使用ACMP反向UART Tx訊號

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 ACMP 當作反向器，將 UART Tx 訊號反向。
BSP 版本	NUC230_240 Series BSP CMSIS V3.01.001
開發平台	NuTiny-EVB-NUC240 V1.2

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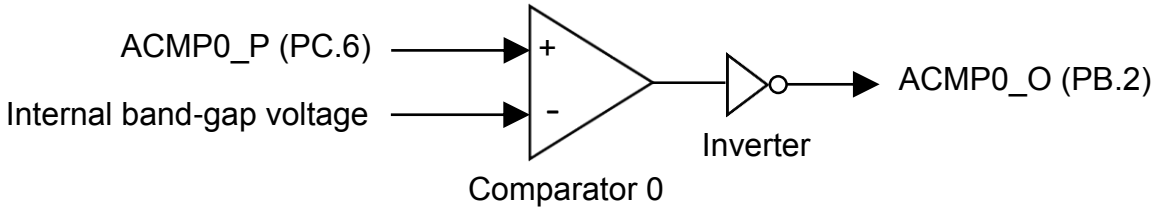
1 功能介紹

1.1 簡介

將MCU內部的ACMP當作反向器使用，把TX 輸入的ACMP的正端，ACMP的負端使用內部的BAND GAP，ACMP的輸出設定成反向信號。

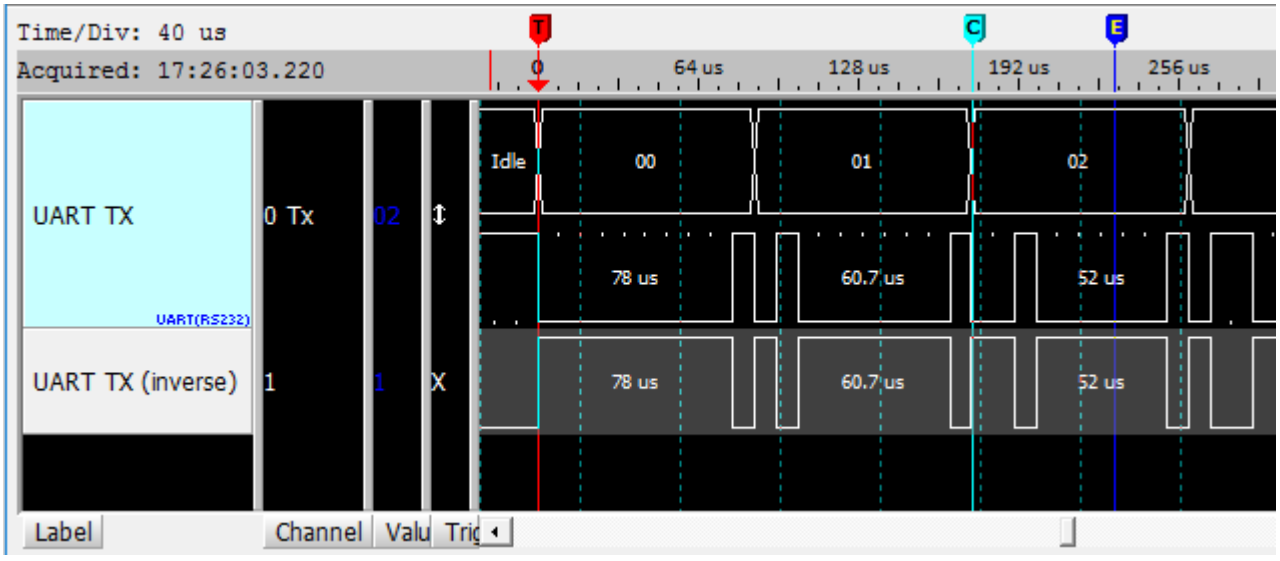
1.2 原理

當比較器的正端輸入電壓大於負端的輸入電壓，則比較器輸出電壓為1。當比較器的正端輸入電壓大於負端的輸入電壓，則比較器輸出電壓為0。另外NUC240還可以選擇將ACMP的輸出訊號反向。



1.3 執行結果

通道1為UART TX(PB.1)訊號，連接至ACMP正端輸入(PC.6) 。通道2量測ACMP輸出訊號(PB.2)，為UART TX訊號反向。



2 代碼介紹

設定ACMP的多功能管腳，選擇PC.6為正端輸入，PB.2為輸出，並關掉其數位輸入路徑。

```
    /* Set PC.6 multi-function pin for ACMP0 positive input pin */
    SYS->GPC_MFP = (SYS->GPC_MFP & (~SYS_GPC_MFP_PC6_Msk)) | SYS_GPC_MFP_PC6_ACMP0_P;
    SYS->ALT_MFP = (SYS->ALT_MFP & (~SYS_ALT_MFP_PC6_Msk)) | SYS_ALT_MFP_PC6_ACMP0_P;
    SYS->ALT_MFP1 = (SYS->ALT_MFP1 & (~SYS_ALT_MFP1_PC6_Msk)) | SYS_ALT_MFP1_PC6_ACMP0_P;

    /* Disable digital input path of analog pin ACMP0_P to prevent leakage */
    GPIO_DISABLE_DIGITAL_PATH(PC, BIT6);

    /* Set PB multi-function pins ACMP0 output */
    SYS->GPB_MFP = (SYS->GPB_MFP & (~SYS_GPB_MFP_PB2_Msk)) | SYS_GPB_MFP_PB2_ACMP0_O;
    SYS->ALT_MFP = (SYS->ALT_MFP & (~SYS_ALT_MFP_PB2_Msk)) | SYS_ALT_MFP_PB2_ACMP0_O;
    SYS->ALT_MFP2 = (SYS->ALT_MFP2 & (~SYS_ALT_MFP2_PB2_Msk)) | SYS_ALT_MFP2_PB2_ACMP0_O;

    /* Disable digital input path of analog pin ACMP0_O to prevent leakage */
     GPIO_DISABLE_DIGITAL_PATH(PB, BIT2);
```

設定ACMP，啟用ACMP0，選擇負端輸入為內部參考電壓，沒有使用遲滯功能。ACMP的輸出訊號經過反向。

```
    /* Configure ACMP0.
       Enable ACMP0 and select internal reference voltage as negative input. */
    ACMP_Open(ACMP, 0, ACMP_CR_VNEG_BANDGAP, ACMP_CR_HYSTERESIS_DISABLE);

    /* Enable ACMP output inverse */
    ACMP_ENABLE_OUTPUT_INVERSE(ACMP,0);
```

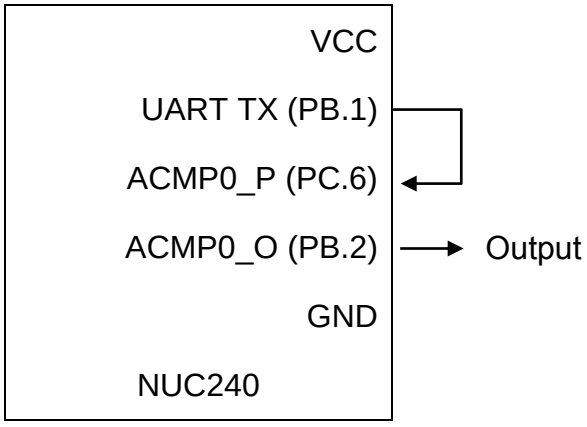
傳送UART Tx字元0x0~0x2。

```
    /* UART send character 0x0~0x2 */
    for(u32Idx=0; u32Idx<3; u32Idx++)
    {
        SendChar_ToUART(u32Idx);
    }
```

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 5.28
- **硬體環境**
  - 電路元件
    - NuTiny-EVB-NUC240 V1.2
  - 示意圖

UART Tx (PB.1)訊號輸出管腳接到 ACMP 正端輸入 (PC.6)，ACMP 輸出為 PB.2。



4 目錄資訊

- EC_NUC240_ACMP_Reverse_UART_Tx_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
  - 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_ ACMP_Reverse_UART_Tx.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Jul. 31, 2019	1.00	1. 初始發布.

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