**SEMICONDUCTOR MEMORIES**

1. **Semiconductor memory is an electronic data storage device, often used as computer memory, implemented on a semiconductor-based integrated circuit.**
2. **It is made in many different types and technologies.**

# [SemiConductor Memory - What is a SemiConductor Memory?](http://ecomputernotes.com/fundamental/input-output-and-memory/what-is-semiconductor-memory)

# A device for storing digital [information](http://ecomputernotes.com/fundamental/information-technology/what-do-you-mean-by-data-and-information) that is fabricated by using integrated circuit technology. [ICs]

# Also known as integrated-circuit [memory](http://ecomputernotes.com/fundamental/input-output-and-memory/what-are-the-different-types-of-ram-explain-in-detail);

# Large-scale integrated memory;

# Memory chip;

# [Semiconductor](http://ecomputernotes.com/fundamental/introduction-to-computer/what-is-semiconductor) storage;

# Transistor memory.

**Semiconductor memory**

* **Semiconductor memory technology is an essential element of today's electronics.**
* **Normally based around semiconductor technology, memory is used in any equipment that uses a processor of one form or another.**
* **With the rapid growth in the requirement for semiconductor memories there have been a number of technologies and types of memory that have emerged. Names such as**
* [**ROM**](http://ecomputernotes.com/fundamental/input-output-and-memory/explain-read-only-memory-what-are-the-types-of-rom)**,**
* [**RAM**](http://ecomputernotes.com/fundamental/input-output-and-memory/what-are-the-different-types-of-ram-explain-in-detail)**,**
* **PROM,**
* **EPROM,**
* **EEPROM,**
* **Flash memory,**
* **DRAM,**
* **SRAM,**
* **SDRAM, and the very new**
* **MRAM**

**Each one has its own advantages and area in which it may be used.**

**Types of semiconductor memory**

**Electronic semiconductor memory technology can be split into two main types or categories, according to the way in which the memory operates:**

1. **RAM -**[**Random Access Memory**](http://ecomputernotes.com/fundamental/input-output-and-memory/what-are-the-different-types-of-ram-explain-in-detail)**:**

* **Random Access Memory (RAM) is the best known form of**[**computer**](http://ecomputernotes.com/fundamental/introduction-to-computer/what-is-computer)**memory.**
* **The Read and write (R/W) memory of a computer is called RAM.**
* **The User can write information to it and read information from it.**
* **The RAM is a volatile memory; it means information written to it can be accessed as long as power is on.**
* **As soon as the power is off, it cannot be accessed.**
* **So this means RAM computer memory is essentially empty.**
* **RAM holds data and processing instructions temporarily until the**[**CPU**](http://ecomputernotes.com/fundamental/introduction-to-computer/what-is-cpu)**needs it.**
* **Scratchpad storage in memory space is used for the temporary storage of data.**

1. **ROM -**[**Read Only Memory**](http://ecomputernotes.com/fundamental/input-output-and-memory/explain-read-only-memory-what-are-the-types-of-rom)**:**

* **Read only memory (ROM) is an example of nonvolatile memory.**
* **ROM is a class of storage medium used in** [**computers**](http://ecomputernotes.com/fundamental/introduction-to-computer/what-is-computer)**and other electronic devices. Read Only Memory (ROM), also known as firmware, is an integrated circuit programmed with specific data when it is manufactured.**
* **The instructions for starting the computer are housed on Read only memory chips.**

**Semiconductor Memory Technologies**

* **There is a large variety of types of ROM and RAM that are available.**
* **These arise from the variety of applications and also the number of technologies available.**
* **This means that there is a large number of abbreviations or acronyms and categories for memories ranging from Flash to MRAM, PROM to EEPROM, and many more:**

**PROM:**

* **This stands for Programmable Read Only Memory. It is a semiconductor memory which can only have data written to it once - the data written to it is permanent.**
* **These memories are bought in a blank format and they are programmed using a special PROM programmer.**
* **Typically a PROM will consist of an array of fusible links some of which are "blown" during the programming process to provide the required data pattern.**
* **The PROM stores its data as a charge on a capacitor.**
* **There is a charge storage capacitor for each cell and this can be read repeatedly as required.**
* **However it is found that after many years the charge may leak away and the data may be lost. Nevertheless, this type of semiconductor memory is found to be widely used in applications where a form of ROM was required, but where the data needed to be changed periodically, as in a development environment, or where quantities were low.**

**EPROM:**

* **This is an Erasable Programmable Read Only Memory.**
* **This form of semiconductor memory can be programmed and then erased at a later time.**
* **This is normally achieved by exposing the silicon to**ultraviolet light.
* **To enable this to happen there is a circular window in the package of the EPROM to enable the light to reach the silicon of the chip.**
* **When the PROM is in use, this window is normally covered by a label, especially when the data may need to be preserved for an extended period.**
* **EEPROM:     This is an Electrically Erasable Programmable Read Only Memory.**
* **Data can be written to it and it can be erased using an electrical voltage.**
* **This is typically applied to an erase pin on the chip. Like other types of PROM, EEPROM retains the contents of the memory even when the power is turned off.**
* **Also like other types of ROM, EEPROM is not as fast as RAM.**
* **EEPROM memory cells are made from floating-gate MOSFETS (known as FGMOS)**

**FLASH MEMORY:**

* **Flash memory may be considered as a development of EEPROM technology.**
* **Data can be written to it and it can be erased, although only in blocks, but data can be read on an individual cell basis.**
* **To erase and re-program areas of the chip, programming voltages at levels that are available within electronic equipment are used.**
* **It is also non-volatile, and this makes it particularly useful.**
* **As a result Flash memory is widely used in many applications including memory cards for digital cameras, mobile phones, computer memory sticks and many other applications.**
* **Flash memory stores data in an array of memory cells.**
* **The memory cells are made from floating-gate MOSFETS (known as FGMOS).**
* **These FG MOSFETs (or FGMOS in short) have the ability to store an electrical charge for extended periods of time (2 to 10 years) even without connecting to a power supply.**

**DRAM:**

* **Dynamic RAM is a form of**[**random access memory**](http://ecomputernotes.com/fundamental/input-output-and-memory/what-are-the-different-types-of-ram-explain-in-detail)**.**
* **DRAM uses a capacitor to store each bit of data, and the level of charge on each capacitor determines whether that bit is a logical 1 or 0.**
* **However these capacitors do not hold their charge indefinitely, and therefore the data needs to be refreshed periodically.**
* **As a result of this dynamic refreshing, it gains its name of being a dynamic RAM.**
* **DRAM is the form of semiconductor memory that is often used in equipment including personal computers and workstations where it forms the main RAM for the computer.**

**Disadvantage: Need to refresh the capacitor charge once in two milliseconds.**

**SRAM:     Static Random Access Memory.**

**This form of semiconductor memory gains its name from the fact that, unlike DRAM, the data does not need to be refreshed dynamically.**

**It is able to support faster read and write times than DRAM (typically 10 ns against 60 ns for DRAM), and in addition its cycle time is much shorter because it does not need to pause between accesses.**

**However it consumes more power, is less dense and more expensive than DRAM.**

**As a result of this it is normally used for caches, while DRAM is used as the main semiconductor memory technology.**

**SDRAM:     Synchronous DRAM.**

**This form of semiconductor memory can run at faster speeds than conventional DRAM.**

**It is synchronized to the clock of the processor and is capable of keeping two sets of memory addresses open simultaneously.**

**By transferring data alternately from one set of addresses, and then the other, SDRAM cuts down on the delays associated with non-synchronous RAM, which must close one address bank before opening the next.**

**MRAM:     This is Magneto-resistive RAM, or Magnetic RAM.**

**It is a non-volatile RAM memory technology that uses magnetic charges to store data instead of electric charges.**

**Unlike technologies including DRAM, which require a constant flow of electricity to maintain the integrity of the data, MRAM retains data even when the power is removed.**

**An additional advantage is that it only requires low power for active operation.**

**As a result this technology could become a major player in the electronics industry now that production processes have been developed to enable it to be produced.**