Lazy 7 / Mini

by parallyze

Hi all,

yes. Another 7 segment clock. But this one turned out too nice to be thrown away and it finally replaces my old "Tiny Edition" design with something I'm a bit more... uhm... less unhappy about.

Actually I'm not really considering publishing further designs right now, but this one was almost done, so here it is.

This one is quite small and using a rather ugly LED strip layout. It does "waste" 7 LEDs. Should you choose to save them you will have to modify the according arrays inside the sketch. A piece of WS2812B LED strip is required, 37 LEDs in total (4x 7 for the digits, 2x for the dots = 30 in use). Doesn't look very nice from the inside and requires a massive amount of depth added to the whole thing - but it does the trick.

L7/M is smaller than the old "Tiny Edition" and almost exactly the same size as my Lazy Mini Grid.

Biggest part is the outer case. This one is 151.8mm x 63.5mm x 48mm and rotated by 45° it will require a build volume of 148.72mm x 148.72mm x 48mm, so just like my Lazy Mini Grid this one should be printable on a wide range of printers.

I **do not** recommend this to beginners. You should know about the Arduino IDE and other things - but judging by the past it's unlikely the ones who should REALLY pay attention are reading this at all. They're already in the comments section, asking for this:

The pictures show the clock running ClockSketch v7. I **highly** recommend reading that Instructable **before** building any of my designs.

Supplies:

Printed parts:

- 1x L7M-Case.STL
- 1x L7M-Case_Clips.STL
- 1x L7M-LED_Frame.STL
- 1x L7M-Clips_LR.STL
- 1x L7M-Elec_Case-All.STL (includes a small cable cover, the button clips and the case lid)
- 1x L7M-Diffusers-All

I recommend printing the diffusers using clear/natural material and the other parts using black. I've used black and natural PLA. The amount of material depends on print settings, but it's roughly ~100g for the black parts and ~30g - ~50g for the diffusers.

Wall widths are always multiples of 0.50mm, so I recommend using an appropiate extrusion width.

Diffusion seems to work better the more material you put into the diffusers. Try to use multiple angles (like 45, -45, 0, 90) for solid infill and avoid too few top layers which might make the infill pattern visible quite easily.

I recommend printing a single digit set at a time to check for the diffusion effect/tolerances. As the picture might suggest I tried a lot of different designs and print settings...

Other parts/electronics:

WS2812B LEDs, 30 LEDs/m

You will need 37 LEDs for this*. The frame will not fit waterproofed or coated strips, only the regular 10mm wide ones which are rather thin (~1mm). There's some variants using very thick adhesive tape - those will work but aren't really a pleasure to put in because of the pressure required.

30 LEDs will be used in the finished clock. 4 are "wasted" to avoid soldering between the rows and another 3 are not used (yet) - the ones above/between/below the dots. If required those can be used by adding breakouts and use them for whatever might come to your mind (am/pm, al1/al2 indicators...)

Note: *As long as the FastLED library does support them, other LED chipsets will also work. Refer to the FastLED documentation regarding the differences and changes you have to make in that case.*

**Obviously you can use 30 LEDs and solder them together for this but you will have to modify the sketch accordingly.*

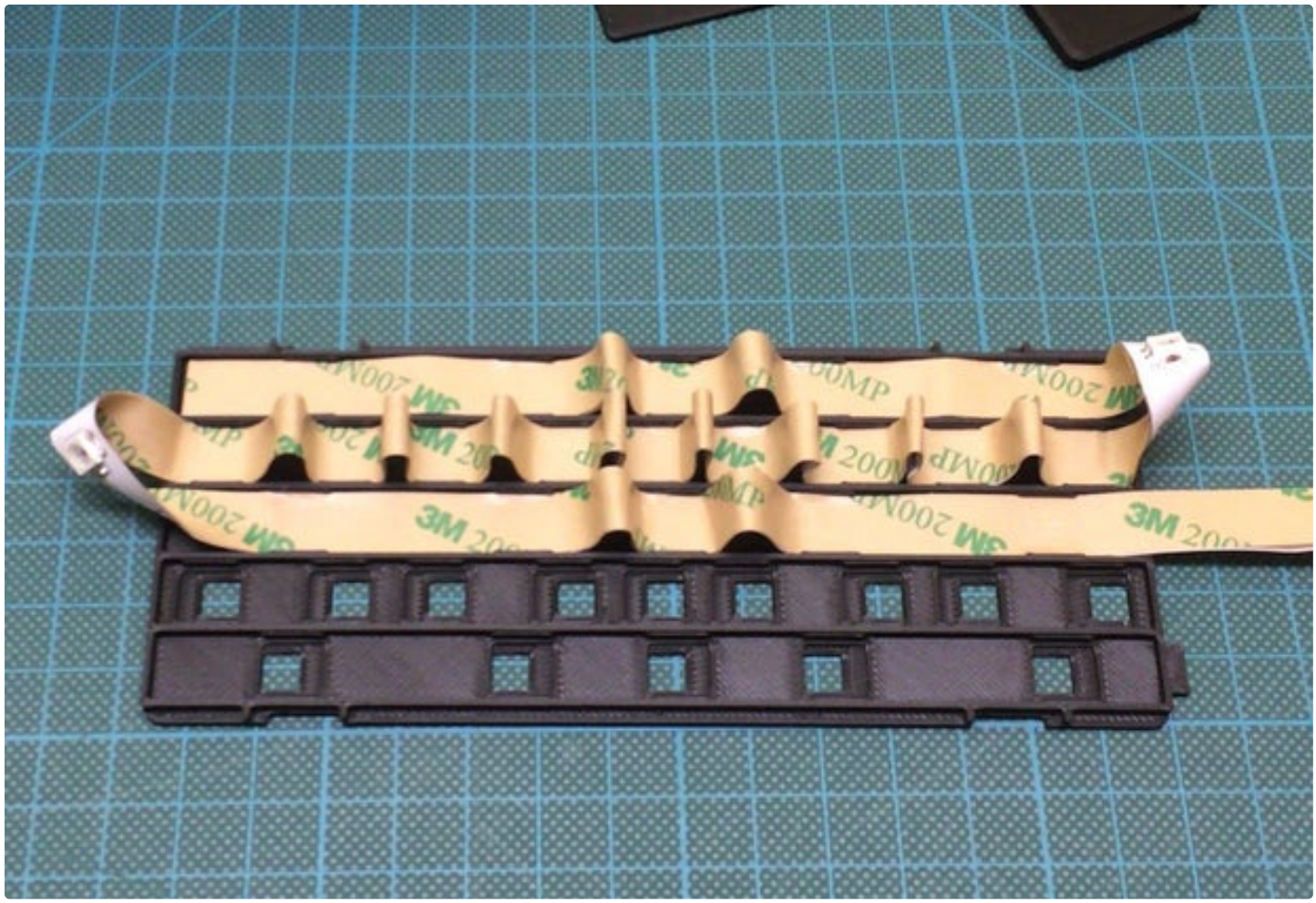
I recommend using a Arduino Nano (AtMega328P) and a DS3231 RTC module. Details can be found in the ClockSketch v7-Instructable.

- 2x push buttons, 6mm x 6mm, shaft length 1.5mm - 4mm
- 1x USB cable
- 1x USB 5V power supply *(sketch is limited to 500mA by default but requirements are also dependent on your choice of hardware. A ESP8266 using WiFi will draw much more power than a Nano...)*

At low brightness settings the clock will consume around 80-180mA, resulting in <1.0W power draw. So if you happen to have an old USB charger from some device left with only ~350mA or so, this might be a way to utilize it.

Theoretically the maximum power consumption for the 37 LEDs is around 2.2A/11W - this is likely way too much for such a small case printed from PLA, so be careful when playing around with sketches that do not enforce power limits and/or might adress all LEDs!

https://youtu.be/A2obfL1uhc4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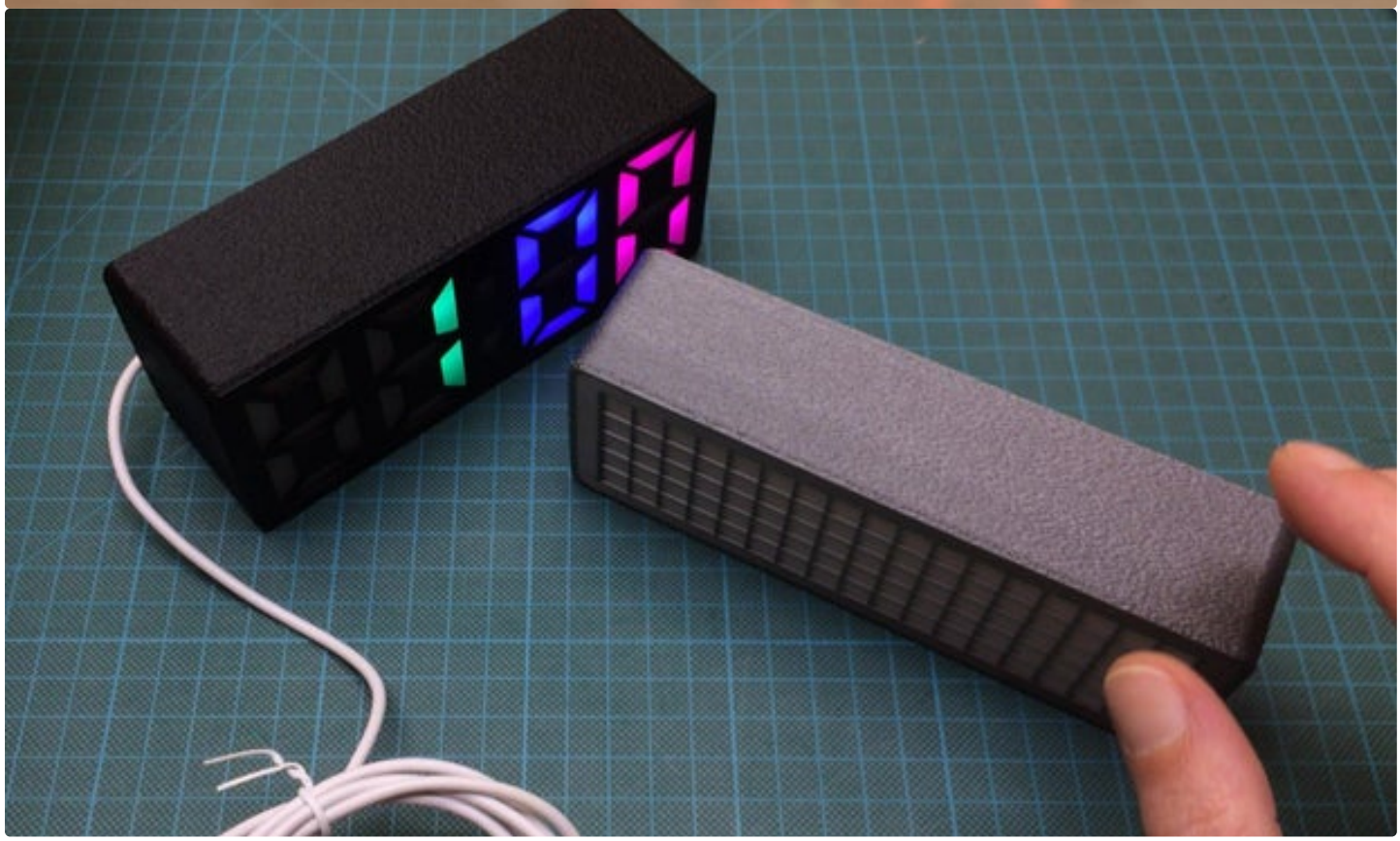


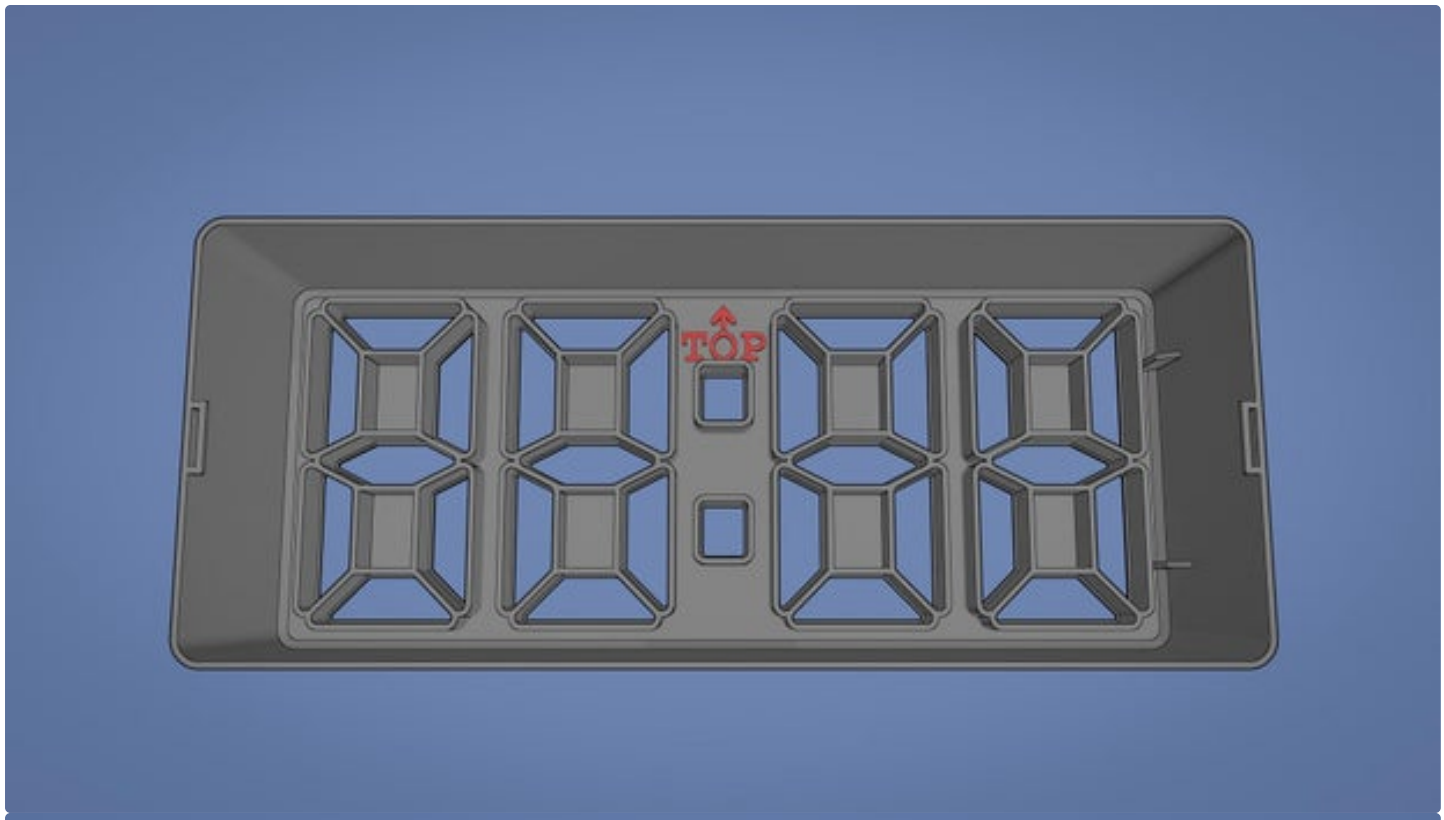
Step 1: In a Nutshell

Here's an overview of how the parts are put together. The really interesting part is the LED_Frame and that'll be covered in detail later.

Pictures show the following parts/steps:

Case, Diffusers put in, LED_Frame + Clips_LR, Electronics Case, Button and Case Clips, Electronics Cover

The case will fit various combinations (microcontroller/rtc/whatever) and the small tabs on the bottom allow using cable ties to hold everything in place.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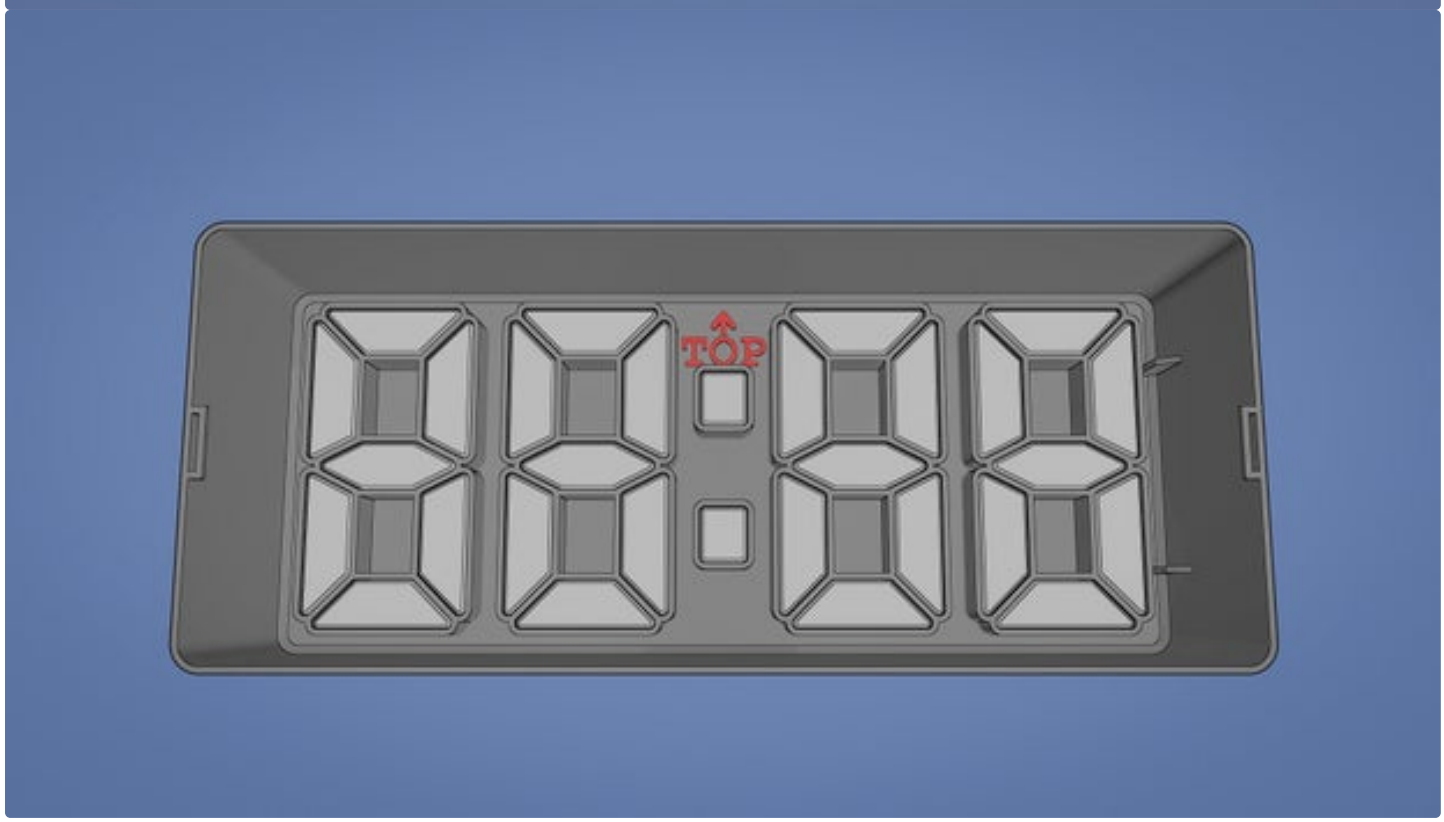
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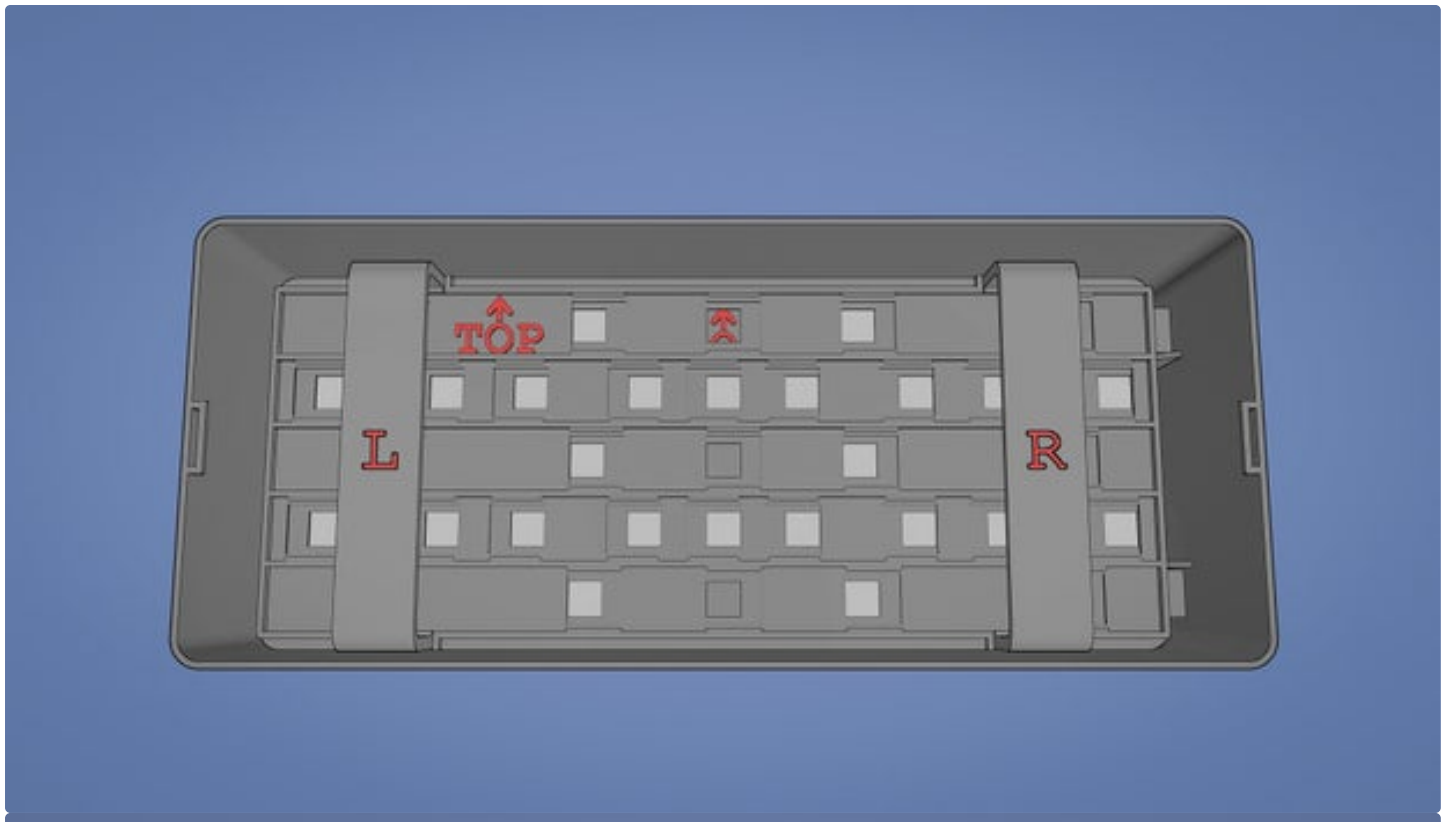
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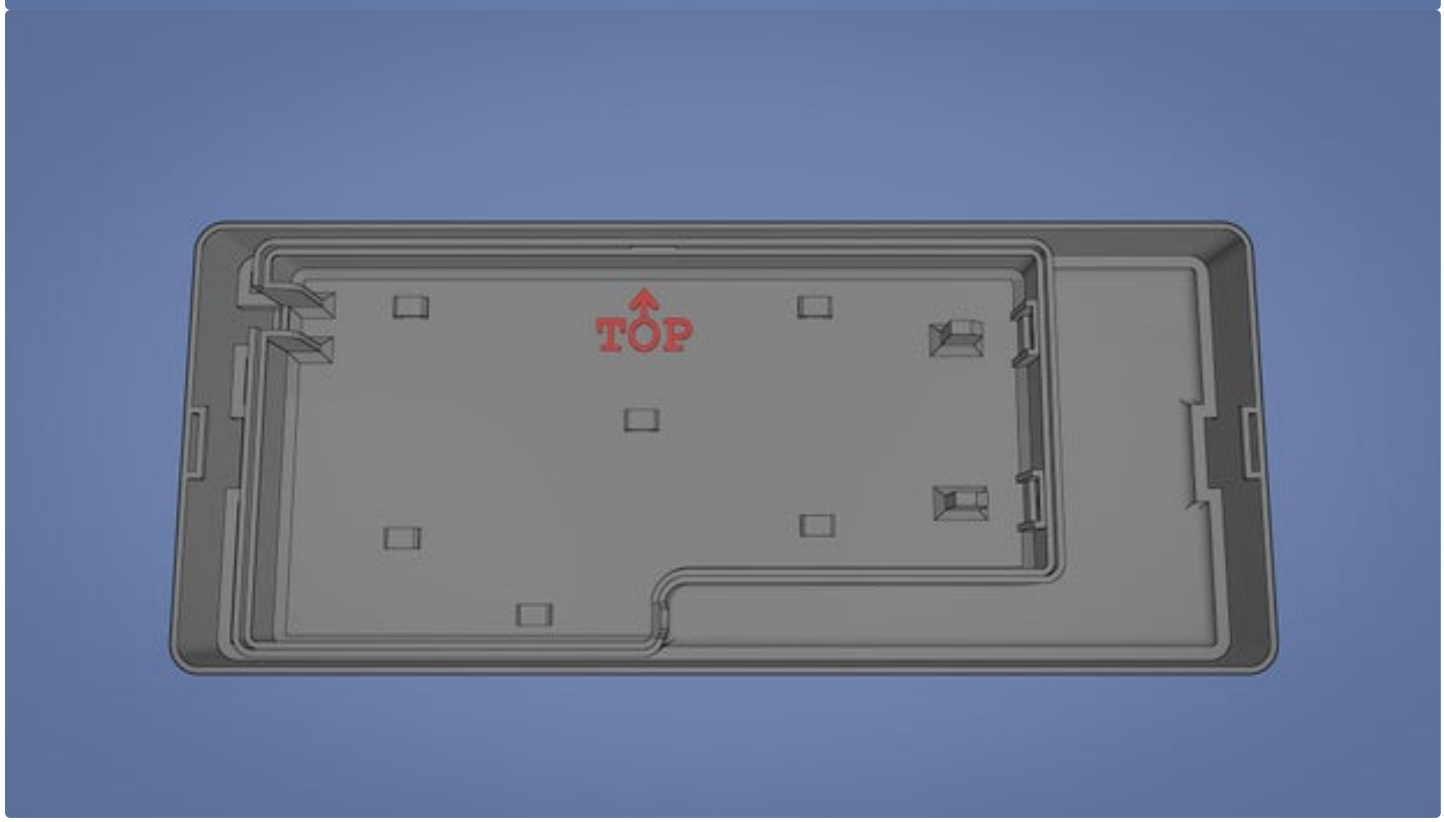
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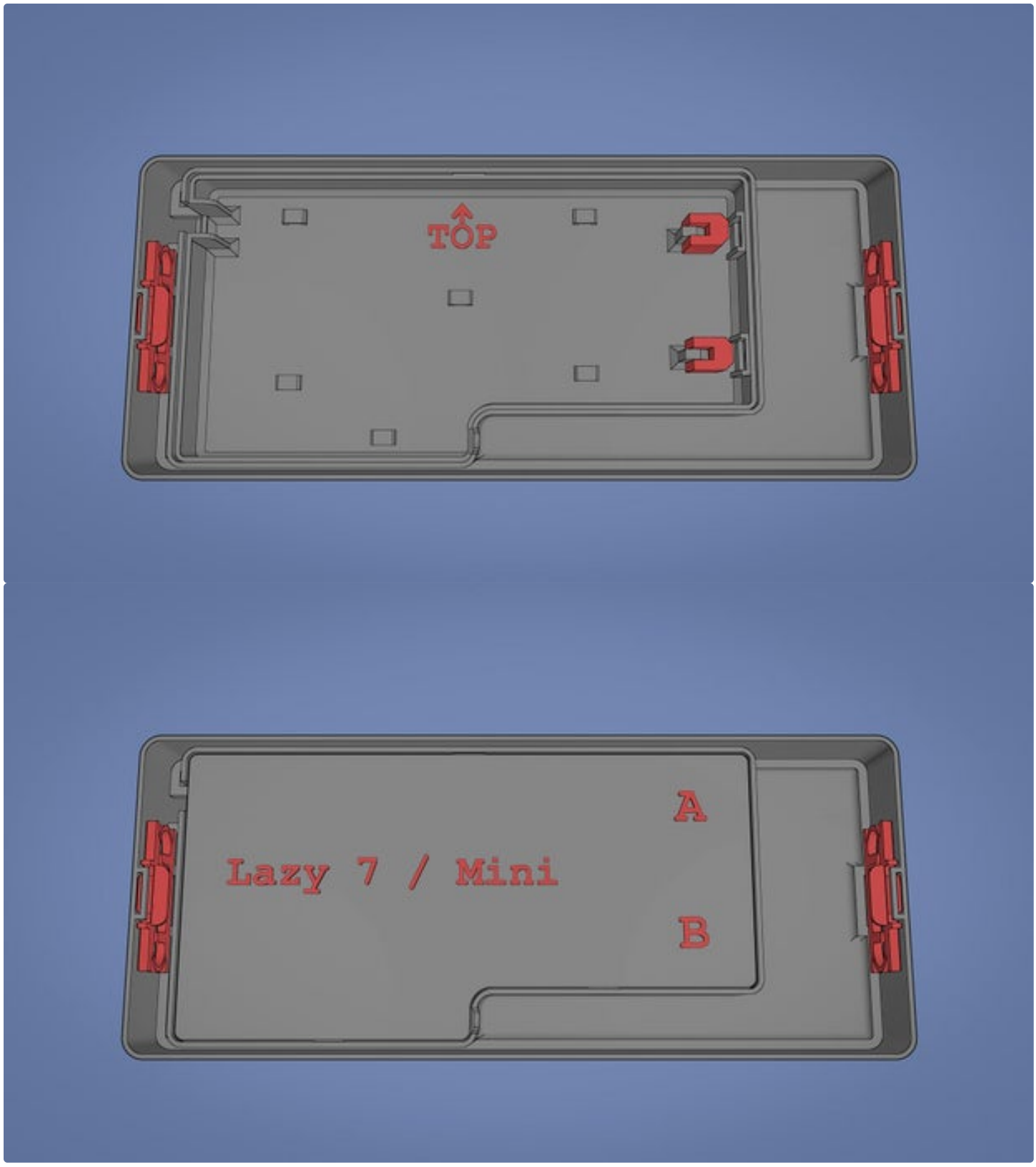


Step 2: Placing the LEDs Inside the LED_Frame

Here's the important part of this Instructable, the direction/routing of the LED strip. Otherwise it's identical to most of my other designs, so I won't go into detail about wiring etc.

Different variants I had a look at all came with the resistor almost in the exact same spot. Should this be different on your strip it should still be possible to push the LEDs in - just be careful not to accidentally knock off some resistors or LEDs.

Be careful when bending the LED strip. While this does work quite well the LEDs absolutely don't like very sharp bends, especially if you're too close to the solder pads - they might break, causing problems later on. Avoid bending directly at the corners of the LEDs, try to keep ~1mm distance.

All LED strips come in pieces of 50cm, soldered together. So in this design you will come across two spots where the LED strip is soldered together - depending on the position this might require more or less fiddling around. At worst you might have to offset the strip by 1-2 LEDs or disconnect/resolder the joint in question.

Start by placing the LED_Frame in front of you, make sure the "TOP" marking is pointing upwards. The top left corner is where we will start.

Slide the LED strip under one of the tabs and align the LED with the hole. Push in the LED strip then so it sits below the tabs on both sides, "trapping" the LED. Proceed to the next LED. As distances are different between LEDs you will have to bend the strip accordingly.

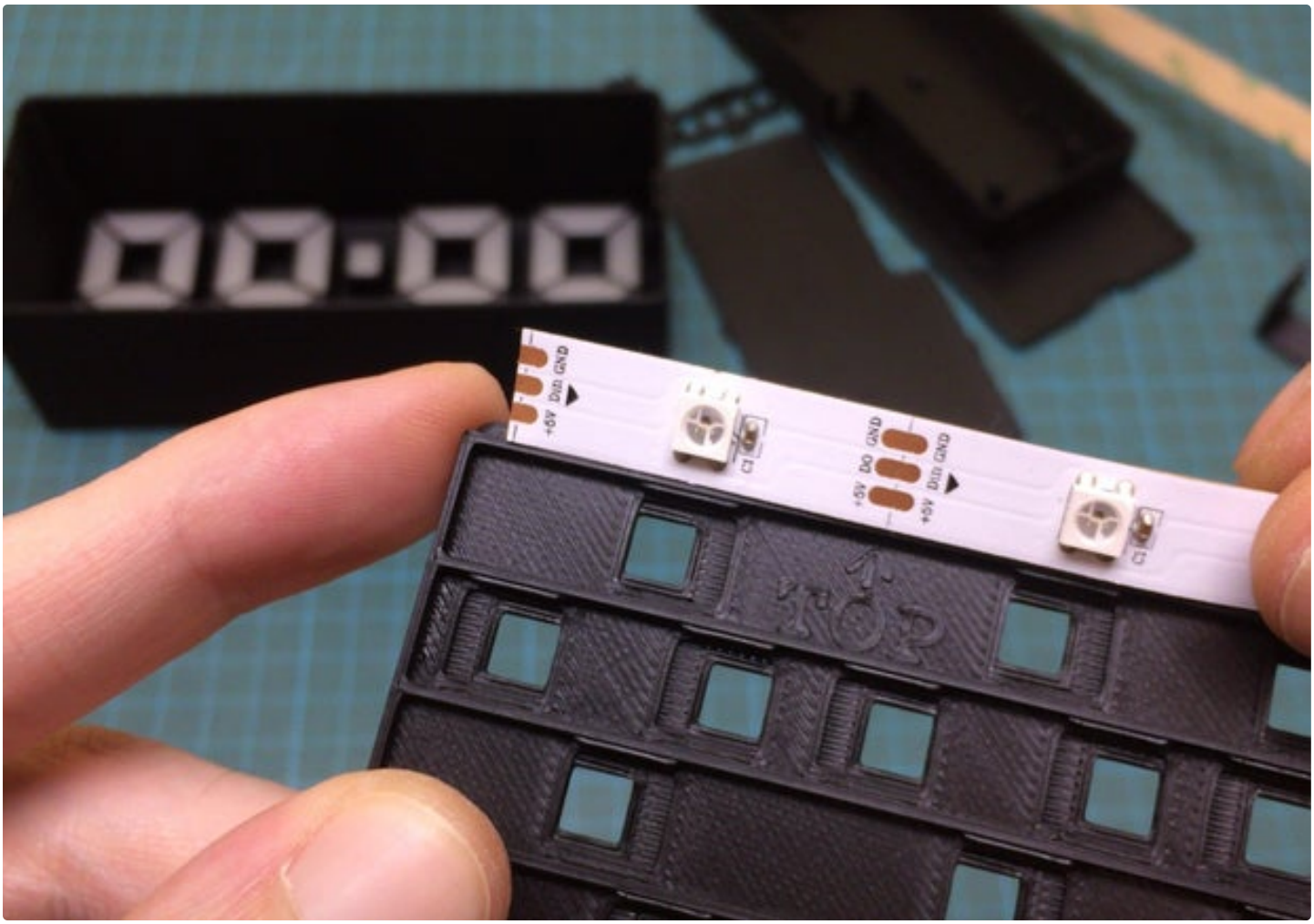
At the end of each row we will waste a single LED to save some soldering.

(The way it's bent here really reminds me of the "old days" with IDE/SCSI ribbon cables inside a pc case... when getting proper airflow could be a real challenge ^^)

Once all LEDs are inserted you should end up with something like can be seen in the last pictures. LED strip starting with DATA IN at the top left and ending at the bottom right corner, 37 LEDs in total.

Carefully bend the wasted LEDs so they're not reaching over the frame borders.

Now it is time to add the Clips_LR parts as seen in the pictures. Make sure no parts of the strip are taller than the clips!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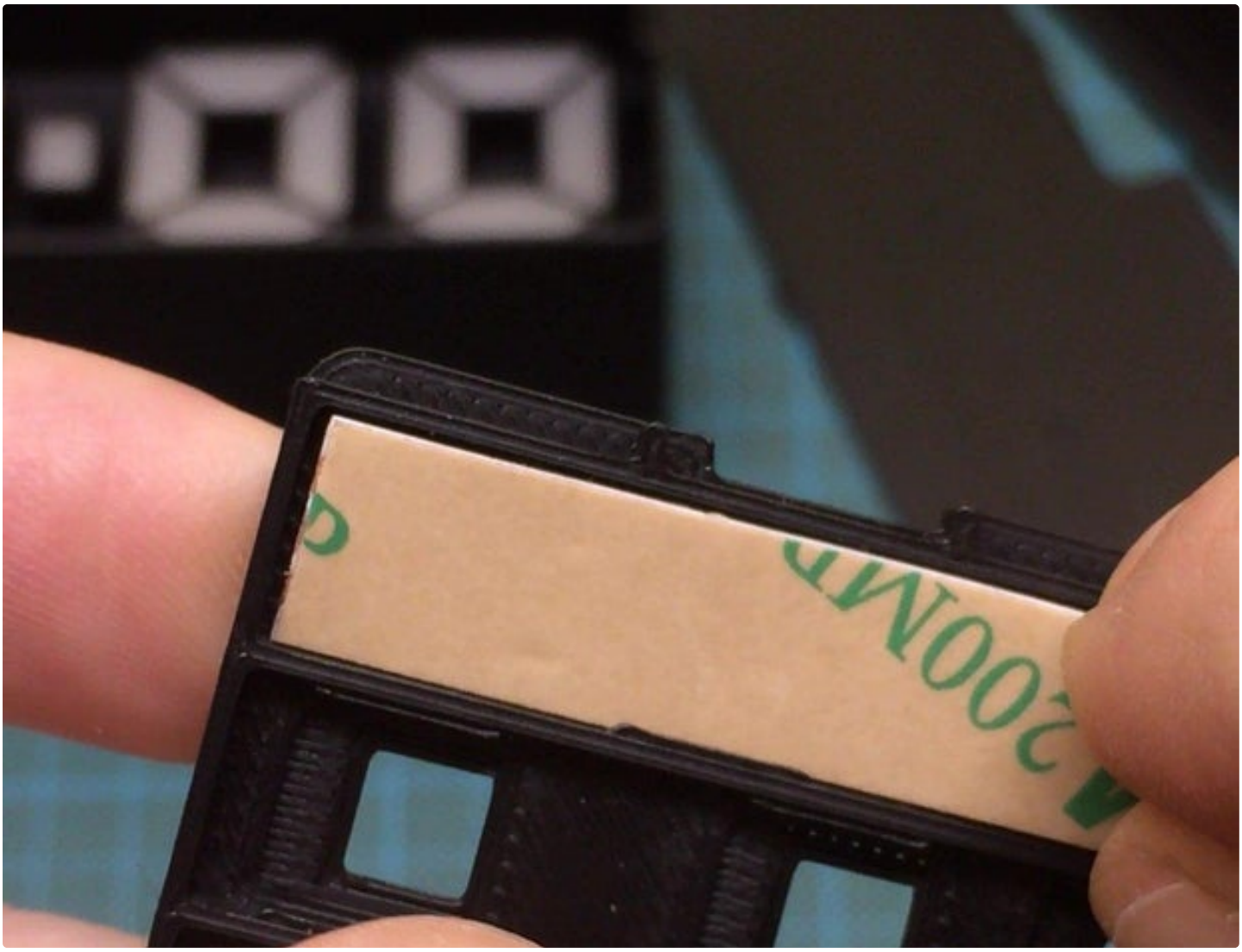
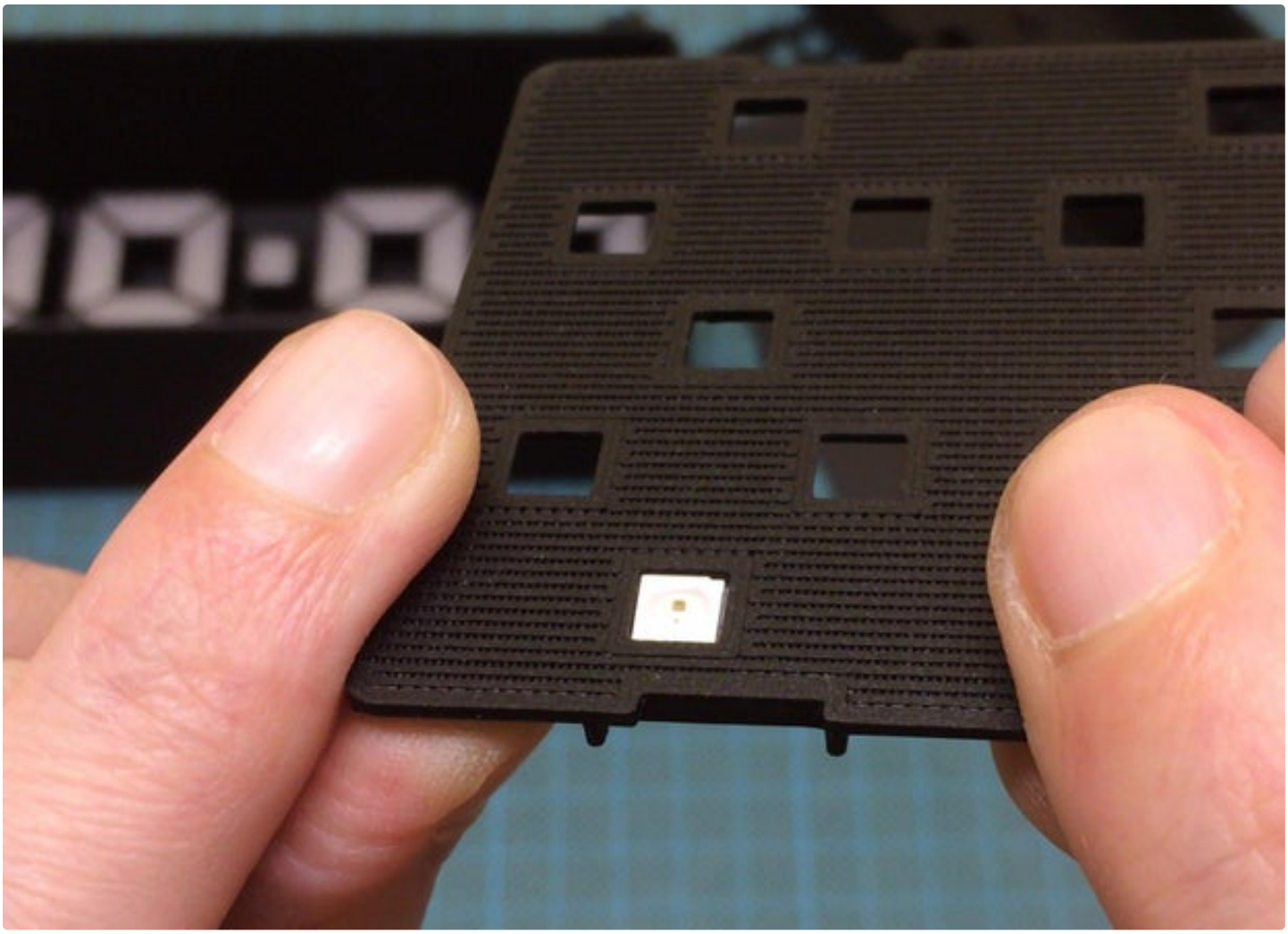
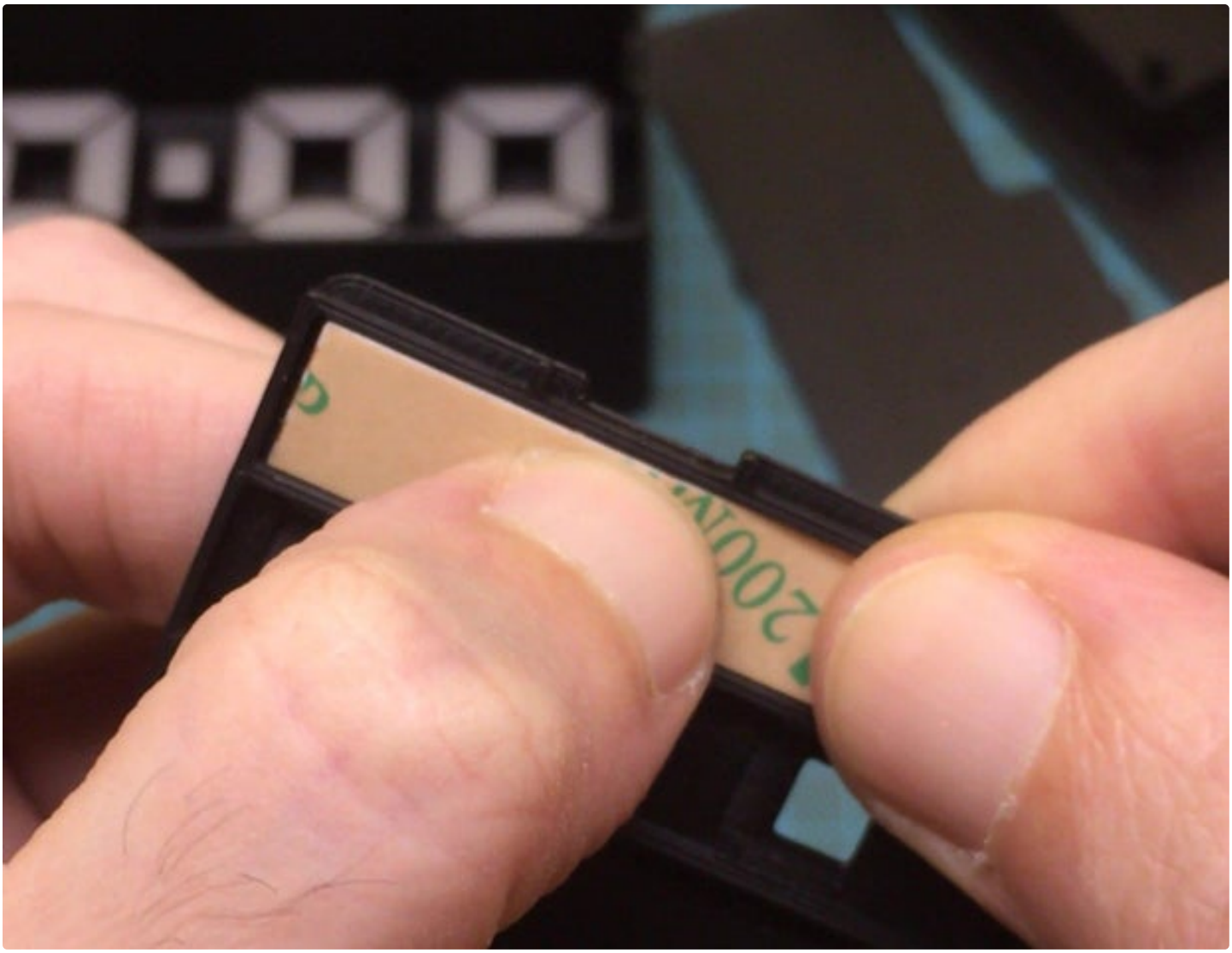
5V+





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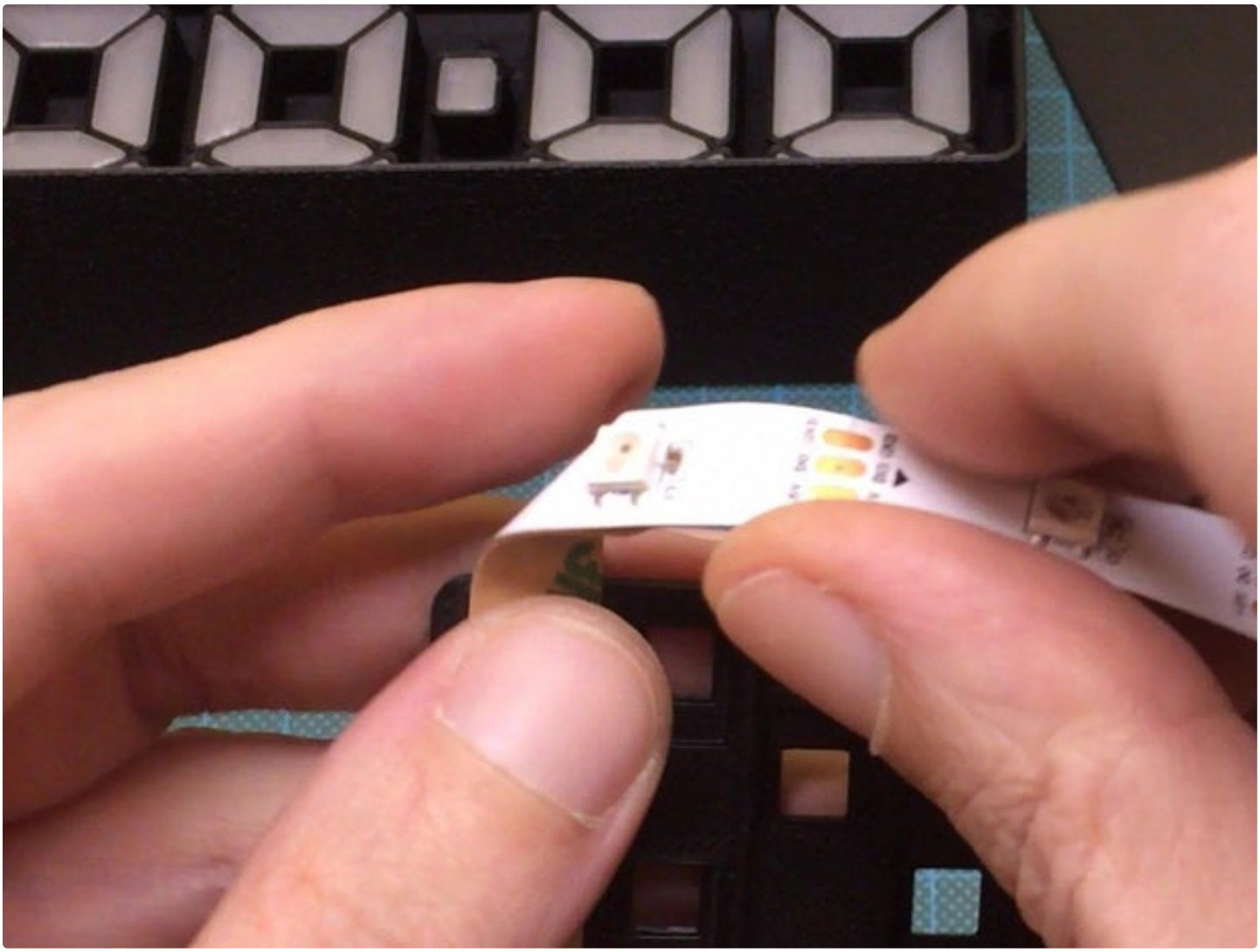


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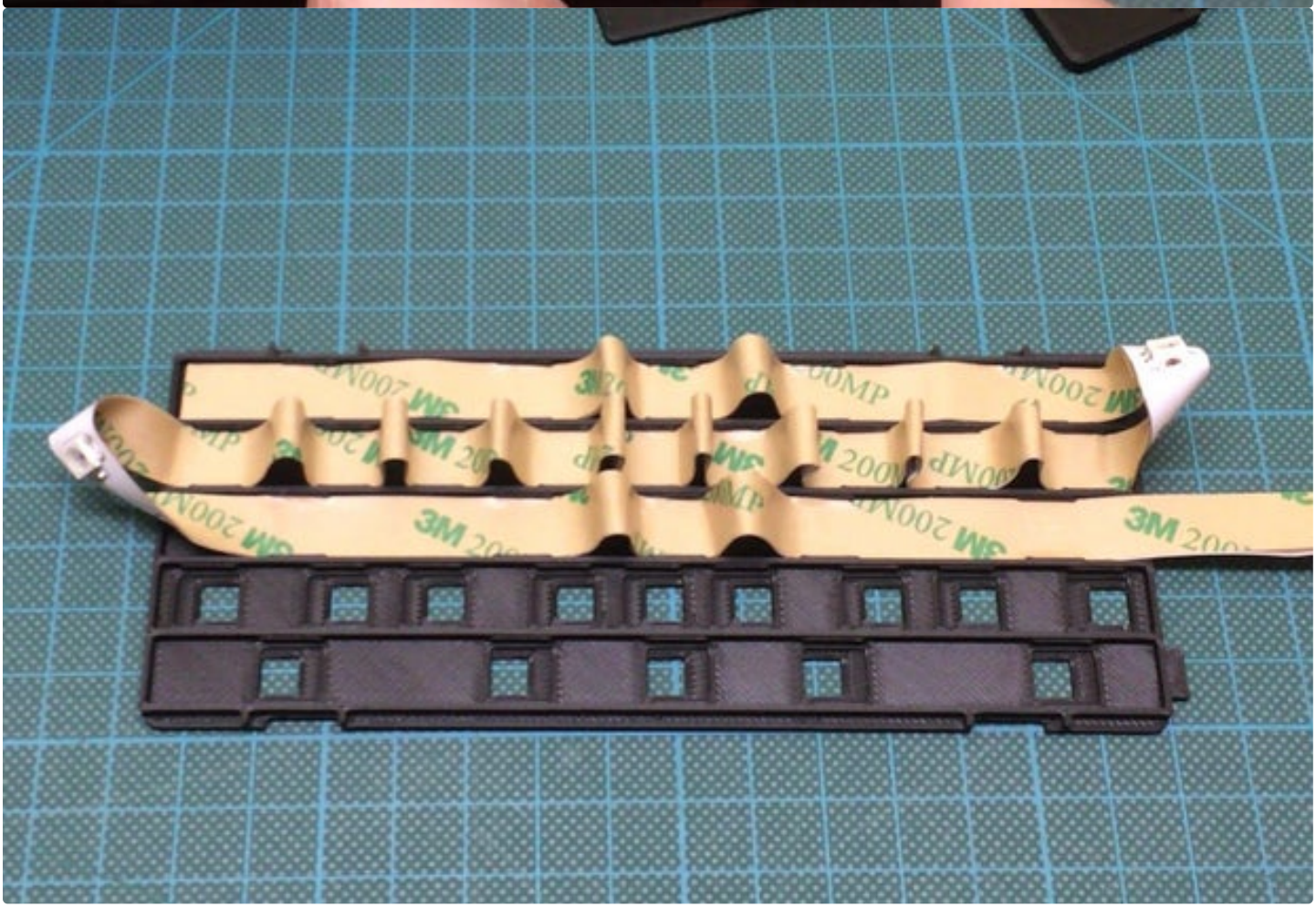
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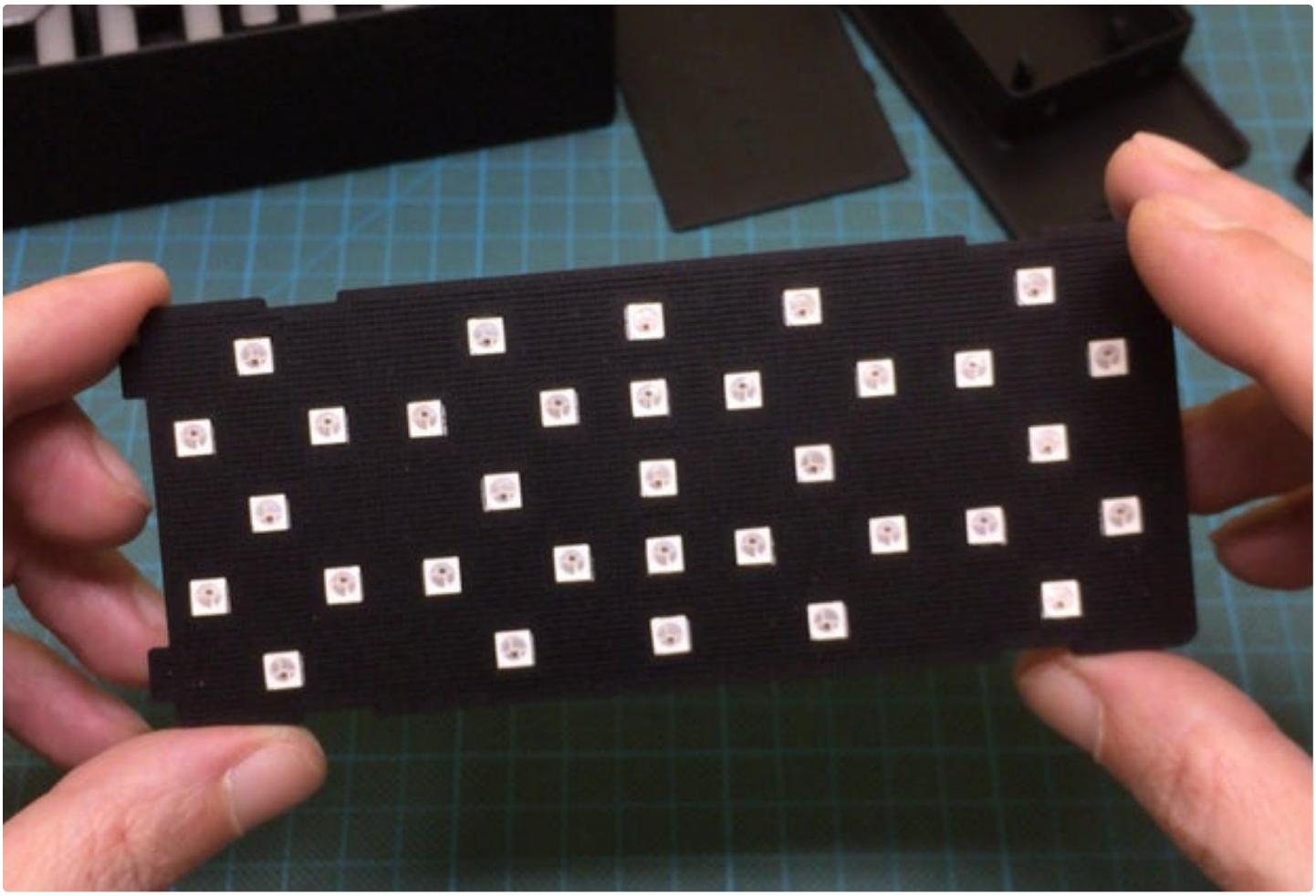

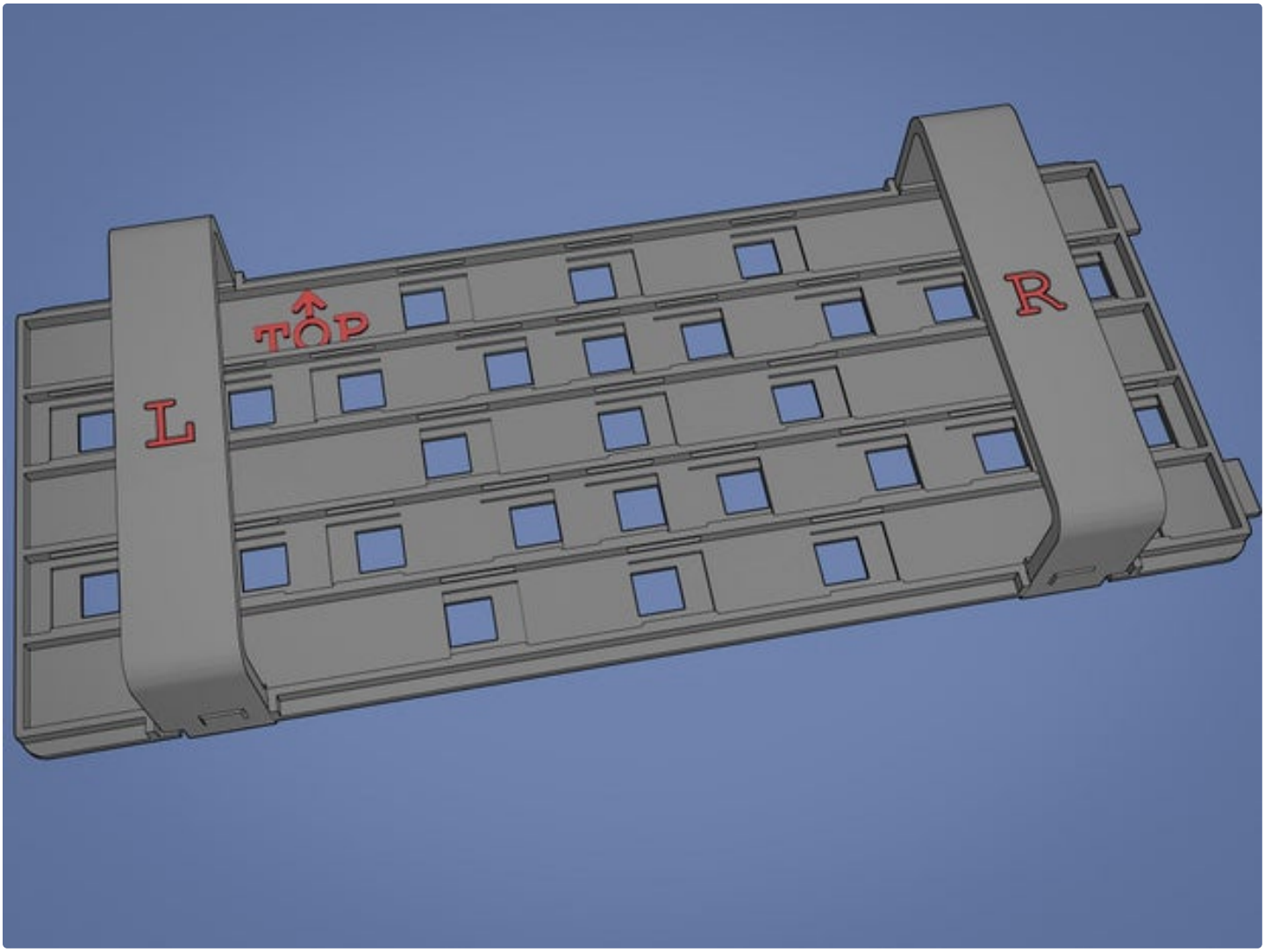
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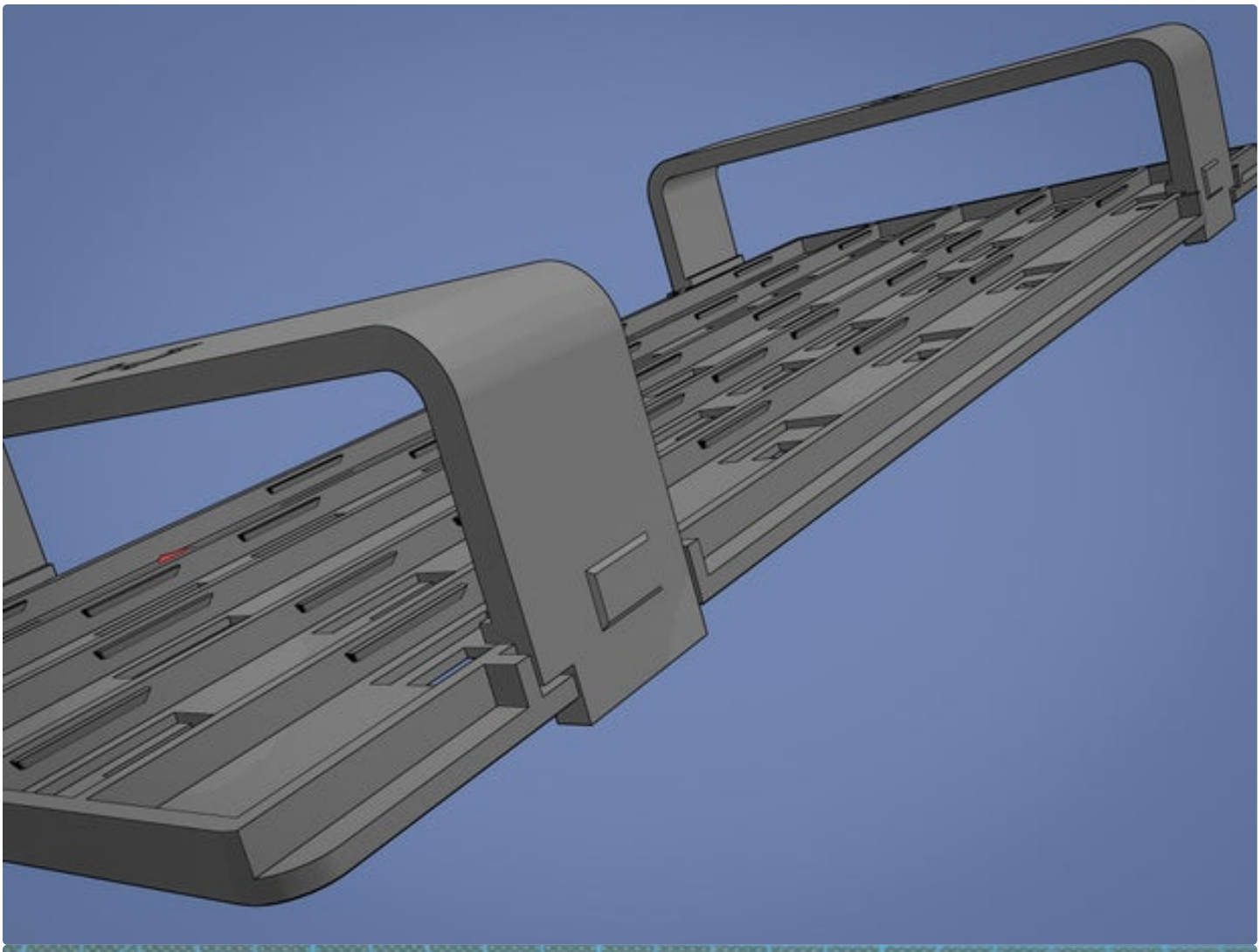
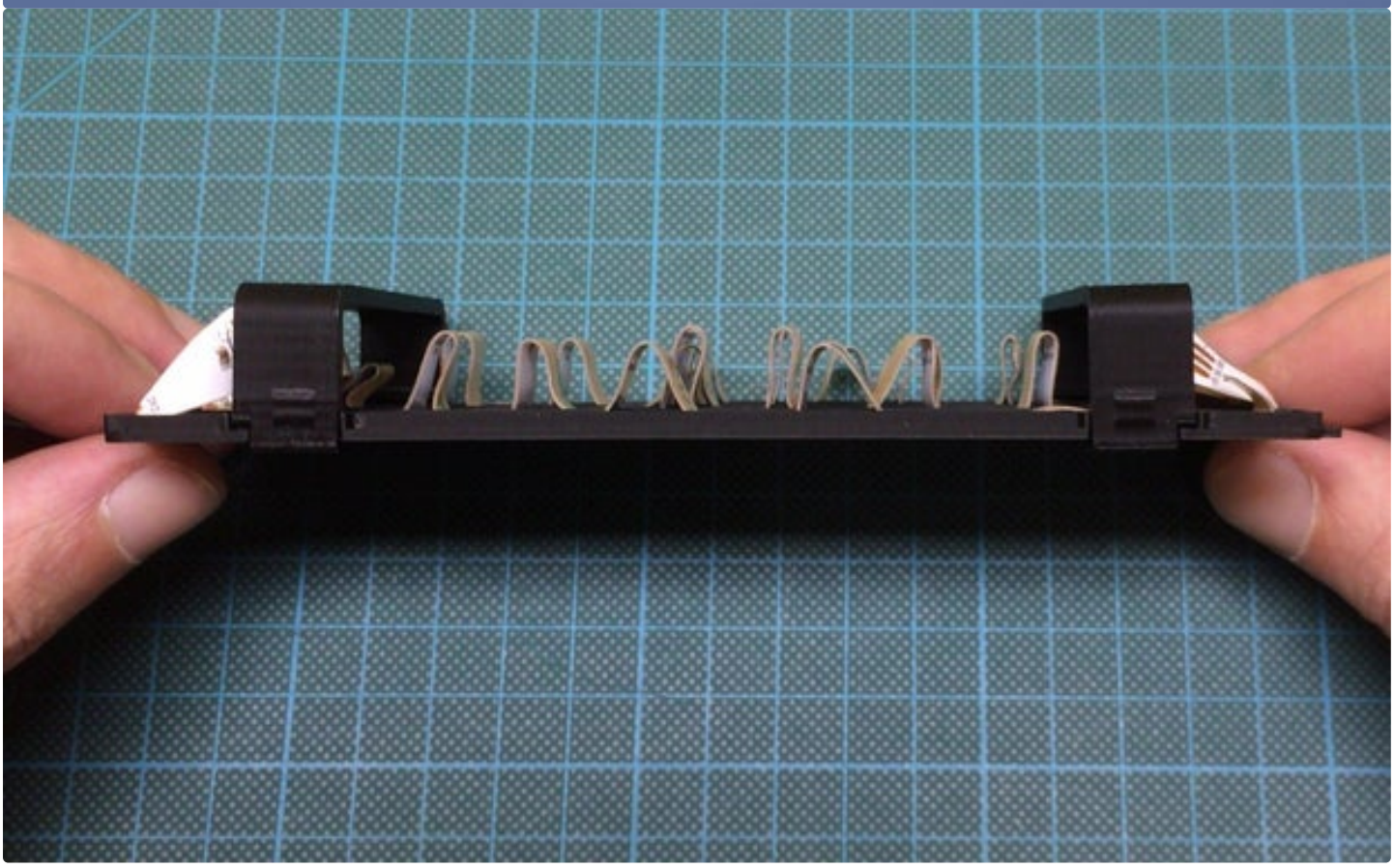


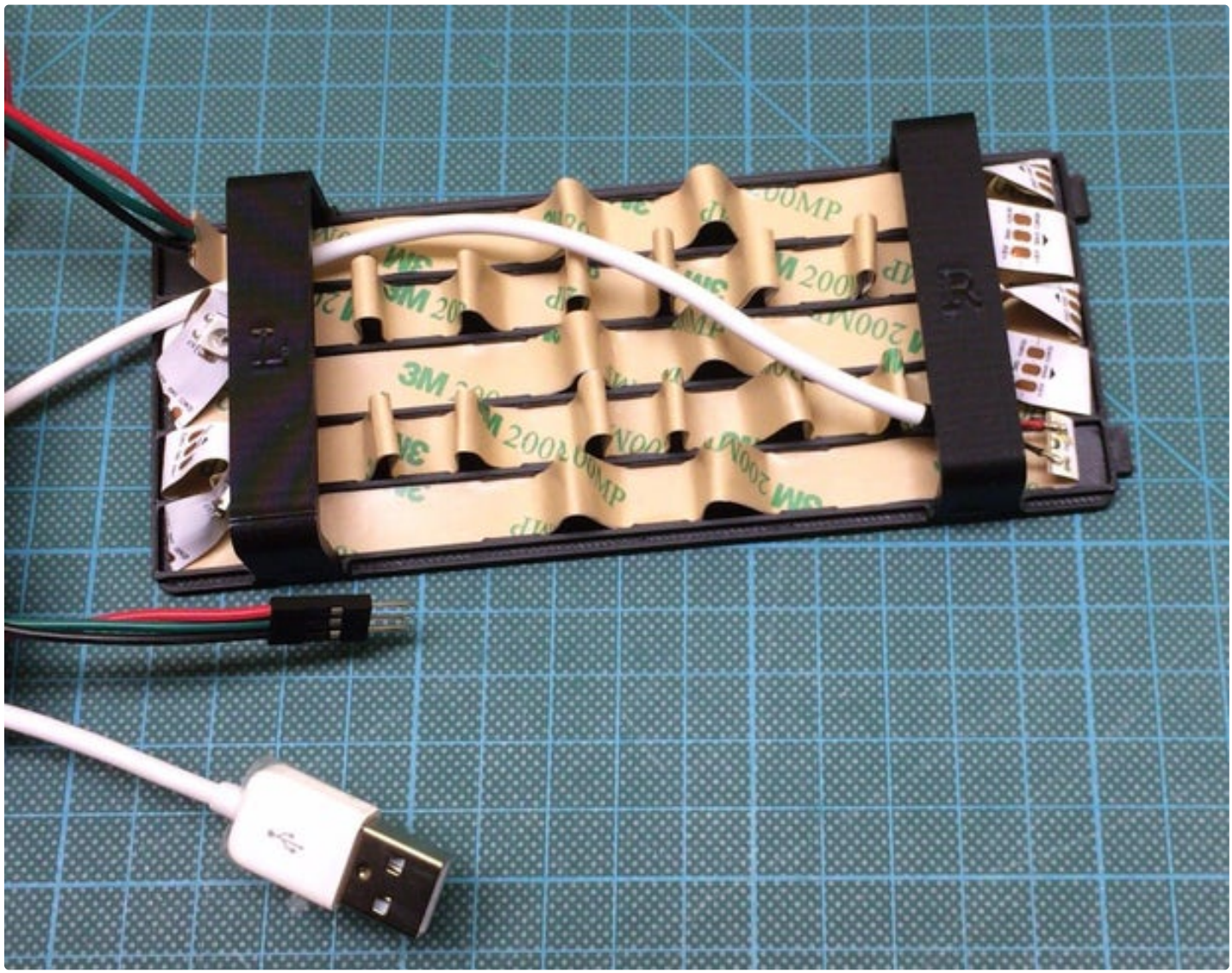


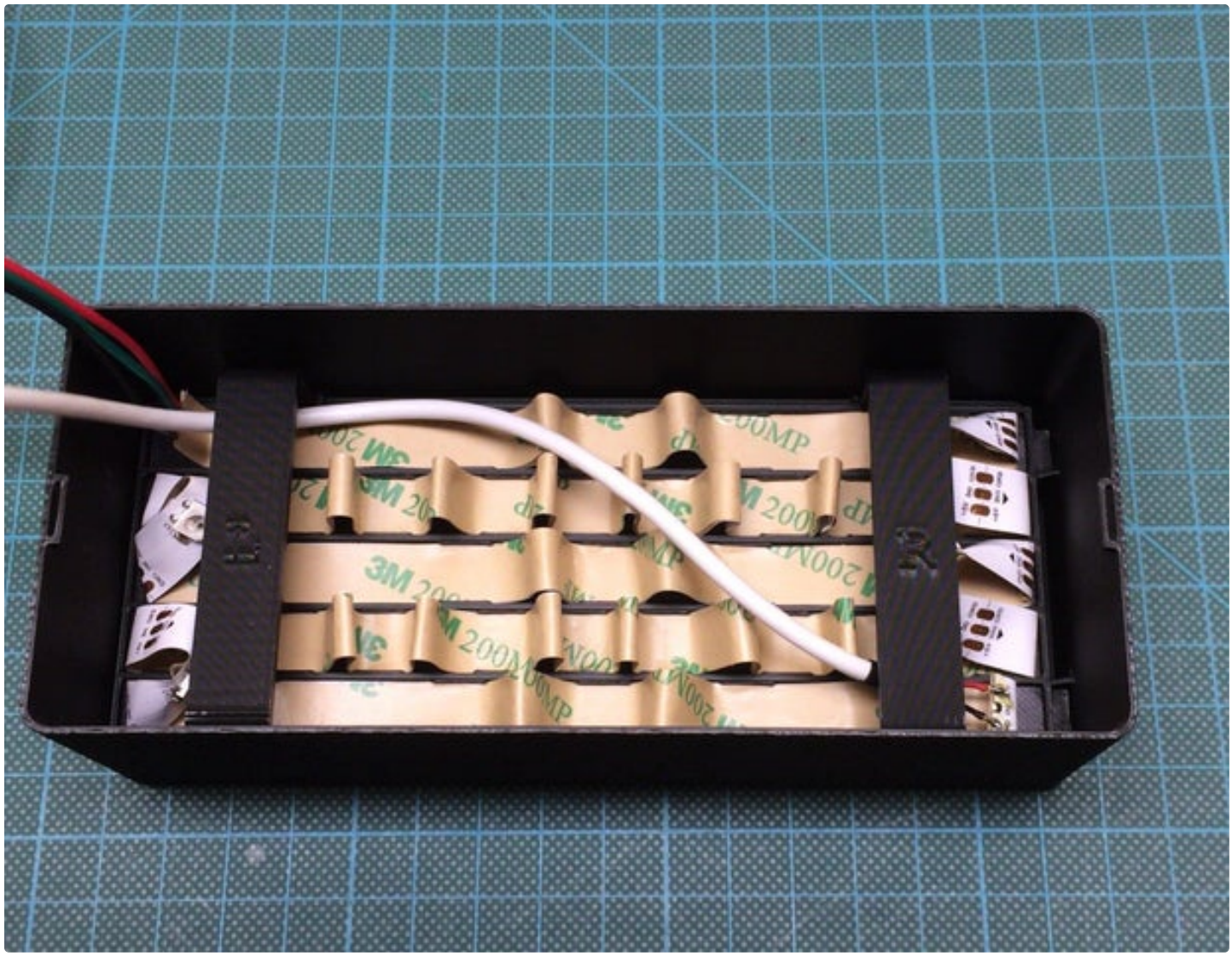
Step 3: LED_Frame Connections

Not much to do here. Like in my other designs there's 3 wires connected to the start of the LED strip, this is where the microcontroller will be connected later on. Also there's a USB cable soldered to the end of the LED strip to power everything. Once those connections are made and you double checked the wires won't interfere with the electronics case resting on the clips, place the LED_Frame inside the case and route the wires to the top left corner.

Now place the electronics case on top of the LED_Frame/Clips_LR and install the case clips to hold everything in place. Place the clip with the lower tab inside the cavity of the electronics case plate, push both sides down and towards the outside case wall. The design has slightly changed after recording the video/rendering to allow for better removal of the clips, but the orientation in the drawing/render is the same.

I'm using wires with 3 pin connectors because I'm not planning to keep this clock. The Arduino Pro Mini, Buttons and RTC from the pictures are leftovers of some design which I put into place solely for the purpose of testing various platforms and taking pictures - so don't use these as reference for wiring work!

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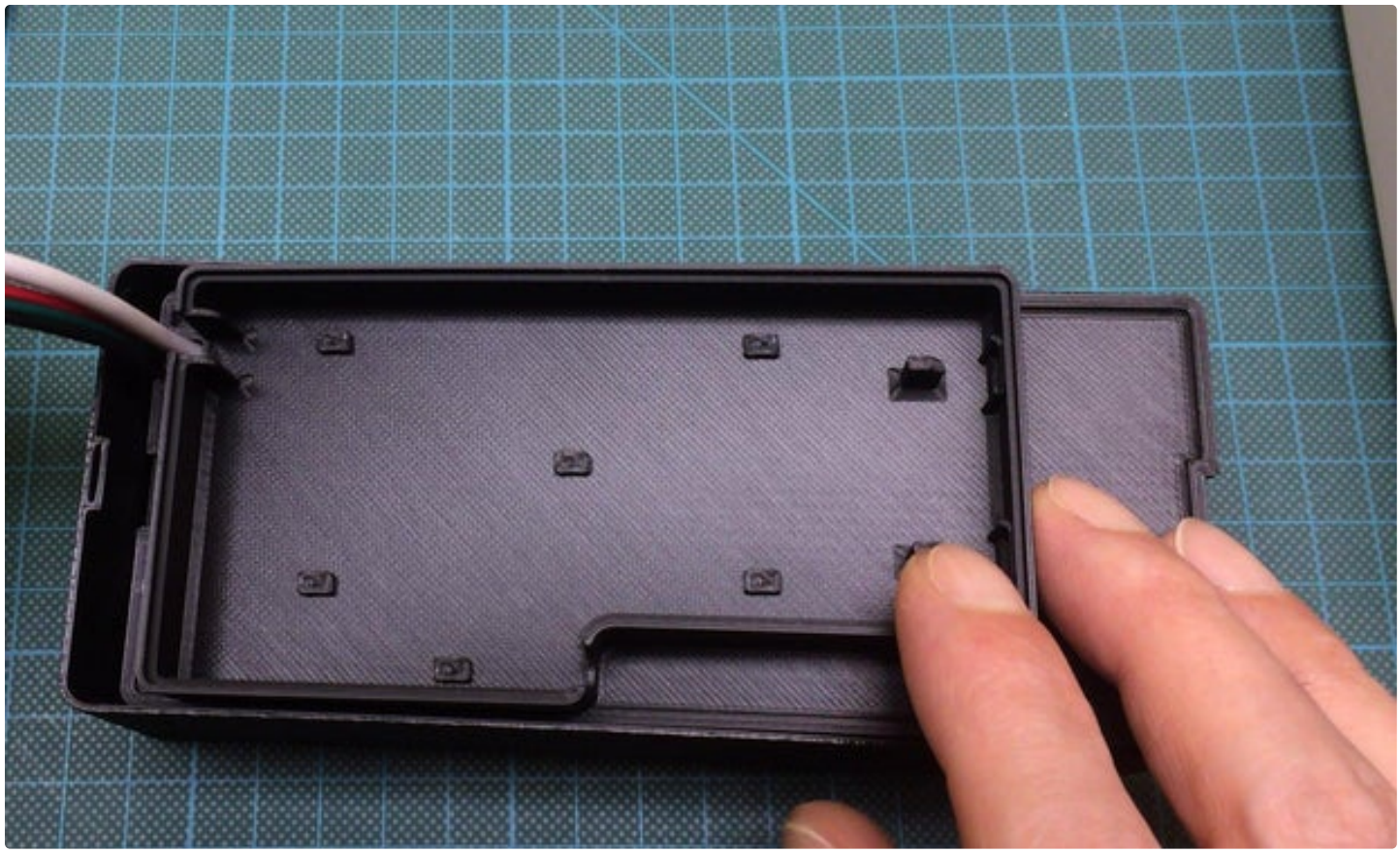
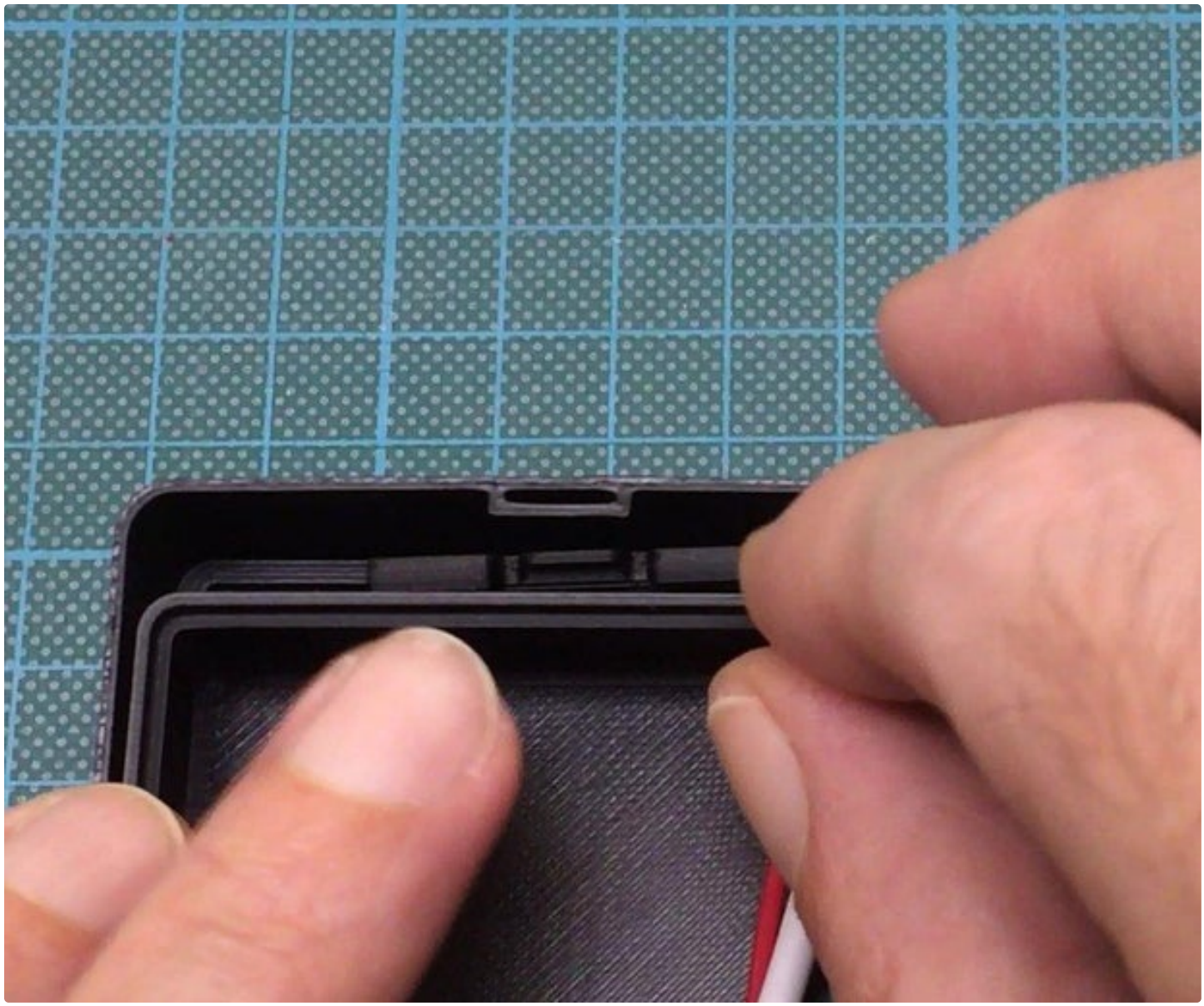
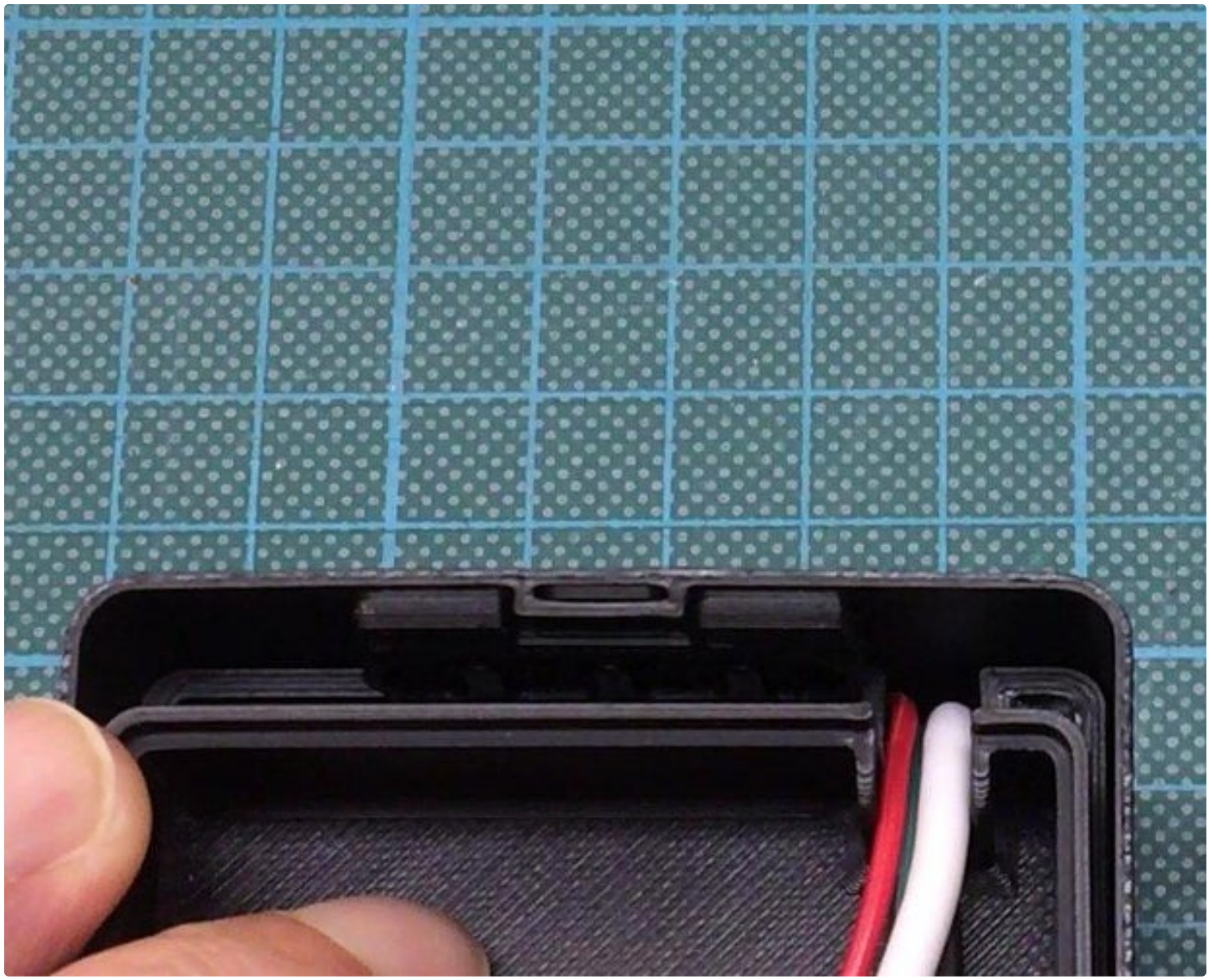
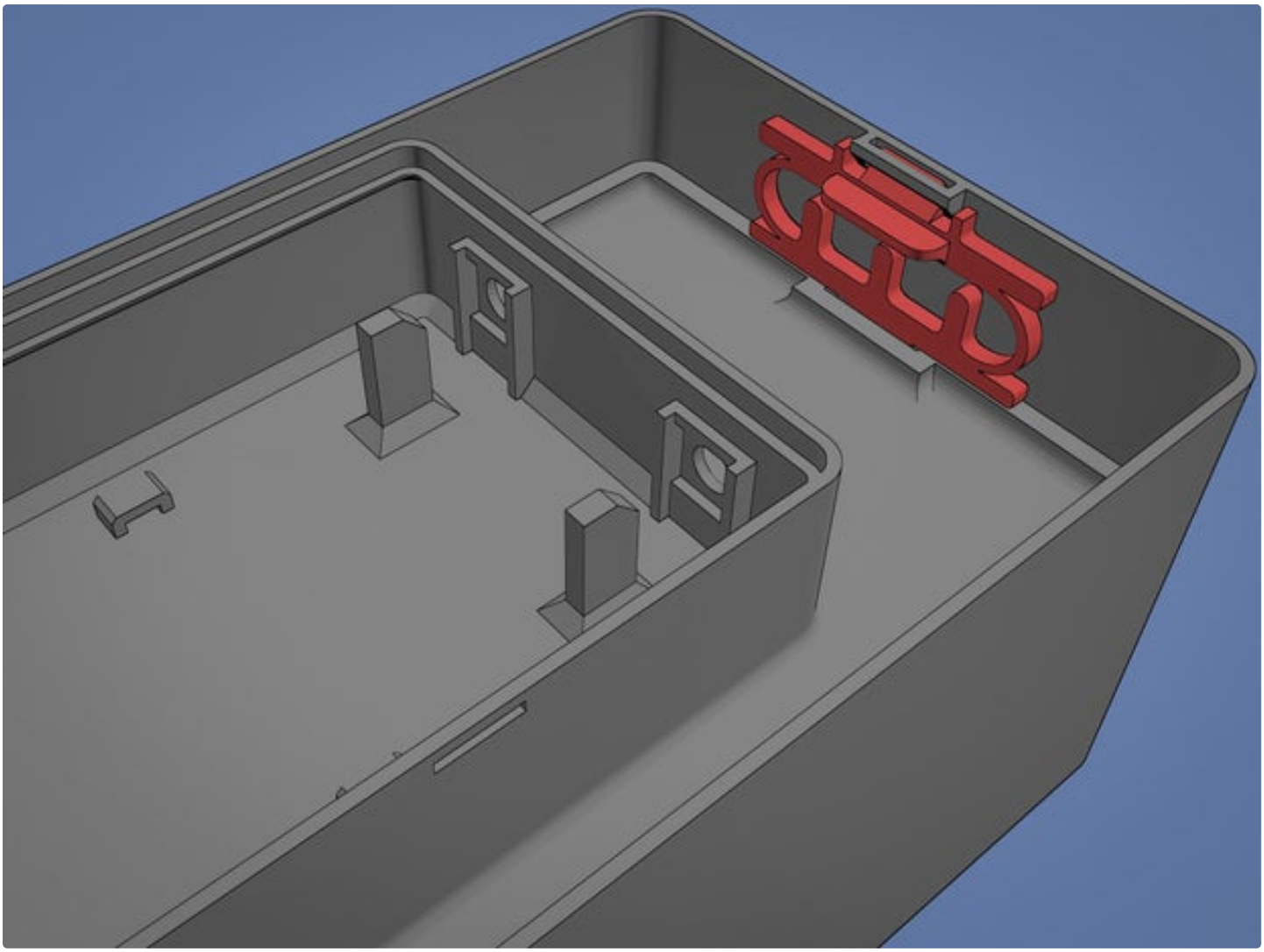






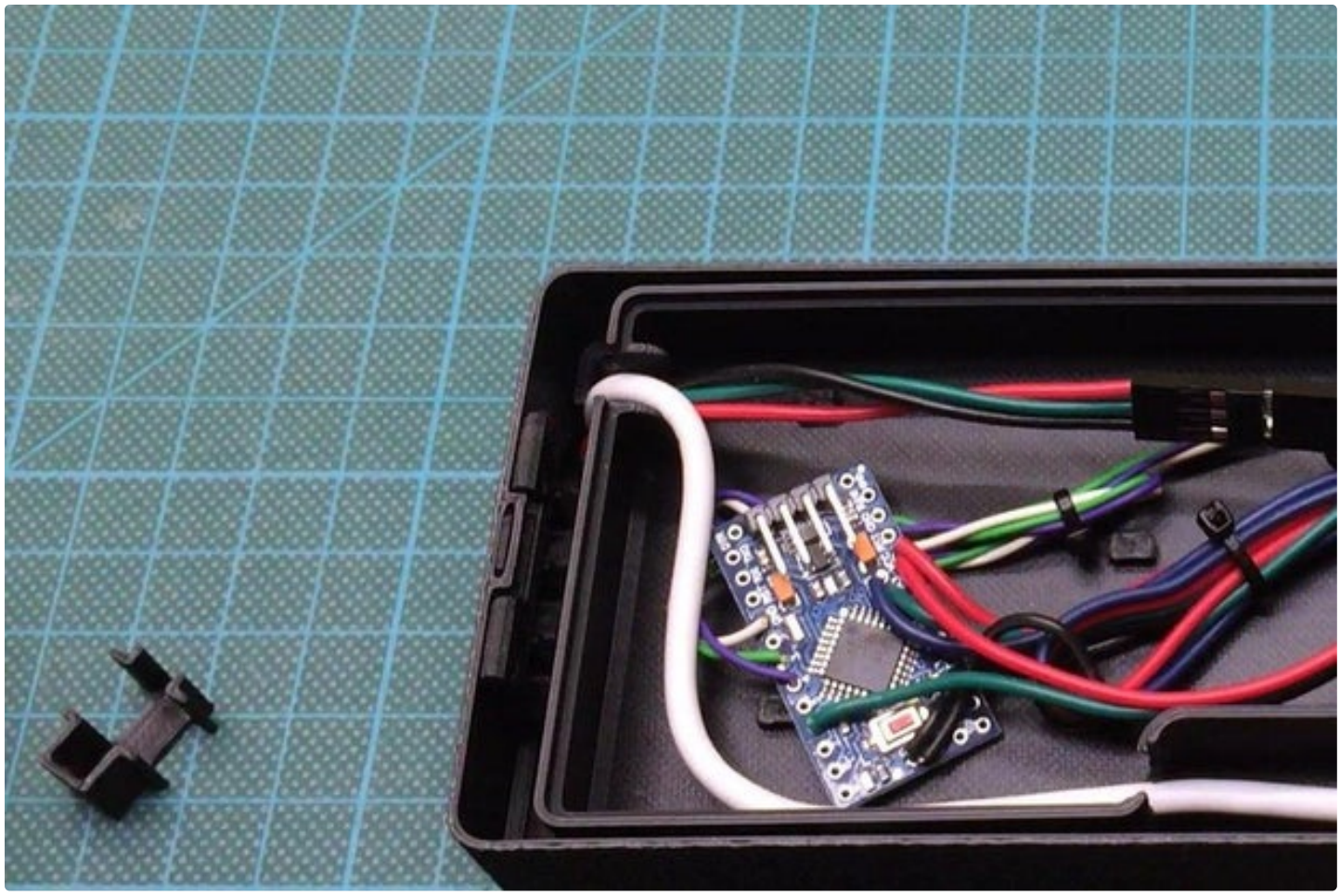


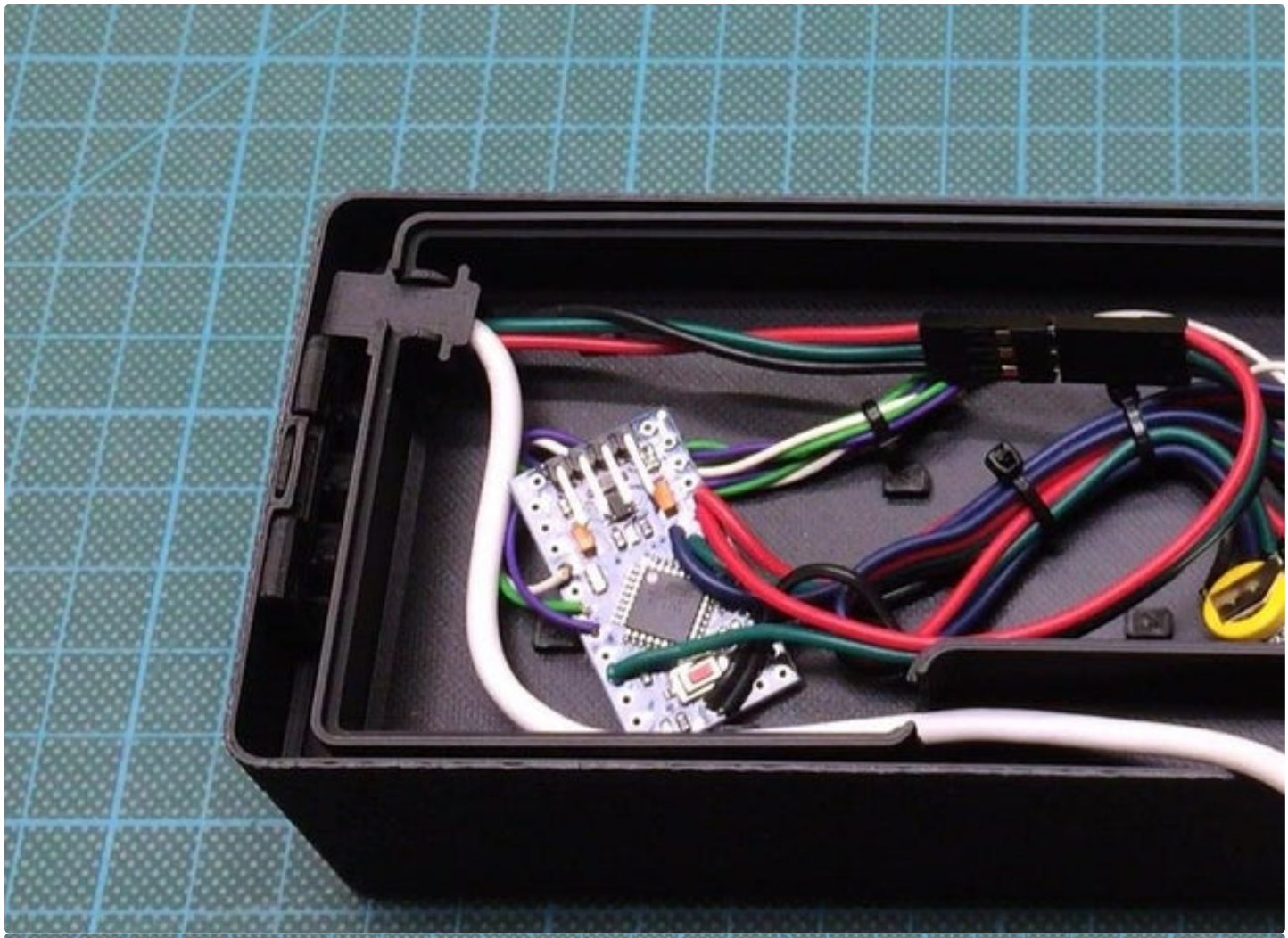
Step 4: Finishing Things Up

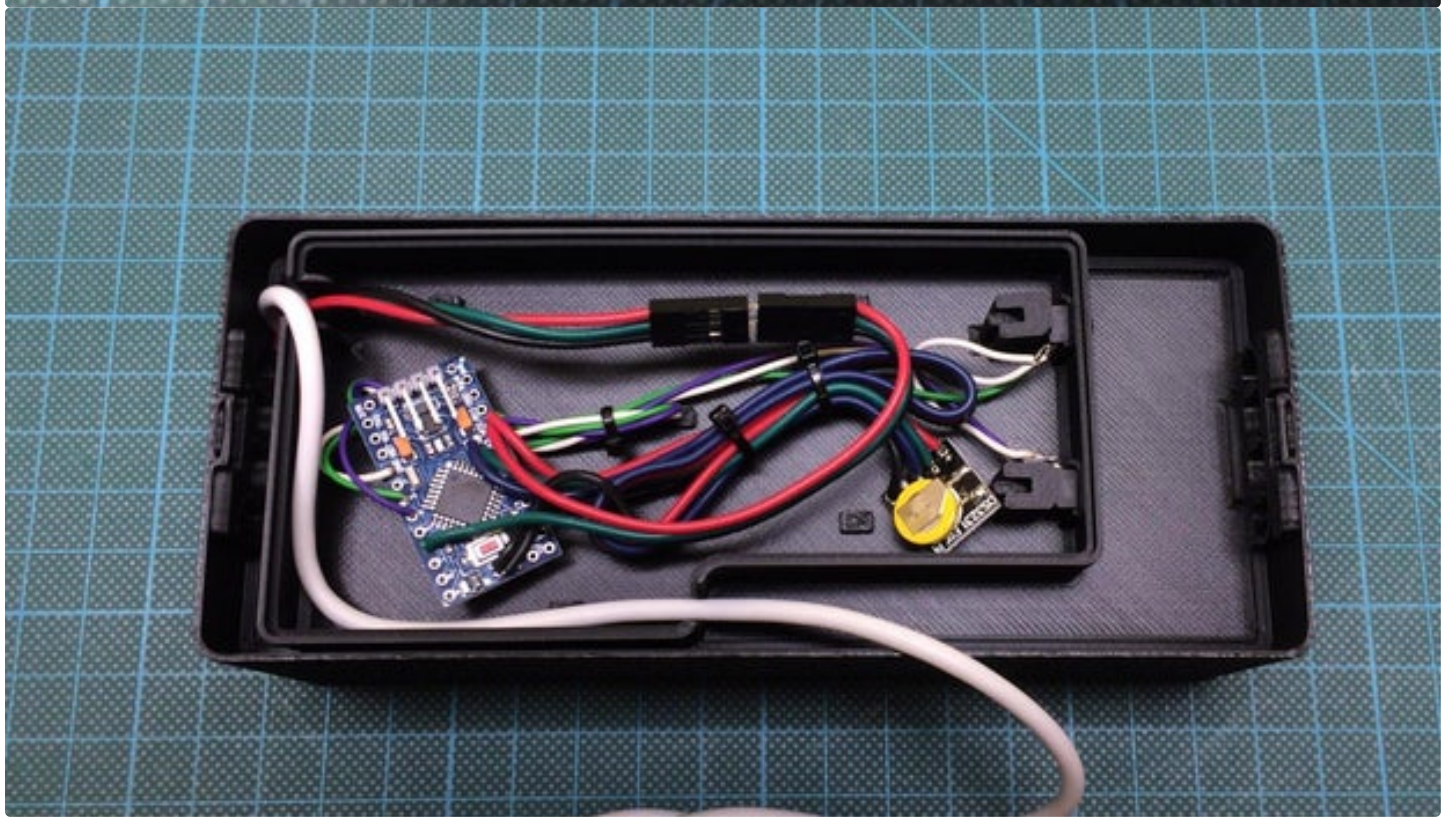
I think there's not much left to say here. Depending on what microcontroller/rtc you choose you should be able to fit them inside the case without much problems. There's a few places where you can add cable ties, I highly recommend one securing the power cable in place. The pictures aren't in the proper order, the small cable cover was added after all was done, so there's just 2 quick screen caps and it isn't visible in all pictures.

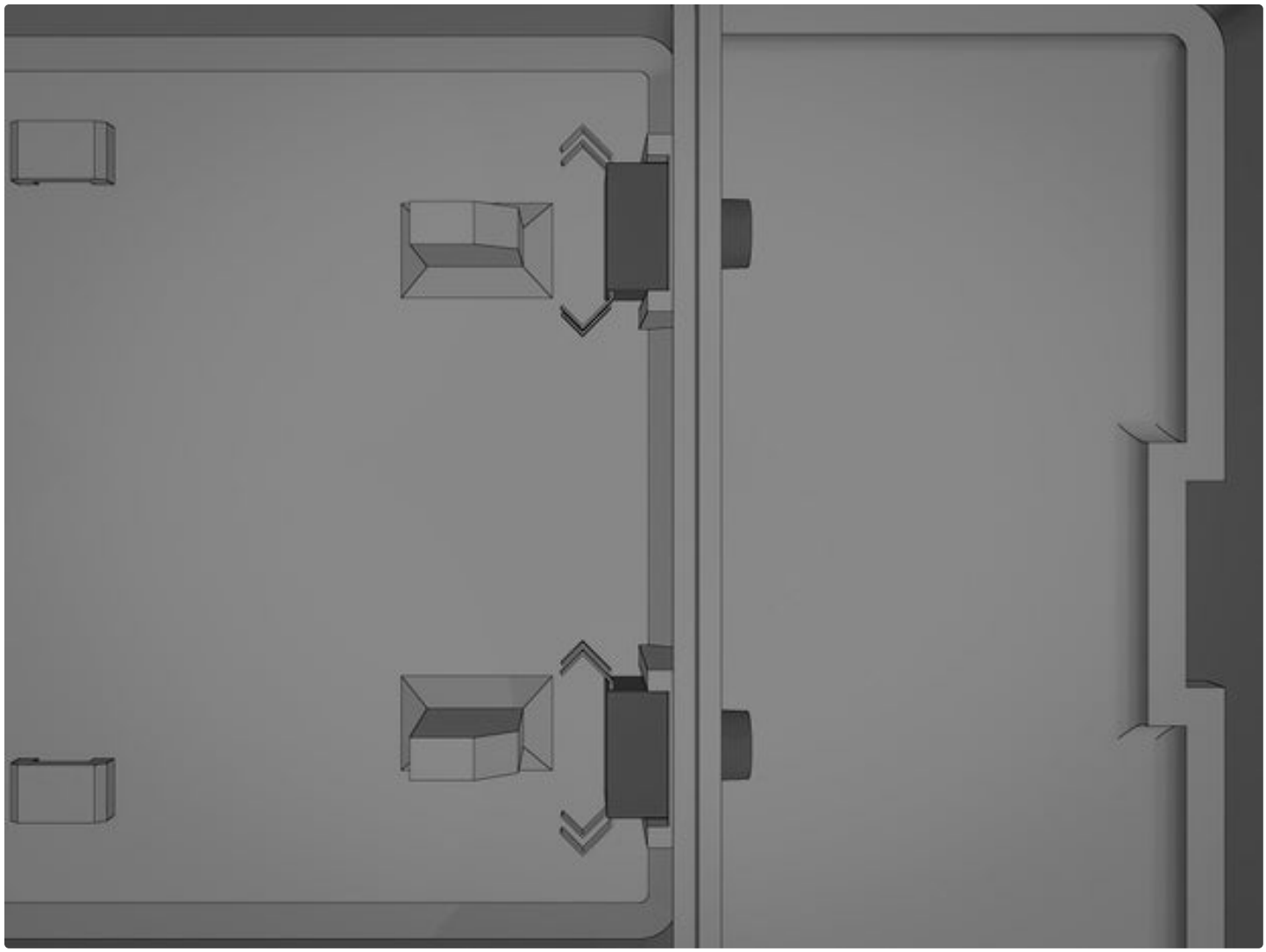
The lid is put in place by sliding in the two tabs at the bottom first, then pushing down on the top one and carefully bending the upper wall slightly outwards. Removal is done in reverse, one of those "spudgers" to open devices can be helpful here (or a guitar pick).

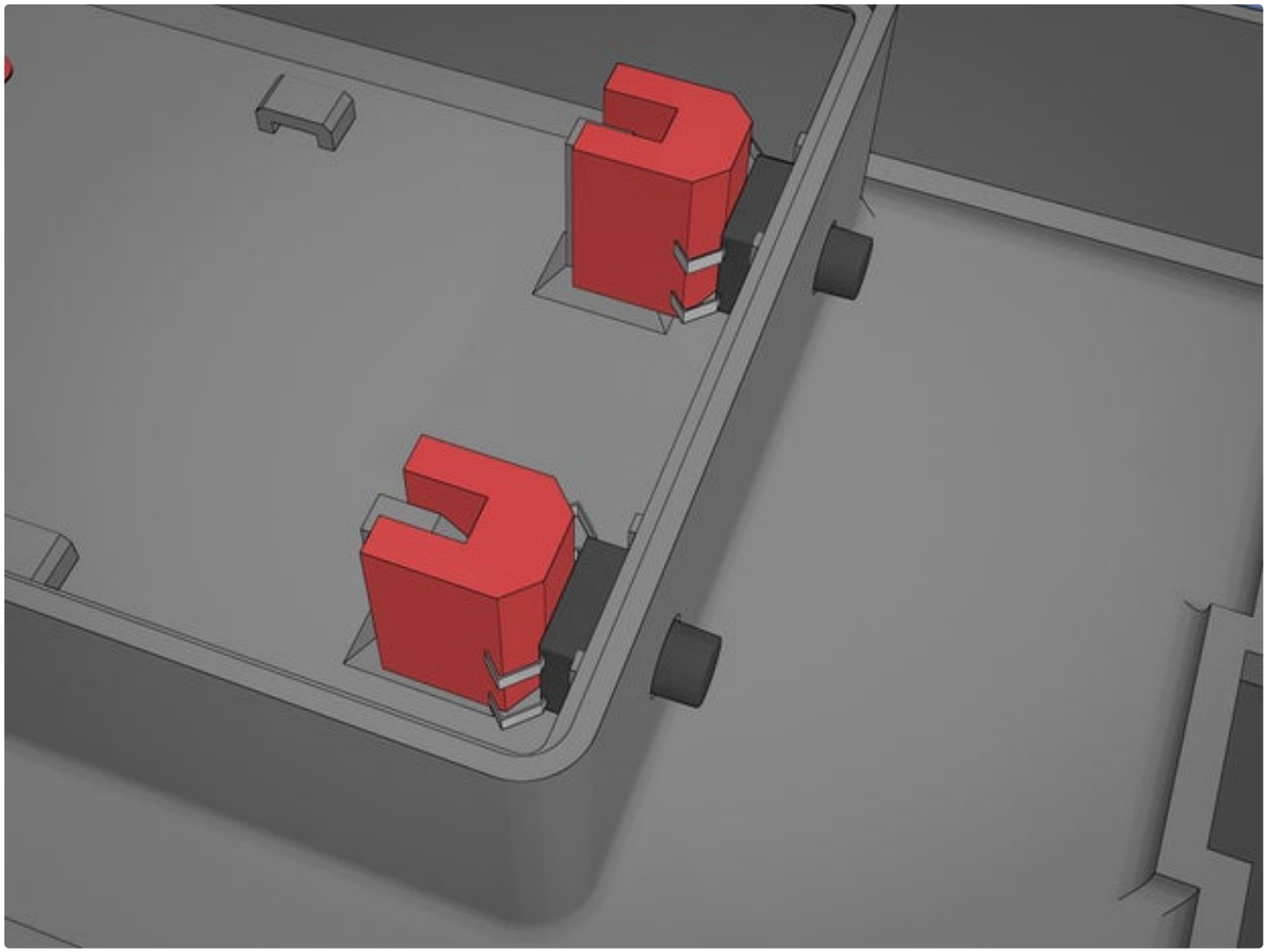
Buttons/Arduino Pro Mini/DS3231 are for illustration purposes, details about supported features and electronics can be found in the CS7-Instructable.









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Lazy 7 / Mini
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