

Tutorial #1

Questions:

5.3 What is the difference between DRAM and SRAM in terms of application?

SRAM is used for cache memory (both on and off chip), and DRAM is used for main memory.

5.4 What is the difference between DRAM and SRAM in terms of characteristics such as speed, size, and cost?

Characteristics	DRAM	SRAM
Structure	One transistor per cell	Six transistor per cell
Speed	Less speed	Faster
Size	Less size	Larger
Cost	Less expensive	More Expensive

5.6 What are some applications for ROM?

Micro-programmed control memory, library subroutines for frequently wanted functions, system programs, and function tables.

Problems

5.2 Consider a dynamic RAM that must be given a refresh cycle 64 times per ms. Each refresh operation requires 150 ns; a memory cycle requires 250 ns. What percentage of the memory's total operating time must be given to refreshes?

In 1 ms, the time devoted to refresh is $64 \times 150 \text{ ns} = 9600 \text{ ns}$. The fraction of time devoted to memory refresh is $(9.6 \times 10^{-6} \text{ s}) / 10^{-3} \text{ s} = 0.0096$, which is approximately 1%.

External problem

Design 8M X 32 bits DRAM from 512K X 8 bits DRAM. Show no. of refreshment circuits

of Row = $8\text{M} / 512\text{K} = 16$ Rows = # of refreshment circuits

of Column = $32 / 8 = 4$ Columns

of Address lines = 23 bits

Address lines are used for:

- 4 bits to select chip (group)
- 19 bits to select byte in chip

