Nano112 比较器模式测PT1000

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	本范例代码使用 Nano112 ACMP Slope 测量 PT1000 温度
BSP 版本	Nano102_112_Series_BSP_CMSIS_v3.03.000
开发平台	NuTiny-SDK-Nano112V

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1 功能介绍

1.1 简介

Single Slop ADC模式是一种利用模数转换去测量未知电阻的阻值的方法，它是利用比较器去完成的而不是单独的ADC模块。这种方法是用已知阻值和未知阻值的电阻对电容进行放电。在电容放电的时候，利用定时器计时电阻放电的时长。电阻值越大时间越长。未知的电阻可以通过参考已知电阻放电的时长计算得到。

只有比较器ACMP0有Single Slope ADC模式。该模式可以花最少的代价得到高分辨率的ADC功能，只需很少的外围器件。这些器件包括一个热敏电阻（如PT1000）、一个参考电阻和一个电容。

1.2 原理

计算热敏电阻阻值的公式：

$$\frac{Tcap_temp}{R_temp} = \frac{Tcap_ref}{R_ref}$$

Tcap_ref：通过参考电阻放电定时器捕获的放电时间值。

R_ref：参考电阻阻值。

Tcap_temp：通过热敏电阻放电定时器捕获的放电时间值。

R_temp：热敏电阻阻值（通过前面三个值算出）。

Pt1000热电阻公式经过解一元二次方程整理后：

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

Rt：温度为t时铂热电阻的电阻值Ω；

t：温度℃;

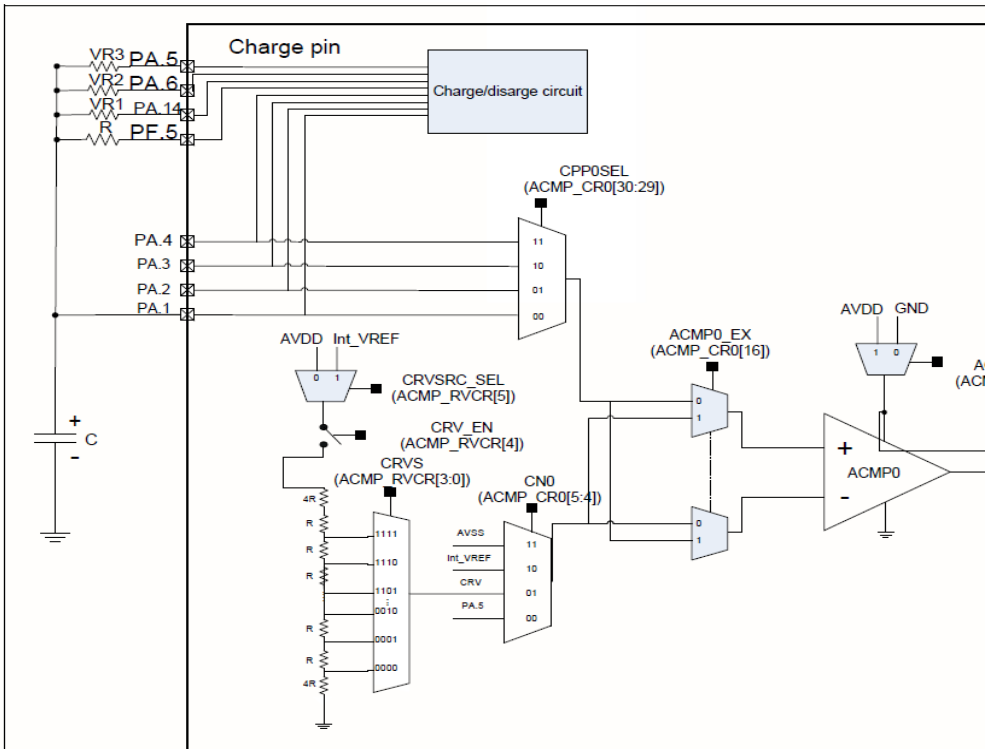
2 代码介绍

计算温度值：

```
        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 软件与硬件环境

- 软件环境
  - BSP 版本
    - Nano102_112_Series_BSP_CMSIS_v3.03.000
  - IDE 版本
    - Keil uVersion 5.26
- 硬件环境
  - 电路组件
    - NuTiny-SDK-Nano112V
    - PT1000
  - 示意图



4 目录信息

- 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 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 Nano112_ACMP_Slope_PT1000.uvproj 。
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开除错模式
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Sept. 17, 2019	1.00	1. 初始发布.

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