

## **EB45(54)12-A0D(I)**

### **1.25Gbps SFP Bi-Directional 100km SFP Transceiver**

#### **PRODUCT FEATURES**

- **Dual data-rate of 1.25Gbps/1.063Gbps operation**
- **1490nm DFB laser and APD photodetector for 100KM transmission**
- **1550nm DFB laser and APD photodetector for 100KM transmission**
- **Compliant with SFP MSA and SFF-8472 with simplex LC 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**

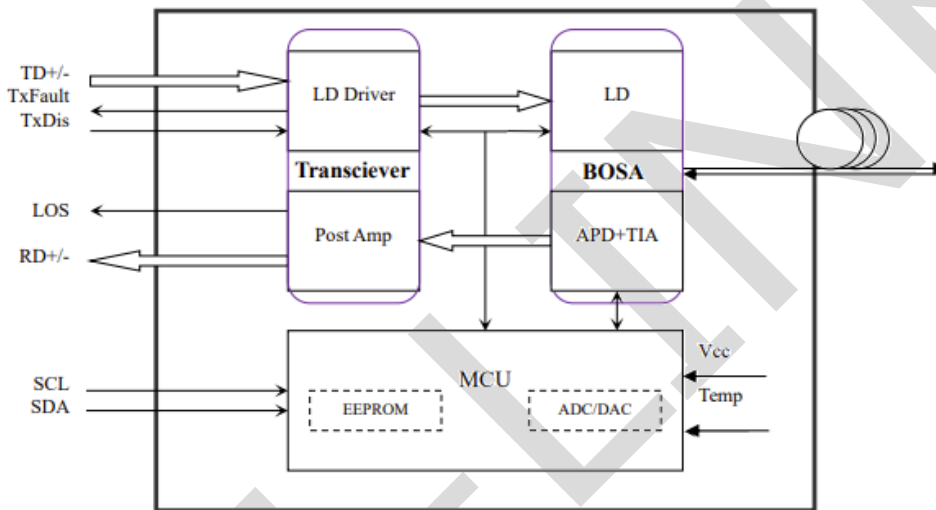
## DESCRIPTIONS

The SFP-BIDI transceivers are high performance, cost effective modules supporting dual data-rate of 1.25Gbps/1.0625Gbps and 100KM transmission distance with SMF.

The transceiver consists of three sections: a DFB laser transmitter, a APD photodiode integrated with a trans-impedance preamplifier (TIA) and 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
EB4512-A0D	1.25G	DFB	SMF	100KM	LC	0~70°C	Y
EB5412-A0D	1.25G	DFB	SMF	100KM	LC	0~70°C	Y
EB4512-A0D(I)	1.25G	DFB	SMF	100KM	LC	-40~85°C	Y
EB5412-A0D(I)	1.25G	DFB	SMF	100KM	LC	-40~85°C	Y

## 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	-	-	100	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>						
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
Input differential impedance	R <sub>in</sub>		100		Ω	1
Single ended data input swing	V <sub>in,pp</sub>	250		1200	mV	

### 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.

## Optical and Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Operating Wavelength	λ <sub>C</sub>	1470	1490	1510	nm	EB4512-A0D(I)
		1530	1550	1570		EB5412-A0D(I)
Ave. output power (Enabled)	P <sub>o</sub>	0		5	dBm	1
Extinction Ratio	ER	9			dB	1

RMS spectral width	$\Delta\lambda$			1	nm	
Rise/Fall time (20%~80%)	Tr/Tf			260	ps	
Output Eye Mask	Compliant with IEEE802.3 z (class 1 laser safety)					
<b>Receiver</b>						
Operating Wavelength		1530 1470		1570 1510	nm	EB4512-A0D(I) EB5412-A0D(I)
Sensitivity	Psen			-30	dBm	1
Min. overload	Pimax	-3			dBm	
LOS Assert	Pa	-45			dBm	
LOS De-assert	Pd			-31	dBm	2
LOS Hysteresis	Pd-Pa	0.5		6	dB	

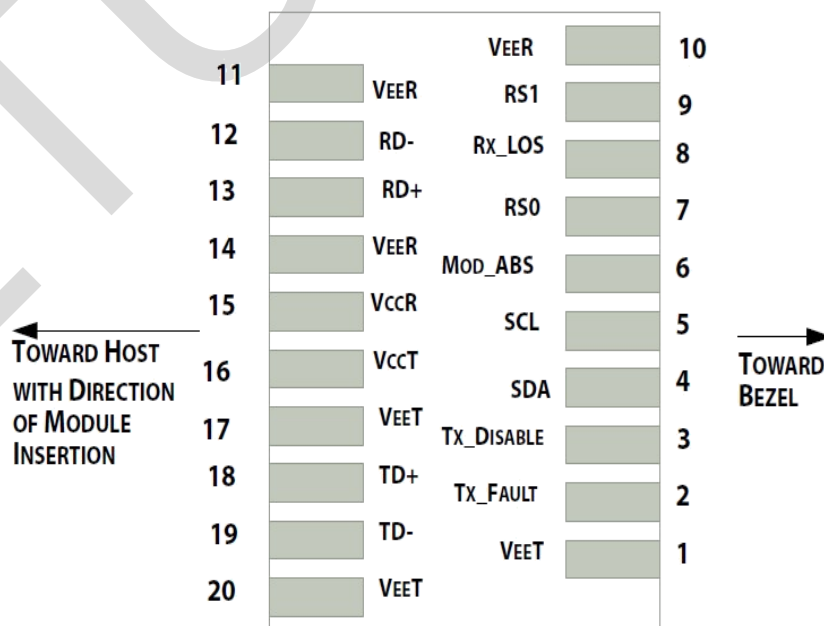
**Notes:**

1. Measure at 2<sup>7</sup>-1 NRZ PRBS pattern
1. Measured with Light source 1490nm (1550nm), ER=9dB; BER =<10<sup>-12</sup> @PRBS=2<sup>7</sup>-1 NRZ.
2. When LOS de-asserted, the RX data+/- output is signal output.

**Digital Diagnostics**

Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 85	±3	°C	Internal
Voltage	0 to Vcc	±3%	V	Internal
Tx Bias Current	0 to 100	±10%	mA	Internal
Tx Output Power	0 to 5	±3	dB	Internal
Rx Input Power	-30 to -3	±3	dB	Internal

**Pin Diagram**



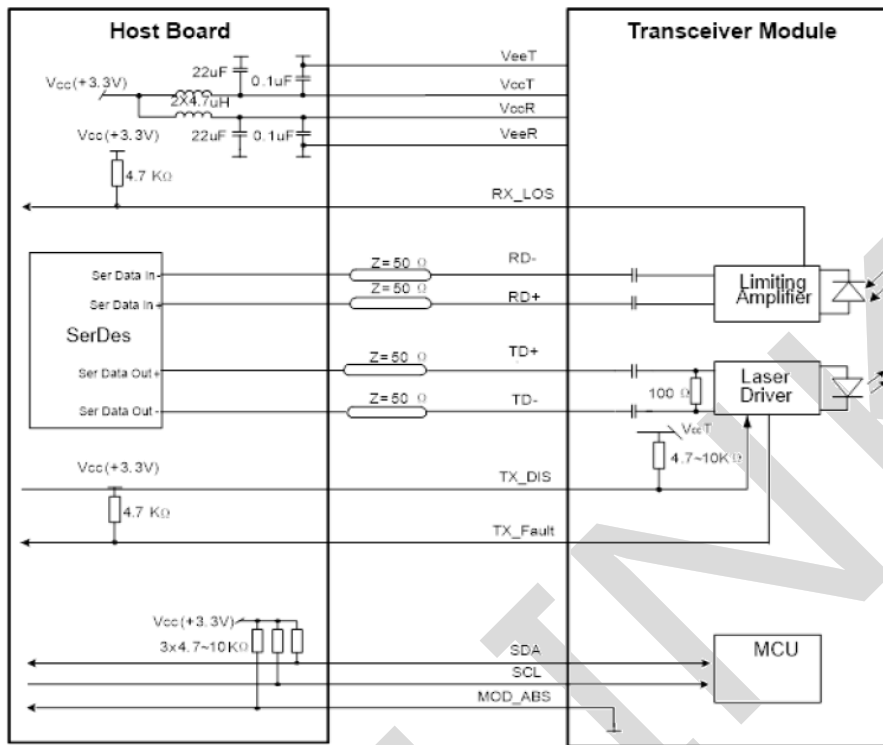
## Pin Definitions

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	

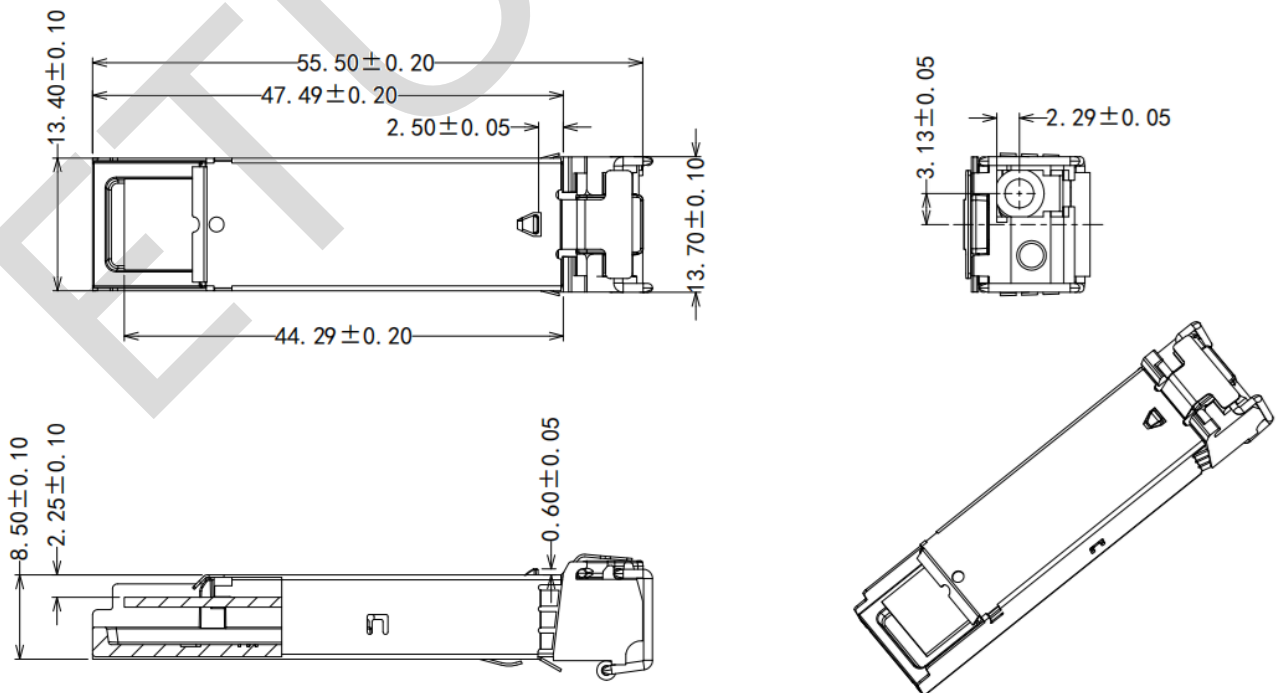
### Notes:

- When high, this output indicates a laser fault of some kind. Low indicates normal operation. And should be pulled up with a 4.7 – 10K $\Omega$  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 – 10K $\Omega$  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 – 10K $\Omega$  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 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$  (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 100 $\Omega$  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	October 11, 2019	Product upgrades
3.0	Sep 02, 2024	Format change

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