

# VT03

## Console and One Bus System

### (Real 16 colors or Virtual 64 colors)

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## Features

### System

- CPU: 6502
- Internal Program RAM: 2K Bytes
- Internal Video RAM: 2K Bytes
- DMA (Sprite and Background)
- One Bus Mode, 8 bits data bus or 16 bits data bus
- Multiple control of IRQ
- Programmable timer
- Bank decoder for expandable memory up to 32M Bytes
- T.V. signal output (NTSC, PAL)
- 8 bits data bus mode has auxiliary 16 I/O pins and 16 bits data bus mode has auxiliary 8 I/O pins.

### Peripheral Applications

- Joystick
- RS232 serial port built-in.

### Graphic Processor

- Resolution: 256x240 pixels
- 64 sprites in one frame
- Background color can be 16 colors (4 color sets) or 4 colors (4 color sets).
- Sprites with 16 colors (4 color sets), have 8X8 or 8X16 character size, and with 4 colors (4 color sets), have 8X8, 8X16, 16X8, 16X16 character size.
- Color palette has 25 or 121 colors.

### Sound Generator

- 4 Rhythm channels,
- 2 Low frequency channels,
- 2 Noise channels ,
- PCM or DWS DMA built-in.

## General Description

VT03 includes the CPU, Graphic Unit, Sound Unit, two internal 2KBytes SRAMs, and some I/O controller. There are two main systems in VT03, program system and video system.

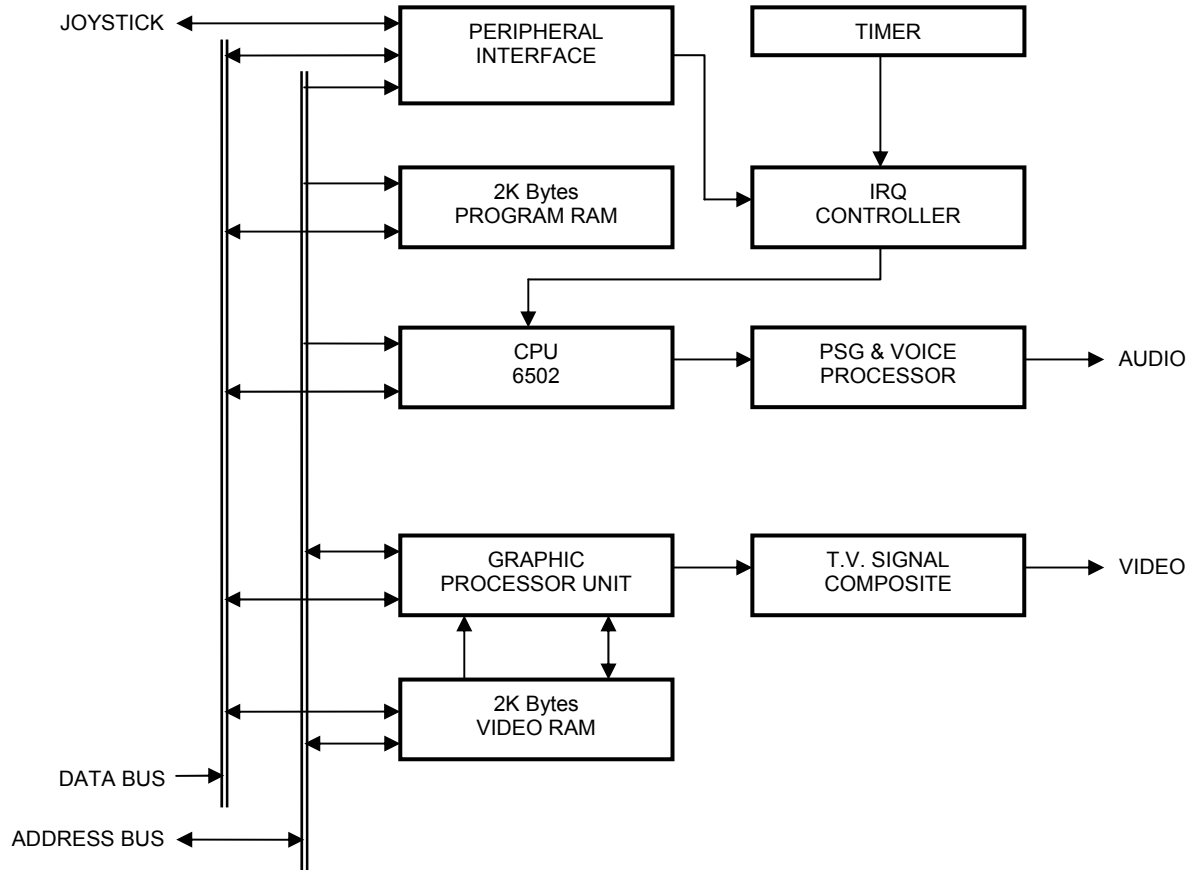
CPU plays the key role in program system. It can access the internal and external program memories. The program memory stores the program command, instructions, and sound data. VT03 is equipped with a 2KByte SRAM as internal program memory. This program RAM will be the zero page RAM, STACK and some memory of CPU. Program system controls the operations of Education machine, including figure, voice, and the title. It means CPU will control the video system to display the specified figure.

Graphic Unit is the main role of the video system. It can

access the video memory automatically to display some figures. In addition to the internal program SRAM, VT03 is equipped the other 2KByte SRAM for Video RAM. Internal Video RAM stores pattern vectors for 2 pages of background. External Video memory stores the video characters to be pointed by the pattern vectors.

VT03 can combine program and video bus into one bus mode. Thus it needs only one memory IC as the program memory and video memory. Under one bus mode, programmer specifies the program and video bank individually in the same external memory and then VT03 will combine the two independent buses into one bus. External memory can be extended to 32Mbytes through the function decoder of VT03.

Block diagram



### Functional description

Console chip is composed of CPU, video, sound function and I/O.

**Video:**

1. Video can handle two objects, SPRITE and BACKGROUND. SPRITE is the moving object as bullet, car, and man. BACKGROUND is the larger figure as tree, forest, house, scenery which can be scrolled.
2. On A TV screen, VIDEO can display 256 pixels on a horizontal coordinate and 240 pixels on a vertical coordinate.
3. Programmer can specify 64 SPRITE to display on a screen. One SPRITE needs four bytes to define.
4. The maximum SPRITE number on a horizontal scanning line is 8. If it is over 8, the rest will be careless and the message will be responded to CPU.
5. A basic SPRITE or BACKGROUND pattern is a character with 8X8 pixels, one pixel which show 4 or 16 kinds of color.
6. Programmer can choose SPRITE being (8X16), (8X8), (16X16), (16X8).
7. Two pages of figure for BACKGROUND can be immediately changed page or scrolled with horizontal or vertical way.
8. 25 or 121 colors in color plate can be defined. One color needs 6 or 12 bits to define.
9. Automatic TV Synchronized signal generation which is independent with program.
10. TV composite signal output.

**Sound:**

1. Providing maximally 256 bytes DMA function for graphic unit updated sprite, background vector and character data.
2. 2 ports for reading the status of sound generator.
3. Every sound channel gets 4 address ports to control its operation.
4. There are 4 Rhythm channels, 2 low frequency channels, 2 noise channels and PCM or DWS DMA built in.
5. Two independent sound DA output pin.

**CPU:**

CPU included in Console gets 16 bits program counter, 8 bits AL and Accumulator, status register, two general purposes registers X, Y, 8 bits stack pointer, 16 bits address bus and 8 bits data bus.

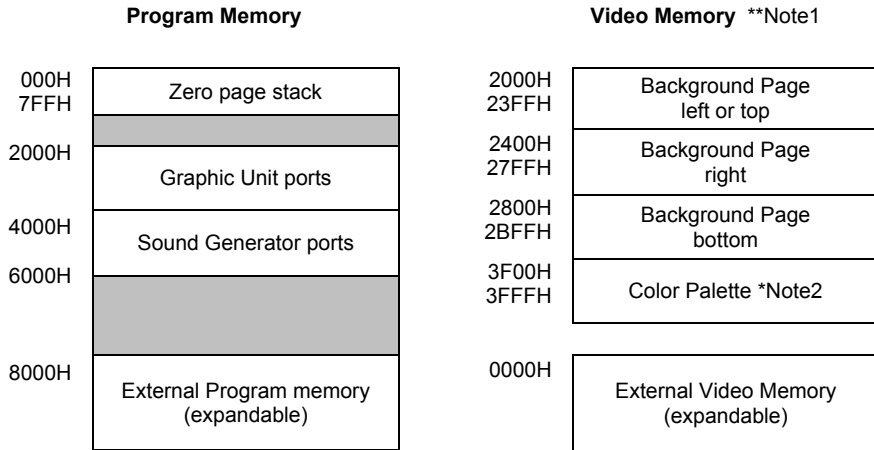
**Internal RAM:**

One 2K bytes RAM for VIDEO Memory, another for Program RAM.

**I/O:**

1. 7 pins for reading peripheral I/O, 3 pins for outputting peripheral I/O, 2 clock pins.
2. Built-in optionally 8 bit serial to parallel I/O for joystick.
3. In one bus mode, 8 bits data bus mode has auxiliary 16 I/O pins and 16 bits data bus mode has auxiliary 8 I/O pins.
4. Built-in optionally RS232 serial port.

### Address Map of Program Memory and Video Memory



**\*\*Note1**

Address of Video Memory should be asserted through 2006H of Graphic Unit ports. The details methods to access video memory are described in section: Access Video Memory and the Bank Mapping.

**\*Note2**

When XRC = 1

3F00-3F1F is the old color mapping location of color palette, total 25 colors.

3F00 is transparent color, and 3F10, 3F04, 3F14, 3F08, 3F18, 3F0C, 3F1C can be ignored.

3F00-3FFF is the new color mapping location of color palette, total 121 colors.

For example, 3F00 and 3F80 will be combined into one color which is 4 bits Luminance data, 4 bits saturation data and 4 bits phase data.