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Push Button Control of Digital Potentiometers (POTs) with an Increment/Decrement Interface

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APPLICATION NOTE

There are a number of ways of programming digital POTs. The best technique depends on the digital POT's type of interface and its application.

This Application Note discusses the push button control of digital POTs which have an increment/decrement interface in applications where there is no embedded processor. Instead, the digital POT is programmed using push button switches to generate the control signals for the UP/$\overline{DN}$, $\overline{INC}$, and $\overline{CS}$ inputs. For those applications where the programming of the digital POT is an ongoing requirement, the push button switches and the interface circuitry will be part of the application. For those applications where the digital POT will be programmed only once during production testing, the switches and their interface will be in an external controller unit. The controller unit containing the push button switches is typically connected to the digital POT using pins, cable and a connector or a bed-of-nails test system.

The circuit in Figure 1 is a low cost, low component count implementation of a push button controller. A SPST UP/DN switch programs the direction of the pot's wiper, and two momentary contact SPDT, INCR and STORE, switches program the increment and store functions. The momentary contact switches are debounced.

The INCR switch enables a low frequency clock which advances the wiper one position every falling edge of the clock. The clock is enabled as long as the INCR switch is held down and its frequency is roughly determined by $f \approx 1/R_1C_1$. A resistor of 200 kΩ and a capacitor of 0.33 μF produces a measured clock frequency of 17 Hz. The oscillator requires a NAND gate with Schmitt-trigger inputs (74HC132 type).

The STORE switch initiates a positive pulse to the chip select line. On the leading edge of this pulse, the current wiper setting of the potentiometer is stored to nonvolatile memory. The pulse width is derived from the R_2 and C_2 differentiator and is roughly determined by $PW \approx 1/R_2C_2$. A resistor of 20 kΩ and a capacitor of 0.001 μF produces a measured pulse width of 18 μsec.

R_3, R_4 and R_5 are the pulldown and pullup resistors for the increment, chip select, and up/down digital POT inputs. For 'program once' applications, all input control signals must have either pullup or pulldown resistors when the programmer is disconnected. The values of the pullup and pulldown resistors are in the 5 kΩ – 50 kΩ range.

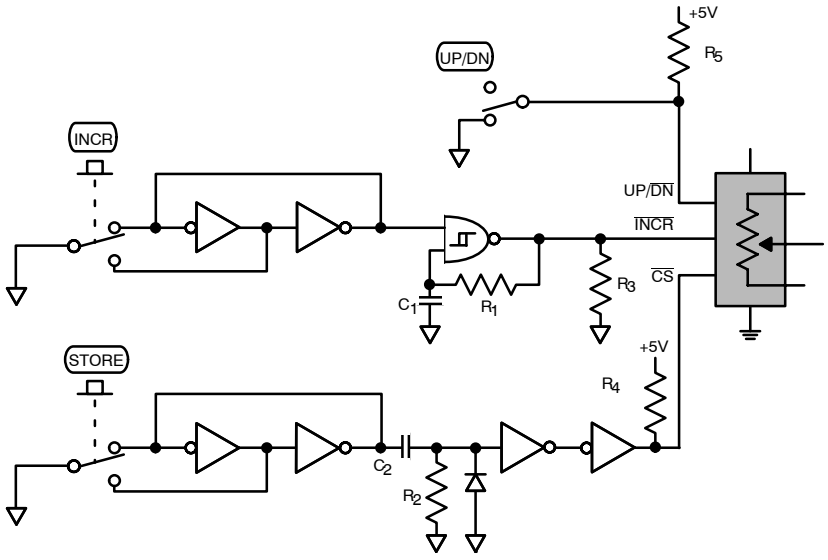

Figure 1. Push Button Controller

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