HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

POWER ELECTRONICS CIRCUITS: THE IGBT AS A SEMICONDUCTOR SWITCH

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This project is dedicated to all my family and especially to my father George and my mother Maria for all the understanding, patience and love they have shown to me through all these years.

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SUMMARY

Power electronics covers device characteristics, conversion techniques and applications. It emphasizes the fundamental principles of power conversions. The application of semiconductor devices in the electric power field has been steadily increasing, and a study of power electronics is now a feature of most electrical and electronic engineering courses.

The power semiconductor devices, such as the diode, thyristor, triac, and power transistor, are used in power applications as switching devices. The development of theory and application relies heavily on waveforms and transient responses, which distinguishes the subject of power electronics from many other engineering studies.

This project deals with the construction of power switch using an IGBT and the construction of the appropriate driving circuit.

A general approach to the semiconductors devices used in power electronic circuits, diodes, thyristors, mosfets, transistors, IGBTs and the DC chopper-using transistor is made at chapter two.

Chapter three deals with the description of the constructions in general. Also it gives the semiconductors' data for each construction.

Chapter four deals with the experimental results and comments on these. Also general conclusions of the project are made in chapter five.

CHAPTER 1

1.1Introduction

Power electronics began with the introduction of the mercury arc rectifier in 1900.The first electronics revolution began in 1948 with the invention of the silicon transistor. Most of today's advanced electronics technologies are traceable to that invention. The next breakthrough was in 1956 with the invention of the PNPN triggering transistor, which was defined as a thyristor or silicon control rectifier.

The second electronics revolution began in 1958 with the development of the thyristor by the General Electric Company. After this many different types of power semiconductor devices and conversion techniques have been introduced.

The power electronics revolution is giving us the ability to shape and control large amounts of power.

1.2General overview

Power electronics deals with the applications of solid-state electronics for the control and conversion of electric power. Conversion techniques require the switching ON and OFF of power semiconductor devices. But an ideal switch should have no switching on and off limitations in terms of turn on time, turn off time, current, and voltage capabilities. Power devices such as power mosfets, scrs, triacs, IGBTs, and other semiconductor devices are used in a wide range of products.

This leads to the purpose of this project, which is dealing with these devices and especially with the IGBT. The idea was to construct a power switch using an IGBT. For this reason construction of associated support circuits is needed.

By constructing such a power switch and using the appropriate driving circuit you can provide a variable dc voltage for driving dc motors.