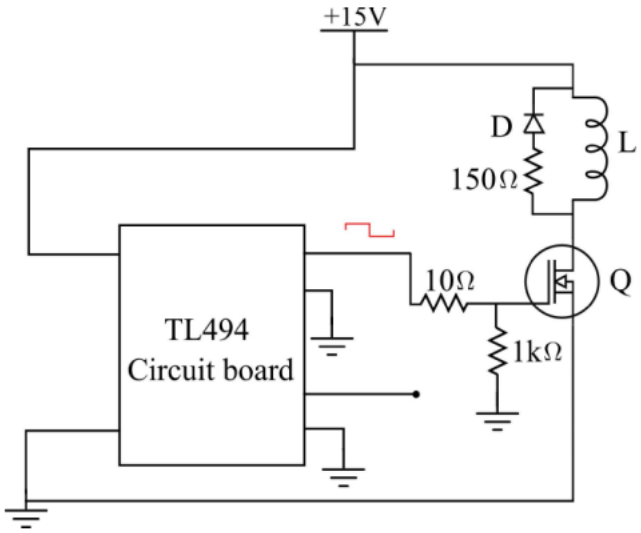
Electrical Machines and Power Electronics Lab Report -3

Experiment Name: Inductor Design and Measurement Circuit

Aim: To find the value of the inductor using the MOSFET circuit and by finding the current through the inductor with the help of pulse generator circuit TL494.

Experiment setup:



Procedure:

1. Get the inductor and test the inductance value.
2. Design the inductor measurement circuit as shown in the figure for measuring the inductance of the designed inductor.
3. To design an inductor measurement circuit, connect the components according to the circuit diagram.
4. Apply the gate pulses using the TL494 PWM generator designed earlier.
5. Set the frequency to 10kHz and maintain a 50% duty cycle.
6. While setting the PWM pulses of TL494, isolate the gate of the MOSFET.
7. Once the pulses are set in TL494, connect the gate pulses to the measuring circuit and obtain the drain-source voltage and drain current.
8. Measure the rise time of the drain current along with the magnitudes at the starting and ending.
9. Calculate the inductance value by the formula using the current reading got through the oscilloscope.
10. Obtain the plots for the inductor voltage and the diode voltage.
11. Turn on the power supply, only after the gate terminal connected to the driver

Observations:

* Finding value of Inductor:

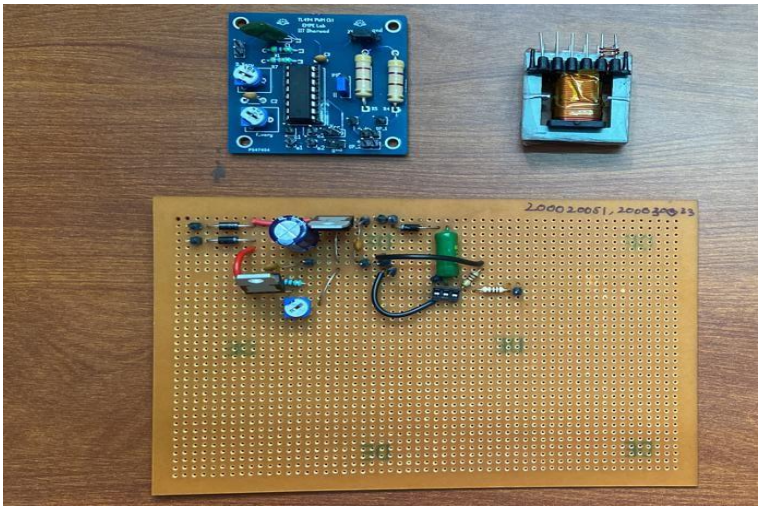
$$V = L \frac{di}{dt}$$

$$15 = L \cdot \frac{0.72}{10^{-9}/2}$$

$$\Rightarrow L = 1.04\ mH$$

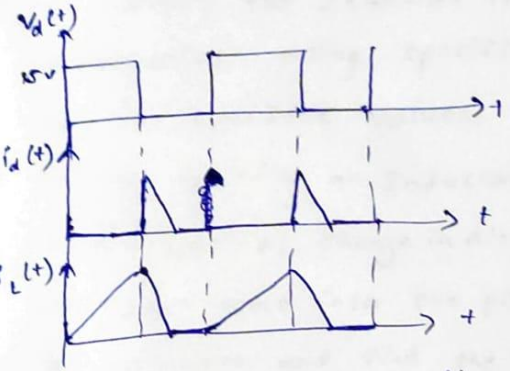
We measured the value of the inductor and found as $L = 1.07\ mH$

Soldered Board:



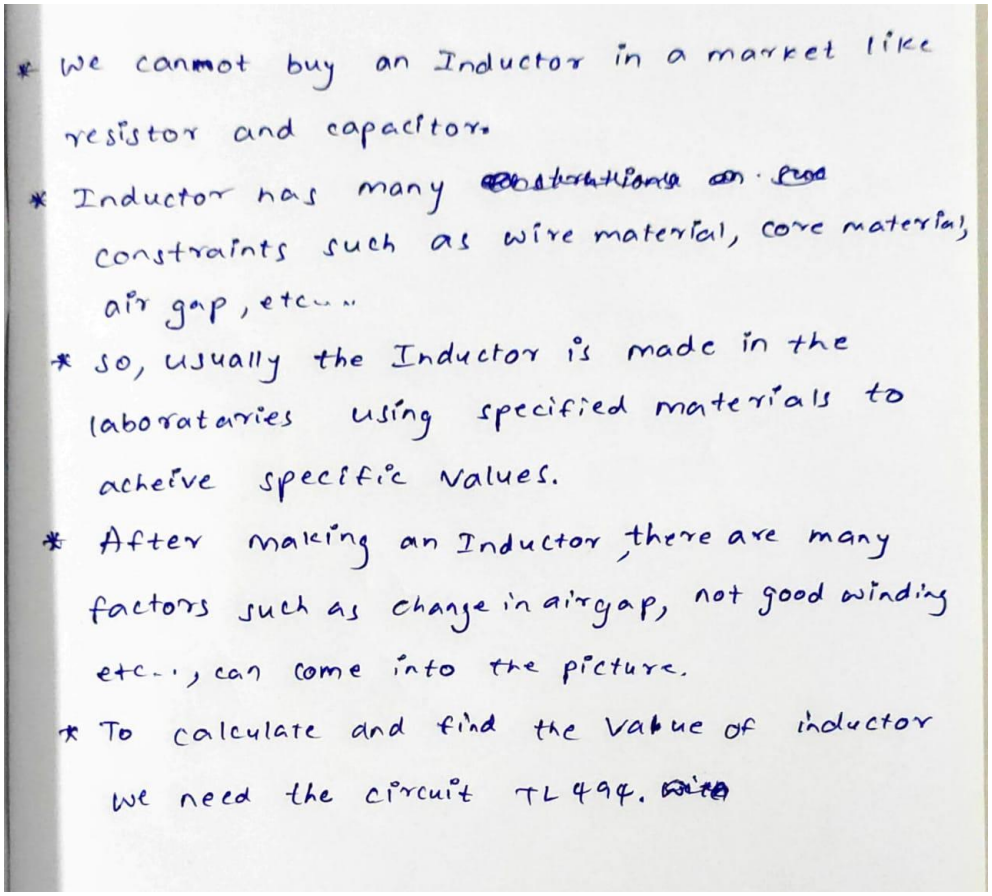
Additional Results:

* From PWM TL494 we need a pulse voltage to switch on the mosfet and switch off the mosfet for certain time.
* Here we uses the EF mode in the TL494 and the Push pull mode to get the desired output.
* Here the current through diode is



* We can observe that the current in off state is same in diode and inductor.
* Here we uses the 4 watt resistor, because the inductor discharges through the resistor.

Analysis:


* We cannot buy an Inductor in a market like resistor and capacitor.
* Inductor has many constraints such as wire material, core material, air gap, etc...
* So, usually the Inductor is made in the laboratories using specified materials to acheive specific values.
* After making an Inductor, there are many factors such as change in airgap, not good winding etc.., can come into the picture.
* To calculate and find the value of inductor we need the circuit TL494.