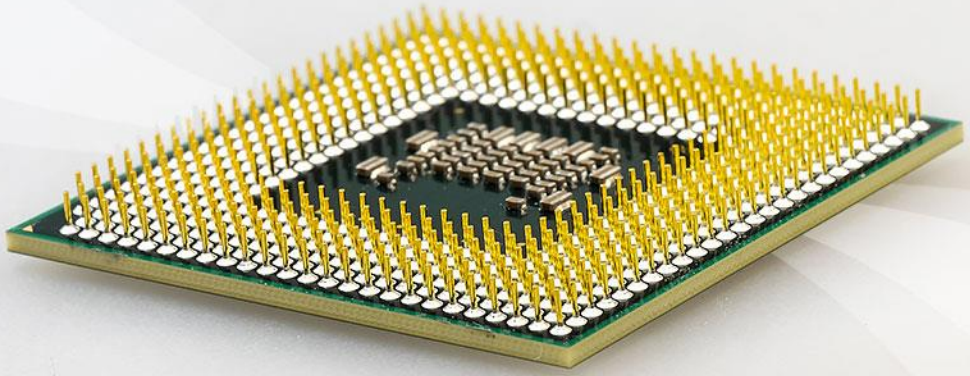


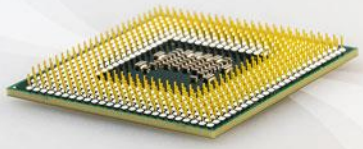
微算機應用實習

RTC模組

課程編號 ： EE4801702

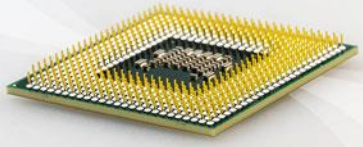
實習課助教 ： 曾子倫

Outline



- RTC Module 介紹
- RTC 記憶體暫存器介紹
- 函式介紹
- Homework2

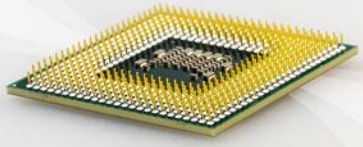
RTC Module 介紹



- RTC (Real-Time Clock)

- 在一般微算機系統上，為了減少CPU的工作負擔，通常都會將Time Clock的電路功能移出系統核心，改由一個RTC的積體電路負責維持時鐘計時功能。

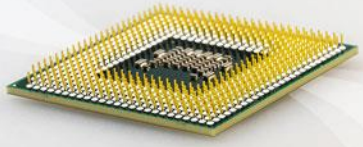
RTC Module 介紹



- 記憶體暫存器介紹

```
/* RTC memory address */
#define RTC_MEM_ADDR_BASE              (0x00200400)
#define rRTC_CTL                       (RTC_MEM_ADDR_BASE+0x00)
#define rRTC_SEC                       (RTC_MEM_ADDR_BASE+0x04)
#define rRTC_MIN                       (RTC_MEM_ADDR_BASE+0x08)
#define rRTC_HOUR                      (RTC_MEM_ADDR_BASE+0x0C)
#define rRTC_DAY                       (RTC_MEM_ADDR_BASE+0x10)
#define rRTC_WEEK                      (RTC_MEM_ADDR_BASE+0x14)
#define rRTC_MONTH                     (RTC_MEM_ADDR_BASE+0x18)
#define rRTC_YEAR                      (RTC_MEM_ADDR_BASE+0x1C)
```

RTC Module 介紹

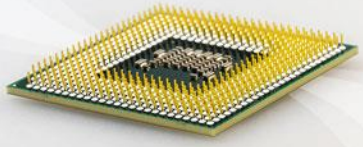


- RTC_CTL （ 設定成0x83 ）

RTC Register: address range 0x0020_0400 ~ 0x0020_07FF

Index	Default	R/W	Bit	Name	Description
00	00	R/W	31:8	Reserved	
		R/W	7	EN_RTC	1: Enable RTC 0: Disable RTC
		R/W	6	CHG_RTC_LCLK	Enable RTC clock = 32 KHz low frequency clock 1: can't not read/write RTC register (Power Down Mode) 0: can read/write RTC register
		R	5	RTC_ALARM	1: Event of alarm 0: No event of alarm
		R	4	RTC_1S	1: Event of RTC 1s 0: No event of RTC 1s
		R/W	3	ALARM_EN	1: Enable alarm wake-up and interrupt 0: Disable alarm
		R/W	2	1S_EN	1: Enable one second wake-up and interrupt 0: Disable one second
		W	1	CLR_ALARM	1: Clear event alarm interrupt 0: No clear event alarm interrupt
		W	0	CLR_RTC_1S	1: Clear event RTC 1s interrupt 0: No clear event RTC 1s interrupt

RTC Module 介紹



- 記憶體暫存器介紹

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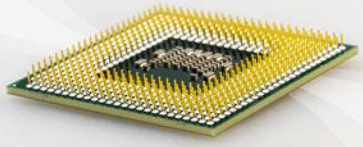
#define rRTC_HOUR                   (RTC_MEM_ADDR_BASE+0x0C)
#define rRTC_DAY                    (RTC_MEM_ADDR_BASE+0x10)
#define rRTC_WEEK                   (RTC_MEM_ADDR_BASE+0x14)
#define rRTC_MONTH                  (RTC_MEM_ADDR_BASE+0x18)
#define rRTC_YEAR                   (RTC_MEM_ADDR_BASE+0x1C)
```

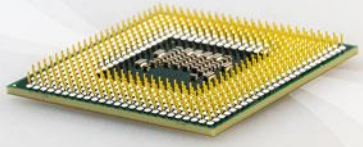
RTC Module 介紹



- 時間設定

04	00	R/W	31:7	Reserved	
			6:0	RTC_SEC[6:0]	Second coded in BCD, range is 0~59. SEC [6:4] represents 10 seconds. SEC[3:0] represents seconds.
08	00	R/W	31:7	Reserved	
			6:0	RTC_MIN[6:0]	Minute coded in BCD, range is 0~59. MIN[6:4] represents 10 minutes. MIN[3:0] represents minutes.
0C	00	R/W	31:6	Reserved	
			5:0	RTC_HOUR[5:0]	Hour coded in BCD, range is 0~23. HOUR[5:4] represents 10 hours. HOUR[3:0] represents hours.
10	01	R/W	31:6	Reserved	
			5:0	RTC_DAY[5:0]	Day of month coded in BCD, range is 1~31. DAY[5:4] represents 10 days. DAY[3:0] represents days.
14	00	R/W	31:3	Reserved	
			2:0	RTC_WEEK[2:0]	Day of week. 000: Sunday 001: Monday 010: Tuesday 011: Wednesday 100: Thursday 101: Friday

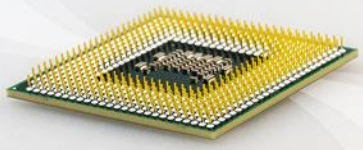
RTC Module 介紹



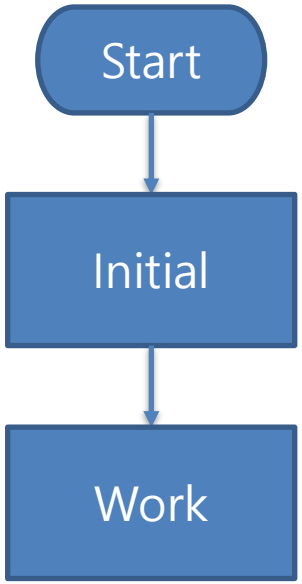
- 時間設定

					110: Saturday
18	01	R/W	31:4	Reserved	
			3:0	RTC_MONTH[3:0]	Month. 0001: January 0010: February 0011: March 0100: April 0101: May 0110: June 0111: July 1000: August 1001: September 1010: October 1011: November 1100: December
1C	00	R/W	31:8	Reserved	
			7:0	RTC_YEAR[7:0]	Year coded in BCD, range is 0~99. YEAR[7:4] represents 10 years. YEAR [3:0] represents years.

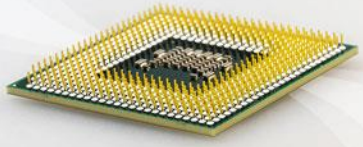
RTC Module 介紹



- 使用流程



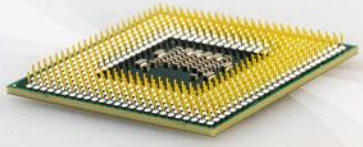
函式介紹



- 函式介紹

函式名稱	函式功能
InitialRTC( )	初始化 RTC
DisplayTime( )	顯示 RTC 目前時間在 LCD 上

函式介紹

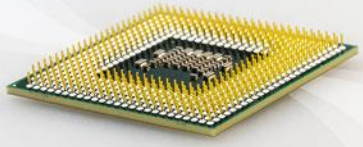


- InitialRTC( )

```
void InitialRTC(char year,char month,char week,char day,char hour,char min,char sec)
{
    OUTW(rRTC_CTL, 0x83);

    OUTW(rRTC_SEC,  sec);
    OUTW(rRTC_MIN,  min);
    OUTW(rRTC_HOUR, hour);
    OUTW(rRTC_DAY,  day);
    OUTW(rRTC_WEEK, week);
    OUTW(rRTC_MONTH,month);
    OUTW(rRTC_YEAR, year);
}
```

函式介紹



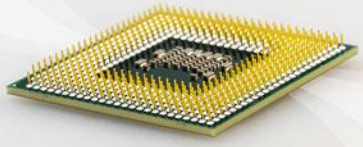
- DisplayTime( )

```
#define To_ASCII 0x30
void DisplayTime(void)
{
    unsigned int year = INW(rRTC_YEAR), mon = INW(rRTC_MONTH), day = INW(rRTC_DAY);
    unsigned int hour = INW(rRTC_HOUR), min = INW(rRTC_MIN),   sec = INW(rRTC_SEC);

    unsigned char week_str[7][3] = {"Sun", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat"};
    unsigned int  week = INW(rRTC_WEEK), i;

    WriteIns(0x80); //STN LCM,第一列
    WriteData('2');
    WriteData('0');
    WriteData(((year >> 4) & 0xF) + To_ASCII);
    WriteData((year & 0xF) + To_ASCII);
    WriteData(':');
    WriteData(((mon / 10) & 0xF) + To_ASCII);
    WriteData((mon % 10) + To_ASCII);
    WriteData(':');
    WriteData(((day >> 4) & 0xF) + To_ASCII);
    WriteData((day & 0xF) + To_ASCII);
    WriteData(' ');
    for (i=0; i<3; i++)
        WriteData(week_str[week][i]);
```

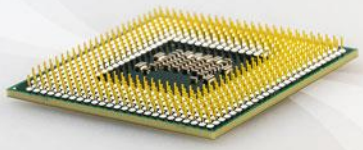
函式介紹



- DisplayTime( )

```
    WriteIns(0xC0); //STN LCM,第二列
    WriteData(' ');
    WriteData(' ');
    WriteData(((hour >> 4) & 0xF) + To_ASCII);
    WriteData((hour & 0xF) + To_ASCII);
    WriteData(':');
    WriteData(((min >> 4) & 0xF) + To_ASCII);
    WriteData((min & 0xF) + To_ASCII);
    WriteData(':');
    WriteData(((sec >> 4) & 0xF) + To_ASCII);
    WriteData((sec & 0xF) + To_ASCII);
}
```

Example



- 顯示特定時間在LCD上

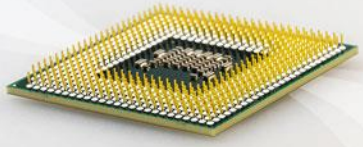
```
int main()
{
    OS_PowerOnDriverInitial();
    char year=0x17; //BCD
    char month=8;   //Decimal
    char week=4;    //Decimal
    char day=0x17;  //BCD
    char hour=0x09; //BCD
    char min=0x23;  //BCD
    char sec=0x00;  //BCD
    // Initial RTC to 2017/08/17 Thu. 09:23:00

    InitialLCD();   //Initial LCD Module
    InitialRTC(year,month,week,day,hour,min,sec); //Initial RTC Module

    while(1)
        DisplayTime();  //Display time on LCD

    return 0;
}
```

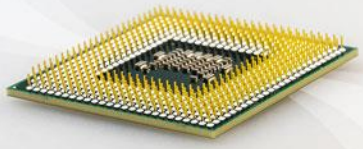
Homework 2



- 開機先顯示 "當前時間" 於 LCD Module（兩行），但秒數為00

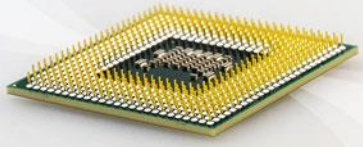
- 按下〝SW2~SW11〞可改變秒數
- 按下〝SW16〞，清除鍵(將秒數清除為00)
- 按下〝SW17〞，確認鍵(確認目前秒數並開始計時)

Homework 2



- 繳交期限：2023/4/27上課前
- 繳交方式：上傳至Moodle

作業格式



- **檔案名稱**請以下列方式命名

  學號_姓名_HW(作業編號)，務必以此格式上傳

  EX : B10607100_王小明_HW2

  請繳交PDF檔(*.pdf)

- 作業範例

  一. 目的&原理

  二. 程式流程圖

  三. 程式碼(含註解)

  四. 程式執行結果(拍照)

  未按照此格式繳交扣分!!!!!