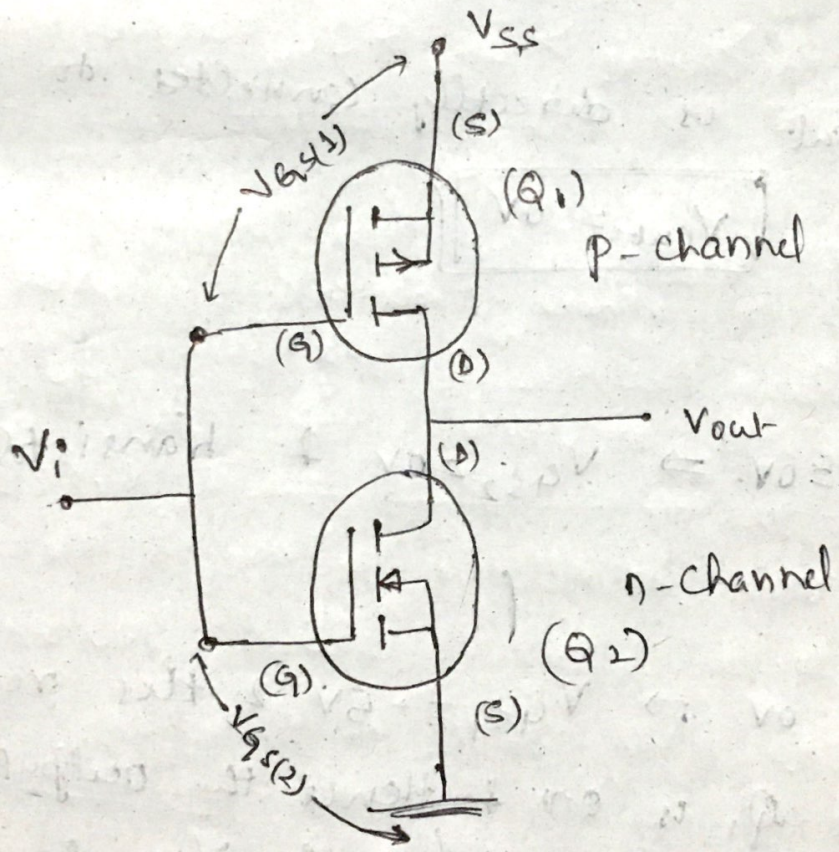
CMOS

(Complementary metaloxide semiconductor Field effect transistor)

A very effective logic circuit can be established by constructing a p-channel & n-channel MOSFET on the same substrate as shown below. a very effective use of complementary arrangement is as an Inverter.



In the above figure both the gate are connected to the input voltage (V_i), both the Drains are connected to the o/p voltage (V_{out}). the Source of p-channel MOSFET is connected to the V_{SS} &

where source of n-channel MOSFET is connected to the Ground.

⇒ when $V_i = 5V \Rightarrow V_{GS(2)} = V_i$ & transistor Q_2 is on.

III^{ly} V_i & V_{SS} are at same +5V hence $V_{GS(1)} = 0V$ this results transistor Q_1 is off

∴ V_{out} is directly connected to ground

hence $\boxed{V_{out} = 0V}$

⇒ when $V_i = 0V \Rightarrow V_{GS_2} = 0V$ & transistor Q_2 is off

III^{ly} $V_i = 0V \Rightarrow V_{GS_1} = -5V$ & this results transistor Q_1 is on & hence the output voltage (V_{out}) is directly connected to the V_{SS} i.e.

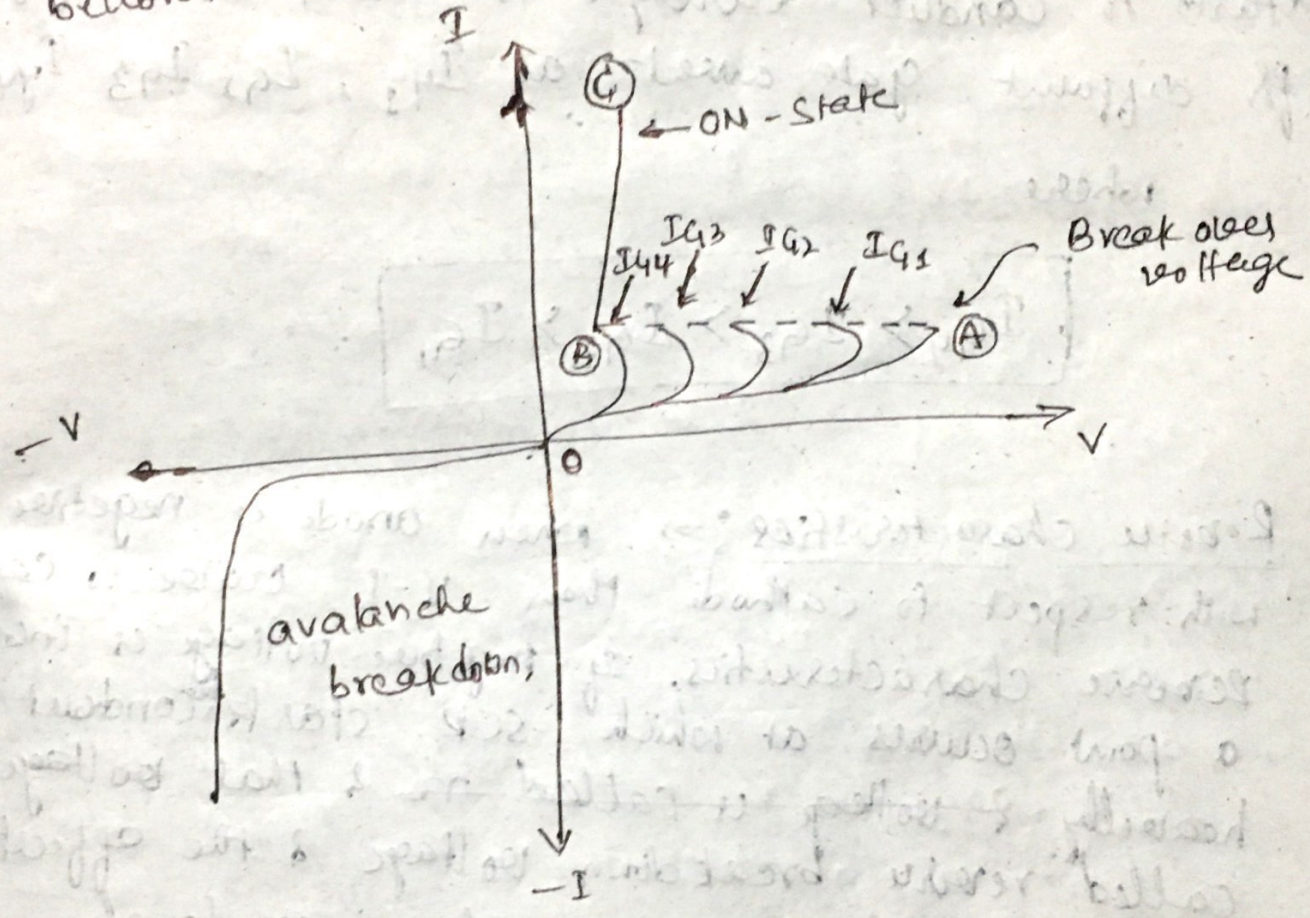
$\boxed{V_{out} = +5V}$

	i/p	o/p
①	0V	+5V
②	5V	0V

SCR (silicon controlled rectifier)

V-I characteristics :-

It is the graphical curve b/n anode-cathode voltage & anode current. & is shown bellow.



forward characteristics :- when the anode is positive with respect to cathode, the curve b/n V-I is called forward characteristics. OABC is forward characteristics of SCR at $I_g = 0$. when a supply voltage is increased from zero, then a point (A) is reached the SCR starts conducting. this voltage is called breakover voltage.

Under this condition voltage across SCR suddenly drops as shown by the doted curve AB & most of supply voltage appear across the load resistance R

If proper gate voltage is applied then SCR starts to conduct early & is shown in the figure for different gate current as I_{G1}, I_{G2} I_{G3} I_{G4}.

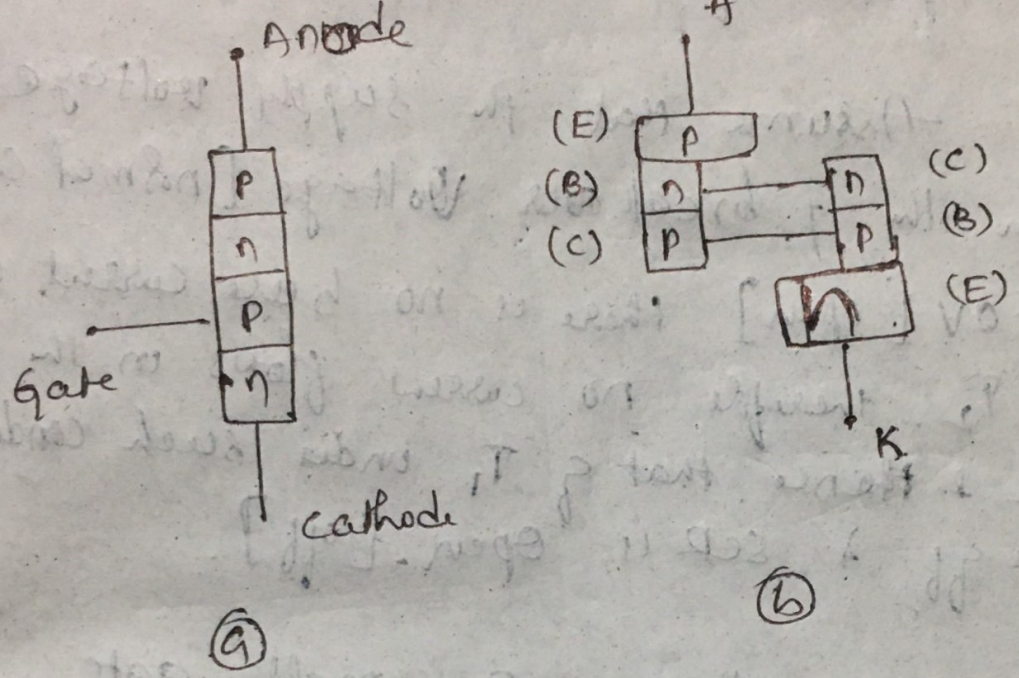
where

$$I_{G4} > I_{G3} > I_{G2} > I_{G1}$$

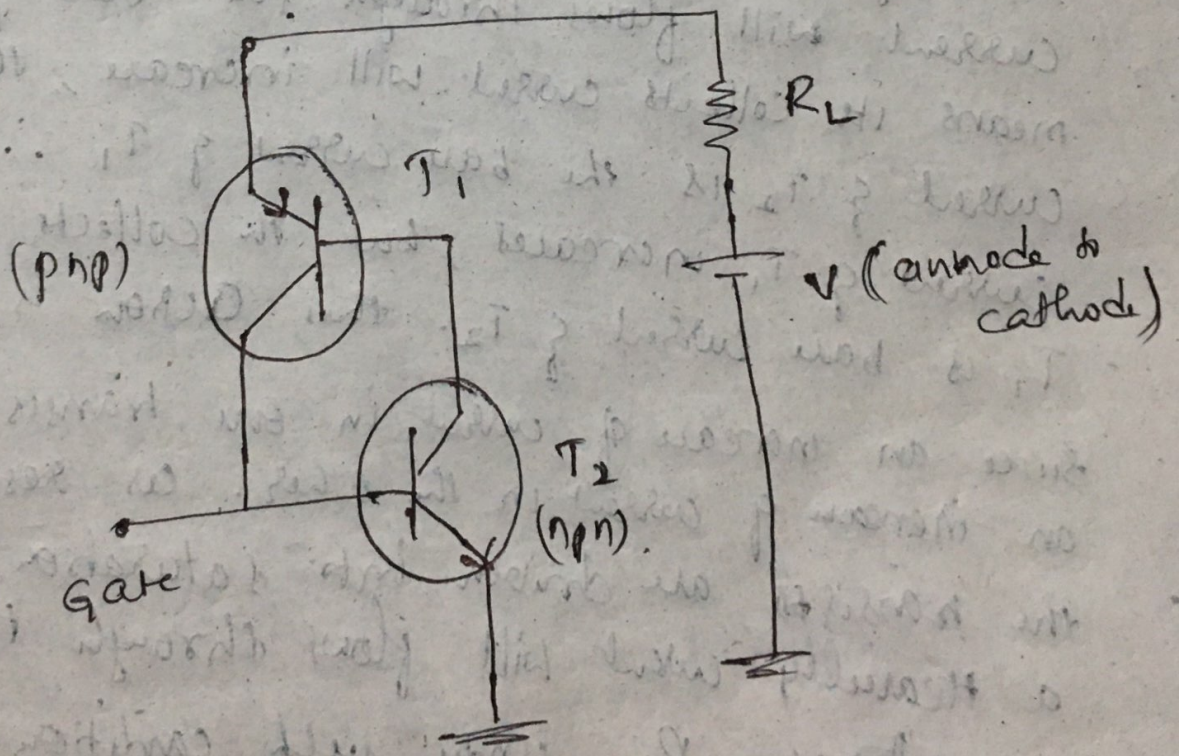
Reverse characteristics :⇒ when anode is negative with respect to cathode then V-I curve is called Reverse characteristics. If negative voltage is increased a point occures at which SCR starts conduct heavily & ~~voltage is called re~~ & that voltage is called reverse breakdown voltage & the effect that conducts current is called avalanche breakdown. & is shown in the figure.

Two transistor Model of SCR

The fig shows the two transistor model of SCR



(a) (b)



(c)

The equivalent circuit of SCR is composed of npn & pnp transistors. In the figure the collector of each is coupled to the base of other three by making a positive feed back loop.

Operation :- Assume that the supply voltage is less than the ∯ breakover voltage [normal case]

⇒ with gate = 0V [open] there is no base current in transistor T_2. therefore no current flows in the collector T_2 & hence that of T_1 under such condition T_1 & T_2 are off & SCR is open. [off].

⇒ with gate = +ve voltage. a small gate current will flows through the base of T_2 which means its collector current will increase, the collector current of T_2 is the base current of T_1 ∴ the collector current of T_1 increases; but T_1 collector current is T_2 base current. this action is accumulative since an increase of current in one transistor causes an increase of current in the other. as result of this the transistors are driven into saturation & hence a heavy current will flows through the load resistance R_L. under such condition SCR is on [closed switch]