**Chapter 3: Bipolar Junction Transistor**

Table of Contents

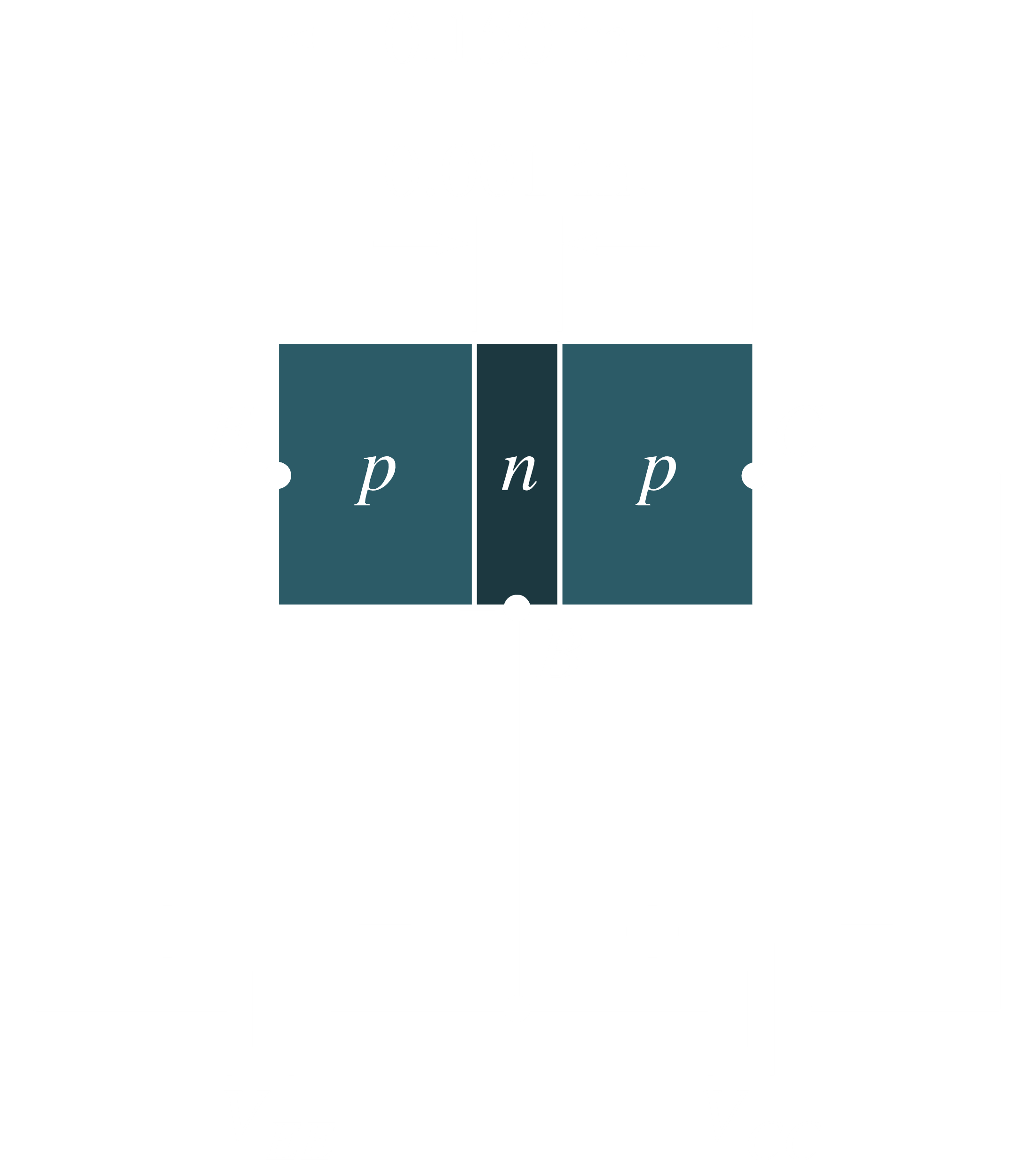
[3.2 Construction 2](#_Toc49599660)

[3.3 Operation 3](#_Toc49599661)

[3.4 Common Base Configuration 4](#_Toc49599662)

[3.5 Common Emitter Configuration 6](#_Toc49599663)

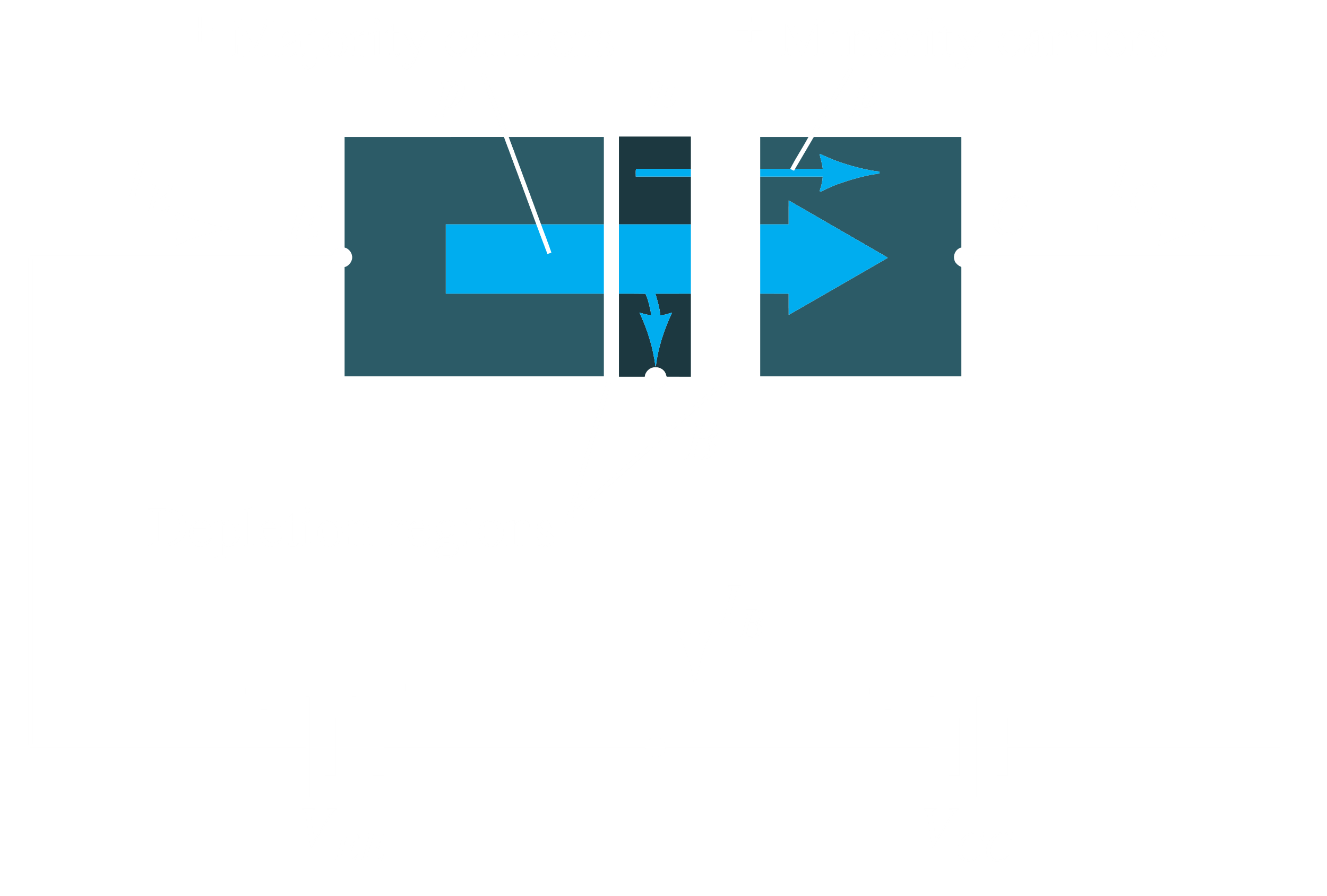
## 3.2 Construction

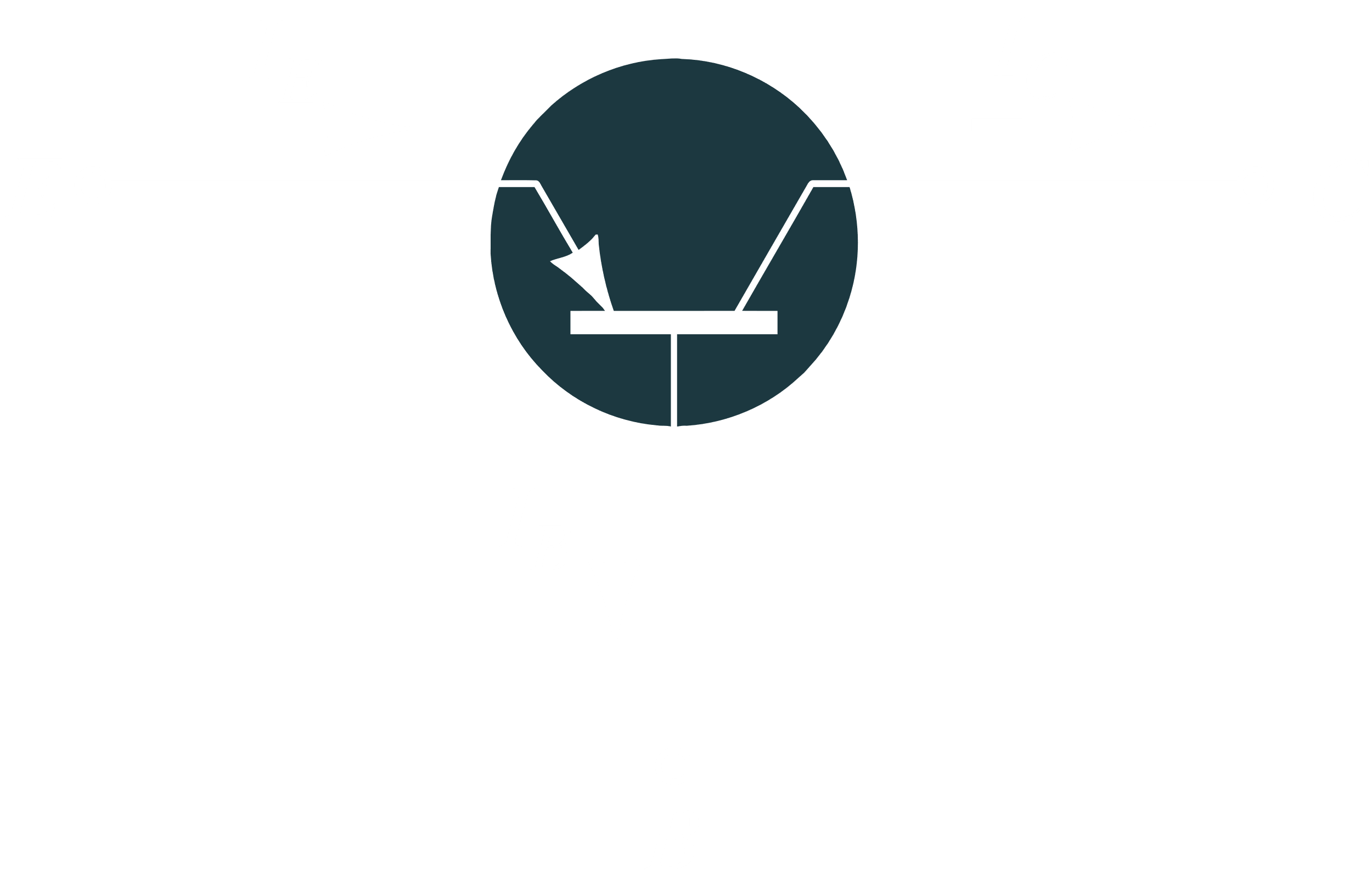
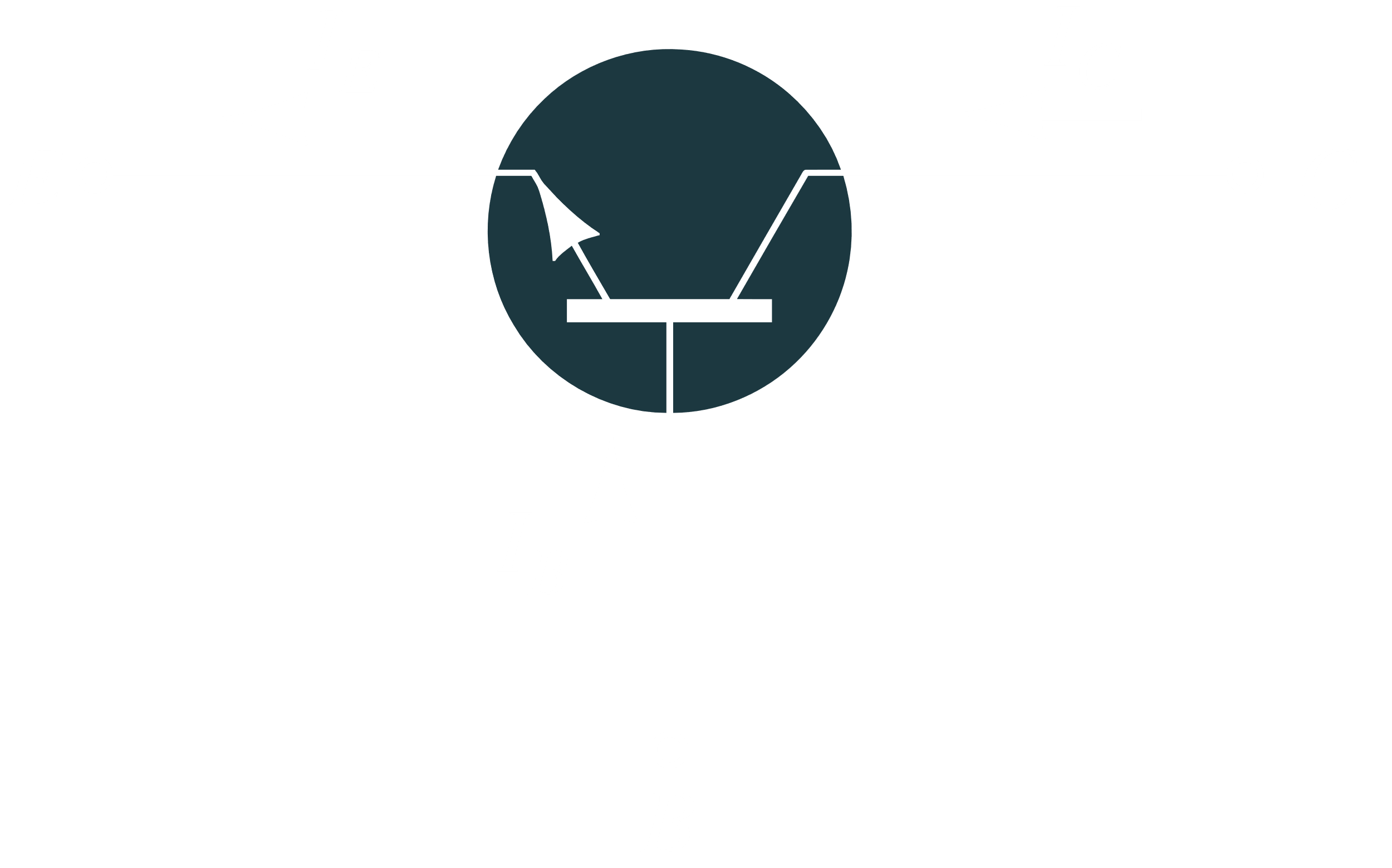


* Transistor – three-layer semiconductor
* Consists of either two n-type and one p-type layers (npn) or two p-type and one n-type layers (pnp)
* Outer layers are much thicker than central layer
* Emitter layer is heavily doped. Collector layer lightly doped. Base layer very lightly doped to decrease conductivity.
* Bipolar – both holes and electrons participate in injection process

## 3.3 Operation

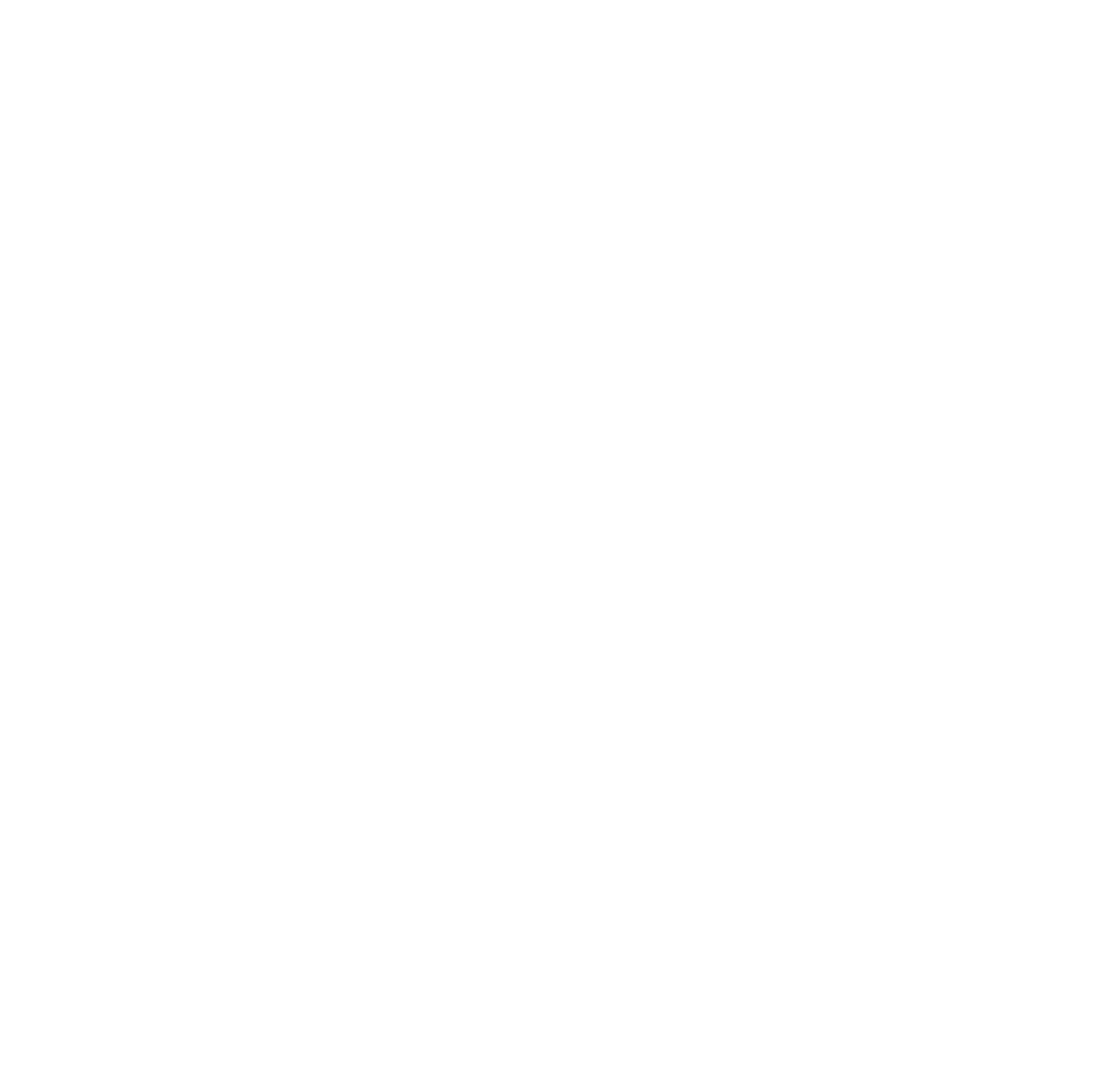
* Forward – Reverse Biased – Active
* Holes being pushed from emitter side since forward biased
* At 0.7V, depletion region overcome
* Holes from emitter push into base, but base is really small so very few are pulled through the base connection ( is small)
* Holes are attracted by collector side since reverse biased. Overcome depletion region. Most flow into collector ( is large). consists of majority carriers from emitter and minority carriers from base (leakage current).
* Small current that is enough to allow depletion region between emitter and base to be overcome allows much larger current to flow through collector (amplification)
* For npn, reverse biases and exact same thing occurs with roles of holes and electrons being reversed. Direction of current reversed.



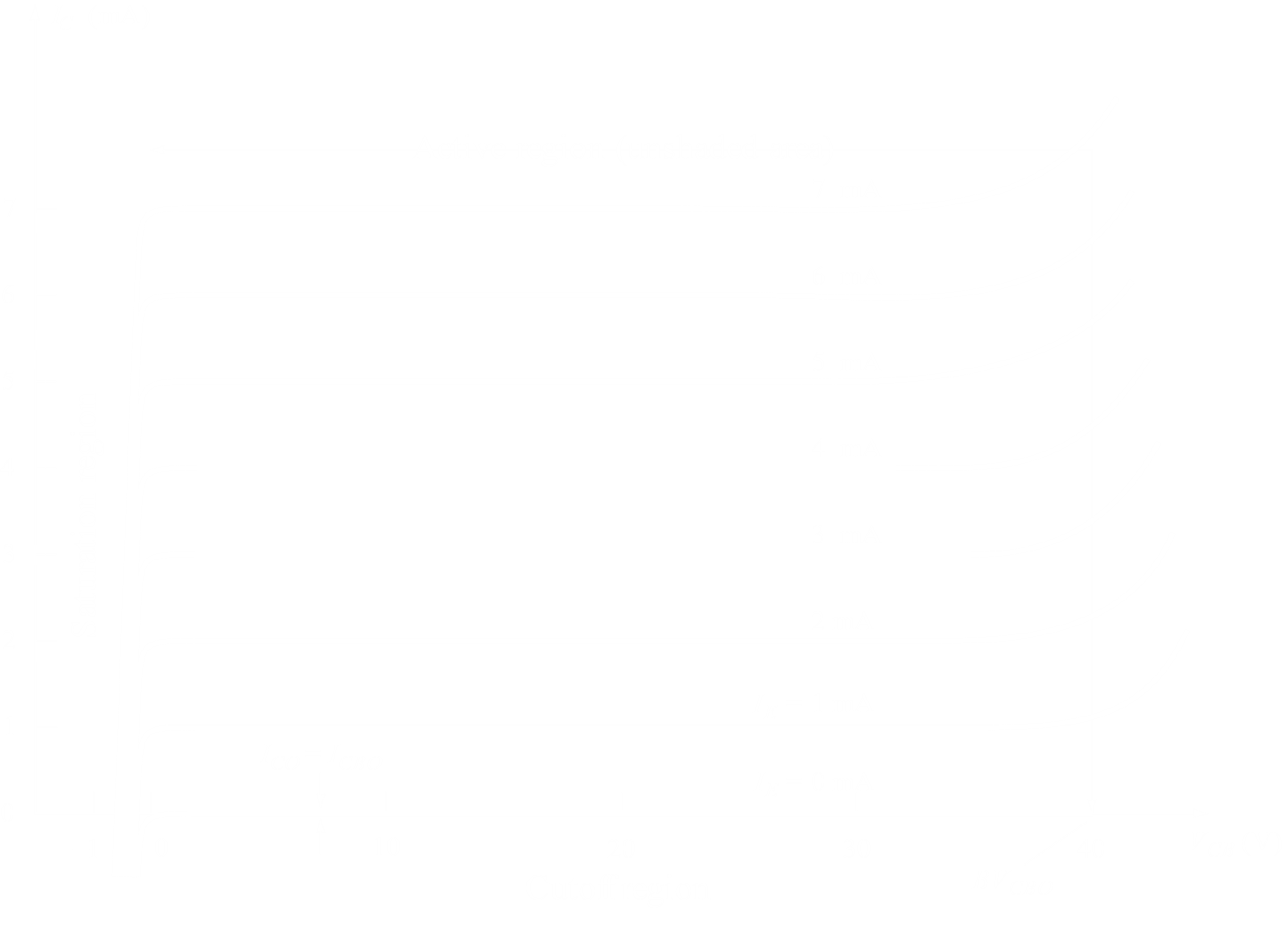
 

## 3.4 Common Base Configuration

* Base is common to both input and output side
* Base is generally grounded
* Forward – Reverse bias – active
* Reverse – Forward Bias depletion region of emitter side increases so worthless
* Forward – Forward Bias – holes from both sides pushed towards each other; heavy current flow – on switch
* Reverse – Reverse bias – only minority carriers from base flow – off switch

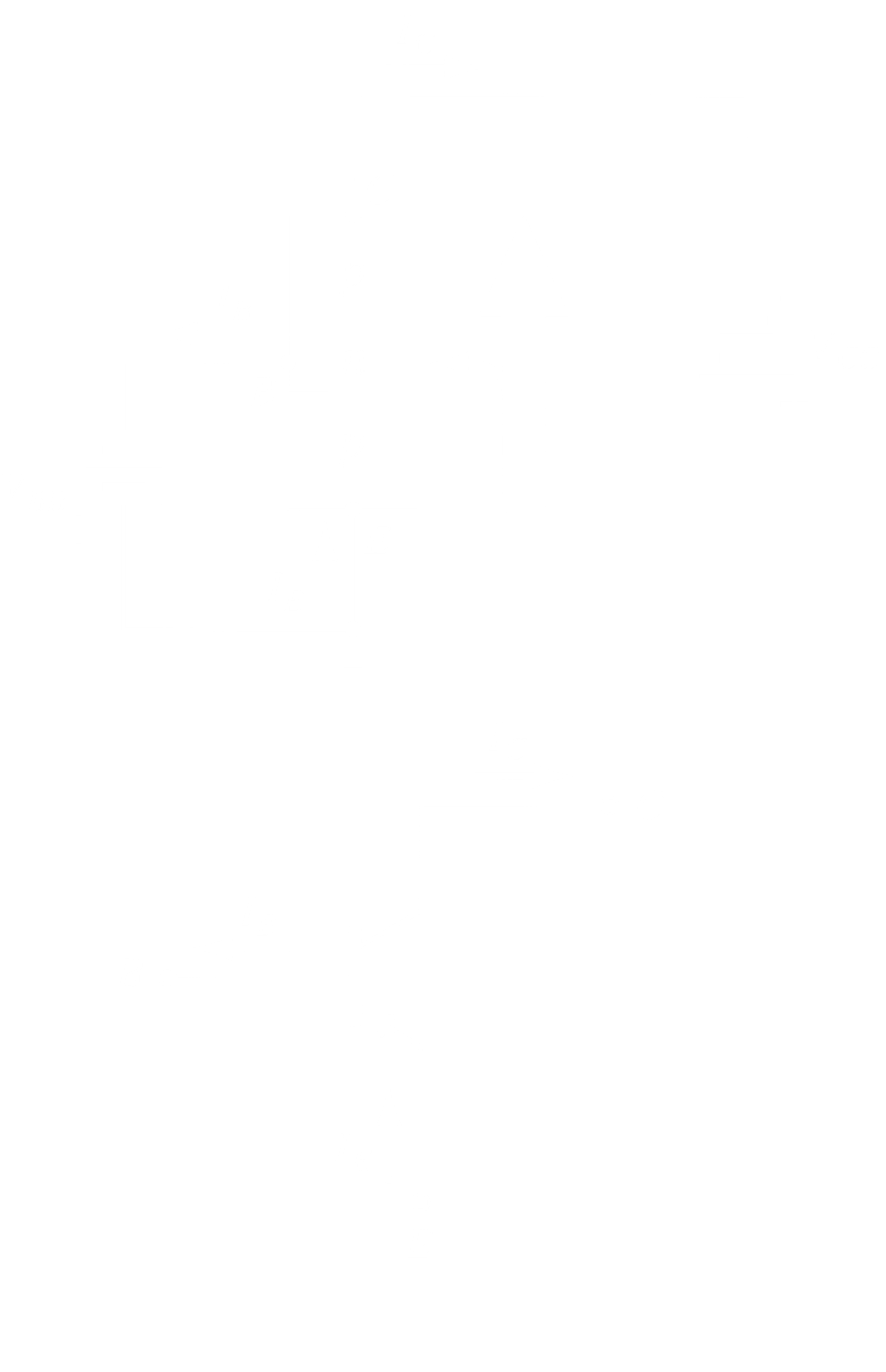


* begins to flow when is large enough to allow
* larger – more attraction for holes – larger

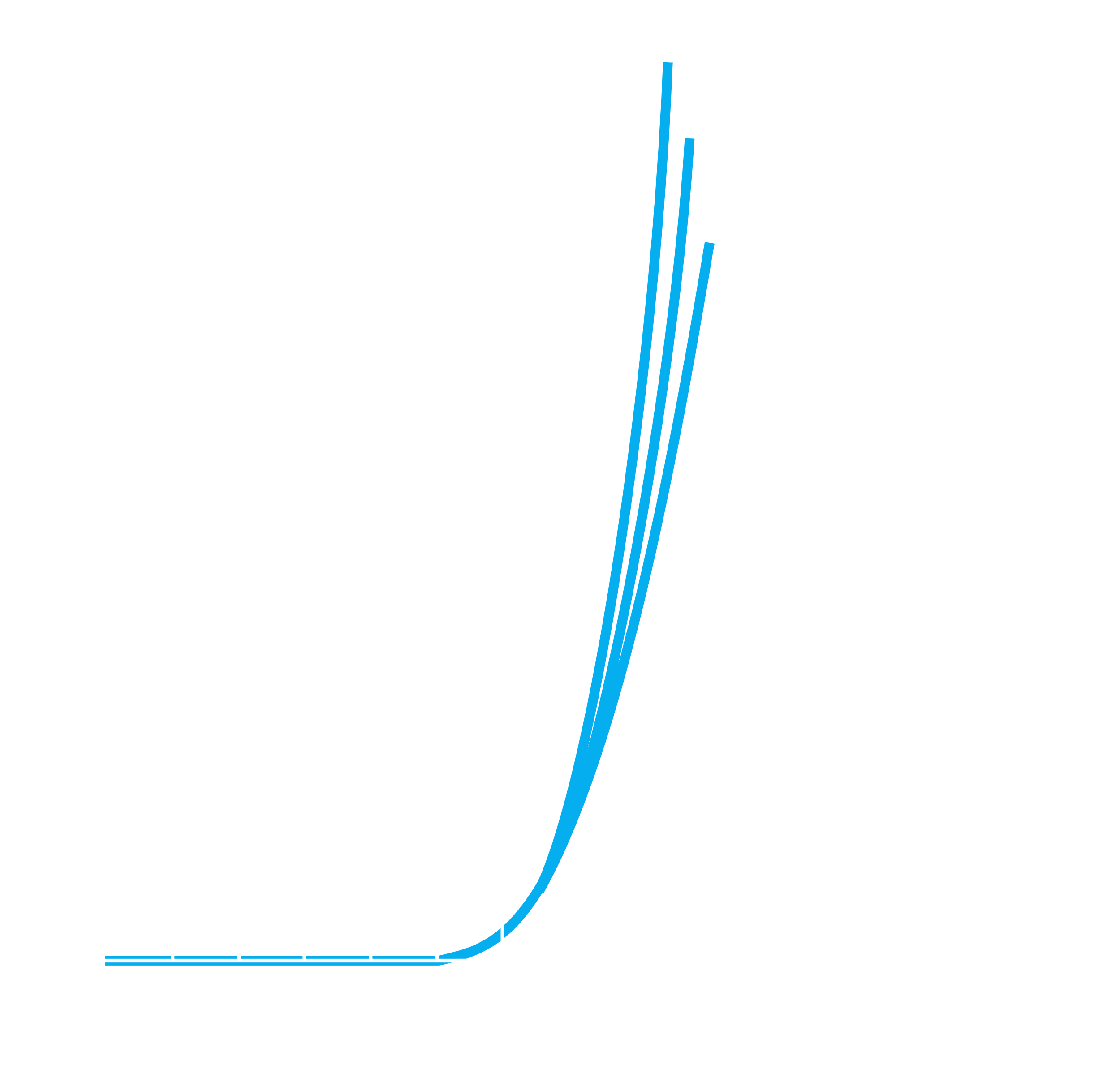


* Active region obvious
* Saturation – notice is negative meaning bias flipped
* Cutoff region – so no input so no output

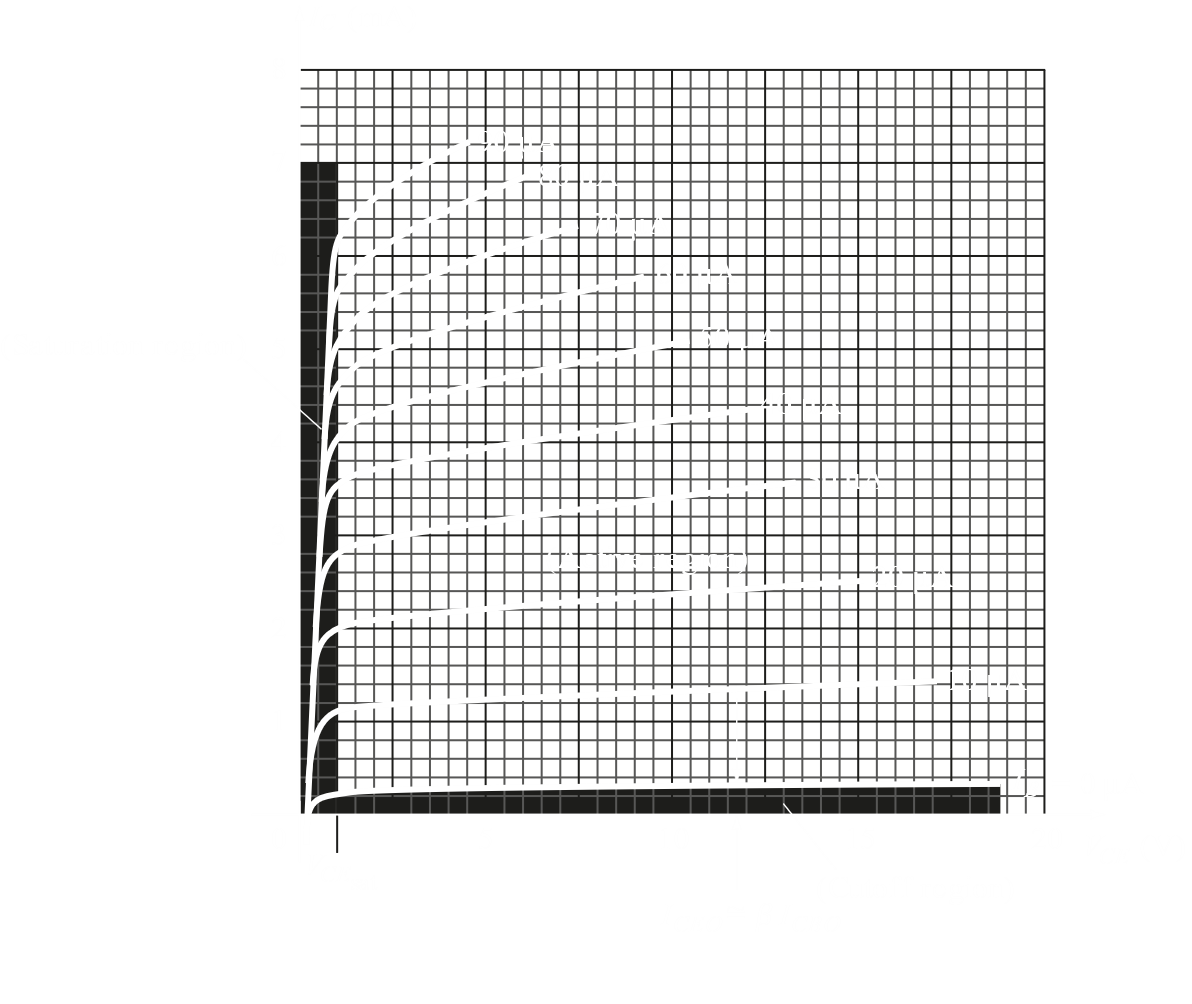
## 3.5 Common Emitter Configuration



* Emitter common to input and output terminals
* Input current is and input voltage is



* Output current is and output voltage is



* influences . Lines not horizontal
* Active region used to amplification
* Cutoff region less obvious; but still some input – no clue why doe