

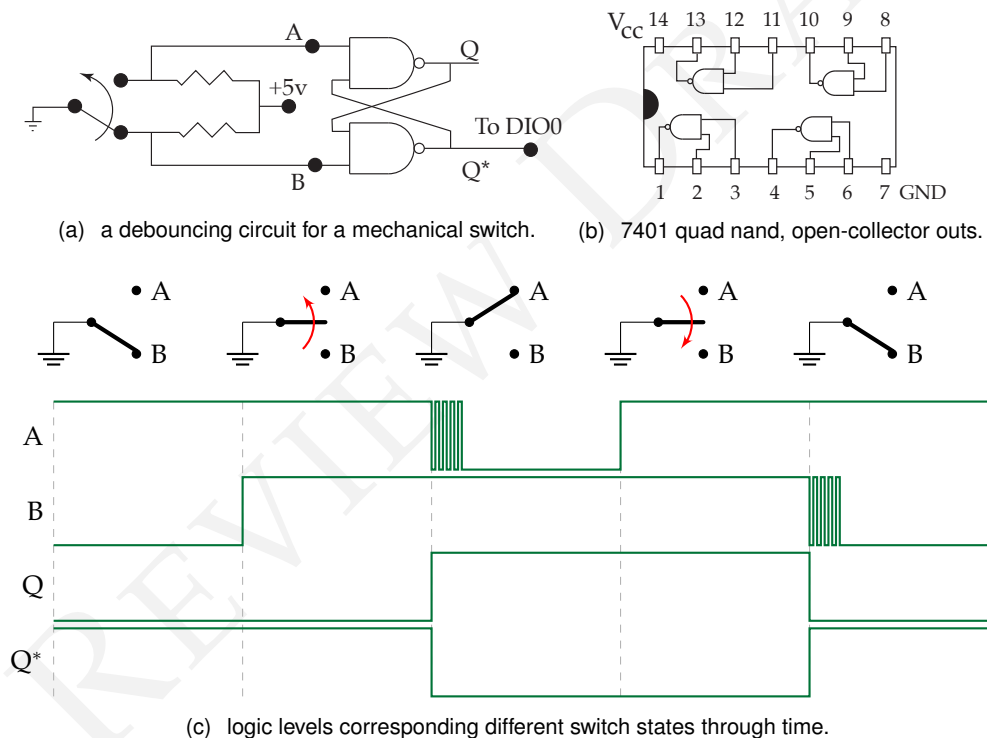
## Lecture 05.04 Debouncing circuits for switches

When a mechanical switch is thrown via a button, toggle, or some other interface, the new contact between the two conductors is not immediately seamless. In fact, over a few milliseconds, contact is made and broken dozens of times Horowitz and Hill (2015). This phenomenon is called *switch contact bounce*.

switch contact  
bounce  
debouncing circuit

Often, we mitigate switch bounce with a circuit—called a *debouncing circuit*—between the switch and the microcontroller. Debouncing circuits yield a single transition of the digital signal, low-to-high or high-to-low.

Consider in detail the debouncing circuit of Figure 05.2. For the outputs to switch, *both* inputs must switch, effectively mitigating bounce.



**Figure 05.2:** an illustration of the operation of a debouncing circuit. With the switch initially drawing B low,  $Q^*$  must be high and Q low. The loss of contact with B does not affect  $Q^*$  or Q. Initial contact with A draws a low and therefore Q high and  $Q^*$  low. The ensuing bounce doesn't affect Q because it doesn't affect  $Q^*$  being low, so Q is high, regardless of A. This logic is then mirrored in the transition from contact with A to B, with its ensuing bounce. A TTL IC, shown in (b), can be used to instantiate this circuit.