



## Analysis of single phase inverter based welding machine using PIC

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### ABSTRACT

Single Phase Inverter Based Welding Machine employ resonant high frequency IGBT inverter technology. Due to soft switching scheme, these machines are very rugged and efficient. Currently 1-Phase 160A, 1-Phase 200A, All the TIG machines have built in high frequency igniter circuit for non - contact arc initiation. All these welding machines have Special feature to shut down the internal electronic circuit when machine is kept idle, This feature enhances the life time of machines. Due to such features, Single phase welding machine is having light and saves the electricity up to 60%. Having used for current 20 to 200 A. This machine is moisture free dc welding. The input characteristics are similar to AC, having features such as high max output voltage, stable against voltage fluctuations. Inner loop control for quick system response, Peak current control mode make the power devices and stable, against frequent short circuit shocks, Arc thrust function, improve the metal transfer Hot arc ignition function small light and energy saving.

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### Introduction

Single Phase Inverter Based Welding Machine employ resonant high frequency IGBT inverter technology. Due to soft switching scheme, these machines are very rugged and efficient. Currently 1-Phase 160A, 1-Phase 200A, all the TIG machines have built in high frequency igniter circuit for non-contact arc initiation. All these welding machines have special feature to shut down the internal electronic circuit when machine is kept idle, this feature enhances the life time of machines. Elements of Welding Machine are three phase bridge rectifier, Capacitor Bank, Full Bridge Circuit using IGBT, IGBT, Current Transformer, Pulse Width Modulation.

### Diode Bridge Rectifier

Diode bridge rectifier is more efficient for this machine, In diode bridge rectifier current in both primary and secondary coil of transformer close for entire cycle and hence for a given power output transformer of small size and less cost may be used (since TUF factor is highest .812). No Centre tapped is required in transformer secondary winding. Hence where ever possible ac voltage can directly we applied to bridge. The current in secondary of transformer is in opposite direction in two half cycles. Hence net dc component through transformer coil is zero which reduces the losses and reduces the danger of saturation of transformer. As two diodes conducts in series in each half cycle, inverse voltage appearing across the diode gets shared. Hence circuit can be used for high voltage application since PIV is low as compare to that of centre tapped transformer type. Therefore peak current control mode makes the power devices and stable & ripple factor should be as low as possible. Its ripple frequency is twice of supply frequency and its efficiency is 81.2%.

### PWM Generator

The PWM Generator block generates pulses for carrier-based pulse width modulation (PWM) converters using two level topology. The pulses are generated by comparing a triangular carrier waveform to a reference modulating signal. The modulating signals can be generated by the PWM generator itself, or they can be vector of external signals connected at the input of the block. One reference signal is needed to generate the

pulses for a single- or a two-arm bridge, and three reference signals are needed to generate the pulses for a three-phase, single or double bridge. Technique of PWM generator are delta, delta-Sigma, Space Vector Modulation, Direct Torque Control, Time Proportioning.

### Analysis of micro-controller UC3856 IC

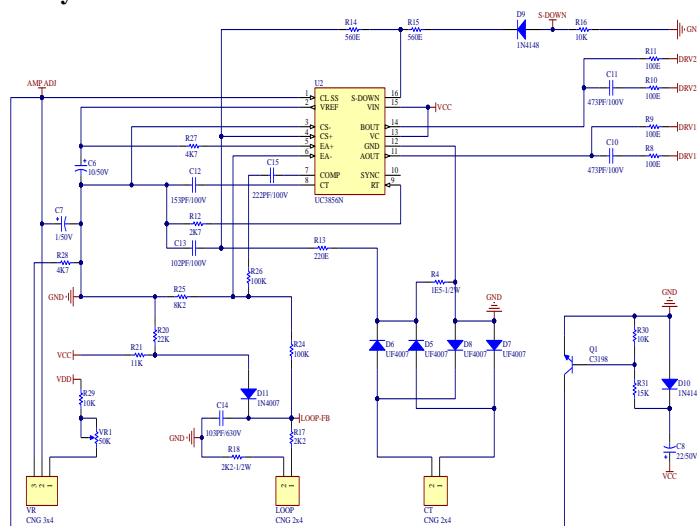


Fig 3.1 Interfacing of PWM Circuit with UC3856 IC  
PWM Card Power Supply

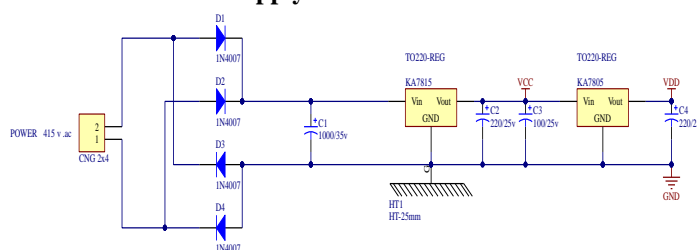


Fig 3.2 PWM Card Power Supply

Input 415 V ac supply is given to the transformer, which gives output 24 Volt. Anode point of diode D1, cathode point of diode D3 connected to connector pin no.2. Anode point of Diode D2, cathode point of Diode D4 connected to connector pin no.1.

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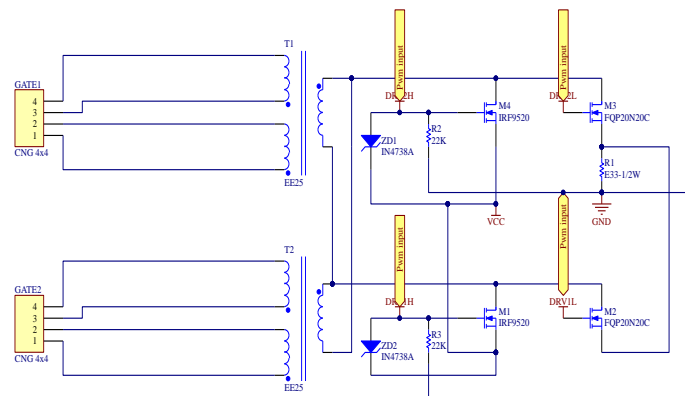
Cathode point of both diode D1 and D2 are connected. Anode point of both diode D3 and D4 are connected, this is called bridge rectifier. 1000mfd 50 Volt connected to the output of bridge rectifier. 7815 regulator connected to the output of capacitor, 7805 regulator and capacitor C2, C3 and C4 are connected in parallel, C3 connected to VCC, C4 connected to VDD.

## IGBT Driver

This device is an advanced gate driver for IGBT. Control and protection functions are included and allow the design of high reliability systems. The innovative active Miller clamp function eliminates the need for negative gate drive in most applications and allows the use of a simple bootstrap supply for the high side driver.

It includes a two-level turn-off feature with adjustable level and delay. This function protects against excessive overvoltage at turn-off in case of over current or short-circuits conditions. The same delay is applied at turn-on to prevent pulse width distortion

## IGBT Driver



**Fig 2.3 Simulation Circuit using IGBT Driver**

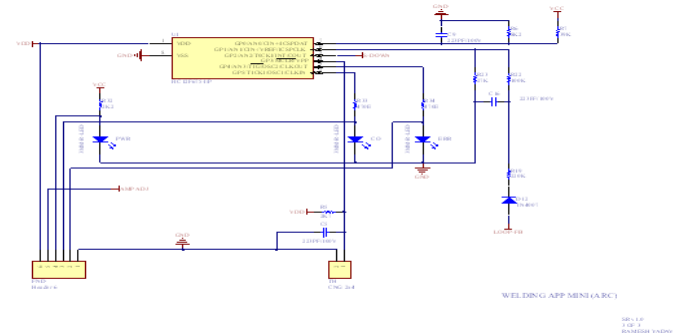
IGBT are available in high voltage and high current ratings. They are used in inverter and power conversion circuit for such diverse application as motor drivers, uninterruptible power supply system and so on.

- IGBT is also featuring fast switching.
- Low collector emitter saturation voltage even in the large current area.
- High input impedance allows voltage drives
- Available in a variety of packages

This is a discrete IGBT. It consists of four IGBT. Each IGBT contains 40 ampere 1200 Volts.

To use aluminium heat sink and air fan for protecting the device and for cooling. It works on 20 kHz frequency. Due to such feature Three Phase Welding Machine is having light and saves the electricity up to 60 %.

### Analysis using PIC12F675 Interfacing



**Fig. 4.1 Functioning of the machine with the help of PIC12F675 IC Interfacing.**

## Functions

When temperature high, then both Error and Power LED on, while Welding LED off, in that case machine will be automatically off, when output wire short then both Welding and Power LED off while Error LED on, in that case machine will be automatically off, when input low voltage occur then Error LED blinks, Welding LED off, Power LED on, in that case also machine will be automatically off. When High input voltage then, Error LED on-off (means initially on then it is permanent off) Welding LED on-off (means initially on then it is permanent off), Power LED on in that case Machine will be automatically off

Otherwise Machine works properly.

## Conclusion

Single Phase Inverter Based Welding Machine employ resonant high frequency IGBT inverter technology. Due to soft switching scheme, these machines are very rugged and efficient. Currently 1-Phase 160A, 1-Phase 200A, All the TIG machines have built in high frequency igniter circuit for non - contact arc initiation. All these welding machines have Special feature to shut down the internal electronic circuit when machine is kept idle, this feature enhances the life time of machines. Due to such features, Three phase welding machine is having light and saves the electricity up to 60%. Having used for current 20 to 200 A. This machine is moisture free dc welding. The input characteristics are similar to AC, having features such as high max output voltage, stable against voltage fluctuations.

## Future Scope

It is use in industry application can be explored so that highly efficient plant can be set up in terms of electricity.

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