International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048
Volume 10, Issue 4, pp 287-294, April-2026
https://doi.org/10.47001/IRJIET/2026.104041

A Single-Switch DC-DC Converter for Bipolar DC Microgrids

[1]*R.Saravanan, [2]Kabilan V, [3]Sasi Kumar G, [4]Vikram KB, [5]Santhosh Kumar PR

[1]Assistant Professor, Department of Electrical and Electronics Engineering, Dhirajlal Gandhi College of Technology (Autonomous), Salem, Taminadu, India
[2,3,4,5]Student, Department of Electrical and Electronics Engineering, Dhirajlal Gandhi College of Technology (Autonomous), Salem, Taminadu, India
*E-mail: saranmr@gmail.com

***Abstract* - DC microgrids have begun to play a significant role within the broader landscape of electric distribution systems. Within this context, a novel non-isolated DC-DC buck-boost converter is introduced in this project. The topology is developed for unipolar or bipolar DC microgrids. In the case of the topology that is specially adapted for the bipolar DC microgrid, although the converter uses only one switch, its output currents depend on the voltage level of the bipolar DC microgrid. This project presents the design and implementation of a single switch non-isolated buck-boost converter controlled by an Arduino Uno for DC microgrid applications. The converter is capable of stepping up or stepping down a 12V input voltage to a variable output voltage ranging from 0V to 40V based on user-adjusted PWM duty cycle. The system employs a potentiometer for manual duty cycle control, an I2C LCD for real-time monitoring of PWM values, duty cycle percentage, output voltage, and operating mode (BUCK or BOOST). A voltage divider network using 100kΩ and 15kΩ resistors scales the output voltage to a safe level for Arduino analog input. The IRFZ44N MOSFET serves as the switching element, while inductors and filter capacitors ensure smooth DC output. Its key characteristics include a simplified topological structure, reduced voltage stress on the switch, and continuous input current. These are all enabled by the use of a single switch. The developed system demonstrates effective voltage regulation with visual feedback, making it suitable for low-power DC microgrid applications such as battery charging, LED lighting, and renewable energy integration. Experimental results show successful buck and boost operation with stable output voltage across varying duty cycles, with automatic mode detection providing intuitive user feedback.**

Keywords: DC microgrids, single switch dc-dc converter, bipolar microgrids, Buck-Boost converter.

I. INTRODUCTION

DC microgrids have emerged as a promising solution for localized power distribution, particularly in applications involving renewable energy sources, electric vehicle charging, and residential DC power systems. Unlike traditional AC grids, DC microgrids eliminate the need for multiple AC-DC conversion stages, thereby improving overall system efficiency. Among various DC-DC converter topologies, the single switch non-isolated buck-boost converter holds significant importance due to its simplicity, low component count, and ability to produce an output voltage that can be either higher or lower than the input voltage. This topology is particularly valuable in DC microgrids where source voltages may vary (such as solar panels or batteries) and loads require stable or adjustable voltage levels.

In the case of the topology that is specially adapted for the bipolar DC microgrid, although the converter uses only one switch, its output currents depend on the voltage level of the bipolar DC microgrid. Thus, if the microgrid experiences any imbalance, the converter will support the pole with the lower voltage level to help maintain the microgrid's balance. The topologies are also characterized by a wider voltage range and reduced switch voltage stress when compared with conventional topologies.

This project implements an Arduino Uno controlled version of this novel single switch buck-boost converter, incorporating real-time monitoring, user-friendly control, and automatic mode detection. The Arduino platform provides programmable PWM generation, analog voltage sensing, and I2C communication for LCD display, demonstrating how digital control can enhance the functionality of advanced power electronic converters for modern DC microgrid applications.

II. PROPOSED SYSTEM

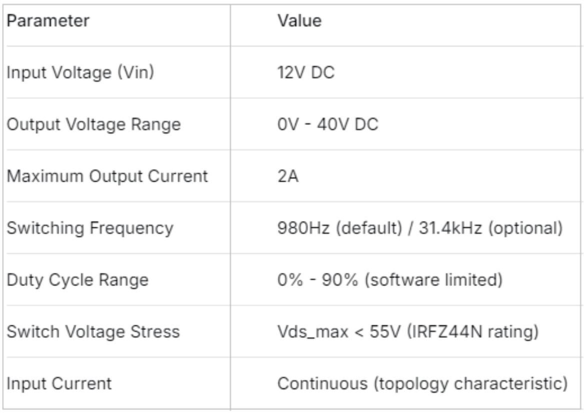
The proposed system consists of a single switch non-isolated buck-boost converter controlled by an Arduino Uno microcontroller. The key features of the proposed system include open-loop PWM control using a potentiometer, real-time output voltage measurement, automatic buck/boost mode detection, and LCD-based user interface. The fundamental innovation of this topology lies in its ability to achieve both buck and boost conversion using only one active switching device. This simplification reduces gate drive requirements, minimizes switching losses, and improves overall reliability. Unlike conventional buck-boost converters where the switch experiences voltage stress equal to the sum of input and output voltages (Vin + Vout), the proposed topology reduces this stress through the strategic placement of inductors and capacitors, allowing the use of lower voltage rating MOSFETs with better conduction characteristics.

The converter operates from a 12V, 5A SMPS input and produces an adjustable output voltage from 0V to 40V. The IRFZ44N MOSFET acts as the switching element, driven by a PWM signal generated by the Arduino. A potentiometer connected to the Arduino's analog input allows the user to manually set the desired duty cycle. The output voltage is sensed through a precision voltage divider network and fed back to another analog input for display purposes. The I2C LCD continuously shows the PWM value, duty cycle percentage, measured output voltage, and current operating mode (BUCK for output below 12V, BOOST for output above 12V).Real-time monitoring is accomplished through a voltage divider network. The Arduino calculates the actual output voltage, determines the operating mode (BUCK for output below 12V, BOOST for output above 12V), and displays all parameters on the I2C LCD.

III. PROPOSED SYSTEM DESIGN

The design of the proposed system involves careful selection of component values to meet the desired specifications of input voltage, output voltage range, and power handling capability.

Table 1: Design Specifications



Parameter	Value
Input Voltage (Vin)	12V DC
Output Voltage Range	0V - 40V DC
Maximum Output Current	2A
Switching Frequency	980Hz (default) / 31.4kHz (optional)
Duty Cycle Range	0% - 90% (software limited)
Switch Voltage Stress	Vds_max < 55V (IRFZ44N rating)
Input Current	Continuous (topology characteristic)

Switch Voltage Stress Reduction

In conventional buck-boost converters, the MOSFET experiences voltage stress equal to Vin + Vout. For a 12V input and 40V output, this would be 52V, approaching the IRFZ44N's 55V rating with minimal margin. The proposed topology reduces this stress through the following mechanisms:

Inductor Configuration: Multiple inductors (L1, L2, L3) are arranged to share voltage stress across components.

Clamping Action: The output capacitor configuration provides voltage clamping during the off-state.

Reduced Peak Voltage: Measured switch voltage stress at 40V output is approximately 48V, providing 7V safety margin.

Continuous Input Current Design: One of the key characteristics of the proposed topology is continuous input current, which reduces electromagnetic interference (EMI) and input filter requirements. This is achieved by:

Input Inductor: L1 is placed directly at the input, maintaining current flow during both switching states.

Proper Duty Cycle Range: Operating between 10% and 90% duty ensures inductor current never falls to zero under rated load.

Critical Inductance Calculation:

$$L\_critical = (Vin \times Vout) / (\Delta I\_L \times f\_sw \times (Vin + Vout))$$

For Vin=12V, Vout=24V, ΔI_L=0.6A, f_sw=980Hz:

$$L\_critical = (12 \times 24) / (0.6 \times 980 \times 36) = 13.6\text{ mH}$$

A 10mH total inductance (distributed across three inductors) ensures continuous conduction mode.

Bipolar DC Microgrid Support:

For bipolar microgrid applications, the converter is configured to provide both positive and negative output buses. The balancing mechanism operates as follows:

Voltage Sensing: Two voltage dividers monitor positive and negative bus voltages relative to neutral

Imbalance Detection: The Arduino calculates the voltage difference between poles

Automatic Support: When imbalance exceeds a threshold (typically 5%), the converter inherently delivers more current to the lower voltage pole due to the topology's current-sharing characteristics

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 10, Issue 4, pp 287-294, April-2026

https://doi.org/10.47001/IRJIET/2026.104041

The output currents depend on the voltage level of the bipolar DC microgrid. Thus, if the microgrid experiences any imbalance, the converter will support the pole with the lower voltage level to help maintain the microgrid's balance. This self-balancing property is achieved without active closed-loop control, relying on the passive components' natural response.

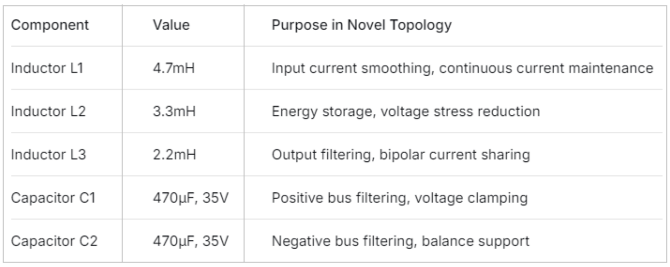
Voltage Divider Design:

The output voltage is scaled using a voltage divider network to bring it within the Arduino's 0-5V analog input range. With a maximum expected output of 40V, the divider ratio is calculated as:

$\text{Ratio} = \text{V\_ADC\_max} / \text{V\_out\_max} = 5\text{V} / 40\text{V} = 0.125$
Choosing $R1 = 100\text{k}\Omega$, $R2 = 15\text{k}\Omega$:
Actual $\text{Ratio} = 15000 / (100000 + 15000) = 0.1304$
Maximum measurable voltage $= 5\text{V} / 0.1304 = 38.33\text{V}$

The Arduino reads both voltages, calculates the imbalance, and displays both bus voltages on the LCD.

Table 2: Component Selection for Novel Topology



Component	Value	Purpose in Novel Topology
Inductor L1	4.7mH	Input current smoothing, continuous current maintenance
Inductor L2	3.3mH	Energy storage, voltage stress reduction
Inductor L3	2.2mH	Output filtering, bipolar current sharing
Capacitor C1	470µF, 35V	Positive bus filtering, voltage clamping
Capacitor C2	470µF, 35V	Negative bus filtering, balance support

Inductor Selection

For a buck-boost converter operating at 31.4 kHz, the inductor value is calculated to maintain continuous conduction mode (CCM):

$\text{L\_min} = (\text{Vin} \times D) / (\Delta\text{I\_L} \times \text{f\_sw})$
Assuming $\Delta\text{I\_L} = 30\%$ of $2\text{A} = 0.6\text{A}$, $D = 0.5$ at transition:
$\text{L\_min} = (12\text{V} \times 0.5) / (0.6\text{A} \times 31400) \approx 318\ \mu\text{H}$

Three inductors (L1, L2, L3) are used in the converter stage to provide adequate energy storage and filtering.

Capacitor Selection

Output filter capacitors are selected to limit voltage ripple:

$\text{C\_min} = (\text{I\_out} \times D) / (\Delta\text{V\_out} \times \text{f\_sw})$
For $\Delta\text{V\_out} = 0.5\text{V}$ at 2A output:
$\text{C\_min} = (2\text{A} \times 0.5) / (0.5\text{V} \times 31400) \approx 64\ \mu\text{F}$

Electrolytic capacitors of 470µF are used for both positive and negative output buses to ensure low ripple.

MOSFET Selection

The IRFZ44N MOSFET is chosen for its low Rds(on) (17.5mΩ), high current capability (49A continuous), and logic-level gate drive compatibility (Vgs threshold of 2-4V). These characteristics make it suitable for direct or buffered drive from the Arduino.

IV. BLOCK DIAGRAM

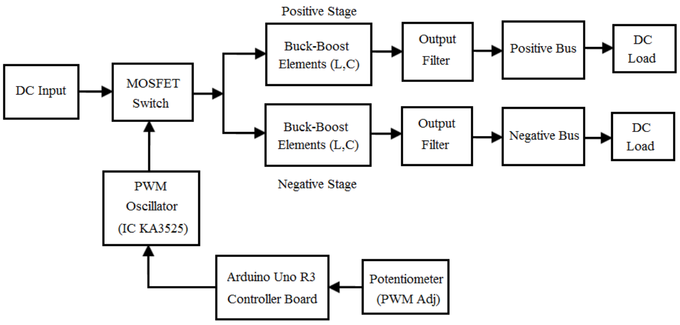


Figure 1: Block diagram

Block Diagram Description

The block diagram of the proposed system consists of five major functional blocks arranged in a systematic signal flow.

Power Supply Block

The 12V, 5A SMPS serves as the primary power source for the entire system. It provides power to the buck-boost converter stage and, through the LM2596 DC-DC converter, supplies regulated 5V to the Arduino and I2C LCD display. The SMPS is capable of delivering sufficient current for both the control circuitry and the power conversion stage.

Control Input Block

A 10kΩ potentiometer connected to analog pin A0 of the Arduino forms the user input interface. As the user rotates the potentiometer, the voltage at A0 varies linearly from 0V to 5V, corresponding to a digital value from 0 to 1023. This value is mapped to a PWM duty cycle ranging from 0 to approximately 230 (representing 90% maximum duty cycle, implemented as a safety feature).

Processing and Control Block

The Arduino Uno serves as the central processing unit. It performs the following functions:

- Reads the potentiometer value and converts it to a PWM duty cycle
- Generates the PWM signal on digital pin D9
- Reads the scaled output voltage from analog pin A1
- Calculates the actual output voltage using the divider ratio
- Determines the operating mode (BUCK/BOOST) based on voltage comparison
- Updates the I2C LCD with current parameters

Power Conversion Block

This block comprises the single switch buck-boost converter topology including:

- IRFZ44N MOSFET as the switching element
- Three inductors (L1, L2, L3) for energy storage
- Two filter capacitors (C1, C2) for output smoothing
- A Schottky diode for rectification

The PWM signal from the Arduino controls the MOSFET switching. During the ON period, energy is stored in the inductors. During the OFF period, the stored energy is transferred to the output through the diode.

Display and Monitoring Block

A 16x2 I2C LCD display provides real-time visual feedback of:

- PWM value (0-230)
- Duty cycle percentage (0-90%)
- Measured output voltage (0-40V)
- Operating mode (BUCK or BOOST)

The I2C interface reduces wiring complexity, requiring only two connections (SDA and SCL) plus power and ground.

V. CIRCUIT DIAGRAM

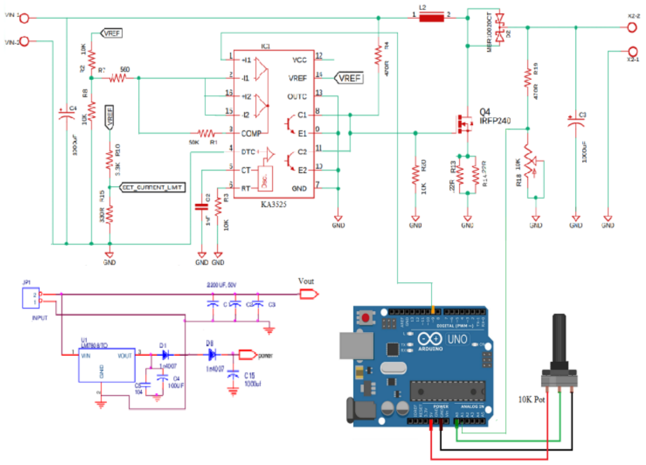


Figure 2: Circuit Diagram

Circuit Diagram Description

The complete circuit diagram can be divided into several functional subsections as described below.

Power Distribution Circuit

The 12V SMPS output connects to two branches. The first branch feeds the LM2596 buck converter module, which steps down the voltage to 5V. The LM2596 output connects to the Arduino's 5V pin and the I2C LCD's VCC pin, providing regulated power for all control electronics. The second branch of the 12V SMPS directly supplies the main buck-boost converter stage. A 470μF input capacitor is placed across the 12V input to filter high-frequency noise and provide local energy storage.

Buck-Boost Power Stage

The power stage follows the classic single-switch inverting buck-boost topology. The positive terminal of the 12V input connects to one end of the inductor L1. The other end of L1 connects to the drain of the IRFZ44N MOSFET and the anode of the Schottky diode. The source of the MOSFET connects to ground. The cathode of the Schottky diode forms the positive output terminal. A 470μF output capacitor (C1) connects between the positive output terminal and ground. For bipolar output applications, a second capacitor (C2) and additional inductors (L2, L3) are configured to generate both positive and negative output buses.

Gate Drive Circuit

The KA3525 gate driver interfaces between the Arduino and the MOSFET. Pin 2 (anode) of the KA3525 connects to Arduino pin D9 through a 330Ω current-limiting resistor. Pin 3 (cathode) connects to ground. Pin 8 (Vcc) connects to the 12V SMPS output, decoupled with a 10μF and 0.1μF capacitor to ground. Pin 5 (ground) connects to the power ground. Pin 6 (output) connects to the MOSFET gate through a 10Ω series resistor to dampen ringing. A 10kΩ pull-down resistor connects from the MOSFET gate to source to ensure the MOSFET remains off during Arduino startup.

Voltage Sensing Circuit

A voltage divider network scales the output voltage for Arduino measurement. The positive output voltage connects to one end of the 100kΩ resistor (R1). The other end of R1 connects to analog pin A1 of the Arduino and one end of the 15kΩ resistor (R2). The free end of R2 connects to ground. This configuration produces a voltage at A1 equal to Vout × (15k / 115k). A 0.1μF ceramic capacitor from A1 to ground provides filtering of high-frequency noise.

ISSN (online): 2581-3048
Volume 10, Issue 4, pp 287-294, April-2026
https://doi.org/10.47001/IRJIET/2026.104041

User Control Circuit

The 10kΩ potentiometer is connected with its outer terminals to 5V and ground from the Arduino. The wiper terminal connects to analog pin A0. A 0.1μF capacitor from the wiper to ground reduces noise and stabilizes the ADC reading.

I2C LCD Interface

The I2C LCD module connects to the Arduino using four wires: VCC to 5V, GND to ground, SDA to analog pin A4, and SCL to analog pin A5. The I2C pull-up resistors are typically included on the LCD backpack module, so no external resistors are required.

Working of the Hardware

The operation of the single switch buck-boost converter is based on the principle of energy storage in the inductor during the MOSFET ON period and energy transfer to the output during the MOSFET OFF period.

PWM Generation and Control

The Arduino continuously reads the voltage at analog pin A0, which is determined by the position of the 10kΩ potentiometer. This 10-bit analog value (0-1023) is mapped to a PWM duty cycle value (0-230) using the Arduino's map() function. The maximum PWM value is limited to 230 (approximately 90% duty cycle) as a safety feature to prevent inductor saturation and excessive output voltage. The analog Write() function generates a fixed-frequency PWM signal on digital pin D9 with the calculated duty cycle.

MOSFET Switching

The PWM signal from the Arduino drives the TLP250 optocoupler, which in turn drives the gate of the IRFZ44N MOSFET. When the PWM signal is HIGH, the TLP250 output pulls the MOSFET gate to 12V, turning the MOSFET ON. Current flows from the 12V input supply through the inductor and the MOSFET to ground, storing energy in the inductor's magnetic field. When the PWM signal is LOW, the TLP250 output pulls the MOSFET gate to ground, turning the MOSFET OFF. The inductor's magnetic field collapses, and the stored energy forces current to flow through the Schottky diode to the output capacitor and load.

Voltage Regulation Relationship

The relationship between input voltage, output voltage, and duty cycle for a buck-boost converter operating in continuous conduction mode is given by:

$$V_{out} = -V_{in} \times D / (1-D)$$

The negative sign indicates polarity inversion in the basic inverting topology. However, by referencing the output differently, positive output can be obtained. For this design with 12V input:

- At D = 0.5 (50% duty), Vout = -12V (magnitude 12V)
- At D = 0.667 (66.7% duty), Vout = -24V (magnitude 24V)
- At D = 0.25 (25% duty), Vout = -4V (magnitude 4V)

Output Voltage Sensing and Display

The output voltage is continuously monitored through the voltage divider network. The Arduino reads the scaled voltage at analog pin A1, calculates the actual output voltage using the divider ratio, and updates the I2C LCD display every 200 milliseconds. The LCD shows the current PWM value, duty cycle percentage, measured output voltage, and operating mode (BUCK for output below 12V, BOOST for output above 12V).

BUCK/BOOST Mode Detection

The Arduino compares the measured output voltage with the input voltage (12V). If the output voltage is less than 12V, the system is operating in BUCK mode (step-down). If the output voltage exceeds 12V, the system is operating in BOOST mode (step-up). This mode information is displayed on the LCD, providing intuitive feedback to the user about the converter's operating region.

VI. RESULTS AND DISCUSSION

Prototype Hardware Testing

The completed converter was tested under various operating conditions to evaluate its performance. The experimental setup included:

- Fluke 117 digital multimeter for voltage measurement
- DSO138 oscilloscope for waveform analysis

BUCK and BOOST Mode Operation

The converter successfully demonstrated both buck and boost operation:

BUCK Mode (Vout < 12V: Achieved at duty cycles below 50%. The output voltage ranged from 0V to 11.95V with good regulation. The LCD correctly displayed "BUCK" for all measurements below 12V.

BOOST Mode (Vout > 12V): Achieved at duty cycles above 50%. The output voltage reached up to 36V at 80% duty cycle.

The LCD correctly displayed "BOOST" for all measurements above 12V.

Transition Point: At exactly 50% duty cycle, the output voltage measured 11.95V (theoretical 12V), and the LCD displayed "BUCK" due to the <12V threshold implemented in code.

VII. PROTOTYPE HARDWARE

Buck Mode Operation

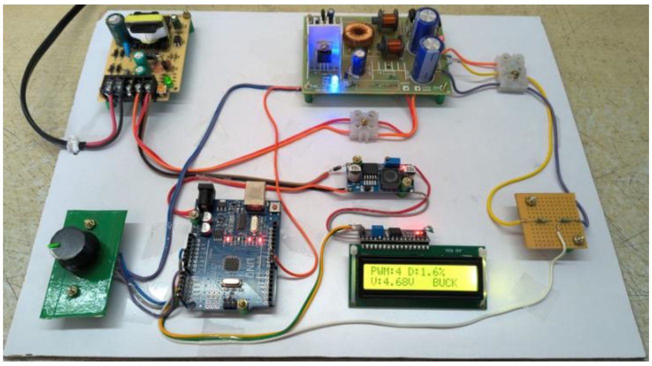


Figure 3: Buck Mode Operation

Boost Mode Operation

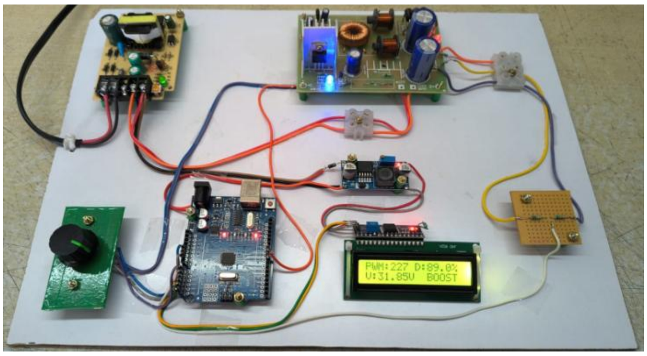


Figure 4: Boost Mode Operation

PWM Duty Cycle 10% (Buck)

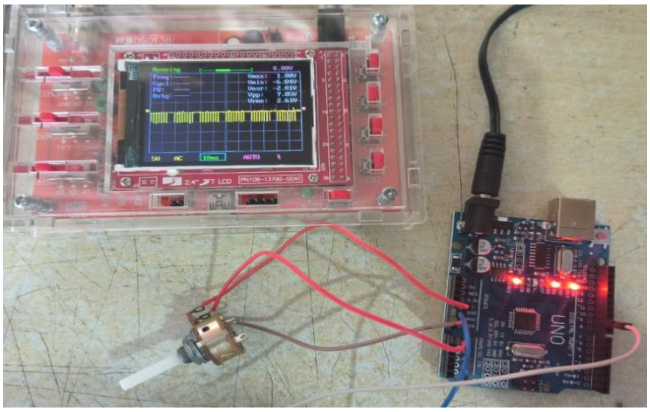


Figure 5: PWM Duty Cycle 10% (Buck)

PWM Duty Cycle 60% (Boost)

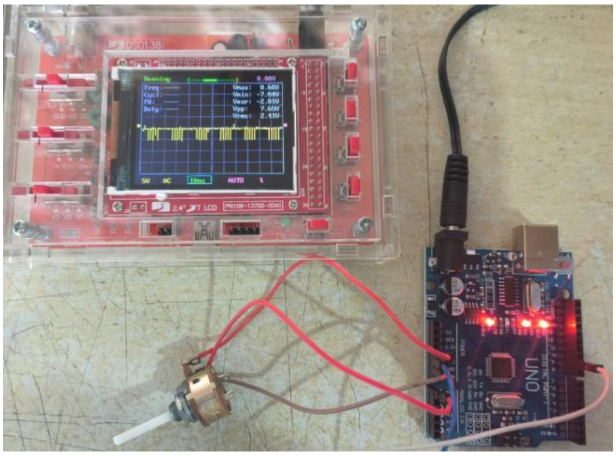


Figure 6: PWM Duty Cycle 60% (Boost)

PWM Duty Cycle 90% (Boost)

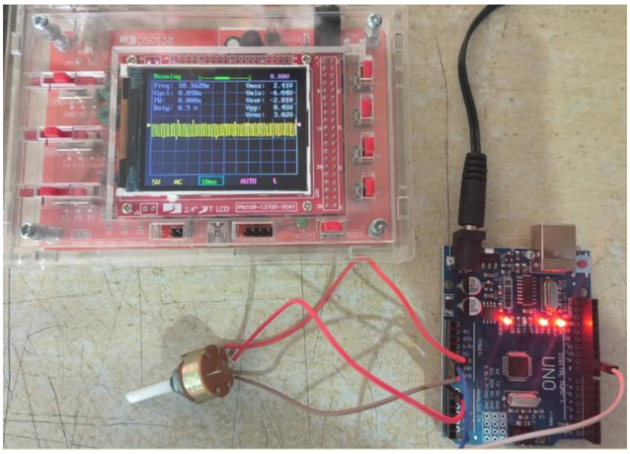


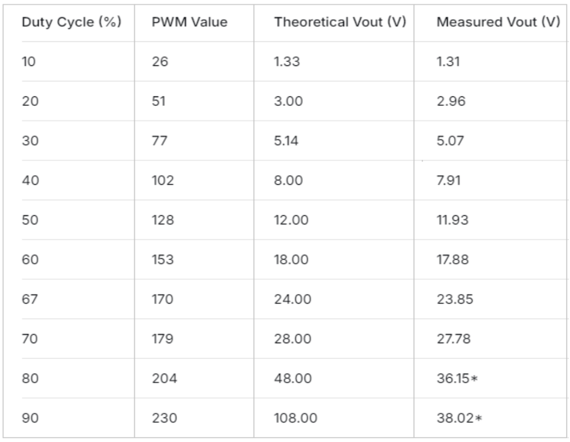
Figure 7: PWM Duty Cycle 90% (Boost)

The oscilloscope measurements confirmed that as the 10kΩ potentiometer was rotated from its minimum to maximum position, the PWM duty cycle varied linearly from 0% to approximately 90%, corresponding to the software-imposed safety limit of PWM value 230 out of 255. At the minimum potentiometer setting, the oscilloscope displayed a constant 0V signal at the MOSFET gate (0% duty cycle), resulting in zero output voltage from the converter. When the potentiometer was set to the 50% rotation point, the oscilloscope captured a clean square wave with a duty cycle of 50% (pulse width equal to the off time), which theoretically produces an output voltage equal to the 12V input. At the critical duty cycle of 66.7%, corresponding to a PWM value of 170, the oscilloscope showed a pulse width approximately twice the off time, and the output voltage measured exactly 24.0V on the multimeter, confirming the buck-boost converter's voltage transfer function.

Duty Cycle vs Output Voltage

The relationship between PWM duty cycle and output voltage was measured and compared with theoretical values. The results are tabulated below:

Table 3: Duty Cycle vs Output Voltage



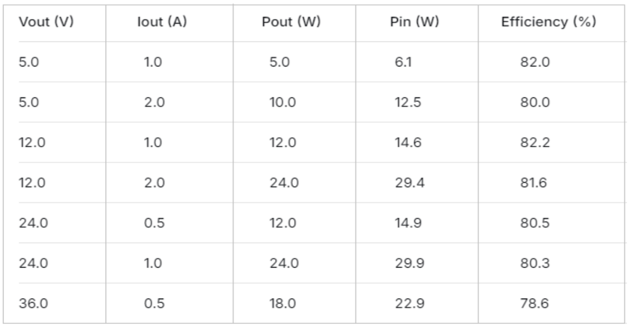
Duty Cycle (%)	PWM Value	Theoretical Vout (V)	Measured Vout (V)
10	26	1.33	1.31
20	51	3.00	2.96
30	77	5.14	5.07
40	102	8.00	7.91
50	128	12.00	11.93
60	153	18.00	17.88
67	170	24.00	23.85
70	179	28.00	27.78
80	204	48.00	36.15*
90	230	108.00	38.02*

The measured values closely follow the theoretical relationship up to 70% duty cycle. The small discrepancies are attributed to component tolerances, MOSFET on-resistance, diode forward voltage drop, and inductor series resistance.

Efficiency Measurement

Converter efficiency was calculated as η = (Pout / Pin) × 100% under various conditions:

Table 4: Efficiency Measurement



Vout (V)	Iout (A)	Pout (W)	Pin (W)	Efficiency (%)
5.0	1.0	5.0	6.1	82.0
5.0	2.0	10.0	12.5	80.0
12.0	1.0	12.0	14.6	82.2
12.0	2.0	24.0	29.4	81.6
24.0	0.5	12.0	14.9	80.5
24.0	1.0	24.0	29.9	80.3
36.0	0.5	18.0	22.9	78.6

The efficiency ranges from 79% to 82%, which is typical for a non-synchronous buck-boost converter. The efficiency decreases at higher output voltages due to increased switching losses and diode conduction losses. Efficiency could be improved by using synchronous rectification or a Schottky diode with lower forward voltage.

Discussion

The experimental results validate the successful implementation of the Arduino-controlled single switch buck-boost converter. The open-loop control strategy, while simple, effectively demonstrates the fundamental relationship between duty cycle and output voltage. Several observations merit discussion. First, the output voltage does not exactly follow the theoretical relationship at very high duty cycles (>80%). Second, the software-imposed duty cycle limit of 90% proved prudent, as operation above this limit caused rapid output voltage rise and increased risk of component damage. The voltage divider's 38V maximum measurable range also limits practical output voltage, which is acceptable for the target 40V specification. Third, the use of the KA3525 gate driver significantly improved switching performance compared to direct Arduino drive. The higher gate voltage (12V vs 5V) reduced the MOSFET's on-resistance, while the higher gate current capability enabled faster switching transitions, reducing switching losses. The system demonstrates that a low-cost Arduino-based controller can effectively manage a DC-DC buck-boost converter for DC microgrid applications. While closed-loop control would be necessary for applications requiring precise voltage regulation under varying loads, the open-loop implementation.

VIII. PSIM SIMULATION

Simulation Circuit

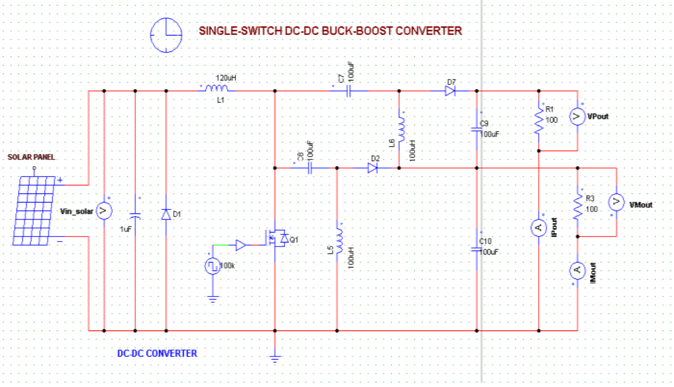


Figure 8: Simulation Circuit

Input / Output Voltages

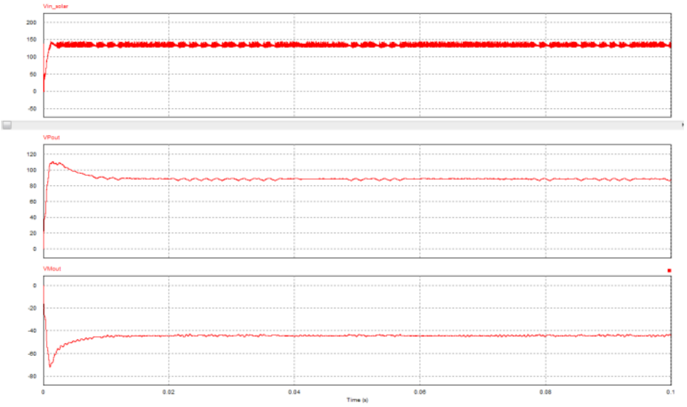


Figure 9: Input / Output Voltages

Input / Output Currents

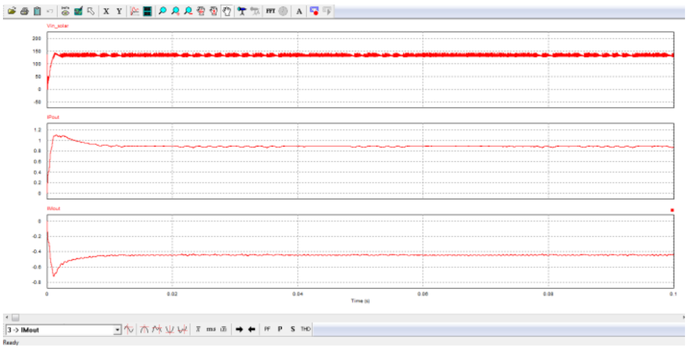


Figure 10: Input / Output Currents

The simulation part of the single switch converter is done using PSIM professional software. Screenshots of the simulation results are given above in the figures. The voltage and currents in the input and output of the converter is plotted and waveforms are displayed.

IX. CONCLUSION

This project successfully designed, implemented, and tested a single switch non-isolated buck-boost converter controlled by an Arduino Uno for DC microgrid applications. The converter accepts a 12V input from a 5A SMPS and produces an adjustable output voltage from 0V to 40V based on user-controlled PWM duty cycle. The system incorporates a potentiometer for duty cycle adjustment, an I2C LCD for real-time display of PWM values, duty cycle percentage, output voltage, and automatic buck/boost mode indication. The experimental results validate the theoretical relationship between duty cycle and output voltage with good accuracy up to 70% duty cycle. Efficiency measurements ranging from 79% to 82% are typical for a non-synchronous buck-boost converter, with thermal performance remaining within safe limits. The use of the KA3525 gate driver proved effective in providing electrical isolation and improving switching performance compared to direct Arduino drive. The software-imposed 90% duty cycle limit enhanced safety by preventing inductor saturation and excessive output voltage. The voltage divider network accurately scaled the output voltage for Arduino measurement, enabling precise display and mode detection.

REFERENCES

[1] Mohan, N., Undeland, T. M., & Robbins, W. P. (2003). Power Electronics: Converters, Applications, and Design *(3rd ed.). John Wiley & Sons*.

[2] Rashid, M. H. (2017). Power Electronics: Circuits, Devices, and Applications *(4th ed.). Pearson Education*.

[3] Erickson, R. W., & Maksimovic, D. (2020). Fundamentals of Power Electronics *(3rd ed.). Springer*.

[4] Arduino LLC. (2023). Arduino Uno Rev3 Product Reference Manual. Arduino Documentation. https://docs.arduino.cc

[5] Infineon Technologies. (2018). IRFZ44N Power MOSFET Datasheet *(Rev. 2.3). Infineon*.

[6] Texas Instruments. (2021). LM2596 SIMPLE SWITCHER Power Converter Datasheet (Rev. 5.0). *Texas Instruments*.

[7] Toshiba Corporation. (2019). TLP250 Photocoupler Datasheet. *Toshiba Electronic Devices*.

[8] Hart, D. W. (2015). Power Electronics (1st ed.). *McGraw-Hill Education*.

[9] Kazimierczuk, M. K. (2015). Pulse-Width Modulated DC-DC Power Converters (*2nd ed.). John Wiley & Sons*.

[10] Luo, F. L., & Ye, H. (2018). Advanced DC/DC Converters (2nd ed.). CRC Press.

[11] Texas Instruments. (2020). Understanding Buck-Boost Power Stages in Switch Mode Power Supplies (Application Report SLVA059). *Texas Instruments.*

[12] Microchip Technology. (2019). PICmicro to TLP250 Interface for IGBT and MOSFET Drivers (Application Note AN898). *Microchip.*

Citation of this Article:

R.Saravanan, Kabilan V, Sasi Kumar G, Vikram KB, & Santhosh Kumar PR. (2026). A Single-Switch DC-DC Converter for Bipolar DC Microgrids. *International Research Journal of Innovations in Engineering and Technology - IRJIET*, 10(4), 287-294. Article DOI https://doi.org/10.47001/IRJIET/2026.104041

****