Simple circuit smoothly drives stepper motors

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The circuit in this Design Idea drives low-power, unipolar stepper motors using only a shift register, a few resistors, and low-power transistors. Adding an inexpensive 4053 analog switch allows bidirectional switching. Compared with other simple stepper-motor-drive circuits, it has better-than-half-step characteristics (Figure 1).

After power-up, all shift-register outputs are in a zero state. Pin QP3 feeds back to the serial input through an inverter—transistor Q5 in Figure 2 and analog-switch IC2 in Figure 3. The circuit generates a sequence of four ones and then four zeros. You can use this pattern to drive, for example, NPN transistors with emitters that tie to ground and collectors that tie to the stepper-motor coils. However, to achieve smoother drive characteristics, the shift-register outputs drive four simple DACs, each comprising two identical resistors.

These DACs can generate output voltages of 0, 2.5, and 5V to drive four emitter followers. A snapshot from an oscilloscope shows the base voltages of Q1 and Q2 (Figure 1). They come close to a quarter-step drive pattern. The circuit can use almost any 8-bit shift register.