Development of 5V DC To 80V DC-DC Boost Converter

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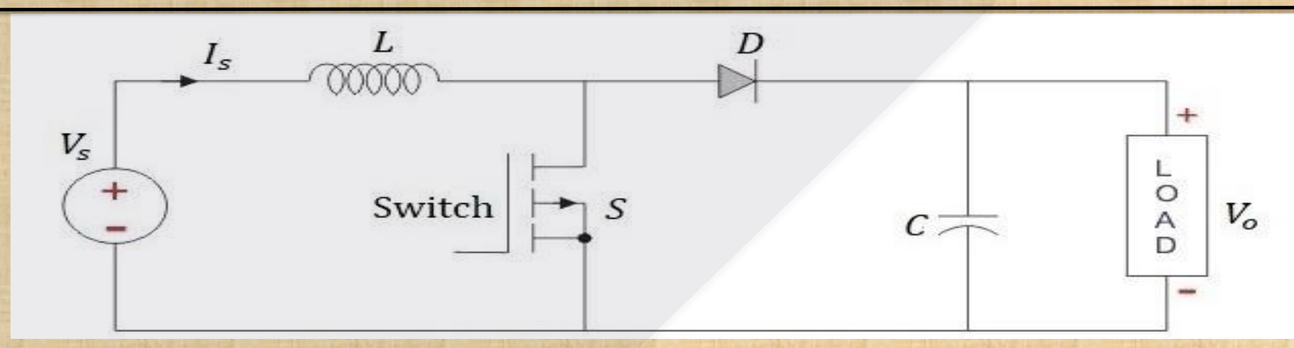
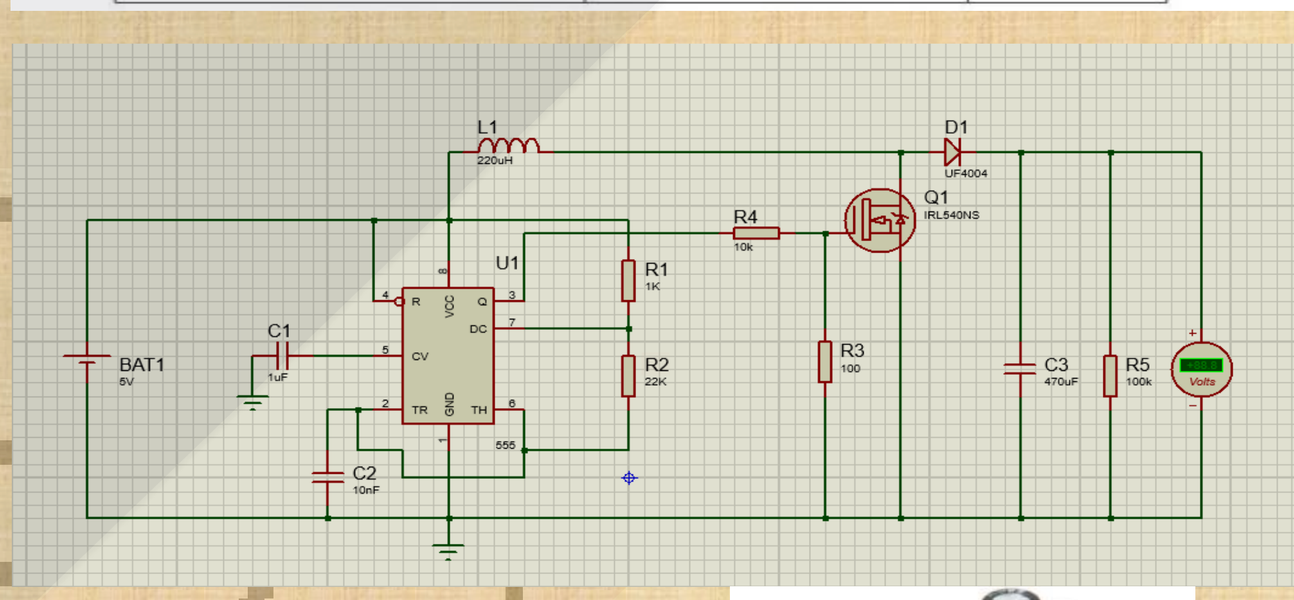
ABSTRACT

This project presents a dual-stage DC-DC boost converter that converts a 5V–10V input into a stable 80V output. The system uses NE555-based PWM control, IRL540N MOSFETs, and an op-amp feedback loop to regulate voltage. Simulations and tests confirm stable performance without microcontroller-based control.

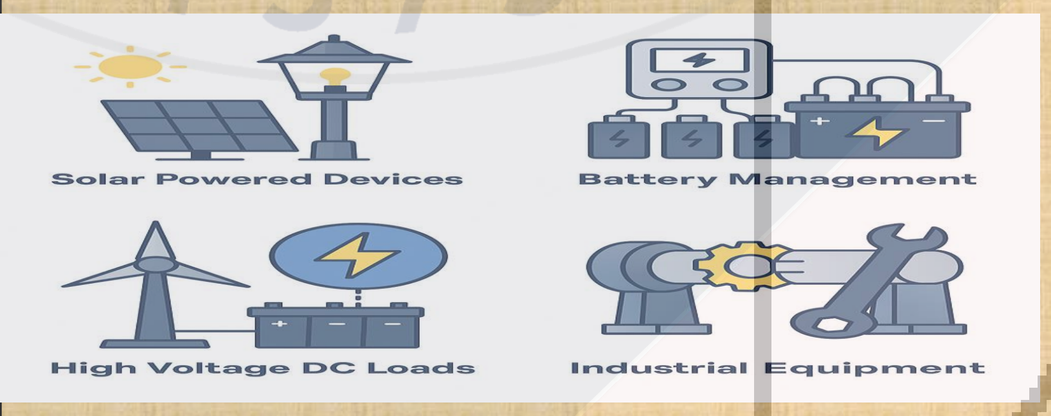


CIRCUIT DIAGRAM

This circuit, which I designed in Proteus, is a simple DC-DC boost converter operating in astable mode using the NE555 timer IC. The PWM signal generated by the NE555 switches the MOSFET, allowing energy to accumulate in the inductor. When the MOSFET turns off, this energy is transferred to the output through a diode, boosting the voltage from 5V to approximately 81.59V. The circuit is built with basic passive components and is suitable for educational and low-power applications. However, since there is no feedback regulation circuit in this design, the output voltage also varies when the input voltage changes.



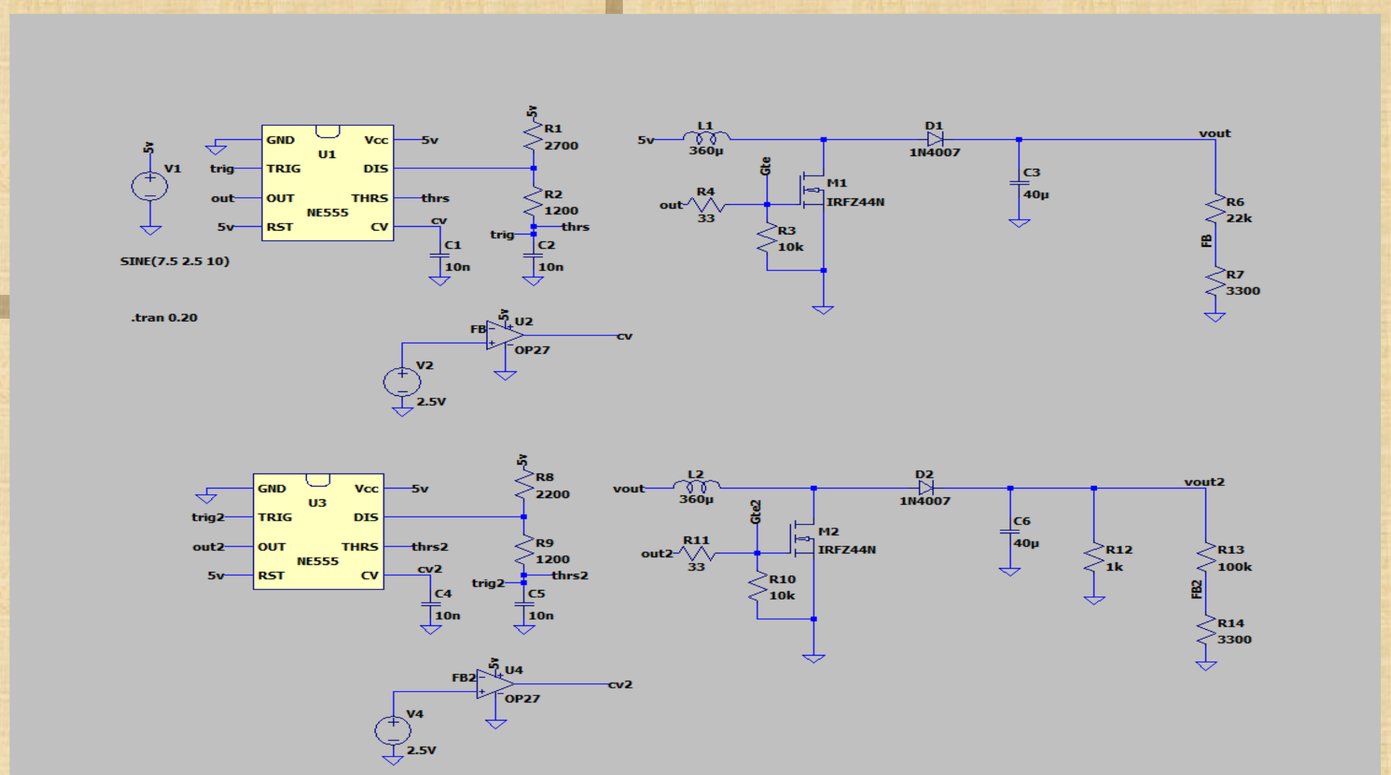
The image shows a high-current **DC-DC Boost Converter Module**, which steps up a lower DC input voltage to a higher, regulated DC output. Key components visible on the board include a large **toroidal inductor**, **electrolytic capacitors**, a **MOSFET**, a **diode**, and a **blue trimpot** for adjusting output voltage. The **aluminum heatsink** at the bottom helps dissipate heat generated during operation. These modules are commonly used in battery charging systems, LED drivers, and portable power supply applications.

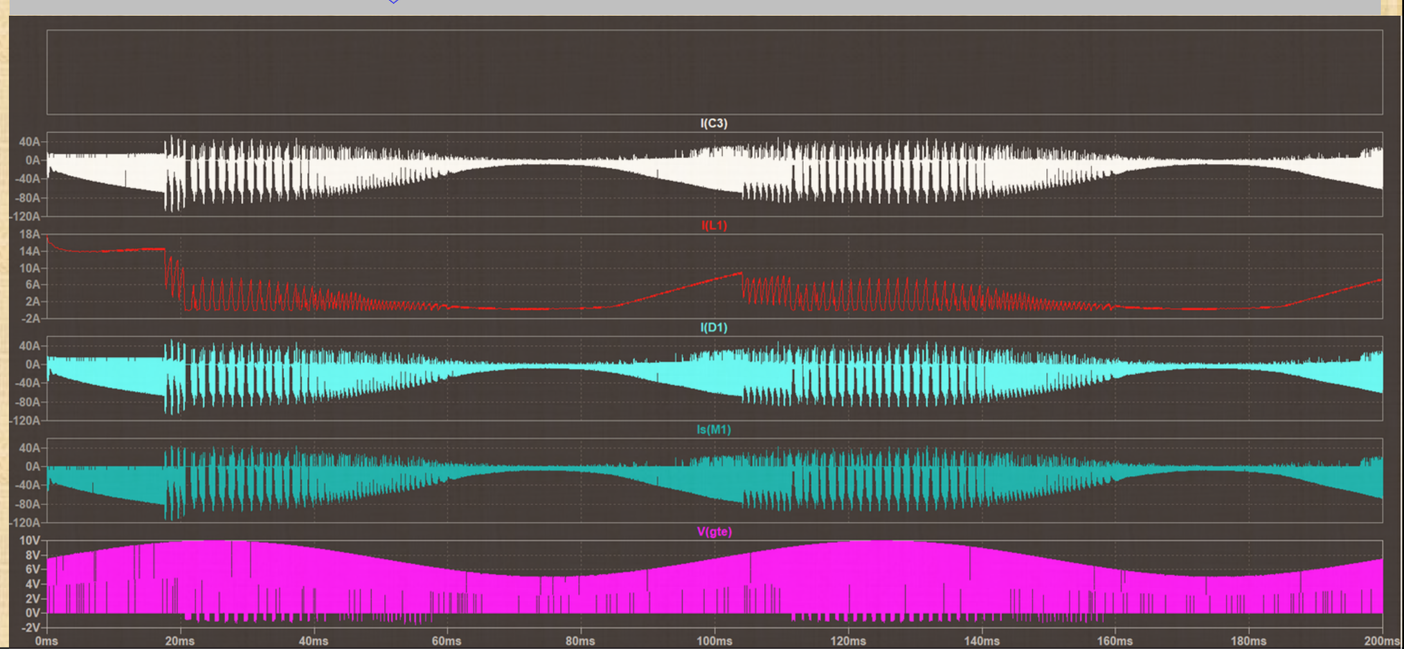


✅ 1. **Solar Powered Devices :**Boost converters are used to step up low voltages from solar panels to power LED lighting or sensor systems.
✅ 2. **Battery Management:**They provide stable voltage in battery management systems to maintain charge levels and improve energy efficiency.
✅ 3. **High Voltage DC Loads:**Ideal for supplying high-voltage DC loads from low-voltage sources.
✅ 4. **Industrial Equipment:**Used in industrial systems to provide regulated high voltage for sensors, control boards, or motor drivers.

HOW IT WORKS

This LTspice circuit simulates a **two-stage DC-DC boost converter** that steps up a 5V input to around 80V. Each stage uses an **NE555 timer IC** to generate a PWM signal that drives an **IRFZ44N MOSFET**, switching an inductor for energy storage. The output voltage is sensed via a resistor divider and compared using an **OP27 operational amplifier**, forming a **feedback loop**. The op-amp controls the NE555's CV pin, dynamically adjusting the duty cycle. This allows the circuit to stabilize the output voltage despite variations in the input.





CONCLUSION

In this project, a two-stage DC-DC boost converter was successfully designed and implemented to generate a stable 80V output from a variable 5V–10V input. By splitting the voltage conversion process into two stages (5V → 20V → 80V), higher efficiency and voltage stability were achieved. The NE555 timer was used for PWM generation, and voltage regulation was accomplished through an op-amp-based feedback circuit. Simulation and experimental results showed that the converter maintained stable output under varying input conditions, with acceptable ripple and around 78% efficiency. This design proved that a microcontroller-free boost converter can deliver high voltage with simple, low-cost components.