MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.622 Power Electronics — Issued: March 6, 2023
Problem Set 4 — Due: March 13, 2023

Reading: KPVS Chapter 7, Chapter 24 through 24.1.3

Problem 4.1 KPVS Problem 7.1

Problem 4.2 KPVS problem 7.24

Problem 4.3 KPVS Problem 7.3

Problem 4.4

Figure 1 shows the schematic of a commercial 200 W *off-line* converter (powered from the ac line voltage). The ac line voltage is rectified to (nominally) provide 340 V dc (across capacitors C_3 and C_4), which the dc/dc converter section uses to generate multiple low-voltage dc outputs.

a. What type of dc/dc topology is at the core of this converter? (Hint: Note the structure of TR1, which is the converter transformer.)
b. The transformer uses a turns ratio from the primary to the 5 V winding of 16:1. If the rectified input voltage is at its nominal value of 340 V dc, what steady-state duty ratio will the converter operate at? (Hint: you may ignore the other outputs in answering this question.)
c. Would the multiple windings on transformer TR1 be wound on a parallel or series magnetic core structure (*e.g.*, KSV Fig. 20.21 or Fig. 20.22)?

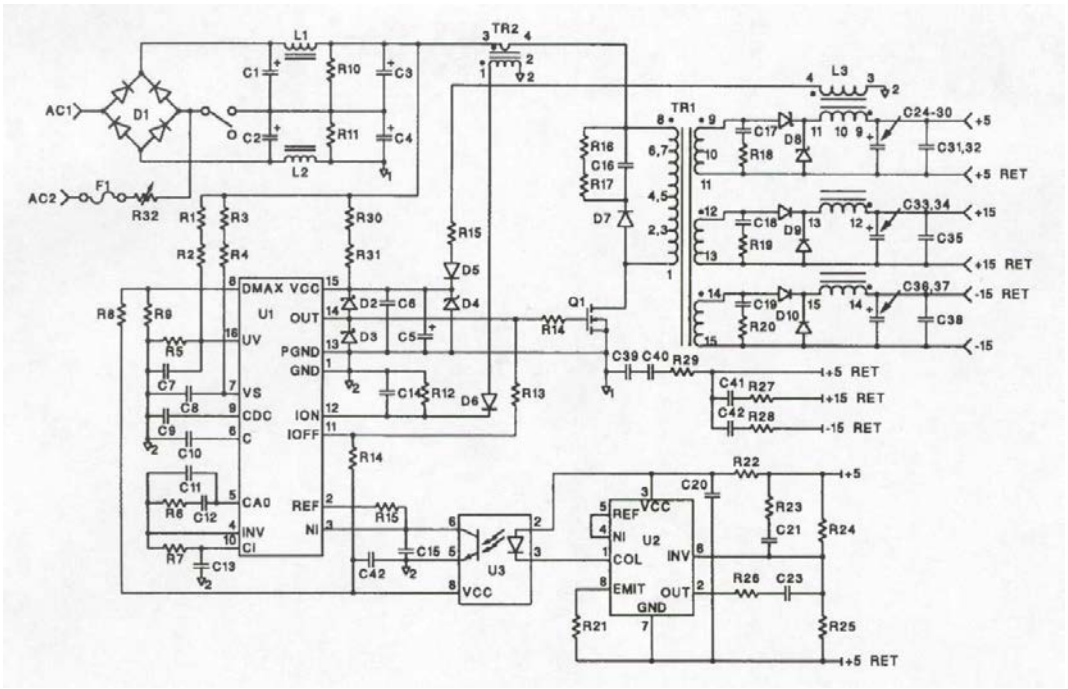

Figure 1 A 200 W off-line converter. (*cf* AN U-135).

Problem 4.5 KPVS Problem 7.25

Problem 4.6 KPVS Problem 24.2

Also, plot the device voltage and current during turn-on and turn-off transitions for this case. *Hint: You may assume that the switch voltage still transitions linearly during the switching process.*

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