Rev.0TF3.30_20230825

10G / 25G SFP28 LR Transceiver
Hot Pluggable, Duplex LC, 1310nm DFB, SMF 10KM, DDM, Dual-Rate

Part Number: FSPP-N7-S13-10DR

Overview

FSPP-N7-S13-10DR is a Small Form Factor Pluggable SFP28 transceiver compliant with SFF-8402 SFP28 MSA standard. The high performance uncooled 1310nm DFB transmitter and high sensitivity PIN receiver with built-in CDR provide superior performance for 10GBASE-LR / 25GBASE-LR Ethernet and CPRI Option #10 applications up to SMF 10km optical links.

Applications

- 10GBASE-LR/LW Ethernet @10.3125G
- 25GBASE-LR Ethernet @25.78G
- CPRI Option #10 @24.33G
- eCPRI 5G Mobile Networks

Features

- Compliant with IEEE802.3cc 25GBASE-LR
- Compatible with IEEE802.3ae 10GBASE-LR/LW
- Compliant with CPRI option10
- Compliant with SFF-8402 SFP28 MSA
- Support 10.3125G / 25.78G Dual-Rate Ethernet
- Built-in CDR on both Transmitter and Receiver
- Hot Pluggable
- 1310nm DFB laser transmitter
- Duplex LC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8472
- Single +3.3V power supply
- Link distance 10km over SM fiber
- RoHS Compliant

Laser Safety

- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous radiation exposure.

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Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Storage Temperature	T_{ST}	-40	+85	°C
Storage Relative Humidity	RH	5	95	%
Supply Voltage	V_{CC3}	-0.5	+4.0	V

Recommended Operating Conditions

Parameters	Symbol	Min.	Typ.	Max.	Unit
Case Operating Temp. (FSPP-N7-S13-10DR)	T_{OP}	0	-	+70	°C
Case Operating Temp. (FSPP-N7-S13-10DRi)	T_{OP}	-40	-	+85	°C
Supply Voltage	V_{CC}	+3.13	+3.3	+3.47	V
Supply Current (FSPP-N7-S13-10DR)	I_{CC}	-	-	360	mA
Supply Current (FSPP-N7-S13-10DRi)	I_{CC}	-	-	400	mA
Power Consumption	P			1.4	W

Link Fiber to Future

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Transmitter Electro-optical Characteristics

V$_{CC}$ = 3.13V to 3.47V, T$_{OP}$ = 0 °C to 70 °C(FSPP-N7-S13-10DR); **T$_{OP}$ = -40 °C to 85 °C**(FSPP-N7-S13-10DRi)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR	10.3125	25.78		Gb/s	
Optical Launch Power	P$_{AVG}$	-7		+2	dBm	1
Optical Launch Power (OMA)	P$_{OMA}$	-4		+2.2	dBm	
Optical Center Wavelength	λc	1270	1310	1350	nm	
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
Dispersion Penalty @25.78G	DP			2.0	dB	2
Optical Eye Mask		{ 0.31, 0.4, 0.45, 0.34, 0.38, 0.4 }				3
Relative Intensity Noise	RIN			-130	dB/Hz	
Differential Data Input Swing	V$_{IN}$	180		850	mV	
Tx Disable Input Voltage-Low (Tx ON)	TDISV$_L$	GND		0.8	V	
Tx Disable Input Voltage-High (Tx OFF)	TDISV$_H$	2.0		Vcc	V	
Tx Fault Output Voltage-Low (Tx Normal)	TFLTV$_L$	GND		0.8	V	
Tx Fault Output Voltage-High (Tx Fault)	TFLTV$_H$	2.0		Vcc	V	

Note1: The optical power is launched into a 9/125μm single mode fiber.
Note2: After 10km G.652D 9/125μm single mode fiber.
Note3: Measured with a PRBS 2^{31}-1 test pattern @25.78Gbps BER<$5x10^{-5}$.
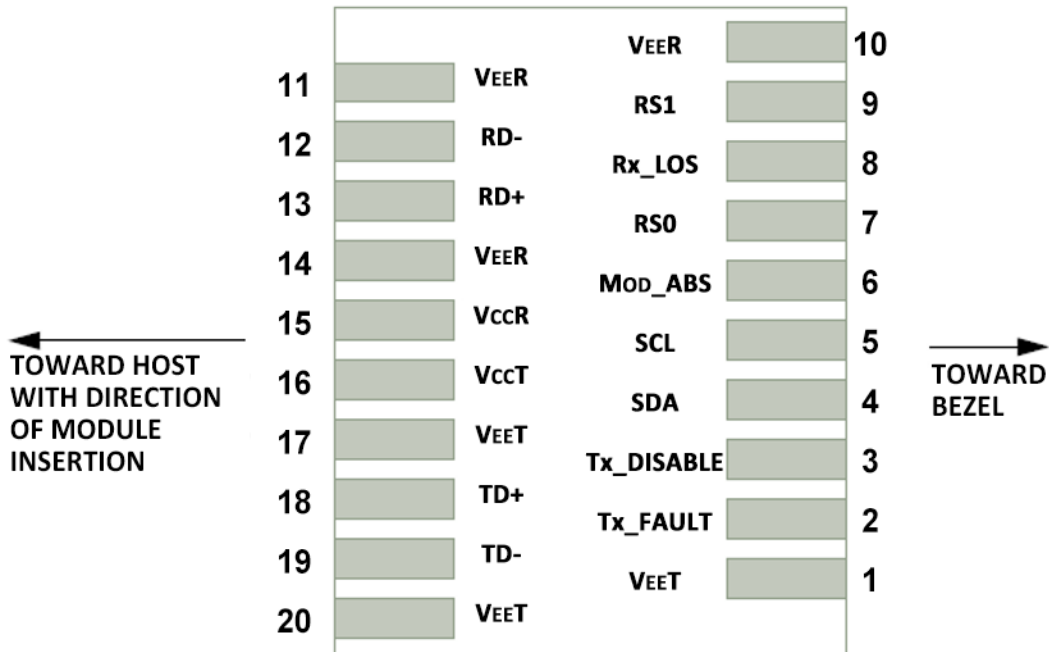
Receiver Electro-optical Characteristics

V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to 70 °C(FSPP-N7-S13-10DR); T_{OP} = -40 °C to 85 °C(FSPP-N7-S13-10DRi)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR	10.3125	25.78		Gb/s	
Receiver Sensitivity @25G	SEN			-13.3	dBm	1
Receiver Sensitivity @10G				-15.5		2
Maximum Receive Power	P_{RX-MAX}	+2			dBm	1
Optical Center Wavelength	λc	1260		1600	nm	
LOS De-Assert	LOS_D			-16.5	dBm	
LOS Assert	LOS_A	-30			dBm	
LOS Hysteresis	LOS_{HY}	0.5			dB	
Differential Data Output Swing	V_{OUT}	300		900	mV	
Receiver LOS Signal Output Voltage-Low	$LOSV_L$	GND		0.8	V	
Receiver LOS Signal Output Voltage-High	$LOSV_H$	2.0		Vcc	V	

Note1: Measured with a PRBS 2^{31}-1 test pattern @25.78Gbps BER<$5x10^{-5}$.

Note2: Measured with a PRBS 2^{31}-1 test pattern @10.3125Gbps BER<10^{-12}.

Pin Assignment

11 — VEER	VEER — 10
12 — RD-	RS1 — 9
13 — RD+	Rx_LOS — 8
14 — VEER	RS0 — 7
15 — VCCR	MOD_ABS — 6
16 — VCCT	SCL — 5
17 — VEET	SDA — 4
18 — TD+	Tx_DISABLE — 3
19 — TD-	Tx_FAULT — 2
20 — VEET	VEET — 1

TOWARD HOST WITH DIRECTION OF MODULE INSERTION

TOWARD BEZEL

Host PCB SFP28 Pad Assignment Top View

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Pin Description

Pin	Name	Function / Description
1	V$_{EE}$T	Transmitter Ground
2	Tx_FAULT	Transmitter Fault Indication (1)
3	Tx_DISABLE	Transmitter Disable – Turns off transmitter laser output (2)
4	SDA	2-wire Serial Interface Data Line (SDA: Serial Data Signal) (3)
5	SCL	2-wire Serial Interface Clock (SCL: Serial Clock Signal) (3)
6	M$_{OD}$_ABS	Module Absent, connected to V$_{EE}$T or V$_{EE}$R in the module (3)
7	RS0	Rate Select 0, optional (5)
8	Rx_LOS	Receiver Loss of Signal Indication (4)
9	RS1	Rate Select 1, optional (5)
10	V$_{EE}$R	Receiver Ground
11	V$_{EE}$R	Receiver Ground
12	RD-	Receiver Inverted Data output, AC coupled
13	RD+	Receiver Non-Inverted Data output, AC coupled
14	V$_{EE}$R	Receiver Ground
15	V$_{CC}$R	Receiver 3.3V Power Supply
16	V$_{CC}$T	Transmitter 3.3V Power Supply
17	V$_{EE}$T	Transmitter Ground
18	TD+	Transmitter Non-Inverted Data Input, AC coupled
19	TD-	Transmitter Inverted Data Input, AC coupled
20	V$_{EE}$T	Transmitter Ground

Note1: Tx Fault is open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Note2: Tx Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7K~10KΩ resistor. 1) Low(0~0.8V): Transmitter on; 2) Between(0.8V and 2V): Undefined; 3) High (2.0~ VccT): Transmitter Disabled; 4) Open: Transmitter Disabled.

Note3: These are the module definition pins. They should be pulled up with a 4.7K~10KΩ resistor on the host board to supply less than VccT+0.3V or VccR+0.3V. M$_{OD}$_ABS is grounded by the module to indicate that the module is present.

Note4: Rx_LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Note5: Tied to ground through a 30K ohm resistor. Rate select can be set through the 2-wire bus in accordance with SFF-8472 v12.1c. Rx Rate Select is set at Bit 3, Byte 110, Address A2h. Tx Rate Select is set at Bit 3, Byte 118, Address A2h. Writing a "1" selects maximum bandwidth operation.

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Digital Diagnostic Functions

As defined by the SFP MSA (SFF-8472) Ficer's SFP28 transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:
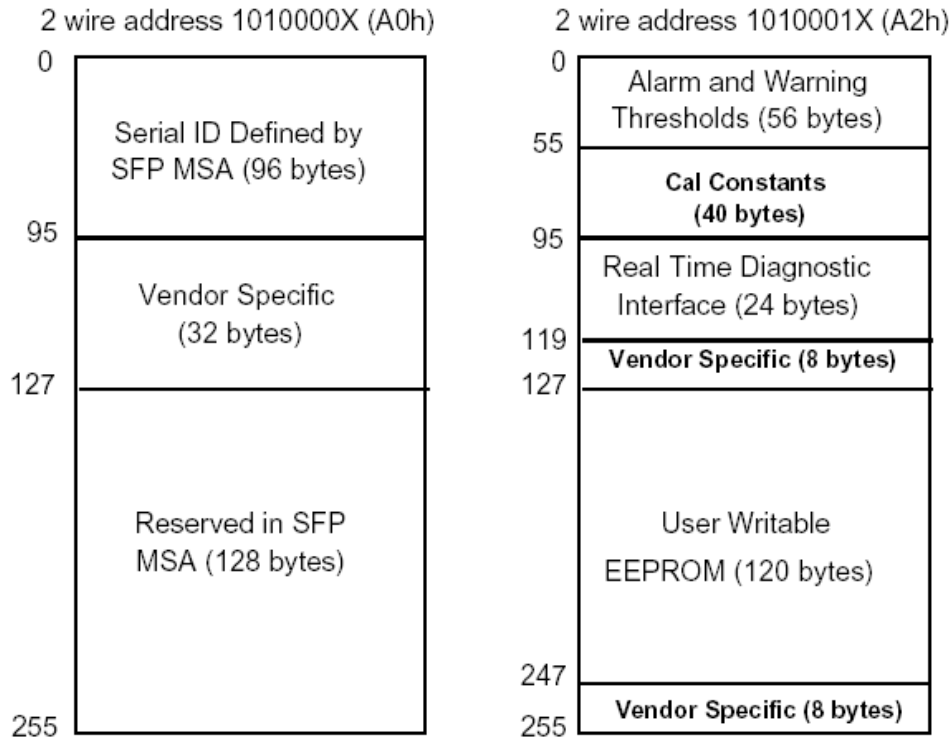
- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the SFP28 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the SFP28 transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. For more detailed information including memory map definitions, please see the SFP MSA (SFF-8472) Specification.
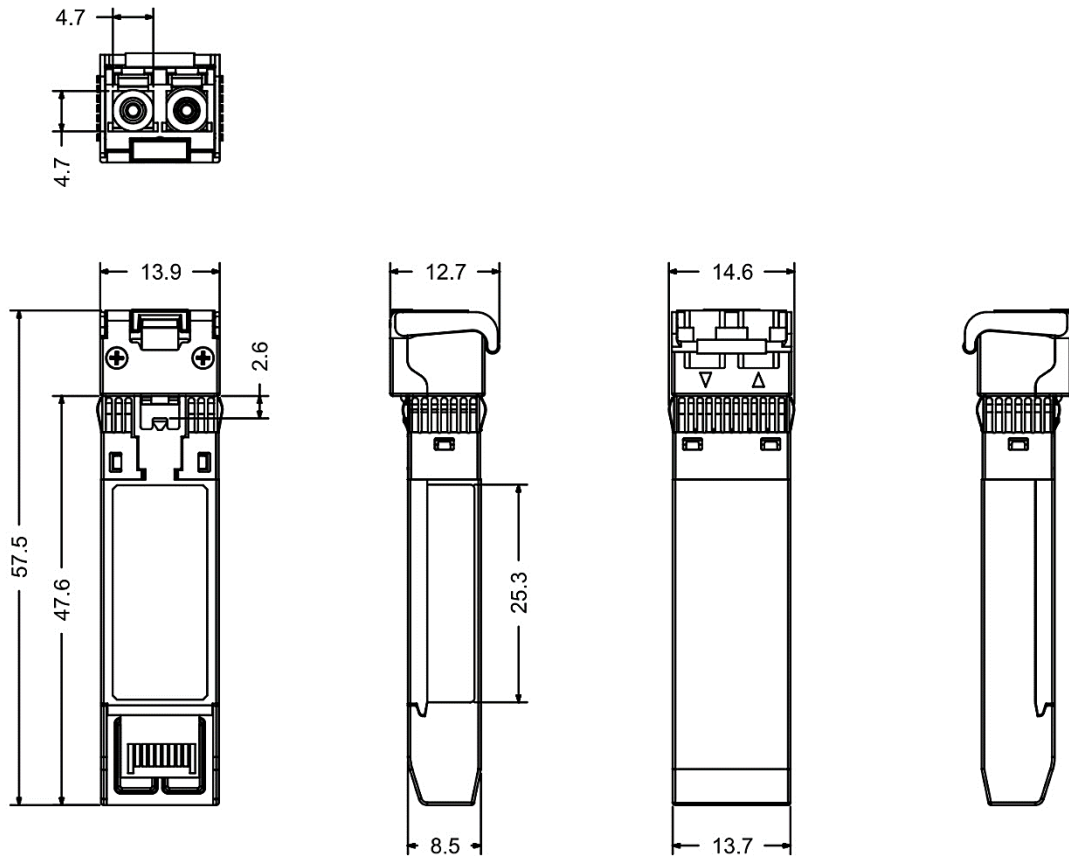
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Digital Diagnostic Memory Map

Digital Diagnostic Monitoring Characteristics

Parameter	Accuracy	Unit	Note
Temperature	±3	°C	Internal Calibration
Supply Voltage	±0.1	V	Internal Calibration
Tx Bias Current	±5	mA	Internal Calibration
Tx Output Power	±3	dB	Internal Calibration
Rx Received Optical Power	±3	dB	Internal Calibration

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Mechanical Dimensions

(All Dimensions are ±0.20mm Unless Otherwise Specified, Unit: mm)

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FSPP-N7-S13-10DR	1310nm	1260nm ~ 1600nm	10km	Yes	0~70°C
FSPP-N7-S13-10DRi					-40~85°C

Note: Distances are indicative only. To calculate a more precise link budget based on specific conditions in your application, please refer to the optical characteristics.