

# SP56-SM31LR10C

## SFP56 53Gb/s 1311nm 10km Transceiver

### PRODUCT FEATURES

- Up to 53 Gbps
- 10km transmission on SMF
- EML Laser and PIN-TIA receiver
- Hot-pluggable SFP28 footprint
- Compliant with SFF 8472 and SFF-8431
- Single 3.3V power supply
- Power dissipation < 2.5W
- Case operating temperature:

Commercial: 0°C to +70°C

Extended: -10°C to +85°C

Industrial: -40°C to +85°C

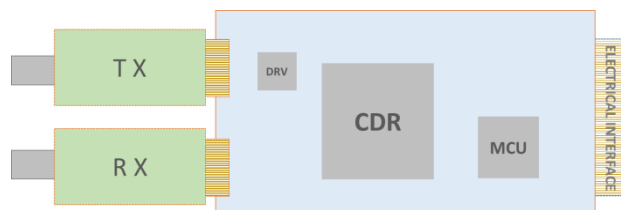


### APPLICATIONS

- 53GBASE-LR
- eCPRI and CPRI

### PRODUCT DESCRIPTION

The Product Requirements Definition (PRD) is present to the critical design specification for SPV's SFP56 53G BASE LR transceiver. SFP56 transceiver design for single electrical lane with 53Gbps high speed data rate transmission. The integrated transmitter (TOSA) built by EML chip modulated with 26.5625Gbaud/s PAM4 signal, receiver embedded with linear transimpedance amplifier for PAM4 signal recover. Both transmitter and receiver need PAM4 retimer PAM4 CDR chip for better transmission performance. On board MCU handling all hardware and firmware initialization and boot loader, firmware design compliance with SFP+ module Management Interface SFF-8472.



## Ordering information

Product part Number	Data Rate (Gbps)	Media	Wavelength (nm)	Transmission Distance(km)	Temperature Range ( Tcase ) ( °C )	
SP56-SM31LR10C	53	SMF	1311	10	0~70	Commercial
SP56-SM31LR10I	53	SMF	1311	10	-40~85	Industrial
SP56-SM31LR10E	53	SMF	1311	10	-10~85	Extended

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	T <sub>s</sub>	-40	-	85	°C	
Relative Humidity	R <sub>H</sub>	5	-	85	%	
Power Supply Voltage	V <sub>CC</sub>	-0.3	-	3.6	V	
Signal Input Voltage	V <sub>SI</sub>	V <sub>CC</sub> -0.3	-	V <sub>CC</sub> +0.3	V	
Static Electrical Discharge (Human Body Model) (1)		1000			V	

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note	
Case Operating Temperature	T <sub>case</sub>	0	-	70	°C	SP56-SM31LR10C	
		-10		85	°C	SP56-SM31LR10E	
		-40		85	°C	SP56-SM31LR10I	
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V		
Power Supply Current	I <sub>CC</sub>	-		757	mA		
Data Rate	BR		53		Gbps		
Transmission Distance	TD			10	km		
Coupled fiber	Single mode fiber						9/125um SMF

## Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>Transmitter</b>						
Average Launched Power EOL	P <sub>O</sub>	-4.5		+4.2	dBm	
Average Launched Power BOL	P <sub>O</sub>	-3.5		+3.5	dBm	
Modulation Format		PAM4				
Center Wavelength Range	λ <sub>C</sub>	1304.5	1311	1317.5	nm	
Outer Optical Modulation	OMA	-1.5	-	4	dBm	

Amplitude(EOL)	outer					
Outer Optical Modulation Amplitude(BOL)	OMA outer	-1.0		+3.5	dBm	
Transmitter and dispersion eye closure for 26.5625Gbd PAM4 (TDECQ) EOL	TDECQ			3.4	dB	
Transmitter and dispersion eye closure for 25.5625Gbd PAM4 (TDECQ) BOL	TDECQ			3.0	dB	
Side-Mode Suppression Ratio EOL	SMSR	30	-	-	dB	
Side-Mode Suppression Ratio BOL	SMSR	35	-	-	dB	
Transmitter and Dispersion Penalty	TDP			2.7	dB	
Extinction Ratio EOL	ER	3.5		-	dB	
Extinction Ratio BOL	ER	4.0		-	dB	
Average launch power of OFF transmitter		-	-	-30	dB	
Optical Return Loss Tolerance				15.6	dB	
Transmitter reflectance				-26	dB	
RIN17.1OMA (max)				-132	dB/Hz	
<b>Receiver</b>						
Input Optical Wavelength	$\lambda_{IN}$	1304.5	-	1317.5	nm	
Receiver Sensitivity OMA,50G EOL at BER= 5E-5	$P_{sen}$	max(-8.4, SECQ-9.8)			dBm	
Receiver Sensitivity OMA,50G BOL at BER= 5E-5	$P_{sen}$	max(-9.0, SECQ-9.8)			dBm	
Input Saturation Power (Overload)	$P_{SAT}$	-11.8	-	4.2	dBm	
Stressed receiver sensitivity (OMA <sub>outer</sub> ) (max) EOL	OMA <sub>outer</sub>	-	-	-6.4	dBm	
Stressed receiver sensitivity (OMA <sub>outer</sub> ) (max) BOL	OMA <sub>outer</sub>	-	-	-7.0	dBm	
LOS Assert threshold, average power,	Los-A	-	-	-11.0	dBm	
DE-LOS Assert threshold, average power,	Los-A	-30	-		dBm	
LOS Hysteresis = LOS_D - LOS_A	D- LOS_A	0.5	-	6.0	dB	
Receiver Reflectance	Ref	-	-	-26	dB	
Stressed eye closure for PAM4 (SECQ)	SECQ	-	-	3.4	dB	

Note: Refer below parameter diagram 7-1 or the following formula for the value of this parameter. The maximum value of this parameter varies with the value of stressed eye closure for PAM4 (SECQ for short)  $RS = \max(-8.4, SECQ-9.8)$  (dB)

## Electrical Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>Transmitter</b>						
Transmitter Fault Output-High	$V_{FaultH}$	2	-	$V_{cc}+0.3$	V	
Transmitter Fault Output-Low	$V_{FaultL}$	0	-	0.8	V	
Transmitter Disable Voltage- High	$V_{DisH}$	2	-	$V_{cc}+0.3$	V	
Transmitter Disable Voltage- low	$V_{DisL}$	0	-	0.8	V	
<b>Receiver</b>						
LOS Output Voltage-High	$V_{LOSH}$	2	-	$V_{cc}+0.3$	V	
LOS Output Voltage-Low	$V_{LOSL}$	0	-	0.8	V	

## ★ Pin Description

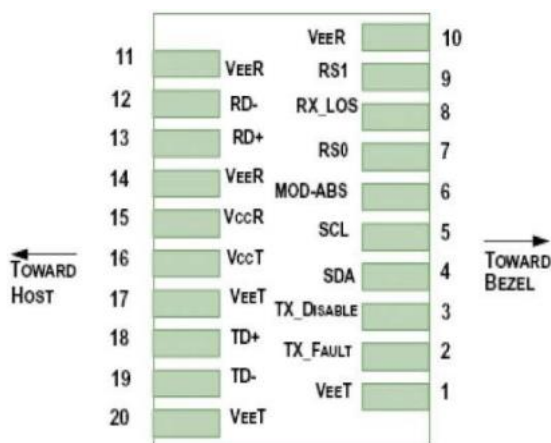


Diagram of Host Board Connector Block Pin Numbers and Name

Pin	Symbol	Name/Description	NOTE
1	$V_{EET}$	Transmitter Ground (Common with Receiver Ground)	1
2	$T_{FAULT}$	Transmitter Fault.	2
3	$T_{DIS}$	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	Rate Select 0, internal pull down	5

Pin	Symbol	Name/Description	NOTE
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	Rate Select 1, internal pull down	5

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:**

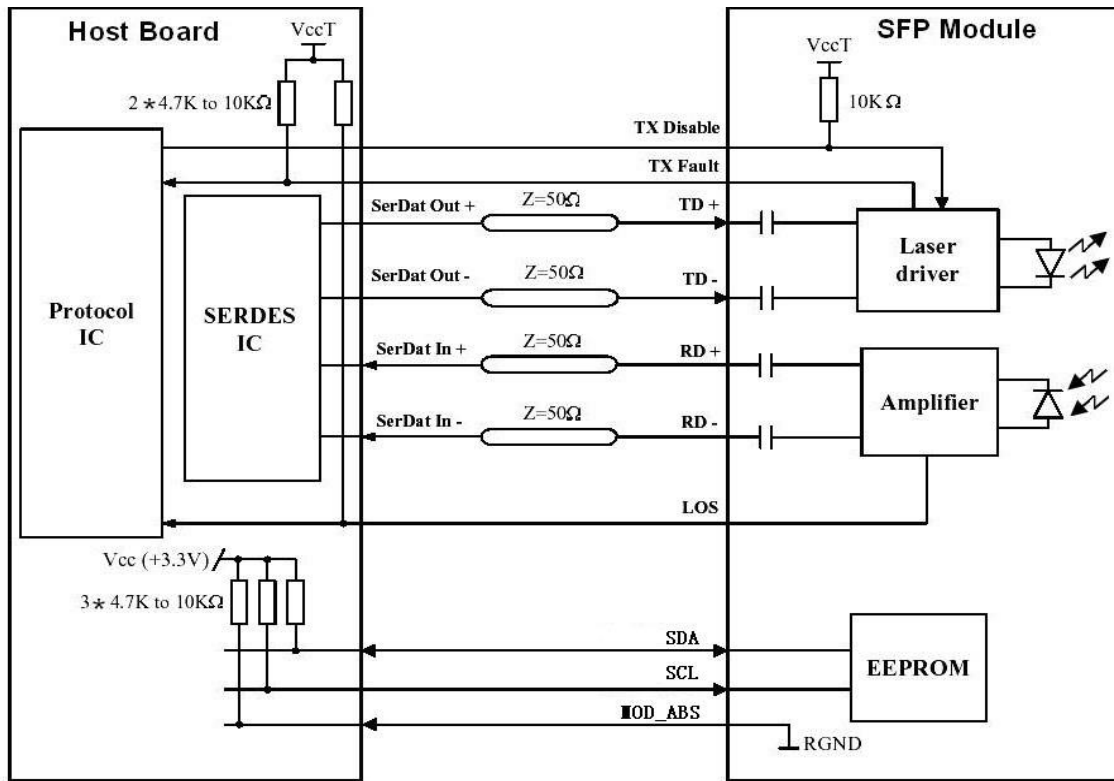
1. Circuit ground is internally isolated from chassis ground.
2.  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{cc} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
4. Should be pulled up with 4.7k $\Omega$ - 10k $\Omega$  host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. Rate select can also be set through the 2-wire bus in accordance with SFF-8472. Rx Rate Select is set at Bit 3, Byte 110, Address A2h. Tx Rate Select is set at Bit 3, Byte 118, Address A2h.
6. LOS is open collector output. It should be pulled up with 4.7k $\Omega$  – 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

### ★ Digital Diagnostic Monitor Accuracy

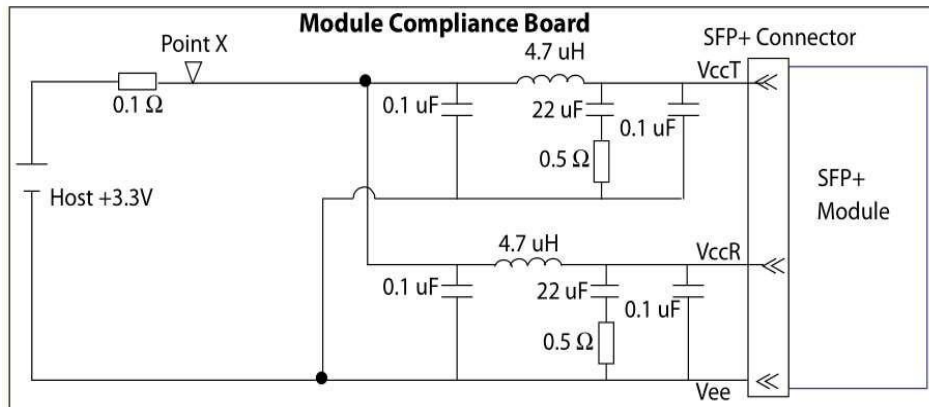
The following characteristics are defined over recommended operating conditions

Parameter	Accuracy	Unit
Internally measured transceiver temperature	+/-3	deg.C
Internally measured transceiver supply voltage	+/-3	%
Measured Tx bias current	+/-10	%
Measured Tx output power	+/-3	dB
Measured Rx received average optical power	+/-3	dB

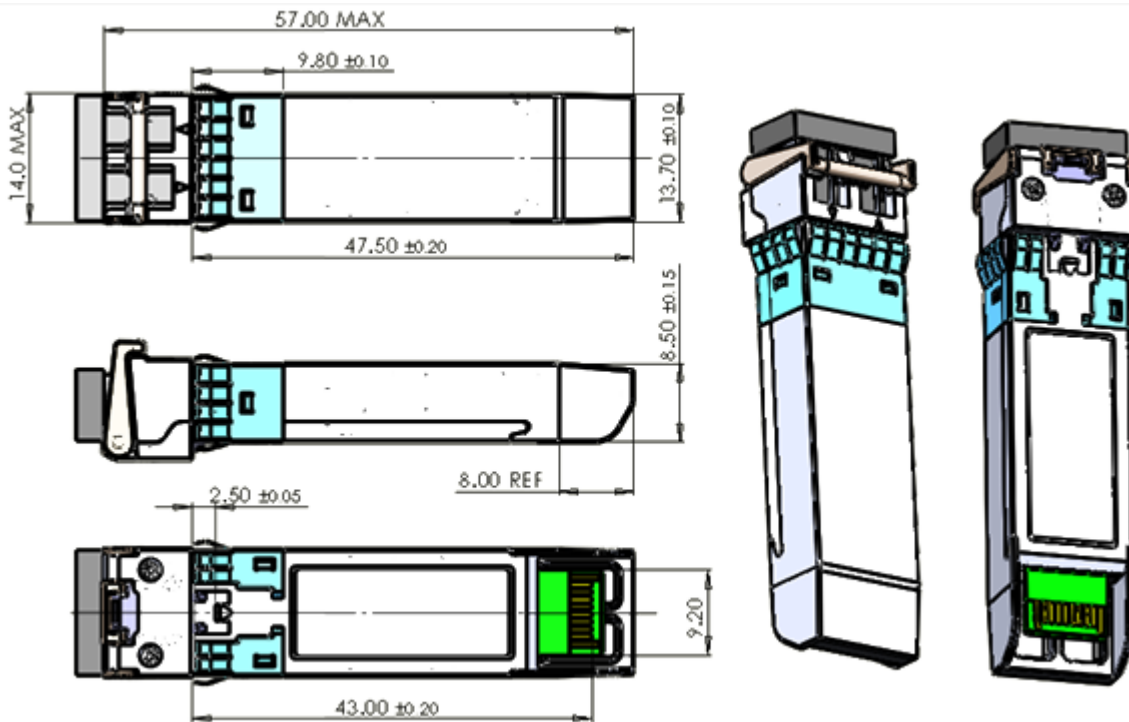
### ★ Recommended Interface Circuit



## Recommended Filter for Voltage Supply



## Machnical Dimensions



## Regulatory Compliance

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950, UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards