NUC240使用I²C驅動DS3231

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	本範例代碼使用NUC240的I²C驅動DS3231
BSP 版本	NUC230_240 Series BSP CMSIS v3.01.001
開發平台	NuEdu-EVB-NUC240 v1.0

1 功能介紹

1.1 簡介

本範例代碼使用I^{2}C介面，去讀寫DS3231暫存器，達成顯示時鐘功能。本範例提供了2個API，讓使用者呼叫：

API	功能
void DS3231_RTC_Write(uint8_t u8Reg, uint8_t u8Value)	寫入DS3231暫存器
uint8_t DS3231_RTC_Read(uint8_t u8Reg)	讀取DS3231暫存器

1.2 原理

DS3231特點如下：

- 是低成本、高精度 I^{2}C 即時時鐘(RTC)。
- 保存秒、分、時、星期、日期、月和年資訊。
- I^{2}C 介面。
- 0~40 ℃範圍內，精度正負 2 ppm；-40~85 ℃範圍內，精度正負 3.5 ppm。

1.3 執行結果

NUC240開發版的PA9(SCK)連接至DS3231的SCL；PA8(SDA)連接至DS3231的SDA。編譯專案並進入除錯模式執行程式， DS3231時間數值會列印在Serial Window UART #1。

```
19/11/5 15: 58: 02
19/11/5 15: 58: 03
19/11/5 15: 58: 04
19/11/5 15: 58: 05
19/11/5 15: 58: 06
19/11/5 15: 58: 07
19/11/5 15: 58: 08
19/11/5 15: 58: 09
19/11/5 15: 58: 10
19/11/5 15: 58: 11
19/11/5 15: 58: 12
19/11/5 15: 58: 13
19/11/5 15: 58: 14
```

2 代碼介紹

2.1 寫入 DS3231 暫存器值

DS3231_RTC_Write此函式主要工作為寫入DS3231暫存器的值，在初始化時可利用此函式來設定起始的時間。

```
void DS3231_RTC_Write(uint8_t u8Reg, uint8_t u8Value)
{
    /* DS3231 I2C slave address */
    g_u8DeviceAddr = 0x68;

    /* DS3231 address map */
    g_au8TxData[0] = u8Reg;

    /* Write data to DS3231 */
    g_au8TxData[1] = dec_to_bcd(u8Value);
    g_u8DataLen = 0;
    g_u8EndFlag = 0;

    /* I2C function to write data to slave */
    s_I2C0HandlerFn = (I2C_FUNC)I2C_MasterTx;

    /* I2C as master sends START signal */
    I2C_SET_CONTROL_REG(I2C0, I2C_I2CON_STA);

    /* Wait I2C Tx Finish */
    while (g_u8EndFlag == 0);

    g_u8EndFlag = 0;
}
```

2.2 讀取 DS3231 暫存器值

DS3231_RTC_Read 此函式主要工作為讀取DS3231暫存器的值，本範例程式在主程式中更新最新讀取的時間。

```
uint8_t DS3231_RTC_Read(uint8_t u8Reg)
{
    /* DS3231 I2C slave address */
    g_u8DeviceAddr = 0x68;

    /* DS3231 address map */
    g_au8TxData[0] = u8Reg;

    g_u8DataLen = 0;
    g_u8EndFlag = 0;

    /* I2C function to read data from slave */
    s_I2C0HandlerFn = (I2C_FUNC)I2C_MasterRx;

    /* I2C as master sends START signal */
    I2C_SET_CONTROL_REG(I2C0, I2C_I2CON_STA);

    /* Wait I2C Rx Finish */
    while (g_u8EndFlag == 0);

    g_u8EndFlag = 0;

    return bcd_to_dec(g_u8RxData);
}
```

3 軟體與硬體環境

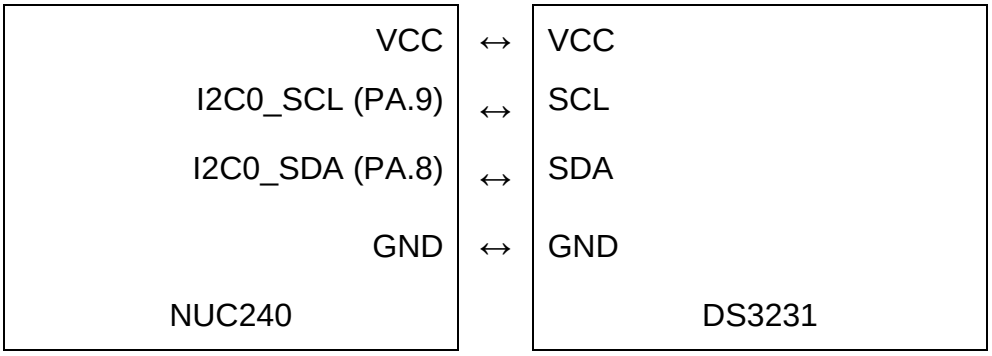
● 軟體環境

- ■ BSP 版本
  - ◆ NUC230_240 Series BSP CMSIS v3.01.001
- ■ IDE 版本
  - ◆ Keil uVersion 4.74

● 硬體環境

- ■ 電路元件
  - ◆ NuEdu-EVB-NUC240 V1.0
  - ◆ DS3231
- ■ 示意圖

NUC240 使用 I^{2}C 腳位讀寫 DS3231 的暫存器值。



4 目錄資訊

- EC_ NUC240_I2C_DS3231_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
    - NuEdu — Library for NuEdu-SDK-NUC240 board
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example code

5 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 NUC240_I2C_DS3231.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Nov. 1, 2019	1.00	1. 初始發布

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.