



EXTERNAL
MEMORY

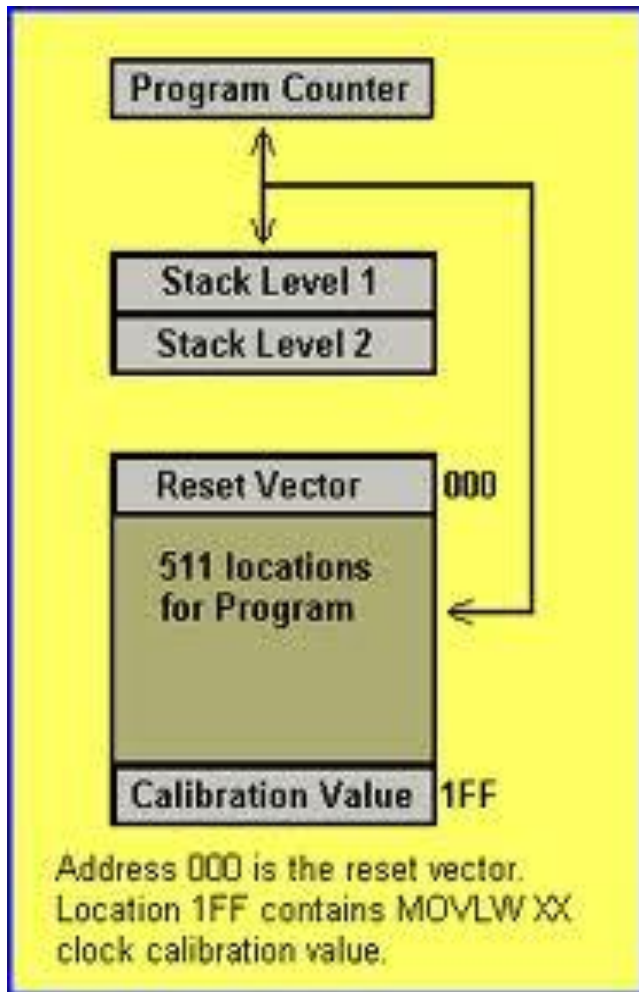
SEMICONDUCTOR MEMORY

- In the design of all microprocessor-based systems, semiconductor memories are used as primary storage for code & data.
- Semiconductor memories are connected directly to the CPU first asks for information.
- For this reason, semiconductors memories are sometimes referred to as primary memory.
- The most widely used are ROM & RAM.

MEMORY CAPACITY

- The no. of bits that a semiconductor memory chip can store is called chip capacity.
- It can be in units of Kbits, Mbits, and so on.
- While the memory capacity of a memory IC chip is always given in bits, the memory capacity of a computer system is given in bytes.

MEMORY ORGANISATION N



- A memory chip contains 2^n locations, where n is the no. of address pins.
- Each location contains m bits, where m is the no. of data pins on the chip.
- The entire chip will contain $2^n * m$ bits.

SPEED

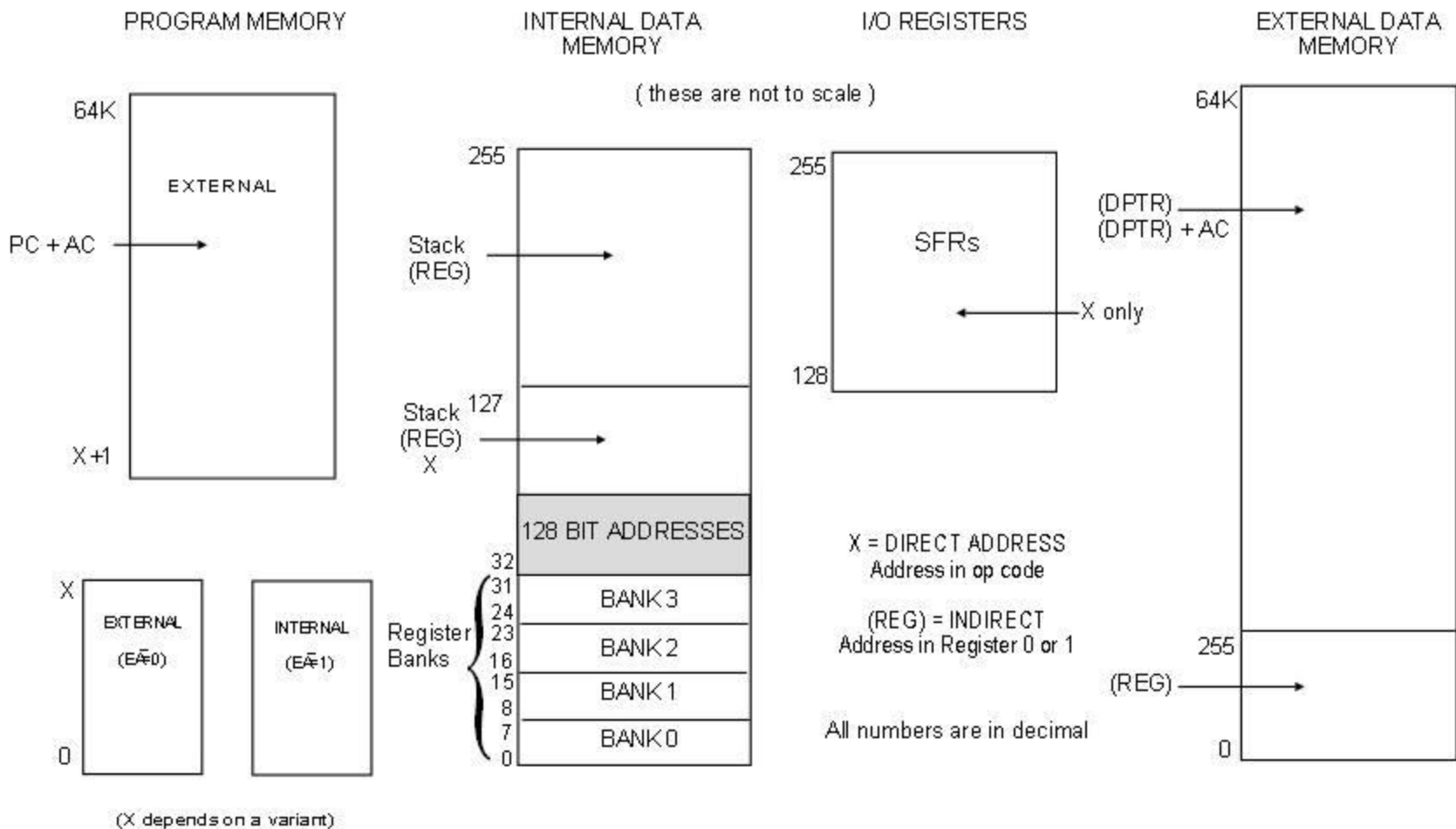


- One of the most important characteristics of a memory chip is the speed at which its data can be accessed.
- To access the data, the address is presented to the address pins, the READ pin is activated, and after a certain amount of time elapsed, the data shows up at the data pins.
- The shorter this elapsed time, the better, and consequently, the more expensive the memory chip.
- The speed of the memory chip is commonly referred to as its access time.

• It varies from a few nanoseconds to hundreds of

Memory mapped IO

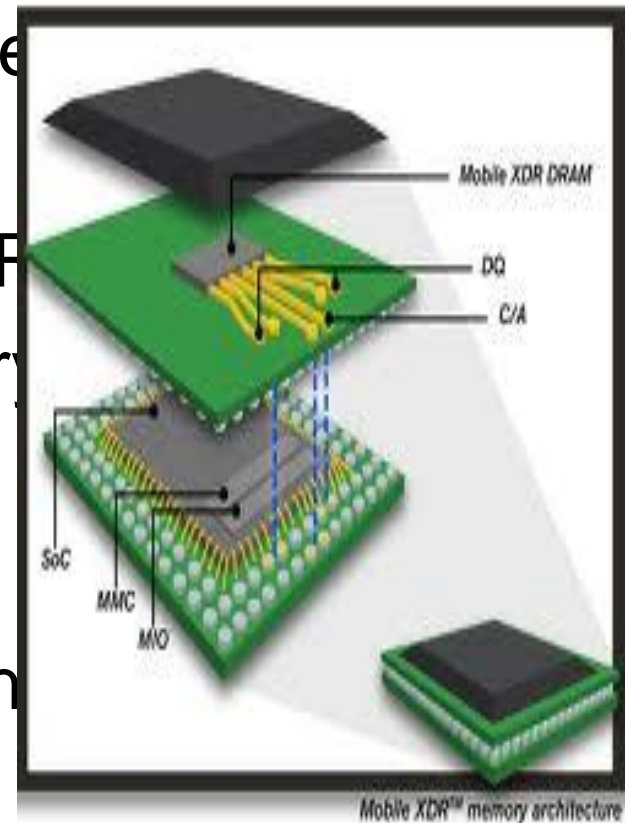
- 8051 Memory and ports assigned the
- addresses such each have distinct range of
- addresses in the data memory address space.
- Interfacing circuit design identical to that
- for the memory connects the external ports
- and programmable peripheral interface
- (PPI).



8051 MEMORY MAP

Harvard Memory Architecture

- Two sets of memory— program memory
- and data memory.
- Two control signals— PSEN and PC
- control read from program memory
- memory.
- Control signal ALE to control use
- AD7 as address or data at a given



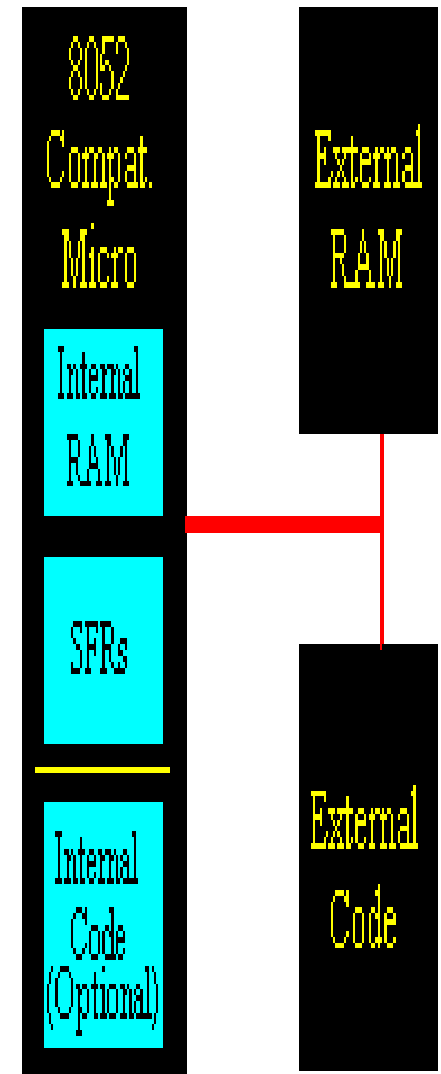
ROM (READ ONLY MEMORY)

- ROM is a type of memory that does not lose its contents when the power is turned off; that's why it is also called as nonvolatile memory.
- There are different types of ROM, such as PROM, EPROM, EEPROM, FLASH EPROM and mask ROM.



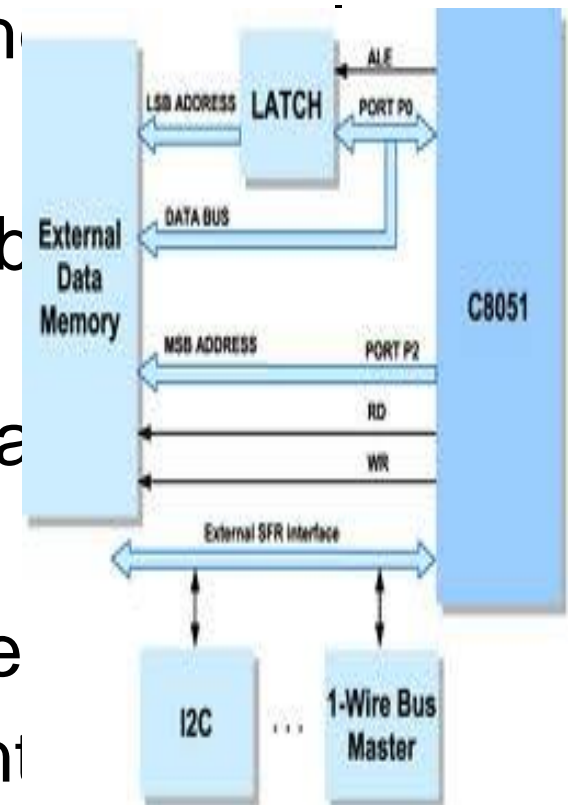
EXTERNAL RAM

- External RAM is any random access memory which is found *off-chip*.
- Since the memory is off-chip it is not as flexible in terms of accessing, and is also slower
- . For example, to increment an Internal RAM location by 1 requires only 1 instruction and 1 instruction cycle. To increment a 1-byte value stored in External RAM requires 4 instructions and 7 instruction cycles. In this case, external memory is 7 times slower!
- What External RAM loses in speed and flexibility it gains in quantity. While Internal RAM is limited to 128 bytes (256 bytes with an 8052), the 8051 supports External



EXTERNAL MEMORY WHEN CONTROL SIGNAL EA INACTIVE

- Then processor always accesses the
- memory whether EA active or not .
- Internal RAM and SFR addresses between 0x0000 and 0xFFFF
- and 0x0000 and 0xFFFF are same as external data memory addresses
- Internal program memory addresses between 0x0000 and 0xFFFF (in case of 4 kB internal ROM)
- are same as external program memory addresses



CONTROL SIGNAL EA



- When a control signal EA activates
- processor always accesses the external
- addresses in memory instead of internal
- memory or register addresses.
- To indicate the program code is stored in external ROM, this pin must be connected to GND.
- This is the case for the 8051-based system.