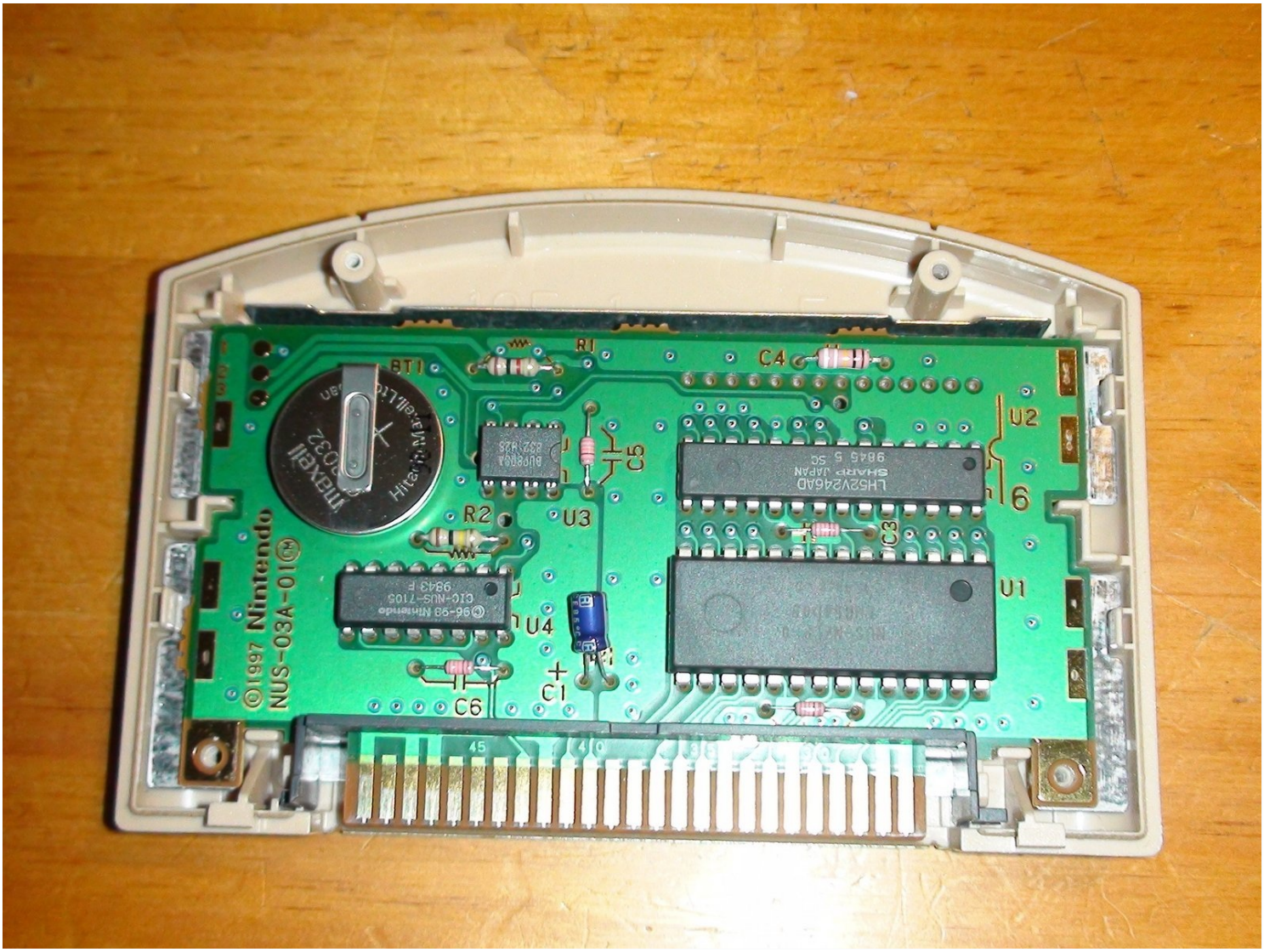
Nintendo 64 Game Cartridge Battery Replacement WITHOUT LOSING SAVE FILES.

To some (or most) people, Save Files for...

Written By: Jackson



INTRODUCTION

To some (or most) people, Save Files for precious childhood games are important. So you could imagine how horrifying it may feel to wake up one morning, boot up your favourite retro game, and find that all your save files have completely disappeared. Not only that, every time you try to make a new file, it keeps disappearing every time you reboot the console and try to go back to it.

Unfortunately, this means that your precious game cartridge has fallen victim to the dreaded case of flat batteries.

A minority of Retro Game Cartridges (at least for N64 titles) were manufactured with a Volatile Memory Flash type known as Static Random Access Memory (SRAM). SRAM is slightly similar to the RAM in a PC. Because it is Volatile Memory (as said before), once the SRAM chip loses its supply of electricity, all data written to the chip will disappear. Of course, the way manufacturers solved this problem was by installing a small battery connected alongside the chip.

I found about this over half a year ago (as of writing this guide in August of 2016). After some research, I found that my nearly 20 year old Nintendo 64 Game Cartridges could be at risk of losing their saves. To add an increased stress factor to that discovery, the games that had SRAM saves just so happened to be the most important to me: Super Smash Bros. and The Legend of Zelda: Ocarina of Time.

Given that some peoples Cartridge Batteries haven't died yet, there was also the possibility that my N64 Games could retain their saves for many, many more years to come.

But being the paranoid I am, I wasn't going to take that risk. I invested a whole month's worth of research into the proper way to replace a Game Cartridge battery WITHOUT losing power to the SRAM chip.

A wide variety of guides showed me how replacing the battery is done. Most notable is YouTube user Chris, whose channel goes by the name of "Memories in 8-bit". His videos are excellent and taught me most of what I know on the subject today. I highly recommend checking out his channel.

Throughout my troubles trying to find a way to save my saves, I found out that it is possible to replace the Cartridge battery without losing the save files by hooking the cartridge up to a Parallel Battery Setup. Doing this would ensure that the power supply to the SRAM has a parity without doubling voltage.

This proved almost difficult to achieve in the subject circumstances however, but I took these findings to my grandfather, who after looking at the circuit board of the cartridge, found a way that it could be done. With his helpful advice, I was able to successfully rescue my Super Smash Bros. save files, as well as the saves of my friends SNES Games.

In this guide, I will show you the best way to replace a Cartridge Battery. More specifically, I will show you how to do this WITHOUT LOSING YOUR SAVES!

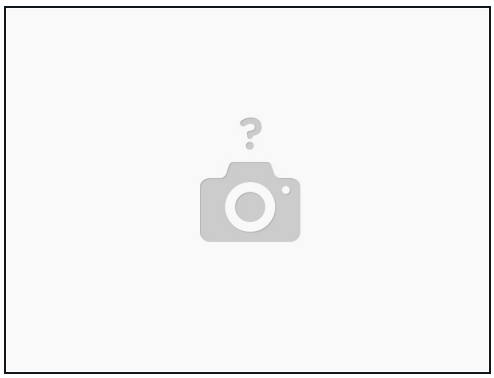
TOOLS:

Gamebit 3.8mm (1)
Phillips Screwdriver (1)
Soldering Iron 60w Hakko 503F (1)
Lead-Free Solder (1)
60% Tin 40% Lead
I advise you use Solder that is 40% Lead. I haven't tried this method with Lead free Solder and don't plan to.
Soldering Pump (1)
Multimeter (1)
Make sure it can read Voltage and at least a 200 Ohms reading.
Spare Rag (1)
To clean the Soldering Iron.
6-in-1 Screwdriver (1)

PARTS:

CR2032 Battery Socket (Holder) Replacement - Designed for Nintendo Cartridges (2)
Can be easily found online
CR2032 Lithium Battery (2)
Spare Copper Wire (1)
1-2mm Thick Cable, Stripped
At least 2 Metres.

Step 1 — Saftey Warnings

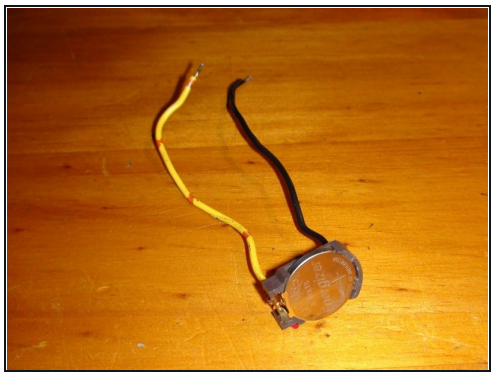


- Before going further with the guide, it is important that I note there is a risk of injury if you do not follow these steps correctly and do not apply proper safety measures.
- I advise wearing good Safety Glasses and some proper Gloves good enough for the task at hand. (I may not have gloves on in this guide, but I do have a few unpleasant burn marks to prove why I should have. So don’t make the same mistake, or you’ll end up soldering yourself.)

Step 2 — Required Tools

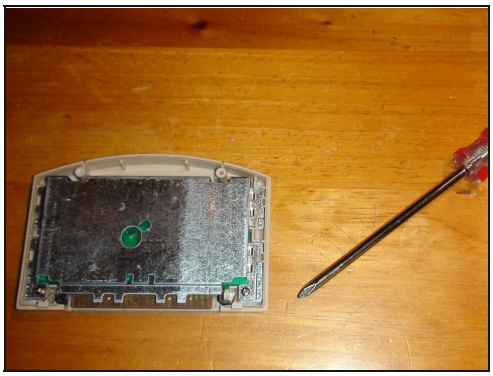
- Ensure that you have the required tools and parts necessary for this replacement, as detailed above.
- Use this image for visual reference. (Note: one of the Batteries and Battery Holders are missing from this image. See step 3 for details.)

Step 3 — Parity Battery



- Before we get to the main event, we need to create a Parity Battery that we'll use to maintain power supply to the Cartridge during the replacement process.
- Take one of the Battery Holders and two pieces of the pre-stripped Copper Wire. Solder one end of each wire on to each of the two pins of the Battery Holder. Be sure to apply a generous amount of solder to the connections to make sure they connect well and are reasonably durable.
- Once you're done soldering on the cables, it should look like the images in this step.
- Also, it is a good idea that you tin the other ends of the cables (as shown in the third image in this step). If you don't know what tinning is, check this link for details: http://www.mediacollege.com/misc/solder/...
- It is also a good idea to label each cable if you need help remembering witch cable connects to the positive end of the battery as well as which cable is the negative end. This will be very important later on.

Step 4 — Cartridge Disassembly

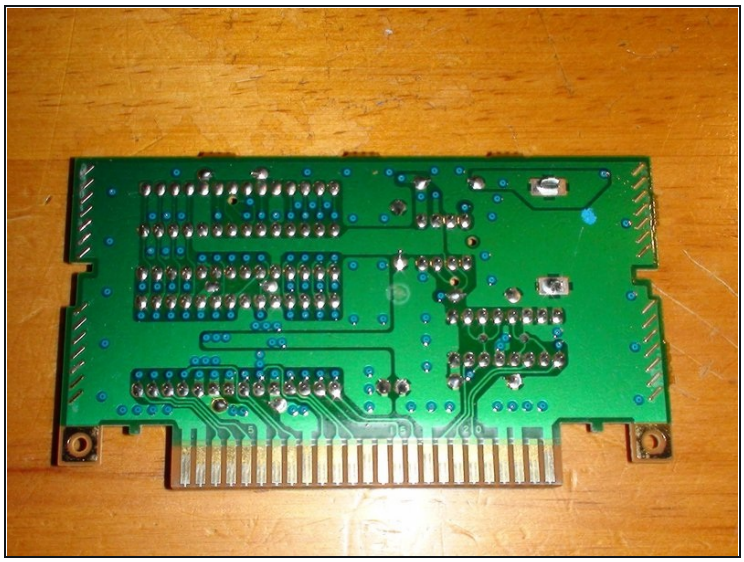

- Now on to the main event. Start by connecting your 3.8mm Gamebit to your Modular Screwdriver. Use the Screwdriver to undo the two Gamebit screws that hold the cartridge together. Once undone, carefully remove the back cover of the cartridge to expose the inner metal shielding.

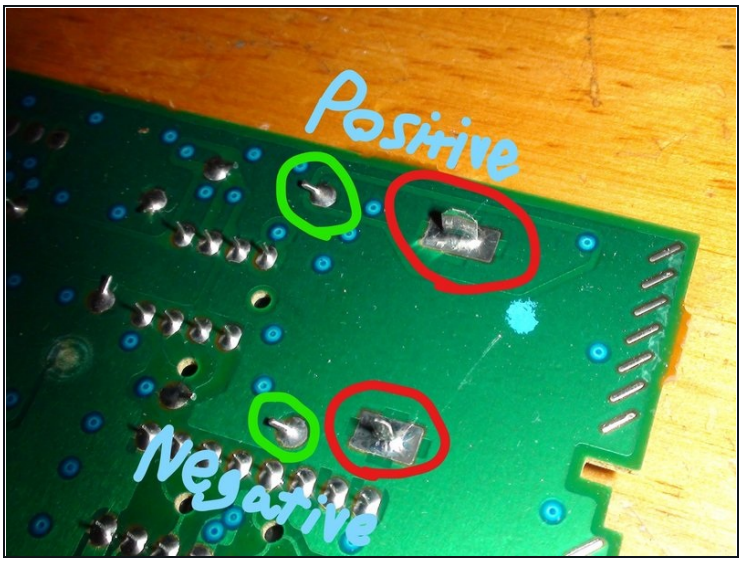
- Now take your Philips-head Screwdriver and undo the two Philips-head screws at the bottom corners of the metal shielding. Remove this metal shielding to expose the cartridge circuit board.

- You can now see the Cartridge PCB with the attached Coin Battery, the source of the problem which we will soon fix.

- From here, carefully remove the PCB from the cartridge casing. Remove the black plastic shield on the cartridge pins and place the PCB on your workspace.

Step 5 — Identifying the Battery Solder Terminals & how to use the Parity Battery





- Now looking at the PCB on it's own, Take note of the 4 Solder Terminals marked on the second image of this step.

- The two terminals circled in Red are the Battery terminals. These terminals compose of the positive and negative pins attached to the battery on the other side of the PCB. The positive terminal is the one higher on the board in this image, while the negative terminal is the one below the first.

- The two terminals circled in Green are the Resistor terminals. The two terminals are the ends of two resistors seen on the other side of the PCB. Why are these important? Well, these terminals are what we will be connecting our Parity Battery to.

- Why connect the Parity Battery to resistors you ask? Well there's logic behind this. Take note of the PCB around the two battery terminals on the first image of this step. If you're unaware of how circuit boards work, the lighter green areas of a PCB (visible in the image) indicate a copper lining under the solder mask.

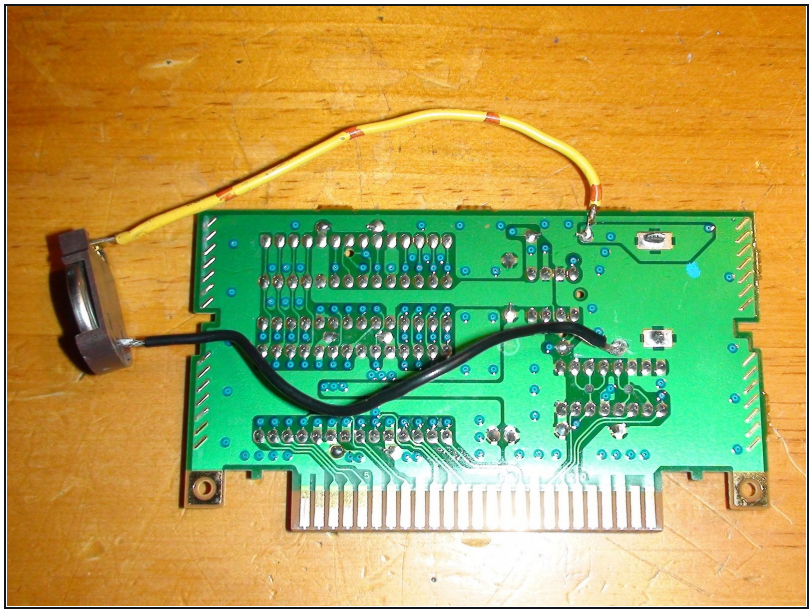
- This copper lining is the link between certain terminals on the PCB. In this case, you'll notice that there's copper lining on the board that links the positive batter terminal with the resistor terminal next to it. The negative terminal in the same respect. This is marked in the second image written in blue.

- To confirm this, you can use your Multimeter to check the voltage of the battery on its two terminals (Red). if you check the two resistor terminals (Green) in the same way, you'll notice that it displays the same voltage as the battery terminals.

- By attaching the Parity Battery to these resistor terminals, electricity will continue to run through the PCB and hold the sensitive data stored on the cartridges SRAM. Meaning that while you replace the Main battery on the PCB, the cartridges saves will not be deleted the moment that the board loses power.

- KEEP IN MIND, that the positive end of the parity battery must connect on the positive circuit of the PCB. Parity is ONLY achieved if the positive and negative ends of the battery are connected to their respective circuits. If you connect the battery the other way around, you'll end up connecting your batteries in Series, which increases Voltage.

Step 6 — Attaching the Parity Battery to the PCB



- Now, we will connect the Parity Battery to the PCB as shown in the image of this step. Many things could go wrong here, so ensure that you have properly followed Step 2 and you are confident in handling a soldering iron for precision jobs.

- Begin by heating up the two ends of the parity batteries cables to the point that the tinning on them starts to melt again. CAUTION: Be careful that you do not cause to much heat as it may adversely affect the battery itself.

- Now start heating up the resistors terminals (circled in green on step 5) to the point that the solder on them starts to melt. CAUTION: Again, be careful how hot the terminals get. You don't want to damage the resistors OR the board itself. Also, too much heat may add extra resistance on the power coming from the battery, losing the SRAM data.
  - For the novices: The reason you need to heat up both ends of what you're soldering is because the solder itself needs to "Flow" onto both surfaces like liquid and that's only possible when they're hot. Looking at the solder terminals as they are now (the images in step 5), you can see how well those solders look. That's what we need to achieve.

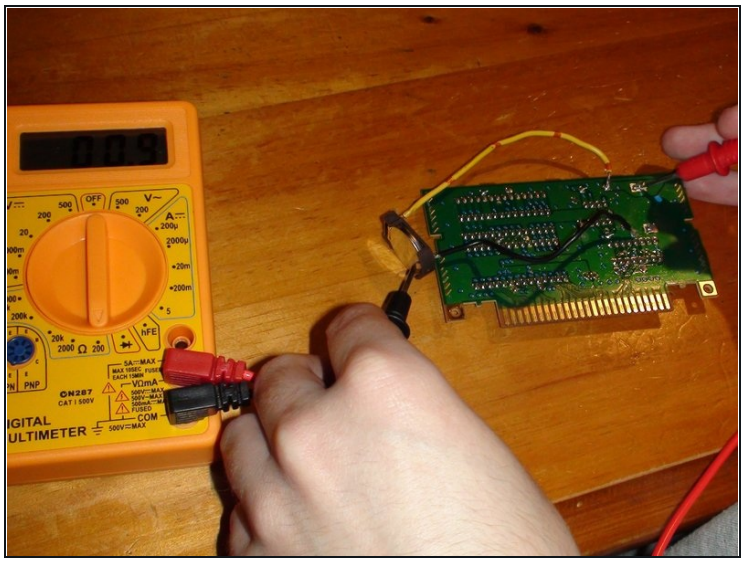
- This is your last warning: **DO NOT MIX UP THE POSITIVE AND NEGATIVE ENDS OF THE PARITY BATTERY WHEN CONNECTING TO THE BOARD!** You want the batteries in Parity, not Series.

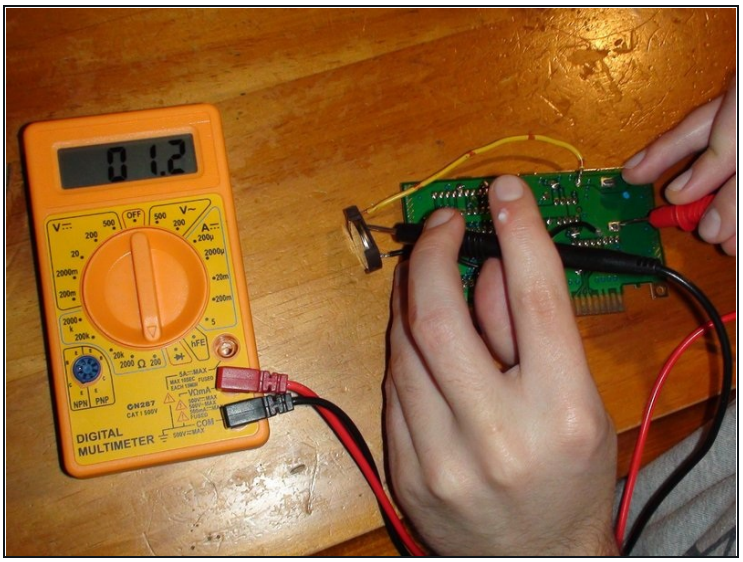
- Now, carefully solder the end of the parity batteries positive cable to the Higher resistor terminal. Ensure that the solder properly flows onto both the resistors pin AND the end of the parity batteries cable almost like liquid. Again, be careful about how much heat is applied. You need to melt the solder, but you must not damage anything.

- Follow the same method for soldering the end of the parity batteries negative cable to the LOWER resistor terminal.

- Once you feel the parity battery is properly attached to the terminals, let the solder cool for a minute or two.

Step 7 — Testing the Parity Battery is working



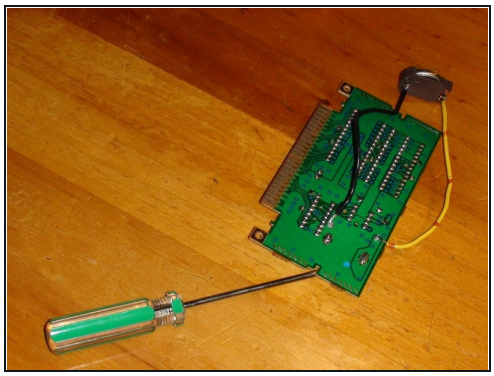
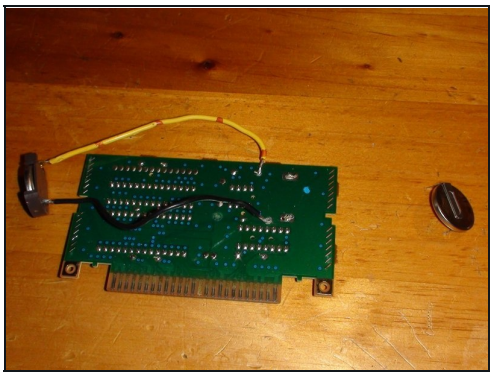
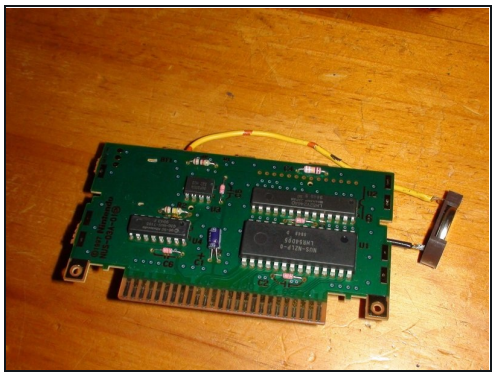


- Now to test that you've made a good connection with the solder. Set your Multimeter to 200 Ohms and test the connection between the main battery terminals and the parity battery. For visual reference, do as shown in the two images on this step.

- The Ohm reading you get by testing the connections should show a solid number somewhere around 1 Ohm. This indicates that you've made a good solder connection.
  - You'll see that the reading I got when testing my negative connection (second image) shows 1.2 Ohms, compared to the much better reading from the positive connection (first image) which shows 0.9. Although it's not perfect, it's all good as long as the number does not variate to far from 1 Ohm. If it does, the connection is loose.

- Another test to do is to check the voltage now shown when testing the main battery. You should now see the voltage read somewhere higher than 3v rather than when the old battery would show something more along the lines of near 3 or 2.98. Either way, seeing a slightly higher voltage than before means you've successfully created a Parity system.
  - I don't know what would happen if you accidentally put your batteries in Serial, but I'm pretty sure your cartridge would explode (or something like that) if it suddenly had 6 volts running through it. This is why it's important to make sure you put the positive cable of your parity battery onto the positive end of the PCB battery area.

Step 8 — Removing the old Cartridge Battery

- **IT IS RECOMMENDED TO HAVE ANOTHER PERSON WITH YOU TO HELP WITH THIS STEP**

- Now that the parity battery is attached, it's time to remove the old battery that we'll be replacing.

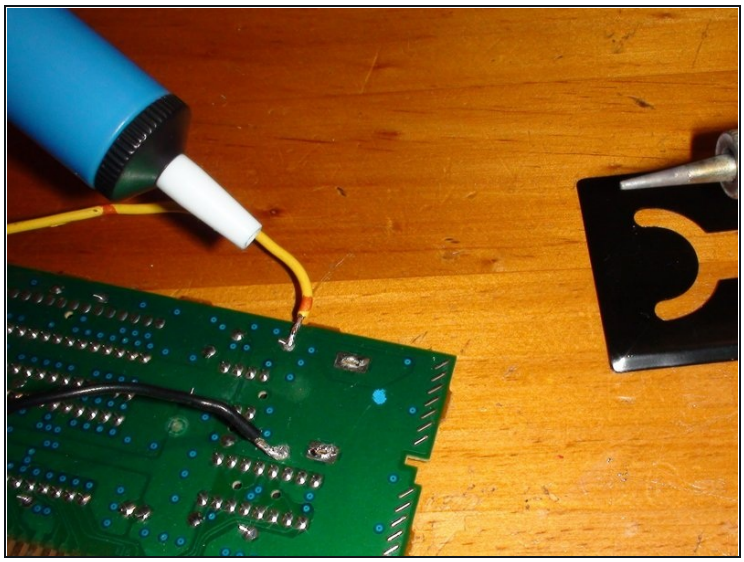
- Grab a flat head screwdriver in place it underneath the battery on the other side of the PCB. Now start carefully heating up the solder on one of the main batteries terminals. While melting the solder, use the screwdriver to carefully push the battery out from the board using the screwdriver as a lever.

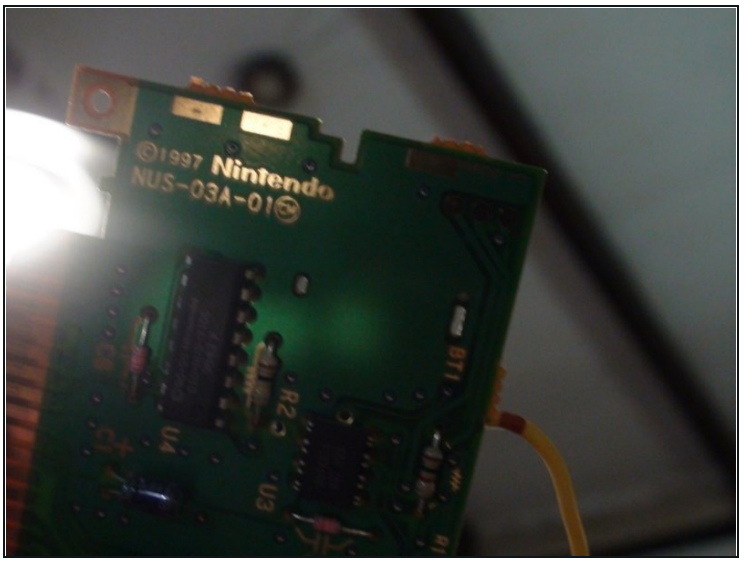
- Eventually, the battery should come loose and the pin should fall from the PCB easily, given you're providing enough pushing force with the screwdriver.

- Follow the same method for removing the other pin from the PCB. This time however, you can pull the battery out while melting the solder rather than using the screwdriver to lever the battery out.

- Just to be sure, use your Multimeter to test the main battery terminals after you've removed the old battery and check that there's still electricity running through the circuit. If you get a stable voltage reading from the main battery terminals (circled Red in step 5) after you've removed the old battery, then your save game is still safe.

Step 9 — Cleaning the Battery Terminals



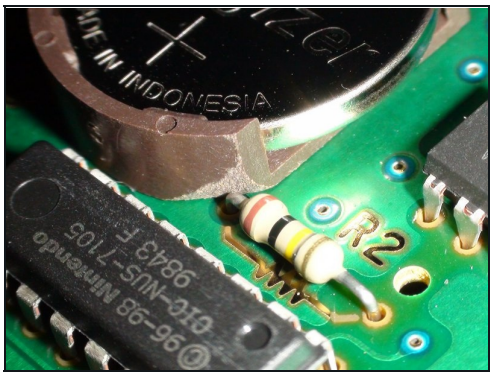


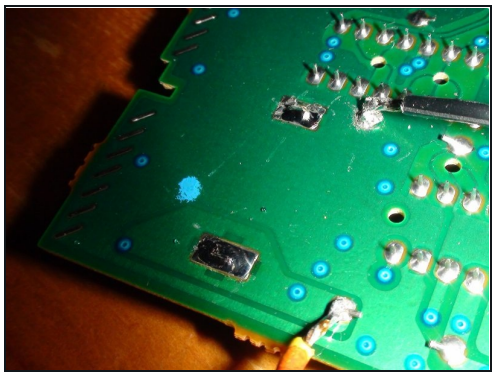
- Now to clean the old solder out of the main battery terminals. This is done to ensure you can put the new battery in easily.

- Again, start carefully heating up the solder on and inside the main battery terminals. While the solder's hot and melted, use you Soldering Pump to extract the solder off of the terminal and out of the inside of the terminal. It might also be a good idea to have someone else use the soldering pump for you while you use the soldering iron.
  - If there's still some solder left inside the terminal, you may have to use something thin to file it out. Keep in mind that this is a last resort as there's a risk of tiny bits of solder going everywhere after filing.

- After cleaning the terminals, the result should be something like the second image of this step.
  - Although it's a bit blurry, you can clearly see that the terminals are very clean and open.

Step 10 — Connecting the new Battery/Battery Holder



- Now to connect the new battery onto the PCB. In this guide, I've used a CR2032 Battery Holder designed for use with any and all Nintendo cartridges. However, you're free to use a standard CR2032 battery with pins already attached to it. A battery holder will make future replacements easier.

- Place the new battery in the same position that the old battery was in on the PCB.
  - **NOTE for Battery Holder users:** You may need to modify the holder slightly. Take note of the second image in this step. One of my cartridges resistors was placed very close to the battery and resulted in it blocking the placement of the holder. If you're in a similar situation, you will need to file off the corner of your holder as shown.

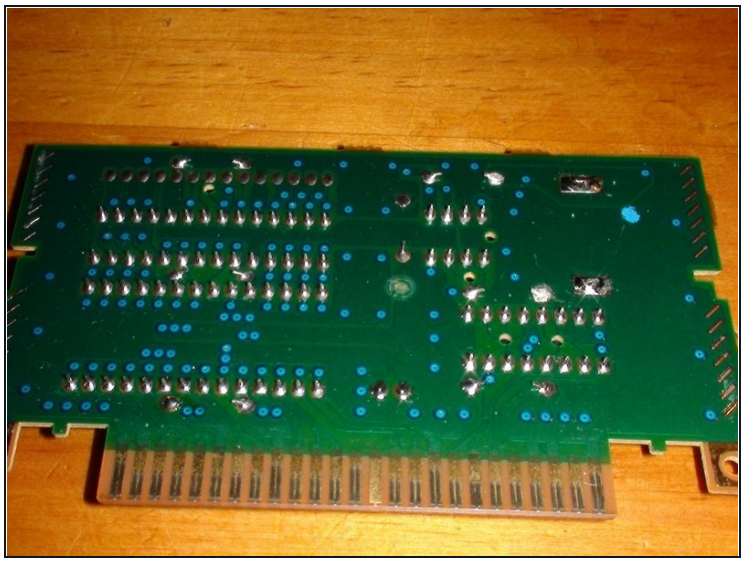
- With the battery in place, begin to **carefully** heat up the terminal and the batteries pins.
  - I use the word "carefully" in the literal sense. Heating up a battery is universally NOT a good idea, but all you need is just enough heat that the replacement solder will flow on to the pin properly.

- Once the terminals and pins are hot enough, begin applying a generous amount amount of new solder to the space between the pins and the terminals.

- Once you're done, you should have something that looks like the third image in this step.

- Let the solder cool off after you're finished. Test the terminals with your Multimeter to make sure everything is still operating normally.

Step 11 — Detach the Parity Battery



- Now for the final part. Exercise caution as you did in step 6.
- Begin heating up one of the terminals your parity battery is attached to. Make sure you're heating up the resistor pin, the terminal, and the parity batteries cable end as you're doing so. While heating up the solder, gently pull on the cable until it comes loose.
  - If you happen to pull off too much solder when detaching the parity batteries cable, quickly start applying more solder to the resistors terminal to ensure the connection remains solid. You don't want to go through all this work for nothing.
- Do the same thing for the next resistor terminal.
- After you've taken off the parity battery, get your Multimeter and test both the main battery terminals and the resistor terminals to make sure that your new battery is supplying a solid 3 volts of power to the cartridge.
  - Also check for an Ohm reading between the resistor terminals and the main battery terminals on their respective copper lining circuits. You should again get a reading of around 1 Ohm in your tests.
- If everything checks out, then that's it! You're done! You've successfully replaced a Nintendo 64 cartridge battery and, if everything went smoothly during the replacement, without losing power to the SRAM chip and deleting your Save Data!

Reassemble the Cartridge in reverse of the way you disassembled it. If all went well during the process and you followed every step correctly, then you did it! Congratulations, and enjoy your preserved Save Game!