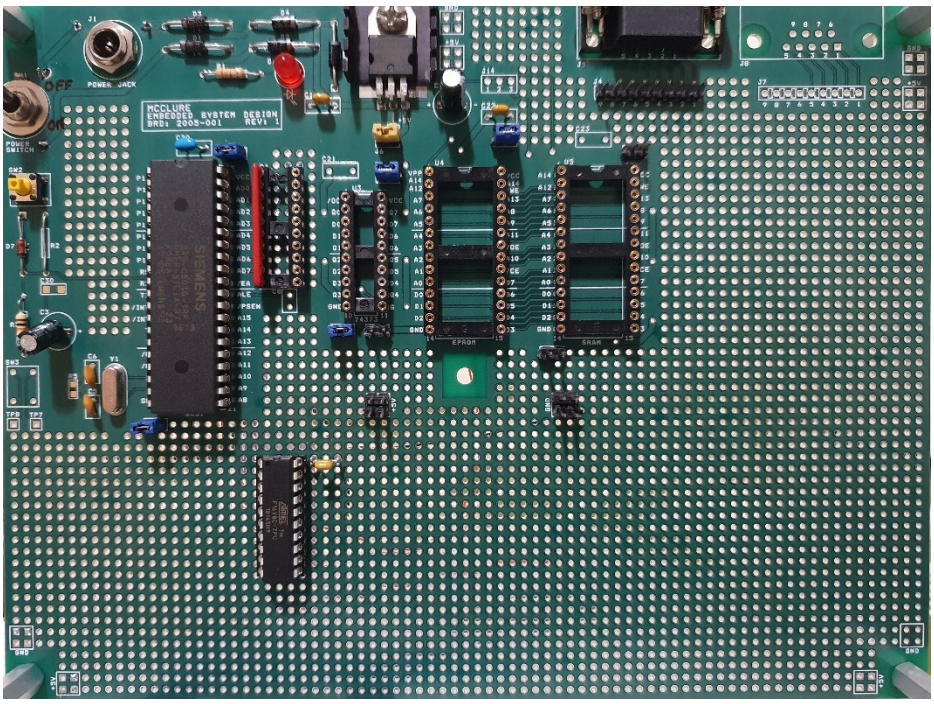
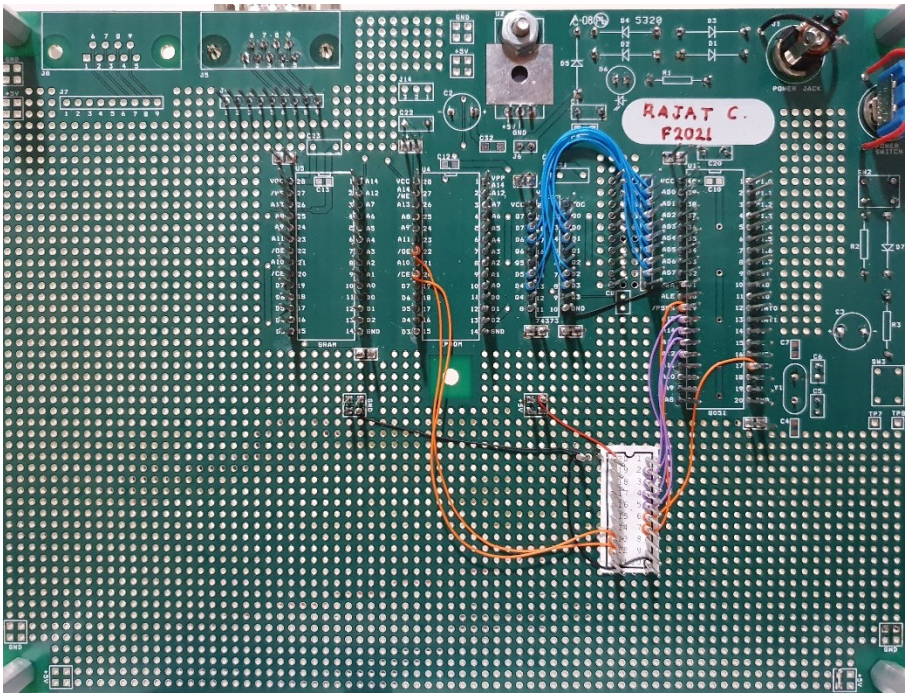
# ESD 5613 Lab1 Submission

# (Rajat Chaple)

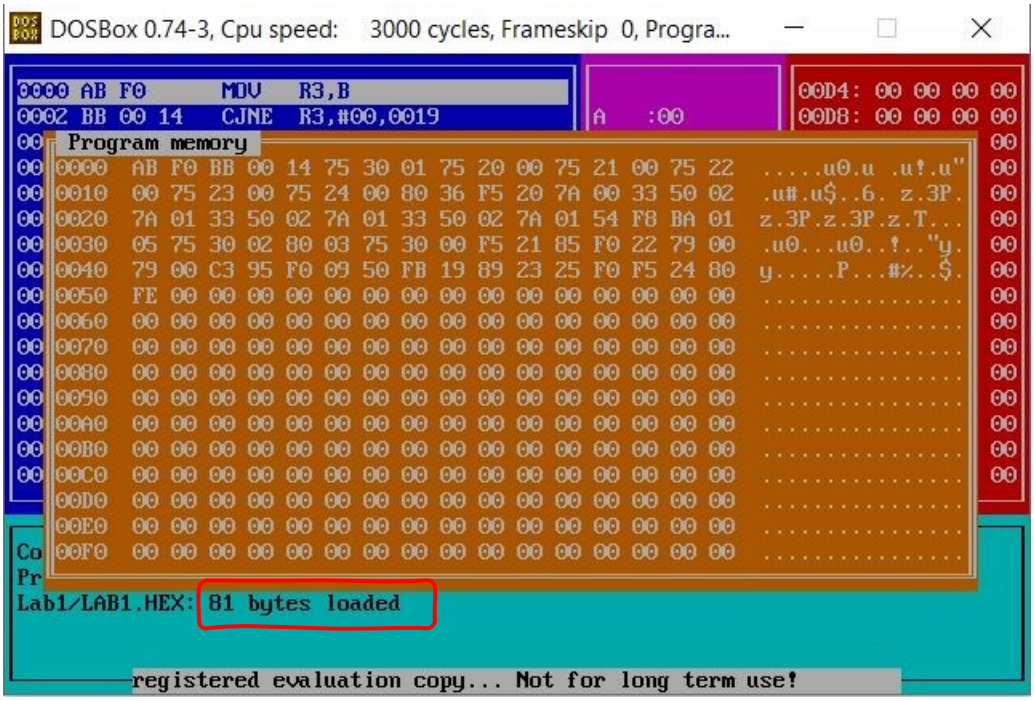
# PCB Layout


POWER JACK
MCCLURE
EMBEDDED SYSTEM DESIGN
BRD: 2005-001 REV: 1
EPROM
SRAM


RAJAT C.
F2021
POWER JACK
SRAM
PROM

## Part 1:

1) How many bytes of code space does your programmer require?
   Code size? ___81 bytes_____




   Another way to find out is sum up number of instruction bytes used by each instruction in a program.

2) How long did your program take to execute for X=0x10 and Y=0x0A? Assume an 11.0592 MHz clock and include the instructions executed from the beginning until you reach the ENDLOOP label. Show the TA your detailed calculations on the code listing during your signoff.

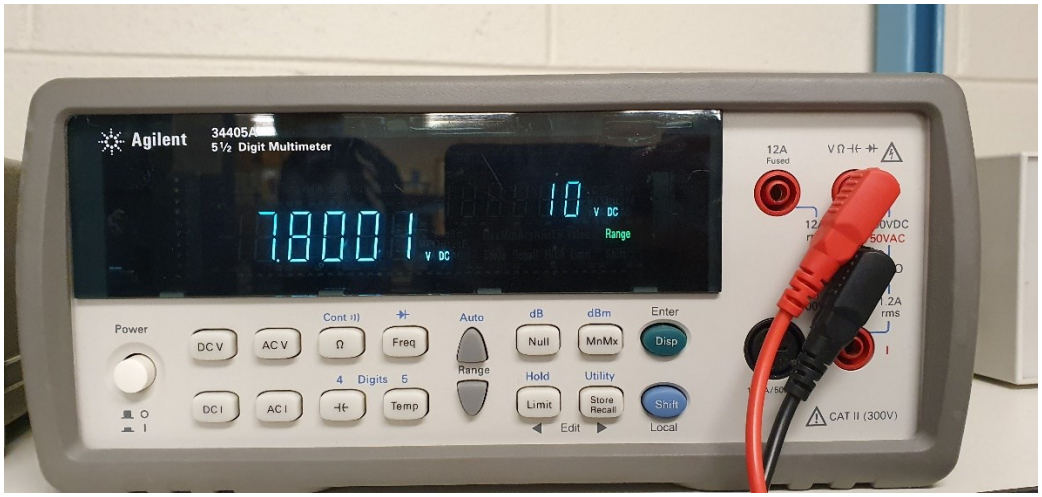
   Execution Time? _____84.63 uSec_____
   Calculation :
   Ans
   = (Total oscillator cycles taken by all the instruction during execution sequence) * period 0f oscillator
   = (936) * (1/11.0592) = 84.63 uSec
   Calculation of 936 oscillator cycles is in **lab_writeup/useful utilities/execution time.xlsx**

**Part 2:**

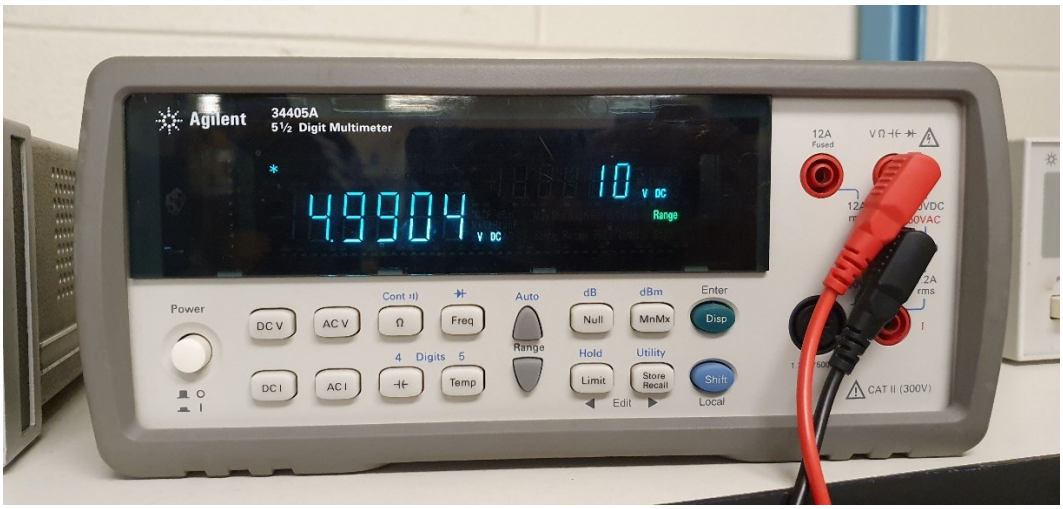
Schematic is attached in schematics folder.

**Part 3:**

1. What voltage is present at the regulator input? Use a digital multimeter.
   _____7.8 V_____

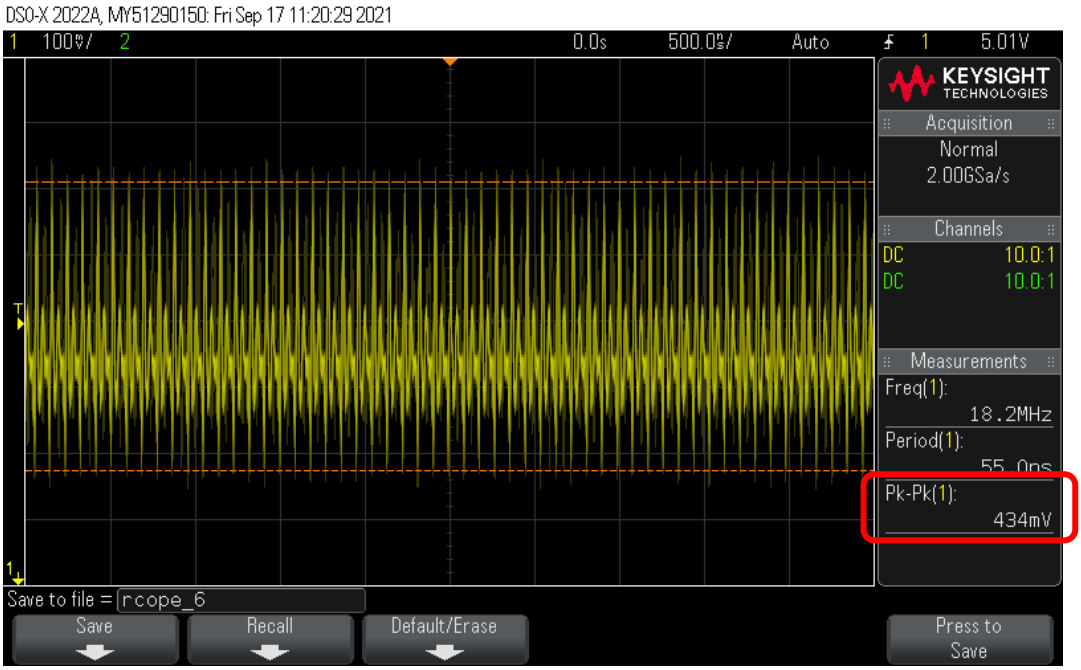



2. What voltage is present at the regulator output? Use a digital multimeter.
   _____4.99 V_____

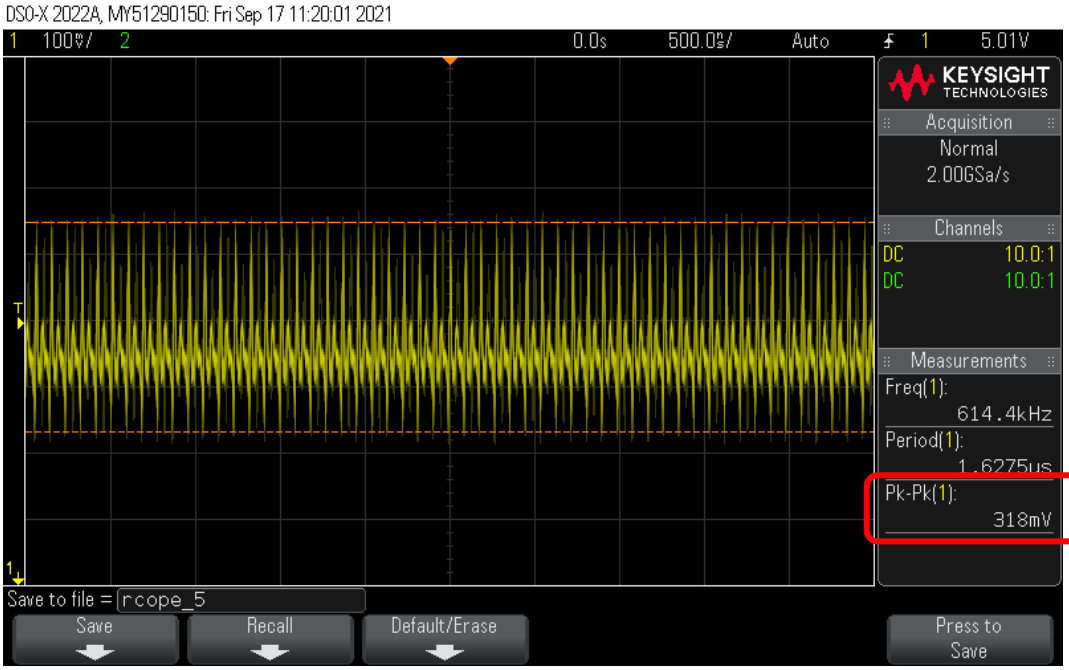


3. What peak to peak noise is present across the processor VCC and GND? Use an oscilloscope.

Measured value at processor package pins on top side of board: __434 mV__



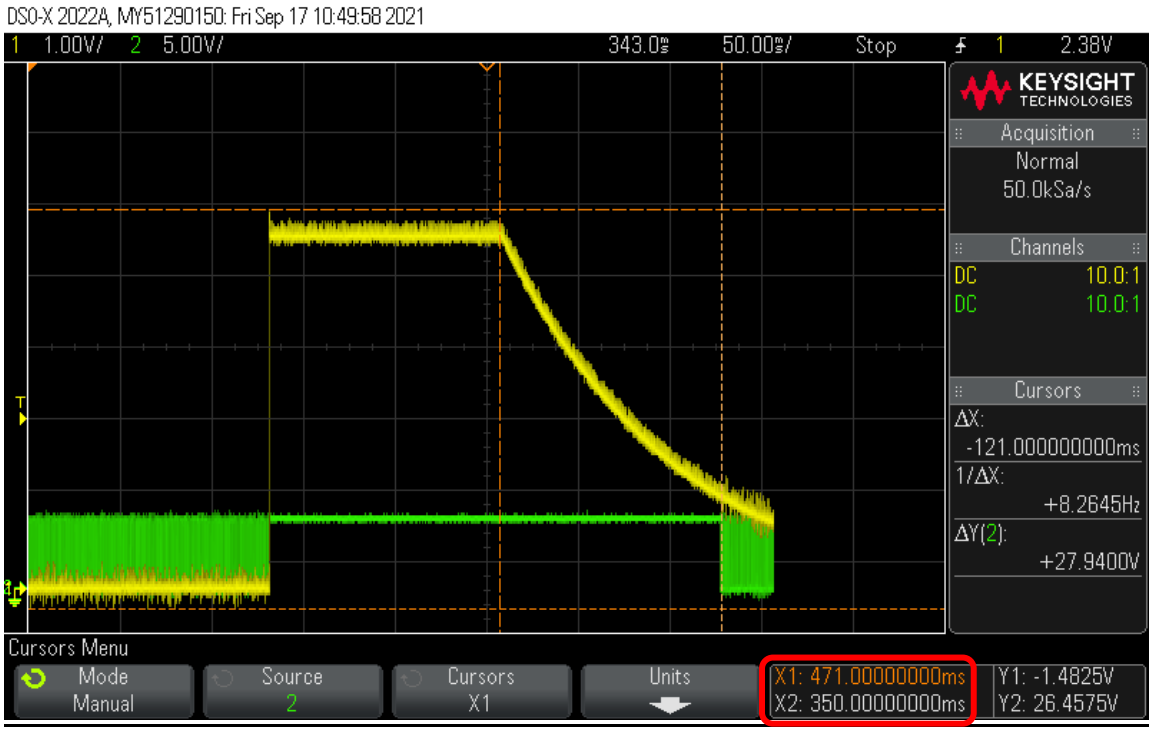

Measured value at wire wrap socket pins on bottom side of board: __318 mV__



4. How long is the processor held in reset after the run-time reset pushbutton is released? Use an oscilloscope and try to measure the time between the release of the pushbutton and the time when noise from ALE is observed on the RST signal.

Measured value: _____121 mSec_____

= 471ms – 350ms




## Submission sheet:

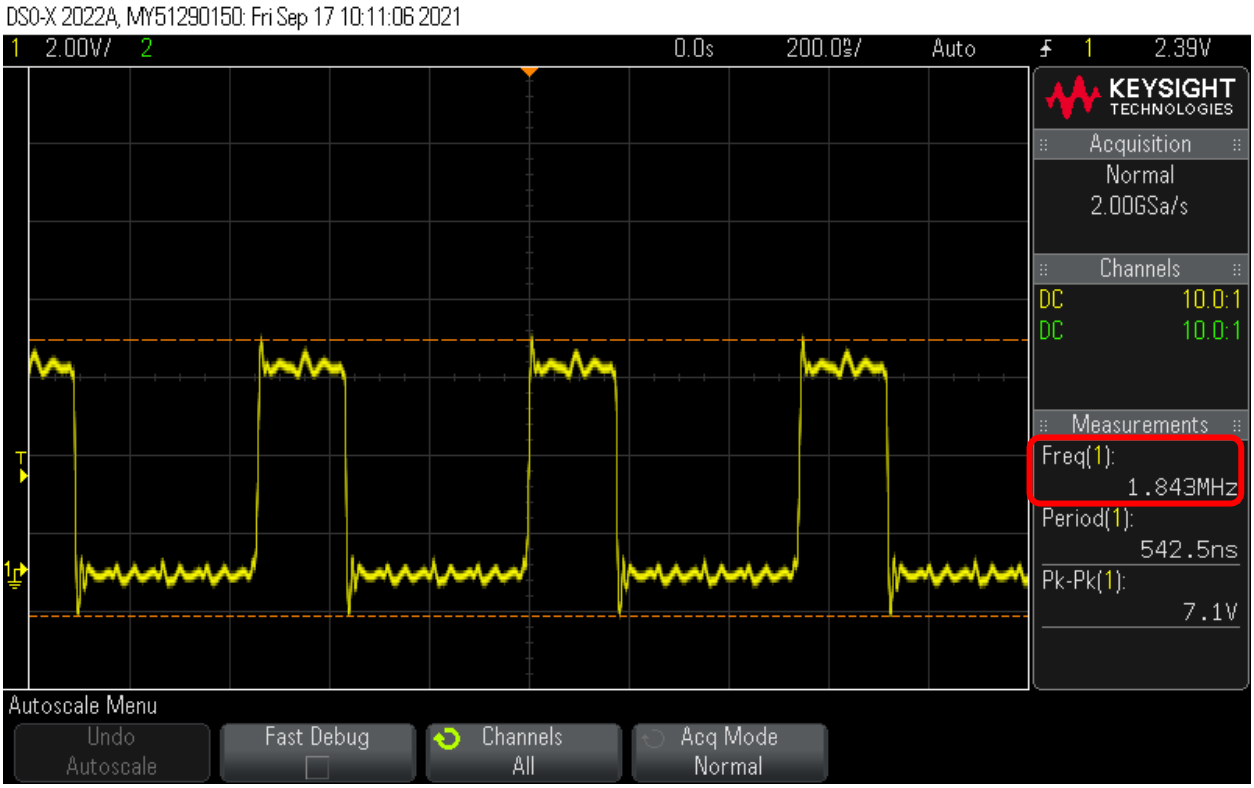
**How much power is dissipated in the regulator, assuming a load current of 125mA?** Assume that the regulator is drawing the max quiescent current shown in the data sheet (use the correct data sheet for the regulator you have on your board). Neatly show all your work.

Max quiescent current = 6mA

Power dissipated = (Vout – Vin)*($I_{Load}$ + $I_Q$) = (7.8 – 4.99)*(0.125 * 0.006)
calculated value = 368 mW

5. What frequency is present at the ALE pin? Use an oscilloscope.

1.843 MHz

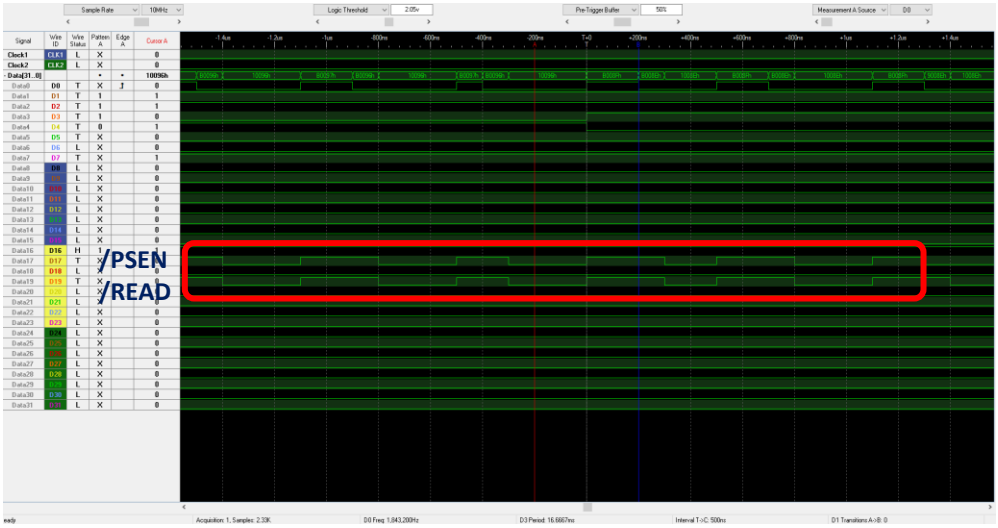


## Learnings:

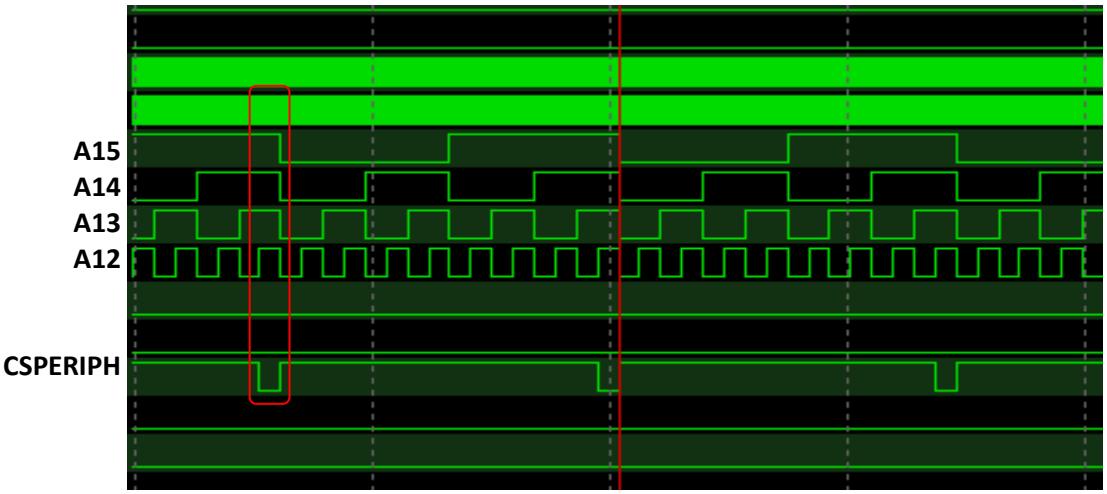
1) Designing a logic using SPLD: WinCUPL and WinSIM.
2) Using Emily52 to run assembly program.

3) Using LogicPort logic analyzer to verify SPLD logic.

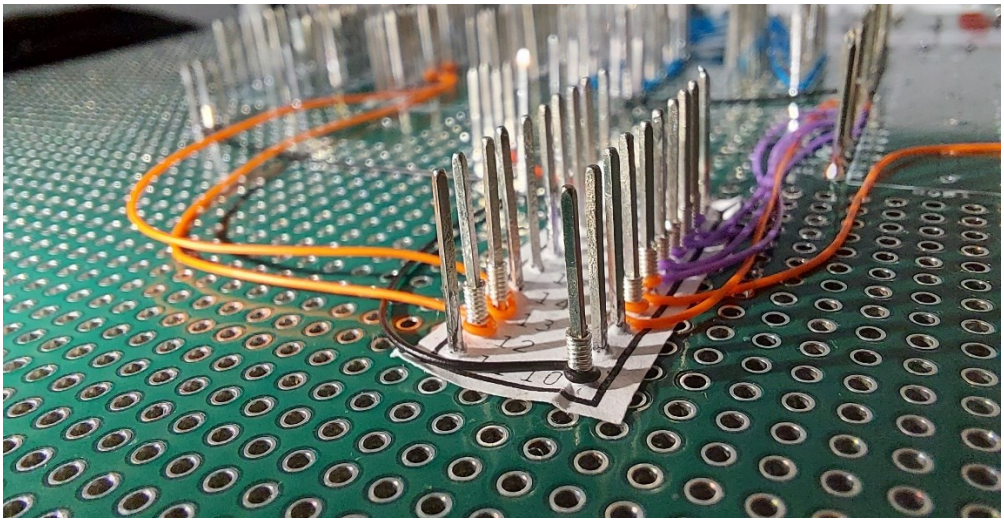
**/READ = /RD & /PSEN**




**/CSPERIPH = !(A15 & A14 & A13 & A12).**



4) Wire wrapping technique



Note:
Supporting utilities and simulation videos are attached in lab_report folder

# Signoff / Submission sheets

| ECEN 5613<br>Fall 2021 | Embedded System Design<br>Lab #1 Signoff Sheet – Part 1 Elements | Week #1<br>8/23/2021 |
|---|---|---|

You will need to obtain the signature of your TA on the following items in order to receive credit.

The Part 1 & Part 2 Elements of Lab #1 should be completed and signed off by **Friday, Sept. 10, 2021** in order to give you time to complete the Part 3 Elements upon receipt of your parts kit. All signoffs are due by **Friday, Sept. 17, 2021**. You need to submit both of your signoff sheets and other required elements by **11:59pm Saturday, Sept. 18, 2021**. Labs completed after the signature due date or submitted after the submission due date will usually receive grade reductions, but there is leniency on Lab #1.

Print your name below and then demonstrate your working hardware/firmware in order to obtain the necessary signatures. All items must be completed to get a signature, but partial credit is given for incomplete labs. Receiving a signature on this signoff sheet does not mean that your work is eligible for any particular grade; it merely indicates that you have completed the work at an acceptable level.

**Student Name:** Rajat Chaple

**Checklist**

- ☑ Student demonstrates detailed knowledge of a simulator (including changing register values, editing data memory, using breakpoints, single stepping, uses /overlay option, etc.)
- ☑ Student assembly program works correctly
- ☑ Student demonstrates detailed knowledge of WinCUPL and WinSim, logic equations correct

**Student Answers to Lab Questions**

1. **How many bytes of code space does your program require?**
   (Show how you arrived at your answer.)

   Code Size? 81 bytes

2. **How long did your program take to execute for X=0x10 and Y=0x0A? Assume an 11.0592 MHz clock and include the instructions executed from the beginning until you reach the ENDLOOP label. Show the TA your detailed calculations on the code listing during your signoff.**

   Execution Time? 84.863usec

9/17/21

**Instructor/TA Comments:** ☐ ☐ ☐ **TA signature and date**

| FOR INSTRUCTOR USE ONLY | Not Applicable | Poor/Not Complete | Meets Requirements | Exceeds Requirements | Outstanding |
|---|---|---|---|---|---|
| SPLD code | ☐ | ☐ | ☑ | ☐ | ☐ |
| Assembly Language Code Style | ☐ | ☐ | ☑ | ☐ | ☐ |
| Required Elements functionality | ☐ | ☐ | ☑ | ☐ | ☐ |
| Sign-off done without excessive retries | | ☐ | ☑ | | |
| Student understanding and skills | ☐ | ☐ | ☑ | ☑ | ☐ |
| Overall Demo Quality | ☐ | ☐ | ☑ | ☐ | ☐ |

**Comments:** Nicely formatted code!

NOTE: This submission sheet should be the top/first sheet of your submission.

| ECEN 5613 | Embedded System Design | Week #1 |
|---|---|---|
| Fall 2021 | Lab #1 Signoff Sheet – Part 3 Elements | 8/23/2021 |

Print your name below, answer the questions, and then demonstrate your working hardware in order to obtain the necessary signatures. All items must be completed to get a signature.

**Student Name:** Rajat Chaple

**Checklist**

- ☑ Schematic of acceptable quality, Student name on board in permanent ink
- ☑ Pins and signals labeled, decoupling capacitors, and two 28-pin wire wrap sockets present on board:
- ☑ Mounting hardware present (e.g. standoffs or an enclosure)
- ☑ Power switch and LED, voltage regulator functional, power jack present
- ☑ Power-on Reset (RC) and Run-time Reset (pushbutton), 8051 bypass cap is present
- ☑ RS-232 connector mounted, 74LS373 transparent latch wired
- ☑ Logic outputs correct (e.g. SPLD generation of /READ and /CSPERIPH; view SPLD code)
- ☑ Student displays good knowledge of oscilloscope
- ☑ Peak to peak noise measured across processor VCC and GND is < 800mV
- ☑ Oscillator functional (check for correct ALE/XTAL2 signals after power on-off cycles)
- ☑ ARM development board functional, student can demonstrate the basic software.

**Student Answers to Lab Questions**

1. **What voltage is present at the regulator input?** Use a digital multimeter. 7.8 V
2. **What voltage is present at the regulator output?** Use a digital multimeter. 4.99 V
3. **What peak to peak noise is present across the processor VCC and GND?** Use an oscilloscope.

   Measured value at processor package pins on top side of board: 434 mV

   Measured value at wire wrap socket pins on bottom side of board: 318 mV
4. **How long is the processor held in reset after the run-time reset pushbutton is released?** Use an oscilloscope and try to measure the time between the release of the pushbutton and the time when noise from ALE is observed on the RST signal.

   Measured value: 121 msec
5. **What frequency is present at the ALE pin?** Use an oscilloscope. 1.843 MHz

Ale Zuñiga 9/17/21

**TA signature and date**

**Instructor/TA Comments:** ☐ ☐ ☐

| FOR INSTRUCTOR USE ONLY | Not Applicable | Poor/Not Complete | Meets Requirements | Exceeds Requirements | Outstanding |
|---|---|---|---|---|---|
| Schematics, SPLD code | ☐ | ☐ | ☑ | ☐ | ☐ |
| Hardware physical implementation | ☐ | ☐ | ☑ | ☐ | ☐ |
| Required Elements functionality | ☐ | ☐ | ☑ | ☐ | ☐ |
| Sign-off done without excessive retries | | ☐ | ☑ | | |
| Student understanding and skills | ☐ | ☐ | ☐ | ☑ | ☐ |
| Overall Demo Quality | ☐ | ☐ | ☐ | ☑ | ☐ |

**Comments:** Very neat wire wrapping, very well prepared for sign-off

NOTE: This submission sheet should be the second sheet of your submission.

## Submission Sheet

Instructions: Print your name below and sign the honor code pledge. Separate the signoff and submission sheets from the rest of the lab and turn in a scan (or clear picture) of these signed forms, the items in the checklist below, and the answers to any applicable lab questions in order to receive credit for your work. No cover sheet please. **Submit all items electronically via Canvas to reduce paper usage. Canvas is https://canvas.colorado.edu .**

In addition to the items listed on the signoff checklist, be sure to review the lab for additional requirements for submission, including:

- ❑ Scan of signed and dated Part 1 signoff sheet as the top sheet (No cover sheet please)
- ❑ Scan of signed and dated Part 3 signoff sheet as the second sheet
- ❑ Scan of submission sheet with signed honor code pledge as the third sheet
- ❑ PDF of complete and accurate final schematic of acceptable quality (all components shown).
- ❑ Fully, neatly, and clearly commented assembly code.

Make copies of your code, SPLD code, and schematic files and save them as an archive.

**Student Name:** Rajat Chaple

**Honor Code Pledge**: "On my honor, as a University of Colorado student, I have neither given nor received unauthorized assistance on this work. I have clearly acknowledged work that is not my own."

**Student Signature:** @chaple

1. **How much power is dissipated in the regulator, assuming a load current of 125mA?** Assume that the regulator is drawing the max quiescent current shown in the data sheet (use the correct data sheet for the regulator you have on your board). Neatly show all your work.

max quiescent current : 6 mA

power dissipated = $(V_{out} - V_{in})(I_L + I_Q)$

$= (7.8 - 4.99)(0.125 + 0.006)$

$= 0.368\ W$

Calculated value: 368 mW

**Comments:**

NOTE: This submission sheet should be the third sheet of your submission.