

# 10Gb/s SFP+ BIDI TX-1490nm/RX-1550nm 80km Optical Transceiver

## Features

- Up to 11.1Gbps data rate
- BIDI LC/UPC type pluggable optical interface
- 1490nm EML laser and APD receiver
- 2-wire interface with integrated Digital Diagnostic monitoring
- Hot- pluggable
- Up to 80km on 9/125µm SMF
- RoHS-10 compliant and lead-free
- Single +3.3V power supply
- Meet ESD requirements, resist 8KV direct contact voltage
- Maximum power consumption 1.5W
- Compliant with SFF-8472
- Case operating temperature: 0 ~ +70°C

## Applications

- Switch to Switch interface
- 10GBASE-ZR/ZW
- 10G Ethernet
- Router/Server interface
- Other optical transmission systems

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## Compliance

- SFP MSA
- SFF-8472
- IEEE802.3z
- RoHS

## Description

The SFP-10G-U80-45 series single-mode transceivers are designed for use in 10-Gigabit Ethernet links up to 80km over single mode fiber. The module consists of EML Laser, APD and Pre-amplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The SFP-10G-U80-45 transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and 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 EEPROM 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.

## Absolute Maximum Ratings

Table1-Absolute Maximum Ratings					
Parameter	Symbols	Min.	Max.	Unit	Notes
Storage Temperature	T <sub>s</sub>	-40	85	°C	
Power Supply Voltage	V <sub>cc</sub>	-0.3	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	TH <sub>d</sub>	0		dBm	

## Recommended Operating Conditions and Power Supply Requirements

Table2-Recommended Operating Conditions and Power Supply Requirements						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T <sub>OP</sub>	0		+70	°C	
Power Supply Voltage	V <sub>cc</sub>	3.135	3.3	3.465	V	
Data Rate			10.3125		Gb/s	
Control Input Voltage High		2		V <sub>cc</sub>	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			80	km	9/125um

## Electrical Characteristic

Tested under recommended operating conditions, unless otherwise noted

Table3-Electrical Characteristic						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Power Consumption	P			1.8	W	

Supply Current	I <sub>cc</sub>			520	mA	
<b>Transmitter</b>						
Single-ended Input Voltage Tolerance	V <sub>cc</sub>	-0.3		4.0	V	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing	V <sub>in,pp</sub>	180		1200	mVpp	
Differential Input Impedance	Z <sub>in</sub>	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	V <sub>dis</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	
Transmit Enable Voltage	V <sub>en</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	2
<b>Receiver</b>						
Differential Output Voltage Swing	V <sub>out,pp</sub>	300		850	mVpp	
Differential Output Impedance	Z <sub>out</sub>	90	100	110	Ohm	3
Data output rise/fall time	T <sub>r</sub> /T <sub>f</sub>	28			ps	4
LOS Assert Voltage	V <sub>losH</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	5
LOS De-assert Voltage	V <sub>losL</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

**Notes:**

[1] Connected directly to TX data input pins. AC coupled thereafter.

[2] Or open circuit.

[3] Input 100 ohms differential termination.

[4] These are unfiltered 20-80% values.

[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 Characteristic

<b>Table4-Optical Characteristic</b>						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda_c$	1480	1490	1500	nm	
Optical Spectral Width	$\Delta \lambda$			0.3	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Power	P <sub>AVG</sub>	1		6	dBm	
Optical Extinction Ratio	ER	8.2			dB	
Average Launched Power(Laser Off)	P <sub>Off</sub>			-30	dBm	

Transmitter Eye Mask	Compliant with 802.3ae(class 1 laser safety)					
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	1540	1550	1560	nm	
Receiver Sensitivity (Average Power)	Sen.			-25	dBm	1
Input Saturation Power (overload)	Psat	-8			dBm	
LOS Assert	LOSA	-38			dBm	
LOS De-assert	LOSD			-26	dBm	
LOS Hysteresis	LOSH	0.5			dB	

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

**Notes:**

[1] Measured with Light source 1490nm @1550nm, ER=8.2dB; BER =  $<10^{-12}$  @10.3125Gbps, PRBS=2<sup>31</sup>-1 NRZ.

### Digital diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode.

Parameter	Symbols	Min.	Max.	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

## Pin Description

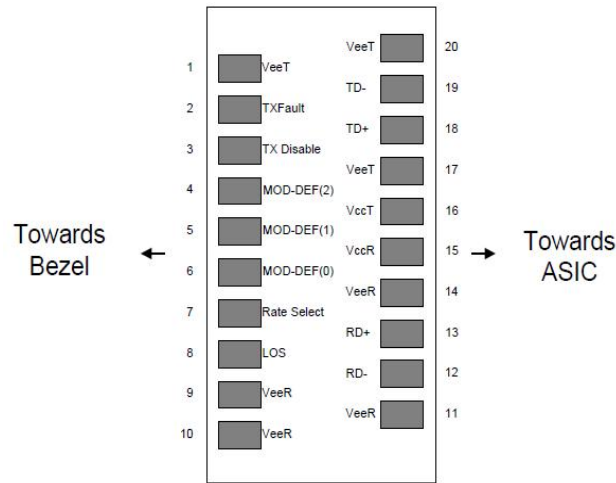


Figure1 Pin view

## Pin Function Definitions

**Table6-Pin Function Definitions**

PIN	Name	Description	Notes
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.Open Drain. Logic "0" indicates normal operation.	
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	2
4	MOD_DEF(2)	Module Definition 2. Data line for Serial ID.	3
5	MOD_DEF(1)	Module Definition 1. Clock line for Serial ID.	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module.	3
7	Rate Select	No connection required.	4
8	LOS	Loss of Signal indication. Open Drain. Logic "0" indicates normal operation.	5
9	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out(CML). AC Coupled	
13	RD+	Receiver Non-inverted DATA out(CML). AC Coupled	
14	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	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 <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

**Notes:**

- [1] Circuit ground is internally isolated from chassis ground.
- [2] Laser output disabled on TDIS>2.0V or open, enabled on TDIS<0.8V.
- [3] Should be pulled up with 4.7k-10k ohms on host board to a voltage between 2.0V and 3.6V.MOD\_DEF (0) pulls line low to indicate module is plugged in.
- [4] This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates).If implemented, the input will be internally pulled down with>30kΩ resistor. The input states are:
  - 1) Low (0 - 0.8V): Reduced Bandwidth
  - 2) (>0.8, <2.0V): Undefined
  - 3) High (2.0-3.465V): Full Bandwidth
  - 4) Open: Reduced Bandwidth
- [5] LOS is open collector output should be pulled up with 4.7k-10k ohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

**Mechanical Dimensions**

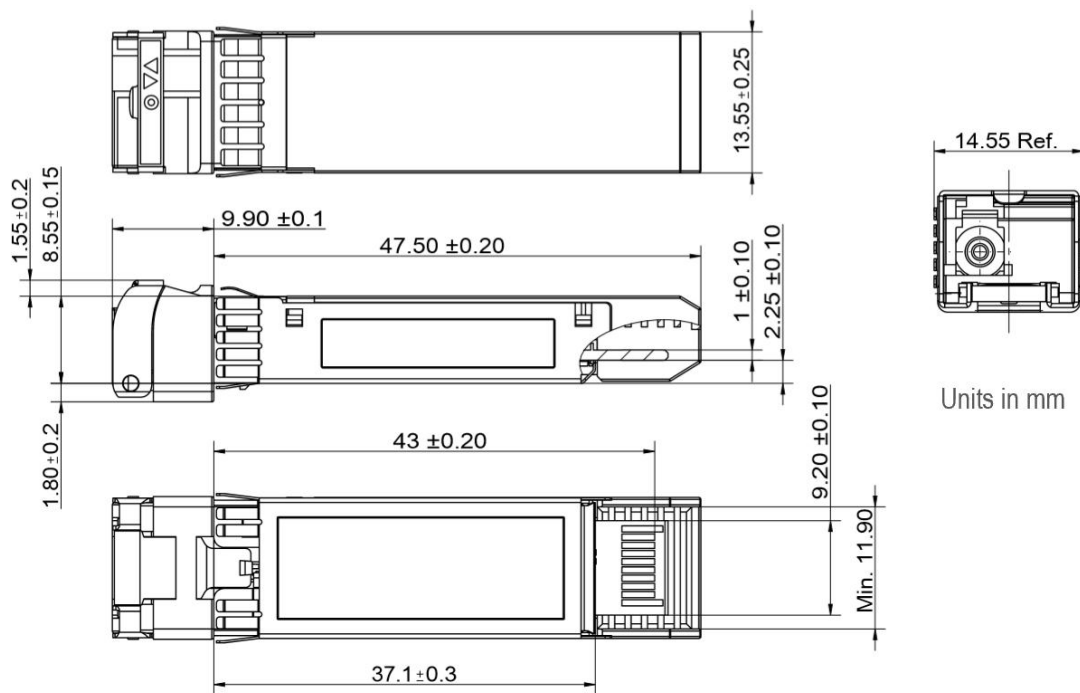


Figure2 Mechanical Outline

**Precautions**

- a. This device 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.
- b. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Further Information:

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## Disclaimer

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2. Nothing herein should be construed as constituting an additional warranty.

3. NADDOD assumes no responsibility for the use or reliability of equipment or software not provided by NADDOD.

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