Nano112 比較器模式測PT1000

NuMicro® 32 位系列微控制器範例代碼介紹

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文件信息

代碼簡述	本範例代碼使用 Nano112 ACMP Slope 測量 PT1000 溫度
BSP 版本	Nano102_112_Series_BSP_CMSIS_v3.03.000
開發平臺	NuTiny-SDK-Nano112V

1 功能介紹

1.1 簡介

Single Slop ADC模式是一種利用模數轉換去測量未知電阻的阻值的方法，它是利用比較器去完成的而不是單獨的ADC模塊。這種方法是用已知阻值和未知阻值的電阻對電容進行放電。在電容放電的時候，利用定時器計時電阻放電的時長。電阻值越大時間越長。未知的電阻可以通過參考已知電阻放電的時長計算得到。

只有比較器ACMP0有Single Slope ADC模式。該模式可以花最少的代價得到高分辨率的ADC功能，只需很少的外圍器件。這些器件包括一個熱敏電阻（如PT1000）、一個參考電阻和一個電容。

1.2 原理

計算熱敏電阻阻值的公式：

$$\frac{Tcap\_temp}{R\_temp} = \frac{Tcap\_ref}{R\_ref}$$

Tcap_ref：通過參考電阻放電定時器捕獲的放電時間值。

R_ref ：參考電阻阻值。

Tcap_temp：通過熱敏電阻放電定時器捕獲的放電時間值。

R_temp ：熱敏電阻阻值（通過前面三個值算出）。

Pt1000熱電阻公式經過解一元二次方程整理後：

$$t = \frac{39083 - \sqrt{175848089 - 231000 * R_t}}{11.55}$$

Rt：溫度為t時鉑熱電阻的電阻值Ω；

t：溫度℃;

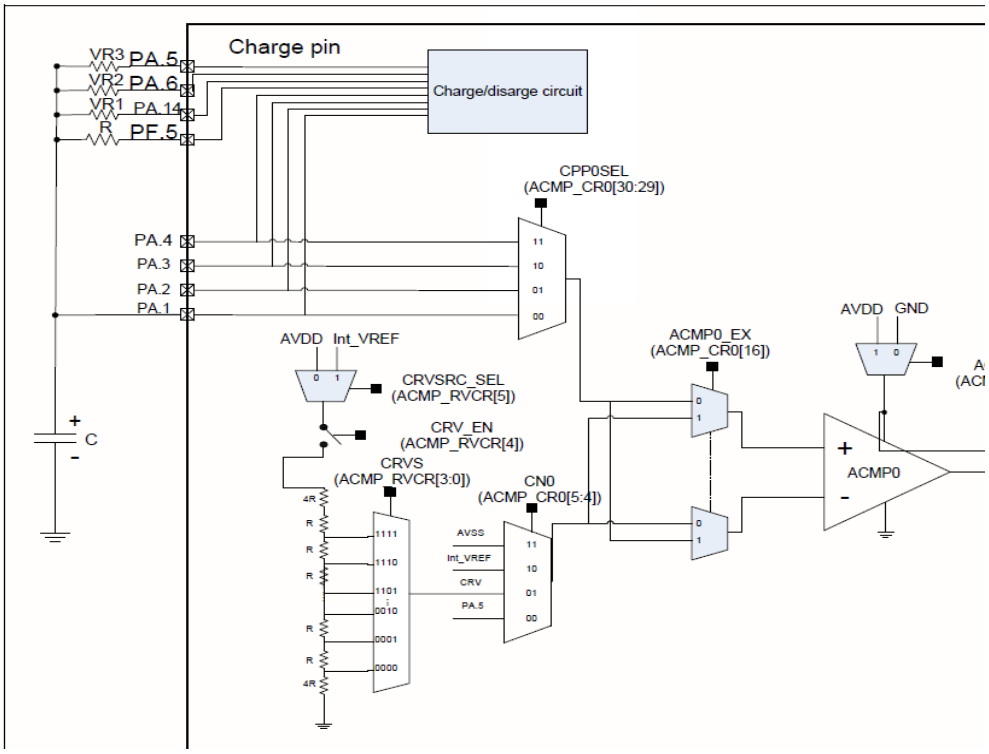
2 代碼介紹

計算溫度值：

```
        for (u32cnt = 0; u32cnt < 0x100000; u32cnt++);


        PE->DOUT   &= ~0x40 ;
        ACMP_SetSlopeConv(ACMP_TIMER01, ACMP_MODCR0_TMR_TRI_LV_FALLING,
ACMP_CR_CPP0SEL_PA4, ACMP_MODCR0_CH_DIS_PINSEL_PA14);
        ACMP_ENABLE(ACMP, 0);


        for (u32cnt = 0; u32cnt < 0x50000; u32cnt++);


        ACMP_START_CONV(ACMP);


        while (!i32Tmr0_cap_complete);
        i32Tmr0_cap_complete = 0;


        ACMP_DISABLE(ACMP, 0);
        u32Tcap_ref = TIMER0->TCAP;    //about 0.2mS


        ACMP_SetSlopeConv(ACMP_TIMER01, ACMP_MODCR0_TMR_TRI_LV_FALLING,
ACMP_CR_CPP0SEL_PA4, ACMP_MODCR0_CH_DIS_PINSEL_PA3);
        ACMP_ENABLE(ACMP, 0);


        for (u32cnt = 0; u32cnt < 0x50000; u32cnt++);


        ACMP_START_CONV(ACMP);


        while (!i32Tmr0_cap_complete);
        i32Tmr0_cap_complete = 0;


        ACMP_DISABLE(ACMP, 0);
        u32Tcap_temp = TIMER0->TCAP;


        u32R_temp = (u32Tcap_temp * 119370 / u32Tcap_ref + u32R_temp) / 2;
        u32C_temp = ((39083 - _sqrt(1758480890 - 231 * u32R_temp)) * 1000 / 1155 +
u32C_temp) / 2;
        PE->DOUT   |= 0x40 ;
```

3 軟件與硬件環境

- 軟件環境
  - BSP 版本
    - Nano102_112_Series_BSP_CMSIS_v3.03.000
  - IDE 版本
    - Keil uVersion 5.26
- 硬件環境
  - 電路組件
    - NuTiny-SDK-Nano112V
    - PT1000
  - 示意圖



4 目錄信息

- EC_Nano112_ACMP_Slope_PT1000_V1.00
  - 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
    - LCDLib — LCD library source code
  - SampleCode
    - ExampleCode — Source file of example code
    - NUTINY-EVB-NANO112 — LCD Panel source code

5 如何執行範例程序

1. 根據目錄信息章節進入 ExampleCode 路徑中的 KEIL 文件夾，雙擊 Nano112_ACMP_Slope_PT1000.uvproj 。
2. 進入編譯模式接口
   a. 編譯
   b. 下載代碼至內存
   c. 進入 / 離開除錯模式
3. 進入除錯模式接口
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Sept. 17, 2019	1.00	1. 初始發佈.

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