

# 25Gb/s SFP28 BIDI TX-1330nm/RX-1270nm 20km Optical Transceiver

## Features

- Up to 25.78Gb/s data rate
- BIDI LC/UPC type pluggable optical interface
- 1330nm DFB laser and PIN receiver
- 2-wire interface with integrated Digital Diagnostic monitoring
- Hot- pluggable
- Up to 20km on 9/125µm SMF
- Low power dissipation
- Metal enclosure, for lower EMI
- RoHS-10 compliant and lead-free
- Single +3.3V power supply
- Maximum power consumption 1.75W
- Case operating temperature: 0 ~ +70°C

## Applications

- Switch to Switch interface
- 25GBASE-LR/LW
- 25G Ethernet
- Router/Server interface
- Other optical transmission systems

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## Compliance

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

## Description

The SFP-25G-D20-32 series single-mode transceivers are designed for use in 25-Gigabit Ethernet links up to 20km over single mode fiber. The module consists of CWDM DFB Laser, PIN 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 transmitter converts 25Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. An open collector compatible Transmit Disable (Tx\_Dis) is provided. Logic "1" or no connection on this pin will disable the laser from transmitting. Logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx\_Fault) is provided. TX\_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX\_Fault output contact is an open drain/collector and shall be pulled up to the Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ. TX\_Disable is a module input contact. When TX\_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor.

The receiver converts 25Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx\_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx\_LOS contact is an open drain/collector output and shall be pulled up to Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx\_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

## 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>	3		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			25.78		Gb/s	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			20	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			1.75	W	
Supply Current	Icc			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		700	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>						
Single-ended Input Voltage Tolerance	V <sub>CC</sub>	-0.3		4.0	V	
Differential Output Voltage Swing	V <sub>out,pp</sub>	300		900	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>	9.5			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

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.

## Optical Characteristic

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

Table4-Optical Characteristic						
Parameter	Symbols	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda_c$	1320	1330	1340	nm	
Optical Spectral Width	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	20			dB	
Average Optical Power	$P_{AVG}$	-7		2	dBm	1
Optical Extinction Ratio	ER	3.5			dB	
Transmitter OFF Output Power	$P_{OFF}$			-30	dBm	
Transmitter and Dispersion Penalty	TDP			2.7	dB	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter Eye Mask	Compliant with 802.3ae(class 1 laser safety)					
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	1260	1270	1280	nm	
Receiver Sensitivity (OMA)	Sen.			-11.5	dBm	2
Stressed Receiver Sensitivity (OMA)				-8.5	dBm	2
Input Saturation Power (overload)	$P_{SAT}$	0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-14	dBm	
Damage Threshold	$TH_d$	3			dBm	
LOS Hysteresis	LOSH	0.5			dB	

Notes:

- [1] Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- [2] Measured with Light source 1310nm, ER=3.5dB; BER =  $<0^{-12}$  @ 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.

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

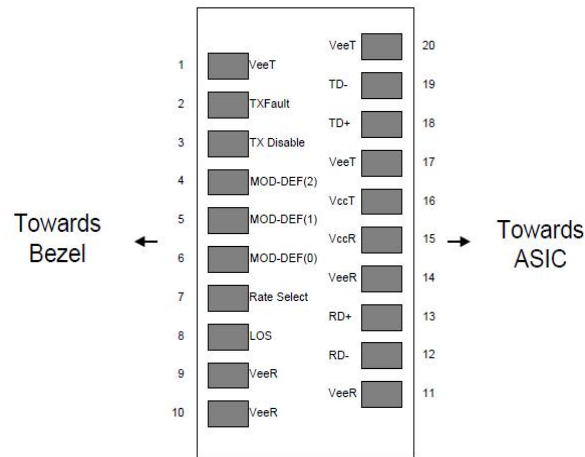


Figure1 Pin view

## 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

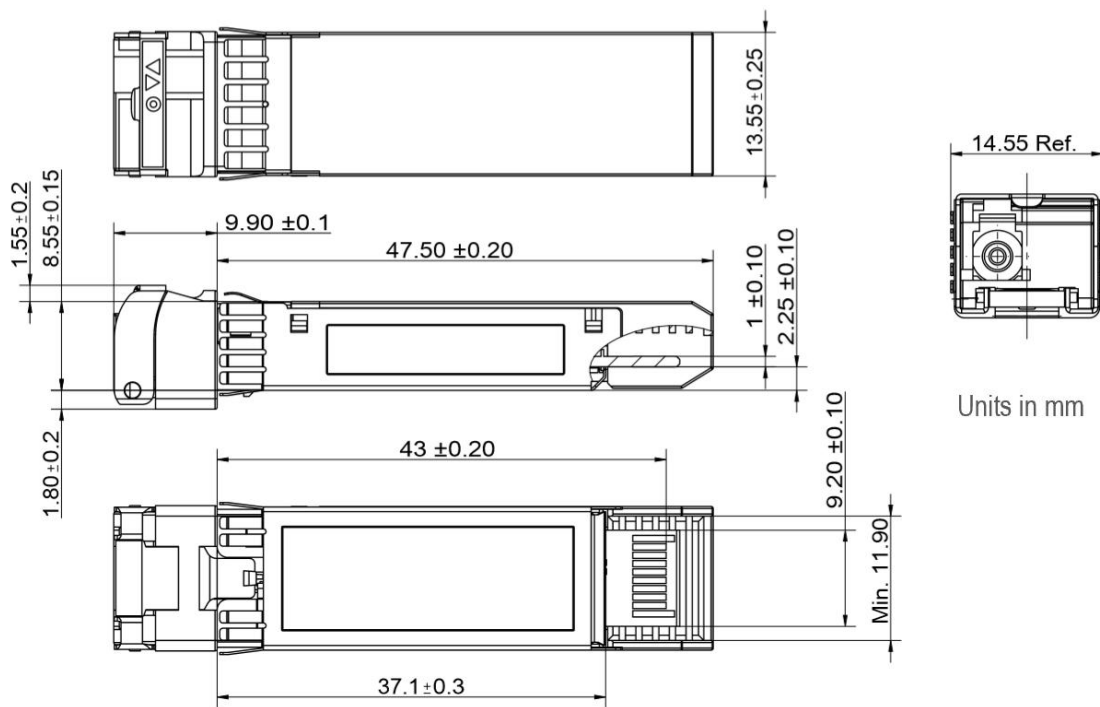


Figure2 Mechanical Outline

## Further Information:

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

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