

ESHxxX-40D(I)

10Gb/s SFP+ DWDM 40km DDM Transceiver

PRODUCT FEATURES

- Support data rate up to 11.3Gb/s
- Support 40 km link distances
- Available in all C-Band Wavelengths on the 50GHz DWDM ITU Grid
- Temperature-Stabilized DWDM EML Transmitter and PIN Receiver
- Duplex LC connector
- Low power consumption:
 - Commercial:<1.5W
 - Industrial: <1.8W
- Positive power supply lines: 3.3 V
- Operating case temperature range:
 - Commercial:0 to 70°C
 - Industrial: -40 to 85°C
- RoHS 6 compliant
- Compliant with SFF-8431 / SFF-8472



APPLICATIONS

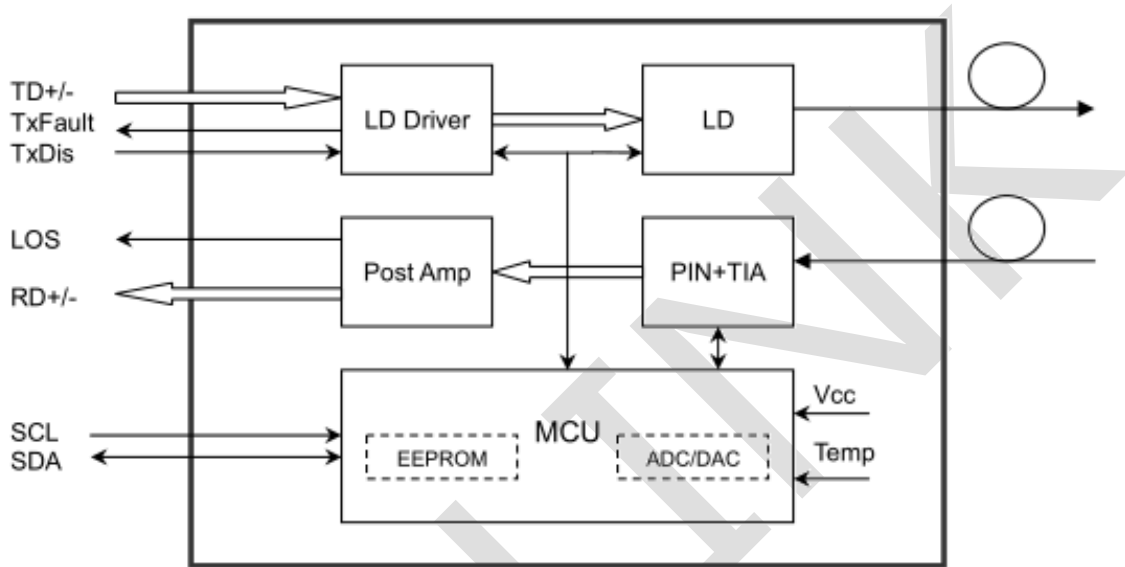
- DWDM 10Gb/s Ethernet
- OTU2/2e
- Other Optical Links

Description

The ESHxxX-40D(I) series single mode transceiver is small form factor pluggable module for duplex optical data communications such as 10GBASE-ER defined by IEEE 802.3. The ESHxxX-40D(I) module is designed for single mode fiber and operates at a nominal wavelength of 1528.38nm to 1564.45nm; the transmitter section uses a multiple quantum well EML, which is class 1 laser compliant according to International Safety Standard IEC-60825.

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
ESHxxX-40D	10.3125Gbps	EML	SMF	40km	LC	0~70°C	Y
ESHxxX-40DI	10.3125Gbps	EML	SMF	40km	LC	0~70°C	Y

Wavelength Guide Table

Channel	Wavelength (nm)	Frequency(THZ)	Channel	Wavelength (nm)	Frequency(THZ)
H17	1563.45	191.75	H40	1544.92	194.05
H18	1562.64	191.85	H41	1544.13	194.15
H19	1561.82	191.95	H42	1543.33	194.25
H20	1561.01	192.05	H43	1542.54	194.35
H21	1560.20	192.15	H44	1541.74	194.45

H22	1559.39	192.25	H45	1540.95	194.55
H23	1558.58	192.35	H46	1540.16	194.65
H24	1557.77	192.45	H47	1539.37	194.75
H25	1556.96	192.55	H48	1538.58	194.85
H26	1556.15	192.65	H49	1537.79	194.95
H27	1555.35	192.75	H50	1537.00	195.05
H28	1554.54	192.85	H51	1536.21	195.15
H29	1553.73	192.95	H52	1535.42	195.25
H30	1552.93	193.05	H53	1534.64	195.35
H31	1552.12	193.15	H54	1533.85	195.45
H32	1551.32	193.25	H55	1533.07	195.55
H33	1550.52	193.35	H56	1532.29	195.65
H34	1549.72	193.45	H57	1531.51	195.75
H35	1548.92	193.55	H58	1530.73	195.85
H36	1548.10	193.65	H59	1529.94	195.95
H37	1547.30	193.75	H60	1529.16	196.05
H38	1546.52	193.85	H61	1528.38	196.15
H39	1545.72	193.95			

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Units
Storage Temperature	T_{stg}	-40	-	85	°C
Relative Humidity - Storage	RH _o	5	-	95	%
Relative Humidity - Operating	RH _s	5	-	85	%
Power Supply	V_{cc}	-0.5	-	3.6	V

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units	Notes
Case Operating Temperature		-40	25	85	°C	Temperature Range = I

Case Operating Temperature		0	25	70	°C	Temperature Range = C
DC Supply Voltage	V _{CC}	3.13	-	3.47	V	
Transmission Distance	TD	-	-	80	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	
Supply Voltage	V _{CC}	3.135		3.465	V		
Supply Current	I _{CC}			450	mA	Commercial	
				540		Industrial	
Power Consumption	P			1.5	W	Commercial	
				1.8		Industrial	
Transmitter (Module Input)							
Differential Input Resistance	R _{Rdin}	80	100	120	Ω		
Input Differential Voltage	R _{Vdiff}	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 _{Rd}	80	100	120	Ohm		
Output Differential Voltage	T _{Vdiff}	360	-	770	mVpp		
Differential Termination Resistance Mismatch	T _{Rdm}	-	-	5	%		
Rx los	Normal Operation	V _{OL}	-0.3	-	0.4	V	
	Loss Signal	V _{OH}	2		V _{CC} HOST	V	

Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter						
Average Output Power	POUT	-1		4	dBm	1
Average Output Power(Laser Off)	POFF			-30	dBm	
Wavelength	λ	λ-0.1		λ+0.1	nm	
Center Wavelength Spacing			100		GHz	4
Spectrum Bandwidth @ -20dB	Δλ			1	nm	
Side mode suppression ratio(SMSR)	SMSR	30			dB	
Extinction ratio	ER	8.2			dB	
RIN _{20OMA}	RIN			-128	dB/Hz	2
Optical return loss tolerance	ORLT	20			dB	
Receiver						

Optical Communications Products Alliance

Wavelength	λ	1270		1610	nm	
Received Sensitivity	P_{IN}			-16	dBm	3
Optical Power Overload	$P_{IN(SAT)}$	0			dBm	
Rx_LOS of Signal Assert	P_A	-30			dBm	
Rx_LOS of Signal De-assert	P_D			-17	dBm	
Rx_LOS of Signal Hysteresis	PHY	0.5			dB	
Optical Return Loss Tolerance	ORLT	20			dB	

Notes:

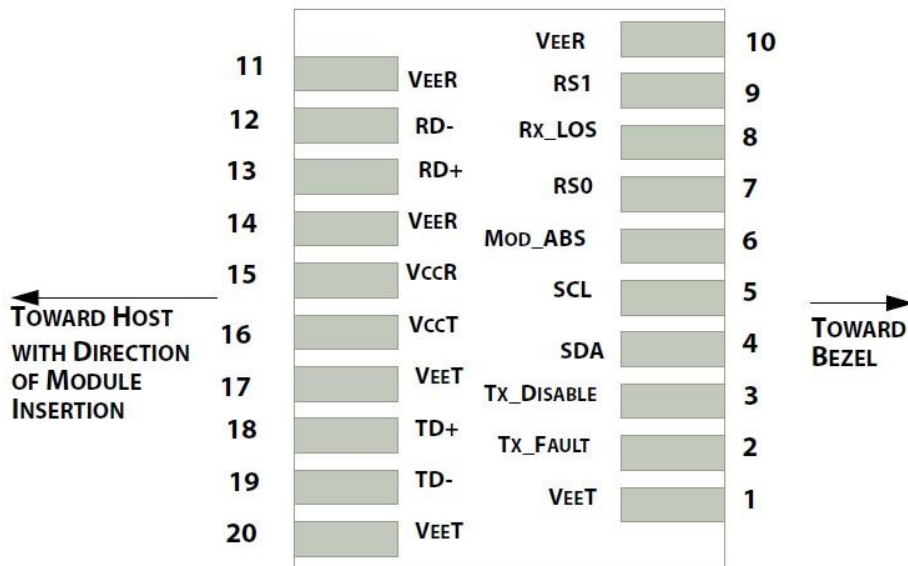
1. Output is coupled into a 9/125um SMF.
2. 12dB reflection.
3. Measured with worst ER, BER less than 1E-12 and PRBS 2^31-1 at 10.3125Gbps.
4. Corresponds to approximately 0.8 nm.

Digital Diagnostic Monitor Accuracy

The following characteristics are defined over recommended operating condition

Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 85	± 3	$^{\circ}\text{C}$	Internal
Voltage	3 to 3.6	$\pm 3\%$	V	Internal
Tx Bias Current	0 to 100	$\pm 10\%$	mA	Internal
Tx Output Power	-1 to 4	± 3	dB	Internal
Rx Input Power	-16 to 0	± 3	dB	Internal

Pin Diagram



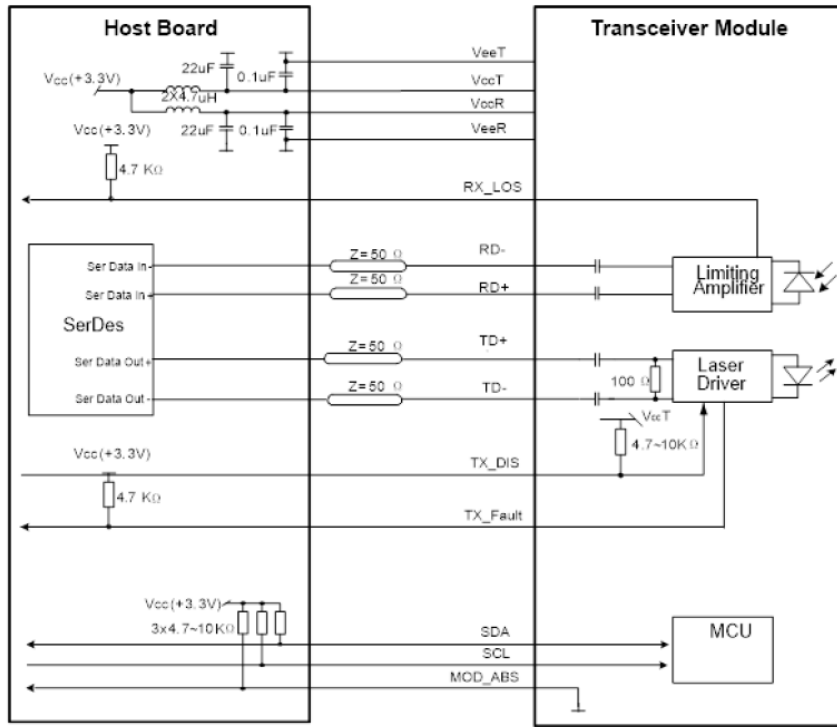
Pin Descriptions

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

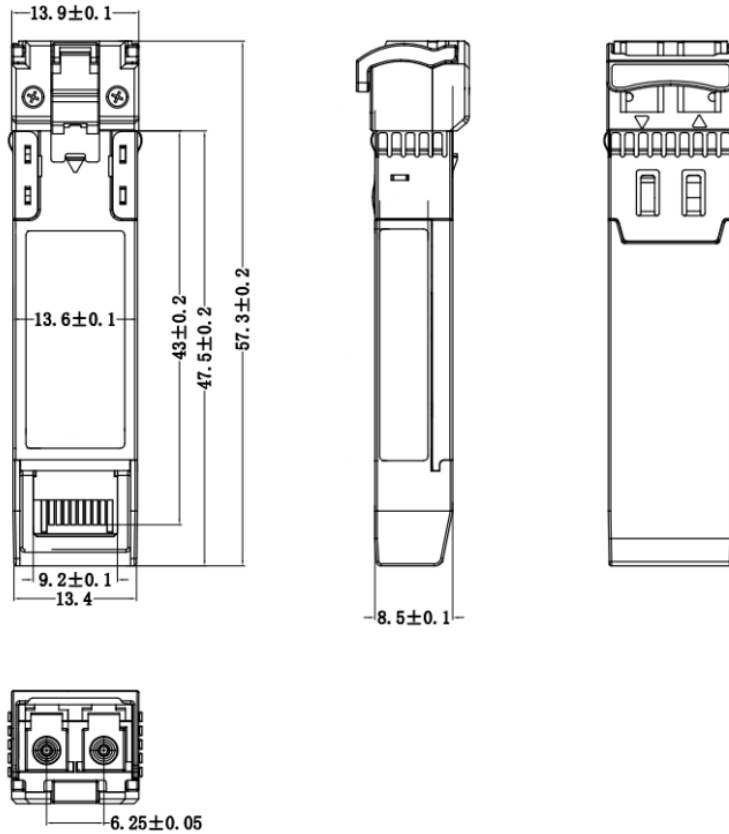
Notes:

- Circuit ground is internally isolated from chassis ground
- 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.
- Laser output disabled on Tx DIS >2.0V or open, enabled on Tx DIS <0.8V.
- 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.
- Internally pulled down per SFF-8431 Rev 4.1.
- 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.

Recommend Circuit Schematic



Mechanical Specifications(Unit: mm)



Revision History

Version No.	Date	Description
1.0	May 28 2022	Preliminary datasheet
2.0	Nov 26 2023	Product upgrades
2.1	Aug 11, 2024	Format change

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