Choosing an MCU

ICOM-5217
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Introduction

- Choosing the right MCU: A Difficult Task
  - Wide Selection of Vendors
  - Large Number of Alternatives
    - CPU Architecture/Programming
    - Embedded peripherals
    - Cost
    - Power
    - Packages
- Try a Search in the DigiKey on-line Catalog
  - More than 16,000 entries for “Microcontroller”
MCU or MPU?

- Let your application dictate the needs & requirements for the system CPU

**Critical Indicators**

1. **Systems Specs**
2. **Memory**: Large
3. **Processing Speed**: Fast
4. **Peripheral Required**
   - **I/O Type**
   - **Bus Type**

**Microprocessor Selection Process**
Classic Microprocessor-based Systems

Microcontroller-based Systems
Embedded Microprocessors Systems

Typical MCU Structure
Core CPU Architecture

- **Word Width**
  - Data resolution
  - Computing power

- **Register Structure**
  - How many?
  - Register types
    - Accumulator-based Vs. Register File Vs. Load/Store
  - Stack type and depth

- **Assembly Language Structure**
  - CISC Vs. RISC

- **Bus Architecture**
  - Harvard Vs. Stanford (Von Neuman)
  - Internal Vs. External

Programmability

- **Programmability**
  - Prefer FLASH devices
    - Many erase/reprogram cycles
    - On-board reprogrammable
  - Other types:
    - EEPROM
    - EPROM
    - OTP
  - External Memory
    - FLASH/EEPROM
    - RAM
    - EPROM
On-chip Peripherals (1/2)

- I/O ports
  - Number of I/Os
  - Individually or byte programmable
  - Driving capability

- Timers
  - Number of Timers
  - Counting bits
  - Prescaler(s)
  - Operating modes:
    - Event/timer
    - Watchdog

On-chip Peripherals (2/2)

- UARTs/USARTs
  - Clocking sources
  - Baud rate generation

- Data Converters
  - Resolution (No. of bits)
  - Analog Channels
  - Conversion Method
  - Speed
  - Referencing

- Other
  - PWM
  - Comparators
  - I²C, CAN, USB, etc.
  - JTAG, BlueTooth, 802.11
Other Considerations

- Physical Packaging
  - Important for prototyping
  - PLCC, QFP, BGA, DIP

- Supply voltage
  - Compatibility with add-on components

- Memory
  - Program memory
  - Data memory
    - Application requirements
  - Word width

- Powerdown Modes
  - Sleep/wake-up

Embedded MPU

Examples
Product Selection Guides

- Allow choosing specific members within a family

Table 1.1. Product Selection Guide

<table>
<thead>
<tr>
<th>Product</th>
<th>Memory Status</th>
<th>RAM</th>
<th>Flash Memory Status</th>
<th>ISP</th>
<th>UART</th>
<th>JTAG</th>
<th>Parallel Port</th>
<th>SPI</th>
<th>USB</th>
<th>Voltage</th>
<th>Package</th>
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<tbody>
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<td>8K</td>
<td>128KB</td>
<td>16K</td>
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<td>3.3V</td>
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</tr>
</tbody>
</table>

**MSP430 Microcontrollers**

Development Tools

- Availability of Development Kits
  - Most Kits can be purchased for $50 or less
- Minimum Contents
  - Development Board
  - IDE/Emulator
  - Assembler
  - C-Compiler
Resources

- [http://www.instructables.com](http://www.instructables.com)
- [http://www.microchip.com/stellent](http://www.microchip.com/stellent)
- [http://archive.chipcenter.com/circuitcellar/march01/c0301cg1.htm](http://archive.chipcenter.com/circuitcellar/march01/c0301cg1.htm)