NUC131 CAN自動波特率調整

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

應用簡述	本範例代碼通過週期改變 NUC131 CAN 的波特率，來接收 CAN 總線上的數據，以此匹配 CAN 總線通信波特率
BSP 版本	NUC131_Series_BSP_CMSIS_V3.00.005
開發平台	NuTiny-EVB-NUC131-LQFP64 V1.0

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1 概述

本範例代碼包含兩個工程，分別是“CAN_TX_RX”和“CAN_Auto_Adjust_BPS”。其中，“CAN_TX_RX”是一個CAN的收發例程，是為了方便測試“CAN_Auto_Adjust_BPS”例程功能寫的一個配套程序。

“CAN_Auto_Adjust_BPS”例程通過週期改變NUC131 CAN的波特率，來接收CAN總線上的數據，直到能正常接收到CAN總線上的數據，以此匹配CAN總線通信波特率。當匹配上CAN總線的通信波特率後，會週期的往CAN總線發送數據包。程序中設置的能檢測的波特率範圍為50Kbps~1Mbps，步進為50Kbps。

1.1 原理

該應用中，“CAN_Auto_Adjust_BPS”例程會先將NUC131的CAN設置為Silent模式，來接收CAN總線上的通信數據。在Silent模式，CAN內核可以接收有效的數據幀和有效的遠程幀，但只在CAN總線上發送隱性位，且不會啟動發送。如果CAN內核需要發送顯性位（ACK位、錯誤幀），該位內部直接連接到RX，所以儘管CAN總線保持在隱性狀態，CAN內核可以檢測到這個顯性位。Silent模式可以用來分析CAN總線的傳輸數據，且不會干擾總線上的數據傳輸。Silent模式下，CAN內核的CAN_TX和CAN_RX的連接如圖1-1所示。

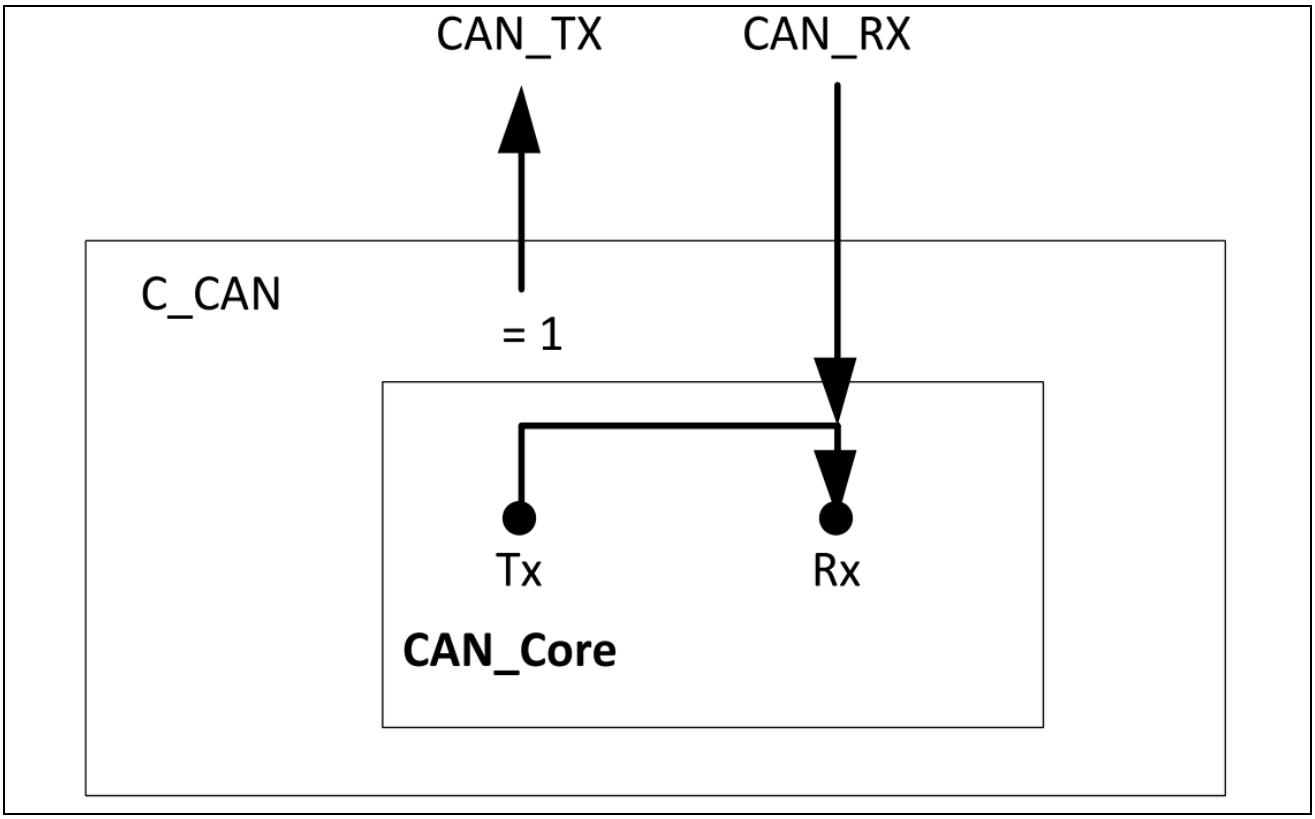

圖1-1 Silent模式CAN內核

1.2 執行結果

用兩塊NUC131 NuTiny板，一塊燒錄“CAN_TX_RX”程序，一塊燒錄“CAN_Auto_Adjust_BPS”程序，然後將兩塊NUC131 NuTiny板按圖3-1所示示意圖進行連接。接著打開串口調試助手，並按提示發送對應的字符。

“CAN_TX_RX”功能的板子打印資訊如圖1-2所示：

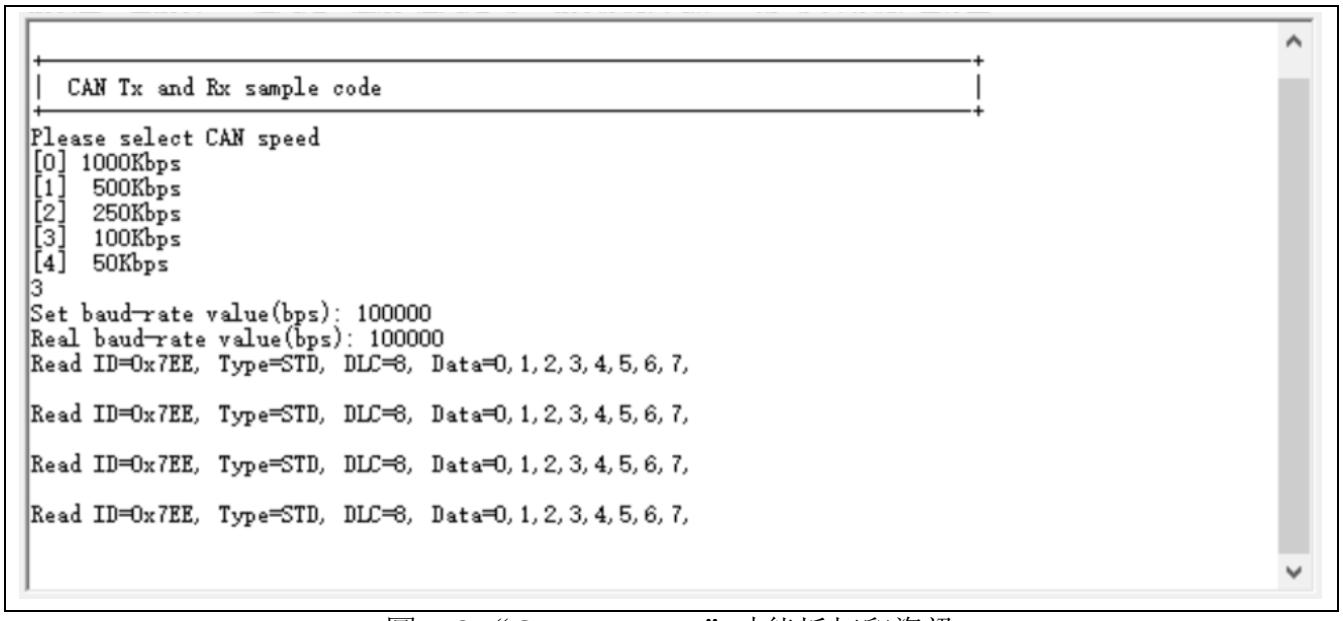

圖 1-2 “CAN_TX_RX”功能板打印資訊

“CAN_Auto_Adjust_BPS”功能的板子打印資訊如圖1-3所示：

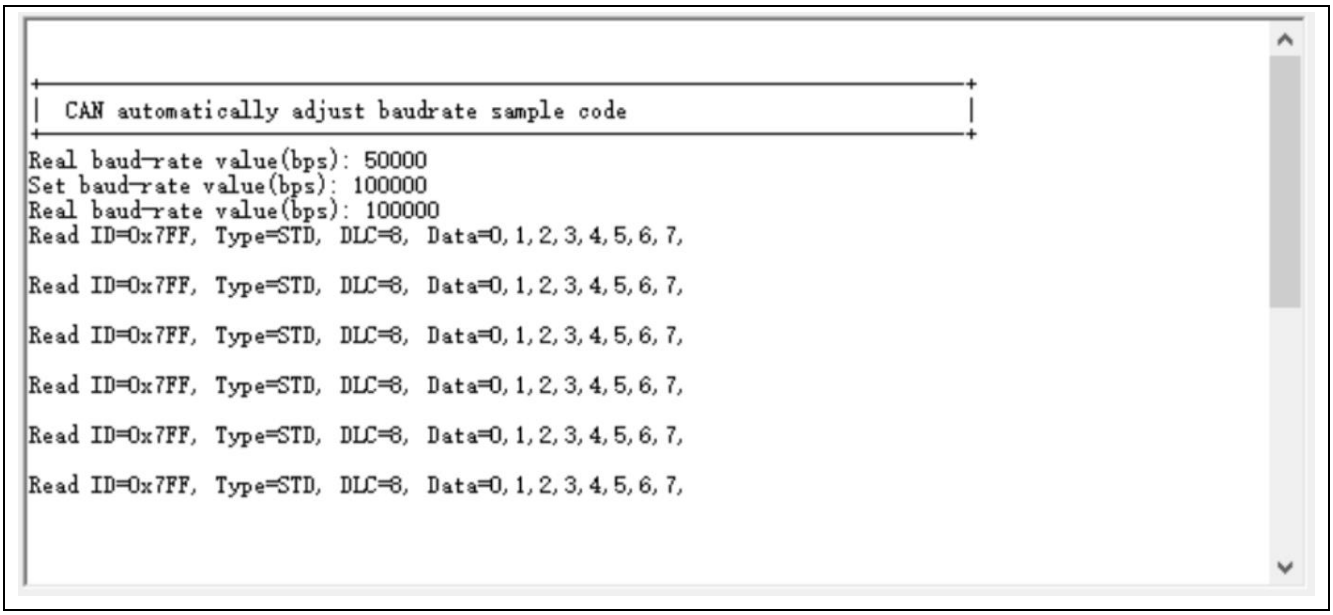

圖1-3 “CAN_Auto_Adjust_BPS”功能板打印資訊

2 代碼介紹

以下代碼介紹均基於“CAN_Auto_Adjust_BPS”例程。

波特率檢測範圍及步進設置：

```
#define BAUDRATE_MIN    50000
#define BAUDRATE_MAX    1000000
#define BAUDRATE_OFFSET 50000
```

初始化 CAN：

```
void CAN_Init(uint32_t u32BaudRate)
{
    uint32_t u32RealBaudRate = 0;

    /* Reset CAN */
    SYS_ResetModule(CAN0_RST);

    u32RealBaudRate = CAN_SetBaudRate(CAN0, u32BaudRate);
    printf("Set baud-rate value(bps): %d\n", u32BaudRate);
    printf("Real baud-rate value(bps): %d\n", u32RealBaudRate);

    /* Enable CAN to Silent mode */
    CAN_EnterTestMode(CAN0, CAN_TEST_SILENT_Msk);

    /* Enable CAN interrupt and corresponding NVIC of CAN */
    CAN_EnableInt(CAN0, CAN_CON_IE_Msk | CAN_CON_SIE_Msk);
    NVIC_SetPriority(CAN0_IRQn, (1 << __NVIC_PRIO_BITS) - 2);
    NVIC_EnableIRQ(CAN0_IRQn);

    if(CAN_SetRxMsg(CAN0, MSG(0), CAN_STD_ID, 0x7FF) == FALSE)
    {
        printf("Set Rx Msg Object failed\n");
    }
}
```

週期更改 CAN 的波特率，直到能正常接收 CAN 總線數據，然後退出 Silent 模式：

```
    if(g_u8RxOkFlag == 0)
    {
        if(g_u8RxOkCount == 0)
        {
            u32BaudRate = u32BaudRate + BAUDRATE_OFFSET;
            if(u32BaudRate > BAUDRATE_MAX)
            {
                u32BaudRate = BAUDRATE_MIN;
            }

            u32RealBaudRate = CAN_SetBaudRate(CAN0, u32BaudRate);
            printf("Set baud-rate value(bps): %d\n", u32BaudRate);
            printf("Real baud-rate value(bps): %d\n", u32RealBaudRate);

            CLK_SysTickLongDelay(100000);
        }
        else if(g_u8RxOkCount >= RX_OK_COUNT)
        {
            g_u8RxOkFlag = 1;
            CAN_LeaveTestMode(CAN0);
        }
    }
```

3 軟體與硬體需求

- **軟體需求**
  - BSP 版本
    - NUC131_Series_BSP_CMSIS_V3.00.005
  - IDE 版本
    - Keil uVersion 4.74
- **硬體需求**
  - 電路元件
    - NuTiny-EVB-NUC131-LQFP64 V1.0
    - CAN 收發器
  - 示意圖

本例程的硬件連接示意圖如圖3-1所示。

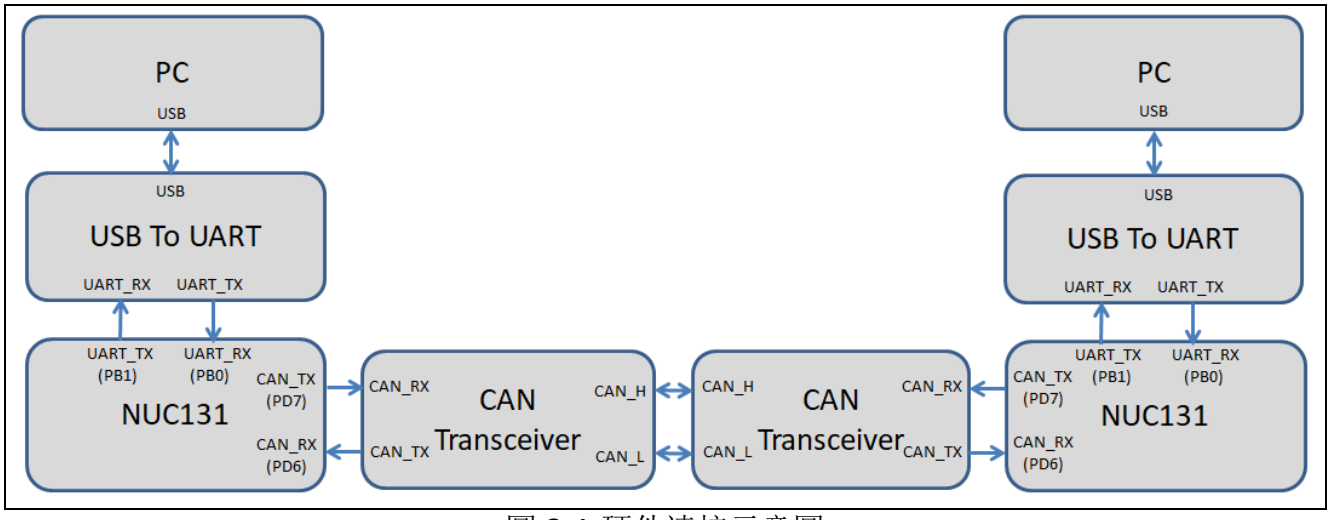

圖 3-1 硬件連接示意圖

本例程測試時，用的CAN收發器是SN65HVD230D，其與NUC131的連接示意圖如圖3-2所示。

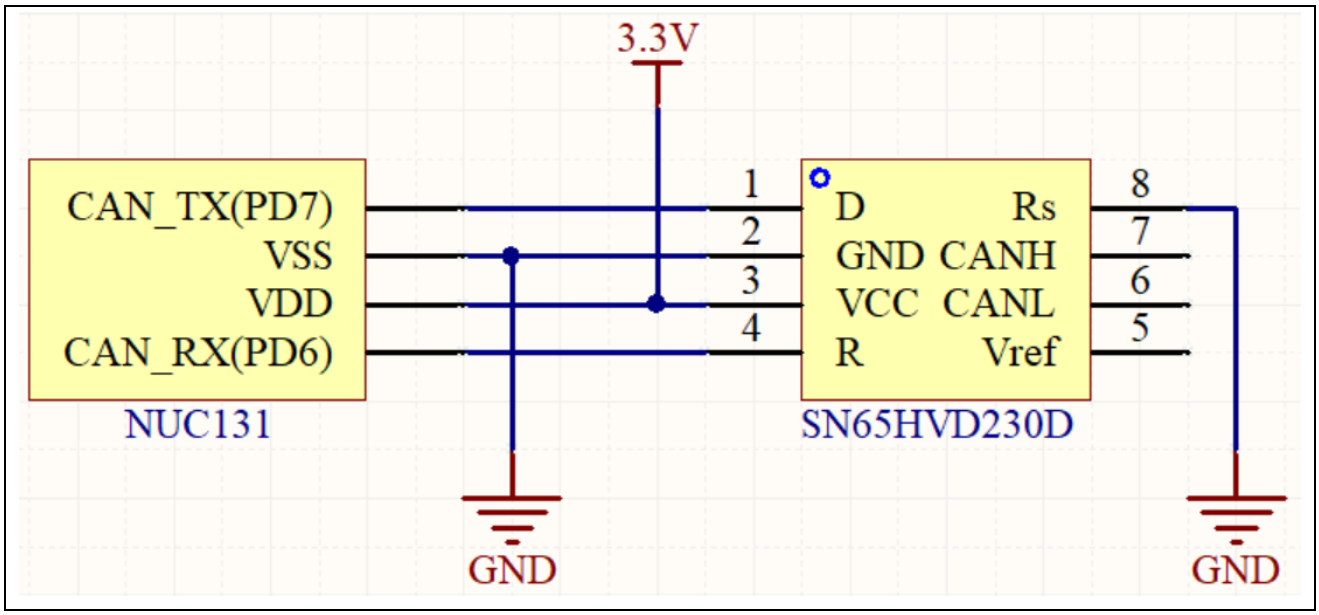

圖 3-2 NUC131 與 CAN 收發器連接示意圖

若使用其它CAN收發器，連接可能會有差異，詳情可參考對應的CAN收發器的數據手冊。

4 目錄資訊

EC_NUC131_CAN_Auto_Adjust_BPS_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

圖 4-1 目錄資訊

5 範例程式執行

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，分別雙擊 CAN_TX_RX.uvproj 和 CAN_Auto_Adjust_BPS.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
2021.08.20	1.00	1. 初始發布.

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