

# Oregon **TECH**

Generously sponsored by:



**MICROCHIP**

and the Oregon Institute of  
Technology Commission on College  
Teaching.

## OWLBOARD JR

Assembly and programming

[Abstract](#)

Pre-release guide

Kevin Pintong  
Kevin.pintong@oit.edu

## Contents

Introduction .....	2
Warning.....	2
OwlBoard Jr. 3D Views .....	3
Owlboard Jr. Schematics.....	0
Owlboard Jr. Layout.....	0
Owlboard Jr. Bill of Materials (BOM) .....	0
Component descriptions.....	1
Assembly Notes.....	4
Software .....	5
Figure 1 Front & back 3D view .....	3
Figure 2 OwlBoard Jr front and rear PCB .....	1
Figure 3 DIP 28 socket for microprocessor .....	1
Figure 4 Breakaway 0.1" male headers .....	2
Figure 5 3mm LEDs.....	2
Figure 6 8 MHz crystal oscillator .....	2
Figure 7 push button.....	2
Figure 8 PIC32 MX250F128B in DIP-28 package .....	3
Figure 9 330 Ohm resistor.....	3
Figure 10 10k ohm resistor .....	3
Figure 11 AMS1117 3.3V linear regulator.....	3
Figure 12 1uF tantalum capacitor .....	3
Figure 13 10uF tantalum capacitor .....	3
Figure 14 Linear regulator location.....	4
Figure 15 Crystal Oscillator .....	4
Figure 16 LED silkscreen polarity .....	4
Figure 17 Fully assembled Owlboard Jr. ....	5

## Introduction

The owlboard JR is based on the reference design and source code used in the 'DIY ChipKit board'. It is programmable

<http://chipkit.net/diy-chipkit-board>

Features:

- Uses 32-bit PIC microcontroller PIC32MX250F128B in SPDIP-28 package with preprogrammed bootloader.
- USB connector built into PCB for easy programmability (Detected as a stk500 programmer).
- Increased PCB thickness for USB connector (2.0mm)
- 19 GPIO pins

## Warning

In order to build the OwlBoard Jr, you will be using soldering equipment, solder, and flux. Soldering equipment will be extremely hot. Solder and flux may contain hazardous substances such as lead.

It is advised that the participant:

- Exercise caution when soldering
- Wear personal protective equipment (PPE) such as safety glasses
- Use fume extractors to reduce participant exposure to solder fumes

**Oregon Institute of Technology and affiliated parties disclaim all liability from injuries, whether emotional or physical, caused by participation in this workshop.**

**Due to continuous improvement, the shape and components of the OwlBoard Jr may change. Functionality may also change.**

# OwlBoard Jr. 3D Views

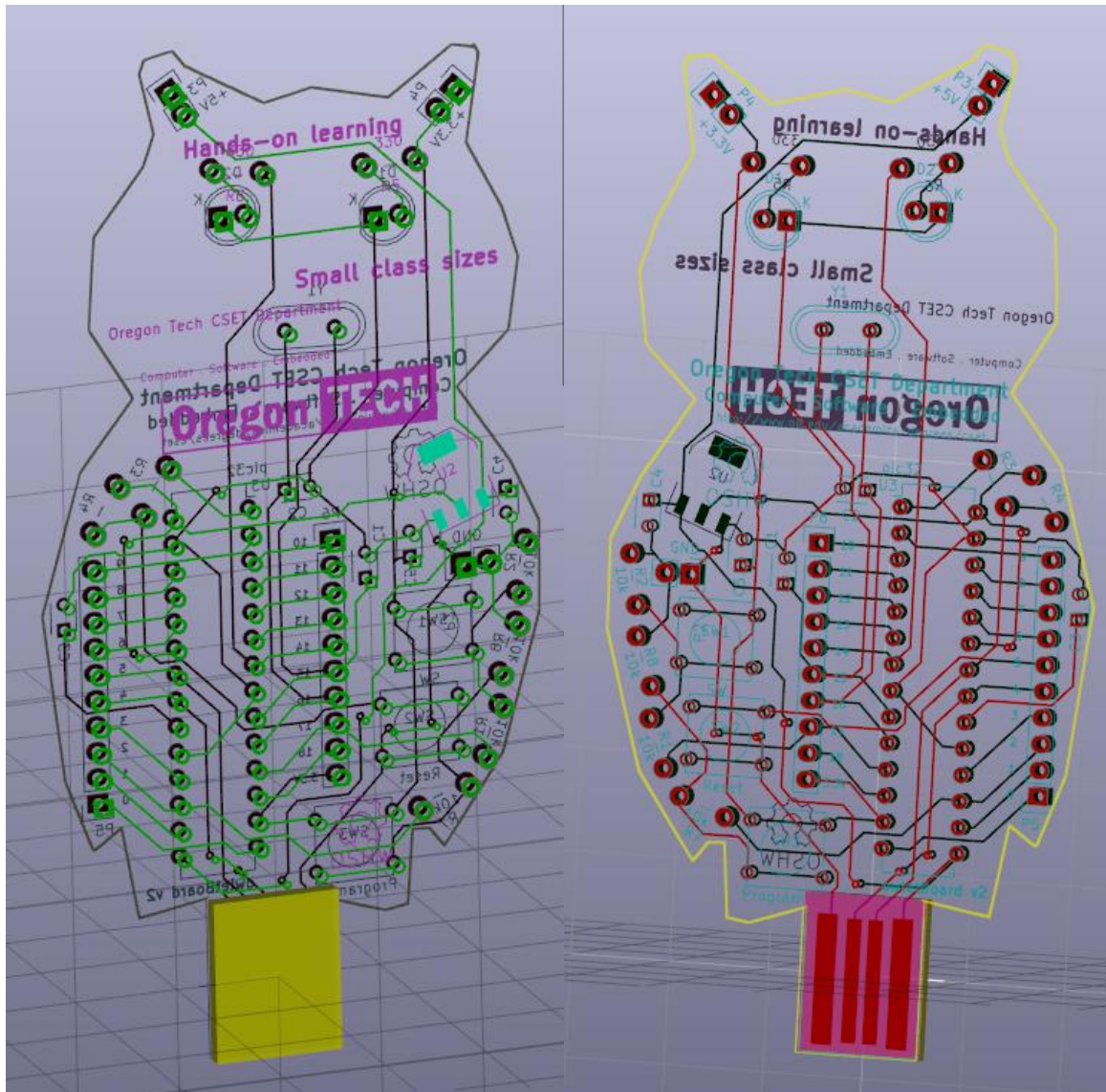
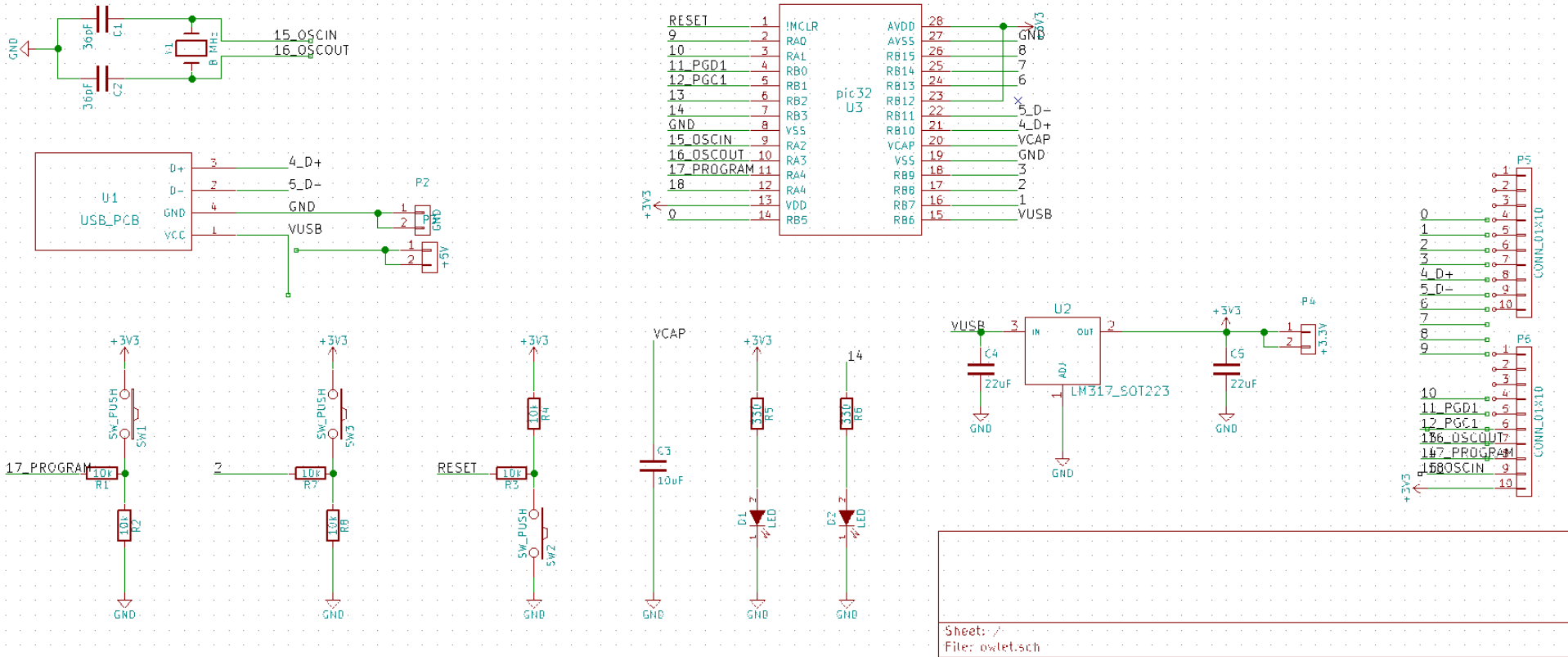
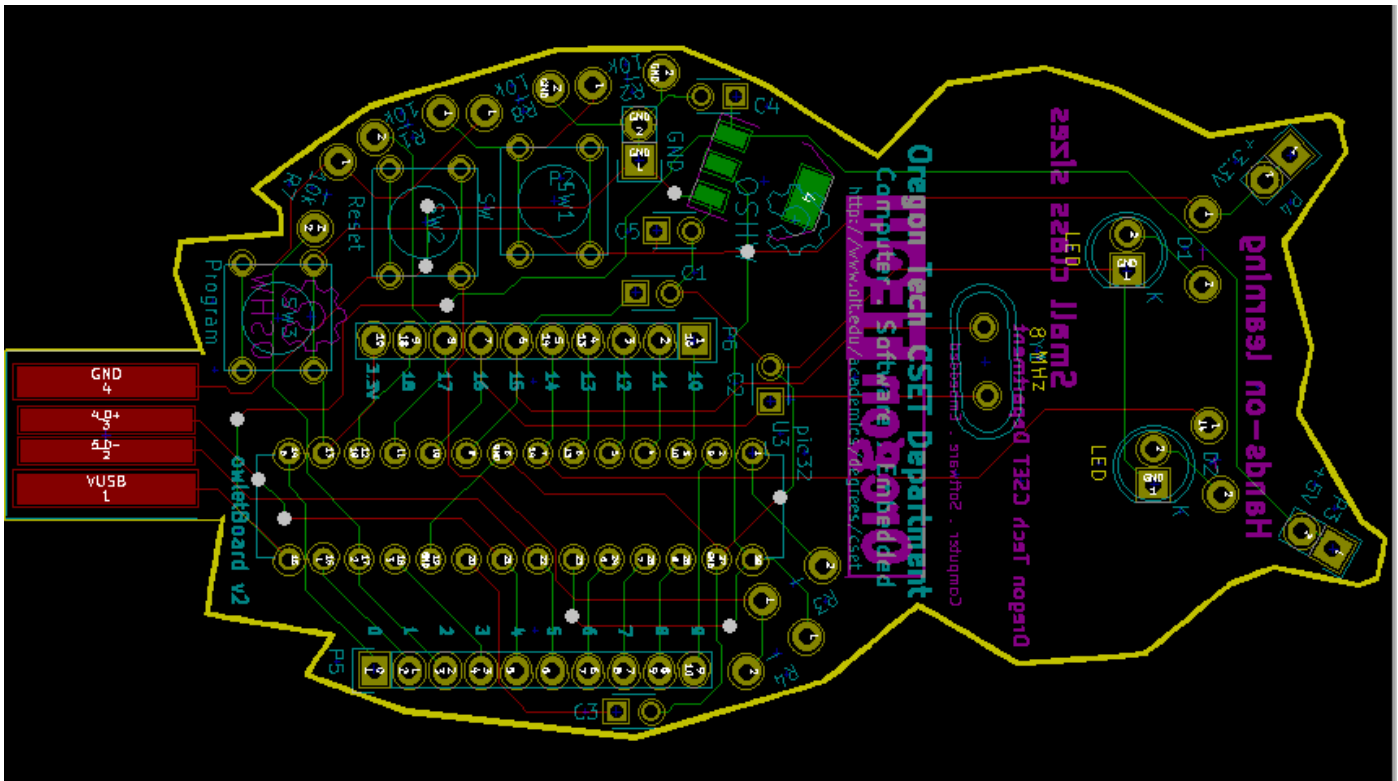


Figure 1 Front & back 3D view

# Owlboard Jr. Schematics



# Owlboard Jr. Layout



# Owlboard Jr. Bill of Materials (BOM)

Table 1 Bill of Materials for OwlBoard Jr

Bill of Materials (BOM) for Owlboard Jr				
Line Item	Description	Footprint	Reference	Quantity
1	Button	through hole	SW1,SW2,SW3	3
2	Resistor 10k	through hole	R1,R2,R3,R4,R7,R8	6
3	Resistor 330	through hole	R5, R6	2
4	3mm or 5mm LED	through hole	D1,D2	2
5	Crystal Oscillator 8 MHz	HC-49	Y1	1
6	Capacitor 1uF (105)	through hole	C4,C5	2
7	Capacitor 3.6pF	through hole	C1,C2	None required
8	Capacitor 10uF (106)	through hole	C3	1
9	PIC32 PIC32MX250F128B	28-pin DIP	U3	1
10	3.3V linear regulator	SOT-223	U2	1
11	10x1 0.1" header	through hole	P5,P6	2

## Component descriptions

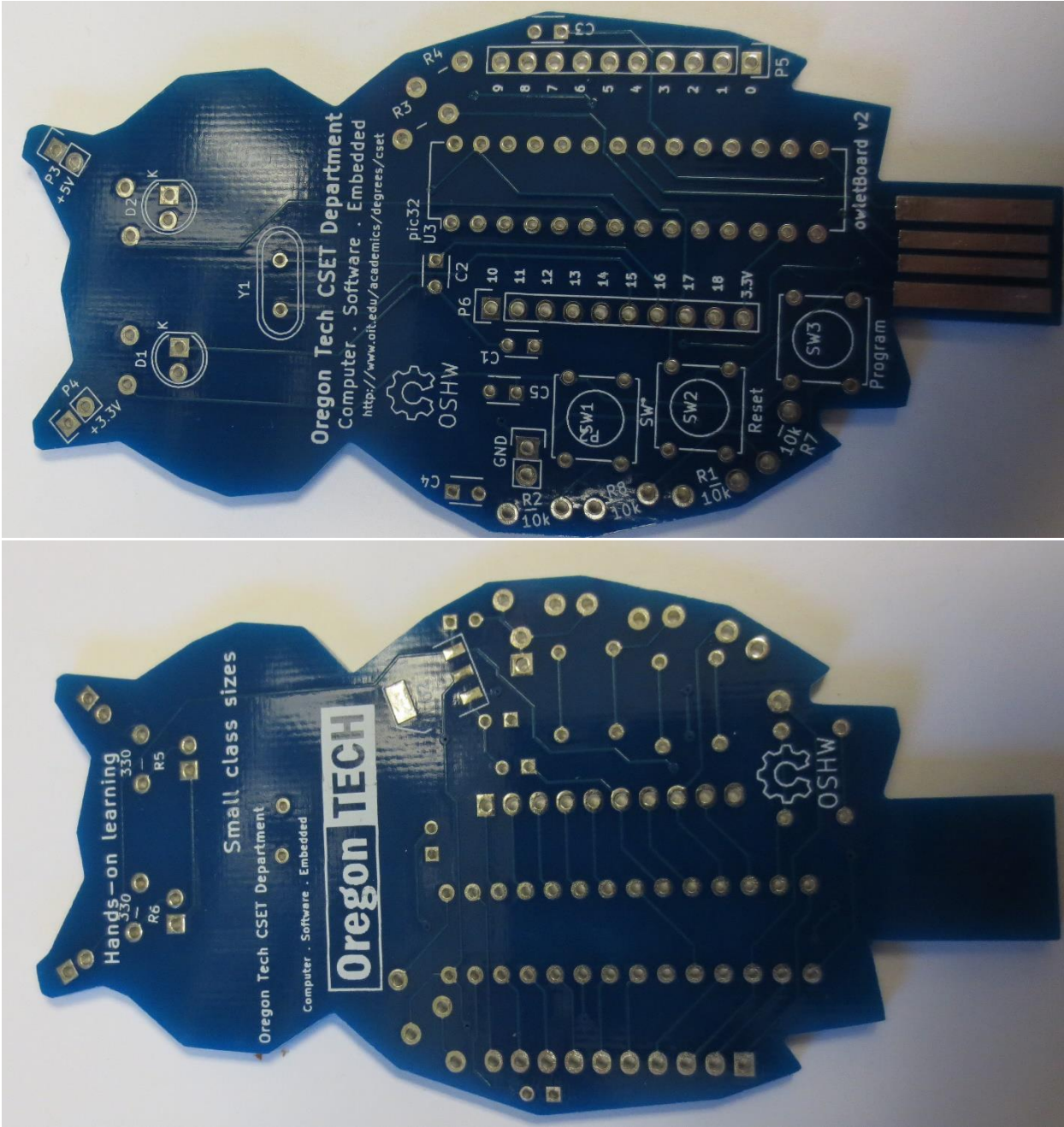


Figure 2 OwlBoard Jr front and rear PCB

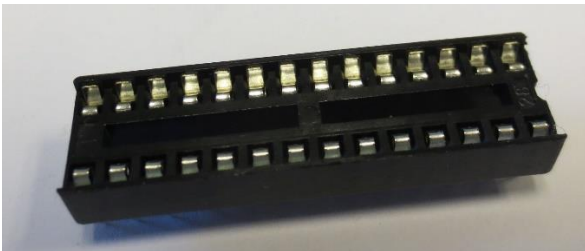


Figure 3 DIP 28 socket for microprocessor

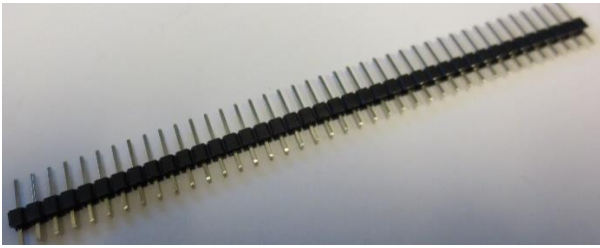


Figure 4 Breakaway 0.1" male headers



Figure 5 3mm LEDs

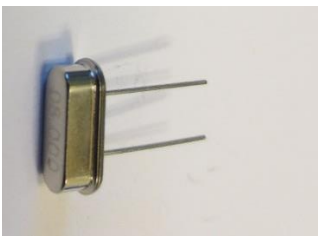


Figure 6 8 MHz crystal oscillator

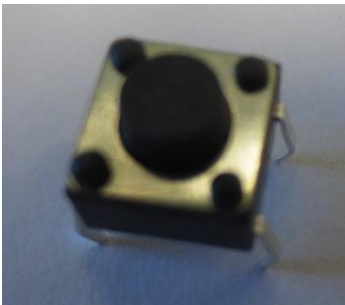


Figure 7 push button





Figure 8 PIC32 MX250F128B in DIP-28 package

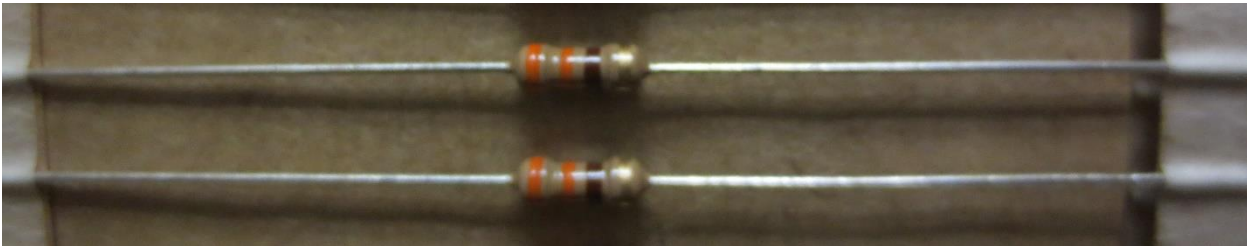


Figure 9 330 Ohm resistor



Figure 10 10k ohm resistor



Figure 11 AMS1117 3.3V linear regulator

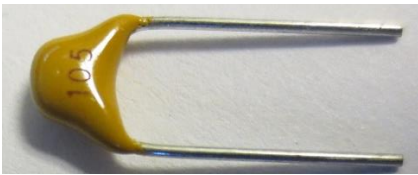


Figure 12 1uF tantalum capacitor



Figure 13 10uF tantalum capacitor

## Assembly Notes

Resistors, capacitors, connectors, sockets on this design are non-polarized. You may insert them in any direction.

PIC32 microprocessor must be oriented as shown in Figure 17 Fully assembled Owlboard Jr. The yellow dot must be oriented towards D1.

Buttons will only fit in one direction. Do not attempt to force the button into the other orientation.

*Linear regulator must be oriented such that you are able to read the text 'AMS1117' when it is placed onto the back of the owlBoard Jr. Assure that you can also see '3.3' on the regulator.*

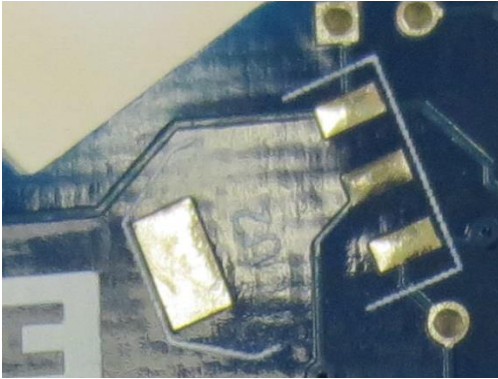


Figure 14 Linear regulator location

Verify that the crystal oscillator is an 8 MHz crystal oscillator before placing onto the board



Figure 15 Crystal Oscillator

LEDs are polarized. Please make sure to insert the flat side of the LED to match the flat side of the silkscreen on the board as indicated in Figure 16 LED silkscreen polarity.

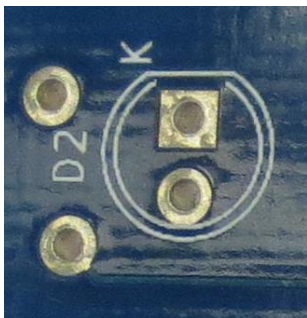


Figure 16 LED silkscreen polarity



Figure 17 Fully assembled Owlboard Jr.

## Software and Programming

### Development environment installation

We will use the Arduino compatible development environment designed for Microchip PIC32 products. Download MPIDE for Windows, MAC, or Linux.

Download the software and install it by navigating to this link and installing the MPIDE for your operating system.

<http://chipkit.net/started/install-chipkit-software>

Extract it to a location of your choice. Note that the driver for the owlBoard Jr. is located in the drivers folder of the zip file.

### Board driver installation

**Warning! Before plugging in your board, ensure that there are no shorts or bridges.**

When plugging in your board, D2 should start rapidly blinking, and your computer should detect something similar to the window below. It should indicate a stk500v2 compatible device. If it does not find a driver, please install the driver from the drivers folder of MPIDE.

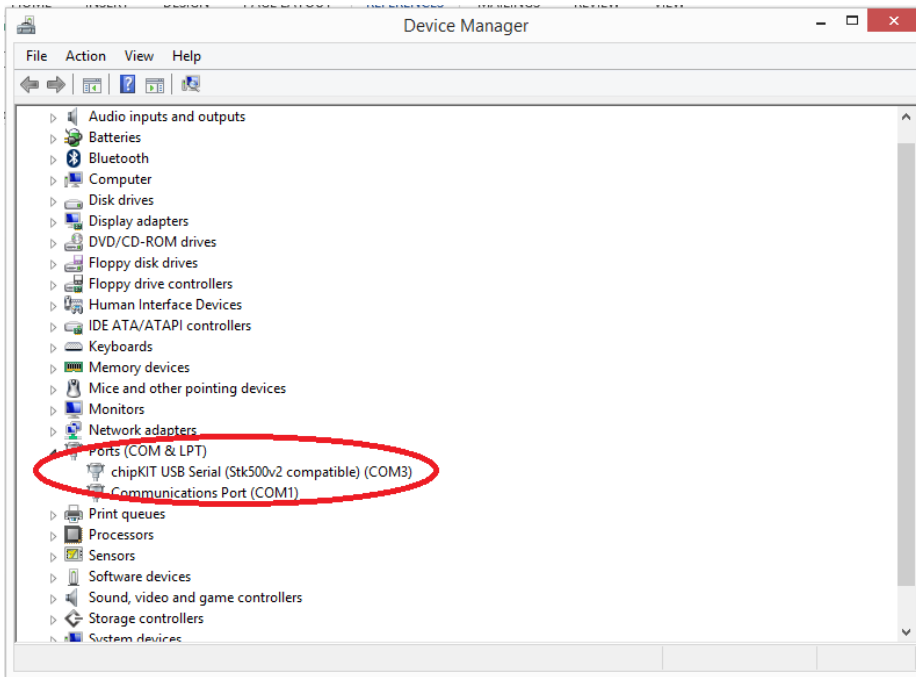


Figure 18 Device Manager Stk500v2

## How to program your board

1. Plug your board into the computer while holding down the button marked 'SW'. Let go after the board is inserted. The SW button is the program button. On this revision of the board, the program button and 'SW' buttons were swapped.
2. The right LED should rapidly start blinking indicating that it is in bootloader mode.
3. When you wish to reprogram the board, hold the 'SW' button down before inserting.
4. If you do not hold the button down, your code will run on the board.

Navigate to the extracted folder and launch MPIDE.

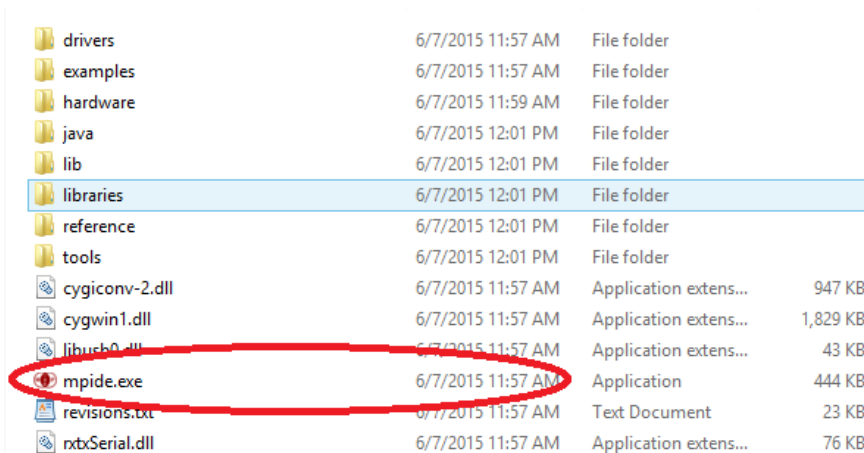


Figure 19 Launch MPIDE

Verify that the DP32 board is selected. This board most closely matches the owlBoard Jr.

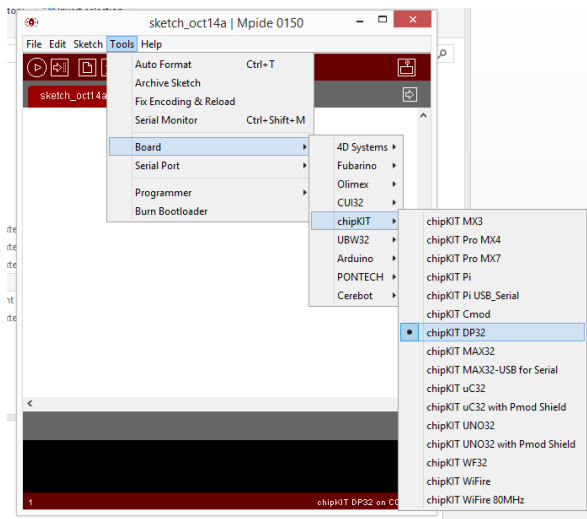
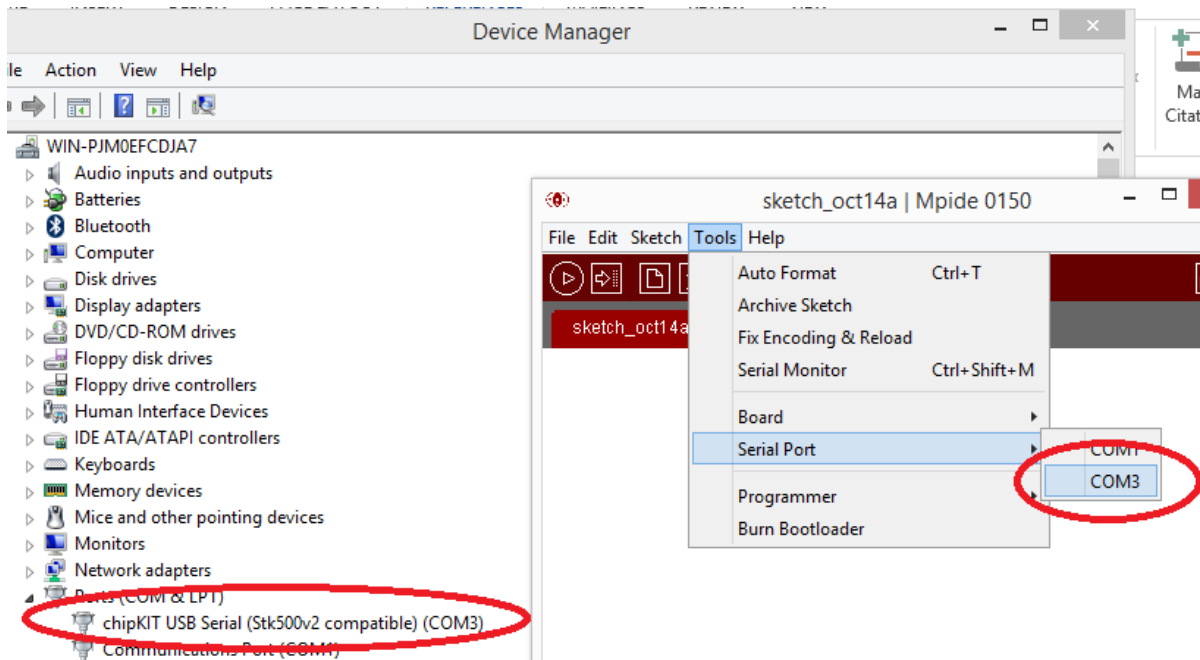


Figure 20 Verify DP32 is selected

Verify that the correct COM port is selected.



Open the Blink Example.

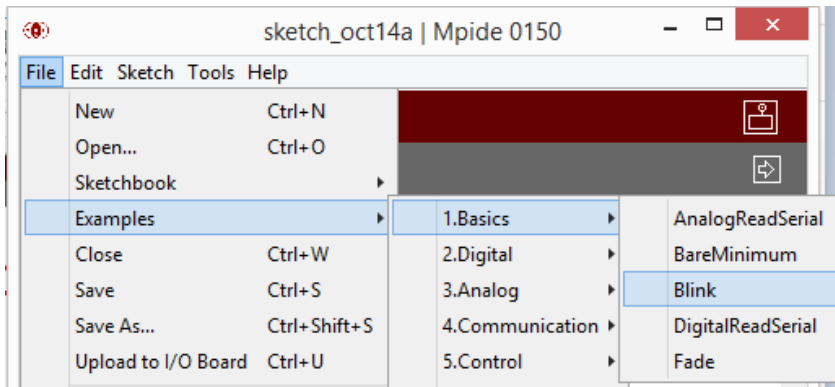


Figure 21

Modify the delay to change the blinking rate. The two delays in Figure 22 can be changed to a different value. Instead of `delay(1000);`, try `delay(1500);` or `delay(2000);`

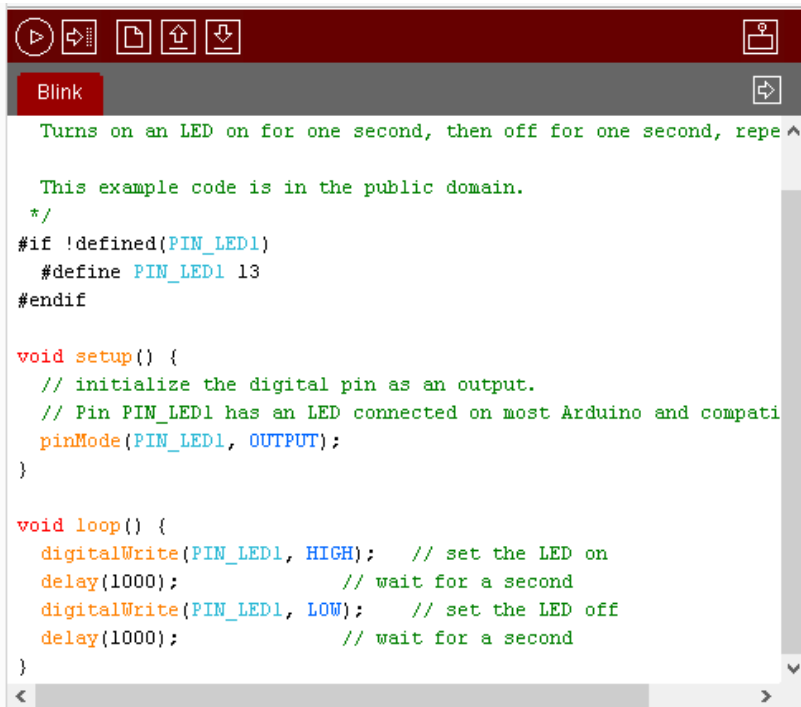


Figure 22

After modifying your code, Verify the correct board and COM port is selected. Click the arrow button. Once the upload is complete, the IDE window should indicate that it is done uploading.

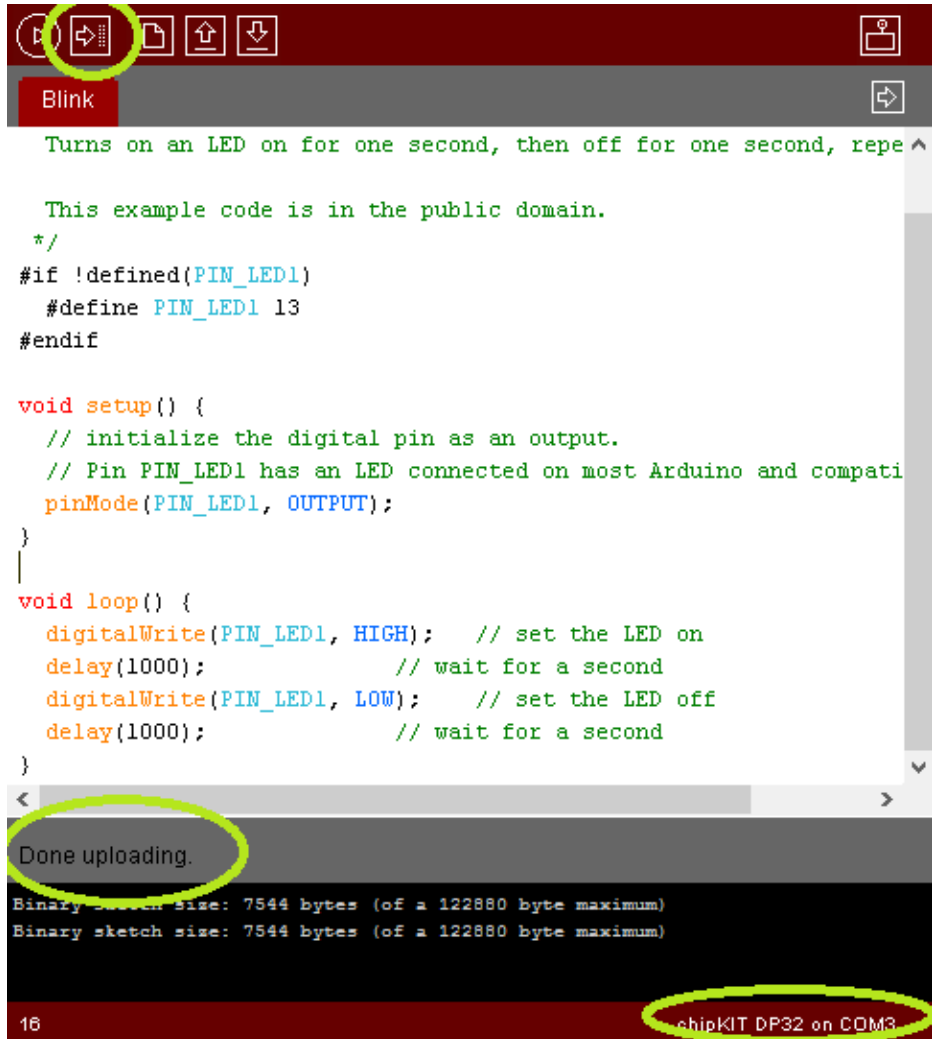


Figure 23

## Pinout information

Pin, button, or LED	Meaning or pin connection
<b>Left LED</b>	This is a power LED indicating your board is powered on.
<b>Right LED</b>	This is a user configurable LED. Use pin 14 to access in code.
<b>SW</b>	This switch is the button you hold down to program the board.
<b>Reset</b>	This resets the board.
<b>Program</b>	Use pin 2 in code
<b>Pins 1-18</b>	Use the appropriate pin number to access the pin in code. For instance, the following sets pin 8 as an output and writes a logic '1' to the pin.  pinMode(8, OUTPUT); digitalWrite(8,HIGH)

# *Tutorial Complete*

*This is a preliminary draft copy.*

*Please send updates, comments, and suggestions to: [kevin.pintong@oit.edu](mailto:kevin.pintong@oit.edu)*

*Thank you for participating in the Oregon Tech owlBoard Jr. outreach project.*

*This project is sponsored by Microchip and the Oregon Tech Committee on College Teaching.*