使用GPIO和TIMER模擬UART傳送

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	使用 GPIO 及 TIMER 模拟 UART 波形
BSP 版本	NUC240 Series BSP CMSIS V3.01.001
开发平台	NuTiny-EVB-NUC240 V1.2

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1 功能介绍

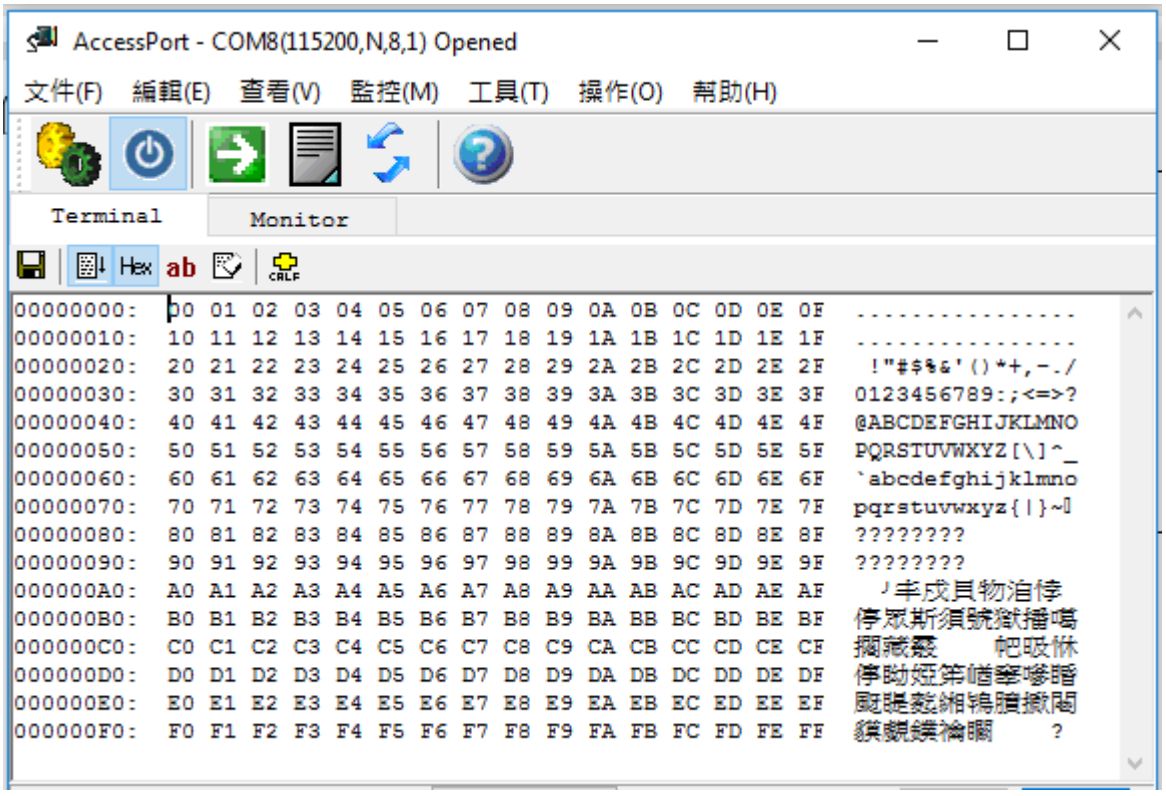
1.1 简介

当在应用时，有时难免会到硬件UART组数不够用，此时便可以用TIMER中断配合GPIO产生UART的波形，因为是软件处理，用户需要小心，在UART丢出去前，把其它中断关闭以免被打断传输。本范例提供了2个API，让使用者呼叫：

API	功能
void SW_UART_INIT(void)	送出字符Software UART的初始化
void UART_GPIO(uint32_t u8UartData)	送出字符

1.2 执行结果

NUC240开发板的PA.0 连接至NuBridge UART RX。开启计算机终端机软件，设置UART传输速度为115200bps，无校验位 ，数据长度为8位，停止位长度为1位。执行程序后，终端机打印出0x00-0xFF。



2 代码介绍

2.1 软件 UART 初始化

SW_UART_INIT负责Software UART的初始化：将GPIO(PA.0)脚位设定成输出模式，配置Timer 0频率为115200Hz，以及开启Timer 0中断。

```
void SW_UART_INIT(void)
{
    /* Configure PA.0 as output mode */
    GPIO_SetMode(PA, BIT0, GPIO_PMD_OUTPUT);

    /* Enable peripheral clock */
    CLK->APBCLK |= CLK_APBCLK_TMR0_EN_Msk;

    /* Select peripheral clock source */
    CLK->CLKSEL1 |= CLK_CLKSEL1_TMR0_S_HIRC;

    /* Open Timer0 frequency 115200 in periodic mode, and enable interrupt */
    TIMER0->TCMPR = (22118400/115200);
    TIMER0->TCSR = TIMER_TCSR_IE_Msk | TIMER_PERIODIC_MODE;
    TIMER_SET_PRESCALE_VALUE(TIMER0, 0);

    /* Enable Timer0 NVIC */
    NVIC_EnableIRQ(TMR0_IRQn);
}
```

2.2 UART 字元傳送

UART_GPIO负责传送UART字符：准备好要传送的字符，加上起始位和停止位，总共10个位的数据。开始Timer 0计数，直到所有位数据都处理完毕，再停止Timer 0计数。

```
void UART_GPIO(uint32_t u32UartData)
{
    /* Prepare transmit data */
    g_u32Data = (u32UartData<<1)|(1<<9);  //STOP BIT + 8 DATA BIT + START BIT
    g_u32Count = 10;

    /* Start Timer0 counting */
```

```
    TIMER_Start(TIMER0);
    while(g_u32Count!=0);

    /* Stop Timer0 counting */
    TIMER_Stop(TIMER0);
}
```

2.3 TIMER 中斷處理

Timer 0中断里根据要传输的数据控制GPIO，如果数据为1就输出高电压准位，如果数据为0就输出低电压准位。

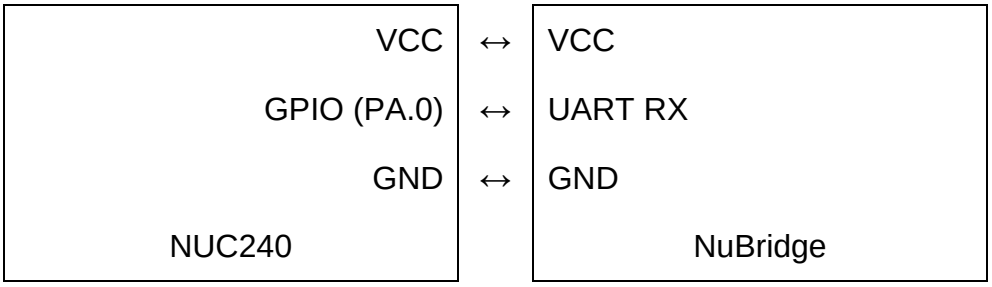
```
void TMR0_IRQHandler(void)
{
    /* Clear Timer0 time-out interrupt flag */
    TIMER_ClearIntFlag(TIMER0);

    /* Control PA.0 output status */
    if(g_u32Count!=0) {
        if((g_u32Data&0x01)==0x01)
            PA0=1;
        else
            PA0=0;
        g_u32Data=g_u32Data>>1;
        g_u32Count--;
    }
}
```

3 软件与硬件环境

- 软件环境
  - BSP 版本
    - NUC240 Series BSP CMSIS V3.01.001
  - IDE 版本
    - Keil uVersion 5.28
- 硬件环境
  - 电路组件
    - NuTiny-EVB-NUC240 V1.2
    - NuBridge
  - 示意图

NUC240 使用 GPIO(PA.0) 脚位模拟 UART 输出波形。



4 目录信息

- EC_NUC240_GPIO_UART_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-xxxx board
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example 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 NUC240_GPIO_UART.uvproj。
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Jul. 31, 2019	1.00	1. 初始发布.

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