Subsystem Design

Frequency Counter: Tone Detection

1 Description

This subsystem example in Figure 1-1 demonstrates how to set up the internal comparator and timers within the MSPM0L and MSPM0G family of devices to implement a simple frequency detector. The capture period can be configured to allow for various ranges of frequencies.

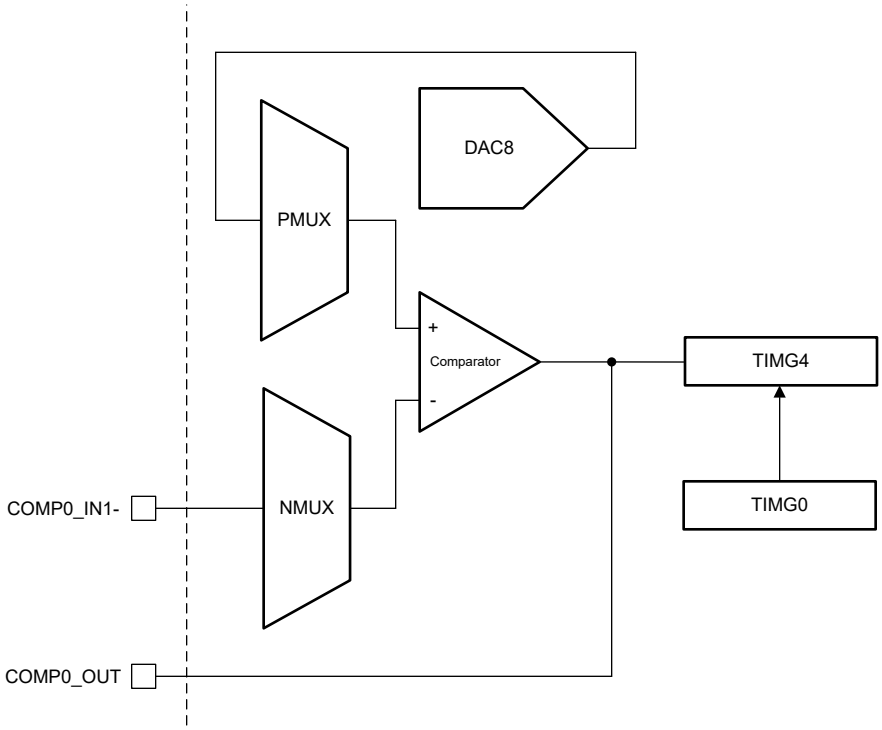

Figure 1-1. Subsystem Functional Block Diagram

2 Required Peripherals

This application requires an integrated COMP and two TIMER modules.

Table 2-1. Required Peripherals

Subblock Functionality	Peripheral Use	Notes
Analog to digital signal conversion	(1 ×) COMP	Called COMP_0_INST in code
Digital signal capture	(2 ×) TIMER	Called COMPARE_0_INST and PERIOD_TIMER_INST in code

3 Design Steps

1. Set COMP peripheral instance, TIMER - Compare instance, TIMER instance, and pin out to desired device pins in SysConfig.
2. Set COMP voltage in SysConfig.
3. Set TIMER - Compare clock speed in SysConfig. Default is 4MHz.
4. Set TIMER clock speed in SysConfig. Default is 32,768Hz.
5. Define desired frequency range.

6. Define the capture period based on desired frequency range.
7. Set TIMER - Compare Number of Edges to Detect in SysConfig. Also define MAX_COMPARE_COUNT in code. (Optional)

4 Design Considerations

1. **Capture Period**: The length of the capture period affects what range of frequencies can be measured. Longer periods allow for slower frequencies to be captured.
2. **Clock Speed**: Choosing a clock speed that allows for accurate measurement of frequency is important for this example to work properly.

5 Software Flow Chart

Figure 5-1 shows the code flow diagrams for Main() plus TIMER ISR for Figure 1-1.

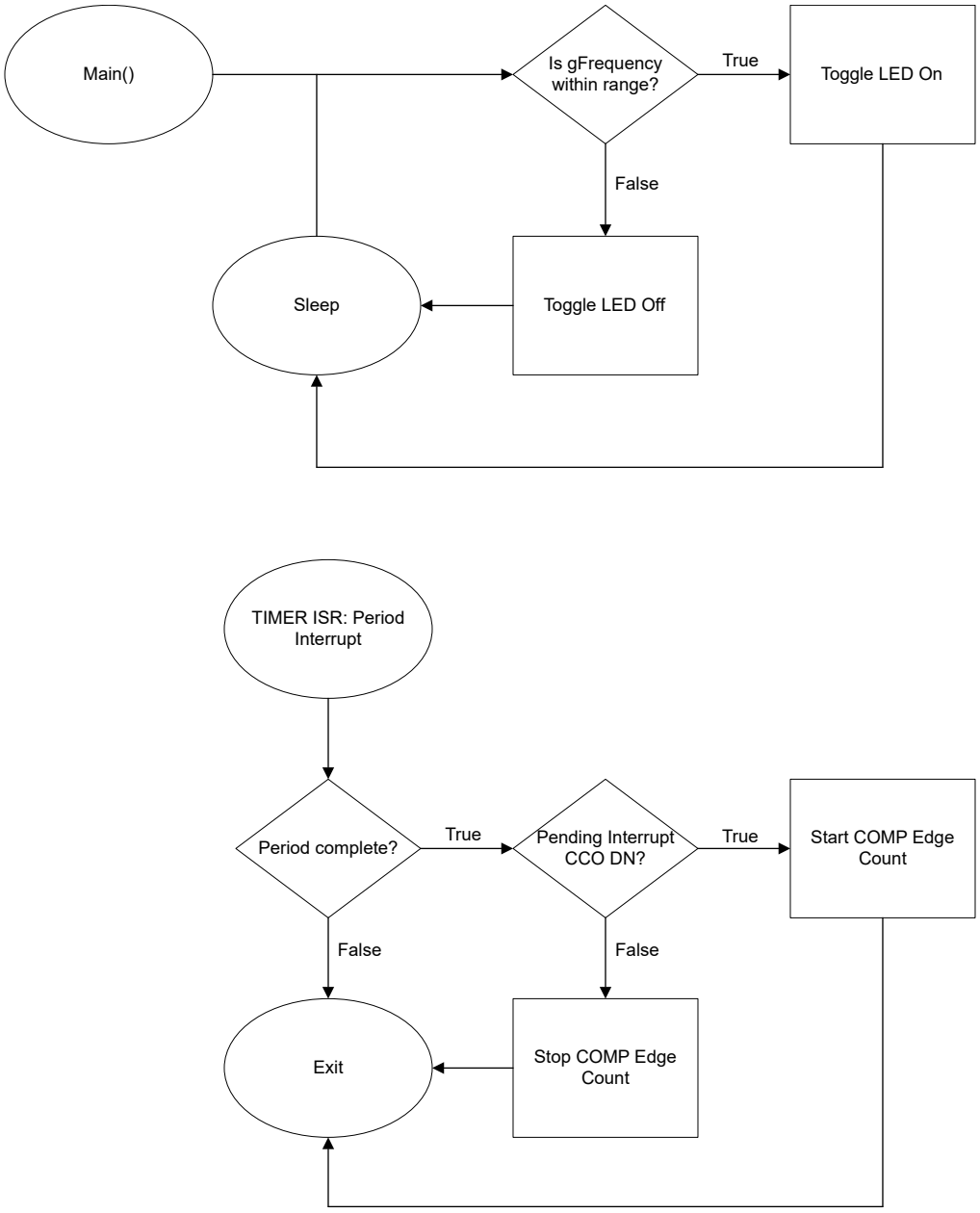

Figure 5-1. Software Flow Diagrams for MAIN Loop and TIMER ISR

6 Device Configuration

This application makes use of TI System Configuration Tool (SysConfig) graphical interface to generate the configuration code for the COMP and two TIMER modules. Using a graphical interface to configure the device peripherals streamlines the application prototyping process.

7 Application Code

To change the specific values used by the TIMERs and desired frequency range, modify the #defines in the beginning of the document, as demonstrated in the following code block:

```
/* Based on required specifications, vary the value
 * between PERIOD_10ms, PERIOD_20ms, and PERIOD_50ms
 * to achieve desired frequency range.
 *
 * RANGES:
 * 10 ms: 100 Hz - 1 MHz
 * 20 ms: 50 Hz - 1 MHz
 * 50 ms: 20 Hz - 1 MHz
 *
 * Please reference [file name] for percent error
 */
#define CAPTURE_PERIOD (PERIOD_20ms) /* CHANGE THIS VARIABLE VALUE */

/* Set the desired frequency range
 * NOTE: see [file name] to ensure proper capture period is set
 * for desired frequency range
 */
#define LOWERBOUND (2000)
#define UPPERBOUND (10000)

/* The maximum amount of rising edge the Timer Compare
 * will read from the COMP. Used as a limit rather than
 * an actual fix value of counts
 */
#define MAX_COMPARE_COUNT 65000
```

8 Additional Resources

- Texas Instruments, Download the MSPM0 SDK
- Texas Instruments, Learn more about SysConfig
- Texas Instruments, MSPM0L LaunchPad™
- Texas Instruments, MSPM0G LaunchPad™
- Texas Instruments, MSPM0 Timer Academy
- Texas Instruments, MSPM0 COMP Academy

9 E2E

See TI's E2E™ support forums to view discussions and post new threads to get technical support for utilizing MSPM0 devices in designs.

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (September 2024) to Revision A (August 2025)	Page
• Removed compatible devices section	1

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265