

# SO-CFP-C-DWDM

CFP, 103/112 Gbps, DWDM tunable, SM, DDM, 18dB, 22000ps/nm

## OVERVIEW

The SO-CFP-C-DWDM module is a Coherent CFP based on DP-QPSK modulation. The tunable DWDM module support 50GHz channel spacing. The dispersion limit in amplified networks are beyond 1200km over legacy infrastructure.

## PRODUCT FEATURES

- Capable to retrofit into existing DWDM infrastructure
- Support 50GHz channel spacing
- 18dB link budget with FEC
- Dispersion limited beyond 1200km over SMF (22 000ps/nm), without inline chromatic dispersion compensation
- Very low latency soft-Decision Forward Error Correction without post-FEC error floor
- CFP MSA Hardware Specification 1.4 compliant
- CFP MSA Management Interface Specification 2.2 compliant
- Support CAUI for 100GE
- Support OTL4.10 for OTU4
- Framed PRBS generator/checker on the host and network side interfaces
- Network loopback at the host serializer/de-serializer point
- Built-in OTN processing
- Hot swappable
- CFP class 4 (Maximum power consumption 32W)
- RoHS compliant

## APPLICATIONS

- DWDM links for metro networks
- 100G BASE Ethernet Links
- Communications: Switches, Routers, and HBAs
- Networked storage systems
- Line-side 40G telecom connections

## ORDERING INFORMATION

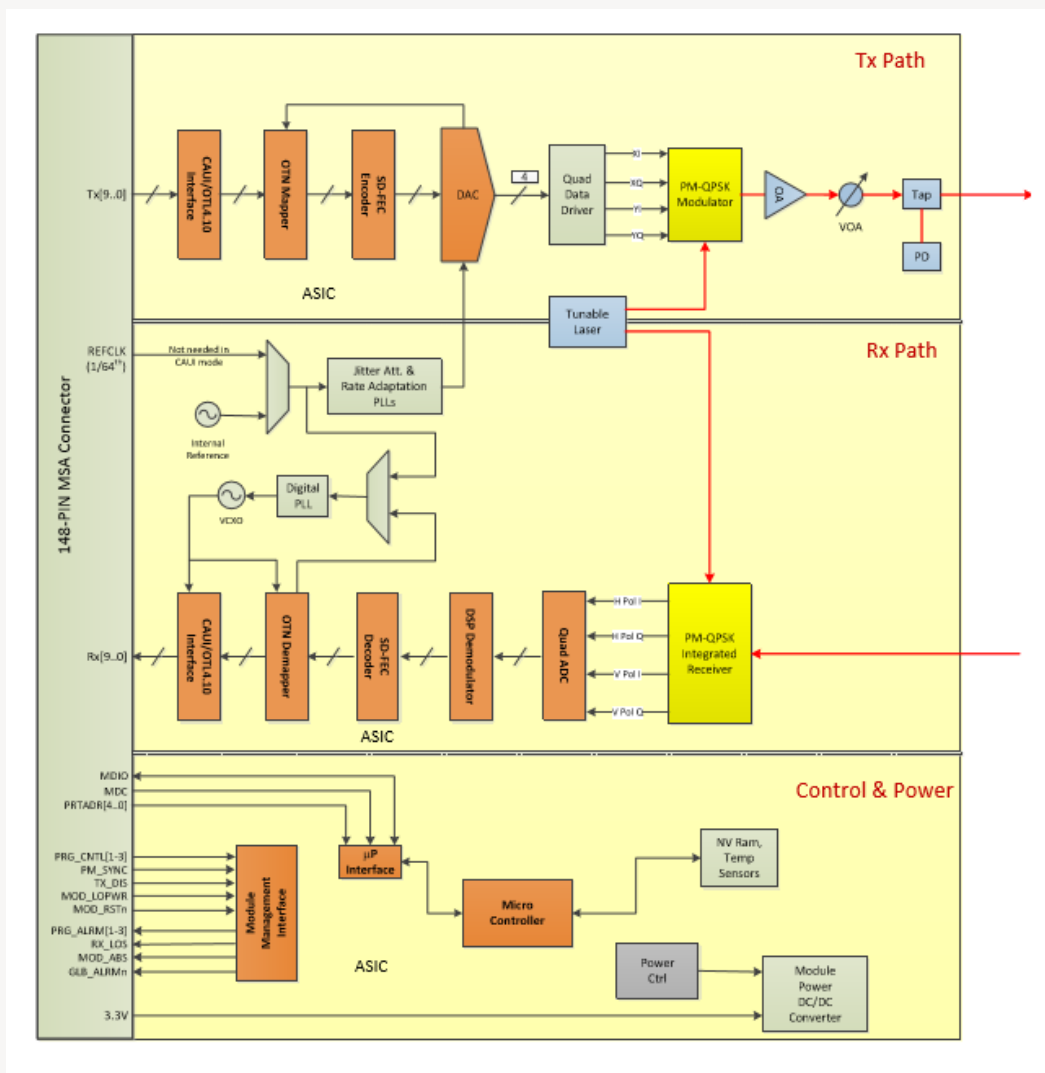
Part Number	Description
SO-CFP-C-DWDM	CFP, 103/112 Gbps, DWDM tunable, SM, DDM, 18dB, 22000ps/nm

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## FUNCTIONAL DIAGRAM

This product converts the 10-channel 10Gbps electrical input data into a 103 or 112 Gbps PM-QPSK modulated optical signal. The receiver part accepts 103 or 112Gbps PM-QPSK modulated optical signals and converts it into 10-channel 10Gbps electrical output data. Figure 1 shows the functional block diagram of this product. The connector interface towards the SM fiber is LC.



## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Storage Temperature	$T_s$	-40	+85	°C
Supply Voltage	$V_{cc}$	-0.5	3.6	V

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	$T_c$	-5		70	°C
Operating Relative Humidity	$RH$	5	85	%	

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## CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Power Consumption	P	2		32	W
Baud rate			103	112	Gbps
Link Distance (SM fiber)				1200	km

## ELECTRICAL CHARACTERISTICS – TRANSMITTER & RECEIVER (EACH LANE)

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter						
Input Amplitude (Differential)	$V_{in}$			1050	mVpp	AC coupled inputs
Differential Input Impedance	$Z_{in}$	80	100	120	Ohm	$R_{in} > 100k\Omega$ @ DC
Receiver						
Output Amplitude (Differential)	$V_{out}$	360		770	mVpp	AC coupled outputs
Differential Output Impedance	$Z_{out}$	80	100	120	Ohm	

## MDIO INTERFACE SPECIFICATION

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input Voltage	$V_{IH}$	0.84	1.2V	1.5	V	
	$V_{IL}$	-0.3		0.36	V	
Input Leak current	$I_{IN}$	-100		100	$\mu$ A	
Output Voltage	$V_{OH}$	1.0		1.5	V	
	$V_{OL}$	-0.3		0.2	V	
Input Capacitance	$C_i$			10	pF	
Input MDC Clock	$f_{MDC}$	0.1		4	MHz	
MDC Clock Period	$T_{MDC}$	250		10000	nsec	
MDIO Hold Time	$T_{hold}$	10			nsec	
MDIO Setup Time	$T_{setup}$	10			nsec	
GLB_ALM	$T_{glb\_alm\_ass}$					
	$T_{glb\_alm\_dea}$					

## OPTICAL CHARACTERISTICS – TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Transmitter frequency range	$\nu$	191.35	-	196.10	GHz	50GHz ITU-T grid. Frequency range over which the specifications hold unless noted otherwise
Channel Spacing	$f_{\text{SPACING}}$	50			GHz	
Laser Tuning Range	$f_{\text{TUNE}}$	Full C-band				
Transmitter laser frequency stability	$\Delta\nu_{\text{EOL}}$	-1.8	-	+1.8	GHz	Frequency stability relative to ITU grid.
Transmitter output power range	$P_{\text{OUT}}$	-15	-	+1	dBm	Transmitter output is settable in steps of 0.1 dB at any power level within the specified frequency range
Output Power accuracy and stability	$\Delta P_{\text{AVG}}$	-1		1	dB	Difference between the set value and actual value over temperature, time, wavelength and aging. For the output range defined
Shutdown Optical Power	$P_{\text{OFF}}$			-40	dBm	E.g., max output power when changing laser frequency
Side Mode Suppression Ratio	SMSR	40			dB	SMSR without modulation
Transmitter turn up time from warm start	$t_{\text{ws}}$			100	ms	Module is in Ready state. The maximum transmitter turn-up time is counted from deassert the Tx_disable Pin to full Tx turn-up.
Transmitter laser disable time	$t_{\text{dis}}$			10	ms	Tx is in full turn-up state. The maximum transmitter turn-off time is counted from assert Tx_disable pin
Transmitter wavelength switching time	$t_{\text{switch}}$			30	s	Tx is in full turn-up state. Maximum switching time from one wavelength to any other wavelength, including modulator bias optimization time
Transmitter turn up time from cold start	$t_{\text{cs}}$			60	s	Module is in Low_Power mode. The maximum Tx turn-up time is counted from de-assert the Low_power pin and Tx_disable pin to full Tx turn-up. The long turnup time happens when the module is soaked at -5C with power off.
Transmitter OSNR	OSNR		27		dB/0.1nm	OSNR at transmitter output (in-band)
Transmit signal-to-max ASE			21		dB/0.1nm	Signal to the maximum out-of-band ASE level
Transmitter optical return loss	$L_r$		27		dB	
Transmitter polarisation dependent power	$\Delta P_{\text{POL}}$			1.0	dB	Power deference between X and Y polarization

## OPTICAL CHARACTERISTICS – RECEIVER

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Receiver frequency range	$\nu$	191.35	-	196.10	GHz	Always on the same frequency with its transmitter
Optimum Input power range	PIN-opt	-13	0	0	dBm	Signal power of the selected channel. The input power range gets optimum OSNR performance defined in OSNR sensitivity
Extended Input power range	PIN-ext	-18		0	dBm	Signal power of the selected channel. The input power range gets OSNR sensitivity performance defined

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Receiver Sensitivity SD-FEC	-21			dBm	Minimum input power needed to achieve post FEC BER < 10 <sup>-15</sup> when OSNR > 35dB and SDFEC is enabled
	RSSD-FEC				
OSNR sensitivity		14.0	15.0	dB/0.1nm	At internal FEC threshold (post FEC BER < 10 <sup>-15</sup> ), input power specified in Optimum Input power range
	OSNR				
OSNRE-4		20.0	23.5	dB/0.1nm	Required OSNR for preFEC BER of 1e-4 with SDFEC enabled; input power defined in Optimum Input power range
	OSNRE-4				
CD Tolerance			22 000	Ps/nm	with less than 0.3dB OSNR penalty at SD-FEC
Filter tolerance	30			GHz	FWHM filter bandwidth, assuming second order Gaussian shape. With less than 0.5dB OSNR penalty at SD-FEC threshold
PMD tolerance			15	ps	PMD tolerance under the following conditions: <input type="checkbox"/> With additional 0.3 dB OSNR from 'OSNR sensitivity' specs. The change in DGD < 45ps per millisecond and change in PSP of < 1 rad/millisecond 15ps of PMD corresponds to max 50 ps of DGD and max 800 ps2 of SOPMD
PDL tolerance	3			dB	PDL tolerance under the following conditions: <input type="checkbox"/> No addition PDL from the source <input type="checkbox"/> With additional 0.5 dB OSNR from OSNR sensitivity specs (6.2.40) Change in PSP is < =1 rad/millisecond
Optical input power transient tolerance	5			dB	Tolerance to variation in received power under the following conditions: less than 0.5 dB OSNR penalty if the received power is within range defined in "input power range" and rise/fall times of power change (defined by 20-80%) of 50ms or slower. <input type="checkbox"/> The OSNR penalty is defined at SD- FEC threshold
Receiver turn-up time from cold start			60	s	Module is in Low_power state and valid Rx input is ready. The time from the de-assert Low_power pin to fullRx turn-up, given that the valid line side signal is ready
Receiver turn-up time from warm start			30	ms	Module Rx is in Wait-forinput state. The maximum receiver turn-up time from valid Rx input power to full Rx turn-up
Dispersion reading accuracy	-3%		3%	Ps/ms	The receiver reports the amount of dispersion being compensated
DGD reading accuracy	-4		+4	Ps	The receiver reports the amount of DGD being com
Input power reading accuracy	-1.3		+1.3	dB	The module reports the actual power as received by the module within the range of 0 to -18 dBm
Input power reading accuracy	-1.8		+1.8	dB	The module reports the actual power as received by the module within the range of -18 to -25 dBm

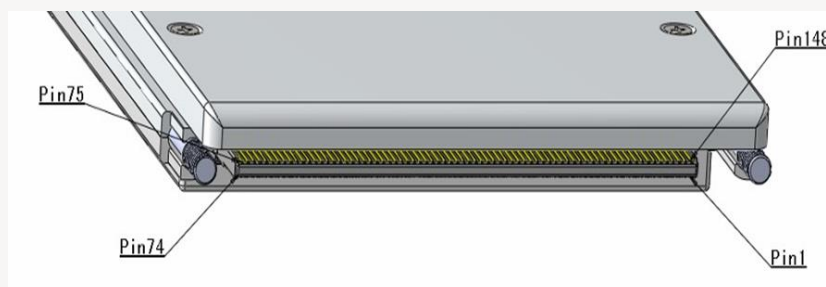
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Clock Recovery OSNR threshold	12	dB/0.1nm	The minimum OSNR sensitivity at which the receiver is able to recover the clock.
Optical Return Loss	27	dB	

## PIN ASSIGNMENT AND FUNCTION DEFINITIONS

### PIN ASSIGNMENT



### PIN DEFINITION

PIN	Signal Name	Description	PIN	Signal Name	Description
1	GND	3.3V Module Supply Ground	148	GND	3.3V Module Supply Ground
2	GND	3.3V Module Supply Ground	147	REFCLKn	Reference Clock Input
3	GND	3.3V Module Supply Ground	146	REFCLKp	Reference Clock Input
4	GND	3.3V Module Supply Ground	145	GND	3.3V Module Supply Ground
5	GND	3.3V Module Supply Ground	144	NC	Not Connected
6	3.3V	3.3V Module Supply Voltage	143	NC	Not Connected
7	3.3V	3.3V Module Supply Voltage	142	GND	3.3V Module Supply Ground
8	3.3V	3.3V Module Supply Voltage	141	TX9n	CML Input
9	3.3V	3.3V Module Supply Voltage	140	TX9p	CML Input
10	3.3V	3.3V Module Supply Voltage	139	GND	3.3V Module Supply Ground
11	3.3V	3.3V Module Supply Voltage	138	TX8n	CML Input
12	3.3V	3.3V Module Supply Voltage	137	TX8p	CML Input
13	3.3V	3.3V Module Supply Voltage	136	GND	3.3V Module Supply Ground
14	3.3V	3.3V Module Supply Voltage	135	TX7n	CML Input
15	3.3V	3.3V Module Supply Voltage	134	TX7p	CML Input
16	GND	3.3V Module Supply Ground	133	GND	3.3V Module Supply Ground
17	GND	3.3V Module Supply Ground	132	TX6n	CML Input
18	GND	3.3V Module Supply Ground	131	TX6p	CML Input
19	GND	3.3V Module Supply Ground	130	GND	Ground (1)
20	GND	3.3V Module Supply Ground	129	TX5n	CML Input
21	VND_IO_A	Module Vendor I/O, NC	128	TX5p	CML Input
22	VND_IO_B	Module Vendor I/O, NC	127	GND	3.3V Module Supply Ground
23	GND	3.3V Module Supply Ground	126	TX4n	CML Input
24	(TX_MCLKn)	Tx Monitor Clock Output	125	TX4p	CML Input
25	(TX_MCLKp)	Tx Monitor Clock Output	124	GND	3.3V Module Supply Ground

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26	GND	3.3V Module Supply Ground	123	TX3n	CML Input
27	VND_IO_C	Module Vendor I/O, must not connect at host board	122	TX3p	CML Input
28	VND_IO_D	Module Vendor I/O, must not connect at host board	121	GND	3.3V Module Supply Ground
29	VND_IO_E	Module Vendor I/O, must not connect at host board	120	TX2n	CML Input
30	PRG_CNTL1	Input LVCOMS	119	TX2p	CML Input
31	PRG_CNTL2	Input LVCOMS	118	GND	3.3V Module Supply Ground
32	PRG_CNTL3	Input LVCOMS	117	TX1n	CML Input
33	PRG_ALARM1	Output LVCOMS	116	TX1p	CML Input
34	PRG_ALARM2	Output LVCOMS	115	GND	3.3V Module Supply Ground
35	PRG_ALARM3	Output LVCOMS	114	TX0n	CML Input
36	TX_DIS	"1" or NC: transmitter disabled "0": transmitter enabled	113	TX0p	CML Input
37	MOD_LOPWR	"1" or NC: module is low power(safe) mode "0": power-on enabled	112	GND	3.3V Module Supply Ground
38	MOD_ABS	"1" or NC: module absent "0": module present	111	GND	3.3V Module Supply Ground
39	MOD_RSTn	"0": resets the module "1" or NC: module enabled	110	NC	Not Connected
40	RX_LOS	"1": low optical signal "0": normal condition	109	NC	Not Connected
41	GLB_ALRMn	Global Alarm "0": alarm condition in any MDIO Alarm register "1": no alarm condition	108	GND	3.3V Module Supply Ground
42	PRTADR4	1.2V CMOS Input, MDIO Physical port address bit 4	107	RX9n	CML Output
43	PRTADR3	1.2V CMOS Input, MDIO Physical port address bit 3	106	RX9p	CML Output
44	PRTADR2	1.2V CMOS Input, MDIO Physical port address bit 2	105	GND	3.3V Module Supply Ground
45	PRTADR1	1.2V CMOS Input, MDIO Physical port address bit 1	104	RX8n	CML Output
46	PRTADR0	1.2V CMOS Input, MDIO Physical port address bit 0	103	RX8p	CML Output
47	MDIO	1.2V CMOS I/O, Management Data I/O bi-directional data	102	GND	3.3V Module Supply Ground
48	MDC	1.2V CMOS Input, Management Data Clock	101	RX7n	CML Output
49	GND	3.3V Module Supply Ground	100	RX7p	CML Output
50	VND_IO_F	Module Vendor I/O, Not Connected Internally	99	GND	3.3V Module Supply Ground
51	VND_IO_G	Module Vendor I/O, Not Connected Internally	98	RX6n	CML Output
52	GND	3.3V Module Supply Ground	97	RX6p	CML Output
53	VND_IO_H	Module Vendor I/O, Not Connected Internally	96	GND	3.3V Module Supply Ground
54	VND_IO_J	Module Vendor I/O, Not Connected Internally	95	RX5n	CML Output
55	GND	3.3V Module Supply Ground	94	RX5p	CML Output
56	GND	3.3V Module Supply Ground	93	GND	3.3V Module Supply Ground
57	GND	3.3V Module Supply Ground	92	RX4n	CML Output
58	GND	3.3V Module Supply Ground	91	RX4p	CML Output
59	GND	3.3V Module Supply Ground	90	GND	3.3V Module Supply Ground
60	3.3V	3.3V Module Supply Voltage	89	RX3n	CML Output
61	3.3V	3.3V Module Supply Voltage	88	RX3p	CML Output
62	3.3V	3.3V Module Supply Voltage	87	GND	3.3V Module Supply Ground
63	3.3V	3.3V Module Supply Voltage	86	RX2n	CML Output

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64	3.3V	3.3V Module Supply Voltage	85	RX2p	CML Output
65	3.3V	3.3V Module Supply Voltage	84	GND	3.3V Module Supply Ground
66	3.3V	3.3V Module Supply Voltage	83	RX1n	CML Output
67	3.3V	3.3V Module Supply Voltage	82	RX1p	CML Output
68	3.3V	3.3V Module Supply Voltage	81	GND	3.3V Module Supply Ground
69	3.3V	3.3V Module Supply Voltage	80	RX0n	CML Output
70	GND	3.3V Module Supply Ground	79	RX0p	CML Output
71	GND	3.3V Module Supply Ground	78	GND	3.3V Module Supply Ground
72	GND	3.3V Module Supply Ground	77	(RX_MCLKn)	Rx Monitor Clock Output
73	GND	3.3V Module Supply Ground	76	(RX_MCLKp)	Rx Monitor Clock Output
74	GND	3.3V Module Supply Ground	75	GND	3.3V Module Supply Ground



