Linear sense amplifier raises sensitivity of touch keyboard

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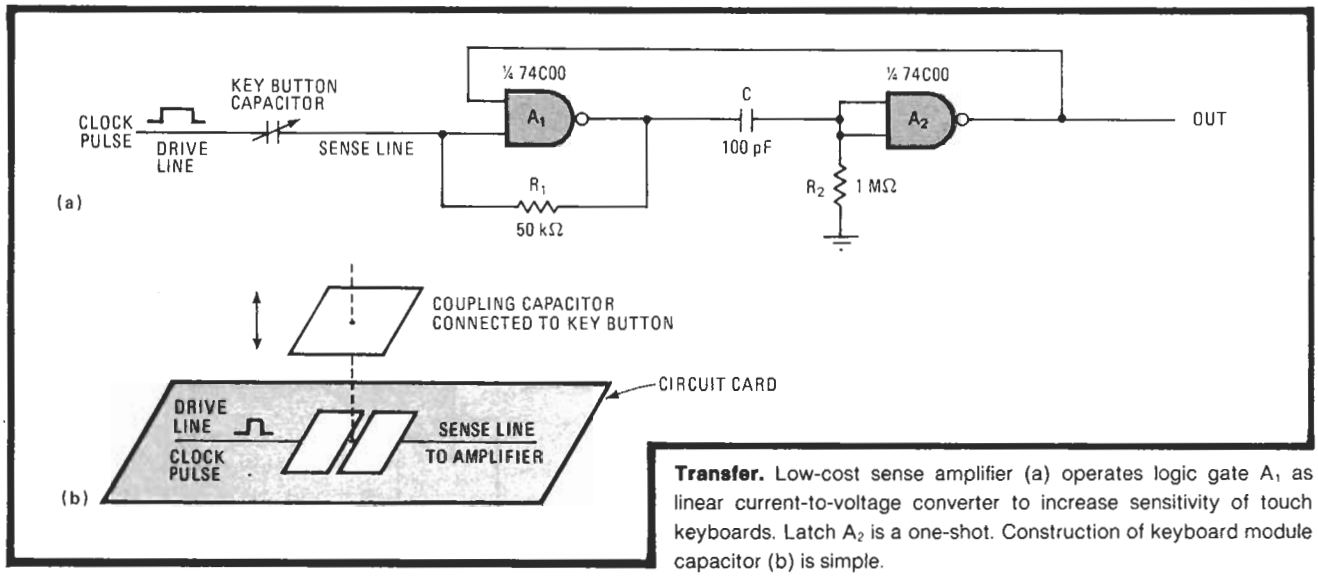
Keyboards relying on hand capacitance to simulate contact closure require a sense amplifier to detect the capacitive changes and thus determine when a key is depressed. Using one half of a complementary-MOS gate array, where one gate is operated in a linear mode to detect currents as low as 50 microamperes, this sense amplifier is not only simple and inexpensive but sensitive as well.

A_1 of the 74C00 quad NAND gate (a) serves as the amplifier, with A_2 functioning as a latch. A_1 is ac-coupled and operates as a self-biasing current-to-voltage converter with a gain of 50 millivolts/μA. Its open-loop gain falls above 100 kilohertz, so the drive-line clock should have a frequency of about 10 kHz. For higher gain, A_1 can be cascaded with other stages within the feedback loop R_1.

When signals having an amplitude of at least 50 μA are coupled to the sense line via the coupling capacitor connected to the keybutton, A_1 goes high and triggers A_2 for about 70 μs. A_2 operates as a one-shot and thus it does not need to be reset.

The construction of the key module capacitor is shown in (b). The coupling capacitor is connected to the keybutton directly. The circuit-card pads are coated with a thin insulating epoxy covering that serves as the dielectric. When the keybutton is depressed, the clock pulse on the drive line will therefore be coupled to the sense line through the electric field of the capacitor. □



Transfer. Low-cost sense amplifier (a) operates logic gate A_1 as linear current-to-voltage converter to increase sensitivity of touch keyboards. Latch A_2 is a one-shot. Construction of keyboard module capacitor (b) is simple.