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32176 Group

Combination of Input Pin and DMAC

1. Overview

The reference sample program combined input pin and DMAC for 32176 group appears on this document.

2. Introduction

These application examples in this document are used in the following microcomputers and conditions.

- Microcomputer: 32176 Group (M32176FnVFP, M32176FnTFP)
- Operating frequency: 20 to 40 MHz (The sample program is compiled assuming a frequency of 40 MHz.)
- Operating Board: Starter kit for 32176 Group

3. Sample program for Combination of input pin and DMAC

3.1 Outline of Sample program

In this sample program, DMA2 starts at rising edge of external signal inputted from TIN18, dummy transmission is started. Transmission counter of DMA2 decrement every dummy transmission so by reading out that value numbers of input event can be measured.

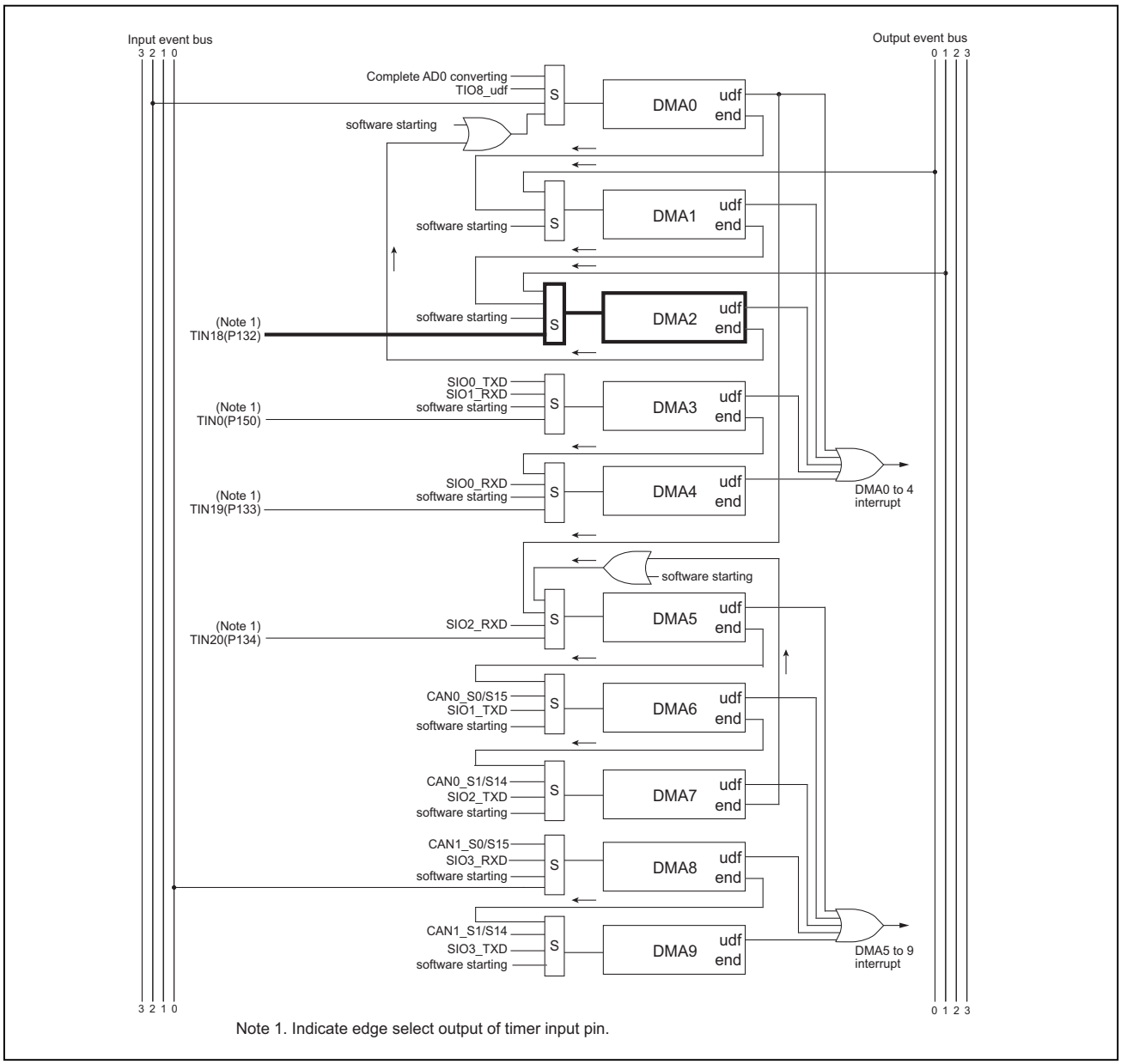


Figure3.1.1 Configuration of Sample for Combination of input pin and DMAC

(Simple event counter using DMAC)

3.2 Description of a reference program

Note: The registers used are indicated as (register name: bit name).

3.2.1 Various initialization functions (init_func())

(1) Call the port initialization function
(2) Call the DMAC initialization function

3.2.2 Port initialization functions (port_init())

(1) Initial setting of output port

- Set Port Input Permit bit of Port Input Special Function Control Register as permit inputting (PICNT: PIEN0)
- Initialize P11 Data Register (P11DATA)
- Set P11 Direction Register as output mode. (P11DIR)
- Set P11 Operation Mode Register as input/output port. (P11MOD)

Note: If a Direction Register is set as output before setting up a Data Register, an unfixed value is outputted until writing will be performed to a Data Register.

(2) Initial setting of input port

- Set P13 Direction Register to input mode (P13DIR)
- Set Port P132 operation mode bit to TIN18 (P13MOD: P132MOD)
- Set TIN18 as rising edge is valid (TINCR3: TIN18S)

3.2.3 DMAC initializing Function (dma_init())

(1) Initial Setting of DMA2

- Set DMA2 interrupt disable. (DM04ITMK: DMITMK2)
- Clear DMA2 interrupt request. (DM04ITMK: DMITST2)
- Set DMA2 source address. (DM2SA)
- Set DMA2 destination address. (DM2DA)
  (It is set same address because only operate transmission)
- Set 256 times as DMA2 transmission number. (DM2TCT)

(2) Set DMA2 channel control register (DM2CNT)

- Starting at inputting TIN18 to DMA2 transmission request factor.
- Set DMA2 transmission enables.
- Set DMA2 transmission size to 8 bit.

3.2.4 Main Function (main())

(1) Call the interrupt prohibitive function
(2) Call the various initialization functions
(3) Call the interrupt permit function
(4) Infinite loop waiting for Interrupt with outputting DMA2 transmission count value to port P11

3.3 Sample program

The sample program for combination of input pin and DMAC is shown below.

Note that the sample program below requires the SFR definition file. The latest SFR definition file can be downloaded from Renesas Technology website. When using the SFR definitions file, adjust the path setting to match the operating computer environment.

3.3.1 TIN_DMA.c

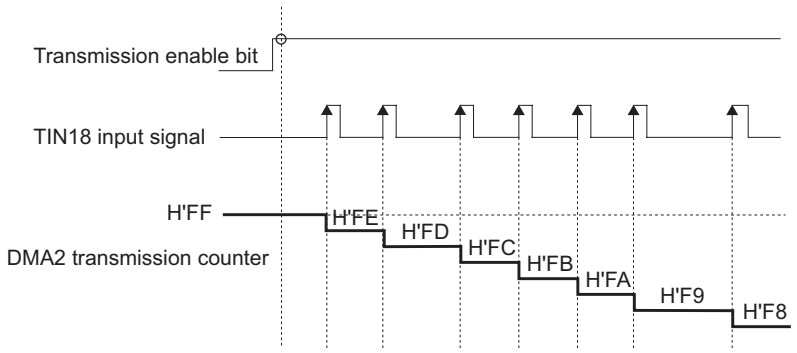
```
/*  FILE COMMENT   ************************************************
 *      M32R C Programming              Rev. 1.01
 *              < Sample Program for 32176 >
 *              < TIN-DMAC >
 *
 *      Copyright (c) 2004 Renesas Technology Corporation
 *                         All Rights Reserved
 ************************************************************************/

/************************************************************************/
/*              Include file                                            */
/************************************************************************/

#include               "..\inc\sfr32176_pragma.h"

/************************************************************************/
/*              Definition of external reference                        */
/************************************************************************/

extern  void            DisInt( void );                     /* Interrupt disable function */
extern  void            EnInt( void );                      /* Interrupt enable function */

/************************************************************************/
/*              Function prototype declaration                          */
/************************************************************************/

        void            main(void);
        void            init_func(void);                    /* Initial setup function */
        void            port_init(void);                    /* Initialize port */
        void            dma_init(void);                     /* Initialize DMA  */

/************************************************************************/
/*              Define macro                                            */
/************************************************************************/

/* DMAC setting data */

                                            /* 0123 4567    */
#define DMA2_INIT       0x2c                /* 0010 1100B   DMA2 channel control register
*/
                                            /* |||| |||+--- Destination address fixed
*/
                                            /* |||| ||+---- Source address fixed
*/
                                            /* |||| |+----- Transfer size of 8-bit
*/
                                            /* |||| +------ Transfer enabled
*/
                                            /* ||++-------- 10: start upon TIN18 input signal
*/
                                            /* |+---------- No transfer request
*/
                                            /* +---------- Normal mode
*/

/* TIN setting data */

                                            /* 0123 4567 89AB CDEF
*/
#define TIN18_MASK      0x3000u             /* 0011 0000 0000 0000B TIN input processing control
register 3 */
#define TIN18_R_Edge    0x1000u             /* 0001 0000 0000 0000B
*/
```

```
   53                                                /*   ++---------------- TIN 18 rising edge
*/
   54
   55  /***********************************************************************/
   56  /*             Variable definition                                     */
   57  /***********************************************************************/
   58
   59  UCHAR DMA_DUMMY;
   60
   61  /*""FUNC COMMENT""*****************************************************
   62   * Function name : init_func()
   63   *-----------------------------------------------------------------------
   64   * Description  : - Initialize ICU
   65   *-----------------------------------------------------------------------
   66   * Argument     : -
   67   *-----------------------------------------------------------------------
   68   * Returns      : -
   69   *-----------------------------------------------------------------------
   70   * Notes        :
   71   *""FUNC COMMENT END""*************************************************/
   72  void init_func(void)
   73  {
   74          port_init();                                /* Initialize those related to port */
   75          dma_init();                                 /* Initialize DMA  */
   76  }
   77
   78  /*""FUNC COMMENT""*****************************************************
   79   * Function name : port_init()
   80   *-----------------------------------------------------------------------
   81   * Description  : - Initialize port
   82   *-----------------------------------------------------------------------
   83   * Argument     : -
   84   *-----------------------------------------------------------------------
   85   * Returns      : -
   86   *-----------------------------------------------------------------------
   87   * Notes        :
   88   *""FUNC COMMENT END""*************************************************/
   89  void port_init(void)
   90  {
   91          USHORT  temp16;
   92
   93          PICNT = PIEN0;                                      /* Enable port input */
   94
   95  /*** LED output port ***/
   96
   97          P11DATA = 0x00;                                     /* Output data (must be set prior to
mode) */
   98          P11DIR = 0xff;                                      /* P110-P117 : Output mode */
   99          P11MOD = 0x00;                                      /* P110-P117 : Input/output port */
  100
  101  /*** Switch input port ***/
  102
  103          P13DIR = 0x00;                                      /* PP130-P137 : Input mode */
  104          P13MOD |= 0x0020u;                                  /* P132:TIN18 */
  105          temp16 = TINCR3;
  106          TINCR3 = ( temp16 & ~TIN18_MASK) | TIN18_R_Edge;    /* Set rise on TIN18 to be the active
edge */
  107  }
  108
  109
  110  /*""FUNC COMMENT""*****************************************************
  111   * Function name : dma_init()
  112   *-----------------------------------------------------------------------
  113   * Description  : - Initialize DMAC
  114   *              :   DMA2: transferred upon TIN18 input signal
  115   *-----------------------------------------------------------------------
  116   * Argument     : -
  117   *-----------------------------------------------------------------------
  118   * Returns      : -
  119   *-----------------------------------------------------------------------
  120   * Notes        : Transfer is dummy
  121   *              : Restart is required if the number of transfers is 256 or more
  122   *""FUNC COMMENT END""*************************************************/
  123  void dma_init(void)
  124  {
  125  /*** DMA2 initial setting ***/
```

```
  126
  127          DM04ITMK |= DMITMK2;                          /* Inhibit DMA2 interrupt */
  128          DM04ITST = (~DMITST2) & 0xFFu;                /* Clear DMA2 interrupt request */
  129
  130          DM2SA = (USHORT)&DMA_DUMMY;                   /* Source address -> dummy */
  131          DM2DA = (USHORT)&DMA_DUMMY;                   /* Destination address -> dummy */
  132
  133          DM2TCT = 0xff;                                /* Number of DMA2 transfer (256 times) */
  134          DM2CNT = DMA2_INIT;                           /* Start and enable transfer upon TIN18 input
signal */
  135  }
  136
  137  /*""FUNC COMMENT""*****************************************************
  138   * Function name : main()
  139   *-----------------------------------------------------------------------
  140   * Description  : - Start DMA2 upon rising edge of TIN18 and count the
  141   *              :   number of transfers, then output number of edge
  142   *              :   inputs (number of transfers) to LED (PORT11)
  143   *-----------------------------------------------------------------------
  144   * Argument     : -
  145   *-----------------------------------------------------------------------
  146   * Returns      : -
  147   *-----------------------------------------------------------------------
  148   * Notes        : Transfer counter is counting down from 255
  149   *""FUNC COMMENT END""************************************************/
  150  void main(void)
  151  {
  152  /*** Initialize microcomputer ***/
  153
  154          DisInt();                                             /* Disable interrupt */
  155
  156          init_func();
  157
  158          EnInt();                                              /* Enable interrupt */
  159
  160          while(1) {
  161                  P11DATA = (255 - DM2TCT);                     /* Display the value for DM2TCT on LED
*/
  162          }
  163  }
```

3.4 Timing of operation

Timing of operation in this reference program is shown below.



Note. In this diagram it is not include timing information detail.

Figure3.4.1 Timing Diagram for combination sample of input pin and DMAC

4. Reference Documents

- 32176 Group User's Manual (Rev.1.01)
- M32R Family Software Manual (Rev.1.20)
- M3T-CC32R V.4.30 User's Manual (Compiler)
- M3T-CC32R V.4.30 User's Manual (Assembler)

(Please get the latest one from Renesas Technology Corp. website.)

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Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Dec.09.05	—	First edition issued

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