



Datasheet: Transceivers

SFP-10G-LR

SFP-10G-LR Optical Transceiver

Key Features

- Up to 10.5 GBd bi-directional data links
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Compliant with SFF8431
- Hot-pluggable SFP+ footprint
- 1310nm DFB laser transmitter
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 10km on SMF
- Single power supply 3.3V
- RoHS Compliance
- Operating temperature range: 0 °C to 70 °C.

Application

- 10GBASE-LR/LW Ethernet

Introduction

ProLabs' SFP-10G-LR optical transceivers are based on 10G Ethernet IEEE 802.3ae standards and SFF-8431 MSA and provide a reliable interface for the 10G Ethernet application. The Digital diagnostics functions are available via 2-wire serial bus specified in SFF-8472.

Compatible Ordering Information

OEM Manufacturer	Prolabs Ordering SKU	Product Description
ADVA	1061701850-02-C	10GBASE-LR SFP+, 1310nm, 10km
Alcatel	3FE62600CA-C	10GBASE-LR SFP+, 1310nm, 10km
Alcatel	3HE04823AA-C	10GBASE-LR SFP+, 1310nm, 10km
Alcatel	SFP-10G-LR-ALC-C	10GBASE-LR SFP+, 1310nm, 10km
Allied	AT-SP10LR-C	10GBASE-LR SFP+, 1310nm, 10km
Arista	SFP-10G-LR-ARISTA-C	10GBASE-LR SFP+, 1310nm, 10km
Avaya	AA1403011-C	10GBASE-LR SFP+, 1310nm, 10km
Blackbox	LSP422-C	10GBASE-LR SFP+, 1310nm, 10km
Brocade	10G-SFP-LR-C	10GBASE-LR SFP+, 1310nm, 10km
BTN/IBM	90Y9412-C	10GBASE-LR SFP+, 1310nm, 10km
BTN/IBM	BN-CKM-SP-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Calix	100-01512-C	10GBASE-LR SFP+, 1310nm, 10km
Checkpoint	CPAC-TR-10LR-C	10GBASE-LR SFP+, 1310nm, 10km
Ciena	XCVR-S10V31-C	10GBASE-LR SFP+, 1310nm, 10km
Cisco	ONS-SC+-10G-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Cisco	SFP-10G-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Cisco	SFP-10G-LR-S-C	10GBASE-LR SFP+, 1310nm, 10km
Cisco SB	LACXGLR-C	10GBASE-LR SFP+, 1310nm, 10km
Dell Force10	GP-10GSFP-1L-C	10GBASE-LR SFP+, 1310nm, 10km
D-Link	DEM-432XT-C	10GBASE-LR SFP+, 1310nm, 10km
D-Link	DEM-432XT-DD-C	10GBASE-LR SFP+, 1310nm, 10km
Emulex	OC10-LR-OPT-1-C	10GBASE-LR SFP+, 1310nm, 10km
Enterasys	10GB-LR-SFP-C	10GBASE-LR SFP+, 1310nm, 10km
Extreme	10302-C	10GBASE-LR SFP+, 1310nm, 10km
F5 Networks	F5-UPG-SFP+LR-R-C	10GBASE-LR SFP+, 1310nm, 10km
Fortinet	FG-TRAN-SFP+LR-C	10GBASE-LR SFP+, 1310nm, 10km
Generic	LR-SFP-10G-C	10GBASE-LR SFP+, 1310nm, 10km
H3C Huawei	SFP-XG-LX-SM1310-H3C-C	10GBASE-LR SFP+, 1310nm, 10km
HP Comware	JD094B-C	10GBASE-LR SFP+, 1310nm, 10km
HP ProCurve	J9151A-C	10GBASE-LR SFP+, 1310nm, 10km
HP Server	455886-B21-C	10GBASE-LR SFP+, 1310nm, 10km
Huawei	OSX001002-C	10GBASE-LR SFP+, 1310nm, 10km
Huawei	OSX010000-C	10GBASE-LR SFP+, 1310nm, 10km
Huawei	OSX010000-LR20-C	10GBASE-LR SFP+, 1310nm, 10km
Intel	E10GSFPLR-C	10GBASE-LR SFP+, 1310nm, 10km
Juniper	EX-SFP-10GE-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Marconi	SU69CA-C	10GBASE-LR SFP+, 1310nm, 10km
Moxa	SFP-10GLRLC-C	10GBASE-LR SFP+, 1310nm, 10km
MRV	SFP-10GD-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Netgear	AXM762-C	10GBASE-LR SFP+, 1310nm, 10km
Netscout	321-1487-C	10GBASE-LR SFP+, 1310nm, 10km
Packetfront	SFP-10GE-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Palo Alto	PAN-SFP-PLUS-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Planet	MTB-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Riverbed	SFP-003-LR -C	10GBASE-LR SFP+, 1310nm, 10km
Riverbed	SFP-CSK-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Riverbed	TRC-1-SFP-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Ruijie	XG-SFP-LR-SM1310-C	10GBASE-LR SFP+, 1310nm, 10km
Telco	BTI-10GLR-DD-SFP+-C	10GBASE-LR SFP+, 1310nm, 10km
TP-Link	TXM431-LR-C	10GBASE-LR SFP+, 1310nm, 10km
Transmode	TRX100100-C	10GBASE-LR SFP+, 1310nm, 10km
ZTE	SFP-10GE-S10K-C	10GBASE-LR SFP+, 1310nm, 10km
ZyXEL	SFP10G-LR-C	10GBASE-LR SFP+, 1310nm, 10km

Specifications

General Specifications						
Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	-	10.3125	-	GBd	IEEE 802.3ae
Bit Error Rate	BER	-	-	10 ⁻¹²	-	-
Operating Temperature	T _{OP}	0	-	70	°C	Case temperature.
Storage Temperature	T _{STO}	-40	-	85	°C	Ambient temperature.
Supply Current	I _S	-	230	260	mA	For electrical power interface.
Input Voltage	V _{CC}	3	3.3	3.6	V	-
Maximum Voltage	V _{MAX}	-0.5	-	4	V	For electrical power interface.

Link Distances		
Parameter	Fiber Type	Distance Range (Km)
10.3125 GBd	9/125um SMF	10

Optical Characteristics-Transmitter V _{CC} =3V to 3.6V, T _C =0°C to 70°C						
Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P _{TX}	-8.2	-	0.5	dBm	Class 1 Product
Optical Center Wavelength	λ _c	1260	-	1355	nm	-
Optical Modulation Amplitude	OMA	-5.2	-	-	-	Per IEEE 802.3ae
Extinction Ratio	ER	3	5.5	-	dB	-
Spectral Width (-20dB)	Δλ	-	-	0.6	nm	-
Side Mode Suppression Ratio	SMSR	30	-	-	dB	-
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	-
Transmitter Dispersion Penalty	TDP	-	-	3.2	dB	-
Transmitter Jitter	-	-	-	-	-	According to IEEE 802.3 Requirements.
Launch Power of OFF Transmitter	P _{OUT_OFF}	-	-	-30	dBm	Average

Optical Characteristics-Receiver V _{CC} =3V to 3.6V, 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}	-14.4	-	0.5	dBm	Average, Informative
Receiver Sensitivity in OMA @ 10.3GBd	R _{X SEN1}	-	-	-12.6	dBm	Measured with worst ER: BER<10 ⁻¹² 2 ³¹ -1 PRBS
Stressed Receiver Sensitivity in OMA @ 10.3Gb/s	P _{SENS2}	-	-	-10.3	dBm	IEEE 802.3ae
Receiver Reflectance	TR _{RX}	-	-	-12	dB	-
Loss of Signal-Asserted	P _{LOS_A}	-25	-	-	dBm	-
Loss of Signal-Deasserted	P _{LOS_D}	-	-	-16	dBm	-
Loss of Signal-Hysteresis	-	0.5	-	-	dB	-

Electrical Characteristics-Transmitter V _{CC} =3V to 3.6V, 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	-	800	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} =3V to 3.6V, T _C =0°C to 70°C						
Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	V _{OUT_PP}	150	300	425	mV	-
Data output rise time (20%-80%)	T _R	-	30	-	ps	-
Data output fall time (20%-80%)	T _F	-	30	-	ps	-
LOS Fault	V _{LOS Fault}	2	-	V _{CC HOST}	V	-
LOS Normal	V _{LOS Normal}	V _{EE}	-	V _{EE} +0.5	V	-

Digital Diagnostic Functions

SFP-10G-LR 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-10G-LR 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 μ Volt, 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 μ A, yielding a total range of 0 to 131mA. Accuracy is better than $\pm 10\%$ over specified operating temperature and voltage.

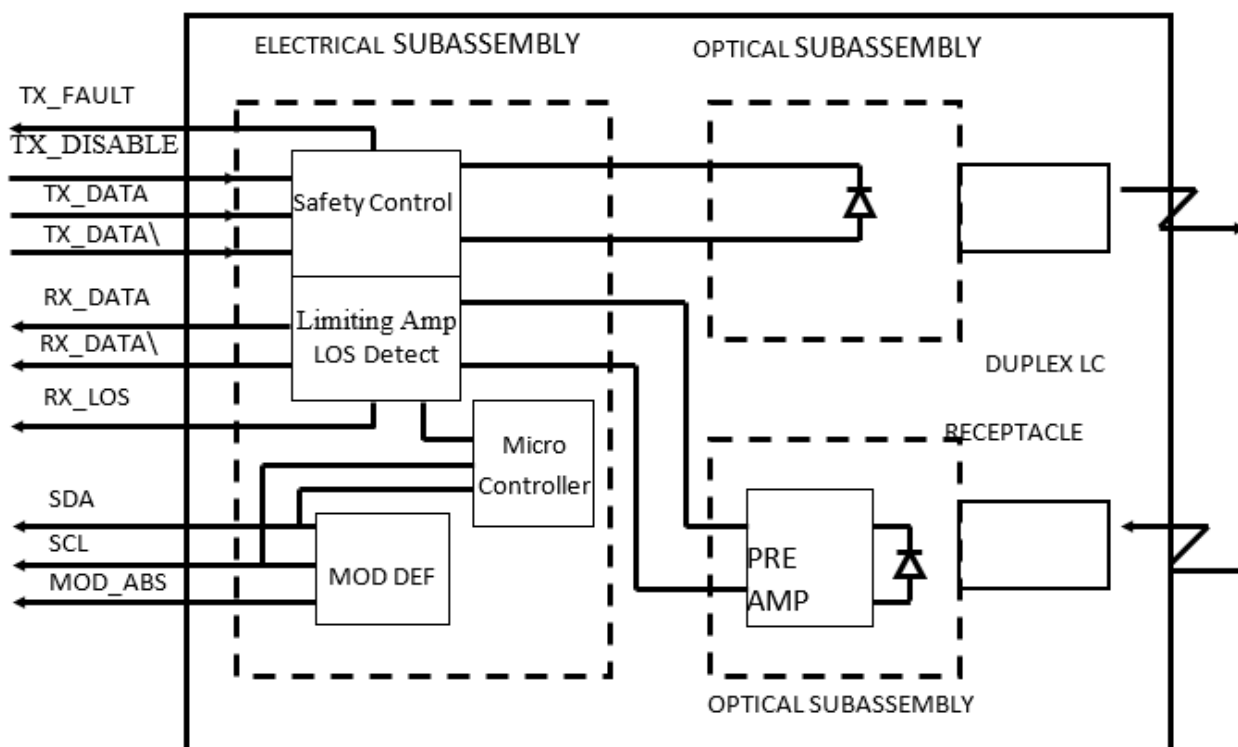
Transceiver TX output power,

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 μ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ± 3 dB 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 μ W. Accuracy is better than ± 3 dB over specified temperature and voltage.

Block Diagram of Transceiver



Transmitter Section

The laser 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. The laser is packaged in an eye safe optical subassembly (OSA) which 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 trans impedance amplifier, with internal 100Ω differential termination.

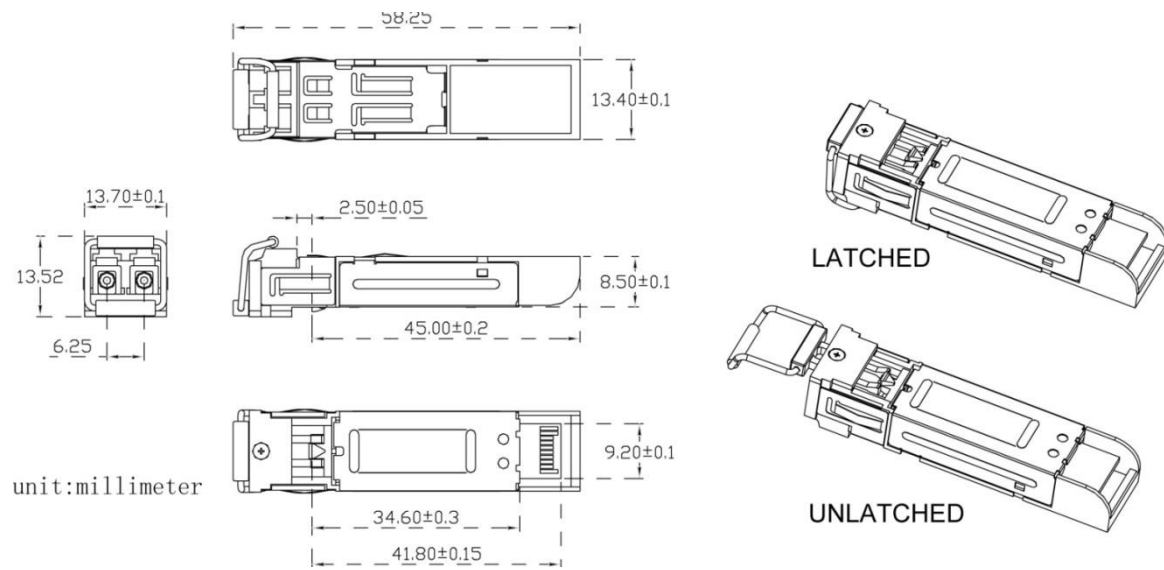
Receive Loss (RX_LOS)

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 statuses to the customer.

Dimensions

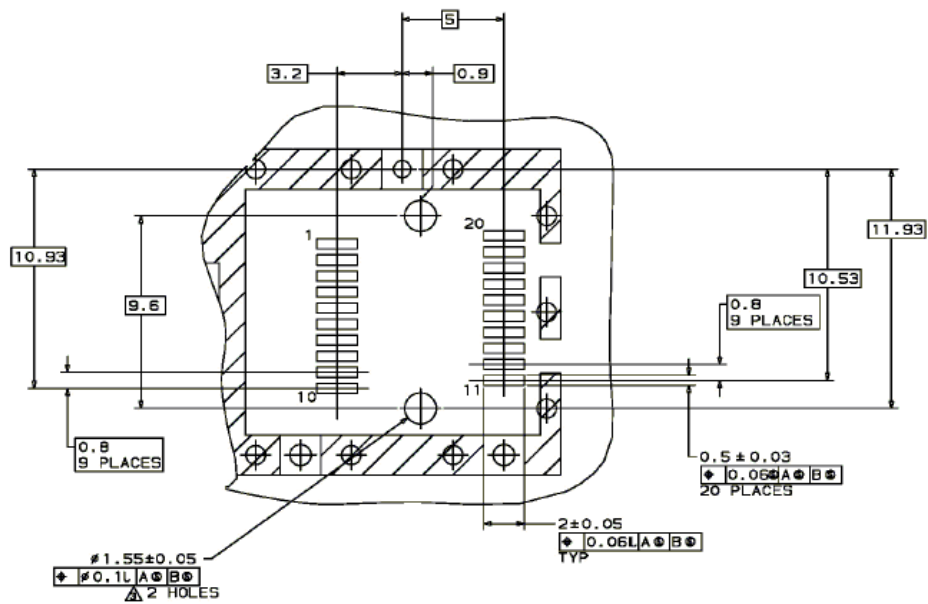


ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

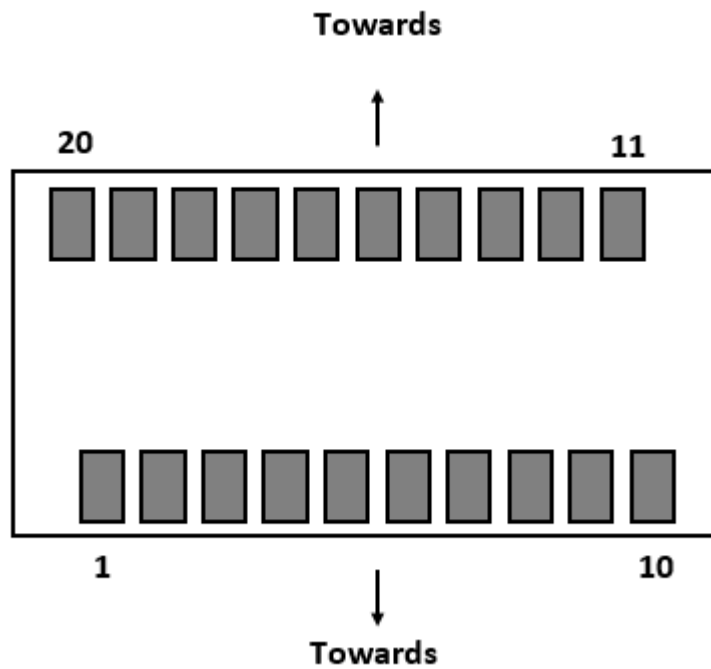
Figure 1 is a mechanical drawing of a component, showing dimensions and tolerances. The drawing includes a cross-hatched area denoting component keep-out (except chasses ground) and a circular area denoting component keep-out (traces allowed). The drawing is labeled with dimensions and tolerances, including:

- Overall dimensions: 42.3 (total width), 26.8 (width of cross-hatched area), 11.99 (total height), 16.25 (height of top section), 8.58 (height of middle section), 4.6 (height of bottom section).
- Tolerances: ± 0.05 for various dimensions, ± 0.1 for hole diameters.
- Holes: 10 holes of diameter $\phi 0.1113$, 9 holes of diameter $\phi 0.095$.
- Traces: 10 places, 11 places, 3 places, 10.00 3 places.
- Detail X: A circular detail showing a pin and traces.

 Through Holes are Unplated



Electrical Pad Layout



20 →	TX GND
19 →	TD- TX DATA IN-
18 →	TD+ TX DATA IN+
17 →	TX GND
16 →	V _{oc} TX
15 →	V _{oc} RX
14 →	RX GND
13 →	RD+ RX DATA OUT+
12 →	RD- RX DATA OUT-
11 →	RX GND

Top of Board

1 →	TX GND
2 →	TX FAULT
3 →	TX DISABLE
4 →	SDA
5 →	SCL
6 →	MOD_ABS
7 →	RS0
8 →	RX_LOS
9 →	RS1
10 →	RX GND

Bottom of Board

PIN Assignments

Pin Assignments			
Pin #	Symbol	Description	Remarks
1	V _{EET}	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
2	T _{FAULT}	Transmitter Fault.	-
3	T _{DIS}	Transmitter Disable. Laser output disable on high or open	Disabled: T _{DIS} >2V or open Enabled: T _{DIS} <0.8V
4	SDA	Data line for serial ID	Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V
5	SCL	Clock line for serial ID	
6	MOD_ABS	Module Absent. Grounded within the module	
7	Rate Select	No connection required	-
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	LOS is open collector output
9	RS1	No Connection Required.	Circuit ground is isolated from chassis ground
10	V _{EER}	Receiver ground (common with transmitter ground)	
11	V _{EER}	Receiver ground (common with transmitter ground)	
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)	Circuit ground is isolated from chassis ground
15	V _{CCR}	Receiver power supply	-
16	V _{CCT}	Transmitter power supply	-
17	V _{EET}	Transmitter ground (common with receiver ground)	Circuit ground is connected to chassis ground
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)	Circuit ground is connected to chassis ground

References

1. IEEE standard 802.3ae. IEEE Standard Department, 2005.
2. Enhanced 8.5 and 10 Gigabit Small Form Factor Pluggable Module “SFP+” – SFF-8431
3. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.

