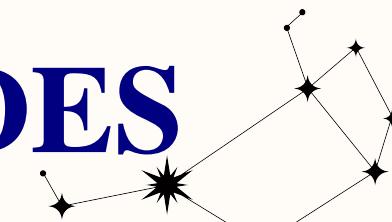
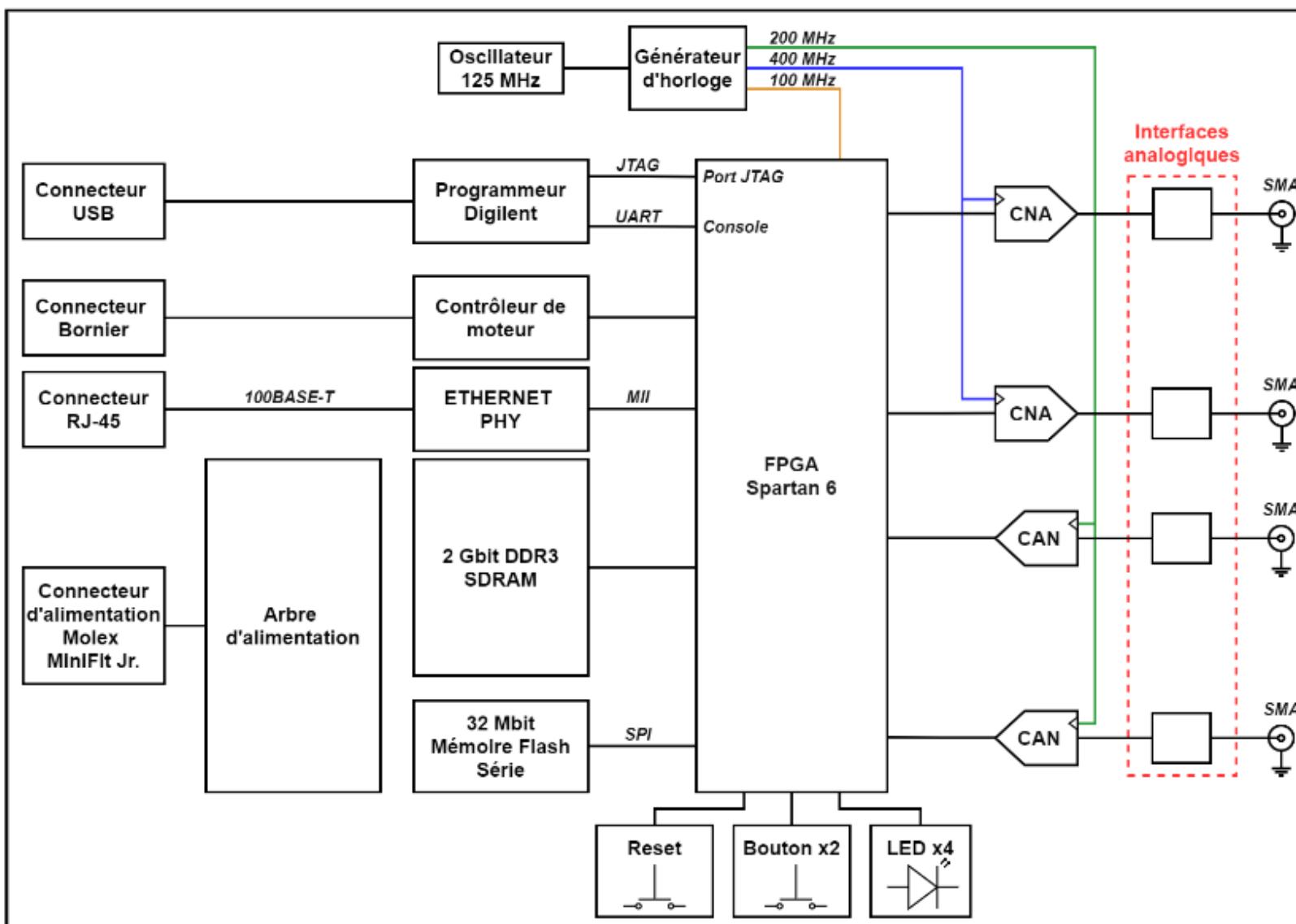


PLEIADES



LACP3102 - Pascal-Emmanuel Lachance
BILF0901 - Frédéric Bilodeau



NOTES FOR REVIEWERS:

Some functionalities not originally asked by the problem have been added for fun and to challenge ourselves.

The following major changes have been done:

- A galvanically isolated PCIe port
- Full Galvanic Isolation on 24V input and motor output
- Voltage and Current sensing on all major power rails
- A JTAG-CONNECT programmation interface with JTAG source selection
- A USB-C connector and an SD card connector
- Advanced thermal control
- A bunch of testpoints and debug features
- And more!

| | | |
|----------------|-----------------------|---|
| Sheet Name | TITLE PAGE | |
| Project Title | PLEIADES | |
| Global Project | <i>UdeS_H24_S7CAS</i> | |
| Size | 11x17 | Group |
| Date | Group P01 | Revision A |
| Filename | TITLE.SchDoc | Designers |
| | | lACP3102 Pascal-Emmanuel Lachance BILF0901 Frédéric Bilodeau |

1 2 3 4 5 6 7 8

A

RESISTORS

RESISTORS (1) DNF

These components should not appear on the PCB or on the BOM.

Specified power package and tolerances are the same for all components of the same value.

These components are for reference and are the only passives type to appear on the BOM. These are placed here to limit copy-paste errors, by having a set of reference components to select from, without needing to create a bunch of library entries.

RX1: 1M, 1/16W, 0402
RX2: 10K, 1/16W, 0402
RX3: 12K, 1/16W, 0402
RX4: 16K9, 1/16W, 0402
RX5: 10K5, 1/16W, 0402
RX6: 12K, 1/16W, 0402
RX7: 10K, 1/16W, 0402
RX8: 10K, 1/16W, 0402
RX9: 4K7, 1/16W, 0402
RX10: 5K1, 1/16W, 0402
RX11: 1K, 1/16W, 0402
RX12: 1K13, 1/16W, 0402
RX13: 1K, 1/16W, 0402
RX14: 768R, 1/16W, 0402
RX15: 530R, 1/16W, 0402
RX16: 240R, 1/16W, 0402
RX17: 174R, 1/8W, 0403
RX18: 120R, 1/8W, 0403
RX19: 100R, 1/8W, 0403
RX20: 75R, 1/8W, 0403
RX21: 56R2, 1/8W, 0403
RX22: 49R9, 1/8W, 0403
RX23: 40R2, 1/8W, 0403
RX24: 11R2, 1/8W, 0403
RX25: 50R, 1/8W, 0403
RX26: 500mR, 1/8W, 0403
RX27: 150mR, 1/8W, 0403
RX28: 30mR, 1/8W, 0403
RX29: 10mR, 1/8W, 0403

B

CAPACITORS

CAPACITORS (1) DNF

CX1: 470uF, 1616
CX2: 100uF, 1010
CX3: 22uF, 2220
CX4: 4.7uF, 1206
CX5: 22uF, 2220
CX6: 10uF, 1206
CX7: 1uF, 1206
CX8: 2.2uF, 1206
CX9: 470nF, 0603
CX10: 220nF, 0603
CX11: 47nF, 0402
CX12: 4.7nF, 0402
CX13: 4.7nF, 1812
CX14: 1nF, 0402

C

CX15: 1nF, 1812
CX16: 470pF, 0602
CX17: 300pF, 0602
CX18: 68pF, 0805
CX19: 22pF, 0602

D

INDUCTORS

INDUCTORS (1) DNF

FBX1: 782633601, 600Ω @ 100MHz, 0603, 1A
FBX2: 782853152, 1K5 @ 100MHz, 0805, 700mA
LX1: ASCH0010050547NJCP, 47nH, 5%, 200mA
LX2: 74439346100, 10uH, 20%, 5A

E

TESTPOINTS

TESTPOINTS (1) DNF

TPX1: TP_HOLE
TPX2: TP_PAD
TPX3: TP_PAD_SMALL
TPX4: TP_PAD_TINY

F

DIODES

DIODES (1) DNF

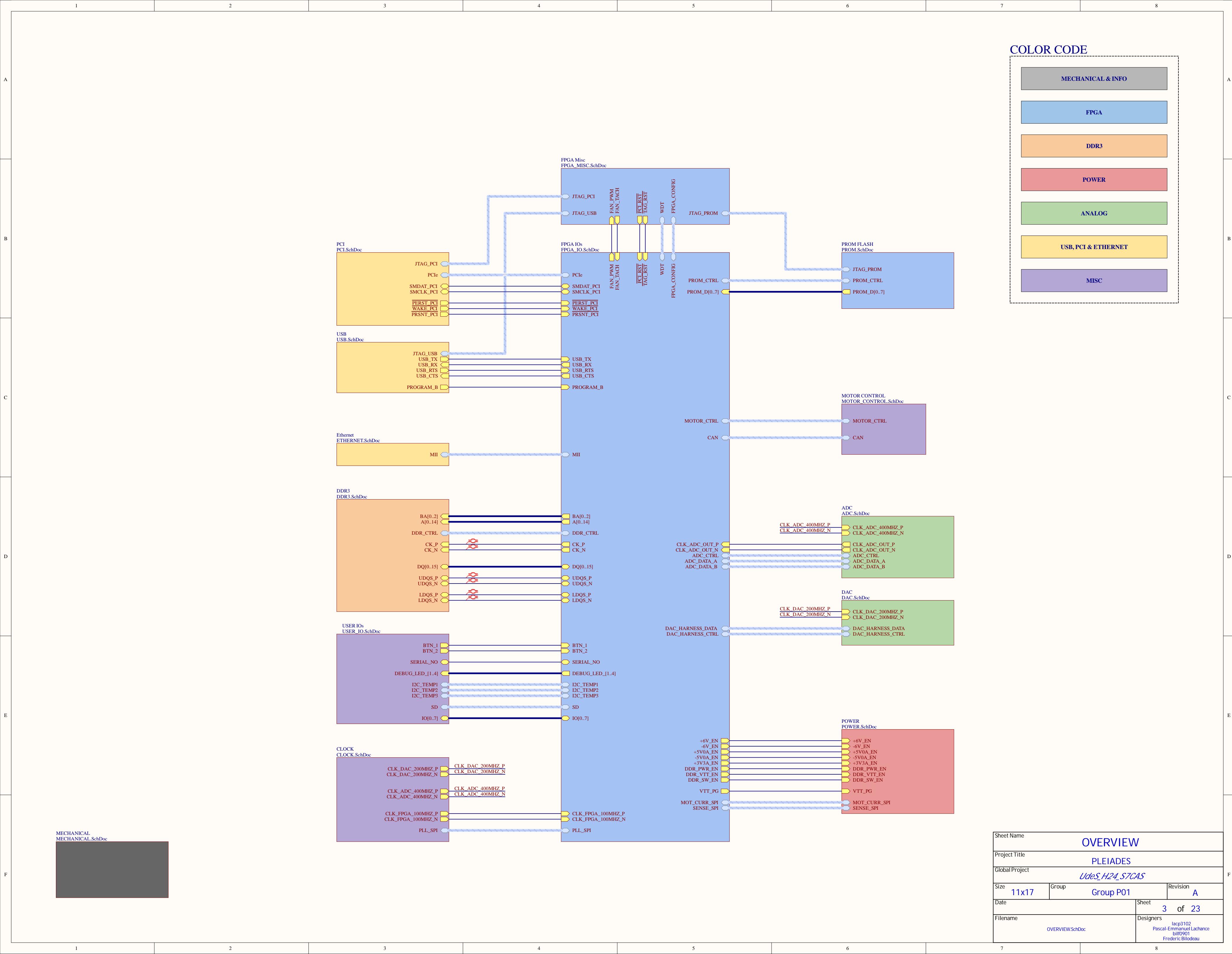
DX1: 36.7V, SMBJ33-13
DX2: B340B-13-F
DX3: SMBJ5.0CA
DX4: BAV99-7-F

COLOR CODE

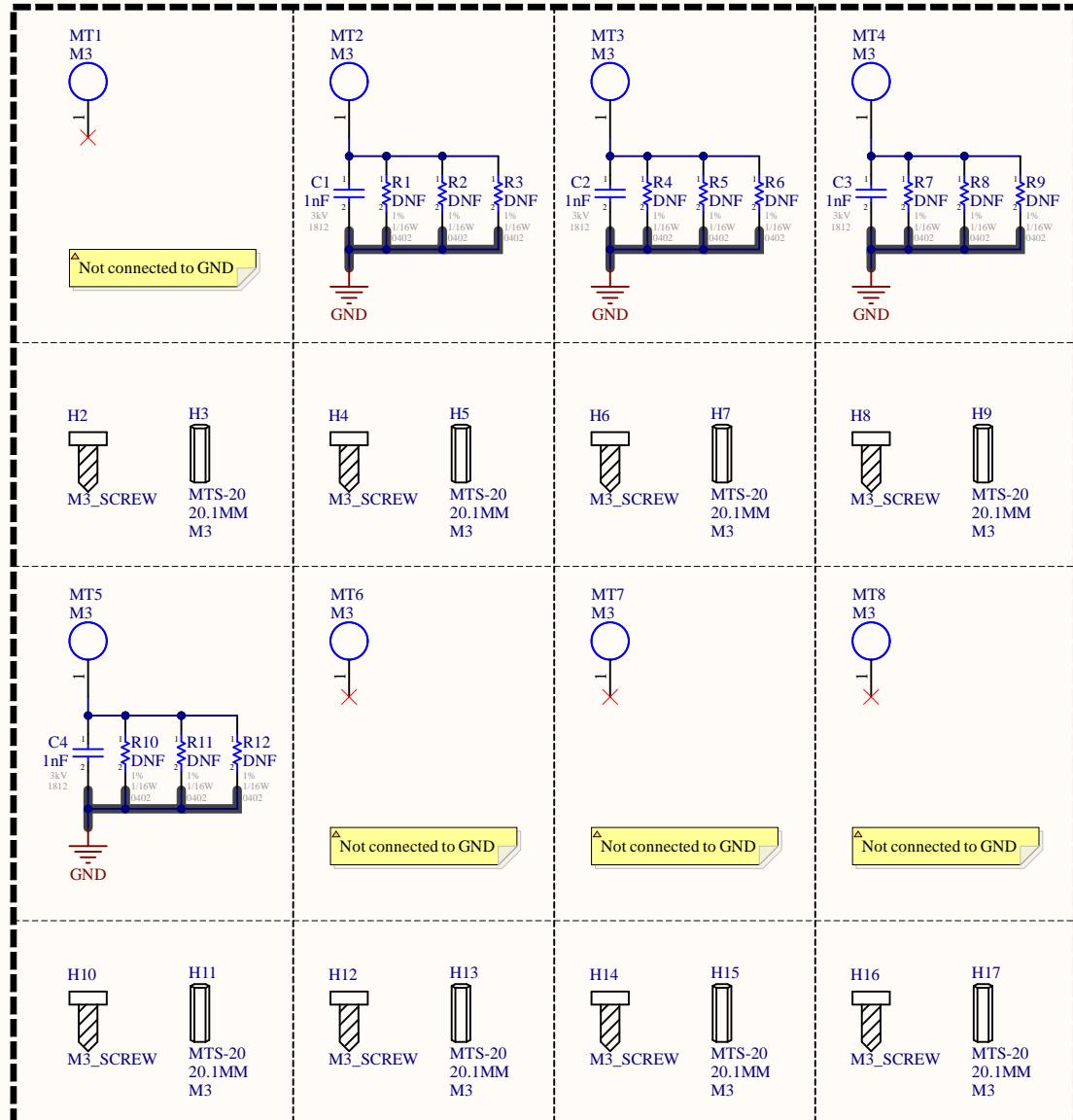
| |
|--|
| MECHANICAL & INFO |
| FPGA |
| DDR3 |
| POWER |
| ANALOG |
| USB & ETHERNET |
| MISC |
| General Notes Assembly, Part Locations, Fabrication, Debug Information etc. |
| Datasheet info Part information, addresses, registers, pull-up/pull-downs, excerpts & tables etc. |
| Calculations Values, tensions & currents, passives, etc. |
| TODO Things that are left to be done, and who should do it |

INFO

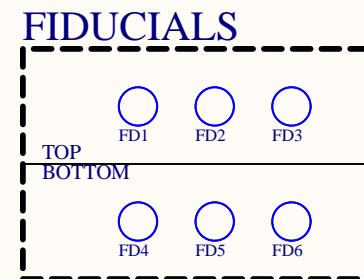
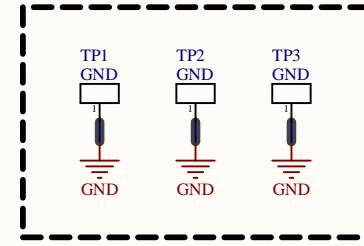
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| Sheet Name | INFO | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | Revision A | | |
| Filename | Sheet 2 of 23 | | |
| Designers | lcap3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau | | |



MOUNTING HOLES



GND TESTPOINTS

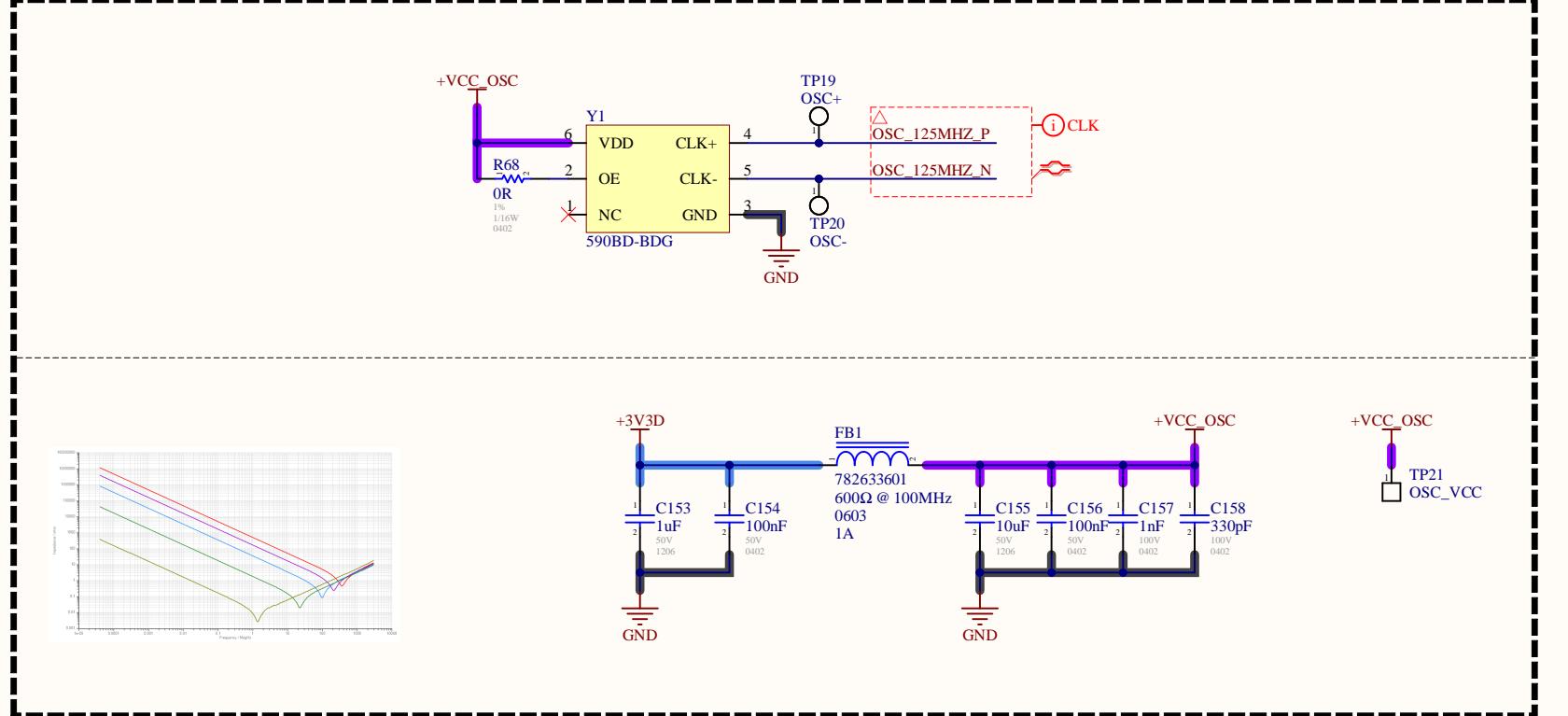


△ Place these testpoints around the PCB.

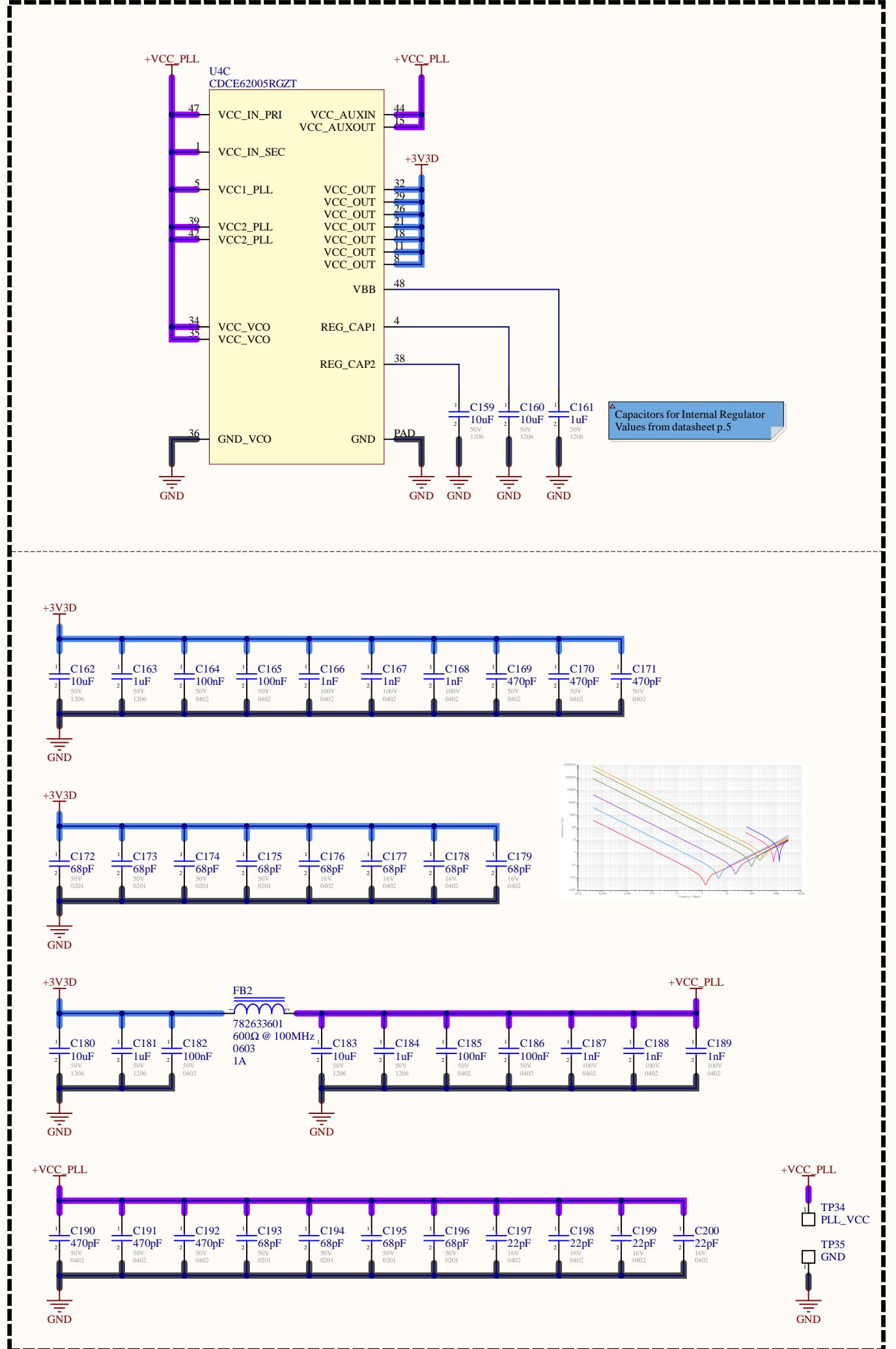
H1
1 ... n
12 LAYERS

| MECHANICAL | | |
|----------------|-------------------|---|
| Project Title | | |
| PLEIADES | | |
| Global Project | | |
| Size | 11x17 | Group |
| Date | Group P01 | Revision |
| 4 of 23 | | A |
| Filename | MECHANICAL.SchDoc | Designers |
| | | Iacp3102 Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau |

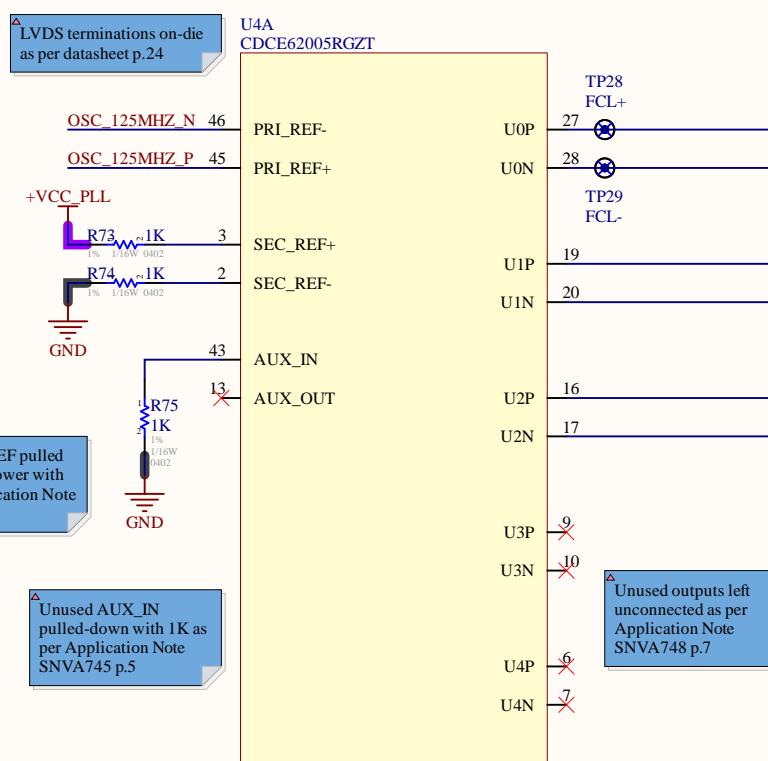
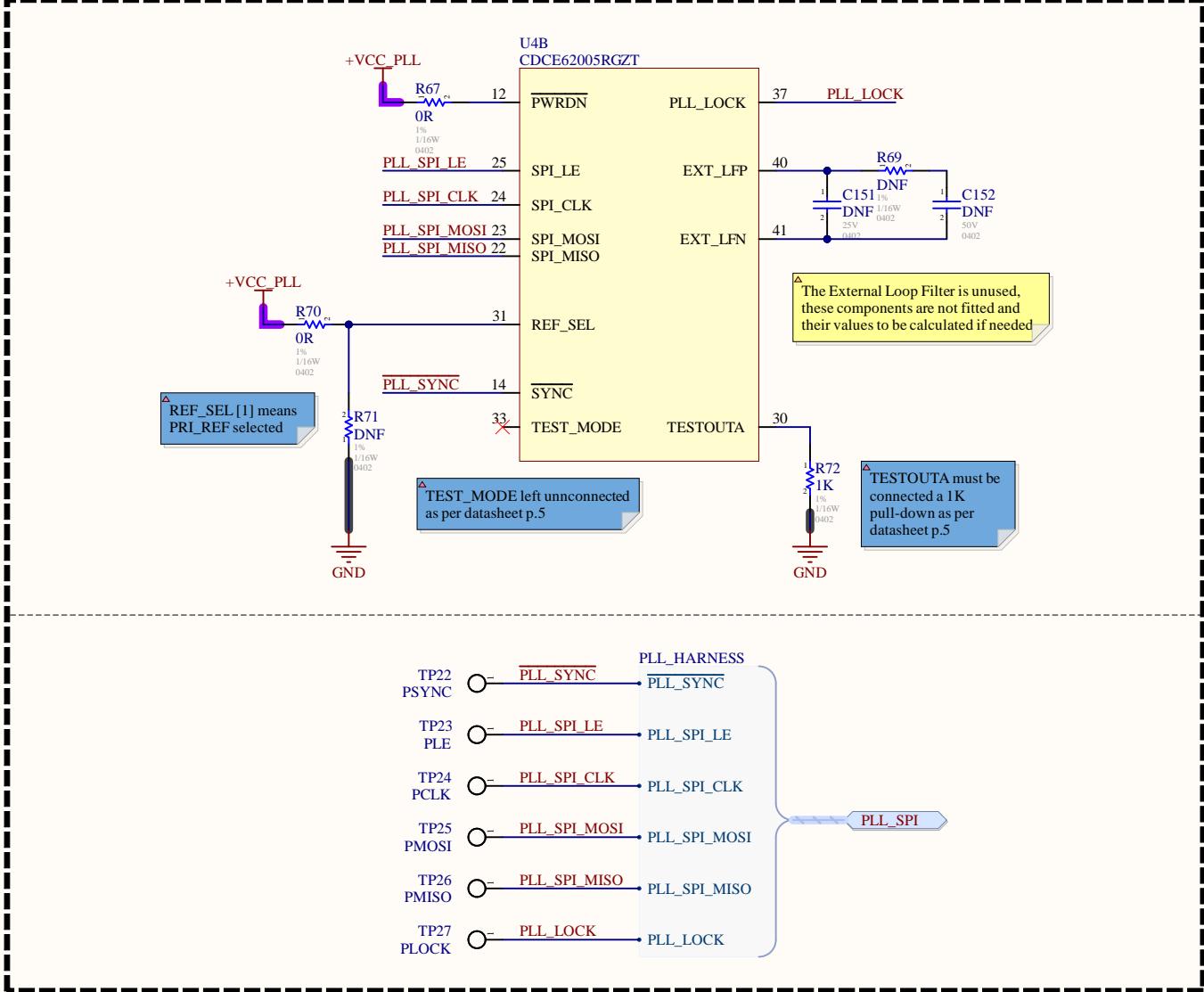
OSCILLATOR



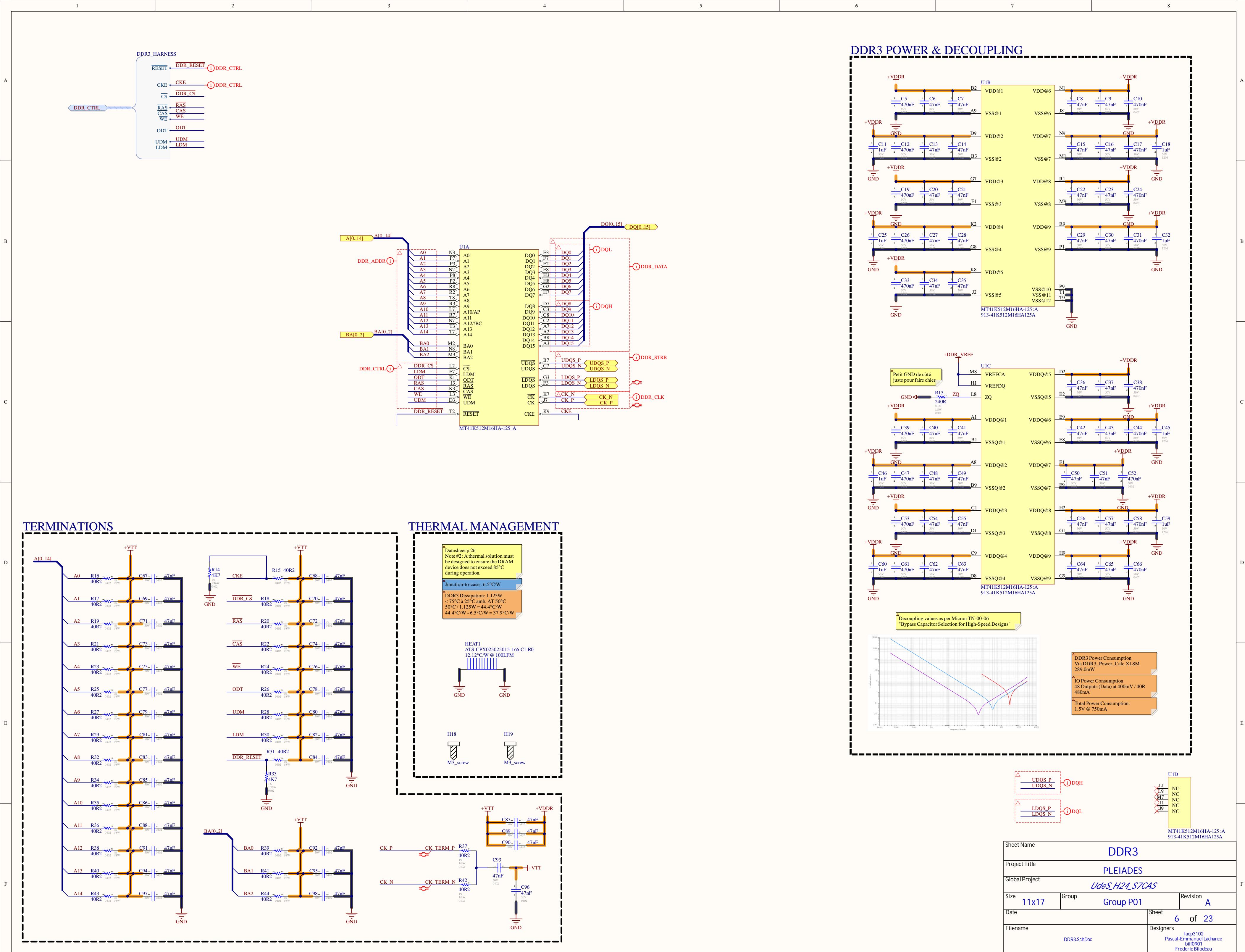
PLL POWER



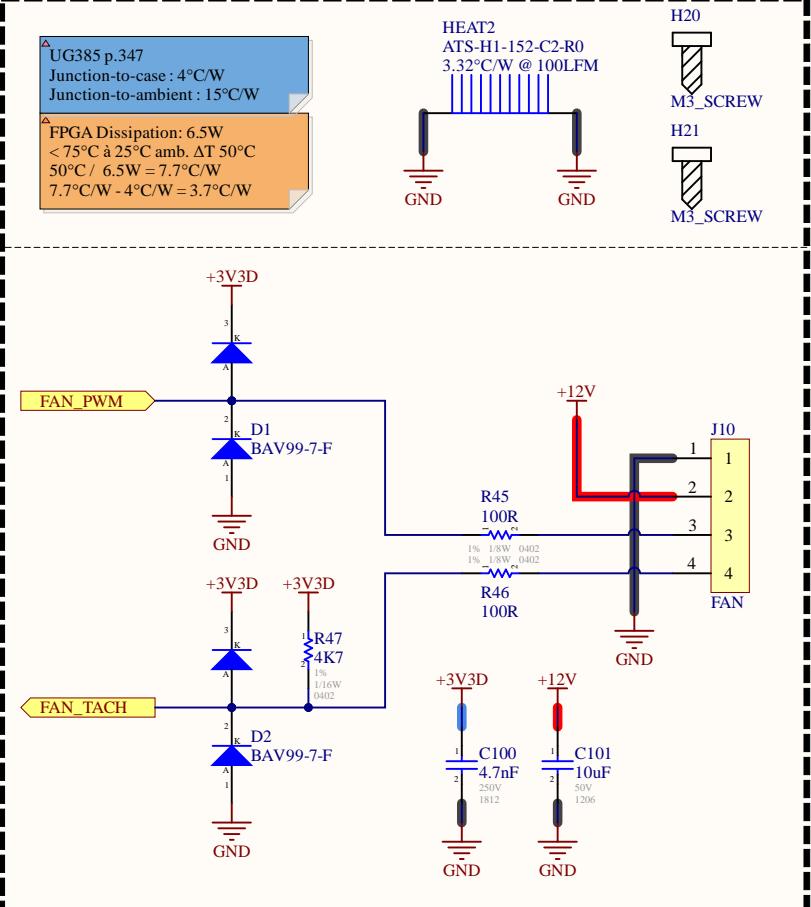
PLL COMM



| Sheet Name | | |
|----------------|--------------|---|
| CLOCK | | |
| Project Title | | |
| Global Project | | |
| UdeS_H24_S7CAS | | |
| Size | 11x17 | Group |
| Date | Group P01 | Revision |
| Filename | CLOCK.SchDoc | Designers |
| | | lcap3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau |
| | | 5 of 23 |



THERMAL MANAGEMENT



DECOUPLING

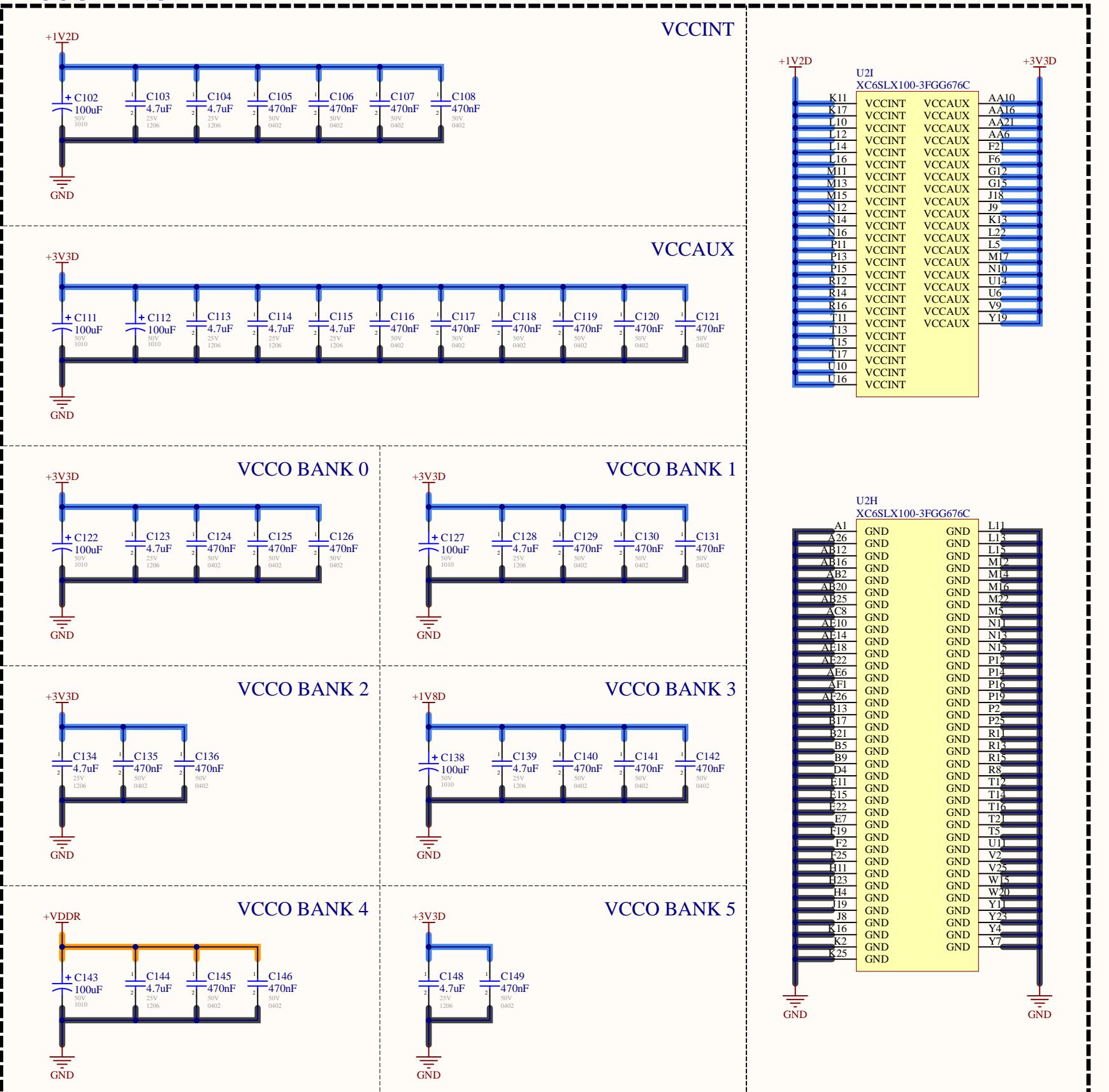
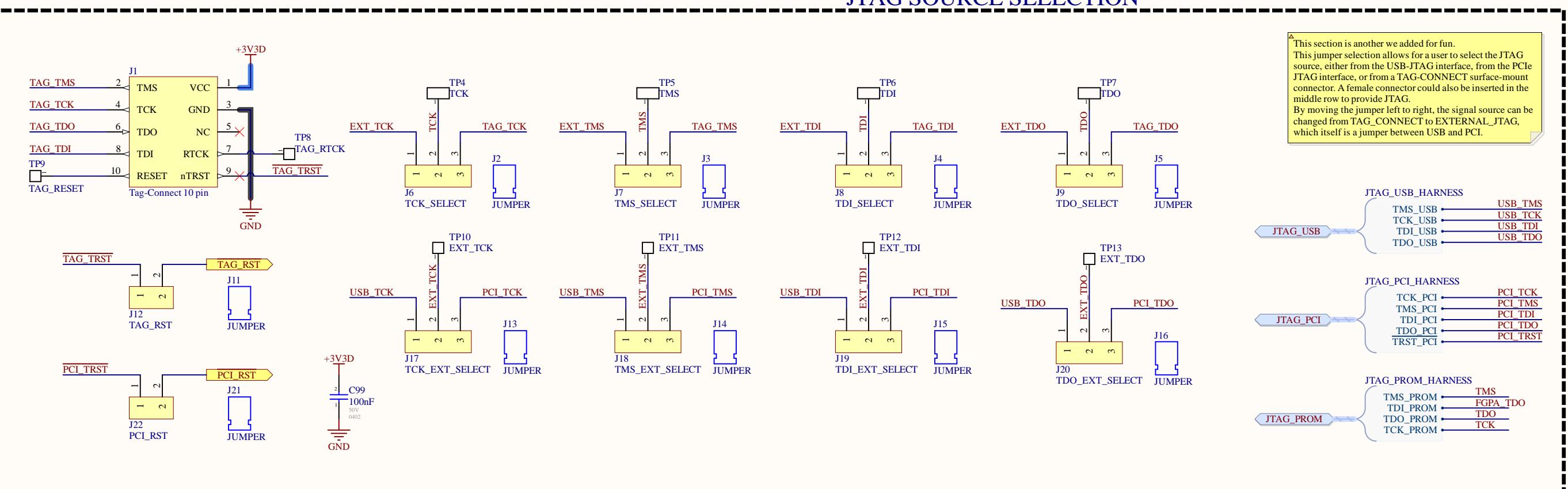
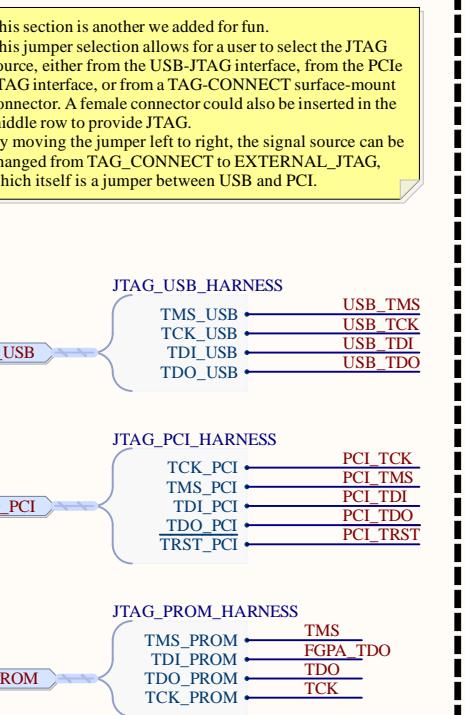


Table 2-1: Required PCB Capacitor Quantities per Device⁽¹⁾⁽³⁾

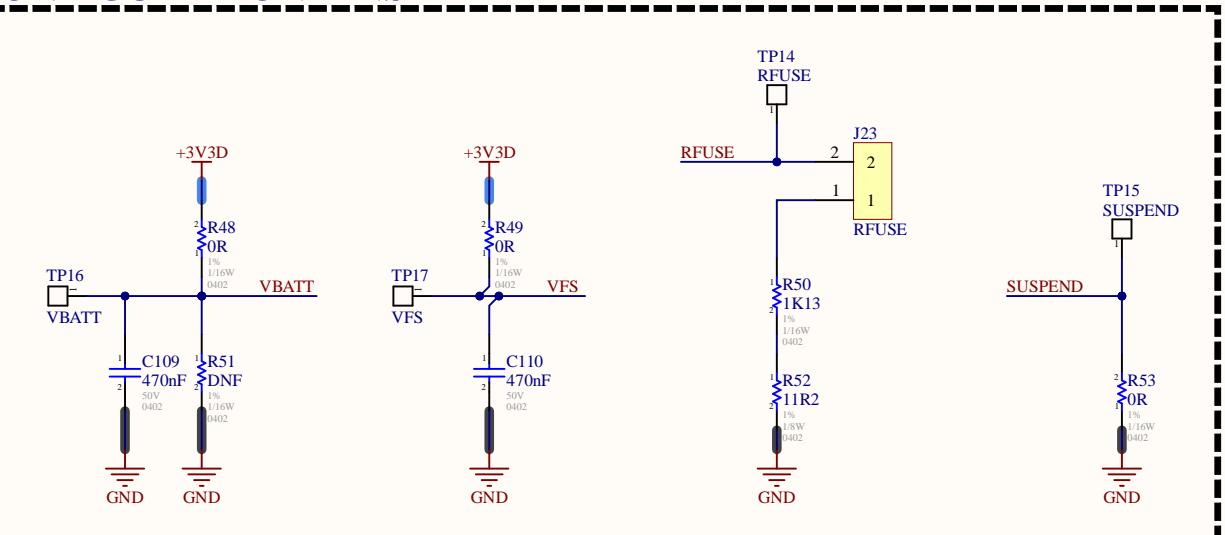
| Package | Device (XCS6) | V _{CCINT} in μ F | V _{CCHAUX} in μ F | V _{CCO} Bank 0 in μ F | V _{CCO} Bank 1 in μ F | V _{CCO} Bank 2 in μ F | V _{CCO} Bank 3 in μ F | V _{CCO} Bank 4 in μ F | V _{CCO} Bank 5 in μ F | Total (2) | | | | | | |
|----------------|---------------|-------------------------------|--------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|-----------|-----|------|-----|-----|------|----|
| | | | | | | | | | | 100 | 4.7 | 0.47 | 100 | 4.7 | 0.47 | |
| FG(G)676 LX100 | | 1 | 2 | 4 | 2 | 3 | 6 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 2 | 46 |



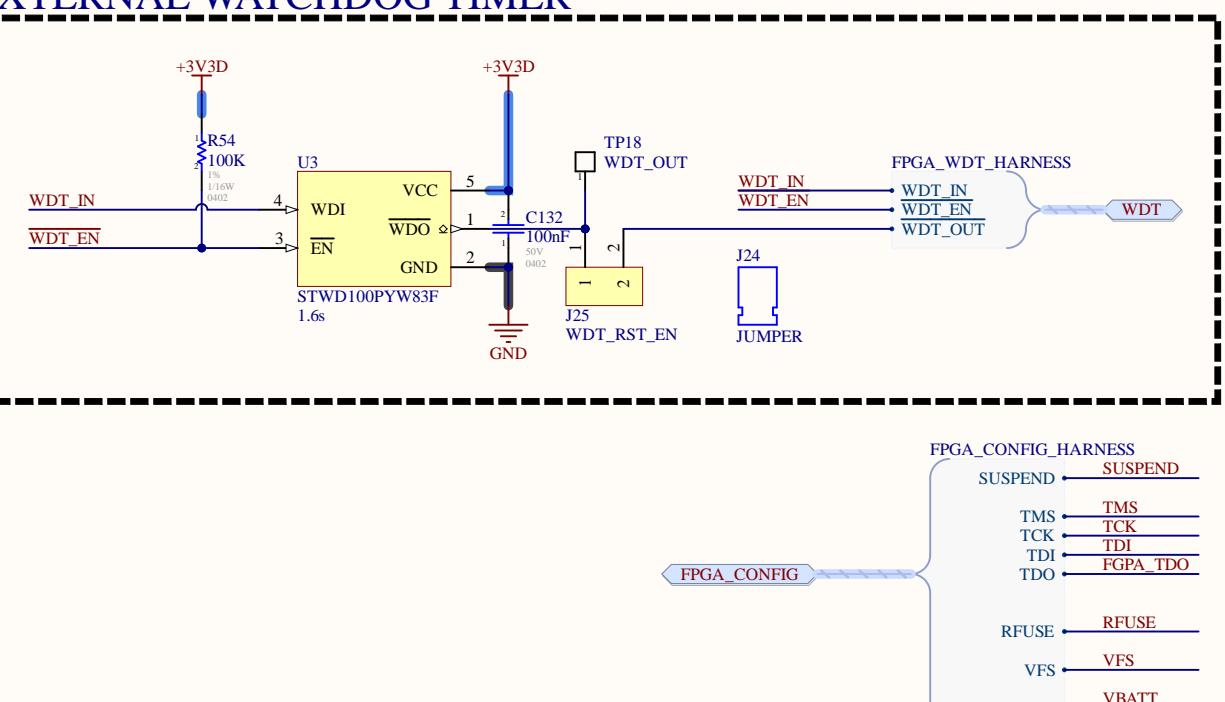
JTAG SOURCE SELECTION



CONFIGURATION PINS



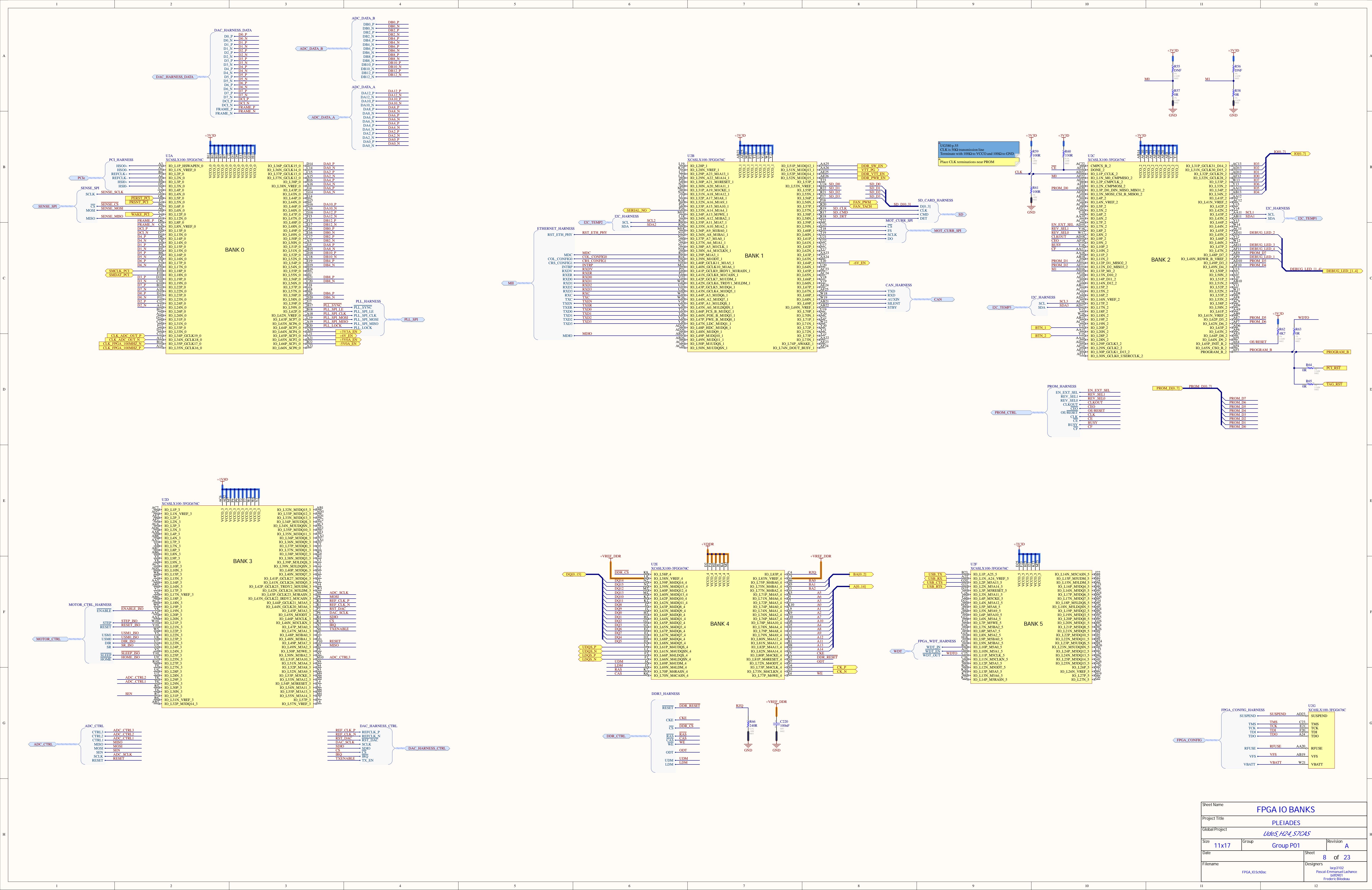
EXTERNAL WATCHDOG TIMER



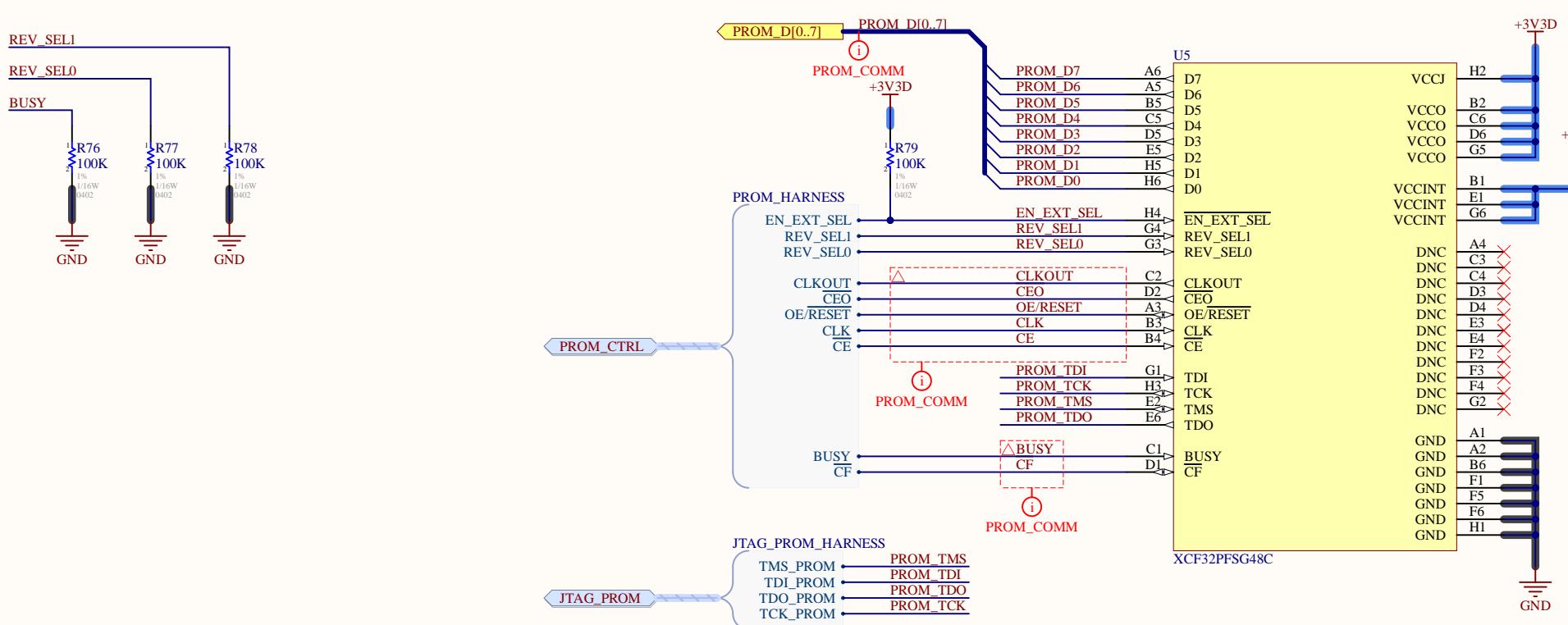
FPGA MISCELLANEOUS

| Sheet Name | Project Title | Global Project | Size | Group | Revision |
|------------------|---------------|----------------|-------|---|----------|
| FPGA_MISC.SchDoc | PLEIADES | UdeS_H24_S7CAS | 11x17 | Group P01 | A |
| | Date | | | Sheet | 7 of 23 |
| | Filename | | | Designers | |
| | | | | Iacp3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau | |

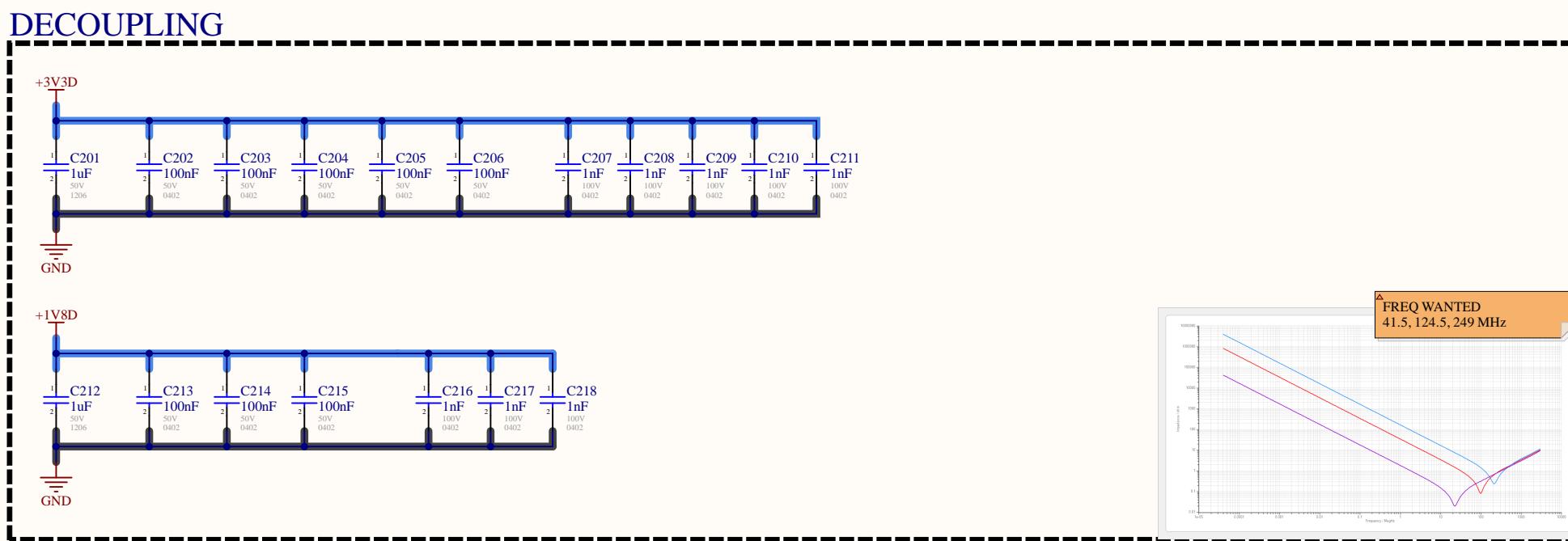
| | | |
|-----|--------------------|-----|
| U21 | XC6SLX100-3FGG676C | H13 |
| E12 | NC NC | H14 |
| E14 | NC NC | J12 |
| F8 | NC NC | J13 |
| G11 | NC NC | J16 |
| G13 | NC NC | K12 |
| G9 | NC NC | K14 |
| H10 | NC NC | K15 |
| H12 | NC NC | K15 |



A



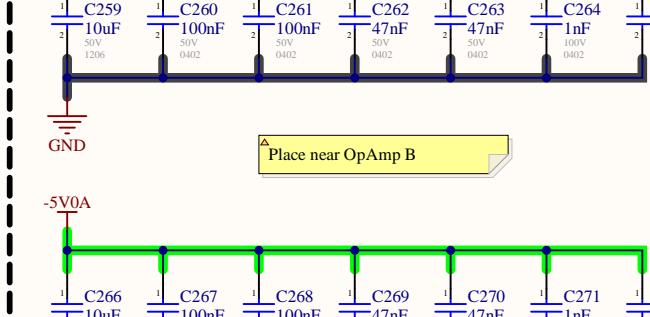
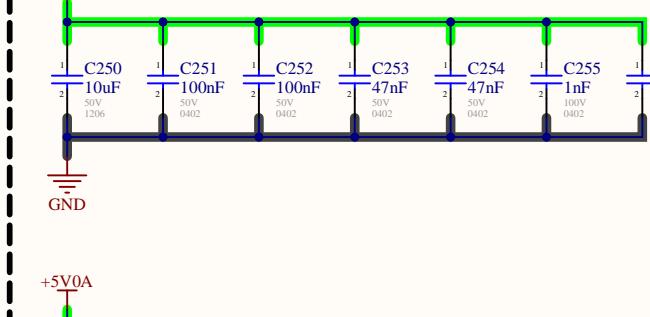
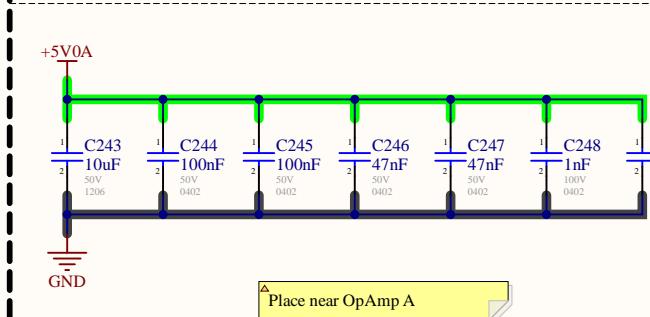
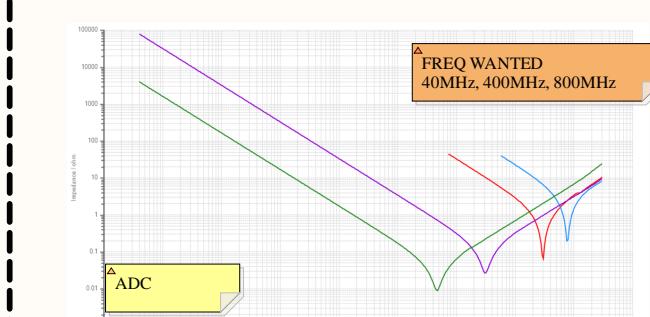
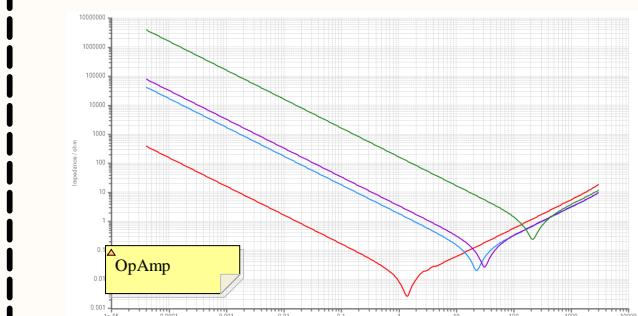
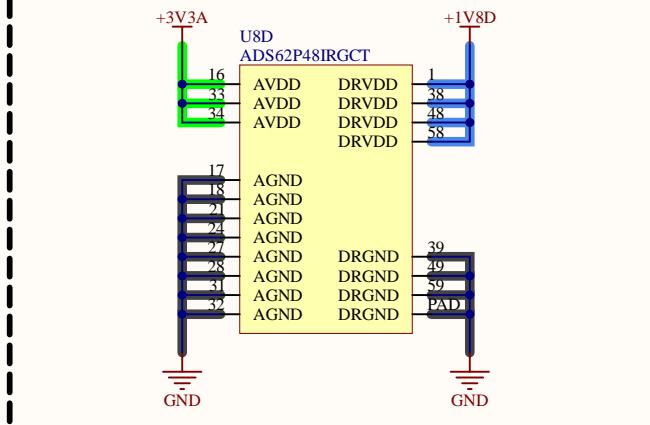
B



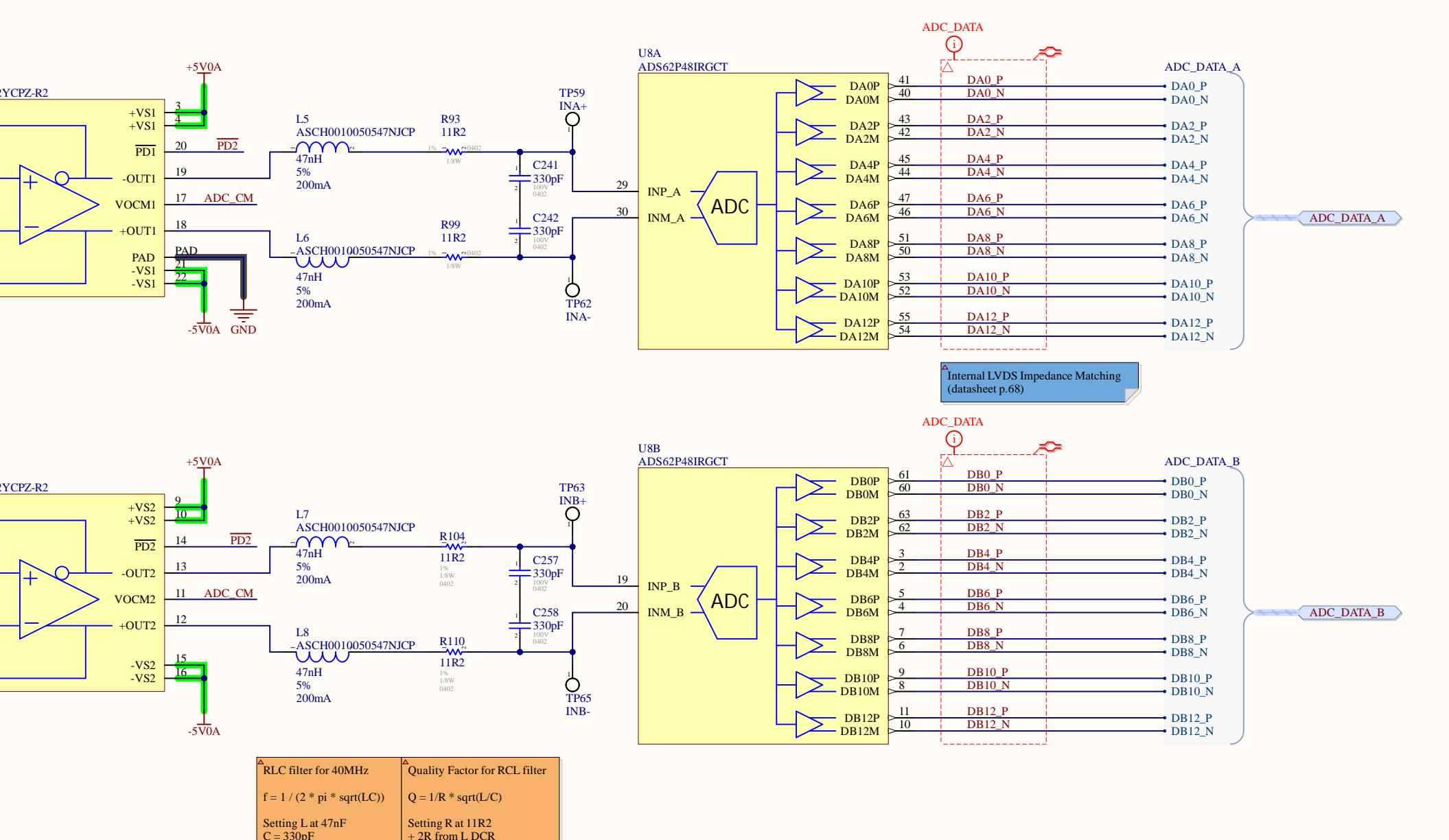
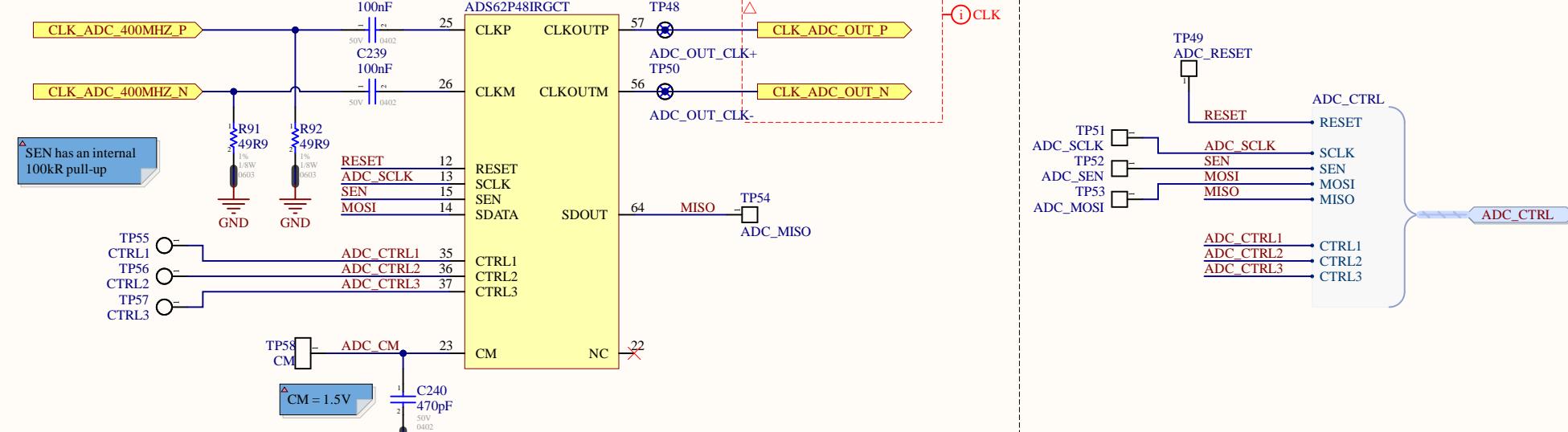
PROM
SPEED = 40Mhz
1V8 @ 10mA
3V3 @ 45mA

| | | | |
|----------------|---|-------|-----------|
| Sheet Name | PROM | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | Sheet A of 23 | | |
| Filename | Designers PROM.SchDoc Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau | | |

DECOUPLING



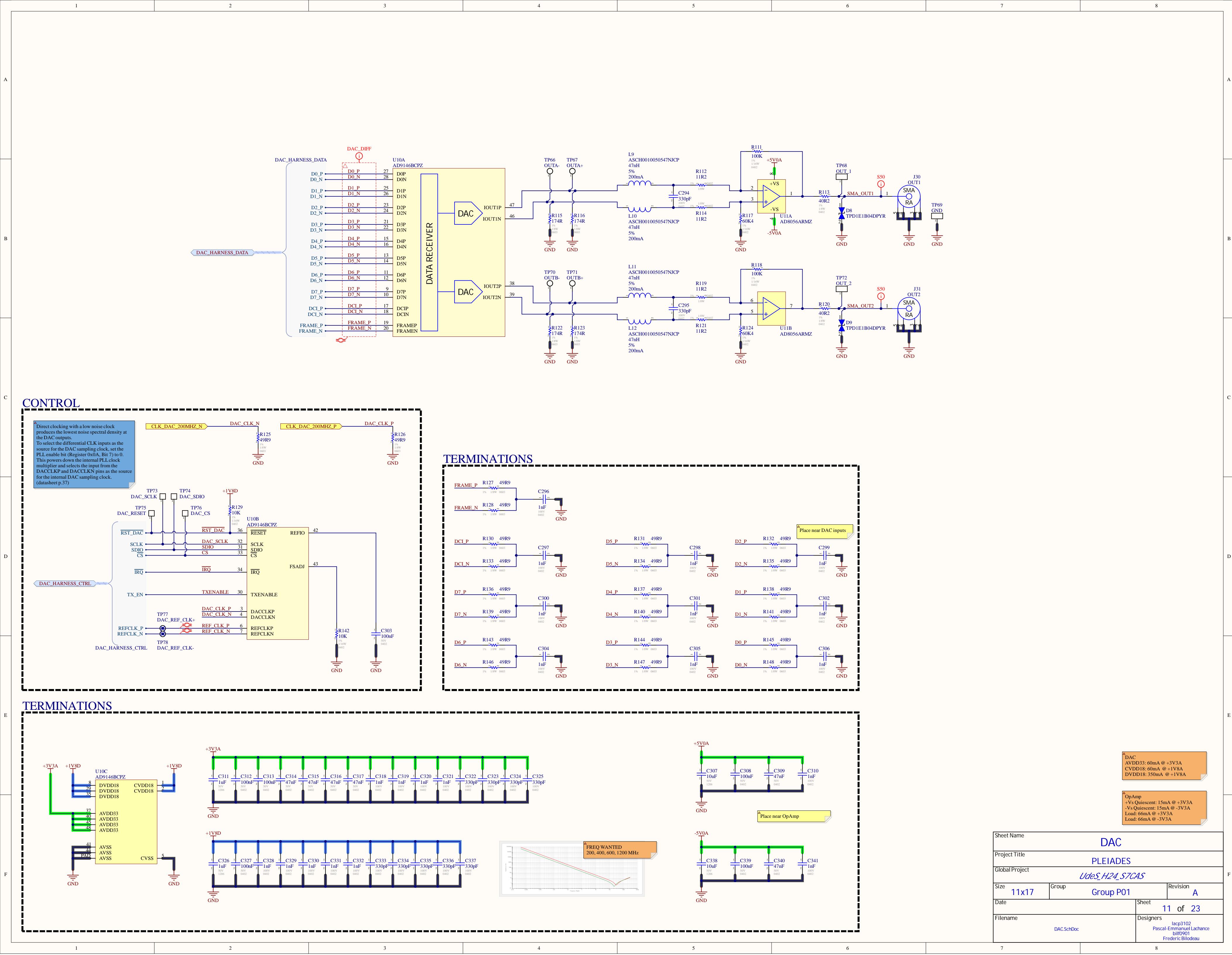
CONTROL



ADC IAVDD (Analog Supply): 320mA @ 3V3A
IDRVDD (LVDS Supply): 165mA @ 1V8A

OpAmp Quiescent Current: 25mA @ +5V0A
Quiescent Current: 25mA @ -5V0A

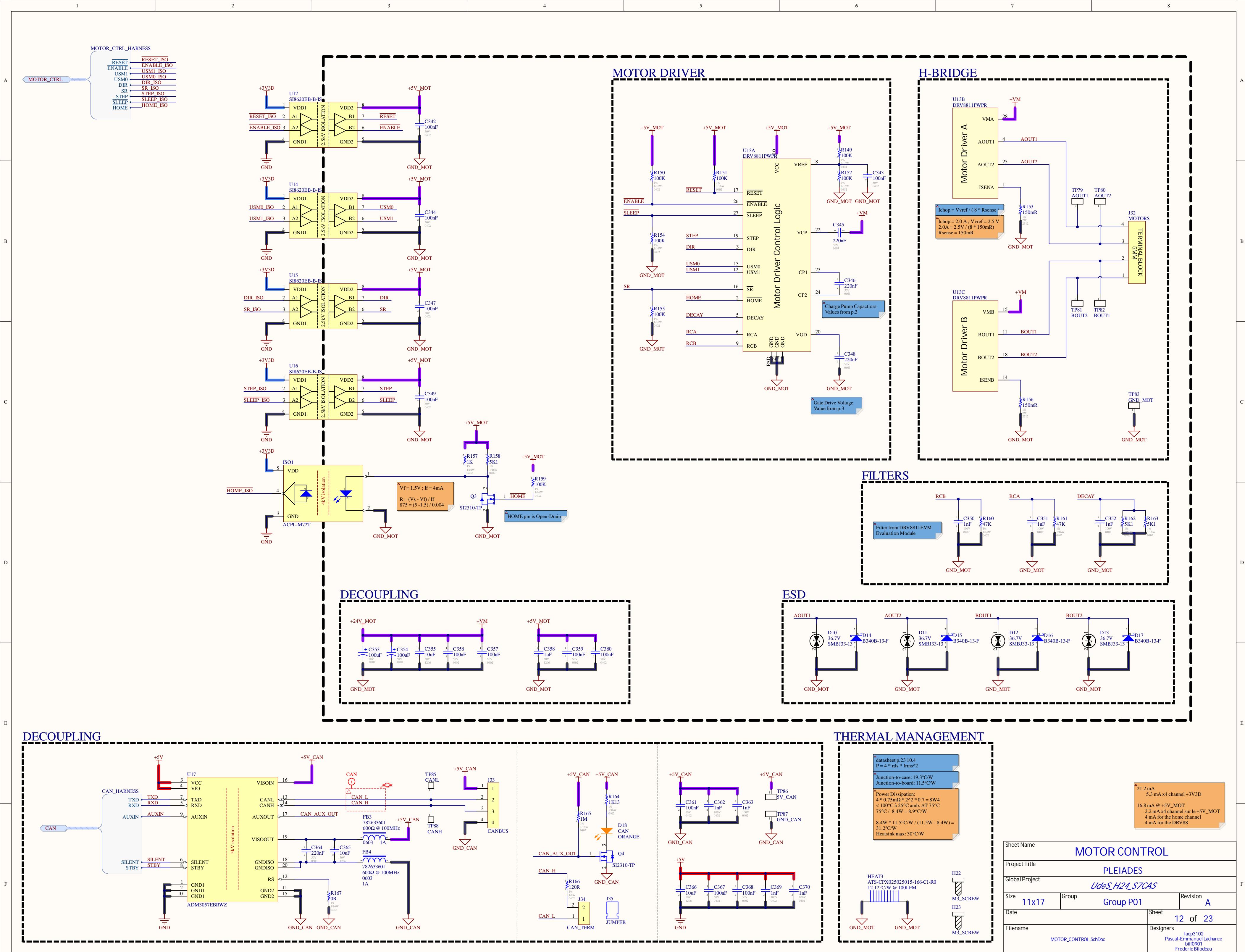
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| Sheet Name | ADC | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | | Revision | A |
| Filename | ADC.SchDoc | Designers | iacp3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau |
| Sheet | 10 of 23 | | |

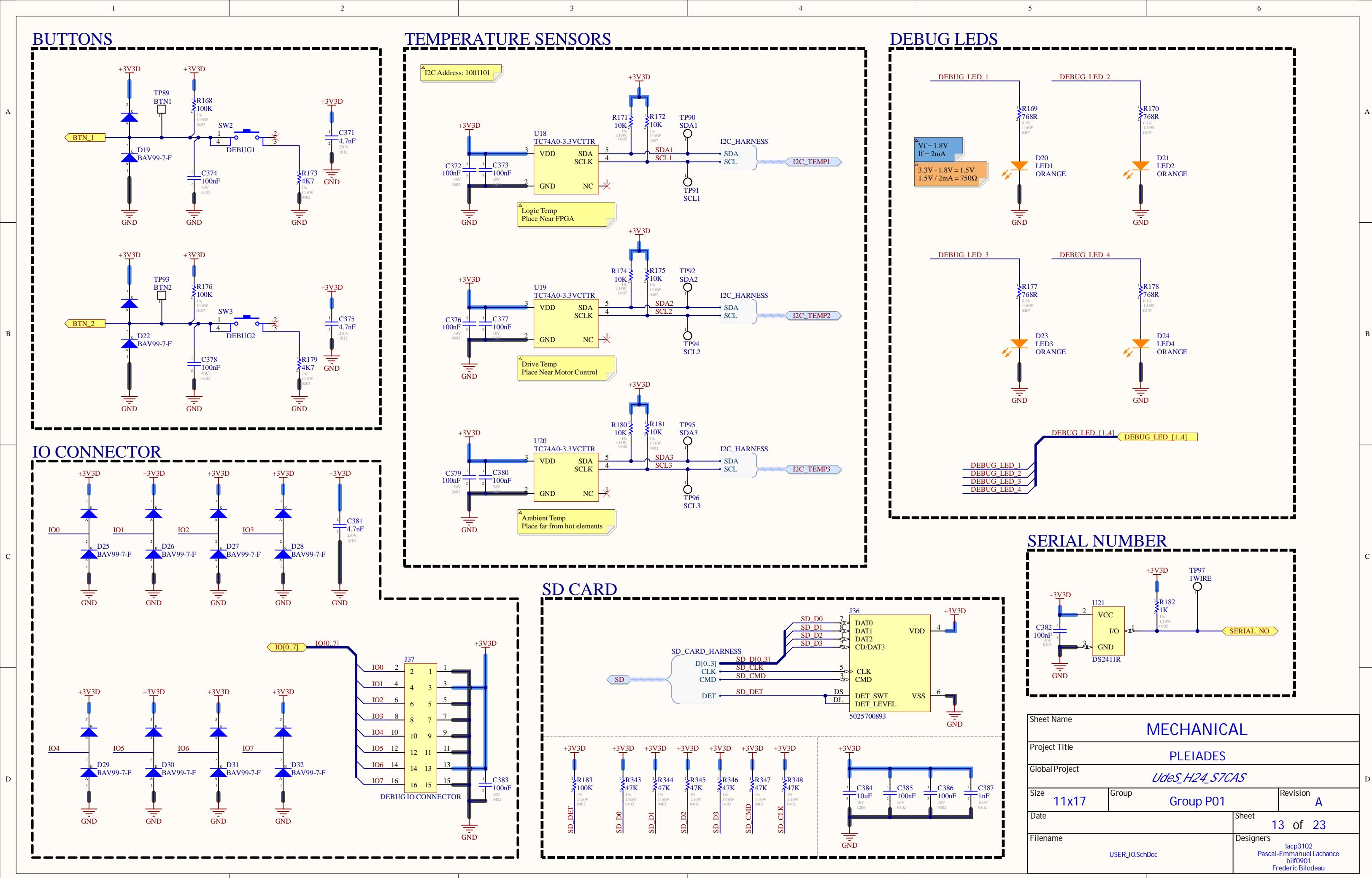


DAC
AVDD33: 60mA @ +3V3A
CVDD18: 60mA @ +1V8A
DVDD18: 350mA @ +1V8A

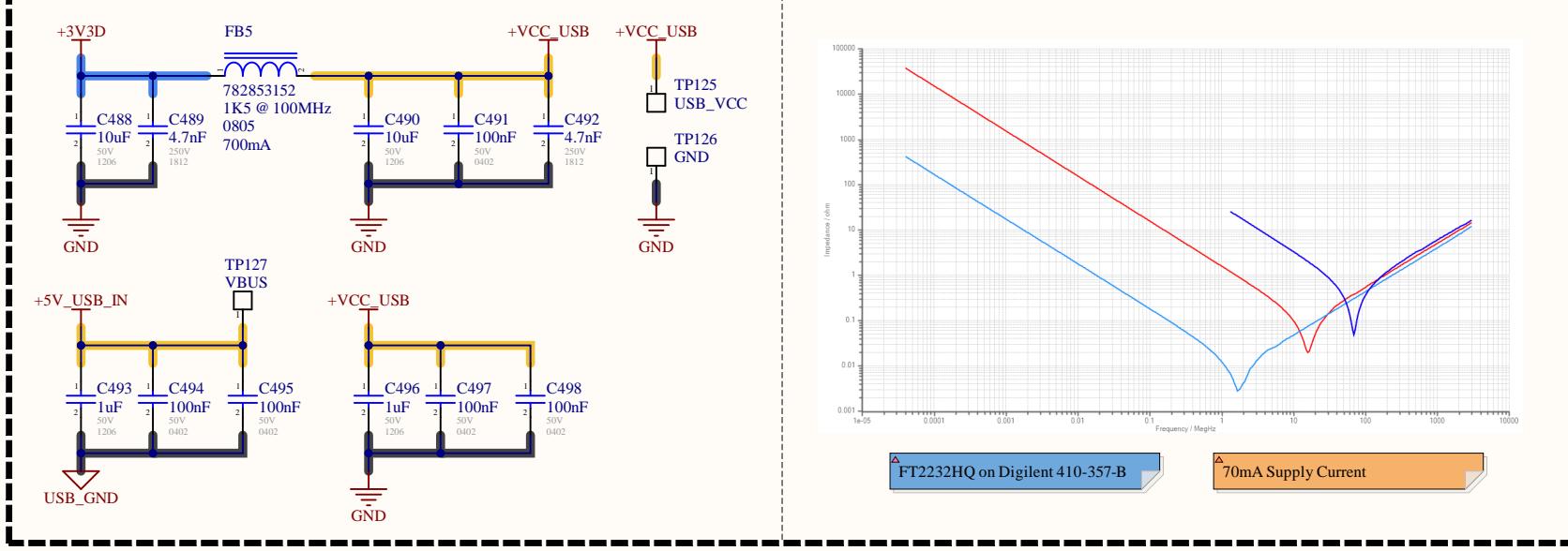
OpAmp
+V_o Quiescent: 15mA @ +3V3A
-V_o Quiescent: 15mA @ -3V3A
Load: 66mA @ +3V3A
Load: 66mA @ -3V3A

| Sheet Name | |
|----------------|---|
| Project Title | DAC |
| Global Project | PLEIADES |
| Size | 11x17 |
| Group | Group P01 |
| Revision | A |
| Date | |
| Filename | DAC.SchDoc |
| Designers | Iacp3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau |
| Sheet | 11 of 23 |

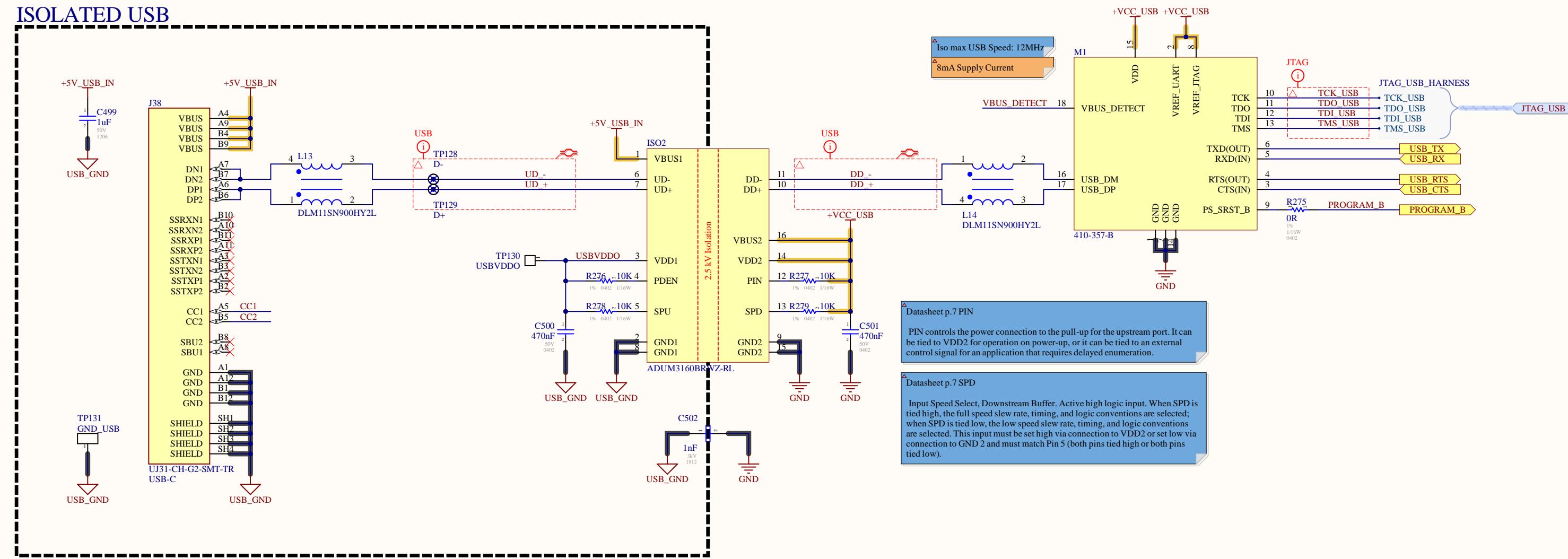




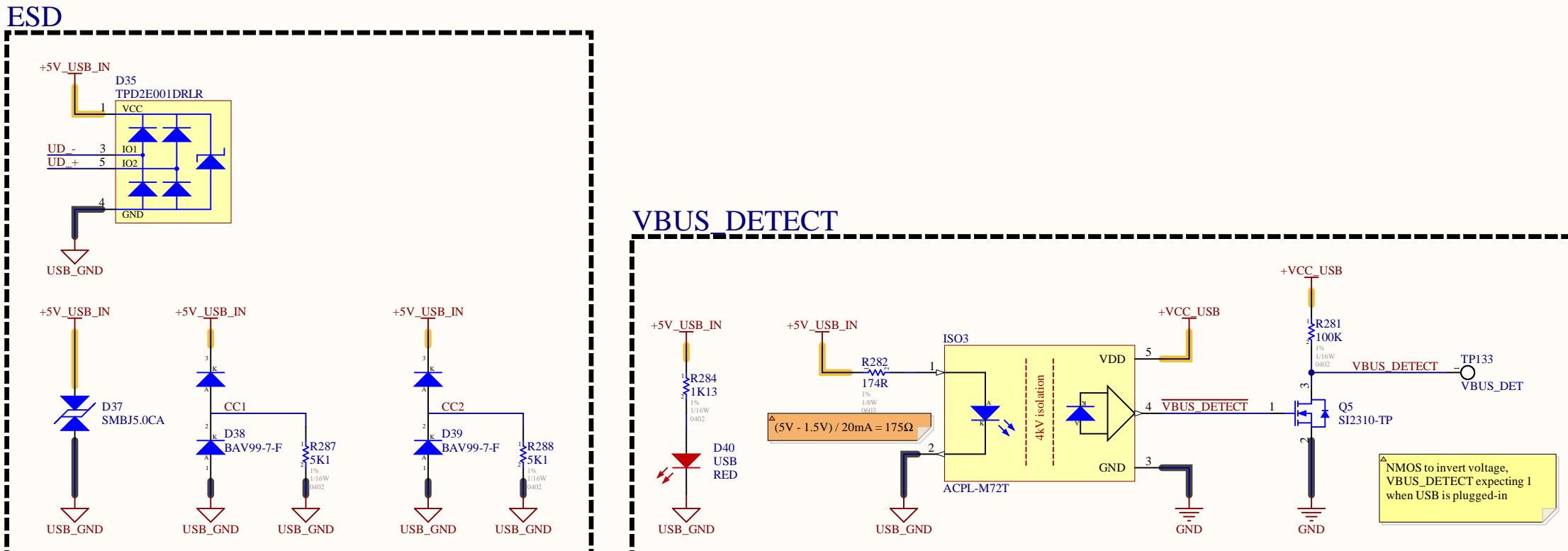
DECOUPLING



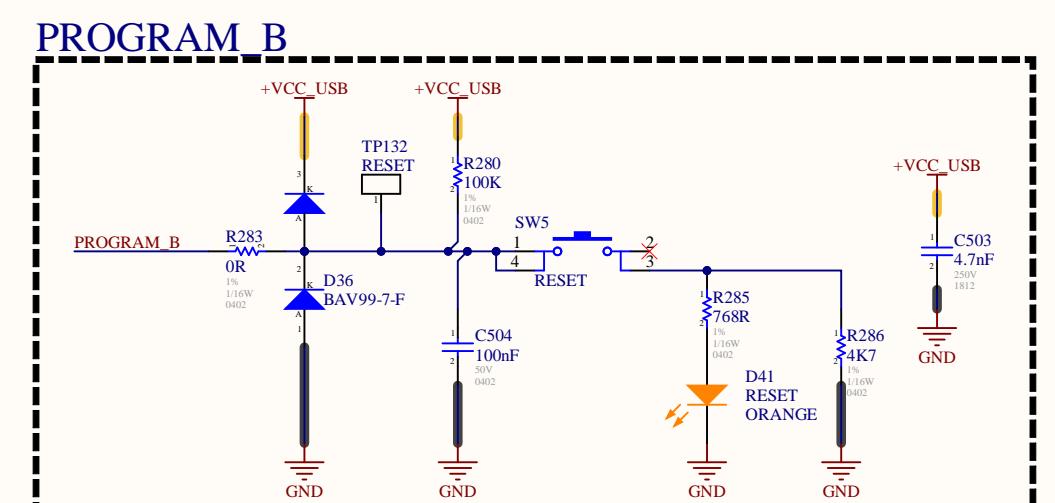
ISOLATED USB



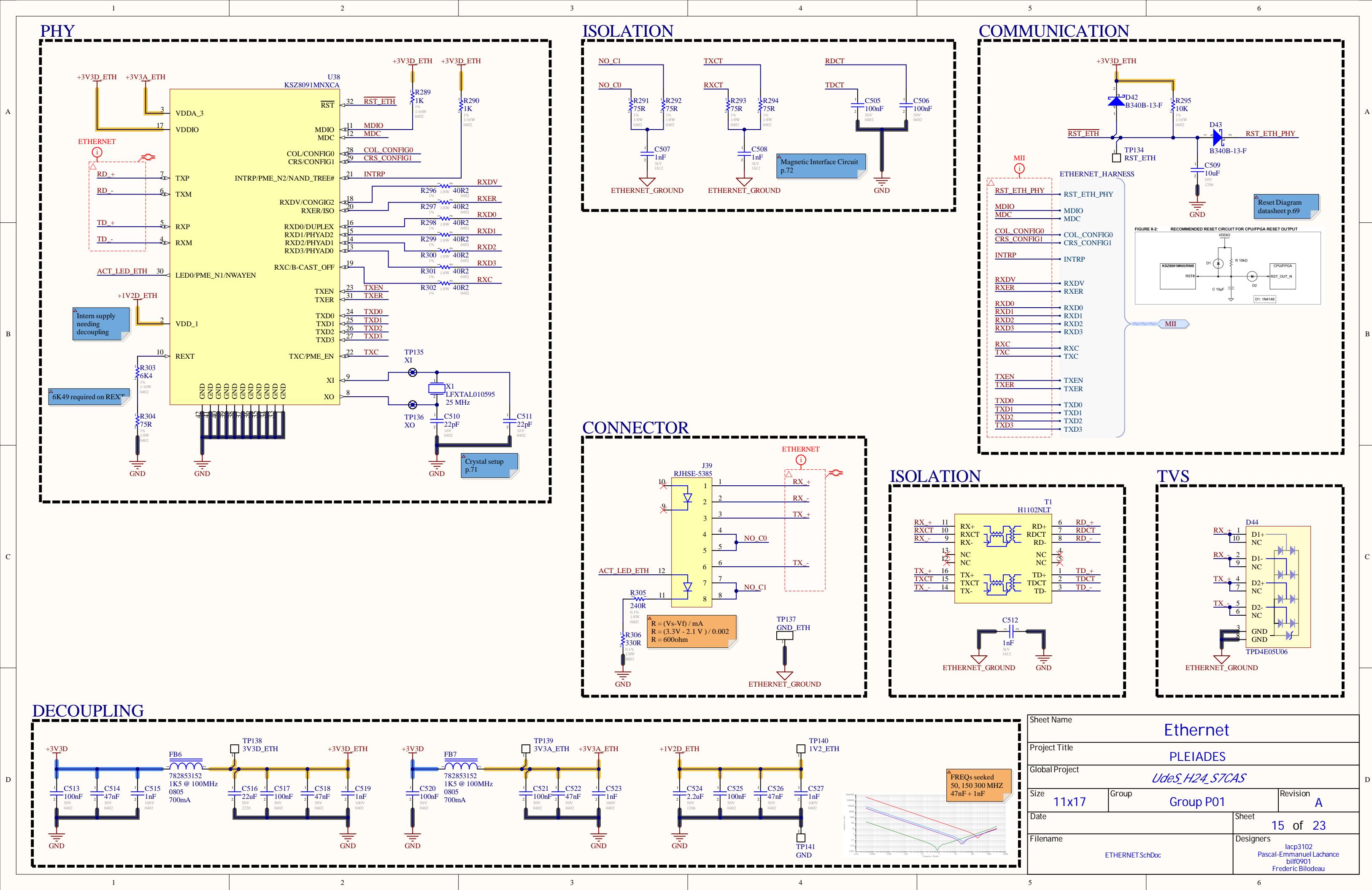
ESD



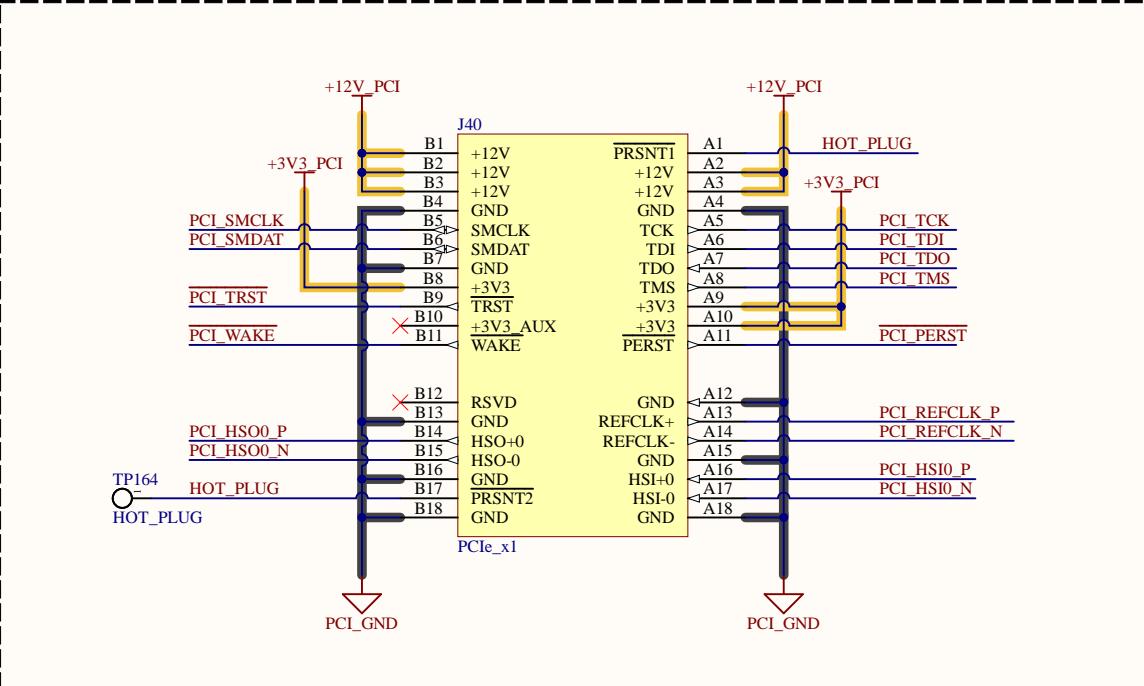
PROGRAM_B



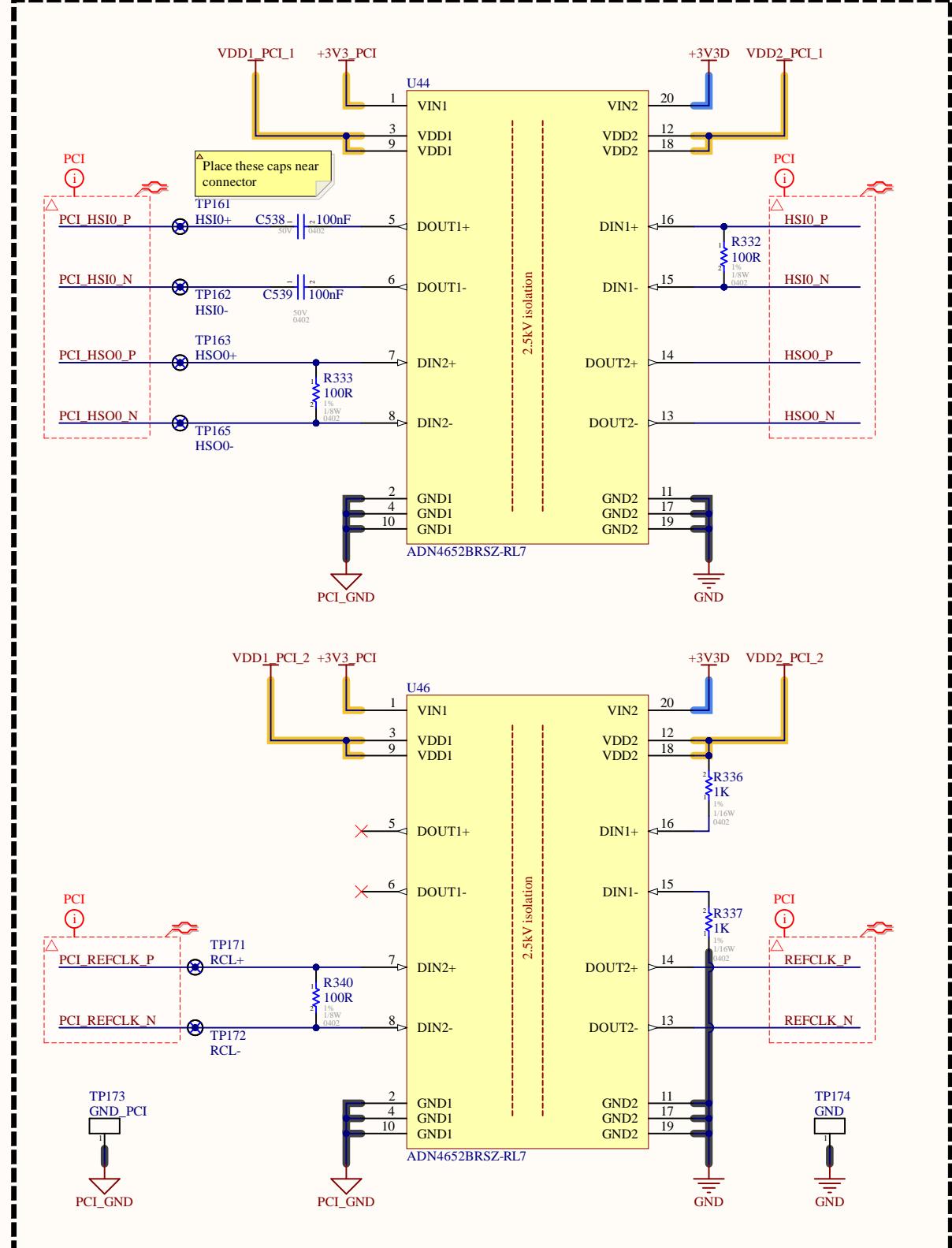
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| Sheet Name | USB | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | | Revision | A |
| Filename | USB.SchDoc | Designers | iacp3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau |



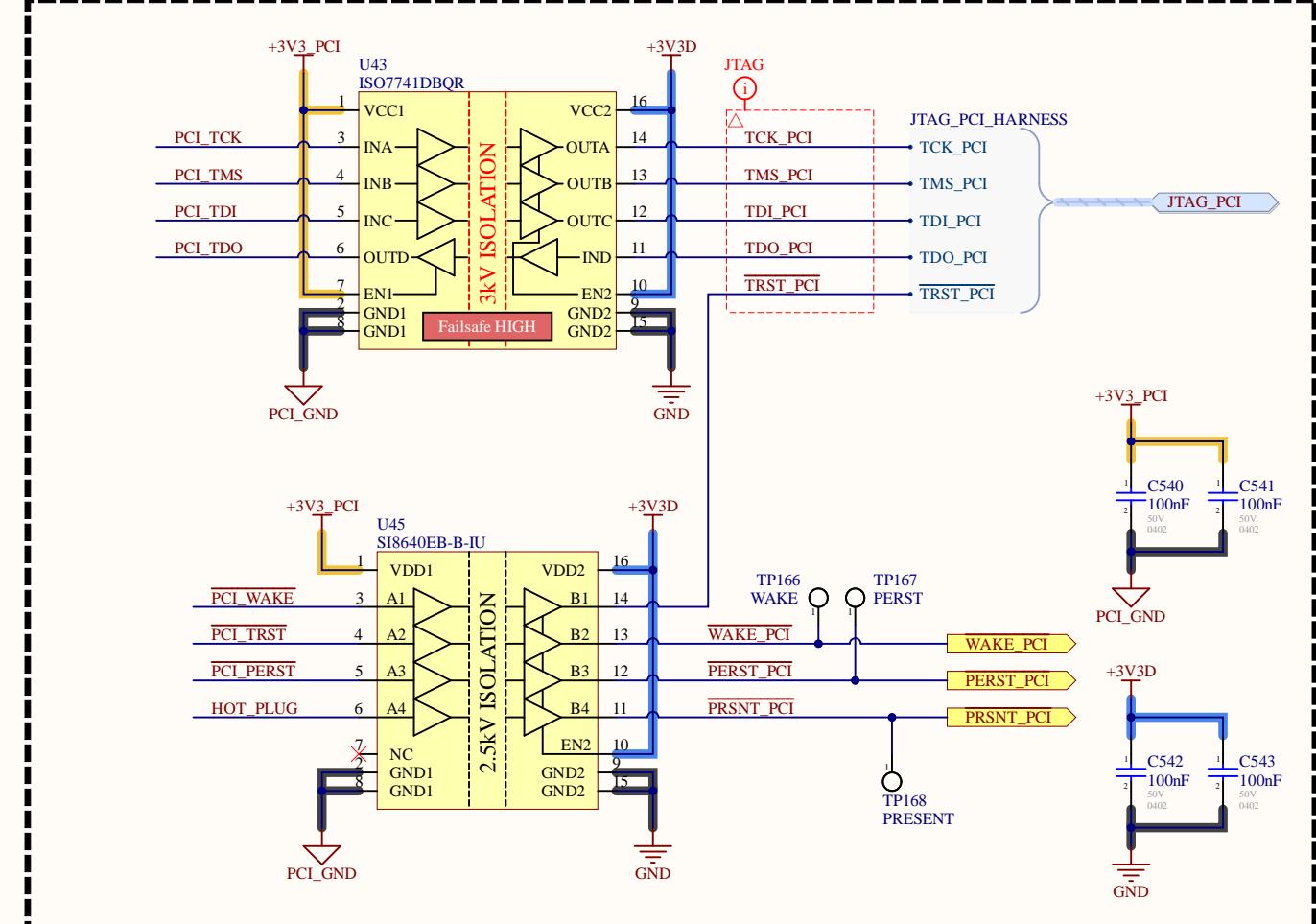
CONNECTOR



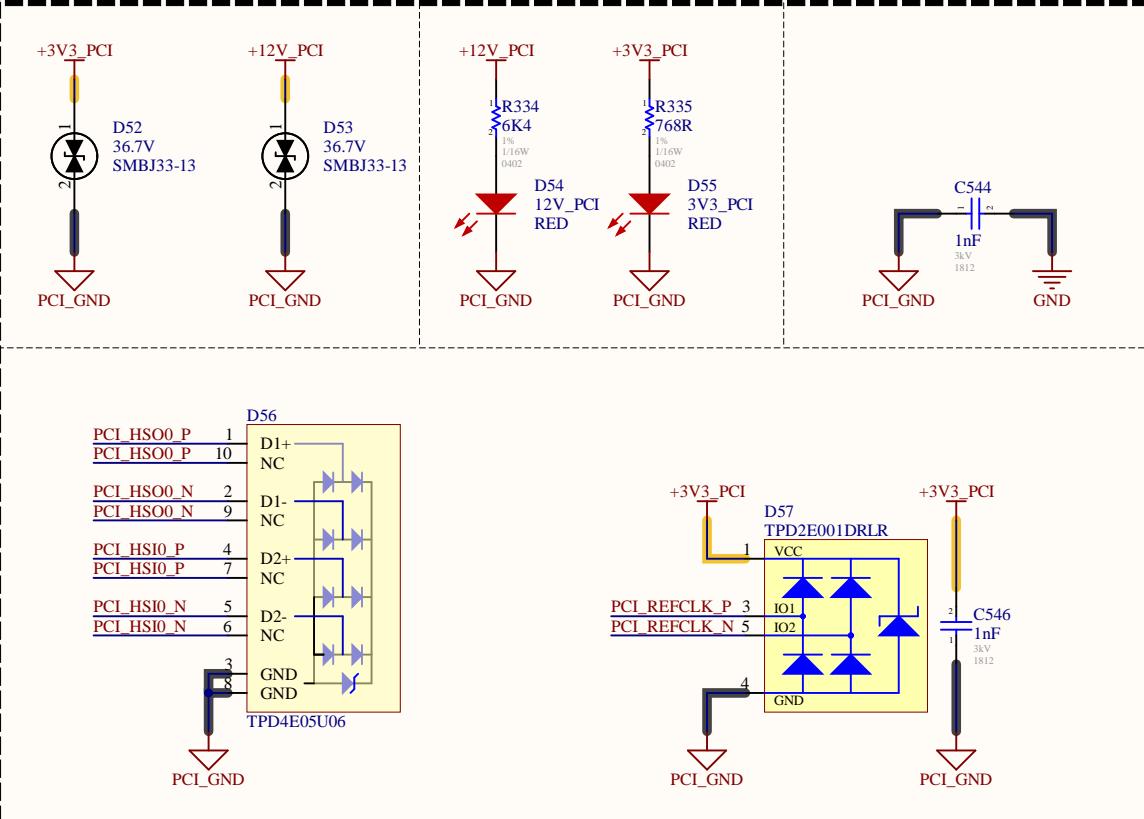
PCI ISOLATION



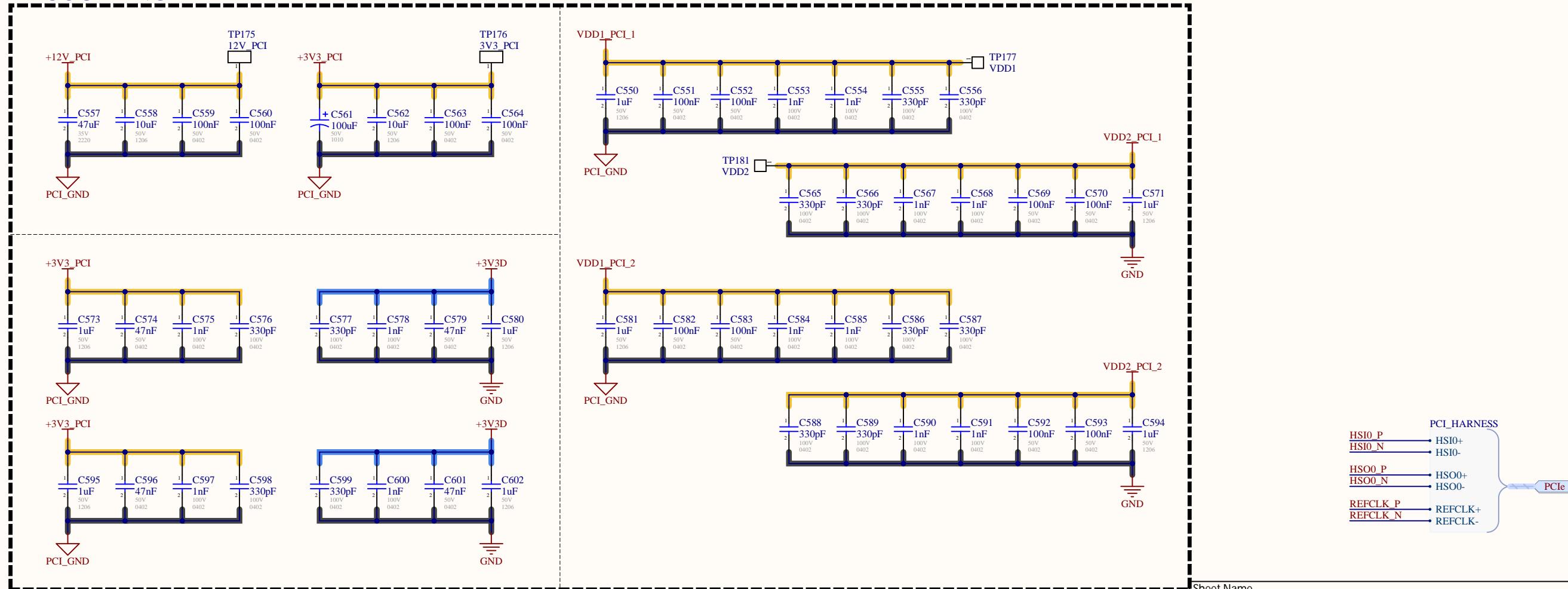
JTAG ISOLATION



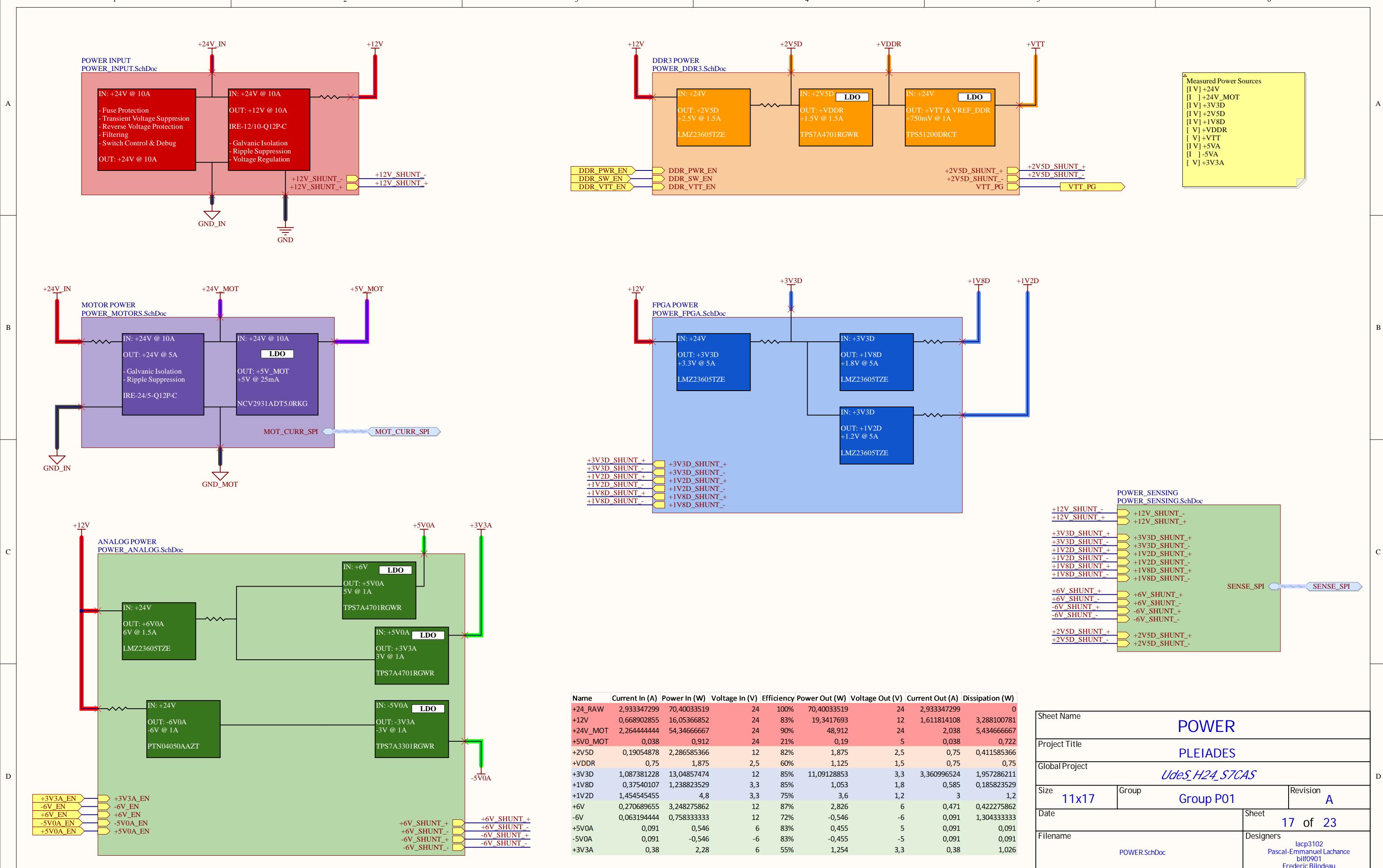
PROTECTIONS & DEBUG

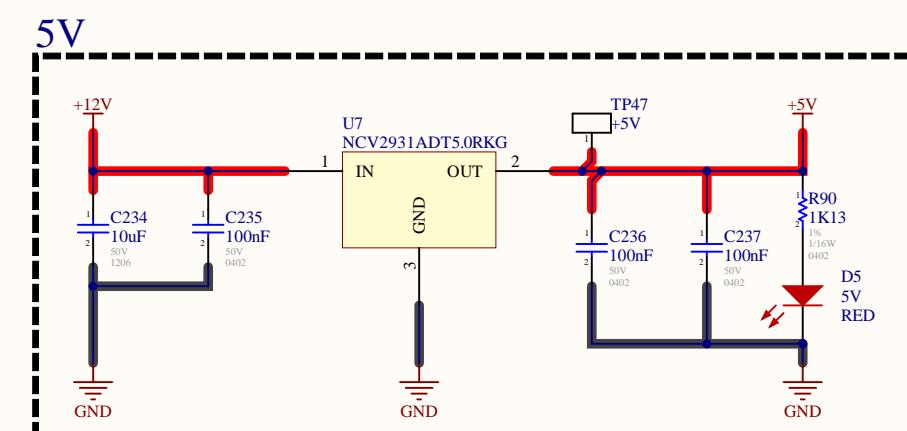
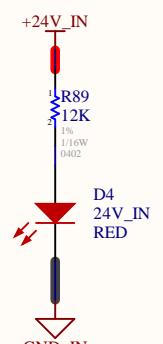
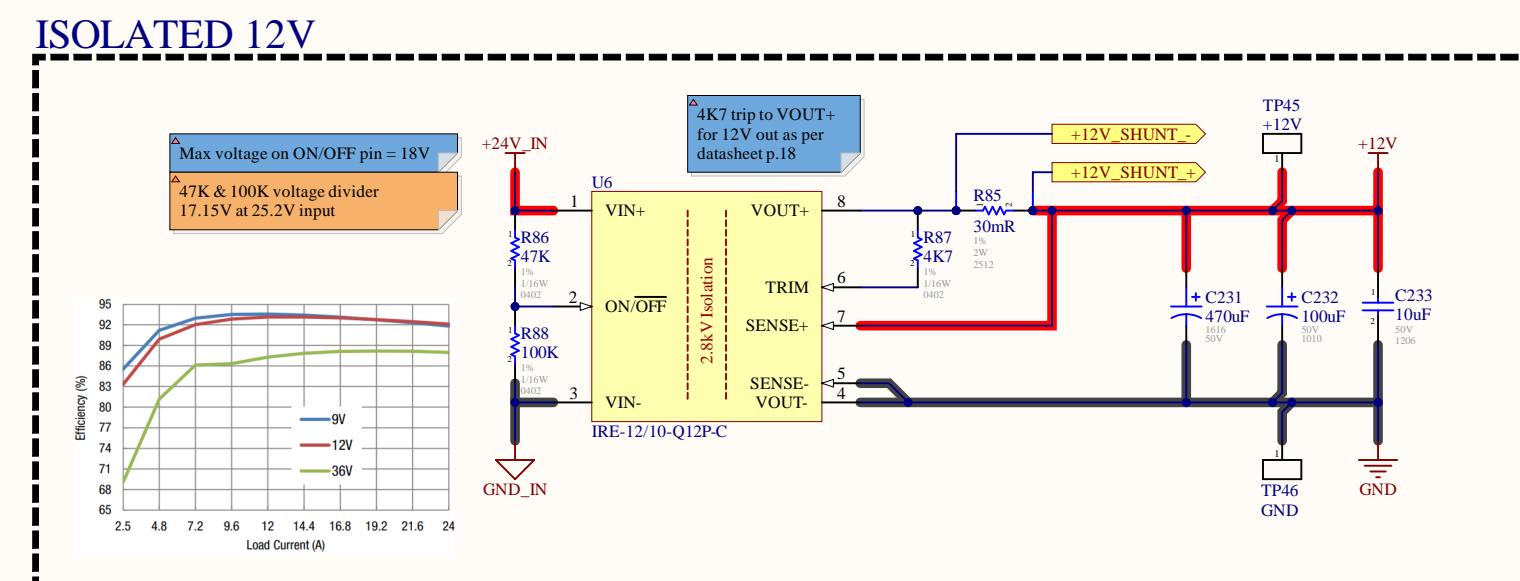
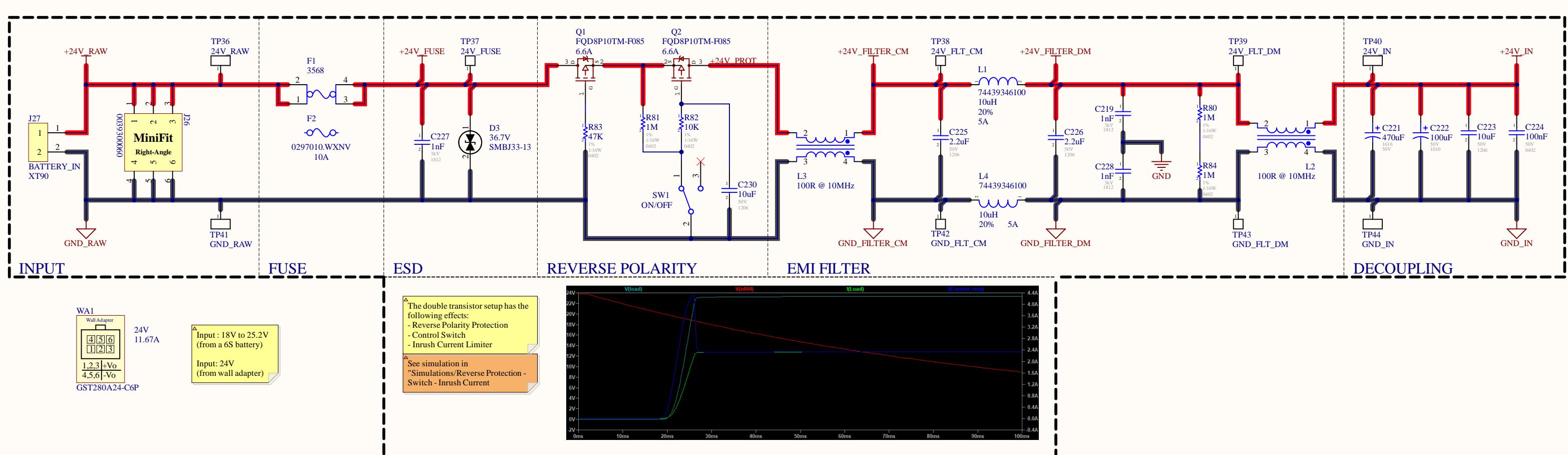


DECOUPLING



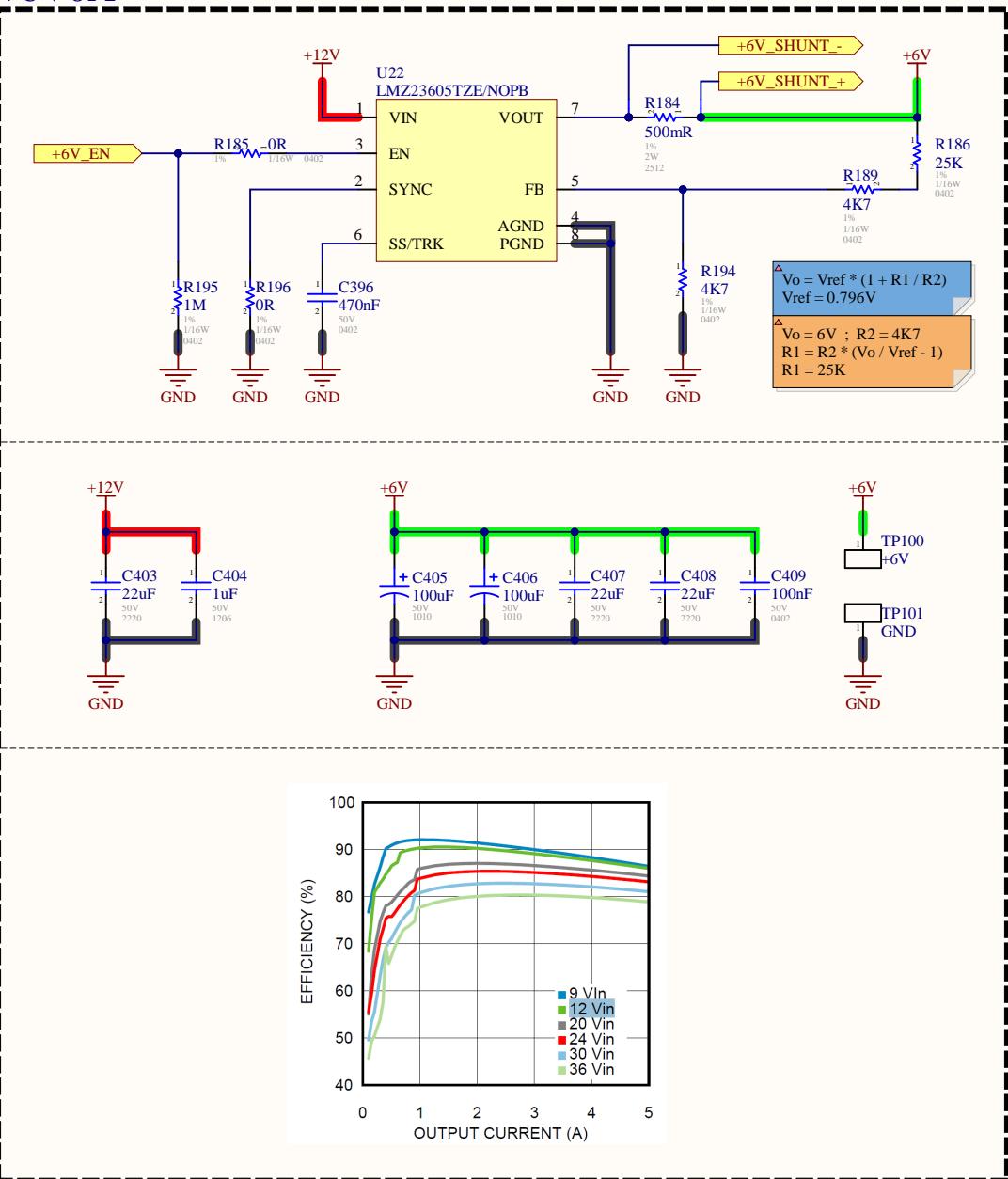
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| Sheet Name | PCI | | | | |
| Project Title | PLEIADES | | | | |
| Global Project | UdeS_H24_S7CAS | | | | |
| Size | 11x17 | Group | Group P01 | Revision | A |
| Date | | | | Sheet | |
| Filename | PCISchDoc | | Designers | IACP3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau | |



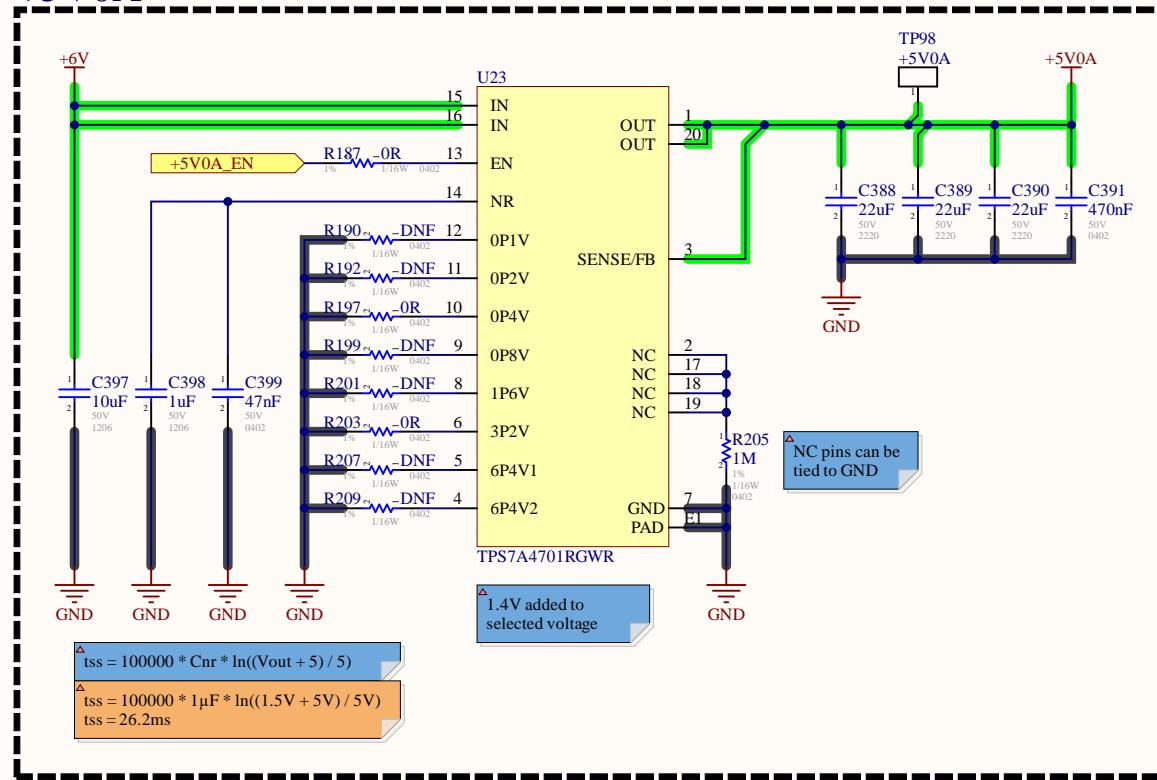


| | | | |
|----------------|---|-------|-----------|
| Sheet Name | POWER INPUT | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | Revision A | | |
| Filename | POWER_INPUT.SchDoc | | |
| Designers | iacp3102 Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau | | |

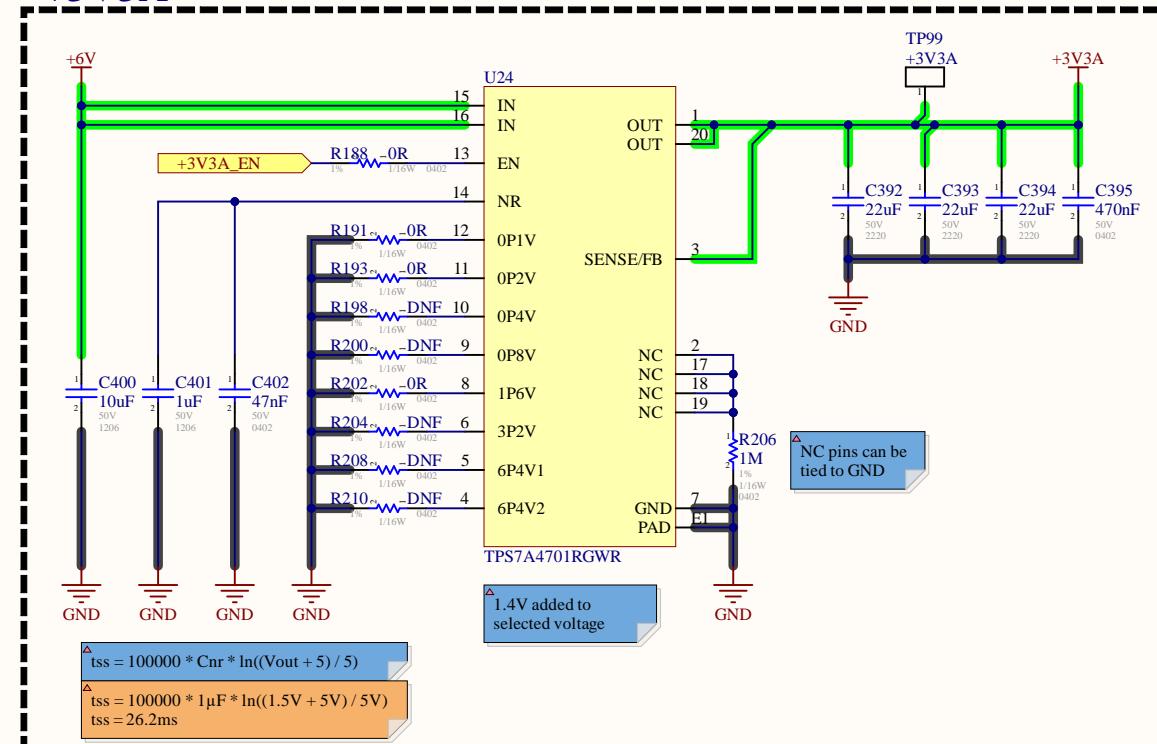
+6V0A



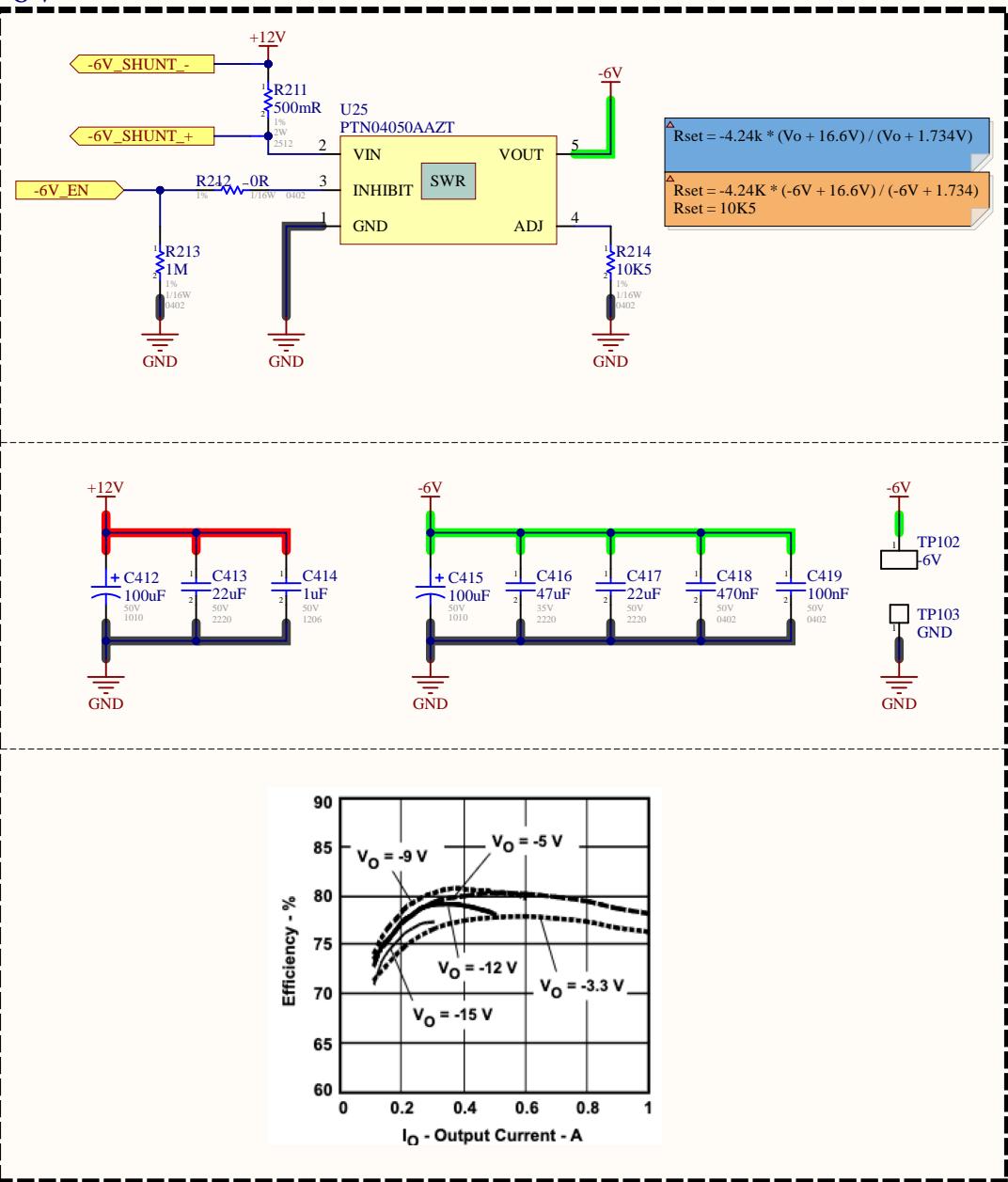
+5V0A



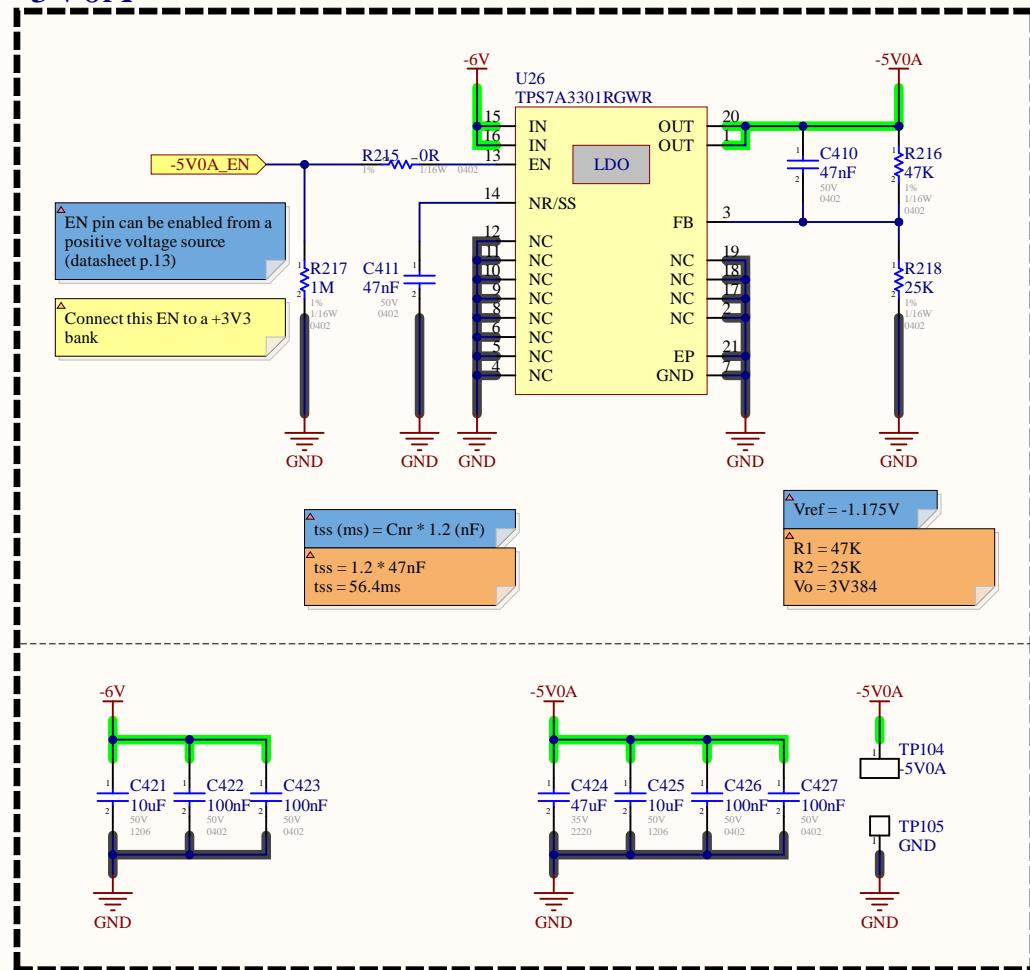
+3V3A



-6V



-5V0A

DAC
AVDD33: 60mA @ +3V3A
CVDD18: 60mA @ +1V8A
DVDD18: 350mA @ +1V8AADC
IAVDD (Analog Supply): 320mA @ 3V3A
IDRVDD (LVDS Supply): 165mA @ 1V8AOpAmp
-Vs Quiescent: 15mA @ -5V0A
-Vs Quiescent: 15mA @ -5V0A
Load: 66mA @ -5V0A
Load: 66mA @ -5V0AOpAmp
Current: 25mA @ -5V0A
Quiescent Current: 25mA @ -5V0A

Sheet Name

POWER

PLEIADES

UdeS_H24_S7CAS

Size

Group

11x17

Group P01

Date

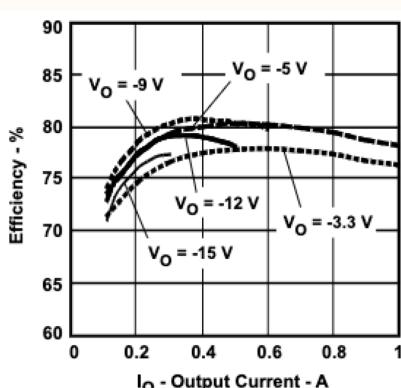
Revision

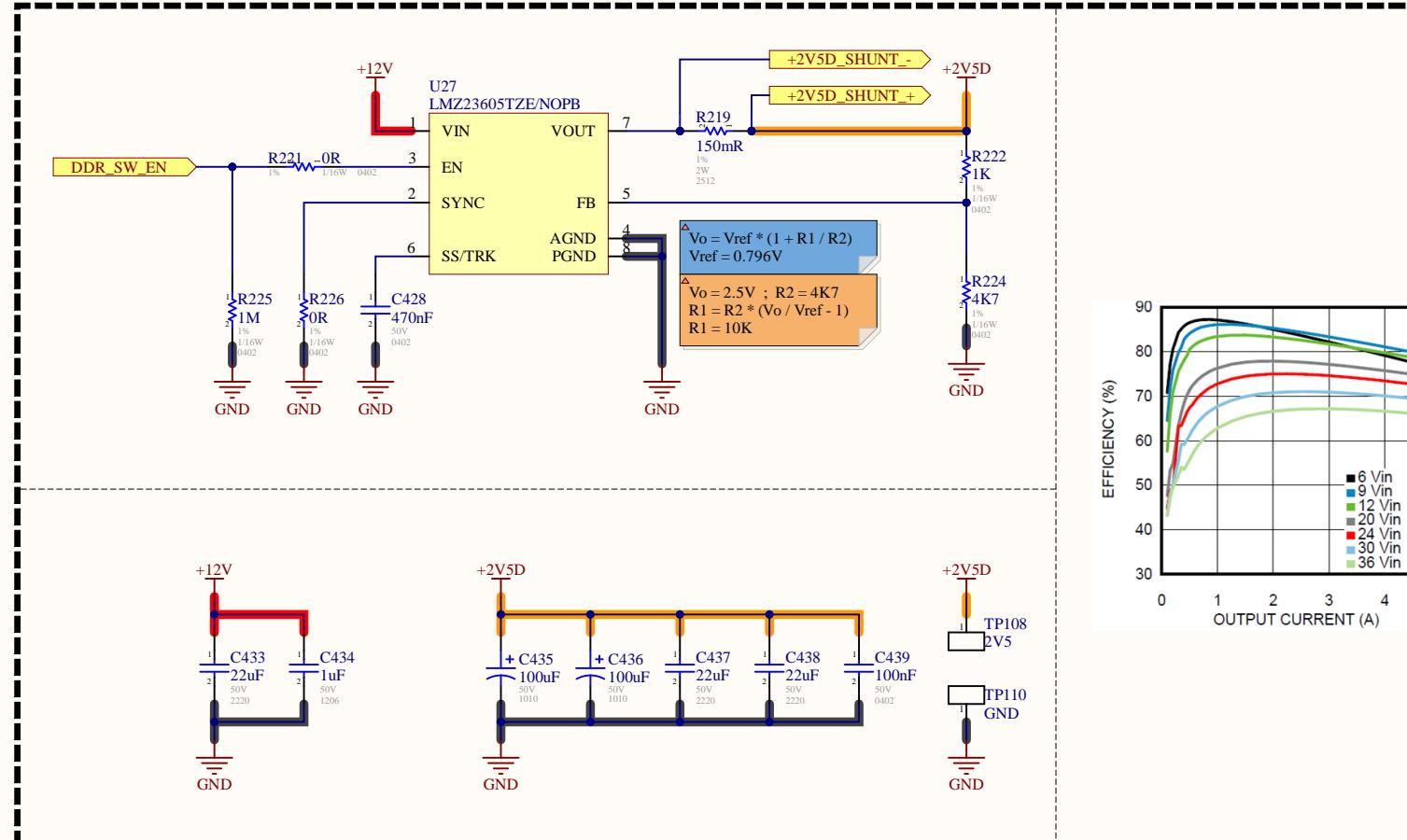
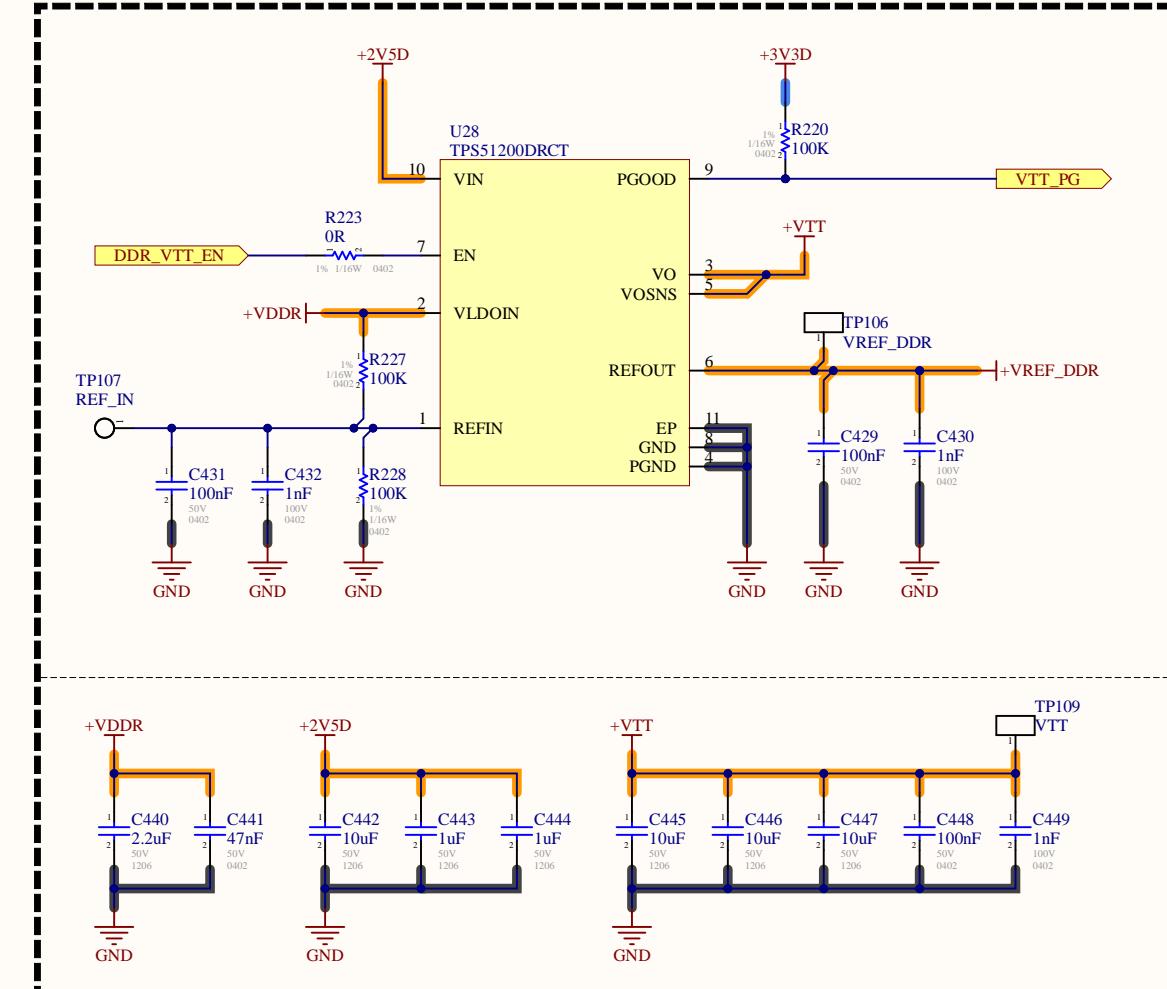
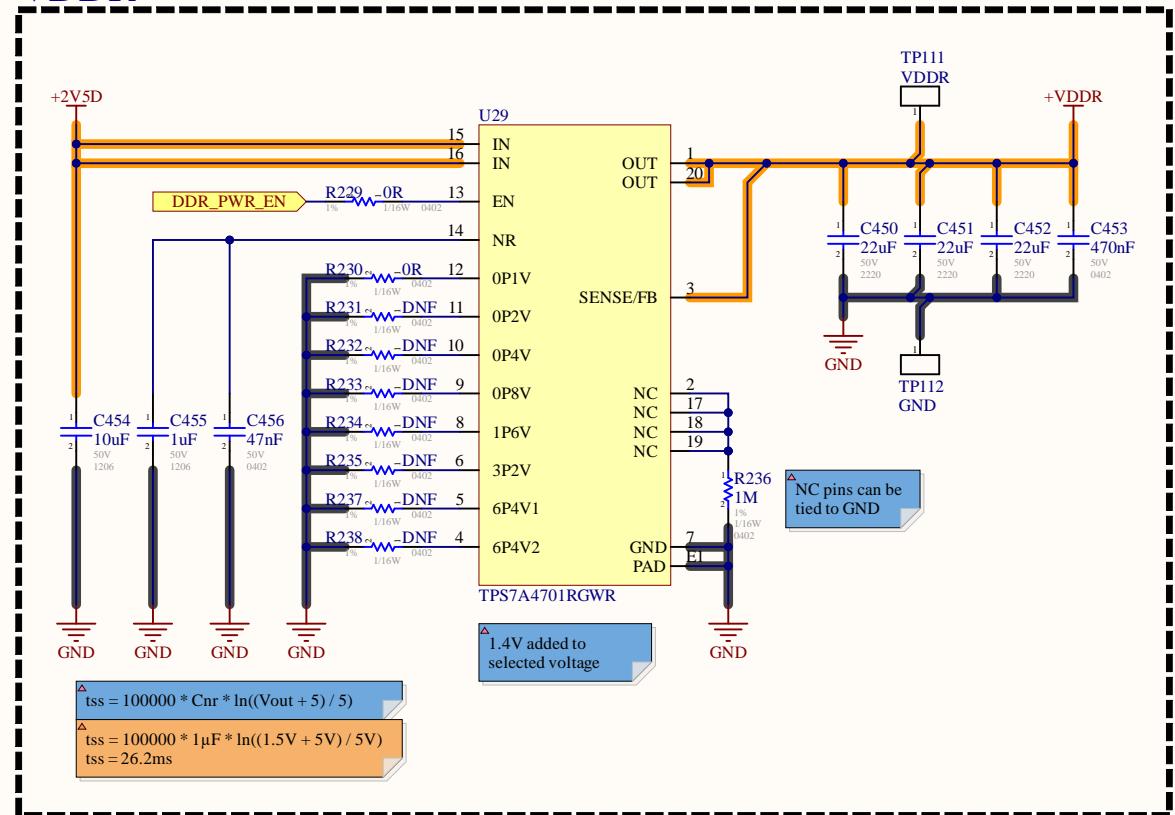
19 of 23

Filename

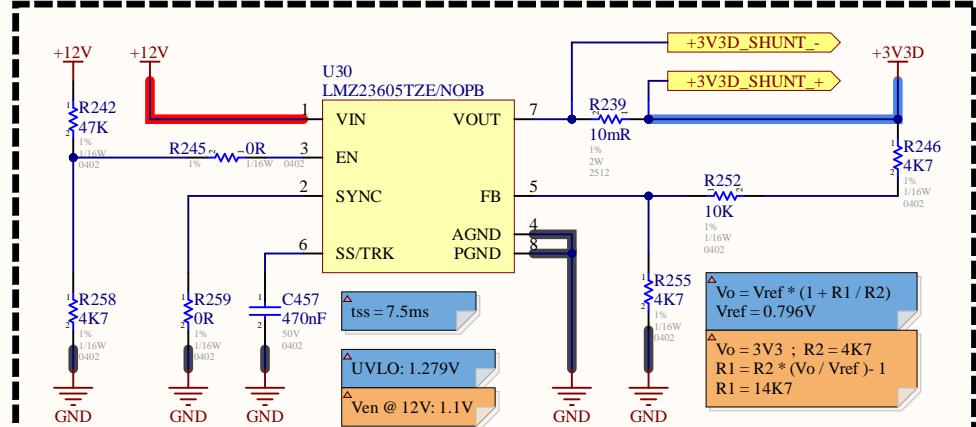
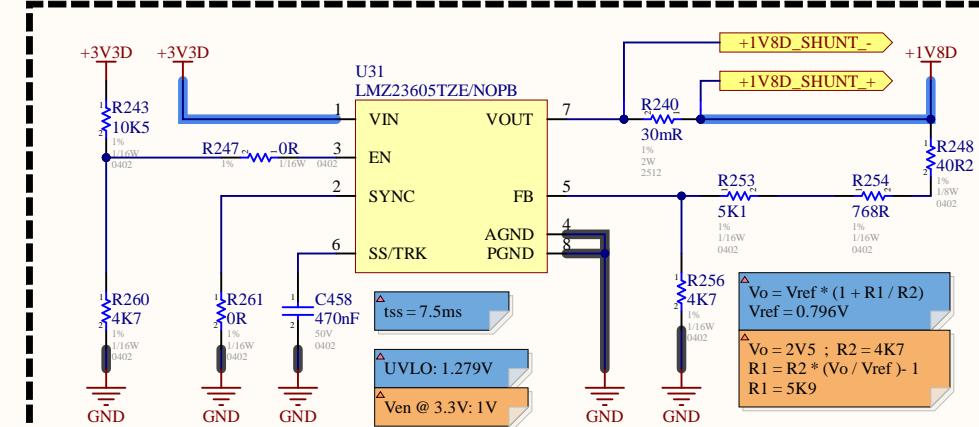
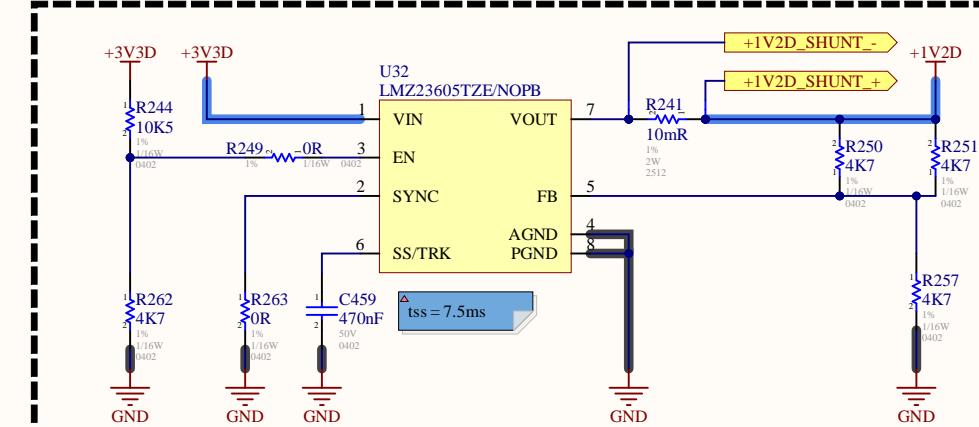
Designers

POWER_ANALOG.SchDoc

Iacp3102
Pascal-Emmanuel Lachance
billf901
Frederic Bilodeau

+2V5D**VTT****VDDR**

| | | | |
|----------------|---|-------|-----------|
| Sheet Name | DDR3 POWER | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | | | |
| Filename | POWER_DDR3.SchDoc | | |
| Designers | iacp3102 Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau | | |

+3V3D**+1V8D****+1V2D**

A

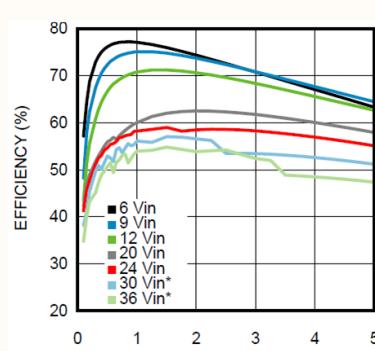
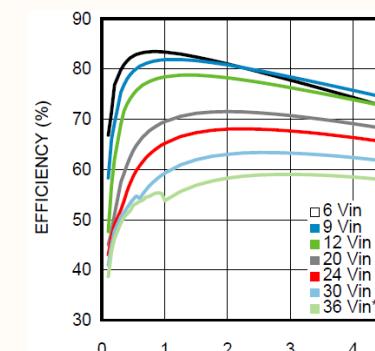
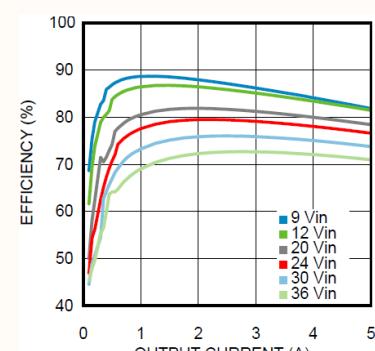
A

B

B

C

C



UG394 p.32
The Spartan-6 FPGA can be powered up and powered down in any sequence. Because the three FPGA supply inputs must be valid to release the POR and can be supplied in any order, there is no FPGA-specific voltage sequencing requirement.

VCCINT: 3A @ 1V2D
VCCAUX: 250mA @ 3V3D
VCCIO: 6x 100mA @ 3V3D
6.405W

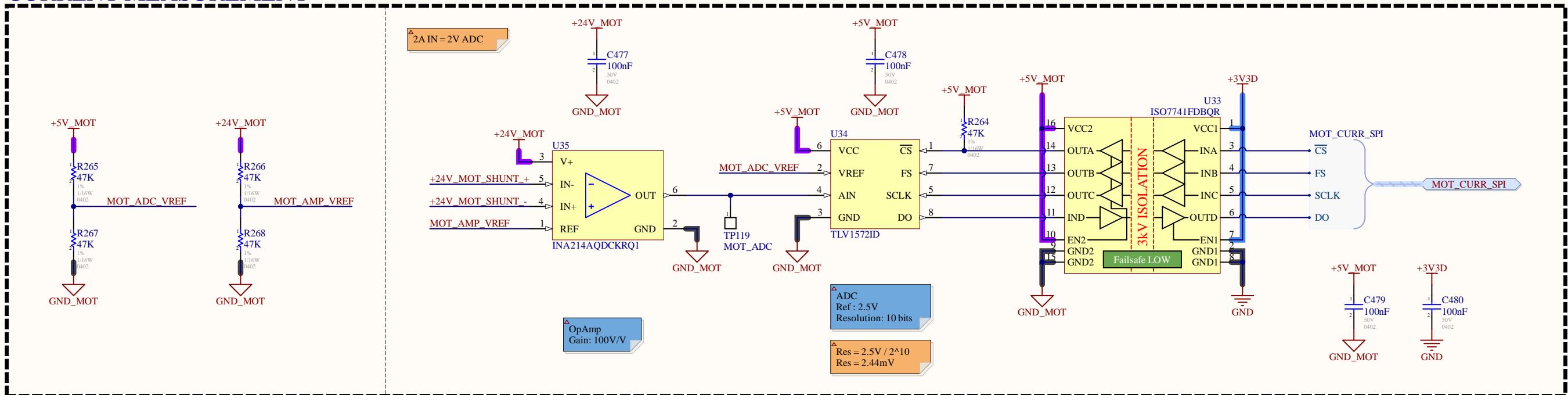
Table 6: Power Supply Ramp Time

| Symbol | Description | Speed Grade | Ramp Time | Units |
|---------------|--|-------------|--------------|-------|
| V_{CCINTR} | Internal supply voltage ramp time | -3, -3N, -2 | 0.20 to 50.0 | ms |
| | | -1L | 0.20 to 40.0 | ms |
| $V_{CCO2(1)}$ | Output drivers bank 2 supply voltage ramp time | All | 0.20 to 50.0 | ms |
| V_{CCAUXR} | Auxiliary supply voltage ramp time | All | 0.20 to 50.0 | ms |

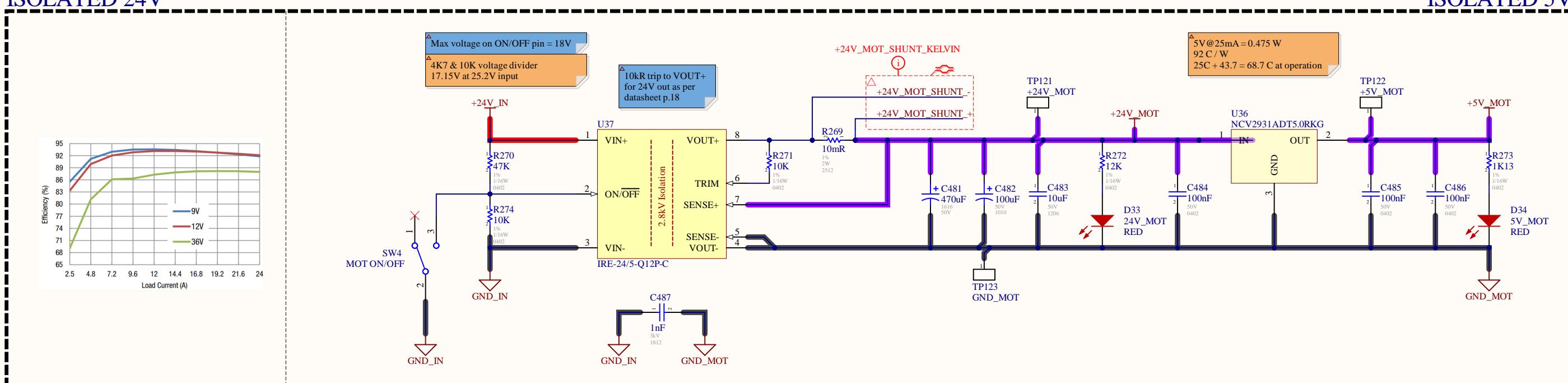
DS162 p.7

| POWER | | | |
|-------------------|--|----------------|------------|
| PLEIADES | | UdeS_H24_S7CAS | |
| Global Project | | Group P01 | |
| Size | 11x17 | Group | Revision A |
| Date | Sheet 21 Of 23 | | |
| Filename | Designers lacp3102 Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau | | |
| POWER_FPGA.SchDoc | | | |

CURRENT MEASUREMENT

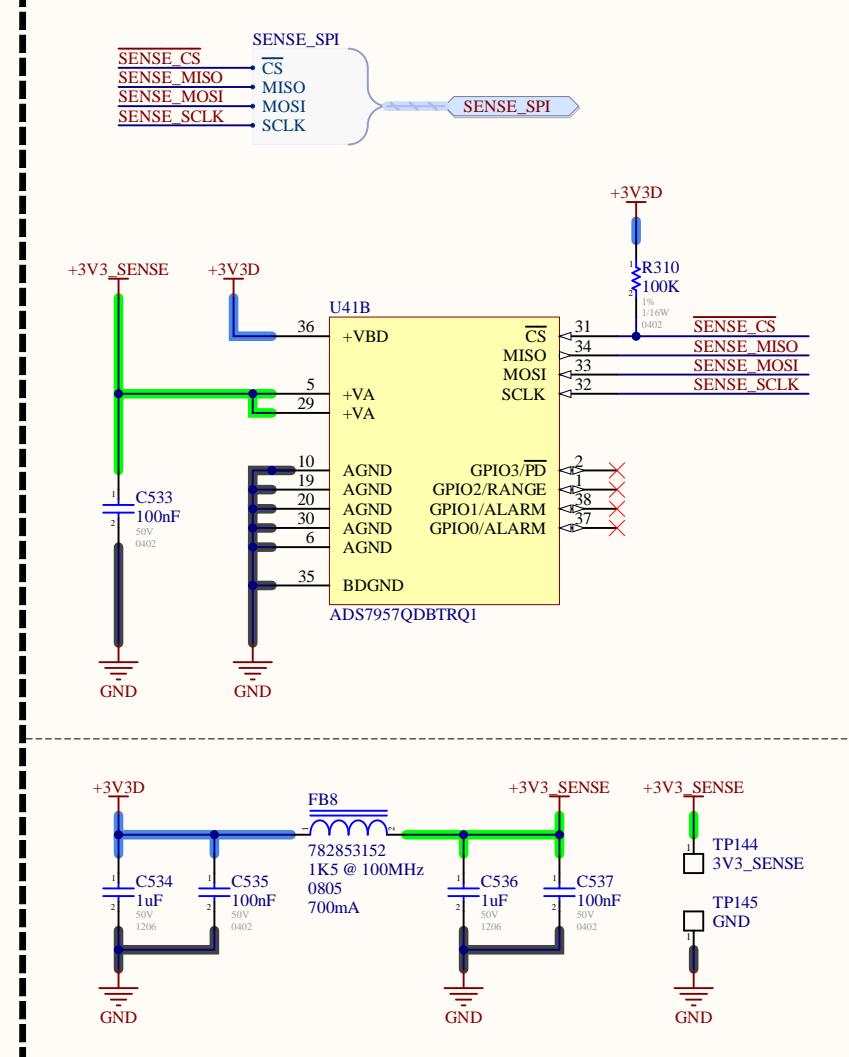


ISOLATED 24V

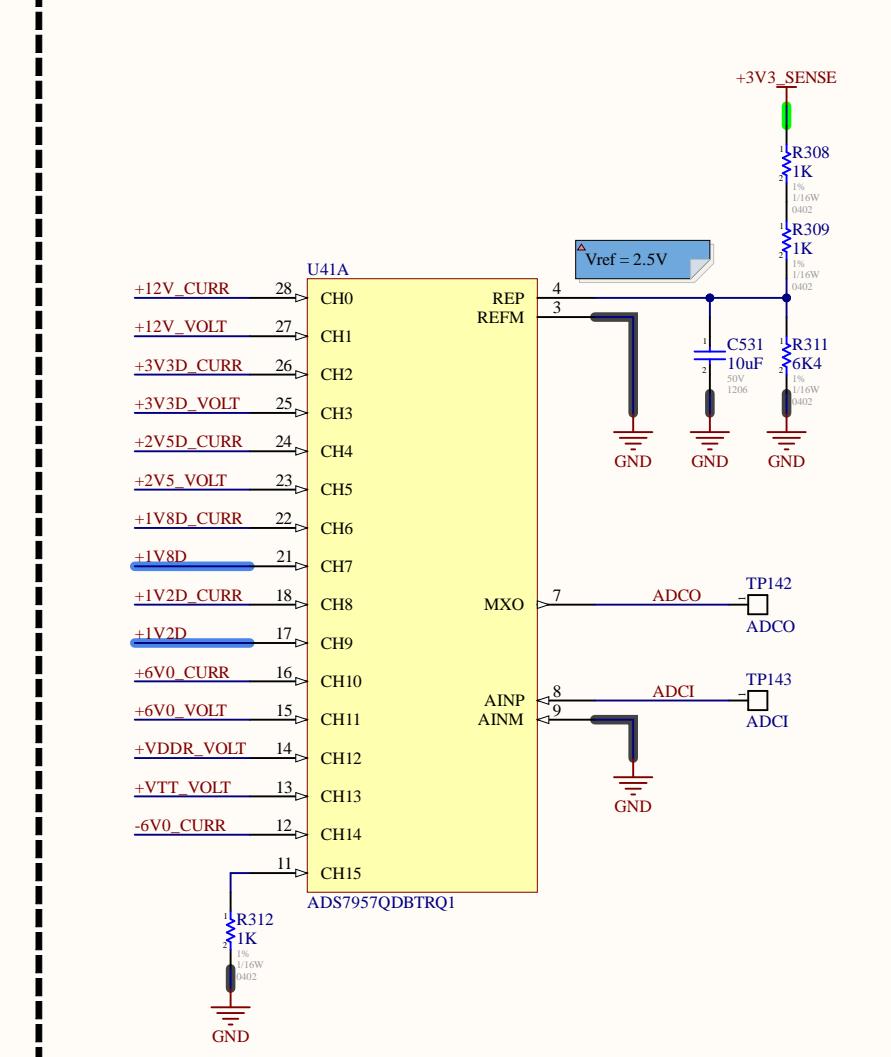


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|----------------|---|-------|-----------|
| Sheet Name | POWER | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | | | |
| Filename | POWER_MOTORS.SchDoc | | |
| Designers | iacp3102 Pascal-Emmanuel Lachance bilf0901 Frederic Bilodeau | | |

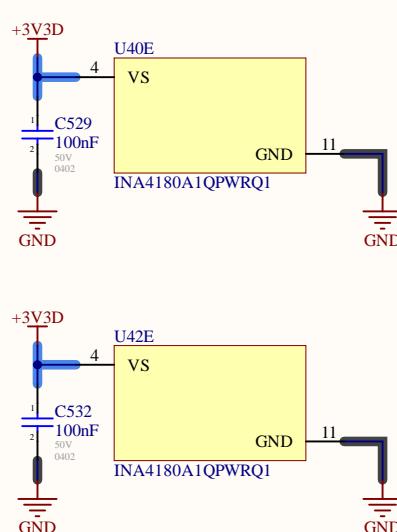
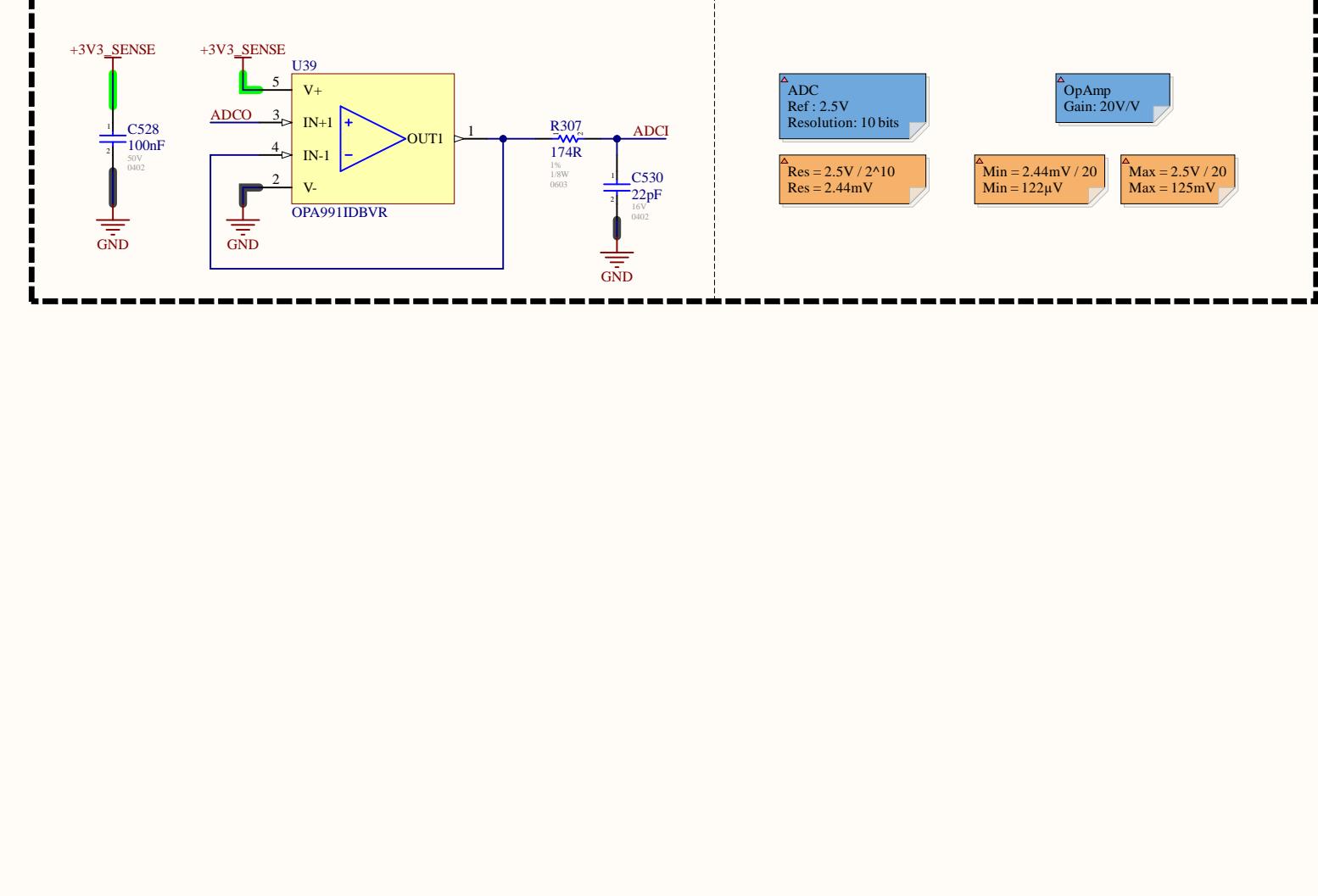
ADC MISC



ADC



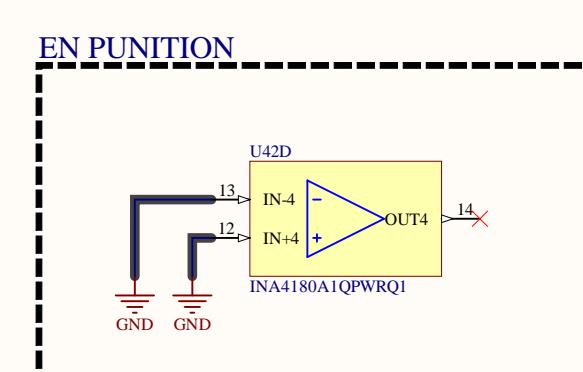
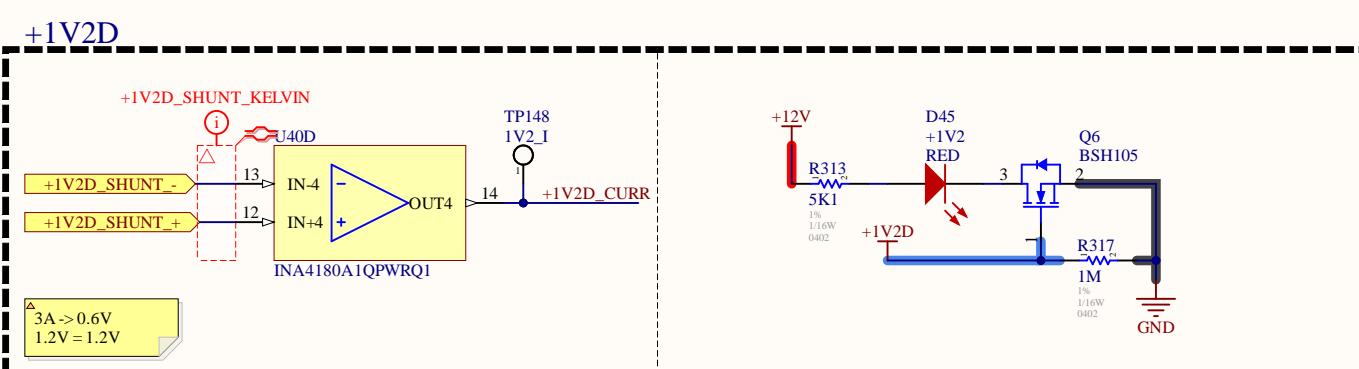
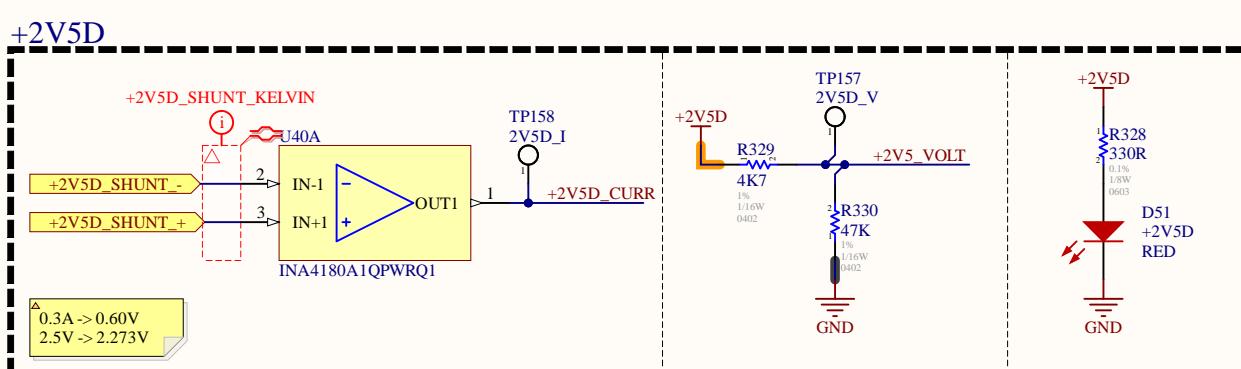
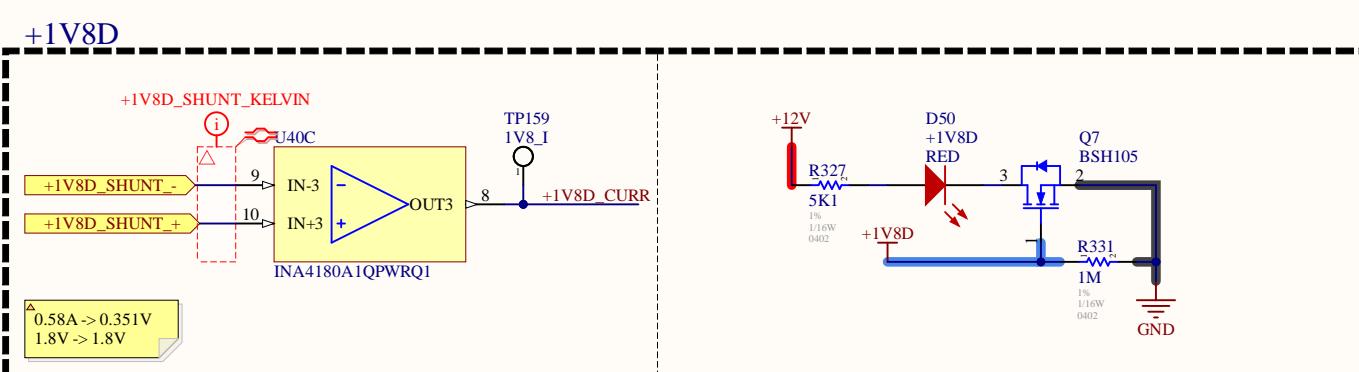
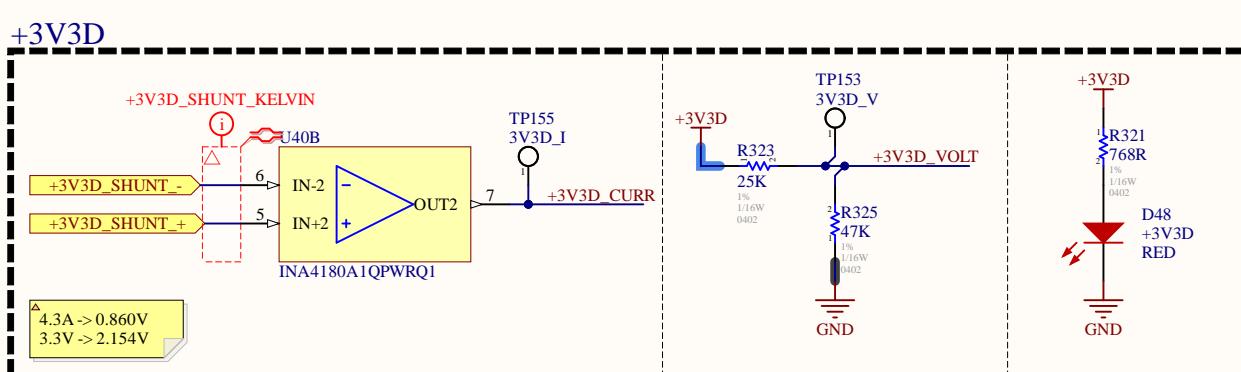
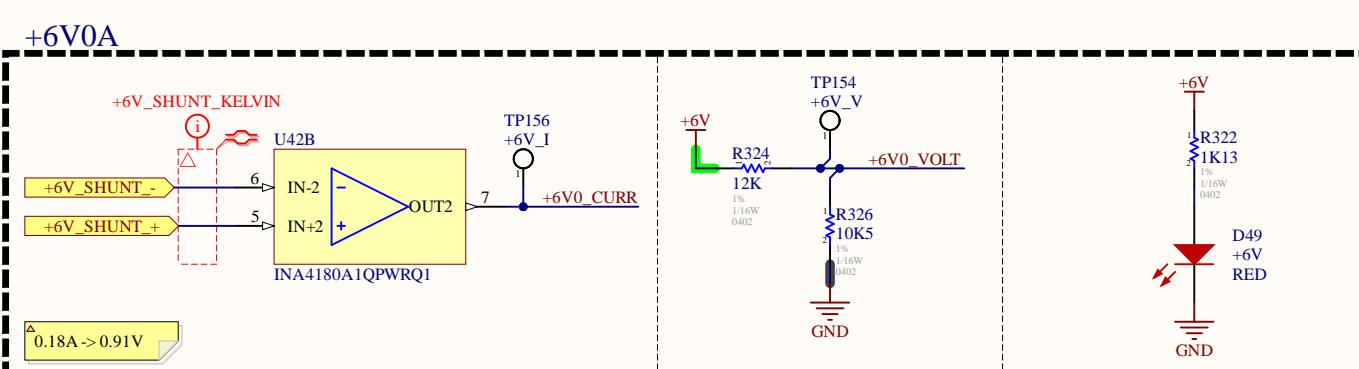
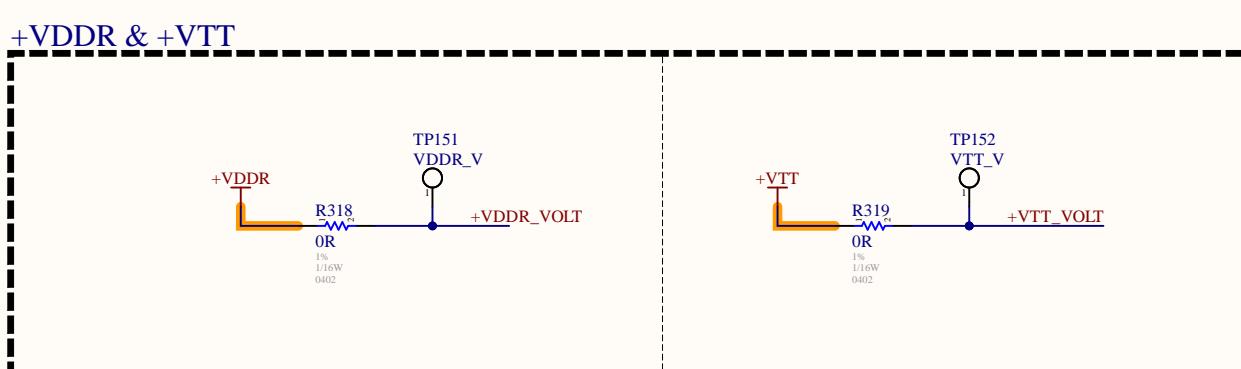
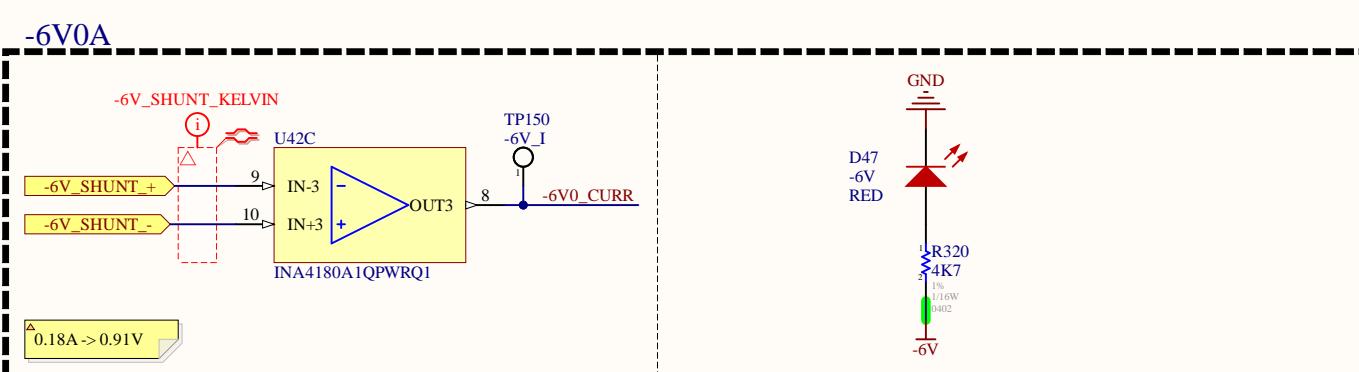
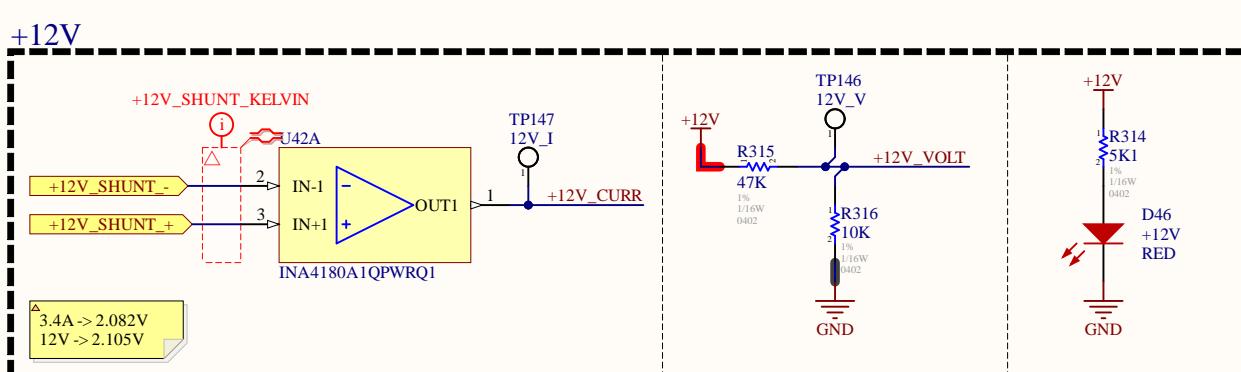
ADC GAIN



Measured Power Sources

- [I] V+24V
- [I] V+24V_MOT
- [I] V+3V3D
- [I] V+2V5D
- [I] V+1V8D
- [V] +VDDR
- [V] +VTT
- [V] -5VA
- [V] +3V3A

C



| | | | |
|----------------|----------------------|-----------|---|
| Sheet Name | POWER | | |
| Project Title | PLEIADES | | |
| Global Project | UdeS_H24_S7CAS | | |
| Size | 11x17 | Group | Group P01 |
| Date | | Revision | A |
| Filename | POWER_SENSING.SchDoc | Designers | IACP3102 Pascal-Emmanuel Lachance billf901 Frederic Bilodeau |
| | | Sheet | 23 of 23 |

