Re: Reducing Source Voltage To Power Supply

Source: http://sci.tech−archive.net/Archive/sci.electronics.basics/2008−01/msg00329.html

- *From*: John Fields <jfields@xxxxxxxxxxxxxxxxxxxx>
- *Date*: Thu, 10 Jan 2008 18:03:27 −0600

On Thu, 10 Jan 2008 14:58:18 −0800 (PST), "Dave.H"
<the1930s@xxxxxxxxxxxxxx> wrote:

> On Jan 11, 6:26 am, John Fields <jfie...@xxxxxxxxxxxxxxxxxxxxx> wrote:
>
> > On Thu, 10 Jan 2008 08:43:50 −0800 (PST), "Dave.H"
>
> > <the19...@xxxxxxxxxxxxxx> wrote:
>
> > > On Jan 11, 3:37 am, John Fields
> > > <jfie...@xxxxxxxxxxxxxxxxxxxxx> wrote:
>
> > > > On Thu, 10 Jan 2008 05:51:50 −0800 (PST),
> > > > "Dave.H"
>
> > > > <the19...@xxxxxxxxxxxxxx> wrote:
>
> > > > > I'm building a power supply
> > > > > for an 8 transistor radio, that
> > > > > originally
> > > > > used 6 "D" cells, involving a
> > > > > rectifier bridge, filtering
> > > > > caps etc,
> > > > > but there's on
> > > > > problem,which is I can't
> > > > > seem to find an AC
> > > > > transformer
> > > > > outputting 6 volts that fits in
> > > > > the case I want to use. I
> > > > > have no
> > > > > problem using a wall wart,
> > > > > but I can't find one of the
> > > > > correct
> > > > > voltage. I have one rated at

> 9 VAC, outputting in the
> range of
> 12.5−13 VAC. Is there a
> way to halve this voltage
> with resistors
> without generating too much
> heat?

−−−
You may want to consider something like
one of these:

http://www.tamuracorp.com/clientuploads/pdfs/pg5.pdf

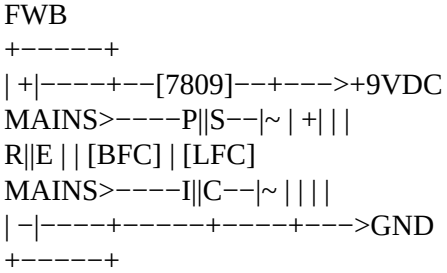
which you can get from Digi−Key.

In any case, how much current does the
radio draw and what current
is your wall−wart rated for when it's
outputting 9V?

−−
JF

> The wall wart is rated at 1 amp. Not sure what the current
> draw is.

−−−
OK, here's what you've got: (View in Courier)



Since your wall−wart puts out 9VRMS when it's loaded with 1 ampere, that's 12.73V peak. You'll lose about 1.4V of that across the diodes in the bridge, leaving you with about 11.3V into the regulator.

The 7809 has a worst−case dropout of 2.5V, so the bad news is that for a 9V output you'll need 11.5V into it, and you've only got 11.3V. :−(

The good news is that your wall−wart's regulation is poor and with a no−load output voltage of 12.5 it may be able to supply the voltage needed by the 7805. Let's see...

For a 1A load we'll have an output, from the bridge, of:

Vout(1) = (VRMS * sqrt(2)) − 1.4V

= (9V * 1.414) − 1.4V = 11.3 volts

For no load we'll have:

Vout(2) = (12.5V * 1.414) − 1.4V = 16.27 volts

That means that from no load to full load we'll have a voltage change of about 5 volts per ampere of current change.

So what?

Well, since the 7805 needs 11.5 V minimum into its input to provide 9V out, that means that (assuming the transformer's voltage VS current change is linear) the load can never draw more than:

$$Il(max) = \frac{Vout(2) - Vdo}{5} = \frac{16.27V - 11.5V}{5V} = 0.954 \text{ ampere.}$$

Realistically, though, we haven't even considered ripple and we need to do that in order to choose the value of the BFC.

In order to do that we need to know how much current your radio draws, but you don't know how much that is.

No matter, we can work something out and then plug in your numbers when you find out.

Let's say your radio's running on a watt. Then the current into it will be:

$$I = \frac{P}{} = \frac{1W}{} = 0.111A = 110mA$$

E 9V

And the voltage out of the bridge will be:

/ 5V * 0.111A \
Vout = Vout(2) − | −−−−−−−−−−−−− |
\ 1A /

= 16.27V − 0.555V

~ 15.72V

Since the 7809's dropout voltage is 11.5V and we have 15.72V available at the output of the bridge, the difference (4.22V) is the ripple we're allowed.

The filter cap's capacitance, then, would be:

Idt 0.111A * 0.01s
C = −−−−− = −−−−−−−−−−−−−−−− = 2.63E−4F = 263µF
dV 4.22V

Since the bridge will be supplying current to the load as well as to the cap when it's charging, the voltage available from the transformer will drop somewhat during that time so it would be a good idea to increase the value of the capacitor in order to compensate for that.

Without going into it analytically, I'd guess that doubling the cap would do it. Even better, throw 1000µF in there; they're cheap!

Only one thing left to do and that's to check on whether you've got enough headroom to get that 11.5V with low mains, and you now ought to have enough information to be able to do that. :−)

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JF

Thanks, but it all sounds so complicated to me, I'm thinking it would be easier to keep it on batteries

−−−
Oh, well...

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JF
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