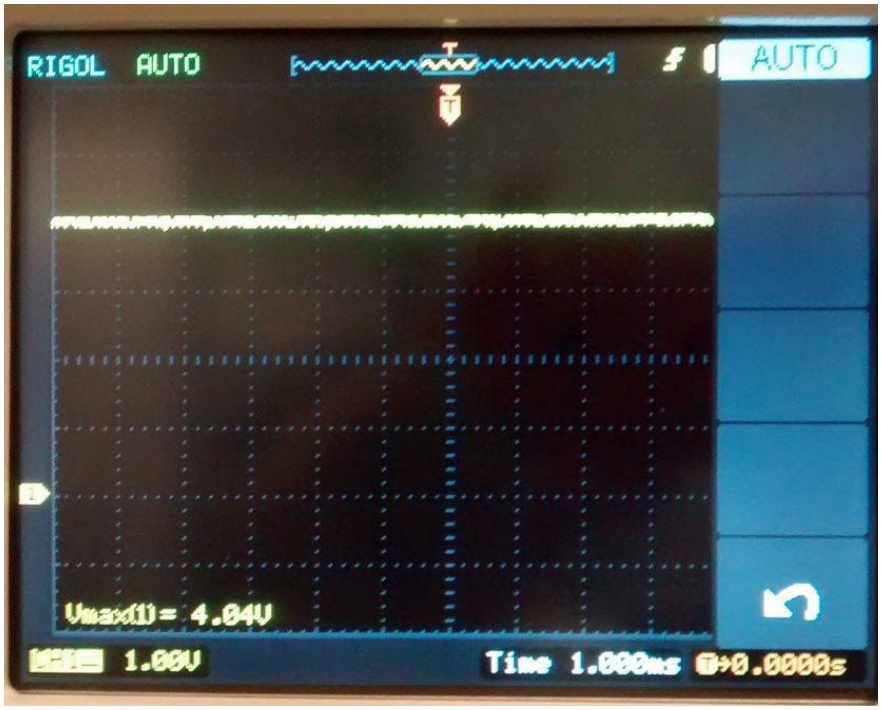
1. The voltage at flyback depends on the pwm signal. The longer the pwm is held open the larger the voltage is seen at the load. The diode helps dissipate the built up back emf that comes from the motor. It is hard to measure the voltage spikes caused by the motor since things are switching so fast. We do see that the diode does not seem to affect the signal much.

Motor running - with flyback diode: 1.36 v

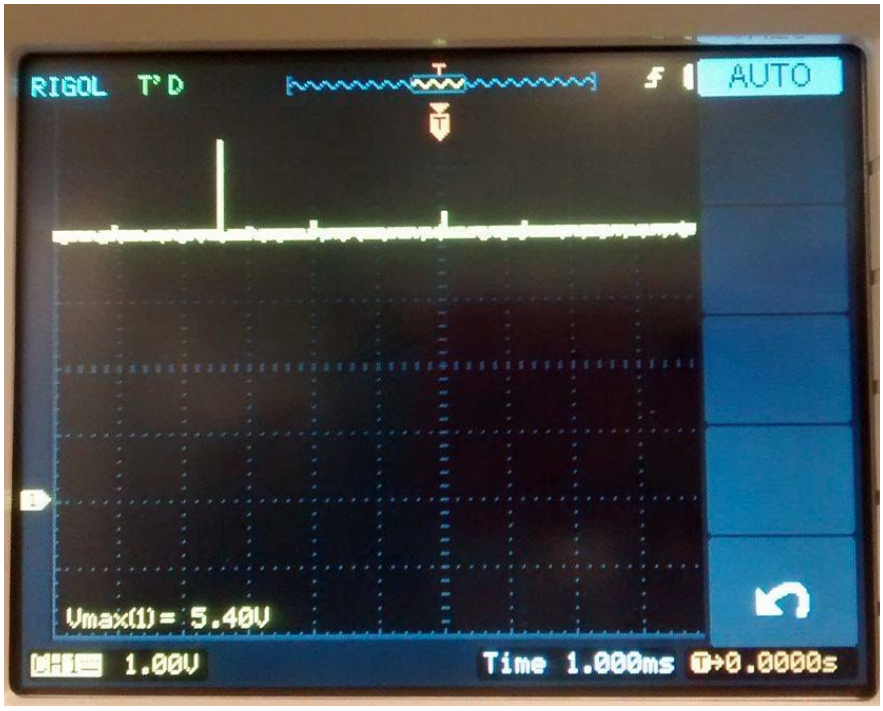
Motor running - without flyback diode: 1.36 v

2. With the capacitor - 4.04 volts, a lot cleaner signal
Without the decoupling cap - see voltage spikes that range from 4.12 to 5, the signal on the o scope is a lot more noisy, the minimum we see is only 4.12

With capacitor

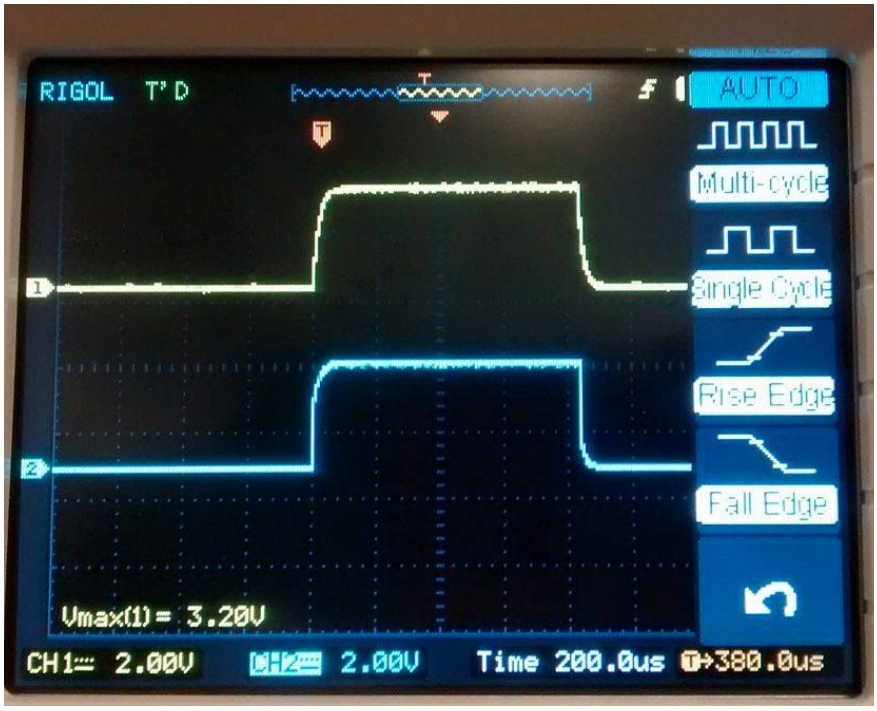


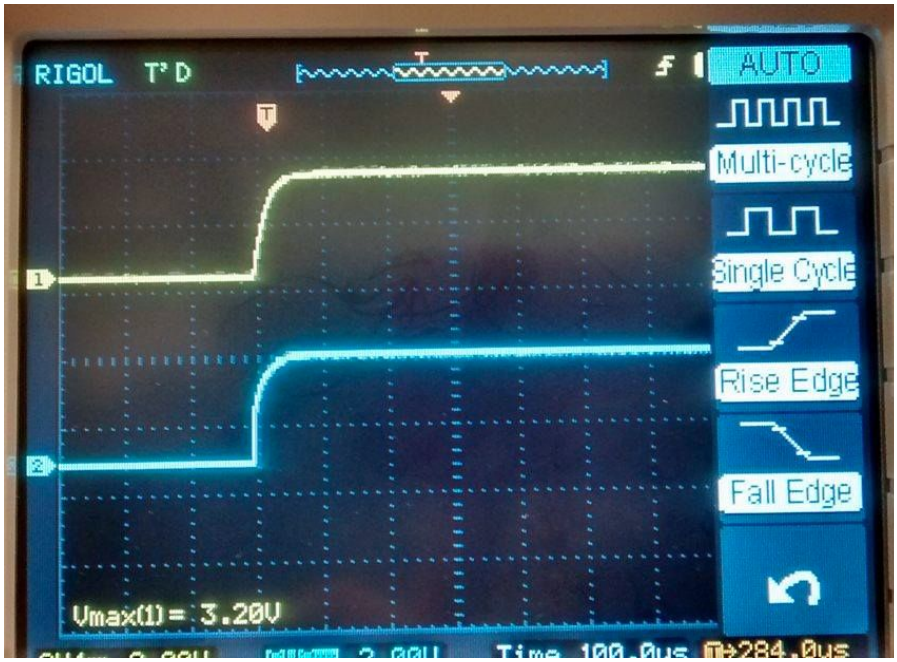
Without capacitor



3. The RC filter smooths the sharp edges of the pwm signal, makes it such that there is a softer transition from open to close of the mosfet. Furthermore it filters high frequency components of the signal which in the case of a square wave are the sharp corners.

The yellow line is the filtered pwm and the blue line is the original. The sharp edges seen in the blue line are eliminated as seen in the yellow line.





4. There are voltage spikes without the filter on the seen at v-flyback. Adding the pwm filter reduces voltages spikes at v-flyback.

With filter - v flyback

No filter - v flyback