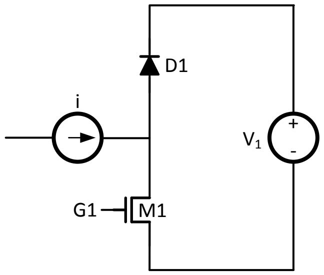
EE155/255 F17 Homework 2
Power Electronics

Assigned 10/2/17
Due 10/9/17

Problem 1



Consider the boost converter shown above. FET M1 is an Infineon IPB65R045C7 with R_{on} = 45mΩ and C_{DS}= 70pF. The FET's current during turn-on ramps at 1A/ns. Suppose i = 10A and V_1=400V. You may assume that the FET drain voltage is piece-wise linear. You may also ignore losses during the turn-off transient in the FET – consider only losses during turn-on.

(a) If diode D1 is ideal, what is the energy dissipated in FET M1 during a turn-on event?

(b) If the converter operates at 100kHz, what is the power lost due to switching?

(c) Suppose the converter has a duty factor of 50% on G1 and D1 has a forward drop of 1V at 10A. What are the conduction losses in M1 and D1?

(d) The 1A/ns current ramp is set by a 1A current drive to the gate of FET M1. Suppose you double the current drive to 2A/ns. What happens to your answers to (a) and (b)?

Problem 2

(a) Consider the converter of Problem 1. Assume the drain of the IPB65R045C7 FET is initially at 400V and that C_{DG} is 75pF. (For this problem we are assuming this very non-linear capacitor has a constant value). Suppose we drive the gate with a 2A current source and the drain begins to fall as soon as the gate voltage reaches V_{th} = 5V. From the point where the drain begins to fall, what is the minimum amount of time required for the drain to reach 0V?

For Reference:

https://www.infineon.com/dgdl/Infineon-IPB65R045C7-DS-v02_01-en.pdf?fileId=db3a30433e78ea82013e790478550043