

Assembly Manual

UNIVERSAL POWER SUPPLY

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K-3435



Mini Short Form Kit

There is more than one way to skin a cat they reckon, and the same applies to designing a power supply. This small board enables you to obtain +15V, -15V or $\pm 15V$ DC from a number of different transformer and rectifier combinations.

It's a problem that has confronted us on a number of occasions over the years; many circuits require $\pm 15V$ DC rails or one or the other and, in each case, a suitable printed circuit board has to be designed. So we decided to solve this problem for a number of different transformer combinations.

One common situation is when you are powering a circuit from a 12VAC plugpack transformer but you want $\pm 15V$ rails, using 3-terminal regulators. Sounds difficult? Nope, piece of cake. Just use two half wave rectifiers to obtain the positive and negative rails and then follow with the regulators.

Or maybe you have a more conventional situation with a 12VAC transformer such as the Ferguson PF2851 (or equivalent). To obtain 15V DC the circuit is the same. But if you have a 30VAC centre-tapped transformer you then use a bridge rectifier, followed by the filter capacitors and 3-terminal regulators.

Anyway, you get the general idea. We are presenting one PCB pattern and showing how to use it in four different ways, depending on what your requirements are and what transformer you are using. Actually, there are other options and we'll mention those later.

The board measures 71 x 52mm

(code 04106881) and was used for the first time in the Studio 200 Stereo Control Unit, part two of which is featured elsewhere in this issue. We'll be using it again in a few months' time.

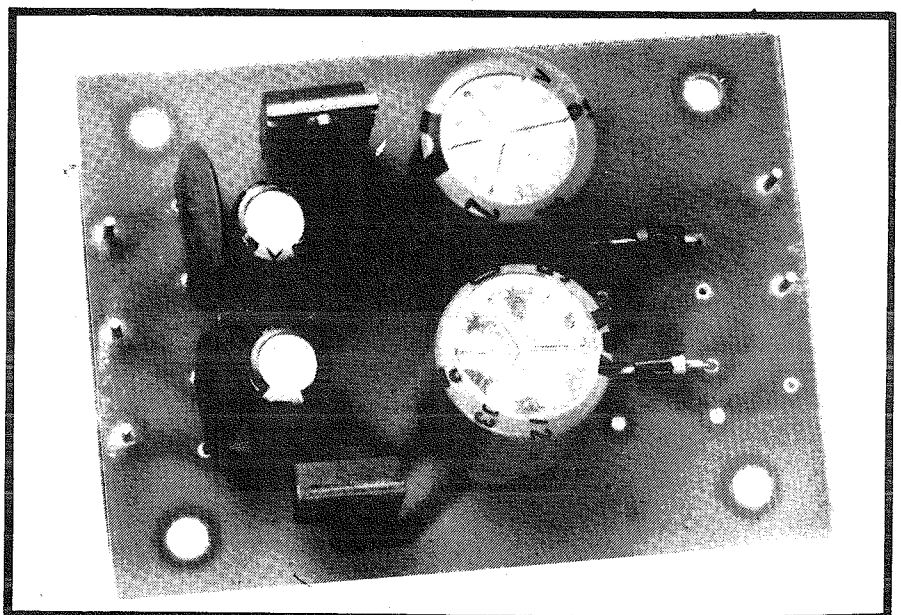
The circuit variations

Fig.1 shows the first circuit situation presented above and could be

used with a 12VAC plugpack or with any chassis mounting transformer with an output voltage of 12 to 15 volts AC. You can regard the circuit in two ways. First, as two half-wave rectifiers, D1 and D2, producing filtered but unregulated DC supply rails of $\pm 18-22V$, depending on the transformer secondary voltage.

The other way of regarding the circuit of Fig.1 is as a conventional half-wave voltage doubler circuit which has been "centre-tapped" at the junction of the two 1000 μ F capacitors. Either way, the result is the same.

Because D1 and D2 function as



This version of the universal power supply board uses half-wave rectifiers and two 3-terminal regulators to give $\pm 15V$ rails (see Fig.1). Note that the LED indicator circuit was added after this photo was taken.

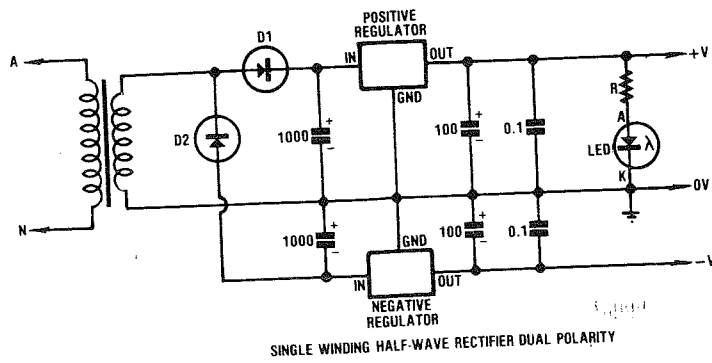


Fig.1: this dual polarity version uses a 12-15V transformer to drive half-wave rectifiers (D1 and D2) and two 3-terminal regulators.

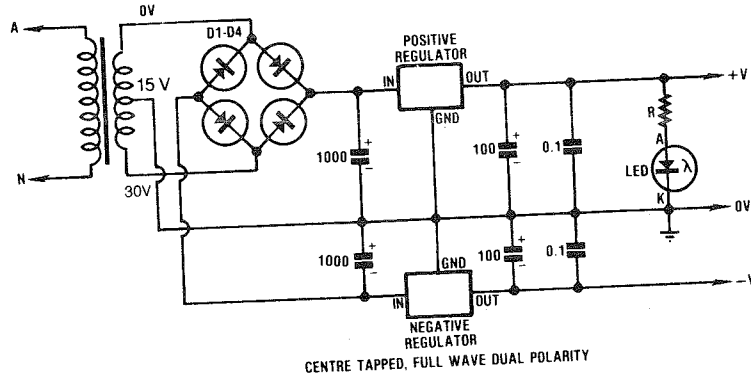


Fig.2: in this circuit, a centre tapped transformer and bridge rectifier are used to drive the 3-terminal regulators.

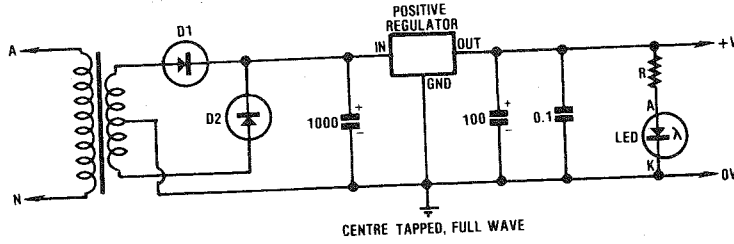


Fig.3: this single supply circuit uses D1 and D2 to provide full wave rectification from a centre-tapped transformer.

half-wave rectifiers, the ripple voltage superimposed on the DC supplies will be 50Hz. This may or may not be a problem but, for a given current drain from the supplies, the ripple voltage will be slightly more than twice the 100Hz ripple obtained if the bridge rectifier circuit of Fig.2 is used.

Fig.2 may be used with the 30V centre-tap M-2855 transformers. Following the bridge rectifier diodes, the unregulated DC voltage will be again be 18-22V, depending on the transformer.

The 3-terminal regulators to be used will normally be 7815 or LM340T-15 (or other variants) for the +15V supply. For the negative rail, the equivalent types are 7915 or LM320T-15 (or other variants). The output side of the regulators have 100µF and 0.1µF capacitors

connected to ensure good transient response and stability. We also made provision for a LED (light emitting diode) power indicator fed via a resistor from the positive supply.

Single supply versions

Fig.3 is a single supply version of the board using a 30V centre-tap (CT) or 24V CT transformer. Here, D1 and D2 provide full wave rectification and the resulting ripple is 100Hz. The unregulated DC voltage will be between +18-22V.

Fig.4 is a single supply circuit using a 12 or 15V transformer feeding a bridge rectifier. Again, the unregulated DC voltage will be between +18-22V with ripple at 100Hz.

All the circuits presented here are good for several hundred

milliamps but those which use full wave rectification will naturally be able to extract more current from the given transformer.

If you want more current, a bigger transformer will be required and the regulator(s) will have to be fitted with heatsink(s). It is also a good idea to go for bigger filter capacitors; ie, 2200µF or 2500µF, instead of the 1000µF units shown on the circuits.

Less than 15V supplies

Want less than 15V? No problem, you can install 12V regulators instead although for a given current drain their dissipation will be slightly higher.

You can also go for 5V or 8V regulators if you wish although then it would be wise to reduce the transformer secondary voltage

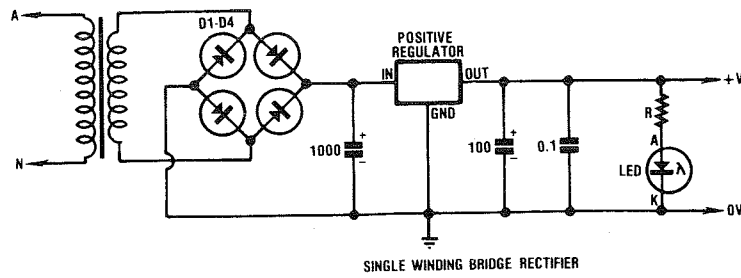


Fig.4: single supply version using a 12-15V transformer and a bridge rectifier. The unregulated DC voltage will be between 18-22V.

from 30V CT to 15V CT for Fig.2 and to around 6-7V for Fig.1.

The LED current limiting resistor can be 1.5kΩ for +12 or +15V outputs, reduced to 680Ω for 8V outputs and to 470Ω for 5V outputs. The LED can be omitted, of course, in which case the limiting resistor can be left out too.

Other variants

You can also produce a single (positive) supply version of Fig.1 if you wish, by leaving out D2, the negative 3-terminal regulator and the three associated capacitors. Or,

if you want a negative supply version, leave out D1, the positive 3-terminal regulator and its three associated capacitors.

Wiring them up

We have shown four wiring diagrams for the circuits depicted in Figs.1 to 4. There are only two particular wrinkles to watch out for when wiring up these boards. First, watch out for the polarity of diodes and capacitors. Second, note that the pinouts for the positive and negative regulators are not the same.

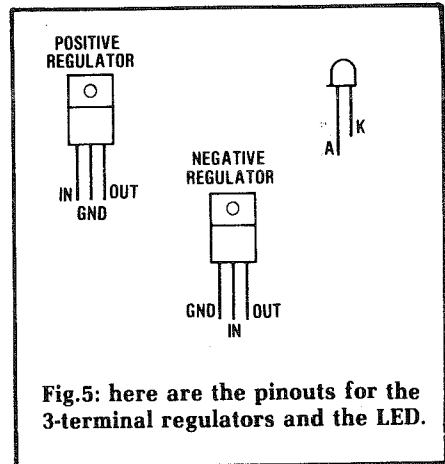


Fig.5: here are the pinouts for the 3-terminal regulators and the LED.

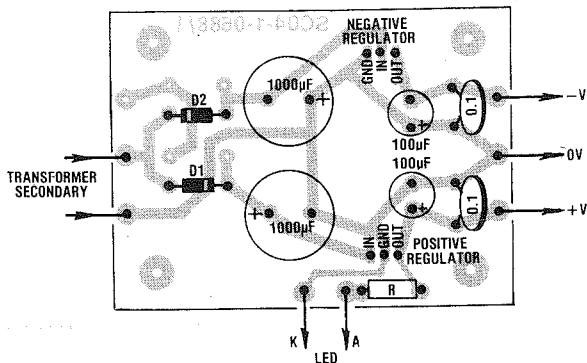


Fig.6: parts layout diagram for the circuit shown in Fig.1. The value of R depends on the supply rail (see text).

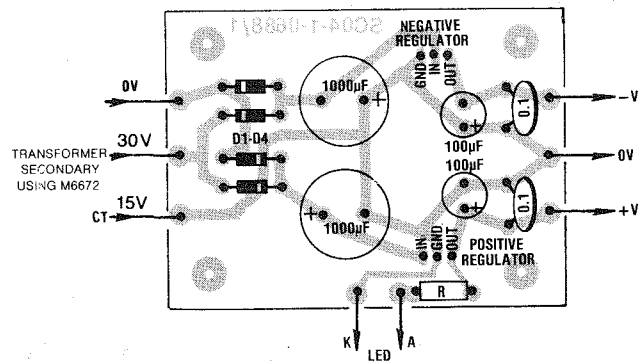


Fig.7: this parts layout diagram corresponds to the circuit shown in Fig.2. Take care with component polarity.

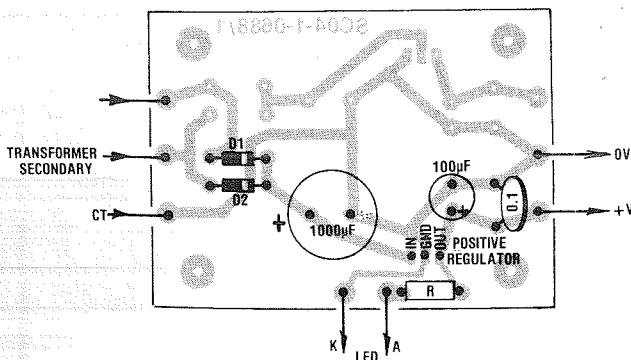


Fig.8: parts layout the single supply version shown in Fig.3. A centre-tapped transformer must be used.

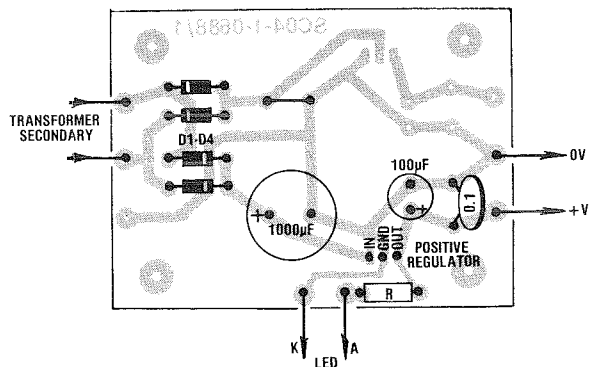


Fig.9: parts layout for the circuit shown in Fig.4. Don't forget to install the wire link.