

September 16, 2016

Full Team + Grad Students + Dr. Li:

- Design heat sink -- material is aluminum alloy
- Gloves & safety goggles will be needed in the lab
- Must take Dr. Li safety quiz
- Will gain open-access to lab space
- Will be given reading materials -- direct questions to graduate students
- Travel possibility to NCSU for PowerAmerica
- Need to create internal timeline for project
- This project is related to research project
- Dr. Li would like hardware results by Dec.
- Next friday will have meeting with Dr. Li and give brief updates
- Select final design by December
- Flowtherm is possible software we can use
- Will need to emulate a heat source for testing purposes
 - Could individual heatsink for power module work?
 - Where will fans be mounted? Will fans be used?
- Read paper by Kolar
 - Stay away from international papers

September 20, 2016

Full Team + Grad Students

- Will be taking safety quiz soon
- Will Establish google drive for collection of documents and presentations
- Begin reading material
- Draft up a bio for website
- Establish internal timeline
 - Can we get a prototype by Dec. 10?
- Webpage is due by Oct 21
- Attend meeting with Dr. Gupta

September 23, 2016

Full Team + Grad Students

- Current design is 100kW output and weight is 6.5 kg, 97% efficiency
- 2 stages with 8 modules in total: 2 + 6
- Each stage has different amount of power loss
- Normal Operating Temp: room - 25C
- Max Junction Temp: 150C

September 30, 2016

Full Team + Grad Students + Dr. Li

- Need to verify how long heatsink will take to fabricate and ship
- Will order aluminum alloy pin fin heatsink by end of Oct
 - Need to get specs today

- Meeting next friday at 10am
 - Give ppt update on the reading material
 - Focus on most relevant papers

October 7, 2016

Full Team + Grad Students + Dr. Li

- Gave ppt update
 - Can ignore leakage, ringing, and magnetic losses
 - Keep in mind efficiency
 - Only consider the device loss
 - Will not use the standard analytical method to calculate losses
 - SiC MOSFET have high ringing losses
- Will need to research ways to output heat
 - Thermal resistors
- Pin Fin is the desired heatsink
- Must read the new papers for power loss calculations
- Neext Friday meeting at 10am
- ME needs to evaluate the pin-fin solution
- Conference will be mid January

October 14, 2016

Full Team + Grad Students

- Power module size: 108mm by 46 mm
 - They dissipate heat evenly on bottom plate
- Should try natural convection first, then forced
- Need to find relationship between input parameters and heat

October 21, 2016

Tianna, Melanie + Grad Students

- Need to determine how to mount the emulator
 - Screws, thermal glue
- Create a small case made of copper

October 21, 2016

Colleen, James, Leslie

- Work on Pressure Drop Calculations for plate fin heatsink
- Practice Comsol

October 28, 2016

Tianna, Melanie + Grad Student

- Two domains exists for power loss calculations
 - Electric domain
 - Thermal domain
- In electric:

- Total power loss is a function of switching frequency, input power, junction temperature
- $P = af + bP_o + cT_j$
- Generate data through simulation to get coefficients
- In thermal
 - Equivalent circuit is junction temp, P_{total} , R_{jc} , R_{ch} , R_{ha}
 - $R_{ja} = R_{jc} + R_{ch} + R_{ha}$, junction case resistance, thermal greases resistance, heatsink thermal resistance, respectively
 - $P_{total} = T_j - T_a/R_{ja}$
- Set power equations equal to each other, solve for maximum allowable heatsink thermal resistance, R_{ha}

November 1, 2016

Full Team + Dr. Shih

- Budget is in question
- Mounting fans is in question
- Plan is to finish heat source design by this Friday
- During staff meeting
 - Send Dr. Shih emails from now on
 - Dr. Li should be responsible for budget issues
 - Should try simulation results before we start experiment
 - Maybe look into 2-phase material
 - Does turning on power module create high temperature spikes?
 - Use ThermoCouple to measure temperature
 - Need to find flow rate of fans

November 4, 2016

Tianna, Melanie + Grad Students

- Use step waveform in Simulink
- Some MOSFETs have different control
- Use 1 control for each phase
- This is open loop simulation
- Read through paper to determine operation for power modules
- The heatsink test must run for 30 minutes
- Later determined will not be doing Simulink simulations

November 8, 2016

Full Team

- Current fans do not fit heatsink in lab
- Need to order 4x4 fan?
- Need to simulate optimal straight fin
- Need help on pin-fin simulations
 - Need Data and calculations
- Will need screws for mounting fans

- 6-32 standard
- Should finish heatsink experiment soon
- Need to create poster for PowerAmerica conference
- Cannot find manufacturer for heatsink order,
 - Current one will not send invoice to CAPS
 - Decided will order with credit card and be reimbursed later
- Time critical:
 - Demo for heatsink results
 - Hardware design
- Ask TK for pin fin heatsink
- Must read Kolar paper
- Q: What is the difference between the real case and simplified case for this project?
 - We are assuming the overall power module power loss,
 - Do not care about individual types of losses
 - Hold switching loss constant
- Conduction loss is related to junction temperature, will need this calculation soon
- Calculate loss for single phase of T-type
- Use datasheet parameters
- ME need to optimize heatsink based on the calculated thermal resistance
- Need to make sure emulated heat source will fit the bill

November 18, 2016

Full Team + Dr. Li + Grad Student

- Need to prepare poster for PowerAmerica
- Be here the week after finals for some finalization
- Need to add all losses together for total loss
- Graph total loss vs junction temperature, determine trend
- Will be able to control input current