Textron Cooling Fan Project

Team: Electron Wranglers

Textron

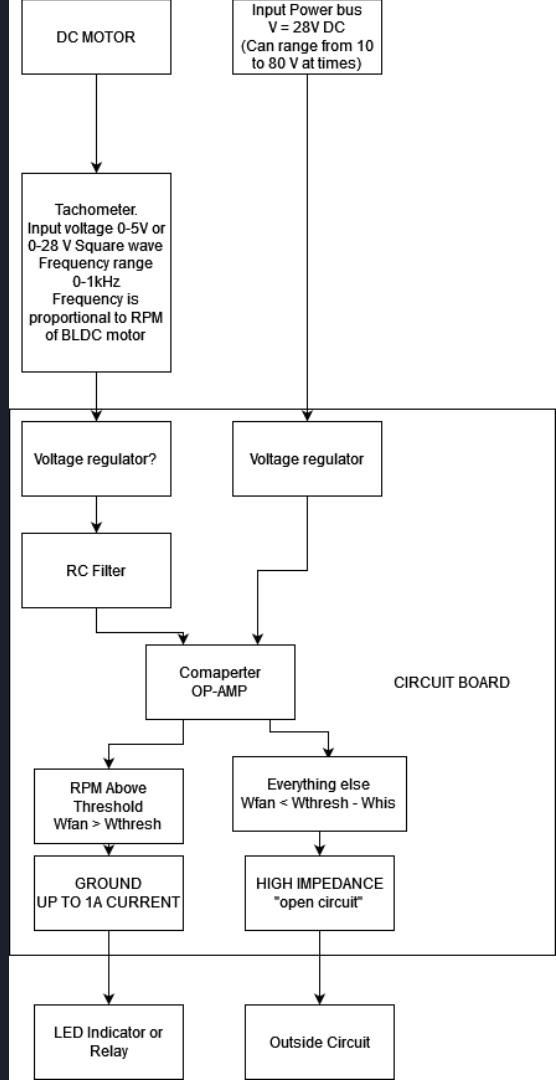
- Ayham Sabra
  - EE
  - Project Lead
- Cody White
  - EE
  - Project Manager
- Mel St.John
  - EE
  - Scribe
- We are going to monitor and make sure a BLDC motor stays within our threshold RPM

Ayham Sabra: Environmental/Component Requirements

- The Environmental Requirements we have are
  - Make sure it works in -55 to 85 Celsius
  - Must be able to operate in altitudes from -1,000 ft to 55,000 ft
  - Make sure it follows DO 160G sections 6, 8 and 22
    - Humidity, Vibration and indirect effects of lighting
- I have contact Textron, the library and NAIR for a copy DO-160G
  - Textron will show us a there copy once we have finished a prototype with all other parts they're looking for
  - Haven't gotten a response for NAIR

Cody White Input

- Receives a power input of 28 V of DC power, but must operate from 10 to 80 V.
- Receives a tachometer input that operates from 0 to 5 V or 0 to 28 V.
  - The Tachometer input is a square wave.
  - Should be able to accept frequencies from 0 to 1 kHz.

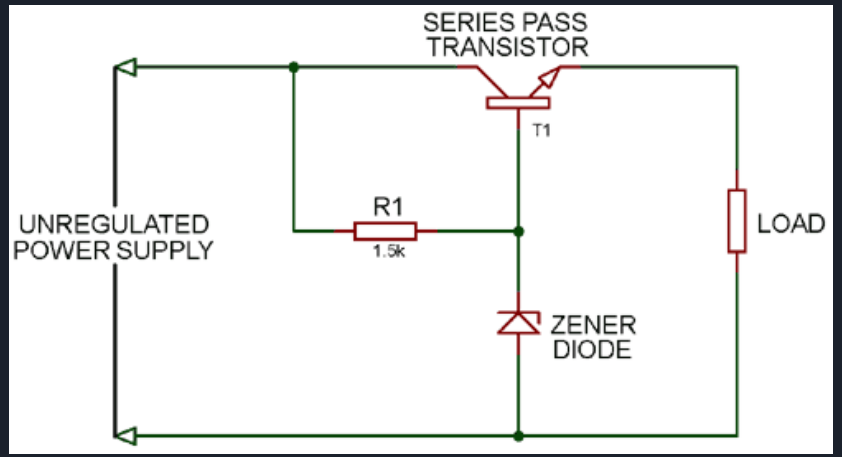


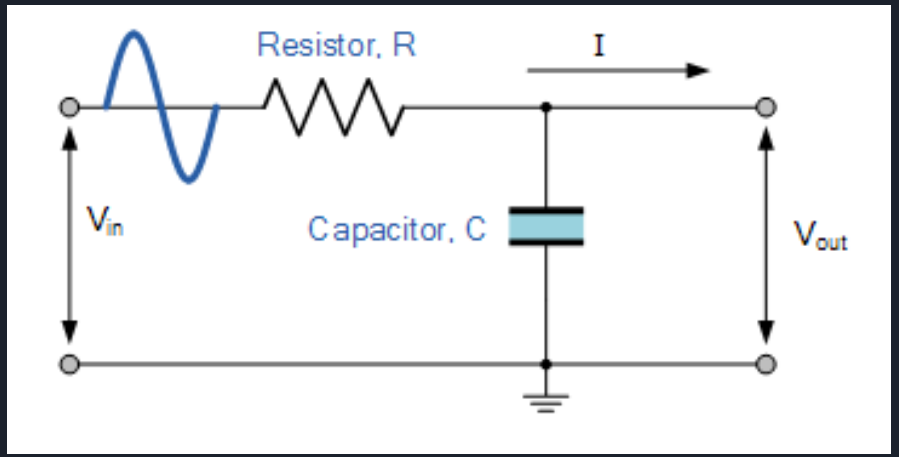
https://www.3ccooler.com/cooler-master-12025-a12025-20rb-3bn-f1-df1202512rfun-r4-l2r-20ac-gp-12v-0-37a-3-wires-led-cooler-fan.html#product-details-tab-specification

Source for fan photograph. This is the same fan provided by Textron for testing,

Cody White

- Based on research into RC filters, we have determined we'll need a low pass filter for the tachometer output to create a smooth signal.
- Based on research into voltage regulators, we have determined we'll need a passive voltage regulator to lower the input coming from the power bus.



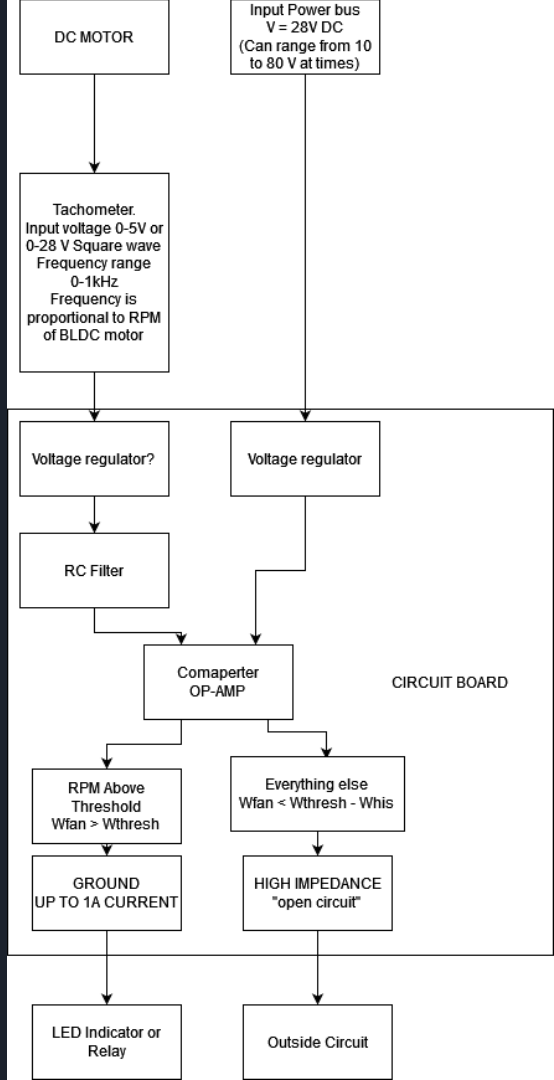


Sources: https://circuitdigest.com/electronic-circuits/voltage-regulators://circuitdigest.com/electronic-circuits/voltage-regulators
https://www.electronics-tutorials.ws/filter/filter_2.html

Mel St.John Output

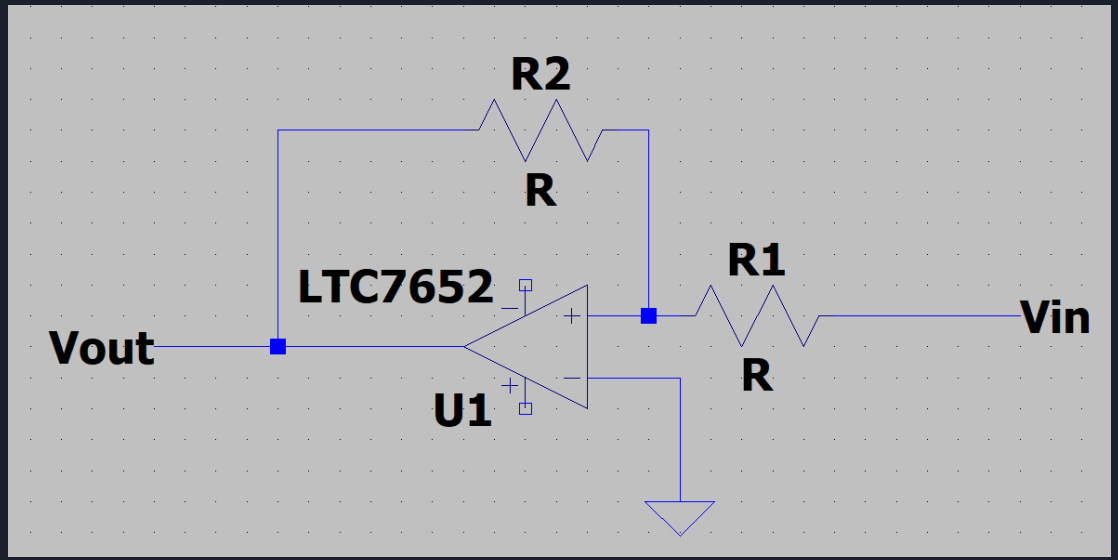
- Component Constraints
  - Make sure to not use programmable chips (No memory in chips)
    - Other testing required for these chips (DO-178 and/or DO-254)
  - Make sure components are generic and can't easily go obsolete

- O/P goes to ground if Rpm above threshold
- O/P provides an open if Rpm below threshold
- Sink 1 amp continuously when providing ground
- Should incorporate hysteresis



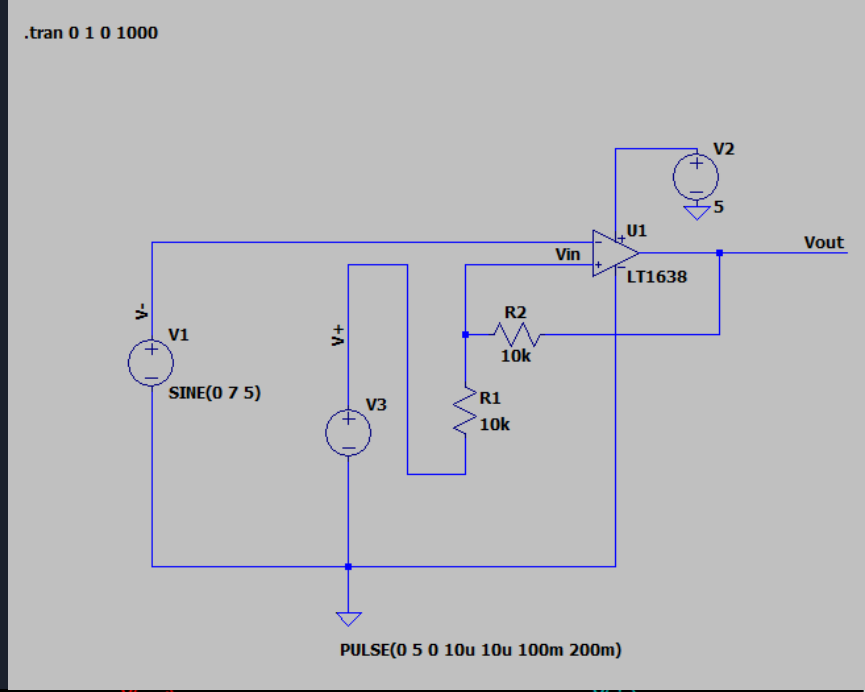
Mel St.John

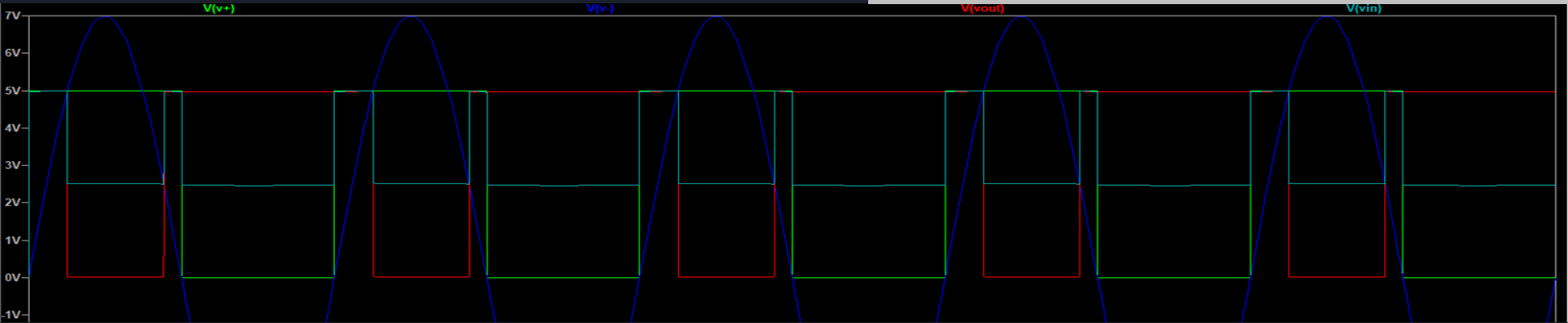
Comparator- Schmitt Trigger (with Hysteresis Feedback)



Ayham Sabra

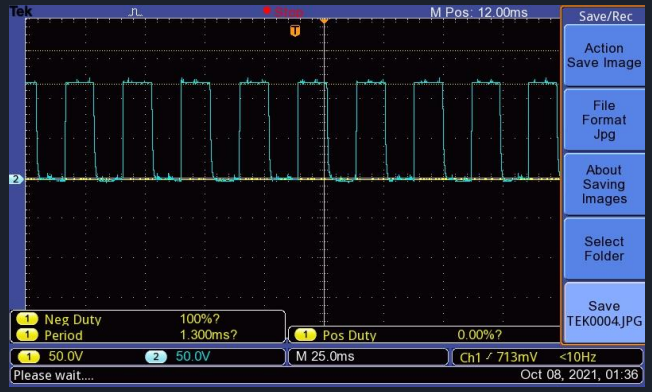
- Schmitt Trigger Comparator Circuit in LTspice

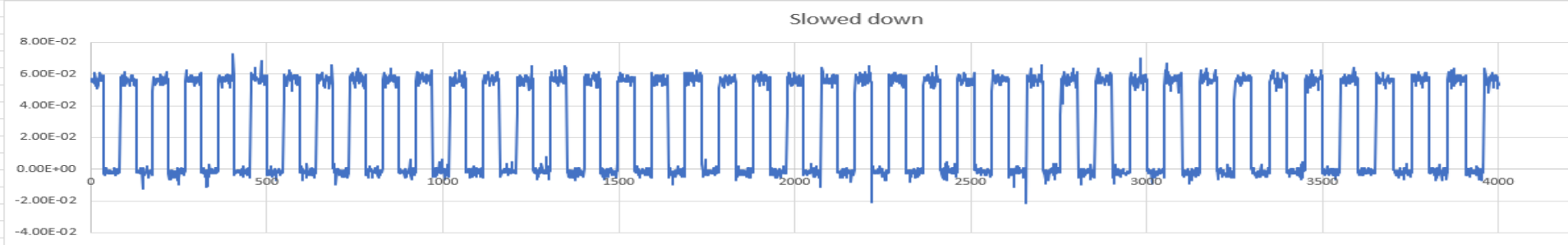


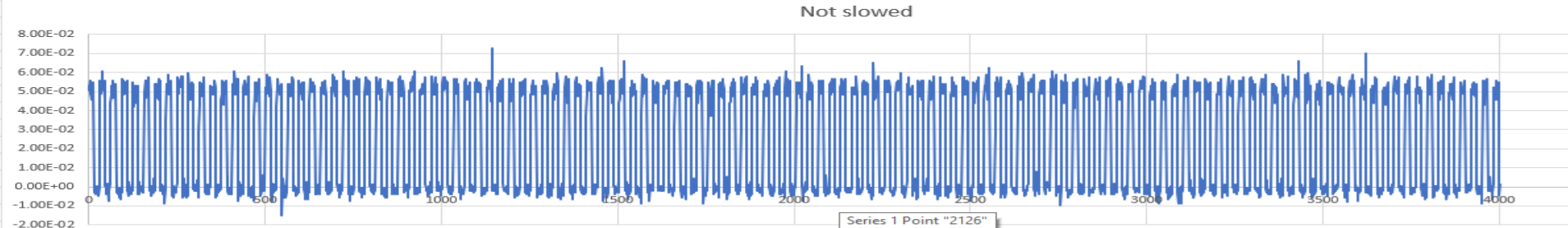


Ayham Sabra

- Fan Tachometer measurements







Thank you