## ECE 320 - Homework #6

H Bridge, DC to DC Converters, Fourier Transform. Due Wednesday, February 20, 2019

## **H-Bridge**

Assume a TIP112 and TIP117 transistor for the following H-bridge (Darlington pairs)

- $\beta = 1000$
- $V_{be} = 1.4V$
- $\min(|V_{ce}|) = 0.9V$
- 1) Determine the voltages V1 and V2 for the following H-bridge

2) Modify this circuit to meet the following requirements

- Input: A,B,C,D. 0/10V binary signals, capable of 20mA
- Output: 50 Ohm resistor
- Relationship: By varying A,B,C,D, the voltage across the 50 Ohm resistor can be set to +12V, -12V, and 0V (+/-1V)



Problem 1 & 2

## DC to DC Converters (Buck converter)

- 3) For the following Buck converter, determine the votlages at V1 and V2 (DC and AC)
- 4) Simulated your design for problem #3 in PartSim (or similar program) to verify the DC and AC voltages at V2
- 5) Modify this circuit so that the votlage at V2 is
  - 5V (DC)
  - 250mVpp (AC)



Problem 3 - 5: Buck Converter

## Fourier Transform:

6) Find the Fourier transform for V1 (problem #3) out to the 5th harmonic. (a 40% duty cycle square wave at 1kHz)

$$V_1(t) = \begin{cases} 20V & 0 < t < 400 \mu s \\ -0.7V & 400 \mu s < t < 1ms \end{cases}$$

7) Using the results from problem #6, find V2(t) in terms of its Fourier Trasnform out to the 5th harmonic.