Measure VDD And Temperature

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	Demonstrate measure internal temperature and supply voltage of IC using internal BandGap 2.5V voltage.
BSP Version	Nano100B Series BSP CMSIS V3.03.000
Hardware	NuTiny-EVB-Nano130-LQPF128

1 Function Description

1.1 Introduction

Demonstrate measure internal temperature and supply voltage of IC using internal BandGap 2.5V voltage.

1.2 Principle

Use internal BandGap 2.5V voltage as IC internal reference voltage.

Enable internal ADC channel 14 and enable temperature detection register to measure IC internal temperature.

The calculate function show as below:

Vtemp(mV) = 2.5*1000* (ADC_14/4096)

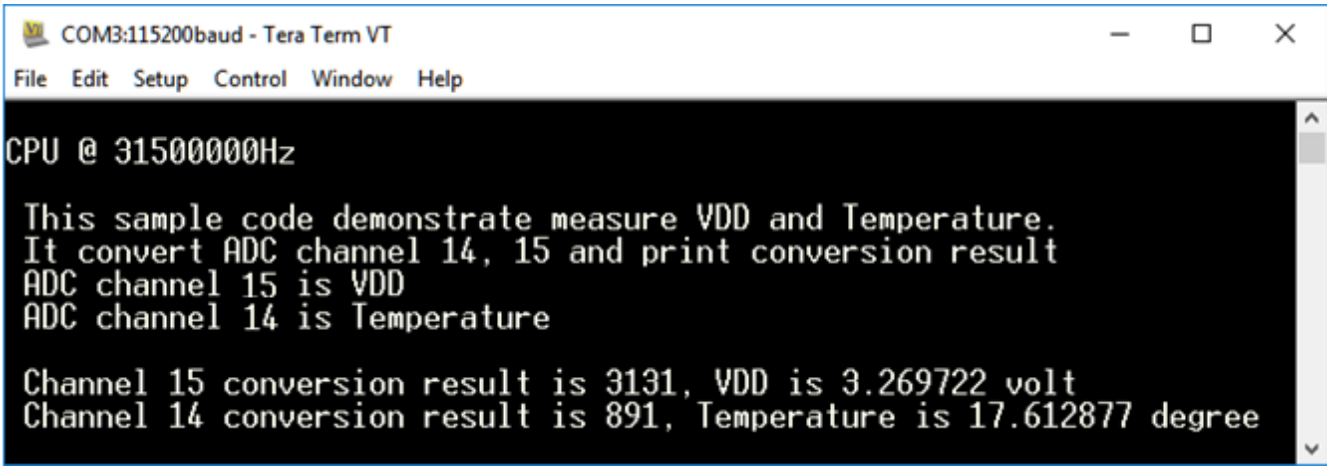
Vtemp (mV) = -1.73 (mV/℃) x Temperature (℃) + 740 (mV).

Measuring the supply voltage using ADC channel 15.

The calculate function show as below:

VDD = (4096/ADC_15)*2.5V

1.3 Demo Result



2 Code Description

Enable temperature sensor and BandGap：

```
    SYS_EnableTempCtl(); // Enable Temperature Sensor
    SYS_EnableIntVRefBGP(1); // Enable Vref is BGP
```

Set ADC and start the A/D conversion：

```
    // Set ADC
    ADC_Open(ADC, ADC_INPUT_MODE_SINGLE_END, ADC_OPERATION_MODE_SINGLE_CYCLE,
ADC_CH_14_MASK | ADC_CH_15_MASK);
    ADC_SetExtraSampleTime(ADC, ADC_CH_14_MASK, 1024);


    ADC_SetVrefVoltage(0); // Set Vref voltage


    // Power on ADC
    ADC_POWER_ON(ADC);


    // Enable ADC ADC_IF interrupt
    ADC_EnableInt(ADC, ADC_ADF_INT);
    NVIC_EnableIRQ(ADC_IRQn);


    ADC_START_CONV(ADC);
```

Get A/D conversion value and calculate VDD voltage and temperature：

```
    u32Result = ADC_GET_CONVERSION_DATA(ADC, 15);
    fAvdd = 2.5 * 0xfff / u32Result;
    printf(" Channel 15 conversion result is %d, VDD is %f volt \n", u32Result, fAvdd);
    u32Result = ADC_GET_CONVERSION_DATA(ADC, 14);
    fTmp = (740 - (1000 * u32Result / 4096) * fAvdd) / 1.73 ;
    printf(" Channel 14 conversion result is %d, Temperature is %f degree \n", u32Result,
fTmp);
```

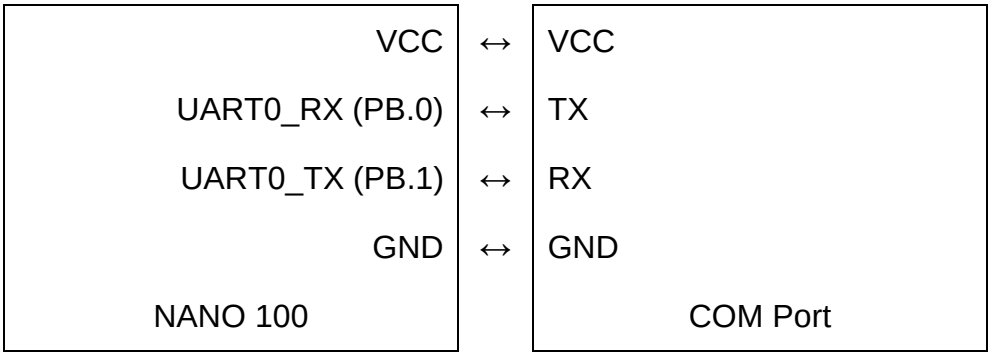
3 Software and Hardware Environment

Software Environment

- BSP version
  - Nano100B Series BSP CMSIS V3.03.000
- IDE version
  - Keil uVersion 5.26

Hardware Environment

- Circuit components
  - NuTiny-EVB-NANO130-LQPF128
- Diagram



4 Directory Information

- EC_Nano100_Use_BandGap_Measure_VDD_And_Temperature
  - 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

5 How to Execute Example Code

1. Browsing into sample code folder by Directory Information (section 4) and double click Nano100_Use_BandGap_Measure_VDD_And_Temperature.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Jun. 26, 2019	1.00	1. Initially issued.

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