

MSP430™ MCUs for Universities

MSP430™ microcontrollers (“MCUs”) are the most student-friendly processors for teaching and building embedded system projects. Programming this simple yet powerful chip is easily done in C or Assembly using TI’s long-established Code Composer Studio Integrated Development Environment. With a high performance 16-bit RISC core, a complete set of innovative analog and digital peripherals, and a wide variety of detailed learning materials, the MSP430 offers a highly effective solution for education.

LaunchPad



eZ430-Chronos



**eZ430-F2013
USB Stick Develop. Tool**



Simple

The MSP430 was designed with two goals in mind: to consume as **little power as possible** and to be **extremely C code efficient**. For these reasons, it is based on a 16-bit, register based, RISC processor with **27 core instructions** and **only 24 emulated instructions**, with memory mapped peripherals all running on a flexible clock system, in the framework of a Von-Neumann memory architecture.

Intelligent

Intelligent peripherals such as A-D & D-A Converters, Op Amps, LCD drivers, serial communication, USB, and low-power RF integrated on a single chip, allow the MSP430 to save power or work on other activities to achieve the highest performance, while giving the user the flexibility to complete many tasks **without complex hardware additions**.

Easy

The software for setting-up and managing these high performance peripherals is only a click away because of thousands of flexible and well documented code examples at www.ti.com/msp430. There are dozens of fully documented projects in our Teaching ROM, and many different example labs contributed from our partner Universities around the world available at www.ti.com/university.

Key Features

- Ultra-low-power consumption
- Up to 25MIPS performance
- Complete signal chain on chip
- Modern 16-bit RISC CPU
- 7 addressing modes usable with all instructions
- **Programmable in C or Assembly**
- Choice of development environments
- Complete debugging environment : CCS is **FREE for academia**
 - Allows single stepping code, watch memory locations, view registers, and set hardware or software breakpoints
 - 1000+ fully documented code examples
 - **A CCS install covers all TI's Processors, including ARM!**
- 24/7 technical support online at community.ti.com
- Low-cost development tools **starting at \$4.30**

MSP430 Product Portfolio

MSP430x1xx: The original '1xx family of MCUs offers a wide range of capabilities from a simple low power controller with a comparator, to complete systems on a chip including high-performance data converters, interfaces and a multiplier.

MSP430F2xx: This ultra-low-power family increases performance up to 16 MHz. Additional enhancements of MSP430F2xx, include a software-selectable integrated $\pm 1\%$ on-chip digitally controlled oscillator, internal pull-up/pull-down resistors and increased number of analog inputs. The in-system programmable Flash has also been improved with smaller 64-byte segments and a lower 2.2-V programming voltage allowing the elimination of external EEPROMs in most systems.

MSP430x4xx: This ultra-low-power family has an integrated LCD controller for low power metering and medical applications. Several devices offer application-based peripherals for single-chip solutions to flow and electricity metering.

MSP430F5xx/6xx: The new Flash-based family features the lowest active power consumption with processing up to 25 MIPS, 1.8V-3.6V operation. These devices include an innovative Power Management Module for optimal power consumption with advanced peripherals like USB, capacitive touch I/O, low power comparators, LCD drivers (6xx only) and more.

CC430: The CC430 family is the first combination of our low-power RF radios with our MSP430 platform. This revolutionary design starts with the sub-1GHz family of radios and the 5xx/6xx families of MSP430 for maximum performance, unique analog integration, and the best power performance for wireless applications.

MSP430G2xx: This family is the "Value Line", consisting of smaller memory devices with some unique peripherals. Essentially 16 bit devices at 8 bit prices! Peripherals include ADC, SPI/I2C ports, selectable oscillators, and capacitive touch IOs. These devices are in easy to use Dual-In-Line Packages ("DIP"). Chip unit prices range from \$0.25 to \$0.75.

Finding the Right Device Quickly

With over 400 different device options, it can be difficult to find the perfect choice. Select a device by peripheral, price, memory, feature, or package, with our simple MCU Selection Tool at www.ti.com/mcutool

Online Teaching Materials

Connexions (<http://cnx.org>) is a free, open source, open content database for all kinds of learning material from music theory to microcontrollers. You can go directly to the MSP430 learning content created by professors and instructors at <http://cnx.org/lenses/TexasInstruments/MSP430>. You can also create your own course collection out of the more than 80 different MSP430 labs online, and then print this custom lab manual on demand for under \$20!

MSP430 Teaching ROM

This ROM provides the vital core materials to enable educators to teach microcontrollers using the MSP430 family. The materials are well documented, fully open for editing, and completely free-of-charge for academia. Contents include:

- slides, labs, tests, programs and application examples written by professors, for professors
- 15 modules each dedicated to a specific aspect of the device, including detailed descriptions and example code
- A step-by-step project guide to using different software development tools, with instructions on how to use the available hardware starter kits to perform the laboratory exercises
- H/W: EXP430FG4618 Experimenter Board, FET430UIF Programmer, EZ430-F2013 USB stick & EZ430-RF2500

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University of Beira Interior, Electromechanical Engineering Department, Portugal, 2009.

Request or Download your Teaching ROM at: <http://www.ti.com/ww/eu/university/roms.html>

Hardware Development Tools

MSP430 Experimenter Board **Part#: MSP-EXP430FG4618** **(University Price)** **\$49.50**
<http://focus.ti.com/docs/toolsw/folders/print/msp-exp430fg4618.html>

This versatile board features a tiny MSP430F2013 and the highly-integrated MSP430FG4618, providing nearly every combination of peripherals available. The integrated wireless evaluation module header and the large RAM size makes it an ideal platform for wireless projects. The integrated peripherals allows a wide range of development possibilities and makes it the ideal learning platform for the MSP430. A Flash Emulation Tool, like the MSP-FET430UIF, is required to program and debug the MSP430s on the board through the JTAG.

Features:

- Integrated peripherals: 12-bit DAC, 12-bit SAR ADC, 16-bit $\Sigma\Delta$ ADC, Operational Amplifiers, DMA, Multiplier, LCD Controller, Comms Interfaces: SPI, UART, I2C, IrDA
- Wireless expansion: Compatible with TI Wireless ChipCon Evaluation Modules
- Board Features: Microphone, buzzer, LCD, capacitive touch-pad, 2x push buttons,
- Prototyping space, RS232 connector, 2x JTAG Programming Interfaces, 3.5mm headphone jack (audio output)

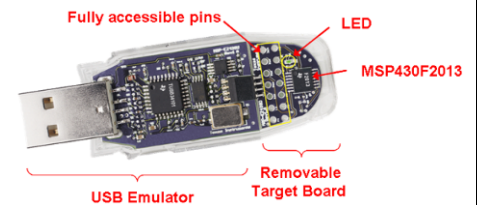


**MSP430 USB Stick
Development Tool**
Part#: EZ430-F2013
\$20
<http://focus.ti.com/docs/toolsw/folders/print/ez430-f2013.html>

Develop a complete project in a convenient USB stick package! The USB port provides enough power to operate the ultra-low-power MSP430 so no external power supply is required.

Features:

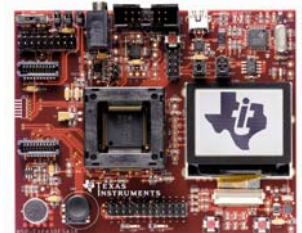
- eZ430-F2013 development tool including a USB debugging interface and detachable MSP430F2013 target board
- LED indicator
- Removable USB stick enclosure
- Full documentation on CD-ROM
- Debugging interface supports development with all MSP430F20xx devices


MSP430F5438 Experimenter Board
Part#: MSP-EXP430F5438
(University Price)
\$99
<http://focus.ti.com/docs/toolsw/folders/print/msp-exp430f5438.html>

The MSP430F5438 Experimenter Board is a development platform for the latest generation MSP430 MCUs. A Flash Emulation Tool, like the MSP-FET430UIF, is required to program and debug the MSP430 devices on the experimenter board through the JTAG interface.

Features:

- 100-pin socket for MSP430F5438
- Power Supply sources: USB, FET, 2x AA batteries
- (5) Accessible analog inputs (12-bit ADC)
- Serial Comm Ports:
 - 4x UART/LIN/IrDA/SPI & 4x I2C/SPI
- PWM outputs: 12
- 16KB RAM 256KB Flash Memory
- 5-position joystick
- 138x110 grayscale, dot-matrix LCD
- USB connectivity for data transfer


eZ430-Chronos Wireless Watch Development Tool
Part#: EZ430-CHRONOS
\$49
<http://focus.ti.com/docs/toolsw/folders/print/ez430-chronos.html>
www.ti.com/chronoswiki

The Chronos watch is a highly integrated, wearable wireless development system based on the CC430 SoC in a sports watch package. It is very popular for student projects!

It may be used as a reference platform for watch systems, a personal display for biomedical monitoring, or as a wireless sensor node for remote data collection.

The watch features a 96 segment LCD display and provides an integrated pressure sensor and 3-axis accelerometer for motion sensitive control. The integrated wireless feature allows the Chronos to act as a central hub for nearby wireless sensors such as pedometers and heart rate monitors. Temperature and battery voltage measurements are also possible. A complete USB-based CC1111 wireless interface is provided for connection to a PC.


MSP430 Wireless Development Tool
Part#: EZ430-RF2500
\$49
<http://focus.ti.com/docs/toolsw/folders/print/ez430-rf2500.html>
MSP430 2.4 GHz Wireless Target Board
Part#: EZ430-RF2500T
\$20
<http://focus.ti.com/docs/toolsw/folders/print/ez430-rf2500t.html>

This is a complete tool that includes all the hardware and software required to develop a two-node wireless project. The tool features a USB-powered emulator to program and debug your application in-system, and two 2.4-GHz wireless target boards featuring the highly integrated MSP430F2274 MCU. The eZ430-RF2500T is the target board used in the eZ430-RF2500, and extra boards can be ordered separately.


MSP430F5529 16 bit Microcontroller Experimenter Board
Part#: MSP-EXP430F5529
\$149
<http://focus.ti.com/docs/toolsw/folders/print/msp-exp430f5529.html>

The MSP-EXP430F5529 Experimenter Board is a development platform based on the MSP430F552x devices with integrated USB. This board is perfect for learning and developing USB-based MSP430 applications. The kit is also pre-programmed with an out-of-box demo to immediately show the capabilities of the MSP430 MCU.



Features:

- A 102x64 dot-matrix LCD
- 3-axis accelerometer
- MicroSD card
- RF expansion headers
- Nine LEDs and 5 capacitive touch pads
- An analog thumb-wheel
- Easy access to spare F5529 pins
- An integrated flash emulation module and Standard JTAG access

MSP430 LaunchPad
Part#: MSP-EXP430G2
\$4.30
<http://focus.ti.com/docs/toolsw/folders/print/msp-exp430g2.html>
www.ti.com/launchpadwiki

Just \$4.30! This affordable kit comes with two MSP430 Value-Line devices (<\$1 unit price) in dual-in-line "DIP" packages. Single in-line headers provide interfacing to breadboards or whatever you want.

Features:

- Integrated eZ430 emulator for full featured, real-time debugging through USB port
- Spy-bi-Wire (2 wire debug interface) available off-chip for custom board debugging
- 2 LEDs, external clock crystal, push-button, through holes for external interface headers, DIP Socket


MSP430 USB Debugging Interface
Part#: MSP-FET430UIF
(University Price)
\$49.50
<http://focus.ti.com/docs/toolsw/folders/print/msp-fet430uif.html>

This powerful flash emulation tool enables you to quickly begin application development on the MSP430. It includes USB debugging interface used to program and debug the MSP430 in-system through the JTAG interface or the pin-saving Spy Bi-Wire (2-wire JTAG) protocol. The flash memory can be erased and programmed in seconds with only a few keystrokes, and since the MSP430 flash is ultra-low power, no external power supply is required.


Features:

- USB debugging interface (MSP-FET430UIF) connects a flash-based MSP430 MCU to a PC for real-time, in-system programming and debugging
- USB cable and a 14-pin conductor cable is provided
- Full documentation on CD
- Technical specifications:
 - Software configurable supply voltage between 1.8 and 3.6 volts at 100mA
 - Supports JTAG Security Fuse blow to protect code
 - Supports all MSP430 boards with JTAG header
 - Supports both JTAG and Spy-Bi-Wire (2-wire JTAG) debug protocols

Software Development Tools

Code Composer Studio
www.ti.com/ccs
FREE

CCSv4 is a landmark release of TI's Integrated Development Environment (IDE). Now based on the Eclipse open source software framework, CCS includes a compiler, assembler, linker, debugger, and every other part of the software tool chain necessary to program and debug your device. This one software install covers all TI MCUs and DSPs, including ARM™. The special Academic Edition provides 100 floating licenses and is free-of-charge on request to the Customer Support Centre.

For students we have the **120 day free version of CCSv4**: <http://focus.ti.com/docs/toolsw/folders/print/ccstudio.html>

"GRACE" - Grace Graphical Code Generation Plug-in for CCS
FREE
<http://focus.ti.com/docs/toolsw/folders/print/grace.html>

A new plug-in for Code Composer Studio that lets you graphically initialize the peripherals on MSP430 MCUs. Instead of looking back and forth between your code and the datasheets, you can now just manipulate the same diagrams from the datasheet via dropdown menus with integrated explanations, tutorials, tips, and calculators for important ratios.

- Support for broad array of MSP430 devices
- Efficient code generated automatically integrates into a project
- Easily explain & understand A/D, serial communication, clocking, IO setup, Memory interfacing, and more
- Basic User, Power User, and Register modes
- Easily integrated into free CCS Software

Prices Valid as of 1st March 2011

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