

100GBASE-LR4 CFP4 10km Optical Transceiver**NF4-S100-L10****Features**

4 channels full-duplex transceiver modules
Transmission data rate up to 28Gbps per channel
4 X 25/28G LAN-WDM EML Integrated TOSA
Cooling transmitter
4 channels PIN-base Integrated ROSA
Compliant with CFP4 MSA hardware specification
Compliant with CFP MSA management specification
Compliant to IEEE 802.3ba specification for 100GBASE-LR4
Compliant to OTU4
Transmission distance up to 10km on SMF
4 parallel electrical serial interface and AC coupling of CML signals
MDIO real-time digital diagnostic and control capabilities
Internal CDR circuits on both receiver and transmitter channels
Hot pluggable
Total Power Consumption<4W
Operating case temperature 0°C to +70°C
3.3V power supply
Duplex LC receptacle optical interface
RoHS 6 compliant(lead free)

Applications

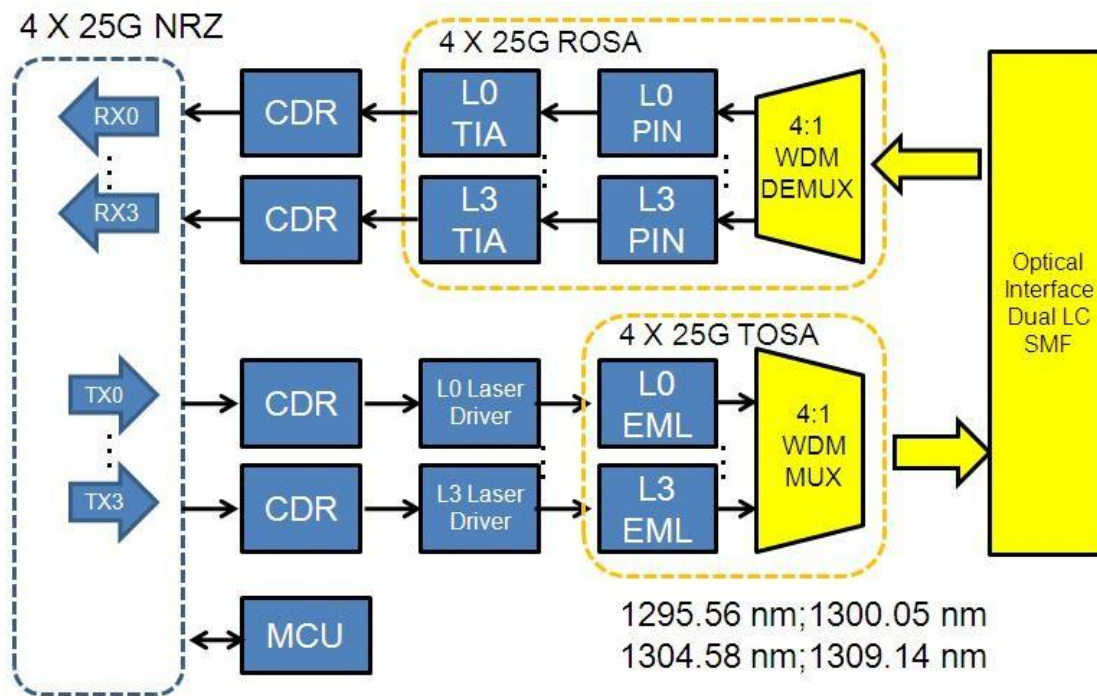
100GbE IEEE 802.3ba 100GBASE-LR4
ITU-T G.959.1 OTU4 (411-9D1F)
Switch to switch interface or Switch to router interface

Description

CFP4 100GBASE-LR4 optical transceiver is a hot pluggable 100Gbps small-form-factor transceiver module. It is designed for use in 100 Gigabit Ethernet links and 4x28G OTN client interfaces over single mode fiber. It is compliant with the CFP MSA, IEEE 802.3ba 100GBASE LR4 and OTU4 411-9D1F. The module converts 4 input channels of 25Gb/s electrical data to 4 channels of LAN WDM optical signals and then multiplexes them into a single channel for 100Gb/s optical transmission. On the receiver side, the module de-multiplexes the 100Gb/s optical into 4 channels of LAN WDM optical signals and then converts them to 4



output channels of electrical data. The module is a multi-rate optical transceiver which data rate up to 28Gbps per channel. The high-performance cooled LAN WDM EML Integrated TOSA and PIN-base Integrated ROSA provide superior performance for Telecom and Datacom applications up to 10km links.



100GE CFP4 LR4 Module Block Diagram

Absolute Maximum Ratings

Parameter	Symbol	Unit	Min	Max
Supply Voltage	VCC	V	-0.5	3.6
Storage Temperature	Ts	°C	-40	85
Operating Case Temperature	Tc	°C	0	70
Relative Humidity (Non condensation)	-	%	5	85

Recommended Operating Conditions

Parameter	Symbol	Unit	Min	Typ	Max
Operating Case Temperature	Tc	°C	0	-	70
Supply Voltage	VCC	V	3.13	3.3	3.47
Supply Current	ICC	A	-	-	1.27
Power Dissipation	-	W	-	-	4

Optical Characteristics

(Tested under recommended operating conditions, unless otherwise noted)

Parameter	Symbol	Unit	Value			Notes
			Min	Typ	Max	
Optical Transmitter Characteristics						
Signaling Rate for Each Lane (100GbE)	-	Gbps		25.78125		
Signaling Rate for Each Lane (OTU4)				27.9525		
Four lane Wavelength Range	λ 1	nm	1294.53	1295.56	1296.59	
	λ 2		1299.02	1300.05	1301.09	
	λ 3		1303.54	1304.58	1305.63	
	λ 4		1308.09	1309.14	1310.19	
Side Mode Suppression Ratio	SMSR	dB	30			
Total Average Launch		dBm			10.5	
Average Launch Power for Each Lane(100GbE)	Pa	dBm	-4.3		+4.5	
Average Launch Power for Each Lane(OTU4)			-2.5		+2.9	
Difference in launch power between any two lanes (Average and OMA)		dB			5	
Extinction Ratio	ER	dB	7			
Average Launch Power OFF	Poff	dBm			-30	
Optical Return Loss Tolerance	dB				20	
Optical Receiver Characteristics						
Receiver Sensitivity in OMA for Each Lane(100GbE)	Pmin	dBm	-	-	-8.6	1
Equivalent Sensitivity for Each Lane(OTU4)					-10.3	2
Los Assert		dBm	-20			
Los De-assert		dBm			-12	
Los Hysteresis		dBm	0.5			
Damage Threshold, each Lane	THd	dBm	5.5			3
Receive Power In OMA for Each Lane	PinOMA	dBm			4.5	
Difference in Receive Power between any Two Lanes (Average and OMA)	Prx,diff	dB			4.5	
Average Receive Power for Each Lane(100GbE)	Pin	dBm	-10.6		4.5	
Average Receive Power for Each Lane(OTU4)			-8.8		2.9	

Note:

1. Minimum average optical power measured at BER less than $1E-12$, with a $2^{31}-1$ PRBS.
2. Measured with PRBS $2^{31}-1$ for BER= 10^{-6} . The BER for the OTU4 application is required to be met only after FEC has been applied.
3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

Electrical Characteristics

(Tested under recommended operating conditions, unless otherwise noted)

Parameter	Symbol	Unit	Min	Typ	Max	Note
Differential Data Output Swing	V _{out,pp}	mV	300	-	850	
Differential Input Voltage Swing	V _{in,pp}	mV			900	
Differential Signal Output Resistance		Ω	90	-	110	
Differential Signal Input Resistance		Ω	90	-	110	

Low Speed Electrical Interface

Parameter	Symbol	Unit	Min	Max	Note
Input Voltage	V _{IH}	V	2.0	V _{cc3} + 0.3	1
	V _{IL}	V	-0.3	0.8	
Output Voltage	V _{OH}	V	V _{dd3} -0.5	V _{dd3} + 0.3	
	V _{OL}	V	0.0	0.4	
Input Leakage Current	3.3VIL	uA	-10	10	
Minimum Pulse Width of Control Pin Signal	T _{CNT L}	us	100		
1.2V LVCMOS Electrical Characteristics					
Input High Voltage	1.2VIH	V	0.84	1.5	
Input Low Voltage	1.2VIL	V	-0.3	0.36	
Input Leakage Current	1.2IIN	uA	-100	+ 100	
Output High Voltage	1.2V0H	V	1.0	1.5	
Output Low Voltage	1.2V0L	V	-0.3	0.2	
Output High Current	1.2IOH	mA		-4	
Output Low Current	1.2IOL	mA	+4		
Input Capacitance	Ci	pF		10	

Note1: V_{dd3} is host +3.3V power supply.

Hardware Control Pins

The CFP4 Module support real-time control functions via hardware pins, listed in the following table: Hardware Control Pins

Pin#	Symbol	Description	I/O	Logic	H	L	Pull-up/down
11	TX_DIS (PRG_CNTL)	Transmitter Disable	I	3.3V LVCMOS	Disable	Enable	Pull-Up Note1
14	MOD_LOPWR	Module Low Power Mode	I	3.3V LVCMOS	Low Power	Enable	Pull-Up Note1
16	MOD_RSTn	Module Reset(Invert)	I	3.3V LVCMOS	Enable	Reset	Pull-Down Note2

Note1: Pull-Up resistor (4.7KOhm to 10 KOhm) is located within the CFP4 module Note2: Pull-Down resistor (4.7KOhm to 10 kOhm) is located within the CFP4 module

Hardware Alarm Pins

The CFP Module supports alarm hardware pins listed in the following table: Hardware Alarm Pins

Pin#	Symbol	Description	I/O	Logic	H	L	Pull-up/down
15	MOD_ABS	Module Absent	O	3.3V LVCMOS	Absent	Present	Pull-Down Note1
12	RX_LOS (PRG_ALARM)	Receiver Loss of Signal	O	3.3V LVCMOS	Loss of Signal	OK	

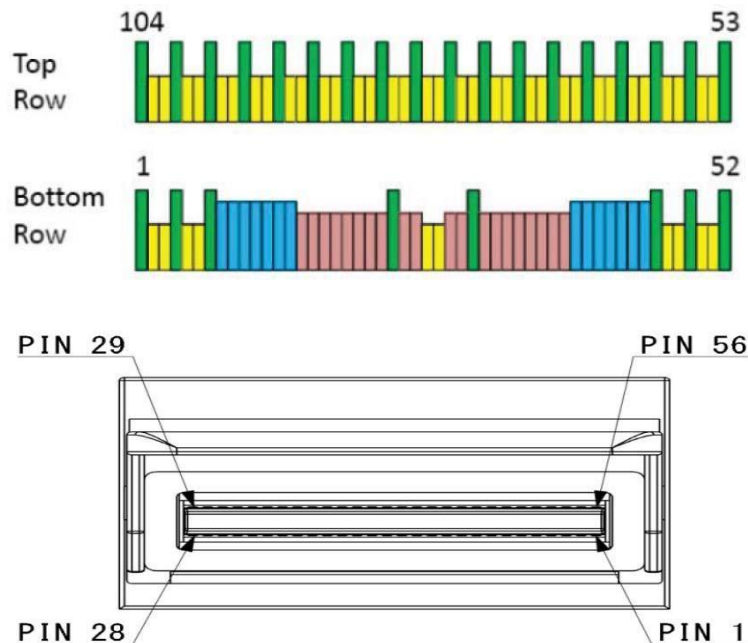
Note1: Pull-Down resistor (<100ohm) is located within the CFP module. Pull-up should be located on the host

Management Interface Pins(MDIO)

The CFP Module supports alarm, control and monitor functions via an MDIO bus. The CFP MDIO pins are listed in

Pin#	Symbol	Description	I/O	Logic	H	L	Pull-up/down
13	GLB_ALRMn	Global Alarm	I	3.3V LVCMOS	Ok	Alarm	
18	MDIO	Management Data Input Output Bi-Directional Data	I/O	1.2V LVCMOS			
17	MDC	MDIO Clock	I	1.2V LVCMOS			
19	PRTADR0	MDIO Physical Port address bit0	I	1.2V LVCMOS	per MDIO document[5]		
20	PRTADR1	MDIO Physical Port address bit1	I	1.2V LVCMOS			
21	PRTADR2	MDIO Physical Port address bit2	I	1.2V LVCMOS			

CFP4 Transceiver Electrical Pad Layout

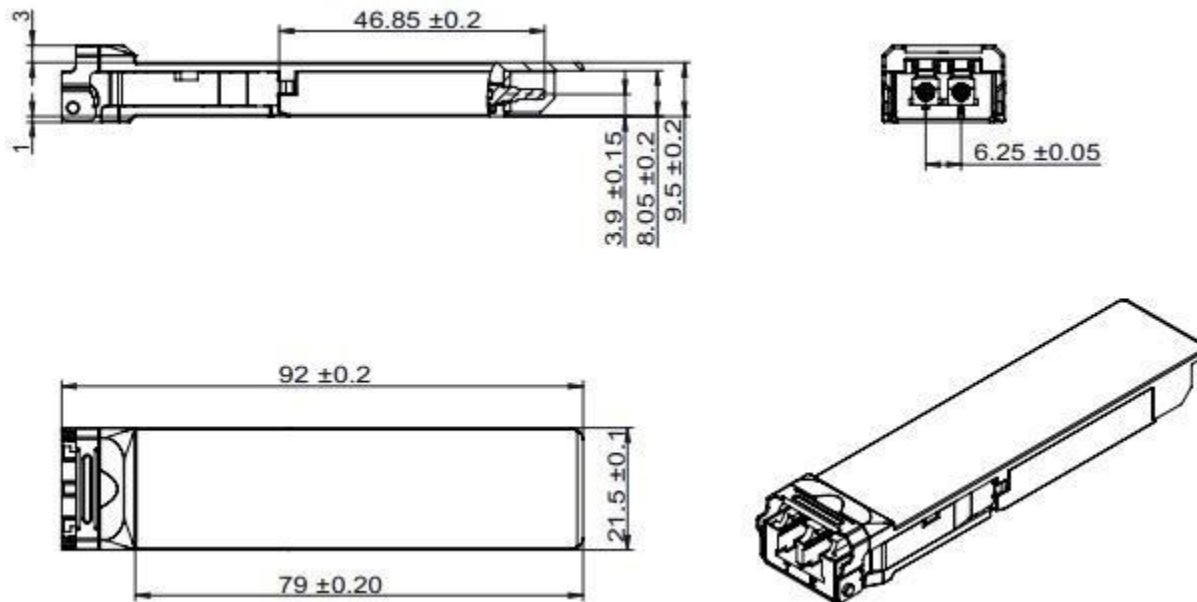


Pin Function Definitions

PIN#	Name	I/O	Logic	Description
1	3.3V_GND			3.3V Module Supply Voltage Return Ground,can be separate or tied together with Signal
2	3.3V_GND			3.3V Module Supply Voltage Return Ground,can be separate or tied together with Signal
3	3.3V			3.3V Module Supply Votage
4	3.3V			3.3V Module Supply Votage
5	3.3V			3.3V Module Supply Votage
6	3.3V			3.3V Module Supply Votage
7	3.3V_GND			3.3V Module Supply Voltage Return Ground,can be separate or tied together with Signal
8	3.3V_GND			3.3V Module Supply Voltage Return Ground,can be separate or tied together with Signal
9	VND_IO_A	I/O		Module Vendor I/O. Do Not Connect
10	VND_IO_B	I/O		Module Vendor I/O. Do Not Connect
11	TX_DIS(PRG_CNTL1)	I	LVC MOS w/PUR	Transmitter Disable for all lanes, "1" or NC=transmitter disabled,"0"=transmitter enabled (Optionally configurable as Programmable Control1 after Reset)
12	RX_LOS(PRG_ALARM1)	O	LVC MOS	Receiver Loss of Optical Signal, "1": low optical signal, "0": normal condition (Optionally configurable as Programmable Alarm1 after Reset)
13	GLB_ALRMn	O	LVC MOS	Global Alarm. "0": alarm condition in any MDIO Alarm register, "1": no alarm condition, Open Drain, Pull Up Resistor on Host
14	MOD_LOPWR	I	LVC MOS w/ PUR	Module Low Power Mode. "1" or NC: module in low power (safe) mode, "0": power-on enabled
15	MOD_ABS	O	GND	Module Absent. "1" or NC: module absent, "0": module present, Pull Up Resistor on Host
16	MOD_RSTn	I	LVC MOS w/ PDR	Module Reset. "0" resets the module, "1" or NC = module enabled, Pull Down Resistor in Module
17	MDC	I	1.2V CMOS	Management Data Clock (electrical specs as per IEEE Std 802.3-2012)
18	MDIO	I/O	1.2V	Management Data I/O bi-directional data

			CMOS	(electrical specs as per IEEE Std 802.3ae-2008 and ba-2010)
19	PRTADR0	I	1.2V CMOS	MDIO Physical Port address bit 0
20	PRTADR1	I	1.2V CMOS	MDIO Physical Port address bit 1
21	PRTADR2	I	1.2V CMOS	MDIO Physical Port address bit 2
22	VND_IO_C	I/O		Module Vendor I/O C. Do Not Connect
23	VND_IO_D	I/O		Module Vendor I/O C. Do Not Connect
24	VND_IO_E	I/O		Module Vendor I/O C. Do Not Connect
25	GND	I/O		Module Vendor I/O C. Do Not Connect
26	MCLKn	O	CML	For optical waveform testing. Not for normal use.
27	MCLKp	O	CML	For optical waveform testing. Not for normal use.
28	GND			
29	GND			
30	RX0p	O	CML	Output Data
31	RX0n	O	CML	Inverted Output Data
32	GND			
33	RX1p	O	CML	Output Data
34	RX1n	O	CML	Inverted Output Data
35	GND			
36	RX2p	O	CML	Output Data
37	RX2n	O	CML	Inverted Output Data
38	GND			
39	RX3p	O	CML	Output Data
40	RX3n	O	CML	Inverted Output Data
41	GND			
42	REFCLKp	In	CML	Reference Input Clock
43	REFCLKn	In	CML	Reference Inverted Input Clock
44	GND			
45	TX0p	In	CML	Input Data
46	TX0n	In	CML	Inverted Input Data
47	GND			
48	TX1p	In	CML	Input Data
49	TX1n	In	CML	Inverted Input Data
50	GND			
51	TX2p	In	CML	Input Data
52	TX2n	In	CML	Inverted Input Data
53	GND			
54	TX3p	In	CML	Input Data
55	TX3n	In	CML	Inverted Input Data
56	GND			

Mechanical Dimensions



Ordering information

Part Number	Product Description
NF4-S100-L10	CFP4, LAN-WDM EML transmitter, PIN ROSA,100GE/OTU4,10km

Regulatory Compliance

NF4-S100-L10 transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Standard
Laser Safety	IEC 60825-1:2014 (Third Edition)
Environmental protection	2011/65/EU
CE EMC	EN55032: 2015 EN55024 : 2010+A1: 2015 EN61000-3-2:2014 EN61000-3-3:2013
FCC	FCC Part 15, Subpart B; ANSI C63.4-2014

References

1. CFP MSA
2. 100GbE IEEE 802.3ba
3. ITU-T G.959.1