

16.311 Electronics Laboratory
Experiment
Bipolar Transistor Characteristics

Objective:

To display and record the collector characteristics of the 2N3904 transistor.
Use the characteristic curves to determine the B_{dc} of the transistor.

Materials Needed:

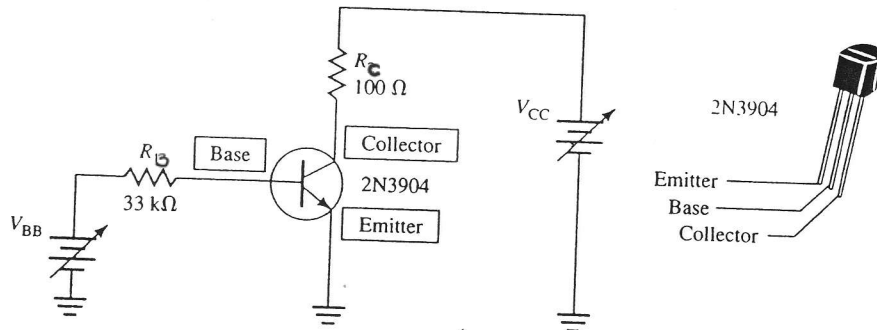
One 2N3904 NPN transistor
Transistor Curve tracer

Reference data:

Sedra & Smith chapter 4 fig. 4.15, 4.34, 4.36

Engineering Problem:

1. Wire the common emitter configuration shown below. Start with both power supplies at 0 volts. Resistor R_B is to limit bias current and to determine the base current.
Slowly increase V_{BB} until voltage across R_B is 1.65 volts. This gives you a base current of $50\mu A$, to check this apply ohms law to R_B .



2. Without adjusting the setting of V_{BB} , slowly increase V_{CC} until 2.0 volts is across the transistor's collector and emitter. This voltage is V_{CE} . Then measure and record V_{CC} for this setting, compute the collector current by applying ohms law to voltage across R_C .
3. Without adjusting the base current repeat with V_{CE} of 4v, 6 v, 8v, 10volts as above.

4. Reset V_{CC} to 0 volts and adjust V_{BB} until V_{RB} is 3.3 volts. The base current should be $100\mu A$.
5. Without adjusting the setting of V_{BB} , slowly increase V_{CC} until 2.0 volts is across the transistor's collector and emitter. This voltage is V_{CE} . Then measure and record V_{CC} for this setting, compute the collector current by applying ohms law to voltage across R_C .
6. Without adjusting the base current repeat with V_{CE} of 4v, 6 v, 8v, 10volts as above
7. Reset V_{CC} to 0 volts and adjust V_{BB} until V_{BB} is 4.95 volts. The base current should be $150\mu A$.
8. Without adjusting the setting of V_{BB} , slowly increase V_{CC} until 2.0 volts is across the transistor's collector and emitter. This voltage is V_{CE} . Then measure and record V_{CC} for this setting, compute the collector current by applying ohms law to voltage across R_C .
9. Plot three collector characteristic curves using the data recorded. The collector characteristic curve is a graph of V_{CE} versus I_C for a constant base current. Label each curve with the base current it represents, graph the data in your notebook, show the Load Line on the graph.
10. Use the characteristic curves you plotted to determine the B_{dc} at V_{CE} of 5 volts
11. Place your transistor on the curve tracer and get a family of the same curves you plotted.