VOLTAGE DOUBLER CIRCUIT

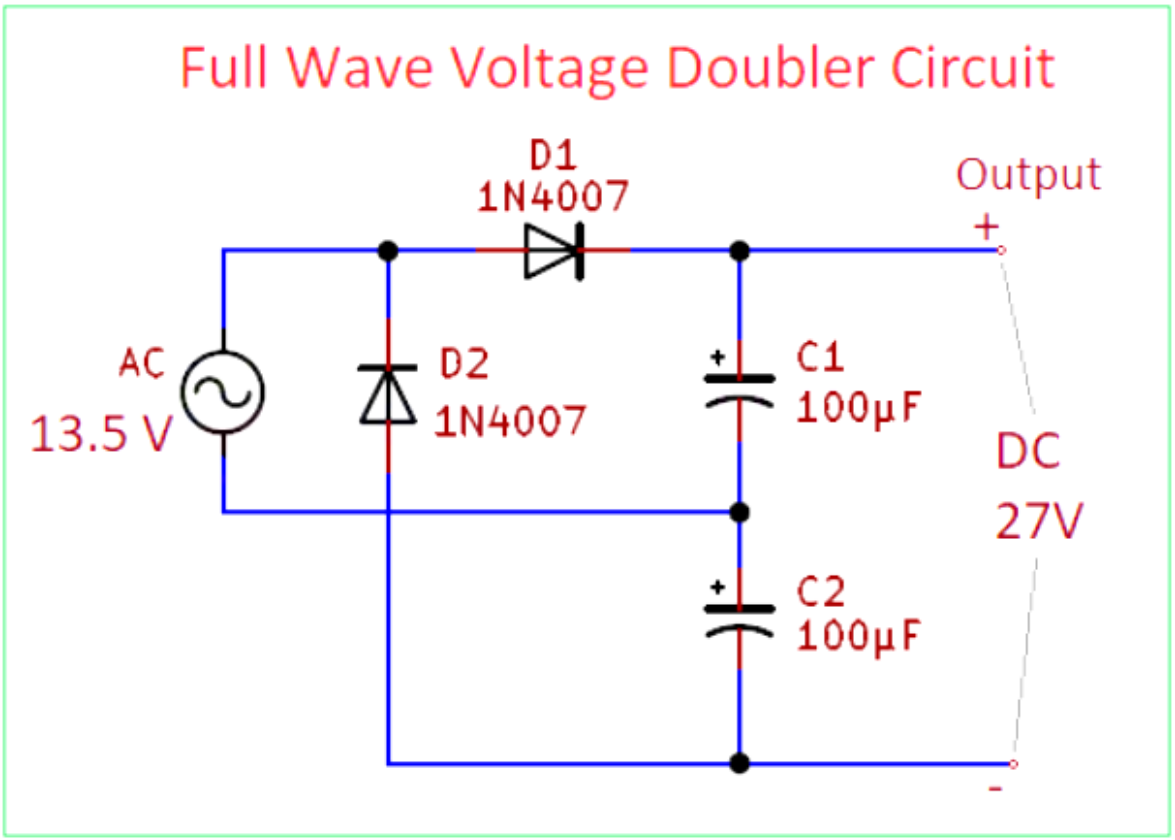
1. Objective

The objective of this project is to design and analyze a Voltage Doubler Circuit that converts an AC input signal into a DC output with approximately twice the peak value of the input voltage. This type of circuit is particularly useful when a higher DC voltage is required without increasing the AC supply voltage or using a transformer with a higher turns ratio.

2. Introduction

A Voltage Doubler Circuit is a type of rectifier circuit that not only converts AC to DC but also doubles the output voltage level. It operates by charging capacitors during alternate half-cycles of the AC waveform and combining their voltages to produce a higher DC voltage. These circuits are commonly used in applications where a higher DC voltage is needed from a low AC supply, such as in CRT monitors, signal demodulation, and power amplifiers.

3. Circuit Diagram



4. Circuit Description

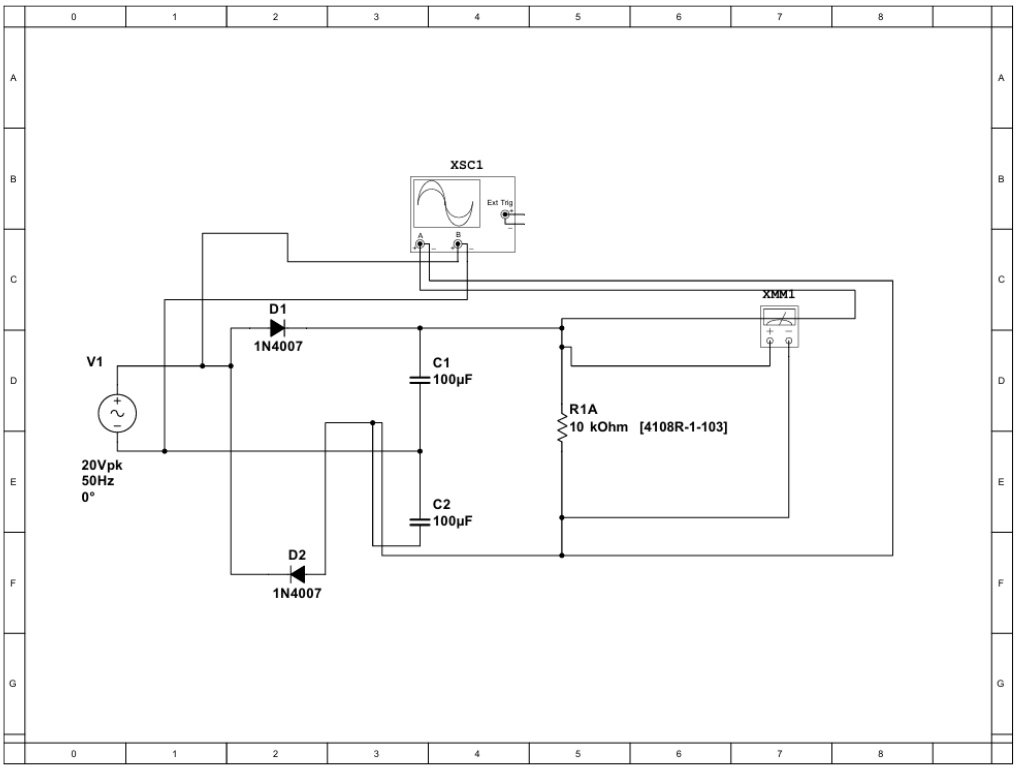
1. **Input Source (V1)**: The AC voltage source provides the input signal, typically a sinusoidal waveform with an amplitude of 20V peak and a frequency of 50Hz.

2. **Diodes (D1, D2 - 1N4007)**: - These diodes are connected in such a way that they conduct during alternate half-cycles of the AC waveform. D1 conducts during the positive half-cycle, charging capacitor C1, while D2 conducts during the negative half-cycle, charging capacitor C2.

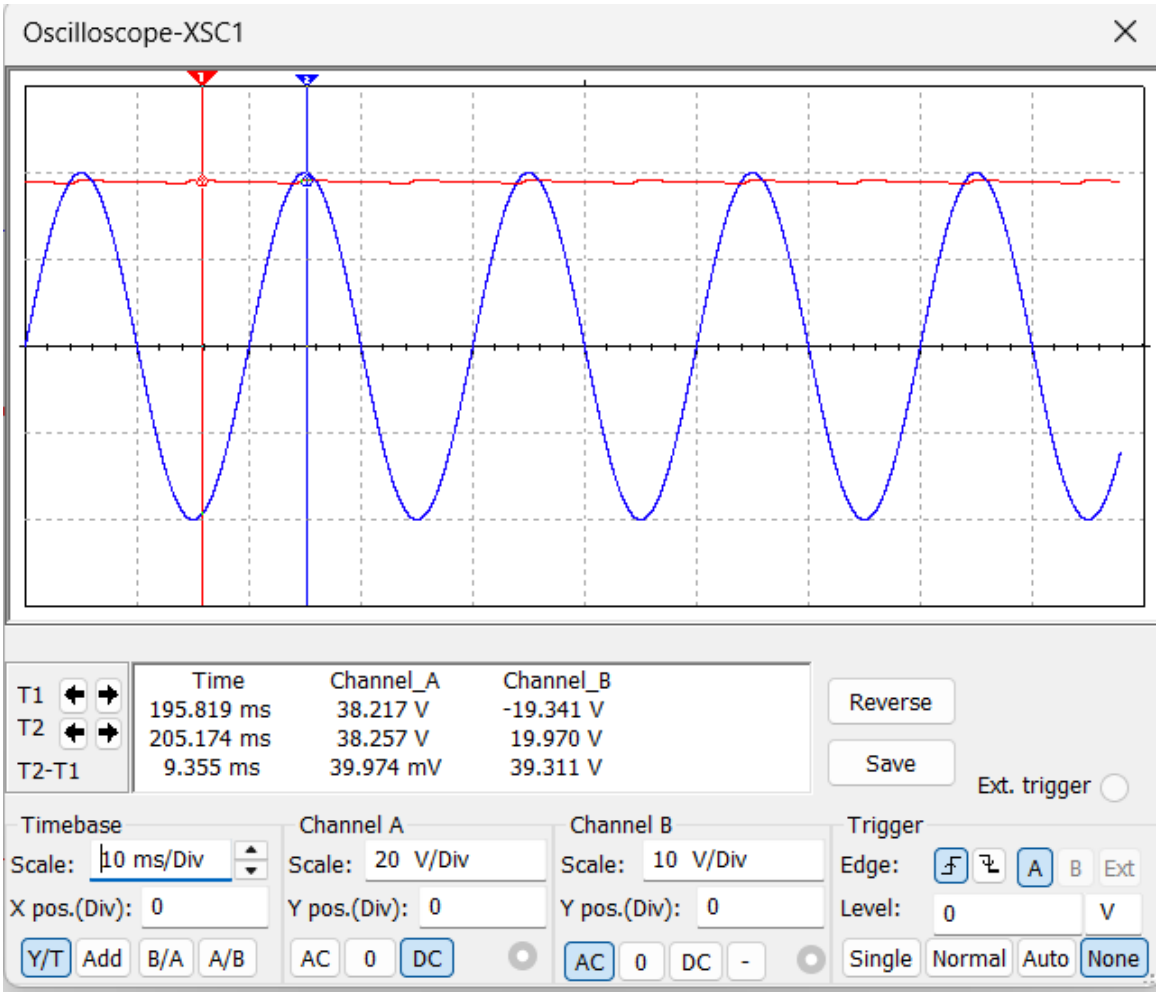
3. **Capacitors (C1 and C2 - 100µF each)**: - These capacitors store and transfer charge during alternate half-cycles. When both capacitors charge to the peak value of the input voltage, the combined voltage across them equals approximately twice the peak input voltage, resulting in the "voltage doubling" effect.

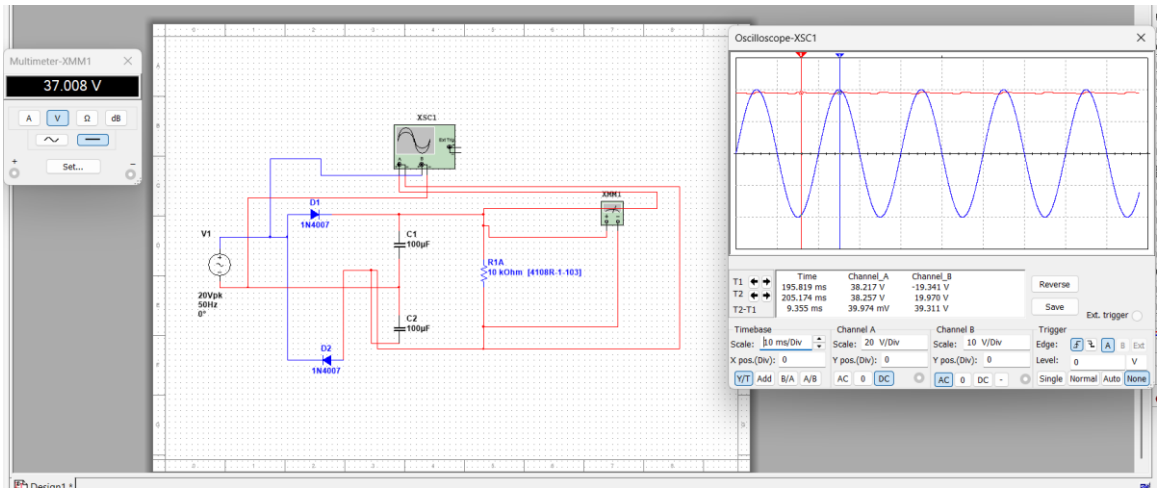
4. **Load Resistor (R1A - 10kΩ)**: - The resistor serves as the load for the circuit and ensures the continuous discharge path for the capacitors. It allows voltage measurement across the output and stabilizes the DC output under varying load conditions.

5. Circuit Diagram on Multisim

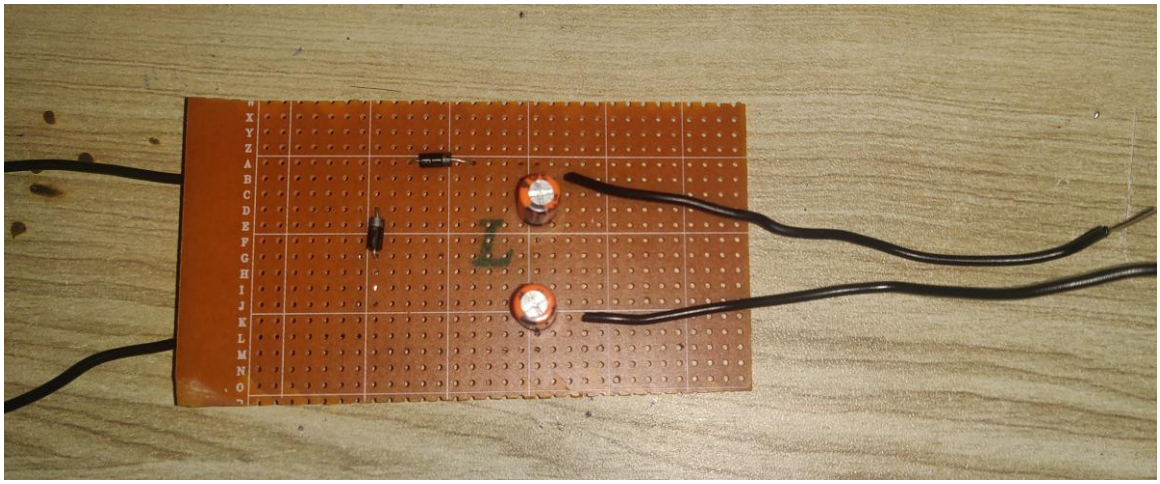


7.Output Waveform and Multimeter reading on Multisim





8.Hardware Implementation



9. Working Principle

During the positive half-cycle, diode D1 conducts, allowing current to flow and charge capacitor C1 up to the peak voltage of the input supply (Vpk). Diode D2 remains reverse-biased during this time.
During the negative half-cycle, diode D2 conducts while D1 is reverse-biased. Capacitor C2 charges through D2, adding to the voltage already stored in C1. As a result, the total voltage across the capacitors becomes approximately twice the peak voltage of the input AC.
Thus, the output across the load resistor (R1A) provides a DC voltage that is nearly twice the peak input voltage.
However, due to diode voltage drops and capacitor losses, the actual output voltage is slightly less than the theoretical 2 × Vpk value.

10. Components Required

S. No	Component	Specification	Quantity
1	AC Voltage Source	20V peak, 50Hz	1
2	Diode	1N4007	2
3	Capacitor C1	100µF/25V	1
4	Capacitor C2	100µF/25V	1
5	Resistor R1A	10kΩ	1
6	Connecting Wires	-	As required

11. Applications

- Used in power supply circuits where higher DC voltage is required from a low AC source.

- Commonly used in cathode-ray tube (CRT) displays and television circuits.
- Employed in RF and microwave transmitters for signal modulation.
- Used in electronic flash circuits of cameras.
- Suitable for experimental and educational demonstrations of rectifier behavior.

12. Advantages

- Simple design and easy to construct.
- Provides high DC voltage without the need for a step-up transformer.
- Cost-effective and reliable circuit.
- Useful for low-current high-voltage applications.

13. Precautions

- Ensure correct polarity of diodes and capacitors before connecting the circuit.
- Avoid touching the circuit when powered as it may store high voltage across capacitors.
- Use capacitors with voltage ratings higher than the expected peak voltage.
- Verify all connections before applying AC input.

14. Result

The constructed Voltage Doubler Circuit successfully converts the input AC voltage (20V peak) into a DC output approximately twice the input peak value. The measured output confirms that the circuit doubles the voltage with minor changes.

15. Conclusion

The Voltage Doubler Circuit is effectively implemented on both hardware and software and simulated on Multisim as well as on CRO and it is doubling the input voltage.