Subsystem Design

DMA Ping Pong With ADC

1 Description

The DMA Ping Pong with ADC example demonstrates how to use the DMA to transfer ADC data between two different buffers, also known as a DMA *Ping Pong*. A DMA Ping Pong is commonly used to transfer data to one buffer while the CPU is working with the other buffer. The blue path in Figure 1-1 shows that the DMA transfers data to Buffer 1 and the CPU gets data from Buffer 2. When the paths switch, the DMA transfers data to Buffer 2 and the CPU gets data from Buffer 1. The benefit to this technique is faster total application runtime because the CPU is free to operate on a section of data at all times. In this example, the ADC is configured in single conversion mode and the DMA and CPU switches between buffers after each conversion.

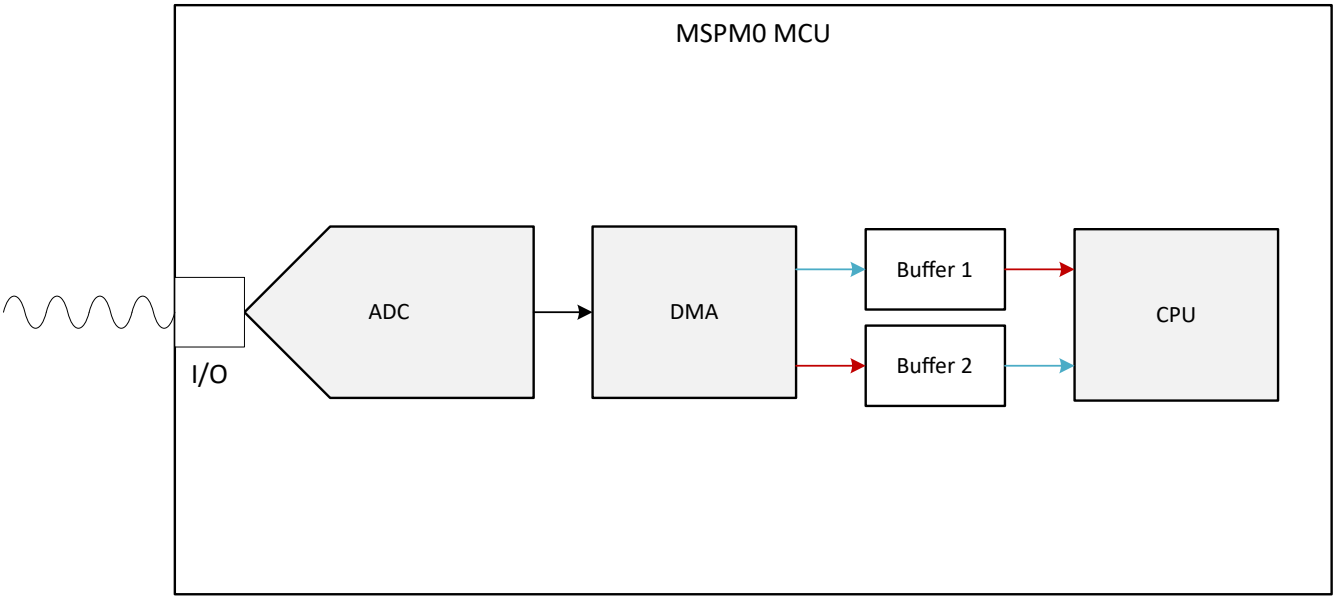

Figure 1-1. Subsystem Functional Block Diagram

2 Required Peripherals

This application requires the integrated ADC and DMA. The internal VREF is an additional option for the ADC reference, if a different reference value is required.

Table 2-1. Required Peripherals

Subblock Functionality	Peripheral Use	Notes
Analog Signal Capture	ADC	Called ADC12_0_INST in code
Moving memory	DMA	Full featured DMA channel is required to utilize the PREIRQ functionality. The example can be altered to work without the PREIRQ.

3 Compatible Devices

Based on the requirements in Table 2-1, some compatible devices are listed in Table 3-1. The corresponding EVM can be used for quick evaluation. Other MSPM0 devices work with this subsystem as long as the required peripherals are met. For quick porting, use the *Switch Device* option in SysConfig.

Table 3-1. Compatible Devices

Compatible Devices	EVM
MSPM0Cx	LP-MSPM0C1104
MSPM0Lx	LP-MSPM0L1306
MSPM0Gx	LP-MSPM0G3507

4 Design Steps

1. Determine the configuration for the ADC including reference source, reference value, resolution, and sampling rate based on the given analog input and design requirements.
2. Generate two array buffers to store the ADC data and set the buffer size and DMA transfer size the same so the DMA fills the whole buffer.
3. Configure the ADC in SysConfig based on the project requirements discovered in Step 1.
4. Configure the DMA in SysConfig in the ADC section.
5. Write *Application Code* to dynamically change the destination address of the DMA to alternate between buffers. See Figure 6-1 for an overview or view the code directly.

5 Design Considerations

1. **Maximum Sampling Speed:** The sampling speed of the ADC is based on input signal frequency, analog front end, filters, or any other design parameters that affect sampling.
2. **ADC Reference:** Choose the reference to align with the expected maximum input to utilize the full scale range of the ADC.
3. **Clock Settings:** The clock source determines the total time for the conversion. The clock divider in tandem with the SCOMP setting determines the total sampling time. SysConfig sets the appropriate SCOMP depending on the sampling time setting.

6 Software Flow Chart

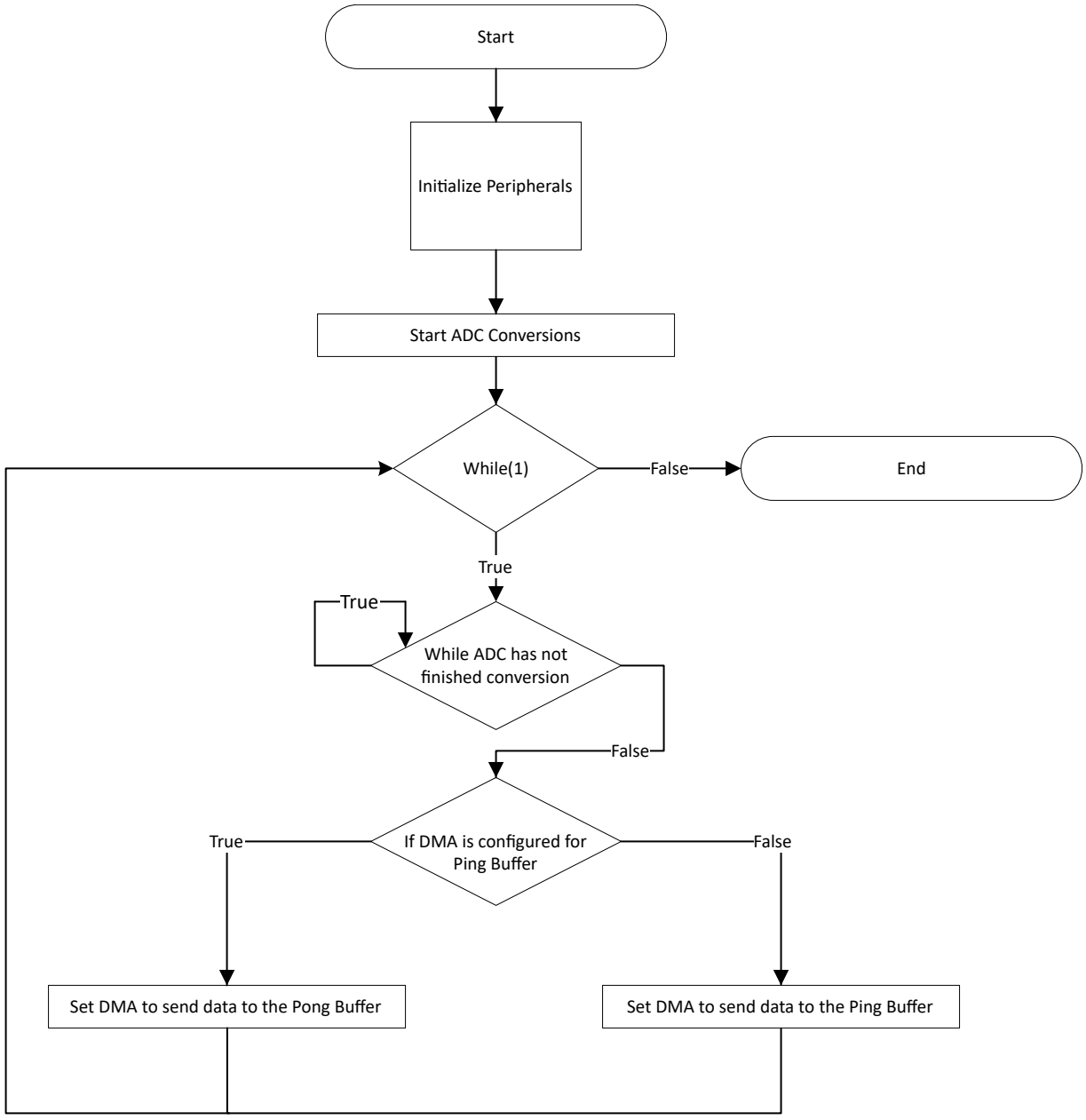

Figure 6-1. Software Flow Chart

7 Design Results

The following contents show the results of the code executing. Figure 7-1 shows the results of the buffers after the first execution of the main loop. After the buffer is filled, the code swaps the DMA destination to the second buffer and the CPU is now free to utilize data in the first buffer.

Figure 7-1. Buffers After First Pass

Figure 7-2 shows the results of the second buffer after the second execution of the main loop. After the buffer is filled, the code swaps the DMA destination back to the first buffer and now the CPU can use the data in the second buffer.

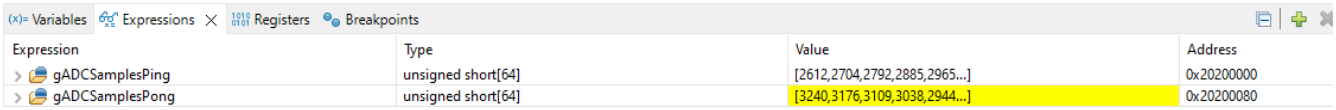

Figure 7-2. Buffers After Second Pass

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 ADC Academy
- Texas Instruments, MSPM0 DMA 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.

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