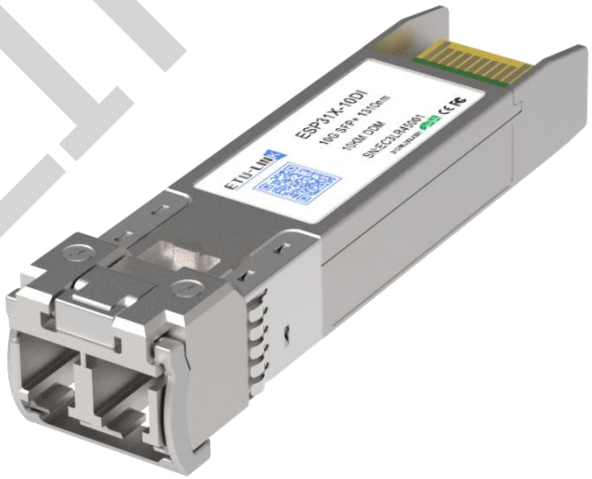
ESP31X-10D(I)

10Gb/s SFP+ LR 10km DDM Transceiver

PRODUCT FEATURES

- **Support data rate up to 11.3Gb/s**
- **Hot-Pluggable SFP Footprint and** duplex LC connector
- **Up to 10km reach for G.652 SMF**
- **1310nm DFB laser and PIN receiver**
- **Temperature Range:**
  - **Commercial:0°C ~70°C**
  - **Extended：-20°C ~85°C**
  - **Industrial: -40°C ~85°C**
- **Power consumption <1W**
- **Compliant with SFP-8431**
- **Compliant with SFP-8432**
- **Compliant with SFP-8472**
- **Compliant with IEEE802.3ae**
- **RoHS 6 compliance**
- **Complies with EU Directive 2015/863/EU**



APPLICATIONS

- **10GBASE-LR/LW**
- **OTU2/2e**
- **Other Optical Links**

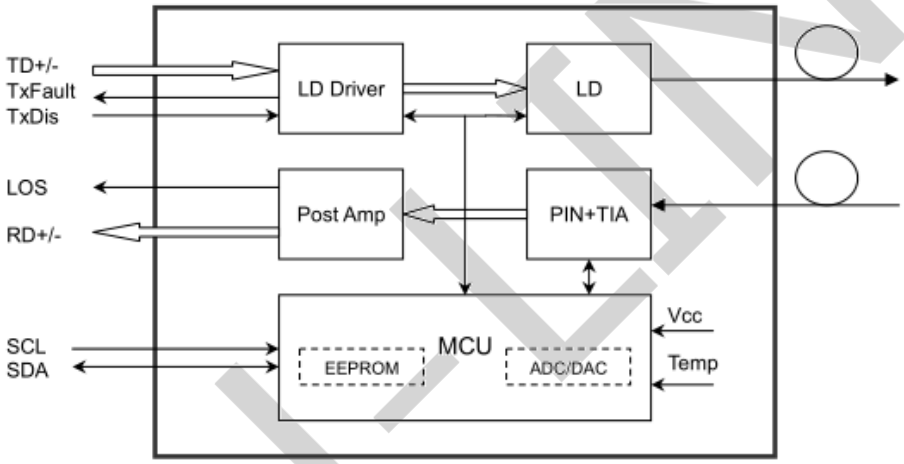
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DESCRIPTIONS

This 1310nm DFB 10Gbps SFP+ transceiver is designed to transmit and receive optical data over single mode. optical fiber for link length 10km.

The SFP+ 10km module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI.

Module Block Diagram



Ordering Information

Part No.	Data Rate(optical)	Laser	Fiber Type	Distance	Optical Interface	Temp	DDMI	Latch Color
ESP31X-10D	10.3125Gbps	DML	SMF	10km	LC	0~70℃	Y	Blue
ESP31X-10DE	10.3125Gbps	DML	SMF	10km	LC	-20~85℃	Y	Blue
ESP31X-10DI	10.3125Gbps	DML	SMF	10km	LC	-40~85℃	Y	Blue

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T_{stg}	-40		+85	°C	
Case Operating Temperature(Commercial)	T_O	0		70	°C	
Case Operating Temperature (Industrial)	T_O	-40		85	°C	

Relative Humidity - Storage	R_{HS}	5		95	%	
Relative Humidity - Operating	R_{HO}	5		85	%	
DC Supply Voltage	V_{CC}	0		3.6	V	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Case Operating Temperature	Top	0	-	70	℃	Commercial
		-40		85		Industrial
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V	
Power Supply Current				1	W	
Transmission Distance	TD	-	-	10	km	Over SMF

Electrical Characteristics

High-Speed Signal: Compliant to CEI-11G-SR

Low-Speed Signal: Compliant to SFF-8419

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter (Module Input)							
Differential Input Resistance		R_R_{din}	80	100	120	Ω	
Input Differential Voltage		R_V_{diff}	110	-	1050	mVpp	
Tx_Disable	Normal Operation	V_{IL}	-0.3	-	0.8	V	
	Laser Disable	V_{IH}	2.0	-	V_{CC}+0.3	V	
Receiver (Module Output)							
Differential Resistance		T_R_d	80	100	120	Ohm	
Output Differential Voltage		T_V_{diff}	360	-	770	mVpp	
Differential Termination Resistance Mismatch		T_R_{dm}	-	-	5	%	
Rx los	Normal Operation	V_{OL}	-0.3	-	0.4	V	
	Loss Signal	V_{OH}	2		VCCHOST	V	

Optical and Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter						
Average Output Power	POUT	-8.2		0.5	dBm	1
Average Output Power(Laser Off)	POFF			-30	dBm	
Wavelength	λ	1260		1355	nm	
Spectrum Bandwidth @ -20dB	Δλ			1	nm	
Side mode suppression ratio(SMSR)	SMSR	30			dB	
Extinction ratio	ER	3.5			dB	

Transmitter and dispersion penalty (TDP)				3.2	dB	
RIN20OMA	RIN			-128	dB/Hz	
Optical return loss tolerance	ORLT	20			dB	
Receiver						
Wavelength	λ	1260		1620	nm	
Received Sensitivity	P_{IN}			-14.4	dBm	2
Optical Power Overload	P_{IN} (SAT)	0.5			dBm	
Damage threshold			1.5		dBm	
Receiver Reflectance	RFL			-12	dB	
Rx_LOS of Signal Assert	P_A	-30			dBm	
Rx_LOS of Signal De-assert	P_D			-18	dBm	
Rx_LOS of Signal Hysteresis	PHy	0.5		5	dB	
Optical Return Loss Tolerance	ORLT	20			dB	

Notes:

1. Output power is coupled into a 9/125μm SMF.

2. Average received power; BER less than 1E-12 and PRBS 231 -1 test pattern.

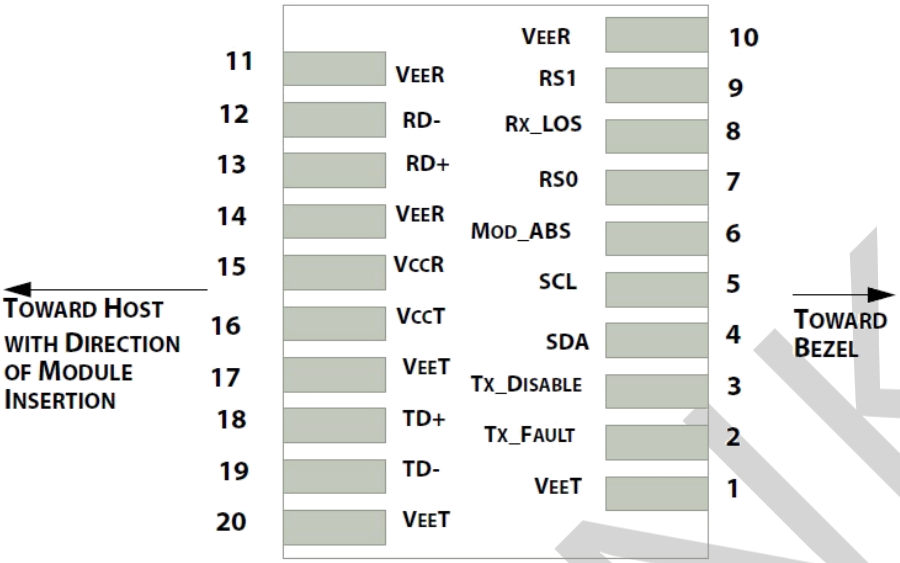
Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 85	±3	℃	Internal
Voltage	0 to Vcc	±3%	V	Internal
Tx Bias Current	0 to 100	±10%	mA	Internal
Tx Output Power	-8.2 to 0.5	±3	dB	Internal
Rx Input Power	-14.4 to0.5	±3	dB	Internal

Communication Interface Timing Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TX_Disable Assert Time	t_off			100	us	
TX_Disable Negate Time	t_on			2	ms	
Time to Initialize Include Reset of TX_FAULT	t_int			300	ms	
TX_FAULT from Fault to Assertion	t_fault			100	us	
TX_Disable Time to Start Reset	t_reset	10			us	
Receiver Loss of Signal Assert Time	T_A,RX_LOS			100	us	
Receiver Loss of Signal Deassert Time	T_d,RX_LOS			100	us	
Rate-Select Chage Time	t_ratesel			10	us	

Pin Diagram



Pin Definitions

PIN #	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	4
5	SCL	2 wire serial interface clock input (SCL)	4
6	MOD-ABS	Module Absent, connect to VeeR or VeeT in the module	4
7	RS0	Rate select0, optionally control SFP+ receiver. When high, input data rate >4.5Gb/ s; when low, input data rate <=4.5Gb/s	5
8	LOS	Receiver Loss of Signal Indication	6
9	RS1	Rate select0, optionally control SFP+ transmitter. When high, input data rate >4.5Gb/s; when low, input data rate <=4.5Gb/s	1
10	VeeR	Module receiver ground	1
11	VeeR	Module receiver ground	1
12	RD-	Receiver inverted data output	
13	RD+	Receiver non-inverted data output	
14	VeeR	Module receiver ground	1
15	VccR	Module receiver 3.3V supply	
16	VccT	Module transmitter 3.3V supply	
17	VeeT	Module transmitter ground	1
18	TD+	Transmitter inverted data output	
19	TD-	Transmitter non-inverted data output	
20	VeeT	Module transmitter ground	1

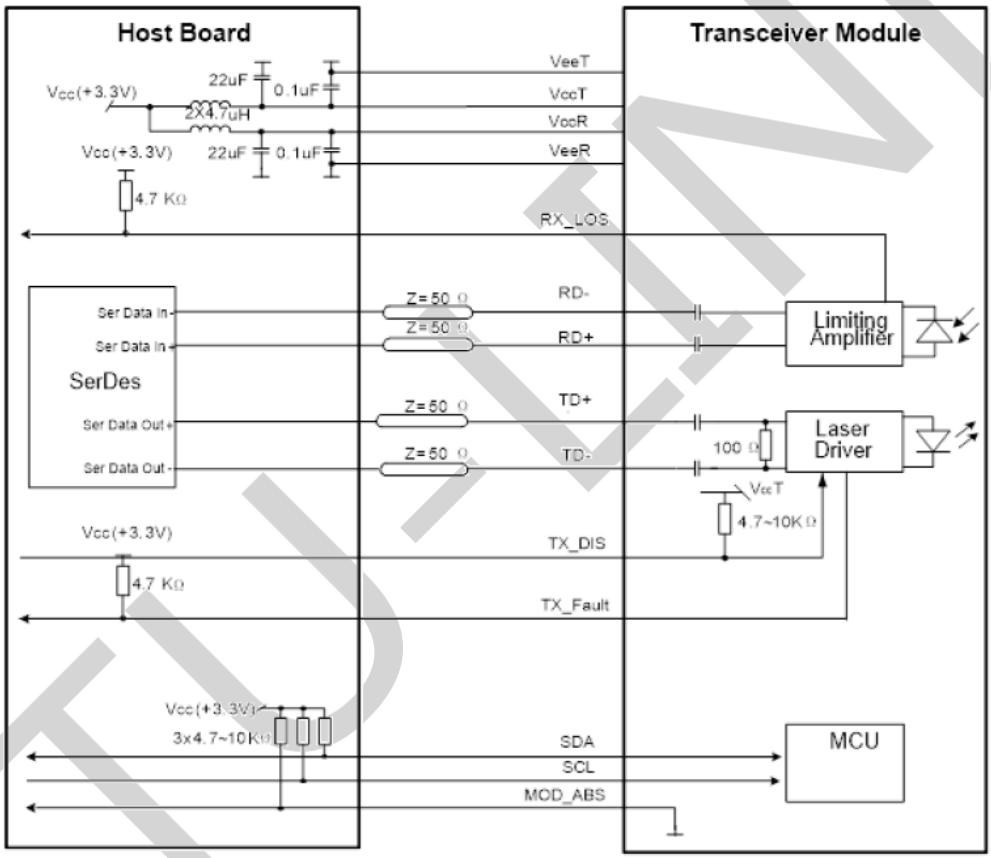
Notes:

1. Circuit ground is internally isolated from chassis ground
2. Tx 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 Vcc + 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.

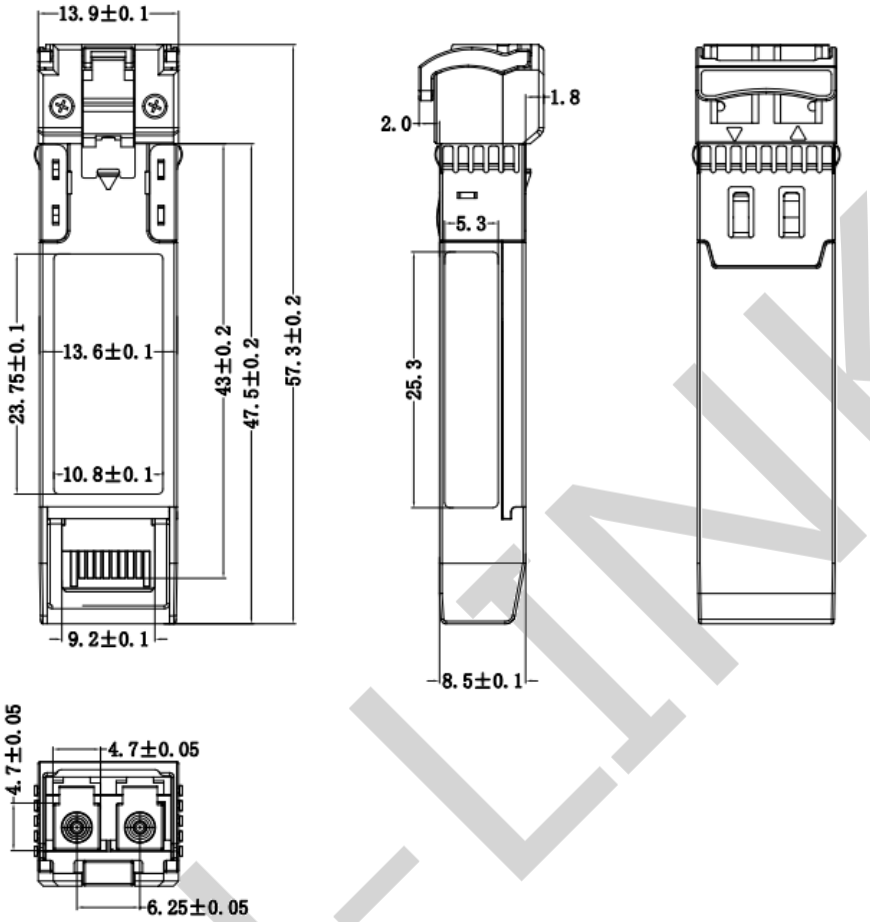
3. Laser output disabled on Tx DIS >2.0V or open, enabled on Tx DIS <0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

Recommended Interface Circuit



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Mechanical Diagram



Revision History

Version No.	Date	Description
1.0	February 8, 2016	Preliminary datasheet
2.0	May 11,2019	Product upgrades
3.0	Aug 30, 2024	Format change

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