

MSP430 Ultra-Low-Power Microcontrollers



Embedded Controllers

Key Features

- Ultra-low-power architecture extends battery life:
 - 0.1- μ A RAM retention
 - 0.8- μ A real-time clock mode
 - 250- μ A/MIPS active
- Wide range of integrated intelligent peripherals offload the CPU
- Modern 16-bit RISC CPU enables new applications at a fraction of the code size
- Complete eZ430-F2013 development tool for only \$20

Key Applications

- Utility metering
- Portable instrumentation
- Intelligent sensing
- Consumer Electronics

MSP430 Modular Architecture

A 16-bit RISC CPU, peripherals and flexible clock system are combined by using a von-Neumann common memory address bus (MAB) and memory data bus (MDB). Partnering a modern CPU with modular memory-mapped analog and digital peripherals, the MSP430 device offers solutions for today's and tomorrow's mixed-signal applications.

Device Configuration

- 1-KB to 120-KB ISP Flash
- RAM up to 10 KB
- 14- to 100-pin options

Integrated Peripherals

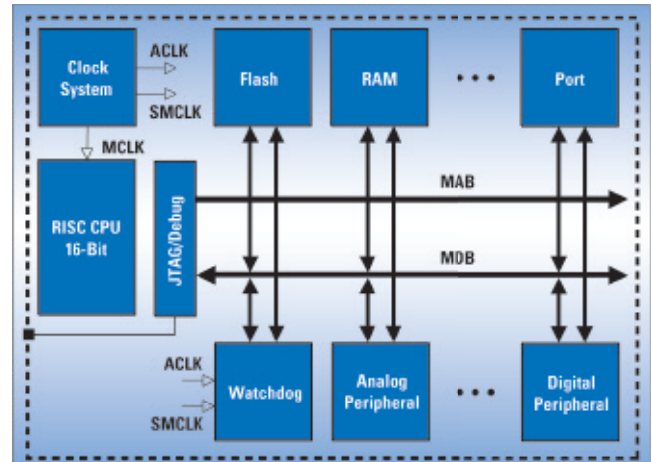
- 10-/12-/16-bit ADC
- 12-bit DAC
- Comparator
- LCD driver
- Supply Voltage Supervisor (SVS)
- Operational amplifiers
- 16-bit and 8-bit timers
- Watchdog timer

Ultra-Low Power

- Zero-power Brown Out Reset (BOR)
- 1- μ s clock startup
- 50-nA pin leakage

- UART/LIN
- I²C
- SPI
- IrDA

- Hardware multiplier
- DMA controller
- Temperature sensor



MSP430 von-Neumann architecture — all program, data memory and peripherals share a common bus structure. Consistent CPU instructions and addressing modes are used.

Modern 16-Bit RISC CPU

- Large register file eliminates accumulator bottleneck
- Optimized for C and assembler programming
- Compact core design reduces power and cost
- Up to 16 MIPS of performance available

The MSP430 MCU's orthogonal architecture provides the flexibility of 16 fully addressable, single-cycle 16-bit CPU registers and the power of a RISC. The modern design of the CPU offers versatility through simplicity using only 27 easy-to-understand instructions and seven consistent-addressing modes. This results in a 16-bit low-power CPU that has more effective processing, is smaller-sized, and more code-efficient than other 8-/16-bit microcontrollers. Develop new ultra-low-power, high-performance applications at a fraction of the code size.

15	0
R0/PC	Program Counter
R1/SP	Stack Pointer
R2/SR	Status
R3/CG	Constant Generator
R4	General Purpose
R5	General Purpose
R6	General Purpose
R7	General Purpose
R8	General Purpose
R9	General Purpose
R10	General Purpose
R11	General Purpose
R12	General Purpose
R13	General Purpose
R14	General Purpose
R15	General Purpose

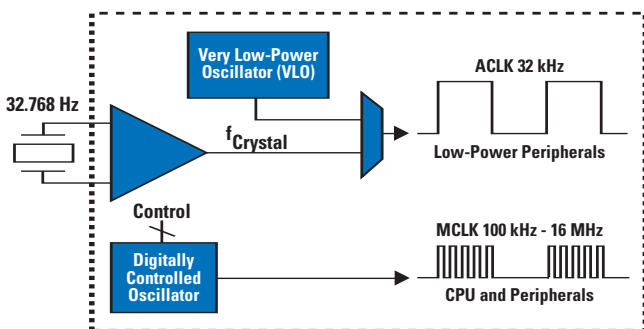
The MSP430 CPU core with **sixteen 16-bit registers**, 27 single-cycle instructions and seven addressing modes results in higher processing efficiency and code density.

Flexible Clock System

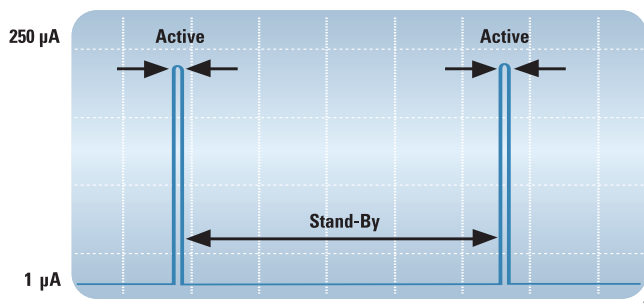
- Low-frequency auxiliary clock:
 - Ultra-low-power stand-by mode
- High-speed master clock:
 - High-performance processing
- Stability over time and temperature

The MSP430 MCU clock system is designed specifically for battery-powered applications. Multiple oscillators are utilized to support event-driven burst activity. A low frequency Auxiliary Clock (ACLK) is driven directly from a common 32-kHz watch crystal or the internal very low-power oscillator (VLO)—with no additional external components. The ACLK can be used for a background real-time clock self wake-up function. An integrated high-speed Digitally Controlled Oscillator (DCO) can source the master clock (MCLK) used by the CPU and sub-main clock (SMCLK) used by the high-speed peripherals. By design, the DCO is active and stable in 1 μ s (F2xx). MSP430 device-based solutions efficiently use 16-bit RISC CPU high-performance in very short burst intervals. This results in very high performance and ultra-low power consumption.

Multiple Oscillator Clock System



Ultra-Low Power Activity Profile



Ultra-fast 1- μ s DCO start-up allows MSP430-based systems to remain in low-power modes for the longest possible interval—extending battery life. The DCO is fully user programmable.

Intelligent Peripherals

With purely software-driven functions, the CPU is 100% active and consuming power. Effectively utilizing peripherals allows the CPU to be turned off to save power or work on other activities to achieve the highest performance.

MSP430 device peripherals are designed to require the least amount of software service. For example, the analog-to-digital converters all have automatic input channel scanning, hardware start-of-conversion triggers and DMA data-transfer mechanisms. These hardware features allow the CPU resources to focus more on differentiated application-specific features and less on basic data handling. Lower cost systems can be implemented using less software and lower power.

MSP430 MCU Portfolio

MSP430x1xx MCUs

The MSP430x1xx generation 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 multiplier.

MSP430x4xx MCUs

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

MSP430F2xx MCUs

The new ultra-low-power MSP430F2xx MCU generation increases performance up to 16 MHz. Additional enhancements of MSP430F2xx devices include an integrated $\pm 1\%$ on-chip digitally controlled oscillator, software-selectable, 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.

Flash-ROM-Based x1xx MCU Platform with 16-Bit Watchdog (V_{CC} 1.8-3.6V)

(C) ROM (F) Flash	Program (KB)	SRAM (B)	I/O	16-Bit Timers		USART ²	I ² C	DMA	SVS	Brown-Out Reset	MPY	Comp_A	Temp Sensor	ADC Ch/Res	Additional Analog	Package(s)	Price ¹	
				A	B													
MSP430F1101A	1	128	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$0.99	
MSP430C1101	1	128	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$0.60	
MSP430F1111A	2	128	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.35	
MSP430C1111	2	128	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$1.10	
MSP430F1121A	4	256	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.70	
MSP430C1121	4	256	14	3	—	—	—	—	—	—	—	✓	—	slope	—	20 DW, PW, 24 RGE	\$1.35	
MSP430F1122	4	256	14	3	—	—	—	—	—	✓	—	—	✓	5/10	—	20 DW, PW, 32 RHB	\$2.00	
MSP430F1132	8	256	14	3	—	—	—	—	—	✓	—	—	✓	5/10	—	20 DW, PW, 32 RHB	\$2.25	
MSP430F122	4	256	22	3	—	1	—	—	—	—	—	✓	—	slope	—	28 DW, PW, 32 RHB	\$2.15	
MSP430F123	8	256	22	3	—	1	—	—	—	—	—	✓	—	slope	—	28 DW, PW, 32 RHB	\$2.30	
MSP430F1222	4	256	22	3	—	1	—	—	—	✓	—	—	✓	8/10	—	28 DW, PW, 32 RHB	\$2.40	
MSP430F1232	8	256	22	3	—	1	—	—	—	✓	—	—	✓	8/10	—	28 DW, PW, 32 RHB	\$2.50	
MSP430F133	8	256	48	3	3	1	—	—	—	—	—	✓	✓	8/12	—	64 PM, PAG, RTD	\$3.00	
MSP430C1331	8	256	48	3	3	1	—	—	—	—	—	✓	—	slope	—	64 PM, RTD	\$2.00	
MSP430F135	16	512	48	3	3	1	—	—	—	—	—	✓	✓	8/12	—	64 PM, PAG, RTD	\$3.60	
MSP430C1351	16	512	48	3	3	1	—	—	—	—	—	✓	—	slope	—	64 PM, RTD	\$2.30	
MSP430F147	32	1024	48	3	7	2	—	—	—	—	—	✓	✓	✓	8/12	—	64 PM, PAG, RTD	\$5.05
MSP430F1471	32	1024	48	3	7	2	—	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$4.60
MSP430F148	48	2048	48	3	7	2	—	—	—	—	—	✓	✓	✓	8/12	—	64 PM, PAG, RTD	\$5.75
MSP430F1481	48	2048	48	3	7	2	—	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$5.30
MSP430F149	60	2048	48	3	7	2	—	—	—	—	—	✓	✓	✓	8/12	—	64 PM, PAG, RTD	\$6.05
MSP430F1491	60	2048	48	3	7	2	—	—	—	—	—	✓	✓	—	slope	—	64 PM, RTD	\$5.60
MSP430F155	16	512	48	3	3	1	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$4.95	
MSP430F156	24	1024	48	3	3	1	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$5.55	
MSP430F157	32	1024	48	3	3	1	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$5.85	
MSP430F167	32	1024	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$6.75	
MSP430F168	48	2048	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$7.45	
MSP430F169	60	2048	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$7.95	
MSP430F1610	32	5120	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$8.25	
MSP430F1611	48	10240	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$8.65	
MSP430F1612	55	5120	48	3	7	2	✓	✓	✓	✓	—	✓	✓	8/12	(2) DAC12	64 PM, RTD	\$8.95	

¹Suggested resale price in U.S. dollars in quantities of 1,000. ²USART includes UART and SPI.

16 MIPS

Flash-Based F2xx MCU Platform with 16-Bit Watchdog (V_{CC} 1.8-3.6V)

(C) ROM (F) Flash	Program (KB)	SRAM (B)	I/O	16-Bit Timers		Brown-Out Reset	SVS	USCI ²	USI ³	DMA	MPY	Comp_A+	Temp Sensor	ADC Ch/Res	Additional Analog	Package(s)	Price ¹
				A	B												
MSP430F2001	1	128	10	2	—	✓	—	—	—	—	—	✓	—	slope	—	14 PW, N, 16 RSA	\$0.55
MSP430F2011	2	128	10	2	—	✓	—	—	—	—	—	✓	—	slope	—	14 PW, N, 16 RSA	\$0.70
MSP430F2002	1	128	10	2	—	✓	—	—	✓	—	—	—	✓	8/10	—	14 PW, N, 16 RSA	\$0.99
MSP430F2012	2	128	10	2	—	✓	—	—	✓	—	—	—	✓	8/10	—	14 PW, N, 16 RSA	\$1.15
MSP430F2003	1	128	10	2	—	✓	—	—	✓	—	—	—	✓	4/16	—	14 PW, N, 16 RSA	\$1.50
MSP430F2013	2	128	10	2	—	✓	—	—	✓	—	—	—	✓	4/16	—	14 PW, N, 16 RSA	\$1.65
MSP430F2101	1	128	16	3	—	✓	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$0.90
MSP430F2111	2	128	16	3	—	✓	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$0.99
MSP430F2121	4	256	16	3	—	✓	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.35
MSP430F2131	8	256	16	3	—	✓	—	—	—	—	—	✓	—	slope	—	20 DGV, DW, PW, 24 RGE	\$1.70
MSP430F2232	8	512	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	—	38 DA, 40 RHA	\$2.40
MSP430F2252	16	512	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	—	38 DA, 40 RHA	\$2.70
MSP430F2272	32	1024	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	—	38 DA, 40 RHA	\$3.10
MSP430F2234	8	512	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	(2) OPAMP	38 DA, 40 RHA	\$2.65
MSP430F2254	16	512	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	(2) OPAMP	38 DA, 40 RHA	\$2.95
MSP430F2274	32	1024	32	3	3	✓	—	✓	—	—	—	—	✓	12/10	(2) OPAMP	38 DA, 40 RHA	\$3.35
MSP430F2330	8	1024	32	3	3	✓	—	✓	—	—	—	—	—	slope	—	40 RHA	\$2.30
MSP430F2350	16	2048	32	3	3	✓	—	✓	—	—	—	—	—	slope	—	40 RHA	\$2.65
MSP430F2370	32	2048	32	3	3	✓	—	✓	—	—	—	—	—	slope	—	40 RHA	\$2.95

¹Suggested resale price in U.S. dollars in quantities of 1,000.

²USCI channel 1 supports UART/LIN, IrDA and SPI; USCI channel 2 supports I²C and SPI. ³USI supports I²C or SPI.

New products are listed in **bold red**.

Flash/ROM-Based x4xx MCU Platform with LCD Driver and 16-Bit Watchdog and Basic Timer (Vcc 1.8-3.6V)

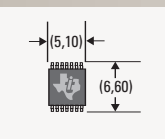
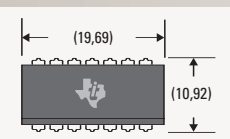
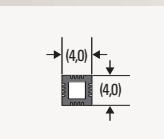
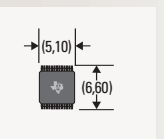
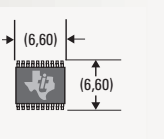
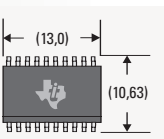
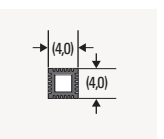
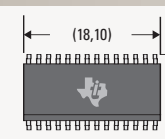
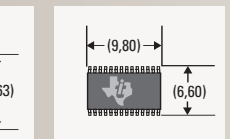
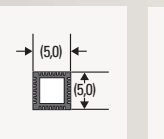
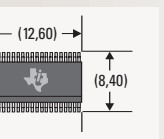
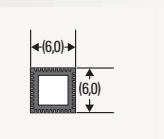
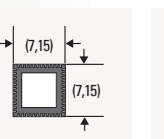
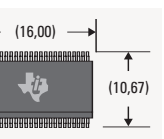
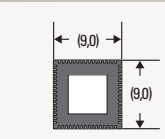
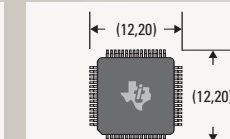
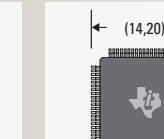
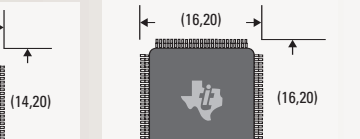
(C) ROM (F) Flash	Program (KB)	SRAM (B)	I/O	16-Bit Timers		Brown-Out Reset	SVS	USART ²	USCI ³	LCD Segments	DMA	MPY	Comp_A	Temp Sensor	ADC Ch/Res	Additional Analog	Package(s)	Price ¹
				A	B													
MSP430F412	4	256	48	3	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM, RTD	\$2.60
MSP430C412	4	256	48	3	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM, RTD	\$1.90
MSP430F413	8	256	48	3	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM, RTD	\$2.95
MSP430C413	8	256	48	3	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM, RTD	\$2.10
MSP430F415	16	512	48	3,5	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM	\$3.40
MSP430F417	32	1024	48	3,5	—	✓	✓	—	—	96	—	—	✓	—	slope	—	64 PM	\$3.90
MSP430FW423	8	256	48	3,5	—	✓	✓	—	—	96	—	—	✓	—	slope	Flow-meter	64 PM	\$3.75
MSP430FW425	16	512	48	3,5	—	✓	✓	—	—	96	—	—	✓	—	slope	Flow-meter	64 PM	\$4.05
MSP430FW427	32	1024	48	3,5	—	✓	✓	—	—	96	—	—	✓	—	slope	Flow-meter	64 PM	\$4.45
MSP430F4250	16	256	32	3	—	✓	—	—	—	56	—	—	—	✓	5/16	DAC12	48 DL, RGZ	\$3.10
MSP430F4260	24	256	32	3	—	✓	—	—	—	56	—	—	—	✓	5/16	DAC12	48 DL, RGZ	\$3.45
MSP430F4270	32	256	32	3	—	✓	—	—	—	56	—	—	—	✓	5/16	DAC12	48 DL, RGZ	\$3.80
MSP430F423	8	256	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	—	64 PM	\$4.50
MSP430F425	16	512	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	—	64 PM	\$4.95
MSP430F427	32	1024	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	—	64 PM	\$5.40
MSP430FE423	8	256	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	E meter	64 PM	\$4.85
MSP430FE425	16	512	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	E meter	64 PM	\$5.45
MSP430FE427	32	1024	14	3	—	✓	✓	1	—	128	—	✓	—	✓	3/16	E meter	64 PM	\$5.95
MSP430F435	16	512	48	3	3	✓	✓	1	—	128/160	—	—	✓	✓	8/12	—	80 PN, 100 PZ	\$4.45
MSP430F436	24	1024	48	3	3	✓	✓	1	—	128/160	—	—	✓	✓	8/12	—	80 PN, 100 PZ	\$4.70
MSP430F437	32	1024	48	3	3	✓	✓	1	—	128/160	—	—	✓	✓	8/12	—	80 PN, 100 PZ	\$4.90
MSP430FG437	32	1024	48	3	3	✓	✓	1	—	128	✓	—	✓	✓	12/12	(2) DAC12, (3) OPAMP	80 PN	\$6.50
MSP430FG438	48	2048	48	3	3	✓	✓	1	—	128	✓	—	✓	✓	12/12	(2) DAC12, (3) OPAMP	80 PN	\$7.35
MSP430FG439	60	2048	48	3	3	✓	✓	1	—	128	✓	—	✓	✓	12/12	(2) DAC12, (3) OPAMP	80 PN	\$7.95
MSP430F447	32	1024	48	3	7	✓	✓	2	—	160	—	✓	✓	✓	8/12	—	100 PZ	\$5.75
MSP430F448	48	2048	48	3	7	✓	✓	2	—	160	—	✓	✓	✓	8/12	—	100 PZ	\$6.50
MSP430F449	60	2048	48	3	7	✓	✓	2	—	160	—	✓	✓	✓	8/12	—	100 PZ	\$7.05
MSP430FG4616	92	4096	80	3	7	✓	✓	1	✓	160	✓	✓	✓	✓	12/12	(2) DAC12, (3) OPAMP	100 PZ	\$9.45
MSP430FG4617	92	8192	80	3	7	✓	✓	1	✓	160	✓	✓	✓	✓	12/12	(2) DAC12, (3) OPAMP	100 PZ	\$9.95
MSP430FG4618	116	8192	80	3	7	✓	✓	1	✓	160	✓	✓	✓	✓	12/12	(2) DAC12, (3) OPAMP	100 PZ	\$10.35
MSP430FG4619	120	4096	80	3	7	✓	✓	1	✓	160	✓	✓	✓	✓	12/12	(2) DAC12, (3) OPAMP	100 PZ	\$9.95

¹Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in **bold red**.

²USART includes UART and SPI. ³USCI channel 1 supports UART/LIN, IrDA and SPI; USCI channel 2 supports I²C and SPI.

Selected Package Options for MSP430 Devices

<p>14-pin PW (TSSOP)</p> 	<p>14-pin N (PDIP)</p> 	<p>16-pin RSA (QFN)</p> 	<p>20-pin DGV (TVSOP)</p> 	<p>20-pin PW (TSSOP)</p> 	<p>20-pin DW (SOIC)</p> 	<p>24-pin RGE (QFN)</p> 
<p>28-pin DW (SOIC)</p> 	<p>28-pin PW (TSSOP)</p> 	<p>32-pin RHB (QFN)</p> 	<p>38-pin DA (TSSOP)</p> 	<p>40-pin RHA (QFN)</p> 	<p>48-pin RGZ (QFN)</p> 	<p>48-pin DL (SSOP)</p> 
<p>64-pin RTD (QFN)</p> 	<p>64-pin PM, PAG (LQFP/TQFP)</p> 	<p>80-pin PN (LQFP)</p> 	<p>100-pin PZ (LQFP)</p> 			

Production Programming:

MSP-GANG430 Programmer

The MSP-GANG430 is a universal Flash device programmer, which can program up to eight targets simultaneously with speeds up to 60 KB in 12 seconds. The MSP-GANG430 can operate stand-alone or connected to the host PC via a standard RS232 serial connection. Devices are programmed as either stand-alone or in-system using a JTAG connection. The MSP-GANG430 Programmer is available for \$199.

MSP-FET430UIF/PIF Programmer

The MSP-FET430UIF is a USB JTAG (4-wire)/Spy-Bi-Wire (2-wire) debugger and programmer interface sold with the FET tools. This interface can be used with any development board with a JTAG header. The MSP-FET430PIF is the similar type of interface, but uses the PC Parallel port and only supports JTAG.

In-System Production Programming

JTAG: Programming through JTAG is supported with all MSP430 devices. A security fuse can be blown to sever JTAG access and prevent reverse engineering. Customers can use the MSP-GANG430 or build their own interface.

Spy-Bi-Wire: 2-wire debug/programming interface similar to JTAG for new low-pin-count MSP430F2xx devices.

Bootstrap Loader: On all MSP430 devices (except MSP430F20xx), the bootstrap loader (BSL), is part of

factory- masked ROM and can be implemented via a UART. Single devices are programmed either stand-alone or in-system. Program, verify, read out and segment erase are password protected. Please see device specific datasheets for details.

For further information on JTAG and Bootstrap Loader, go to www.ti.com/msp430appnotes and download Application Notes SLAA149, SLAA089b and SLAA096b.

ROM and Flash

For high-volume customers, masked ROM and factory programmed Flash devices can be ordered. The ROM process takes approximately 8-12 weeks from the receipt of a customer's verified code to the production of the first silicon. Flash devices take approximately 6-8 weeks. A customer-specific coded part number will be released.

Third Party Production Programmers

MSP430 devices may also be programmed by manual and automated production programming systems from third party vendors such as SoftBaugh, BP Microsystems, Data I/O, Elprotronic and others.

www.softbaugh.com
www.dataio.com

www.bpmicro.com
www.elprotronic.com

Development Tool Selection:

Part Number	PC Port	Contents Include	Devices Supported	Price ¹
eZ430-F2013	USB	Interface and target board	MSP430F20x1, 20x2, 20x3	\$ 20
MSP-FET430UIF	USB	Interface only	All	\$ 99
MSP-FET430U14	USB	Interface and target board	14-pin TSSOP	\$ 149
MSP-FET430U28	USB	Interface and target board	20-/28-pin SOP	\$ 149
MSP-FET430U38	USB	Interface and target board	38-pin TSSOP	\$ 149
MSP-FET430U40	USB	Interface and target board	MSP430F23x0	\$ 149
MSP-FET430U48	USB	Interface and target board	48-pin SOP	\$ 149
MSP-FET430U64	USB	Interface and target board	64-pin QFP	\$ 149
MSP-FET430U80	USB	Interface and target board	80-pin QFP	\$ 149
MSP-FET430U100	USB	Interface and target board	100-pin QFP	\$ 149
MSP-FET430PIF	Parallel	Interface only	All	\$ 49
MSP-FET430P120	Parallel	Interface and target board	20-/28-pin SOP	\$ 99
MSP-FET430P140	Parallel	Interface and target board	64-pin QFP	\$ 99
MSP-FET430P410	Parallel	Interface and target board	64-pin QFP	\$ 99
MSP-FET430P430	Parallel	Interface and target board	80-pin QFP	\$ 99
MSP-FET430P440	Parallel	Interface and target board	100-pin QFP	\$ 99
MSP-GANG430	Serial	Production programmer	All	\$ 199

¹Price per unit in U.S. dollars.

New tools are listed in bold red.

MSP-FET430 Flash Emulation Tool

- JTAG based real-time in-system emulation
- Target board, interface box, cable and samples
- CD-ROM includes IAR Kickstart
- USB and parallel cable versions available

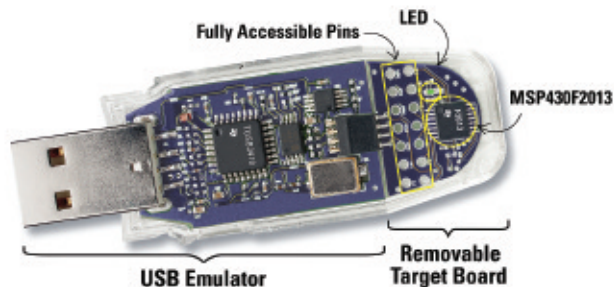
The Flash Emulation Tool (FET) supports complete in-system development and is available for all Flash devices. Programming, assembler/C-source level debug, single stepping, multiple hardware breakpoints, full-speed operation and peripheral access are all fully supported in-system using JTAG or Spy-Bi-Wire (USB tools only). The FET comes complete with everything required to complete an entire project.

MSP430 eZ430-F2013 Development Tool

NEW

Designing with the world's lowest-power MCU just got even easier with the new eZ430-F2013 complete development tool for only \$20. The platform provides all needed hardware and software in a portable USB stick enclosure. The eZ430-F2013 uses the included IAR IDE, providing full emulation with the option of designing a stand alone system or detaching the removable MSP430F2013 MCU target board to integrate into an existing design. The eZ430-F2013 supports all members of the MSP430F20xx family, one of the smallest MCUs available. The devices combine 16 MIPS and less than 1 microamp standby with the choice of performance analog converters and are code-compatible with all existing MSP430 platforms.

For more information visit www.ti.com/ez430.



Designing with the world's lowest-power MCU just got even easier.

Embedded Emulation with MSP430 MCUs

- Development is in-system and subject to the exact same characteristics of the final application
- Non-obtrusive in portable and high-pin count situations
- Common user software and physical interface

Today's applications operating at lower voltages, with tighter packaging and higher-precision analog, benefit greatly from the MSP430 MCU's in-system emulation approach. The MSP430 MCU's dedicated embedded emulation logic resides on the actual device itself and is accessed via JTAG or Spy-Bi-Wire using no additional system resources. From the first day of development, firmware engineers can now unobtrusively develop and debug their embedded code with full-speed execution, breakpoints, and single steps in an application.

Embedded emulation becomes even more important with high-performance mixed-signal systems that must maintain the integrity of microvolt analog signals. Signal integrity is virtually impossible with cumbersome in-circuit emulators that are sensitive to cabling crosstalk. And, unlike abstract background debuggers, no time-sharing of system serial communication resources is required with embedded emulation on the MSP430 device.

Integrated Development Environments

Texas Instruments and third party developers offer Integrated Development Environments (IDE) to program all MSP430 devices. Full C-compilers are available enabling customers to develop and debug code in seconds. Free, code-limited versions of IAR Embedded Workbench Kickstart and TI Code Composer™ Essentials are also available for download.

www.iar.com
www.ti.com/cce
mspgcc.sourceforge.net
www.pyton.com

www.rowley.co.uk
www.quadravox.com
www.imagecraft.com
www.htsoft.com

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page

support.ti.com

TI Semiconductor KnowledgeBase Home Page

support.ti.com/sc/knowledgebase

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Domestic www.tij.co.jp/pic

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Indonesia 001-803-8861-1006
Korea 080-551-2804
Malaysia 1-800-80-3973
New Zealand 0800-446-934
Philippines 1-800-765-7404
Singapore 800-886-1028
Taiwan 0800-006800
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