CPU08	The CPU08 Central Processing Unit M68HC08 and HCS08 microcontrollers
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- Features of CPU08
- Architecture Overview
- Addressing Modes
- A note on assemblers
- CPU08 Instruction Summary

## Features of CPU08

- CPU08 is an 8-bit architecture
- 8-MHz CPU standard bus frequency
- 64-Kbyte memory space
- Fully object-code compatible with the M68HC05
- Instructions designed around stack manipulation
- 16 addressing modes
- Instructions capable of moving data from memory-to-memory without using the accumulator
- Extensible addressing range beyond the 64K boundary















CPUU8
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## Indexed Addressing Example

- The following example shows the three different modes of index addressing
  LDA ,x ; no offset
  ; load value pointed to by HX
  LDA \$FF,x ; 8-bit offset
  ; load value pointed to by
  - ; HX + \$FF
  - LDA \$1000,x ; 16-bit offset
    - ; load value pointed to by
      - ; HX + \$1000

## Stack Pointer Addressing

- Indexing off of the Stack Pointer is done much the same way as Indexed Addressing
- If interrupts are off, this mode allows the Stack Pointer to be used as a second index register

# **Relative Addressing**

- Relative addressing is done relative to the current value of the Program Counter (PC)
- The CPU automatically adds a signed offset (-128
- to 127) to the PC
- The offset gives the relative address starting from the address location following the current branch instruction
- Only conditional branch instructions use this addressing mode

#### Memory to Memory Add

- Memory to Memory is expensive - Is a three-byte, four cycle operation
- But is less expensive than having to save the contents of the accumulator
- Moving Memory with Accumulator takes 9 cycles:

  - PSHA ; (2 cy) save contents of A LDA #\$55 ; (2 cy) load A with data
  - STA \$10 ; (3 cy) save A into memory
  - PULA ; (2 cy) restore A
- Moving Memory with MOV takes 4 cycles: MOV #\$55, \$10 ; (4 cy)

## Memory to Memory cont.

- · Moving memory using Direct to Direct mode also saves time
  - 10 cycles for doing so with accumulator - 5 cycles for doing so using MOV
- This is a valuable addressing mode because the contents of the accumulator are not changed
- · Savings can be substantial with a lot of data movement

# A Note on Assemblers

- The programmer generally does not need to keep in mind which mode of Index, Relative, or SP addressing mode to use
- For instance, the assembler can automatically select no offset, 8-bit, or 16-bit Index addressing mode
- The assembler can also calculate offsets for Relative Addressing mode, and verify that they are within range

#### **Resets and Interrupts**

 CPU is designed in a way as to execute instructions sequentially

- However, external events such as interrupts and resets are asynchronous to program execution and require special handling by the CPU
- Reset is the mechanism by which we force (initialize) the CPU into a known state. This includes loading the Program Counter (PC) from a pre-defined non-volatile memory location to start execution from a known state
- Interrupts temporarily suspend normal program execution and cause the CPU to switch context to service the interrupt
- The CPU08 has up to 128 different interrupt sources















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