

EE4101 – Industrial Electronics

Test 1 (2015-2016) – Set B

Name: _____ ()

Level-1 questions: 15 marks

Level-2 questions: 15 marks

Level-3 questions: 15 marks

Level-1 questions:

1. Explain how the voltage drop of the body diode of a MOSFET can be further reduced when it is conducting.

[3 marks]

Use the concept of synchronous rectifier.

2. Suggest a circuit arrangement that can help reduce the possibility of false triggering in a MOSFET gate drive.

[3 marks]

Use an PNP transistor or a level-shifter circuit discussed in the lecture.

3. Draw the circuit schematic of a boost converter and its dual circuit.

[5 marks]

The dual circuit of a boost converter is the buck converter.

4. Explain why the steady-state output voltage of a transformer must be zero.

[4 marks]

The average voltage across the transformer must be zero. Otherwise, the current will keep increasing or decreasing.

Level-2 questions:

5. Fig. 1 shows the circuit schematic of a power supply.

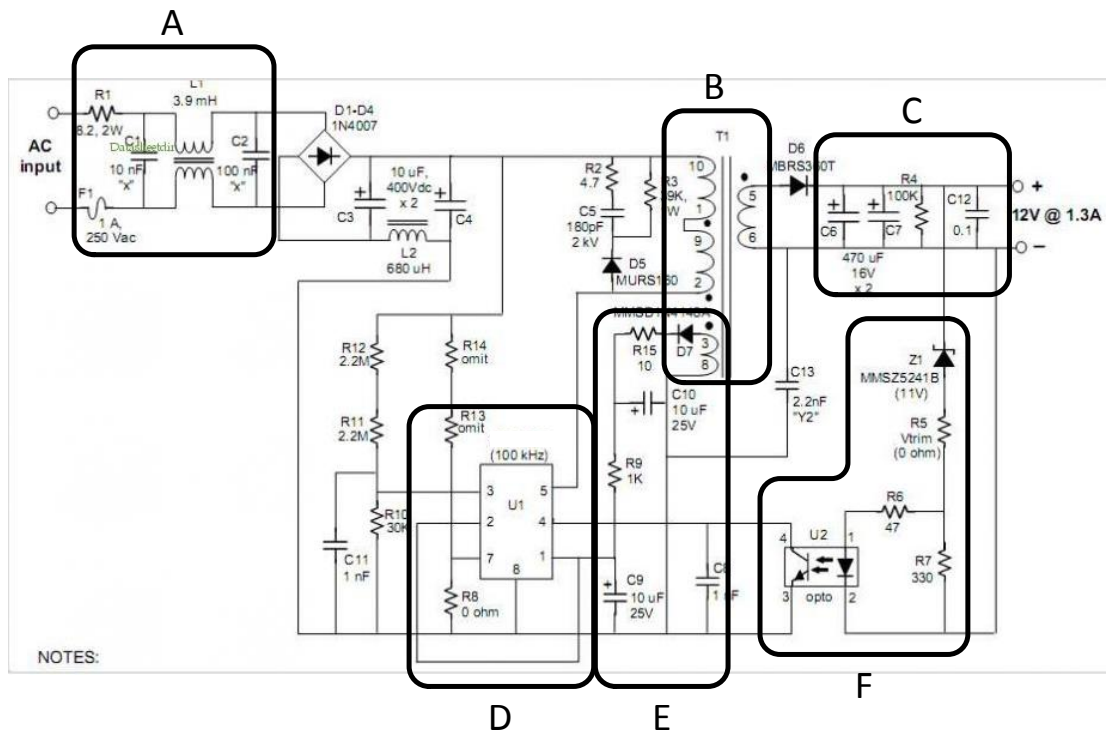


Fig. 1

Discuss the functions of the networks B, D, and F.

[6 marks]

Network B: Flyback transformer

Network D: controller that regulate the output. It includes a switch.

Network F: Feedback circuit with opto-isolation for sensing the output voltage to the controller.

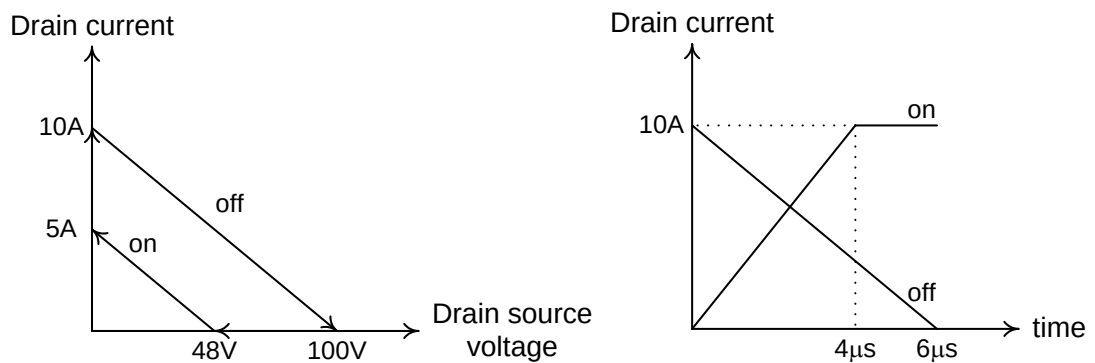
6. What is the function of D5 in Fig. 1?

[2 marks]

To clamp the voltage of pin 5 of the controller. When there is an overvoltage, D5 will be turned on.

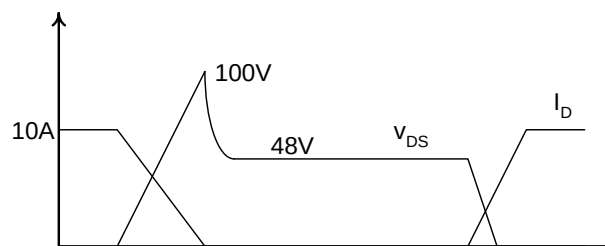
Level-3 questions:

10. The following figures show the switching characteristics of a MOSFET.

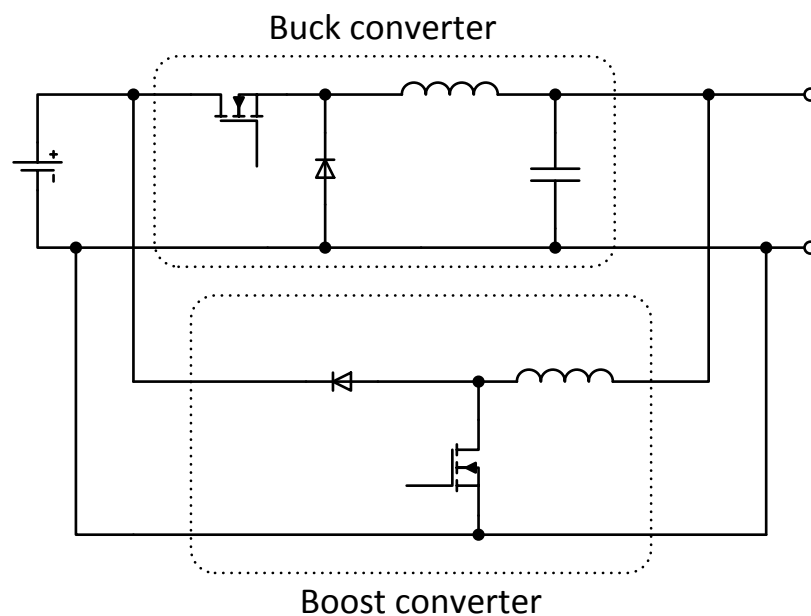


Sketch the time waveforms of the drain current and drain-source voltage of the MOSFET.

[5 marks]



11. The following circuit shows a circuit arrangement for testing the performance of a buck converter with a boost converter.



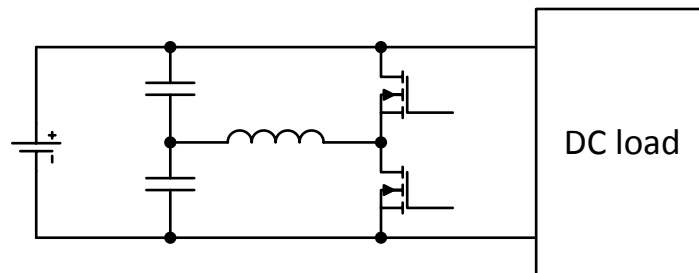
Explain how the buck converter can be tested. What is the key advantage of such arrangement?

[5 marks]

The boost converter acts a load on the buck converter. Then, the output of the boost converter can recycle the energy back to the supply. Then, it is possible to use less energy to test the buck converter at the full-load condition.

12. Discuss how the following can balance the voltages across the two capacitors.

[5 marks]



The inductor and the two switches form a buck-boost converter that transfers energy between the two capacitors.