

MEMORY

Memory structures are crucial in digital design. – ROM, PROM, EPROM, RAM, SRAM, (S)DRAM, RDRAM,..

- All memory structures have an address bus and a data bus – Possibly other control signals to control output etc. •E.g. 4 Bit Address bus with 5 Bit Data Bus ADDR DOUT
- There are two types of memories that are used in digital systems:
 - Random-access memory(RAM): perform both the write and read operations.
 - Read-only memory(ROM): perform only the read operation.
- The read-only memory is a programmable logic device. Other such units are the programmable logic array(PLA), the programmable array logic(PAL), and the field-programmable gate array(FPGA).

Random-Access Memory:

- A memory unit stores binary information in groups of bits called words.
 - byte = 8 bits
 - word = 2 bytes
- The communication between a memory and its environment is achieved through data input and output lines, address selection lines, and control lines that specify the direction of transfer.

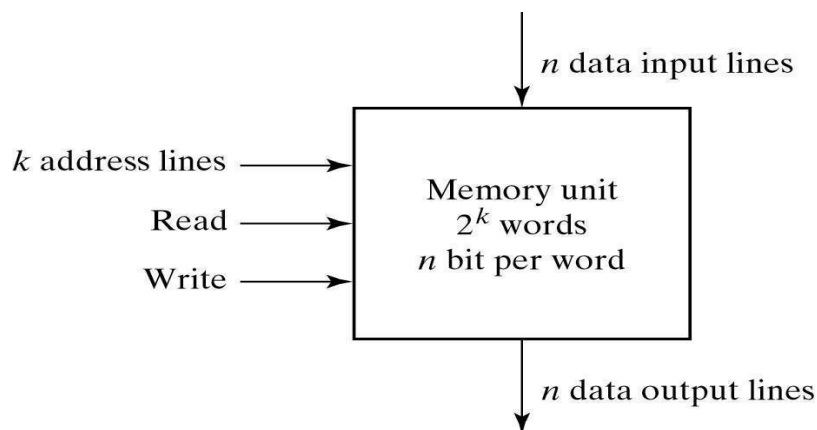


Fig. 7-2 Block Diagram of a Memory Unit

- In random-access memory, the word locations may be thought of as being separated in space, with each word occupying one particular location.
- In sequential-access memory, the information stored in some medium is not immediately accessible, but is available only certain intervals of time. A magnetic disk or tape unit is of this type.
- In a random-access memory, the access time is always the same regardless of the particular location of the word.

In a sequential-access memory, the time it takes to access a word depends on the position of the word with respect to the reading head position; therefore, the access time is variable.

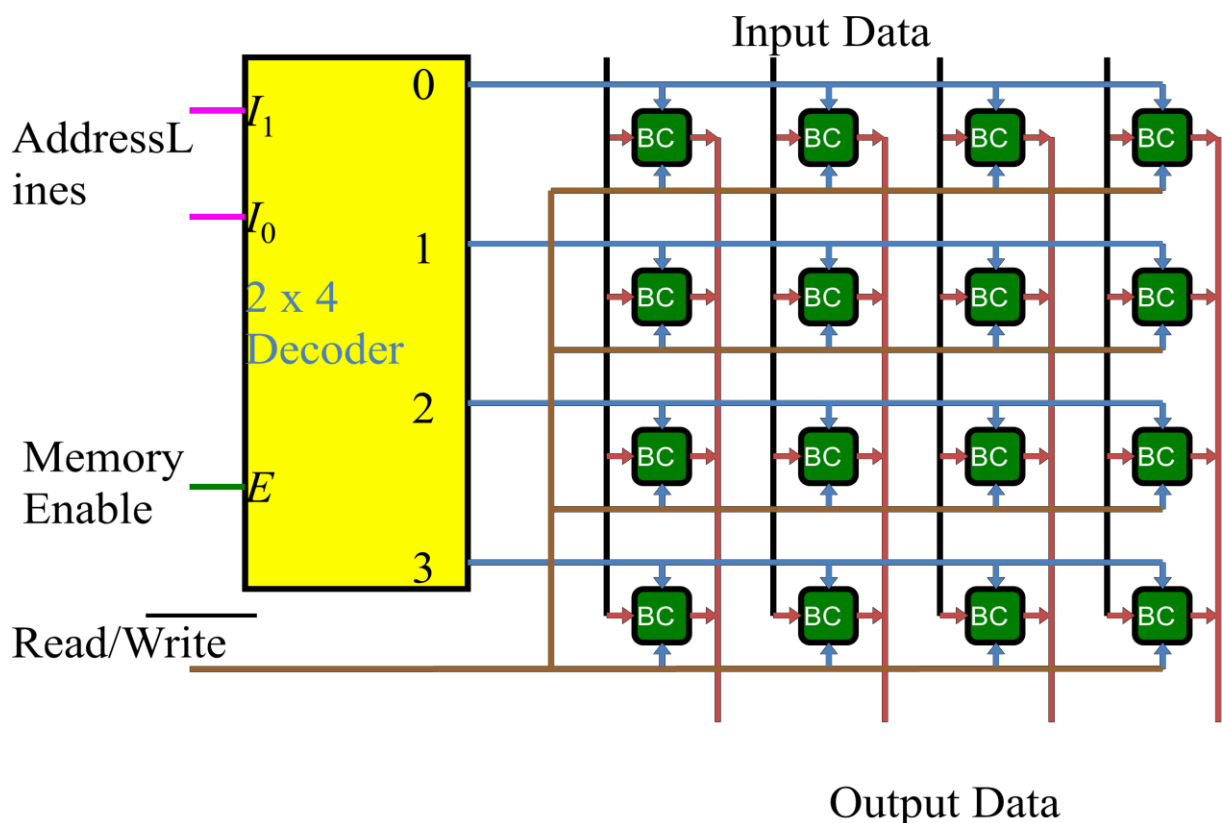
Static RAM

- ❑ SRAM consists essentially of internal latches that store the binary information.
- ❑ The stored information remains valid as long as power is applied to the unit.
- ❑ SRAM is easier to use and has shorter read and write cycles.
- ❑ Low density, low capacity, high cost, high speed, high power consumption.

Dynamic RAM

- ❑ DRAM stores the binary information in the form of electric charges on capacitors.
- ❑ The capacitors are provided inside the chip by MOS transistors.
- ❑ The capacitors tend to discharge with time and must be periodically recharged by refreshing the dynamic memory.
- ❑ DRAM offers reduced power consumption and larger storage capacity in a single memory chip.
- ❑ High density, high capacity, low cost, low speed, low power consumption.

Memory decoding



□ The equivalent logic of a binary cell that stores one bit of information is shown below.

- Read/Write = 0, select = 1, input data to S-R latch
- Read/Write = 1, select = 1, output data from S-R latch

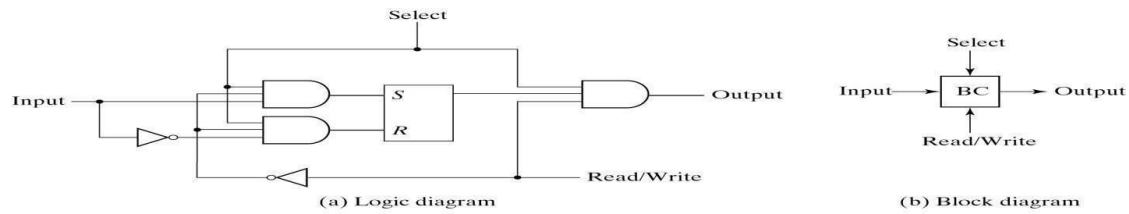


Fig. 7-5 Memory Cell

