

Compact DC/AC Power Inverter

Design Proposal

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- Industry & the Little Box Challenge
- Power Inverters
- Build Specifications
- FAST Diagram
- Design: Phases, Specifics, Proposed, Issues
- Budget
- Summary
- Timeline
- Questions

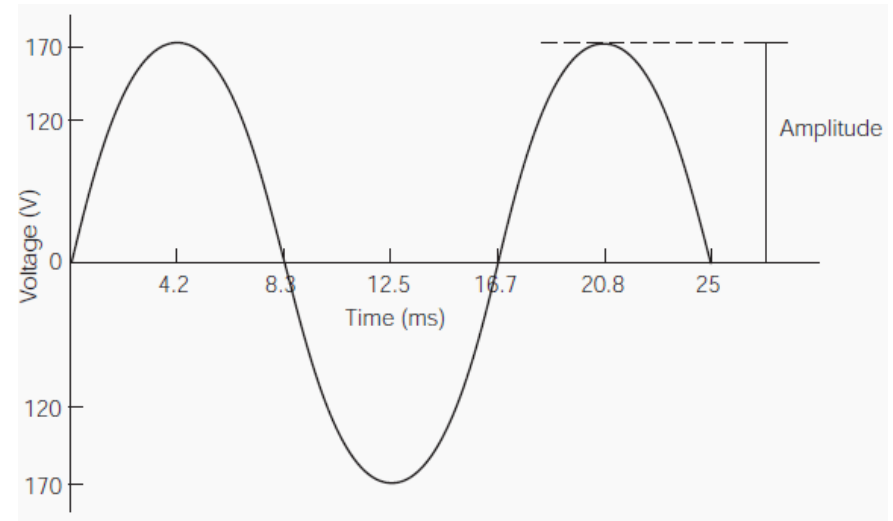
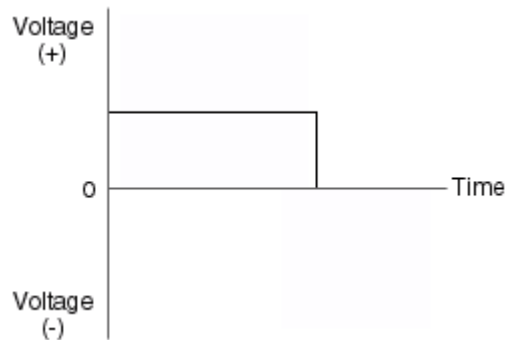
- What's an inverter?
- Problems
 - Size, Efficiency, Power Density
- Industry Drivers
 - Above Problems
 - Renewable Microgrids



www.competitivecyclist.com



en.wikipedia.com



<http://www.aselabs.com/images/userstuff/uploadedimages/2003/07/30/514.png>

<https://www.ipqdf.com/wp-content/uploads/2014/02/1voltage-waveform-power-supply.gif>

- Direct Current to Alternating Current
- Input/output transformers
- EMC filtering



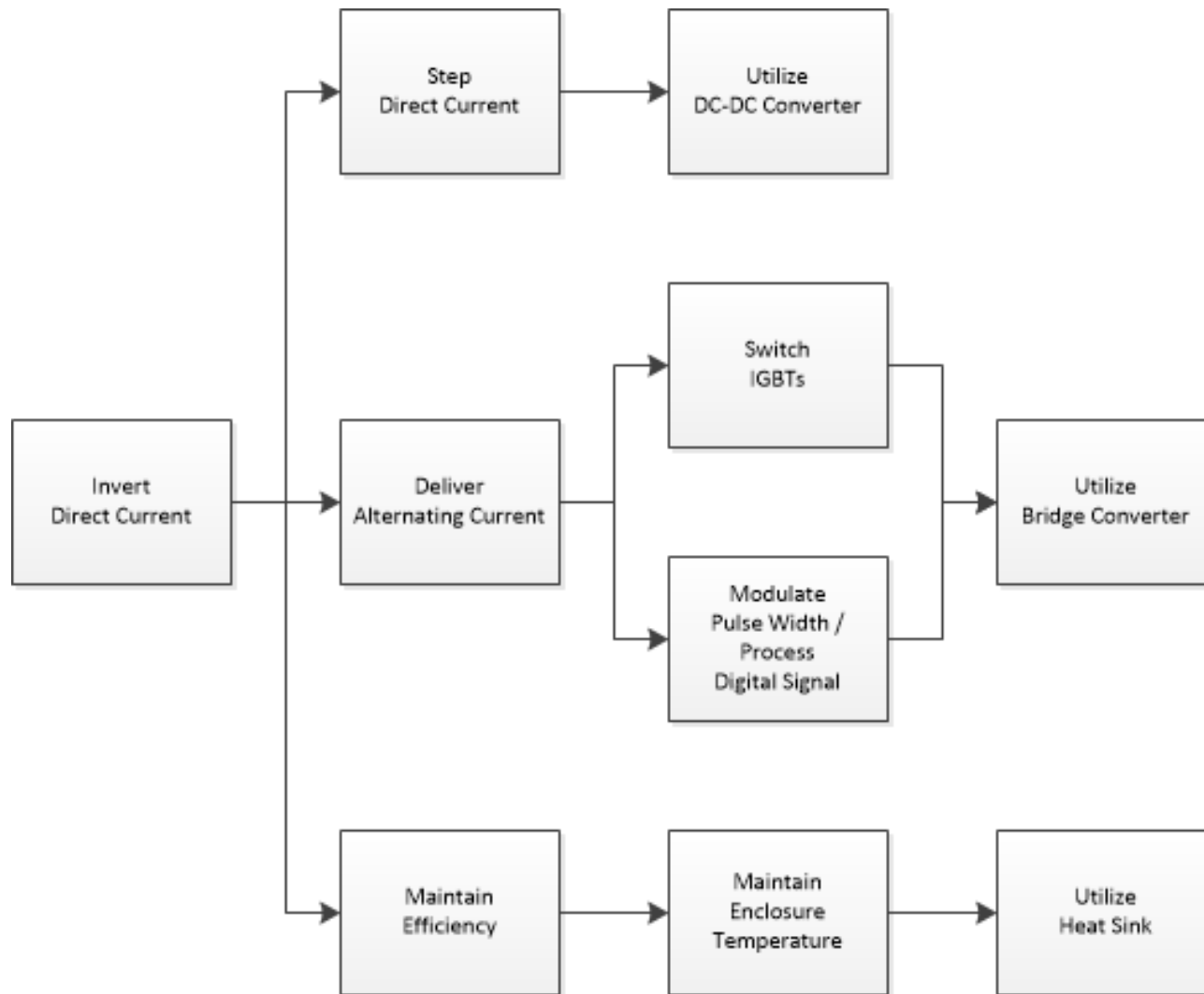
LITTLE BOX CHALLENGE



Parameter	Requirement (Nominal)
Maximum Load	2 kVA
Power Density	> 50 W/in ³
Volume	< 40 in ³
Voltage Input	450 V DC
Voltage Output	240 V RMS AC
Frequency Output	60 Hz
Maximum Outer Temperature	< 60 °C
Electromagnetic Compliance	FCC Part 15 B

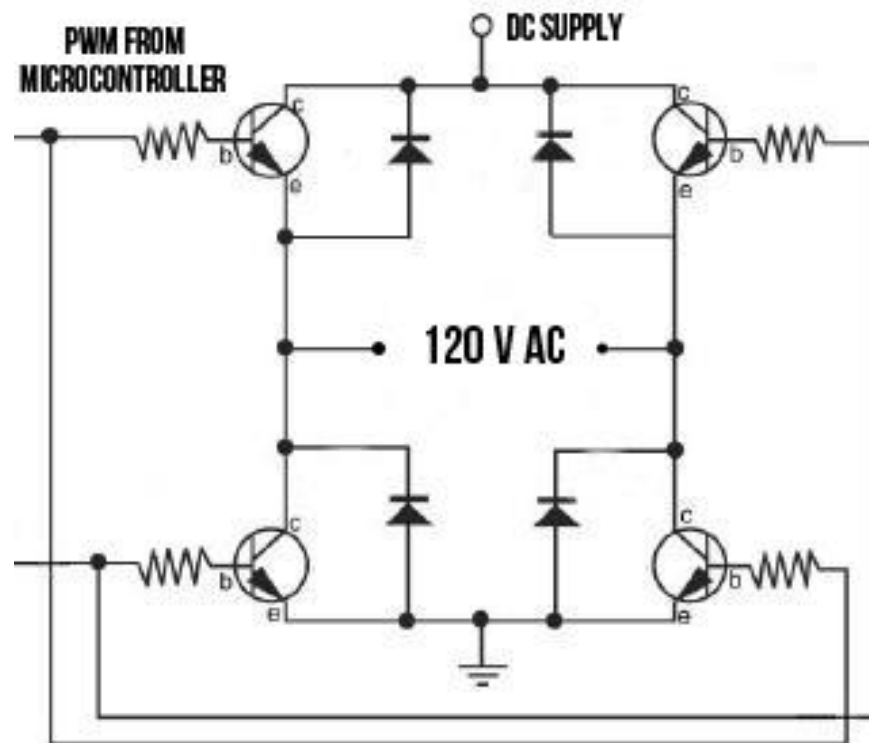
Team 7 Build Specifications

Parameter	Requirement (Nominal)
Maximum Load	1 kVA
Power Density	> 25 W/in³
Volume	< 40 in³
Voltage Input	200 V DC
Voltage Output	120 V RMS AC
Frequency Output	60 Hz
Maximum Outer Temperature	< 60 °C
Electromagnetic Compliance	FCC Part 15 B

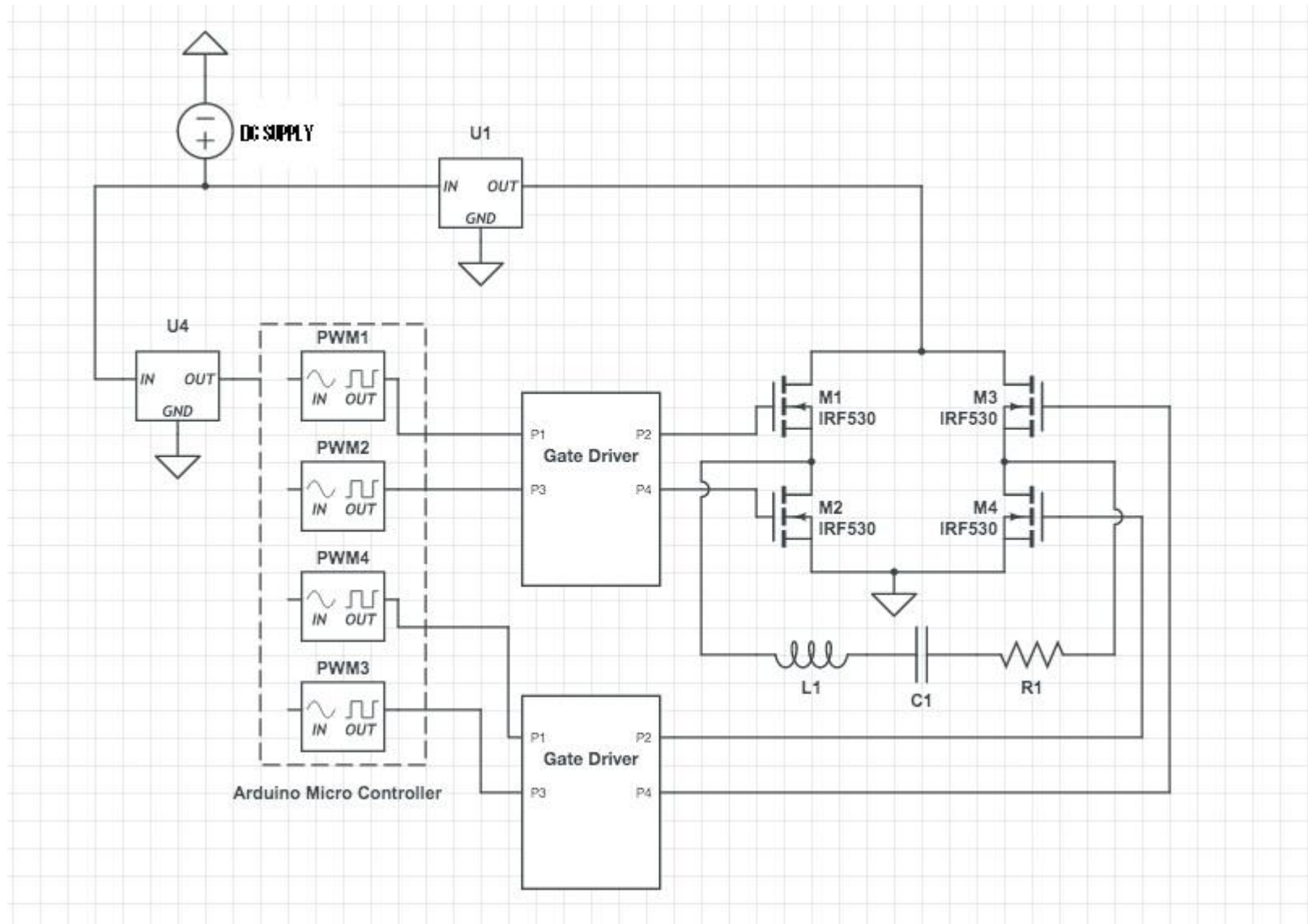


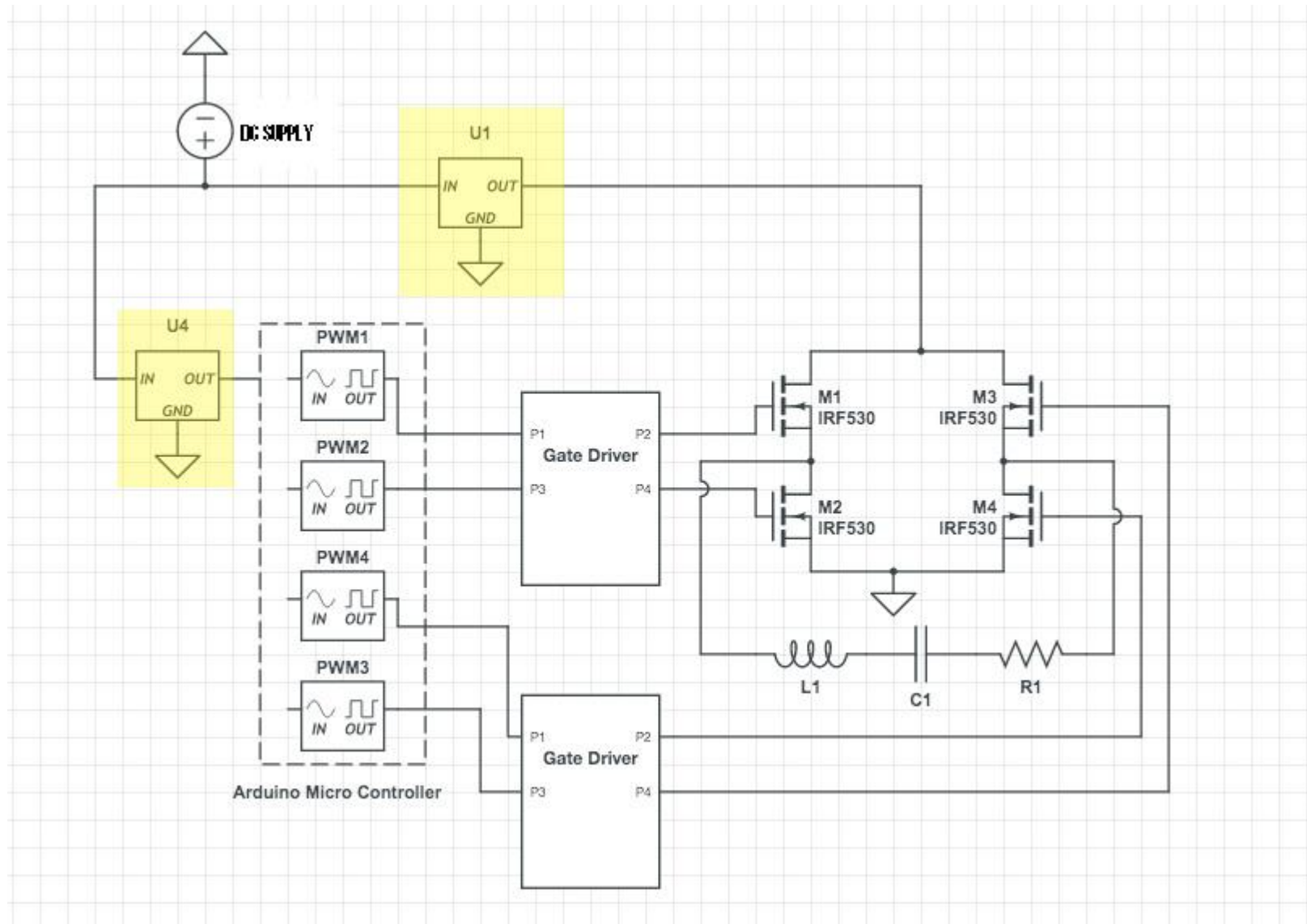
- Phase 1: PSpice Modeling and Car Inverter Research
 - Gather proposed solutions and test feasibility
- Phase 2: Silicon Prototype
 - Build, test, and discover heat limits
- Phase 3: Silicon Carbide Prototype
 - Build, test, and (carefully) discover heat limits
- Phase 4: Final Design and Build
 - Test thoroughly and perfect heat sink

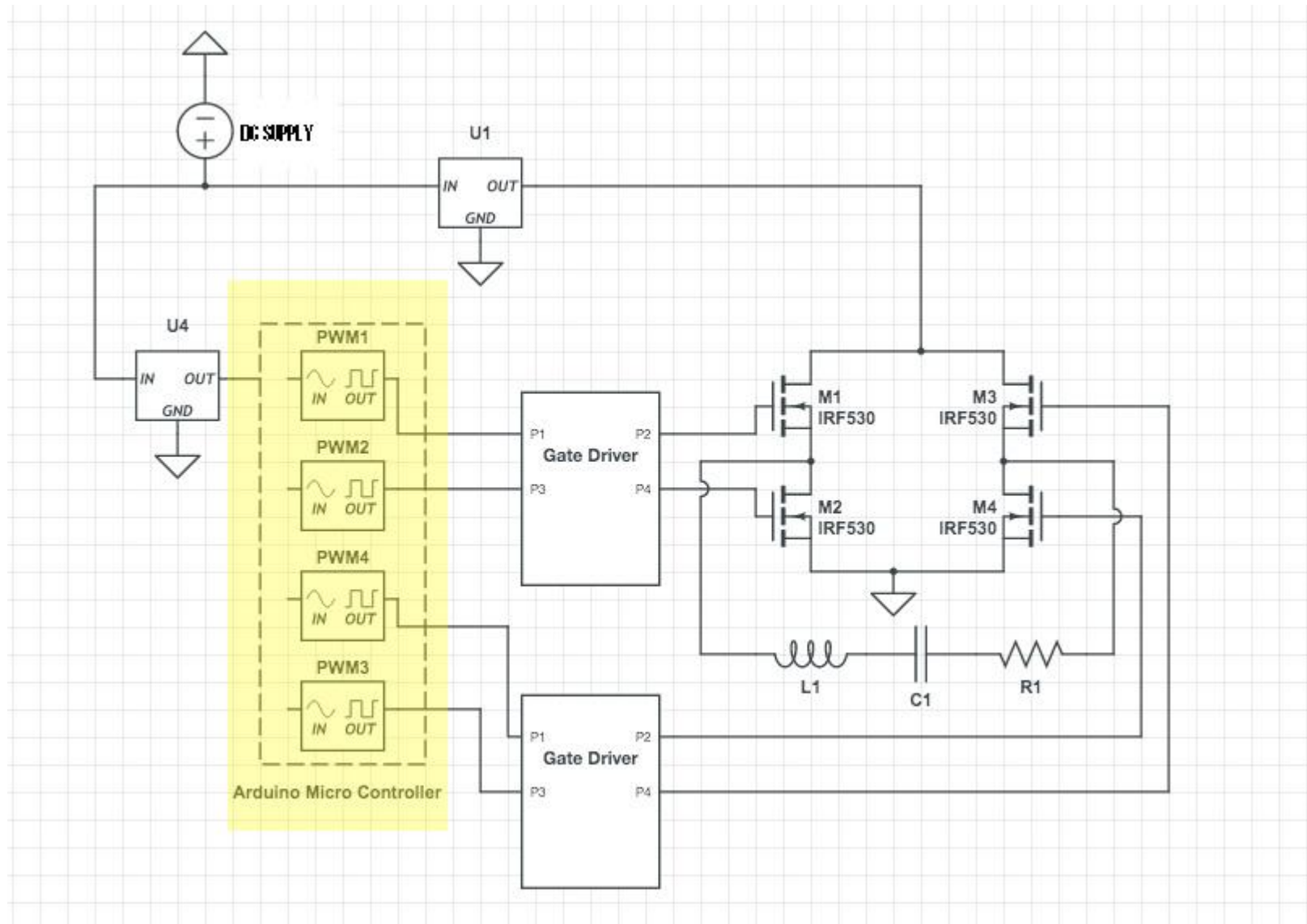
- H-bridge Using IGBTs
 - 200 V DC Rail
 - Controlled by gate driver

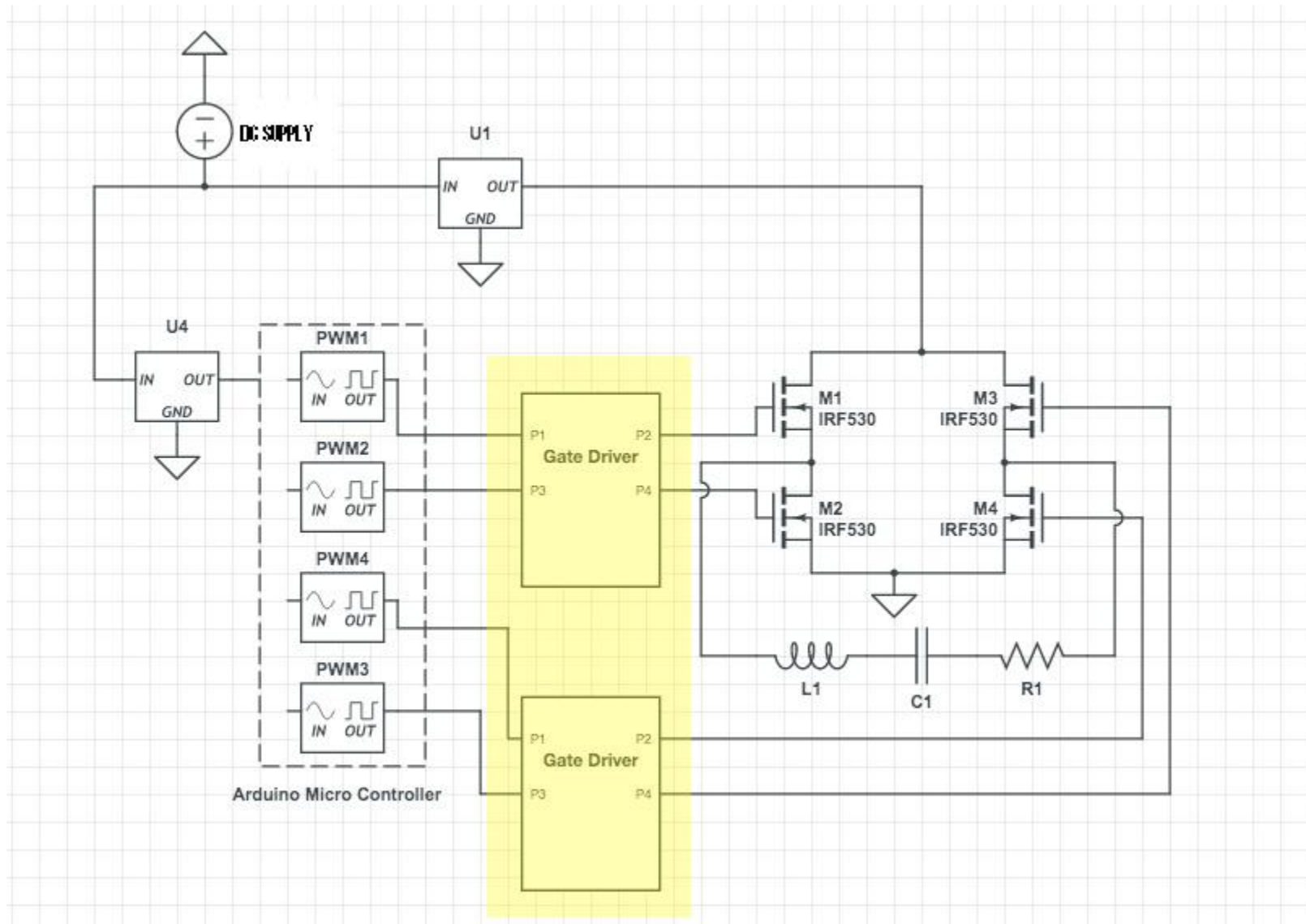


Proposed Design

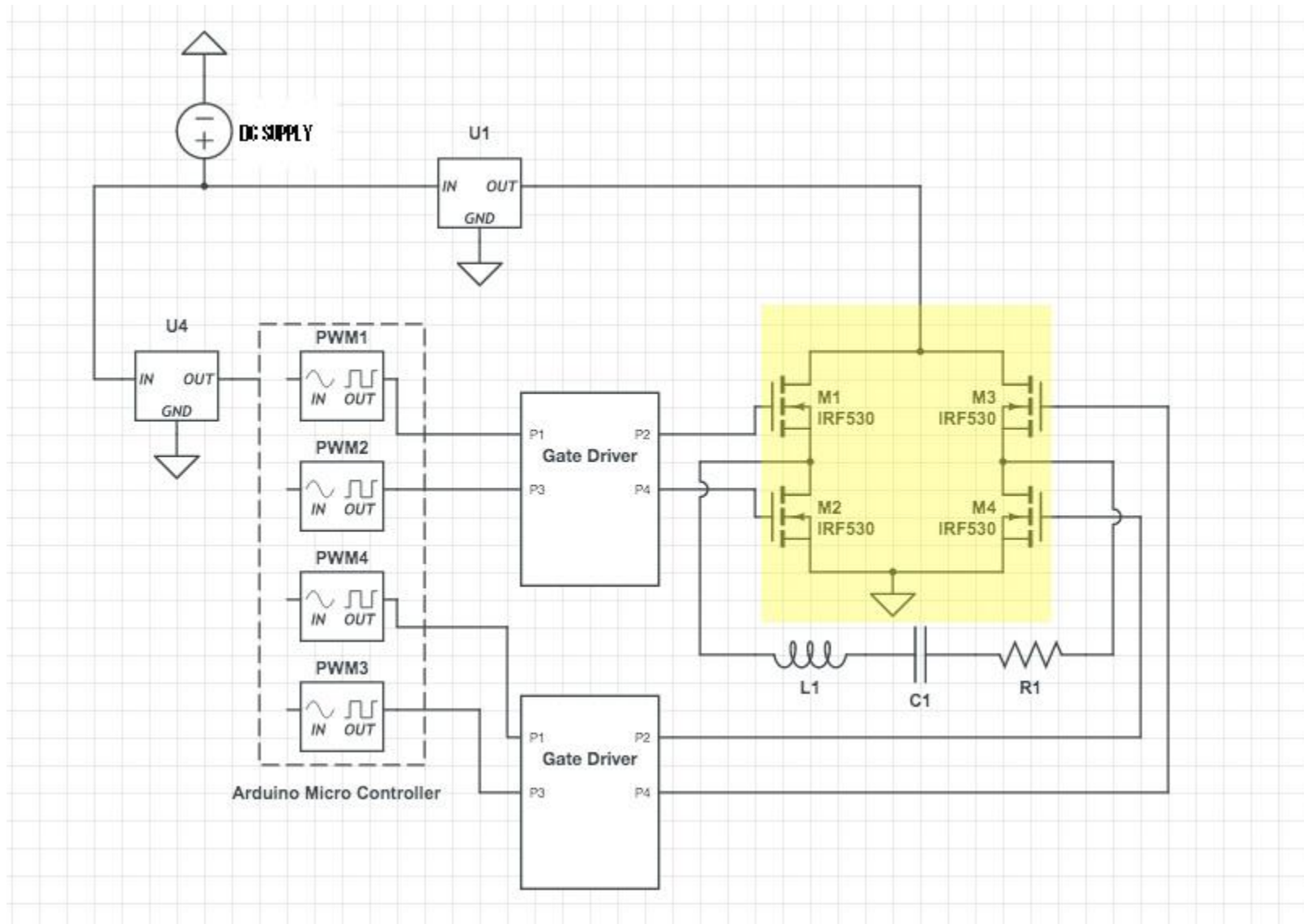


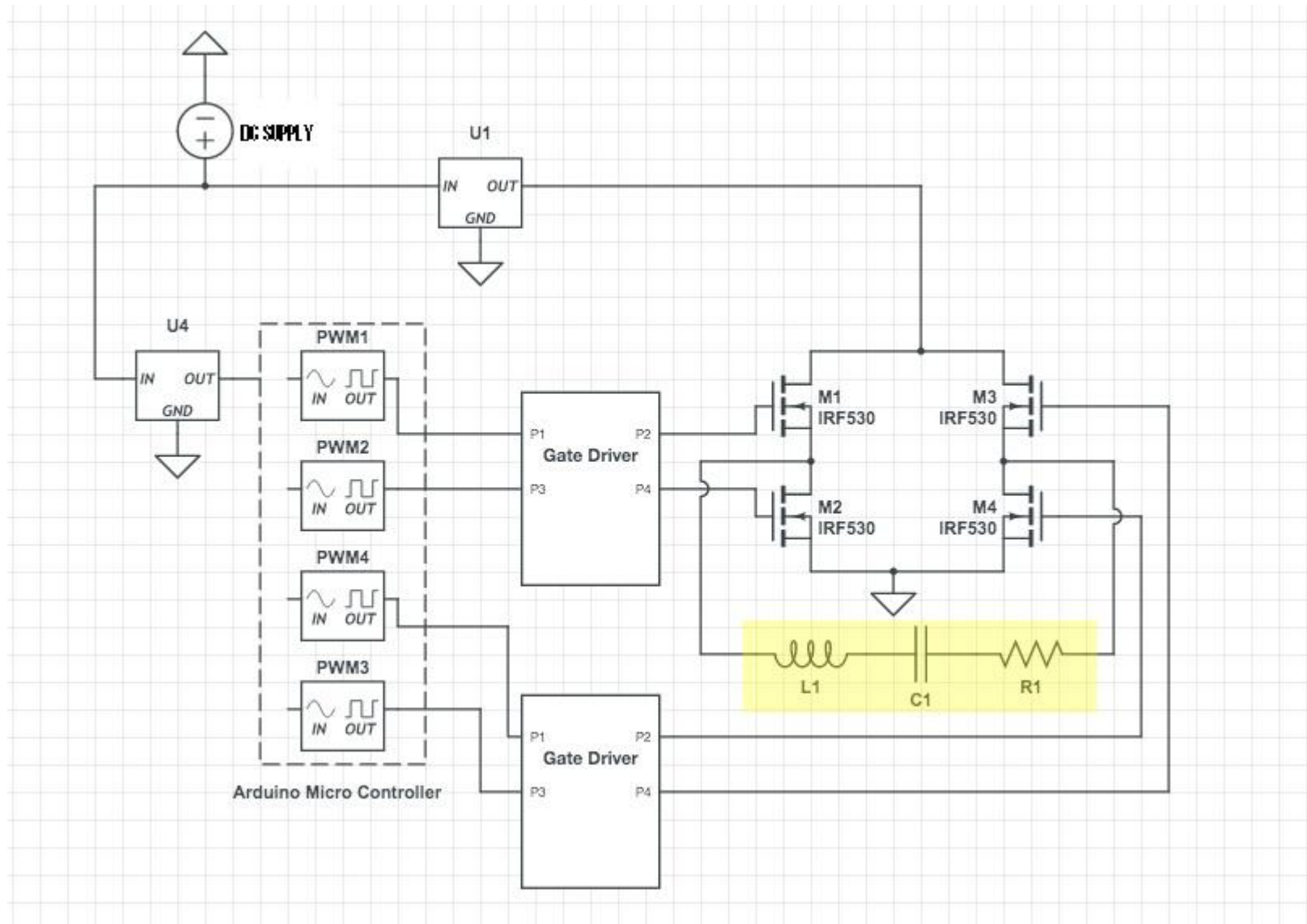




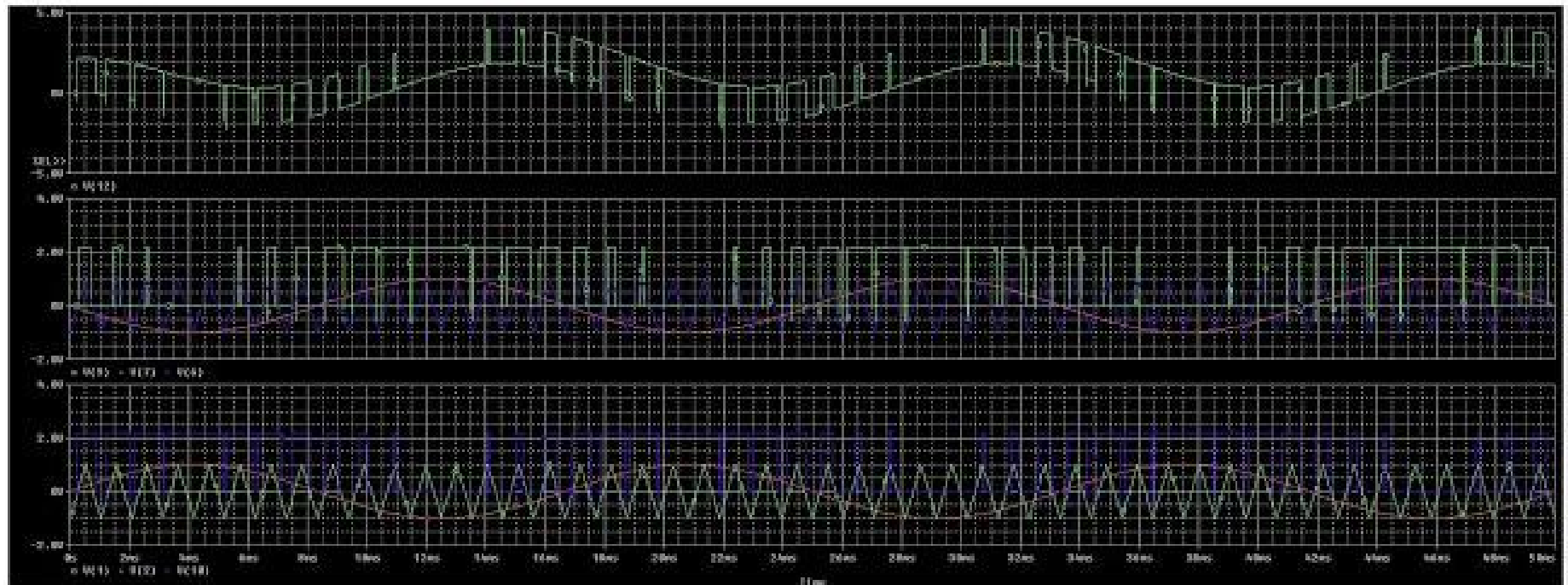


H-Bridge

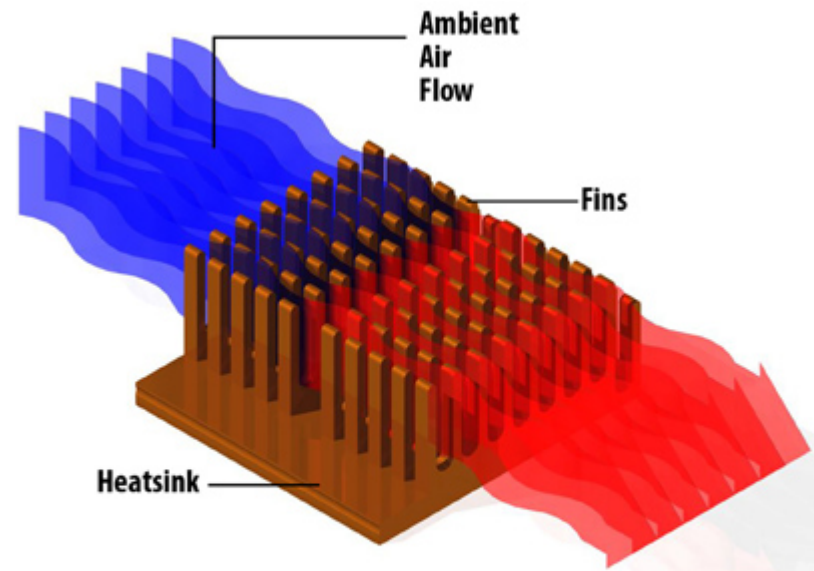




PSpice prior to proper output filter alignment (currently in progress)



- Risks
 - High DC
 - Heat
- Issues
 - Heat sinks
 - Enclosure Design

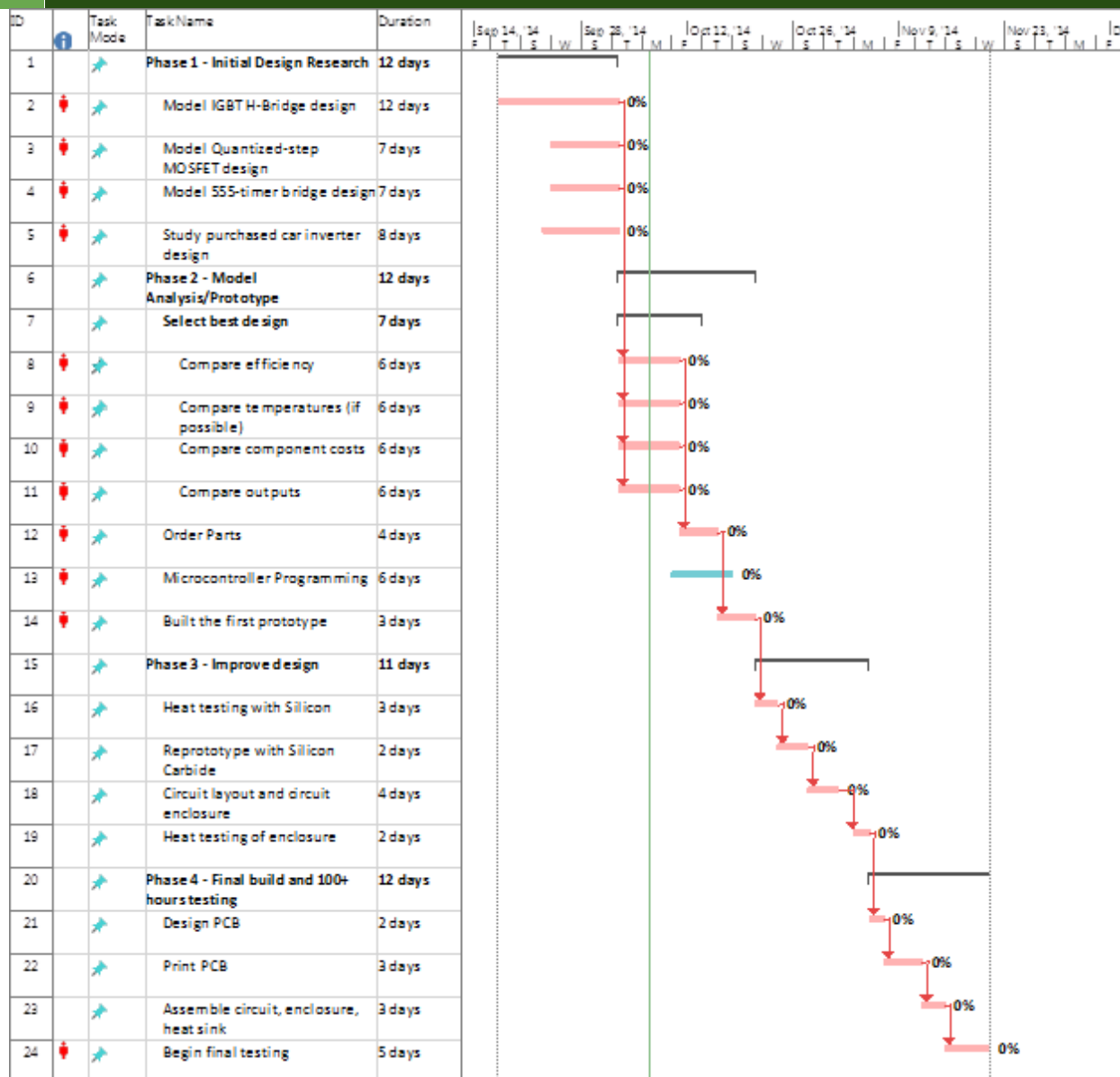


www.ecnmag.com

Item	Price	Quantity	Total	Description
C2M0025120D	\$91.61	4	\$366.44	Silicon Carbide IGBTs
UCC27211A	\$5.50	2	\$11.00	120 Volt Gate Driver
DC-DC Converters	\$32.15	3	\$96.45	Supply Rail for Micro Controller
Heat Sink	\$5.00	1	\$5.00	Aluminum Milled Heat Sink
Enclosure	\$8.00	1	\$8.00	High Temp Enclosure
Arduino Microcontroller	\$4.95	1	\$4.95	ATMega328
PCB	\$7.00	1	\$7.00	Printed Circuit Board
		TOTAL:	\$498.84	

- Main Challenge: Size
 - Component Efficiency
 - Heat Sinks
- Arduino Programing
- Build and Test
 - Silicon
 - Silicon Carbide

Timeline



Questions?