Keywords: digital potentiometer, potentiometer, EPOT, switch debouncer, debounce, ESD protection

APPLICATION NOTE 1802

Few Components Needed for an ESD-Protected Solid-State Potentiometer (EPOT) System with Two Pushbuttons

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Abstract: This design note shows how a simple circuit uses two pushbuttons and three tiny ICs to implement a debounced, ESD-protected solid-state potentiometer (EPOT). The design features the MAX5161digital potentiometer, the MAX6308 programmable reset IC, and the MAX6817 switch debouncer.

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As systems grow smaller, it becomes increasingly attractive to replace mechanical potentiometers with smaller and less expensive silicon equivalents (EPOTs). A common interface for such EPOTs consists of a chip select, increment, and active-low up/down line. CS activates the device, and on a rising edge of active-low INC steps the wiper in a direction indicated by the active-low U/D pin. The simple circuit of **Figure 1** employs two pushbuttons (one for up and one for down) and a few tiny silicon devices to implement a debounced, ESD-protected EPOT system.

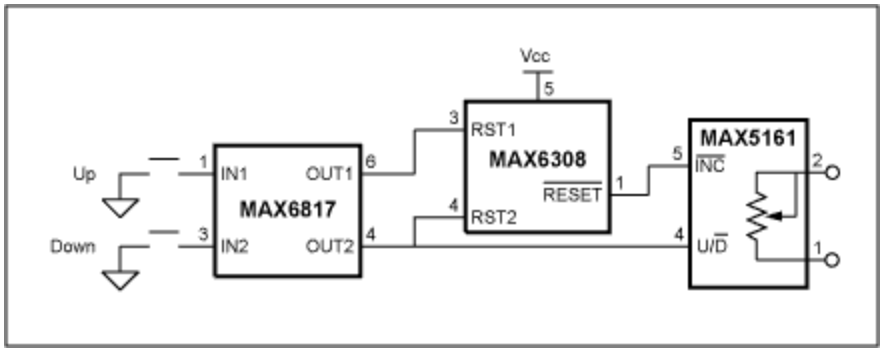

Figure 1. These three ICs form a solid-state potentiometer (EPOT).

The normally open pushbutton switches feed into an ESD-protected switch debouncer in a SOT23 package (MAX6817) which has internal pullup resistors on the inputs and buffered, non-inverting CMOS outputs. In the absence of a switch closure, the normally open switches hold the MAX6817 outputs high. In turn, that condition ensures a low state for the active-low, push-pull output of the MAX6308; an SC70 reset device with two reset inputs that are independent of the V_{CC} pin. The reset device must have extra

reset inputs rather than a manual reset input, because the glitch-immunity protection of MR inputs is not sufficient to guarantee proper operation.

The MAX5161 is a 32-tap, linear-taper EPOT in a SOT23 package, with the standard (active-low INC)-active-low U/D interface. (The CS input is pulled high internally.) Its t_{setup} requirement is 50ns, meaning the active-low U/D signal must be stable for 50ns preceding a rising edge at the active-low INC pin. That requirement is met with the delay introduced by transient-filtering circuitry internal to the MAX6308. The delay (shown in **Figure 2** as t_f) is typically 10µs to 30µs. Active-low INC goes high again only after the reset timeout interval expires. For the MAX6308, that interval (t_{reset}) is preset at the factory with a value as short as 1ms.

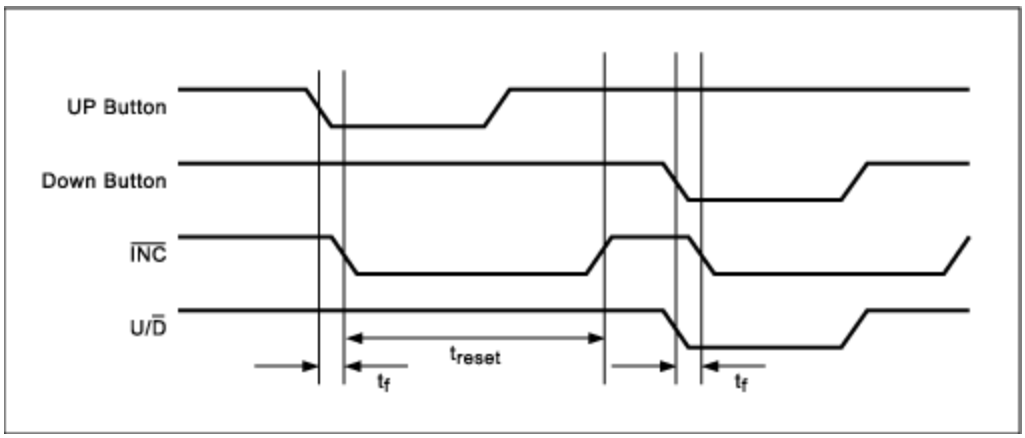

Figure 2. Closing either pushbutton in Figure 1 increments the potentiometer output in a direction indicated by the MAX5161's active-low U/D input.

Related Parts		
MAX5161	Low-Power Digital Potentiometers	Free Samples
MAX6308	5-Pin, Multiple-Input, Programmable Reset ICs	Free Samples
MAX6817	±15kV ESD-Protected, Single/Dual/Octal, CMOS Switch Debouncers	Free Samples

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