68HC11 Operating Modes
Modes

• Single-Chip
• Expanded Multiplexed
• Special Bootstrap
• Special Test
Setting the Mode

- Use pins MODA and MODB (on the EVBPlus board, these are configured using jumpers)

<table>
<thead>
<tr>
<th>TABLE 5.3</th>
<th>MODE SELECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input pins</strong></td>
<td><strong>MODE selected</strong></td>
</tr>
<tr>
<td>MODA</td>
<td>MODB</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Single-Chip Mode

• In single chip mode, only resources available on the 68HC11 are used

• Therefore, no external address or data bus is needed

• Therefore, all ports are available for I/O

• Saves costs, and can improve reliability
Expanded Multiplexed Mode

- In expanded mode, ports B and C are used for the address and data buses.

- Port C serves a dual (multiplexed) purpose; It carries the low byte of the address, as well as the byte of data (not at the same time though!)

- The EVBPlus board runs in expanded mode.

- This mode is generally used when more memory or I/O is needed than that provided on-chip.
Expanded Multiplexed Mode 2

- This mode also uses pins strobe A/Address strobe (STRA/AS) and strobe B/read/write (STRB/R/W)
- These form part of the control bus
- In single chip mode these pins are STRA and STRB
- In expanded multiplexed mode, they are used as AS and R/W
Expanded Multiplexed Mode 3

- Multiplexing Pros: Reduces total pin count
- Multiplexing Cons: Usually requires additional hardware to demultiplex the address and data signals
- 68HC11 N-series has a nonmultiplexed bus system (but more pins!)
Special Bootstrap Mode

• Used to run a program stored externally to the Microcontroller

• Commonly used for running test code, EEPROM programming, running a monitor program or calibration.

• When in Bootstrap mode, the interrupt vector table is replaced with the bootstrap mode interrupt vectors

• The Bootstrap ROM is 192 bytes with address range $BF40 to $BFFF
Memory Map

- $0000: 256 Bytes RAM
- $00FF: 64-Byte Register Block
- $1000: 512 Bytes EEPROM
- $8600: 8 KBytes ROM
- $E000: Special Test
- $FFFF: Normal Modes Interrupt Vectors
- Special Modes Interrupt Vectors
- Single Chip
- Expanded
- Bootstrap

Monday, 22 April 13
Bootstrap Operation

START

ROM
Bootstrap Program Code

get more code

Program Code in Off-line Memory

RAM

and load it into RAM

then execute it

then execute it
Bootstrap Operation: 68HC11

Get 256 bytes from serial port and transfer them to RAM (Page 0)
Special Test Mode

• This mode is primarily intended to allow Motorola to test the chip at the factory

• There is very little documentation about this mode, as it is not intended to be used by anyone but Motorola

• This procedure is used in modern IC design to detect and correct faults.
Minimal Circuit Layout: Single Chip

Jumpers J1, J2 shown for single-chip mode,