

# Texas Instrument (TI) *LaunchPad* Evaluation Kit

A complete tutorial and guide for the TI LaunchPad with  
featured microcontroller MSP430F5529

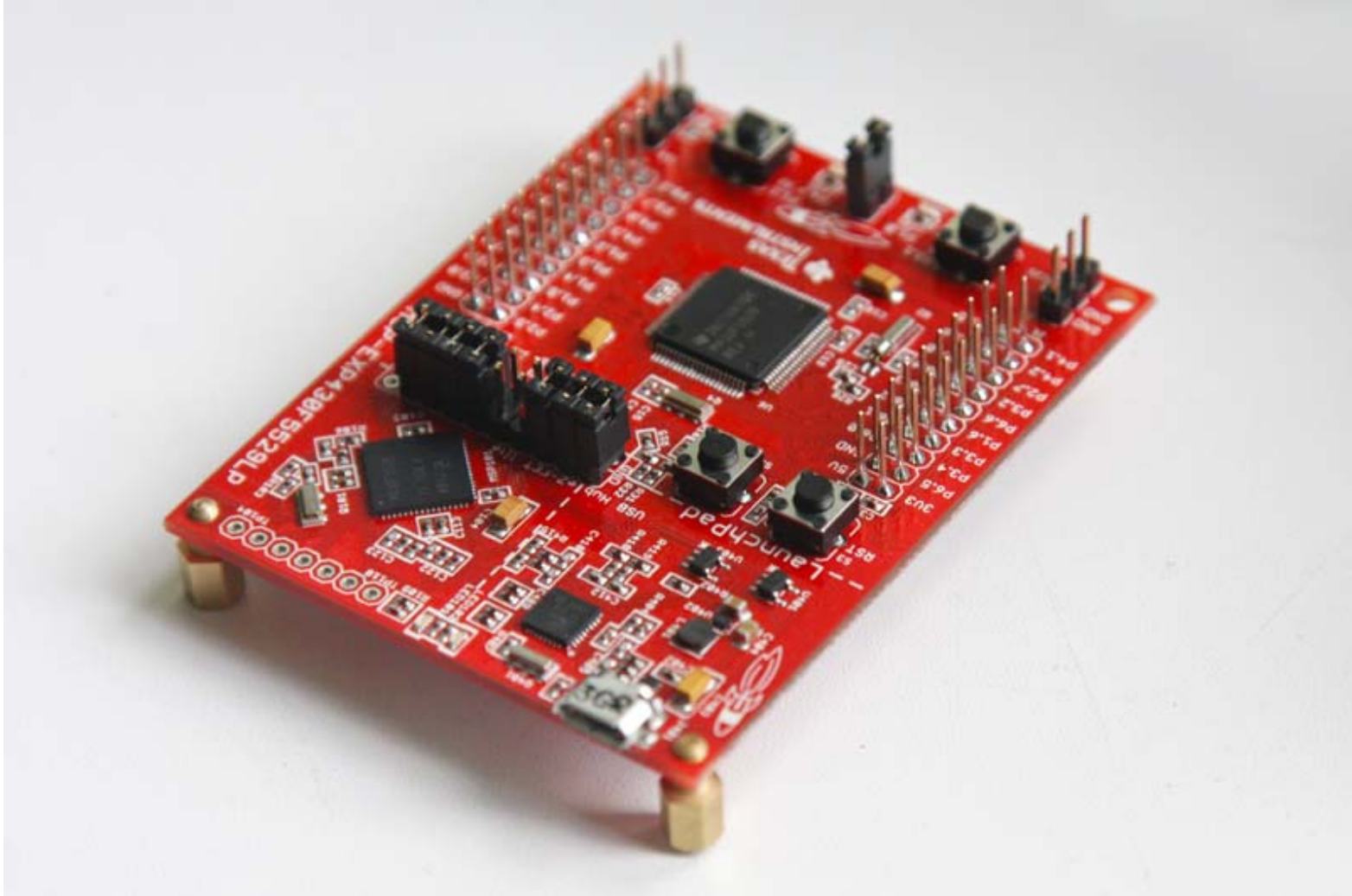
EECE456 Embedded Systems Design Lab

Electrical and Computer Engineering  
Howard University

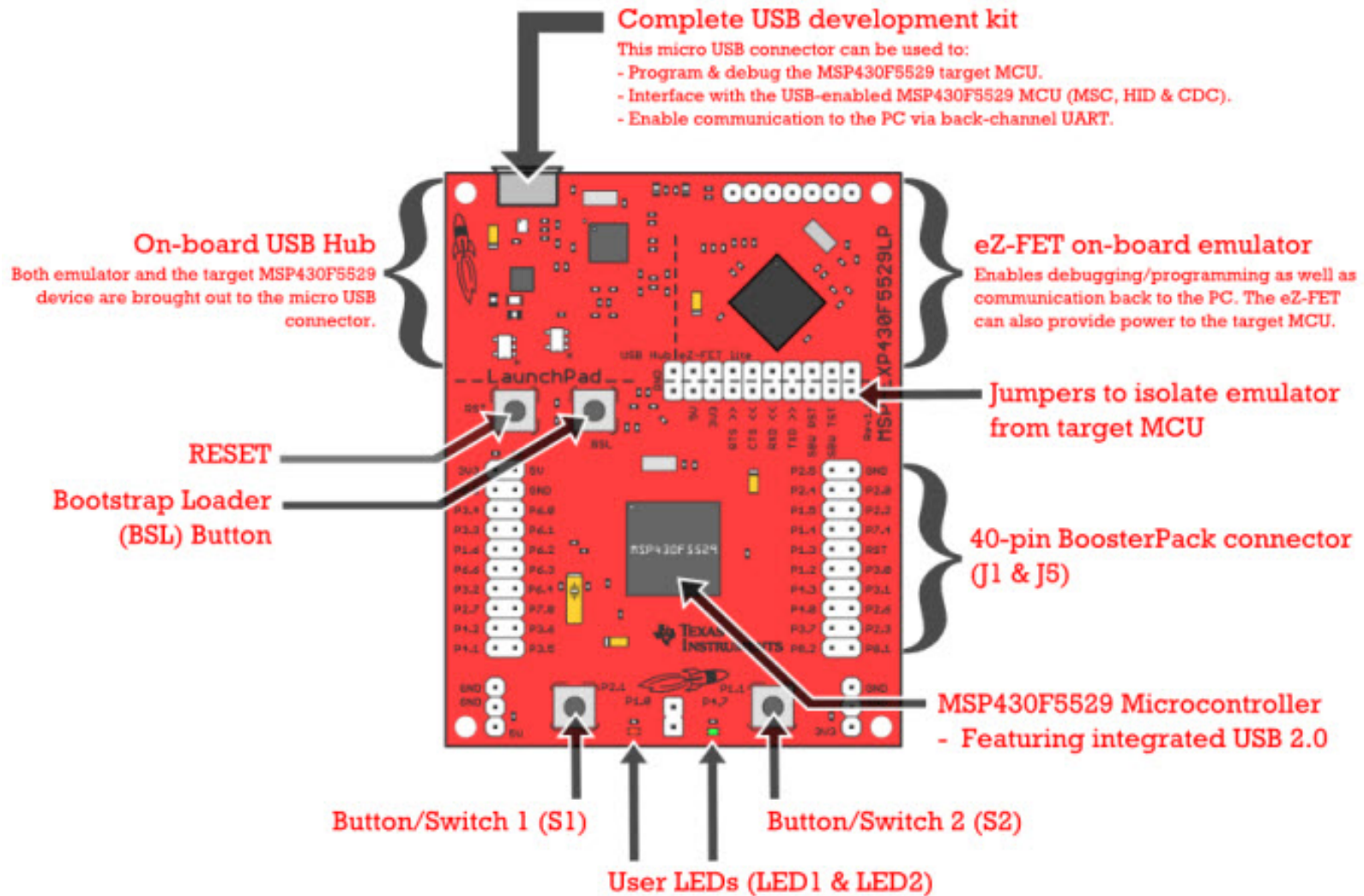
Instructor: Dr. Charles Kim  
TA: Derrick Anang

[WWW.MWFTR.COM/emblab.html](http://WWW.MWFTR.COM/emblab.html)

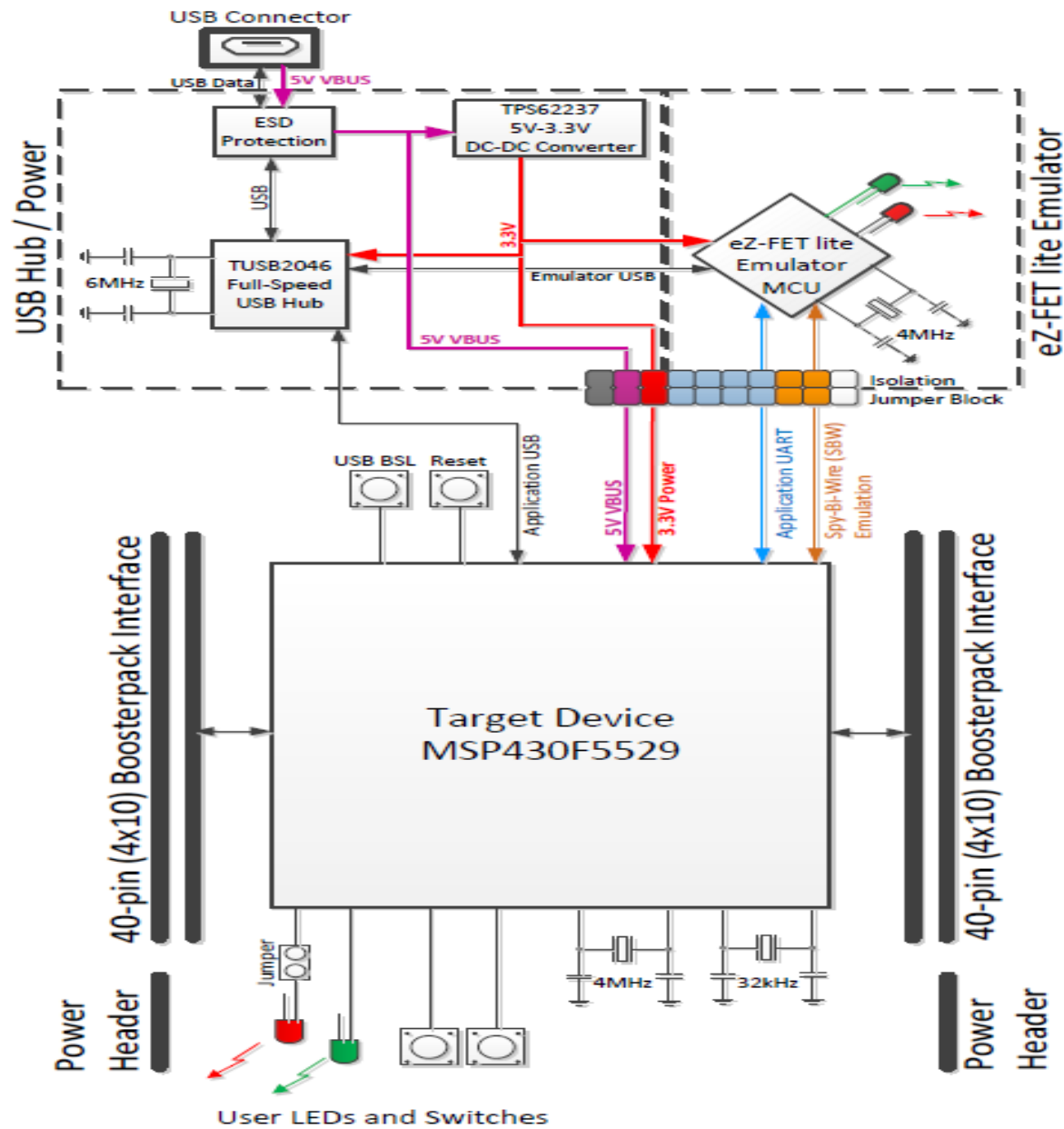
# TI LaunchPad MSP-EXP430F5529LP



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## OVERVIEW OF THE LaunchPad MSP-EXP430F5529LP

- MSP-EXP430F5529LP (or the “F5529 LaunchPad”)
  - inexpensive and simple development kit
  - with an MSP430F5529 USB microcontroller.
- It offers an easy way to start developing on the MSP430
  - on-board emulation for programming and debugging
  - buttons and LEDs for a simple user interface
- The MSP430F5529 16-bit microcontroller unit (MCU) has:
  - 128KB flash memory
  - 8KB RAM
  - 25-MHz CPU
  - integrated USB
  - many peripherals
- Free software development tools are available:
  - TI’s Eclipse-based Code Composer Studio IDE (CCS)
  - IAR Embedded Workbench IDE (IAR)
  - the community-driven ENERGIA open-source code editor

## **KEY FEATURES OF THE USB-Enabled MSP430F5529 MCU**

- Up to 25-MHz System Clock
- 1.8-V to 3.6-V operation
- 128KB of flash, 8KB of RAM
- Five timers
- Up to four serial interfaces (SPI, UART, I<sup>2</sup>C)
- 12-bit analog-to-digital converter
- Analog comparator
- Integrated USB with a complete set of USB tools, libraries, examples and reference guides.
- Power sourced from the USB host. The 5-V bus power is reduced to 3.3-V using an on-board dc-dc converter.
- Both male and female 40-pin BoosterPack headers, configured for stacking. 20-pin BoosterPacks can also be attached.
- Compatible with the 40-pin LaunchPad BoosterPack development tool standard.

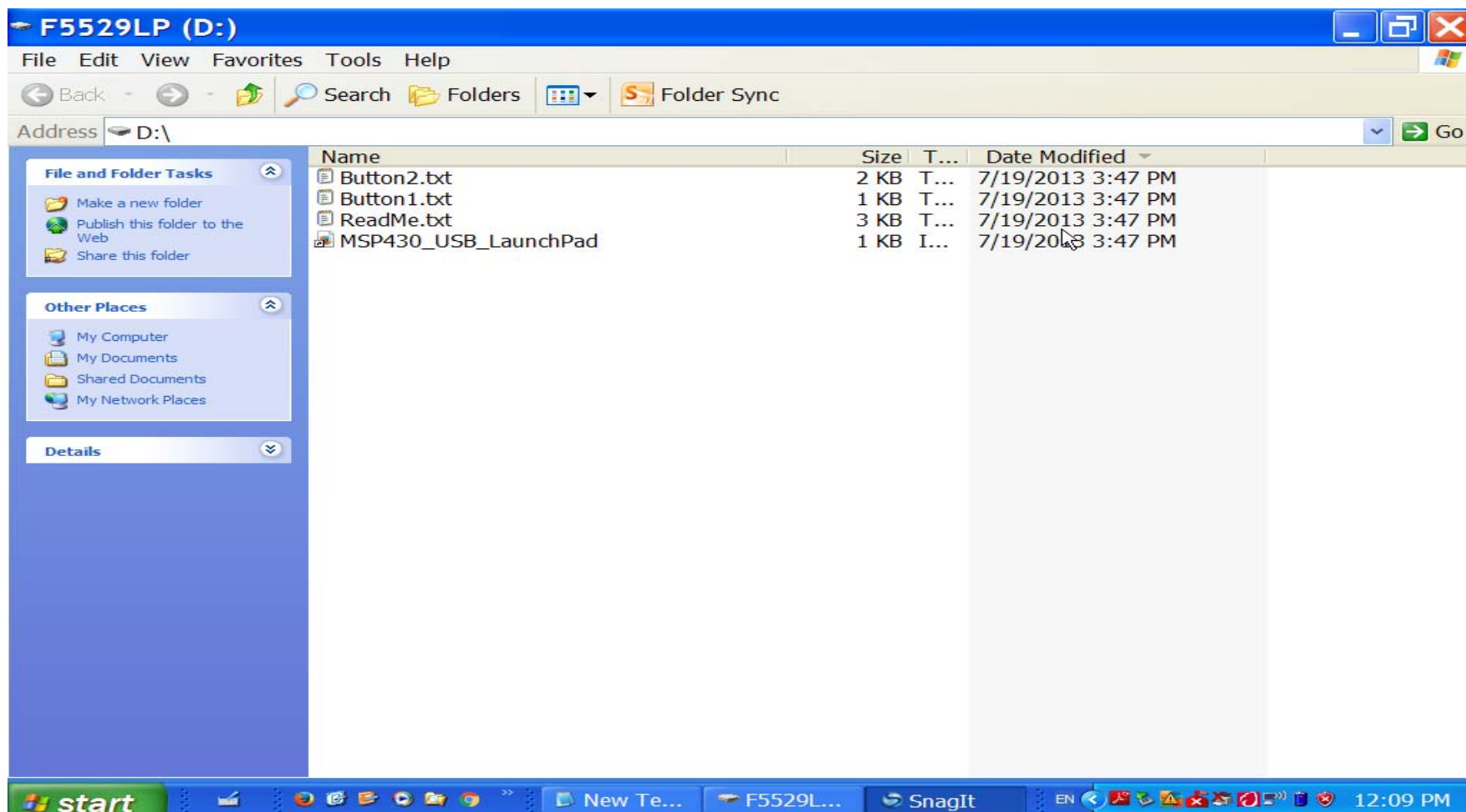
## GETTING STARTED (*OUT OF BOX DEMO*)

- The LaunchPad comes pre-loaded with some demo functionality.
- Connect the LaunchPad using the included USB cable to a computer. If prompted, let it install necessary software.
- When connected to your computer, the device will be enumerated on the computer as a composite USB device to demonstrate 2 USB implementations.
- When plugged in over USB, the LaunchPad will enumerate as a Mass Storage Class Device.
- The LaunchPad will show up as a removable disk (“F5529LP”) on the computer and will contain several files on FAT volume (See next page)
  - Button1.txt = “Hello World”
  - Button2.txt = This contains ASCII art of the LaunchPad “Rocket” Logo.
  - MSP430\_USB\_LaunchPad.url
  - ReadMe.txt
- Press S1 or S2 button on the LaunchPad, and observe text stored in the Button1 and Button2.txt files be sent to your computer as “keystrokes”.
- Open up a text editor (e.g. “Notepad”) to see the incoming characters.



# GETTING STARTED (*OUT OF BOX DEMO*)

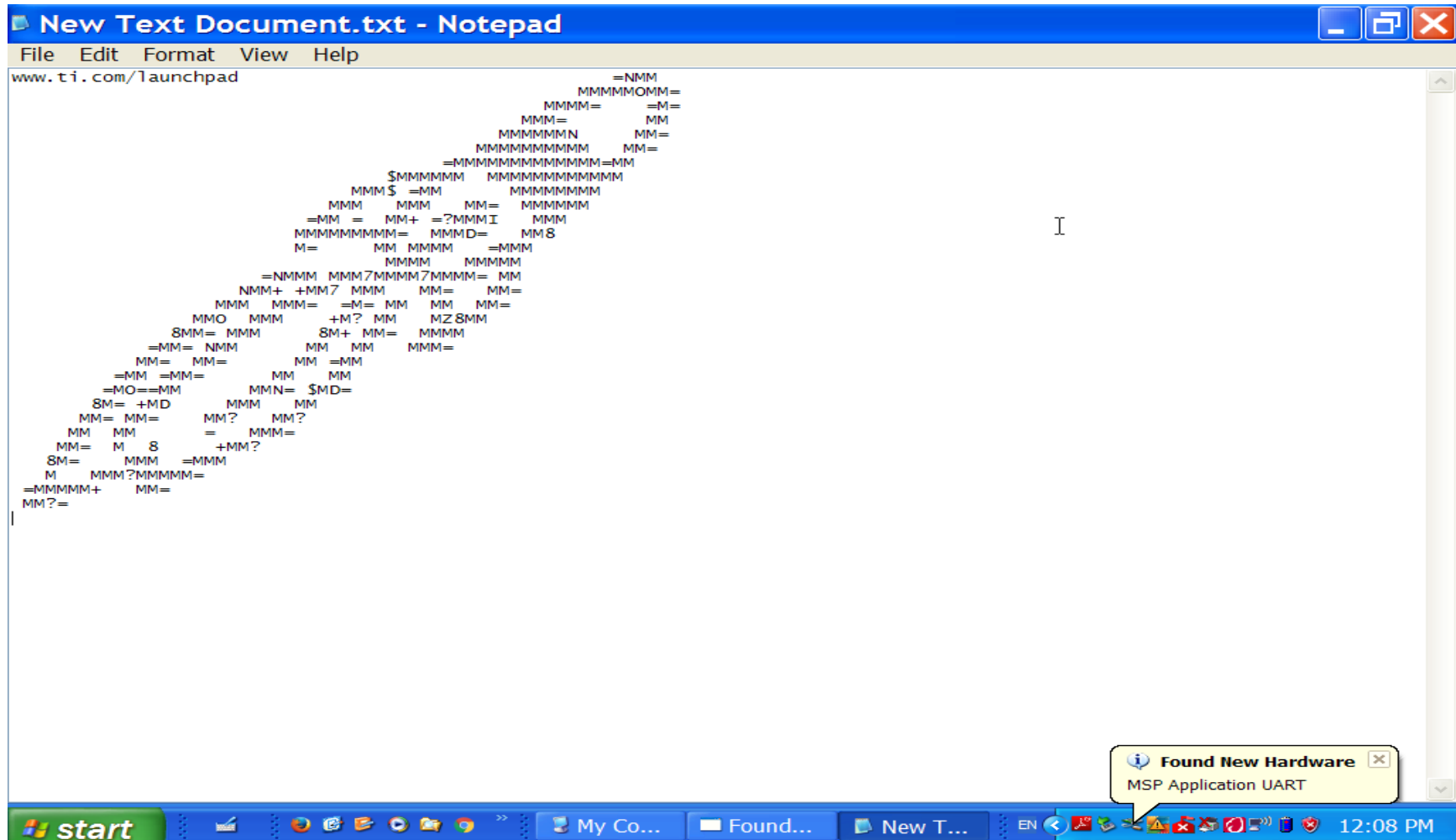
- LaunchPad enumerated as Mass Storage Class Device





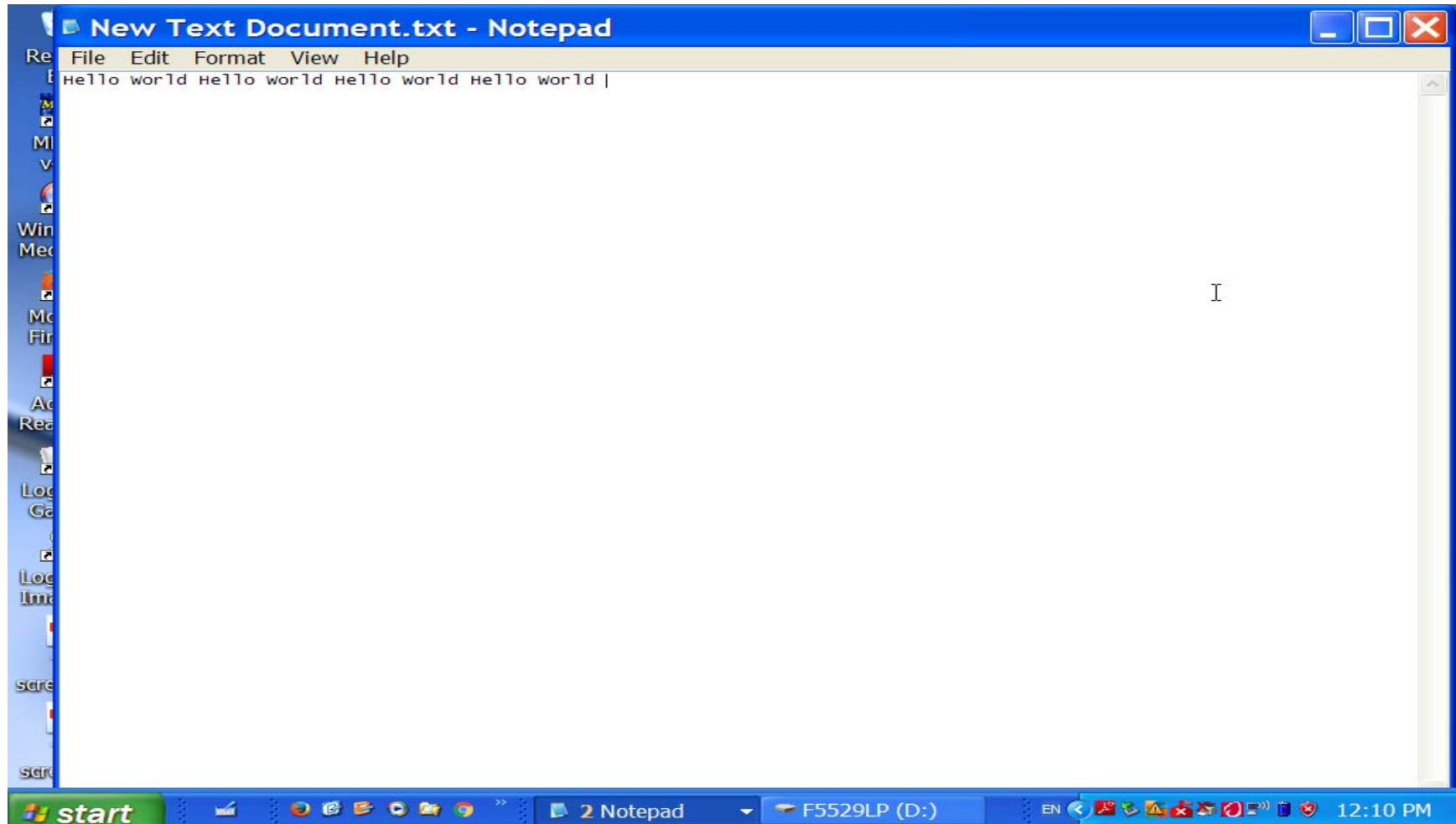
## GETTING STARTED (*OUT OF BOX DEMO*)

- ASCII art of the LaunchPad “Rocket” Logo



# GETTING STARTED (*OUT OF BOX DEMO*)

- “Hello World”



# SOFTWARE DEVELOPMENT TOOLS

- The LaunchPad provides multiple-points of entry in terms of software development.
- For the purposes of this course, we will use the community-made ENERGIA integrated development environment (IDE)
- Link to download this IDE can be found below:

[www.energia.nu/download](http://www.energia.nu/download)

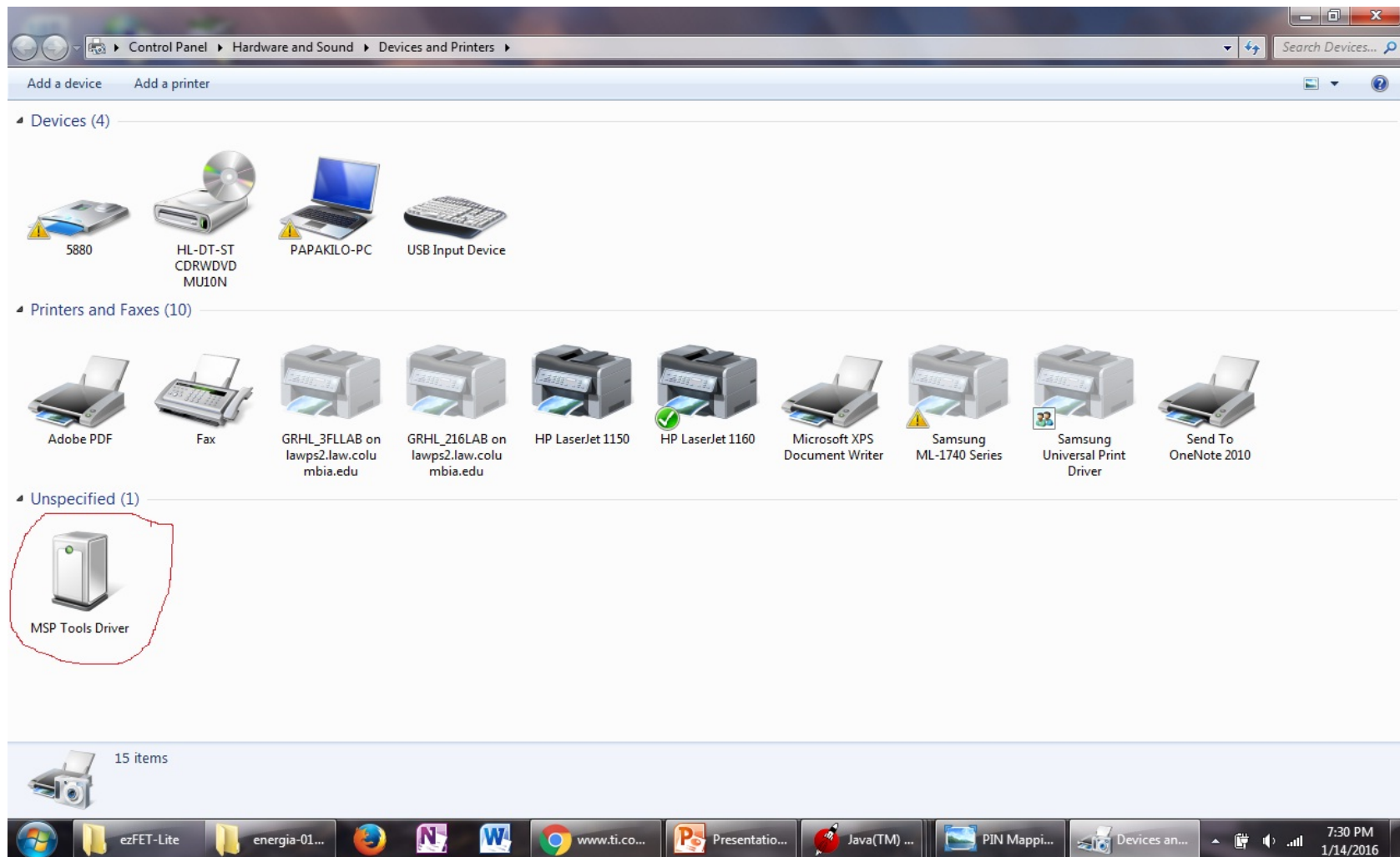


# INSTALLING USB DRIVERS

- The MSP430F5529 device is supported by a robust USB development ecosystem which includes open source APIs for MSC, HID and CDC USB implementations.
- Check the link (in the class note website) to download the drivers necessary for interfacing the LaunchPad MSP-EXP430F5529LP eZ-FET lite with ENERGIA IDE.
- Two drivers are available:
  - DPinst.exe ---- For users with 32-bit Windows systems
  - DPinst64.exe ----- For users with 64-bit Windows systems
- TI LaunchPad is now ready to interface with the ENERGIA IDE.
- **NOTE:** Users must ensure that there is no already existing IDE software (for Galileo or Arduino) and their driver installations when attempting to install and run Energia and its drivers. Any such installations must first be removed from the computer before installing ENERGIA IDE and its drivers.
- To confirm if the correct USB drivers have been installed, perform the following:
  - Connect the LaunchPad using the included USB cable to the computer.
  - Allow for some time to elapse then go to the “START” menu.
  - Click on “Devices and Printers” option.
  - When “Devices and Printers” window opens, look out for a mainframe-like icon named “MSP Tools Driver” under the unspecified catalog. (See pages 13 – 14)

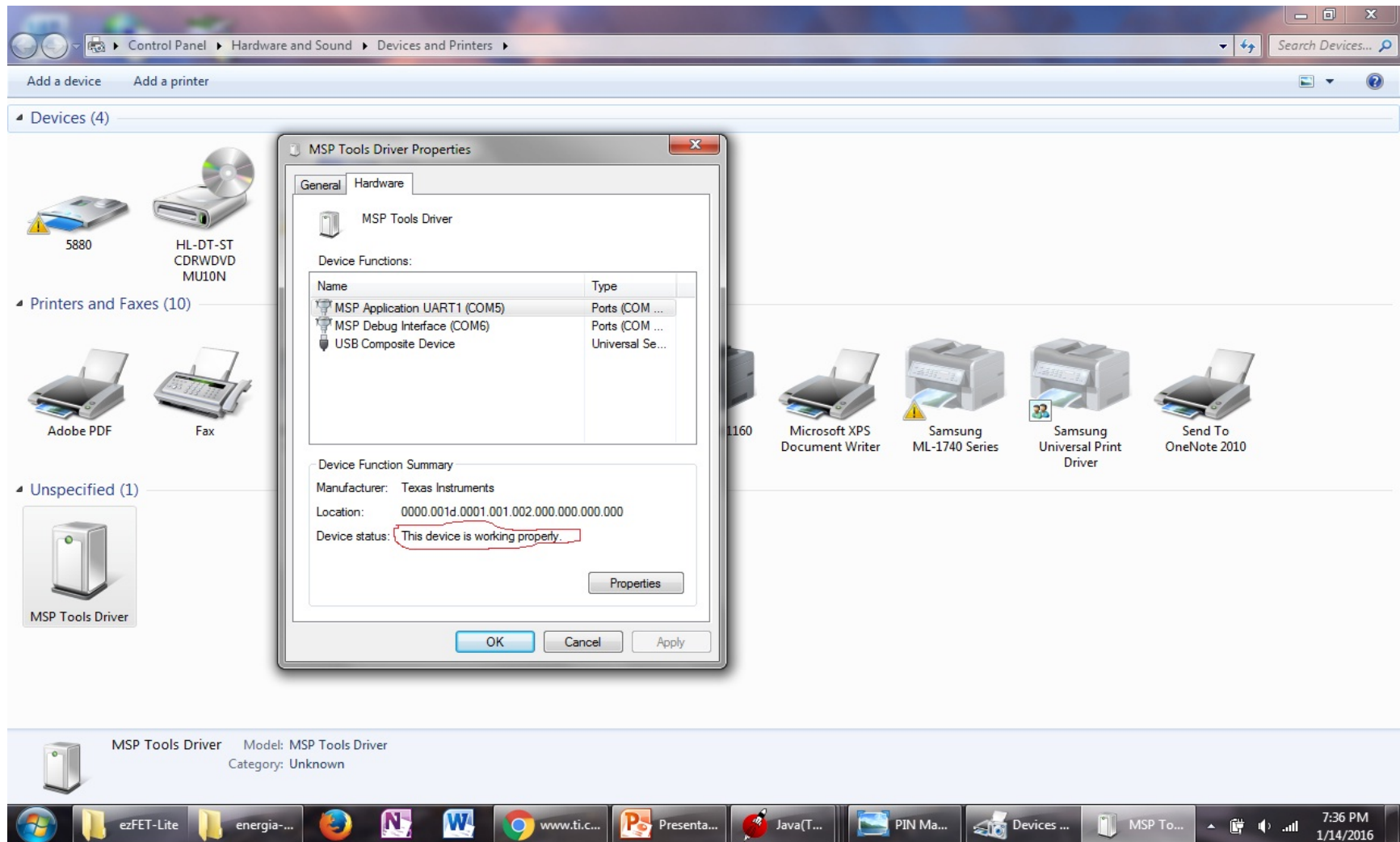
# INSTALLING USB DRIVER

- Double-click on the 'MSP Tools Driver' icon



# INSTALLING USB DRIVER

- Check “Hardware” tab to make sure device is working properly.



## ENERGIA IDE

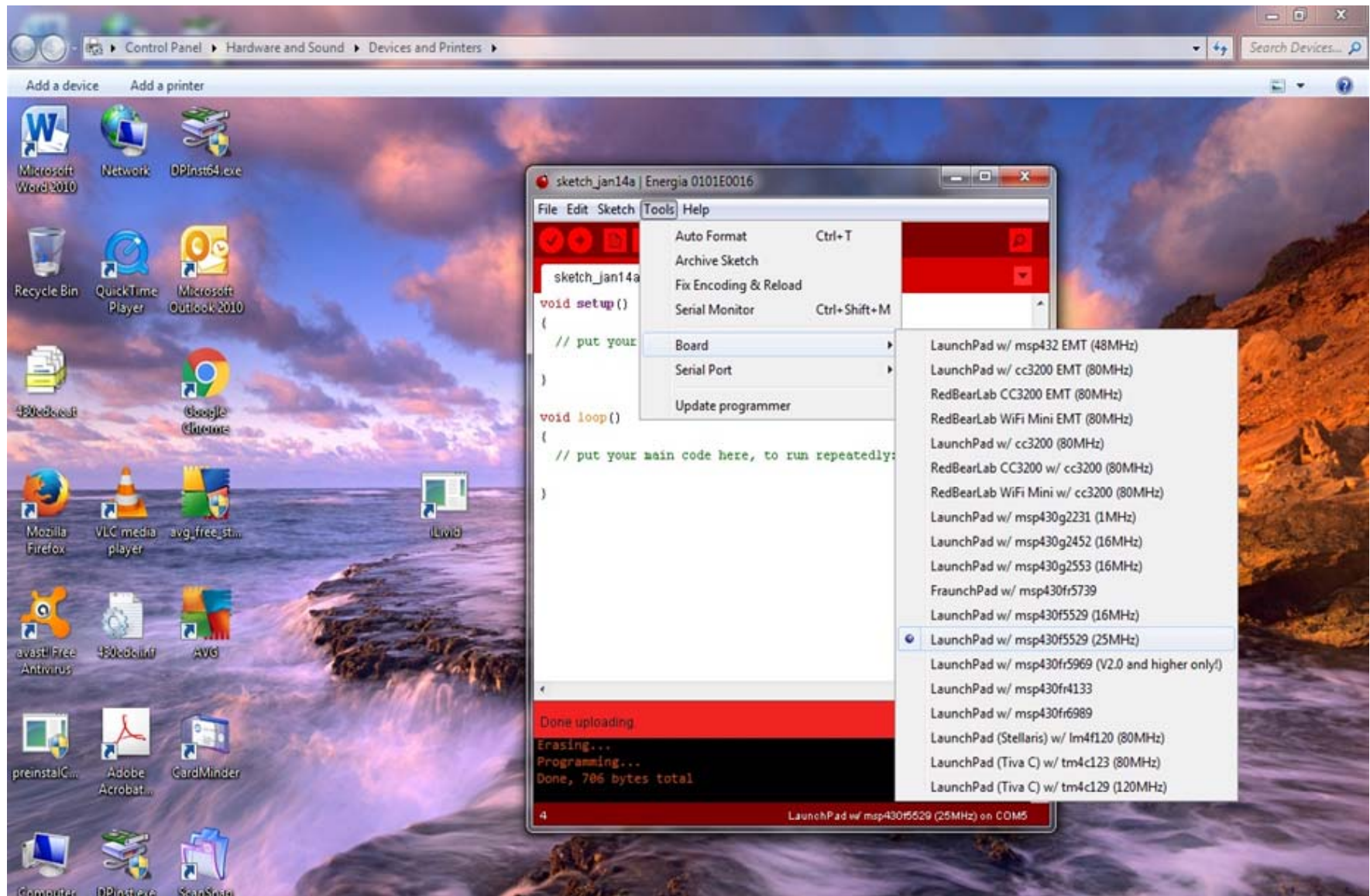
- Energia is an open-source electronics prototyping platform started by Robert Wessels in January of 2012 with the goal to bring the **Wiring and Arduino framework** to the Texas Instruments MSP430 based LaunchPad.
- Energia includes an integrated development environment that is based on processing.
- Energia uses the **mspgcc** compiler and is based on the Wiring and Arduino framework.
- Together with Energia, LaunchPad can be used to develop interactive objects, taking inputs from a variety of switches or sensors and controlling a variety of lights, motors and other physical outputs.



## Initialization of Energia IDE

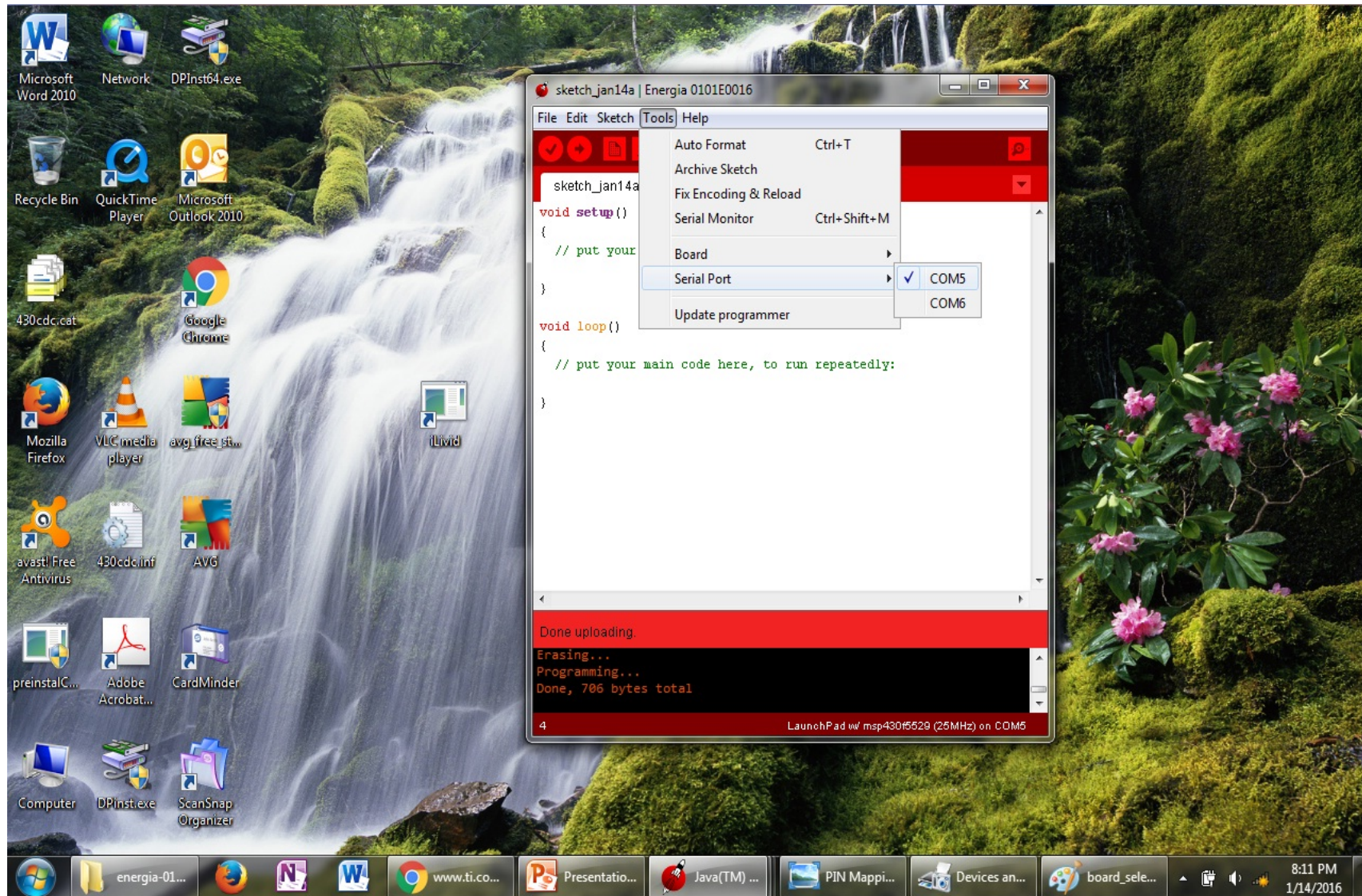
- Run the **energia.exe** application from where it is stored on your computer.
- Connect the LaunchPad using the included USB cable to the computer.
- In some situations, the IDE might ask you to run an update. To do so, click the “Tools” tab then go all the way down and click “Update programmer” to run an update for the IDE.
- Now we select the type of board connected to the computer.
- Under the same “Tools” tab, go down and choose the “Board” option.
- Select the appropriate TI LaunchPad board connected to the computer.
- **NOTE:** For the purposes of this course, will use the LaunchPad MSP430F5529 (25MHz)
  - Be careful not to choose the 16MHz option.
- Now check the serial port option to make sure Energia IDE recognizes the port the board is connected to.
- Under “Tools” tab, scroll down to “Serial Port” option.
- Usually, two serial ports should be listed. The lower port number is mostly used as our application UART and should be selected.
- The second, higher port number, is used during the debugging interface.
- These port numbers (COM) can be confirmed under “Devices and Printers”, double click on “MSP Tools Driver” and under the “Hardware” tab.

# Initialization of Energia IDE





# Initialization of Energia IDE



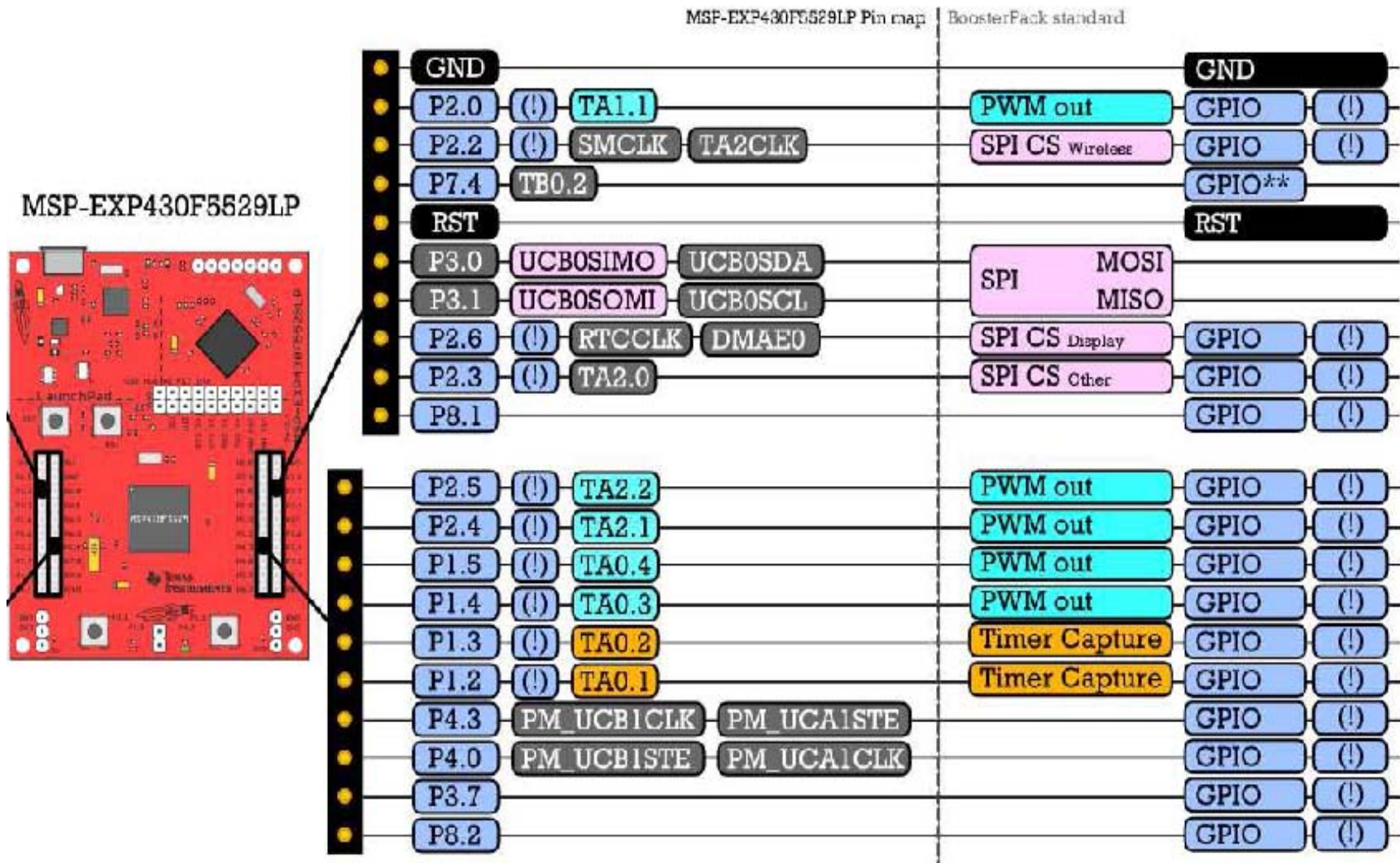
## Running a Sample Code - Step 1

- Before sample code is run, it is prerequisite to know the pin map.
- Check the next 3 pages (PP.20 – 22) for the pin map of the MSP-EXP430F5529LP Launchpad and for BoosterPack connector.
- Now we will run a sample code to make sure Energia IDE is able to communicate with the board.
- Run Energia IDE.
- Under “File” tab, select “Examples”.
- Then select “Basics” option then choose “Blink” sample code.
- A new window should pop-up containing the “Blink” sample code.



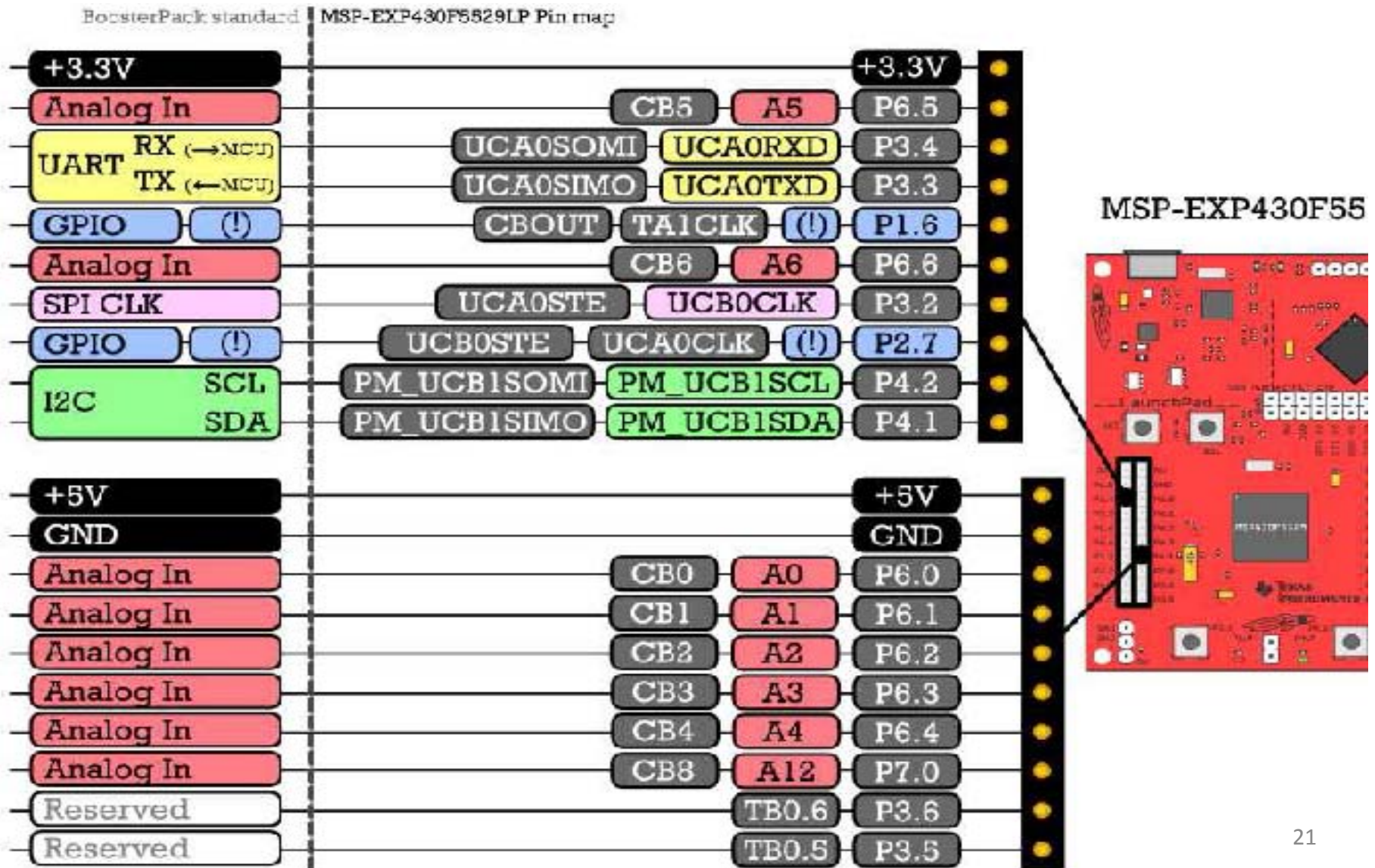
# Pin Map

- MSP-EXP430F5529LP Pin-map (Boosterpack standard)



# Pin Map

- MSP-EXP430F5529LP Pin-map (Boosterpack standard)





## Pin Map



## LaunchPad with MSP430F5529

Revision 1.4

Flash	128	KB
SRAM	8	KB

Serial	hardware	
ADC	12	bits
Use pins numbers only!		
Default I <sup>2</sup> C = (1)		
Default SPI = (0)		

+3.3V				J1	J3			+5V
		A5	P6_5	2	21			GND
		RX (1)	P3_4	3	23	P6_0	A0	
		TX (1)	P3_3	4	24	P6_1	A1	
			P1_6	5	25	P6_2	A2	
		A6	P6_6	6	26	P6_3	A3	
	SCK (0)		P3_2	7	27	P6_4	A4	
	CS (0)		P2_7	8	28	P7_0	A12	
	MISO (1)	SCL (1)	P4_2	9	29	P3_6		
	MOSI (1)	SDA (1)	P4_1	10	30	P3_5		
>>RDX	jumper	RXD	P4_5					GND
<<TXD	jumper	TXD	P4_4					GND
temperature		A10						+5V



Hardware
Pin number
Other Pins

A diagram showing three communication protocols stacked vertically in colored boxes: I<sup>2</sup>C (yellow), Serial UART (orange), and SPI (red).

analogRead()  
digitalRead() and digitalWrite()  
digitalRead(), digitalWrite()  
and analogWrite()

[illegible]

P1_0	jumper	RED_LED
P1_1		PUSH2
P2_1		PUSH1
P4_7		GREEN_LED

P6_7	A7	jumper	<<RTS
P1_7		jumper	>>CTS

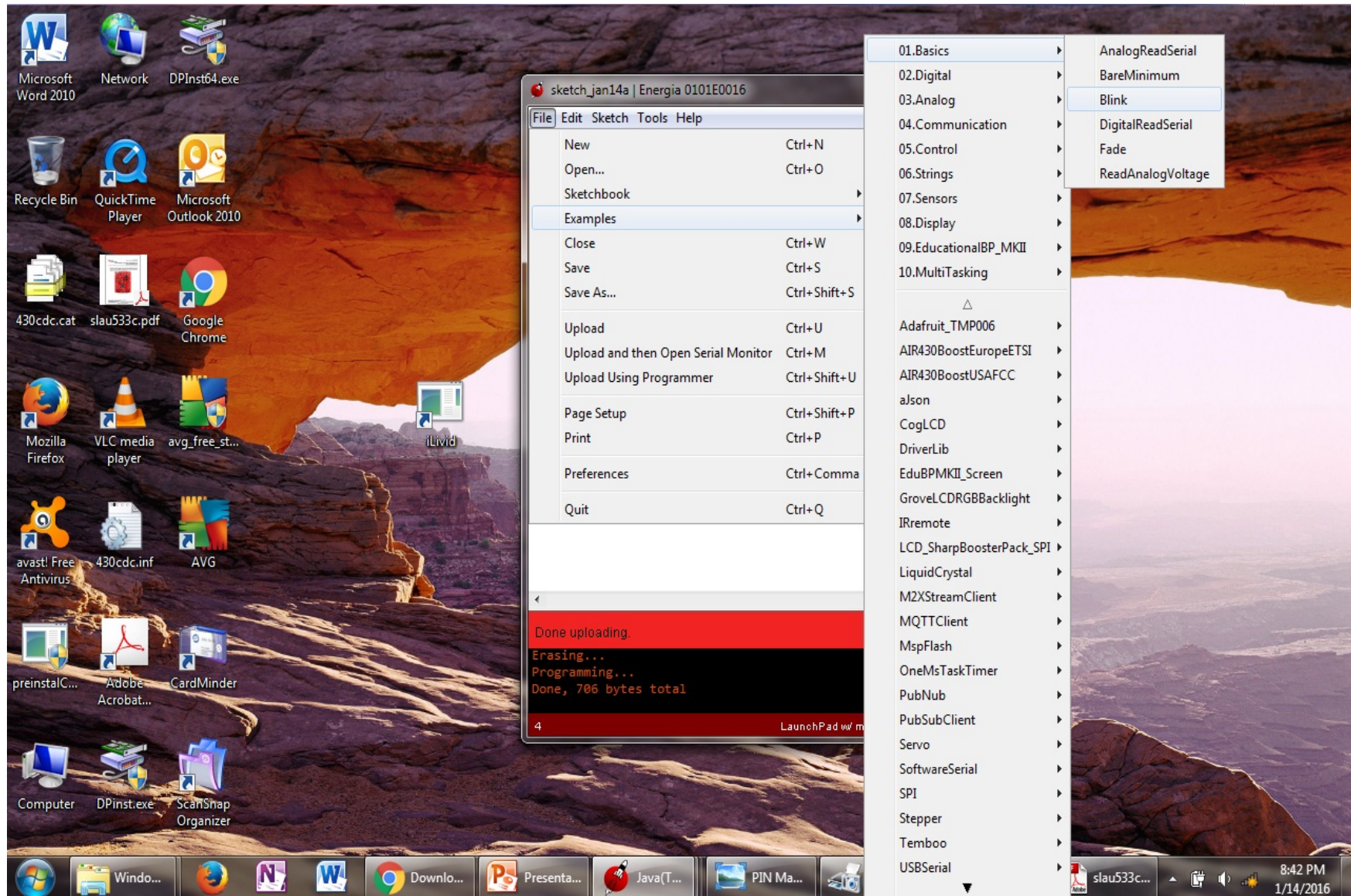

 Rei Vilo, 2012-2015  
[embeddedcomputing.weebly.com](http://embeddedcomputing.weebly.com)  
 version 2.1    2015-09-13



## Running a Sample Code - Step 2

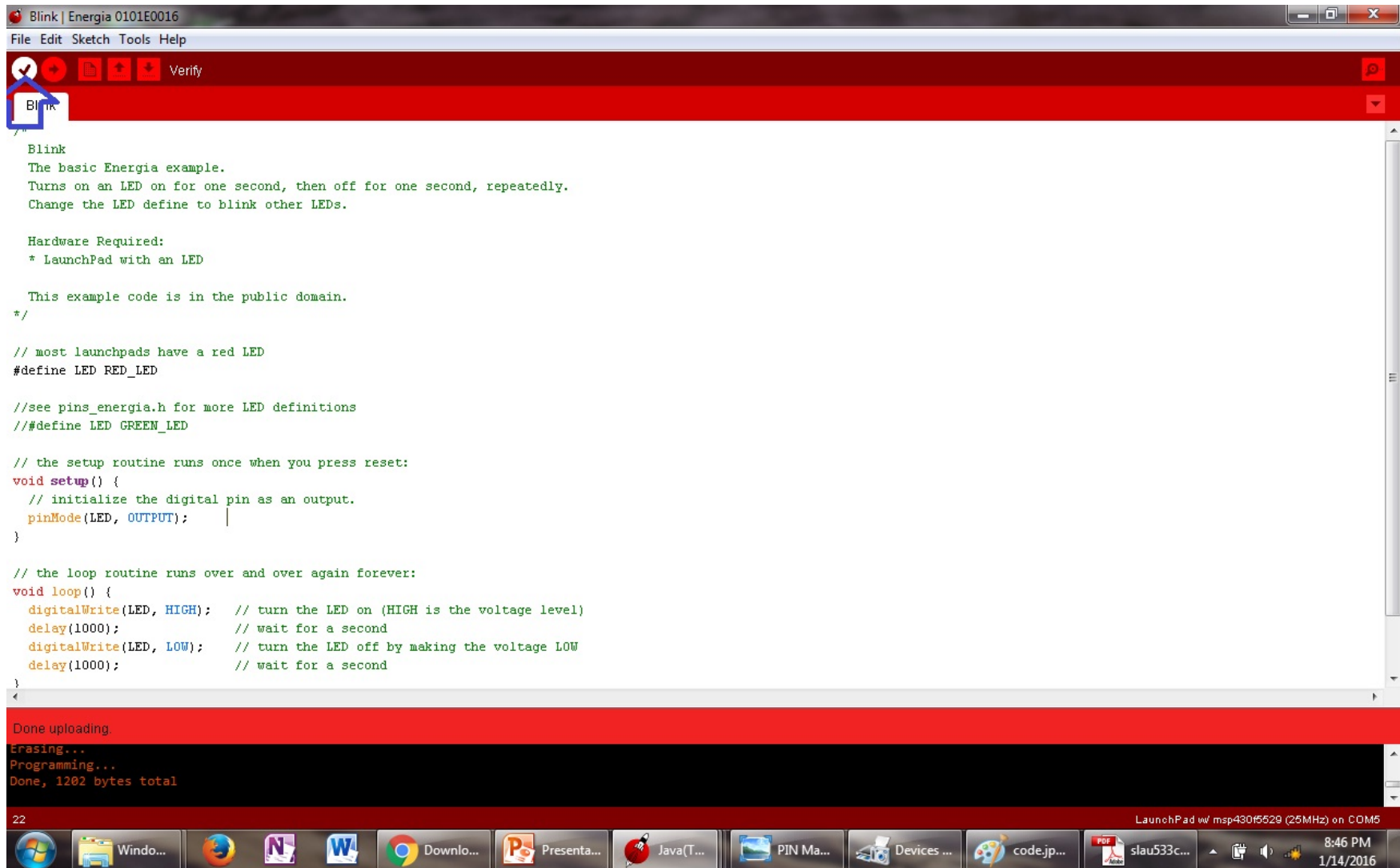
- Now we will run a sample code
  - Run Energia IDE.
  - Under “File” tab, select “Examples”.
  - Then select “Basics” option then choose “Blink” sample code. (See p. 24)
  - A new window should pop-up containing the “Blink” sample code. (See p. 25)

# Running a Sample Code



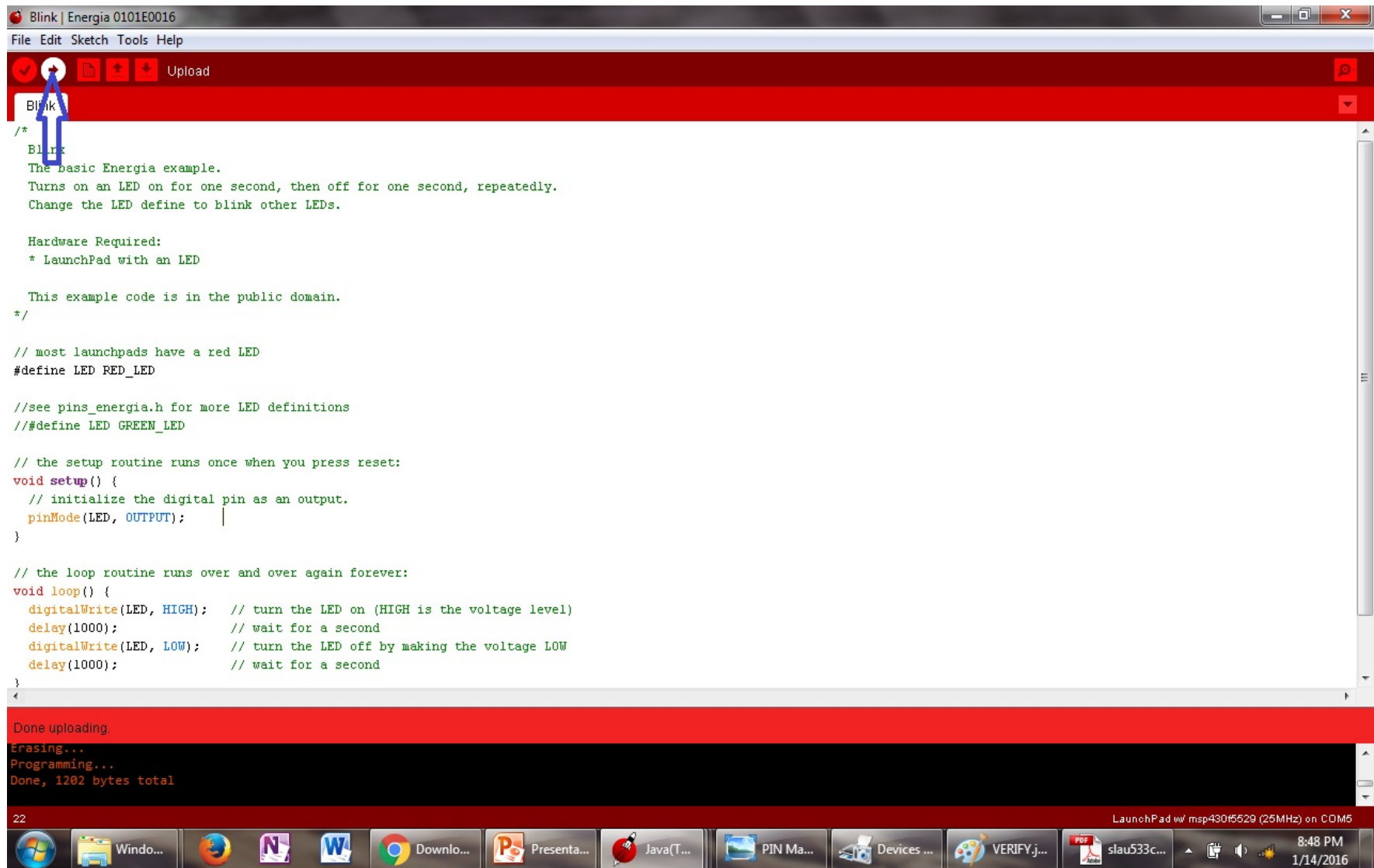
## Running a Sample Code – Step 3

- Now we **verify** the code by clicking on the “VERIFY” option.



# Running a Sample Code – Step 4

- We then **upload** the verified code to the board and observe what happens.



```
Blink | Energia 0101E0016
File Edit Sketch Tools Help
[Checkmark] [Sketch] [Upload] [Reset] [Blink] Upload
Blink
/*
 * Blink
 * The basic Energia example.
 * Turns on an LED on for one second, then off for one second, repeatedly.
 * Change the LED define to blink other LEDs.

 * Hardware Required:
 * LaunchPad with an LED

 * This example code is in the public domain.
 */

// most launchpads have a red LED
#define LED RED_LED

//see pins_energia.h for more LED definitions
//#define LED GREEN_LED

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(LED, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(LED, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);             // wait for a second
  digitalWrite(LED, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);             // wait for a second
}

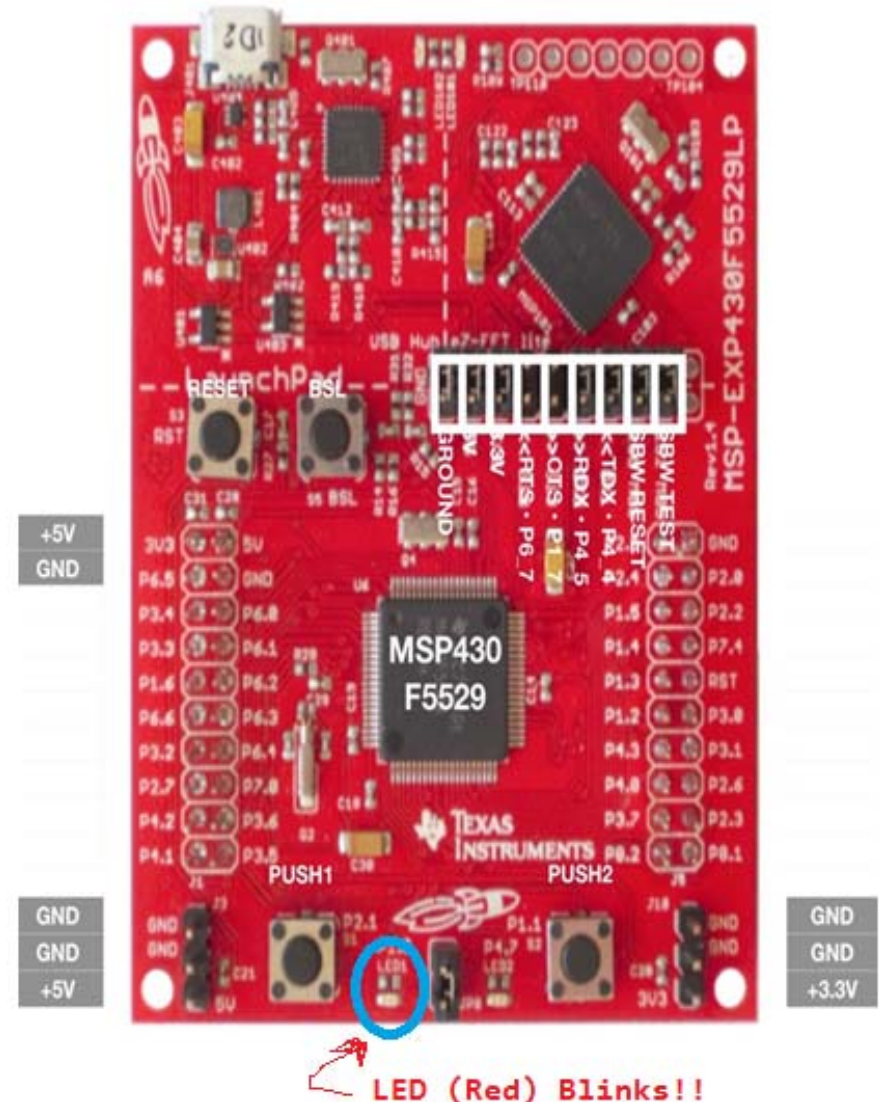
Done uploading.
Erasing...
Programming...
Done, 1202 bytes total

22 LaunchPad w/ msp430f5529 (25MHz) on COM5
Windows Explorer Firefox Notepad Word Chrome Download Photoshop Presenta... Java(T... PIN Ma... Devices ... VERIFY.j... slau533c... 8:48 PM 1/14/2016
```



# Running a Sample Code

- After upload is successful, an on-board **red** LED (“LED1”) lights up and blinks. (See the mark in the bottom of the board)
- If on-board LED does not blink, go back and review the steps and ensure everything has been setup properly.
- Happy TI Launching!



# Troubleshooting\*

- Unfortunately, getting the blink sketch to work is not an “Out of Box Demo”
- You may receive the “**no unused FET found error**” in the text console while trying to upload the sketch to the board
- The problem is the firmware on the MSP 430F5529 TI board is outdated and would not allow a “sketch upload”
- To update the firmware, download and extract **slac623e.zip** file (Web Link provided in the main class note page)
- Required: To access this file, you need to register a TI account
- Navigate into “Drivers” library then “Emulation”

Path (Root directory excluded):

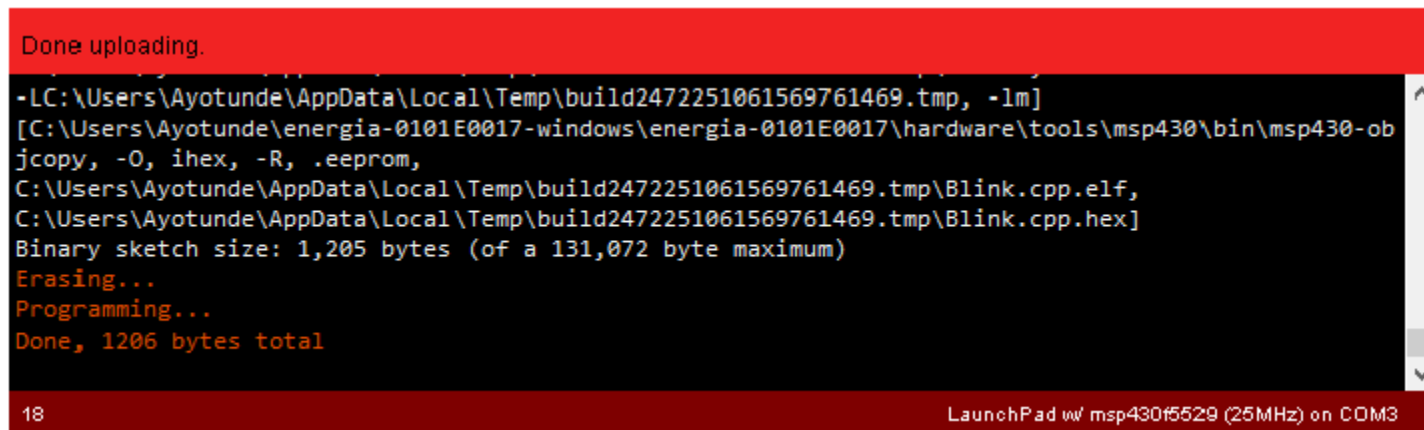
slac623\MSP-EXP430F5529LP Software Examples\Drivers\Emulation

- Download and Install MSP430 FET USB drivers (a shortcut is provided in the folder)
- Store in parent directory where “energia-0101e0017-windows” resides. (I didn’t have to place it in the energia folder itself)

\*Troubleshooting section is provided by Mr. Ayotunde Odejayi, a student of the class.

# Troubleshooting\*

- Close and restart the Energia IDE
- You should be prompted to “update programmer”, navigate to Tools->Update programmer. If not prompted, go ahead and update it.
- NOTE: This can be done from the command line, but it is more straightforward with the Energia IDE.
- Compile and upload blink sketch to board ( The text console window should display the following)



```
Done uploading.  
-LC:\Users\Ayotunde\AppData\Local\Temp\build2472251061569761469.tmp, -lm]  
[C:\Users\Ayotunde\energia-0101E0017-windows\energia-0101E0017\hardware\tools\msp430\bin\msp430-ob  
jcopy, -O, ihex, -R, .eeprom,  
C:\Users\Ayotunde\AppData\Local\Temp\build2472251061569761469.tmp\Blink.cpp.elf,  
C:\Users\Ayotunde\AppData\Local\Temp\build2472251061569761469.tmp\Blink.cpp.hex]  
Binary sketch size: 1,205 bytes (of a 131,072 byte maximum)  
Erasing...  
Programming...  
Done, 1206 bytes total
```

18 LaunchPad w/ msp430f5529 (25MHz) on COM3

- Firmware update is complete!
- Observe one of the on-board programmable LED's blink!

\*Troubleshooting section is provided by Mr. Ayotunde Odejayi, a student of the class.



# Questions?

Send email your inquiry to the  
TA, Mr. Derrick Anang:  
[derrickann23@gmail.com](mailto:derrickann23@gmail.com)