An Overview of the Motorola 68HC11
A Little History

- Computers – MicroProcessors – MicroControllers
  Old! 1970 1974

- MicroControllers are defined by ‘integration’. They are not simply MicroProcessors (although they contain them), they have many other devices integrated into the same chip.

- The Motorola 68HC11 is upwardly compatible with the original Motorola 6800. There are some interesting ‘features’ which resulted from the effort to maintain compatibility.
A Typical MicroController System

Overview
The MCU (MicroController Unit)
The CPU
Overview

- Hardware:
  - 8 Kbytes of ROM (for version A8) (version A1 has none)
  - 512 Bytes of EEPROM
  - 256 Bytes of RAM (These are dependant on the specific chip)
  - 16 Bit timer (Three input capture, five output compare, prescaler)
  - 8 Bit Pulse Accumulator Circuit
  - Serial Communications Interface
  - Serial Peripheral Interface
  - 8 Channel, 8 bit Analog-to-Digital Converter
  - Real Time Interrupts
  - Watchdog timer
Block Diagram of the 68HC11
Chip Package
Programmer’s Model: CPU Registers

8-BIT ACCUMULATORS A & B
OR 16-BIT DOUBLE ACCUMULATOR D
INDEX REGISTER X
INDEX REGISTER Y
STACK POINTER
PROGRAM COUNTER
CONDITION CODES
CARRY/BORROW FROM MSB
OVERFLOW
ZERO
NEGATIVE
1-INTERRUPT MASK
HALF CARRY (FROM BIT 3)
X-INTERRUPT MASK
STOP DISABLE
What is a Register?

- Registers are specialised locations that the CPU uses to read or write a binary number.

- In the 68HC11, all registers are 8 or 16 bits wide.

- Registers may have different functionality on read and write (some bits may have no functionality at all!)

- Registers are used both by the CPU and the I/O subsystem.
## Memory Map

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>DEVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0000-$01FF</td>
<td>68HC11E family on chip RAM, $0000-$00FF for A family</td>
</tr>
<tr>
<td>$2000-$3FFF</td>
<td>Chip Select for external devices.</td>
</tr>
<tr>
<td>$4000-$5FFF</td>
<td>8K EEPROM, U4</td>
</tr>
<tr>
<td>$6200</td>
<td>Port G</td>
</tr>
<tr>
<td>$6202</td>
<td>Direction register for port G</td>
</tr>
<tr>
<td>$6201</td>
<td>Port F</td>
</tr>
<tr>
<td>$6203</td>
<td>Direction register for port F</td>
</tr>
<tr>
<td>$6400-$87FF</td>
<td>used by system, not available to users</td>
</tr>
<tr>
<td>$8800-$FFFF</td>
<td>30K emulation RAM for user code</td>
</tr>
<tr>
<td>$B600-$B7FF</td>
<td>512 byte EEPROM</td>
</tr>
</tbody>
</table>
How do we play with it?

• EVBPlus2 Evaluation Board
• Operates tethered to a PC
  – We write code on the PC, download to the board, run on the 68HC11

• EVB2 includes:
  – Debugger ROM
  – Extra RAM
  – 68HC24 Port Replacement Unit
  – RS232 level shifters
  – 7-Segment Displays
  – LEDs and DIP Switches
  – Potentiometer
  – LCD
  – IR Serial Transceiver