

## EB35(53)12-20D(I)-S

### 1.25Gbps SFP Bi-Directional 20km SFP Transceiver

#### PRODUCT FEATURES

- Dual data-rate of 1.25Gbps/1.063Gbps operation
- 1310nm FP laser and PIN photodetector for 20KM transmission
- 1550nm DFB laser and PIN photodetector for 20KM transmission
- Compliant with SFP MSA and SFF-8472 with simplex SC receptacle
- Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration
- Compatible with SONET OC-24-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature range:  
0 °C to +70 °C (Commercial)  
-40 °C to +85 °C (Industrial)



#### APPLICATIONS

- Gigabit Ethernet
- Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

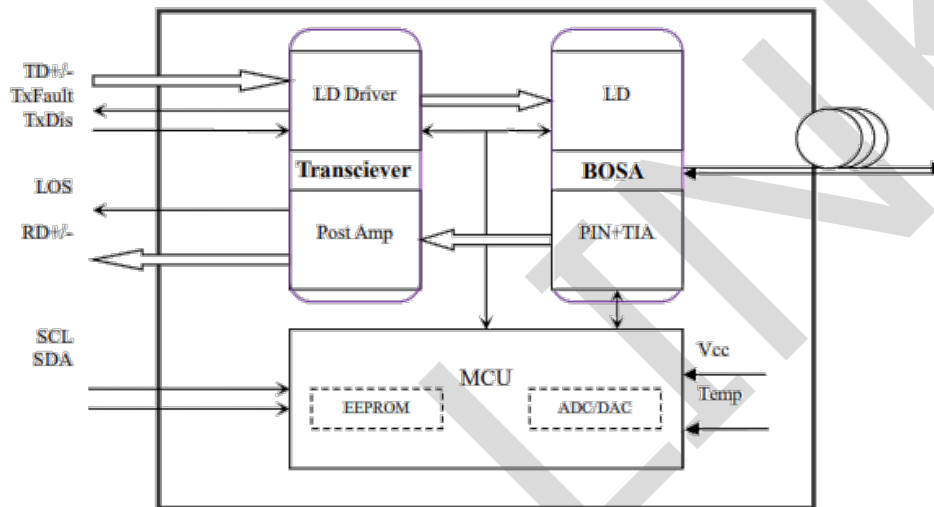
#### DESCRIPTIONS

The SFP-BIDI transceivers are high performance, cost effective modules supporting dual data-rate of 1.25Gbps/1.0625Gbps and 20KM transmission distance with SMF.

The transceiver consists of three sections: a FP 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
EB3512-10D-S	1.25G	FP	SMF	20KM	SC	0~70°C	Y	Blue
EB5312-10D-S	1.25G	DFB	SMF	20KM	SC	0~70°C	Y	Yellow
EB3512-10D(I)-S	1.25G	FP	SMF	20KM	SC	-40~85°C	Y	Blue
EB5312-10D(I)-S	1.25G	DFB	SMF	20KM	SC	-40~85°C	Y	Yellow

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Maximum Supply Voltage	Vcc	-0.5		4.7	V	
Storage Temperature	TS	-40		85	°C	
Case Operating Temperature	TOP	0		70	°C	(Commercial)
Case Operating Temperature	TOP	-40		85	°C	(Industrial)

## 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	-	-	20	km	Over SMF

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

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Voltage	V <sub>cc</sub>	3.15	3.3	3.6	V	
Supply Current	I <sub>cc</sub>		185	280	mA	
<b>Transmitter (Module Input)</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 (Module Output)</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	VLOS fault	V <sub>cc</sub> -0.5		V <sub>cc</sub> HOST	V	5
LOS Normal	VLOS norm	V <sub>ee</sub>		V <sub>ee</sub> +0.5	V	5
Power Supply Rejection	PSR	100			mVpp	6

### Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. 20 – 80 %
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
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.

## Electrical Input / Output Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter (Module Input)</b>						
Diff. input voltage swing		120		820	mVpp	1
Tx Disable input	H	V <sub>IH</sub>	2.0	V <sub>cc</sub> +0.3	V	
	L	V <sub>IL</sub>	0	0.8		

Tx Fault output	H	VOH	2.0		V <sub>cc</sub> +0.3	V	2
	L	VOL	0		0.8		
Input Diff. Impedance		Z <sub>in</sub>		100		Ω	

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
<b>Receiver (Module Output)</b>							
Diff. output voltage swing			340	650	800	mVpp	3
Rx LOS Output	H	VOH	2.0		V <sub>cc</sub> +0.3	V	2
	L	VOL	0		0.8		

**Notes:**

1. TD+/- are internally AC coupled with 100Ω differential termination inside the module.
2. Tx Fault and Rx LOS are open collector outputs, which should be pulled up with 4.7k to 10kΩ resistors on the host board. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V.
3. RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES

## Optical and Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Operating Wavelength	λ <sub>C</sub>	1260 1530	1310 1550	1360 1570	nm	EB3512-20D(I)-S EB5312-20D(I)-S
Ave. output power (Enabled)	P <sub>o</sub>	-9		-3	dBm	1
Extinction Ratio	ER	10			dB	1
RMS spectral width	Δλ			4	nm	
Rise/Fall time (20%~80%)	Tr/Tf			0.26	ps	2
Output Eye Mask	Telcordia GR-253-CORE and ITU-T G.957 compatible					
<b>Receiver</b>						
Operating Wavelength		1530 1260		1570 1360	nm	EB3512-20D(I)-S EB5312-20D(I)-S
Sensitivity	P <sub>sen</sub>			-22	dBm	3
Min. overload	P <sub>imax</sub>	-3			dBm	
LOS Assert	P <sub>a</sub>	-36			dBm	
LOS De-assert	P <sub>d</sub>			-28	dBm	4
LOS Hysteresis	P <sub>d</sub> -P <sub>a</sub>	0.5		6	dB	

**Notes:**

1. Measure at 2<sup>23</sup>-1 NRZ PRBS pattern
2. Transmitter eye mask definition
3. Measured with Light source 1550nm (1310nm), ER=10dB; BER =<10<sup>-12</sup> @PRBS=2<sup>23</sup>-1 NRZ.
4. When LOS de-asserted, the RX data+/- output is signal output.

## Digital Diagnostics

ETU-LINK'S EB35(53)12-20D(I)-S transceivers support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the E2PROM defined in the GBIC standard, with the same electrical specifications.

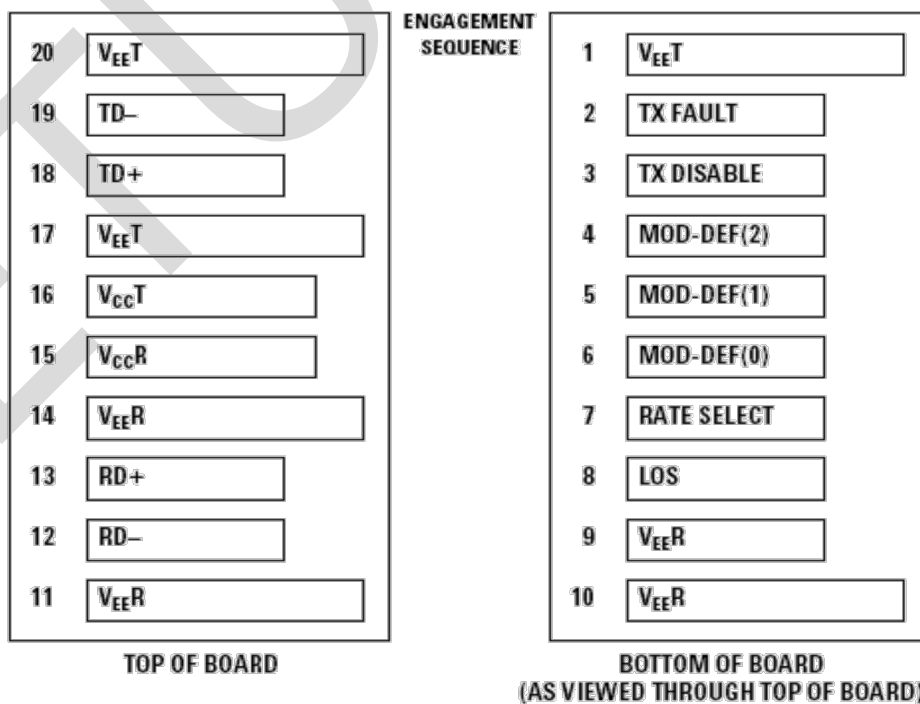
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

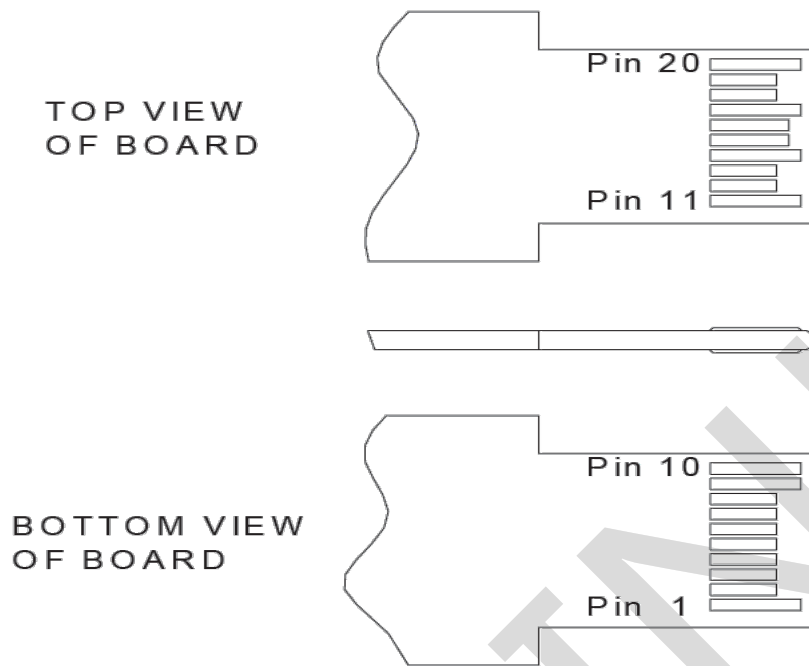
Additionally, ETU-LINK SFP transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. 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 E2PROM that is accessible over a 2-wire serial interface at the 8bit 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 E2PROM 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 EB3512-20D-S are Internally calibrated by default.

## Pin Diagram





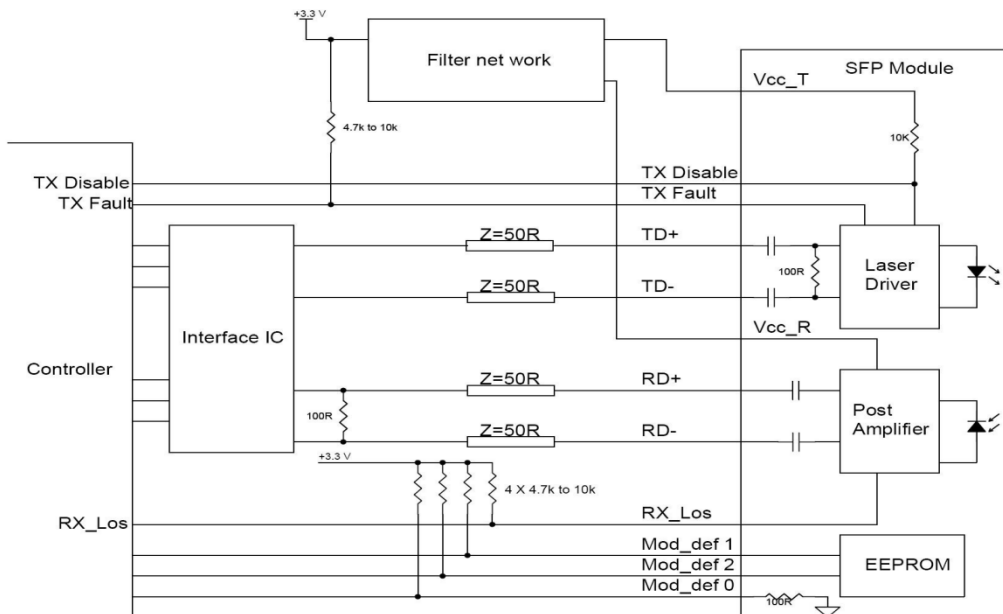
## Pin Definitions

PIN #	Name	Function	Notes
1	VeeT	Tx ground	
2	Tx Fault	Tx fault indication, Open Collector Output, active "H"	1
3	Tx Disable	LVTTTL Input, internal pull-up, Tx disabled on "H"	2
4	MOD-DEF2	2 wire serial interface data input/output (SDA)	3
5	MOD-DEF1	2 wire serial interface clock input (SCL)	3
6	MOD-DEF0	Model present indication	3
7	Rate select	No connection	
8	LOS	Rx loss of signal, Open Collector Output, active "H"	4
9	VeeR	Rx ground	
10	VeeR	Rx ground	
11	VeeR	Rx ground	
12	RD-	Inverse received data out	5
13	RD+	Received data out	5
14	VeeR	Rx ground	
15	VccR	Rx power supply	
16	VccT	Tx power supply	
17	VeeT	Tx ground	
18	TD+	Transmit data in	6
19	TD-	Inverse transmit data in	6
20	VeeT	Tx ground	

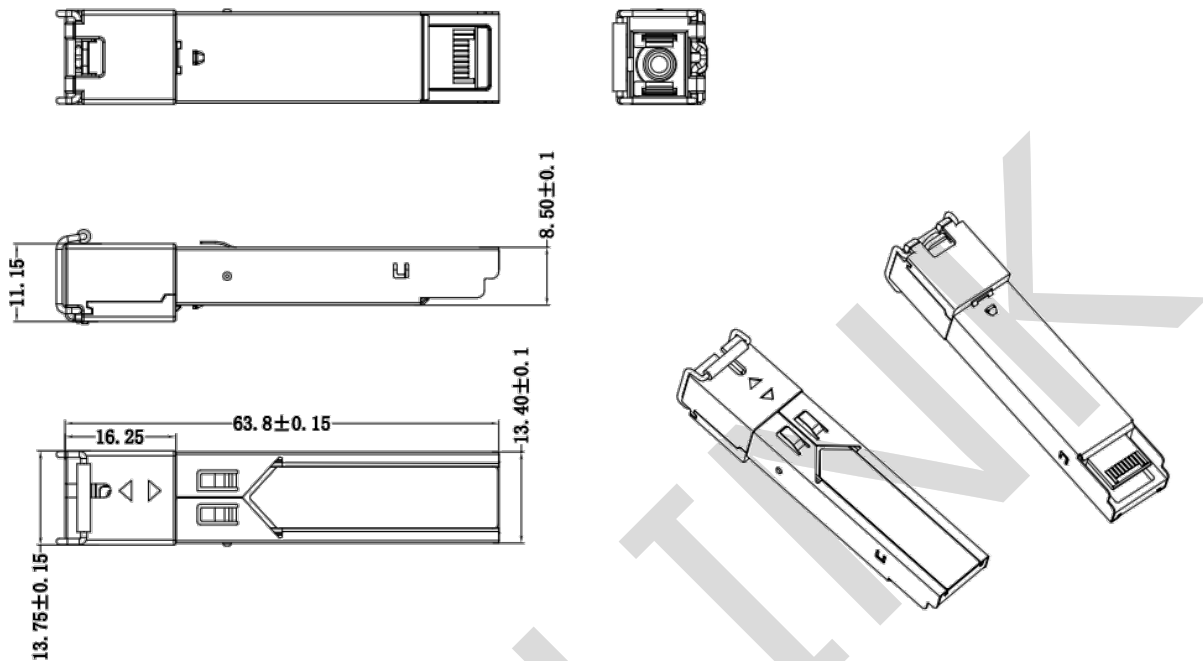
**Notes:**

- When high, this output indicates a laser fault of some kind. Low indicates normal operation. And should be pulled up with a 4.7 – 10KΩ resistor on the host board.
- TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 – 10KΩ resistor. Its states are:  
Low (0 – 0.8V): Transmitter on ( $>0.8, < 2.0V$ ): Undefined  
High (2.0V~Vcc+0.3V): Transmitter Disabled Open: Transmitter Disabled
- Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K – 10KΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.  
Mod-Def 0 has been grounded by the module to indicate that the module is present  
Mod-Def 1 is the clock line of two wire serial interface for serial ID  
Mod-Def 2 is the data line of two wire serial interface for serial ID
- When high, this output indicates loss of signal (LOS). Low indicates normal operation.
- RD+/-: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.
- TD+/-: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

**Recommended Interface Circuit**



## Mechanical Diagram



## Revision History

Version No.	Date	Description
1.0	February 8, 2016	Preliminary datasheet
2.0	July 11, 2018	Product upgrades
2.1	Aug 11, 2024	Format change

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