

Input: 12V @ 500ma

Output: 2000V or Higher.

For those of you who need some way of charging large capacitors but don't like the idea of messing around with mains current, then this is a great alternative.

This circuit gives a simple way to charge large capacitor banks to high voltages. It incorporates a few simple components and a transformer. The transformer can either be purchased or built. I would recommend building a transformer to fit your specific needs. Because of the simplicity of this circuit, the transformer is the main variable when predicting voltage/current output. Here is a quick run through of how the circuit works.

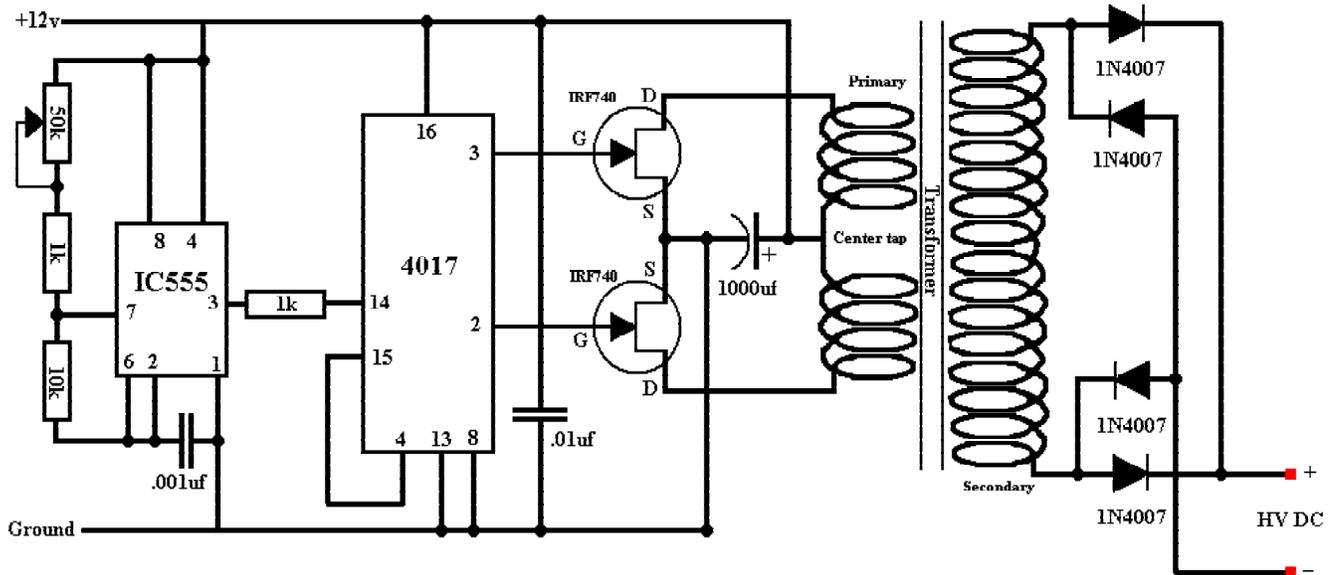
The 555 timer circuit acts as a pulse generator. Frequency is adjustable by R1 from 2kHz-100kHz. These pulses enter the decade counter at its input. Which then outputs two pulse trains from its two outputs. The two outputs drive the two power MOSFETS. These MOSFETS switch the primary side of the transformer on/off with great force, which induces a high voltage on the secondary winding. The last part of the circuit is the bridge rectifier. Quite simply, it converts the +/- swings of the AC voltage to pulsed DC.

Parts:

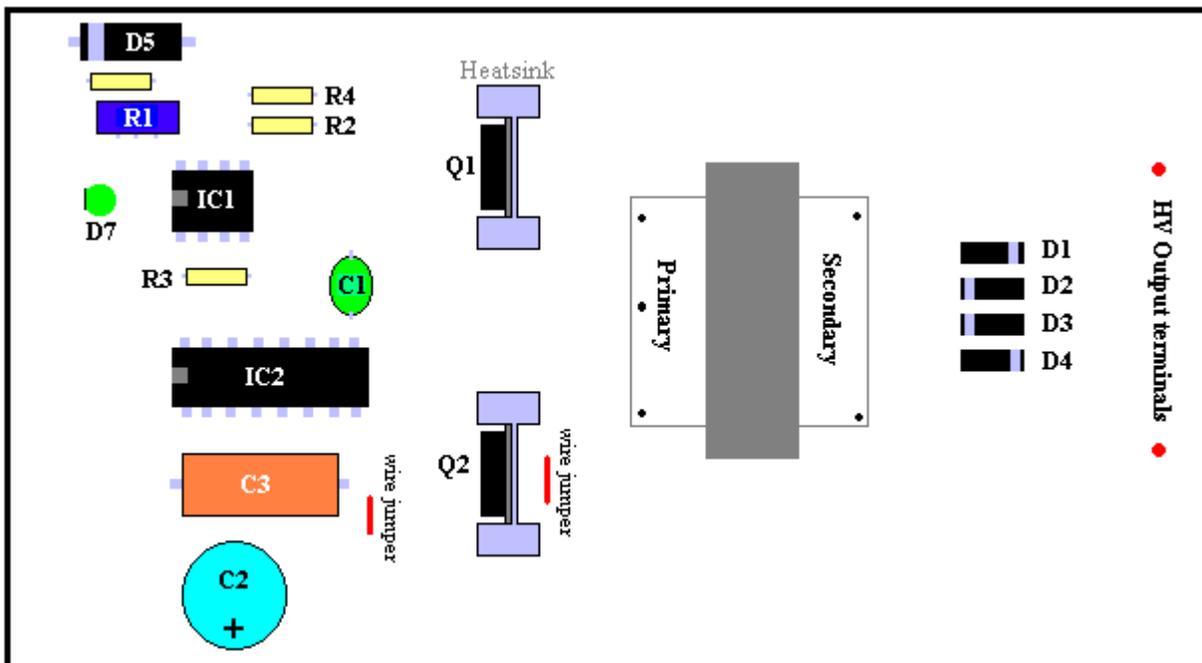
IC1	NE555 timer IC	8pin Dip
IC2	CMOS 4017 Decade counter	16 pin Dip (rated for 15v)
D1-4	1N4007	1,000V 1A general purpose Diode
D5	1N5821	
D7	Color LED	
R1	50k pot	
R2,R3,R5	1k ohm	.25 watt
R4	10k ohm	.25 watt
C1	1 nf capacitor	
C2	1000 uf Electrolytic capacitor	
C3	0.1uf Capacitor	
Q1, Q2	IRF740	N channel MOSFET 400V 10A
T1	Ferrite E-Core transformer set with bobbin.	
T1	6 feet of 28 AWG magnet wire	(Primary)
T1	1 (4oz) spool of 32 AWG magnet wire	(Secondary)
Board	1 4"x 6" one side copper plated circuit board	
	Etchant of some kind	

Schematic

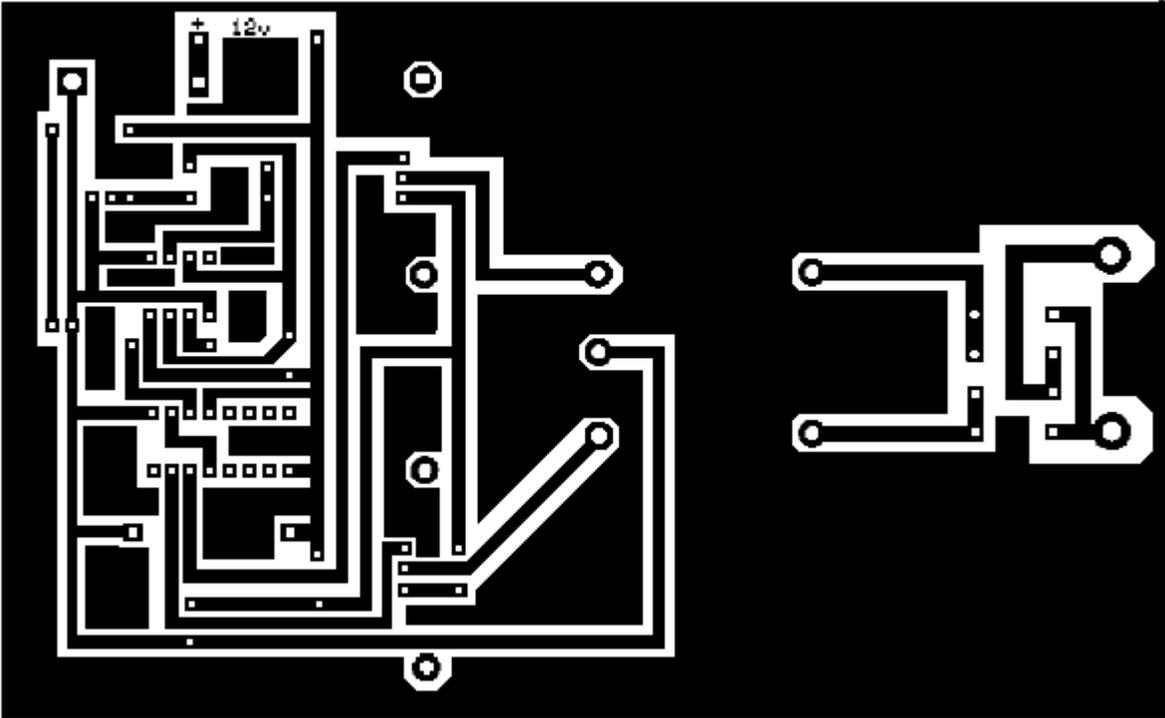
TRANSFORMER CHARGER CIRCUIT



Layout

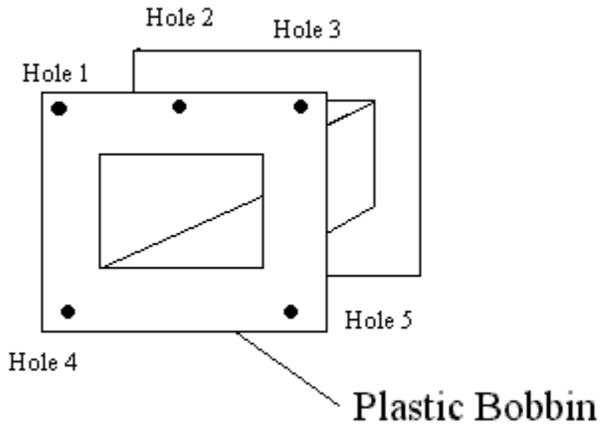


PCB

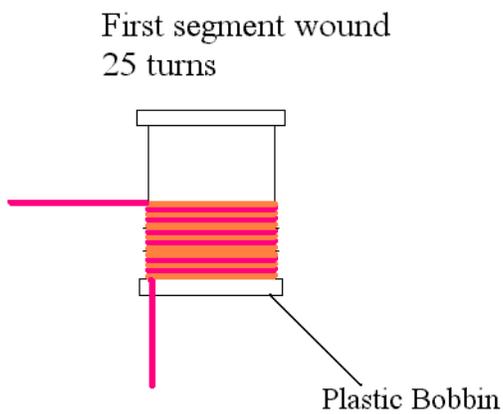


Transformer construction:

STEP 1: Drill 5 holes into E-core plastic bobbin. These holes are for the magnet wire.

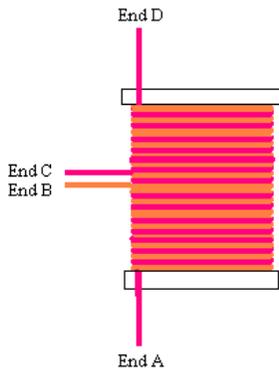


STEP 2: Cut two, 3 foot pieces of the 26awg magnet wire. Start with one 3' segment, insert one end through hole #1(have about 1" of wire sticking through) and wind 25 turns onto the bobbin starting from the bottom up. This should cover half of the bobbin.

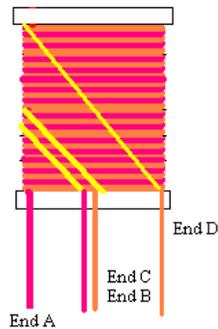


STEP 3: With the other 3' piece of 26awg wire wind another 25 turns starting where the first segment stopped. (middle of the bobbin). Now you should have 50 turns/1 layer of coils on the bobbin.

50 TURNS/ONE LAYER, CENTER TAPPED.



STEP 3

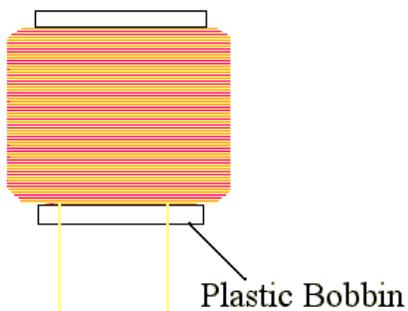


STEP 4

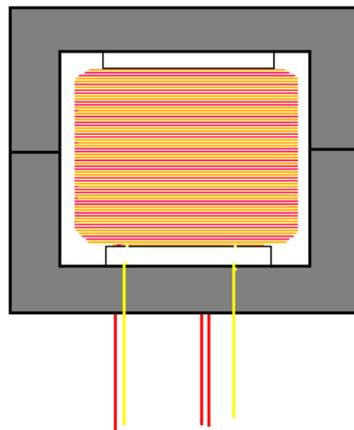
STEP 4: Arrange the wire segments onto the bobbin. End A goes through hole 1. End B and C both go into hole 2, and End D goes into hole 3.

Now, its time to wind the primary side. Place the end of the 32 AWG magnet wire (from the spool) through hole 4. Start winding from the bottom of the bobbin up. Wind 2000 turns, once finished place the cut end of the wire through hole 5. 2000 turns is a lot to do by hand. Rig an attachment to slide the bobbin onto and stick the whole thing into a drill. Make sure your spool of wire is able to spin freely. I just stick mine onto a peg.

Secondary complete
2000 turns

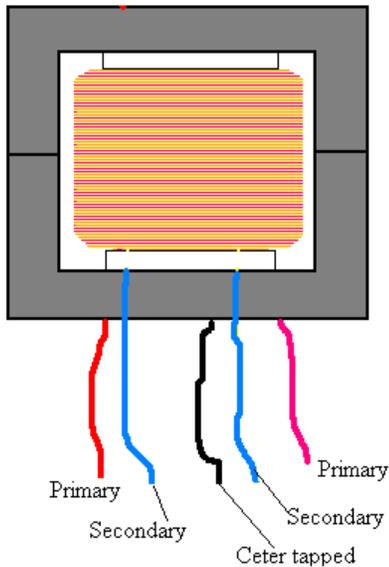


Ferrite E-cores in place



Now slide the E-cores in place. I use a little bit of super glue to hold them together.

Using sandpaper remove the lamination from the ends of the magnet wire. Should be shiny copper. Solder Ends B and C together. Solder some sort of hookup wire to all the ends now. Obviously you only need one wire for B and C.



Test the whole thing with an ohmmeter. Readings should be in the ballpark of:

Primary to C.T. - .8 ohms

Primary to Primary- 1.6 ohms

Secondary to Secondary 150 ohms

That's it! You're done.

Construction notes:

Depending on the gauge of your wire in the secondary and how many turns you have, you might need to break up the secondary into isolated layers. Every 500 turns stop and rap the coils in a small piece of clear Scotch tape to insulate it. I had no trouble with shorting when I built the 50/2000 turn transformer as described above. I did have trouble when I bumped the secondary winding count to 3000 turns to gain higher output voltage, the transformer started arcing and making horrible noises. These problems were fixed with layer isolation.

Make sure the 4017 you choose is rated for 12V or higher. You will fry the 5V chip. NTE makes a good decade counter.

My PCB software is not really available. Therefore I had to make the PCB in a simple graphics program. I have another version in Express PCB (old version) which is better quality. I am going to up load a new version of this PCB soon.

If you have any questions my user name is WilliamN