

# 10Gb/s SFP+ 1310nm 20km Optical Transceiver

(TN3SFP10GSMLC)



## DESCRIPTION

The TN3SFP10GSMLC Enhanced Small Form Factor Pluggable SFP+ transceivers are designed for use in 10G Ethernet links up to 20km over SingleMode fiber. They are compliant with SFF-8431, SFF-8432 and IEEE802.3ae 10GBASE-LR/LW. The transceiver designs are optimized for high performance and cost effective to supply customers the best solutions for telecommunication.

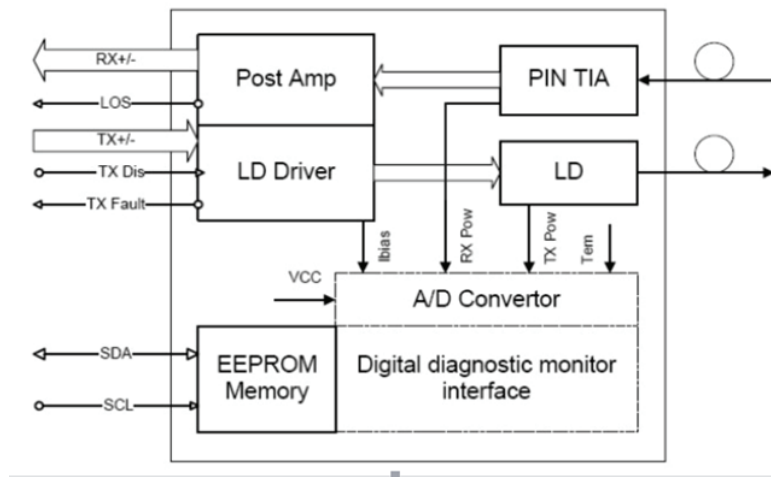
## PRODUCT FEATURE

- Duplex LC connector
- Low power consumption<1W
- Hot pluggable SFP+ footprint
- Operating temperature: 0~+70°C
- Support 9.95 to 10.5Gb/s bit rates
- Digital Diagnostic Monitor Interface
- Applicable for 20km SMF connection
- Electrical interface compliant to SFF-8431
- Uncooled 1310nm DFB transmitter, PIN photo-detector
- Optical interface compliant to IEEE 802.3ae 10GBASE-LR

## APPLICATION

Other optical links  
10G Fiber Channel  
10GBASE-LR/LW at 10.3125Gbps

## DIMENSION



## ABSOLUTE MAXIMUM RATING

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.5	4.0	V
Storage Temperature	TS	-40	85	°C
Relative Humidity	RH	0	85	%

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the transceiver.

## GENERAL OPERATING CHARACTERISTIC

Parameter	Symbol	Min.	Typ	Max.	Unit
Data Rate		9.953	10.3125	10.518	Gb/s
Supply Voltage	Vcc	3.13	3.3	3.47	V
Supply Current	Icc5			285	mA
Operating Case Temp.	Tc	0		70	°C

## ELECTRICAL CHARACTERISTIC

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
<b>Transmitter</b>						
Differential data input swing	VINPP	180		700	mVpp	1
Transmit Disable Voltage	VD	VCC-0.8		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+0.8		
Input differential impedance	Rin		100		Ω	
<b>Receiver</b>						
Differential data output swing	Vout, pp	300		850	mVpp	2
Output rise time and fall time	Tr, Tf	28			Ps	3
LOS asserted	VLOS_F	VCC-0.8		Vcc	V	4
LOS de-asserted	VLOS_N	Vee		Vee+0.8	V	4

Note:

1. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
2. Into 100Ω differential termination.
3. 20-80%. Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's sequence in the PRBS 9 is an acceptable alternative.
4. LOS is an open collector output. Should be pulled up with 4.7kΩ–10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1.

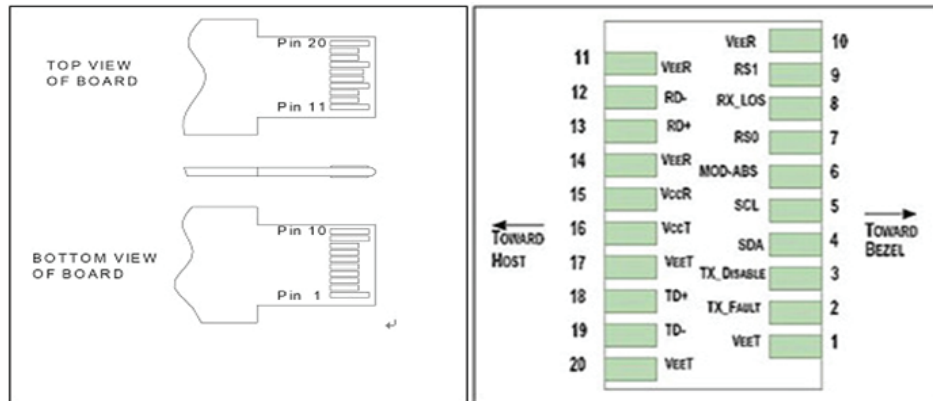
## OPTICAL CHARACTERISTIC

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
Transmitter						
Operating Wavelength	λ	1260	1310	1355	nm	
Ave. output power (Enabled)	PAVE	-5		1	dBm	1
Side-Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	ER	4	4.5		dB	
RMS spectral width	Δλ			1	nm	
Rise/Fall time (20%~80%)	Tr/Tf			50	ps	2
Dispersion penalty	TDP			3.2	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Output Optical Eye	Compliant with IEEE 0802.3ae					
Receiver						
Operating Wavelength		1270		1600	nm	
Receiver Sensitivity (ER=4.5)	PSEN1			-13.6	dBm	3
Receiver Sensitivity (ER=6)	PSEN2			-14.4	dBm	3
Overload	PAVE			0.5	dBm	
LOS Assert	Pa	-30			dBm	
LOS De-assert	Pd			-18	dBm	
LOS Hysteresis	Pd-Pa	0.5			dB	

## Notes:

1. Average power figures are informative only, per IEEE 802.3ae.
2. Valid between 1260 and 1355 nm. BER<10<sup>-12</sup>, 231 – 1 PRBS.
3. Valid between 1260 and 1355 nm. Per IEEE 802.3ae.

## PIN DEFINITION AND FUNCTION



Pin	Symbol	Name/Description
1	VEET [1]	Transmitter Ground
2	Tx_FAULT [2]	Transmitter Fault
3	Tx_DIS [3]	Transmitter Disable. Laser output disabled on high or open
4	SDA [2]	2-wire Serial Interface Data Line
5	SCL [2]	2-wire Serial Interface Clock Line
6	MOD_ABS [4]	Module Absent. Grounded within the module
7	RS0 [5]	Rate Select 0
8	RX_LOS [2]	Loss of Signal indication. Logic 0 indicates normal operation
9	RS1 [5]	Rate Select 1
10	VEER [1]	Receiver Ground
11	VEER [1]	Receiver Ground
12	RD-	Receiver Inverted DATA out. AC Coupled
13	RD+	Receiver DATA out. AC Coupled
14	VEER [1]	Receiver Ground
15	VCCR	Receiver Power Supply
16	VCCT	Transmitter Power Supply
17	VEET [1]	Transmitter Ground
18	TD+	Transmitter DATA in. AC Coupled
19	TD-	Transmitter Inverted DATA in. AC Coupled

#### Notes:

1. Module circuit ground is isolated from module chassis ground within the module.
2. Should be pulled up with 4.7k–10k ohms on host board to a voltage between 3.15V and 3.6V.
3. Tx\_Disable is an input contact with a 4.7kΩ-10kΩ pullup to VccT inside the module.
4. Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7kΩ-10kΩ. Mod\_ABS is asserted “High” when the SFP+ module is physically absent from a host slot.
5. RS0 and RS1 are module inputs and are pulled low to VeeT with >30kΩ resistors in the module.

## SERIAL INTERFACE FOR ID AND DDM

The TN3SFP10GSMLC transceiver support the 2-wire serial communication protocol as defined in the SFP+ MSA. The standard SFP+ serial ID provides access to identification information that describes the transceiver’s capabilities, standard interfaces, manufacturer, and other information. Additionally, This SFP+ transceivers provide an 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 EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X(A0h), so the originally monitoring interface makes use of the 8 bit address(A2h), so the originally defined serial ID memory map remains unchanged. The structure of the memory map is shown in Table1

2 wire address 1010000X (A0h)		2 wire address 1010001X (A2h)	
Address	Information	Address	Information
0~95	Serial ID Defined by SFP MSA (96 bytes)	0~55	Alarm and Warning Thresholds (56 bytes)
96~127	Vendor Specific (32 bytes)	56~95	Calibration Constants (40 bytes)
128~255	Reserved,SFF8079 (128 bytes)	96~119	Real Time Diagnostic Interface (24 bytes)
		120~127	Vender Specific (8 bytes)
		128~247	User Writable EEPROM (120 bytes)
		248~255	Vender Specific (8 bytes)

## DIGITAL DIAGNOSTIC SPECIFICATION

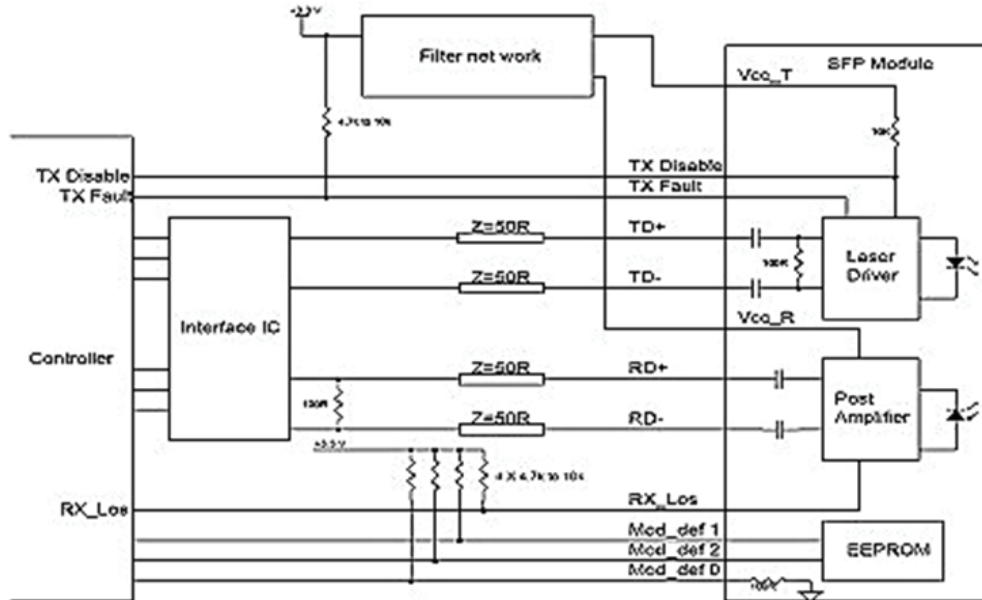
The TN3SFP10GSMLC transceivers can be used in host systems that require either internally or externally calibrated digital diagnostics.

Parameter	Symbol	Units	Min.	Max.	Accuracy	Note
Transceiver temperature	DTemp-E	°C	-5	+70	±5°C	1
Transceiver supply voltage	DVoltage	V	2.8	4.0	±3%	
Transmitter bias current	DBias	mA	0	80	±10%	2
Transmitter output power	DTx-Power	dBm	-8	+2	±2dB	
Receiver average input power	DRx-Power	dBm	-16	0	±2dB	

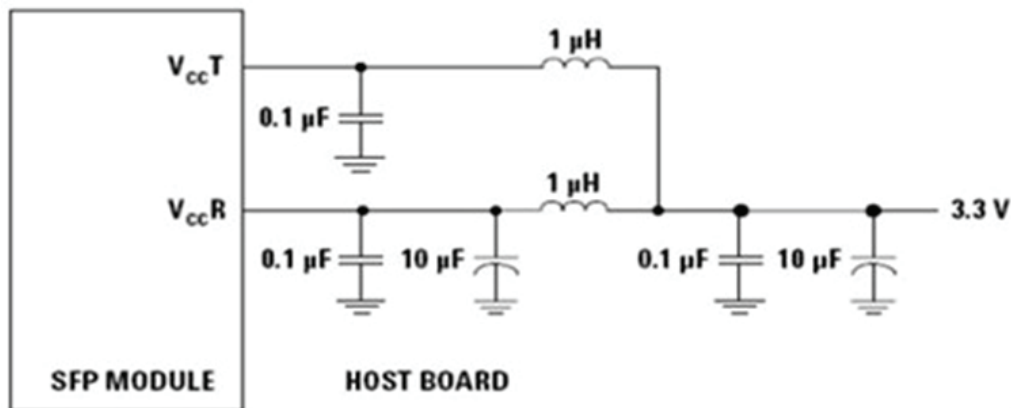
Notes:

1. Internally measured
2. The accuracy of the Tx bias current is 10% of the actual current from the laser driver to the laser.

## TYPICAL INTERFACE CIRCUIT



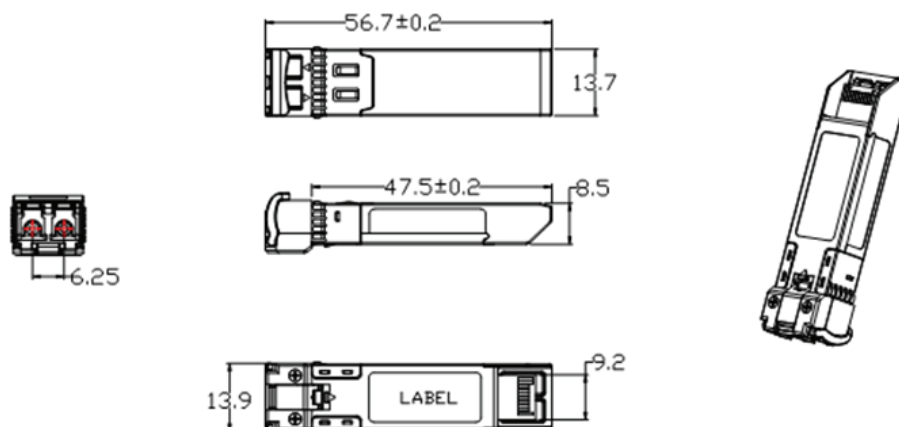
## RECOMMENDED POWER SUPPLY FILTER



Note:

Inductors with DC resistance of less than 1Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value

## PACKAGE DIMENSION



Dimensions are in Millimeter

Tolerance without indication is  $\pm 0.1$ mm

## ORDERING INFORMATION

Part Number	Description
TN3SFP10GSMLC	SFP+, 9.95 to 10.5Gb/s, 1310nm, 20km, 0~+70°C, with DDM