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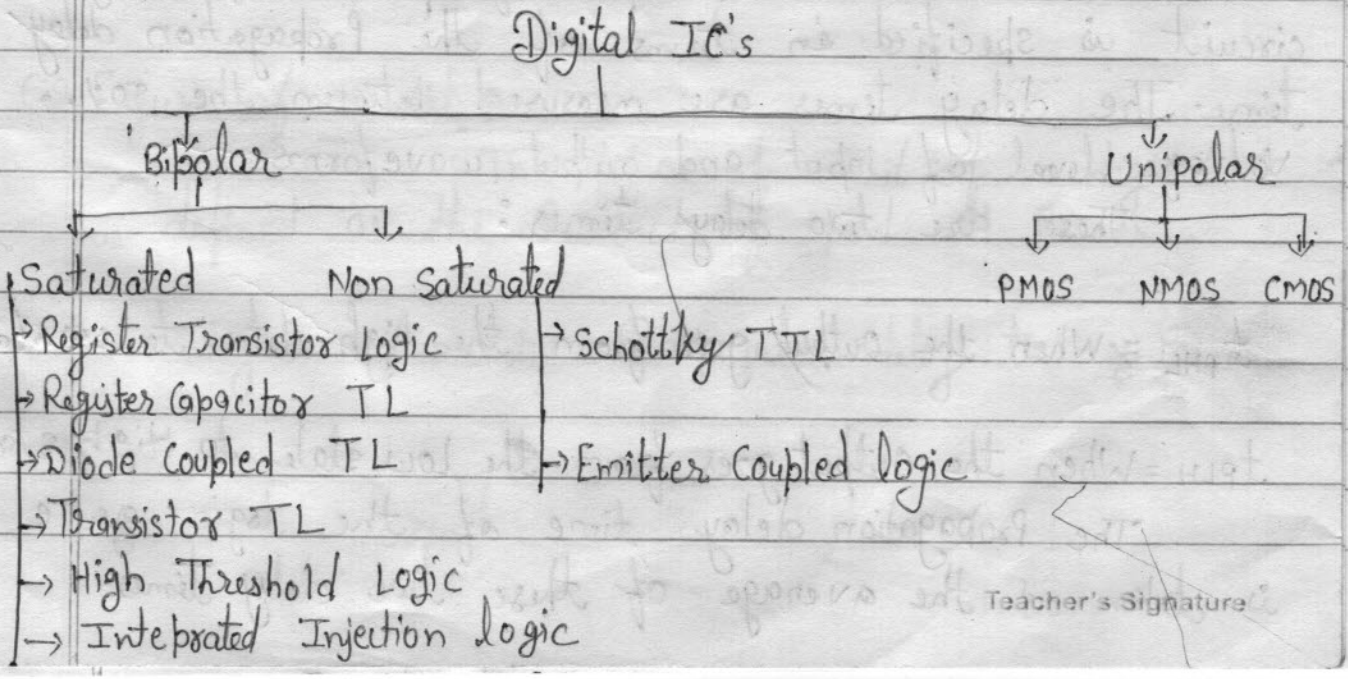
Digital Logic Families

→ Introduction :-

The digital IC's are categorized as Small scale integration (SSI) with fewer as a part of the chip, Medium Scale Integration (MSI) with 10 to 100 gates per chip and large Scale Integration (LSI) with more than 100 to 1000 gates per chip. The Very large scale integration (VLSI) has several 1000 gates per chip.

Digital IC's are classified not only by their level of logic operation but also by the specific circuit technology. The technology is known as Digital logic family.



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→ Characteristic of Digital IC's :-

Digital IC's are classified their according to the complexity of the circuit as the Relative number of individual basic gates. The various characteristic of digital IC's used to compare their Performances are:

(1) Speed of operation
(2) Power dissipation
(3) Figure of Merit
(4) Fan out
(5) Current and Voltage Parameters
(6) Noise immunity
(7) Operating temperature range
(8) Power supply requirements

(1) Speed of Operation :-

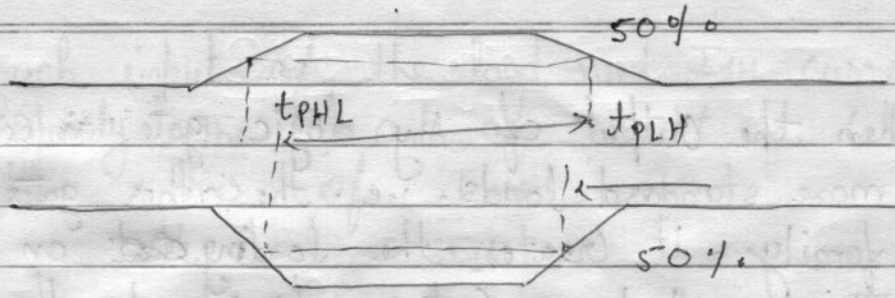
The speed of operation of a digital circuit is specified in terms of the Propagation delay time. The delay times are measured between the 50%., Voltage level of input and output waveforms.

These are two delay times:

t_{PHL} = When the output goes from the high state to Low state

t_{PLH} = When the Output goes from the Low state to High state

The Propagation delay time of the logic gate is taken as the average of these two delay times.



Input and output voltage waveforms to define Propagation delay times

(2) Power Dissipation :-

This is refer as the Power dissipated in an IC. It is determined by the current Icc, that is draws from the Vcc supply and value of its given by Vcc x Icc.

The Icc is the average value of ~~ICC(0)~~ Icc(0) and Icc(1). This Power is specified in milliwats.

(3) Figure of Merit :-

The figure of merit of a digital IC is defined as the Product of speed and Power.

Figure of merit = Propagation delay time x Power

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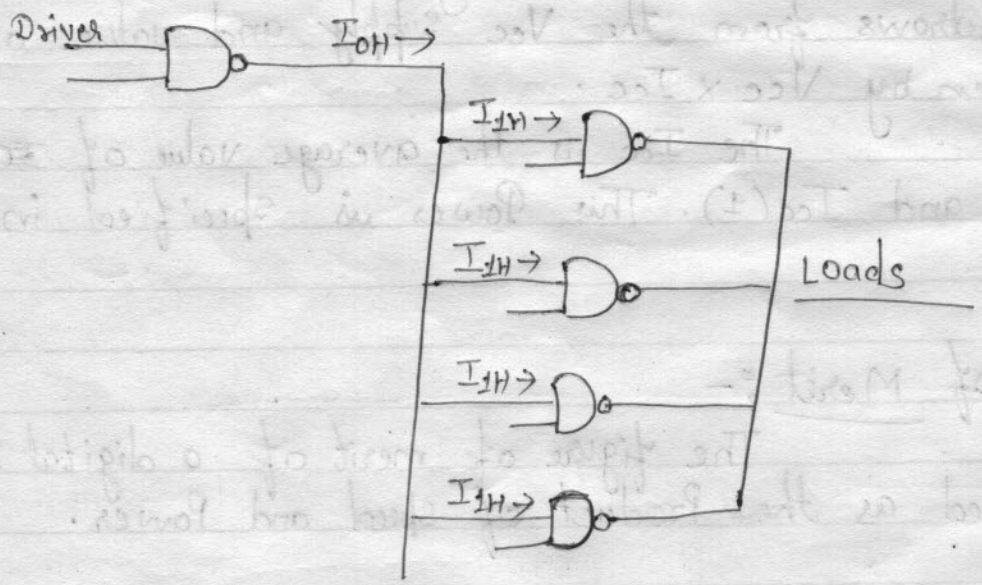
(4)

(4) Fan Out :-

When the Output of Any logic gate is connected to one or more standard loads, i.e. the other gates of same logic family, it creates the loading ~~that~~ on the driver gate. There will be a Certain limit to the number of loads that can be driven by output current of the driver gate. This limit of the loads is Called Fan-Out.

It is also known as loading because the output of a gate can supply a limited amount of Current.



High level state circuit.

The Output of the driver is connected to the input of other gates. It is working as the Current Source (I_{OH}) for the loadly gates.

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Each input of the load need I_{IH} current to operate Properly. The Fan out of circuit is calculated from the ratio of $\frac{I_{OH}}{I_{IH}}$.

5) Current and Voltage Parameters :-

The following currents and voltages are specified which are very useful in the design of digital system

→ High-level input Voltage, V_{IH} : This is the minimum input voltage which is recognized by the gate as logic 1.

→ Low-level input Voltage, V_{IL} → This is the maximum input voltage which is recognized by the gate as Logic 0.

→ High-level output Voltage, V_{OH} : This is the min voltage available at the output corresponding to logic 1.

→ Low-level output voltage, V_{OL} : This is the max voltage available at the Output Corresponding to logic 0.

→ High-level input current, I_{IH} : This is the minimum current which must be supplied by a driving source Corresponding to 1 level voltage.

→ Low-level input Current, I_{IL} : This is the min current which must be supplied by a driving source corresponding to 0 level voltage.

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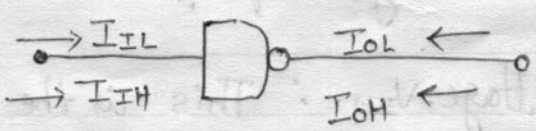
→ High-level output current, I_{OH} : This is the max current which the gate can sink in 1 level.

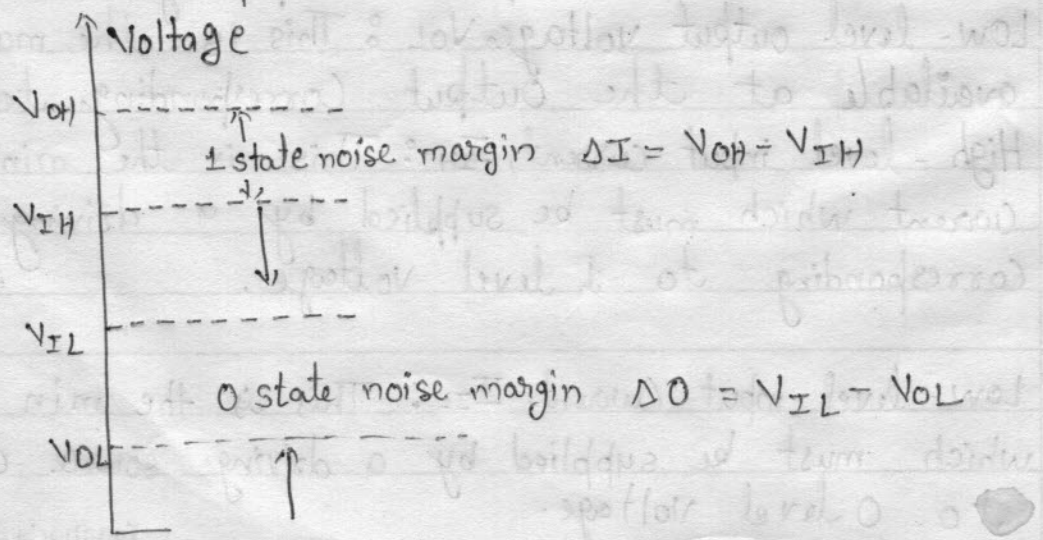
→ Low-level output current, I_{OL} : This is the max current current which the gate can sink in 0 level.

→ High-level supply current, $I_{CC}(1)$: This is the supply current when the output of the gate is at logic 1.

→ Low-level supply current, $I_{CC}(0)$: This is the supply current when the output of the gate is at logic 0.



(6) Noise immunity :- The input and output voltage defined in stary electric and magnetic fields may induce unwanted, known as noise, on the connecting wires between logic circuits. This may cause the voltage at the input to a logic circuit to drop below V_{IH} or rise above V_{IL} and may Produce underived operation



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The circuits ability to tolerate noise signals is referred to as the noise immunity a quantitative measure of which is called noise margin.

(7) Operating temperature :- The temperature range in which an IC functions Property must be known. The accepted temperature range are 0° to 70°C for Consumer and Industrial applications.

(8) Power supply Requirements :-

The supply voltage and the amount of Power required by an IC are important characteristics required to choose the Proper Power Purpose.

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