

INVERTER

1. Introduction

Electric inverters are essential devices that convert Direct Current (DC) into Alternating Current (AC). These are widely used in regular houses to supply power.

This project demonstrates a simple DC to AC inverter that converts 12V DC from a battery into 220V AC, capable of powering small AC appliances.

2. Objective

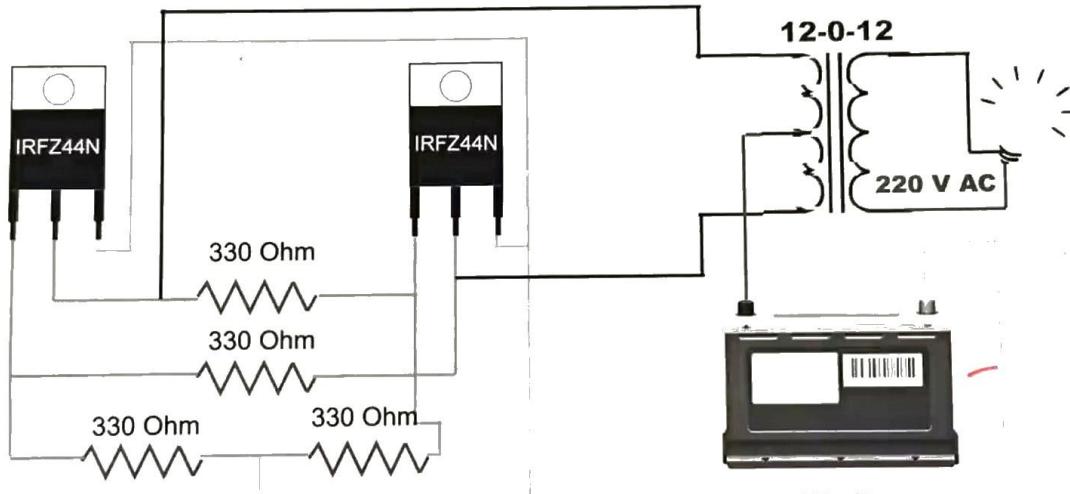
The main objective of this project is to:

- Convert 12V DC into 220V AC (approx) using a simple MOSFET-based switching circuit.
 - Understand the working principle of a push-pull inverter.
 - Study the behaviour of power MOSFETs in switching mode.
 - Design a cost-effective inverter circuit for small loads.
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3. Components Used

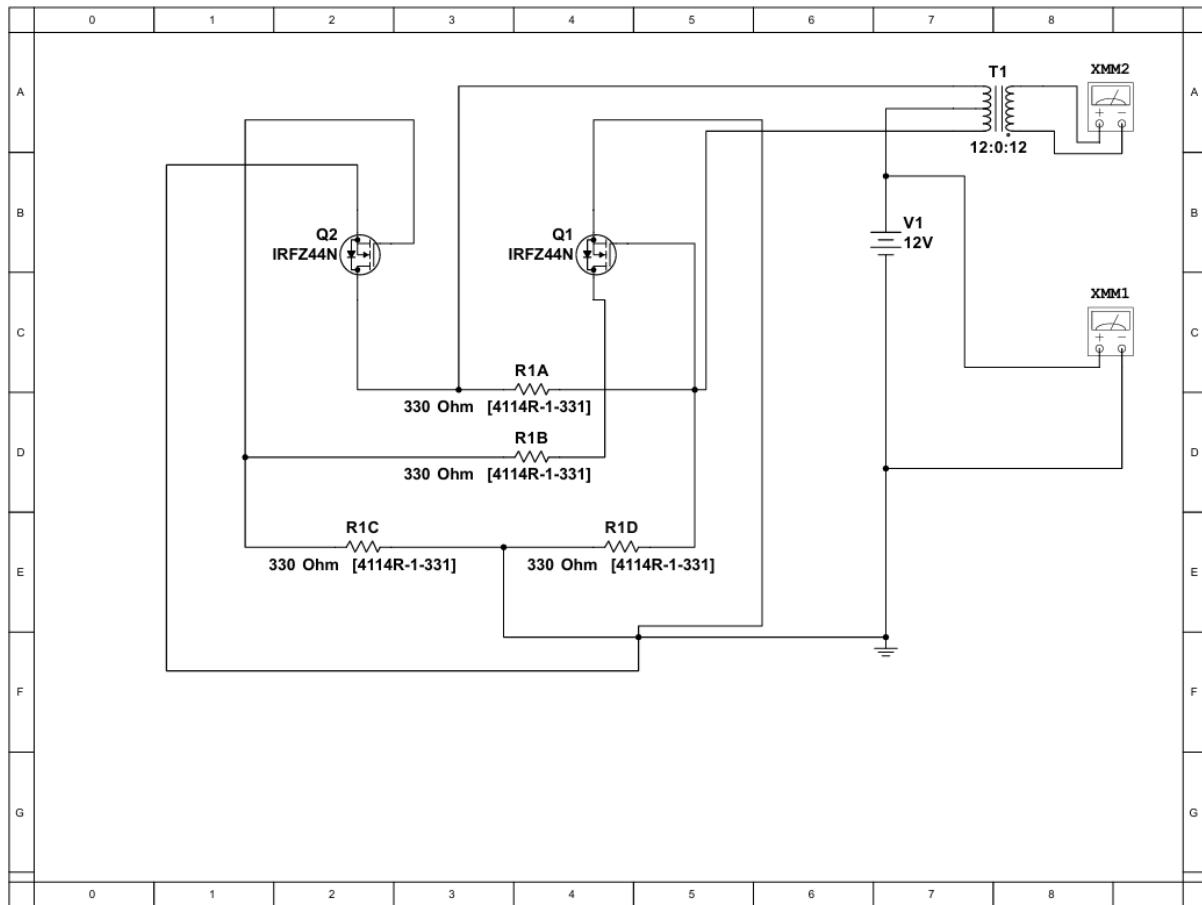
Component	Specification	Quantity	Description
IRFZ44N MOSFET	N-channel Power MOSFET	2	Used as electronic switches to drive the transformer
Transformer	12-0-12V to 220V, 5A	1	Steps up low voltage AC to 220V AC
Resistors	330Ω, 0.25W	4	Gate resistors to limit current
Battery	12V, DC	1	Provides input power to the circuit
Zero PCB	—	—	For circuit connections
Oscillator Circuit (CD4047 / 555 Timer)	Optional	1	Generates alternate switching pulses for MOSFETs

4(a). Circuit Diagram

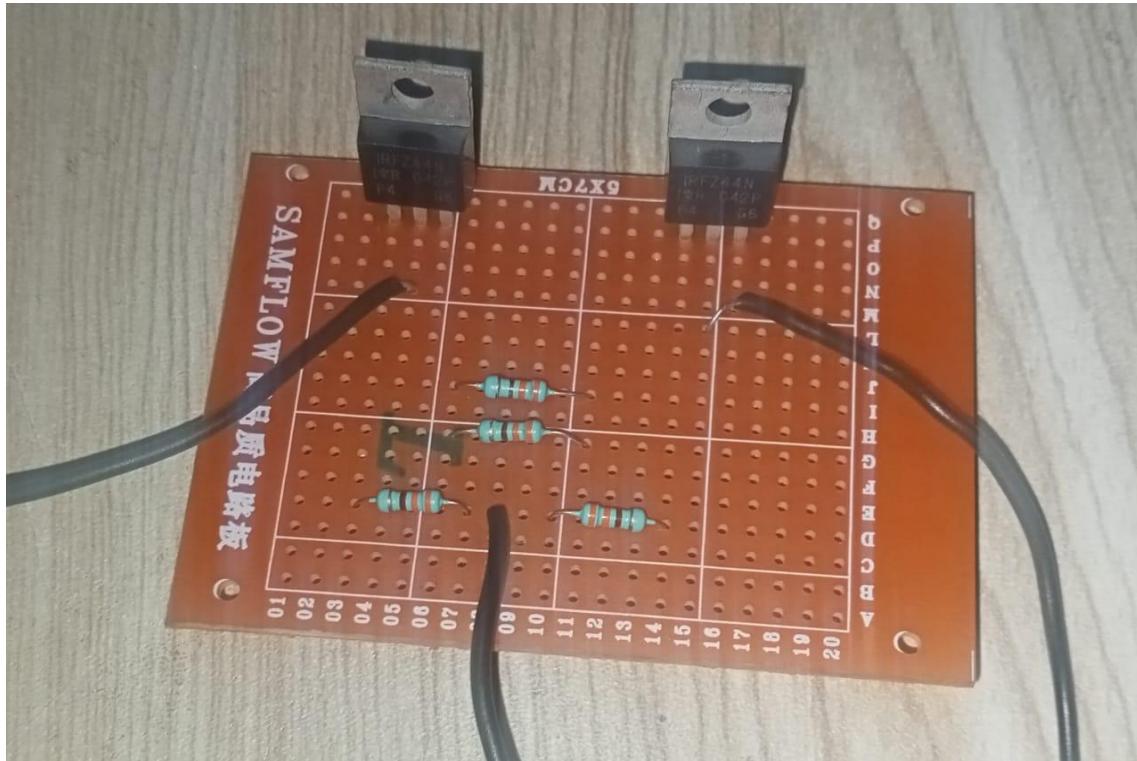


The circuit consists of two IRFZ44N MOSFETs connected in a push-pull configuration. The center tap of the transformer is connected to the positive pin of 12V supply. The other two ends of the primary winding are connected to the drains of the two MOSFETs. Each MOSFET gate is connected to the control signal through a 330Ω resistor.

4(b). Schematic Diagram



4(c). Implementation on Zero PCB



5. Working Principle

Step A — One MOSFET slightly wins

Because no two MOSFETs are perfectly identical, one of them turns on just a little bit faster.

Step B — Current flows in one half of the primary

This creates a rising magnetic flux in the transformer.

Step C — Flux induces a gate signal in the other MOSFET

Through the $330\ \Omega$ resistors:

- The conducting MOSFET gets reinforced (its gate pulled more positive).
- The opposite MOSFET gets reversed (its gate pulled down).

Result:

One MOSFET fully turns on, the other fully turns off.

Step D — Saturation and switch-off

As the core magnetizes, its voltage drops, Gate drive weakens and eventually the first MOSFET shuts off.

Step E — Polarity flips

Now the previously-off MOSFET gets forward gate drive.

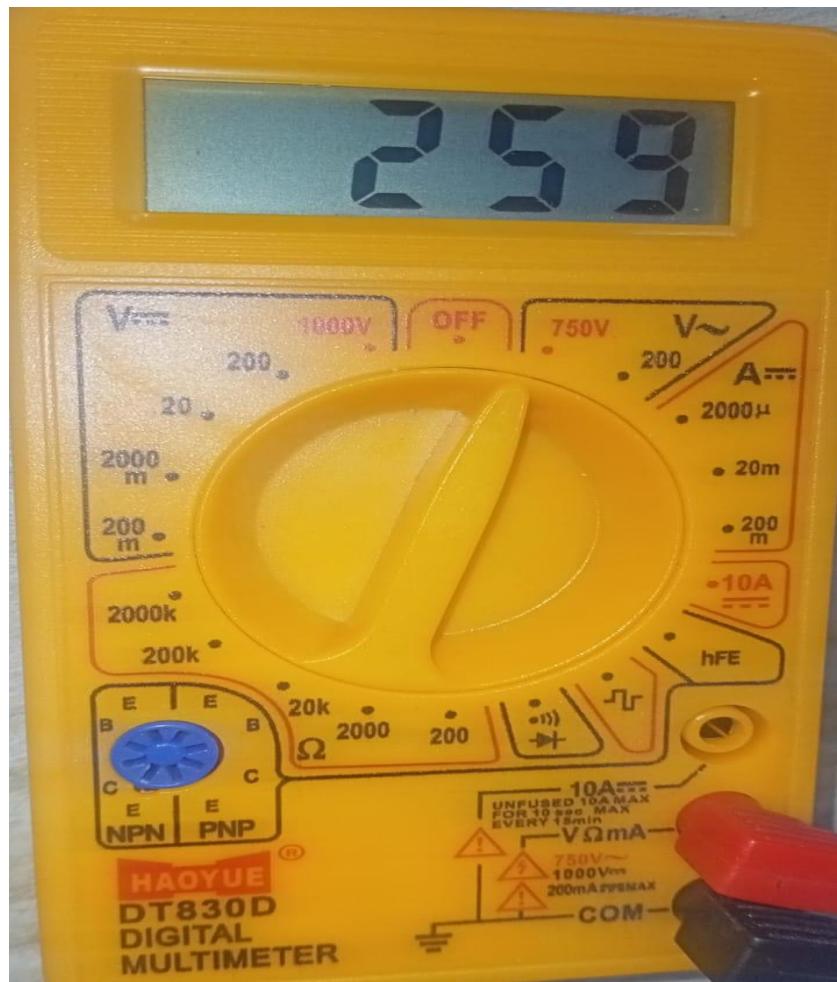
It switches on, and the whole cycle repeats with sides reversed.

Hence due to this we don't need external oscillators.

6(a). Operation Steps

1. Connect the 12V DC battery to the circuit.
2. Observe AC voltage at the transformer's secondary winding using a multimeter.
3. A 220V AC output can be used to power small resistive loads such as bulbs or fans.

6(b). Multimeter Output



7. Applications

- Emergency backup power for small appliances.
 - Portable inverter units.
 - Educational demonstration of inverter working.
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8. Advantages

- Simple and low-cost design.
 - High efficiency with MOSFET switching.
 - Can handle higher loads by changing transformer capacity.
 - Compact and portable circuit.
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9. Limitations

- Unsuitable for sensitive electronic devices (like laptops or audio equipment).
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10. Precautions

- Ensure proper **heat sinking** for MOSFETs.
 - Verify the transformer ratings before connection.
 - Do not short circuit the output.
 - Always check circuit connections before applying power.
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11. Conclusion

This project successfully demonstrates the working of a **12V DC to 220V AC inverter** using **IRFZ44N MOSFETs**.

The design is simple yet effective for understanding inverter fundamentals and can be extended with microcontroller-based control or sine wave modulation for improved performance.