

## NT-SFP-1G-BX-60

1.25Gb/s Bi-Directional SFP Transceiver, SMF, Tx1310/Rx1550nm or Tx1550/Rx1310nm, 60km

### Features

- Supports 1.25Gbps/1.0625Gbps bit rates
- Bi-Directional LC connector
- Hot pluggable SFP footprint
- 1310nm DFB laser and 1550nm PIN photo detector
- 1550nm DFB laser and 1310nm PIN photo detector
- Applicable for 60km SMF connection
- Low power consumption, < 0.8W
- Compliant with SFP MSA and SFF-8472
- Very low EMI and excellent ESD protection
- ROHS compliant and Lead Free
- Operating Temperature: Standard 0~70°C, Industrial -40~85°C
- Optional Digital Diagnostic Monitor Interface



### Applications

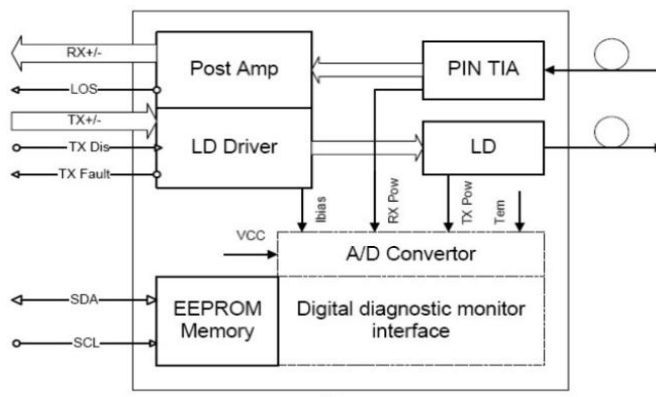
- 1G Fiber Channel, Switch to Switch Interface
- Gigabit Ethernet, Switched Backplane Applications
- Broadband aggregation and wireless infrastructure
- Router/Server Interface
- Other Optical networking

### Description

Netiks NT-SFP-1G-BX-60 family are high performance, cost effective SFP BIDI modules supporting dual data-rate of 1.25Gbps/1.0625Gbps and 60km transmission distance with SMF. The transceiver consists of three sections: a FP/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.

There are two versions of the series 1G SFP BIDI optical transceiver modules for different applications. The Standard grade (0~70°C) is for commonly commercial application, the Industrial grade (-40~85°C) is made with robust and reliable components to meet the needs of Industrial Ethernet application under harsh environmental conditions. Industrial optical transceivers have an "IND" suffix in the PN.

### Functional Diagram



## Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Maximum Supply Voltage	V <sub>cc</sub>	-0.5	4.0	V	
Storage Temperature	T <sub>s</sub>	-40	85	°C	
Operating Humidity	RH	5	85	%	

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	V <sub>cc</sub>	3.13	3.3	3.47	V	
Power Supply Current	I <sub>cc</sub>			220	mA	
Case Operating Temperature	T <sub>c</sub>	0		70	°C	Standard
		-10		85	°C	Extended
		-40		85	°C	Industrial
Data Rate			1.25		Gbps	Gigabit Ethernet
			1.06		Gbps	Fiber Channel
Transmission Distance				60	km	9/125μm SMF

## Optical Characteristics

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
Transmitter						
Operating Wavelength	$\lambda$	1270	1310	1360	nm	NT-SFP-1G-BX-60-U
		1510	1550	1570		NT-SFP-1G-BX-60-D
Ave. output power (Enabled)	P <sub>AVE</sub>	-9		-3	dBm	1
Extinction Ratio	ER	9			dB	1
Side-Mode Suppression Ratio	SMSR	30			dB	
RMS spectral width	$\Delta\lambda$			1	nm	1310nm DFB
RMS spectral width				1	nm	1550nm DFB
Rise/Fall time (20%~80%)	Tr/Tf			0.26	ns	2
Dispersion penalty	TDP			3.9	dB	
Output Optical Eye	Compliant with IEEE802.3 z (class 1 Laser safety)					
Receiver						
Operating Wavelength	$\lambda$	1510	1550	1570	nm	NT-SFP-1G-BX-60-U
		1270	1310	1360		NT-SFP-1G-BX-60-D
Receiver Sensitivity	P <sub>SEN1</sub>			-24	dBm	3
Overload	P <sub>AVE</sub>	-3			dBm	3
LOS Assert	Pa	-35			dBm	
LOS De-assert	Pd			-25	dBm	
LOS Hysteresis	Pd-Pa	0.5			dB	

**Note :**

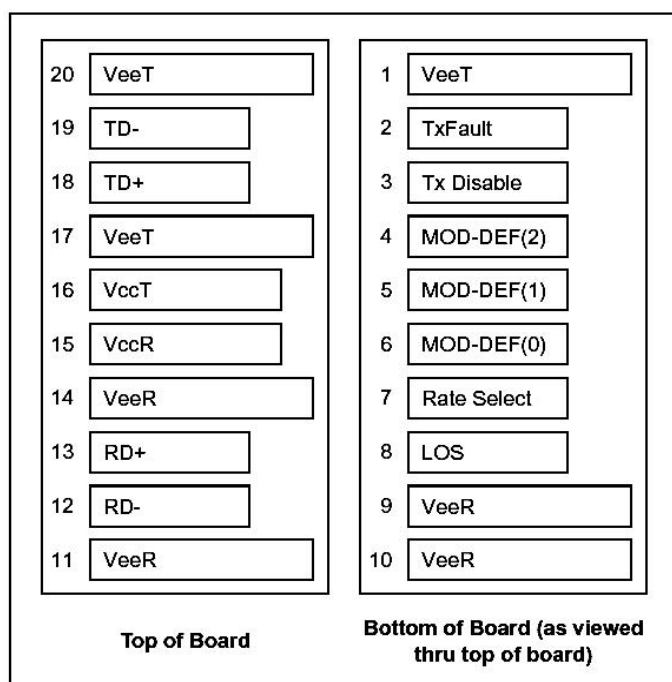
1. Measured at 1.25Gbps with PRBS 2<sup>7</sup>– 1 NRZ test pattern.
2. Unfiltered, measured with a PRBS 2<sup>7</sup>-1 test pattern @1.25Gbps
3. Measured at 1250 Mb/s with PRBS 2<sup>7</sup>– 1 NRZ test pattern for BER < 1x10<sup>-12</sup>

**Electrical Characteristics (T<sub>OP(C)</sub> = 0 to 70°C, T<sub>OP(I)</sub> = -40 to 85°C, V<sub>CC</sub> = 3.13 to 3.47 V)**

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
<b>Transmitter</b>						
Differential data input swing	V <sub>IN,PP</sub>	120		820	mVpp	1
Tx Disable Input-High	V <sub>IH</sub>	2.0		V <sub>CC</sub> +0.3	V	
Tx Disable Input-Low	V <sub>IL</sub>	0		0.8	V	
Tx Fault Output-High	V <sub>OH</sub>	2.0		V <sub>CC</sub> +0.3	V	2
Tx Fault Output-Low	V <sub>OL</sub>	0		0.8	V	2
Input differential impedance	R <sub>in</sub>		100		Ω	
<b>Receiver</b>						
Differential data output swing	V <sub>out,pp</sub>	340	650	800	mVpp	3
Rx LOS Output-High	V <sub>ROH</sub>	2.0		V <sub>CC</sub> +0.3	V	2
Rx LOS Output-Low	V <sub>ROL</sub>	0		0.8	V	2

**Notes:**

1. TD+/- are internally AC coupled with 100Ω differential termination inside the module.
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 V<sub>CC</sub>+0.3V.
3. RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES.

**Pin Definitions**


## Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	Model present indication	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inverse Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

### Notes:

- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:  
Low (0 to 0.8V): Transmitter on                      (>0.8V, < 2.0V): Undefined  
High (2.0 to 3.465V): 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~10kΩ resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>.  
Mod-Def 0 is 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
- LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- RD-/+: These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω

differential termination inside the module.

## Digital Diagnostic Functions

Netiks 1.25Gb/s SFP BiDi optical transceiver support the 2-wire serial communication protocol as defined in the SFP MSA. It is very closely related to the E2PROM 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, Netiks 1.25Gb/s SFP BiDi optical transceiver provide an optional 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 E2PROM 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 module. 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 this 1.25G SFP BiDi optical transceiver is internally calibrated by default.

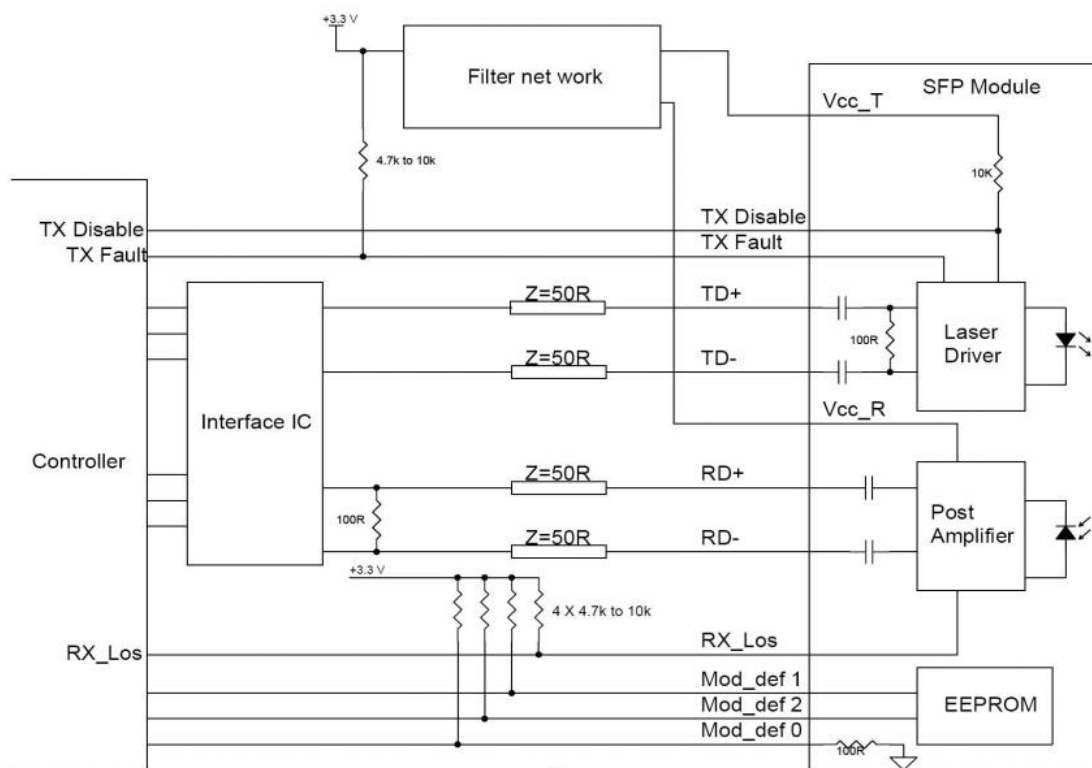
The 1G BiDi SFP transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

Parameter	Symbol	Units	Min.	Max.	Accuracy	Note
Transceiver temperature	D <sub>Temp-E</sub>	°C	-45	+90	±5°C	1
Transceiver supply voltage	D <sub>Voltage</sub>	V	2.8	4.0	±3%	
Transmitter bias current	D <sub>Bias</sub>	mA	2	80	±10%	2
Transmitter output power	D <sub>Tx-Power</sub>	dBm	-8	0	±3dB	
Receiver average input power	D <sub>Rx-Power</sub>	dBm	-25	0	±3dB	

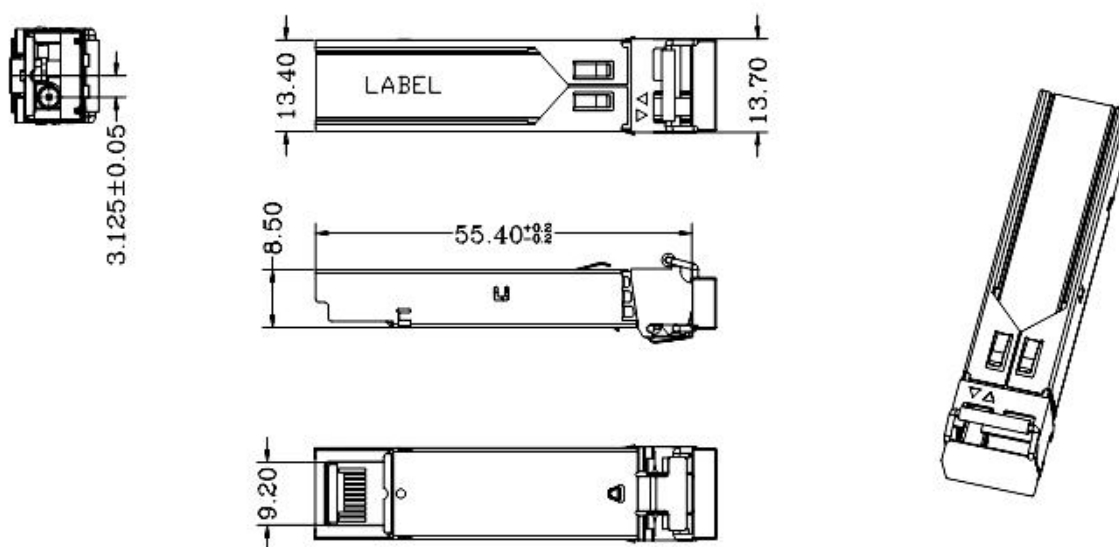
### Notes:

1. When Operating temp.=0~70 °C, the range will be min=-5,Max=+75
2. The accuracy of the Tx bias current is 10% of the actual current from the laser driver to the laser
3. Internal/ External Calibration compatible.

## Typical Interface Circuit



## Mechanical Dimensions



Units in mm

Tolerance without indication is  $\pm 0.1\text{mm}$

## Ordering information

Part number	Description
NT-SFP-1G-BX-60-U	1.25G BiDi SFP Transceiver, SMF, Tx:1310nm/Rx:1550nm, 60km, LC, DDM, 0°C~+70°C
NT-SFP-1G-BX-60-D	1.25G BiDi SFP Transceiver, SMF, Tx:1550nm/Rx:1310nm, 60km, LC, DDM, 0°C~+70°C
NT-SFP-1G-BX-60-U-IND	1.25G BiDi SFP Industrial Transceiver, SMF, Tx:1310nm/Rx:1550nm, 60km, LC, DDM, -40°C~+85°C
NT-SFP-1G-BX-60-D-IND	1.25G BiDi SFP Industrial Transceiver, SMF, Tx:1550nm/Rx:1310nm, 60km, LC, DDM, -40°C~+85°C

## Warnings

### *Process plug*

The transceiver optics is supplied with a dust cover. This plug protects the transceiver optics during standard manufacturing processes by preventing contamination from air borne particles. It is recommended that the dust cover remain in the transceiver whenever an optical fiber connector is not inserted.

### *Handling Precautions*

The transceiver optics is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

### *Laser Safety*

The transceiver optics is a Class 1 laser product per international standard IEC 60825-1. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Standards

Netiks optical transceivers comply with the requirements set out in the Council Directive relating to Electromagnetic Compatibility Directive on (2014/30/EU). For the evaluation regarding the EMC, the following standards were applied:

**EN 55032 (2012+AC: 2013)**

**EN 61000-3-2 (2014)**

**EN 61000-3-3 (2013)**

**EN 55024 (2010)**

For more product information, visit us on the web at [www.netiks.rs](http://www.netiks.rs)



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