SRAM

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ECE 3080

Overview

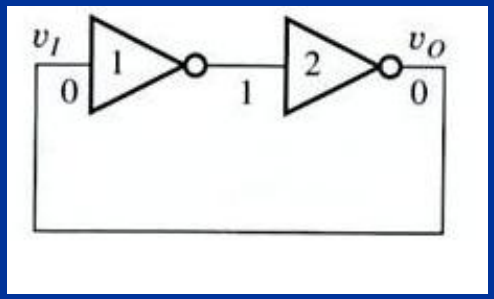
- History of RAM
- Structure And Operation of SRAM
- Application
- Future of SRAM

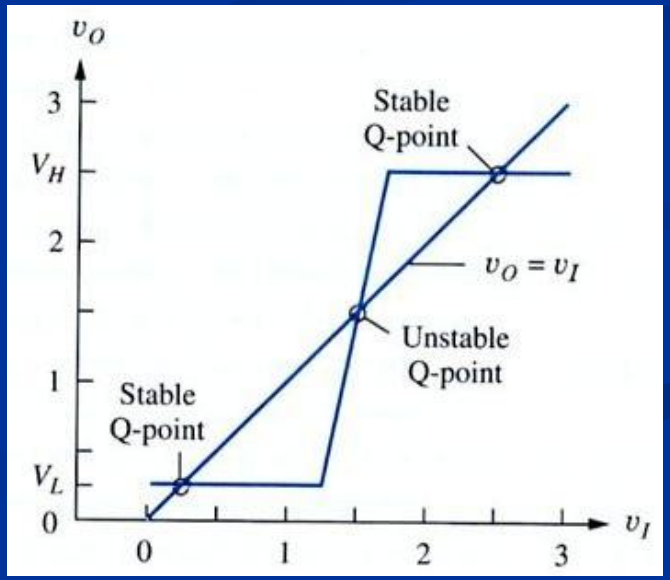
Birth of Memory

- Mid-1960s-discussion of development of random-access memory (RAM) using MOS technology at IEEE Solid-State Circuits Conference.
- 1974- first commercial 1024-bit (1 Kb) MOS RAM developed.
- Modern day- storage capacity increased to more than 1 million times the storage capacity of the original RAMs.

SRAM Static Random-Access Memory (SRAM)

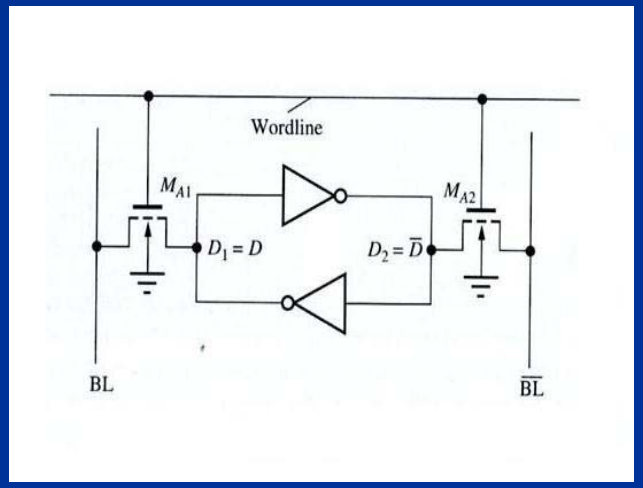
- Static Memory-holds data as long as power is applied
- SRAM- able to store information in bit format
- Main storage unit consists of two cross- coupled inverters

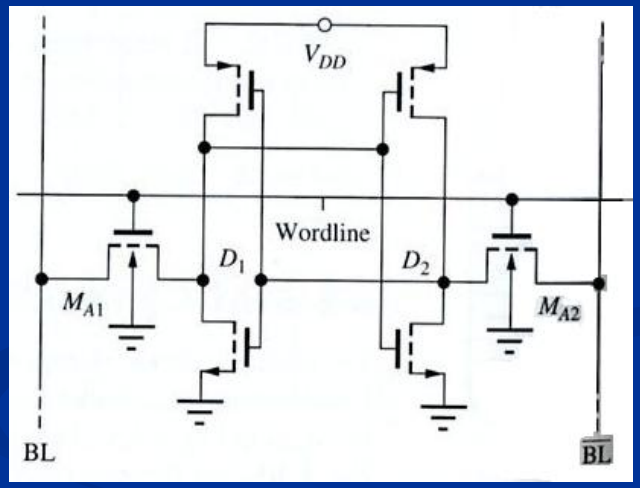




Structure

- Standard 6T-Cell Structure





Transistor M_{A1} and M_{A2} provide path to access data

Complete schematic showing all six CMOS or NMOS transistors

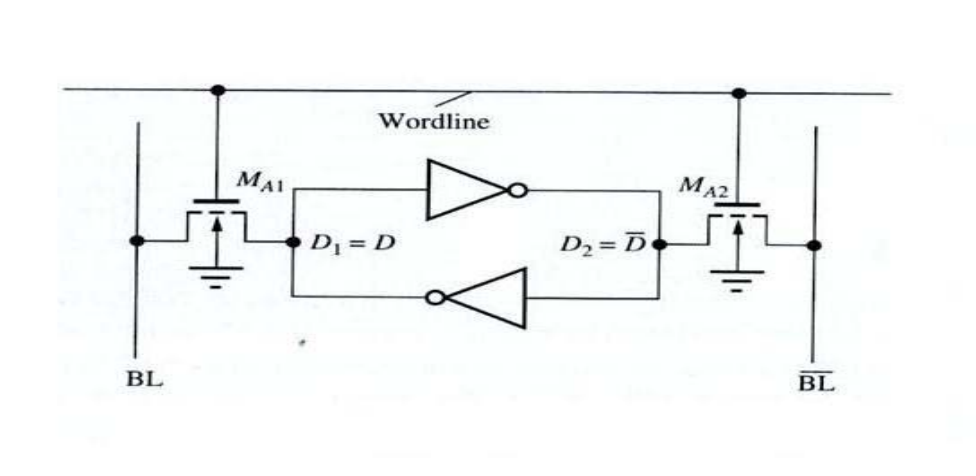
Operation

- Three modes of operation:

1. Standby or Idle
2. Read
3. Write

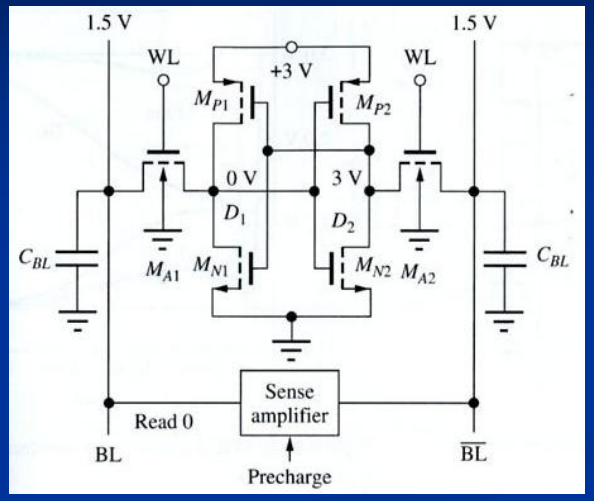
Standby

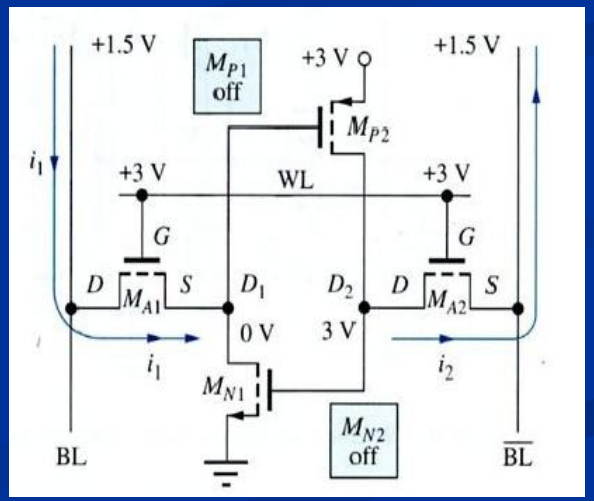
- Wordline not asserted or kept low
- Data access transistors- M_{A1} and M_{A2} disconnect cell from bit lines
- Inverters continue to store information.



Read

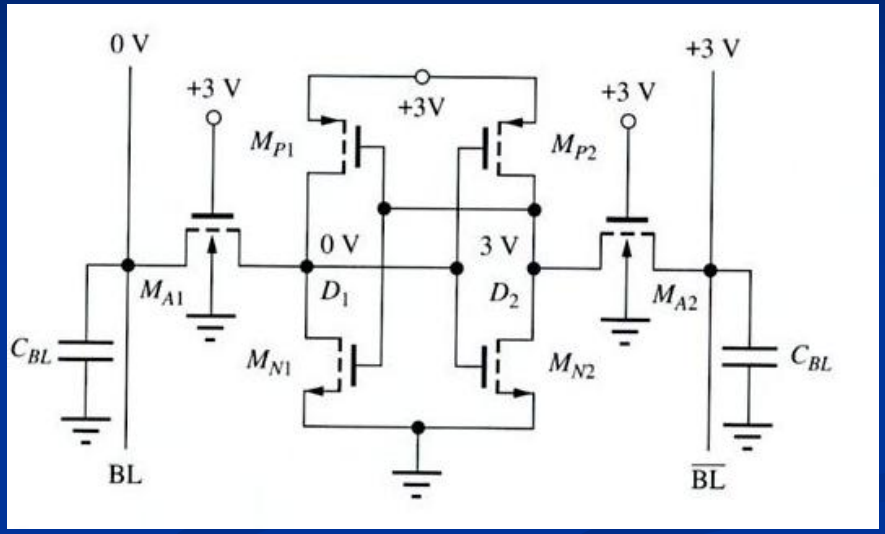
1. Pre-charge both bitlines (BL) high using sense amplifier
2. Turn on Wordline
3. M_{A1} and M_{A2} turn on and allow access to inverters
4. Current flows as shown into the Bitlines and causes the sense amplifier to assume same state as data stored on cell
5. The Bitlines voltages also settle at the same values as D_1 and D_2

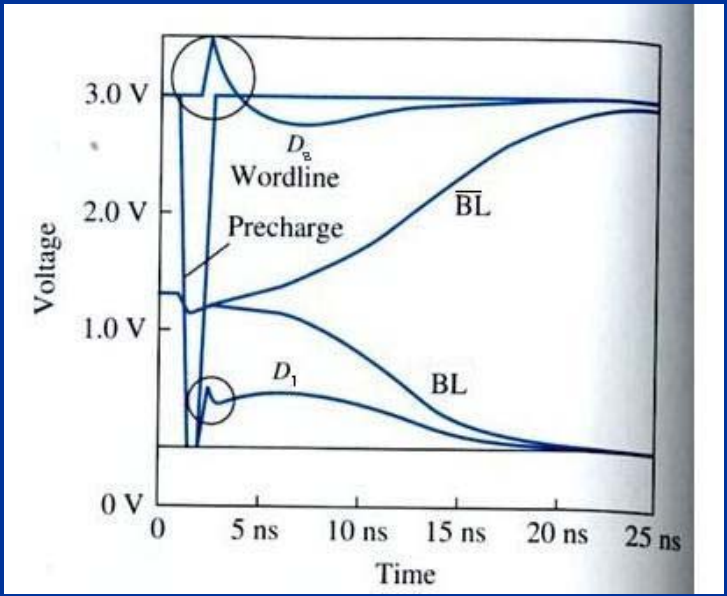




Read Continued

- Figure (right) shows final steady state of 6T-cell
- No current flow through M_{A1} or M_{A2}

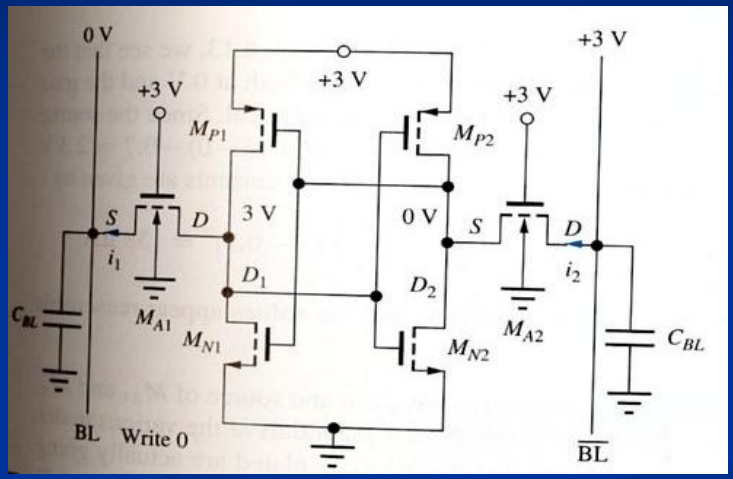


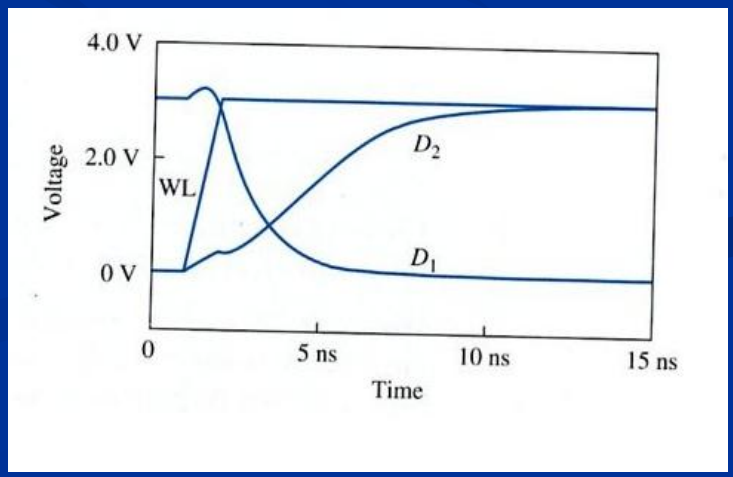


- Memory waveform during read operation
- State of memory cell disturbed but not destroyed

Write

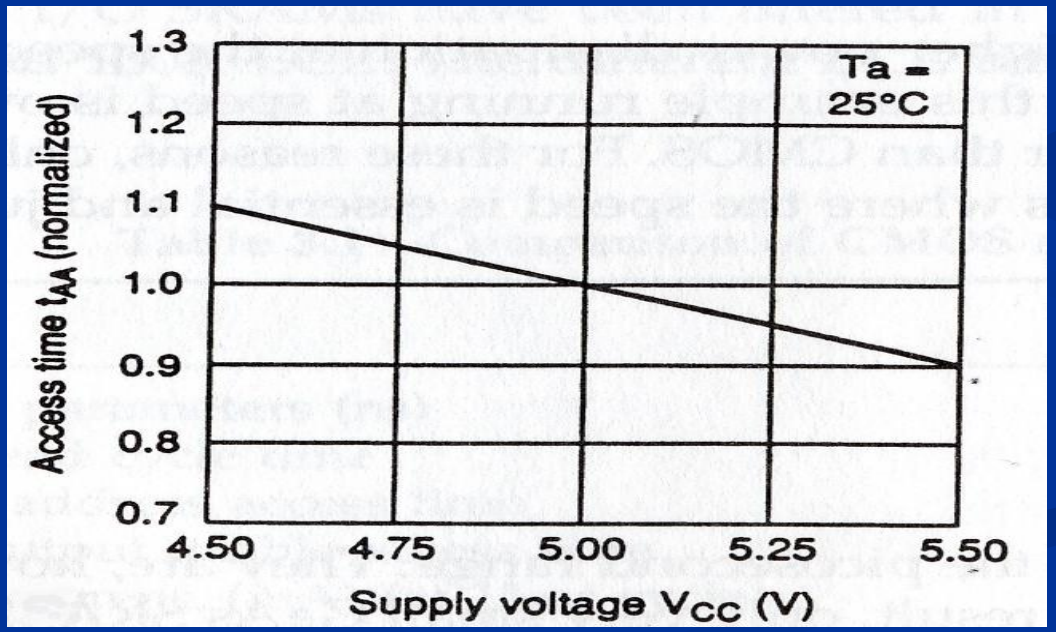
- Bitlines are initialized with the data to be written
- Wordline is turned on-access to cell created
- Bitlines overpower cell with new value





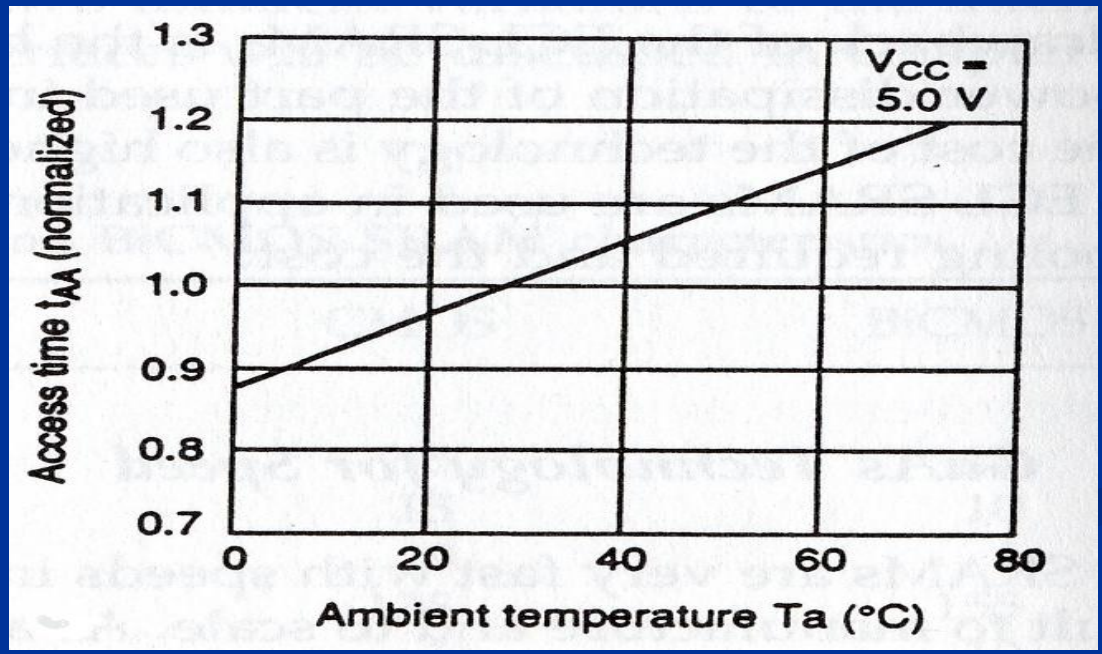
Effect of Voltage

- The graph shows that access time or read/write time varies inversely with input voltage
- Decreasing the input voltage increases the access time



Effect of Temperature

- Data access times are improved when the temperature is decreased
- The graph below shows this relationship between access time and temperature



Applications

- SRAM is used in personal computers, workstations, routers and peripheral equipment
- In Computers it is used for internal CPU cashes
- LCD screens and printers also normally employ static RAM to hold the image displayed
- Small SRAM buffers are also found in CDROM and CDRW drives

SRAM benefits over other RAMs

- SRAM is more power efficient than the highly used DRAM (Dynamic Random-Access Memory)
- Faster data access as compared to DRAM
- Easier to control than DRAM

Future uses

- SRAM variant 1T-SRAM developed by MoSys, Inc combines the benefits of both SRAM and DRAM-high speed of access while reducing overall size.
- 1T-SRAM used in the Nintendo Wii to allow faster load times
- Intel's new 32nm chip for its new processor line due to begin production in 2009 will utilize SRAM

Questions?

Sources

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