EB35(53)24-10D(I)-S

2.488Gbps SFP Bi-Directional 10km SFP Transceiver

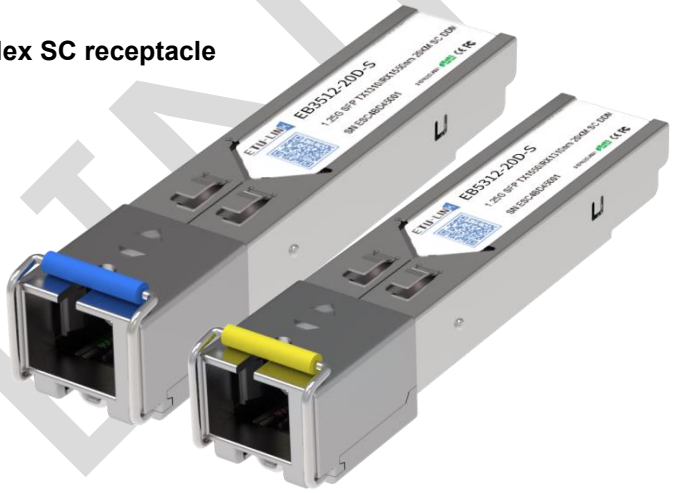
PRODUCT FEATURES

- **Dual data-rate of 2.488Gbps/2.125Gbps operation**
- **1550nm/1310nm DFB laser and PIN photodetector for 10km transmission**
- **Compliant with SFP MSA and SFF-8472 with simplex SC 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

  Industrial : -40 to +85°C



APPLICATIONS

- **SDH STM-16 and SONET OC-48 system**
- **Fiber Channel**
- **Switch to Switch interface**
- **Switched backplane applications**
- **Router/Server interface**
- **Other optical transmission systems**

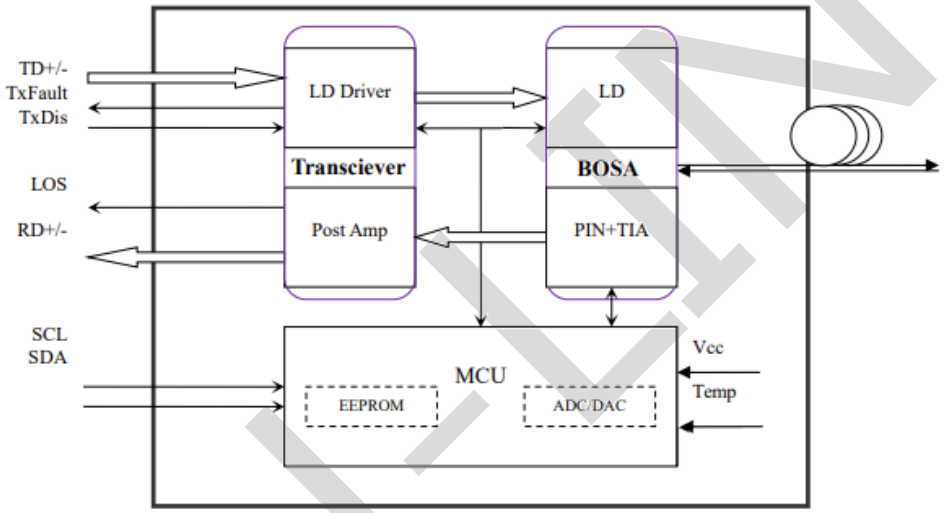
DESCRIPTIONS

The SFP-BIDI transceivers are high performance, cost effective modules supporting dual data-rate of 2.488Gbps/2.125Gbps and 10km 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
EB3524-10D-S	.2.488G	DFB	SMF	10KM	SC	0~70℃	Y	Blue
EB5324-10D-S	.2.488G	DFB	SMF	10KM	SC	0~70℃	Y	Yellow
EB3524-10DI-S	.2.488G	DFB	SMF	10KM	SC	-40~85℃	Y	Blue
EB5324-10DI-S	.2.488G	DFB	SMF	10KM	SC	-40~85℃	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	℃	Commercial
		-40		85		Industrial
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	
Transmission Distance	TD	-	-	10	km	Over SMF

Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Voltage	Vcc	3.15	3.3	3.6	V	
Supply Current	Icc		185	280	mA	
Transmitter (Module Input)						
Input differential impedance	Rin		100		Ω	1
Single ended data input swing	Vin,pp	250		1200	mV	
Transmit Disable Voltage	VD	Vcc–1.3		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+ 0.8	V	2
Transmit Disable Assert Time				10	us	
Receiver (Module Output)						
Single ended data output swing	Vout,pp	250		800	mV	3
Data output rise time	tr		100	175	ps	4
Data output fall time	tf		100	175	ps	4
LOS Fault	VLOS fault	Vcc–0.5		VccHOST	V	5

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 LVTTL. 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
Transmitter (Module Input)							
Diff. input voltage swing			120		820	mVpp	1
Tx Disable input	H	VIH	2.0		Vcc+0.3	V	
	L	VIL	0		0.8		
Tx Fault output	H	VOH	2.0		Vcc+0.3	V	2

	L	VOL	0		0.8		
Input Diff. Impedance		Zin		100		Ω	

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

Notes:

Note 1) TD+/- are internally AC coupled with 100Ω differential termination inside the module.

Note 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 Vcc+0.3V.

Note 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
Transmitter						
Operating Wavelength		1260 1530	1310 1550	1360 1570	nm	EB3524-10D(I)-S EB5324-10D(I)-S
Ave. output power (Enabled)	Po	-5		0	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					
Receiver						
Operating Wavelength		1480 1260		1580 1360	nm	EB3524-10D(I)-S EB5324-10D(I)-S
Sensitivity	Psen			-18	dBm	3
Min. overload	Pimax	-3			dBm	
LOS Assert	Pa	-30			dBm	
LOS De-assert	Pd			-22	dBm	4
LOS Hysteresis	Pd-Pa	0.5		6	dB	

Notes:

Note

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

Digital Diagnostics

ETU-LINK EB35(53)24-10D(I)-S transceivers support the 2-wire serial communication protocol as defined in the SFP MSA1. It is

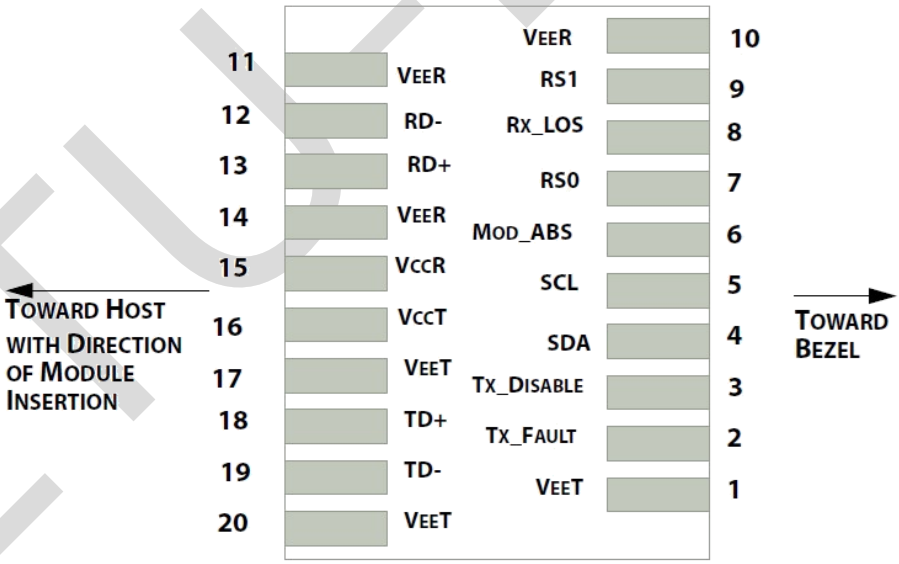
very closely related to the EEPROM defined in the GBIC standard, with the same electrical specifications.

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, 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 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 EB35(53)24-20DI-S are internally calibrated by default.

Pin Diagram



Definitions

PIN #	Name	Function	Notes
1	VeeT	Tx ground	
2	Tx Fault	Tx fault indication, Open Collector Output, active "H"	1
3	Tx Disable	LVTTL 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:

Note 1) When high, this output indicates a laser fault of some kind. Low indicates normal operation. And it should be pulled up with a 4.7 – 10KΩ resistor on the host board.

Note 2) 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

Note 3) 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

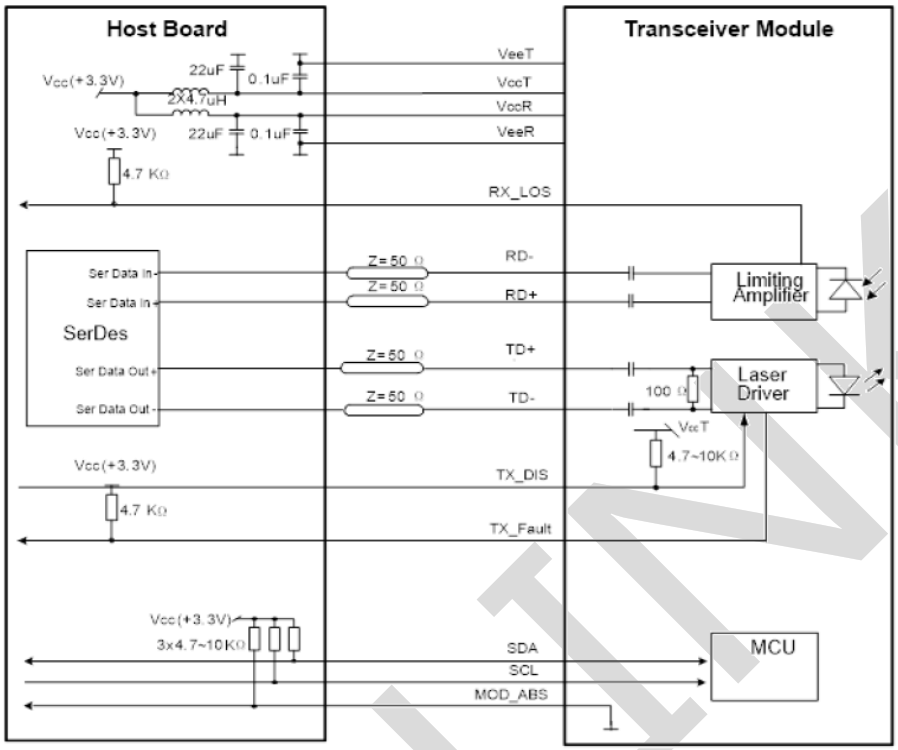
Mod-Def 2 is the data line of two wire serial interface for serial ID

Note 4) When high, this output indicates loss of signal (LOS). Low indicates normal operation.

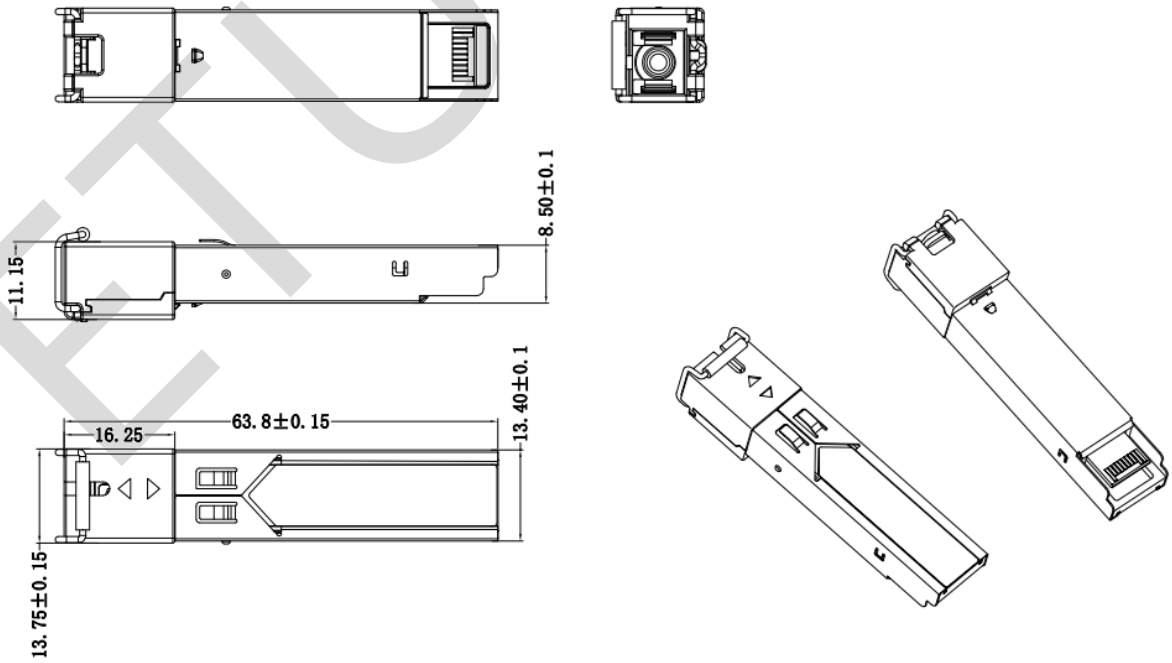
Note 5) RD+/-: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

Note 6) 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 boar

Recommended Interface Circuit



Mechanical Diagram



Revision History

Version No.	Date	Description
1.0	February 8, 2015	Preliminary datasheet
2.0	July 22, 2024	Format change

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