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M32C/83 Group

[CAN] Transmission of a Data Frame

REJ05B0252-0100Z
Rev.1.00
Oct. 16, 2003

1. Abstract

This document describes about transmission of a data frame for M32C/83 group.

The following is contents of this document.

Table of contents

2. Transmitting Messages

CAN messages are transmitted following three procedures described below.

- CAN configuration procedure
- Slot configuration procedure
- Data processing procedure

2.1. CAN Configuration Procedure

Set each relevant bit of CAN0 control register 0 during CAN initialization mode.

Refer to the application note (REJ05B0149-) for details about the CAN configuration procedure.

2.2. Slot Configuration Procedure

Set the desired transmit mode by using the CAN0 message slot i control register (i = 0-15)

Table 1. shows the setting value of CAN0 message slot i control register (i = 0-15).

Table 1. Setting value of CAN0 message slot i control register

CAN0 message slot i control register								Contents of transmit modes set for a slot
bit7 TrmReq	bit6 RecReq	bit5 Remote	bit4 RspLock	bit3 RemActive	bit2 MsgLost	bit1 TrmData	bit0 SentData	
0	0	-	-	-	-	-	-	Do not transmit or receive.
1	0	0	0	0	0	0	0	Transmit a data frame.
0	1	1	1/0*1	0	0	0	0	Receive a remote frame and when finished receiving, transmit a data frame. *1RspLock: 0: After receiving a remote frame, automatically transmit a data frame. 1: After receiving a remote frame, stand by waiting for instruction. When set to transmit a data frame, the slot starts sending it.

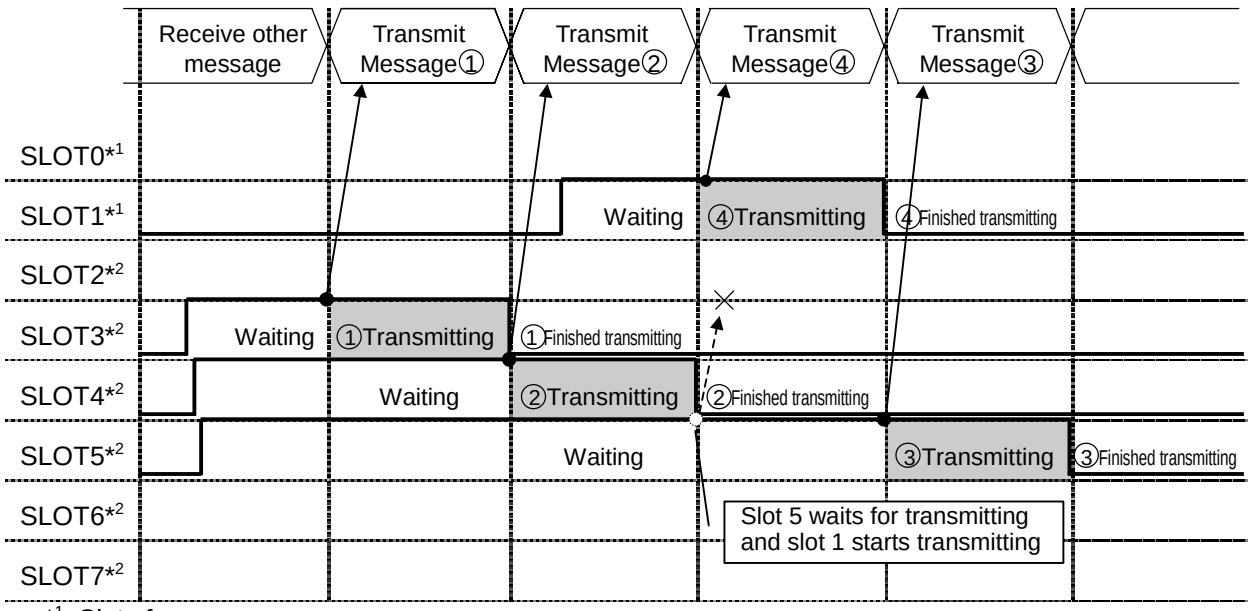
2.3. Data Processing Procedure

Process a message when the CAN module has finished transmitting it successfully.

3. Priority of Message Transmit Slots

If two more slots are set to transmit at the same time, they are allowed to start transmitting in order of slot numbers, with the smallest-number slot given the highest priority.

Figure 1 shows transmission priority.



*1: Slots for emergency messages
*2: Slots for ordinary messages

Use slots with small numbers to transmit emergency messages and those with larger numbers to transmit ordinary messages.

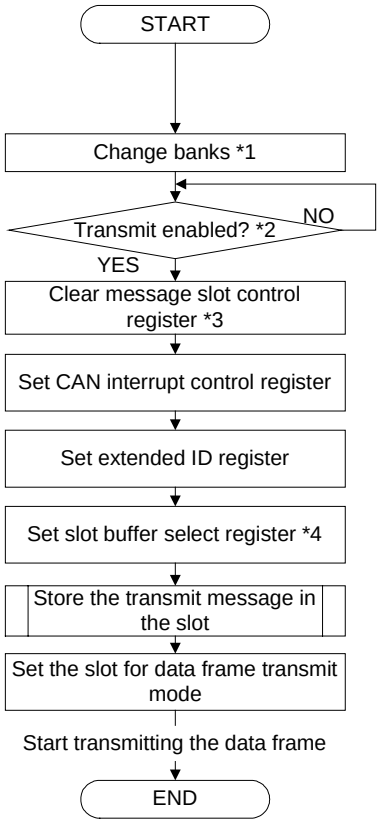
Figure 1. Transmission priority

4. Data Frame Transmit Mode

By setting a slot for data frame transmit mode, it is possible to transmit the data frame currently set in that slot.

Figure 2. shows the transmitting procedure of a data frame.

< When transmitting a standard ID data frame >




```
void set_trm_std_dataframe_can0(
            char in_slot,
            can_std_data_def *in_trm_data
)
{
            unsigned char lp_dlc;     /* Data length code loop variable */
            banksel_c0ctlr = 0;     /* Change banks */
            /* Prepare for storing transmit message */
            while(c0mctl[in_slot].transmit.trmactive){}
                 /* Check whether the slot is ready to transmit */
            c0mctl[in_slot].byte = 0;
                 /* Initialize the message slot control register */
            c0simkr_addr.word |= 0x8000>>in_slot;
                 /* Select to use interrupts */
            c0idr_addr.word &= ~(0x8000>>in_slot);
                 /* Select standard ID format */
            /* Store a transmit message in the slot */
            buffer1_c0sbs = in_slot;/* Use slot buffer 1 */
            c0slot1.ba.sidh = ((in_trm_data->id)>>6)&0x1F;
            c0slot1.ba.sidl = (in_trm_data->id)&0x3F;
            c0slot1.ba.dlc = in_trm_data->dlc;
            for(lp_dlc=0; (lp_dlc<in_trm_data->dlc)&&(lp_dlc<8); ++lp_dlc){
                        c0slot1.ba.data[lp_dlc] = in_trm_data->data[lp_dlc];
            }
            /* Start transmitting the message */
            c0mctl[in_slot].byte = 0x80;
}
```

*1: If the program is written in such a way that the CAN0 bank select bit is set to 1 before setting the CAN0 mask registers and cleared to 0 after setting up those registers, there is no need to set the CAN0 bank select bit here.
*2: Although this confirmation step is written as an infinite loop here, give it a time-out time equal to or greater than the longest transmit frame time when actually writing a program.
*3: Before the slot can be set to transmit or receive new frames after it finished transmitting successfully, the CAN message slot control register must be temporarily cleared to '00h'. Always be sure to follow this procedure.
*4: After setting the CAN0 message slot buffer 0,1 number select bits, if those bits are rewritten by interrupt handling while storing a message in the selected slot, the message may be stored in another slot after returning from the interrupt handling. To avoid this problem, follow one of the procedures described below.
(1) Use CAN0 message slot buffers 0 and 1 separately. For example, use buffer 0 during interrupt handling and buffer 1 during other processing.
(2) Use CAN0 message slot buffers 0 and 1 separately, one for transmit operation and one for receive operation.
(3) At the beginning of interrupt handling, save the value of the CAN0 slot buffer select register then held in it. And restore the register value when leaving interrupt handling.

Figure 2. Transmitting procedure of a data frame

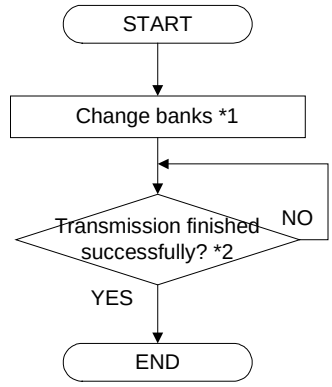
5. Confirmation of a Successful Transmission

The following describes how to confirm that the CAN module has finished transmitting a message successfully.

For this confirmation, use the CAN0 slot interrupt status register or the CAN0 message slot i control register (i = 0-15).

5.1. Confirmation by Polling

Figure 3 shows the confirming procedure of a successful transmission by polling.




```
void check_trm_std_dataframe_can0(char in_slot)
{
        int result;
        banksel_c0ctlr = 0;     /* Change banks */

        /* Confirm that transmission has finished successfully */
        while(!c0mctl[in_slot].transmit.sentdata){}

}
```

*1: If the program is written in such a way that the CAN0 bank select bit is set to 1 before setting the CAN0 mask registers and cleared to 0 after setting up those registers, there is no need to set the CAN0 bank select bit here.
*2: Although this confirmation step is written as an infinite loop here, give it an appropriate time-out time when actually writing a program. The time-out time varies with the message ID to transmit or the CAN bus status.

Figure 3. Confirming procedure of a successful transmission by polling

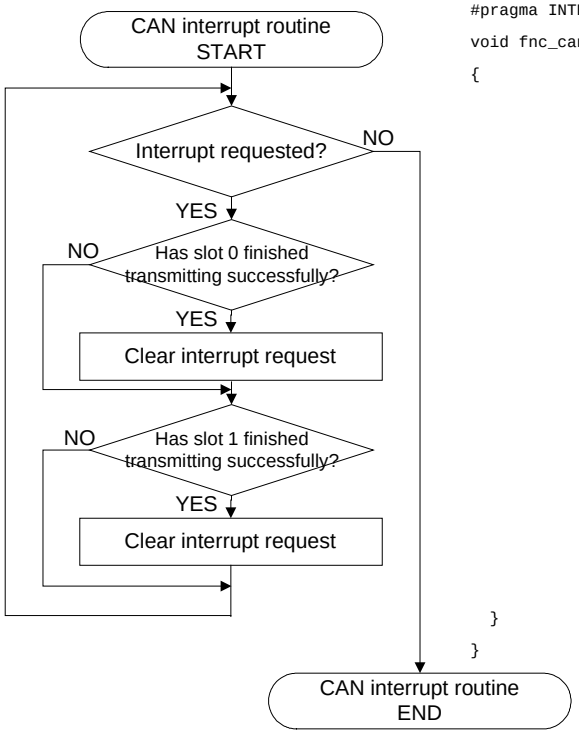
5.2. Confirmation by Using CAN Interrupts

When using CAN interrupt for confirmation of a successful transmission, first set the interrupt control register to enable interrupts and then the corresponding interrupt enable register. Next, set the CAN0 slot interrupt mask register bits to 1 that correspond to each slot. That way, CAN interrupts can be enabled for each slot individually.

The interrupt control register is used in common for CAN transmission-completed interrupt, CAN reception-completed interrupt, and CAN error interrupt. The CAN0 slot interrupt mask register is used in common for CAN transmission-completed interrupt and CAN reception-completed interrupt.

Figure 4 shows the confirming procedure of a successful transmission by using a CAN interrupt. In this confirmation procedure, judgment is made by inspecting the CAN0 slot interrupt status register for the slot that has been set for transmission.

< When setting CAN slot 0 and 1 for transmitting slots >




```
#pragma INTERRUPT fnc_can1ic
void fnc_can1ic(void);
{
            /* Example for CAN1 interrupt */
            while(irf7_iio10ir){
            /* When CAN0 slot 0 has finished transmitting successfully */
            if(c0sistr0){
            /* Write processing to be performed after the slot has
            finished transmitting successfully here */
                        c0sistr0 = 0;
                        irf7_iio10ir = 0;
            }
            /* When CAN0 slot 1 has finished transmitting successfully */
            if(c0sistr1){
            /* Write processing to be performed after the slot has
            finished transmitting successfully here */
                        c0sistr1 = 0;
                        irf7_iio10ir = 0;
            }
  }
}
```

Figure 4. Confirming procedure of a successfully transmission by using CAN interrupt

6. Precaution about Sample Program in This Document

6.1. Symbol Description of Each Register

Symbol of each register which is included in the sample program of this document complies with the description of C-language SFR header file for Renesas standard M32C/83 group.

6.2. Structure of Sample Program

Structure which is included in the sample program of this document is following configuration.

```
/* Definition of a standard data frame */
typedef struct{
   unsigned short id;
   unsigned char dlc;
   unsigned char data[8];
}can_std_data_def;

/* Definition of a standard remote frame */
typedef struct{
   unsigned short id;
   unsigned char dlc;
}can_std_remote_def;

/* Definition of an extend data frame */
typedef struct{
   unsigned long id;
   unsigned char dlc;
   unsigned char data[8];
}can_ext_data_def;

/* Definition of an extend remote frame */
typedef struct{
   unsigned long id;
   unsigned char dlc;
}can_ext_remote_def;
```

6.3. Infinite Loop of " **`while`** "

In some part of the sample program an infinite loop is formed with "`while`", however, it is described in this way so that the description could be simplified. In actual programming, each while-loop must have a time limit. At over-time it should come out of the loop.

7. Reference

- M32C/83 group Data Sheet
- M32C/83 group Hardware Manual

When using this document, be sure to download the latest manual from Renesas website.

8. Website and Contact Information for Technical Support

- Renesas's technology corporation semiconductor website
  http://www.renesas.com
- Contact information for technical support for CAN MCU
  E-mail : csc@renesas.com

REVISION HISTORY	M32C/83 Group [CAN] Transmission of a Data Frame

Rev.	Date	Description	
		Page	Summary
1.00	Oct 16, 2003	-	First edition issued

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