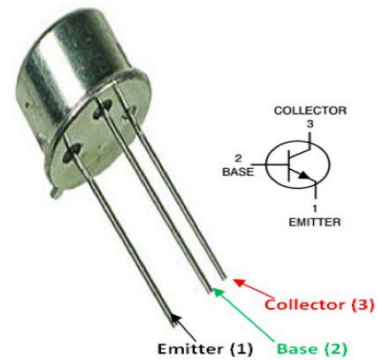


WORKING OF A TRANSISTOR



Er. J. Sravankumar



BIPOLAR JUNCTION TRANSISTORS (BJTs)

THE SURPRISING ACTION OF A TRANSISTOR

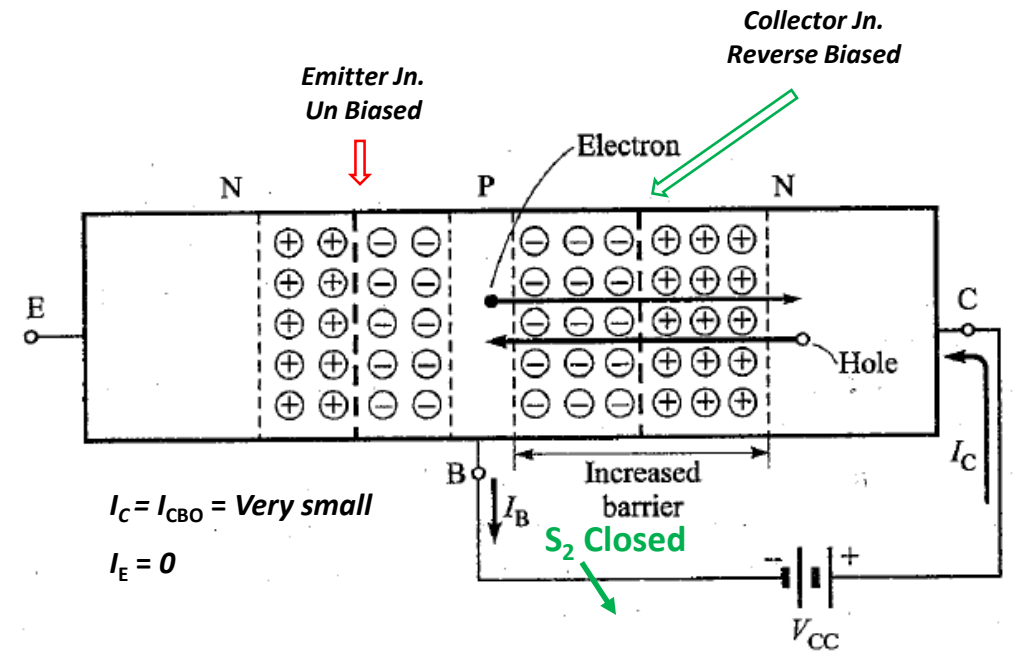
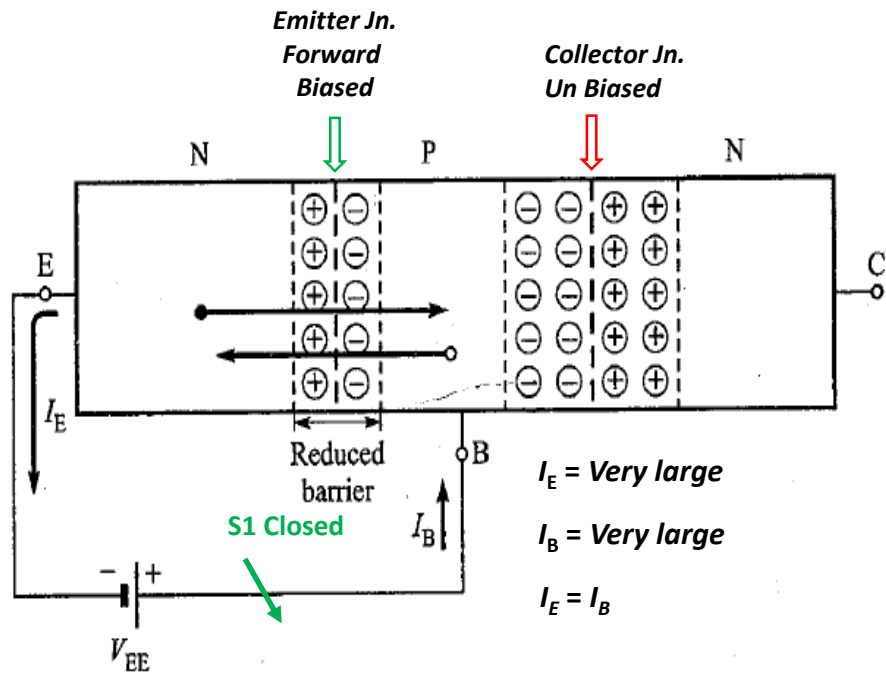
junctions **2**

emitter junction and
a collector junction

4

ways
of
biasing

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active
II	FF	Forward biased	Forward biased	Saturation
III	RR	Reverse biased	Reverse biased	Cutoff
IV	RF	Reverse biased	Forward biased	Inverted



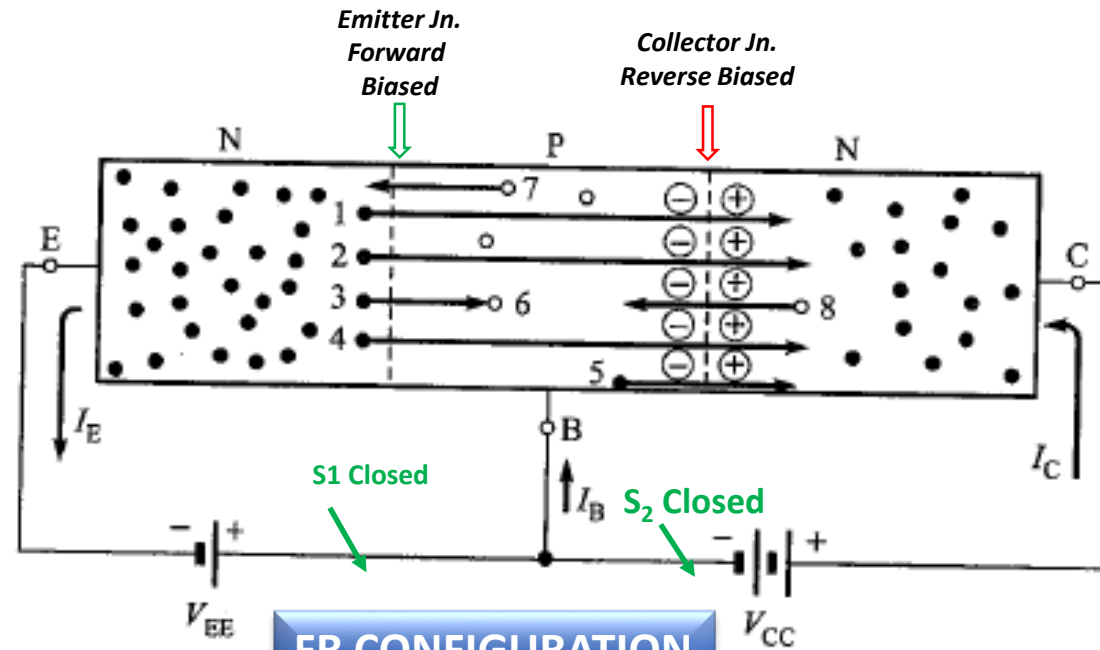
Expected

$I_E = \text{Very large}$

$I_B = \text{Very large}$

$I_E = I_B$

$I_C = I_{CBO} = \text{Very small}$



Actual

$I_E = \text{large (as expected)}$

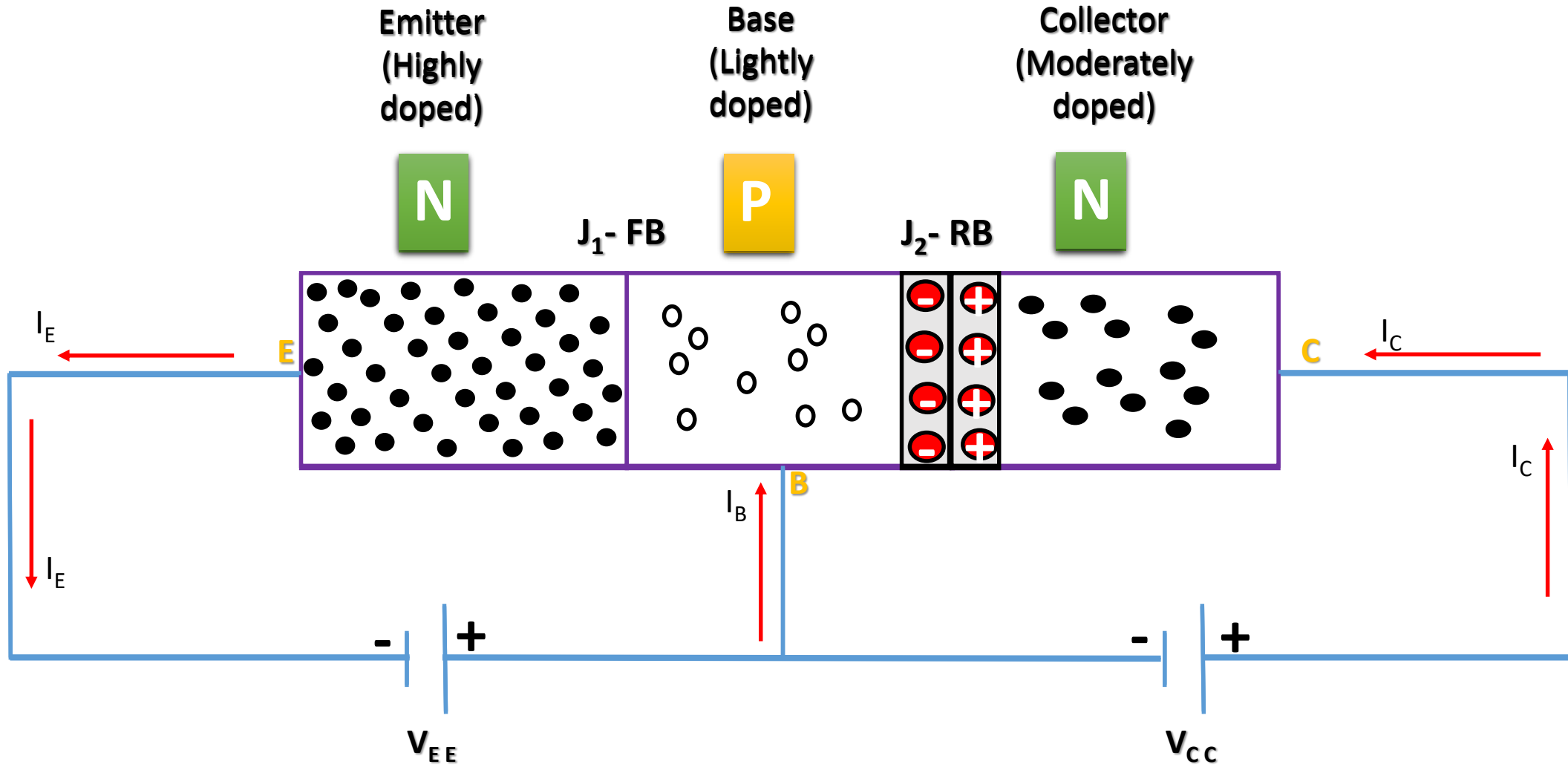
$I_B = \text{very small (surprising)}$

$I_C = \text{large current (surprising)}$

FR CONFIGURATION

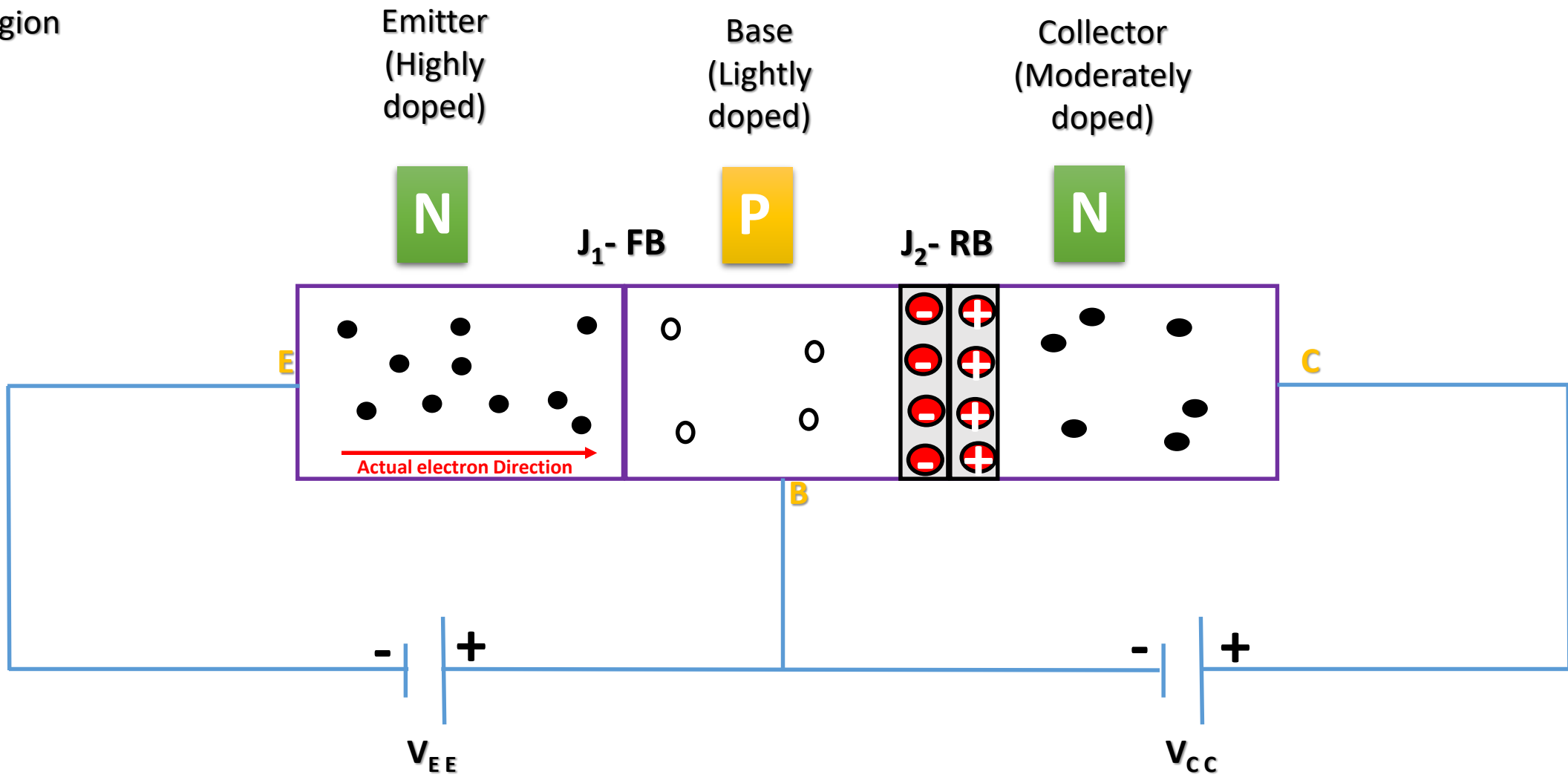
Condition	Emitter Junction	Collector Junction	Region of operation
I	FR	Reverse biased	Active

- Electrons
- Holes



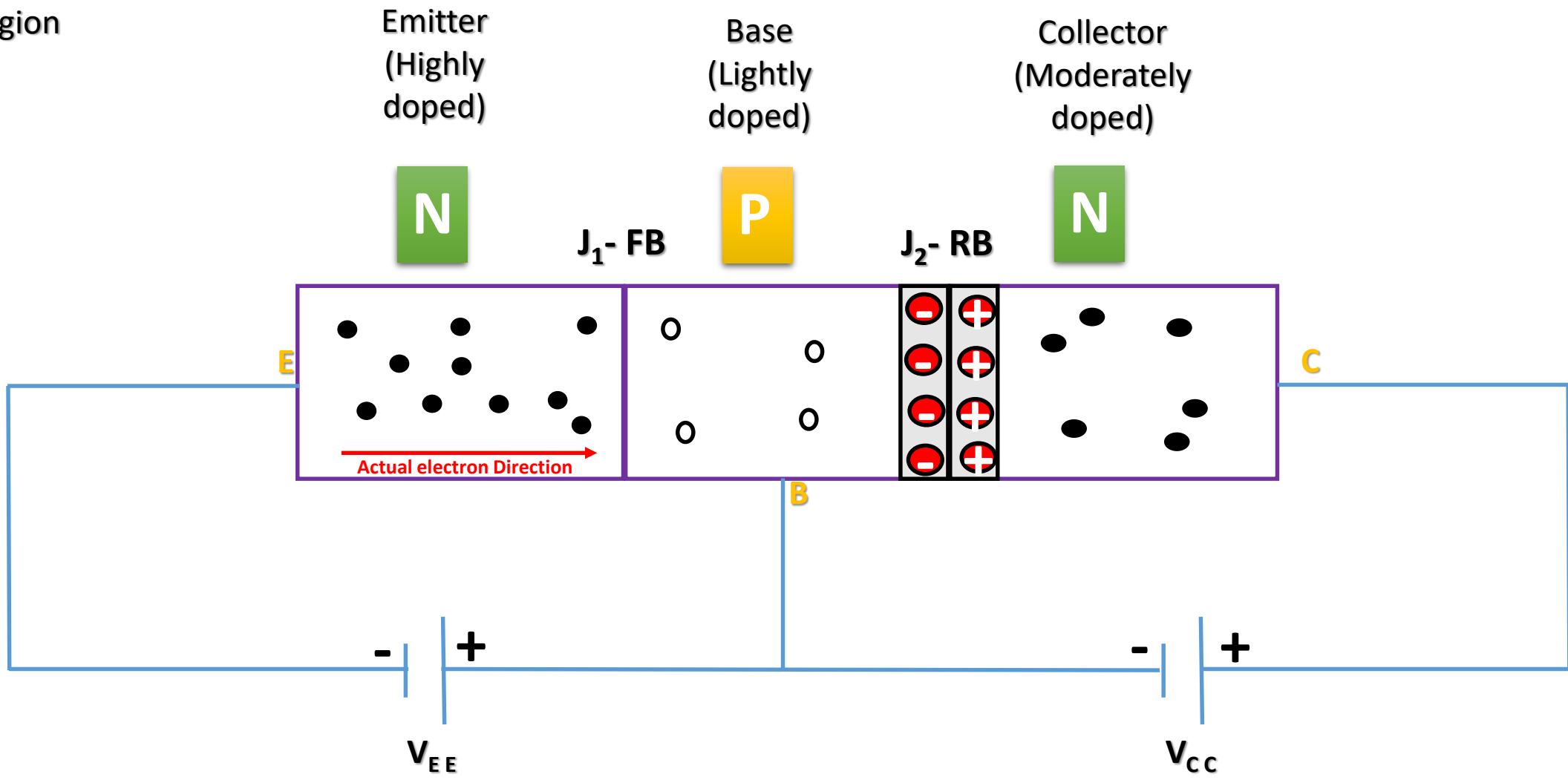
- Electrons
- Holes
- Electron-Hole recombination in P region

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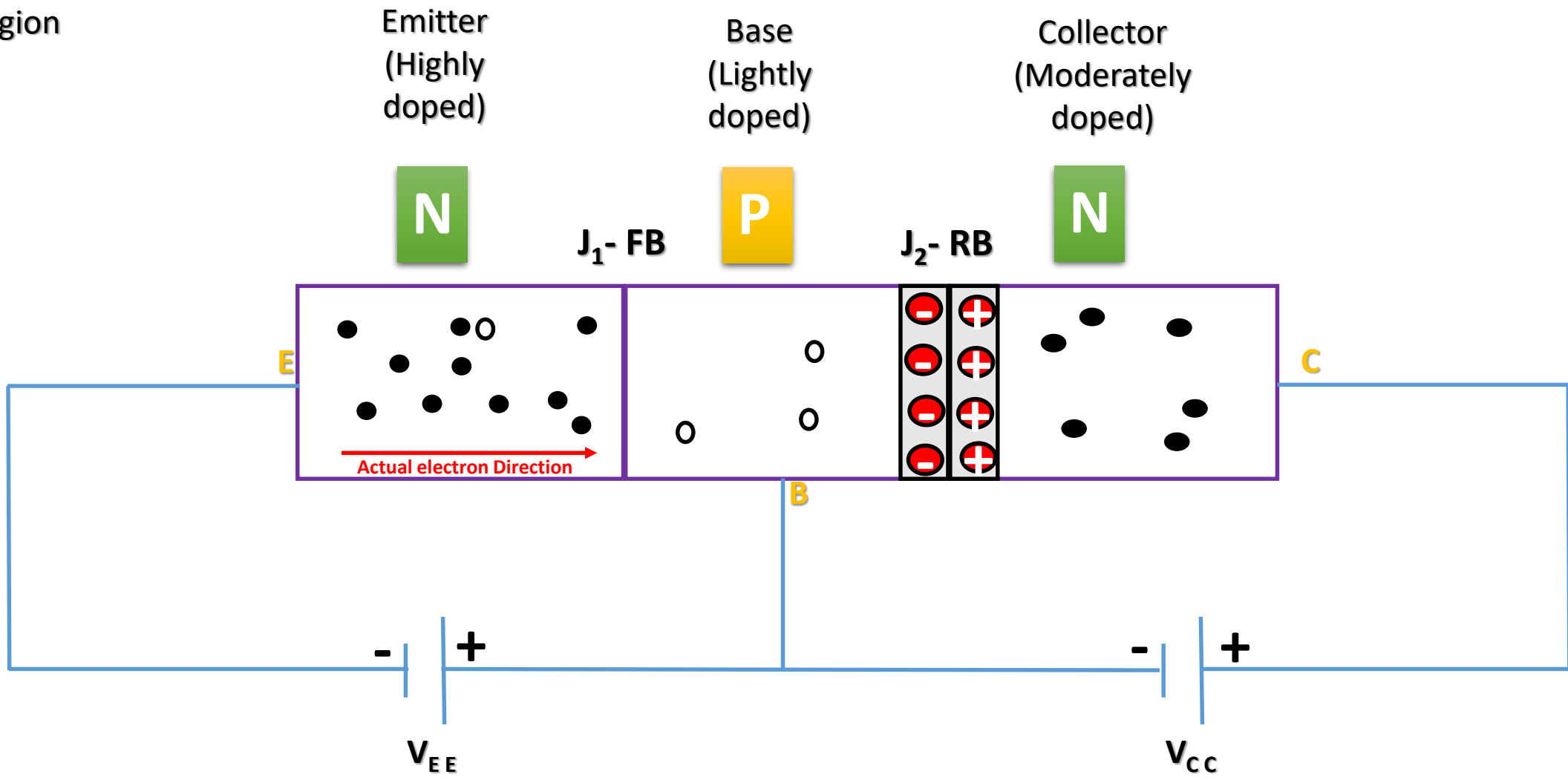
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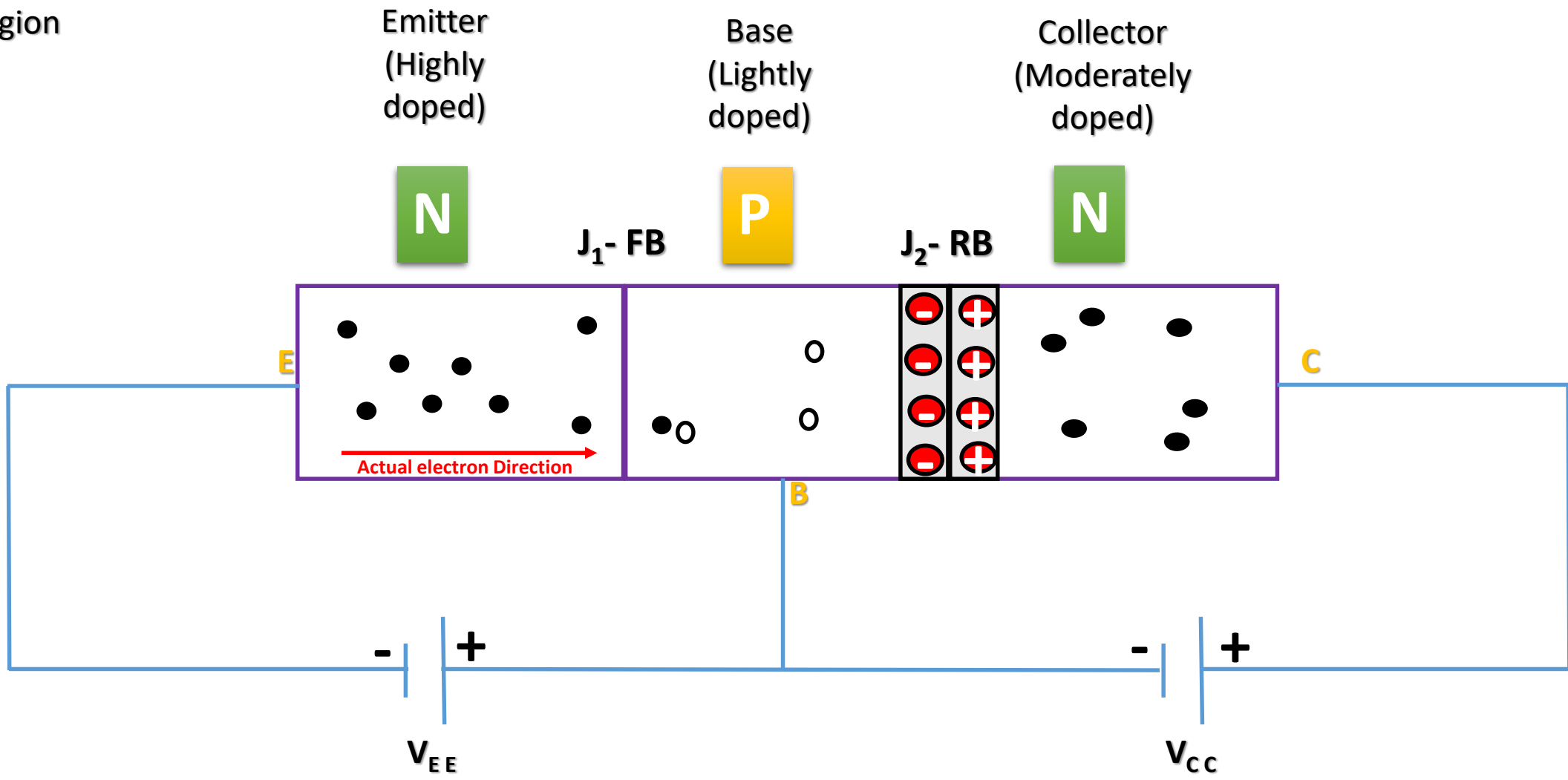
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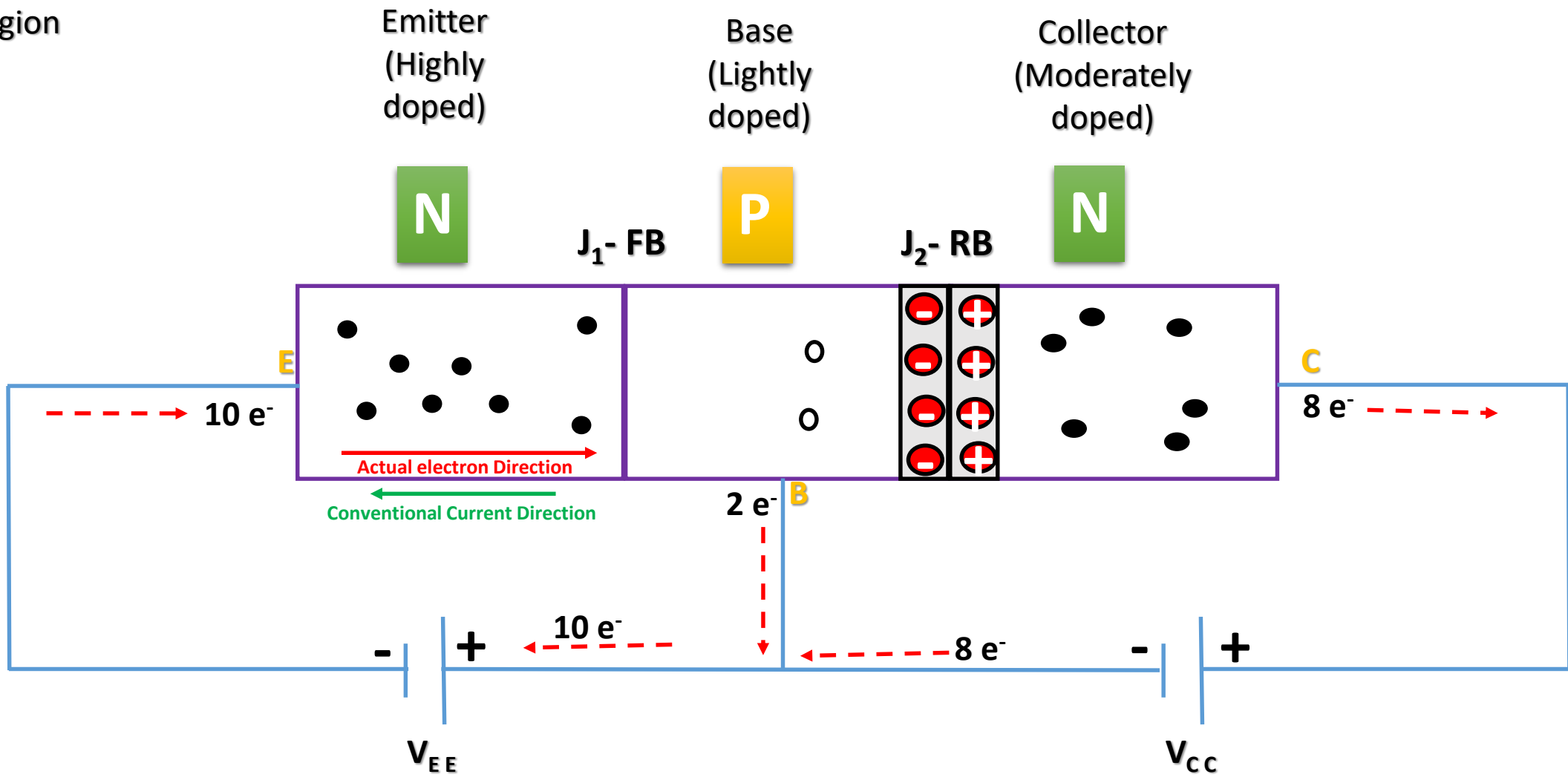
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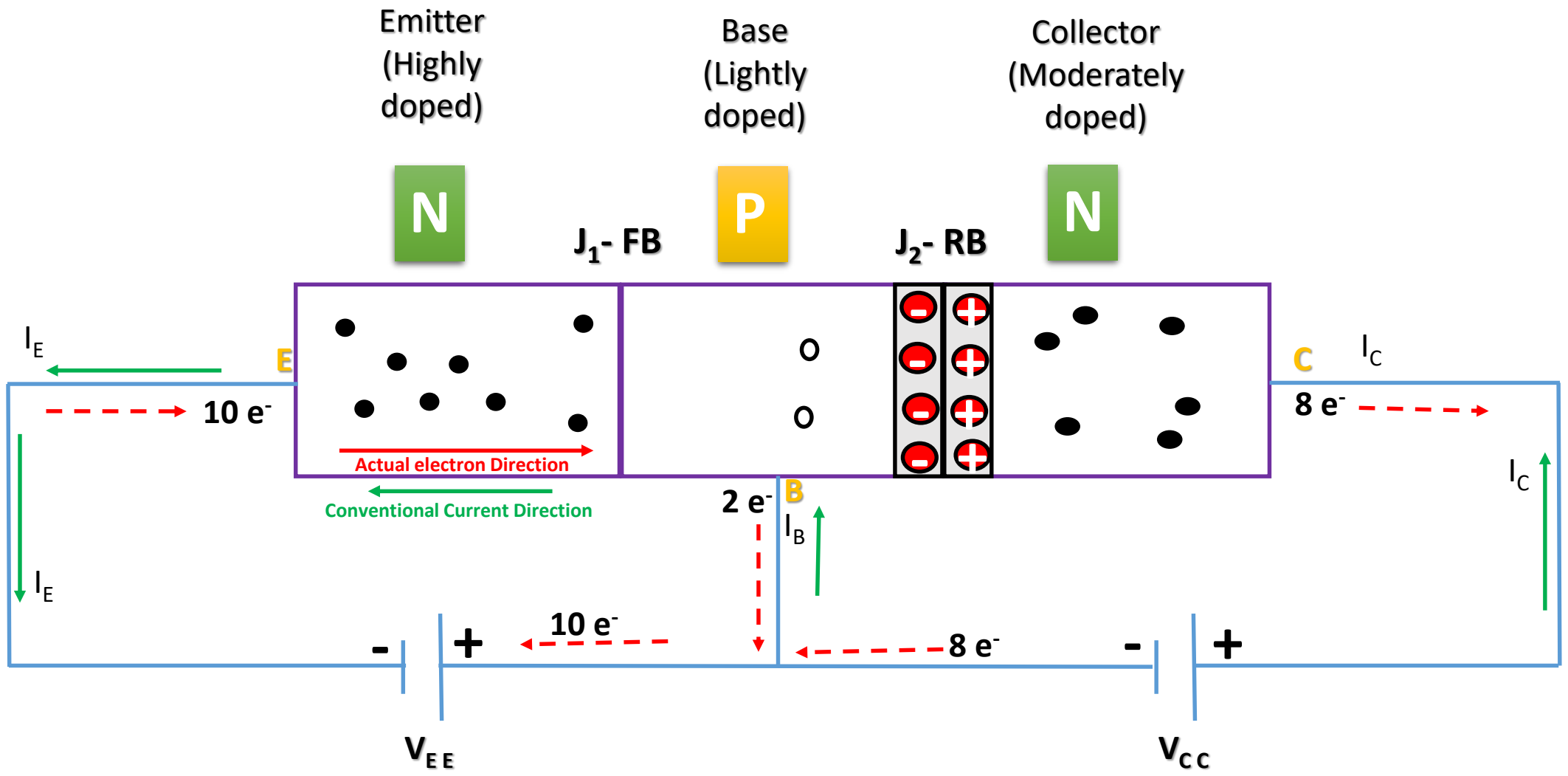
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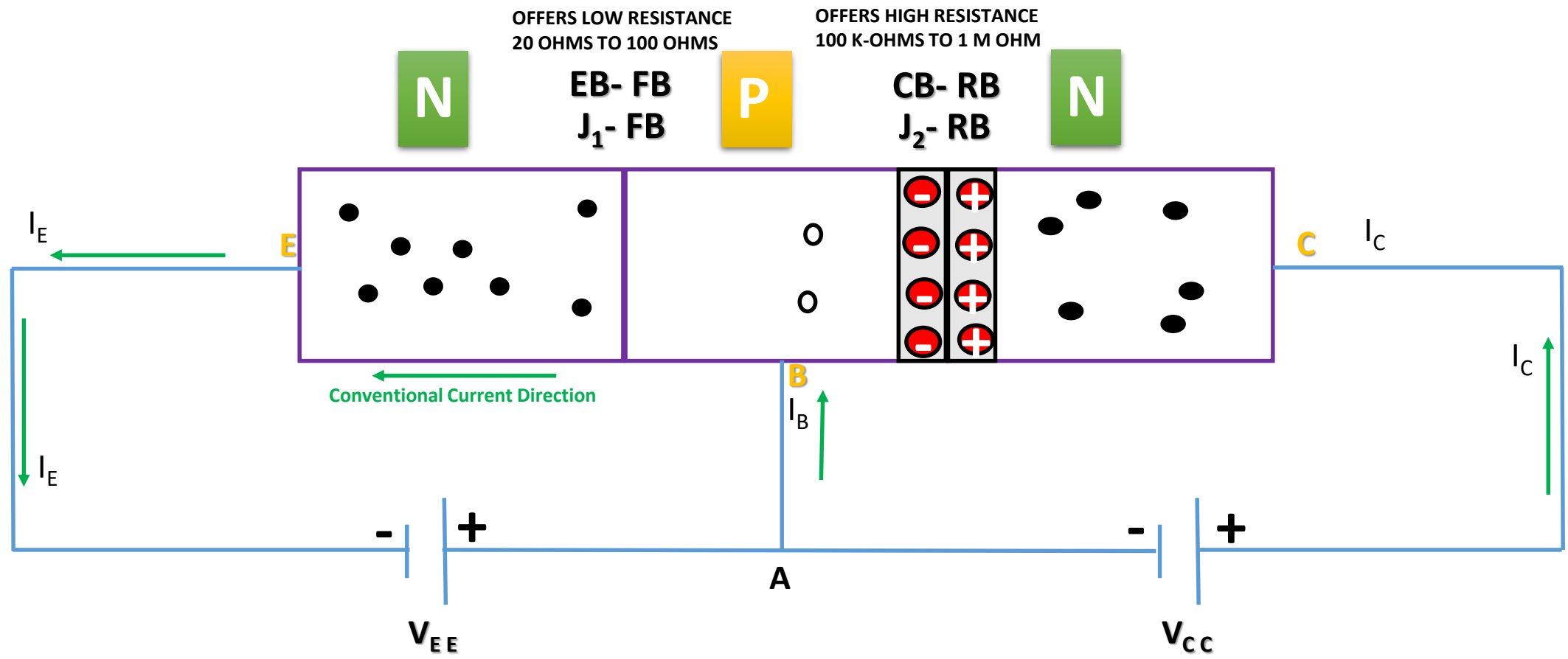
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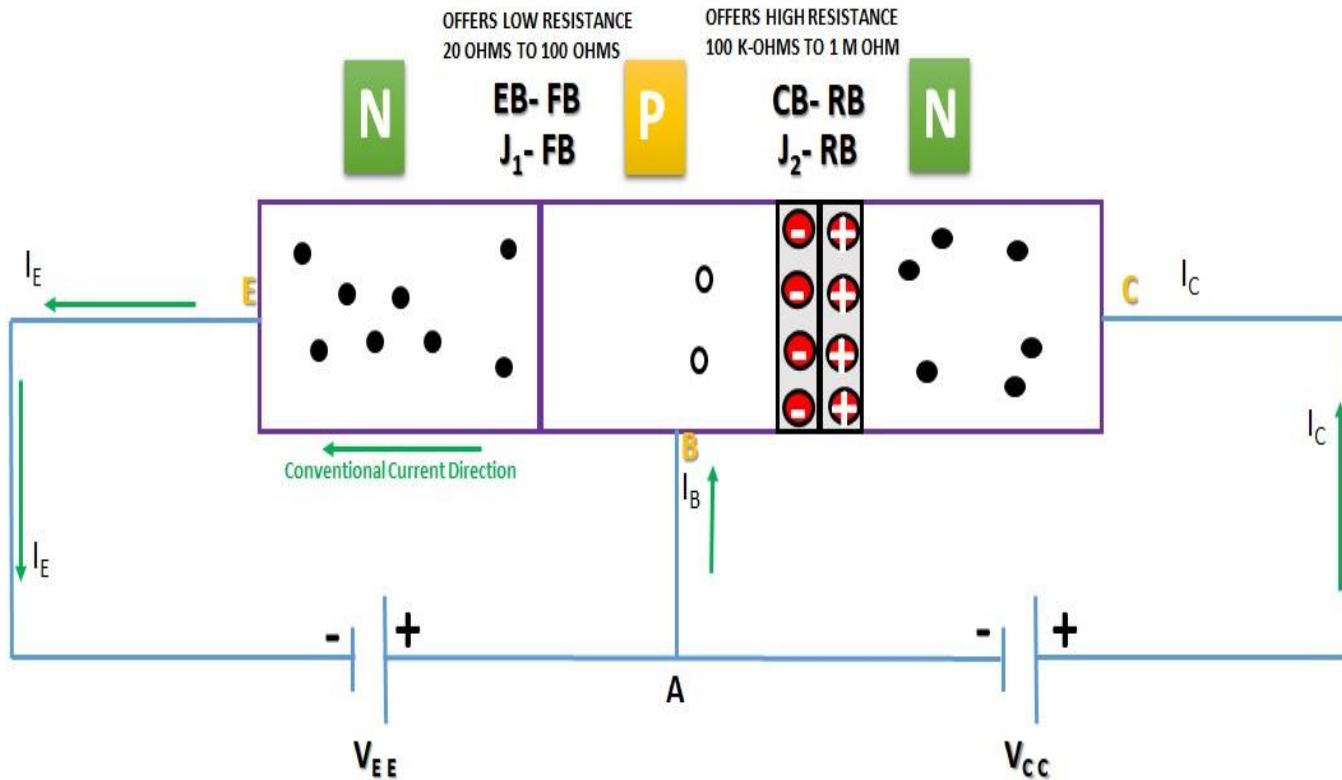


@ A: Applying KCL: $I_E = I_B + I_C$

Also : $I_C = \alpha_{dc} I_E + I_{CO}$

- Electrons
- Holes

Condition		Emitter Junction	Collector Junction	Region of operation
I	FR	Forward biased	Reverse biased	Active



@ A: Applying KCL: $I_E = I_B + I_C$

Also : $I_C = \alpha_{dc} I_E + I_{CO}$

Where reverse leakage current, I_{CO} = very small and can be neglected

$$I_C = \alpha_{dc} I_E$$

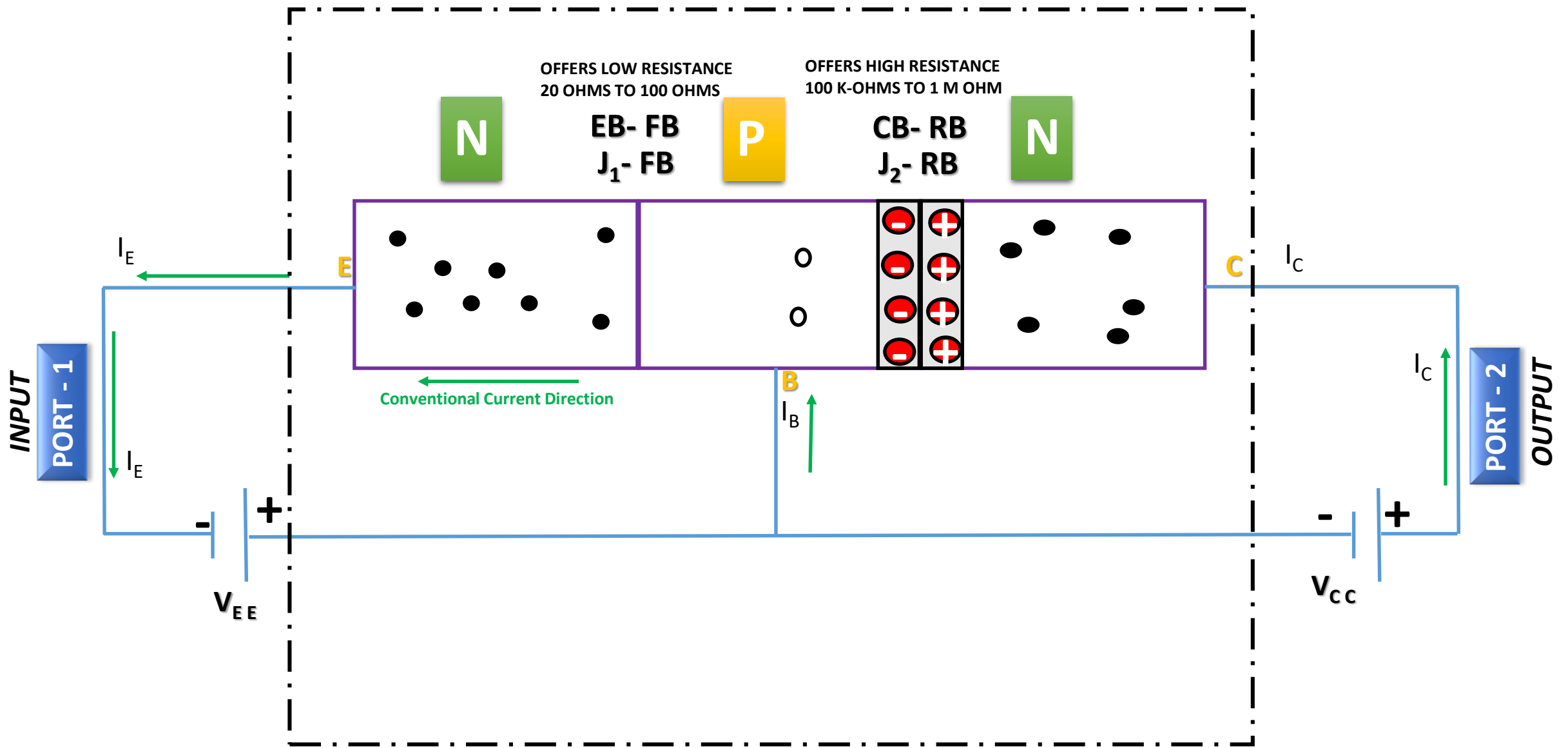
$$\alpha_{dc} = \frac{I_C}{I_E}$$

$$0.95(\text{always}) < \alpha_{dc} = \frac{I_C}{I_E} < 1(\text{always})$$

- Electrons
- Holes

Two port network

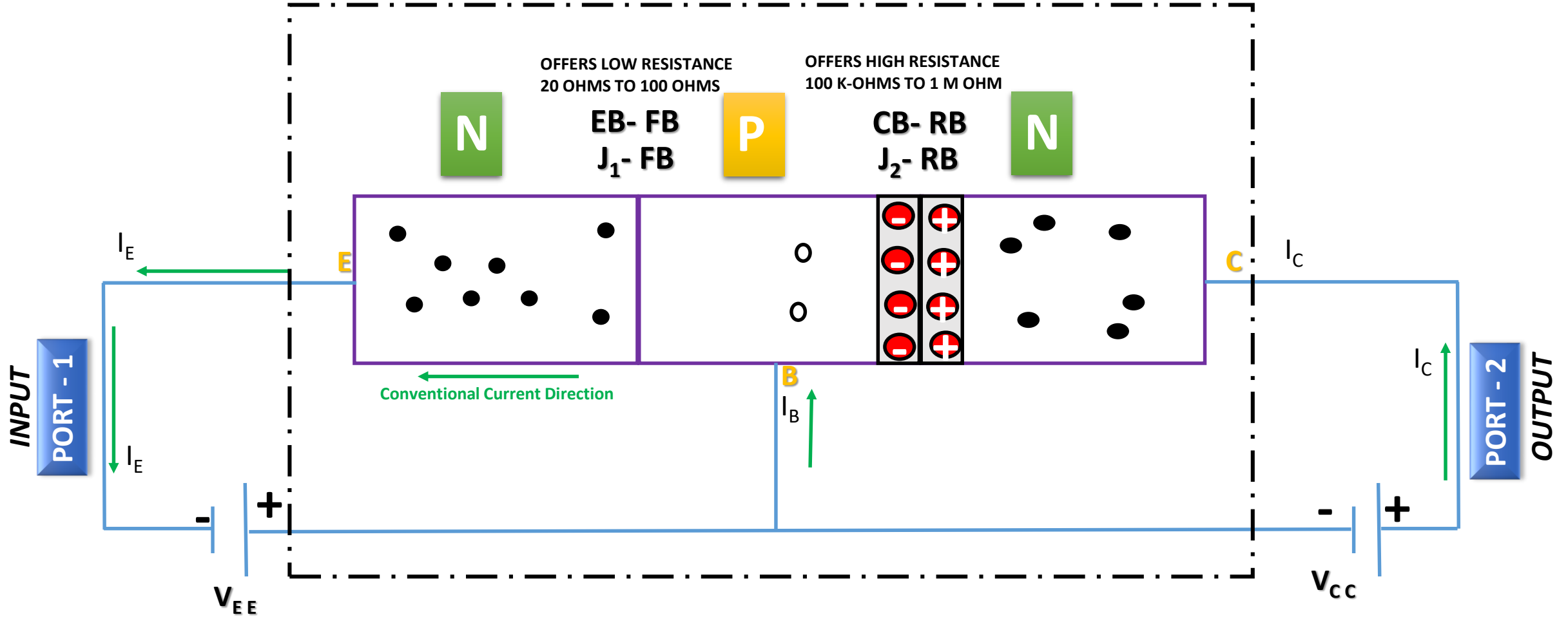
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- Electrons
- Holes

Two port network

Condition		Emitter Junction	Collector Junction	Region of operation
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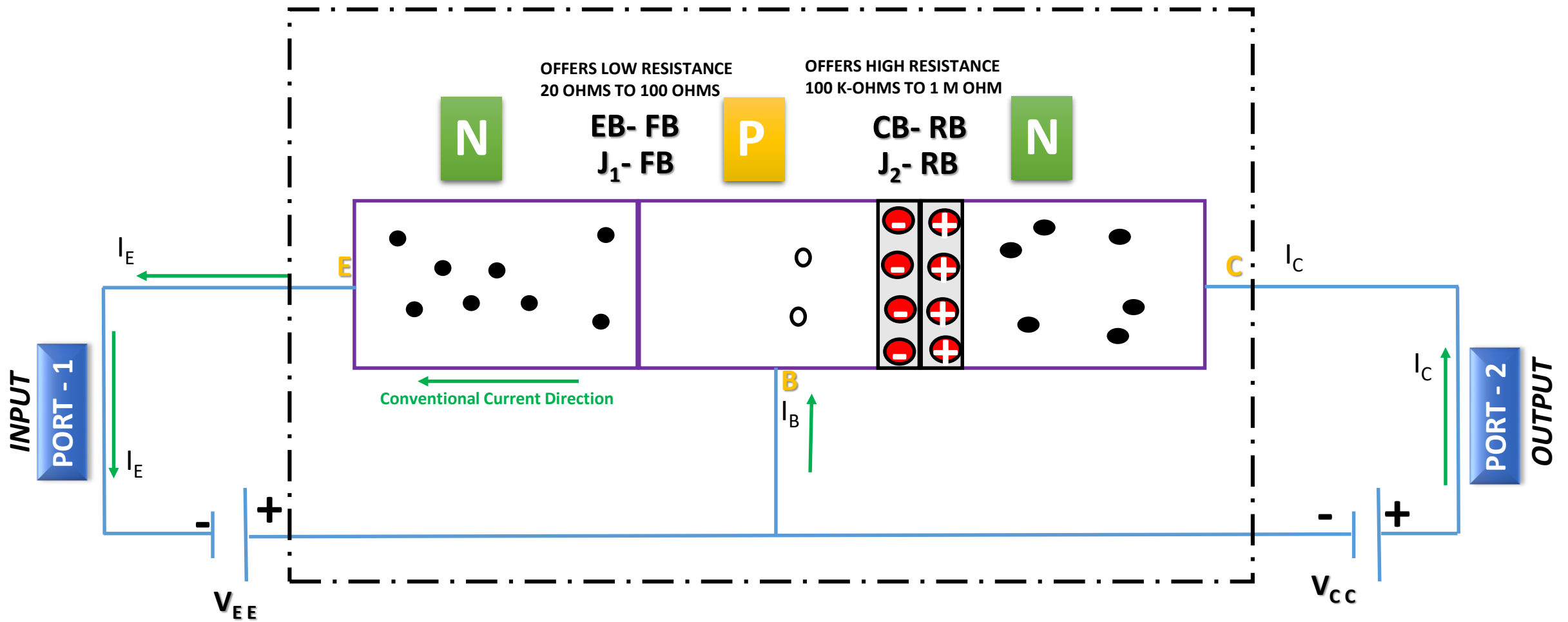


Transfers current signal from low resistance to high resistance
TRANSFER + RESISTOR = TRANSISTOR

- Electrons
- Holes

Two port network

Condition		Emitter Junction	Collector Junction	Region of operation
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Transfers current signal from low resistance to high resistance
TRANSFER + RESISTOR = TRANSISTOR