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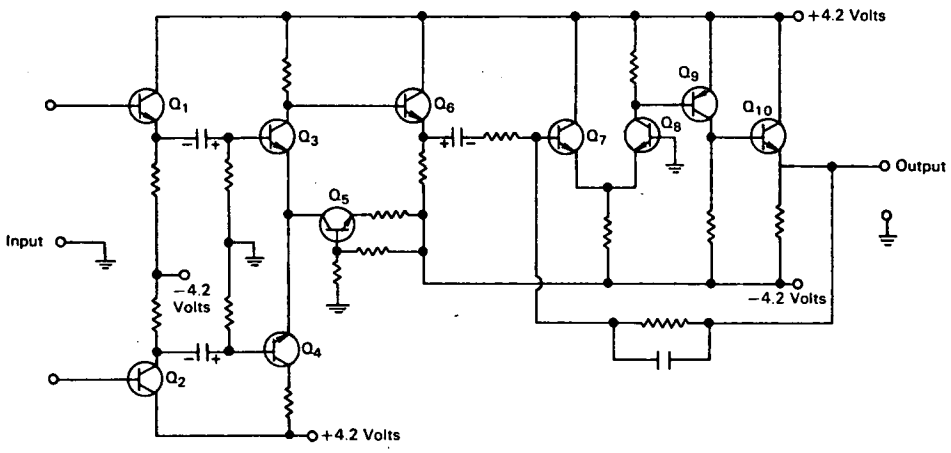
Brief 65-10203

NASA TECH BRIEF

Tiny Biomedical Amplifier Combines High Performance, Low Power Drain



The problem: To facilitate biomedical studies on mobile subjects, develop a miniaturized, high-performance, high-reliability, battery-operated, solid-state amplifier of low power consumption, that is suitable for both general biomedical use and space research. Amplifiers meeting the requirements of physiological research are available commercially, but they are often too bulky and require too much power for many applications. Small amplifiers have been developed but often with compromise of some aspect of performance.

The solution: A transistorized, portable, high-performance amplifier that utilizes a differential input to obtain a common-mode rejection of 25,000 to 1. Because of its small size and low power drain it may be mounted directly on an ambulatory subject.

How it's done: Transistors Q_1 and Q_2 are emitter followers and provide the necessary high input impedance of about 10 megohms differential. The differential output of the emitter followers is converted to a single-ended signal by a difference amplifier consisting of Q_3, Q_4, and Q_5. Transistor Q_5 provides the difference amplifier with the high emitter impedance necessary for high common-mode rejection. The signal is fed sequentially through an emitter follower Q_6, a second difference amplifier Q_7 and Q_8, a common emitter amplifier Q_9, and a final emitter follower Q_{10}. Capacitance coupling in these stages is minimized to provide good low frequency response from 0.15 cps. The amplifier exhibits a gain of 1,000 while drawing 5 milliwatts of power.

Notes:

1. This amplifier has been constructed in a weld-connected cordwood configuration with dimensions of 2.0 cm by 1.7 cm by 0.9 cm and weighing 4.5 grams.
2. This device should find application in the biomedical field for amplifying electrocardiogram and electromyogram signals.

(continued overleaf)

3. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
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Reference: B65-10203

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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