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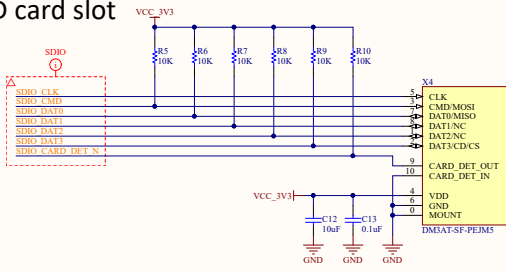
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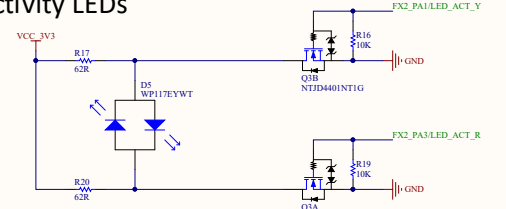
Title: P-board.Header		
File: 0_HEADER.SchDoc	Size: A4	
Drawn by: Vaagn Oganessian	Version: v1.0.0	
Date: 09.12.2020	Time: 16:04:19	Sheet: 1 of 6

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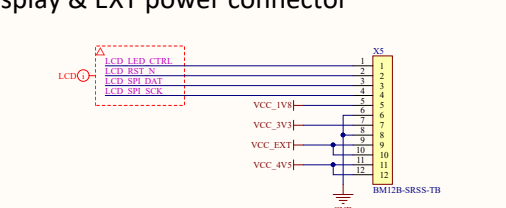
SD card slot



Activity LEDs



Display & EXT power connector



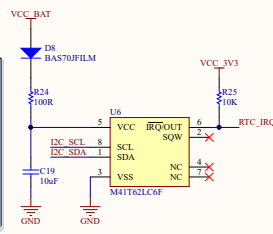
Real time clock

Backup capacitor of 10uF allows to keep RTC state for at least 30 seconds during battery replacement (of course, if battery was not fully discharged).

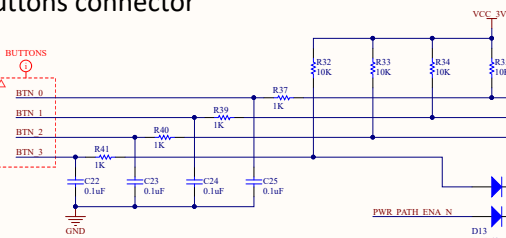
$V_{bat} = 3.0V$ (discharged battery state)
 $V_f = 0.41V$ (max diode drop)
 $I_{rtc} = 350nA$ (average RTC timekeeping current)
 $I_r = 100nA$ (max diode reverse current)

$V_{min} = 1.0V$ (RTC lowest time keeping voltage)
 $V_{start} = V_{bat} - V_f = 2.59V$ (initial capacitor voltage)
 $I_{max} = I_{rtc} + I_r = 450nA$

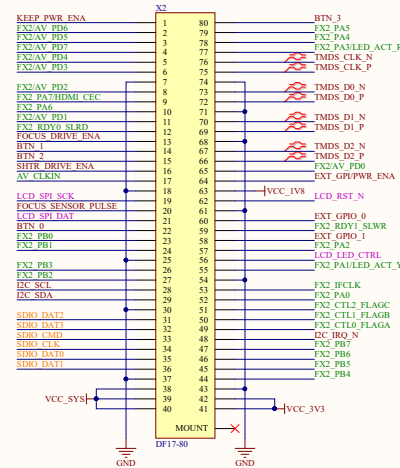
$T = C * (V_{start} - V_{min}) / I_{max}$
 $T = 10uF * 10^{-6} * (2.59V - 1.0V) / (450nA * 10^{-9}) = 35 sec$



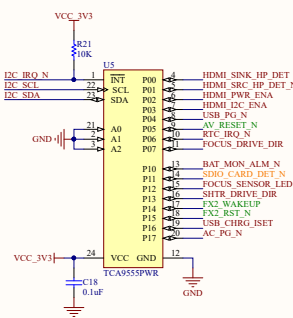
Buttons connector



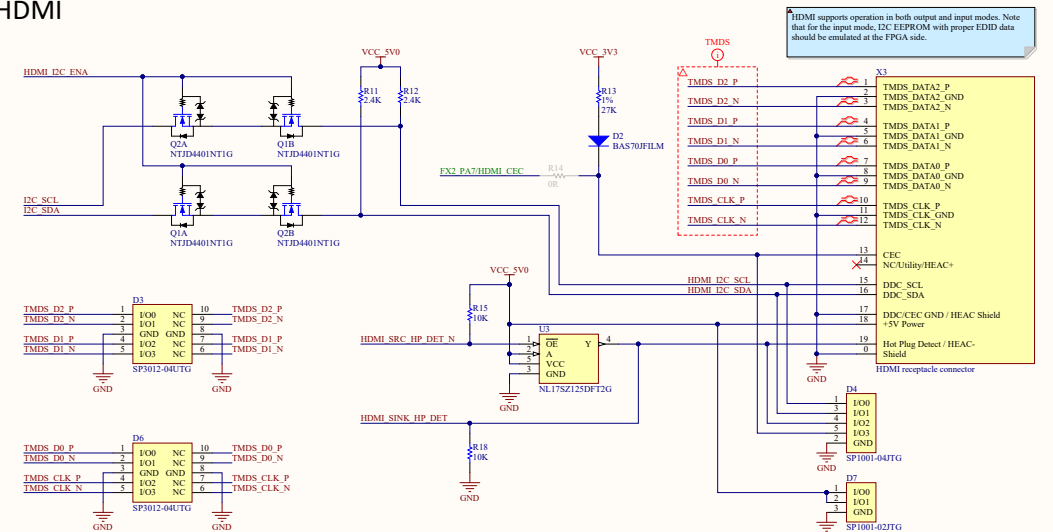
M-board connector



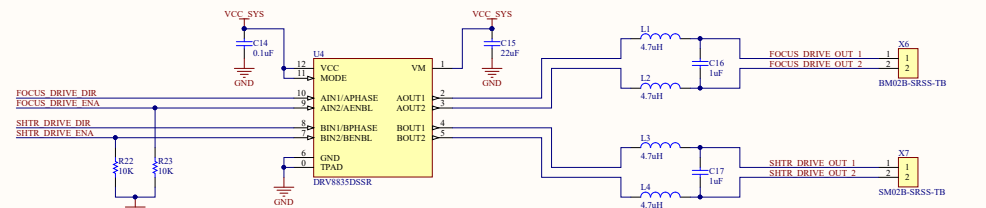
I2C I/O expander



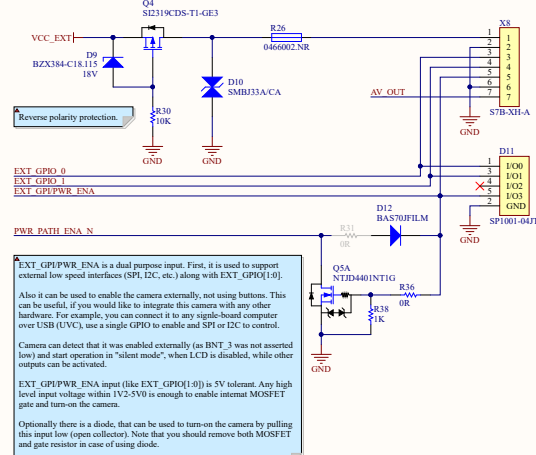
HDMI



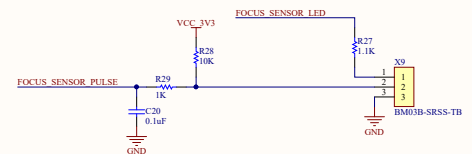
Shutter & focus motor control



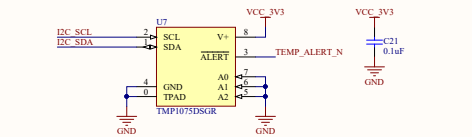
AV & GPIO external connector



Focus sensor connector



Temperature sensor



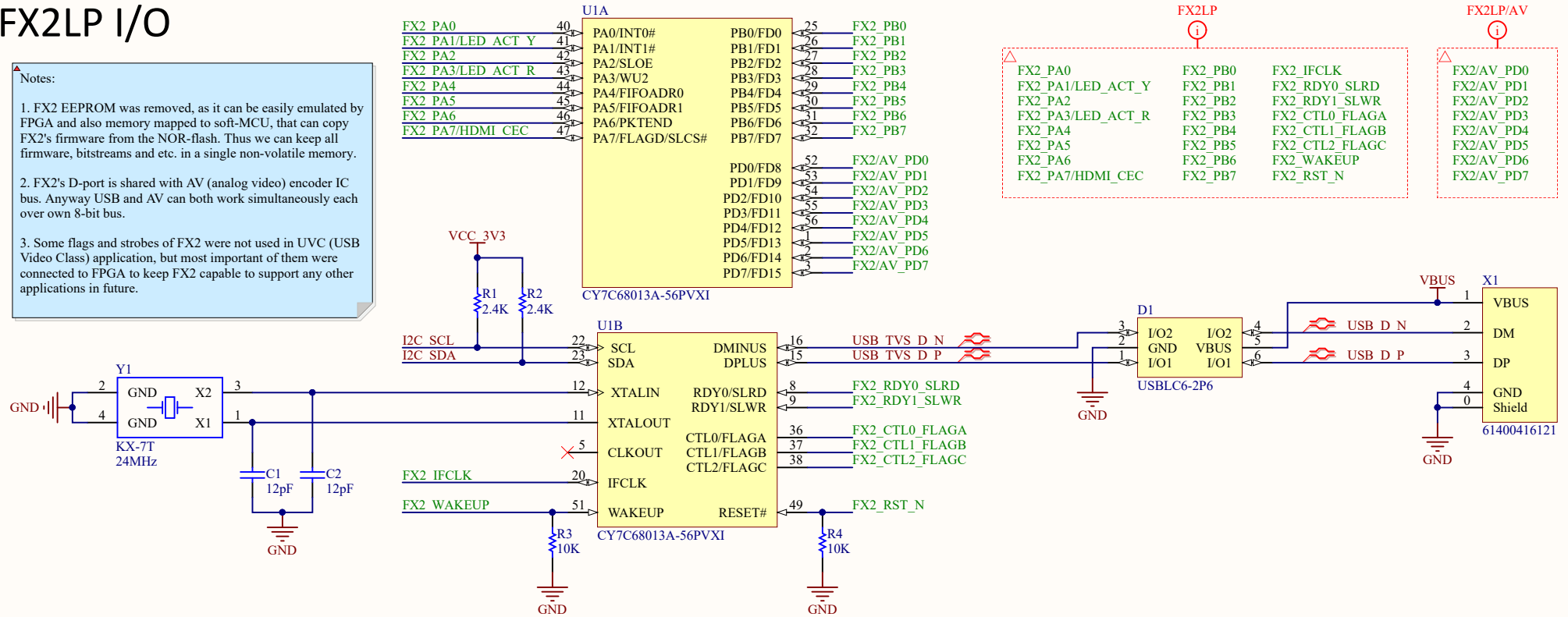
PCB stacking spacers



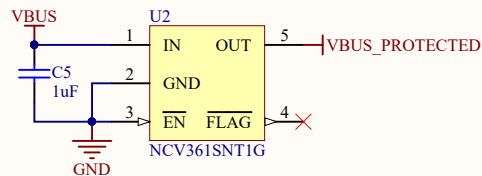
FX2LP I/O

Notes:

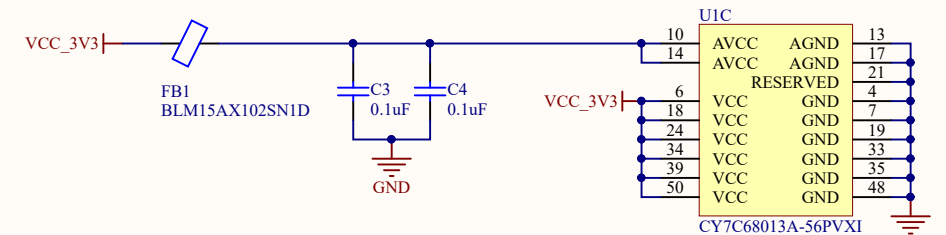
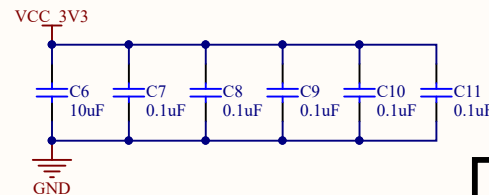
1. FX2 EEPROM was removed, as it can be easily emulated by FPGA and also memory mapped to soft-MCU, that can copy FX2's firmware from the NOR-flash. Thus we can keep all firmware, bitstreams and etc. in a single non-volatile memory.
2. FX2's D-port is shared with AV (analog video) encoder IC bus. Anyway USB and AV can both work simultaneously each over own 8-bit bus.
3. Some flags and strobes of FX2 were not used in UVC (USB Video Class) application, but most important of them were connected to FPGA to keep FX2 capable to support any other applications in future.



USB power protection



FX2LP power



Title: P-board.USB

File: 2_USB.SchDoc

Drawn by: Vaagn Oganessian

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AV encoder

The schematic diagram illustrates the circuit for an AV encoder, centered around the ADV7391BCPZ IC (U8). The IC is configured with various input and output signals, power supply connections, and timing components.

Inputs:

- AV RESET N** and **AV CLKIN** are connected to pins 14 and 13, respectively. They are pulled up to **VCC_3V3** by resistors **R42** (10K) and **R43** (10K).
- FX2/AV PD0** through **FX2/AV PD7** are connected to pins 30 through 25, respectively. They are pulled up to **VCC_3V3** by resistors **R47** (10K) and **R48** (10K).
- I2C SDA** and **I2C SCL** are connected to pins 11 and 12, respectively.
- ALSb** is connected to pin 10.
- PGND**, **AGND**, **DGND**, and **GND_IO** are connected to pins 15, 18, 6, and 29, respectively.
- TPAD** is connected to pin 0.

Outputs:

- DAC1**, **DAC2**, and **DAC3** are connected to pins 22, 21, and 20, respectively. They are pulled up to **VCC_3V3** by resistor **R44** (1% 300R).
- COMP** is connected to pin 23. It is pulled up to **VCC_3V3** by capacitor **C26** (2.2nF).
- EXT_LF** is connected to pin 16. It is pulled up to **VCC_3V3** by capacitor **C28** (12nF).
- RSET** is connected to pin 24. It is pulled up to **VCC_3V3** by resistor **R46** (1% 4.12K).
- PVDD**, **VAA**, **VDD**, and **VDDIO** are connected to pins 17, 19, 5, and 28, respectively. They are pulled up to **VCC_3V3** by capacitor **C35** (0.1uF).
- FB2** and **FB3** are connected to pins 27 and 25, respectively. They are pulled up to **VCC_1V8** by capacitors **C29** (4.7uF) and **C30** (4.7uF).
- FB1** is connected to pin 26. It is pulled up to **VCC_1V8** by capacitor **C31** (150nF).

Power Supply:

- VCC_3V3** is connected to pins 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
- VCC_1V8** is connected to pins 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Timing and Filtering:

- Capacitor **C26** (2.2nF) is connected to **COMP** and **VCC_3V3**.
- Capacitor **C28** (12nF) is connected to **EXT_LF** and **VCC_3V3**.
- Capacitor **C31** (150nF) is connected to **FB1** and **VCC_3V3**.
- Capacitor **C35** (0.1uF) is connected to **PVDD**, **VAA**, **VDD**, and **VDDIO** and **VCC_3V3**.
- Capacitor **C29** (4.7uF) is connected to **FB2** and **VCC_1V8**.
- Capacitor **C30** (4.7uF) is connected to **FB3** and **VCC_1V8**.
- Capacitor **C33** (4.7uF) is connected to **FB2** and **VCC_3V3**.
- Capacitor **C34** (4.7uF) is connected to **FB3** and **VCC_3V3**.

Resistors:

- R42** (10K) and **R43** (10K) are pull-up resistors for **AV RESET N** and **AV CLKIN**.
- R47** (10K) and **R48** (10K) are pull-up resistors for **FX2/AV PD0** through **FX2/AV PD7**.
- R44** (1% 300R) is a pull-up resistor for **DAC1**, **DAC2**, and **DAC3**.
- R46** (1% 4.12K) is a pull-up resistor for **RSET**.
- R45** (1% 169R) is a pull-up resistor for **FB1**.

Capacitors:

- C26** (2.2nF) is a timing capacitor for **COMP**.
- C28** (12nF) is a timing capacitor for **EXT_LF**.
- C31** (150nF) is a timing capacitor for **FB1**.
- C35** (0.1uF) is a timing capacitor for **PVDD**, **VAA**, **VDD**, and **VDDIO**.
- C29** (4.7uF) and **C30** (4.7uF) are timing capacitors for **FB2** and **FB3**.
- C33** (4.7uF) and **C34** (4.7uF) are timing capacitors for **FB2** and **FB3**.

Diodes:

- FB2** and **FB3** are diodes connected to **VCC_1V8** and **VCC_3V3**.

IC Pinout:

Pin	Signal
1	VCC_3V3
2	VCC_3V3
3	VCC_3V3
4	VCC_3V3
5	VCC_3V3
6	DGND
7	VCC_3V3
8	VCC_3V3
9	VCC_3V3
10	ALSb
11	I2C SDA
12	I2C SCL
13	AV CLKIN
14	AV RESET N
15	PGND
16	EXT_LF
17	PVDD
18	AGND
19	VAA
20	DAC3
21	DAC2
22	DAC1
23	COMP
24	RSET
25	HSYNC
26	VSb
27	FB2
28	VDD
29	DGND
30	FX2/AV PD0
31	FX2/AV PD1
32	FX2/AV PD2
33	FX2/AV PD3
34	FX2/AV PD4
35	FX2/AV PD5
36	FX2/AV PD6
37	FX2/AV PD7
38	GND_IO
39	TPAD
40	VCC_3V3
41	VCC_3V3
42	VCC_3V3
43	VCC_3V3
44	VCC_3V3
45	VCC_3V3
46	VCC_3V3
47	VCC_3V3
48	VCC_3V3
49	VCC_3V3
50	VCC_3V3
51	VCC_3V3
52	VCC_3V3
53	VCC_3V3
54	VCC_3V3
55	VCC_3V3
56	VCC_3V3
57	VCC_3V3
58	VCC_3V3
59	VCC_3V3
60	VCC_3V3
61	VCC_3V3
62	VCC_3V3
63	VCC_3V3
64	VCC_3V3
65	VCC_3V3
66	VCC_3V3
67	VCC_3V3
68	VCC_3V3
69	

AV output buffer

The diagram illustrates the AV output buffer circuit. It features an operational amplifier (U9, ADA4432-1BRJZ-R2) configured as a voltage follower. The non-inverting input (pin 1, IN) is connected to the DAC output (DAC OUT) and the AV RESET N signal. The inverting input (pin 2, VDD) is connected to the output (pin 4, OUT) and a 0.1uF capacitor (C38) to ground. The output (pin 4) is connected to the AV_OUT pin through a 1% 75R resistor (R49). The op-amp is powered by VCC 3V3 (pin 5, ENA) and ground (pin 3, GND). Pin 6 is connected to ground, and pin 7 (NC) is left unconnected.

Title: P-board.Analog Video	
File: 3_AVIDEO.SchDoc	Size: A4
Drawn by: Vaagn Oganesyanyan	Version: v1.0.0
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A



2. R52 is assembled (factory default):
Device will always sink <500ma for battery charge, no matter if it is turned on/off, enumerated or not, connected to PC or USB wall adapter. This mode is not compliant to USB specification, though is more practical behaviour nowadays.

A



C



NOTE: we refused from using factory protected 18350 Li-Ion batteries, as cell's dimention (especially length) can vary too much from manufacturer to manufacturer. You simply won't be able to insert the battery into battery holder. At the same time dimention of unprotected batteries are much more predictable.

C



openRV

v1.0.0
- initial release

Title: P-board.ChangeLog		
File: 5_CHANGELOG.SchDoc	Size: A4	
Drawn by: Vaagn Oganessian	Version: v1.0.0	
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