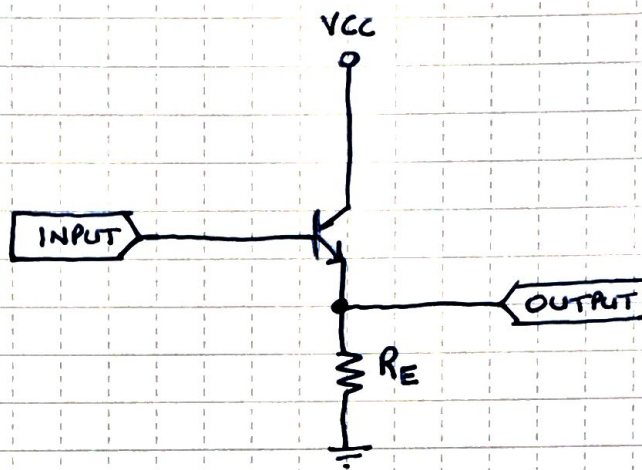


BACK TO BASICS: THE EMITTER FOLLOWER

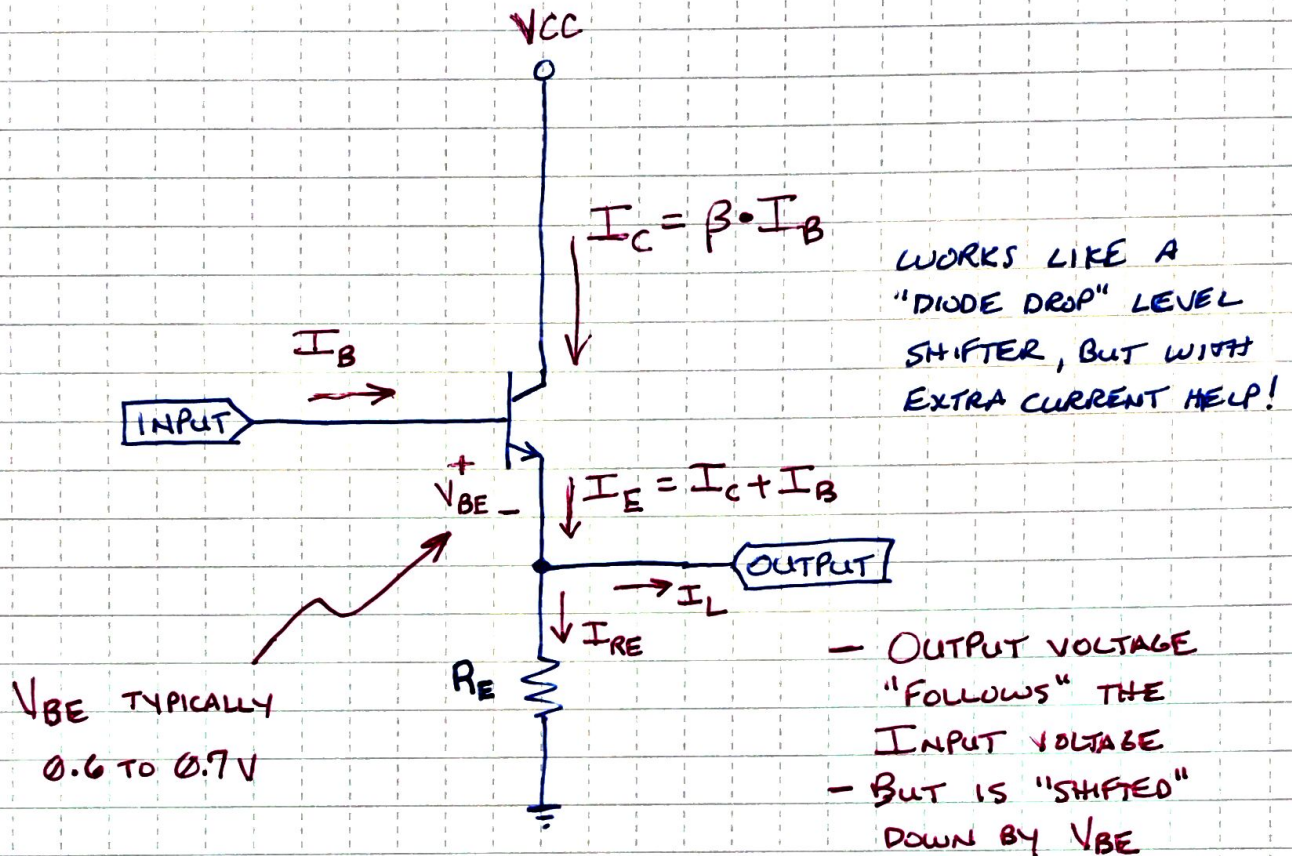
-OR-

COMMON COLLECTOR AMPLIFIER



FEATURES & CHARACTERISTICS:

- HIGH INPUT IMPEDANCE
 - WON'T LOAD DOWN THE SOURCE
- LOW OUTPUT IMPEDANCE
 - CAN DRIVE "HEAVY" LOADS
- UNITY VOLTAGE GAIN
 - USED MAINLY AS A BUFFER
 - ISOLATE STAGES

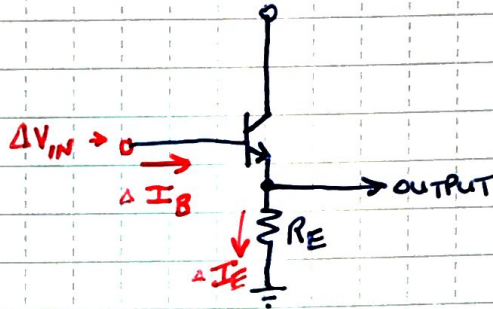
How it works:OPERATIONAL CONDITIONS

- ONLY WORKS WHEN THE TRANSISTOR IS BIASED "ON"
- ONLY WORKS WHEN THE EMITTER SOURCES CURRENT (CANNOT "SINK" CURRENT)

INPUT & OUTPUT IMPEDANCE

INPUT

- HOW MUCH DOES THE INPUT CURRENT CHANGE ΔI_B AS THE INPUT VOLTAGE CHANGE ΔV_{IN} ?



$$I_E = (\beta + 1) \cdot I_B$$

$$I_E \approx \beta \cdot I_B$$

- OUTPUT VOLTAGE IS SIMPLY THE INPUT - V_{BE}
- $\Delta V_{OUT} = \Delta V_{IN}$
- ΔV_{IN} RESULTS IN ΔI_E
- $\Delta I_B = \Delta I_E / \beta$

ACTUALLY R_E IN PARALLEL WITH THE LOAD

$$Z_{IN} = \frac{\Delta V_{IN}}{\Delta I_B} = \frac{\Delta V_{IN}}{\Delta I_E / \beta} = \beta \cdot \frac{\Delta V_{IN}}{\Delta I_E} = \underline{\underline{\beta \cdot R_E}}$$

OUTPUT



- IMPEDANCE LOOKING "INTO" THE OUTPUT:

R_E IN PARALLEL WITH:
 - INTRINSIC EMITTER RESISTANCE (r_e)
 IN SERIES WITH EFFECTIVE SOURCE IMPEDANCE (R_{in}/β)

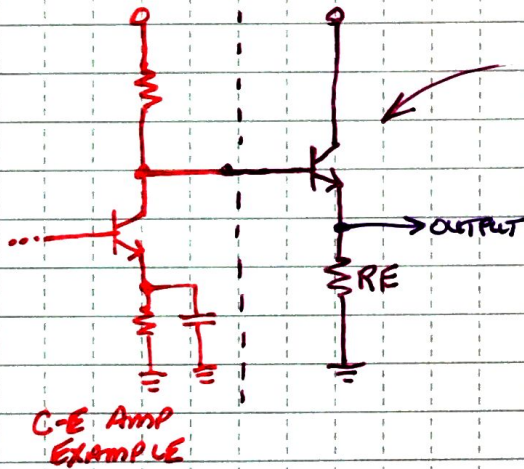
$$Z_{OUT} = R_E \parallel (r_e + R_{in}/\beta)$$

$$Z_{OUT} \approx r_e + \frac{R_{in}}{\beta}$$

$$r_e = \frac{26mV}{I_C}$$

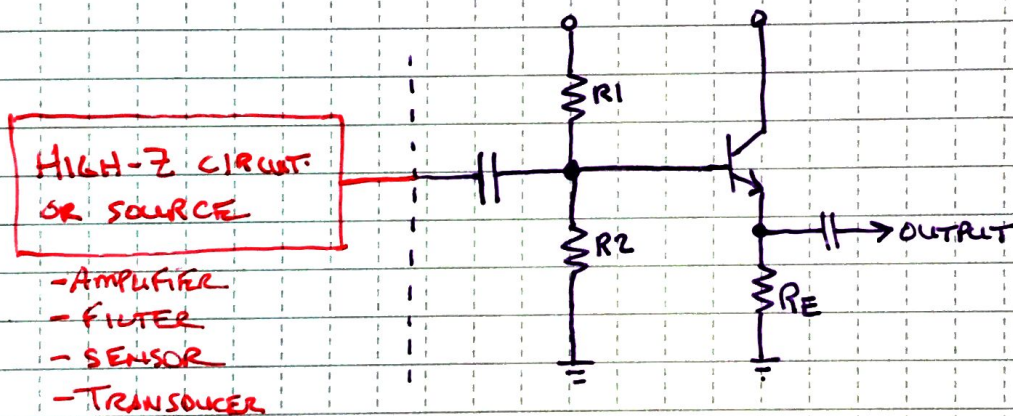
PRACTICAL CONSIDERATIONS

- THE TRANSISTOR ALWAYS NEEDS TO BE BIASED "ON".



- DC COUPLED EXAMPLE:

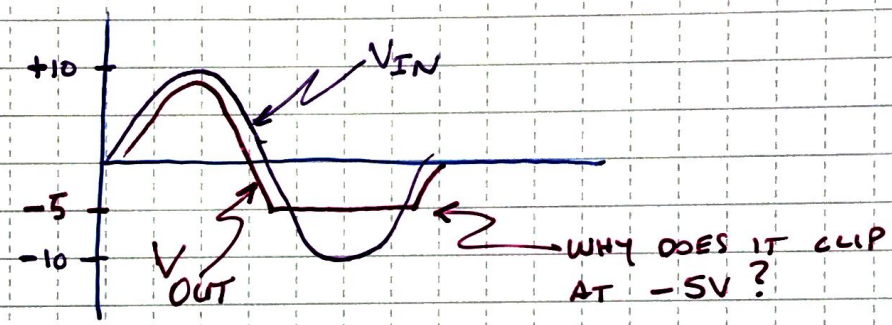
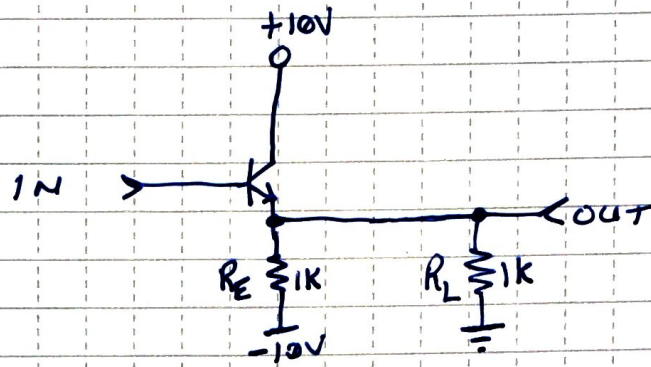
THE QUIESCENT VOLTAGE AT THE COLLECTOR OF THE C-E AMP SUFFICIENTLY BIASES THE EMITTER FOLLOWER



- AC COUPLED EXAMPLE

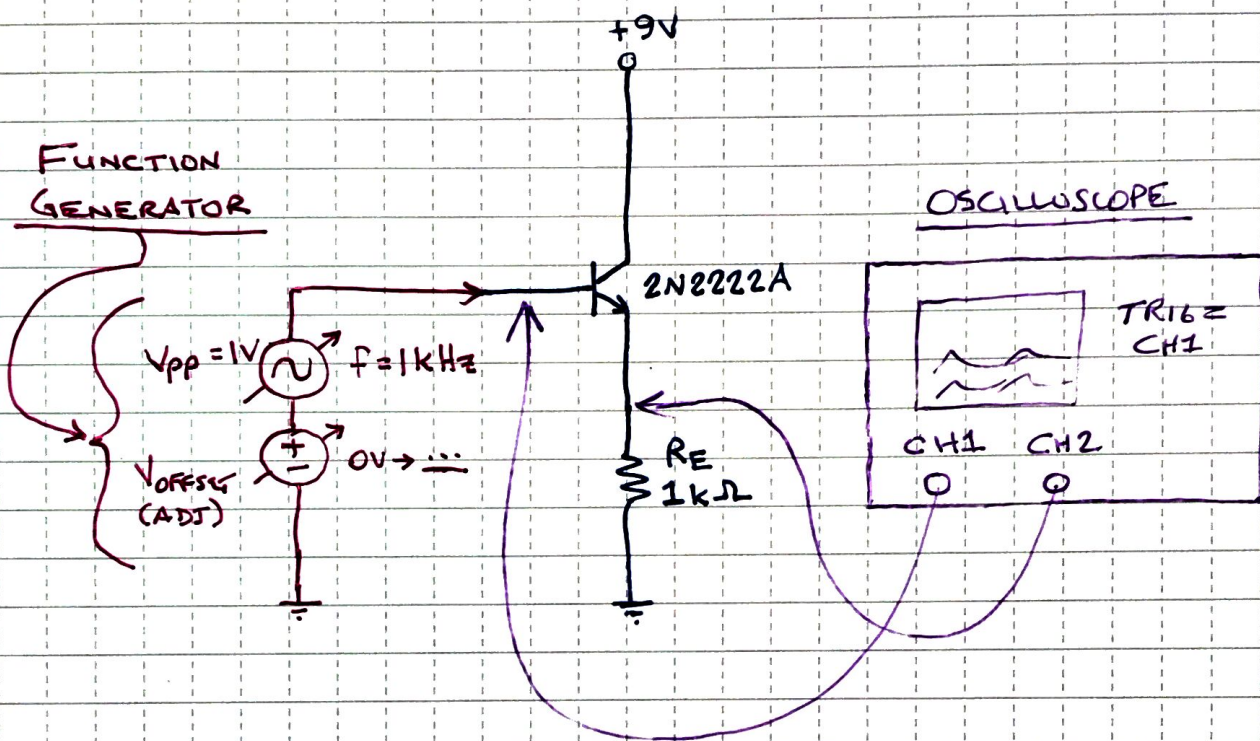
- IF INPUT CAN'T PROVIDE DC BIAS, THEN ADD COUPLING CAP & R1, R2
- IF OUTPUT MUST BE AC-COUPLED, ENSURE THAT RE CAN SINK OUTPUT CURRENT TO KEEP $I_E > 0$.

THE "ART OF ELECTRONICS" EXAMPLE



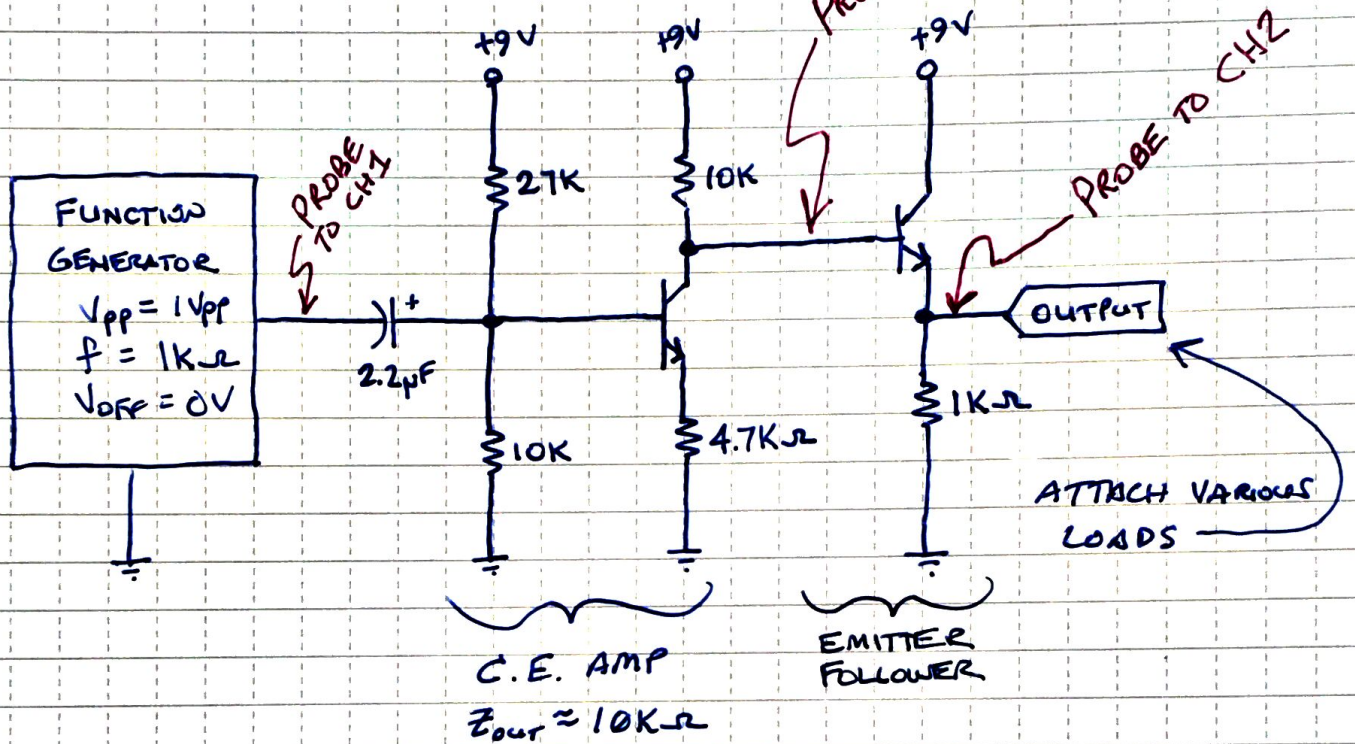
TEST CIRCUITS

"HOW IT WORKS"



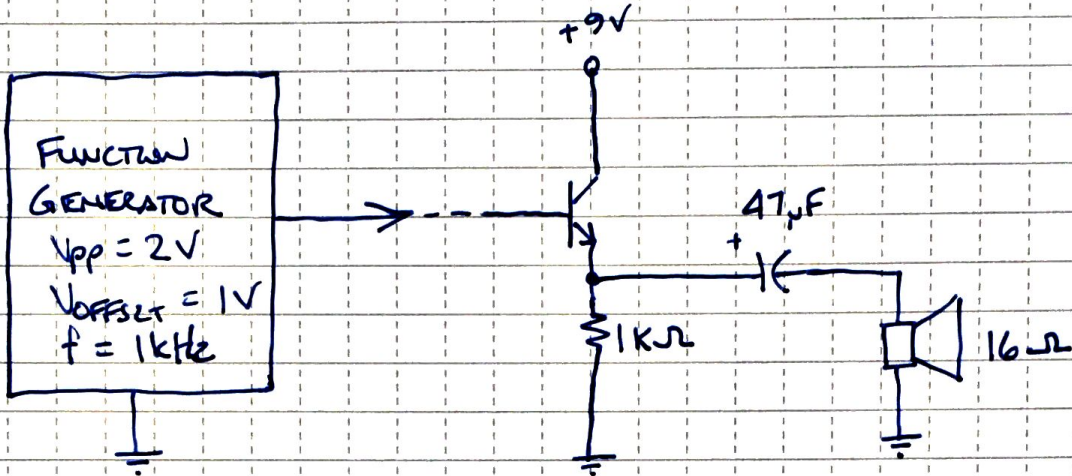
TEST CIRCUITS

"PRACTICAL CONSIDERATIONS"



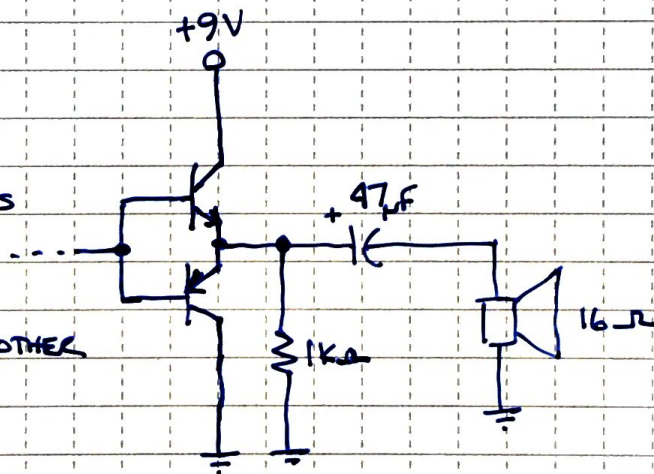
TEST CIRCUITS

"AC-COUPLED, LOW-Z LOAD"



"Push-Pull"
 NPN + PNP E-FOLLOWERS

- BUT - NOW HAVE ANOTHER
 PROBLEM ...



- SEE MY VIDEO ON "VBE MULTIPLIER" TO SEE
 AN EXAMPLE OF HOW TO CORRECT FOR
 CROSS-OVER DISTORTION