EE 452 – Power Electronics Design
Experiment 1 Pre-lab Assignment: Part C

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Introduction

The purpose of this assignment is to prepare you to conduct Experiment 1C. Please make sure you have read and understand the experimental procedure *before* attending your designated lab section.

This assignment will be due at the *beginning* of your lab section. Like your homework, you will submit the prelab assignments through Canvas. For each problem, please provide written analysis where appropriate, show your work, and clearly label all plots, if any.

Parts

Experiment 1 will be done on the PCB using the following parts. In the electronic version of this document, you may click on the hyperlink embedded in the "Part number" column to bring up the data sheet for a given part. In addition to the components below, this experiment will also require resistors and capacitors of your choosing.

Description	Manufacturer	Part number
Power MOSFET	Infineon Technologies	IRFB4615PbF
Power MOSFET	Texas Instruments	CSD19535KCS
Half-bridge Gate driver	Infineon Technologies	IRS2184PBF
PWM Controller	Texas Instruments	UC3525AN

Prelab tasks

1. **Component familiarization.** Using the applicable data sheets, determine the following **(10 pts)**:

   - The drain-to-source resistance of both power MOSFETs in the on state.

   - The threshold gate-to-source voltage of the power MOSFETs.

   - The rated drain current of the MOSFETs.

   - The gate charge of both power MOSFETs

   - The rise and fall times of both power MOSFETS

- The minimum logic high input voltage of the gate driver.

2. **Possible PWM frequency (5 pts)** Using data from q1, compute the maximum possible switching frequency for both MOSFETS.

3. **GRAD STUDENTS REQUIRED: Bootstrap circuit design. (10pts)** Study the UCC27712 gate driver datasheet. This datasheet has better guidance than the IRS 2184.

   Compute the following for each MOSFET with a 5% boot capacitor ripple voltage.

   - Bootstrap capacitance

   - Bootstrap resistance (assuming a boostrap diode peak current of 3A)

   Consider: why do we need a bootstrap capacitance? (not graded, just for learning)