RAM—a memory device for reading/writing data

Since random-access memory (RAM) is principally used as temporary storage for the operating system and the applications, it does not much matter that some types of RAM lose data when they are powered off. What matters more is the cost and the read/write speed. There are mainly two types of RAM: one is DRAM (dynamic RAM), and the other is SRAM (static RAM). DRAM stores information in capacitors, and since the capacitors slowly discharge, the information fades away unless the capacitor charge is refreshed periodically. In practice, the data on DRAM need to be read and rewritten (i.e., refreshed) dozens of times per second. In contrast, SRAM needs no refreshing because it uses flip-flop circuits* to preserve the data. SRAM is more expensive than DRAM because of the complex circuitry involved, but is also faster.

*

> Flip-flop circuit: An electronic circuit that stores a single bit of data that represents either 0 or 1.

Although all RAM basically serves the same purpose, there are a few different types commonly in use today:

- Static RAM (SRAM)
- Dynamic RAM (DRAM)
- Synchronous Dynamic RAM (SDRAM)
- Single Data Rate Synchronous Dynamic RAM (SDR SDRAM)
- Double Data Rate Synchronous Dynamic RAM (DDR SDRAM, DDR2, DDR3, DDR4)
- Graphics Double Data Rate Synchronous Dynamic RAM (GDDR SDRAM, GDDR2, GDDR3, GDDR4, GDDR5)
- Flash Memory

Synchronous DRAM

RAM is a volatile memory. In other words, the data and instructions written to the RAM are not permanent. Therefore, the data will erase when power off the computer. It is possible to perform both read and write operations in RAM. Moreover, it is fast and expensive. There are two types of RAM. They are the Static RAM (SRAM) and Dynamic RAM (DRAM). The SRAM requires a constant flow of power to retain data while DRAM requires constant refreshes to retain data. Synchronous DRAM and Asynchronous DRAM are two types of DRAM.

In Synchronous DRAM, the system clock coordinates or synchronizes the memory accessing. Therefore, the CPU knows the timing or the exact number of cycles in which the data will be available from the RAM to the input, output bus. It increases memory read and write speed. Overall, the Synchronous DRAM is faster in speed and operates efficiently than the normal DRAM.

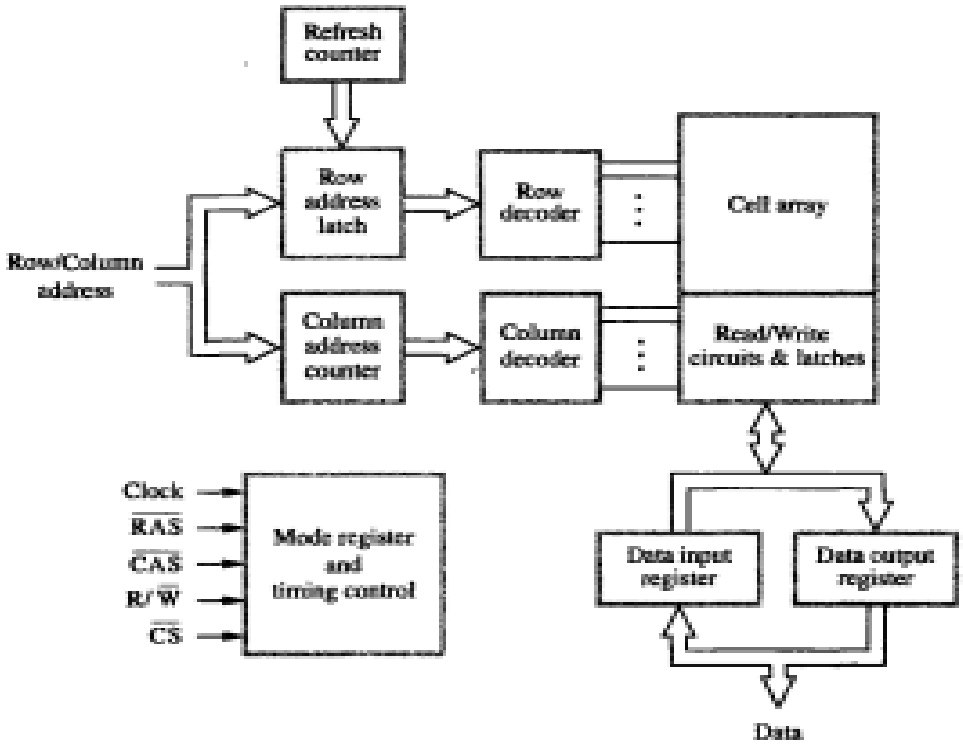

Figure 5.8 Synchronous DRAM.

Asynchronous DRAM

The first personal computers used asynchronous DRAM. It is an older version of DRAM. In asynchronous DRAM, the system clock does not coordinate or synchronizes the memory accessing. When accessing the memory, the value appears on the input, output bus after a certain period. Therefore, it has some latency that minimizes the speed.

Usually, asynchronous RAM works in low-speed memory systems but not appropriate for modern high-speed memory systems. At present, the manufacturing of asynchronous RAM is quite low. Today, synchronous DRAM is used instead of the asynchronous DRAM.

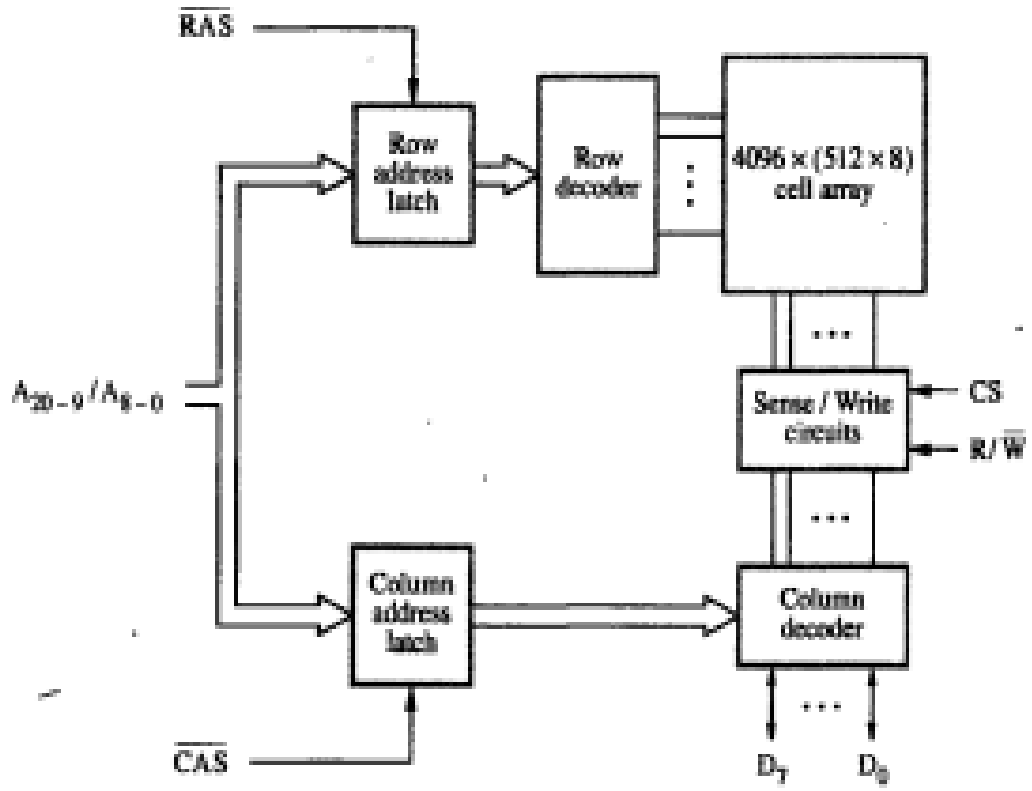

Figure 5.7 Internal organization of a 2M x 8 dynamic memory chip.

What is the Difference Between Synchronous and Asynchronous DRAM?

Synchronous DRAM uses a system clock to coordinate memory accessing while Asynchronous DRAM does not use a system clock to synchronize or coordinate memory accessing. Synchronous DRAM is faster and efficient then asynchronous DRAM.

Furthermore, synchronous DRAM provides high performance and better control than the asynchronous DRAM. Modern high-speed PCs uses synchronous DRAM while older low-speed PCs used asynchronous DRAM.