

## ESP3106-40D(I)

622Mbps SFP Optical Transceiver, 40KM Reach

### PRODUCT FEATURES

- Up to 622Mbps data-rate
- 1310nm DFB laser and PIN photo detector for 40km transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:

Standard: 0 to +70°C

Extended: -20 to +85°C

Industrial: -40 to +85°C



### APPLICATIONS

- SDH/SONET
- STM-4, IR1, L-4.1 Interface
- ATM Switches
- Other Optical Links

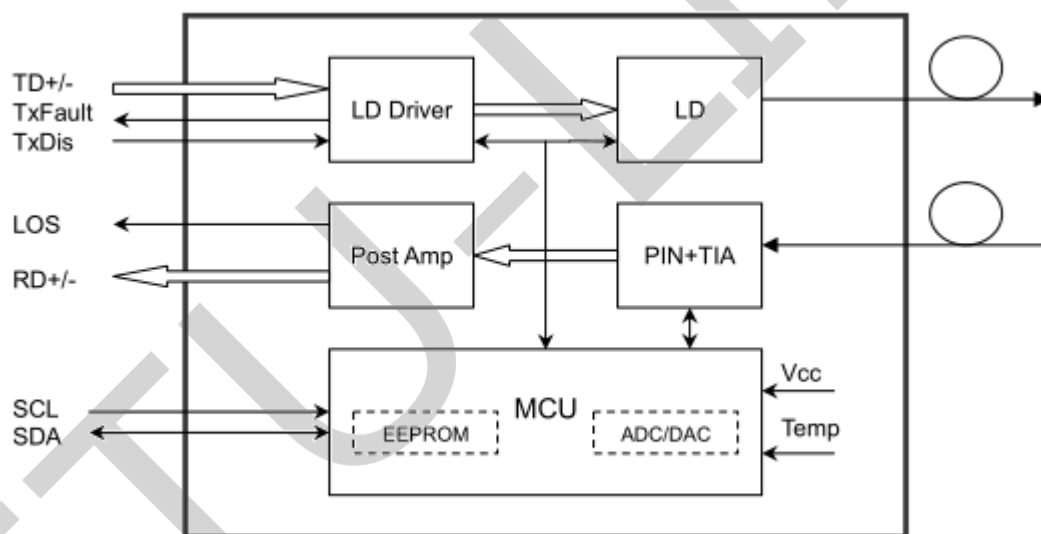
## DESCRIPTIONS

The SFP transceivers are high performance, cost effective modules supporting dual data-rate of 622Mbps and 40KM transmission distance with SMF.

The transceiver consists of three sections: a DFB laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety Requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.

## Module Block Diagram



## Ordering Information

Part No.	Data Rate(optical)	Laser	Fiber Type	Distance	Optical Interface	Temp	DDMI	Latch Color
ESP3106-40D	622Mbps	DFB	SMF	40km	LC	0~70℃	Y	Blue
ESP3106-40DE	622Mbps	DFB	SMF	40km	LC	-20~85℃	Y	Blue
ESP3106-40DI	622Mbps	DFB	SMF	40km	LC	-40~85℃	Y	Blue

## Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	V <sub>cc</sub>	-0.5		4.7	V	
Storage Temperature	TS	-40		85	°C	
Case Operating Temperature	TOP	0		70	°C	

## Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Case Temperature	T <sub>OP</sub>	0		70	°C	Commercial
		-40		85		Industrial
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V	
Power Supply Current	I <sub>CC</sub>			280	mA	
Data Rate			622		Mb/s	
Control Input Voltage High		2		V <sub>cc</sub>	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			40	km	9/125um

## Electrical Characteristics(TOP = 0 to 70℃, VCC = 3.15 to 3.60Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Input differential impedance	R <sub>in</sub>		100		Ω	1
Single ended data input swing	V <sub>in,pp</sub>	250		1200	mV	
Transmit Disable Voltage	VD	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	
Transmit Enable Voltage	VEN	V <sub>ee</sub>		V <sub>ee</sub> + 0.8	V	2
Transmit Disable Assert Time				10	us	
<b>Receiver</b>						
Single ended data output swing	V <sub>out,pp</sub>	250		800	mV	3
Data output rise time	t <sub>r</sub>		100	175	ps	4
Data output fall time	t <sub>f</sub>		100	175	ps	4
LOS Fault	V <sub>LOS fault</sub>	V <sub>cc</sub> -0.5		V <sub>cc</sub> HOST	V	5
LOS Normal	V <sub>LOS norm</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6

Notes:

1. 1. Connected directly to TX data input pins. AC coupled thereafter.
2. 2. Or open circuit.
3. 3. into 100 ohms differential termination.
4. 4. 20 – 80 %
5. 5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. 6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.
7. through the recommended power supply filtering network.

## Optical and Characteristics (TOP = 0 to 70°C, VCC = 3.15 to 3.60Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Output Opt. Pwr (End of Life)	POUT	-5.0		0.0	dBm	1
Optical Wavelength	$\lambda$	1290	1310	1330	nm	
Wavelength Temperature Dependence			0.08	0.125	nm/°C	
Spectral Width (-20dB)	$\sigma$			3.0	nm	
Optical Extinction Ratio	ER	8.2			dB	
Sidemode Suppression ratio	SSRmin	30			dB	
Optical Rise/Fall Time	tr/ tf		100	160	ps	
RIN	RIN			-120	dB/Hz	
Transmitter Jitter (peak to peak)				100	ps	
<b>Receiver</b>						
Average Rx Sensitivity @ Gigabit Ethernet	RSSENS3			-28.0	dBm	2
Maximum Input Power	PMAX	-3.0			dBm	
Optical Center Wavelength	$\lambda_C$	1270	1310	1610	nm	
LOS De - Assert	LOSD			-36	dBm	
LOS Assert	LOSA	-40			dBm	
LOS Hysteresis			1.0		dB	
Receiver Jitter Generation @622Mbps				160	ps	3

### Notes:

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. with worst-case extinction ratio. Measured with a PRBS 2<sup>23</sup>-1 test pattern, @622Mb/s, BER<10<sup>-12</sup>.
3. Jitter added by receiver (peak to peak). Measured at -28.0dBm average Rx sensitivity, PRBS 2<sup>23</sup>-1 test pattern.

## Digital Diagnostics

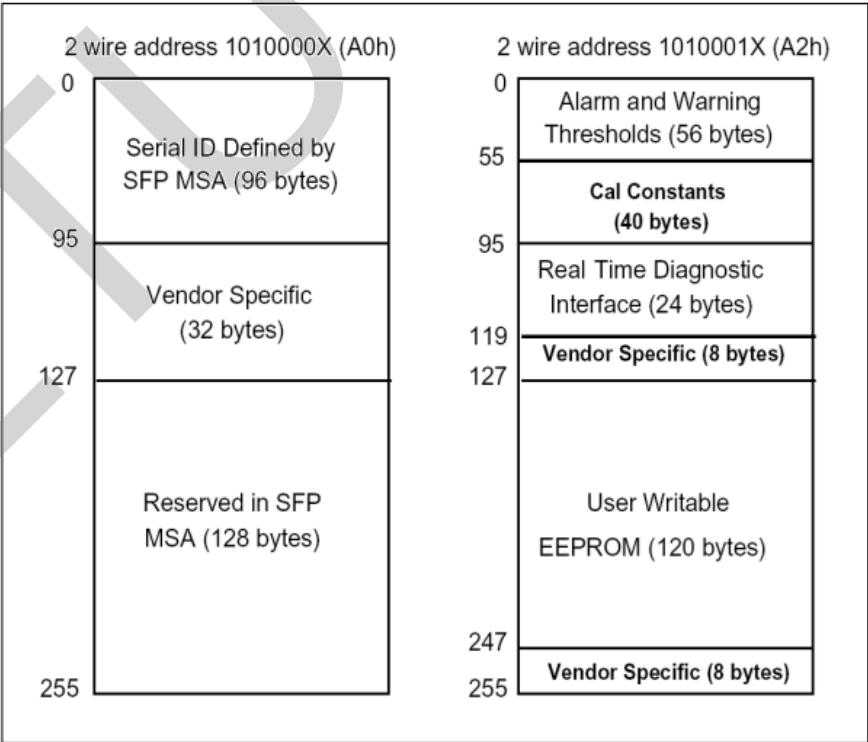
ETU-LINK ESP3106-40D(I) transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1. It is very closely related to the EEPROM defined in the GBIC standard, with the same electrical specifications.

The standard SFP serial ID provides access to identification information that describes the transceiver's

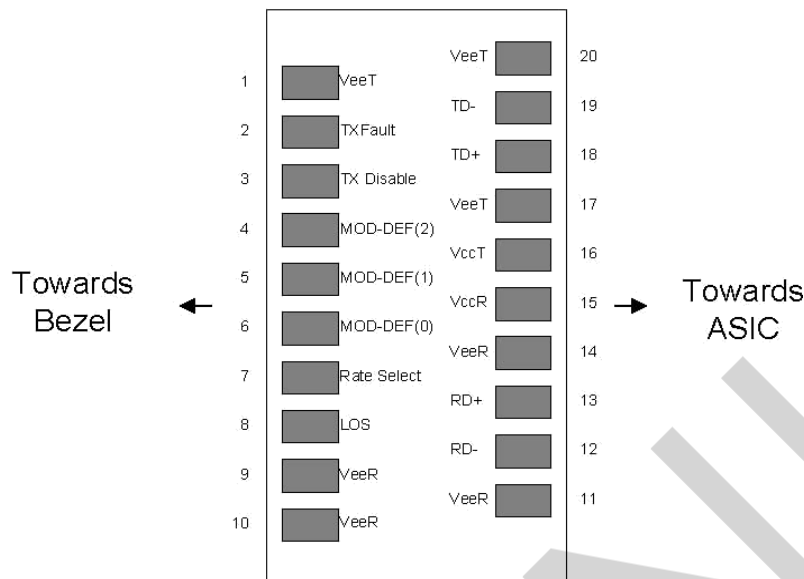
capabilities, standard interfaces, manufacturer, and other information. Additionally, ETU-LINK SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use Of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged. The interface is identical to, and is thus fully backward compatible with both the GBIC Specification and the SFP Multi Source Agreement.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the EEPROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. Digital diagnostics for the ESP3106-40D(I) are internally calibrated by default.



## Pin Diagram



## Pin Definitions

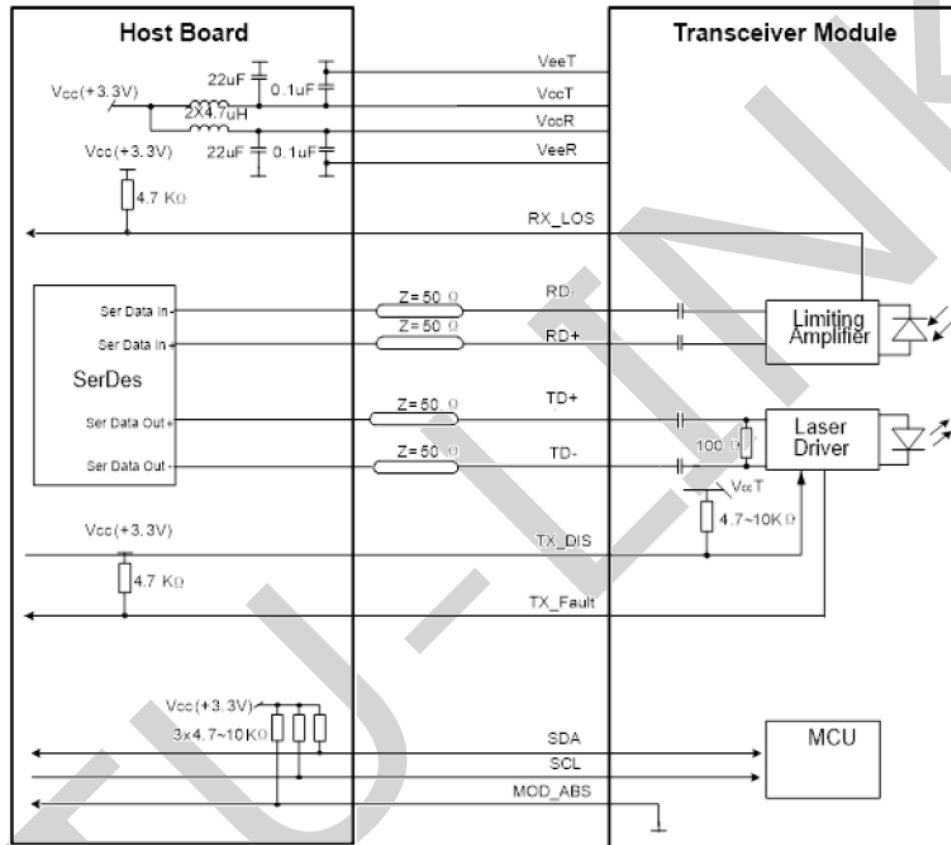
Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	3
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	4
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	4
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	4
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	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 <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

### Notes:

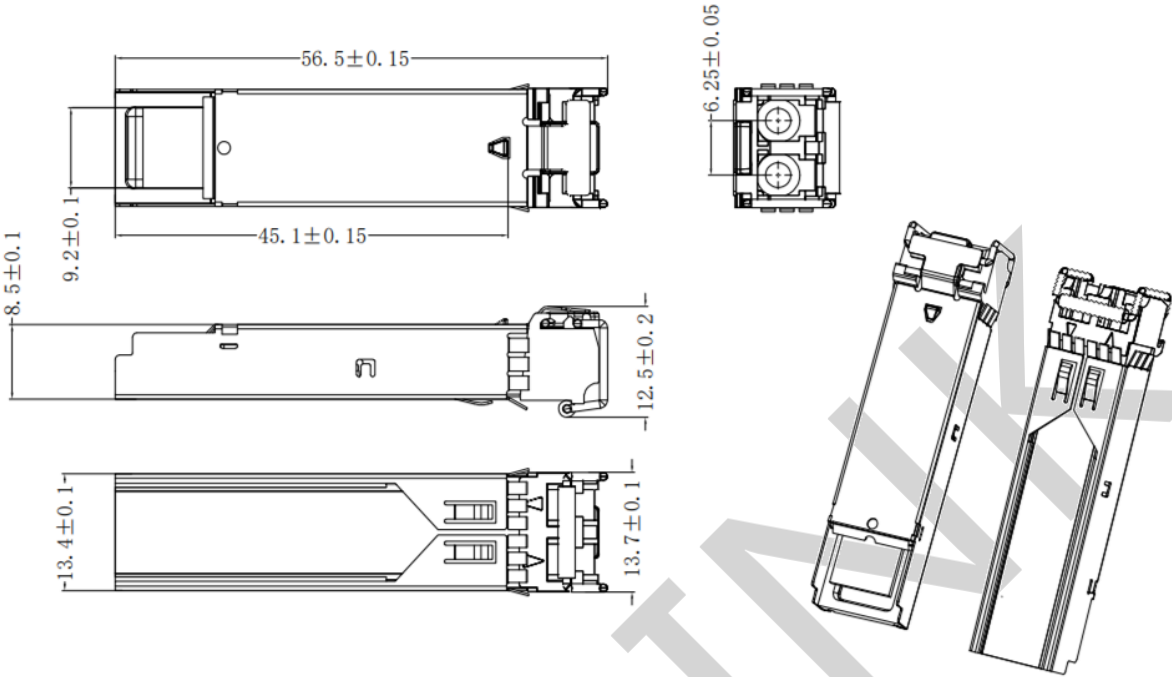
1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use.

- 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  $TDIS > 2.0V$  or open, enabled on  $TDIS < 0.8V$ .
  4. Should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V.  $MOD\_DEF$  (0) pulls line low to indicate module is plugged in.
  5. LOS is open collector output. It should be pulled up with 4.7k - 10 kohms 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	Sep,12, 2015	Preliminary datasheet
2.0	October 18,208	Product upgrades
3.0	July 26, 2024	Format change

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