M460 CANFD FIFO Receiving

Example Code Introduction for 32-bit NuMicro® Family

Document Information

Application	This example code uses M460 series microcontroller (MCU) to receive and print out all messages on CANFD bus.
BSP Version	M460_Series_BSP_CMSIS_V3.00.001
Hardware	NuMaker-M467HJ V1.0

1. Overview

This is a simple example code using the M460 series microcontroller (MCU) to receive and print out CANFD messages.

1.1 Principle

The M460 series MCU has a powerful CANFD. The following only introduces M460 RX FIFO structure for easy understanding.

In the SID filter and XID filter, all IDs defined for messages can be accepted or rejected. The messages that have passed the filter will be deposited in FIFO1.

The structure is shown in Figure 1-1.

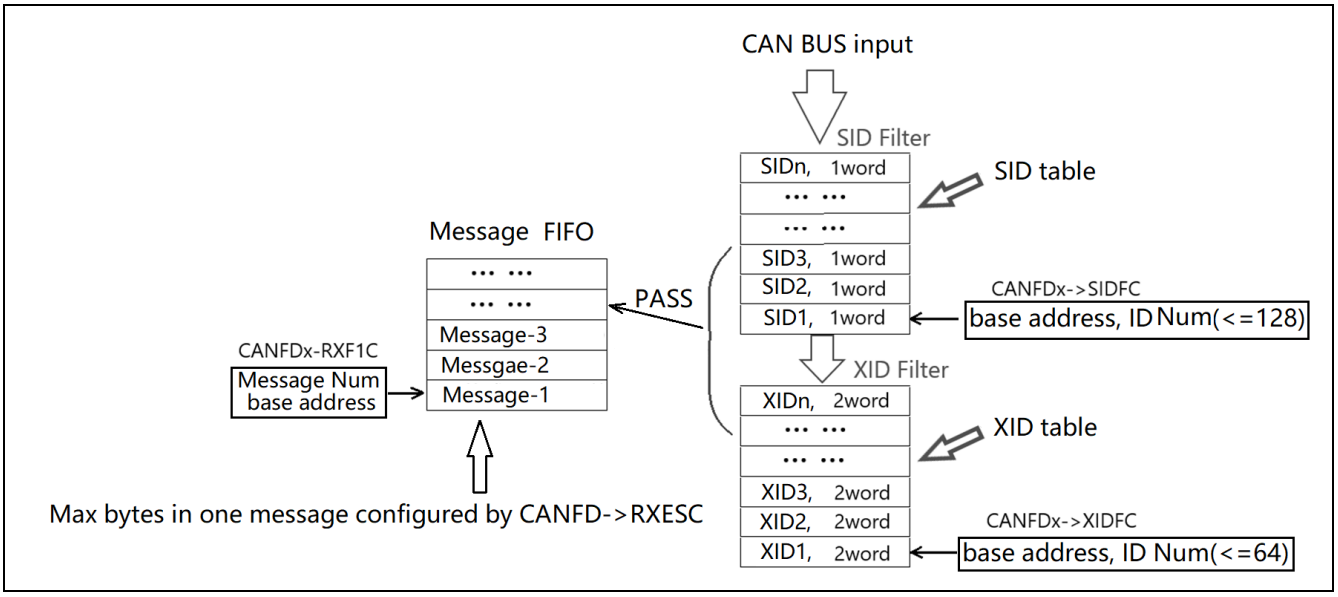

Figure 1-1 CANFD RX FIFO Receiving Structure

Figure 1-2 shows the data structure of standard ID.

Bit	31	24	23	16	15	8	7	0
S0	SFT [1:0]	SFEC [2:0]	SID1[10:0]		-	SID2(or Mask)[10:0]		

Figure 1-2 Standard ID Filter Data Structure

Figure 1-3 shows the extended ID filter data structure.

Bit	31	24	23	16	15	8	7	0
F0	EFECV [2:0]	XID1[28:0]						
F0	EFT [1:0]	-	XID2(or MASK)[28:0]					

Figure 1-3 Extended ID Filter Data Structure

1.2 Demo Result

The execution results of this example code are shown in Figure 1-4. The messages received from CAN bus will be printed out from UART interface.

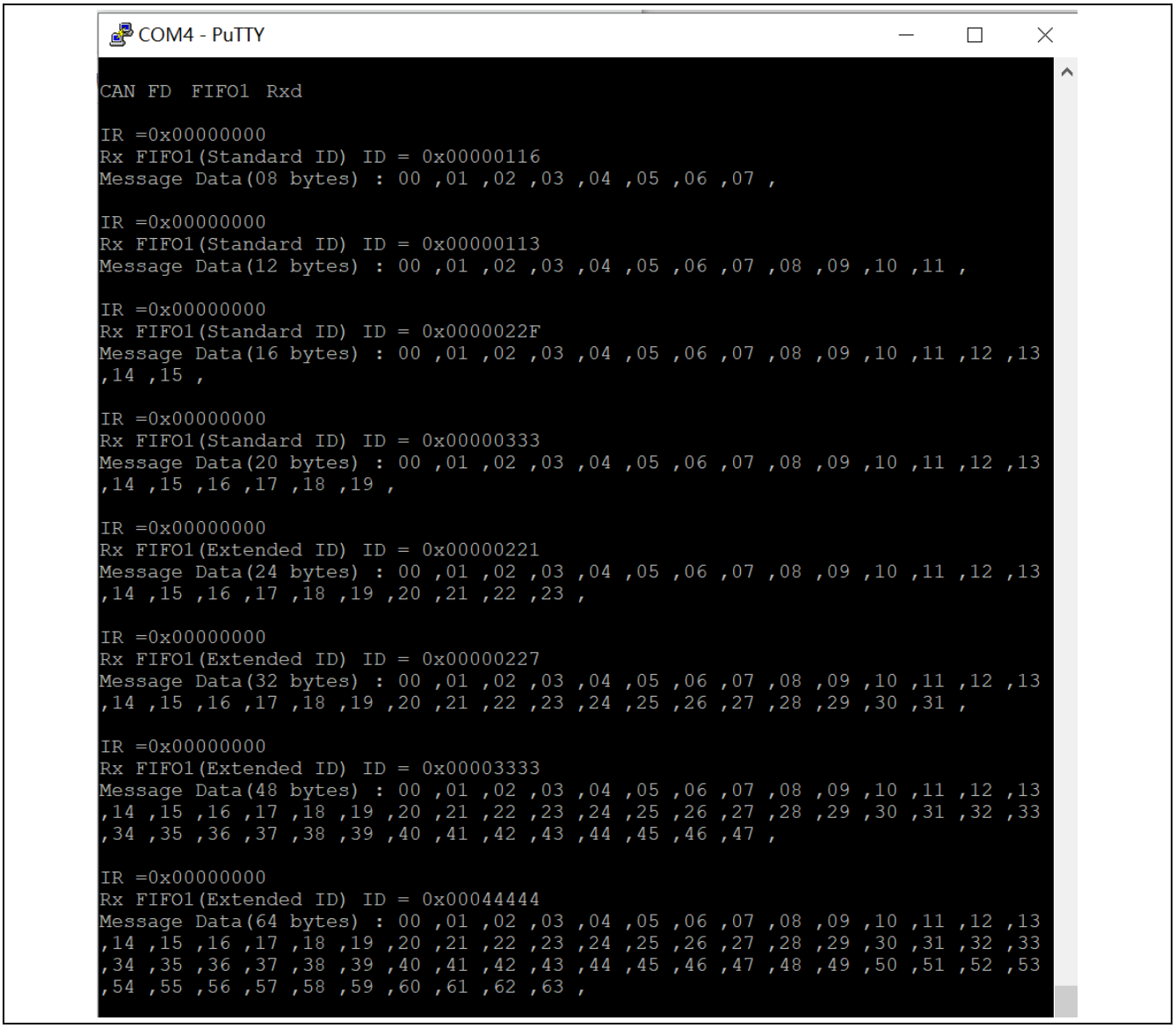

Figure 1-4 Messages Printed out

2. Code Description

The clock assignment of one bit is as Figure 2-1.

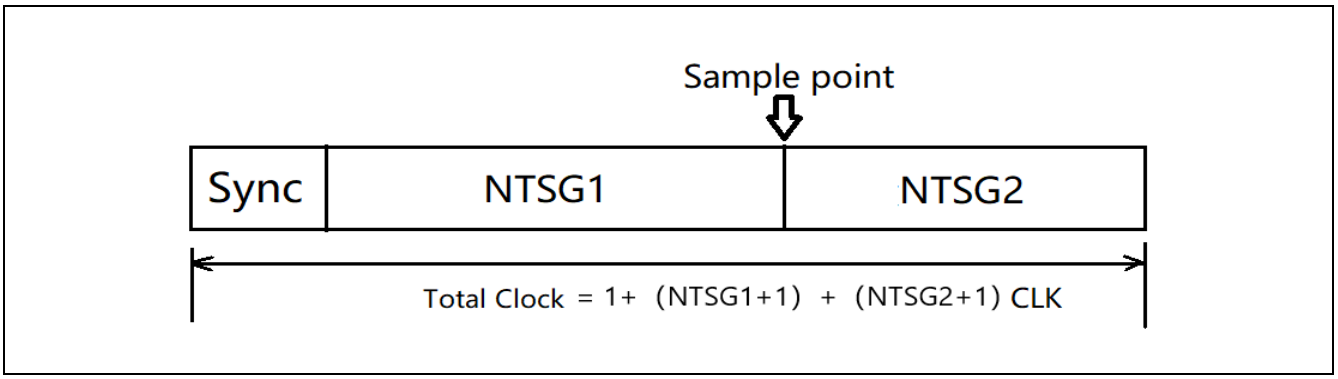

Figure 2-1 Bit Clock Assign

The function to configure bit baud rate is located in *main.c*.

```
/*---------------------------------------------------------------------------*/
/*                  Init CAN FD bit Rate                                     */
/*---------------------------------------------------------------------------*/
// input: psCanfd, The value must be CANFD0,CANFD1,CANFD2 or CANFD3
void CANFD_BitRate_Init(CANFD_T *psCanfd)
{                                          // CANFD_CLk = 200M/5 = 40MHz

    psCanfd->NBTP = (3 << 25) +       // NSJW  = 3+1 =4  CLK
                    (1 << 16) +       // NBRP  = 1+1 =2 ,     // prescaler = 2
                    (13 << 8) +       // NTSG1 = 13+1=14 CLK
                    (5 - 1);          // NTSG2 = 5  CLK      // One bit = 1+14+5 = 20 CLK

    psCanfd->DBTP = ((1 - 1) << 16) +   // DBRP  = 1 prescaler
                    ((6 - 1) << 8) +    // DTSG1 = 6 CLK     // One bit = 1+6+3 = 10 CLK
                    ((3 - 1) << 4) +    // DTSG2 = 3 CLK
                    (2 - 1);            // DSJW  = 2CLK
}
```

The SID and XID configuration function is located in *main.c*. The code between #if and #else is to configure CANFD to receive all messages on CAN bus.

```
void CANFD0_RX_Initial(void)
{
  // 0=>8Byte, 1=>12Byte, 2=>16Byte, 3=>20Byte, 4=>24Byte, 5=>32Byte, 6=>48Byte, 7=>64Byte
    CANFD0->RXESC=(CANFD0->RXESC & (~CANFD_RXESC_F1DS_Msk)) | (7 << CANFD_RXESC_F1DS_Pos);

    CANFD0->RXF1C = (60 << CANFD_RXF1C_F1WM_Pos)        // watermark = 60 messages
                    | (64 << CANFD_RXF1C_F1S_Pos)       // FIFO1 can hold 64 messages
                    | 0x300 ;                 // FIFO1 start address =0x40020000 +0x300

    CANFD0->SIDFC = (16 << 16) + 0 ;                    // 16-SID at 0  address
    CANFD0->XIDFC = (16 << 16) + 0x40 ;                 // 16-XID at 0x40 address
```

```
#if 1
   CANFD0_SID_Buff[0].VALUE = CANFD_RX_FIFO1_STD_MASK(0, 0); // receive all SID messages

   CANFD0_XID_Buff[0].LOWVALUE = CANFD_RX_FIFO1_EXT_MASK_LOW(0) ;
   CANFD0_XID_Buff[0].HIGHVALUE=CANFD_RX_FIFO1_EXT_MASK_HIGH(0);//receive all XID messages

#else
   ……

#endif

    CANFD_EnableInt(CANFD0, (CANFD_IE_TOOE_Msk | CANFD_IE_RF1NE_Msk), 0, 0, 0);
    NVIC_EnableIRQ(CANFD00_IRQn);
}
```

3. Software and Hardware Requirements

3.1 Software Requirements

- BSP version
  - M460_Series_BSP_CMSIS_V3.00.001
- IDE version
  - Keil uVersion 5.38

3.2 Hardware Requirements

- Circuit components
  - NuMaker-M467HJ V1.0
- Pin Connect
  - Two NuMaker-M467HJ boards are connected to each other with the CANFD interface as Figure 3-1 to show the execution results. One executes the program EC_M460_CANFD_Tx_Simply_V1.00 and the other executes this code.

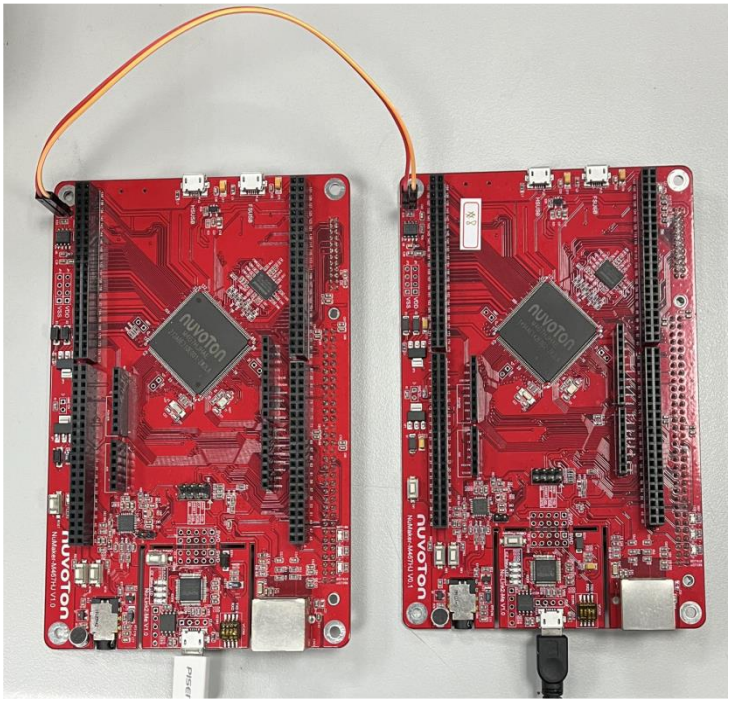

Figure 3-1 Two NuMaker-M467HJ Boards Connecting Together

4. Directory Information

The directory structure is shown below.

EC_M460_CANFD_FIFO_RX_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

Figure 4-1 Directory Structure

5. Example Code Execution

1. Browse the sample code folder as described in the Directory Information section and double-click *M460_CANFD_FIFO_RX.uvprojx*.
2. Enter Keil compile mode.
   - Build
   - Download
   - Start/Stop debug session
3. Enter debug mode.
   - Run

6. Revision History

Date	Revision	Description
2023.06.23	1.00	Initial version.

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