Memory Devices

Prof. **V. Baranidharan,** B.E., M.Tech.,

Assistant Professor,

Dept. of Electronics and Communication Engineering,

Bannari Amman Institute of Technology, Sathy.

svbaranidhar@gmail.com

OVERVIEW OF MEMORY

Three Important Characteristics of Semiconductor Memory:

- ***Density***
  - **Amount of data that the memory can store**

- ***(Non-) Volatility***
  - **Data storage capability if power is disconnected**

- ***Read/write capability***
  - **Capability to update memory**

OVERVIEW OF MEMORY (Cont'd.)

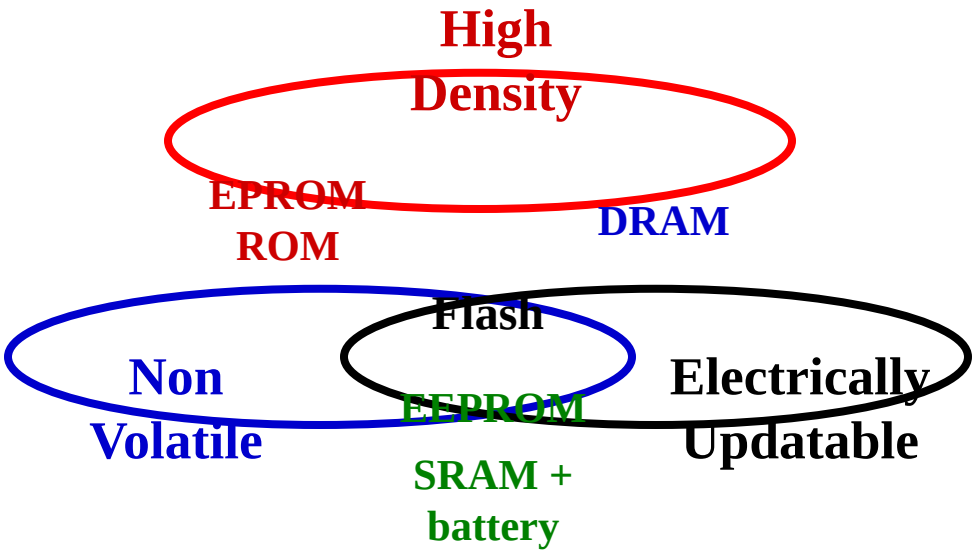
Categories of Semiconductor Storage Cells:

- **SRAM (static random-access memory)**
- **DRAM (dynamic random-access memory)**
- **ROM (read-only memory)**
- **EPROM (electrically programmable ROM)**
- **EEPROM (electrically erasable PROM)**
- **Flash Memory**

See next slide for characteristics of each category of memory.

OVERVIEW OF MEMORY (Cont'd.)

Important Semiconductor Memory Characteristics:



Courtesy of
Intel Corporation

RANDOM-ACCESS MEMORY (RAM)

Characteristics of RAM:

- Data can be “written” to RAM
- Stored data can be “read” at any time
- *Volatile* - cannot be used for permanent memory
- Access to any memory location (address) at any moment

Types of RAM:

- SRAM (static RAM) - stores data in flip-flop-like cells.
  Holds 0 or 1 as long as IC has power (volatile).
- DRAM (dynamic RAM) - memory cells need refreshing
  many times per second. Also volatile.

READ-ONLY MEMORY (ROM)

Characteristics of ROM:

- *Non-volatile* - memory is not lost when power is turned off
- Data is stored permanently
- Data stored in ROM can be “read” at any time
- ROM cannot be reprogrammed
- High density

PROGRAMMABLE READ-ONLY MEMORY (PROM)

Data can be programmed or "burned" into a PROM

Types of PROM:

- **Mask-programmable ROM (usually simply called ROM)**
- **Field-programmable ROM (PROM)**
- **Erasable programmable ROM (EPROM)**
- **Electrically erasable PROM (EEPROM or E^2PROM)**
- **Flash EEPROM**

NONVOLATILE READ/WRITE MEMORY

- **SRAM with battery backup**
  - **Typically a long-life lithium battery**
- **NVSRAM (non-volatile static RAM)**
  - **Better access speed and overall life than SRAM with battery backup**
- **Flash Memory**
  - **Nonvolatile**
  - **In-system rewritable (read/write)**
  - **Highly reliable**
  - **Low power consumption**
  - **High density**

MEMORY PACKAGING

Common Methods of Packaging Semiconductor Memory:

- **DIP (dual in-line package)**
- **SIP (single in-line package)**
- **ZIP (zig-zag in-line package)**
- **SIMM (single in-line memory module)**
- **Memory cards**

COMPUTER BULK STORAGE DEVICES

Primary storage **- computer's internal storage**

Secondary storage **- external storage**

Types of secondary storage devices:

- **Mechanical Devices**
  - **Punched paper card**
  - **Punched or perforated paper tape**
- **Magnetic Devices**
  - **Magnetic tape (sequential-access device)**
  - **Magnetic drum**
  - **Hard disk**
  - **Floppy disk**

COMPUTER STORAGE DEVICES

Types of Secondary Storage Devices (cont'd.):

- **Optical Devices**
  - CD-ROM (Read-only)
  - WORM (write-once, read-many)
  - Read/write
- **Semiconductor Devices**
  - Flash EEPROM semiconductor

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