

## EB23(32)X-60D(I)

10Gb/s SFP+ BIDI 60km DDM Transceiver

### PRODUCT FEATURES

- Support data rate up to 11.3Gb/s
- Hot-Pluggable SFP Footprint and Single LC Connector
- Up to 60km reach for G.652 SMF
- 1270nm DFB Transmitter and 1330 APD receiver for EB23X-60D(I)
- 1330nm DFB Transmitter and 1270 APD receiver for EB32X-60D(I)
- Temperature Range:
  - Commercial: -0°C ~70°C
  - Industrial: -40°C ~85°C
- Power consumption:
  - Commercial: 1W
  - Industrial: 1.2W
- Compliant with SFP-8431
- Compliant with SFP-8432
- Compliant with SFP-8472
- Compliant with IEEE802.3ae
- RoHS 6 compliance
- Complies with EU Directive 2015/863/EU



### APPLICATIONS

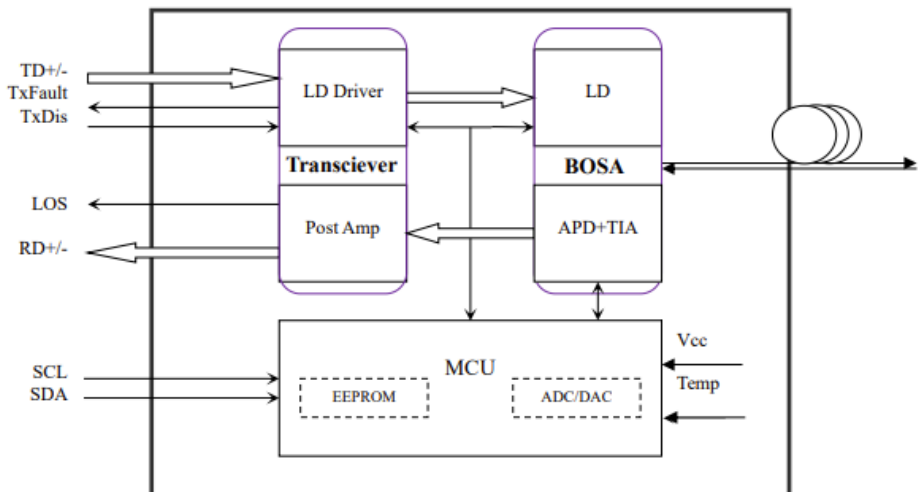
- 10GBASE-LR
- OTU2/2e
- Other Optical Links

## DESCRIPTIONS

The EB23(32)X-60D(I) series single mode transceiver is small form factor pluggable module for duplex optical data communications such as 10GBASE-LR defined by IEEE 802.3. The EB23(32)X-60D(I) module is designed for single mode fiber and operates at a nominal wavelength of 1270nm or 1330nm; the transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

The SFP+ 60km 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	Latch Color
EB23X-60D	10.3125Gbps	DFB	SMF	60km	LC	0~70°C	Y	Gray
EB32X-60D	10.3125Gbps	DFB	SMF	60km	LC	0~70°C	Y	Green
EB23X-60DI	10.3125Gbps	DFB	SMF	60km	LC	-40~85°C	Y	Gray
EB32X-60DI	10.3125Gbps	DFB	SMF	60km	LC	-40~85°C	Y	Green

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T <sub>stg</sub>	-40		+85	°C	
Case Operating	T <sub>o</sub>	0		70	°C	

Temperature(Commercial)						
Case Operating Temperature (Industrial)	T <sub>o</sub>	-40		85	°C	
Relative Humidity - Storage	R <sub>HS</sub>	5		95	%	
Relative Humidity - Operating	R <sub>HO</sub>	5		85	%	
DC Supply Voltage	V <sub>CC</sub>	0		3.6	V	

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Case Operating Temperature	T <sub>op</sub>	0	-	70	°C	Commercial
		-40		85		Industrial
Power Supply Voltage	V <sub>CC</sub>	3.13	3.3	3.47	V	
Transmission Distance	TD	-	-	60	km	Over SMF

## Electrical Characteristics

High-Speed Signal: Compliant to CEI-11G-SR

Low-Speed Signal: Compliant to SFF-8431

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes	
Supply Voltage	V <sub>CC</sub>	3.135		3.465	V		
Supply Current	I <sub>CC</sub>			300	mA	Commercial	
				360		Industrial	
Power Consumption	P			1	W	Commercial	
				1.2		Industrial	
<b>Transmitter (Module Input)</b>							
Differential Input Resistance	R <sub>Rdin</sub>	80	100	120	Ω		
Input Differential Voltage	R <sub>Vdiff</sub>	110	-	1050	mVpp		
Tx_Disable	Normal Operation	V <sub>IL</sub>	-0.3	-	0.8	V	
	Laser Disable	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.3	V	
<b>Receiver (Module Output)</b>							
Differential Resistance	T <sub>Rd</sub>	80	100	120	Ohm		
Output Differential Voltage	T <sub>Vdiff</sub>	360	-	770	mVpp		
Differential Termination Resistance Mismatch	T <sub>Rdm</sub>	-	-	5	%		
Rx_Ios	Normal Operation	V <sub>OL</sub>	-0.3	-	0.4	V	
	Loss Signal	V <sub>OH</sub>	2		V <sub>CC</sub> HOST	V	

## Optical and Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						

Average Output Power	POUT	0		5	dBm	1
Average Output Power(Laser Off)	POFF			-30	dBm	
Wavelength	$\lambda$	1260	1270	1280	nm	EB23X-60D(I)
		1320	1330	1340		EB32X-60D(I)
Spectrum Bandwidth @ -20dB	$\Delta\lambda$			1	nm	
Side mode suppression ratio(SMSR)	SMSR	30			dB	
Extinction ratio	ER	3.5			dB	
RIN <sub>20</sub> OMA	RIN			-128	dB/Hz	
Optical return loss tolerance	ORLT	20			dB	
<b>Receiver</b>						
Wavelength	$\lambda$	1320	1330	1340	nm	EB23X-60D(I)
		1260	1270	1280		EB32X-60D(I)
Received Sensitivity	P <sub>IN</sub>			-22	dBm	BER<1x10 <sup>-12</sup>
Optical Power Overload	P <sub>IN</sub> (SAT)	-6			dBm	
Receiver Reflectance	RFL			-12	dB	
Rx_LOS of Signal Assert	P <sub>A</sub>	-30			dBm	
Rx_LOS of Signal De-assert	P <sub>D</sub>			-23	dBm	
Rx_LOS of Signal Hysteresis	PH <sub>y</sub>	0.5		5	dB	
Optical Return Loss Tolerance	ORLT	20			dB	

Notes:

- The optical power is launched into SMF.

## Digital Diagnostics

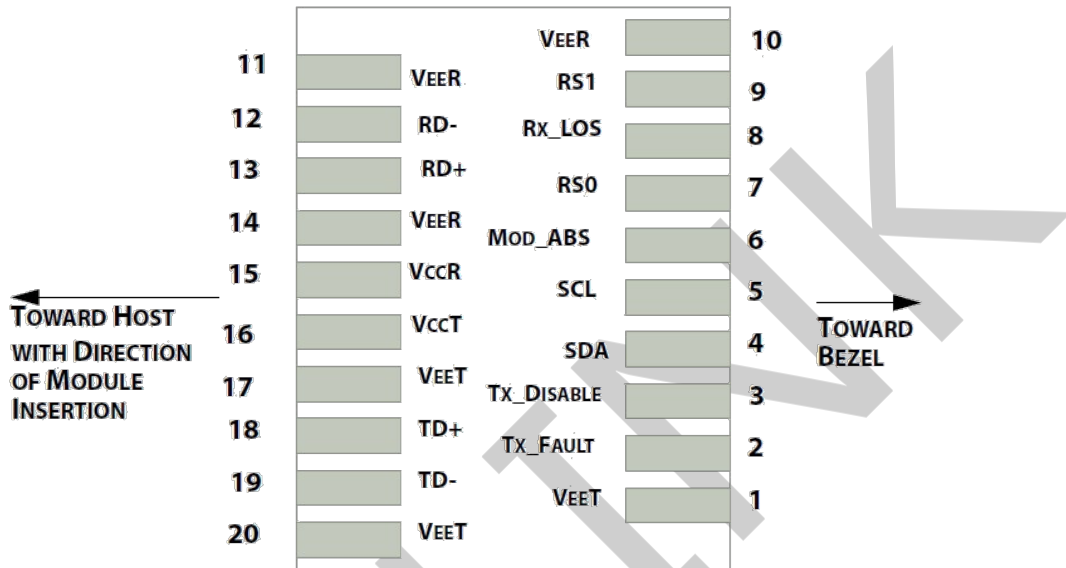
Parameter	Range	Accuracy	Unit	Calibration
Temperature	-40 to 85	±3	°C	Internal
Voltage	0 to V <sub>CC</sub>	±3%	V	Internal
Tx Bias Current	0 to 100	±10%	mA	Internal
Tx Output Power	0 to 5	±3	dB	Internal
Rx Input Power	-20 to 0.5	±3	dB	Internal

## Communication Interface Timing Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
TX_Disable Assert Time	t <sub>off</sub>			100	us	
TX_Disable Negate Time	t <sub>on</sub>			2	ms	
Time to Initialize Include Reset of TX_FAULT	t <sub>int</sub>			300	ms	
TX_FAULT from Fault to Assertion	t <sub>fault</sub>			100	us	
TX_Disable Time to Start Reset	t <sub>reset</sub>	10			us	

Receiver Loss of Signal Assert Time	T <sub>A,RX_LOS</sub>			100	us	
Receiver Loss of Signal Deassert Time	T <sub>d,RX_LOS</sub>			100	us	
Rate-Select Chage Time	t <sub>ratesel</sub>			10	us	

## Pin Diagram



## Pin Definitions

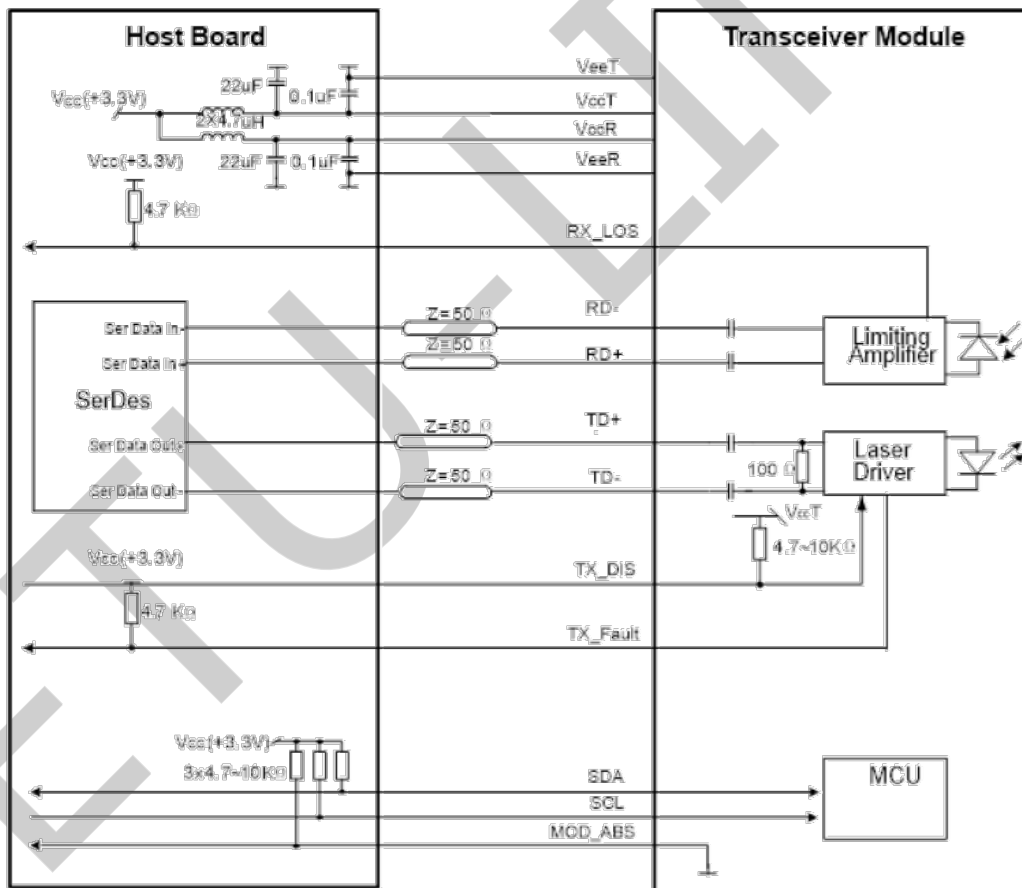
PIN #	Name	Function	Notes
1	VeeT	Module transmitter ground	1
2	Tx Fault	Module transmitter fault	2
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3
4	SDL	2 wire serial interface data input/output (SDA)	4
5	SCL	2 wire serial interface clock input (SCL)	4
6	MOD-ABS	Module Absent, 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

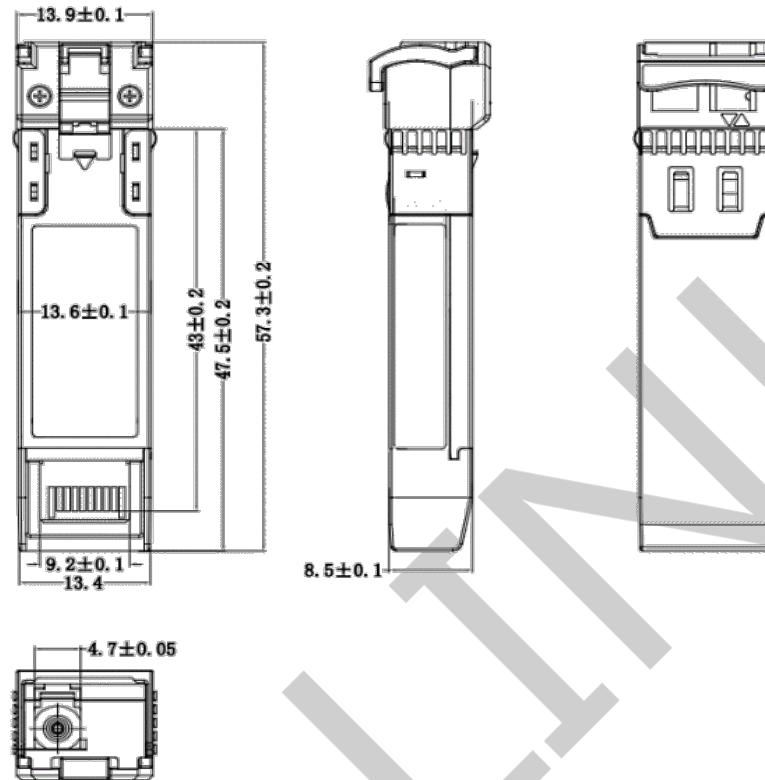
Notes:

1. Circuit ground is internally isolated from chassis ground
2. 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.
3. Laser output disabled on Tx DIS >2.0V or open, enabled on Tx DIS <0.8V.
4. 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.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. 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.

Recommended Interface Circuit



## Mechanical Diagram



## Revision History

Version No.	Date	Description
1.0	Sep 17, 2016	Preliminary datasheet
2.0	July 8, 2021	Product upgrades
3.0	Aug 27, 2024	Format change

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