Knowledge Assessment

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**Question 1:**

To control the power on a resistive load we need a circuit able to convert a fixed DC voltage source into a variable DC voltage/power output. Commonly this is achieved through DC-DC converters, which makes the use of a controlled switch to connect and disconnect the source from the output. If we control the time interval in which the switch is turned ON (TON) we are able to control the voltage at the output and consequently the power over the load. The time ON over the period (TON + TOFF) is the duty cycle (D) which might be controlled by the microcontroller in the range from 0 to 100%.

To drive inductive load extra care must be taken, because the energy stored as magnetic field needs to be discharged when the switch turns OFF. At the moment the switch opens, the change in the current generates back EMF with the opposite polarity to the current flow causing large negative voltage spikes that will potentially damage the circuit. The most common solution to discharge the inductive load is the employment of a free-wheel diode, however other solutions like MOSFETs with integrated active clamp are already found in the market.

**Question 2:**

https://wokwi.com/projects/340608846514881106