BJT Characteristics (H.1)

20170107

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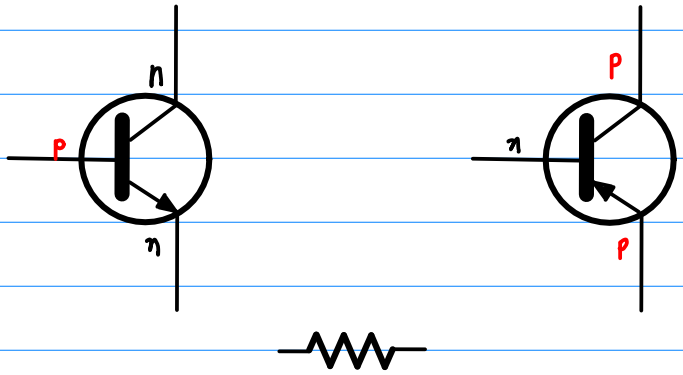
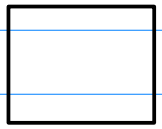
References

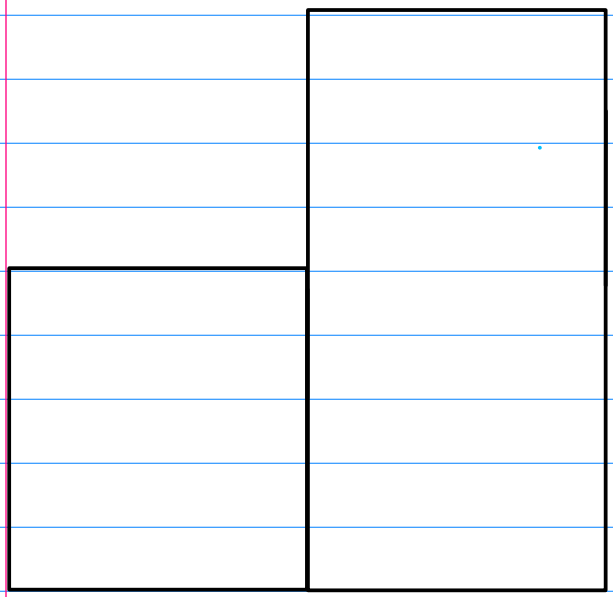
Based

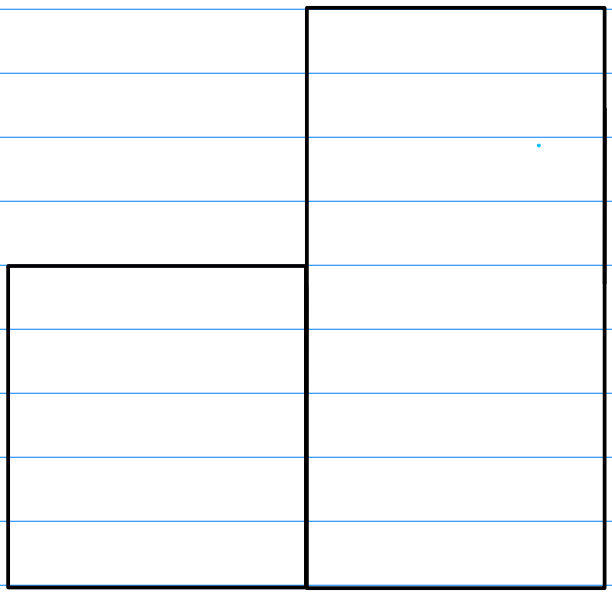
[1] Floyd, Electronic Devices 7th ed
[2] Cook,

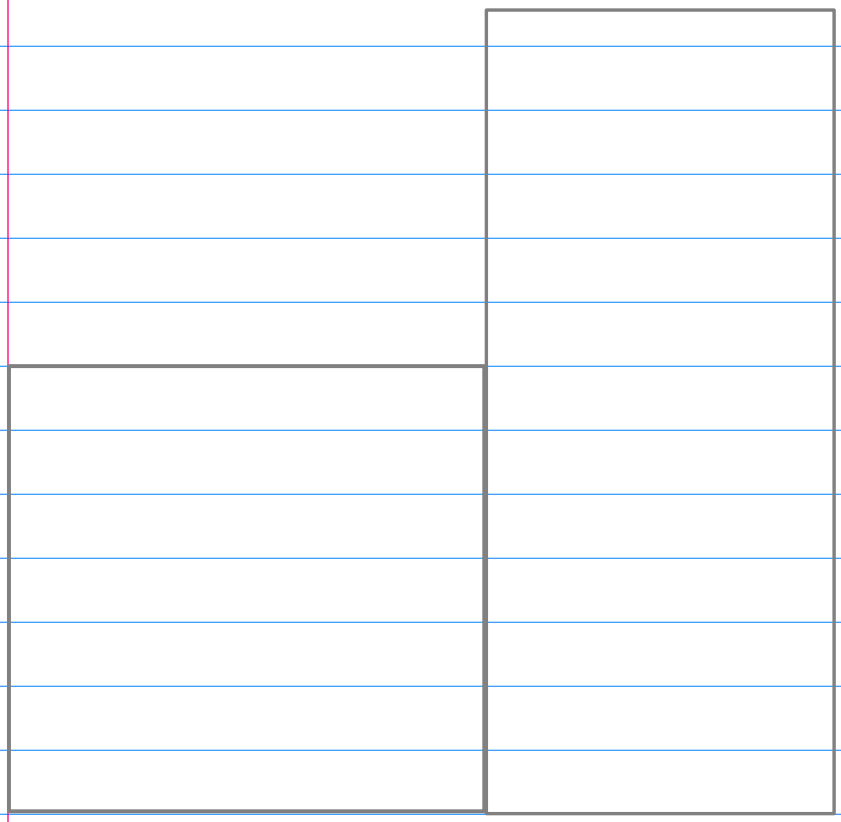
[2] en.wikipedia.org

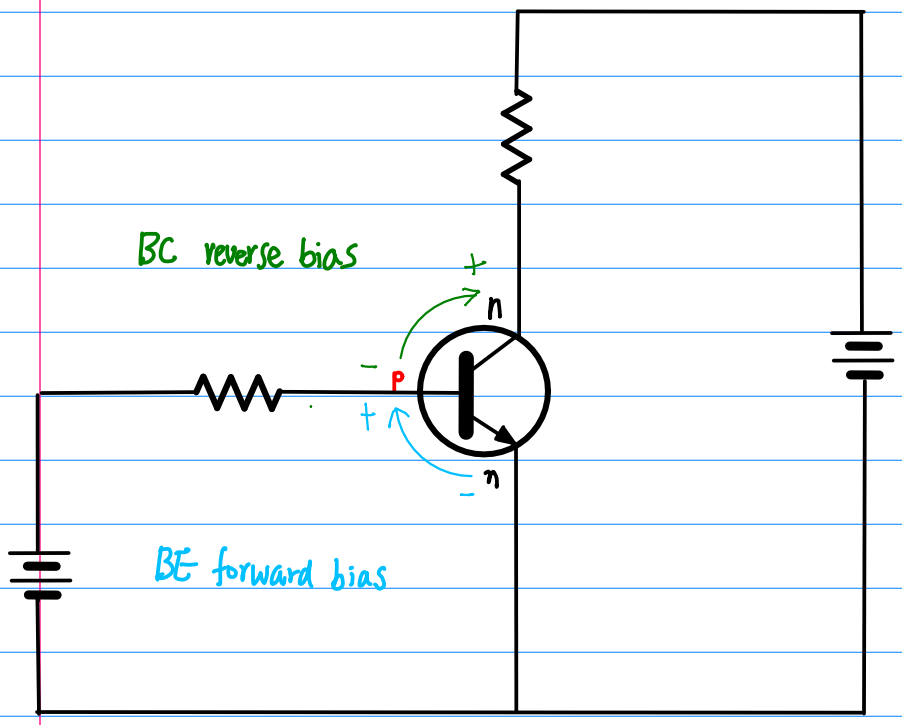

n
P
n
P
n
P

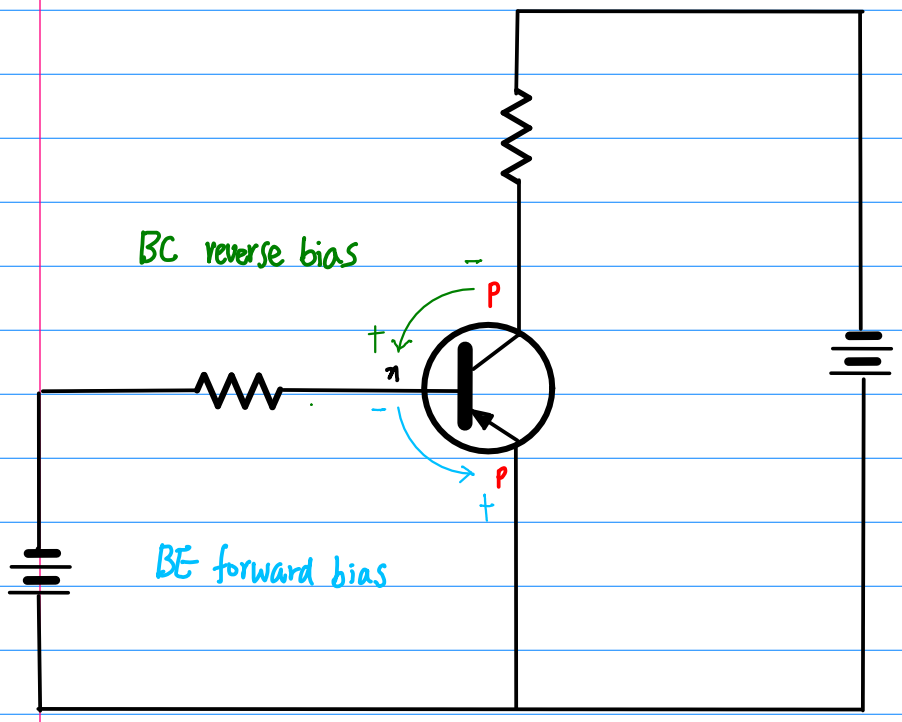




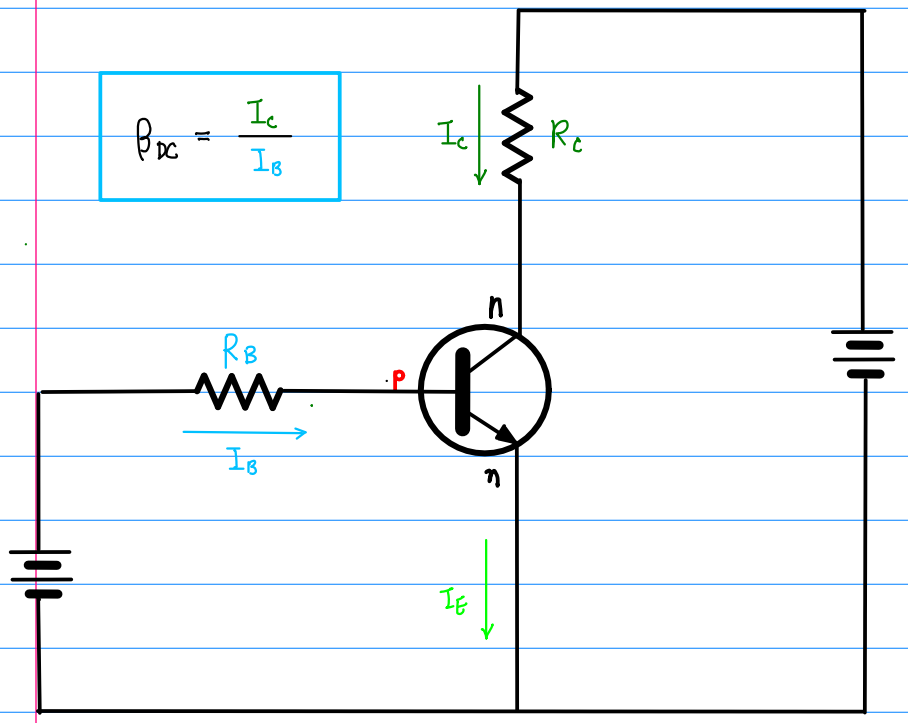





BC reverse bias
+
n
−
P
+
−
n
BE forward bias

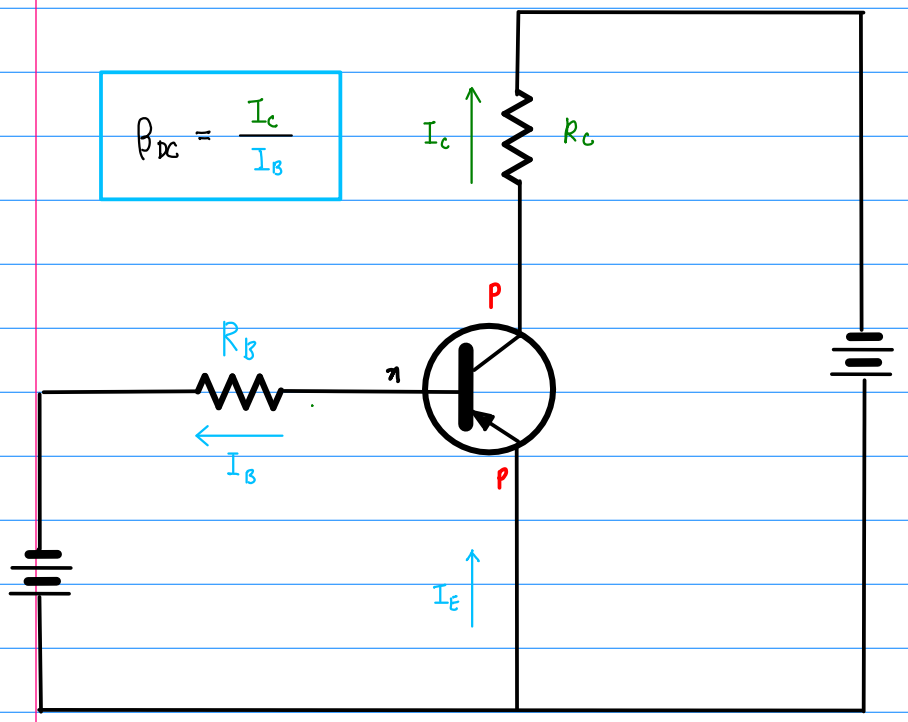

BC reverse bias
−
P
+
n
−
P
+
BE forward bias

$\beta_{DC} = \frac{I_C}{I_B}$



$\alpha_{DC} = \frac{I_C}{I_E}$

$\beta_{DC} = \frac{I_C}{I_B}$

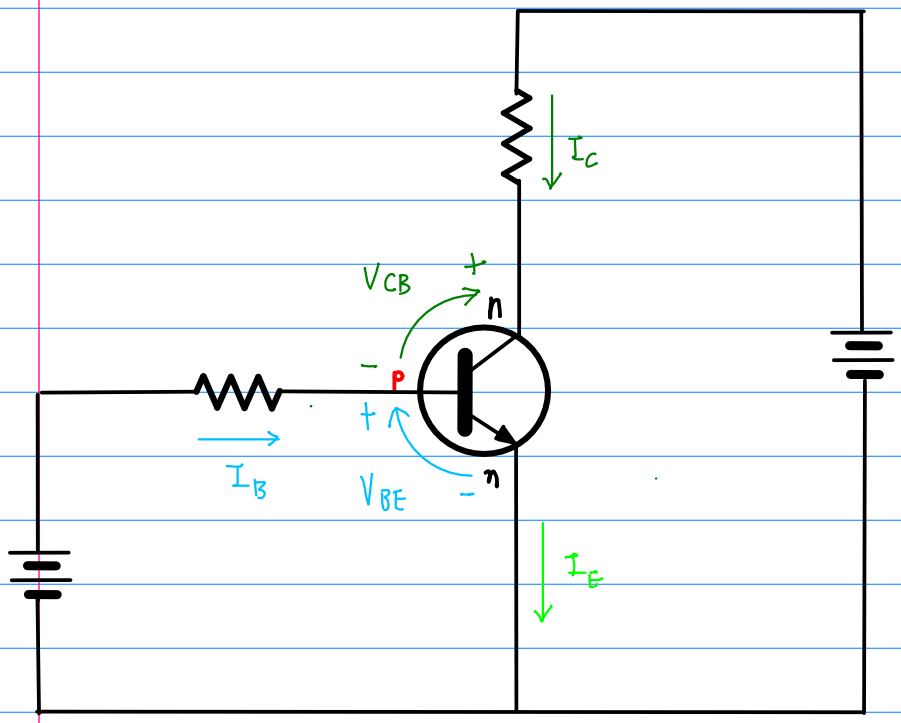


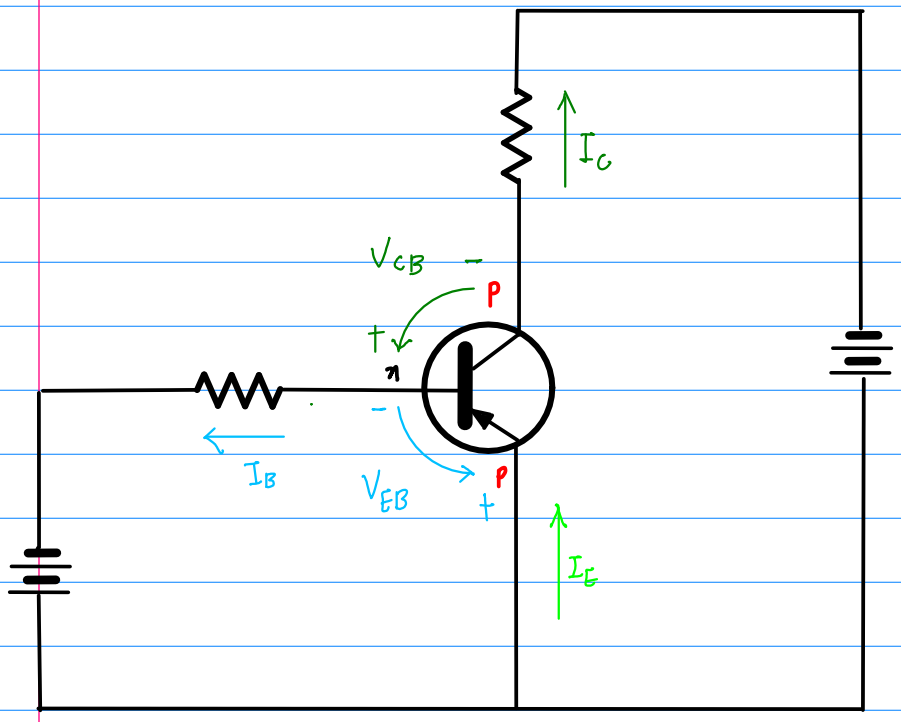
$\alpha_{DC} = \frac{I_C}{I_E}$

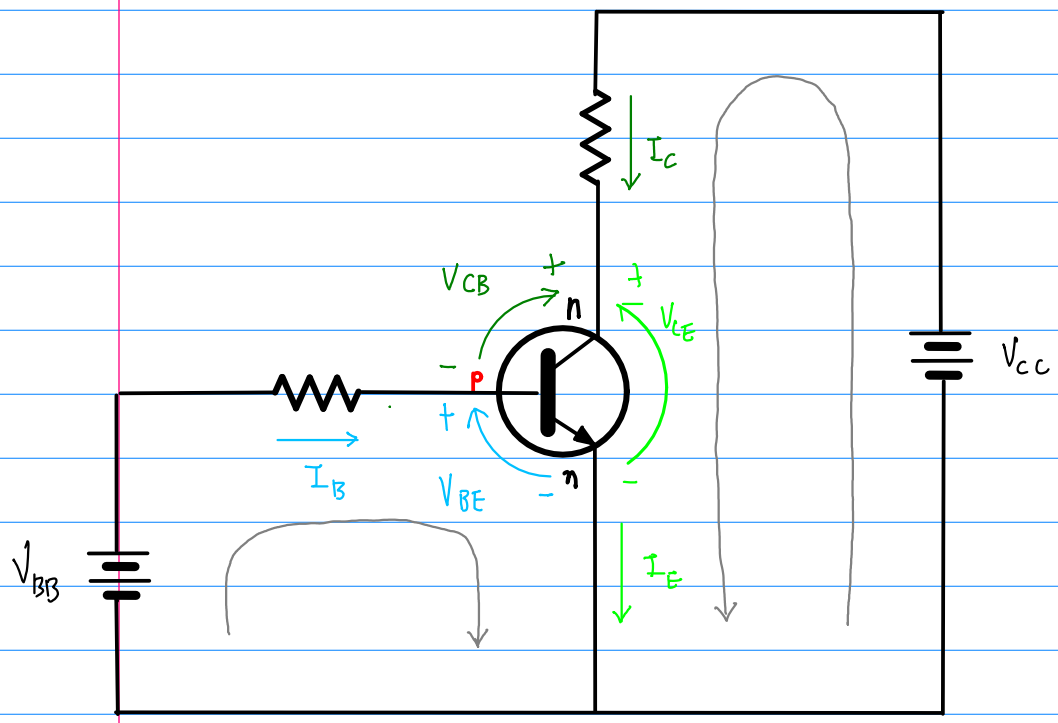
$$\beta_{DC} = \frac{I_C}{I_B}$$ 20 ~ 200

$$h_{FE} = \beta_{DC}$$

$$\alpha_{DC} = \frac{I_C}{I_E}$$ 0.95 ~ 0.99

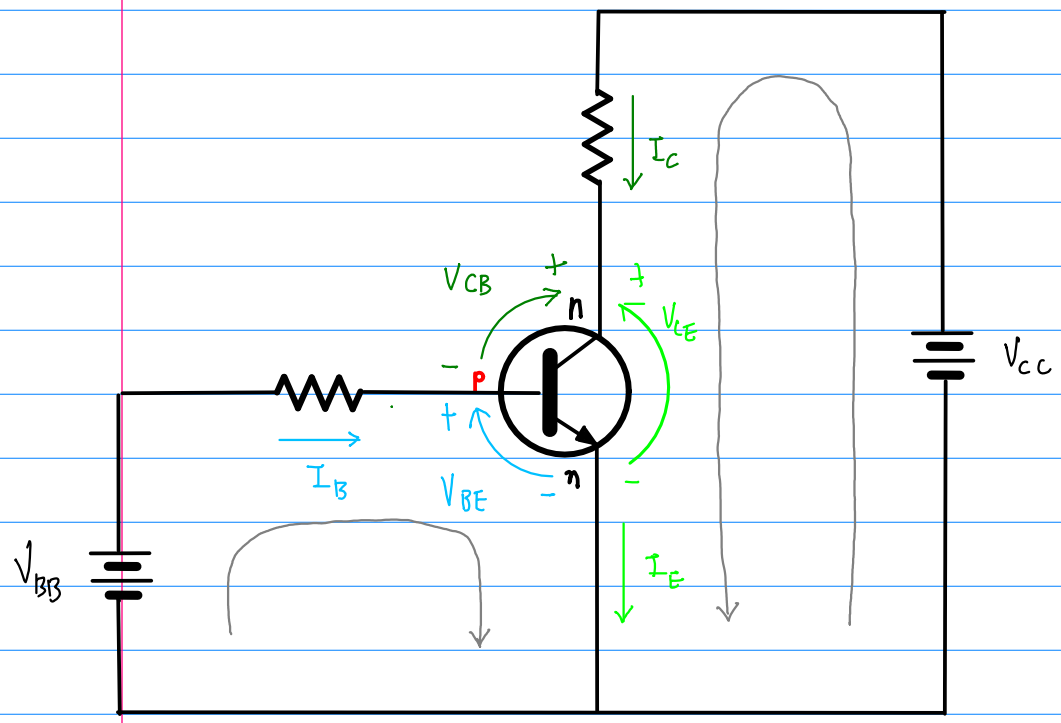

I_C
V_{CB}
+
n
−
P
+
I_B
V_{BE}
−
n
I_E

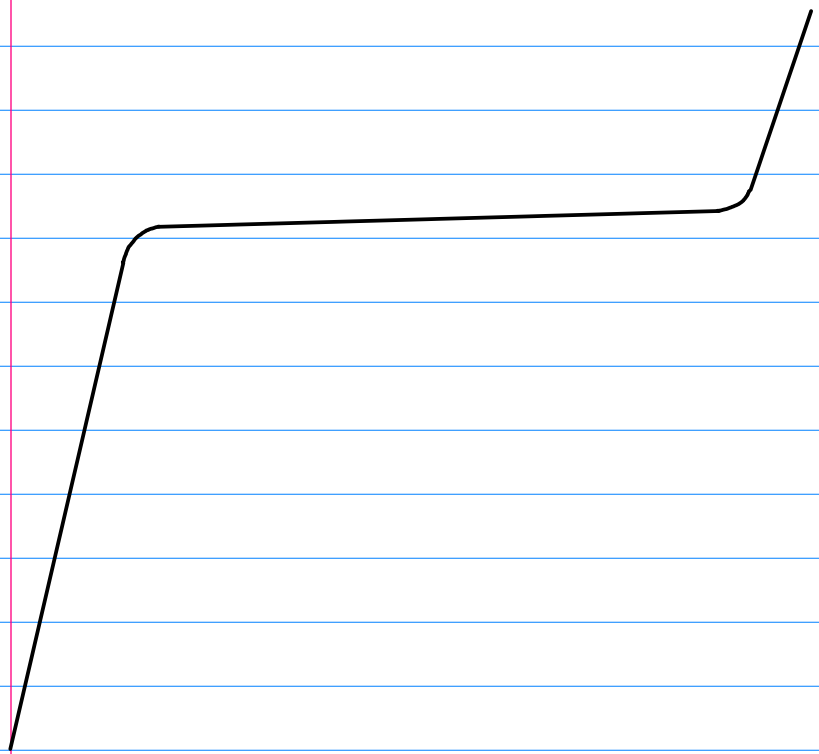

I_C
V_{CB}
−
P
+
n
−
I_B
V_{EB}
+
P
I_E

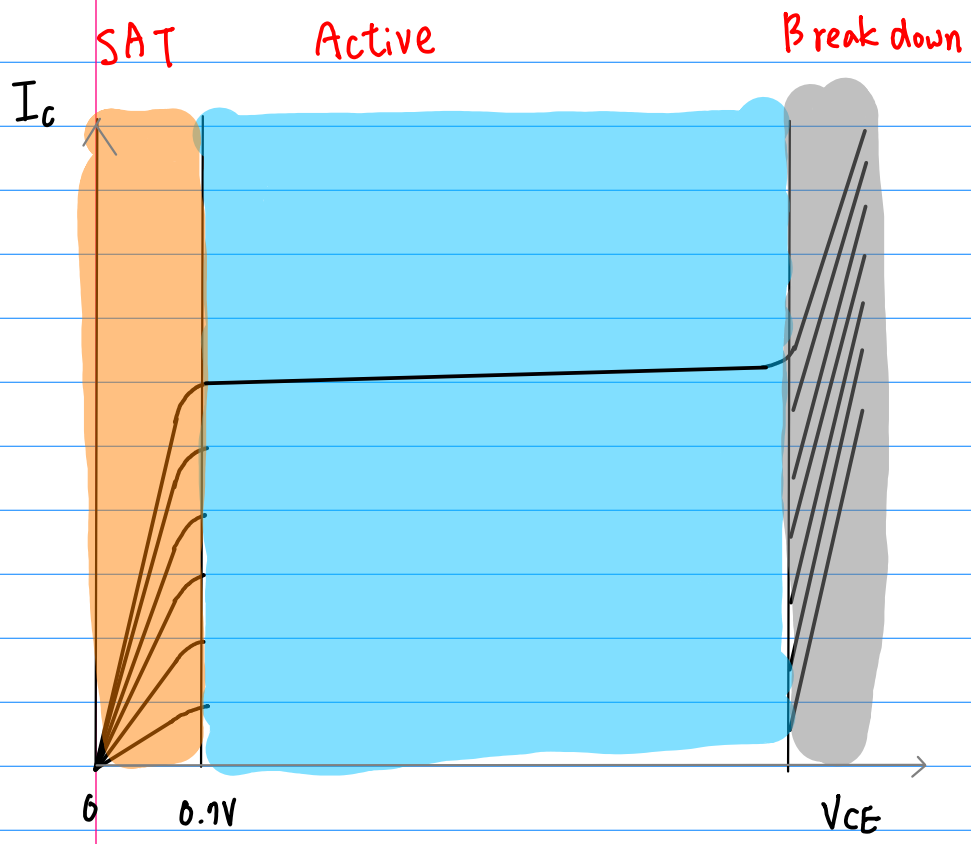


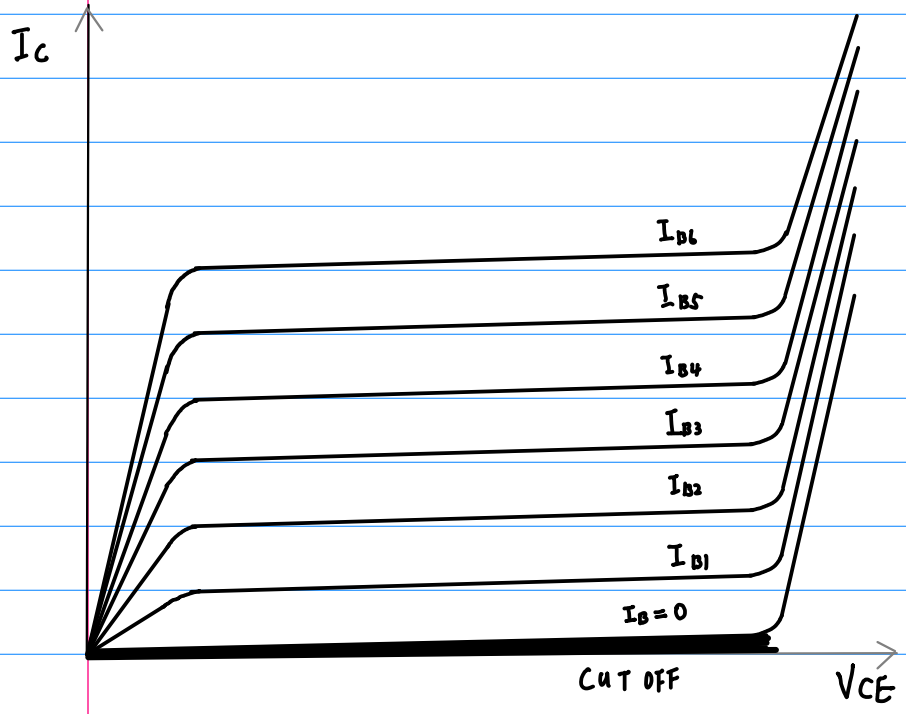
$$V_{BB} = I_B R_B + V_{BE} \qquad V_{CC} = I_C R_C + V_{CE}$$

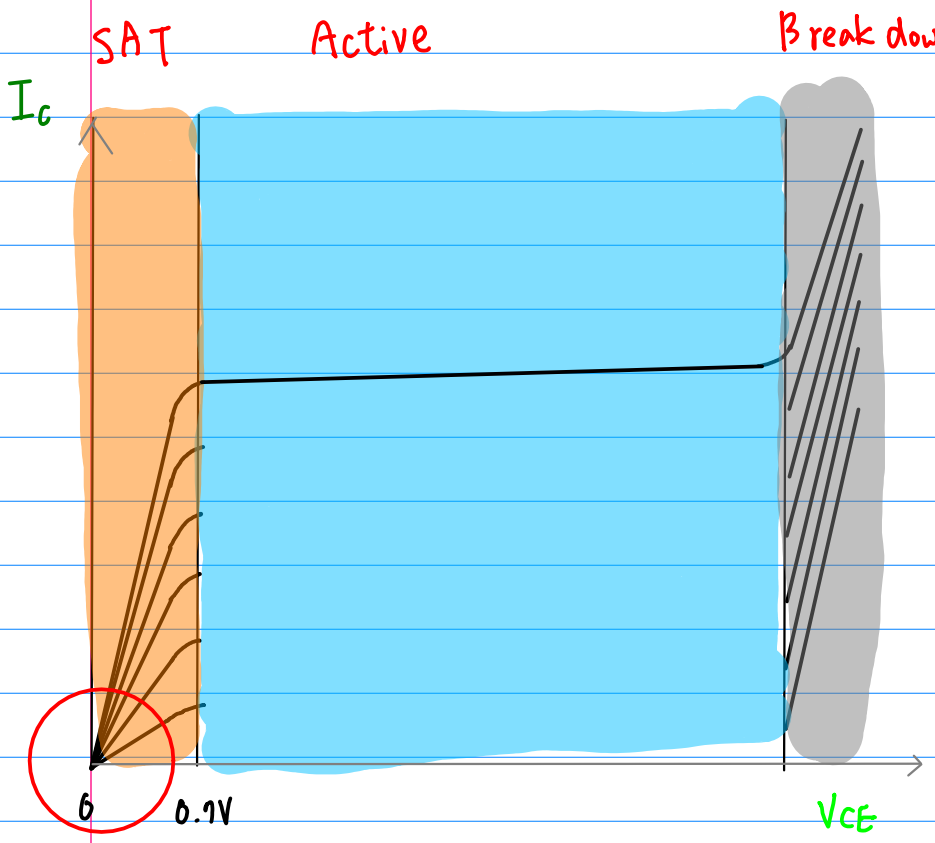
$$I_B = \frac{V_{BB} - V_{BE}}{R_B} \qquad I_C = \frac{V_{CC} - V_{CE}}{R_C} \qquad V_{CE} = V_{CC} - I_C R_C$$

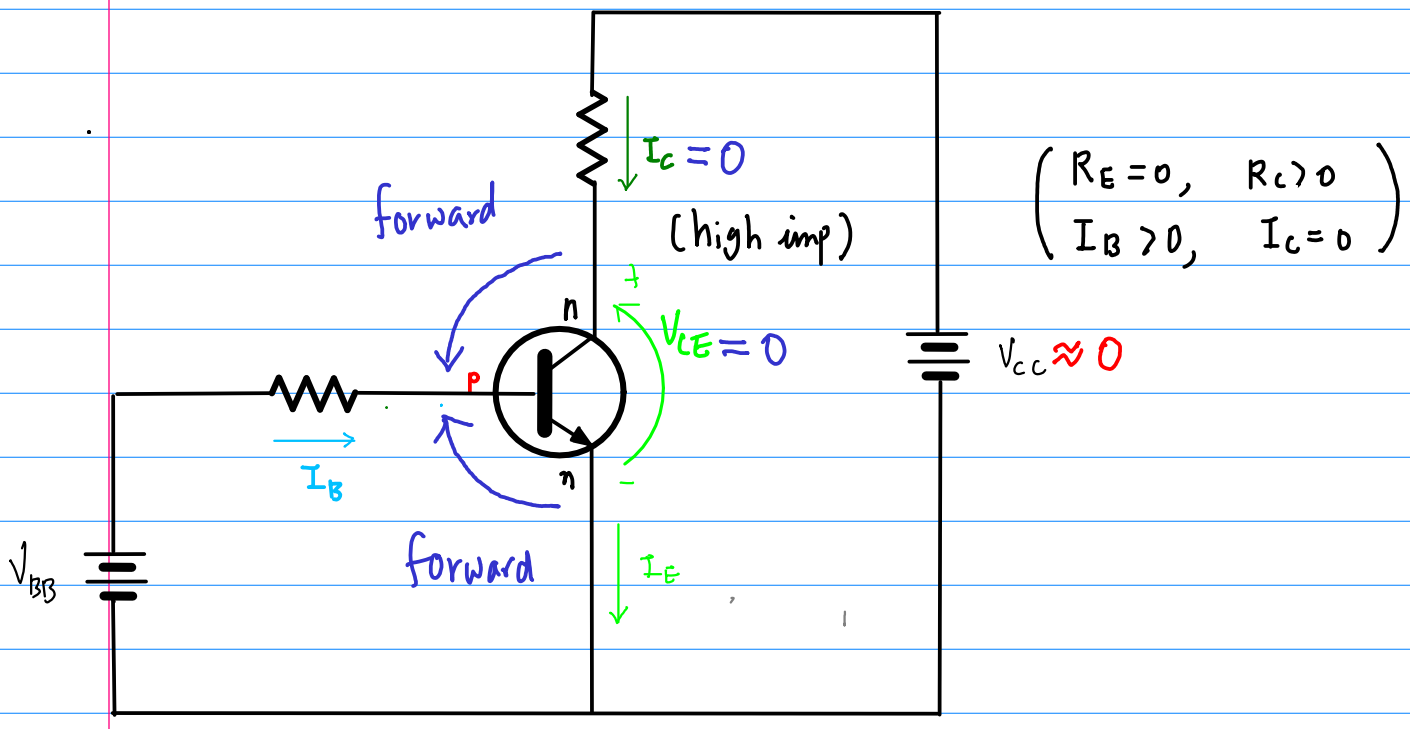

I_C
V_{CB}
+
n
V_{CE}
−
P
+
I_B
V_{BE}
−
n
V_{BB}
I_E
V_{CC}



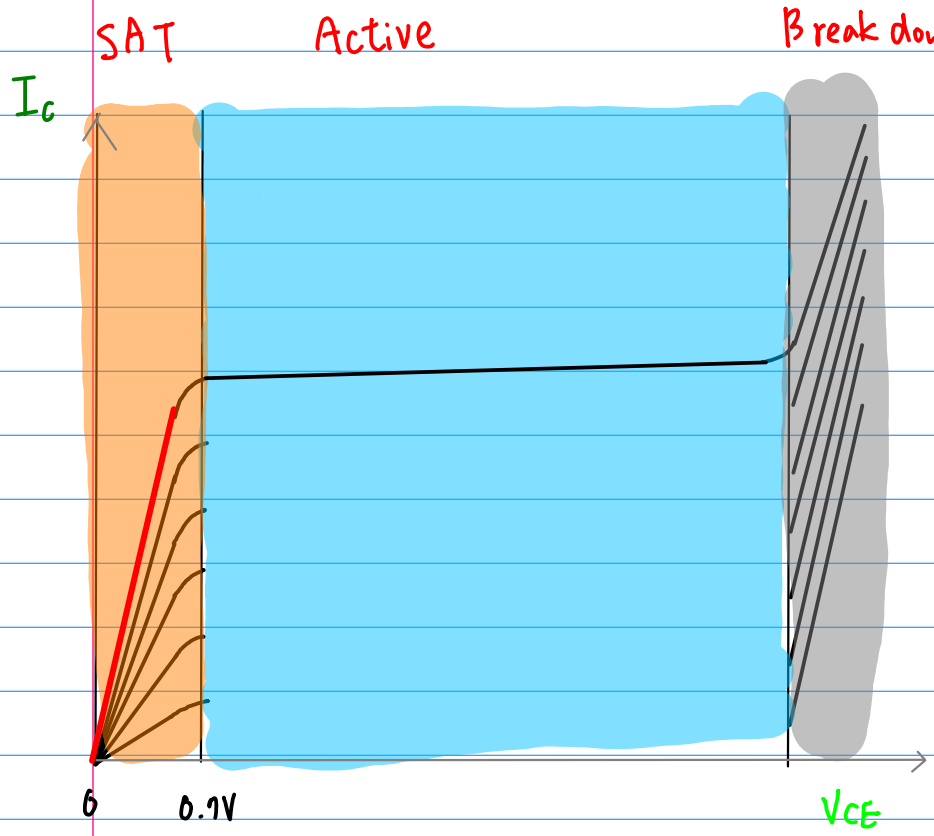

SAT
Active
Break down
I_C
0
0.7V
V_{CE}

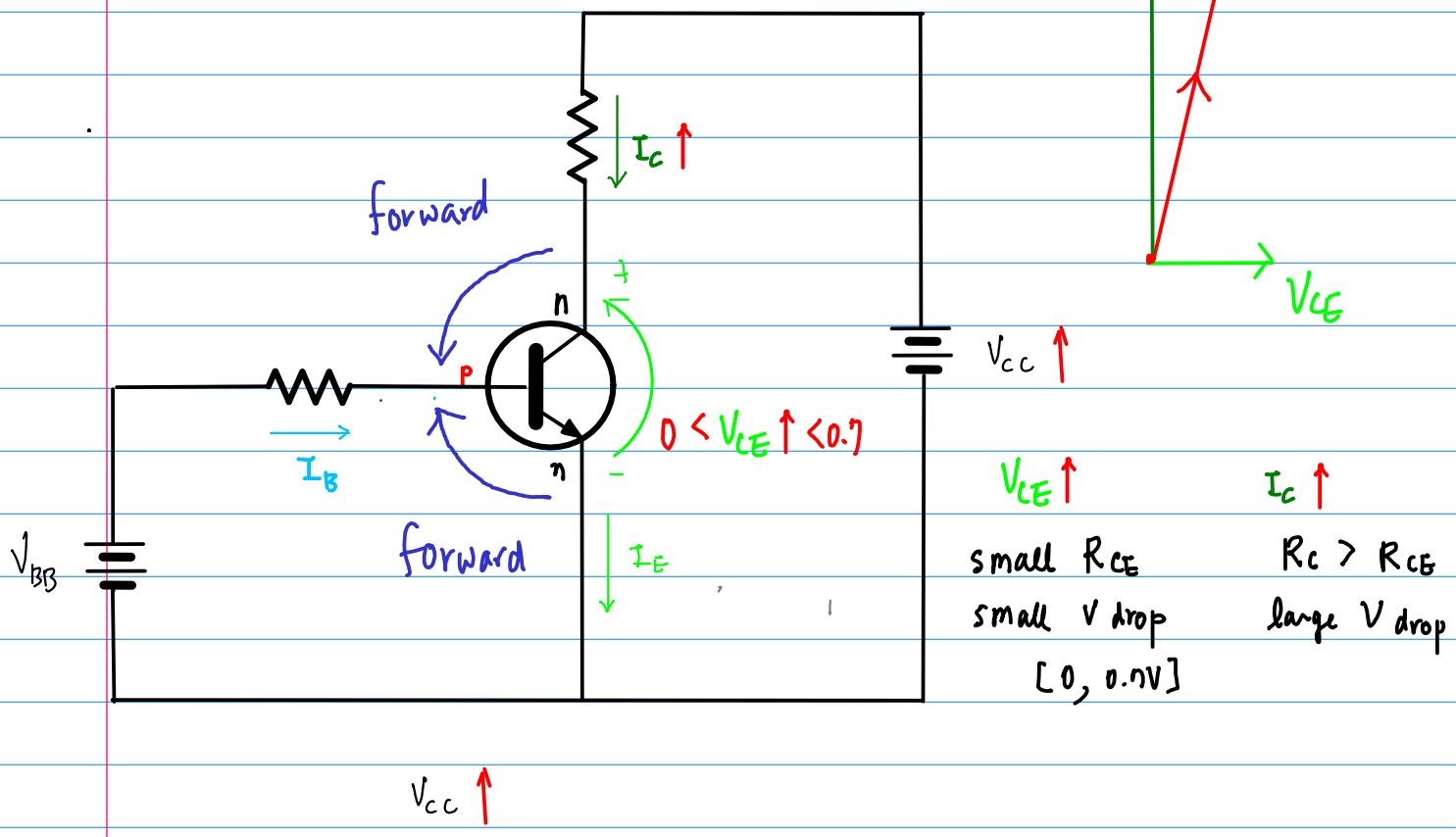

I_C
I_{B6}
I_{B5}
I_{B4}
I_{B3}
I_{B2}
I_{B1}
$I_B = 0$
CUT OFF
V_{CE}

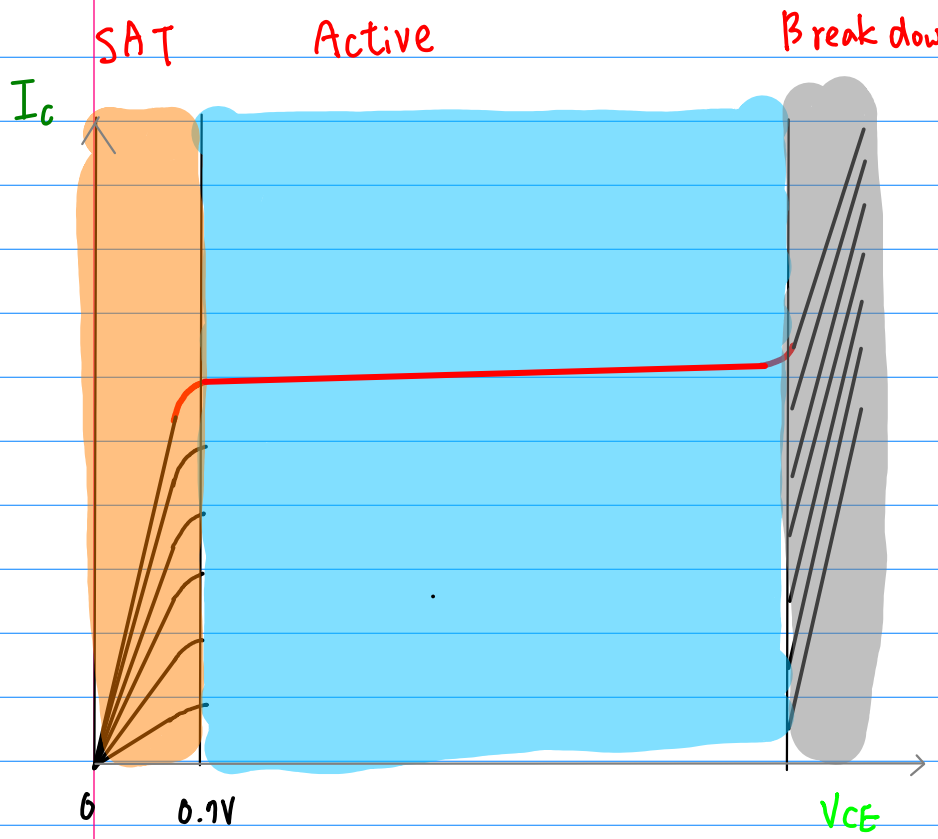


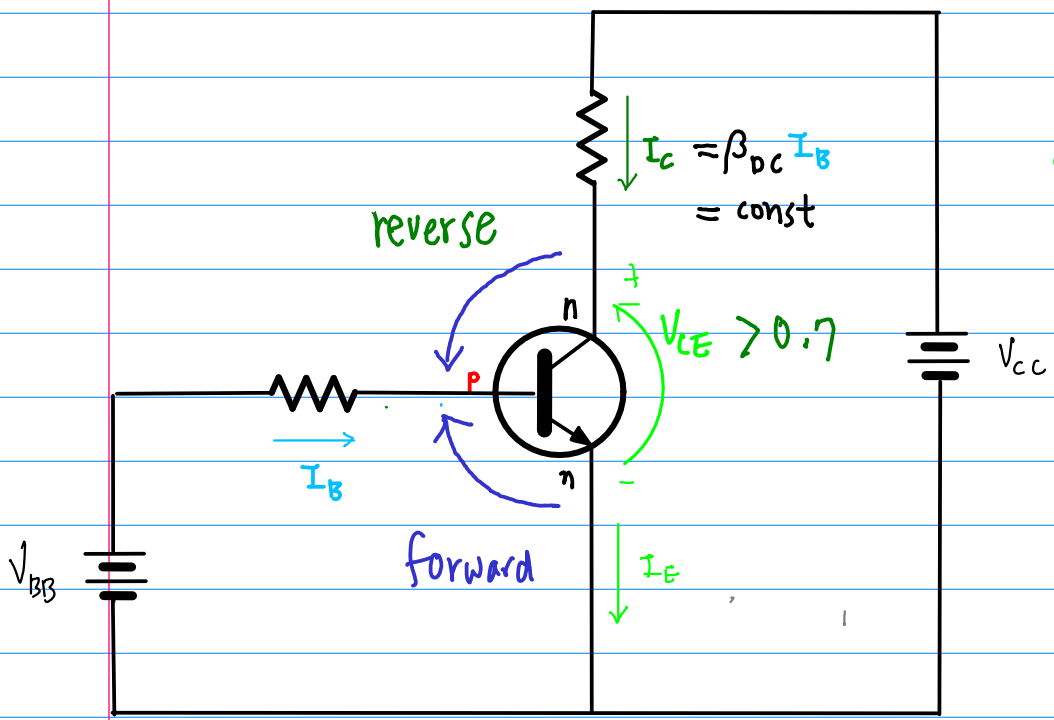


$$\left(\begin{array}{ll} R_E = 0, & R_C > 0 \\ I_B > 0, & I_C = 0 \end{array} \right)$$

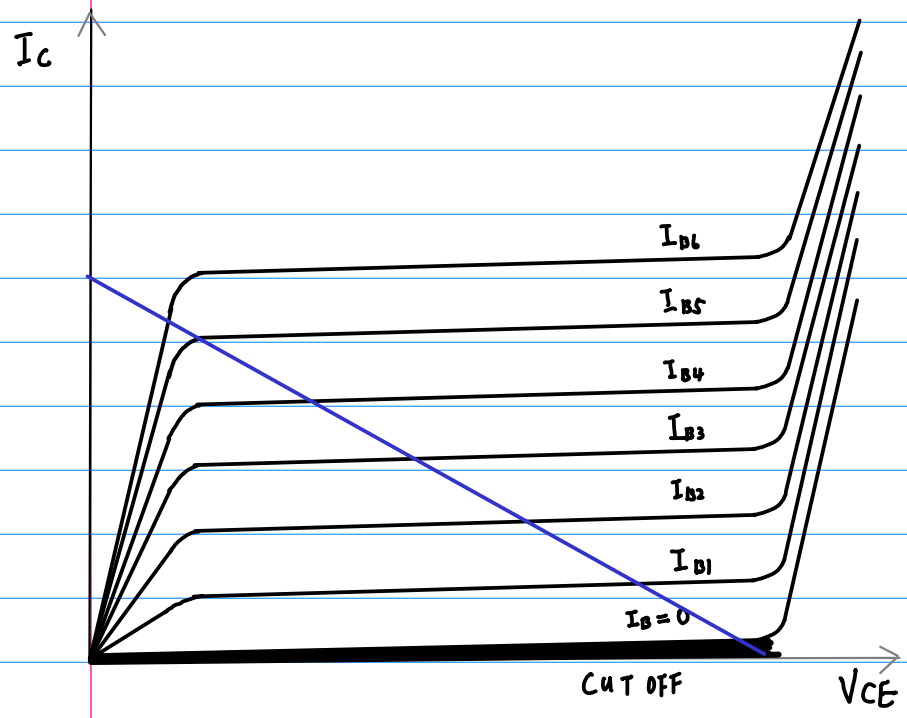

SAT
Active
Break down
I_C
0
0.7V
V_{CE}


I_C ↑
forward
n
P
n
I_B
V_{BB}
forward
I_E
V_{cc} ↑
$0 < V_{CE}$ ↑ < 0.7
V_{CE}
V_{CE} ↑
small R_{CE}
small V drop
[0, 0.7V]
I_C ↑
$R_C > R_{CE}$
large V drop
V_{cc} ↑


SAT
Active
Break down
I_C
0
0.7V
V_{CE}


$I_C = \beta_{DC} I_B$
= const
reverse
n
P
n
$V_{CE} > 0.7$
V_{CC}
I_B
V_{BB}
forward
I_E

$$V_{CE} + V_{R_C} = V_{CC}$$


I_C
I_{B6}
I_{B5}
I_{B4}
I_{B3}
I_{B2}
I_{B1}
$I_B = 0$
CUT OFF
V_{CE}