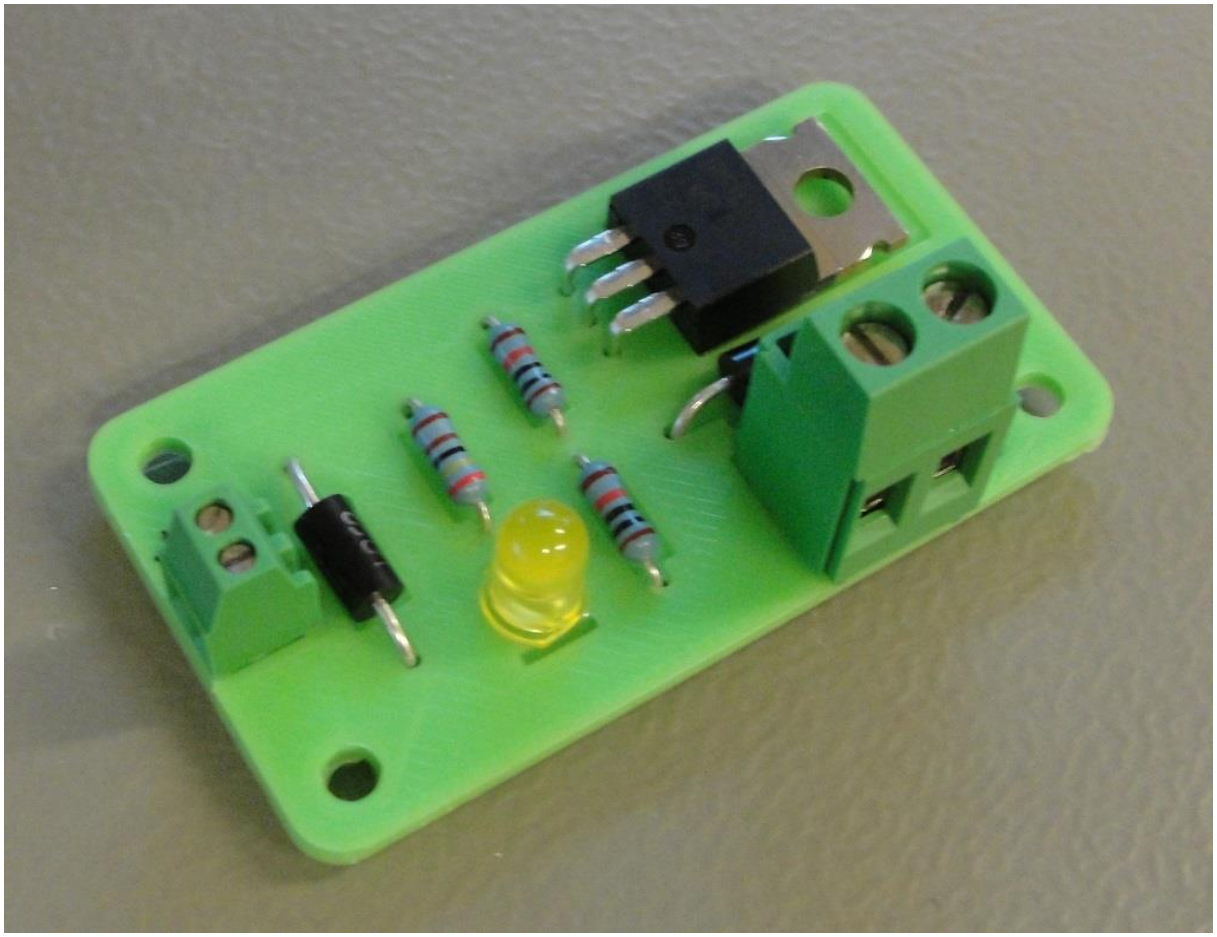
Heated bed MosFET hack V2.0
PCB assembly guide



Created 2014-12-05 by JonnyBischof

Preparations

You'll need the following tools:

- A soldering station with temperature control.
  Don't use an electrician's soldering iron that goes directly to the mains socket. These are not suitable for soldering electronics.
  I'm using a Weller WHS 40D.
- Standard electronics solder, preferably Sn60/Pb40. Small diameter (around 0.5mm) makes it easier to get the right amount of solder on the parts. Set the temperature on the soldering station to 360°C for Sn60/Pb40.
- Some hand tools:

- Last but not least: ESD protection!

  The best thing to use is an ESD dissipative table mat, connected to the PE (protective earth) terminal of your mains socket. You can also use an ESD protective armband.

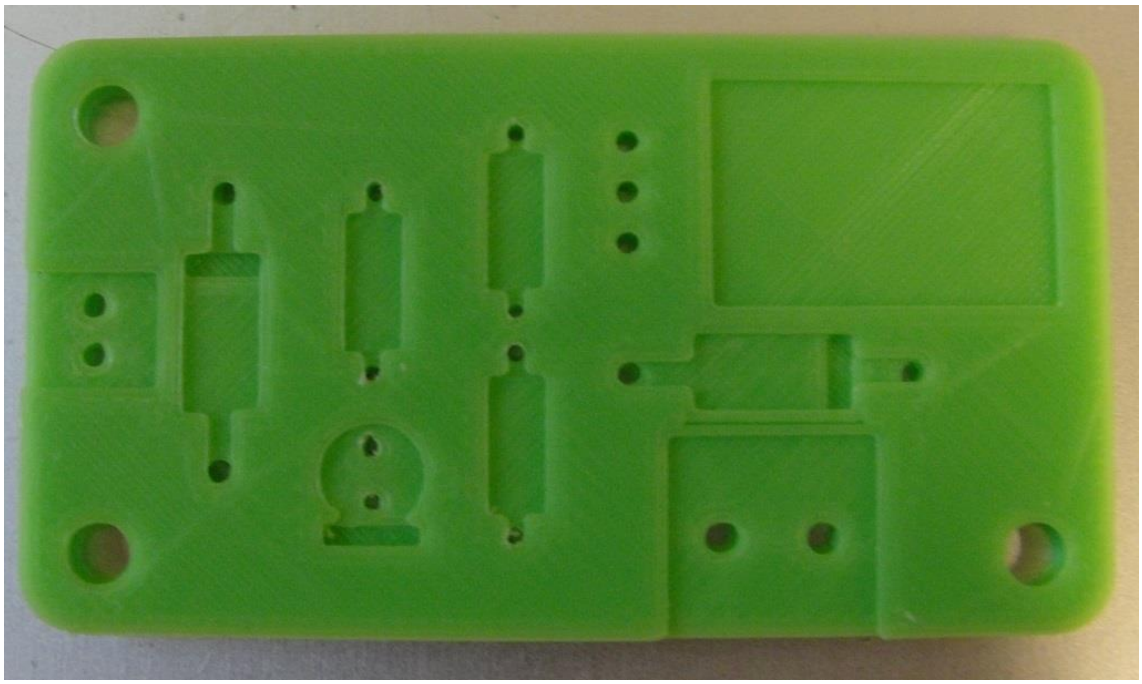
  If you don't have or can't get any of these, then at least make sure to minimize your static charge: Don't wear wool or polyester clothes. Don't work on a carpet. Don't roll around in an office chair when working, and don't rub your hands on anything (friction can generate static charges). Before you start working on any sensitive components, discharge your body by touching a grounded object. I always use my desktop computer's case for that. Just touch a bare metal part of your desktop computer's case. Laptops or computers with external power supply bricks won't work!

  Please also read the Wikipedia article about ESD (electrostatic discharge) before you continue.

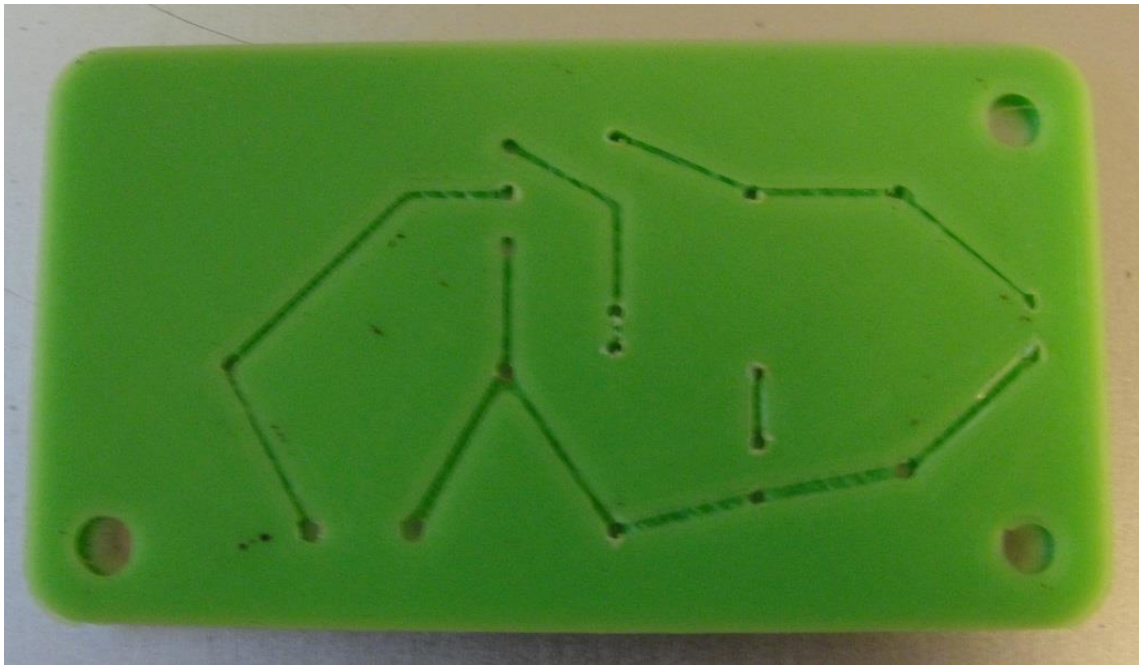
Printing the circuit board

Print the circuit board at 0.1mm layer height and 100% scale!
Recommended: 2 shells, 100% infill, 35 mm/s.

I used PLA. It will melt a little when soldering, but that doesn't matter. I wouldn't use ABS because it will melt just as much as PLA, but will also smell bad...



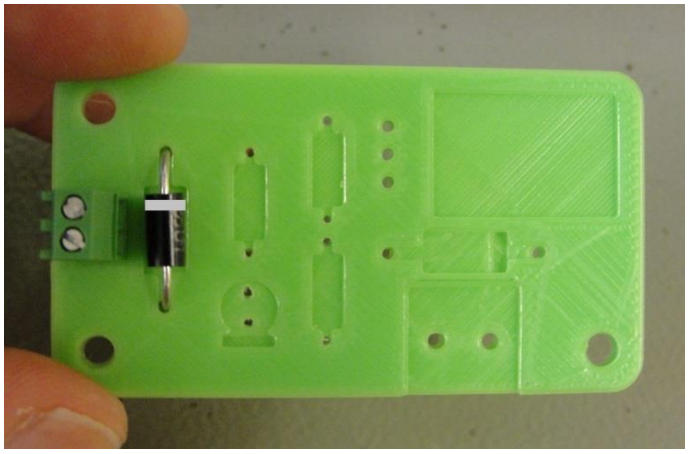
You might have to use a small drill for the holes (I used a 0.8mm bit). A hot needle will also do the trick.



The tracks in the bottom only need to be visible, not perfect in shape. They'll melt to shape when you solder the wires.

Print the top and bottom covers as well before you start assembling the PCB! The covers are needed to protect the PCB against ESD damage.
I know, almost every RepRap electronics part you've bought before didn't mention this, and you may never have had any problems before. But just trust me and do it right for this one ;-)

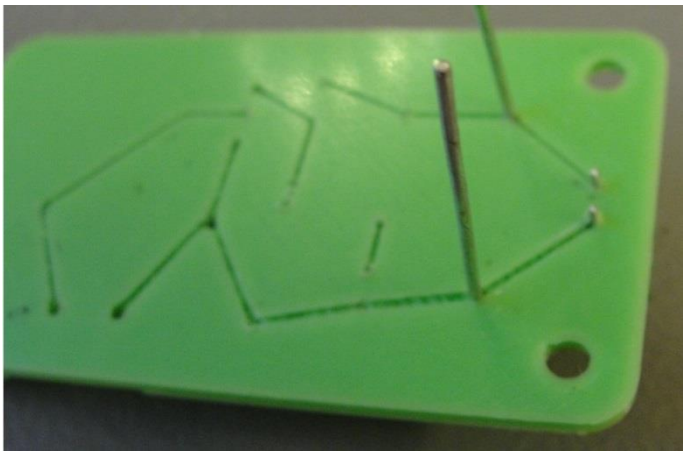
Step 1



Place the small connector and one SA24A ESD protection diode as shown in the picture.
You'll have to bend the diode's legs to make it fit in place.

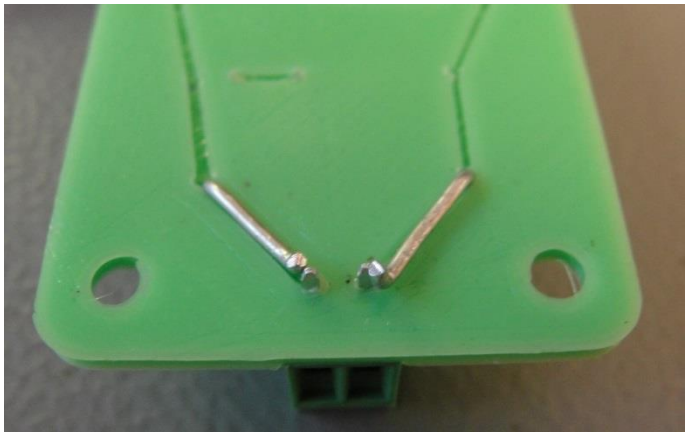
Mind the diode's polarity! It is marked with a ring on one end of the body.

The connector's wire outlets must face outwards (to the left in the picture).



Turn the PCB (printed circuit board) around.

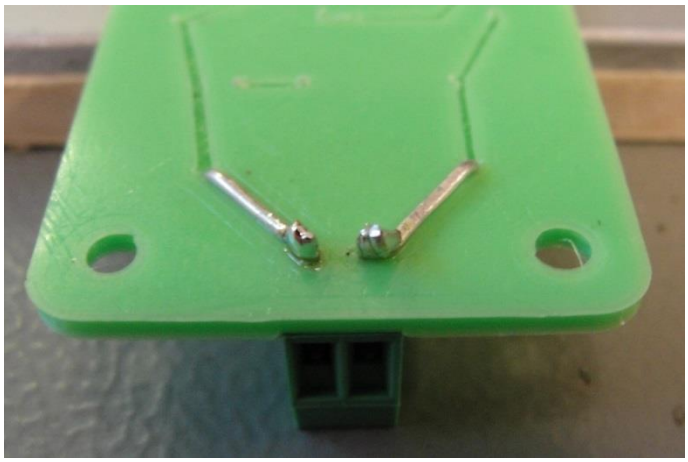
Make sure the components don't slide out by holding them in place.



Bend the diode's legs towards the connector's pins. This works best using thin pliers (the blue/red one in the picture on page 2).

Cut off any excess length.

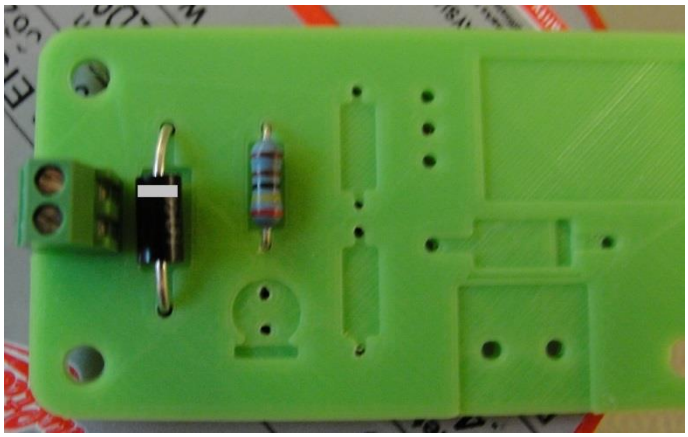
You can bend the ends of the diode's legs upwards a little bit, so that they run in parallel with the connector's pins. This makes soldering them together easier, but is not necessary.



Note: Don't throw away any of the cut-off component legs! You'll need some of them later

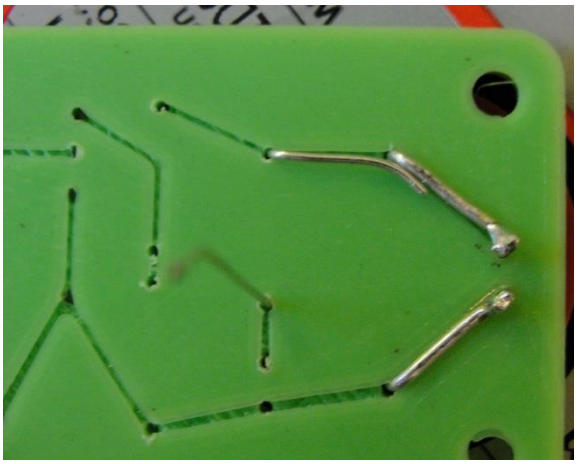
Solder the two connections as shown in the picture.

Step 2



Place the 2.2 kΩ resistor.

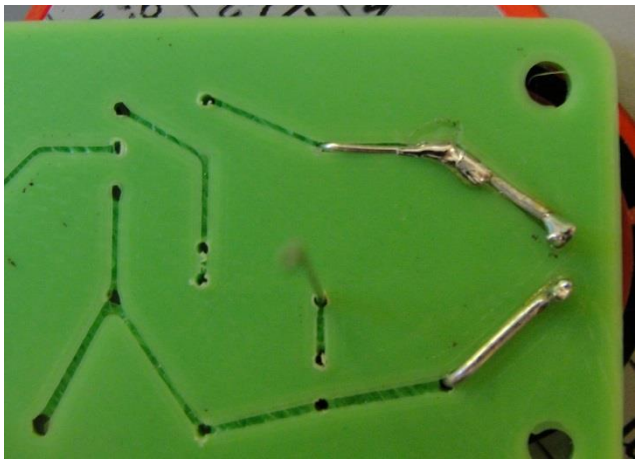
Resistors are not polarized, so it doesn't matter which way around you put it in.



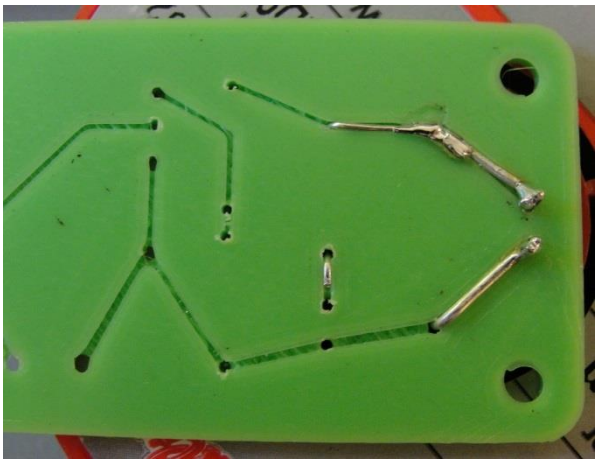
Turn the PCB around and bend the resistor's upper leg.

Run it a bit in parallel to the diode's leg so that you have enough space to solder the two together.

Cut off excess length.

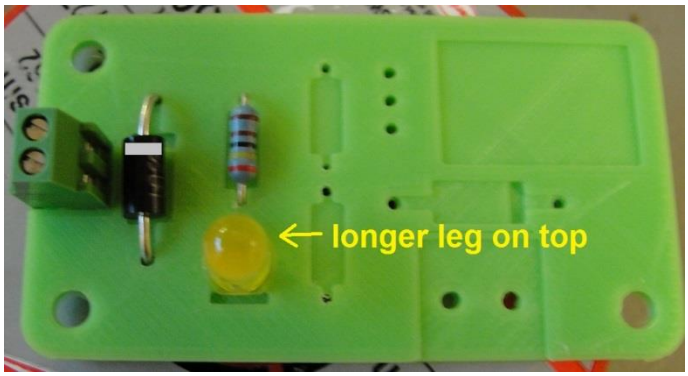


Solder the two legs together.



Now bend the resistor's other leg and cut it so that it ends a bit before the adjacent hole. Avoid blocking the other hole.

Step 3

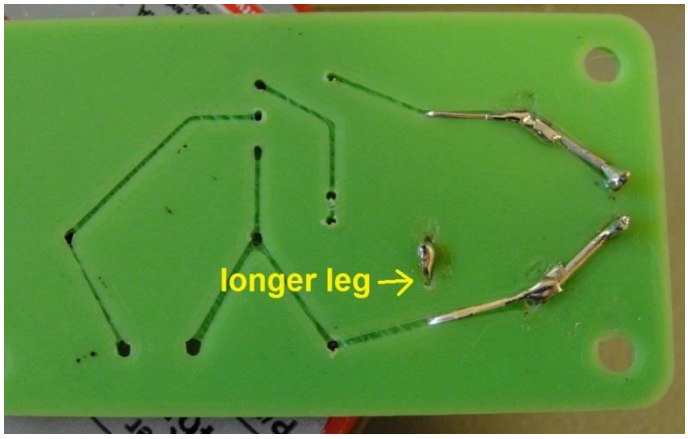


Place the LED.

Mind the polarity! The LED has one longer leg which marks the anode (+ pole). This anode is on top in the picture.

The shorter leg is the cathode
(- pole). Most LEDs have a dent in the case to mark the cathode as well.

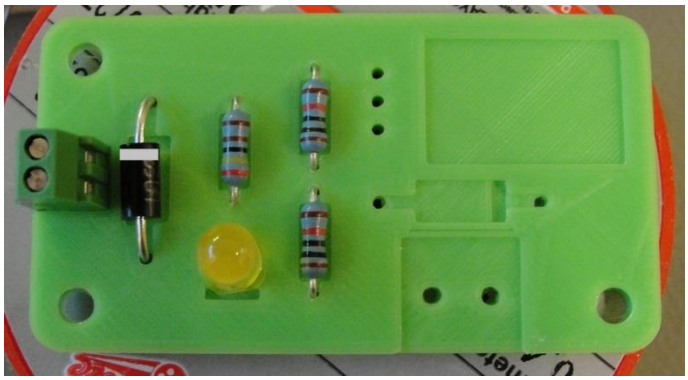
The cathode is marked with a big **–** on the PCB.



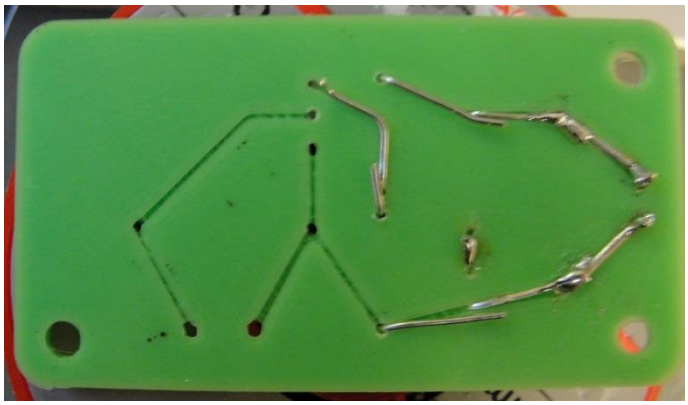
Bend the anode (longer leg) upwards and cut it. Again, run it in parallel with the other wire to get a good solder connection.

Bend the cathode (shorter leg) to the right towards the diode.
Bend – cut – solder.

Step 4

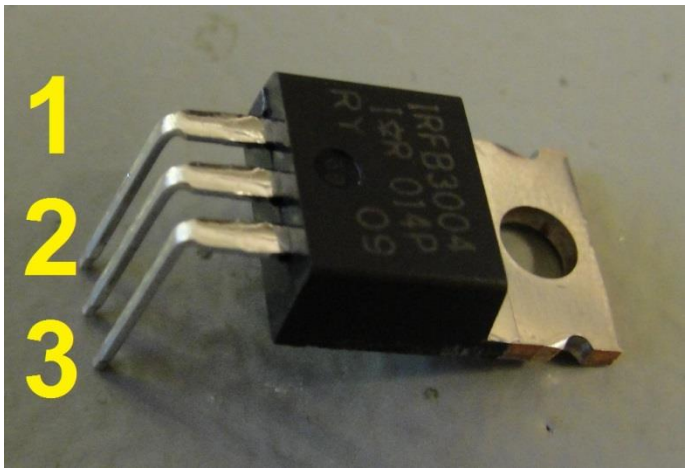


Place the two 10kΩ resistors. Again – no worries about polarity here.



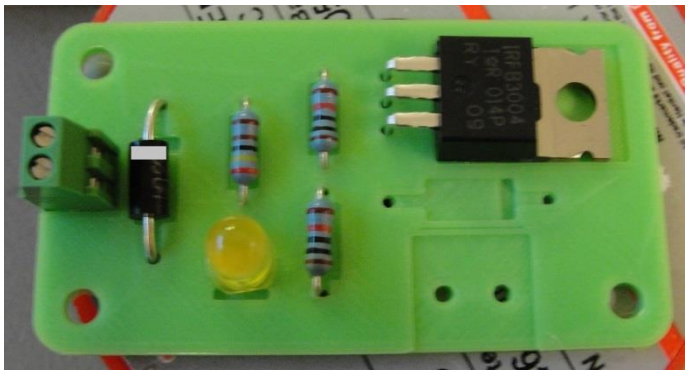
Bend – cut – solder. Like in the picture.

Step 5

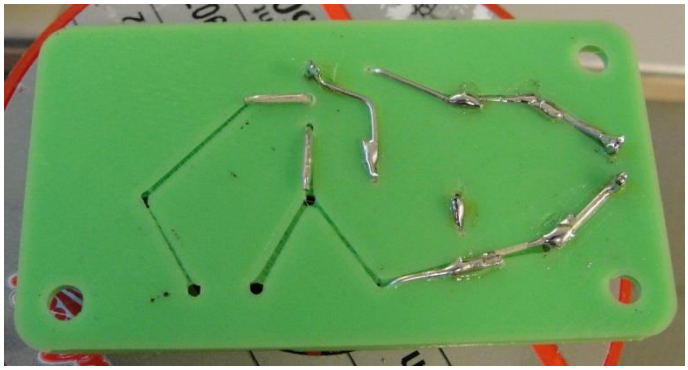


Take the MosFET (this is an ESD sensitive device!) and bend it's legs as shown in the picture.

If you use another MosFET than the ones specified in the BOM, make sure it has the same connections:
1: Gate
2: Drain
3: Source



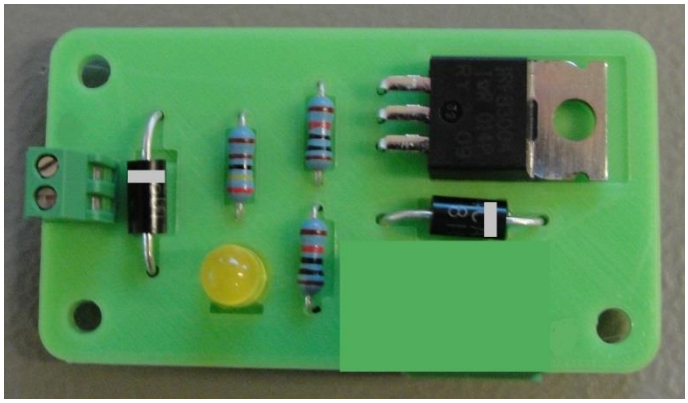
Place the MosFET.



Bend – cut – solder.

There's only one solder connection yet: the top one, which is the MosFET's gate connection.

Step 6a



Place the second SA24A diode.

Mind the polarity!

Now comes the tricky part: You're gonna run out of legs soon (lol…).

First, bend & cut the diode's legs:

The left one goes upwards and to the right.

The right one goes down and to the left. Bend it upwards a little at the end, just like you did in the first step with the other diode's legs. You'll solder that end to the second connector later.

Solder the top left connection.

Now you need to add a wire (it is marked yellow in the picture).
Use one of the legs that you cut off one of the resistors before.

Now, add another wire (marked yellow).
Use one of the legs that you cut off one of the diodes (thicker than the others!).

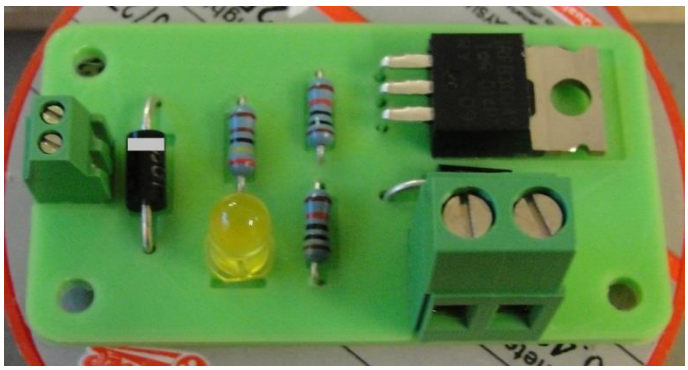
This is not necessary, but you're reinforcing the high-current path with more metal to carry that current.

Step 6b

Solder that reinforced part. You might have to hold it down with pliers or tweezers.

Pay attention not to heat the wires for too long and not to push them down into the melting plastic – they must not melt through the plastic!

Step 7



Now for the final component!

Place the larger connector.

The wire connections must face outwards (downwards in the picture).

Solder the connection to the right.

Make sure the connector sits flush on the PCB, you'll have to hold it in place when soldering.

Add another wire (from a diode – thick one) and solder it in.

Take two more wires (thick ones if you have any left) and reinforce this connection as well. This is the second high-current path.

All the other wires will not carry any large currents and don't need to be made thick.

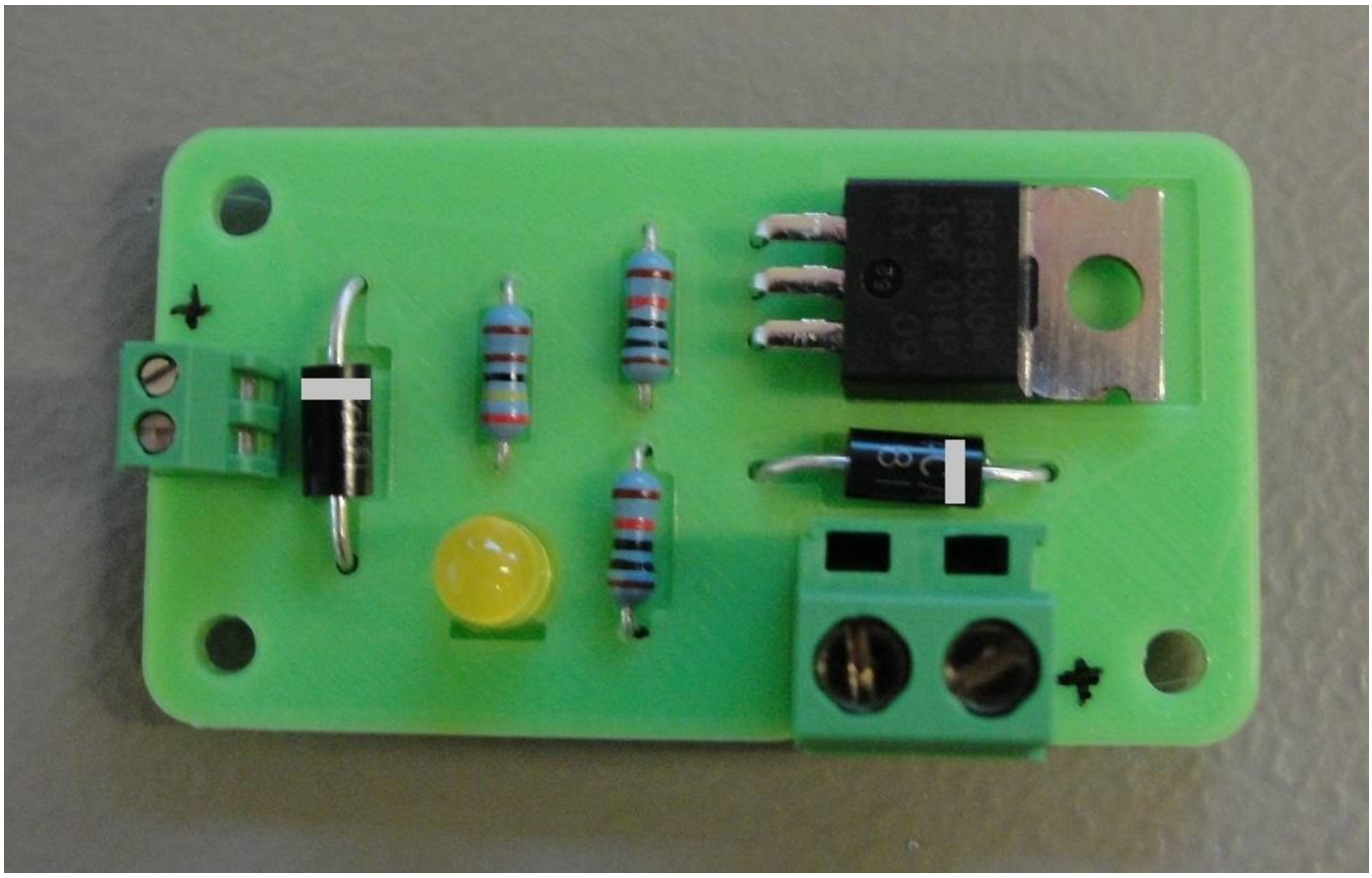
Note that these reinforcements are a bit overkill – but while you have the stuff laying around, why not use it?

Almost done…

Inspect your work:

1. Are the two diodes properly oriented (polarity marks)?
2. Are there absolutely no short-circuits between connections where there shouldn't be any?

…Now you're done!



Make sure to keep the printed covers ready and make the final assembly now. The MosFET is still susceptible to ESD damage! Once you put it inside the cover – it is protected. The only metal connections that remain are the connectors, both of which are protected by ESD diodes.