

LEA Logo

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USB-C  
Cable

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[https://github.com/upb-lea/LEA\\_control\\_board](https://github.com/upb-lea/LEA_control_board)

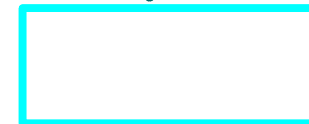
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PADERBORN UNIVERSITY DEPARTMENT OF POWER ELECTRONICS AND ELECTRICAL DRIVES

Sheet: /

File: LCB-CCB-01.kicad\_sch

**Title: LCB-CCB-01: Control Board – Debugger XDS100 / JTAG**

Size: A4 Date: 2025-02-21

KiCad E.D.A. 8.0.8

Rev: 1.1.0

Id: 1/11

## XDS100 USB-C Port

# External Debugger

J202  
FTR-110-03-G-D-06-TR

+3.3V\_LV

4k7 R224

EXT\_TMS 1

EXT\_TDI 3

EXT\_TDO 7

R222 0R0

EXT\_TCK 11

R220 4k7

EXT\_TRST 2

4

8

10

12

14

16

18

20

GND\_LV

+3.3V\_LV

R221

## Debugger Selection

U204  
ADG736BRMZ

U205  
ADG736BRMZ

U206  
ADG736BRMZ

[illegible]

**Power Status LED**

+3.3V\_LV ← D201 (2mA) R202 (680Ω) → GND\_LV

**12 MHz Clock**

The diagram shows the clock circuit for the ECS-2033-120-AU. The clock signal (CLK\_12MHz) is connected to the Output pin (pin 3) of the device. The Vdd pin (pin 4) is connected to the 3.3V\_LV supply, and the Tri-State pin (pin 1) is connected to the 3.3V\_LV supply. The Gnd pin (pin 2) is connected to the GND\_LV supply. A 100nF capacitor (C210) is connected between the 3.3V\_LV supply and the Vdd pin.

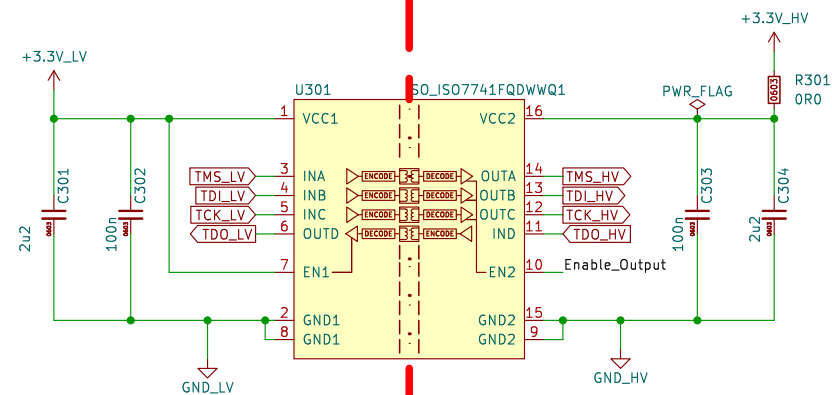
## Decoupling Capacitors

### MCU FT232HL

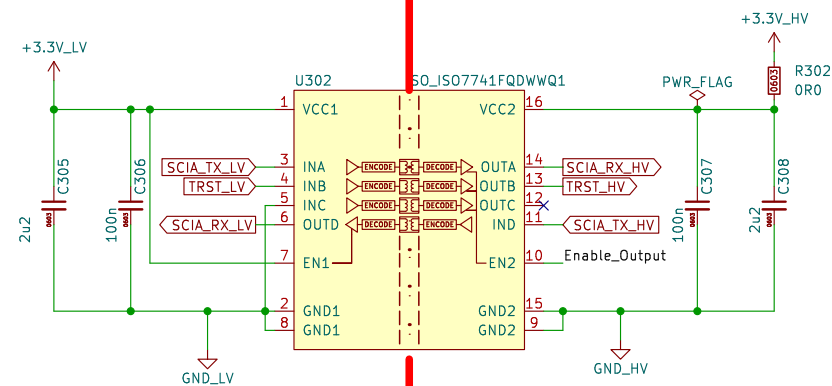
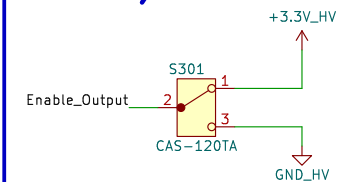
The diagrams illustrate the decoupling capacitor network for the MCU FT232HL. The left circuit is for the +3.3V\_LV supply, featuring capacitors C211 through C215, each with a 100nF value. The right circuit is for the +1.8V\_HV supply, featuring capacitors C216 through C220, each with a 100nF value. Both circuits show the capacitors connected to a common ground labeled GND\_LV.

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# JTAG and SCI Isolation



## Enable/Disable Debugger



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Sheet: /Isolation – Page 3/

File: Isolation.kicad\_sch

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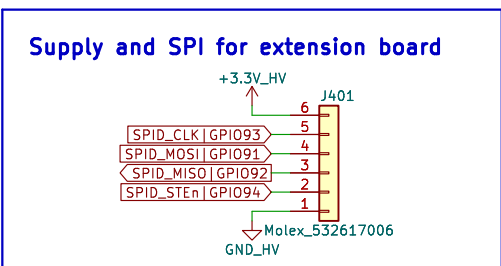
Size: A4

Date: 2025-02-21

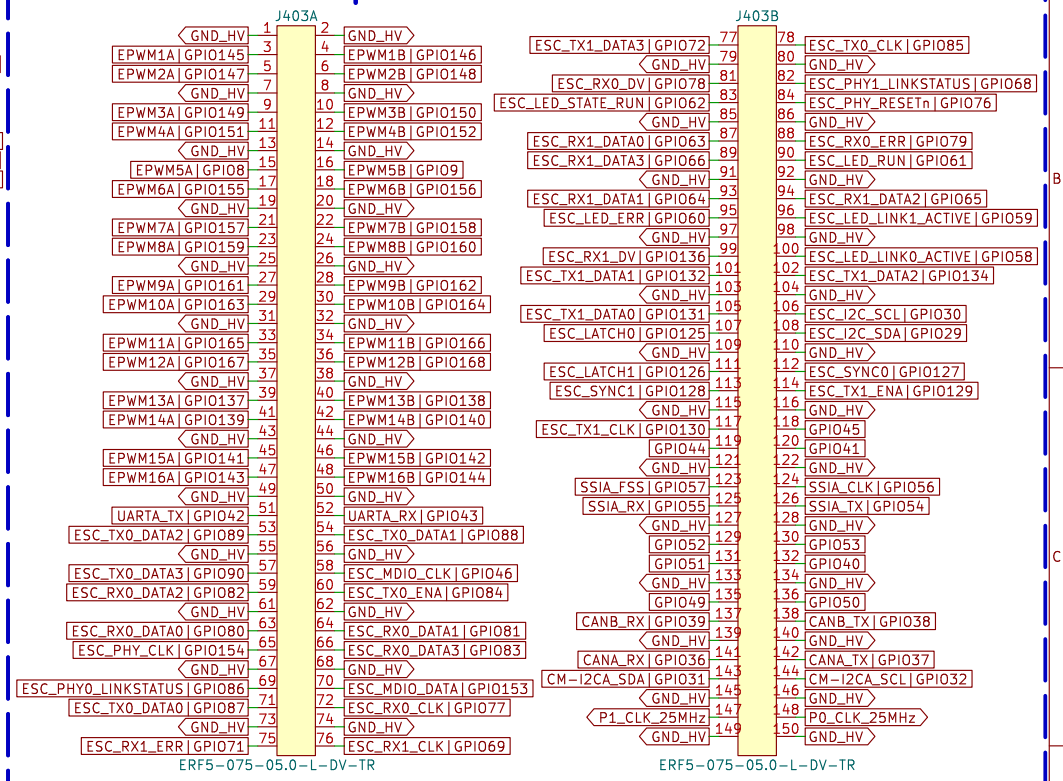
Rev: 1.1.0

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Id: 3/11



## Top J403 Connector



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## Bottom J501 Connector

J501A	J501B
+3V3_Connector_HV	<GND_HV>
+3V3_Connector_HV	ENET_MII_TX_ERR GPIO113
+3V3_Connector_HV	ENET_MII_TX_EN GPIO118
+3V3_Connector_HV	<GND_HV>
+3V3_Connector_HV	ENET_MII_TX_Data2 GPIO123
<GND_HV>	ENET_MII_RX_Data1 GPIO115
<GND_HV>	ENET_MII_TX_Data3 GPIO124
FreePin1	ENET_CLK_25MHz
MCAN_RX GPIO70	<GND_HV>
<GND_HV>	FreePin3
I2CA_SCL GPIO1	FreePin5
SCIC_TX GPIO12	FreePin7
<GND_HV>	<GND_HV>
SPIA_MOSI GPIO16	SPIA_MISO GPIO17
SPIA_STEn GPIO19	SPIA_CLK GPIO18
<GND_HV>	<GND_HV>
SPIC_MOSI GPIO100	SPIC_MISO GPIO101
SPIC_STEn GPIO103	SPIC_CLK GPIO102
<GND_HV>	<GND_HV>
SPIB_MOSI GPIO24	SPIB_MISO GPIO25
SPIB_STEn GPIO27	SPIB_CLK GPIO26
<GND_HV>	<GND_HV>
SCIB_TX GPIO22	SCIB_RX GPIO23
GPIO20_nErr1	GPIO15_Err1
GPIO21_nErr2	GPIO95_Err2
GPIO104_nErr3	GPIO99_Err3
<GND_HV>	<GND_HV>
GPIO14_nErr4	GPIO96_Err4
GPIO33	GPIO34
<GND_HV>	<GND_HV>
ENET_MDIO_CLK GPIO105	ENET_RMII_CLK GPIO73
ENET_MII_INTR GPIO108	ENET_PPSSO GPIO47
<GND_HV>	<GND_HV>
ENET_MDIO_DATA GPIO106	ENET_REVMII_MDIO_RST GPIO107
ENET_MII_COL GPIO110	ENET_MII_RX_DV GPIO112
<GND_HV>	<GND_HV>
ENET_MII_CRS GPIO109	ENET_PPSS1 GPIO48
ENET_MII_RX_CLK GPIO111	ENET_MII_RX_Data0 GPIO114

ERM5-075-05.0-L-DV-K-TR

ERM5-075-05.0-L-DV-K-TR

## Bottom J502 Connector

J502A	J502B
<GND_HV>	<GND_HV>
EPWM1A GPIO145	EPWM1B GPIO146
EPWM2A GPIO147	EPWM2B GPIO148
<GND_HV>	<GND_HV>
EPWM3A GPIO149	EPWM3B GPIO150
EPWM4A GPIO151	EPWM4B GPIO152
<GND_HV>	<GND_HV>
EPWM5A GPIO153	EPWM5B GPIO154
EPWM6A GPIO155	EPWM6B GPIO156
<GND_HV>	<GND_HV>
EPWM7A GPIO157	EPWM7B GPIO158
EPWM8A GPIO159	EPWM8B GPIO160
<GND_HV>	<GND_HV>
EPWM9A GPIO161	EPWM9B GPIO162
EPWM10A GPIO163	EPWM10B GPIO164
<GND_HV>	<GND_HV>
EPWM11A GPIO165	EPWM11B GPIO166
EPWM12A GPIO167	EPWM12B GPIO168
<GND_HV>	<GND_HV>
EPWM13A GPIO169	EPWM13B GPIO170
EPWM14A GPIO171	EPWM14B GPIO172
<GND_HV>	<GND_HV>
EPWM15A GPIO173	EPWM15B GPIO174
EPWM16A GPIO175	EPWM16B GPIO176
<GND_HV>	<GND_HV>
UARTA_TX GPIO42	UARTA_RX GPIO43
ESC_TX0_DATA2 GPIO89	ESC_TX0_DATA1 GPIO88
<GND_HV>	<GND_HV>
ESC_TX0_DATA3 GPIO90	ESC_MDIO_CLK GPIO46
ESC_RX0_DATA2 GPIO82	ESC_TX0_ENA GPIO84
<GND_HV>	<GND_HV>
ESC_RX0_DATA0 GPIO80	ESC_RX0_DATA1 GPIO81
ESC_PHY_CLK GPIO154	ESC_RX0_DATA3 GPIO83
<GND_HV>	<GND_HV>
ESC_PHY0_LINKSTATUS GPIO86	ESC_RX0_CLK GPIO77
ESC_TX0_DATA0 GPIO87	<GND_HV>
<GND_HV>	ESC_RX1_ERR GPIO71
ESC_RX1_ERR GPIO71	ESC_RX1_CLK GPIO69

ERM5-075-05.0-L-DV-K-TR

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Sheet: /Connector Bottom - Page 5/

File: Connector\_Bottom.kicad\_sch

**Title: LCB-CCB-01: Control Board - Debugger XDS100 / JTAG**

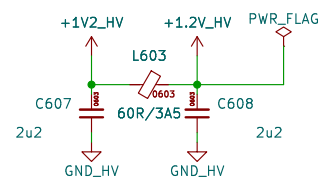
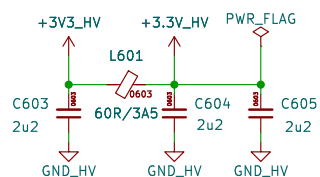
Size: A4 Date: 2025-02-21

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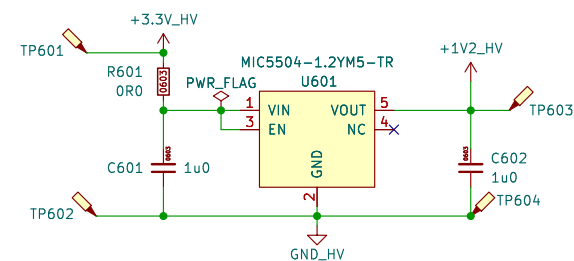
Rev: 1.1.0

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## Ferrit Beads

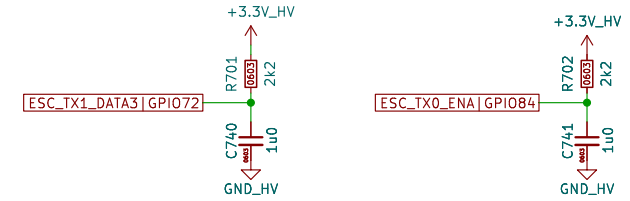


## LDO 1.2V for MCU Core

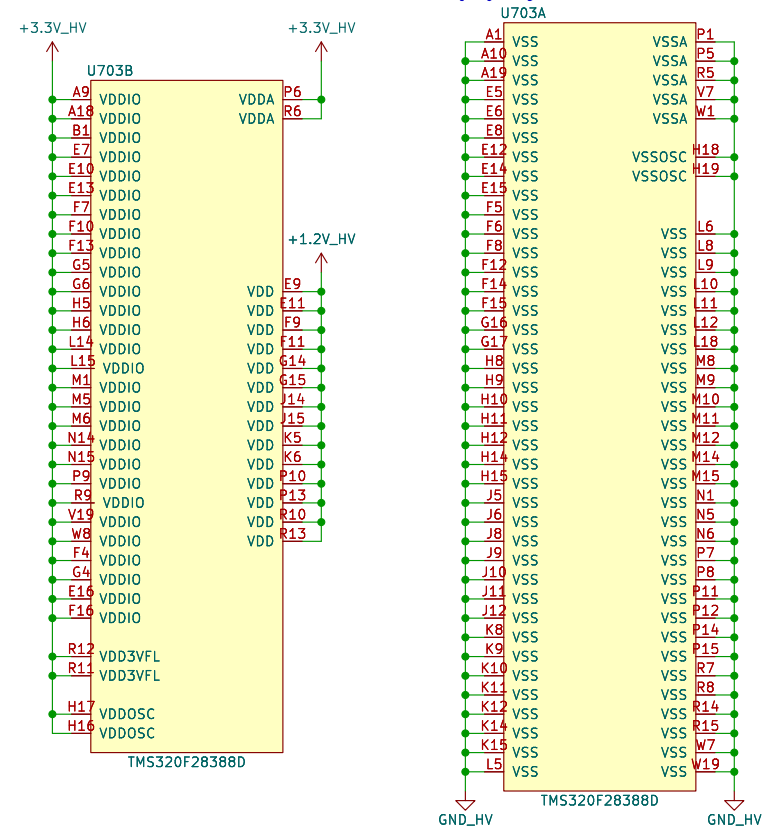
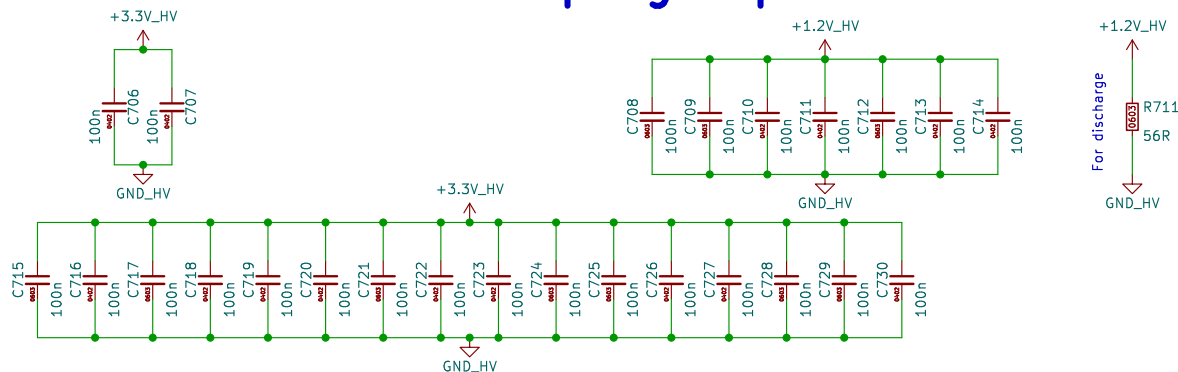
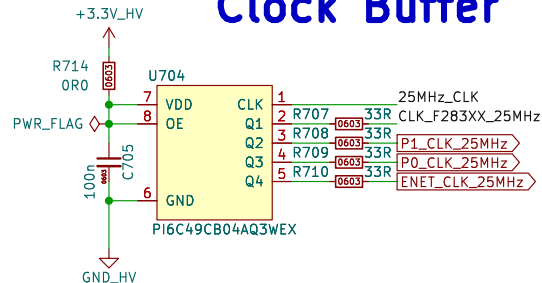




## Boot Mode Pins

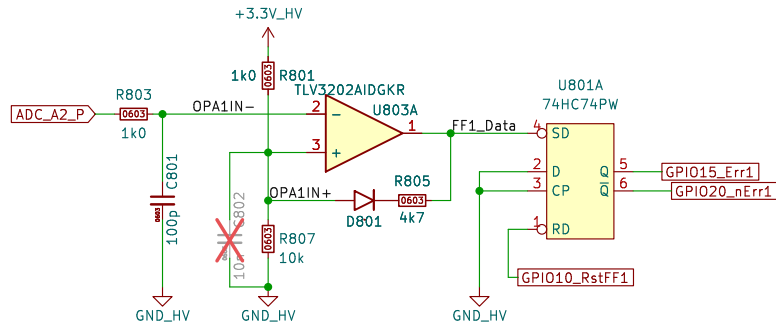


## Clock Buffer

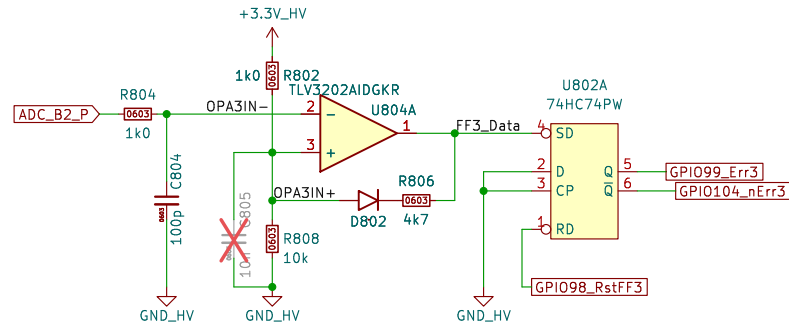


Id: 7/11

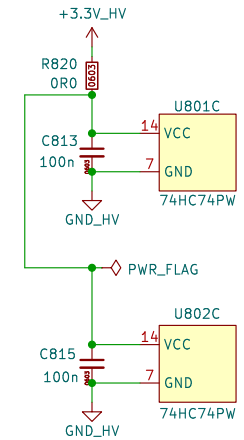
## Error1 – A2



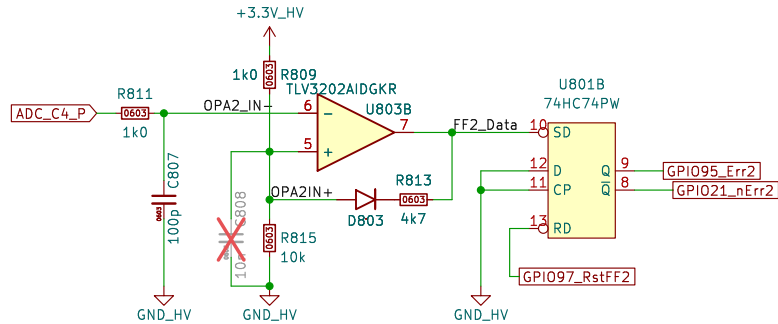
## Error3 – B2



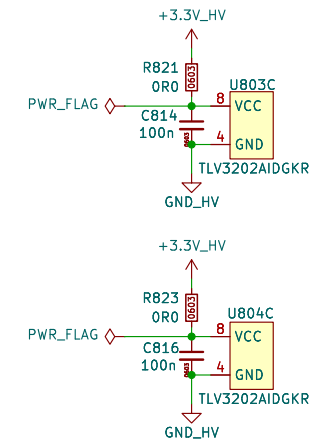
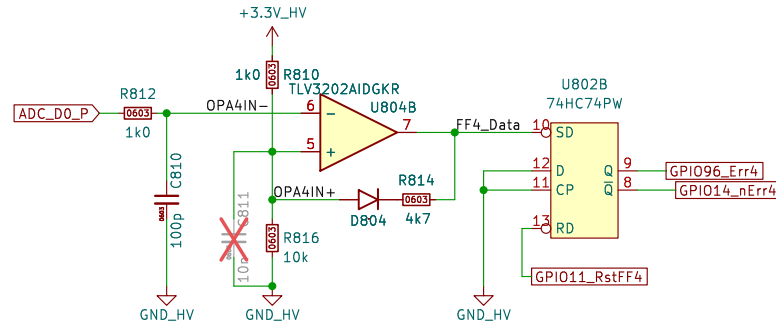
## Power Supply



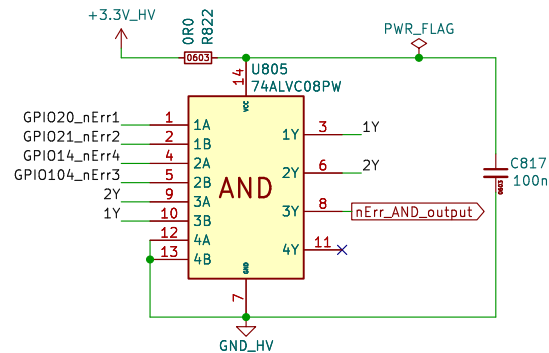
## Error2 – C4



## Error4 – D0



## Error AND Gate



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Sheet: /Error Detection – Page 8/

File: ErrorcComparator.kicad\_sch

Title: LCB-CCB-01: Control Board – Debugger XDS100 / JTAG

Size: A4 Date: 2025-02-21

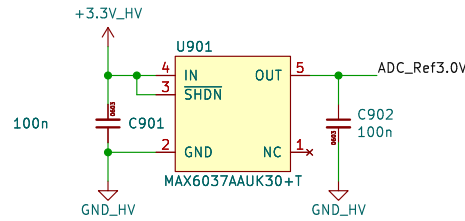
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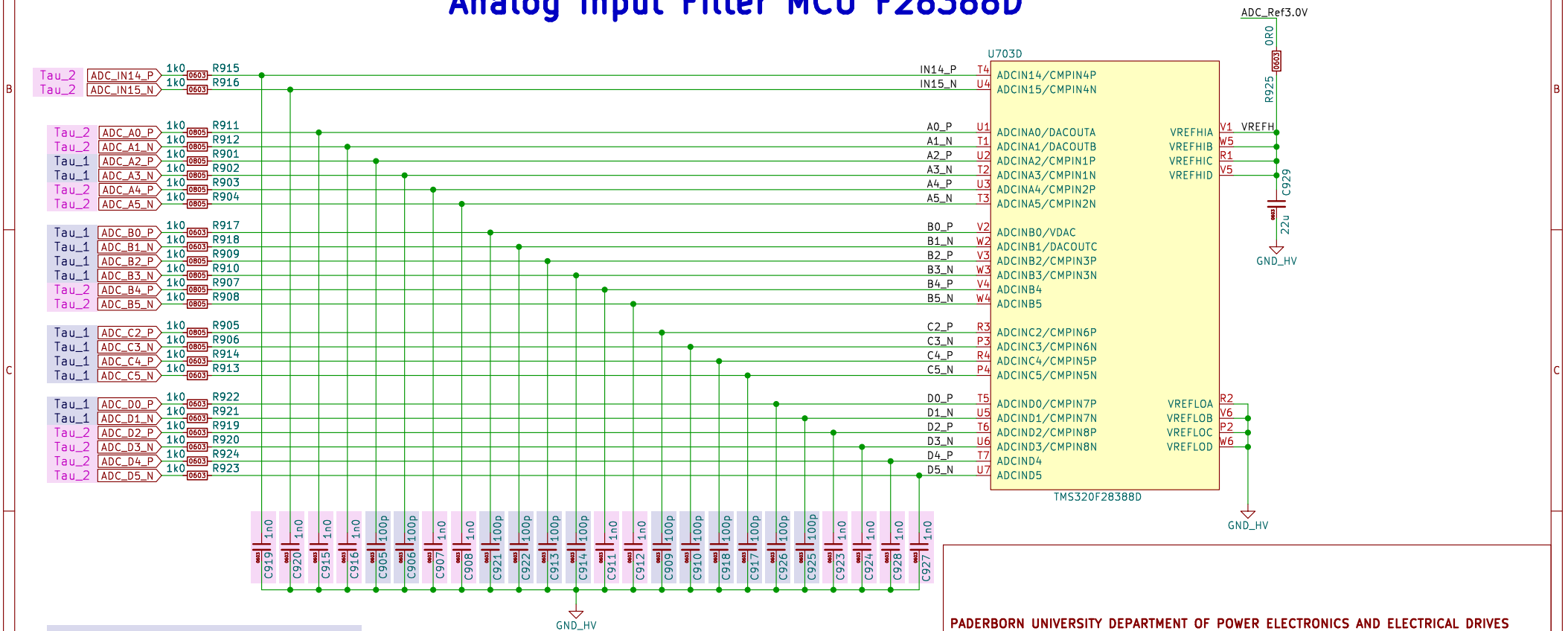
Id: 8/11



## 3V Reference Voltage



## Analog Input Filter MCU F28388D



$$\text{Tau}_1 = 100\text{ns} = 1\text{k}\Omega \cdot 100\text{pF}$$

$$\text{Tau}_2 = 1\mu\text{s} = 1\text{k}\Omega \cdot 1\text{nF}$$

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Sheet: /Analog Filter - Page 9/

File: AnalogFilter.kicad\_sch

**Title: LCB-CCB-01: Control Board - Debugger XDS100 / JTAG**

Size: A4

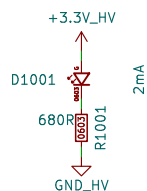
Date: 2025-02-21

Rev: 1.1.0

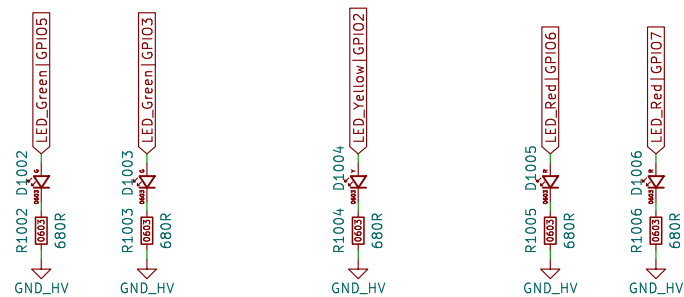
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Id: 9/11

## Power LED



## Status LEDs



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Sheet: /Status LEDs – Page 10/

File: LEDS.kicad\_sch

**Title: LCB-CCB-01: Control Board – Debugger XDS100 / JTAG**

Size: A4

Date: 2025-02-21

Rev: 1.1.0

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## F28388D MCU GPIO Configuration

