

Design of RTC Real Time Clock

Huang Jian
 XiJing University
 Xi'an 710123, China
 565200245@qq.com

Abstract—In embedded system design, accurate reference clock is very important, and crystal oscillator is often used as clock source. Using 8MHz clock as CPU clock source, in addition to the 8MHz crystal oscillator, there is often a 32.768MHz crystal oscillator, using it as the real-time clock benchmark. It can provide accurate information such as time and seconds.

Keywords—CPU, clock source, crystal oscillator

I. INTRODUCTION

In engineering practice, when an embedded system works, there must be an accurate clock. Usually we have to design a hardware circuit, the commonly used clock processing chip is DS1302, it can provide accurate time, seconds, years, months and days and other information. The IIC interface can be easily connected with various microprocessors. For advanced microprocessors, such as STM32, there is a real-time clock RTC built-in to facilitate access to time information.

A. Hardware Design

The hardware circuit design is shown in Figure 1. The sequence diagram of ADC data acquisition is described in detail in the figure. The highest clock frequency of ADC_CLK is 1MHz. The data is collected at the descending edge of AET_ADON, and the analog is converted into digital. After the conversion, the EOC outputs high level. At this time, the CPU can read the data.

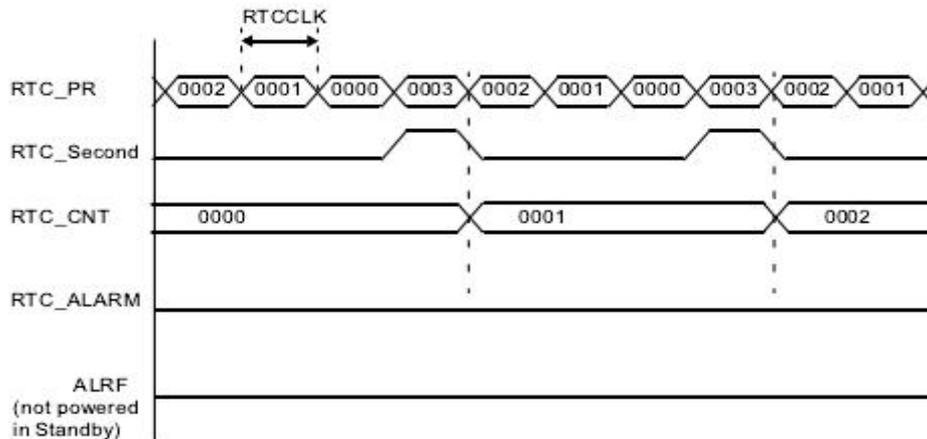


Fig 1 RTC Second Alarm

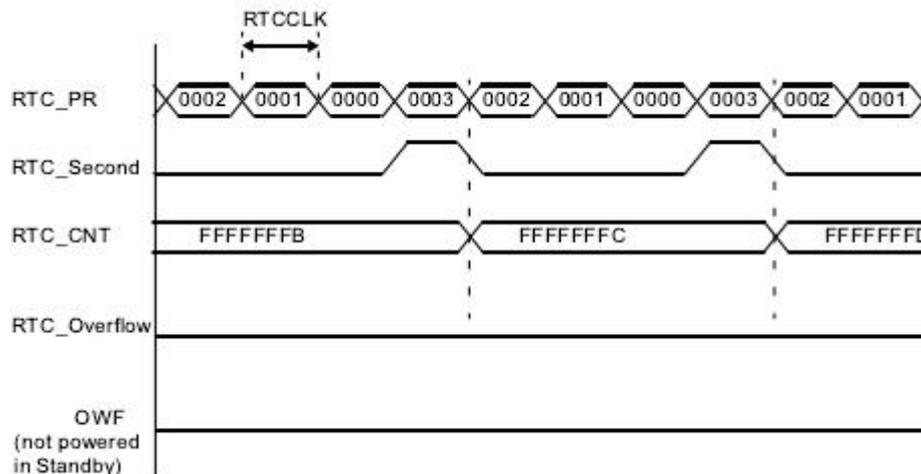


Fig2. RTC Overflow Chart

B. Software

In this design, KEIL 5 is programmed in C language. Configure RTC, trigger interrupt, 1s clock read data once. The following code is given.

```
u8 RTC_Init(void)
{
    u8 temp=0;
    if(BKP->DR1!=0X5050)
    //if(BKP->DR1!=0X0050)
    {
        RCC->APB1ENR|=1<<28;
        RCC->APB1ENR|=1<<27;
        PWR->CR|=1<<8;
        RCC->BDCR|=1<<16;
        RCC->BDCR&=~(1<<16);
        RCC->BDCR|=1<<0;
        while(!(RCC->BDCR&0X02))&&temp<250)
        {
            temp++;
            delay_ms(10);
        };
        if(temp>=250)return 1;
        RCC->BDCR|=1<<8;
        RCC->BDCR|=1<<15;
        while(!(RTC->CRL&(1<<5)));
        while(!(RTC->CRL&(1<<3)));
        RTC->CRH|=0X01;
        while(!(RTC->CRL&(1<<5)));
        RTC->CRL|=1<<4;
        RTC->PRLH=0X0000;
        RTC->PRLL=32767;                //RTC_Set(2014,3,8,22,10,55);
        RTC_Set(2016,6,23,8,57,00);

        RTC->CRL&=~(1<<4);
            while(!(RTC->CRL&(1<<5)));
        BKP->DR1=0X5050; )
        printf("FIRST TIME\n");
    }else
    {
        while(!(RTC->CRL&(1<<3)));
        RTC->CRH|=0X01;
        while(!(RTC->CRL&(1<<5)));
        printf("OK\n");
    }
}
```

```

}
MY_NVIC_Init(2,2,RTC_IRQn,2);
RTC_Get();
return 0; //ok
}
u8 Is_Leap_Year(u16 year)
{
    if(year%4==0)
    {
        if(year%100==0)
        {
            if(year%400==0)return 1;
            else return 0;
        }else return 1;
    }else return 0;
}
u8 RTC_Set(u16 syear,u8 smon,u8 sday,u8 hour,u8 min,u8 sec)
{
    u16 t;
    u32 seccount=0;
    if(syear<1970||syear>2099)return 1;
    for(t=1970;t<syear;t++)
    {
        if(Is_Leap_Year(t))seccount+=31622400;
        else seccount+=31536000;
    }
    smon-=1;
    for(t=0;t<smom;t++)
    {
        seccount+=(u32)mon_table[t]*86400;
        if(Is_Leap_Year(syear)&& t==1)seccount+=86400; }
    seccount+=(u32)(sday-1)*86400;
    seccount+=(u32)hour*3600;
    seccount+=(u32)min*60;
    seccount+=sec;
    RCC->APB1ENR|=1<<28;
    RCC->APB1ENR|=1<<27;
    PWR->CR|=1<<8;
    RTC->CRL|=1<<4;
    RTC->CNTL=seccount&0xffff;
    RTC->CNTH=seccount>>16;

```

```

RTC->CRL&=~(1<<4); while(!(RTC->CRL&(1<<5)));
RTC_Get();
return 0;
}

```

II. SUMMARY

This paper expounds the working principle and method of collecting internal CPU temperature by STM32, gives the hardware circuit design diagram, describes the timing of ADC acquisition in detail, and writes the driver program in C language under KEIL, which can accurately collect internal temperature and meet the design requirements. It has certain practical value.

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