**ECE 4723: Embedded Systems**

**Spring 2019**

**Lab 8**

**ESOS and the ECE 4723/6723 Target Board**

**Authors:**

Christian Bush, Spencer Callicott, Will Carroll,

Landon Casey, Jack Fletcher

{cbb330, sc2257, woc17, lec426, jdf469}@msstate.edu

1/26/2019

# Board Assembly Procedure

## STEP 1: Power

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.
* Solder jumper from MCLR (pin 1) on the serial header, to RTS# (pin 6) on the FTDI header
* Solder jumper from MCUTX to pin 1 on H1, check continuity between MCUTX and RF0.
* 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 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.

POT

* 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.

## STEP 7: Temp Sensor (IC1) and LM4128 (IC2)

IC1

* Check continuity between IC1 footprint pad-1 (VS) and 3.3V.
* Check continuity between IC1 footprint pad-3 (GND) and ground.
* Check continuity between IC1 footprint pad-2 (VO) and pad on R5
* Solder IC1 onto board.

IC2

* Check continuity between IC2 footprint pad-1 (VIN) and VLM4128\*.
* Check continuity between IC2 footprint pad-2 (EN) and SJ4 pad-2.\*
* Check continuity between IC2 footprint pad-3 (VSS) and ground.
* Check continuity between IC2 footprint pad-4 (VO) and pads connected to VREF (SJ5 / SJ6)
* Solder IC1 onto board.

\*Must ensure jumpers are soldered as follows:\*

* SJ4 pad-2 must be soldered to SJ4 pad-1 to ensure the LM4128 is always enabled.
* SJ1 pad-2 must be soldered to SJ4 pad-1 to ensure the LM4128 is powered by 3V3 and not VRAW. (Which could cause damage.)

## STEP 8: LCD Display

LCD

* Check continuity between LCDD0 and MCU
* Check continuity between LCDD1 and MCU
* Check continuity between LCDD2 and MCU
* Check continuity between LCDD3 and MCU
* Check continuity between LCDD4 and MCU
* Check continuity between LCDD5 and MCU
* Check continuity between LCDD6 and MCU
* Check continuity between LCDD7 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
* Solder Jumper connecting R6 and R7 to complete the voltage divider circuit to the LCD.

## STEP 9: MCP4922

DAC

* Check continuity between U4P1 and 3.3V
* Check continuity between U4P9 and 3.3V
* Check continuity between U4P8 and GND
* Check continuity between U4P4 and SCK on MCU
* Check continuity between U4P5 and SDO on MCU
* Check continuity between U4P3 and RD0 on MCU (Needed jumper wire)
* Check continuity between U4P13 and VREF (After soldering jumper SJ5)
* Check continuity between U4P11 and VREF (After soldering jumper SJ6)
* Check continuity between U4P14 and DACA on MCU
* Check continuity between U4P12 and GND
* Check continuity between U4P10 and DACB on MCU
* Solder U4 Pins to Board
* Solder Jumpers on SJ5
* Solder Jumpers on SJ6
* Solder Jumpers from SDA Via to SDA header pin
* Solder Jumpers from SCLK Via to SCLK header pin

## STEP 10: CAN Headers

* Check continuity between CAN1 P1 and GND
* Check continuity between CAN1 P2 and CANH
* Check continuity between CAN1 P3 and CANL
* Check continuity between CAN1 P4 and CANL
* Check continuity between CAN1 P5 and CANH
* Check continuity between CAN1 P6 and GND
* Check continuity between CAN2 P1 and GND
* Check continuity between CAN2 P2 and CANH
* Check continuity between CAN2 P3 and CANL
* Check continuity between CAN2 P4 and CANL
* Check continuity between CAN2 P5 and CANH
* Check continuity between CAN2 P6 and GND
* Solder JP3 onto board
* Solder R8 onto board

## STEP 11: MAX3051

* Check continuity between U3 P1 and CANTXD on MCU
* Check continuity between U3 P2 and GND
* Check continuity between U3 P3 and VCC
* Check continuity between U3 P4 and CANRXD on MCU
* Check continuity between U3 P5 and RD3 Through jumper SJ2
* Check continuity between U3 P6 and CANL on CAN1 & CAN2
* Check continuity between U3 P7 and CANH on CAN1 & CAN2
* Check continuity between U3 P8 and GNDs
* Solder U3 onto board.