

## SNS SFP-TGD-SR4

### 4.25 Gbps Multi-Rate Single-Mode 10 km SFP Transceiver



#### Highlights

- SFP MSA transceiver
- Data-rates: 1.0625/2.125/4.25 Gbps
- Protocols:
  - 1 Gbps Ethernet
  - 1/2/4 Gbps Fibre Channel
  - SONET OC-24-LR-1
- Single-mode fiber
- Dual Fiber (Tx/Rx)
- 1310nm DFB Laser and PIN photodetector
- 10km transmission
- Duplex LC connector
- Digital Diagnostics
- Hot-swap

#### Overview

Optical SNS SFP is a high performance transceiver compliant with 1G Small Form-Factor Pluggable (SFP) Multi-Source Agreement (MSA), supporting data-rate of 1.25Gbps and transmission distance up to 10km on SMF. The transceiver consists of three sections: a DFB laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. Transmitter and receiver are separate within a wide temperature range of 0°C to +70°C (Commercial) or -40°C to +85°C (Industrial) and offers optimum heat dissipation and excellent electromagnetic shielding thus enabling high port densities for Fibre Channel per FC-P1-2 Rev. 10.0. and compatible with Gigabit Ethernet as specified in IEEE Std 802.3. 1GbE systems.

#### Specifications

Data Rates:	1.0625/2.125/4.25Gbps
Wavelength Tx	1310 nm
Tx Power	-8 ~ 0 dBm
Tx Disable	Yes
Wavelength Range	1260 nm ~ 1360 nm
Rx Sensitivity	-18.0 dBm
Receiver Reflectance	-20 dBm
Operating Temperature Range	0°C to +70°C (Commercial) or -40°C to +85°C (Industrial)
Power Consumption	< 1 Watts

## Module Block Diagram

## Optical and Electrical Characteristics

**Table 3 - Optical and Electrical Characteristics**

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Transmitter							
Data Rate				4.25		Gb/S	
Centre Wavelength		$\lambda_c$	1260	1310	1360	nm	
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Average Output Power(BOL)		P <sub>out</sub>	-8		0	dBm	1
Extinction Ratio		ER	5			dB	
Average Launch Power-OFF Transmitter		P <sub>out</sub>			-40	dBm	
Optical Eye Diagram			Fibre Channel Compliant				
Optical Rise/Fall Time (20%~80%)		t <sub>r</sub> /t <sub>f</sub>			130	ns	
Data Input Swing Differential		V <sub>IN</sub>	200		2400	mV	2
Input Differential Impedance		Z <sub>IN</sub>	90	100	120	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		V <sub>cc</sub>	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		$\lambda_c$	1260		1360	nm	
Receiver Sensitivity(BOL)		Sen			-18	dBm	3
LOS De-Assert		LOS <sub>D</sub>			-18	dBm	
LOS Assert		LOS <sub>A</sub>	-28			dBm	
LOS Hysteresis			0.5		6	dB	
Receiver Reflectance					-20	dB	
Data Output Swing Differential		V <sub>out</sub>	350		1800	mV	4
Loss of Signal (LOS) Assert Time		T <sub>Assert</sub>			500	nS	
Loss of Signal (LOS) Deassert Time		T <sub>Deassert</sub>			500	nS	
LOS	High		2.0		V <sub>cc</sub>	V	
	Low				0.8	V	

**Notes:**

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @4250Mbps, BER ≤1×10<sup>-12</sup>.
4. CML Output,internally AC-coupled.

## Timing and Electrical

**Table 4 - Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t <sub>on</sub>			1	ms
Tx Disable Assert Time	t <sub>off</sub>			10	µs
Time To Initialize, including Reset of Tx Fault	t <sub>init</sub>			300	ms
Tx Fault Assert Time	t <sub>fault</sub>			100	µs
Tx Disable To Reset	t <sub>reset</sub>	10			µs
LOS Assert Time	t <sub>loss_on</sub>			100	µs
LOS De-assert Time	t <sub>loss_off</sub>			100	µs
Serial ID Clock Rate	f <sub>serial_clock</sub>			400	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

## Diagnostics

**Table 5 – Diagnostics Specification**

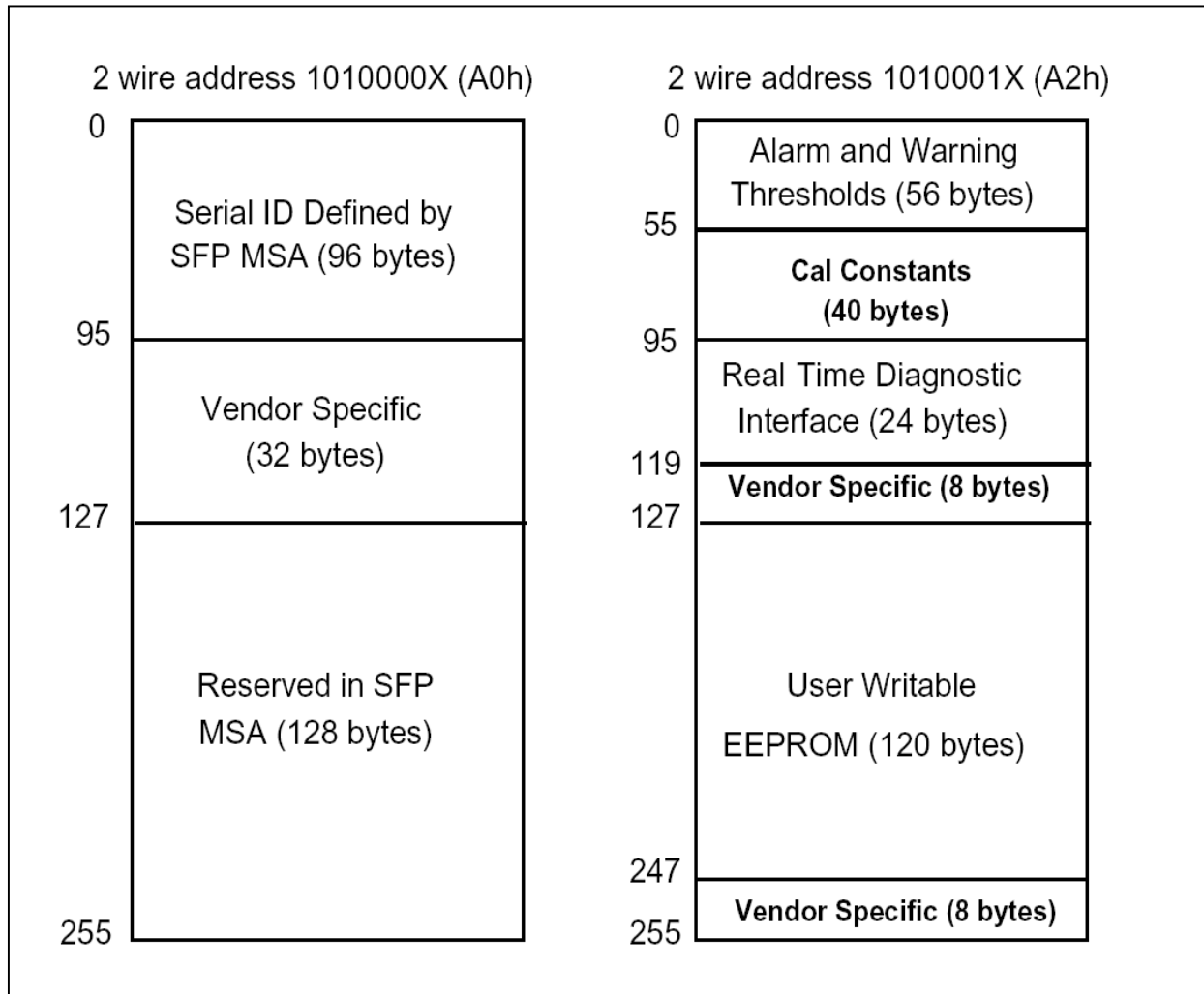
Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	-9 to -3	dBm	±3dB	Internal / External
RX Power	-23 to -3	dBm	±3dB	Internal / External

## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

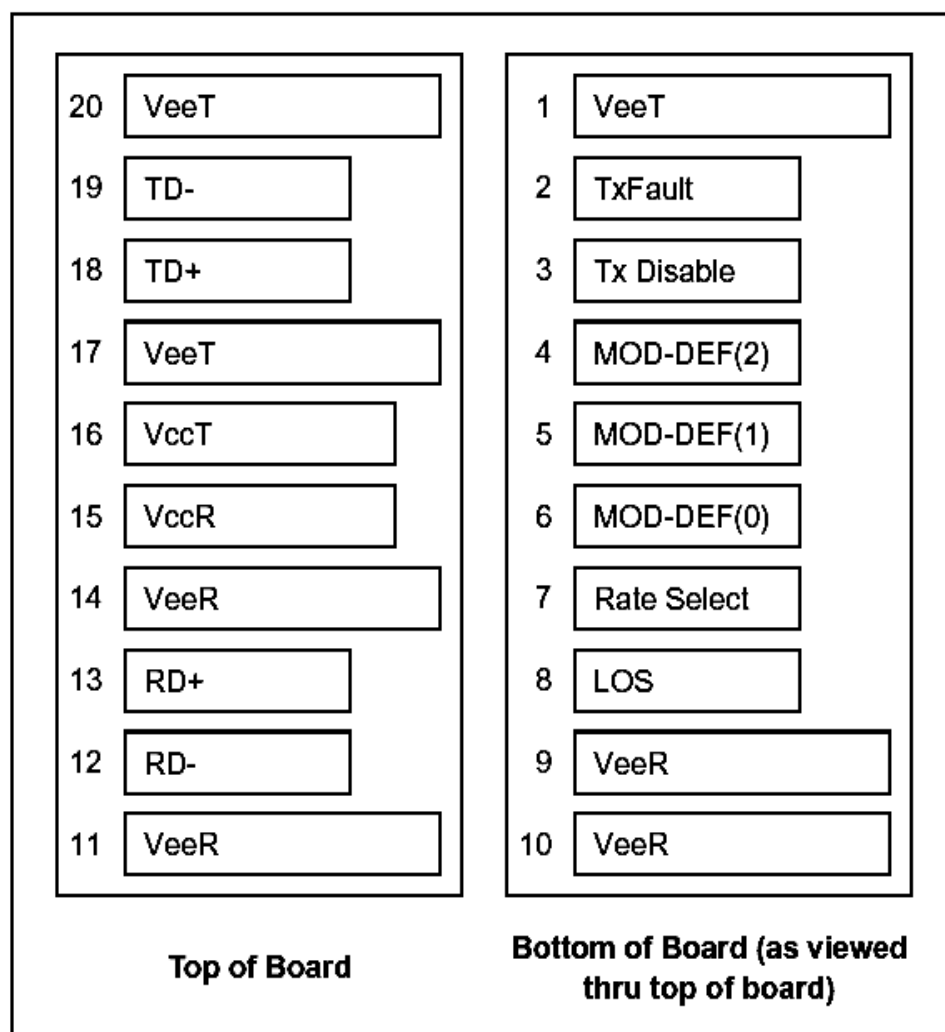
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



## Pin Definitions

### Pin Diagram



## 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)	TTL Low	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-	Inv. 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:

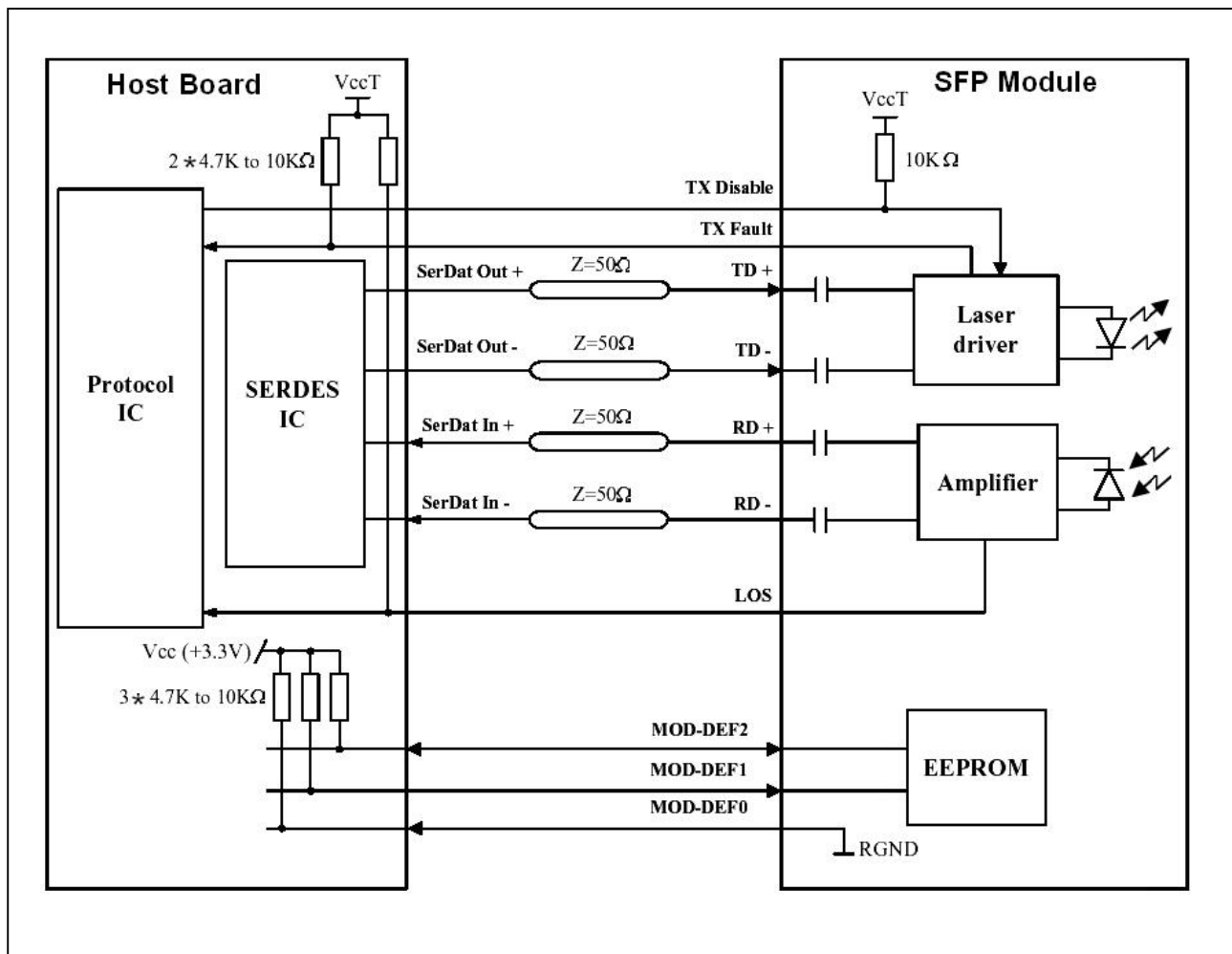
Plug Seq.: Pin engagement sequence during hot plugging.

- 1) 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.
- 2) 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
- 3) 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>.
 

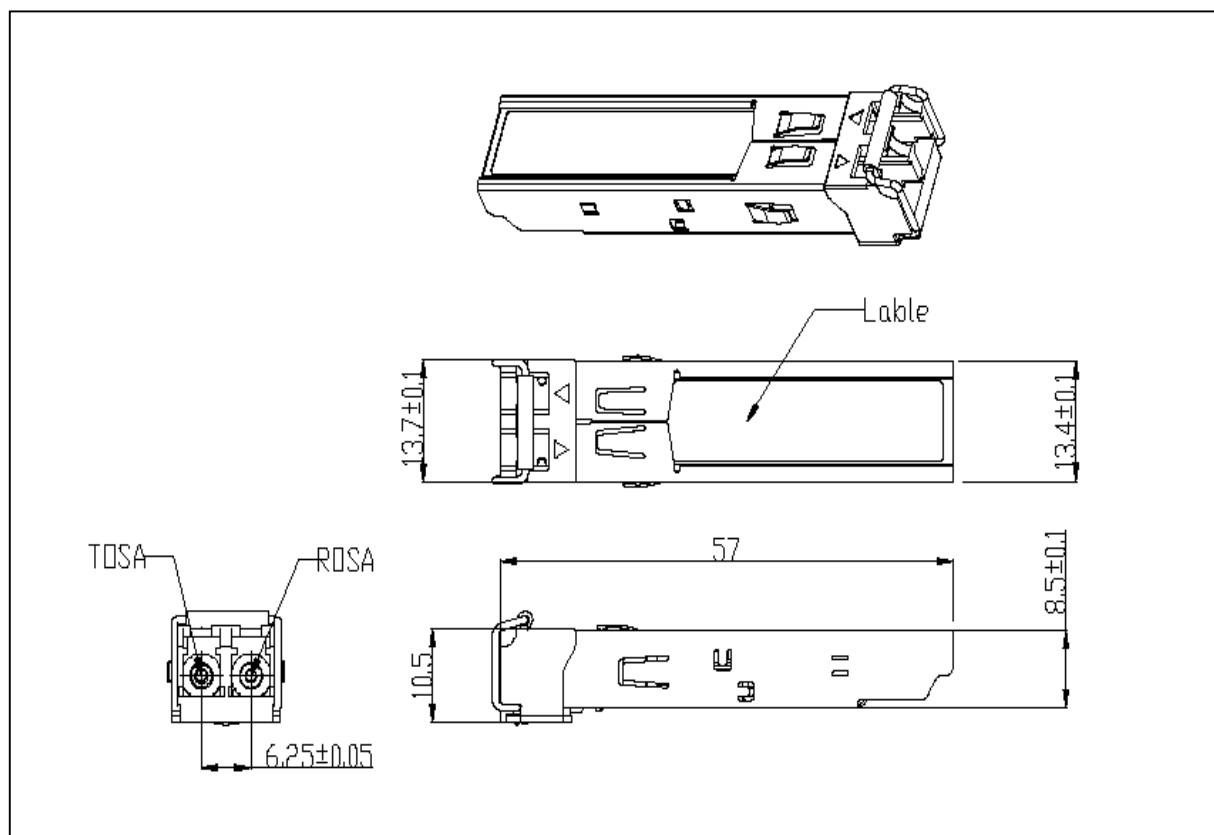
Mod-Def 0	is grounded by the module to indicate that the module is present
Mod-Def 1	is the clock line of two wire serial interface for serial ID
Mod-Def 2	is the data line of two wire serial interface for serial ID
- 4) LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. 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.
- 5) 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.
- 6) TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

## Recommended Interface Circuit





## Mechanical Dimensions



## Regulatory Compliance

SFP transceiver is designed to be Class I Laser safety compliant and is certified per the following standards

Feature	Agency	Standard	Certificate / Comments
Laser Safety	FDA	CDRH 21 CFR 1040 and Laser Notice No. 50	1120295-000
Product Safety	BST	EN 60825-1: 2007 EN 60825-2: 2004 EN 60950-1: 2006	BT0905142001
Environmental protection	SGS	RoHS Directive 2002/95/EC	GZ0902007478/CHEM
EMC	CCIC	EN 55022: 2006+A1: 2007 EN 55024: 1998+A1: 2001+A2: 2003	CTE09020023

### Ordering information

Part Number	Product Description
SNS SFP-TGD-SR4	1310nm, 4.25Gbps Multi-Rate Single-Mode 10 km, 0°C ~ +70°C SFP Transceiver
SNS SFP-TGD-SR4TH	1310nm, 4.25Gbps Multi-Rate Single-Mode 10 km, -40°C ~ +85°C SFP Transceiver

### References

1. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
2. Telcordia GR-253 and ITU-T G.957 Specifications.

### Important Notice

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