NUC131 CAN自动波特率调整

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

应用简述	本范例代码通过周期改变 NUC131 CAN 的波特率，来接收 CAN 总线上的数据，以此匹配 CAN 总线通信波特率
BSP 版本	NUC131_Series_BSP_CMSIS_V3.00.005
开发平台	NuTiny-EVB-NUC131-LQFP64 V1.0

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1 概述

本范例代码包含两个工程，分别是“CAN_TX_RX”和“CAN_Auto_Adjust_BPS”。其中“CAN_TX_RX”是一个CAN的收发例程，是为了方便测试“CAN_Auto_Adjust_BPS”例程功能写的一个配套程序。

“CAN_Auto_Adjust_BPS”例程通过周期改变NUC131 CAN的波特率，来接收CAN总线上的数据，直到能正常接收到CAN总线上的数据，以此匹配CAN总线通信波特率。当匹配上CAN总线的通信波特率后，会周期的往CAN总线发送数据包。程序中设置的能检测的波特率范围为50Kbps~1Mbps，步进为50Kbps。

1.1 原理

该应用中，“CAN_Auto_Adjust_BPS”例程会先将NUC131的CAN设置为Silent模式，来接收CAN总线上的通信数据。在Silent模式，CAN内核可以接收有效的数据帧和有效的远程帧，但只在CAN总线上发送隐性位，且不会启动发送。如果CAN内核需要发送显性位（ACK位、错误帧），该位内部直接连接到RX，所以尽管CAN总线保持在隐性状态，CAN内核可以检测到这个显性位。Silent模式可以用来分析CAN总线的传输数据，且不会干扰总线上的数据传输。Silent模式下，CAN内核的CAN_TX和CAN_RX的连接如图1-1所示。

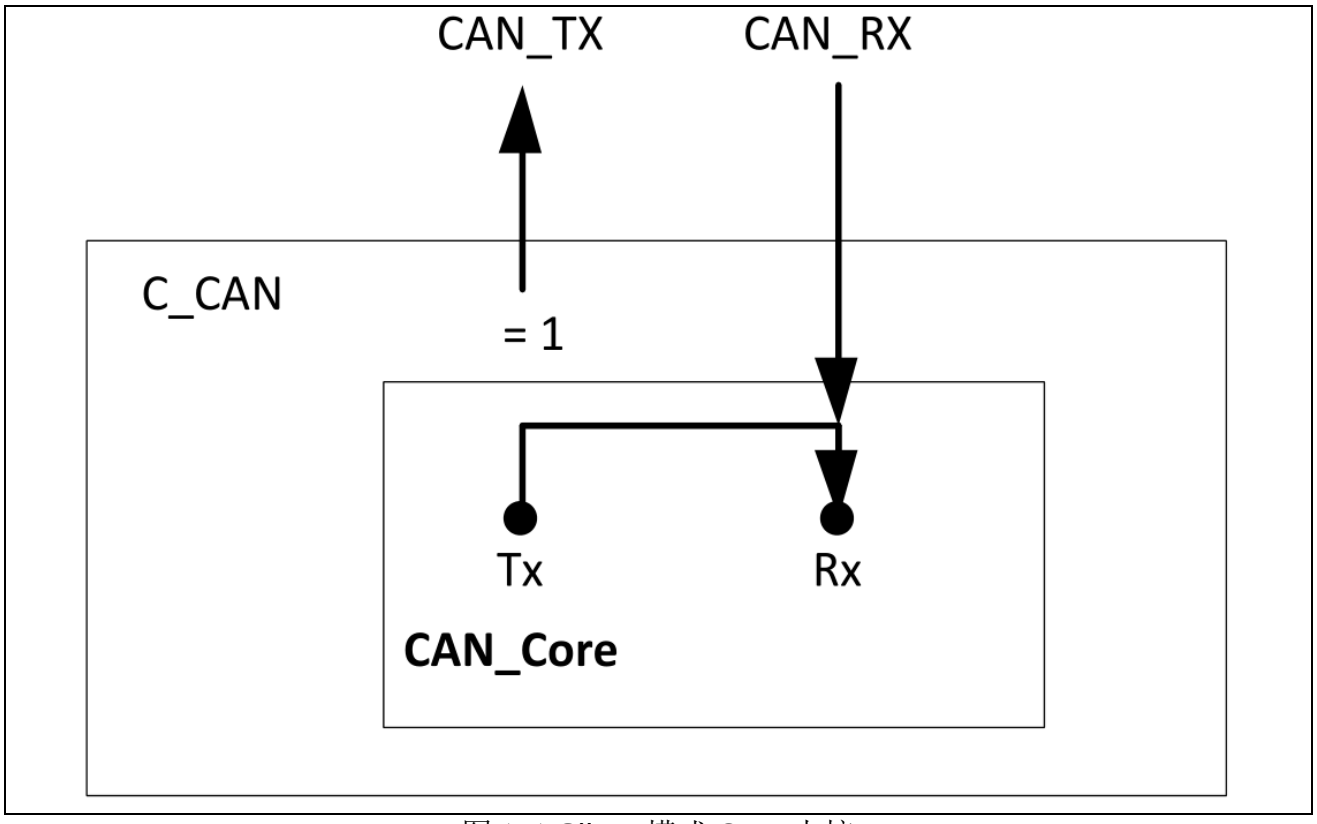

图 1-1 Silent 模式 CAN 内核

1.2 执行结果

用两块NUC131 NuTiny板，一块烧录“CAN_TX_RX”程序，一块烧录“CAN_Auto_Adjust_BPS”程序，然后将两块NUC131 NuTiny板按图3-1所示示意图进行连接。接着打开串口调试助手，并按提示发送对应的字符。

“CAN_TX_RX”功能的板子打印信息如图1-2所示：

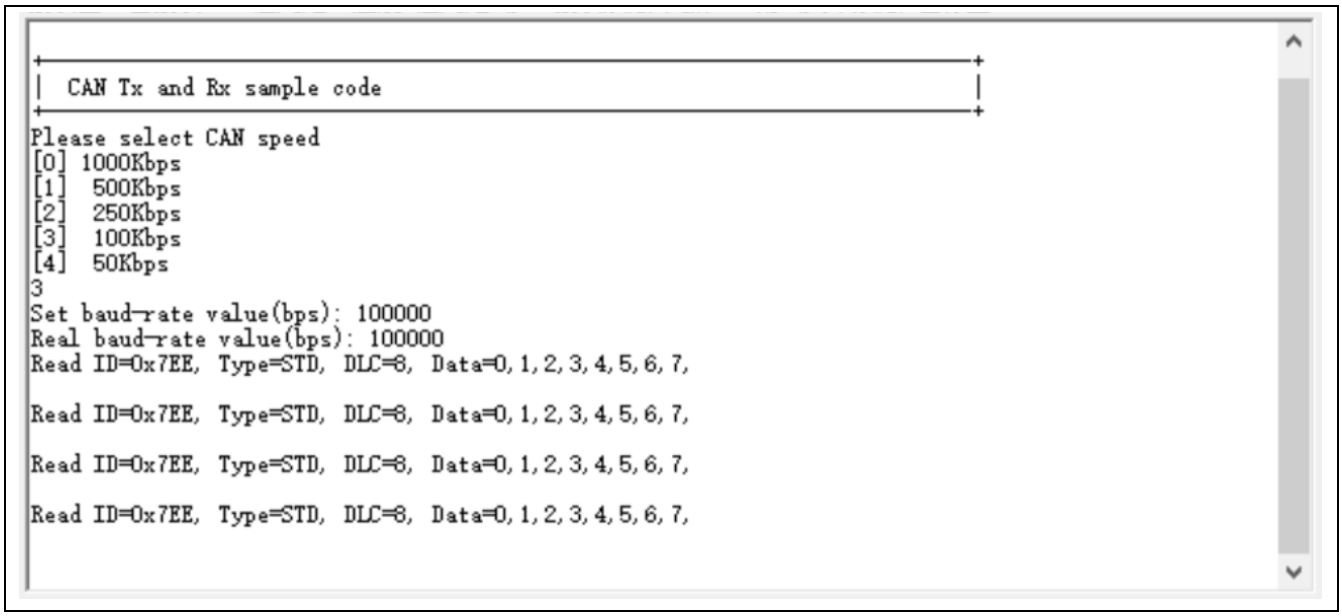

图 1-2 “CAN_TX_RX”功能板打印信息

“CAN_Auto_Adjust_BPS”功能的板子打印信息如图1-3所示：

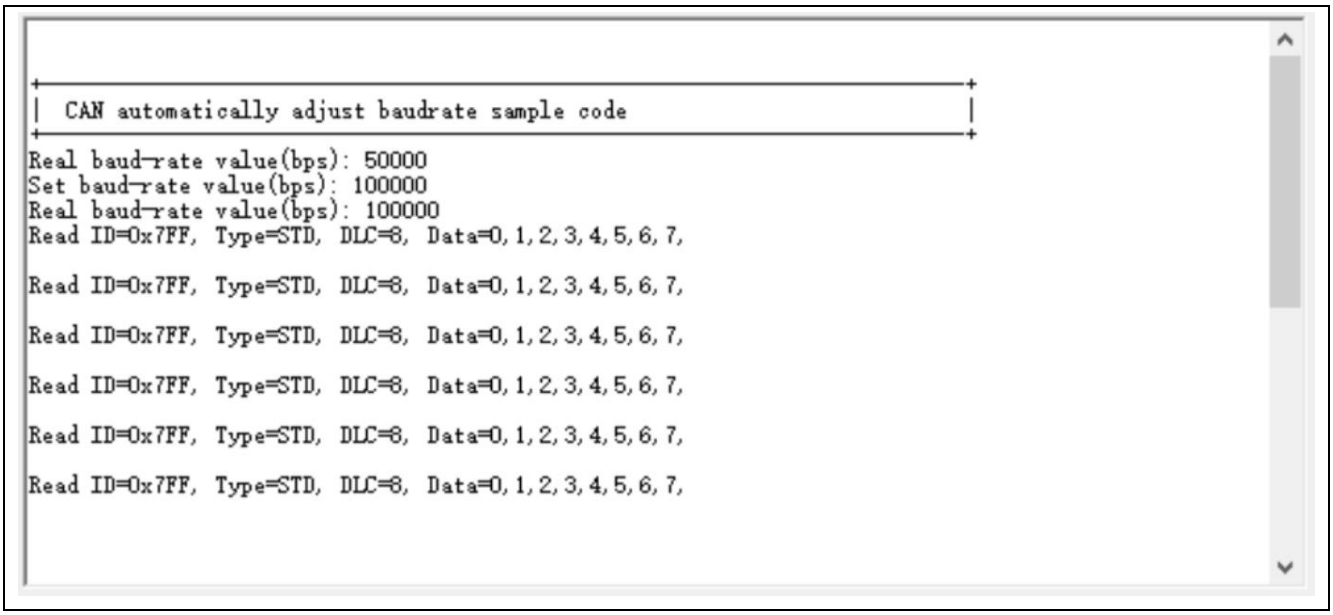

图 1-3“CAN_Auto_Adjust_BPS”功能板打印信息

2 代码介绍

以下代码介绍均基于“CAN_Auto_Adjust_BPS”例程。

波特率检测范围及步进设置：

```
#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");
    }
}
```

周期更改 CAN 的波特率，直到能正常接收到 CAN 总线数据，然后退出 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 软件与硬件需求

- 软件需求
  - BSP 版本
    - NUC131_Series_BSP_CMSIS_V3.00.005
  - IDE 版本
    - Keil uVersion 4.74
- 硬件需求
  - 电路组件
    - NuTiny-EVB-NUC131-LQFP64 V1.0
    - CAN 收发器
  - 示意图

本例程的硬件连接示意图如图3-1所示。

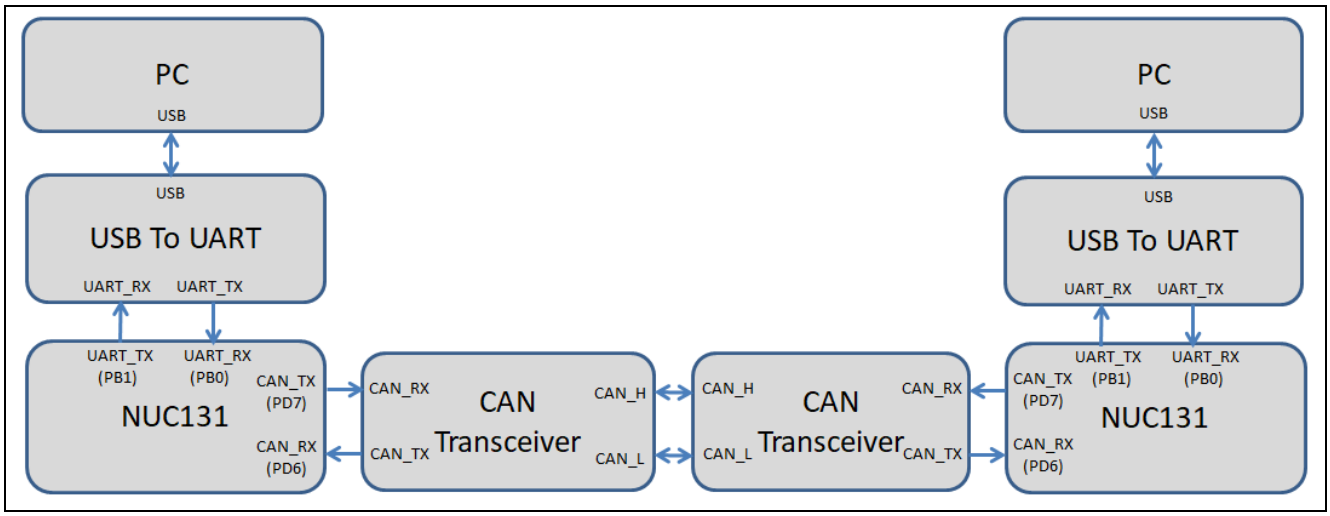

图 3-1 硬件连接示意图

本例程测试时，用的CAN收发器是SN65HVD230D，其与NUC131的连接示意图如图3-2所示。

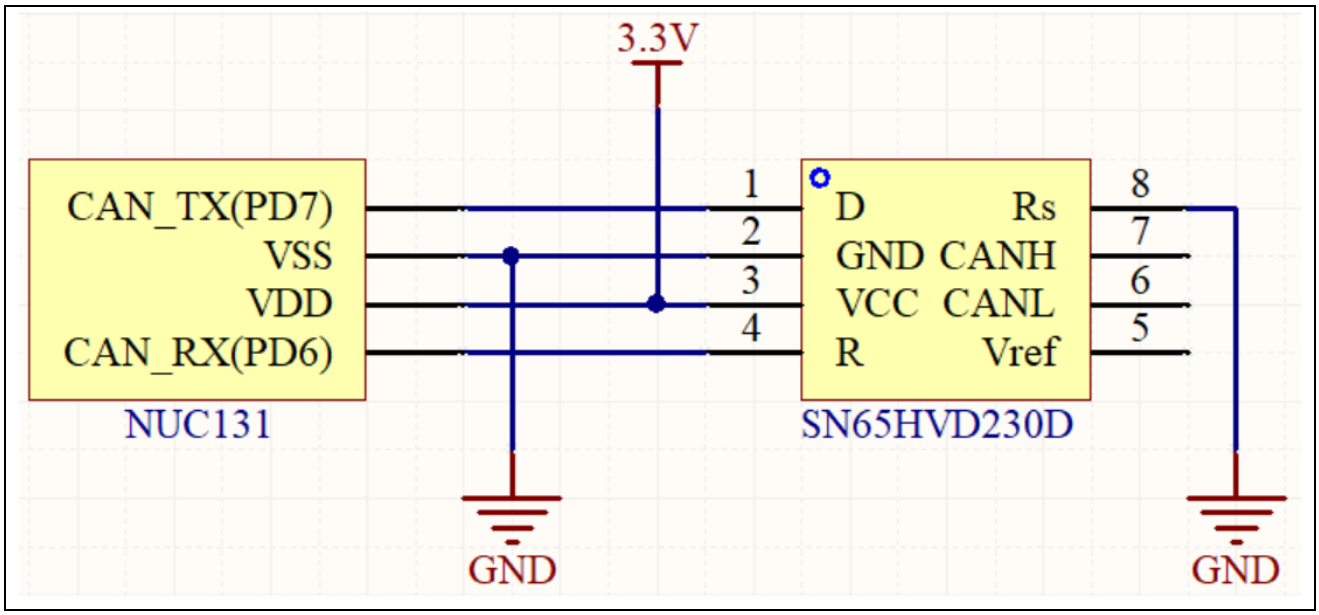

图 3-2 NUC131 与 CAN 收发器连接示意图

若使用其它CAN收发器，连接可能会有差异，详情可参考对应的CAN收发器的数据手册。

4 目录信息

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

图 4-1 目录信息

5 范例程序执行

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，分别双击 CAN_TX_RX.uvproj 和 CAN_Auto_Adjust_BPS.uvproj。
2. 进入编译模式界面
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开仿真模式
3. 进入仿真模式界面
   a. 执行代码

6 修订纪录

Date	Revision	Description
2021.08.20	1.00	1. 初始发布.

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