



University
of Glasgow

Department of Electronics and Electrical Engineering

School of Engineering

Power Electronics

Lab Project: DC-DC Buck Converter

Student Name :

Matriculation Number:

Dr. Kelian Zhou

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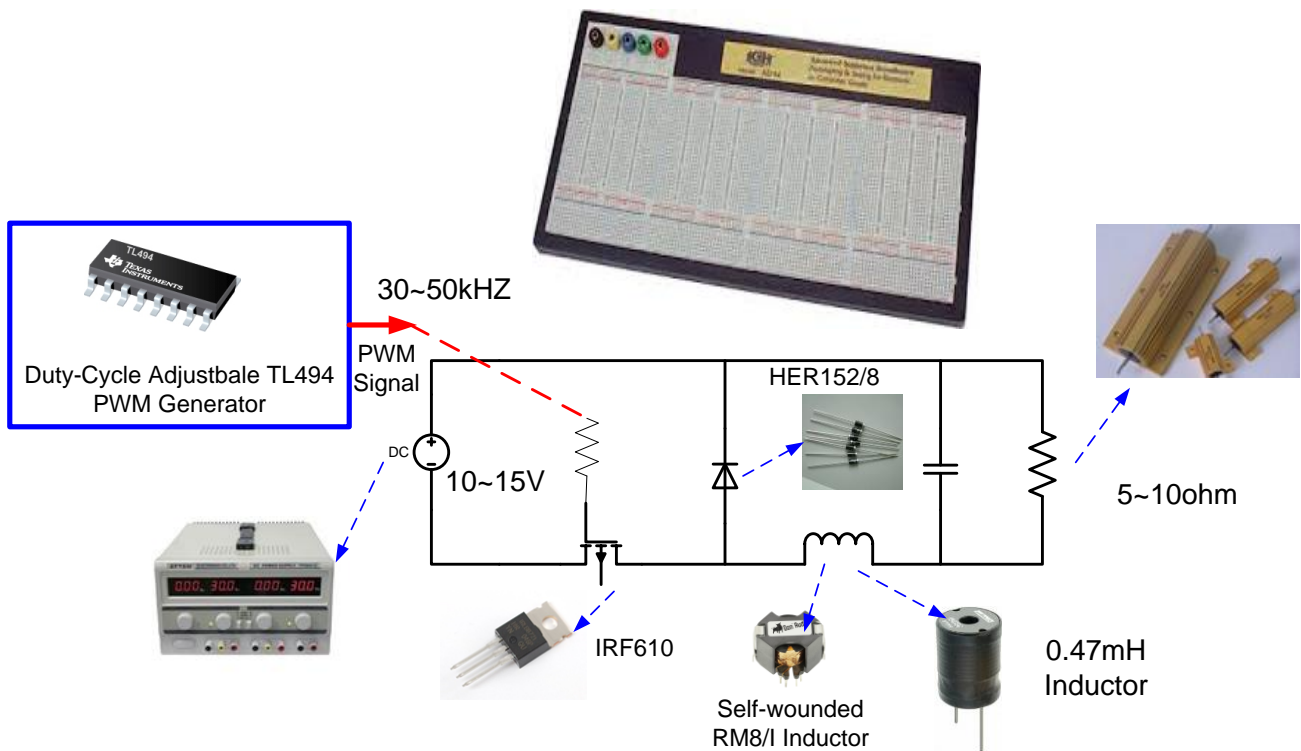


Figure 1 DC-DC Buck Converter

Project Description:

The project is to design and build a 5W DC-DC buck converter hardware on breadboard. You are to

1. Use control chip TL494 to design and build a 30~50kHz variable duty cycle PWM generation and drive circuit for the MOSFET switch for the DC-DC converter.
2. N-channel MOSFET IRF610 should be used.
3. FRD Diode HER158 should be used
4. A 0.47mH inductor would be used for initial buck converter testing.
5. An inductor core is of type RM8. You have to design and wind one for the converter in continuous conduction mode operation.
6. Select an electrolytic DC capacitor plus a film capacitor for the output filter to achieve <1% output voltage ripple with 5V output voltage and 10Ω resistor load.
7. Respectively test converters with two inductor to determine their performance.

Project Support:

Tutorials: I will run tutorials to help get you going – times to be advised. Each tutorial will cover different material.

Components: Semiconductors, inductor cores, and most other components you need are available from Power Electronics lab.

Tools: Each group must have their own basic set of tools.

Benches: Benches with power supplies, oscilloscopes and DMM are available in the Power Electronics lab during Term 2. Do not spread beyond these benches or take equipment from other benches.

One common LCR meter and current probe will be available for measure the inductors and test the inductor current.

Practical work (laboratory investigations, design and testing) is to be carried out in groups of 2 or 3(max).

Schedule:

1st Week: Nominate your groups. Two or Three people per group.

5th Week: Components are issued and lab made available.

9th Week: Laboratory investigation.

13th Week: Final lab report submission.

The **lab review will take place in the Power Electronics Lab**. You must bring a copy of your circuit diagram and your design notes to the lab review. The marking schedule for the lab review will be based around the following sorts of questions and all members of the same group who attend and participate will receive the same. Each group will briefly indicate every group member's individual contributions to the project. This will be used in the allocation of individual marks.

Review mark:

- ☐ Explain the principle of operation of your PWM control system.
- ☐ Demonstrate how to change the pulse width.
- ☐ Demonstrate the gate signal driving your power MOSFET(s).
- ☐ Demonstrate how the output voltage change with the pulse width
- ☐ Demonstrate the current waveform through your power MOSFET(s) is continuous
- ☐ Demonstrate the voltage waveform across the switch, the diode and the inductor

Demonstrate the output voltage ripple is less than 1%

Note: You should provide loops on your board so that a current probe can easily be inserted to measure inductor current.

Your report must be a group report, which should include all aspects of the design, operation and overall performance of your converter. There will be a late report penalty of 10% per day, unless otherwise pre-arranged.