



µChip simple VGA console manual





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INTRODUCTION

Thank you for buying uChip simple VGA console.

This open source project allows you to play and create simple video games, using a VGA monitor, and an USB gamepad or keyboard.

In this document we show some details and suggestions to mount this kit. For a general guide, refer to the uChip Kit quick start manual.

uSVC Kit contains all the required components, the PCB and one uChip. Not included in the package are:

- The micro SD Memory card. The card **MUST** be formatted with the FAT32 file system. **Older FAT16 or FAT12 are not supported.**
- The 5V USB power supply*.
- The USB-B cable for power supply
- Any audio or VGA cable
- The USB micro A to A cable, to connect the keyboard or mouse.

*For the USB power supply, we recommend a 500-mA USB power supply (note that the actual current consumption will be much lower than 500mA). USB power supplies that provide more current are adequate too.

uSVC requires of course a VGA monitor, capable of handling a vertical resolution of 57 Hz and a horizontal resolution of 30 kHz. These values can be changed in the headers, but we found that 57 Hz is the best tradeoff.

The full source code of these kits, as well as the updated schematics and PCB layout (KiCad format) are available on the website.



ESD Warning! uChip contains electrostatic sensitive devices. Electrostatic charge might permanently damage uChip. Observe precautions when handling it. Itaca Innovation is not responsible for any damage caused by ESD or improper handling/usage. Please note that other components (e.g. MOSFETs, ICs, etc.) provided in the kit might be electrostatic sensitive devices.

GETTING STARTED

Please find all the components shown in the bill of materials (BOM), and make sure that none is missing!

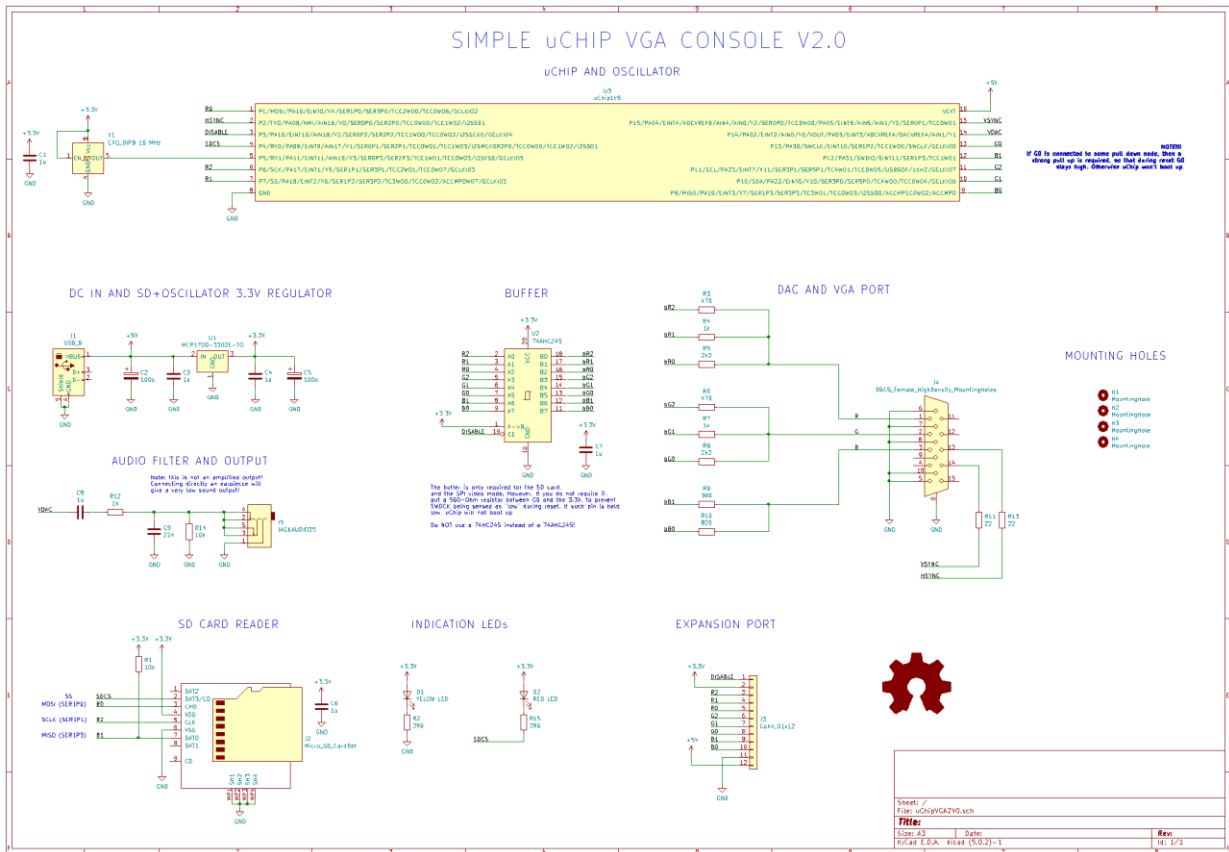
Try to keep everything well-organized, so that you can quickly find everything when you need!

All the components are clearly indicated on the silkscreen of the board! We suggest to follow the bill of material (BOM), which is arranged with the following criteria:

- All the components with the same specifications are grouped.
- The components are listed in order of height, to facilitate soldering.

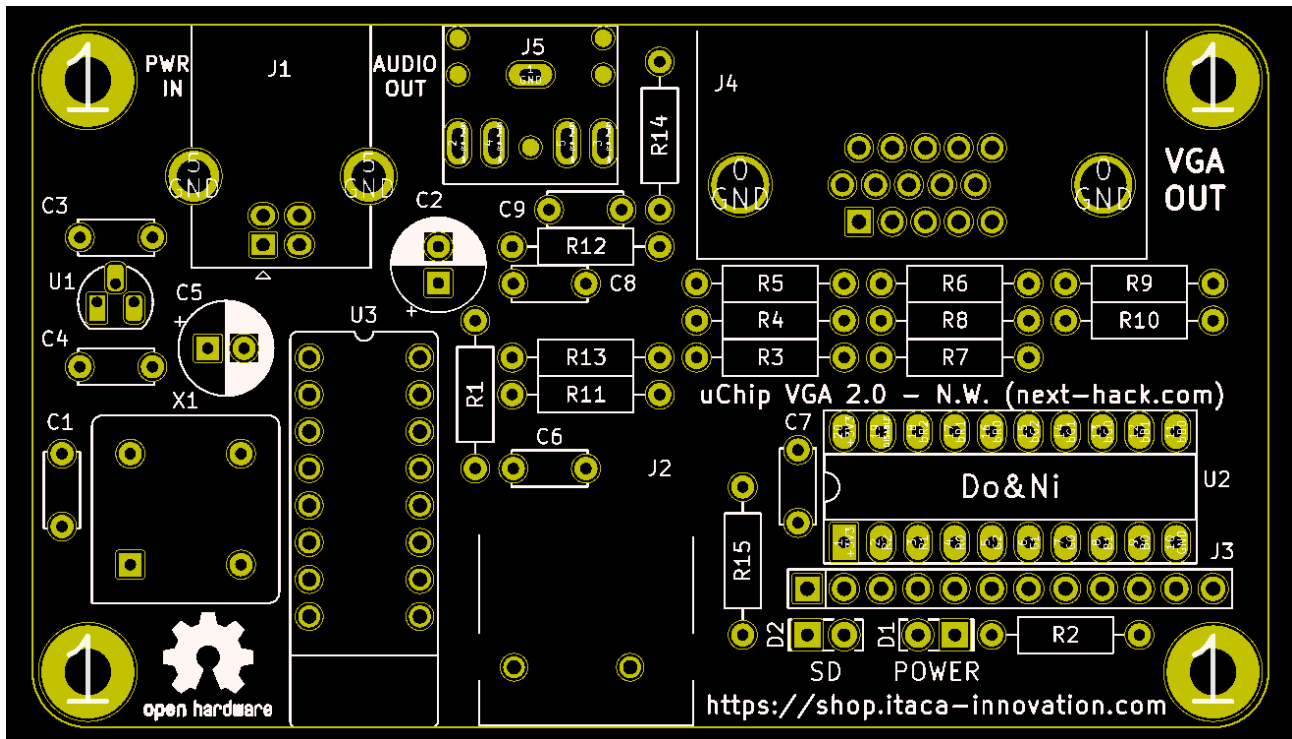
SCHEMATICS

The schematics is show below. You can download a separated PDF version from the download page o shop.itaca-innovation.com.



COMPONENT PLACEMENT

Below you can find the assembly drawing of uSVC. The full design project files are available in the download section of shop.itaca-innovation.com.



BILL OF MATERIALS

Here is the component list, in order of component height and component value (to ease assembly).

Reference Designator	Value and notes
R1	Resistor 10k Ohm, 5% (brown, black, orange, gold)
R14	Resistor 10k Ohm, 5% (brown, black, orange, gold)
R4	Resistor 1k Ohm, 1% (brown, black, black, brown, brown)
R7	Resistor 1k Ohm, 1% (brown, black, black, brown, brown)
R12	Resistor 1k Ohm, 1% (brown, black, black, brown, brown)
R5	Resistor 2.2k Ohm, 1% (red, red, black, brown, brown)
R8	Resistor 2.2k Ohm, 1% (red, red, black, brown, brown)
R11	Resistor 22 Ohm, 5% (red, red, black, gold)
R13	Resistor 22 Ohm, 5% (red, red, black, gold)
R2	Resistor 390 Ohm, 1% (orange, white, black, black, brown)
R9	Resistor 390 Ohm, 1% (orange, white, black, black, brown)
R15	Resistor 390 Ohm, 1% (orange, white, black, black, brown)
R3	Resistor 470 Ohm, 1% (yellow, violet, black, black, brown)
R6	Resistor 470 Ohm, 1% (yellow, violet, black, black, brown)
R10	Resistor 820 Ohm, 1% (gray, red, black, black, brown)
U2 + socket	74AHC245. DO NOT SOLDER IT DIRECTLY. Solder the IC Socket first! Respect the correct orientation!
J5	3.5 mm Jack Audio Jack socket
C1	Capacitor, Ceramic, 1uF, 25V

C3	Capacitor, Ceramic, 1uF, 25V
C4	Capacitor, Ceramic, 1uF, 25V
C6	Capacitor, Ceramic, 1uF, 25V
C7	Capacitor, Ceramic, 1uF, 25V
C8	Capacitor, Ceramic, 1uF, 25V
X1	16 MHz crystal oscillator, 3.3V. Pay attention to the orientation!
C9	Capacitor, Polyester, 22 nF, 100V
C2	Capacitor, Electrolytic, 100uF, 25V. Respect the correct polarity!
C5	Capacitor, Electrolytic, 100uF, 25V. Respect the correct polarity!
U1	IC, 3.3V voltage regulator in TO92 package, MCP1700-3302E-TO or equivalent (part number varies depending on availability)
U3 (sockets)	2x 8-pin female headers.
D1	Yellow rectangular LED. Note that the cathode (shortest pin) is indicated by the square pad
D2	Red rectangular LED. Note that the cathode (shortest pin) is indicated by the square pad
J1	USB B connector
J4	VGA Connector
-	4 x Hex spacer
-	4 x screw with washer
-	PCB
J2	ALREADY SOLDERED, micro SD card socket.
J3	Expansion port header, NOT PROVIDED

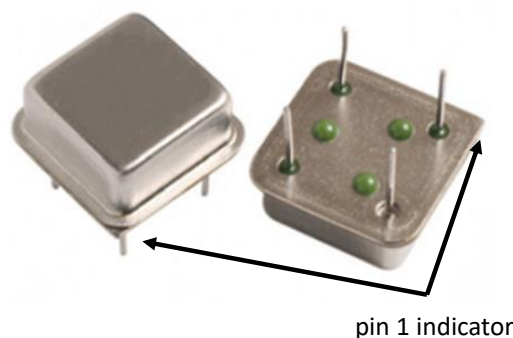
SOLDERING

We suggest to solder the components in the same order shown in the bill of materials.

In particular, we suggest to solder these component first:

- Resistors.
- IC socket.
- The 3.5 mm audio connector.
- Ceramic capacitors

Then solder the 16-MHz crystal oscillator X1 (see picture below). **Warning**, take note of the pin 1 indicator (as shown below, it is the corner which is not rounded. It is usually also indicated by a dot on the silkscreen on the top side of the oscillator). This must match the silkscreen in the PCB!



After that, you can proceed with:

- The polyester capacitor C9
- The electrolytic capacitors C2 and C5.
- The TO-92 voltage regulator U1.

Only few components left now! For the remaining ones these tricks might come in handy!

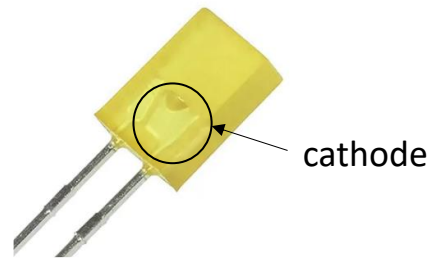
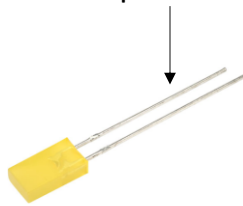
- 1) Soldering the uChip female headers.

We suggest to mount the headers into uChip, and THEN put the headers into the PCB. This will ensure that they will be soldered with the correct spacing! Once you have soldered just a couple of terminals for each header, you can (**gently!**) remove uChip, and finish the soldering operation (put back uChip in its antistatic bag).

- 2) Soldering the LEDs.

Please notice the orientation of the LED. The cathode is marked by the square pad on the PCB, while the anode is the rounded pad. The two LEDs have OPPOSITE orientation (the two anodes are close to each other, the cathodes are external). In this kit, the cathode is the shortest terminal. You can also infer its position by looking at the internal LED electrode: the cathode is the bigger “trapezoidal” one.

shortest pin = cathode



It is up to you to decide to mount the LED either vertical or at right angle (if you plan to build a case for the finished console). If you mount them vertically, to get the correct (and equal) height, we suggest this trick:

- Mount all the 4 spacers as shown below in the four holes H1-H4 (i.e. in the **opposite** way they will be mounted in the finished board!). This will ensure a 1-cm LED mounting height.
- Put the LEDs and flip the board on a flat surface.
- Ensure that both LEDs are perpendicular to the flat surface.

If done correctly, the two LEDs should be perfectly aligned at the perfect distance!

You can remove now the spacers and solder the USB and VGA connectors.

After that, mount the spacers (this time in the correct side!) and voilà, it should be finished.

PRELIMINARY SETTINGS AND POWER UP

Before powering uSVC, check twice that you mounted all the components in the correct positions and orientation. Also double check for short-circuits, solder balls and ensure that all the pins have been soldered!

We also suggest you to use isopropyl alcohol and an old toothbrush to clean the PCB of any solder flux residues (and after this operation, we also suggest to never use again that toothbrush to brush your teeth!).

uChip should come with the console bootloader pre-flashed. Download and copy to the SD card the various uSVC game files (.USC) you find on our website. To update the bootloader see the “Installing or updating the uSVC Game Loader” section you can find below.

Connect the VGA cable, the audio cable to some amplified speakers (earpieces might work too, but the sound will be quite faint!), and insert the micro SD card. NEVER remove or insert the SD Card when uSVC is

powered on! Connect also the USB micro A to USB A cable. The USB device can be connected/disconnected at any time.

After that, connect the USB power cable (and of course the power cable to an USB port or power supply). uSVC should boot up instantly and show all the .USC files present in the SD card. Using the up-down arrow keys (or the up-down d-pad on the gamepad) select the file you want to upload. Pressing enter (or any of the gamepad buttons) the file will be copied into uChip, and the game/demo should start after few seconds.

NOTE! In order for the microSD to work properly, the external power cable should be connected to the USB-B (marked as PWR IN)

VIDEO CALIBRATION

While all the monitors (both LCD and CRT monitor and even LCD television with VGA input) should immediately recognize the VGA signal, with the correct settings, some might require some tuning (especially on the horizontal or vertical position). If you feel the image is not correct or unstable, refer to your monitor/television user manual for the correct adjustments.

TROUBLESHOOTING

Here is a step-by-step guide to solve any issues.

Problem: no image on screen.

- 1) Is POWER LED (yellow) on ?
NO: → Check power supply, and check for any short circuits. Double check also for the correct polarity of the LED and if it is correctly soldered.
YES: → go to step 3.
- 2) Is the SD LED (red) on ?
NO: → go to step 3.
YES: → ensure that PWR IN cable is connected to a 5V USB power supply (this is required for the microSD to work properly). If this does not solve the problem, go to step 3.
- 3) Is uChip LED blinking about once per second?
NO: → go to step 4.
YES: → go to step 7.
- 4) Press twice quickly on the uChip reset. Is LED glowing with a pulsating pattern?
NO: → go to step 6.
YES: → go to step 5.
- 5) Check if the crystal oscillator is feeding correctly the 16 MHz square wave to uChip pin 5. Ideally you should do this by using an oscilloscope, but if you don't have one, you can use a digital multimeter and try to measure the voltage at that pin. If it is 1.65 V, likely the square wave is there. Is the square wave arriving?
NO: → Check if the crystal oscillator is correctly mounted (including orientation and the solder joints). Check also if the 3.3V power supply between pins 1 and 8 (note that the four pin are numbered as 1, 4, 5, 8!) is correct.
YES: → Probably the game bootloader is corrupted or missing, Reflash the game loader (see guide).
- 6) Carefully check the voltage between pin 8 and 16 on uChip. Is 5V?
NO: → check if you have soldered correctly the socket pins.
YES: → Either uChip's bootloader has been corrupted or uChip has been damaged. Try with another uChip, or if you do not have a spare one, but you own an SWD programmer, try reflashing uChip's bootloader. You can also try to reflash the bootloader using any Arduino Zero, Due or other 3.3V based Arduino boards and the sketch shown here:
<https://www.hackster.io/nicola-wrachien/sam-d21-board-unbricker-ccceel1>
- 7) Is the video cable connected and the monitor correctly set up?

YES: go to step 8

NO: fix connections or try with another monitor.

- 8) Check the 74AHC245: check if there is any short or missing solder joints on U2, uChip connectors and the VGA. Check also resistors R11 and R13. These should be 22 Ohm (red-red-black-gold), and check if they are correctly soldered. Carefully measure the voltage between pin 20 and 10. Check if it is 3.3V. Try replacing the 74AHC245.

Problem: no audio

Check for jack, speaker volume, resistors R12 (1k Ohm 1%, brown, black, black, brown, brown), R14 (10k Ohm 5%, brown, black, orange, gold), capacitors C8 (1 μ F ceramic) and C9 (22nF, polyester) and the jack audio socket.

Problem: cannot load files from SD card.

- 1) Is the card formatted using FAT32 ?
NO: → The card MUST be formatted with the FAT32 file system. Older FAT16 or FAT12 are not supported.
YES: → go to step 2.
- 2) Is the red LED briefly flashing when you reset uChip ?
NO → check the RED Led and resistor R15 (390 Ohm 1%, orange, white, black, black, brown). Check also the solder joints on uChip pin 4, and U3 pin 1.
YES: Check if there are any shorts on J2, or on the 74AHC245 or uChip. Check also R1 (10k Ohm 5%, brown, black, orange, gold). If problem persists, try with another SD card.

Problem: colors are too dark, missing, flickering or “weird”.

- Check for all the resistors R3-10, and VGA solder joints. If these are ok, try with another monitor. Check also the voltage at the 74AHC245 (between pin 20 and 10, it should be 3.3V).

INSTALLING OR UPDATING THE USVC GAME LOADER

Normally the uChip shipped with the uSVC kit is already programmed with the game loader, which sits on top of the standard uChip bootloader. However, to update, modify or simply upload it, this section is for you.

- 1) Download and install Atmel Studio 7 from Microchip’s website.
- 2) Download the “uChip Quickstart Guide” from the Download page of <https://shop.itaca-innovation.com>.
- 3) From the “uChip Quickstart Guide”, follow the indications shown in section “Integration with Atmel Studio 7 IDE”.
- 4) Download the uSVC game loader source code.
- 5) Unzip the archive, and open the file uChipSimpleVGAConsoleBootloader.atsln (either by double clicking on it or using Atmel Studio (Menu File → Open → Project Solution)).
- 6) Build it (Press F7).
- 7) Double tap on the reset button of uChip to enter bootloader mode.
- 8) Upload the built binary with selecting from the Tools menu, the “Program uChip” entry you created on step 3.

The game loader should be now installed / updated.

CONTACT US

For any question, bugs, support, suggestion, etc, contact info@itaca-innovation.com.

Due to the large number of emails, we kindly ask you to be very concise, clear, while being exhaustive in order for us to reproduce your issue.