

Questions?

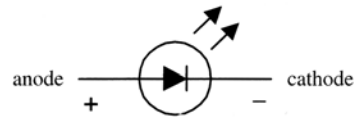
- Project?

Diode: Key circuits (III)

- Keyboard matrix: how to avoid ghost?

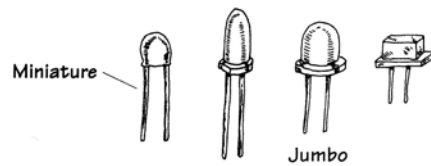
LED: key facts:

- Light Emitting Diode



- Examples

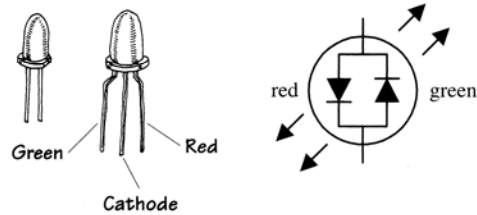
Visible-Light LEDs



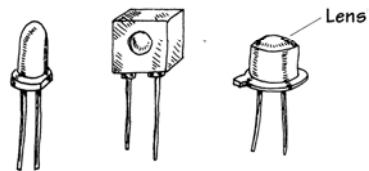
Blinking LEDs



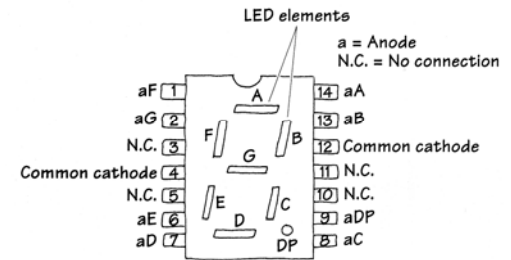
Tricolor LEDs



Infrared LEDs

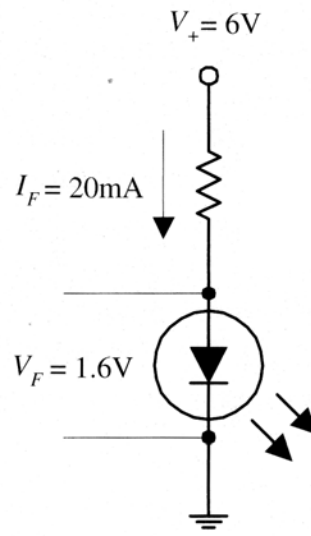


LED Displays



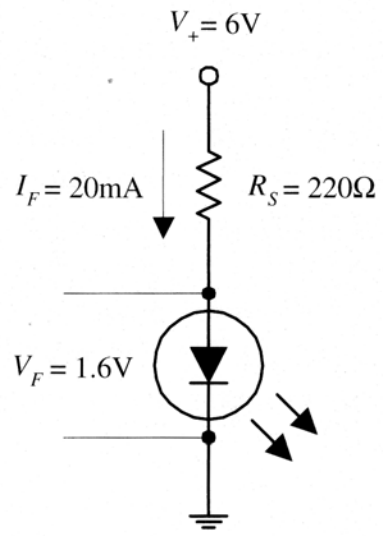
LED: Key circuits

- Load limitation



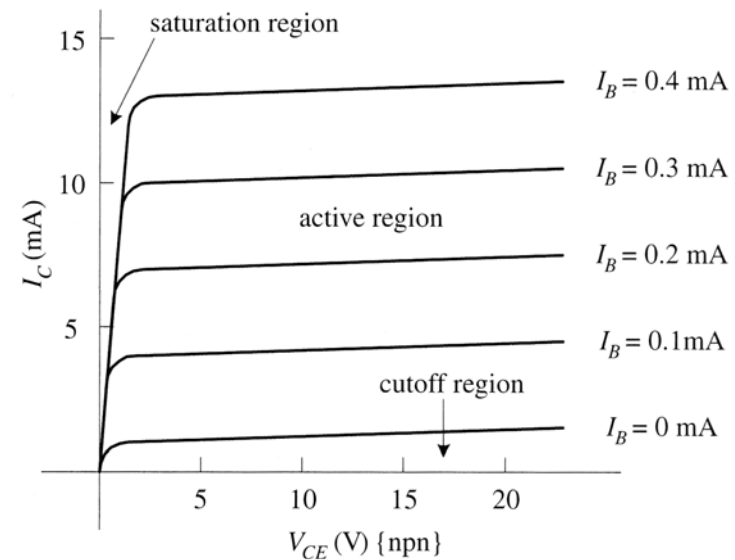
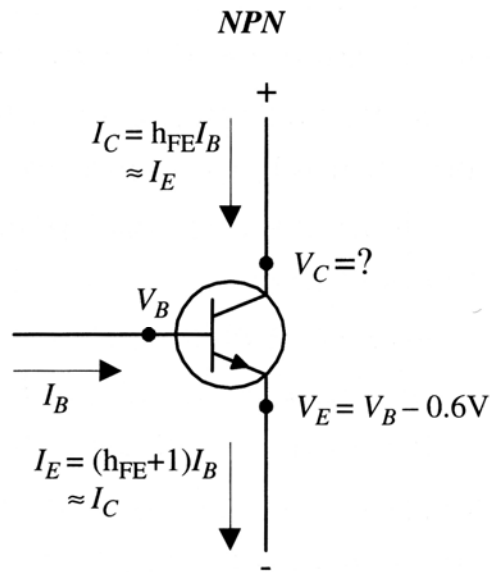
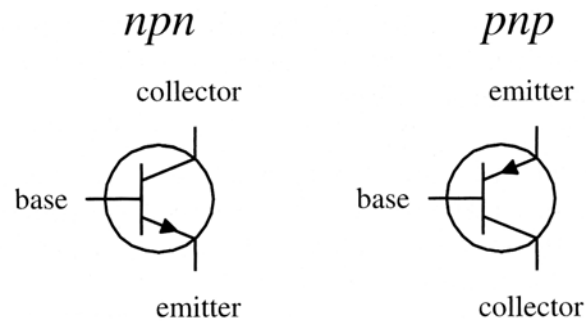
LED: Key circuits

- Load limitation



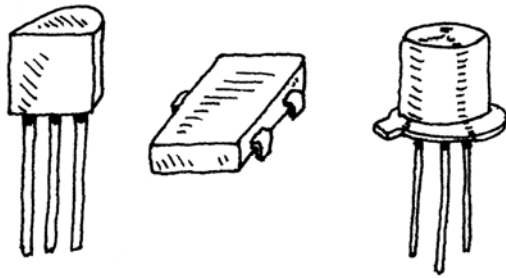
Bipolar transistor: key facts

- Two varieties:

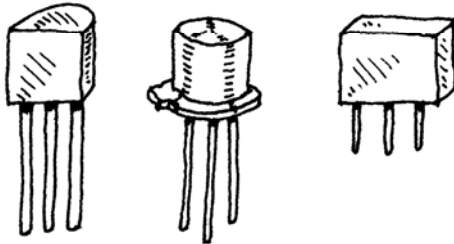


Bipolar transistor: Examples

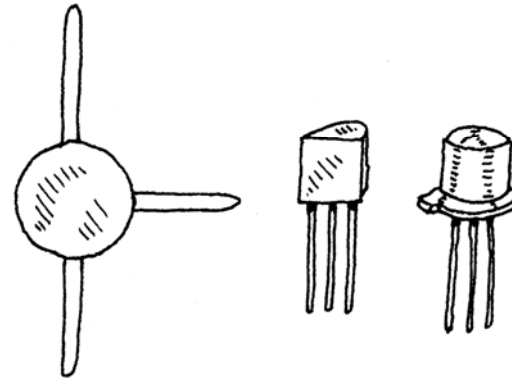
SMALL SIGNAL



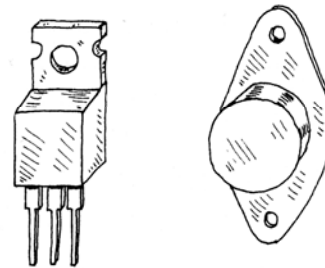
SMALL SWITCHING



HIGH FREQUENCY (RF)

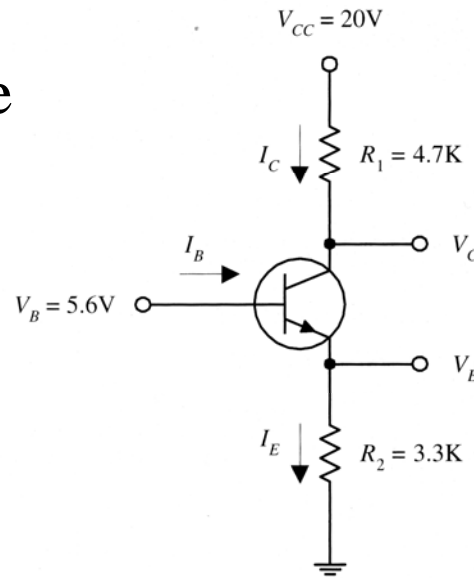


POWER

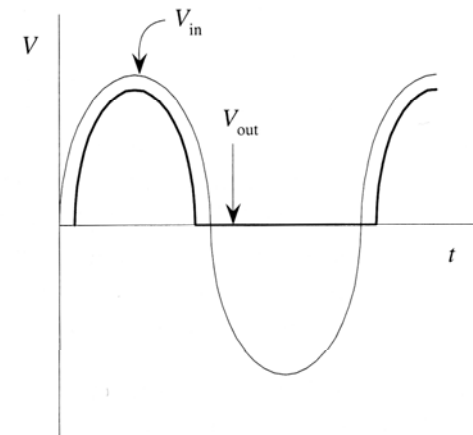
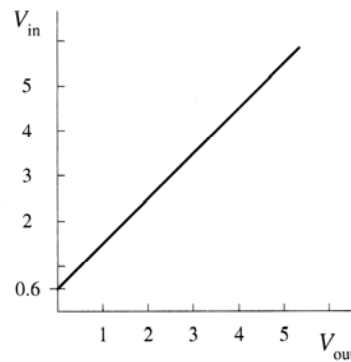
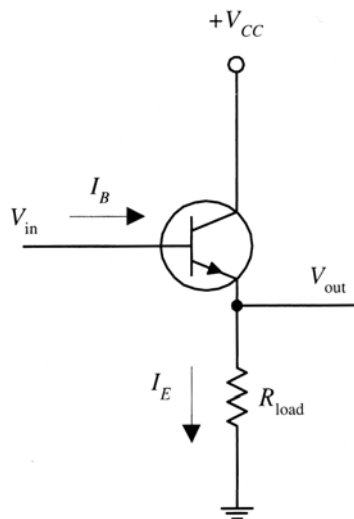


Bipolar transistor: Key circuits

- Simple example



- Follower



Bipolar transistor: Key circuits (Follower)

- Follower (cont'd)

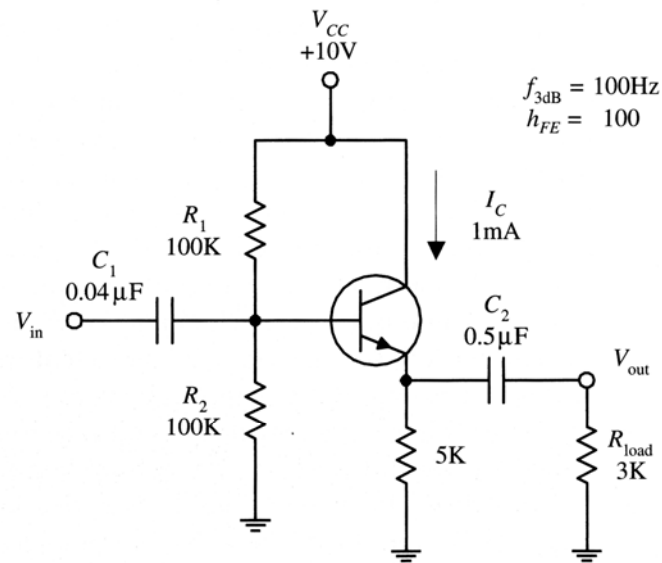
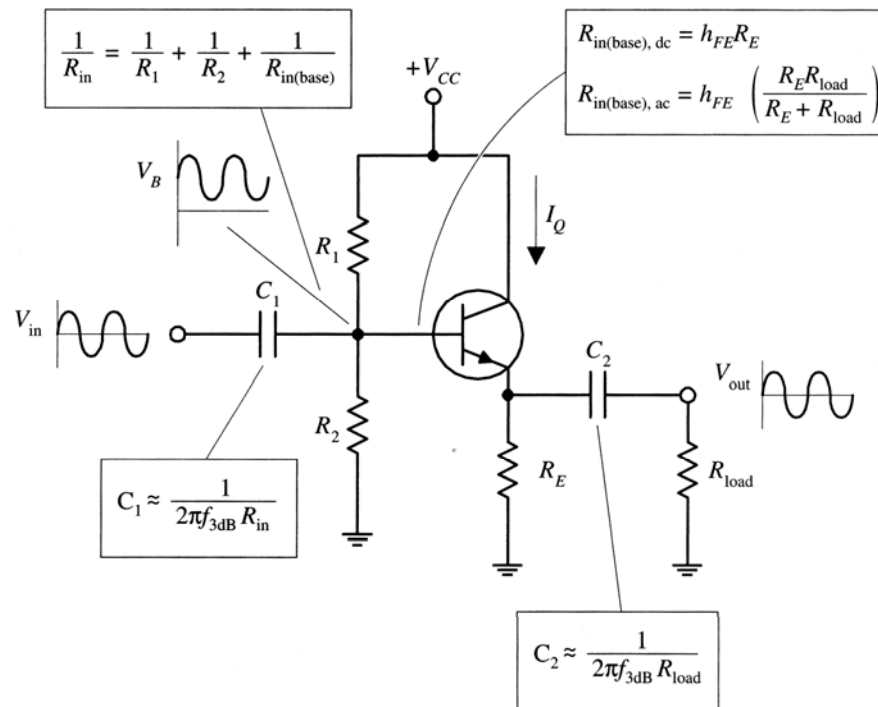


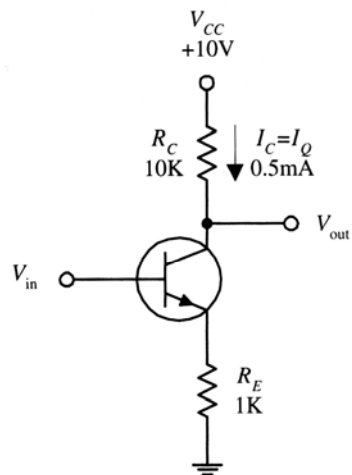
FIGURE 4.32

Bipolar transistor: Key circuits (Follower)

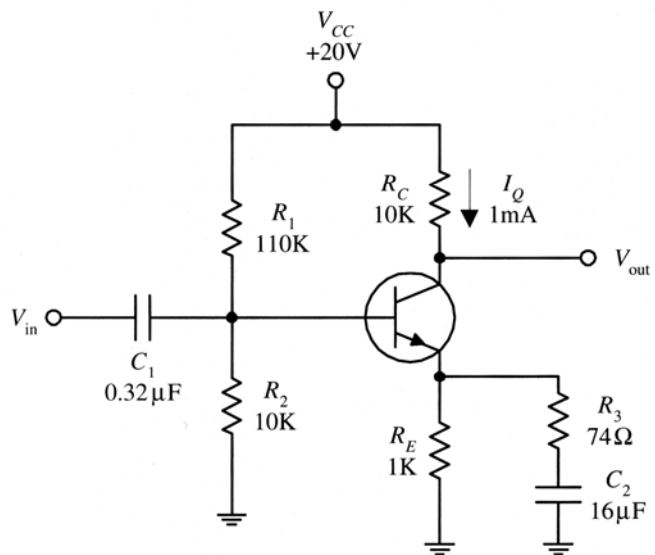
- Follower (cont'd)



Bipolar transistor: Key circuits (Amplifier)

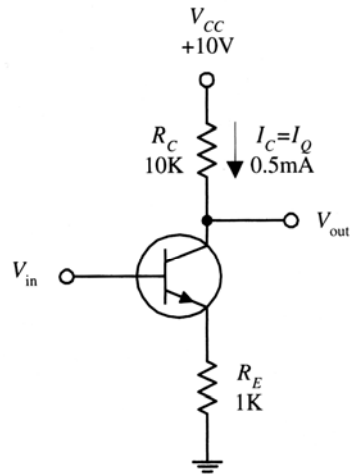


$$\Delta V_{\text{out}} = -\frac{R_C}{R_E} \Delta V_{\text{in}}$$

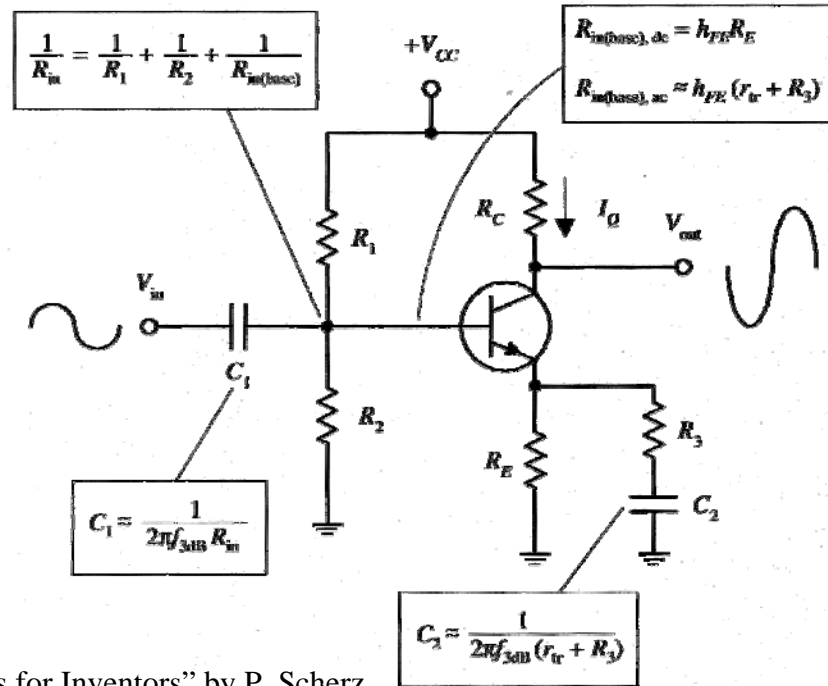


$$\Delta V_{\text{out}} = -\frac{R_C}{r_{\text{tr}} + R_3} \Delta V_{\text{in}}$$

Bipolar transistor: Key circuits (Amplifier)

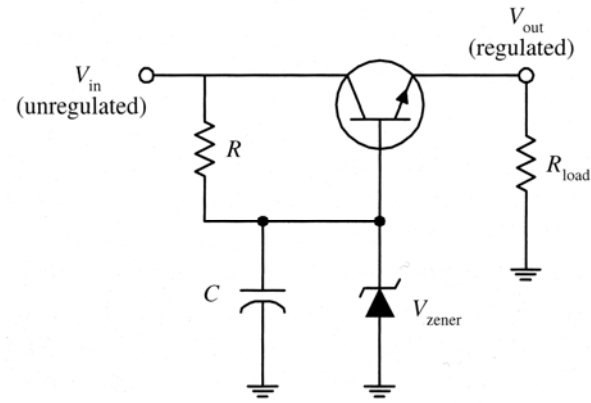


$$\Delta V_{out} = -\frac{R_C}{R_E} \Delta V_{in}$$

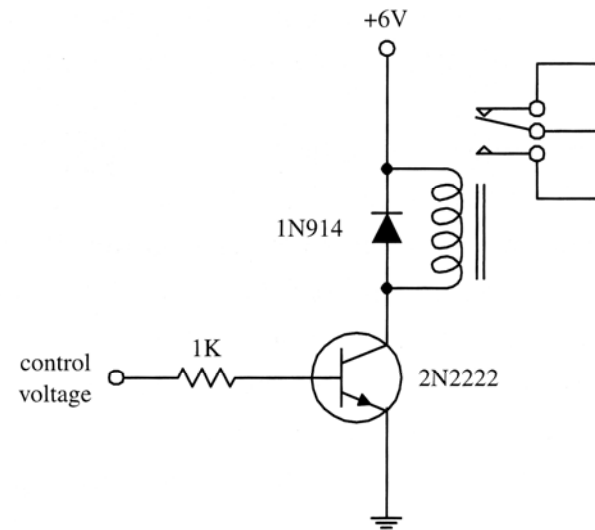


$$\Delta V_{out} = -\frac{R_C}{r_{tr} + R_3} \Delta V_{in}$$

Bipolar transistor: Key circuits (regulator)

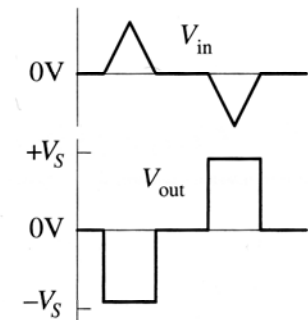
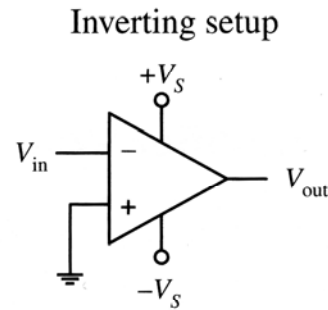
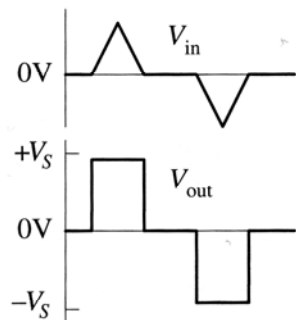
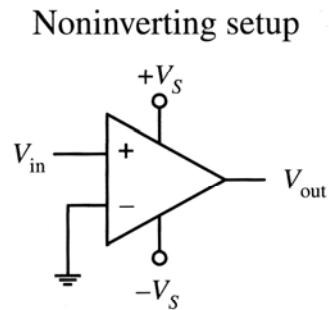
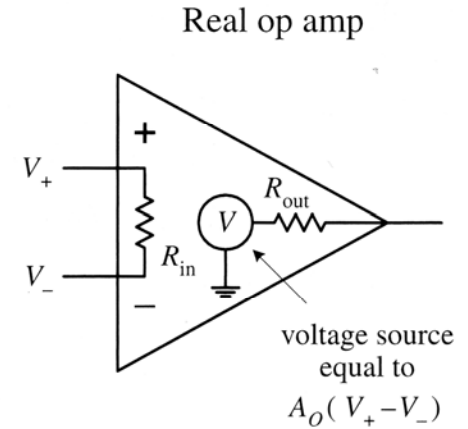
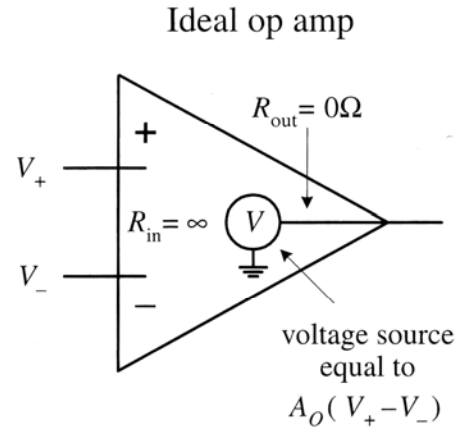
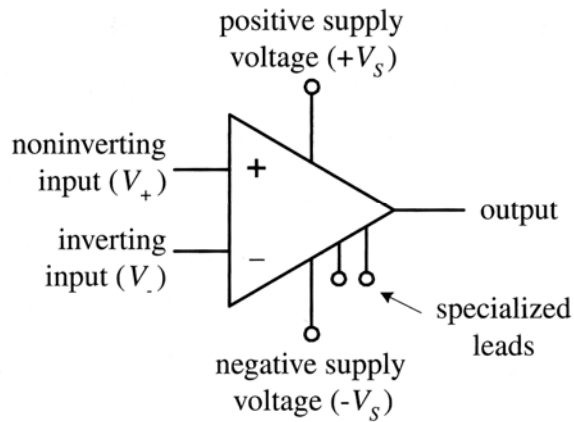


Bipolar Transistor: key circuits (Relay driver)

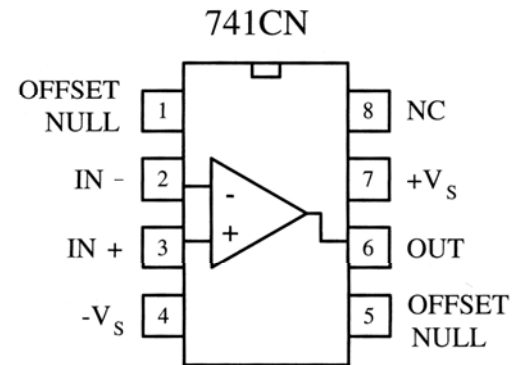
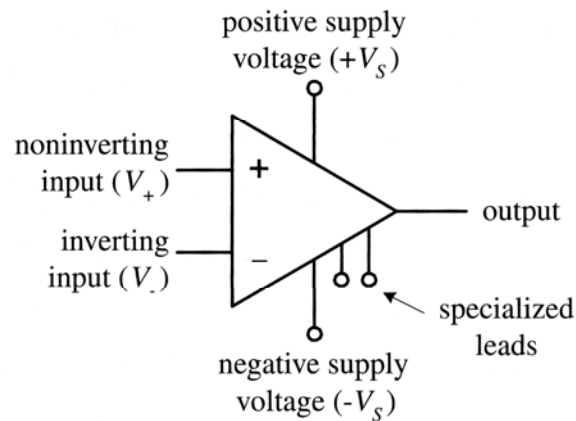


Operational Amplifier: key facts

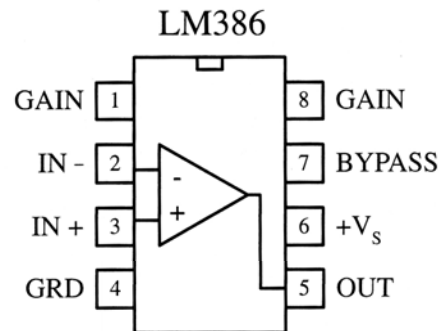
Basic principle:



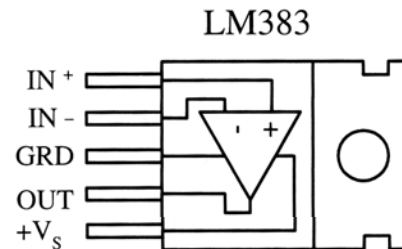
Operational Amplifier: Examples



Audio Amplifiers



low-voltage power amplifier



8-watt power amplifier