

## Product Features

- ✧ Supports 9.95Gb/s to 10.3Gb/s data rates
- ✧ Simplex LC Connector Bi-Directional SFP+ Optical Transceiver
- ✧ Digital Diagnostic SFF-8472 Compliant
- ✧ Hot pluggable
- ✧ 1270(1330) nm DFB Laser transmitter, 1330(1270) nm APD receiver
- ✧ Up to 60km on 9/125um SMF
- ✧ Compliant with IEEE 802.3ae 10GBASE-LR and 10GBASE-LW
- ✧ SFP+ MSA SFF-8431 Compliant
- ✧ Operating case temperature: 0 to 70 °C



## Applications

- ✧ 10GBASE-ER at 10.3125Gbps
- ✧ 10GBASE-EW at 9.953Gbps
- ✧ Other optical links

## Ordering Information

Part Number	Output Power	Rec. Sens	Data Rate	Wavelength	Distance
FH-SPB231TCDL60	1 ~ 6 db	-20 db	10.3125G	TX1270/RX1330nm	60km
FH-SPB321TCDL60	1 ~ 6 db	-20 db	10.3125G	TX1330/RX1270nm	60km

## General Descriptions

FH-SPB23(32)1TCDL60 Series single mode transceiver is small form factor pluggable module for duplex optical data communications such as 10GBASE-ER/EW defined by IEEE 802.3ae. It is with the SFP+ 20-pin connector to allow hot plug capability. Module is designed for single mode fiber and operates at a nominal wavelength of 1270nm The transmitter section uses a multiple quantum well DFB, which is class 1 laser compliant according to International Safety Standard IEC-60825.

The receiver section consists of a APD photodiode integrated with a TIA

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Supply Voltage	V <sub>cc</sub>	-0.5	4.0	V	
Storage Temperature		-40	85	°C	
Relative Humidity			85	%	

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the module

## General Operating Characteristics

Parameter		Symbol	Min.	Typ	Max.	Unit	Note
Data Rate	Ethernet			10.3125		Gb/s	
Supply Voltage		V <sub>cc</sub>	3.13	3.3	3.47	V	
		V <sub>cc</sub>				V	
Supply Current		I <sub>cc5</sub>				mA	
		I <sub>cc3</sub>			400	mA	
Operating Case Temp.		T <sub>c</sub>	0		70	°C	

## Electrical Input/Output Characteristics

Parameter		Symbol	Min.	Typ	Max.	Unit	Note
Transmitter							
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	
Receiver							
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		

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 Characteristics

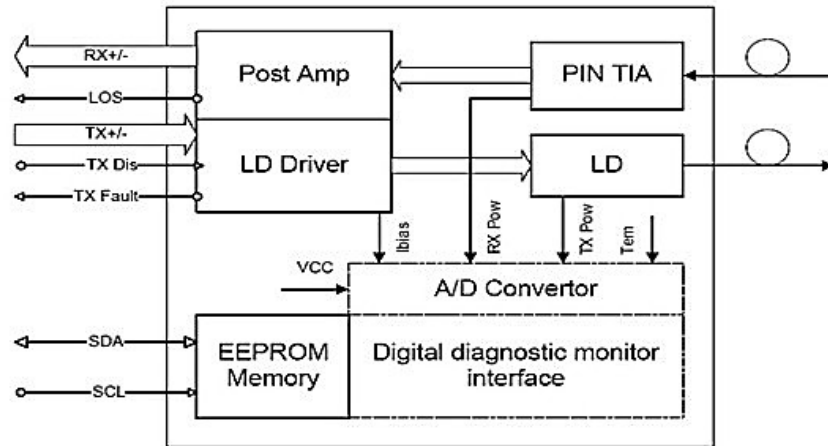
Parameter	Symbol	Min.	Typ	Max.	Unit	Note
<b>Transmitter</b>						
Operating Wavelength		1260 (1320)	1270 (1330)	1280 (1340)	nm	
Ave. output power (Enabled)	Po	1		6	dBm	1
Extinction Ratio	ER	5			dB	1
RMS spectral width	$\Delta\lambda$			1	nm	
Rise/Fall time (20%~80%)	Tr/Tf			50	ps	2
Optical modulation amplitude	OMA	-6.2			dBm	
Dispersion penalty				1	dB	
Output Optical Eye	Compliant with IEEE 0802.3ae					
<b>Receiver</b>						
Operating Wavelength		1320 (1260)	1330 (1270)	1340 (1280)	nm	
Sensitivity	Psen			-20	dBm	3
Min. overload	Pimax	-7			dBm	
LOS Assert	Pa	-32			dBm	
LOS De-assert	Pd			-25	dBm	
LOS Hysteresis	Pd-Pa	0.5		4	dB	

Note 1) Measured at 10.3125b/s with PRBS 2<sup>31</sup> – 1 NRZ test pattern.

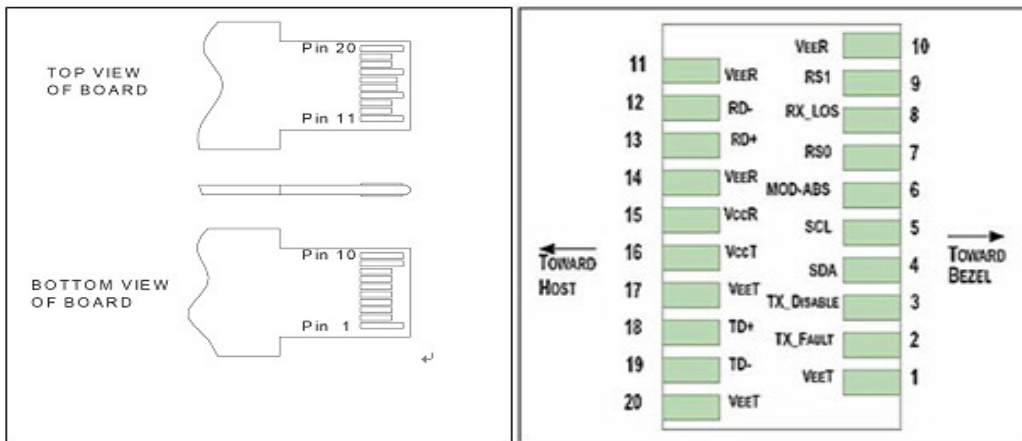
Note 2) 20%~80%

Note 3) Under the ER worst case, measured at 10.3125 Gb/s with PRBS 2<sup>31</sup> - 1 NRZ test pattern for BER < 1x10<sup>-12</sup>

## Functional Diagram



## Pin Definitions And Functions



Pin	Symbol	Name/Description
1	VEET [1]	Transmitter Ground
2	Tx_FAULT [2]	Transmitter Fault
3	Tx_DIS [3]	Transmitter Disable. Laser output disabled on high or open
4	SDA [2]	2-wire Serial Interface Data Line
5	SCL [2]	2-wire Serial Interface Clock Line
6	MOD_ABS [4]	Module Absent. Grounded within the module
7	RS0 [5]	Rate Select 0

8	RX_LOS [2]	Loss of Signal indication. Logic 0 indicates normal operation
9	RS1 [5]	Rate Select 1
10	VEER [1]	Receiver Ground
11	VEER [1]	Receiver Ground
12	RD-	Receiver Inverted DATA out. AC Coupled
13	RD+	Receiver DATA out. AC Coupled
14	VEER [1]	Receiver Ground
15	VCCR	Receiver Power Supply
16	VCCT	Transmitter Power Supply
17	VEET [1]	Transmitter Ground
18	TD+	Transmitter DATA in. AC Coupled
19	TD-	Transmitter Inverted DATA in. AC Coupled
20	VEET [1]	Transmitter Ground

**Notes:** [1] Module circuit ground is isolated from module chassis ground within the module.

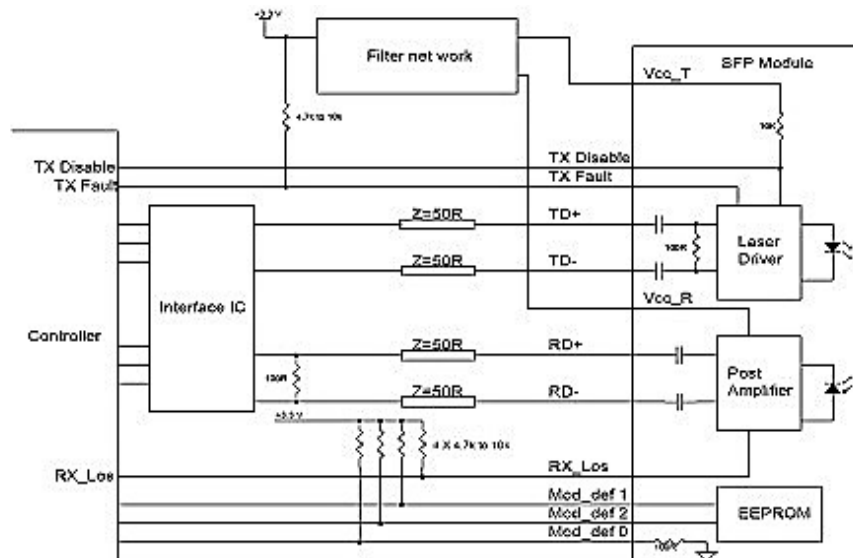
[2].should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

[3]Tx\_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VccT inside the module.

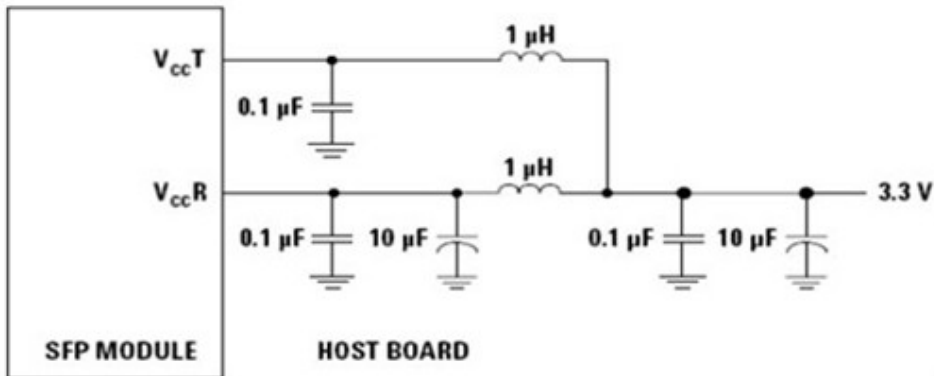
[4]Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7 kΩ to 10 kΩ.Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.

[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.

## Typical Interface Circuit

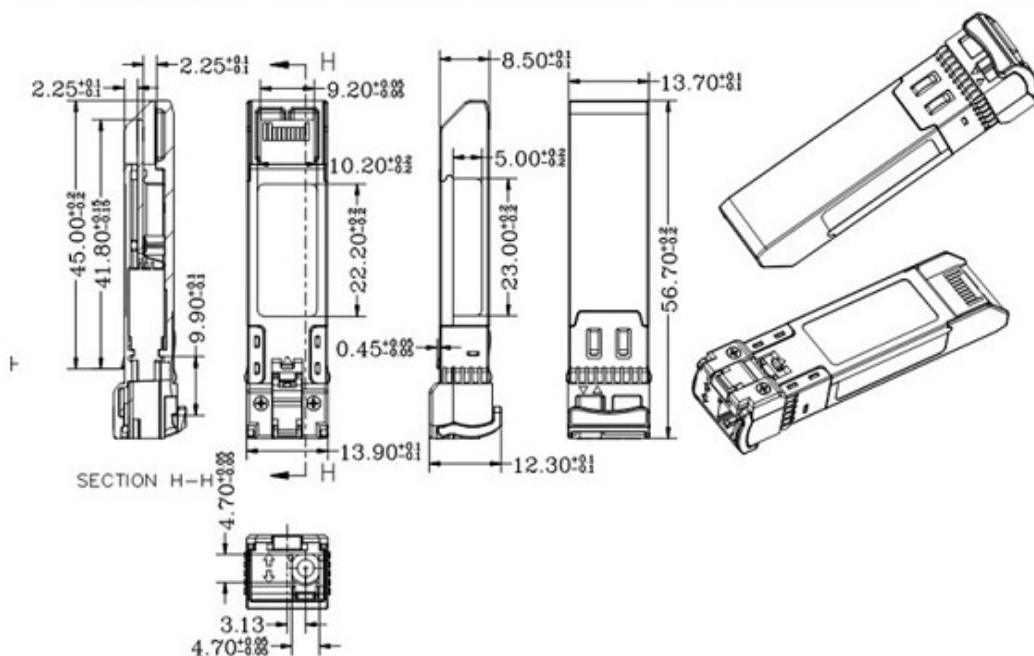


## Recommended power supply filter



Note: Inductors with DC resistance of less than  $1\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value

## Package Dimensions





FH-SPB23(32)1TCDL60  
10G SFP+ WDM 1270/1330 60KM DDMI LC

## For More Information

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