Digital Design – Stopwatch

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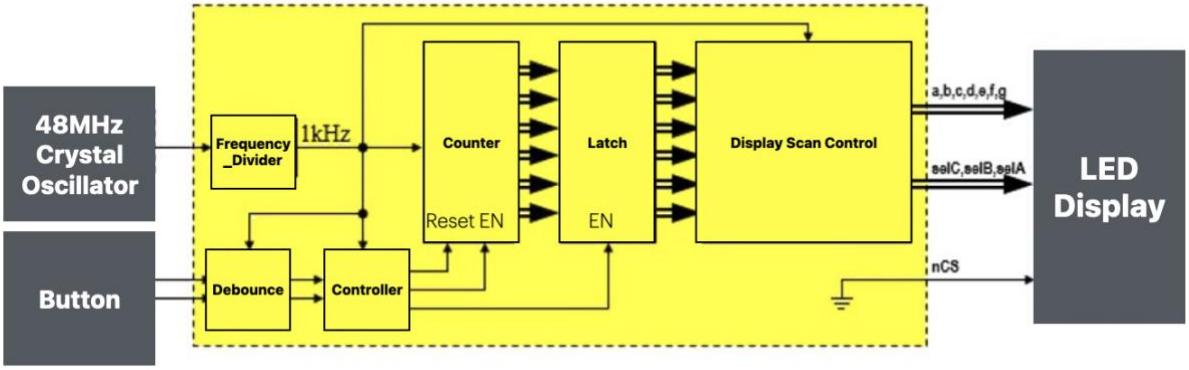
Architecture

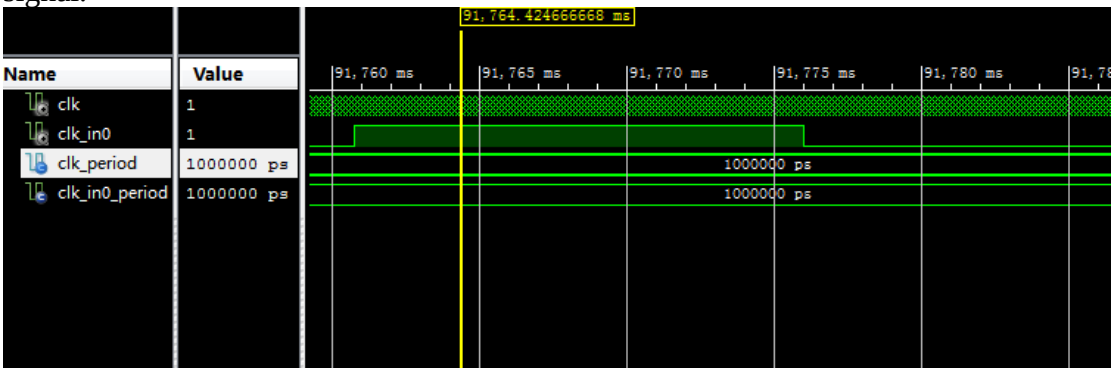


Each block in this design works together to implement the stopwatch functionality, where:

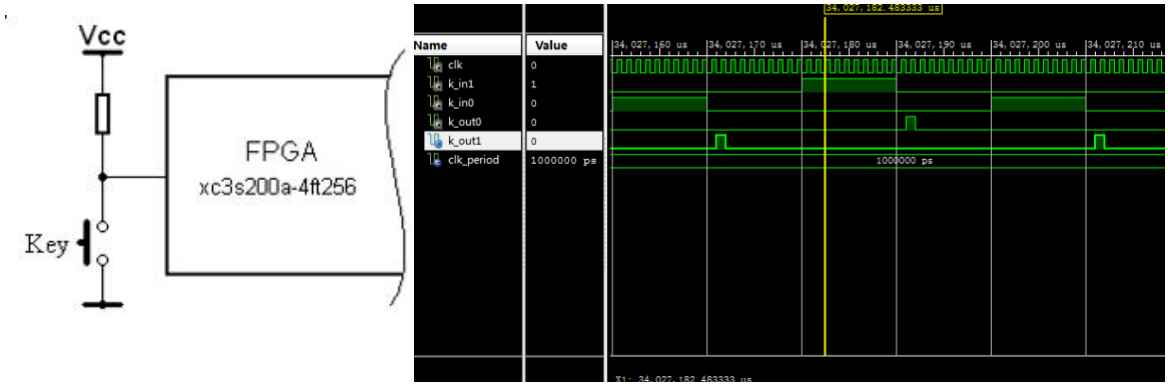
- The frequency divider synchronizes the timing.
- The debounce and control circuits handle user input.
- The counter and latch manage timekeeping.
- The display circuits handle the visual output.

Component

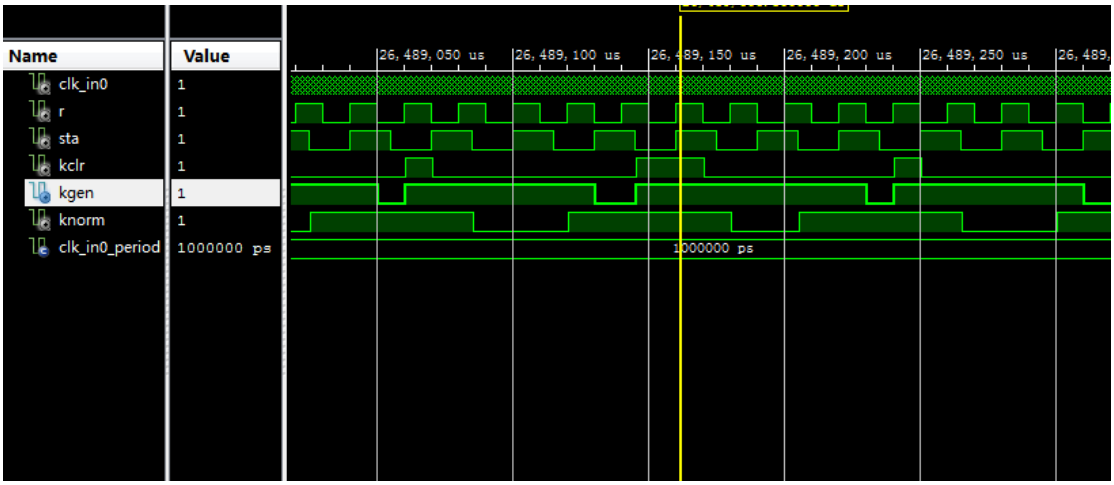
1. **48MHz Crystal Oscillator**: This is the main clock source for the entire circuit. It provides a high-frequency signal that is divided down for timing purposes.
2. **Frequency Divider**: This module divides the 48MHz signal down to 1kHz to match the time scale needed for the stopwatch. This divided frequency serves as the primary timing signal.



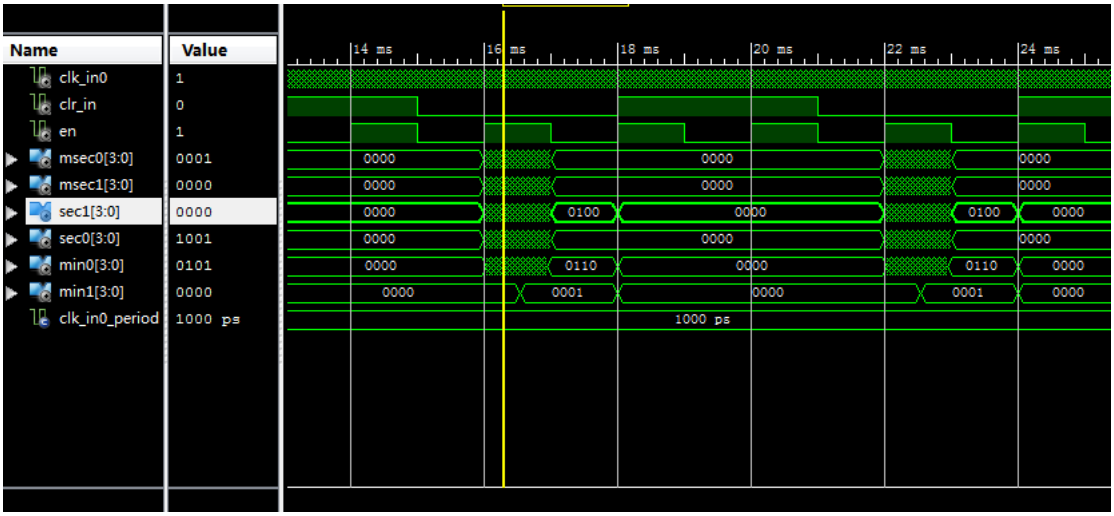
3. **Button Switch & Debounce Circuit**: The button switch allows the user to interact with the stopwatch (start, stop, reset). The debounce circuit stabilizes the button signals to prevent false triggering due to mechanical bounce.



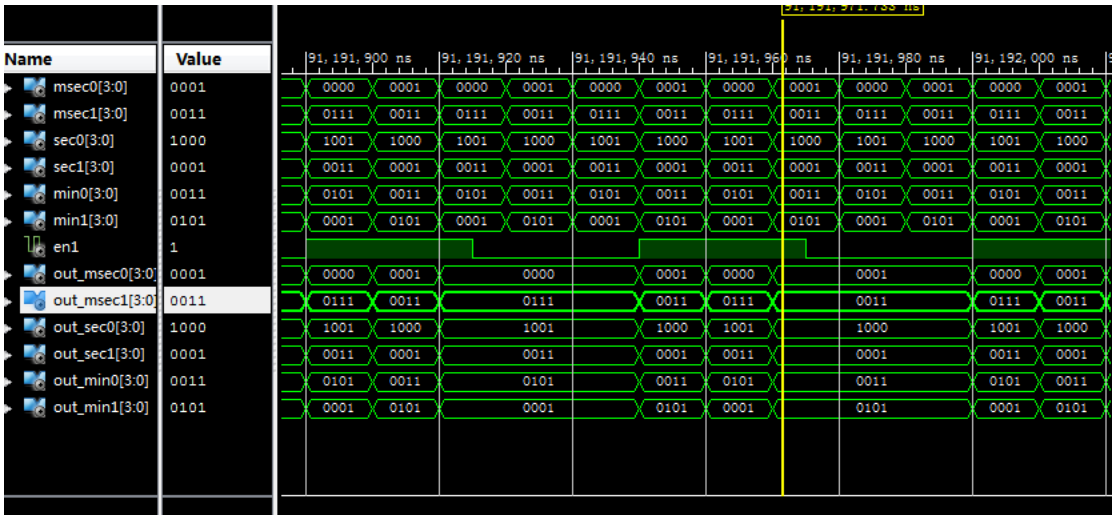
4. **Control Circuit**: This module interprets the button inputs and generates control signals to manage stopwatch states like start, stop, and reset.



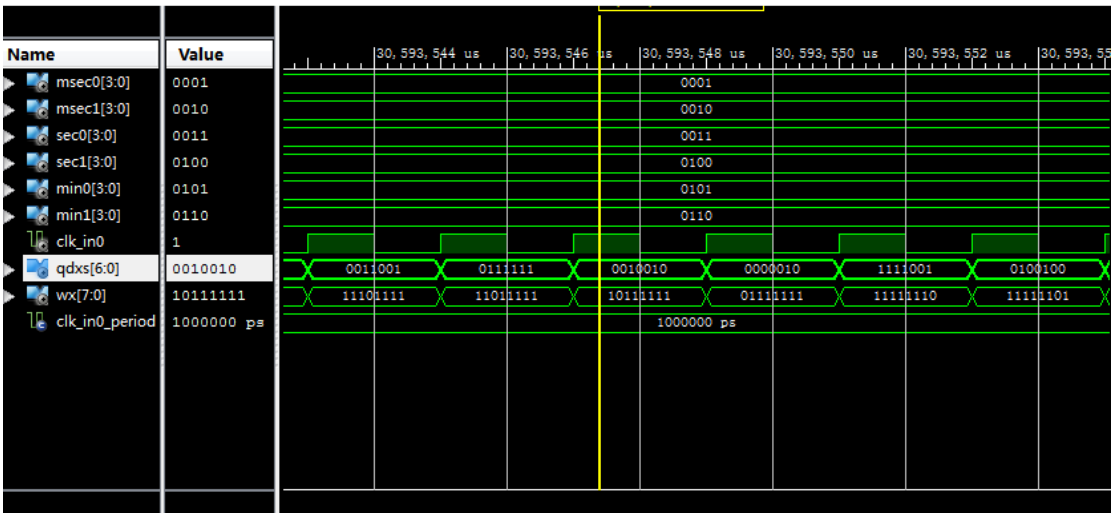
5. **Counter**: The counter module handles the time-keeping aspect. It increments based on the 1kHz clock signal and counts milliseconds, seconds, and minutes as needed.



6. **Latch**: The latch module stores the current count when the stopwatch is paused. This allows the display to show the stopped time without resetting the counter.



7. **Scan Display Control**: This module drives the LED display by generating signals for digit selection (selC, selB, selA) and segment activation (a, b, c, d, e, f, g). It also includes display encoding to represent numbers.



8. **LED Display Circuit**: This is the visual interface that shows the stopwatch count. The display control signals control which digit and segments are lit.