

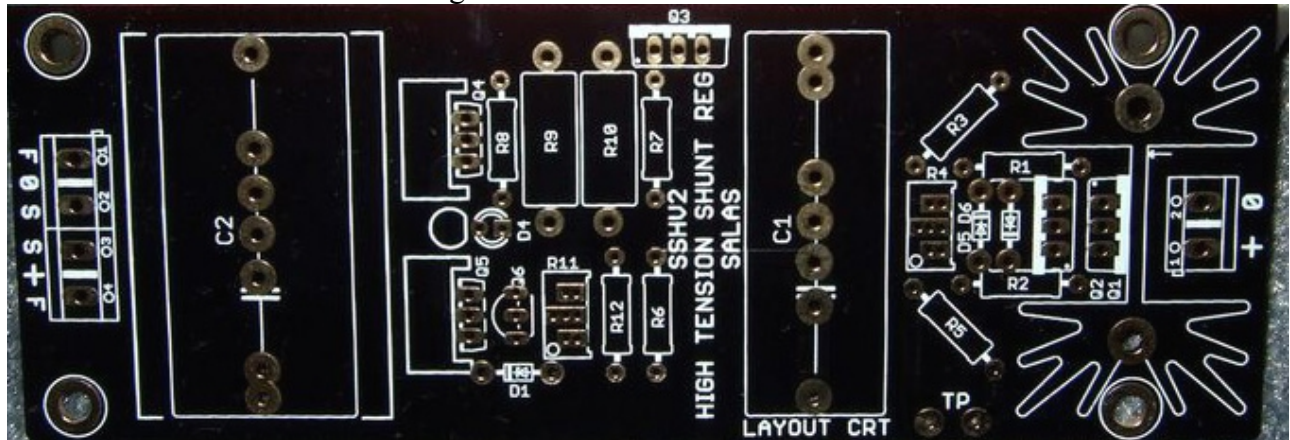
# A short guide to SSHV2 regulator (Salas Shunt High Voltage Two)

## 1. What is SSHV2:

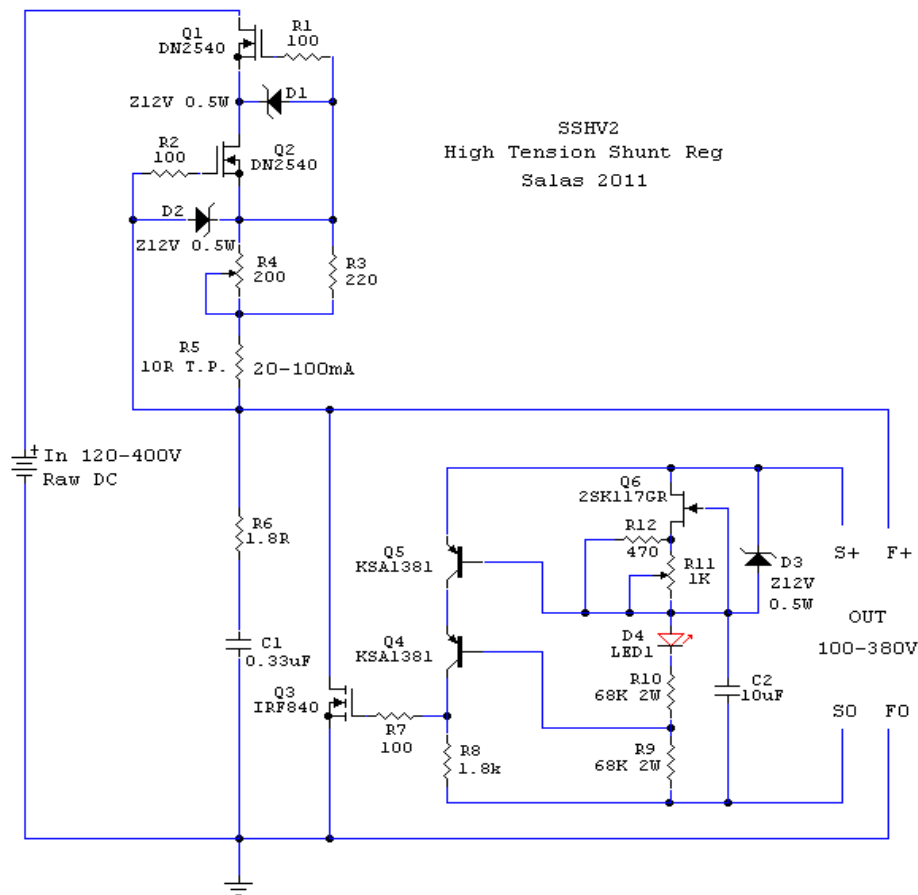
Its a constant current parallel high voltage regulator useful for powering tube circuits. Its an evolution of SSHV1 targeting easier setting, more stability, more subjective resolution.

## 2. Description:

There is an official PCB designed and tested for it which shall look like this:



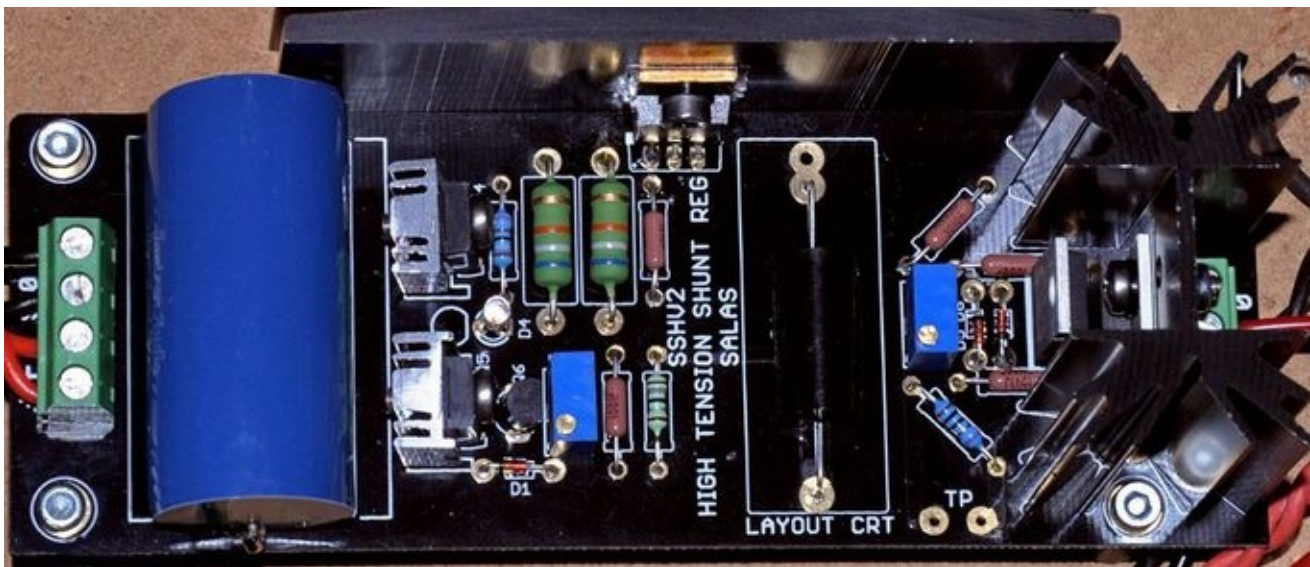
It implements this schematic:



For circuit description click this link: [CCT details](#)

### 3. How to build and test:

Populate the board. LED's cathode goes to square pad. Secure Q1 on its local sink, insulate it. Use a proper\* external sink for Q3, and insulate it. Get a dummy load resistor for simulating your target circuit's nominal consumption current at nominal B+ voltage. If you are making the reg for a preamp that needs 20mA @ 200V for instance, Ohm's law gives 10K ( $200/0.02=10000$  Ohm). Dissipation on it will be  $V_{\text{squared}}/R=4W$ . Use a 10W to avoid overheating it. The idea is to have safe but life like conditions to set the regulator and evaluate its working and heat emission order, before applying it to your precious real circuit. Attach S0 & F0 to one resistor's leg, S+ & F+ to its other leg. All 4 wires should be used always, there is damage danger even if not. Set R4 and R11 to middle positions. Attach raw DC short enough twisted cables to the regulator's input. 20V higher DC input than target DC output level is good drop over the regulator to work correctly. Power on. Quickly measure voltage between the two points marked TP. What you see there in mV is representing CCS mA times 10. If you target 50mA, you should turn R4 to read 500mV across TP for example. Your target current should always be your real circuits nominal consumption current plus 20mA spare for the reg's own proper consumption to good output impedance spec. Now measure voltage across dummy load resistor. Turn R11 until you reach target B+. Examine it for 15 minutes. If voltage drift is just a few volts and heat on sinks is acceptable, trim out the voltage drift with R11 and power off. Next is to remove the dummy load and attach S+ & F+ to your circuits B+ connecting point, also S0 & F0 to its PSU ground point. Use tightly twisted wire pairs for each point. Wire gauge is largely indifferent since this 4 wire technique that is called "remote sensing" is devised to ignore wire resistance. Just use manageable high voltage insulation wire. No need to keep the regulator board near hot tubes, its performance will stay the same for logical distances due to remote sensing. You get significant freedom of arrangement. A finished regulator shall look like this:



\*Q3 dissipates spare current times B+ in W. Calculate C/W spec sink for no more than 60C total temperature in hottest ambient conditions.

**4. Specifications:** 120V-400VDC input. 100-380VDC output. 20-100mA total current. 60dB open loop gain. 24KHz open loop bandwidth. 90 deg phase margin at 7 MegaHz. 11mOhm output impedance 20Hz to 20kHz for 20mA spare current . PCB 136x48mm double layer.

## Parts list:

Resistors (1/4W else otherwise noted):

R1,R2,R7=100 Ohm

R3=220 Ohm

R4=200 Ohm multiturn trimmer 0.5W top screw type

R5=10 Ohm

R6=1.8 Ohm

R8=1.8K

R9,R10=68K 2W (Up to 300Vout 1W permissible)

R11=1K multiturn trimmer 0.5W top screw type

R12=470 Ohm

Capacitors 400V MKP:

C1=0.33uF axial or radial

C2=10uF axial or radial

Semiconductors:

D1,D2,D3=12V 0.5W Zener

D4= 3mm Red LED generic

Q1,Q2=DN2540 DMOSFET Supertex

Q3=IRF840 MOSFET N channel

Q4,Q5=KSA1381 Fairchild (2SA1381 or "SA1381" Sanyo FBET)

Q6=2SK117GR Toshiba NJFET low noise ~ 4mA IDSS

Sinks:

On board 25.4mm pitch sink for Q1. See example Wakefield 647-10ABP

TO-126 mini sinks for Q4,Q5 (not necessary below 300Vout)

Outboard sink for Q3. 1-2C/W in most applications, see\* at the end of section 3.

Miscellaneous:

Insulation pads and grommets for two TO-220s, thermal grease, 3pcs 5mm pitch Molex connectors.

### Disclaimer1:

This regulator is not guaranteed to work on every load and raw DC situation without untoward reactions no matter it has shown proper behavior in all prototypes as for now. See to have smooth DC input without large turn on peak and not very reactive loads as minimum good practice. Keep last raw DC filter capacitor near enough the regulator's input, use twisted cables.

### Disclaimer2:

Building and testing high voltage circuits like this one takes extreme caution. There is hazard for serious accidents. If never done such circuits before, you are recommended to avoid this one. Read high voltage precautions guides available on the web. Its your own risk to proceed.

### Thanks:

To the "fellowship of the reg", namely crt for layout, vgeorge, Tea-Bag, Stixx, sonata149, for their dedication in organizing and testing the SSHV2 prototypes run and their invaluable feedback. Also to DIYA for its kind hosting, and to all supporters of "simplistic" MOSFET regulators for their long time encouragement.

**Salas February 2012**

