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DESIGN OF MODULE-INTEGRATED ISOLATED SOLAR MICRO-INVERTER WITHOUT ELECTROLYTIC CAPACITORS

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ABSTRACT:
A micro-inverter that takes as input the DC power generated by a solar panel (about 250W) and delivers it directly as AC power to the mains line is presented. The micro-inverter has been designed with discrete components, as it is common practice, since there are no silicon technologies that can be used to integrate the complete circuit and the passive components. The proposed micro-inverter has been extensively simulated and is currently under realisation. The obtained conversion efficiency is greater than 95% and the total harmonic distortion at the output is less than 0.4%.

KEYWORDS: Micro- Inverter, Solar, Capacitor, Photovoltic

INTRODUCTION:

There are two types of sources for electrical power generation. One is conventional and other is nonconventional. Today to generate most of electrical power conventional sources like coal, gas, nuclear power generators are used. Some of conventional source are polluted the environment to generate the electricity. And nuclear energy is not much preferable because of its harmful radiation effect on the mankind. After some of ten years conventional sources will not sufficient enough to fulfill the requirements of the mankind. So some of the electrical power should be generated by non-conventional energy sources like solar, wind .With the continuously reducing the cost of PV power generation and the further intensification of energy crisis, PV power generation technology obtains more and more application. In this paper cost effective method is used to implement single phase solar inverter. Solar cell/ PV cells convert solar energy into electrical energy.

This dc voltage is boosted using dc to dc boost converter. This boosted dc voltage is fed to inverter. Inverter converts dc voltage into ac voltage. Here sine coded PWM push-pull inverter is used. The output of inverter is given to step-up transformer and low-pass filter which will give 220V 50Hz sine wave output. This output is given to the load. Inverter topology is sine wave push pull inverter is selected. This topology is used to decrease the cost of solar inverter. In this topology only two MOSFETs are used.

WORKING:

Connect the battery to the circuit using crocodile clips. The red clip should be connected to the positive terminal of the battery and the black clip should be connected to the negative terminal of the battery. If crocodile clips are connected to the wrong terminals of the battery, LED1 glows to alert you.

Now flip switch S1 towards ‘on’ position to enable the circuit. LED3 glows to indicate power-‘on’ and 12V DC reaches regulator IC 7805 (IC1).

The regulated output is fed to the oscillator-cum-divider and driver while the centre terminal of the inverter transformer primary is connected to the positive terminal of the car battery through high-current carrying wires. Capacitor C1 functions as a reservoir capacitor.

Low-battery indicator. For long life of the battery, it should not be allowed to discharge to a voltage below 10 V. Even a single event of deep discharge Can reduce the charge-holding capacity of the battery permanently mFor audio-visual indication of the low-battery level, dual operational amplifier IC LM358 has been used. A fixed reference voltage of 5.1V is applied to its positive input, while the sensing voltage is applied to its negative input. Set preset VR1such that the Piezobuzzer sounds when the on load battery voltage falls below 10V DC.

When the battery voltage drops below 10V, the sense input voltage drops below 5.1V and output pin 1 of IC4 goes high to sound the buzzer and light up LED2.

OSCILLATOR-CUM-DIVIDER:

The oscillator-cum-divider section is built around timer IC LM555 (IC2) and dual J-K flip-flop 7473 (IC3). Only one flip-flop of the dual JK flip-flop is used here.

Timer LM555 is wired as an astable multivibrator, whose time period is decided by resistors R7 and R8 and capacitor C5. It produces 1—Hz at output pin3, which is given to pin 5 of the J-K flip-flop to produce 50 Hz with J-K flip-flop to produce 50 Hz with 50% duty cycle. When the inverter is switched on using switch S1, IC2 stars producing 100Hz, while the J-K flip-flop produces 50Hz at its output pins 8 and 9. The output of timer IC2 can be checked using the oscilloscope at test point (TP).

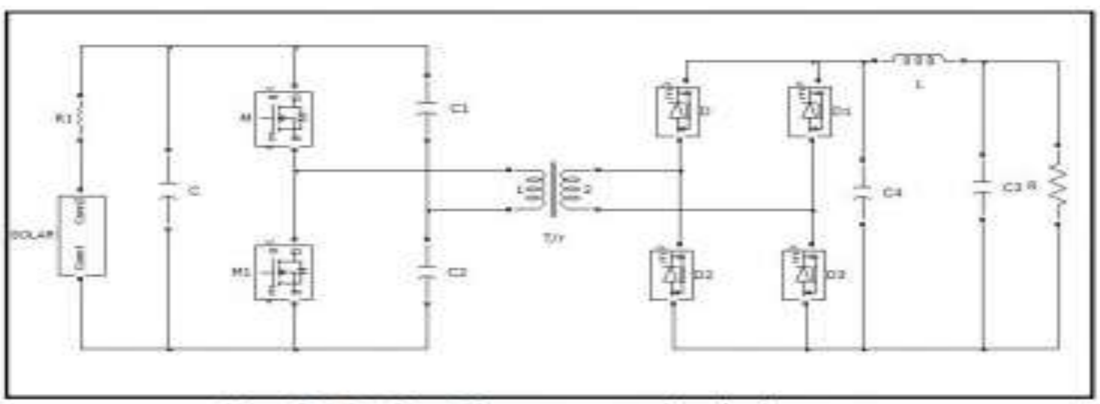


Fig. 3. Push-pull converter circuit diagram

DRIVER CIRCUIT:

The flip- flop output is fed to MOSFET driver transistors T1 and T2 via a diode-resistor combination. At any instant, if the voltage of pin 8 of IC3 is +5V, the voltage at its pin 9 will be 0V, and vice versa. Therefore when transistor T1 conducts, transistor T2 is cut off, and vice versa. Whenever output pin 8 of IC3 goes high, npn transistor T1 conducts and the corresponding set of MOSFETs (T3 through T5) remains cut off while the collector of transistor T2 is at 5V. Thus current flows through half of the inverter transformer are primary winding. Similarly, when output pin 9 of IC 3 goes high, npn transistor T2 conducts and the corresponding set of MOSFETs (T6 through T8) remains cut off while the collector of transistor T1 IS AT 5V. A thus current flow through the inverter transformer's primary winding.

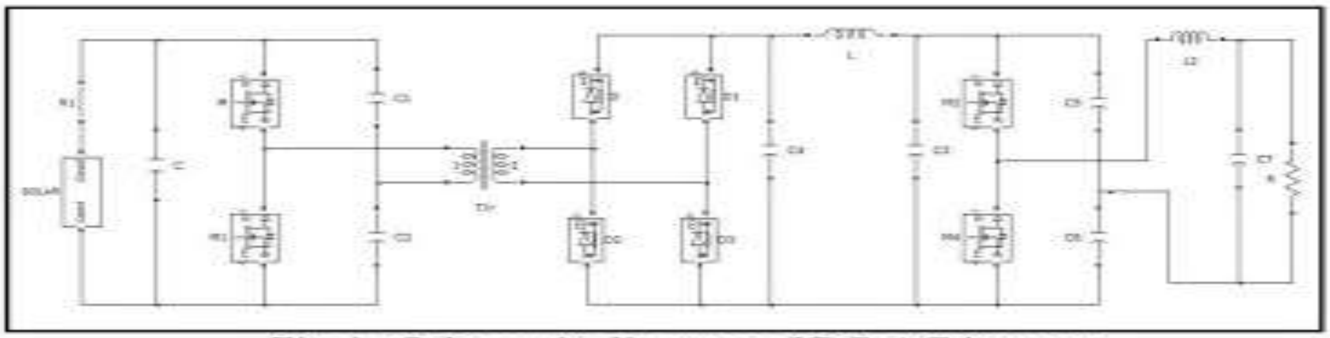
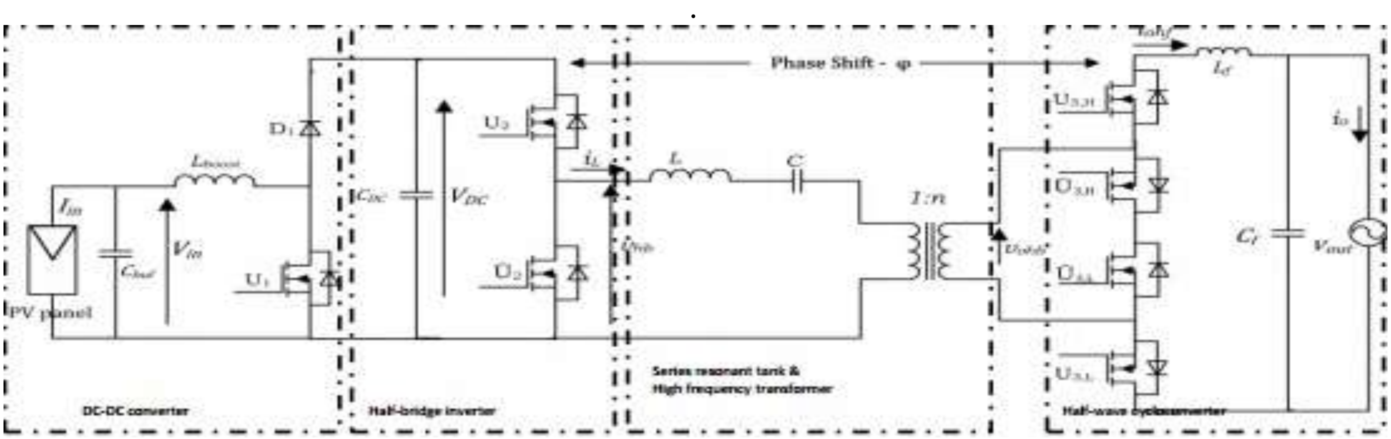


Fig.4. Schematic diagram of DC-AC inverter

POWER AMPLIFIER:

The power amplifier section comprises two sets of three powers MOSFETs (IRFZ44) connected in parallel for operation of the inverter. The output of IC3 drives the MOSFETs (T3 through T5, and T6 through T8) via transistors T1 and T2 to generate 50 Hz, 230V AC at the output of inverter



FABRICATION PROCESS:

You can assemble the circuit on any general-purpose PCB. However, an actual-size, single-side PCB for the medium-power inverter circuit is shown in Fig.3 and its component layout in Fig.4. Pin configurations of MOSFET IRFZ44, regulator IC 7805 and npn transistor

After construction, enclose the entire circuit in a portable box (seeFig.6) The first MOSFET set comprises T3, T4 and T5, and the second MOSFET set comprises T3, T4 and T5. Use separate heat-sinks for each MOSFET set. Since MOSFETs T3 through T5, T6 through T8, are connected in parallel, connect the drains of the MOSFETs (internally connected to the back plate having a through hole) using a copper/ brass nut/bolt onto the respective common heat-sink. Mount all the status LEDs, Piezobuzzer and switches on the front panel. Use heavy-gauge, multistrand battery wires (2.5 sq. mm or more) for the following DC connections:

1. From positive battery terminal to the middle of transformer X1 primary.
2. From the negative terminal of the battery to the common ground on the PCB using copper/brass nut and bolt (provision for the same is made on the PCB).
3. From each heat-sink set (where the drains of the MOSFETs have been connected using nuts and bolts) to the respective primary terminals of transformerX1.

Following additional precautions may also be taken:

1. On full load, the current drawn from the battery could be a high as 30 amperes. Therefore the ground track around source terminals of the MOSFETs on the PCB may be strengthened by depositing additional solder.
2. You may add a resistor (0.5-ohm rated at 20W) in series with positive battery lead going to the middle terminal of transformer X1 primary. In the case of excessive rent being drawn by any of the MOSFETs (due to shorting, etc), only the resistor will burn, which can be easily replaced.

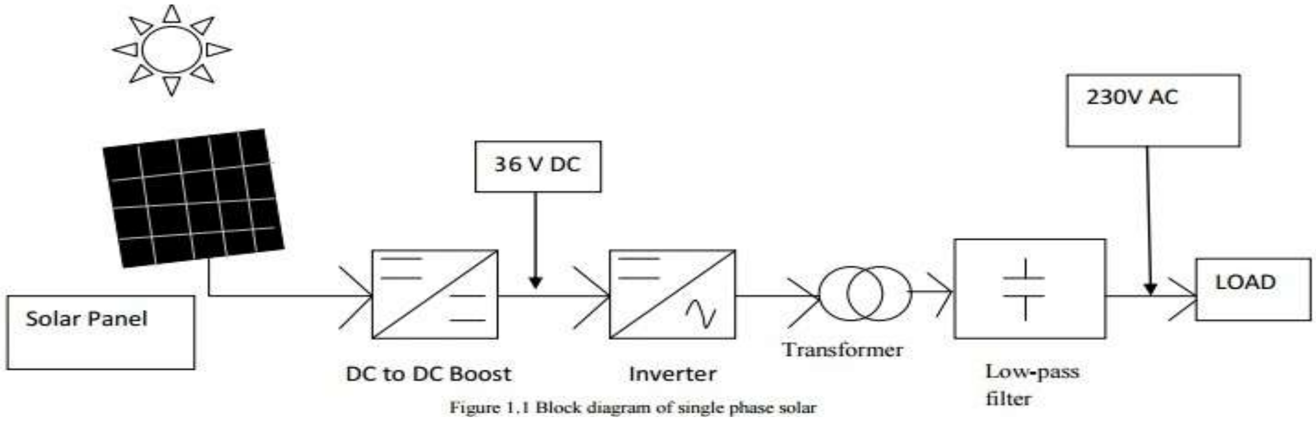


Figure 1.1 Block diagram of single phase solar

CONCLUSION:

Use of sine wave push pull inverter reduces the cost of single phase solar inverter considerably. In this topology only two switches are used and the isolation requirement between control and power is less. Advantages of this topology help to decrease the cost. Value of the components for dc to dc boost converter and inverter is calculated. This calculated value of components is used to simulate dc to dc boost converter and inverter. Simulation for different conditions viz. no load, full load, load transition and input voltage transitions are carried out and found satisfactory

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