

Tube amp high-voltage delay

jan.didden

2019-10-09 8:37 am



jan.didden

AX tech editor

Joined 2002

2019-10-09 8:37 am

ShareBookmark#1

Some of you might remember my **article in AudioXpress of a few years ago for a tube amp high voltage delay** ([URL: https://www.audioxpress.com/article/how-to-extend-the-useful-life-of-those-precious-tubes-use-a-tube-amplifier-high-voltage-delay](https://www.audioxpress.com/article/how-to-extend-the-useful-life-of-those-precious-tubes-use-a-tube-amplifier-high-voltage-delay)). Many people build it, but it was time for a New & Improved version (really!).

AudioXpress published it and agreed to allow **free download** ([URL: https://www.audioxpress.com/article/you-can-diy-a-high-voltage-delay-for-tube-amplifiers-the-sequel](https://www.audioxpress.com/article/you-can-diy-a-high-voltage-delay-for-tube-amplifiers-the-sequel)) for diyaudio members (nice people there!).

Jason agreed to make a **kit available in the diyaudio store** ([URL: https://diyaudiostore.com/collections/kits/products/high-voltage-delay-for-tube-amplifiers](https://diyaudiostore.com/collections/kits/products/high-voltage-delay-for-tube-amplifiers)).

Let me know what you think and we can disuss details of the design here.

Jan

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dubadub



jan.didden

AX tech editor

Joined 2002

2019-10-09 9:09 am

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Some visuals.

Jan

Attachments

[\(URL: /community/attachments/assembled-psudel-jpg.786654/\)](https://community.attachments/assembled-psudel-jpg.786654/)

assembled psudel.JPG


658.5 KB · Views: 1,307

[\(URL: /community/attachments/concept-hvdel-png.786655/\)](https://community.attachments/concept-hvdel-png.786655/)

concept HVdel.PNG

13.9 KB · Views: 1,344

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Ketje
Member
Joined 2012

2019-10-09 9:49 am < > #3

jan.didden said: ([URL: /community/goto/post?id=5938784](/community/goto/post?id=5938784))
Let me know what you think and we can discuss details of the design here.

Well, you asked for it
Mona

Attachments
[\(URL: /community/attachments/jd-hstraag-png.786659/\)](/community/attachments/jd-hstraag-png.786659/)
JD-HStraag.png
59.3 KB · Views: 1,499



jan.didden ●
AX tech editor
Joined 2002

2019-10-09 10:47 am < > #4


What? You can use a red pencil?

The depletion mode FET should have a different symbol?
What do you mean by the other red stuff?

Jan

Last edited: 2019-10-09 10:54 am

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Ketje
Member
Joined 2012

2019-10-09 11:18 am < > #5

jan.didden said: ([URL: /community/goto/post?id=5938872](/community/goto/post?id=5938872))
What? You can use a red pencil?

Like that it's more easy to see the changes.





The depletion mode FET should have a different symbol?

Yes.

What do you mean by the other red stuff?

A zener for safety, if the fet fails and replaced by another one without internal zener
The divider R8-R9 can produce a voltage much higher than V_d , no good for the PIC.
With $R_{10}=680\Omega$ the current is limited to less than 1mA. In your article you stated 1,8mA. Still rather low for PIC+Q2drive+LED+zener
Mona

Last edited: 2019-10-09 11:21 am


<div data-bbox="135 230 269 257">jan.didden ●</div> <div data-bbox="116 268 237 291">AX tech editor</div> <div data-bbox="127 295 225 313">Joined 2002</div>	<div data-bbox="333 141 544 163">2019-10-09 11:27 am</div> <div data-bbox="1370 141 1482 163">  #6</div> <div data-bbox="359 208 908 232">Ketje said: (URL: /community/goto/post?id=5938894)</div> <div data-bbox="359 253 1214 277">Yes. A zener for safety, if the fet fails and replaced by another one without internal zener</div> <div data-bbox="333 340 1417 396">As you noticed, the FET has an internal zener. But yes, if you want to replace it with one without a build-in zener, it is a good idea to add one.</div> <div data-bbox="359 461 908 486">Ketje said: (URL: /community/goto/post?id=5938894)</div> <div data-bbox="359 506 1171 530">The divider R8-R9 can produce a voltage much higher then Vd, no good for the PIC.</div> <div data-bbox="333 593 692 618">The PIC has internal clamp diodes.</div> <div data-bbox="359 683 908 707">Ketje said: (URL: /community/goto/post?id=5938894)</div> <div data-bbox="359 728 1385 815">With R10=680Ω the current is limited to less then 1mA. In your article you stated 1,8mA. Still rather low for PIC+Q2drive+LED+zener Mona</div> <div data-bbox="333 878 1479 936">Part of that 1.8mA does not flow through R10. R10 is only there to assure some minimal headroom. The kit has a LED specifically selected for low current-high brightness, as described in the article.</div> <div data-bbox="333 972 1447 1030">The whole idea of this is to have a reliable delay switch that can be retro-fitted to pretty much any tube amp, without upsetting the supply and grounding, that uses minimal current and doesn't need heatsinking.</div> <div data-bbox="333 1066 1181 1090">Also maximum flexibility to set the delay from 20 secs to 254 secs in a simple way.</div> <div data-bbox="333 1128 375 1153">Jan</div> <div data-bbox="1184 1187 1461 1209">Last edited: 2019-10-09 11:32 am</div> <div data-bbox="333 1256 1158 1281">High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div data-bbox="162 1449 245 1473">Bigun ●</div> <div data-bbox="135 1485 207 1507">Member</div> <div data-bbox="122 1512 220 1532">Joined 2009</div>	<div data-bbox="333 1357 544 1379">2019-10-09 11:42 am</div> <div data-bbox="1370 1357 1482 1379">  #7</div> <div data-bbox="333 1408 1461 1588">I keep reading that a delay in the high-voltage supply for a tube amp is unnecessary and can even be counterproductive if not well implemented, so is there generally not a consensus, it's every body decides for them selves ? The article says the jury is out but my perception is at least on this form the people with a solid understanding of the science say it is not required. My post is probably taking this thread off in the wrong direction but I'm about to consider building a high voltage 845 amp I keep my eye out for important topics like this</div> <div data-bbox="1184 1624 1461 1644">Last edited: 2019-10-09 11:45 am</div>

<p>Ketje Member Joined 2012</p>	<p>2019-10-09 12:16 pm < □ #8</p> <div><p>jan.didden said: (URL: /community/goto/post?id=5938902)</p><p>The PIC has internal clamp diodes.</p></div> <p>I looked it up, you are right, clamp current 20mA no problem. More comfortable the the old Cmos and TTL-logic, one had to be carefull not to activate the parasitic PNP transistor.</p> <div><p>Part of that 1.8mA does not flow through R10. R10 is only there to assure some minimal headroom.</p></div> <p>Yes, i see now, only the current for the PIC and zener. That's also the reason for D2 AND D6 ! Mona</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2019-10-09 12:42 pm < □ #9</p> <p>Exactly! I really thought a lot about keeping the current consumption low. The earlier unit used a separate heater winding that had to be floating which meant often a separate small transformer. That's a nuisance. But supplying it from the HV means it must be mean and lean ;-) Even at 600V, 1.8mA is just over one watt, which is manageable.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2019-10-09 12:46 pm < □ #10</p> <div><p>Bigun said: (URL: /community/goto/post?id=5938915)</p><p>I keep reading that a delay in the high-voltage supply for a tube amp is unnecessary and can even be counterproductive if not well implemented, so is there generally not a consensus, it's every body decides for them selves ? The article says the jury is out but my perception is at least on this form the people with a solid understanding of the science say it is not required. My post is probably taking this thread off in the wrong direction but I'm about to consider building a high voltage 845 amp I keep my eye out for important topics like this</p></div> <p>It depends on who you read, but there are people that feel it is absolutely necessary to extend tube life. The other thing is that at start-up, when no current is drawn, the HV can rise quite a lot higher than the operating design value. A 420V supply with 450V caps can easily go over 450V at no-load. That is also avoided with this unit.</p> <p>I have also noticed is that it often prevents a switch-on thump because of the gentle HV rise.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>

Ketje Member Joined 2012	<p>2019-10-09 1:26 pm</p> <p>There is another problem with delayed HT. If the tubes are hot and autobias with fat chemicals on the cathode there is suddenly HT and -Vg=0 resulting in a big current surge in the finals. Same thing with autobias circuits, no current sensed gives -V to the tubes turned down. During the time to adjust the -V bias (can be very slow) to much current.Unless provisions are made to keep -V at it's max without HT. Mona</p>
jan.didden ● AX tech editor Joined 2002	<p>2019-10-09 1:45 pm</p> <p>Bigun said: (URL: /community/goto/post?id=5938915) I'm about to consider building a high voltage 845 amp I keep my eye out for important topics like this</p> <p>What voltage/current will you need for the supply?</p> <p>Jan</p> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
Bigun ● Member Joined 2009	<p>2019-10-09 2:05 pm</p> <p>jan.didden said: (URL: /community/goto/post?id=5939027) What voltage/current will you need for the supply?</p> <p>Jan</p> <p>I'm looking at a single channel mono set up, single ended. I have some 1kV capacitors that if used would dictate a B+ just under 1kV (paper in oil caps).</p> <p>Current would have to be enough for the 845, driver and input/gain tube - possibly 150mA.</p> <p>Tubes will all be cathode bias.</p>
kodabmx Member Joined 2011	<p>2019-10-09 3:28 pm</p> <p>Funny. When I need an HV delay I just use one of these!</p> <p>NE555 DC 12V Delay Relay shield Timer Switch Adjustable Module 0 To 10 Second eBay (URL: https://www.ebay.ca/itm/NE555-DC-12V-Delay-Relay-shield-Timer-Switch-Adjustable-Module-0-To-10-Second/182058770538/)</p> <p>But I don't need to switch more than 400V, and I use this to control another relay with better ratings.</p> <p><i>Quando omni flunkus moritati</i></p>

<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-09 3:41 pm ↩ 🔖 #15</div> <div>Yes there any many ways to skin a cat. But 10sec is really too short for this. And it needs a separate supply. And it doesn't switch on a zero crossing. And it has so many connections ;-)</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-09 4:05 pm ↩ 🔖 #16</div> <div>Bigun said: (URL: /community/goto/post?id=5939046) I'm looking at a single channel mono set up, single ended. I have some 1kV capacitors that if used would dictate a B+ just under 1kV (paper in oil caps). Current would have to be enough for the 845, driver and input/gain tube - possibly 150mA. Tubes will all be cathode bias.</div> <div>Just finished a regulated supply that could handle that. Maybe something for another thread ;-)</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>Windcrest77</div> <div>Member</div> <div>Joined 2019</div>	<div>2019-10-09 7:39 pm ↩ 🔖 #17</div> <div>kodabmx said: (URL: /community/goto/post?id=5939128) Funny. When I need an HV delay I just use one of these! NE555 DC 12V Delay Relay shield Timer Switch Adjustable Module 0 To 10 Second eBay (URL: https://www.ebay.ca/itm/NE555-DC-12V-Delay-Relay-shield-Timer-Switch-Adjustable-Module-0-To-10-Second/182058770538) But I don't need to switch more than 400V, and I use this to control another relay with better ratings.</div> <div>You just need to change a few parts to get over 10 seconds. But at under 2 bucks that's ok. The 555 is reliable proven for many years.</div>






<p>petertub ●</p> <p>Member</p> <p>Joined 2015</p>	<p>2019-10-09 8:22 pm ↩ 📄 #18</p> <div data-bbox="336 190 1481 465"><p>Ketje said: (URL: /community/goto/post?id=5938999)</p><p>There is another problem with delayed HT.</p><p>If the tubes are hot and autobias with fat chemicals on the cathode there is suddenly HT and -Vg=0 resulting in a big current surge in the finals.</p><p>Same thing with autobias circuits, no current sensed gives -V to the tubes turned down.</p><p>During the time to adjust the -V bias (can be very slow) to much current. Unless provisions are made to keep -V at it's max without HT.</p><p>Mona</p></div> <p>Interesting thoughts !</p> <p>As for delayed B+, maybe it should be restored gradually, ramping up after 30s 50V/s or so. It could be done with a power FET, it will get hot but only for a limited time, reducing heatsink capacity. This does not cure the "autobias problem" though...</p>
<p>disco</p> <p>Member</p> <p>Joined 2006</p>	<p>2019-10-09 9:37 pm ↩ 📄 #19</p> <div data-bbox="336 723 1481 913"><p>petertub said: (URL: /community/goto/post?id=5939386)</p><p>Interesting thoughts !</p><p>As for delayed B+, maybe it should be restored gradually, ramping up after 30s 50V/s or so. It could be done with a power FET, it will get hot but only for a limited time, reducing heatsink capacity. This does not cure the "autobias problem" though...</p></div> <p>I've been thinking about a PIC to perform these functions but never built it. That's for the next version, else Jan gets bored</p>
<p>Magz</p> <p>Member</p> <p>Joined 2009</p>	<p>2019-10-09 10:10 pm ↩ 📄 #20</p> <p>I just use two switches in my 833C amp. One turns on the 10V, 10A 833C filament supply, 6E5P plate supply and 833C bias supply, the second turns on the 2.3kV plate voltage for the 833C (with a soft start circuit). I throw the first switch, go get an appropriate beverage, then I throw the second switch.</p> <p>Been working just fine for 5 years now. Still the original 833C tubes with very little sign of degradation.</p> <p>Last edited: 2019-10-09 10:13 pm</p>

<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-12 8:03 am ↩ 📌 #21</div> <div>Several questions about the zero-crossing switching after the delay has ended: how does the circuit 'know' that there is a zero crossing?</div> <div>The connection Vraw (J3) connects to the top of the capacitor after the rectifiers, where - after switch-on - the high voltage will appear.</div> <div>But, and this is not obvious, before that, the capacitor is not charged, so at the top of that cap, at Vraw, you see a double-rectified mains sine wave, positive half-waves. And that goes to zero twice per mains period, easy to detect.</div> <div>Jan</div> <div><div>Attachments</div><div> (URL: /community/attachments/fig-2-didden-psudelay-ax-2019-pdf.787293/)</div><div>fig 2 didden psudelay ax 2019.pdf</div><div>102.4 KB · Views: 200</div></div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>hpeter</div> <div>Member</div> <div>Joined 2013</div>	<div>2019-10-15 6:08 pm ↩ 📌 #22</div> <div>it looks oldschool, but can't beat a reliable thyristor</div> <div>secondly, charge limiter is kind to components; very important when you are feeding 1000µf no relay welding, no kaboom.</div>
<div>disco</div> <div>Member</div> <div>Joined 2006</div>	<div>2019-10-15 8:47 pm ↩ 📌 #23</div> <div>I'd say the relay shorts out the charge limiter once the cap is full, but this does not do so...</div>
<div>P</div> <div>peteki</div> <div>Member</div> <div>Joined 2009</div>	<div>2019-10-15 9:02 pm ↩ 📌 #24</div> <div>Physics does not support a delayed switch on. The potential between plate and cathode would need to be several thousand volts to rip electrons from the cathode and also consider the electrolytics. There is ample literature on the subject if one goes hunting.</div>



<p>trobbins Member Joined 2009</p>	<p>2019-10-16 1:56 am ↩ 🔖 #25</p> <p>I'm just installing an ebay cheapy delay relay (as per post #14) in a valve diode heater circuit. Direct heated diodes like 5U4 are similar to ss diodes in that B+ comes up to a max within a few seconds. Even an indirectly heated diode like GZ34 can bring B+ up a second or two before output stage valves can avoid a B+ overshoot.</p> <p>Applied to a diode heater, the relay contact really needs to be paralleled with an NTC, as that will remove heater in-rush, and alleviates relay contact stress.</p> <p>The time delay can nicely sequence with the rise in load current, whether an indirect or directly heated diode valve is used.</p> <p>The timer relay pcb includes an input series diode and 100uF cap, which provides the latter portion of a capacitor input doubler, so the timer/relay can be powered from the 5VAC supply. (I will confirm this in the next few days).</p>
<p>trobbins Member Joined 2009</p>	<p>2019-10-16 2:14 am ↩ 🔖 #26</p> <p>Jan, what limits Vgs on Q3 ? I can see that model fet includes ESD protection but it still has a 30V max rating.</p> <p>The power transformer CT link in a full-wave B+ supply is often an appropriate location for a fuse to provide better fault discrimination than just a mains side fuse. Fuses take their time to blow, especially for secondary side circuits where a prospective fault current level is only a few times the max continuous level required to operate the amp. Have you thought about including an over-current protection function that would be much more discriminating than a fuse?</p> <p>Last edited: 2019-10-16 2:19 am</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2019-10-16 6:23 am ↩ 🔖 #27</p> <p>During the delay, Vgs is shorted (sort of) by Q2. After the delay, its R2 and the internal Q3 zener.</p> <p>I have not considered a current limit; my goal was a small, simple and plug-and-play-and-forget thingy.</p> <p>That was an important consideration for me. I know you can do such a delay in many, many ways and we read here about them. But I haven't seen a method that is so easy to use, so unobtrusive, doesn't need its own power supply, such a small thing you can tuck away and forget about. And, I would add, can be easily set to a wide range of delays.</p> <p>But I also perceive some resistance because it is not a typical tube-type circuit. Solid state and, Ohm forbid, a small controller. I think that is also a factor, which I underestimated.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>trobbins Member Joined 2009</p>	<p>2019-10-16 7:35 am ↩ 🔖 #28</p> <p>Ta. The internal zener of Q3 is devoid of any datasheet specification or even generic description from Fairchild (and now on-semi), apart from the ESD spec being passed and the device symbol. That is what prompted my post query as I was thinking you may have some other information that provides definition.</p> <p>From what I can tell the 2kV body model compliance pretty much just allows manual handling of the part to cope with sub ms spikes, and is pretty generically designed in to most semi-parts nowadays.</p> <p>Have you checked what the gate voltage sits at nominally?</p>

<p>jan.didden ●</p> <p>AX tech editor</p> <p>Joined 2002</p>	<p>2019-10-16 10:32 am ↩ 🔖 #29</p> <div data-bbox="336 188 1481 293"><p>trobbins said: (URL: /community/goto/post?id=5945870)</p><p>Have you checked what the gate voltage sits at nominally?</p></div> <p>No, and I will do it and report. I think I and some friends have build and use about 6 units so far with no issues. But yes, I'm curious what the actual level is.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>Rod Coleman</p> <p>Member</p> <p>Joined 2004</p>	<p>2019-10-16 12:00 pm ↩ 🔖 #30</p> <div data-bbox="336 656 1481 792"><p>trobbins said: (URL: /community/goto/post?id=5945707)</p><p>Jan, what limits Vgs on Q3 ? I can see that model fet includes ESD protection but it still has a 30V max rating.</p><p><trunc></p></div> <p>Yes, any internal zener should be considered for ESD protection only, unless stated otherwise.</p> <p>TOSHIBA state this expressly:</p> <p><u>Is it possible to use the Zener diode between the gate and source for surge absorption? Toshiba Electronic Devices & Storage Corporation Europe(EMEA)</u> (URL: https://toshiba.semicon-storage.com/eu/design-support/faq/mosfet/is-it-possible-to-use-the-zener-diode-between-the-gate-and-sourc.html).</p> <p>The external circuit should always prevent the gate voltage exceeding Vgss, including the negative condition, and power up/down transients. The customary zener diode should always be present!</p>




<div><div>jan.didden</div><div>AX tech editor</div><div>Joined 2002</div></div>	<div><div>2019-10-16 12:11 pm</div><div><div></div><div></div><div>#31</div></div></div> <div><p>I understand, but consider that the series R is 1Meg. Even with 500V, the max current into that on-board zener is 500uA. This is much, much less than a typical ESD discharge, which can be ampere-level pulses.</p><p>And I don't know the Toshiba context, but it is normal practice to consider the internal zener as protection, circuits all over the 'net.</p><p>That has to be the reason I don't see any failures.</p><p>And sometimes understanding part and circuit parameters lets you use stuff in a way not foreseen by the manufacturer, who is always concerned about using both belt and braces.</p><p>But I will measure it later today.</p><p>Jan</p><div><div>Attachments</div><div><div>(URL: /community/attachments/mosfet-png.788126/)</div><div>mosfet.PNG</div><div>63.8 KB · Views: 365</div></div></div><div><div>Last edited: 2019-10-16 12:20 pm</div></div><div><div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div></div></div>
<div><div>jan.didden</div><div>AX tech editor</div><div>Joined 2002</div></div>	<div><div>2019-10-16 12:48 pm</div><div><div></div><div></div><div>#32</div></div></div> <div><p>OK, just measured it. During the delay, the Vgs is 1.2V. After the delay is it 24.4V. This is switching a 340V power supply.</p><p>Nothing onward I think.</p><p>Jan</p><div><div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div></div></div>


<div data-bbox="135 230 274 253">Rod Coleman</div> <div data-bbox="135 264 207 284">Member</div> <div data-bbox="122 291 220 309">Joined 2004</div>	<div data-bbox="333 141 547 163">2019-10-16 12:50 pm</div> <div data-bbox="1359 141 1484 163">  #33</div> <p>ESD strikes are extremely brief - they originate from a capacitor. In a IEC 61000-4-2 ESD, it's all over in about 60ns. Energy ratings and power ratings are not the same thing!</p> <p>In fact, most of the current in an ESD strike test will flow through the the gate-to-source capacitance of the FET. The internal zener is there limit voltage, but not at any particular power level.</p> <p>With DC voltage, none of the current is diverted through the capacitor.</p> <p>The reason TOSHIBA say "do not use it " is that it does not guarantee (across all production samples) that the DC voltage that will be clamped to the safe value, and there is no guarantee that the zener will not be damaged if slower transient events are present.</p> <p>There is another issue with uncontrolled DC voltage supplies for driving FET gates:</p> <p>Reliability of Power MOS FETs is degraded by operating them at high values of Vgs. They have a thin layer of oxide controlling the channel, and the stress on the oxide is Vgs dependent. So if you are relying on a protection zener (which has no data sheet values of voltage, or its tolerance), the voltage can drift up to 30V, or even higher, and degrade the MTBF. There's an old IR app-note around that puts numbers on this; but the upshot is that Vgs should be limited to the lowest level necessary for the ON-current in the application.</p> <p>where reliability is concerned, it is the designer should be concerned with belt and braces! The BZX55C8V2 costs around 2¢.</p> <p>What possible reason is there to omit it?</p>
<div data-bbox="135 1102 274 1124">jan.didden </div> <div data-bbox="116 1140 239 1160">AX tech editor</div> <div data-bbox="129 1167 226 1184">Joined 2002</div>	<div data-bbox="333 1012 531 1034">2019-10-16 1:18 pm</div> <div data-bbox="1359 1012 1484 1034">  #34</div> <p>No reason other than it seemed unnecessary with a zener gate protected MOSFET, and none of the many prototypes had an issue.</p> <p>But I'll add one on the next board revision.</p> <p>I will also add a note on the web page on how to add one on the current board.</p> <p>Well, it seems you're never to old to learn</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>

<div><div>jan.didden</div><div>AX tech editor</div><div>Joined 2002</div></div>	<div>2019-10-16 1:27 pm<div>↩ 📌 #35</div></div> <div><p>A zener could be added to the bottom of the board as shown here. A 12V 400mW is OK. Note that this view is from the top of the board, and the zener should be mounted on the bottom. Take care not to short the zener wires to other connections.</p><p>Edit: added to The HV Delay Linear Audio NL (URL: https://linearaudio.nl/hv-delay).</p><p>Thanks guys!</p><p>Jan</p><div><div>Attachments</div><div>(URL: /community/attachments/zener-protect-png.788135/)</div><div>zener protect.PNG</div><div>34.1 KB · Views: 301</div></div><div>Last edited: 2019-10-16 1:44 pm</div><div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div></div>
<div><div>Mark Johnson</div><div>Member</div><div>Joined 2011</div></div>	<div>2019-10-16 1:49 pm<div>↩ 📌 #36</div></div> <div><p>Congratulations, Jan! You've got a nice and tight implementation of a great concept. Special kudos for (a) finding such a low cost, 1 kilovolt rated (!), depletion MOSFET; and (b) daring to use a microcontroller in pure analog circuitry. You could remind naysayers that Acoustic Research's virtual VU meters ("GhostMeter"™) also employ microcontroller ICs...</p><p>—</p><div><div>Attachments</div><div>(URL: /community/attachments/ghost-jpg.788136/)</div><div>ghost.jpg</div><div>51.1 KB · Views: 336</div></div></div>
<div><div>petertub</div><div>Member</div><div>Joined 2015</div></div>	<div>2019-10-16 8:27 pm<div>↩ 📌 #37</div></div> <div><p>Rubli has made an even simpler delay, splice the B+ and mount the device here. No ground connection needed, no power supply needed.</p><p>Se http://n.manet.nu/tubedoc/rubli-article.pdf (URL: http://n.manet.nu/tubedoc/rubli-article.pdf).</p></div>
<div><div>trobbins</div><div>Member</div><div>Joined 2009</div></div>	<div>2019-10-17 12:17 am<div>↩ 📌 #38</div></div> <div><div><div>petertub said: (URL: /community/goto/post?id=5946533)</div><div>Rubli has made an even simpler delay</div></div><p>Worth noting that delay applies a step B+ connection to output stage, doesn't aim to limit first filter cap peak voltage or reduce inrush.</p></div>


<p>hpeter Member Joined 2013</p>	<p>2019-10-18 3:51 pm ↩ 🔖 #39</p> <div><p>disco said: (URL: /community/goto/post?id=5945491)</p><p>I'd say the relay shorts out the charge limiter once the cap is full, but this does not do so...</p></div> <p>good point, but since there is low consumption on my headamp, i do not need it. on those fets there is only 1-2v across d-s ; they are cold.</p>
<p>hpeter Member Joined 2013</p>	<p>2019-10-18 3:53 pm ↩ 🔖 #40</p> <div><p>peteki said: (URL: /community/goto/post?id=5945510)</p><p>Physics does not support a delayed switch on. The potential between plate and cathode would need to be several thousand volts to rip electrons from the cathode and also consider the electrolytics. There is ample literature on the subject if one goes hunting.</p></div> <p>you are actually right. some rectifiers have a long time to fully heat the cathode, literally working as softstart. delay is required only for gas tubes, but softstart is what saves components.</p> <p>Last edited: 2019-10-18 4:20 pm</p>
<p>Pano  Administrator Joined 2004</p>	<p>2019-10-18 6:37 pm ↩ 🔖 #41</p> <p>HV reg posts split off to here: Jan's HV regulator (URL: https://www.diyaudio.com/forums/tubes-valves/344141-jans-hv-regulator.html)</p>
<p>A Alashikata Member Joined 2012</p>	<p>2019-10-19 4:15 am ↩ 🔖 #42</p> <p>Jan,</p> <p>Would voltage delay increase the B+ more than 450V? Or it acts as on/off switch. I was looking at your circuit before but out of stock so I went on to buy different brand from ebay since I was lazy to build one from your document.</p> <p>Right now, every time I turned it on, the delay works as it's support to but the first resistor in the circuit got smoke. I am planning to remove voltage delay to see if it causes the problem or something else.</p> <p>--->---VD---B+---R1----R2: my R1 get smoke every time VD activates. It used to work before.</p>
<p>jan.didden  AX tech editor Joined 2002</p>	<p>2019-10-19 5:52 am ↩ 🔖 #43</p> <p>I don't understand where your R1 and R2 are. Is that part of your decoupling or what? Which delay are you using now? The delay shouldn't do anything to the voltage, just connect its input to its output after some time. Are you sure you connected it right?</p> <p>Can you post a schematic, even if a pic from your phone?</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>

<p>disco Member Joined 2006</p>	<p>2019-10-19 10:09 am ↩ 📌 #44</p> <p>A matter of inrush current?</p> <div data-bbox="336 241 1481 584"><p>Attachments</p><p>(URL: /community/attachments/load-switch-jpg.788781/)</p><p>load switch.JPG</p><p>48.5 KB · Views: 283</p><p>(URL: /community/attachments/inrush-current-jpg.788780/)</p><p>inrush current.JPG</p><p>22.9 KB · Views: 285</p></div>
<p>A Alashikata Member Joined 2012</p>	<p>2019-10-19 4:24 pm ↩ 📌 #45</p> <p>Thank you, that's I thought, I have 1 for each channel, used to work for a while. Happen only 1 channel. The other channel still works fine.</p> <p>This is the one I have</p> <p>Then the first R (R115) comes out smoke when the H-VD starts. Even replaced new R still the same. I turned off right away so I am not sure where to start trouble-shooting yet.</p>
<p>Ketje Member Joined 2012</p>	<p>2019-10-19 4:34 pm ↩ 📌 #46</p> <div data-bbox="336 1171 1481 1361"><p>Alashikata said: (URL: /community/goto/post?id=5949443)</p><p>Thank you, that's I thought, I have 1 for each channel, used to work for a while. Happen only 1 channel. The other channel still works fine.</p><p>Then the first R (R115) comes out smoke when the H-VD starts. Even replaced new R still the same. I turned off right away so I am not sure where to start trouble-shooting yet.</p></div> <p>That has nothing to do with the delay, you have a short to ground between R114 and R115. Mona</p>
<p>A Alashikata Member Joined 2012</p>	<p>2019-10-19 4:46 pm ↩ 📌 #47</p> <div data-bbox="336 1559 1481 1693"><p>Ketje said: (URL: /community/goto/post?id=5949449)</p><p>That has nothing to do with the delay, you have a short to ground between R114 and R115. Mona</p></div> <p>I have checked many times between R114 and R115. Any points after R114 seem normal. I will check again later.</p> <p>If the Output is bad, would it give the problem too since it connects to the Output?</p>

 <p>Ketje Member Joined 2012</p>	<p>2019-10-19 4:58 pm ↩ 🔖 #48</p> <div><p>Alashikata said: (URL: /community/goto/post?id=5949459)</p><p>I have checked many times between R114 and R115. Any points after R114 seem normal. I will check again later.</p><p>If the Output is bad, would it give the problem too since it connects to the Output?</p></div> <p>The current comes for the output and to R114. Without a deviation all current from R115 goes through R114 and that one would burn too.</p> <p>Mona</p>
 <p>Alashikata Member Joined 2012</p>	<p>2019-10-19 5:22 pm ↩ 🔖 #49</p> <p>When R115 starts spark and smoke, I turn it off so R114 is fine. Even I raised the PCB up a little to make sure nothing touching the case. I compared with the working channel and couldn't find anything different. Did a lot of measurement to compare. At least H-VD is not the problem, I will take time again to check all the points with GND again.</p> <p>Spark at the legs of R115 and R114</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2019-10-19 5:23 pm ↩ 🔖 #50</p> <div><p>Alashikata said: (URL: /community/goto/post?id=5949459)</p><p>I have checked many times between R114 and R115. Any points after R114 seem normal. I will check again later.</p><p>If the Output is bad, would it give the problem too since it connects to the Output?</p></div> <p>A very simple quick check is to bridge the delay with a wire. If it still smokes, it isn't the delay. I agree with Ketje's diagnosis. If R114, R115 are slightly different (large tolerance), could be a shorted elcap: disconnect C103 and see if your trouble is over.</p> <p>Although it could also be a shorted tube in that case.</p> <p>Jan</p> <p>Last edited: 2019-10-19 5:28 pm</p> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
 <p>Alashikata Member Joined 2012</p>	<p>2019-10-19 5:30 pm ↩ 🔖 #51</p> <p>Oh yeah, why didn't I think to bridge the Delay instead of remove ..lol.. thanks that's an easy trouble-shooting.</p> <p>Already swapped all the tubes from working channel but still the same.</p> <p>Sorry, didn't mean to hijack your thread but it's very helpful in my case. I will start with C103 to see what happen.</p> <p>R114 and R115 value pretty much the same.</p>






<div>jan.didden</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-19 8:22 pm</div> <div><div></div><div></div><div>#52</div></div> <div>What happens if you disconnect R114? Maybe C103 is shorted and R114 has failed short the first time.</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>A</div> <div>Alashikata</div> <div>Member</div> <div>Joined 2012</div>	<div>2019-10-20 12:47 am</div> <div><div></div><div></div><div>#53</div></div> <div>I think I will start with C103 since I removed both R114 and R115 to do a measurement, the R114 has exactly value while the R115 value just a little slower than the R114 but not that much.</div> <div>I haven't done removing R114 to power on yet. I will do that too. Actually, I don't have time to fix it right now since working to remodel the audio room. May take another 2 months to complete before I can setup and have time to work on it. Your info and others are great guide to start trouble-shooting. All I did was swapped the tubes, compared all the points from working channel, and replaced the R115. Haven't done anything you and others mentioned in here yet.</div>
<div>jan.didden</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-20 8:05 am</div> <div><div></div><div></div><div>#54</div></div> <div>Well you have our attention now ...</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>jan.didden</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2019-10-25 7:18 am</div> <div><div></div><div></div><div>#55</div></div> <div>Did some more searching about the cathode stripping effect and found the attached. Sounds plausible.</div> <div>An argument you often hear is 'I own a 1962 radio with original tubes and it still plays fine'. But these old radios had tube rectifiers and therefor build-in high voltage delay. So this is really an argument showing the benefits of high voltage delay ...</div> <div>Jan</div> <div><div>Attachments</div><div><div></div><div>(URL: /community/attachments/cathode-stripping-pdf.790154/)</div></div><div>cathode stripping.pdf</div><div>31.2 KB · Views: 139</div></div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>








<p>trobbins Member Joined 2009</p>	<p>2019-10-25 8:07 am ↩ 🔖 #56</p> <p>Yes I read that the other day - it is just conjecture.</p> <p>That said, there certainly are many examples of output stage valves, and perhaps to a lesser extent preamp valves that show a walk-away effect of grid voltage in a typical circuit with just grid leak resistor. Measuring the anode voltage whilst shorting the grid leak resistor shows up a step change in anode voltage, and is one way to gauge this.</p> <p>Not sure how one would test if the valve was gassy, versus had enhanced emission from the input grid. Perhaps via an insulation resistance measurement of the anode to say the screen for an output stage pentode - gassy may show up some leakage versus voltage.</p> <p>I would imagine there would be some non-zero percentage of poorly made cathodes that may well loose some surface material, or crack or whatever, and the input grid ends up being mottled with enhanced emitter material. Whether turn-on conditions are the dominant pathway to that happening is a query.</p> <p>I suppose the counter proposal relates to how many valve amplifiers exist with ss or directly heated diodes (as they both cause B+ conditions well before output stage conduction), and what percentage of those amps experience output stage valves that have a noticeably shorter lifetime than expected, and how many of those poorer valves weren't exposed to the general rigours of red plating or some other failure mode etc.</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2019-10-25 9:57 am ↩ 🔖 #57</p> <div data-bbox="336 904 1481 1066"><p>trobbins said: (URL: /community/goto/post?id=5955071)</p><p>Yes I read that the other day - it is just conjecture.</p><p>That said,</p></div> <p>.. there must be something, somewhere, that is solid info. Where do you get yours in this context ? How do you know what is conjecture, and what isn't it?</p> <p>Jan</p> <p>Last edited: 2019-10-25 10:01 am</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>trobbins Member Joined 2009</p>	<p>2019-10-25 12:31 pm ↩ 🔖 #58</p> <p>RCA 1962 Electron Tube Design is my usual go to reference. I don't recall seeing this particular mechanism described, but I didn't trawl through the manual again today.</p>

<p>Rod Coleman Member Joined 2004</p>	<p>2019-10-25 1:58 pm ↩ 📄 #59</p> <p>The J.H. van de Weijer in that text is Hans van de Weijer, a cathode designer at Koninklijke Philips N.V. Picture Tube division.</p> <p>His suggested precautions against grid-current does offer an explanation for one other phenomenon, at least: the application environment for electrometer applications.</p> <p>The Brimar 6BS7 is an audio tube which was built to a standard that allowed it to be used for Electrometer purposes.</p> <p>The Brimar 6BS7 Data Sheet warns of mandatory pre-heating in electrometer applications (where low grid-current is supremely important).</p> <p>Expressly, that the 6BS7 heater should be powered for 1 minute or more, before the HV arrives.</p> <p>http://www.mif.pg.gda.pl/homepages/frank/sheets/019/6/6BS7.pdf (URL: http://www.mif.pg.gda.pl/homepages/frank/sheets/019/6/6BS7.pdf)</p> <div><p>Attachments</p><p>(URL: /community/attachments/6bs7powerseq-jpeg.790232/)</p><p>6BS7powerseq.jpeg</p><p>51.9 KB · Views: 253</p></div>
<p>jan.didden  AX tech editor Joined 2002</p>	<p>2019-10-25 2:21 pm ↩ 📄 #60</p> <p>Thanks Rod, that's useful. I guess this guy knows what he is talking about.</p> <p>I like his ' the valve must be operated in total darkness' ;-)</p> <p>Jan</p> <p>Last edited: 2019-10-25 2:24 pm</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>trobbins Member Joined 2009</p>	<p>2019-10-25 10:36 pm ↩ 📄 #61</p> <p>That 6BS7 topic is definitely worthy of more digging. There is an application doc on it too. First time i have seen microphony spectrum plot in a specific valve`s datasheet, as well as grid current levels and other population statistics.</p>
<p>TonyTecson Member Joined 2003</p>	<p>2019-10-27 2:52 am ↩ 📄 #62</p> <p>one rule of thumb in my toolbag, all elements of the tube must connect to something and never left hanging...</p> <p>have seen this play out in a chinese tube amp wherein the one half of the dual triode was left hanging, after sometime, youse the amp with tubes lit and no sound, simply replacing the tube brought back the sound, but i wonder for how long?</p> <p>so in that case, i paralleled the unused triode to the corresponding element of the triode used, i.e. pin 1 to pin 6, pin 2 to pin7 and then pin3 to pin8....end of problem...</p>

<div>S</div> <div>schirr</div> <div>Member</div> <div>Joined 2018</div>	<div>2021-09-23 9:16 pm</div> <div>< □ #63</div> <div><div>jan.didden said: (URL: /community/goto/post?id=5941824)</div><div>... how does the circuit 'know' that there is a zero crossing?</div><div>....</div><div>before that, the capacitor is not charged, so at the top of that cap, at Vraw, you see a double-rectified mains sine wave, positive half-waves. And that goes to zero twice per mains period, easy to detect.</div></div> <div>This won't work with a choke input filter, will it?</div>
<div>S</div> <div>schirr</div> <div>Member</div> <div>Joined 2018</div>	<div>2021-09-23 9:50 pm</div> <div>< □ #64</div> <div>Typed too soon and did thinking and the simulation afterwards. Of course it will work.</div>
<div>Bigun</div> <div>Member</div> <div>Joined 2009</div>	<div>2021-09-23 10:12 pm</div> <div>< □ #65</div> <div><div>jan.didden said: (URL: /community/goto/post?id=5955040)</div><div>Did some more searching about the cathode stripping effect and found the attached. Sounds plausible.</div></div> <div>The one thing that struck me in this article is the idea that pieces getting ripped off the cathode would be caught in the sieve of the grid. I have a sieve in my kitchen and it's made of a tight mesh and I could imagine it catching stuff thrown into it. But when I go look at the grid of an average tube I don't find such a tight mesh, it's hard to imagine the grid intercepting very much at all ??</div> <div>Last edited: 2021-09-23 10:17 pm</div>
<div>Bigun</div> <div>Member</div> <div>Joined 2009</div>	<div>2021-09-23 10:17 pm</div> <div>< □ #66</div> <div><div>hpeter said: (URL: /community/goto/post?id=5948467)</div><div>...softstart is what saves components.</div></div> <div>Why does the softstart save components? As far as I can see, the 'input signal' of mains ac is at 50Hz / 60Hz and after rectification the waveform is 100Hz / 120Hz which ain't too impressive. The audio signals run up to 10's kHz and many components will be subjected to much higher slew rates from the audio signal than they'll ever 'see' from the power supply coming on. I can't see where the issue is - Have I taken your comment too far out of context by mistake ?</div> <div>Last edited: 2021-09-23 10:19 pm</div>


<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2021-09-24 6:51 am</div> <div>< □ #67</div> <div>I think the comparison is flawed because the power levels and transient currents in a power supply are in a different order than in the amplifier circuit.</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>Mark Johnson ●</div> <div>Member</div> <div>Joined 2011</div>	<div>2021-09-24 1:19 pm</div> <div>< □ #68</div> <div>My work focuses on solid state amps, not valve amps. In solid state amps with semiconductor rectifiers and large (>500 VA) power transformers, I think of soft start as a protection mechanism whose main purpose is to limit the "inrush current" at switch-on. Lowering the inrush current reduces stress upon the mains fuse, the power on/off switch, the transformer (both primary and secondary), the rectifiers, and the bulk filtering capacitors. Most importantly it lets me select a mains fuse to handle the expected worst case <i>operating current</i> instead of the worst case inrush current. I consider that an improvement in safety.</div>
<div>petertub ●</div> <div>Member</div> <div>Joined 2015</div>	<div>2021-09-24 3:00 pm</div> <div>< □ #69</div> <div><div>Mark Johnson said: (URL: /community/goto/post?id=6795616)</div><div>My work focuses on solid state amps, not valve amps. In solid state amps with semiconductor rectifiers and large (>500 VA) power transformers, I think of soft start as a protection mechanism whose main purpose is to limit the "inrush current" at switch-on. Lowering the inrush current reduces stress upon the mains fuse, the power on/off switch, the transformer (both primary and secondary), the rectifiers, and the bulk filtering capacitors. Most importantly it lets me select a mains fuse to handle the expected worst case <i>operating current</i> instead of the worst case inrush current. I consider that an improvement in safety.</div></div> <div>A very good observation. Applicable on larger tube amps too.</div> <div>A simple form is a resistor in the primary that shorts by a relay after a few seconds.</div>
<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2021-09-24 4:13 pm</div> <div>< □ #70</div> <div>I just want to remind you guys that inrush current issues are a completely different issue than the subject of this thread. Maybe not to hijack it.</div> <div>Jan</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>TonyTecson</div> <div>Member</div> <div>Joined 2003</div>	<div>2021-09-25 12:00 am</div> <div>< □ #71</div> <div>an NTC in series with the power trafto primary is just about all that is needed for tube power amps.....</div> <div>my observations using a power monitor at the primary, at the flick of the switch there is a surge of current even as the filaments are still cold, then power goes down, and as the filaments warmed up the power went up and settled to a fixed value...</div> <div>in all, i never saw that the mains fuse was in danger of busting as the fuse rating was way above the turn on currents that i saw...</div> <div>with SS amps, there is no such, up down and up again scenario, after the initial surge died down, then it is idle power all the way...</div>

<div data-bbox="119 230 287 315">Mark Johnson ● Member Joined 2011</div>	<div data-bbox="335 141 552 163">2021-09-25 12:42 pm</div> <div data-bbox="1361 141 1484 163">  #72</div> <p data-bbox="335 192 1484 282">Tony, here's how the solid-state amp called "First Watt M2" behaves, when connected to a Dim Bulb Tester. This amp is class-A so its idle power is quite high, but the optoisolater-based bias control circuit has a very very long timeconstant (> 20 seconds).</p> <p data-bbox="335 318 1484 407">At switch-on, there is a large inrush current as the power supply filtering capacitors are charged, and the transformer flux transitions from (zero) to (sinusoidal). Then the bias controller sloooooowly ramps up the current in the output stages and eventually, more than 20 seconds later, the final class-A idle power is reached.</p> <p data-bbox="335 519 347 533">—</p> <div data-bbox="335 555 1484 1155"><div data-bbox="359 580 515 607">Attachments</div><div data-bbox="359 627 932 651">(URL: /community/attachments/m2_dimbulb-png.985961/)</div><div data-bbox="381 665 536 687">M2_dimbulb.png</div><div data-bbox="381 712 553 734">27 KB · Views: 239</div><div data-bbox="359 750 847 775">(URL: /community/attachments/ckt-png.985962/)</div><div data-bbox="381 788 451 810">ckt.png</div><div data-bbox="381 835 568 857">77.6 KB · Views: 237</div><div data-bbox="379 902 461 1003"></div><div data-bbox="478 940 1243 965">(URL: /community/attachments/pass_optical_bias_us4752745-pdf.985963/)</div><div data-bbox="381 1050 703 1072">Pass_Optical_Bias_US4752745.pdf</div><div data-bbox="381 1097 568 1120">431.6 KB · Views: 55</div></div>
<div data-bbox="119 1321 266 1404">TonyTecson Member Joined 2003</div>	<div data-bbox="335 1232 552 1254">2021-09-26 12:03 am</div> <div data-bbox="1361 1232 1484 1254">  #73</div> <p data-bbox="335 1283 1035 1308">surge duration is what? to 5 cycles? so at 50hz, that is 100msecs.....</p>

<div data-bbox="135 230 269 257">jan.didden ●</div> <div data-bbox="116 268 237 291">AX tech editor</div> <div data-bbox="127 295 225 313">Joined 2002</div>	<div data-bbox="335 141 537 163">2021-09-26 7:51 am</div> <div data-bbox="1359 141 1482 163">  #74</div> <div data-bbox="335 192 1482 309"><p>What is missing in this story is the xformer magnetizing current. If you switch on the transformer on the same waveform position as it was switched off, the magnetizing current is small.</p><p>If you switch the xformer on 180deg from the point where it was switched off, it presents basically a short to the mains.</p></div> <div data-bbox="335 318 857 340"><p>This is all without the effect of any secondary load.</p></div> <div data-bbox="335 349 1439 434"><p>See attached example measurement from my Sequencer project. Inrush magnetizing current with no load is >40A peak on 230VAC mains. (The red curve is just some measurement points to facilitate understanding what's going on).</p></div> <div data-bbox="335 472 1463 528"><p>The sequencer has a small controller that makes sure that the switch off and switch on points were always the same to minimize magnetizing inrush.</p></div> <div data-bbox="335 566 373 589"><p>Jan</p></div> <div data-bbox="357 640 515 667">Attachments</div> <div data-bbox="376 714 461 817"></div> <div data-bbox="478 752 1069 777"><p>(URL: /community/attachments/05102010-a-pdf.986142/)</p></div> <div data-bbox="378 864 531 887"><p>05102010-a.pdf</p></div> <div data-bbox="378 911 561 934"><p>48.3 KB · Views: 83</p></div> <div data-bbox="335 1019 1158 1041"><p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p></div>
<div data-bbox="154 1209 253 1234">jean-paul</div> <div data-bbox="110 1243 258 1263">Disabled Account</div> <div data-bbox="135 1267 231 1285">Joined 2002</div>	<div data-bbox="335 1120 541 1142">2021-09-26 7:58 am</div> <div data-bbox="1359 1120 1482 1142">  #75</div> <div data-bbox="335 1171 1457 1225"><p>A 10 Ohm NTC works perfect to limit that. This is the simple standard method as used with toroids above 500 VA to 1 kVA in 230V mains voltage areas. A 1 part solution.</p></div> <div data-bbox="335 1263 1471 1350"><p>In telecom 1 kVA toroids were/are used in the field for decades in this way and both toroids and NTCs survive almost anything that happens <i>except lightning strikes</i>. Sidenote: their modern replacements don't last 10 years (SMPS).</p></div> <div data-bbox="1197 1386 1460 1404"><p>Last edited: 2021-09-26 8:27 am</p></div>
<div data-bbox="146 1572 260 1597">petertub ●</div> <div data-bbox="134 1610 205 1630">Member</div> <div data-bbox="122 1635 217 1653">Joined 2015</div>	<div data-bbox="335 1482 547 1505">2021-09-26 11:45 am</div> <div data-bbox="1359 1482 1482 1505">  #76</div> <div data-bbox="357 1547 963 1572"><p>jan.didden said: (URL: /community/goto/post?id=6797477)</p></div> <div data-bbox="357 1592 1444 1722"><p>What is missing in this story is the xformer magnetizing current. If you switch on the transformer on the same waveform position as it was switched off, the magnetizing current is small.</p><p>If you switch the xformer on 180deg from the point where it was switched off, it presents basically a short to the mains.</p><p>This is all without the effect of any secondary load</p></div> <div data-bbox="782 1787 1037 1812"><p>Click to expand... (URL:)</p></div> <div data-bbox="335 1843 1126 1868"><p>I use a SSR with zero crossing as mains switch. Cheap reliable and surgefree.</p></div>

jean-paul Disabled Account Joined 2002	<p>2021-09-26 12:19 pm < □ #77</p> <p>No that is <i>every time</i> power on surge (! when using zero crossing SSR's !). Worse than a simple power switch.</p> <p>Hint: it is not a resistor that is being powered. You are definitely not alone in this thinking but unfortunately it is the opposite of what is really happening It is also worst scenario for the SSR and the transformer and it may cause EMI/RF</p> <p>Don't repeat this error, folks! Just know your stuff regarding transformers and you'll be able to easily explain what is happening.</p> <p>Last edited: 2021-09-26 12:49 pm</p>
jan.didden ● AX tech editor Joined 2002	<p>2021-09-26 2:41 pm < □ #78</p> <p>Indeed. The dV/dT is max at a zero crossing, zero at a peak.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
Mark Johnson ● Member Joined 2011	<p>2021-09-26 3:43 pm < □ #79</p> <p>Then it might be a nice idea to have the sequencer switch the mains at a voltage peak, both switch-on and switch-off.</p>
jan.didden ● AX tech editor Joined 2002	<p>2021-09-27 6:28 am < □ #80</p> <p>Yes, then the magnetizing current is minimum. Of course, the secondary load current inrush charging the caps is maximum then :-(</p> <p>But if you have a controller in the system anyway, you can apply some intelligence ;-)</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
jean-paul Disabled Account Joined 2002	<p>2021-09-27 6:29 am < □ #81</p> <p>Overengineering 101. The NTC does a good job in all circumstances. Probably too simple and too effective</p>
jan.didden ● AX tech editor Joined 2002	<p>2021-09-27 7:03 am < □ #82</p> <p>NTCs are boring for an audio diy-er JP!</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>

<https://www.diyaudio.com/community/threads/tube-amp-high-voltage-delay.343711/print> Page 25 of 37

TonyTecson Member Joined 2003	2021-09-28 1:02 am ^with arduino, imo that is possible with the right sensors...	2021-09-28 1:02 am #88
jan.didden ● AX tech editor Joined 2002	2021-09-30 9:05 am Some info on how to select NTCs for transformer inrush protection. Read especially the 1st para, saying that you <i>should not</i> switch on at zero crossing! I have been preaching that for years, only to be cut down for it ... Jan <div>Attachments  (URL: /community/attachments/xformer-inrush-protection-calc-pdf.987060/) xformer inrush protection calc.pdf 803.8 KB · Views: 136</div>	2021-09-30 9:05 am #89
jean-paul Disabled Account Joined 2002	2021-09-30 9:14 am Common knowledge on dutch technical schools decades ago. Anyone reading Elektuur/Elektor knew this too. It seems today some people search for complicated ways to solve non-issues already solved a long time ago. Or, worse, to find a new way of doing things that is way worse than the old method. On this forum one can detect some design errors in designs that are accepted <i>and</i> defended. Nah, quality and efficiency are boring	2021-09-30 9:14 am #90 Last edited: 2021-09-30 9:20 am
jan.didden ● AX tech editor Joined 2002	2021-09-30 9:50 am J-P, you seem, uhh, unhappy, lately. Everything OK with you? Jan	2021-09-30 9:50 am #91
jean-paul Disabled Account Joined 2002	2021-09-30 9:56 am Oh I am OK but I am disappointed in new developments that run backwards and basic technical stuff being forgotten.	2021-09-30 9:56 am #92 Last edited: 2021-09-30 10:21 am

jan.didden ● AX tech editor Joined 2002	2021-09-30 10:36 am It's only audio Jan High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB	↩ 📌 #93
jean-paul Disabled Account Joined 2002	2021-09-30 10:38 am Yeah I am done with it I think	↩ 📌 #94
TonyTecson Member Joined 2003	2021-09-30 10:56 am when using a simple toggle switch how is one to know that you are not switching at the zero crossing?	↩ 📌 #95
jean-paul Disabled Account Joined 2002	2021-09-30 10:59 am Not. It is a matter of statistics. How high is the chance that one switches at exactly the zero crossing? And what if one does once in a year? In case of the "SSR with zero crossing switching" ask the same questions Last edited: 2021-09-30 11:02 am	↩ 📌 #96
TonyTecson Member Joined 2003	2021-09-30 11:02 am do i care? never, i just toggle it on or off as needed...	↩ 📌 #97
jean-paul Disabled Account Joined 2002	2021-09-30 11:03 am That is THE modus operandi of mechanical switches. Just suppose you <i>have</i> to switch exactly at zero crossing or otherwise things go wrong A bit like syncing was done by hand in the old days with generators. Sweat in the hands. <div>Attachments (URL: /community/attachments/generator-synchroscope-jpg.987070/) generator-synchroscope.jpg 73.7 KB · Views: 95</div> Last edited: 2021-09-30 11:07 am	↩ 📌 #98

TonyTecson Member Joined 2003	2021-09-30 11:15 am thanks for the reassurance.....	🔗 📌 #99
jan.didden ● AX tech editor Joined 2002	2021-09-30 12:07 pm A zero xing SSR does NOT switch on at the zero crossing. It ignites the triac at the zero crossing. That triac takes several msecs to get all fired up, so to say, which places the mains switching point almost smack on the top of the sine wave. When I started working on the sequencer, with a small microcontroller, I'd switch the triac a couple of msec before the zero xing to neatly switch the load transformer at exact zero crossing. I couldn't understand why those fuses popped, until I discovered that at zero crossing the dV/dT is max and the xformer looks almost like a short. And so you learn what the professionals learned decades before you! Jan	🔗 📌 #100
Bigun ● Member Joined 2009	2021-09-30 12:23 pm <div>jean-paul said: (URL: /community/goto/post?id=6801980) Oh I am OK but I am disappointed in new developments that run backwards and basic technical stuff being forgotten.</div> +1 This whole thread is unnecessary and propagates the myth that delayed B+ is needed. I was surprised that it's become an official pcb for sale by this forum.	🔗 📌 #101









<p>jean-paul Disabled Account Joined 2002</p>	<p>2021-09-30 12:35 pm ↩ 🔖 #102</p> <div data-bbox="336 190 1481 488"><p>jan.didden said: (URL: /community/goto/post?id=6802086)</p><p>A zero xing SSR does NOT switch on at the zero crossing. It ignites the triac at the zero crossing. That triac takes several msecs to get all fired up, so to say, which places the mains switching point almost smack on the top of the sine wave.</p><p>When I started working on the sequencer, with a small microcontroller, I'd switch the triac a couple of msec before the zero vix to neatly switch the load transformer at exact zero crossing. I couldn't understand why those</p><p>Click to expand... (URL:)</p></div> <p>I think you should rethink this. Well I am even sure Triac with electronic stuff is not equal to "zero crossing SSR". Don't believe simple members but take it from TE:</p> <p>https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN (URL: https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN)</p> <p>As said, many new developments have no benefit but drawbacks. Let's call it by the correct name then. Now I am off to the lab developing wireless mains power.</p> <p>Last edited: 2021-09-30 12:49 pm</p>
<p>TonyTecson Member Joined 2003</p>	<p>2021-10-01 1:02 am ↩ 🔖 #103</p> <p>never used them and no plans to use them ever in any of my amps....a toggle switch is best for me...</p>
<p>TonyTecson Member Joined 2003</p>	<p>2021-10-01 1:04 am ↩ 🔖 #104</p> <div data-bbox="336 1225 1481 1413"><p>Bigun said: (URL: /community/goto/post?id=6802100)</p><p>+1</p><p>This whole thread is unnecessary and propagates the myth that delayed B+ is needed. I was surprised that it's become an official pcb for sale by this forum.</p></div> <p>horses for courses, some amps particularly with too many filter caps can sure use them, but for tube amps, can do without and in most cases an NTC is enough...</p> <p>Last edited: 2021-10-01 1:07 am</p>


<p>TonyTecson Member Joined 2003</p>	<p>2021-10-01 1:06 am ↩ 📄 #105</p> <div><p>jean-paul said: (URL: /community/goto/post?id=6802110)</p><p>I think you should rethink this. Well I am even sure Triac with electronic stuff is not equal to "zero crossing SSR". Don't believe simple members but take it from TE:</p><p>https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN (URL: https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN)</p><p>As said many new developments have no benefit but drawbacks. I let's call it by the correct name then. Now I am</p></div> <p>tried the solid state switch maybe 20 years ago, did not like it, my EI traffo went bussing, never tried it again after that...</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2021-10-01 1:36 am ↩ 📄 #106</p> <div><p>jean-paul said: (URL: /community/goto/post?id=6802110)</p><p>I think you should rethink this. Well I am even sure Triac with electronic stuff is not equal to "zero crossing SSR". Don't believe simple members but take it from TE:</p><p>https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN (URL: https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN)</p><p>As said many new developments have no benefit but drawbacks. I let's call it by the correct name then. Now I am</p></div> <p>Yes they say exactly the same as I said; I found out the hard way. I didn't have that paper, thanks for finding it.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>jan.didden ● AX tech editor Joined 2002</p>	<p>2021-10-01 1:38 am ↩ 📄 #107</p> <div><p>TonyTecson said: (URL: /community/goto/post?id=6802758)</p><p>horses for courses, some amps particularly with too many filter caps can sure use them, but for tube amps, can do without and in most cases an NTC is enough...</p></div> <p>Tony, you DO know that the subject of this thread has nothing to do with transformer inrush current, right? The thread got hijacked somewhere along the way. Or people just read sloppy.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>
<p>TonyTecson Member Joined 2003</p>	<p>2021-10-02 2:11 am ↩ 📄 #108</p> <p>thread posts can be looked at in so many ways, not just from your viewpoint...</p>

<div>TonyTecson</div> <div>Member</div> <div>Joined 2003</div>	<div>2021-10-02 2:50 am ↩ 🔖 #109</div> <div>dc resistance of transforer secondaries reffered to primary and any other resistances in series form a time constant wit filter capacitance....these forn the inherent delays...</div> <div>looking at tube power amp designs you can see high resistances used.. even a famous Sansui tube receiver employed such tricks... these issues are very well know even in the 70's by engineers designing them...</div> <div>it is only that now some diyers have become aware...always a welcome thing...</div>
<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2021-10-02 7:01 am ↩ 🔖 #110</div> <div>Delays? Do you have an idea of the value of those delays? Can you give us some numbers then? I think you are confused. In the discussion for the B+ delay, we are talking about a delay that is long enough to make sure that the heater is at temperature and emission has stabilized. A few tens of seconds.</div> <div>Edit: for those who are wondering: 1 ohm and 1000uF is 1millisec time constant.</div> <div>Jan</div> <div>Last edited: 2021-10-02 7:30 am</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>
<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2021-10-02 7:04 am ↩ 🔖 #111</div> <div><div>TonyTecson said: (URL: /community/goto/post?id=6803789) thread posts can be looked at in so many ways, not just from your viewpoint...</div></div> <div>Sure, but it is good form here (actually is in the rules) to not hijack a thread. Sort of common decency. Of course, if you are confused about what the subject of the thread actually means, you may be excused. At least, until it has been explained to you.</div> <div>Edit: for those wondering: <i>Threadjacking is the practice of taking over a thread by posting off-topic replies such that the original topic becomes diluted or lost.</i> From rule # 1.</div> <div>Jan</div> <div>Last edited: 2021-10-02 7:24 am</div> <div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div>


<p>petertub ●</p> <p>Member</p> <p>Joined 2015</p>	<p>2021-10-02 7:13 am ↩ 📄 #112</p> <div data-bbox="336 190 1481 488"><p>jean-paul said: (URL: /community/goto/post?id=6802110)</p><p>I think you should rethink this. Well I am even sure Triac with electronic stuff is not equal to "zero crossing SSR". Don't believe simple members but take it from TE:</p><p>https://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchtrrv&DocNm=13C3206_AppNote&DocType=CS&DocLang=EN</p><p>As said many new developments have no benefit but drawbacks. I let's call it by the correct name then. Now I am</p></div> <p>Interesting read. I had no idea. However, been using SSR relays to control both power amps (AR-D76 Dynaco ST0 & MKIII preamps etc) since 1980</p> <p>with zero ill effect. In fact works like a dream. I guess the initial surge is absorbed with no ill effect.</p> <p>Using conventional relays will randomly act at zero crossing some times.</p>
<p>jean-paul</p> <p>Disabled Account</p> <p>Joined 2002</p>	<p>2021-10-02 8:30 am ↩ 📄 #113</p> <p>That is called denial of facts but please go on. It is the absolute worst of solutions but that is fashion in some circles. The zero ill effect is probably that nothing has died yet, then the SSR is overdimensioned. It does not work like a dream as you have not looked with scope what happens and guess stuff. It works but less OK for all parts involved. If overdimensioned and stressed stuff does not die that is not OK but "mediocre" or "bad" compared to solutions that don't stress parts and also work OK.</p> <p>In engineering the rule of thumb is to use zero crossing SSR's only for ohmic loads. Like halogen heaters in copy machines etc. Why would I know? Well I made the error in switching neon lighting in a building with overdimensioned SSR's thinking it would work out OK. It did. It "worked like a dream" for a while Some got noisy, some neon ballasts started to make noise, SSR's started to die... Oh oh after investigation it turned out to be that zero crossing SSR's are better not used on reactive loads. Then someone got a light shock when changing a neon tube. After a while the SSR's leaked enough for electric shock and some neon tubes lighted up lightly when off. Disapproved solution, not safe.</p> <p>So please measure your AR-D76 Dynaco ST0 & MKIII preamps and check if they are completely unpowered when OFF. Another drawback compared to the already mentioned ones.</p> <div data-bbox="336 1355 1481 1550"><p>jan.didden said: (URL: /community/goto/post?id=6803901)</p><p>In the discussion for the B+ delay, we are talking about a delay that is long enough to make sure that the heater is at temperature and emission has stabilized. A few tens of seconds.</p><p>Edit: for those who are wondering: 1 ohm and 1000uF is 1millisec time constant.</p></div> <p>There is nothing a tube rectifier won't solve</p> <p>Last edited: 2021-10-02 8:58 am</p>
<p>petertub ●</p> <p>Member</p> <p>Joined 2015</p>	<p>2021-10-02 11:05 am ↩ 📄 #114</p> <p>I now see that there is peak-switching SSR available. I'll use them in future builds.</p>

jean-paul Disabled Account Joined 2002	<p>2021-10-02 11:07 am ↩ 📄 #115</p> <p>Now you had me surprised as these were AFAIK not available last time when I did a project with SSR's. Good development!</p> <p><u>Solid State Relay - 1 phase Peak Switching Solid State Relays ECD Controls (URL: https://www.ecdcontrols.com/electrical-components.1118/solid-state-relay-1-phase-peak-switching.aspx)</u></p> <p>One sees that simple solutions often have the better specs so I would look critically to these peak switching relays when using them and check what happens. Some modern solutions are not as nice as they are presented. I really like LT4320 ideal rectifiers and still use these with pleasure. Someone here pointed at the 6 MHz charge pump in these.... I don't have an issue with it in reality but this info is NOT in the datasheet...</p> <p>I dare to say that a simple old fashioned good quality power switch and an NTC to the primaries are the best way of switching on transformers in all its simplicity <i>and when all plusses and minuses are added up</i>. Further surge reduction can be done at the secondary side. Complex EE wet dream smart solutions often miss a few essential things here and there.</p> <p>Last edited: 2021-10-02 11:32 am</p>
TonyTecson Member Joined 2003	<p>2021-10-02 11:14 am ↩ 📄 #116</p> <div><p>jan.didden said: (URL: /community/goto/post?id=6803901)</p><p>Edit: for those who are wondering: 1 ohm and 1000uF is 1millisec time constant.</p><p>Jan</p></div> <p>or 1000ohms and 1ufd is also 1 millisec....</p>
TonyTecson Member Joined 2003	<p>2021-10-02 11:35 am ↩ 📄 #117</p> <p>my experience, it takes a while before the sound comes on even if the filaments have warmed up...it can take almost a minute....</p> <p>in my 6c33 set amp build it is almost 10 minutes before the sound comes on...i do not mind the wait...</p>
myfirstamplifier Member Joined 2013	<p>2022-12-09 3:21 pm ↩ 📄 #118</p> <p>Hello, I would like to use this hv delay on my own PCB for my preamp but I cannot find the program for the pic, or the pic programming instructions? Any help would be appreciated!</p>
jan.didden ● AX tech editor Joined 2002	<p>2022-12-09 3:26 pm ↩ 📄 #119</p> <p>As I answered to your email, I don't think it is online. I don't think I ever posted the code. It is currently out of stock at the diyaudiostore, but I'm working on another batch which should appear in the store beginning of January.</p> <p>Jan</p> <hr/> <p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p>

<div data-bbox="185 152 220 197">E</div> <div data-bbox="167 230 239 250">EL506</div> <div data-bbox="167 264 239 282">Member</div> <div data-bbox="159 291 250 309">Joined 2021</div>	<div data-bbox="335 141 534 161">2022-12-19 1:04 am</div> <div data-bbox="1348 141 1481 161">   #120 </div> <p>NTC on the primary of the mains transformer with a delay tube to prevent driver tubes lighting up like a flash bulb to extend the filament life and a damper tube between the central tap of the mains transformer H.T. to ground is all that's needed. No silicon stuff that in 5, 10 or 20 years is unobtainable. 50 year life expectancy. Soft start filament and B+ and easy on the B+ capacitors with no voltage overshoot if values are selected properly. Easy.</p>
<div data-bbox="124 510 284 530">tiefbassuebertr</div> <div data-bbox="135 544 207 562">Member</div> <div data-bbox="124 568 218 586">Joined 2005</div>	<div data-bbox="335 418 545 439">2023-09-22 8:09 pm</div> <div data-bbox="1348 418 1481 439">   #121 </div> <div data-bbox="359 486 914 510" style="border: 1px solid #ccc; padding: 5px;"> <p>Bigun said: (URL: /community/goto/post?id=5938915)</p> <p><u>I keep reading that a delay in the high-voltage supply for a tube amp is unnecessary and can even be counterproductive if not well implemented, so is there generally not a consensus, it's every body decides for them selves ?</u> The article says the jury is out but my perception is at least on this form the people with a solid understanding of the science say it is not required. My post is probably taking this thread off in the wrong direction but I'm about to consider building a high voltage 845 amp I keep my eye out for important topics like this</p> </div> <p>shortly I start this thread: https://www.diyaudio.com/community/...-on-variants-which-one-is-most-useful.403470/ (URL: https://www.diyaudio.com/community/threads/extending-life-expectancy-of-power-amp-tubes-like-el34-by-which-kind-of-switch-on-variants-which-one-is-most-useful.403470/) Delayed anode voltage after switch on is one step for extending service life of several others - that's what I thought until now, because commercial products also sometimes incorporate this delay for anode voltage. OTOH - I have not been able to find any descriptions of investigations as to whether it makes a difference to the life expectancy of tubes if the high voltage is switched on with a delay or not.</p> <p>Rod Elliott mention the same - OTOH he observed a longer lifetime on a certainly model of a tube amp - go to https://sound-au.com/valves/ht-delay.html (URL: https://sound-au.com/valves/ht-delay.html)</p> <p>Under this URL in German http://www.elektronikinfo.de/strom/roehrenirrtum.htm#Betrieb (URL: http://www.elektronikinfo.de/strom/roehrenirrtum.htm#Betrieb) - go to No 12 - is to read, that the correct delay time is important</p> <p>For me it would be interesting to know, what recommend the tube manufacturers in this case (like Svetlana, JJ, Tesla and so on). In the datasheets I don't find any advice regarded high voltage delay after switch on - go to https://www.jj-electronic.com/images/stories/product/power_tubes/pdf/el34_e34l.pdf (URL: https://www.jj-electronic.com/images/stories/product/power_tubes/pdf/el34_e34l.pdf)</p>
<div data-bbox="146 1579 258 1601">petertub ●</div> <div data-bbox="135 1617 207 1635">Member</div> <div data-bbox="124 1641 218 1659">Joined 2015</div>	<div data-bbox="335 1487 545 1507">2023-09-23 6:58 am</div> <div data-bbox="1348 1487 1481 1507">   #122 </div> <p>If the delay applies B+ suddenly then there is a huge potential for damage. Only if tube current are ramped up (as when filament heats up) or a B+ is gradually increasing over a time longer then the timeconstants in the circuit some value could be found.</p> <p>The most common reason for delaying B+ is concerns for filter capacitors exceeding rated voltage until tubes start to conduct. The cure here is "use higher voltage caps".</p>
<div data-bbox="124 1888 284 1908">tiefbassuebertr</div> <div data-bbox="135 1921 207 1939">Member</div> <div data-bbox="124 1946 218 1964">Joined 2005</div>	<div data-bbox="335 1796 545 1816">2023-09-23 11:14 am</div> <div data-bbox="1348 1796 1481 1816">   #123 </div> <p>I don't understand what happens exactly in this case.</p>

<p>tiefbassuebertr Member Joined 2005</p>	<p>2023-09-23 11:27 am ↩ 📌 #124</p> <div data-bbox="336 190 1481 436"><p>petertub said: (URL: /community/goto/post?id=7461233)</p><p><u>If the delay applies B+ suddenly then there is a huge potential for damage. Only if tube current are ramped up (as when filament heats up) or a B+ is gradually increasing over a time longer then the time constants in the circuit some value could be found.</u></p><p>The most common reason for delaying B+ is concerns for filter capacitors exceeding rated voltage until tubes start to conduct. The cure here is "use higher voltage caps".</p></div> <p>If the switch resp. the relay contact from the delay unit in the anode voltage rail behind the filter capacitor, the voltage at the filter elcap is much more higher than the nominal value (because this the voltage without the idle current load of the power stage tubes) - then you are right with your claim in post #122. But if those switch resp. relay contact is located between anode secondary winding of the main transformer and the silicon rectifier (maybe trough a NTC inrush current limiter resistor) or even between the primary winding in case of separate main transformer for heating and anode voltage, I don't believe any potential for damage.</p>
<p>petertub  Member Joined 2015</p>	<p>2023-09-23 12:32 pm ↩ 📌 #125</p> <p>A sudden current rush while not in "working conditions" might cause higher currents then the electron cloud can supply, thus forcing a huge amount of electrons that might rip cathode material with them. Any appliance of B+ when cathode is hot should be done slower that any timeconstants in the amp, that is as a "ramp-up" taking seconds.</p> <p>Instead of "believing" read dave gillespies articles about this : <u>http://tronola.com/html/maximize_tube_life.html</u> (URL: http://tronola.com/html/maximize_tube_life.html)</p> <p>Taking the other view, none of the (audio)tube vendors has any advices against applying B+ at power on. Is'nt that a clue ?</p> <p>(adding comments about slow ramp up)</p> <p>Last edited: 2023-09-23 12:50 pm</p>
<p>trobbins Member Joined 2009</p>	<p>2023-09-24 12:50 pm ↩ 📌 #126</p> <p>If you look at Dave G's article it relates to specific set of conditions - which are quite different to the OP's method of switching the power transformer secondary. So post #125 is bringing up a type of operation that is effectively irrelevant, and should have had a heads up on that matter.</p>

<div>tiefbassuebertr</div> <div>Member</div> <div>Joined 2005</div>	<div>2023-09-24 7:13 pm</div> <div><div><div></div><div></div><div>#127</div></div></div> <div><div>peter tub said: (URL: /community/goto/post?id=7461414)</div><div>A sudden current rush while not in "working conditions" might cause higher currents than the electron cloud can supply, thus forcing a huge amount of electrons that might rip cathode material with them. Any appliance of B+ when cathode is hot should be done slower than any time constants in the amp, that is as a "ramp-up" taking seconds.</div><div>Click to expand... (URL:)</div></div> <div>good advice - very interesting article. Thank you for this URL</div> <div>under https://web.archive.org/web/2011081...rise.com/host/tektronix/reference/cathode.asp (URL: https://web.archive.org/web/20110815001132/http://www.reprise.com/host/tektronix/reference/cathode.asp) is mentioned this article: "Thermionic Mysteries", by Ray Osterwald Electric Radio magazine, Issue 54, October 1993 - maybe also to find in this book https://www.ermag.com/product/hollow-state-design-2nd-edition/ (URL: https://www.ermag.com/product/hollow-state-design-2nd-edition/) (Thermatron seems to be another term for tube resp. valve https://kj7um.wordpress.com/2021/09/17/valve-vs-tube-vs-thermatron/ (URL: https://kj7um.wordpress.com/2021/09/17/valve-vs-tube-vs-thermatron/))</div>
<div>Tony Tecson</div> <div>Member</div> <div>Joined 2003</div>	<div>2023-09-25 12:06 am</div> <div><div><div></div><div></div><div>#128</div></div></div> <div>just look at the high voltage amps designed in the past and how they implemented it, you gain a lot of insights, no need to relitigate what has been done in the past..</div>
<div>S</div> <div>scooby</div> <div>Member</div> <div>Joined 2013</div>	<div>2024-01-17 4:39 am</div> <div><div>New<div><div></div><div></div><div>#129</div></div></div></div> <div>Hi Jan, bought two kits from DIY Store and in the process of putting the boards together. Two questions for the boards (v4):</div> <div><div>1. My downstream of the delay is a MOSFET voltage regulator, this should be ok right?</div><div>2. You mentioned max 600V, what would min-V be to activate the board, say, for setting the delay time, without getting fried? Would >100VDC work?</div></div> <div>Was puzzled by D5 on the board, but saw your previous post called for 12V zener.</div> <div>Thanks for any info!</div>
<div>jan.didden ●</div> <div>AX tech editor</div> <div>Joined 2002</div>	<div>2024-01-17 8:24 am</div> <div><div>New<div><div></div><div></div><div>#130</div></div></div></div> <div><div>1) Should be no problem</div><div>2) I am not sure about the exact minimum. It's been years since I measured it, IIRC I tested at 150V and all was fine.</div><div>Just try it.</div></div> <div>Jan</div> <div><div>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</div><div>scooby</div></div>

<div><div>S</div><div><div>skooby</div><div>Member</div><div>Joined 2013</div></div></div>	<div><div>2024-01-23 3:03 am</div><div>New ↩ 📌 #131</div></div> <div><p><i>what would min-V be to activate the board...?</i></p><p>Tested, setting a new on-time, at 40VDC in the end, but 15VDC seemed to work just fine too. Good thing, don't have to worry about frying my fingers with high-V.</p><p>Oddly, the minimum time seems to be 22-sec/11-flashes, can't do any lower. I'd like about 10-15 secs, but this would be fine too. Have to learn to be patient...</p><p>Thanks, Jan, for helping out the DIY community!</p></div>
<div><div></div><div><div>jan.didden</div><div>AX tech editor</div><div>Joined 2002</div></div></div>	<div><div>2024-01-23 6:54 am</div><div>New ↩ 📌 #132</div></div> <div><p>Thanks for the feedback!</p><p>Jan</p><hr/><p>High-Voltage regulator - SuperRegulator - High-Voltage Delay - Linear Audio PDFs on USB</p></div>

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