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INTELLIGENT POWER EMULATOR

Anand kumar T[1], Anbarasu S[2], Santhosh kumar M[3], Visalini K[4]

[1]*Assistant Professor, Department of Electrical and Electronics Engineering, Dr.Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu, India*
[2]*Student, Department of Electrical and Electronics Engineering, Dr.Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu, India*
[3]*Student, Department of Electrical and Electronics Engineering, Dr.Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu, India*
[4]*Student, Department of Electrical and Electronics Engineering, Dr.Mahalingam College of Engineering and Technology, Pollachi, Tamil Nadu, India*

Abstract - *In testing of various circuits in laboratory, the power converters are tested on the separate module. This occupies a large area, since the testing of power converters are made individually. To overcome this difficulty, the conventional module is replaced with new testing equipment called intelligent power emulator (IPE) which is incorporated with protective device, bread board, driver circuit, switching device (MOSFET), DSO, etc., The protective device such as voltage protection, circuit breakers, fuse, relays are used to protect the device from damages due to an voltage drop, short circuits or from any other fault in the equipment. Since DSO is attached to this equipment, the wave forms can be generated and be easily analyzed. In this (IPE) module, the rotary switching mechanism and patch is used. The space occupied by this power module is less. The testing and functioning of power converters are analyzed and hardware is completed.*

***Key Words*: Rectifier, Buck converter, Boost converter, Inverter, Microcontroller,**

1. INTRODUCTION

Intelligent Power Emulator (IPE) aims to implement a module which consists of the testing and functioning of various power converters. Testing of electronic circuits is made in separate modules. The electronic circuit consists of converters or inverter or rectifiers etc., on a separate module. "Intelligent Power Emulator "is regarding combining the separate module of converters operation and put them on a single module. This module will be able to perform the functions of converters such as

The module mainly consists of various converter circuit, driver circuit, protective devices, sensors, micro-controller, etc. The transformer with multi output is used as the driver circuit. Here the rectifier IC (DB107) is used to rectify the Ac voltage from the transformer and provides the constant Dc voltage to the switches used in the module. Optocoupler after rectifier circuit is used.TLP-250 is mostly suitable for MOSFET and IGBT. Since MOSFET has high switching speed, MOSFET is used as the switching device in this module. Hence TLP-250 is used here. The input stage has a light emitting diode and output stage have photo diode. This driver circuit will give the voltage, with which the switches such as MOSFET can be operated.

Fuses are fixed at each switches, this will protect the switches from any of the sudden fluctuations. Burg is used to receive input voltage from the receiver. Using fuses the switch and other components will be protected against the internal damage. All These circuits with proper connections and with a whole setup will be incorporated inside the Galvani steel module. This module will have rotary switches, Digital signal oscilloscope screen, patches, probe outlets, test points on the module. The remaining circuit will be incorporated inside this module.

1.1. CONVENTIONAL MODULE

The conventional module consists of a circuit where we can test separate power converters on separate module. The output of the power converter can be check with the help of digital storage oscilloscope. This occupies a large area space, since separate modules are used. This is of high cost.

1.2. PROPOSED MODULE

This Proposed module consists of operation of several converters on a single module. The output can be stored and analyzed using the digital storage oscilloscope which is inbuilt within the module. This relatively occupies a less space. Hence comparatively, the proposed system is more useful than the conventional module. Since patches are used here and for future extension rotary switches will be made.

2. BLOCK DIAGRAM

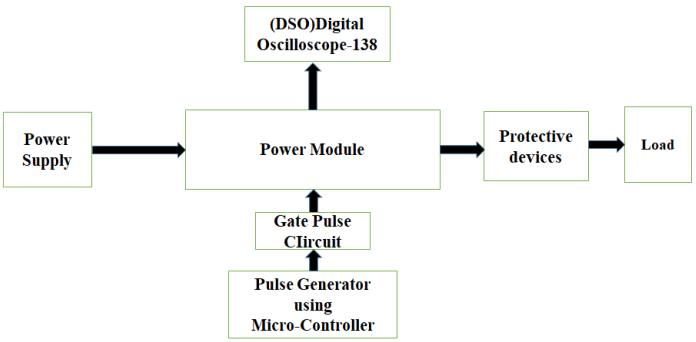


Fig 1: Block diagram

2.1. BLOCK DIAGRAM DESCRIPTION

The block diagram consists of module which is encapsulated with Gate pulse circuit, pulse generator using micro-controller, Digital signal oscilloscope (DSO-138), Protective devices, and rotary switches.

This module will be able to perform the functions of converters such as buck, boost. Hence this advanced power emulator is better in its operation as well as it will occupy only less space when compared to the conventional module. This Proposed module consists of operation of several converters on a single module. The output can be stored and analyzed using the digital storage oscilloscope which is inbuilt within the module. Hence comparatively, the proposed system is more useful than the conventional module. Since patches are used here and for future extension rotary switches will be made. This relatively occupies less space.

2.1.1. TRANSFORMER

The transformer with 1 input and 6 outputs is used here. The transformer fed with 230v ac input and the output with ac is fed to the rectifier circuit, where ac input from transformer is rectified to dc supply and is fed to the switches. The supply to switches is basically fed through transformer.

2.1.2. GATE PULSE CIRCUIT

The gate pulse circuit consists of rectifier IC, Optocoupler-TLP250,Screw connector.

2.1.3. RECTIFIER IC-DB107:

The rectifier converters ac input into dc. Rectifier ICDB107 is used to rectify A.C voltage and provides constant D.C voltage. This is a 1000v rectifier.

A rectifier is Associate in Nursing device that converts alternating current(AC) that sporadically reverses direction to direct current(DC)

2.1.4 OPTOCOUPLER -(TLP-250)

The optocoupler TLP-250 is mostly suitable for MOSFET and IGBT. Since MOSFET is the switching device used in this module, optocoupler (TLP-250) is best suitable for MOSFET. It has an advantage that it is optically isolated.

Input stage has a light emitting diode and output stage have a photo diode. Whenever input stage LED falls on output stage photo detector diode, the output becomes high.

pin 1 and 4 is not connected to any point physically and hence not in use.

Pin 2 and 3 are anode and cathode points of input stage LED. It works like a normal light emitting diode. It has similar characteristic of forward voltage and input current. Maximum input current is in the range of 7-10mA and forward voltage drop is about 0.8 volt.TLP-250 provides output from low to high with minimum threshold current of 1.2mA and above. It is provided by controller .Hence Pin 2 is Arduino pins(+5v) and Pin 3 is Ground in Arduino.

Pin 8 is used to provide power supply to TLP-250 and pin 5 is ground pin, which provides return path to power supply ground. Maximum power supply voltage between 12-30 volt dc is given to TLP-250.Hence pin 8 is power supply(+ve) and pin 5 is ground. Pin 6 and 7 is internally connected to each other. Output can be taken from either 6 or 7.Totem Pole configuration is used in TLP-250.In case of high input, output becomes high with output voltage equal to supply voltage in case of low input, output becomes low with output voltage level equal to ground.TLP-250 can be used up to 25kHZ frequency due to slow propagation delay.

2.1.5. MOSFET

MOSFET is used in this module. Metal Oxide Semiconductor Field Effect Transistor has high switching speed. Hence in this emulator, for switching speed MOSFET is preferred.

2.1.6. FUSES

Fuse is connected in fuse connector. It protects the device from high current. It is an electrical safety device that operates to provide over current protection of an electrical circuit.

2.1.7. PATCH CORDS

Patch cable or patch cord is used in the module for connections.By using 2mm patch cord connectors, the circuit is formed. The patch cord is of various colors. If the cord is

red, it is positive. For black, it is negative. For blue, it is source or collector. For green, it is drain or emitter.

2.1.8. SCREW CONNECTOR

Two types of screw connectors are used. They are,3Pin screw connector, 2pin screw connector

2.1.9. TEST POINTS

A test point is a location within an electronic circuit that is used to monitor the state of flow of electricity also it is used to check the module from outside.The test points are fixed at different parts.

2.1.10. DIGITAL STORAGE OSCILLOSCOPE (DSO)

A digital storage oscilloscope is an type of oscilloscope which stores and analyses the signal.. In this module DSO-138 is fixed inside the module. Hence it will not occupy more space

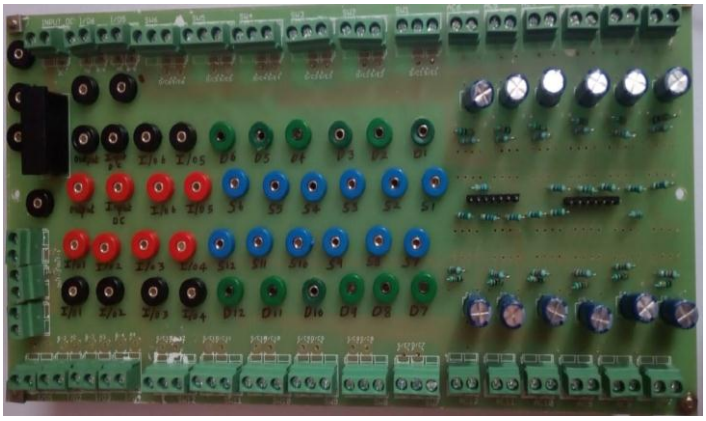
3. HARDWARE SETUP

A normal PCB board is used for patch work. This consists of the following:

1. 3 pin connectors
2. 2 pin connectors
3. Capacitors
4. Test points
5. Male beg
6. Input ports
7. Output ports
8. Patch for switches
9. Test points

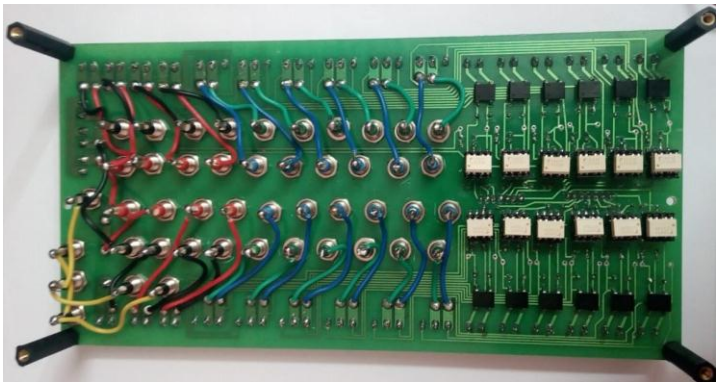
The Intelligent Power Emulator (IPE)is incorporate with all these components in the PCBboard .

This PCB board is shown below where the components such as connectors, capacitors, mosfet, testpoints, ports for inputs as well as for output is fixed. However, this module will be like more conventional than the proposed one.

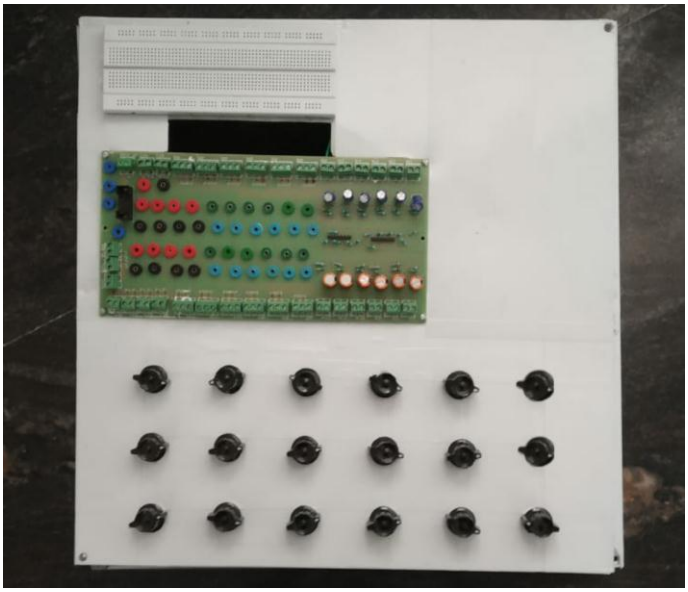


3.1. PCB BOARD

Pin connectors are used to insert the MOSFET or IGBT into the PCB layout. The berg is used to give supply to the circuit connections. The test points are used, to check the circuit whether it is in good condition or damaged due to short circuit or any other fluctuations. The input and output ports are provided to fed the supply to the circuit and to get the output respectively. Berg used in this board is male berg, which is incorporated within this circuit. To give supply to the circuit female berg is used and supply will be fed through the male berg. The internal connections of the patches are shown below

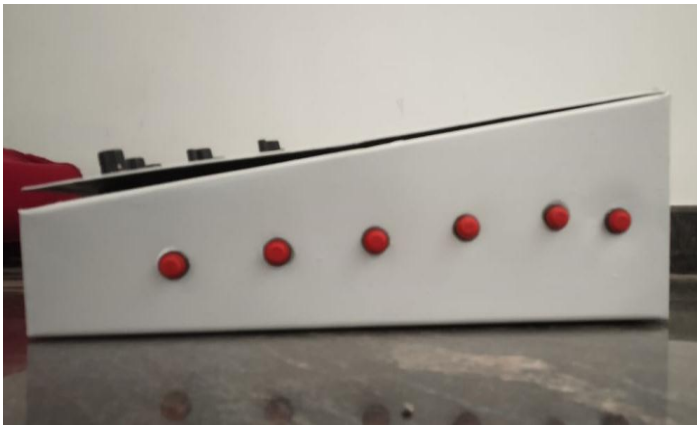


3.2. PCB WITH CONNECTIONS



3.3. INTELLIGENT POWER EMULATOR (IPE)

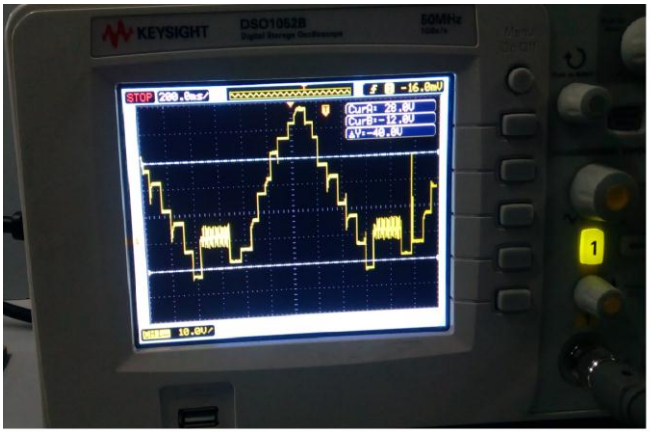
This is the final setup of intelligent power emulator (IPE).This consists of bread board on top of the module and below it has the PCB board with internal connection to perform the patch connections. The aurdino is incorporated inside the module, below which the rotary switches are placed.The supply to this circuit will be provided from outside the module.Separate transformers are thus provided to provide supply to the circuit.The rotary switches are interconnected depending on the switching mechanism.This replaces the conventional module in efficiency and space saving, we can perform with both patch as well as the rotary switching mechanism.



3.4. SIDE VIEW OF (IPE)

This the side view of the Intelligent power emulator.Here the separate fuses are the provided for the internal protection of the module.The module is made of galvanized steel .

To prevent the short circuit from outside the module ,it is painted with white paint so as to prevent shock. The output from a nine level inverter is taken as output from the circuit. The output on DSOis shown below.



3.5. DSO OUTPUT

4. CONCLUSION

This Proposed module consists of operation of power converters on a single module.The output can be stored and analyzed using the digital storage oscilloscope . Hence comparatively, the proposed system is more useful than the conventional module. Circuit connections are done with the rotary switches and also patches are used. This proposed system is more convenient than the conventional module.

REFERENCES

[1].Ankita Pandey, Dr. Dharmendra Singh, "A Buck Converter Based On PID Controller for Voltage Step-Down Application", IJSR, (Volume 4 Issue 12), pp. 1164-1167 December 2015

[2].Mirza Fuad Adnan, Mohammad Abdul Moin Oninda, Mirza Muntasir Nishat, Nafiul Islam, "Design and Simulation of a DC - DC Boost Converter with PID Controller for Enhanced Performance", IJRET, (Volume 6 Issue 09), pp. 27-32 September 2017

[3].Jose Rodriguez,Senior Member,IEEE, Jih Sheng Lai,Senior Member, IEEE, and Fang Zheng Peng, Senior Member,IEEE,"multilevelinverters,Topologies,controls and applications".

[4].Sanjay Murmu, SSPM Sharma B, "Study and Design, Simulation of PWM based Buck converter for Low Power Application", IOSR- JEEE, (Volume 10 Issue 4), pp. 01-17 August 2015