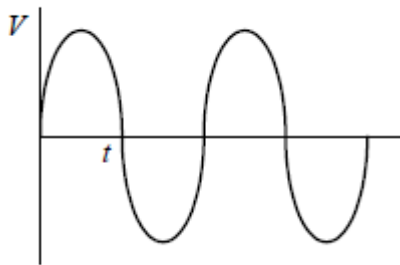
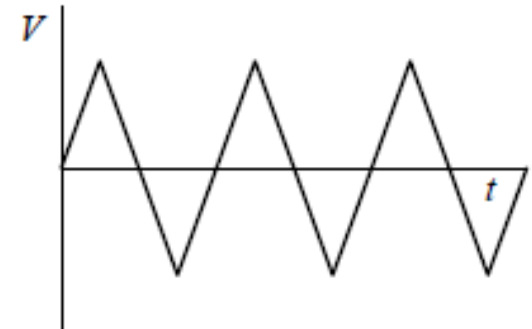
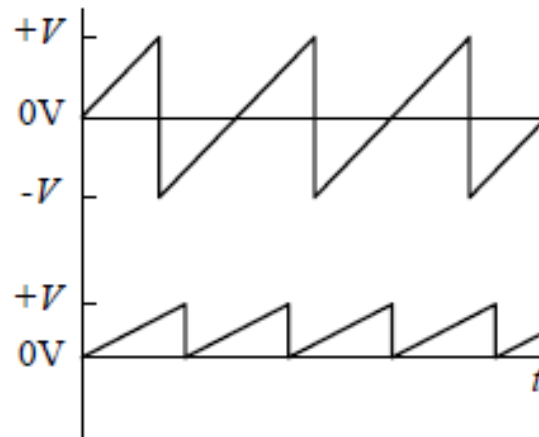
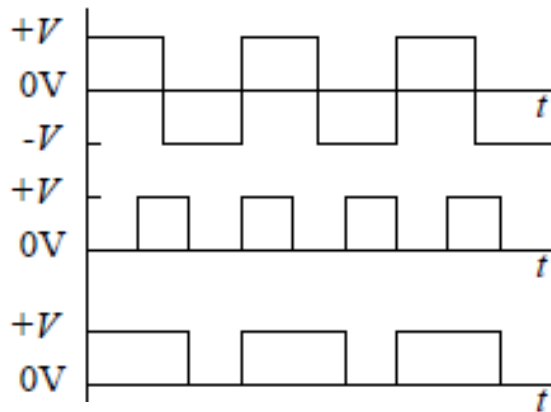
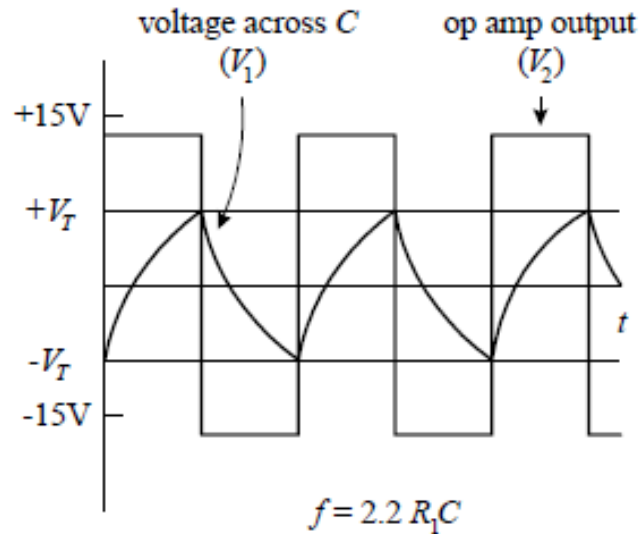
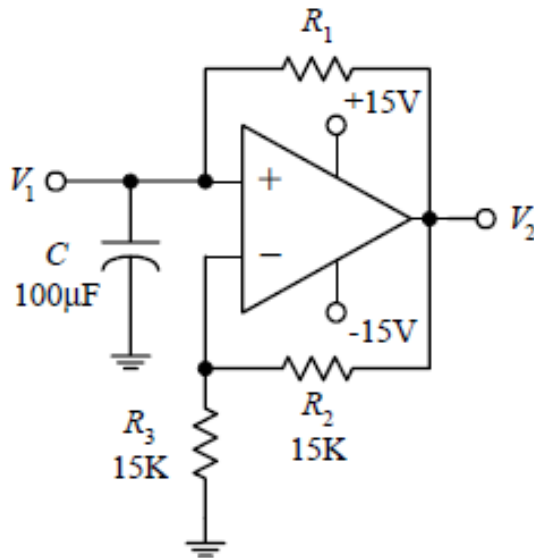


Oscillators and Timers

Different Types of Signals



RC-Relaxation Oscillator



$$V_T = \frac{R_3}{R_3 + R_2} (+15\text{V}) = \frac{15\text{ k}\Omega}{15\text{ k}\Omega + 15\text{ k}\Omega} (+15\text{V}) = +7.5\text{V}$$

The 555 Timer IC

Huge applications:

- Digital clock waveform generator
- LED and Lamp flasher Circuits
- Tone generators
- One-shot timer circuits
- Bounce-free switches
- Triangular waveform generator
- Frequency Divider

How 555 Timer Works

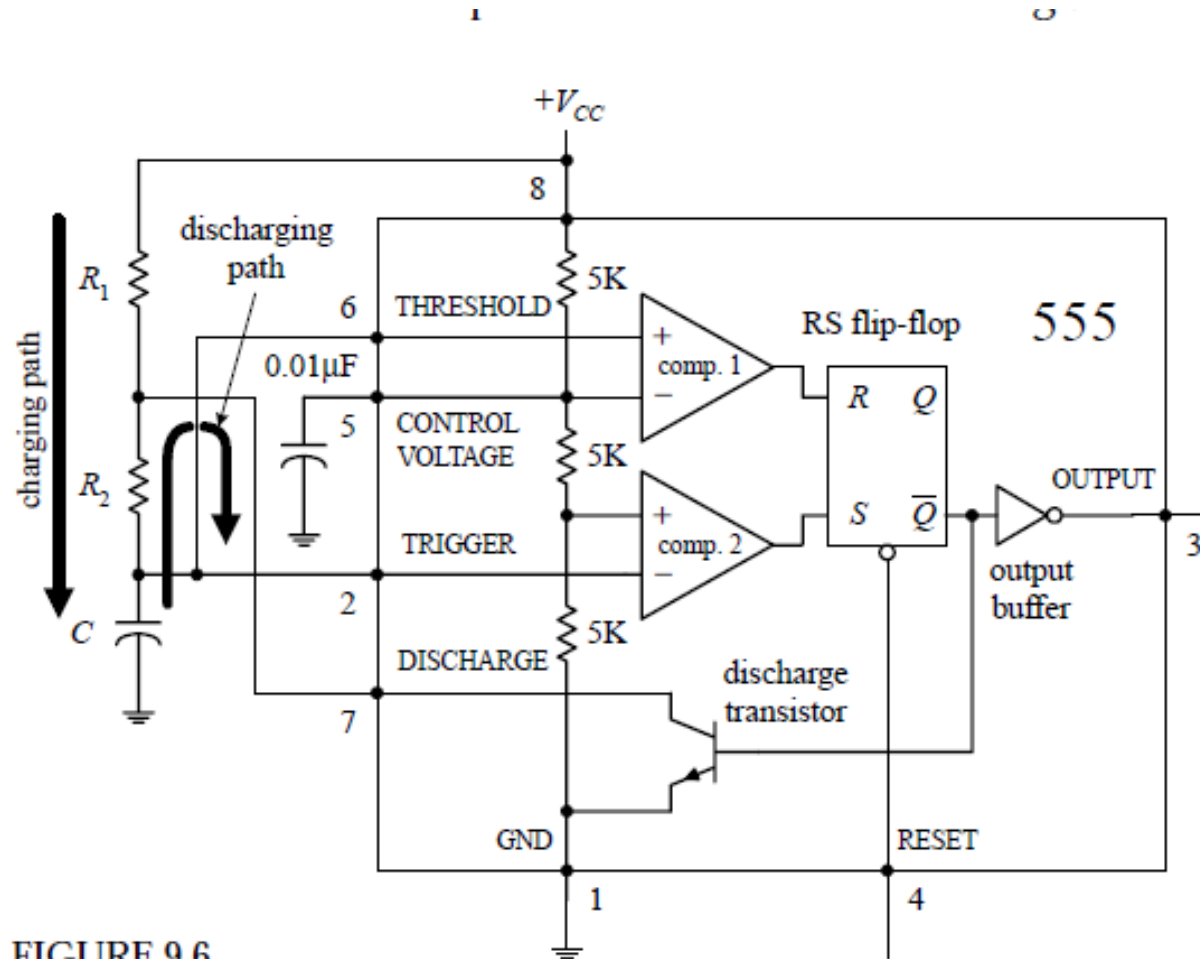
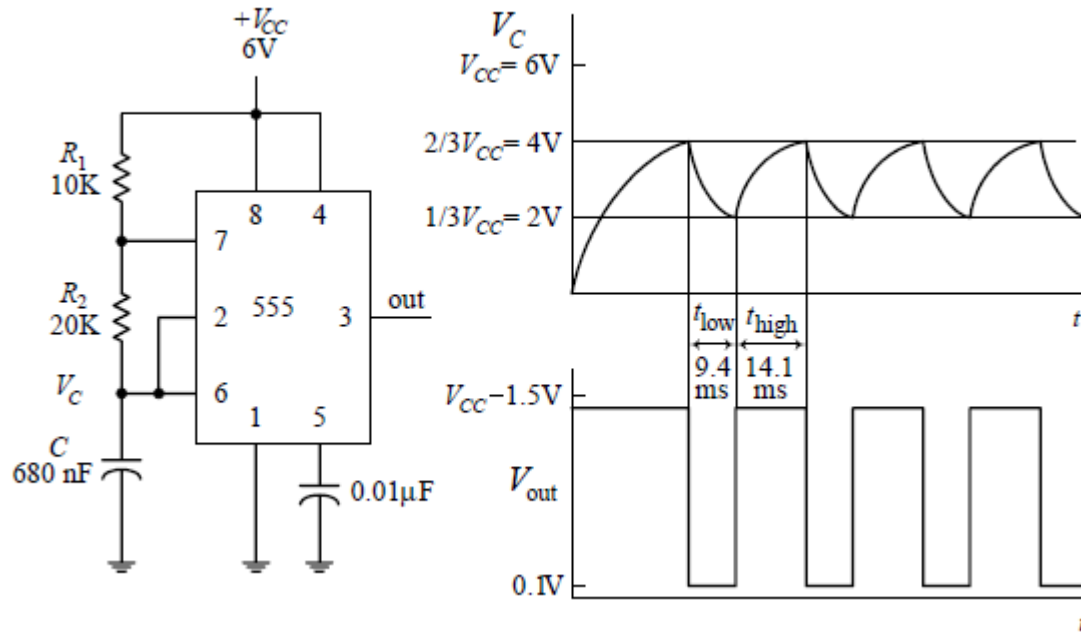


FIGURE 9.6

Basic Astable Operation



$$t_{low} = 0.693(20K)(680nF) = 9.6ms$$

$$t_{high} = 0.693(10K + 20K)(680nF) = 14.1ms$$

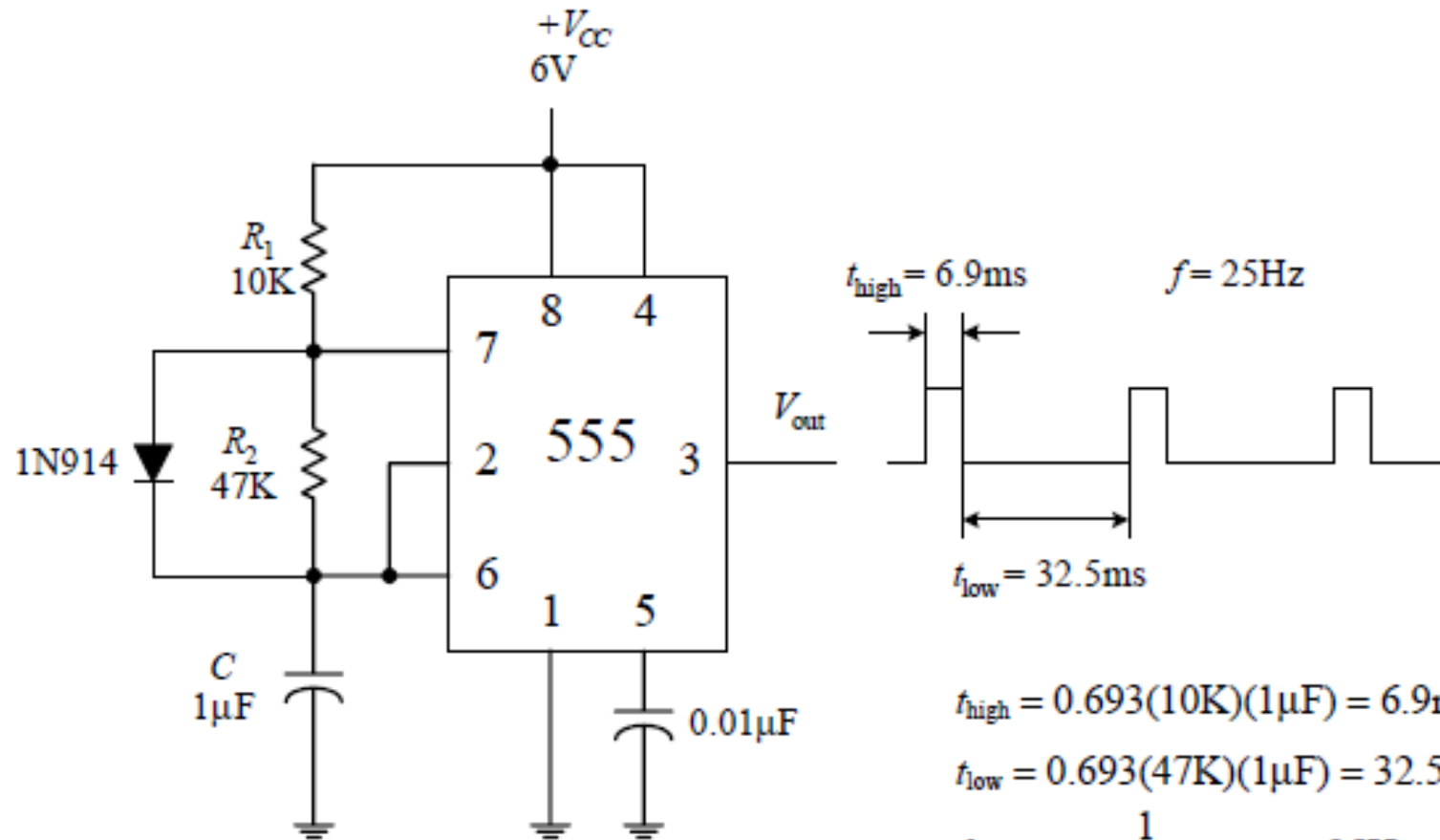
$$f = \frac{1}{9.6ms + 14.1ms} = 42Hz$$

$$\text{duty cycle} = \frac{14.1ms}{14.1ms + 9.6ms} = 0.6$$

$$t_{low} = 0.693R_2C$$

$$t_{high} = 0.693(R_1 + R_2)C$$

Low-Duty-Cycle Operation (Astable Mode)



$$t_{high} = 0.693(10K)(1\mu F) = 6.9ms$$

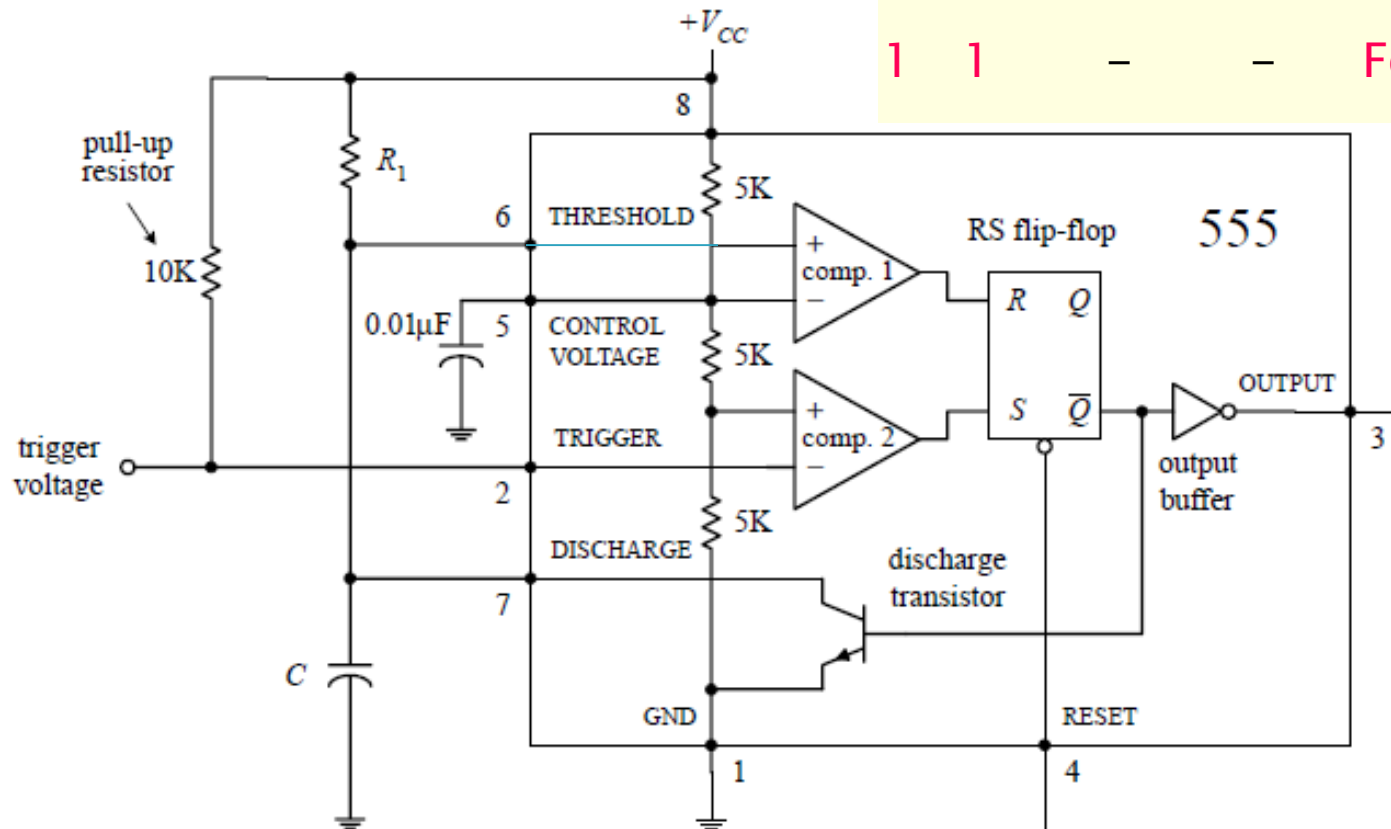
$$t_{low} = 0.693(47K)(1\mu F) = 32.5ms$$

$$f = \frac{1}{6.9ms + 32.5ms} = 25Hz$$

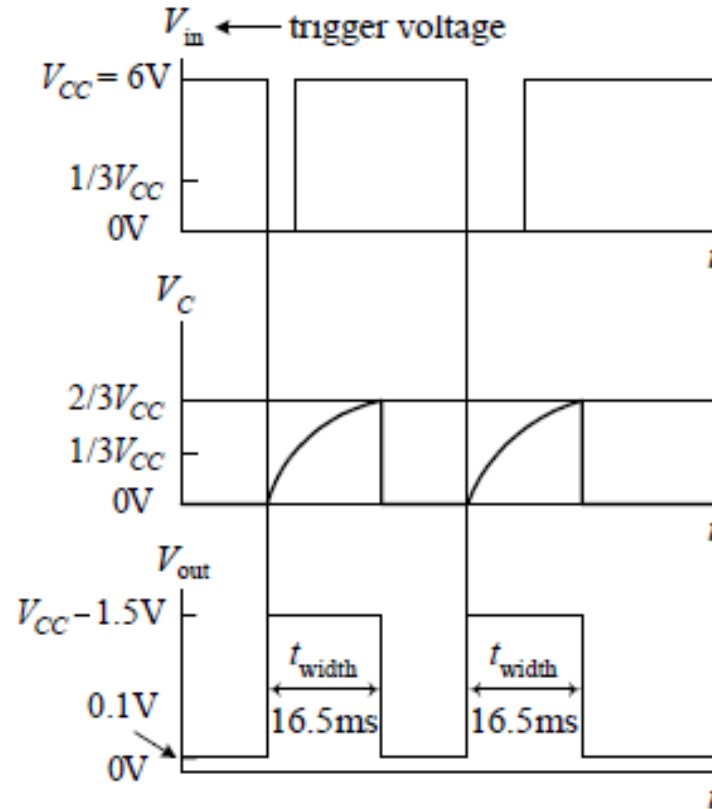
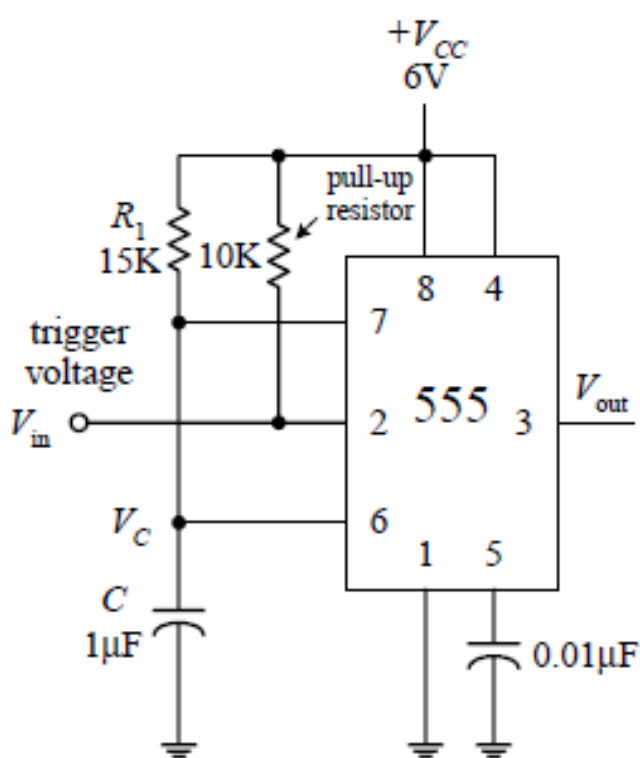
$$\text{duty cycle} = \frac{6.9ms}{6.9ms + 32.5ms} = 0.18$$

Monostable

S	R	Q	/Q	Remark
0	0	Q_n	$/Q_n$	Save the state
1	0	1	0	Set
0	1	0	1	Reset
1	1	–	–	Forbidden



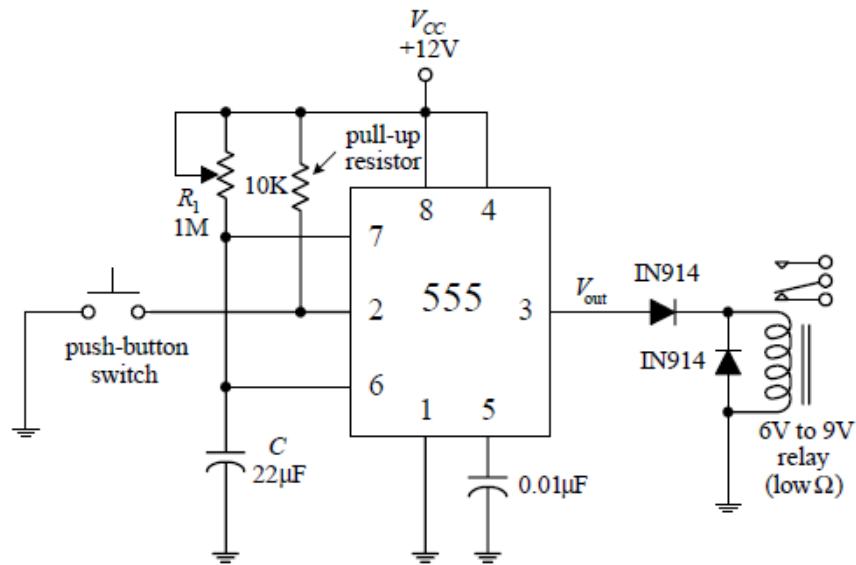
Monostable Mode



$$t_{width} = 1.10 R_1 C$$
$$t_{width} = 1.10 (15K)(1\mu F) = 16.5ms$$

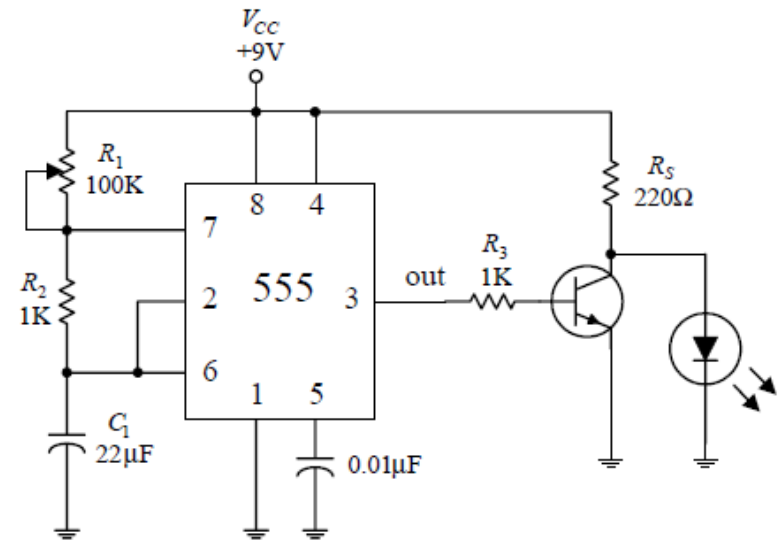
Applications

Relay Driver (Delay Timer)



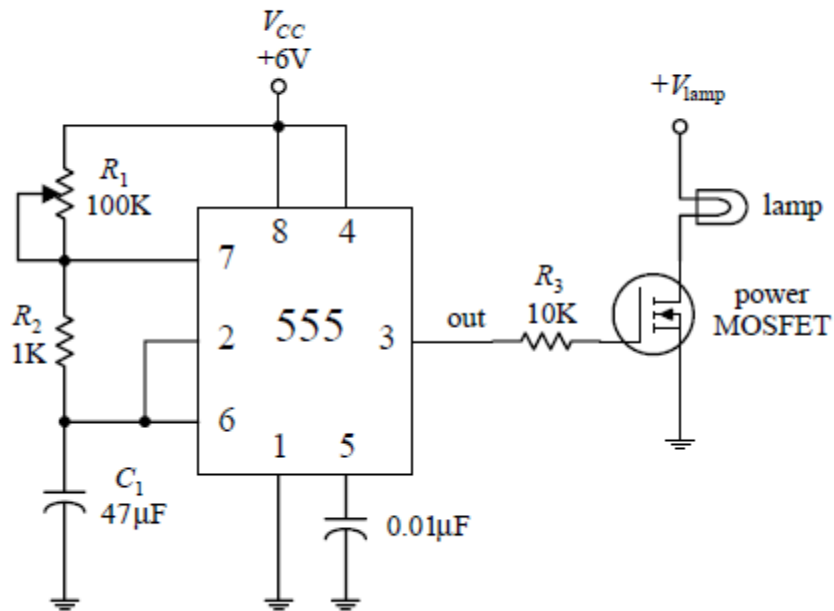
LED and Lamp Flasher and Metronome

LED Flasher

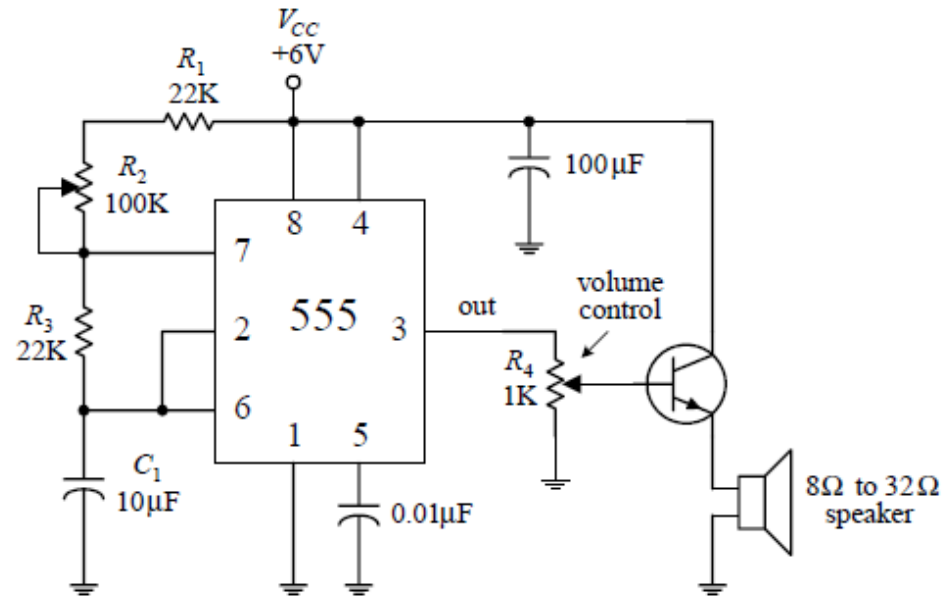


Applications

Lamp Flasher

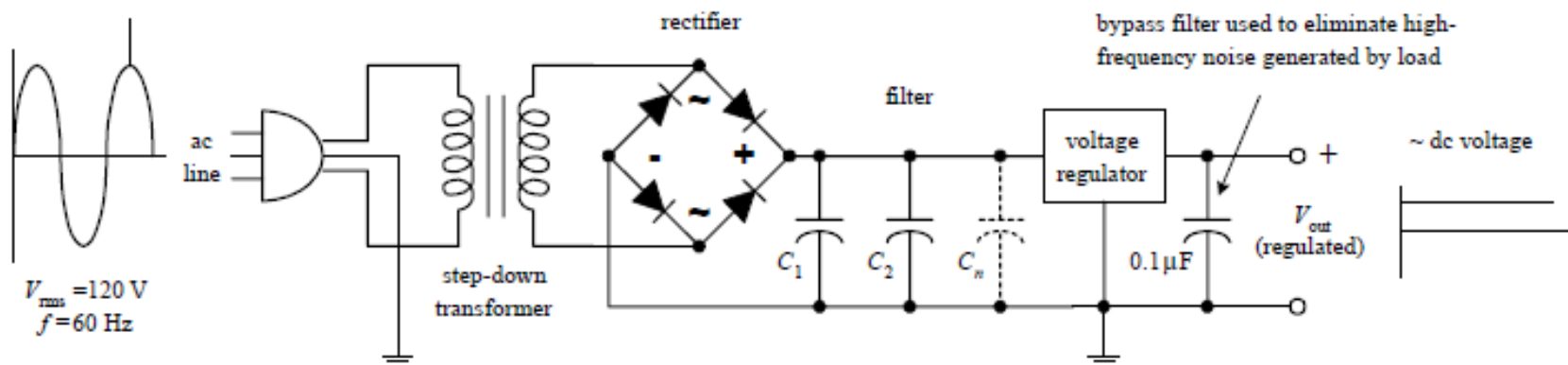
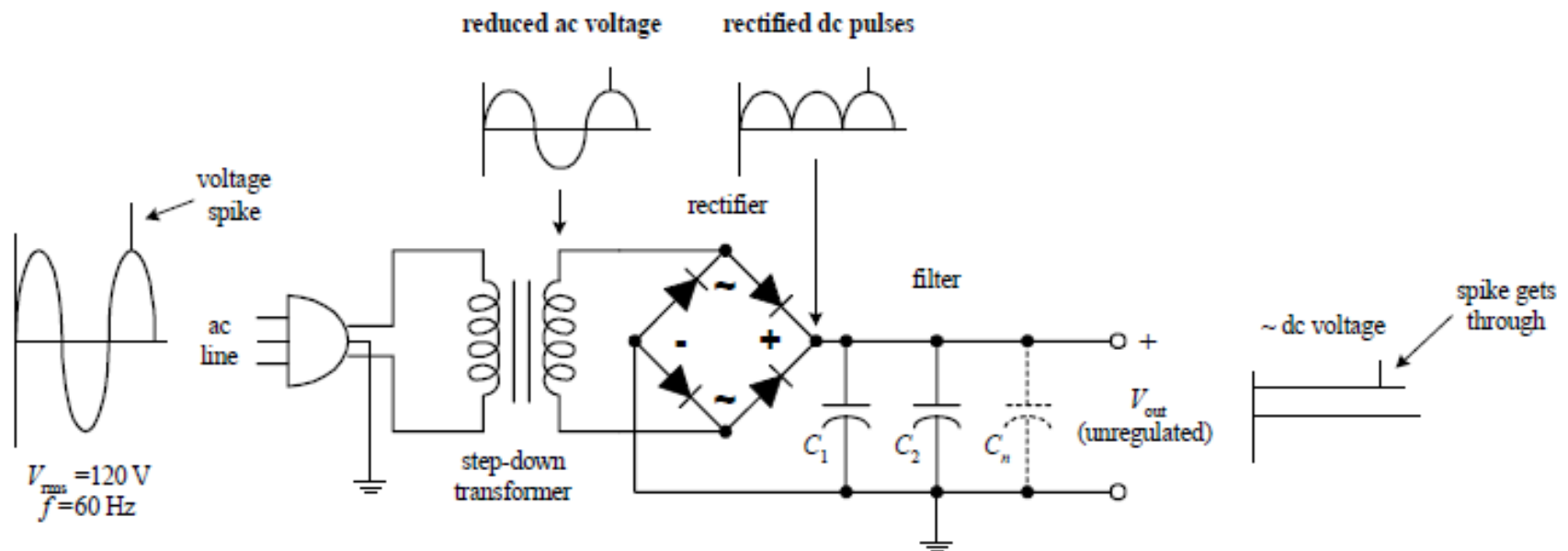


Metronome

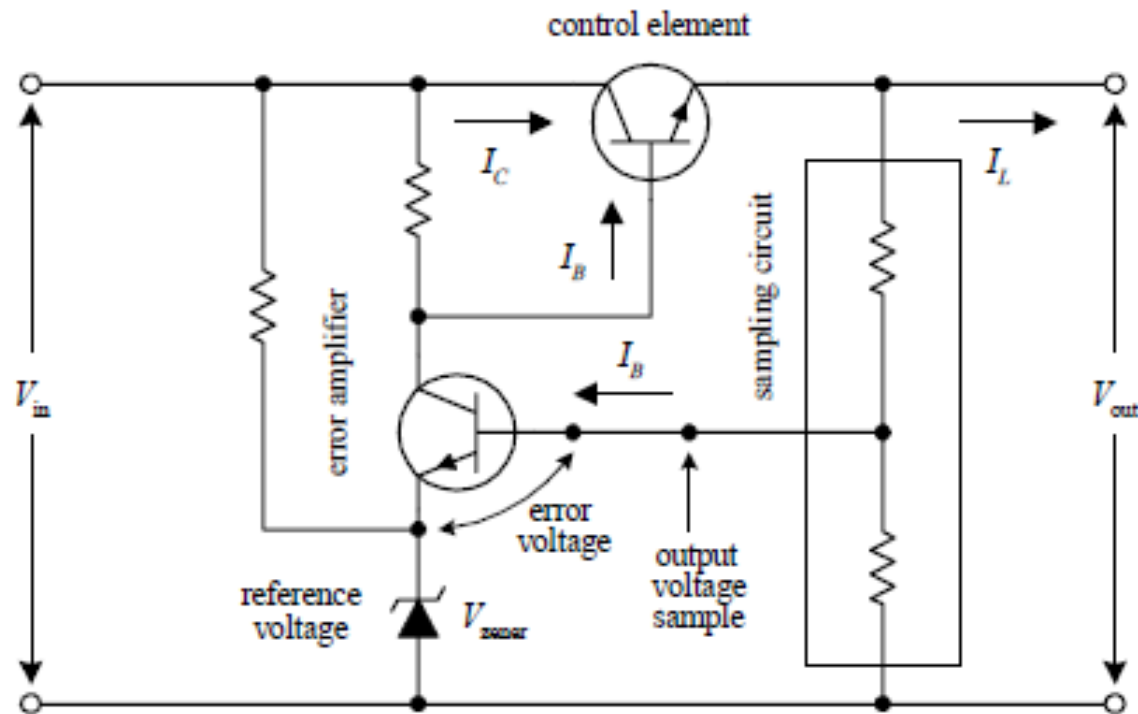


Voltage Regulators and Power Supplies

Power Supply

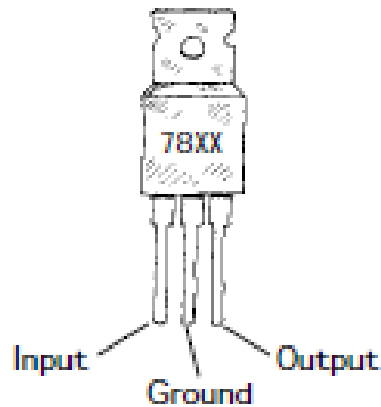


Voltage Regulator

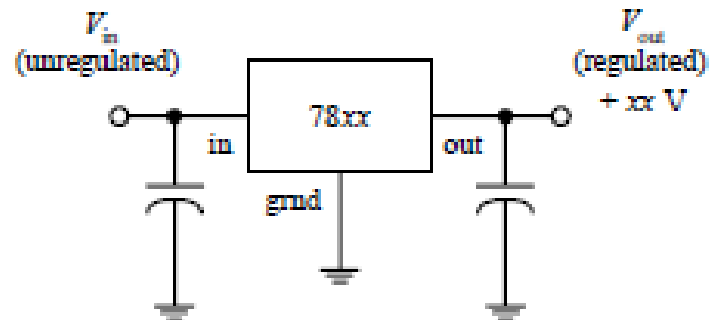


Fixed IC Regulator

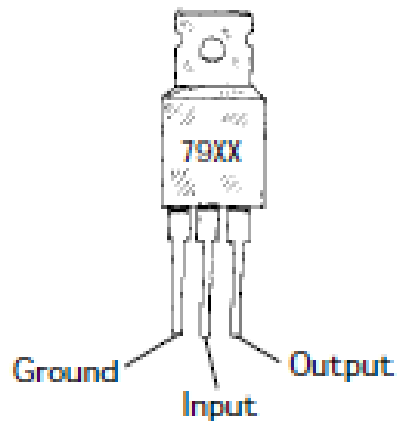
Positive voltage regulator



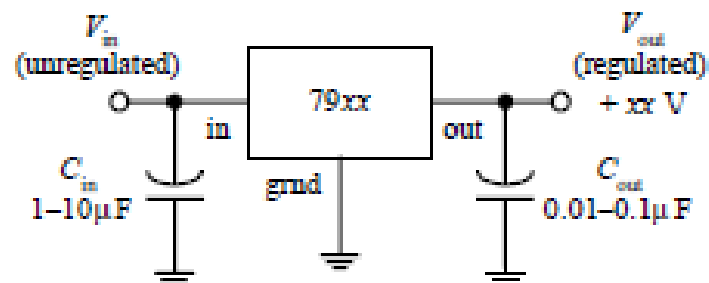
positive voltage regulator



Negative voltage regulator



negative voltage regulator



Adjustable IC Regulators

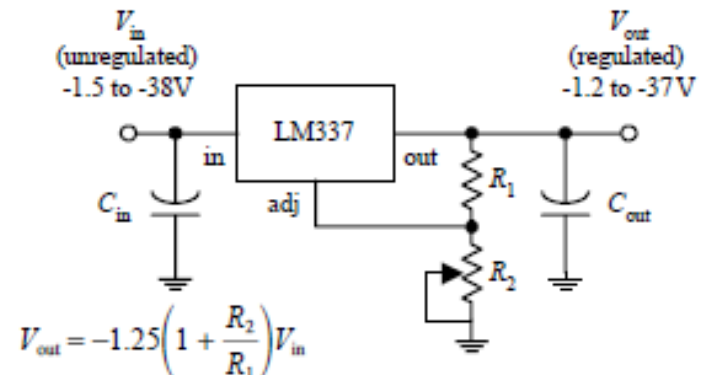
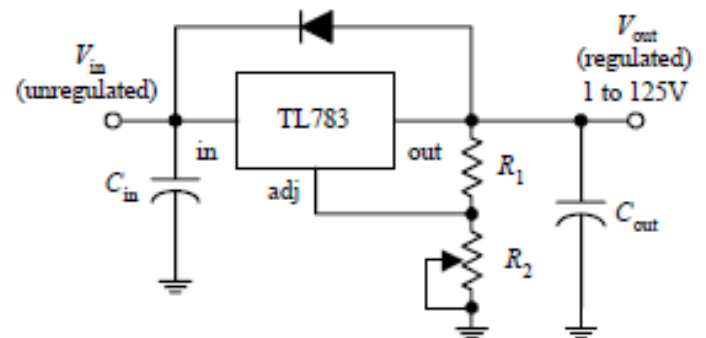
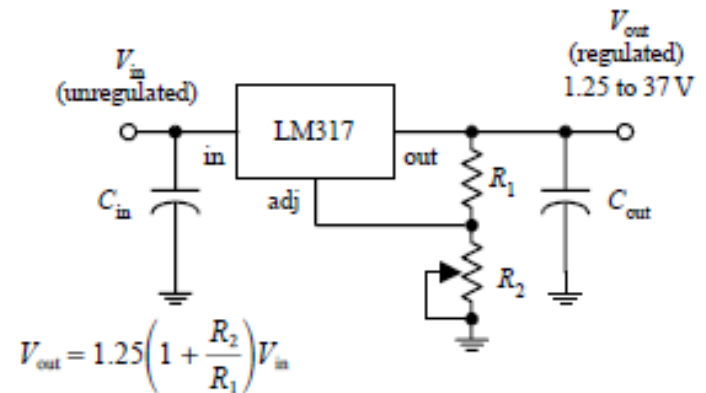
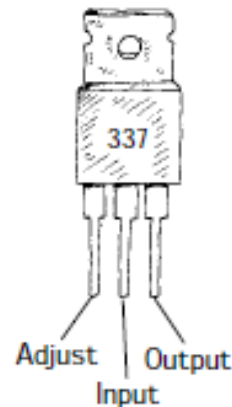
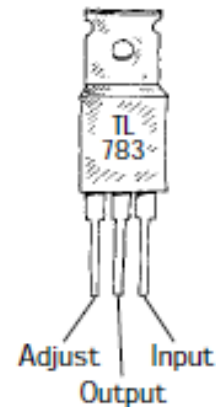
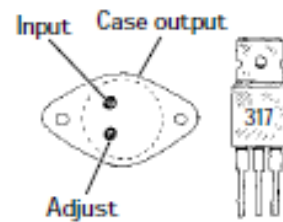
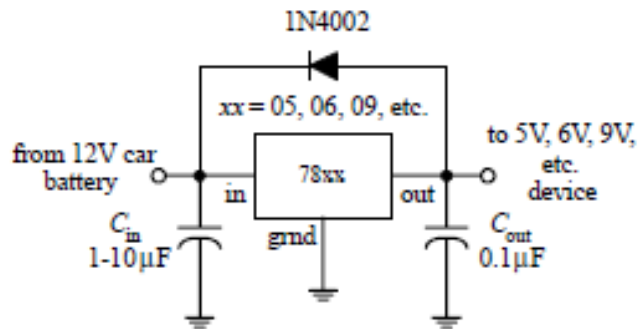


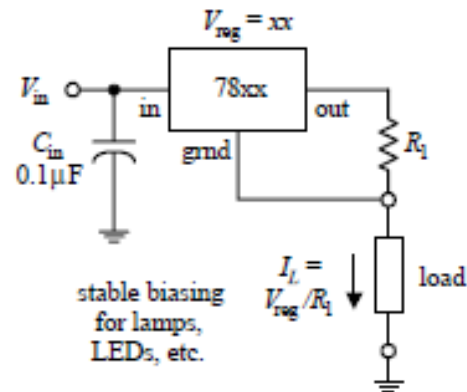
FIGURE 10.5

Applications

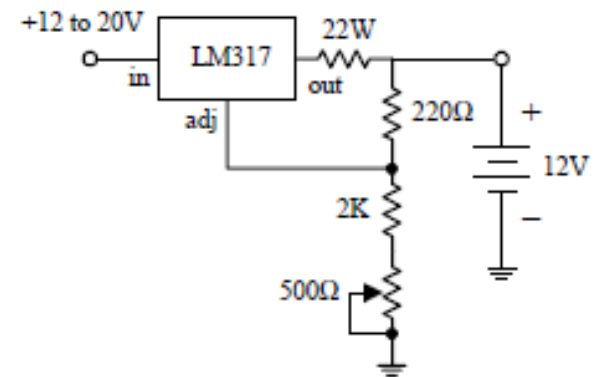
Car battery voltage regulation



Current regulator

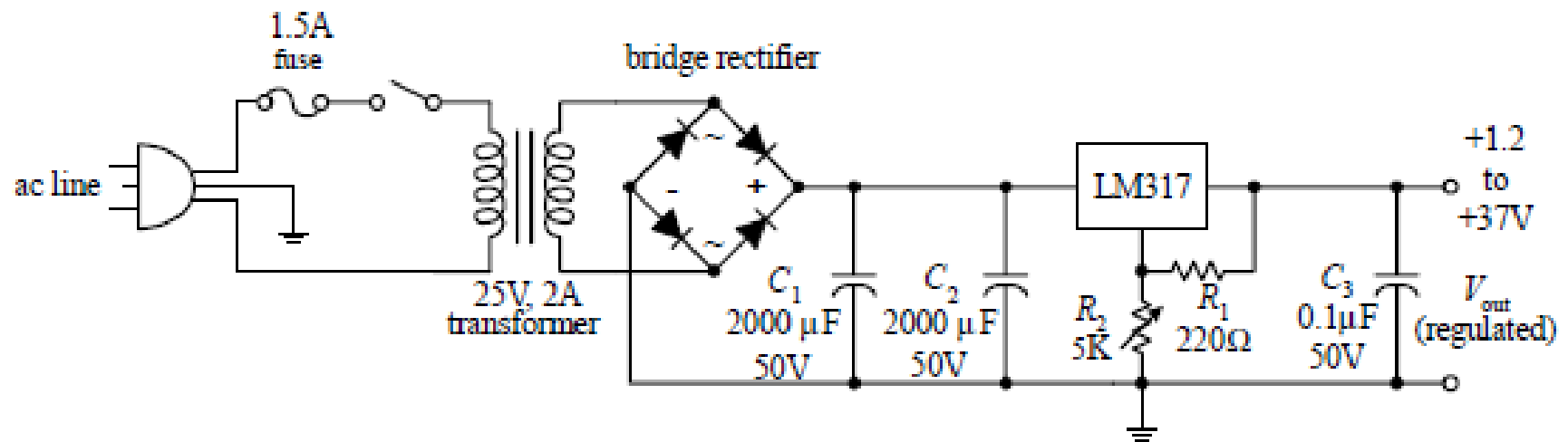


12V battery recharger



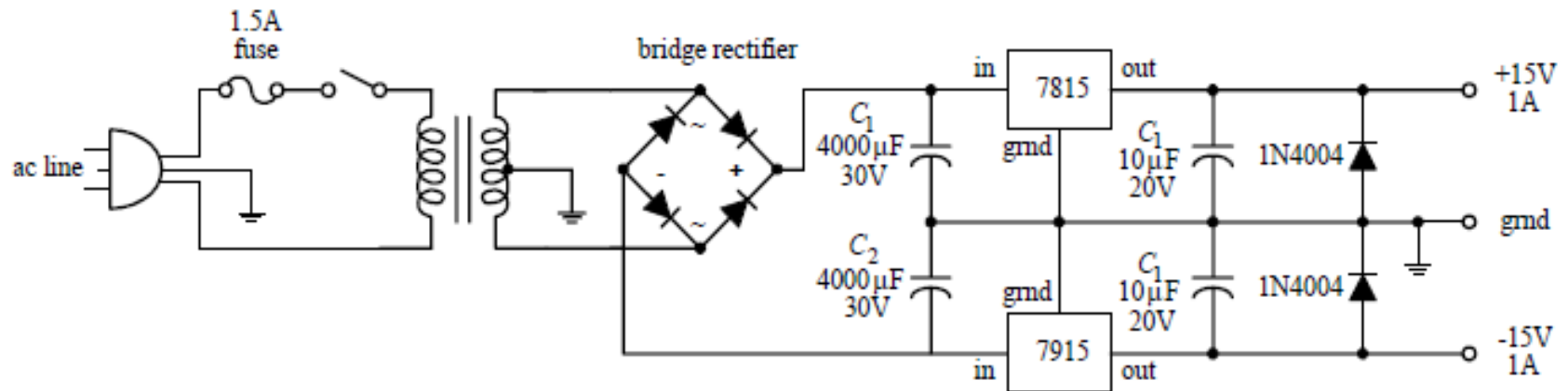
Power Supplies

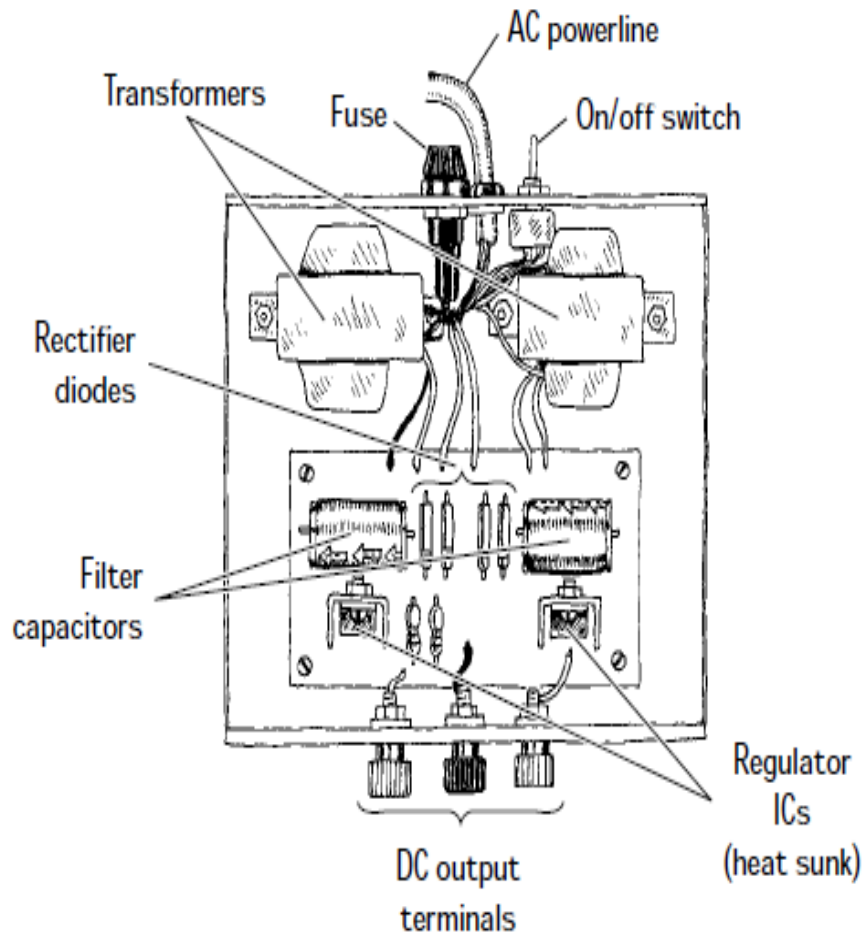
Adjustable +1.2- to +37-V, 1.5-A Supply



Applications of Power Supplies

$\pm 12\text{-V}$ and $\pm 15\text{-V}$ Power Supplies





Build Your Own Power Supply

- Mount the transformer directly to the metal enclosure box, toward the rear.
- Install fuses, power switch, and binding posts at the rear of the box.
- Mount circuit boards on standoffs within the box.
- Place diode or rectifier modules, along with the capacitors and voltage regulators, on the circuit board.
- Make sure to heat-sink voltage regulators.
- Place supply output jacks on the front of the box.
- Drill holes in box to allow cooling.
- Ground the box.
- Place the power-line core through a hole in the rear. Use a rubber grommet for strain relief.
- To avoid shocks, make sure to insulate all exposed 120-V power connections inside the box with heat-shrink tubing.

Audio Electronics

Nature of Sound

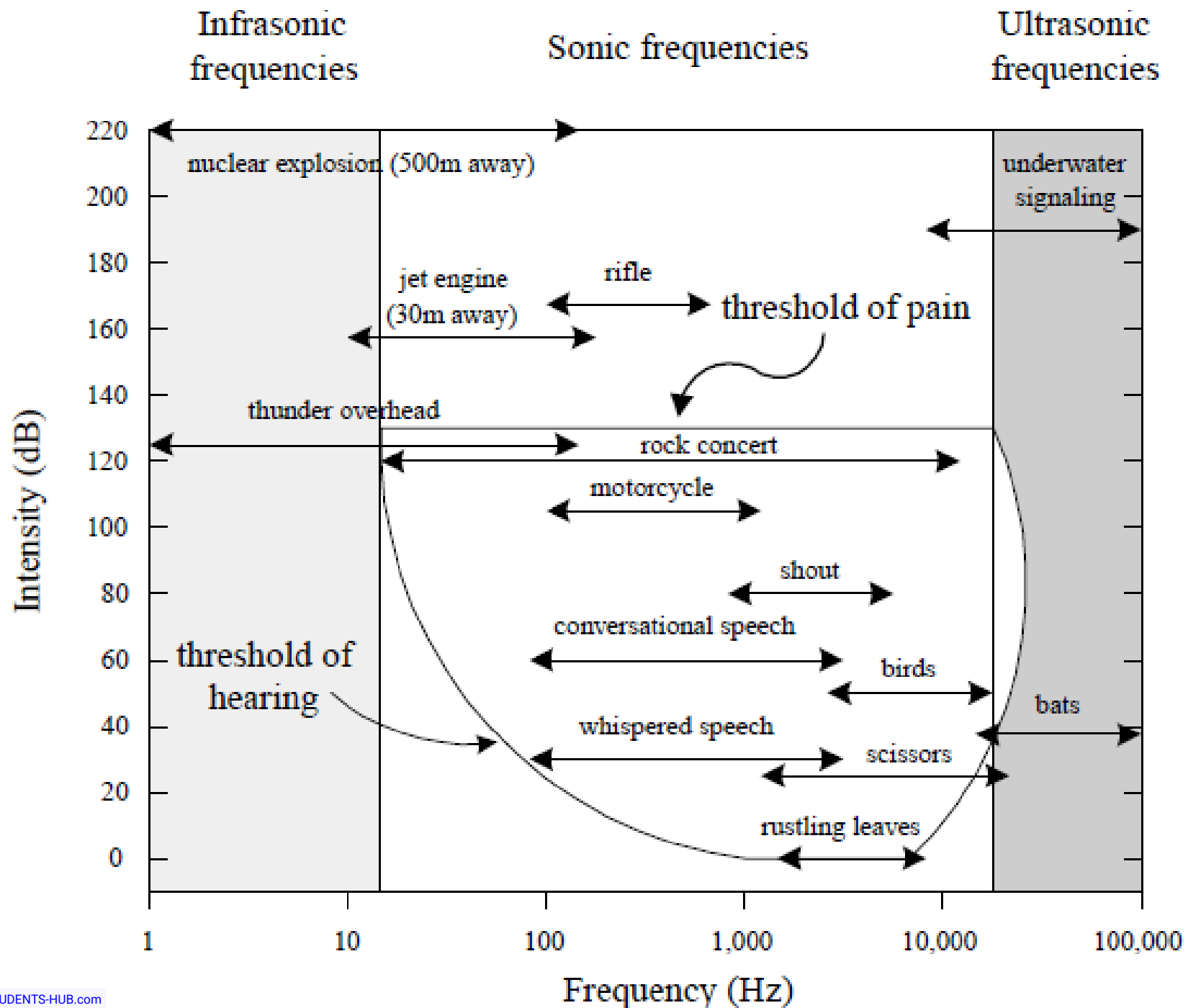
- Frequency

- Intensity (loudness)

- Timbre (overtones)

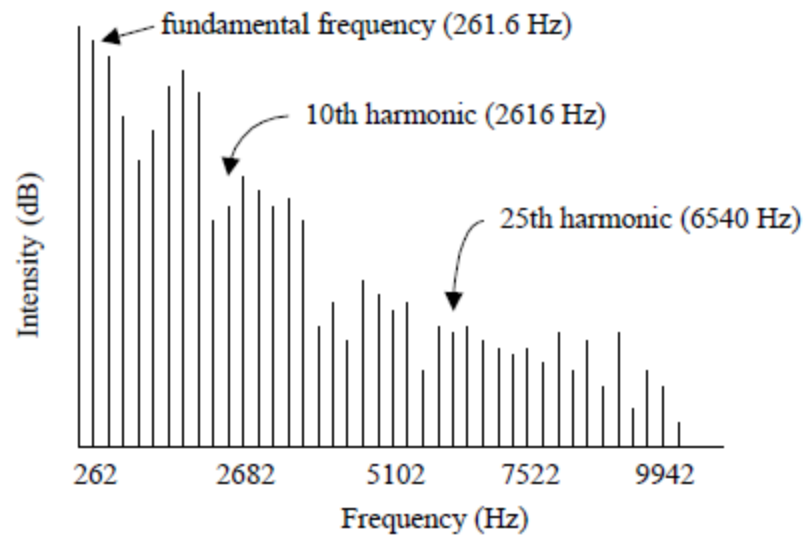
Frequency: Human Ear can perceive frequencies from 20–25000Hz, however ear most sensitive in the range 1000–2000Hz

Intensity : from 10^{-12} to 1 W/m^2 i.e., from 0–120dB

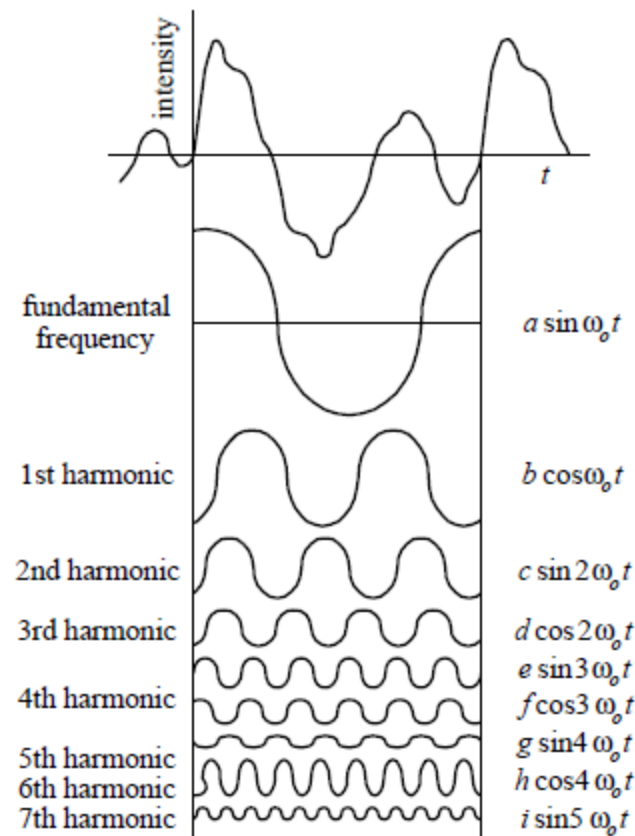


Timbre

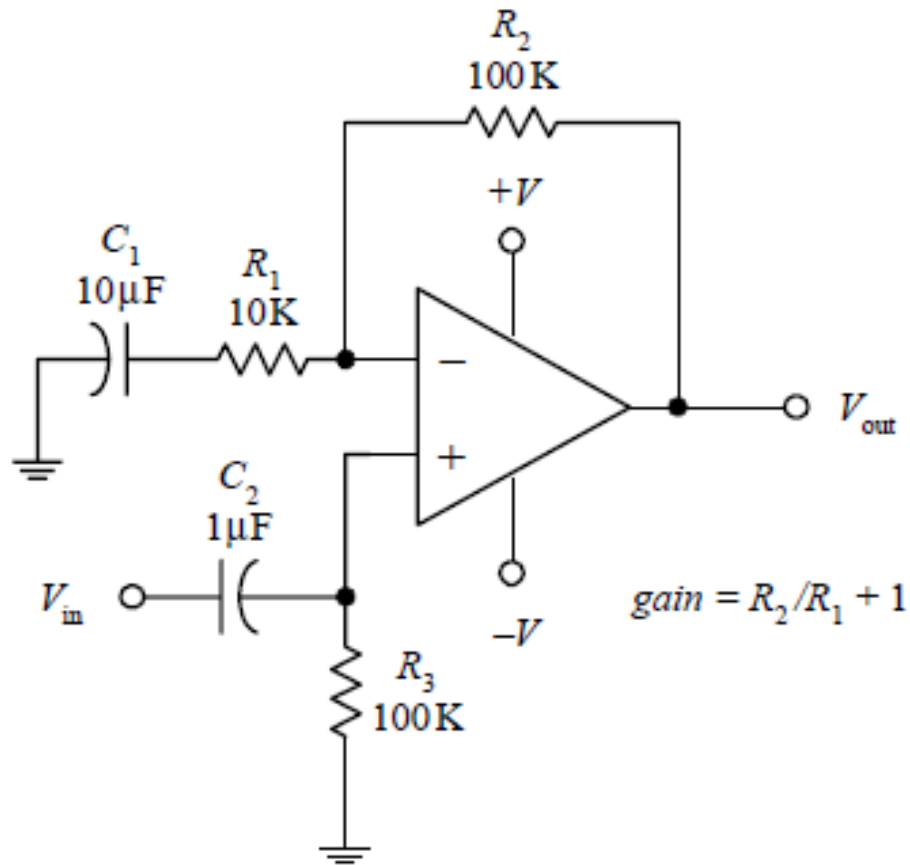
Spectral plot for an oboe tuned to middle C



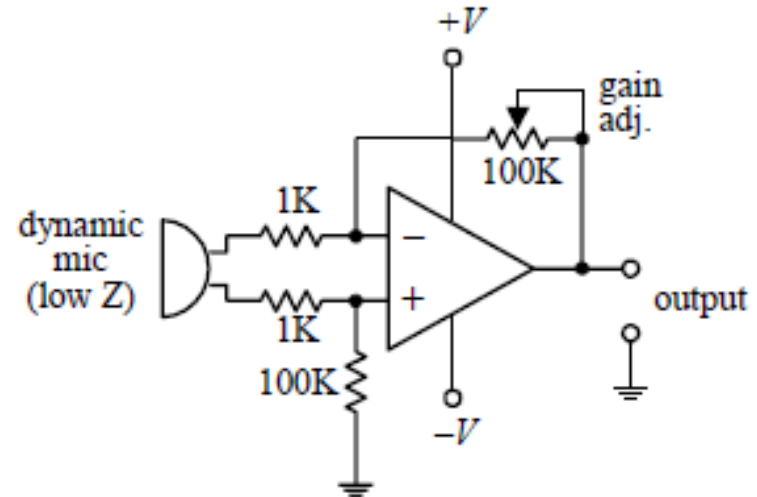
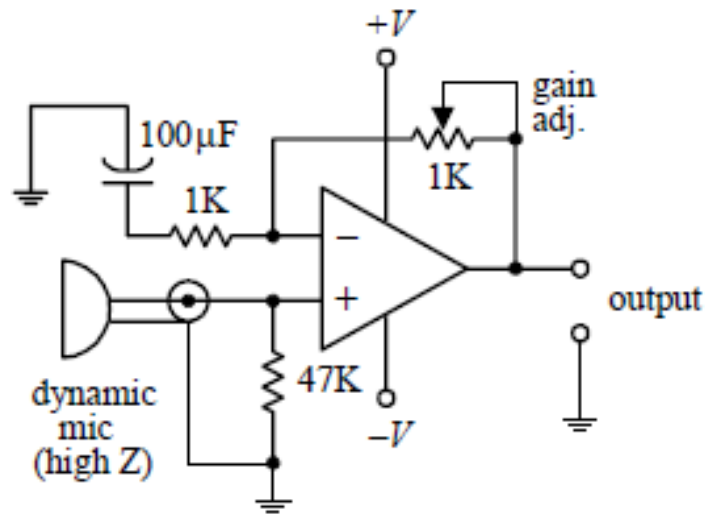
complex tone



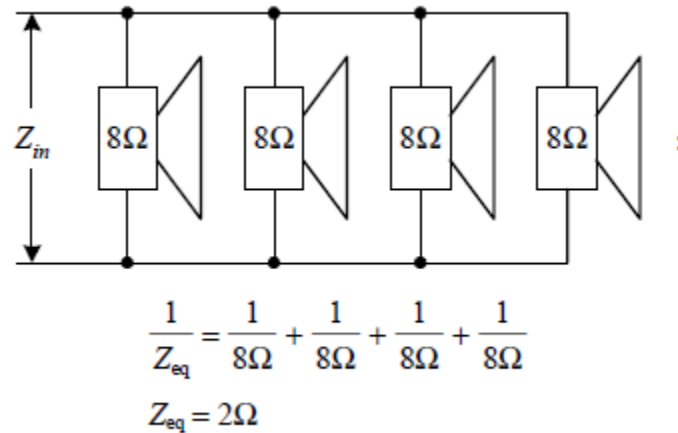
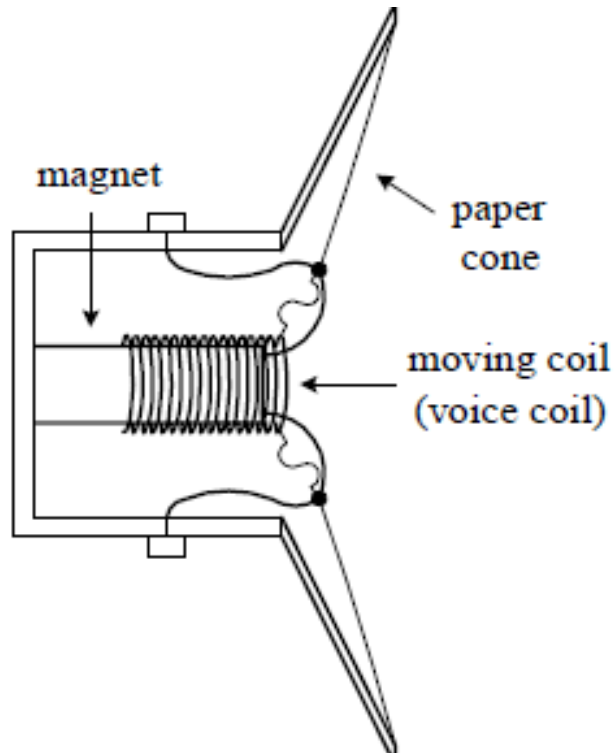
Audio Amplifier



Preamplifier



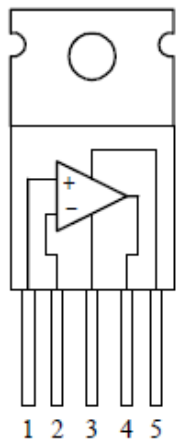
Speakers



Speakers convert electrical signals in audible signals. The most popular speaker used today is the dynamic speaker. The dynamic speaker operates on the same basic principle as a dynamic microphone. When a fluctuating current is applied through a moving coil (voice coil) that surrounds a magnet (or that is surrounded by a magnet), the coil is forced back and forth (Faraday's law). A large paper cone attached to the coil responds to the back-and-forth motion by "drumming off" sound waves.

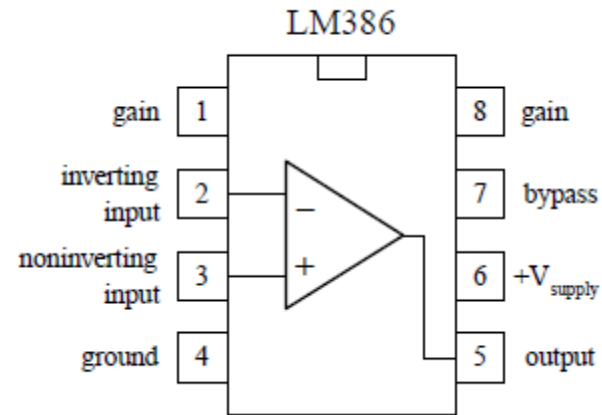
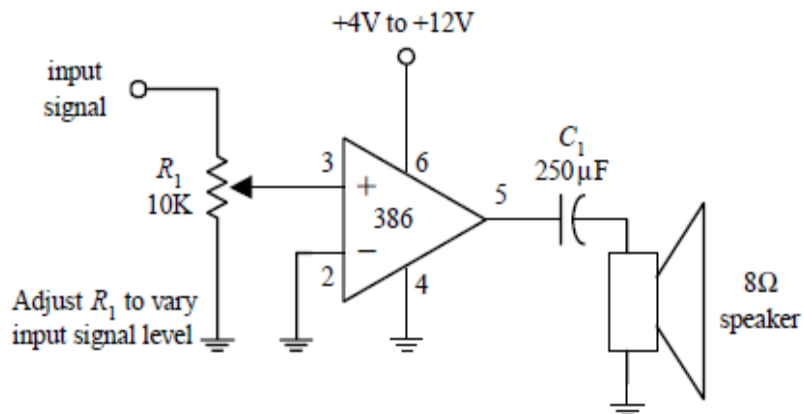
Audio Amplifier

Audio Amplifier (LM383)

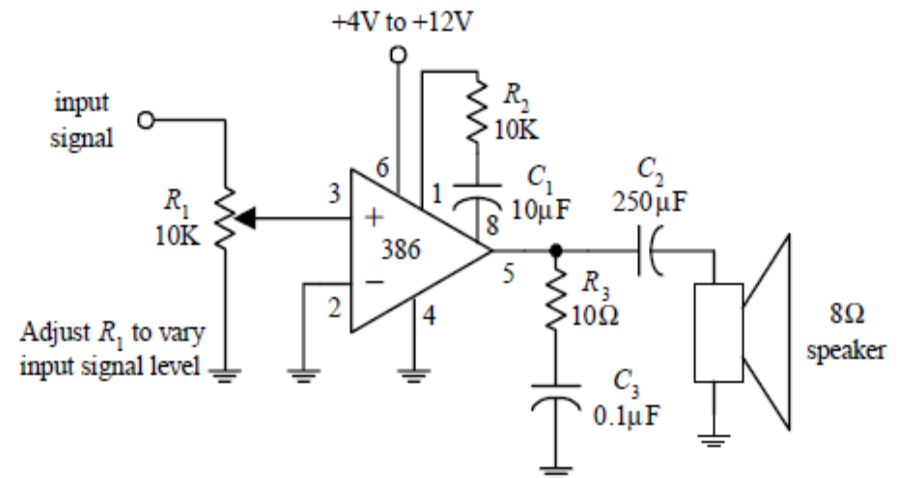


- 1 = noninverting input
- 2 = inverting input
- 3 = ground
- 4 = output
- 5 = supply voltage

Audio amplifier (gain of 20)

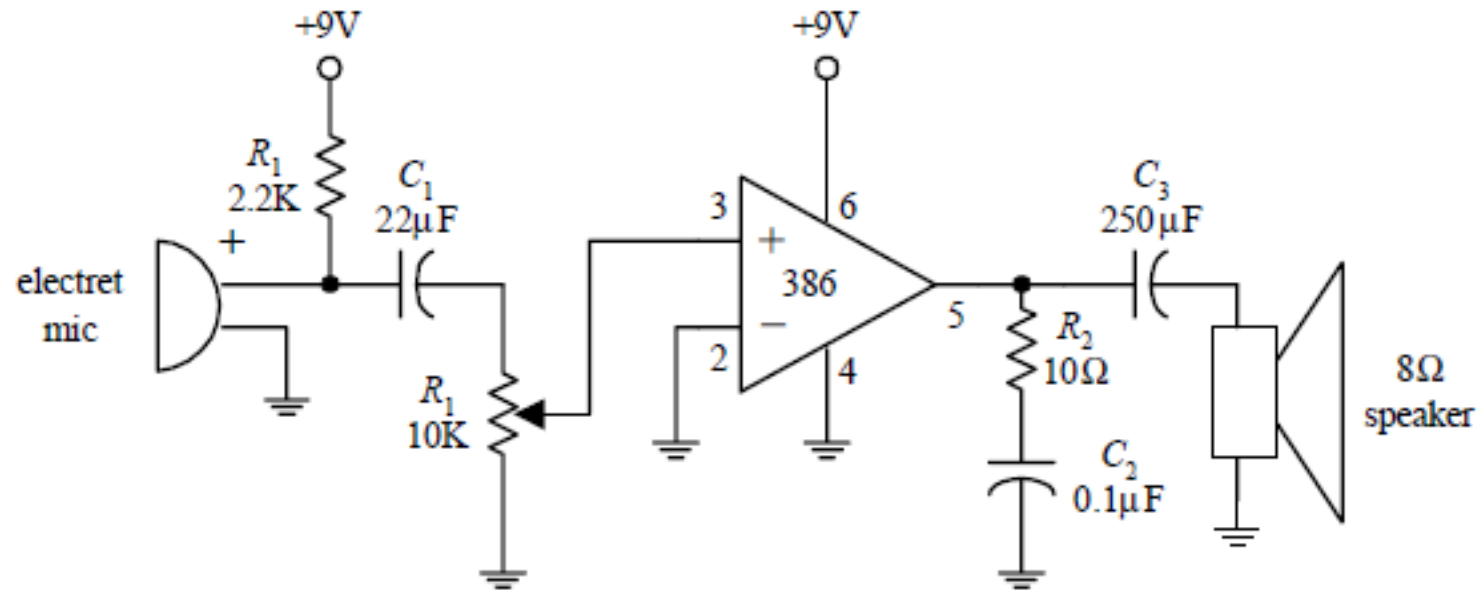


Audio amplifier (gain of 200)



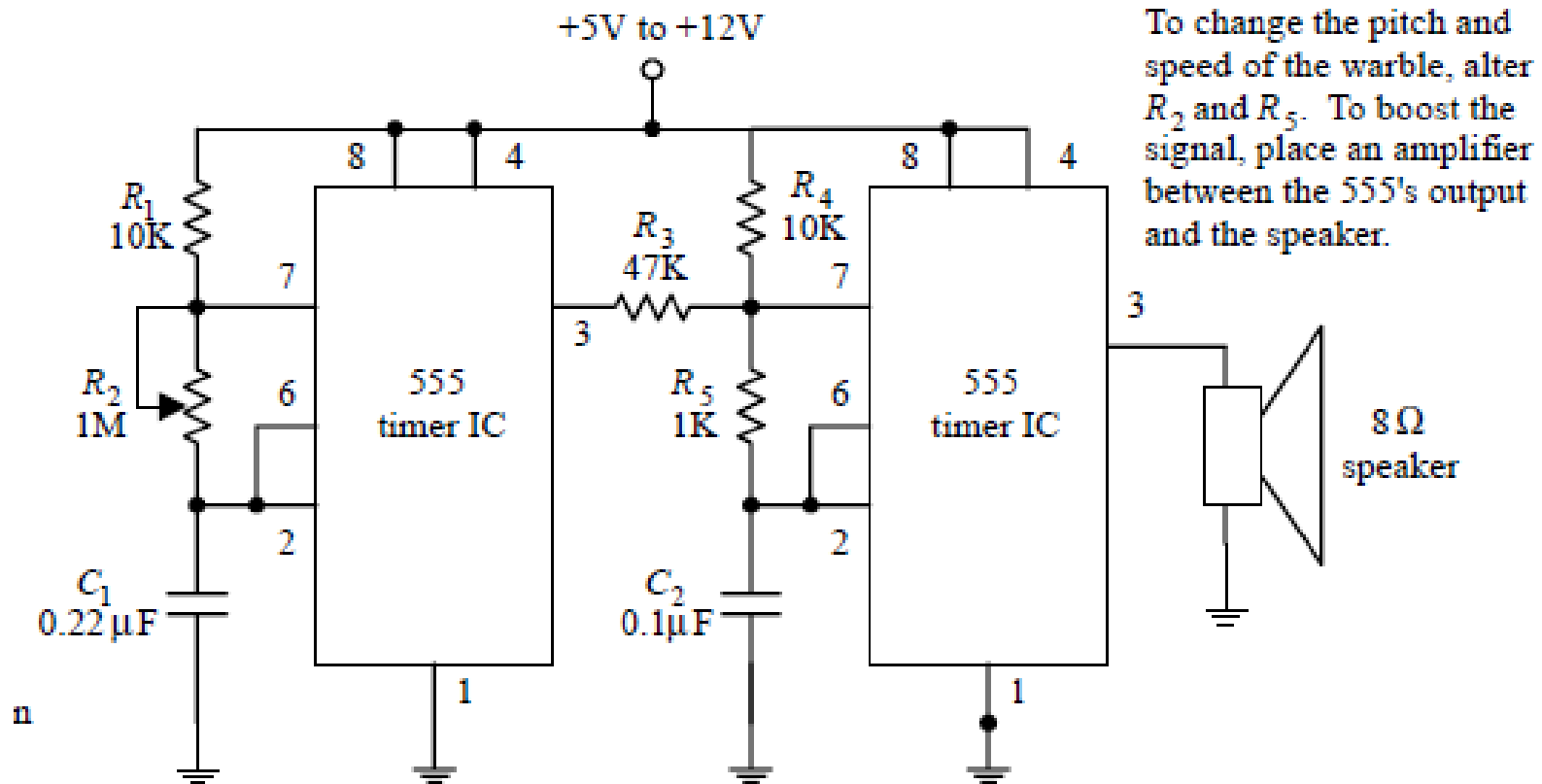
Applications

Megaphone



Applications

Warbler siren



Applications

Sound-Activated Switch

