Switching power supply on the **555** chip

For powering nixie tubes and electron tubes

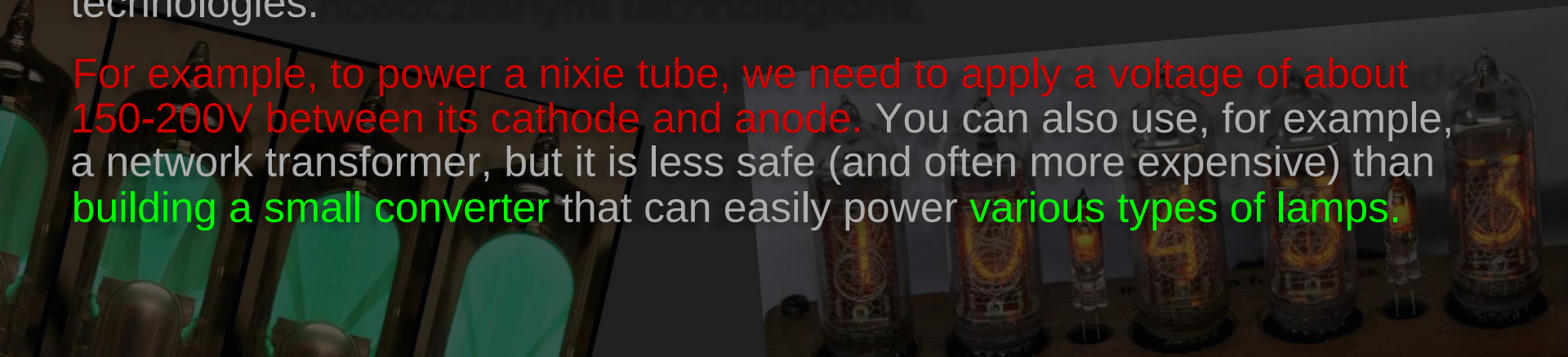
Robert Piotrowski 4AP
www.piotrowsky.dev

Introduction - why do we need a converter?

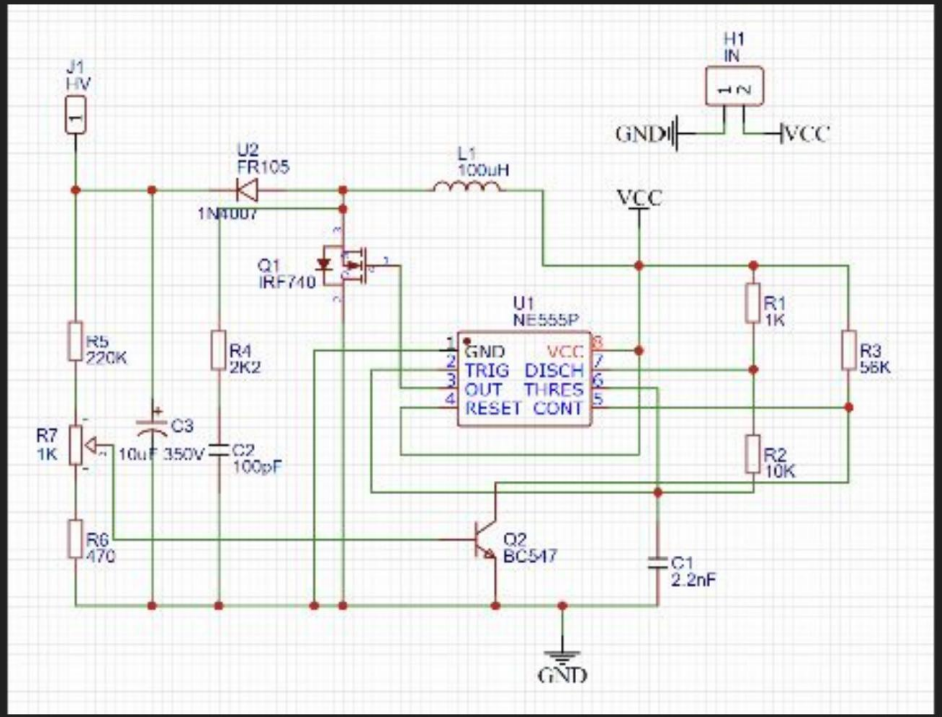
"Last century" technology often runs on high voltages, particularly vacuum tubes - some need several hundred volts to operate.

Although the vacuum tubes have been replaced by transistors, the unique design of tubes displaying cyras, nixies or changing the filling of the indicator ("may eye") is difficult to replace with modern technologies.

For example, to power a nixie tube, we need to apply a voltage of about 150-200V between its cathode and anode. You can also use, for example, a network transformer, but it is less safe (and often more expensive) than building a small converter that can easily power various types of lamps.



Schematic and description of the NE555 converter



The very popular 555 timer, whose period and duty cycle is controlled by the capacitor C1 and the resistors R1, R2, generates a square wave given to MOSFET Q1.

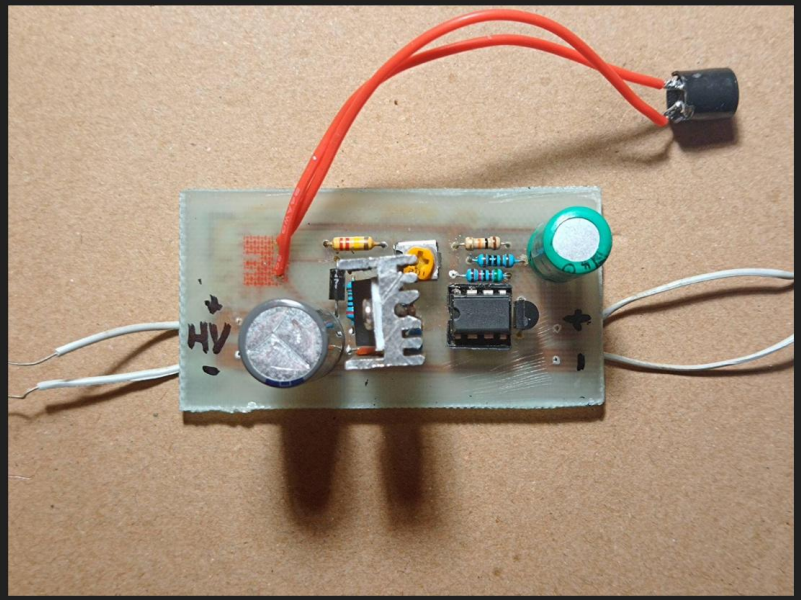
The attached moset connects the coil (or transformer) L1 to the supply voltage, and then disconnects it when the state is low. This induces a voltage in the coil, which charges the capacitor C3 through a fast diode, and we get a higher voltage at the output (J1) .

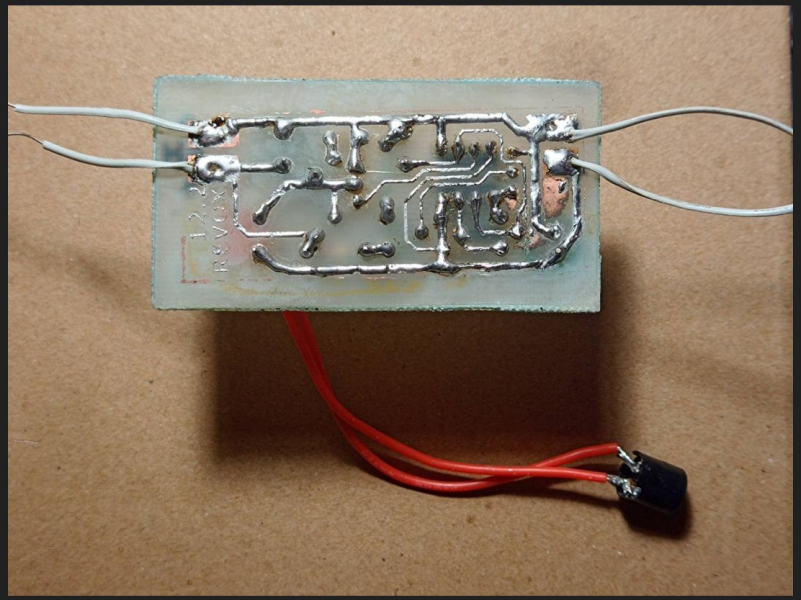
The system is additionally stabilized by the Q2 transistor controlling the 555 control pin. The voltage divider R5, R7 (potentiometer), R6 applied to the Q2 base allows you to set the desired output voltage.

Implementation of the converter I

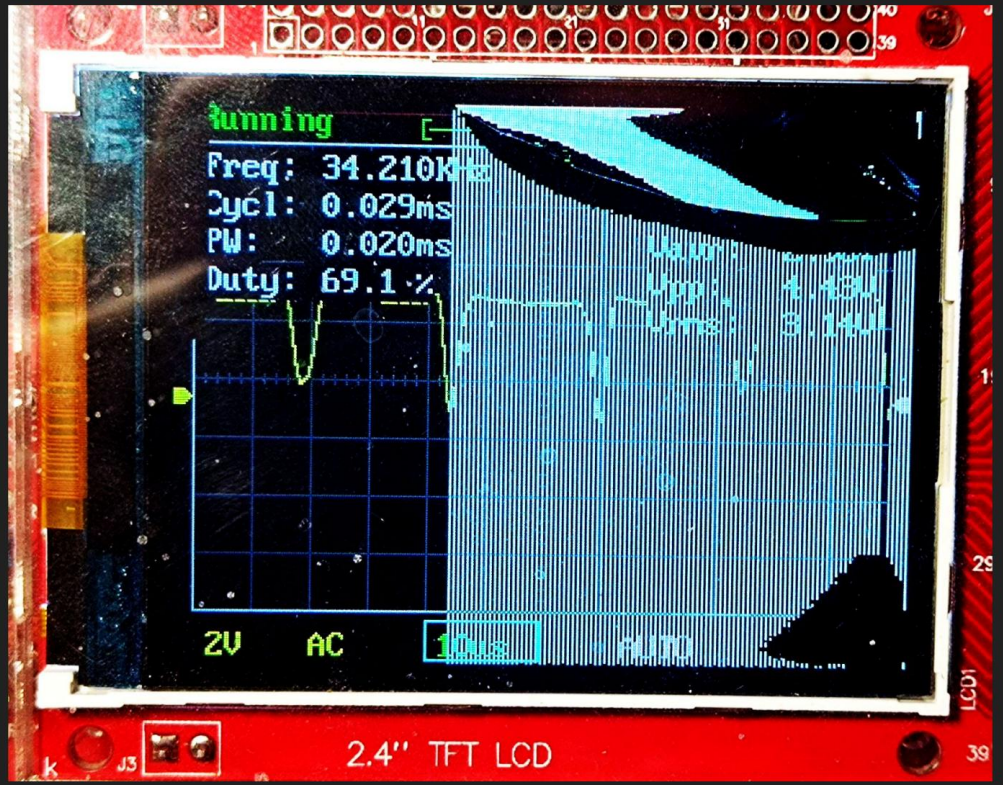
made this board in December 2022 using the thermal transfer method.

The laminate was not cleaned properly, so it didn't come out perfect, but it does the job.





output waveform



Ignoring the damage to the "toy" screen of the oscilloscope, you can clearly see the waveform that the 555 generates.

=ok. 30 kHz, load dependent High state means the MOSFET is on.

Practical use

I used this converter to power the "maic eye" 6E2 vacuum tube (EM84 replacement).

It requires anode voltages of about 250V (and 6.3V for filament).

Practical use cont

I made a practically identical circuit and used it to power the Nixie ÿÿ-14 tubes (IN-14 after "ours") in the clock.

They are multiplexed with transistors controlled by the ESP32 microprocessor and the time itself is downloaded from the Internet.

They need about 170V between cathode and anode to display cyra.