Subsystem Design

Signal Acquisition With Integrated Op Amp

1 Description

This subsystem is used to demonstrate how the MSPM0 operational amplifier (op amp) and a single ADC channel can accommodate two different sensor input requirements.

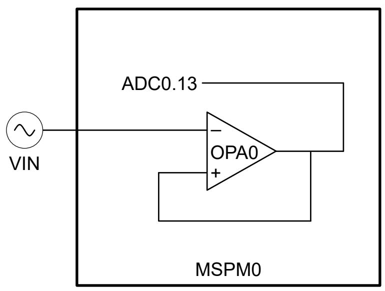

Figure 1-1. Unity-Gain Buffer

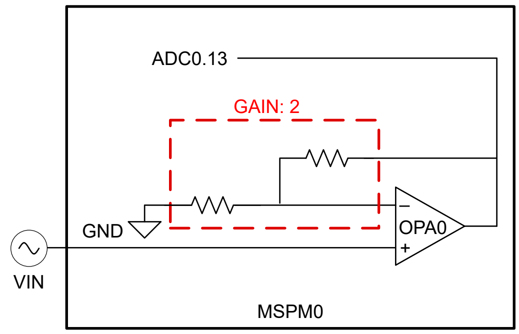

Figure 1-2. Op Amp With Programmable Gain of 2

The subsystem consists of a single op-amp architecture implemented using the internal OPA of the MSPM0 and a single-channel ADC. Figure 1-1 amplifies the input signal with a programmable gain of one which is commonly referred to as a unity-gain buffer. Figure 1-2, with a programmable gain of two, amplifies the input signal according to the set gain.

2 Required Peripherals

Table 2-1 describes the required integrated peripherals.

Table 2-1. Required Peripherals

Subblock	Peripheral Used	Notes
Input/output voltage measurement	ADC12	Monitors OPA0 output

3 Design Steps

Use the following steps for the design:

1. Configure an op amp with one ADC channel
2. Power up the system and initialize peripherals beginning with the buffer
3. Measure the output voltage and proceed to the next sensor
4. Sleep during instances of no input signal recognition.

4 Design Considerations

Voltage Range Centering: Apply a voltage ranging from 0V to 3.3V to the input for the unity-gain buffer. For the op amp with a programmable gain of 2, apply a voltage ranging from 0V to 1.65V.

5 Software Flow Chart

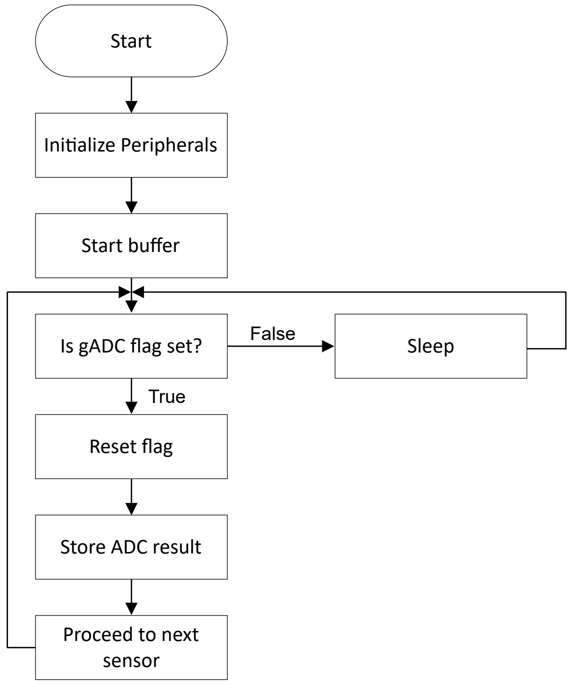

Figure 5-1. Software Flow Chart

6 Device Configuration

This subsystem utilizes TI's SysConfig graphical tool to configure all necessary peripherals. Using a graphical interface to configure the device peripherals streamlines the application prototyping process.

7 Application Code

The main loop runs sequence that includes ADC result read, addition of breakpoints, and proceeding to next sensor after output voltage confirmation.

```
int main(void)
{
    SYSCFG_DL_init();
    /* Start with Buffer configuration */
    OPAConfig = eBuffer;
    OPA0_Buffer();
    NVIC_EnableIRQ(ADC12_0_INST_INT_IRQN);
    DL_ADC12_enableConversions(ADC12_0_INST);

    while (1) {
        /* Remain in low-power mode until ADC interrupt is serviced */
        if(!(gADC0_Flag))
            __WFI();
        if(gADC0_Flag == true)
        {
            /* Clear flag */
            gADC0_Flag = false;
            /* Reconfigure OPA for next sensor*/
            if(OPAConfig == eBuffer)
            {
                ADC0_sensorOutput[eBuffer] = ADC0_Result;
                __BKPT(0); /* set a BKPT to examine result */

                /* Configure OPA as Non-Inverting */
                OPAConfig = eNonInverting;
                OPA0_NonInverting();

            }
            else
            {
                ADC0_sensorOutput[eNonInverting] = ADC0_Result;
                __BKPT(0); /* set a BKPT to examine result */

                /* Configure OPA as Buffer */
                OPAConfig = eBuffer;
                OPA0_Buffer();

            }

        }
    }
}
```

Figure 7-1. signal_acquisition.c Code

8 Additional Resources

- Texas Instruments, Download the MSPM0 SDK
- Texas Instruments, Learn more about SysConfig
- Texas Instruments, MSPM0G LaunchPad™ Development Kit
- Texas Instruments, MSPM0 Academy

9 E2E

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

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