

Single Phase to Three Phase Conversion by Using SPWM

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Abstract— Sinusoidal PWM has been a very popular technique used in AC motor control. This is a method that employs a triangular carrier wave modulated by a sine wave and the points of intersection determine the switching points of the power devices in the inverter. Though this method is unable to make full use of the inverter's supply voltage and the asymmetrical nature of the PWM switching characteristics produces relatively high harmonic distortion in the supply it is still popular for its simplicity.

This abstract describes the theory of SPWM and the project shall be made using a programmed microcontroller of 8051 family duly interfaced to 3 phase inverter with 6 no's MOSFET from DC derived from a single phase or 3 phase ,50 Hz supply. The load shall be a three phase 50Hz motor, 440volt, 0.5 to 1 HP motor. Alternatively a star lamp load can be used to view the waveform only. This project uses an 8051 family microcontroller duly interfaced to the opto-isolators for feeding to the bridge drivers. 3 no's of dual bridge drivers are used to feed 3 phase bridge inverter with the DC supply developed from single phase AC after rectification. Powering the circuit is achieved by a pair of control transformers with bridge rectifier and filter capacitors. One set of this power is used for the microcontroller and the other one is used for driving circuits of the three phase bridge.

I. Introduction

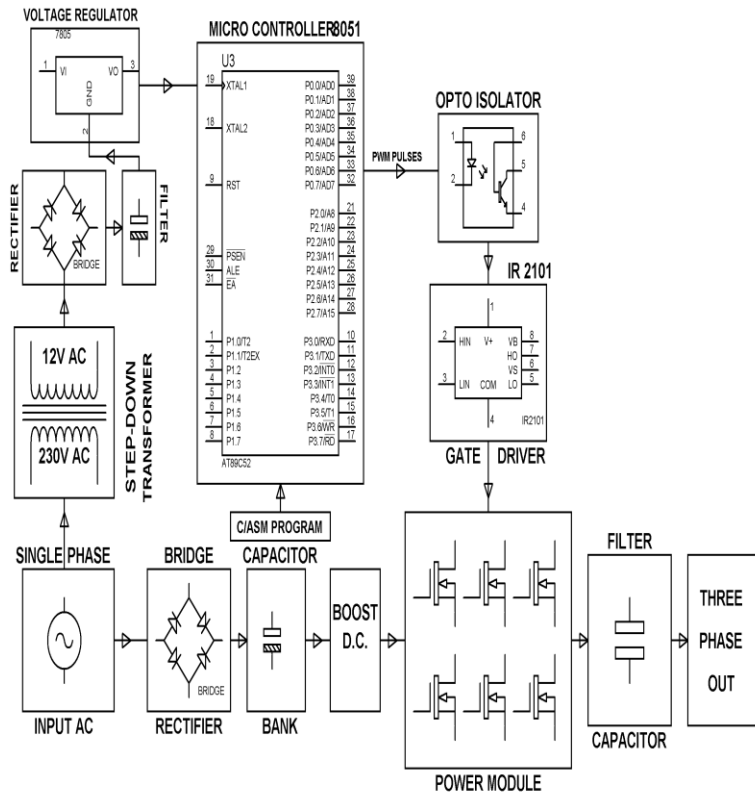
An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc. Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose.

II. Literature survey

- [1] S. Chen, B. Mulgrew, and P. M. Grant, "A clustering technique for digital communications channel equalization using radial basis function networks," IEEE Trans. on Neural Networks, vol. 4, pp. 570-578, July 1993.
- [2] J. U. Duncombe, "Infrared navigation—Part I: An assessment of feasibility," IEEE Trans. Electron Devices, vol. ED-11, pp. 34-39, Jan. 1959.
- [3] C. Y. Lin, M. Wu, J. A. Bloom, I. J. Cox, and M. Miller, "Rotation, scale, and translation resilient public watermarking for images," IEEE Trans. Image Process., vol. 10, no. 5, pp. 767-782, May 2001.

III. Block diagram



IV. Hardware requirement

1. **TRANSFORMER**:-Transformers convert AC electricity from one voltage to another with a little loss of power. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high voltage to a safer low voltage.

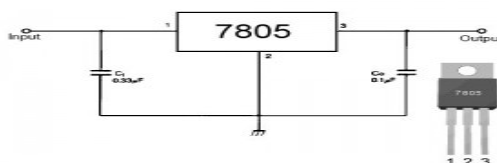


The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down and current is stepped up.

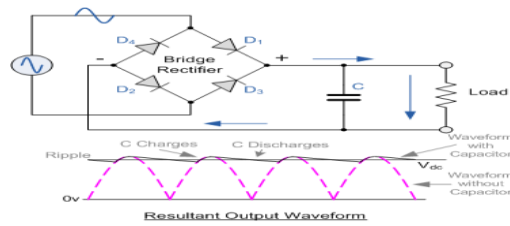
2. **VOLTAGE REGULATOR 7805**:-

Features

- Output Current up to 1A.
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V.
- Thermal Overload Protection.
- Short Circuit Protection.
- Output Transistor Safe Operating Area Protection.



The LM78XX/LM78XXA series of three-terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a Wide range of applications. Each type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output Current.

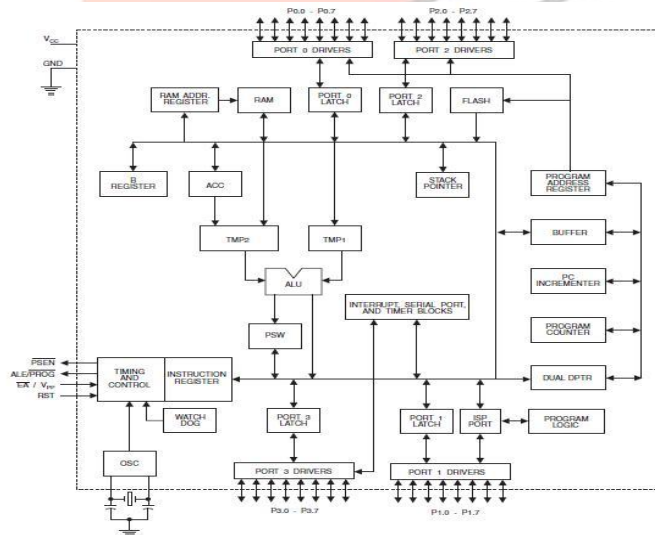


Capacitive filter is used in this project. It removes the ripples from the output of rectifier and smoothens the D.C. Output received from this filter is constant until the mains voltage and load is maintained constant. However, if either of the two is varied, D.C. voltage received at this point changes. Therefore a regulator is applied at the output stage.

3. MICROCONTROLLER AT89S52:-

Features:

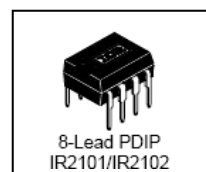
- 32 Programmable I/O Lines.
- Three 16-bit Timer/Counters.
- Eight Interrupt Sources.
- Full Duplex UART Serial Channel.
- Low-power Idle and Power-down Modes.
- Interrupt Recovery from Power-down Mode.
- Watchdog Timer.
- Dual Data Pointer.
- Power-off Flag.



4. IR2101:-

- Floating channel designed for bootstrap operation Fully Tolerant to negative transient voltage dV/dt immune.
- Gate drive supply range from 10 to 20V.
- Undervoltage lockout.
- 3.3V, 5V, and 15V logic input compatible.

operational to +600V



- Matched propagation delay for both channels.
- Outputs in phase with inputs (IR2101) or out of phase with inputs (IR2102)

DESCRIPTION:-

The IR2101(S)/IR2102(S) are high voltage, high speed power MOSFET and IGBT drivers with independent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 600 volts.

5. **IRF730 MOSFET:-****FEARURES:-**

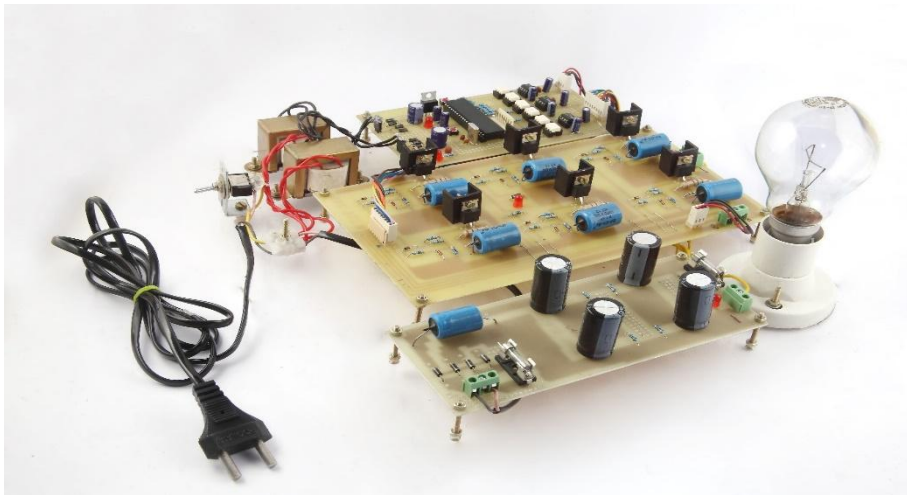
- typical $R_{DS(on)} = 0.75 \Omega$.
- extremely high dv/dt capability.
- 100% avalanche tested
- very low intrinsic capacitances gate charge minimized

DESCRIPTION:- This power MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY process. This technology matches and improves the performances compared with standard parts from various sources

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
IRF730	400 V	$< 1 \Omega$	5.5 A

V. **SOFTWARE REQUIREMENTS**

- Keil Micro Vision (Ide).
- Compiler
- Cross Compiler
- Kiel C Cross Compiler
- Building An Application In μ vision2
- Creating Your Own Application In μ vision2
- Debugging An Application In μ vision2
- Starting μ vision2 And Creating A Project
- Window – Files
- Building Projects And Creating A Hex Files
- Cpu Simulation
- Database Selection
- Start Debugging
- Disassembly Window
- Embedded C

VI. **PROJECT VIEW**

VII. RESULTS

In this project studied single phase convert to three phase using power electronic device, the result is obtained output of three phase motor.

VIII. CONCLUSION

This Thesis Report deals with the analysis of Single Phase Sinusoidal Pulse Width Modulation (SPWM), It includes both simple and practical SPWM VSI. The Simulink model for both simple and practical inverter has been simulated in MATLAB. Its various parameters such as L and C for LC Filter design, k_p and k_i for PI controller and parasitic has been calculated for Simulink modelling and then simulated. These parameters are varied and the resulting voltage and current graphs has been studied.

IX. REFERENCE

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