

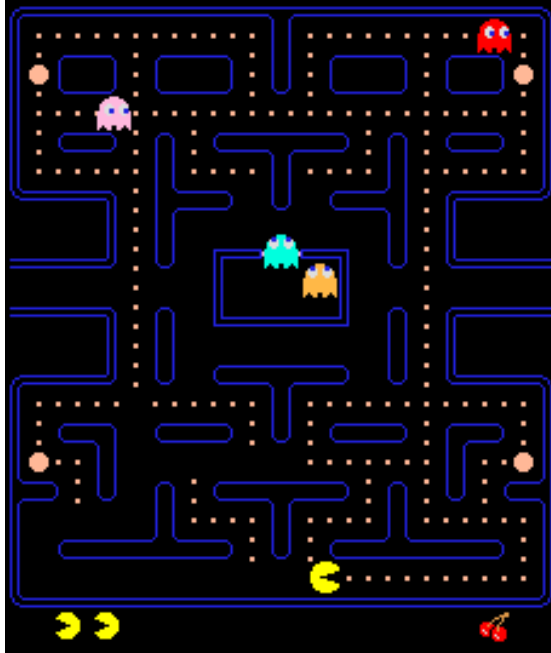
# Sprite Graphics

Stephen A. Edwards

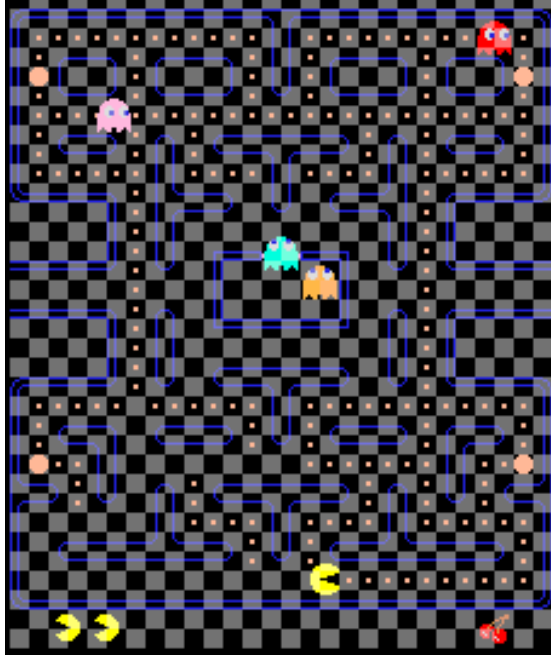
Columbia University

Spring 2019

360 HIGH SCORE 4600



360 HIGH SCORE 4600



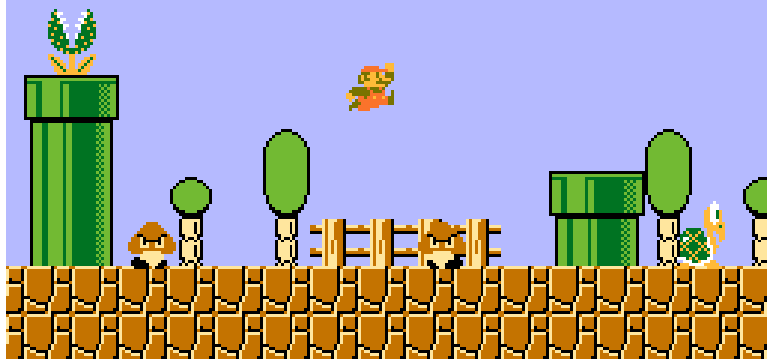
MARIO  
000700

0 x 01

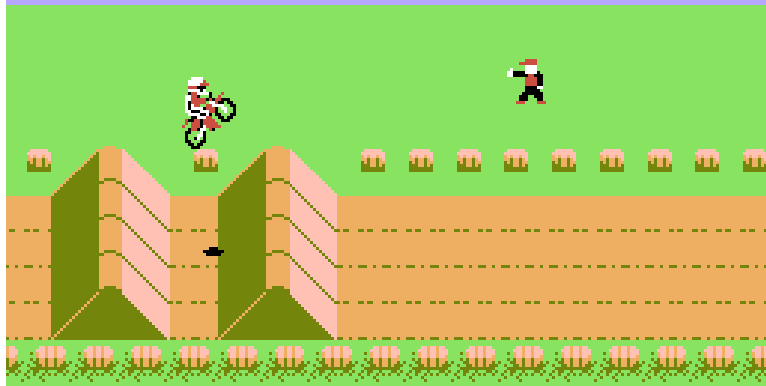
WORLD  
8-1

TIME  
242

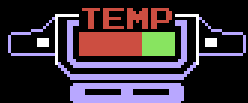
0 0



NINTENDO



3RD  
1:24:00



TIME  
0:13:15

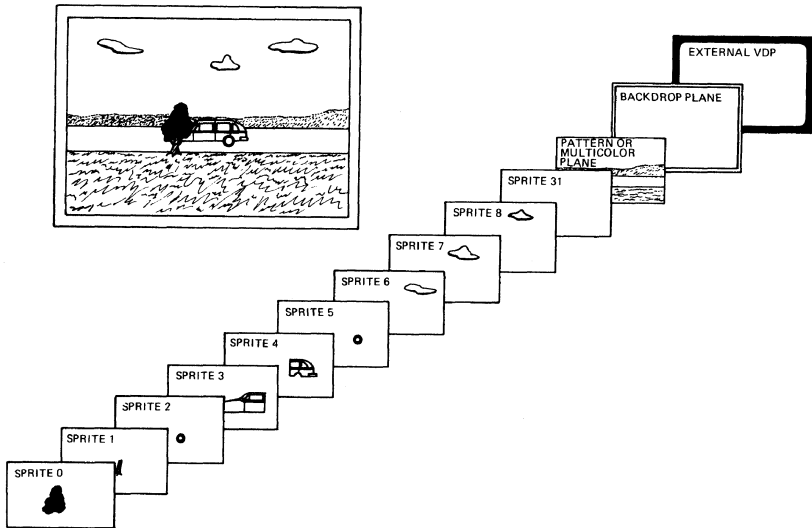
TUNNELS



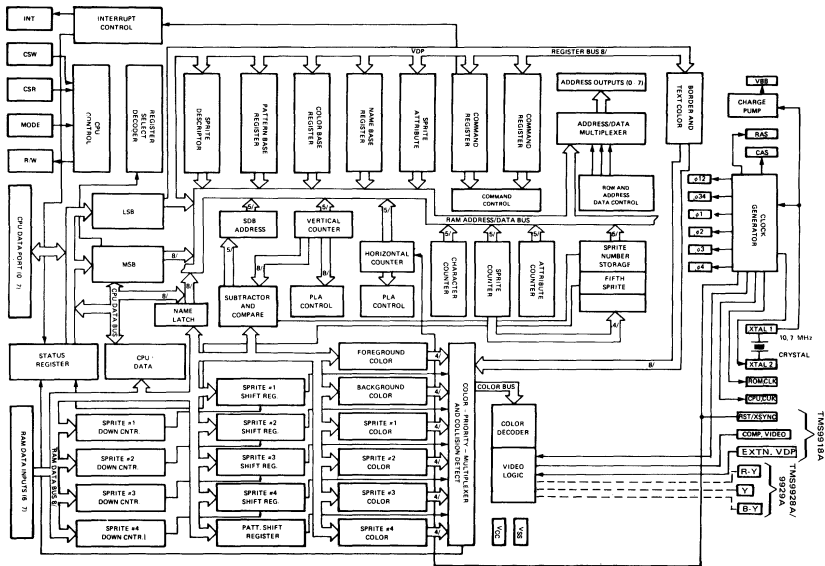
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TEXAS INSTRUMENTS

# TMS9918 Video Display Processor

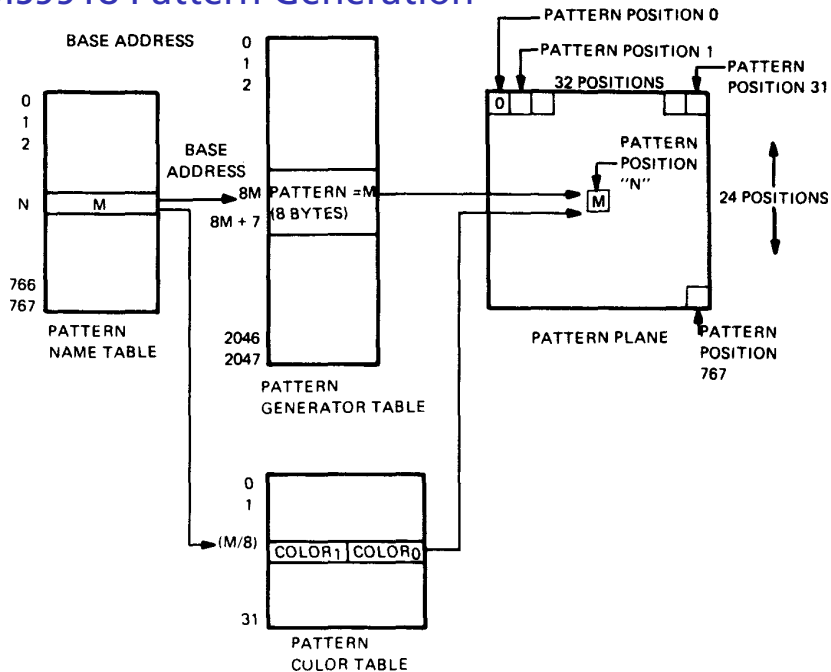


# TMS9918 Video Display Processor

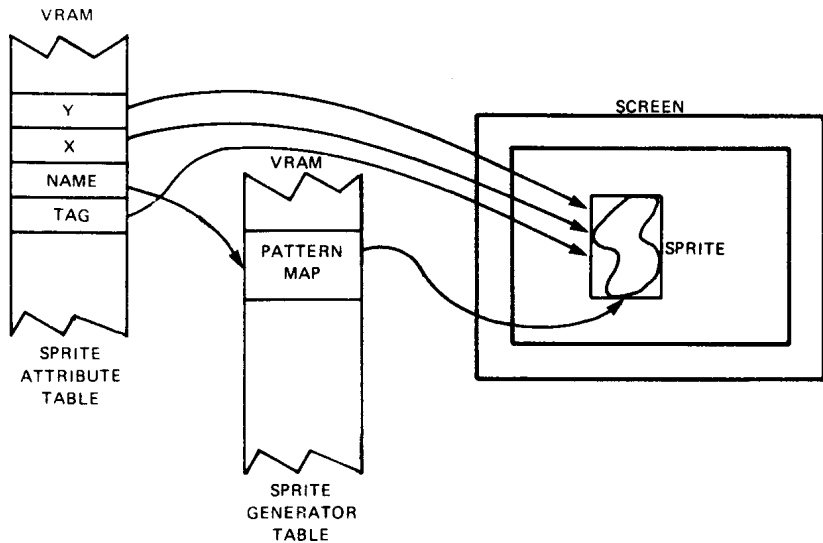




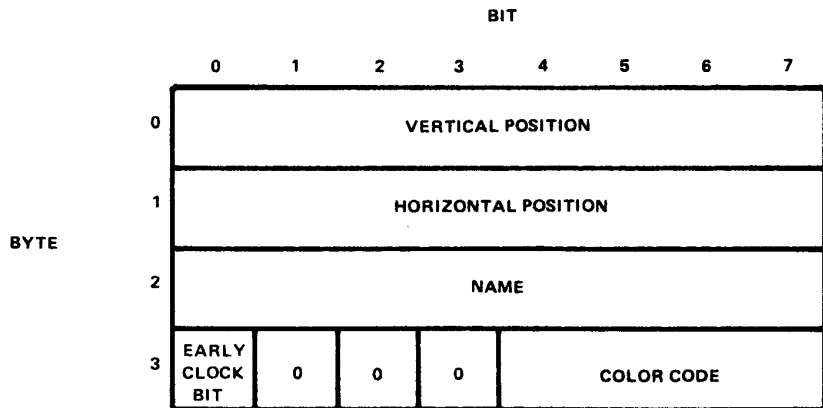
# TMS9918 Pattern Generation



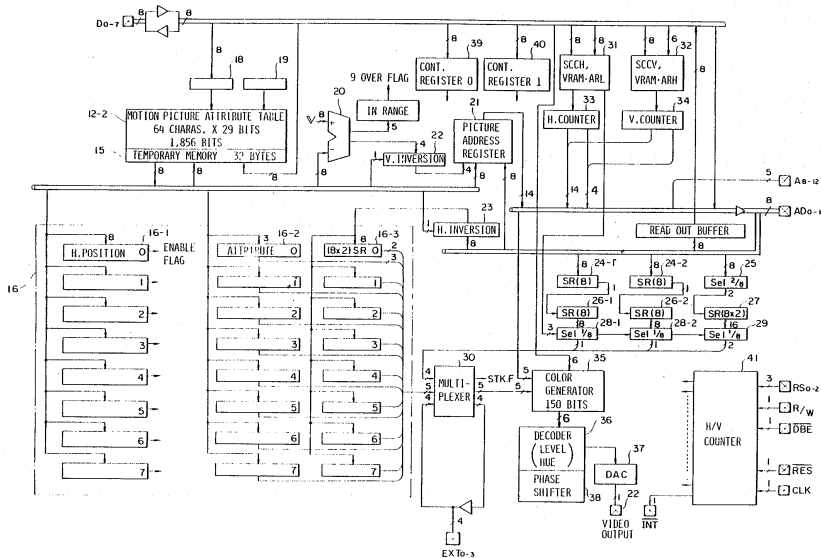
# TMS9918 Sprite Generation



# TMS9918 Sprite Attribute Table Entry



# Nintendo NES/Famicom

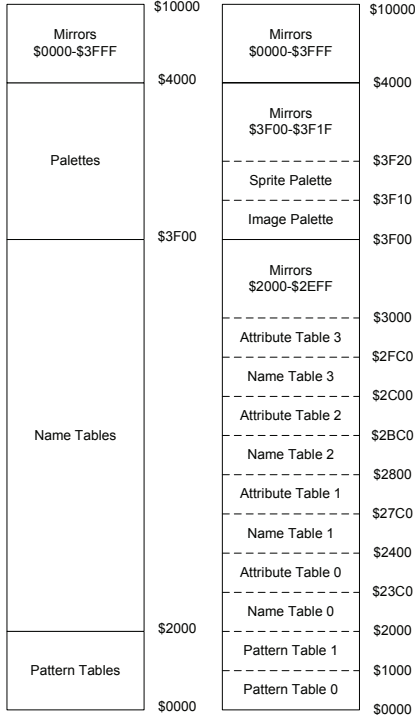


# Basic Operation

For each line,

- ▶ Fetch color palette
- ▶ Fetch tiles
- ▶ Fetch tile bitmaps
- ▶ Read sprite location data for 64 sprites
- ▶ Save and prioritize up to 8 visible sprites

# Video RAM Memory Map



Palettes: Groups of 16 colors selected from  $\approx 60$

Name Table: Tile numbers

Attribute Table: Extra tile color information

Pattern Table: Tile bitmaps

## A Sprite Attribute Table Entry

64 sprites max; 8 per line max

|                      |  |                 |  |          |  |   |   |   |    |  |    |  |            |  |  |
|----------------------|--|-----------------|--|----------|--|---|---|---|----|--|----|--|------------|--|--|
| 7                    |  |                 |  |          |  |   |   | 0 |    |  |    |  |            |  |  |
| Y coordinate         |  |                 |  |          |  |   |   |   |    |  |    |  |            |  |  |
| Tile (bitmap) number |  |                 |  |          |  |   |   |   |    |  |    |  |            |  |  |
| Vertical Flip        |  | Horizontal Flip |  | Priority |  | 0 | 0 | 0 | b3 |  | b2 |  | color bits |  |  |
| X coordinate         |  |                 |  |          |  |   |   |   |    |  |    |  |            |  |  |

Tiles are  $2 \times 8$  bytes each. First 8 are bitmaps of LSB color value, next 8 are next color bit.

# References

Steven Collins. Computer Graphics during the 8-bit Computer Game Era. Siggraph Newsletter, 32(2) May 1998.

NES Development <http://nesdev.parodius.com>

NES Palette Generator

[http://nesdev.parodius.com/kevin\\_palette.txt](http://nesdev.parodius.com/kevin_palette.txt)

Nintendo Entertainment System Documentation v. 0.40.

[http://db.gamefaqs.com/console/nes/file/nes\\_tech.txt](http://db.gamefaqs.com/console/nes/file/nes_tech.txt)

Patrick Diskin, *Nintendo Entertainment System Documentation, Version 1.0*, August 2004, <http://nesdev.parodius.com/NESDoc.pdf>

Ueda et al. TV Game System Having Reduced Memory Needs. United States Patent #4,824,106. April 25, 1989.