FAIR Timing Receiver (FTRN) PMC form factor - CSL_FTRN_PMC

SHEET	TITLE
1	TITLE PAGE
2	Block diagram
3	Power Tree
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5	POWER LDOs, FPGA BYPASS
6	FPGA configuration
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9	PMC, SFP to FPGA
10	PMC host
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13	IO blocks 4-5, IO clk

DATE	REVISION DESCRIPTION	DRAWN	REV
04.12.2014	Initial version	dslavinec	A
21.4.2015	Added fixes found during HDL synthesis check and changes during PCB layout	dslavinec, bpecnik	A
21.5.2015	PCB layout ready for review	dslavinec, bpecnik	A
19.9.2016	Page 04: - LTM4620 replaced with LTM4628 - LTM4628, core voltage rail set to 1.13V (R4, 68.1K), - added resistors R380-R383, R370-R371 for configuration of DCDC converters - added solder jumper SJMP2 to sense signals on LTM4628 Page 05: - LOG1P, VCCIO3A and VCCIO3D from 2.5V to 3.3V supply - LOG1Q, VCCPD3 from 2.5V to 3.3V supply - capacitors C147, C148, C151, C157, C159, C160 for FPGA BANK3 moved from 2.5V to 3.3V supply - voltage indicator LED resistors (R21, R23, R26, R29) replaced with 10K Page 06: - fixed bug, swapped signals SPI_SO_D1 and SPI_WP2_D2 on LOG1O - SPIFLASHX4_1, N25Q512A13GF840E replaced with N25Q256A13EF840 Page 07: - fixed Title Block - 10K pull-up resistors for display (R64-R70) replaced with 1K - added buttons PBF2 parallel to PBF1 and PBP2 parallel to PBP1 - USB1A microcontroller, added pull-up and pull-down on URES (R94) and WAKEUP (R93) signals - higher values for LED resistors Page 08: - changed reference designators L1A > L6, L1B > L7, L1C > L8 Page 09: - LOG1N (BANK GXB_L1), unused RX pins connected to GND - LOG1M (BANK GXB_L0), unused RX and REFCLK pins connected to GND - WR clock to LOG1L (BANK 8D), added 0R resistors (R390, R391, R392, R393) parallel to capacitors - PCI clock to LOG1L (BANK 8D) pins C15, B15, removed caps C348, C349, now clock is DC coupled - removed LOG1K (BANK 8A) - moved BANK 4D to this page, for PCI bus signals, added GNT, REQ, INTxB-D Page 10: - replaced voltage translators with bus switches (PCISW1-6) on PCI signals - added 0R resistors (R300-R355) between bus switches and PMC connectors - added circuit for bus switches power (DSH2, R364, R363) - added 0R resistor (R362) on signal PCI_M66EN to GND Page 11: - removed LOG1E (BANK 4D) - placed LOG1K (BANK 8A) - on OSC_RFCK clock to BANK 8A, added 0R resistors (R392, R393) parallel to capacitors - changed Reference Designator J33_ODRV to JODRV_33 Page 12: - added 0R resistors parallel to fuses on IOs - different resistors for IO leds (swapped values) - marked IO path with 50R impedance Page 13: - added 0R resistors parallel to fuses on IOs - different resistors for IO leds (swapped values) - marked IO path with 50R impedance	dslavinec	B

Value	Capatitors used
12p	0402, 50V, C0G, 1%
22p	0402, 50V, C0G, 1%
10n	0402, 25V, X7R, 10%
100n	0402, 25V, X7R, 10%
1u	0603, 16V, X7R, 10%
2.2u	1210, 100V, X7R, 10%
10u	1210, 25V, X7R, 10%
22u	1210, 10V, X7R, 10%
100u	1210, 10V, X5R, 20%

All resistors are SMD 0402, 63mW, 1% except where marked differently.

Components marked DNP (Do Not Place) are foreseen for testing purposes.

TOP layer

FM1 FIDUCIAL FM2 FIDUCIAL FM3 FIDUCIAL

BOTTOM layer

FM4 FIDUCIAL FM5 FIDUCIAL FM6 FIDUCIAL

DRAWN	Dušan Slavinec		19.9.2016
CHECKED	-		
APPROVED	-		

Title: FAIR Timing Receiver (FTRN) PMC form factor - CSL_FTRN_PMC

Size: A3 | Type: SE | DWG.NO. CSL_FTRN_PMC | REV. B

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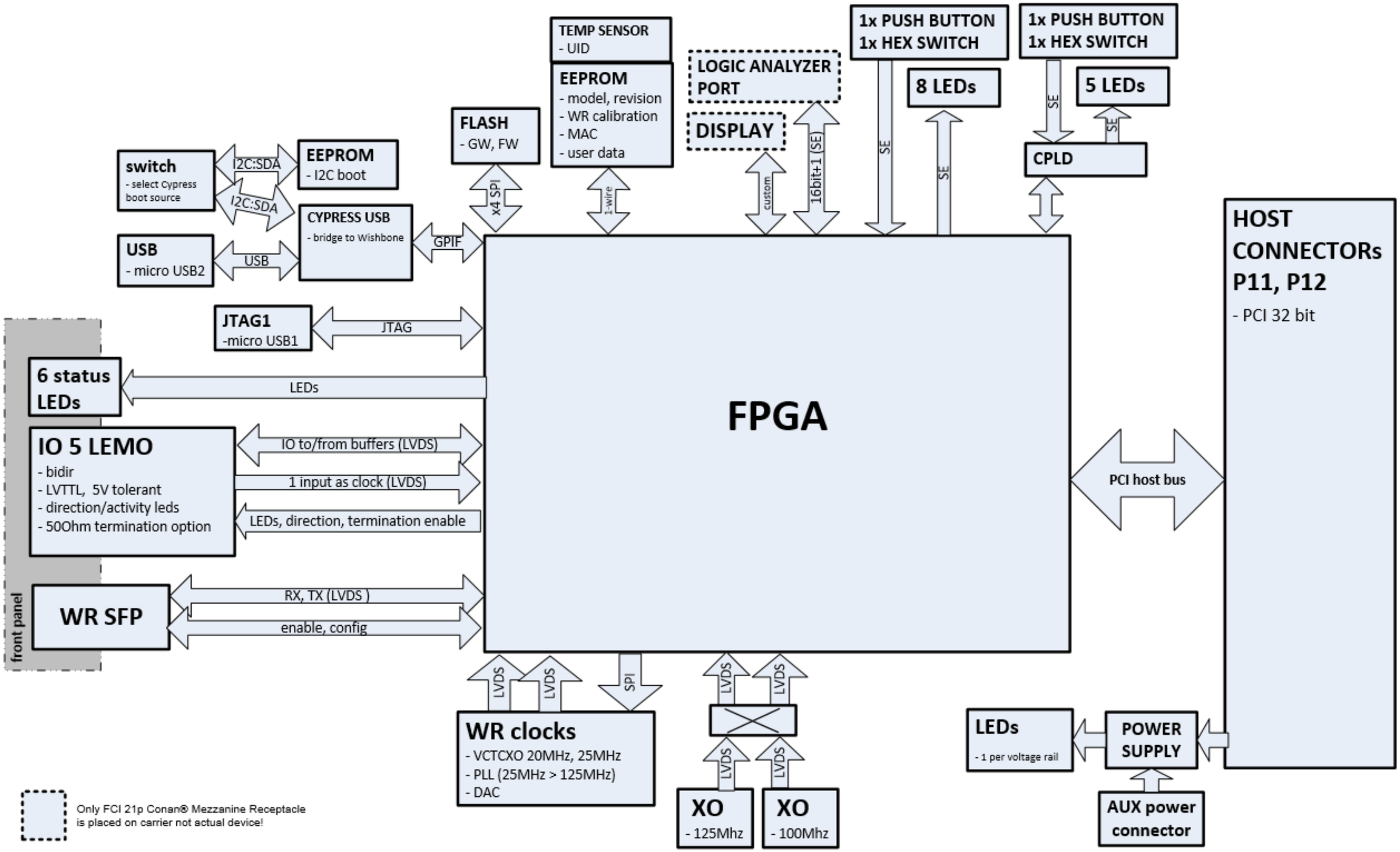
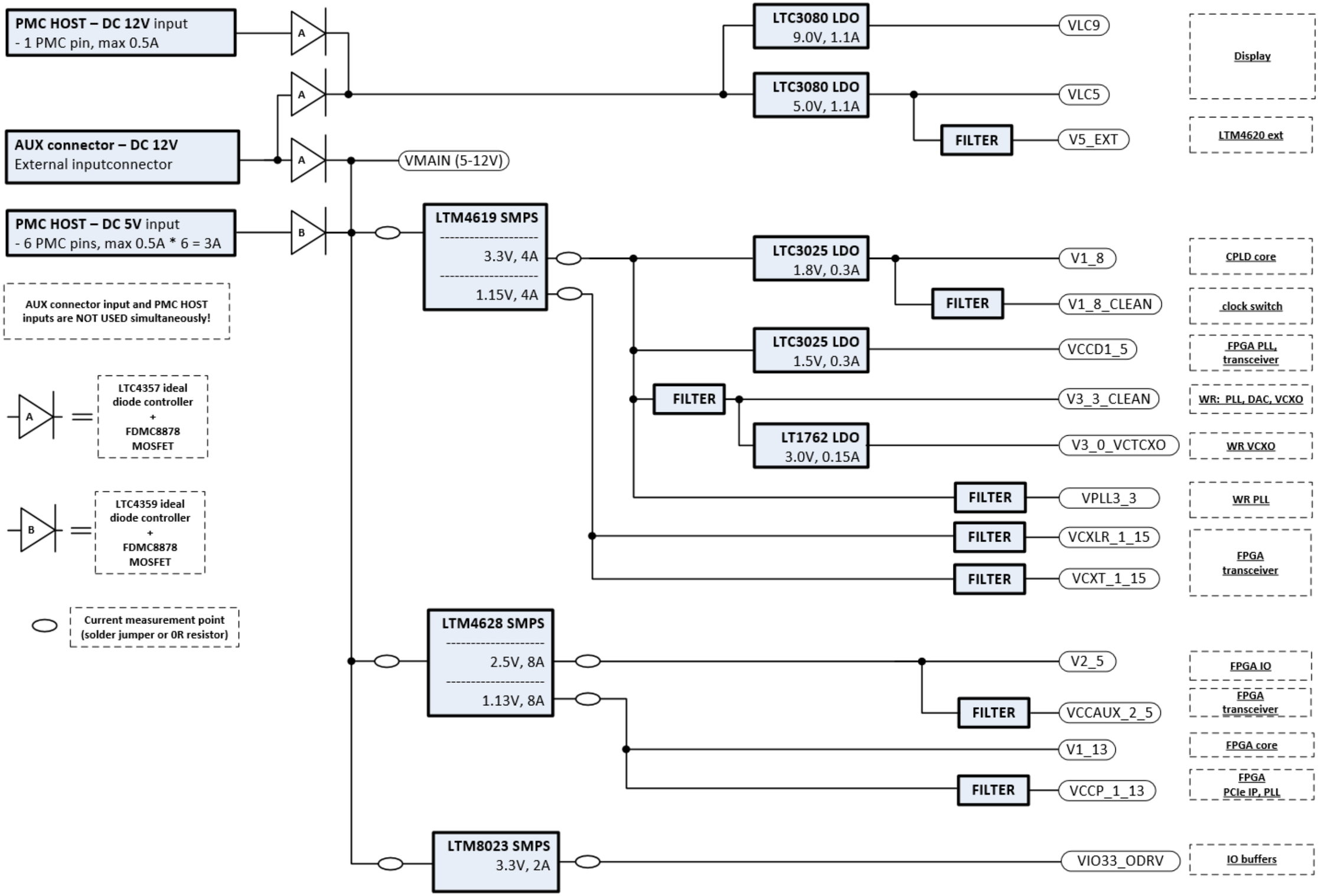
Block Diagram



Title: Block Diagram			
Size: A3	Type: SE	DWG.NO. CSL_FTRN_PMC	REV. B
			SHEET 2 OF 13

Power tree block scheme



Title	Power tree block scheme		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
			SHEET 3 OF 13

Power entry and main DCDC power regulators

AUXPOW1

12V AUX power is used ONLY when board is NOT in then PMC host!

F1 4A — **F2** 4A — **F3** 4A

FET1 FDMC8878CT — **IDIODE1** LTC4357CDCB

FET2 FDMC8878CT — **IDIODE2** LTC4359IDCB

FET3 FDMC8878CT — **IDIODE3** LTC4357CDCB

FET4 FDMC8878CT — **IDIODE4** LTC4357CDCB

PMC 5V pins are used as main current source when in the PMC host

PMC 12V pins are used as current source for 12V when in the PMC host

ROOM: POWER_ENTRY

LTM4619 input Voltage Range: 4.5V to 26.5V

POW115_33A LTM4619EV — 1.15V — 3.3V

POW115_33B LTM4619EV

POW115_33C LTM4619EV

ROOM: LTM4619_DCDC

LTM4628 input Voltage Range: 4.5V to 16V

POW11_25A LTM4628EV — 1.1V — 2.5V

Actual voltage on 1.1V rail is 1.13V!

Sense connection at FPGA!

POW11_25B LTM4628EV

POW11_25C LTM4628EV

ROOM: LTM4620_DCDC

5V power for LTM4619 and LTM4628 EXTVCC

IND5 BLM31PG121SN1L

(1) - place capacitors on the regulator outputs

(2) - place capacitors away from the regulator outputs

Title: Power entry and main DCDC power regulators				
Size: A3	Type: SE	DWG.NO. CSL_FTRN_PMC	REV. B	
			SHEET 4 OF 13	

FPGA decoupling, LDO regulators, power indicators

LOG1R

5AGXMA3D4F27I3N

AA22	GND1	GND74	L25
AA25	GND2	GND75	L26
AA26	GND3	GND76	L5
AB11	GND4	GND77	L8
AB14	GND5	GND78	M11
AB17	GND6	GND79	M13
AB20	GND7	GND80	M15
AB23	GND8	GND81	M17
AB24	GND9	GND82	M19
AB5	GND10	GND83	M23
AB8	GND11	GND84	M24
AC2	GND12	GND85	M9
AC24	GND13	GND86	N10
AC25	GND14	GND87	N12
AC26	GND15	GND88	N14
AE11	GND16	GND89	N16
AE14	GND17	GND90	N20
AE17	GND18	GND91	N22
AE2	GND19	GND92	N25
AE20	GND20	GND93	N26
AE22	GND21	GND94	N8
AE5	GND22	GND95	P11
AE8	GND23	GND96	P13
AF2	GND24	GND97	P15
B11	GND25	GND98	P17
B14	GND26	GND99	P19
B17	GND27	GND100	P2
B2	GND28	GND101	P23
B20	GND29	GND102	P24
B23	GND30	GND103	P5
B26	GND31	GND104	R10
B5	GND32	GND105	R12
B8	GND33	GND106	R14
C26	GND34	GND107	R16
D23	GND35	GND108	R20
D24	GND36	GND109	R22
E11	GND37	GND110	R25
E14	GND38	GND111	R26
E17	GND39	GND112	R8
E2	GND40	GND113	T11
E20	GND41	GND114	T13
E22	GND42	GND115	T15
E25	GND43	GND116	T17
E26	GND44	GND117	T19
E5	GND45	GND118	T21
E8	GND46	GND119	T23
F23	GND47	GND120	T24
F24	GND48	GND121	T5
G22	GND49	GND122	T9
G25	GND50	GND123	U16
G26	GND51	GND124	U2
G5	GND52	GND125	U20
H11	GND53	GND126	U25
H14	GND54	GND127	U26
H17	GND55	GND128	U8
H2	GND56	GND129	V18
H20	GND57	GND130	V19
H23	GND58	GND131	V21
H24	GND59	GND132	V22
H5	GND60	GND133	V23
H8	GND61	GND134	V24
J22	GND62	GND135	W11
J25	GND63	GND136	W14
J26	GND64	GND137	W17
K11	GND65	GND138	W20
K23	GND66	GND139	W22
K24	GND67	GND140	W25
L14	GND68	GND141	W26
L16	GND69	GND142	W5
L19	GND70	GND143	W8
L2	GND71	GND144	Y2
L20	GND72	GND145	Y23
L22	GND73	GND146	Y24
AD1	DNU1	DNU5	H6
AD2	DNU2	DNU6	K14
C25	DNU3	DNU7	V14
D25	DNU4	DNU8	V20

GND GND

LOG1P

NOTE: BANK 3 VCCIO3 moved from 2.5V to 3.3V!

V1_1 V2_5 V3_3

M10	VCC1	VCCIO3A_1	AA19
M12	VCC2	VCCIO3A_2	AB22
M14	VCC3	VCCIO3A_3	AD21
M16	VCC4	VCCIO3D_1	AC15
N11	VCC5	VCCIO3D_2	AC18
N13	VCC6	VCCIO3D_3	AF17
N15	VCC7	VCCIO3D_4	Y15
N9	VCC8		
P10	VCC9	VCCIO4A_1	Y3
P12	VCC10	VCCIO4A_2	Y6
P14	VCC11		
P16	VCC12	VCCIO4C_1	AB7
P9	VCC13	VCCIO4C_2	AC4
R11	VCC14	VCCIO4C_3	AE7
R13	VCC15	VCCIO4C_4	AF4
R15	VCC16		
R9	VCC17	VCCIO4D_1	AB10
T10	VCC18	VCCIO4D_2	AC12
T12	VCC19	VCCIO4D_3	AF10
T14	VCC20	VCCIO4D_4	Y12
T16	VCC21		
		VCCIO5A_1	N4
		VCCIO5A_2	R1
		VCCIO5A_3	R4
		VCCIO5A_4	U4
		VCCIO6A_1	G1
		VCCIO6A_2	K1
		VCCIO6A_3	M5
		VCCIO6A_4	H4
		VCCIO7A_1	D3
		VCCIO7A_2	F5
		VCCIO7C_1	A7
		VCCIO7C_2	D7
		VCCIO7C_3	F9
		VCCIO7C_4	G7
		VCCIO7D_1	A10
		VCCIO7D_2	C13
		VCCIO7D_3	D10
		VCCIO7D_4	F13
		VCCIO8A_1	D22
		VCCIO8A_2	F21
		VCCIO8A_3	G19
		VCCIO8D_1	A18
		VCCIO8D_2	C16
		VCCIO8D_3	D18
		VCCIO8D_4	F15

VCCP_1_1 — L11 VCCP1, L15 VCCP2, L9 VCCP3, M8 VCCP4, N17 VCCP5, T8 VCCP6, U11 VCCP7, U15 VCCP8, U9 VCCP9, VCCP10

VCCAUX_2_5 — L10 VCC_AUX1, L17 VCC_AUX2, U10 VCC_AUX3, U17 VCC_AUX4

VCCD_1_5 — U13 VCCD_FPLL1, L12 VCCD_FPLL2, T18 VCCD_FPLL3, N7 VCCD_FPLL4, L18 VCCD_FPLL5

U14 VCCA_FPLL1, L13 VCCA_FPLL2, P18 VCCA_FPLL3, P7 VCCA_FPLL4, M18 VCCA_FPLL5

5AGXMA3D4F27I3N

NOTE: VCCPD3 moved from 2.5V to 3.3V!

LOG1Q

V3_3 V2_5

VCCAUX_2_5 — T20 VCCA_GXBL0, M20 VCCA_GXBL1

VCCD_1_5 — P20 VCCH_GXBL0, L21 VCCH_GXBL1

VCXLR_1_15 — P21 VCCL_GXBL0_1, P22 VCCL_GXBL0_2

K22 VCCL_GXBL1

K21 VCCR_GXBL_1, N21 VCCR_GXBL_2, U21 VCCR_GXBL_3, U22 VCCR_GXBL_4

VCXT_1_15 — R21 VCCT_GXBL0_1, T22 VCCT_GXBL0_2, M21 VCCT_GXBL1_1, M22 VCCT_GXBL1_2

VCCD_1_5 — J21 VCCBAT

R11 2K, R12 2K — D26 RREF_TL, AE1 RREF_BR

		VCCPD3_1	V17
		VCCPD3_2	W19
		VCCPD5_1	R7
		VCCPD5_2	P8
		VCCPD6_1	M7
		VCCPD6_2	L7
		VCCPD8_1	K16
		VCCPD8_2	K19
		VCCPD4A	V8
		VCCPD7A	K8
		VCCPD4BCD_1	U12
		VCCPD4BCD_2	V11
		VCCPD7BCD_1	K13
		VCCPD7BCD_2	K9
		VCCPGM1	H7
		VCCPGM2	W21

5AGXMA3D4F27I3N

GND

IMPORTANT! (LOG1Q)
In the PCB layout, the traces from FPGA pins D26 and AE1 to the R11 and R12 resistors need to be routed so that they avoid any aggressor signals.
R11 and R12 must be 1% or better!

IMPORTANT!
Separate VCC and VCCP planes into two different power layers on the PCB!

VCC 1.1V

V1_1 — 21x

100n C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C122, C123, C132, C133, C134

GND

VCCP 1.1V

VCCP_1_1 — 10x

100n C222, C223, C224, C225, C226, C227, C228, C229, C230, C231

GND

VCCP_1_1

10u C272, C273, C274, C275

GND

ROOM: CAPS_VCCP_1_1

VCCT_GXB

VCXT_1_15

100n C280, C281, C282, C283

10u C284, C285

GND

VCCR_GXB VCCL_GXB

VCXLR_1_15 — 7x

100n C264, C265, C266, C267, C268, C269, C270

10u C262, C263

GND

ROOM: CAPS_VCC_GX_1_15

VCCIO 2.5V

V2_5 — 22x

100n C145, C146, C149, C150, C152, C153, C154, C155, C156, C158, C161, C162, C163, C164, C165, C166

GND

VCCPD 2.5V

V2_5 — 6x

100n C170, C171, C172, C173, C174, C175

GND

ROOM: CAPS_VCC_2_5

VCCIO 3.3V

V3_3 — 20x

100n C193, C194, C195, C196, C197, C198, C199, C200, C201, C202, C203, C204, C205, C206, C207, C208, C209, C210, C211, C212

BANK 3 VCCIO3A-D PINS

100n C147, C148, C157, C159, C160, C151

GND

ROOM: CAPS_VCCIO_3_3

NOTE: capacitors C147, C148, C157, C159, C160, C 151 moved from 2.5V to 3.3V!

VCCD_FPLL VCCH_GXBL VCCBAT

VCCD_1_5 — 8x

100n C214, C215, C216, C217, C218, C219, C220, C221

GND

ROOM: CAPS_VCC_1_5

V1_1

10u C286, C287, C288, C289

GND

ROOM: CAPS_VCC_1_1

VCCAUX 2.5V VCCA_FPLL VCCA_GXB

VCCAUX_2_5 — 9x

100n C232, C233, C234, C235, C236, C237, C238, C239, C240

4x

100n C242, C257, C258, C259

10u C260, C261

GND

ROOM: CAPS_VCCAUX_2_5

VCCPD 3.3V

V3_3 — 10x

100n C213, C183, C184, C185, C186, C187, C188, C189, C190, C191

GND

ROOM: CAPS_VCCPD_3_3

POWcpld18 — LDO 1.8V for CPLD, WR CLOCK SWITCH

V3_3 — C53 100n — GND

VIN, BIAS, SHDN, VOUT, ADJ, GND, GNDP — LTC3025EDC

30K1 R9, 8K45 R10

C54 100n, C56 10u, C57 1u, C55 100n — GND

V1_8 — L1 BLM18PG121 — V1_8_CLEAN — TP11

C58 10u — GND

POW_1_5 — LDO 1.5V for VCCH_GXB VCCD_FPLL, VCC_BAT

V3_3 — C77 100n — GND

VIN, BIAS, SHDN, VOUT, ADJ, GND, GNDP — LTC3025EDC

30K1 R15, 10K7 R16

C78 100n, C80 10u, C81 1u, C79 100n — GND

VCCD1V5 — TP12 — J_VCCD1V5 — JMP_V2 — VCCD_1_5

ROOM: POWER_LDO

POWVLC5 — LDO 5.0V for LCD

V12_0 — C73 100n — GND

IN1, IN2, IN3, VCON, OUT1, OUT2, OUT3, EPAD, SET — LT3080EDD

R14 510K

C74 100n, C76 10u, C75 100n — GND

TP13 — VLC5J — J_VLC5 — JMP_V2 — VLC5

POWVLC9 — LDO 9.0V for LCD

V12_0 — C69 100n — GND

IN1, IN2, IN3, VCON, OUT1, OUT2, OUT3, EPAD, SET — LT3080EDD

R13 806K

C70 100n, C72 10u, C71 100n — GND

VLC9 — TP14

ROOM: POWER_LCD_LDO

IND1

V2_5 — C61 100n, C62 10u — GND

IND1 BLM31PG121SN1L — VCCAUX_2_5

IND2

V1_1 — C63 100n, C64 10u — GND

IND2 BLM31PG121SN1L — VCCP_1_1

IND3

V1_15 — C65 100n, C66 10u — GND

IND3 BLM31PG121SN1L — VCXLR_1_15

IND4

V1_15 — C67 100n, C68 10u — GND

IND4 BLM31PG121SN1L — VCXT_1_15

ROOM: POWER_FILTERS

LED_5

VLC5 — R32 2K — LED_5 LR QH9P — GND

LED_33

V3_3 — R33 11K5 — LED_33 LR QH9P — GND

LED_18

V3_3 — R21 10K — LED_18 LR QH9P — MMBT3904 Q1 — R20 22K — GND

V1_8 — R22 1K

LED_115

V3_3 — R23 10K — LED_115 LR QH9P — MMBT3904 Q2 — R25 22K — GND

V1_15 — R24 1K

LED_11

V3_3 — R26 10K — LED_11 LR QH9P — MMBT3904 Q3 — R28 22K — GND

V1_1 — R27 1K

LED_15

V3_3 — R29 10K — LED_15 LR QH9P — MMBT3904 Q4 — R31 22K — GND

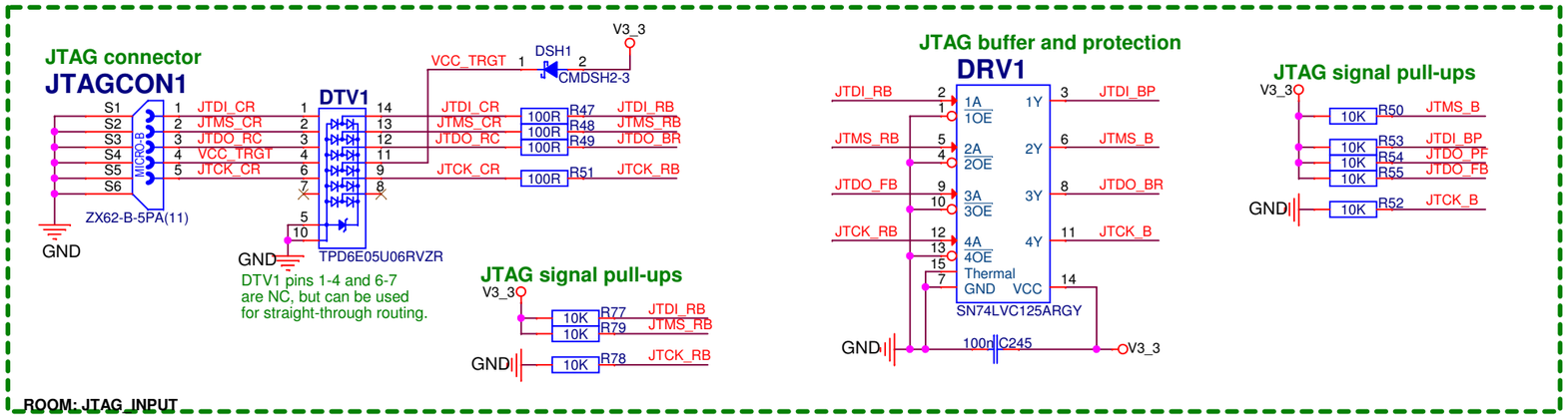
VCCD_1_5 — R30 1K

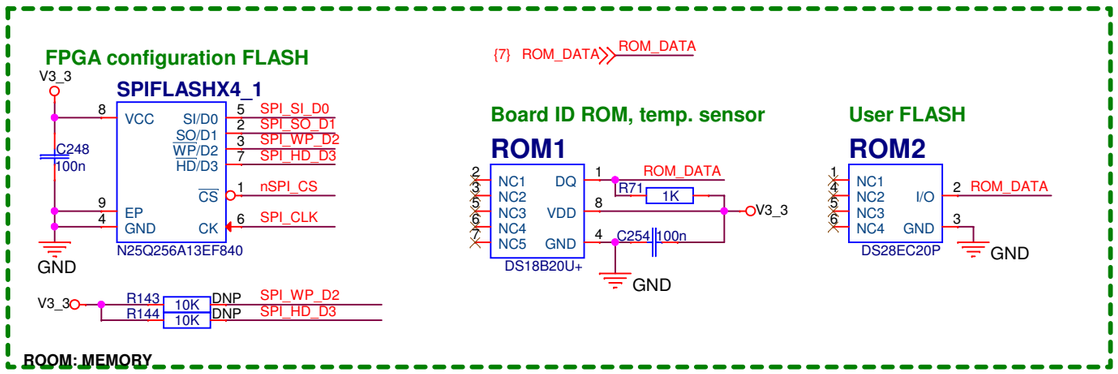
ROOM: POWER_INDICATORS

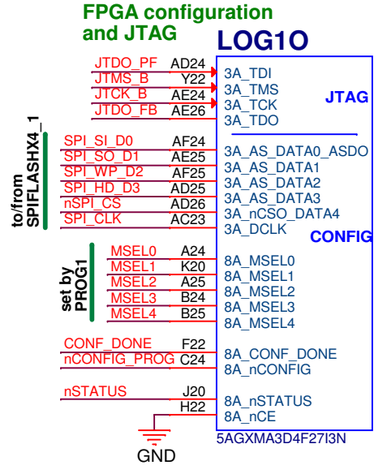
Title	FPGA decoupling, LDO regulators, power indicators		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
			SHEET 5 OF 13

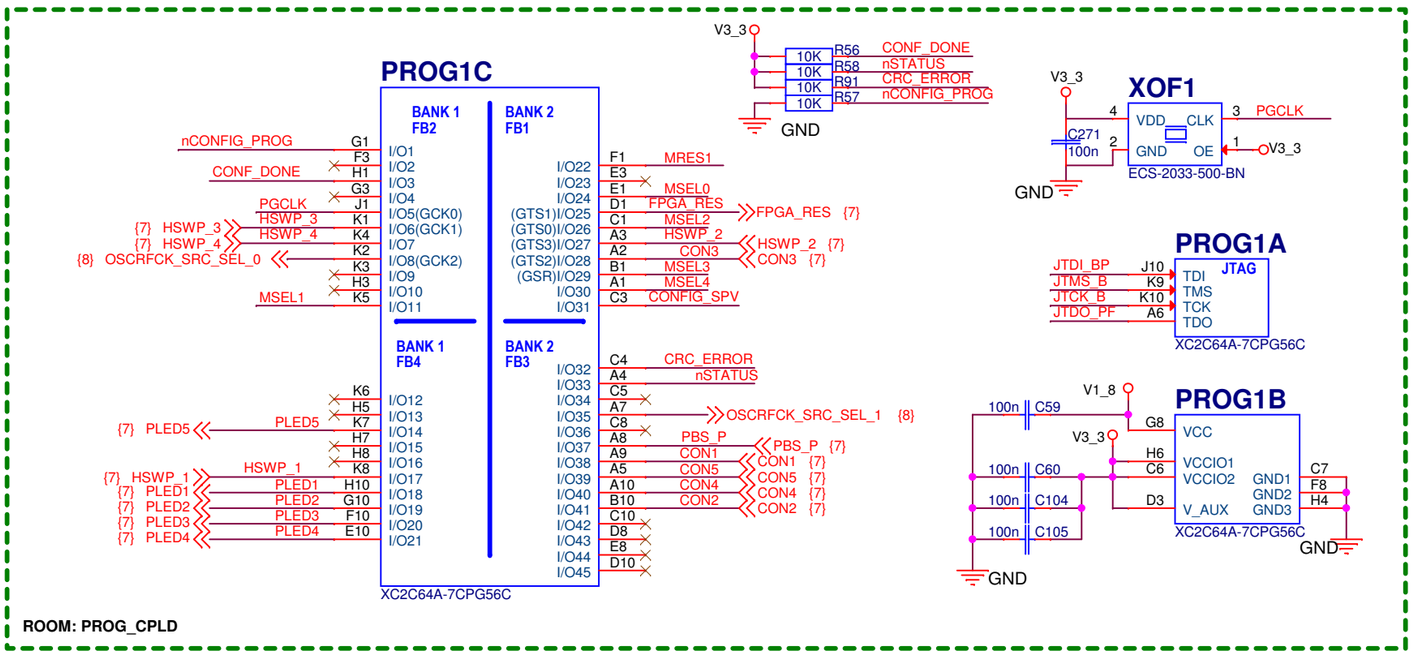
FPGA and CPLD JTAG, FPGA gateware FLASH, User Flash

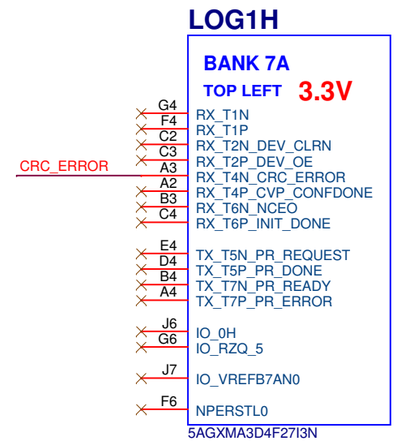
USB connector JTAG signals flow : C (connector) > R (resistor) > B (buffer) > P (PROG - CPLD) > F (FPGA) > B > C

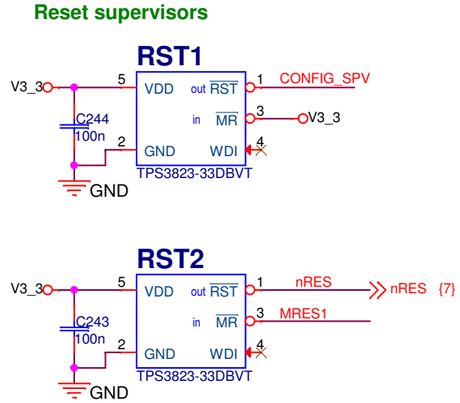








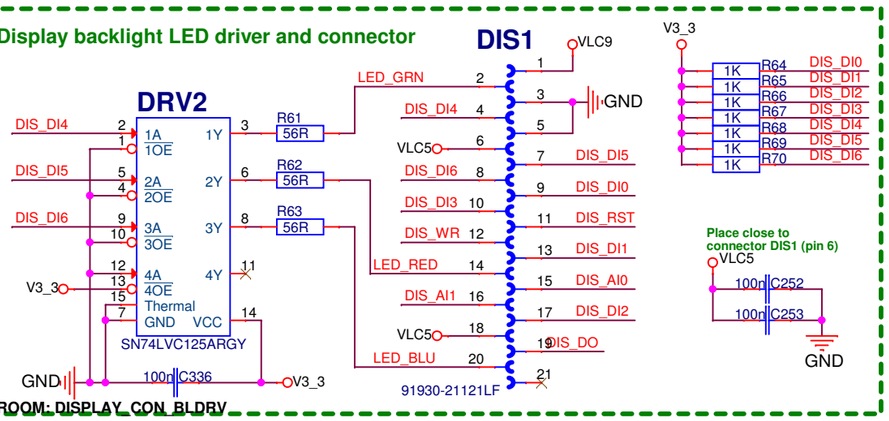




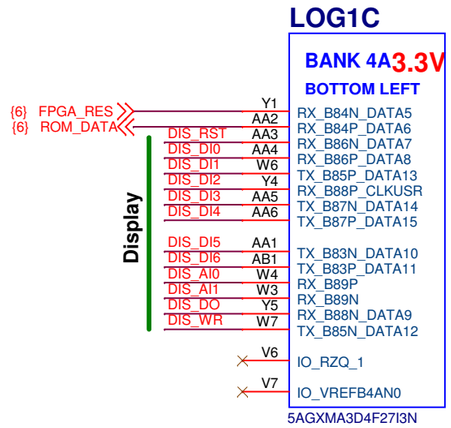
Title	FPGA and CPLD JTAG, FPGA gateware FLASH, User Flash		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 6 OF 13	

User interface - USB, Display, push buttons, HEX switch, LEDs

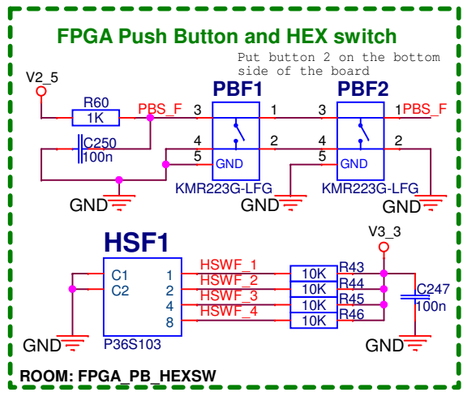
Display backlight LED driver and connector



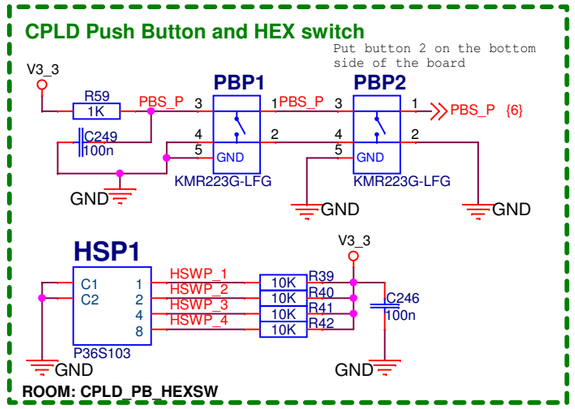
LOG1C



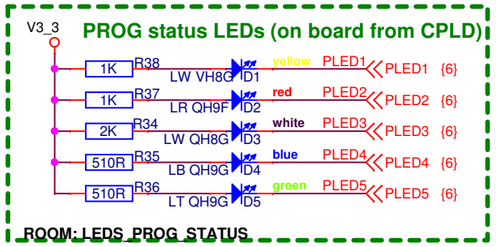
FPGA Push Button and HEX switch



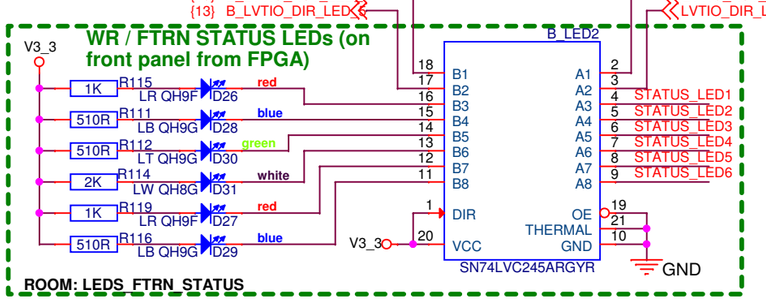
CPLD Push Button and HEX switch



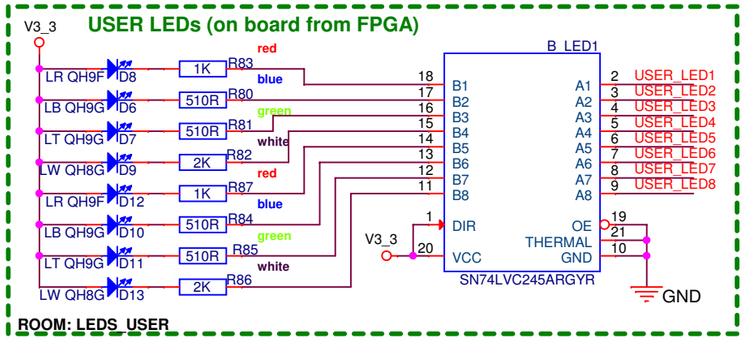
PROG status LEDs (on board from CPLD)



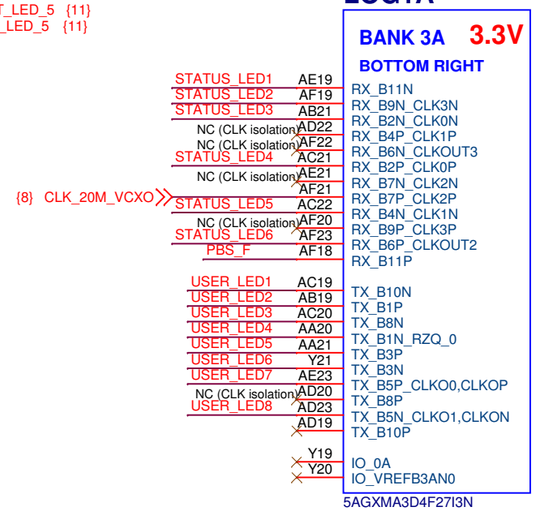
WR / FTRN STATUS LEDs (on front panel from FPGA)



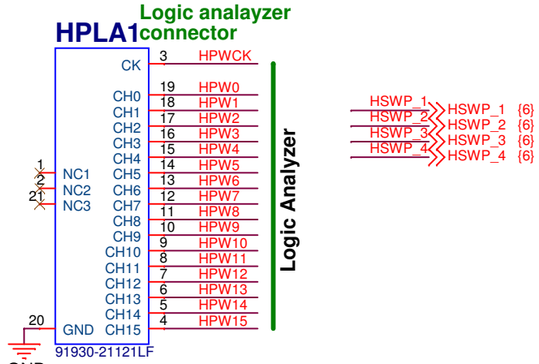
USER LEDs (on board from FPGA)



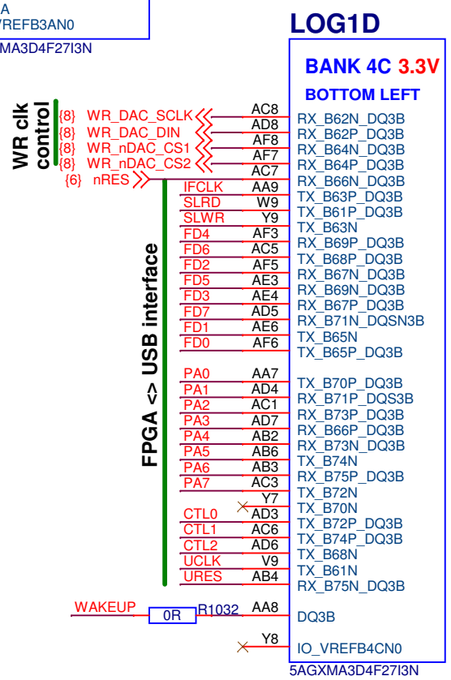
LOG1A



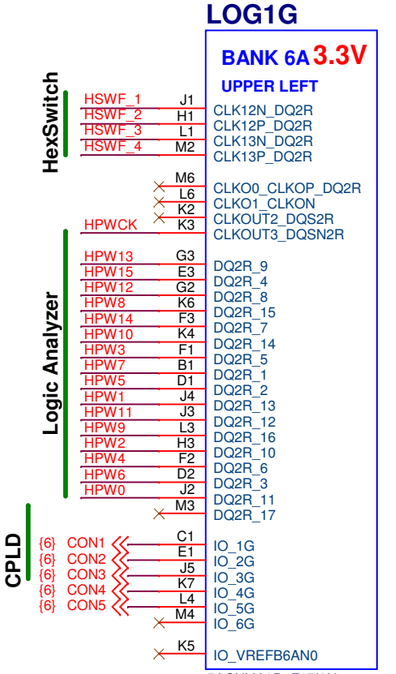
Logic analayzer connector



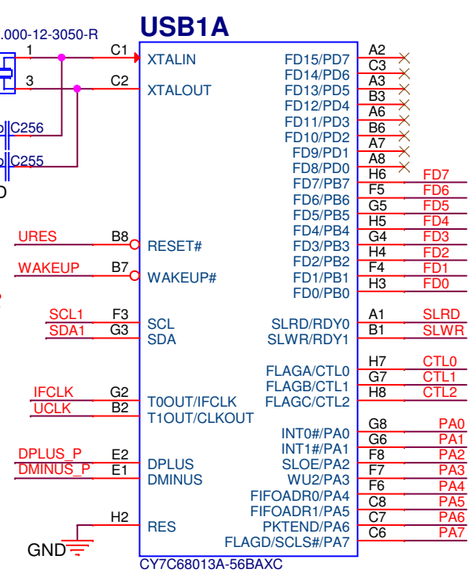
LOG1D



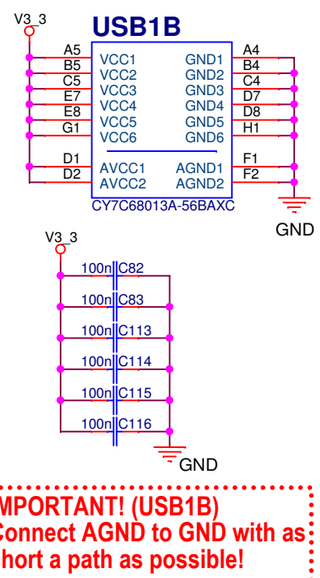
LOG1G



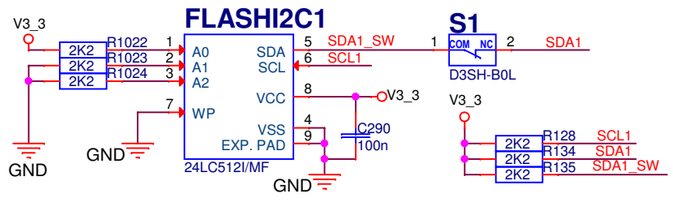
USB1A



USB1B



FLASHI2C1

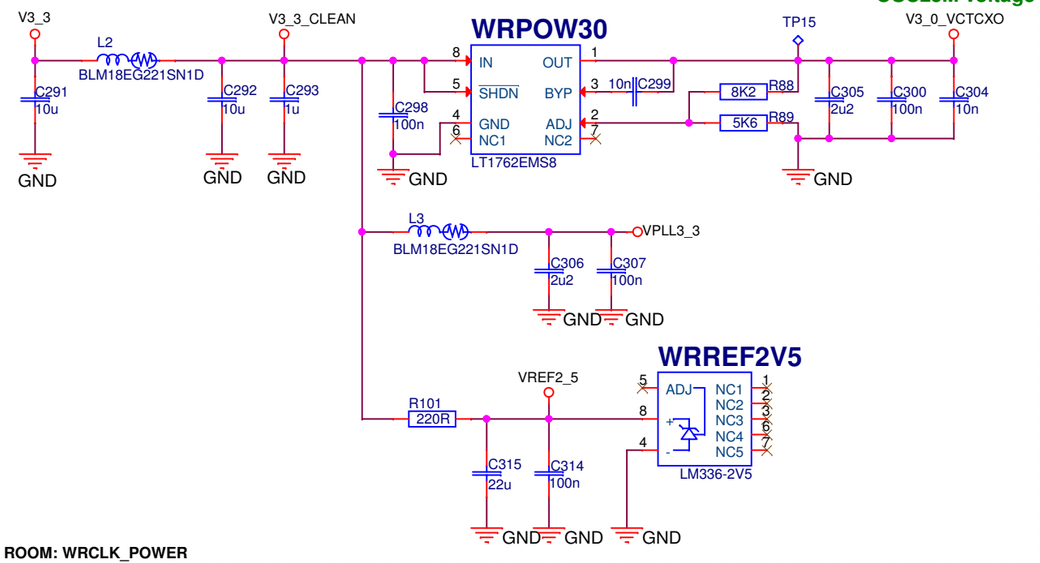


Title	User interface - USB, Display, push buttons, HEX switch, LEDs		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 7 OF 13	

Clocking: White Rabbit DAC, oscillators, PLL ; System clocks and clock crosspoint switch

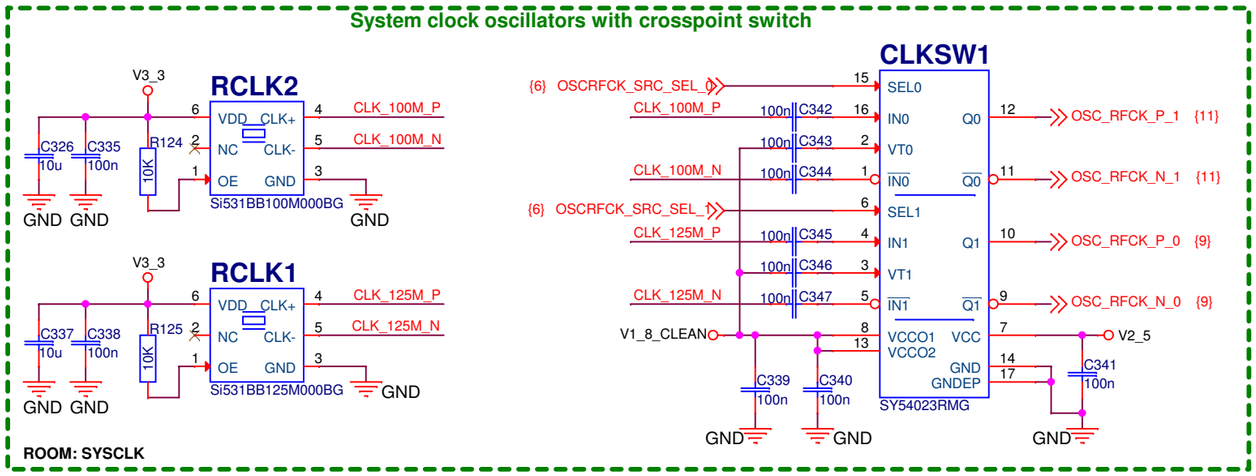
White Rabbit clocking power supply

OSC25M voltage



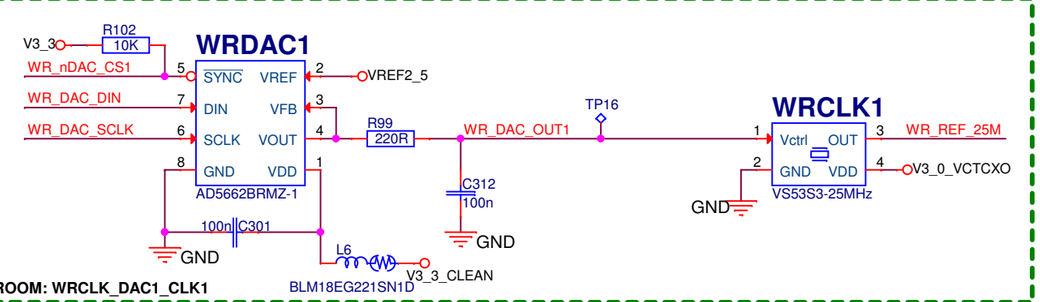
ROOM: WRCLK_POWER

System clock oscillators with crosspoint switch

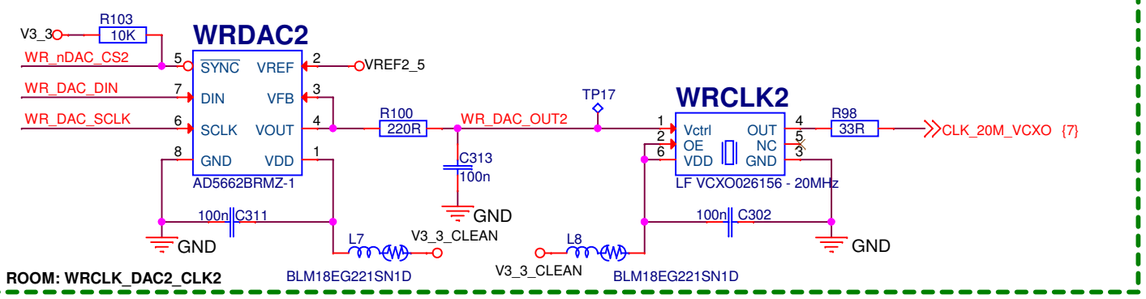


ROOM: SYSCLK

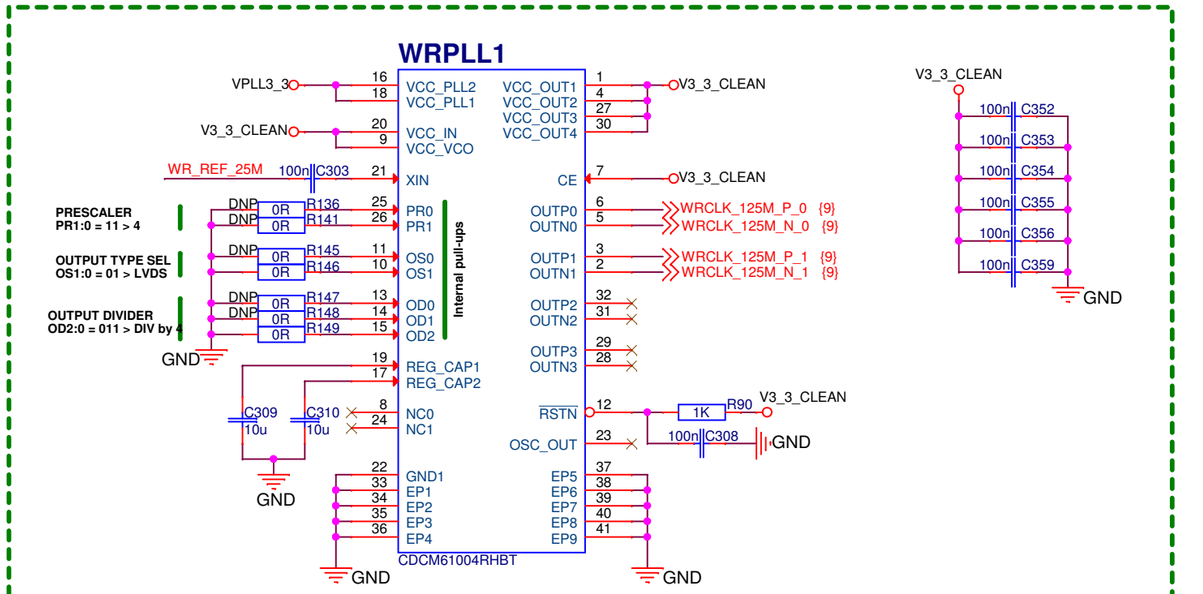
{7} WR_nDAC_CS1 → WR_nDAC_CS1
{7} WR_nDAC_CS2 → WR_nDAC_CS2
{7} WR_DAC_DIN → WR_DAC_DIN
{7} WR_DAC_SCLK → WR_DAC_SCLK



ROOM: WRCLK_DAC1_CLK1



ROOM: WRCLK_DAC2_CLK2

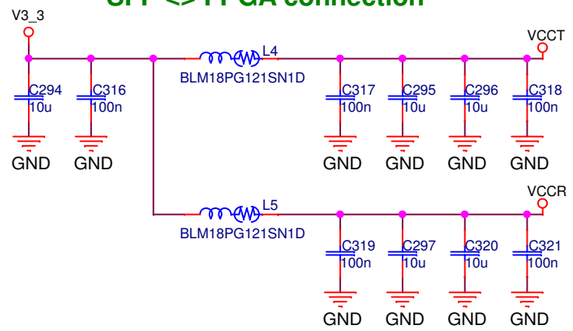


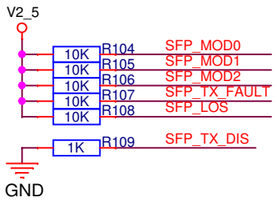
ROOM: WRCLK_PLL

Title	Clocking: White Rabbit DAC, oscillators, PLL ; System clocks and clock crosspoint switch		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 8 OF 13	

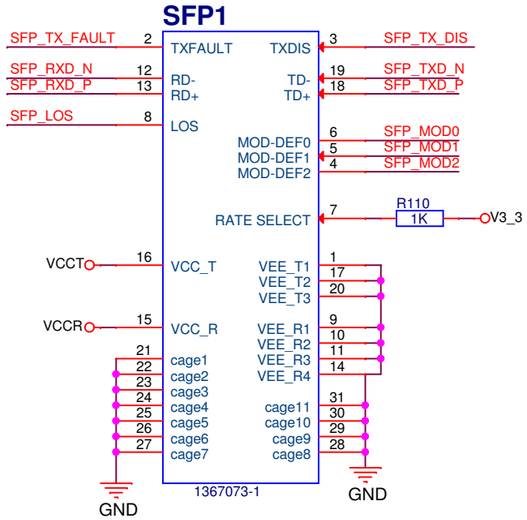
Fiber SFP, PCI <> FPGA connections

SFP <> FPGA connection

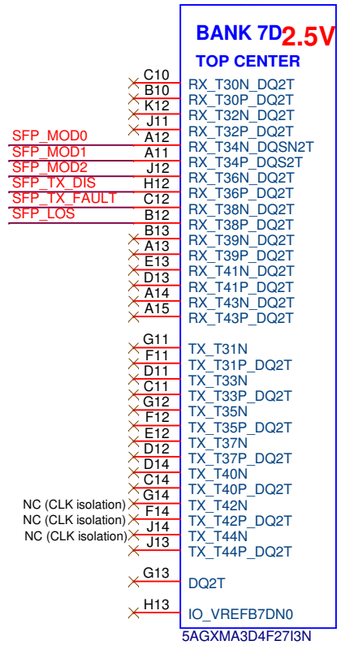




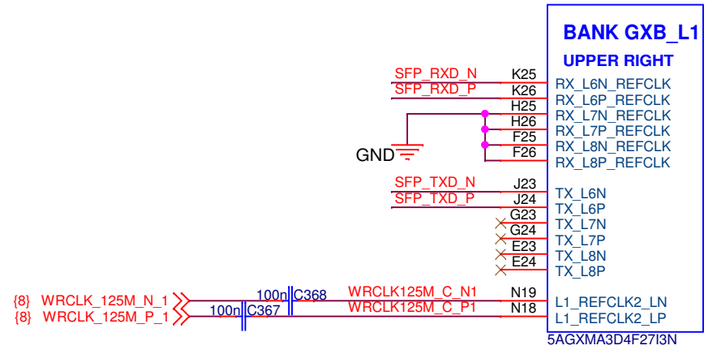
SFP1



LOG1J

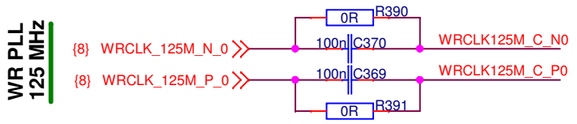


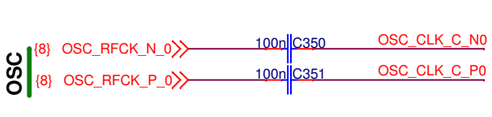
LOG1N



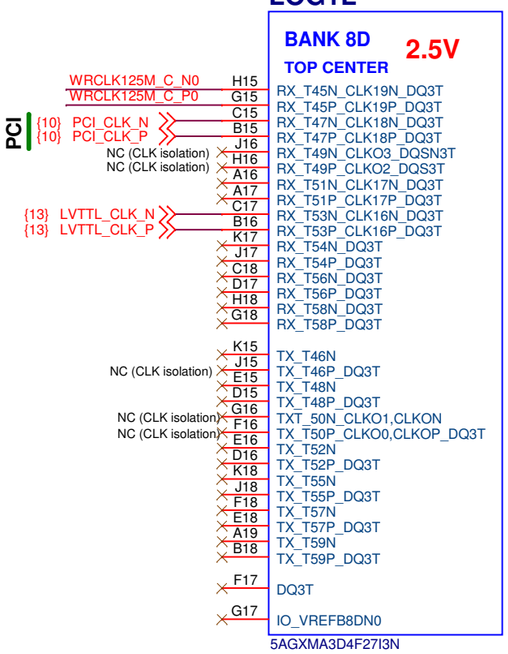
ROOM: SFP

Place resistor footprint over capacitor (optional AC-coupling)
Only resistors will be placed!

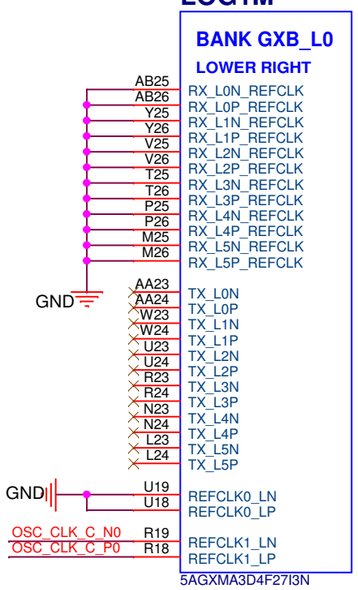




LOG1L



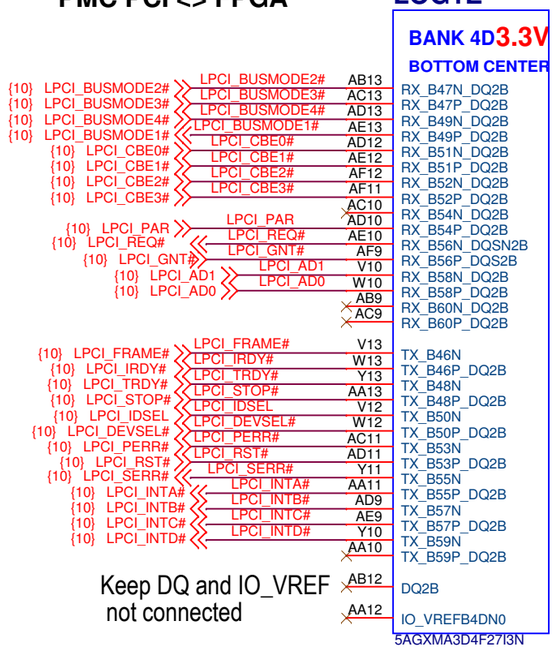
LOG1M



SWAP pins as needed inside and between banks 3D and 4D

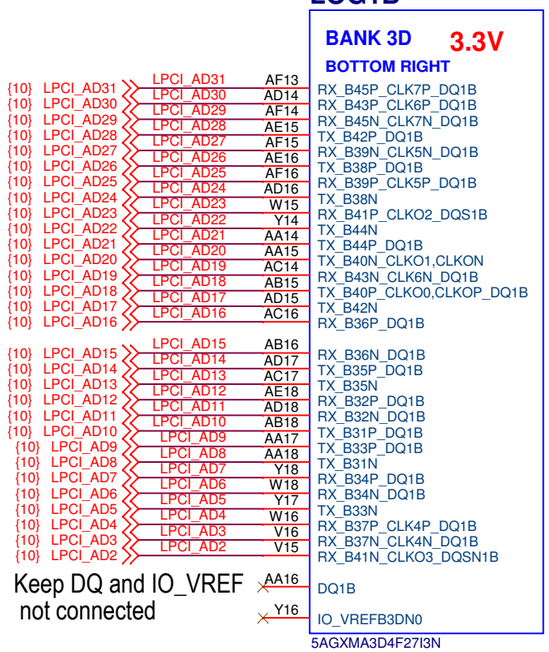
PMC PCI <> FPGA

LOG1E



Keep DQ and IO_VREF not connected

LOG1B



Keep DQ and IO_VREF not connected

Title	Fiber SFP, PCI <> FPGA connections		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 9 OF 13	

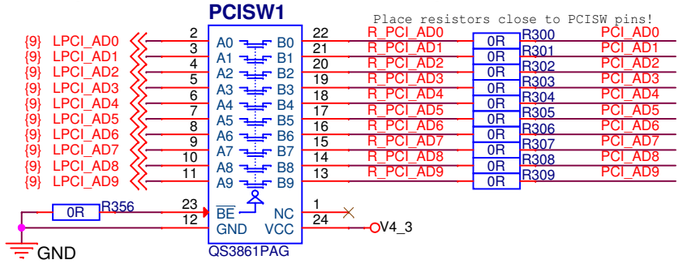
PMC host interface

FPGA side <---> PCI bus side

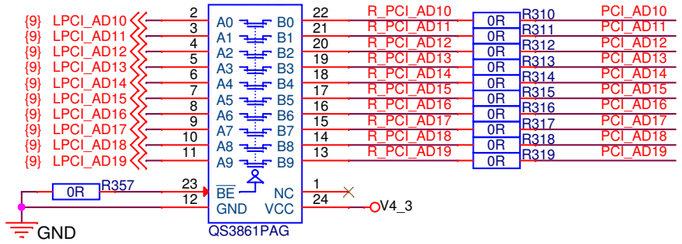
Swap as needed across bus switches for easier layout!

Place resistors close to PCISW pins!

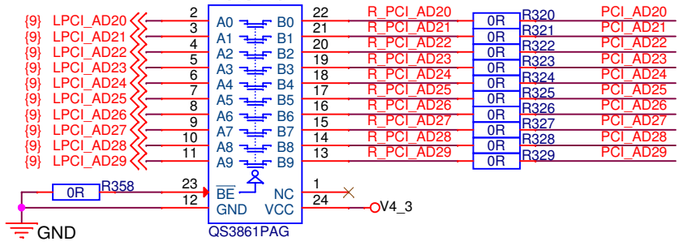
PCISW1



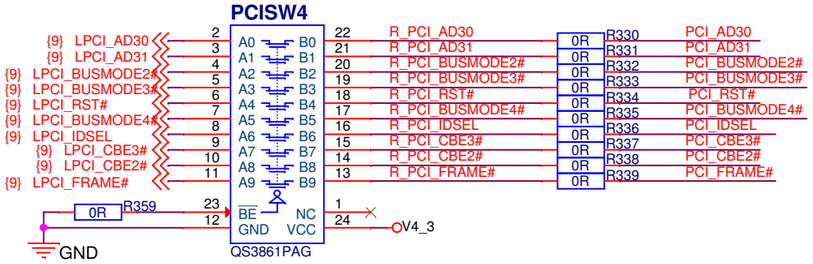
PCISW2



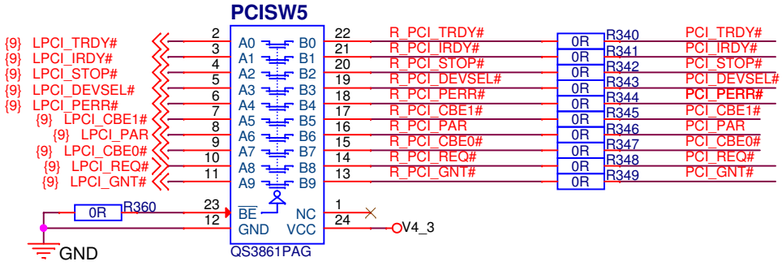
PCISW3



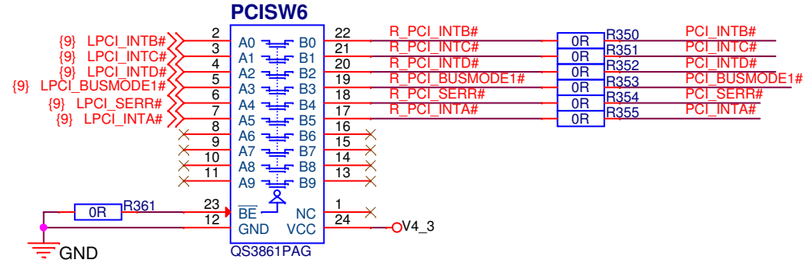
PCISW4



PCISW5

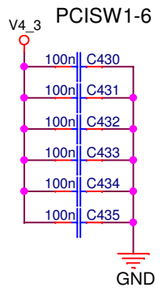


PCISW6

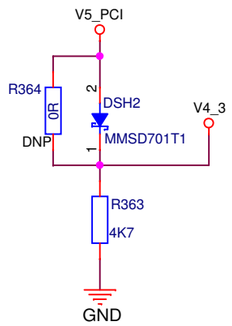


ROOM: PMC_BUFFERS

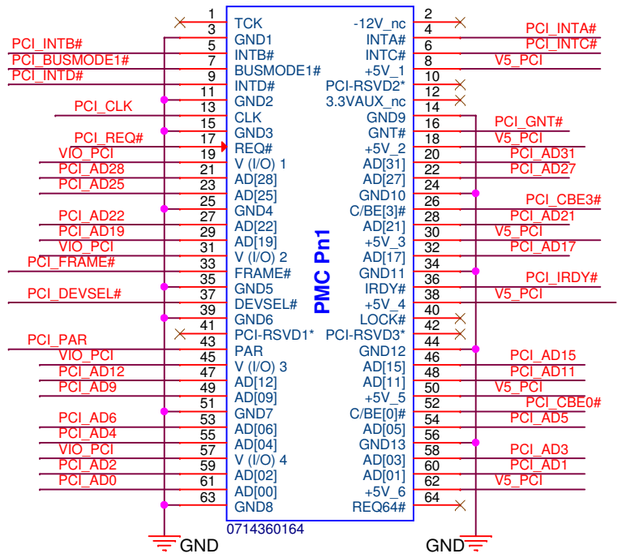
PCISW1-6



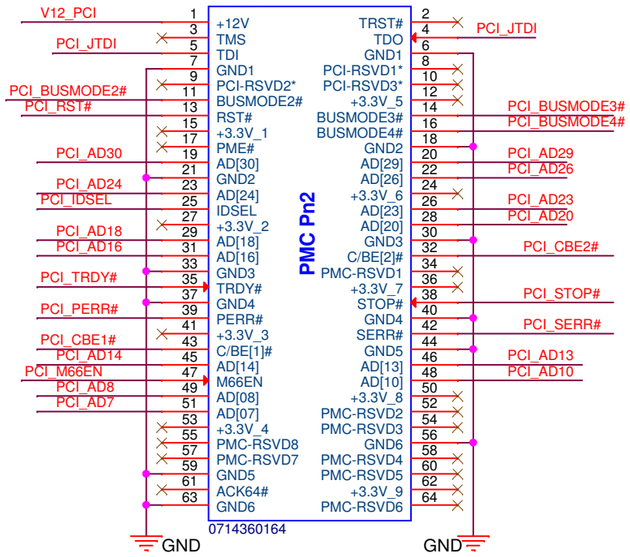
VCC for bus switches, see
- https://www.altera.com/content/dam/altera-www/global/en_US/pdfs/literature/ds/ds_stratix_pci_bd.pdf
- https://www.altera.com/content/dam/altera-www/global/en_US/pdfs/literature/an/an330.pdf



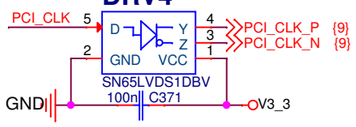
PN1



PN2

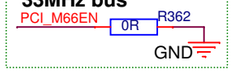


DRV4

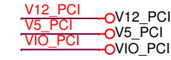


IMPORTANT! (DRV4)
Place close to connector PN1, pin 13!

supporting only 33MHz bus

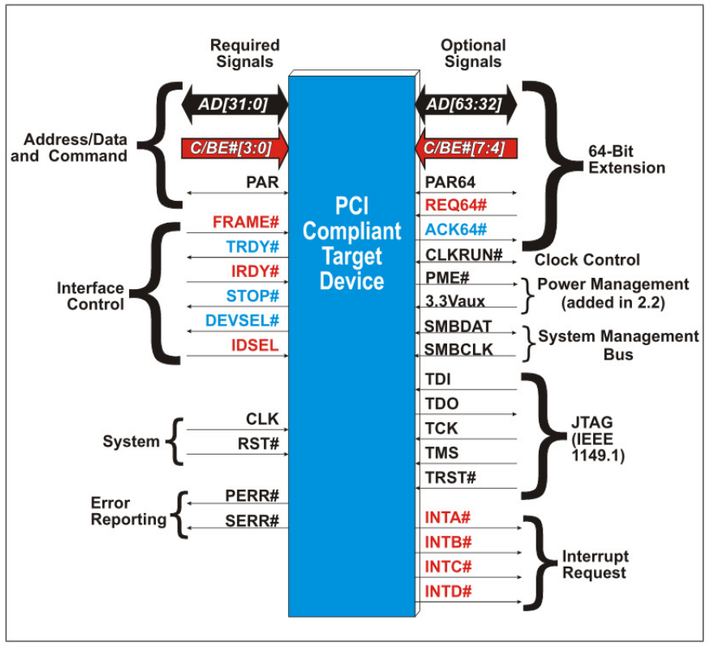


BACKPLANE POWER



ROOM: PMC

Figure 4-2: PCI-Compliant Target Device Signals



Title: PMC host interface				
Size: A3	Type: SE	DWG.NO. CSL_FTRN_PMC		REV. B
			SHEET 10 OF 13	

IO block power supply, FPGA <> IO block connections

{12} LVTIO_OUT_P_1 — LVTIO_OUT_P_1
{12} LVTIO_OUT_N_1 — LVTIO_OUT_N_1
{12} #LVTIO_OE_1 — #LVTIO_OE_1
{12} LVTIO_IN_P_1 — LVTIO_IN_P_1
{12} LVTIO_IN_N_1 — LVTIO_IN_N_1
{12} LVTIO_TERM_EN_1 — LVTIO_TERM_EN_1
{12} LVTIO_DIR_LED_1 — LVTIO_DIR_LED_1
{12} LVTIO_ACT_LED_1 — LVTIO_ACT_LED_1

{12} LVTIO_OUT_P_2 — LVTIO_OUT_P_2
{12} LVTIO_OUT_N_2 — LVTIO_OUT_N_2
{12} #LVTIO_OE_2 — #LVTIO_OE_2
{12} LVTIO_IN_P_2 — LVTIO_IN_P_2
{12} LVTIO_IN_N_2 — LVTIO_IN_N_2
{12} LVTIO_TERM_EN_2 — LVTIO_TERM_EN_2
{12} LVTIO_DIR_LED_2 — LVTIO_DIR_LED_2
{12} LVTIO_ACT_LED_2 — LVTIO_ACT_LED_2

{12} LVTIO_OUT_P_3 — LVTIO_OUT_P_3
{12} LVTIO_OUT_N_3 — LVTIO_OUT_N_3
{12} #LVTIO_OE_3 — #LVTIO_OE_3
{12} LVTIO_IN_P_3 — LVTIO_IN_P_3
{12} LVTIO_IN_N_3 — LVTIO_IN_N_3
{12} LVTIO_TERM_EN_3 — LVTIO_TERM_EN_3
{12} LVTIO_DIR_LED_3 — LVTIO_DIR_LED_3
{12} LVTIO_ACT_LED_3 — LVTIO_ACT_LED_3

{13} LVTIO_OUT_P_4 — LVTIO_OUT_P_4
{13} LVTIO_OUT_N_4 — LVTIO_OUT_N_4
{13} #LVTIO_OE_4 — #LVTIO_OE_4
{13} LVTIO_IN_P_4 — LVTIO_IN_P_4
{13} LVTIO_IN_N_4 — LVTIO_IN_N_4
{13} LVTIO_TERM_EN_4 — LVTIO_TERM_EN_4
{12} LVTIO_DIR_LED_4 — LVTIO_DIR_LED_4
{12} LVTIO_ACT_LED_4 — LVTIO_ACT_LED_4

{13} LVTIO_OUT_P_5 — LVTIO_OUT_P_5
{13} LVTIO_OUT_N_5 — LVTIO_OUT_N_5
{13} #LVTIO_OE_5 — #LVTIO_OE_5
{13} LVTIO_IN_P_5 — LVTIO_IN_P_5
{13} LVTIO_IN_N_5 — LVTIO_IN_N_5
{13} LVTIO_TERM_EN_5 — LVTIO_TERM_EN_5
{7} LVTIO_DIR_LED_5 — LVTIO_DIR_LED_5
{7} LVTIO_ACT_LED_5 — LVTIO_ACT_LED_5

LOG1F

BANK 5A
LOWER LEFT
3.3V

LVTTL IO control signals:
#LVTIO_OE_1 — N5
LVTIO_TERM_EN_1 — P1
LVTIO_ACT_LED_1 — P3
LVTIO_DIR_LED_1 — R2
#LVTIO_OE_2 — R3
LVTIO_TERM_EN_2 — R6
LVTIO_ACT_LED_2 — T1
LVTIO_DIR_LED_2 — T2
#LVTIO_OE_3 — T3
LVTIO_TERM_EN_3 — T6
LVTIO_ACT_LED_3 — U1
LVTIO_DIR_LED_3 — T7
#LVTIO_OE_4 — U5
LVTIO_TERM_EN_4 — V1
LVTIO_ACT_LED_4 — V4
LVTIO_DIR_LED_4 — V5
#LVTIO_OE_5 — W1
LVTIO_TERM_EN_5 — W2
LVTIO_ACT_LED_5 — N6
LVTIO_DIR_LED_5 — P4
{13} #LVTTL_IN_CLK_EN — #LVTTL_IN_CLK_EN — P6

N1 — CLK14N_DQ1R
M1 — CLK14P_DQ1R
N3 — CLK15N_DQ1R
N2 — CLK15P_DQ1R
R5 — DQ1R_1
T4 — DQ1R_2
U6 — DQ1R_3
V2 — DQ1R_4
DQ1R_5 … DQ1R_18
IO_1F … IO_7F
U3 — DQSN1R
V3 — DQS1R
U7 — IO_VREFB5AN0

5AGXMA3D4F27I3N

Power supply for output drivers

V_MAIN
100K R130
100n C329
GND
PRUN_3V3_IO
10K R133
PGOOD_3V3_IO
red D17
LR QH9F
GND

POWIO33A
H5 RUN/SS
H6 PGOOD
F7 SHARE
AUX F5
BIAS G5
SYNC G6
ADJ H7
R_T G7
LTM8023EV
10K R132
154K R131
49K9 R129
GND

POWIO33B
V_MAIN
C331 100n
C330 10u
GND GND
G1 G2 G3 H1 H2 H3 — V_IN1 V_IN2 V_IN3 V_IN4 V_IN5 V_IN6
V_OUT1 V_OUT2 V_OUT3 V_OUT4 V_OUT5 V_OUT6 V_OUT7 V_OUT8 V_OUT9 V_OUT10 V_OUT11 V_OUT12 — A1 A2 A3 A4 B1 B2 B3 B4 C1 C2 C3 C4
LTM8023EV
ODRV
TP18
C332 22u
GND
JODRV_V33
JMP_V2
V33_ODRV
C333 100u
C334 100u
GND GND

POWIO33C
A5 A6 A7 B5 B6 B7 C5 C6 C7 D1 D2 D3 — GND1 GND2 GND3 GND4 GND5 GND6 GND7 GND8 GND9 GND10 GND11 GND12
F6 E7 E6 E5 E4 E3 E2 E1 D7 D6 D5 D4 — GND24 GND23 GND22 GND21 GND20 GND19 GND18 GND17 GND16 GND15 GND14 GND13
LTM8023EV
GND GND

ROOM: IO_POWER

LOG1K

BANK 8A 2.5V
TOP RIGHT

A23 — RX_T86N_CLK21N
B22 — RX_T86P_CLK21P
A21 — TX_T82P
D21 — TX_T89P
E21 — TX_T89N_RZQ_6
G21 — TX_T85P_CLKO0,CLKOP
A20 — RX_T81P_CLK23P
C19 — RX_T79P
H19 — TX_T87P
D20 — RX_T84N_CLKOUT3
C22 — RX_T88N_CLK20N
C23 — RX_T88P_CLK20P
B19 — RX_T81N_CLK23N
F19 — TX_T80N
E19 — TX_T80P
J19 — TX_T87N
B21 — RX_T83P_CLK22P
D19 — RX_T79N
H21 — TX_T85N_CLKO1,CLKON
A22 — TX_T82N
C21 — RX_T83N_CLK22N
C20 — RX_T84P_CLKOUT2
F20 — IO_0K
G20 — IO_VREFB8AN0

5AGXMA3D4F27I3N

LOG1I

BANK 7C
TOP LEFT 2.5V

LVTTL IO data inputs:
LVTIO_IN_N_1 — A6
LVTIO_IN_P_1 — A5
LVTIO_IN_N_2 — C6
LVTIO_IN_P_2 — B6
LVTIO_IN_N_3 — E6
LVTIO_IN_P_3 — D6
LVTIO_IN_N_4 — F7
LVTIO_IN_P_4 — E7
LVTIO_IN_N_5 — H9
LVTIO_IN_P_5 — G9
D8 C8 E9 D9 H10 G10 — RX_T19N_DQSN1T RX_T19P_DQS1T RX_T21N_DQ1T RX_T21P_DQ1T RX_T15N_DQ1T RX_T15P_DQ1T RX_T17N_DQ1T RX_T17P_DQ1T RX_T23N_DQ1T RX_T23P_DQ1T RX_T24N_DQ1T RX_T24P_DQ1T RX_T26N_DQ1T RX_T26P_DQ1T RX_T28N_DQ1T RX_T28P_DQ1T

LVTTL IO data outputs:
LVTIO_OUT_N_1 — A9
LVTIO_OUT_P_1 — A8
LVTIO_OUT_N_2 — C7
LVTIO_OUT_P_2 — B7
LVTIO_OUT_N_3 — D5
LVTIO_OUT_P_3 — C5
LVTIO_OUT_N_4 — G8
LVTIO_OUT_P_4 — F8
LVTIO_OUT_N_5 — J8
LVTIO_OUT_P_5 — J9
K10 J10 C9 B9 — TX_T25N TX_T25P_DQ1T TX_T22N TX_T22P_DQ1T TX_T18N TX_T18P_DQ1T TX_T20N TX_T20P_DQ1T TX_T16N TX_T16P_DQ1T TX_T27N TX_T27P_DQ1T TX_T29N TX_T29P_DQ1T
E10 — DQ1T
F10 — IO_VREFB7CN0

5AGXMA3D4F27I3N

Place resistor footprint over capacitor (optional AC-coupling)
Only resistors will be placed!

OSC
{8} OSC_RFCK_N_1
{8} OSC_RFCK_P_1
0R R392
100n C358
100n C357
0R R393
OSC_RFCK_C_N1
OSC_RFCK_C_P1

* - IO overvoltage protection bias circuit is based OHWR FMC-DIO-5CHTTLA

Title: IO block power supply, FPGA <> IO block connections			
Size: A3	Type: SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 11 OF 13	

LVTTL IO blocks 1-3

Trace from ODAx pin 4 and ODBx pin 4 to the fuse must be equal lenght!

Trace from OTx pin 5 to ODAx pin 2 and ODBx pin 2 must be equal lenght!

Place 0R resistor over fuse.

TTLIO1 — EPL.00.250.NTN — DNP 0R R401 — F200 140mA-60V — TVS1 CDSOD323-T05L — 5K6 R200 — IO_OD1

ODA1 SN74LVC1G125DCK — OT1 SN65LVDT2DBV — DNP 100R R206 — LVTIO_OUT_P_1 {11} — LVTIO_OUT_N_1 {11}

ODB1 SN74LVC1G125DCK — 2K R205 V33_ODRV — #LVTIO_OE_1 {11}

Q200 BSH103 — R202 R203 100R 100R 250mW — R201 2K

IB1 SN74LVC1G125DCK — 2K R204 — IO_a1 — IT1 SN65LVDS1DBV — LVTIO_IN_P_1 {11} — LVTIO_IN_N_1 {11}

LVTIO_TERM_EN_1 {11}

LB VH9G D201 blue — 1K5 R208 — B_LVTIO_ACT_LED_1

IO Activity Indicator

LR VH9F D202 red — 2K R209 — B_LVTIO_DIR_LED_1

IO Direction Indicator

V33_ODRV — 100n C400 C401 C402 C403 C404

ROOM: IO_BLOCK_1

Trace from ODAx pin 4 and ODBx pin 4 to the fuse must be equal lenght!

Trace from OTx pin 5 to ODAx pin 2 and ODBx pin 2 must be equal lenght!

Place 0R resistor over fuse.

TTLIO2 — EPL.00.250.NTN — DNP 0R R402 — F201 140mA-60V — TVS2 CDSOD323-T05L — 5K6 R217 — IO_OD2

ODA2 SN74LVC1G125DCK — OT2 SN65LVDT2DBV — DNP 100R R212 — LVTIO_OUT_P_2 {11} — LVTIO_OUT_N_2 {11}

ODB2 SN74LVC1G125DCK — 2K R213 V33_ODRV — #LVTIO_OE_2 {11}

Q201 BSH103 — R207 R211 100R 100R 250mW — R214 2K

IB2 SN74LVC1G125DCK — 2K R210 — IO_a2 — IT2 SN65LVDS1DBV — LVTIO_IN_P_2 {11} — LVTIO_IN_N_2 {11}

LVTIO_TERM_EN_2 {11}

LB VH9G D204 blue — 1K5 R215 — B_LVTIO_ACT_LED_2

IO Activity Indicator

LR VH9F D203 red — 2K R216 — B_LVTIO_DIR_LED_2

IO Direction Indicator

V33_ODRV — 100n C405 C409 C408 C407 C406

ROOM: IO_BLOCK_2

Trace from ODAx pin 4 and ODBx pin 4 to the fuse must be equal lenght!

Trace from OTx pin 5 to ODAx pin 2 and ODBx pin 2 must be equal lenght!

Place 0R resistor over fuse.

TTLIO3 — EPL.00.250.NTN — DNP 0R R403 — F202 140mA-60V — TVS3 CDSOD323-T05L — 5K6 R226 — IO_OD3

ODA3 SN74LVC1G125DCK — OT3 SN65LVDT2DBV — DNP 100R R221 — LVTIO_OUT_P_3 {11} — LVTIO_OUT_N_3 {11}

ODB3 SN74LVC1G125DCK — 2K R222 V33_ODRV — #LVTIO_OE_3 {11}

Q202 BSH103 — R218 R220 100R 100R 250mW — R223 2K

IB3 SN74LVC1G125DCK — 2K R219 — IO_a3 — IT3 SN65LVDS1DBV — LVTIO_IN_P_3 {11} — LVTIO_IN_N_3 {11}

LVTIO_TERM_EN_3 {11}

LB VH9G D206 blue — 1K5 R224 — B_LVTIO_DIR_LED_3

IO Activity Indicator

LR VH9F D205 red — 2K R225 — B_LVTIO_ACT_LED_3

IO Direction Indicator

V33_ODRV — 100n C410 C414 C413 C412 C411

ROOM: IO_BLOCK_3

— Z = 50R !

B_LED3 — SN74LVC245ARGYR

B_LVTIO_ACT_LED_1	18	B1	A1 2 — LVTIO_ACT_LED_1 {11}
B_LVTIO_DIR_LED_1	17	B2	A2 3 — LVTIO_DIR_LED_1 {11}
B_LVTIO_ACT_LED_2	16	B3	A3 4 — LVTIO_ACT_LED_2 {11}
B_LVTIO_DIR_LED_2	15	B4	A4 5 — LVTIO_DIR_LED_2 {11}
B_LVTIO_ACT_LED_3	14	B5	A5 6 — LVTIO_ACT_LED_3 {11}
B_LVTIO_DIR_LED_3	13	B6	A6 7 — LVTIO_DIR_LED_3 {11}
B_LVTIO_ACT_LED_4	12	B7	A7 8 — LVTIO_ACT_LED_4 {11}
B_LVTIO_DIR_LED_4	11	B8	A8 9 — LVTIO_DIR_LED_4 {11}
{13} B_LVTIO_ACT_LED_4			
{13} B_LVTIO_DIR_LED_4			
	1	DIR	
V3_3	20	VCC	
	19	OE	
	21	THERMAL	
	10	GND	GND

Title	LVTTL IO blocks 1-3		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 12 OF 13	

LVTTL IO blocks 4-5, IO CLOCK input

Trace from ODAx pin 4 and ODBx pin 4 to the fuse must be equal lenght!

Trace from OTx pin 5 to ODAx pin 2 and ODBx pin 2 must be equal lenght!

Place 0R resistor over fuse.

TTLIO4 — EPL.00.250.NTN — TTLIO4 — DNP 0R R404 — F203 140mA-60V — IO_OD4

TVS4 CDSOD323-T05L — 5K6 R235 — GND

Q203 BSH103 — R227 100R, R229 100R — **250mW** — R232 2K — GND

ODA4 SN74LVC1G125DCK — V33_ODRV — GND

OT4 SN65LVDT2DBV — IO_OT4 — DNP 100R R230 — LVTIO_OUT_P_4 {11} — LVTIO_OUT_N_4 {11}

ODB4 SN74LVC1G125DCK — 2K R231 V33_ODRV — #LVTIO_OE_4 {11}

IB4 SN74LVC1G125DCK — 2K R228 — IO_a4

IT4 SN65LVDS1DBV — LVTIO_IN_P_4 {11} — LVTIO_IN_N_4 {11} — V33_ODRV

LVTIO_TERM_EN_4 {11}

LB VH9G — blue — D208 — 1K5 R233 — B_LVTIO_ACT_LED_4 {12}

IO Activity Indicator

LR VH9F — red — D207 — 2K R234 — B_LVTIO_DIR_LED_4 {12}

GND **IO Direction Indicator**

V33_ODRV — 100n C415, 100n C419, 100n C418, 100n C417, 100n C416 — GND

ROOM: IO_BLOCK_4

Trace from ODAx pin 4 and ODBx pin 4 to the fuse must be equal lenght!

Trace from OTx pin 5 to ODAx pin 2 and ODBx pin 2 must be equal lenght!

Place 0R resistor over fuse.

TTLIO5 — EPL.00.250.NTN — TTLIO5 — DNP 0R R405 — F204 140mA-60V — IO_OD5

TVS5 CDSOD323-T05L — 5K6 R244 — GND

Q204 BSH103 — R236 100R, R238 100R — **250mW** — R241 2K — GND

ODA5 SN74LVC1G125DCK — V33_ODRV — GND

OT5 SN65LVDT2DBV — IO_OT5 — DNP 100R R239 — LVTIO_OUT_P_5 {11} — LVTIO_OUT_N_5 {11}

ODB5 SN74LVC1G125DCK — 2K R240 V33_ODRV — #LVTIO_OE_5 {11}

IB5 SN74LVC1G125DCK — 2K R237 — IO_a5

IT5 SN65LVDS1DBV — LVTIO_IN_P_5 {11} — LVTIO_IN_N_5 {11} — V33_ODRV

LVTIO_TERM_EN_5 {11}

LB VH9G — blue — D210 — 1K5 R242 — B_LVTIO_ACT_LED_5 {7}

IO Activity Indicator

LR VH9F — red — D209 — 2K R243 — B_LVTIO_DIR_LED_5 {7}

GND **IO Direction Indicator**

V33_ODRV — 100n C420, 100n C424, 100n C423, 100n C422, 100n C421 — GND

ROOM: IO_BLOCK_5

IBC6 SN74LVC1G125DCK — V33_ODRV R245 2K — IO_a6 — GND 100n C361

ITC6 SN65LVDS1DBV — LVTTL_CLK_P {9} — LVTTL_CLK_N {9} — V33_ODRV — GND 100n C360

#LVTTL_IN_CLK_EN {11}

V33_ODRV — 100n C425, 100n C429 — GND

ROOM: IO_BLOCK_CLK

Z = 50R !

Title	LVTTL IO blocks 4-5, IO CLOCK input		
Size A3	Type SE	DWG.NO. CSL_FTRN_PMC	REV. B
		SHEET 13 OF 13	