2000 Watts Induction Heater

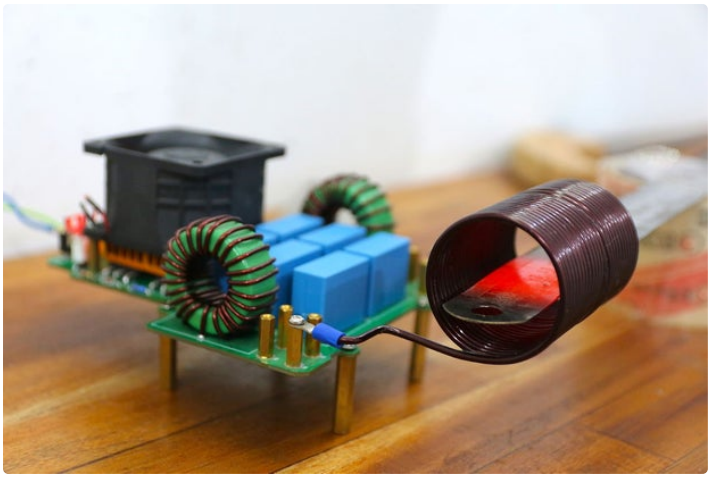
by DIY KING 00

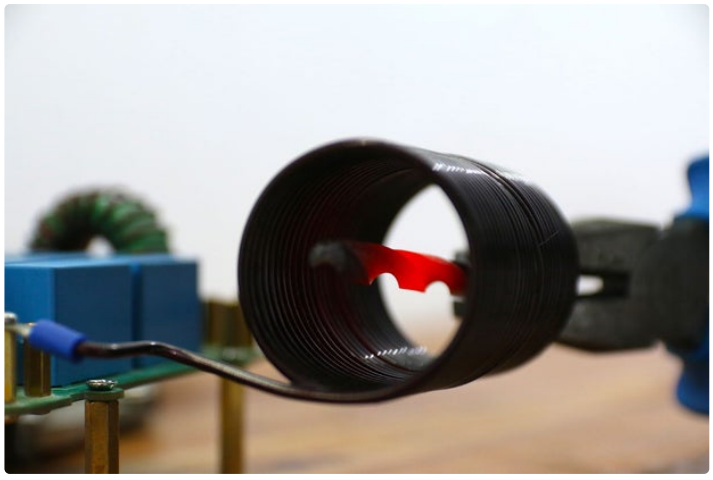
//www.youtube.com/embed/5VK446fku58

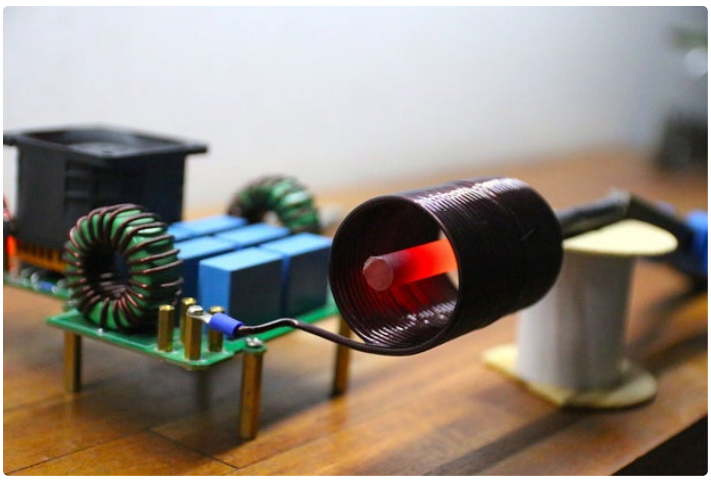
Induction heaters are a great piece of tool for heating metal objects that can come in handy in a DIYers workspace when you need to get things red hot without messing up the whole space.

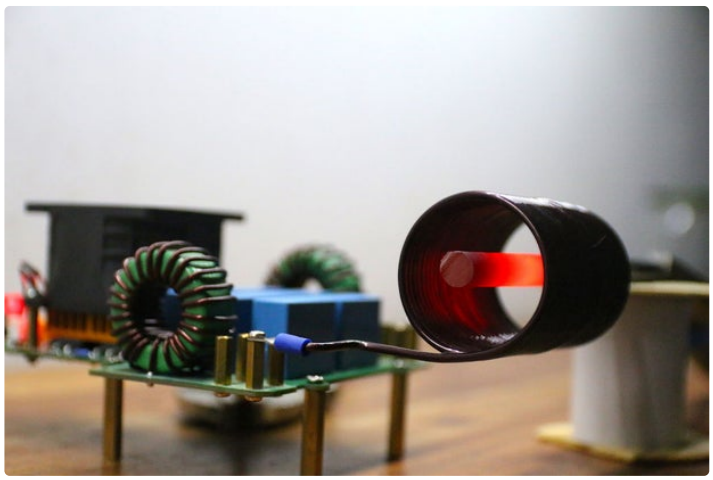
So today we are going to create an extremly powerful induction heater totally from scratch and the good thing is that this unit is built using customized Printed Circuit Boards which makes the whole building process for you guys a piece of cake and neat aswell.

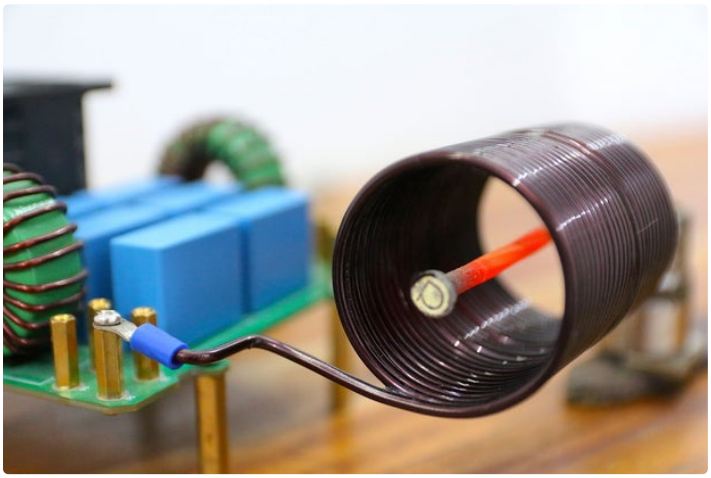
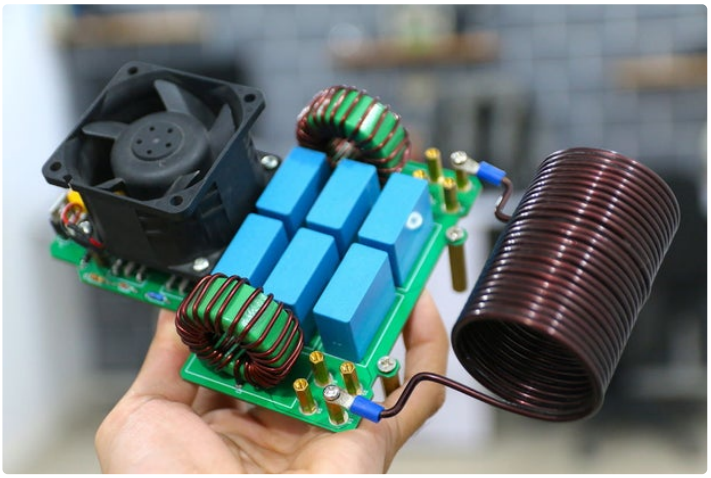
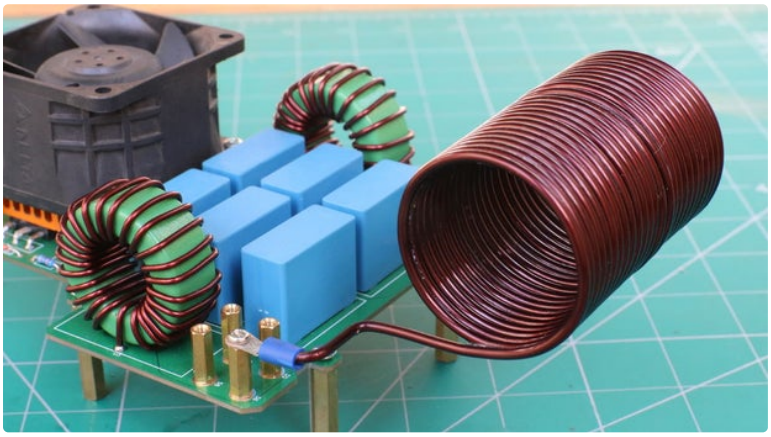
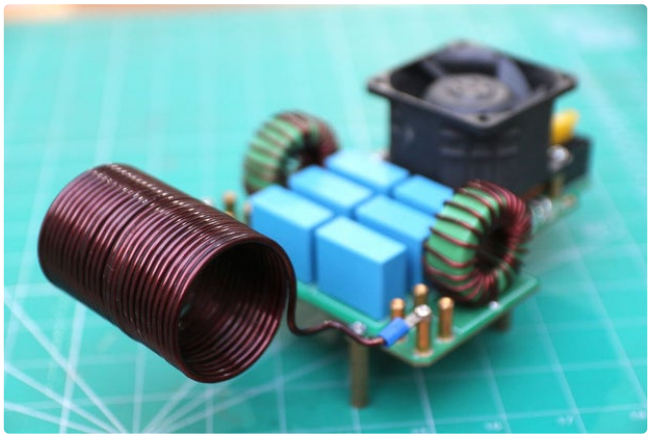
https://youtu.be/5VK446fku58









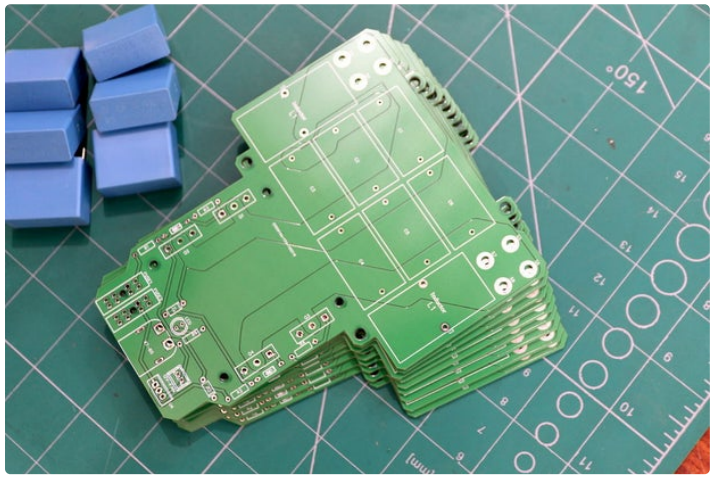
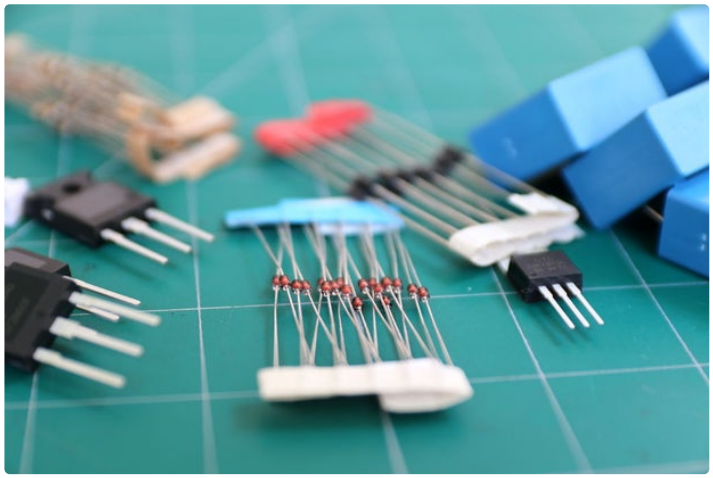
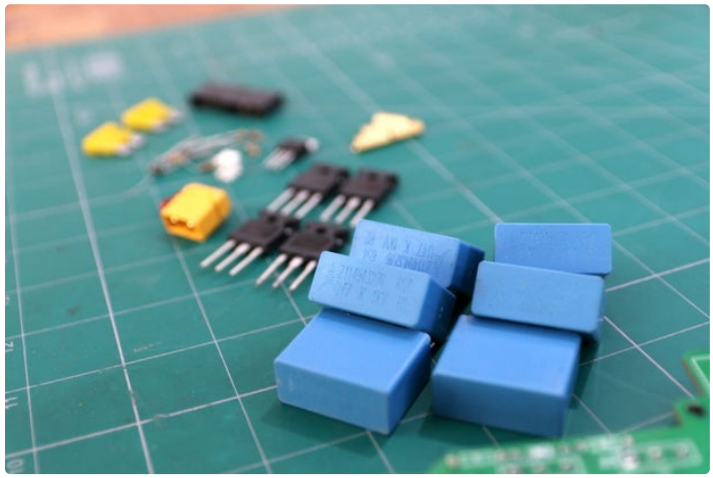
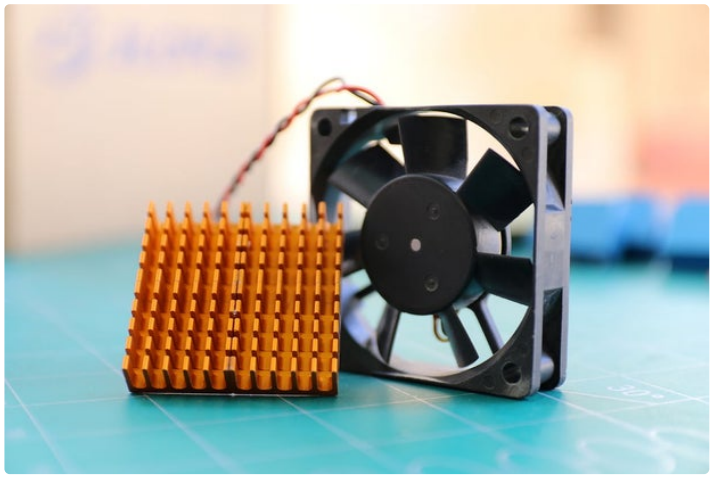
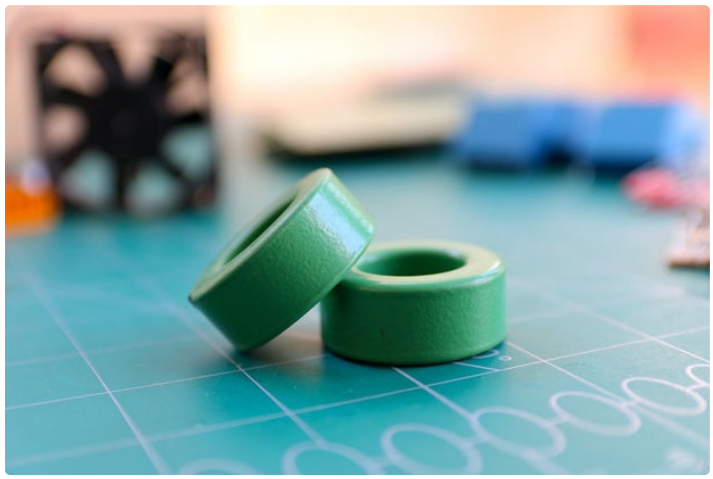
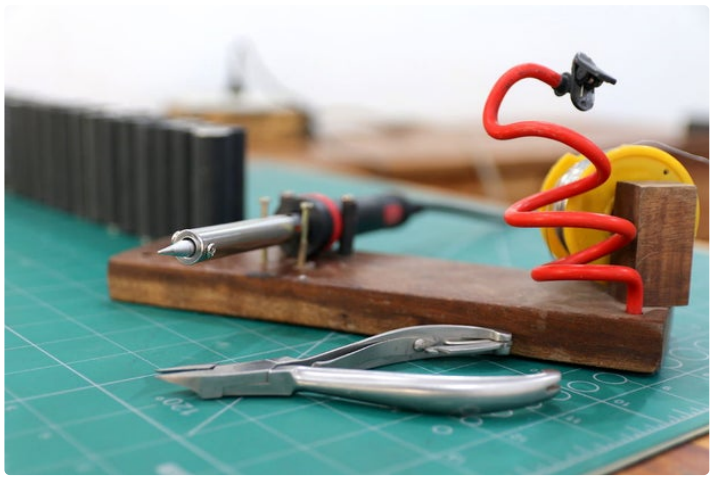





Step 1: Tools and Material Required

- **List of material required for this project :**
- Customised printed circuit board
- 12 AWG & 16 AWG enamel copper wire
- Ferrite cores
- 12v DC fan
- Heat sink
- Resistors
- Capacitors
- Diodes

List of tools used in this projects :

- Soldering Iron
- Soldering wire
- Cutters
- Pliers

Step 2: Designing the Schematic

The unit works as an LC oscillator and thus inducing the current into metal objects with a continiously changing magnetic field.

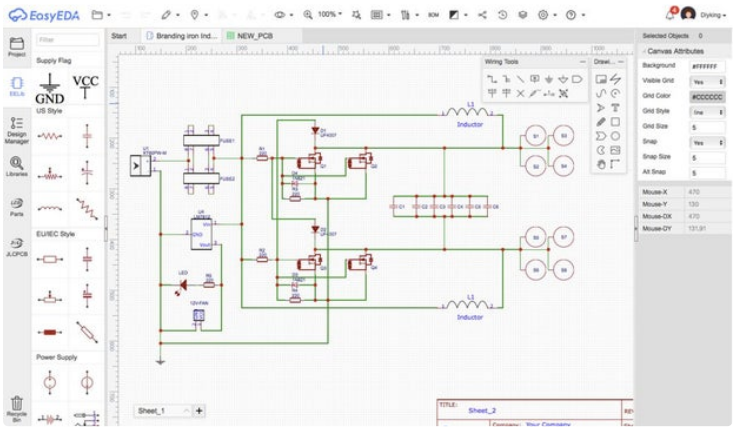
The input is a DC voltage ranging from 12v to 36v. At the initial stage we have the DC fuses just to make sure that thing wont blow up in case of any fault. From there the supply is split into two parts, one of which is the LM7812 12v voltage regulator that is used to drive the cooling fan to keep the mosfets cool.

we decided to go with the tanks circuit configuration which offers two on board inductors and has a single output coil inducing the electromagnetic field into the object being heated.

The other part of the supply is then fed to the four N-Channel mosfets, a pair of which is driving the two channels that are working alternately and thus changing the DC voltage into a continiously changing electric field.

Now there are two possible configuration, we can either go with only one onboard inductor and have the output coil split into two parts which makes the design of the output coil a bit more complicated thus

With this design in mind we have designed the customized PCBs on easyEDA, an extremly useful platform for PCB designing



Step 3: Designing the Printed Circuit Board

As I finished the schematic I have decided to go with designing a dedicated PCB for the induction heater as it will not only help us to keep everything neat but I intended to design this unit so thats its capable of further modifications for my other DIY projects.

The idea of designing a PCB might seems to take a whole lot of efforts but believe me it worth that all when you get your hands on customized boards. So with that in mind I designed the PCB for the induction heater unit.Then i also made customised packages for inductors on the boards.

I have also added four mounting holes which will be helpful to mount the controller and also hold the cooling fan along with the heat sink above the MOSFETs.

Schematic, Gerber Files and BOM(Bill Of Material):

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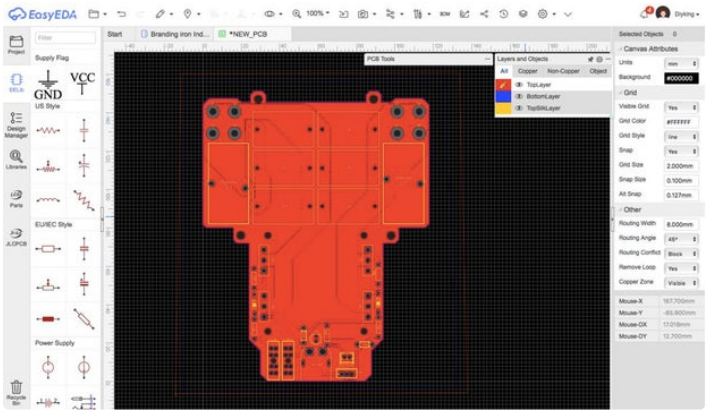
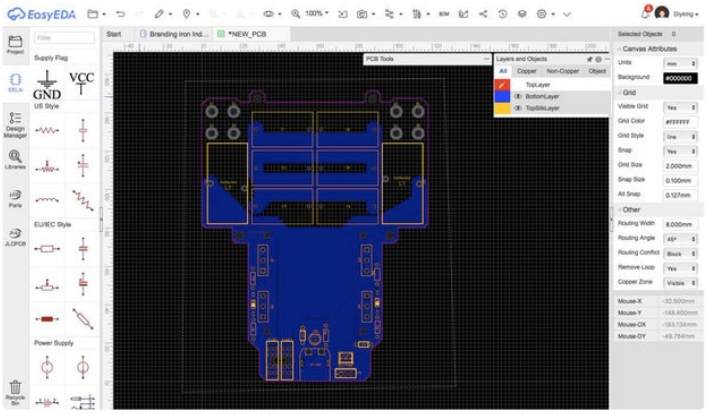
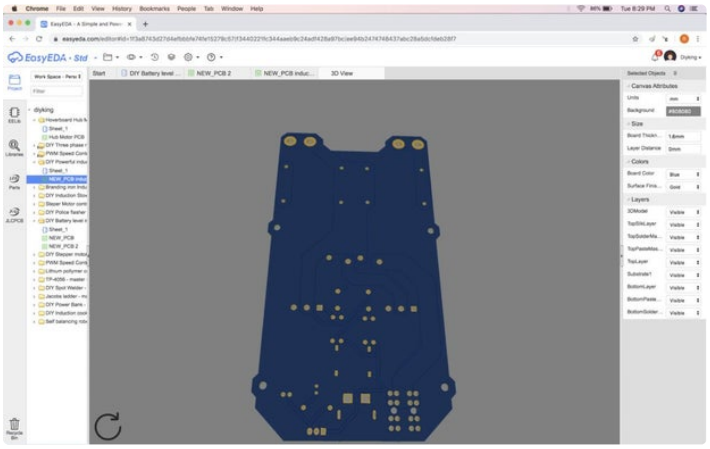
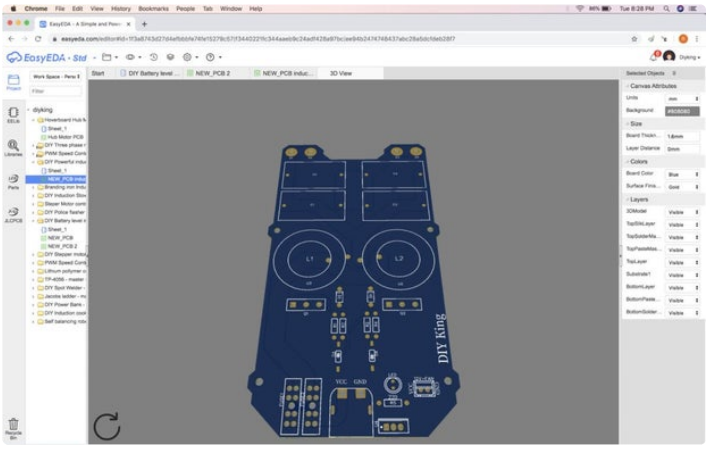
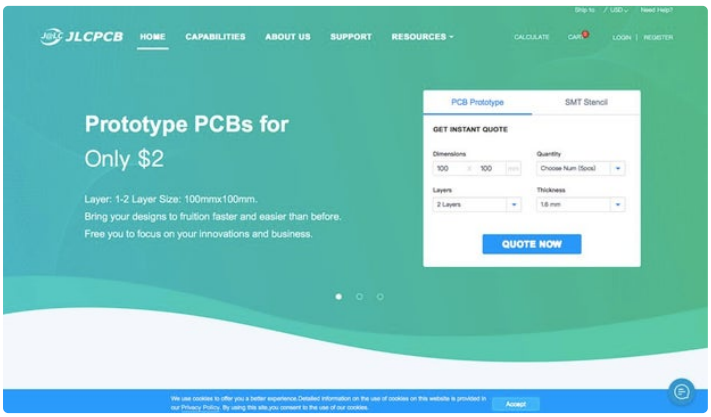
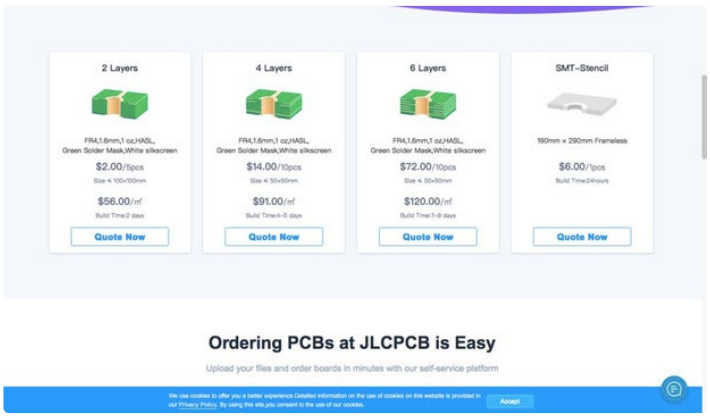





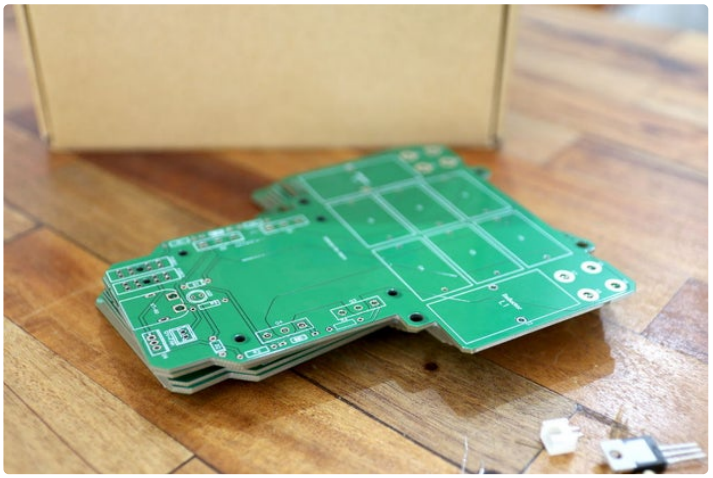
Step 4: Ordering the PCBs

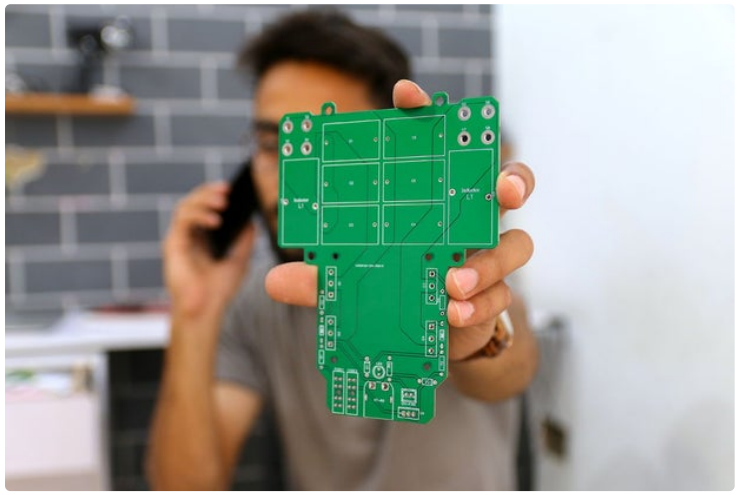
Unlike any other customised part for your DIY Project, PCBs are surely the easiest one to get. Yes Now once we generated gerber files of our finilized PCB layout we are just a few clicks away from ordering our customized PCBs.

What all I did is to head upto JLCPCB and after going through a bunch of options there I uploaded my gerber files. Once the deisgn is checked for any errors by their techinical team your design is forwarded to the manufacturing line. The whole process will take two days to complet and hopefully you will get your PCBs within just a week. JLCPCBhave made this project possible by their support so take your time and have a look at their website. They are offering Standard PCB, Quick-turn PCB, SMD etc so for discounts of upto 30% on your PCBs visit this link. Gerber files,schematic and the BOM (Bill Of Material) for the PCB is avaliable here.





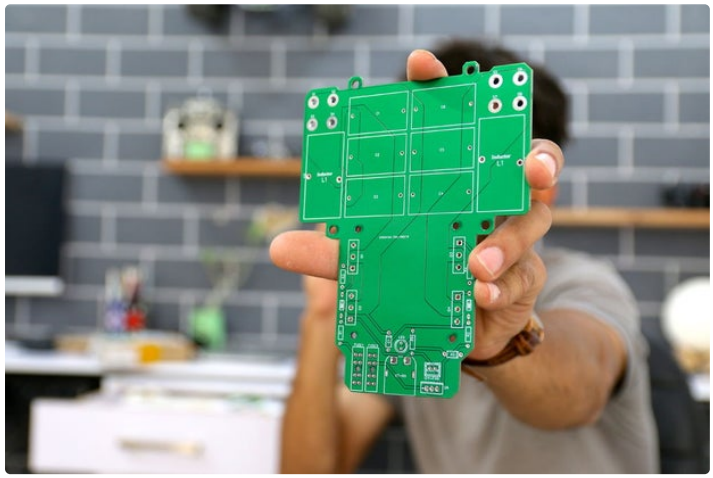
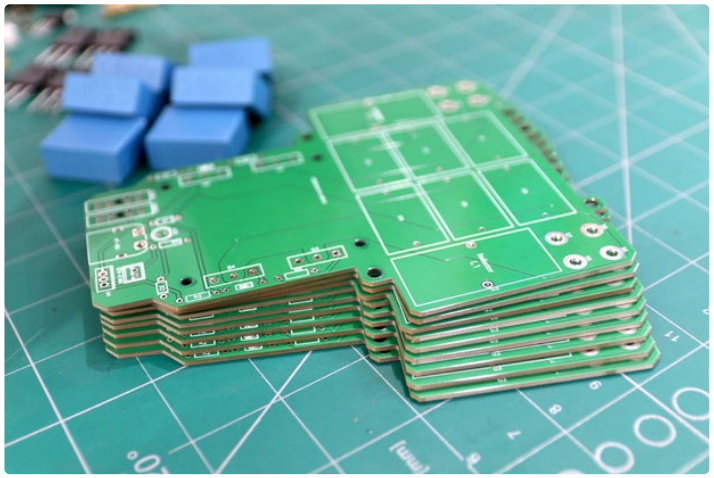
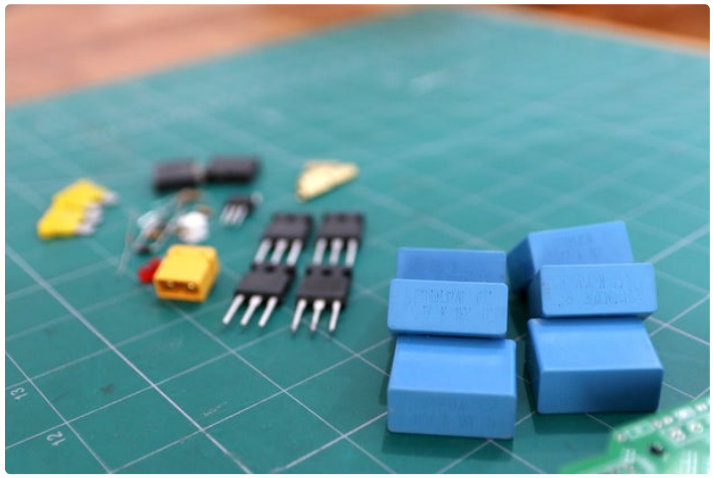
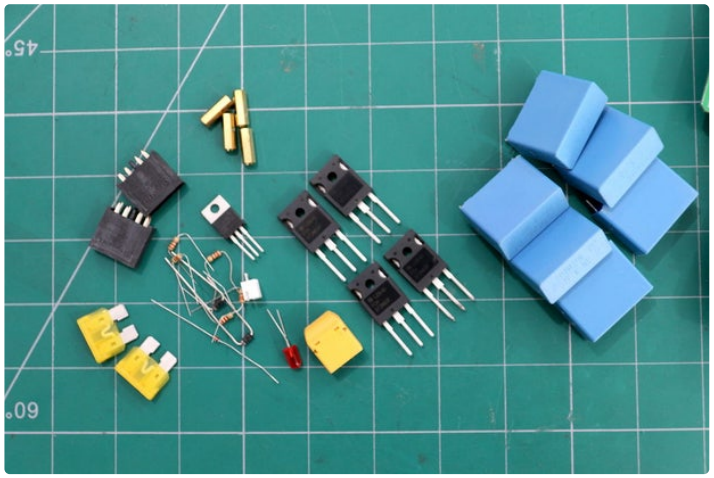
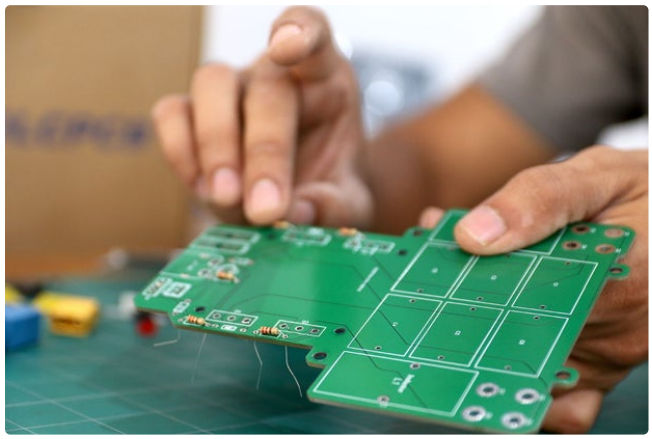


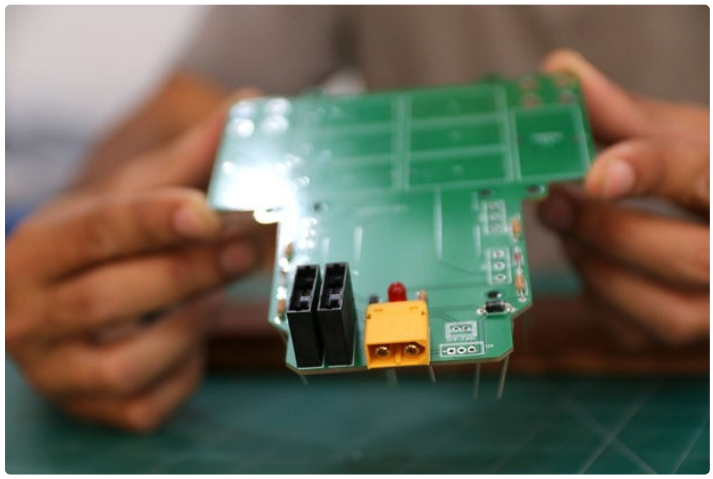
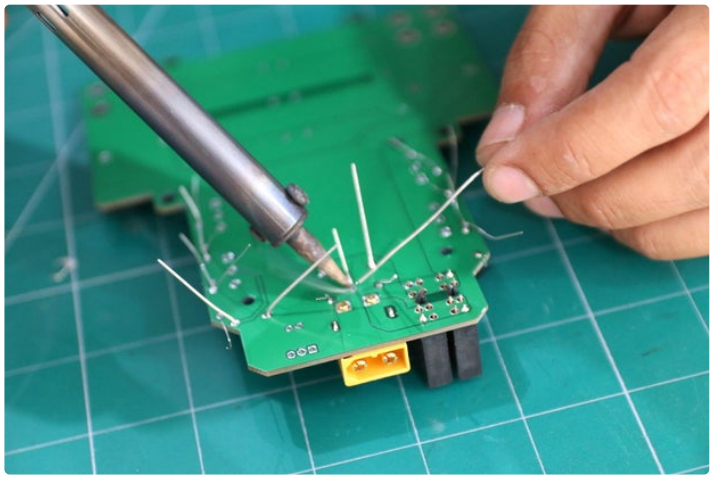


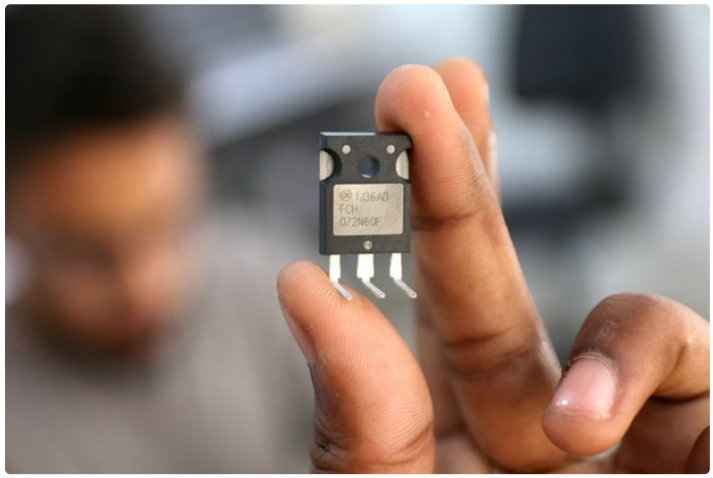
Step 5: Assembling the PCB

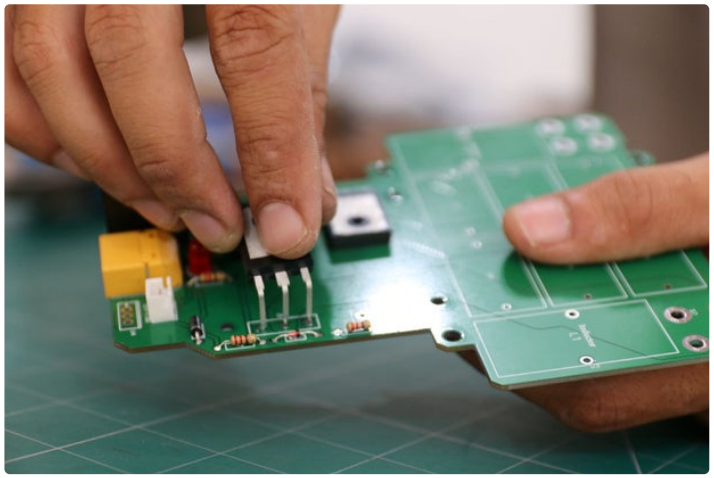
As expected the PCBs arrived within a week and the finish is just too good. The quality of the PCBs is absolutely flawless. Now time to gather all the components as mentioned in the BOM(Bill of Material) and drop them in place.

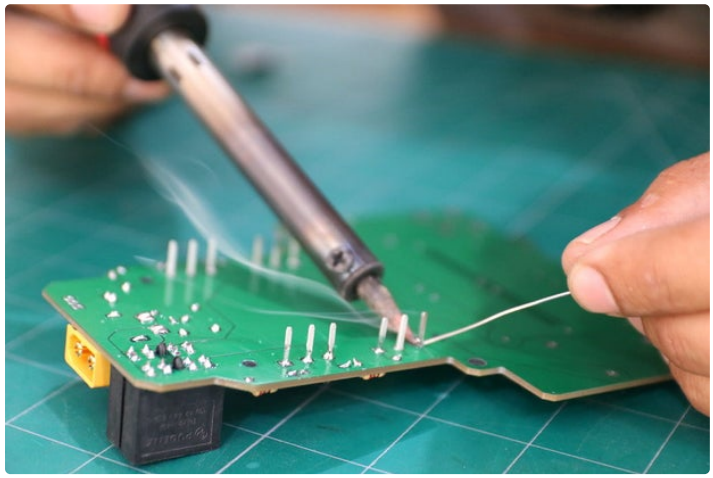
To keep things flowing we need to start with the smallest component on the PCB which is some resistors, diodes and some connectors. After soldering these components we have to move towards larger components. And then we have bend the Mosfets legs and soldered it on the board.

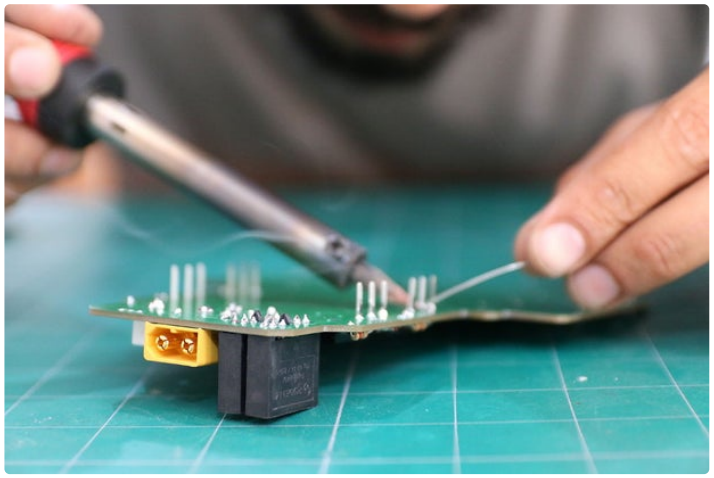






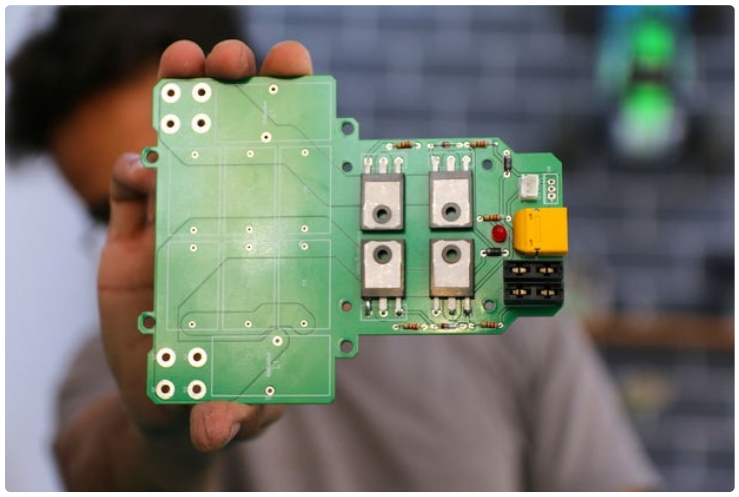









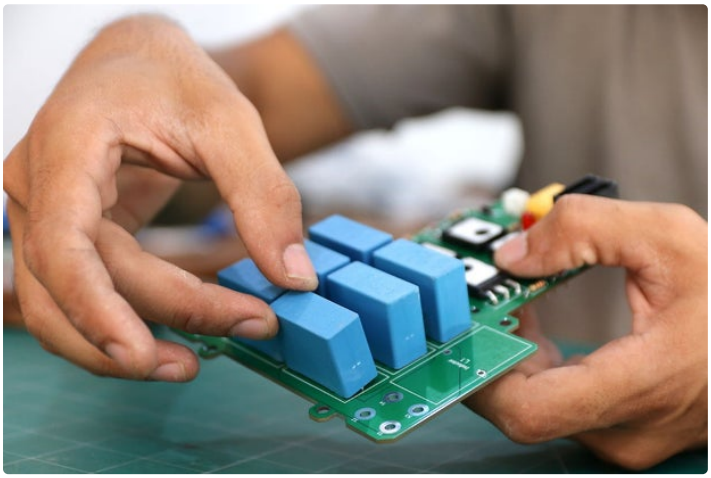
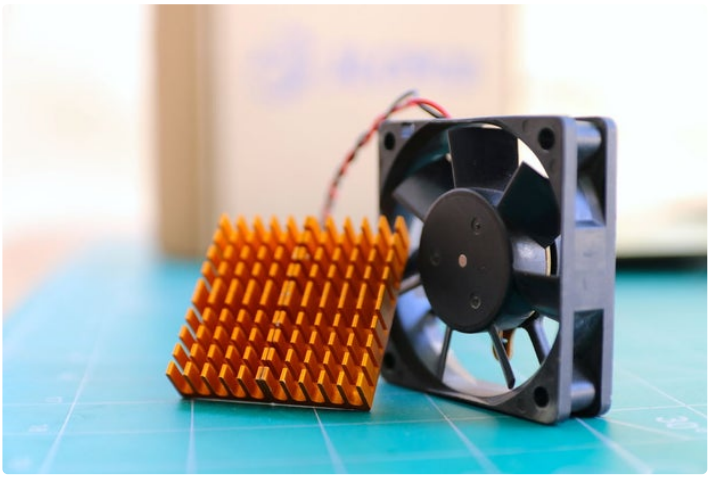
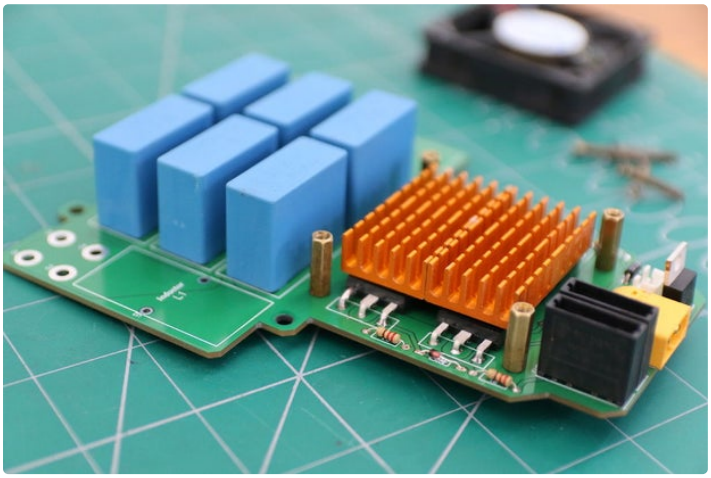
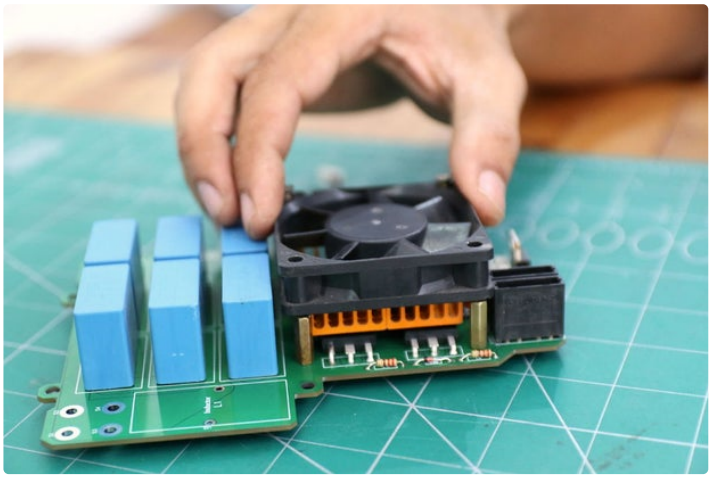
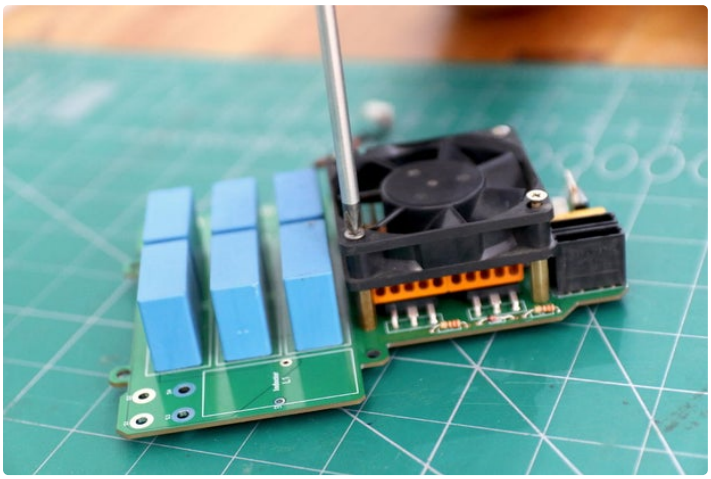
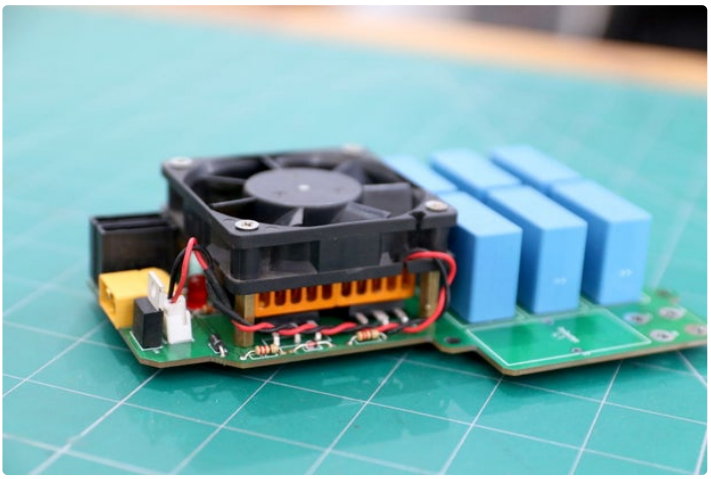
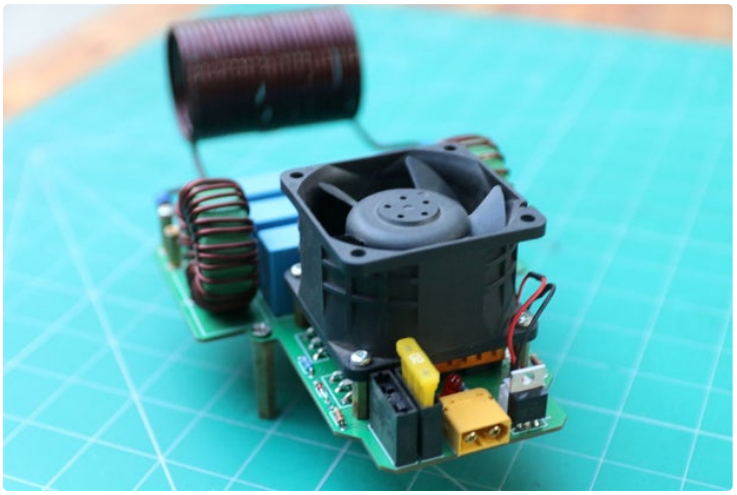




Step 6: Attaching Capacitors and Cooling Fan

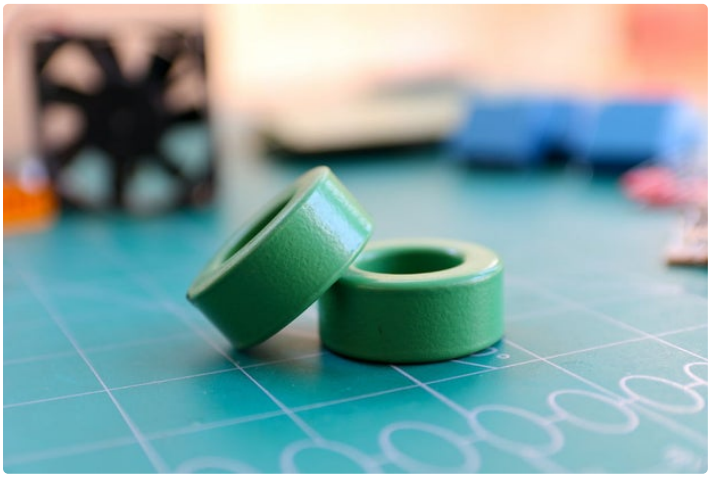
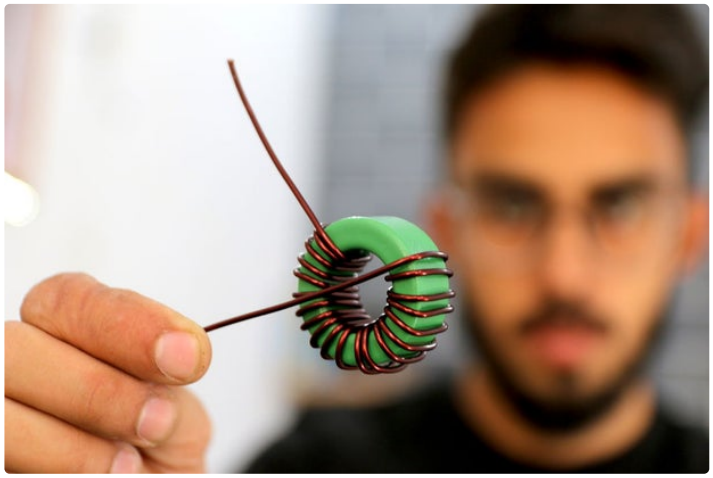
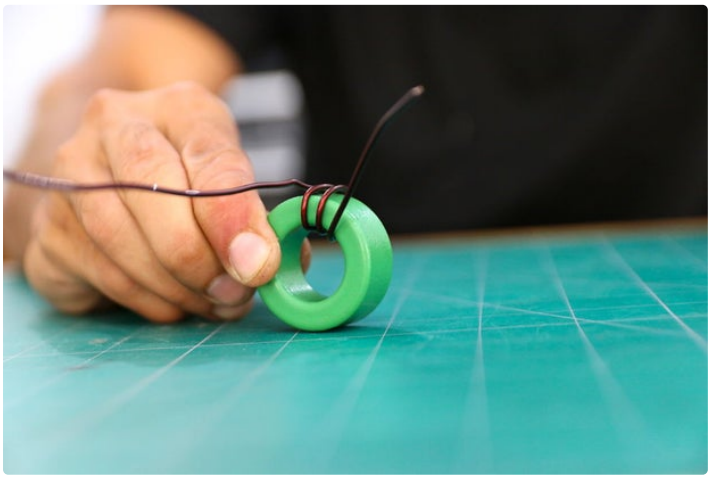
After that we have placed the capacitor on the boards. In order to cool down the MOSFETs we have placed the 12v dc fan with the heat sink sandwich in between.

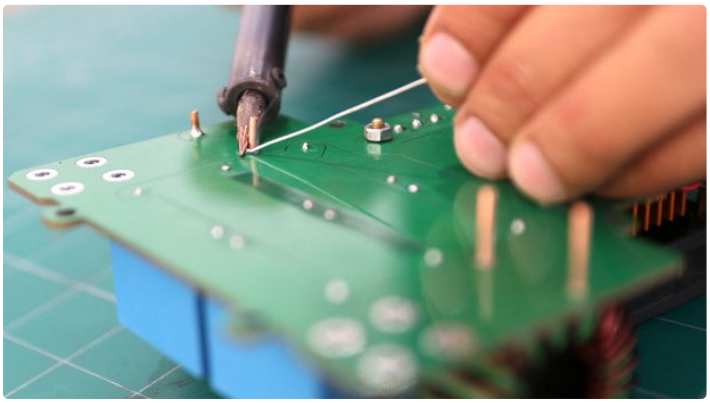
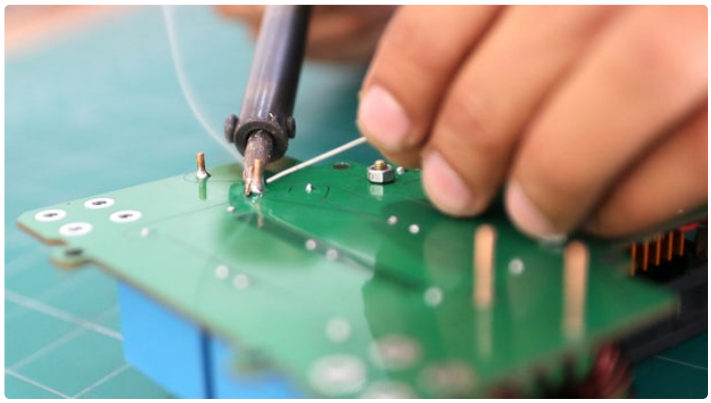
But after that we have realized that this fan is not enough powerful so we have replaced it by some bigger one.

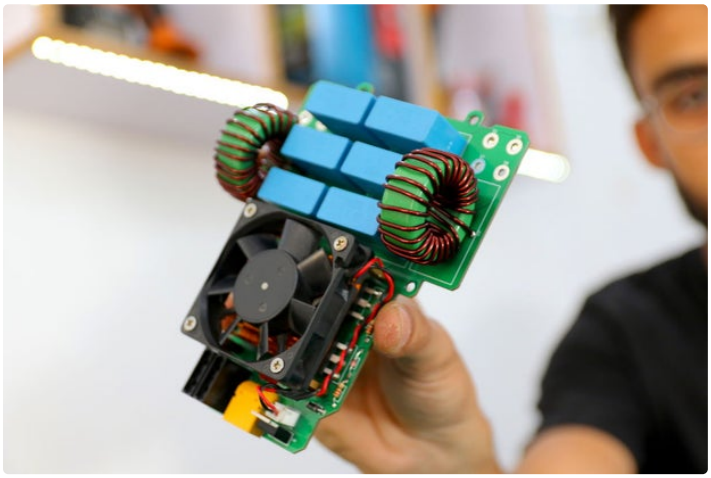








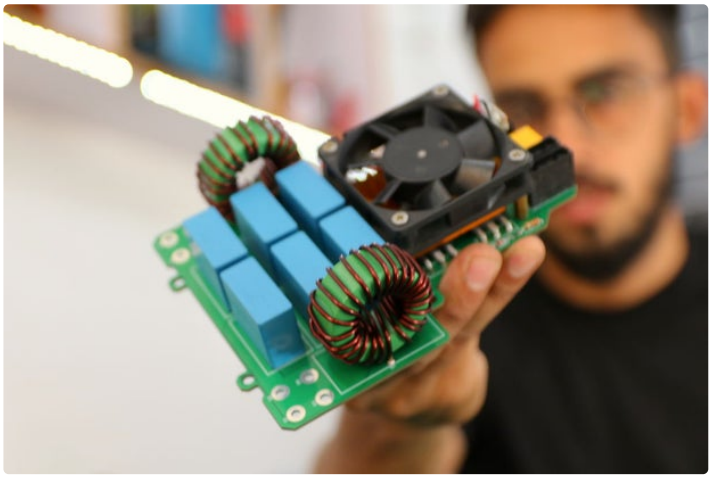
Step 7: Making the Inductors

For tank circuit we have use 24mm ferrite core and 16 AWG enamel copper wire. We have wind 22 turns on the each ferrite core in order to get suitable frequency. And then soldered it on the boards.

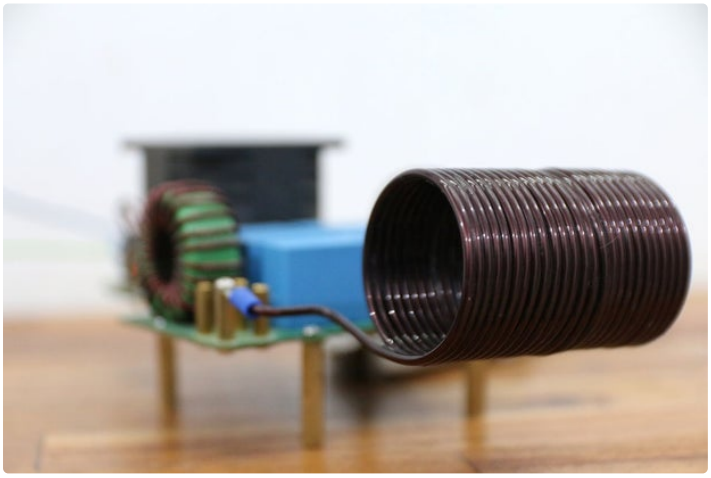



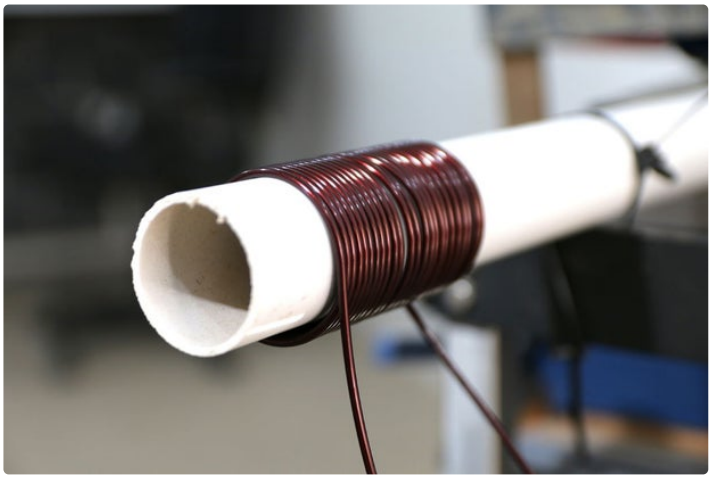


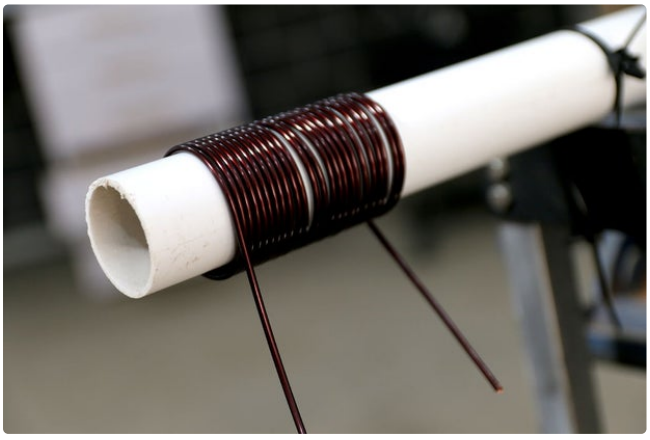


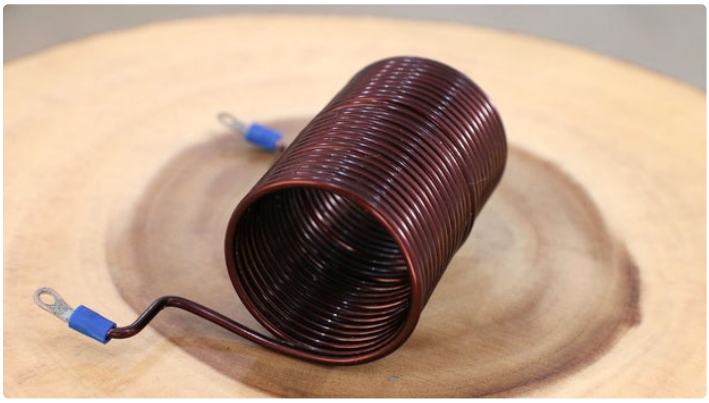
Step 8: Induction Coil

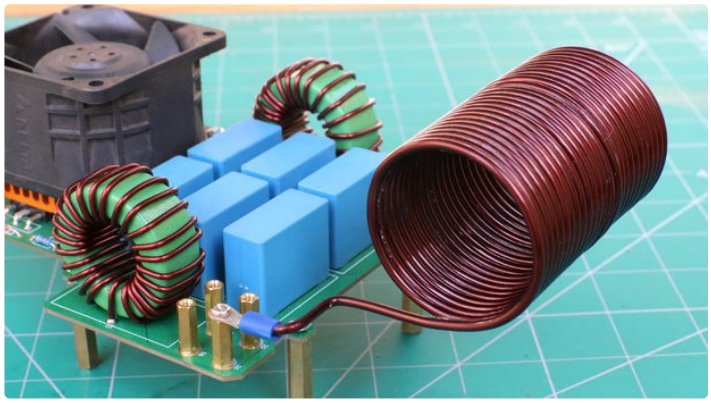
After placing the inductors its time to make the induction coil and for that we have used 12 AWG enamel copper wire. First we have straitened the wire and then wind it on the PVC pipe in order to get the perfect shape. And screwed it on the terminals.

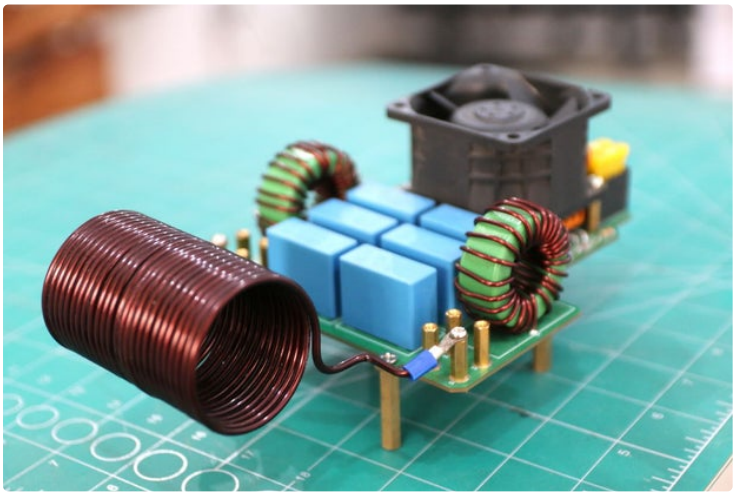












Step 9: Final Results

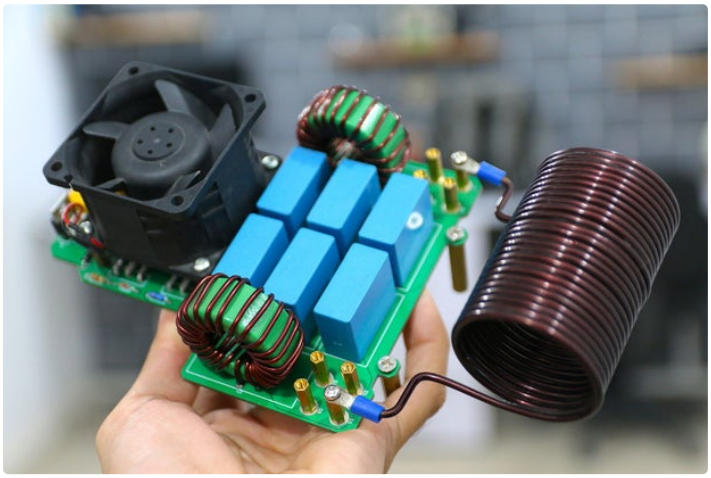
This induction heater performed like a champ. From a metal ruller to a half inch thick rod, it took not more than a couple of seconds to heat it red hot.

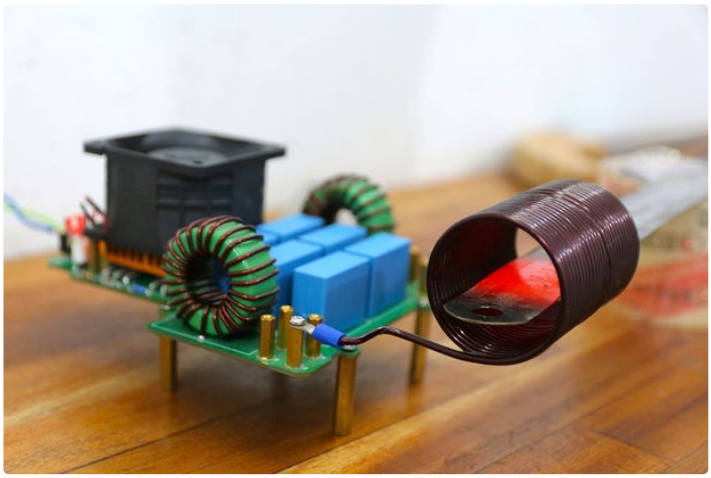
The heater can work inbetween 12v to 36vDC and can handle surges of upto 2000 watts which is a suffient amount of energy to handle large objects.

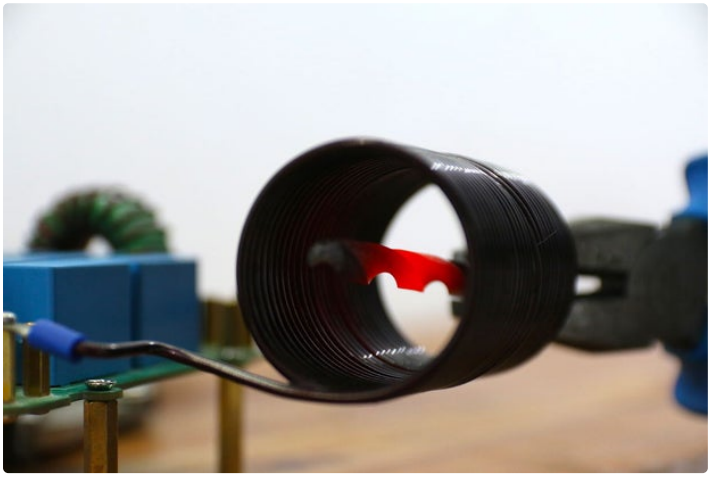
Drop down your thoughts in the comments section below.

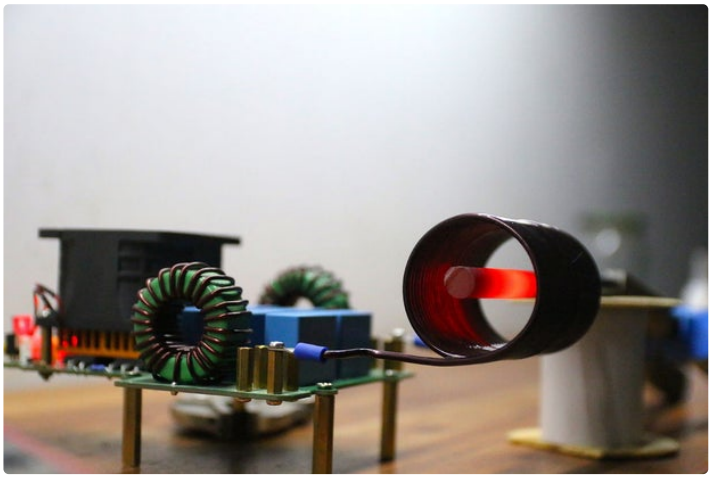
Regards,

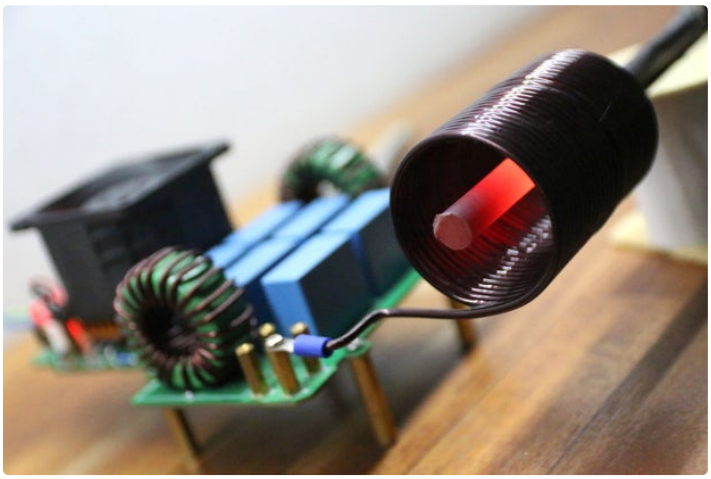
DIY King

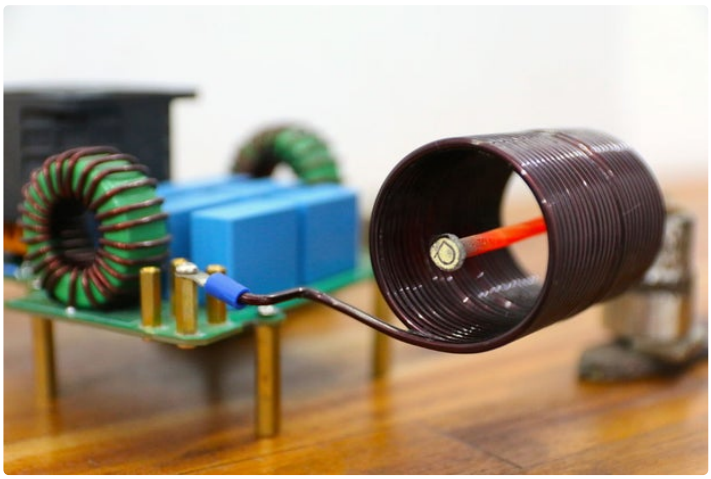


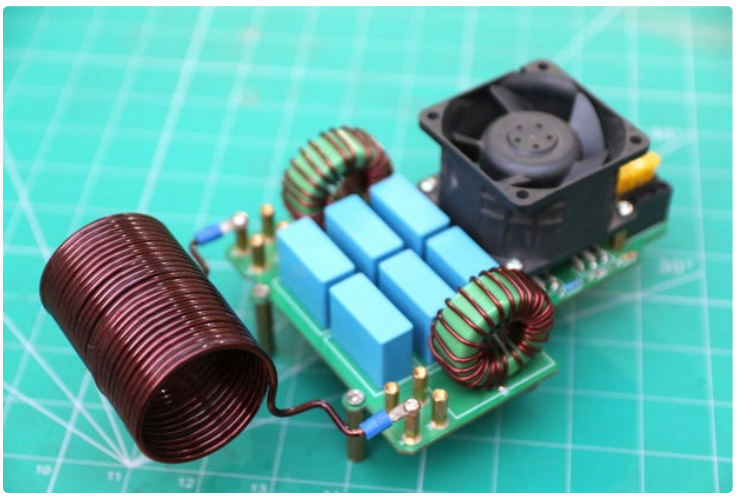










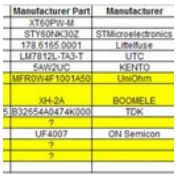


This looks more like an advertizement for JLCPCB than an Instructable? A super-vague component list and very detailed instructions on hot use the JLCPCB website. This should be titled "How to go to the JLCPCB and order a customized board." Looked interesting, but ended up being of little use unless I wanted to get "customized" circuit boards.

Sorry guys the link for the gerber files and the documents for the PCBs and components is updated in the step 4 (Ordering the PCB).

Sorry guys the link for the gerber files and the documents for the PCBs and components is updated in the step 4 (Ordering the PCB).

Hi dear sir
i am zein from horizon
would you please answer me on the questions related to the 2000 w induction heater please?
you can find my questions by oppening the attached photo.
i will be appreciated for help.
thanks for help in advance. ZEIN



Manufacturer Part	Manufacturer
XT60PW-M	
STY60NK30Z	STMicroelectronics
178.6165.0001	Littelfuse
LM7812L-TA3-T	UTC
5AW2UC	KENTO
MFR0W4F1001A50	UniOhm
XH-2A	BOOMELE
B32654A0474K000	TDK
?	
UF4007	ON Semicon
?	
?	

U1, U2 ==> I1 AND I2: USE 300uH;
However remember, you also need to have a DC power supply that can supply the current for this.
25V at 80 Amps.
Better settle for a lower power like 1 KW 24V at 40 Amps.
Also take into consideration the comments above from:

RomasP

7 hours ago

Sorry but this is very bad implementation of ZVS drive. I do not recommend to do this. LM7812 absolute maximum input voltage 35V, no way to use 36V supply. With resistor 220 ohm LED will blow at any moment (current over 40 mA at 12V from 7812). Zeners must be powerful and at least for 10 -12 V, not like these 0.4W 6.2V. At 12-15 V supply this

"device" can work some time, not in very good regime, but this is waste
of good transistors. Please change elements according almost any normal
ZVS drive schematic on internet

LM7812 any manufacturer should be fine.
5MM LED - Yes, any LED that has a forward current of 20ma (50 ma max) should be fine.
220 - You are right, the designation shows a 1/4 watt 1K resistor, not 220 ??? Author?
XH-2H - Yes, that is a connector for the fan. I would use a high CFM fan like
Sanyo Denki 9GA0412P3J01
Standoff (for electrical coil) this from Mouser should work:
https://www.mouser.com/ProductDetail/Keystone-Electronics/24408?
qs=sGAEpiMZZMtrde5aJd3qw%252BllydFDFR6guiPEgGSZiiE%3D
1N821A should be fine. It just has lower impedance than the 1N821 (10 compared to 15)
U2, U3 should be L1, L2 for sure. Mouser part 871-B64290L0659X035 should work fine. He shows how to wind them.

I may be able to help with some of your questions. (numbers from picture)

4) any 12 volt regulator should work. It is only driving the fan and LED, so just make sure it can handle the amps your fan requires.
5) The LED is only to show the unit is on, so any kind of LED would work.
6) Not sure the values of the resistors - Seems like 1k ohm would be better. I say this because the resistor in series with the LED (at 12 volts) would need to be higher than 220 ohms, more like the 1k ohm range. I would bet it is supposed to be 1k.
7) any fan will work. Just make sure it is big enough (if stuff starts getting too hot, smelling bad or letting smoke out, its not big enough) and you can hook it to 12 volts and make it work.
9) These are standard standoffs, meant to support PCBs above a base. They are being used here as connectors, not their intended purpose. They are metal and tall enough that you can connect the thick wire to easily. The exact measurements are not needed. Use what you can find, or use a different type of connector that you are familiar with that can handle large amperage.
11) 1N821 vs 1N821A - they are the same zener diode, only the "A" version is 10 ohms where the no-A version is 15. Either should work, I would think.
12) Not sure, I didn't catch what henrys the inductor was.
13) The exact size and composition of the PCB doesn't affect how the device works. I would go for the cheapest option. Choose what is prettiest to you. Or make your own (that's what I do). Or use perf board. Or drill holes in thin plywood and then wire components up manually with wire under the plywood. Or plexiglass.

Hope this helps.

Very useful project. Can I buy one assembled?

yes. you can get them very cheap on ebay ranging from 120 Watts to 1KW.

Sorry but this is very bad implementation of ZVS drive. I do not recommend to do this. LM7812 absolute maximum input voltage 35V, no way to use 36V supply. With resistor 220 ohm LED will blow at any moment (current over 40 mA at 12V from 7812). Zeners must be powerful and at least for 10 -12 V, not like these 0.4W 6.2V. At 12-15 V supply this "device" can work some time, not in very good regime, but this is waste of good transistors. Please change elements according almost any normal ZVS drive schematic on internet

It looks very useful!, thanks for sharing. I've two questions:
1) what kind of power supply does it need? (I readed 12-36V, but how many amperes?)
2) what's (more or less) is the cost of the project?
Thank you

Thanks for your shared. But I would like to ask, how does it work? Where the Freq generator for MOSFET?

As the article says in its first sentence, this is a LC oscillator and the frecuency (if not posted) can be calculated from the hand wound inductors and the capacitors in the Bill of Materials. I estimate that the frequency is in the high kilo-Hertz (kHz) range.

For those who may think of it, this is how induction cooktops work. I have a Sears unit with four elements and the entire unit only consumes 2kW (the same as this Instructable), so if you wire the inductor coil in a flat circular spiral format (use special shellac to keep the wires stuck together) you can create a similar inductive cooktop unit. My wife loves the cooktop, and it has a black glass cover, so all spills are easy to clean up. The only limitation is that the cooking utensil must be "Induction Type" and most modern utensils have an icon of a spiral coil underneath that identifies the use on an induction cooktop. Steel and iron are the most common materials, but some aluminum items have a steel core that allows induction to heat it up. Or else, buy a flat iron plate and heat that to cook with other non-inductive types on it, such as glass and copper.

Inductive cooking is as fast as gas, and safer than gas or regular electric, since only the utensil gets hot. If powered on with no utensils it will not create heat so it is safer for small children, too.

I may be naive but I figure that the power supply would have to deliver abouy 50 amps @ 36 volts. Please tell me I am incorrect!

Due to some disability issues, I dont believe I'd be able to make that...I am interested in buying a finished o mostly finished product from you.

Nice project, have you plans to sell a kit or finished product? I know guys in who make knifes could possibly be interested.