DESIGN AND CONSTRUCTION OF 1KVA SINGLE PHASE INVERTER WITH DIGITAL OUTPUT DISPLAY

BY

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(2004/18796EE)

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DECEMBER,2009.

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THIS THESIS PRESENTED AND SUBMITTED IN PARTIAL FULFILMENT FOR THE AWARD OF FIRST DEGREE IN ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

DECEMBER,2009.

DEDICATION

This project is dedicated first of all to the almighty God ; the creator of my life, then to my parent , Elder and Mrs J.S Ayeni for their generous contribution in terms of moral, spiritual and education.; wishing you long life and prosperity. Also, to my elder sister; Mrs Ifejola Ephraim, my younger once, Ayeni Bosede and Ayeni Moyinoluwa.

ATTESTATION /DECLARATION

I Ayeni Eyitayo hereby declare that this project was done by me and has never been presented elsewhere for the award of degree. I hereby give up the copyright to the federal university of technology minna.

-- 17/12/09 --

Ayeni Eyitayo Date

-- 17/12/09 --

Engr. Mrs. C.O.Alenoghena Date

(Supervisor)

.... May 6, 2010 ....

Engr.Dr.Y.A.Adediran Date

(H.O.D)

ACKNOLEDGEMENT

I give all thanks to the almighty father, who has kept me since the very first day I was born till this very moment.

Also, I want to appreciate my parent Elder and Mrs. J.S Ayeni, my elder sister; Mrs. Ifejola Ephraim and my younger sisters; Ayeni Bosede and Ayeni Moyinoluwa who are the backbone to the success of this work, I say long life and prosperity to you all

More also, I want to give thanks to my supervisors; Engr. Mrs. Alenoghena and Mallam Yahaya for their generous contribution from the beginning to the end of this work, I say big thanks.

Finally, To as many whose names where not specifically mentioned but have in one way or the other blessed my life during this period. I wish to sincerely say that the Lord knows you all and will reward you accordingly.

ABSTRACT

The aim of this project is to design and construct a single phase 1KVA inverter with digital output display. This was achieved by converting a 12V DC battery source to a 230V AC supply which thus justifies the aim/objective of the project. The design was achieved using a top-down design approach with the result at the output of each modules tested and verified.

An astable multivibrator was used to provide a drive for the switching circuit (i.e. IRF3205 MOSFET). The output of the MOSFET was fed into a step-up transformer which step-up the voltage to 230V. A 230V, 10A AC relay was used to connect and disconnect the oscillator from the circuit. The digital display was achieved using LL7107IC with a seven segment- display

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CHAPTER ONE

1.1 GENERAL INTRODUCTION

The availability and adequate supply of energy is a matter of great concern in our nation and the world at large. Enormous amount of energy is being consumed on a daily basis. Thus, for the fact that our ability to consume power is far greater than the ability to supply power, the need arise to provide a substitute that will help to reduce inadequate power supply i.e. frequent ON and OFF system of power in our country Nigeria. Thus, bringing the idea, design and construction of 1KVA single phase inverter with digital output display.

The digital inverter generates power for a short period of time , say between twenty minutes and five hours(depending on the capacity of the battery used and the rate of consumption) but this power could be very crucial, since in some office setup, a failure of about one minute could cause losses that could run into millions.

The need for the digital output display arises in order to know the behavior of the given output voltage at any point in time. This digital display indicates various conditions using a 7-Segment display. The 7-Segments display unit contains 7 LED in the shape of number 8 or alphabet B. [3] this very output display component is basically of two types namely:

1 Common Anode type

2 Common Cathode type

In the common Anode type 7-Segment display, anode points of all the LEDs are joined together and this common anode point is connected to the positive supply, while in the

Common Cathode type, Cathode point of all the LEDs are joined together and this Common Cathode point is connected to the negative supply.

1.2 PROJECT OBJECTIVES

No doubt about it, an inverter provides an alternative source of power supply to homes appliances where information storage, emergency, sensitivity etc are of vital importance. Thus, the aim and objectives of the subject matter is to reduce the problems generated in power sector as a result of inadequate funding by providing a substitute to AC power supply.

1.3 MOTIVATION

The inadequate supply of electricity in Nigeria is very paramount which brings about the need to get a tangible solution, thus arise the innovation for the design and construction of this thesis. Also, It is no longer news that the world is going digital. Digital techniques are increasingly gaining grounds in Telecommunications, Computing, Control, Automation and almost every other aspect of Electrical and Computer Engineering. Hence, the digital output of the said 1KVA single phase inverter will take a rightful place as new technology evolves.

1.4 SCOPE OF WORK

This work, design and construction of 1KVA single phase inverter with digital output display is restricted to the design and construction of an inverter that will be able to carry house appliances, office equipments, medical instrument e.t.c of total load not more than 1000watt.

1.5 METHODOLOGY

In this design, a circuit unit is used to build up the system. The design is divided into several stages i.e. the oscillator, driver, charger stage, change-over stage, power supply stage, amplifier stage etc. The diagram of which will be shown in the block diagram. The oscillator, generate two separate signal pulses which switch on the MOSFET separately for the production of current alternatively. The MOSFET function as the power transistor and send voltage to the secondary coil transformer to induce magnetic flux to the primary coil for the production of alternating current voltage from the direct current source.

Meanwhile, it is the transformer that creates network induction between secondary and primary coil to convert from direct current (DC) to alternating current (AC). Hence, the 12V DC source from the battery is then converted to 220 – 250V required. The change over engaged in automatic switching from the main supply and vice-versa. The charger circuit is incorporated into the change over circuit through the transformer terminals and then does automatic recharging of the battery when run down.

1.6 CONSTRAINTS TO ACHIEVABLE PERFORMANCE/LIMITATIONS

It is of great importance to know that, however good and reliable an inverter (as a source of uninterrupted power supply) is, it still offer some limitations/constraints to achievable performance. The constraints to achievable performance will be discussed in the later chapter. Thus, some among the limitations are stated below:

1. The single-phase voltage source inverter covers low range power applications unlike a three-phase voltage source inverter which covers a wider range of power applications.

2. Also, there is no AC voltage regulation, i.e. when the AC main is available; the inverter sends the AC mains to its output socket without any correction.

3. With regards to the capacity used, the inverter can only work for a small range period of time.

4. A voltage fluctuation is also another limitation of the device.

5.Sudden power outage when the battery is exhausted with out any prior notice.

1.7 AREAS OF APPLICATION OF THE PROJECT

Some of the practical and field applications of this project can be found in:

1. It is of great importance/use at research centers and local areas where the direct current (DC) supply generated by the supply authority could not be reached.

2. Television sets, video cassette recorder and other appliances that run on alternating current (AC).

3. The emergency fluorescent light used in homes, hospitals, schools and generator control rooms.

1.8 PROJECT OUTLINE

This work was carried out in various parts as stated below:

- **CHAPTER ONE**: Gives the general introduction to the subject matter, the why (objectives) and how (methodology) the project is carried out. Also, sources of materials used and limitations of the project are stated.

CHAPTER TWO: Carries the literature review/theoretical background and previous work of others.

CHAPTER THREE: Gives the detailed design and modular construction of the project.

CHAPTER FOUR: Gives the test, results and discussion result carried out.

CHAPTER FIVE: Gives a summary of work, the result obtained and problems encountered.

CHAPTER TWO

LITERATURE REVIEW / THEORETICAL BACKGROUND

2.1 DEFINITION

The word inverter brings to mind a device that changes an alternating current to a direct current or vice – versa. It can as well be referred to as a device that accepts an input that is a function of both the maximum voltage and time [2].Also, from a layman, it can also be seen as a device that takes in positive signal and put out a negative signal –a circuit with one input and one output i.e. When the input is low, the output will be high.

Thus, regarding the subject matter " 1KVA single phase inverter with digital output display ",an inverter can be defined as an electronic device which is capable of converting an input from a DC source to a greater output of alternating current.

Static power converters, specifically inverters, are constructed from power switches and the AC output waveform is therefore made up of discrete values. These lead to the generation of waveform that feature fast transitions rather than smooth ones.

2.2 FUNDAMENTAL ISSUES

Inverters fall in the class of power electronics circuits. The most widely accepted definition of a power electronics circuit is that the circuit is actually processing electric energy rather than information. One of the most important performance consideration of power electronic circuits, like inverters, is their energy conversion efficiency is the problem of removing large amounts of heat from the power devices . Of course, the judicious use of energy is also paramount, especially if the inverter is fed from batteries such as in electric cars. For this reason, inverters operate the power devices, which control the flow of energy, such as switches. In the ideal case of switching event, there would be no power loss in the switch since either the current in the switch is zero (switch open) or the voltage across the switch is zero (switch closed) and the power loss is computed as the product of both.

In reality, there are two mechanisms that do create some losses; however, these are on-state losses and switching losses. In order to avoid audible noise being radiated from motor windings or transformers, most modern inverters operate at switching frequencies substantially above 10 KHz.

2.3 DEVELOPMENT OF AN INVERTER

The development of a linear dc to ac converter (inverter) is a new technology of obtaining an alternating current from direct current source. Before the development, stand by generating set was the only source of alternative to the main supply from PHCN mains. The power failure occurrence which has led to the damage and loss of so many domestic and industrial appliances and consequently to the loss of both human lives and property in places where constant power supply is inevitable. Aside this fact, it is obvious that generating sets are also very expensive to produce and maintain because of continuous purchase of fuel needed by the generator as well as the required routine maintenance. More so, research justifies the deadly and harmful effect of the exhaust of generator. The exhaust is usually carbon mono oxide (CO), a very poisonous gas.[4] All these conditions, no doubt brings about the development of an inverter. The development made is possible for us to obtain alternating current from the batteries at a cheaper rate.

2.4 DIFFERENCE BETWEEN INVERTER AND UPS

It should be noted that inverter and UPS generally does the same job of providing uninterrupted AC power supply, when the AC main fail [3]. From the fact that, they do the same work, some differences still exist between them. To short out this, the working principle of an inverter and a UPS must be noted.

An inverter comprises of the following sections:

1. The charging section.
2. Inverter section. While;

An UPS contains the following sections:

1. Charging section.
2. Inverter section.
3. Automatic voltage regulator section (AVR).

These states out clearly the difference between the two means of power supply i.e. The presence of automatic voltage regulation section in an UPS which is not contained in an inverter. The AVR section is an additional section in the UPS; when the AC main is available, the inverter sends the AC mains to its output socket, without any correction. In an UPS, when the AC main is available, the AVR section of the UPS regulates every incoming AC supply and provides a regulated output at its output socket.

2.5 INVERTER RATING

It often becomes difficult to decide the appropriate rating for the inverter. Generally, DC to AC inverters are available with ratings such as 500w, 1000w, 1200w, and so on. The inverter is proportional to their wattage. Analysis of the requirement must be done appropriately before designing DC to AC inverter. When designing the inverter, it is advised that one add the safety margin to arrive at the actual rating of the system. The power requirement of all the electrical items that one wants to run on the inverter should be added up to arrive at the rating.[4]

2.6 POWER CONVERSION

Power conversion deals with the process of converting electric power from one form to another. The power electronics apparatus performing the power conversion are called power converters. The power conversion is achieved using power semiconductor devices, which are used as switches. The power devices used are SCRs (Silicon Control Rectifiers, or thyristors), triacs, and power transistors; power MOSFET, insulated gate bipolar transistors (IGBT). The power converters are generally classified as:

1. AC – DC converters (phase controlled converters)
2. Direct AC – AC converters (cyclo-converters)
3. DC – AC converters (inverters)
4. DC – DC converters (choppers, buck and boost converters)

2.6.1 DC -TO – AC CONVERTERS

The DC-to-AC converters are generally called converters. The AC supply is first converted to a variable –voltage and variable frequency power supply. This generally consists of a three-phase bridge connected to the AC power source, a DC link with a filter and a three - phase Inverter Bridge connected to the load.

As earlier mentioned, inverter can be classified as a voltage source inverters (VSIs) and current source inverters (CSIs). A voltage source inverter is fed by a stiff DC voltage, whereas a current source inverter is fed by a stiff current source. A voltage source can be converted to a current source by connecting a series inductance and then varying the voltage to obtain the desired current.

It is assumed that the load on the output consist of a series resistance and inductance.[6] Thus, it can be concluded that:

- The output voltage is non sinusoidal
- Due to the presence of the presence of the freewheeling diodes, the output voltage is independent of the direction of the load current is only dependent on the ON and OFF state of the switch.
- The semiconductor switches are freewheeling diodes from two rectifiers. They are connected in inverse parallel. The semi-conductor switches make the energy flow from the DC side to the AC side possible.

2.7 CONTROL OF THE OUTPUT VOLTAGE

In voltage source inverter, the output voltage is controlled by the following methods:

- In inverters with square-wave operation, voltage changes on the Dc side
- Voltage cancellation, which is feasible in single-phase full-bridge inverters.
- Programmed harmonic elimination switching.
- Tolerance band controlling.
- Fixed-frequency control.

As viewed from previous work of others, the following are the visible factors that limit the performance of their work.

- Inability to obtain a digital output display due to the scarcity of LL7107IC
- Inability to have automatic stoppage in the charging process when the battery is full.
- Overheating of some ICs due to continuous testing e.t.c

CHAPTER THREE

DESIGN AND IMPLEMENTATION

3.1 INTRODUCTION

The design and implementation of this project was carried out with the use of top down design approach .That is, design that is achieved through the breaking down of system(s) into sub-levels or segments or units.

Steps taken for this design involved the block schematic layout, the circuit design, the circuit simulation, the breadboard design, test and records of the results, the fixing of components on the Vero-board and finally, the entire circuit constructed being housed in a pack or case(metal in this case).

System design is simply the technique employed for analysis and determination of the various component values to specification required in appropriateness of the design targeted purpose.

3.2 THE DESIGN

The project consists of the following units namely:

1. The Oscillator unit
2. MOSFET drive
3. Transformer section
4. Relay section

5. Meter section
6. Display section
7. Charging section.

3.2.1 BLOCK SCHEMATIC DIAGRAM/LAYOUT

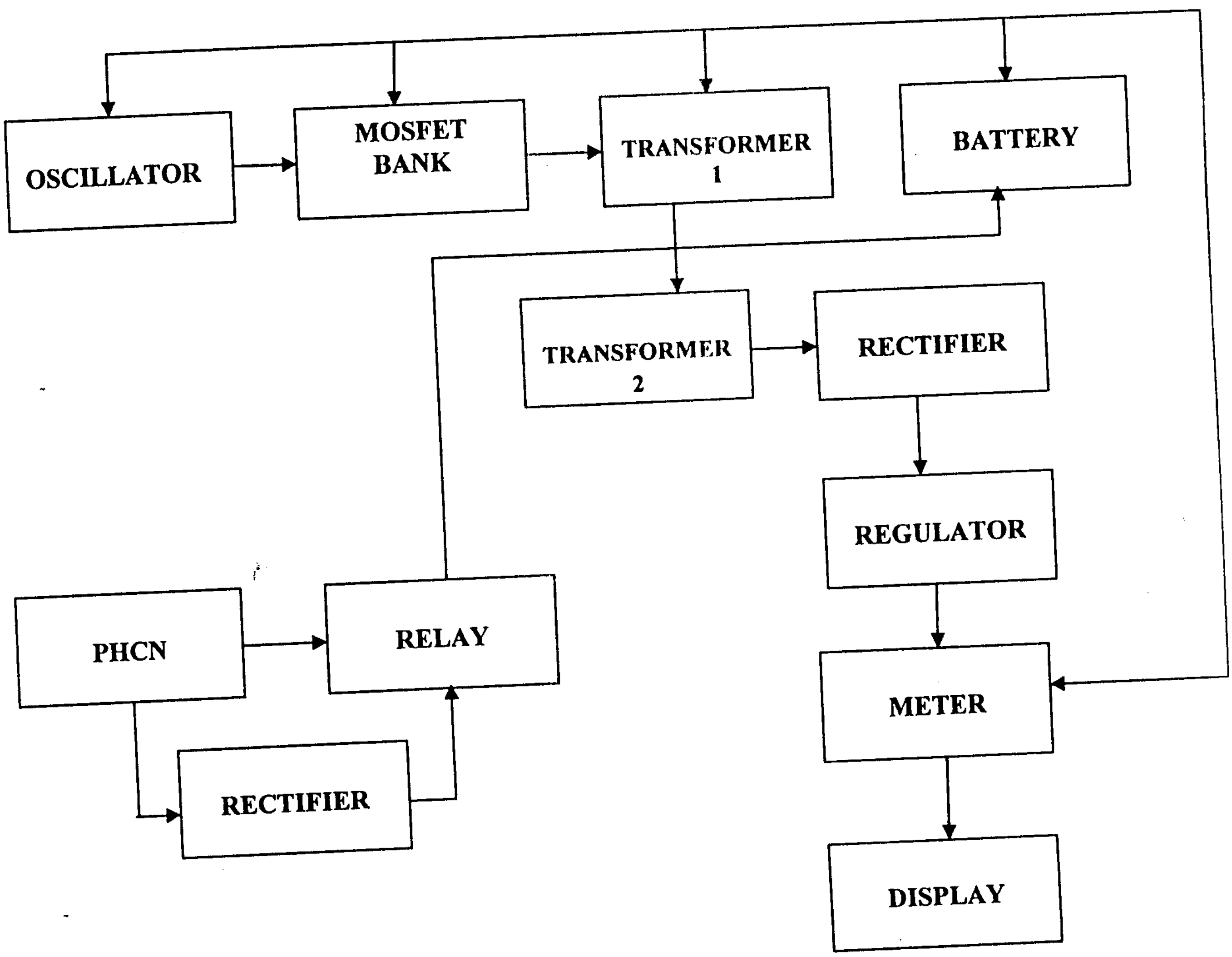

Fig 3.1 Blocks Diagram Of The Thesis

3.2.2 OSCILLATOR UNIT

The oscillator used here is a transistor based **astable multivibrator**.The oscillator works on the basis of charging of capacitor, C within a very short period, followed by the discharge through a resistor R. The discharging period, depends on the RC combination. The output of the oscillator is not a sine wave; it may be a saw tooth or a rectangular wave. The circuit of the unit can be shown as bellow.

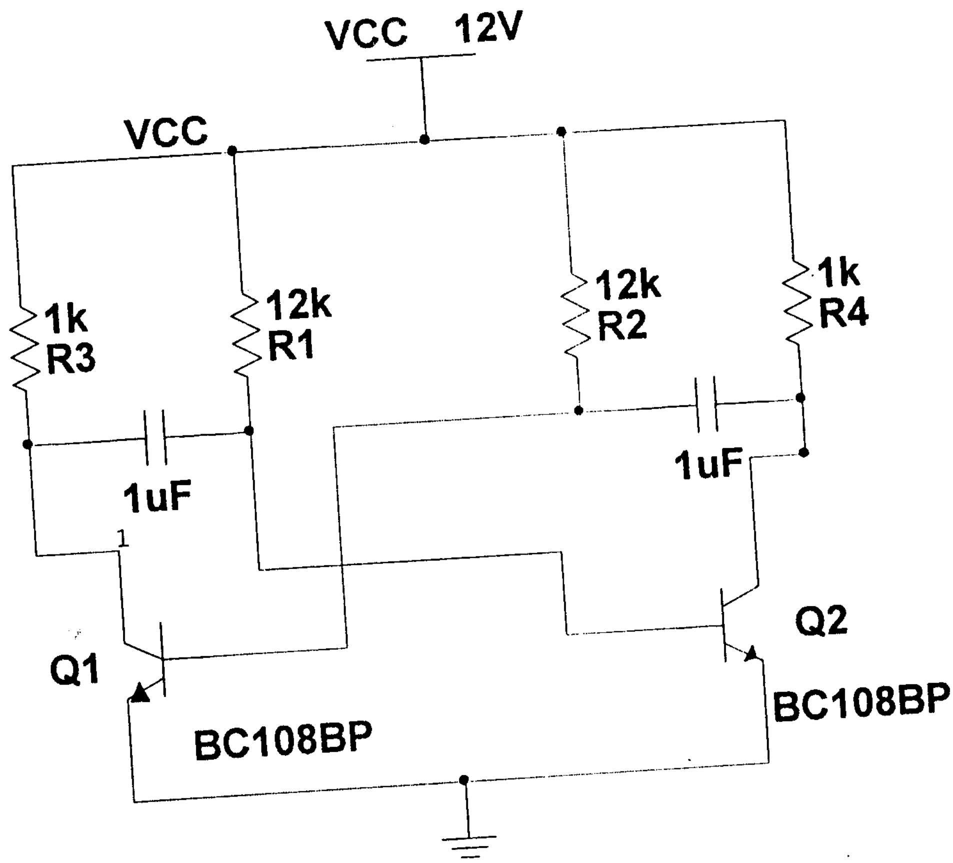

Fig.3.2 Multivibrator Section

3.2.3 MATHEMATICAL ANALYSIS

The design calculations are as follows:

$Vcc = IcRc + Vce$

Since the transistor is switching ON and OFF, then $Vce = 0$

Let $Rc = 1000\Omega$.

$Ic = Vcc/\ 1000 = 12/1000 = 0.012A$

Also, taking the forward gain current, $hfe = 12$

$hfe = Ic\ /\ Ib$

$Ib = Ic/hfe = 0.012/12 = 0.001A$

Therefore, $Vb = IbRb$, $Vb = 12V$

$Rb = 12/0.001 = 12K\Omega \approx 12.2K\Omega$

$Rb = R1 = R2 = 12.2K\Omega$

Finding the capacitance, recall that frequency F is giving by the following equations:

$T1 = RC\ 2.3\log_{10}2 = 0.69RC$

Since the RC circuit are two in number,

$T2 = 0.69RC$

$T = T1 + T2 = 0.69R_1C_1 + 0.69R_1C_2$

The circuit is symmetrical. Thus, $C_1 = C_2 = C$, $R_1 = R_2 = R$

$T = 0.69(2RC)$

$F = 1/T = 0.725/(12K\Omega\ X\ 1\mu F) \approx 60HZ$

3.2.4 WORKABILITY

The astable or free- running multivibtrator is a two stage coupled common-emitter amplifier with the whole of its output fed back to the input. When the supply Vcc is connected, the inevitable asymmetry causes one transistor to conduct quicker than the other. Assuming that at the moment the supply is applied TR1 starts conducting and becomes saturated while TR2 gets cut off. After sometimes, the situation is reversed, and as a result the output is taken from the collector of either transistor.

3.2.5 MOSFET BANK

The term MOSFET means metal oxide semi-conductor field effect transistor. It is a very important component in electronics. Thus, it is used in this work for switching operation. The job of a switch is to keep the flow of current in a circuit in ON and OFF state. By controlling the voltage at the gate of MOSFET, one can start or stop the flow of current from its drain to source i.e. MOSFET can be switch ON or OFF.

The MOSFET used is IRF3205.Thus the maximum drain current, IDmax. From the data sheet is 110A and the trigger voltage is between the range of 3-20V. This is to say that the MOSFET can take up to 110A and anything above will destroy it. As a result of the positive temperature co-efficient, they can be cascaded in parallel so that the current passing through each is greatly reduced. From experience of things, it is better for gate voltage to be between 3-5V. The drain – source voltage, VDS = 60V.

3.2.6 MATHEMATICAL ANALYSIS.

The reason for using the number of MOSFET is that; the power ratting of the inverter is equal to 1000VA = 1kVA. Thus,

P = IV ....(1)

Since voltage source = 12V

1000 = I x 12

I = 1000/12 ≈ 83

But normally, there should be allowance for energy wasted as a result of heat. Thus, using 100Amps.

P = IV =100 X 12 =1200VA

So that 200VA is assumed for energy wastage. For this reason, one must select MOSFET that can handle this capacity without damaging. Thus, using two (2) of the MOSFET heats up. Therefore, I decided to use four (4) pieces, two (2) at each side.

Each two set is cascaded in parallel so that it divides the current into two equal halves as a result of its positive temperature co-efficient. Therefore each MOSFET carries 50Amps..The module can be shown bellow:

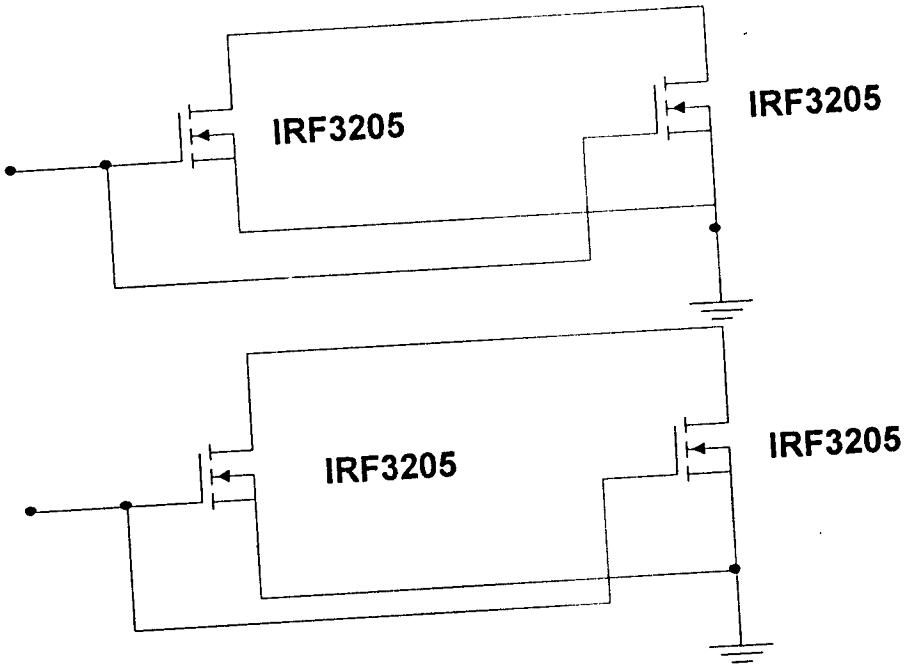

Fig.3.3 Circuit Diagram Of The MOSFET Unit

3.2.7 PRINCIPLE OF OPERATION OF THE OSCILLATOR AND THE MOSFET

As a matter of fact 5V was supplied at point A and B respectively but when A is 5V, B is 0V and when B is 5V, A is 5V. Thus as a result, when A is 5V, 12V flows through MOSFET Bank 1 to ground, the current I(A) spited equally. That is, if am using 100Amps. Battery, its divides the current (I) to 50:50 each. At this point B is 0V and no action is seen at MOSFET bank 2. This happens allover and vice – versa.

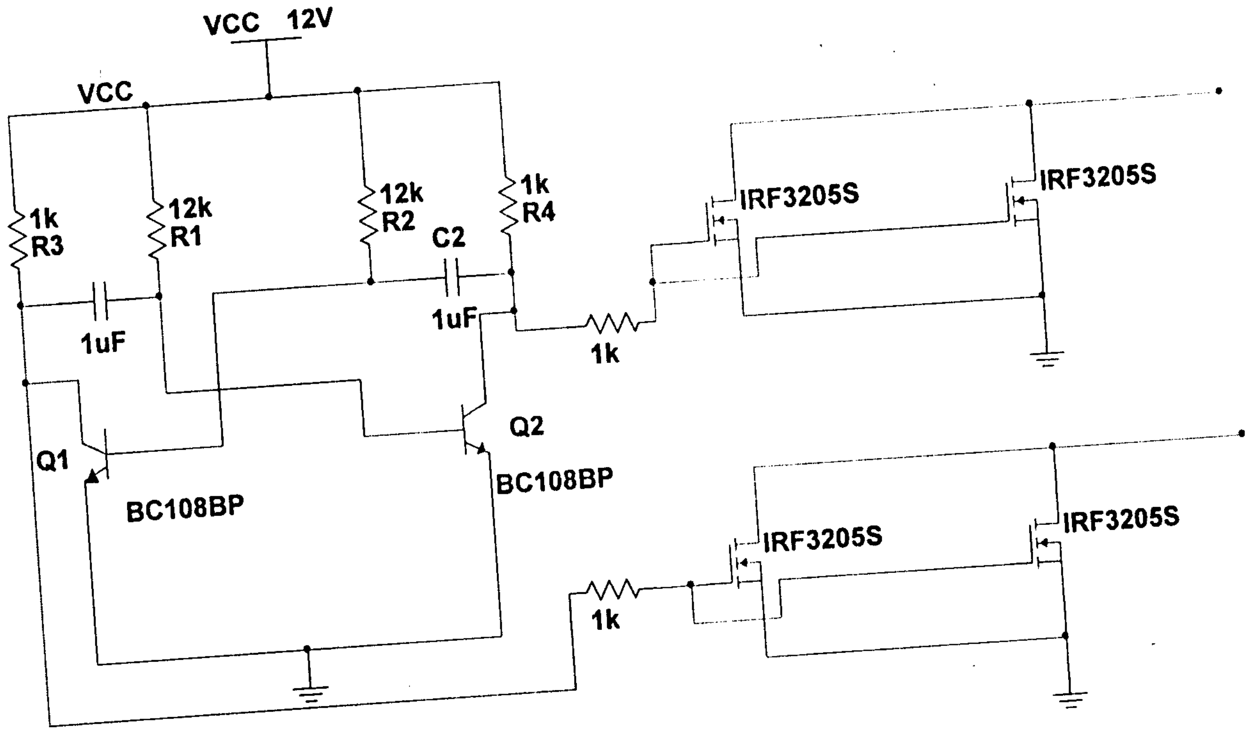

FIG.3.4 Circuit Diagram Of The Oscillator And MOSFET

3.2.8 TRANSFORMER UNIT

The transformer used is a 1KVA, 12V central tap transformer. The transformer is cascaded with the circuit; it is a device that work based on the principle of mutual induction. It works on AC signals and not on DC signal in the sense that DC signals can not generate mutual induction. In the transformer, electrical energy is transfer from one circuit to another circuit. During transfer, the current and voltage can change, the output wattage also depends on the thickness of the secondary and the primary turns.

M=NI

Since we want the transformer to step the 12VAC to 220VAC, the turn ratio of the transformer can be determined from.

$V1/V2=N1/N2$

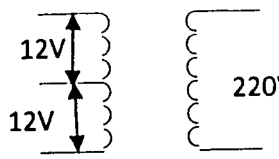

Fig.3.5 A 12v To 220v Step Up Transformer

3.2.9 RELAY SECTION

The relay used is an AC relay of rating 220(AC), 10Amps. That is to say only 10Amps maximum is needed to pass through the relay. This relay is used to disconnect the oscillator from power and to connect the charging system to power. When PHCN gives power, the relay is energized and it helps to stop power from entering the multivibrator, thereby stopping the system from inverting. It also enables automatic charging.

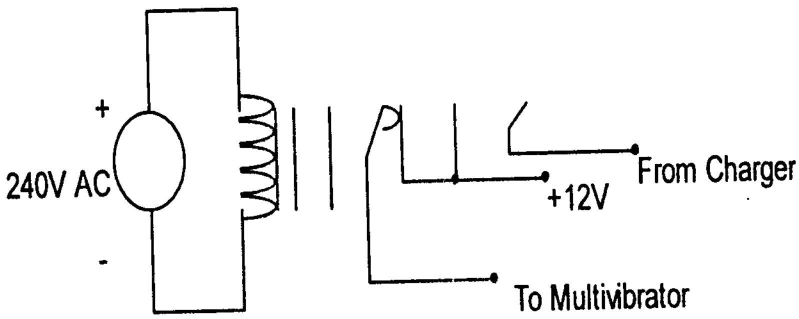

Fig. 3.6 circuit diagram of the relay section

3.2.10 CHARGING SECTION

The inverter battery gets discharged with use, so it needs to be charge regularly. The charging section of the inverter does this job and the section consist of a step down transformer which step down PHCN supply(230V) to 12V.This AC voltage is then rectified and converted to a DC and, afterward, its filtered shown bellow

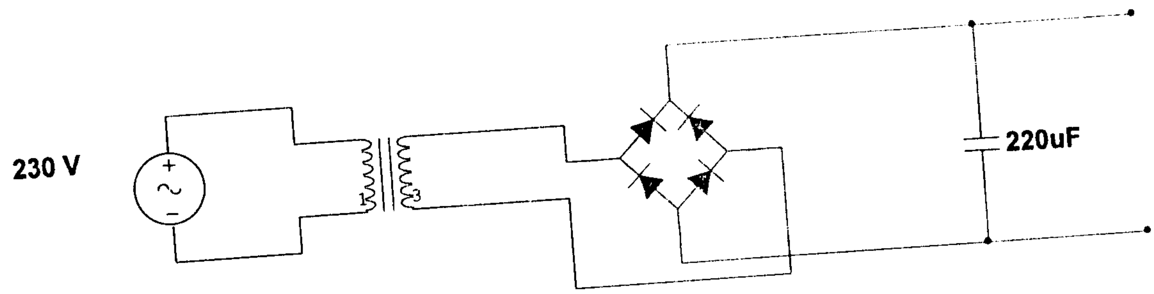

Fig.3.7 Circuit Diagram Of The Charging Section

3.2.11 MATHEMATICAL ANALYSIS

It = Cdv

I = 0.5Amp.

T =1/2f =0.01sec.

dv = 15% of the of peak voltage

But peak voltage = $\sqrt{2}$ x 12 = 16.97

15/100 x 16.97 = 2.5V

C = It/dv = 2200μF

3.2.12 METER SECTION

The meter section is responsible for the display of the behavior of the inverter i.e. the voltage behavior of the inverter. This consists of the main component 7107IC. It is a meter IC which uses dual power supply as shown bellow.

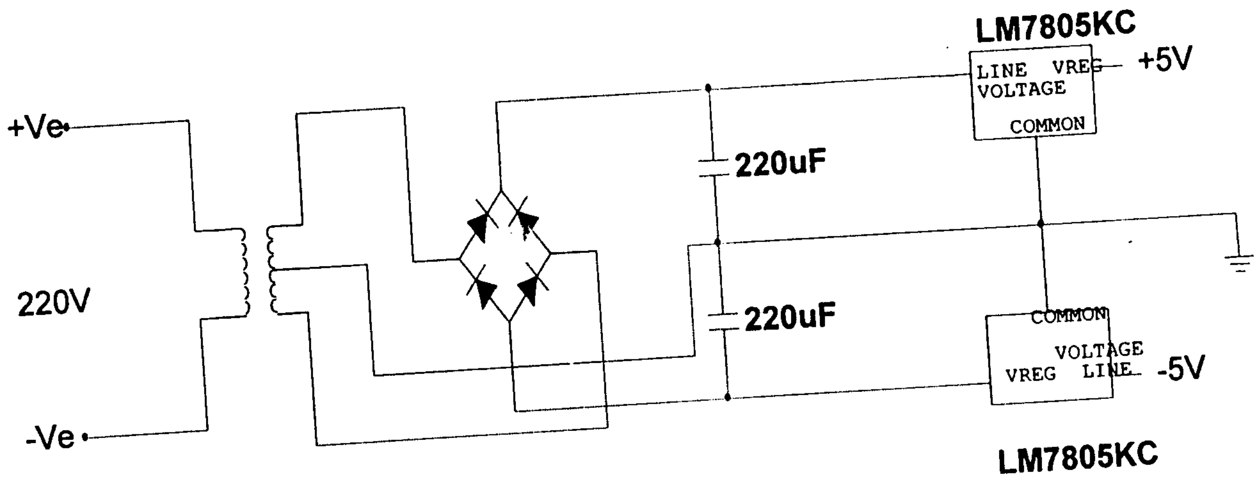

Fig.3.8 Circuit Diagram Of The Meter Section

3.2.13 MATHEMATICAL ANALYSIS

The design analysis is the same as in charging section.

3.2.14 IC SECTION OF THE METER

This consists of the 7107 and some other discrete components which are used as basic support components. These are specified by the manufacturer of the IC (7107).The ICL7107 is designed to operate from ±5V supplies, however when a negative supply is not available it can be generated from a clock output with two diodes, two capacitors, and an inexpensive IC.

This digital voltmeter is ideal to use for measuring the output voltage of the said inverter.

The circuit can be analyzed as shown bellow.

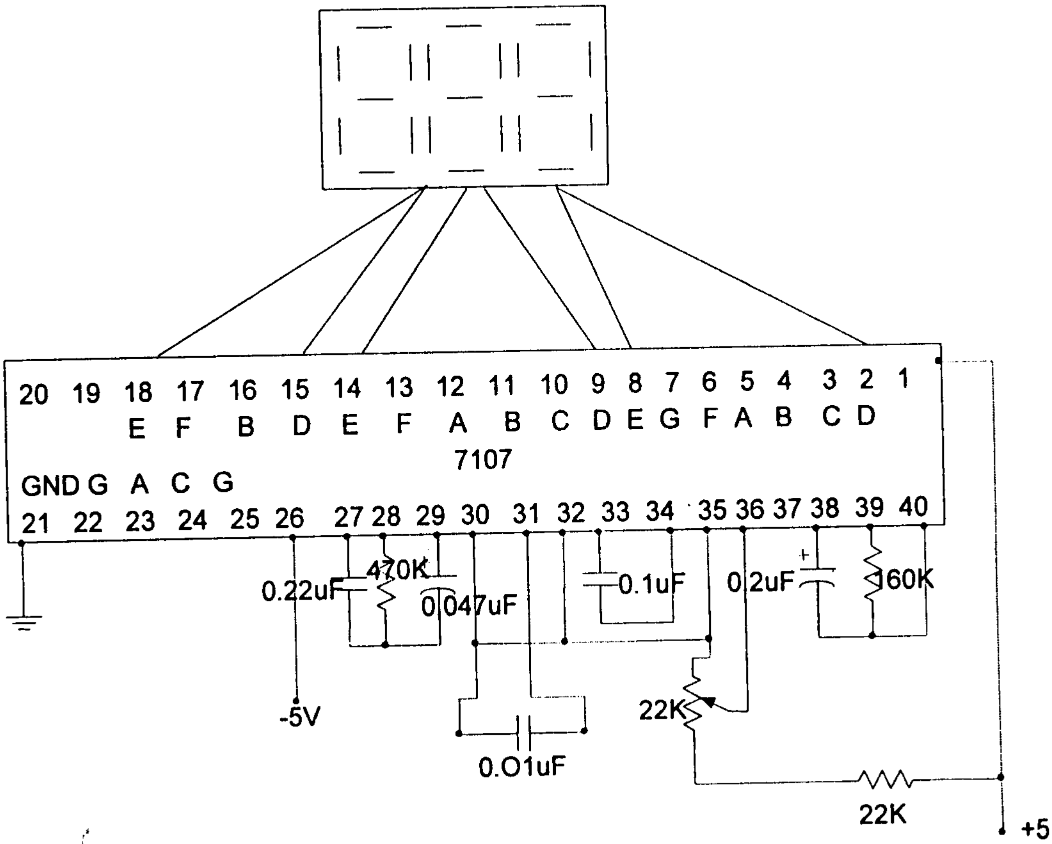

Fig.3.9 Circuit Diagram Of The 7107IC

1.2.1 IMPLEMENTATION

The components needed were purchased after which was realized and simulated on a breadboard to ascertain its workability. The final construction was done by soldering the components on a Vero- board and encasing in a metal casing with a fine finishing.

CHAPTER FOUR

TEST, RESULT, AND DISCUSSION

4.1 TESTING

The physical realization of the project is very vital. This is where the fantasy of the whole idea meets reality. The designer will see his work not just on paper, but as a finished hardware system.

After carrying out all paper design and analysis, the project was implemented and tested to ensure of it's working capability. The process of testing and implementation involved the use of some electrical components as listed bellow;

(i) BENCH POWER SUPPLY

This was used to supply voltage to the various stages of the circuit during the breadboard test before the power supply in the circuit was built and soldered. The bench power supply was also used to set the "charge'' and "discharge" voltage condition of the battery.

(ii) OSCILLOSCOPE

The oscilloscope was used to observe the ripples in the power supply waveform and also to check the oscillator wave form as well as the oscillator frequency. The oscilloscope was also used to check for signals in the ADC calibration circuit which oscillates at a low frequency.

(iii) DIGITAL MULTIMETER

The digital multimeter basically measures voltage, resistance, continuity, current, temperature and also polarity of the components. The process of implementation of the design on the breadboard require that the measurement of parameters like voltage, current, and resistance value of components so as to test there status. Frequency measurement was used to check the frequency of the oscillator stage to confirm its functionality. The ammeter in the digital multimeter was used to check the charging current of the battery to confirm if the battery is charging.

v) LOAD – TIME FRAME

The 1KVA single phase inverter with a digital output display was loaded gradually starting from a 60W to 800W load(taking power factor into consideration) in other to ascertain it conform with the aim/objective of the work.

.2 RESULT

As an electrical/computer engineering student, every test undergone must be followed by a certain results. The result obtained may either conform or may not totally conform with the desired specification, but effort must be made to make sure there is conformity with the specification. The following result was obtained:

(i) CONTINUITY

After a careful test, it was observed that the jumpers were well connected/soldered, thus continuity ascertained.

(ii) MEASUREMENT

With the aid of a multimeter, the following result were obtained

Tab.4.1 Table showing the load connected and the period the inverter can last.

S/N	LOAD(W)	QTY	PERIOD(hrs)
1	60	1	5hrs
2	100	1	4.5hrs
3	200	1	3hrs
4	200	2	2hrs
5	200	3	1.5hrs

Tab.4.2 Table showing the input and output voltage of the inverter

S/N	**INPUT(BATTERY) VOLTAGE**	**OUTPUT VOLTAGE FROM INVERTER**	**EXPECTED RESULT FROM METER**
1	**12V**	**230V**	**230V**
2	**11V**	**210V**	**210V**
3	**10V**	**192V**	**192V**
4	**9V**	**172.5V**	**172.5V**
5	**8V**	**153.3V**	**153.3V**
6	**7V**	**134V**	**134V**
7	**6V**	**At this point, the inverter can not sustain any load**	

(iii) LOAD -TIME – FRAME

It can be seen that, the time it will last is inversely proportional to the load i.e. the lesser the load, the longer it will last. Also, the lesser the load ,the higher the magnitude of the voltage. Thus, the higher the intensity of the light.

4.3 DISCUSSION OF RESULT

With the aim/objective and scope of this project, it can be seen that, the work has been done appropriately. Thus, can be said to be successive.

Also, the time frame is inversely proportional to the applied load, i.e. the time frame can however be increased if the load on the inverter is reduced and vice-versa. More also, the load is inversely proportional to the intensity of the light.

4.4 PRECAUTIONS

During the cause of the project, some of the precautions taken in other to attain the desired goal are as follows:

1. I ensured that the correct ratings were used for all the components involved in the implementation of the project to avoid burnt of component.
2. I also ensured high voltage while soldering to avoid stay soldering which can lead to bridging of components
3. I ensured that correct polarity of the component was strictly noted.
4. I ensured that an external heat sink was connected to the MOSFET in other to avoid its damage.
5. Proper calibration of the digital voltmeter (i.e. 7107 IC) to avoid irregular/non-linear display.

4.5 PROBLEMS ENCOUNTERED

In the course of implementation, testing, and construction of the project, series of problems were encountered, some of which are as followed:

1. The efficiency of the system.
2. The power MOSFET's were at a time dissipating a lot of heat, hence the use of heat sinks which is placed on each MOSFET to allow for proper heat dissipation.
3. The calibration of the meter was a very difficult task which called for series of consultations from people with higher knowledge.
4. Another problem encountered during the implementation of the project is the successive closure of the school, thus making it difficult to co-ordinate my activities with my project supervisor. There are many more but few are mentioned.

4.6 LIMITATION

The meter circuit was not achieved accurately, possibly because of the capacitor between pin 31 and 30.

CHAPTER FIVE

RECOMENDATION AND CONCLUSION

5.1 CONCLUSION

The project was designed considering some factors such as economy, availabity of components and re search materials, efficiency, compatibility and also durability. The performance of the project after test met design specification and hence can be said to be satisfactory.

The general operation of the project and performance is dependent on the user who is prone to make human error such as battery polarity change or tendency to overload the system, and other conditions such as low battery level, which are prevalent to such battery – powered equipments. In addition, the construction was done in such a way that it makes maintenance and repairs an easy task and affordable for the user. The project has really exposed me to power, digital, and practical electronics which is one of major challenges I shall meet in m6y field now and I in the nearest feature.

Thus, the design and construction of 1KVA single phase inverter with digital output display was quite challenging and tedious compared to work asynchronously with the whole system was not an easy task.

I hereby wish to thank the department, my supervisors and project coordinator for giving me the opportunity to carryout the project work. However, like every aspect of engineering, there is still room for improvement and further research on the project as suggested in the recommendation above

5.2 RECOMMENDATION

I hereby recommended that further work should be done on the following areas:

1. The meter area should be worked on to ensure that the display is accurate.

2. Higher rating should be constructed

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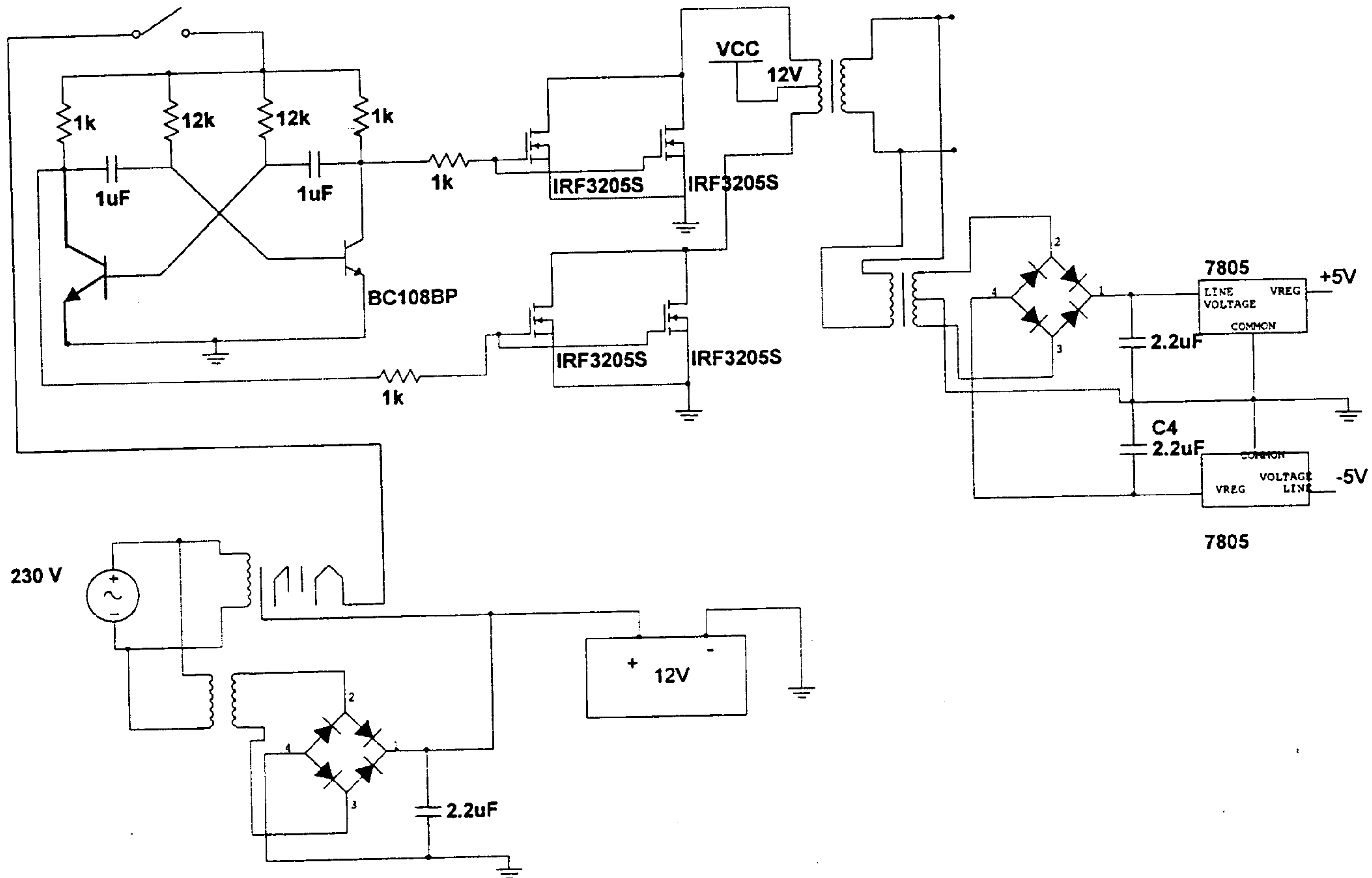
Appendix One
Main Circuit Diagram of the Inverter



APPENDIX TWO

MAIN CIRCUIT DIAGRAM OF LL7107IC