NES Programming

Mike Moss

NES Virtualization

Mike Moss

Overview

- Graphical Capabilities/Limitations
- Tools
- Assembly Basics
- Programming
  - Drawing Sprites
  - Gamepad Input
- Using Programs on a Real Nintendo

Graphical Capabilities/Limitations

- ## Screen
  - 256x240 Resolution
  - Horizontal Scanlines (240)
- ## Memory
  - PRG-ROM - 32 KB (2 Banks)
  - CHR-RAM - 8 KB
  - MMC's (later) could be used to extend these values

Graphical Capabilities/Limitations

- Sprites
  - 8x8 and 8x16
    - 8x16 are two memory locations.
    - All sprites must be aligned to the same memory size, so 8x8 sprites take up a 8x16 position.
  - Max of 64 sprites on the screen at one time.
    - Max of 8 sprites per scanline.
    - More causes flickering.

Graphical Capabilities/Limitations

- Colors
  - 4 colors per sprite (technically 3, the fourth is transparent).
  - Store up to 48 4-color palettes.
  - Max of 56 colors total (...yea…).
  - 25 colors max per scanline.
    - Note, each sprite can have up to 3 colors.
    - 8*3=24, which is the max-1.

Tools

- Emulator
  - fceu - Nintendo Emulator
- Assembler
  - xa - Don't use this...
  - tasm - Don't use this...
  - nesasm - Nintendo assembler.
- Graphic Tools
  - Palette Generator - Not really needed...
  - yy-chr - You will need this...

Assembly Basics

Lets program!

Programming

Lets program!

Using Programs on a Real Nintendo

- Inside of a cartridge.

Using Programs on a Real Nintendo

- Several Types:
  - MMC1
  - MMC2
  - MMC3
  - MMC4
  - MMC5
  - MMC6

Using Programs on a Real Nintendo

- ## MMC1
  - ### PRGROM 2x16 KB banks.
  - ### CHRROM 2x4 KB banks.

Using Programs on a Real Nintendo

- ## MMC2
  - ○ PRGROM 1x8 KB bank (24KB locked).
  - ○ CHRROM 2x4 KB banks.

Using Programs on a Real Nintendo

- # MMC3
  - ## PRGROM 2x8 KB banks.
  - ## CHRROM 2x2 KB and 4x1 KB banks.

Using Programs on a Real Nintendo

- ## MMC4
  - ### PRGROM 1x16 KB bank (16KB locked).
  - ### CHRROM 2x4 KB banks.
  - ### Battery powered SRAM.

Using Programs on a Real Nintendo

- ## MMC5
  - Just speculation, increased memory.
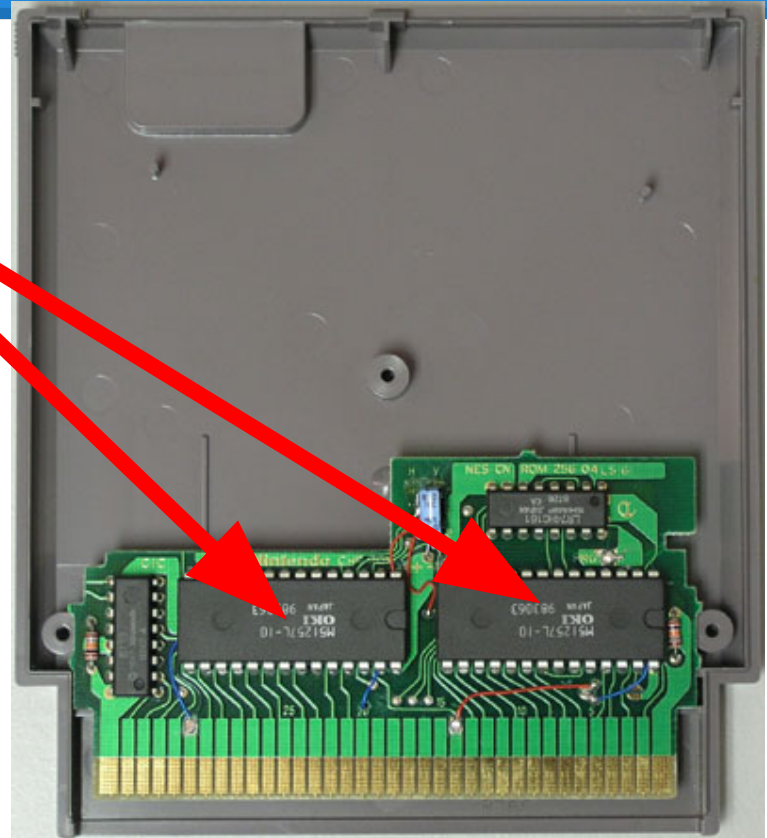 - Extra 1 KB of RAM.

Using Programs on a Real Nintendo

- ## MMC6
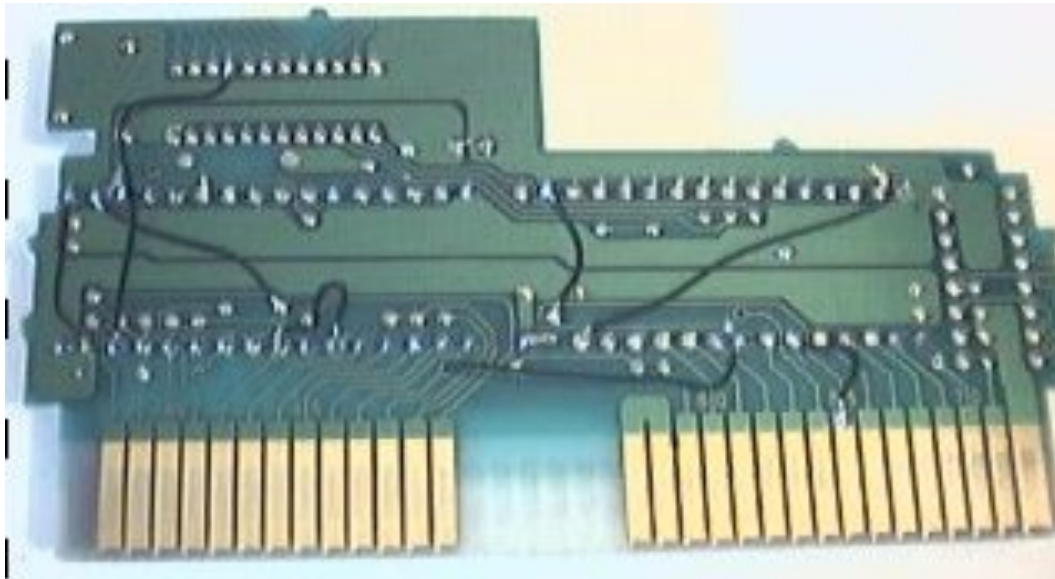 - Same as MMC3.
  - Extra 1 KB of RAM.

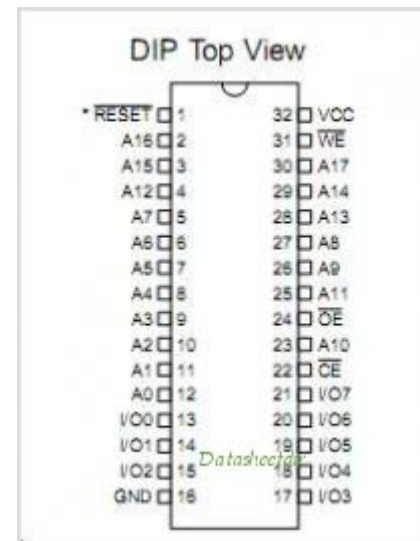# Using Programs on a Real Nintendo

- Unsolder these.
- Solder in sockets.

Using Programs on a Real Nintendo

● Change some of the traces.

Using Programs on a Real Nintendo

- Buy two AT49F002 chips.

DIP Top View

* RESET □ 1	32 □ VCC
A16 □ 2	31 □ WE
A15 □ 3	30 □ A17
A12 □ 4	29 □ A14
A7 □ 5	28 □ A13
A6 □ 6	27 □ A8
A5 □ 7	26 □ A9
A4 □ 8	25 □ A11
A3 □ 9	24 □ OE
A2 □ 10	23 □ A10
A1 □ 11	22 □ CE
A0 □ 12	21 □ I/O7
I/O0 □ 13	20 □ I/O6
I/O1 □ 14	19 □ I/O5
I/O2 □ 15	18 □ I/O4
GND □ 16	17 □ I/O3

Datasheet

Using Programs on a Real Nintendo

- Buy a universal EEPROM programmer.

Using Programs on a Real Nintendo

- Process *.nes file through ReadNES.
- Upload program data to one chip.
- Upload resources to other chip.

Questions?

Sources

- https://helloacm.com/tutorial-1-c-programming-for-6502-8-bit-cpu/
- http://www.cc65.org/doc/funcref-84.html
- http://anton.maurovic.com/posts/nintendo-nes-gamedev-part-1-setting-up/
- http://atariage.com/forums/topic/154232-cc65-link-error/
- http://forums.nesdev.com/viewtopic.php?t=8493&start=30
- http://skilldrick.github.io/easy6502/
- http://patater.com/gbaguy/nesasm.htm
- http://wiki.nesdev.com/w/index.php/PPU_registers
- http://wayofthepixel.net/index.php?topic=10784.5
- http://fms.komkon.org/EMUL8/NES.html
- http://wiki.nesdev.com/w/index.php/PPU_palettes
- http://callanbrown.com/index.php/basic-nes-reproduction
- http://www.raphnet.net/electronique/nes_cart/nes_cart_en.php
- http://www.kevinselwyn.com/ReadNES/