ECE581

Real Boost Converter Design

In this problem, you will design a boost converter using real commercially-available silicon MOSFETs. There may not be a single correct answer to this problem; you will be graded based on the performance of your design. The best-performing design(s) will receive 50 points of extra credit applied toward the final homework grade. If multiple designs tie, the points will be split among them.

The goal of the problem is to select commercially-available MOSFETs which will allow the smallest overall converter size (approximately measured as $L + C$) while meeting the following specifications

- The boost converter is considered at a single operating point defined by $V_g = 10\text{V}$, $V = 50$ V, and the output power is 50 W.
- Power stage efficiency $\eta \geq 95\%$
- Inductor current ripple $\Delta i_l \leq 10\%$
- Output voltage ripple $\Delta v_c \leq 2\%$

Small ripple approximations do apply. You may use the following sites, or any other site, to select the MOSFETs you would like to use.

https://www.digikey.com/en/products/filter/transistors/fets-mosfets/single-fets-mosfets/278

https://www.mouser.com/c/semiconductors/discrete-semiconductors/transistors/

You may use two of the same MOSFET, or two different MOSFETs. From the device datasheets, you must consider the nominal on-resistance, gate charge, and the full C_{oss}-vs-V_{ds} characteristic. If one of these is not given in the datasheet, or is inadequately reported, the device is not eligible. The MOSFETs must be made of silicon, wide bandgap semiconductors are not eligible.

You may consider that the gate drive circuit for each MOSFET is ideal, with a voltage Vdr of your choosing. However, you must consider the internal gate resistance of the devices you are using. If the gate resistance is not reported in the datasheet, you may assume $R_g = 1\Omega$.

Additionally, the following site may be useful to help quantify the C_{oss}-vs-V_{ds} curve from the datasheets

http://web.eecs.utk.edu/~dcostine/personal/PowerDeviceLib/DigiTest/index.html

Turn in the following:

- Part number(s) of the device(s) selected
- Values of L, C, and f_s.
- Numerical values used for both the devices' C_{oss}-vs-V_{ds} curves, and plots of the curves copied from the device datasheets
- Numerical data used in computation of gate drive losses
- Computed conduction, switching, and gate drive losses at the specified operating point