## ECE 320 - Homework \#6

H-Bridge, DC to DC Converters, DC to AC Converters. Due Wednesday, February 21st, 2018

## H-Bridges

1) Determine the voltages and currents for the follownig H-bridge. Assume $3904 / 3907$ transistors:

- $\beta=100$
- $\mathrm{V}_{\text {ce(sat) }}=0.2 \mathrm{~V}$
- $\mathrm{V}_{\text {be }}=0.7 \mathrm{~V}$

2) Modify this circuit so that $\mathrm{I}=200 \mathrm{~mA}$ (approx)
3) Simulate your circuit for problem \#2 in PartSim. Check that the voltages and currents you compute are correct.
4) Lab: A dual H-brigde is a L1110 (\$0.91 ea - shown right). Connect

- $\mathrm{Vcc}=+12 \mathrm{~V}$
- gnd $=0 \mathrm{~V}$
- A-1A and A-1B are the control inputs ( $0 \mathrm{~V} / 5 \mathrm{~V}$ ).
- MOTOR-A: DC motor


Measure the voltage across the motor for the following inputs:

| Forward |  | Stp[ |  | Reverse |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{A}-1 \mathrm{~A}$ | $\mathrm{~A}-1 \mathrm{~B}$ | $\mathrm{~A}-1 \mathrm{~A}$ | $\mathrm{~A}-1 \mathrm{~B}$ | $\mathrm{~A}-1 \mathrm{~A}$ | $\mathrm{~A}-1 \mathrm{~B}$ |
| 0 V | 5 V | 0 V | 0 V | 5 V | 0 V |



## DC to DC Converters (Buck converters)

5) Find the voltage (DC and AC) for V1 and V2
6) Modify this circuit so that

- The voltage at V2 is 8VDC
- With a ripple of 2 Vpp when $\mathrm{C}=0$, and
- With a ripple of 0.5 Vpp with $\mathrm{C}>0$.

7) Check your analysis in PartSim (or similar program)


## DC to AC Converters

8a) Determine the first two terms of the Fourier series for the following waveform

$$
y(t) \approx a+b \cdot \cos (\omega t+\phi)
$$

8b) How much of the total energy is contained in these two terms?


