MOS Technology 6502
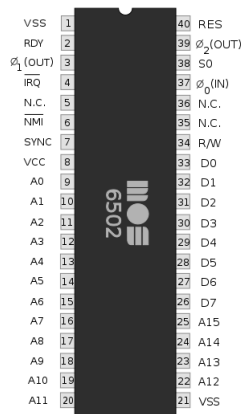## Architecture, Design, and Impact

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Spring 2016

MOS Technology 6502 Overview

- Released in 1975 in 40-pin DIP package.
- Competed directly with the Intel 8080 and Zilog Z80.
- Lead to rapidly decreasing prices in the microprocessor market.
- Widely popular in personal computer and system integration applications.
- MOS acquired by Commodore in 1976.
- Still used in embedded systems today.

	6502	
VSS	1	40	RES
RDY	2	39	$\varnothing_2$(OUT)
$\varnothing_1$(OUT)	3	38	S0
IRQ	4	37	$\varnothing_0$(IN)
N.C.	5	36	N.C.
NMI	6	35	N.C.
SYNC	7	34	R/W
VCC	8	33	D0
A0	9	32	D1
A1	10	31	D2
A2	11	30	D3
A3	12	29	D4
A4	13	28	D5
A5	14	27	D6
A6	15	26	D7
A7	16	25	A15
A8	17	24	A14
A9	18	23	A13
A10	19	22	A12
A11	20	21	VSS

History

- Chuck Peddle noticed Motorola customers were frustrated with high 6800 unit cost.
- Proposed a lower area, lower power, lower cost 6800 spin-off.
- New design leverages depletion-mode metal oxide semiconductor transistors.
- Frustrated by Motorola management, Peddle joins MOS Technology, who fund the 6502.
- 1975 saw a recession impact the silicon industry; 6502 sales flop as a result.

Beginnings of the Microcomputer

- To bolster sales, Peddle designs the MDT-650 single-board computer development platform.

- MDT-650 extremely popular with both engineers and hobbyists.

- Apple, Commodore, Atari, BBC capitalize on the emerging hobbyist/home computer market.

- Apple II, Commodore PET & VIC-20, BBC Micro, Atari 800 all designed around the 6502.

Specifications

- 3 8-bit General Purpose Registers
- 8-bit Stack Pointer
- 8-bit Status Register
- 16-bit Program Counter
- 1 Edge-Triggered Non-Maskable Interrupt
- 1 Maskable Level-Sensitive Interrupt
- External Memory Address/Data Bus
- RDY output for Hardware Step-Through
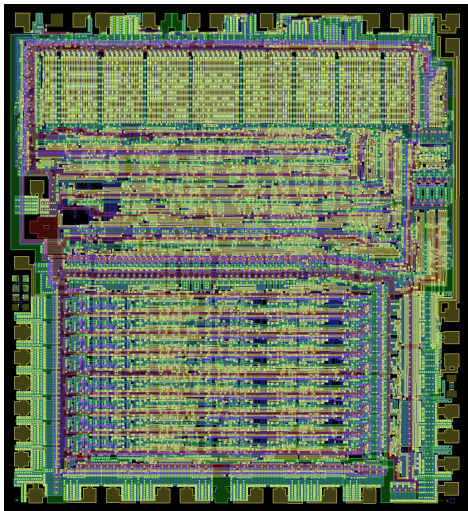
6502 Implementation
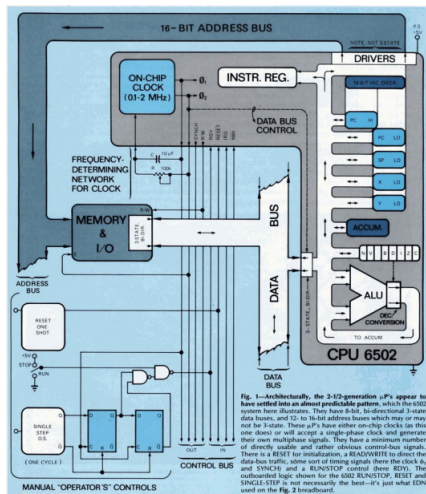
- ▶ 1-2 MHz typical clock frequency.
- ▶ Two synchronizations per cycle.
- ▶ Static PLA used for instruction decoding.
- ▶ 2-stage concurrent fetch pipeline.
- ▶ 3,510 total transistors.

6502 Polysilicon Diffusion Layers
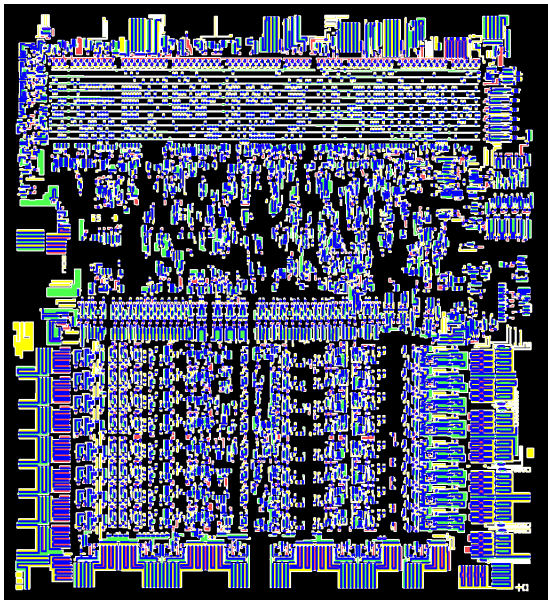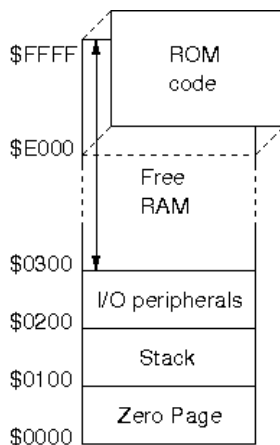
6502 Layer Overlay

6502 Visualization:
http://www.visual6502.org/JSSim/index.html

Addressing Modes

- ▶ Absolute (Immediate Address)
- ▶ Branch-relative
- ▶ Zero Page
- ▶ Absolute/Zero-Page Indirection

Home Game Consoles Emerge

- Ted Dabney and Nolan Bushnell begin investigating microprocessor-based video games.
- Unlike previous games based on dedicated discrete logic, microprocessor-based systems could play multiple games.
- Dabney and Bushnell realize that such a system would create it's own proprietary software market.
- "Stella" prototype adapted to use the low-cost 6502 in 1975.
- The Atari Video Computer System (later Atari 2600) was released in 1977.

6502 in the Japanese Market

- After success in the arcade game market, Nintendo decides to enter the personal computer market, work on the "Advanced Video System" begins.
- Management decides that the keyboard and terminal will discourage non-technophiles from purchasing the system; controllers are the only remaining interface in the final design.
- Engineers design a system around the cost-effective 6502, essentially unknown in Japan at the time.
- Obscurity of the 6502 in the Japanese market led Nintendo to produce it's own proprietary cross-development platform.
- The "Famicom" is released to critical acclaim in 1983.
- The NES is released in the US in 1985.
- Nintendo's unified development platform and licensing model is still used in the console market today.