

# OC-48/STM-16 SR-1 SFP 1310nm 2km DOM LC SMF Transceiver

ONS-SI-2G-S1-LL



## Applications

- SONET OC48 / SDH STM-16
- SONET OC-12 / SDH STM -4
- SONET OC-3 / SDH STM -1
- 1X/2X Fiber Channel
- Other Optical Link

## Features

- Up to 2.5Gb/s Data Links
- Hot-Pluggable
- 1310nm FP Laser Transmitter
- Duplex LC Connector
- RoHS Compliant and Lead Free
- Up to 2km on 9/125 $\mu$ m SMF
- Single +3.3V Power Supply
- Monitoring Interface Compliant with SFF-8472
- Commercial Operating Temperature Range: 0°C to 70°C

## Description

SFP 2.5Gb/s LR 2km transceiver is a high performance, cost effective module which has a duplex LC optics interface. Standard DC coupled CML for high speed signal and LVTTTL control and monitor signals. The receiver section uses a PIN receiver and the transmitter uses 1310 nm FP laser, up to 8dB link budget ensures this module STM-16/OC-48 2km application.

## Product Specifications

### I. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	$T_S$	-40		+85	°C
Supply Voltage	$V_{CC}$	-0.5		4	V
Relative Humidity	RH	0		85	%

### II. Recommended Operating Environment

Parameter	Symbol	Min.	Typical	Max.	Unit
Case Operating Temperature	Commercial $T_C$	0		+70	°C
Supply Voltage	$V_{CC}$	3.135		3.465	V
Supply Current	$I_{CC}$			300	mA
Inrush Current	$I_{surge}$			$I_{CC}+30$	mA
Maximum Power	$P_{max}$			0.7	W

### III. Electrical Characteristics (TOP = T<sub>c</sub> ° C, V<sub>CC</sub> = 3.0 to 3.60 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Transmitter Section</b>						
<b>Input Differential Impedance</b>	R <sub>in</sub>	90	100	110		
<b>Single Ended Data Input Swing</b>	V <sub>in</sub> PP	200		1200	mVp-p	
<b>Transmit Disable Voltage</b>	V <sub>D</sub>	V <sub>CC</sub> - 1.3		V <sub>CC</sub>	V	2
<b>Transmit Enable Voltage</b>	V <sub>EN</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	
<b>Transmit Disable Assert Time</b>	T <sub>dessert</sub>			10	us	
<b>Receiver Section</b>						
<b>Single Ended Data Output Swing</b>	V <sub>out</sub> pp	300		1000	mv	3
<b>Data Output Rise Time</b>	t <sub>r</sub>			260	ps	4
<b>Data Output Fall Time</b>	t <sub>f</sub>			260	ps	4
<b>LOS Fault</b>	V <sub>losfault</sub>	V <sub>CC</sub> - 0.5		V <sub>CC</sub> _host	V	5
<b>LOS Normal</b>	V <sub>los norm</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.5	V	5
<b>Power Supply Rejection</b>	PSR	100			mVpp	6
<b>Total Generated Receiver Jitter (peak to peak)</b>	J <sub>RXp-p</sub>			0.07	UI	
<b>Total Generated Receiver Jitter (rms)</b>	J <sub>RXrms</sub>			0.007	UI	

**Note:**

1. AC coupled.
2. Or open circuit.
3. Into 100 ohm differential termination.

4. 20 – 80 %.

5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

#### IV. Optical Parameters (TOP =TC, V<sub>CC</sub> = 3.0 to 3.60 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
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##### Transmitter Section

<b>Center Wavelength</b>	$\lambda_c$	1270	1310	1360	nm	
<b>Spectral Width (RMS)</b>	$\sigma_{RMS}$			4	nm	
<b>Optical Output Power</b>	$P_{out}$	-10		-3	dBm	1
<b>Extinction Ratio</b>	ER	8.2			dB	
<b>Optical Rise/Fall Time</b>	$t_r/t_f$			260	ps	2
<b>Relative Intensity Noise</b>	RIN			-120	dB/Hz	
<b>Total Generated Transmitter Jitter (peak to peak)</b>	$J_{TXp-p}$			0.07	UI	
<b>Total Generated Transmitter Jitter(rms)</b>	$J_{TXrms}$			0.007	UI	
<b>Output Eye Mask</b>	Compliant with eye mask Telcordia GR-253-GORE					

##### Receiver Section

<b>Optical Input Wavelength</b>	$\lambda_c$	1260		1360	nm	
<b>RX Sensitivity @ OC-48/STM-16</b>	Sen1			-18	dBm	3

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>RX Sensitivity @ 2xFibre Channel</b>	Sen2			-19	dBm	4
<b>RX Sensitivity @ Gigabit Ethernet</b>	Sen3			-19	dBm	4
<b>RX Sensitivity @ OC-12/STM-4</b>	Sen4			-19	dBm	5
<b>RX Sensitivity @ OC-4/STM-1</b>	Sen5			-19	dBm	5
<b>RX_LOS A<sub>assert</sub></b>	LOS <sub>A</sub>	-35			dBm	
<b>RX_LOS D<sub>e-assert</sub></b>	LOS <sub>D</sub>			-19	dBm	
<b>RX_LOS Hysteresis</b>	LOS <sub>H</sub>	0.5			dB	

## V. General Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
<b>Data Rate</b>	BR	155		2667	Mb/s	
<b>Bit Error Rate</b>	BER			10 <sup>-12</sup>		
<b>Max. Supported Link Length on 9/125µm SMF @ OC-48/STM-16</b>	L <sub>MAX1</sub>		2		km	
<b>Max. Supported Link Length on 9/125µm SMF @ 2xFibre Channel</b>	L <sub>MAX2</sub>		5		km	
<b>Max. Supported Link Length on 9/125µm SMF @ Gigabit Ethernet</b>	L <sub>MAX3</sub>		10		km	
<b>Max. Supported Link Length on 9/125µm SMF @ OC-12/STM-4</b>	L <sub>MAX4</sub>		10		km	
<b>Max. Supported Link Length on 9/125µm SMF @ OC-4/STM-1</b>	L <sub>MAX5</sub>		10		km	

### Note:

- Compliant with FDA/CDRH and EN (IEC) 60825 regulations (Class 1 Laser Safety).

- 2. 20-80%.
- 3. Measured with PRBS 231-1 at 10-12 BER.
- 4. Measured with PRBS 27-1 at 10-12 BER.
- 5. Measured with PRBS 223-1 at 10-12 BER.

## VI. Digital Diagnostic Monitor Characteristics (A2h)

Data Address	Parameter	Accuracy	Unit
96-97	Transceiver Internal Temperature	± 3.0	° C
98-99	V <sub>CC3</sub> Internal Supply Voltage	± 5.0	%
100-101	Laser Bias Current	± 10	%
102-103	Tx Output Power	± 3.0	dBm
104-105	Rx Input Power	± 3.0	dBm

## VII. Regulatory Compliance

The OP3602D complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

<b>Electrostatic Discharge (ESD) to the Electrical Pins</b>	MIL-STD-883E Method 3015.7	Class 1(>1000 V)
<b>Electrostatic Discharge (ESD) to the Duplex LC Receptacle</b>	IEC 61000-4-2GR-1089-CORE	Compatible with standards
<b>Electromagnetic Interference (EMI)</b>	FCC Part 15 Class BEN55022 Class B (CISPR 22B) V <sub>CC</sub> I Class B	Compatible with standards

## VIII. Pin Assignment

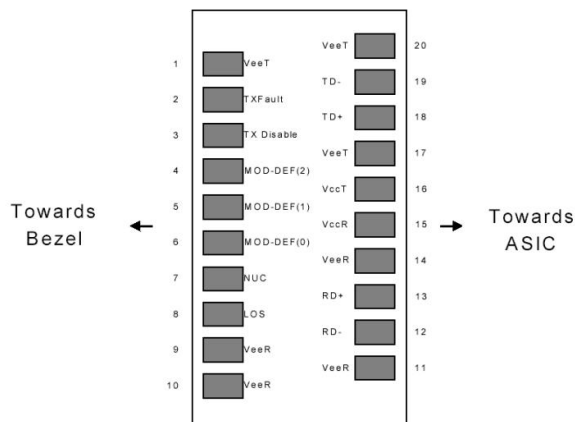


Figure 1. Diagram of Host Board Connector Block Pin Numbers and Names

## IX. Pin Description

Pin No	Name	Function	Plug Seq	Notes
1	$V_{eeT}$	Transmitter Ground	1	1
2	TX Fault	Transmitter Fault Indication	3	
3	TX Disable	Transmitter Disable	3	2
4	MOD-DEF2	Module Definition	2	3
5	MOD-DEF1	Module Definition 1	3	3
6	MOD-DEF0	Module Definition 0	3	3
7	Rate Select	Not Connected	3	4
8	LOS	Loss of Signal	3	5
9	$V_{eeR}$	Receiver Ground	1	1
10	$V_{eeR}$	Receiver Ground	1	1
11	$V_{eeR}$	Receiver Ground		1
12	RD-	Inv.Received Data Out	3	6
13	RD+	Received Data Out	3	6
14	$V_{eeR}$	Receiver Ground	3	1
15	$V_{ccR}$	Receiver Power	2	1
16	$V_{ccT}$	Transmitter Power	2	

Pin No	Name	Function	Plug Seq	Notes
17	V <sub>ee</sub> T	Transmitter Ground	1	
18	TD+	Transmit Data In	3	6
19	TD-	Inv.Transmit In	3	6
20	V <sub>ee</sub> T	Transmitter Ground	1	

### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF(0) pulls line low to indicate module is plugged in.
4. Rate select is not used.
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled.

## X. Recommended Circuit

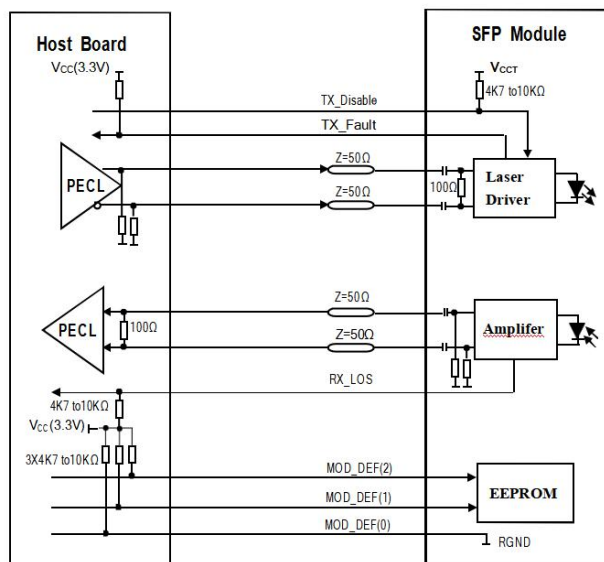


Figure 2. SFP Host Recommended Circuit



## XI. Serial ID Memory Contentsn

Data Address	Length(Byte)	Name of Length	Description and Contents
<b>Base ID Fields</b>			
<b>0</b>	1	Identifier	Type ofSerial transceiver (03h=SFP)
<b>1</b>	1	Reserved	Extended identifier of type serial transceiver(04h)
<b>2</b>	1	Connector	Code of optical connector type (07=LC)
<b>3-10</b>	8	Transceiver	
<b>11</b>	1	Encoding	NRZ(03h)
<b>12</b>	1	BR, Nominal	Nominal baud rate, unit of 100Mbps
<b>13</b>	1	Reserved	(0000h)
<b>14</b>	1	Length (9um,km)	Link length supported for 9/125um fiber, units of km
<b>15</b>	1	Length (9um)	Link length supported for 9/125um fiber, units of 100m
<b>16</b>	1	Length (50um)	Link length supported for 50/125um fiber, units of 10m
<b>17</b>	1	Length (62.5um)	Link length supported for 62.5/125um fiber, units of 10m
<b>18</b>	1	Length (Copper)	Link length supported for copper, units of meters
<b>19</b>	1	Reserved	
<b>20-35</b>	16	Vendor Name	SFP vendor name:
<b>36</b>	1	Reserved	
<b>37-39</b>	3	Vendor OUI	SFP transceiver vendor OUI ID

Data Address	Length(Byte)	Name of Length	Description and Contents
<b>40-55</b>	16	Vendor PN	PartNumber: "LonglineXXXXXX" (ASCII)
<b>56-59</b>	4	Vendor rev	Revision level for part number
<b>60-61</b>	2	Wavelength	Laser wavelength
<b>62</b>	1	Reserved	
<b>63</b>	1	CCID	Least significant byte of sum of data in address 0-62
<b>Extended ID Fields</b>			
<b>64-65</b>	2	Option	Indicates which optical SFP signals are implemented (001Ah=LOS, TX_FAULT, TX_DISABLE all supported)
<b>66</b>	1	BR, max	Upper bit rate margin, units of %
<b>67</b>	1	BR, min	Lower bit rate margin, units of %
<b>68-83</b>	16	Vendor SN	Serial number (ASCII)
<b>84-91</b>	8	Date code	Manufacturing date code
<b>92</b>	1	Diagnostic Type	Diagnostics
<b>93</b>	1	Enhanced Options	Diagnostics
<b>94</b>	1	SFF-8472	Diagnostics
<b>95</b>	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
<b>Vendor Specific ID Fields</b>			
<b>96-127</b>	32	Readable	Vendor specific data, readonly

Data Address	Length (Byte)	Name of Length	Description and Contents
128-255	128	Reserved	Reserved for SFF-8079

## XII. Mechanical Dimensions

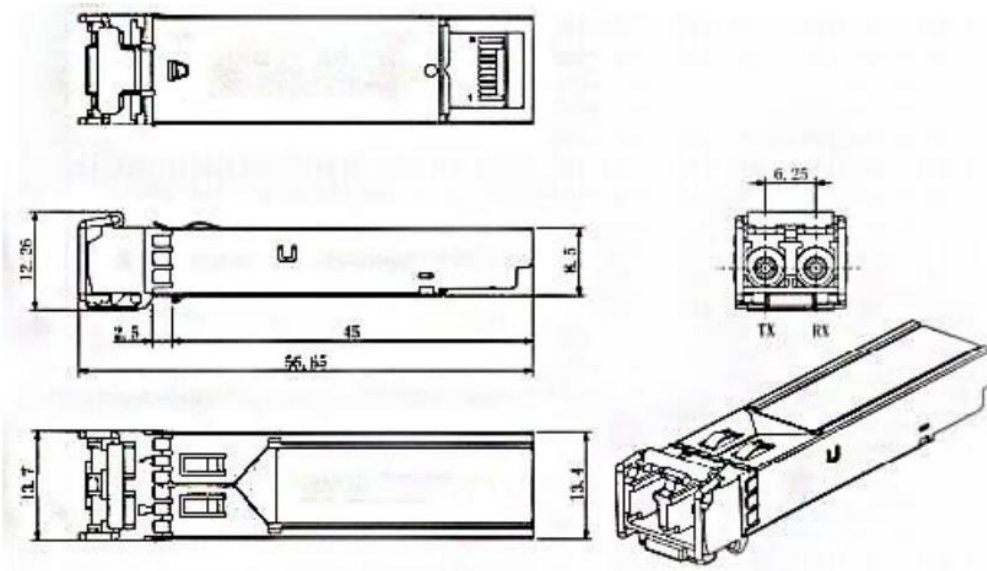


Figure 3. Mechanical Drawing