Re: LM78XX imput/output capacitors

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2007−09/msg04081.html

- *From*: "vincent.thiernesse" <vincent.thiernesse@xxxxxxxxxx>
- *Date*: Fri, 21 Sep 2007 20:24:35 +0200

"John Fields" <jfields@xxxxxxxxxxxxxxxxxxxxx> a écrit dans le message de news:k62re3l1vnjp8h9csfc9s3drigihbu214n@xxxxxxxxxx

> On Fri, 14 Sep 2007 17:38:49 +0100, Eeyore
> <rabbitsfriendsandrelations@xxxxxxxxxxx> wrote:
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> > John Fields wrote:
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> > > > > > > Eeyore wrote:
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> > > > > > > > "vincent.thiernesse" wrote:
> > > > > > > >
> > > > > > > > > these are minimum values.
> > > > > > > > >
> > > > > > > > > the input capacitor doesn't replace

the filter capacitor.

for the filter capacitor, take 1000uF per Ampere for 1 volt input variation.

I take it you mean ripple ? Your numbers are out by about 7−8:1

You need ~ 8000uF for 1V (pk−pk) of ripple @ 1A load and 50Hz.

−−−

8000µF?

If
you
want
to
be
pedantic,
asshole,
you
might
at
least
try
to

get

it
right.

Let's see
your
calculation
then if you
think my
number is
wrong.

−−−

Idt 1A * 0.01s
C = −−−−− =
−−−−−−−−−−− = 1E−2F =
10000µF
dV 1V

Where the hell do you get 10ms from ? I
suggest you go and look at a

ripple waveform.

−−−
LOL, you really _are_ stupid!

What's the period of full−wave rectified 50Hz?

> That's not the relevant answer.
>
> What's relevant is the discharge period.
>
> Hint − NOT 10ms. I suggest you either measure or simulate.
>
> You're not as smart as you claim to be.

−−−
I've never claimed that I was smart, just less stupid than most. Including you.

However, in one of your rare moments of lucidity, your "What's relevant is the discharge period." brought me up short since that's correct and I hadn't earlier considered that the recharge time was irrelevant.

Thanks for that. :−)

Moreover, including the recharge time in the waveform's period, 'dt',

Idt
C = −−−−−
dV

makes the solution inaccurate because it doesn't consider the discharge time boundary created when the rise of voltage from the rectifier causes the reservoir capacitor's losses to cease.

So what's the right way to do it?

As I see it, first determine the peak DC needed into the regulator. For a 7824 that would be:

Vin = Vout + Vdo + Vrpl = 24V + 2.5V + 1.0V = 27.5V

Where Vin is the peak input voltage to the regulator,
Vout is the output voltage of the regulator,
Vdo is the regulator's dropout voltage, and
Vrpl is the allowable peak−to−peak ripple voltage on the input of the regulator.

Next, determine the angle which corresponds to the valley voltage of the ripple:

Vin − Vrpl 26.5V
arcsin = −−−−−−−−−−−− = arcsin −−−−−−− = 74.5°

Vin 27.5V

Then, determine the length of the capacitor's discharge time.

For a 50Hz sinewave, we're dealing with:

1 0.02s
t = −−−−−− = −−−−−−−
50Hz 360°

which is also:

0.02s
t = −−−−−−− ~ 55.5µs/°
360°

Since the cap is fully charged at 90° and discharges to 26.5V in the time it takes to go from 90° to 0° and then back up to 74.5°, that's a total of:

n = 90° + 74.5° = 164.5°

To get the discharge time, then, we multiply the total excursion, 164.5° by 55.5µs/°, and wind up with:

164.5° 55.5µs
Td = −−−−−−− * −−−−−−−− ~ 9.13E−3s = 9.13ms
1 °

Now, since we're feeding a fixed voltage (the output of the regulator) into a fixed resistance, (the load) we can say that the input current into the regulator will be what the load dissipates and we can finally say that the value of the reservoir capacitor should be, at least,

Idt 1A * 9.l3E−3s
C = −−−−− = −−−−−−−−−−−−−− = 9.13E3 ~ 9100µF
dv 1V

Hello,

You did not take into account the fact that during dischage the wave doesn't leaves the first sinus at t=0.

So I made the study.

You found 9133 uF for 1 V peak to peak and the corrected value is 9119 uF.

futher investigation shows that for 16V peak to peak we need 374 uF instead of 397 uF....

so, well, I just did waist my time...

Just don't care...

Vincent

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