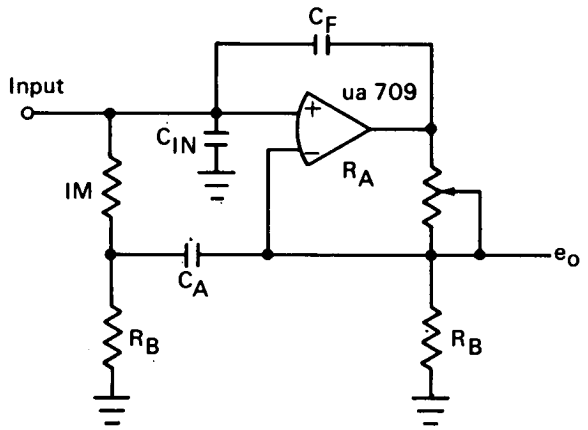
December 1970

Brief 70-10651

NASA TECH BRIEF

AC-Coupled Ultrahigh Input Impedance Amplifier

High input impedance and low input capacitance have been achieved with a conventional unity gain buffer amplifier modified by the addition of positive feedback. The circuit, which is stable over a temperature range of 25° to 70°C, achieves input impedances of several hundred megohms and input capacitances of less than 1 picofarad (pf).



C_F = 68 Picofarads $C_{IN} \approx$ 2 Picofarads

C_A = 0.1 Microfarad

R_A = 500Ω R_B = 10K

The high input impedance is obtained by positive feedback through capacitor C_A to the plus (+) input of the amplifier (see fig.). The input capacitance plus the capacitance to ground is C_{IN}, which can be cancelled by adding the feedback capacitor C_F and adjusting resistor R_A. The following relationship applies:

$$\frac{R_A}{R_B} \approx \frac{C_{IN}}{C_F}$$

Low frequency response is determined primarily by capacitor C_A, for which an electrolytic capacitor can be used. High frequency response is limited by the operational amplifier. The value of R_A is determined by applying a square wave to the input and adjusting R_A to produce an acceptable square wave output, in much the same manner that a 10X scope probe is adjusted.

The circuit was used to amplify a 5 μsec wide pulse coupled through a capacitor of less than 1 pf. Slew rate for the circuit was approximately 0.5 V/μsec.

Gains other than unity can be obtained, but this would probably be simpler if another separate amplifier is used.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B70-10651

Patent status:

No patent action is contemplated by NASA.

Source: Arthur G. Birchenough
Lewis Research Center
(LEW-11154)

Category 01