

Subject - ADDV
Class - 6th Sem ECE
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Unit - 2

Very-large-scale integration (VLSI)

VLSI is the process of creating integrated circuits by combining thousands of transistor-based circuits into a single chip. VLSI began in the 1970s when complex semiconductor and communication technologies were being developed.

The first semiconductor chips held one transistor each. Subsequent advances added more and more transistors, and as a consequence more individual functions or systems were integrated over time. The microprocessor is a VLSI device.

The first "generation" of computers relied on vacuum tubes. Then came discrete semiconductor devices, followed by integrated circuits. The first Small-Scale Integration (SSI) ICs had small numbers of devices on a single chip — diodes, transistors, resistors and capacitors (no inductors though), making it possible to fabricate one or more logic gates on a single device. The fourth generation consisted of Large-Scale Integration (LSI), i.e. systems with at least a thousand logic gates. The natural successor to LSI was VLSI (many tens of thousands of gates on a single chip). Current technology has moved far past this mark and today's microprocessors have many millions of gates and hundreds of millions of individual transistors

2.2 HARDWARE used for VLSI Designing:-

CPLD stands for Complex Programmable Logic Device. It is a programmable logic device with complexity between that of FPGAs

architectural features from both. The building block of a CPLD is the **macro cell**,

which contains logic implementing disjunctive normal form expressions and more specialized logic operation.

2.2.1 Programmable logic device

- A programmable logic device or PLD is an electronic component used to build reconfigurable digital circuits.
- Unlike a logic gate, which has a fixed function, a PLD has an *undefined function* at the time of manufacture. Before the PLD can be used in a circuit it must be programmed (i. e. reconfigured).

2 Programmable Array Logic

(i.e. reconfigured).

The term **Programmable Array Logic (PAL)** is used to describe a family of programmable logic device semiconductors used to implement logic functions in digital circuits introduced by Monolithic Memories, (MMI) in March 1978.

PAL devices consisted of a small PROM (programmable read-only memory) core and additional output logic used to implement particular desired logic functions with few components.

Unlike specialized machines, PAL devices were "field-programmable". Each PAL device was "one-time programmable" (OTP), meaning that it could not be updated and reused after its initial programming. (MMI also offered a similar family called HAL, or "hard array logic", which were like PAL devices except that they were mask-programmed at the factory.)

Programmable logic array

A programmable logic array (PLA) is a programmable device used to implement combinational logic circuits. The PLA has a set of programmable AND gate planes, which link to a set of programmable OR gate planes, which can then be conditionally complemented to produce an output. This layout allows for a large number of logic functions to be synthesized in the sum of products (and sometimes product of sums) canonical forms.

One application of a PLA is to implement the control over a data path. It defines various states in an instruction set, and produces the next state (by conditional branching). [eg. if the machine is in state 2, and will go to state 4 if the instruction contains an immediate field; then the PLA should define the actions of the control in state 2, will set the next state to be 4 if the instruction contains an immediate field, and will define the actions of the control in state 4]. Programmable Logic Arrays should correspond to a state diagram for the system.

Other commonly used programmable logic devices are PAL, CPLD and FPGA.

PALs and PLAs

- The programmable array logic (PAL) is a logic device with fixed OR array
- and a programmable AND array. It is user 'friendly' → PALs easier to
- program but not as flexible as PLA.

- The programmable logic array (PLA) is a logic device with programmable AND and OR array.

What is difference between Programmable Array Logic (PAL) and Programmable Logic Array (PLA)?

For PLAs

- Of the two organizations the PLA is the most flexible
- Both AND and OR arrays are programmable
- One PLA can implement a huge range of logic functions
- But many pins; large package, higher cost

For PALs :

- AND array is programmable, OR array is fixed at fabrication
- Each device is cheaper than a PLA
- less flexible