High Speed Mezzanine Card (HSMC) for CoaXPress™

Data Book
2013

International Distributors

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Revision History

Version	Date	Notes
0.1	23.1.13	Initial Release

2.1 Safety Precautions

With your ***High Speed Mezzanine Card for CoaXPress™ (HSMC-CXP)*** board in hand, please take a minute to read carefully the precautions listed below in order to prevent unnecessary injuries to you or other personnel or cause damage to property.

- **Before using the product, read these safety precautions carefully to assure correct use.**
- **These precautions contain serious safety instructions that must be observed.**
- **After reading through this manual, be sure to act upon it to prevent misuse of product.**

Caution

In the event of a failure, disconnect the power supply. If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately and contact our sales personnel for repair.
If an unpleasant smell or smoking occurs, disconnect the power supply. If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately. After verifying that no smoking is observed, contact our sales personnel for repair.
Do not disassemble, repair or modify the product. Otherwise, a fire or electric shock may occur due to a short circuit or heat generation. For inspection, modification or repair, contact our sales personnel.
Do not touch a cooling fan. As a cooling fan rotates in high speed, do not put your hand close to it. Otherwise, it may cause injury to persons. Never touch a rotating cooling fan.
Do not place the product on unstable locations. Otherwise, it may drop or fall, resulting in injury to persons or failure.
If the product is dropped or damaged, do not use it as is. Otherwise, a fire or electric shock may occur.
Do not touch the product with a metallic object. Otherwise, a fire or electric shock may occur.
Do not place the product in dusty or humid locations or where water may splash. Otherwise, a fire or electric shock may occur.
Do not get the product wet or touch it with a wet hand. Otherwise, the product may break down or it may cause a fire, smoking or electric shock.
Do not touch a connector on the product (gold-plated portion). Otherwise, the surface of a connector may be contaminated with sweat or skin oil, resulting in contact failure of a connector or it may cause a malfunction, fire or electric shock due to static electricity.

Do not use or place the product in the following locations. ● Humid and dusty locations ● Airless locations such as closet or bookshelf ● Locations which receive oily smoke or steam ● Locations close to heating equipment ● Closed inside of a car where the temperature becomes high ● Static electricity replete locations ● Locations close to water or chemicals Otherwise, a fire, electric shock, accident or deformation may occur due to a short circuit or heat generation.
Do not place heavy things on the product. Otherwise, the product may be damaged.

2.2 Disclaimer

This product should be used for CoaXPress video acquisition and generation. It also can be used for digital input/output (GPIO) purposes. KAYA Instruments assumes no responsibility for any damages resulting from the use of this product for purposes other than those stated.
Even if the product is used properly, KAYA Instruments assumes no responsibility for any damages caused by the following:

- Earthquake, thunder, natural disaster or fire resulting from the use beyond our responsibility, acts caused by a third party or other accidents, the customer's willful or accidental misuse or use under other abnormal conditions.
- Secondary impact arising from use of this product or its unusable state (business interruption or others).
- Use of this product against the instructions given in this manual or malfunctions due to connection to other devices.

KAYA Instruments assumes no responsibility or liability for:

- Erasure or corruption of data arising from use of this product.
- Any consequences or other abnormalities arising from use of this product, or damage of this product not due to our responsibility or failure due to modification.

Repair of this product is carried out by replacing it on a chargeable basis, not repairing the faulty devices. However, non-chargeable replacement is offered for initial failure if such notification is received within two weeks after delivery of the product.

3 Key Features

3.1 Overview

The ***HSMC-CXP*** is the industry's first High Speed Mezzanine Card providing a high performance CoaXPress compliant connection. The ***HSMC-CXP*** is capable of capturing video from up to 4 CoaXPress mode cameras and is ideally suited to industrial, defense and aerospace applications. This mezzanine card might be also used as camera simulator, emulating up to 4 transmitting channels. Customer specific data pre-processing or custom protocols are easily accommodated via FPGA carrier card. The ***HSMC-CXP*** also provides isolated GPIO for input/output signals, such as triggers, shaft encoders, exposure control and general I/O.

The ***HSMC-CXP*** uses a standard HSMC connector as an interface to the host board, general purpose I/O and can be used in a ruggedized conduction cooled factor for harsher environments. Up to 4 host and 4 device links can be provided using BNC connectors. Each link supports standard CoaXPress bitrates up to 6.25 Gbps. Each host link is capable of providing up to 13W of power to compatible devices via Power over CoaXPress (PoCXP). The ***HSMC-CXP*** can support up to 4 individual links, or combinations of aggregated CoaXPress links (e.g. two cameras requiring two links, and two additional cameras each using one link). Additionally, up to 4 individual or aggregated device links are supported.

3.2 Features

- Interfaces:
  - Up to 4 CoaXPress host links
  - Up to 4 CoaXPress device links
  - 12 opto-isolated inputs
  - 12 opto-isolated outputs
  - External power supply for extended use of PoCXP (optional)
- Altera HSMC compliant
- 8 BNC vertical connectors
- MIL-I-46058c conformal coating (optional)
- 78mm x 92mm, single slot HSMC
- Power over CoaXPress support
- Support standard CoaXPress data rates up to 6.25Gpbs
- -40°C to 85°C operating environment temperature (industrial grade)

3.3 Product Applications

- High speed cameras
- High definition cameras
- Panoramic cameras
- Existing coax systems upgrade
- Defense remote systems
- Slip Ring systems
- Automotive surround view system
- Surveillance
- Robotic Vision

3.4 Related documents and accessories

Documents:

- EQCO62R20.3 Datasheet from EqcoLogic
- EQCO62T20.3 Datasheet from EqcoLogic
- HSMC mezzanine card standard from Altera

Accessories:

- Board Standoffs set
- Transmission cable set (different length)
  - BNC-BNC
  - DIN-BNC

4.1 Block Diagram

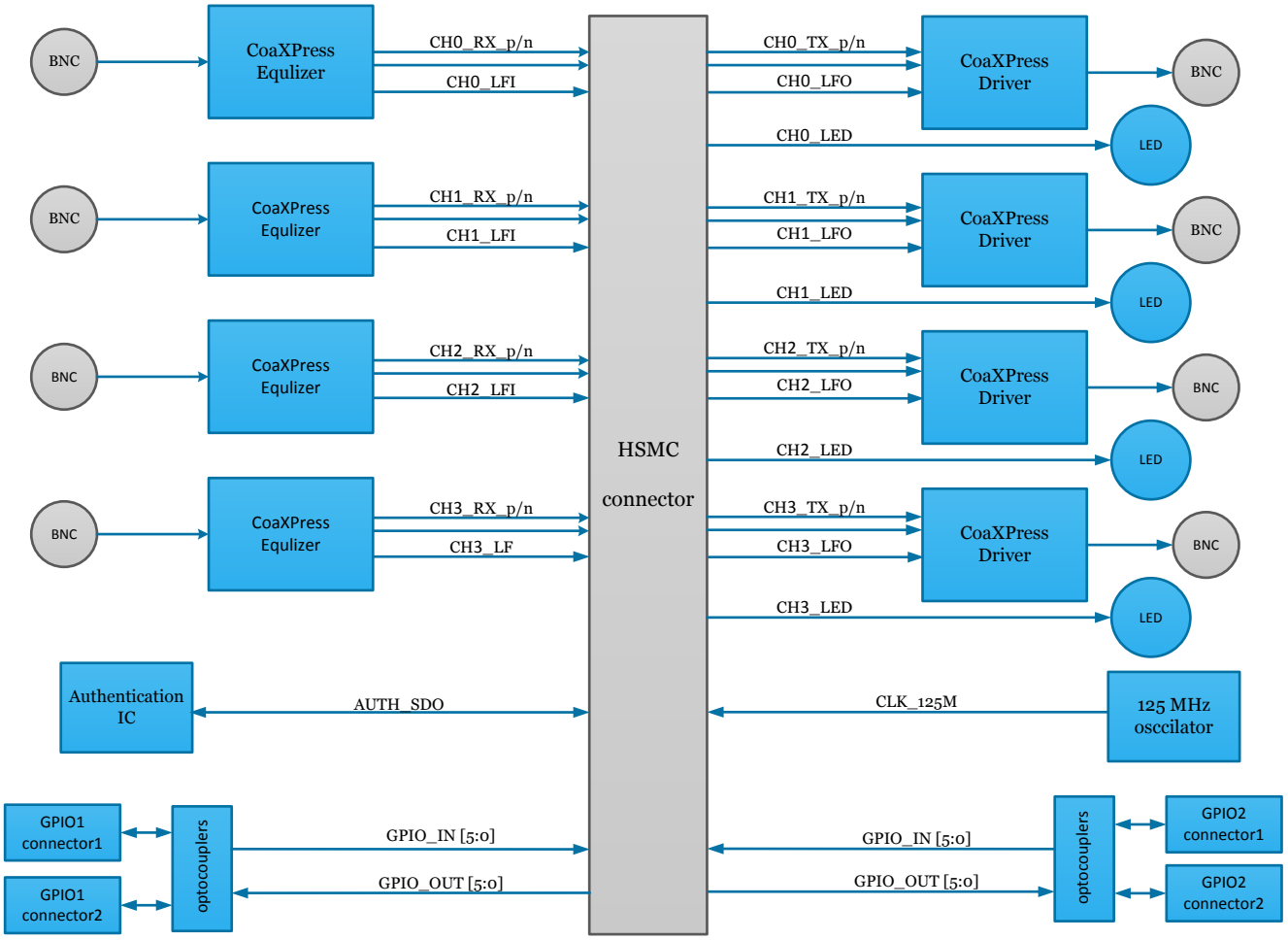

Figure 1 : HSMC CoaXPress block diagram

4.2 External View of the Board

Figure 2 shows the ***HSMC-CXP*** board specification.

External Dimensions: 78mm x 92mm

Board Thickness: 1.6mm

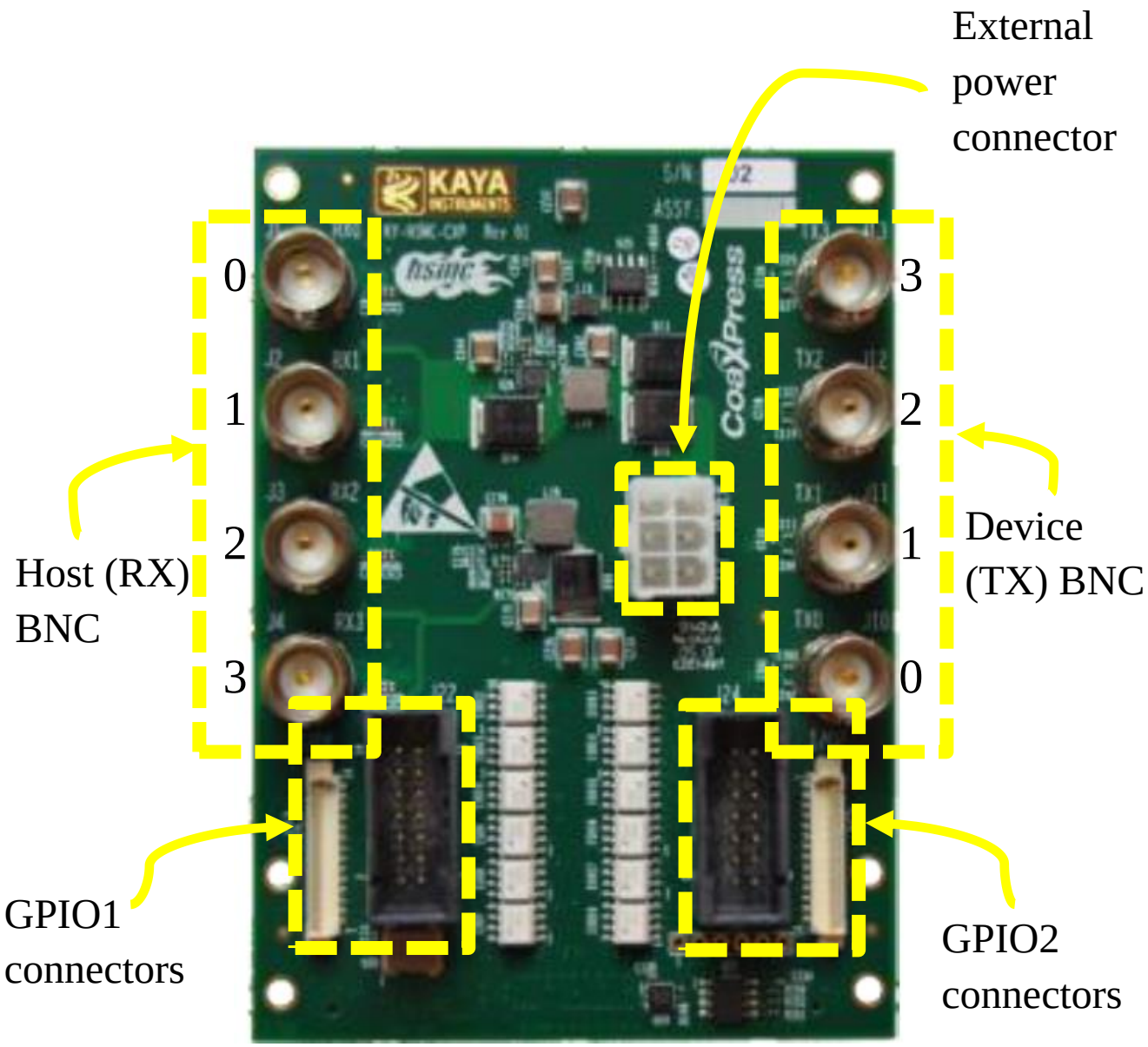

Figure 2 : HSMC-CXP external view

4.3 Power supply to the board

Figure 3 shows the power supply circuit of the ***HSMC-CXP*** board.

The board receives +3.3V from the HSMC connector and dispenses it to the GPIO and Drivers.

A +12V from the HSMC connector converted into +1.2V which proceed to Drivers and Equalizers.

Host channels 0 and 1 receive 24V from shared power supply. As where host channels 2 and 3 receive 24V from other shared power supply. The 24V power supplies can be powered from the HSMC connector or from external connector for power demanding applications.

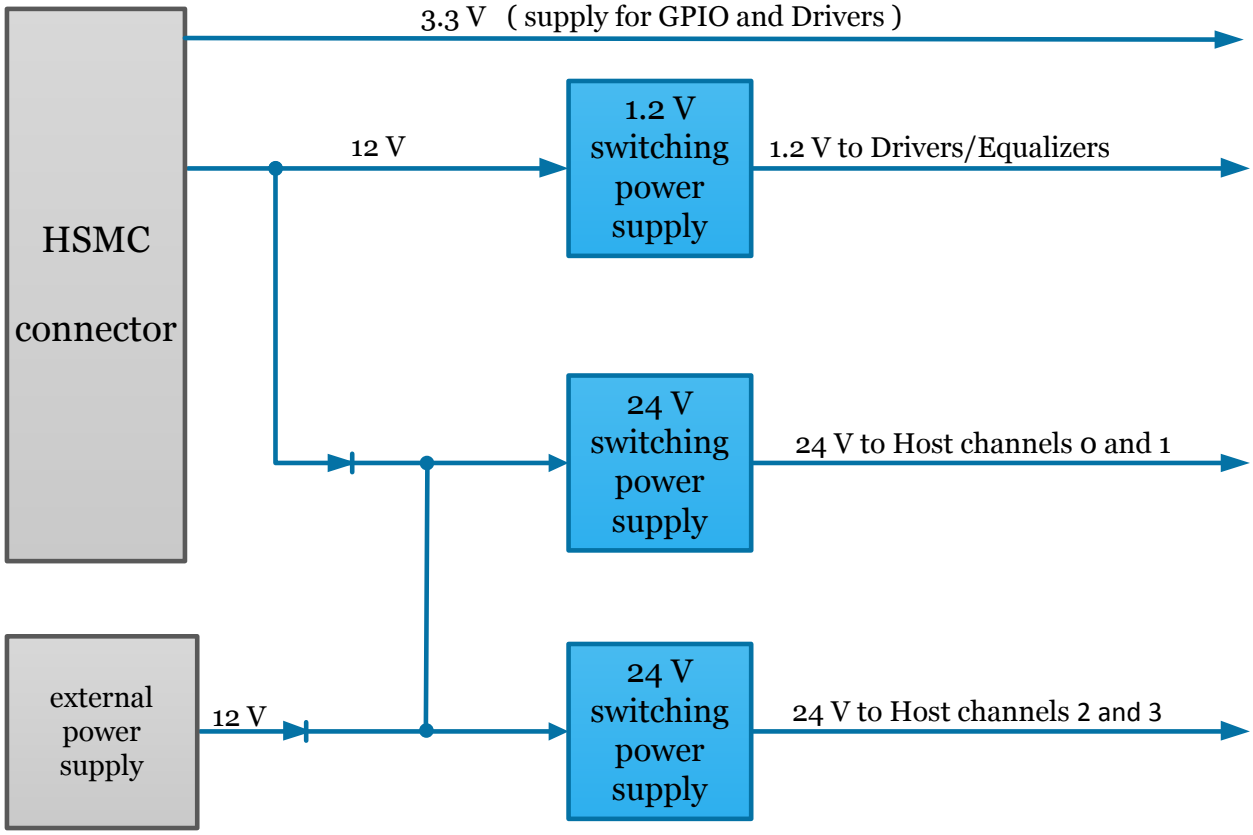

Figure 3 : HSMC-CXP power supply dispense

5.1 HSMC pin assignments

The HSMC connector pin assignment is given in Table 1. The direction is according to carrier (FPGA) side.

#	HSMC Spec	I/O	Signal Name	Description
1	TXp7	-	N/C	Not connected
2	RXp7	-	N/C	Not connected
3	TXn7	-	N/C	Not connected
4	RXn7	-	N/C	Not connected
5	TXp6	-	N/C	Not connected
6	RXp6	-	N/C	Not connected
7	TXn6	-	N/C	Not connected
8	RXn6	-	N/C	Not connected
9	TXp5	-	N/C	Not connected
10	RXp5	-	N/C	Not connected
11	TXn5	-	N/C	Not connected
12	RXn5	-	N/C	Not connected
13	TXp4	-	N/C	Not connected
14	RXp4	-	N/C	Not connected
15	TXn4	-	N/C	Not connected
16	RXn4	-	N/C	Not connected
17	TXp3	O	SDIp3	CoaXPress device channel 3 fast speed link Transmit (Positive)
18	RXp3	I	SDop3	CoaXPress host channel 3 fast speed link Receive (Positive)
19	TXn3	O	SDIn3	CoaXPress device channel 3 fast speed link Transmit (Negative)
20	RXn3	I	SDon3	CoaXPress host channel 3 fast speed link Receive (Negative)
21	TXp2	O	SDIp2	CoaXPress device channel 2 fast speed link Transmit (Positive)
22	RXp2	I	SDop2	CoaXPress host channel 2 fast speed link Receive (Positive)
23	TXn2	O	SDIn2	CoaXPress device channel 2 fast speed link Transmit (Negative)
24	RXn2	I	SDon2	CoaXPress host channel 2 fast speed link Receive (Negative)
25	TXp1	O	SDIp1	CoaXPress device channel 1 fast speed link Transmit (Positive)
26	RXp1	I	SDop1	CoaXPress host channel 1 fast speed link Receive (Positive)
27	TXn1	O	SDIn1	CoaXPress device channel 1 fast speed link Transmit (Negative)
28	RXn1	I	SDon1	CoaXPress host channel 1 fast speed link Receive (Negative)
29	TXp0	O	SDIp0	CoaXPress device channel 0 fast speed link Transmit (Positive)
30	RXp0	I	SDop0	CoaXPress host channel 0 fast speed link Receive (Positive)
31	TXn0	O	SDIn0	CoaXPress device channel 0 fast speed link Transmit (Negative)
32	RXn0	I	SDon0	CoaXPress host channel 0 fast speed link Receive (Negative)
33	SDA	-	N/C	Not connected
34	SCL	-	N/C	Not connected
35	JTAG_TCK	-	N/C	Not connected
36	JTAG_TMS	-	N/C	Not connected
37	JTAG_TDO	I	TD	JTAG Loopback to JTAG_TDI
38	JTAG_TDI	O	TD	JTAG Loopback to JTAG_TDO
39	CLKOUT0	-	N/C	Not connected
40	CLKIN0	I	CLKIN	125MHz Reference clock
41	D0	O	SD0	Authentication IC connection to IP Core
42	D1	-	N/C	Not connected
43	D2	-	N/C	Not connected
44	D3	-	N/C	Not connected
45	3.3V_1	-	3.3V	Connected to 3.3V
46	12V_1	-	12V	Connected to 12V

47	D4/TXp0	I	LFI0	CoaXPress host channel 0 low speed link TX
48	D5/RXp0	O	LFO0	CoaXPress device channel 0 low speed link RX
49	D6/TXn0	I	LFI1	CoaXPress host channel 1 low speed link TX
50	D7/RXn0	O	LFO1	CoaXPress device channel 1 low speed link RX
51	3.3V_2	-	3.3V	Connected to 3.3V
52	12V_2	-	12V	Connected to 12V
53	D8/TXp1	I	LFI2	CoaXPress host channel 2 low speed link TX
54	D9/RXp1	O	LFO2	CoaXPress device channel 2 low speed link RX
55	D10/TXn1	I	LFI3	CoaXPress host channel 3 low speed link TX
56	D11/RXn1	O	LFO3	CoaXPress device channel 3 low speed link RX
57	3.3V_3	-	3.3V	Connected to 3.3V
58	12V_3	-	12V	Connected to 12V
59	D12/TXp2	O	LED1	General purpose LED 1 (Active Low)
60	D13/RXp2	O	LED2	General purpose LED 2 (Active Low)
61	D14/TXn2	O	LED3	General purpose LED 3 (Active Low)
62	D15/RXn2	O	LED4	General purpose LED 4 (Active Low)
63	3.3V_4	-	3.3V	Connected to 3.3V
64	12V_4	-	12V	Connected to 12V
65	D16/TXp3	O	IO0_OUT0	Isolated GPIO output 0 (GPIO1)
66	D17/RXp3	O	IO0_OUT1	Isolated GPIO output 1 (GPIO1)
67	D18/TXn3	O	IO0_OUT2	Isolated GPIO output 2 (GPIO1)
68	D19/RXn3	O	IO0_OUT3	Isolated GPIO output 3 (GPIO1)
69	3.3V_5	-	3.3V	Connected to 3.3V
70	12V_5	-	12V	Connected to 12V
71	D20/TXp4	O	IO0_OUT4	Isolated GPIO output 4 (GPIO1)
72	D21/RXp4	O	IO0_OUT5	Isolated GPIO output 5 (GPIO1)
73	D22/TXn4	I	IO0_IN0	Isolated GPIO input 0 (GPIO1)
74	D23/RXn4	I	IO0_IN1	Isolated GPIO input 1 (GPIO1)
75	3.3V_6	-	3.3V	Connected to 3.3V
76	12V_6	-	12V	Connected to 12V
77	D24/TXp5	I	IO0_IN2	Isolated GPIO input 2 (GPIO1)
78	D25/RXp5	I	IO0_IN3	Isolated GPIO input 3 (GPIO1)
79	D26/TXn5	I	IO0_IN4	Isolated GPIO input 4 (GPIO1)
80	D27/RXn5	I	IO0_IN5	Isolated GPIO input 5 (GPIO1)
81	3.3V_7	-	3.3V	Connected to 3.3V
82	12V_7	-	12V	Connected to 12V
83	D28/TXp6	O	IO1_OUT0	Isolated GPIO output 0 (GPIO2)
84	D29/RXp6	O	IO1_OUT1	Isolated GPIO output 1 (GPIO2)
85	D30/TXn6	O	IO1_OUT2	Isolated GPIO output 2 (GPIO2)
86	D31/RXn6	O	IO1_OUT3	Isolated GPIO output 3 (GPIO2)
87	3.3V_8	-	3.3V	Connected to 3.3V
88	12V_8	-	12V	Connected to 12V
89	D32/TXp7	O	IO1_OUT4	Isolated GPIO output 4 (GPIO2)
90	D33/RXp7	O	IO1_OUT5	Isolated GPIO output 5 (GPIO2)
91	D34/TXn7	I	IO1_IN0	Isolated GPIO input 0 (GPIO2)
92	D35/RXn7	I	IO1_IN1	Isolated GPIO input 1 (GPIO2)
93	3.3V_9	-	3.3V	Connected to 3.3V
94	12V_9	-	12V	Connected to 12V
95	D36/CKO1p	I	IO1_IN2	Isolated GPIO input 2 (GPIO2)
96	D37/CKI1p	I	IO1_IN3	Isolated GPIO input 3 (GPIO2)
97	D38/CKO1n	I	IO1_IN4	Isolated GPIO input 4 (GPIO2)
98	D39/CKI1n	I	IO1_IN5	Isolated GPIO input 5 (GPIO2)
99	3.3V_10	-	3.3V	Connected to 3.3V
100	12V_10	-	12V	Connected to 12V
101	D40/TXp8	-	N/C	Not connected
102	D41/RXp8	-	N/C	Not connected
103	D42/TXn8	-	N/C	Not connected
104	D43/RXn8	-	N/C	Not connected

105	3.3V_11	-	3.3V	Connected to 3.3V
106	12V_11	-	12V	Connected to 12V
107	D44/TXp9	-	N/C	Not connected
108	D45/RXp9	-	N/C	Not connected
109	D46/TXn9	-	N/C	Not connected
110	D47/RXn9	-	N/C	Not connected
111	3.3V_12	-	3.3V	Connected to 3.3V
112	12V_12	-	12V	Connected to 12V
113	D48/TXp10	-	N/C	Not connected
114	D49/RXp10	-	N/C	Not connected
115	D50/TXn10	-	N/C	Not connected
116	D51/RXn10	-	N/C	Not connected
117	3.3V_13	-	3.3V	Connected to 3.3V
118	12V_13	-	12V	Connected to 12V
119	D52/TXp11	-	N/C	Not connected
120	D53/RXp11	-	N/C	Not connected
121	D54/TXn11	-	N/C	Not connected
122	D55/RXn11	-	N/C	Not connected
123	3.3V_14	-	3.3V	Connected to 3.3V
124	12V_14	-	12V	Connected to 12V
125	D56/TXp12	-	N/C	Not connected
126	D57/RXp12	-	N/C	Not connected
127	D58/TXn12	-	N/C	Not connected
128	D59/RXn12	-	N/C	Not connected
129	3.3V_15	-	3.3V	Connected to 3.3V
130	12V_15	-	12V	Connected to 12V
131	D60/TXp13	-	N/C	Not connected
132	D61/RXp13	-	N/C	Not connected
133	D62/TXn13	-	N/C	Not connected
134	D63/RXn13	-	N/C	Not connected
135	3.3V_16	-	3.3V	Connected to 3.3V
136	12V_16	-	12V	Connected to 12V
137	D64/TXp14	-	N/C	Not connected
138	D65/RXp14	-	N/C	Not connected
139	D66/TXn14	-	N/C	Not connected
140	D67/RXn14	-	N/C	Not connected
141	3.3V_17	-	3.3V	Connected to 3.3V
142	12V_17	-	12V	Connected to 12V
143	D68/TXp15	-	N/C	Not connected
144	D69/RXp15	-	N/C	Not connected
145	D70/TXn15	-	N/C	Not connected
146	D71/RXn15	-	N/C	Not connected
147	3.3V_18	-	3.3V	Connected to 3.3V
148	12V_18	-	12V	Connected to 12V
149	D72/TXp16	-	N/C	Not connected
150	D73/RXp16	-	N/C	Not connected
151	D74/TXn16	-	N/C	Not connected
152	D75/RXn16	-	N/C	Not connected
153	3.3V_19	-	3.3V	Connected to 3.3V
154	12V_19	-	12V	Connected to 12V
155	D76/CKO2p	-	N/C	Not connected
156	D77/CKI2p	-	N/C	Not connected
157	D78/CKO2n	-	N/C	Not connected
158	D79/CKI2n	-	N/C	Not connected
159	3.3V_20	-	3.3V	Connected to 3.3V
160	PSNTn	I	GND	Connected to Signal Ground
GND1	GND	-	-	Signal Ground
GND2	GND	-	-	Signal Ground

GND3	GND	-	-	Signal Ground
GND4	GND	-	-	Signal Ground
GND5	GND	-	-	Signal Ground
GND6	GND	-	-	Signal Ground
GND7	GND	-	-	Signal Ground
GND8	GND	-	-	Signal Ground
GND9	GND	-	-	Signal Ground
GND10	GND	-	-	Signal Ground
GND11	GND	-	-	Signal Ground
GND12	GND	-	-	Signal Ground

Table 1 : HSMC connector pin assignments

5.2 BNC Connector pin assignment

Connector	Channel
J1	RX0
J2	RX1
J3	RX2
J4	RX3
J10	TX0
J11	TX1
J12	TX2
J13	TX3

Table 2 : BNC connector pin assignment

5.3 External power connector pin assignments (J17)

Pin	Signal
1	12V
2	12V
3	12V
4	GND
5	GND
6	GND

Table 3 : External power connector pin assignment (J17)

- Connector PN 0039281063 from Molex

5.4 Schematic of the host channel (RX)

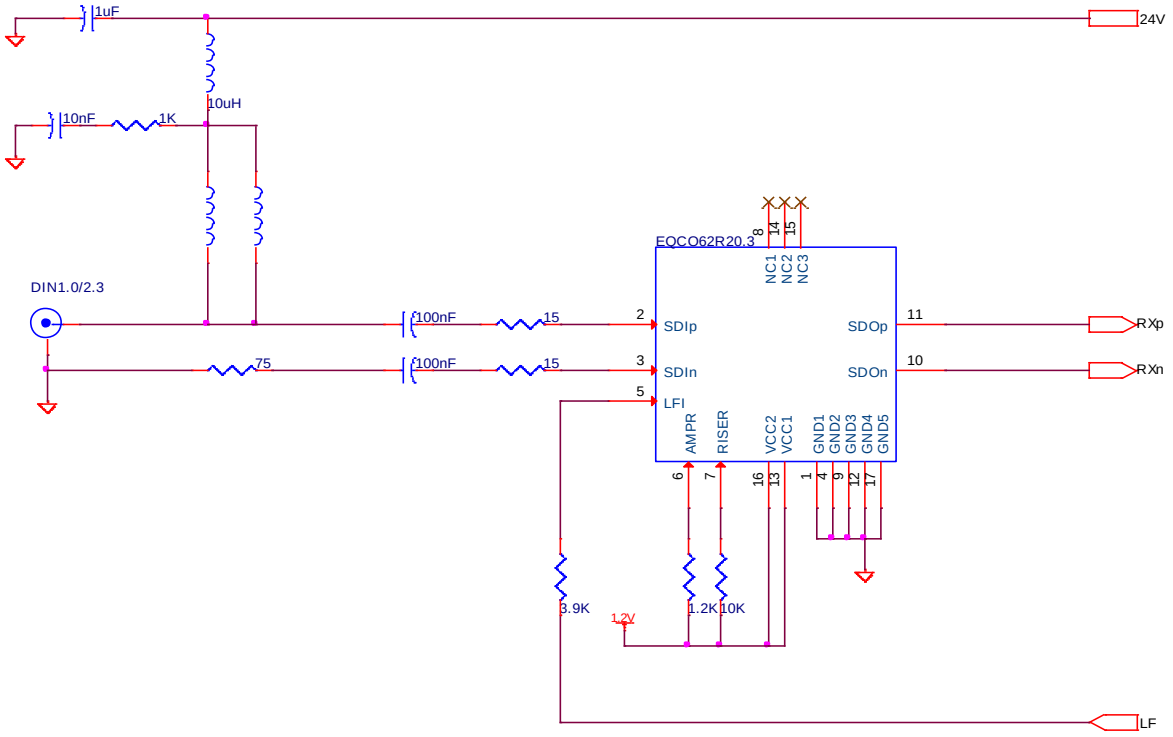

Figure 4 : Schematic of the host channel (RX)

5.5 Schematic of the device channel (TX)

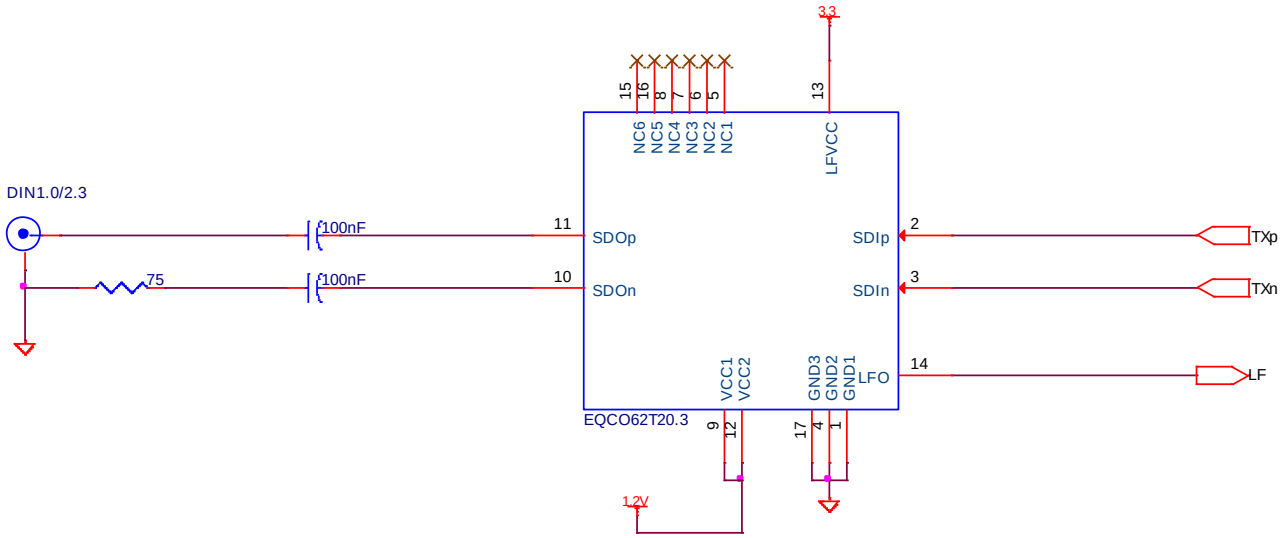

Figure 5 : Schematic of the device channel (TX)

5.6 GPIO Connector pin assignments (J22, J23, J24, J25)

Each GPIO bus us connected in parallel to two connectors. GPIO bus 1 is connected to J22 and J23, while GPIO bus 2 is connected to J24 and J25. J22 and J24 are a standard 2.54mm pitch headers while J23 and J25 are Molex Pico Blade connectors (PN 53398-1471 from Molex). All of the connectors have the same pin-out.

Pin	Signal
1	GPIO OUT 0
2	GPIO OUT 1
3	GPIO OUT 2
4	GPIO OUT 3
5	GPIO OUT 4
6	GPIO OUT 5
7	GPIO GND
8	GPIO GND
9	GPIO IN 0
10	GPIO IN 1
11	GPIO IN 2
12	GPIO IN 3
13	GPIO IN 4
14	GPIO IN 5

Table 4 : GPIO Connector pin assignments (J22, J23, J24 and J25)

5.7 GPIO schematics

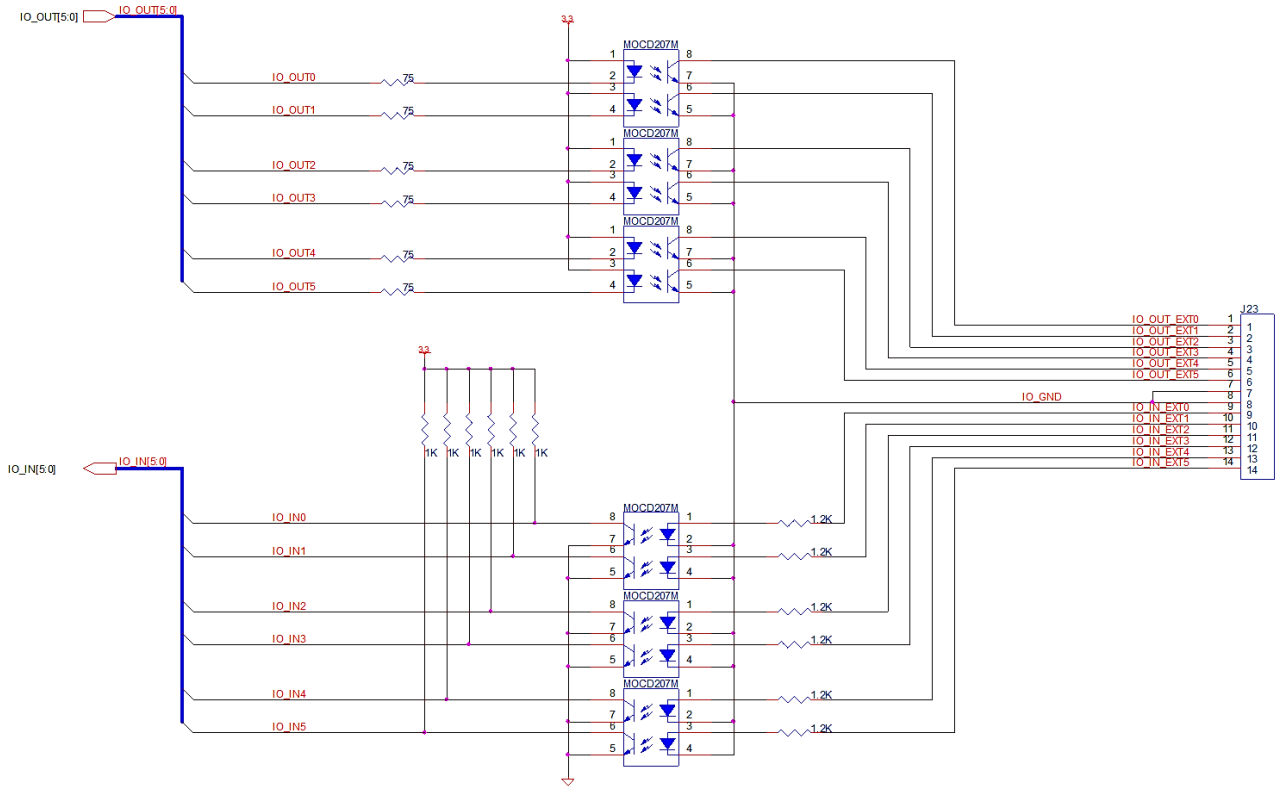

Figure 6 : GPIO schematics

5.8 CoaXPress cables

CoaXPress is a new digital transmission standard that allows high speed data from a device, such as a camera, to be transferred to a host, such as a frame grabber. Each CoaXPress link supports up to 6.25Gbps data rates, along with device power up to 13W and device control at 20Mbps, all on a single coax cable. For very fast devices, the links can be aggregated to provide multiples of the single coax bandwidth. Long cable lengths are supported – up to 40 meters at 6.25Gbps and over 100 meters at 3.125Gbps.

Table 5 gives an overview of typical link performance at room temperature for the link between two FMC-CXP boards, using the downlink channel, uplink channel and power transmission simultaneously.

BELDEN

	Name	Belden 7731A	Belden 1694A	Belden 1505A	Belden 1505F	Belden 1855A
	Type	Long Distance	Industry Standard	Compromise Coax	Flexible	Thinnest cable
Diameter	(mm)	10.3	6.99	5.94	6.15	4.03
1.25 Gbps	(m)	194	130	107	80	55
2.5 Gbps	(m)	162	110	94	66	55
3.125 Gbps	(m)	147	100	86	60	55
5.0 Gbps	(m)	87	60	52	35	38
6.25 Gbps	(m)	58	40	35	23	25

GEPCO

	Name	Gepco VHD1100	Gepco VSD2001	Gepco VPM2000	Gepco VHD2000M	Gepco VDM230
	Type	Long Distance	Industry Standard	Compromise Coax	Flexible	Thinnest cable
Diameter	(mm)	10.3	6.91	6.15	6.15	4.16
1.25 Gbps	(m)	212	140	109	81	66
2.5 Gbps	(m)	185	120	94	67	66
3.125 Gbps	(m)	169	110	86	61	62
5.0 Gbps	(m)	102	66	53	36	38
6.25 Gbps	(m)	68	44	35	24	25

Table 5 : Typical link performance

6.1 Absolute maximum ratings

Specification	Values
3.3V power supply	-0.5V to 3.6V
12V power supply	-0.5V to 14V
Storage Temperature	-55 °C to 125 °C
Operating Temperature	-40°C to 85 °C
Voltage on high speed serial lines	-0.5V to 1.6V
Voltage on LF signals	-0.5V to 3.6V
LED voltage	-0.5V to 3.6V
GPIO Voltage (FPGA Side)	-0.5V to 3.6V
GPIO Voltage (External Side)	-0.5V to 26V

Table 6 : Absolute maximum ratings

6.2 Operating conditions

Parameter	Description	Minimum	Typical	Maximum
3.3V VCC	Supply voltage	3.14V	3.3V	3.46V
12V VCC	Supply voltage	11.4V	12V	12.6V
Is 3.3V	Supply Current		15mA	100mA
Is 12V	Supply Current		21mA	(1)
LF VIL	Input LOW Voltage		0V	
LF VIH	Input HIGH Voltage		3.3V	
LF VOL	Low output level		0V	
LF VOH	High output level		3.3V	
DVo	Output differential amplitude on RX		1200mV	
DVi	Input differential amplitude on TX	500mV	600mV	
GPIO FVIL	Low level input voltage on GPIO (FPGA side)	-0.5V	0V	1.1V
GPIO FVIH	High level input voltage on GPIO (FPGA side)	2V	3.3V	4.2V
GPIO VIL	Low level input voltage on GPIO	-0.5V	0V	1.1V
GPIO VIH	High level input voltage on GPIO	5V		26V
GPIO FVOL	Low level output voltage on GPIO (FPGA side)		0V	
GPIO FVOH	High level output voltage on GPIO (FPGA side)		3.3V	
LED Von	Led ON voltage	1.8V		

Table 7 : Operating conditions

(1) The maximum power consumption on 12V depends on power output on the receiver channels

7.1 Available Configurations

The ***High Speed Mezzanine Card for CoaXPress™*** board is available in various configurations depending on the number of Host or Device Links.

Model	Host Links	Device Links
HSMC-CXP-1R1T	1	1
HSMC-CXP-4R4T	4	4
HSMC-CXP-4T	0	4
HSMC-CXP-4R	4	0

Table 8 : Available Configurations

7.2 Installation instructions

1. Before installing, turn off the power to the board.
2. Firmly press the HSMC connector to the HSMC carrier board.
3. Use spacers if the HSMC is not aligned correctly with the carrier board.