The Byte Attic's

Agon light™

Manual

Last updated on: 6/29/22 10:38:14 PM

What is Agon light?

- A modern 8-bit microcomputer and microcontroller in one small, low-cost board
- Requires no host PC: Agon light puts out its own video (VGA), audio (2 identical mono channels), accepts a PS/2 keyboard and has µSD-card storage
- Features a control port with SPI, I^2C, 20 distinct GPIOs, a system clock output, as well as power (3.3V and 5V) and ground rails
- Features a separate ACCESS.bus header for e.g. an optional status display
- Aims at the best possible trade-off across performance, cost and flexibility with cutting-edge technology
- There are no FPGAs and no emulation in Agon™: the 'bare wires' are exposed directly to the firmware programmer
- Agon light is powered by USB and runs internally at 3.3V

What is so unique and attractive about it?

- Instant-on, stand-alone, BASIC-programmed* microcontroller: no host PC or sketch compilation required
- Control your whole house from the immediacy of a BASIC prompt*
- Say goodbye to assembly:
  - C-programmable audio/video coprocessor firmware with freely available tooling
  - C-programmable CPU firmware with freely available tooling
- A hardware canvas for you to make of it your own dream, firmware-customized microcomputer
- A laboratory for computer science experimentation
- The most advanced 8-bit microcomputer to date
- The best balance of cost, performance and programmability
- Agon light is an open-hardware and open-source project, so you get *all* the information about the system

* Needs installation of Quark™ firmware

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Technical overview and specifications

Architecture and specifications

- Two subsystems:
  - The *processor subsystem*
  - The *terminal subsystem*
- The *processor subsystem* comprises:
  - CPU (eZ80F92 running at 18.432MHz)
  - System memory (512KB, 10ns, parallel SRAM)
  - µSD-card port (as main storage)
  - ZDI port (for programming the firmware of the CPU)
  - Control port (including 20 GPIOs) to control your projects from BASIC*

* Needs installation of Quark™ firmware

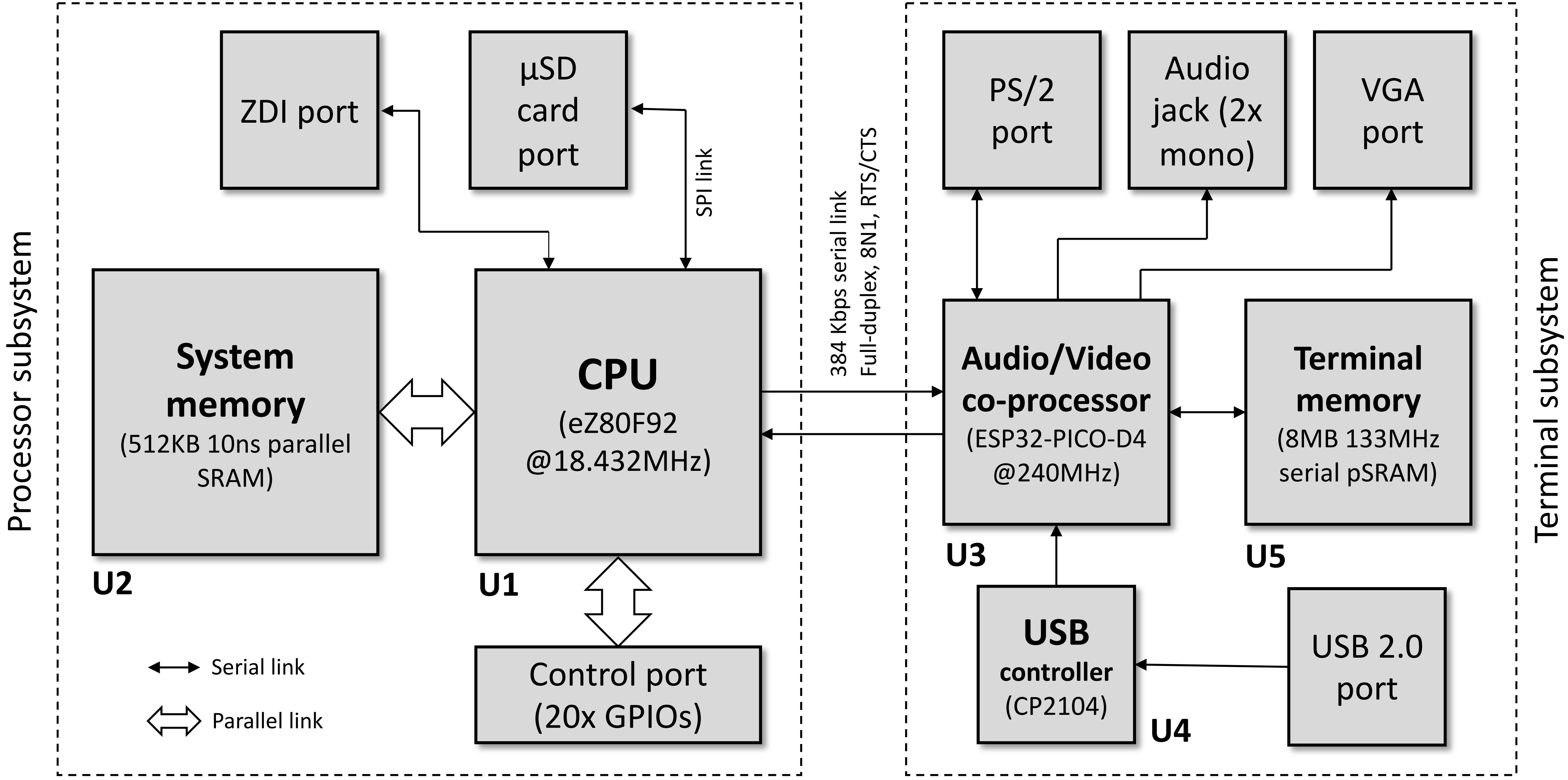
- The *terminal subsystem* comprises:
  - Audio/video coprocessor (ESP32-PICO-D4 running at 240MHz)
  - Terminal memory (8MB, 133MHz, serial pSRAM)
  - Keyboard port (PS/2)
  - VGA port
  - Audio jack (2x mono)
  - USB 2.0 port (for power and programming the ESP32's firmware)
- The two subsystems communicate with each other via full-duplex high-speed serial (384 kilobits per second), featuring flow control

Theory of operation

- The *terminal subsystem:*
  - Reads out the (PS/2) keyboard and sends the corresponding keypress tokens to the CPU via a high-speed serial link
  - Generates the screen based on display-list commands issued by the CPU and sent to the ESP32 via a high-speed serial link
  - Produces the VGA & audio signals
  - Supports the FabGL™ library
- The *processor subsystem:*
  - Runs the BIOS and BASIC interpreter*
  - Executes application code
  - Drives the GPIOs based on the application code
  - Drives the *terminal subsystem* by issuing display-list and audio-related commands to the ESP32 via a high-speed serial link
  - Manages storage (µSD-card)

* Needs installation of Quark™ firmware

System diagram



Circuit board

Audio jack

PS/2 port

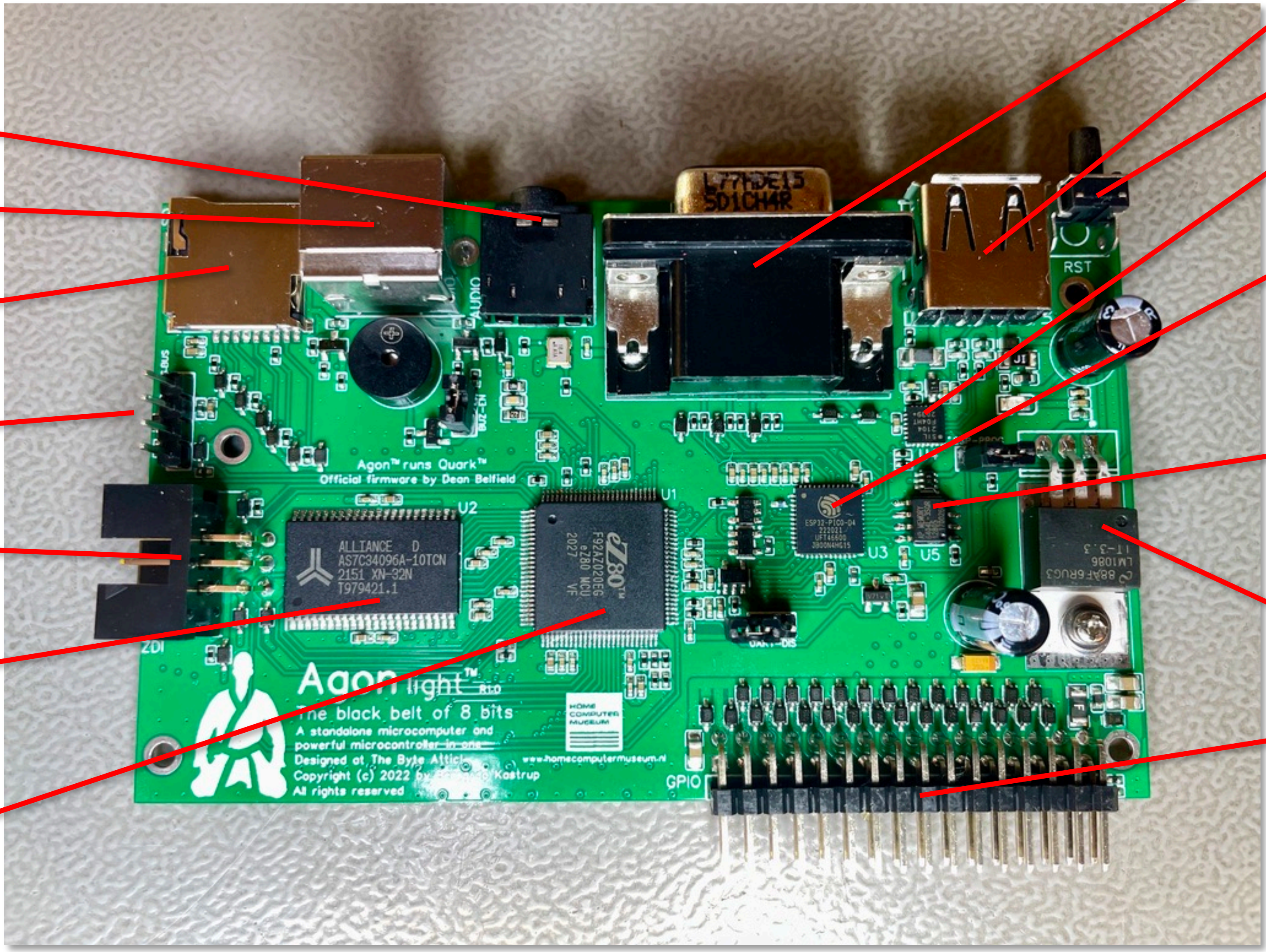
µSD-card port

ACCESS.bus header

ZDI port

System memory (512KB, 10ns, parallel SRAM)

CPU (eZ80F92 @18.432MHz)



VGA port

USB 2.0 port

Reset button

USB controller

Audio/video coprocessor (ESP32-PICO-D4 @240MHz)

Terminal memory (8MB, 133MHz, serial pSRAM)

LDO regulator (3.3V)

Control port (20x GPIOs)

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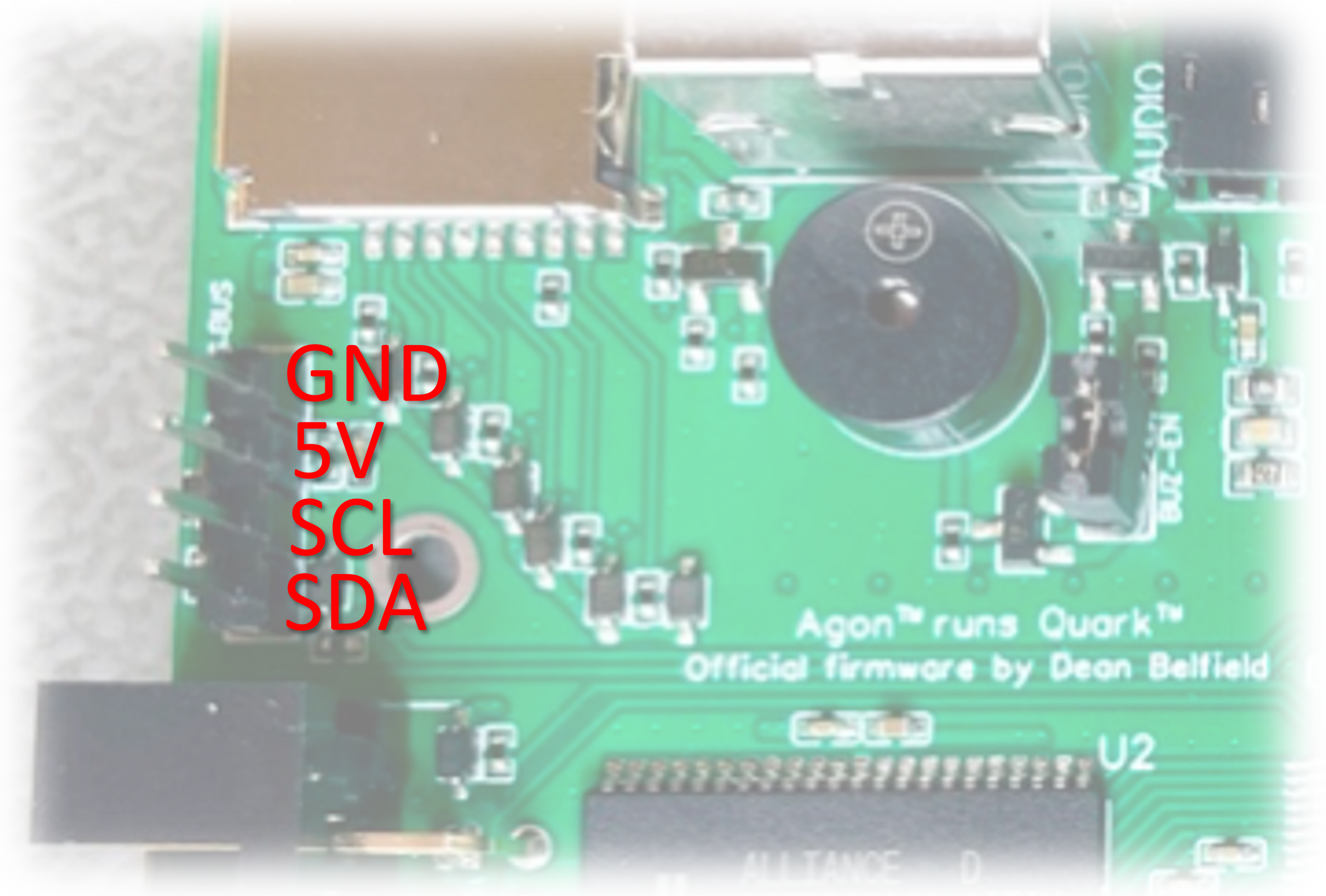
User's guide

Control port pinout

See schematics for signal references

ACCESS.bus header pinout



Pinout of serial link between CPU and ESP32

- On the *eZ80F92*’s side:
  - Pin 68 (**PD0/TXD0/IR_TXD**) is the transmitter
  - Pin 69 (**PD1/RXD0/IR_RXD**) is the receiver
  - Pin 70 (**PD2/!RTS0**) is RTS (signal ‘*eZ80RTS*’ in the schematics)
  - Pin 71 (**PD3/!CTS0**) is CTS (signal ‘*eZ80CTS*’ in the schematics)
- On the *ESP32-PICO-D4*’s side:
  - Pin 10 (**IO34**) is the receiver (connected to signal ‘*eZ80TxD*’ in the schematics)
  - Pin 22 (**IO2**) is the transmitter (connected to signal ‘*eZ80RxD*’ in the schematics)
  - Pin 17 (**IO14**) is CTS (connected to signal ‘*eZ80RTS*’ in the schematics)
  - Pin 20 (**IO13**) is RTS (connected to signal ‘*eZ80CTS*’ in the schematics)

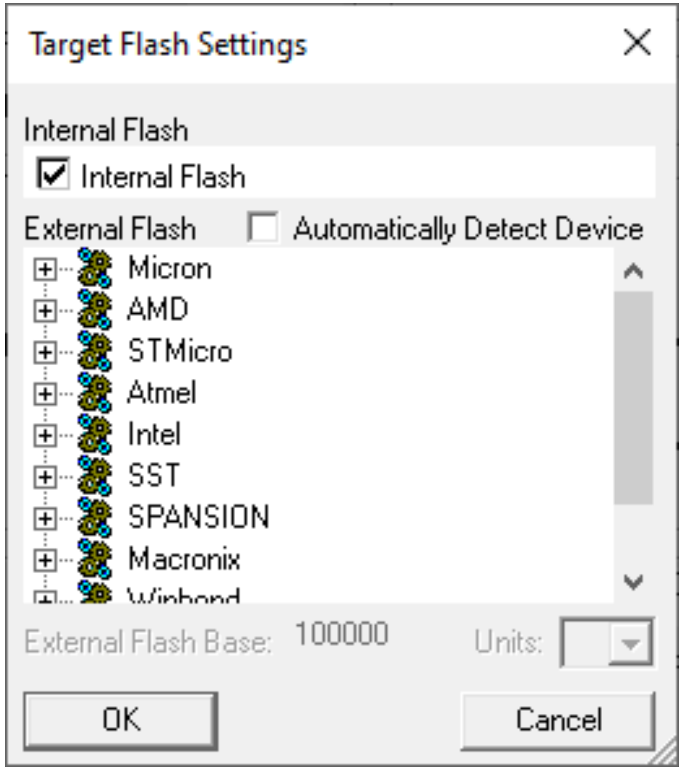
Recommended configuration of serial link between CPU and ESP32

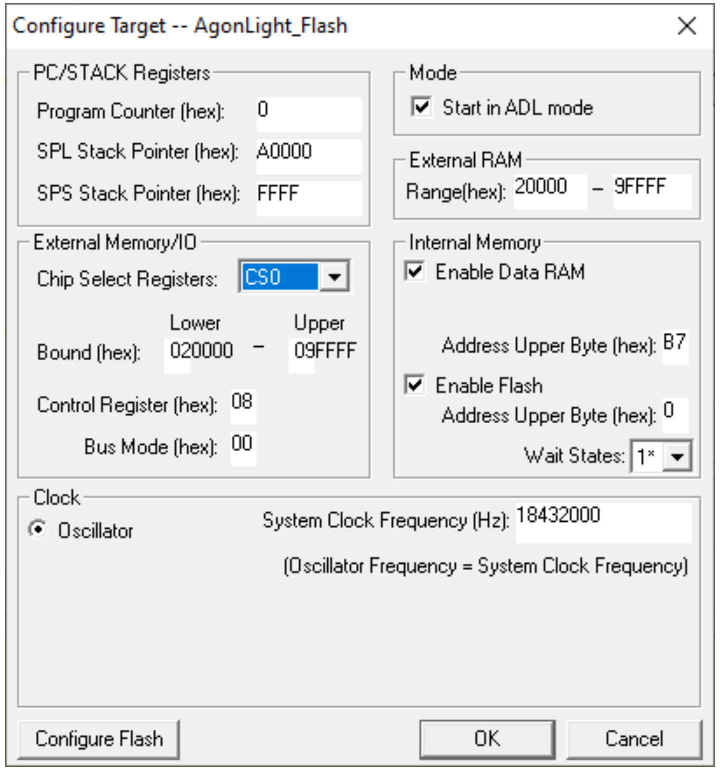
Channel:	full duplex, asynchronous
Baud rate:	384,000 bits per second
Signal structure:	1 start bit, 8 data bits, 1 stop bit, no parity bit (8N1)
Flow control:	CTS/RTS

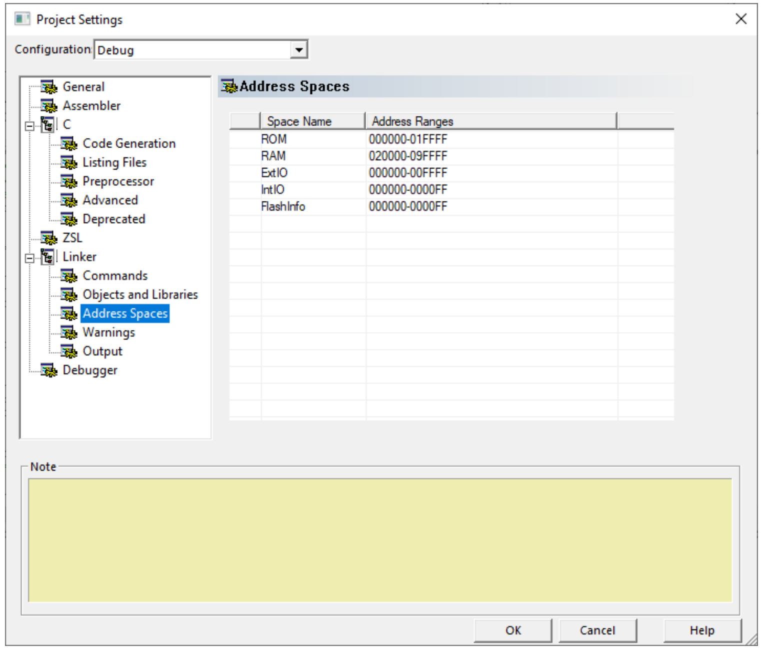
Other possible baud rates are: 115200, 128000, 144000, 192000, 230400 and 288000 bps

Developing firmware for the eZ80F92

- Use the freely-available Zilog ZDS-II™ IDE
- Installation files and documentation are provided in the Agon light Github repository, in the directories `/Third party tools` and `/Third party documentation`, respectively
- Configure your project as per the figures below (CS1, CS2 and CS3 are *not* used in Agon light, so their settings don't matter)

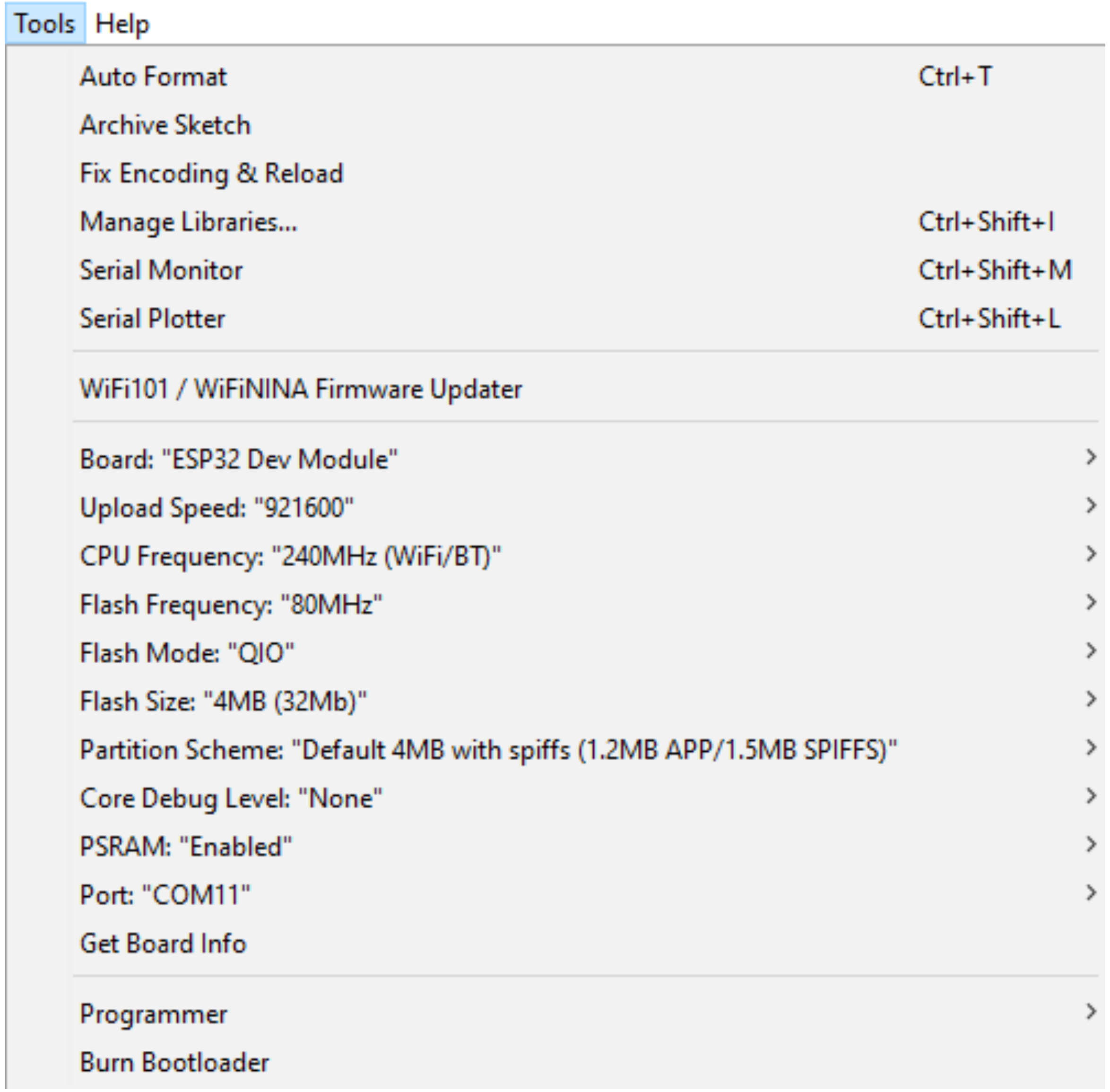






Developing firmware for the ESP32-PICO-D4

- Use the freely-available Arduino™ IDE
- Install the FabGL™ library as per instructions available online
  - Link to the FabGL library: http://www.fabglib.org/index.html
  - Link to installation tutorial: https://youtu.be/8OTaPQlSTas
- The figure to the right illustrates a suitable configuration for loading an Arduino sketch into the ESP32
  - Change the port number to the one active in your case



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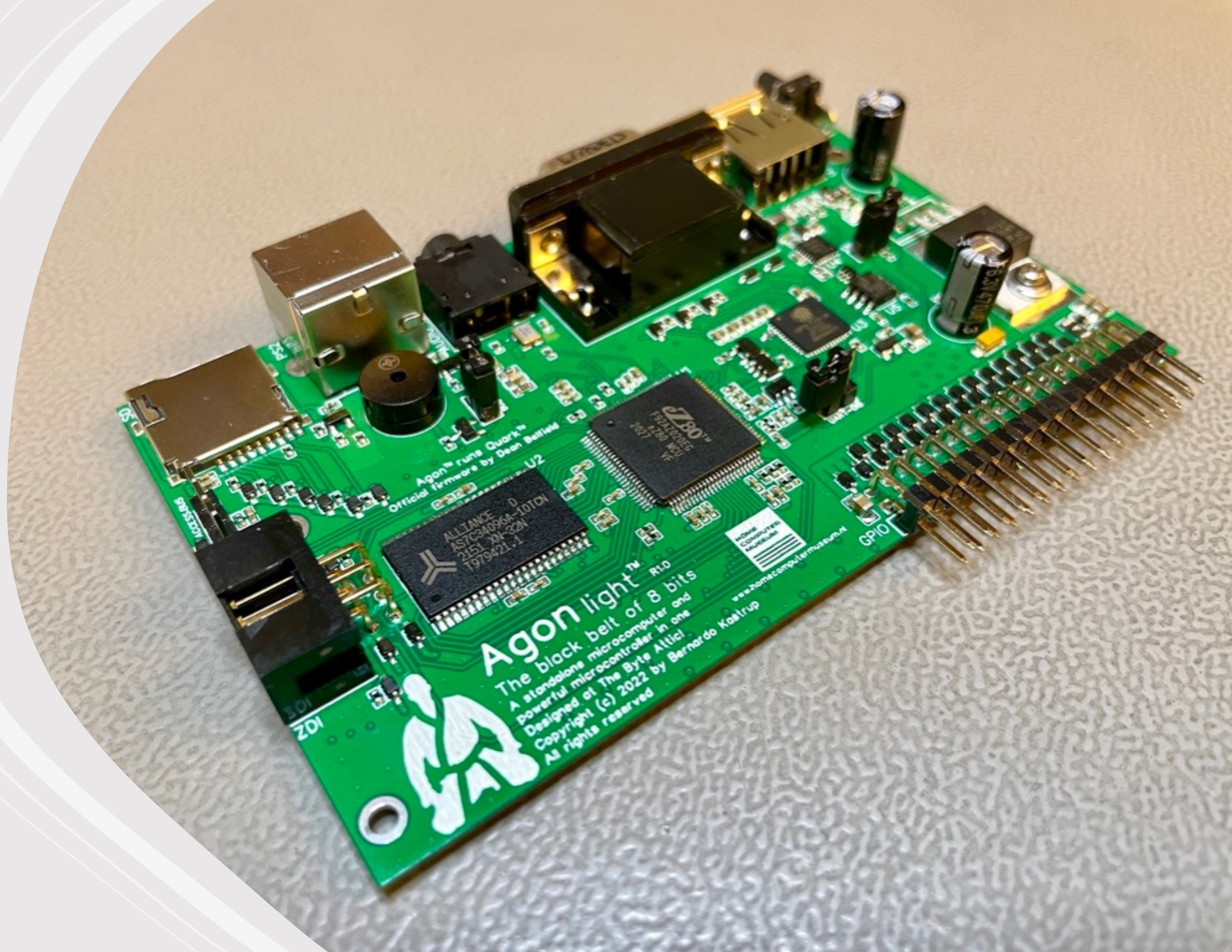
Assembly guide



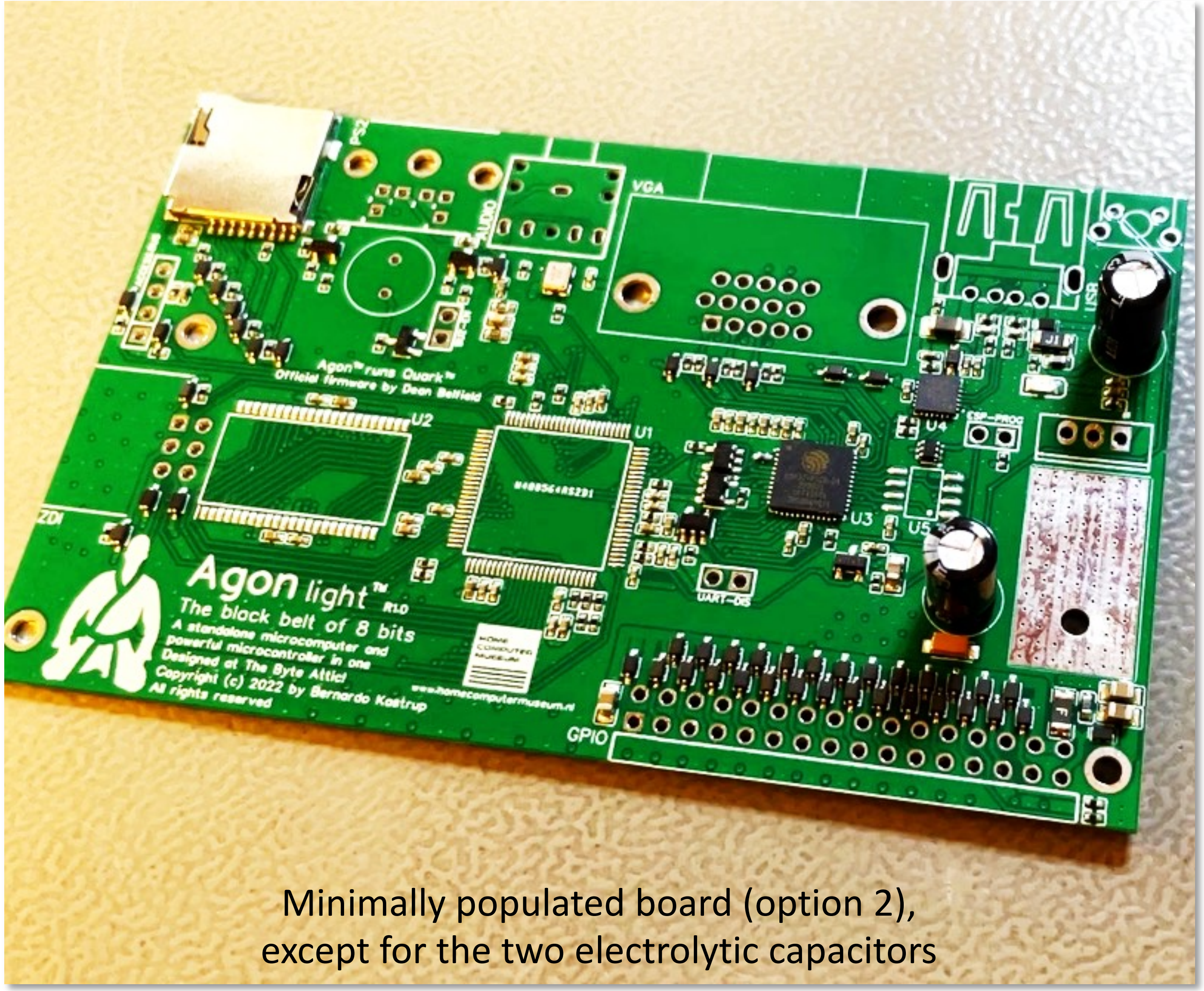
Assembly options

- There are four options:
  1. You buy the bare PCB and fully populate it yourself (requires a stencil and reflow oven)
  2. You buy a PCB minimally populated with the small parts and the two QFN ICs (U3 and U4), which are hard to solder by hand
  3. You buy a PCB with all SMD parts already populated from factory, only the through-hole parts still needing to be soldered
  4. You buy a fully-populated board, so you need not do any soldering yourself

- Options (1), (3) and (4) will not be discussed further: if you choose option (1) you know what you are doing, option (3) is easy enough, and option (4) requires nothing of you
- Option (2) requires though-hole and fine-pitch QFP drag-soldering. Here are the instructions for doing it properly: https://youtu.be/k9TF2ZCngoE
- Reasons for choosing option (2): PCB makers charge a premium (usually 50% of the parts' costs) for procuring parts for you, and there are multiple import fees involved. It's cheaper (and better, if you know how to do it) to buy and populate the most expensive parts (U1, U2 and U5) yourself, especially if you are building Agon light to sell it commercially

Manufacturing files

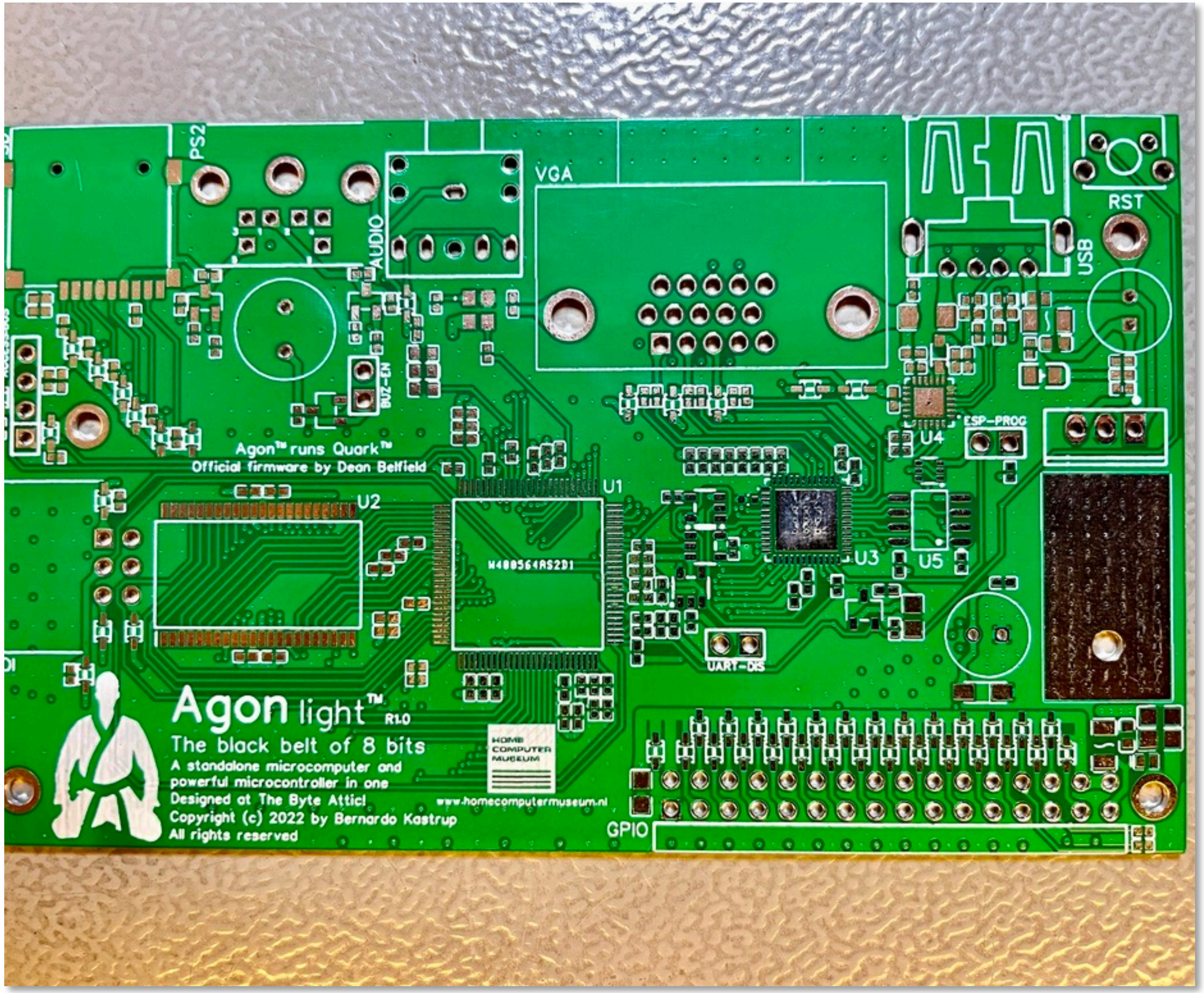
- All files are available in the `/Manufacturing` directory of Agon light's Github repository at: https://github.com/TheByteAttic/AgonLight
- For option (4), send the following files to your PCB manufacturer, next to the Gerber file (`Gerber_PCB_AgonLight_R1.0.zip`):
  - `PickAndPlace_PCB_AgonLight_R1.0.csv`
  - `BOM_PCB_AgonLight_R1.0.csv`
- For option (3), send these files:
  - `PickAndPlace_PCB_AgonLight_R1.0 NoTHT.csv`
  - `BOM_PCB_AgonLight_R1.0 NoTHT.csv`
- For option (2), send these:
  - `PickAndPlace_PCB_AgonLight_R1.0 MINIMAL.csv`
  - `BOM_PCB_AgonLight_R1.0 MINIMAL.csv`



Minimally populated board (option 2),
except for the two electrolytic capacitors

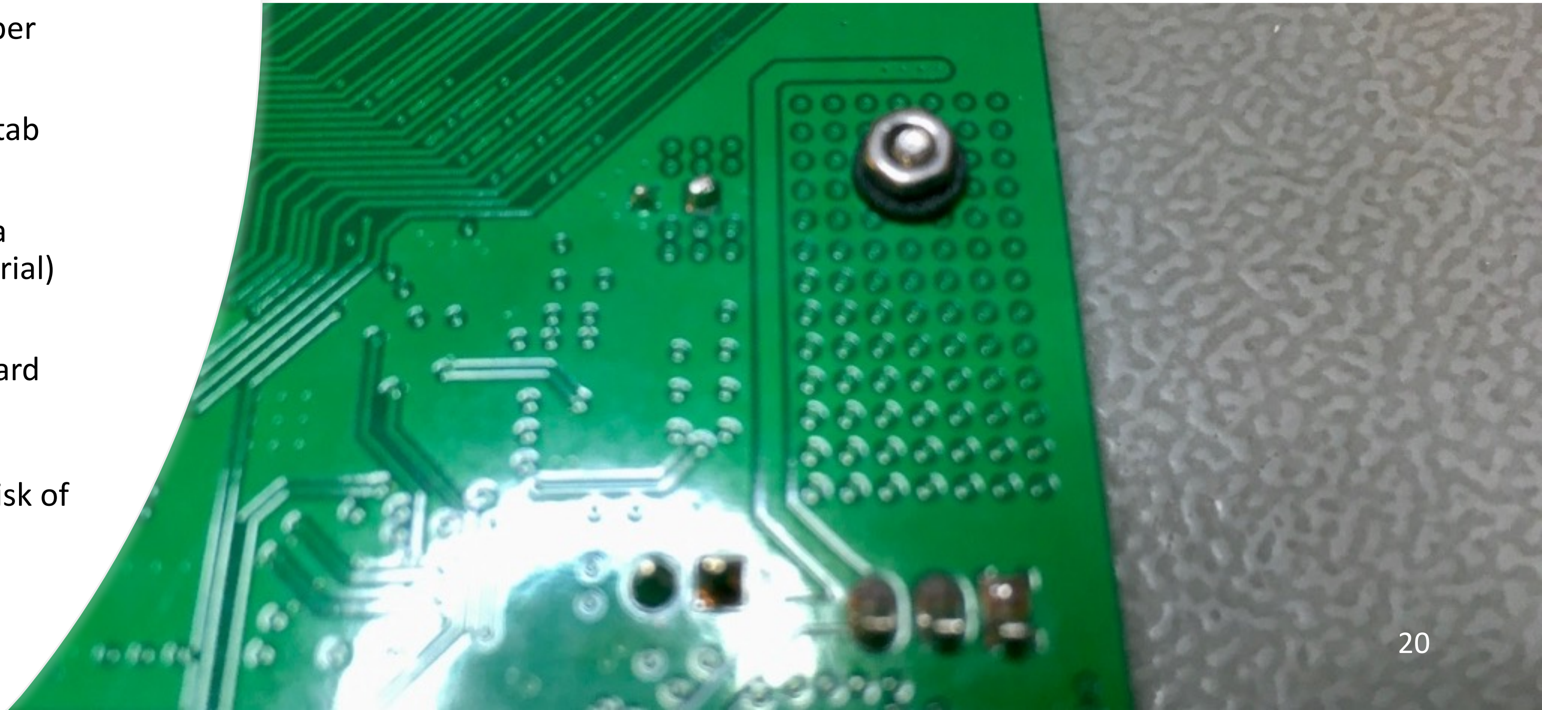
PCB layer stack

- Agon light’s PCB has four layers:
  - Two signal layers (top and bottom)
  - Two inner planes (GND and 3.3V)
- The stack is as follows:
  - *TopLayer* (signals + 3.3V copper flood)
  - *Inner1* (GND plane)
  - *Inner2* (3.3V plane)
  - *BottomLayer* (signals + GND copper flood)
- Agon light has tiny VIAs: **0.4mm** diameter with **0.205mm** drill holes, so choose a compatible process with your manufacturer
- I recommend total PCB thickness of **0.8mm**, so to improve signal integrity

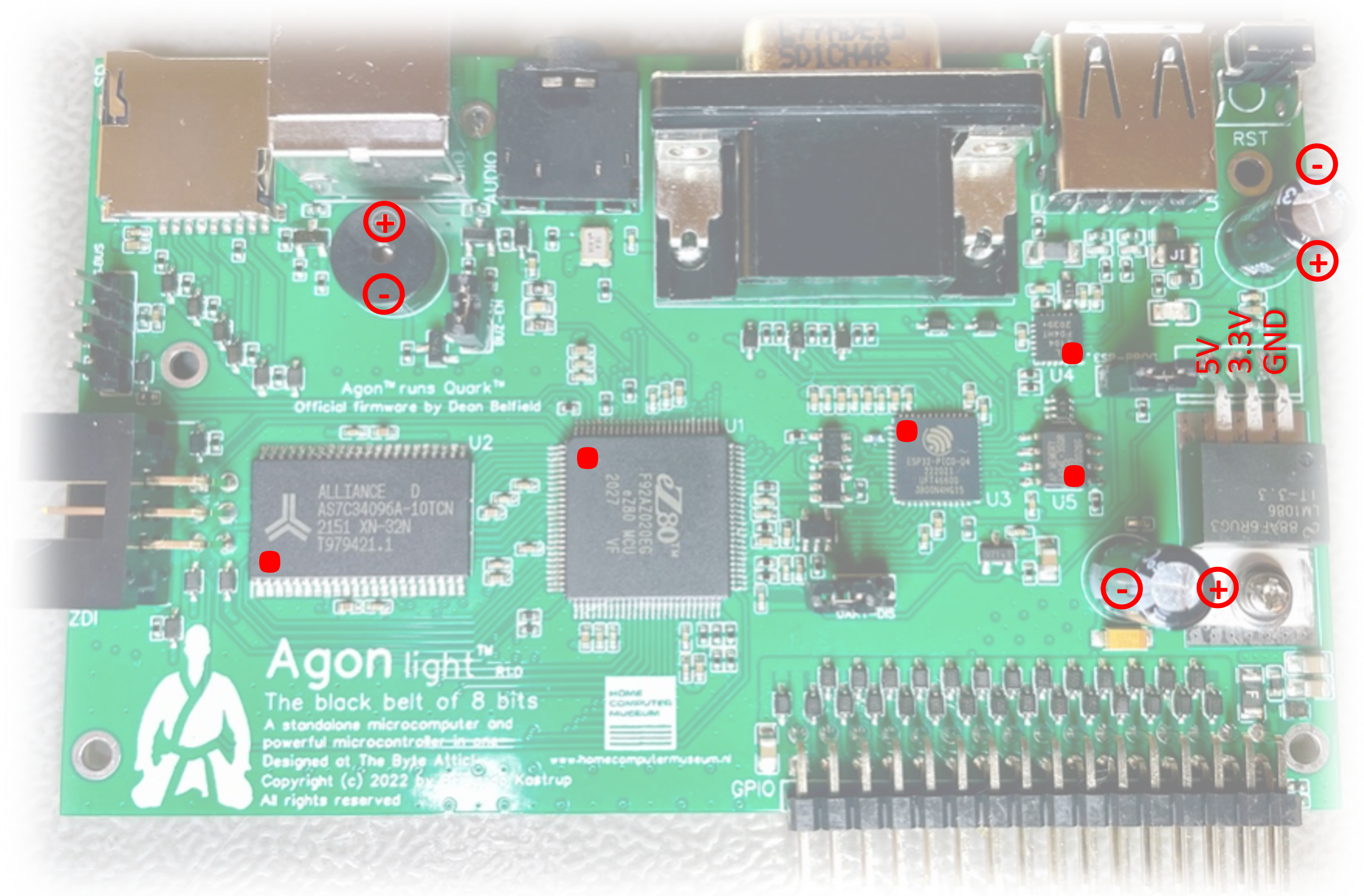


Mounting the LDO regulator

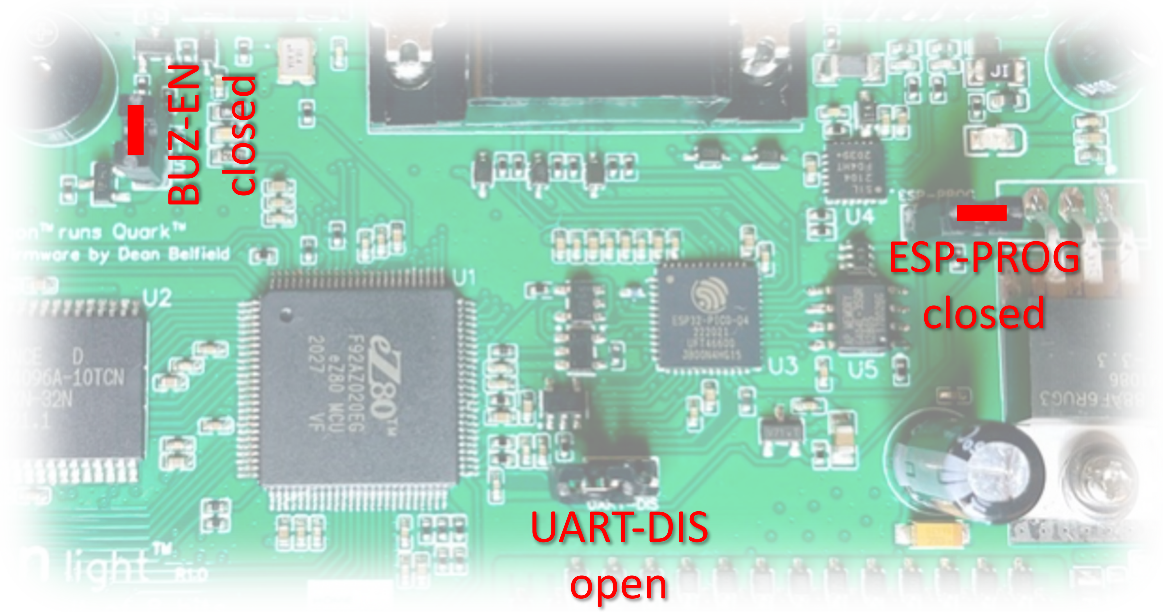
- Agon light’s 3.3V V_{CC} rail is provided by a Low-DropOut (LDO) linear regulator
- The regulator must be mounted flush against the corresponding exposed metal area on the top of the PCB (see top-right photo)
- The regulator’s tab (chassis) is at 3.3V, as is the exposed copper area on which it is to be mounted
- Use *no thermal paste or insulating spacers*; simply clean the tab and the exposed metal area with IPA before mounting
- Affix the regulator with a 2mm-diameter bolt, a regular and a lock washer on the top, and a nylon (or other dielectric material) washer and nut at the back (see bottom-right photo)
- The nylon washer is important to insulate the back of the board (which is copper-flooded with GND) from the bolt-nut combination, which will be at 3.3V
    - Using a metal washer on the back side increases the risk of a short-circuit if the solder mask fails

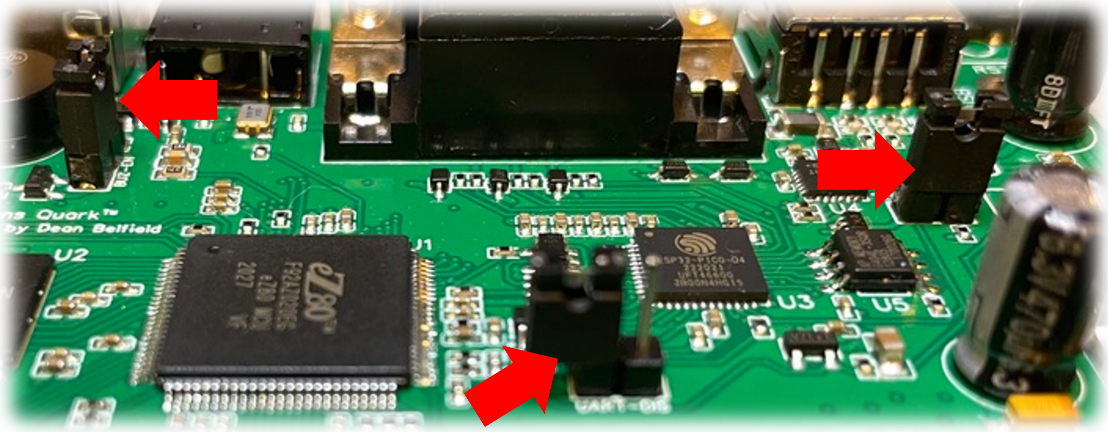


Part orientations



Default settings for the jumpers





When to change jumper settings

- Agon light should operate normally during both firmware programming and application execution with the default jumper settings (see previous page), but the ESP32 is known to be a sensitive device
  - Therefore, Agon light has built-in resources to deal with that sensitivity
- If the ESP32 goes into programming mode during execution, remove the jumper 'ESP-PROG' after programming (remember to place it back before reprogramming the ESP32)
- If you fail to program the ESP32, place the jumper 'UART-DIS' during programming (remember to remove it after programming, or Agon light will not operate properly)
- The buzzer produces sounds if speakers are not connected. If those sounds bother you, you can disable the buzzer by removing the jumper 'BUZ-EN'

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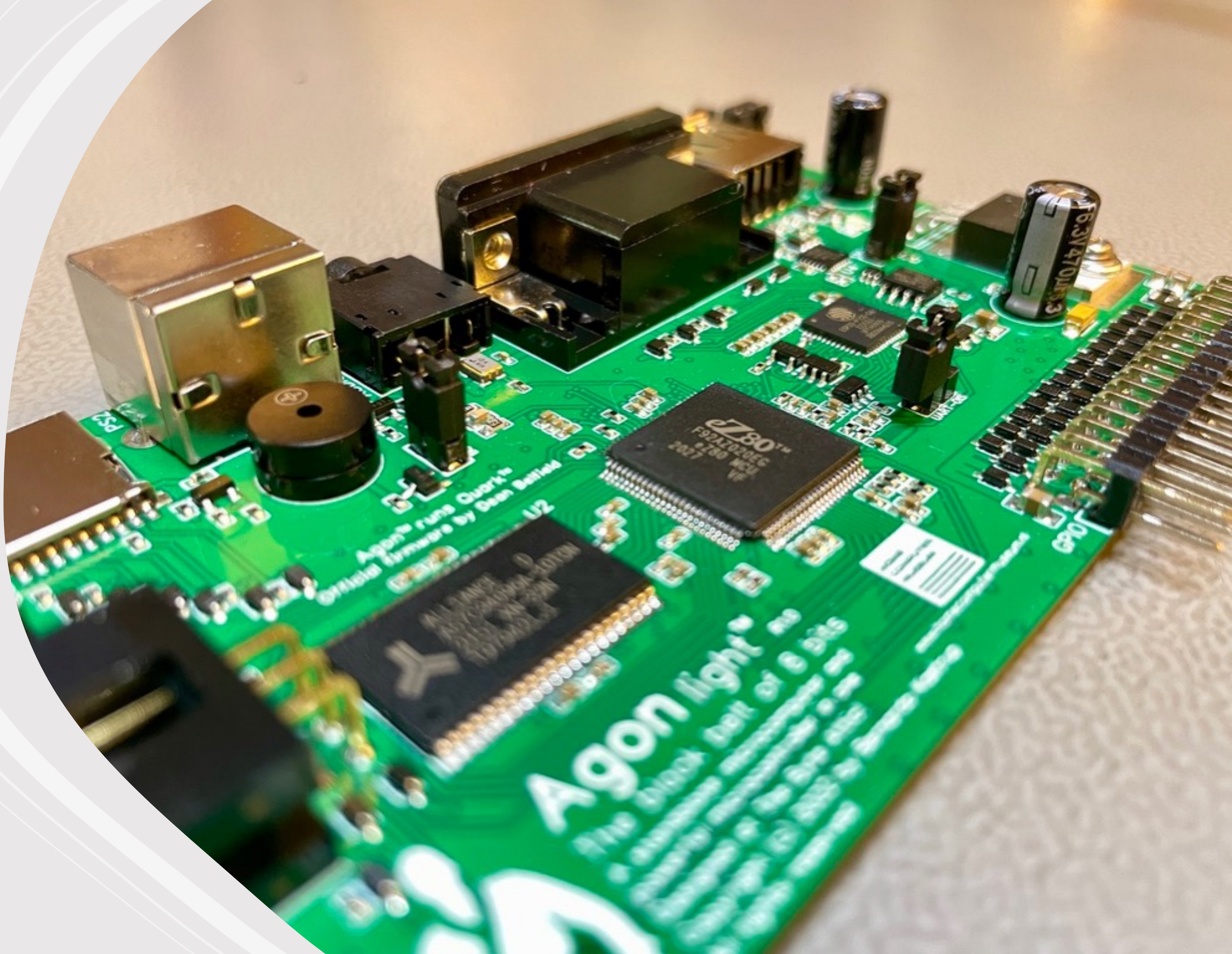
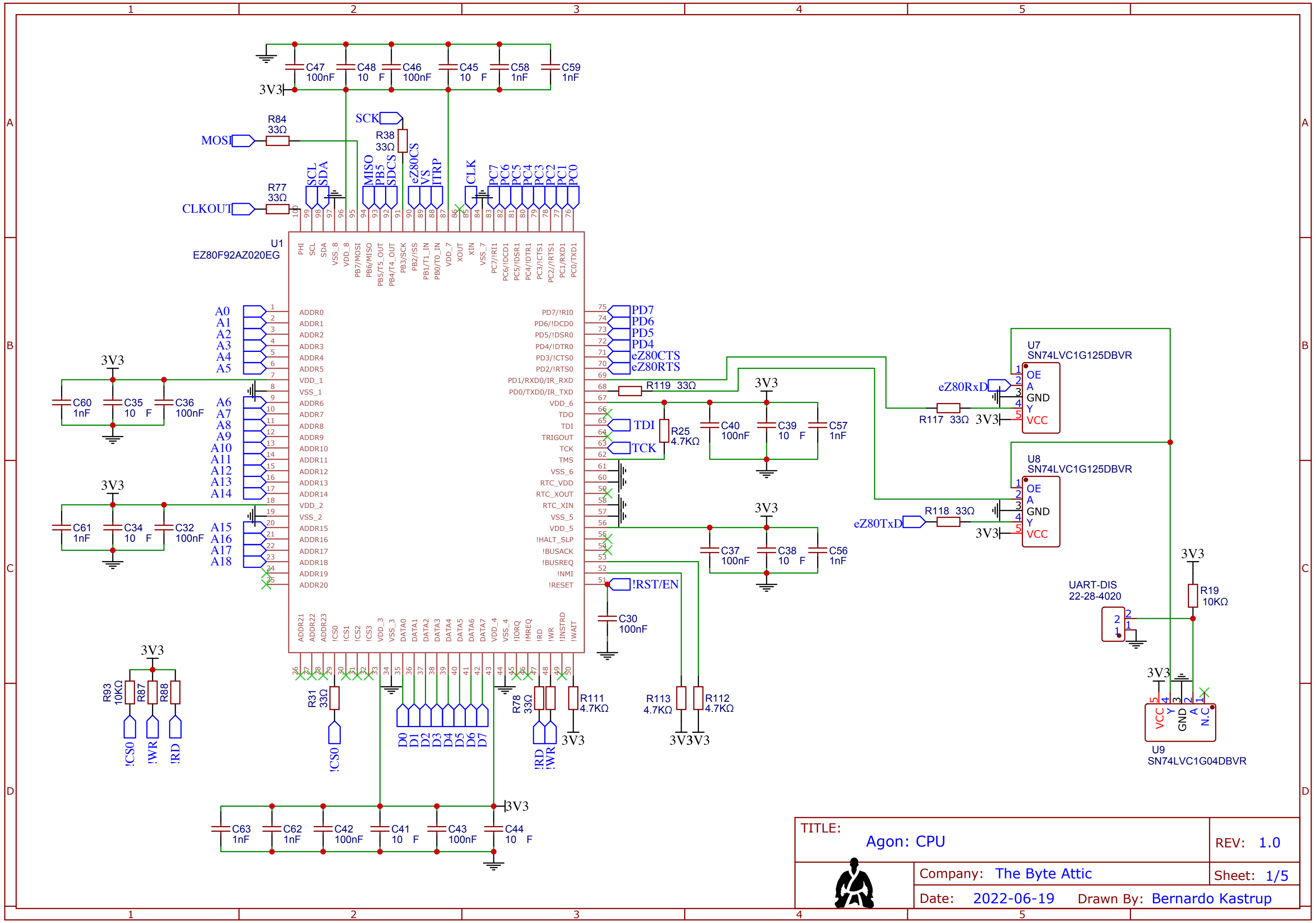
Schematics

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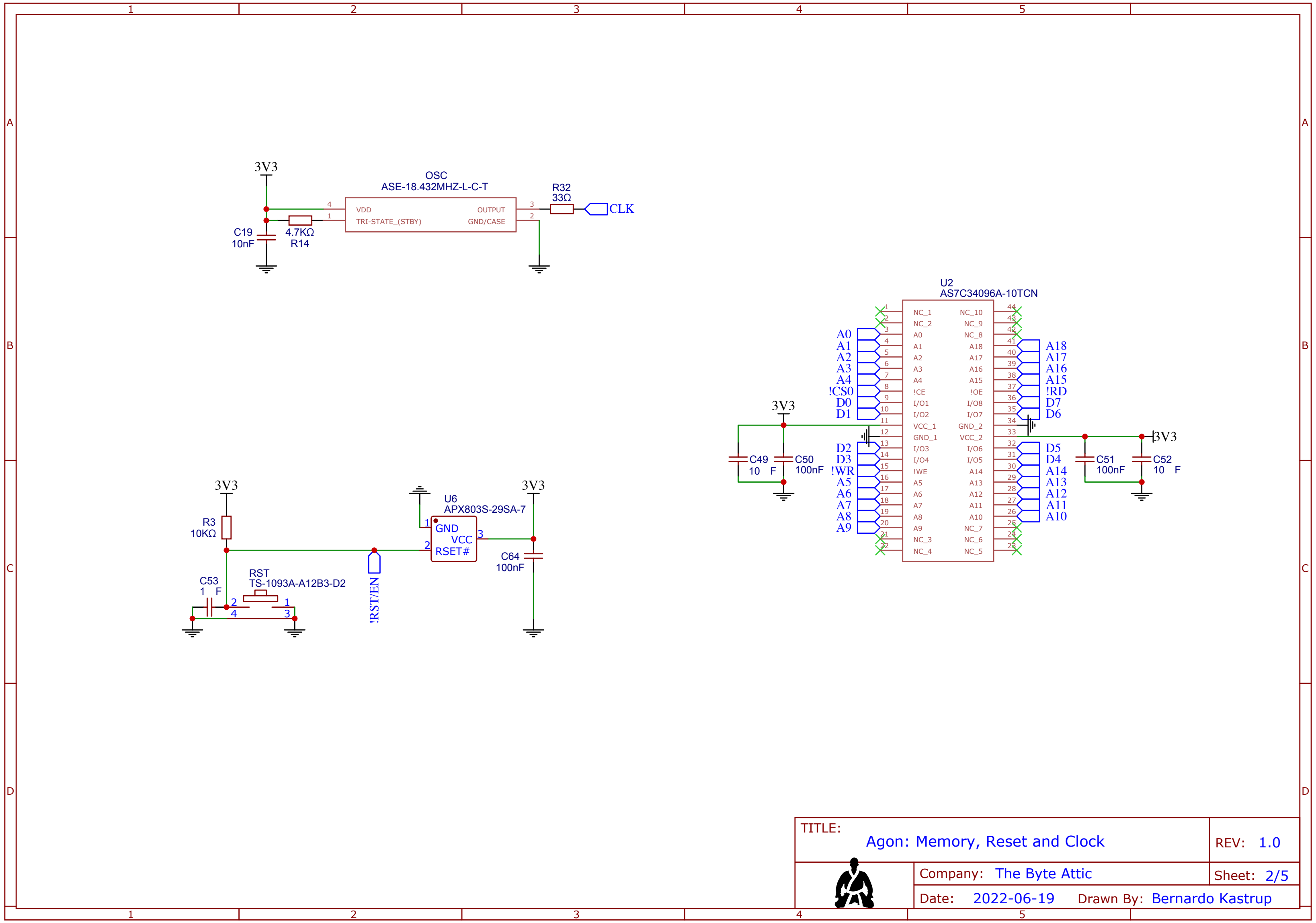
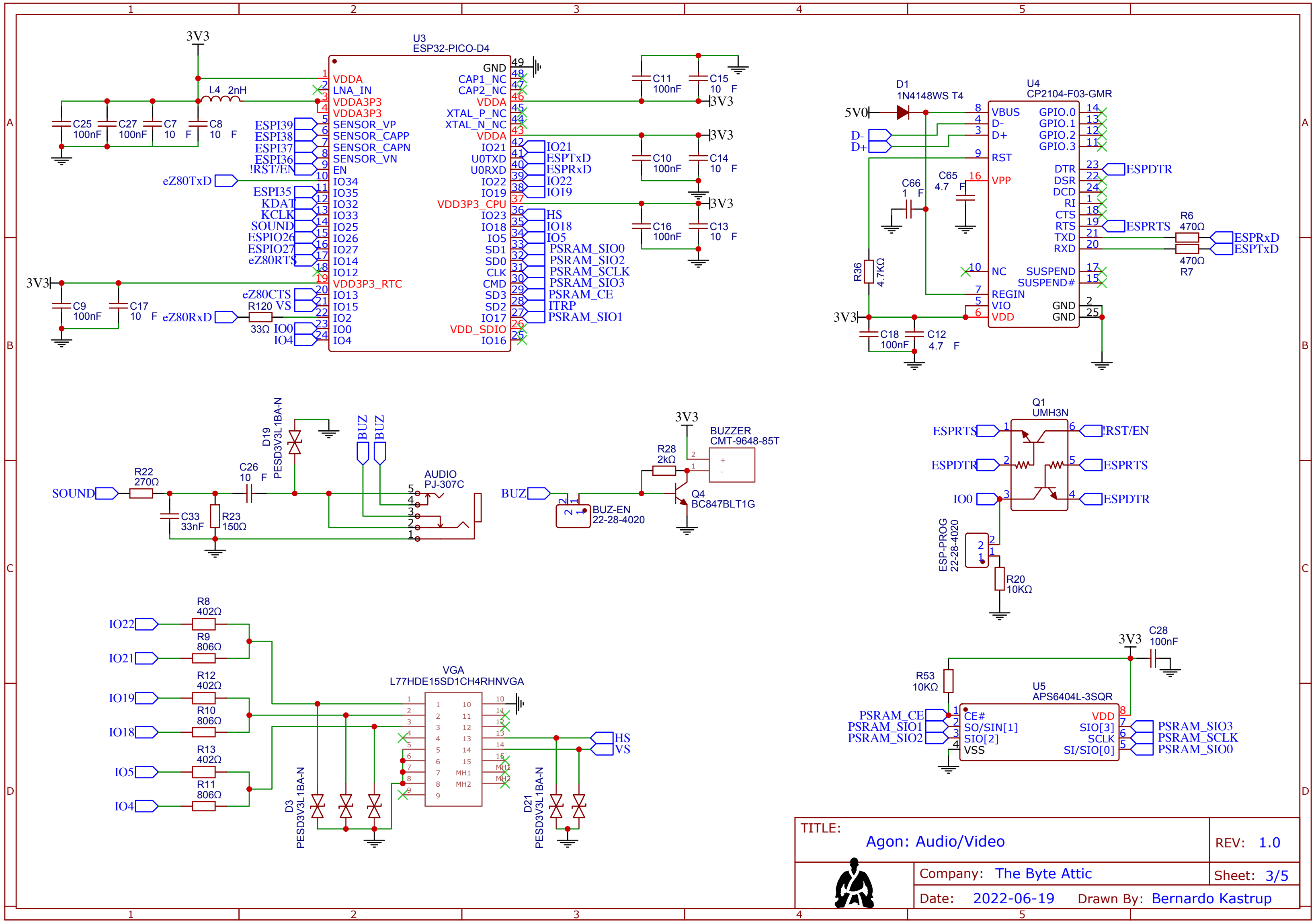
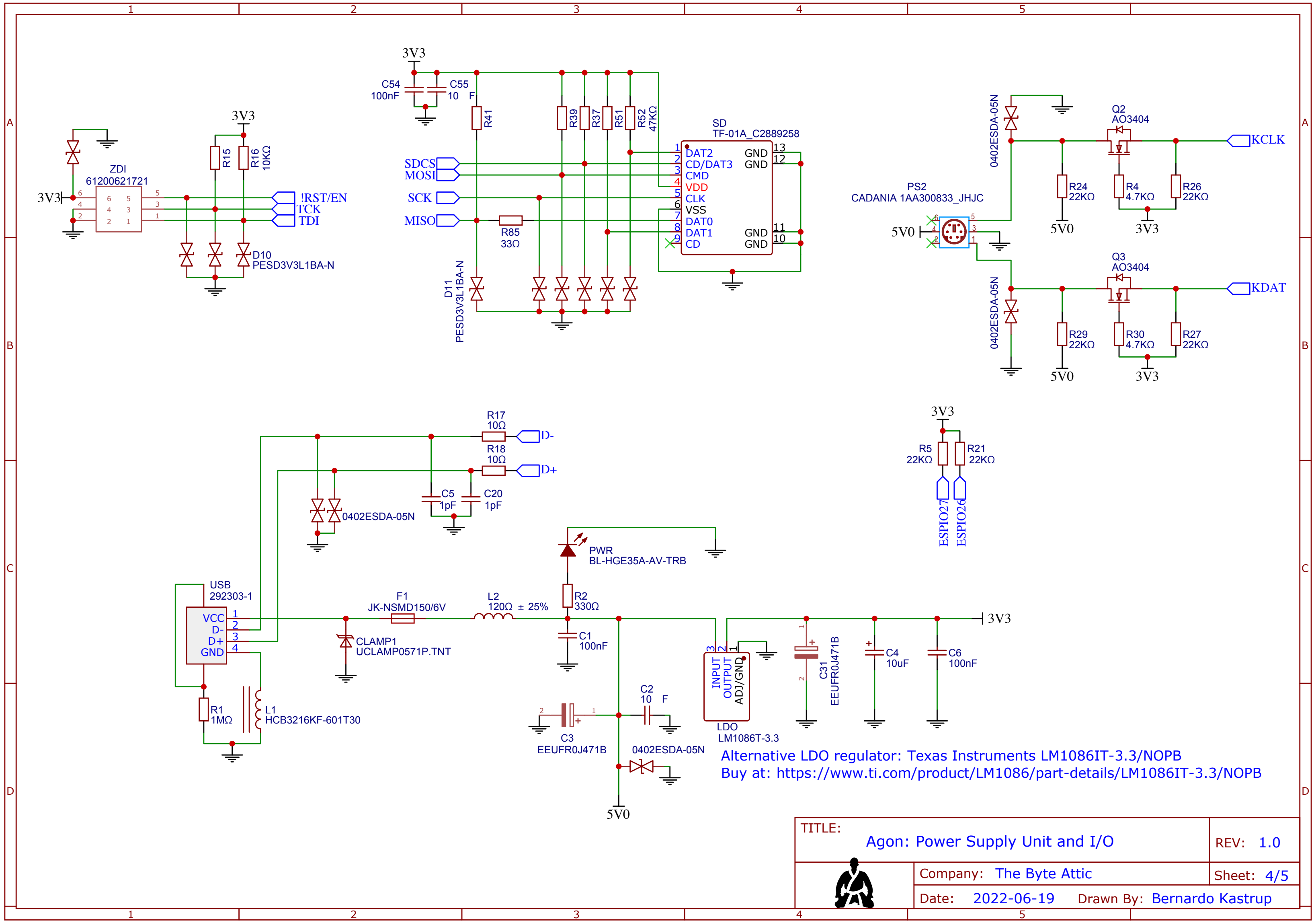
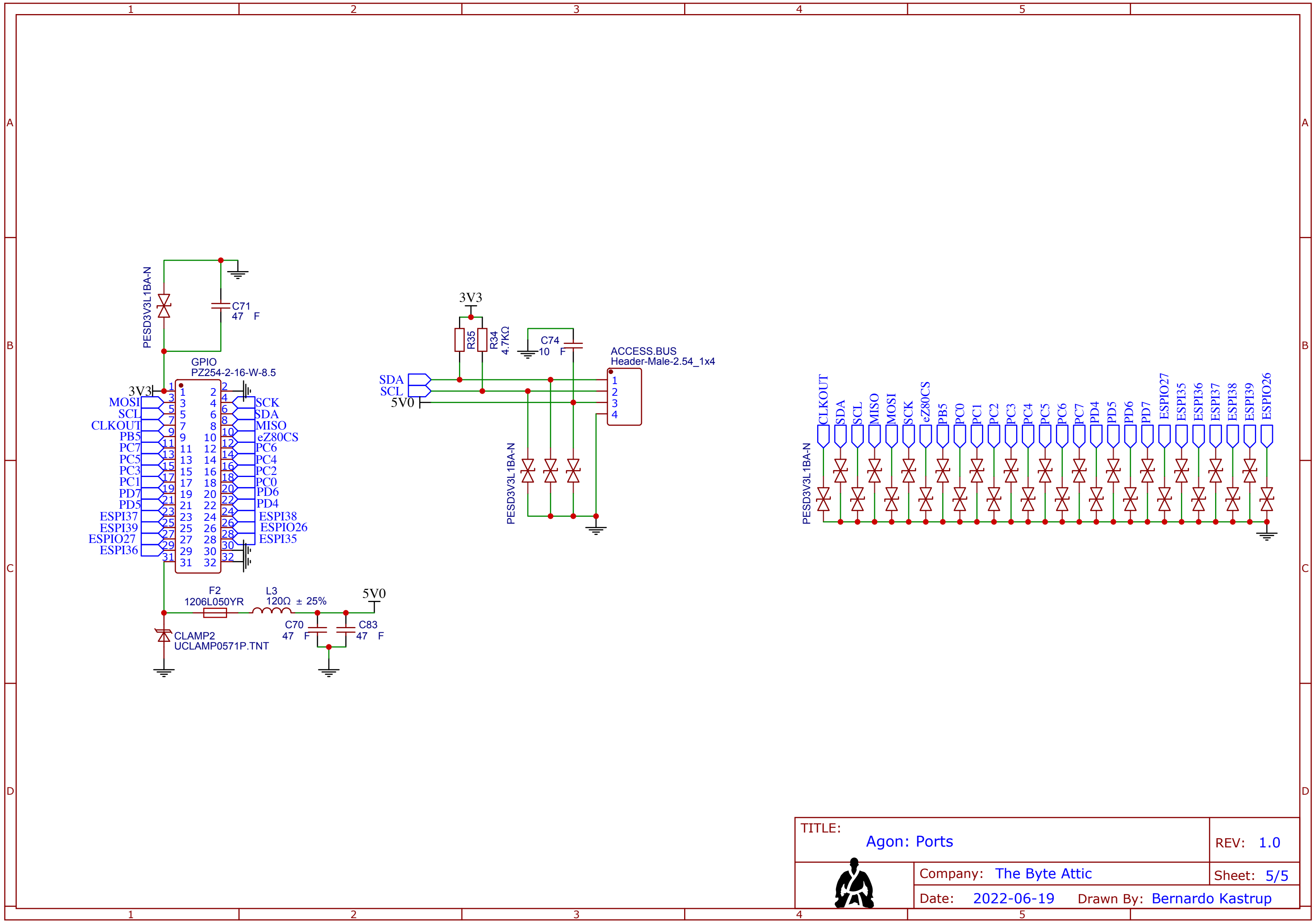
Agon: CPU
REV: 1.0
Company: The Byte Attic
Sheet: 1/5
Date: 2022-06-19
Drawn By: Bernardo Kastrup


3V3
OSC
ASE-18.432MHZ-L-C-T
VDD
TRI-STATE_(STBY)
OUTPUT
GND/CASE
R32
33Ω
CLK
C19
10nF
4.7KΩ
R14
U2
AS7C34096A-10TCN
3V3
U6
APX803S-29SA-7
GND
VCC
RSET#
R3
10KΩ
C64
100nF
RST
TS-1093A-A12B3-D2
C53
!RST/EN
C49
C50
100nF
C51
100nF
C52
TITLE:
Agon: Memory, Reset and Clock
REV: 1.0
Company: The Byte Attic
Sheet: 2/5
Date: 2022-06-19
Drawn By: Bernardo Kastrup


TITLE:
Agon: Audio/Video
REV: 1.0
Company: The Byte Attic
Sheet: 3/5
Date: 2022-06-19
Drawn By: Bernardo Kastrup
U3
ESP32-PICO-D4
U4
CP2104-F03-GMR
D1
1N4148WS T4
Q1
UMH3N
BUZZER
CMT-9648-85T
Q4
BC847BLT1G
AUDIO
PJ-307C
VGA
L77HDE15SD1CH4RHNVGA
U5
APS6404L-3SQR
ESP-PROG
22-28-4020
BUZ-EN
22-28-4020



3V3
C54
100nF
C55
R41
R39
R37
R51
R52
47KΩ
SD
TF-01A_C2889258
DAT2
CD/DAT3
CMD
VDD
CLK
VSS
DAT0
DAT1
CD
GND
SDCS
MOSI
SCK
MISO
R85
33Ω
D11
PESD3V3L1BA-N
ZDI
61200621721
R15
R16
10KΩ
!RST/EN
TCK
TDI
D10
PESD3V3L1BA-N
Q2
AO3404
Q3
AO3404
0402ESDA-05N
KCLK
KDAT
PS2
CADANIA 1AA300833_JHJC
5V0
R24
22KΩ
R4
4.7KΩ
R26
22KΩ
R29
22KΩ
R30
4.7KΩ
R27
22KΩ
R5
22KΩ
R21
22KΩ
ESPIO27
ESPIO26
R17
10Ω
D-
R18
10Ω
D+
C5
1pF
C20
1pF
PWR
BL-HGE35A-AV-TRB
USB
292303-1
VCC
D-
D+
GND
F1
JK-NSMD150/6V
L2
120Ω ± 25%
R2
330Ω
C1
100nF
CLAMP1
UCLAMP0571P.TNT
R1
1MΩ
L1
HCB3216KF-601T30
C3
EEUFR0J471B
C2
INPUT
OUTPUT
ADJ/GND
LDO
LM1086T-3.3
C31
EEUFR0J471B
C4
10uF
C6
100nF
Alternative LDO regulator: Texas Instruments LM1086IT-3.3/NOPB
Buy at: https://www.ti.com/product/LM1086/part-details/LM1086IT-3.3/NOPB
TITLE:
Agon: Power Supply Unit and I/O
REV: 1.0
Company: The Byte Attic
Sheet: 4/5
Date: 2022-06-19
Drawn By: Bernardo Kastrup


GPIO
PZ254-2-16-W-8.5
PESD3V3L1BA-N
C71
47 F
3V3
MOSI
SCL
CLKOUT
PB5
PC7
PC5
PC3
PC1
PD7
PD5
ESPI37
ESPI39
ESPIO27
ESPI36
SCK
SDA
MISO
eZ80CS
PC6
PC4
PC2
PC0
PD6
PD4
ESPI38
ESPIO26
ESPI35
F2
1206L050YR
L3
120Ω ± 25%
5V0
C70
47 F
C83
47 F
CLAMP2
UCLAMP0571P.TNT
R35
R34
4.7KΩ
C74
10 F
ACCESS.BUS
Header-Male-2.54_1x4
SDA
SCL
5V0
TITLE:
Agon: Ports
REV: 1.0
Company: The Byte Attic
Sheet: 5/5
Date: 2022-06-19
Drawn By: Bernardo Kastrup

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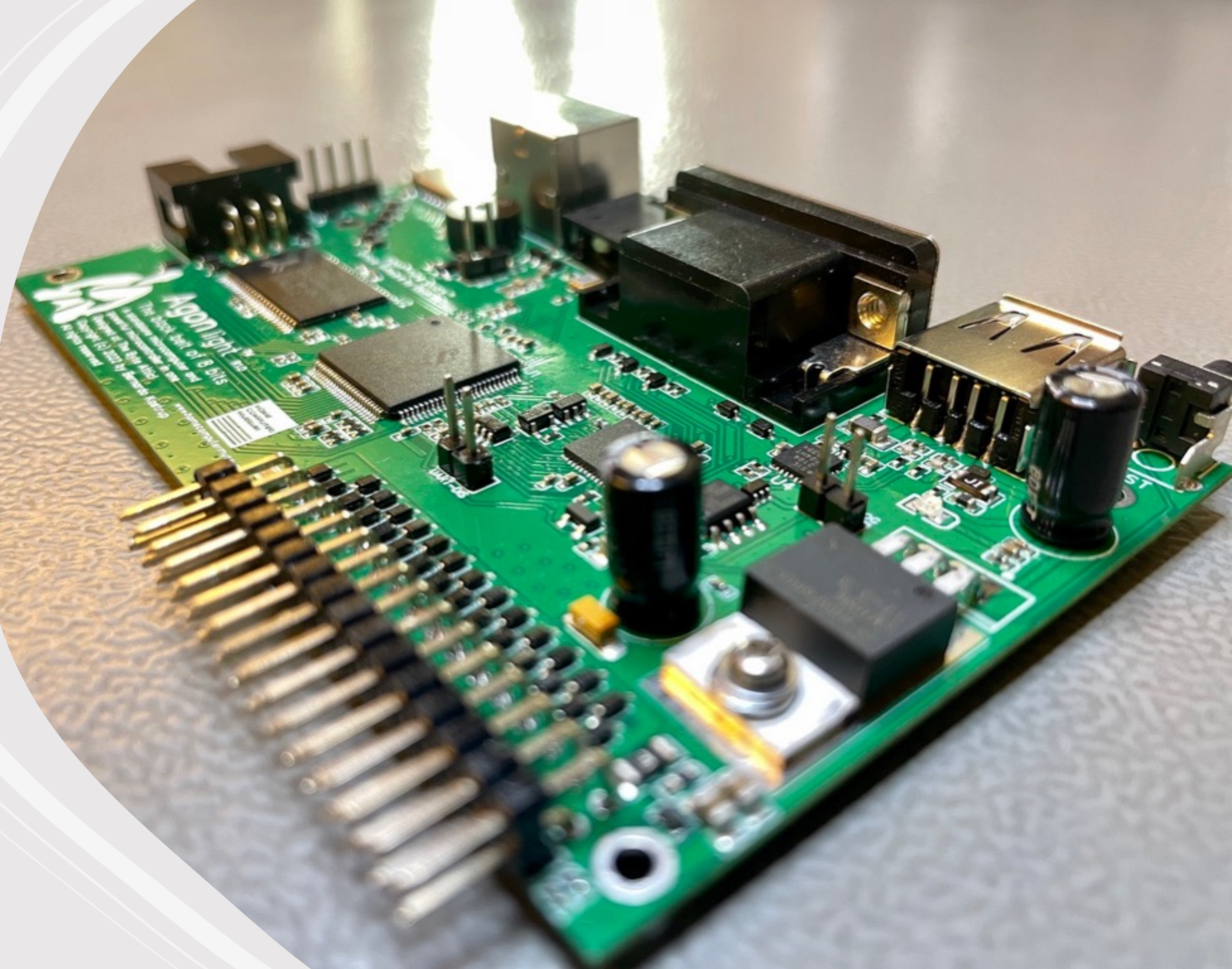
Bill of Materials

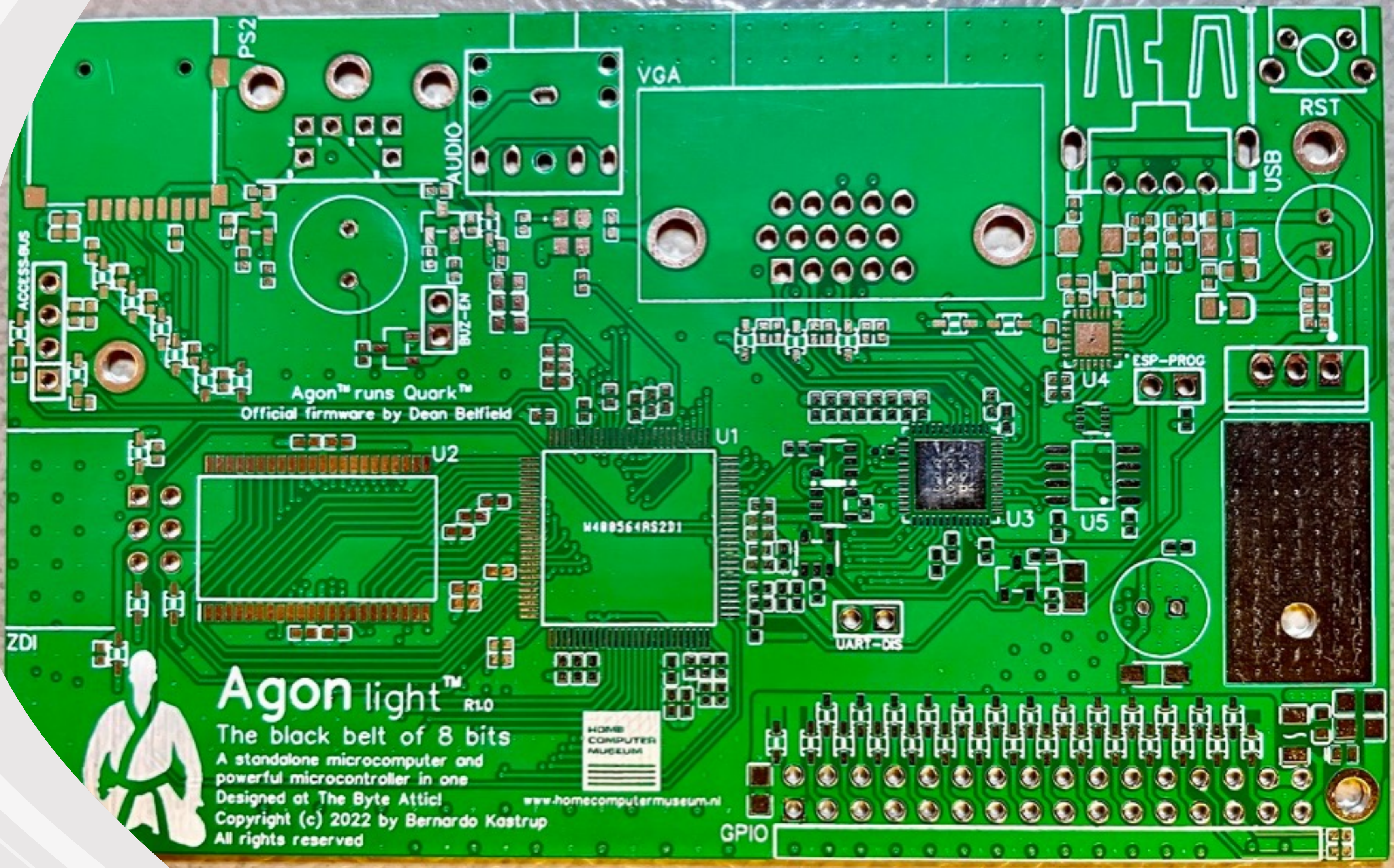


ID	Name	Designator	Footprint	Quantity	Manufacturer Part	Manufacturer	Supplier	Supplier Part	Price
1	BC847BLT1G	Q4	SOT-23-3_L2.9-W1.6-P1.90-LS2.8-BR	1	BC847BLT1G	ON	LCSC	C94393	0.035
2	2kΩ	R28	R0402	1	0402WGF2001TCE	UniOhm	LCSC	C4109	0.001
3	ASE-18.432MHZ-L-C-T	OSC	ASE18432MHZLCT	1	ASE-18.432MHZ-LC-T	ABRACON	Mouser	815-ASE18.432MHZLCT	
4	AS7C34096A-10TCN	U2	SOP80P1181X120-44N	1	AS7C34096A-10TCN	Alliance Memory	Mouser	913-AS7C34096A-10TCN	
5	PZ254-2-16-W-8.5	GPIO	HDR-TH_32P-P2.54-H-M-R2-C16-S2.54	1	PZ254-2-16-W-8.5	HCTL(华灿天禄)	LCSC	C2894996	0.384
6	Header-Male-2.54_1x4	ACCESS.BUS	HDR-TH_4P-P2.54-V-M	1	'4P L=11.6MMGold-plat	Ckmtw	LCSC	C124378	0.049
7	PJ-307C	AUDIO	AUDIO-TH_PJ307C	1	PJ-307C	BOOMELE	LCSC	C16684	0.043
8	22-28-4020	BUZ-EN,ESP-PROG,UART-DIS	HDR-TH_2P-P2.54-V-M-1	3	22-28-4020	MOLEX	LCSC	C234182	0.076
9	CMT-9648-85T	BUZZER	CMT964885T	1					
10	100nF	C1,C6,C9,C10,C11,C16,C18,C25,C27,C28,C30,C32,C36,C37,C40,C42,C43,C46,C47,C50,C51,C54,C64	C0402_NEW	23	CL05B104KO5NNNC	SAMSUNG	LCSC	C1525	0.001
11	10μF	C2,C7,C8,C13,C14,C15,C17,C26,C34,C35,C38,C39,C41,C44,C45,C48,C49,C52,C55,C74	C0402	20	CL05A106MQ5NUNC	SAMSUNG	LCSC	C15525	0.005
12	1pF	C5,C20	C0402	2	0402CG1R0C500NT	FH	LCSC	C1550	0.001
13	4.7μF	C12,C65	C0402	2	CL05A475MP5NRNC	SAMSUNG	LCSC	C23733	0.006
14	10nF	C19	C0402	1	CL05B103KB5NNNC	SAMSUNG	LCSC	C15195	0.001
15	1nF	C56,C57,C58,C59,C60,C61,C62,C63	C0402	8	0402B102K500NT	FH	LCSC	C1523	0.001
16	1μF	C66	C0402	1	CL05A105KO5NNNC	SAMSUNG	LCSC	C29266	0.003
17	EEUFR0J471B	C3,C31	CAPPRD250W55D630H1270	2	EEU-FR0J471B	Panasonic	Mouser	667-EEU-FR0J471B	
18	10uF	C4	CAP-SMD_L3.2-W1.6-R-RD	1	TAJA106K016RNJ	AVX	LCSC	C7171	0.098
19	33nF	C33	C0603	1	CL10B333KB8NNNC	SAMSUNG	LCSC	C21117	0.006
20	1μF	C53	C0805	1	CL21B105KBFNNNE	SAMSUNG	LCSC	C28323	0.009
21	47μF	C70,C71,C83	C0805	3	CL21A476MQYNNNE	SAMSUNG	LCSC	C16780	0.026
22	UCLAMP0571P.TNT	CLAMP1,CLAMP2	SGP1610N2_L1.6-W1.0-P1.1-RD	2	UCLAMP0571P.TNT	SEMTECH	LCSC	C512387	0.403
23	1N4148WS T4	D1	SOD-323_L1.8-W1.3-LS2.5-RD	1	1N4148WS T4	CJ	LCSC	C2128	0.013
24	PESD3V3L1BA-N	D2,D3,D4,D5,D6,D7,D9,D10,D11,D12,D13,D14,D15,D16,D17,D19,D20,D21,D22,D23,D24,D25,D26,D27,D28,D29,D31,D44,D53,D60,D63,D64,D65,D66,D67,D68,D73,D74,D75,D76,D77,D78,D83,D84,D85,D92	SOD-323_L1.8-W1.3-LS2.5-BI	46	PESD3V3L1BA-N	Bourne Semicon (Shenzhen)	LCSC	C316020	0.051
25	ESD3	D8	D0402-BI	1	0402ESDA-05N	Bourne Semicon (Shenzhen)	LCSC	C316049	0.019
26	0402ESDA-05N	D88,ESD4,ESD-PROT1,ESD-PROT2,ESD-PROT3	D0402-BI	5	0402ESDA-05N	Bourne Semicon (Shenzhen)	LCSC	C316049	0.019
27	JK-NSMD150/6V	F1	F1206	1	JK-nSMD150/6V	JK(金科)	LCSC	C2830249	0.036
28	1206L050YR	F2	F1206	1	1206L050YR	Littelfuse	LCSC	C163512	0.065
29	HCB3216KF-601T30	L1	L1206	1	HCB3216KF-601T30	TAITEC	LCSC	C357023	0.028
30	120Ω ±25%	L2,L3	L0603	2	BLM18KG121TN1D	MuRata	LCSC	C85831	0.017
31	2nH	L4	IND-SMD_L1.2-W0.6	1	AISC-0402-2N0J-T	Abracon LLC	LCSC	C186816	0.224
32	LM1086T-3.3	LDO	TO-220-3_L10.0-W4.5-P2.54-L	1	LM1086T-3.3	HGSEMI	C, Distrelec, F	C444381	0.241
33	CADANIA 1AA300833_JHJC	PS2	PS2_PORT	1					
34	BL-HGE35A-AV-TRB	PWR	LED0805-R-RD	1	BL-HGE35A-AV-TRB	Bright LED Elec	LCSC	C165984	
35	UMH3N	Q1	SC-70-6_L2.2-W1.3-P0.65-LS2.1-BR	1	UMH3N	CJ	LCSC	C62892	0.047
36	AO3404	Q2,Q3	SOT-23-3_L2.9-W1.3-P1.90-LS2.4-BR	2	AO3404	Guangdong Hottech	LCSC	C192925	0.049
37	1MΩ	R1	R0402	1	0402WGF1004TCE	UniOhm	LCSC	C26083	0.001
38	330Ω	R2	R0402	1	0402WGF3300TCE	UniOhm	LCSC	C25104	0.001
39	10KΩ	R3,R15,R16,R19,R20,R53,R87,R88,R93	R0402	9	0402WGF1002TCE	UniOhm	LCSC	C25744	0.001
40	4.7KΩ	R4,R14,R25,R30,R34,R35,R36,R111,R112,R113	R0402	10	0402WGF4701TCE	UniOhm	LCSC	C25900	0.001
41	22KΩ	R5,R21,R24,R26,R27,R29	R0402	6	0402WGF2202TCE	UniOhm	LCSC	C25768	0.001
42	470Ω	R6,R7	R0402	2	0402WGF4700TCE	UniOhm	LCSC	C25117	0.001
43	402Ω	R8,R12,R13	R0402	3	PTFR0402B402RN9	RESI(开步睿思)	LCSC	C2692962	0.079
44	806Ω	R9,R10,R11	R0402	3	TC0225B8060TCE	Uniroyal Elec	LCSC	C150511	0.061
45	10Ω	R17,R18	R0402	2	0402WGF100JTCE	UniOhm	LCSC	C25077	0.001
46	33Ω	R31,R32,R38,R77,R78,R79,R84,R85,R117,R118,R119,R120	R0402	12	0402WGF330JTCE	UniOhm	LCSC	C25105	0.001
47	47KΩ	R37,R39,R41,R51,R52	R0402	5	0402WGF4702TCE	UniOhm	LCSC	C25792	0.001
48	270Ω	R22	R0603	1	0603WAF2700T5E	UniOhm	LCSC	C22966	0.001
49	150Ω	R23	R0603	1	0603WAF1500T5E	UniOhm	LCSC	C22808	0.002
50	TF-01A_C2889258	SD	TF-SMD_TF-02	1	TF-01A	Yuandi(台湾元迪)	LCSC	C2889258	0.088
51	EZ80F92AZ020EG	U1	QFP50P1600X1600X160-100N	1	EZ80F92AZ020EG	Zilog	Mouser	692-EZ80F92AZ020EG	
52	ESP32-PICO-D4	U3	QFN-48_L7.0-W7.0-P0.50-BL-EP5.4	1	ESP32-PICO-D4	Espressif Systems	LCSC	C193707	3.82
53	CP2104-F03-GMR	U4	QFN-24_L4.0-W4.0-P0.50-BL-EP2.6	1	CP2104-F03-GMR	SILICON LABS	LCSC	C47015	2.361
54	APS6404L-3SQR	U5	SOP-8_L4.9-W3.9-P1.27-LS6.0-BL	1	APS6404L-3SQR-SN	AP Memory	Mouser	878-APS6404L-3SQR-SN	
55	APX803S-29SA-7	U6	SOT-23-3_L2.9-W1.6-P1.90-LS2.8-BR	1	APX803S-29SA-7	Diodes Incorporated	LCSC	C143831	
56	SN74LVC1G125DBVR	U7,U8	SOT-23-5_L3.0-W1.7-P0.95-LS2.8-BR	2	SN74LVC1G125DBVR	TI	LCSC	C23654	0.087
57	SN74LVC1G04DBVR	U9	SOT-23-5_L3.0-W1.7-P0.95-LS2.8-BR	1	SN74LVC1G04DBVR	TI	LCSC	C7827	0.112
58	292303-1	USB	USB-A-TH_USB-302-T	1	292303-1	TE Connectivity	LCSC	C86461	0.407
59	L77HDE15SD1CH4RHNVGA	VGA	L77HDE15SD1CH4RHNVGA	1					
60	61200621721	ZDI	SHDRRA6W64P254X254_2X3_1528X88	1					
61	TS-1093A-A12B3-D2	RST	KEY-TH_4P-L7.1-W12.4-P4.50-LS2.5	1	TS-1093A-A12B3-D2	Yuandi	LCSC	C499319	0.062

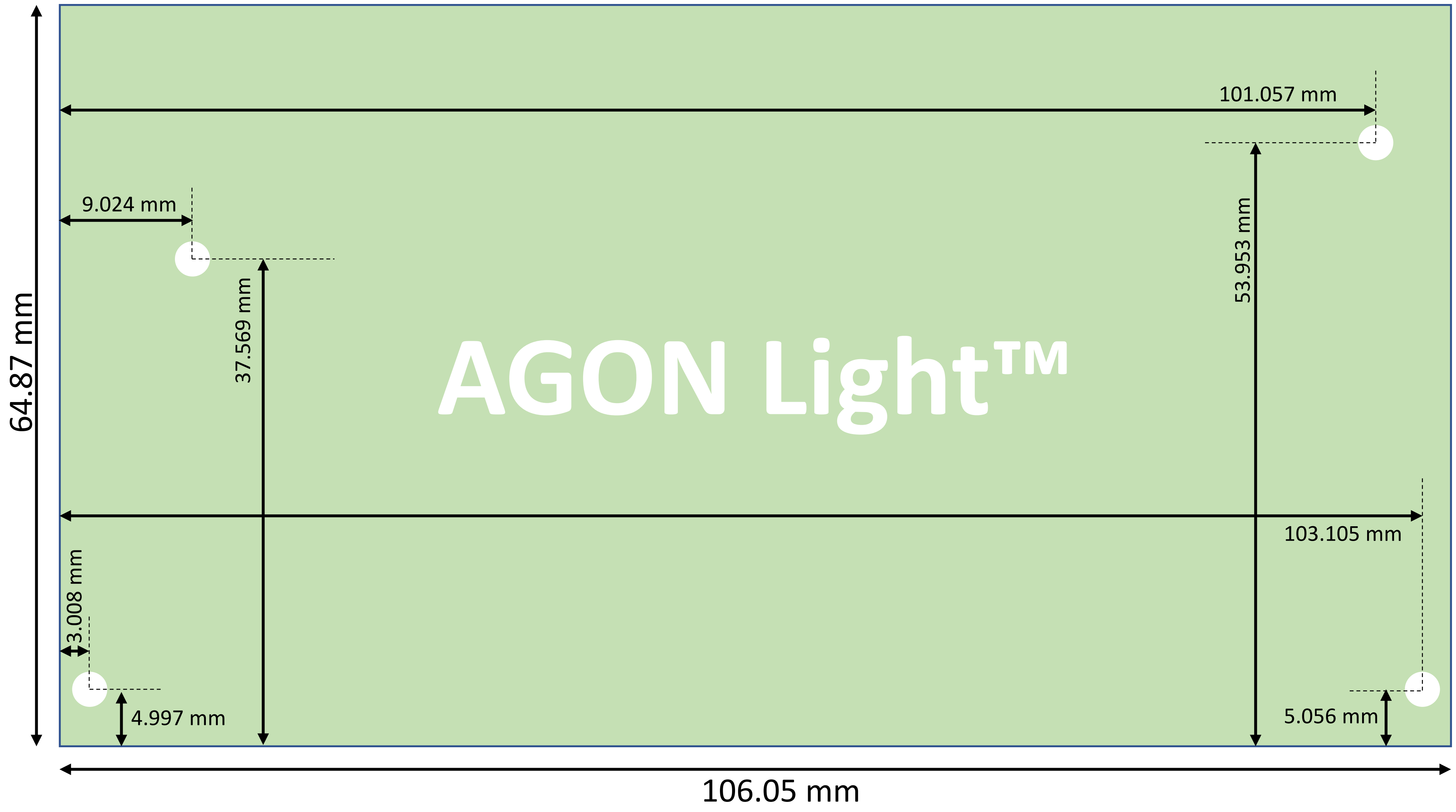
The Byte Attic’s

Agon light™

PCB dimensions



PCB dimensions (diagram *not* to scale)

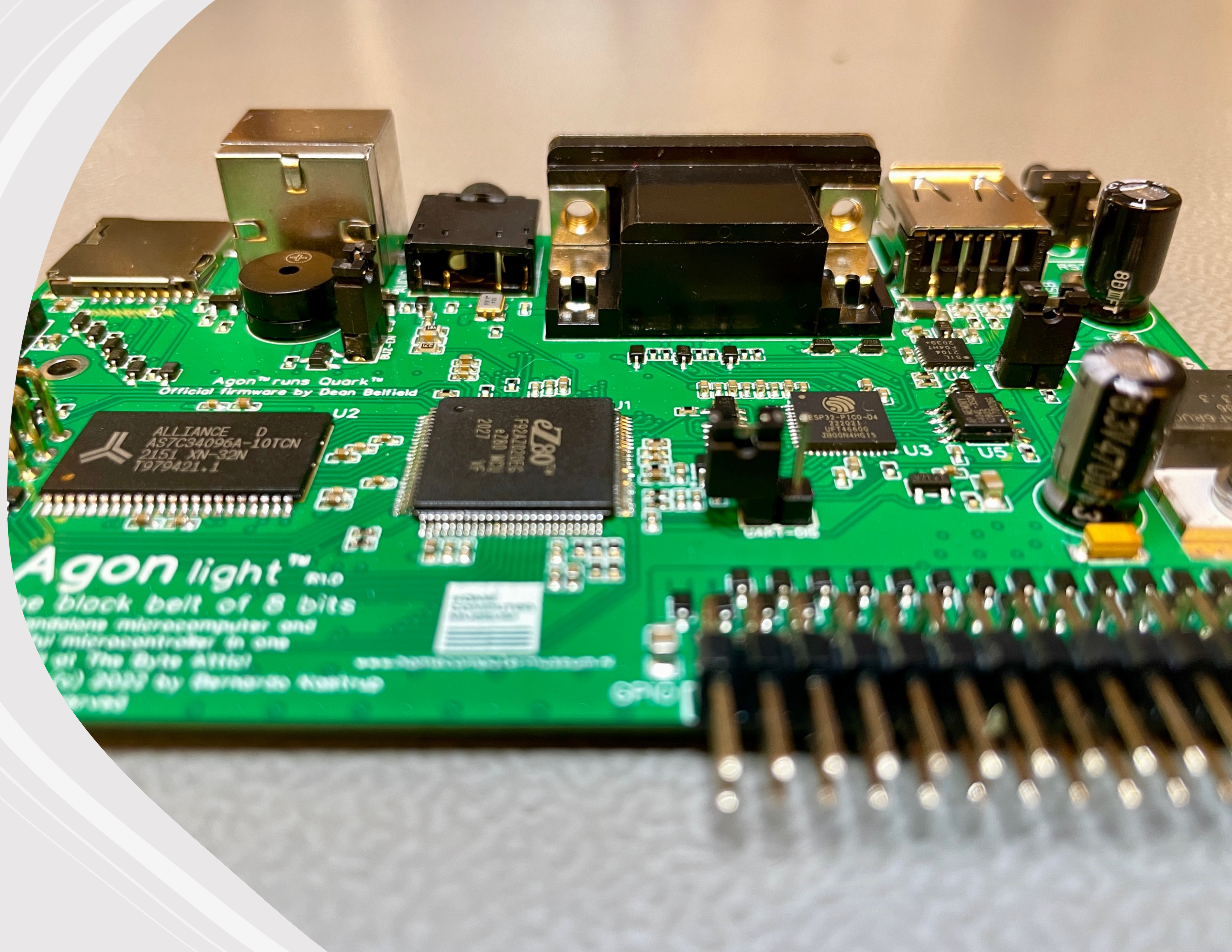


All holes are 2.505mm in diameter

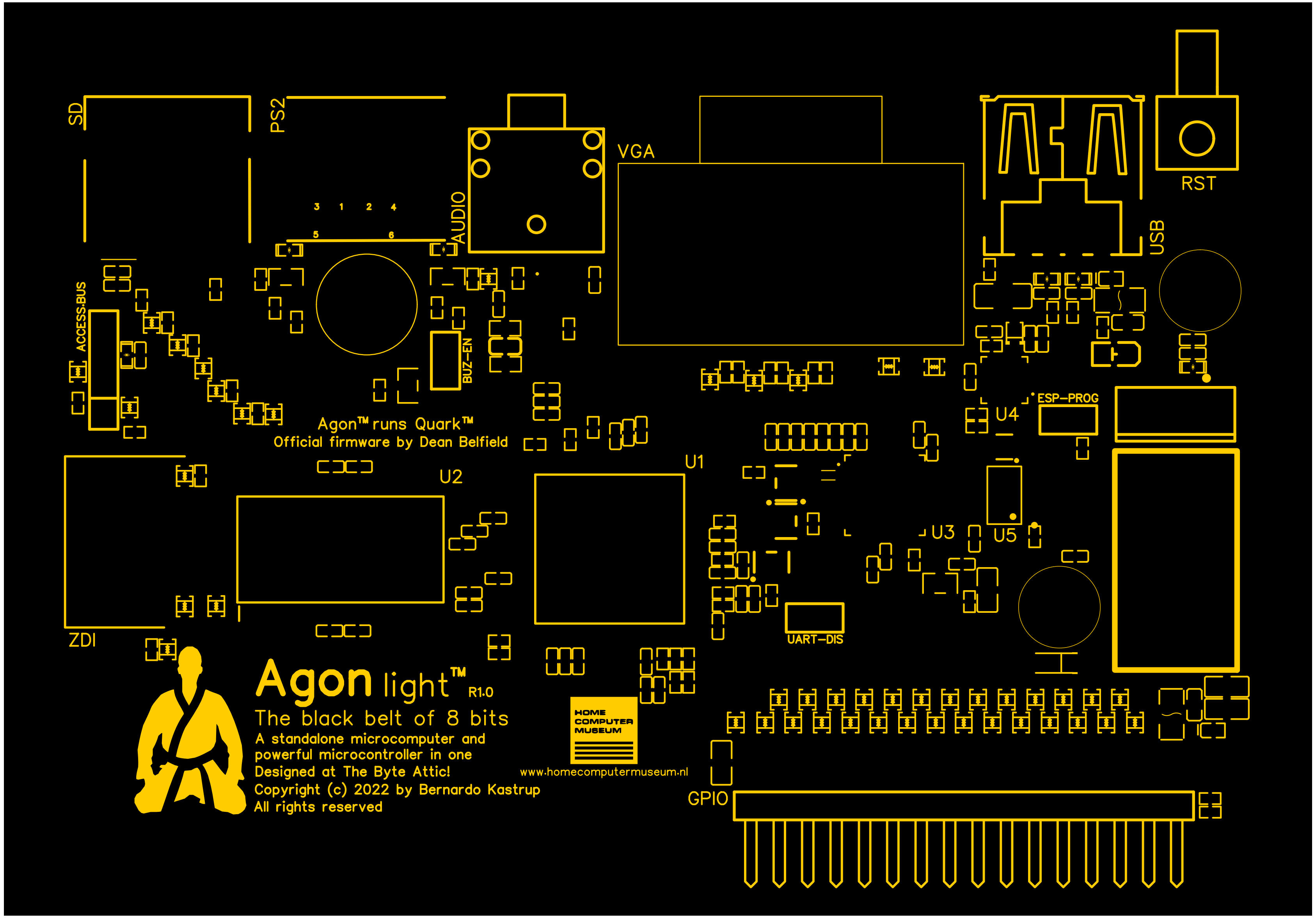
The Byte Attic's

Agon light™

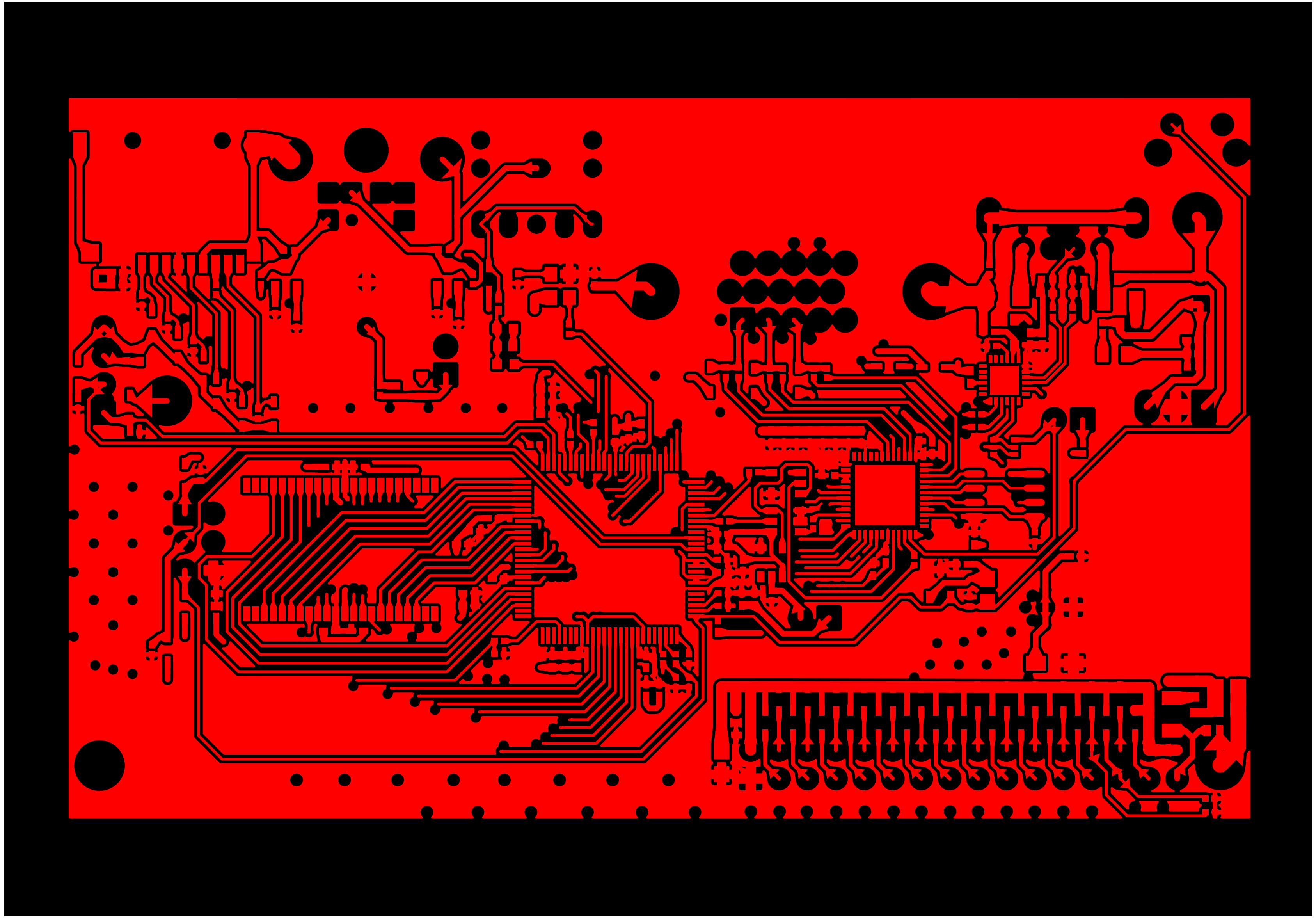
PCB layers design



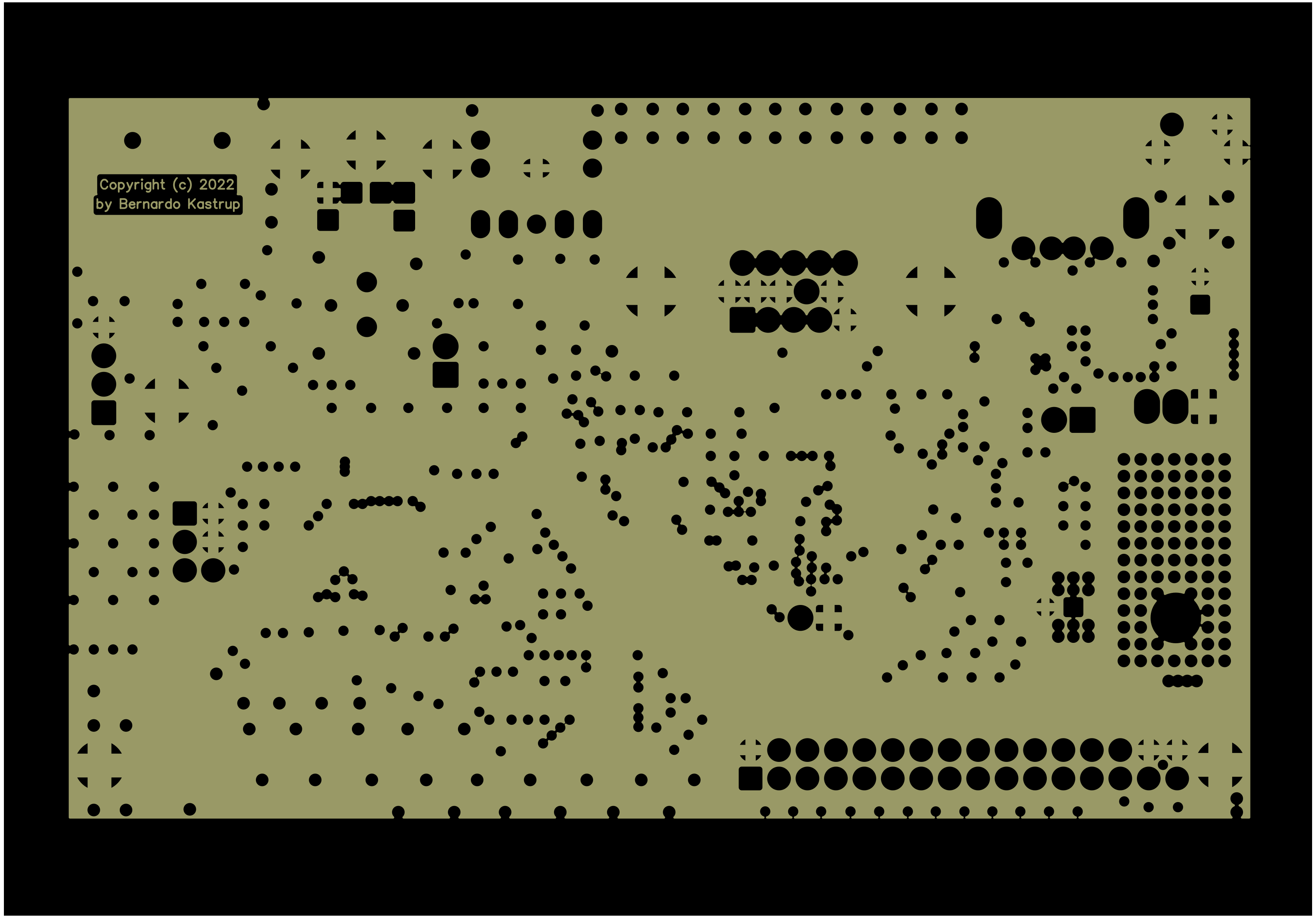
Top silkscreen



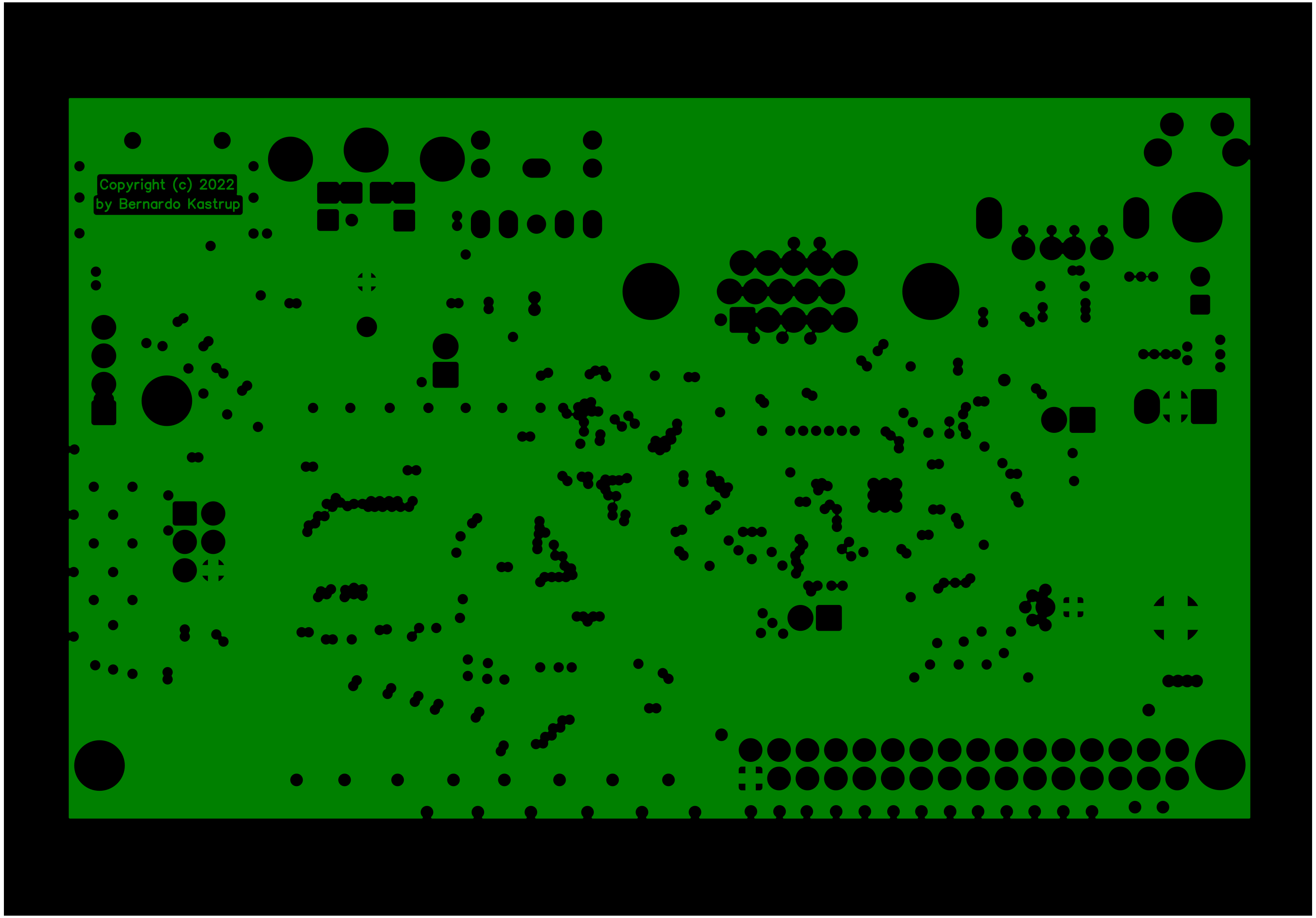
Top metal layer (3.3V filled)



First inner plane (GND)



Second inner plane (3.3V)



Bottom metal layer (GND filled)