

BASICS OF A V_{BE} MULTIPLIER

< AKA: AMPLIFIED/ADJUSTABLE DIODE >

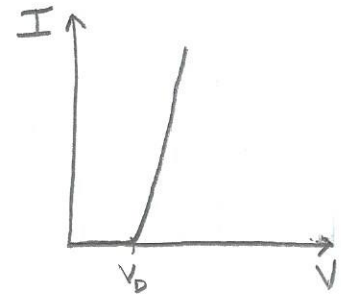
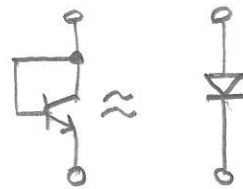


- USED TO CREATE A USER-DESIRED VOLTAGE DROP
- APPLICATIONS INCLUDE:
 - DC LEVEL / OFFSET SHIFTING
 - BIAS OF PUSH-PULL OUTPUT STAGES
- DIODES PROVIDE LIMITED FLEXIBILITY

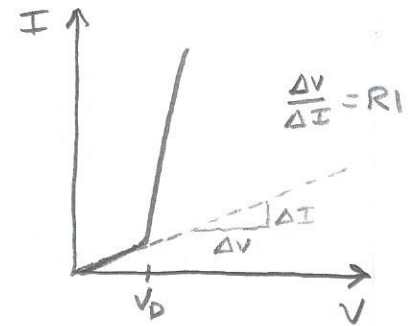
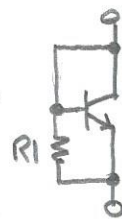


HOW THE V_{BE} MULTIPLIER WORKS ...

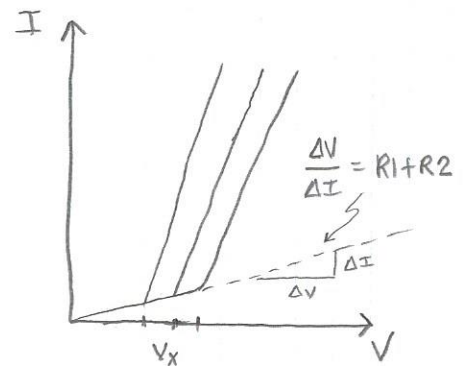
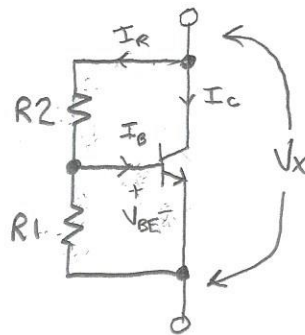
- TRANSISTOR AS A DIODE ...



... ADD A RESISTOR ACROSS B-E ...



... AND, REPLACE C-B SHORT WITH A RESISTOR ...



IF $I_R \gg I_B$

THEN $I_{R1} \approx I_{R2}$

$$I_{R1} = V_{BE} / R1$$

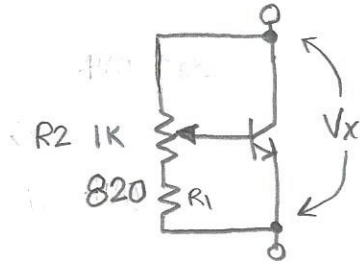
$$V_{R2} \approx \frac{V_{BE}}{R1} * R2$$

$$V_X \approx V_{BE} + \left(V_{BE} * \frac{R2}{R1} \right) = V_{BE} * \left(1 + \frac{R2}{R1} \right)$$

$$V_X \approx V_{BE} * \left(1 + \frac{R2}{R1} \right)$$

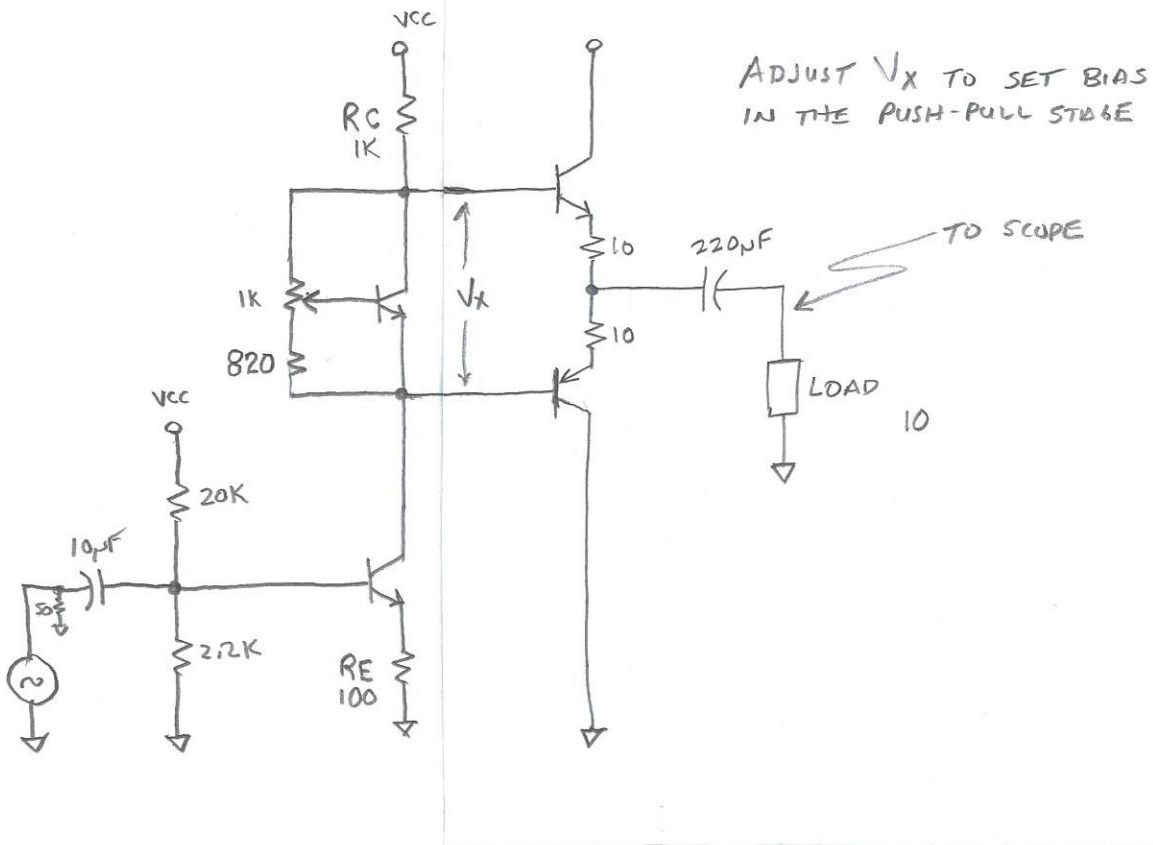
V_{BE} MULTIPLIER APPLICATION EXAMPLES

- ADJUSTABLE V_{BE} MULTIPLIER EXAMPLE



$$V_{BE} * 1.0 < V_x < V_{BE} * 2.2$$

- DC OFFSET / LEVEL SHIFT - INTO A PUSH-PULL DRIVER STAGE



ADJUST V_x TO SET BIAS IN THE PUSH-PULL STAGE

ALL TRANSISTORS SHOWN ARE SIMPLY GENERAL PURPOSE DEVICES SUCH AS 2N3904, 2N3906, ETC.