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Operating Speeds of Digital Potentiometers (POTs)

How fast we can move the wiper of the digital POT and then transfer the wiper position to and from memory is governed by the type of serial interface and the AC electrical specifications of the potentiometer. This Application Note lists the dominant operating time and frequency characteristics of programming digital POTs.

Digital POTs with 3-wire Serial Interfaces (CAT5112/5113)

There are three key operations:

1. *Digitally Incrementing/Decrementing the Wiper*
 $t_{CYC} \geq 1 \mu s$
 $f \leq 1 \text{ MHz}$
2. *Programming the Wiper to a Specific Voltage*
 $T = t_{CYC} + t_{1W} \geq (1 \mu s + 5 \mu s)$
 $f \leq 167 \text{ kHz}$

The parameter t_{1W} is the time it takes the analog wiper voltage to respond. The wiper can be moved digitally at a 1 MHz rate until its final position is reached, and then 5 μs must be allowed for the wiper's analog voltage to reach its final value.

3. *Storing the Digital Wiper Position in Nonvolatile Memory*
 $T = t_{WR} \leq 10 \text{ ms}$
 $f \geq 100 \text{ Hz}$

Conditions: V_{CC} stable

APPLICATION NOTE

Digital POTs with Microwire-like Serial Interfaces (CAT52X Series)

There are two key operations:

1. *Programming the Wiper (Digital and Analog) or Executing a Volatile Write*
 $T = \{11 \text{ clks} \times 1 \mu s/\text{clk}\} + t_{DS}$ (settling time) $\geq (11 \mu s + 10 \mu s) \geq 21 \mu s$
 $f \leq 47.6 \text{ kHz}$
2. *Storing the Wiper Position in Nonvolatile Memory*
 $T \leq 5 \text{ ms}$ (dominant)
 $f \geq 200 \text{ Hz}$

Conditions: V_{CC} stable

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