

## ESP55X-40D(I)

10Gb/s SFP+ ER 40km DDM Transceiver

### PRODUCT FEATURES

- Support data rate up to 11.3Gb/s
- Hot-Pluggable SFP Footprint and Single LC Connector
- Up to 40km reach for G.652 SMF
- EML laser and PIN receiver
- Temperature Range:
  - Commercial: 0°C ~70°C
  - Extended: -20°C ~85°C
  - Industrial: -40°C ~85°C
- Low power consumption :<1.5W
- 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

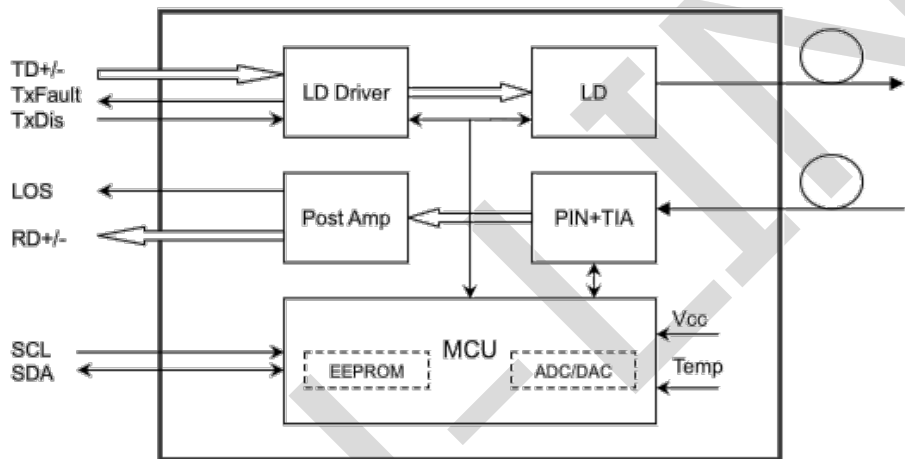
- 10G Ethernet
- OTU2/2e
- Other CPRI option 1,2,3,4,5,6,7,7A,8
- Optical Links

## DESCRIPTIONS

This 1550nm EML 10Gbps SFP+ transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 80km.

The SFP+ 40km 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
ESP55X-40D	10.3125Gbps	EML	SMF	40km	LC	0~70°C	Y	Red
ESP55X-40DE	10.3125Gbps	EML	SMF	40km	LC	-20~85°C	Y	Red
ESP55X-40DI	10.3125Gbps	EML	SMF	40km	LC	-40~85°C	Y	Red

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T <sub>stg</sub>	-40		+85	°C	
Relative Humidity - Storage	R <sub>HS</sub>	5		95	%	
Relative Humidity - Operating	R <sub>HO</sub>	5		85	%	
DC Supply Voltage	V <sub>CC</sub>	0		3.6	V	

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Case Operating Temperature	Top	0	-	70	°C	Commercial
		-40		85		Industrial
Power Supply Voltage	V <sub>CC</sub>	3.13	3.3	3.47	V	
Transmission Distance	TD	-	-	40	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	
<b>Transmitter (Module Input)</b>							
Differential Input Resistance	R <sub>Rdin</sub>	80	100	120	Ω		
Input Differential Voltage	R <sub>Vdiff</sub>	110	-	1050	mVpp		
Tx_Disable	Normal Operation	V <sub>IL</sub>	-0.3	-	0.8	V	
	Laser Disable	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	
<b>Receiver (Module Output)</b>							
Differential Resistance	T <sub>Rd</sub>	80	100	120	Ohm		
Output Differential Voltage	T <sub>Vdiff</sub>	360	-	770	mVpp		
Differential Termination Resistance Mismatch	T <sub>Rdm</sub>	-	-	5	%		
Rx los	Normal Operation	V <sub>OL</sub>	-0.3	-	0.4	V	
	Loss Signal	V <sub>OH</sub>	2	-	V <sub>CC</sub> HOST	V	

## Optical and Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Average Output Power	POUT	-1		4	dBm	1
Average Output Power(Laser Off)	POFF			-30	dBm	
Wavelength	λ	1530		1565	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)				3.0	dB	
RIN20OMA	RIN			-128	dB/Hz	
Optical return loss tolerance	ORLT	21			dB	
<b>Receiver</b>						
Wavelength	λ	1530		1565	nm	

Received Sensitivity	$P_{IN}$			-16.5	dBm	$BER < 1 \times 10^{-12}$
Optical Power Overload	$P_{IN}$ (SAT)	0			dBm	2
Receiver Reflectance	RFL			-26	dB	
Rx_LOS of Signal Assert	$P_A$	-30			dBm	
Rx_LOS of Signal De-assert	$P_D$			-17	dBm	
Rx_LOS of Signal Hysteresis	$P_{Hy}$	0.5		5	dB	

**Notes:**

1. The optical power is launched into SMF.
2. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

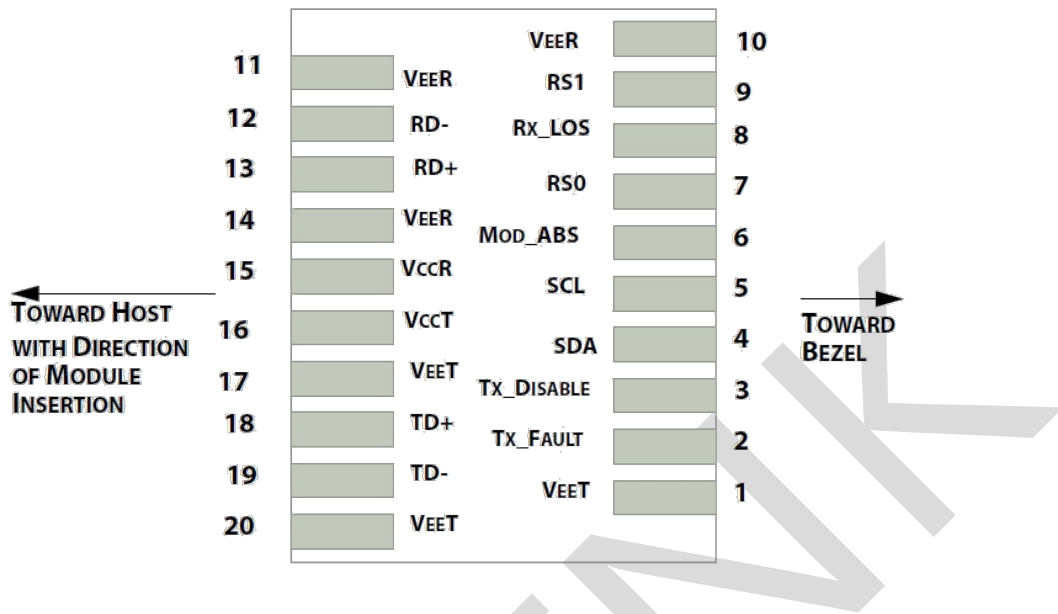
## Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 85	$\pm 3$	$^{\circ}\text{C}$	Internal
Voltage	0 to $V_{CC}$	$\pm 3\%$	V	Internal
Tx Bias Current	0 to 100	$\pm 10\%$	mA	Internal
Tx Output Power	-1 to 4	$\pm 3$	dB	Internal
Rx Input Power	-17 to -5	$\pm 3$	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

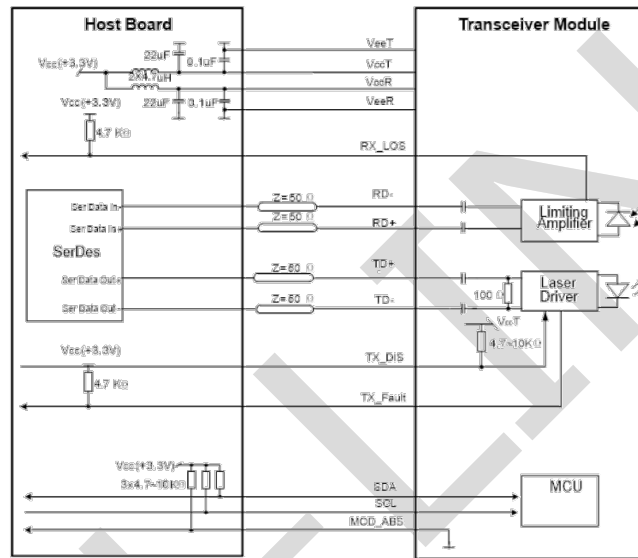
PIN #	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	4
5	SCL	2 wire serial interface clock input (SCL)	4
6	MOD-ABS	Module Absent, 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:

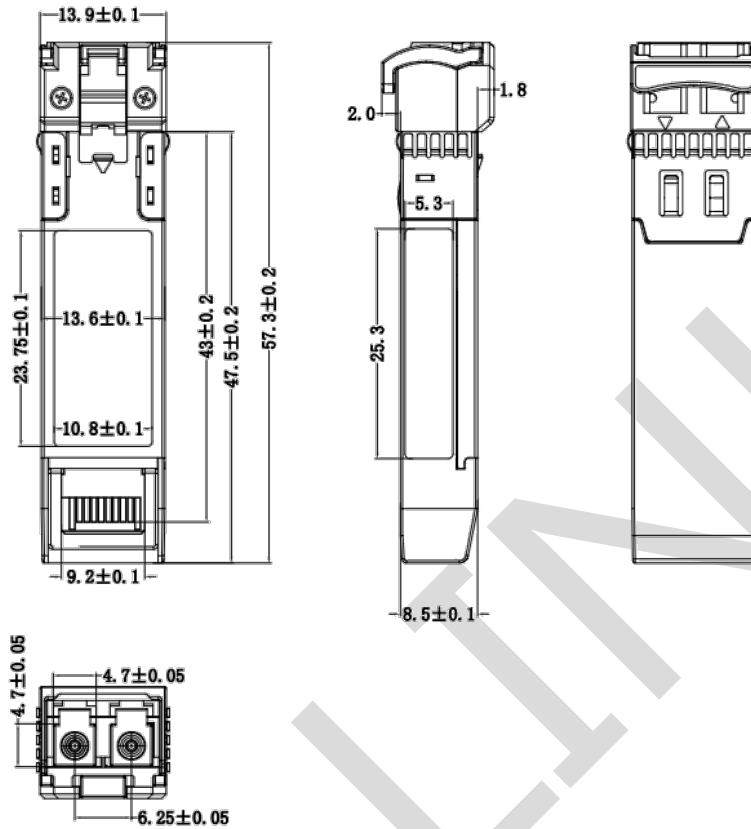
1. Circuit ground is internally isolated from chassis ground

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



## Mechanical Diagram



## Revision History

Version No.	Date	Description
1.0	February 8, 2016	Preliminary datasheet
2.0	October 11, 2023	Product upgrades
3.0	July 26, 2024	Format change

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