M031 Read NAU7802

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	An example code for the M031 series microcontroller (MCU) to control NAU7802 via I²C interface. This document introduces how to use the example code to configure NAU7802, start ADC conversion and read out data from NAU7802.
BSP Version	M031 BSP CMSIS V3.03.000
Hardware	NuMaker-M031SE Ver1.1

1. Overview

This example code is used to configure Nuvoton's NAU7802 and then read out ADC data from it. The NAU7802 is a dual channel, 24-bit analog-to-digital converter (ADC) that can be used for audio application, electric balance or industrial control. This document introduces the example code of pin configuration, input channel configuration, PGA gain configuration, ADC calibration, conversion starting, reading out data and so on.

1.1 Demo Result

To test this sample code, an adjustable power supply can be the input source of NAU7802, and its voltage range is between -1.55 and 1.55 volts. After executing the program, the output result is listed below.

```
input vol = VIN1P - VIN1N = 0.00      input vol = VIN1P - VIN1N = -0.00
input vol = VIN1P - VIN1N = 0.14      input vol = VIN1P - VIN1N = -0.11
input vol = VIN1P - VIN1N = 0.26      input vol = VIN1P - VIN1N = -0.21
input vol = VIN1P - VIN1N = 0.36      input vol = VIN1P - VIN1N = -0.31
input vol = VIN1P - VIN1N = 0.46      input vol = VIN1P - VIN1N = -0.41
input vol = VIN1P - VIN1N = 0.56      input vol = VIN1P - VIN1N = -0.51
input vol = VIN1P - VIN1N = 0.66      input vol = VIN1P - VIN1N = -0.61
input vol = VIN1P - VIN1N = 0.76      input vol = VIN1P - VIN1N = -0.71
input vol = VIN1P - VIN1N = 0.87      input vol = VIN1P - VIN1N = -0.81
input vol = VIN1P - VIN1N = 0.97      input vol = VIN1P - VIN1N = -0.92
input vol = VIN1P - VIN1N = 1.07      input vol = VIN1P - VIN1N = -1.02
input vol = VIN1P - VIN1N = 1.17      input vol = VIN1P - VIN1N = -1.12
input vol = VIN1P - VIN1N = 1.27      input vol = VIN1P - VIN1N = -1.22
input vol = VIN1P - VIN1N = 1.38      input vol = VIN1P - VIN1N = -1.32
input vol = VIN1P - VIN1N = 1.49      input vol = VIN1P - VIN1N = -1.32
input vol = VIN1P - VIN1N = 1.52      input vol = VIN1P - VIN1N = -1.43
input vol = VIN1P - VIN1N = 1.54      input vol = VIN1P - VIN1N = -1.54
```

Figure 1-1 Demo Result

2. Code Description

Define the device address of the NAU7802.

```
#define ADC_SLAVE_ADDR    0x2A
```

I²C initialization:

```
/* Init I2C1 to access ADC chip(NAU7802) */
    I2C1_Init();
```

NAU7802 initialization:

```
    /* Iint NAU7802 chip */
    ADCchip_Init();
```

Start ADC Conversion:

```
    /* Start adc Conversion */
    ADC_StartConversion();
```

ADC conversion and read out results:

```
while (1)
{
        /* Wait ADC conversion done */
        while ((ADC_ReadReg(PU_CTRL_ADDR)&CR_Msk) != CR_DATA_RDY);

        /* Read Conversion data */
        i32ConversionData = ADC_Read_Conversion_Data();

i32ConversionData = (int)(u32i32ConversionData << 8);
    /* Shift the number back right to recover its intended magnitude */
        i32ConversionData = (i32ConversionData >> 8);

/* REFP - REFN measured value = 3.14v */
        printf("input vol = VIN1P - VIN1N = %.2f\n", ((float) i32ConversionData/ 16777216)
 * (float)(3.14));

        for (i = 0; i < 0x5fffff; i++);
}
```

3. Software and Hardware Requirements

3.1 Software Requirements

- BSP version
  - M031 Series BSP CMSIS v3.03.000
- IDE version
  - Keil uVersion 5.26

3.2 Hardware Requirements

- Circuit components
  - NuMaker-M031SE Ver1.1
  - ADC chip (NAU7802)
- Pin Connect

	V_{DD}	↔	AV_{DD}/DV_{DD}/REFP		
	I2C1_SDA (PB.0)	↔	SDA	VIN1P	←
	I2C1_SCL (PB.1)	↔	SCL	VIN1N	←
	GND	↔	GND		
	GND	↔	REFN		
	NuMaker-M031SE		NAU7802		

Figure 3-1 Pin Connect

4. Directory Information

The directory structure is shown below.

EC_M031_Read_NAU7802_V1.01	
Library	Sample code header and source files
CMSIS	Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
Device	CMSIS compliant device header file
StdDriver	All peripheral driver header and source files
SampleCode	
ExampleCode	Source file of example code

Figure 4-1 Directory Structure

5. Example Code Execution

1. Browse the sample code folder as described in the Directory Information section and double-click *I2C_ADCCHIP.uvproj* .
2. Enter Keil compile mode.
   - Build
   - Download
   - Start/Stop debug session
3. Enter debug mode.
   - Run
4. Print debug information.
   - Open UartAssist.exe
   - Baud rate: 115200bps

6. Revision History

Date	Revision	Description
2023.01.16	1.01	1. Optimize NAU7082 initialization process. 2. Modify the input voltage range to -1.55V~1.55V.
2021.05.20	1.00	1. Initially issued.

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