FPGASID

The better SID.

Installation Manual

Version 20181204

Index

Introduction

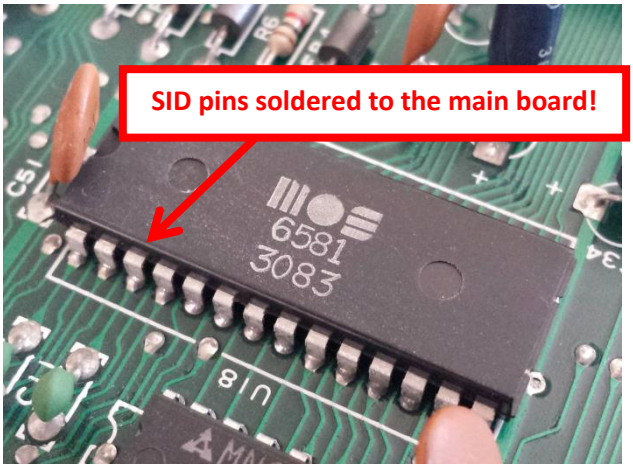
In this manual you will find all the details on how to install an FPGASID in a C64 or C128 computer. The pictures in this manual show an ASSY-250469 board which is the latest version of C64 mainboards. Older board revisions look quite differently so it's always good to refer to the text where the details are described in a way that fits to all C64 board revisions. The FPGASID shown in this manual is a prototype. It looks a bit different from your production FPGASID.

We have tested FPGASID in a large number of C64/SX64 and C128 model variations. But Commodore produced these computers in so many different variations that it was impossible to check everything. We have done our best to address all issues that have been identified during our tests. Nevertheless it may be possible that one or the other small problem occurs. In this case please contact the FPGASID team. We will try to get a solution for you.

Known issues

General issues

- In some (seldom) cases the original SID chip is directly soldered into the mainboard without a socket. The picture is showing this situation. In this case there is no other way than unsoldering the original SID. It has to be replaced with a DIP-28 socket before the FPGASID can be installed. Unsoldering a 28-pin DIP IC is not easy. In case you have never done this before, please ask someone with more experience to do it for you.



- Many C64 computers have a metalized carton shield above the main board. But most C128 and some C64 computers come with a solid metal plate shielding. The carton shield usually causes no problem during the FPGASID installation. But the solid metal shielding can be a problem because the FPGASID is using more space than the original SID. Often it does not fit well under the metal shield. Nevertheless in most cases it should be possible to fit the shield back again by bending the plate slightly to free the required space.

Special wiring in a C128

- The C128 requires a different wiring than a C64. Please refer to the chapter "Installation in a C128/C128D" for more details.

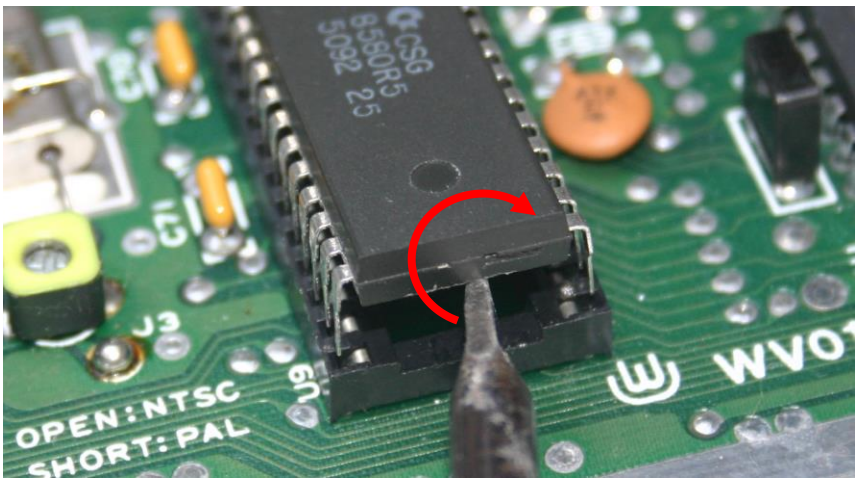
Installation of the FPGASID

Opening the Computer

1. Remove all cables from the computer.
2. Open the computer by removing the screws on the bottom side, then lift off the top part of the case. Depending on the type of case, the top part will be fixed with multiple clamps to the bottom part. Be careful: These clamps can easily break when you use too much force.
3. Unplug the keyboard and LED plugs and put the top part with the keyboard on the side.
4. Bend away the metalized carton shielding or remove the metal plate shielding in order to access the main board.

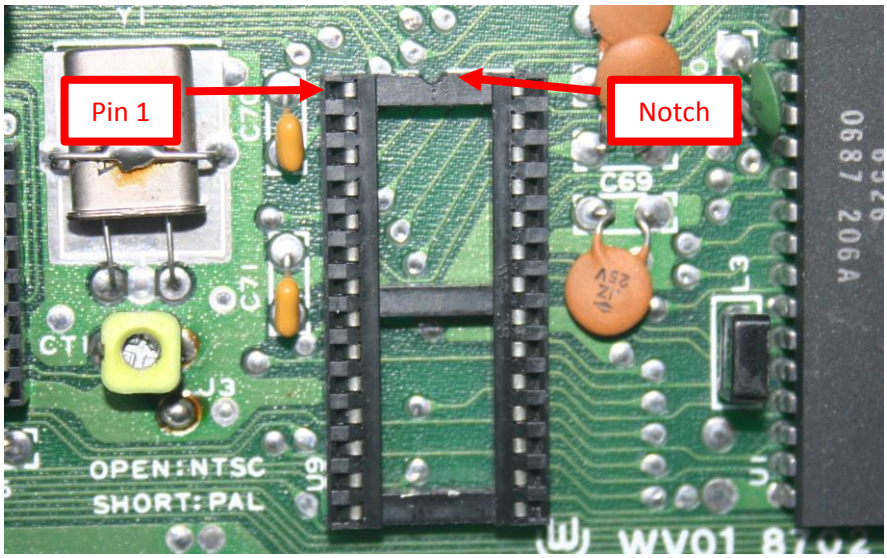
Removing the old SID

5. Locate the SID on the mainboard. It is a 28-pin IC marked either with the number 6581 or with 8580.
6. Remove the original SID from its socket. This works best with a flat and wide screwdriver that is pushed below the SID chip between SID and socket. Then carefully turn the screwdriver left and right to lift the SID out of its socket.

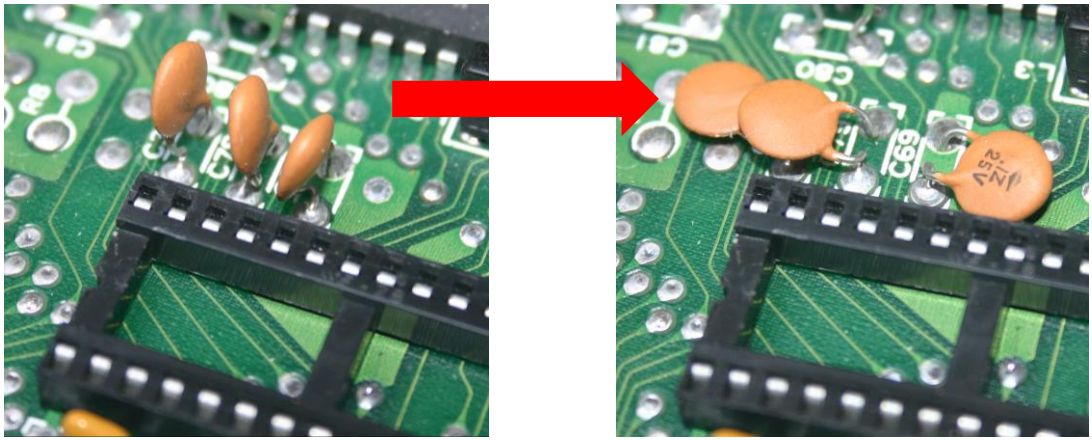


Inserting the FPGASID

7. Identify the PIN1 marking of the SID socket. Pin 1 is the first pin left of the notch in the socket.



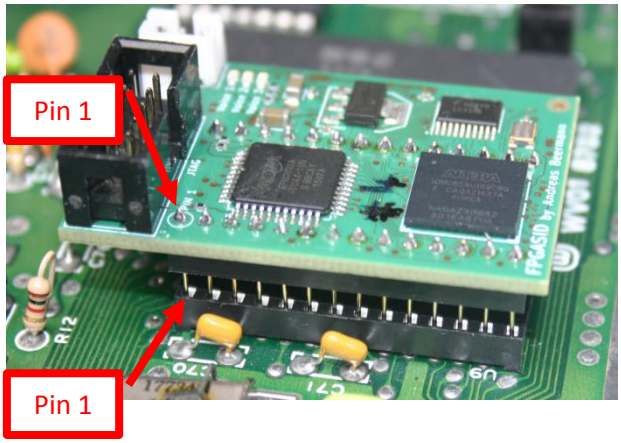
8. Carefully bend the capacitors around the SID socket flat to the board to allow the FPGASID board to fit in the socket without touching any components on the main board.



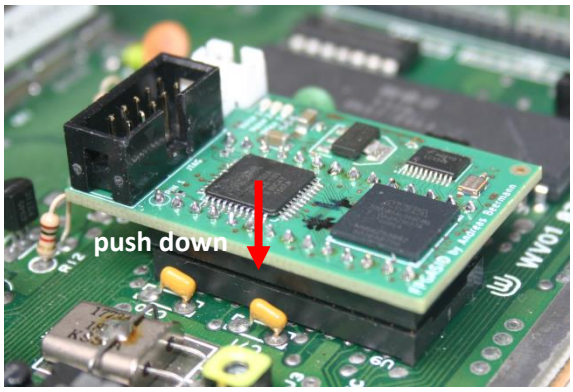
Hint: If space problems occur a DIP-28 IC socket can be inserted to raise the FPGASID by a few millimeters.

9. Now remove the FPGASID from the packaging.
Attention: The pins of the FPGASID are quite thin and bend easily. If a pin is bent, it should be carefully made straight again now.

10. Gently put the FPGASID with all pins into the SID socket. The PIN1 marking on the FPGASID board must correspond to PIN1 of the SID socket. All pins must fit into the socket and no pin should stand over.
    This should be checked by a lateral control view on the right and left.



11. THEN press the FPGASID carefully into the socket.

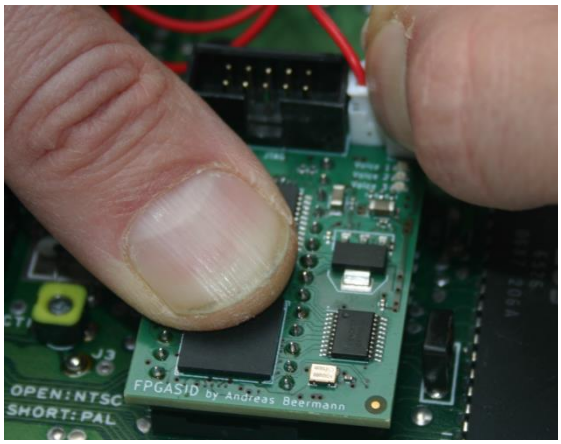


In this state FPGASID already works as a SID replacement. To use the stereo mode, you have to connect the supplied cables.

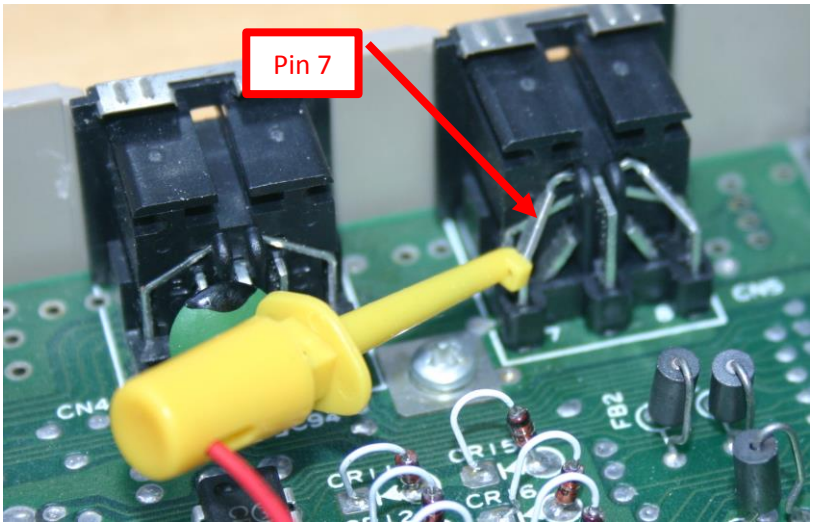
Connect Internal Wiring

Audio Cable

12. Use the red 1-wire cable and connect it to the white 2-pin socket of the FPGASID. Make sure that the FPGASID is not levered off the socket again. It is best to fix the FPGASID with a gentle thumb pressure towards the socket while the cables are connected.



13. The red-wire provides the audio signal of the second SID. Use the clamp hook of the red wire and connect it to pin 7 of the AV-connector of the computer.



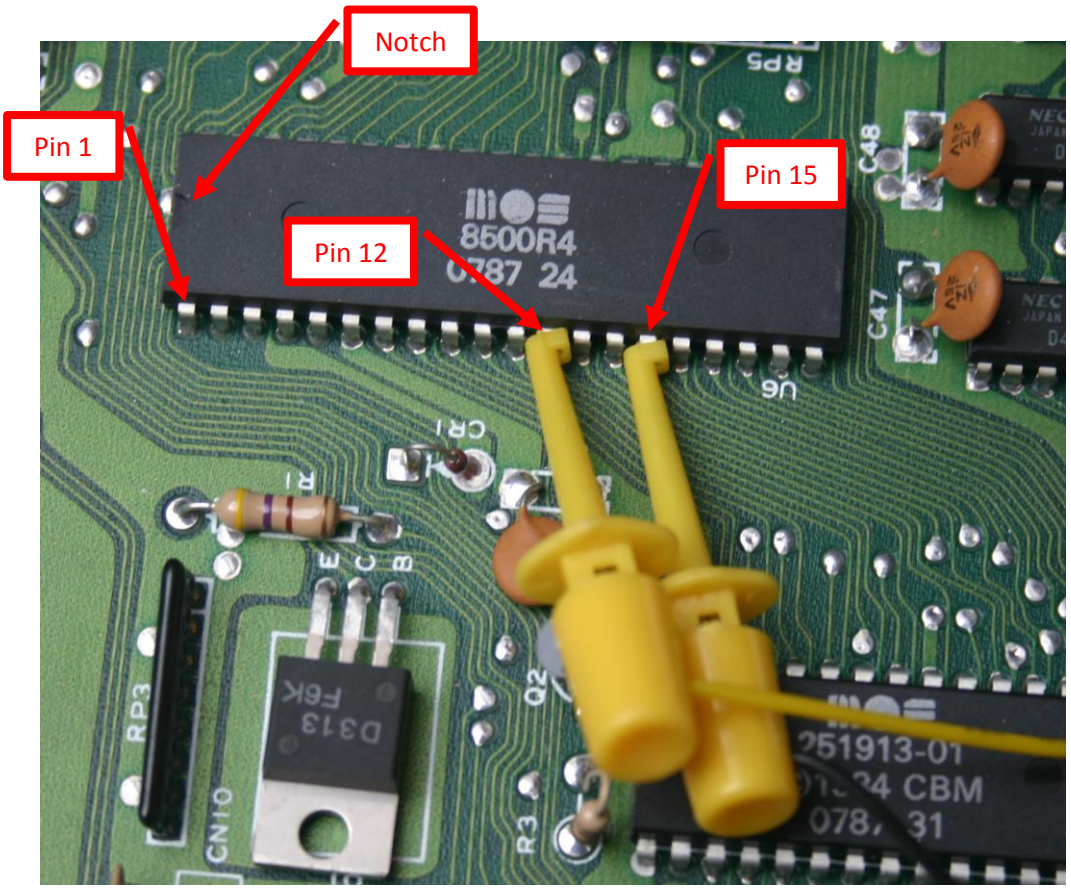
Chip Select and Addressing

14. Next is the three-wire cable. It is used for the address and chip-select lines of the second SID. Connect the cable to the FPGASID. Again press the FPGASID into the socket that it does not tip out when the cable is connected to it.

15. Like for the audio cable, the three wires of the cable terminate in clamp hooks. With these hooks you can connect to the necessary signals in the computer. The table shows the signals that are required.

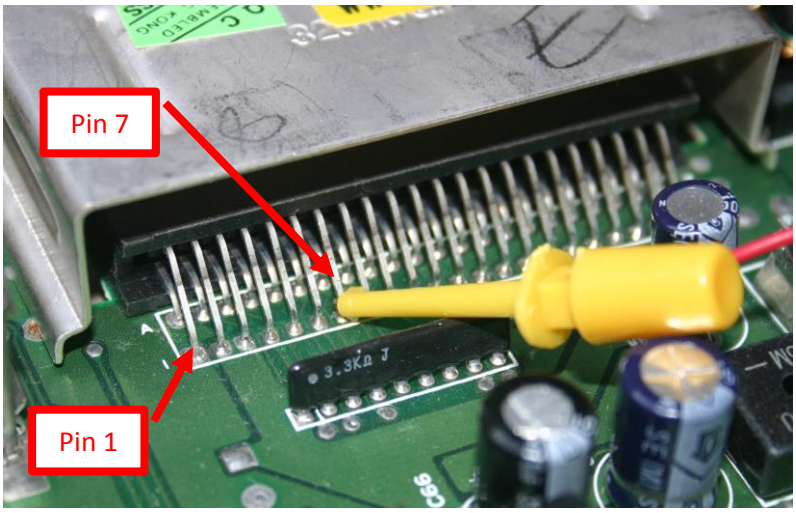
Signal Name	Wire Color
A5	yellow
A8	black
/IO1	red

16. The signals A5 and A8 can be accessed at many different points on the mainboard. For example at the CPU. Lookout for a 40-pin IC marked with either 6510 or 8500. Locate pin 1 of the CPU. With pin 1 at the top left, the pins are numbered from pin 1 downwards to pin 20. Locate pins 12 and 15. Connect the yellow wire to pin 12 (A5) and the black wire to pin 15 (A8).



17. When the hooks are connected to the tapping pins, check that they are in contact with the tapping point only and not with the adjacent pins. Sometimes the spring in the clamping hook is too weak to pull the hook far enough back in. In this case the hook should be retracted manually to ensure safe contact.

18. The signal /IO1 (chip select for the DE00 address range) can be grabbed at the expansion-port-connector's back side. When looking at the back of the connector, pin 1 is in the first row facing to you at the leftmost position. Count towards the right to locate pin number 7. Connect the red wire to pin number 7:

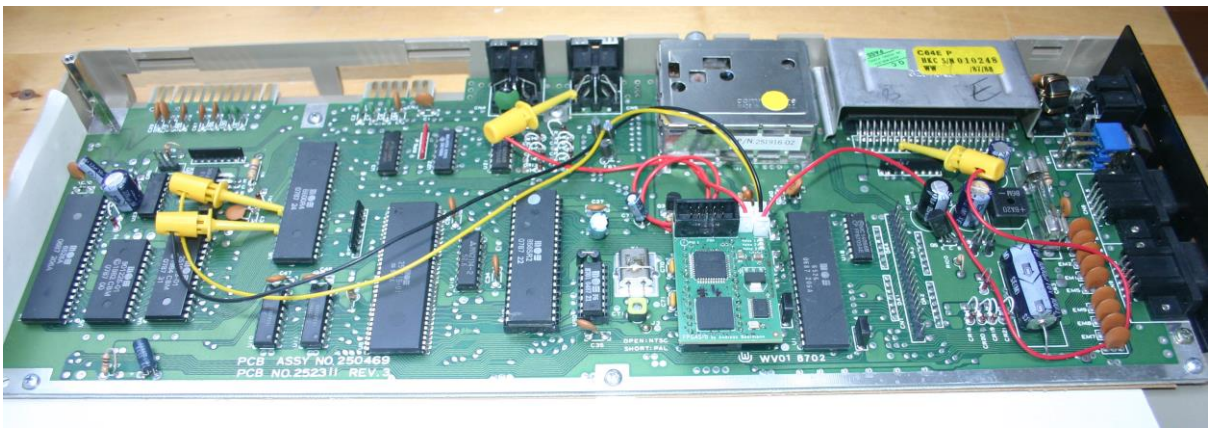


Hint for pros: Alternatively you can cut the hooks away and solder all wires directly to the tap points.

Note: The black 10-pin connector on the FPGASID is the JTAG interface mainly for programming the FPGA device. Some of its pins can be used for future features described in separate documentation.

Check before Reassembly

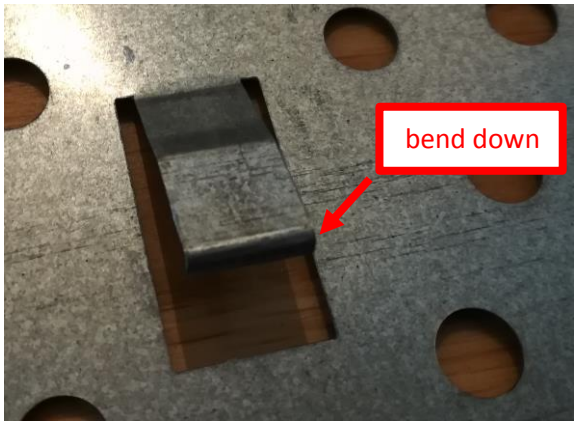
19. Check again if all wires and hooks are connected properly and if the FPGASID sits well in the socket. The final result should look like this:



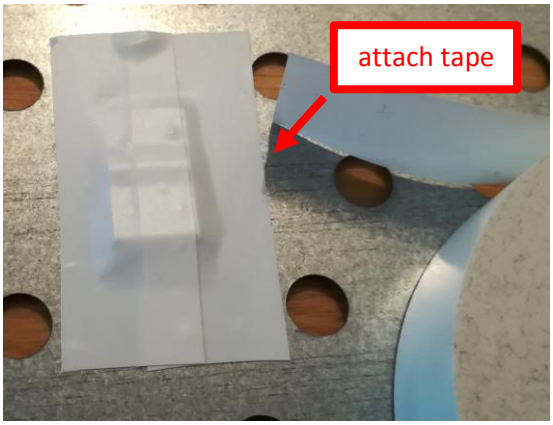
Reassembly

20. When your computer has a metal plate shield you have to check if the shield can be put back again without touching the FPGASID. Bent up the lid that goes down from the shield to the original SID chip. Remove the white thermal paste from the lid. Then stick electrical tape on the lower surface of the shield in a way that no metal part of the shield can touch the FPGASID even when someone should press on the shield from the top side.

Before:



After:

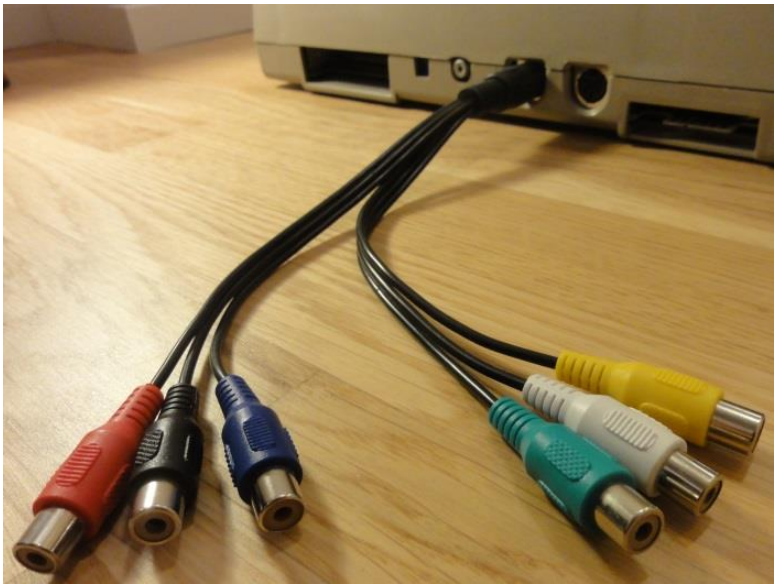


Note: Computers with metalized carton shielding do not required any special measures.

21. Now take the upper part of the case and connect the keyboard and LED plugs back again. Then close the case. You may chose not to re-fit all screws before the final test is done.

22. Connect the computer to its power supply and to the other peripherals.

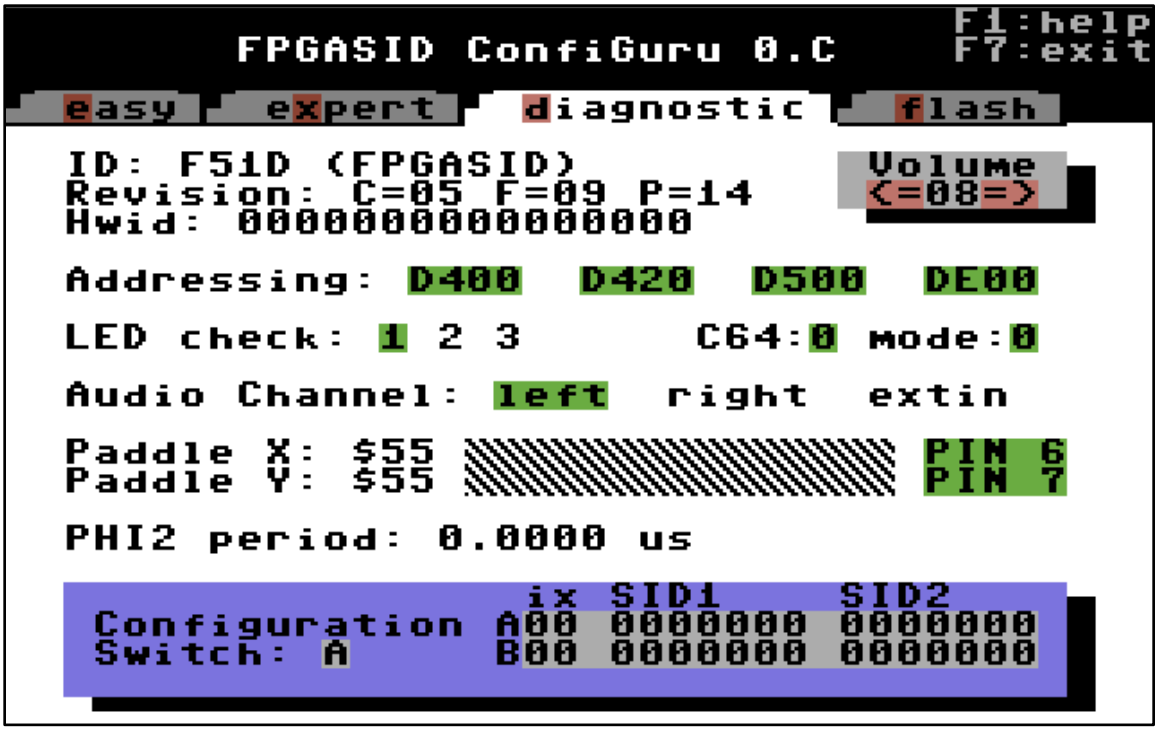
23. The audio signal of the second SID is now fed to pin 7 of the AV-Socket:



To access the audio signals, you can use the FPGASID breakout cable that we provide as accessory.

For more details, please consult the chapter ‘Breakout Cable’ below.

24. As a final test load the FPGASID configuration program ConfiGuru and go to the diagnostics page. Everything should be shown in green. Watch out for the SID2-Addressing because on wrong wiring it will show failures in red. Then check the beeping sound at both audio channels to assure that you can hear SID1 and SID2.



ConifGuru can be obtained here: http://www.fpgasid.de/downloads

Installation in a C128 or C128D

With a C128 there is a specific problem related to the stereo address decoding: The FPGASID cannot use the address $D500 for addressing the second SID because the address $D500 is occupied by the C128 MMU.

This is not a big problem in C128 mode, because due to that problem, there is no existing software for the C128 mode that uses the $D500 address range for a second SID. And self-written programs could simply use the other address ranges $D420 or $DE00 for the second SID.

In the C64 mode the situation is different: Even though the MMU is not available in C64 mode, the problem still occurs and in C64 mode the address space $D500 is not usable for a SID. But existing software for the C64 that uses a second SID, may expect the SID located at $D500. This software would no longer work correctly on a C128.

To overcome this situation a workaround has been developed. It allows using the $D500 address space in the C64 mode (only). This workaround requires one additional internal wire between the FPGASID and the MMU and is easy to install.

This chapter describes this special wiring for the C128.

Audio Cable

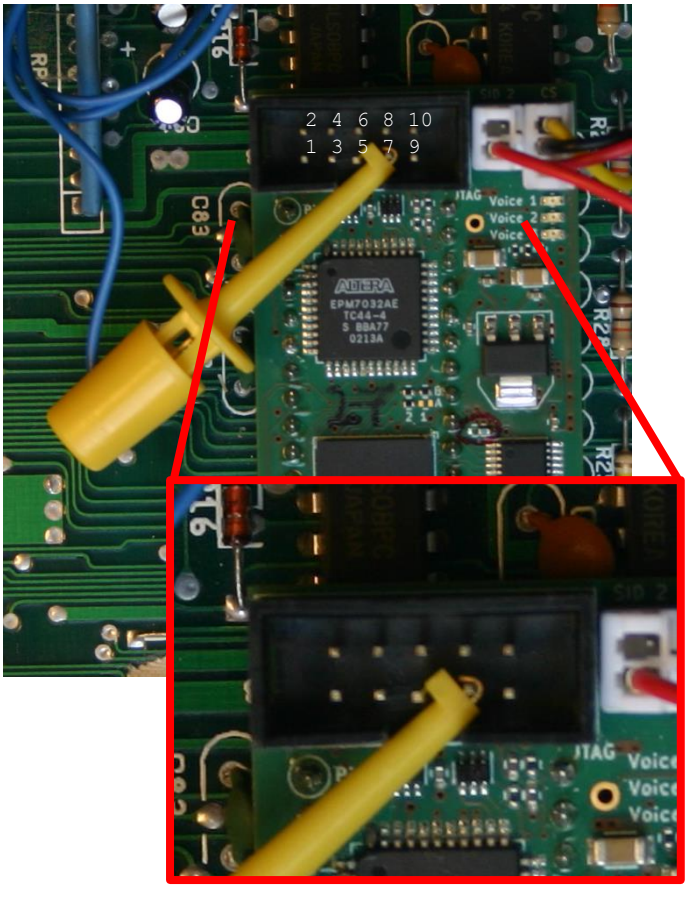
Like in a C64, the audio cable (single red wire) is connected to pin 7 of the AV connector.

Address Decoding

1. One end of the **blue wire** has to be connected to pin 7 of the FPGASID's JTAG-connector.

The picture shows how this is done.

As shown the pins of the JTAG connector start counting at the lower left edge with pin 1.

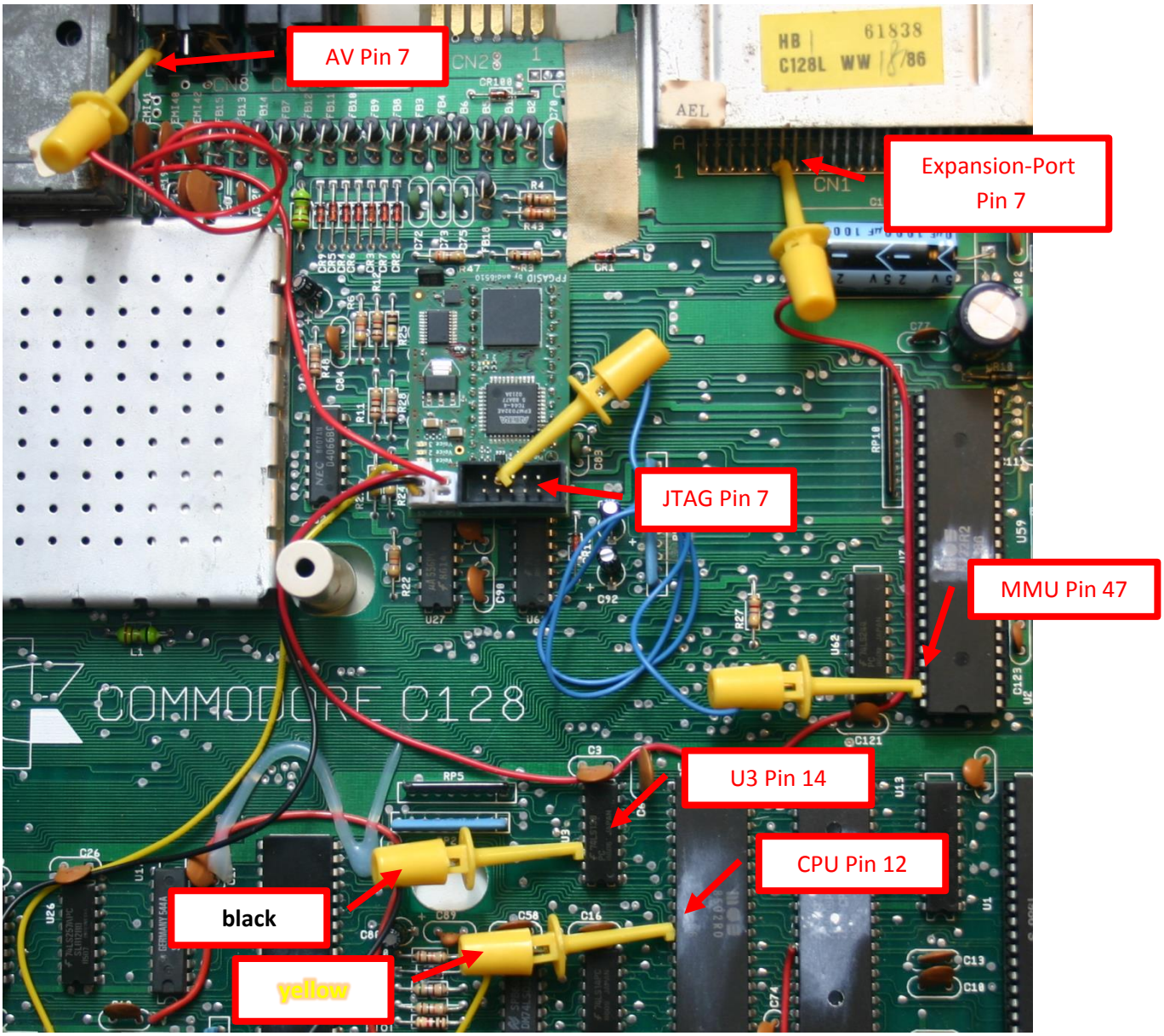


Note: When the hook is connected exactly in this way, it is still possible to mount the metal shield of the C128 back again.

2. Then connect the three wires for address decoding and the **blue wire** to the C128 main board as follows:

Signal Name	Wire Color	Tap Point
A5	yellow	CPU 8502, U6 pin 12
NC (/D500)	black	74LS138, U3 pin 14
/IO1	red	Expansion Port pin 7
128/64	blue	MMU 8722, U7 pin 47

3. The final result should look like this:



Note: Pin 1 of all ICs in a C128 is facing to the front side. Therefore the FPGASID is shown "upside down" in this picture. This is the correct orientation.

Configuration Switch

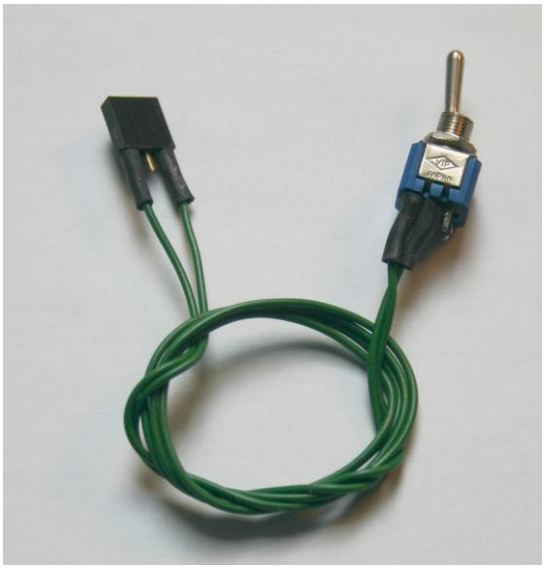
The FPGASID can store two configuration sets in its flash memory. An external switch can be connected to the FPGASID to switch between both configuration sets.

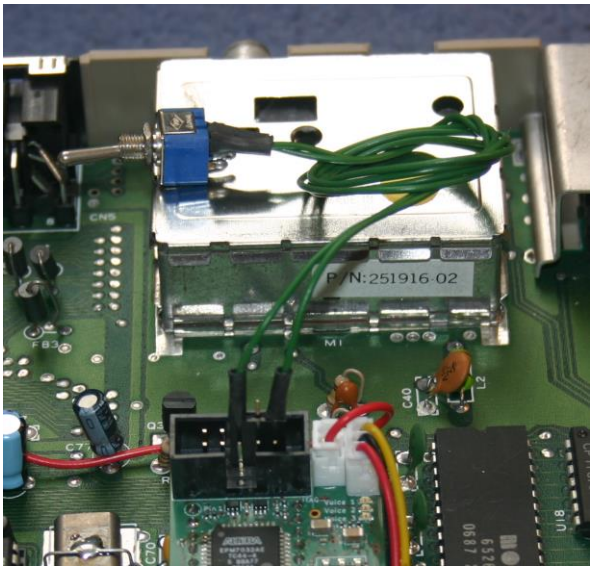
Warning! The required switch, cable and connector are not provided by us and have to be purchased separately. Soldering skills are required.

Connecting the switch

Simply connect the switch between pin 6 (switch) and pin 10 (ground) of the JTAG connector. When the switch is open, configuration set ‘A’ is selected. With the switch closed, configuration set ‘B’ is selected. Switching can be done on the fly, even when the FPGASID is in full operation.

These pictures show an example of how such a switch can be build and how it is connected to the FPGASID:

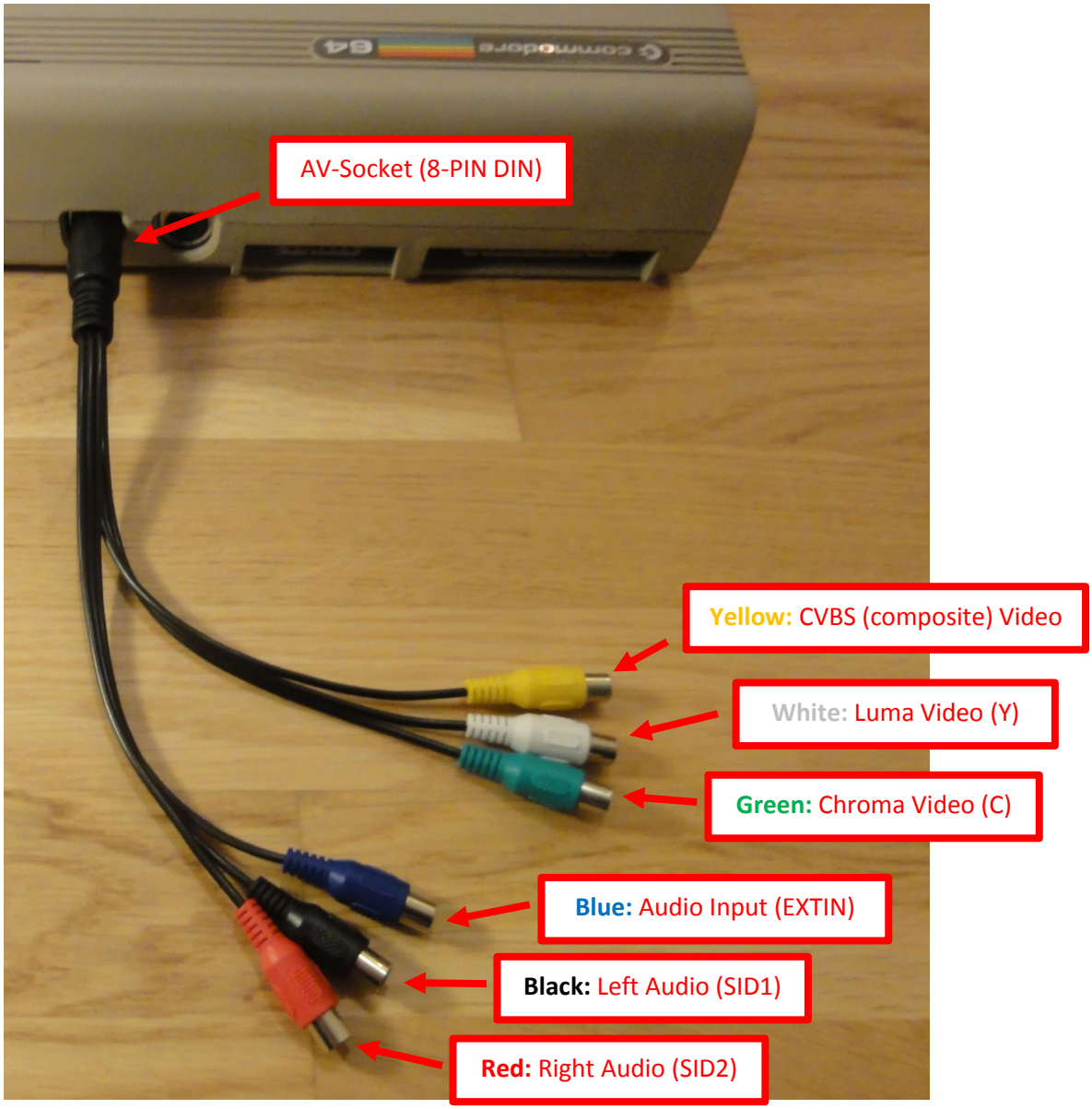




Breakout Cable

As mentioned before, we also provide a breakout cable. It can be used to access the additional audio signal of the second SID in the FPGASID. It also provides all other signals available at the AV-connector of the C64 or C128.

Signal Allocation



More information

Please consult the FPGASID website for more information on installing the FPGASID:

http://www.fpgasid.de/installation