

## PS-50W500 Tube Amplifier Switching Power Supply

### Features

- Complete tube amp supply for 50W, class AB designs
- Compatible with 6L6, EL34, EL84, and 6V6 tubes
- Multiple outputs: B+, Heaters, Negative grid bias, Op-amps
- Fully regulated B+. User settable from 340V to 500V
- Fully regulated -60V Negative Grid bias.
- Universal input range: 100-240Vac, 47-63Hz
- Over-current protection, Over-temperature protection

### Benefits

- Stiff, regulated B+ provides “punch” and clean headroom ideal for high gain tube amps
- Adjustable B+ allows the designer flexibility when choosing the plate voltage.
- DC 6.3V heater eliminates hum on first stage preamp tube
- Light weight
- Replaces heavy “oversized magnetics” in high gain amps, including power transformer and choke.
- Universal input range eliminates export model design. Plugs in anywhere in the world

The PS-50W500 is an all in one AC/DC power solution intended for high gain 50W class AB tube amplifiers.

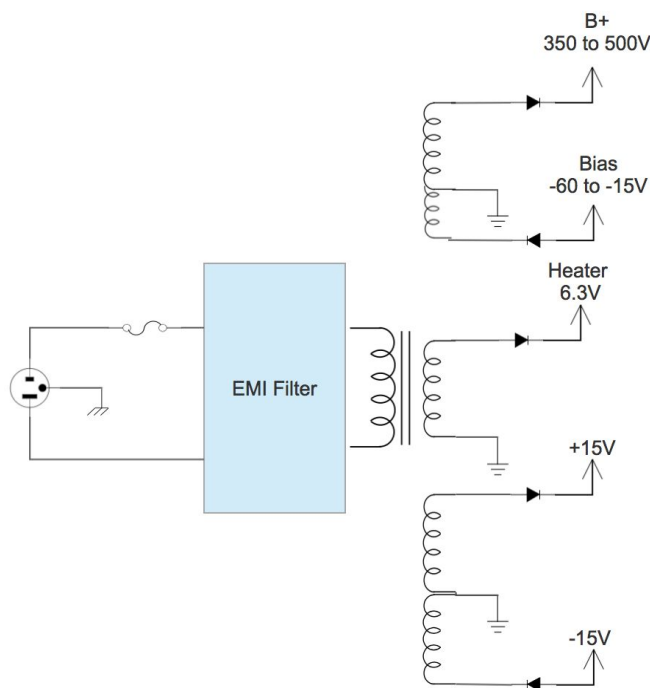
The fully regulated B+ provides the low end “punch” and clean headroom most high gain amplifiers get by using large, heavy transformers and chokes. The fully regulated B+ also eliminates all 120Hz ripple on the power section, meaning large chokes between B+ and the pre-amp section can be removed. The voltage can be adjusted from 340V to 500V by installing jumpers on a 0.1” header. The B+ output can drive power amps with 2x 6L6, 2x EL34, 4x EL84<sup>5</sup> or 4x 6V6 tubes without being overloaded.

The 6.3Vdc output provides power to all pre-amp and power-amp tube heaters. Having a DC supply for the first pre-amp tube is critical for high gain amplifiers. The 6.3V supply can also be regulated down to 5V and 3.3V for logic gates, microcontrollers, and other digital ICs.

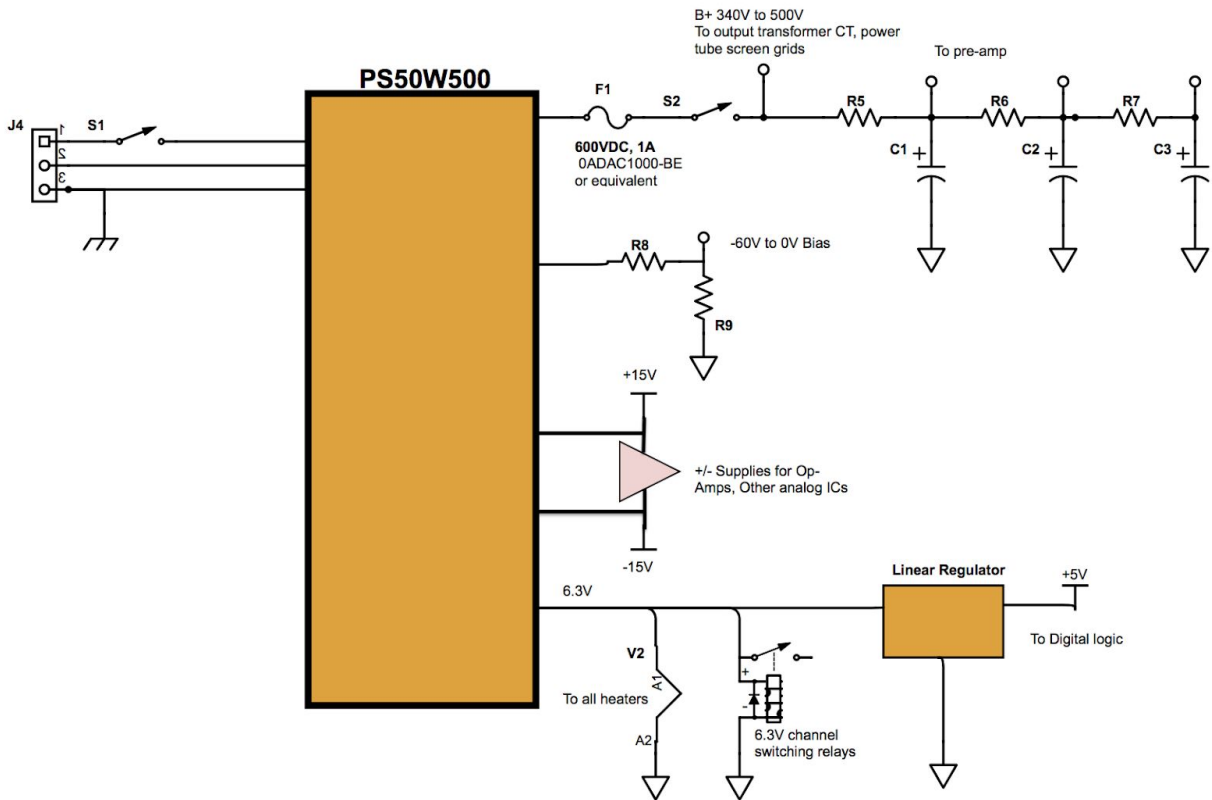
The Negative grid bias output provides the bias to the power amp. The output is a -60V voltage source with a 1-63K user settable Thevenin resistance. Bias voltages from -60V to 0V can be achieved with an external resistor to ground.

A ±15V output can be used for low voltage analog circuits like FX loop buffers and headphone outputs.

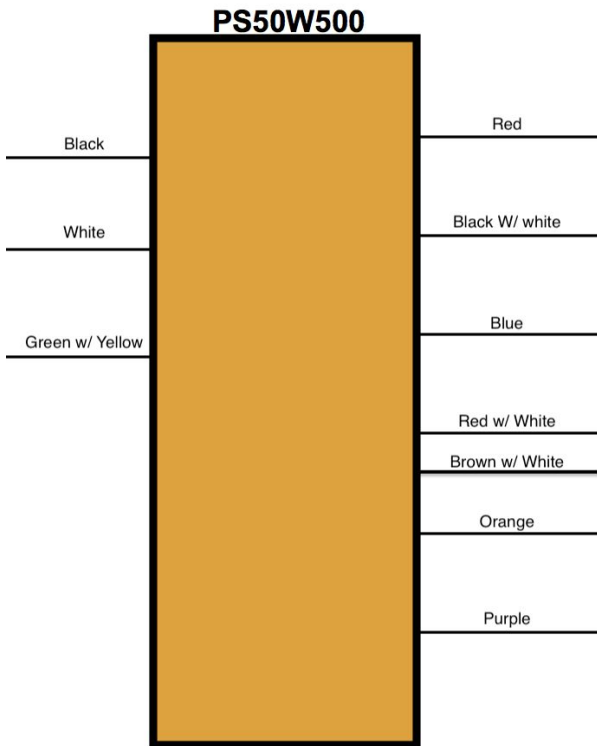
### Simplified Internal Schematic



## Typical Application



## Wiring Diagram



<b>Black</b>	<b>AC Line</b>
<b>White</b>	<b>AC Neutral</b>
<b>Green w/ Yellow</b>	<b>Earth Gnd</b>
<b>Red</b>	<b>B+ Output</b>
<b>Black w/ White</b>	<b>Analog Gnd</b>
<b>Red w/ White</b>	<b>+6.3V Heater</b>
<b>Brown w/ White</b>	<b>Heater Gnd</b>
<b>Orange</b>	<b>+15V</b>
<b>Purple</b>	<b>-15V</b>

## Electrical Characteristics

All parameters at 25C case temperature unless noted otherwise.

<b>Parameter</b>		<b>Test Condition</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Units</b>
<b>B+ Output</b>						
B+	High voltage output		340		500	V
	Setpoint Resolution			5		V
	Setpoint Accuracy	I <sub>out</sub> = 80mA <sup>1</sup>	0.1	.5	1	%
	Line regulation	425V setpoint , 100-240Vac			2	%
	Load regulation	425V setpoint, 6L6 power amp	.5	1	2	%
	Ripple Voltage	I <sub>out</sub> = 80mA <sup>1</sup> , 20MHz Bandwidth			0.1	V <sub>pk-pk</sub>
	Short Circuit current	V <sub>in</sub> = 240Vac	2	2.5	3.5	A

<b>Negative Bias output</b>						
Vbias	Negative Gate bias	Ibias = -1mA <sup>2</sup>	-61.2	-60	-58.8	V
	Setpoint Accuracy	Ibias = -1mA <sup>2</sup>	-2		2	%
Ibias	Output Current	See note 2, Application section	-5		0	mA
<b>Heater Output</b>						
Vheat	Heater voltage	Iheat = 3.3A <sup>3</sup>	6.0	6.3	6.6	V
	Ripple Voltage	Iheat = 3.3A <sup>3</sup>			0.1	Vpk-pk
Iheat	Heater Output Current				4	A
	Short circuit current	Fault condition		6	7.7	A
<b>Analog Supply Outputs</b>						
Vana	Analog supply voltage		±14.7	±15	±15.3	V
	Ripple Voltage	Measured from each rail to ground			0.05	Vpk-pk
Iana	Output Current	Measured from each rail to ground			±0.5	A
	Short circuit current	Measured from each rail to ground			±0.5	A
<b>Input Characteristics</b>						
Vin	Input Voltage, operating		100		240	Vac
	Input Voltage, non-operating				264	Vac
Iin	Input Current	Vin = 100Vac			2.0 <sup>4</sup>	A rms
	Internal fuse rating			3.5		A rms
Freq	Input Frequency		47		63	Hz
Pdiss	Power dissipation	Vin = 100Vac, B+ = 425V,		10 <sup>1</sup>	17 <sup>4</sup>	W

<b>Notes</b>	
1	Condition where standby is on, no guitar signal. Two power tubes biased at 35mA each, four 12AX7 preamp tubes biased at 1.25mA per triode
2	Choose external bias resistor so I <sub>bias</sub> does not exceed 5mA.
3	I <sub>heat</sub> = 3.3A for designs with two 6L6 power tubes, five 12AX7 pre-amp tubes.
4	Maximum power dissipation and current draw measured while playing any Pantera riff
5	While the B+ can supply 4x EL84 tubes, the 6.3V heater will use 3A of a possible 4A. The remaining heater current can power at most 3 pre-amp tubes.

### Thermal Characteristics

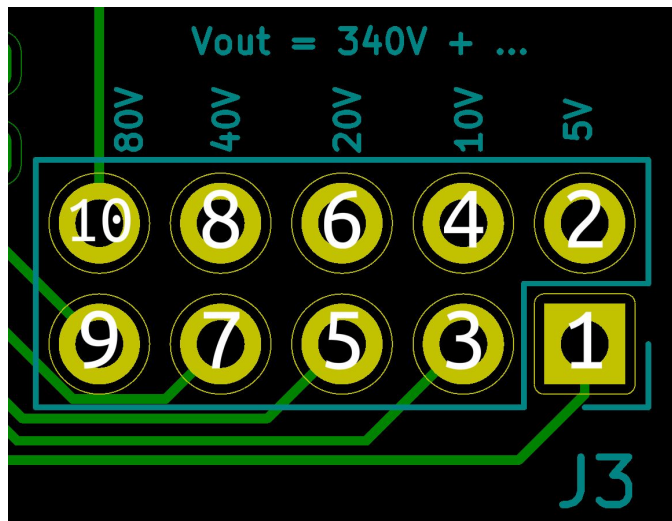
<b>Parameter</b>		<b>Test Condition</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Units</b>
T <sub>case</sub>	Maximum case temperature				85	C
P <sub>diss</sub>	Power dissipation	V <sub>in</sub> = 100V, B+ = 425V,		10 <sup>1</sup>	17 <sup>4</sup>	W

## Application Information

### B+ Voltage Adjustment

The B+ output can be adjusted from 340 to 500V with 5V resolution by installing jumpers. With no jumpers installed the B+ voltage will be 340V. Installing a jumper will add 5, 10, 20, 40, or 80V, as indicated on the PCB. Installing multiple jumpers adds all values to B+. This allows the output voltage to be set from 340 to 500V with 5V resolution.

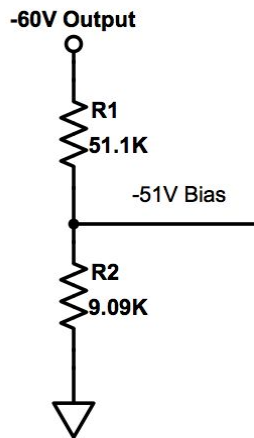
Example: Set B+ to 465V.  $465 = 340 + 80 + 40 + 5$ . Install the 80V, 40V, and 5V jumpers.



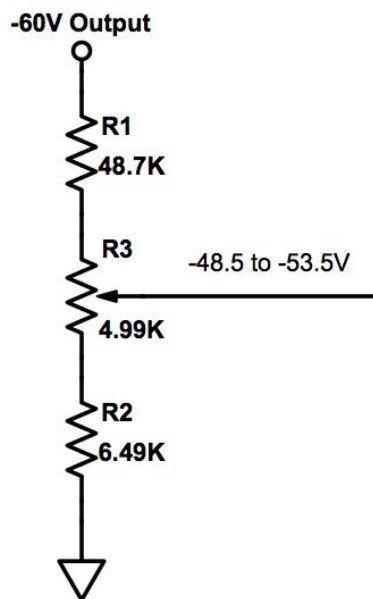
### Vbias Output

A 60V zener diode provides -60V bias which can sink up to 5mA. Ensure the total resistance to ground is at least 12K. For convenience, choose the total resistance to be 60K. This sets the bias voltage in kOhms.

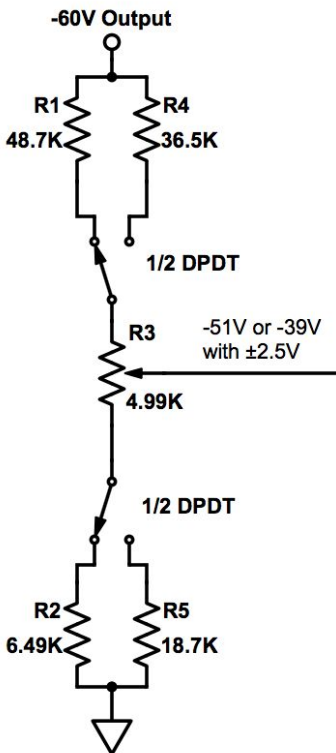
Example 1: Set the bias to -51V for fixed bias amps.  $60 = 51 + 9$ . Choose  $R1 = 9K$ ,  $R2 = 51K$ .



Example 2: Set the bias to  $-51V \pm 2.5V$ . Choose  $R1 = 6.5K$ ,  $R2 = 48.5K$ ,  $R3 = 5K$  pot.



Example 3: Add a DPDT bias select switch for EL34 or 6L6, with  $\pm 2.5V$  adjustment. Note that each path adds to 60 kOhm



### Heater Supply

The 6.3V heater supply has a maximum continuous output of 4A. This is the highest power low voltage supply available. Channel switching logic, relays, digital circuits and micro-controllers should be powered from the 6.3V outputs.

Analog circuits in the audio signal path should not be connected to this supply to reduce noise.

### Analog Supplies

The  $\pm 15V$  supply can be used for op-amps in the audio signal path. This is ideal for FX loops, headphone outputs, and analog onboard effects. Analog circuits running at lower voltage should use a linear regulator from the +15V supply, rather than from the 6.3V supply to reduce noise in the audio path.

### Protection Features

The B+ output is over-temperature protected. When the B+ output reaches an internal temperature of 125 °C, all outputs will shut down. All the outputs will restart when the B+ output reaches 115 °C.

The B+ output is not fully over-current protected. If the B+ output current exceeds 1.1A, the output voltage will sag. If the voltage sags below 330V, the output current will increase beyond



1.1A. The B+ output should be fused with a 1A, 500V, fast blow fuse. A lower current fuse can be used for low power designs.

All low voltage outputs are over-temperature and over-current protected. OTP and OCP levels are as follows:

	<b>Over Temperature Protection (°C)</b>	<b>Over Current Protection Level (A)</b>	<b>Notes</b>
<b>B+</b>	125	N/A	Use 1A external fuse, OTP shuts down entire converter
<b>-60V Bias</b>	125	-0.005	
<b>6.3V Heater</b>	140	7.5	
<b>±15</b>	150	0.5	

### **Thermal Considerations and Mounting**

The case of the PS-50W500 must be kept below 85 °C to prevent thermal shutdown.

The PS-50W500 uses its bottom surface for cooling. In most situations, the PS-50W500 can be mounted to the amplifier chassis for cooling. The amplifier chassis should act as a heat sink. Thermal grease, or a thermal pad should be used between the amplifier chassis and PS-50W500. In some situations, an external heatsink may need to be added to the bottom side of the PS-50W500. In rare situations, a fan can be added for airflow across the bottom of the PS-50W500 chassis. If a fan is used, it should be powered from the 6.3V heater output.