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SOLAR PV BASED DC TO DC BOOST CONVERTER FOR WATER PUMPING SYSTEM

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ABSTRACT

In this paper we learn that the switching mode power supply are use in market to quick operation in power system. So, we design DC to DC boost converter to convert variable dc to fixed dc supply. This is a electronic circuit. The boost power converters play in important role in solar powers system. It is a step of transformer; it is also known as DC chopper. This paper presents the overview of the various boost converter topologies. Boost converter is made up of inductors, capacitors, resistance and MOSFET. MOSFET is used as a switch. They have a negative site of this project varied efficiency level under changed weather condition. Each boost convertor is evaluated on its capability to implement to operate efficient, size and cost of implementation. The objective of this project is to maximize efficiency to standalone PV system under changed of solar power levels.

Keywords: Boost Converter, Dc To Dc Boost Converter, DC Converter.

I. INTRODUCTION

A solar cell is a device that converts light into electric power using the photovoltaic effect. The first solar cell was constructed in 1880s by Charles Fritts. Solar power is about the conversion of renewable energy from sunlight into electricity. In technical applications, it is required to convert a fixed voltage DC source to variable voltage DC output. Light can convert into an electric current by photovoltaic cells using the photovoltaic effect. Combination of photovoltaic cell to made a solar panel. It can be used as a step up and step down a DC voltage source, as per requirement. DC converter are widely used in traction motor control and various power electronic device control in electrical equipment. They provide high efficiency, good acceleration control and dynamic resources.

The function of class of switched mode power (SMPS) containing at least two semi-conductors device like diode and transistor. A capacitor, inductors, or the two in combinations. To reduce voltage ripples, capacitors filters is used.

In a DC-to-DC boost converter the output voltage is change by the PWM signal to be above or equal V in. As power is used, a boost converter 3x time the input voltage will be able to the supply 1/3rd the current that it draws from the supply

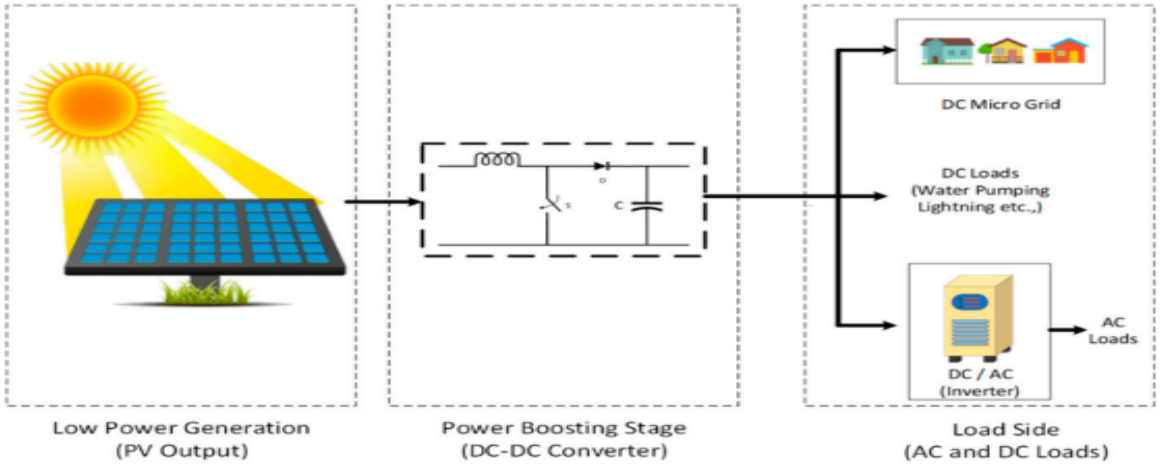

Figure 1. Solar PV integrated system with DC–DC converters fed to the load

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II. METHODOLOGY

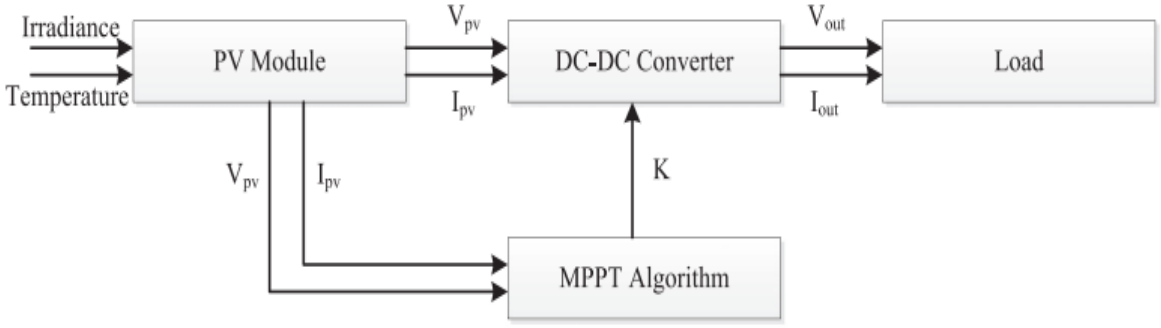

Figure 2. Block diagram of dc-to-dc boost converter.

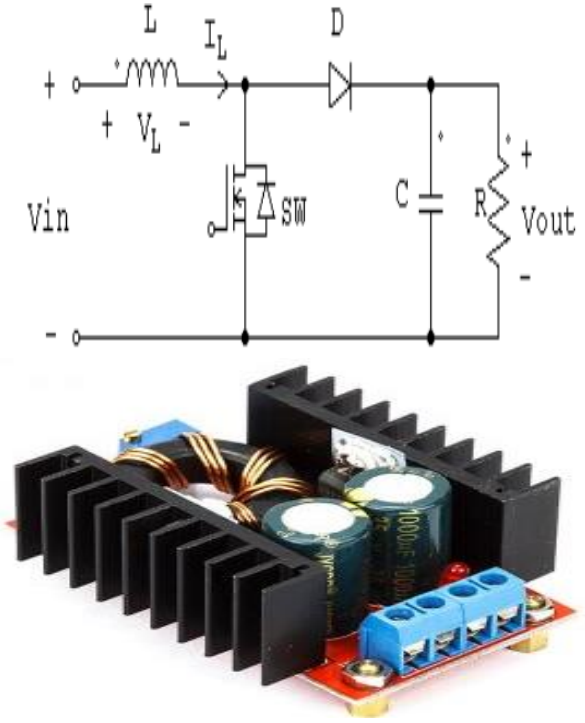

Figure 3. Boost Converter

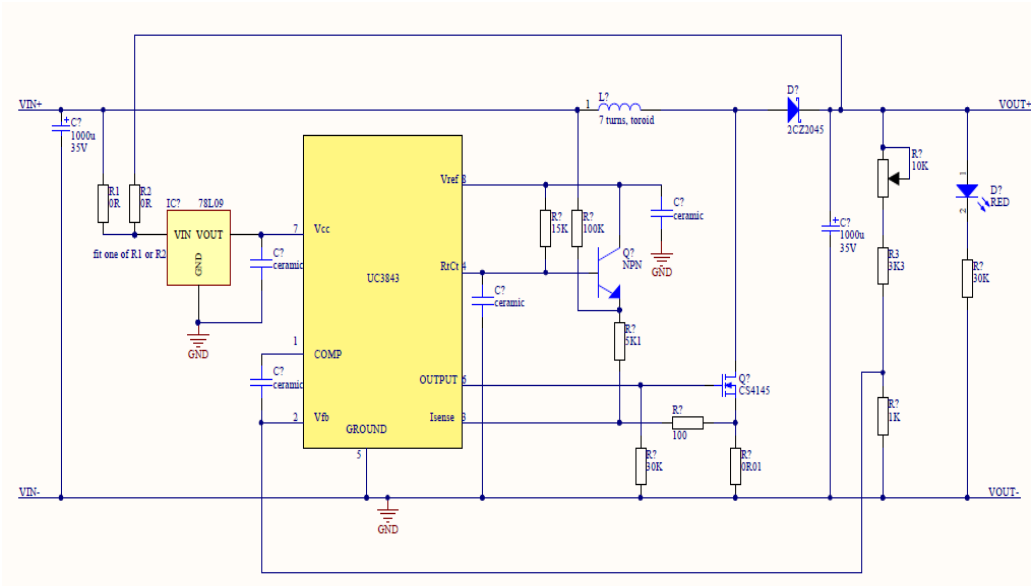

Figure 4. schematic diagram

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III. WORKING OF DC-TO-DC BOOST CONVERTER

The function of DC-to-DC boost converter can be divided into two modes, M1 and M2. M1 begins when MOSFET M1 is switched on at time t=0. The input current increase and flows through inductor L and MONFET M1. M2 begins when MOSFET M1 is switched off at time t=t1. The input current now flows through L, C, load, and diode Dm. The inductor current falls until the next cycle. The energy stored in inductor L flows through the load.

The principle that drives the DC-to-DC boost converter is an inductor to resist changes in current by again increasing and decreasing the energy stored in the inductor field. In a DC-to-DC boost converter, the output voltage is always greater than the input voltage.

- At the time of switch is closed (on-state), current flows through the inductor in the clockwise direction and the inductor stores some energy and magnetic field produced. The inductor left side positive Polarity.
- At the time of switch is opened (off-state), current will be reduced as the impedance is greater. The magnetic field already created will be reduced in power to stable the current to the load. That timer polarity will be opposite. The result, two sources will be in series at the bottom of a greater voltage to charge the capacitor by the diode D.

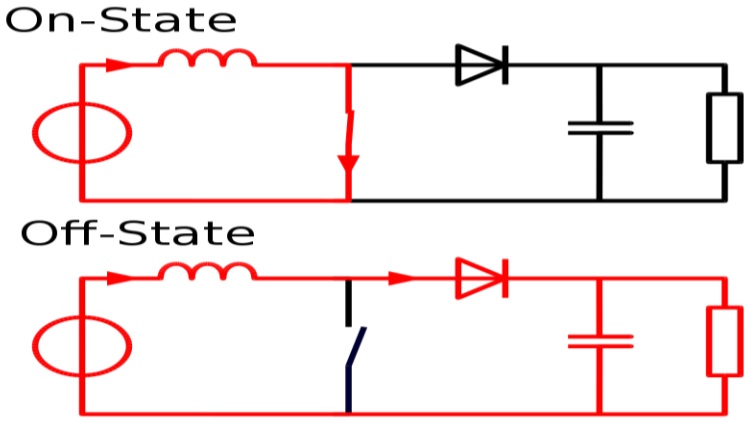
The inductor will not totally discharge in between charging stages, and the always output voltage is greater than the input voltage at the time of switch is opened and at the time of switch is opened, the capacitor connected in parallel with the load and charged the total voltage. At the time of switch is closed and the right-hand side is shorted from the left-hand side, the capacitor is i.e., able to transfer the power to the load. That time, the blocking diode proacted the capacitor from discharging by the switch.

The basic principle of a DC-to-DC Boost converter.

- In the on-state, the switch closed, that time increase in the inductor current;
- At the time of off-state, the switch is open and the only one-way flow to inductor current is through the flyback diode, this results in moving the power combined during the on-state.
- The input current is the equal as the inductor current as be seen So it is not alternate in the DC-to-DC buck converter and the demand on the input filter for relaxed compared to a DC-to-DC buck converter.

DC-DC Boost Converter Specifications:

- Input Voltage: 10v – 32v DC
- Output Voltage: 12v – 35v DC
- Output Current: 1A MAX
- Input Current: 6A (MAX)
- Output Ripple: 2% MAX
- Full-Load temperature: 45 degrees.
- No-load current: 25mA typical.
- Voltage regulation: ± 0.5%.
- Load regulation: ± 0.5%.



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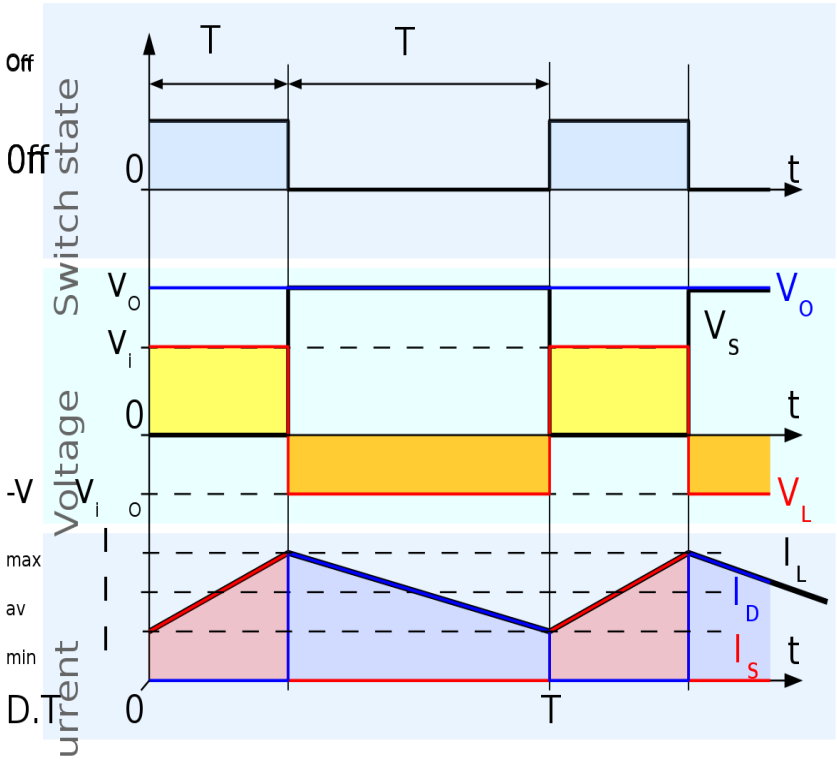

Figure 5. Boost Converter ON-State and Off-State

Figure 6. Submersible Pump

Specifications

- Power: 60W
- Current: 3A
- Submersible Flow: 10-15L/min
- Operating voltage 24V

IV. RESULTS AND CALCULATIONS

DC-DC Boost converter

DC converter is used boost dc convert unregulated dc voltage to a regulated dc output. A DC-to-DC boost converter using a power MOSFET with high switching frequency is considered to reduce the size of DC filter

Output Voltage Vo = Vin/1-D

= 22V/1-0.37

= 35 V

Output Current Io = Vo/Ro

= 35V/72.91 Ω

= 0.5A

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Figure 7. Solar PV based DC to DC Boost Converter for Water Pumping System

Internal Resistance Rin = Vo/Io

= 35V/1.2A

Internal Resistance Rin = 29.16Ω

Load Resistance Ro = 2.5*29.16

Load Resistance Ro = 72.91 Ω

Duty cycle = 1-Vin/Vo

= 1-22V/35V

Duty cycle = 0.37

Ripple current Δ Io = 0.4 * 0.5

Ripple current Δ Io = 0.2 A

Calculation of **Capacitor** in μF = 4Vo*D/Δ Io*Ro*fs

= 4*35*0.37/0.2*72.91*2500

= 1400 μF

Calculation of **Inductor** in mH = Vo*D/2* Δ Io*fs

= 35*0.37/0.2*2500

= 2.59 mH

Parameter for boost converter is measured as

D = 37.69%, **L** = 2.59 mH, **C** = 1400μF.

Switching frequency Fs = 25KHz

Results:

Table 1. Supply rating

MODE	RATING	MODE	OUTPUT
Power Rating (P)	150W	Power Rating (P)	40W
Output Current (Iout)	6A	Output Current (Iout)	1A
Switching Frequency (f)	50KHZ	Switching Frequency (f)	25KHZ
Input Voltage (Vin)	12-22V	Output Voltage (Vin)	30-35V

Power for DC-to-DC boost converter can come from the solar panel, like that batteries, solar panels. A operation to changed one DC voltage to the changed different DC voltage is called DC to DC conversion. A DC-to-DC boost converter is a DC-to-DC converter with an output voltage higher than the input voltage. A DC-to-DC boost converter is also called a step-up converter. The power (P=VI) must be conserved, the output current is smaller than the input current.

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V. CONCLUSION

From the proposed design, the boost converter is able to produce a constant output voltage of 12V from a variable voltage of solar panel. The boost converter is able to deliver power with the highest efficiency of 95%. Components had been chosen based on the consideration made. is able to perform the voltage feedback control technique.

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