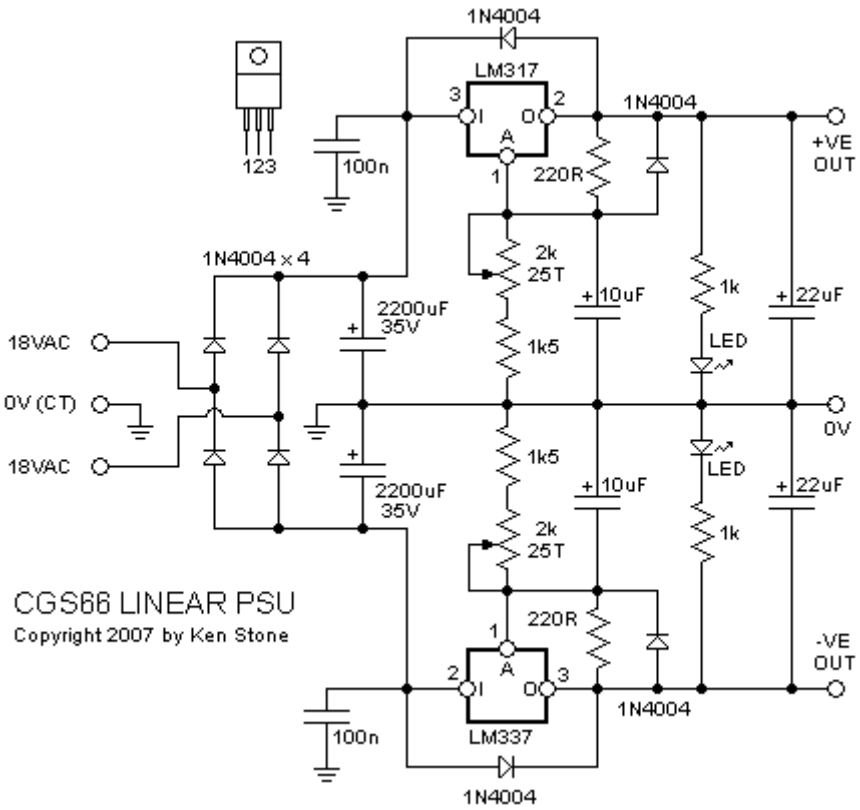
Power Supply

for music synthesizers.

Note: this project may require wiring a transformer to the A.C mains. This is best left to people who are qualified to do so. Where possible, use a plug-pack, wall-wart or line-lump, or other product where the mains wiring has already been done.

The Power Supply is a companion or alternative to the CGS14 +/- 15 Volt Power Supply. It is suitable for use with VCOs and more "analog" modules. It is of course quite capable of driving the noisier digital modules too, and in all likelyhood will do a better job than the CGS14.

A little on how it works:



The schematic for the Power Supply.

The incoming AC power is rectified, then filtered. The filtered DC is regulated by the positive and negative voltage regulators. The regulator minimum load requirements are met by placing a LED and its associated resistor between each output and the 0 volt (ground) line. Capacitors are placed close to the input, adjustment and output pins of the regulators to improve stability and transient response. Two additional diodes per regulator protect the regulators should the outputs be shorted together, or should a voltage be fed into the output of the power supply. It is very much a standard configuration, detailed in many data books.

When fed from a 30 volt center tapped transformer (15v-0v-15v) you should be able to pull around 200ma at +/-15 volts from the PSU without problems, and notably more at +/-12V output. If using for +/-15 volts there will be minimal heat generated by the regulators because they will be running close to their minimum voltage drop, though you do risk ripple getting through to the output as the load increases.

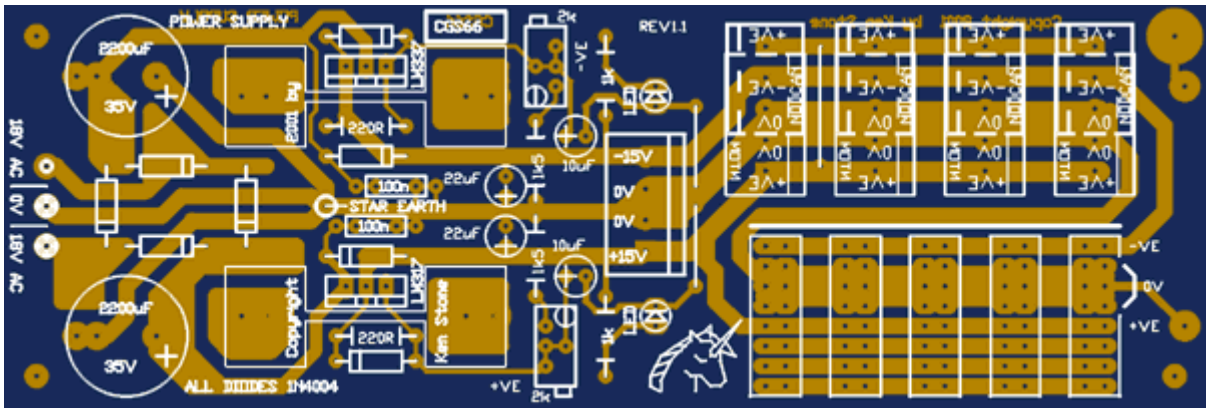
When fed from a 36 volt center tapped transformer (18v-0v-18v) you should be able to pull around 600ma, at +/-15 volts, from the PSU without problems. There will be a fair amount of heat generated by the regulators and diodes, so make sure there is adequate airflow around the board. 600ma is close to the maximum D.C. current you can draw from this PSU when powered from a 1 amp transformer. You may also wish to use 3300 mfd 25 volt capacitors instead of the specified 2200 mfd.

Drawing more than 600ma, while possible with a larger transformer, is not recommended, as there is inadequate heatsinking on a number of components, and the electrolytic capacitors are much too close to the heatsinks.

Another factor limiting the maximum current that can be drawn from the unit is the size of the heatsink. With 600ma being drawn, each regulator can easily be dissipating 6 watts, and will require a heatsink with a rating of 12°C/W or better to operate in an ambient of 25°C. As heat in an enclosed space may well be greater than this, I'd recommend going for the best heatsink of the correct profile you can get. Hobby shops in Australia have them available at 8.5°C/W (50 mm) and 11°C/W (40 mm), depending on the shop, though I have used 63 mm heatsinks I salvaged from old switch-mode power supplies. The profile used is simply listed as PCB mount TOP-3 in the local catalogs.

As a note of interest, the prototype was tested running from a HP printer line-lump with a 10v-0-10v coil, the supply outputting +/-12 volts for driving Eurorack modules.

Construction



The component overlay for the Power Supply.

Before you start assembly, check the board for etching faults. Look for any shorts between tracks, or open circuits due to over etching. Take this opportunity to sand the edges of the board if needed, removing any splinters or rough edges. (With the boards supplied by me, the edges are already milled, and etching faults are very rare.)

When you are happy with the printed circuit board, construction can proceed as normal, starting with the resistors first, followed by the IC socket if used, then moving onto the taller components.

Take particular care with the orientation of the polarized components such as electrolytics, diodes, transistors and ICs.

The easiest way to install the regulators is to mount them on the heatsinks before installing them and the heatsinks on the PCB. The heatsink mounting holes may need enlarging to accommodate the pins of your selected heatsink. The heatsink I have used is of a very common extruded profile and is available in differing lengths. See above for more details.

Notes:

- There are some variants of the regulators with different pin outs. Make sure you get the right sort.
- The very first run of PCBs (No ver number) have a few small errors on it. The 1N4004 around the LM337 is backwards, and a 220R resistor goes to the wrong place. This requires a track to be cut (already done by me) and a link to be added as marked on the board in marker. The 10uF capacitor beside the -15V pin of the 4 pin MOTM style connector is also shown on the overlay backwards.
- On the REV1.1 board, the 10uF capacitor beside the -15V pin of the 4 pin MOTM style connector is also shown on the overlay backwards. The other errors have been corrected.
- There is a pad available at the center of the star earth for those who need it.
- The negative regulator is at the TOP of the board, so the schematic layout is a mirror of the actual PCB layout when viewed from above.
- The LEDs could be mounted on the front panel of the synthesizer as indicators.
- Though I have specified 1N4004 diodes, any power diode with at least 100V PIV and a current rating of 1 amp could be substituted.
- If you are planning on running this unit hard, it may be appropriate to use a pair of chassis mounted electrolytic capacitors for the filter capacitors, as the heat from the heatsinks may cook them if they are left on the PCB. Keep the leads as short as possible.
- If using +/- 18 volt regulators you may need to use 50 volt electrolytics, as depending on your chosen transformer, the rectified DC may be too close to the limit of 35 volt electrolytics for comfort.
- Can this PCB be used with a conventional AC-wall-wart (two AC wires out)? A center tapped transformer is better, though it is possible to use a wall-wart between CT (the 0V connection on the PCB) and one 18V AC connection. The required pads are marked with large white circles. The result will be half wave rectification. If you use larger caps (3300uf) and limit the loading, you will be okay. My test bench power supply had been running like this for years. Watch the output with a CRO if you can, to find the limit. If you really wanted to, two wall-warts could be used, each between one of the 18V connections, and commoned at the CT connection. You'd have to make sure the phases were right though. With the one wire from each of the wall-warts connected together, measuring across the other two wires should give you something like 36 volts. If it gives you 0 volts, you will need to swap the wires from one of the wall-warts.
- **PCB info:** 2" x 6" with four 3mm mounting holes 0.15" in from the edges.
- Please email me if you find any errors.

Parts list

This is a guide only. Parts needed will vary with individual constructor's needs.

If anyone is interested in buying these boards, please check the PCBs for Sale page to see if I have any in stock.

Can't find the parts? See the parts FAQ to see if I've already answered the question. Also see the CGS Synth discussion group.

Part	Quantity
Capacitors	
100n	2
10uF 25V	2
22uF 25V	2
2200 uF 35V	2
Resistors	
220R	2
1k	2
1k5	2
2k - 2k5 25 turn trimmer	2
Semi's	
3mm or 5mm LED	2

1N4004	8
LM317	1
LM337	1
Misc.	
TOP-3 heatsink	2
0.156 4 pin connector	as required
DIP Headers	as required
CGS66 PCB	1

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