Objectives

Describe the purpose of diode clampers.

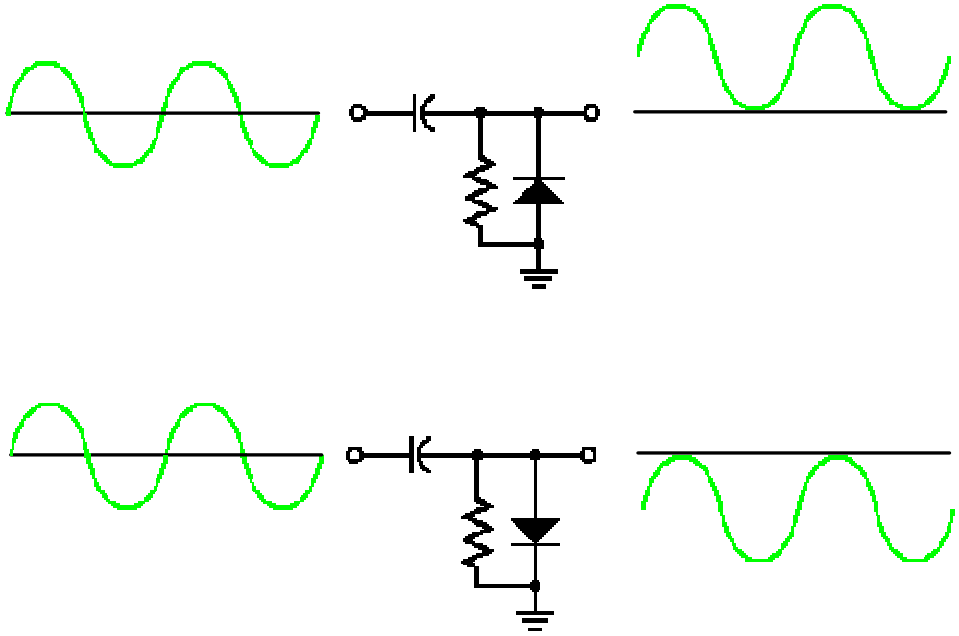
Identify the two different types of diode clamper circuits.

Describe diode clamper operation.

The purpose of a diode clamper is to clamp an AC input signal at a DC output level.

The AC signal can be changed so either the positive or negative peak is at 0 volts.

The peaks can also be placed above or below 0 volts.



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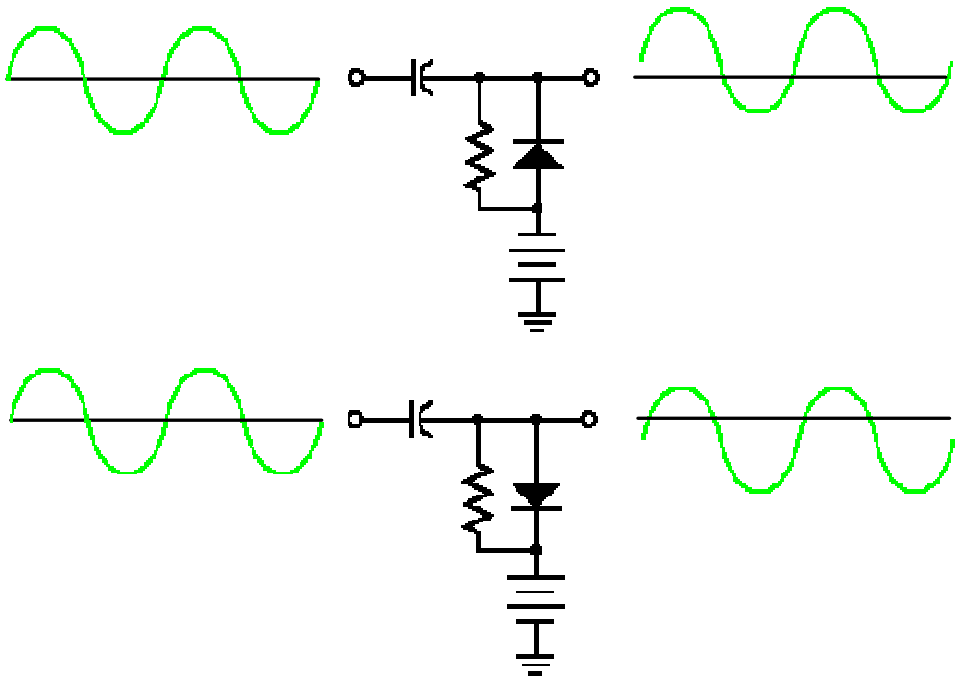


A clamper's effect on an input signal depends on how circuit components are connected.

The operation of each circuit is based on the action of the junction diode.

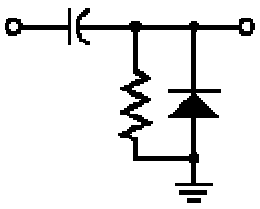
A forward biased diode conducts, acting almost like a short circuit.

A reverse biased diode is cutoff, acting like an open circuit.

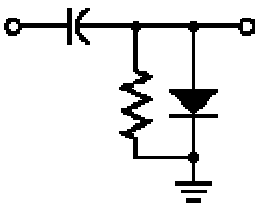
By placing the diode in different configurations, different output signals are produced.

The two basic configurations of diode clampers are:

Positive

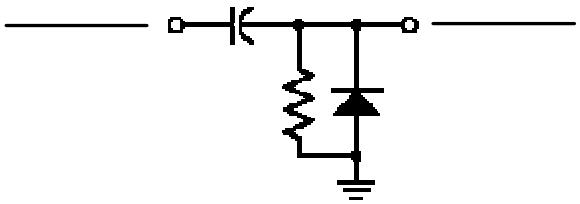


Negative



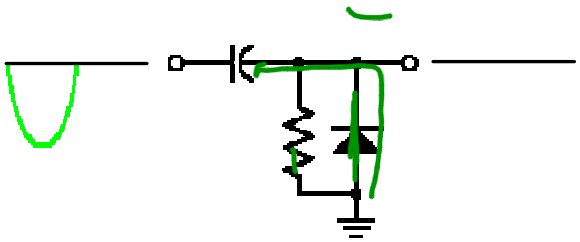
A positive clamper has the diode pointing up. The output signal will move in the direction the diode is pointing.

Positive clampers add a positive DC voltage.



An input signal's negative alternation forward biases the diode.

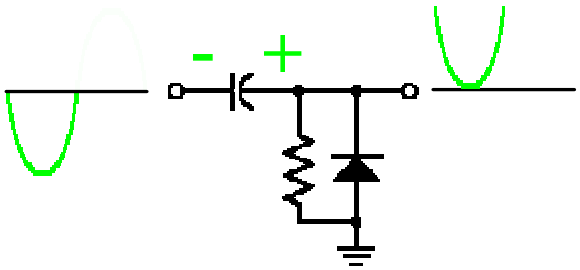
When the diode is forward biased, the path for AC current is through the low resistance of the diode to ground.



The capacitor quickly charges to the peak value with the positive polarity on the output.

Adding the positive voltage stored in the capacitor to the negative peak voltage of the input signal produces a half cycle in the positive region with 0 volts at the outputs lowest point.

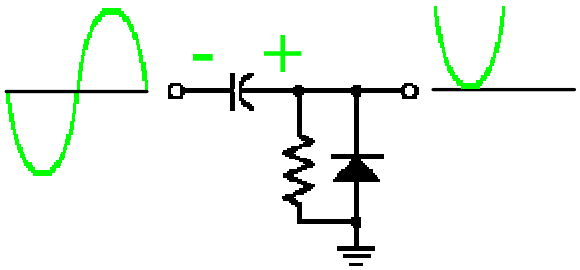
The positive charge on the capacitor raised the voltage level of the output signal.



The positive alternation of the input signal reverse biases the diode.

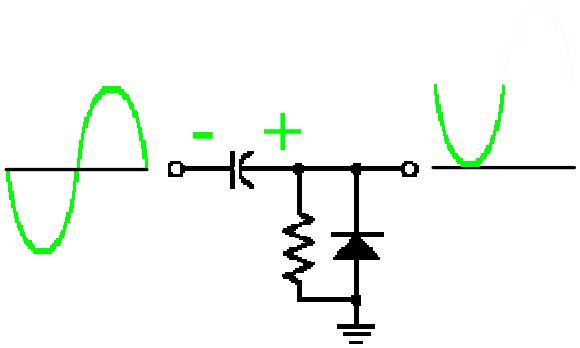
When the diode is reversed biased, the path for AC current is through the resistor because the diode acts like an open. This increases the RC time constant of the capacitor.

The capacitor does not have the time to discharge through the resistor, so the positive voltage on the capacitor remains.



Adding the positive peak voltage of the input signal to the positive voltage stored in the capacitor doubles the output voltage.

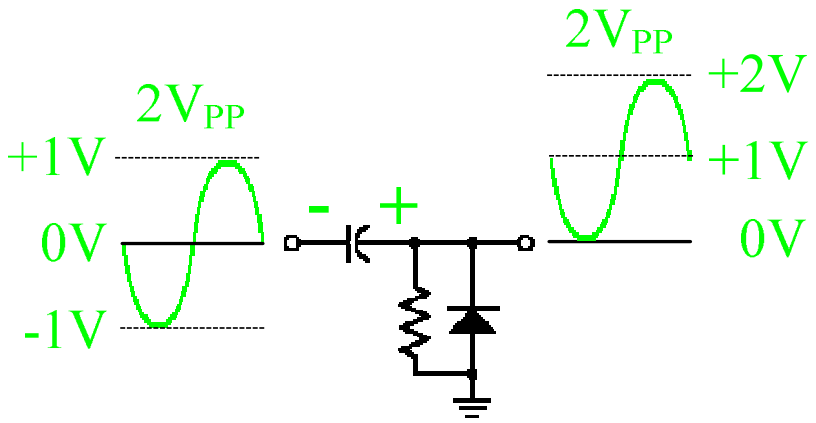
The positive charge on the capacitor raised the voltage level of the output signal.



The peak to peak value of the output signal does not change, only the DC level.

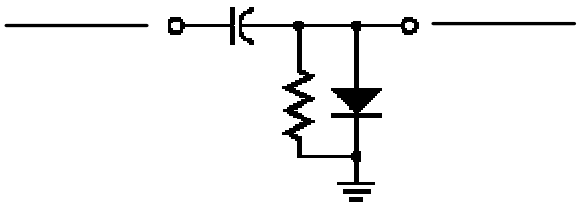
Remember, the diode action allows the capacitor to charge quickly through the low resistance and discharge slowly through the high resistance. The capacitor charges but does not discharge quickly.

The positive voltage on the capacitor is added to the input signal.



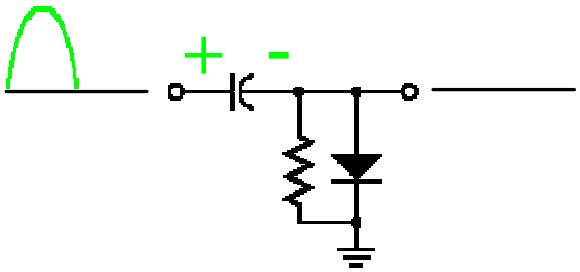
A negative clamper has the diode pointing down. The output signal will move in the direction the diode is pointing.

Negative clampers add a negative DC voltage.

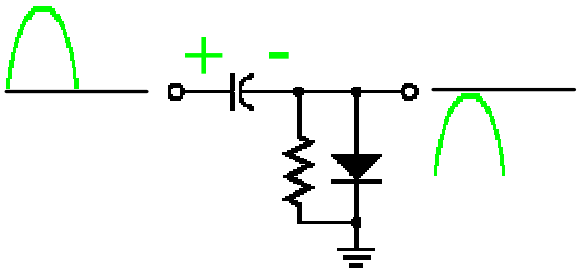


During the positive alternation, the diode is forward biased.

The capacitor quickly charges to the peak value with the negative polarity on the output.



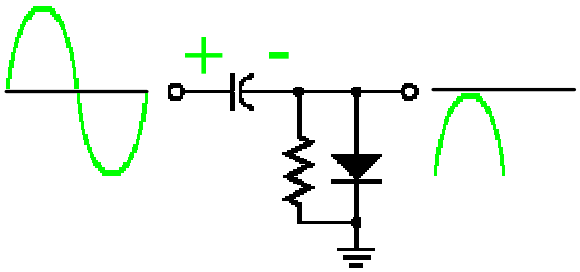
Adding the negative voltage stored in the capacitor to the positive peak voltage of the input signal produces a half cycle in the negative region with 0 volts at the outputs highest point.



The negative alternation of the input signal reverse biases the diode.

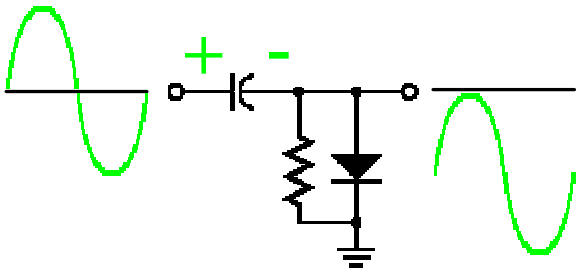
When the diode is reversed biased, the path for AC current is through the resistor because the diode acts like an open. This increases the RC time constant of the capacitor.

The capacitor does not have the time to discharge through the resistor, so the negative voltage on the capacitor remains.



Adding the negative peak voltage of the input signal to the negative voltage stored in the capacitor doubles the output voltage.

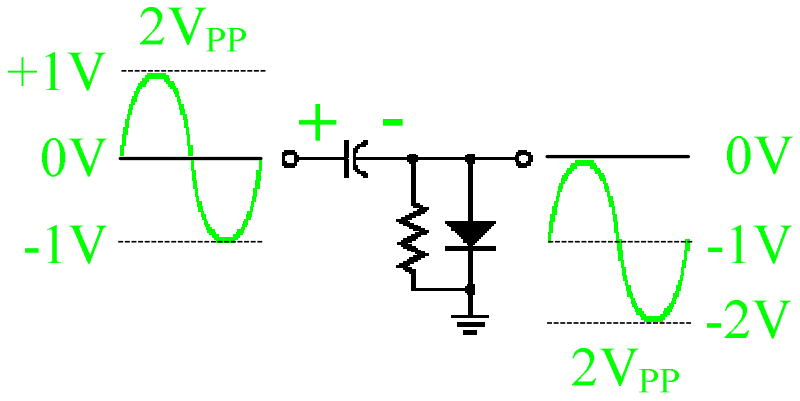
The negative charge on the capacitor lowered the voltage level of the output signal.



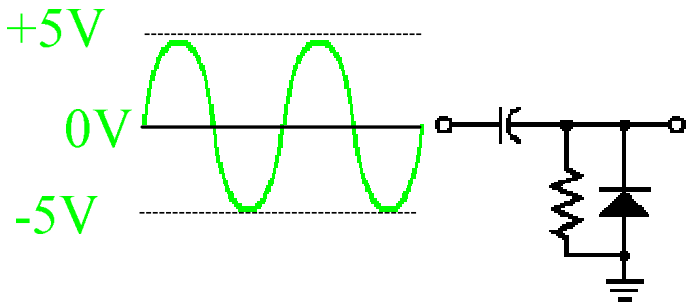
The peak to peak value of the output signal does not change, only the DC level.

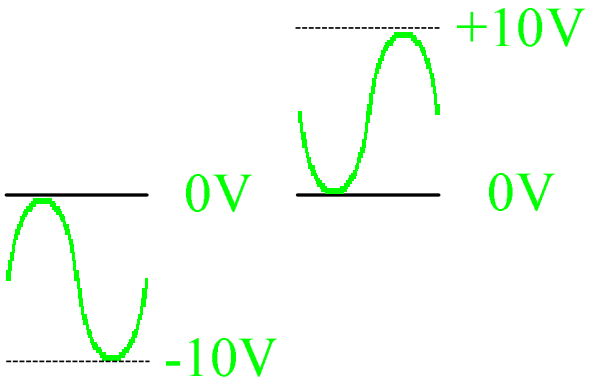
Remember, the diode action allows the capacitor to charge quickly through the low resistance and discharge slowly through the high resistance. The capacitor charges but does not discharge quickly.

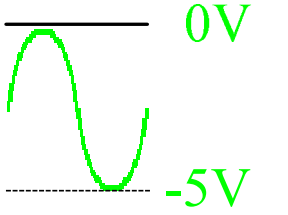
The negative voltage on the capacitor is added to the input signal.

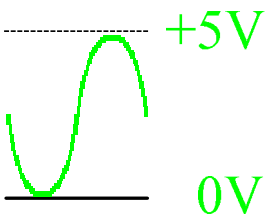


Select the correct output for this diode clamper.

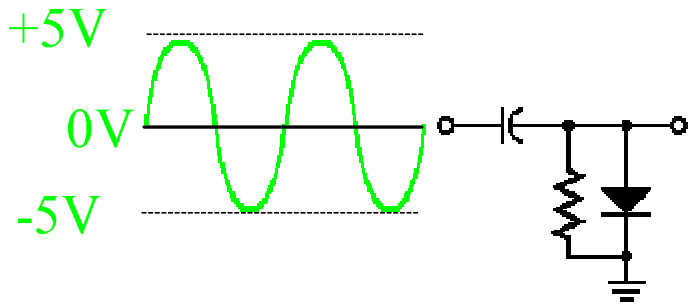


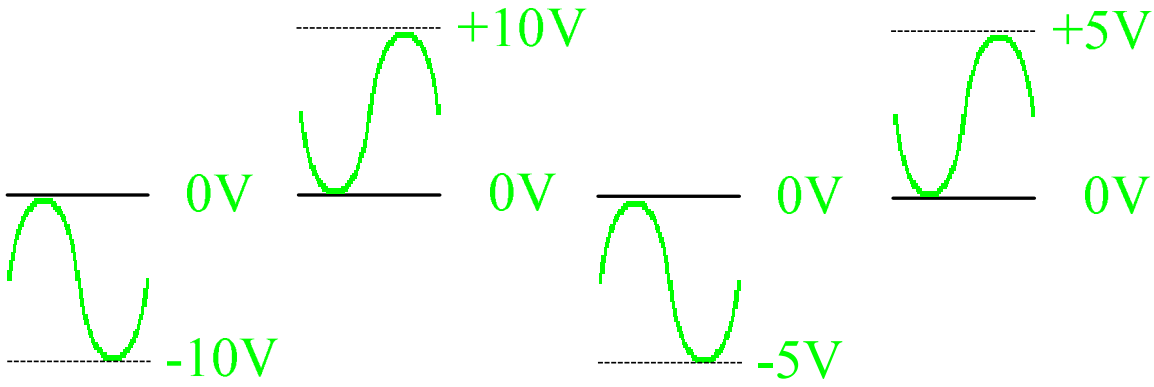




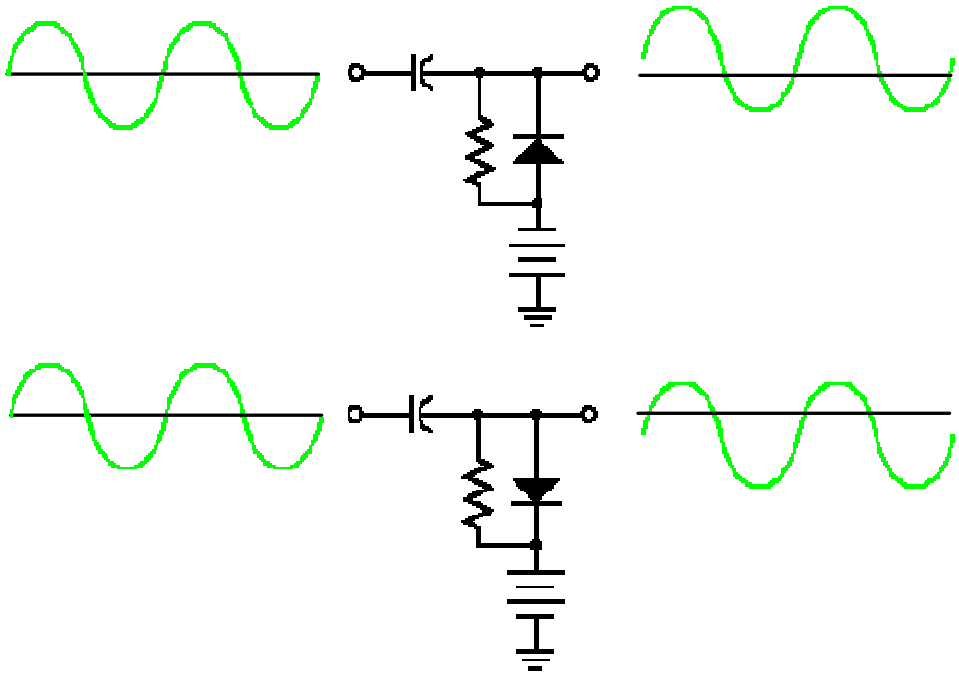


Select the correct output for this diode clamper.



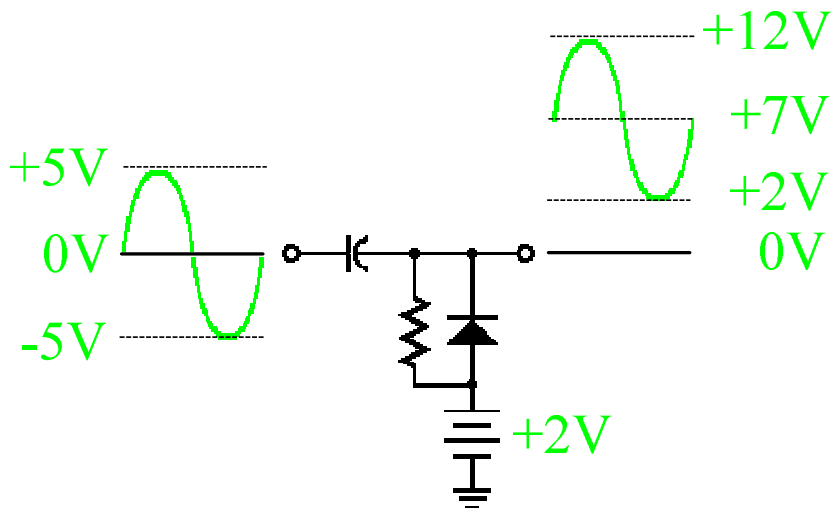


By adding circuit bias, the voltage level of the peaks are changed from 0 volts.



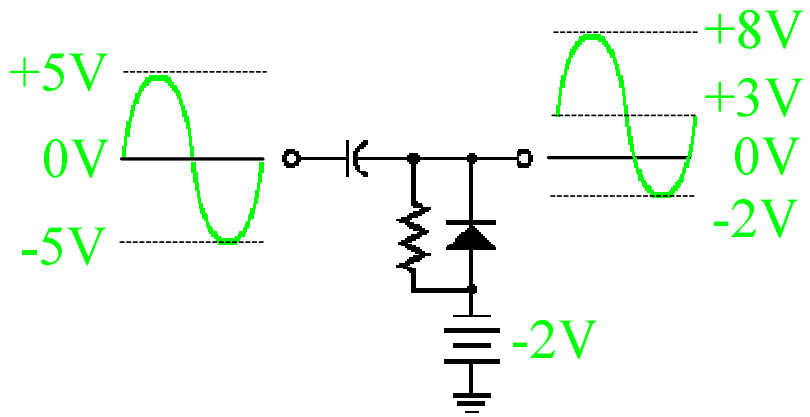
A positive bias on a positive clamper raises the output voltage DC level.

The peak to peak input and output voltage is still 10 volts, but the negative peak was raised to the level of the bias voltage.



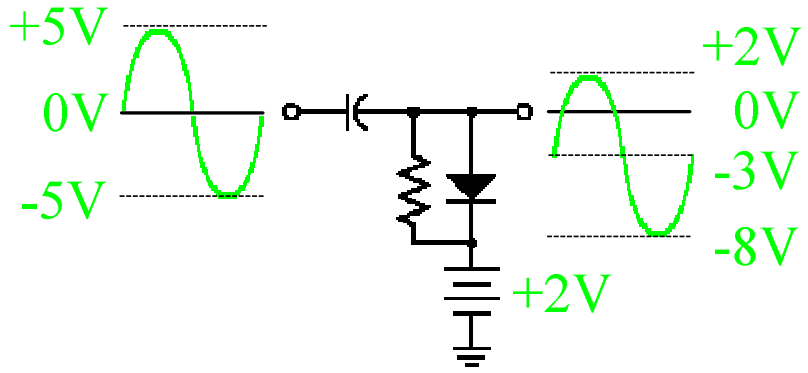
A negative bias on a positive clamper lowers the output voltage DC level.

The peak to peak input and output voltage is still 10 volts, but the negative peak was lowered to the level of the bias voltage.



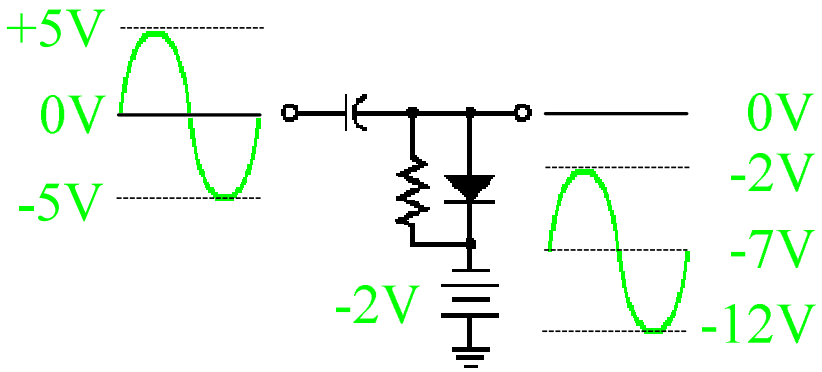
A positive bias on a negative clamper raises the output voltage DC level.

The peak to peak input and output voltage is still 10 volts, but the positive peak was raised to the level of the bias voltage.



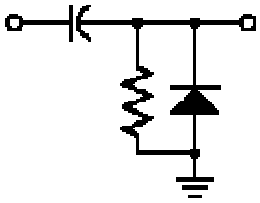
A negative bias on a negative clamper lowers the output voltage DC level.

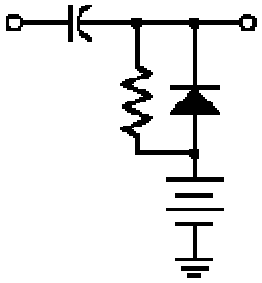
The peak to peak input and output voltage is still 10 volts, but the positive peak was lowered to the level of the bias voltage.



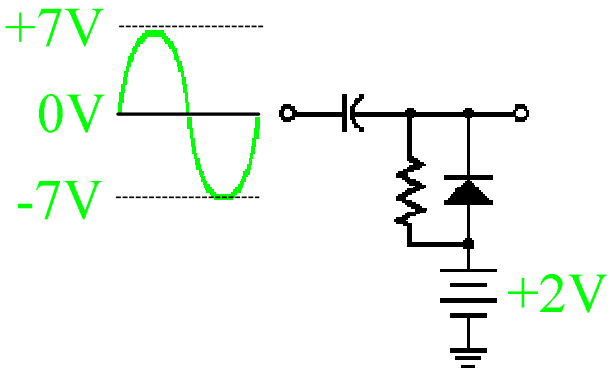
Remember, a biased clamper works just like an unbiased clamper.

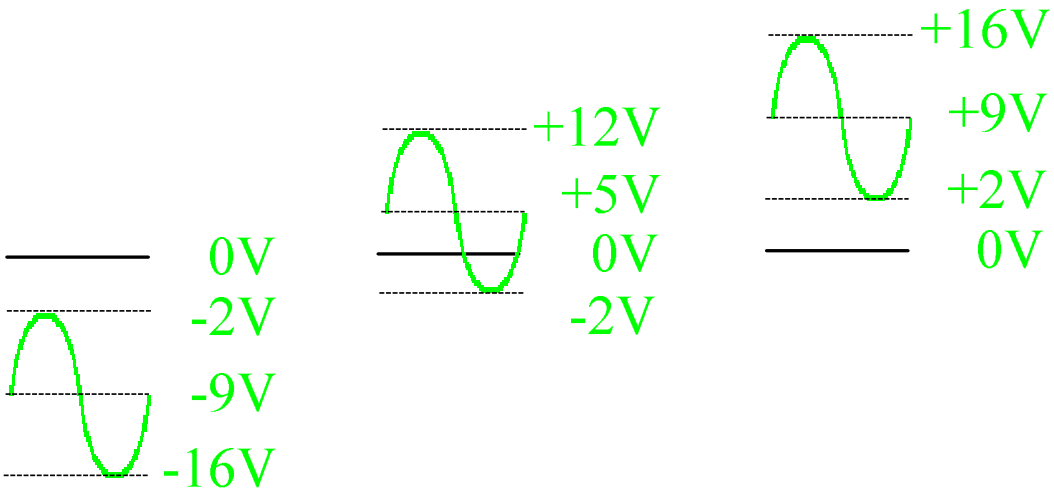
The bias either raises (positive bias) or lowers (negative bias) the DC level.





Select the output signal for this clamper.





Select the output signal for this clamper.