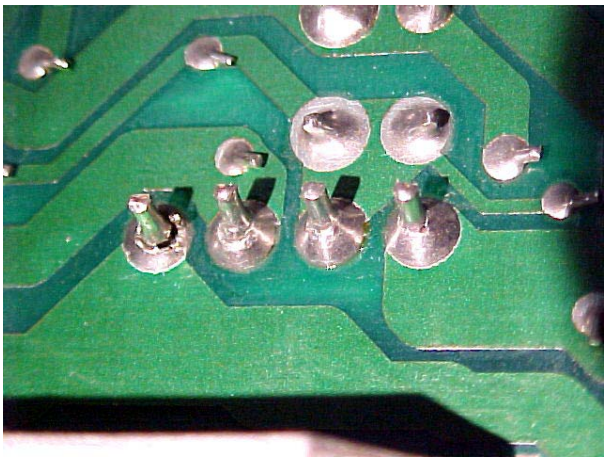
Ampeg SVT4-Pro Service Notes

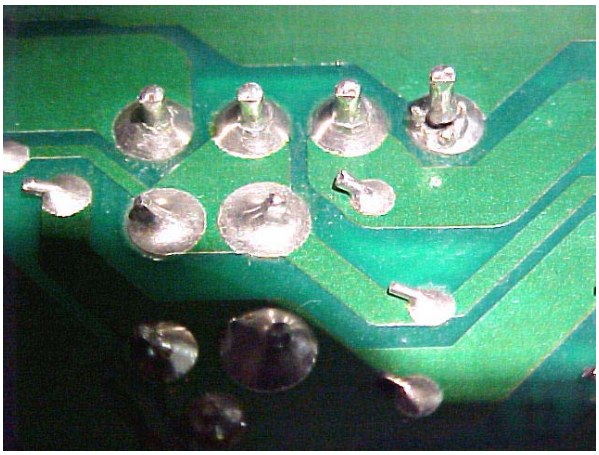
3/19/09

SVT-4 Pro Asset # 003342

Low output, distorted. Powered up, found idle power low for solid state two-ch power amp/preamp…47 watts @ 120VAC. Powered down, disassembled. Photographed AC Mains wiring, as well as recorded connections (AC Outlet—Blk J13, Wht J14, Grn J39 Chassis Gnd). AC Ckt Brkr Blk J15, Pwr Sw J18 Pwr Xfmr Primary—Wht J21, Vio J22, Blk J19, Brn J20, Blu J23, Gry J24, Blu/Wht J17

After removal of power amp pcb assy, close inspection of circuit board solder joints revealed severe solder fractures on all 4 leads of main bridge rectifier.



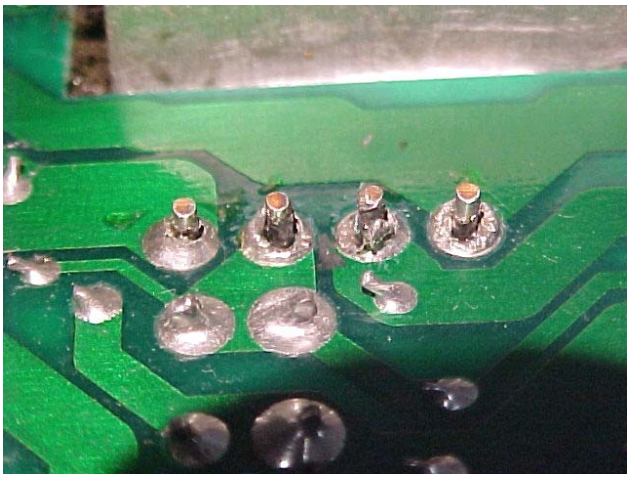


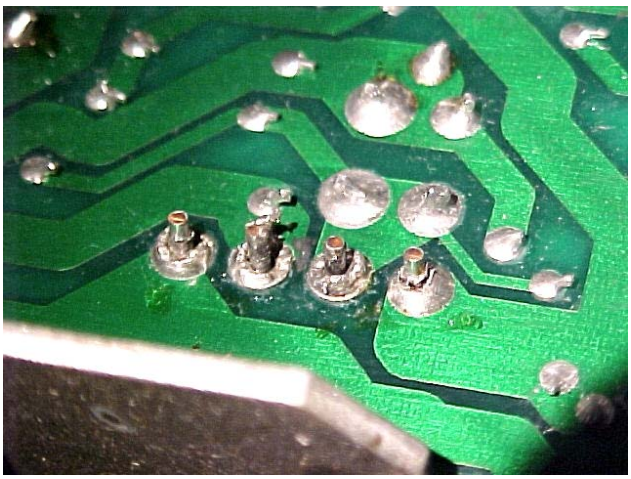
Desoldered, cleaned, resoldered bridge leads. Checked all Mosfets & drivers for blown devices, all ok. Also found two phone jacks on main PCB with solder fractures…repaired. Rest of PCB components ok, reassembled, powered up….130W @ 120VAC at idle. Amp working fine. Checked all functions, sounds nominal.

3/20/09

SVT-4 Pro Asset # 003216

Low output, distorted. Powered up, found same low power reading 47W @ 120VAC. Power Xfmr on this unit 120VAC primary only, not universal primary. Connections: AC Outlet…Blk J13, Wht J14, Grn J39. Ckt Brkr J15, Pwr Sw J18 Xfmr Primary Blk J19, Wht J21





Removed power amp pcb assy, and again, close inspection of circuit board solder joints revealed same severe solder fractures on all 4 leads of main bridge rectifier

Desoldered, cleaned, resoldered bridge leads. Checked all Mosfets & drivers for blown devices, all ok. Rest of PCB components ok, reassembled & powered up…130W @ 120VAC. In checking amp & all functions, found master volume pot gritty, couldn't exercise out noise. Removed preamp PCB assy, removed master volume pot & line out pot, sprayed with Caig DeoxIT D5, exercised, cleaned, reinstalled. Sounds quiet, all works fine again.

2/24/10

Ampeg SVT4 Pro Asset # 106065 No label or indication of problem

This doesn't feel like one of the amps I've serviced before, as the front panel handles are loose. So to begin with, it needs the mechanical retro-fit I started last year during servicing this series of hybrid amps.

Replaced the front handle mounting hardware (removed Graphic EQ module, preamp PCB module to access bottom two handle screws). Removed the main power amp PCB assembly to inspect the bridge rectifier connections and look around for any signs of failure. First noticed lower screw that had been threaded into stud standoff thru low voltage power supply board was missing the screw head---sheared off. In trying to remove the upper screw, that suffered the same fate. Got the PCB assy off, but had to come up with a new pair of 1/2" standoffs or spacers. No # 6-32 stud-standoffs on hand, so drilled out a pair of # 4 1/2" spacers to # 6, then cut down some 2" 6-32 PHMS to 7/8" to replace the needed hardware. Where did the sheared-off screw head disappear to?

While dealing with that, I discovered R118 had burnt up, with trace damage on back side. Also found 47 ohm R119 open. Checked the transistors local to that region, all look ok. Checking schematic. R118 was 1k 1/4W bias resistor to Q102, an MJE 350, at the top of the voltage gain stage of the power amp's input stage op amp. I need to check the whole series string that Q102 is at the top of. Q102 failed CE short, none on hand…need to order MJE 340's & 350's.

In the PCB region where parts have failed and have to be removed & replaced, it's very sad to find the PCB layout designer accepted the default pad size of his program, which places tiny little annular rings of copper, instead of proper sized pads allowing for removal of parts without the tiny pads de-laminating and separating from the all-too-small circuit traces. The result of that now requires me to repair the PCB in addition to replacing the parts that failed!! There is no mechanical support for the clip-on heatsink of theTO-126 cased MJE 350. Only tensioning and spreading the component leads anchors the part to the board, but the pads vaporize upon removal of the part!! Bastards!

2/25/10

Back to the Ampeg SVT4 Pro service.

I found Q118 (IRFP240 N-Ch MosFET) shorted and R162 gate resistor open. Had to cut away the Bergquist thermal insulator pad to remove the TO-247 MosFET device. When I get replacements, I'll have to use greased mica on the install.

Went to see if I had anything in my semiconductor database on these IRFP9240 and IRFP240 MosFet's, but don't. Went to the internet, only to find Internet service isn't working now! This is getting frustrating!!

Set the Ampeg SVT4 Pro aside, after installing the replacement 47ohm & 1k resistors.

3/12/10

The IRFP240 N-Channel MosFets arrived from Hong Kong, so now I have the parts needed to complete the Ampeg SVT4-Pro Bass Amp, when I get to it (after this QSC PL 6.0, the QSC PL 9.0, if the transformer repair goes ok). I had already received the MJE 340 & 350 med power transistors and the P-Channel MosFets.

3/15/10

Ampeg SVT4-Pro Bass Amp Pro Asset # 106065

Having received the IRFP240 N-Channel MosFet xstr needed for the output stage of the SVT4 Pro amp, and already received the MJE340 & MJE350's, I installed the two parts needed, and repaired the ripped collector trace of the MJE350 (PCB designer did a piss-poor layout job offering no copper for repairs!!). Now, putting the unit back together to see if I found everything.

Put unit back together, brought up slowly. No smoke, but it's drawing 450W AC, so powered down immediately. Damn!! No service loop, these amps don't power up on the bench as a stand-alone module, so now I have to tear it all apart again and find what I missed the first time around! Another big waste of time. Checking documentation.

After removing the amp assembly again, I found somehow I missed catching an open 0.47 ohm/5W Source resistor R164. A bitch to replace, as they are half underneath the heatsink, but I did manage to force it into place. Would its' absence this last time

powering up without it cause the high current draw? I checked the MosFets on this channel, turning them on with the ohmmeter, checking the Source-Drain in the on-condition. Then turned them off by reversing the Source-Gate connections, and verifying they go off. Not all responded the same way, but….this isn't really a reliable way of testing MosFets.

I hate like hell having to put the whole thing back together, only to have to tear it all apart again if I still have some bad or leaky MosFets that resulted in the failure of the one device I replaced. Are the power supply leads from the transformer long enough to power this assembly outside the chassis? No…..leads are too short. Unless I make extender Fast-On insulated Male/Female cables to extend the primary wires, it can't be powered up outside the chassis.

I put the main board back in, minimal hardware, primary wiring installed, didn't bother with the extra PCB's. Brought it back on line slowly, saw the power increase, and backed it down. Removed the high voltage AC from the bridge, leaving just the low voltage. That all comes up ok. The main amplifier IC 5532AN IC1 needs to have the main amp up in order to complete the feedback. Without it, both channels of the op amp are at -13.5VDC. I wanted to see what the center point of the voltage amp was, but….there's gobs and gobs of RTV silicon glue everwhere, and, of course, covering up the 3 resistors I need to get at!! That shit is impossible to remove!!

3/16/10

Back to the Ampeg SVT4-Pro bass amp. Checked current limiter circuit for shorts, ok. Brought power up to below 50W AC to see if there's any issues with the voltage gain stage….it's balanced, nothing unusual there. I guess I'll have to try and disconnect the output stage devices, leaving only 1 pair connected, and start re-connecting pairs until I find the fault.

3/17/10

I brought in male 1/4" insulated fast-on terminals in order to make transformer wire extenders, to allow operating the Ampeg SVT4-Pro amp assembly outside of the chassis. I'll have to leave the multipin connectors unattached---I hope this will be ok, haven't checked all the circuit to see if this creates any issues.

Made up fourteen 18AWG male to female 1/4" fast-on extender wires. I need to bring in some basic inventory of connectors, as well as more 18AWG wire colors besides my Blk, Brn, Red, Grn, Wht colors. Checking both Mouser, Digi-Key and ebay.

Found 5 rolls of 18AWG stranded Belden type 8522 PVC wire, 100ft ea, in Org, Yel, Blu, Gry, Wht colors for $60 + $15 shipping on ebay. Seller also has discrete rolls of Belden 8522 18AWG, any color @ $24.99 ea. This gives me Blk, Brn, Red, Org, Yel, Grn, Blu, Gry, Wht colors, missing Vio.

Found reasonable prices on Molex 0.250 male & female fast-ons, fully insulated, in both 18-22AWG and 14-16AWG sizes. And 3M partially insulated 0.110, 14-16AWG. Couldn't come up with 18-22AWG 0.110 terminals. Might check at Electronic City for those.

Back to the Ampeg SVT4-Pro. Installed the wire extenders, brought the AC mains up to where the amp is drawing around 60-70 Watts, and checked to see what kind of current is flowing in the output stage MosFets. Most at that level have 100-125mA, though the new MosFet was maybe a third of that. Checked the other channel, and at that line voltage, virtually no current flowing. I haven't turned down the bias control yet to see if that's working….need to check that next.

I can't turn them down enough, so we've got something out of whack still.

3/29/10

Ampeg SVT4-Pro Asset # 106065

I left off with now having extender wires allowing power-up outside the chassis. Unit is still pulling too much current in the output stage, even after turning the bias control all the way down. Now, one of the devices in the output voltage gain stage failed short, and an emitter resistor on that device failed as well. The other channel isn't pulling output current. I do see a mismatch in current on the output MosFets, but I am also seeing too much current on the MosFet that I just replaced. That makes me suspicious of the other voltage gain stage transistor at the opposite end of the string. I think I'll replace that and see what changes. Did that, no difference. Now suspicious of the bias string, changing the lower transistor in the bias string Q107, just in case MPS A06 NPN. No change. Replaced the main op amp IC1, no change. Might as well replace Q106, just in case. If that doesn't change things, then I need to look at replacing MosFet's. I was able to adjust the amount of bias earlier with the bias trim pot. I've been reluctant to just pull the entire output stage, but at this point, I think that would be all I have left to do. I'd leave the one already replaced installed, and remove the rest of the top/bottom devices. It doesn't appear like there's just one causing the problem, though even the new device is getting pulled into conduction. That's why it seems like a drive stage problem, and not an output stage problem.

3/30/10

Back to the Ampeg SVT4-Pro amp problem (why is this taking so long???!?)

Reluctantly, I removed Q106 bias transistor, replaced with a fresh MPS A-06. As I powered back up, used to seeing the power consumption climb quickly after 60VAC, it didn't happen….stopped at 75VAC and checked to see what the gate to gate voltage was and the IR drop on the Drain Source resistors. It wasn't turned on any more, so I advanced the AC mains to 110VAC. Now I was getting a range of voltage from 13mV thru 28mV across the Source resistors….on all but the MosFet I had replaced…it was only measuring 4mV drop. I checked the other channel, all were in the basic working range, so now I have an odd-ball MosFet. I think I need to find one that's more typical than this, so there's proper load current sharing.

So it was a bias problem. Figures it would be the last part checked…just couldn't get the bias turned down low enough….was that bias xstr damaged during the failure? Checked the A-06 after removing it…..measures like a good transistor, though just ohmmeter check.

Replaced the first MosFet with another randomly chosen from the 10 pcs. Second one measures even lower than the first! Are these all low transconductance parts? Had to dick around with the Hameg semiconductor tester, to see if I could get it to measure FET's again. Something is still wrong with the damn thing in FET mode. I did finally manage to get it to work, sort of…..but it won't set up correctly. I need to find my Tektronix 7CT1N plug-in, since that Hameg is being a total pain. I installed the highest gain device I found, and still it only yielded about 4.8mV, while the rest were 4-7 times that value. I think I better look for another batch of IRFP240 MosFets.

Put SVT4-Pro back together. Plugged in, powered it up. It's drawing only half the current it should, no sound. Something is still wrong. How F**KING TYPICAL ON THIS AMP. LET'S SEE HOW MANY F**KING DAYS – NO WEEKS WE CAN SPEND TO GET IT TO WORK AGAIN!!!

Tear it apart again. What in the hell can be wrong this time?? No DC offset, relay's pulling in. Why isn't it drawing 90-100W, though? No output thru the power amp sections, via Power Amp input jacks.

PCB assy back out of the chassis, hooked up the transformer primary to the board, only the secondary wires won't reach (of course!!), so it's back to plugging in the wire extenders. SERVES ME RIGHT FOR NOT VERIFYING SIGNAL FLOW WHEN IT WAS STILL CONNECTED OUTSIDE THE CHASSIS!! I DON'T EVEN KNOW IF IT WAS WORKING. It just had the correct voltages & quiescent current, so it should have worked.

DO WE FEEL STUPID YET?? YOU CONNECTED THE OUTPUT OF THE TURNED-OFF OSCILLATOR TO THE AMP, NOT THE PINK NOISE GENERATOR THAT YOU THOUGHT WAS CONNECTED!! IT WORKS!!! PUT THE STUPID THING BACK TOGETHER AGAIN!
THIS AMP IS JINXED!!!

Back together again, signal connected to the correct source (pink noise generator), powered up, both output channels work fine. I still don't have a long bridge mono cable to reach across the room to where the test speakers reside, so I didn't check it in bridge mono mode. Everything works (finally!), so I attached the top cover and wheeled it back over to the Guitar Dept. And glad to get it off the bench and out of the shop!!

9/14/11

Time to tear into Matt Borden's Ampeg SVT4PRO. S/N BRIDN80006 'low output'

Start 11AM Stop 12:00PM Start 12:25PM Stop 2:25PM Total time 3 hrs labor.

Pulled the top cover off, quick visual inspection. Basically clean inside, nothing obvious. Removed the Graphic EQ board, the pot knobs & hardware, then the preamp PCB, set both aside. Tackled the handle/panel mounting first. The top screws were already loose, though the handles weren't yet loose. Removed the panel, cleaned it & the sub-panel. Then, replaced the handle hardware with the # 10-24 Socket Cap screws, lock & flat washers, adding Loctite to the threads as I installed the screws.

Checked the preamp PCB first for any signs of broken solder joints. On first pass, I didn't see anything like I've usually seen, but on the second pass, I did find some that were beginning to form, and repaired what I found. About 5-6 joints. Didn't find anything wrong on the EQ board. Re-installed both.

Now, moving to the power amp section, and the multiple boards.

Found some solder fractures on the bottom row of phone jacks…one I think was the preamp out jack & loop thru. The EQ/Mute contacts were definitely fractured. Also some joints on the output relays. Also the XLR outputs on the upper PCB. I didn't see any fractures on the bridge rectifier, though expected to. Cleaned the connections to get a good look, just to be sure. Also found some cold joints on some jumpers and components, and repaired what I found.

Putting it back together. Had to do a bit of lead dress, which hadn't been done before. All back together. Brought it up slowly on the variac…….all ok. Powered down, waited, then powered back up as per normal. Comes up fine. First checked both amp channels with 4 ohm Ampeg speaker cabinet & pink noise, then moved on to the Carvin Bass. Unit now has normal full output, no problems that I can hear, so I think I've got it nailed. Putting the top cover back on.

5/20/14

Ampeg SVT4-Pro Asset # 3342 Loose hardware, & Start 2PM Stop 4:45PM

Pulling top cover to have a look at what besides the usual mechanical problems there are inside. I removed the graphic EQ board, preamp tube hold-down clamp, revealing the middle tube's broken tube (tit at top of tube broken off), then removed the preamp PCB. With the preamp PCB out, I was able to remove the remaining 3 handle screws. The right top handle screw was missing, along with the flat washer & lock washer. I removed the left top handle screw, then installed the replacement #10-24 x 7/8 socket cap screws, with their split lock & flat washers. I'm out of Loctite, so I wasn't able to apply any threadlock compound, but drove the hardware in very securily.

Next, I rotated the chassis to face the rear, and removed the PCB assemblies top down, so I could finally lift up and out the main PCB, without disconnecting the AC Mains primary wiring from the transformer. I tilted up the chassis, and found the missing handle screw, but never found the two missing washers. I don't hear them rattling around inside….don't hear anything loose anymore. Probably lost those two items somewhere along the way, as they could slip thru the vent openings.

With the main PCB exposed, I went over the solder side carefully, found solder fractues on the AC mains connector (as usual), though the Bridge Rectifier solder joints were fine, as were all the rear panel phone jacks and power supply filters…all large item solder joints were sound…had to clean the board to verify all of that. Then, checked the emitter & gate resistors and power MosFET's for any signs of failure. No burnt parts found anywhere, nor any bad semi's where I looked.

Put the main PCB back into the chassis, and re-assembling the amp from bottom up. Got the rear end back together, preamp board back in, EQ board back in, connectors seated. Now need a replacement 12AX7 for the preamp board, and I'll be ready to power this up.

Relays close immediately when I'm at line voltage. I thought they pulled in after a time delay, but I don't hear that happen. And, I don't get any output. Pulling up the service documents to have a look.

The relays are N.O. (normally open). They have to be energized for connecting amp to the output jacks. I did find different low level DC on each channel. I next injected signal directly into the Power Amp inputs, and got output from each channel, so the power amp section is working.

So, where am I losing signal? I don't have signal from the input jack. Wrong….I do have signal….it was very low level….had to crank the gain way up as usual on these amps. I got signal out of each channel with the bass, as well as with the burst pink noise.

Once I had the bass plugged in, had to have the Input level cranked to around 3 o'clock, and master 12 o'clock or higher. All functions worked, both output channels worked, so I switched to Bridge Mono and got another 6dB of output, and it always sounds better in Bridge Mono anyhow. Played it a little, then shut it down to wrap it up.

10/21/14

Ampeg SVT4-Pro Asset # 106475 Preventative Maintenance Start 12:30PM
Stop 3:35PM

No record of being serviced here in the shop. Pulling apart for full inspection.
After removing the top cover, I see my handiwork on the front panel handles, for starters. So, I had to have serviced this amp before. Re-checking my database. I still didn't see the S/N in my list, so going thru my original service notes spaning 3/17/09 thru 5/1/09 to see if I missed it. I did find that I had brought in the # 10-24 Socket Cap screws & hardware, loctite for dealing with all the loose Ampeg SVTx-Pro amps handles by 4/2/09.

While looking at the back of the chassis to see if maybe the S/N had been changed, a screw bounced from one end to the other….looks to be a PCB mounting screw….I presume from the main PCB, not seeing any missing on the front panel PCB.

There's no Asset # 3087 in the Inventory list, while I did service it back on 12/1/09. I have gone thru my service records thru 12/30/10, and no record on the # 106475. So, I guess I'll just open it up further, since there's already a loose screw. It's a lot of work to pull apart, but maybe it will be worth the effort. Wish I knew WHEN I had serviced it!

I got the main PCB lifted out. I have NOT found where that chassis screw came from…..I didn't find any missing screws so far…unless I'm blind and it still is from the preamp board section.

I found solder fractures on the Neutrik NL4 PCB, and on Power Amp B jacks, as well as on the Speaker Jacks. Bridge was fine, all the solder joints on the rectifier board were fine, all the joints on the power amp looked fine. And, no clue where that extra screw came from! There were also fractures on the top PCB's I/O cable header. So, it was worth while pulling this amp apart.

I re-installed the main amp PCB into the chassis, and re-connected the AC Mains & secondary wiring. Now, I'll have to remove the front panel & EQ PCB assemblies, just to be thorough. But, that will have to wait until Wednesday, as I've run out of time today

10/22/14

Ampeg SVT4-Pro Asset # 106475 Preventative Maintenance Start 1:30PM

After I get thru with the front end of this amp, I'll get some bias current readings on the MosFETs @ idle, as well as at 1W, 10W and maybe another wattage to see what the distribution of current is on an aged SVT4-PRO amp. The owner of that SVT4-PRO amp that I had responded to on the forum posted additional questions, after having bought new matched MosFET's, and referenced some test criteria. I'll add some additional input to the thread shortly.

I checked thru the rest of my service notes last night, and NEVER found any record of this Asset #. But, there is an Asset number that's NOT on the Inventory list, # 3087. But, I only found the one service record on it. # 106065 had accumulated a lot of time on repairs, and had bias current issues as well.

This amp has one long Bergquist K6 insulator strip, and at first, I thought I might have replaced a bank of MosFET's, but upon closer inspection, I see a small light blue color dot on each of the devices, so I suspect not. I'll have to see if there's similar mark on the other set.

No solder fractures on the front panel board, so that's going back into the chassis. On the graphic EQ board, I re-soldered the I/O header, as it looked questionable.

The front row of MosFET's are one side of both channels. Their mates are on the other heatsink, not accessible

Xstr	Vs@ Idle	Is	Vs@ 10W	Is	Vs@ 100W	Is
Q110	29.3mV	62.3mA	62.8mV	134mA	190mV	404mA
Q112	20.5mV	43.6mA	51.2mV	109mA	175mV	372mA
Q114	23.6mV	50.2mA	58.0mV	123mA	185mV	394mA
Q116	25.4mV	52.1mA	59.6mV	126mA	188mV	400mA
Q118	26.9mV	57.2mA	63.0mV	134mA	195mV	415mA
Q210	25.8mV	54.9mA	55.2mV	117mA	179mV	381mA
Q212	29.8mV	63.4mA	59.6mV	127mA	188mV	400mA
Q214	36.4mV	68.9mA	65.5mV	139mA	194mV	413mA
Q216	24.3mV	51.7mA	53.0mV	113mA	178mV	379mA
Q218	22.8mV	48.5mA	49.3mV	105mA	169mV	360mA

I^2 (R) = Pwr. So, for 100W, I^2 = Pwr/R and 100/8 = 12.5A. Tot I is sqrt 12.5A = 3.54A, and 1/2 of that is 1.77A. Each half of the amp stage is supplying that current. Total of Q110 thru Q118 is 1.99A. If the other half is providing the same, then the output is much greater than 100W….3.98A, and I^2(R) = 126W. I measure 28.3V RMS into 8 ohm. I just don't have access to the other half of the output stage. I also don't know that the source resistors are all 0.47 ohm….close with tolerance.

For 100W/8 ohms, what SHOULD the currents be? 1.77A/5 = 354mA per MosFET
For 10W/8 ohms, 559mA/5 = 112mA per MosFET
After measuring the Source resistors, I found they are NOT 0.47 ohm, from my point of measurement to each MosFET Source lead.

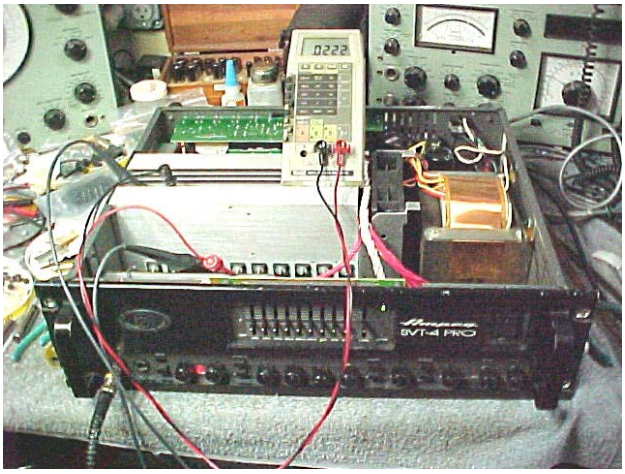
Q110 R = 0.52 ohm;	Q112 R = 0.55 ohm	Q114 R = 0.55 ohm
Q116 R = 0.57 ohm	Q118 R = 0.54 ohm	

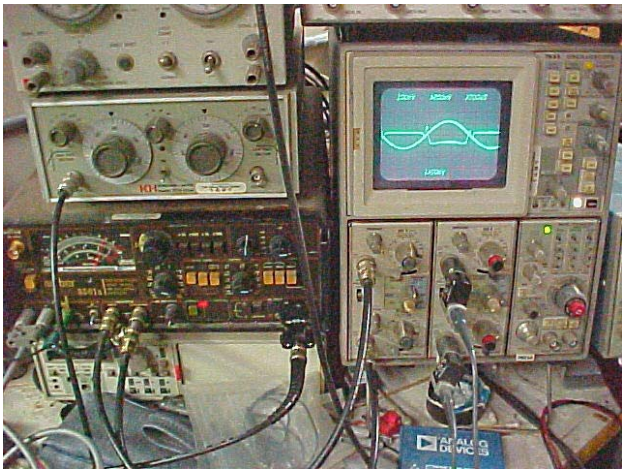
Q210 R = 0.54 ohm	Q212 R = 0.57 ohm	Q214 R = 0.57 ohm
Q216 R = 0.59 ohm	Q218 R = 0.56 ohm	

Recalculating for DC Idle current & AC currents for 10W & 100W levels:

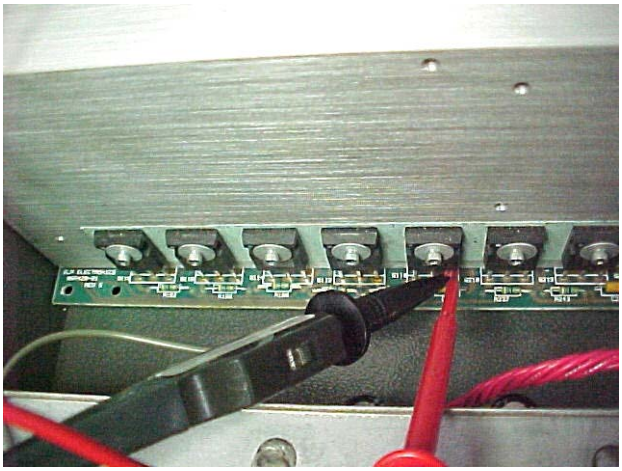
Q110	29.3mV	56.3mA	62.8mV	121mA	190mV	365mA
Q112	20.5mV	37.3mA	51.2mV	93.1mA	175mV	318mA
Q114	23.6mA	47.8mA	58.0mV	105mA	185mV	336mA
Q116	25.4mV	44.6mA	59.6mV	105mA	188mV	330mA
Q118	26.9mV	49.8mA	63.0mV	117mA	195mV	361mA
Q210	25.8mV	47.8mA	55.2mV	102mA	179mV	331mA
Q212	29.8mV	52.3mA	59.6mV	105mA	188mV	330mA
Q214	36.4mV	63.9mA	65.5mV	115mA	194mV	340mA
Q216	24.3mV	41.2mA	53.0mV	89.8mA	178mV	302mA
Q218	22.8mV	40.7mA	49.3mV	88.0mA	169mV	302mA

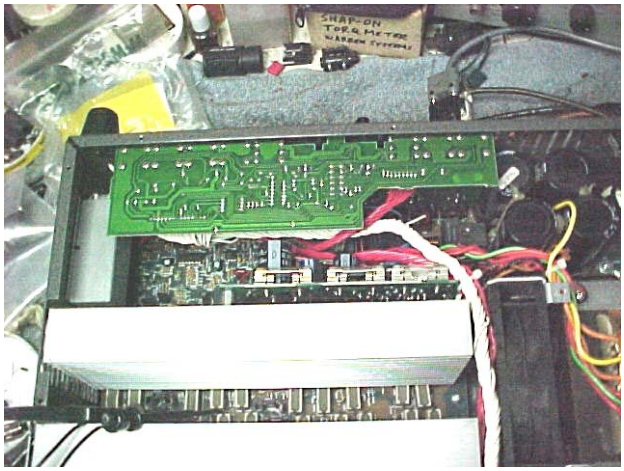
Before I go further, I need to look at the waveform differentially from the output buss to the source terminals of the MosFET's, to see how much more beyond zero-crossing the half-sine wave waveform is there. Measuring that 'envelope with an RMS meter, even after now having the resistance recorded for each of the emitter resistors plus the circuit trace resistance to account for the real IR drop, I suspect I'm accumulating error in trying to measure/compute the output wattage by way of summed currents. I may be able to remove some of the PCB's to get at the rear half of one of the two channels, so I can get the rest of the current distribution. I'd like to post my findings on this.

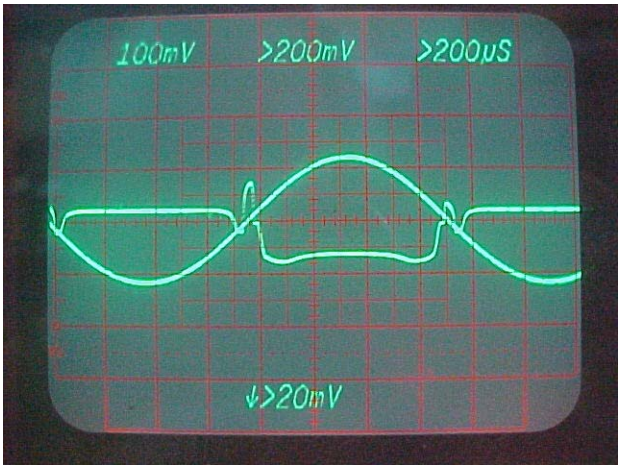


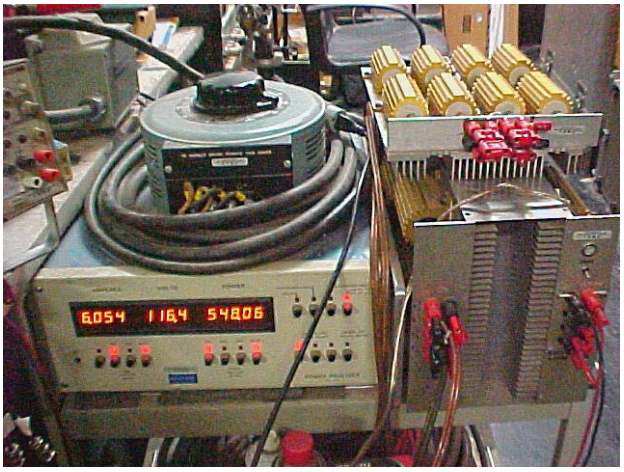


The waveshape seen differentially across the source resistor is NOT sinusoidal, but rather an offset squarewave, with artifacts.

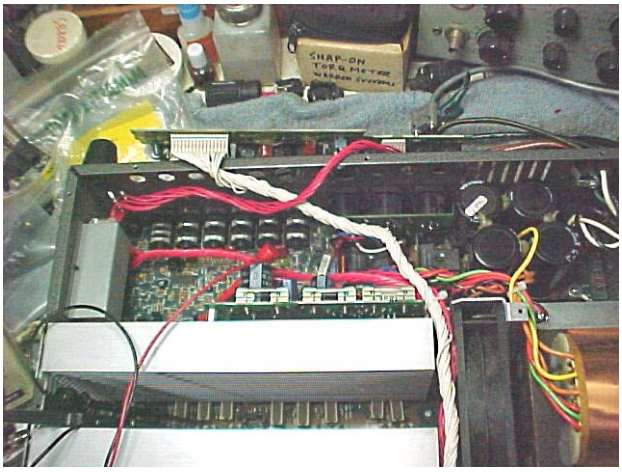
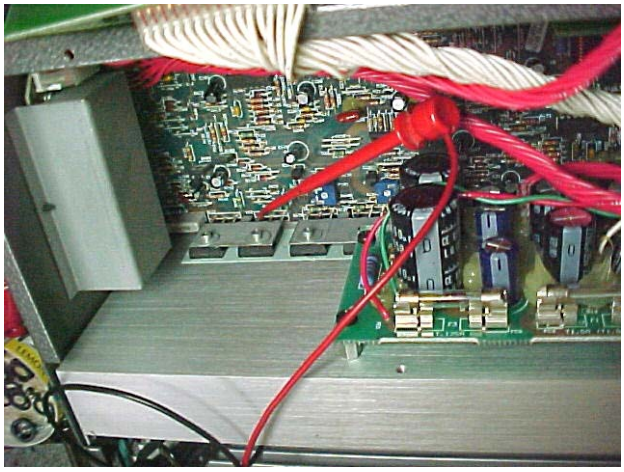








Getting at the back side of the amp channels requires removing the rear top PCB Assy

But, the LV PS is still in the way to access the other channel's MosFET's.
It was odd that in making the differential measurement across the MosFET's Source Resistor, I was unable to get the waveform going positive. I swapped probe test points, no change. Swapped probe inputs, no change. Change to triggering on the Voltage waveform from the Amber, and still couldn't get the current waveform to change direction. I moved on rather than stop to figure it out. I published it as it was, and will address that later if anyone asks. I did get a second set-up photo showing the voltage and current waveforms correctly. I even moved the scope probe to the 'bottom half' of the circuit, and it remained the same!

Put the cover back on, after I plugged into the amp in Bridge Mono mode with the bass. All sounds fine. When I removed the top rear PCB assembly, I managed to loose one of the fiber spacers on the 8 phone jacks…could not find it, so left if off the one associated with the xfmr DI outputs.

I put a lot of time in on this, but for what I did, I can only charge $150 labor (3 hrs)…the rest for my curiosity and source material for my forum posts.

Got some good replies on that forum post.

6/15/15

An Ampeg SVT 4Pro from Brian Wilson's bass player came in, presently over at the Guitar Dept, so heading over to fetch it.

Ampeg SVT4Pro S/N BR1DN70005 Intermittent Start 1:30PM

Removed the top cover, then the Preamp PCB assembly & EQ board, after removing knobs, panel nuts, tube clamp. Pulled the two PCB assemblies and moved them to the test bench for scrutiny.

Found the usual solder fractures…though NOT on the input jacks for a change. Master Volume,, Gain, EQ pots and others, also fractures on the widest PCB harness connector header. Repaired all those. Cleaned the flux off the tube and switch solder joints for better visibility, but all ok.

Moved to the EQ PCB. Found solder fractures on nearly every connector header solder connection!...repaired those.

Now, time to replace the handle screws with Socket Cap screws, flat & split lock washers. Replaced the handle hardware, so now putting the preamp & EQ boards back into place.

Got the rear upper panel removed, the output DI transformer PCB assy removed, all the connector nuts and screws removed, along with the PCB mounting screws. So, now I just need to remove & label the AC Mains cables to the PCB assy, and I can carefully remove the main power amp PCB assembly for full inspection and repair.

There was a front panel screw that was missing a lock washer, and I've been hearing something metallic rattling around inside…presume it's that…maybe in two pieces, or intact., from someone else having reattached the screw, not finding the washter.

I need to buy more loctite compound.

Got the main PCB assembly out and over to the test bench for close scrutiny. Found a number of phone jacks with solder fractures….including the Ch A signal path. Also found fractures on multipin headers. The IEC Mains input connector had fractures on all there pins, repaired those. Cleaned up all the flux to get a close look at the FET solder joints, as well as the filters and bridge connections. All those looked healthy. Repaired what I found, then moved on to the power supply PCB assembly. The 3-pin LV input header had fractures, repaired those.

Then, moved on to the upper PCB. The usual XLR DI outputs were all fractured…repaired those, along with multipin header connections.

Put the main board back in installed the AC mains wiring, secondary supply connections, fan connector & mtg screws. Then the DI Xmr board and the upper PCB assy.,re-connecting all the harness connectors, and installing the mounting screws….and finally reconnected the harness connectors to the preamp board.

I removed the EQ board again to look at the 5-position switch, as the ITL washer I found in the chassis looked like it might have come from that, but I didn't see the need for it, so didn't take it apart again.

Powered it up slowly to be safe….all nominal. Powered down, back up again, all sounded quiet with speaker connected. Grabbed the bass, checked both channels separately first, then in Bridge Mono. Solid as a rock. Put the cover back on. Now, gotta write this up. I need billing information to compete that.

8/25/15

What do I have on hand in IRFP240 & 9240 MosFET's ? I still need to set up a screening process for them. The BK Precision curve tracer works for measuring bipolar xstrs just fine. It briefly showed the vertical breakdown voltage for IDSS, but, that was short lived….test lead connection failed, restored that, but I have NOT seen any FET curves produced on that instrument. The small curve tracer module sitting below the

Amber stopped measuring FET's some time back, and is difficult enough to make work measuring bipolar devices. I didn't want to flog that horse any further.

I downloaded a circuit from JM Fahey, on Music Electronics Forum, and while it shows gate-source voltages for roughly 11mA, thru a 1k from the V- side to Source, it's not what I want either, I don't think. What I believe I need is something set up with a constant current source and fixed voltage potential that will put the FETinto conduction and allow me to measure the source current. I hate being too far removed for practical intelligence to coble something together that will provide what I think I need for the task.

I finally got the Hameg to work…using bias voltages Vg set between 3.6V and 4.0V, 40V Max, I get a set of 5 curves that vary. So, now on the right track with this instrument for use in matching MosFET's. The rest of my notes on this are on the Hameg HM8042 Curve Tracer Set-up Notes.

8/26/15

I resumed re-setting the Hameg Curve Tracer to see if I could restore the settings I had when I left off. Succeeded, but don't have it down to a step-by-step sequence. But, once there, found a 12-pos header and crimp sockets for it, suitable to make a test cable for the TO-247, and fabricated it,.
Then, tried using the small machinist vise as a heat sink, and that works well enough to hold the Id readings constant, with 0-40V sweep, Vg = 3.6V thru 4.0Vsteps.

I cut out a 5-position and 3-position socket shell from the 12-position socket housing, so I have enough to make a test cable for TO-220, when I need to. I didn't stop to make one at this time, not having the immediate need for it.

On the results for IRFP240 N-Ch MosFET's, tested at 3.8Vg, 20V Vd, I had 7 new parts, 6 pulls. Readings were:

14.5mA, 14.7mA, 16.4mA, 17.1mA, 18.1mA, 20.0mA, 20.2mA,….all new parts
22.0mA, 23.7mA, 27.8mA, 31.4mA, 41.5mA and 50.0mA, all used parts.

I only have one used IRFP9240 on hand. I haven't set up the Hameg for that yet, so I'm sure it will require as much pain-staking effort as it took to arrive at the range of curves I saw here on the N-Channel parts.

Next, I need to set up a constant current source for a specific operating current, with regulated Vd, and measure the Vg voltages found on these parts I just tested.. I know I can configure an LM317 as a constant current source for the N-Ch MosFET's, and probably an LM337 for the P-Ch MosFET's.

No new LM317's, but I do know I have some on hand. Need to look at the data sheet to see what I need for that. And, need to review my notes on Ampeg SVT4-Pro idle current readings.

I recall publishing my findings on the SVT4-Pro with conditions at idle, and different drive levels. I thought I had that data in a file, but I don't find any file on that, so I'll have to find my forum posting on it to copy that info into a file. It should be in the SVT4-pro

Service Notes file. I'll bet it IS in my service notes, but what date? 10/22/14, on SVT4-Pro # 106475 In reviewing what I had measured, I was getting all the data on the N-Ch side, for both channels, as that was easily accessible. I may have gathered some info on the accessible side of the P-Channel half I also gathered data on 10/31/14, on SVT4-Pro # 106067, but again that was on the N-Ch side, making comparisons to the # 106475 unit.

On 11/18/14, using SVT4-Pro # 106065, I did get bias current numbers on the P-Ch side for the Left Ch, but nothing for the Right channel, due to it being inaccessible (within the chassis, that is).

At idle, I was seeing, in terms of DCV across the 0.47 ohm Source resistors a range from 5 to 29 mV on the N-Ch side and 23 to 29mV on the P-Ch side. N-Ch side had one at 5mV, the rest in the 23-29mV, while the P-Ch side had two in the 13-15mV, and the rest in the 23-29mV range. This translated to current levels at idle of 53-61mA on both halves, disregarding the ones running much lower. I did see under higher power (100W) operating conditions the current balance was much more even than at lower power and idle.

So, maybe I need to set up the constant current level of about 50mA for measuring Vg. Checking the test procedure and bias adjustment notes from Ampeg for further info. From Ampeg's SVT4 Pro Power Amp Service Notes dated 5/16/03, they were setting the bias control for an average of 25mV across the 0.47 ohm Source Resistors (found between the two heat sinks. 25mV across 0.47 ohms is equal to 53mA I could call it 50mA just to make it a nice round number. How much power is that per transistor? (Vd – Vd) x 50mA = Pw disp.

Looking at the Vg vs Id curves of the IRFP240, 50mA is around 4.0V Vg. I'll know more once I set up a test circuit to measure this.

Power supply voltages from their schematic looks like about +/- 83VDC at idle, so Vds would be still be about the same 83V x 50mA = 4.15W. With a DCV of 20V, and 50mA, Pwr would be 1W. I'd need the high voltage power supply, or the Tegor supply, stacking the pair of 40V supplies up to get 80V to have the same power dissipation to be near circuit equivalent as they would be soldered into the amp circuit. I should look at this difference, once I get a test circuit built. Back to the constant current source, Radj for 50mA is Vref/50mA, or 1.25V/50mA = 25 ohms. 24 ohms would yield 53mA. Close enough for rock n' roll.

8/27/15

I pulled up MultiSim, and while I was intending to use an LM317 strapped as a current source, no voltage regulators found in the database, so I set one up with a transistor, resistors and LED. Database had the IRFP240, so cobbled a circuit together with a couple meters to monitor Vgs and source current. Trouble with a constant current source in this case is….all the voltage ends up across the Vcd of the current source, and no Vds, hence no power dissipation. I need the MosFET to be dissipating power so the test is real, and can see the variation of Vgs

I really wanted to NOT have to tweak Id for every device under test.

Revised the test circuit to be similar to Fig 4 in Nelson Pass' MosFET Testing article. I found setting a moderately low Drain resistor of 200 ohms, source resistor of 10 ohms (for measuring Id test current across), and setting the gate voltage with a precision 100k pot, 1M from gate to wiper, between the Drain and Ground gave the most repeatable results. About half the supply voltage is across the Drain resistor, the rest across the device under test. I looked thru my salvaged pots from decommissioned test gear, found I have a 10 turn small Bourns pot with dial indicator, as well as a 100k Type J single turn. I'm inclined to use the 10-turn dial pot for setting drain current. Now de-soldering the leads from that pot to verify I have a winner.

Looking over the different project boxes I have on hand, the Pomona box, having grooved walls its' extrusion, to which identical top and bottom plates attach with 8 screws each seems tie easiest to fabricate with. Drawing the circuit diagram of the fixture now, in order to construct it.

Got the plate laid out, punched and loaded. Now, need to wire it up, and label it. I did just check to see what I get with 40V for the supply voltage. 31V dissipated in the MosFET, with having to trim the gate voltage to around 15% of total to get in the 50mA Id range. So, based on the simulation, this should work.

Now, after setting up the static Vgs test circuit with the power supply (at 20V) and dialing in the gate voltage adjust pot to set Id to 50mA, I was typically reading 3.92 to 3.93V. In the selection of IRFP240's I was testing, six of the seven unused parts fell quite close in Vgs values. Then, set up the curve tracer to sweep from 3.7V thru 4.1V Vgs, I found this group ranging from 35mA thru 50mA at 3.9V. There's no further resolution in the settings of Vgs voltage….so there was more of a variation of the Id reading and curves. Going to 4.0V , the Id reading was into the 60mA region on the upper group, But, between these two set-ups, I will be able to screen parts now…..that was the objective. So, I do need to assign a labor value to this effort, as this will be repeatable for the future in matching parts for the Ampeg SVT MosFET output stage amps like the SVT4-Pro

I haven't yet grounded the Vgs test fixture, so I need to do that next, as well as labeling the panel. I need AAA batteries to proceed ahead with that task.

With the Tek PS503A supply feeding +/-20V to the fixture, using the -20V potential as 0V, that puts 40V into the unit. I have to re-set the bias pot to achieve 50mA Id for this potential, but it works fine. Cabling it is a bit more clumsy, but this works. It would be easier using the Trygon / Syston Donner supply, as it is a dual 40V supply. Vgs at this higher dissipation drops down slightly, from 3.90V to 3.886V. So, I think it's time to order parts from Mouser.

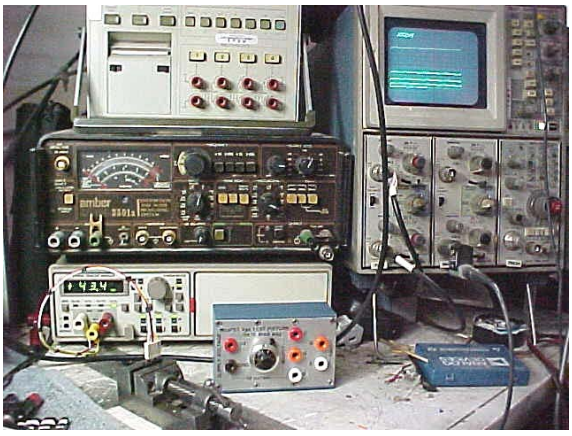
I'll get photos after I pick up AAA batteries to restore the P-Touch printer's batteries…..and label the box. Got the housing grounded…filed out a relief in the extrusion to fit in a solder lug, strapped to the Ground (0V) terminal from the power supply.

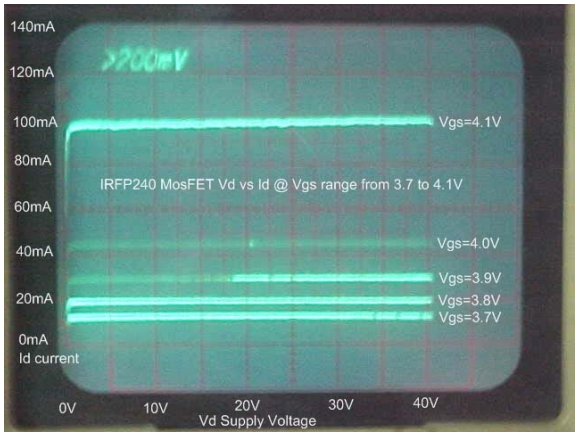
Odd thing I notice….with the HP 3467A toggling thru it's two channels (used to measure Vgs and Id), if I monitor Vds, I am seeing Vds change as it switches. Vds drops from

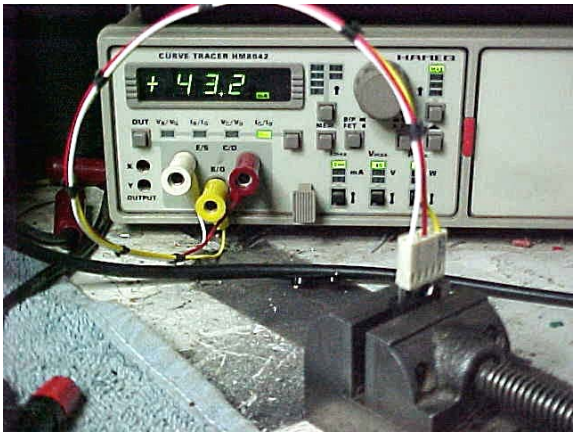
32V to 30V when measuring Id (V across Rs, between Gnd and Source). Is there something about the 4-ch multimeter that I don't understand?

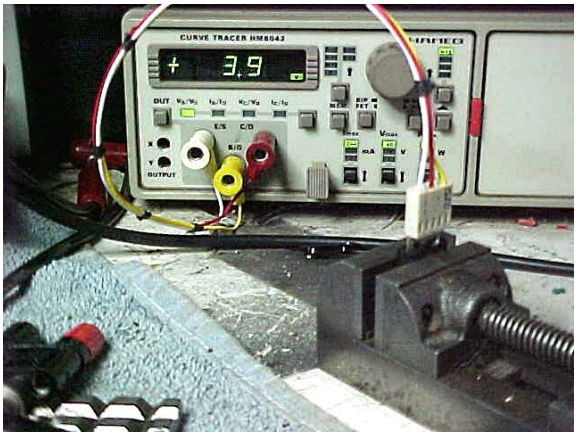
8/29/15

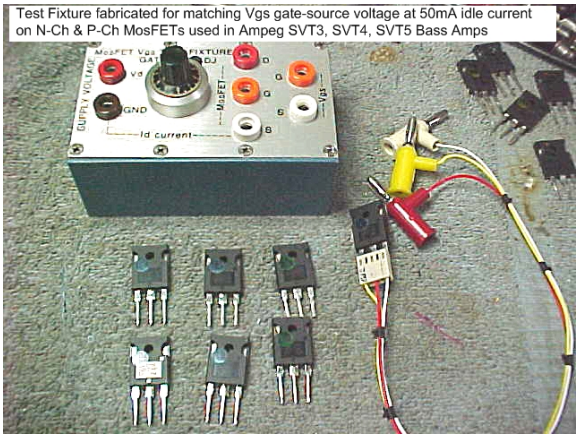
Replaced 3 of the six AAA batteries in the P-Touch label printer, so I could label and then photograph the MosFET Vgs Test Fixture & test set-ups.

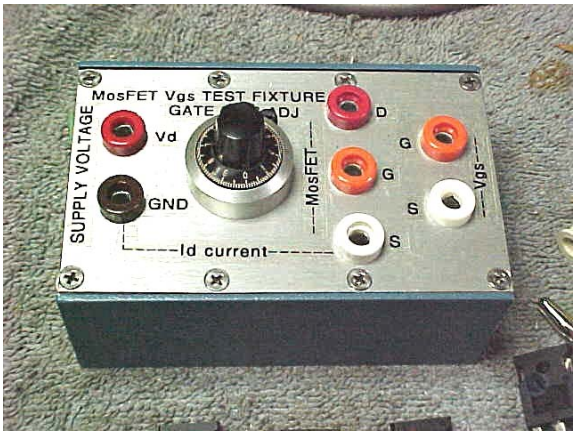


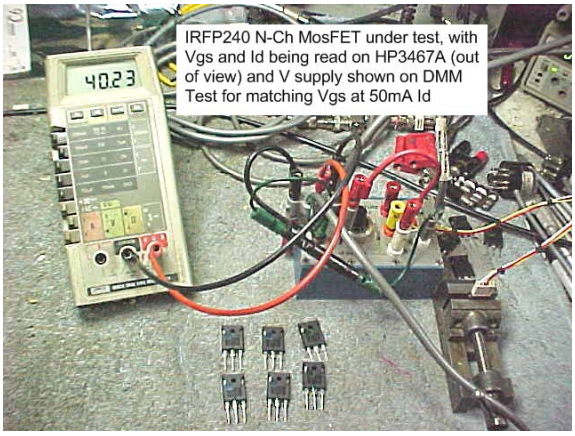




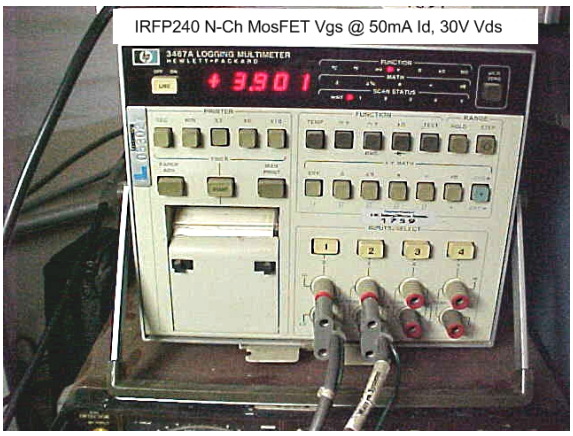








IRFP240 N-Ch MosFET under test, with Vgs and Id being read on HP3467A (out of view) and V supply shown on DMM Test for matching Vgs at 50mA Id



IRFP240 N-Ch MosFET Vgs @ 50mA Id, 30V Vds

Both the curve tracer and the Vgs fixture are needed in selecting and matching MosFET's for the Ampeg SVT3 Pro, SVT4-Pro and SVT5-Pro bass amps. With seven unused IRFP240 MosFET's, at 50mA Id & 30V Vds, I found Id ranging (on the curve tracer) from 35mA to 50mA, while Vgs was only varying from 3.92 to 3.93V. Which would I test first, and how do they compare to IRFP9240 P-CH MosFET's? Not yet sure. So far I haven't yet tested any of the P-Ch MosFET's. But at least now I'm in a position to do so with repeatable results. The real test will be to see them in the amplifier. I may want to use the Trygon Dual 40V supply, as I can set the supply voltage for 80V for near-idle operating conditions.

9/15/15

MosFET Testing Start 2:40PM Stop 4:50PM

Now beginning to screen the tube of 20 pcs of IRFP240's, range from Vg of 3.7V to 4.0V, choosing 3.9V as frame of reference. This batch has MUCH higher gain than what I was looking at on the parts I had on hand. Range is from 70mA thru 155mA.! Distribution looks as follows:

70mA, 71mA

80mA thru 84mA, 3 pcs

90mA thru 105mA, 6 pcs

110, 113mA

120mA thru 130mA, 5 pcs….best grouping

135mA, 155mA

Contrast this (at Vg = 3.9V) to what I had on hand, unused:

37/nA thru 45mA, 5 pcs @ Vg = 3.9V
47mA
50mA
55mA

69mA
95mA
105mA

So, I have three reasonable groups. 37mA thru 45mA, 90mA thru 100mA, and 120mA thru 130mA.

If I lower Vg to 3.8V, the current levels will be much lower. I'll look into that tomorrow. Then, I'll have to set up for measuring the P-Ch IRFP9240's, and see just how more radical those are, as I've heard.

I wasn't thinking when I turned everything off. That means I have to take the time to re-calibrate the curve tracer all over again. But, I guess that helps train me how to set it up. It still isn't quite intuitive.

9/16/15

MosFET testing Start 8:40AM

I need to mark these devices, now that they are basically grouped. It's quite a wide spread of current values at the common Vg value set. What I had on hand was well below the nominal values that came in with the 20 devices, which seems to peak at around 100-105mA (not having actually graphed the readings).

I will want to re-test at a lower Vg value. In the application (Ampeg SVT4-Pro, with 25mV being the nominal value to set bias at thru 0.47ohm source resistors, that current value is 53.2mA.

I don't yet have a feel for how sell these parts, now grouped, will stay that way when I re-test at a fixed Id value of 50mA, then batching based on Vg readings.
It should be similar, since my screening has been done at a Vg value of 3.9V

As for marking, maybe use sort-hand of Id/Vg, like 89/3.9; 118/3.9, written on the back. At some point, a dot o paint would seem like a way to identify the batched parts. As for storing them, I do have a collection of antistatic bags on hand.

What happens if the P-Ch MosFET's are totally different in their match? I'll have to read up on that in Nelson Pass's paper.

I didn't document the actual numbers yesterday…only got basic groupings, recorded the min/max loosely as a starting point. I'll record numbers this morning, then re-test at a lower Vg value, seeking the 50mA range. I should be able to see what to expect from the family of curves on the CRT, as to what to expect.

Looking at the data sheets of these two parts, their Id vs Vds curves begin at 4.5V, and progress on to 10V in 0.5V increments, both for the N-Ch and P-Ch. What I'm looking at presently is way lower, so I may be getting fooled by my readings. Notes on the published curves from Vishay state 20uS pulse, so the family of curves are produced with pulsed gate voltage. I don't see anything in the operation document on the Hameg HM8042 as to how it operates.

In order to get a reading on the P-Ch MosFET's, I had to lower the Vg range from -3.4V thru -3.7V, using -3.6V as the test curve. The Lot code was the same throughout (Y46K AH), and the current readings were very tightly grouped, ranging from -86mA thru -103mA. Now, if I lower the Vg voltage ref curve for the N-Ch devices, the current readings are going to be quite low.

Listing the two sets of parts, as my first test results show are as follows:

N-Channel			P-Channel		
Id mA	Vg	Lot Code	-Id mA	-Vg	Lot Code
35mA	3.9V	IR715P	-86Ma	-3.6V	Y46K AH*
36mA	3.9V	IR714P	-87mA	-3.6V	Y46K AH*
39mA	3.9V	IR714P	-90mA	-3.6V	Y46K AH*
41mA	3.9V	IR714P	-91mA	-3.6V	Y46K AH*
44mA	3.9V	IR714P	-92mA	-3.6V	Y46K AH
45mA	3.9V	IR714P	-94mA	3.6V	Y46K AH*
47mA	3.9V	IR605XB	-96mA	-3.6V	Y46K AH#
50mA	3.9V	IR605XB	-96mA	-3.6V	Y46K AH#
55mA	3.9V	IR605XC	-97mA	-3.6V	Y46K AH#
60mA	3.9V	IR432L	-98mA	-3.6V	Y46K AH#
69mA	3.9V	Y56K AH	-98mA	-3.6V	Y46K AH#
70mA	3.9V	Y56K AH	-98mA	-3.6V	Y46K AH$
70mA	3.9V	IR432L	-99mA	-3.6V	Y46K AH$
78mA	3.9V	Y56K AH	-99mA	-3.6V	Y46K AH$
81mA	3.9V	Y56K AH#	-101mA	-3.6V	Y46K AH$
80mA	3.9V	Y56K AH#	-101mA	-3.6V	Y46K AH$
87mA	3.9V	Y56K AH#	-101mA	-3.6K	V46K AH
90mA	3.9V	Y56K AH#	-102mA	-3.6V	Y46K AH
91mA	3.9V	Y56K AH#	-102mA	-3.6V	Y46K AH
93mA	3.9V	IR605XA	-103mA	-3.6V	Y46K AH
95mA	3.9V	Y56K AH			
101mA	3.9V	Y56K AH$			
104mA	3.9V	Y56K AH$			
106mA	3.9V	Y56K AH$			
110mA	3.9V	Y56K AH$	4mA	3.6V	Y56K AH
114mA	3.9V	Y56K AH$	5mA	3.6V	Y56K AH
119mA	3.9V	Y56K AH*	7mA	3.6V	Y56K AH
123mA	3.9V	Y56K AH*	8mA	3.6V	Y56K AH
125mA	3.9V	Y56K AH*	9mA	3.6V	Y56K AH
126mA	3.9V	Y56K AH*	8mA	3.6V	Y56K AH
129mA	3.9V	Y56K AH*	0mA	3.6V	Y56K AH
135mA	3.9V	Y56K AH	32mA	3.6V	Y56K AH
154mA	3.9V	Y56K AH	35mA	3.6V	Y56K AH

Looking at the P-Ch parts, I could use each successive 5-parts as a group (88-92mA, 94-98mA, 98-101mA, and 101-103mA, so it should yield tight matching.

The N-Ch parts, I now have to go back and see what the current looks like at Vg = 3.6V I looked at the highest range parts, which resulted in nearly a 4:1 reduction of current. And, the difference using the lowest current batch of P-Ch, it's more than a 3:1 difference. Now, how does one balance this in actual use?

Stop 2PM…checked emails, Planning Center / MCC to see what bass parts are listed for this week. I'm at odd's with the recorded bass part on Touch The Sky
Start 2:30PM

Re-read Nelson Pass' article, though no mention of mismatch of Id current levels like I have with the two sets of parts, now half-way selected. Next move it to see what I find when I set Id to 50mA and measure Vg I'll start at 20V, and work upwards.

The Kikisui 0-300V Supply is the easiest power supply to use for this phase of Vg vs Id testing.

At 20VDC, the difference between N-Ch and P-Ch is small…about 150mV difference, and within the devices, around 15mV in the current range.

At 40VDC, the difference increases to 250mV between N-Ch and P-Ch devices. That will no doubt be more significant at 80VDC, or whatever the supply voltage actually is….83VDC at idle, according to their schematic.

At 83VDC, difference is between 3.583V and 3.188V or 395mV. That's fairly significant!

9/17/15

MosFET Testing, continued Start 10AM

Continuing with the finding at the end of yesterdays' readings at 83VDC Vds…..the biasing network is traditional…controlling how much a transistor (in this case a pair of them) is turned on, straddling the gate buses of both N-Ch and P-Ch. Current flow will still be from top half thru bottom half, so even current distribution is necessary. How will the difference in Vgs between N-Ch and P-Ch affect the results?

The nominal gate buss rails are 3.6V & 3.5V for N-Ch & P-Ch, with the N-Ch devices at 83VDC Vds sitting with 3.63-3.65V Vgs, while the P-Ch devices are now turned on with their 3.39-3.38V Vgs values.

What I noticed in the Id vs Vds family of curves for the P-Ch devices was pronounced rising slope of Id as a function of Vds voltage. I only saw it to 40V, the highest the Hameg will produce.

Will one half be running the same current as the other half? I'm tempted to only put in one complimentary pair of MosFET's and look to see what the result is.

I still have to pull the amp PCB assembly apart to replace all the failed parts, so there's a lot of work to do here.

I've been digging thru Music Electronics Forum and other internet listings with regards to complimentary MosFET matching, hoping to save me grief, seeing as I have a vast difference in that area. So far, I haven't seen it really addressed. I have

I still have to get Vgs readings on the 'batched' parts I selected. How to mark? Vgs/50mA?

I documented all the IRFP240 N-Ch devices, finding Vgs ranging from 3.52V @ 50mA (154mA/3.9Vgs) to 3.84V@ 50mA (35mA/3.9Vgs), a diff of 0.32V over that current range in the Id screening., while holding Id constant. The P-Ch parts ranged from 3.21V to 3.19V @ 50mA on the lowest 5 Id/Vgs reading parts.

How much worse Vgs difference gets when I have to batch up another set will be pondered, after I see what results I get in re-building this SVT4-PRO channel. Now time to begin that process.

9/17/15

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair as needed Start 2:40PM Stop 6PM

Pulled the power supply module off the rear heat sink, then the fan and brackets, 7 mtg screw for the main bridge rectifier. Then, had to unsolder all the MosFET's in order to remove the heat sinks, allowing access to all the source resistors and support parts to the output stage. The rear heat sink had three clamps pressing bias xstrs up against the heat sink, which had to be removed, before that heat sink with all the MosFET's attached could be removed.

Now, have all the Source 5W resistors, gate resistors removed, found one side of the Source sense resistors to the current limiter had also failed (all 1.5k resistors), so those came up (didn't' know those had failed). Now removing the supporting cast of parts an searching for any additional parts not yet discovered. Making progress, at least.

Got the gate resistors, source resistors, sense resistors installed, some of the failed semi's. Need a 10uF/35V NP (C114).

9/18/15

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair Start 11:15AM

It occurs to me that while I have the two heat sinks removed, and all the MosFET's mounted on it, that this is the perfect time to test the two sets of N-Ch and P-Ch parts that are 'matched' from Ampeg (they purchase matched parts from the mfgr. Not knowing how close the Id value is or the Vgs value is in the two groups, this will be valuable information for my database, and useful to add into my up-coming forum posting on this procedure.
Now, what to use in lieu of having any no-polar caps to choose from (as far as I know), for replacing the 10uF/35V part for C114. After searching thru the Neotek and Harrison Console channel strips, and parts bin, I found NO non-polar parts, so installed back-to-

back Nichicon PW series 22/63V caps, tack-soldered the (-) terminals in the middle, so that crisis is over.

Now, I need to scrutinize the front end circuit components for any open resistors, bad semi's that I haven't already found. What are the chances of the driver front end Op Amp (NE5532 IC1, which is common to both channels. Usually if the Op Amp failed (1/2 of a dual), the other suffers ill effects. But, it wouldn't be a bad idea to replace it just in case.

Good thing I looked into the rest of the circuits, having found an open emitter resistor R126. Also replaced IC1, and cap C110 (47/35) just on principal. Now, trying to find R35..a 47k 1/2W part that looks to be from the Drain of Q118 to Ground. Found it…it has a compliment, R36, where both of these parts are ballast resistors to drain the supply caps after powering down. I measure around 1.5k in one direction, and a neg reading in the opposite. Don'tknow where R36 is

Now that I'm back to checking the 'working channel's N-Ch MosFET's, I had to reset the curve tracer all over again..so leaving it powered up is no assurance that it will remain set as last left. But, for some reason, even after setting the Vg range from 3.7V to 4.1V, the analyzer is rejecting what I assumed to be known good parts! I don't understand. Did I kill parts in the process of desoldering everything yesterday??? I find THAT hard to believe. Time to make DMM measurements first

I checked the curve tracer with known good parts, and it reads just fine. I tested the 'good channel's parts for switching function, and they all work. But, with them mounted on the heat sink, the curve tracer rejects every N-Ch FET, showing some negative-going curve briefly before turning the test function back off. I tried to remove a part to test off the heat sink, but the thermoset is holding them fast, so since I have to take the shorted parts off, I'll see what it takes to remove them. I'd just assume leave the working channel parts mounted.

If I'm unable to test these 'working parts' on the curve tracer, this is going to complicate matters.

I move one of the 'working' IRFP240's to the Vgs fixture, supply still dialed up to 83V. Vgs reading, once I re-set Id for 50mA was 3.02VDC. That explains it. I had set Vgs range for 3.6 to 4.0V. So, I need to recalibrate Vgs to cover 2.8V to 3.2V and try again. Regardless, what this is also telling me is Vgs is WAY higher on these replacement parts than the factory spec. I wonder what the P-Ch parts are like?

That now yields functional readings. With the range I had, it must have been exceeding the power or current level of the instrument. Not like I have a nice Tektronix curve tracer that can do these things.

Now, to see what the readings are like. I wasn't able to get the P-Ch parts to read, so I went to measure Vgs at 50mA/83VDC. Vastly different….3.47V to 3.50V…a spread of 0.23V for common Id current, whereas Vg for the N-Ch devices ranged from 2.93V to 3.15V, a spread of 0.22V for common Id current, and a difference of Vgs of 0.46VDC. That's more than the spread I have selected, choosing the Id current readings, those still being at nearly a 3:1 difference..

With the selected Ampeg parts, their Id at 3.1Vgs ranged from 13mA to 75mA, 31mA being the nominal, and the Id @ 3.5Vgs ranged from 36mA to 45mA, a much tighter spread., and not that far from the compliment. So, I think I can proceed with using the selected parts I batched.

I want to get photos of the test set-ups using the Ampeg heat sinks with the curve tracer and Vgs fixture

It's already 3:15PM!! Time sure flies when you're having fun. I stopped to take photos of the test set-ups measuring the Ampeg Working Channel MosFET's, which reveal interesting information, and offer the best information I've found with regards to matching parts, and showing the mismatch at idle conditions (as far as Vgs goes). Measuring Vgs first will reveal where to set the Vgs range on the Curve Tracer, so that instrument doesn't keep rejecting the guessed-at settings.

Wide difference in Vgs between the factory-matched N-Ch and P-Ch parts, while much tighter current balance exists (discounting a 5-1 range in one batch of parts, measured at a nominal Vgs curve). This suggests I can go ahead and install the selected and matched parts I grouped this past week.

Test Results on the working Ampeg IRFP 240 & IRFP 9240 parts:

Sch #	Id/Vgs	Vgs @ 50mA	Device
Q210	31mA/3.1V	3.05V	IRFP 240
Q212	75mA/3.1V	2.93V	IRFP 240
Q214	32mA/3.1V	3.04V	IRFP240
Q216	13mA/3.1V	3.15V	IRFP 240
Q218	23mA/3.1V	3.08V	IRFP 240
Q217	43mA/3.5V	3.47V	IRFP 9240
Q217	36mA/3.5V	3.50V	IRFP 9240
Q215	37mA/3.5V	3.50V	IFRP 9240
Q213	45mA/3.5V	3.47V	IFRP 9240
Q211	44mA/3.5V	3.47V	IRFP 9240

9/19/15

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair Start 3:15PM Stop 6:30PM

I guess I'll use the sets of parts I batched. Now, having pried off one part from the Bergquist insulator sheet, I need to look at that material again, and see if I dare re-use it. Otherwise, my thoughts are to use greased mica, assuming I have enough insulators.

While looking for date codes on the amp, I found on the IRC 0.47 ohm 5W resistors 0236 = week 36 of 2002. And on the N-CH and P-Ch MosFET's, N230 lot codes, which could also mean week 30 of 2002, which would fit. Grey dot's on the 9240's, Grn dots on the 240's.

I have enough TO3P micas to do the job, but I now need to re-order TO-247 and TO-3P mica this week

I got all the parts back onto the assembly, apart from the LV power supply assembly. In order to measure Id current at idle, I need access to the gates, or to the bottom of the PCB assy. That may be the only way I can get the info, due to the power supply PCB assembly being totally in the way.

I'm still at odds of leaving the two N-Ch parts having Id of 75mA and 13mA in place, with the remainder sitting at around 35 mA or so (Vgs curve of 3.1V). I'll fire this up tomorrow…time to pack it in.

9/21/15

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair Start 2PM

Installing the power supply assembly, then gotta find the AC mains extension leads so I can rife this up outside the chassis.

Universal primary on the transformer. I didn't bother labeling the transformer or AC mains leads, so I need to find my document calling out the color code. Time to produce an SVT4-Pro Service Document, so all that info is in one easy-to-find location.

A bag of test leads fell off the top of my Adapter chest, down the back wall and onto either the floor behind the Yamaha console, or onto a box heading to that location. So, had to move everything out of the way to retrieve that. Pushed the cabinet further back on the self, which promptly sent another bag falling down below!

In that stack of bags was my bag full of cable extensions for SVT4-Pro amps, so I have that now. I found in the Power Amp schematics a wiring diagram of the PCB and strappings, though it's incomplete. It doesn't actually show the wiring of a Universal Primary strapped for 120V! So, still to read between the lines, and marked up the insulated female fast-on covers. The two leads off the accessory AC outlet are NOT insulated, and plugging them in presents a hazard, as does NOT plugging them in, as they are stiff, short and would like nothing else than coming into contact with that end of the PCB that will be exposed. So, I need to either change them to insulated fast-ons, or sleeve them temporarily.

I got the primary leads all re-connected, and replaced the un-insulated AC outlet connector leads replaced with insulated ones, so the PCB is now wired up. I removed the Neutrik NL4 output board, along with the DI output Xfmr PCB assy, with the remainder of the PCB assemblies re-connected. Now, I just need to get instrumentation connected to both sides of the PCB so I can monitor this as I bring up the AC mains.

I looked thru my two boxes of test leads, only finding a pair of EZ-Hook BNC to EZ-hook via breakout box at the hook end, removed the standard red & blk hooks and soldered in the long Yellow and Blue equivalent test probes I had collecting dust in a drawer. I did NOT find the coax dual banana to long EZ-hook probes, so I may have given that to Charles.

I should have another pair of Pomona BNC to EZ-hook cables in my cable case. But, I really specifically need the long probes.

Does Pac Radio carry those? NO. I didn't find their carrying any Pomona parts, other than MDP dual banana plugs.

9/22/15

I need to track down new long EZ Hook test clips elsewhere, or the Pomona equivalent. Also need to order more TO-3P and TO-247 mica washers.

I couldn't find ANY Pomona EZ hooks on Mouser, so googled EZ-Hook, got the real company, was able to order 3 pair of the XL Hooks in RED and BLK directly from them. Then, went to ebay, found the TO-247 and TO3P mica washers ordered those, then looked for suitable replacement Test leads, as my probes here in the shop are failing. So much Chinese junk listed in the $3-$4 range, it took forever to find anything of quality. Ended up purchasing some Fluke probes, and have an auction coming up on Friday at 8:35AM or so for another pair of decent probes in a kit with pouch. Haven't yet placed a bid…real auction this time. Probably will lose, but worth pursuing. Now, there should still be another box of cables here…gotta go back up top to look, or dig in the pile of boxes on the floor.

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair Start 12PM

I did locate one of my test probe cables…silicon rubber, having EZ-Hooks at the end, MDP at the other end. So, I now have probes on the P-Ch MosFET's source terminal and other end at the output buss. So, I'm effectively ready to start powering this up. But, I don't yet have probes on the output bus and Gnd so I can monitor the DC output level as I bring the supplies up. I have to do that, and, I think the thing to do now is to fashion test lead hoops on both output busses as well as Ground, so I can go probing from the back side. More time, but in the long run, it will be far easier than what I just put myself thru trying to grab hold of those leads folding down directly from the bathtub bodies.

Stop @ 1:30PM, start @ 3:30PM

I got the amp successfully powered up, and recorded the data from both channels, after trimming up the bias. The newly replaced output stage is actually very evenly matched, in spite having such a difference in current levels of the two sets of parts. The original parts in Ch B has one N-Ch part running more than twice the current as the others, with one other part running 5 times lower than the high one. I was reluctant in changing those two parts out, not having an equal match with the other parts.

The results are below:

Ch A	DC Output Level	10.0mV		
Device	DCV/0.47R	DC Current	Vgs	Curve Tracer Id/Vgs/20Vd
Q110	23.6mV	50.0mA	3.61V	30/3.6
Q112	22.5mV	47.9mA	3.61V	27/3.6
Q114	23.0mV	48.9mA	3.61V	29/3.6
Q116	21.9mV	46.6mA	3.61V	28/3.6
Q118	22.0mV	46.8mA	3.61V	28/3.6
Q111	-24.8mV	51.9mA	-3.23V	92/3.6
Q113	-22.5mV	47.9mA	-3.23V	90/3.6
Q115	-22.1mV	47.0mA	-3.23V	87/3.6
Q117	-21.6mV	46.0mA	-3.23V	86/3.6
Q119	-22.8mV	48.5mA	-3.23V	91/3.6
Ch B	8.95mV			
Device	DCV/0.47R	DC Current	Vgs	Curve Tracer Id/Vgs/20Vd
Q210	16.6mV	35.3mA	3.00V	31/3.1
Q212	42.0mV	89.4mA	2.97V	75/3.1
Q214	18.0mV	32.3mA	3.00V	32/3.1
Q216	6.84mV	14.0mA	3.01V	13/3.1
Q218	11.2mV	23.8mA	3.00V	23/3.1
Q211	-19.6mV	41.7mA	-3.45V	44/3.5
Q213	-19.4mV	41.3mA	-3.45V	43/3.5
Q215	-16.2mV	34.5mA	-3.45V	37/3.5
Q217	-15.6mV	33.2mA	-3.45V	36/3.5
Q219	-20.2mV	43.0mA	-3.45V	45/3.5

Looking at the results, it makes me want to go and replace the N-Ch MosfET for Ch B, as the P-Ch devices look relatively even, and would probably balance out just fine, based on what I now see. I think that would yield a much safer amplifier, as Q212 is running so much hotter, and Q216 and Q218 sharing such a little amount of the load current.

I better do that. This will take more time, but, it's justified in the end! Now, what group will I use? I selected the closest match I had with the two groups all mismatched. I used the parts from 120-130mA. For this batch, I'll use 101mA thru 114mA…one of those being an IR part. Next lower batch, ranges from 87mA thru 95mA, and also has one IR part in the batch. In both cases, the current readings on the curve tracer was with the same Vgs. Do I have Vgs at 50mA on those parts recorded? Yes. Very similar, around 30mV higher.

I'll have to make this change tomorrow morning, as it's already 4:36PM

All a learning process, I'm afraid. I didn't know this when I pulled it all apart, due to the failure and tear-down. Now, to find the parts.

9/23/15

Ampeg SVT4-Pro Asset # 3342 Blown Channel Repair Start 9:30AM

Having gotten out the replacement IRFP240 MosFET's yesterday, I re-positioned the amplifier PCB assembly such that I could first unsolder the parts installed, then remove and clean each of it's thermal grease, mark down the curve tracer Id/Vgs numbers previously recorded, and then replace each with the new parts, having set them into a sensible order (highest Id on the outsides, lowest in the middle). Cleaned the board of the flux, and re-positioned it back into the chassis.
One of the parts was a pull from something, probably another SVT4-Pro. It tested good, as did several others having been pulled. It fit in with the Id grouping, and read fine at nominal supply @ 50mA, Vgs being very close to the other four

Now, re-connecting the test leads so I can power it back up and re-set the bias, after verifying nominal operational status. The change made a significant improvement. Good current distribution now on Ch B, although two of the P—Ch parts are still a bit lower, but not horribly off.

Ch B	8.78mV			
Device	DCV/0.47R	DC Current	Vgs	Curve Tracer Id/Vgs/20Vd
Q210	23.9mV	50.9mA	3.66V	110/3.9
Q212	22.0mV	46.8mA	3.66V	95/3.9
Q214	23.3mV	49.6mA	3.66V	104/3.9
Q216	23.9mV	48.9mA	3.66V	101/3.9
Q218	24.3mV	51.5mA	3.66V	114/3.9
Q211	-24.2mV	51.5mA	-3.48V	44/3.5
Q213	-23.7mV	50.4mA	-3.48V	43/3.5
Q215	-19.9mV	42.3mA	-3.48V	37/3.5
Q217	-18.9mV	40.2mA	-3.48V	36/3.5
Q219	-24.1mV	51.3mA	-3.47V	45/3.5

Idle current on the amplifier sitting at 1.45A/123W @ 120VAC Mains

I went back and added the Curve Tracer readings of Id/Vgs@ 20V Vd for all the parts installed, so that gives sp,e frame of reference/ I should also add the Vgs @ 50mA values recorded on the selected parts, just to be complete. Loading the parts into the amplifier circuit, with feedback around it and nominal operational circuit conditions show that the large differences dwindle and smooth out, though you can still identify the parts based on their relative current levels within the groupings selected.

I think this will work. I think its' safe to connect load to the channels and apply signal thru the power Amp input jacks and verify I have a working amplifier. I looked at all 10 devices of Ch A @ 8V out/4ohms (16W), and saw 90-93mV across the board, which is 193-197mA. Checking at 20V out, which would be 100W. There, I'm reading 206 to 212mV across 0.47 ohms, or 438mA to 451mA. Now, checking Ch B @ 8V out, I was seeing 88mV thru 94mV, with the one N-Ch IR part reading around 108mV. That's 187mA thru 200mA, with the IR part at 230mA. At 100W (20V/4 ohms), the readings ranged from 200mV thru 215mV, with the IR part reading 255mV. That's 426mA thru

457mA, with the IR part reading 543mA. I wasn't prepared for that. I guess I should have stayed with the other parts. Is it too late? The next closest part I have is 95mA. I had used the grouping of 114-110-106-104-101, not expecting that 106 Id IR part to be the rouge it is. I suppose I could replace it with the 95mA part

That discrete ranging sure tightens up when they're all in circuit. So, best to stay with the same lot code, as apart from that one IR part, I have that common lot code grouping. Gotta change it out.!

22.0mV across 0.47 ohms is 46.8mA, so that's reasonable in the distribution. I updated the list above. Now, checking the results under drive at 8V & 20V. That is now reading in the same range with the other parts, as recorded above, so now I can go ahead and strike the test set-up and put this back together for final testing. So, as I had read, keeping within the same lot code IS very important…seemingly more than the difference in Id current, even though it might be a little further out from very tight grouping.

I briefly had one of the P-Ch MosFET's of Ch B…Q217 appearing NOT to be sharing load current. When I ran the output up to 20V and checked again, it was reading fine, and was again reading fine at 8V.

The top cover is still off, but I have the PCB assembles all back inside and secured, both relays still pull in, based on seeing the recorded DC offset values while I had the assembly all connected with the multichannel DMM. So, I'll let this idle while I go pee and relax a bit.

1/15/16

Ampeg SVT4 Pro AuntieM A-SVTProIV-a Intermittent output Start: 4:15PM Stop 7:30PM

Remove from road case. Pulled the top cover. Noticed (as usual) the Right front handle is loose. Pulled all the connectors from the main PCB, removed the upper rear panel PCB's, side panel PCB, and lifted out the main PCB, labeling all the push-on connectors. The RED Neutrik 1/4" Faston would not disconnect..instead, it removed the plastic shell from the connector! I did manage to get it free.

Now inspecting the main PCB for solder fractures. I found the main bridge rectifier with solder fractures, half of the rear panel phone jacks, some output source resistors, AC Mains input connector, others. Repaired all I found on the main PCB. Now moving on to the LV PCB assy, before setting that aside to get to the rest. Of the boards, including the preamp PCB assy.

I found fractures on the 3-pin connector of the LV board, as well as on the two power supply caps, so good thing I looked there too.

The Front panel PCB had fractures on most of the front panel pots, as well as the MR switch. Also fractures on some of the rear end I/O connectors. Repaired all those. Jacks were ok. The EQ board had fractures on its' I/O connector. The rear panel Neutrik NL-4 PCB had fractues on it, and the upper row connector PCB had the usual XLR fractures, while all the 1/4" jacks there looked ok. DI output xfmr board was fine.

Replaced the front panel screws with socket cap screws. I ran out of SS flat washers, so I need to get more of those. Also need to get some Loctite thread locking compound, as I used to dip the screws into that for the front panel handle screws.

Now, I can re-assemble this amp. Now I have the amp re-assembled.

2/10/16

Ampeg SVT4-Pro Asset # 3342 No Output. Start 8:35AM Stop 9AM

This is the amp I had rebuilt with screened MosFET's, having left one set in place from the prior failure. I wonder if I lost those parts this time? Pulling the top cover off, and may have to pull the main PCB to get at everything.

Only have access to the front N-Ch parts….Ch 1 side has shorted MosFET's, while the other side behave like switches, turning the device on and off with the DMM's potential on the gate. So, this looks like another full melt-down I'm still seeing gate resistors, though no longer measuring as 47 ohms, so this hasn't apparently decoupled from the supplies, and as such, shouldn't be powered up until repairs are made. I suspect I'll have to replace the 0.47 ohm source resistors as well as the gate resistors. So, a Mouser Order will have to be put together. When I did, I have some additional parts needed from Mouser….what were they?

More Tie Wraps, and Tie Wrap mtg blocks to replace what I used on the Wild Tracks job for starters. 330uF caps? Yes…330uF/35V PW series radial Elect. What else? Need to take stock of fuses, as I'm low on some values. 470 Ohm 3W MOS…Mouser MOS3C471J Koah Speer.

I'll resume repairs on this amp later…putting top cover back on.

2/16/16

Ampeg SVT4-Pro Asset & 3342 Left Ch dead Start 10:30AM Stop 1:50PM

Channel 1 appears to be the only channel that failed…..it was total failure of the output stage. I don't understand why, either. I lost most of the 0.47 ohm/5W source resistors, though the base resistors survived. So, I'll have to remove the heat sinks to get at everything. I need to order parts first I'm having trouble reading the sense resistors (1.5k 1/2W flame-proof off the source terminals. I better replace all those while I'm at it. Still have to check the zeners and current limiter clamp transistors. As well as the front end parts

Parts needed:

10	0.47 ohm/5W WW Resistors	Vishay 71-CP5-J-0.47
5	IRFP 240 N-Ch MosFET	
5	IRFP 9240 P-Ch MosFET	
10	1.5k 1/2W MO	
10	1uF/50V NP	

10 10uF/35V NP
10 22uF/35V NP
10 1N3070 200V/100mA diode
10 1N751A 5.1V zener

I added additional parts to this order…fuses,, tie wraps, another cap value that I ran out of. I'll place the order, though no doubt as soon as I get rolling on other repairs, I'll need something else.

I'll set the amp aside for now, and will wait until the parts have arrived before tearing the main PCB apart to make the repairs. I've already unsoldered the MosFET's and 0.47 ohm 5W resistors, and removed one of the cobbled NP caps I made from a pair of polar caps.

2/24/16

Ampeg SVT4 Pro Asset # 3342 Ch 1 Dead Start 4PM Stop 5PM

I've removed just the front heat sink. I think I can replace the Source resistors with it out of the way, instead of removing both heat sinks. It will be more tedious, but, worth trying.

I removed the rear heat sink, after removing the mounting hardware and freeing the Ch 2 MosFET's, removing the bad ones on both sides. I was able to install the new Source resistors without removing the other heat sink, although it was a pain. I found Mouser short-changed me on the quantity of the resistors, in spite what their package stated. Two separate bags, but qty still wrong…got 18, NOT 20 as purchased.

2/25/16

Ampeg SVT4 Pro Asset # 3342 Ch 1 Dead Start 10:30AM Stop 5PM

After putting the hea tsink back into place, having verified the 1.5k sense resistors were all intact (1.5k /5 = 300 ohms, which you read across any of the installed resistors), I looked thru the pulled 0.47 ohm resistors. 4 had opened, one went to 10ohms, and the remaining five were still 0.47 ohms. When I went to put them into the drawer with other low value resistors, I found I had inventory on the new Dale 0.47 ohm 5W bath-tube parts. So, I really didn't need to order more resistors.

Now, I need to select the next closest batch of N-C & P-Ch MosFET's, having used the closest match previously.

Looking at my test results chart from 9/16/15, I'll use the N-Ch MosFET's & P-Ch MosFET's as shown below:

N-Channel			P-Channel		
Id mA	Vg	Lot Code	-Id mA	-Vg	Lot Code
81mA	3.9V	Y56K AH#	-96mA	-3.6V	Y46K AH#
80mA	3.9V	Y56K AH#	-96mA	-3.6V	Y46K AH#
87mA	3.9V	Y56K AH#	-97mA	-3.6V	Y46K AH#
90mA	3.9V	Y56K AH#	-98mA	-3.6V	Y46K AH#
91mA	3.9V	Y56K AH#	-98mA	-3.6V	Y46K AH#

Now that I have removed the railed parts from the PCB, there are probably some that didn't actually fail. What to do with those? In checking, nine out of ten are hard short failures…with only one N-Ch part still working like a switch with the DMM. Surprising I had 5 source resistors survive, though I replaced everything.

Now to find the parts, grease them up and install them. Got the parts installed, now installing the PCB assy back into the chassis. OI, now the PCB assy is installed, top I/O board dangling outside the chassis, and DI assy not yet installed. So, now just need to clip in test leads for measuring the N-Ch and P-Ch Drain current.

I've powered up the amp, and after a setting the bias to around 25mV, I've seen it drift some, which is typical. Q110 runs a little high….29.5mV with the rest around 25mV as an average…..23-25mV on both the N-Ch & P-Ch devices. When I had looked at Vgs, I came back and found the bias level had dropped to around 7mV from 25mV, and no explanation for that. I reset the bias again.

DC output level is +10mV, Now letting it idle for a while to see if it changes much. I'll then run at different power levels to see what changes. I still don't know why it failed. I did loose one of the current limiter transistors when it failed.

There is a problem on this channel. When I plugged in burst pink noise, 8 oym load, the bias voltage went up and remained up, unlike the other channel, which during the off time of the burst, the bias voltage drops back to nominal quiescent level. After running signal even under no load, the bias voltage went up to around 150mV, remained high for a while, slowly decreasing. While I was watching the Ch 2 bias level on the N-Ch side, the Ch 1 bias voltage suddenly dropped down to less than 1mV…and eventually crept back up to 10mV and was still coming back up (heading, I'd presume to 22-25mV where I had left it.

So, I need to pull the PCB assy back out and replace some more components, those that measure ok, or didn't show signs of failure. What are the likely candidates? C110….a 47uF/35V cap across the bias network. It could have a long time constant if it was damaged. Also, C103 22uF/35V NP ahead of the power amp's op amp stage. And, both of the 10uF/50V NP caps in the current limiter stage, as well as the 1uF/50V NP across the base-collector of each current limiter Also C106 10uF/35V NP to the Vac-Tec driver op amp

While I'm at it, I'd replace both bias transistors MPS A06, along with the pair of MJE 340 & MJE 350's of the voltage gain stage.

I'll bet whichever part got damaged the first time back when this amp failed last year, it caused this channel to fail again, holding the bias level up for way too long,until it just tanked.

2/26/16

Ampeg SVT4 Pro Asset # 3342 Ch 1 Dead Start 10:45AM Stop 4:55PM

Resume where I left off on changing out components I finished replacing components. Put the PCB back in, wired it up, probed it, and began powering up. The current thru the MosFET's are now coming on hard at around 35VAC, with the bias pot all the way down, so I've got something wrong! Gotta pull the PCB assy back out to find out what I did wrong!

With the new bias parts and voltage gain stage parts, I had to turn the bias pot a lot further CW to get the voltage level across the source resistors. Having set it to around 23mV, seen on both N & P sides, after moving the probe around on the P-Ch devices, the bias level dropped to around 5mV on both sides. I saw that happen before too.

With no load, driving it with burst pink noise, the bias level increased substantially, as did the AC mains current. Turning the signal back to 0 at least got the bias to drop back down. I dead-patched CH A, so it would NOT be driven, and ran the signal up again, driving just Ch B. NO change in bias level. So, there's still something wrong here. I got over 4A mains current with no load.

Need to monitor the bias levels on Ch B to be sure, but I don't see the mains current changing.

Is this channel oscillating? Is C117 0.1uF cap shorted or low impedance? Something is certainly causing this to draw current. I don't see any oscillation. I don't measure any load with the 3.3 ohm/0.1uF RF load. But, whether it's burst pink noise or sine wave, the bias increases only on this Ch A side and the AC mains current climbs as a result. I do NOT see this behavior on the other channel.

I don't have a clue still. What do I need to do in order to find the cause of this? I don't see any oscillation. 1kHz Sine increases bias, burst pink noise increases it. Is it frequency dependent? Is there a low impedance load that I'm not seeing?
I didn't replace the baker clamps and steering diodes 1N3070's on the voltage gain stage string. I may as well replace those. Maybe I should also replace the resistors in the bias network. I'm now grasping at straws, which I hate. So, pulling this bloody thing out again!

I just powered the amp back up, no signal attached, just scope connected to the output, analyzer connected to output. I heard the transformer groan, saw a flash and one of the 0.47 ohm resistors blew sky high. So, I'm back to a totally dead amplifier again, besides having no clue what was causing the bias to increase under no-load drive conditions! Scared the dickens out of me to boot.

Pulled the amp back out, have pulled the power devices out, source resistors out, failed zeners, the 1N 3070 diodes out, sense resistors out, and still de-constructing the amp.

Still no clue what tailed, but I may need to replace the bias trim pot. It was cranked over a bit from normal, though it was sitting at stable bias, disregarding the odd performance behavior.

2/29/16

Ampeg SVT4 Pro Asset # 3342 Ch 1 Dead Start 11:30AM Stop 4:50PM

Resuming where I left off, still removing failed parts. Installed new sense resistors, new gate resistors, new bias string resistors, new 1N3070 diodes, new zener diodes, pulled and cleaned the bias adjust pot, new bias transistors, new current limiter transistors, replaced one of the voltage gain stage transistors.

Removed C115 & C116 680pF/200V compensation caps from the gate to supply buses. Have it on the GR 1617 Cap bridge to check for leakage/breakdown at nominal & greater supply voltage. Both appear to be ok, measure fine as caps.

Connected the B & K 1023 between output buss and ground, ran it up to full output (10V RMS, without finding anything odd there. Did the same using the output from the Amber 3501a oscillator, higher source impedance, and it was being affected by I presume the zener diodes or par of the limiter circuit diode/capacitor network.

But, haven't found any clues as to what is causing the high current draw under signal drive conditions, open circuit.

I haven't yet put the new MosFET parts back in.. I'm replacing all the mica insulators, just incase there's something leaky there. Still have to make a more thorough inspection of the PCB traces. SOMETHING is causing grief.

Time to start packing up for the day.

3/1/16

Ampeg SVT4 Pro Asset # 3342 Ch 1 Dead Start 10:20AM Stop 2:30PM

Selecting this next batch of MosFET's in rebuilding this channel. I will now have to order more parts, as if I get more failures, I may be hard pressed to make any substitute.

N-Channel			P-Channel		
Id mA	Vg	Lot Code	-Id mA	-Vg	Lot Code
101mA	3.9V	Y56K AH$	-98mA	-3.6V	Y46K AH$
104mA	3.9V	Y56K AH$	-99mA	-3.6V	Y46K AH$
106mA	3.9V	Y56K AH$	-99mA	-3.6V	Y46K AH$
110mA	3.9V	Y56K AH$	-101mA	-3.6V	Y46K AH$
114mA	3.9V	Y56K AH$	-101mA	-3.6V	Y46K AH$

Gotta put new mica washers into place, and cut the corners of for of them for the TO-92 parts installed against the heat sink.

Bad news. Those N-Ch parts have already been used. I don't have a setoff 5 parts that match Looked in the parts drawer, found a different set, much lower in current. I also chose a different set, leaving -92, -98, -99, -99, -101 parts left over.

N-Channel			P-Channel		
Id mA	Vg	Lot Code	-Id mA	-Vg	Lot Code
35mA	3.9V	47 XW	-101mA	-3.6V	Y46K AH
36mA	3.9V	47 XW	-101mA	-3.6V	Y46K AH
39mA	3.9V	47 XW	-102mA	-3.6V	Y46K AH
41mA	3.9V	47 XW	-102mA	-3.6V	Y46K AH
44mA	3.9V	47 XW	-103mA	-3.6V	Y46K AH

I've no idea how these will match with the P-Ch parts. I need to order more parts again. The parts are now installed, not yet soldered. White grease everywhere! Hate that stuff! Now, beginning to look at the PCB for any evidence of sneak paths off the output buss feed routed to the relay.

After soldering the parts back into place, and cleaning up the flux on the recent repairs as well as all over, I trimmed off some over-hanging component leads that just looked dubious, though not shorting. Cleaned everything, and never did find anything obvious as a cause for what was previously causing mains current to be drawn under signal drive with no load.

I powered it up with the bias pot at full CCW., which resulted in around 0.80mV typical on all the source terminals…bringing the variac up slowly, monitoring the mains current and the bias levels. DC offset ends up around +13mV I cautiously increased the bias adjust pot to around 23mV. The N-Ch range was from 28mV to 20mV, while the P-Ch range was -22 to -24mV.

I connected the Amber analyzer and burst pink noise to see what happens this time under signal drive, no load. This time, no change in mains current under signal drive. I've also been able to power it up repeatedly at 120V mains, and no change. So, I'll probably never know just what caused the failure this past time. I suspect whatever killed it and was causing the current increase to have been there when I rebuilt it back in September.

What is interesting is the bias level on both N-Ch & P-Ch appears to be near equal even though the measured values during batching are very different with regards to gate voltage and drain current. Within the loop, it seems to balance out. That was my original objective, so if this holds up this time around, my objective has been reached.

Letting it idle for a while, still feeling uneasy about it, from the most recent experience with this amp. I still have yet to connect load, and to run it in bridge mono. It drives the speaker just fine in mono, and works fine in bridge mono. The bias current drops right back to idle during the off time under burst drive, so I've solved whatever it was that was causing the current to hang up. Finished putting it all back together, and now writing up the failure document.

2/21/17

Ampeg SVT4-PRO Auntie M SVT IVPro-b Low Output, distorted Start 12:40PM
Stop 4:40PM 4 hrs labor

Pulling amp out of the road case, pulling top cover for inspection The Right handle is loose, and the preamp tube hold-down clamp had the wrong SMS installed. Replacing those with # 6 SMS. Left middle top cover screw was stripped, need to replace.

I removed the rear panel upper connector board, the DI Xfmr board and the NL-4 connector board. Then, removed the power supply assy from the heat sink, so I could get at the rest of the MosFET's, having already verified all the N-Ch MosFET's from the preamp side of the board were ok, as were the Source resistors. All the rest of the gate and source resistors were fine, an no shorts, so I'm no doubt dealing with solder fracture problems again. A clue was the loose handle on the Right side of the amp.

So, now I need to carefully remove and label all the Pwr Xfmr wires from the main PCB so I can lift that assembly out for full inspection and repair.

On the bottom panel, the two screws that thread into the Fan bracket are missing. Those take # 6 PH SMS's.

The power amp PCB assy is now out of the chassis for inspection and repair. Once I looked…sure enough…the Bridge Rectifier had one major solder failure, on the Neg output, and fractures on the positive as well, though minor. I de-soldered and re-soldered all the Bridge terminals, with the part still fine. The Ch 2 N-CH MosFET terminals were all screwed up and re-soldered those. All the output phone jack terminals were cold globular piles of solder. So, it took a little while to get everything back to normal. Now all looks ok on the power amp board. I need to remove the Power supply PCB to inspect it, then I'll find the appropriate screws for the Fan bracket before re-installing this power amp assy. I still have to remove the preamp board, after which I can get at the rest of the front panel handle screws.

After removing the Preamp PCB and Graphic EQ PCB, I removed the handle screws, and replaced them with the # 10-24 x 7/8 Socket Cap screws, split lock and flat washers, so now the front penal is solidly mounted. Now I can proceed ahead with the preamp and EQ boards to see if they're in need of repair. Only minor issues on the preamp board; some preamp tube socket terminals, the lead on one of the 450V snap-in power supply caps, and terminals on a couple pots. All else looked fine. EQ board was fine.

I've now re-assembled the amp, and down to patching the AC mains & Primary Xfmr wires onto the PCB. Then, I need to add tie wraps, but I'll wait on that until I see the amp is working and healthy. There's n M 3.5 x 13mm PHMS missing on the chassis, within the output bus region. I never found one loose in the chassis. I checked my stock of M3.5 screws, and they were too short.

Plugging in the Primary wiring now. Now wired up, bringing up the AC mains. Nominal current draw (1.2A @ 120VAC. Stereo mode. DC offset less than 10mV each channel.

Patched into the Power Amp input jacks, rear panel, to check that I have two working power amps. Both work fine, clipping level around 55V RMS 8 ohms. So, moved the amp around to get at the front panel, patched in the Burst Pink Noise, and went thru the panel functions. All worked (though I never did set it up for bi-amp).

Patched in the bass, played thru both power amp channels, then put it into Bridge Mono. Everything works fine. Now a solid bass amp again!!

12-26-17

Ampeg SVT4-Pro Asset # 3216 Repair as needed (no notes): Start: 3:55PM Stop: 4:55PM Est Inv # 1111 1 hr labor

With the cover removed, I briefly looked at the accessible side of the N-Ch MosFETs, finding one of the Source resistors open, but not getting any 'normal' DMM junction readings on the devices. Viewing the front of the devices, the terminals are, left to right: Gate-drain-Source. The gate resistors are all intact; one of the Source resistors reads nearly open, and there are no shorts measured on the N-Ch side of the amp. I need to remove the main PCB in order to make repairs, as it stands. Primary wiring on this Pwr Xfmr is domestic…NOT universal. Still, I need to mark the wire terminals as I remove them, making it easier to re-assemble when I get to that stage.. Hopefully I can at least get the main P CB lifted out for tomorrow's efforts.

OK, I now have the main PCB assembly lifted out of the chassis, and the Primary leads labeled. Now, to see what's on the P-Ch side of the world All of the MosFET's can be turned on and off, so there's no shorted devices. I had read an open Source Resistor, but that has turned out to be a solder fracture on the MosFET end of the resistor. So, that's a relief, thus far. I still have the rest of the semi's to go thru, but, it's now 4:50PM, and I should start wrapping this up. I'll resume the search in the morning.

12/27/17

Ampeg SVT4-Pro Asset # 3216 Repair as needed (no notes): Start: 1PM Stop: 4:55PM Estimate Inv # 1111 4 hr s labor

I repaired the solder fracture on one of the Ch 1 source resistors, and then re-soldered the bridge rectifier terminals, as they looked suspect, though not outright bad. I inspected all the other solder joints on the main PCB, and checked all the other diodes and transistors throughout the assembly. I'll have to find out about the IC's, hoping there's no issues there. I still have the rear panel PCB and the preamp assembly up front. When did I last service this amp? April 2008, and then 10/30/14. I'll check that record. I had pulled the preamp PCB and found solder fractures all across the front panel controls, and repaired all that damage. I had also found some loose hardware rattling around inside. So, maybe this is ready to fire back up. Still could be preamp tubes. I'll take a chance putting it back together and fire it up 2009, it was the Bridge Rectifier solder joints, and changed the handle hardware.

The problem(s) appear to be in the front end. In 'Normal' Gain (not -15dB', the MUTE button produces loud 'POP' engaging/dis-engaging it. The HUM / noise from the front end is horrible. I've juggled all three preamp tubes, first swapping V1 with V3, then with

that change, V1 with V2, all yielding the same nastiness. Why would there be all that 'POP'? Gotta be some DC present, or perhaps oscillation? I'll pull the preamp board out for inspection to start with. There are two different schematic revisions. I don't find any PCB identifier numbers to suggest which version this is. So, I'm looking at the 53905 version (instead of the 53904).

ON the input to the first tube stage, there is a J175 Muting FET, controlled by a 2N5210 transistor, while the base of this 2N5210 is tied to a circuit called MUTE F8. There's also a diode off the same control line that goes to some circuit labeled 'P', where a lot of other diodes attach. I haven't found either of those circuit nodes. I need to see what the J175 FET is. It's a P-channel Switching FET. It doesn't list typical or min, but max ON resistance is 125 for the J175. A -30V part What do I have that's suitable as a replacement? I think all my switching FET's are N-Ch. I found Mute F8 goes to J20 Pin 1 of the Power Amp PCB via harness. Found the 'P' circuit. It's the Peak Indicator LED driver, driven by an MPS A13.

There are a lot of J175's and J112 Complimentary Op Amp output driver circuits in use. I'm assuming the Q1 P-Ch FET is the one causing the 'POP'. The MUTE F8 circuit connects to a Foot Switch thru the rear panel F/S jack. +15V thru 10k., which will turn on Q2 2N5210 NPN Xstr, and turn on the J175 P-Ch FET, though it's doing that with a Positive voltage !?? Why? I'd expect a Negative voltage to do this. There's a 100k resistor to the gate of Q1, which in MUTE is ground or near ground. Normally there is a positive bias on the gate, which must turn it off hard. I do have J174 P-Ch FET's. similar to the J175 (same family), so I'll swap it out and see if that cures the POP. If it cures the POP, then I'm left with the grungy noise. That's involved with V1 & V2, as V3 is the MF resonant circuit.

12/28/17

Ampeg SVT4-Pro Asset # 3216 Repair as needed (no notes): Start: Noon
Stop: 2PM Est Inv # 1111

I got to thinking about the loud pop, and wondered if the 0dB input jack was making Gnd contact on the tip to short the input. I plugged in the Open Circuit Dummy Plug, then removed it, and found no difference in the residual noise. And, with it open, the pop is loud. I then patched in the shorting plug, and tried again, and the pop is greatly subdued, though still a little bit of a snit/pop. There is a pair of 1N915 diodes back-biased between the +/- 16V supplies, with a 100k resistor tied to the junction of those two and connects to the grid of the input stage. If either of those diodes is leaky, that would also contribute to the pop.

There's still too much residual noise to my liking on this front end, though I don't have any fresh low noise 12AX7's to slip in. I pulled the PCB assy back out, removed the 0dB input jack, drove the Top contact out far enough to re-tension it, pressed it back into the plastic body, checked it, now making solid contact closure for grounding, and re-installed the jack. I also put the J175 P-Ch FET back into place…I did manage to lift one of the solder pads in the process! Repaired that by folding the lead over onto scraped/prepared trace, soldered down.

The amp now behaves normal, no more loud popping. And, the residual noise doesn't seem bad…I think the tubes are ok how they're now oriented. Now letting the amp burn in, I wrote up the Est Inv # for this amp as well as the Fender The Twin, which I had forgotten to do. When I went to print them out, the printer halted. I thought I had another paper jam, but instead, it's out of paper. I went up front, having seen the front office door open earlier. It's closed and locked, so I'm without paper again. I wonder if I can get some from Dispatch across the street? He had a little bit of a ream left and gave that to me.

I switched the amp over to Bridged Mono, hooked up with the Neutrik NL-4 adapter.

I used this labor to complete the July 2017 Shop Space/Labor Invoice, with carry-over to Aug 2017 of 3/4 hrs, and will add the Fender The Twin and the two SWR SM900's onto that invoice.

I can shut down the Ampeg SVT4-Pro, add the tie wraps back into the harness wiring, and button it back up. I'll return it to the Guitar Dept next week.

10/14/18

Ampeg SVT4-Pro Asset # 3342 No Output last svc'd 9/23/15 Start: 1:25PM Stop:2PM
Est Inv # 1264

I've removed the top cover, and began turning up the variac, with the HP 3467A DMM probes attached to both Ch A and Ch B output stages. Ch A is going north quickly, so I have failure of MosFET's on that channel. Ch B is starting up without going high offset. So, I now have to pull the amp apart to dig into the Ch A output stage. I don't know how many parts have failed, and won't until I get the main PCB removed. I don't have any new MosFET's measured and batched for sets, but do have parts to do both N-Ch and P-Ch. That operation will take time to do, and is accountable hours, unless C/S wants to pay $12-15 per MosFET, and no certainty that they will match. I need to check my previous service on this to see what I used.

The amp came into the shop 8/21/15, and I see on 9/21/15, I'm already powering up the amp, so between these dates is where I had to make the repairs. 9/14-9/18/15 has the MosFET screening, started on 9/15/15.

I never did get any further with the Ampeg SVT4-Pro. I need to get busy on that, and advise Jimbo of the MosFET screening & matching process that has to happen in order to repair this amp, it needing replacement MosFET's now.

10/17/18

Ampeg SVT4-Pro Asset # 3342 No Output Start: 12:50PM Stop: 4:25PM
Est Inv # 1264

Pulling the amp apart. I now have the power amp PCB assy removed and on the test bench. Now, to survey the damage. I've already found the top of one of the source resistors rattling around in the chassis.

The P-Ch side of Ch A has open gate & source resistors, all of the P-Ch MosFET's failed. The N-Ch side of Ch A has gate resistors, it looks like one N-Ch MosFET failed for sure, and the source resistors also survived. There are some burned parts around Q105. Q105 failed, R125 & R126 burned/failed. The sense resistors across the source resistors, nominally 1.5k, are measuring high….2.5k on the P-Ch side. On the N-Ch side, I'm reading 300 ohms, where the 5 of them are in parallel, so that would yield 1.5k.

So, there's massive failure on the Ch A power amp. This wouldn't be as time-consuming if I already had matched / batched MosFET's marked & set aside into sets. Now, I can generate the Est. Invoice. I sent that off to Jimbo, calling the repair 3-4 hrs and the batching 4-5 hrs.

I've now removed the N-CH devices. Four of the five behave like MosFET's with one dead short. I have some N-Ch & P-Ch devices left over, though the matching numbers aren't like what's installed. Going to the previous repairs from 2015 to see what I installed. I found I had installed IR715P lot code parts ranging from 35mA/3.9vg thru 44mA/3.9vg. the 39mA/3.9vg failed. The closest part on hand from that batching is 69mA/3.9vg, and I'll try it. Soldering those parts back in, then moving to the P-Ch parts, where all the damage is. I'll have to remove the heat sink on that side, so I can replace the source resistors and other damaged parts.

The current sense resistors all fried as well, and I have more solder pad failure on the PCB as a result of this melt-down.

The P-Ch MosFET's I removed range from -101mV/-3.6vg thru -103mV/-3.6vg, and are type Y46K. These are a lot higher transconductance than the N-Ch MosFET's they were paired up with. What do I have left from the previous screened parts? Y46k, ranging -92/-3.6, -98/-3.6, -99/-3.6, -99/-3.6 & -101/-3.6. Almost a matched set., though a little closer than the previous set.

I had made the comment after measuring the existing parts in Ch B, that while those seemed better matched, the difference in Vgs between the N-Ch and the P-Ch parts, I could go ahead and use the parts I had batched in Sept 2015. The amp lasted until Sept 2018 before that channel failed. So, what does THAT tell me. It was the P-Ch parts that failed, along with one in the N-Channel group.

Now, I need replacement 1.5k 1/2W resistors, 47 ohm 1W MO gate resistors, and 0.47 ohm/5W source resistors. Q105 is a MJE340….I have old BGW stock on those. I found a bag of 5 pcs 47 ohm/1/2W MO, where I had removed 47 ohm 1W MO. I found 1.5k 1W MO, for the sense resistors. I need to order more 47 ohm 1W MO, 1.5k 1W MO. Also more MJE340 & MJE350 for general purpose & servicing the SVT3-Pro thru SVT6-Pro amps.

I have more jumpers to install, and patching up the circuits from all the damage done. I'll have to deal with all that tomorrow, as it's now 4:25PM

The MosFET testing began 9/14/15-9/18/15 and 9/21/15 – 9/25/15 service notes.

10/18/18

Ampeg SVT4-Pro Asset # 3342 No Output Start: 11:15AM Stop:
Est Inv # 1264

I printed out the schematics and parts placement map. Now finding more of the failed parts in the circuit, and, with the burnt gate resistors and output current sense resistors, there is a lot of damaged solder pads, where I will have to scrape away solder mask and tin the traces leading up to the pads, as the pads are NOT going to take solder, and instead will lift off the PCB. As it is, I already have several failed solder pads so the component leads have to be folded over and attached to the circuit traces. This is going to take a lot more time than just replacing parts with new ones! The lower half of the output stage also took out the pair of back-to-back 10V zeners, and the current limiting xstr MPS A56. The positive rail side survived that ordeal. I need an additional 47 ohm resistor…the five I have 1/2W MO are allocated to the sense resistors, while I need one more as the emitter resistor for Q105.

I'll start by rebuilding the center region between the two heat sinks, and won't put the gate resistors in until the replacement power xstrs are mounted. I'll need to install new jumpers and extend the circuits where damage has occurred on the back side of the heat sink. Now, on to salvaging the solder pads and traces of the current limiter circuit.

I now have installed the source resistors, the sense resistors, the zeners, the MPSA56 & MPS A06, the pair of 1N4740A 10V zeners, the 47 ohm & 100 ohm resistors for Q105, Q105 itself. Q102, Q103 & Q104 are ok, though I haven't checked the 2.7k resistors R120 & R121, nor the 1N3070 signal diodes around Q102 and Q105. I then installed the heat sink, installed the two brackets for the fan. The rear heat sink's # 6-32 tapped holes began to strip as I drove the screws into it thru the fan bracket, but didn't have that issues on the front heat sink. Re-mounted the fan, with the label facing the power xfmr, and the leads exiting the bottom rear, so it would plug back into the main PCB.

I first re-mounted the Ch B MosFET clamps, then installed the new P-CH MosFET's on Ch A, after applying fresh greasing to each one, and temporarily installed the screws & clamp washers without the dual clamps, since I need to install the gate resistors and jumpers, and the dual clamps would be in the way. The power supply board is still unmounted.

I cleaned up the PCB, and washed off the silicon grease, then washed my hands to sit down and add these notes, and take a short break. It's now 1:40PM. Resume 2:50PM

I now have the rest of the amp module re-assembled and soldered back together. Time is now 3:40PM. I need to clear space on the test bench, as the next step is a bit dicey. I need to extend the power xfmr harness & wiring so I can power this board up outside of the chassis to check the results of the re-build, measure the gate and source voltages, as well as re-adjust the bias. No guarantees this will work, since I only removed the shorted N-Ch MosFET, and returned the remaining four that measured like normal working MosFET's, but may NOT work in circuit under load. That could outright fail and leave me with a real mess from the damage that would cause. I know what everyone on the forum would say….replace the rest of the N-Ch MosFET's so that

DOESN'T happen! I still have time to do that, but, one of those replacements IS a used N-Ch MosFET. It all gets right back to spending the time to Screen, measure and batch new N-Ch & P-Ch MosFET's so I DO have new working sets.

I WOULD feel a lot more confident with new N-Ch MosFET's in the amp.

Pulling up my MosFET Testing file to review the procedure.

10/19/18

I spent the morning reading posts in the Pickup Measurement domain on MEF, and found some interesting threads, though I am guessing nothing has yet become a standard means of testing pickups. Still gave me some ideas in using a controlled vibrating string that is also used as an induction coil to induce magnetic vibrating field into a pickup passing perpendicular across the pickup coil like a normal guitar string does. Adopting an old B & K 2305 or even a 2307 chart recorder system to do this came to mind.

But, now back to reality. I need to next set up to measure the two tubes of N-CH MosFET's and P-Ch MosFET's, and see if I have a similar new matched set that I can put in to work with the new P-Ch MosFET's I installed yesterday.

MosFET Testing Start: 10:30AM Stop: 4:30PM Est Inv #

I finally got the Hameg Curve Tracer set up properly with the scope for X/Y display, with Vgs range from 3.4V-3.8V, 20mA/Div vertically and 4V/Div Horizontally, 20V middle screen, 40V max sweep range on this Curve Tracer.

I've been looking at the existing IRFP240's tested, then at 3.9Vgs. I'm looking now at 3.6Vgs. I had stated in Sept 2015 the nominal gate voltage was 3.6V and -3.5V, so I'll try testing at 3.6V, with my Vgs range being 3.4V thru 3.8V & 20mA/Div vertically, @ 20Vd.

N-Ch IRFP240

Id	Vgs	Lot Code
15.6mA	3.6V	Y57K
15.7mA	3.6V	Y57K
16.6mA	3.6V	Y57K
16.8mA	3.6V	Y57K
17.1mA	3.6V	Y57K
17.4mA	3.6V	Y57K
17.7mA	3.6V	Y57K
17.7mA	3.6V	Y57K
18.2mA	3.6V	Y57K
18.2mA	3.6V	Y57K
18.8mA	3.6V	Y57K
18.9mA	3.6V	Y57K
19.2mA	3.6V	Y57K
19.6mA	3.6V	Y57K

P-Ch IRFP9240

Id	Vgs	Lot Code
-35.0mA	-3.5V	Y56K
-35.0mA	-3.5V	Y56K
-36.0mA	-3.5V	Y56K
-36.1mA	-3.5V	Y56K
-36.6mA	-3.5V	Y56K
-36.8mA	-3.5V	Y56K
-37.0mA	-3.5V	Y56k
-37.0mA	-3.5V	Y56K
-37.4mA	-3.5V	Y56K
-37.5mA	-3.5V	Y56K
-49.0mA	-3.5V	Y56K
-49.0mA	-3.5V	Y56K
-50.0mA	-3.5V	Y56K
-50.1mA	-3.5V	Y56K

20.0mA	3.6V	Y57K	-51.3mA	-3.5V	Y56K
20.7mA	3.6V	Y57K	-51.7mA	-3.5V	Y56K
20.7mA	3.6V	Y57K	-52.4mA	-3.5V	Y56K
20.8mA	3.6V	Y57K	-53.0mA	-3.5V	Y56K
21.0mA	3.6V	Y57K	-53.1mA	-3.5V	Y56K
22.0mA	3.6V	Y57K	-54.0mA	-3.5V	Y56K

That's the grouping from lowest Id thru highest Id @ 3.6Vgs, at 20Vd. The curves looked very linear with respect to Id/Vd With higher Vgs, the Id did increase noticeably. This is, though the first stage of testing.

Now, to set up for the P-Ch devices, using -3.5Vgs as target @ -20V. Do I have to make the scope sweep opposite, or does it just change the readings, while still sweeping like I see it on the N-Ch devices? The scales just become negative, while sweeping ^ vertically and > horizontally. The P-Ch MosFET's have a slope to them. -37.5mA @ -10.3V>>-50.3mA @ -20.0V>>-63mA@ -30.1V. That's 25.5mA/20V, or 1.28mA/V rate of change @ 3.5Vgs. So, not linear like the N-Ch MosFET's

10/22/18

Ampeg SVT4-Pro Asset # 3342 No Output, repair Ch A Start: 11:30AM Stop: 4:30PM Est Inv # 1264

Checking the MosFET's at nominal supply voltage & at 50mA Id, to see what the Vgs reads. After getting the test setup wired up, I've found with both the Vgs and the Id meter readings active, switching between them on the HP 3467A causes the current to drop on the Kikisui, when it's reading the Vgs. I've dialed in the Idss with the test fixture trim pot, for a current reading on the Kikisui current meter as on the HP. The readings I recorded and wrote onto the devices were after about 10 sec, where the reading changes slowed down and settled, though would continue to drop if given time, as the part would heat up. 10 sec or so was my 'approximate bench mark.

When I got to the P-Ch MosFET's, I first tried grounding the (+) output with the grounding strap, but that didn't work in the test setup, so I just switched the red and black supply leads to the fixture, which did work. When I got to the parts having a -37.5mA and lower Id, it pulled more current, and I had to trim it back up to 50mA with the dial pot. Not sure why that is. Between the two ranges of Id readings off the curve tracer at the nominal Vgs (3.6Vgs & -3.5Vgs), the range is 15.6mA to 22.0mA vs -35.0mA to -54.0mA. 15.6mA to 22mA is a 41% increase, while -35mA to -54mA is also a 54.3% change. 15.6mA to 35mA is 124% difference.

NOW, on the N-Ch side, one of the five failed, all being lot code 714P, and I installed a Y56K in it's place. Checking my records from Sept 2015. I highlighted the parts from the tested parts listed on 9/16/15 that failed in GRN, and what was installed back then on the N-Ch side, together with what I just installed from that tested batch from back then in RED. I put in a 69mA/3.9Vgs part in with the 35mA/3.9Vgs thru 44mA/3.9Vgs N-Ch parts, and -92mA/-3.6Vgs, -98mA/-3.6Vgs thru -101mA/-3.6Vgs parts.

I've spent too much time on this, and, though I'm hesitant, I've gotten away with installing new MosFET's with those that appeared to work with the ohmmeter test as I

did on the remaining parts of the N-Ch set. Time to try and power this amp up and see how it reads, before installing the PCB assy back into the chassis.

Now I need to find the extension cables. Found them, though they're not labeled. I've installed all of the leads. I don't have a ground wire between the chassis and the PCB assy. I also want to re-do the gate connection on the one end N-Ch MosFET where I lost the entire trace to it from the jumper. The jumper lead I installed wasn't long enough to wrap around it, and is just barely making contact, relying on a blob of solder more than anything else. So, I need to lay in a solid contact there with an extra lead wire.

The amp powers up, DC offset is nominal, and the P-Ch MosFET's seem reasonable, and the N-Ch MosFET's would be workable, except for the part I replaced. The nominal range of Source voltages were from around 15mV to 20mV, with the oddball at 33mV.

I need to record the Source Voltages, as well as the Gate voltages before I go any further.

Part	Vs	Ids	Vgs	Part	Vs	Ids	Vgs
Q110	17.5mV	37.2mA	3.86V	Q111	-18.3mV	-38.9mA	-3.23V
Q112	32.8mV	69.8mA	3.86V	Q113	-21.6mV	-46.0mA	-3.23V
Q114	18.0mV	38.3mA	3.86V	Q115	-23.5mV	-50.0mA	-3.23V
Q116	21.3mV	45.3mA	3.86V	Q117	-22.0mV	-46.8mA	-3.23V
Q118	20.4mV	43.4mA	3.86V	Q119	-22.7mV	-48.3mA	-3.23V

Q112 is pulling 70% more current than the average current (41mA) in the N-Ch stage. The P-Ch stage is an average of 46mA. I'm afraid if I let this go, the amp will be back soon with another failure. I think I have no choice but to replace the N-Ch stage. But, how will they stack up against the P-Ch stage I just installed?

I looked at what I measured on the N-Ch side of the previous SVT4-Pro I checked out. It had two odd-ball devices, one per channel. Q110 was about 10mV Vs while the rest were between 25-31mV, and Q117 was like 45mV, with the rest between 25-31mV. So, Ch B on that amp is very much like Ch A on this amp….and also that 10mV device being nearly 1/3 of the current as the other 4 devices. Neither a good match, though it has been surviving.

I suppose I should just drive a load and look with the scope to see what kind of voltage sharing I'm seeing. Will this even out under load? That's what I really need to know. I'll begin with 8 ohm load. With the scope, I'm seeing full sine wave at the Source terminal of each MosFET, so under load, they all appear to be sharing the same current.

I'm measuring this wrong. I need to be measuring across the Source resistors, which will show me the current sharing. I'd need two probes, and set the plug-in for differential. In lieu of that, I could just use the DMM to measure between the output and the individual source terminals. I won't see the waveform, but I will be able to measure the voltage across each resistor.

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	63.0mV	134mA	Q111	58.7mV	125mA
Q112	63.0mV	134mA	Q113	62.4mV	133mA
Q114	60.9mV	130mA	Q115	64.1mV	136mA
Q116	65.1mV	139mA	Q117	61.3mV	130mA
Q118	63.6mV	135mA	Q119	61.7mV	131mA
Total current		672mA			655mA

10V RMS output into 8 ohms = 1.25A RMS
N-Ch + P-Ch current 672mA + 655mA = 1.33A RMS

The current sharing seen here under moderate load looks reasonable. I think I'm ok with the output stage, even though it looks dicey at idle. It's how it shares current under drive that counts. I think I will re-install the amp module, and do final test. Now, I could do one more test, though I'd only have access to the N-Ch side. Run it at higher output under 4 ohm load and see what the current sharing looks like then. First I'll redo this 8 ohm test, but at 50W (20V RMS into 8 ohm load)

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	134.3mV	286mA	Q111	123.8mV	263mA
Q112	121.3mV	258mA	Q113	129.3mV	275mA
Q114	130.0mV	277mA	Q115	132.3mV	281mA
Q116	135.1mV	287mA	Q117	128.0mV	272mA
Q118	133.0mV	283mA	Q119	127.0mV	270mA
Total current		1.39A			1.36A

20V RMS output into 8 ohms = 2.5A RMS, 50W
N-Ch + P-Ch current 1.39A + 1.36A = 2.75A

Current sharing still looks reasonable for all of the MosFET's. I'm probably ok. Just don't like seeing gross idle current imbalances. OK, I can shut down the test, and remove all the lead extensions so I can put this all back together in the morning. Interesting procedure and findings.

10/23/18

Ampeg SVT4-Pro Asset # 3342 No Output, repair Ch A Start: Noon Stop: 3:15PM
Est Inv # 1264

40V RMS Out into 8 ohms 200W, 5A RMS

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	271mV	577mA	Q111	255mV	543mA
Q112	241mV	513mA	Q113	262mV	557mA
Q114	266mV	566mA	Q115	266mV	566mA
Q116	273mV	581mA	Q117	259mV	551mA
Q118	272mV	579mA	Q119	256mV	545mA
Total current		2.78A			2.76A

N-Ch + P-Ch current 2.78A + 2.76A = 5.54A

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Ampeg SVT4-Pro No Output   MEF Thread posted today

Sometimes I dread SVT4-Pro's arriving with no output, though hopeful it's something simple. Not this time. With a couple probes monitoring the output busses of the two amp channels at the Source resistor community between the heat sinks, as I began bringing up the variac, Ch A's offset climbed Positive immediately, indicating a complete failure of the P-Ch devices and source resistors (all open). Ch B looked nominal, for a far as I advanced the variac (10VAC mains).

The 'dread' aspect was knowing I was sure I had exhausted all of my previous batched/matched IRFP240's and IRFP9240 MosFET's, but, did have two fresh tubes of 20 pcs each, but not yet screened/batched and matched. I pulled the amp apart, set the chassis and rear panel modules aside, leaving the Power Amp PCB assembly in the test bench for scrutiny.

The P-Ch devices were all shorted, source resistors all open, gate resistors all open, current sense resistors fried on the P-Ch side, neg driver xstr shorted, neg current limiter xstr shorted. N-Ch devices were measuring bad, though one was obviously shorted. After making the beginning of a parts list, I began pulling parts off the rear heat sink so I could remove the heat sink, as so many of the output stage parts are underneath the bottom relief of the heat sinks.

This isn't the first time the Ch A side had failed…last time in Sept 2015, and had my notes on that. This time around, the scorching of the sense resistors damaged a few traces & solder pads, leaving a crusty surface on the plated pads. Removing the MosFET's and gate resistors also did further harm to some solder pads, as careful as I went in the surgery. Only one of the five N-Ch parts failed. The other four measured ok with DMM testing.

Still, I needed to power up the Hameg HM-8042 Curve Tracer (stand-alone unit, XY output coupled to Tek 7633 Storage Scope/Plug-ins). I have somewhat of a love-hate relationship with that Hameg, as it is very tedious to set up, and changing from N-Ch to P-Ch, you have to go thru all that again. You also need to have some idea of the gate voltage range for the MosFET's being tested (in this case), or you'll be chasing your tail forever before finding the right range and begin seeing the results on the screen. Once there, however, it is nice, since you also get digital readout of Vgs, Vd, Id relative to where you've set the cursor…being able to scroll thru a range of 5 gate voltages and the range of supply voltage. The Hameg only lets you get to 40V max in the Vd (or Vc), but it does at least yield useful results.

I found I still had 5 P-Ch parts left over from the previous screenings, as well as 8 N-Ch parts. The N-Ch part was close to twice the Id/Vgs value as the rest of the N-Ch stage, which I re-tested. I had enough of the P-Ch parts, though the Id range on the two sets were not equal. In circuit, Vgs on the positive and negative sides aren't equal anyway (3.86V vs -3.23V)

I carefully put all the fresh parts in, patching circuits back together as needed, wishing for better quality PCB material. Then, I'd need to use my extender cables to couple the pwr xfmr primary wiring to the amp PCB assy and set that on it's front HS, with the

bottom of the PCB facing me for probing. It powered up just fine, thankfully. I got the idle measurements as follows:

Part	Vs	Ids	Vgs	Part	Vs	Ids	Vgs
Q110	17.5mV	37.2mA	3.86V	Q111	-18.3mV	-38.9mA	-3.23V
Q112	32.8mV	69.8mA	3.86V	Q113	-21.6mV	-46.0mA	-3.23V
Q114	18.0mV	38.3mA	3.86V	Q115	-23.5mV	-50.0mA	-3.23V
Q116	21.3mV	45.3mA	3.86V	Q117	-22.0mV	-46.8mA	-3.23V
Q118	20.4mV	43.4mA	3.86V	Q119	-22.7mV	-48.3mA	-3.23V

I was concerned about Q112 being so much higher in Ids. But, this is at idle, and NOT under driven load current.

After verifying I had good output signal with no surprises, I wanted to measure the output current of each of the MosFET's, looking across their respective 0.47 ohm/5W Source resistors. Now, I didn't stop to measure & record each of them, other than seeing they all were in the 0.465-0.483 ohm range. Close enough. I used a True RMS HP 3467A 4-Ch DMM with shielded probes, com lead connected to the output buss, and moving the plus lead from Source to Source terminals, recording the results. I began with 10V RMS / 8 ohm load, which would be a 1.25A output current total.

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	63.0mV	134mA	Q111	58.7mV	125mA
Q112	63.0mV	134mA	Q113	62.4mV	133mA
Q114	60.9mV	130mA	Q115	64.1mV	136mA
Q116	65.1mV	139mA	Q117	61.3mV	130mA
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Total current		672mA			655mA

10V RMS output into 8 ohms = 1.25A RMS
N-Ch + P-Ch current 672mA + 655mA = 1.33A RMS

Next, I increased the output to 20V RMS into 8 ohms

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	134.3mV	286mA	Q111	123.8mV	263mA
Q112	121.3mV	258mA	Q113	129.3mV	275mA
Q114	130.0mV	277mA	Q115	132.3mV	281mA
Q116	135.1mV	287mA	Q117	128.0mV	272mA
Q118	133.0mV	283mA	Q119	127.0mV	270mA
Total current		1.39A			1.36A

20V RMS output into 8 ohms = 2.5A RMS, 50W
N-Ch + P-Ch current 1.39A + 1.36A = 2.75A RMS

Finally, I increased the output to 40V RMS into 8 ohms

Part	Vs RMS	Is RMS	Part	Vs RMS	Is RMS
Q110	271mV	577mA	Q111	255mV	543mA
Q112	241mV	513mA	Q113	262mV	557mA
Q114	266mV	566mA	Q115	266mV	566mA
Q116	273mV	581mA	Q117	259mV	551mA
Q118	272mV	579mA	Q119	256mV	545mA
Total current		2.78A			2.76A

40V RMS output into 8 ohms = 5A RMS, 200W
N-Ch + P-Ch current 2.78A + 2.76A = 5.54A RMS

While the output current per device is half-wave, the readings are no doubt distorted by that, and the sum of the two stages are higher than the sinewave output, it's showing the current sharing of all the devices aren't grossly out of whack. I was expecting Q112 to be hogging current with it's higher Vs curve. In fact, just the opposite as the output current increases under load. Q110, 114, 116 & 118 average to 576mA @ 40V output, with Q112 being only 513mA, 11% low.

With all this seen, I put the amp back together, and felt better seeing my fears of potential failure not being realized.

Back in 2015, I had begun buying the IRFP240's and IRFP9240's in bulk, and screening them, sorting per Is/Vgs, and then for Vgs at 83V Vd/50mA Id for both. The nominal supply voltages on the SVT4-Pro is +/- 83VDC. In 2015, the N-Ch and P-Ch matched parts from Ampeg were about $13 ea, $130/ch, $260 per amplifier (both channels). The discrete parts were $1.65 & $2.10 ea, so a lot cheaper to screen them yourself. That was 3 yrs ago…prices have gone up since then both from Ampeg and distributor prices on the MosFET's.

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Now, I need to complete the re-assembly of the amp, as I've only gone as far as powering up the rear amp PCB assy. All put back together, powered it back up, everything is working, including Bridge Mono output. The Bright switch was intermittent, which seems a common aliment on these amps. I had to exercise the switch repeatedly for several minutes before it would reliably turn on the Bright mode. I haven't plugged in the bass, but, I've spent enough time on this amp, and feel confident all is well with it again. I still need to total my labor hours for both MosFET screening & amp repair.

1/22/19

Ampeg SVT4-Pro Asset # 106475 Prev Maint last svc'd 10/22/14 Start: 11:10AM
Stop: 1:10PM Est Inv # 1315

Pulling top cover. I had found one of the PCB mounting screws wedged along the side vent holes, and extracted it, so it has to get put back, unless I pull the main PCB out.

The N-Ch MosFET's are all running on the high side..30mV to 35mV typically, one at 42mV, one at 28mV, and all close, so that side looks fine. The current/power draw is 1.42A/123W @ 120VAC, so it seems nominal.

The DC Offset is less than 10mV. All the controls work. The EQ sliders are really stiff, hard to move in trying to 'fine tune' a tone setting. I'll pull that board and see what I can do about that. I suspect the only real way would be to pull each of the sliders, apply red grease on the insides and put them back together and back onto the PCB. I removed the Graphic EQ board, and pulled each of the EQ sliders off, opened them up, greased them, put them back together and re-installed them onto the PCB. I did manage to loose the detent ball bearing on the Gain Control

The Master Volume is gritty at the starting end of the pot, so I'm going to see if I can inject spray with my bent nozzle, otherwise I'd have to pull the PCB assy out, to get better access to it. I was able to inject spray, once I turned the amp on its' right side, and used the extender hose.

Getting at the P-Ch MosFET's to check bias is, as usual, near impossible on the Right Ch, and very tedious on the Left Ch. I never did pull the rear panel PCB's out to try and get at the P-Ch MosFET's. The AC mains current and the source potentials on the N-Ch MosFET's looked nominal, so I'll assume all is ok. Amp sounds normal, both in Dual Mono and Bridge Mono. And, as usual, it always seems to not have sufficient gain with my Burst Pink Noise generator, without using the extra gain on the EQ board. I also never found a missing screw hole to account for that extra screw I found lodged in the chassis/heat sink vent opening.

1/30/19

Ampeg SVT4-Pro Asset # 3216 Loose input jack(s). Start: 11:30AM Stop: 2:15PM
Est Inv # 1331

Pulling top cover, checking out the complaint. The rear panel has red tape over the NL4 outputs for the two channels, amp set up in Bridge Mono, which is NL4. My NL-4 to Locking Phone Jack adapter is MISSING! Not hanging up on the wall where it normally is, not on any cable. Where is it??? I wouldn't have left it plugged into anything that I returned, as it would be outright obvious. Not on the floor, looked in the corner amidst the power tube boxes, the cable is large enough that it wouldn't fall off the cable rack. I don't see any evidence of it having falling onto the floor back there, but, it's the only one I have for single Ch/Bridge Mode using 1+/1- pins. I have to have that adapter!!

It was hidden in plain sight under a fold in the towel on the bench. Onward.

I have the amp powered up on the bench, though cover is still in place. I am NOT finding ANY issues with the input jack, nor the Tuner Output jack, which works as an input, though 6dB lower. I'm using Switchcraft plugs, both as Pomona BNC/T-S plug adapter and on my 6ft T/S cable. The input jack is TIGHT, I can't get the plug to cause any dropouts. Now, if someone is using a different kind of plug on their cord that isn't mating, I can't control that. These jacks don't lock, and you can step on a cord and cause it to unplug. I don't want to pull this amp apart and replace the jack to have the same complaint. I will, though, dig out some other similar connector to check the fit.

The Plug dia on the sleeve is 0.247", and the opening of the chrome sleeve is 0.253" That's 0.005" clearance and with the contact tension of the jack's Sleeve and Tip leaf

springs, it holds and makes good contact. So, there just isn't an issue here. Neutrik's T/S plugs, including their Silent Plugs, are 6.29mm dia, which calculates to 0.248" dia. So, I don't see an issue here. Rean calls out the same dia.

Oh, what the hell. I'll remove the bloody PCB assembly, as it will rack up labor hours. I just don't see the need to replace something that's working. Maybe I'll find something on the PCB that IS causing dropout.

I did find some solder joint issues all over the PCB. While the connection from the wiper of the gain pot to the tube was ok, that trace passes on the outside edge of the PCB, and where there's a breakaway/cut-out on the front left corner of the board to clear the handle hardware, the trace is distorted as it passes thru that region, so just to be sure, I'm going to lay in a separate insulated 28AWG wire from the resistor lead to the pot wiper, and then glue it into place. I de-soldered and re-soldered all the solder joint fractures I found, so it was worth pulling the PCB out. But, I don't see any reason to remove / replace the input jack.

OK, the wire is in place, along with spots of RTV to hold it into place. Now, moving the chassis back to the bench to re-assemble everything. OK, the PCB is back into place, all hardware back on, top cover back on after verifying the amp was working normal. I'm letting it run a little while longer, before moving it back into the road case.

I moved the amp, in the road case to the check-out bench, and, to my surprise, the amp is NOT powering up. It WAS powering up sitting on the bench, not supported by rack rails, and off of the isolated variac. Now, just off the 20A GR Variac, thru the Valhalla power analyzer, it is NOT coming up. I swapped out the power cord, no change.

What's going on here?

Moving it to the test bench, to check again. It is NOT powering up now. So, pulling the amp back out of the rack, pulling the top cover off, and having a look to see what is going on here. I moved the two AC mains wires on the power switch to the other pair of contacts, and that got it working again. Bad switch contacts on the pair I was using? Very odd. I cycled powering up and down several times, all working. Put it back together, tried it at every step, back into the road case, still working. The fuse was fine (no longer a circuit breaker on this amp). It continued working, so I put the covers back onto the case and set it aside for pickup.

5/8/19

Ampeg SVT4-Pro Auntie M SVTIV-Pro-b No Output Start: 2:15PM Stop: 4:20PM

I pulled the top cover, after getting it out of the road case and onto the bench. Peering into the rear half of the main PCB, I saw a couple blackened 1/4W resistors. Fired up the Fluke to see how extensive the damage is. Ch A N-Ch MosFET's are shot, and I have open gate resistors on Ch B N-Ch MosFET's, so this looks expensive to repair. I have to pull the amp apart to get the main PCB out, then see how extensive the damage is. Chances are I'll be replacing both Channels' MosFET's, which won't leave me with many. I'll have to check to see what I charged CenterStaging on the screening process, as I'll need to replace these.

I'll send an email to Martyn once I have the main board out and have assessed the damage.

Channel A is a total failure….open gate resistors, Source resistors, all of the N & P-Ch MosFET's are shorted. Ch B appears to be ok, thankfully. That cuts the parts cost in half. I still have to come up with the cost of the output stage parts. This will no doubt take at least 4 hrs, if not more to repair, since both heat sinks have to come off, I have to replace insulators in the process. I still have the circuits ahead of the output stage to sort thru, as there's already known damage there.

I've removed the MosFET's, Source Resistors, open Gate resistors, some semiconductors and some resistors that died along the way. I'll have to make a list of what I've pulled in the morning. I also have to take inventory of what I have on hand in resistors to replace these, and add those to my next parts order.

5/09/19

Ampeg SVT4-Pro Auntie M SVTIV-Pro-b No Output Start: 11AM Stop: 4:30PM

Now making a list of parts needed, and verifying what I have/don't have.

47 ohm 1W MOS resistors, 7 pcs @ $0.10 ea
0.47 ohm/5W WW resistors, 7 pcs @ $1.23 ea
R125 1k 1/4W resistor @ $0.05 ea
R126 47 ohm (as above)
R134 100 ohm 1/4W resistor @ $0.05 ea
C114 10uF/35V NP Electrolytic Cap @ $0.50 ea
D116 1N4740A 10V Zener Diode @ $0.15 ea
Q109 MPS A56 PNP xstr @ $0.20 ea
Q110, 112, 114, 116, 118 IRFP 240 N-Ch MosFET, matched set @ $31.15
Q111, 113, 115, 117, 119 IRFP 9240 P-Ch MosFET, matched set @ $33.60

The current price of IRFP9240PBF 10-99 pc is $2.72 ea, and the IRFP240 is $2.23 ea 10-99 pc. My labor on the matching process was billed at 4 hrs on 10/23/18. So, 50 pcs @ $200 works out to $4 ea, so a matched N-Ch set would be $31.15 and the P-Ch set would be $33.60. I'll have to eat the part that failed, my fault from oversight.

I have all but the MosFET's installed, and have the heat sinks back onto the PCB, Fan/brackets on, power supply regulator on, though that may need to come off to get the P-Ch MosFET's into place.

I need to order more of the 0.47 ohm/5W WW resistors, P/N 71-CP5-J-0.47, 10 pcs to restock my inventory.

Now, looking at the MosFET's ratings on the back of the parts to select this amp's batch. For N-Ch parts, 20.0, 19.6, 19.2, 18.9 & 18.8, and P-Ch parts, -36.8, -37.0, -37.0, -37.4 & -37.5. That will leave me 10 pcs of each.

OK, I have the parts mounted, now waiting for the soldering iron to heat up and solder them into place. OK, that's done, along with some other solder touch-up that I missed the first time during parts replacement. I double-checked my work. Gathered up the failed parts into a lid, and now ready to install the power amp PCB assembly back into the chassis and wire it up. Powering up the first time ALWAYS makes me nervous. Got to remember to monitor the gate voltages so the previous bias setting doesn't turn the output stage on hard and kill all the work I just put in. Time for a cup of coffee, then proceed ahead.

I was NOT getting ANY bias readings on either the N-Ch nor P-Ch MosFET's of Ch A. I looked at Ch B, and was seeing 17mV. Re-connected to Ch A, with the meter across Output buss and N-Ch Source terminal. I attempted to adjust the bias pot AP101, and got no response at all on Ch A. I turned it back to about where it was, then connected one of the meters between Output buss and Gate on one of the N-Ch devices. As I turned up the voltage, I heard a pop and a blast of smoke billowing out from the P-Ch side! I've killed the amp! DAMN!!!

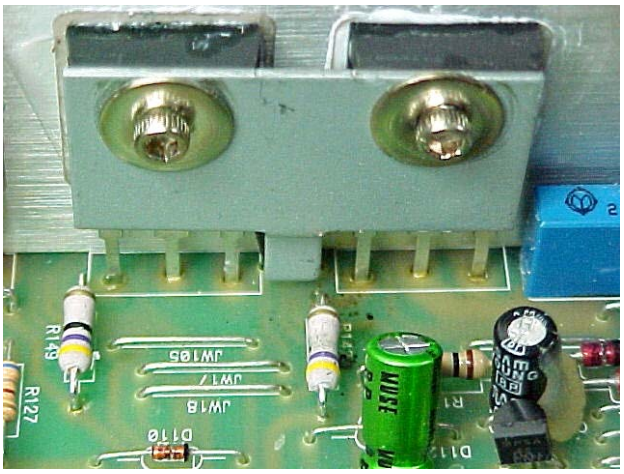
I hate this part when nothing is moving forward like this, then disaster follows! So, now I have to pull this completely apart again to see WHAT happened. I fear the worst. I've lost both the P-Ch parts, as well as the N-Ch parts. The P-Ch parts are all shorted. The N-Ch parts, while NOT hard-shorted, are NOT responding like working MosFET's in circuit as the Ch B parts do. So, I've just racked up a shit load of $$$ in this process! All of the Gate & Source resistors measure ok though. I don't see what I did wrong, though I was NOT getting ANY bias voltage on the source resistors. From a cold start, where should the bias pot be? From the schematic, showing AP101, if it's fully CW, then that would be turning off Q106/Q107, allowing the output stage to turn on hard, so it should be CCW, so they instead would be turning on, pulling the gates of the output stage lower, so no current flows. Nothing happened until I connected the DMM in DCV mode between the output buss and one of the gates. I don't see why that would have caused this failure. But, IT HAPPENED, SO MOVE ON!

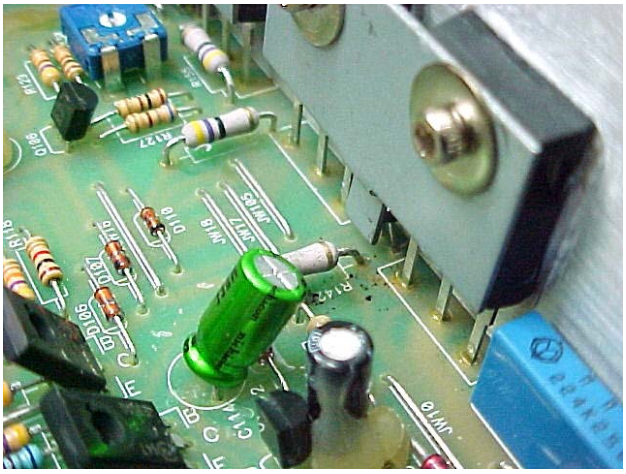
Apparently only Q111 shorted. Q113, Q115, Q117 & Q119 all behave normal, having unsoldered all of them. When I removed Q110, 112, 114, 116, 118, each of them behaved like a normal MOSFET, though NOT when installed in the PCB. Is that because of Q111, which physically cracked and shorted. Once I removed it, though I had already de-soldered those parts, they all tested ok. I've already re-mounted the N-Ch devices, though I have NOT yet soldered them back in.

And, in the course of Desoldering this time, I've had solder pad and trace failures occur, just to make my life pleasant!!! I removed the back side P-Ch parts, and then one by one, scraped off the insulators, so now I have to install greased Mica washers before putting those parts back into place. And, I now have to pull one of the P-Ch parts from the remaining 10 pcs, just to make life more miserable. Any chance I have some others that are close? The range on these is -37 thru -37.5. I'll look. Only one, a pull, with no markings. The other tube that had IRFP 9240's is empty, so I will have to use one of the remaining new parts. NOW, again….WHY did this FAIL????!!

I believe I have the answer now. Having found no spare P-Ch parts, and the next range jumped into the -50 range, I used a new set, and put the remainder of the previous set back into the tube…which I'll have to retest to be sure.

While applying the thermal grease & mica washers, then struggling to get them to pass back thru the PCB and not pull off the solder pads/traces, and registered them, as I went to put the first dual-device clamp into place, I found the finger that forces the TO-92 part up against the heat sink was touching the gate resistor in that same space. I had left the gate resistors proud of the PCB a touch, and, that was enough to make contact with the clamp, putting those at Ground potential! THAT's why I wasn't getting ANY bias! I still don't know why it just suddenly blew, but, that's what it did….cracked the case of the end P-Ch MosFET.





I have re-mounted and soldered in all the parts, but I still need to check all of the support devices due to this fault, and make sure I didn't also short anything else out. From these photos, it looks like I need to double-check that gate resistor, as it has overheated, enough that the black band has nearly disappeared.

5/10/19

Ampeg SVT4-Pro Auntie M SVTIV-Pro-b No Output Start: 11AM Stop: 2:30PM

I wrote up a thread on this misadventure, then replaced the other 10V zener diode that was measuring wrong, the 47 ohm gate resistor that got stressed, checked the other parts in the circuit that might have been damaged, and all appears normal.

I re-installed the power amp PCB, just mounting it and connecting the AC mains again, along with the secondary connections, and the two connections between the main PCB and the power supply PCB to the front Preamp board. I haven't installed any of the other boards thus far.

After powering it back up, with monitoring both N-Ch and P-Ch source terminals along with the output buss, I brought the supplies up slowly, watching the DC offset initially go high, until the rest of the power amp circuit began biasing up, then it settled down to low mV. I wasn't yet seeing source voltage, and had a screwdriver parked in the bias pot. After about a minute, I began seeing source voltage creep up, now controlling it. I found as it turned it CW, I hit a point where it would begin to climb abruptly, and backed away from that. I left it at first around 10mV, and both N-Ch & P-Ch were nearly identical, apart from their polarity. After being on for a few minutes at this potential, I turned it off

and on a few times, to watch how it would track up to where I had set it. AC mains current at this 10mV range was only around 1.15A. Turning the bias up to 25mV got it up to around 1.45A. On the P-Ch side, when it was still set lower, I sequentially moved the probe from Q111 all the way to Q119, and finding close to the same in all cases, so this is encouraging. That's harder to do on the N-Ch, as I'm presently facing the rear of the chassis. I finally set the bias up to 25mV (24mV & 25mV respectively) and let it set there for a while, having done this after it had been on for about 10 minutes.

I've shut it off, and will now wait before turning it back on, to see if it goes back to that. I did plug in sinewave into the Power Amp Input jack, no load, just monitoring the output on the analyzer. I could turn it up to yield a bit over 40VAC out, after which the vactec limiter prevented further output level. So, it's passing signal, and looks normal.

I will finish reassembling this after cycling it on and off a few times to watch the bias, then I'll heat up the heat sinks driving Ch B into a load, while watching Ch A. I'll then connect load to Ch A and see how this behaves, before putting it all back together.

This is working fine….turning up the Ch B side to increase the heat sink temp only affects it a little bit….like from 25mV to 27-28mV. Finally moved the load to the Ch A side, 4 ohm load, cranked it up to full power (40V), and back, just unplugging the signal from the PA input jack, and it drops right back down to nominal bias, actually a little under (23-24mV), so I think it's time to complete the assembly work.

Everything works, including Bridge Mono. Now, what did puzzle me was leaving the gain and volume setting alone, after listening to both channels in Stereo, then switching to Bridge Mono, and not hearing the output level increase by 6dB. Seems like it should, unless there's something in the gain structure that compensates for that. I don't see anything like that. The Bridge Mono circuit takes a sample from the unity gain input buffer to the power amp stage, passes it thru a unity gain inverting stage and into the Ch B input. So, that right there would say the output should be twice as high. I wasn't seeing the Limit lamp light up, so, maybe it was, and I just didn't hear it. I didn't have the SPL meter out and on to verify this.

I've put the top cover back on, and moved it back into the road case, so this is working and done.

12/09/19

Ampeg SVT4-Pro Asset # 3216 No Output Start: 11:15AM Stop: 3:55PM
Est Inv # 1553

Checking the LV power supply regulators….I forgot to check them when I had the amp all together. Not having seen any obvious faults yet, it could be there where the fault is.

I connected the +/- 20V from the Tek PS503A to the AC input header of the power supply PCB, to see if I had the correct voltages from the power supply regulators. I got +/- 15V nominal, and had correct voltages on all the outputs except for IC1, both outputs at -13.8VDC, which drives the output stage. Also IC3's output voltages were at near extremes….A & B neg, C & D positive. What is that IC in the circuit? IC3A & B drive the relay circuits, IC3C drives the Fan circuit, and IC3D is sourcing a reference voltage

to the Relay circuits. So, those would be other than audio potentials. Wetting my sponges for the soldering iron, and replacing IC1 with another 5532A IC.

Replacing IC1 with a new part caused the output to latch Positive instead of Negative. Now, that is probably due to the IC being inside the feedback loop. I tried connecting the Output line to it's feedback to 0V, but that didn't change anything. So, now I'll attempt to power up the output stage with the HP 6227B, which will only get me to +/- 25VDC. I don't know if it will be enough, but, I can hope. This time, I'll monitor the outputs. I also noticed something odd. Before, when I had the HP 3467A monitoring the outputs of the two bipolar regulators, I got the output relays to pull in. When I didn't connect those outputs to the DMM, the relays did NOT pull in, until I monitored them again. That doesn't make any sense. But, regardless, this time I'll connect them to the amp outputs down in the source resistor canyon.

I've just made matters worse. After finding I had installed a 5534 into IC1 instead of an IC5532, then corrected that, I was still getting positive latch-up on IC1's output. I had moved the 6227B into place, connecting its' +/- outputs to D3 anode/D4 cathode to apply up to +/- 25VDC to the busses. I was still getting negative voltage on the output busses. Noticing the terminals for the Tracking Supply wire connection wasn't really tight, I tightened that up, and now, the supplies are folding back to near zero voltage. It's the Positive Output that's folding back. I don't yet know what I killed, but, once again, I've damaged the HP 6227B power supply! So, not only do I not have a working amplifier, but now I have a bad power supply to boot! And, I still don't have a handle on what's wrong with the amplifier circuit!

It did make sense that IC1 was found to have latch-up problems, only replacing it hasn't changed anything, other than killing one of my lab supplies. I didn't have a lot of output current dialed in, so it does surprise me that this has happened. That's another project, I'm afraid.

So, now what do I do? If I remove IC1, and ground drive point of the output stage at R120, R121 & R111, along with R220, R221 & R211, that leaves the output stage as a single voltage-gain stage with MosFET follower, and if all is ok in the output & voltage gain stages, the output should go to near zero volts. I suppose I should first try connecting the xfmr wiring back up with the PCB assembly still outside the chassis, using the extension cables, and see if IC1 has made any difference.

OH….now I see why IC1 by itself will latch up. It's only with the full circuit that it is operates correctly, since the feedback is coming to the positive input, and not the negative input. It's the voltage gain stage flipping phase that sets it to be stable. Still not sure why the HP 6227B failed suddenly. I'll know more when I get this cobbled back together.

OK, I have the power xfmr wired back up to it externally, and I still have the same problem….both channels are going negative. I'll try replacing IC1 again, though this time with something else….how about a NJM2068D Dual Low Noise op amp? NO. Try an NJM4560D. That didn't change anything…the output is still latching up. Are my bipolar supplies coming up correctly? When I connected the other two HP 3467A channels to monitor them, the outputs are NOW remaining low offset….less than 5mV each channel, and the relays' are pulling in. So, I have a working amp again. Should I

try the NE5532A again in IC1? YES. I put it back in, it being a different IC, and now I have less than 1mV of offset. So, I'll return the NJM4560D to it's storage envelope. AND, now I can put this amp back together to see if I have a working amp again.

OK, the amp is reassembled. The upper right rear panel foot (left viewing rear panel) has been knocked out of alignment. The screw has been bent. I tried to pull the screw back into alignment, only to knock the pem nut out of the chassis. Metric thread, so I put the screw into the drill press vise, straightened it that way, put it back into the plastic rear panel foot, screwed it into the pem nut, then held it with my surgical needle nose pliers as I tightened it up firmly. We'll live with that upper corner bent inwards.

Now, ready to check the complete amp for proper function. Again, monitoring the output's DC levels. It's back to negative DC offset.

Is there something about having the outputs of the bipolar regulators being monitored that makes it work? Does that suggest solder joints on the power supply PCB, perhaps? Didn't I already remove that PCB for inspection?

I read my notes from last Friday, but there wasn't any mention of my having removed the power supply regulator PCB assy. But, I do recall removing it for inspection. Now, just for shits & giggles, I'm adding DMM cables to measure those outputs. I still have no idea why having DMM monitoring on those outputs made the outputs of the amp behave. I managed to get the output back to normal again, by both having cables connected to the DMM AND unplugging the bipolar supply outputs from the preamp board. With the bipolar output monitor cables removed, it's producing high offset. So, I have something flakey with the power supply board. Gotta tear this down partially…hopefully not all the way to get it off. I'll replace the two regulators, I guess. I went to remove the two IC's, after having desoldered their three terminal legs. That wasn't enough. The nuts were soldered to the bloody screws!!! I had to unsolder the stupid nuts in order to remove the screws and then remove the regulators. The heat spreader plate came off with them, as Thermoset had long since taken place, gluing the regulators to the insulator sheets (mica substitute), so now, I have to replace those with mica insulators and thermal grease.

It's now 3:55PM, and I've run out of time today.

12/10/19

Ampeg SVT4-Pro Asset # 3216 No Output Start: 9:45AM Stop: 11:45AM
Est Inv # 1553

Resuming where I left off with installing the replacement 7815T & 7915T IC Voltage Regulators & greased mica washers. I got the new regulators installed. I also found solder joint fractures on the AC input header pins, which I repaired while I was on the PCB. Somehow I missed those before….probably because I didn't have the loupes on when I looked at the solder joints….if I did, I just flat-out missed them. So, it's possible the two regulators I removed work just fine. I'll have to test them later, when there's time.

I put the power supply board back into place, re-assembled the rear boards & cables, and turned the chassis around to try again. Connected the two channels of monitoring on the power amps for any DC offset, and carefully turned up the AC mains. Both channels came up ok this time, with all the amplifier's DC loads present. Relays clicked in.

I then connected the output cable to the analyzer/scope, applied burst pink noise to the input, and turned up the gain and master. Output was frightfully low! With Gain at full, Master at full, I was only getting less than 3V RMS! So, something else is wrong.

I checked for +/- 15VDC on the preamp board, and that was present, so no mistakes made on the power supply board. I lifted up the chassis, standing it on it's power xfmr end, and plugged signal into the Power Amp A Input, and output cable into the CH A Output. I had plenty of signal there, so did the same for Ch B. Plenty of signal there as well. Changed to the oscillator from the Amber 3501a, and had full signal, with the Clipping Limiter engaged. So, the problem is NOT in the power amp.

I've dead-patched the inputs to the power amps, and now about to go looking for clues in the preamp section. Maybe just tubes? I have gain thru the Graphic EQ, so no problems there. This repair is taking a lot of time now, now past 7 hrs.

Patching thru the input, then dead-patching the power amp inputs, I wasn't getting substantial signal at the Preamp output. I connected the analyzer to the Send jack, and got a reference level from the input, only around 500mV. I removed the tube hold-down clamp and swapped the first preamp tube….presently out of new tubes. I selected a GT V2 preamp tube from a Hot Rod DeVille from sometime past, and inserted that into the input tube, and got a 6dB improvement. I then swapped the V2 tube in the SVT4-Pro with V1, and got a reduction again, so I swapped that tube with another from recent tube exchanges…not sure from where. That restored the loss. Then, tried a different tube on the output, this time changing to the Preamp Output, power amps still dead-patched. No difference.

I plugged the shop bass into the input at this point, to see what we have. I found the Master Volume pot REALLY gritty/noisy, so stopped to spray the dual-gang pot as best I could, reaching in with the right-angle nozzle. Exercised the control, and tried again. Now that pot is quiet…all the others appeared to be fine. Amp sounds ok again, so I put the top cover back on, finally done. 8 hrs labor on this.