

Physics 319, 2016-17

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- Web Page:

<http://www.physics.ubc.ca/~michal/phys319/>

- Lecture times: Th. 11:30 –12:30
- Place: Hebb 12
- Labs: M, T, Th 2-6 PM Hebb 42

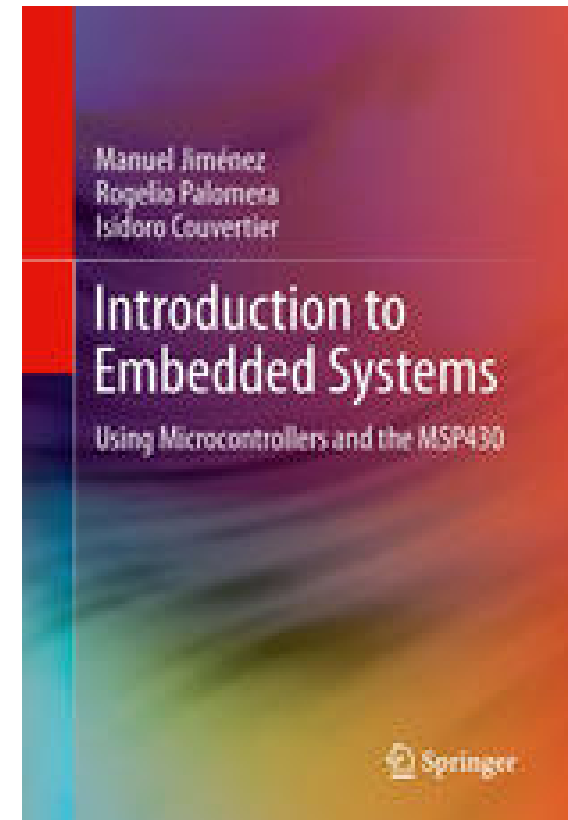
Text

Introduction to Embedded Systems Using
Microcontrollers and the MSP430.

Available for download from
the UBC library at

<http://webcat2.library.ubc.ca/vwebv/holdingsInfo?bibId=7372090>.

We won't follow this text
closely, but its a great
reference.



PHYS 319 Electrical Laboratory:

A project-oriented course introducing the design, construction and programming of microprocessor-controlled devices.

Course outline:

- First 6 weeks:

Crash course in microprocessor programming in assembler and C and incorporating external hardware.

Working on example programs and explaining how hardware and software works

- Next 6 weeks: projects of your choice
- Old projects and suggestions are on the web page

Examples of past projects:

3d-scanner

persistence of vision display (bicycle wheel)

Home alarms

Medical thermometers

Luminance meters with data logger

Blood pressure meter

Pulse monitor

Soil conductance meter

Magnetic position detector

Telescope drive

Talking clock

Bike computer

Music keyboard

Frequency analyzer

Sound activated switch

Guitar tuner

FFT audio analyzer

Why take this course?

- Last chance: you did not take 309 and one of these is required to graduate...
- Microprocessors are everywhere – maybe it is worth knowing something about them.
- Understanding programming on its most basic level – assembler
- Learn how to quickly and cheaply build an instrument, a part of an industrial system or an appliance which will save a lot of experimental time.
- Learn how to extract useful information from datasheets
- It is good experience for a summer job or grad school



Lab procedures:

- Individual work
- Laptops
- Notes
- Submitting lab reports and programs
- Lab manual and Technical manuals (on line, frequent changes and updates!)
- The lab is open M, T, Th 2-6 PM and by appointment with Sing Chow (no help)
- Take home boards with USB cables
- How to set up at home (Linux, Windows, Mac).

Lab procedures:

- You are encouraged to work on your own computer
- To use the lab computers you must have a PHAS ID (available in Henn 205).
- See the lab computers guide on the web page.
- Version management
(eg git, see: <http://rogerdudler.github.io/git-guide/>)

Marking:

Lecture questions and activities 5%

Programs and lab reports in first 6 weeks 20%

Midterm 20%

Project proposal + Status report 5%

Project quality and functionality 20%

Presentation 10%

Final report 20%

Questions

Laptops?

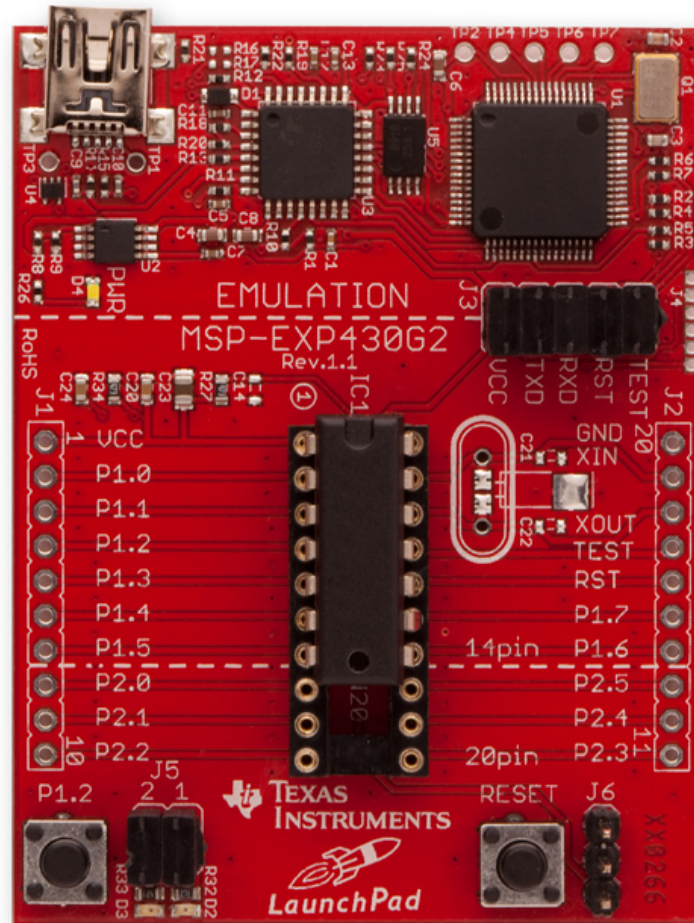
Windows, Mac or Linux?

Programming experience?

Programming in assembler experience?

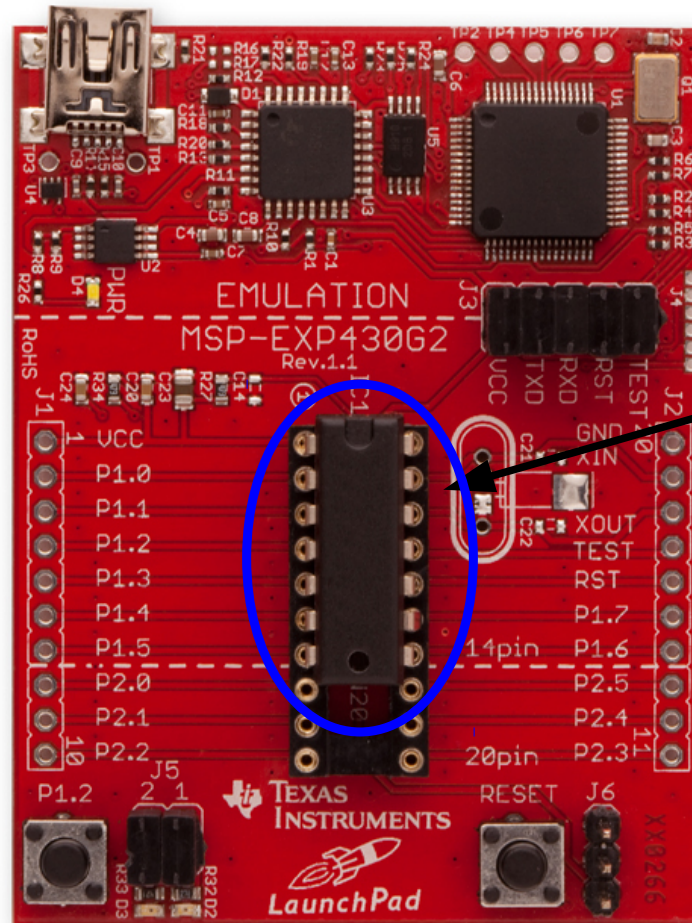
Work with microprocessors?

Texas Instruments MSP430 LaunchPad



<http://www.ti.com/tool/msp-exp430g2>

Texas Instruments MSP430 LaunchPad



MSP430G2231

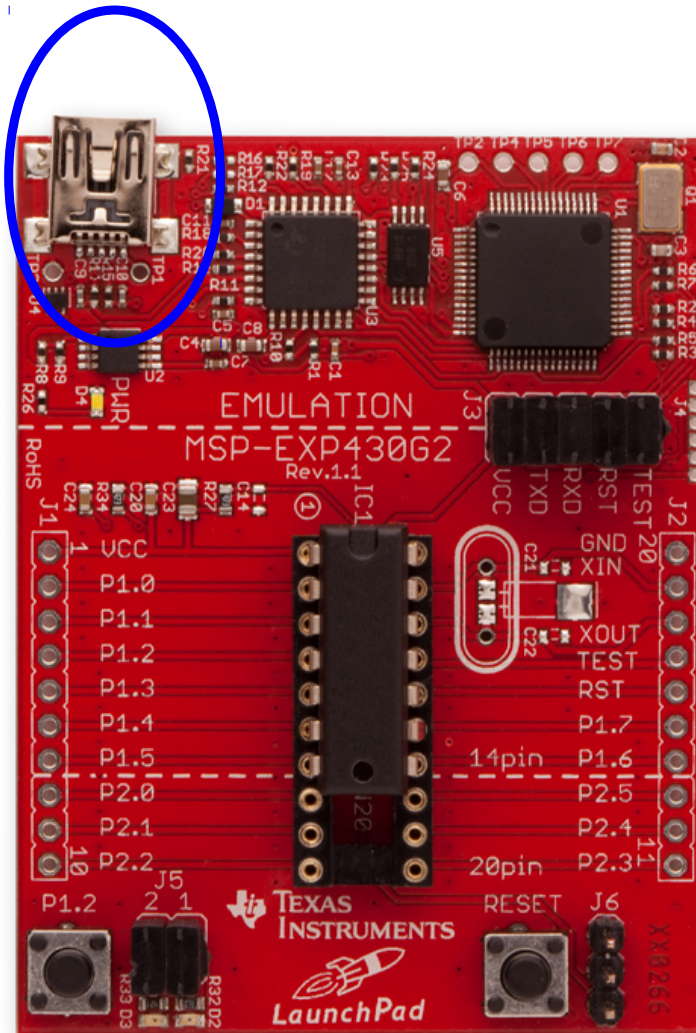
One of more than 400 different part numbers in the MSP430 family. This chip = \$1.40

<http://www.ti.com/tool/msp-exp430g2>

Texas Instruments MSP430 LaunchPad

USB:

- 1) loading programs into the MSP430
- 2) power
- 3) communications between program running on the MSP430 and a program on the host.



<http://www.ti.com/tool/msp-exp430g2>

Texas Instruments MSP430 LaunchPad



Push button for program use

Push button to reset

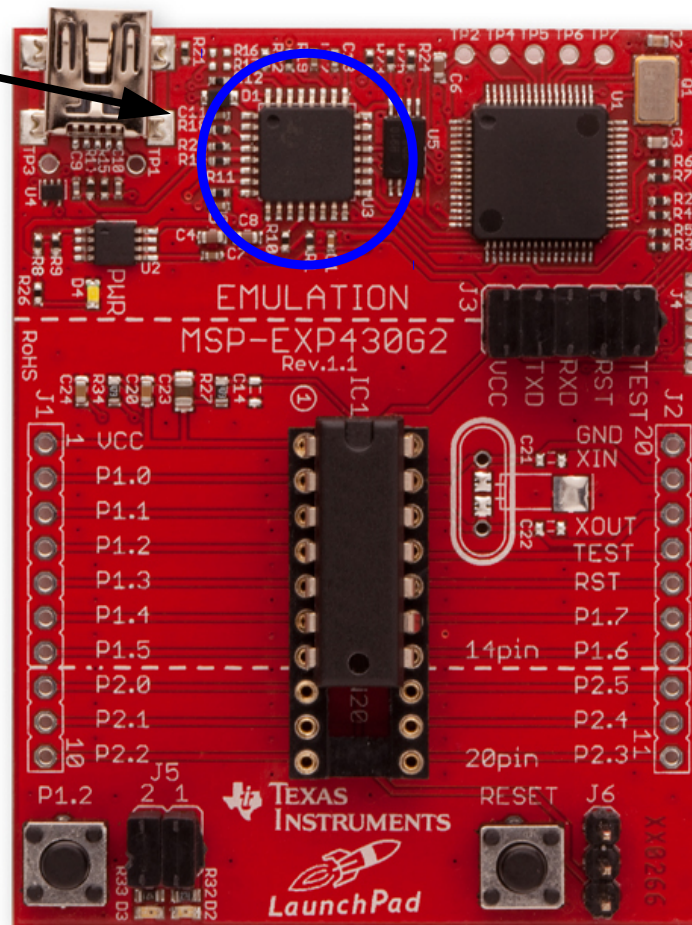
Two LED's for program use

<http://www.ti.com/tool/msp-exp430g2>

Texas Instruments MSP430 LaunchPad

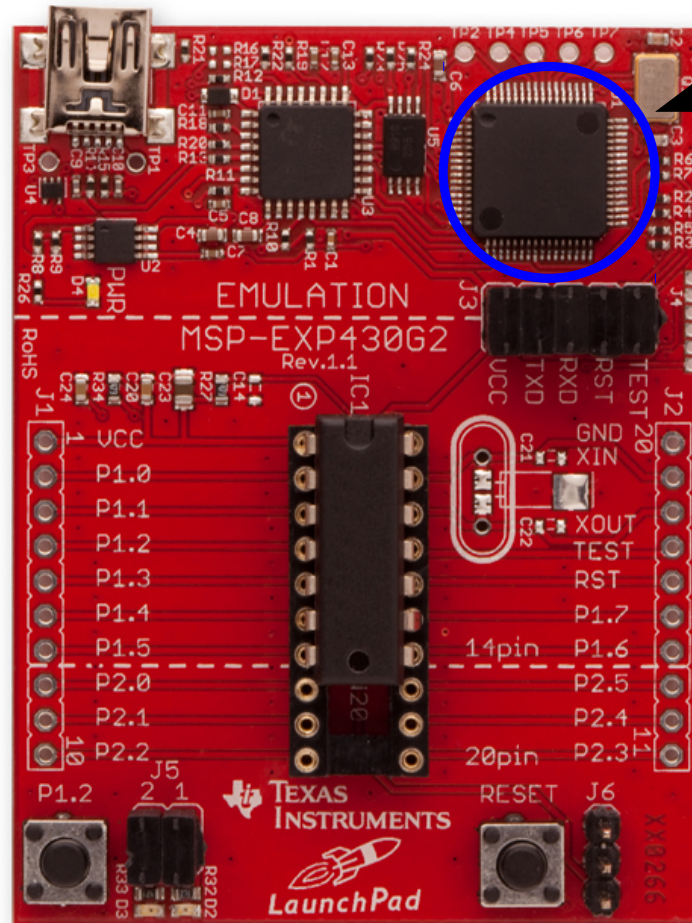
USB interface (\$7)

Contains an 8502 cpu



<http://www.ti.com/tool/msp-exp430g2>

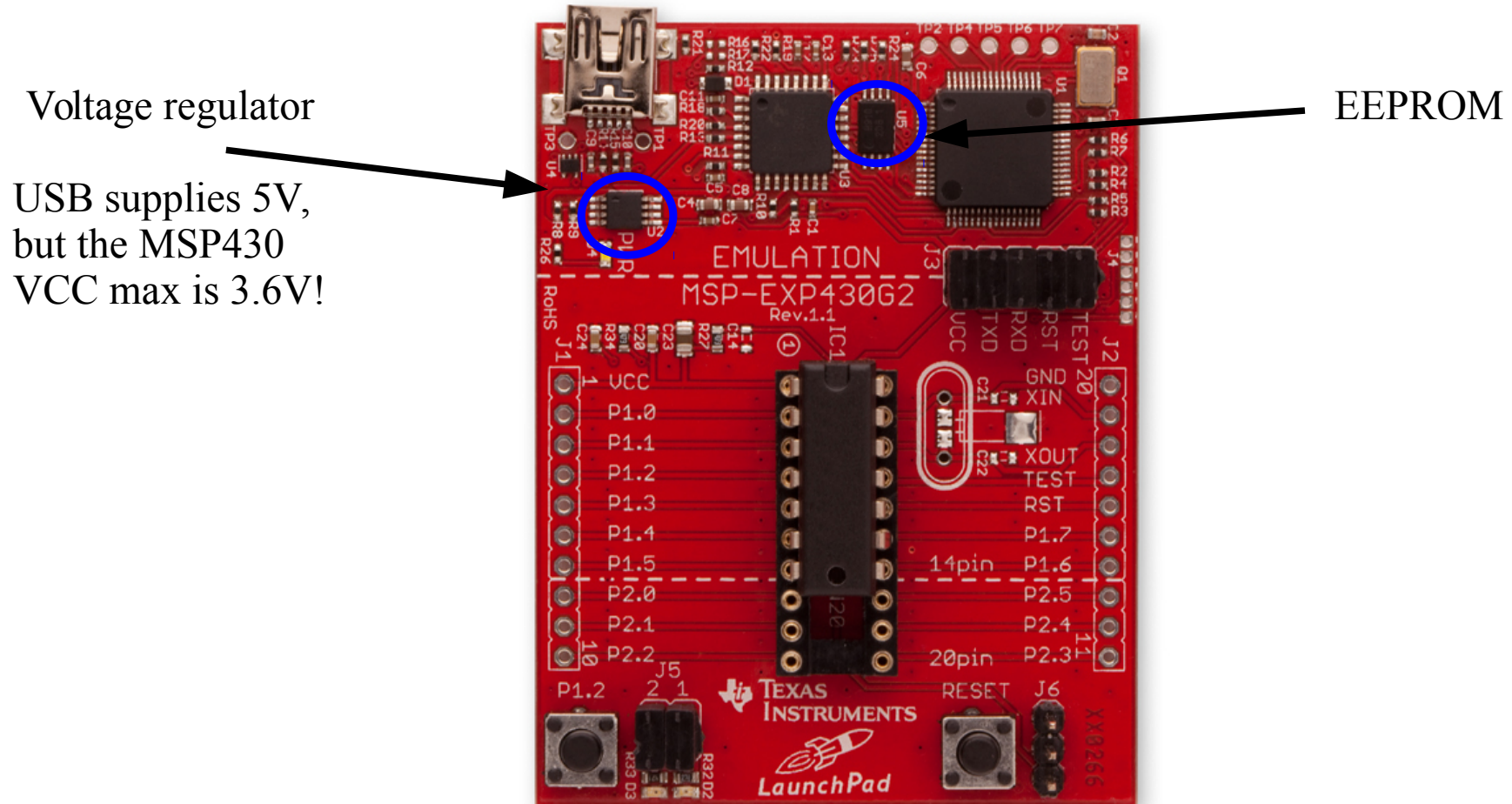
Texas Instruments MSP430 LaunchPad



MSP430F1612 (\$18)
used to program and
control the target device

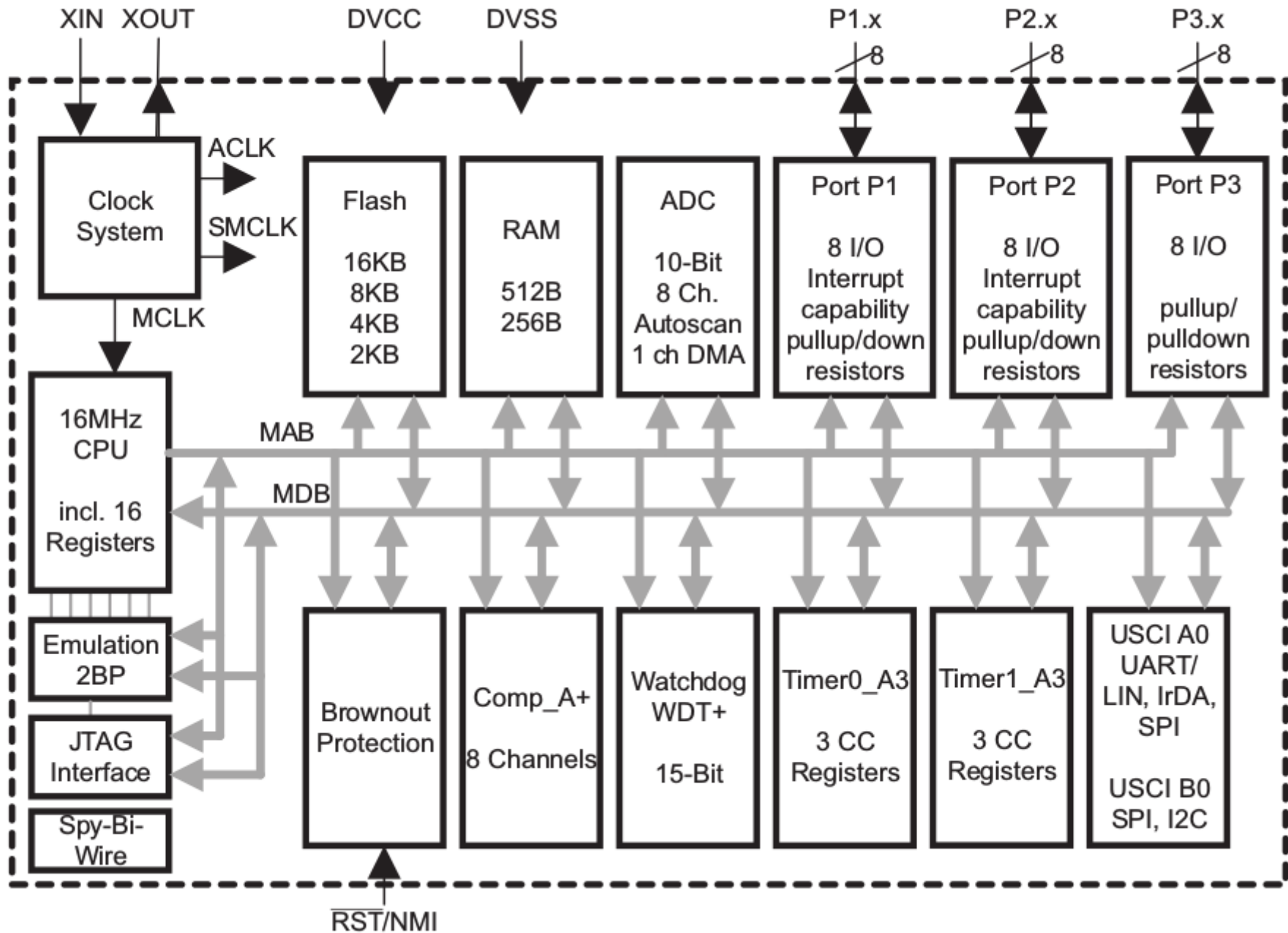
<http://www.ti.com/tool/msp-exp430g2>

Texas Instruments MSP430 LaunchPad



<http://www.ti.com/tool/msp-exp430g2>

Functional Block Diagram, MSP430G2x53



How does the Microprocessor work?

- Performs simple operations:

- add
- subtract
- compare
- fetch/store bytes/words

(For the MSP430, a word is 16 bits = 2 bytes).

Before next lab:

- get PHAS ID (Henn 205) if you don't have one.
- read the lab manual for week two.
- look at the tools installation guide for OS of your choice and/or lab computer guide, install assembler and flasher on your own computer (or prepare a USB stick to use our OS image).

Multiplexed 7-segment Display

