(1) Power Rectification diodes Ex (1N4001 → 1N4007) → , 1N4148.

(2) PhoTo Diode

(3) shottky Diode Ex (1N5711, 1N5819) → (<0.7)

(4) variCap Diode

(5) zener diode Ex (BZX55C7V5) →

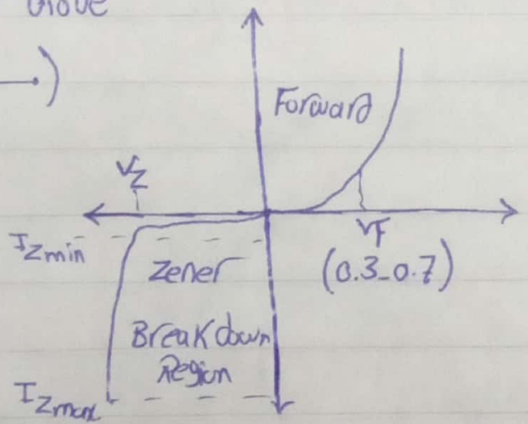
* (1N4148) → withstand High Frequency.

→ we can check the Diode by using (DMM).

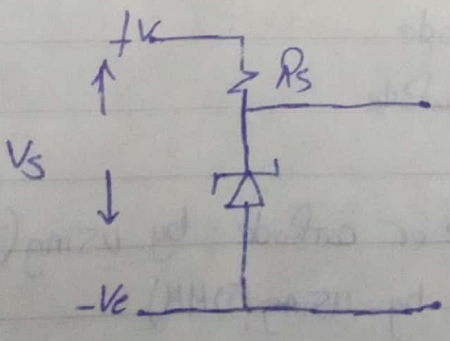
in the Forward Bias → DMM gives a value between (0.5_0.7)v.

in the backward Bias → DMM doesn't give a value (Open Loop)

* zener diode



- if Current is more than I_{max}, zener diode is damaged.
- in Reverse Bias voltage will noT Pass if it doesn't reach (V_Z).



$R_S = \frac{V_S - V_Z}{I_Z}$, To make the CurrenT Passing through Zener Less than (I_{Zmax})

Examples of zener diodes BZX85 , BZX55

BZX85 → 13W , BZX55 → 500mW.

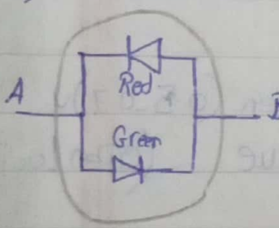
For Example → BZX55C7V5
as this zener diode its Power rating is 500mW and the voltage output is 7.5

→ we can connect more than one zener diode in series with each others.

* (LED diode)
→ the voltage and current of each led varies from one to another according to the colour
* LED Diode can be checked by using (DMM)

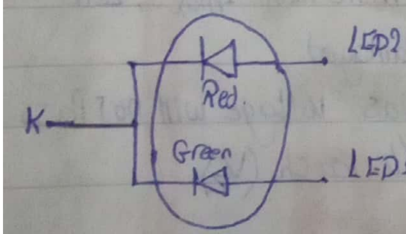
APPLications on LED :-

→ Bi Colour LED

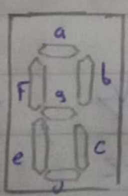


- if (A) +ve , (B) -ve → Red led is on. and vice versa.
- if we use an AC current a Mixture colour will appear (Yellow)

→ Multi Colour LED



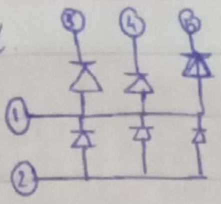
→ Seven Segment



→ 1) Common anode
→ 2) Common cathode

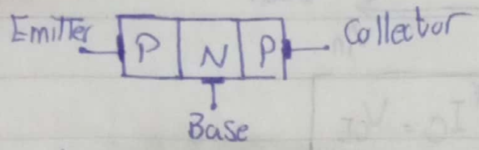
we can determine if seven segment is common anode or cathode by using (DMM)
and we can also determine (a, b, c, d, e, F, g) by using (DMM)

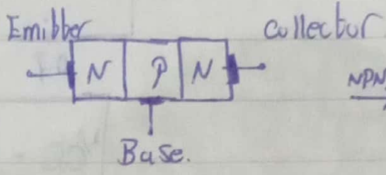
→ Dot Matrix



* each row and Column has a Common anode and Cathode.

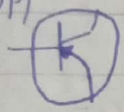
Transistors

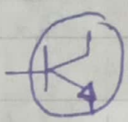




NPN → Most Common

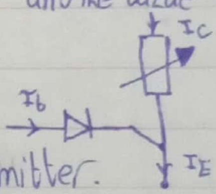
(PNP)



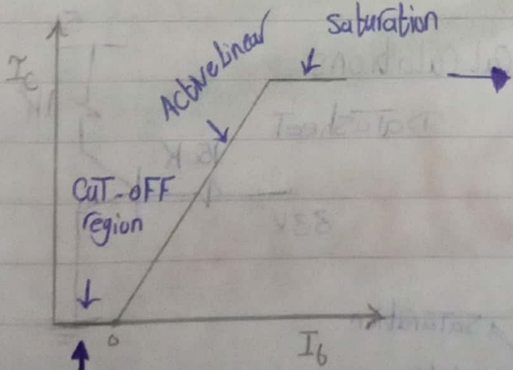


(NPN)

* Current Passes From Collector to the emitter, and the base Control the Current Passing through the emitter
* we can Consider the Transistor as Variable Resistance and the value of this Resistance Varies according to the Current of (I_b) base.



* As I_b inc, I_c inc.
* ~~Transistor~~ base needs at Least 0.7 Volt greater than Emitter.
* one of Advantages of Transistor that (I_B) is very small Compared to (I_c) so, it Permits Very Small Current to Control large currents.

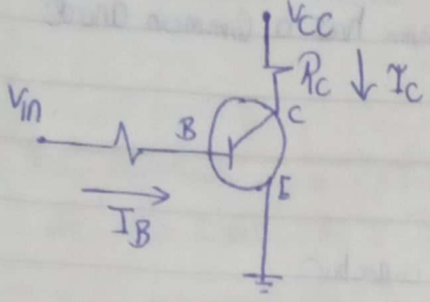


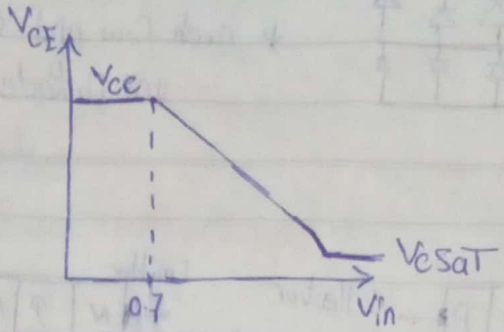
→ in saturation region, Transistor act as a closed switch I_b = large

in the cut off region the Transistor act as an open switch ($I_b = 0$)

$$\boxed{I_C = \beta I_B}$$

* NPN Transistor is opposite to PNP Transistors





$\boxed{V_{CC} - R_C * I_C = V_{CE}}$

* Power dissipated by Transistors $P_D = I_C * V_{CE}$

* Determining the Case of Transistor (Cut off, Active, Saturation

$I_B \leq 0$
Cut-off
$I_C = 0$

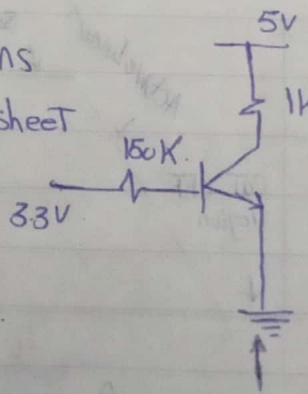
$I_B > 0$
V_{CE} نحسب

$V_{CE} \leq 0.2V$
Saturation
$I_C = I_{C\,sat}$

$V_{CE} > 0.2V$
Active
$I_C = \beta I_B$

Example on Transistor Circuits Calculations

$V_{BE} = 0.7V$, $\beta = 120$, $V_{CE(sat)} = 0.2V$ Datasheet



① $I_B = ?$

$3.3 - 150\times10^3 I_B - 0.7 = 0$

$I_B = (15.3\ \mu A) > 0$ Saturation / Active

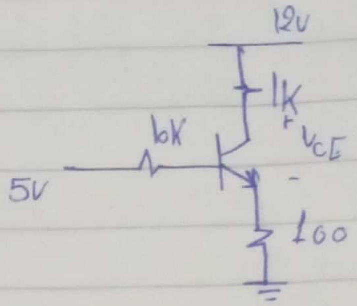
② $V_{CE} = ?$

$5V - 1\times10^3 \times I_C - V_{CE} = 0$

Assume Transistor is in an Active state , $I_C = \beta I_B = 1.84\ mA$

$\therefore V_{CE} = 3.16V > 0.2$ (Active)

Another Example on Determining Mode of Transistor



$5 - 10kI_B - 0.7 - 100\,I_C = 0$

Assume Transistor Active

$I_C = \beta I_B$

$I_C = 120\ I_B$ where $\beta = 120$

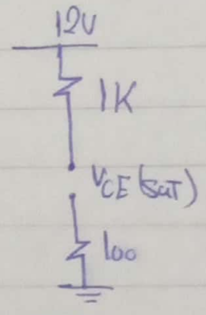
$5 - 10\times10^3\ I_B - 0.7 - 100\times120\ I_B = 0$

$I_B = 195.5\ \mu A > 0 \longrightarrow$ Sat $\longrightarrow$ Active

$12 - 1\times10^3\ I_C - V_{CE} - 100\,I_C = 0$

$I_C = 120\times195.5\ \mu A = 23.5\ mA$

$\therefore V_{CE} = -13.85 < 0.2 \longrightarrow$ Saturation.



$\therefore 12 - 1\times10^3\ I_C - \cancel{V_{CE}}^{\,0.2} - 100\ I_C = 0$

$I_C = 10.73\ mA$ #

Some Examples on Common Transistors (BC547, BC337, 2N2222, BD139, ...)

* in case of using Transistor as a switch, I_B should be More than ~~original~~ its value by 5 or 10 time.

$$R_B = \frac{V_{in} - V_{BE}}{I_B} = \frac{3.3-0.7}{0.91} = 2.857\ k\Omega$$