Rev 1 Initial Document

This document contains notes and information concerning the construction of the Control Board, modifications to the MSP430FR2355 board and general information pertinent to Project 7. The steps are presented in the order of easiest assembly. It is suggested to use what is relevant to your needs. This document ONLY covers the assembly notes associated with the Project 7. Refer to the Project 7 Assignment for project deliverables and Project specific instructions. Some of the photos were taken using an earlier class board. While there are differences, when the old photos are used the information is the same between old board and new.

READ AND UNDERSTAND EACH STEP BEFORE EXECUTING THE STEP!!

Assembly of the Control Board.

Step 1.

Before beginning assembly, print out the board views for both the top and bottom. It is very easy to install a component between two pads where each is from different devices. The files are on the class home page.

PCB Schematic	SCH_Control_Module_?????.pdf	The Schematic for the Control Board
PCB Bill of Material	BOM_Control_Module_?????.pdf	The bill of materials for the Control Board
PCB Layout	PCB_Control_Module_?????.pdf	View of bare circuit board

Having a permanent marker will make assembly go much smoother. When getting ready to install a device, place a permanent marker dot to the middle of the device on the circuit board.
The view of the bare circuit board uses colors to identify some of the nets. It is possible that all nodes of a particular net have not been identified.

DO NOT WORK WITH PARTS OVER A CARPET.

DROPPED PARTS WILL BE LOST FOREVER.

You should not install any parts until they are required for a project. Doing so may cause irreparable harm to the circuit. Some parts added early on must be taken off in later projects.

It is critical not to install any parts other than those identified until after demonstrating projects.

Step 2.

While working with the hardware, Software coding can be done in parallel, make sure that you write the software for the Thumb Wheel. This provides a known analog signal that the code can be tested with. Write your code to write the value to the display. Note the ADC will generate a hexadecimal value with values from 0x0000 to 0x0FFF. You cannot display these values on the

LCD, even casting them to char will not work. You will need to convert each of the nibbles to a character.

Create 4 variables, all chars. You can use what you want, but here is what I used.

```
// globals
char thousands;
char hundreds;
char tens;
char ones;
```

Call a function to Convert HEX number to BCD values. Pass the read ADC value

In the function, create a series of while loops. The value is between 0 and 1024 [0x0000 to 0x03FF]. Since the number will either be greater than 1000 or not a simple if statement will work for the thousands value. It is up to you to correct for the example magic numbers.

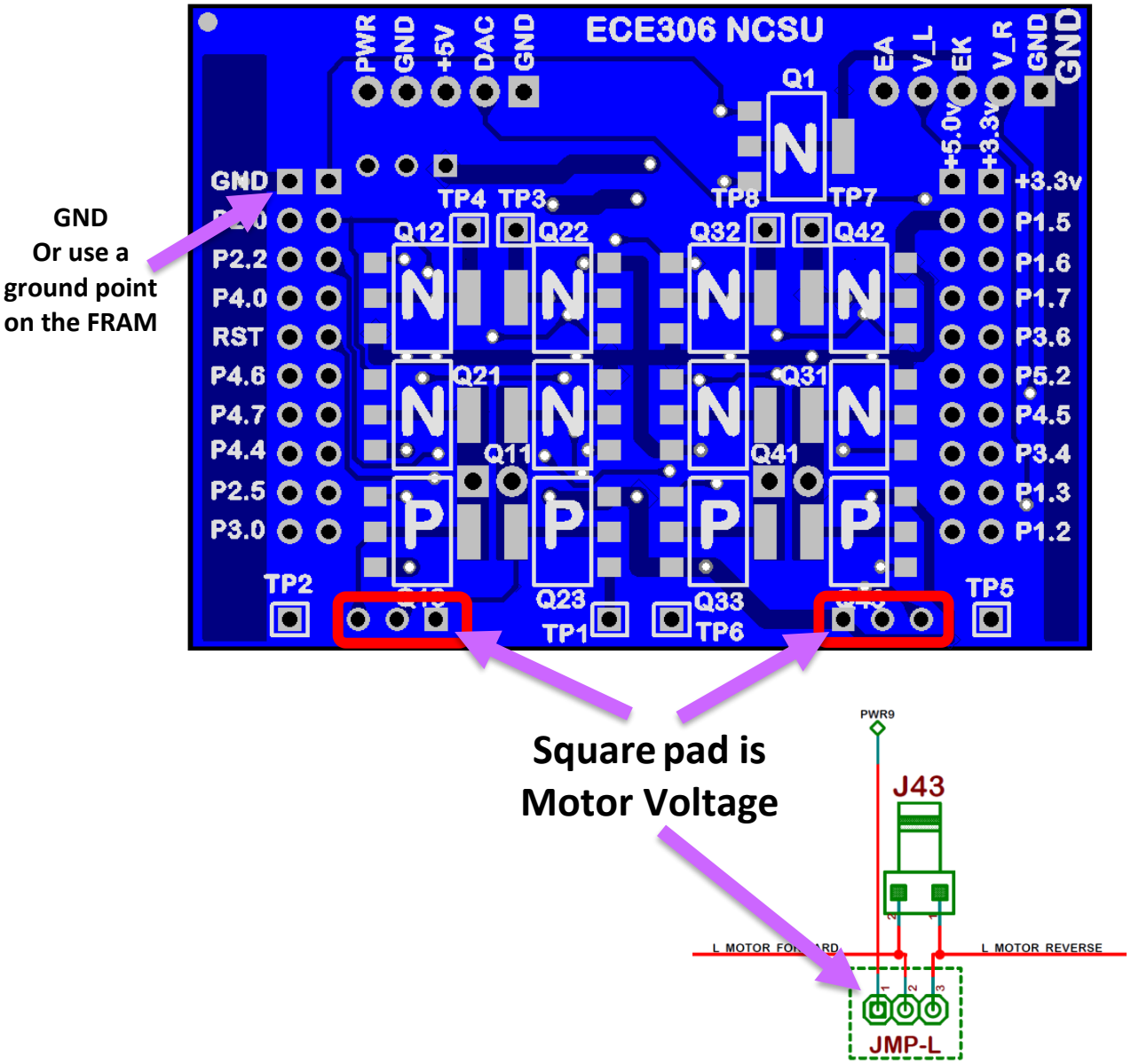
```
Thousands = 0;
If(value_passed >= 1000){
  value_passed = value_passed – 1000;
  thousands = 1;
}
```

Now use while loops each time checking if the value is greater than a numeric position, increment and subtract until are numeric positions; hundreds, tens and ones is accounted for. This will give a BCD value for each of the numeric positions. To write it to the display, a conversion to an ASCII equivalent is necessary. ORing each with the hex value 0x30 will convert them.

In the meantime, you can use the watch window in IAR to see the value of the ADC.

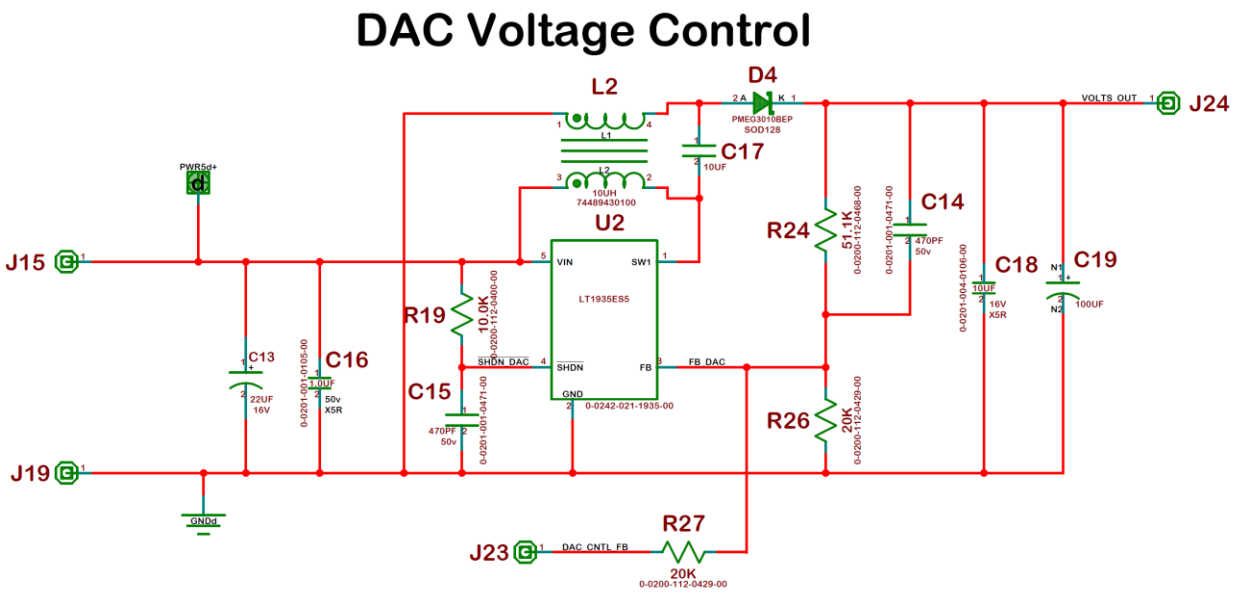
Step 3.

A separate PCB is provided for DAC Voltage Control Power Board installation. The graphic below shows where to Check Motor Voltage. Measure the Motor Voltage on your board without the DAC Board attached and confirm you are measuring Batter voltage.



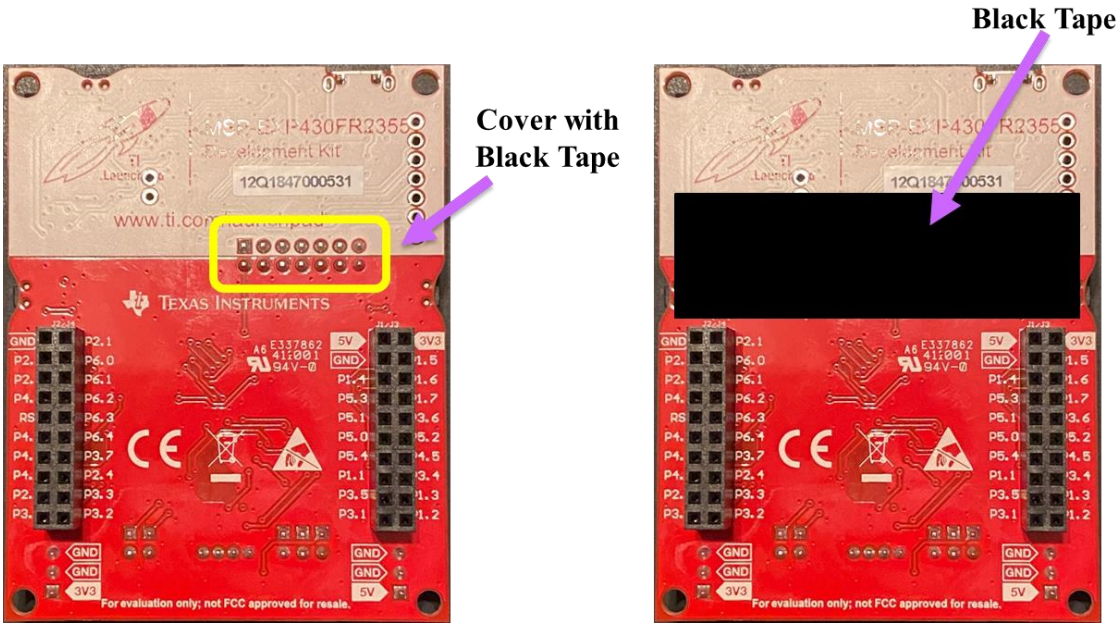
Step 4.

Prior to installing the DAC Board. Review the Schematic and recognize how the DAC board works. Use LTSpice to test various DAV voltages applied to J23.



Step 5.

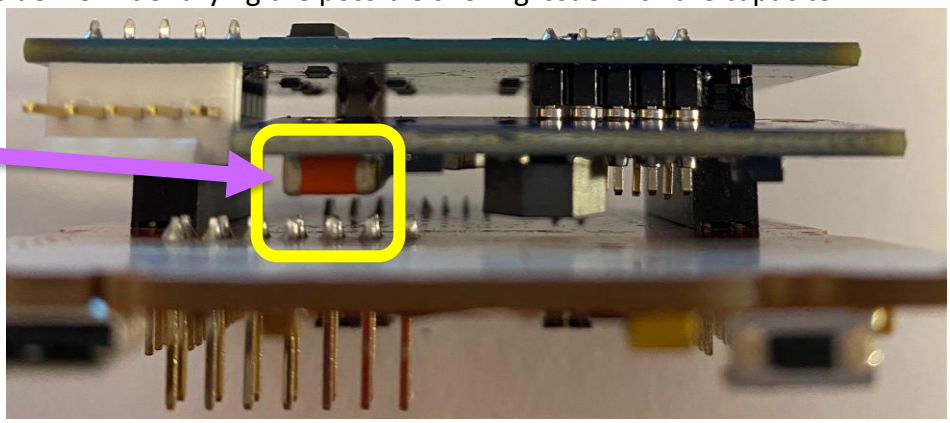
Some protections need to be put in place to protect the FRAM board with the DAC board installed. Place a piece of Black Electrical Tape on the Rear of the FRAM board as shown below.



Step 6.

The graphic below is a side view identifying the possible shoring issue with the capacitor.

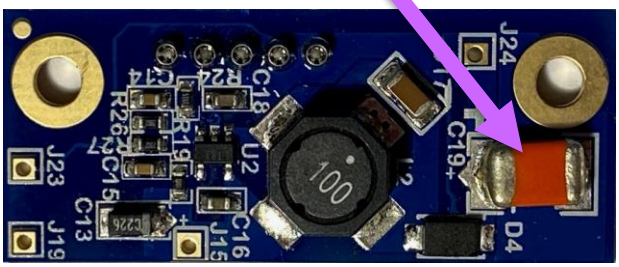
Capacitor is close to FRAM connector pins



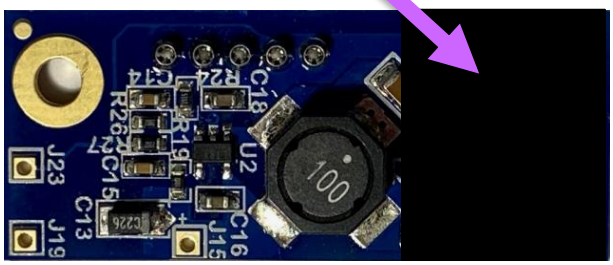
Step 7.

Possible Shorting area. Cover with Black tape. Suggest wrapping tape around the DAC Board a couple times for added protection.

Capacitor is close to FRAM connector pins.

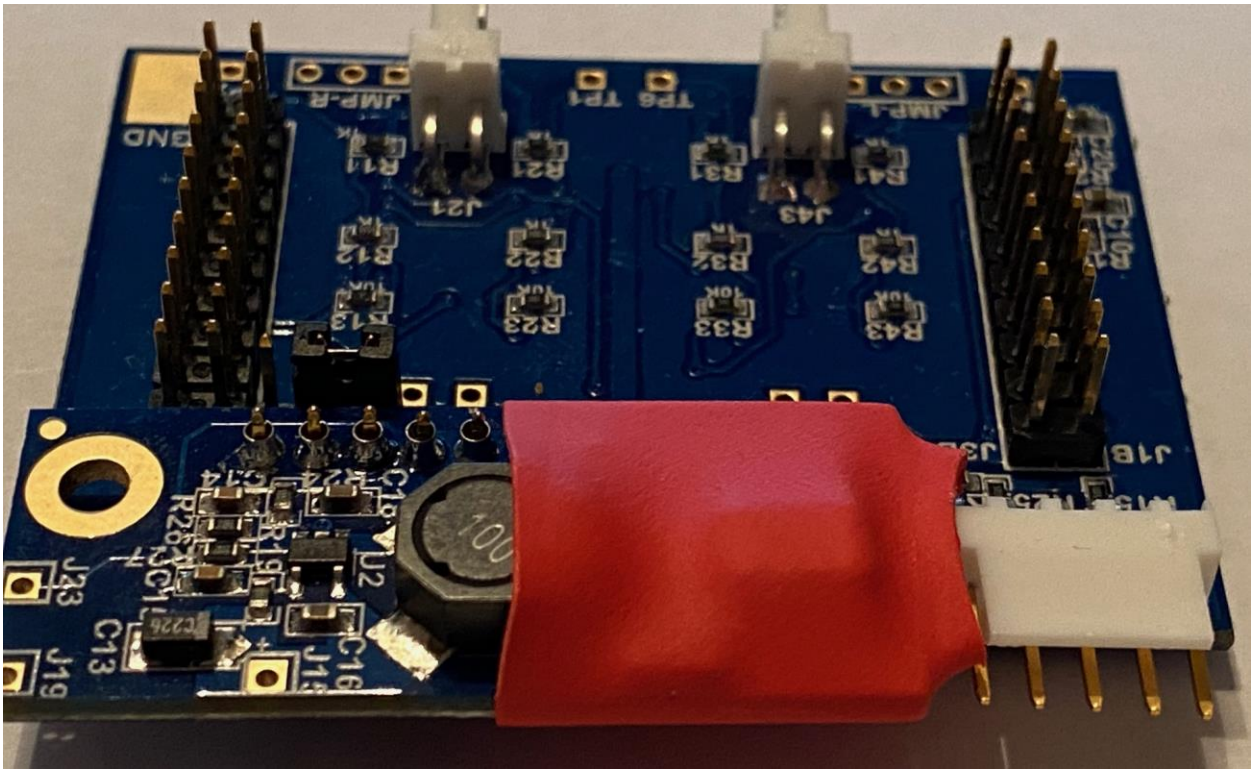


Black Tape



Step 8.

Attach the DAC Board to the FET Board. In the image below, instead of black tape, the board has shrink wrap tubbing applied over the capacitor. Notice the Change in position for the jumper JP1.



Step 9.

Add the appropriate code to support the DAC.

Step 10.

Now mount to your vehicle.