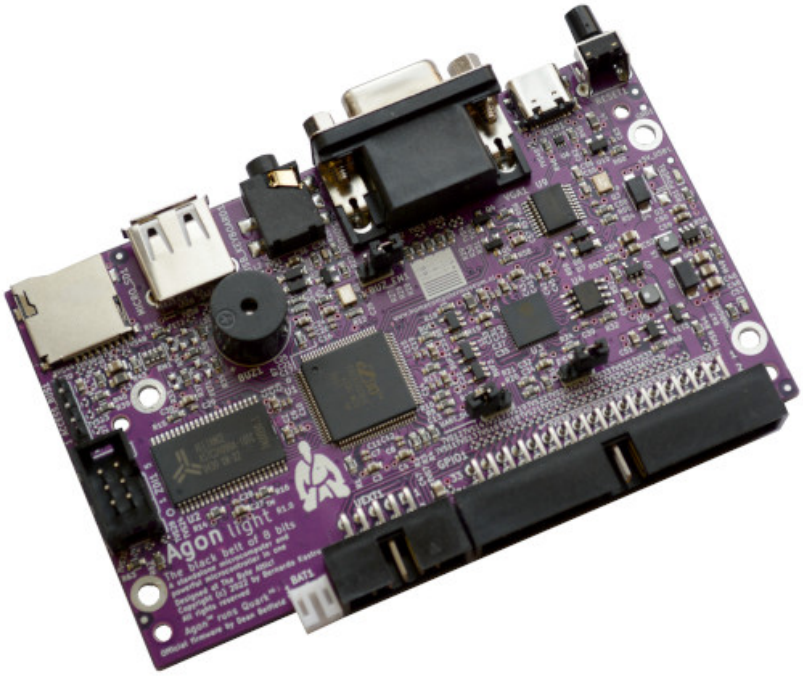


AgonLight2

User Manual

Document revision 1.2., June 2023

www.olimex.com

Table of Contents

Introduction

What is AgonLight2?

AgonLight2 is a re-design of the original AgonLight eZ80F92 retro computer, designed as a hobby project by Bernardo Kastrup;

AgonLight2 is a complete Single Board Computer (SBC) with VGA display output, PS2 keyboard, and SD card (acting as an external disk). This means that to write and run programs you do not need an external computer like Arduino boards do;

AgonLight2 has a GPIO connector with GPIO ports, I2C, SPI, and more signals which are accessible and can be used to interact with other hardware (sensors, expansions, etc;)

AgonLight and AgonLight2 are Open Source Hardware and officially OSHWA certified;

All CAD source files are available at AgonLight and AgonLight2 GitHub repositories. They are released under CERN Open Hardware License Version 2 – Strongly Reciprocal and allow users to learn, study, edit, modify, produce, and sell same or derivative products based on these designs. The only requirements is to open source their work under the same licensee.

The firmware of AgonLight is written by Dean Belfield and reproduces BBC Basic for Z80. The firmware is also Open Source Software and available on GitHub. The same firmware works on AgonLight2 without any modifications.

AgonLight2 is RoHS, REACH, CE and UKCA compliant.

Order codes for AgonLight2 and accessories:

AgonLight2	Single board BBC Basic Z80 Retro style Computer
MICRO-SD-CLASS	You need a microSD card to store Basic and software (demos, examples)
AgonLight2-Proto	DIY expansion kit with big proto area; compatible with AgonLight2
BOX-AGONLIGHT2-BLACK	Metal box for AgonLight2
CABLE-USB-A-C-1M	USB-C data and power cable
BATTERY-LIPO1400mAh	Li-po battery 3.7V 1400mAh – note that these batteries can be shipped only by ground so we can deliver only to EU destinations
USB-KEYBOARD-PS2	USB keyboard which supports PS2 and can be used for AgonLight2
BREADBOARD-1	Breadboard for experimenting with AgonLight2
JW-200x10-FM	10 pieces female-male jumper wires for breadboarding
JW-200x10	10 pieces male-male jumper wires for breadboarding
JW-200x10-FF	10 pieces female-female jumper wires for breadboarding
UEXT modules	Different sensors, relays, LCDs, RTC, GSM, GPS etc accessories which can be connected to AgonLight2 UEXT connector
MOD-Wii-UEXT-NUNCHUCK	3 axis joystick, two buttons game controller with UEXT connector

The differences between AgonLight and AgonLight2:

AgonLight2 has these differences from the original design:

- KiCad is used for the CAD, instead of EasyEDA. KiCad is open source software – free to download and use, it is a more fitting CAD tool for an Open Source Hardware project;
- USB-C connector for power supply;
- DCDC power converter with up to 2A output instead of linear power converter;
- Li-Po battery backup power supply, the battery acts like a UPS and will power the computer even if the USB-C gets disconnected. The battery is charged automatically when USB or external power supply is present;
- USB connector for keyboard (but the keyboard must be PS2 compatible!!!);
- SRAM routed with 40 ohm impedance as per part datasheet;
- Fixed some wrong signal naming on ESP32-PICO-D4 GPU co-processor;
- Fixed GPIO and programming connector pin ordering;
- Replaced the naked header 32-pin connector with a plastic boxed 34-pin connector following the same layout and adding two additional signals Vbat and Vin which allow AgonLight2 to be powered by this connector too;
- Added a UEXT connector (https://www.olimex.com/Products/Modules/) which allows AgonLight2 to be connected to: temperature sensors, environmental air quality sensors, pressure, humidity, gyroscope, light, RS485, LCDs, LED matrix, relays, Bluetooth, Zigbee, Lora, GSM, RFID reader, GPS, Pulse, EKG, RTC etc;
- Added 4 grounded mount holes with 3mm diameter, but also kept the original 2.5 mm mount holes.

First time start up or how to prepare the SD card and boot

Important! Notice that AgonLight2 comes completely assembled, tested, and programmed with firmware. The only thing you would need to do is prepare a microSD card with BBC basic and some examples, then connect your display and peripherals and apply power supply.

1. Open a web browser and navigate to:

https://github.com/OLIMEX/AgonLight2

2. Click on: Code -> Local tab, Download ZIP;

3. Uncompress the downloaded ZIP file in your PC;

4. Enter the folders “SOFTWARE” and then “FIRMWARE” and then “1-SD-card-contents”, then copy the contents of the folder;

5. Insert a class-10 microSD card in your Windows PC (pre-formatted as Fat32 and with a partition of maximum 32GB).

6. Paste the contents of the folder “1-SD-card-contents” which you’ve copied in step 4, onto the microSD card. Files should be placed directly into main folder of the card.

7. Eject the microSD card from your Windows PC.

8. Insert the microSD card into the board.

9. Connect a VGA monitor and a PS/2 keyboard (or a PS/2-compatible USB keyboard,

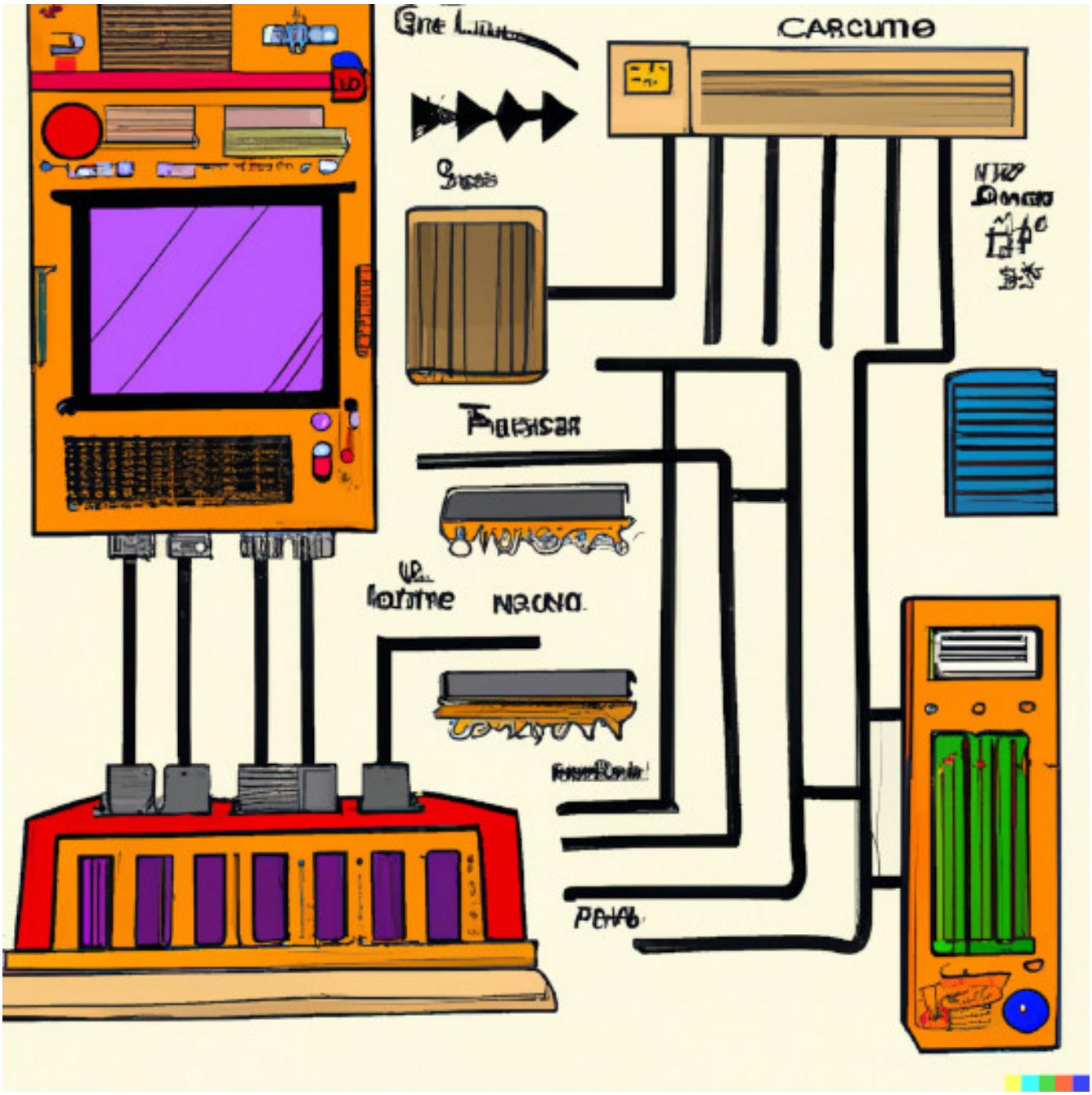
via a PS/2 adapter) to the AgonLight2 unit.

10. Turn the AgonLight2 board on by connecting it to the USB cable:

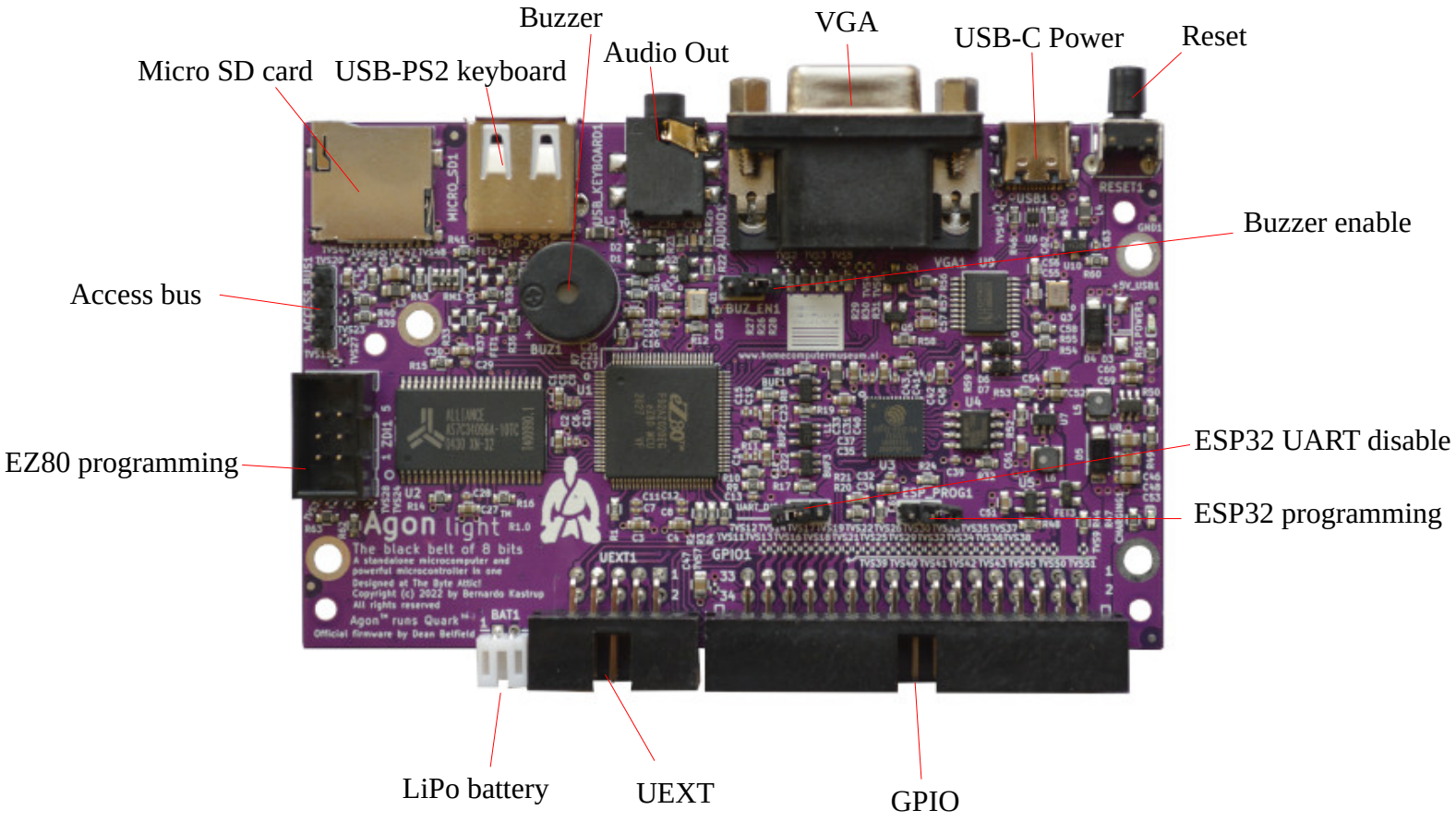
AgonLight references documents:

Here we link original AgonLight Hardware Manual, QuickStart Guide and Firmware Installation Guide.

HARDWARE

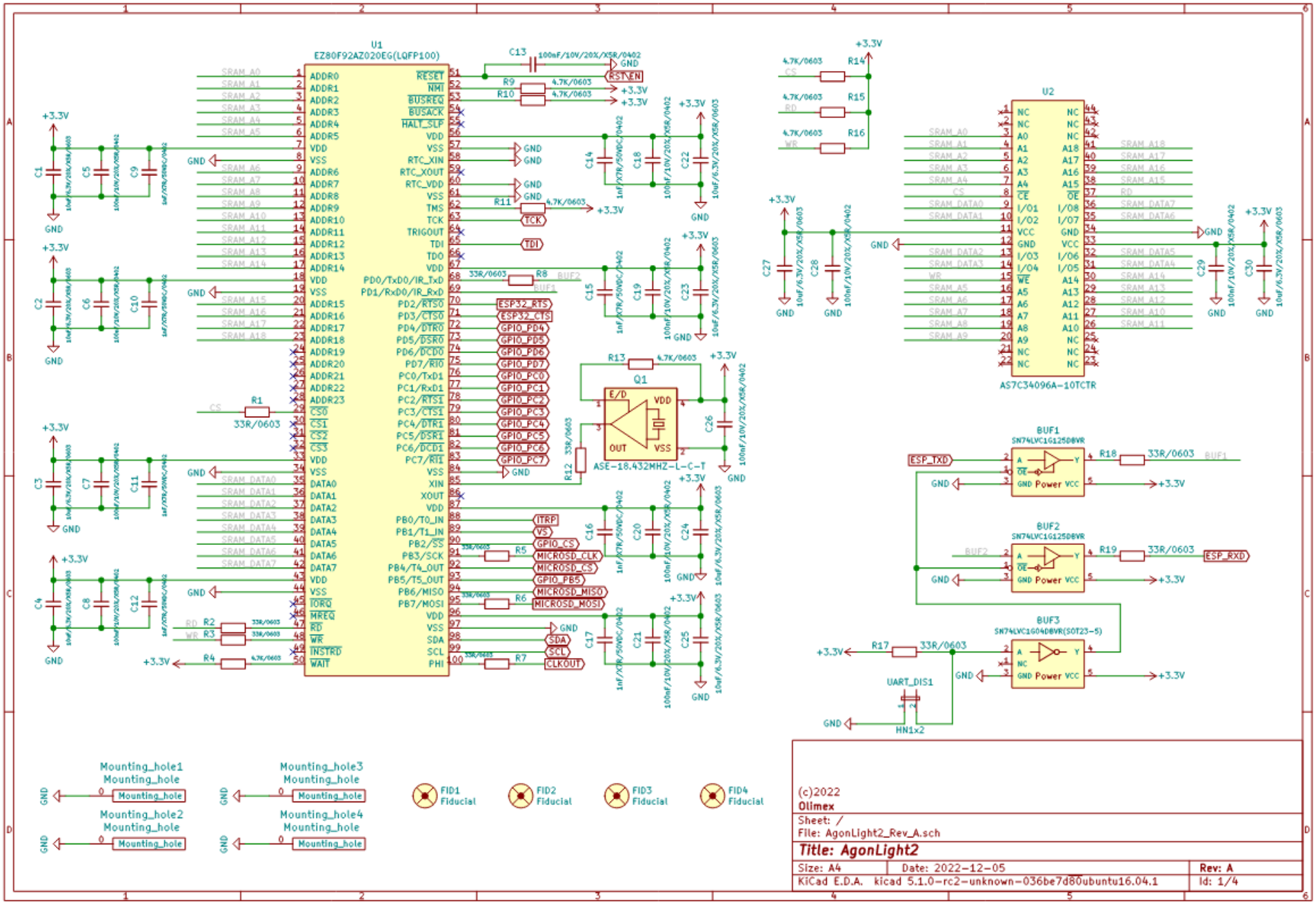


AgonLight2 layout:



AgonLight2 schematic:

The current AgonLight2 schematic is available for download and print on GitHub


U1
EZ80F92AZ020EG(LQFP100)
U2
AS7C34096A-10TCTR
Q1
ASE-18.432MHZ-L-C-T
BUF1
BUF2
BUF3
SN74LVC1G125DBVR
SN74LVC1G04DBVR(SOT23-5)
UART_DIS1
HN1x2
Mounting_hole1
Mounting_hole2
Mounting_hole3
Mounting_hole4
FID1
FID2
FID3
FID4
(c)2022
Olimex
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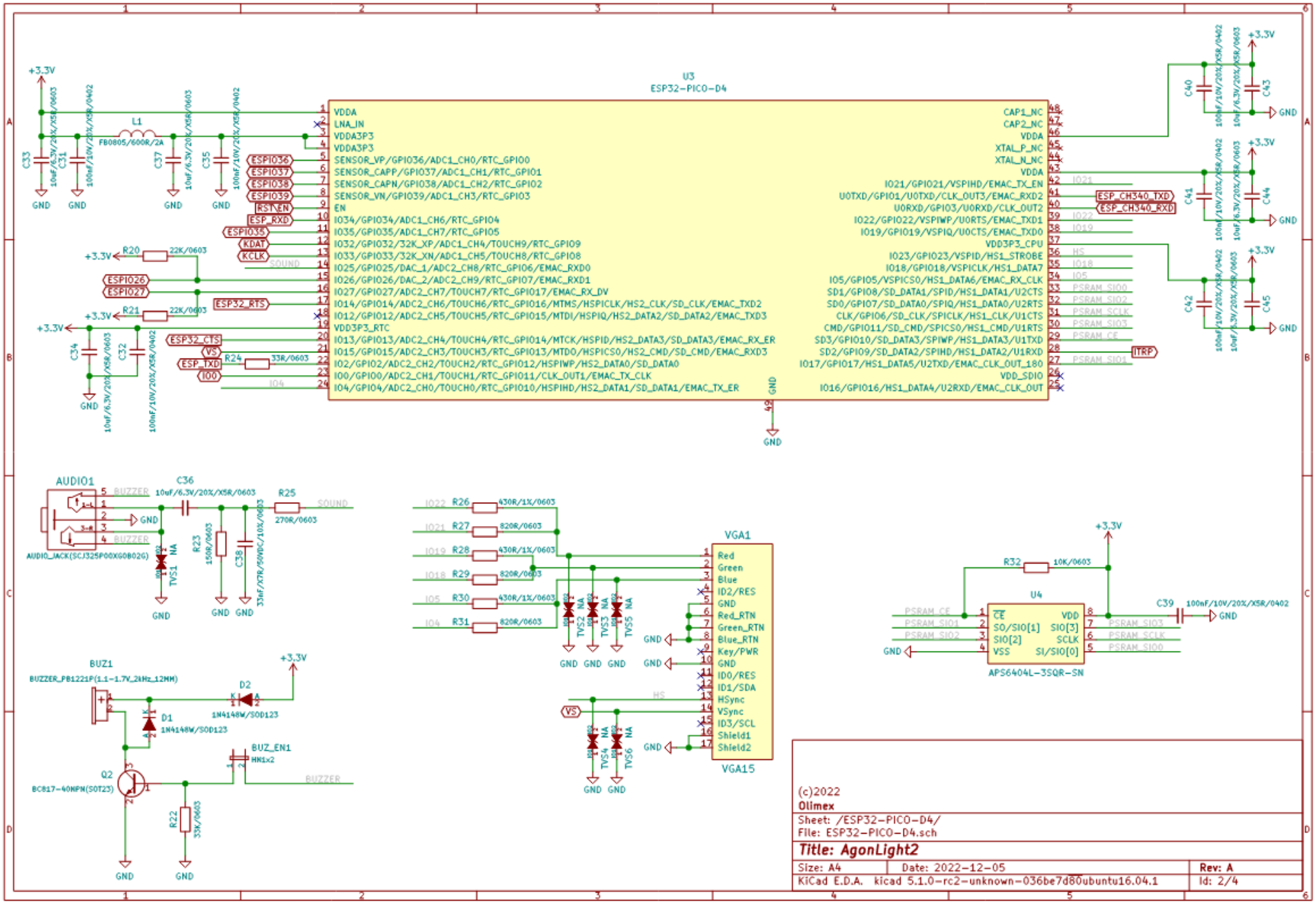
U3
ESP32-PICO-D4
VDDA
LNA_IN
VDDA3P3
VDDA3P3
SENSOR_VP/GPIO36/ADC1_CH0/RTC_GPIO0
SENSOR_CAPP/GPIO37/ADC1_CH1/RTC_GPIO1
SENSOR_CAPN/GPIO38/ADC1_CH2/RTC_GPIO2
SENSOR_VN/GPIO39/ADC1_CH3/RTC_GPIO3
EN
IO34/GPIO34/ADC1_CH6/RTC_GPIO4
IO35/GPIO35/ADC1_CH7/RTC_GPIO5
IO32/GPIO32/32K_XP/ADC1_CH4/TOUCH9/RTC_GPIO9
IO33/GPIO33/32K_XN/ADC1_CH5/TOUCH8/RTC_GPIO8
IO25/GPIO25/DAC_1/ADC2_CH8/RTC_GPIO6/EMAC_RXD0
IO26/GPIO26/DAC_2/ADC2_CH9/RTC_GPIO7/EMAC_RXD1
IO27/GPIO27/ADC2_CH7/TOUCH7/RTC_GPIO17/EMAC_RX_DV
IO14/GPIO14/ADC2_CH6/TOUCH6/RTC_GPIO16/MTMS/HSPICLK/HS2_CLK/SD_CLK/EMAC_TXD2
IO12/GPIO12/ADC2_CH5/TOUCH5/RTC_GPIO15/MTDI/HSPIQ/HS2_DATA2/SD_DATA2/EMAC_TXD3
VDD3P3_RTC
IO13/GPIO13/ADC2_CH4/TOUCH4/RTC_GPIO14/MTCK/HSPID/HS2_DATA3/SD_DATA3/EMAC_RX_ER
IO15/GPIO15/ADC2_CH3/TOUCH3/RTC_GPIO13/MTDO/HSPICS0/HS2_CMD/SD_CMD/EMAC_RXD3
IO2/GPIO2/ADC2_CH2/TOUCH2/RTC_GPIO12/HSPIWP/HS2_DATA0/SD_DATA0
IO0/GPIO0/ADC2_CH1/TOUCH1/RTC_GPIO11/CLK_OUT1/EMAC_TX_CLK
IO4/GPIO4/ADC2_CH0/TOUCH0/RTC_GPIO10/HSPIHD/HS2_DATA1/SD_DATA1/EMAC_TX_ER
CAP1_NC
CAP2_NC
VDDA
XTAL_P_NC
XTAL_N_NC
VDDA
IO21/GPIO21/VSPIHD/EMAC_TX_EN
U0TXD/GPIO1/U0TXD/CLK_OUT3/EMAC_RXD2
U0RXD/GPIO3/U0RXD/CLK_OUT2
IO22/GPIO22/VSPIWP/U0RTS/EMAC_TXD1
IO19/GPIO19/VSPIQ/U0CTS/EMAC_TXD0
VDD3P3_CPU
IO23/GPIO23/VSPID/HS1_STROBE
IO18/GPIO18/VSPICLK/HS1_DATA7
IO5/GPIO5/VSPICS0/HS1_DATA6/EMAC_RX_CLK
SD1/GPIO8/SD_DATA1/SPID/HS1_DATA1/U2CTS
SD0/GPIO7/SD_DATA0/SPIQ/HS1_DATA0/U2RTS
CLK/GPIO6/SD_CLK/SPICLK/HS1_CLK/U1CTS
CMD/GPIO11/SD_CMD/SPICS0/HS1_CMD/U1RTS
SD3/GPIO10/SD_DATA3/SPIWP/HS1_DATA3/U1TXD
SD2/GPIO9/SD_DATA2/SPIHD/HS1_DATA2/U1RXD
IO17/GPIO17/HS1_DATA5/U2TXD/EMAC_CLK_OUT_180
VDD_SDIO
IO16/GPIO16/HS1_DATA4/U2RXD/EMAC_CLK_OUT
GND
+3.3V
L1
FB0805/600R/2A
C33
C31
C37
C35
C40
C43
C41
C44
C42
C45
C34
C32
C36
R20
R21
R24
R25
22K/0603
33R/0603
270R/0603
ESPI036
ESPI037
ESPI038
ESPI039
RST_EN
ESP_RXD
ESPI035
KDAT
KCLK
SOUND
ESPI026
ESPI027
ESP32_RTS
ESP32_CTS
VS
ESP_TXD
IO0
IO4
ESP_CH340_TXD
ESP_CH340_RXD
ITRP
PSRAM_CE
PSRAM_SIO1
PSRAM_SIO2
PSRAM_SIO3
PSRAM_SCLK
PSRAM_SIO0
AUDIO1
AUDIO_JACK(SCJ325P00XG0B02G)
BUZZER
TVS1
R23
C38
VGA1
VGA15
R26
R27
R28
R29
R30
R31
430R/1X/0603
820R/0603
TVS2
TVS3
TVS5
TVS4
TVS6
Red
Green
Blue
ID2/RES
Red_RTN
Green_RTN
Blue_RTN
Key/PWR
ID0/RES
ID1/SDA
HSync
VSync
ID3/SCL
Shield1
Shield2
HS
U4
APS6404L-3SQR-SN
R32
10K/0603
C39
100nF/10V/20%/X5R/0402
BUZ1
BUZZER_PB1221P(1.1-1.7V_2kHz_12MM)
D1
D2
1N4148W/SOD123
BUZ_EN1
Q2
BC817-40NPN(SOT23)
R22
33K/0603
(c)2022
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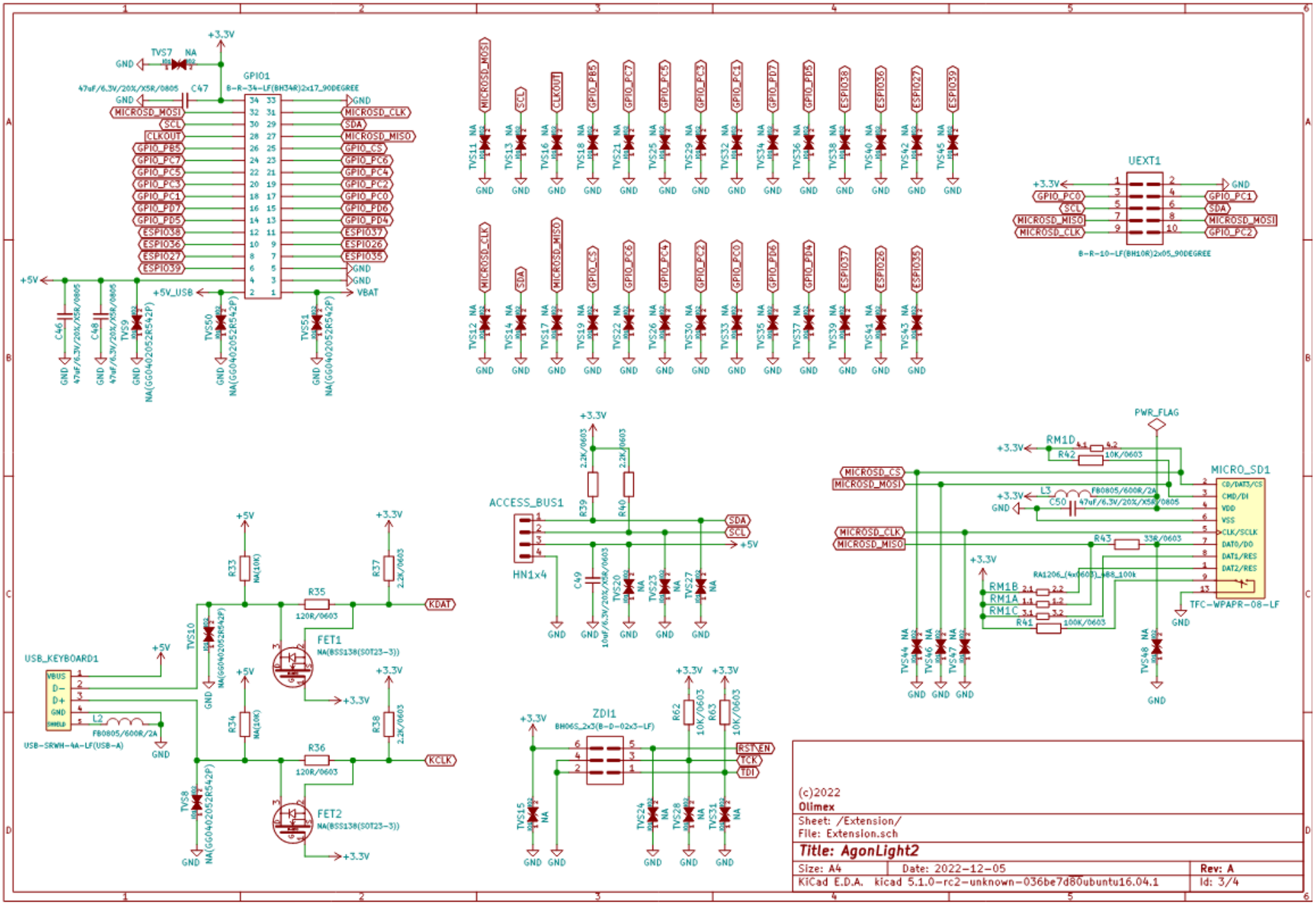
GPIO1
8-R-34-LF(BH34R)2x17_90DEGREE
C47
47uF/6.3V/20%/X5R/0805
MICROSD_MOSI
SCL
CLKOUT
GPIO_PB5
GPIO_PC7
GPIO_PC5
GPIO_PC3
GPIO_PC1
GPIO_PD7
GPIO_PD5
ESPI038
ESPI036
ESPI027
ESPI039
MICROSD_CLK
SDA
MICROSD_MISO
GPIO_CS
GPIO_PC6
GPIO_PC4
GPIO_PC2
GPIO_PC0
GPIO_PD6
GPIO_PD4
ESPI037
ESPI026
ESPI035
+3.3V
+5V
+5V_USB
VBAT
GND
TVS7
NA
C46
C48
TVS9
TVS50
TVS51
NA(GG04020052R542P)
TVS11
TVS13
TVS16
TVS18
TVS21
TVS25
TVS29
TVS32
TVS34
TVS36
TVS38
TVS40
TVS42
TVS45
TVS12
TVS14
TVS17
TVS19
TVS22
TVS26
TVS30
TVS33
TVS35
TVS37
TVS39
TVS41
TVS43
UEXT1
8-R-10-LF(BH10R)2x05_90DEGREE
ACCESS_BUS1
HN1x4
R39
R40
2.2K/0603
C49
10uF/6.3V/20%/X5R/0603
TVS20
TVS23
TVS27
PWR_FLAG
RM1D
R42
10K/0603
MICRO_SD1
TFC-WPAPR-08-LF
CD/DAT3/CS
CMD/DI
VDD
VSS
CLK/SCLK
DAT0/DO
DAT1/RES
DAT2/RES
L3
FB0805/600R/2A
C50
47uF/6.3V/20%/X5R/0805
R43
33R/0603
RA1206_(4x0603)_4x8_100k
RM1B
RM1A
RM1C
R41
100K/0603
TVS44
TVS46
TVS47
TVS48
R33
R37
R35
120R/0603
FET1
NA(BSS138(SOT23-3))
KDAT
R34
R38
R36
KCLK
FET2
TVS10
TVS8
NA(GG04002052R542P)
USB_KEYBOARD1
USB-SRWH-4A-LF(USB-A)
L2
FB0805/600R/2A
VBUS
D-
D+
GND
SHIELD
ZDI1
BH06S_2x3(B-D-02x3-LF)
R62
R63
10K/0603
RST\EN
TCK
TDI
TVS15
TVS24
TVS28
TVS31
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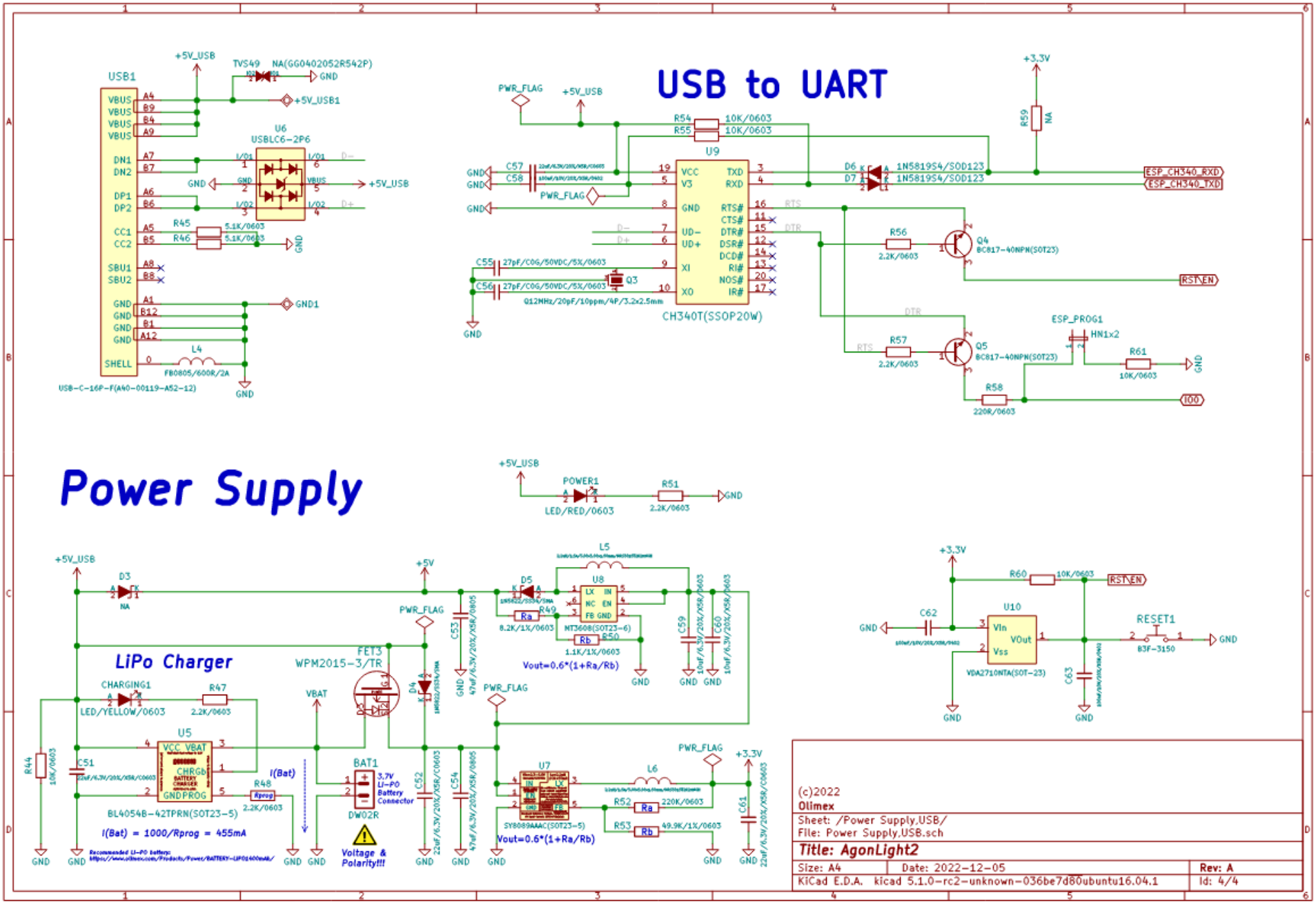
USB to UART
Power Supply
LiPo Charger
USB1
USBLC6-2P6
CH340T(SSOP20W)
BL4054B-42TPRN(SOT23-5)
MT3608(SOT23-6)
SY8089AAAC(SOT23-5)
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Rev: A
KiCad E.D.A. kicad 5.1.0-rc2-unknown-036be7d80ubuntu16.04.1
Id: 4/4

AgonLight2 power supply and consumption:

AgonLight2 can be powered by 3 sources:

- USB-C connector;
- Li-Po battery connector;
- GPIO.pin2 (5V_USB) note that this signal is connected to USB 5V signal so when you power AgonLight2 with this pin you should not connect it to the USB!!!

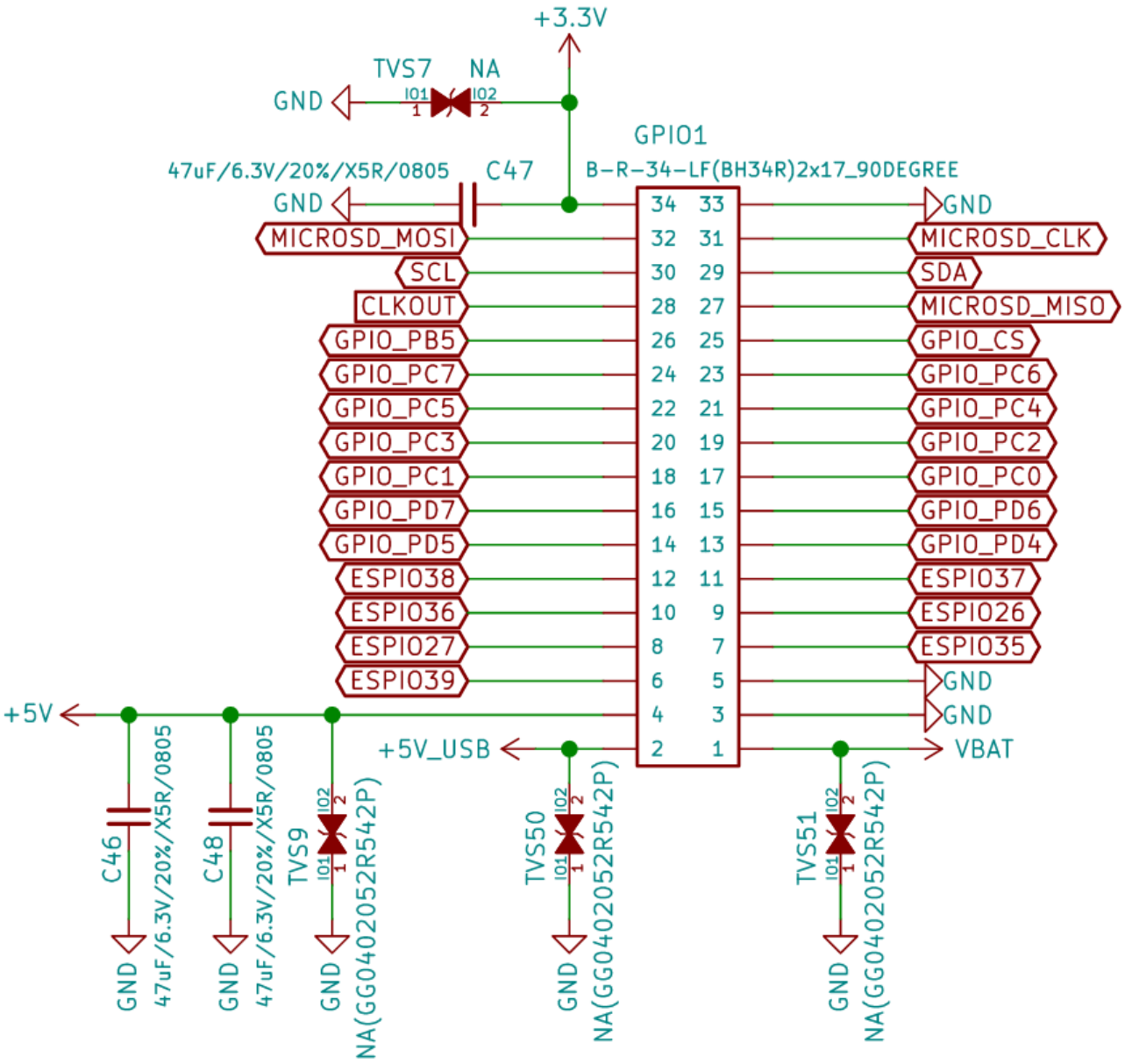
The power consumption of AgonLight2 is approximately 130mA without a keyboard and around 180mA with connected keyboard.

If a Li-Po battery is connected it will get charged automatically when power supply is attached with up to 100mA.

When the LiPo battery is attached and external power supply is missing internal DCDC step-up converter and switching circuit automatically powers AgonLight2 from the battery. 1400mAh battery will provide about 8 hours of stand-alone operation.

+ The LiPo battery connector is JST 2.0 mm connector and with Olimex's battery polarity. If you use batteries from other manufacturers please make PLUS and MINUS are connected properly as you may damage the board!!!

GPIO connector:



Pin.1 is connected to the Li-Po battery PLUS you can connect external battery on this pin or to use battery voltage to external circuits.

Pin. 2 is 5V power supply connected to USB-C +5V signal, you can power the board from this signal if the USB-C is not connected. It must be regulated 5V power supply, applying more than 5V will damage the board.

Pin.3, **Pin.5**, **Pin.33** are GND

Pin.34 is +3.3V output capable to source up to 2A note that 200mA are used by AgonLight2

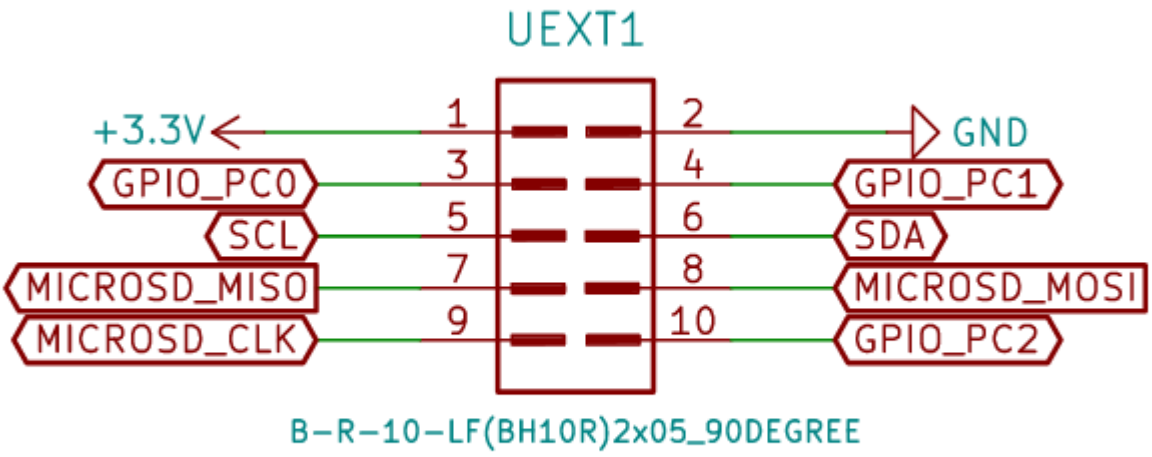
Pin.4 is +5V output capable to source up to 2A (1.8A + AgonLight2 0.2A), it's backed by LiPo UPS so even if there is interruption on power supply if LiPo battery is attached there will be 5V on this pin.

All GPIOs are operating on +3.3V. This means you should not connect signals above 3.3V on these ports as this will damage the board.

UEXT connector:

UEXT connector stands for Universal EXTension connector and contain +3.3V, GND, I2C, SPI, UART signals:

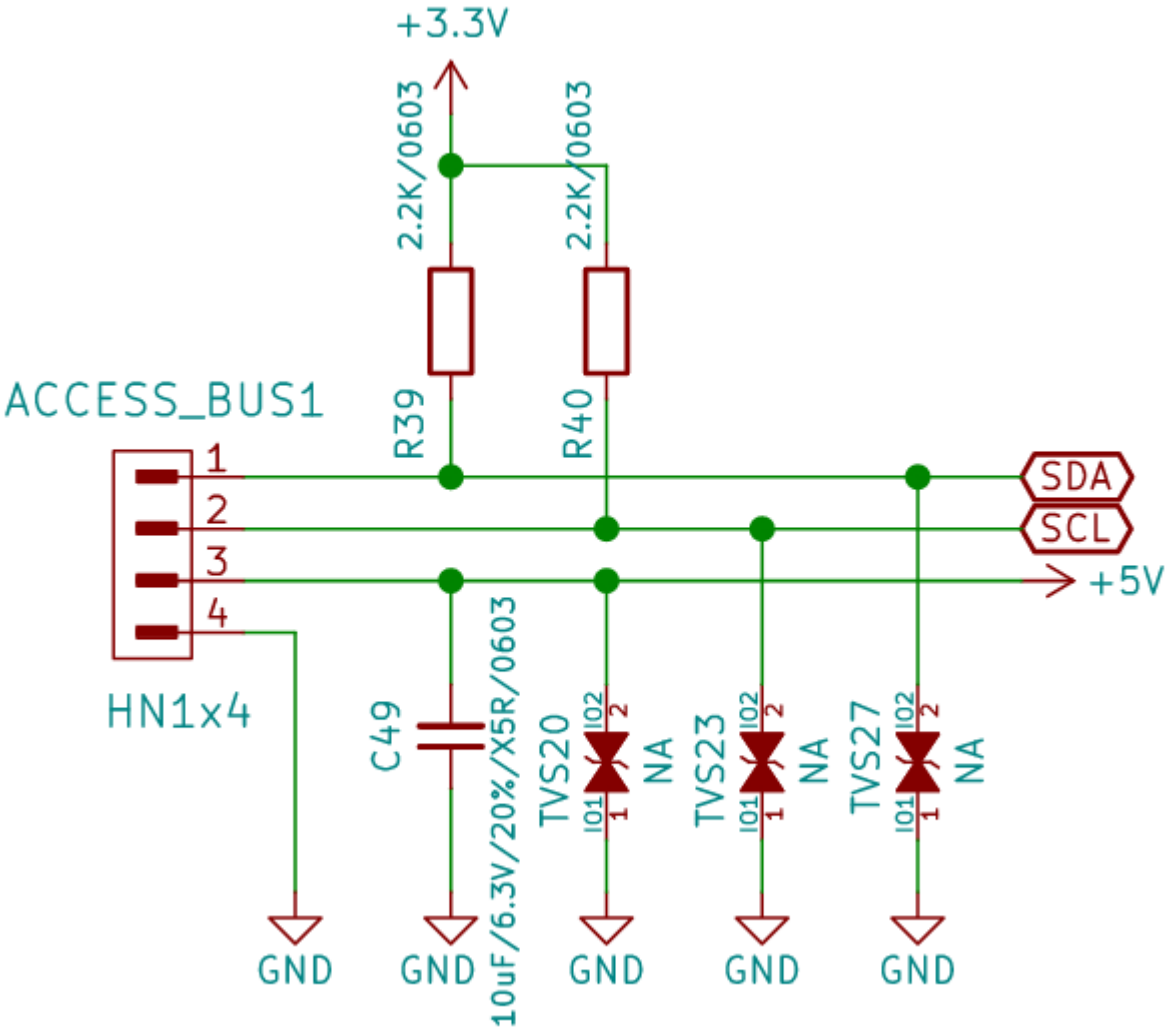
UEXT is 0.1" 2.54mm step boxed plastic connector. All signals are with 3.3V levels.



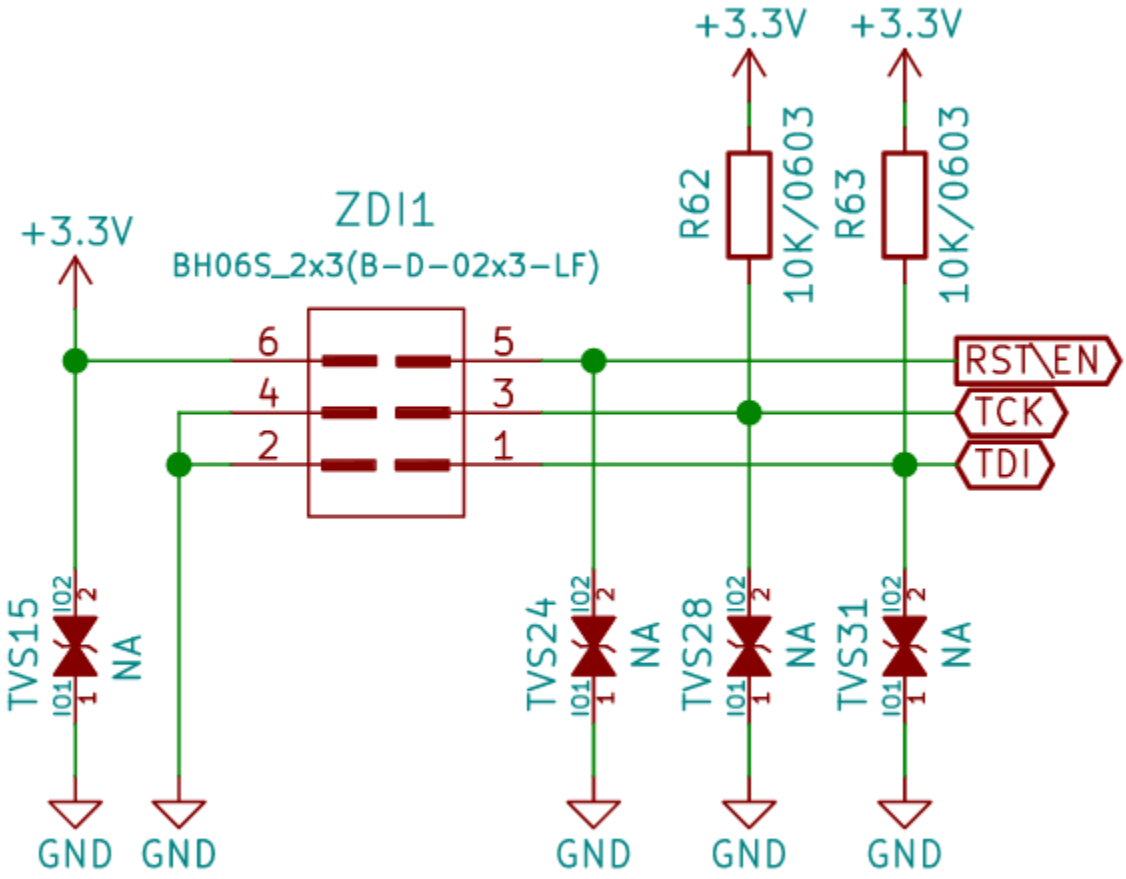
Olimex has developed number of MODULES with this connector. There are temperature, humidity, pressure, magnetic field, light sensors. Modules with LCDs, LED matrix, relays, Bluetooth, Zigbee, WiFi, GSM, GPS, RFID, RTC, EKG, etc.

Access bus connector:

This is I2C and power supply with 3.3V levels.



eZ80 programming connector:



This connector is used for initial programming of eZ80 microcontroller. AgonLight2 comes with pre-programmed firmware so you do not need to use this connector nor programmer for it.

If you want to develop your own firmware Jeroen Venema wrote flash utility which allows you to flash new firmware without need of external programmer.

Jumpers:

Typically you don’t need to change the positions of the jumpers to use the board.

BUZ_EN1 – buzzer enable jumper – when closed the buzzer plays the sound commands.

Default state: Open (Buzzer disabled)

ESP_PROG1 – ESP programming enabled when closed ESP32 enters bootloader mode at reset and can be programmed over the USB connector.

Default state: Open (ESP programming handled by software)

UART_D – UART disable – when closed the UART connection between eZ80 and ESP32 is disconnected. This is necessary when ESP32 is programming.

Default state: Open (communication between eZ80 and ESP32 enabled)

SOFTWARE:

General AgonLight2 Firmware

The three modules of AgonLight2 official firmware, called Quark™, can be found here:

- Quark™ BBC BASIC – BBC Basic interpreter
- Quark™ MOS - command line machine operating system, similar to CP/M or DOS
- Quark™ VDP - The VDP is a serial graphics terminal that takes a BBC Basic text output stream as input. The output is via the VGA connector on the Agon.

Olimex tested firmware and examples

Can be found in the repository here:

https://github.com/OLIMEX/AgonLight2/tree/main/SOFTWARE/FIRMWARE

Disclaimer: Most of the examples located in the repository above are NOT written by Olimex. We have just tested them and confirmed them working at the time of release.

The repository contains: examples taken from AgonLight repository, solutions to our weekly programming challenge, and other interesting examples we found online.

MOS commands:

LOAD “”

SAVE “”

*CAT *DIR

*CD /

*MKDIR

*BYE *CPM

*ERA file

*ESC [ON OFF]

*EXEC file

*OPT

*REN oldfile ewfile

*SAVE file aaaa bbbb

*SPOOL file

*TYPE file

*| comment

BBC Basic commands reference:

Variables:

- X – float
- X% - integer
- X$ - string
- &X – hex

Pressing ESC key breaks the code execution

This is list of the BBC Basic commands click on the command name for more info and use.

ABS	EOR	LOMEM	REPORT
ACS	ERL	MID$	RESTORE
ADVAL	ERR	MOD	RETURN
AND	ERROR	MODE	RIGHT$(
ASC	EVAL	MOVE	RND
ASN	EXP	NEW	RUN
ATN	EXT	NEXT	SAVE
AUTO	FALSE	NOT	SGN
BGET	FN	OFF	SIN
BPUT	FOR	OLD	SOUND
CALL	GCOL	ON ERROR	SPC
CHAIN	GET	ON ERROR OFF	SQR
CHR$	GET()	ON X%	STEP
CLEAR	GET$	OPENIN	STOP
CLG	GOSUB	OPENOUT	STR$
CLOSE	GOTO	OPT	STRING$(
CLS	HIMEM	OR	TAB(X)
COLOUR	IF	PAGE	TAB(X,Y)
COS	INKEY	PAGE	TAN
COUNT	INKEY$	PI	THEN
DATA	INPUT	PLOT	TIME
DEF	INSTR(	POINT(	TO
DEG	INT	POS	TRACE
DELETE	LEFT$	PRINT	TRUE
DIM	LEN	PROC	UNTIL
DIV	LET	PTR	USR
DRAW	LINE	PUT A, X	VAL
ELSE	LIST	RAD	VDU
END	LN	READ	VPOS
ENDPROC	LOAD	REM	WIDTH
ENVELOPE	LOCAL	RENUMBER	
EOF	LOG	REPEAT	

Software access to GPIOs:

eZ80 ports are described in the eZ80-specification.

Port direction register set if the port is INPUT or OUTPUT. Upon RESET all GPIOs are set as Inputs.

Direction registers are 8 bit and each bit corresponds to port signal. If 1 is written on the corresponding port will be set as Input if 0 as Output.

Port B data direction register is at address: 009Bh = 153 decimal

Port C data direction register is at address: 009Fh = 159 decimal

Port D data direction register is at address: 00A3h = 163 decimal

If we read the Port C direction register we can PRINT GET(159) and it should return 255

If we want to set GPIO_PC0 as output we should write 0 in bit 0 with the command PUT 159,254.

Data registers are 8 bit and each bit corresponds to port signal. If 1 is written on the corresponding port will be set 3.3V if 0 is written 0V will be set.

Port B data register is at address: 009Ah = 152 decimal

Port C data register is at address: 009Eh = 158 decimal

Port D data register is at address: 00A2h = 162 decimal

If we read data register with GET() command, for instance PRINT GET(158) it will return the state of Port C.

We can write the data register with PUT command, for instance PUT 158,1 will set GPIO_PC0 to +3.3V and PUT 158,0 will set it to 0V.

Software access to I2C:

TBD

Software access to SPI:

TBD

Software access to VPU:

TBD

Revision History

Revision 1.0 January 2023

- initial release

Revision 1.1 January 2023

- added “How to prepare the SD card and boot the first time”, taken and edited from “Agon light™ Firmware Installation Guide.pdf”

Revision 1.2 June 2023

-general improvements to the structure of the document; added more info about first steps with the board