

# Re: An update on my TIG inverter project

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*Source:* <http://sci.tech-archive.net/Archive/sci.electronics.design/2005-10/msg00978.html>

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- *From:* Chris Jones <[luginut808@xxxxxxxxxxxxxxxxxxxx](mailto:luginut808@xxxxxxxxxxxxxxxxxxxx)>
  - *Date:* Fri, 07 Oct 2005 22:28:29 +0100
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Ignoramus10070 wrote:

>> One option that I have used in the past is to make a triangle – wave  
>> oscillator using an op–amp as an integrator (non–inverting input to a  
>> fixed mid–rail voltage (such as resistive divider between the supply  
>> rails with bypass cap), and a capacitor from op–amp output to inverting  
>> input, and a resistor from the inverting input to the signal to be  
>> integrated which is the output of a comparator mentioned next...), and a  
>> comparator wired to have hysteresis (resistor from output to  
>> non–inverting input, and resistor from non–inverting input to op–amp  
>> output, and fixed mid–rail DC voltage on the inverting input) to set the  
>> upper and lower extremes of the triangle  
>> wave. You can then vary the frequency of the triangle wave using one  
>> pot, which would be in series with the resistor between the comparator  
>> output  
>> and the op–amp inverting input. You can set up a second comparator with  
>> the non–inverting input connected to the wiper of a second pot between  
>> the supply rails, the other comparator input is connected to the triangle  
>> wave  
>> as produced previously at the op–amp output. When the triangle wave is  
>> above the threshold set by your second pot, then the output is high,  
>> otherwise it is low. By adjusting the second pot you set the duty cycle.  
>> I have used this kind of circuit before but don't have a schematic ready  
>> to  
>> post. It is a bit of a tricky circuit to get working because of the  
>> hysteresis calculations and also the many ways of getting the feedback in  
>> the wrong sense. For that reason I would use the 555 as a first step.

>  
> This is way beyond my electronics level. I would rather try to find  
> some simple PWM chip or some such.  
Actually it would appear simple if I could be bothered drawing a proper  
diagram. I'll have to download one of those ASCII–ART programs one day.

>>> Yes, I will put something, but I think that the IGBT manual specified  
>>> a "snubber circuit". Which is a resistor and a capacitor between  
>>> source and drain. Table 5–3 on page 5–9 of the fuji manual.  
>> I think you would need the varistor(s) too.  
>

## Re: An update on my TIG inverter project

> I will check the IGBT application notes and look for that.

I think it is more a characteristic of the welder that makes you need the varistors, so the IGBT manufacturer may not have foreseen this need.

Anyway I would just look in your preferred component catalogue for a varistor rated at maybe 1.5 or 2 times the open circuit voltage of the welder, and which looks stout enough that it won't melt on the first little spike. I have used Siemens varistors in the past but they are called Epcos now. I think Harris used to make them too.

[...]

> Another issue that concerns me is dead time. If the H bridge is turned  
> off for, say, 500 ns 100 times a second, could it possibly confuse  
> electronics of the welding machine in some way that is destructive to  
> it?

>

> Adding capacitors and snubber circuits could alleviate this  
> issue,, but I would like to hear your thoughts on it.

>

> I have schematic of my welder, in fact.

>

> i

I would say dead time is OK, provided you connect some varistors and preferably also some sturdy capacitors across the output of the welder where it supplies the IGBT bridge. If all the IGBTs go off for a microsecond, then 200 Amps would charge 1uF to 200 Volts which your IGBTs could handle. On the other hand I would suggest using more like 10–100uF across the supply, because physically bigger caps might handle the current pulses better. The capacitor will have to deal with whatever ripple voltage is on the welder output, it will not normally be able to smooth the ripple due to the rectified mains frequency. If you were to put an electrolytic of 10000uF across the welder, the electrolytic would probably be unable to handle the ripple current and would explode. On the other hand if you put a polypropylene motor run capacitor of maybe 10uF instead, then that should handle the mains ripple without too many problems, because even though the ripple voltage would be similar, the high impedance of the capacitor to mains – related ripple would limit the current in the capacitor to a level that would not overheat it. If the capacitor is sturdy it should be OK with the 1us pulses of 200A whenever the IGBTs all turn off, as long as the frequency of the IGBT drive is not too high.

If you decide to use no dead time then you should probably not put a capacitor across the welder output, but you should still include the varistors.

Chris

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- **References:**

- ◆ **Re: An update on my TIG inverter project**

- ◇ *From:* Chris Jones

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