

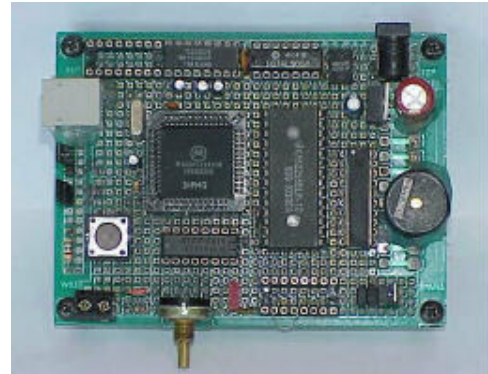
HC-11 Evaluation Board

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Build a low-cost learning board, HC-11 EVB for studying the MOTOROLA 68HC11A1 Assembly and C language programing. Downloadable Buffalo V3.4 through the use of Randy's S19 Downloader.

Introduction

After reading the [Mobile Robots Book](#), written by Joseph L. Jones and Anita M. Flynn, and get the Interactive-C file from <ftp://cher.media.mit.edu>, I found a very nice S19 downloader written by Randy Sargent. I started to download the pcode to my HC-11 board, and run Interactive C. No problem with my board, it works very nice. Then I got the idea for the Buffalo monitor, to use Randy's Downloader writes the S19 file of the Buffalo with special boottrap mode. After changing to expanded mode, press reset, the buffalo prompt appeared. It also works even the circuit was very simple. I thought, I should provide the page for making the board for studying Assembly and C first, and another page, with additional sensor board, for Rug Warrior Robot experiment. The materials herein is for beginners to practice build the microcontroller by themselves.



Hardware

A circuit diagram of the HC-11 EVB is depicted in Figure 1. MODA and MODB pin can be used to configure four operating modes, i.e., special boottrap, special test, expanded and single chip modes. To use with Buffalo monitor, we use only two modes, special boottrap with both pin low for downloading the Buffalo and the expanded mode with both pin logic high for experimenting under Buffalo. A 32kB SRAM 62256 uses 15 lines address, A0-A14, while A15 and E pins connect NAND gate, 74HC00, to CE pin. This makes the address space of the SRAM to be 8000H-FFFFH, i.e., A15 must be '1' to enable 62256. The Latch 74HCT373 provides A0-A7 to the SRAM. Carefully see the connection for input data and the output latch, if you find 74HC573, the connection may easier. The RS232 Level converter uses DS275 or MAX232, whichever you find. ULN2003 is used for LED driving and also for small DC motor experimenting with PWM. The i/o port left for experiment are port E analog input, port A and port D.

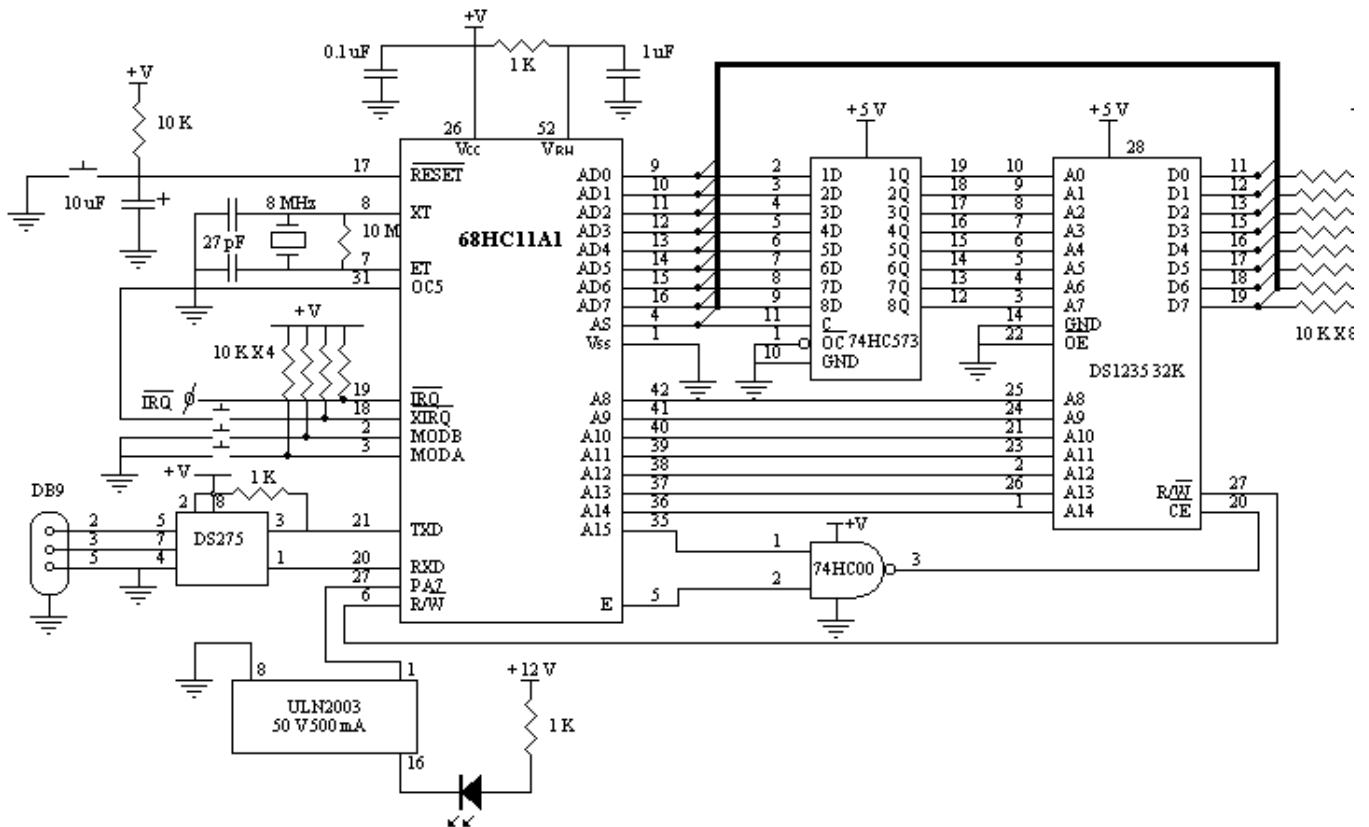


Figure Figure 1: Circuit Diagram of the HC-11 Evaluation Board

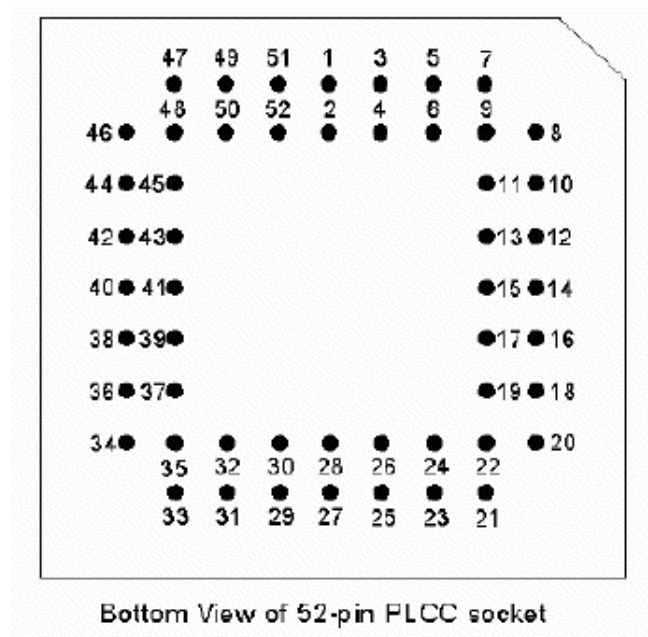


Figure 2: PLCC Socket for Universal PCB Soldering

Software

Randy'S19 Downloader, [dl.exe](#), is used for downloading the [Buf34.s19](#) into the HC-11'32kb SRAM, \$E000-\$FFFF. The downloader works well under DOS mode. To download Buffalo, first, put the 68HC11 to bootstrap loading, by making MODA and MODB to GND, then invoked;

```
c:./buffalo/dl buf34<
```

After success downloading, change operation mode to normal expanded mode, i.e., left MODA and MODB high. Run any terminal emulation program with 9600 8n1, that all. Figure 4 shows example of Buffalo monitor functions. Study also the buffalo source code, Buf34.asm, and use of [As11.exe](#), the 68HC11 Assembler, for experimenting with Assembly programming. See [AS11 reference manual](#) for details.

```

HC-11 EVB - HyperTerminal
File Edit View Call Transfer Help
P-9005 Y-008D X-4A20 A-20 B-18 C-90 S-0041
P-9005 9000
>
BUFFALO 3.4 (ext) - Bit User Fast Friendly Aid to Logical Operation
>asm 9000
9000 LDAA #29      >ldaa #29
      86 29
9002 ADDA #01     >adda #1
      8B 01
9004 DAA         >
9005 JMP $E000   >.
>t
LDAA #29        P-9002 Y-008D X-4A20 A-29 B-18 C-90 S-0041
>
ADDA #01        P-9004 Y-008D X-4A20 A-2A B-18 C-90 S-0041
>
DAA             P-9005 Y-008D X-4A20 A-30 B-18 C-90 S-0041
>
JMP $E000      P-E000 Y-008D X-4A20 A-30 B-18 C-90 S-0041
>
Connected 0:09:51  Auto detect  9600 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo

```

Figure 3: Using Line Assembler and Trace commands

Using NVSRAM

If you use a 32kB SRAM, the buffalo will lost when the HC11 board has switched off. NVSRAM, however, provides a small battery backup, after success downloading the buffalo, thus no need to reboot and load the buffalo provided the board was properly operated, otherwise, reload the buffalo again. Such NVRAMs found are DS1230, DS1235, say.

Single Stepping

Buffalo also has a command for single stepping code, i.e., t command. To use this command, connects PA7 and /XIRQ together. Single stepping is useful for studying the HC11 instruction set and program operation.

HC-11 EVB Links

- [68HC11 Microcontroller Resources](#) : useful information and Assembler, free C compiler for 68HC11.
- [Hot-Tub Controller](#) : buffalo and AS11 manual, FORTH, design example.
- [HANDY BOARD](#): MIT's 68HC11 controller board designed by Fred Martin.

Credit

DL.exe, the Motorola S19 downloader, was written by Randy Sargent.

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