



# TEXAS INSTRUMENTS

## MSP430 16-Bit Microcontroller

The Solution for Battery Powered Measurement

# SELECTION GUIDE



June 2002

## MSP430 Key Features

### 16bit RISC CPU

- high throughput ( down to 125-ns instruction cycle time)
- up to 8 MIPS possible
- only 27 basic instructions
- 16 CPU registers
- highly orthogonal structure
- seven different addressing modes

### LOW POWER MODES

- operating range down to: 1.8 V - 3.6 V; 2.5V – 5.5V
- five different low-power modes
- active current down to 250  $\mu$ A at 2.2 V
- standby current down to 0.8  $\mu$ A at 2.2 V in LPM3
- current consumption in RAM retention off mode down to 0.1  $\mu$ A at 3 V

### HARDWARE MULTIPLIER

- multiplication in all 16-bit / 8-bit combinations
- signed and unsigned multiply
- signed and unsigned multiply and accumulate
- no extra cycle needed for the multiplication after loading the two registers

### MEMORY

- 1 / 4 / 8 / 16 / 32 / 48 / 60 Kbytes Flash versions
- 2 / 4 / 8 / 12 / 16 / 24 / 32 Kbytes ROM versions
- 8 / 16 / 32 Kbytes OTP/EEPROM versions

### OSCILLATOR MODULE

- 32-kHz crystal for peripherals, no external components necessary

### 12+2 BIT A/D CONVERTER 6 Channels

- 12-bit ADC with 4 different ranges                      sample time: 96  $\mu$ s
- 14-bit ADC with auto range                                sample time: 132  $\mu$ s
- integrated current source

### 12 BIT A/D CONVERTER 8 Channels

- 12-bit ADC with one range Vref+ or Vref-              sample time: 5  $\mu$ s

### 10 BIT A/D CONVERTER 8 Channels

- 10 bit ADC with DTC (data transfer controller)      sample time: 5 $\mu$ s

### LCD DRIVER

- up to 120 segments possible
- external voltage divider for lower power consumption
- segment line can be used as general-purpose outputs

### TIMER/PORT MODULE

- slope A/D conversion of resistive sensors possible (R/D converter)
- general purpose cascadable 8-bit timer

### Timer\_A

- 16-bit timer with up to 5 capture / compare registers
- several operating modes for various applications

### Timer\_B

- 8-, 10-, 12 or 16-bit timer with up to 7 capture / compare registers
- 4 capture / compare / shadow registers
- several operating modes for various applications

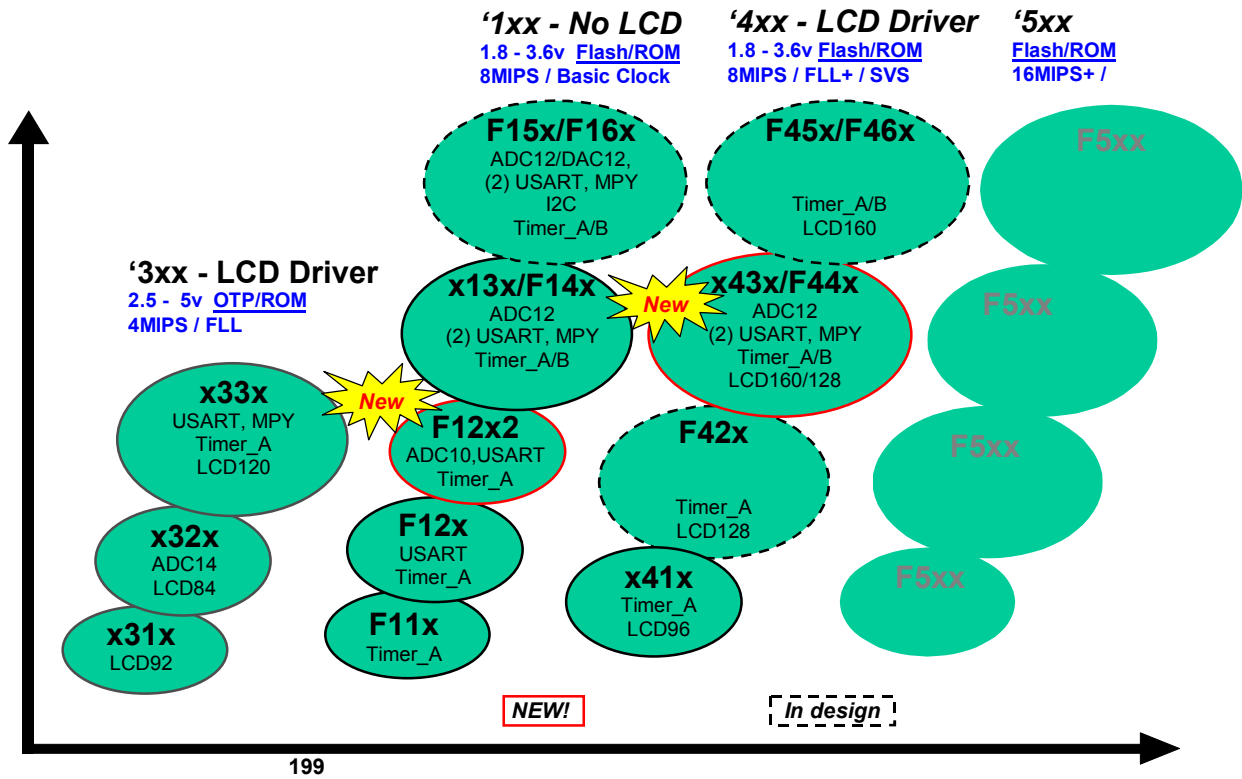
### USART

- UART or SPI function selectable by software

### COMPARATOR\_A

- analog signal compare function
- slope A/D conversion

MSP430 Roadmap



MSP430 Typical Applications

Utility Metering

- Gas Meter
- Water Meter
- Electricity Meter
- Heat Cost Allocators
- Heat Volume Counter
- Meter Reading Systems(RF)

Portable Instrumentation

- Blood Pressure Meter
- Blood Sugar Meter
- Breath Measurement
- Sports Computers
- Weight Scales
- EKG System
- Airflow Measurement
- Alcohol Meter
- Barometer
- Altimeter
- Emission/Gas Analyzer
- Humidity Measurement
- Temperature Measurement
- Hearbeat Logger
- Data Logger

Intelligent Sensing

- Air Conditioning
- Control Unit
- Thermostat
- Boiler control
- Smoke/Fire detector
- Irrigation System
- Door Control
- Glass Break Sensors
- White Goods
- Shutter Control
- Access Control Systems
- Personal Identification Systems

## MSP430 Family Quick Reference

### MSP430 devices without LCD Driver

DEVICE	ROM	OTP	Flash	RAM	ADC	Com p	USART	PACKAGE
MSP430P112IDW		4KB		256B	No	No	No	20SOIC – DW
PMS430E112JL		4KB		256B	No	No	No	20DIL - JL
MSP430F1101IDW			1KB	128B	slope	Yes	No	20SOIC – DW
MSP430F1111IDW			2KB	128B	slope	Yes	No	20SOIC – DW
MSP430F1121IDW			4KB	256B	slope	Yes	No	20SOIC – DW
MSP430C1101IDW	1KB			128B	slope	Yes	No	20SOIC – DW
MSP430C1111IDW	2KB			128B	slope	Yes	No	20SOIC – DW
MSP430C1121IDW	4KB			256B	slope	Yes	No	20SOIC – DW
MSP430F122IDW			4KB	256B	slope	Yes	1	28SOIC – DW
MSP430F123IDW			8KB	256B	slope	Yes	1	28SOIC – DW
MSP430F1122IDW			4KB	256B	10bit	No	No	20SOIC – DW
MSP430F1132IDW			8KB	256B	10bit	No	No	20SOIC – DW
MSP430F1222IDW			4KB	256B	10bit	No	Yes	28SOIC – DW
MSP430F1232IDW			8KB	256B	10bit	No	Yes	28SOIC – DW
MSP430F1121AIDGV			4KB	256B	slope	Yes	No	20TVSOP – DGV
MSP430F1101IPW			1KB	256B	slope	Yes	No	20TSSOP – PW
MSP430F1111IPW			2KB	128B	slope	Yes	No	20TSSOP – PW
MSP430F1121IPW			4KB	256B	slope	Yes	No	20TSSOP – PW
MSP430C1101IPW	1KB			256B	slope	Yes	No	28TSSOP – PW
MSP430C1111IPW	2KB			256B	slope	Yes	No	28TSSOP – PW
MSP430C1121IPW	4KB			256B	slope	Yes	No	28TSSOP – PW
MSP430F122IPW			4KB	256B	slope	Yes	1	28TSSOP – PW
MSP430F123IPW			8KB	256B	slope	Yes	1	28TSSOP – PW
MSP430F1122IDW			4KB	256B	10bit	No	No	20TSSOP – PW
MSP430F1132IDW			8KB	256B	10bit	No	No	20TSSOP – PW
MSP430F1222IDW			4KB	256B	10bit	No	1	28TSSOP – PW
MSP430F1232IDW			8KB	256B	10bit	No	1	28TSSOP – PW
MSP430F1331IPM			8KB	256B	12bit	Yes	1	64QFP – PM
MSP430C1331IPM	8KB			256B	slope	Yes	1	64QFP – PM
MSP430F1351IPM			16KB	512B	12bit	Yes	1	64QFP – PM
MSP430C1351IPM	16KB			512B	slope	Yes	1	64QFP – PM
MSP430F1471IPM			32KB	1024	12bit	Yes	2	64QFP – PM
MSP430F1481IPM			48KB	2048	12bit	Yes	2	64QFP – PM
MSP430F1491IPM			60KB	2048	12bit	Yes	2	64QFP – PM

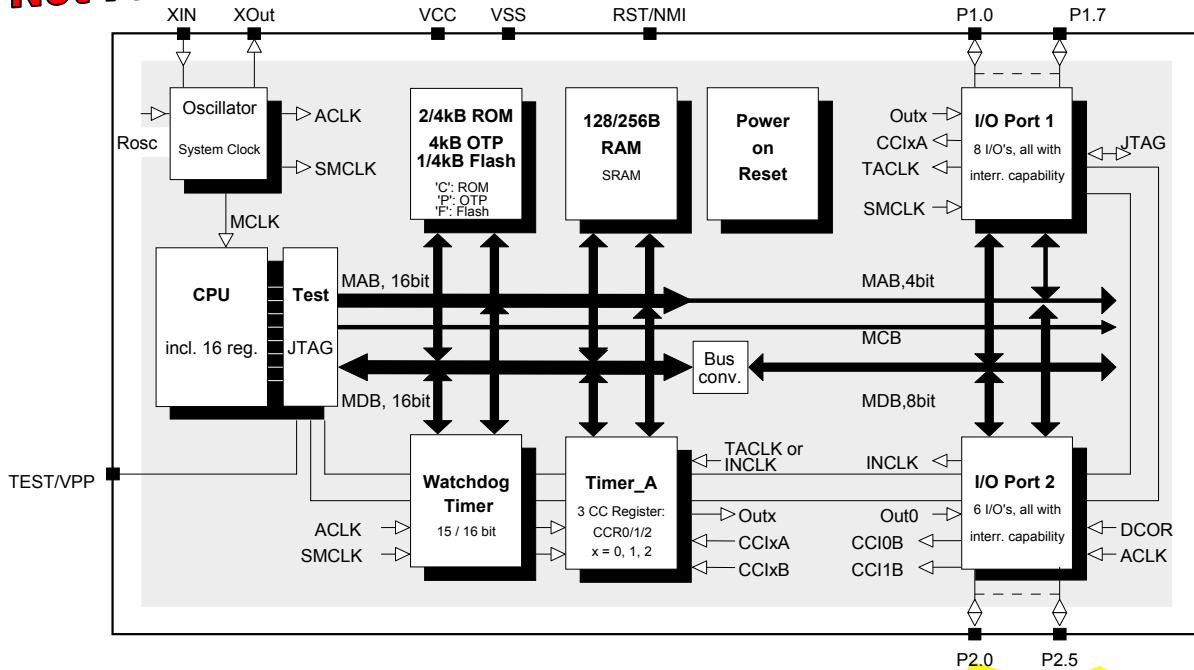
**MSP430 devices with LCD Driver**

DEVICE	ROM	OTP	FLASH	RAM	ADC	Comp	USART	PACKAGE
MSP430C311SIDL	2KB			128B	slope	No	No	48SSOP - DL
MSP430C312IDL	4KB			256B	slope	No	No	56SSOP - DL
MSP430C313IDL	8KB			256B	slope	No	No	56SSOP - DL
MSP430C314IDL	12KB			512B	slope	No	No	56SSOP - DL
MSP430C315IDL	16KB			512B	slope	No	No	56SSOP - DL
MSP430P315IDL		16KB		512B	slope	No	No	56SSOP - DL
MSP430P315SIDL		16KB		512B	slope	No	No	48SSOP - DL
PMS430E315FZ		16KB		512B	slope	No	No	68CLCC - FZ
MSP430C323IPG	8KB			256B	14bit	No	No	64QFP - PG
MSP430C323IPM	8KB			256B	14bit	No	No	64QFP - PM
MSP430C323IPN	8KB			256B	14bit	No	No	68PLCC - FN
MSP430C325IPG	16KB			512B	14bit	No	No	64QFP - PG
MSP430C325IPM	16KB			512B	14bit	No	No	64QFP - PM
MSP430C325IFN	16KB			512B	14bit	No	No	68PLCC - FN
MSP430P325(A)IPG		16KB		512B	14bit	No	No	64QFP - PG
MSP430P325(A)IPM		16KB		512B	14bit	No	No	64QFP - PM
MSP430P325(A)IFN		16KB		512B	14bit	No	No	68PLCC - FN
PMS430E325FZ		16KB		512B	14bit	No	No	68CLCC - FZ
MSP430C336IPJM	24KB			1KB	slope	No	1	100QFP - PJM
MSP430C337IPJM	32KB			1KB	slope	No	1	100QFP - PJM
MSP430P337IPJM		32KB		1KB	slope	No	1	100QFP - PJM
MSP430P337AIPJM		32KB		1KB	slope	No	1	100QFP - PJM
PMS430E337HFD		32KB		1KB	slope	No	1	100CQFP - HFD
MSP430F412IPM			4KB	256B	slope	Yes	No	64QFP - PM
MSP430C412IPM	4KB			256B	slope	Yes	No	64QFP - PM
MSP430F413IPM			8KB	256B	slope	Yes	No	64QFP - PM
MSP430C413IPM	8KB			256B	slope	Yes	No	64QFP - PM
MSP430F435IPZ			16KB	512B	12bit	Yes	1	100QFP - PZ
MSP430F436IPZ			24KB	1024B	12bit	Yes	1	100QFP - PZ
MSP430F437IPZ			32KB	1024B	12bit	Yes	1	100QFP - PZ
MSP430F447IPZ			32KB	1024B	12bit	Yes	2	100QFP - PZ
MSP430F448IPZ			48KB	2048B	12bit	Yes	2	100QFP - PZ
MSP430F449IPZ			60KB	2048B	12bit	Yes	2	100QFP - PZ
MSP430F435IPN			16KB	512B	12bit	Yes	1	80QFP - PN
MSP430F436IPN			24KB	1024B	12bit	Yes	1	80QFP - PN
MSP430F437IPN			32KB	1024B	12bit	Yes	1	80QFP - PN

MSP430x1xx Family without LCD Driver – Device Configuration

Device Configuration  
 MSP430C111, MSP430C112, MSP430P112

**Not recommended for new design. Use x11x1 instead.**

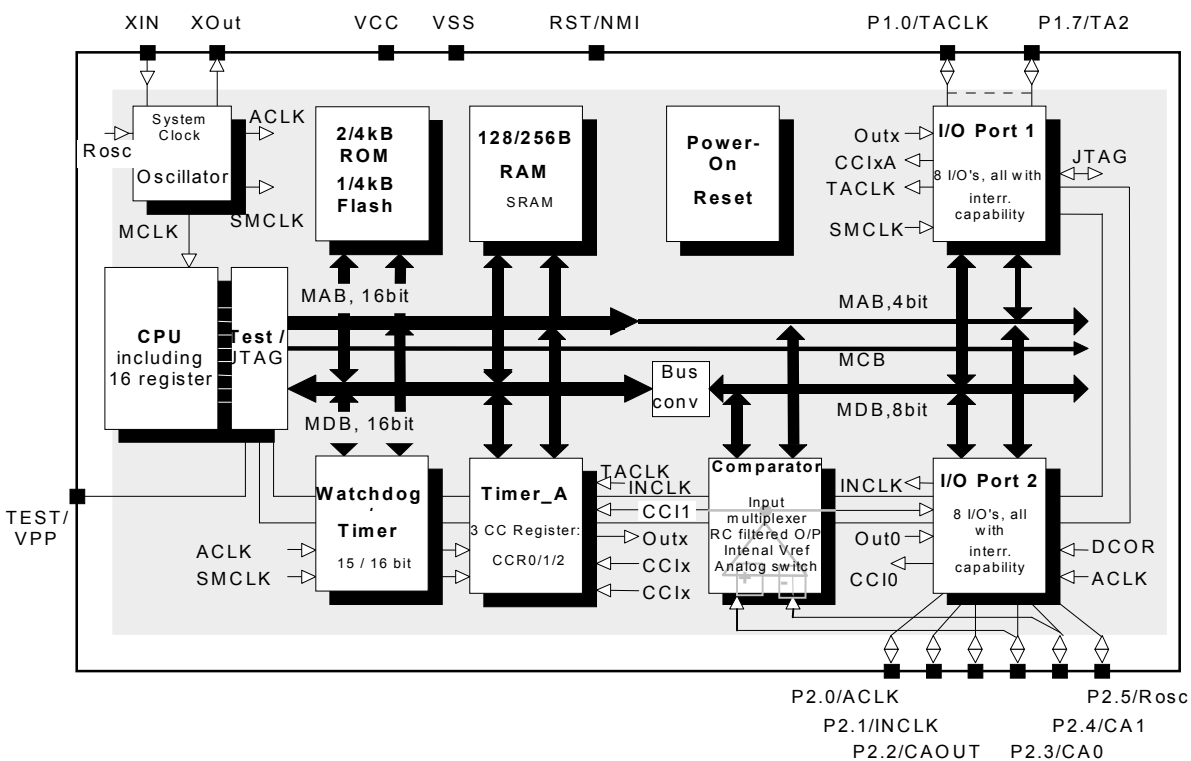


Package: 20 SOIC (DW)

**100% compatible to x11x + free Comparator !!!**

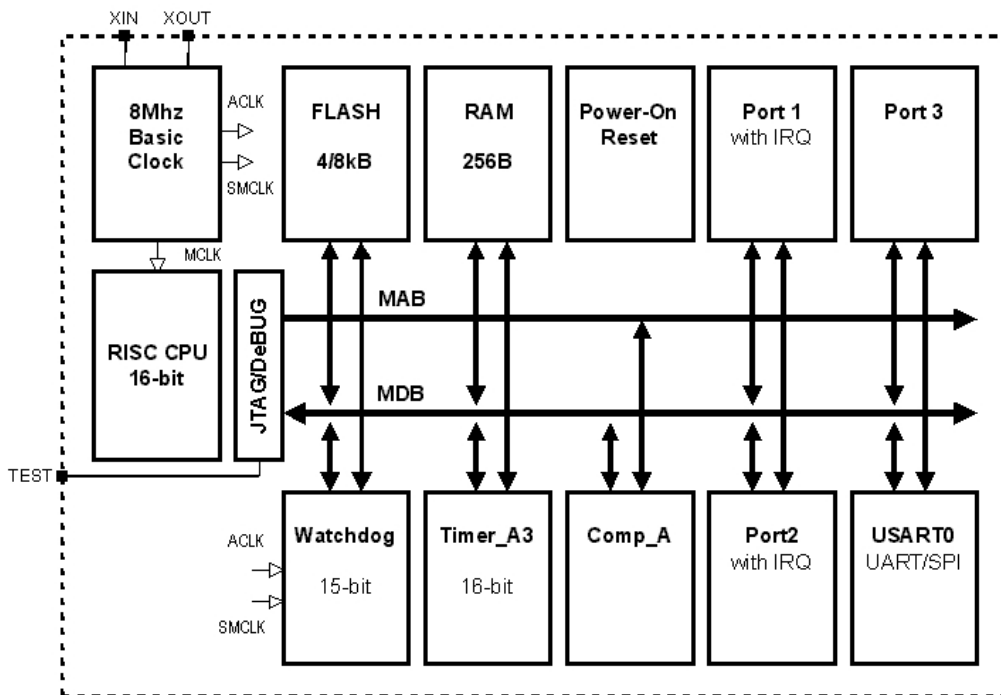
Device Configuration

MSP430F1101, MSP430F1111, MSP430F1121, MSP430C1101, MSP430C1111, MSP430C1121



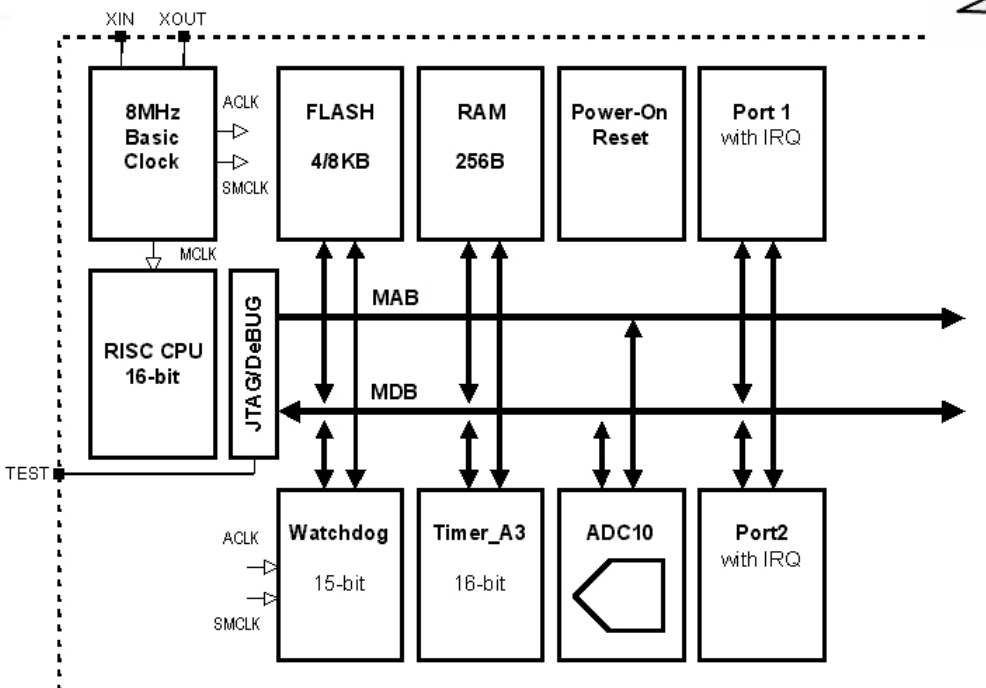
Package: 20 SOIC (DW); 20 TSSOP (PW), 20 TVSOP (DGV)

**Device Configuration**  
**MSP430F122, MSP430F123**



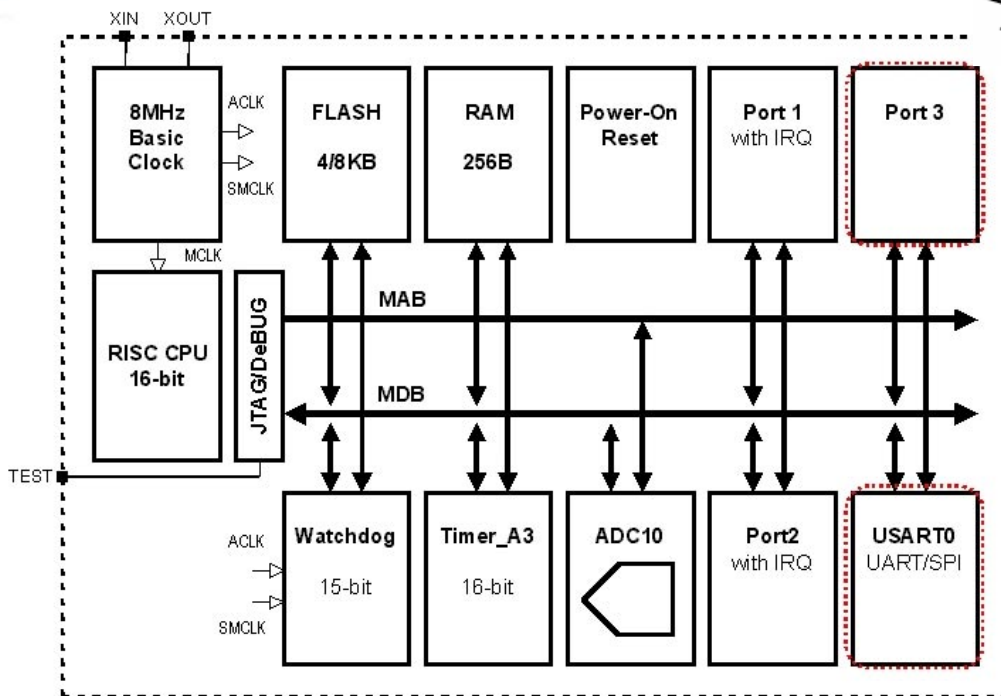
Package: 28 SOIC (DW); 28 TSSOP (PW)

**Device Configuration**  
**MSP430F1122, MSP430F1132**



Package: 20 SOIC (DW); 20 TSSOP (PW)

### Device Configuration MSP430F1222, MSP430F1232

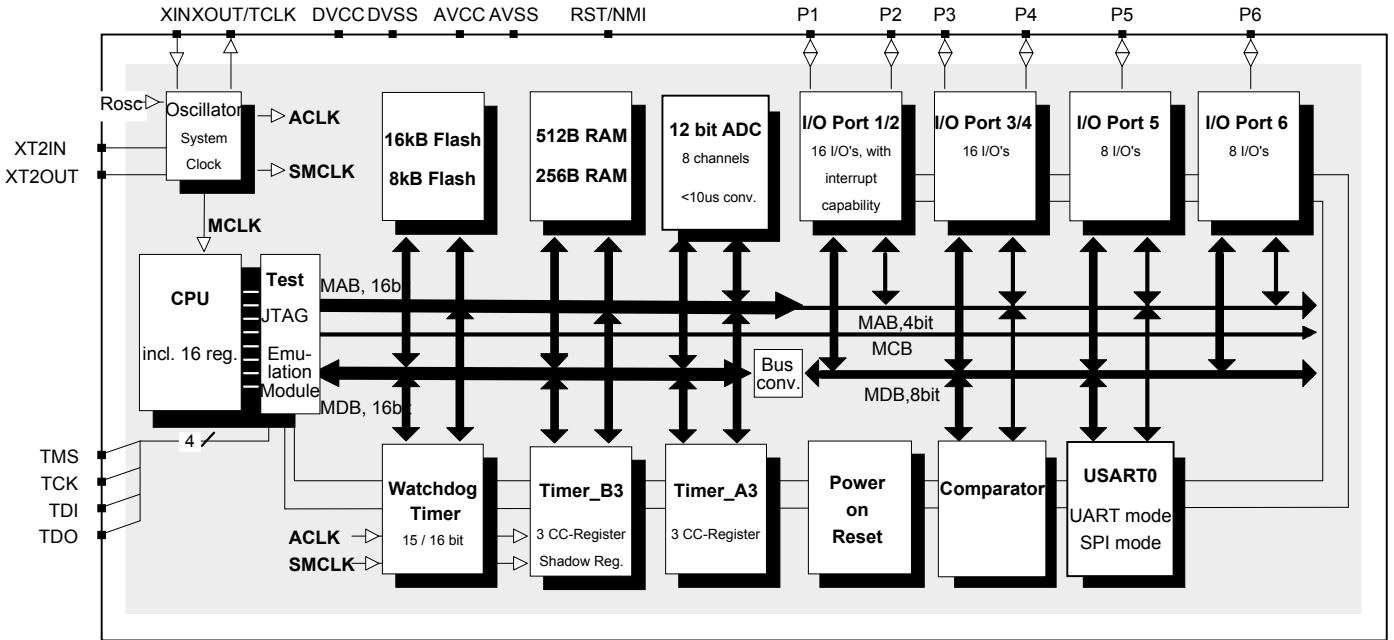


Package: 28 SOIC (DW); 28 TSSOP (PW)



**Device Configuration**

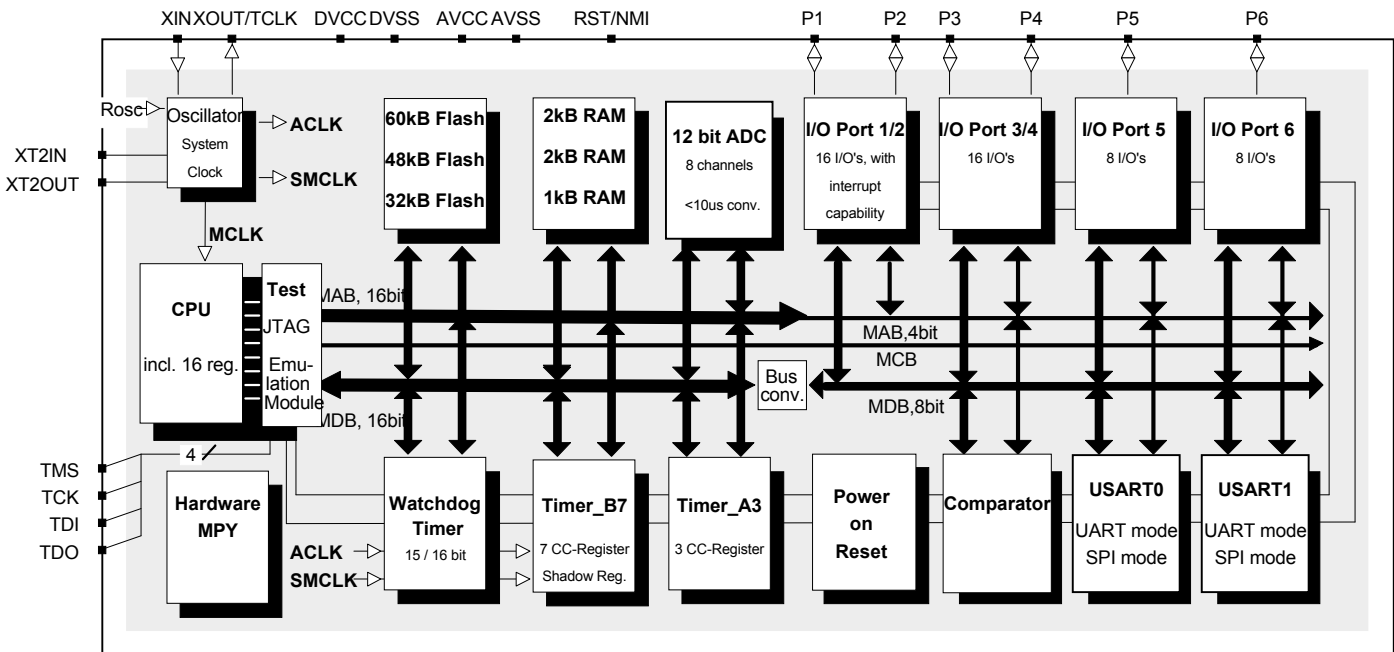
**MSP430F133, MSP430F135 and MSP430C1331, MSP430C1351 without 12bit ADC**



Package: 64 QFP (PM)

**Device Configuration**

**MSP430F147, MSP430F148, MSP430F149**

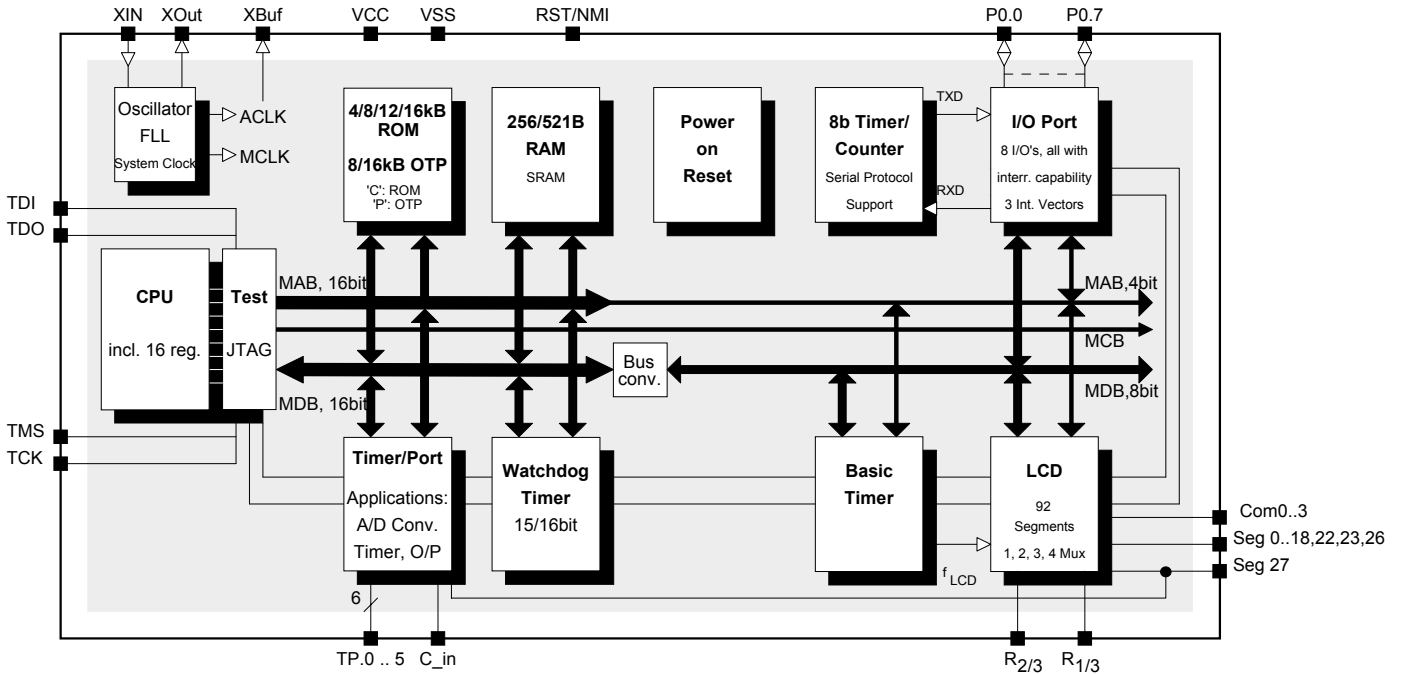


Package: 64 QFP (PM)

**MSP430x3xx Family with LCD Driver – Device Configuration**

**Device Configuration**

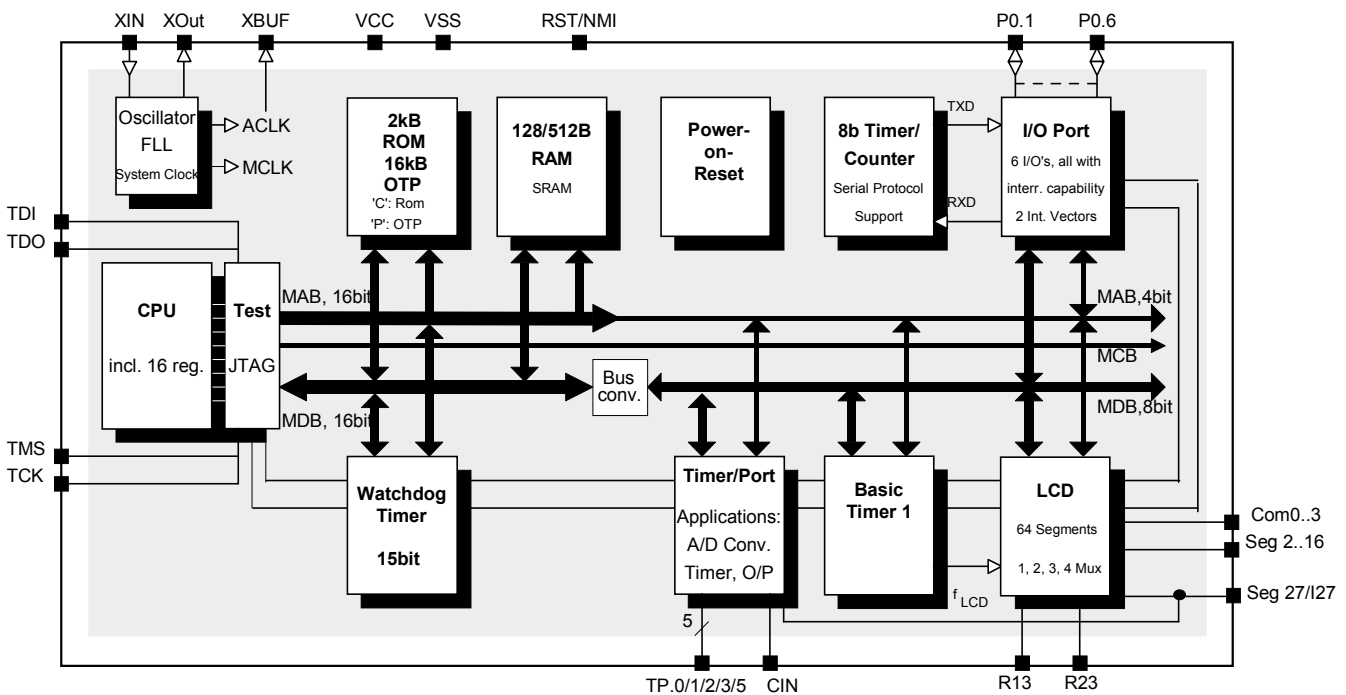
**MSP430C312, MSP430C313, MSP430C314, MSP430C315, MSP430P315**



Package: 56 SSOP (DL)

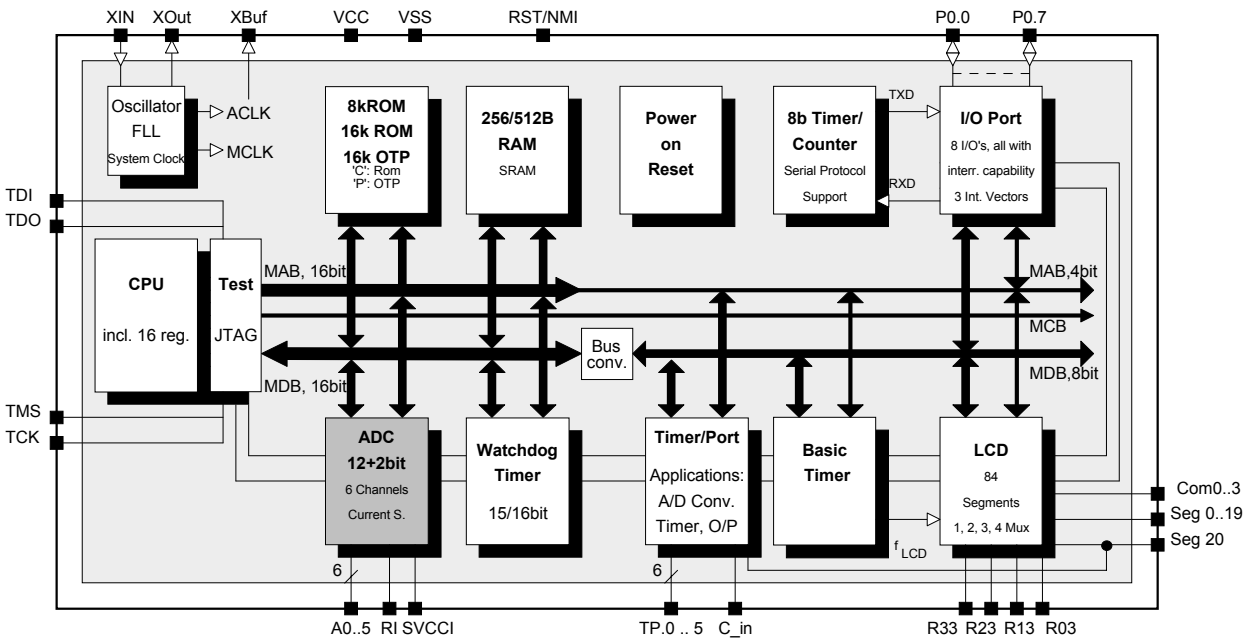
**Device Configuration**

**MSP430C311S, MSP430P315S**



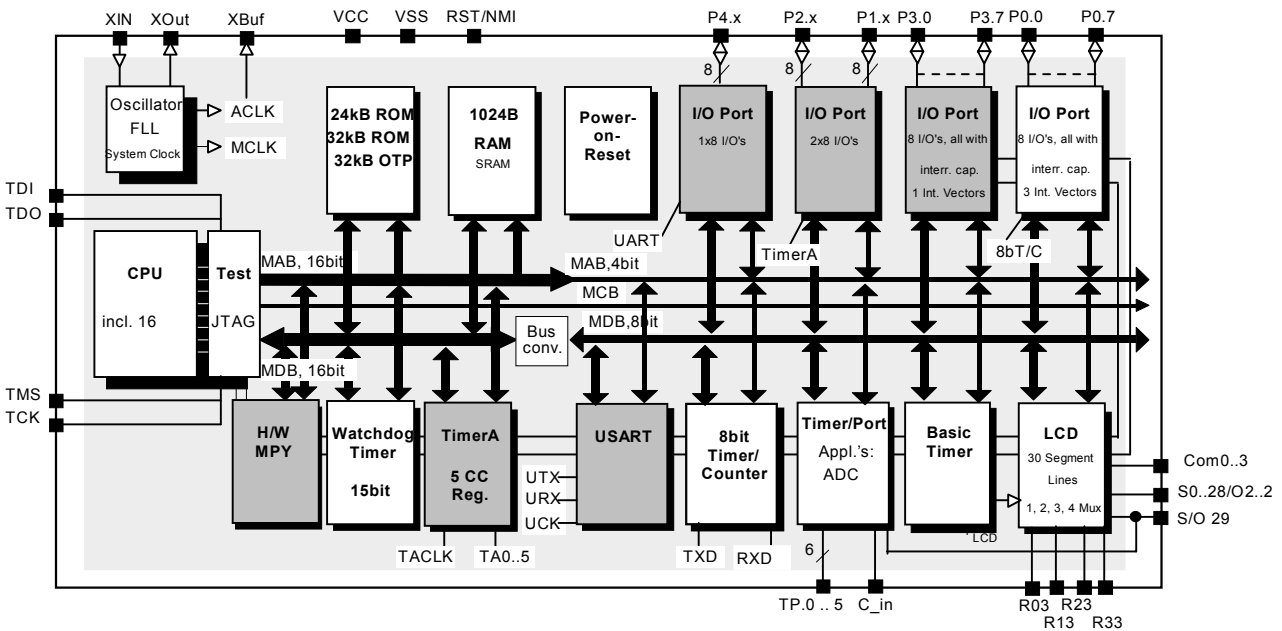
Package: 48 SSOP (DL)

**Device Configuration**  
**MSP430C323, MSP430C325, MSP430P325, MSP430P325A**



Package: 64 QFP (PG), 64 QFP (PM), 68 PLCC (FN)

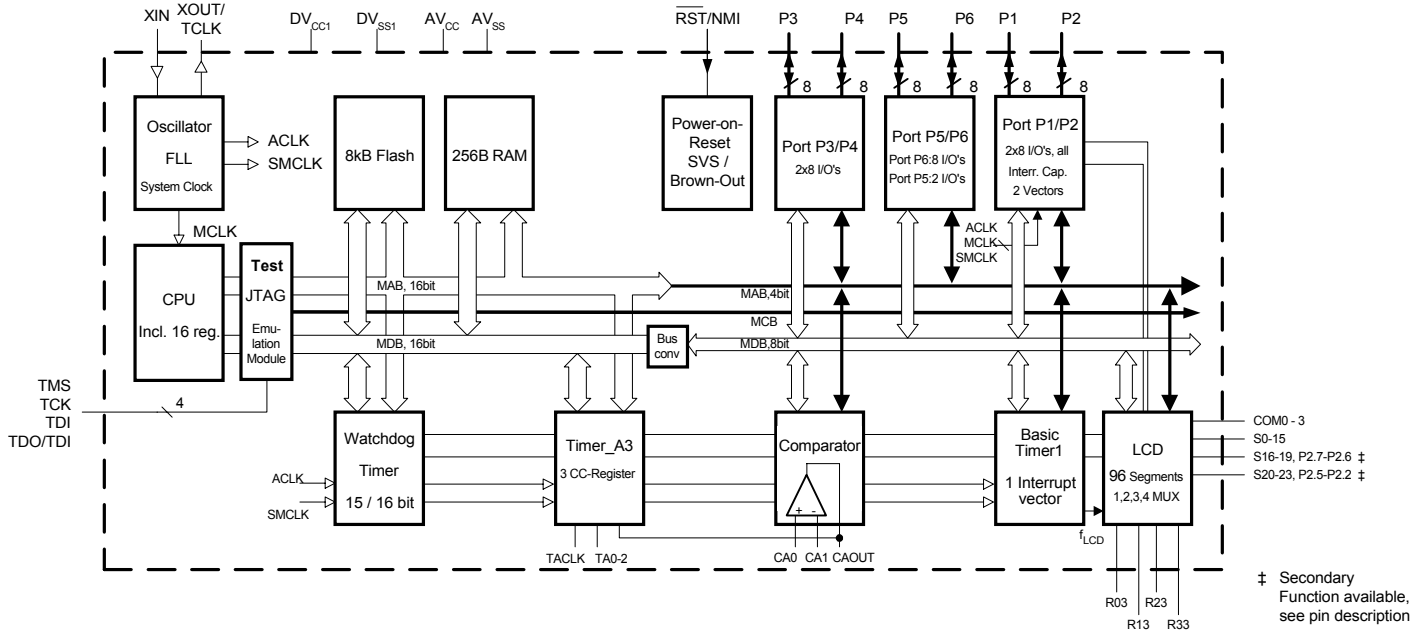
**Device Configuration**  
**MSP430C336, MSP430C337, MSP430P337, MSP430P337A**



Package: 100 QFP (PJM)

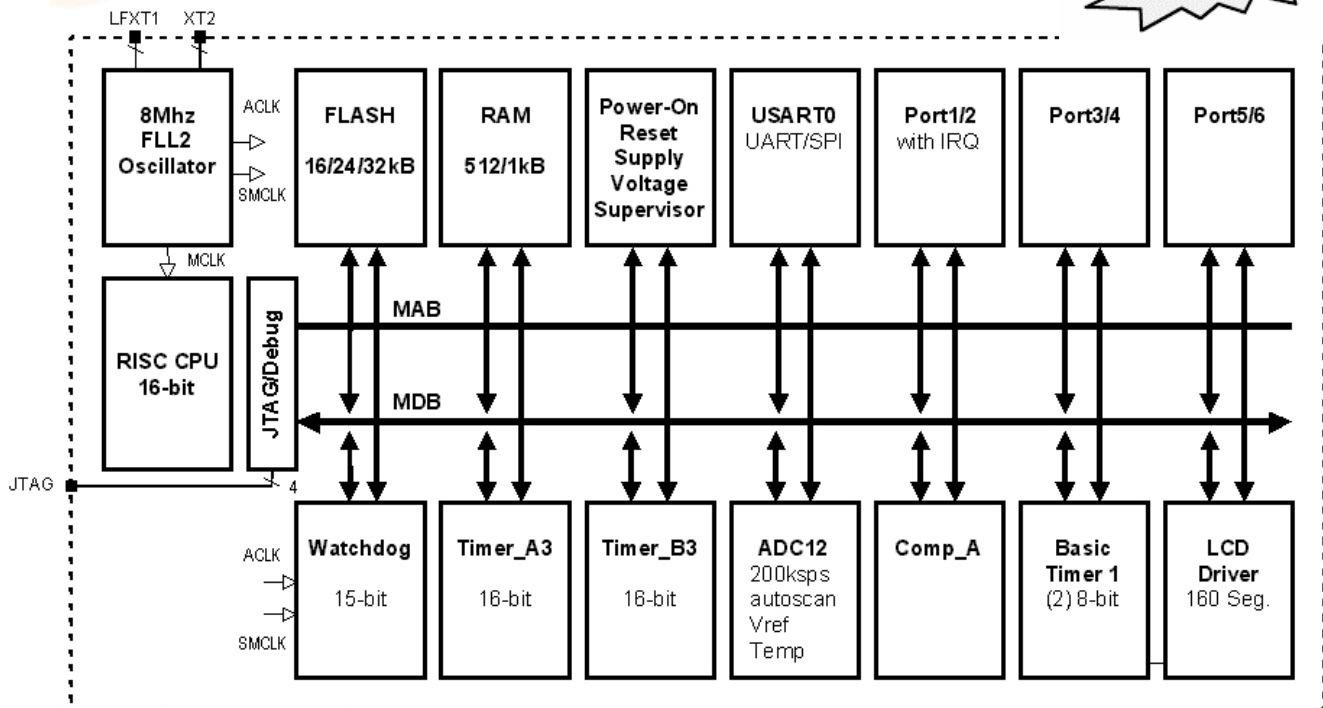
**MSP430x4xx Family with LCD Driver – Device Configuration**

**Device Configuration  
MSP430F412, MSP430F413, MSP430C412, MSP430C413**



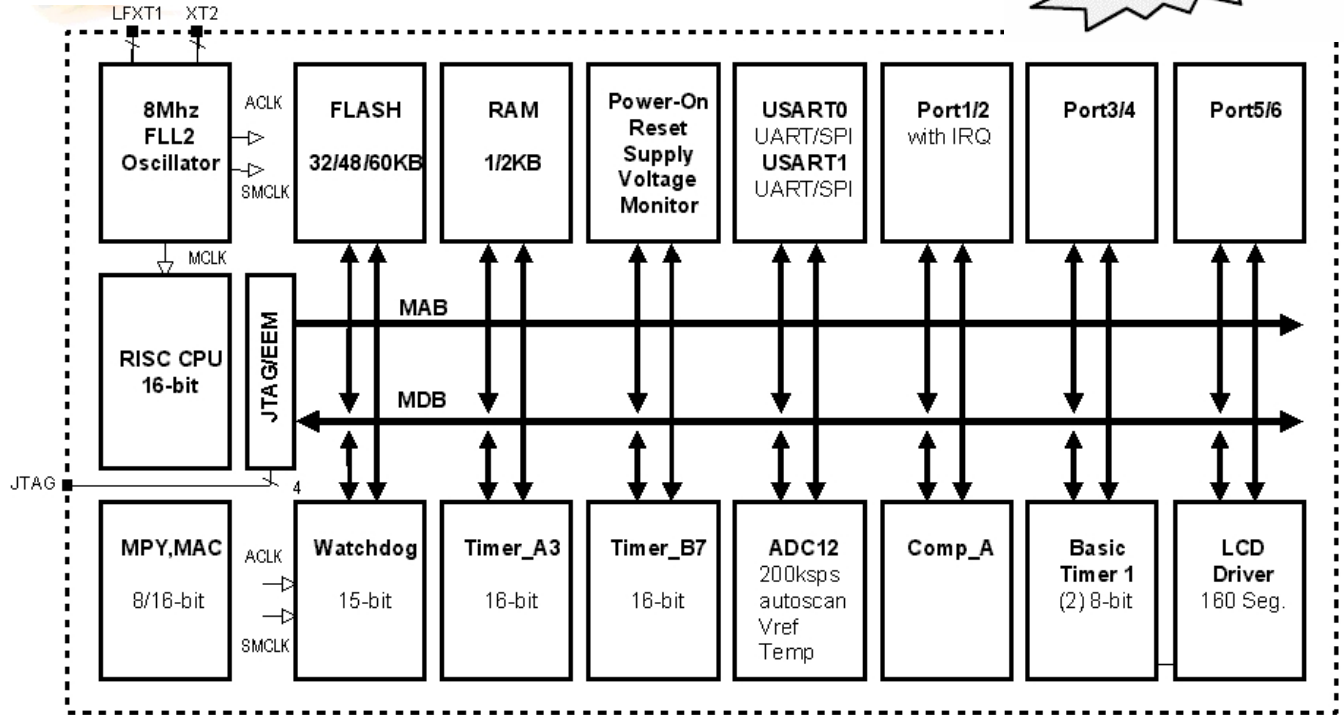
Package: 64 QFP (PM)

**Device Configuration  
MSP430F435, MSP430F436, MSP430F437**



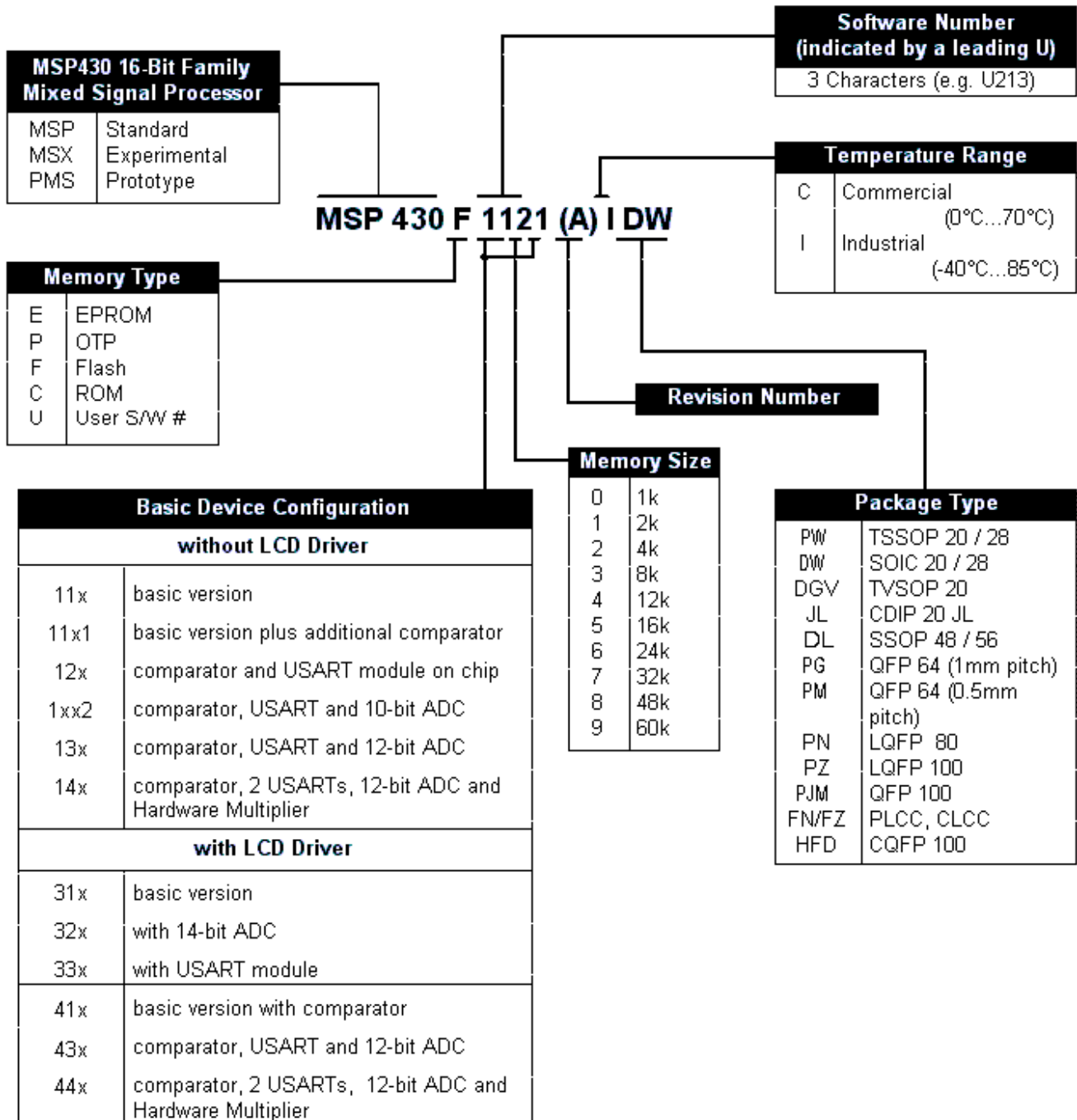
Package: 100 QFP (PZ) or 80 QFP (PN)

**Device Configuration**  
MSP430F447, MSP430F448, MSP430F449

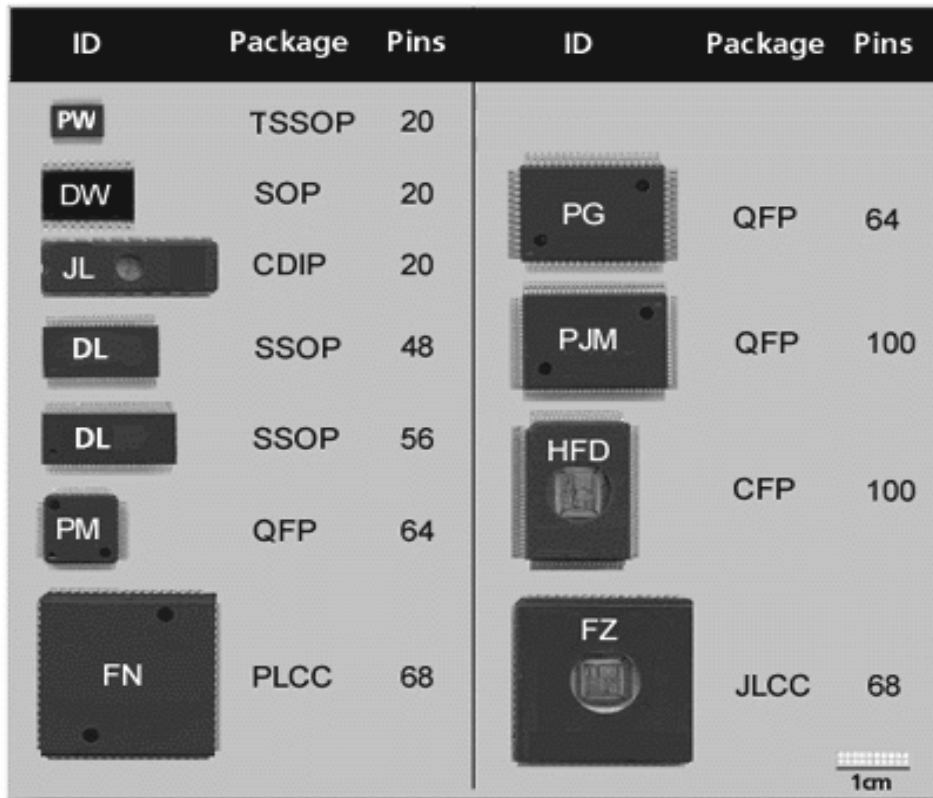


Package: 100 QFP (PZ)

**MSP430 Production Code**



MSP430 Device Packages



**20 TSSOP – PW**

MSP430F1101IPW  
MSP430F1111IPW  
MSP430F1121IPW  
MSP430C1101IPW  
MSP430C1111IPW  
MSP430C1121IPW  
MSP430F1122IPW  
MSP430F1132IPW

**20 SOIC – DW**

MSP430P112IDW  
MSP430F1101IDW  
MSP430F1111IDW  
MSP430F1121IDW  
MSP430C1101IDW  
MSP430C1111IDW  
MSP430C1121IDW  
MSP430F1122IDW  
MSP430F1132IDW

**20 DIL – JL**

PMS430E112JL

**20 TVSOP – DGV**

MSP430F1121AIDGV

**28 TSSOP – PW**

MSP430F1221PW  
MSP430F1231PW  
MSP430F1222IPW  
MSP430F1232IPW

**28 SOWB – DW**

MSP430F122IDW  
MSP430F123IDW  
MSP430F1222IDW  
MSP430F1232IDW

**48 SSOP – DL**

MSP430C311SIDL  
MSP430P315SIDL

**56 SSOP – DL**

MSP430C312IDL  
MSP430C313IDL  
MSP430C314IDL  
MSP430C315IDL  
MSP430P315IDL

**64 QFP – PM**

MSP430F133IPM  
MSP430C1331IPM  
MSP430F135IPM  
MSP430C1351IPM  
MSP430F147IPM  
MSP430F148IPM  
MSP430F149IPM  
MSP430F412IPM  
MSP430F413IPM

**64 QFP – PG**

MSP430C323IPM  
MSP430C325IPM  
MSP430P325IPM  
MSP430P325AIPM  
MSP430C323IPG  
MSP430C325IPG  
MSP430P325IPG  
MSP430P325AIPG

**68 PLCC – FN**

MSP430C323IFN  
MSP430C325IFN  
MSP430P325IFN  
MSP430P325AIFN

**68J LCC FZ**

PMS430E315FZ  
PMS430E325AFZ

**80 QFP – PN**

MSP430F435IPN  
MSP430F436IPN  
MSP430F437IPN

**100 QFP – PZ**

MSP430F435IPZ  
MSP430F436IPZ  
MSP430F437IPZ  
MSP430F447IPZ  
MSP430F448IPZ  
MSP430F449IPZ

**100 QFP – PJM**

MSP430C336IPJM  
MSP430C337IPJM  
MSP430P337IPJM  
MSP430P337AIPJM

**100 CFP – HFD**

PMS430E337AHFD

## MSP430 Design Support

### Texas Instruments Tools

<b>MSP430x11x FLASH EMULATION TOOL</b>	<b>MSP-FET430X110</b>	<b>49\$ **</b>
<b>MSP430x14x FLASH EMULATION TOOL</b>	<b>MSP-FET430P140</b>	<b>99\$ **</b>
<b>MSP430x41x FLASH EMULATION TOOL</b>	<b>MSP-FET430P410</b>	<b>99\$ **</b>
<b>MSP430x12x and x1xx2 FLASH EMULATION TOOL</b>	<b>MSP-FET430P120</b>	<b>99\$ **</b>
<b>MSP430x43x and x44x FLASH EMULATION TOOL</b>	<b>MSP-FET430P440</b>	<b>99\$ **</b>



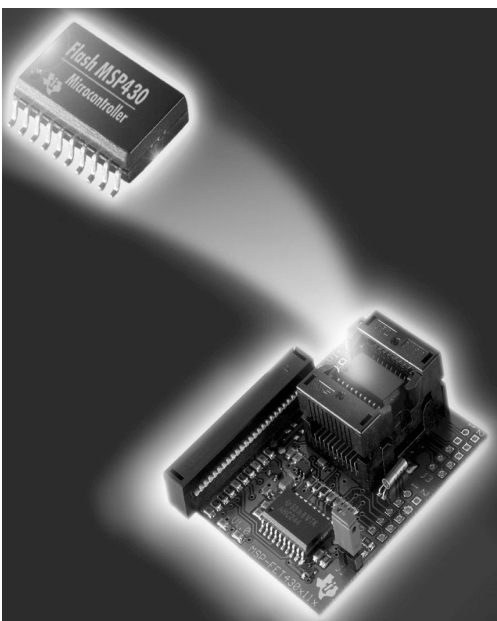
The MSP430 Flash Emulation Tools, combined with the IAR Kickstart environment, enable system designers to quickly **update, download, run and debug their code** without ever disconnecting the MSP430 from the PC. This speeds up the development and debug portions of the application development cycle significantly. The FET Tools allow designers the flexibility of operating the device under JTAG control, running to internal breakpoints or free running the MSP430. Each FET comes with an **evaluation board, Flash device samples, PC parallel connection, development software and the MSP430 CD-ROM.**

The MSP-FET430X110 is a complete low-cost application development for MSP430F11x(1) products. The MSP-FET430P140 supports application development for both the MSP430F13x and MSP430F14x product families. It includes a parallel interface that also allows direct in-circuit programming of MSP430 Flash devices. The MSP-FET430P410 supports the MSP430F412 and F413 chips, but thanks to pin-to-pin compatibility it can also be used for the MSP430F13x and and F14x devices. The MSP-FET430P440 is the development tool for the currently most integrated MSP430 families, the MSP430F43x and F44x. The MSP-FET430P120, is available now and comes with two device samples of either F123 and the latest addition to the MSP430 family, the F1232.

**Latest FET Driver: Version 3.04 – also available for download**

[www.ti.com/sc/msp430](http://www.ti.com/sc/msp430)

then click on “free tools/downloads”



MSP-FET430X110



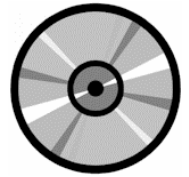
MSP-FET430P140



**IAR KICKSTART ENVIRONMENT**

free

Kickstart is a fully integrated Windows-based development environment. It is derived from the popular IAR Workbench user interface. This one interface allows the user to **develop code, simulate operation, download software and debug applications** for all MSP430 derivatives. Kickstart allows the setting of breakpoints and the monitoring of special function registers, memory, the stack, as well as other useful information. Kickstart includes the **IAR assembler, a software simulator, a free 4KB version of the IAR C compiler and the C-SPY debugger**. Upgrading to the full version of IAR C is simple and does not require the user to learn a new interface. MSP430 devices with Flash, OTP or UV-EPROM memory can be programmed directly from Kickstart using either a Flash Emulation Tool (FET) or the new Serial Programming Adapter MSP-PRGS430. The Kickstart Environment is available on the free MSP430 CD-ROM, which is shipped with the TI Tools or available under lit. code SLAC001E.



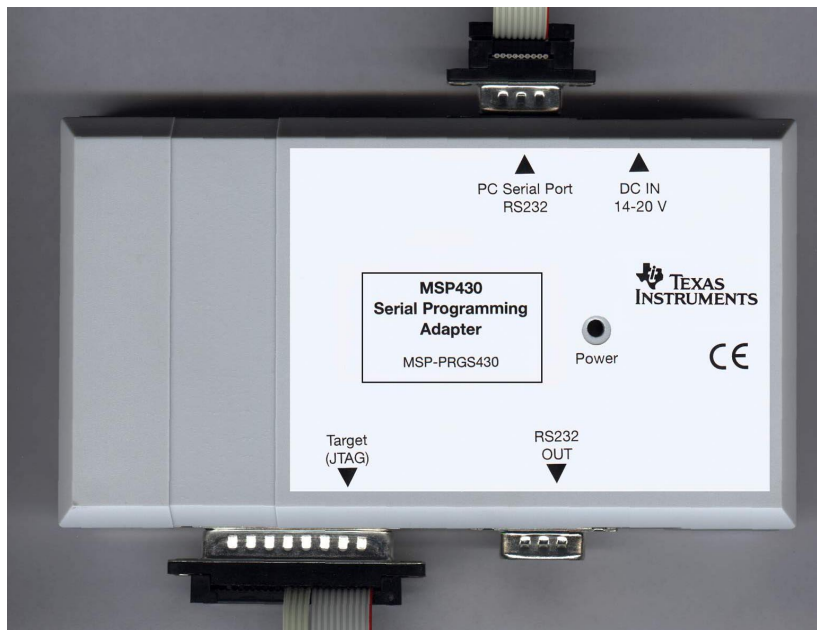
**MSP430 SERIAL PROGRAMMING ADAPTER**

**MSP-PRGS430**

199\$ \*\*

The serial programming adapter is a second-generation programming Tool that can program any MSP430 Flash, OTP or UV-EPROM device. Devices can be programmed in stand-alone sockets or in-circuit. Software is included to facilitate device programming.

**Software Version: 1.2**



MSP-PRGS430

**MSP430x320 EVALUATION KIT  
MSP430x330 EVALUATION KIT**

**MSP-EVK430S320  
MSP-EVK430S330**

399\$ \*\*  
399\$ \*\*

The MSP430 Evaluation Kits (EVK) are powerful development Tools that include much of the hardware and software required to complete your application development. Each EVK comes with an evaluation board, two UV-EPROM devices, serial programming adapter, development software and CD-ROM. The MSP-EVK430S320 EVK supports the MSP430x32x family of devices. The MSP-EVK430S330 EVK supports the MSP430x33x and MSP430x31x families of devices. The EVKs are combined with the **new IAR Kickstart** environment. The **new Serial Programming Adapter** is a second-generation programming Tool that can program any MSP430 Flash, OTP or UV-EPROM device. Devices can be programmed in stand-alone sockets or in-circuit.

## MSP430 Third Party Support

### Hitex

DProbe430-DP110 (+DBox16)	Supporting the x1x configurations
DProbe430-DP300 (+DBox16)	Supporting the 3xx configurations
MX430L	Supporting the 11x configuration

With the new DProbe430, Hitex offers a modular emulation system which is specifically designed to develop, test and optimize MSP430 applications. Starting with the entry-level system DProbe430, up to the high-end system DBox16, real-time debugging at the highest frequencies and with all the power saving modes is now possible without restrictions. Changing from one derivative to another can be done by an easy and low-cost exchange of the derivative specific part

With the convenient and easy to learn HiTOP user interface, all the processor internals and application structures are made transparent. Symbolic high-level language debugging, as well as examination down to assembler code, can be done to speed up the development and ensure quality in the application. The high-end features of the DBox16 allow the user to find and eliminate even the most complex bugs.

For more information please contact Hitex: [www.hitex.de](http://www.hitex.de).

## C-CROSS-COMPILER and C/ASM-DEBUGGER

### IAR

The EW430 integrates C compiler, linker, librarian and assembler in a seamless environment with easy-to-use project and option handling. The CW430 is a HLL debugger incorporating a complete C expression analyzer and full C-type knowledge. It combines a detailed control of code execution, needed for embedded development debugging, with the flexibility and power of the C language. The source window can display C source code and mix it with assembler.

CW430 simulator allows an unlimited number of breakpoints on C statements, assembler instructions and on any address with an access type of read, write and opcode fetch. Interrupt simulation implements commands to launch specific interrupts at a specific cycle-count or periodically. For interrupt simulation with intermittent interrupts, the same algorithm as the hardware, for choosing the highest priority interrupt to be executed, will be selected. The same interface is available to work on the EVK-Board (CW430R).

For more information please contact IAR on [www.iar.se](http://www.iar.se)

### Quadravox

The AQ430 integrated development environment from Quadravox including c-compiler, assembler, linker, librarian is available since June 2002 and supports all flash programmable MSP430 devices. A 30 days trial version is available for download at the Quadravox homepage, the full version of the software can be purchased for US\$395 plus VAT. One year of free support and updates is included in this price.

To find out more about Quadravox AQ430 and how to purchase it, please check: [www.quadravox.com/AQ430.htm](http://www.quadravox.com/AQ430.htm)



## UNIVERSAL PROGRAMMING SYSTEM

### BP Microsystems

BP Microsystems Inc. designs and manufactures device programmers for both engineering and production applications. Leading the industry in device support, performance, and cost of ownership, BP provides complete device programming solutions to customers worldwide. The company offers a full line of single-site device programmers and Universal Programmers, and multi-site Concurrent Programming Systems. The MSP430 can be programmed using any of the universal engineering programmers (BP-1200 and BP-1400), the manual, multi-site Concurrent Programming Systems.

For more information, please visit the BP web site: [www.bpmicro.com](http://www.bpmicro.com)

### ON-CHIP EMULATION SOFTWARE for the MSP430

#### Goepel electronic

This solution is based on a complete software and hardware kit that turns any PC into a powerful device emulator. A standardized IEEE1149.1 / JTAG 4-wire testbus is plugged onto the parallel port via scan controller, while a powerful 32-bit software enables access to the different resources for programming, verification and debug. High efficiency is achieved through interactive control and direct download of the operation software into the on-chip EPROM. With the CPU emulator, debugging of TI assembler code is possible.

A low-cost and true high-level emulator is the result of features such as breakpoint setting, step function, re-assembler and extended register watching that makes the source code traceable and easy-to-debug. For recording user actions a script language is used. This ASCII language contains commands for memory and register handling, for programming the EEPROMS and blowing fuses.

For more information please contact Goepel on [www.goepel.com](http://www.goepel.com)

### Universal Bootstrap Loader (BSL) Interface package for the MSP430

#### Geßler Electronic GmbH

Later Flash derivatives from TI's MSP430 Microcontroller have an integrated bootstrap loader (BSL) that provides access to the embedded memory. The BSL is located in the ROM without using any Flash resources. It supports download of code and parameters into the Flash memory during prototyping phase, production and in the field.

The Universal Bootstrap Loader Interface allows easy access to the MSP430 with any PC through the serial port. It supports the data signal transfer and provides the power supply for the target device. Firmware updates of MSP430 devices can be done as easily as programming the device the first time. Note also that this is the only way to re-program the MSP430 once the security fuse has been blown.

A communications library that is part of the software package provides access to the target device's BSL. It can also be used by other programs since the documentation of the API of this library is included in the package.

For more information please check [www.gessler-electronic.com/msp430](http://www.gessler-electronic.com/msp430)

### MSP430 Literature, Application Notes & Examples

Description	Part Number
MSP430 Product Brochure	SLAB034C
MSP430 CD-ROM	SLAC001E
MSP430F11x Data Sheet	SLAS256B
MSP430C11x/P112 Data Sheet	SLAS196B
MSP430x11x1 Data Sheet	SLAS241D
MSP430F13x/F14x Data Sheet	SLAS272C
MSP430C13x1 Data Sheet	SLAS341
MSP430x31x Data Sheet	SLAS165D
MSP430P325 Data Sheet	SLAS164A
MSP430C32x/P325A Data Sheet	SLAS219B
MSP430P337 Data Sheet	SLAS163
MSP430C33x/P337A Data Sheet	SLAS227A
MSP430F41x Data Sheet	SLAS340A
MSP430F12x Data Sheet	SLAS312
MSP430F43x/44x Data Sheet	SLAS344A
MSP430F12x2/11x2 Data Sheet	SLAS
Getting Started with MSP430	SLAU028
MSP430x1xx Family User's Guide	SLAU049A
MSP430x3xx Family User's Guide	SLAU012
MSP430x4xx Family User's Guide	SLAU056A
MSP430x1xx Clock System	SLAA081
MSP430x3xx Clock System	SLAA080
MSP430 Family Software User's Guide	SLAUE11
MSP430 Family Assembler User's Guide	SLAUE12
MSP430 Family Application Report	SLAA024

#### Application Notes

[http://www.ti.com/sc/docs/apps/process/msp430\\_ultra\\_low\\_power\\_microcontrollers.html](http://www.ti.com/sc/docs/apps/process/msp430_ultra_low_power_microcontrollers.html)

## MSP430 ROM Mask Versions

- Mask Version C3xx for volumes >25ku/y, C1xx1 and C41x for volumes >100ku/y.
- Mask Cost: 7 k\$ per mask
- Lead time for the first prototypes / production units: 12-14 weeks after code delivery and order entry
- Risk order of at least 3ku (non cancelable) is needed for any new project

TI will assist in setting up new ROM codes for the MSP430. This section describes the detailed flow to be used to ensure a smooth and quick setup.

### U-Code Name Generation

The customer's finished program code is sent to the TI Sales Representative responsible for the ROM code project. It is important that the program code file format is using the Intel Hex code standard. The TI Sales contact then obtains a unique three digit U-code number from the TI ROM code coordinator identifying the customer specific device programming and the package option, e.g. MSP430U999IPM for a MSP430 in a QFP package. This 3-digit U-code is being used to track the new ROM code device through its implementation cycle as well as to generate new entries for the ordering system when the device goes into production.

### ROM Code Release Sheet Submission

For each new ROM code, a ROM code release sheet will be submitted to the customer. It contains all device characteristics like symbolization, pull-up, pull-down resistors, operating voltage ranges, package options etc. The customer can compare the file as received by TI with his original program file and he can also verify all device setups.

### ROM Code Release Sheet Return

After the customer verified the program code and device settings and finds everything ok, he confirms this by sending back the release form with the program code and a written release confirmation for the risk run. To speed up the process, only the first two pages and the last page can be faxed to TI and the whole document is then sent by mail.

### Risk Order Entry

To initiate mask pattern generation and the production of the risk lot, the risk order of 3ku or more has to be entered. After order has been entered and ROM code release sheet has been approved and returned by the customer, lead time for the delivery of the risk lot is around 12 weeks.

### NRE Order Entry

For each new ROM code, a fixed amount of 7k\$ NRE will be entered in addition to the risk order.

### First Sample Delivery

The first sample shipment (i.e. the risk order, usually 3ku) is shipped to the customer directly from the TI PDC, as if it was a standard TI device. If the customer needs samples separated from this standard shipment (might be the case for material that comes in tape&reel), he needs to write down this request in the ROM Code Release Sheet.

### ROM Code Approval

The customer needs to provide formal ROM code approval based on the first samples, prior to placement of high volume production orders. This final approval is sent to TI by fax or mail and the Mask ROM device will become available for volume production orders.

### MSP430 Wafer Business

**only possible for designated device configurations – always check with TI Representative**

Possible with following rules:

- OTP versions on wafer are only available in a min. quantity to verify the ROM code in special cases
- Unsawed, inked wafers only, no die-business
- Production code: YS
- Currently available configurations: MSP430C311YS and MSP430C315YS
- Tested only at room temperature or above
- NDA is needed as yield data is visible on the wafer
- Wafer Business is a special service for customers needing it for space reasons only, it is **not** a cost reduction program
- Minimum quantity goal for Wafer Business is 100ku (order has to be entered in the system!)
- Customer must have the expertise to handle a Wafer Business

### MSP430 Die Business

**only possible for designated device configurations – always check with TI Representative**

Possible with following rules:

- Chips are sawn and packed in waffle packs
- Production code: CY
- Currently available configurations: MSP430P315CY, MSP430P325ACY, MSP430F1121(A)CY, MSP430F413CY, MSP430F149CY, MSP430F437CY and MSP430F449CY
- NDA must be in place since TI proprietary information will be shared with the customer
- Die Business is a special service for customers needing it for space reasons only; it is **not** a cost reduction program
- Minimum quantity goal for Die Business is 100ku (order has to be entered in the system!)
- Customer must have the expertise to handle a Die Business

### MSP430 Tools by Texas Instruments - Overview

Tool	Product Code	Suggested Resale Price
MSP 430 FLASH EMULATION TOOL for x11x1	MSP-FET430X110	\$ 49
MSP 430 FLASH EMULATION TOOL for x13x/14x	MSP-FET430P140	\$ 99
MSP 430 FLASH EMULATION TOOL for x41x	MSP-FET430P410	\$ 99
MSP 430 FLASH EMULATION TOOL for x12x/x1xx2	MSP-FET430P120	\$99
MSP 430 FLASH EMULATION TOOL for x43x/x44x	MSP-FET430P440	\$99
MSP430 EVALUATION KIT x320	MSP-EVK430S320	\$ 399
MSP430 EVALUATION KIT x330	MSP-EVK430S330	\$ 399
MSP430 SERIAL PROGRAMMING ADAPTOR	MSP-PRGS430	\$ 199
TRF6900/MSP430 EVALUATION KIT	MSP-EVKTRF6900	\$399



!! - NEW - !!

## MSP430 Product Selection Overview

## MSP430 Product Selection Guide

(C)ROM (E)UV	(F) Flash (P)OTP	Pins/ Pkg	Program	SRAM	I/O	Vcc	LCD Seg	Basic Timer (2) 8-Bit	Watchdog 16-Bit	Interval Timer 8-Bit	Timer/ Port (2) 8-Bit	Timer_A 16-Bit	Timer_B 8-16 bit	USART	MPY	Comp_A	ADC	Price <sup>2</sup>
<b>Flash Based F1xx Family</b>																		
MSP430F1101		20 DW,PW	1 kB	128	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	X	slope	\$0.99
MSP430F1111		20 DW,PW	2 kB	128	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	X	slope	\$1.34
MSP430C1111		20 DW,PW	2 kB	128	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	X	slope	\$1.23
MSP430F1121		20 DW,PW, DGV	4 kB	256	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	X	slope	\$1.74
MSP430C1121		20 DW,PW, DGV	4 kB	256	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	X	slope	\$1.47
MSP430P112		20 DW,PW	4 kB	256	14	2.7 - 5.5	-	-	X	-	-	X	-	-	-	-	slope	\$2.33
PMS430E112		20 CDIP	4 kB	256	14	2.7 - 5.5	-	-	X	-	-	X	-	-	-	-	slope	\$49.00
MSP430F1122		20 DW,PW	4 kB	256	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	-	ADC10	\$2.24
MSP430F1132		20 DW,PW	8 kB	256	14	1.8 - 3.6	-	-	X	-	-	X	-	-	-	-	ADC10	\$2.48
MSP430F122		28 DW,PW	4 kB	256	22	1.8 - 3.6	-	-	X	-	-	X	-	1	-	X	slope	\$2.39
MSP430F123		28 DW,PW	8 kB	256	22	1.8 - 3.6	-	-	X	-	-	X	-	1	-	X	slope	\$2.51
MSP430F1222		28 DW,PW	4 kB	256	22	1.8 - 3.6	-	-	X	-	-	X	-	1	-	-	ADC10	\$2.62
MSP430F1232		28 DW,PW	8 kB	256	22	1.8 - 3.6	-	-	X	-	-	X	-	1	-	-	ADC10	\$2.79
MSP430F133		64 PM	8 kB	256	48	1.8 - 3.6	-	-	X	-	-	X	X	1	-	X	ADC12	\$2.96
MSP430C1331		64 PM	8 kB	256	48	1.8 - 3.6	-	-	X	-	-	X	X	1	-	X	slope	\$1.95
MSP430F135		64 PM	16 kB	512	48	1.8 - 3.6	-	-	X	-	-	X	X	1	-	X	ADC12	\$3.55
MSP430C1351		64 PM	16 kB	512	48	1.8 - 3.6	-	-	X	-	-	X	X	1	-	X	slope	\$2.25
MSP430F147		64 PM	32 kB	1024	48	1.8 - 3.6	-	-	X	-	-	X	X	2	X	X	ADC12	\$4.95
MSP430F148		64 PM	48 kB	2048	48	1.8 - 3.6	-	-	X	-	-	X	X	2	X	X	ADC12	\$5.65
MSP430F149		64 PM	60 kB	2048	48	1.8 - 3.6	-	-	X	-	-	X	X	2	X	X	ADC12	\$5.95
<b>Flash Based F4xx Family with LCD Driver</b>																		
MSP430F412		64 PM	4 kB	256	48	1.8 - 3.6	96	X	X	-	-	X	-	-	-	X	slope	\$2.55
MSP430C412		64 PM	4 kB	256	48	1.8 - 3.6	96	X	X	-	-	X	-	-	-	X	slope	\$1.90
MSP430F413		64 PM	8 kB	256	48	1.8 - 3.6	96	X	X	-	-	X	-	-	-	X	slope	\$2.90
MSP430C413		64 PM	8 kB	256	48	1.8 - 3.6	96	X	X	-	-	X	-	-	-	X	slope	\$2.10
MSP430F435		80 PN, 100 PZ	16 kB	512	48	1.8 - 3.6	160	X	X	-	-	X	X	1	-	X	ADC12	\$4.40
MSP430F436		80 PN, 100 PZ	24 kB	1024	48	1.8 - 3.6	160	X	X	-	-	X	X	1	-	X	ADC12	\$4.65
MSP430F437		80 PN, 100 PZ	32 kB	1024	48	1.8 - 3.6	160	X	X	-	-	X	X	1	-	X	ADC12	\$4.85
MSP430F447		100 PZ	32 kB	1024	48	1.8 - 3.6	160	X	X	-	-	X	X	2	X	X	ADC12	\$5.65
MSP430F448		100 PZ	48 kB	2048	48	1.8 - 3.6	160	X	X	-	-	X	X	2	X	X	ADC12	\$6.40
MSP430F449		100 PZ	60 kB	2048	48	1.8 - 3.6	160	X	X	-	-	X	X	2	X	X	ADC12	\$6.95
<b>ROM/OTP Based X3xx Family with LCD Driver</b>																		
MSP430C311S		48DL	2 kB	128	11	2.5 - 5.5	64	X	X	X	X	-	-	-	-	-	slope	\$1.99
MSP430P315S		48DL	16 kB	512	11	2.7 - 5.5	64	X	X	X	X	-	-	-	-	-	slope	\$5.16
MSP430C312		56 DL	4 kB	256	14	2.5 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$2.40
MSP430C313		56 DL	8 kB	256	14	2.5 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$2.61
MSP430C314		56 DL	12 kB	512	14	2.5 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$2.82
MSP430C315		56 DL	16 kB	512	14	2.5 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$3.04
MSP430P315		56 DL	16 kB	512	14	2.7 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$5.16
PMS430E315		68 FZ	16 kB	512	14	2.7 - 5.5	92	X	X	X	X	-	-	-	-	-	slope	\$99.00
MSP430C323		64 PM, FN, PG	8 kB	256	14	2.5 - 5.5	84	X	X	X	X	-	-	-	-	-	ADC14	\$5.23
MSP430C325		64 PM, FN, PG	16 kB	512	14	2.5 - 5.5	84	X	X	X	X	-	-	-	-	-	ADC14	\$5.53
MSP430P325A		64 PM, FN, PG	16 kB	512	14	2.5 - 5.5	84	X	X	X	X	-	-	-	-	-	ADC14	\$6.87
PMS430E325A		68 FZ	16 kB	512	14	2.5 - 5.5	84	X	X	X	X	-	-	-	-	-	ADC14	\$99.00
MSP430C336		100 PJM	24 kB	1024	40	2.5 - 5.5	120	X	X	X	X	X	-	1	X	-	slope	\$6.10
MSP430C337		100 PJM	32 kB	1024	40	2.5 - 5.5	120	X	X	X	X	X	-	1	X	-	slope	\$6.38
MSP430P337A		100 PJM	32 kB	1024	40	2.5 - 5.5	120	X	X	X	X	X	-	1	X	-	slope	\$7.53
PMS430E337A		100 PZ	32 kB	1024	40	2.5 - 5.5	120	X	X	X	X	X	-	1	X	-	slope	\$99.00

<sup>1</sup> Temp. Range for all MSP430 is Industrial, except all Exxx parts (25 °C). <sup>2</sup> Suggested 10,000 unit resale price in U.S. dollars (budgetary only); C-Versions require minimum quantity of 25,000 units per year

**Notes**

**TI Worldwide Technical Support**

**MSP430 Home Page**

[www.ti.com/sc/msp430](http://www.ti.com/sc/msp430)

**TI Distributors**

[www.ti.com/sc/docs/general/distrib.htm](http://www.ti.com/sc/docs/general/distrib.htm)

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India	000-117	-800-800-1450
Indonesia	001-801-10	-800-800-1450
Korea	001-800-8800-6800	
Malaysia	1-800-800-011	-800-800-1450
New Zealand	000-911	-800-800-1450
Philippines	105-11	-800-800-1450
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