EXP 02- GENERATION OF PULSED WAVEFORMS USING (TL494)

Report by:

Shivam Kumar(200020044)

Shashi Prabha(200020043)

AIM:

Pulse generation for MOSFETS/IGBTS with controlled frequency and duty cycle.

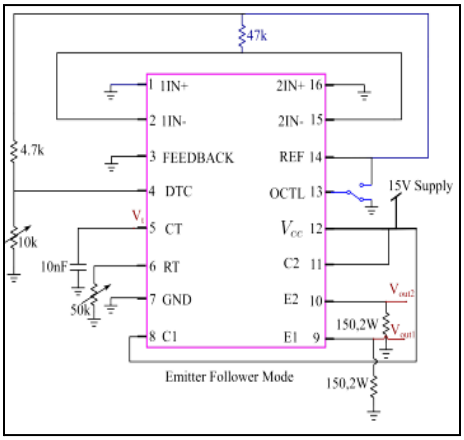
COMPONENT USED:

- TL494 PWM Controller with IC Base
- Resistors - a) 47kΩ, 4.7kΩ; 0.25W b)2, 150Ω; 2W
- Rheostat (50kΩ; 10kΩ)
- Circuit of Uncontrolled Rectifier (using LM317 or IC7815)
- Shorting pins
- Capacitor(100nF, 10nF, 100nF)
- PCB Board
- Wires(M & F), Wire stripper
- Regulator IC 7815 & LM317
- Soldering Equipment
- Oscilloscope
- Regulated Power Supply

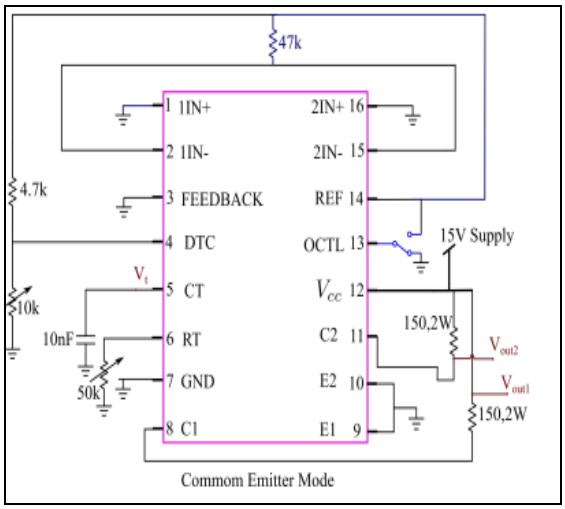
SUMMARY:

In this experiment we are using TL494 IC to generate the PWM pulses in output with a desired frequency say 50KHz.

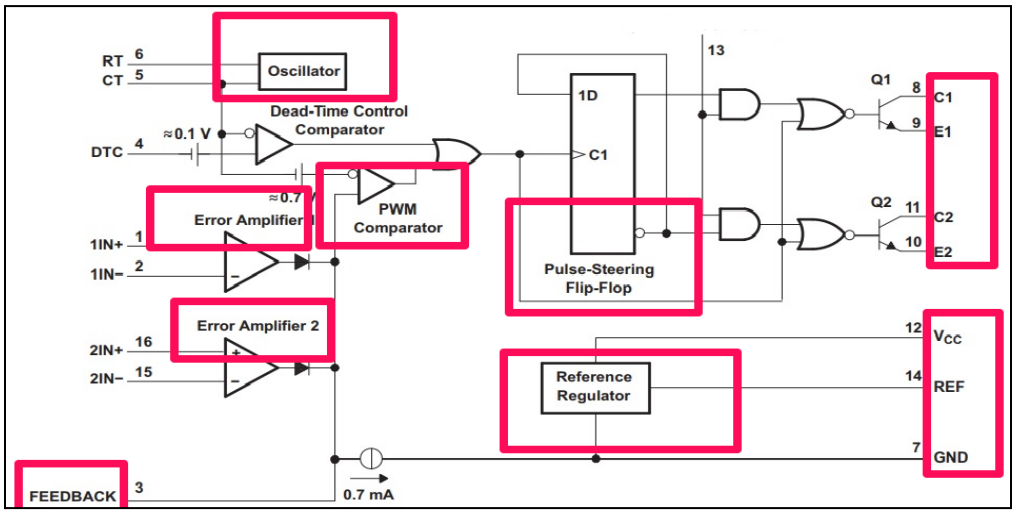
CIRCUIT DIAGRAM:



Fig(a) : Circuit connection of TL494 when the MOSFET configuration works in Emitter-Follower mode.



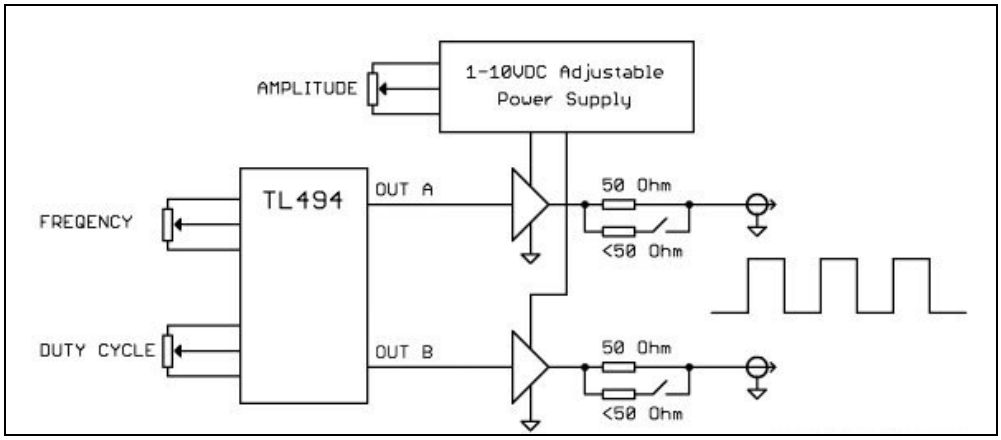
Fig(b) : Circuit connection of TL494 when the MOSFET configuration works in Common-Emitter mode.



Fig(c) : Schematic internal circuit of PWM controller TL494.

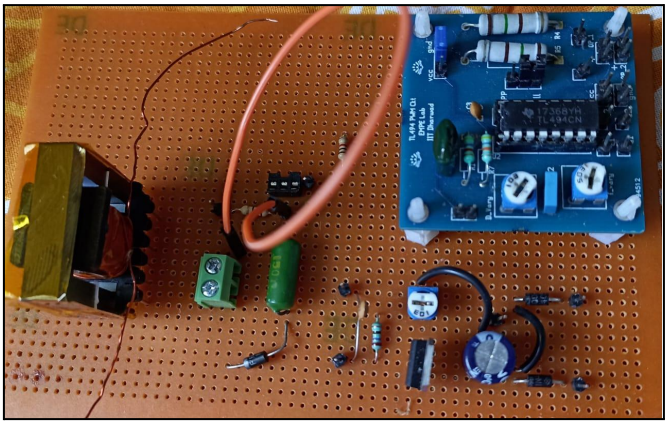
TL494 working:

It is a variable PWM IC with a frequency of specific setup. The timing capacitor has two internal oscillators, whose sawtooth waveforms are compared to either one of the control signals to adjust the pulse width. When the control signal falls below the voltage of the sawtooth waveform, the output amplitude rises.



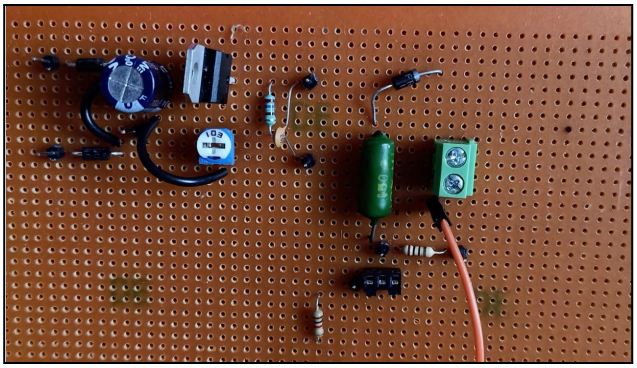
Fig(d): Schematic diagram for the TL494's overall circuit in its basic form. (***component's value is not the same***)

WHOLE CIRCUIT :

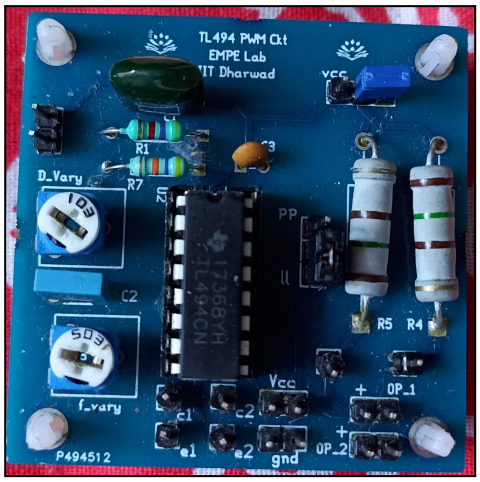


PROCEDURES:

- Step1: We arranged the 'Circuit of the Uncontrolled Rectifier' from the previous lab experiment. This is the snapshot of PCB with LM317:



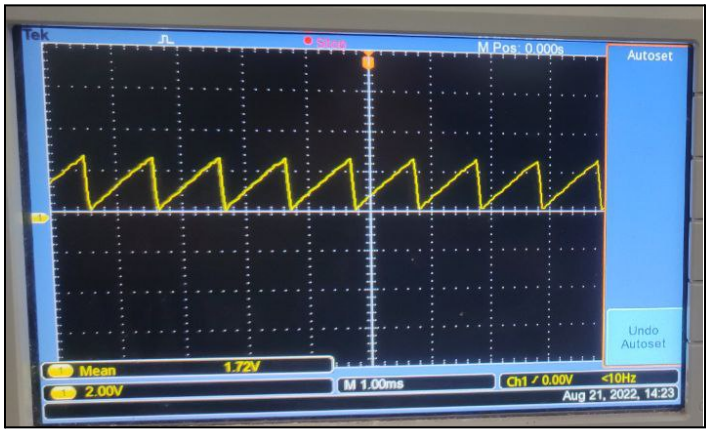
- Step2: Soldered the base pins and resistors, capacitors, potentiometers, IC base pin, and male jumper pins with desired refdes on the blue PCB for TL494. Below is the snapshot of the PCB of TL494:



- Step3: After connecting the circuit of an uncontrolled rectifier LM317 board and TL 494 PCB circuit to get a 15V input supply, also we obtained a sawtooth waveform from CT(PIN5) of TL494.
- Step4: At first, we implemented the EF(Emitter Follower)) configuration of the MOSFET, ie., we gave pins C1, C2 to +Vcc [15V] and E1, E2 to resistor R5 and R4, and o/p 1 and o/p 2 probes are connected to an oscilloscope. We configured the push-pull and single-ended supply mode to get the output waveform.
- Step5: After that, we implemented the CE(common-emitter) configuration of the MOSFET, ie., we gave pins C1, C2 to R4, R5 and E1, E2 to the ground, and o/p 1 and o/p 2 probes are connected to an oscilloscope. We configured the push-pull and single-ended supply mode to get the output waveform.
- Step6: We observed the output effect by changing the frequency and duty cycle of the given potentiometers on the TL494 board. We can vary the frequency/ duty cycle to change the switching time (T_{sw}) of the PWM generator.

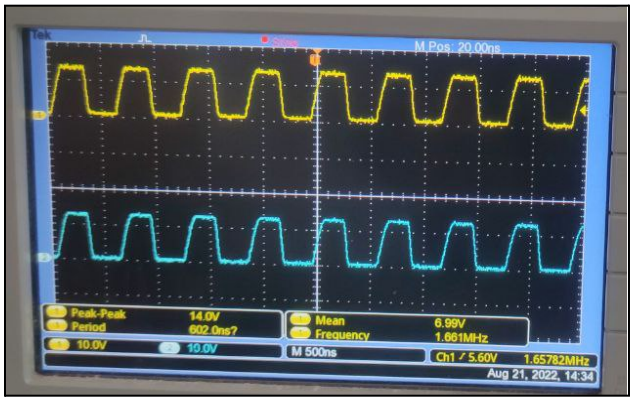
RESULTS and OUTPUTS:

- First observed the sawtooth waveform while connecting the probe with the 5th pin of IC TL494:



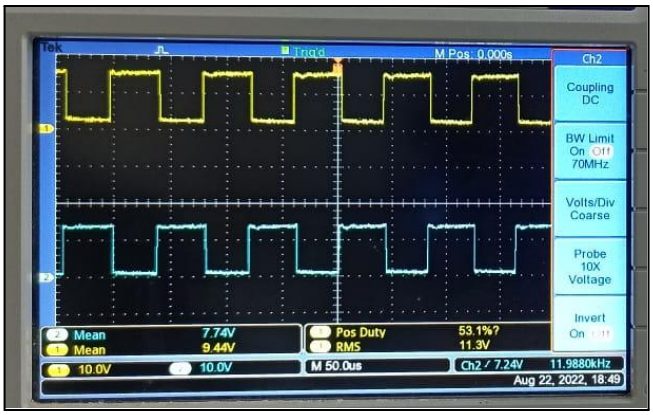
RESULT: The complementary resistor RT controls the constant current that the oscillator's sawtooth waveform uses to charge the external timing capacitor CT (see fig. c)

- The PWM generated due to the single-ended supply mode in the **<u>emitter follower</u>** circuit of TL494:



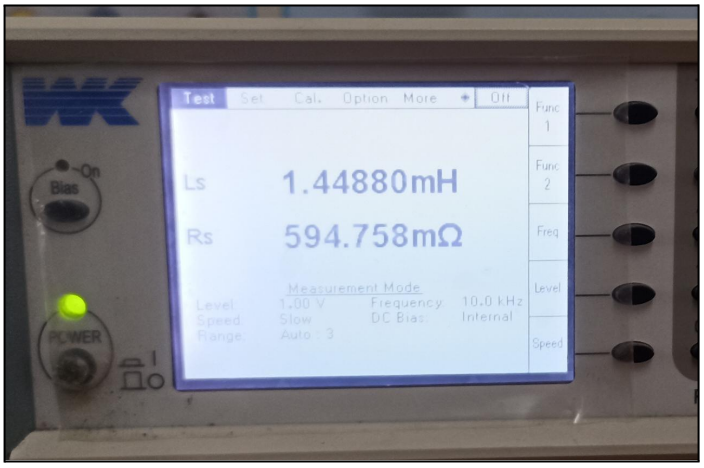
RESULT: with a duty cycle of 50% and frequency around 50kHz we got an emitter follower waveform in single ended mode.

- The PWM generated due to the push pull supply mode in **<u>the common emitter</u>** circuit of TL494:



RESULT: with a duty cycle of 50% and frequency around 50kHz we got a common emitter waveform in push pull mode.

- Inductor value calculated from LCR machine is found to be as shown which is comparable to inductor value found through TL494.



ANALYSIS:

- The sawtooth oscillator generates a sawtooth wave of 0.3 – 3V,where oscillation frequency is adjustable by using an external resistor (Rt) and capacitor (Ct). Thus, the default oscillation frequency is : f =1/Rt*Ct(single ended)
  For push pull oscillation frequency is: f =1/2*Rt*Ct
- CE(common-emitter) configuration: n of the MOSFET, ie., we gave pins C1, C2 to R4, R5 which are internally connected to Vcc =15V and E1, E2 to the ground , so when we give 15V Vcc, and the switch is off there will be no output, when we turn on switch there will

be increase in current and rise in output then it become constant and then capacitor will discharge and there will be decrease in current and fall in output.

- Single Ended amplifiers have a single driver that is always active and operating on a bias so that it only has to work in one direction.
- Push pull amplifier has a complementary transistor pair driving the output where one or the other is pushing or pulling.