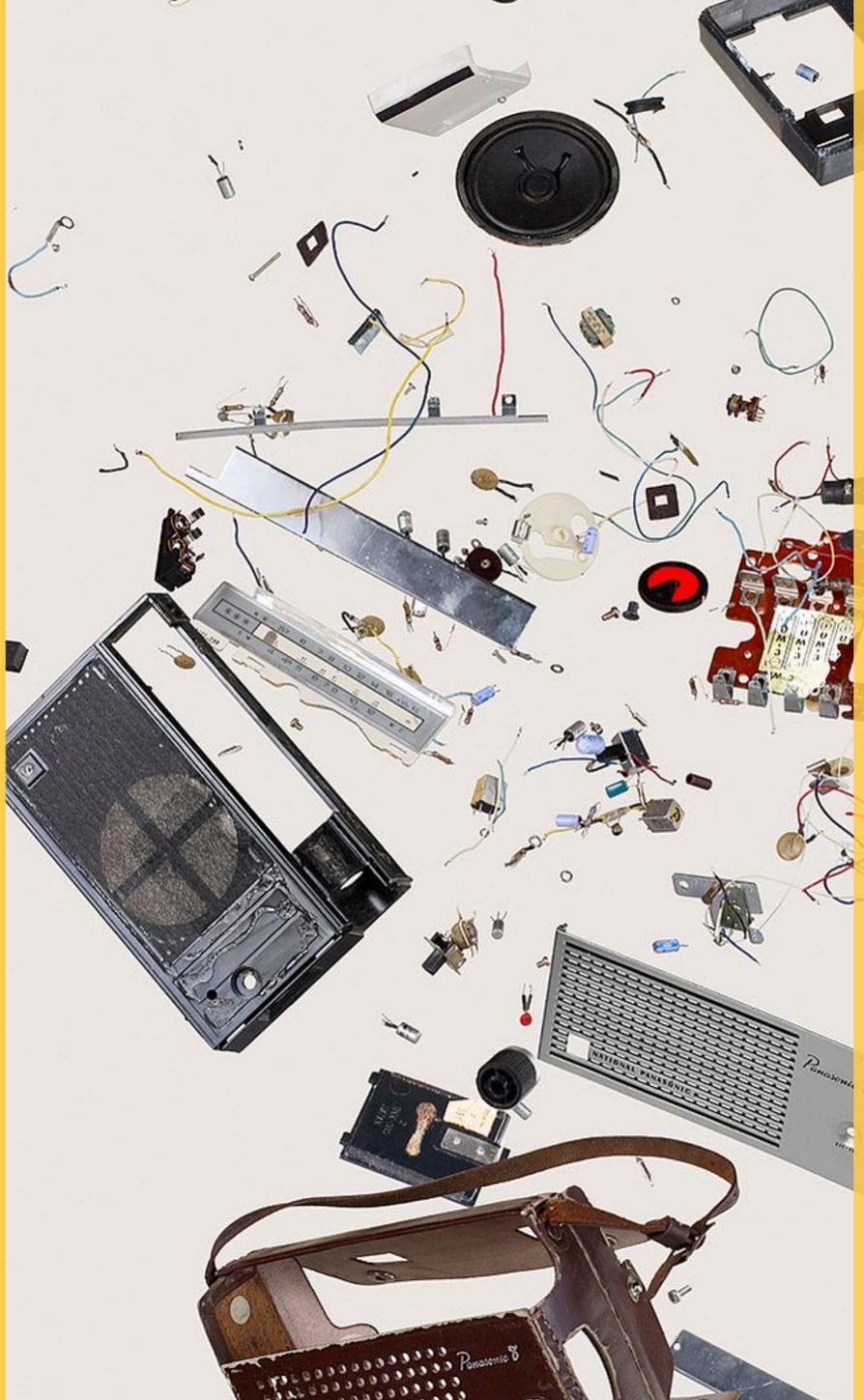


ELEKTRONIKA ANALOG

Pertemuan 5 – Transistor

Frida Hasana, S.Pd., M.Eng.

Transistor: Tipe

1

BJT

BIPOLAR JUNCTION TRANSISTOR

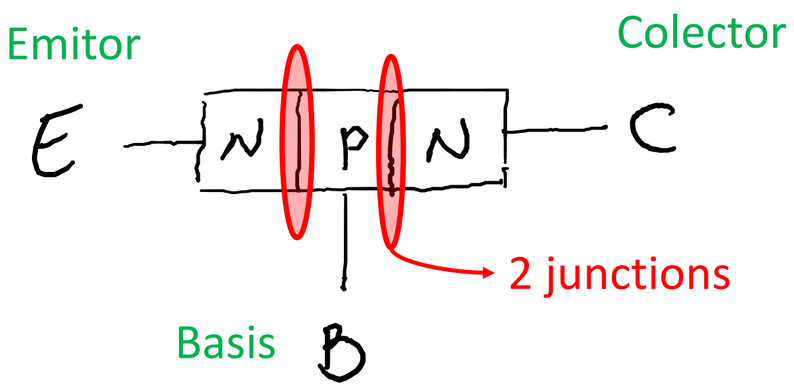
2

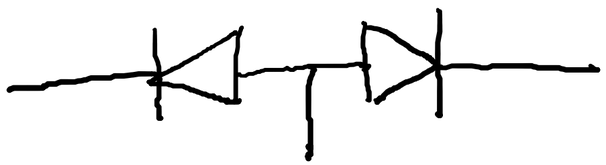
FET

FIELD EFFECT TARANSISTOR

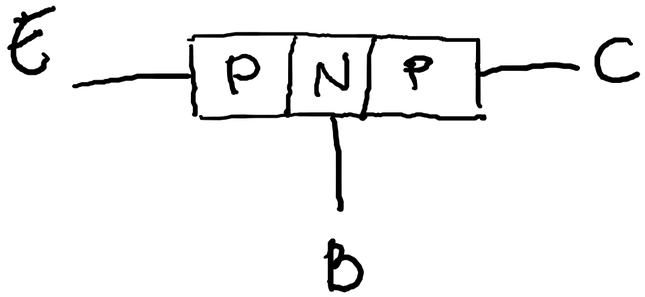
Transistor: BJT

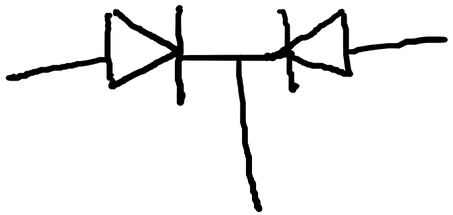
NPN





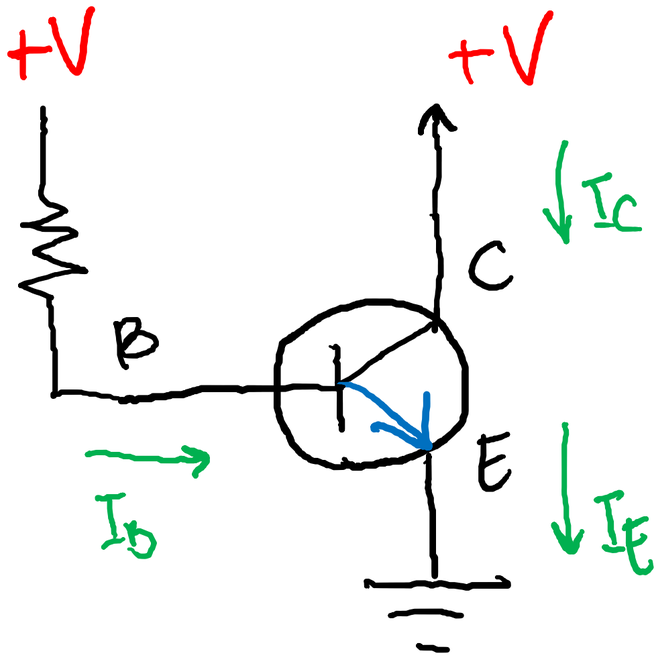
PNP





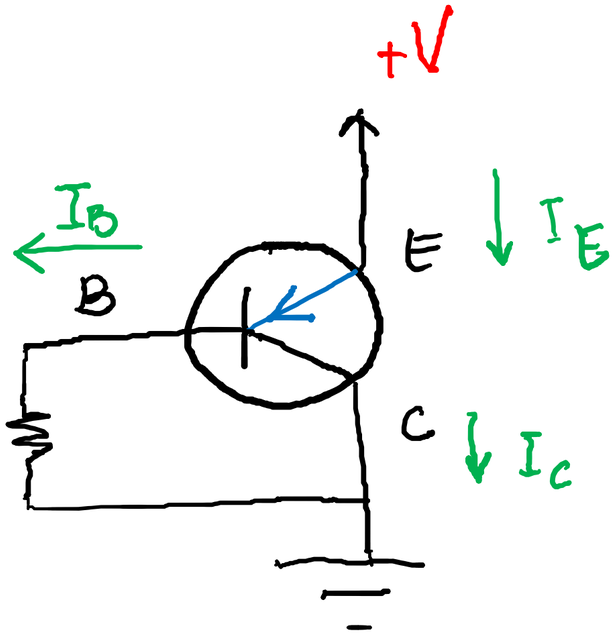
Transistor: Symbol

NPN



COMPLETELY OPPOSITE

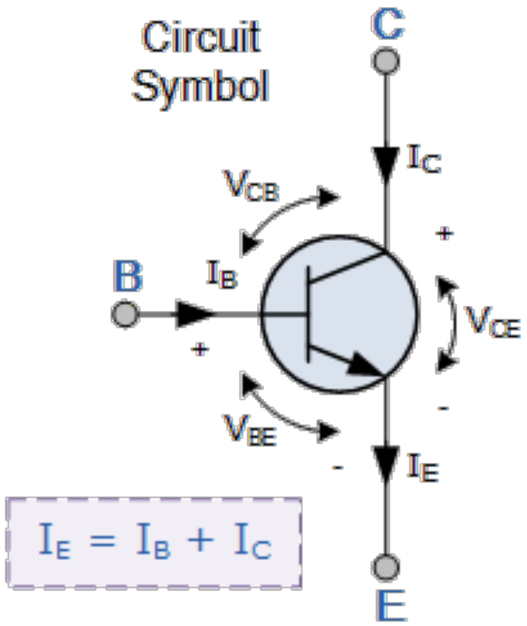
PNP



- **Arus** mengalir dari positif ke negatif
- Arrow = Emitor

Transistor: NPN

NPN



$I_C = \beta \, . \, I_B$

$\beta = hfe$

$I_E = I_C + I_B$

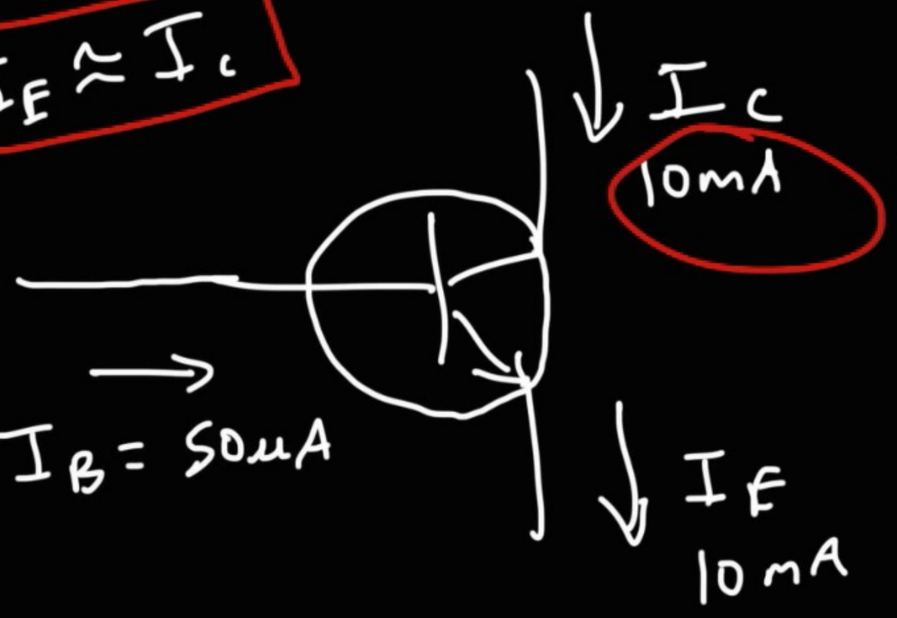
$I_E = \beta \, . \, I_B + I_B$

$I_E = I_B (\beta + 1)$

Transistor: NPN

1000 μA = 1 mA

$I_E \simeq I_C$



hfe = 200
hfe > 1000

$I_C = \beta I_B$

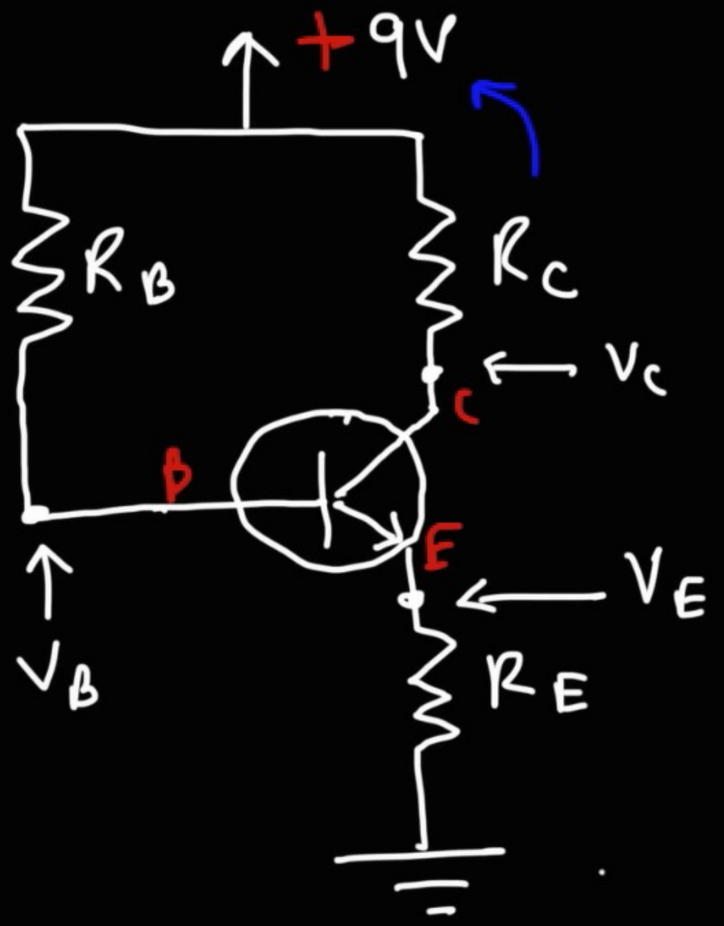
$I_C = 200(50\,\mu A)$

$I_C = 10{,}000\,\mu A$

$I_C = 10\,mA$

$I_E = I_B + I_C$
$= 50\mu A + 10{,}000\,\mu A = 10{,}050\,\mu A = 10.05mA$

Transistor: Identification



$$V_{CE} = V_C - V_E$$

$$V_{BE} = V_B - V_E =$$

$$0.6 - 0.7 \text{ V}$$

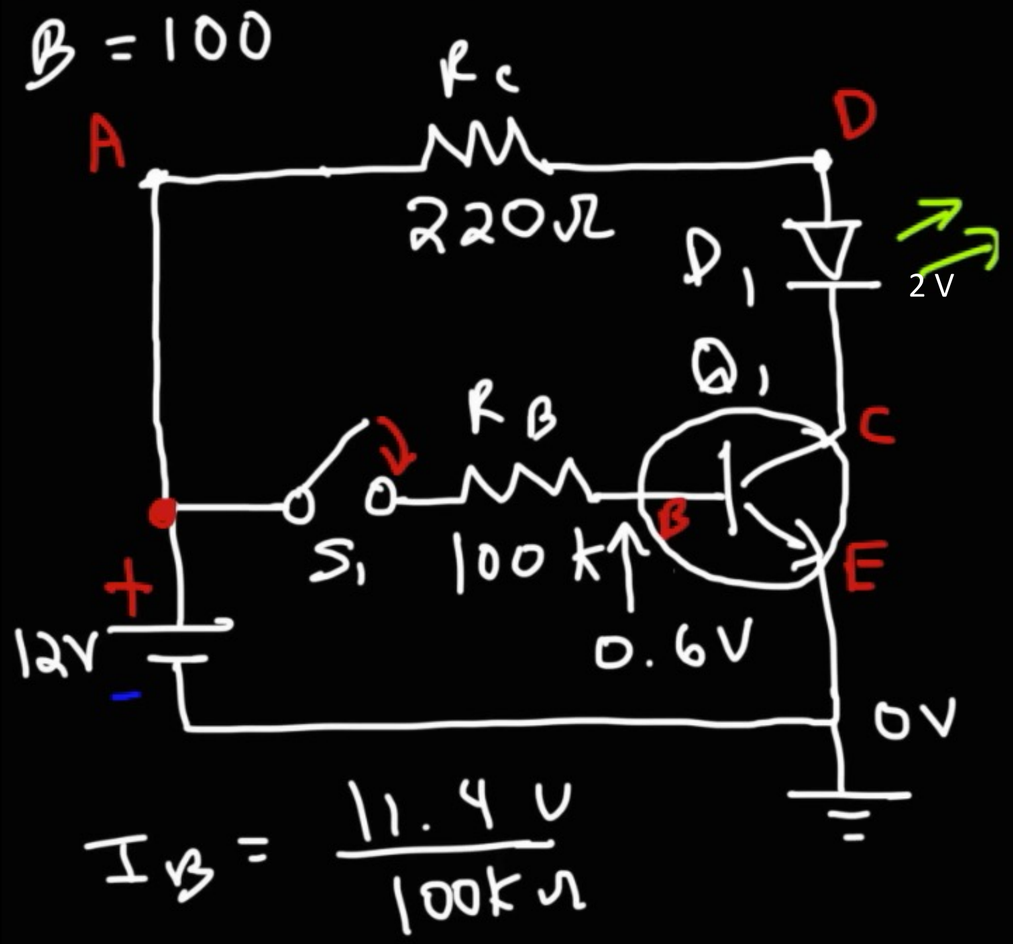
V_{BE} harus bernilai tersebut agar ON

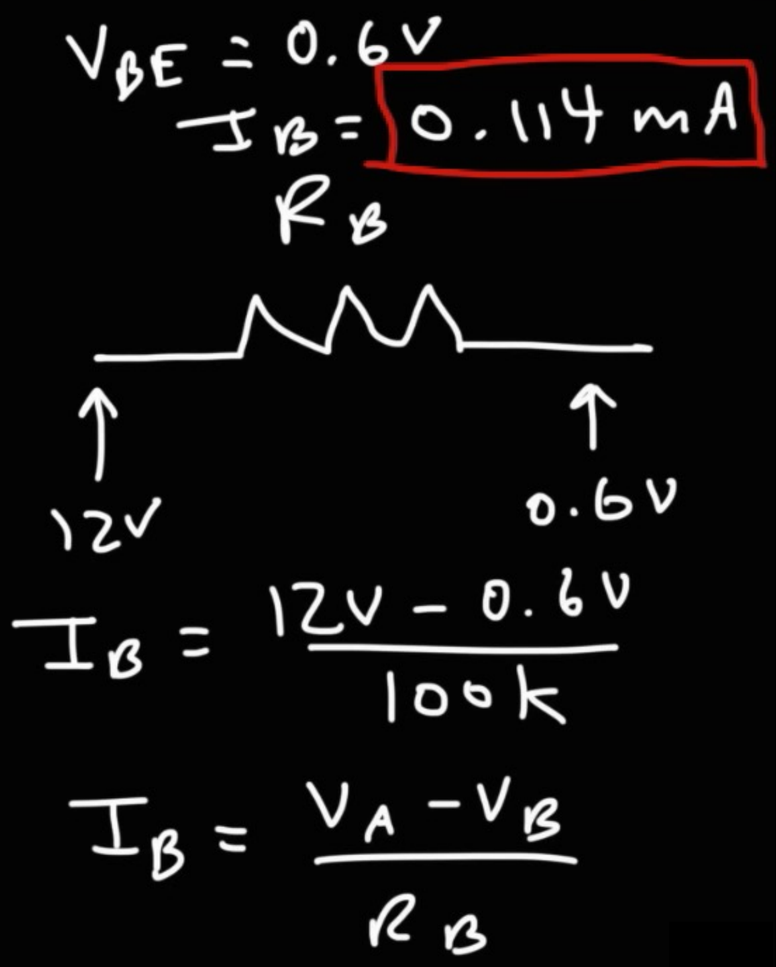
$$V_{CB} = V_C - V_B$$

$$V_{CC} = +9\text{V}$$

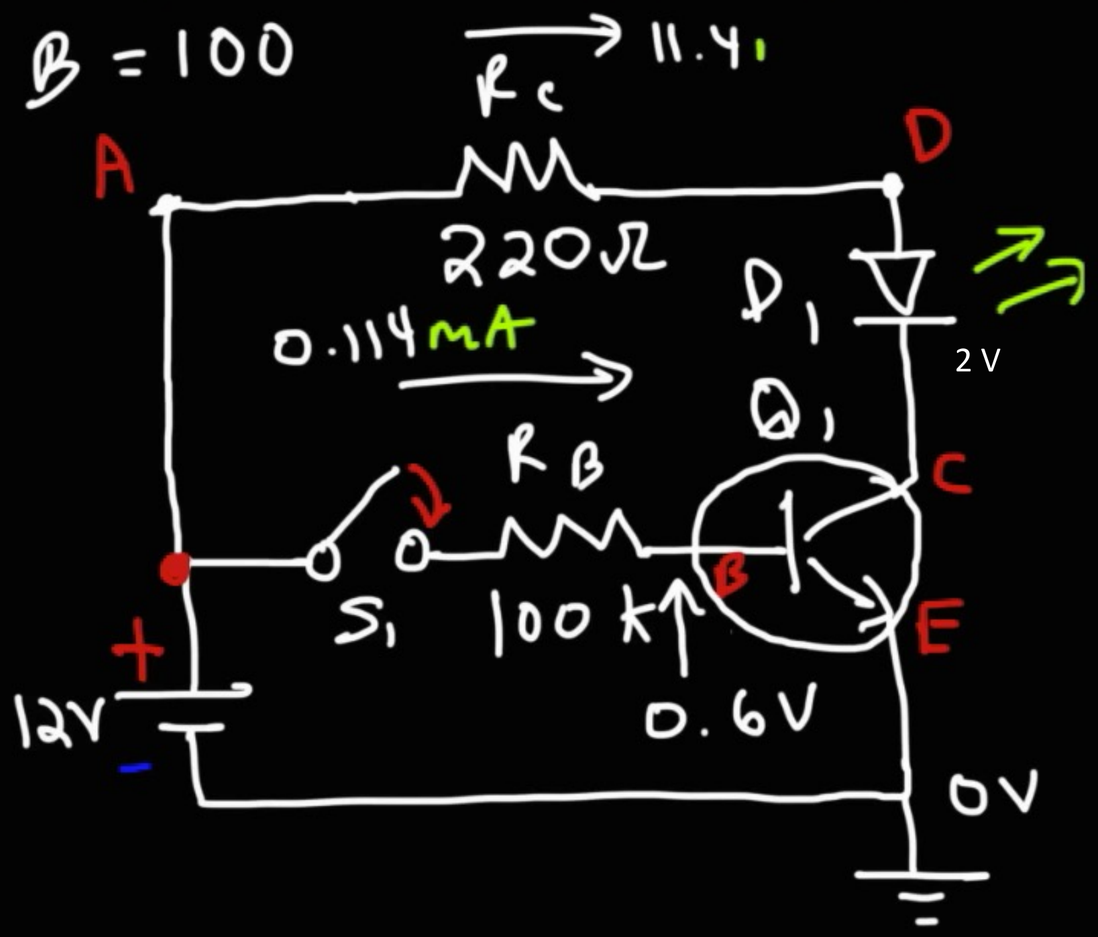
$$V_{EE} = 0\text{V}$$

Transistor: Identification





Transistor: Identification



$V_{BE} = 0.6V$

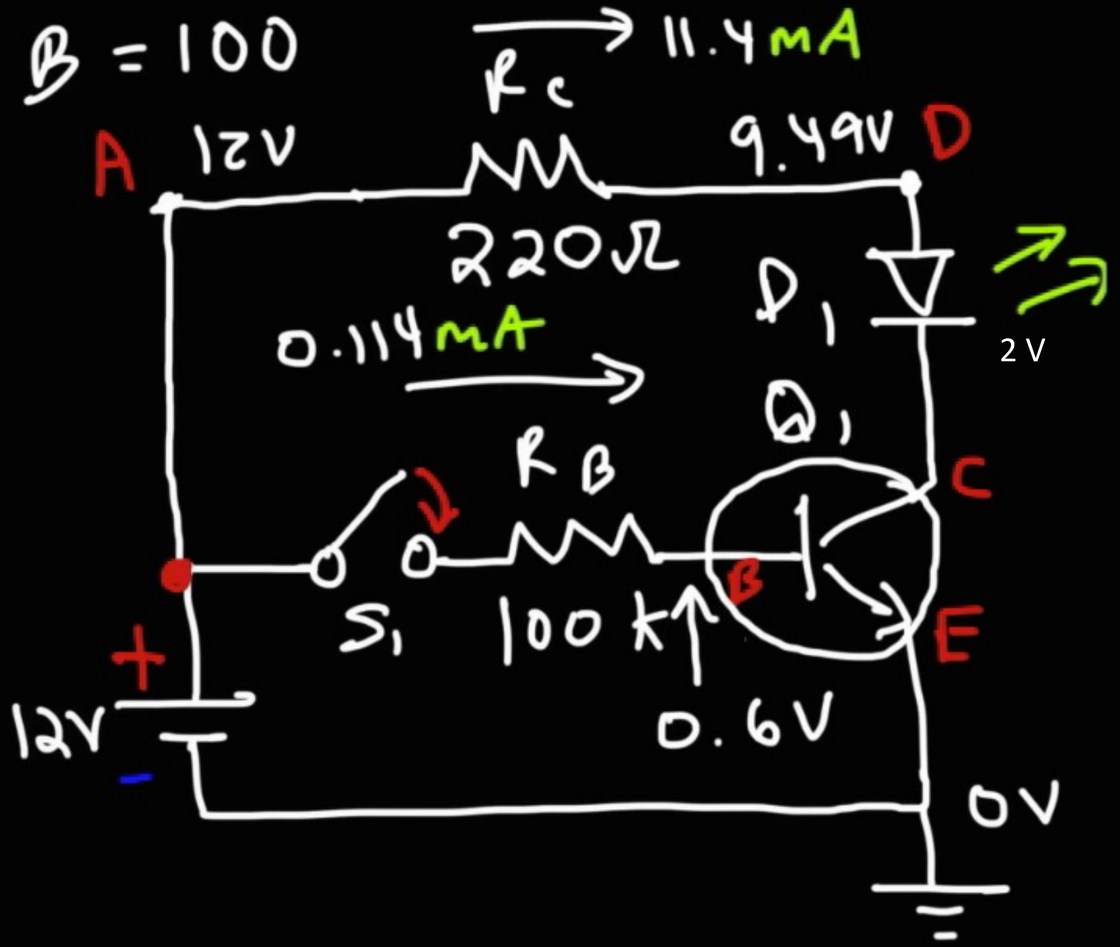
$I_B = 0.114\ mA$

$I_C = B\, I_B$

$= 100\,(0.114\ mA)$

$I_C = 11.4\ mA$

Transistor: Identification



$$\Delta V = I R$$

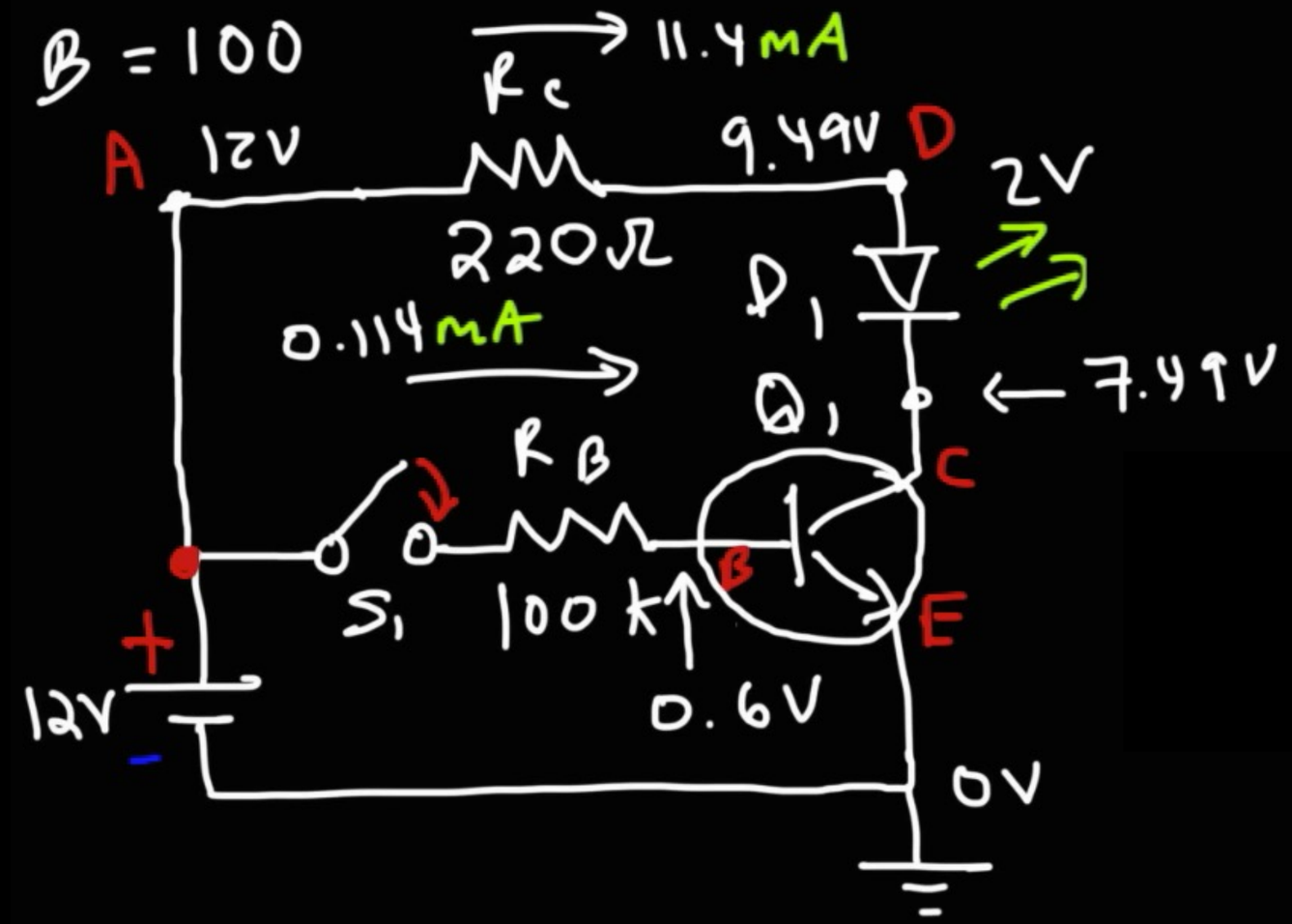
$$V_A - V_D = I_C R_C$$

$$V_D = V_A - I_C R_C$$

$$V_D = 12 - (0.0114)(220)$$

$$\boxed{V_D = 9.492\,V}$$

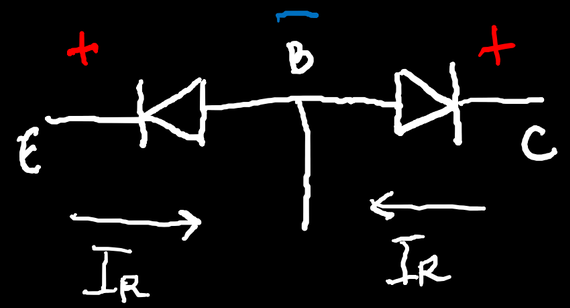
Transistor: Identification



$$V_{CE} = 7.49V$$

Transistor: Region

CUTOFF



- $V_B < V_E$; $V_B < 0{,}6V$

  Maka, berlaku reverse biased pada E-B junction

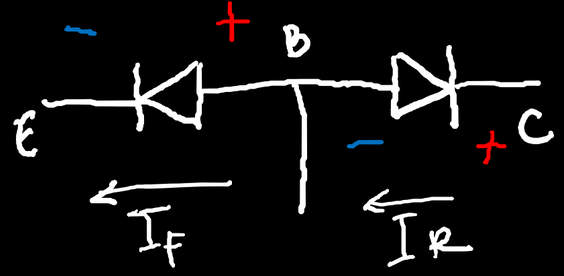
- $V_B < V_C$; $V_{CE} = V_{CC}$

  Maka, berlaku reverse biased pada C-B junction

- $I_C \approx 0\,A$

Transistor OFF -> OPEN SWITCH

ACTIVE



- $V_{BE} \geq 0{,}6\,V$

  Maka, berlaku forward biased pada E-B junction

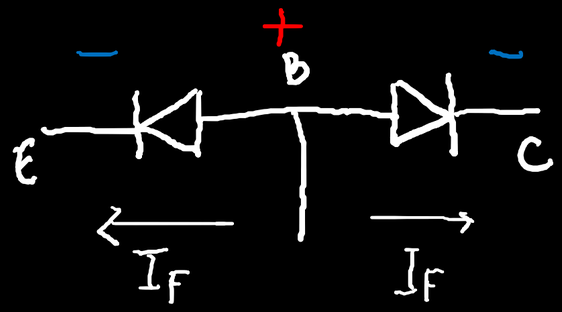
- $V_B < V_C$; $0 < V_{CE} < V_{CC}$

  Maka, berlaku reverse biased pada C-B junction

- $0 < I_C < I_{sat}$; $I_C = \beta . I_B$

Transistor = Amplifier

SATURATION



- $V_{BE} \geq 0{,}6V$

  Maka, berlaku forward biased pada E-B junction

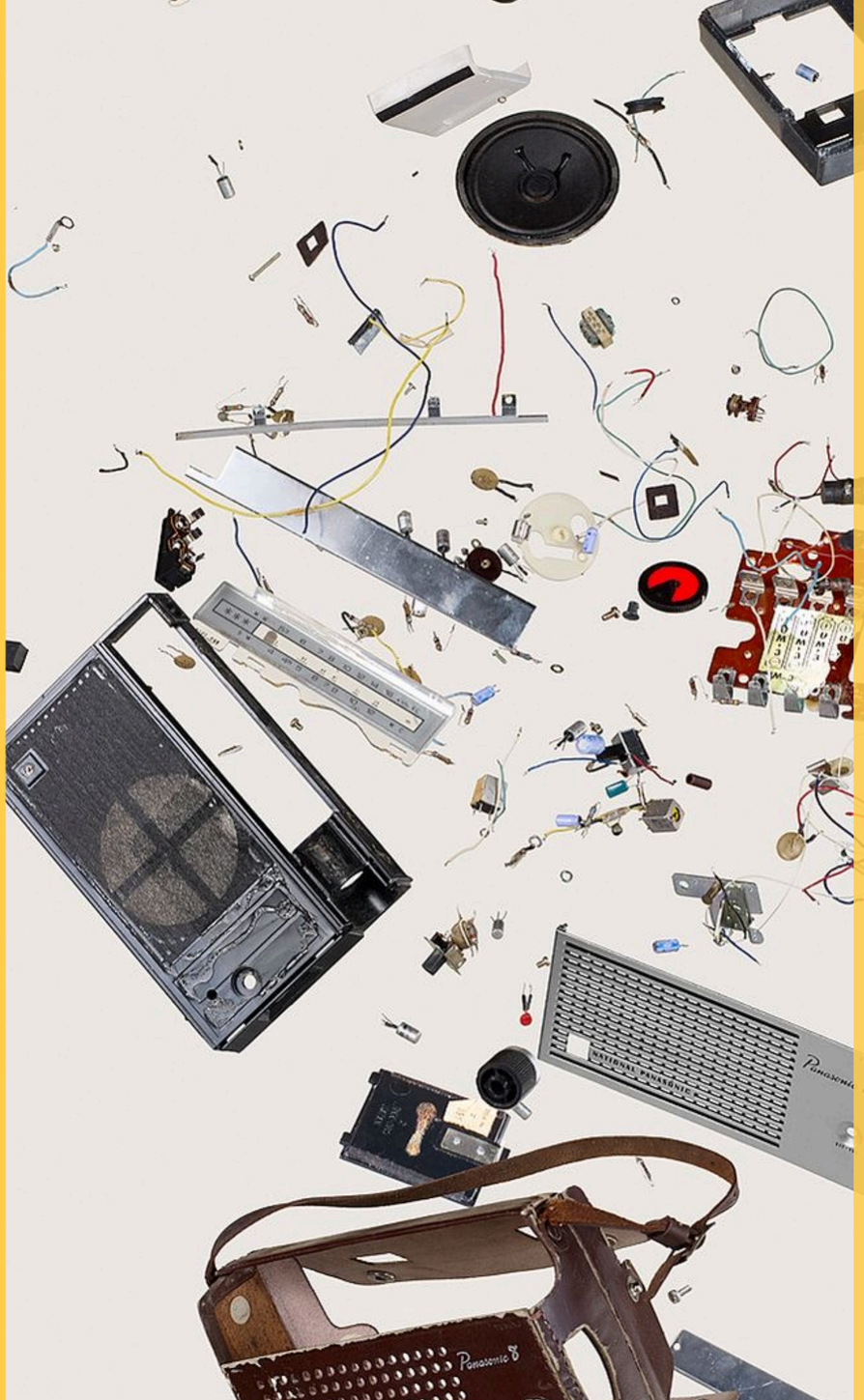
- $V_{CE} \approx 0V$

  Maka, berlaku forward biased pada C-B junction

- $I_C \approx I_{C(sat)}$

  $I_{C(sat)} = \frac{\Delta V}{\Sigma R} = \frac{V_{CC} - V_D}{R_C}$

Transistor ON -> CLOSED SWITCH



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