

# 10GBASE-LR SFP+ 1310nm 10km Industrial DOM Transceiver

XCVR-S10V31-I-LL



### **Application**

- 10GBASE-LR/LW 10G Ethernet
- 8G/10GFC
- CPRI rates 2.4576 Gb/s, 4.9152Gb/s, 6.144Gb/s, 9.8304 Gb/s

#### **Features**

- Hot-pluggable SFP+ footprint
- Supports 9.95 to 10.52Gb/s bit rates
- Power dissipation < 1W
- RoHS-6 compliant (lead-free)
- Industrial temperature range : -40°C to 85°C
- Single 3.3V power supply
- · Maximum link length of 10km
- Uncooled 1310nm DFB laser

- · Receiver limiting electrical interface
- Duplex LC connector
- Built-in digital diagnostic functions



# Description

The 10G LR 10Gigabit 1310nm DFB Transceiver is designed to transmit and receive serial optical data links up from 2.1 Gb/s to 10.52 Gb/s data rate over 10km singlemode fiber. The Transceiver is compliant with SFF-8432, 10GFC, FC-PI-4, IEEE802.3ae and applicable portions of SFF-8431. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

# **Product Specifications**

## I. General Specifications

Data Rate Specifications	Symbol	Min	Тур.	Max	Units	Ref.
Bit Rate	BR	2.1		10.52	Gb/s	1
Bit Error Ratio	BER			10-12		2
Max. Supported Link Length	L MAX			40	km	1

#### Notes:

- 1. 10GBASE-LR, 10GBASE-LW, 1200-SM-LL-L 10GFC.
- 2. Tested with a 231 1 PRBS.



## **II. Absolute Maximum Ratings**

Parameter	Symbol	Min	Тур.	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	Ts	-40		85	°C	
Case Operating Temperature	Тор	-40		85	°C	
Relative Humidity	RH	0		85	%	1
Receiver Optical Damage Threshold	RxDamage	5			dBm	

Note:

Non-condensing.

# III. Electrical Characteristics (TOP = -40 to 85 °C, VCC = 3.14 to 3.46 V)

Parameter	Symbol	Min	Тур.	Max	Unit	Ref.			
Supply Voltage	Vcc	3.14	3.30	3.46	V				
Supply Current	lcc		200	285	mA				
Transmitter									
Input differential impedance	R <sub>in</sub>	80	100	120	Ω	1			
Differential data input swing	Vin,pp	180		700	mVpp				
Transmit Disable Voltage	$V_{D}$	2		V <sub>CCHOST</sub>	V				
Transmit Enable Voltage	V <sub>EN</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V				
Transmit Fault Assert Voltage	$V_{FA}$	22		V <sub>CCHOST</sub>	V				
Transmit Fault De-Assert Voltage	V <sub>FDA</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.4	V				



Receiver								
Differential data output swing	$V_{OD}$	450	600	850	mVp-p			
Output rise time and fall time	Tr, Tf	25			ps			
LOS Fault	$V_{\text{LOSFT}}$	2		$V_{\text{CCHOST}}$	V			
LOS Normal	$V_{LOSNR}$	$V_{\text{EE}}$		V <sub>EE</sub> +0.8	V			

#### Notes:

- 1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
- 2. Into 100 differential termination.
- 3. 20 80%. Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's sequence in the PRBS 9 is an acceptable alternative.
- 4. LOS is an open collector output. Should be pulled up with 4.7k 10k on the host board. Normal operation is logic 0; loss of signal is logic 1.
- 5. The transceiver is a "limiting module", i.e., it employs a limiting receiver. Host board designers using an EDC PHY IC should follow the IC manufacturer's recommended settings for interoperating the host-board EDC PHY with a limiting receiver SFP+ module.



# IV. Optical Characteristics (TOP = -40 to 85 $^{\circ}$ C, VCC = 3.14 to 3.46 V))

Parameter	Symbol	Min	Тур.	Max	Unit	Note
	Transmitter					
Optical Modulation Amplitude (OMA)	Рома	-5.2			dBm	
Average Launch Power	P <sub>AVE</sub>	-8.2		+0.5	dBm	1
Optical Wavelength	λ	1260		1360	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.2	dB	
Average Launch power when Tx is OFF	Poff			-35	dB m	
Relative Intensity Noise	RIN			-128	dB/Hz	
	Receiver					
Receiver Sensitivity (OMA) @ 10.3Gb/S	R <sub>SENS1</sub>			-12.6	dB m	2
Receiver Sensitivity (OMA) @ 10.3Gb/s	R <sub>SENS2</sub>			-10.3	dB m	3
Average Receive Power	P <sub>AVE</sub>	-14.2		+0.5	dB m	
Optical Center Wavelength	$\lambda_{C}$	1260		1610	nm	
Receiver Reflectance	Rrx			-12	dB	



LOS De-AssertLOS De-Assert	$LOS_D$		-17	dBm	
LOS Assert	LOS <sub>A</sub>	-30		dBm	

#### Notes:

- 1. Sensitivity for 10G PRBS 231-1 and BER better than or equal to 10E-12
- 2. The stressed sensitivity value in the table are for system level BER measurements which include the effects of CDR circuit.

# V. Digital Diagnostic Specifications

10GBASE-LR SFP+ transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

Parameter	Symbol	Min	Тур.	Max	Units	Ref.		
Accuracy								
Internally measured transceiver temperature	$\Delta DD_Temperature$			3	°C			
Internally measured transceiver supply voltage	$\Delta \text{DD}_{\text{Voltage}}$			3	%			
Measured TX bias current	$\Delta DD_{\text{Bias}}$			10	%	1		
Measured TX output power	$\Delta DD_Tx\text{-Power}$			2	dB			
Measured RX received average optical power	$\Delta DD_Rx\text{-Powe}$			2	dB			



Dynamic	Range	for	Rated	Accuracy

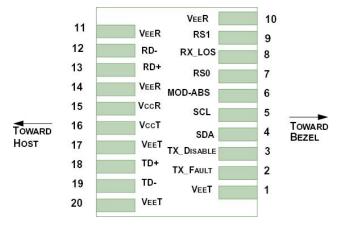
Internally measured transceiver temperature	DDTemperature	-40	85	°C			
Internally measured transceiver temperature	DD <sub>Voltage</sub>	3.1	3.5	V			
Measured TX bias current	$DD_Bias$	10	90	mA			
Measured TX output power	DD <sub>Tx-Power</sub>	-8.2	+0.5	dBm			
Measured RX received average optical power	$DD_Rx\text{-Powe}$	-14.2	+0.5	dBm			
Max Reporting Range							
Internally measured transceiver temperature	DDTemperature	-40	125	°C			
Internally measured transceiver supply voltage	DDvoltage	2.8	4.0	V			
Measured TX bias current	$DD_Bias$	0	20	mA			
Measured TX output power	$DD_Tx ext{-Power}$	-10	+2	dBm			
Measured RX received	DD <sub>Rx-Power</sub>			dBm			

#### Notes:

Accuracy of measured Tx bias current is 10% of the actual bias current from the laser driver to the laser.



# VI. Pin Description

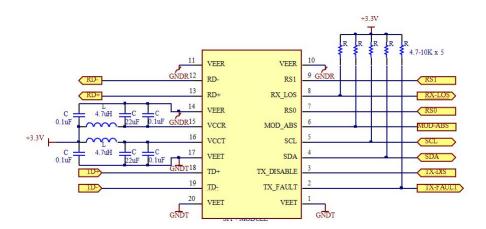


Pin	Symbol	Name/Description	Ref.
1	$V_{EET}$	Transmitter Ground	1
2	T <sub>FAULT</sub>	Transmitter Fault	2
3	$T_{DIS}$	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	2
5	SCL	2-wire Serial Interface Clock Line	2
6	MOD_ABS	Module Absent. Grounded within the module	2
7	RS0	Rate Select 0.	4
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	RS1	Rate Select 1.	4
10	$V_{EER}$	Receiver Ground	1
11	$V_{EER}$	Receiver Ground	1
12	RD-	Receiver Inverted DATA out. AC Coupled.	
13	RD+	Receiver Non-inverted DATA out.  AC Coupled.	
14	$V_{EER}$	Receiver Ground	1



15	$V_{CCR}$	Receiver Power Supply	
16	Vсст	Transmitter Power Supply	
17	V <sub>EET</sub>	Transmitter Ground	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	$V_{EET}$	Transmitter Ground	1

# **VII.Typical Application Circuit**





# VIII. Mechanical Specifications

