**ECE 4723: Embedded Systems**

**Spring 2020**

**Lab 5:  
LCD Character Module**

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STEP 1: Power

Board Assembly Procedure

* LM2937
  + Solder three terminals, as well as the heat sink to the heat plate pads on the reverse side.
  + Check continuity between heat plate and the heat sink using a multimeter with probes between the heat plates on the reverse side and the heat sink on the chip.
  + Confirm that pin 1 of the chip is connected to pad C of the JP1 pin junction.
* C6
  + Solder on 0.1uF capacitor.
  + Check continuity between positive pad between C6 and pad C of JP1.
  + Check continuity between negative pad between C6 and ground.
* C7
  + Solder on 10uF capacitor.
  + Check continuity between positive pad of C7 and pin 3 of LM2937.
  + Check continuity between negative pad of C7 and ground.
* R1
  + Solder on 1.5k Ohm resistor.
  + Check continuity between pin 3 of LSM2937 to input of R1.
* 3.3V Power LED
  + Discover cathode pad for LED by using continuity test between the pads and ground.
  + Solder on Green LED.
  + Check continuity between anode of LED and output of R1.
* C1, C2, C3, C4, C5
  + Check continuity between all input pads and 3.3V.
  + Check continuity between all output pads and ground.

STEP 2: MCU:

* dsPIC33EP512GP806
  + Ensure the circle in the MCU is placed over the circle printed on the PCB.
  + Ensure that all footprints line up on the PCB and solder the MCU.

STEP 3: MCU Output LEDs

* LED1
  + Discover cathode pad for LED by using continuity test between the pads and ground.
  + Solder on Red LED.
  + Check continuity between anode of LED and output pad of R2
* LED2
  + Discover cathode pad for LED by using continuity test between the pads and ground.
  + Solder on Yellow LED.
  + Check continuity between anode of LED and output pad of R3
* LED3
  + Discover anode pad for LED by using continuity test between the pads and output pad of R4.
  + Solder on Green LED.
  + Check continuity between cathode of LED and input to MCU LED3 signal.
* R2
  + Solder on 1.5k Ohm resistor.
  + Check continuity between input of resistor and output of MCU LED1 signal.
  + Check continuity between output of resistor and cathode of LED1.
* R3
  + Solder on 1.5k Ohm resistor.
  + Check continuity between input of resistor and output of MCU LED1 signal.
  + Check continuity between output of resistor and cathode of LED2.
* R4
  + Solder on 1.5k Ohm resistor.
  + Check continuity between input of resistor and 3.3V.
  + Check continuity between output of resistor and cathode of LED3.

STEP 4: MCU Serial Connection to PC (FTDI - MCU)

* FTDI
  + Cut 6 pins off of the 40-pin part in the kit.
  + Solder on the 6-pin header.
  + Check continuity between MCUTX and MCURX pin headers (4,5) and MCUTX and MCURX pins on MCU.
  + Check continuity between USB5V pin header and JB1 pad 1.
  + Check continuity between Ground pin header and ground.

STEP 5: MCU Programming (ICSP)

* SV1
  + Cut 6 pins off of the 40-pin part in the kit.
  + Solder on the 6-pin header.
  + Check continuity between MCLR, VICP, PGED, PGEC, and PGLVP pin headers (1,2,4,5,6) and their respective pins on the MCU.
  + Check continuity between Ground pin header and ground.

STEP 6: MCU Inputs (SW1, SW2, SW3, RPG1, and POT)

* SW1
  + Discover correct input of SW1 by testing continuity between SW1 MCU pin and pads of SW1 footprint.
  + Solder the SPST switch.
  + Check continuity between the output of SW1 and ground.
* SW2
  + Discover correct input of SW2 by testing continuity between SW2 MCU pin and pads of SW2 footprint.
  + Solder the SPST switch.
  + Check continuity between the output of SW2 and ground.
* RESET switch
  + Solder on SPST switch.
  + Check continuity between output of R0 and input of switch.
  + Check continuity between switch and ground.
* C0
  + Solder on 10uF capacitor.
  + Check continuity between VCAP output on MCU and input of C0
  + Check continuity between VCAP MCU pin and pads of C0 footprint.
  + Check continuity between output of C0 and ground.
* R0
  + Check continuity between 3.3V MCU pin and pads of R0 footprint.
* S0
  + Solder potentiometer.
  + Check continuity between 3.3V footprint pad and 3.3V.
  + Check continuity between VPOT footprint pad and VPOT MCU pin.
  + Check continuity between ground footprint pad and ground.
* POT
  + Solder on 10k Ohm resistor.
  + Check continuity between output of R0 and RESET switch footprint.
  + Solder the rotary encoder.
  + Check continuity between the SW3 pad and the SW3 MCU pin.
  + Check continuity between RPGA/B pads and the RPGA/B MCU pins.
  + Check continuity between ground pad and ground.

STEP 7: Temperature Sensor (IC2)

* IC2
  + Check continuity for VO pin to pin 13 on MCU through R5 and C15, GND pin to GND, and VS pin to VDD
  + Solder IC onto board, followed by C20, R5, and C15.
  + Redo continuity checks.

STEP 8: LCD Display

* LCD
  + Check continuity between LCD\_D0 through LCD\_D7 and MCU
  + Check continuity between LCDE and MCU
  + Check continuity between LCDRW and MCU
  + Check continuity between LCDRS and MCU
  + Check continuity between VSS and GND
  + Check continuity between VDD and 3.3V
  + Solder LCD Pins to Board