



Department of Electrical Engineering

Term Project

Power Electronics

BS 8TH (Fall 2019)



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Attributes Coverage																
PLOs												EA1	EA2	EA3	EA4	EA5
1	2	3	4	5	6	7	8	9	10	11	12					

The Term Project is of 20 marks and will count as 20% weightage of your whole grade.

Proposal is of 5 marks (5% of total weightage)

Final Report is of 15 marks (15% of total weightage)

Task: To write a report on the complete analysis of a Power Electronics Application.

Due Date: End of semester.

Final Report

Problem Description

1. Select any one switching device from the following list and state its characteristics
 - a. Power diode
 - b. Thyristors (SCR)
 - c. Bipolar -Junction Transistor (BJT)
 - d. Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET)
 - e. Insulated-Gate Bipolar Transistor (IGBT)

2. What are the merits and demerits of your selected switching device as compared to the others?

Ans) MERITS OF MOSFET

- They can be operated in either enhancement mode or depletion mode.
- They have much higher input impedance compare to JFET.
- They have high drain resistance due to lower resistance of channel.
- They are easy to manufacture
- .They support high speed of operation compare to JFETs.

DEMERIT OF MOSFET

- In MOSFET, the layer between Gate and Channel is very fragile which is vulnerable to electro-static damage during installation. It requires well designed circuit to avoid the issue.
- MOSFET is very susceptible to overload voltages , hence special handling is required during installation.

3. Select one power electronics circuit (rectifier, invertor, DC converter) in which your selected switch is used.

ANS)

Inverter

4. Explain the working of the circuit, what is the purpose of the switch in this circuit and what are the jobs of the other components used in the circuit

ANS)

WORKING OF THE CIRCUIT

A metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET) is a field-effect transistor (FET with an insulated gate) where the voltage determines the conductivity of the device. It is used for switching or amplifying signals. The ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals. MOSFETs are now even more common than BJTs (bipolar junction transistors) in digital and analog circuits.

A MOSFET is by far the most common transistor in digital circuits, as hundreds of thousands or millions of them may be included in a memory chip or microprocessor. Since they can be made with either p-type or n-type semiconductors, complementary pairs of MOS transistors can be used to make switching circuits with very low power consumption, in the form of CMOS logic.

5. Select one application of your selected circuit. Explain the application in detail and the purpose/working of your selected circuit in the application.

Ans

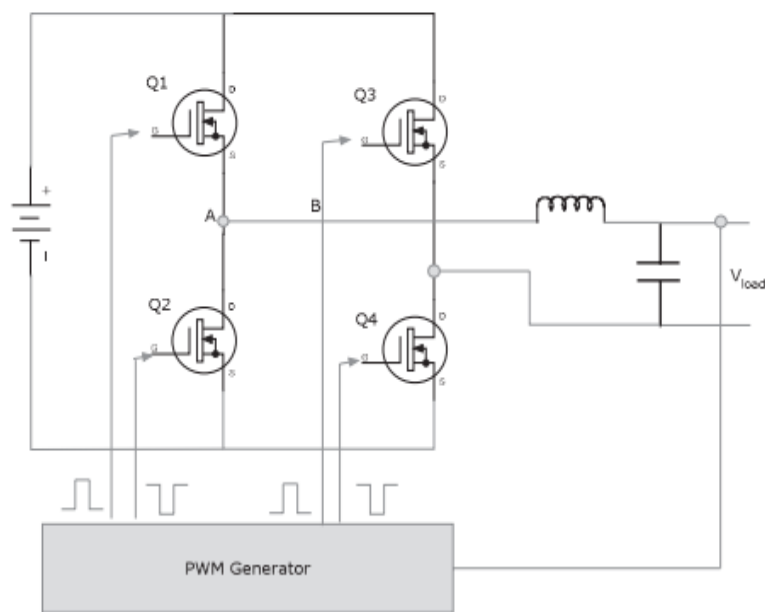
- convert DC to AC which is the one of the important application of the inverter.

Inverter circuit is one of the fundamental building blocks in digital circuit design (not to be confused with a power inverter). The inverters can be applied directly to the design of logic gates and other more complex digital circuits.

It is the simplest MOSFET inverter circuits, it has a load resistance R and n-MOS transistor connected in series between supply voltage and ground. If V_{in} is less than the threshold voltage of the n-MOS the transistor is off. The capacitor can be changed to supply voltage and the output voltage equals to the supply voltage. When the input is greater than the threshold voltage of the transistor and we get zero voltage at output it's disadvantages is that it occupies large area IC fabrication. Here we use n MOS transistors as active load instead of resistor. There are two kinds of transistors in the circuit pull down transistor to pull the output voltage to the lower supply voltage (usually 0V) and pull up transistor to pull the output voltage to the upper supply voltage.

6. Design the complete circuit of your selected application.

Circuit of the selected application



7. What are the parameters of your circuit (input and output power, current and voltage)

Ans.)

- Inductor
- Capacitor
- PMW generator
- MOSFET transistor
- Battery

PMW generator are connected to the gate of the MOSFET to allow the transistor on and off and vice versa and use as input and battery which supply input dc power to the circuit which convert into AC as output and which is load.

8. State the equations used for deriving the values of the components. Mathematically derive each value of your component.

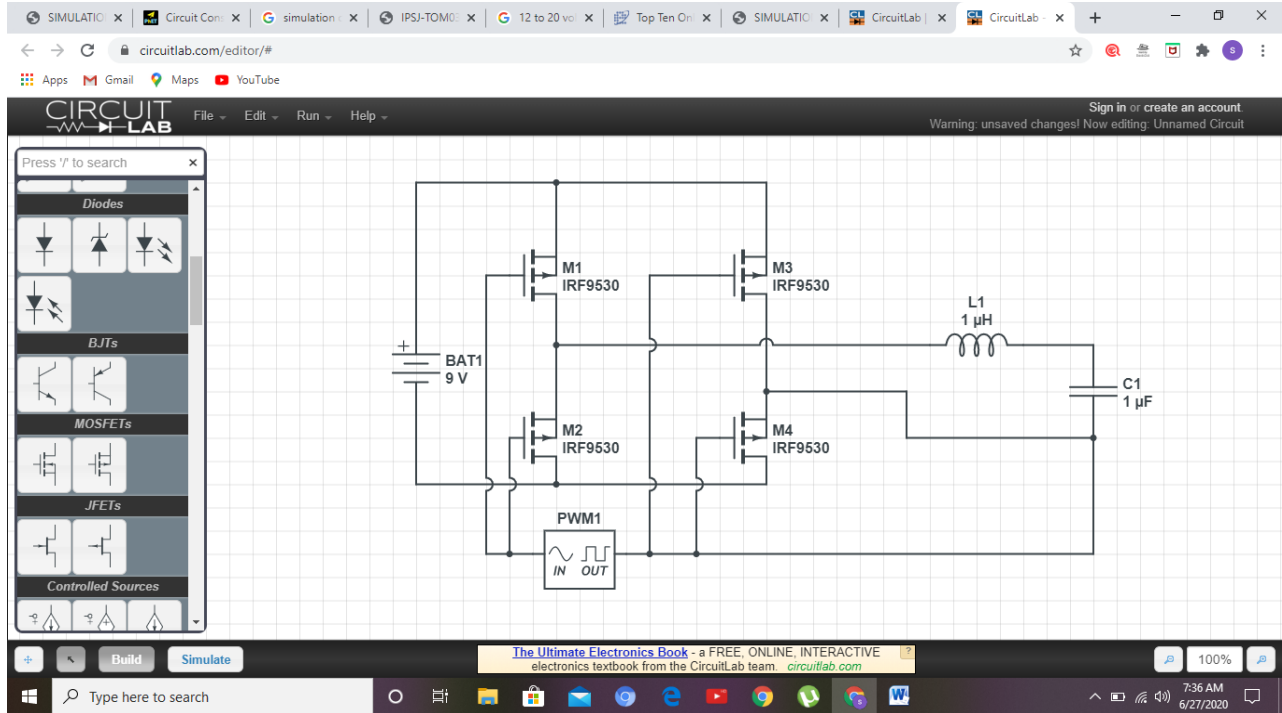
$M = V_{\text{controller}} / V_{\text{carrier}}$

$M = 0.3$ for one value and

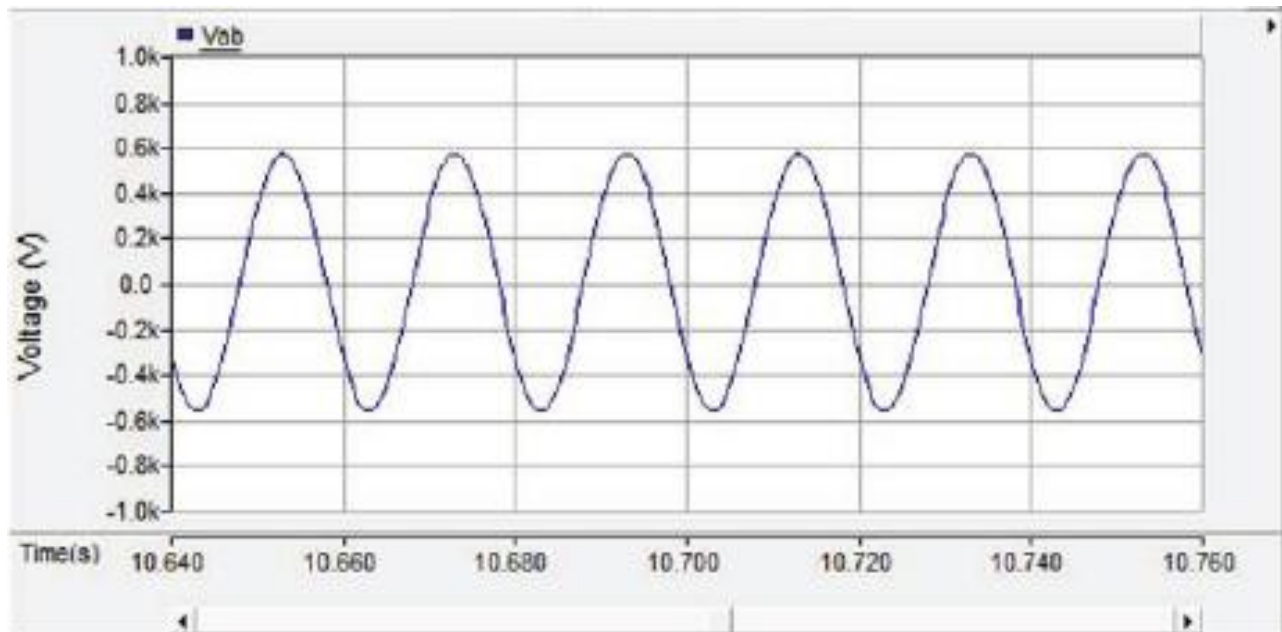
$M = 0.2$ for the second value (reference (IPJSJ-TOM0303013.pdf))

9. Using Multisim or Matlab simulate your circuit. Show and explain the results of your simulation.

Simulation on software



OUTPUT OF THE INVERTER



10. Write your conclusion about the project.

We conclude that simple voltage driven inverter circuit using power transistors as switching devices is build, which converts 12V DC signal to single phase 220V AC. every inverter circuit is to produce oscillations using the given DC and apply these oscillations across the primary of the transformer by amplifying the current. A 12V DC to 220 V AC converter can also be designed using simple transistors. It can be used to power lamps up to 35W but can be made to drive more powerful loads by adding more MOSFETS .The inverter implemented in this circuit is a square wave inverter and works with devices that do not require pure sine wave AC. By using a 24V battery, loads up to 85W can be powered, but the design is inefficient. In order to increase the capacity of the inverter, the number of MOSFETS must be increased.

Templet

1. All text should be in Times New Roman font.
2. Headings should be **bold** and in **14** size.
3. Sub-heading should be **bold** in **12** size.
4. Rest of the text should be normal in 12 size.
5. Labelling of figures and tables should be *Italic* in *11* size.
6. Use proper referencing.

Do not write the complete questions. Only give its designated number and main heading

Do not copy paste the figures, tables and graphs. Redraw the figures. Remake the table and graphs from the data available in the papers.

Plagiarism should not be more than **20%**. **You have to submit plagiarism report with the task.**

Engr. Shayan Tariq Jan
Course Instructor