Clippers -- Overview

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OBJECTIVES

After performing this lab exercise, learner will be able to:

- Understand the working of positive and negative clipper circuit
- Design positive and negative clipper circuits
- Use 2231A power supply to provide clipping bias to the circuit
- Use a digital oscilloscope to capture and analyze output waveforms

EQUIPMENT

To carry out this experiment, you will need:

- TBS 1000B-EDU series oscilloscope from Tektronix
- Voltage probe (provided with oscilloscope) / BNC cables
- Breadboard and connecting wires
- Circuit components -
    - Resistor 1K, 0.25W
    - Diode IN4002 / IN4148 or equivalent
- Regulated DC supply 0-30V DC (Keithley 2231A)
- Signal /Function generator (AFG3000 from Tektronix)

THEORY

- Clippers are also known as voltage or current limiters, amplitude selectors or slicers as they clip a selected part of the waveform.
- Clipping circuits are used to select and transmit a part of the given waveform without distorting it.
- Clipper circuit utilizes the unidirectional conduction property of the diode. Diodes can be biased to specify at what voltage level clipping should occur.
- A positive clipper will clip/limit the positive swing of the input waveform.
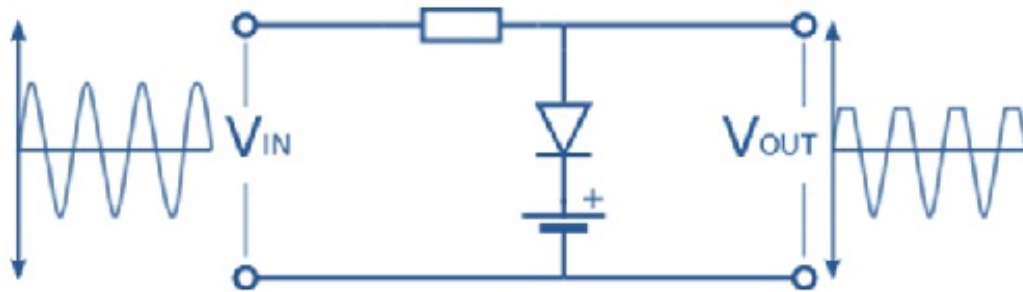
- A negative clipper will clip/limit the negative swing of the input waveform.
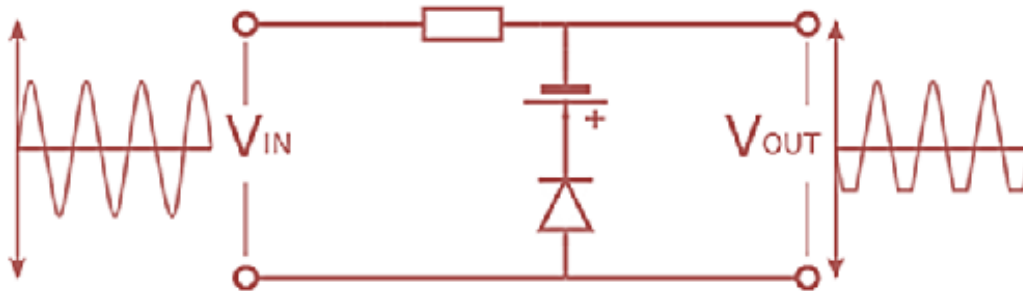
- Positive and negative clippers can be combined to clip both the swings of input waveform
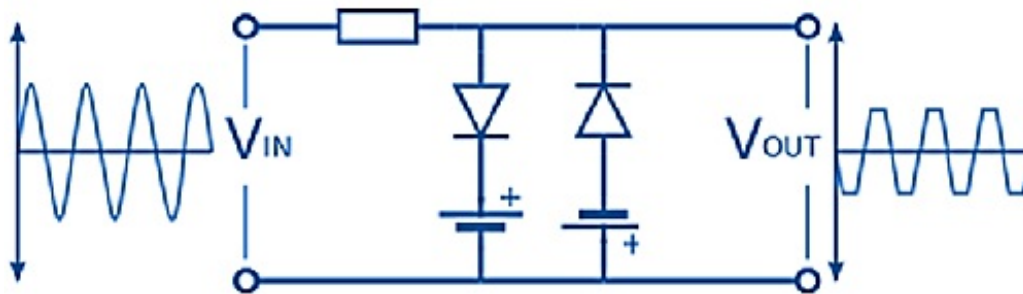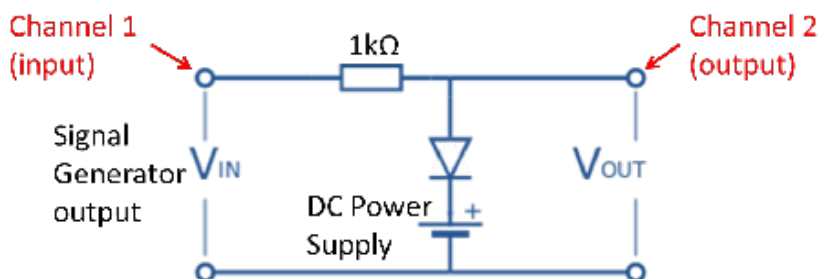

Clippers -- Procedures

Step 1

DUT / CIRCUIT SETUP
Make the circuit as shown below:

Step 2

Probe Channel 1 at AFG output (input to the circuit) and Channel 2 at clipper circuit output (Vout)

Step 3

Switch on the signal generator and set voltage to 10V P-P and frequency to 1kHz

Step 4

Turn on the DC Power Supply 2231A. Set DC voltage to 2V.

1. Push **CH1** button on front panel
2. Using numerical key, enter the voltage value. You can alternatively use the rotary wheel to change the voltage value
3. Press **Enter** to set the value
4. Enable the channel output

Step 5

1. Turn on the oscilloscope.
2. Do the autoset or manually configure the vertical / horizontal and trigger setting to optimally view 2-3 cycles of the signals.

Step 6

MEASUREMENT SETUP

1. Add MAXIMUM and MINIMUM measurements for both Ch1 and Ch2 on the oscilloscope
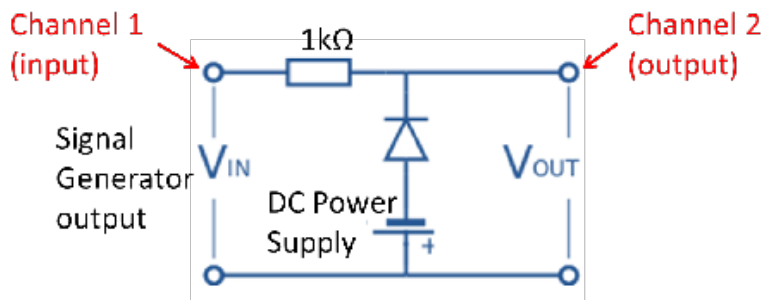2. Record the measurement value

Step 7

Verify that output (Ch2) waveform is the clipped version of Ch1 waveform

1. The MAXIMUM value of Ch2 should be around 2V (DC voltage set on power supply)
2. The MINIMUM value and the remaininig unclipped waveshape remains same as CH1

Step 8

DUT / CIRCUIT SETUP
Now modify the circuit as shown below, to make negative clipper:

Step 9

Repeat Step # 2 to #6 and verify that output (Ch2) waveform is the clipped version of Ch1 waveform

1. The MINIMUM value of Ch2 should be around 2V (DC voltage set on power supply)
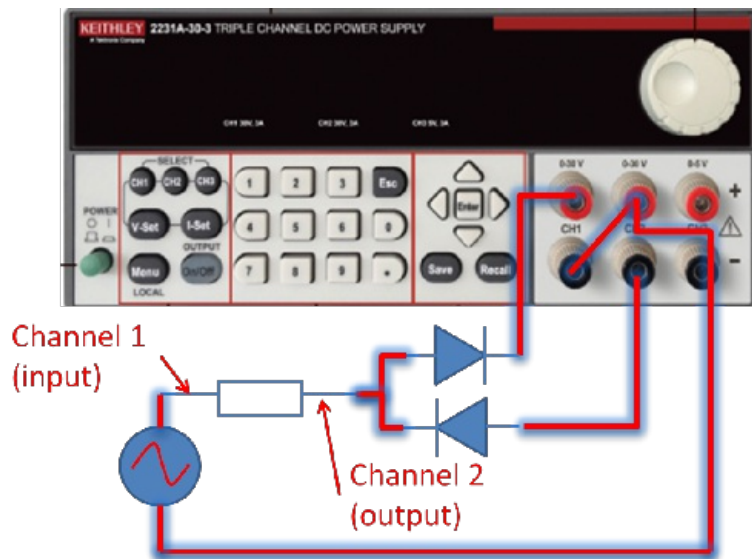2. The MAXIMUM value and the remaininig unclipped waveshape remains same as Ch1

Step 10

Now combine the two circuit to make a Positive & Negative clipper:
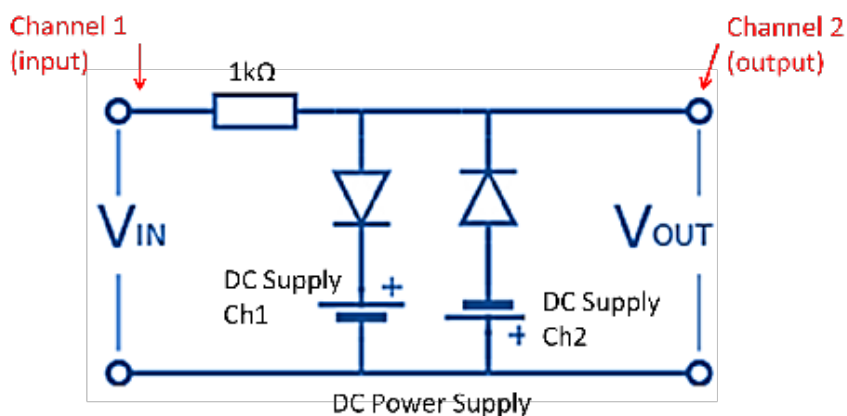
Step 11

We will have to use 2 channels of DC power supply, connected in series:

1. Select **CH1**
2. Set voltage as 2V
3. Select **CH2**
4. Set voltage to be 2V
5. Press **MENU** button on the front panel and select **Combine Ch1 + Ch2**
6. Push the down arrow key to select the option **V1+V2 Series**
7. Ensure the connections as below

Channel 1 (input)

Channel 2 (output)

Step 12

Repeat the experiment for this clipper circuit (Step # 2 to #6) and verify that output (Ch2) is the clipped version of Ch1

1. The MAXIMUM and MINIMUM value of Ch2 should be around 2V (DC voltage set on power supply)
2. The the remaininig unclipped waveshape remains same as CH1

Step 13

CAN YOU ANSWER THIS?

When you measure the clipped voltage at the output, is it exactly 2V or close to 2.7V? comment on your observation.