Learn about RAM technologies: DRAM, SRAM, SDRAM and newer

Today, we also talk about RAM but not the basic concept, but about the most common RAM technologies: DRAM, SRAM, SDRAM as well as newer RAM technologies.

RAM is no longer a strange concept for computer users. If you follow the articles on TipsMake.com, you certainly have read the article about the frequency of RAM laptop and what you need to know. Today, we also talk about RAM but not the basic concept, but about the most common RAM technologies: DRAM, SRAM, SDRAM as well as newer RAM technologies.

1. 2 ways to check RAM and check RAM errors on the computer with the highest accuracy rate
2. RAM & ROM: two concepts are easily confused

What is DRAM?

DRAM stands for Dynamic random-access memory, a type of memory that is widely used on computer systems such as main memory. In terms of capacity, it can achieve 8GB for each chip in modern IC.

Physically, DRAM stores each bit of data in a separate capacitor inside the integrated circuit. Capacitors can be charged or discharged, these two states represent two states of a bit (commonly referred to as 0 and 1). DRAM is called dynamic because it needs to be refreshed or charged after a few milliseconds to compensate for the electrolytic leakage from the capacitor. Because the capacitor is leaking electricity, if it is not refreshed or recharged regularly, the data bits stored on the DRAM will disappear.

Traditional RAM on computers is DRAM. Newer computers use DDR (Dual Data Rate) DRAM to improve performance.

A DDR3 DRAM bar

What is SRAM?

SRAM stands for Static random-access memory. SRAM stores data bits in memory as long as the power supply is fully supplied. Unlike DRAM, storing data bits in batteries containing capacitors and transistors, SRAM does not need to be refreshed periodically.

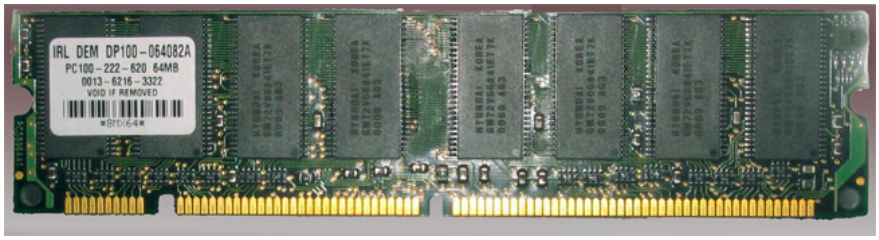
SRAM contains only transistors and inverters, data is fed into SRAM with the help of bitline and forwarded by wordline. Inverter is used to generate feedback, used as input for transistors, so SRAM does not need to refresh thousands of times in a cycle like DRAM. But in a memory bit with 6 SRAM transistors, it is quite bulky and requires more space than DRAM (1 memory bit has only 1 transistor of DRAM). SRAM needs more power than DRAM because it needs to operate 6 transistors (instead of one like DRAM).

SRAM is faster and more expensive than DRAM, it is often used inside the CPU [What is CPU?]. Due to the high speed, SRAM is also used as cache and main memory in servers to get the best performance.

A static RAM chip from a copy of Nintendo Entertainment System (2K x 8 bits). Photo source: Wikipedia

What is SDRAM?

SDRAM stands for Synchronous dynamic random access memory. SDRAM is DRAM synchronized with the system bus. This is the common name for the different types of DRAM synchronized with the optimal clock speed of the processor. SDRAM can run at a higher clock rate than regular memory. It is synchronized with the CPU bus and is capable of running at 133MHz, about 3 times faster than conventional FPM RAM, about 2 times faster than DRAM EDO and DRAM BEDO. SDRAM is gradually replacing DRAM EDO in many new computers.



Eight SDRAM ICs on one PC100 DIMM package. Photo source: Wikipedia

What is MRAM?

MRAM stands for Magnetoresistive Random Access Memory, which is a type of memory that does not self-erase, stores data based on the principle of effect from giant resistors (or more precisely the effect from tunneling resistance. MRAM stores information in nano magnets. The read delay can be as fast as anything in the CPU, the recording delay is one nanosecond (1 billionth of a second). This memory is quite complicated and has a detailed article on Wikipedia, you are interested in reading more.

MRAM uses less energy than other RAM technologies, so it is ideal for on-chip memory. It also has larger storage capacity, faster access time than regular RAM. MRAM retains the content until the computer is disconnected.

MRAM is currently on the market with small capacity, large capacity, which is quite difficult to achieve.

Things to know when choosing to buy mainboard

What is ReRAM?

ReRAM stands for Resistive Random Access Memory, a modern alternative to flash technology with the same structure and characteristics as MRAM.

ReRAM has two advantages over MRAM. ReRAM has higher resistance, allowing thicker memory structure, called overflow. This leads to less cell (cell) area. ReRAM can also store more levels for each cell, allowing more bits to be stored. This means that a single ReRAM array can increase capacity without taking up additional space. ReRAM with 7 bits for each cell has been proven to be achievable.

ReRAM has two drawbacks: it requires relatively high voltage to write and poor durability. High voltages contribute to energy consumption and make integration with CMOS processes more difficult. ReRAM's durability issue makes it impossible to use cache memory.

Overall, ReRAM has achieved read, write rates at nanoseconds, has much potential for disks, and DRAM technology.

What is PCM?

PCM stands for Phase change memory, memory changes phase, has many characteristics similar to ReRAM but the physical mechanism is completely different. As a result, it has a low durability of about 10 ^ 8. However, system designers have created clever tricks to make PCM possible to replace some DRAM applications. PCM has also been built and parts compatible with DIMMs are available.

14 secrets of a laptop buyer

What is FRAM?

FRAM stands for Ferroelectric random access memory, which works in the same way as DRAM. The main difference is that the material in the capacitor is the magnet and therefore, it stores information by changing the capacitance value. Imagine the capacitor as an electrical container, the process of changing this capacitance value is like changing the size of the bin to store information. FRAM has very high durability, more than 10 ^ 15. There are some problems with FRAM, it has similar performance as DRAM but is not dynamic so this is the only advantage. Theoretically, FRAM is better than DRAM but it has not been invested properly.

Ramtron's FRAM. Photo source: Wikipedia

Conclude

There are 3 application layers for memory, depending on the class that require different speed or power consumption: long-term storage, main memory and on-chip cache.

SRAM and DRAM are classic, variable and expandable memory technologies. Newer memory technologies show faster performance and add non-volatility, saving power leakage.

Among these technologies, MRAM and FRAM have good durability enough to use on chips. MRAM has satisfactory latency for chip circuits. ReRAM and PCM are able to replace DRAM technology and easily pass

flash and disk for long-term storage.

Please read more:

1. Instructions on how to upgrade RAM on computers and Laptops
2. Instructions on how to create a RAM drive on Windows
3. This is a list of all CPU sockets
4. What is Intel's new Core i9 CPU line?
5. Notes when buying a computer hard drive