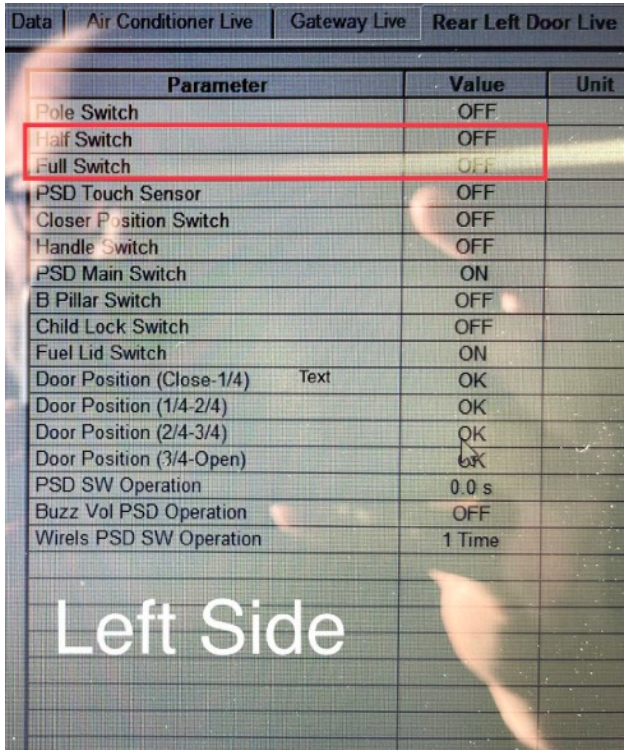
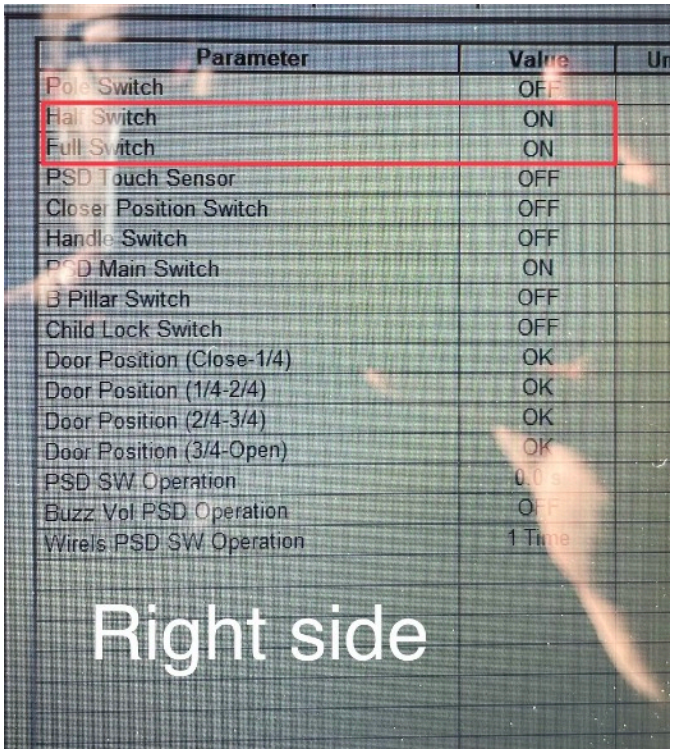
Diagnosing a misbehaving power slide door

Quick issue summary: my 2008 Sienna driver side power slide door would only open. When I hit the button to close it, it would try to open again, and then stop.

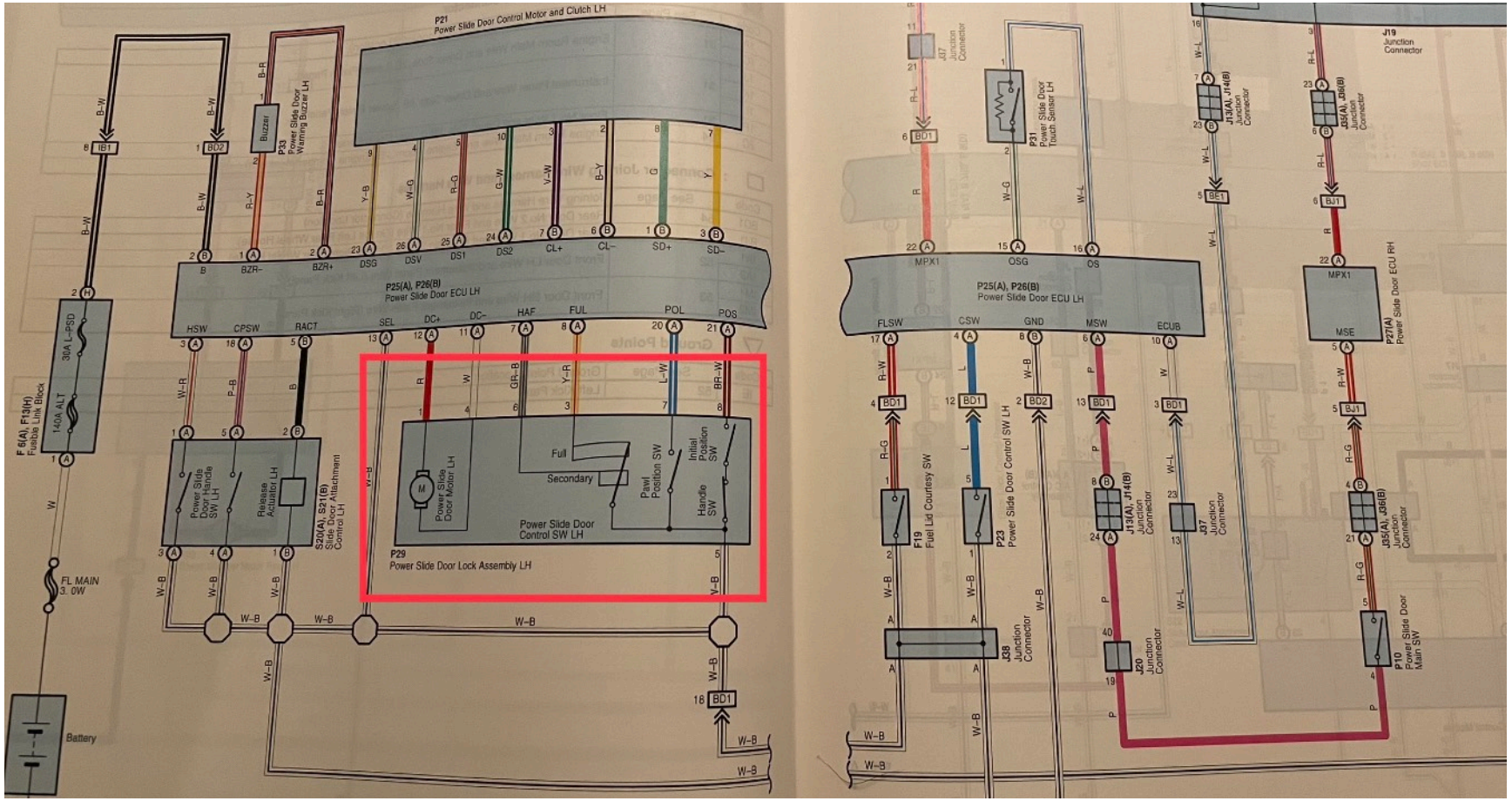
After posting on siennachat.com, a user called Johnny5 suggested that I check out a cheap usb OBD-II dongle on aliexpress. It came with a cracked version of the Toyota Techstream software. I ordered it and have a cheap windows laptop that I set the software up on. I would prefer to not play tech support for folks trying to do the same, but I believe there are plenty of posts on sienna chat where this is covered.

Once I was able to connect to the car, I looked at the switch/sensor values for both the driver (left) and passenger (right) side sliding doors when they were open. From there, I was able to see a difference in the values.



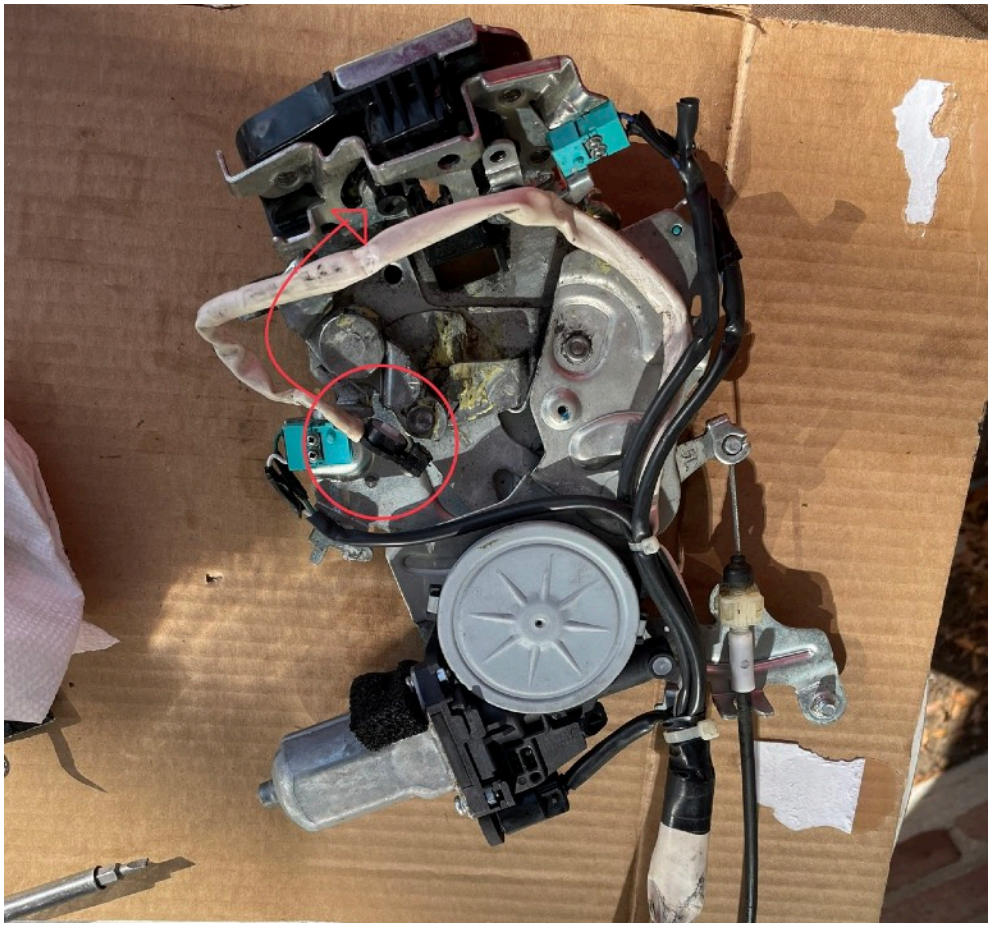


Finally! I had somewhere to start. In my previous attempts to fix this problem, I had purchased a full set of wiring diagrams for the 2008 Sienna. Looking through the diagrams for the door, I found this:



I admit that the naming isn't exactly a match to the feedback on in the Techstream view, but the Full/Secondary switches seemed like the closest match. I pulled the door panel and looked around for a yellow and red wire (the Y-R on the diagram). I found one and only one and it ran inside of the door, above the window regulator panel (the black part that holds all of the electronics and supports the window regulator on the other side), and towards the back of the door.

Googling “Power Slide Door Lock Assembly,” I found this helpful series of YouTube videos on how to disassemble the door enough to get to that assembly. Technically, the one video of the series of 5 that shows the actual assembly being pulled out is missing, but the videos show everything else and that missing bit is pretty straight forward if you have the skills to make it that far.



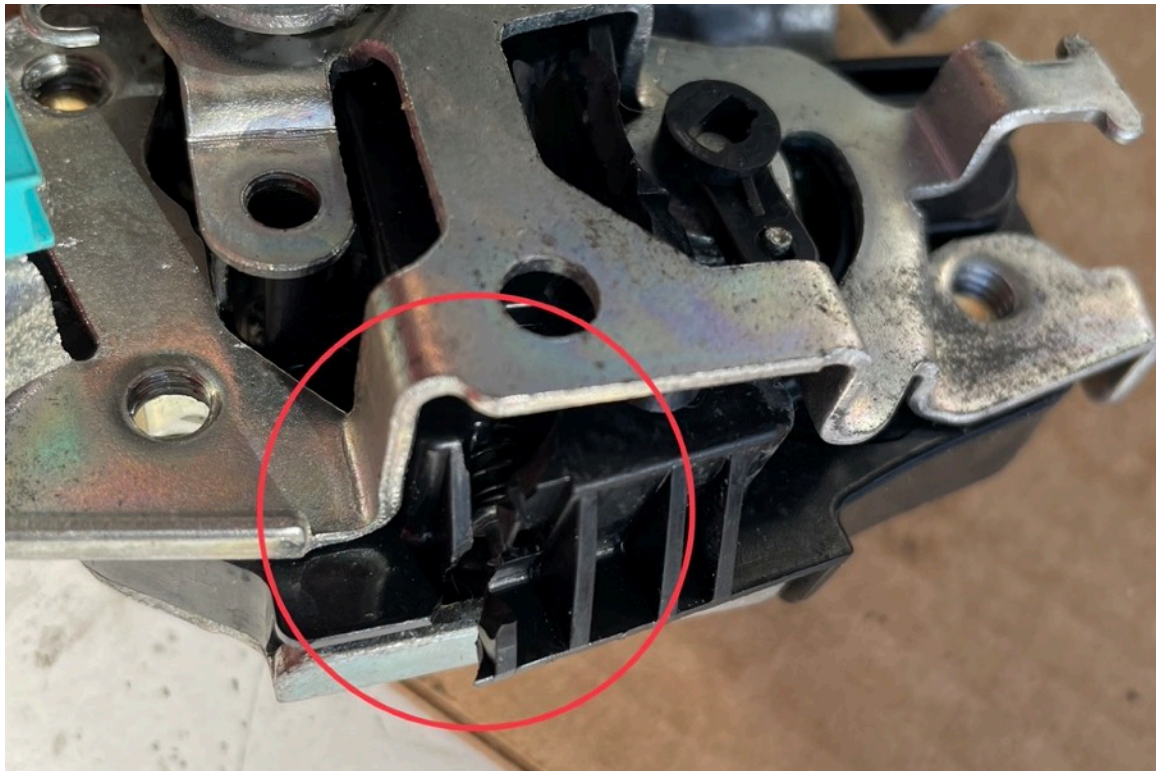
So, once I pulled the assembly, I was able to see what my problem was!

There is a position sensor that was completely broken off of the assembly. It let's the door CPU know the position of the latch pawl, effectively telling it whether or not the door is open or closed. Apparently my sensor was in the closed position and since it broke off, it would never change the value. That's why the door would only ever try to open.

Diagnosis complete. Now to the repair.

Fixing the power slide door lock assembly

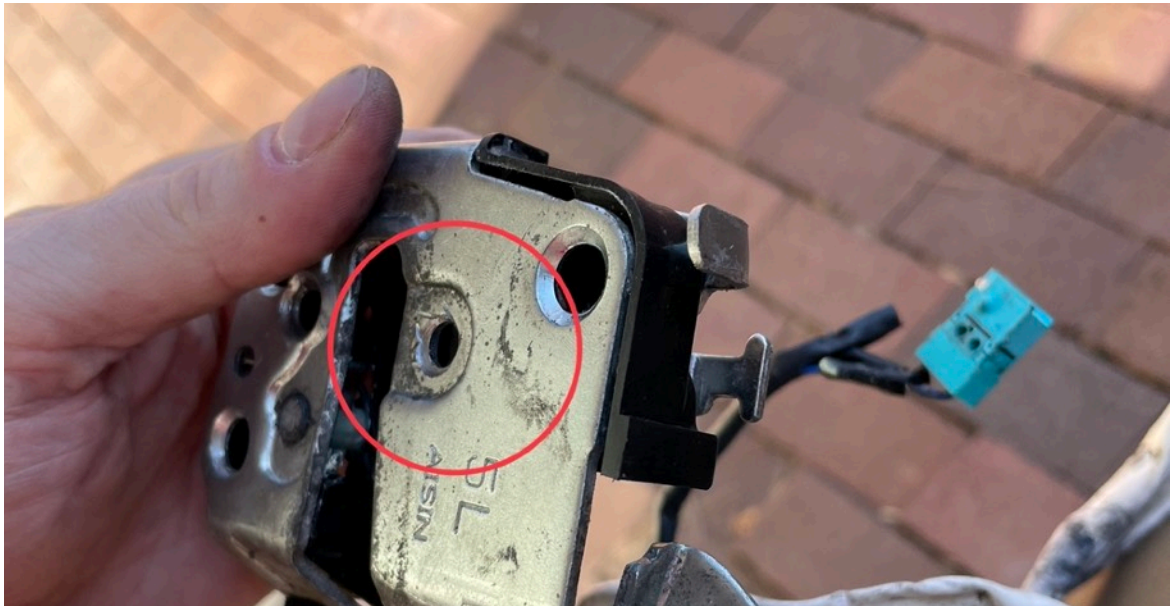
It turns out that the broken sensor mount wasn't the only issue. The entire piece of ABS plastic holding the pawl assembly was broken.



Unfortunately, this piece of ABS plastic is sandwiched between two pieces of stamped sheet metal and they are connected by machine screw (no problem) and a pressed pin (problem). That pin meant that this assembly wasn't designed to be disassembled and fixed. But the frustrating part is that everything else was working as far as I could tell, so it was just a broken piece of plastic that was the issue.

The assembly itself is part number 69300 - 08011. Looking it up, it costs somewhere between $450-700 USD to have shipped. I was going to order one and be done with it, but after sleeping on it, I woke up angry and decided to have a go at fixing the thing anyway. Damn it, I'm a former professional mechanic and also have a background in industrial design. Surely I had a chance of figuring something out, right?

For starters I drilled out the spot on the pressed pin where the end was smashed to hold it in place. Unfortunately, I didn't think to take a picture of it first.



This picture shows the location, though. I drilled it by hand with a cordless drill and then used a narrow punch to remove the pin. The other end of the pin is unique in shape and so the pin needed to be kept around.

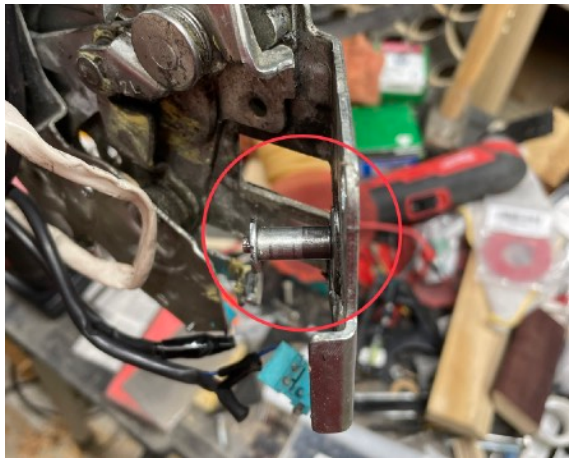
I then drilled and tapped a hole in the end of the pin that I had just ground out in order to be able to put a machine screw in it to hold it in place. I clamped it in a vice and drilled it with a drill press. I don't think I would have been able to get a good hole otherwise. Because I had drilled into it earlier and my original hole was a little offset from the center of the pin, my new hole was off center as well. Since the pin doesn't need to move, this turned out to not be a problem at all.

A test fitting showed that the pin would stay in place and so I started to work on replacing the broken plastic housing.

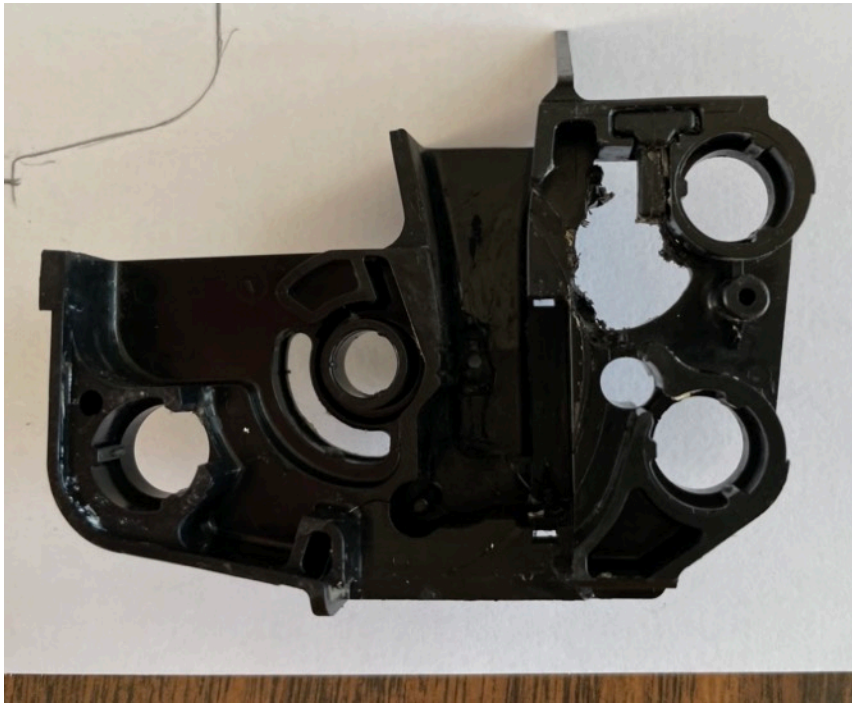
Notes at this point:

1.The other end of the pin looks a little beat up. That's because it is. I admittedly started working at removing the wrong end of the pin when I first set about removing the pi. You can learn from my mistake.

2. The hole with the machine screw in it is the same that I drilled out earlier. I honestly don't remember the size. I think it's more about what you might have on hand and what you can get to be flush with the raised part of the stamped metal. (Where 5L is stamped)

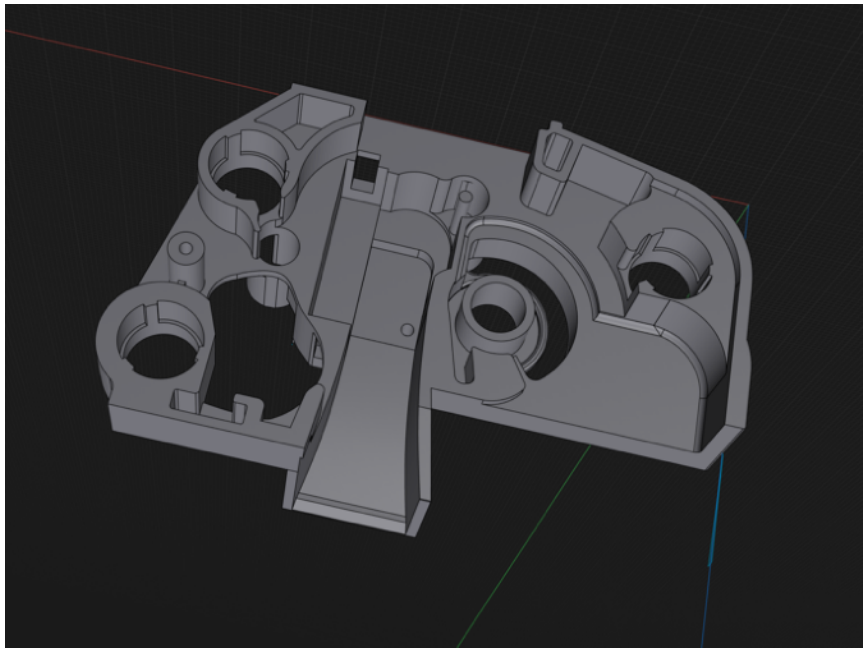


With the pin removed, the area I was working off came off into a smaller sub assembly consisting of one piece of stamped sheet metal, the broken housing, and various parts contained in the housing. The stamped metal was still attached to the housing in a way that I couldn't easily remove it. There is a pivoting piece, also attached via a pressed pin, that runs through the plastic assemble. I had zero confidence that I could remove it and put it back in a way that it still worked, so instead, I cut out part of the plastic around where the pin came through. As I did this, I realized that the plastic housing didn't really serve a structural purpose. That was huge, because it allowed me to modify the replacement part for easier assembly. The rotating pin is held securely between the two pieces of stamped metal when the assembly is all together.



That's what the ragged looking hole is at in the upper left hand corner in the picture above.

Once this was out, it was CAD time. I used a pair of digital calipers to take measurements and slowly and painfully started to reverse engineer the part. I used software called Shapr3D on an iPad Pro, but any parametric solid modeling software would have been sufficient.



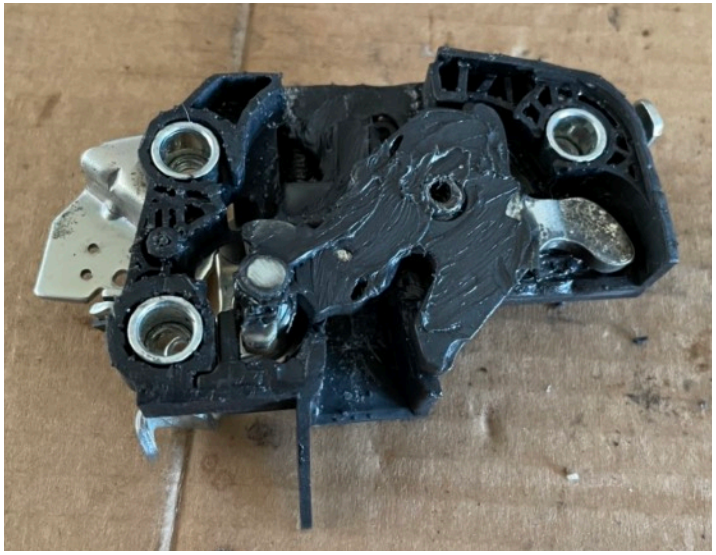
I decided that the level of detail and number of overhangs was too specific for an FDM 3D printer (the kind that most people think about with the big spool of plastic on the top) and besides… mine is currently inoperable after I “upgraded” it recently.

So, instead, my parts are printed in ABS-like UV-curing resin. It took 6 iterations of the part to get to the final one. I printed all but the final in clear plastic. At first it was because it was what I had on hand. After I picked up some black ABS-like resin, I printed in clear because I was struggling to get the black to print right. But eventually, I realized that I really liked the clear for the development process because it let me visualize the thicknesses of the plastic and allowed me to identify places where I needed to strengthen the design.

The process was:
1. Work on the 3D model.
2. Print the part.
3. Try fitting the part and find the mistakes that I made.
4. Be sure that I knew all of the things that needed to be fixed.
5. Repeat

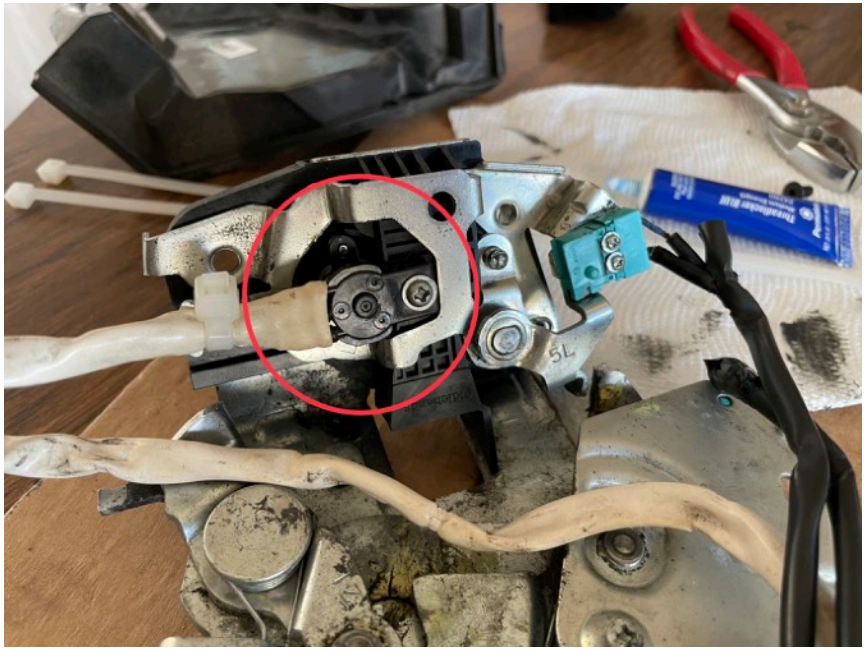
As I mentioned, it took 6 iterations. After the 5 iteration, I had a part that fit and everything worked. I made a follow up pass adding more material in places that wouldn't interfere with the function and fit but would help make the part stronger.

That's what the ribbing is on the top of the piece on the left (mine) vs the original on the right (Toyota's). I'm not kidding myself. I don't think that my piece will hold up for the 15 years the original did, but honestly, I don't need it to. I can either replace it again if needed. But it's a low stress piece and I think there is a good chance that it will hold up.



So, I greased it all up and reassembled the sub assembly.

I used BLUE thread locker liquid to put the machine screw into the pressed-fit pin. I figure that it will hold just fine, but there is a chance that I will have to get back into this thing again some day.



After the parts were together, I was able to secure attach the pawl position sensor to the assembly. After that, it was a simple matter of reversing the removal process.

The file for the assembly can be found here:

https://github.com/idlehands/toyota_door_latch_assembly_plastic_housing