10GBASE BIDI SFP+ 40KM Optical Transceiver with DDM	IP-HFLK40B23(32)X

PRODUCT FEATURES

- Up to 11.3Gbps Data Links
- 1270nm DFB laser transmitter and APD/TIA receiver for IP-HFLK40B23
- 1330nm DFB laser transmitter and APD/TIA receiver for IP-HFLK40B32
- Up to 40km on 9/125μm SMF
- Hot-pluggable SFP footprint
- BIDI LC/UPC type pluggable optical interface
- Low power dissipation
- Metal enclosure, for lower EMI
- ROHS compliant and lead-free
- Support Digital Diagnostic Monitor interface
- Single +3.3V power supply
- Compliant with SFF-8472
- Case operating temperature

  Commercial: 0°C to +70°C
  Industrial: -40°C to +85°C

APPLICATIONS

- 10GBASE-LR/LW 10G Ethernet

COMPLIANCE

- Compliant with SFF-8472 and SFP+ MSA
- Compliant to SFF-8431 and SFF-8432
- Compliant with IEEE 802.3ae
- RoHS Compliant

Ordering information

Part Number	Data Rate (Gb/s)	Media	Wavelength(nm)	Operating distance(km)	Temperature(℃)
IP-HFLK40B23C	10.3125	SMF	1270T/1330R	40	0~70
IP-HFLK40B32C	10.3125	SMF	1330T/1270R	40	0~70
IP-HFLK40B23I	10.3125	SMF	1270T/1330R	40	-40~85
IP-HFLK40B32I	10.3125	SMF	1330T/1270R	40	-40~85

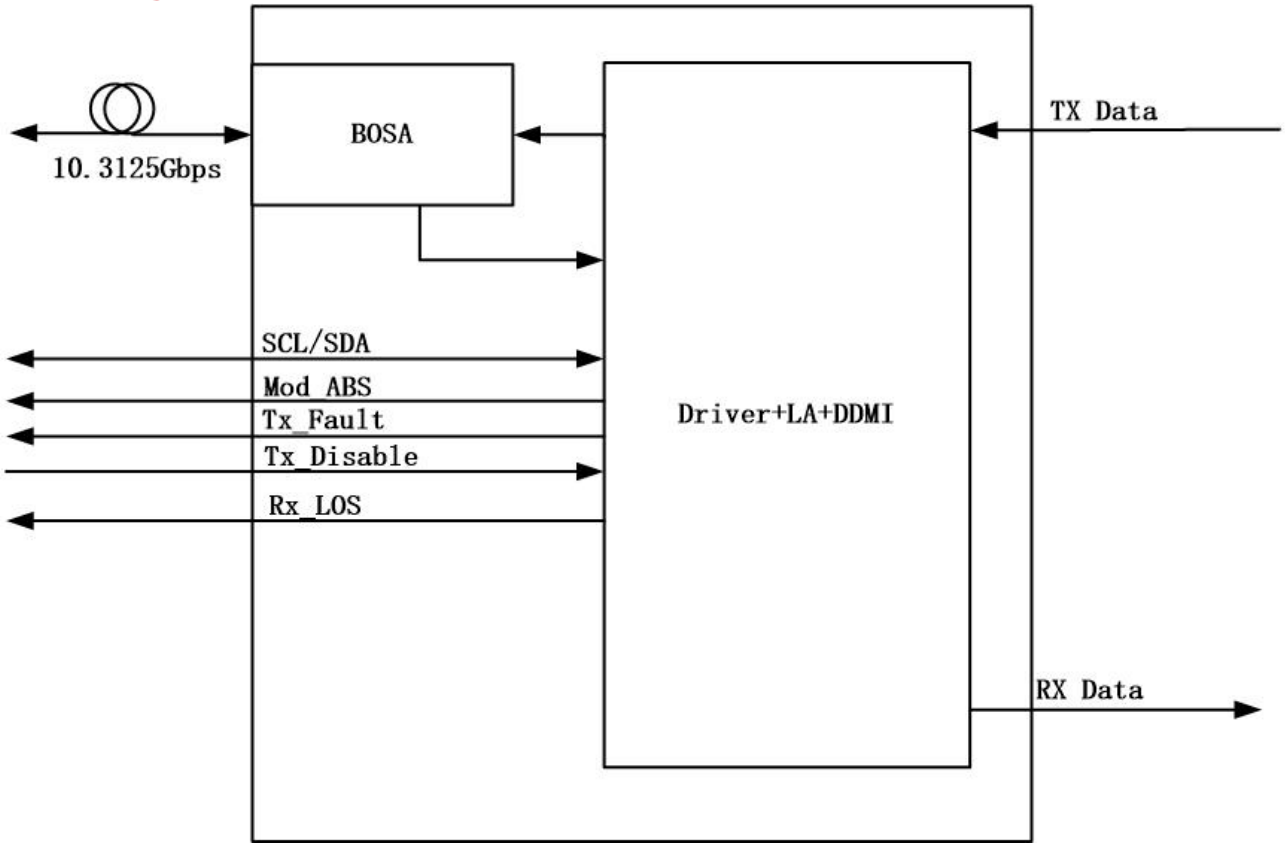
PRODUCT DESCRIPTION

IP-HFLK40B23(32) SFP+ transceivers are compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA). The transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the 1270nm DFB laser (the 1330nm DFB laser) and the APD/TIA. The module data link up to 40km in 9/125um Single-mode fiber.

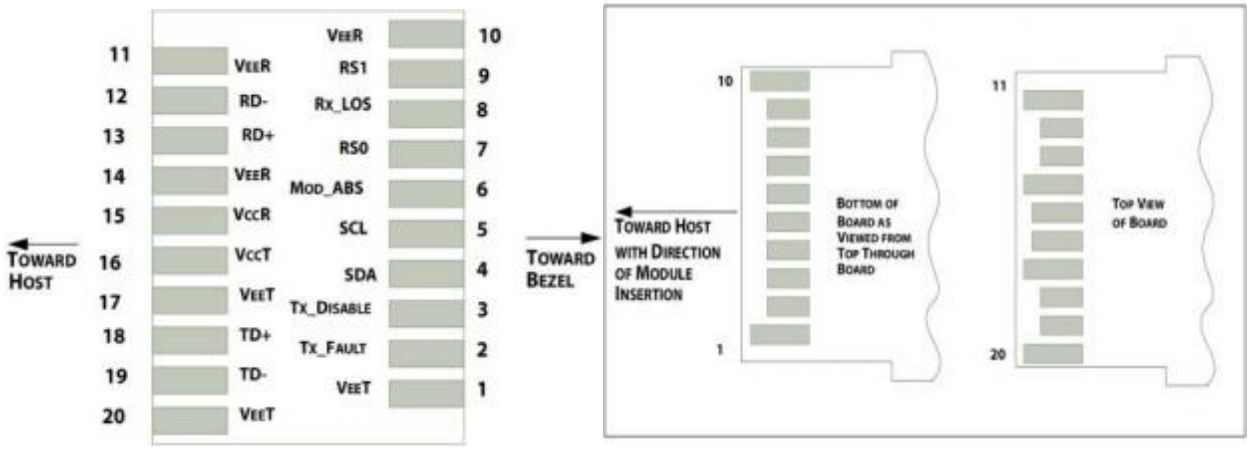
This transceiver meets SFP+ industry standard package utilizing an integral LC-Bi-directional optical interface connector. An enhanced Digital Diagnostic Monitoring Interface compliant with SFF-8472 has been incorporated into the transceiver. It allows real time access to the transceiver operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage by reading a built-in memory with I^2C interface.

The optical output can be disabled by a LVTTL logic high-level input of Tx Disable, and the system also can disable the module via I^2C. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver or the link status with partner. The system can also get the LOS (or Link)/Disable/Fault information via I^2C register access.

1.Block Diagram



2. Pin Assignment



Host PCB SFP+ pad assignment top view and Names.

3. Pin Descriptions

Pin	Symbol	Name/Description	Ref.
1	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T_{FAULT}	Transmitter Fault.	2
3	TDIS	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	No connection required	
8	LOS	Loss of Signal indication. Logic “0” indicates normal operation.	5
9	RS1	No connection required	
10	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
11	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out.AC Coupled	
13	RD+	Receiver Non-inverted DATA out.AC Coupled	
14	V_{EER}	Receiver Ground (Common with Transmitter Ground)	1
15	V_{CCR}	Receiver Power Supply	
16	V_{CCT}	Transmitter Power Supply	
17	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V_{EET}	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TX Fault is an open drain output, which should be pulled up with 4.7K ~ 10KΩ resistor on the host board. Pull up voltage between 2.0V to VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V. When sensing an improper power level in the laser driver, the SFP sets this signal high and turns off the laser. TX-FAULT can be reset with the TX-DISABLE line. The signal is in LVTTL level.
3. TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with 4.7K ~ 10KΩ resistor. Its states are: Low (0 ~ 0.8V): Transmitter on; (>0.8, < 2.0V): Undefined; High (2.0V to VccT/R+0.3V): Transmitter Disabled; Open: Transmitter Disabled. The TX-

DISABLE signal is high (LVTTL logic “1”) to turn off the laser output. The laser will turn on when TX-DISABLE is low (LVTTL logic “0”).

4. Should be pulled up with 4.7K ~ 10KΩ on host board to a voltage between 2.0V to VccT/R+0.3V. MOD_ABS pull line low to indicate module is plugged in.

5. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with 4.7K ~ 10KΩresistor. Pull up voltage between 2.0V to VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

6. The RX-LOS is high (LVTTL logic “1”) when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in LVTTL level.

4. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Storage Temperature	T_S	-40		85	ºC	
Storage Ambient Humidity	H_A	0		85	%	
Power Supply Voltage	V_{CC}	-0.5		4	V	
Signal Input Voltage		-0.3		V_{cc}+0.3	V	
Receiver Damage Threshold		-1			dBm	

5. Recommended Operating Environment

Parameter	Symbol	Min	Typ	Max	Unit	Note
Data Rate	BR	-	10.3125	-	Gbps	
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	
Power Supply Current	Icc	-	-	450	mA	
Power Dissipation	PD	-	-	1.5	W	
Case Operating Temperature	Tc	-40	-	85	°C	IP-HFLK40B23(32)I
		0	-	70	°C	IP-HFLK40B23(32)C
Transmission Distance	TD	-	-	40	km	1

Note:

1. Measured with ITU-T G.652 SMF

6. Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	VCC	3.13	3.30	3.47	V	
Supply Current	ICC			450	mA	
Transmitter						
Input different impedance	Rin	90	100	110	Ω	1
Single ended data input swing	Vamp	150		425	mV	
Transmitter Disable Voltage	VDIS	2		VCC	V	
Transmitter Enable Voltage	VEN	0		0.8	V	
Receiver						

Output different impedance	R_{out}	90	100	110	Ω	1
Single ended data output swing	$V_{out, pp}$	150		425	mV	2
LOSAsserted	V_{LOSA}	2		VCCHOST	V	3
LOSDe-asserted	V_{LOSD}	0		0.8	V	3

Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Into100Ω differential termination.
3. Loss of Signal is LVTTL. Logic “0” indicates normal operation; logic “1” indicates no signal detected.

7. Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter						
TX Center Wavelength	λC	1260	1270	1280	nm	IP-HFLK40B23C(I)
		1320	1330	1340	nm	IP-HFLK40B32C(I)
Data Rate	BR	-	10.3125	-	Gbps	
Average Output Power	PO	0	-	5	dBm	
Optical Extinction Ratio	ER	3.5		-	dB	
Spectral Width	Δλ	-	-	1	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average Launch power of Tx OFF	Poff	-	-	-30	dBm	
Optical Eye Mask	Compliant with IEEE 802.3ae					
Receiver						
RX Center Wavelength	λC	1320	-	1340	nm	IP-HFLK40B23C(I)
		1260	-	1280	nm	IP-HFLK40B32C(I)
Data Rate	BR	-	10.3125	-	Gbps	
Receiver Sensitivity	Rsen	-	-	-20	dBm	1
Maximum Input Power(Overload)	Pmax	-6	-	-	dBm	1
LOS Assert	LOSA	-35	-	-	dBm	
LOS De-Assert	LOSD	-	-	- 21	dBm	
LOS Hysteresis	LOSH	0.5	-	5	dB	
Receiver Reflectance	RR	-	-	- 12	dB	

Notes:

1. Measured with ER=4dB, RPBS 2^31- 1 test pattern @ 10.3125Gbs BER=< $10^{-12.}$

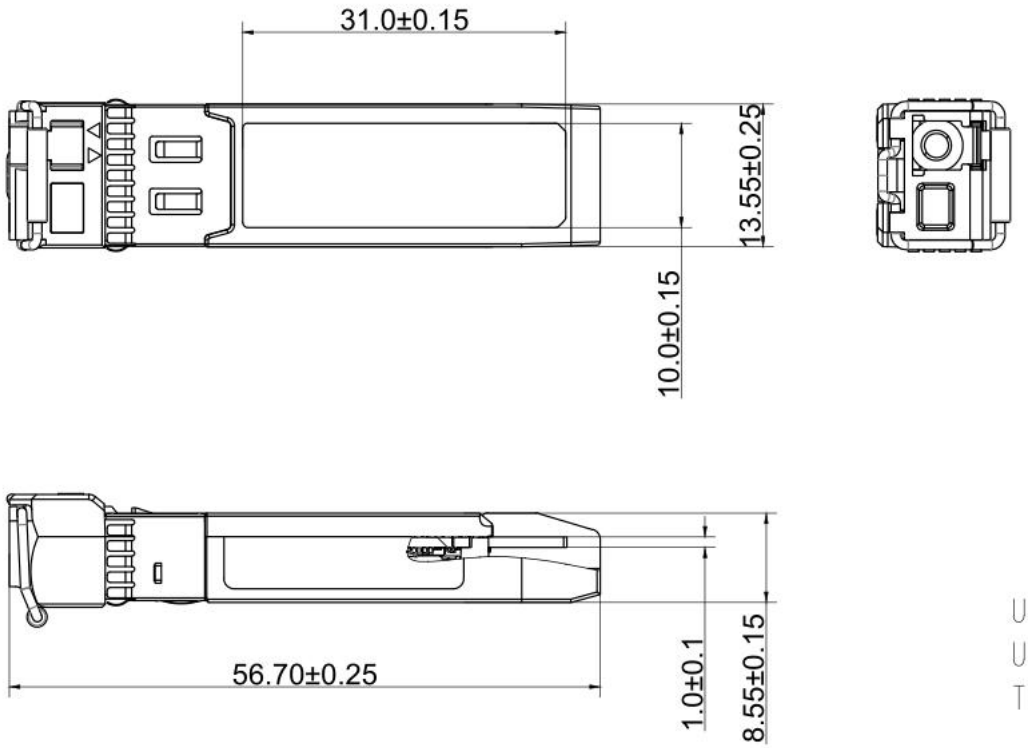
8. Digital Diagnostic Monitor Characteristics

Parameter	Accuracy	Unit
Case Temperature	±5	℃
Supply Voltage	±3%	V
Tx Bias Current	±10%	mA

Tx Optical Power	±3	dB
Rx Optical Power	±3	dB

9. Mechanical Dimensions

单位：mm



Unit:mm
Unspecified
Tolerance:±0.1mm

IP-HFLK40B23(32)X

10. Regulatory Compliance

Feature	Reference	Performance
EMC	EN61000-3	Compatible with standards
Electrostatic Discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, EC/EN 60825-2	Class 1 laser product
Component Recognition	IEC/EN 60950, L 60950	Compatible with standards
RoHS 2.0	2011/65/EU	Compatible with standards

11. Contact Information

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12. Revision History

Version No.	Date	Description
1.0	Jun. 4, 2024	Preliminary datasheet
1.1	Jun.30, 2024	Update contact information.
1.2	Sep.4, 2024	Add part number IP-HFLK40B23(32)I and corresponding contact Information, updata the Product Features, Applications, Compliance, Product Description, Block Diagram, Absolute Maximum Ratings, Recommended Operating Environment, Electrical Characteristics, Optical Characteristics, the Digital Diagnostic Monitor Characteristics and the Mechanical Dimensions.