ELECTRICAL ENGINEERING

Snubber causing more problems than benefits

Asked 5 years, 1 month ago Active 3 years ago Viewed 2k times

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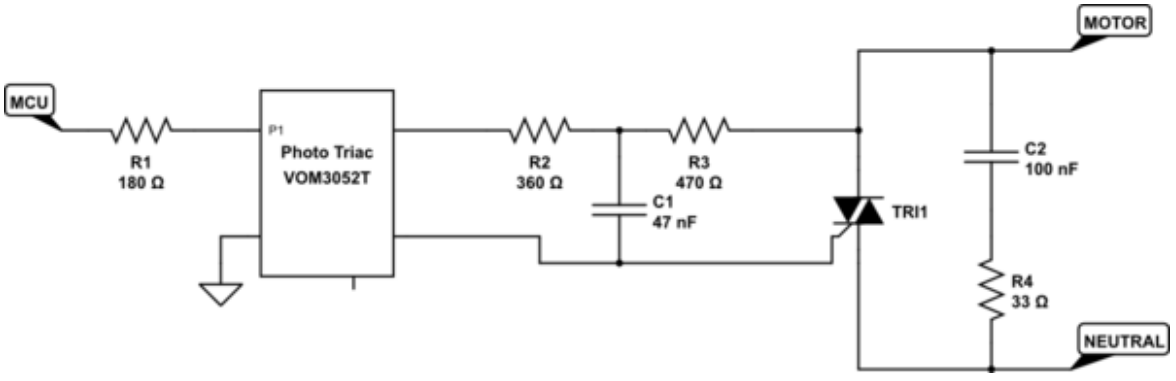
When designing and building a simple motor controller i used 2 snubber circuits, one to protect the main triac and another one the smooth the communication between the phototriac and the main triac. See schematic below.



simulate this circuit – Schematic created using CircuitLab

The Phototriac is a VOM3052T and the main triac is a BTA137-600.

When testing the circuit however, no matter if the Microcontroller's pin is high or low, the motor always turns on. I found that when removing C1 the problem did not occur and the circuit perform as it originally was supposed to do.

now that C1 is removed, the phototriac does not have a snubber anymore, but seems to work fine

The questions is: Is removing C1 from the circuit a viable option, or will this cause the circuit to fail in

the long run? why does the circuit not work when C1 is placed?

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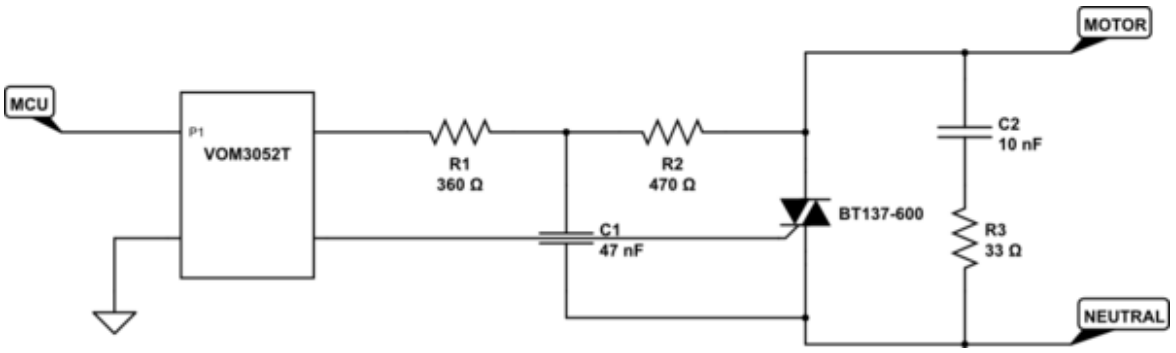
Based upon community feedback (thanks!) & more online research I decided to update the circuit:



simulate this circuit

Where the resistors are 2W the the capacitors are film.

triac snubber

edited Aug 25 '14 at 7:16

asked Aug 24 '14 at 18:14
user43487
64 ● 2 ● 9

C1 is definitely the cause why the TRIAC fires. Why did you implement it? Where did you find the circuit diagram? – jippie Aug 24 '14 at 18:54

I cant remember where i found it, Though I'm sure i found it on the internet somewhere and wrote it down. I think that if i connect C1 between r3/r4 and Neutral the circuit will work. – user43487 Aug 24 '14 at 19:36

Yes connecting it to neutral will work too. It'll introduce a slight phase shift for the current through the photo-TRIAC, which may improve triggering of the main TRIAC. – jippie Aug 24 '14 at 22:00

3 Answers

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Let's talk order magnitude for ease of understanding. Say your high voltage side is 50Hz mains power. In that case the reactance of the capacitor is:

$$X_C = \frac{1}{2\pi f C} = \frac{1}{2\pi \cdot 50 \cdot 47 \cdot 10^{-9}} \approx 68\text{k}\Omega$$

As the capacitor's reactance is much higher than R3 and therefore we can safely ignore R3 for sake of this discussion. Also the maximum gate voltage will be in the order of 1V, which can again be ignored with respect to eg. 100V mains voltage.

If the mains power is 100V then the gate current of the TRIAC will be approximately:

$$I = \frac{U}{X} = \frac{100}{68\text{k}} \approx 1.5\text{mA}$$

For an average TRIAC 1.5mA is sufficient gate current to trigger it and the photo-TRIAC has no part in it at all. When using a 230V mains, the current will even peak at approximately 5mA. As Wouter mentions in his answer aswell, the current calculated is shifted in phase with respect to the voltage across the TRIAC, causing the TRIAC to reliably trigger.

I am unsure why C1 was included in the circuit. The TRIAC doesn't act as an inductive or capacitive load, so there is little need for a snubber arounc C1 anyway. The other snubber C2/R4 can be much more benificial, although a snubber should ideally be dimensioned for a specific load.

edited Aug 24 '14 at 21:34

answered Aug 24 '14 at 21:15

jippie

28.1k ● 13 ● 79 ● 144

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I don't know where you got that circuit(r2,r3,c1), but IMO it is rubbish.

Think of what happens when the foto-triac is not conductiong. In effect you can remove it and R2 from the circuit. Now you have the gate of your triac triggered via R3/C1, which delivers a phase-shifted current through the gate, 'conveniently' non-zero when the triac voltage is zero, thus switching the triac on after each zero-crossing, eactly as you observe.

The function of a snubber circuit is to suppress rapid voltage transients, which would otherwise cause the triac to start conduction. But at the same time the snubber circuit should not conduct so much current that it causes the load to be switched on. The trouble with your 'snubber' for the foto triac is that it conducts so much current that it always triggers the triac.

answered Aug 24 '14 at 21:11

Wouter van Ooijen

45.3k ● 1 ● 54 ● 122

It seems that the OP has edited the circuit after I posted this answer, so it might not be relevant for the current circuit. – Wouter van Ooijen Sep 21 '16 at 15:35

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The snubber circuit improves the triac behavior but it imposes to the device stresses which limit its use.

http://www.thierry-lequeu.fr/data/AN437.pdf

answered Sep 21 '16 at 10:01

Nandiboy

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