Amplifier Topologies

Simon Hobbs

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Chapter 1

Amplifiers

1.1 Functional Types

Table 1.1: Types of amplifiers by function

Voltage Voltage in, voltage out. Need high impedance in, low out.

Current Current in, current out. Need low impedance in, high out.

Transimpedance Current in, voltage out. Need low impedance in, low out.

Transconductance Voltage in, current out. Need high impedance in, high out.

For a voltage input you want high impedance so that the signal is not loaded and therefore distorted by the amp regardless of the impedance of the source. For voltage output you want low impedance so that the signal is not distorted by the load. For current input you want low impedance so that the source can drive the signal without the current being distorted. For current output you want high impedance as a high output impedance reduces the effect of a finite resistance in the current source, the higher the ratio of $Z_{load}/Z_{intrinsic}$ the closer to ideal the amp.

Combining different section of these basic types can better address the design goals than just one. A transconductance amp cannot drive a large load without significant distortion, so a current amp following would allow a load to be driven without distortion.

1.2 Choosing BJTs or FETs

1.2.1 BJT Issues

Miller Effect

Early Voltage

Thermal Runaway

Base Current

Temperature Drift

1.2.2 JFET Issues

Component Variability

Low Gain

Noise

Chapter 2

OPAMPS

2.1 When Not to use an OPAMP

2.2 Flaws

2.2.1 Slew Rate

2.2.2 Noise

2.2.3 Saturation

2.2.4 Common Mode Gain

2.2.5 Power Supply Rejection

2.2.6 Temperature Drift

2.2.7 Input Capacitance

Chapter 3

Basic Single BJT

3.1 Analysis Techniques

3.1.1 β Transform

Assume that the transistor is in the active region, take the definition of β:

$$i_e \equiv (\beta + 1) \cdot i_b \tag{3.1}$$

to move the resistor terms from the base to the emitter or from the emitter to the base (whichever is more convenient). The you can calculate the gain etc. using Kirkoffs laws.

3.2 Common-Emitter

3.3 Common-Base

3.4 Common-Collector

AKA emitter follower

3.5 Comparison

The three single BJT amplifier types have different applications for the different amplifier types (Section 1.1).

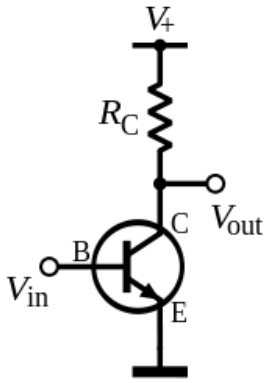


Figure 3.1:

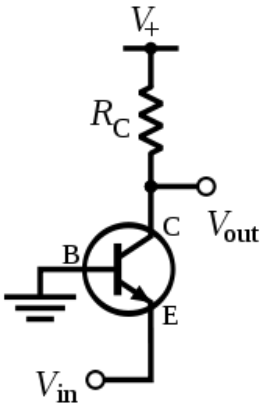


Figure 3.2:

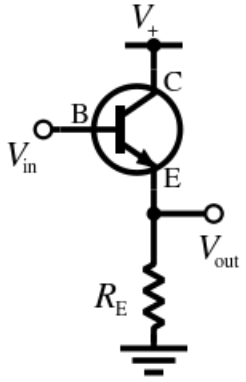


Figure 3.3:

Table 3.1: Comparison of the three basic BJT amps

Type	**Input Impedance**	**Ouput Impedance**	**Ideal Amp Use**
CC	Large	Medium	Voltage
CB	Small	Medium	TIA
CE	Large	Small	Voltage, Current, TCA

Chapter 4

Basic Single FET

4.1 Common-Source

4.2 Common-Gate

4.3 Common-Drain

Chapter 5

Multisection BJT Amps

5.1 Cascade

5.2 Cascode

5.3 Darlington

Basically a super β, slow BJT.

5.4 Differential Emitter-Coupled

AKA Long-tail

5.5 Current Mirrors

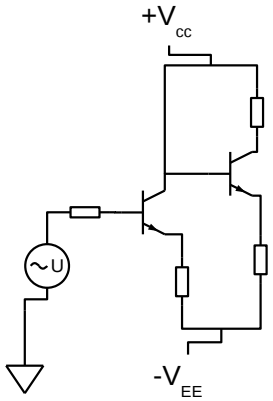


Figure 5.1:

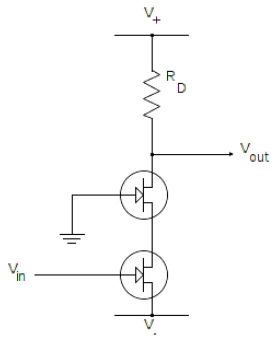
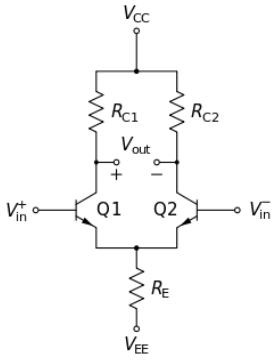


Figure 5.2:



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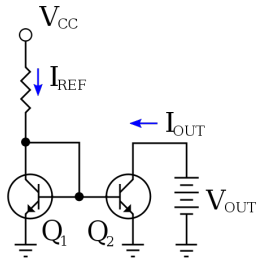

Figure 5.4:

Chapter 6

Amplifier Concepts

6.1 Emitter Degeneration

6.2 Bootstraping

Bibliography

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