

CFP4 LR4 Transceiver

100G-BASE 10km CFP4



Features:

- Hot pluggable CFP4 MSA package
- 3.3V Power supply and MDIO management interface for digital diagnostics
- Duplex LC Connector Interface
- Integrated 4-LAN WDM TOSA/ROSA for up to 10km link over G.652 SMF
- Operating data rate at 112Gbps
- Compliant with 100GBASE-LR4
- CFP4-MSA-CFP4-HW-Specification compliant
- Operating Case Temperature: 0 ~ +70°C
- Power consumption less than 6W
- No external reference clock

Applications:

- 100GBASE-LR4 Ethernet
- OTU4 4I1-9D1F

Product Description

TC4-HG10-30DCR CFP4 transceivers are designed for use in 100 Gigabit Ethernet links over 10km single module fiber, and it compliant to the CFP4 MSA CFP4 HW and IEEE 802.3ba 100GBASE-LR4. Digital diagnostics are available via MDIO as specified in the CFP4 MSA Management Interface Specification. The transceiver's designs are optimized for high performance and cost efficiency to provide customers the best solutions for Datacom and Telecom applications. The transceiver is RoHS-6 compliant and lead-free per Directive 2002/95/EC.

Ordering information

Part No.	Data Rate	Laser	Fiber Type	Distance ^{*Note1}	Optical Interface	Bail color	Temp. ^{+Note2}	DDMI
TC4-HG10-30DCR	112G	4-LANE: 1295.56, 1300.05, 1304.58, 1309.14,	SMF	10km	LC	Blue	ST	YES

Note1: 10km with 9/125µm SMF

Note2: ST: 0 ~ +70deg C

Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compliant with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compliant with standards Noise frequency range: 30 MHz to 6 GHz. Good system EMI design practice required to achieve Class B margins. System margins depend on customer host board and chassis design.
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compliant with standards. 1kHz sine-wave, 80% AM, from 80 MHz to 1 GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1 EN (IEC) 60950-1:2006+A1+A11+A12	CDRH compliant and Class I laser product. TUV Certificate No. R50271605
Component Recognition	UL and CUL EN60950-1:2006	TUV Certificate No. E344594 (CB:JPTUV-053877)
RoHS2.0	20011/65/EU	Compliant with standards

Absolute Maximum Ratings^{*Note3}

Parameter	Symbol	Min	Max	Unit
Storage Temperature	TS	-40	+85	°C
Supply Voltage	V _{CC}	-0.5	3.6	V
Operating Humidity	-	5	85	%

Note3: Exceeding any one of these values may destroy the device permanently.

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T _C	0		70	°C
Power Supply Voltage	V _{CC}	3.2	3.3	3.4	V
Power dissipation	P			6	W
Low Power dissipation	P _{Low}			1	W

Performance Specifications – Electrical

Parameter	Symbol	Min	Typ.	Max	Unit	Notes
3.3V LVCOMS						
Input High Voltage	V _{IH}	2		V _{CC} +0.3	V	
Input Low Voltage	V _{IL}	-0.3		0.8	V	
Input Leakage Current	I _{IN}	-10		10	mA	
Output High Voltage (I _{OH} = -100uA)	V _{OH}	V _{CC} -0.2		V _{CC} +0.3	V	
Output Low Voltage (I _{OL} = 100uA)	V _{OL}	-0.3		0.2	V	
Minimum Pulse Width of Control Pin Signal	t _{CNTL}	100			us	
1.2V CMOS						
Input High Voltage	V _{IH}	0.84		1.5	V	
Input Low Voltage	V _{IL}	-0.3		0.36	V	
Input Leakage Current	I _{IN}	-100		100	uA	
Output High Voltage	V _{OH}	1	-	1.5	V	
Output Low Voltage	V _{OL}	-0.3		0.2	V	
Output High Current	I _{OH}			-4	mA	
Output Low Current	I _{OL}	4			mA	
Input capacitance	C _i			10	pF	
Reference Clock						
Impedance	Z _d	85	100	115	ohm	
Frequency		1/64 of host lane rate				
Frequency Stability	X _f	-100		100	ppm	
Input Differential Voltage	V _{diff}	150		1000	mV	
Output Amplitude Voltage	V _{diff}	360		900	mV	
RMS Jitter	σ			10	ps	
Clock Duty Cycle		40		60	%	
Clock Rise/Fall Time 10/90%	Tr/f	200		1250	ps	

Timing Specifications

Parameter	Symbol	Min	Typ.	Max	Unit
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Hardware MOD_LOPWR Assert	t_MOD_LOPWR_assert		1	ms
Hardware MOD_LOPWR De-assert	t_MOD_LOPWR_deassert		10	s
Receiver Loss of Signal Assert Time	t_loss_assert		100	us
Receiver Loss of Signal De-Assert Time	t_loss_deassert		100	us
Global Alarm Assert Delay Time	GLB_ALRMn_assert		150	ms
Global Alarm De-Assert Delay Time	GLB_ALRMn_deassert		150	ms
Host MDIO t_setup	t_setup	10		ns
Host MDIO t_hold	t_hold	10		ns
CFP4 MDIO t_delay	t_delay	0	300	ns
Initialization time from Reset	t_initialize		2.5	s
Transmitter Disabled (TX_DIS asserted)	t_deassert		100	us
Transmitter Enabled (TX_DIS de-asserted)	t_assert		2	ms
Management Interface Clock Frequency	F_MDC	0.1	4	MHz
Management Interface Clock Period	t_prd	250	10000	ns
MDC high and low time	twidth	40	60	%
		160		ns
MDIO/MDC termination in CFP4	Zt	100		kOhm

Performance Specifications – Optical

(OUT4 4I1-9D1F)

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Transmitter						
Channel data rate			27.95		Gbps	
Data rate variation		-20		+20	ppm	
Centre Wavelength	λ_{CT0}	1294.53	1295.56	1296.59	nm	
	λ_{CT1}	1299.02	1300.05	1301.09	nm	
	λ_{CT2}	1303.54	1304.58	1305.63	nm	
	λ_{CT3}	1308.09	1309.14	1310.19	nm	
Total Average Launch Power	Pout			8.9	dBm	
Average Launch Power per Lane	Pavg	-2.5		2.9	dBm	
Difference in Launch power between any two lanes(OMA)				5	dB	
Extinction Ratio	ER	7			dB	

Average Launch Power of TX_DIS Transmitter per lane	P_{OFF}	-30	dBm	TX_dis=H
SMSR	SMSR	30	dB	
Optical Eye Mask {X1, X2, X3, Y1, Y2, Y3}	G.959.1 Compliant			NOTE4

Receiver

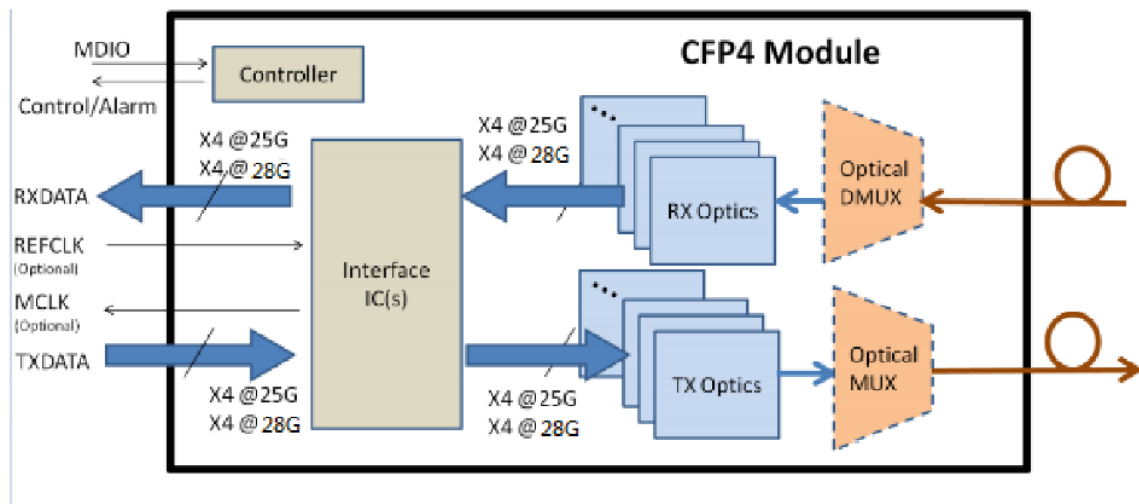
Channel data rate	27.95			Gbps	
Data rate variation	-20	20		ppm	
Centre Wavelength	λ_{CT0}	1294.53	1295.56	1296.59	nm
	λ_{CT1}	1299.02	1300.05	1301.09	nm
	λ_{CT2}	1303.54	1304.58	1305.63	nm
	λ_{CT3}	1308.09	1309.14	1310.19	nm
Damage threshold	λ_c	5.5		dBm	
Average receiver power per lane	P_{in}	-8.8	4.0	dBm	
Equivalent Receiver Sensitivity per lane	P_{sen}	-10.6		dBm	
Vertical eye closure penalty per Lane				1.5	dB
Rx-Lane LOS Assert	-21.3			dBm	
Rx-Lane LOS De-assert	-11.3			dBm	
Rx-Lane LOS Hysteresis	0.5			dB	

(100GBASE LR4)

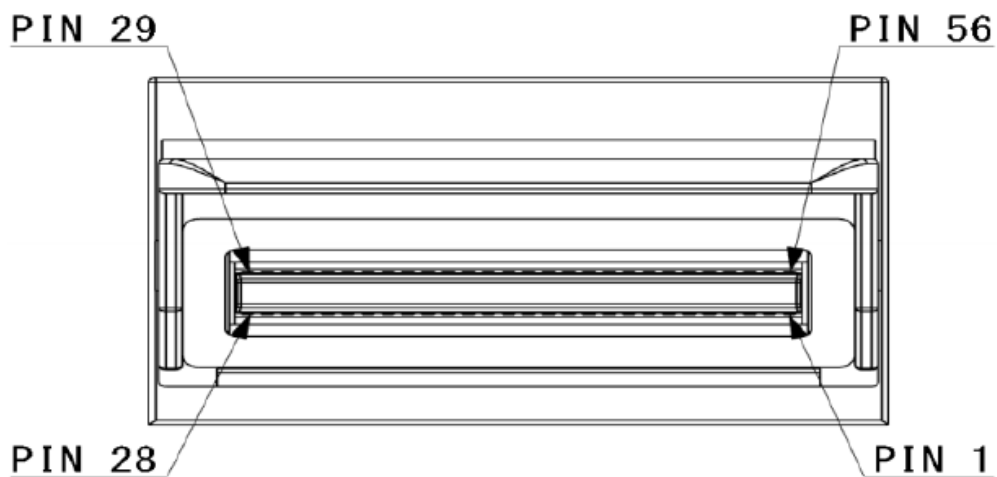
Parameter	Symbol	Min	Typ.	Max	Unit	Note
Transmitter						
Channel data rate	25.78			Gbps		
Data rate variation	-100		+100		ppm	
Centre Wavelength	λ_{CT0}	1294.53	1295.56	1296.59	nm	
	λ_{CT1}	1299.02	1300.05	1301.09	nm	
	λ_{CT2}	1303.54	1304.58	1305.63	nm	
	λ_{CT3}	1308.09	1309.14	1310.19	nm	
Total Average Launch Power	P_{out}	10.5		dBm		
Average Launch Power per Lane	P_{avg}	-4.3	4.5		dBm	
Difference in Launch power between any two lanes(OMA)				5	dB	
Extinction Ratio	ER	4		dB		
Average Launch Power of TX_DIS Transmitter per lane	P_{OFF}	-30		dBm	TX_dis=H	
SMSR	SMSR	30		dB		
Optical Eye Mask {X1, X2, X3, Y1, Y2, Y3}	IEEE802.3 Clause 88 100GBASE LR4				NOTE4	
Receiver						
Channel data rate	25.78			Gbps		
Data rate variation	-100		+100		ppm	

Centre Wavelength	λ_{CT0}	1294.53	1295.56	1296.59	nm
	λ_{CT1}	1299.02	1300.05	1301.09	nm
	λ_{CT2}	1303.54	1304.58	1305.63	nm
	λ_{CT3}	1308.09	1309.14	1310.19	nm
Damage threshold	λ_c	5.5			dBm
Average receiver power per lane	Pin	-10.6		4.0	dBm
Receiver Sensitivity in OMA per lane	Psen			-8.6	dBm
Stressed Sensitivity(OMA) per Lane	SRS			-6.8	dB
Rx-Lane LOS Assert		-20.6			dBm
Rx-Lane LOS De-assert				-10.6	dBm
Rx-Lane LOS Hysteresis		0.5			dB

Internal reference structure



Pin Layout



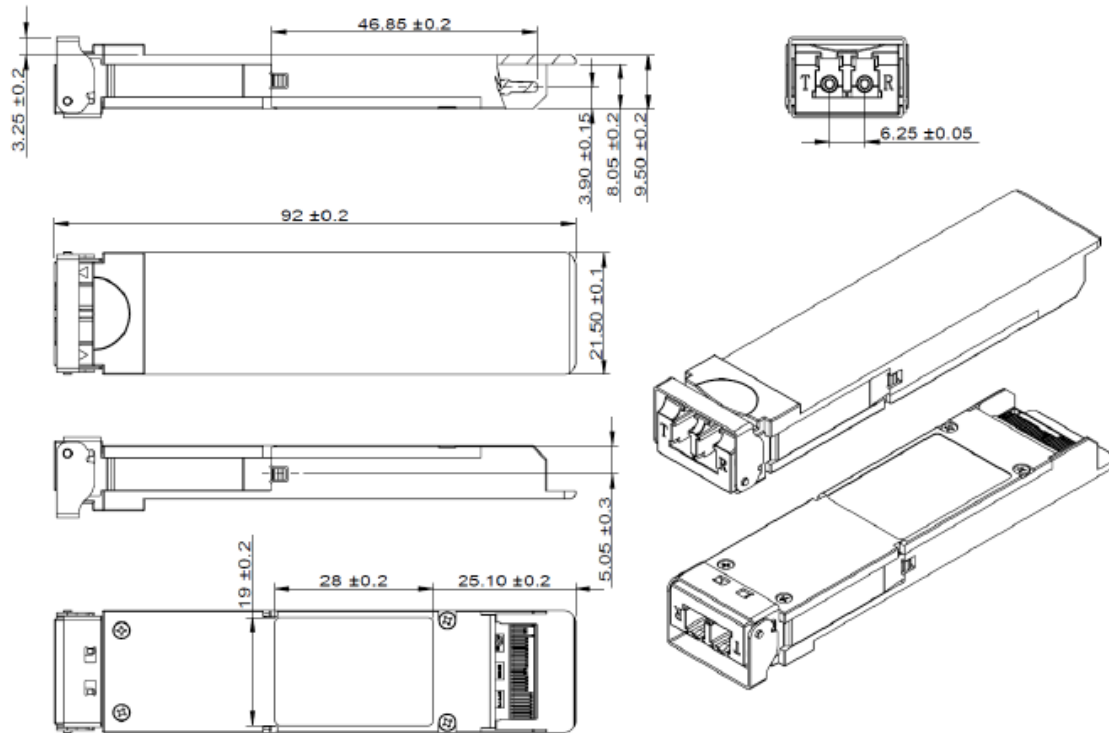
Bottom Row		Top Row	
1	3.3V_GND	56	GND
2	3.3V_GND	55	TX3n
3	3.3V	54	TX3p
4	3.3V	53	GND
5	3.3V	52	TX2n
6	3.3V	51	TX2p
7	3.3V_GND	50	GND
8	3.3V_GND	49	TX1n
9	VDN_IO_A	48	TX1p
10	VDN_IO_B	47	GND
11	TX_DIS(PNG_CNTL1)	46	TX0n
12	TX_LOS(PNG_ALRM1)	45	TX0p
13	GLB_ALRMn	44	GND
14	MOD_LOPWR	43	(REFCLKn)
15	MOD_ABS	42	(REFCLKp)
16	MOD_RSTn	41	GND
17	MDC	40	RX3n
18	MDIO	39	RX3p
19	PRTADR0	38	GND
20	PRTADR1	37	RX2n
21	PRTADR2	36	RX2p
22	VDN_IO_C	35	GND
23	VDN_IO_D	34	RX1n
24	VDN_IO_E	33	RX1p
25	3.3V_GND	32	GND
26	(MCLKn)	31	RX0n
27	(MCLKp)	30	RX0p
28	3.3V_GND	29	GND

Pin Function Definitions

Pin Num.	Name	Function	Notes
1,2,7,8	3.3V_GND	GROUND	3.3V Module Supply Ground, Internally connected to Signal Ground
3,4,5,6	3.3V	3.3V Module Supply Voltage	3.3V ± 5%
9	VDN_IO_A	I/O	Module Vendor I/O A. NC
10	VDN_IO_B	I/O	Module Vendor I/O B. NC
11	TX_DIS (PNG_CNTL1)	I	"1" or NC = transmitter disable," 0" = transmitter enable
12	TX_LOS (PNG_ALRM1)	O	"1" = loss of signal(low optical signal) "0" = normal condition
13	GLB_ALRMn	O	"0" = alarm condition in any MDIO Alarm register "1" = no alarm conditon

14	MOD_LOPW	I	"1" or NC=module in low power mode "0" =power_on enable
15	MOD-ABS	O	"1" or NC=module absent "0" =module present
16	MOD_RSTn	I	"0" =resets the module "1" or NC=module enabled
17	MDC	1.2V CMOS I	Management Data Clock
18	MDIO	1.2V CMOS I/O	Management Data I/O bi-directional data
19	PRTADR0	1.2V CMOS I	MDIO Physical Port address bit 0
20	PRTADR1	1.2V CMOS I	MDIO Physical Port address bit 1
21	PRTADR2	1.2V CMOS I	MDIO Physical Port address bit 2
22	VDN_IO_C	I/O	Module Vendor I/O C. NC
23	VDN_IO_D	I/O	Module Vendor I/O D. NC
24	VDN_IO_E	I/O	Module Vendor I/O E. NC
25,28,29,32,35,38, 41,44,47,50,53,56	GND	Ground	Signal Ground
26	(MCLKn)	CML O	For optical waveform testin
27	(MCLKp)	CML O	For optical waveform testin
30	RX0p	Lane 0 RX Output O	CML OUTPUT
31	RX0n		
33	RX1p	Lane 1 RX Output O	CML OUTPUT
34	RX1n		
36	RX2p	Lane 2 RX Output O	CML OUTPUT
37	RX2n		
39	RX3p	Lane 3 RX Output O	CML OUTPUT
40	RX3n		
42	(REFCLKn)	Reference Clock I	Reference Clock Input
43	(REFCLKn)		
45	TX0p	Lane 0 TX Input I	I
46	TX0n		
48	TX1p	Lane 1 TX Input I	I
49	TX1n		
51	TX2p	Lane 2 TX Input I	I
52	TX2n		
54	TX3p	Lane 3 TX Input I	I
55	TX3n		

Mechanical Specifications



Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

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