

## Objective

To verify the application and action of diode as a clamper; positive clamper and negative clamper and observe the waveforms.

## Equipment Required

Diode, Resistors, Capacitor, DC regulated power Supply, Signal generator and CRO.

## Theory for Diode Working as a Clamper

A clamper is an electronic circuit that prevents a signal from exceeding a certain defined magnitude by shifting its DC value. The clamper does not restrict the peak-to-peak excursion of the signal, but moves it up or down by a fixed value. A diode clamp relies on a diode, which conducts electric current in only one direction; resistors and capacitors in the circuit are used to maintain an altered dc level at the clamper output. A clamping circuit (also known as a clamper) will bind the upper or lower extreme of a waveform to a fixed DC voltage level. These circuits are also known as DC voltage restorers.

The clamper is also referred to as an ac signal level shifter. The clamping network is one that will "clamp" a signal to a different DC level. The network must have a capacitor, a diode and a resistive element, but it can also employ an independent DC supply ( $V_{ref}$ ) to introduce an additional shift. The magnitude of R and C must be chosen such that time constant  $t = RLC$  is large enough to ensure the voltage across capacitor does not discharge significantly during the interval of the diode is non-conducting.

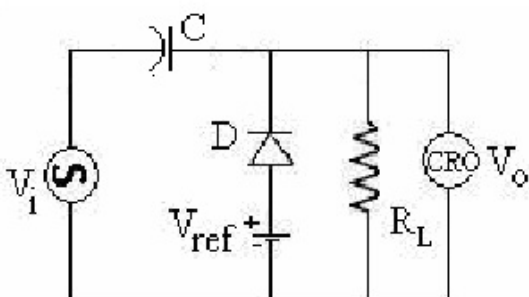
## Positive Clamper

When the circuit pushes the signal on the positive side or upward, the negative peak of the signal coincides with the zero level and the circuit is called the positive clamper. In the negative cycle of the input AC signal, the diode is forward biased and conducts, charging the capacitor to the peak positive value of  $V_{IN}$ . During the positive cycle, the diode is reverse biased and thus does not conduct. The output voltage is therefore equal to the voltage stored in the capacitor plus the input voltage again, so  $V_{OUT} = 2V_{IN}$

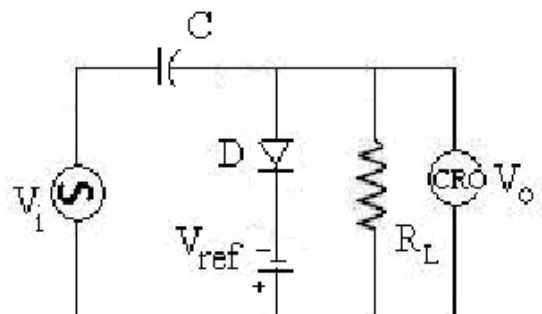
## Negative Clamper

When the signal is pushed on the negative side or downward, the positive peak of the input signal coincides with the zero level and the circuit is called the negative clamper. A negative clamp is the opposite of the equivalent positive clamp. In the positive cycle of the input AC signal, the diode is forward biased and conducts, charging the capacitor to the peak value of  $V_{IN}$ . During the negative cycle, the diode is reverse biased and thus does not conduct. The output voltage is therefore equal to the voltage stored in the capacitor plus the input voltage again, so  $V_{OUT} = -2V_{IN}$

## Circuit Diagrams



circuit diagram for positive clamper



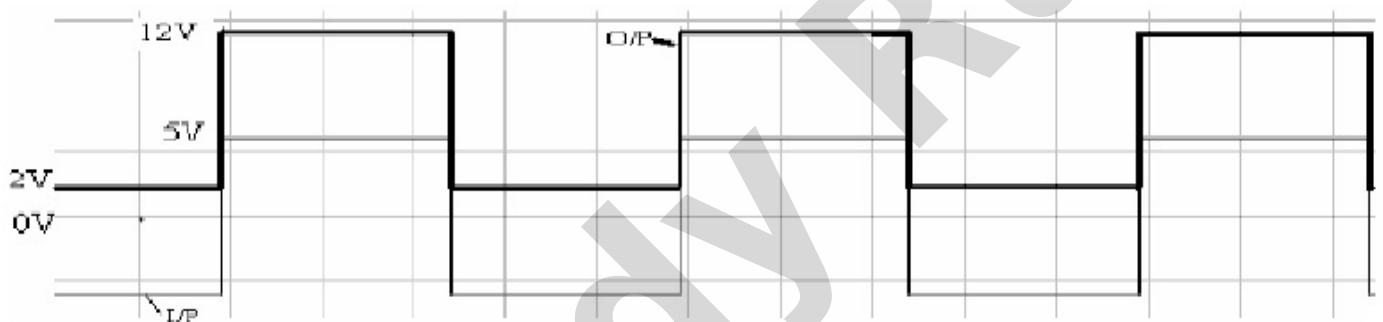
circuit diagram for negative clamper

## Procedure

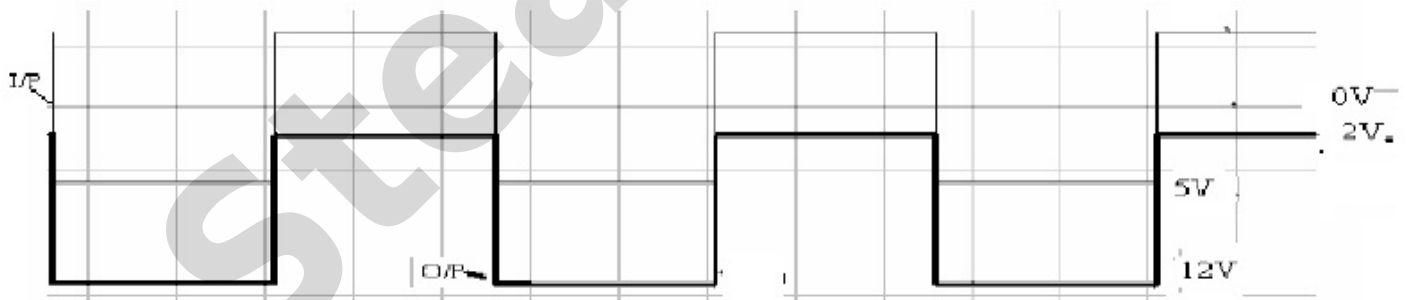
1. Before making the connections check all components using multimeter.
2. Make the connections as shown in circuit diagram.
3. Using a signal generator apply a square wave input ( $V_i$ ) of peak-to-peak amplitude of 10V (and Electronics Devices & Circuit Lab Manual: 3rd semester(ET&T) 9 frequency greater than 50Hz) to the circuit. (Sine wave can also be applied).
4. Observe the clamped output waveform on CRO.
5. CRO in DUAL mode and DC mode. Also the grounds of both the channels can be made to have the same level so that the shift in DC level of the output can be observed.
6. For negative clampers reverse the directions of both diode and reference voltage and repeat the procedure 2,3,4 and 5.

## Observation

Observe the waveforms on the CRO for both the positive and negative clamper.



**Input and output waveform for positive clamper circuit with reference voltage = 2V**



**Input and output waveform for negative clamper circuit with reference voltage = 2V**

## Result

Output Voltage  $V_o$  = ..... during positive half cycle.

Output Voltage  $V_o$  = ..... during negative half cycle.

## Precautions

- 1) All electrical apparatus that connects to the AC power line must have a protective ground through a three-wire power cable.
- 2) Always double check circuit wiring before applying power. Always have a single switch or button that will immediately remove power from the circuit in case of trouble.
- 3) Always switch the circuit power off before changing components or connections. It is tempting to become lazy

and change connections in low-power circuits with the supply on, but this is asking for trouble in the form of unintentional short circuits and blown components.

4) Always ask for directions or help if you are unsure of the correct measurement procedure or circuit connection.

### **Viva Questions and Answers for Diode action as a Clipper**

Question.1: What is clamper?

Question.2: Explain the working of clamping circuit?

Question.3: What are the components required for clamping circuit?

Question.4: What is the necessity for establish the clamping?

Question.5: What are various types of clamping circuit?

Question.6: What is positive and negative clamp circuit?

Question.7: Why we do clamping for input protection?

Question.8: Principles of operation of clamp circuit?

Question.9: Give the examples of clamper?

Question.10: The values of R and C required for good clamping?

Steady Run