

400GBASE-DR4 OSFP PAM4 1310nm 500m Transceiver

P/N: 6C-OSFP-DD-DR4



Features:

- Compliant with IEEE 802.3-2022:
- - 400GBASE-DR4 optical interface
- Compliant with IEEE 802.3ck-2022:
- - 400GAUI-4/200GAUI-2/100GAUI-1 C2M
- electrical interface
- Compliant with OSFP RHS
- Compliant with CMIS Rev 5.2
- Case operating temperature 0°C to 70°C
- Two wire serial Interface with digital diagnostic monitoring
- Complies with EU Directive 2011/65/EU (RoHS compliant)
- Class 1 Laser

I. Module Characteristics

Table 1 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Temperature	T_S	-40	85	°C	
Supply Voltage	V_{CC}	-0.5	3.6	V	
Relative Humidity (non-condensing)	RH	5	95	%	
Data Input Voltage Differential	$ V_{DIP}-V_{DIN} $	-	1	V	
Control Input Voltage	V_I	-0.3	$V_{CC}+0.5$	V	
Control Output Current	I_O	-20	20	mA	

Table 2 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T_{OPR}	0	-	70	°C	1
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Instantaneous peak current at hot plug	I_{CC_IP}	-	-	3600	mA	
Sustained peak current at hot plug	I_{CC_SP}	-	-	2997	mA	
Maximum Power Dissipation	P_D	-	-	9	W	
Maximum Power Dissipation, Low Power Mode	P_{DLP}	-	-	2	W	
Signalling Speed per Lane	DRL	-	53.125	-	GBd	
Control Input Voltage High	V_{IH}	$V_{CC}*0.7$	-	$V_{CC}+0.3$	V	
Control Input Voltage Low	V_{IL}	-0.3	-	$V_{CC}*0.3$	V	
Two Wire Serial Interface Clock Rate	-	-	-	400	kHz	
Power Supply Noise 1 kHz - 1 MHz (p-p)	-	-	-	66	mVpp	
Operating Distance	-	2	-	500	m	

II. Functional Characteristics (Optical)

The following tables list the performance specifications for the various functional blocks of the integrated optical transceiver module.

Table 3 – Transmitter Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_C	1304.5	1311	1317.5	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average Launch Power, each lane	AOP_L	-2.9	-	4.0	dBm	1
Outer Optical Modulation Amplitude (OMA _{outer}), each Lane	T_{OMA}	-0.8	-	4.2	dBm	
Launch power in OMA _{outer} minus TDECQ, each lane	$T_{OMA-TDECQ}$	-2.2	-	-	dBm	
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each lane	TDECQ	-	-	3.4	dB	
TDECQ – 10log10(Ceq), each lane	-	-	-	3.4	dB	
Average Launch Power of OFF Transmitter, each lane	T_{OFF}	-	-	-15	dBm	

Extinction Ratio	ER	3.5	-	-	dB	
Transmitter transition time	Tr			17	ps	
RIN _{21.4} OMA	RIN	-	-	-136	dB/Hz	
Optical return loss tolerance	ORL	-	-	21.4	dB	
Transmitter Reflectance	T _R	-	-	-26	dB	2

Note 1: Average launch power, each lane (min) is informative and not the principal indicator of signal strength

Note 2: Transmitter reflectance is defined looking into the transmitter.

Table 4 – Receiver Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_{CO}	1304.5	1311	1317.5	nm	
Damage Threshold, each Lane	AOP _D	5	-	-	dBm	
Average Receive Power, each Lane	AOP _R	-5.9	-	4	dBm	
Receive Power (OMaouter), each Lane	OMA _R	-	-	4.2	dBm	
Receiver Reflectance	RR	-	-	-26	dB	
Receiver Sensitivity (OMaouter), each Lane	S _{OMA}	-	-	Max(-3.9, SECQ - 5.3)	dBm	1
Stressed Receiver Sensitivity (OMaouter), each Lane	SRS	-	-	-1.9	dBm	2
Conditions of stressed receiver sensitivity test						
Stressed eye closure for PAM4 (SECQ), lane under test	SECQ	-	3.4	-	dB	
SECQ - 10log10(Ceq), lane under test	Ceq	-	-	3.4	dB	
OMaouter of each aggressor lane	-	-	4.2	-	dBm	

Note 1: Receiver sensitivity (OMaouter), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB.

Note 2: Measured with conformance test signal at TP3 for the BER = 2.4x10⁻⁴

III. Functional Characteristics (Electrical)

Table 5 – Electrical Specification High Speed Signal (compliant with IEEE802.3ck C2M)

Receiver (Module Output, TP4)						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Peak-to-peak AC common-mode voltage	-				mV	
Low-frequency, VCMLF Full-band, VCMFB		-	-	32 80		
Differential peak-to-peak output voltage	-					
Short mode Long mode		-	-	600 845	mV	
Eye height	EH	15	-	-	mV	
Vertical eye closure	VEC	-	-	12	dB	
Common-mode to differential-mode return loss	RLDc	802.3ck 120G-1			dB	
Effective return loss	ERL	8.5	-	-	dB	
Differential termination mismatch	-	-	-	10	%	
Transition time	-	8.5	-	-	ps	

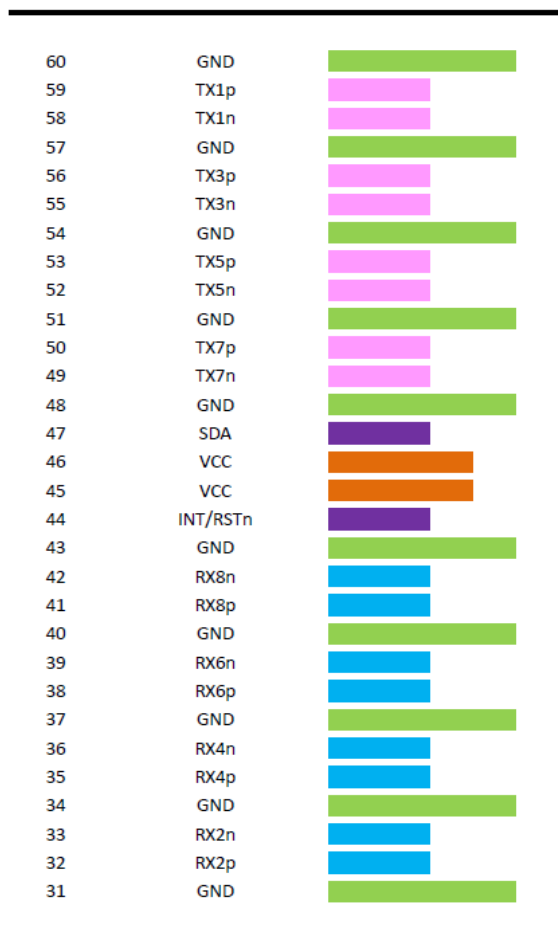
DC common-mode voltage tolerance	-	-0.35	-	2.85	V	
Transmitter (Module Input, TP1)						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential pk-pk input Voltage tolerance (TP1a)	-	750	-	-	mV	
Peak-to-peak AC common-mode voltage tolerance	-				mV	
Low-frequency, VCMLF		-	-	32		
Full-band, VCMFB				80		
Differential-mode to common-mode return loss	RLcd	802.3ck 120G-2			dB	
Effective return loss	ERL	8.5	-	-	dB	
Differential termination mismatch	-	-	-	10	%	
Single-ended voltage tolerance range	-	-0.4	-	3.3	V	
DC common-mode voltage tolerance	-	-0.35	-	2.85	V	

Table 6 – Electrical Specification Low Speed Control and Sense Signals

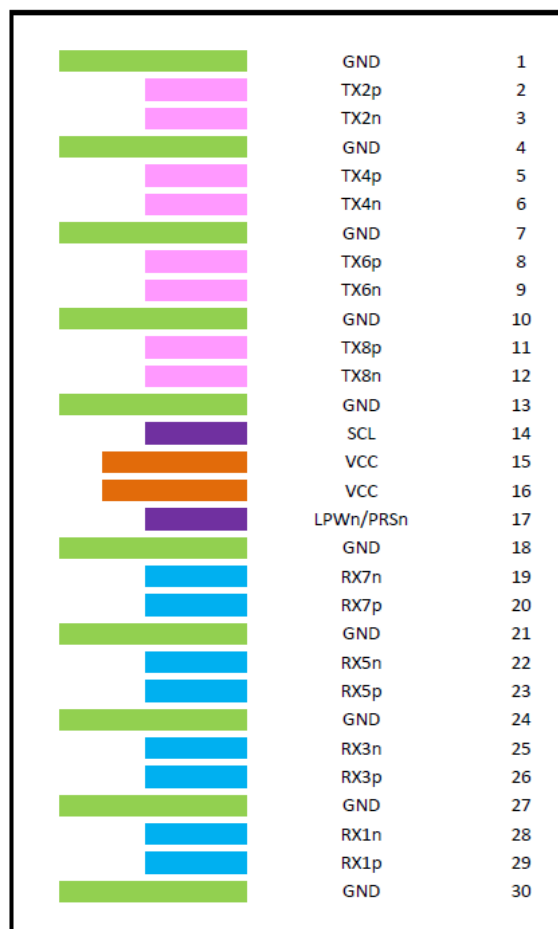
Parameter	Symbol	Min.	Max.	Unit	Condition
Module output SCL and SDA	V _{OL}	0	0.4	V	
Module Input SCL and SDA	V _{IL}	-0.3	V _{CC} *0.3	V	
	V _{IH}	V _{CC} *0.7	V _{CC} +0.5	V	
InitMode, ResetL and ModSelL	V _{IL}	-0.3	0.8	V	
	V _{IH}	2	V _{CC} +0.3	V	
IntL	V _{OL}	0	0.4	V	
	V _{OH}	V _{CC} -0.5	V _{CC} +0.3	V	

IV. Pin Definitions

Top Side (viewed from top)



Bottom Side (viewed from bottom)



----- Module Card Edge -----

Figure 1 – Pinout definitions of OSFP module inputs/outputs

Table 7 – Module Pin Definitions

Pin #	Symbol	Description	Logic	Notes	Pin #	Symbol	Description	Logic	
1	GND	Ground			31	GND	Ground		
2	TX2p	Transmitter Data Non-Inverted	CML-I		32	RX2p	Receiver Data Non-Inverted	CML-O	
3	TX2n	Transmitter Data Inverted	CML-I		33	RX2n	Receiver Data Inverted	CML-O	
4	GND	Ground			34	GND	Ground		
5	TX4p	Transmitter Data Non-Inverted	CML-I		35	RX4p	Receiver Data Non-Inverted	CML-O	
6	TX4n	Transmitter Data Inverted	CML-I		36	RX4n	Receiver Data Inverted	CML-O	
7	GND	Ground			37	GND	Ground		
8	TX6p	Transmitter Data Non-Inverted	CML-I	1	38	RX6p	Receiver Data Non-Inverted	CML-O	1
9	TX6n	Transmitter Data Inverted	CML-I	1	39	RX6n	Receiver Data Inverted	CML-O	1

10	GND	Ground			40	GND	Ground		
11	TX8p	Transmitter Data Non-Inverted	CML-I	1	41	RX8p	Receiver Data Non-Inverted	CML-O	1
12	TX8n	Transmitter Data Inverted	CML-I	1	42	RX8n	Receiver Data Inverted	CML-O	1
13	GND	Ground			43	GND	Ground		
14	SCL	2-wire Serial interface clock	LVC MOS-I/O		44	INT/RST _n	Module Interrupt / Module Reset	Multi-Level	
15	VCC	+3.3V Power			45	VCC	+3.3V Power		
16	VCC	+3.3V Power			46	VCC	+3.3V Power		
17	LPWn/P _{RSn}	Low-Power Mode / Module Present	Multi-Level		47	SDA	2-wire Serial interface data	LVC MOS-I/O	
18	GND	Ground			48	GND	Ground		
19	RX7n	Receiver Data Inverted	CML-O	1	49	TX7n	Transmitter Data Inverted	CML-I	1
20	RX7p	Receiver Data Non-Inverted	CML-O	1	50	TX7p	Transmitter Data Non-Inverted	CML-I	1
21	GND	Ground			51	GND	Ground		
22	RX5n	Receiver Data Inverted	CML-O	1	52	TX5n	Transmitter Data Inverted	CML-I	1
23	RX5p	Receiver Data Non-Inverted	CML-O	1	53	TX5p	Transmitter Data Non-Inverted	CML-I	1
24	GND	Ground			54	GND	Ground		
25	RX3n	Receiver Data Inverted	CML-O		55	TX3n	Transmitter Data Inverted	CML-I	
26	RX3p	Receiver Data Non-Inverted	CML-O		56	TX3p	Transmitter Data Non-Inverted	CML-I	
27	GND	Ground			57	GND	Ground		
28	RX1n	Receiver Data Inverted	CML-O		58	TX1n	Transmitter Data Inverted	CML-I	
29	RX1p	Receiver Data Non-Inverted	CML-O		59	TX1p	Transmitter Data Non-Inverted	CML-I	
30	GND	Ground			60	GND	Ground		

Notes 1: Not use.

V. Recommended OSFP Host Board Schematic

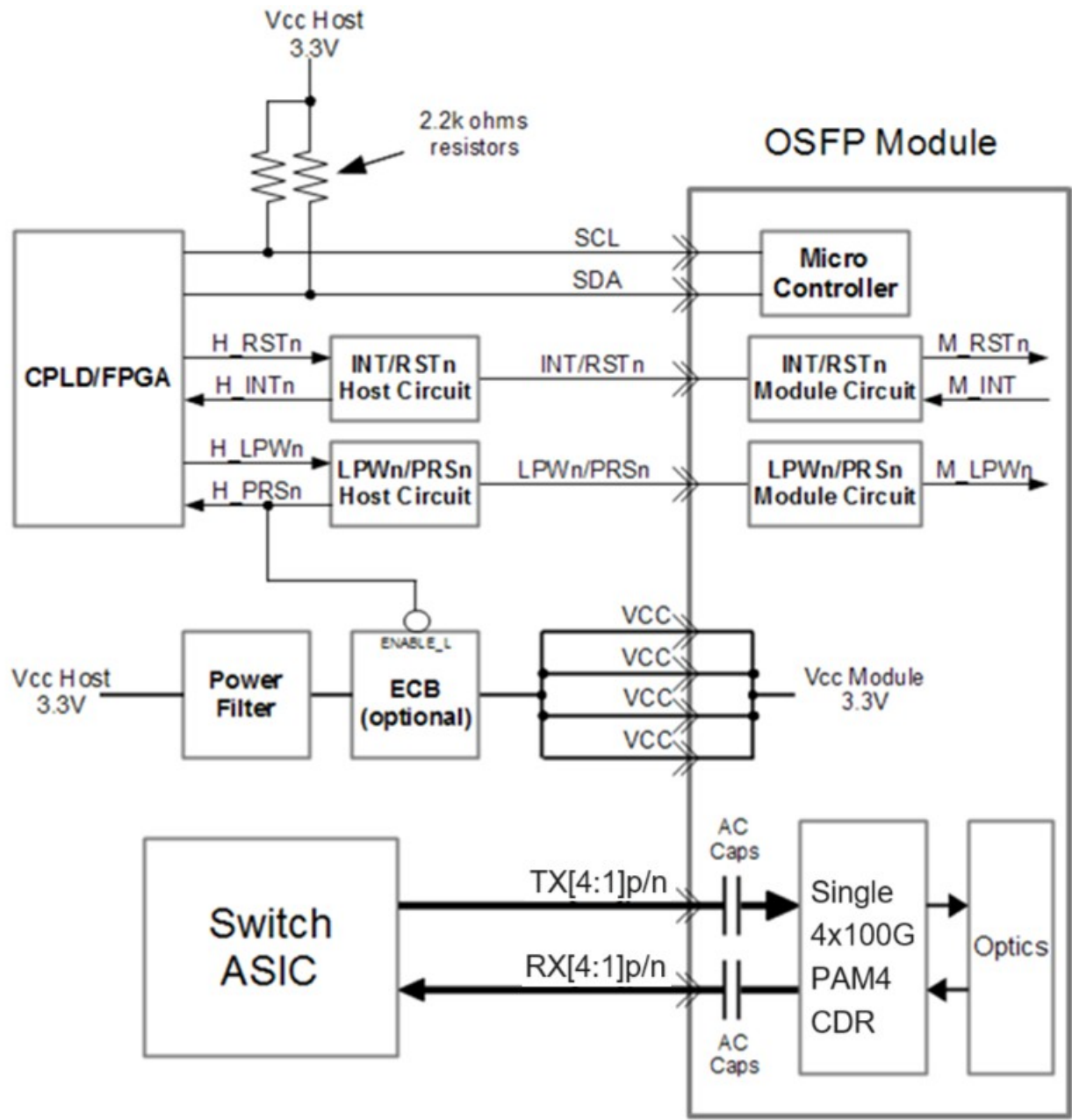


Figure 2 – Recommended OSFP Host Board Schematic

Table 8 – Digital Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	±3	°C	Internal
Voltage	0 to V _{cc}	0.1	V	Internal
Tx Bias Current (Each Lane)	0 to 100	10%	mA	Internal
Tx Output Power (Each Lane)	-2.9 to +4	±3	dB	Internal
Rx Receive Power (Each Lane)	-5.9 to +4	±3	dB	Internal

VI. Ordering Information

Table 9 - Ordering Information

Part No.	Application	Data Rate	Laser Source	Fiber Type
6C-OSFP-DD-DR4	400GBASE-DR4	425Gb/s	EML	Single Mode Fiber

VII. Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Class 1 Laser Product. Complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.