PIC Lecture

Scott Herdic

September 28, 2005
Overview

• Microcontroller Overview
• Processor Architecture
• Product Families
• Microcontroller Comparison
• Microchip Development Tools
• Resources
## Microcontroller Overview

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<td>Sharp</td>
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Figure 1-1  Worldwide market share for producers of 8-bit microcontrollers, sorted by units shipped. (2002 Microcontroller Market Share and Unit Shipments, Tom Starnes, Gartner Dataquest, June 2003)
Microcontroller Overview

![Graph showing market share trends for Motorola and Microchip Technology from 1992 to 2002]

Peatman, John. *Embedded Design with the PIC18F452 Microcontroller*. Prentice Hall 2003
Figure 1-3  Microcontroller unit shipments per year, as distinguished by data word length (Dataquest).

Peatman, John. *Embedded Design with the PIC18F452 Microcontroller*. Prentice Hall 2003
Processor Architecture

- **Von Neumann**
  - Single data bus for instructions and data
  - Motorola HC11

- **Harvard**
  - Separate memory spaces for data and instruction
  - Fetch instruction and data simultaneously
  - Microchip PIC
Product Families

- 8-bit
  - PIC10
    - 6 pins, 2 MIPs, 768 Bytes
  - PIC12
    - 8 pins, 5 MIPs, 3584 Bytes
  - PIC16
    - 14 - 80 pins, 10 MIPs, 14336 Bytes
  - PIC18
    - 18 - 128 pins, 12 MIPs, 131072 Bytes
Product Families

• 16-bit: dsPIC30F
  – 18 to 80 pins, 30 MIPs, 144kB
  – Single Core Integrating MCU and DSP
    • FFT, Digital Filters, Matrix Operations
  – 16 x 16 Working Register Array
  – Three Operand Instruction: C =A+B
  – Optimized for C Programming
## Microcontroller Comparison

<table>
<thead>
<tr>
<th>Microcontroller</th>
<th>Max Speed</th>
<th>Internal Oscillator</th>
<th>Program Memory</th>
<th>Data EEPROM</th>
<th>RAM</th>
<th>ADC</th>
<th>Timers</th>
<th>Capture/Compares</th>
<th>Communication</th>
<th>Price</th>
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<tr>
<td><strong>Motorola HC11</strong></td>
<td>12 MHz</td>
<td>No</td>
<td>12 KB</td>
<td>512 Bytes</td>
<td>512 Bytes</td>
<td>8 - 8 bit</td>
<td>1- 16 bit</td>
<td>SCI</td>
<td>SPI</td>
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<td><strong>PIC12F683</strong></td>
<td>20 MHz</td>
<td>8 MHz</td>
<td>3584 Bytes</td>
<td>256 Bytes</td>
<td>128 Bytes</td>
<td>4 - 10 bit</td>
<td>2 - 8 bit</td>
<td>1</td>
<td>No</td>
<td>$1.47</td>
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<td><strong>PIC16F916</strong></td>
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<td>8 MHz</td>
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<td>256 Bytes</td>
<td>352 Bytes</td>
<td>5 - 10 bit</td>
<td>2 - 8bit</td>
<td>1</td>
<td>AUSART I2C</td>
<td>$2.71</td>
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<td><strong>PIC18F4520</strong></td>
<td>40 MHz</td>
<td>8 MHz</td>
<td>32 KB</td>
<td>256 Bytes</td>
<td>1536 Bytes</td>
<td>13 - 10bit</td>
<td>1-  8bit</td>
<td>AUSART I2C</td>
<td>SPI</td>
<td>$5.79</td>
</tr>
</tbody>
</table>
Development Tools

• **MPLAB IDE**
  – Integrated Development Environment
  – Free Download (http://www.microchip.com)

• **MPLAB SIM** – Simulate Program in MPLAB
  – Included with MPLAB

• **ICD2** – *InCircuit* Debugger
  – Debugger/Programmer
  – $159

• **PICSTART Plus**
  – Programmer for all DIP packages
  – $199
Visual Initializer
Visual Initializer
ICD2

- Debugger/Programmer
- Integrates with MPLAB
- Works in Application Circuit
- Allows:
  - Pause Program
  - Set Breakpoints
  - Examine Register/Variable Values
  - Modify Register/Variable Values
- Occupies 2 I/O pins
- USB and Serial Interface w/ PC
- Cost: $159 from Microchip
PICSTART Plus

- Programmer
- Remove chip for programming
- Works on DIP packages
- Integrates with MPLAB
- Cost: $199 from Microchip
Microchip Resources

• Microchip Website: http://www.microchip.com
  – Product Data Sheets, Application Notes, Development Tools, Discussion Forum

• Embedded Design with the PIC18F542 Microcontroller
  – http://www.picbook.com

• ECE4175 – Embedded Microcontroller Design