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RESEARCH ARTICLE

INVERTER USING SMPS (SWITCH MODE POWER SUPPLY)

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ABSTRACT

The project 'Inverter uses switch mode power supply' is use to convert direct current into alternating current using IC LM 324 and IC CD4047. This project is designed to meet up with power demand in home and office in the absence of power supply. It is designed in such a way that it will take 12v DC from the battery and convert it into 220v, 50hz AC. The circuit is capable of charging the battery that is 12v source in case of power is present.

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INTRODUCTION

A inverter is device that changes D.C. voltage into A.C. voltage. A DC (direct current) which flows in only one direction, an alternating current that which flows in both positive and negative direction. An inverter has three types of waveform square wave, sine wave, and modified sine wave. But mainly we use pure sine wave inverter for domestic purposes. We consider sin wave output desirable because many electronics products work best with sine wave AC power source. Power inverter is a device that converts DC waveform into AC using electronic circuits. It is an application that converts battery voltage into conventional household AC voltage which converts battery voltage into conventional household AC voltage which allows you to use electronic devices when mains are not available. There are three types of inverter, the first set of inverter made are absolute and produce square wave signal at the output. The second one is modified square wave also known as modified sine wave inverter which produce square wave with some dead spot between positive and negative half cycle at the output, and a cleanest supply like power source is provided by pure sine wave inverter. Because of the benefits which sine wave inverter offers the market is shifted from modified sine wave inverter to pure sine wave inverter?

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COMPONENT USED

This is the hardware of the project.

Embedded system and integrated circuits

1. (CD4047BCN)– This IC can be operated either in monostable or astable mode. This IC can convert 12V DC to 220V AC, 50Hz. We use this IC for oscillator and transistors driver the transformers to output. This IC has very low power consumption. It can create pulse by generating 50% duty cycle. These are used in frequency division, frequency discriminators. They manly manufactured by TEXAS INSTRUMRNTS. It also provides good astable frequency stability.

LM324 – This IC consist of four independent high gain frequency compensated operational amplifier that are designed to operate from single supply or split supply over a wide range of voltage. They can be used as comparators, oscillators, amplifiers, rectifier and etc. It has bipolar architecture. operating temperature rate is about 0 to 70. It has a catalog type rating . it is a low power quad operational amplifiers.

Transistors

1. BC 548 – It is a general purpose silicon, NPN, bipolar junction transistor. It is used for switching and amplification. There are various types of BC 548 like 548A, 548B and 548C.

Figure 1. IC CD 4047

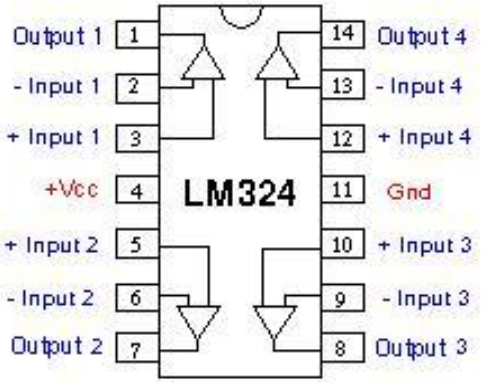

Figure 2. LM324 IC

It is used in common emitter configuration for amplifiers. They are two transistors which is equivalent to this taransistor are 2N3904 and 2SC1815 but has different lead assignments. When base signal is not present, it gets completely off.

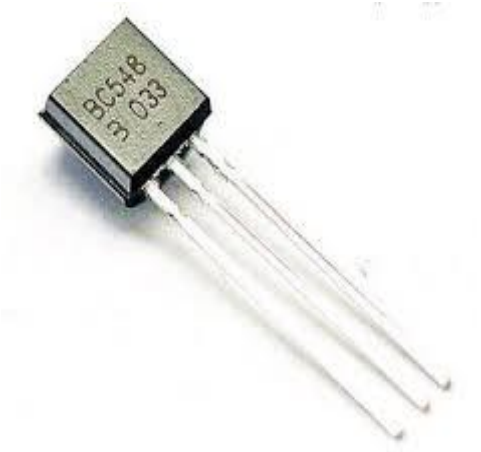

Figure 3. BC548 Transistor

2. TIP47 – It is a NPN silicon transistor.

This transistor is designed for line operated audio output amplifier, switch mode power supply drivers and other switching applications. It has three legs emitter, collector and base. This is one of the important transistors used in this project.

Figure 4. TIP47 Transistor

3.2. N3055 (npn) – It is a complementary silicon power transistor for general purpose switching and amplifier application. It is a 15A 100V, 15V power transistor with a forward current gain of 20 to 70 at collector current of 4A. It has a transition frequency of 3 Hz. It works in excellent safe operating area.

Figure 5. 2N3055 Transistor

C. Zener Diode (1N5338B)

This is a 5W zener diode voltage regulator with tight limits and has a better operating characterstics that reflects the superior capabilities of silicon oxide passivated junctions. In zener diode is the diode which allows current to flow in the forward direction normally, but it also allowing it to flow in reverse direction when the voltage is above a certain value. This value is known as breakdown voltage which is also known as zener voltage. This diode has highly doped p-n junction.

Transformer

It is a electrical device that transfer electrical energy between two or more circuits. Electromagnetic induction produce an electromotive force within a conductor which produces a magnetic field transformer are generally used to increase or decrease the alternating voltages in electric power application.

Figure 6. 1N5338B

The current in a transformer's primary winding produce a magnetic flux in a transformer core a varying field impinging on transformer's secondary winding. We have used two types of transformer.

[1] Step-up Transformer- In this type of transformer the number of turns in secondary winding in greater than that of primary winding as a result the secondary output voltage will be greater than the primary input voltage. In this project we are using 12-0-12 step up transformer.

[2] Step-down Transformer – In this type of transformer the number of turns in secondary winding is less than that of primary winding as a result the secondary output voltage will be less than primary input. In this project we are using 0-12 v ratting transformer with 5 ampere current.

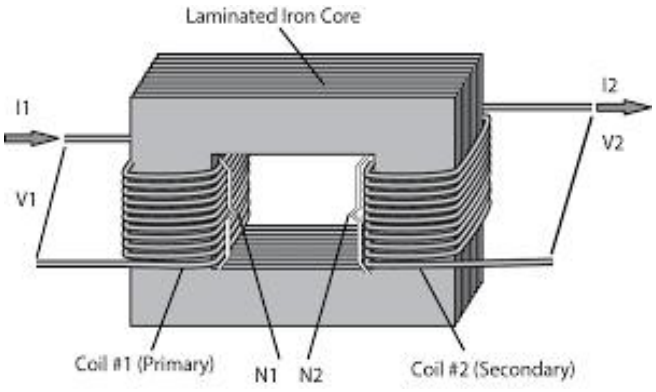

Figure 7. Transformer

Power supply

Power supply in used to convert on form of electrical energy into another, they are sometimes referred to as electrical power converter. In this project we have used lead acid with rating 12v, 7.5A battery for our inverter which gives 12 v dc power supplies.

Efficiency

Efficiency is basically the percentage of the power that goes into the inverter and comes out as the usable AC current (A system is never 100% efficient there will always be some loses in the system). Efficiency will vary according to how much power is being used at the time. Efficiency is greater when no power is used. Cable loses are lower because power is transported around the system in the form of AC rather than DC.

WORKING

Our circuit consists of two parts:

Charging circuit

Main inverter circuit

Charging circuit

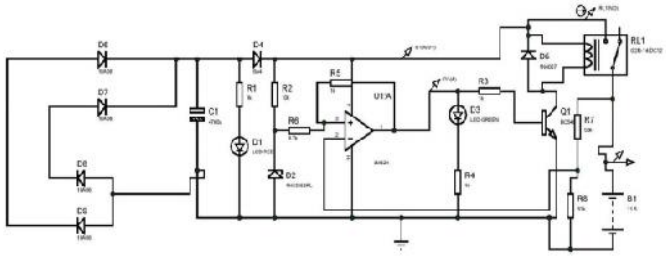

Figure 8. Charging Circuit

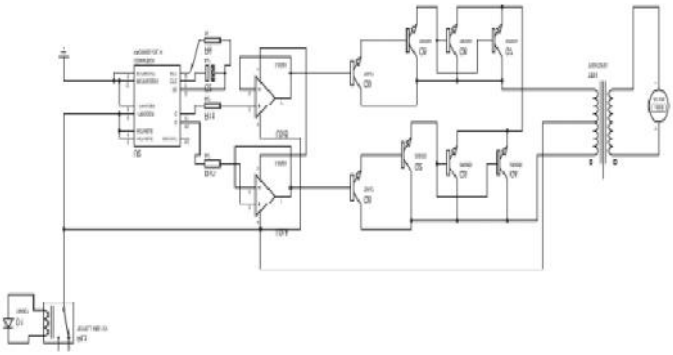

Figure 9. Main Inverter Circuit

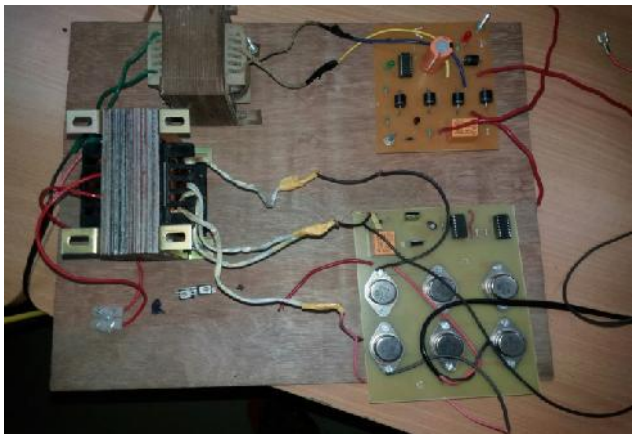

Figure 10. Final Project

A charge controller circuit for battery makes it easy for switching the charger with different battery levels. The main advantage of the circuit is improved life and low current consumption as it switches of the charger when battery is fully charged. The main component of the circuit is LM324

comparator IC which has four in-built comparator inside but we are using only one. A charging control circuit can be applied with any system that makes use of re chargeable batteries like UPS, emergency, telephone receivers, inverters. Here we have used LEDs to indicate charging status.

Step down transformer steps down the line voltage to 15V and bridge rectifier converts AC to DC. It is followed by a capacitor filter which removes AC ripples. The power supply of a working of charger circuit is given from the battery. The non inverting terminal of the comparator is connected to zener diode and a 1K resistor which is used to make reference voltage of 1.5V and its inverting terminal is used to monitor the battery level. Use of zener diode instead of resistors makes sure that the reference value is independent of the battery level and temperature variances. If the battery level is below the lower threshold point then the reference voltage becomes higher than the proportional battery value. Thus the output of comparator becomes positive. Then the transistor is switched ON (the output of the comparator is connected to a base of transistor BC548 through a 1K resistor followed by a relay. The freewheeling diode along with the relay to de-energize the inductor.

Main inverter circuit

Here is a 70W inverter circuit with minimum number of components. Here we use CD4047 IC for generating generating 100Hz pulses and four 2N3055 transistors for driving the load. IC1CD4047 wired as an astable multivibrator produces to 180 degree out of phase 100Hz pulse trains. These pulses trains are pre-amplified by two TIP47 transistor, the output of TIP47 transistor are amplified by four 2N3055 transistor (two transistor for each half cycle) to drive the inverter transformer. The 220AC volt will be available at the secondary of the transformer. This circuit work great for small bulbs and fans.
Important notes for making invertert

- A 12 V car battery can be used as the 12V source.
- Use the POT R1 to set the output frequency to 50 hz.
- Use a 10 A fuse in series with battery.
- Mount the ic on an ic holder.

Conclusion

In areas where power inverter units become equivalent for traditional mains line supply, a sine wave output is most suited owing to the fact that most electronic units get fully optimized to be most useful with a sine wave alternating current source of power.

Sine wave inverter possessing more than three block in the wave output may be considered a bit more advanced and include much higher price if compared to a modified sine wave.

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