

# 10Gb/s SFP+ BIDI TX-1270nm/RX-1330nm10km Optical Transceiver

## Features

- Up to 11.1Gbps data rate
- BIDI LC/UPC type pluggable optical interface
- 1270nm DFB laser and PIN receiver
- 2-wire interface with integrated Digital Diagnostic monitoring
- Hot- pluggable
- Up to 10km on 9/125µm SMF
- RoHS-10 compliant and lead-free
- Support Digital Diagnostic Monitoring interface
- Single +3.3V power supply
- Maximum power consumption 1.5W
- Compliant with SFF-8472
- Case operating temperature: 0 ~ +70

## Compliance

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

# **Applications**

- Switch to Switch interface
- 10GBASE-LR/LW
- 10G Ethernet
- Router/Server interface
- Other optical transmission systems



#### Description

The SFP-10G-U10-23 series single-mode transceivers are designed for use in 10-Gigabit Ethernet links up to 10km over single mode fiber. The module consists of CWDM DFB Laser, PIN and Preamplifier 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-U10-23 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	Ts	-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>	5		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	٥C		
Power Supply Voltage	Vcc	3.135	3.3	3.465	V		
Data Rate			10.3125		Gb/s		
Control Input Voltage High		2		Vcc	V		
Control Input Voltage Low		0		0.8	V		
Link Distance (SMF)	D			10	km	9/125um	

#### **Electrical Characteristic**

Table3-Electrical Characteristic						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
Power Consumption	Ρ			1.5	W	
Supply Current	lcc			450	mA	

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	Transmitter					
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	Vin,pp	180		700	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	Vdis	Vcc-1.3		Vcc	V	
Transmit Enable Voltage	Ven	Vee		Vee+0.8	V	2
		R	eceiver			
Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	3
Data output rise/fall time	Tr/Tf	28			ps	4
LOS Assert Voltage	VlosH	Vcc-1.3		Vcc	V	5
LOS De-assert Voltage	VlosL	Vee		Vee+0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

Tested under recommended operating conditions, unless otherwise noted

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 LVTTL. 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**

Table4-Optical Characteristic						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
		Trans	mitter			
Center Wavelength	$\lambda$ <sub>C</sub>	1260	1270	1280	nm	
Optical Spectral Width	$\Delta \lambda$			3.5	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Power	P <sub>AVG</sub>	-6		-1	dBm	
Optical Extinction Ratio	ER	3.5			dB	
Transmitter OFF Output Power	POff			-30	dBm	



Transmitter Eye Mask	Compliant with 802.3ae(class 1 laser safety)					
		Recei	ver			
Center Wavelength	$\lambda$ <sub>C</sub>	1320	1330	1340	nm	
Receiver Sensitivity (Average Power)	Sen.			-14.4	dBm	1
Input Saturation Power (overload)	Psat	0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-17	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 1270nm @1330nm, ER=3.5dB; BER =<10^-12 @10.3125Gbps, PRBS=2^31-1 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.

Table5-Digital Diagnostic Functions							
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**



### **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	VEER	Receiver Ground (Common with Transmitter Ground)	1				
11	VEER	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	VEER	Receiver Ground (Common with Transmitter Ground)	1				
15	V <sub>CCR</sub>	Receiver Power Supply					
16	Vcct	Transmitter Power Supply					
17	VEET	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 Fi ber Channel 1x and 2x Rates). If implemented, the input will be internally pulled down with> $30k\Omega$  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 Outline



Figure2 Mechanical Outline



# Further Information:

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