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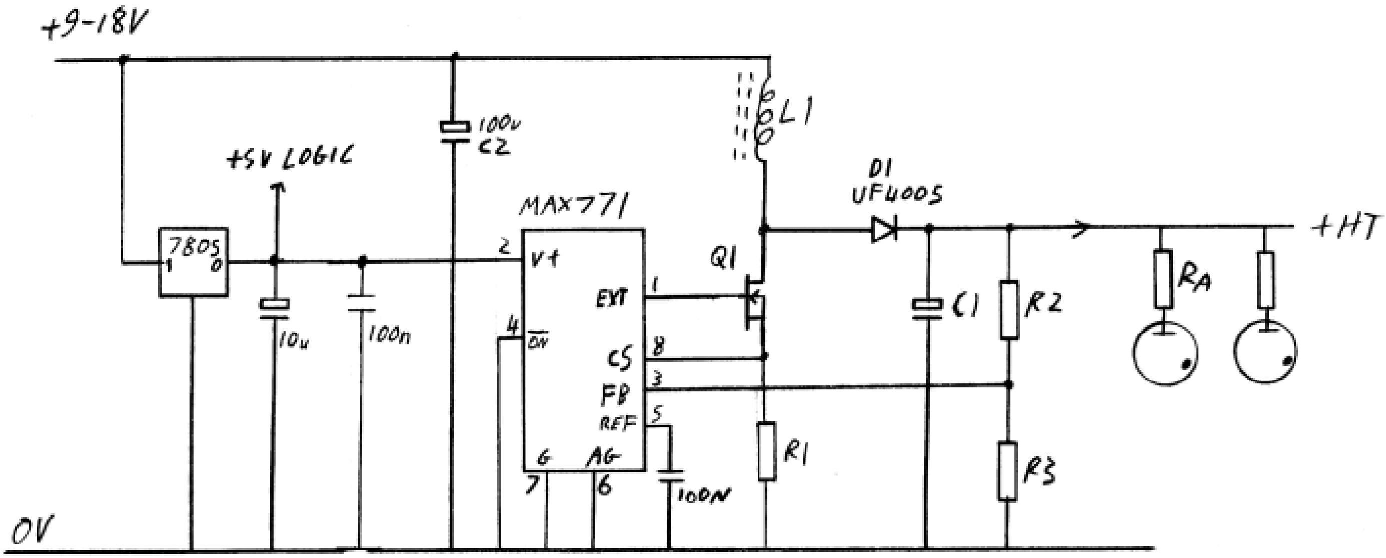
Nixie power supply



This circuit provides a comparatively safe way of powering nixies from a DC supply.

R1 sets the maximum output power, and the value will depend on the inductor and the input voltage. Value will typically be from 0.1 to 2.2 ohms. Start at 1 ohm and reduce until the output voltage is maintained with all tubes on. (The easiest way to experiment with values this low is by paralleling 1 ohm resistors. You must solder them - breadboards will have too much contact resistance). Keep an eye on the input current consumption - if you see the off-load power draw rise significantly with no corresponding increase in output voltage, the inductor may be saturating, in which case you need a physically larger inductor.

R2 and R3 set the output voltage - 180 to 200 volts should normally be sufficient. As the supply is regulated, there is no need to use high-value anode resistors and high supply voltages to get even brightness. Keeping the voltage low reduces power consumption, and reduces the required inductor size.
Using 10K for R3, R2 is given by R2= (6.7 * Vout) Kohms. 1.2M gives 180V. (The complete formula is R2 = R1 x (Vout/1.5), give or take a volt or so). It is recommended that you use two series resistors of similar value for R2 to reduce the possibility of long-term drift due to the high voltage, and this also makes it easier to fine-adjust the voltage with standard resistor values.

Select the Anode resistors (RA) to get the required tube current as recommeded in the tube data sheet (typically 2-3mA). For a 180VDC supply, a typical value is in the range of 22-47K. You can easily measure the tube current by measuring the voltage across the anode resistor - the current in milliamps is the the voltage across the resistor divided by the resistance in Kohms.

L1 is typically 220 microhenries, although the physical size, DC resistance and current rating is more important than the exact inductance, and values from 100 to 470uH will normally work OK, depending on the supply voltage and required output voltage and current. DC resistance should be less than 1 ohm. For example Toko 8RHB series, Panasonic ELC series. Suitable coils are typically wound on small ferrite bobbins about 6-10mm diameter by 5-8mm high - you may be able to salvage something

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suitable from scrap equipment - they are often used as output filters in switchmode power supplies. They are often marked with a 3 digit code representing microhenries, the last digit being the number of zeros, like the resistor colour code, e.g. 221 is 220uH. Small Axial-leaded RF chokes will usually not be suitable due to insufficient current capacity.

Q1 is a high-voltage (Vds>300V) MOSFET, with a gate threshold voltage Vg(th) below 4V. I used an IRF830. It should not require heatsinking (if it gets hot there is something wrong!).

D1 can be any fast-recovery diode with a suitable voltage rating (300V minimum). 1N4148, 1N914 and 1N400x series parts are NOT suitable. UF400x series parts are usually the cheapest suitable fast diodes. Use a diode rated for at least 1 amp - although smaller ones will usually work, they tend to die after even a momantary output short.

C1 will typically be around 2.2 or 4.7uF, 250VDC Larger values may be needed for stability with higher output loads.
C2 should be a low-ESR, high-frequency type.

Due to the high output voltage, the normal method of powering the MAX771 shown in the data sheet cannot be used. As the system will almost always have a 5v logic supply, this is used to power the MAX771. A 7805 is shown above - you may be able to use the smaller 78L05 depending on the total power draw from the 5v supply and the input voltage.

Pin 4 of the MAX771 can be used for on/off control if required - taking it high (+5V) will disable the HT supply.

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