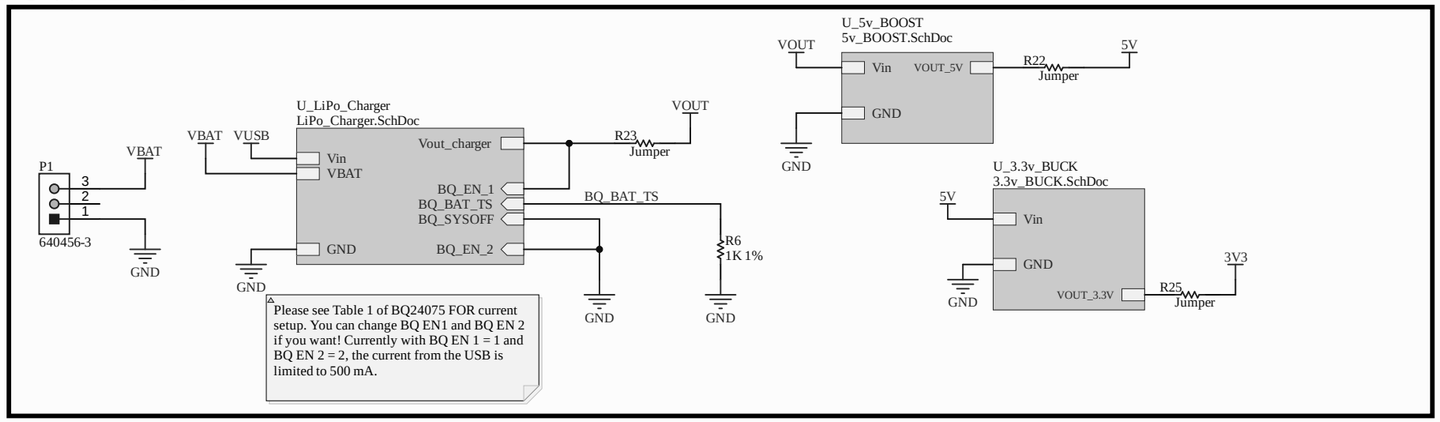
DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED

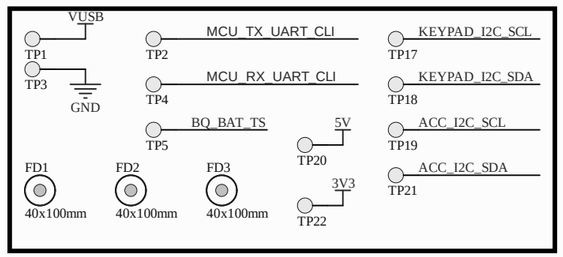
POWER SUPPLY



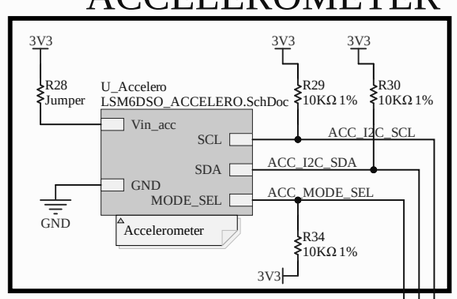
NOTES

Section to add version notes or any other general information

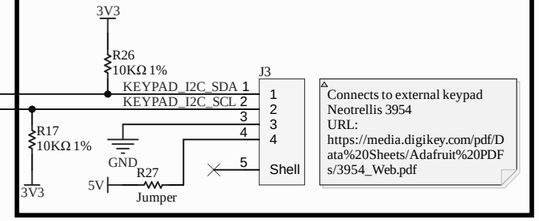
TEST POINTS AND FIDUCIALS



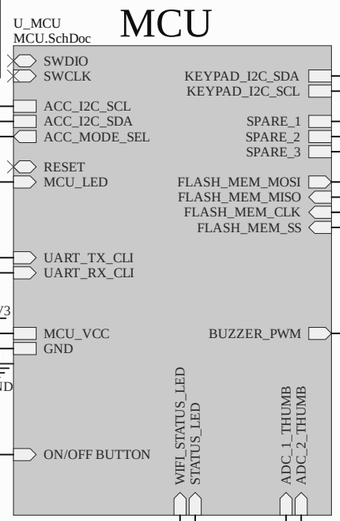
ACCELEROMETER



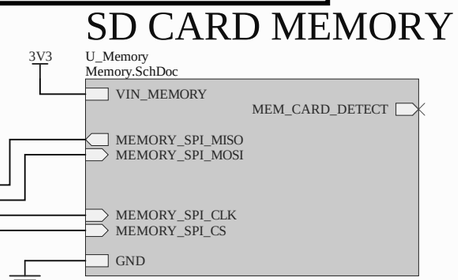
KEYPAD



MCU



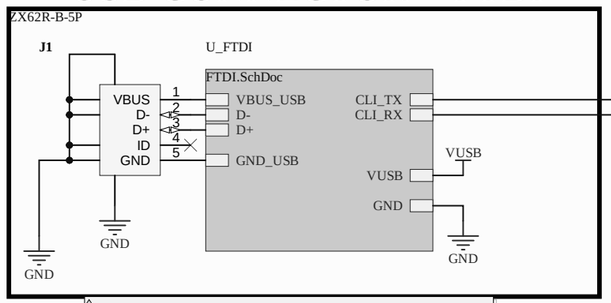
SD CARD MEMORY



Note:
This is the SD Card, which we will use for our project. PLEASE DO NOT ERASE! Connect a 3V3 rail to this SD Card.

The SD CARD needs 100 mA (worst case, most common is 30mA). If your existing power supply cannot handle this added current, please use the 3V3 LDO found in this project to power your SD Card.

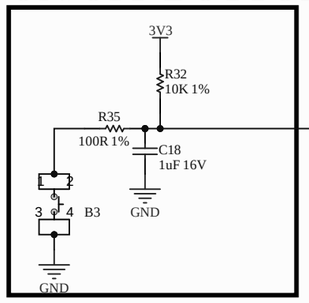
USB CONNECTOR + FTDI



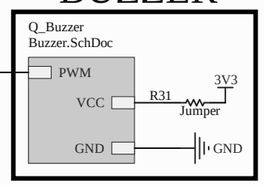
NOTE:

The FTDI Chip is an useful chip that allows us to convert USART cmessages into USB signals. It allows us to connect the MCU directly to the USB port of a computer and use the serial terminal (it is the same bridge used on the SAMW25 Xplained Board).The FTDI device also contains protection circuitry for the USB.

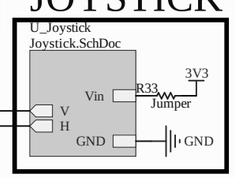
ON/OFF BUTTON

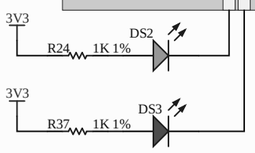


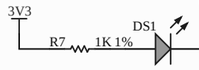
BUZZER



JOYSTICK







APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

PROJECT: Shipwars

Penn Engineering
200 S 33rd Street
Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

TITLE: Shipwars Main Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME: MAIN.SchDoc | SHEET 1 OF 10

DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED

MEMORY_SPI_MOSI → MEM_SPI_MOSI
MEMORY_SPI_MISO → MEM_SPI_MISO
MEMORY_SPI_CLK → MEM_SPI_CLK
MEMORY_SPI_CS → MEM_SPI_CS
MEM_CARD_DETECT → SD_CARD_DETECT

3V3_SD
VIN_MEMORY
GND
GND

TESTPOINTS

TP6 3V3_SD
TP7 SD_CARD_DETECT
TP8 MEM_SPI_MOSI
TP9 MEM_SPI_MISO
TP10 MEM_SPI_CLK
TP11 MEM_SPI_CS

SD CARD

3V3_SD
R13
10K 1% 0603(1608)
SD1
3V3_SD
MEM_SPI_CS
MEM_SPI_MOSI
MEM_SPI_CLK
MEM_SPI_MISO
GND
DAT2
CD
DAT3
CMD
VDD
CLK
VSS
DAT0
DAT1
SD CARD
104031-0811
CD_A
CD_B
SHLD
SHLD
GND
GND
3V3_SD
R14
10K 1% 0603(1608)
SD_CARD_DETECT

CDA abd CDB are a card detect switch. When the SD card in inserted, the switch is closed, and the SD_CARD_DETECT line goes low. When the SD card is not detected, said line goes high.

SD Card is wired to be used on SPI mode

3V3_SD
C15
CAP 100nF 16V
GND

Place bypass near VDD Pin of SD Card

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

PROJECT: Shipwars

Penn Engineering
200 S 33rd Street
Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

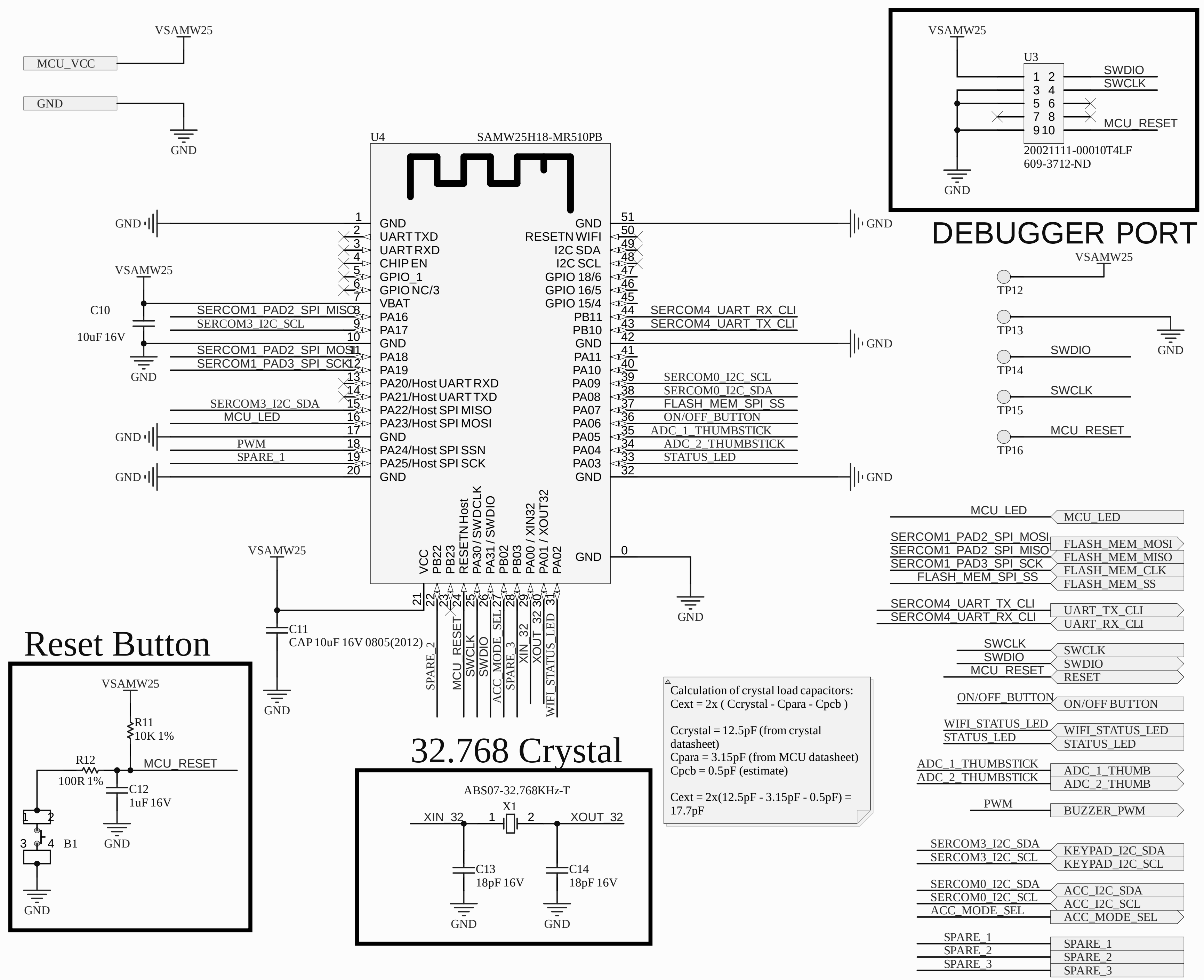
TITLE: Shipwars Memory Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME: Memory.SchDoc | SHEET 2 OF 10

DWG NO: .1.0.0 REV: 2

REVISION	DESCRIPTION	DATE	APPROVED


VSAMW25
MCU_VCC
GND
GND
U4
SAMW25H18-MR510PB
GND
UART TXD
UART RXD
CHIP EN
GPIO_1
GPIO NC/3
VBAT
PA16
PA17
GND
PA18
PA19
PA20/Host UART RXD
PA21/Host UART TXD
PA22/Host SPI MISO
PA23/Host SPI MOSI
GND
PA24/Host SPI SSN
PA25/Host SPI SCK
GND
GND
RESETN WIFI
I2C SDA
I2C SCL
GPIO 18/6
GPIO 16/5
GPIO 15/4
PB11
PB10
GND
PA11
PA10
PA09
PA08
PA07
PA06
PA05
PA04
PA03
GND
VCC
PB22
PB23
RESETN Host
PA30 / SWDCLK
PA31 / SWDIO
PB02
PB03
PA00 / XIN32
PA01 / XOUT32
PA02
GND
C10
10uF 16V
SERCOM1_PAD2_SPI_MISO
SERCOM3_I2C_SCL
SERCOM1_PAD2_SPI_MOSI
SERCOM1_PAD3_SPI_SCK
SERCOM3_I2C_SDA
MCU_LED
PWM
SPARE_1
SERCOM4_UART_RX_CLI
SERCOM4_UART_TX_CLI
SERCOM0_I2C_SCL
SERCOM0_I2C_SDA
FLASH_MEM_SPI_SS
ON/OFF_BUTTON
ADC_1_THUMBSTICK
ADC_2_THUMBSTICK
STATUS_LED
C11
CAP 10uF 16V 0805(2012)
SPARE_2
MCU_RESET
SWCLK
SWDIO
ACC_MODE_SEL
SPARE_3
XIN_32
XOUT_32
WIFI_STATUS_LED
U3
SWDIO
SWCLK
MCU_RESET
20021111-00010T4LF
609-3712-ND
DEBUGGER PORT
TP12
TP13
TP14
TP15
TP16
Reset Button
R11
10K 1%
R12
100R 1%
C12
1uF 16V
B1
32.768 Crystal
ABS07-32.768KHz-T
X1
C13
18pF 16V
C14
18pF 16V
Calculation of crystal load capacitors:
Cext = 2x (Ccrystal - Cpara - Cpcb)
Ccrystal = 12.5pF (from crystal datasheet)
Cpara = 3.15pF (from MCU datasheet)
Cpcb = 0.5pF (estimate)
Cext = 2x(12.5pF - 3.15pF - 0.5pF) = 17.7pF
FLASH_MEM_MOSI
FLASH_MEM_MISO
FLASH_MEM_CLK
FLASH_MEM_SS
UART_TX_CLI
UART_RX_CLI
RESET
ON/OFF BUTTON
ADC_1_THUMB
ADC_2_THUMB
BUZZER_PWM
KEYPAD_I2C_SDA
KEYPAD_I2C_SCL
ACC_I2C_SDA
ACC_I2C_SCL
ACC_MODE_SEL

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	

REFERENCE DOCUMENTS
BOM:
ASSY DWG:
FAB DWG:
PCB DWG:

PROJECT: Shipwars

Penn Engineering
200 S 33rd Street
Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

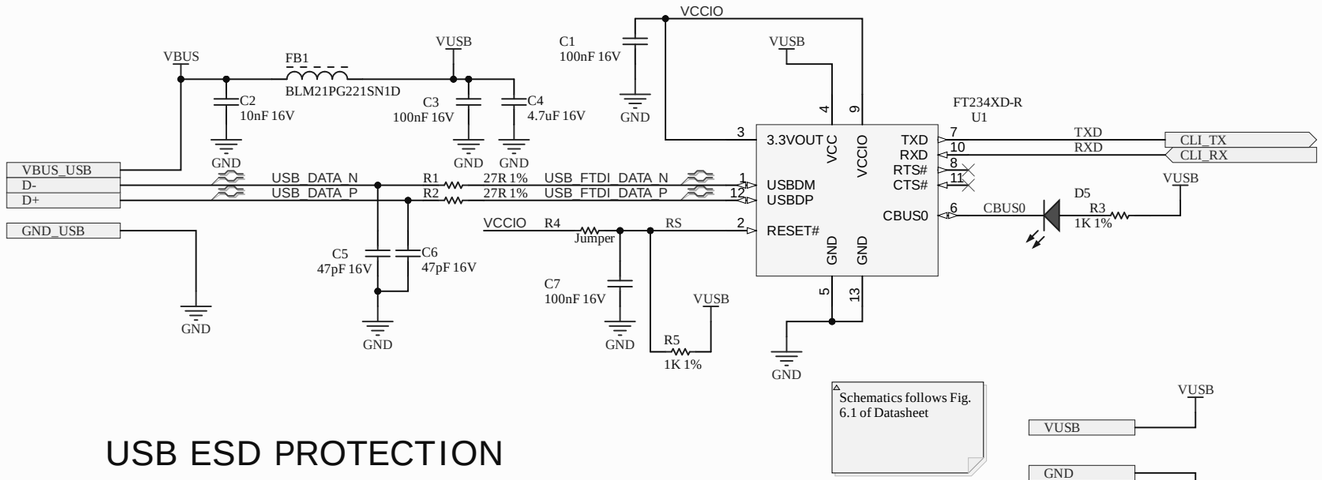
TITLE
Shipwars MCU Schematic

SIZE: B | CAGE CODE: | DWG NO.: | REV: .1.0.0
SCALE: | FILE NAME: MCU.SchDoc | SHEET 3 OF 10

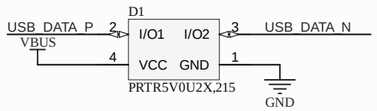
DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED

FTDI CHIP



USB ESD PROTECTION



APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

PROJECT: Shipwars

Penn Engineering

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Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

TITLE

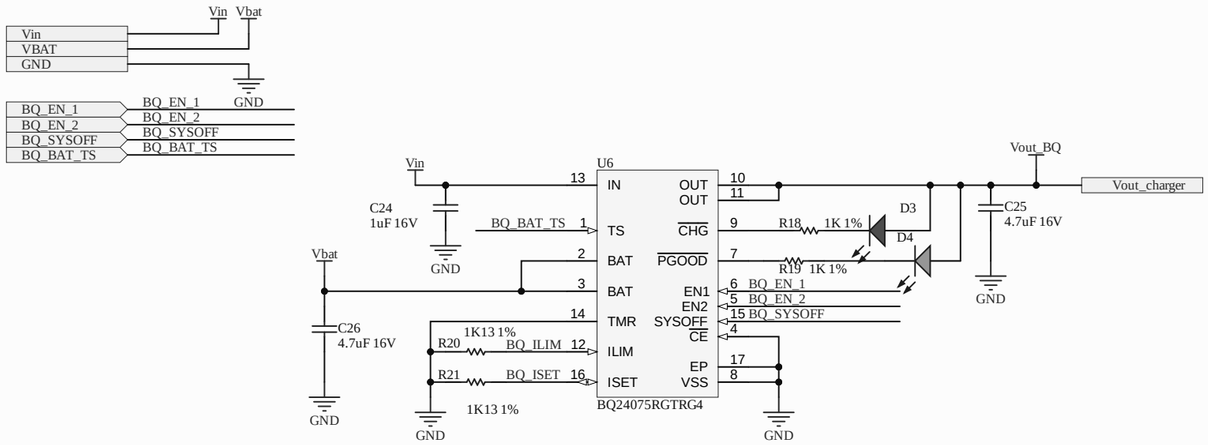
Shipwars FTDI Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME: FTDI.SchDoc | SHEET 4 OF 10

DWG. NO. .1.0.0 REV SHT

REVISION	DESCRIPTION	DATE	APPROVED



ilim = Kilim/Rilim => 1610/1130 = 1.42A
(if EN2=1, EN1=0)

ISET = KISET/RSET => 890/1130 = 0.788A

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

PROJECT: Shipwars

Penn Engineering
200 S 33rd Street
Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

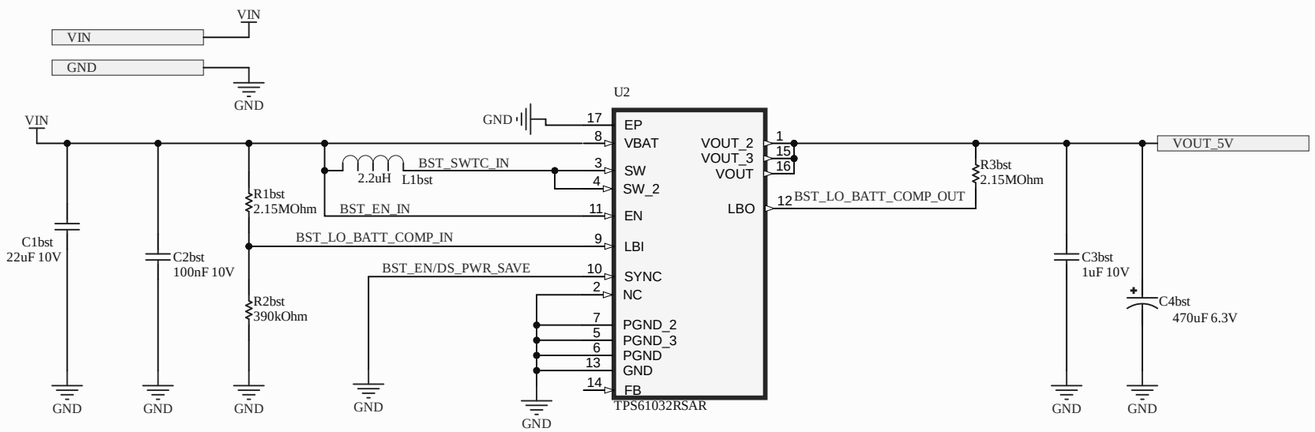
TITLE: Shipwars Charger Shematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME: LiPo_Charger.SchDoc | SHEET 5 OF 10

DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED



TPS61032
VIN: 3.3V to 5V
OUT: 5V up to 2A
REF: https://webench.ti.com/appinfo/webench/scripts/SDP.cgi?ID=0929BF869665908F

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

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Philadelphia
PA 19104

PROJECT: Shipwars
PROJECT REVISION:
DOCUMENT REVISION:
DESIGN ITEM:

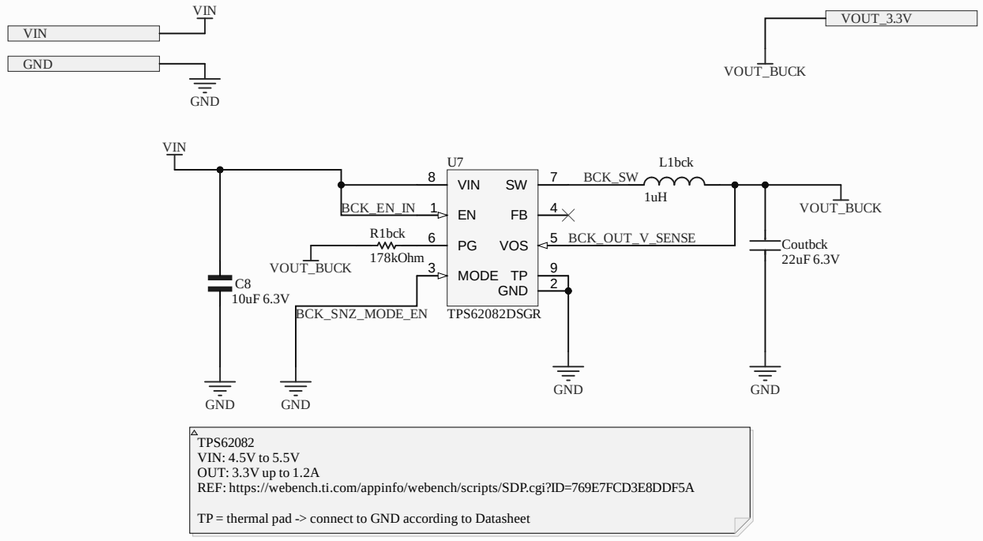
TITLE: Shipwars Boost Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: FILE NAME 5v_BOOST.SchDoc SHEET 6 OF 10

DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED



TPS62082
VIN: 4.5V to 5.5V
OUT: 3.3V up to 1.2A
REF: https://webench.ti.com/appinfo/webench/scripts/SDP.cgi?ID=769E7FCD3E8DDF5A

TP = thermal pad -> connect to GND according to Datasheet

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

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PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

TITLE

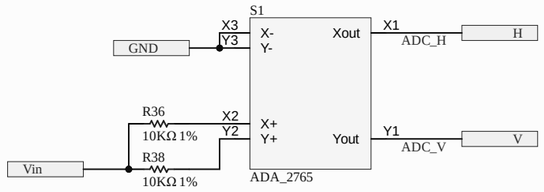
Shipwars Buck Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME 3.3v BUCK.SchDoc | SHEET 7 OF 10

DWG. NO. .1.0.0 REV SHT

REVISION	DESCRIPTION	DATE	APPROVED



Sparkfun COM-09032 Thumb Joystick

REF:
http://cdn.sparkfun.com/datasheets/BreakoutBoards/Joystick-Breakout-v12b.pdf

pin reference in :

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

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Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

TITLE

Shipwars Joystick Schematic

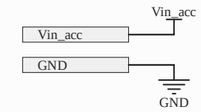
SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

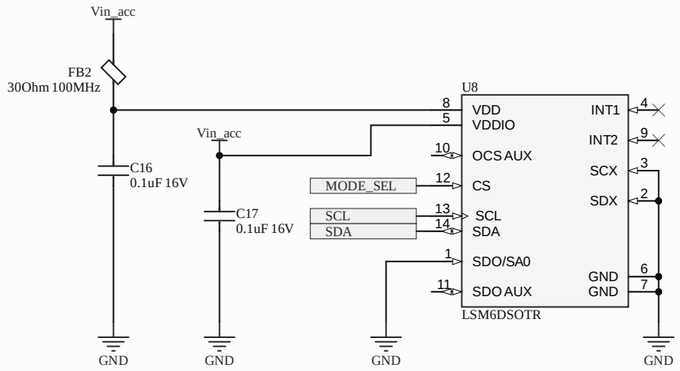
SCALE: | FILE NAME Joystick.SchDoc | SHEET 8 OF 10

DWG. NO. .1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED

Text





SLM6DSOTR ACCELEROMETER

REF: https://cdn.sparkfun.com/assets/3/1/6/b/c/SparkFun_Qwiic_6DoF_LSM6DSO_Schematic.pdf

OR

REF: https://www.st.com/resource/en/datasheet/lsm6dso.pdf (Page35)

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

PROJECT: Shipwars

Penn Engineering

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Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: | DOCUMENT REVISION: | DESIGN ITEM:

TITLE

Shipwars Accelero Schematic

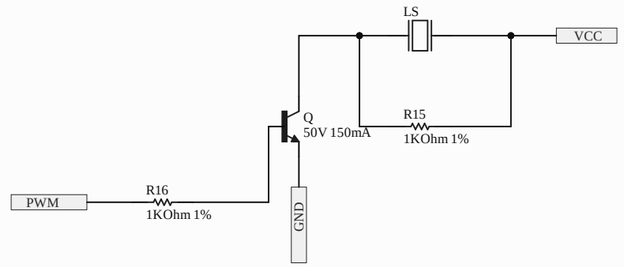
SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME: LSM6DSO_ACCELERO.SchDoc | SHEET 9 OF 10

DWG NO. .1.0.0 REV

DWG. NO. 1.0.0 REV. SHT.

REVISION	DESCRIPTION	DATE	APPROVED



PS1240P02BT 3V 4kHz buzzer

REF:
https://www.snapeda.com/parts/PS1240P02BT/TDK%20Corporation/datasheet/ (page 2)

APPROVALS	DATE
ENG: SP, PS	
DSN: SP, PS	
CHK: SP, PS	
REFERENCE DOCUMENTS	
BOM:	
ASSY DWG:	
FAB DWG:	
PCB DWG:	

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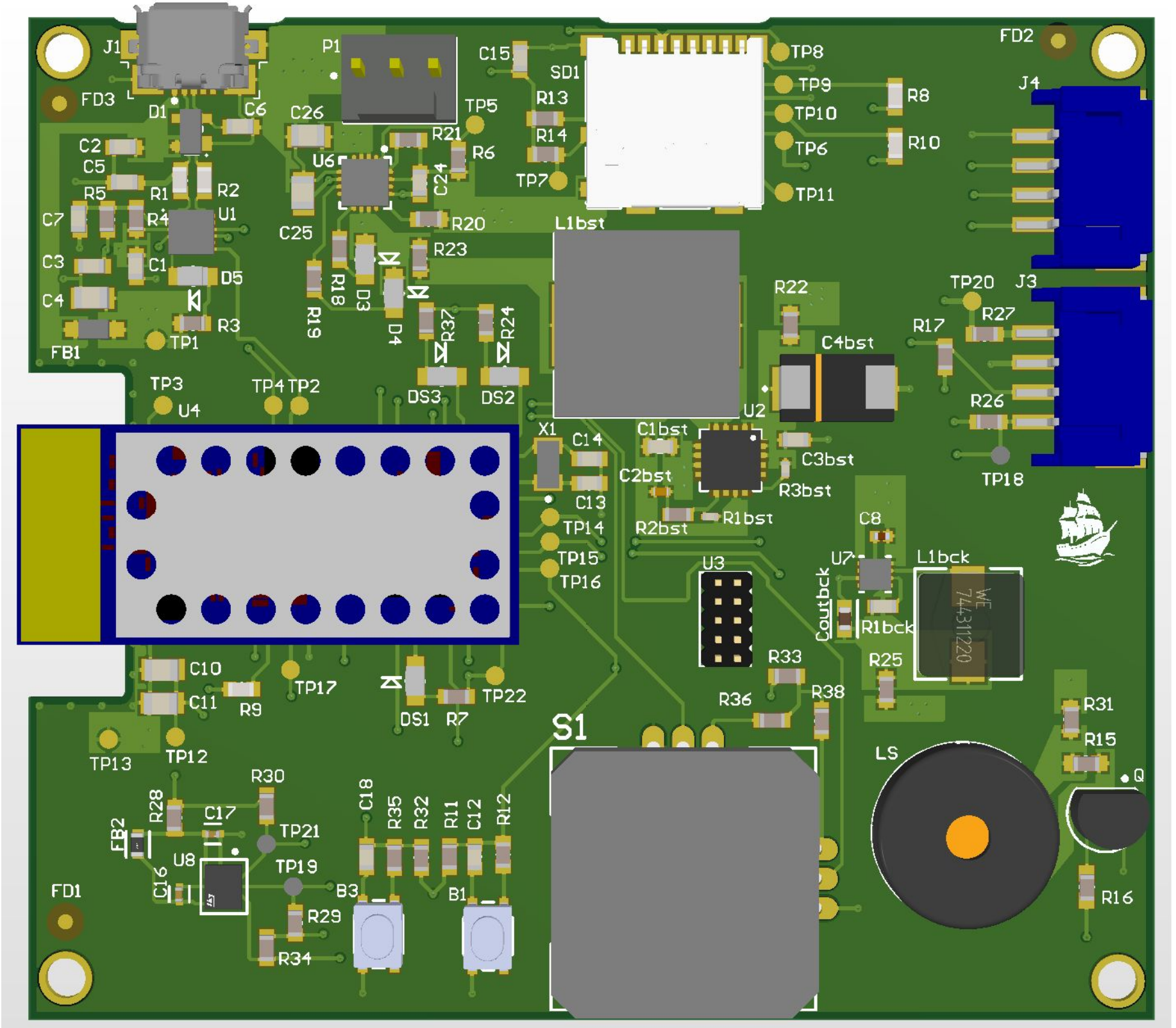
TITLE

Shipwars Buzzer Schematic

SIZE	CAGE CODE	DWG NO.	REV
B			.1.0.0

SCALE: | FILE NAME Buzzer.SchDoc | SHEET 10 OF 10

DWG. NO. REV. SHT. 1.0.0

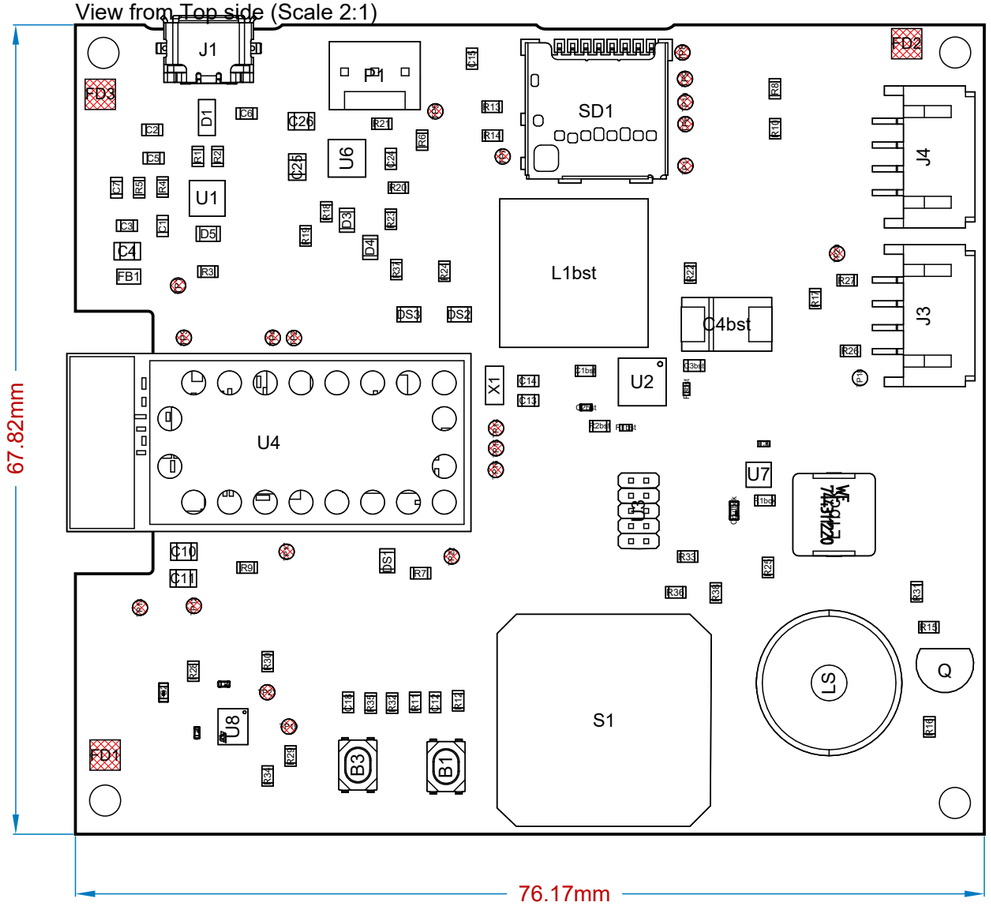

J1
P1
C15
SD1
TP8
TP9
TP10
TP6
TP11
FD2
J4
FD3
D1
C6
C26
TP5
R13
R14
R8
R10
C2
C5
R5
R1
R2
U6
R21
R6
C24
TP7
C7
R4
U1
C25
R20
L1bst
C3
C1
D5
R23
R22
TP20
J3
C4
R3
R18
R19
D3
D4
R37
R24
R27
R17
C4bst
FB1
TP1
TP3
TP4
TP2
DS3
DS2
U2
R26
X1
C14
C1bst
C3bst
TP18
C2bst
R3bst
C13
R1bst
R2bst
TP14
C8
TP15
TP16
U3
U7
L1bck
Coutbck
R1bck
R33
R25
C10
C11
R9
TP17
DS1
R7
TP22
R36
R38
R31
S1
LS
TP13
TP12
R30
R15
R28
C17
C18
R35
R32
R11
C12
R12
Q
FB2
TP21
U8
TP19
B3
B1
C16
R29
R16
FD1
R34

REVISION	DESCRIPTION	DATE	APPROVED

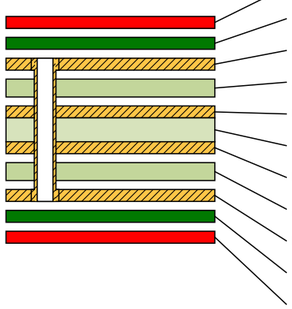
Manufacturing Notes:

Four (4) Layers
Dimensions: 67.82mm x 76.17mm
Thickness: 1.53mm
Number of Boards: 1
Material of Dielectric: FR4
Surface Finish: ENEPIG
Number of Holes: 188
Minimum Hole Diameter: 0.2mm
Minimum trace: 0.152mm
Minimum distance between copper features: 0.152mm
Solder mask color: Green

View from Top side (Scale 2:1)



Layer Stack Legend



Material	Layer	Thickness	Dielectric Material	Type	Gerber
	Top Overlay			Legend	GTO
Surface Material	Top Solder	0.03mm	Solder Resist	Solder Mask	GTS
Copper	**Top Layer**	**0.04mm**		**Signal**	**GTL**
Prepreg		*0.33mm*	*PP-006*	*Dielectric*	
CF-004	**GroundPlane**	**0.02mm**		**Signal**	**G1**
Core		*0.71mm*	*Core-009*	*Dielectric*	
CF-004	**PowerPlane**	**0.02mm**		**Signal**	**G2**
Prepreg		*0.33mm*	*PP-006*	*Dielectric*	
Copper	**Bottom Layer**	**0.04mm**		**Signal**	**GBL**
Surface Material	Bottom Solder	0.03mm	Solder Resist	Solder Mask	GBS
	Bottom Overlay			Legend	GBO

Total thickness: 1.53mm

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DSN: SP, PS	--/--/--
CHK: SP, PS	--/--/--
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PROJECT *
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Detkin Lab
Philadelphia
PA 19104

PROJECT REVISION: =VersionControl_ProjectRevision | DOCUMENT REVISION: =VersionControl_DocumentRevision | DESIGN ITEM ID: =VersionControl_DesignItemId

TITLE
Shipwars Layout

SIZE	CAGE CODE	DWG NO.	REV
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SCALE: =SCH_SCALE | FILE NAME: StarterBoardFabrication.PCBDwf | SHEET 1 OF 10

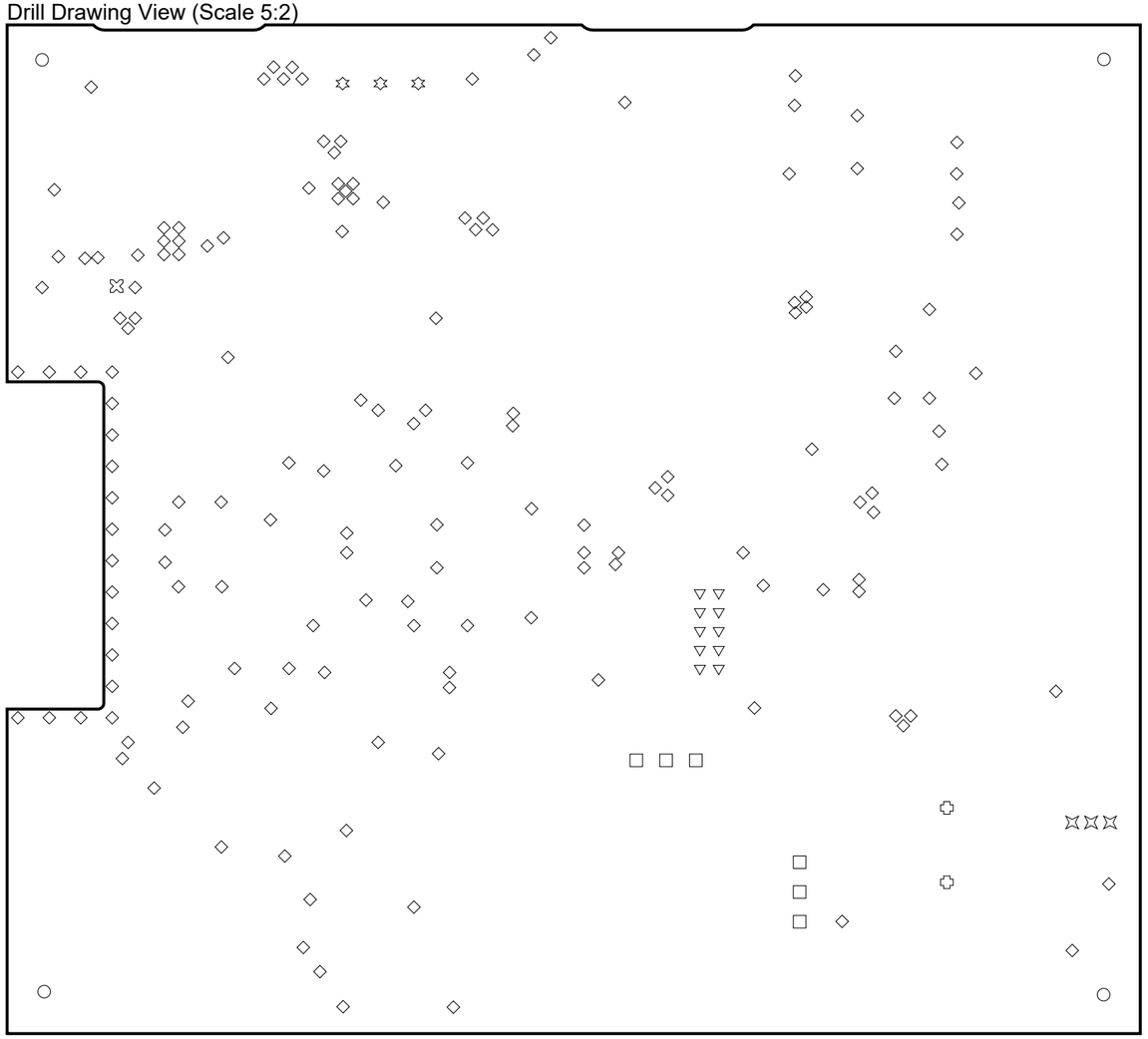
=DOC_NO_SCH_DWG .ItemRevision

REVISION	DESCRIPTION	DATE	APPROVED

Drill Table

Symbol	Count	Hole Size	Plated	Hole Tolerance
◇	159	0.20mm	Plated	
⊠	1	0.30mm	Plated	
▽	10	0.65mm	Plated	
⛝	3	0.76mm	Plated	
✣	2	0.85mm	Plated	
□	6	0.90mm	Plated	
✡	3	1.27mm	Plated	
○	4	2.70mm	Plated	
	188 Total			

Drill Drawing View (Scale 5:2)



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PROJECT *

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PROJECT REVISION: =VersionControl_Pro DOCUMENT REVISION: DESIGN ITEM: =Revision

TITLE: Shipwars Layout

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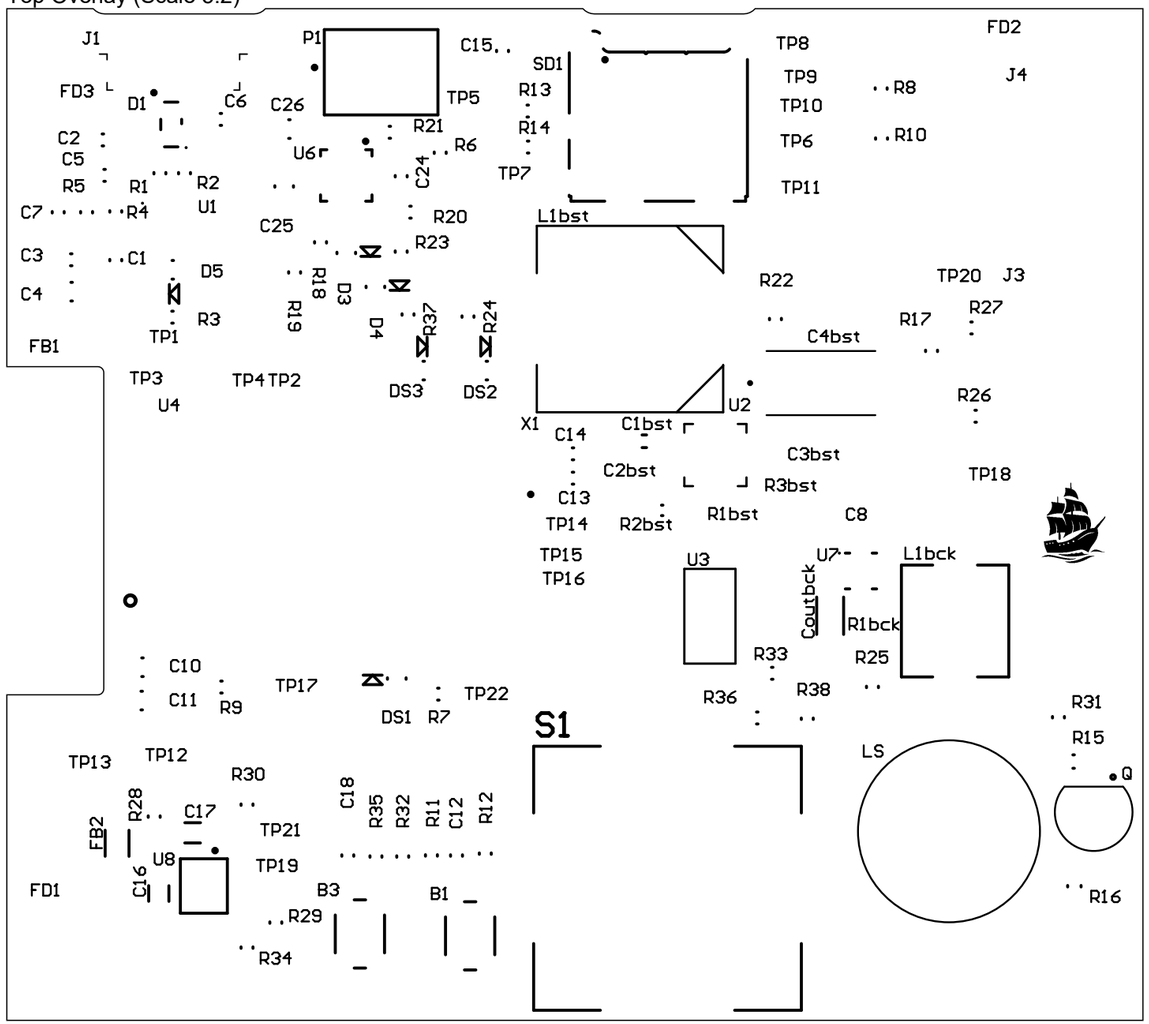
SCALE: =SCH_SCALE	FILE NAME: StarterBoardFabrication.PCBDwf	SHEET 2 OF 10	

=DOC_NO_SCH_DWG .ItemRevision

REVISION	DESCRIPTION	DATE	APPROVED

Top Overlay (Scale 5:2)



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PROJECT: *

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TITLE: Shipwars Layout

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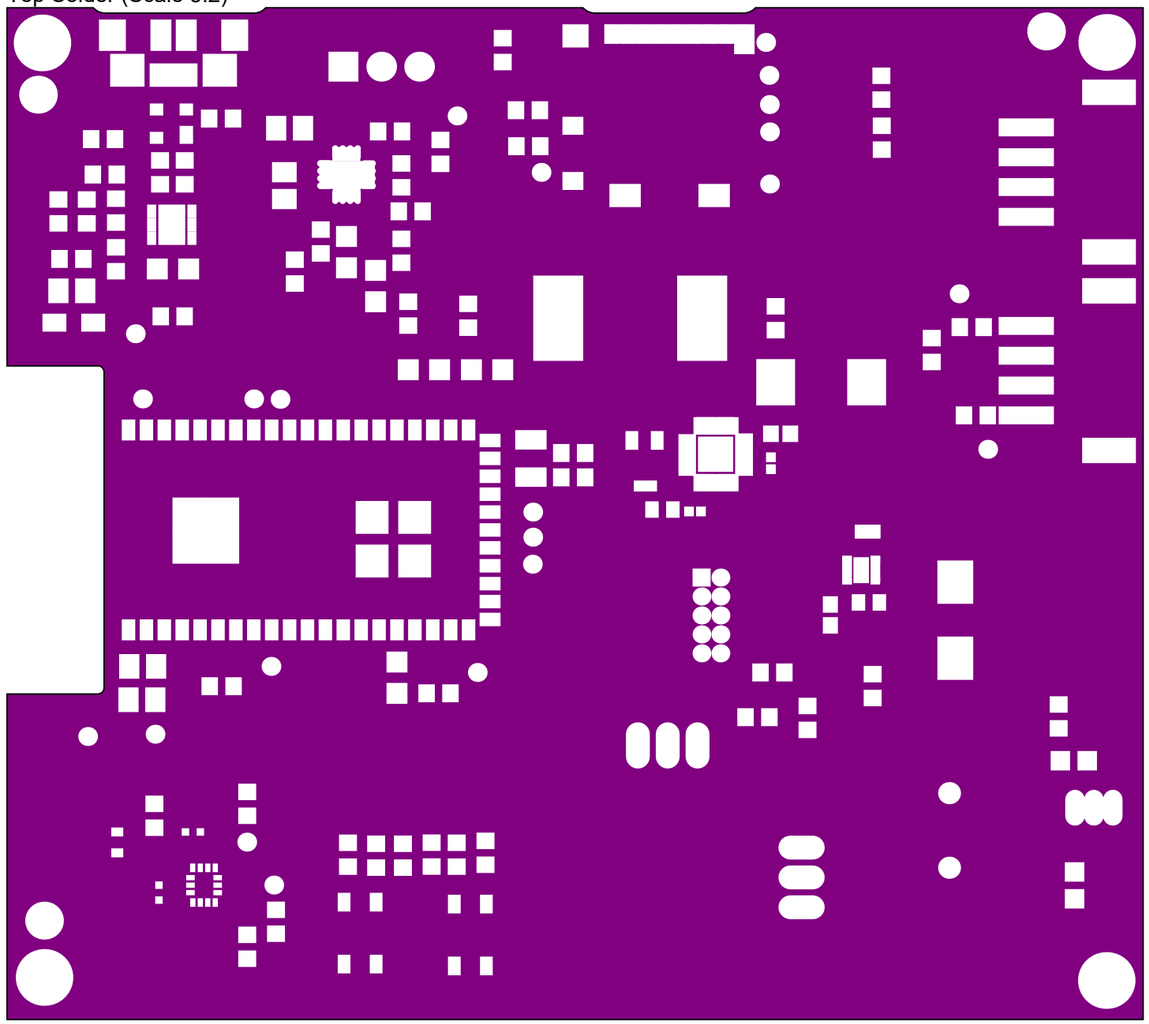
REVISION	DESCRIPTION	DATE	APPROVED

Top Solder (Scale 5:2)



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PROJECT
*

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PROJECT REVISION: =VersionControl_ProjectRevision DOCUMENT REVISION: =DesignItemId.LastRevisionId25fcd250be19d3

TITLE
Shipwars Layout

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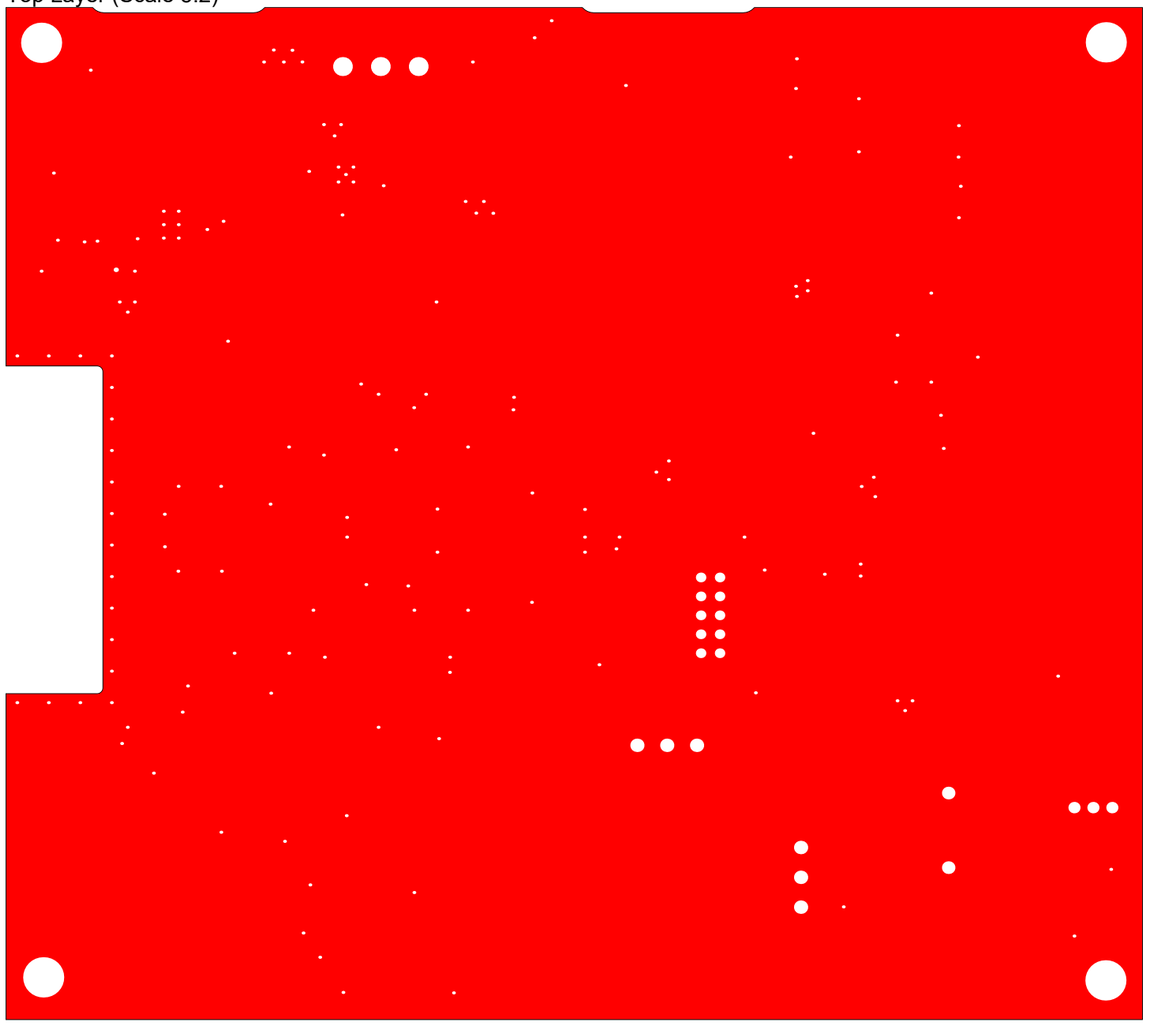
REVISION	DESCRIPTION	DATE	APPROVED

Top Layer (Scale 5:2)



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PROJECT: *

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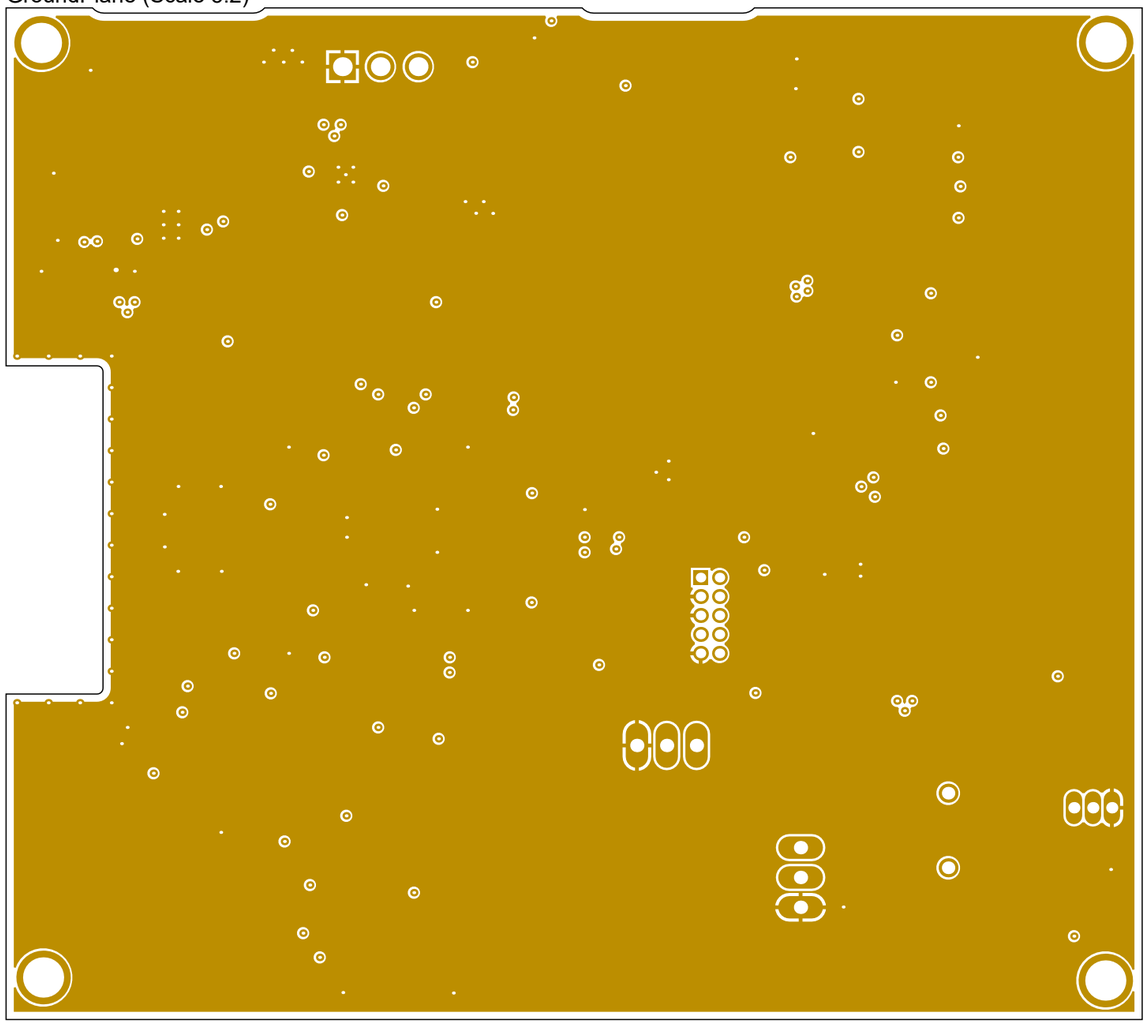
REVISION	DESCRIPTION	DATE	APPROVED

GroundPlane (Scale 5:2)



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PROJECT: *

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TITLE: Shipwars Layout

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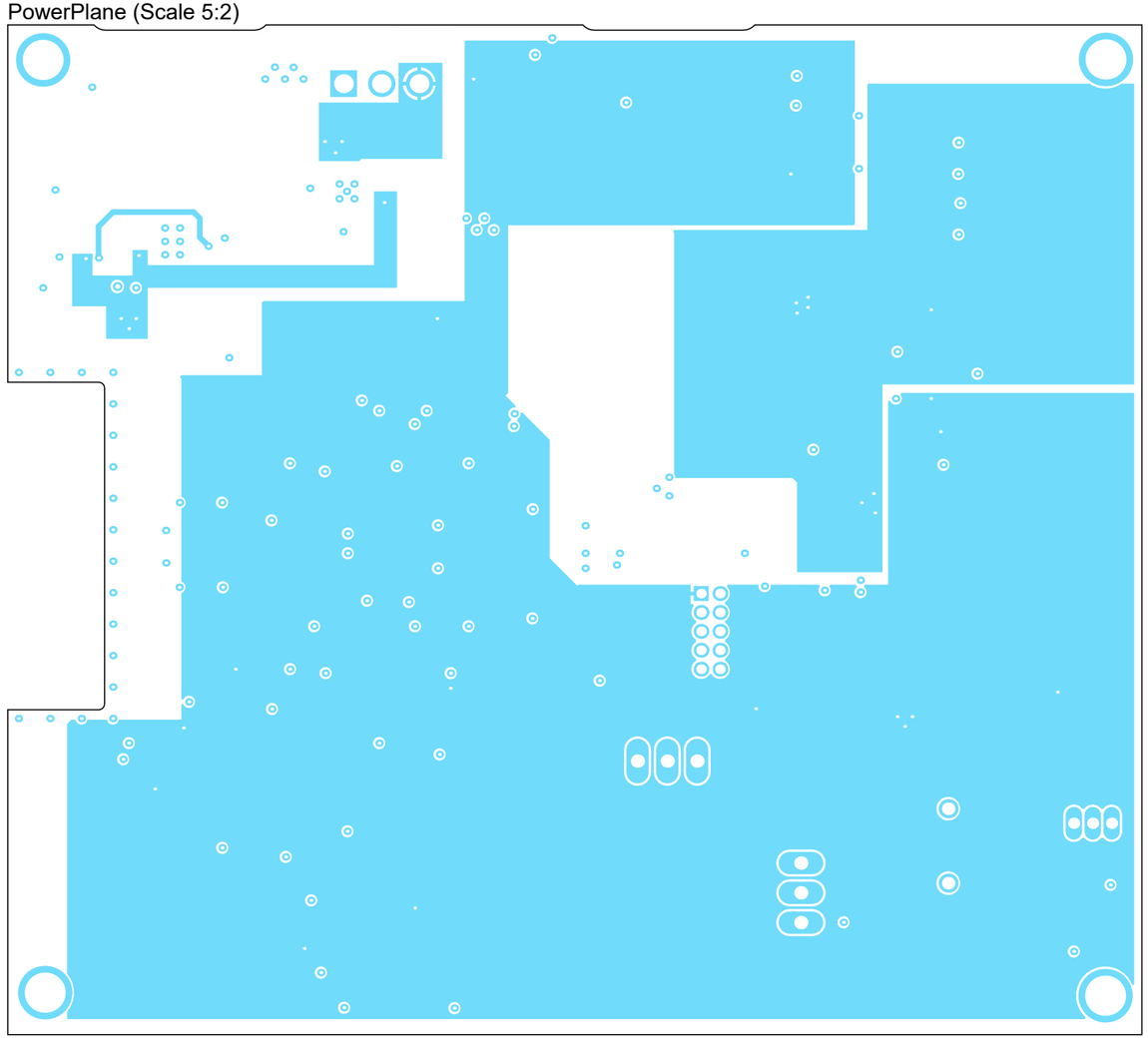
REVISION	DESCRIPTION	DATE	APPROVED

PowerPlane (Scale 5:2)



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PROJECT *

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PA 19104

PROJECT REVISION: =VersionControl_Pro... DOCUMENT REVISION: ... DESIGN ITEM ID: ...

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Shipwars Layout

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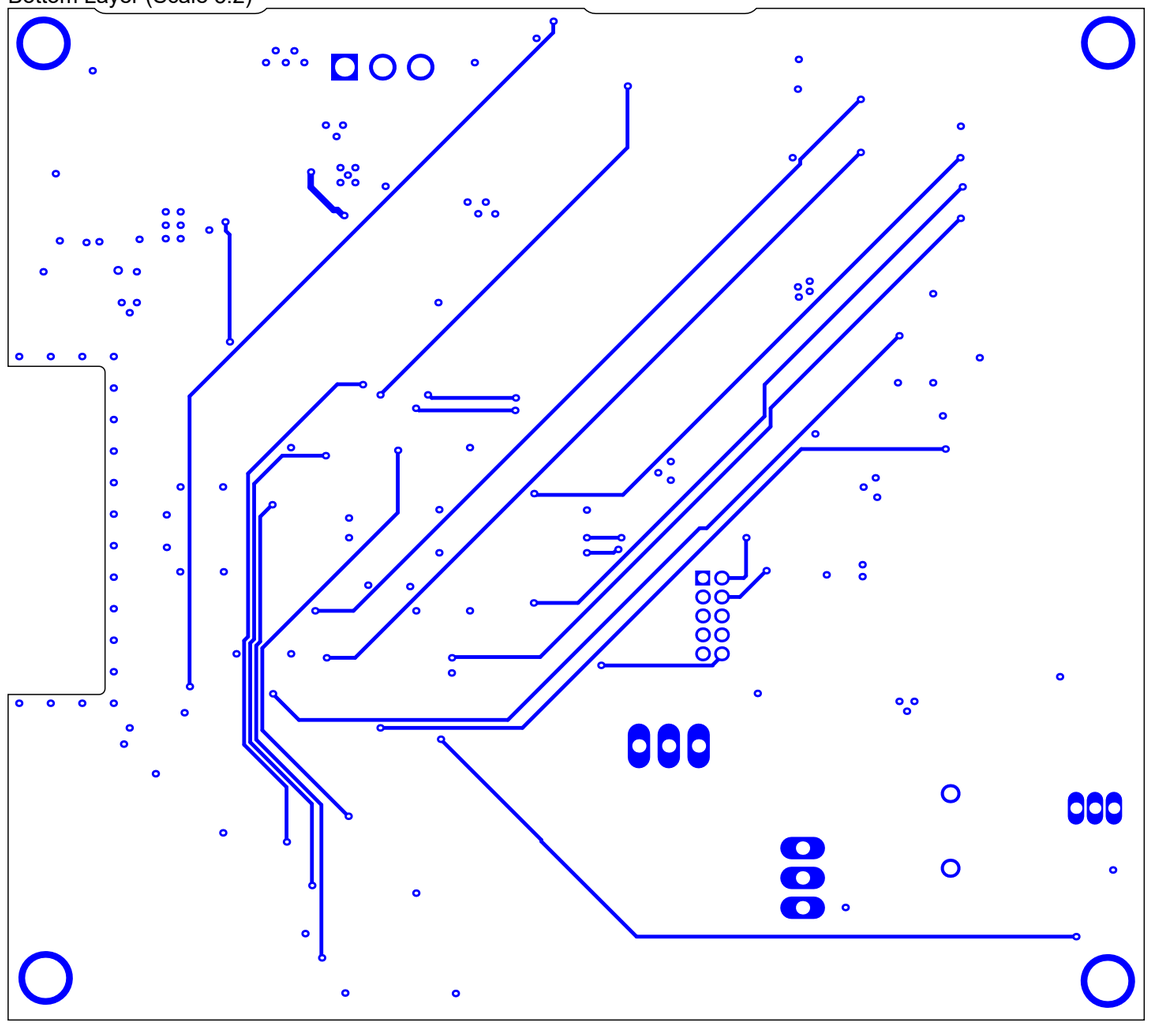
=DOC_NO_SCH_DWG .ItemRevision

REVISION	DESCRIPTION	DATE	APPROVED

Bottom Layer (Scale 5:2)



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PROJECT: *

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PROJECT REVISION: =VersionControl_ProjectRevision | DOCUMENT REVISION: =DOC_NO_SCH_DWG.ItemRevision | DESIGN ITEM ID: 8f1e25fcd250be19d5

TITLE: Shipwars Layout

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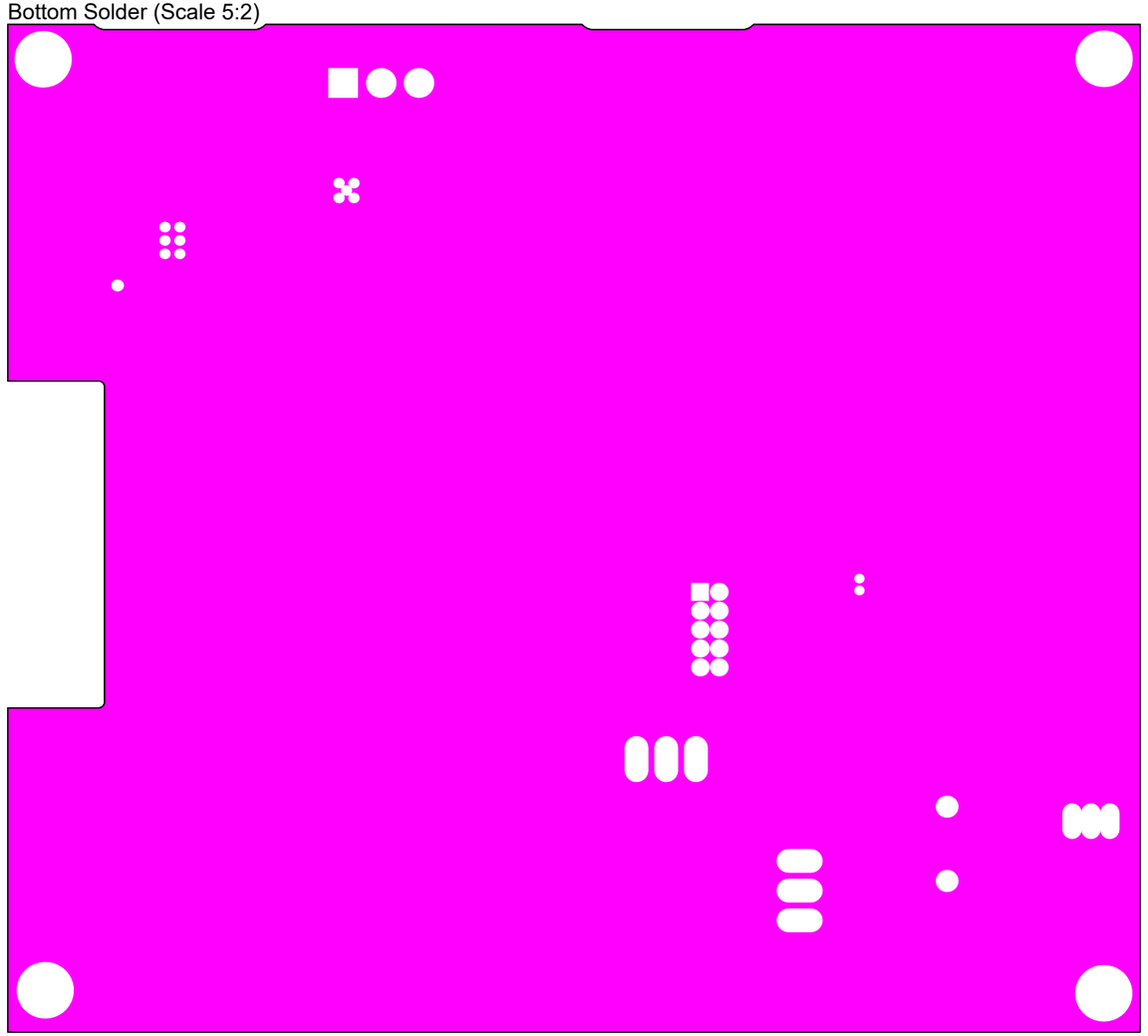
REVISION	DESCRIPTION	DATE	APPROVED

Bottom Solder (Scale 5:2)



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PROJECT REVISION: =VersionControl_Pro... DOCUMENT REVISION: ... DESIGN ITEM ID: ...

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Shipwars Layout

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SCALE: =SCH_SCALE | FILE NAME: StarterBoardFabrication.PCBDwf | SHEET 9 OF 10

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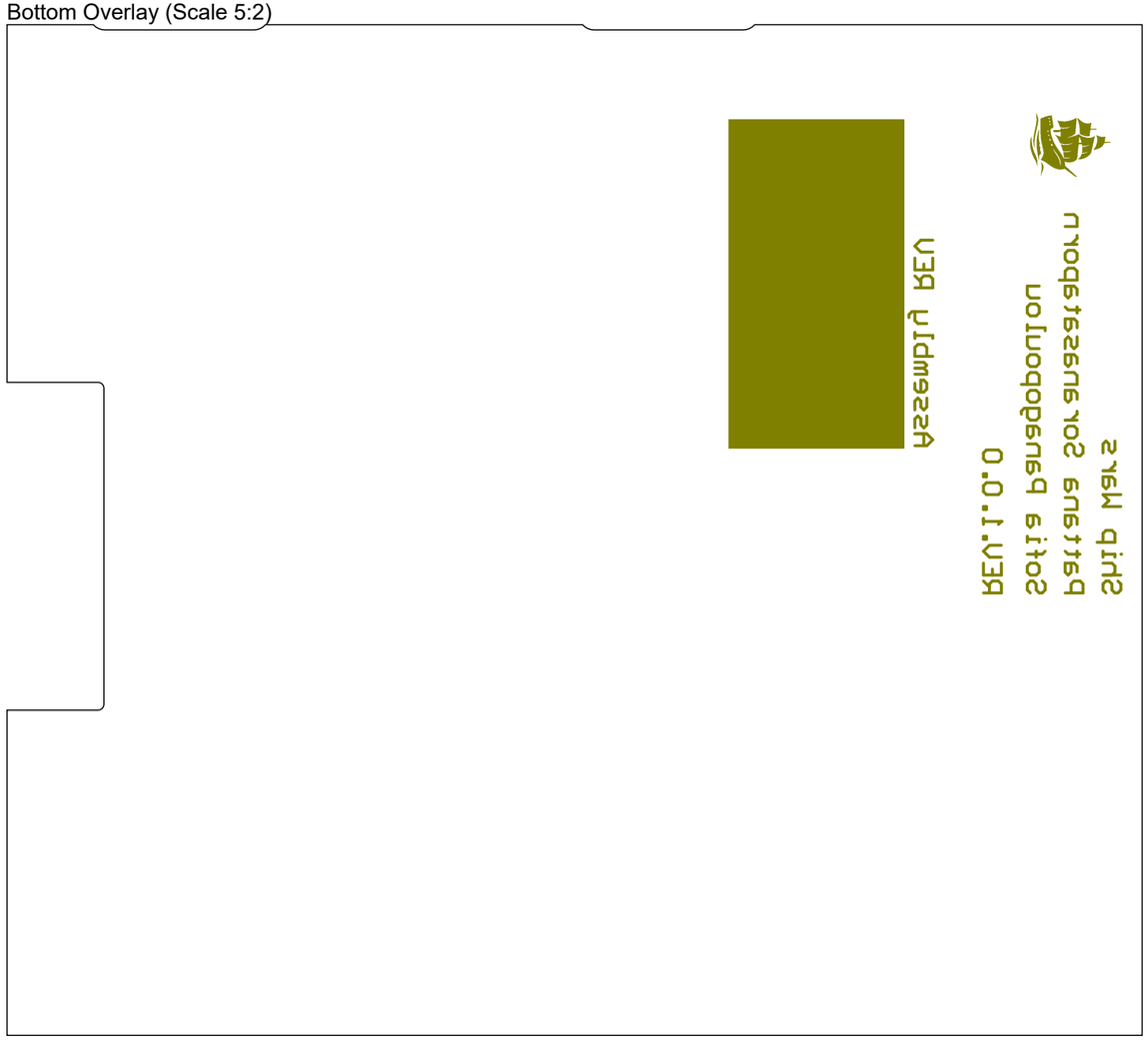
REVISION	DESCRIPTION	DATE	APPROVED

Bottom Overlay (Scale 5:2)



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PA 19104

PROJECT REVISION: =VersionControl_ProjectRevision DOCUMENT REVISION: =DESIGNITEMID

TITLE

Shipwars Layout

SIZE	CAGE CODE	DWG NO.	REV
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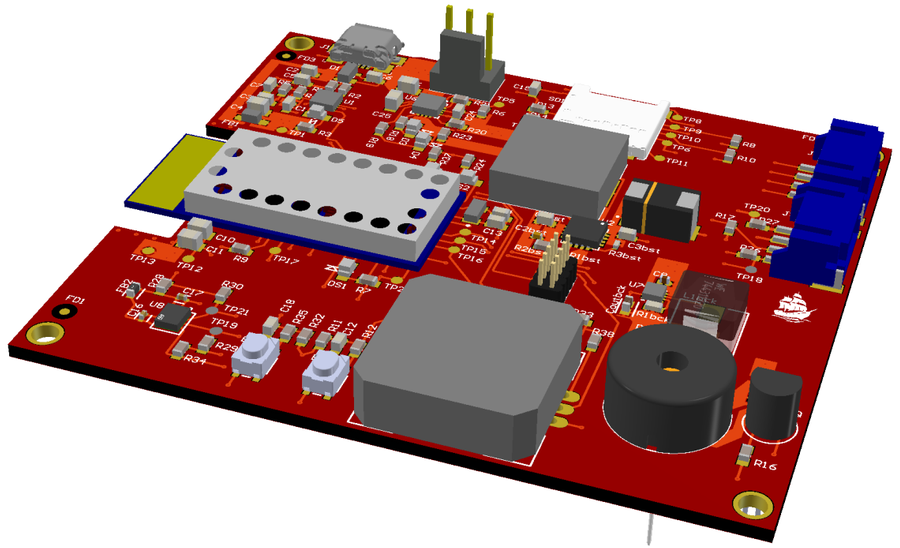
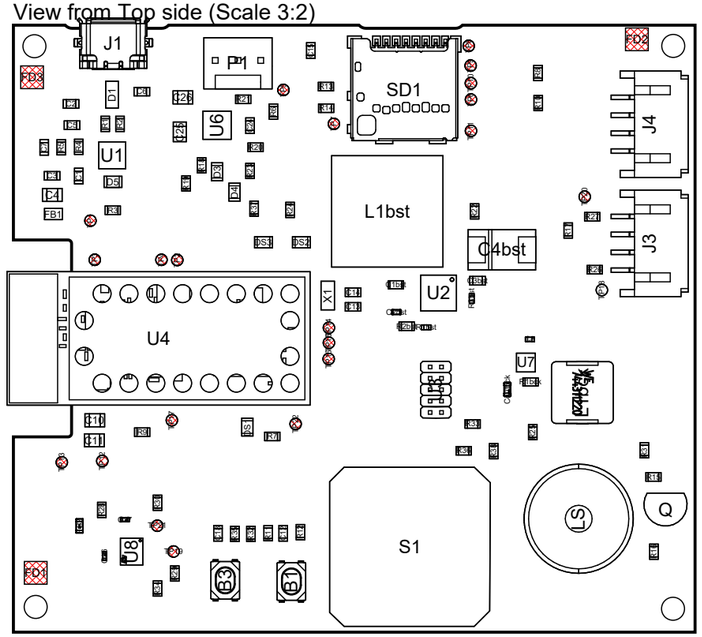
REVISION	DESCRIPTION	DATE	APPROVED

Notes (Unless otherwise specified):

NOTES:
1. THIS ITEM IS ELECTROSTASTIC SENSITIVE
AND SHALL BE HANDLED ACCORDINGLY



View from Top side (Scale 3:2)



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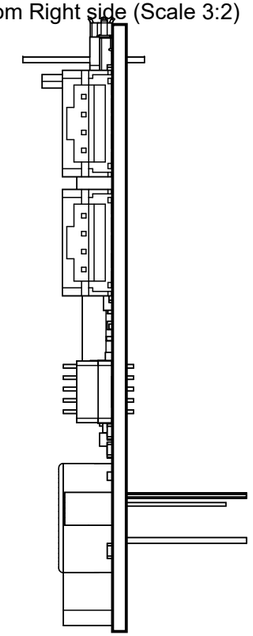

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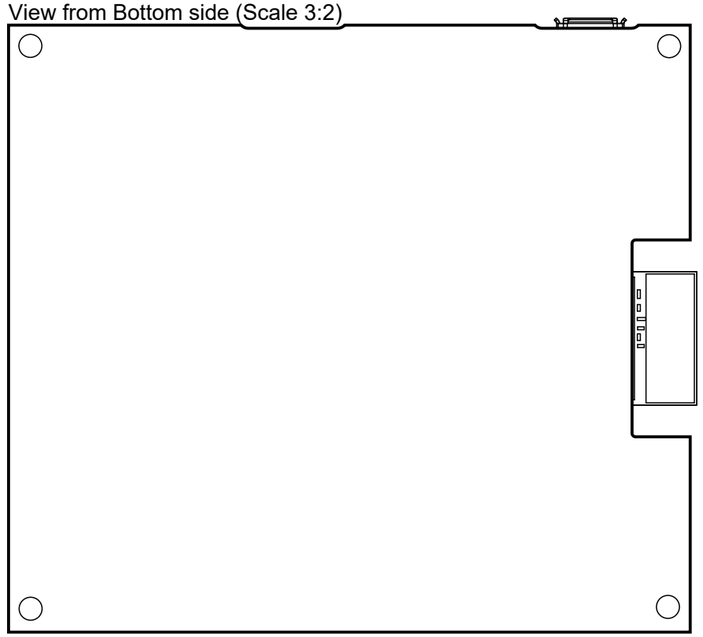

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PROJECT: *

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PROJECT REVISION: =VersionControl_ProjectRevision | DOCUMENT REVISION: =VersionControl_DocumentRevision | DESIGN ITEM ID: =Item128656b516e15

TITLE: Shipwars Assembly Layout

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=DOC_NO_SCH_DWG
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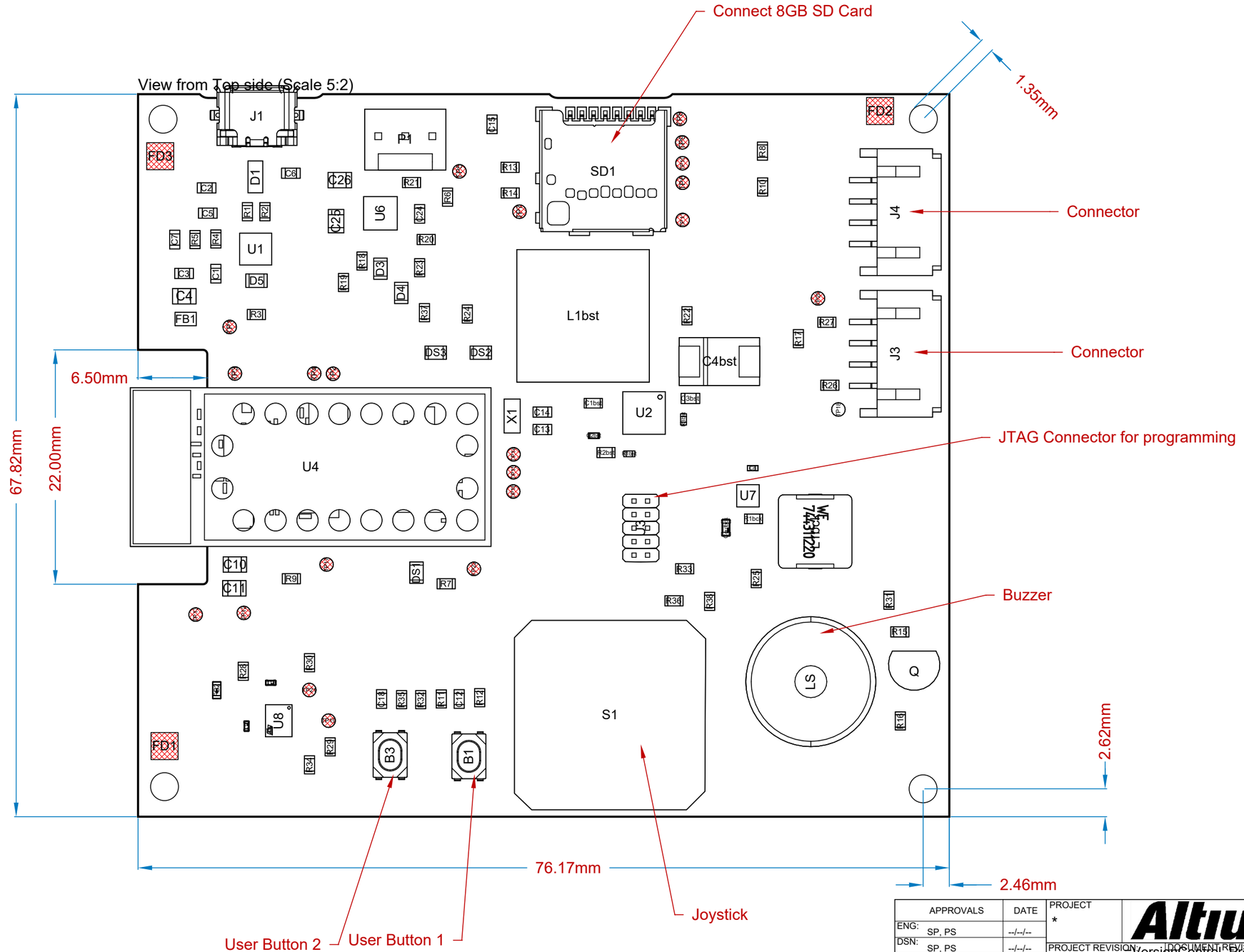
REVISION	DESCRIPTION	DATE	APPROVED

View from Top side (Scale 5:2)



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TITLE
Shipwars Assembly Layout

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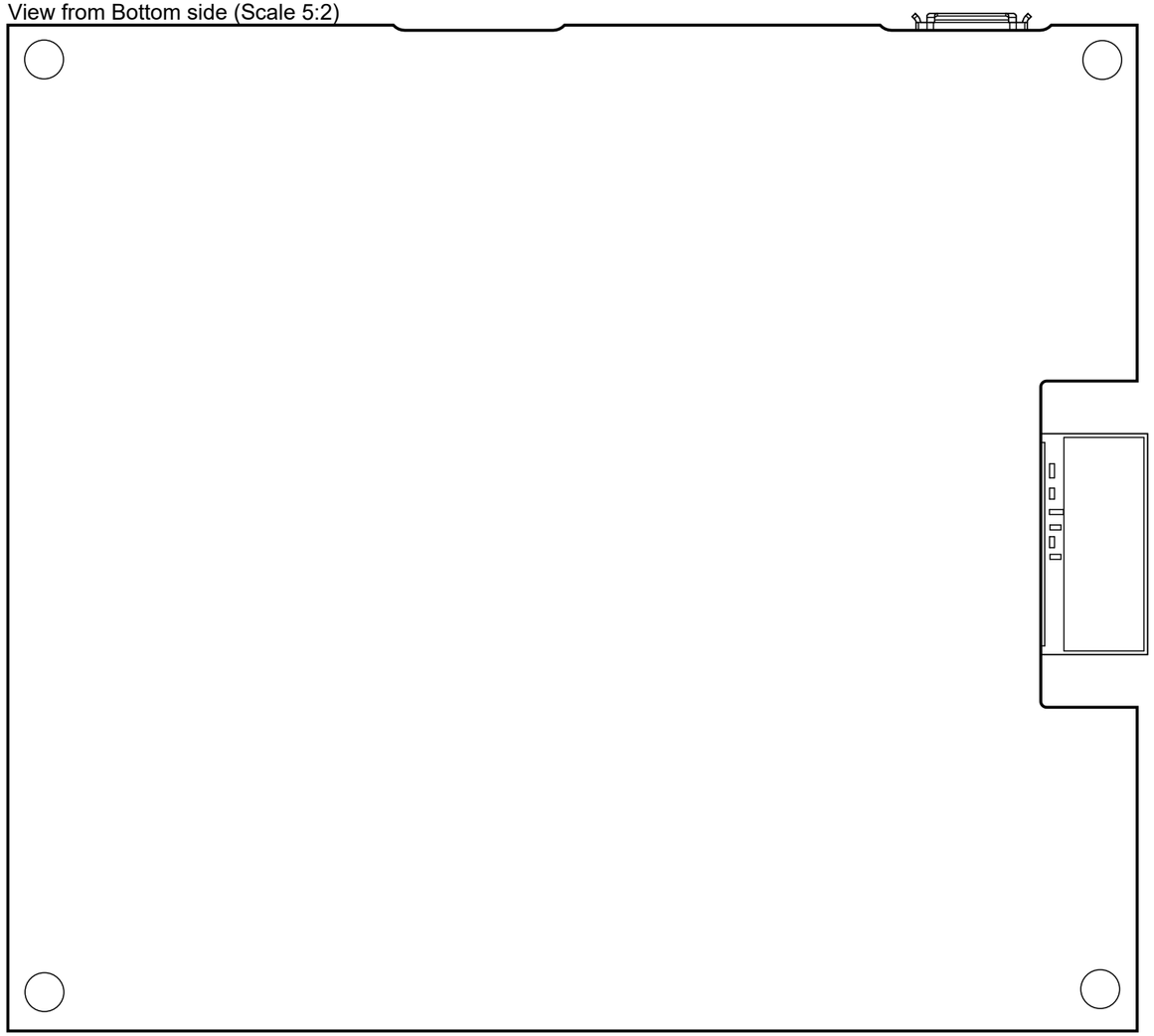
REVISION	DESCRIPTION	DATE	APPROVED

View from Bottom side (Scale 5:2)



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PROJECT REVISION: =VersionControl_ProjectRevision | DOCUMENT REVISION: =VersionControl_DocumentRevision | DESIGNATED: =VersionControl_DesignItemId28656b516e15

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Shipwars Assembly Layout

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