MSP430 Senior Design
MSP430 Ultra-Low-Power MCUs

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Agenda

• MSP430 Overview
• Tools
• Getting Started with IAR Workbench
• eZ430-RF2500
• Resources
Ultra-low Power + High-Performance

- 0.1µA power down
- 0.8µA standby mode
- 250µA / 1MIPS
- <1µs clock start-up
- Zero-power BOR
- <50nA pin leakage
- Modern 16-bit RISC CPU
- 1K to 128KB+ ISP Flash
- 14- to 100-pin options
- Intelligent peripherals boost performance
- Embedded emulation
MSP430 vs. Competitors

MSP430
- Ultra-low power MCU
- Less code space needed
- Real-time debugger
- Embedded emulation
- Highly integrated

Competitors
- Low-power but stripped down
- Less integrated
MSP430 Roadmap

Integration

Performance

Device
- Production
- Sampling
- Development
- Future

5xx-Next Gen
- 25 MIPS
- 32-256 KB
- USB-RF

2xx-Catalog
- 16 MIPS
- 1-120KB
- 500nA Stand By

1xx-Catalog
- 8 MIPS
- 1-60KB

4xx-LCD
- 8/16 MIPS
- 4-120KB
- LCD Driver

F = Flash
C = Custom ROM

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Most Common MSP430 in Schools...

- **MSP430F16x**

- Complete Signal Chain on Chip
- Coming Soon: MSP430F26x
  - 2xx Upgrade to F16x
Ultra-low Power Activity Profile

- Extended Ultra-low Power standby mode
- Minimum active duty cycle
- Interrupt driven performance on-demand

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Why *Ultra-low Power* Is Important

- Longer battery life
- Smaller products
- Simpler power supplies
- Less EMI simplifies PCB
- *Permanent* battery
- Reduced liability
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IAR Embedded Workbench V3.41A

• Kickstart Version – Free
  ▪ 4KB Limit on C code size
  ▪ Unlimited assembler code size
  ▪ Available from MSP430 web page
  ▪ Supported by TI PIC

• Baseline Version ~$795
  ▪ 12KB Limit on C code size
  ▪ Unlimited assembler code size
  ▪ Available and supported by IAR

• Full Version ~$2695
  ▪ Unlimited code size
  ▪ Available and supported by IAR

• All versions support all available MSP430 devices
Code Composer Essentials v2.0

- Professional Version – $250 University Price
- Kickstart Version – FREE
  - 8kB limit on C code
  - Available online
  - Supported by TI PIC
- Supports all MSP430 devices including eZ430-F2013
- Based on the Eclipse open-source platform
- Free upgrade to V2.0 for existing V1.0 users
- Available Today!
Embedded Emulation

- **Real-time in-system debug**
  - No application resources used
  - Full speed execution
  - H/W breakpoints
  - Single stepping
  - Complex triggering
  - Trace capability

- **Easy to use tools**

- **Spy Bi-Wire**
  - 2-wire debug interface
  - No pin function impact

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USB Flash Emulation Tool (FET)

- **MSP430 FET**: real-time debug and programming tool
- **Supports** *ALL* MSP430 devices
  - 4-wire JTAG
  - 2-wire Spy Bi-Wire
- **Available with socketed target board**
  - Example: MSP-FET430U14 = FET Interface + 14-pin target board
- **Supported by all MSP430 IDEs**
- **University Pricing**: $75 with board
  
  $49 interface alone
eZ430-F2013 Development Tool

• Complete development tool that fits in your pocket
• Supports **MSP430F20xx devices only**
  • MSP430F20xx devices available in DIP
• Unrestricted programming and debugging
• Fast, easy to use operation
• Includes IAR Kickstart IDE
• Supported by CCE V2
• $20
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IAR Workbench

• Startup screen
  - Click Create new project in current workspace

• Create new project
IAR Workbench

• Save Project
• Add files to your project
IAR Workbench

- Right Click on Project → Options
IAR Workbench

- Set the appropriate settings
IAR Workbench

- Right click on project → Rebuilt All
  - This will compile your project
IAR Workbench

- Project → Debug
  - This will automatically save your project and compile and download code through JTAG.
IAR Workbench: Debug Mode

• Click on Run
Agenda MSP430 Day 2007

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• eZ430-RF2500
• Resources
eZ430-RF2500. Wireless Made Easy.

- Star network stack included
- $49
- Coming October ‘07

Includes 2 RF targets & battery expansion board
eZ430-RF2500 Battery Board
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Important Documents

• **Datasheets**
  ▪ Technical Documents for every device

• **User Guide**
  ▪ How to use MSP430 guide
  ▪ Divided into families
    – 1xx
    – 2xx
    – 4xx

• **Code Example**
  ▪ Code examples by family products.

• **Application Notes**
  ▪ Sample applications on interfacing an MSP430
  ▪ Use it!
Tools Link

- www.ti.com/msp430
- www.ti.com/ez430
- www.sparkfun.com
Obtaining Samples?

- [www.ti.com/msp430](http://www.ti.com/msp430)
- Type “msp430fxxxx” in “Part Number”
designmsp430.com

- Website for 2006 MSP430 Design Contest
- ~100 complete designs available online to review and download
- Repository for student projects or research topics
- Project Submission will reopen shortly for MSP430 community development
- Eligible for ’07 Design Contest
- Several student design projects submitted
Summary

I hear, I forget;
I see, I remember;
I do, I understand.

Confucius

- MSP430 – easy to use tools and intuitive architecture turns academic theory into real world practice