

Transistor Biasing Lab – Formula Sheet (Transistor Pinout on back.)

This week's lab will be Experiment #5 handouts on Transistor Bias Circuits. A copy will be provided for you in class.

Part 1: Build & verify all 4 circuits. You may substitute a 2N2222 for the 2N3904. Suggestion: Use your multi-meter to check each transistor BEFORE putting it in the circuit. A pdf of the proper procedure is posted on the forums and will be provided to you in class/lab. **Do NOT do Part 2.**

You will make the measurements for each of 3 transistors for each circuit. This will help demonstrate the stability of the Q-point with respect to transistor variations.

Here are the formulas required for each circuit (note Fig. #):

Fig. 5-1:

$$V_{RB} = V_{CC} - 0.7V$$

$$I_B = (V_{CC} - 0.7V) / R_B$$

$$I_C = (\beta) * I_B \text{ (assume } \beta \text{ around } 150\text{-}200\text{)}$$

$$V_{RC} = I_C * R_C$$

$$V_C = 12V - V_{RC}$$

$$V_{CE} = V_C - V_E = V_C - 0 = V_C$$

Fig. 5-2:

$$I_B = (V_{CC} - 0.7) / (R_B + \beta * R_E)$$

$$V_{RB} = I_B * R_B$$

$$I_C = \beta * I_B$$

$$V_{RC} = I_C * R_C$$

$$V_C = V_{CC} - V_{RC}$$

$$V_{CE} = V_C - V_E = V_C - V_{RE} \text{ where } V_{RE} = I_C * R_E$$

Fig. 5-3:

$$V_B = V_{CC} (R_2 / (R_1 + R_2))$$

$$V_E = V_B - 0.7$$

$$I_E = I_C = (V_E - 0) / R_E$$

$$V_{RC} = I_C * R_C$$

$$V_C = V_{CC} - V_{RC}$$

$$V_{CE} = V_C - V_E$$

Fig. 5-4:

$$V_B = 0.7$$

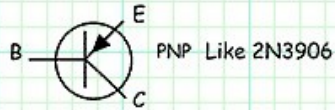
$$I_E = I_C = (V_{CC} - V_{BE}) / (R_B / \beta + R_C) = (V_{CC} - 0.7) / (R_B / \beta + R_C)$$

$$V_{RC} = I_C * R_C$$

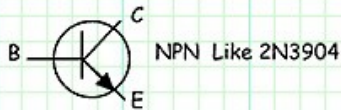
$$V_C = V_{CC} - V_{RC}$$

Transistor Pinouts

TO-92 (Plastic)



PNP Like 2N3906



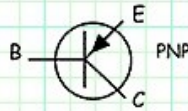
NPN Like 2N3904

Here's a very common plastic package: the TO-92. Beware, not all parts in the TO-92 package share this pinout. Here are some that do:

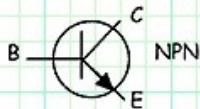
NPN: 2N3903, 2N3904, 2N4400, 2N4401, PN2222A

PNP: 2N3905, 2N3906, 2N4402, 2N4403, PN2907A

TO-18 Metal



PNP



NPN

Here's a common metal can called the TO-18. This package can handle more power than the TO-92 above. Here are some parts that share this pinout:

NPN: 2N2222, 2N2222A

PNP: 2N2907, 2N2907A

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