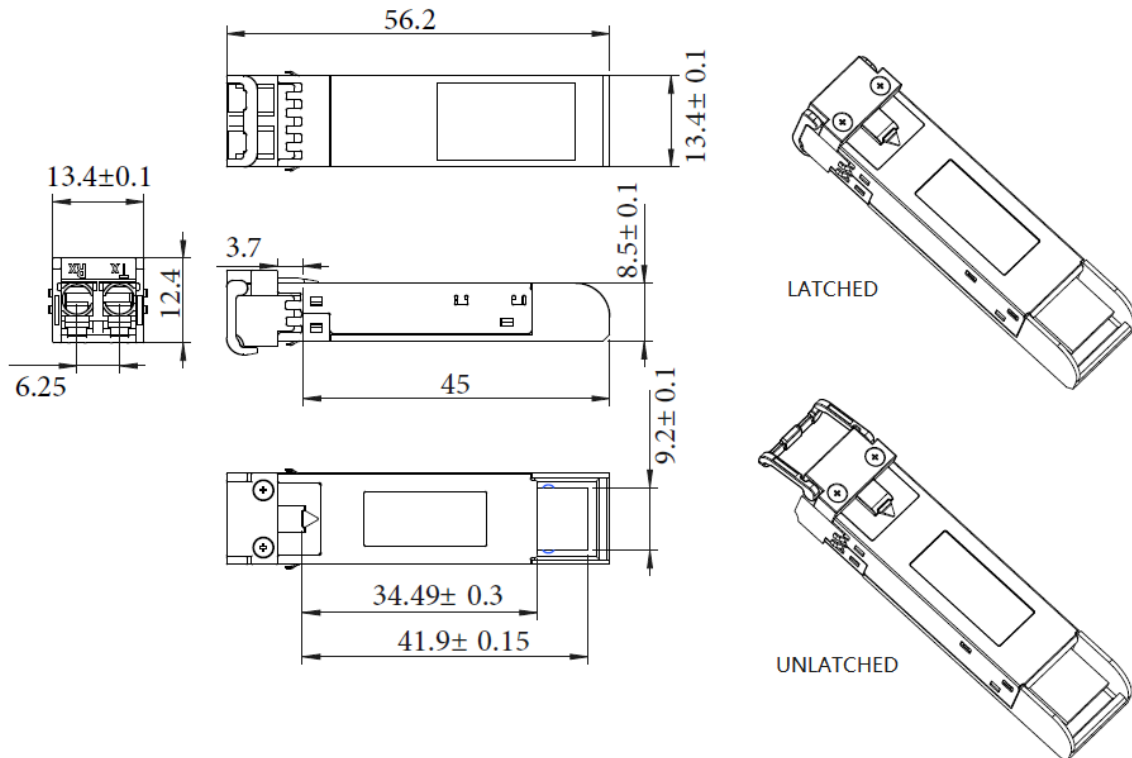
Receive Loss (RX_LOS)

The RX_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.

Controller Section

The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

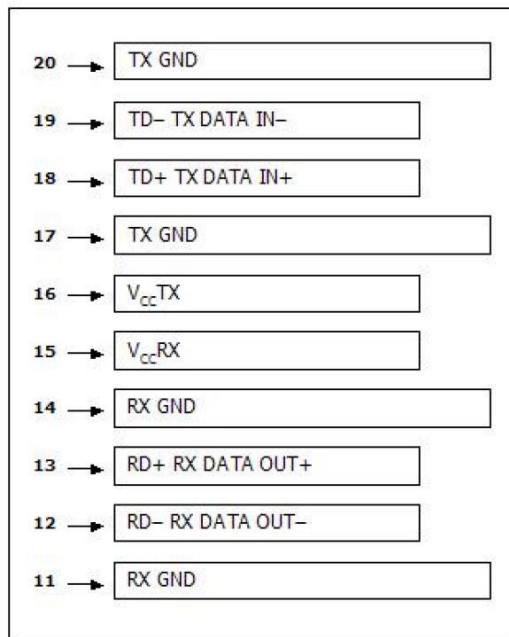
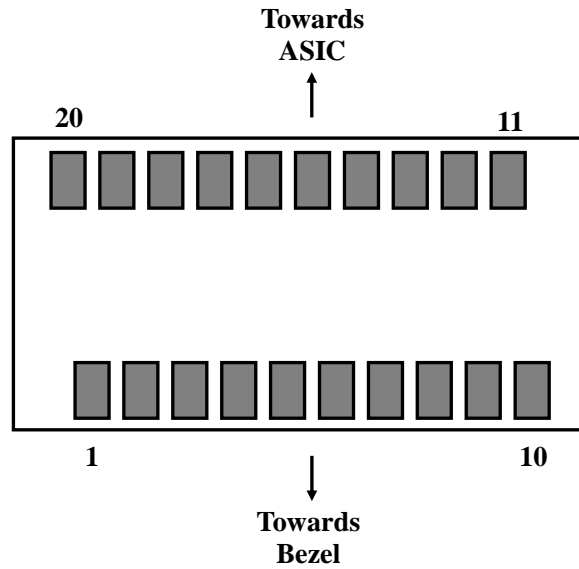
Dimensions



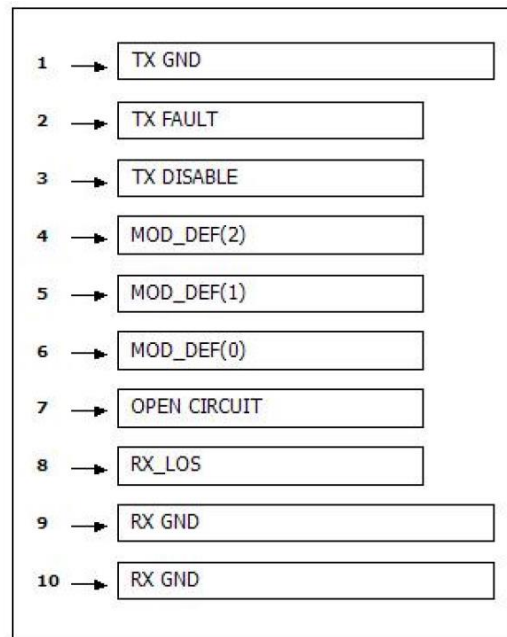
ALL DIMENSIONS ARE $\pm 0.2\text{mm}$ UNLESS OTHERWISE SPECIFIED

UNIT: mm

Electrical Pad Layout



Top of Board



Bottom of Board

Pin Assignment

PIN #	Symbol	Description	Remarks
1	V _{EET}	Transmitter ground (common with receiver ground)	1
2	T _{FAULT}	Transmitter Fault. Not supported	
3	T _{DIS}	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 _{EER}	Receiver ground (common with transmitter ground)	1
10	V _{EER}	Receiver ground (common with transmitter ground)	1
11	V _{EER}	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 _{EER}	Receiver ground (common with transmitter ground)	1
15	V _{CCR}	Receiver power supply	
16	V _{CCT}	Transmitter power supply	
17	V _{EET}	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 _{EET}	Transmitter ground (common with receiver ground)	1

Notes:

1. Circuit ground is isolated from chassis ground
2. Disabled: T_{DIS}>2V or open, Enabled: T_{DIS}<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. Bellcore GR-253 and ITU-T G.957 Specifications.