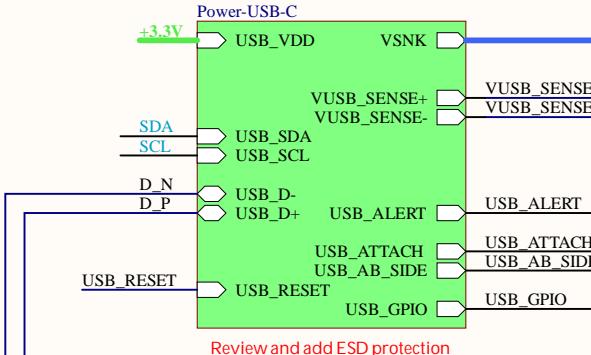
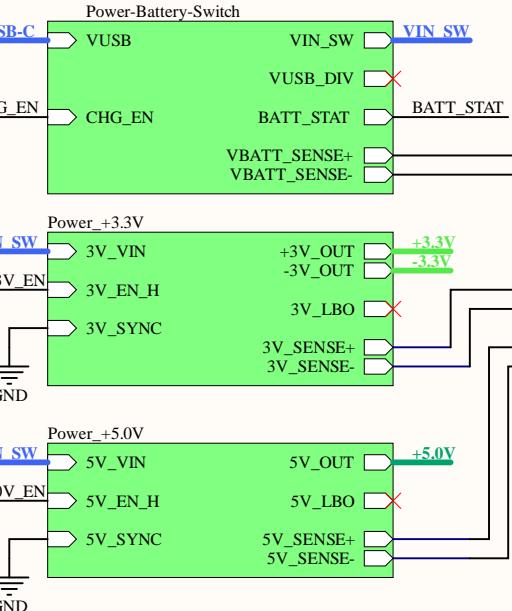


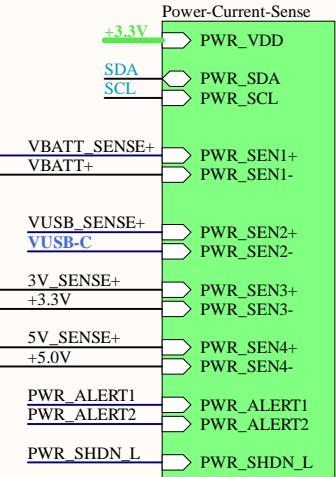
# USB-C Power Delivery



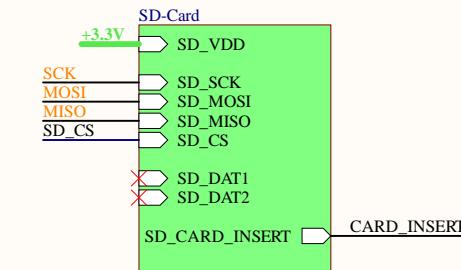
# Power Selection



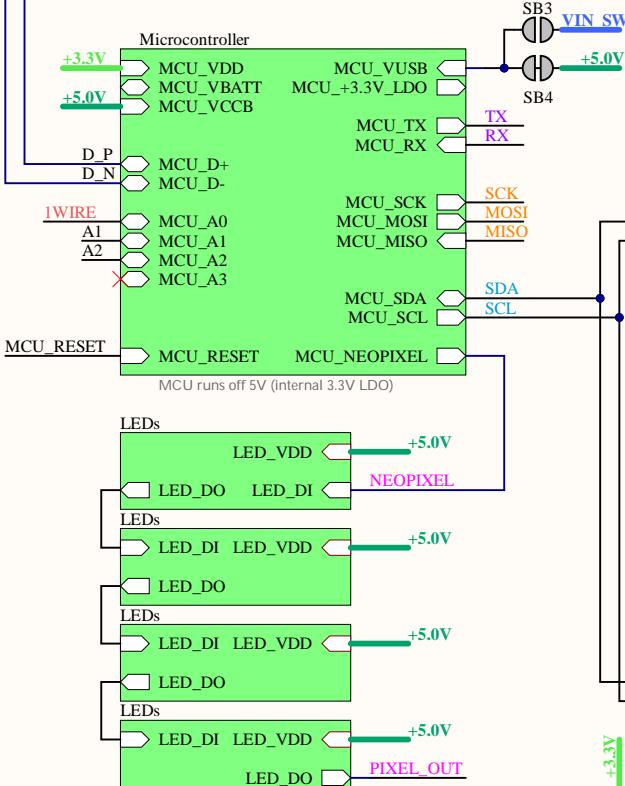
# Power Measurement



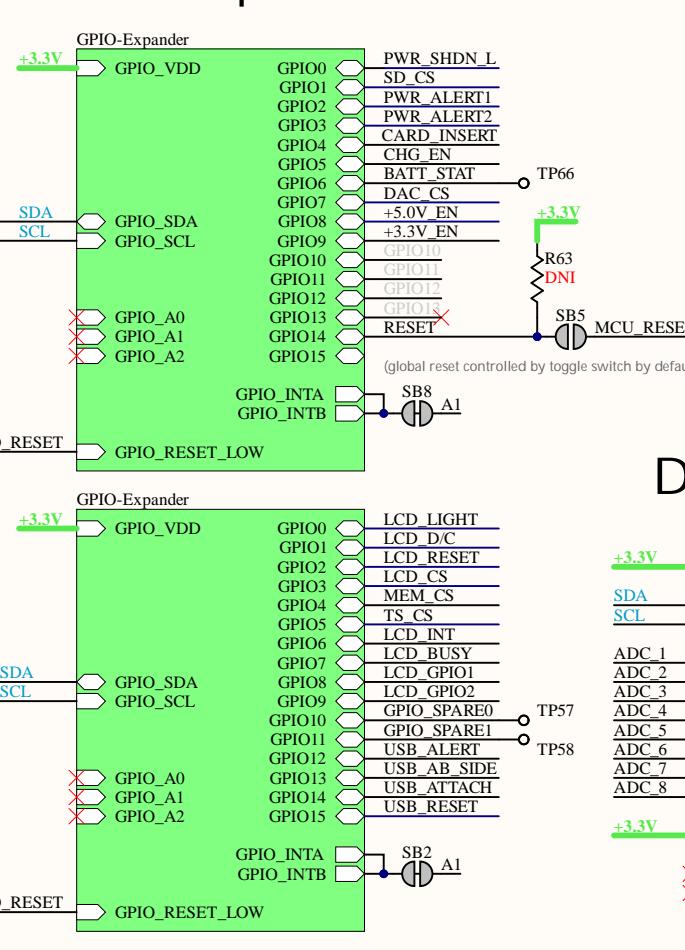
# SD-Card



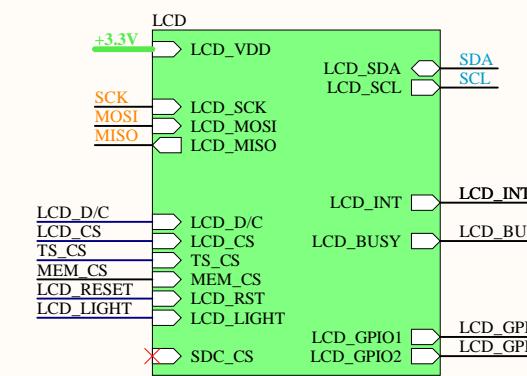
# Wireless MCU



# GPIO Expanders



# LCD Connector



(Global Reset)

(board 1 EN)

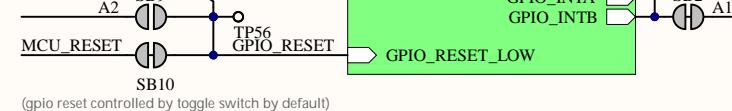
(Board 2 EN)

(Board 3 EN)

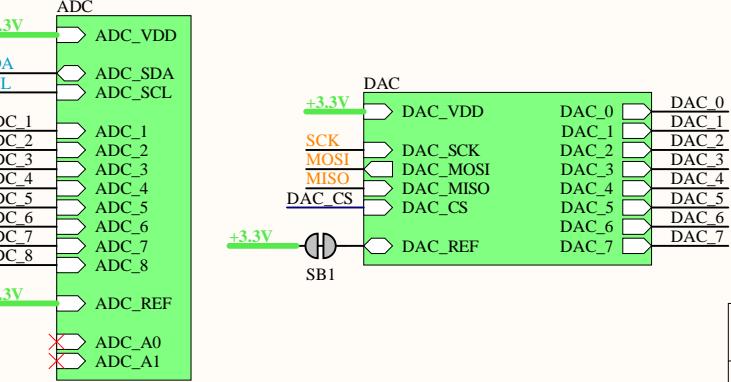
(NC)

(Out to next board)

# NeoPixel LEDs



# Digital/Analog Converters



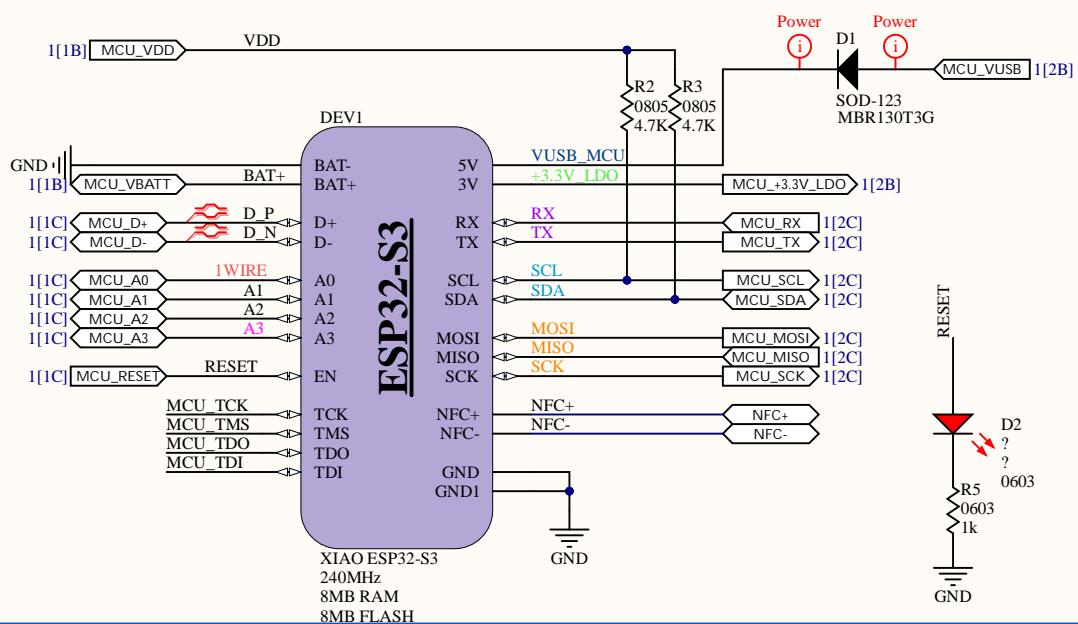
(Top)

(Bot)

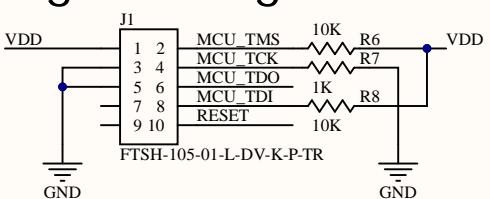
F1 F2 F3  
Circular Fiducial  
2mm  
(Fiducial markers)

Title			Revision
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B			
Date:	8/26/2023	Sheet of	
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# ESP32-S3 Wireless MCU



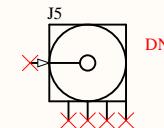
## Programming Header



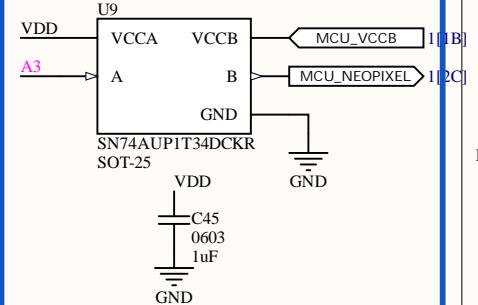
## Test Points

TP3	MOSI	TP4	BAT+
TP5	MISO	TP5	VUSB MCU
TP7	SCK	TP6	+3.3V LDO
TP13	1WIRE	TP8	RESET
TP15	A1	TP10	RX
TP17	A2	TP12	TX
TP19	A3	TP14	SCL
TP21	GND	TP16	SDA
TP33	NFC+	TP18	GND
TP47	NFC-	TP20	GND

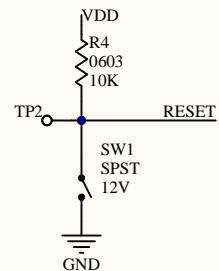
## RF Connector



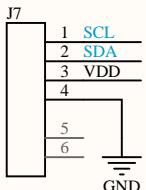
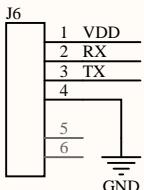
## Level Translator



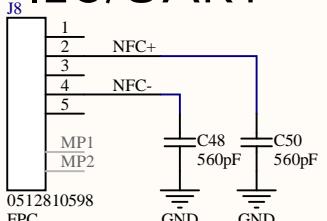
## Reset Switch



## I2C/UART



## I2C/UART



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Number

Revision

Date:

8/26/2023

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File:

C:\Users\...\Microcontroller.SchDoc

Drawn By:

# Power Sensing

**EQUATION 5-2: CALCULATING R<sub>SENSE</sub>**

$$R_{SENSE} = \frac{FSR}{I_{Max}}$$

Where:

$FSR$  = Full-scale  $V_{SENSE}$  voltage input  
 $R_{SENSE}$  = External  $R_{SENSE}$  resistor value  
 $I_{Max}$  = Maximum current to measure

Full-Scale Current (FSC) can be calculated with Equation 5-3.

**EQUATION 5-1: BUS VOLTAGE**

$$V_{SOURCE} = \frac{V_{BUS}}{\text{Denominator}}$$

Where:

$V_{SOURCE}$  = The measured voltage on the SENSE+ pin  
 $V_{BUS}$  = The value read from the  $V_{BUS}$  results registers  
 $\text{Denominator}$  =  $2^{16}$  for unipolar measurements  
=  $2^{16}$  for FSR/2 measurements  
=  $2^{15}$  for bipolar measurements

**EQUATION 5-3: FULL-SCALE CURRENT**

$$FSC = \frac{100 \text{ mV}}{R_{SENSE}}$$

Where:

$FSC$  = Full-Scale Current  
 $R_{SENSE}$  = External sense resistor value

The actual current through  $R_{SENSE}$  can then be calculated using Equation 5-4.

**EQUATION 5-4: SENSE CURRENT**

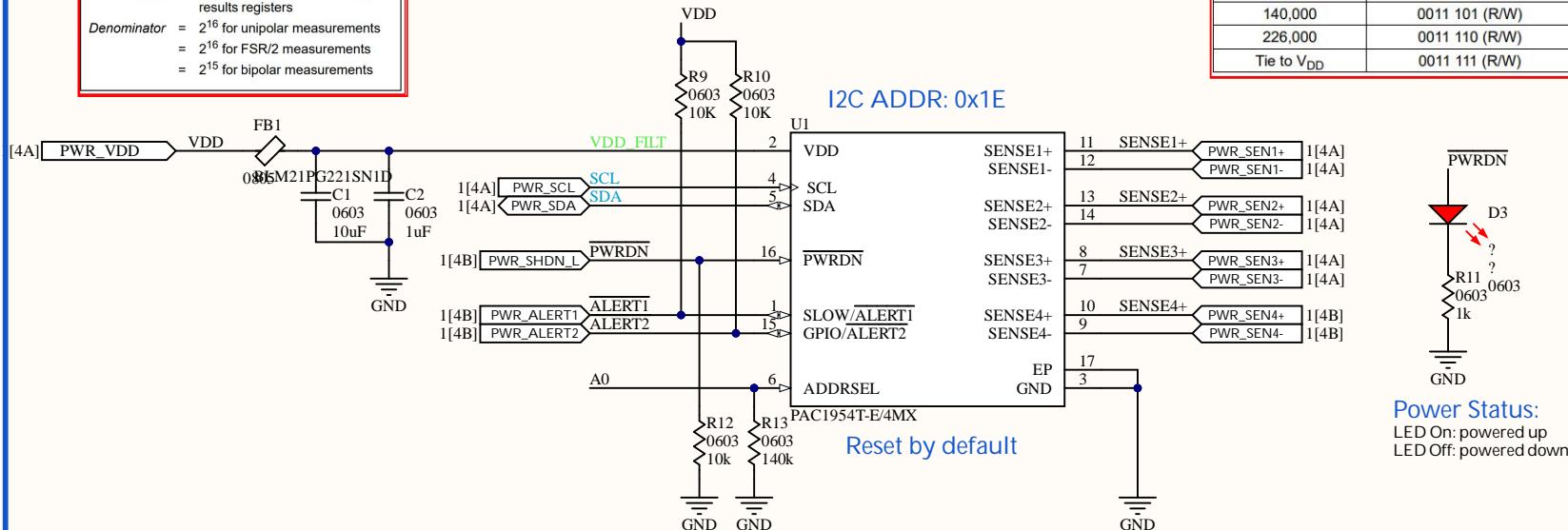
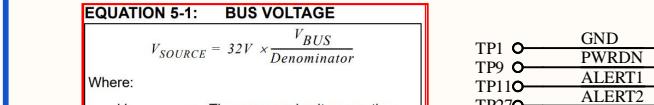
$$I_{SENSE} = FSC \times \frac{V_{SENSE}}{\text{Denominator}}$$

Where:

$I_{SENSE}$  = Actual bus current  
 $FSC$  = Full-Scale Current value (from Equation 5-3)  
 $V_{SENSE}$  = The value read from the  $V_{SENSE}$  results registers  
 $\text{Denominator}$  =  $2^{16}$  for unipolar measurements  
=  $2^{16}$  for FSR/2 measurements  
=  $2^{15}$  for bipolar measurements

**TABLE 6-1: ADDRESS SELECT RESISTOR**

RESISTOR (1%)	SMBus Address
0 (GND)	0010 000 (R/W)
499	0010 001 (R/W)
806	0010 010 (R/W)
1,270	0010 011 (R/W)
2,050	0010 100 (R/W)
3,240	0010 101 (R/W)
5,230	0010 110 (R/W)
8,450	0010 111 (R/W)
13,300	0011 000 (R/W)
21,500	0011 001 (R/W)
34,000	0011 010 (R/W)
54,900	0011 011 (R/W)
88,700	0011 100 (R/W)
140,000	0011 101 (R/W)
226,000	0011 110 (R/W)
Tie to $V_{DD}$	0011 111 (R/W)



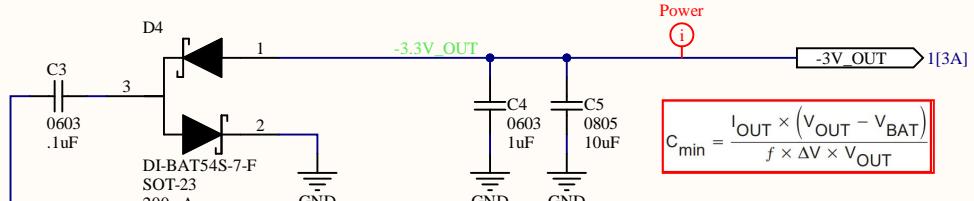
Title

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File:	C:\Users\...\Power-Current-Sense.SchDoc	Drawn By:

# +3.3V Power Supply

$$L = \frac{V_{BAT} \times (V_{OUT} - V_{BAT})}{\Delta I_L \times f \times V_{OUT}}$$

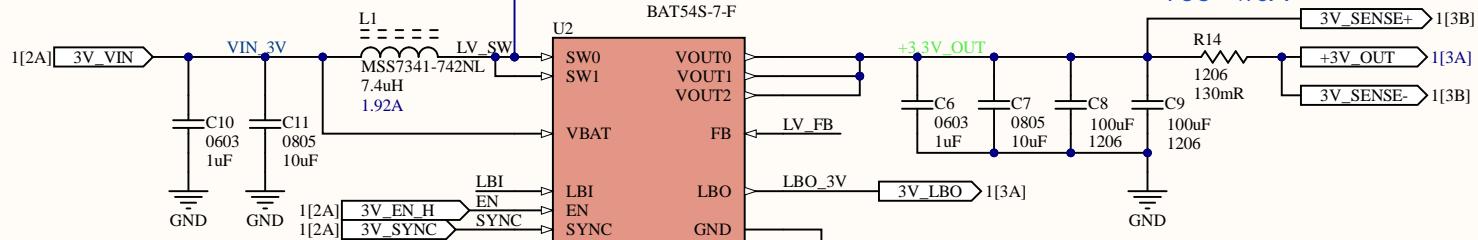
$$I_L = I_{OUT} \times \frac{V_{OUT}}{V_{BAT}} \times 0.8$$



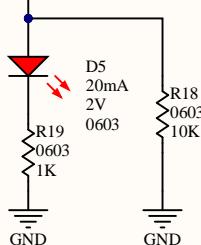
FSC = .75A

## Test Points

TP22	+3.3V_OUT
TP23	-3.3V_OUT
TP24	EN
TP25	LV_SW
TP26	VIN_3V
TP28	GND



+3.3V Disabled by Default



$$R1 = R2 \times \left( \frac{V_{BAT}}{V_{LBI} - \text{threshold}} - 1 \right) = 390 \text{ k}\Omega \times \left( \frac{V_{BAT}}{500 \text{ mV}} - 1 \right)$$

$$R3 = R4 \times \left( \frac{V_O}{V_{FB}} - 1 \right) = 180 \text{ k}\Omega \times \left( \frac{V_O}{500 \text{ mV}} - 1 \right)$$

Title

Size  
A

Number

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File: C:\Users\...\Power\_+3.3V.SchDoc

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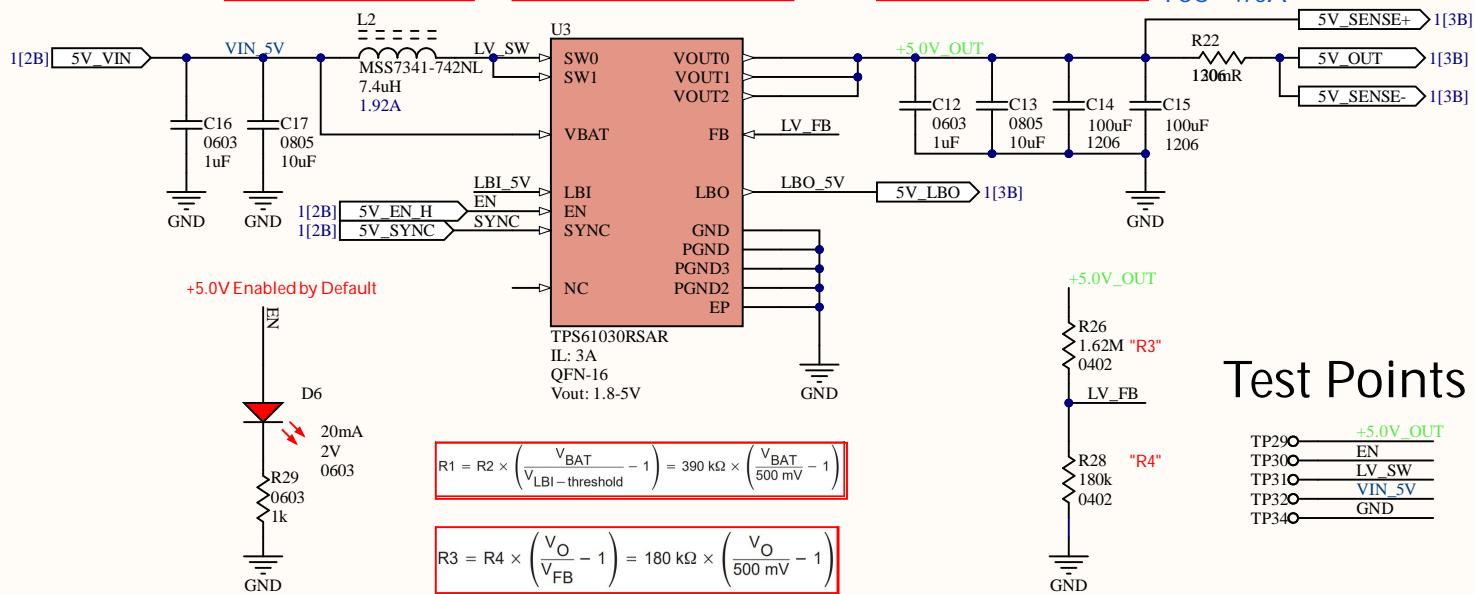
# +5.0V Power Supply

$$L = \frac{V_{BAT} \times (V_{OUT} - V_{BAT})}{\Delta I_L \times f \times V_{OUT}}$$

$$I_L = I_{OUT} \times \frac{V_{OUT}}{V_{BAT} \times 0.8}$$

$$C_{\min} = \frac{I_{\text{OUT}} \times (V_{\text{OUT}} - V_{\text{BAT}})}{f \times \Delta V \times V_{\text{OUT}}}$$

FSC = .75A



## Test Points

TP29○ +5.0V\_OUT  
TP30○ EN  
TP31○ LV\_SW  
TP32○ VIN\_5V  
TP34○ GND

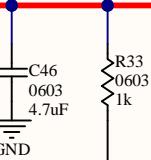
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Size A	Number	Revision
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File:	C:\Users\...\Power_+5.0V.SchDoc	Drawn By:

# USB-C Power Device Controller

A

## Test Points

TP35	VBUS
TP36	VSNK GATE
TP37	VSNK SOURCE
TP38	+1V2
TP39	+2V7
TP40	VSNK
TP41	CC1
TP42	CC2
TP43	RESET
TP44	ALERT
TP50	POK2
TP60	POK3
TP61	GND



VBUS SB15 VSNK

1[1A]

USB\_VDD

+3.3V

SB14

VDD

D10

+1V2

+2V7

BAT60A

SDA

SCL

1[1A]

USB\_SDA

1[1A]

USB\_SCL

1[1A]

USB\_RESET

1[1A]

RESET

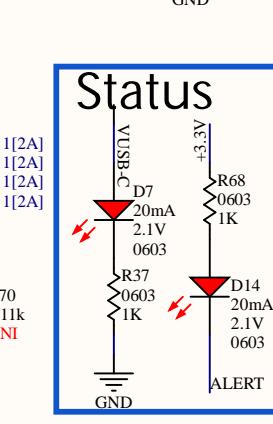
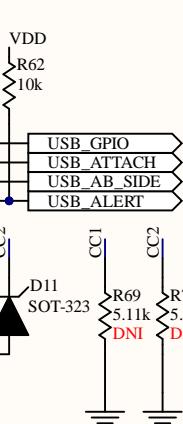
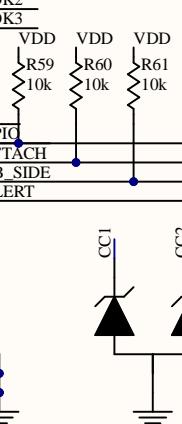
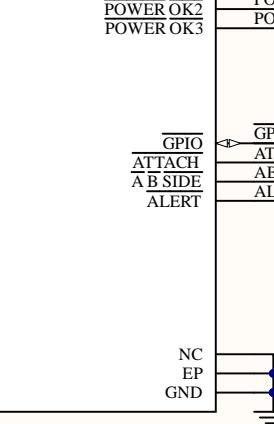
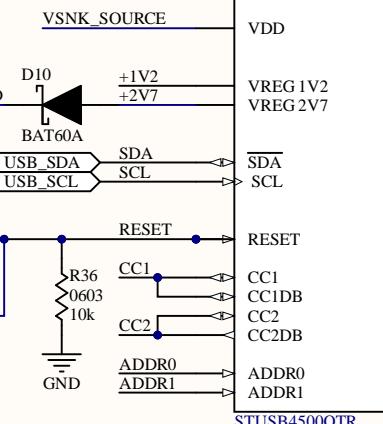
R36

0603

10k

GND

Reset



## Status

VUSB-C

A

D7 20mA 2.1V 0603

1K

R68

0603

1K

D7 20mA 2.1V 0603

1K

R68

0603

1K

GND

D14 20mA 2.1V 0603

1K

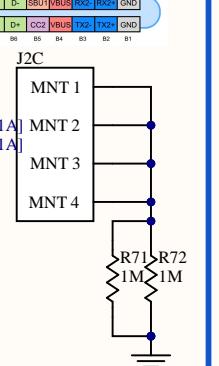
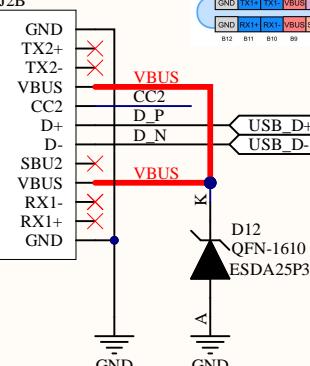
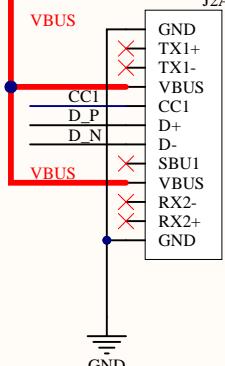
R68

0603

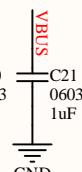
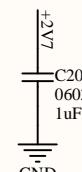
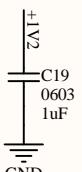
1K

GND

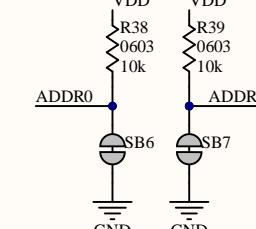
## USB-C Connector



## Decoupling



## I2C ADDR



Title

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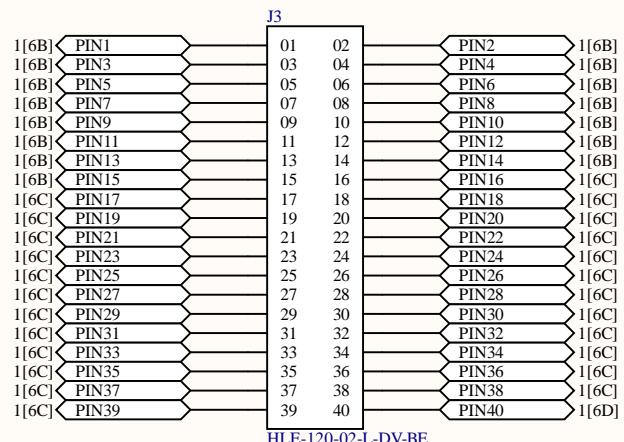
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C

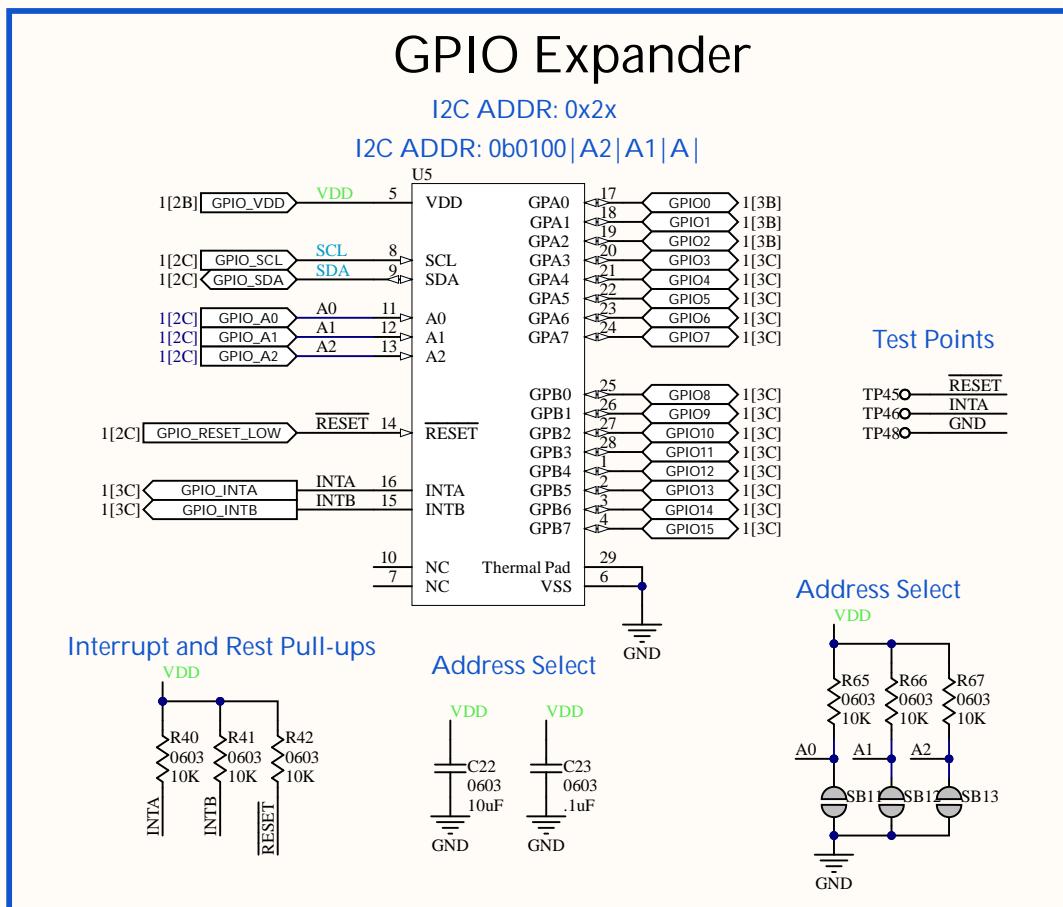
D

D

# Expansion Port

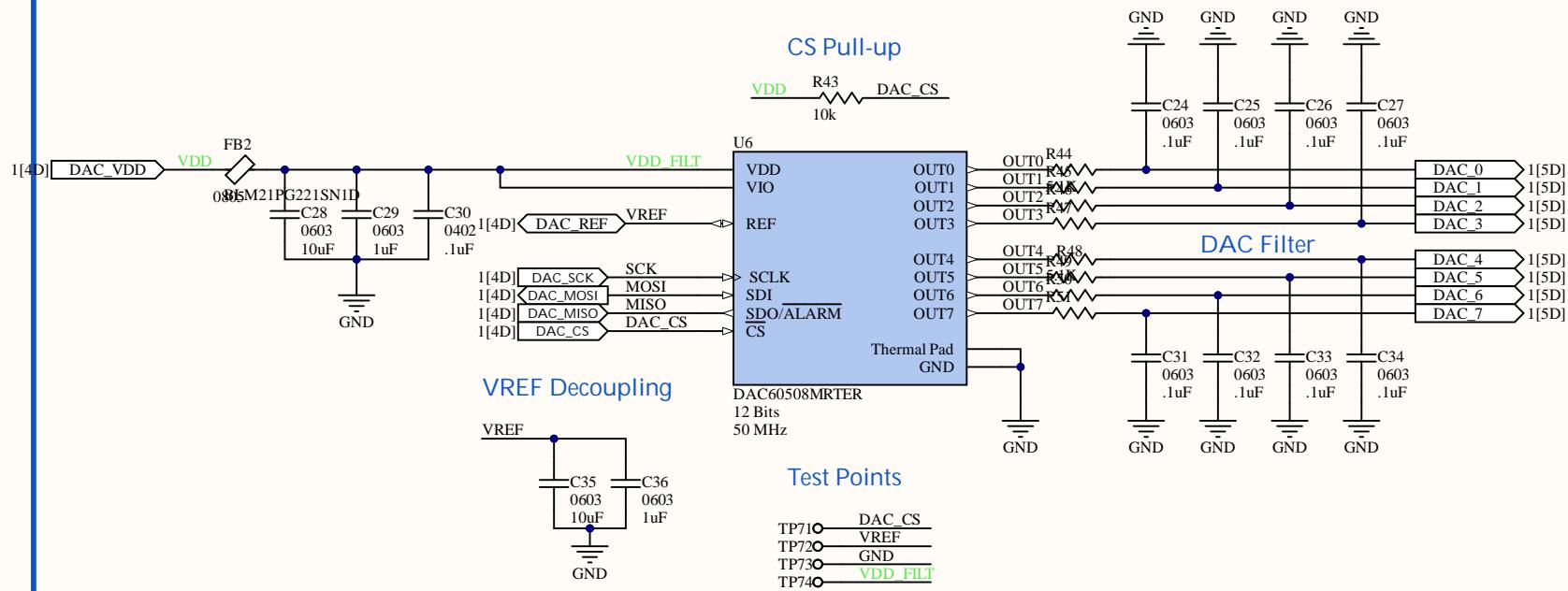


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Size	Number	Revision
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Date:	8/26/2023	Sheet of
File:	C:\Users\...\GPIO-Expander.SchDoc	Drawn By:

# Analog to Digital



A

A

B

B

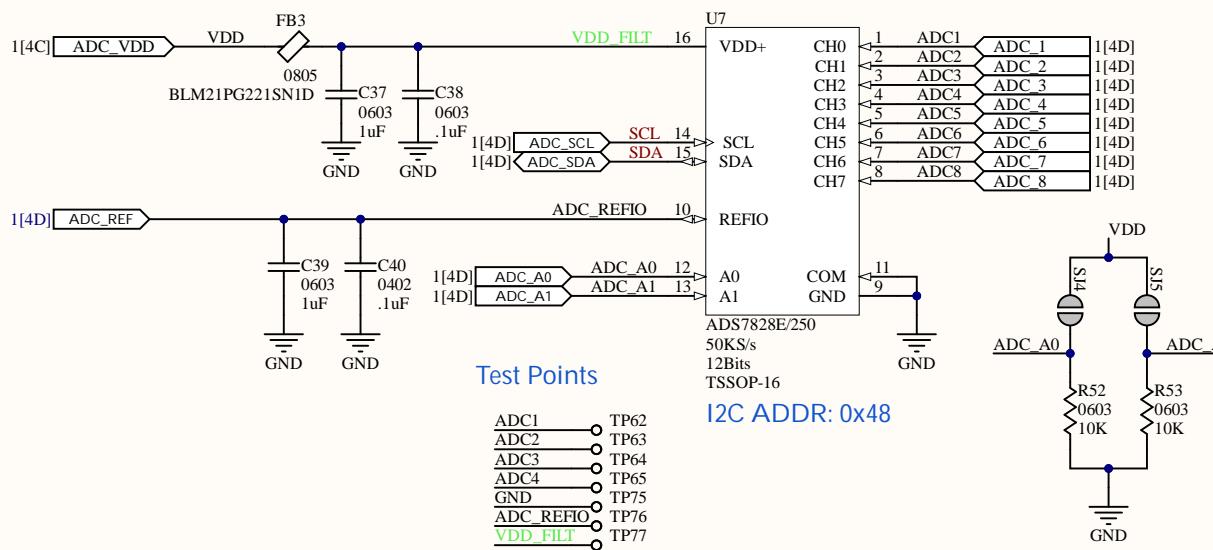
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C

D

D

# Analog to Digital



Title

Size

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Number

Revision

Date:

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Sheet of

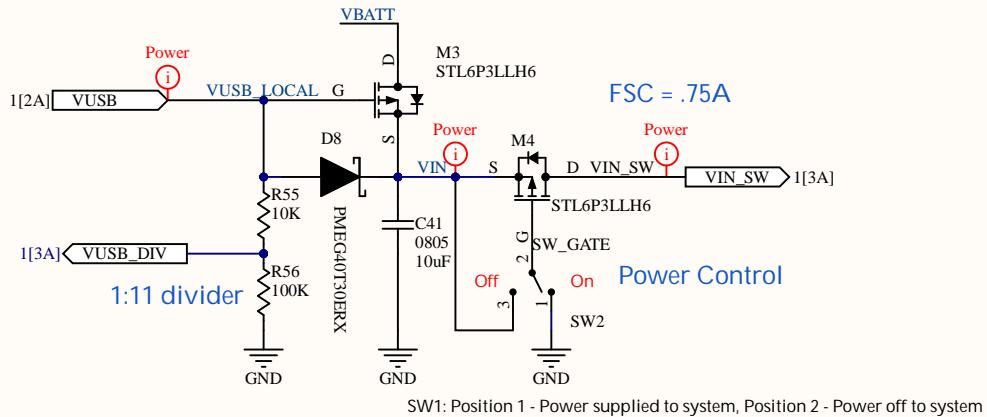
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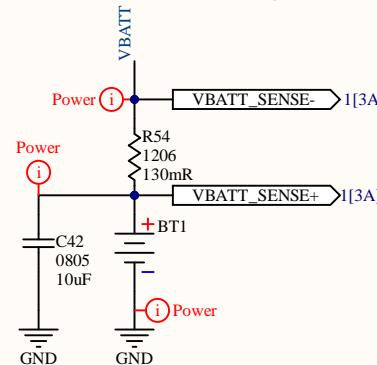
Drawn By:

# Battery, Charging and On/Off Switch

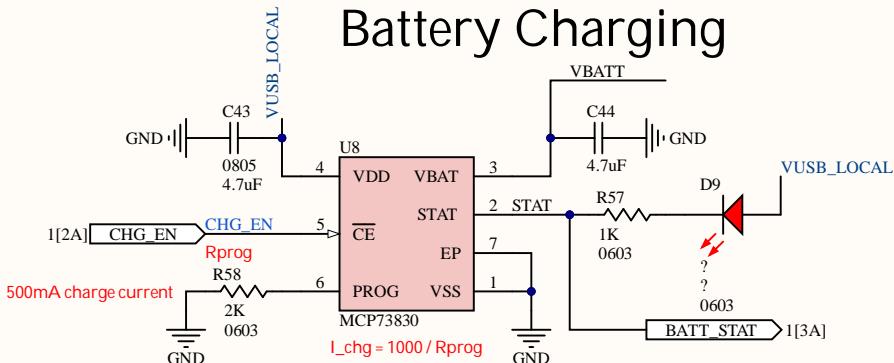
## Input Power Switch



## Li-Po Battery



## Battery Charging



## Test Points

TP49	VIN_SW
TP50	VIN
TP51	VUSB_LOCAL
TP52	VBATT
TP53	STAT
TP54	SW_GATE
TP55	GND

Title

Size

A

Number

Revision

Date:

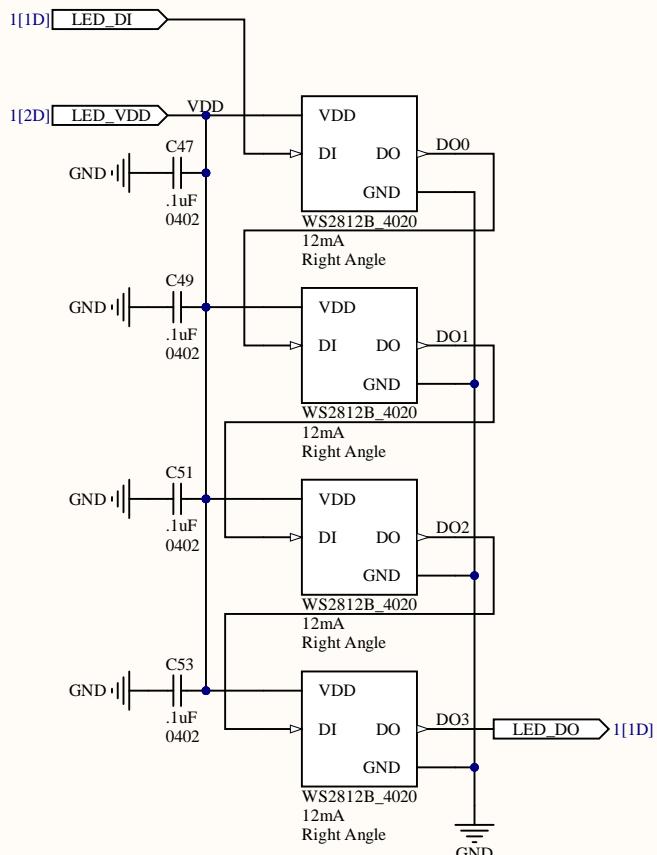
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# RGB LEDs



Title

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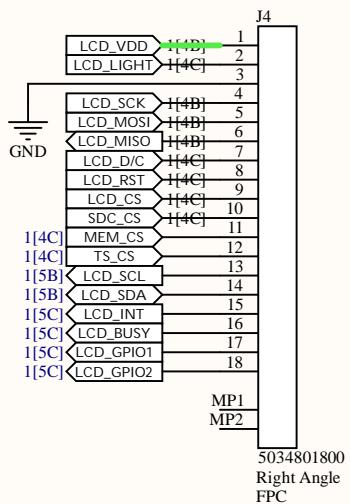
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C

D

D

# LCD Connector (Eye SPI)



Title

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A

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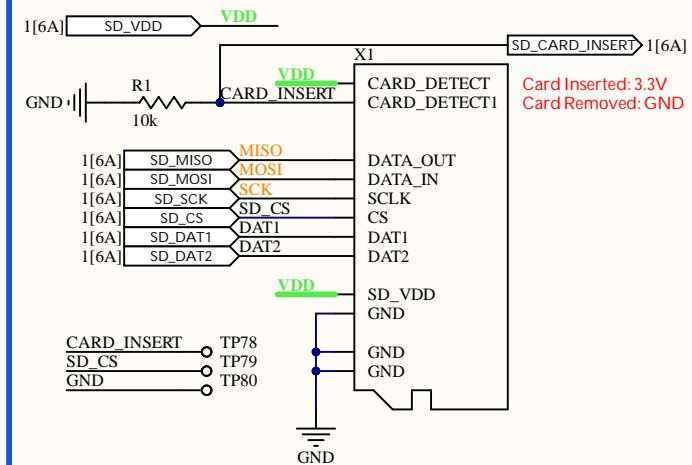
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## SD-Card Port



Title

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Number

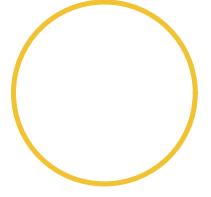
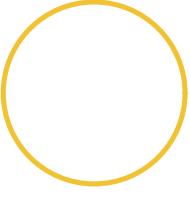
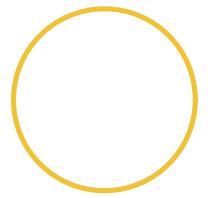
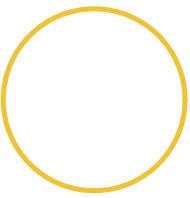
Revision

Date: 8/26/2023

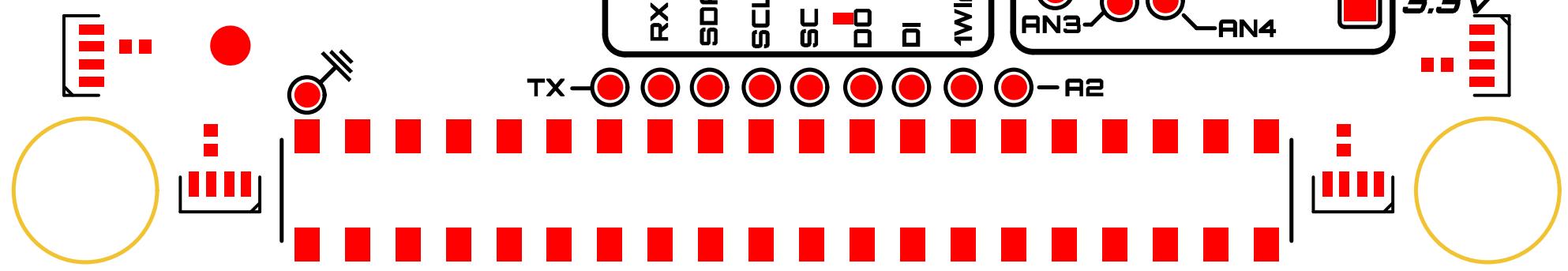
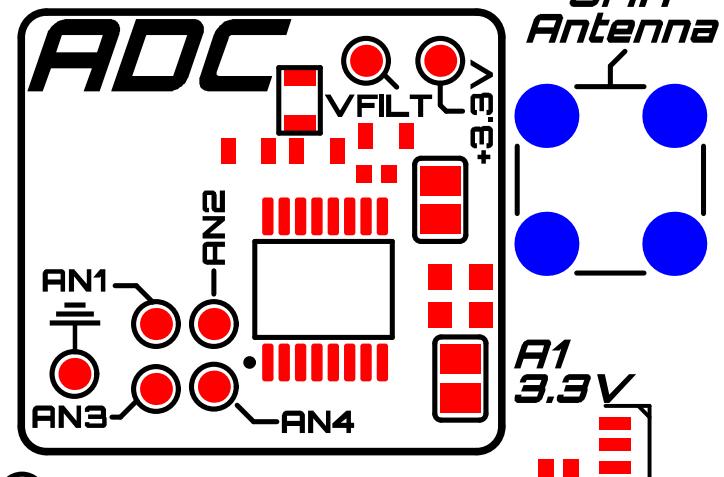
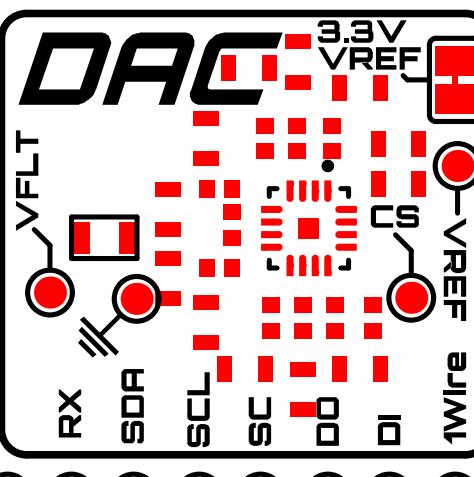
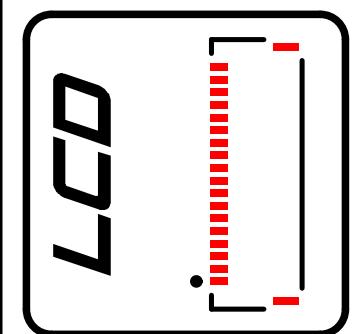
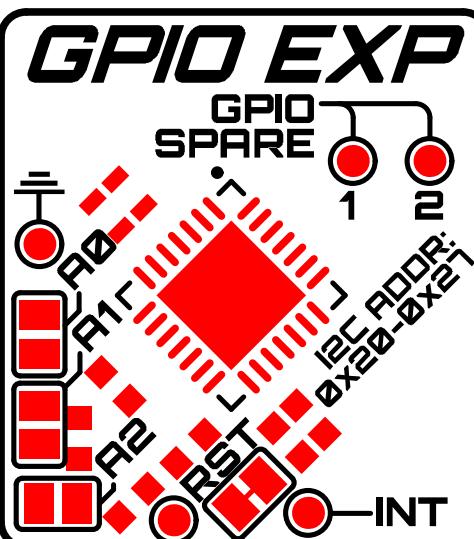
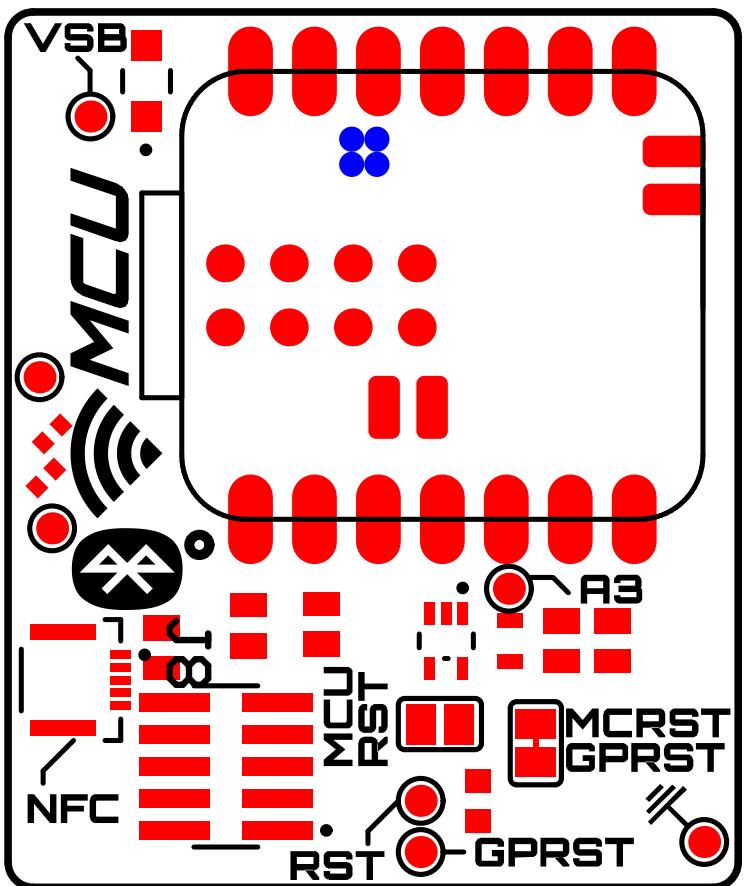
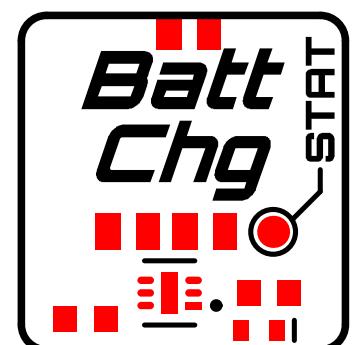
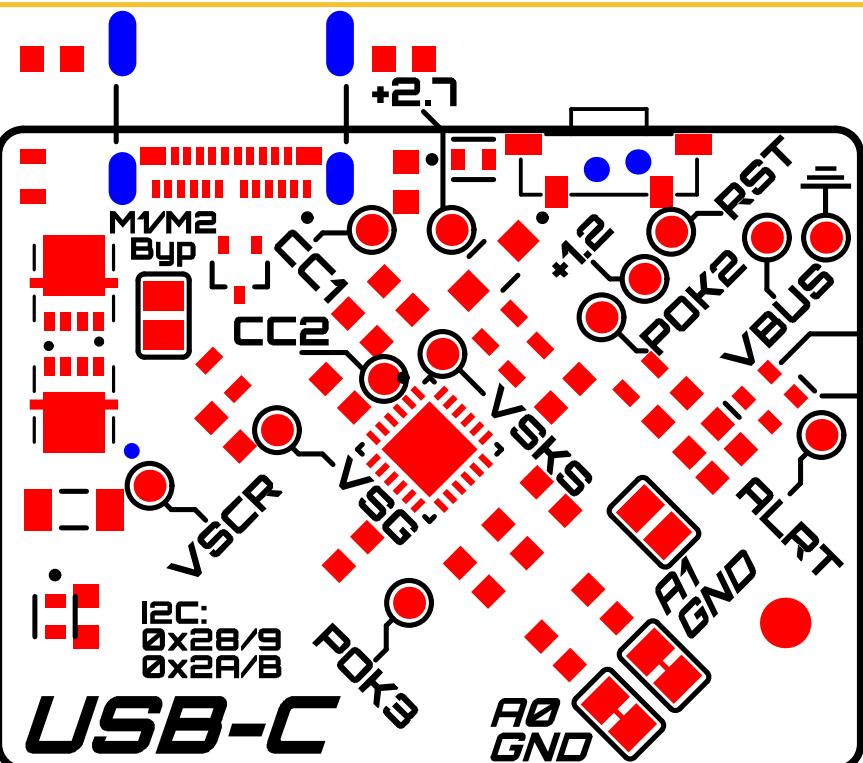
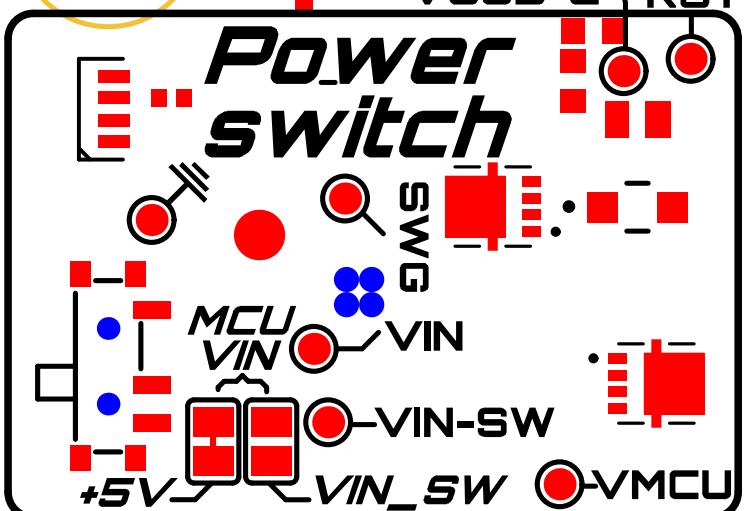
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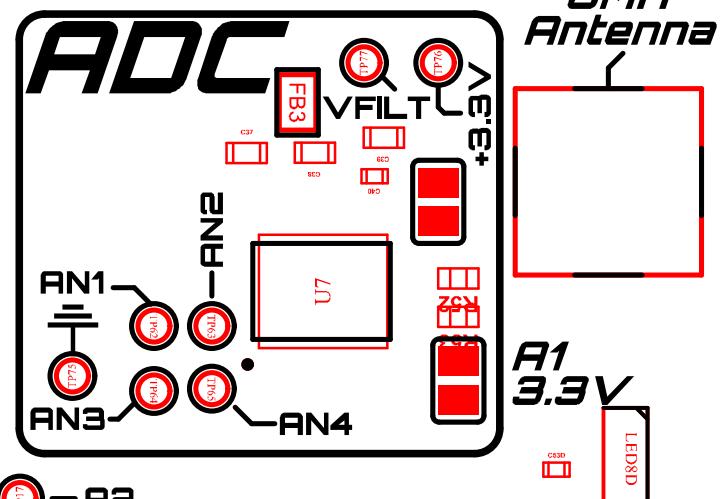
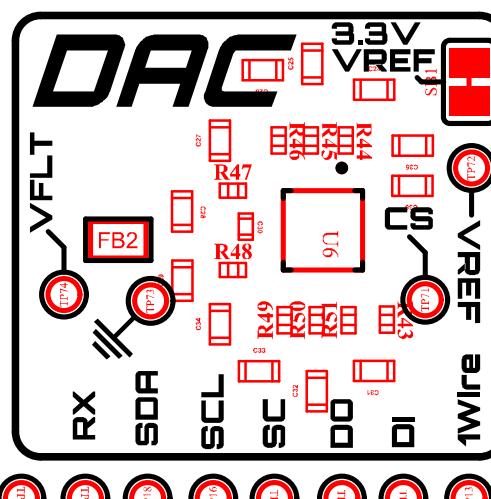
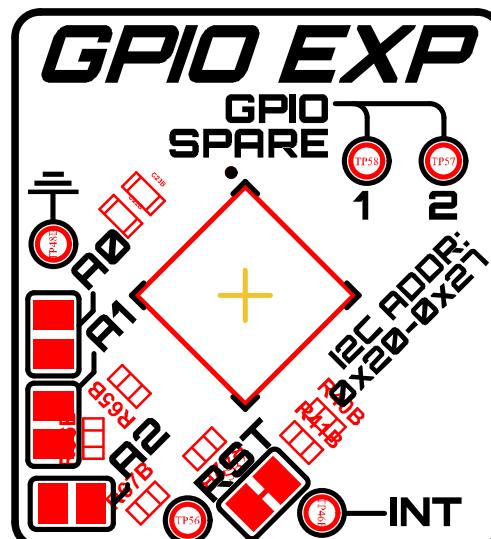
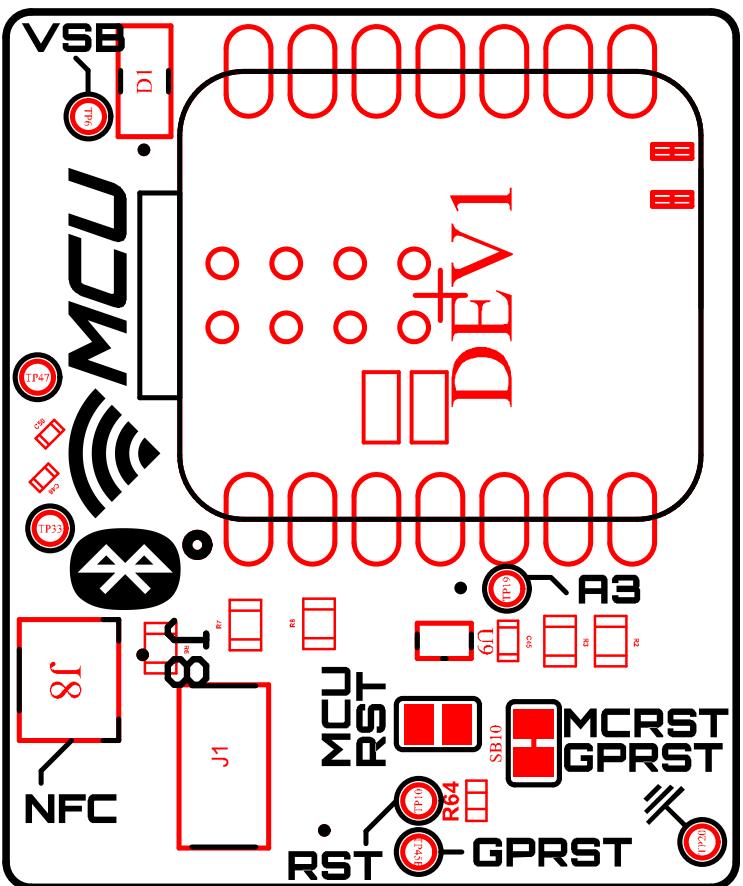
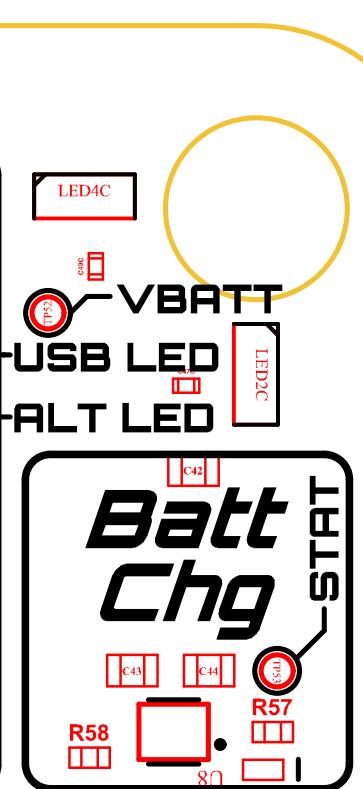
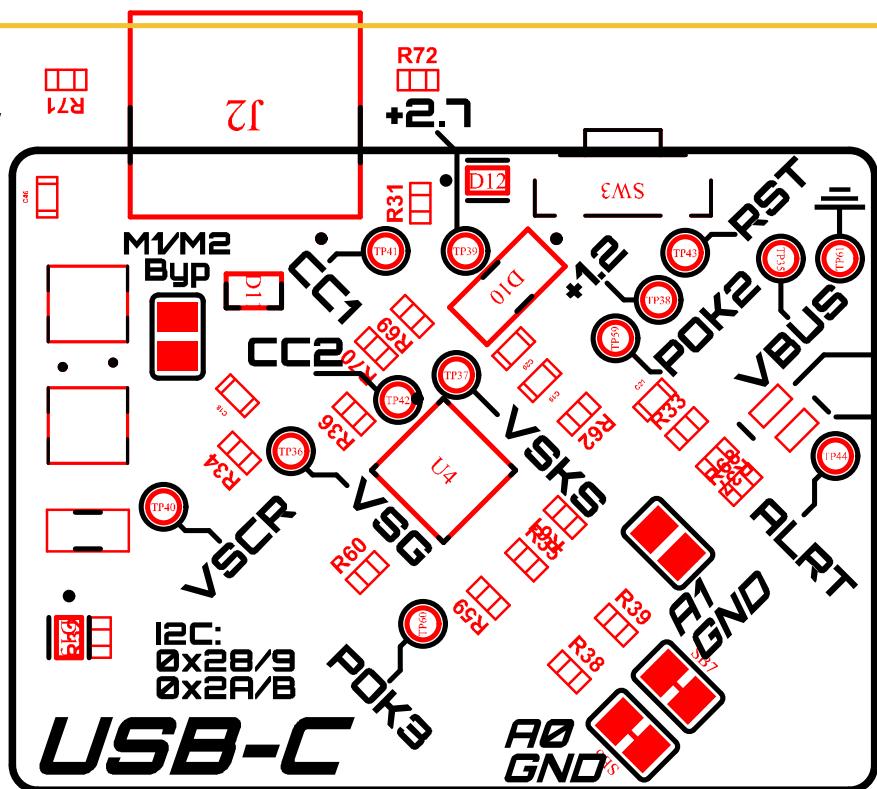
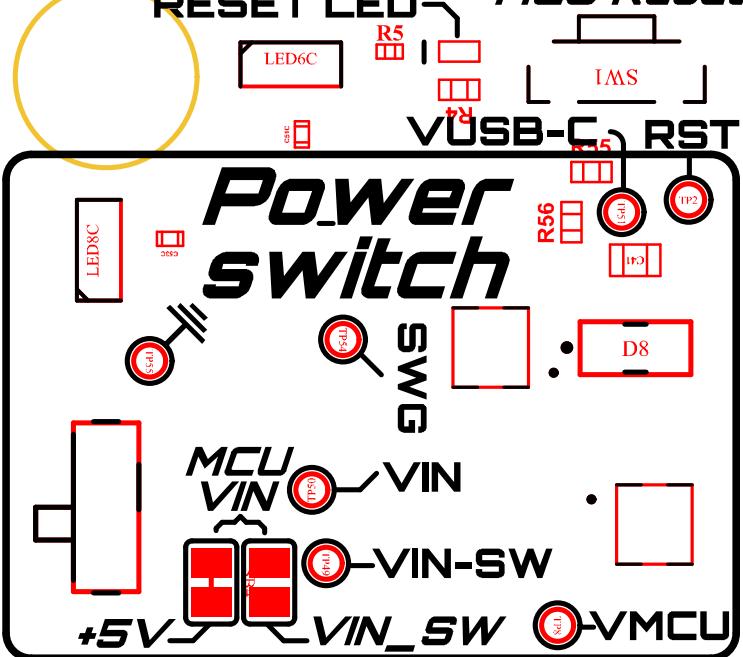
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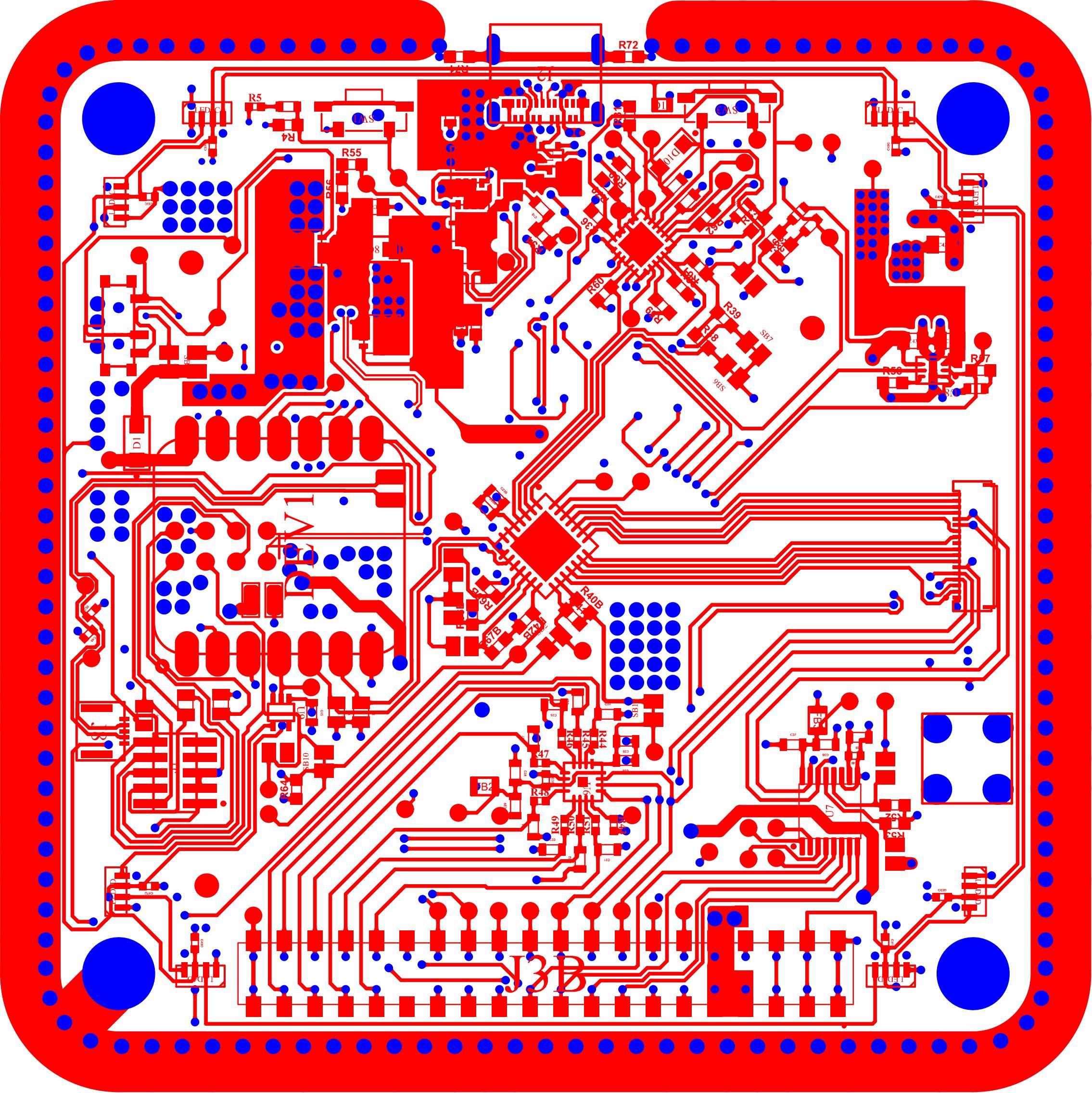
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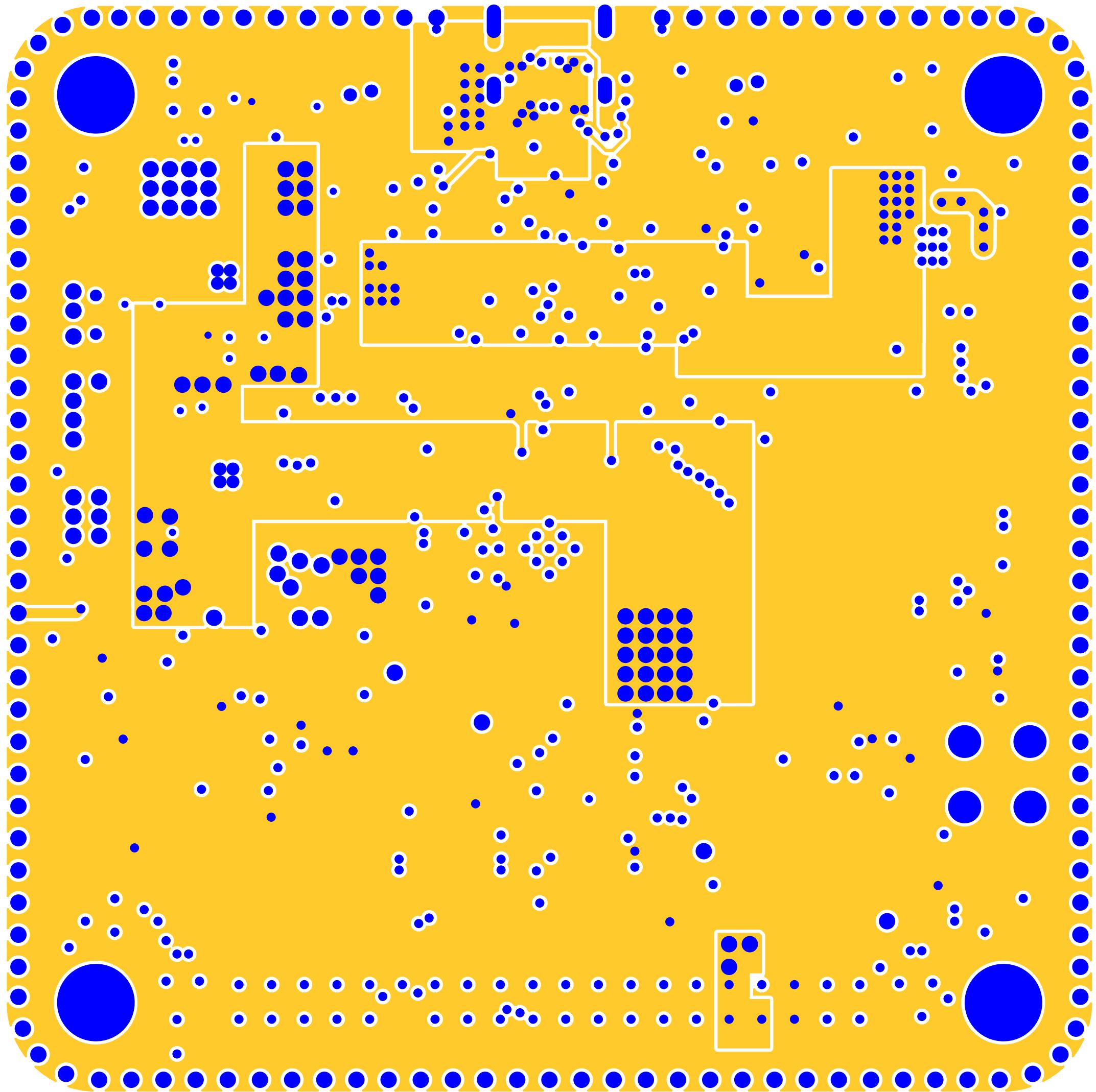


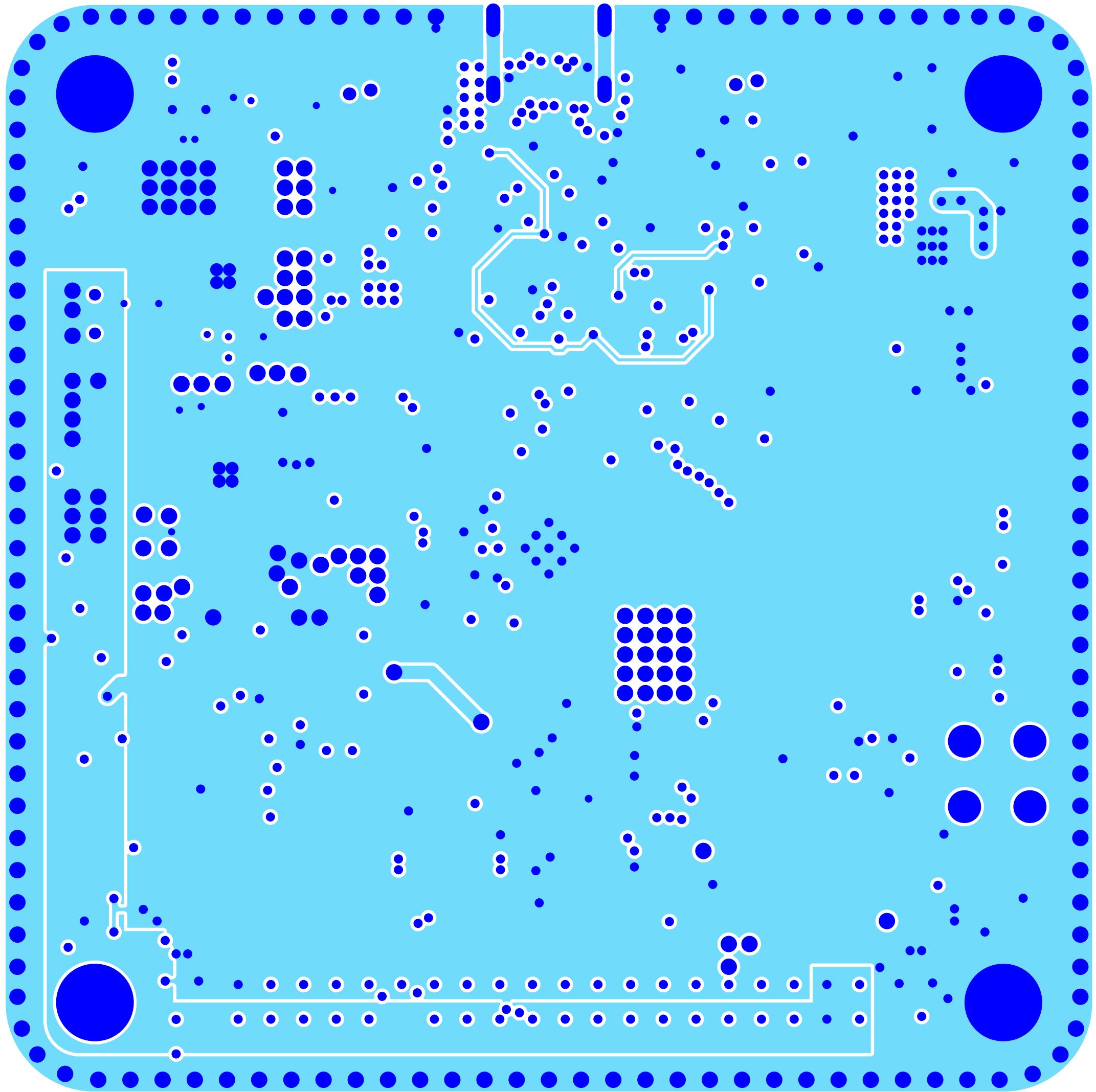
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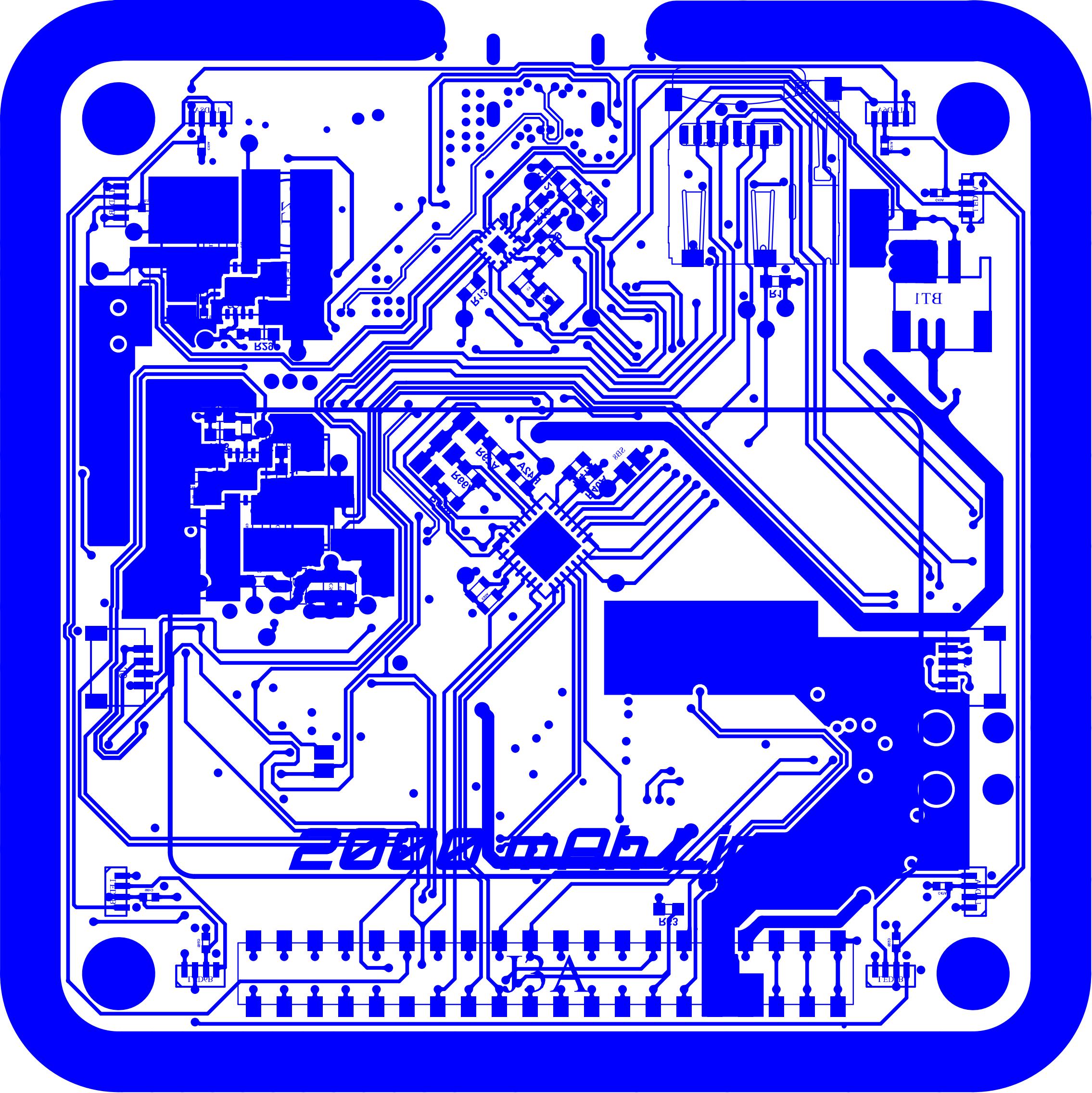


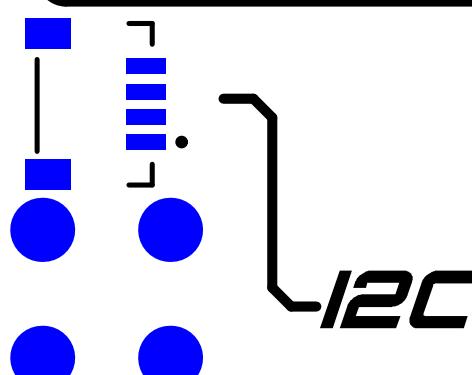
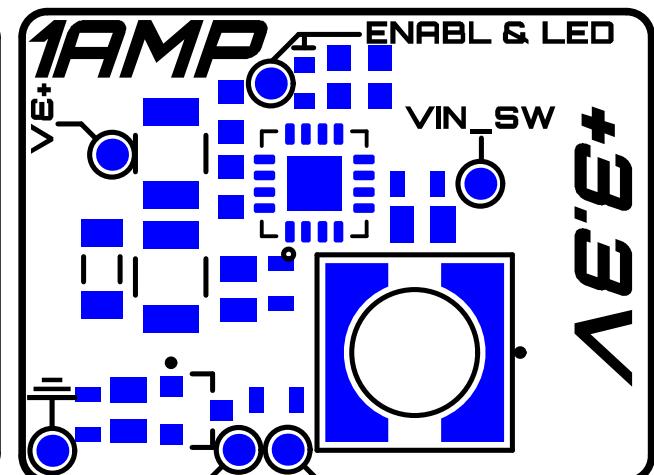
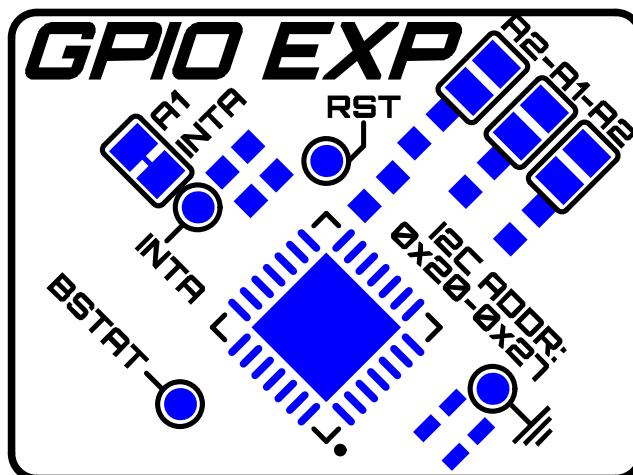
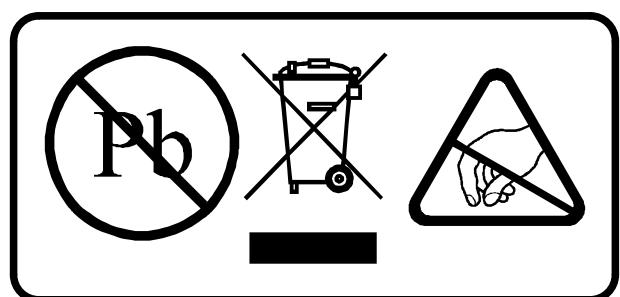
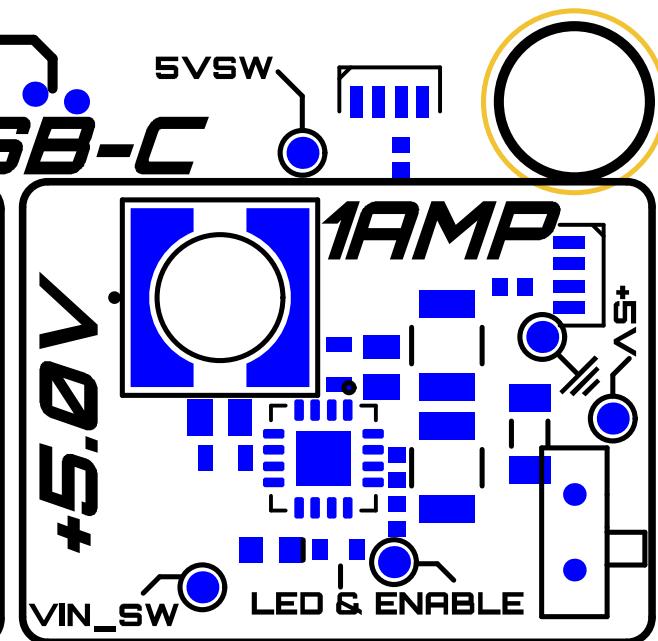
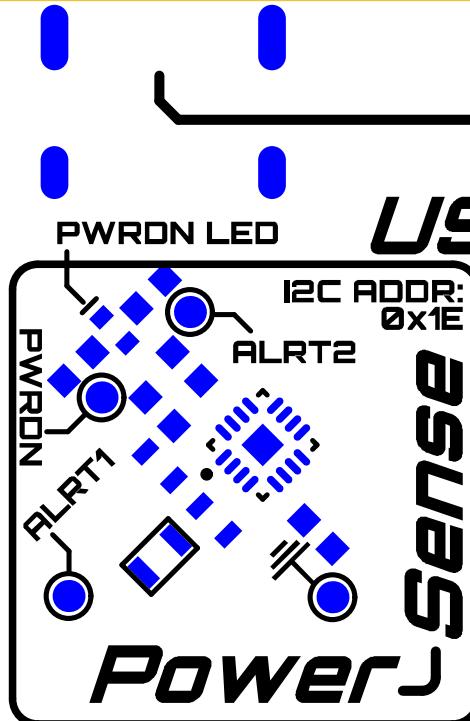
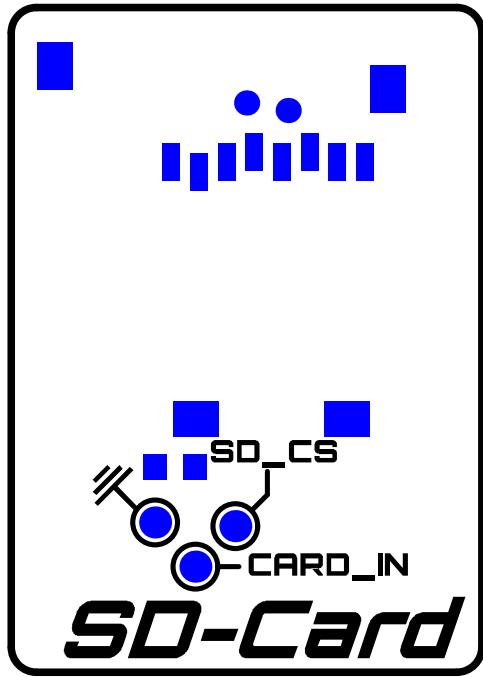
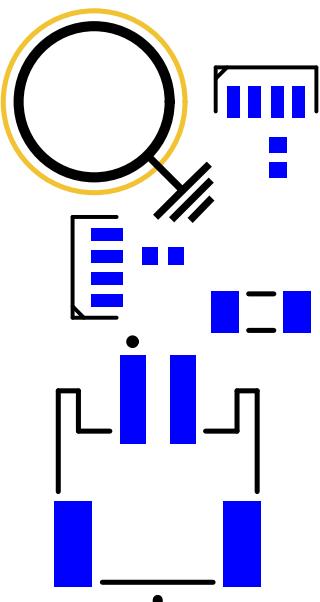




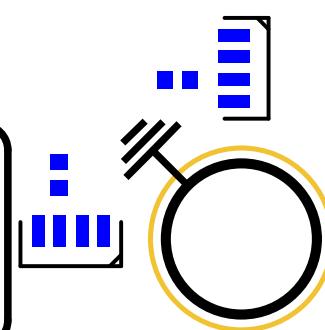
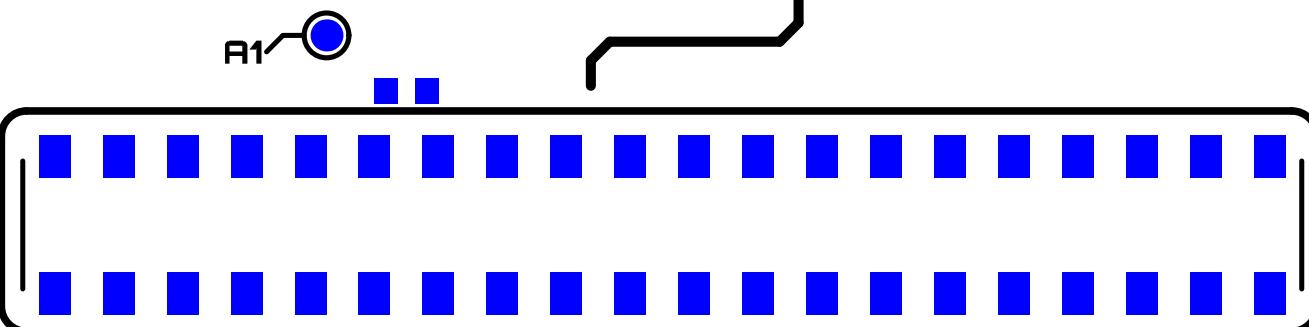
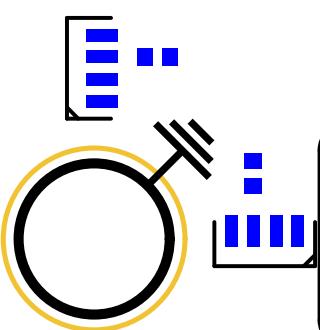


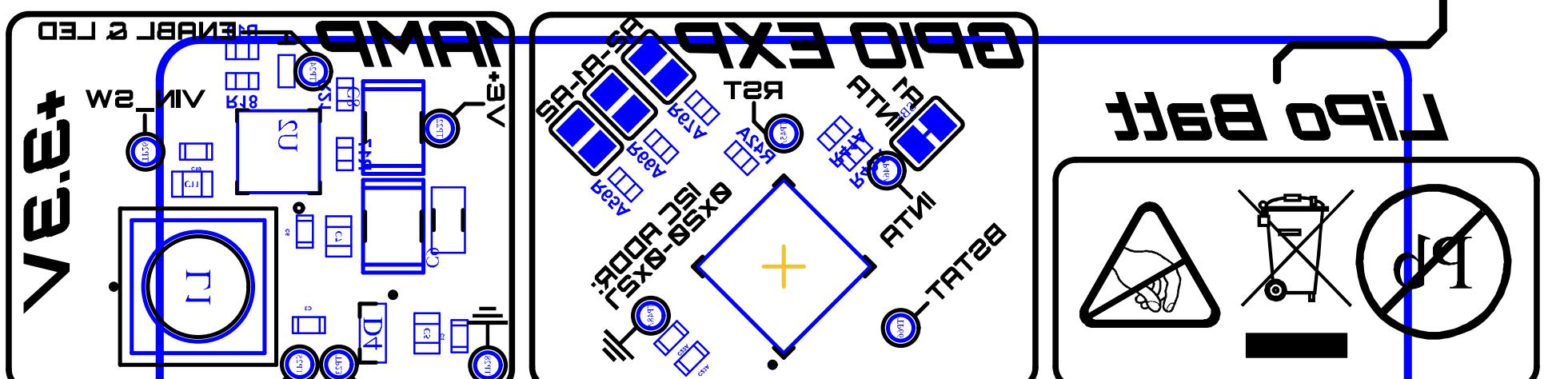
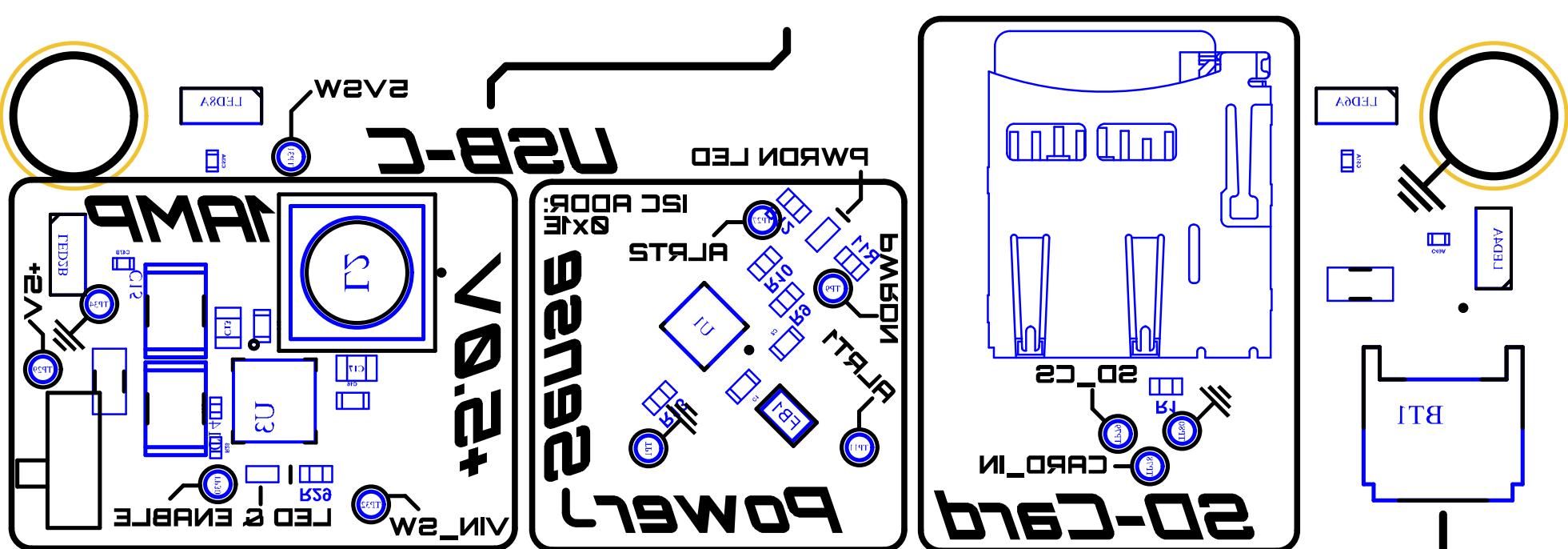






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# סנටקווין פולט 2000 Lipo

