

## Re: (Beginner) Varistor or TVS

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- *From:* "Ant\_Magma" <[vcteol@xxxxxxxxxx](mailto:vcteol@xxxxxxxxxx)>
  - *Date:* 2 Mar 2006 01:25:43 -0800
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Thx Chris for your advice. Sad to say i'm currently on my own. About the 240/120 isolation transformer i'll have to check with the lab. But i'll definitely put my own safety as the first priority =)

I did some designs on my own, taking into account your advice and some other resources that i've managed to find and i was wondering if you could give your opinion on it:

[http://geocities.com/Antonio\\_Magma/transient.jpg](http://geocities.com/Antonio_Magma/transient.jpg)

I decided to use a 3-stage protection circuit with a gas discharge tube, a resistor and a MOV (as stated in the Bel coupler datasheet). For the MOV i followed the coupler datasheet and i chose the LITTLEFUSE Varistor 390V 130J (V250LA40B). The gas discharge tube, the EPCOS 350V (EC350X). These parts i chose based on the availability of it in my area.

However, for the series resistor i'm not sure how do i choose the value, that's where i hope you can help me.

Next, i was thinking since my signal is transmitted at 4Mhz-21Mhz, i could probably design a high-pass filter to filtering out everything else. Thus, i designed a 4pF capacitor and 10k resistor to form my high-pass filter.

For the PSU, i decided to take your advice and i'll search for a linear power supply of maybe 10V output then use a LM317 to bring it further down to my operating voltage of 3.3V.

What do you think?

Chris wrote:

Ant\_Magma wrote:

Thanks for you advice Chris. There were a few problems that had me started with this project too late which i won't elaborate further.

If i follow your method, won't i have 2 plug heads (don't know what's the proper term)? 1 plug brings in the signal to the transformer then

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to the coupler and the other brings in the power supply from the wall wart?

I have already ordered Bel's powerline signal coupler, can i try and build it like the schematic drawn in the datasheet? The live and neutral wires are connected parallely to the coupler and the PSU (step-down transformer). Since the coupler only passess the Homeplug frequency of 4Mhz-20Mhz filtering out the 50/60Hz power frequency i should be safe right? For the step-down transformer i'm thinking of using any encapsulated PCB transformer available on Farnell.

Please advice.

Btw, Chris i guessed you have read the datasheet (however brief) it is of the Bel's powerline signal coupler. At the last couple of pages with the schematics, at the capacitor it writes 4.7n x2 class. What does x2 class mean? And the 2 resistors 200k, can't they just use a 400k resistor?

At the Electrical specifications part of the Bel coupler, the parameters of the coupler has this Hi Pot @60Hz 1mA and a value of 2000V. What does it mean? It rejects the 60Hz?

Hi, Ant\_Magma. One thing at a time.

A real engineering prototype would have one line cord, with the split to the powerline modem and the power supply occurring inside the box. For a proof-of-concept prototype, and for initial work, you can have two plugs. You can always add a small linear or switching power supply later, after you have the thing working. Points off for proof-of-concept as opposed to full engineering prototype, but no points if it doesn't work. You need to get something going NOW.

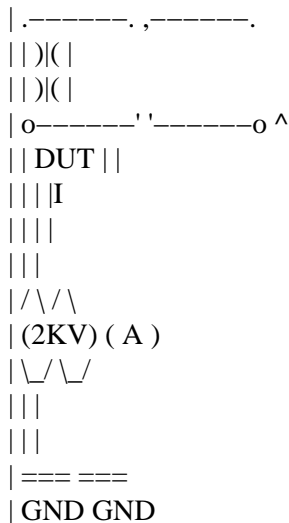
Whenever you're working with line voltage in an engineering lab environment, you should use an isolation transformer. This is first of all for safety. As an extra benefit, you can realistically step down from 240VAC to 120VAC, which should provide additional safety. I'd rather work with 120VAC than 240VAC. The thing is, you apparently have very little non-SPICE experience, and you're dealing with potentially lethal voltages. You need an isolation transformer for your personal safety. This is also why you need an advisor who has worked with line voltage before, and can keep a watchful eye on this part of the circuit (once you've got it done, you can enclose it and be done with it).

According to the coupler datasheet, it provides 2KV of isolation between the line primary and the secondary. This is pretty much standard for transformers. On paper, you should be fine. The X-10

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looked good on paper, too. But I have a vision of your getting to the last couple of days, and a line transient jumps up and smokes your works. Pobre Ant\_Magma. Line voltage accidents are usually explosive. Apart from any electrical safety considerations, you don't and won't have the time to fix this if a line transient smokes your prototype in the last week. Do everything you can to keep your prototype safe, and only use it and the other piece of comm equipment with an isolation transformer.

By the way, here's what happens with a hipot transformer test. It measures the coupling between the transformer primary and secondary, and is required for proving isolation from line voltage. This is a standard safety test which is used to get listing from regulatory agencies like UL and CSA.



(created by AACircuit v1.28.5 beta 02/06/05 www.tech-chat.de)

The 4.7nF cap they're talking about is one rated for line voltage use. In the event of overvoltage, it's made to be self-healing instead of just shorting out. Don't use a cap which isn't rated for the line voltage you're using. And 200K is a standard resistor value. Also, resistors have a voltage rating as well as a wattage rating. If you apply more than the rated voltage, it may arc over the surface of the resistor, which would cause failure. Using two resistors means you can halve the voltage across each resistor, which might be a good thing -- they're not self-healing. ;-)

On a personal note, I had the pleasure in days of yore to work in a place where they liked to hire one or two undergrads and work them to the bone part-time for peanuts. As part of the deal, they had unofficial use of lab facilities after hours, and the use of all the kibbitzing they could wheedle out of the staff for their senior project. I tried to give them a hand when I could, and had quite a bit of fun working with them. It's satisfying to see students finally "get it".

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I'm not qualified to help you here. I've never done a component-level, "from-scratch" network interface. And in order to get an answer to two or three basic questions here, you had to wait over 10 hours. If your project is due in 9 weeks, you've only got about 1500 hours left. You need to get that loop lag down, and get your questions answered now, in quantity, by someone who knows what they're doing. If you wait for the kindnesses of strangers, you'll still be talking at deadline. Get some help, you're out of time.

Actually, the real lesson of the senior project is how to do projects. By doing something enormous by yourself, you get a practical baptism of fire in the gentle art of working under brutal pressure. It's a required part of the engineering skillset.

Good luck  
Chris