Team Agreement

EC463/EC464 - Senior Design
Fall 2018 – Spring 2019

We, the members of team number __1__, called _____Analog Devices_____, have entered into a project titled _____Parallel Battery Management Evaluation Board_____ for the customer, _____Analog Devices, Inc._____ as part of Senior Design Project, ENG EC463/EC464.

The general objective of our project is:
To create an evaluation board for Analog Devices Inc.'s MAXIM chips. Namely, the MAX17330 will be used for parallel multiple battery management. With one USB-C input, two batteries will be able to be charged simultaneously and intelligently. This board will serve as proof of the utility of the chip in parallel battery management, a technology useful also in biomedical devices.

We expect that our major project deliverables will include the following:
Fully fabricated, assembled, and shipped Printed Circuit Board (PCB) with the expected functionality of parallel battery charging with one USB Type-C input. This PCB will include the ADI ICs with the following functionalities: Battery Management, Type-C Power Deliver Controller, Switch-Capacitor, Boost Converter. Also, an LCD and a microcontroller will be soldered separately. The next deliverable will be the code for the microcontroller in order for it to communicate with the ICs and charge the batteries smartly as well as display information on the LCD.

GENERAL CRITERIA FOR SUCCESS

We understand that evaluation of our work in Senior Design will depend on several factors. First is our team's success at meeting our proposed objectives, as described by our specifications, and providing our deliverables in working fashion, with the required documentation, by the course deadlines. Second is our demonstration of individual proficiency at design and at keeping adequate engineering records of our work. Third is our individual and collective team skill in listening, helping others to reach their goals, and negotiating technical and team problems. Finally, we understand the department policy for reimbursement of expenditures made in executing our project and agree that anything spent about the amount reimbursed by the department will be equally shared among all team members.

INDIVIDUAL LEADERSHIP

We understand that Senior Design teams shall be organized to give each member clear responsibility for one or more design areas. Several people may collaborate on a problem, but only one person should be the designated 'leader' for a design area. Each of us should be the leader of at least one design area so that we can clearly demonstrate our individual proficiency in design and in keeping professional engineering records (in our logbooks).

RESOLVING TEAM CONFLICTS

We understand that we need to work to resolve interpersonal and technical disputes within our team, in a professional and respectful manner. This will sometimes involve compromise, and we agree to be open to reasoned technical arguments about our individual areas and the team's collective efforts. We will seek faculty or mentor help when problems appear serious and are not resolved quickly by our efforts.

NON-PERFORMANCE OF DUTIES BY A TEAM MEMBER

We understand that each of us must pursue our design and team tasks in a professional and timely fashion to ensure our team's success. Should a team member fail to show diligence and concern for the team, a meeting of the team and the course faculty will be held to assess the situation and recommend specific short-term performance goals for the team member, and possibly the whole team. If these goals are not met, the course faculty may decide to remove the offending team member from the team. The student will then have to complete the course reporting directly to the faculty as a team of one. This is a serious step and suggests a significant failure on the part of the individual, and possibly the whole team. It should not be considered except as a last resort.

QUESTIONS

We understand that students and teams are welcome to approach the course faculty about this agreement at any time.

INDIVIDUAL TEAM MEMBER RESPONSIBILITIES

The remaining pages list our team members and our individual 'leader' responsibilities.

TEAM MEMBER ADDENDUM (submit one for each team member):

Team Member Name: (printed) Sunwoo Park

Team Number ___1___ Team Name: Analog Devices

I have read this entire document, including my teammates' descriptions of their 'leader' roles. I understand the document and agree with the descriptions of roles.

Team Member Signature Sunwoo Park

Date: 12/1/22

The following paragraph(s) describes the technical problem(s) for which I hold leader responsibility. (Please give technical details if possible. Broad topical claims will be difficult to assess.)

The technical problems for which I hold leader responsibility are the malfunctioning of an IC due to over-voltage or mishandling; the malfunctioning of the microcontroller and LCD; and the malfunctioning of our program before, during, and after uploading to the microcontroller.

If any of the ICs (MAX17330, MAX77958, MAX77932, and MAX77986A) malfunction or break due to over-voltage or mishandling, I will take responsibility to replace the evaluation boards with the broken IC(s) that ADI sent us with new ones. We already have several backup evaluation boards of the ICs, however in the worst case that all boards for one IC break, I have a plan to replace them as soon as possible by getting into contact with the client, ADI. Most importantly, I will try to figure out how the IC was damaged so that we do not make the same mistake again.

Furthermore, if the microcontroller or LCD components malfunction, I will take responsibility to see if any connections are being shorted and whether or not all necessary connections are properly made. We also have backup components of these, however in the case that even the backup components break, I will order replacements from DigiKey as soon as possible if troubleshooting efforts fail.

Finally, if any errors occur within our main software program, I will work with Antonio to debug the code and backtrack to test on individual ICs before retrying on the entire circuit.

Beyond these problems that we may face, I am responsible for understanding the software design to properly read and write to the correct registers within each IC via Raspberry Pi (using I2C communication). I will run this program with all ICs and the final circuit to verify it works.

TEAM MEMBER ADDENDUM (submit one for each team member):

Team Member Name: (printed) David Liu

Team Number ___1___ Team Name: Analog Devices

I have read this entire document, including my teammates' descriptions of their 'leader' roles. I understand the document and agree with the descriptions of roles.

Team Member Signature David Liu

Date: 12/1/22

The following paragraph(s) describes the technical problem(s) for which I hold leadership responsibility. (Please give technical details if possible. Broad topical claims will be difficult to assess.)

The technical problems I hold leadership responsibilities for are understanding the circuitry function and the debugging of the circuit.

I will be responsible for understanding the physics and the function of the components used in the project. More specifically if a component uses a certain circuitry principle (such as switching capacitor) I am responsible for understanding its fundamental operating principle and any issues that may arise with it. This also means that I am responsible for understanding how the different functions of the different components interact with each other.

By extension I am also responsible for debugging the circuit and understanding any complications that arise due to interconnections of the circuit. Complications often arise between circuit components due to incompatibility of their individual operating principles. If for example a battery does not charge for a given prototype iteration it is up to me to understand why, how to replicate the issue, and how to solve the issue.

Besides these two responsibilities I am also responsible for communicating these concepts that may be helpful to other aspects of the project. For example if the software side of the project needs to understand the function of a component's register and its electrical properties I am responsible for helping them to understand.

TEAM MEMBER ADDENDUM (submit one for each team member):

Team Member Name: (printed) Harry Katsaros

Team Number __1____ Team Name: Analog Devices

I have read this entire document, including my teammates' descriptions of their 'leader' roles. I understand the document and agree with the descriptions of roles.

Team Member Signature hk

Date: 12/1

The following paragraph(s) describes the technical problem(s) for which I hold leader responsibility. (Please give technical details if possible. Broad topical claims will be difficult to assess.)

The technical problems for which I will hold responsibility are the design and implementation of our circuitry on Altium. Eric Cho and I will be responsible for translating our on-paper design into an Altium model that can be fabricated by ADI. If we fail to meet the deadline on this, or our PCB ends up not functioning, I will claim responsibility.

To prevent this from happening, I will do my best to learn how to use Altium. It will be a primary responsibility of mine to watch as many tutorial videos as needed and do appropriate readings and research on the Altium software. This will most likely ensure that I will be able to translate the schematics of our interconnected evaluation boards into a complete design on Altium.

In addition, I–like David–will claim some responsibility in understanding the physics and electric principles behind the components used in our printed circuit board. I will put a dedicated effort into researching the buck-boost converter as well as the switch capacitor. This will allow me to help troubleshoot any arising issues.

TEAM MEMBER ADDENDUM (submit one for each team member):

Team Member Name: (printed) Antonio Alonso Montealegre

Team Number __1__ Team Name: Analog Devices

I have read this entire document, including my teammates' descriptions of their 'leader' roles. I understand the document and agree with the descriptions of roles.

Team Member Signature AAM

Date: 12/2/2022

The following paragraph(s) describes the technical problem(s) for which I hold leader responsibility. (Please give technical details if possible. Broad topical claims will be difficult to assess.)

The problems for which I will hold technical responsibility are any software bugs that may arise once we begin working with the microcontroller. This includes unexpected behavior of the algorithm created to identify how much power to supply for charging, unexpected behavior of the microcontroller, and unexpected behavior of what is displayed on the LCD. Some of this responsibility will be shared between myself and Sunwoo Park, as we are the two CEs in the group, but it will mainly land on me.

To prevent these issues from ever occurring I will make sure to create extensive tests before uploading any code onto the microcontroller. To create these tests I will have a separate microcontroller setup where I will upload test scripts that will use the same algorithms but instead of communicating with the ICs through the I2C protocol, it will have predetermined inputs.

Moreover, to avoid issues related to my use of the I2C protocol, I will make sure that I learn its ins and outs. I have never worked with this protocol before, but I am proficient in Python, and have learned how to use many new libraries before, so using MicroPython to code should be relatively easy.

Finally, before any of these errors could possibly occur, I will make sure that our design is fundamentally concrete. Alongside Sunwoo I will create a work plan that we can stick to and create the functionalities step by step, in an agile manner.

TEAM MEMBER ADDENDUM (submit one for each team member):

Team Member Name: (printed) Eric Cho

Team Number ___1___ Team Name: Analog Devices

I have read this entire document, including my teammates' descriptions of their 'leader' roles. I understand the document and agree with the descriptions of roles.

Team Member Signature Eric Cho

Date: 12/2/2022

The following paragraph(s) describes the technical problem(s) for which I hold leader responsibility. (Please give technical details if possible. Broad topical claims will be difficult to assess.)

The technical problem that I will be responsible for solving is the design of the PCB. I will create the schematic and footprint library so that each electronic component on our board passes all design rules and matches the specifications within their respective datasheets. I will then use these components that we have constructed an electronic schematic that successfully connects all the ICs we plan to use. I will imitate the schematics within the evaluation boards that we have tested throughout the semester and connect them together so that there is only one power source required to power all electronic components.

The PCB design will also require me to do research on how we intend to design the physical aspects of the board. This would include deciding which voltages we would like to be able to test with test points/vias, how many layers we would like the board to be, and how wide we would like our traces that interconnect all electronic components. We will also need to make sure that all of our design choices conform to ADI's fabrication design rules.

I, like Harry and David, will need to conduct additional research to better understand the physics and electric principles behind the components we plan to use on the PCB. We will require simulations of components such as the switch capacitor on softwares such as LtSpice. These voltage simulations will help us guarantee that the schematic designs which we make in Altium properly function and create the outputs that we desire.

We plan to finish all PCB designing before the end of the year, so once we get a physical board prototype, I will test the outputs of the boards through our implemented test points when connected to a power source and see if the board functions properly. If there are mistakes, it will be my responsibility to make changes to the board design and reorder another prototype.