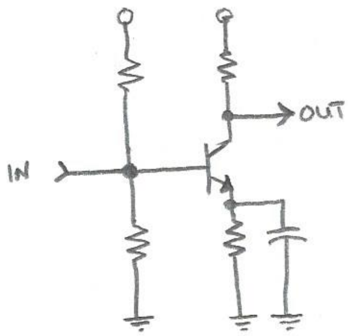
COMMON EMITTER AMPLIFIER
DESIGN TIPS & SHORTCUTS

W2AEW

CLASS A OPERATION

- USUALLY START WITH GOALS & CONSTRAINTS
  - DESIRED GAIN
  - INPUT / OUTPUT / LOAD RESISTANCES
  - INPUT / OUTPUT SIGNAL LEVELS
  - POWER SUPPLY VOLTAGE
  - POWER DISSIPATION
  - MORE...



- RELATED VIDEOS:

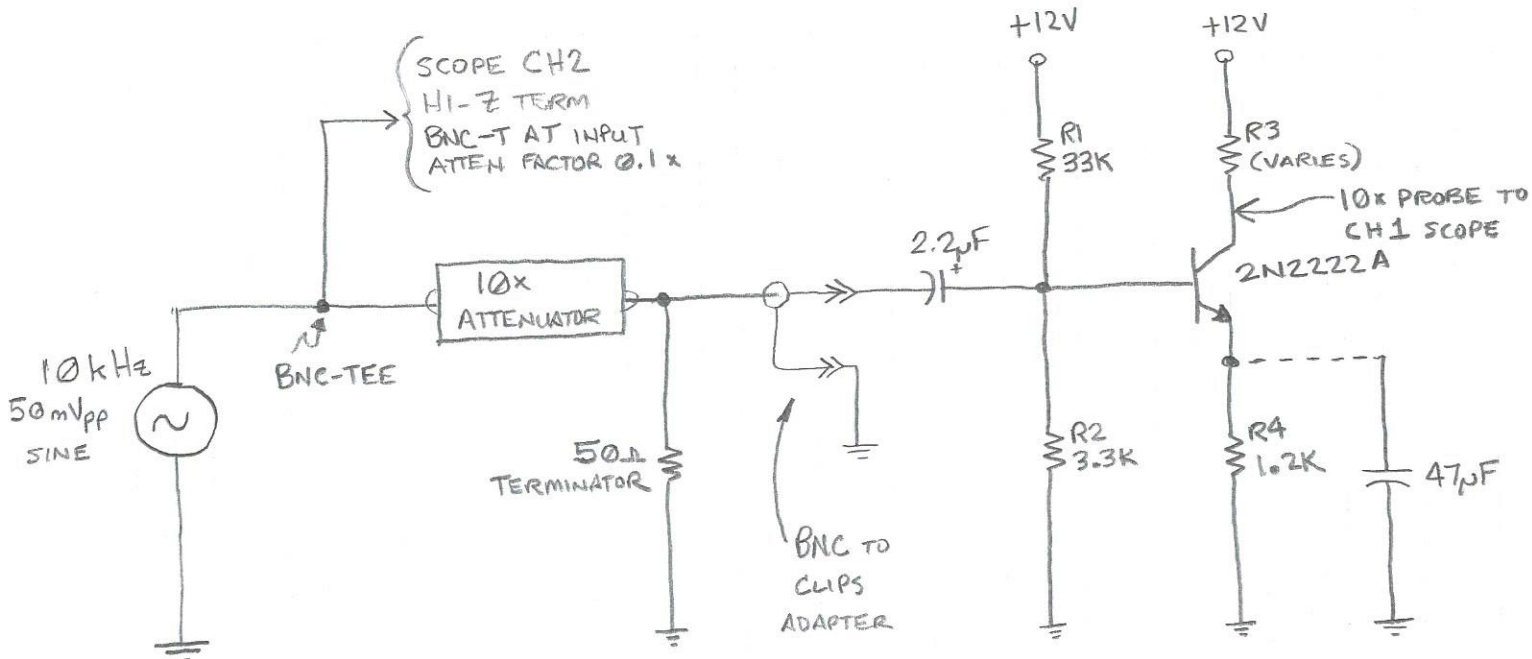
#185: BIPOLAR TRANSISTOR BIAS CIRCUITS & BETA DEPENDENCE

#114: COMMON EMITTER / BASE / COLLECTOR AMPLIFIERS

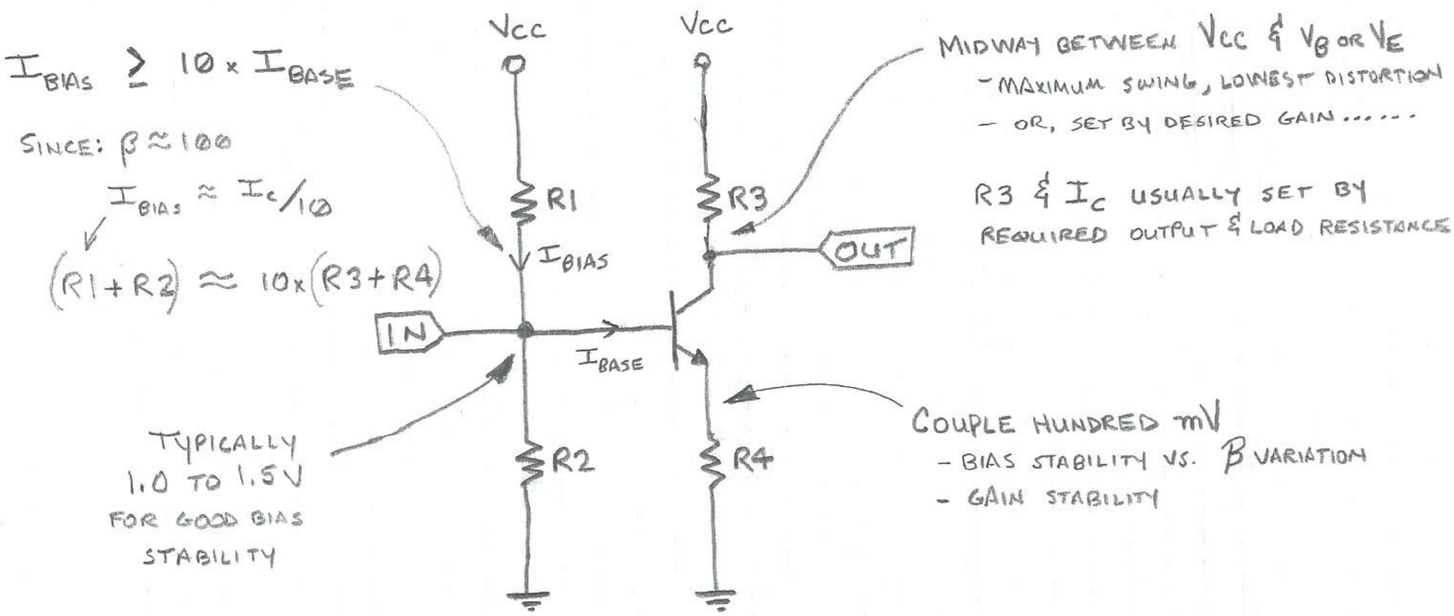
#113: TRANSISTOR BIAS POINT & CLASS OF OPERATION

#67: COMMON EMITTER AMP GAIN & FREQ. RESPONSE

TEST CIRCUIT

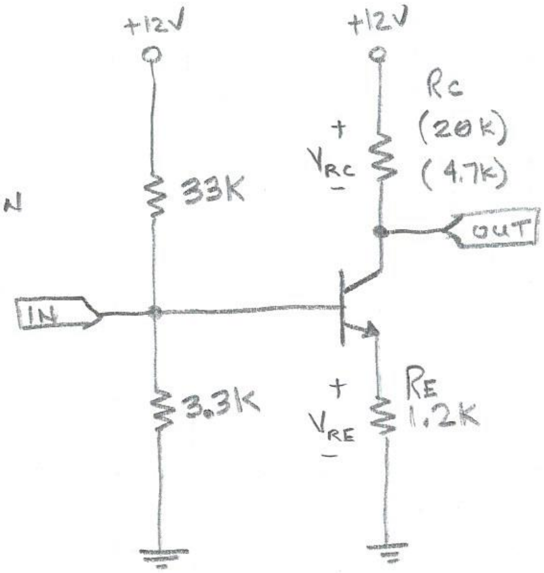


DC BIAS POINT CONSIDERATIONS



GAIN CALCULATIONS

- LOW GAIN
- LOW DISTORTION

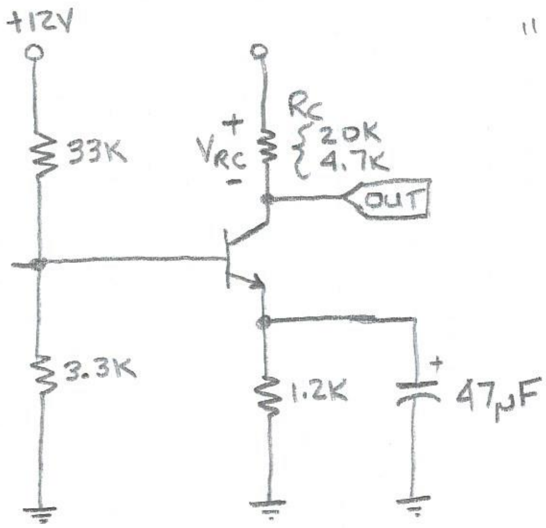


"WITH EMITTER DEGENERATION"

- WITH FEW HUNDRED mV AT EMITTER
  - IGNORE INCREMENTAL EMITTER RESISTANCE $r_e = 1/g_m = V_T/I_C$
- SINCE: $I_C \approx I_E$
  - ANY CHANGE IN $I_E \approx \Delta I_C$
- THUS, $A_v \cong -\dfrac{V_{RC}}{V_{RE}}$

$$\boxed{A_v \cong -\frac{R_C}{R_E}}$$

- HIGH GAIN
- MORE DISTORTION



"WITH EMITTER BYPASSED"

- CAPACITOR SHORTS DEGENERATION AT SIGNAL FREQUENCIES
- EBERS-MOLL APPROXIMATE GAIN EQUATION

$$A_v \cong -g_m \cdot R_C$$

WHERE: $g_m = \dfrac{I_C}{V_T}$

$V_T = 26\text{mV}$ @ ROOM TEMP

ALSO $r_e = \dfrac{1}{g_m} = \dfrac{V_T}{I_C}$

$A_v = \dfrac{R_C}{r_e}$ (SAME AS ABOVE)

SUPER SIMPLE SHORTCUT

$$\boxed{A_v \cong -\frac{V_{RC}}{V_T}}$$

ACCURATE ≈ 10% FOR SMALL SIGNALS ($\Delta V_{BE} < 10\text{mV}$)

$$A_v = -g_m \cdot R_C$$
$$= -\frac{I_C}{V_T} \cdot R_C$$
$$= -\frac{1}{V_T} \cdot (I_C \cdot R_C)$$
$$= -\frac{V_{RC}}{V_T}$$