Dual limit comparator using single op-amp

This circuit was designed to give a positive output when the input voltage exceeded plus or minus 8.5 volts. Between these limits the output is negative. The positive limit point is determined by the ratio of R_1, R_2, and the negative point by R_1, R_3. The forward voltage drop across the diodes must be allowed for. The output may be inverted by reversing the inputs to the operational amplifier. The 709 is used without frequency compensation.

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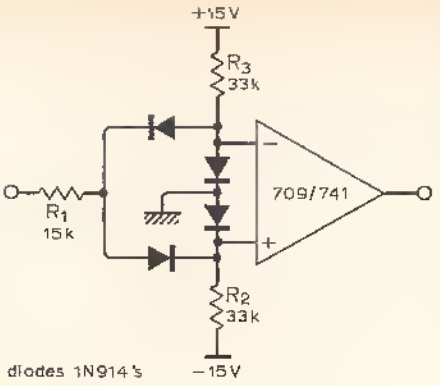

Novel power amplifier

This circuit obtains a differential output from a type 741 operational amplifier, by using its power supply pins. These outputs are used to drive power Darlingtons, which use high voltage supplies. This type of differential output is possible due to the op-amp power supply rejection ratio (typically 30μV/V) and its class B output stage. The output pin of the 741 is loaded with R_{11} to obtain maximum current swings at the 741's supply pins.

The ±15 volt supplies required by the 741 are obtained by resistor divider chains R_3, R_4 and R_5, R_6 and transistors Tr_1 & Tr_2 transfer their outputs to the 741's supply pins by their emitter follower action.

Quiescent current drawn from each high voltage rail by the 741 (typically 1.7mA) flows through the transistors producing a voltage across their collector loads that is fed to the base of the power Darlington output transistors to set their quiescent current. Darlington pairs are used to prevent loading of the voltages developed by the current variations through Tr_1 and Tr_2.

The capacitor connected between the 741's output and the power Darlington's output, supplies stabilizing negative feedback to the last-mentioned. The capacitor across R_{10} provides high frequency roll-off.

For other supply voltages, change the divider resistors but maintain the 5mA through the divider chain. Any general-purpose transistors for Tr_1 and Tr_2 may be used and the Darlington pairs may be made up from discrete types of transistors. Higher gains can also be used by changing R_1 and R_{10} and C_1 to maintain maximum frequency response with stability.

Components shown in broken lines are for optional zeroing of output offset, if the circuit is used in a servo system for example. With component values as shown, 30 watts can be delivered into eight ohms from d.c. to 100kHz (with ×10 gain) with less than 0.2% distortion.

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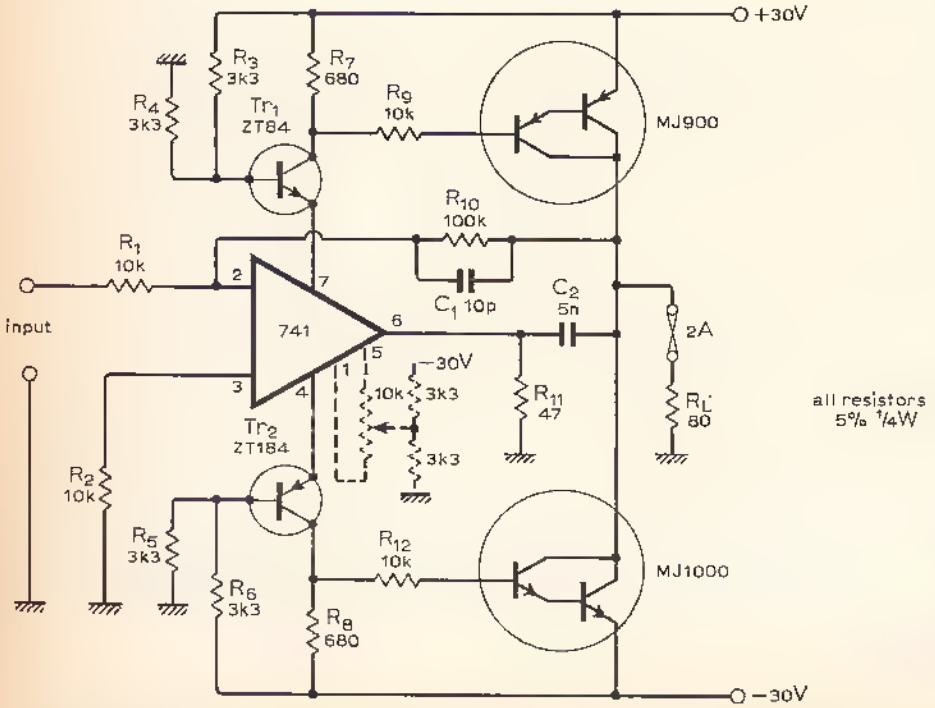
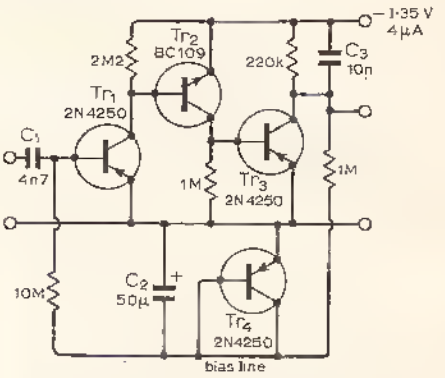


Micropower low-noise amplifier

This amplifier has ultra-low power requirements (1.35V, 4μA), low noise (about 10μV pk-pk equivalent input noise with 10MΩ source impedance), 10MΩ input impedance, and a high voltage gain of 2000. It was designed for use in implanted transmitters which detect brain and heart potentials.



High input impedance is attained by current-starving Tr_1, which operates in the 200nA region. The 2N4250 transistor was chosen because its gain remains high ($\beta \times 200$) at very low voltages and currents. It is, in addition, a low-noise transistor. The low current in Tr_1 limits the bandwidth of the amplifier to about 5kHz, but this is acceptable for biological work. The input impedance is determined primarily by the 10MΩ bias feed resistor. The transistors Tr_2 and Tr_3 provide additional gain.

The amplifier had gain constant to within 10% over a −10°C to +100°C temperature range. It is self-biased, with Tr_4 clamping the bias line, to prevent low-frequency instability. The low-frequency roll-off is determined primarily by C_1, but when changing this capacitor C_2 should also be altered in the same ratio. This will prevent another form of low-frequency instability which occurs when C_2 is too small. Capacitor C_3 adjusts the high-frequency cut-off point, and may be omitted if desired. As shown, the amplifier has 3-dB points at 3 and 80Hz, suitable for heart-beat monitoring.

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