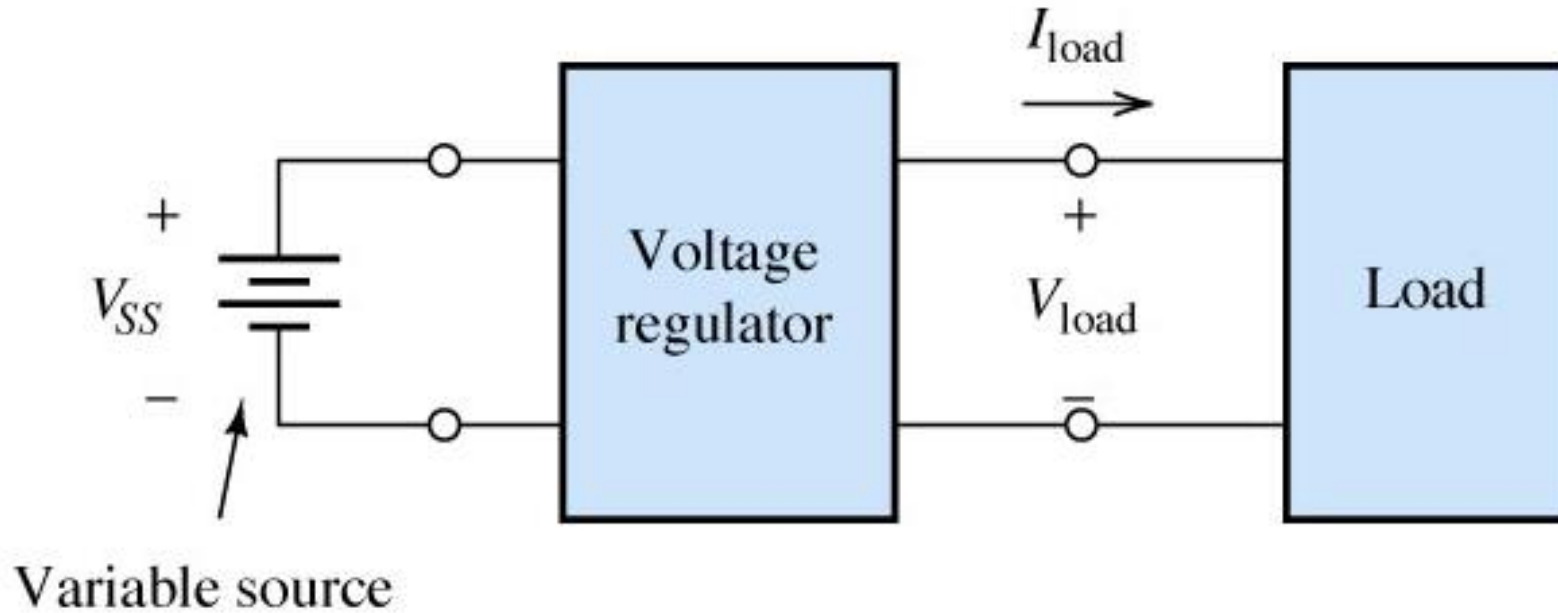


# Voltage Regulator

# Voltage Regulator

A voltage regulator supplies constant voltage to a load.

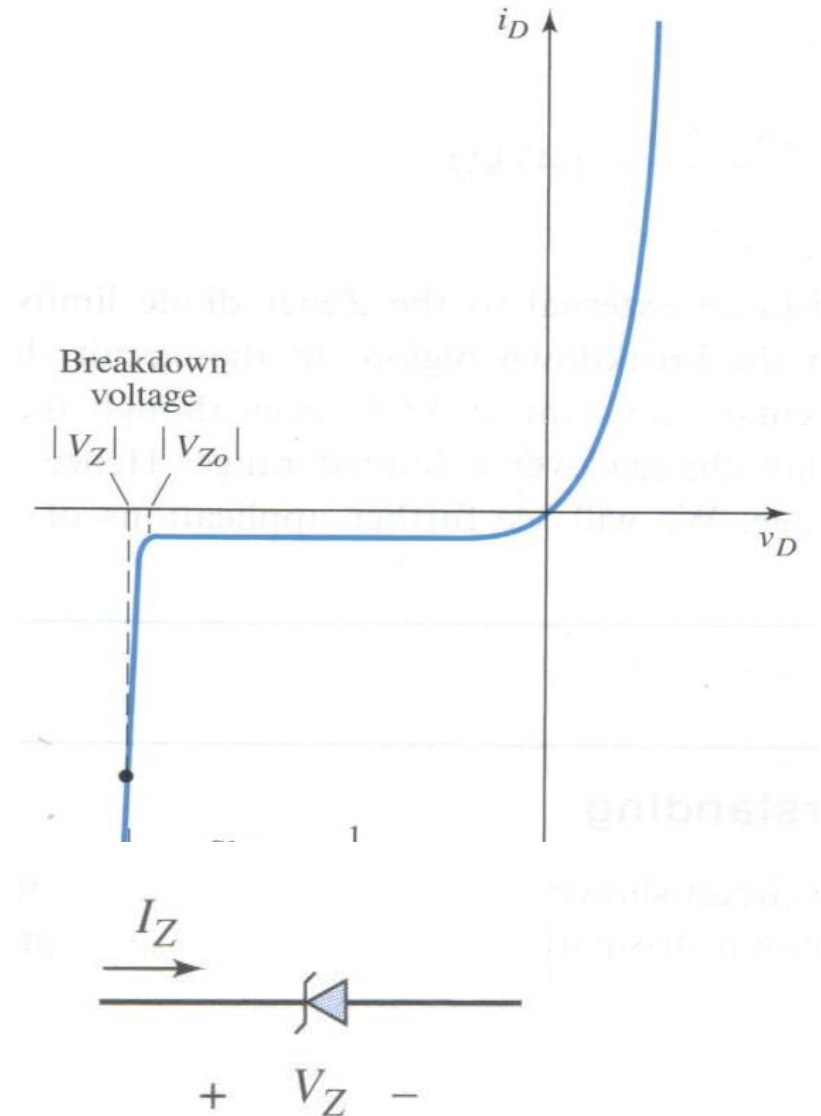


# Zener Diode

- A diode with a sharp breakdown voltage can be used as a constant voltage reference in a circuit.
- The applied reverse biased voltage cannot increase without limit since at some point breakdown occurs causing current to increase rapidly.
- The voltage at that point is known as the breakdown voltage,  $V_Z$
- Diodes are fabricated with a specifically design breakdown voltage and are designed to operate in the breakdown region are called **Zener diodes**.

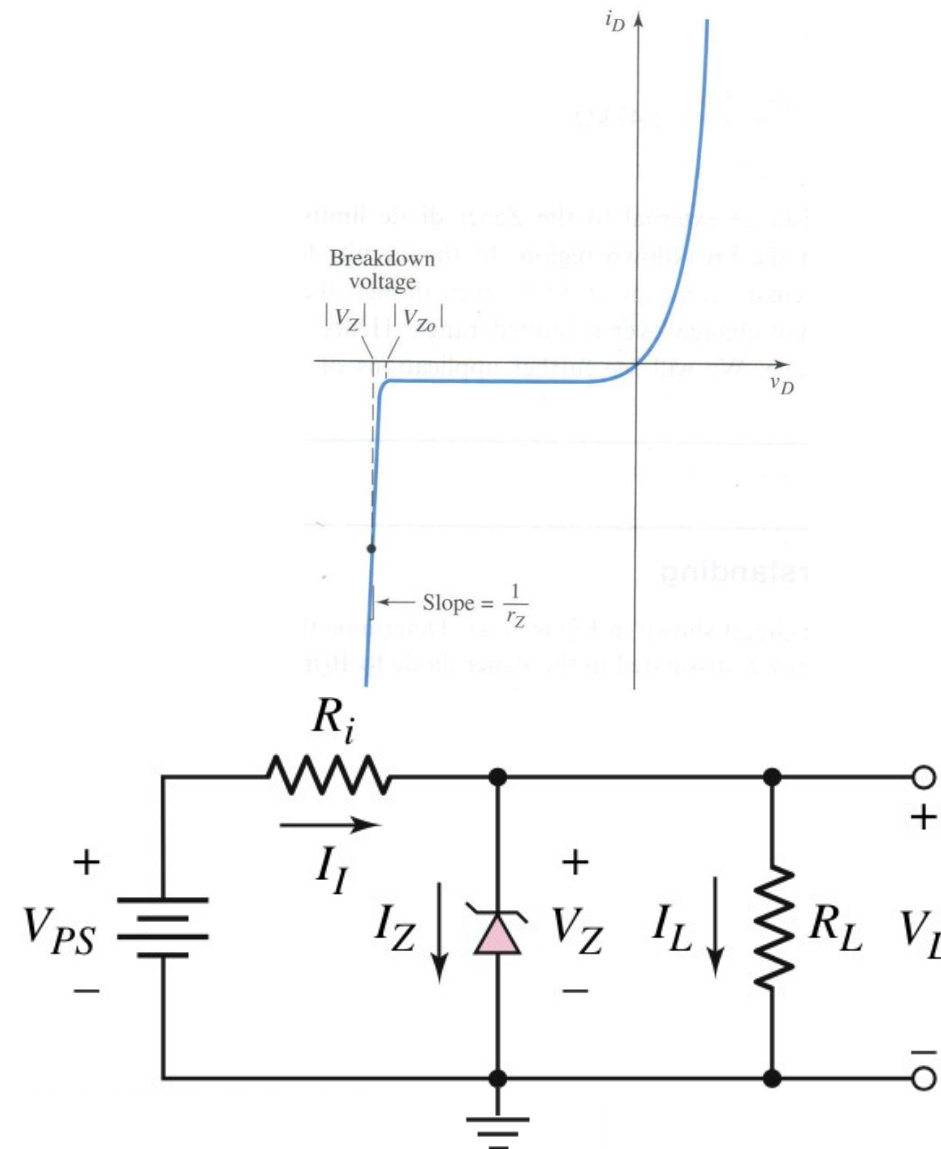
**NOTE:** A Zener diode when forward biased, it acts like a normal PN junction diode.

A Zener diode when reverse-biased, it acts at the breakdown region



# Zener Diode as Voltage Regulator

- The breakdown voltage of a Zener diode is nearly constant over a wide range of reverse-bias currents.
- This make the Zener diode useful in a voltage regulator, or a constant-voltage reference circuit.
- The Zener diode holds the voltage constant regardless of the current
- The load resistor sees a constant voltage regardless of the current
- The remainder of  $V_{PS}$  drops across  $R_i$

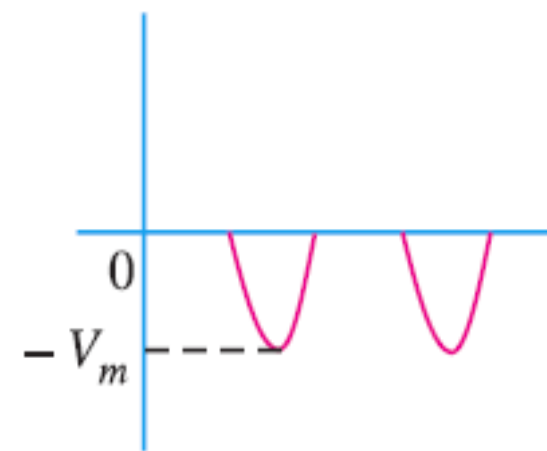
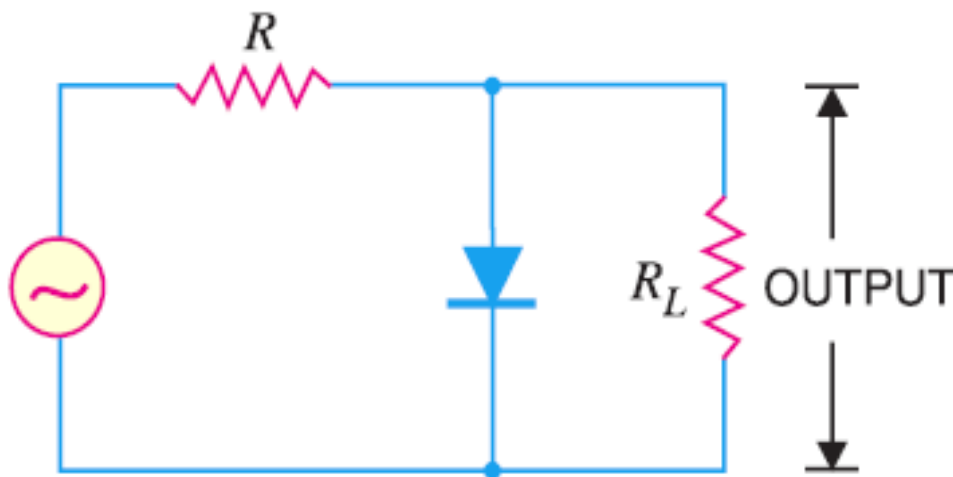
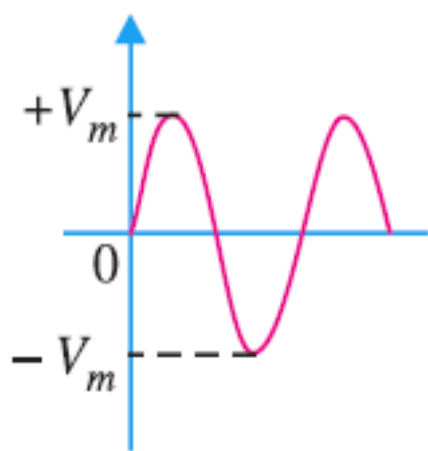


Clipper

# Clipper

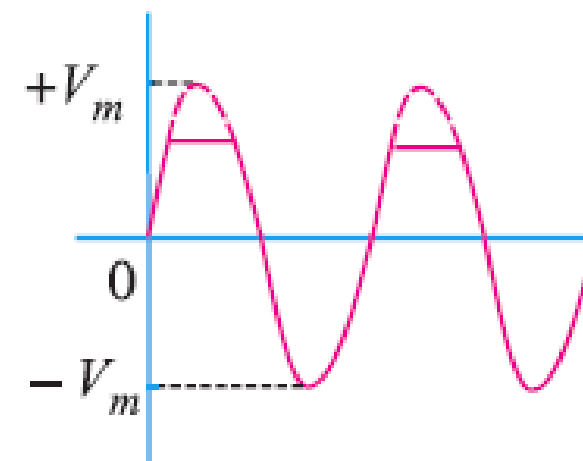
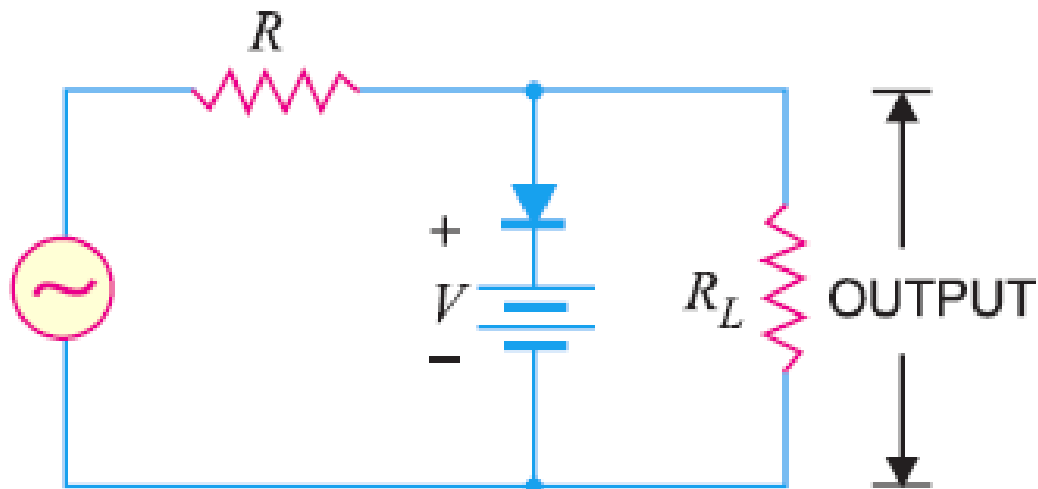
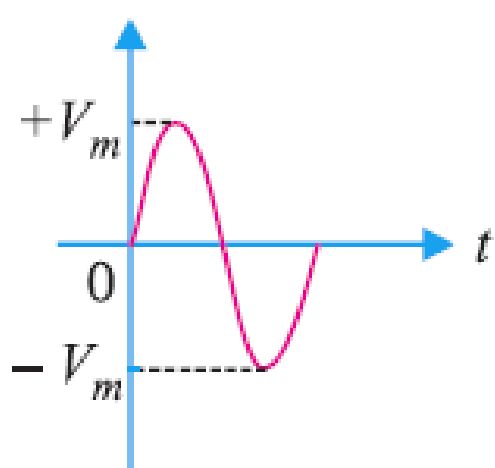
- A clipper (or limiter) is used to clip off or remove a portion of an a.c. signal.
- The half-wave rectifier is basically a clipper that eliminates one of the alternations of an a.c. signal.
- Clippers find extensive use in radar, digital and other electronic systems.

**Positive clipper:** A positive clipper is that which removes the positive half-cycles of the input voltage.



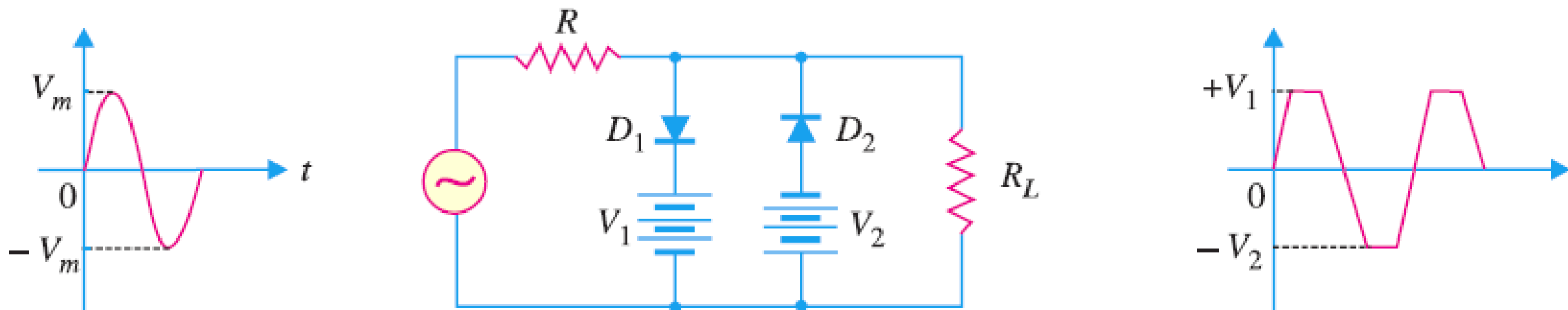
# Biased Clipper

- Sometimes it is desired to remove a small portion of positive or negative half-cycle of the signal voltage. For this purpose, biased clipper is used.



# Combination Clipper

- It is a combination of biased positive and negative clippers. With a combination clipper, a portion of both positive and negative half-cycles of input voltage can be removed or clipped

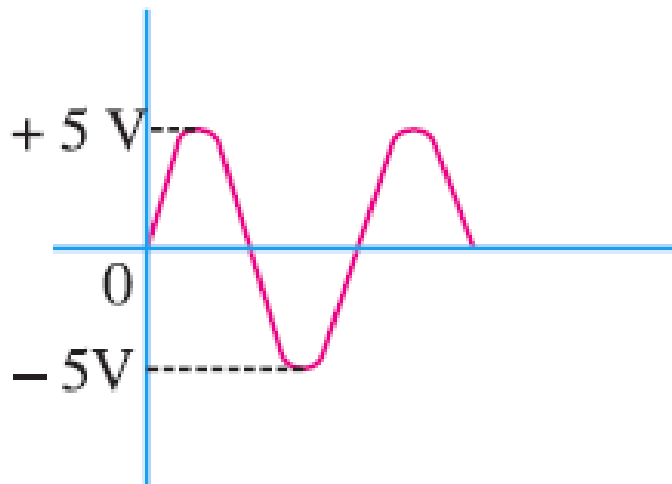




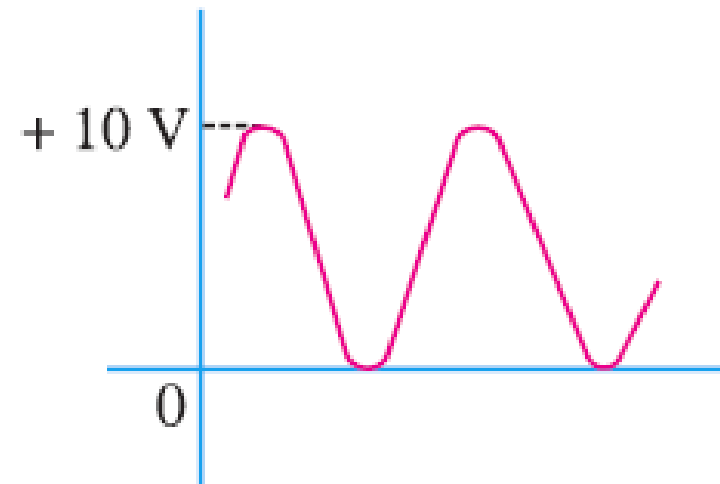
# Clamper

# Clamper

- A circuit that places either the positive or negative peak of a signal at a desired d.c. level is known as a **clamping circuit**.
- A clamping circuit should not change peak-to-peak value of the signal; it should only change the dc level.
- A clamping circuit uses a capacitor, together with a diode and a load resistor  $R_L$
- The operation of a clamper is based on the principle that charging time of a capacitor is made very small as compared to its discharging time.

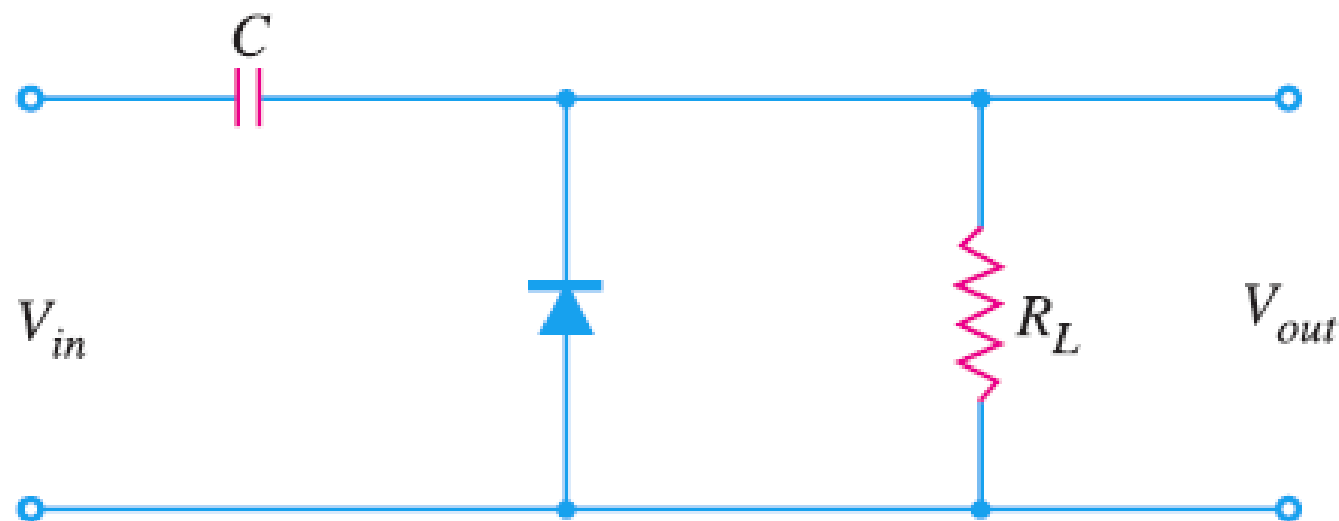
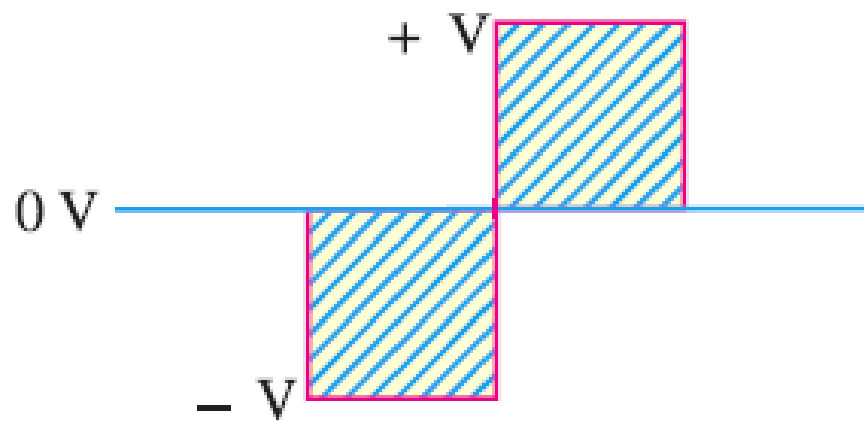


POSITIVE  
CLAMPER

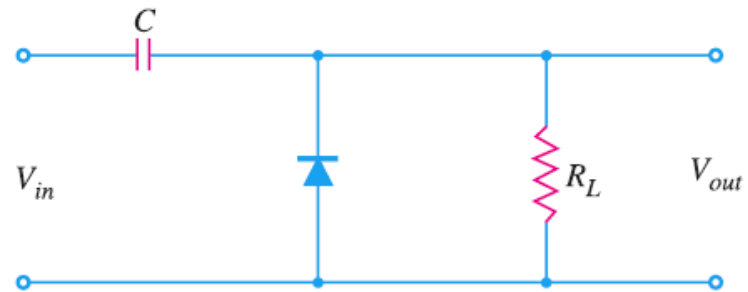
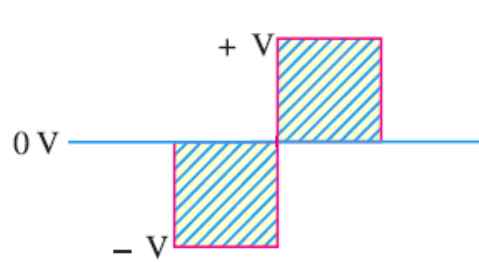


# Positive Clamper

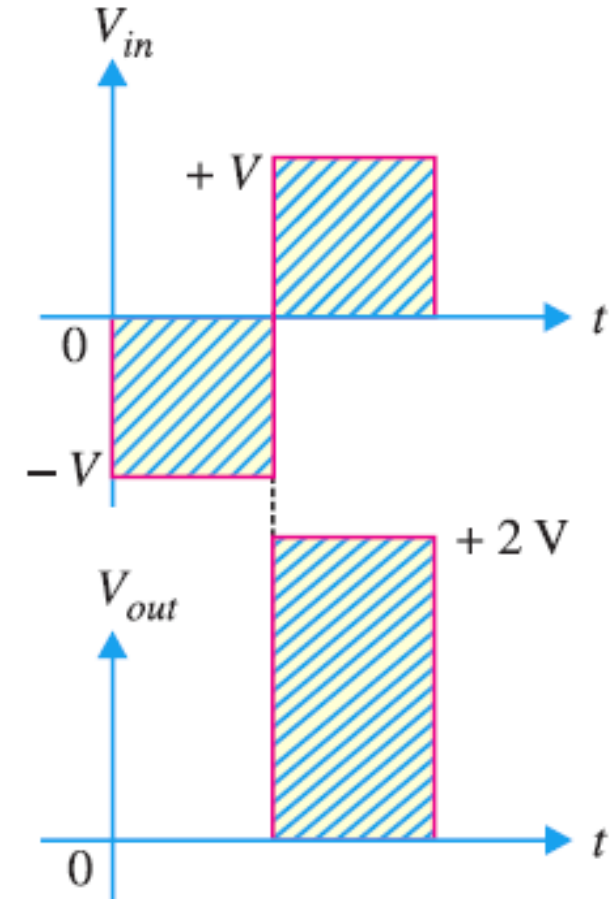
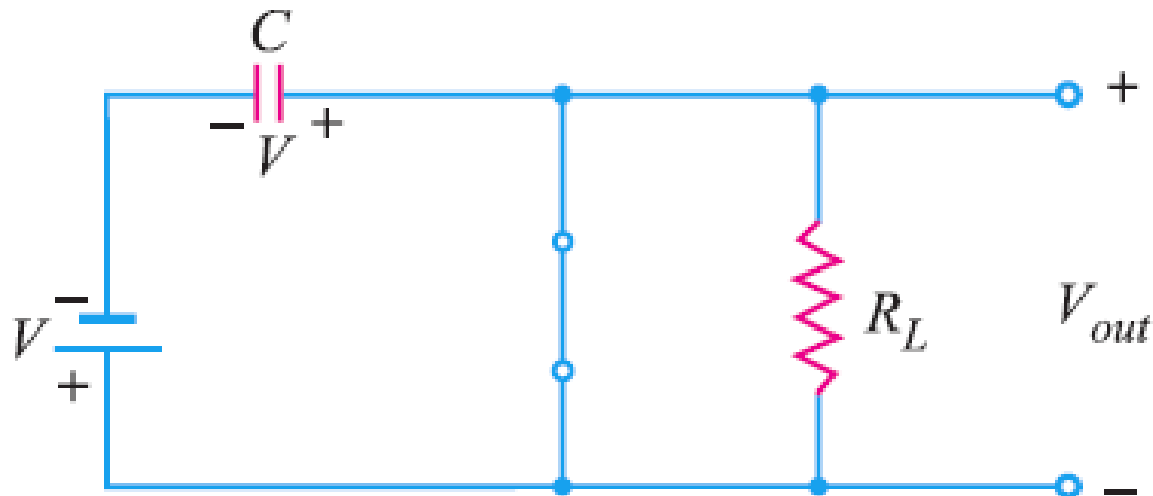
- Positively clamped output.
- The values of  $C$  and  $R_L$  are so selected that time constant  $\tau = CR_L$  is very large.



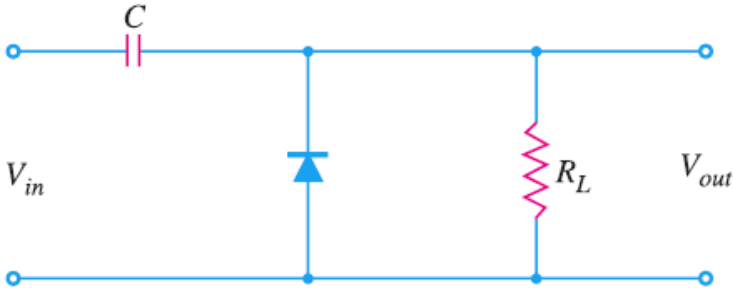
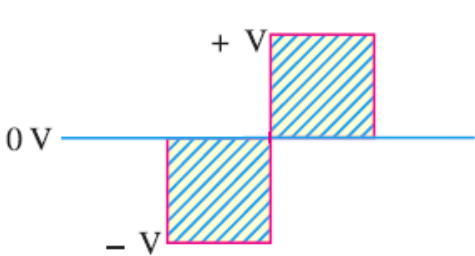
# Positive Clamper



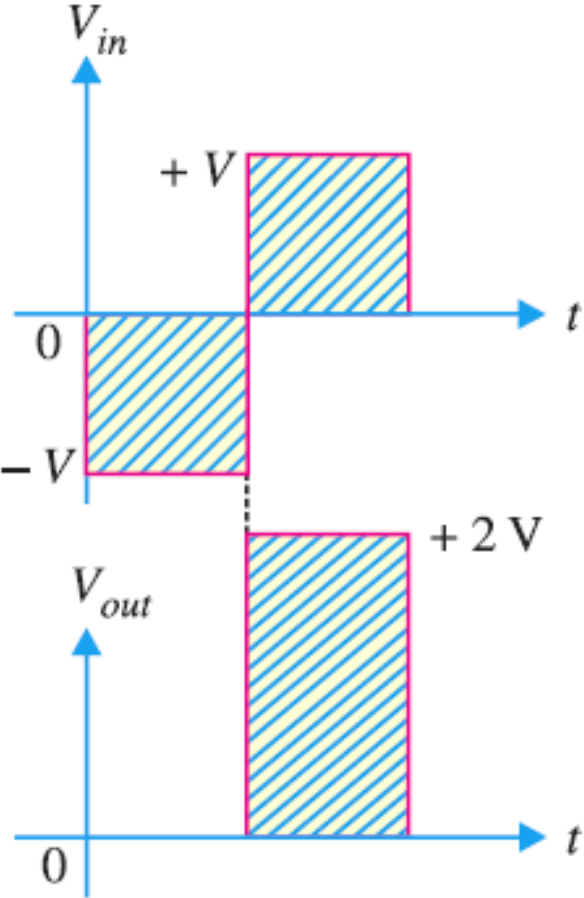
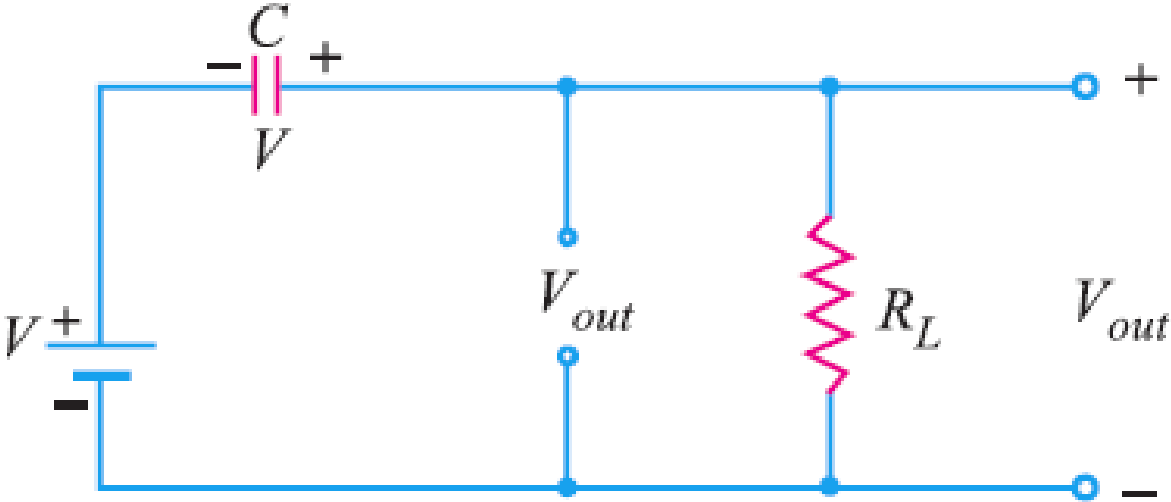
During the negative half-cycle



# Positive Clamper

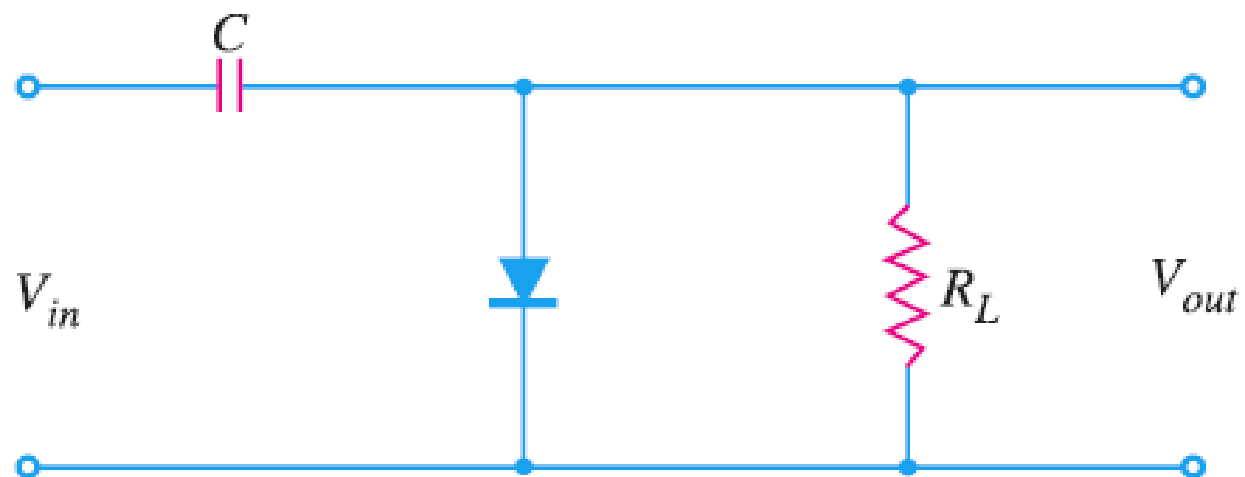
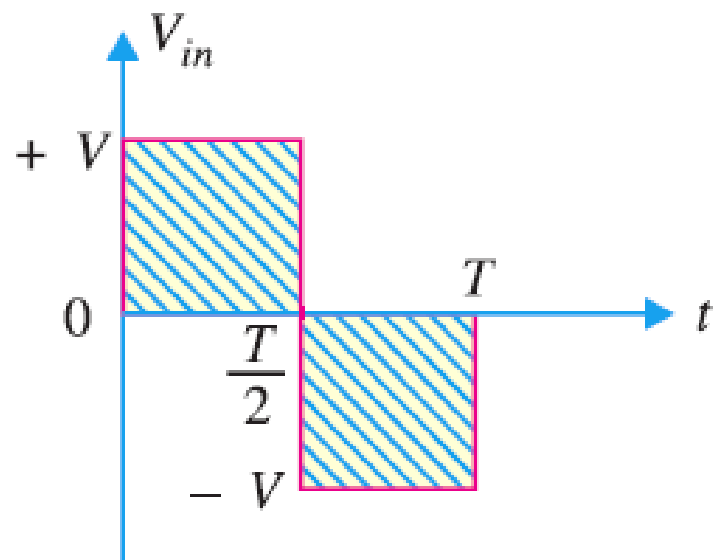


During the positive half-cycle

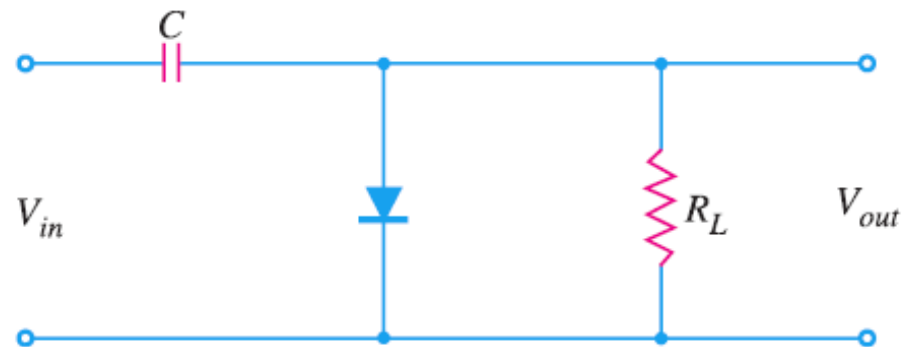
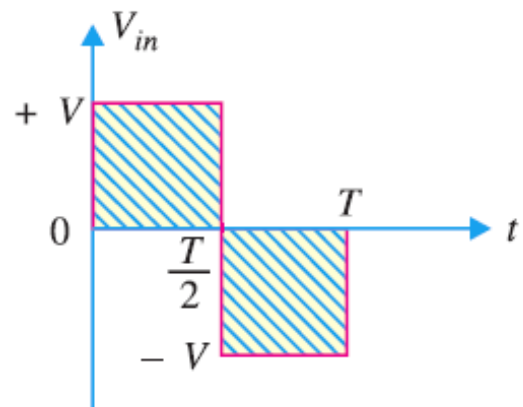


# Negative Clamper

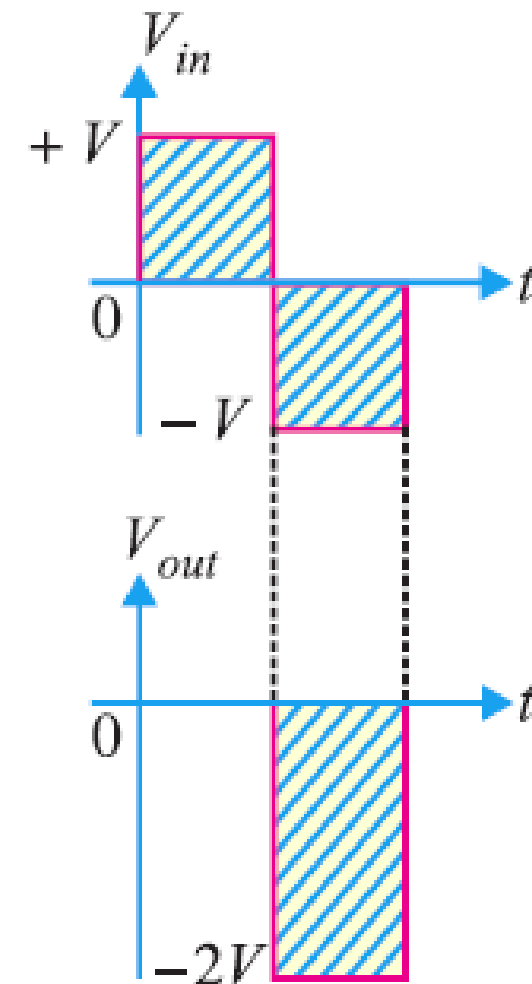
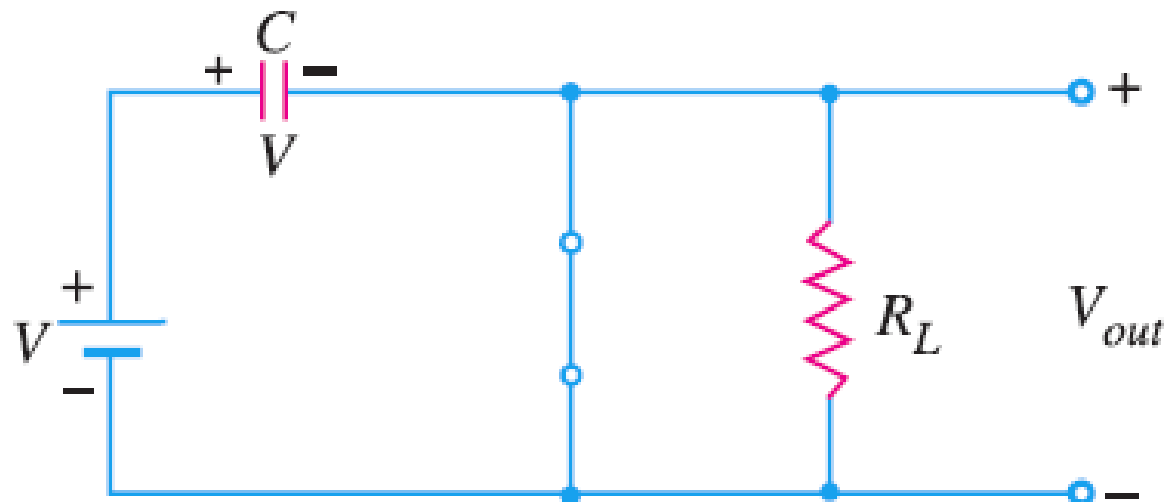
- negatively clamped output.



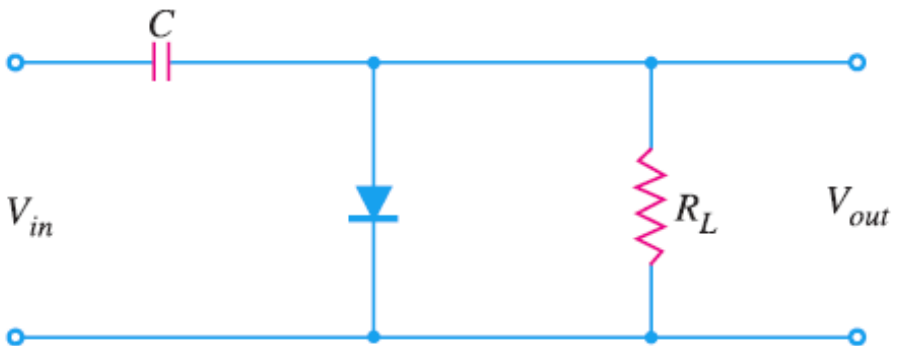
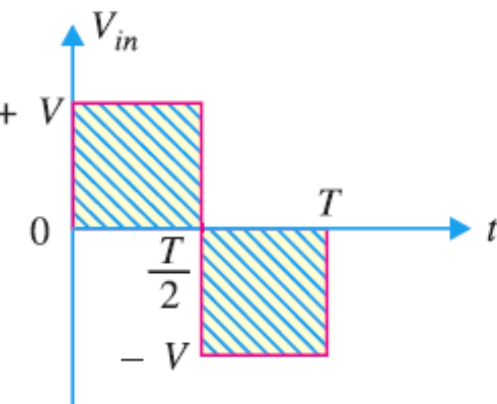
# Negative Clamper



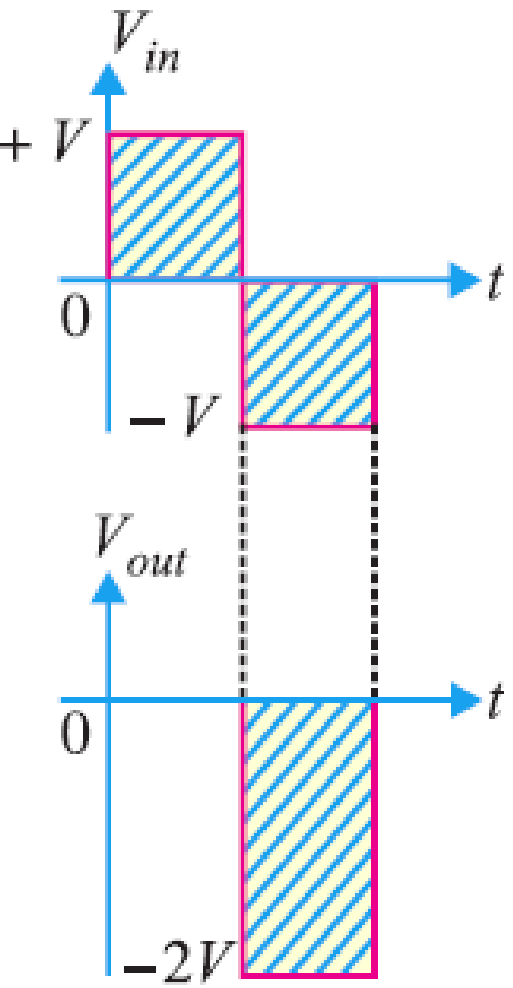
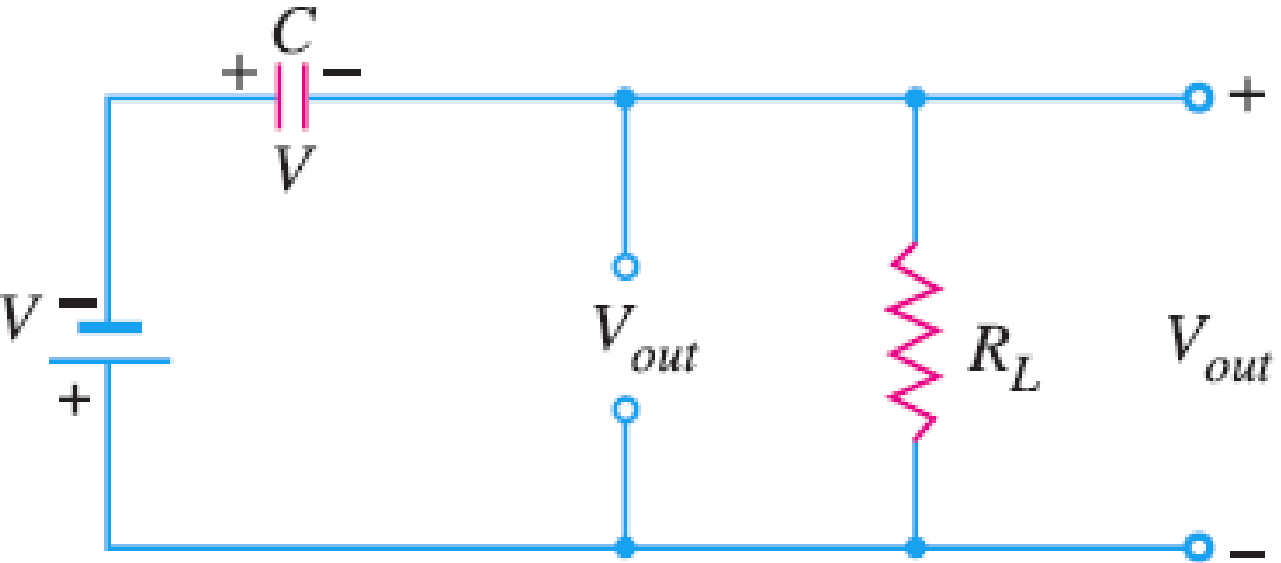
During the positive half-cycle



# Negative Clamper

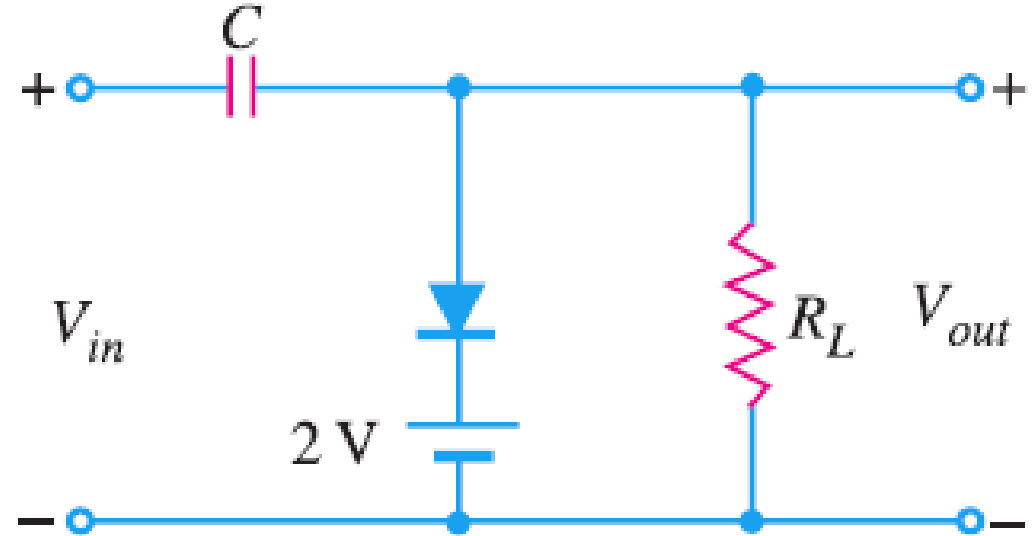
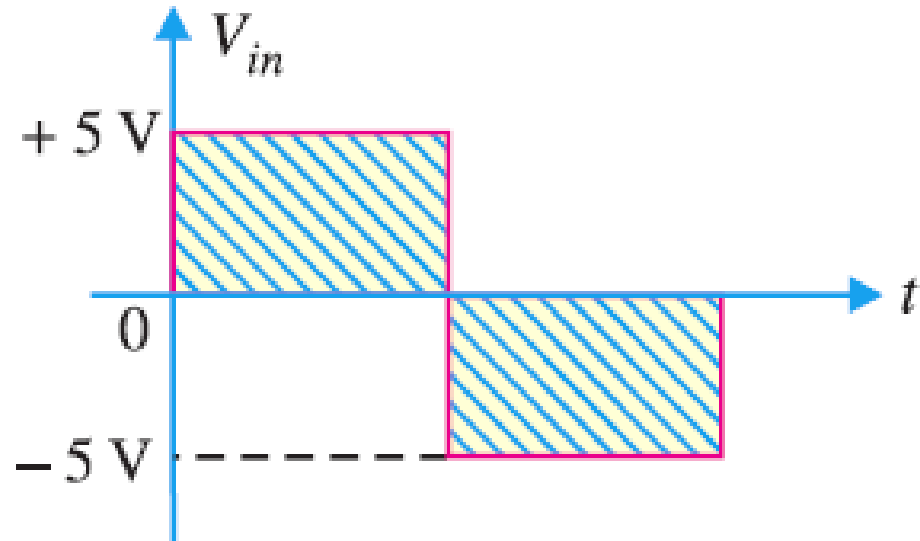


During the negative half-cycle



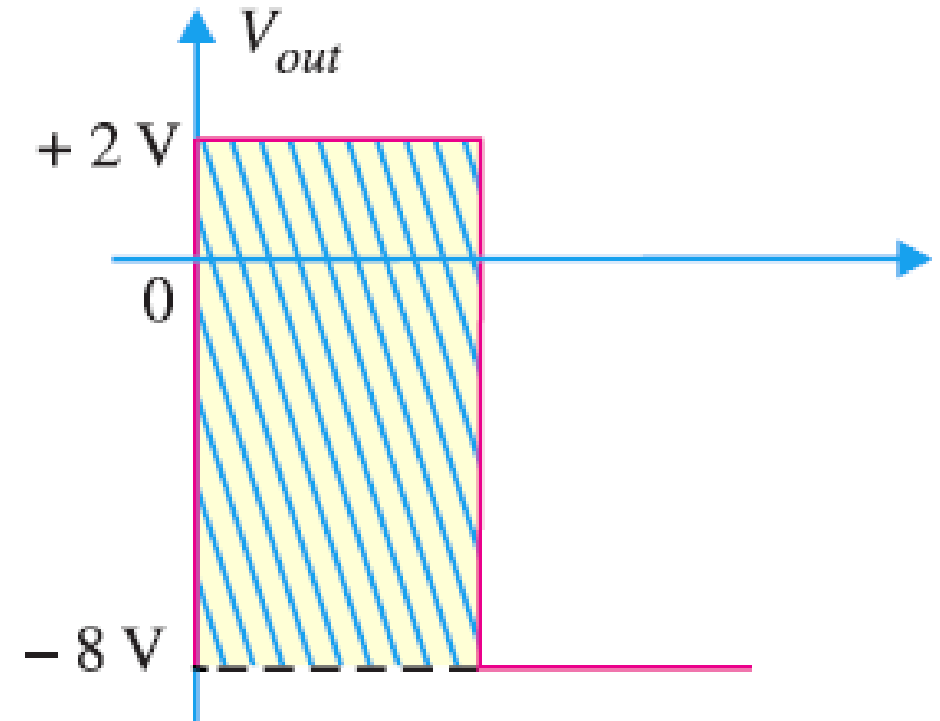
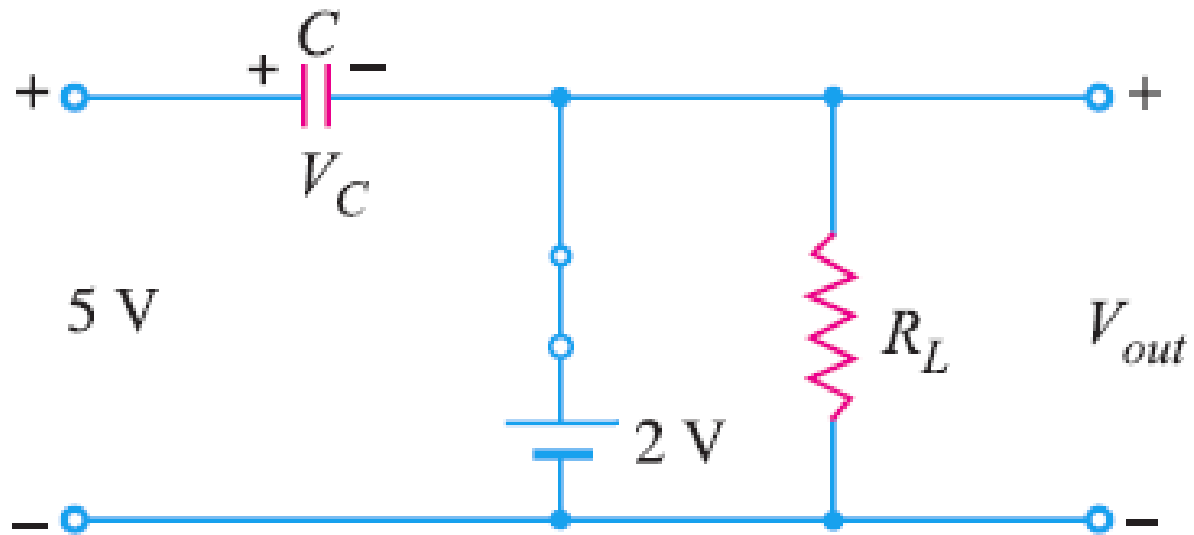


# Biased Clamper



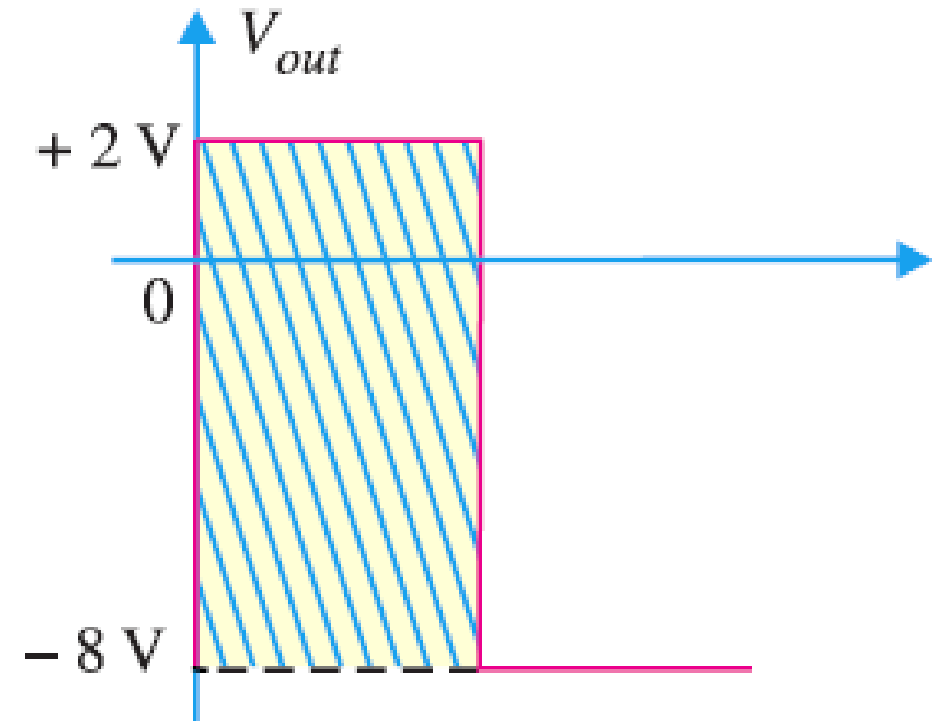
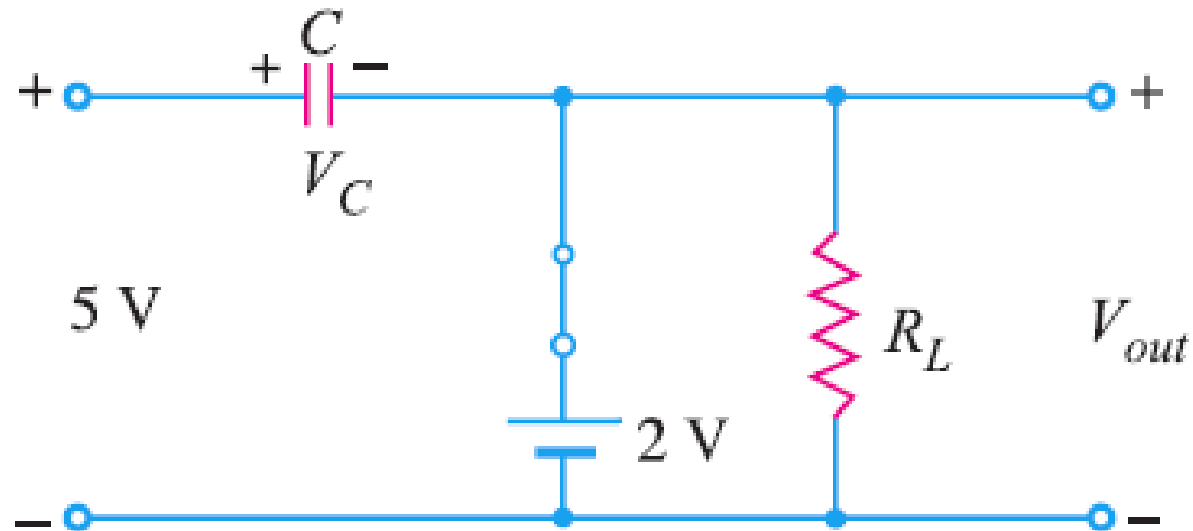
# Biased Clamper

During the positive half-cycle



# Biased Clamper

During the positive half-cycle



# Biased Clamper

During the negative half-cycle

