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EEE419 Project Part 3

Introduction:

A Flyback converter which converts V_d=6V to V_O=27V is designed. The schematic can be seen below.

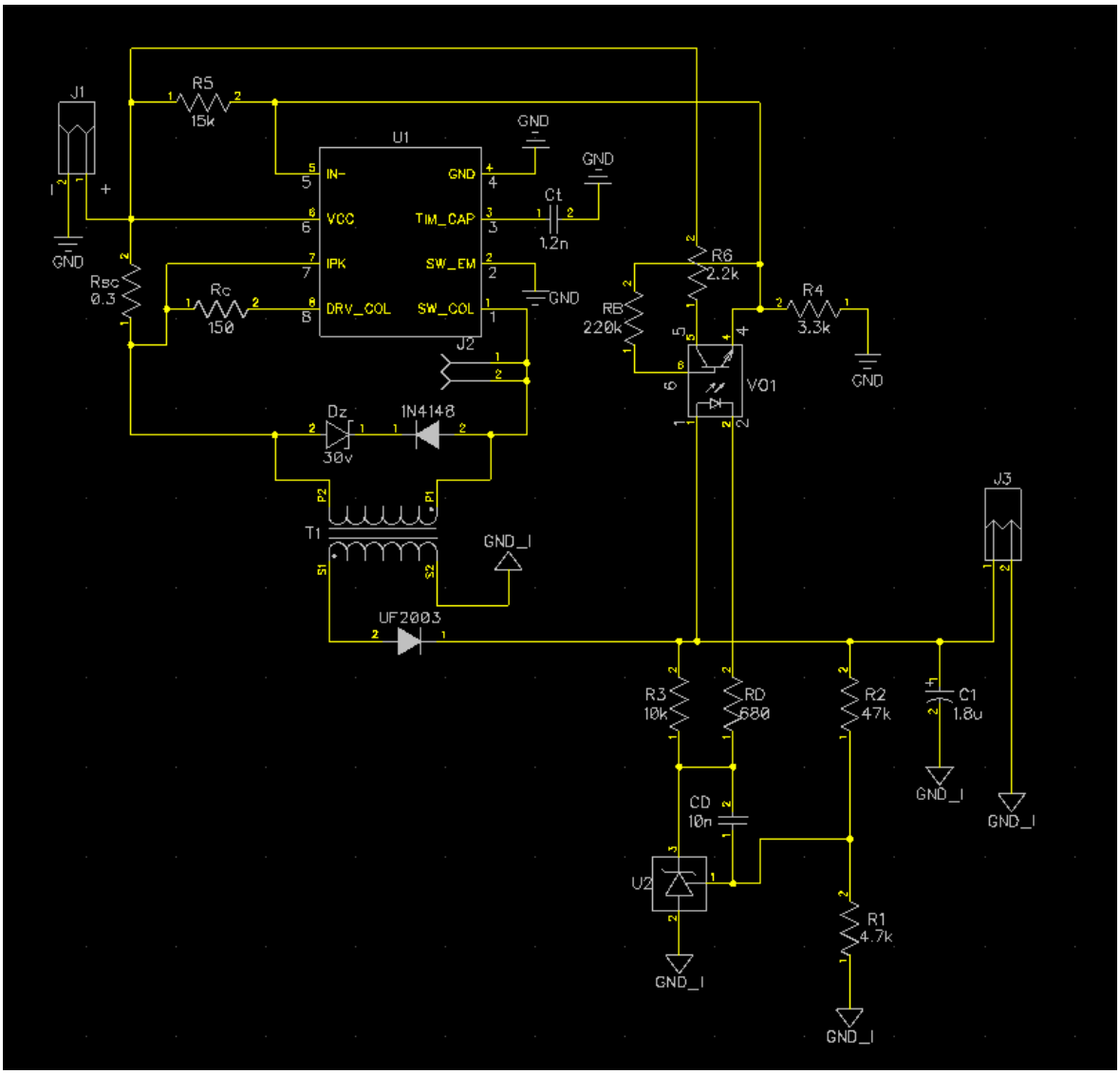

Fig. 1: Circuit Schematic

Analysis:

Below figures show the top and bottom side of the PCB respectively.

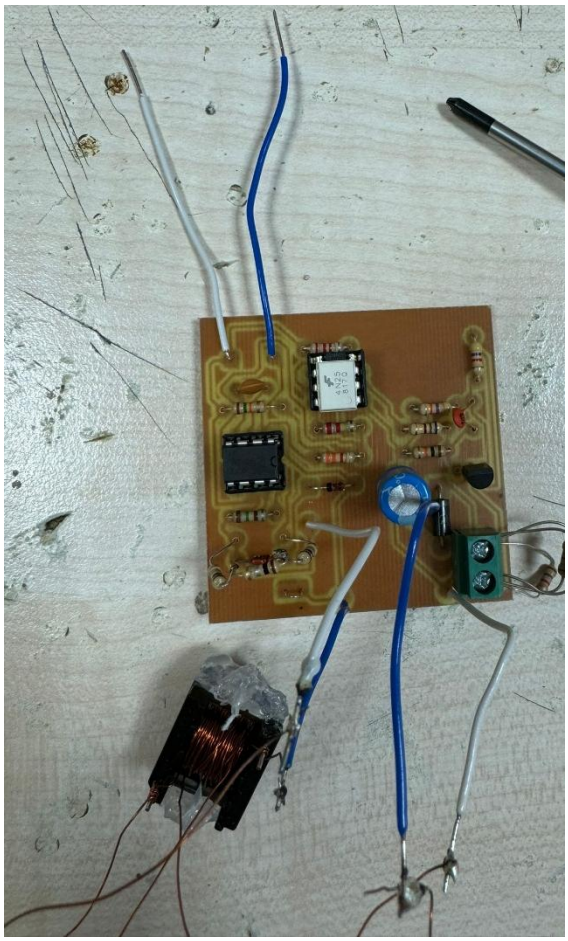

Fig. 2: Top side

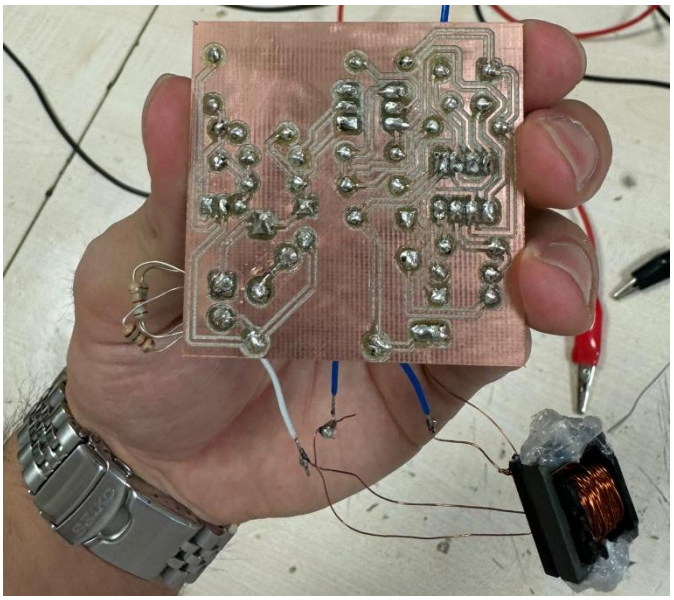

Fig. 3: Bottom side

The connected load resistance is 1.8KΩ. Fig. 4 shows the input voltage and input current values.

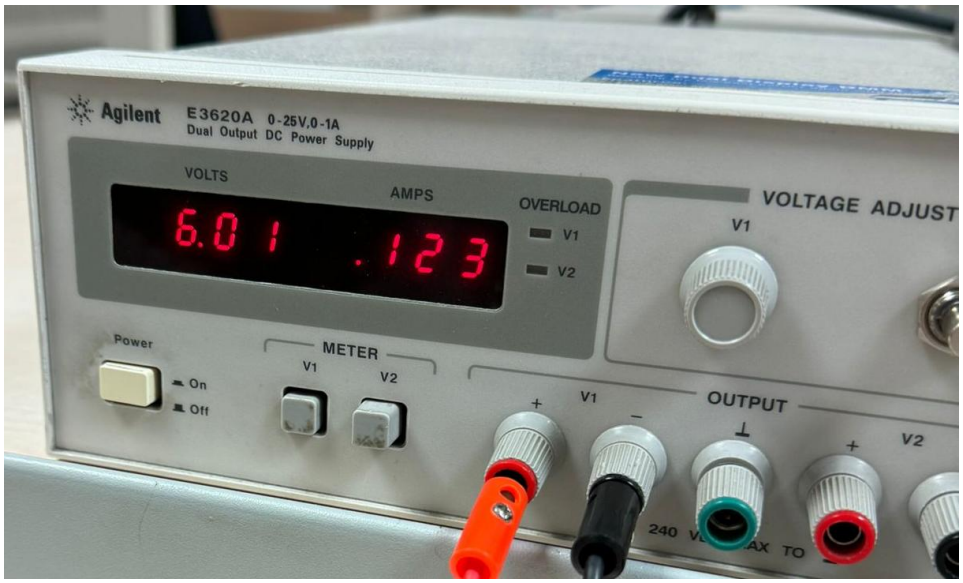

Fig. 4: Input voltage and current with R_L=1.8KΩ

The input power is calculated as 0.74W.

Fig. 5 shows the output voltage V_O at the 1.8KΩ resistor measured with a DC voltmeter. The output power is calculated as 0.4W. The efficiency is calculated as 54%

Fig. 5: Output voltage R_L=1.8KΩ

To get at least 1W at the output, I connected three 1.8KΩ resistor parallel, which gives me 600Ω as load resistor R_L. With this value, the output voltage is measured as 26.28V. It is inside the acceptable boundaries (27 ± 5%). Fig. 6 shows the result. The input voltage and current with this load resistor value can also be seen at Fig. 7.

Fig. 6: Output voltage with R_L=600Ω

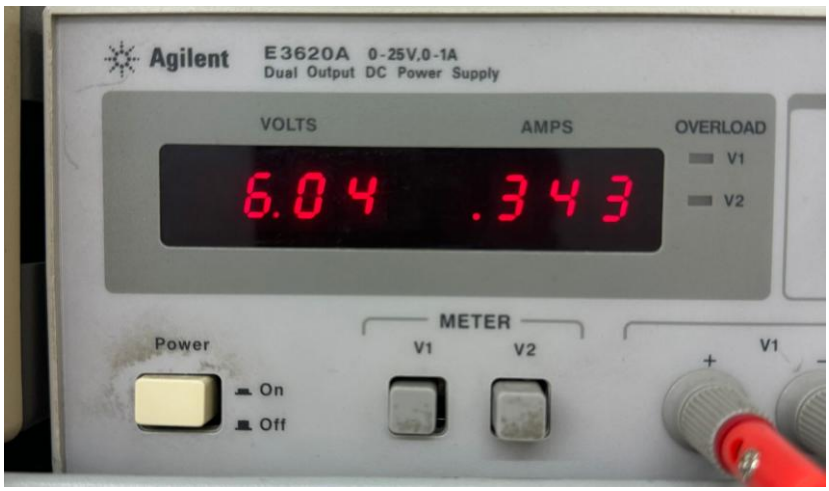

Fig. 7: Input voltage and current with R_L=600Ω

With R_L=600Ω, output power is calculated as 1.15W. The input power is calculated as 2.07W. The corresponding efficiency value is 55%.

Fig. 8 shows the switch voltage graph.

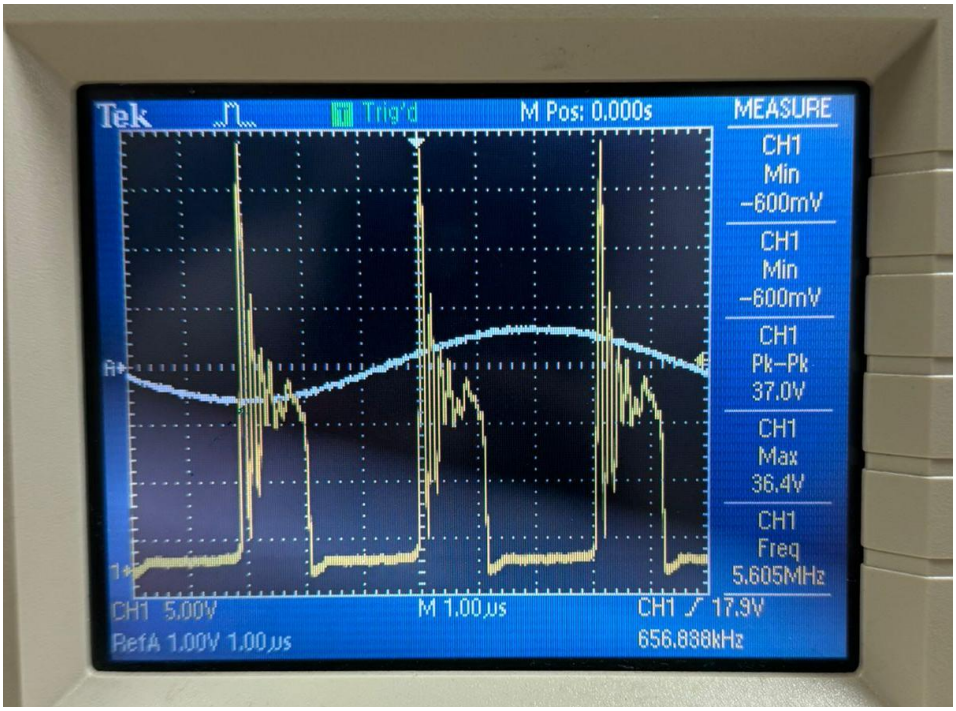

Fig. 8: Switch voltage

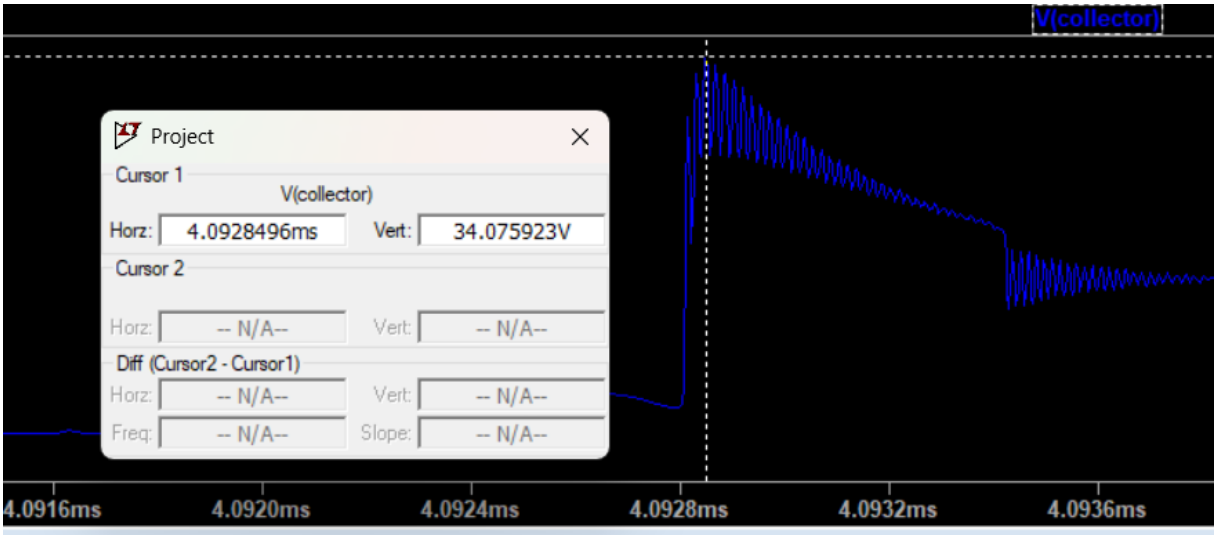

Fig. 9: Simulation result for switch voltage

As seen from both figures above, the experiment and simulation results resembles to each other.

Fig. 10: Output voltage ripple

Fig. 10 shows the output voltage ripple. As seen, the ripple amount is measured as 152mV, which is inside the accepatable boundary. Parallel connected capacitors at the output will lower the ripple amount due to lower ESR values. For this case, a single 150µF 35V capacitor is connected.

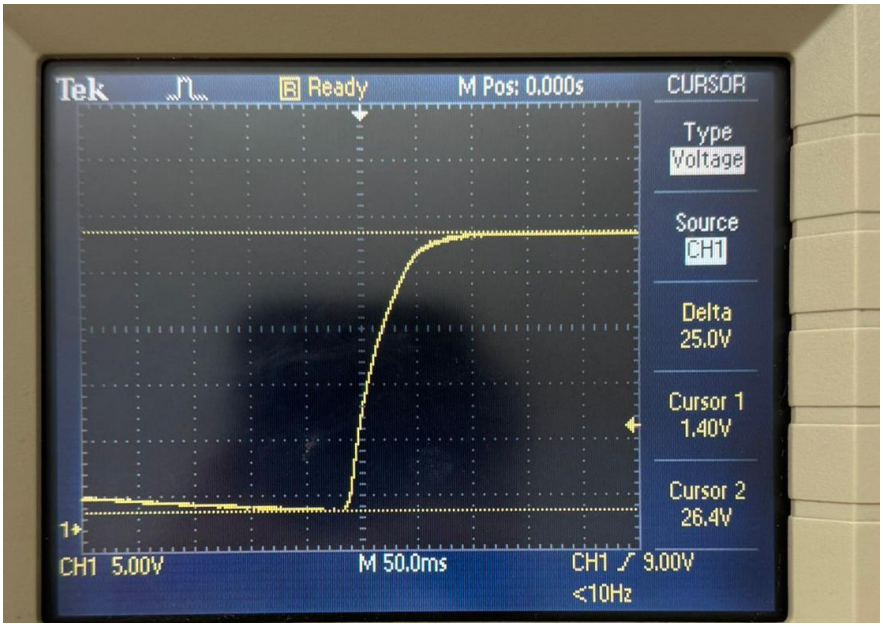

Fig. 11: Power turn-on transient

Fig. 11 shows the power turn-on transient of the system. The measured value is 25V. The expected value is 27V. The results are close to each other with a slight error included due to instability of the lab material.

As calculated above, the efficiency of the system with R_L=1.8KΩ is 54% and with R_L=600Ω is 55%. When R_L is 600Ω, the output power is above 1W, (1.15W), however the output voltage is a bit less than the case R_L=1.8KΩ. This difference may be due to the higher input current, therefore more power dissipation on the system such as heat.

Youtube video link: https://youtube.com/shorts/brQc_mYqQOU?si=yoB5jwAqJ1gXvuEr