

# SO-CFP-40GBase-FR

CFP, 41.25 Gbps, FR4, 1550nm, SM, DDM, 6dB, 2km

## OVERVIEW

The SO-CFP-40GBase-FR is a CFP optical transceiver module which is a hot pluggable form factor designed for high speed optical networking applications. The SO-CFP-40GBase-FR converts 4-lane, 10.3125 Gbps electrical input data streams to a 41.25 Gbps serial optical output signal and a 41.25 Gbps optical input signal to 4-lane, 10.3125 Gbps electrical data streams. The EOLC-1540G-02's optical and electrical interface is fully compliant with the IEEE 802.3bg 40GBASE-FR standard. The EOLC-1540G-02 supports SONET OC768 SR2, SDH VSR2000 3R2 and OTU3 client optical interface modes. The high performance DFB-EML transmitter and high sensitivity PIN receiver provide excellent performance for 40Gigabit Ethernet applications as well as SONET/SDH and OTN VSR applications up to 2km. The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the CFP MSA Hardware Specification Revision 1.4.

## PRODUCT FEATURES

- 40Gbps serial optical interface
- 1550nm EML laser and PIN receiver
- Up to 2km transmission on SM fiber
- IEEE802.3bg 40GBase-FR compliant
- ITU-T G.693 VSR2000-3R2 compliant
- Hot-Pluggable CFP footprint duplex LC connector interface
- Single 3.3V power supply and power dissipation
- Class 1 FDA and IEC60825-1 laser safety compliant
- MDIO interface with Digital Diagnostic Monitoring (DDM)
- XLAUI/OTL3.4/STL256.4/SFI5.2 interface
- Compliant with CFP MSA specification
- RoHS6 compliant
- Operating temperature: 0°C to +75°C

## APPLICATIONS

- 40GBASE-FR Ethernet links
- OTU-3

## ORDERING INFORMATION

Part Number	Description
SO-CFP-40GBase-FR	CFP, 41.25 Gbps, FR4, 1550nm, SM, DDM, 6dB, 2km

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## FUNCTIONAL DESCRIPTION

The SO-CFP-40GBase-FR optical transceiver is a bi-directional module with a transmitter and receiver in the CFP MSA form factor. The figure below shows the functional block diagram of SO-CFP-40GBase-FR CFP transceiver. SO-CFP-40GBase-FR contains a 4:1 MUX, a 1:4 DMUX, optical transmitter (OTX), optical receiver (ORX), and a module management block including an MDIO interface.

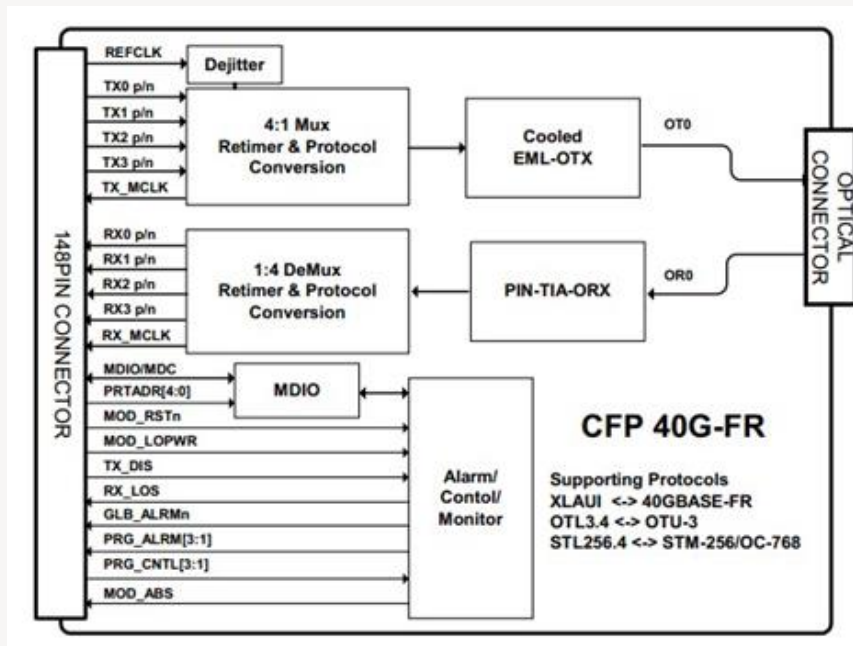


Figure 1. Functional diagram

### TRANSMITTER OPERATION:

The transceiver module receives 4-lane, 10.3125 Gbps electrical inputs and a reference clock. The reference clock frequency should be 1/64 or 1/16 of the electrical input lane (host lane) rate and should be synchronized to the electrical input lanes. De-jitter circuitry reduces phase noise of the reference clock before feeding it into the 4:1 MUX. The 4:1 MUX synthesizes the reference clock and generates a 41.25 GHz clock for multiplexing the input 4-lane signals. The 4:1 MUX multiplexes 4-lane electrical signals to a serial 41.25 Gbps data stream after reshaping and retiming received electrical input lane signals. The OTX converts serial 41.25 Gbps electrical data stream to an optical domain signal through Laser driver and Laser diode which is packaged in a Transmitter Optical Sub-Assembly package. The optical output power is held constant by an automatic power control (APC) circuit. The transmitter output can be turned off by using the TX\_DIS hardware pin and/or through the MDIO module management Interface. The operation mode of the transmitter can be changed to SDH (SONET) mode or OTU3 mode by changing the MDIO register for "TX Rate Select". More detail on mode change refers to "MDIO Registers for Signal Rate and Operation Mode" section.

### RECEIVER OPERATION

The SO-CFP-40GBase-FR receives 41.25 Gbps optical signal. The ORX converts optical signal to electrical data stream. The 1:4 DMUX de-multiplexes 41.25 Gbps data streams to 4-lane 10.3125 Gbps electrical output signals which are compliant with XLAUI interface requirements. The receiver monitor clock, RX\_MCLK, is recovered from received optical signal. This RX\_MCLK is normally disabled and can be enabled through MDIO register. Received optical signal power is monitored and reported through the MDIO. If the received optical signal is weaker than the threshold level, RX\_LOS hardware alarm will be asserted. The operation mode of the receiver can be changed to SDH (SONET) mode or OTU3 mode by changing the MDIO register for "RX Rate Select".

## ABSOLUTE MAXIMUM RATINGS

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Parameter	Symbol	Min	Max	Unit
Storage Temperature	$T_s$	-40	+85	°C
Supply Voltage	$V_{cc}$	-0.5	3.6	V
Operating Relative Humidity	$RH$	5	85	%

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	$T_c$	-10		75	°C
Power Supply Voltage	$V_{cc}$	3.2	3.3	3.4	V
Power Supply Current			4848		mA
Power Consumption	$P$			8	W
Low power mode dissipation				2	W
Signalling rate	40Gbase-FR		41.25		Gbps
	STM-256/OC-768		39.81312		
	OTU3		43.018413		
Link Distance (SM fiber)				1	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
Input Voltage	$V_{IH}$	0.84		1.5	V
	$V_{IL}$	-0.3		0.36	V
Input Leak current	$I_{IN}$	-100		100	μA
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	$T_{glb\_alm\_ass}$				
	$T_{glb\_alm\_dea}$				

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## OPTICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Transmission distance on 9/125 $\mu$ m SMF	$L$			2	km
Signalling rate	40Gbase-FR		41.25		Gbps
	STM-256/OC-768		39.81312		Gbps
	OTU3		43.018413		Gbps
Signalling rate tolerance	40Gbase-FR		$\pm 100$		ppm
	STM-256/OC-768		$\pm 20$		ppm
	OTU3		$\pm 20$		Ppm
Channel insertion loss		0		4	dB
Transmission power penalty				2	dB
Total Link budget		6			dB

## OPTICAL CHARACTERISTICS – TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Unit
Center wavelength range	$\lambda_c$	1530	1550	1565	nm
Total Average Launch Power	$P_o$	0		+3	dBm
Optical path penalty				2	dB
Side Mode Suppression Ratio	$SMSR$	35			dB
Optical Return Loss Tolerance				20	dB
Extinction Ratio	$ER$	8.2			dB
RIN20 OMA	$RIN$			-132	dB/Hz
Optical return loss	$T_{off}$			20	dB
Transmitter reflectance				-12	dB
Output Optical Eye	40GBase-FR		{0.25,0.4,0.45,0.22,0.25,0.4}		
	VSR2000		{0.2,0.25,0.75,0.25,0.25}		

## OPTICAL CHARACTERISTICS – RECEIVER

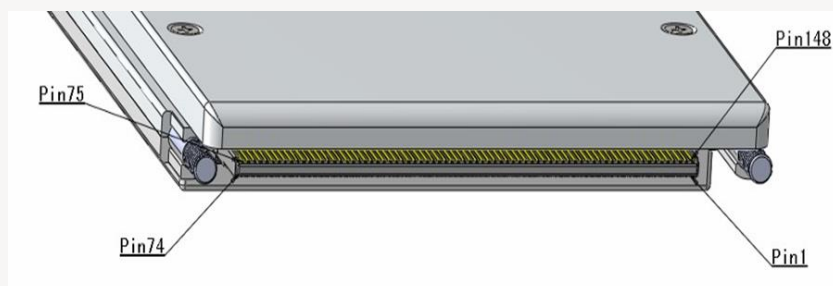
Parameter	Symbol	Min	Typ	Max	Unit
Central wavelength range		1530		1565	nm
Damage threshold	$P_{indm}$	4			dBm
Receiver Sensitivity	$P_{min}$			-6	dBm
Receive Overload	$P_{max}$	3			dBm
Optical Return Loss	$ORL$			-27	dB
LOS Assert	$LOS_A$	-30		-12	dBm
LOS Deassert	$LOS_D$			-9	dBm
LOS Hysteresis	$LOS_H$	0.5			dB

## PIN ASSIGNMENT AND FUNCTION DEFINITIONS

## PIN ASSIGNMENT

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## 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
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

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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
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

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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

MECHANICAL DRAWING

