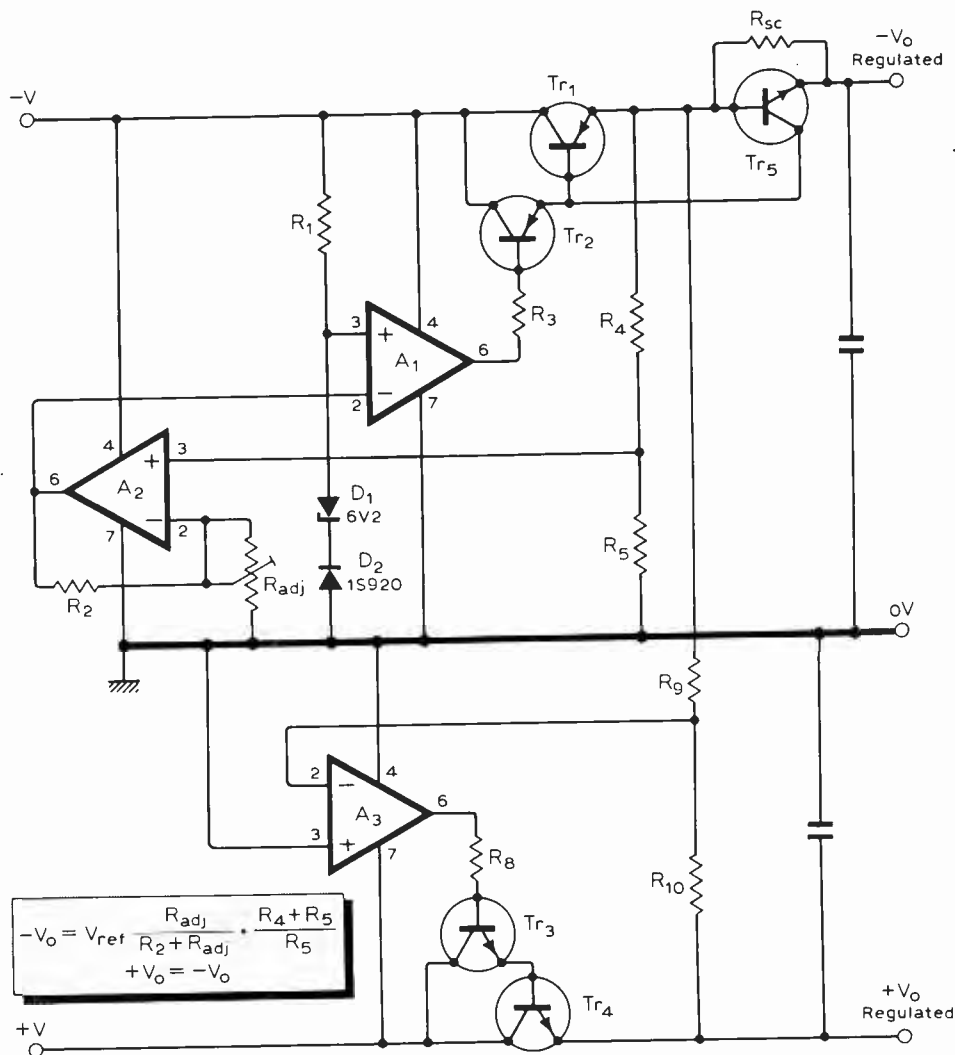


## Adjustable tracking voltage regulator

BOTH OUTPUTS of this regulator can be adjusted simultaneously by one potentiometer. Diodes  $D_1$  and  $D_2$  act as a reference, where the positive temperature coefficient of  $D_1$  is cancelled by the negative temperature coefficient of  $D_2$ . Amplifier  $A_1$  regulates  $-V_0$  so that the output of  $A_2$  is always at the reference voltage. Amplifier  $A_3$  has its non-inverting input connected to 0V and the point between  $R_9$  and  $R_{10}$  is also at 0V. Because  $-V_0$  is fixed,  $+V_0$  has to be regulated at the same voltage as  $-V_0$ . Resistor  $R_9$  equals  $R_{10}$ ,  $R_4$  and  $R_5$  are scaled to give a constant  $K$  so that  $-V_0$

$$= V_{ref} \cdot \frac{R_{adj}}{R_3 + R_{adj}} \cdot K.$$

$R_{11}$  acts as a current sense resistor, and provides a current limit of approximately  $\frac{0.68 \text{ A}}{R_{11}}$ .  
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## Negative supply for op-amps

A SINGLE TIMER i.c. used as an astable multivibrator can provide a 200mA negative supply from a positive rail voltage. The square-wave output drives a diode-clamp consisting of  $C_1$  and  $D_1$ . Components  $C_2$  and  $D_2$  smooth the squarewave to give a negative d.c. output. With the component values shown the oscillator frequency is about 2kHz, but any value between 1kHz and 4kHz is satisfactory.

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