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# 12V DC to 230V AC Microinverter

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**ABSTRACT:** Micro-inverter technology is an upcoming area of research in the field of photovoltaic (PV) as it enables solar arrays to work as plug and play devices. Most of the papers in this field are based on the arrangement of different DC–DC converters and inverters. The effort is mostly towards attaining greater stability, lesser complexity and better performance. The micro inverter solution, also called AC module, is the integration of PV and inverter into one electrical device.

A solar micro–inverter is designed such that the 12V dc input of solar panel is converted into 230V AC. It is named "MICRO-INVERTER" because these inverters are meant to be embedded and integrated with the PV panel reducing overall system cost. A micro inverter, is a device used in photovoltaic that converts direct current (DC) generated by a single solar module to alternating current (AC). The output from several micro inverters is combined and often fed to the electrical load.

## I.INTRODUCTION

Micro-inverter technology is an upcoming area of research in the field of photovoltaic (PV) as it enables solar arrays to work as plug and play devices. Most of the papers in this field are based on the arrangement of different DC–DC converters and inverters. The effort is mostly towards attaining greater stability, lesser complexity and better performance. The micro inverter solution, also called AC module, is the integration of PV and inverter into one electrical device.

Each micro inverter works independent of the others to guarantee maximum power of each photovoltaic module. This set up unable direct over the production of single photovoltaic module, consequently improving the frequency and reliability of the system.

A two-module micro-inverter system can provide a more optimized system solution than a single module micro-inverter system. This is accomplished by reducing material costs, such as AC connectors, metal enclosures, and housekeeping power supplies. They reduce the installation labor cost due to the reduced inverter number. It also provides the flexibility to adapt with future higher power high-quality power to the utility. Thus, a non-electrolytic, high-reliability capacitor can be used.

The purpose of this project was to design a grid connected solar micro inverter. Solar micro inverters convert the power from a photovoltaic panel to power that can be injected into the grid. In this project, the solar micro inverter was designed using a DC-DC

## II. PROPOSED WORK

**1.Solar pannel: -**

Fig No 1.solar panel

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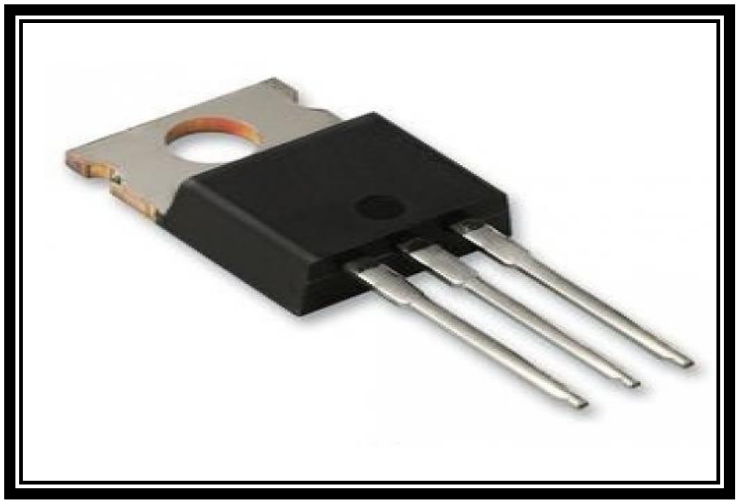
**2.MOSFET: -**



**FigNo.2 MOSFET**

Power MOSFETs have great potential as switches for high speed high voltage applications like pulsed power. The theoretical carrier transit time from drain to source is on the order of 200 ps in any cell of the silicon die. Although the power MOSFET is intrinsically capable of switching in about 1ns, this is not achieved in commercial devices, largely due to the package inductances.

**3.Transformer: -**

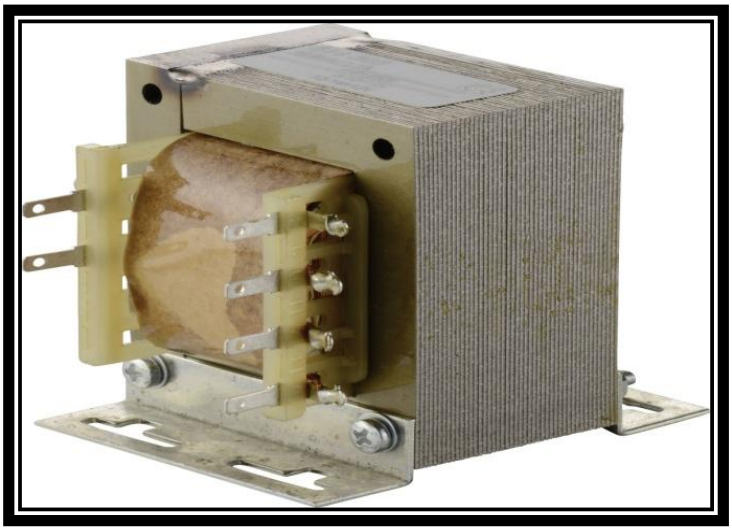


**Fig No.3 Transformer**

It is a general purpose chassis mounting mains transformer. Transformer has 240 V primary windings and centre tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx 100 mm long). The Transformer act as step down transformer reducing AC - 230V to AC - 12V.The Transformer gives two outputs of 24V, 12V and 0V. The Transformer's construction is written below with details of Solid Core and Winding.

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||Volume 9, Issue 5, May 2020||

**4.Battery:-**


**Fig No.4 Lead acid Battery**

A sealed lead acid battery or gel cell is a lead acid battery that has the sulfuric acid electrolyte coagulated (thickened) so it cannot spill out. They are partially sealed, but have vents in case gases are accidentally released for example by overcharging. They can be used for smaller applications where they are turned upside down. They are more expensive than normal lead acid batteries, but they are also safer.

**5.Heat sink: -**

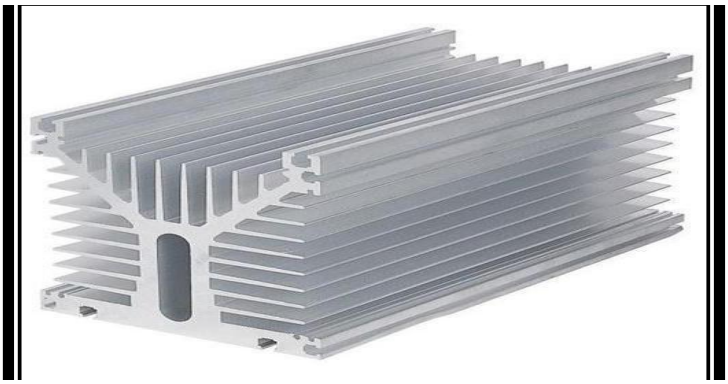

**Fig No.5Heat sink**

A heat sink is a passive heat exchanger that transfers heat. The heat sink is typically a metallic part which can be attached to a device releasing energy in the form of heat, with the aim of dissipating that heat to a surrounding fluid in order to prevent the device overheating. A heat sink is a thermal conductive metal device designed to absorb and disperse heat away from a high temperature object such as a computer processor.

**6.Transistor bc547: -**

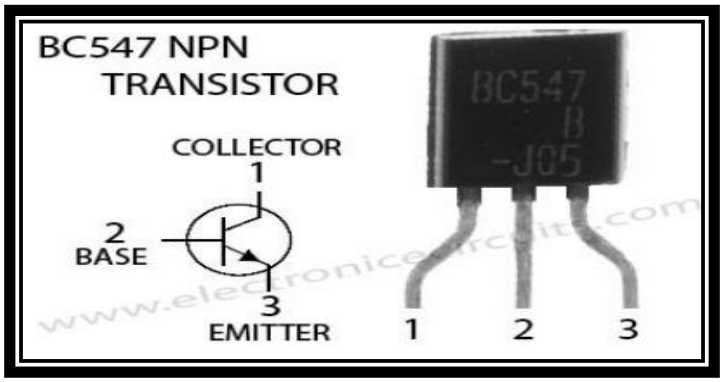


**Fig no.6 Transistor BC547**

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BC547is an NPN Bipolar Junction Transistor. Mostly it is used for the switching purpose as well as for amplification purposes. Similar to the other transistors BC547 is also used for the amplification of current. The smaller amount of current at the base is used to control the larger amount of currents at collector and emitter as well. Its basic applications are switching and amplification.

**7.Diode 1N4007: -**

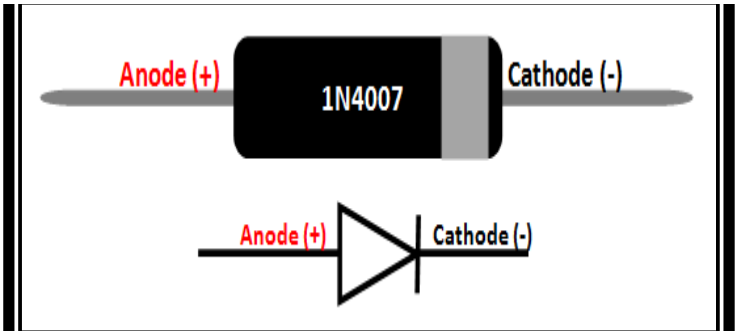


**Fig No.7 Diode 1N4007**

A diode is a device which allows current flow through only one direction. That is the current should always flow from the Anode to cathode. The cathode terminal can be identified by using a grey bar as shown in the picture above.
For 1N4007 Diode, the maximum current carrying capacity is 1A it withstands peaks up to 30A. Hence we can use this in circuits that are designed for less than 1A. The reverse current is 5uA which is negligible. The power dissipation of this diode is 3W.

**8.Zener diode 5V:-**

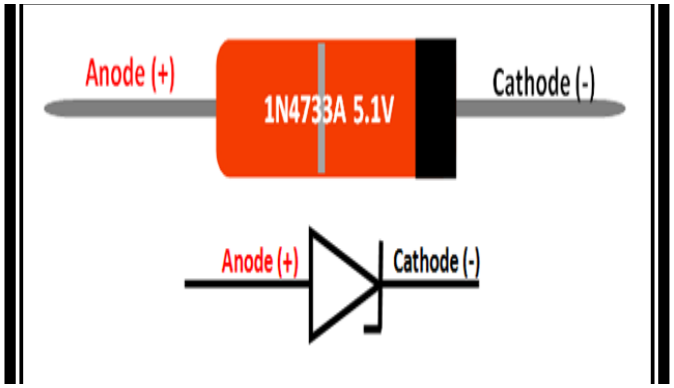


**Fig no.8Zener Diode**

A Zener diode is another form of diode but is used for entirely different purpose. They are mainly used in protection circuits or as crude voltage regulators. Let us see how we can select one for your application.

**9.Ceramic Capacitor 104J: -**

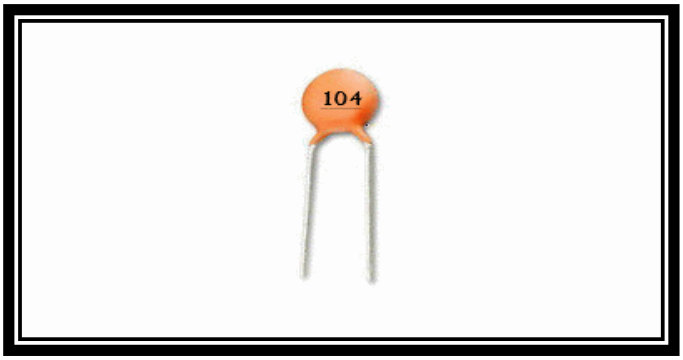


**Fig No.9 Ceramic Capacitor**

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The Ceramic Capacitors has no polarity. Meaning they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also. The symbol for ceramic capacitor is just two plain lines as shown above since they do not have any polarity.

**Designing of Components:**

**Transformer: -** A transformer is a device that couples two AC circuits magnetically and provides electrical isolation between the circuits while allowing a transformation of voltage and current from one circuit to another i.e. it is mainly used for voltage and current transformation and hence we made use of current voltage transformers in this project.

The data in hand are:
**Secondary Voltage** = 230 Volts.
**Primary Current (Output Current)** = 10 Amps.
**Primary Voltage (Output Voltage)** = 12-0-12 volts, that is equal to 24 volts.
**Output Frequency** = 50 Hz
**MOSFET: -** The Metal Oxide Semiconductor Field Effect Transistoror MOSFET is a voltage controlled semiconductor, unlike BJT, that is current controlled. A selection of semiconductors depending on power and operation frequency is resumed. Finally, with high frequencies MOSFETs are the semiconductors selected, as their switching losses are lower comparing with the rest.
**Zener diode:-**
**Voltage Vz: -** The Zener voltage refers to the reverse breakdown voltage—2.4 V to about 200 V; can go up to 1 kV while the maximum for the surface-mounted device (SMD) is about 47 V).
**Current Iz (max.):** -Maximum current at the rated Zener voltage Vz—200 uA to 200 A).
**Current Iz (min.):-** Minimum current required for the diode to break down—5 mA and 10 mA.
**Power rating: -** The maximum power the Zener diode can dissipate; given by the product of voltage across the diode and the current flowing through. Typical values are 400 mW, 500 mW, 1 W, and 5 W; for surface mounted, 200 mW, 350 mW, 500 mW, and 1 W are typical.
**Voltage tolerance: -** Typically ±5%.

## III.METHODOLOGY

**Hardware Implementation**

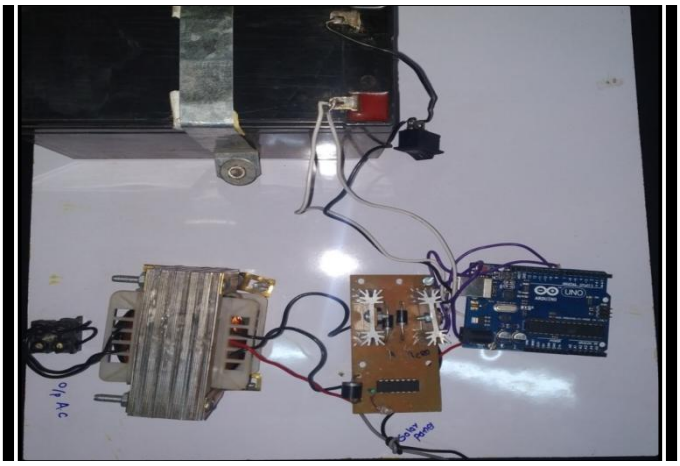

**Fig No.10Model of Hardware**

The circuit can be divided into three parts: oscillator, amplifier and transformer. A 50Hz oscillator is required as the frequency of AC supply is 50Hz.
This can be achieved by constructing a stable multivibrator which produces a square wave at 50Hz. In the circuit, R1, R2, R3, R4, C1, C2, T2 and T3 form the oscillator.
Each transistor produces inverting square waves. The values of R1, R2 and C1 (R4, R3 and C2 are identical) will decide the frequency. The formula for the frequency of square wave generated by the a stable multivibrator is,

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F = 1/ (1.38*R2*C1)

The inverting signals from the oscillator are amplified by the Power MOSFETS T1 and T4. These amplified signals are given to the turns ratio of the transformer must be 1:19 in order to convert 12V to 220V. The transformer combines both the inverting signals to generate a 220V alternating square wave output.

## IV. RESULTS

**For 7Watt Lamp:**

| Input | | Output | |
|---|---|---|---|
| **Current(amp)** | **Voltage(volt)** | **Current(amp)** | **Voltage(volt)** |
| 0.9 | 18 | 0.24 | 230 |

## V.CONCLUSION

Solar systems have low efficiency and are used in assistance with the power electronics based system for efficient energy harvesting. Micro inverter technology is an upcoming field and provides a good room for research.

The goal of this project was to design, simulate and implement a micro-inverter that takes input from a single solar panel (open circuit voltage 12V DC, short circuit current 2.5 amps and power 30 watts) and that provides output of an AC wave of 50 Hz, 220 volts which would be cheap to manufacture, and fairly efficient in the method in which it produces it.

## REFERENCES

1. OSR Journal of Electrical and Electronics Engineering ,ISSN No: 2278-1676, Volume 1, Issue 6 ,year of publication: July-Aug. 2012, PP13-21.
2. Natalie Matta, Rana Rahim-Amoud, Leila Merghem-Boulahia, Akil Jrad, “A wireless sensor network for substation monitoring and control in the smart grid”, IEEE International Conference on Green Computing and Communications, Conference on Internet of Things, and Conference on Cyber, Physical and Social Computing, (IEEE)2012.
3. M. Kezunovic, Y. Guan, M.Ghavami, “New concept and solution for monitoring and control system for the 21 st century substation”(IEEE)
4. V. Gungor, B. Lu, And G. Hancke, “Opportunities And Challenges Sensor Networks In Smart Grid”,IEEE transaction on Industrial Electronics,vol. 57, ISSN no. 10, Year of publication: Oct. 2010, pp. 3557 – 3564.
5. , Yanqing, Cheng Chen, and Qing Xie. "Research of an improved grid-connected PV generation inverter control system." Power System Technology (POWERCON), 2010 International Conference on. IEEE, 2010.
6. Joshi, Madhuwanti, et al. "A low cost bi-directional grid tied solar PV micro inverter." Photovoltaic Specialists Conference (PVSC), 2016 IEEE 43rd. IEEE, 2016.
7. Muhammad H.Rashid, Power electronics: Circuits, Devices &applications, Prentice Hall India, third edition, 2004.
8. Mohan, Tore M. Undeland, William P.Robbins, Power electronicsconverters, applications and design, John Wiley and sons, Third edition, 2003.