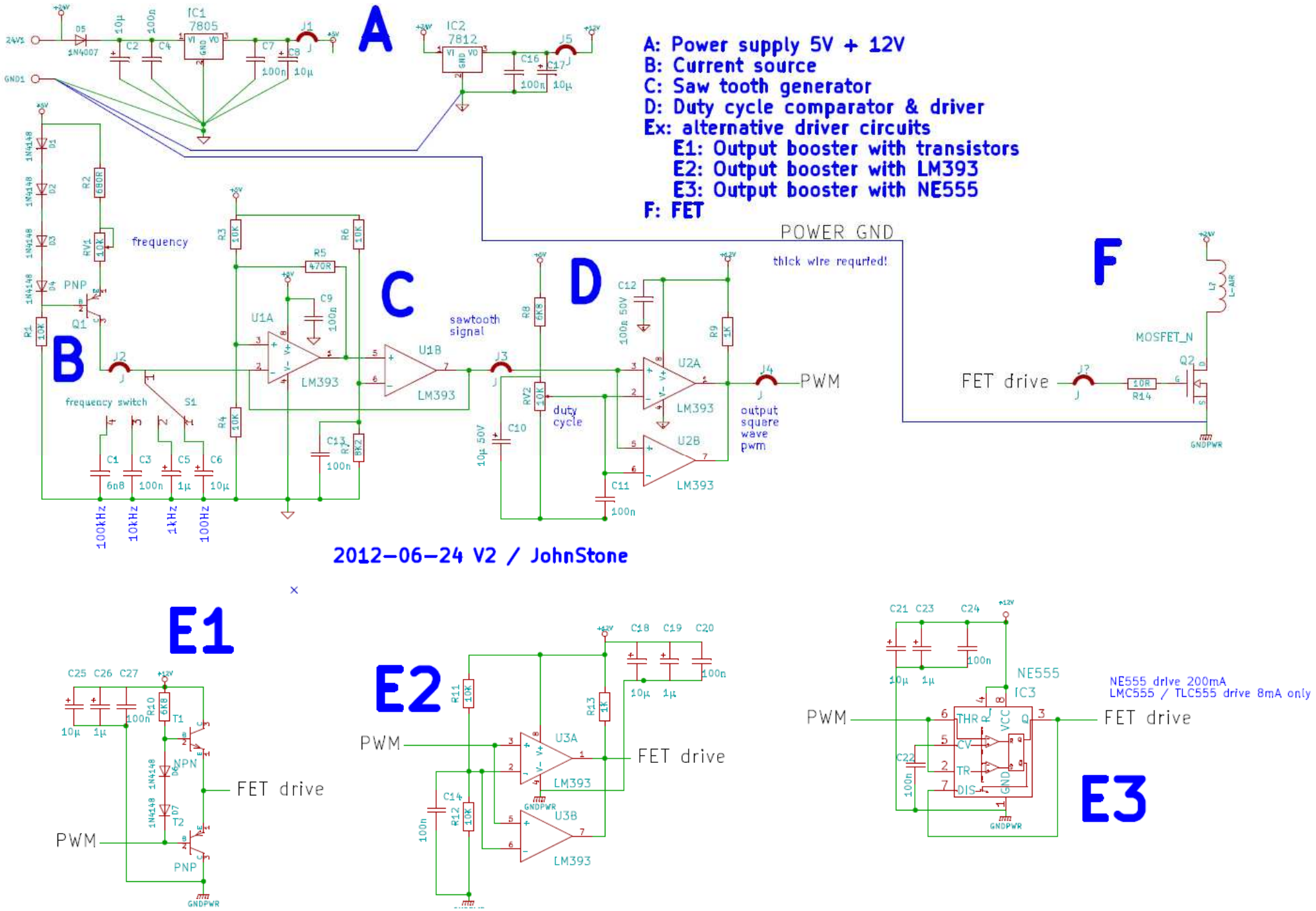
# PWM FET Driver (V2 2012-06-24)



# PWM FET Driver (V2 2012-06-24)

The circuit refers to the PWM generator posted 2012-06-16.

**Disclaimer:** This document is no 100% instructable and will not guarantee a failsafe construction of the circuits. Take it as suggestion and learning material. If you build these circuits you do it on your own risk. If you have already a working unit, do not modify it. Build a new one if you decide to follow these instructions.

## Modifications V1 vs. V2:

- The generator itself was NOT modified (section A…C)
- The generator is now unloaded from the task of direct driving any FETs.
- The section D is now a genuine generator output being supplied by 12V.
- Dedicated FET drivers were introduced instead (E1…E3).

## Fractioned circuit

Any circuit setup needs to be negotiated between low component count / apparent simplicity and good performance / mastering the circuit

Extremely saving of components will be necessary at high volume production only because auf cost savings. In practical prototype circuits some fractioned approach is advised. Thus the circuit was segmented conforming real functions in order to ease understanding, measurement and repair. The increase of components is moderate.

## FET Drivers

FETs contain a gate capacitance of about 1nF and therefore at every switching action it needs to be charged and discharged. The speed of charging action will be directly responsible for switching speed and low temperature operation.

Additionally there is an internal capacitance from drain to gate. At switch off time a step voltage increase at drain terminal will cause a short current pulse to the gate via the aforementioned capacitor. If the driver can't deal with this additional current some inconvenient and undefined switching states will arise.

Please understand that if you have a functioning unit at 12V coil drive there is no guarantee that it will do well at higher voltages if you made use of a poor driver.

Thus it is essential to spend some concern to the driver stage. The suggestions above negotiate between low cost / low effort and performance. It is no guarantee that it will function at all your setups but the probability is much more increased.

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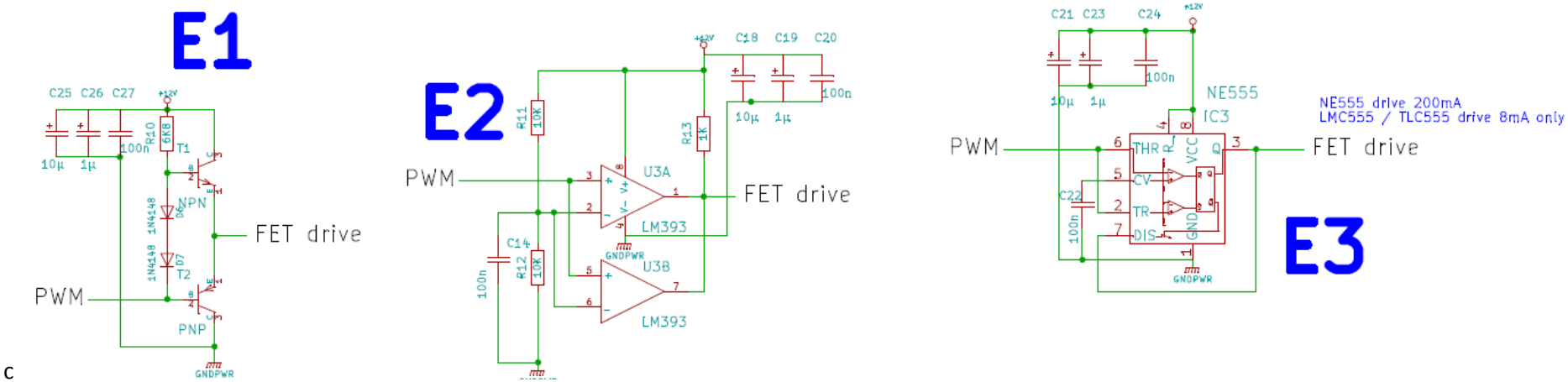
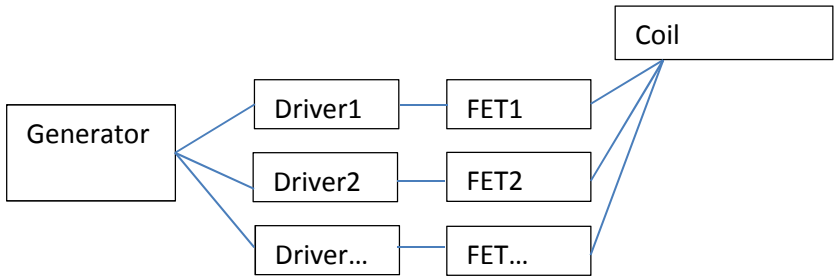



c

The driver with NE555 is simple to build and offers powerful driving capability -it is my favorite. Please understand that the CMOS type can drive about 8mA only vs. 200mA at NE555. But the CMOS type (LMC555, LMC555) is much faster so it could perform better at lower drive requirements. If you intend to try both please use an IC-socket.

It is recommended to build one FET drive first being tested at one or several FETs. But every additional FET will slow down the overall switching speed (adding gate capacitance) and require longer wires. If more current (i.e. more than 5A) is to be switched, please consider the possibility to add a dedicated driver to every FET or to a pair of FETs. The driver should be attached as close as possible to the FET and shall be referred to the GND of that individual FET.

Thus we get a highly scalable setup being at same time easy to repair.



## Inverted Drive:

Some of the drivers suggested perform with inverted signal. In this case please interchange the pins 3/5 with 2/6 at the device U2 (generator output). This measure will invert the generator output.

## Power Supply

It is a good reason to use different power supplies in order to surely prevent unwanted interactions.

- The generator runs out of stable 5V.
- The drivers run out of dedicated 12V. This voltage can drive almost all FETs available.
- The voltage applied to the coil and FETs can be any value tolerated by the FETs – several hundreds of volts if you want.

## Grounds

As there is no ideal conductor all wires perform as inductance, resistance and capacitance. While at DC level we deal with resistance only, the present circuit is sensible to the other 2 parameters.

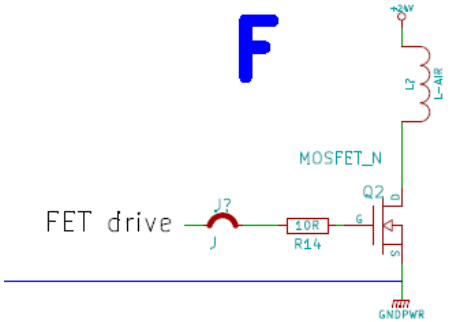
This is the reason why the grounds were processed in a very special way. For the power GND thick wires shall be applied. Keep all ground wires as short as possible – the more current the shorter!

The schematic above cares for this facts and gives hints how to generate nests of blocking capacitors (see drivers) and how to connect grounds regarding FETS, and voltage regulators.

## Gate resistor

FETs tend to oscillate after state changes for a while. This can be prevented by inserting a resistor between driver and gate. In this circuit 10 Ohm is suggested. Usually the real value needs to be measured.

Please understand that the insertion of this resistor is optional and is a final measure in order to prevent spurious oscillations. It cannot prevent oscillations originating from minor wiring and long wires.

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