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M16C/65 Group

Buzzer output

1. Abstract

The timer mode is used to make the buzzer ring.

Use the following peripheral function:

- The pulse-outputting function in timer mode of timer A.

2. Introduction

This application note is applied to the M16C/65 group microcomputers.

This application note can be used with other M16C Family MCUs which have the same special function registers (SFRs) as the above group. Check the manual for any modifications to functions. Careful evaluation is recommended before using the program described in this application note.

3. Specification

(1) Sound a 2kHz buzz beep by use of timer A0.

(2) Effect pull-up in the relevant port by use of a pull-up resistor. When the buzzer is off, set the port high-impedance, and stabilize the potential resulting from pulling up.

(3) Connect a 20MHz oscillator to XIN.

(4) Using POFS0 bit in TAPOFS register, select the output polarity of the TA0OUT pin.

4. Operation

(1) The MCU begins performing a count on timer A0. Timer A0 has disabled interrupts.

(2) The MCU begins pulse output by setting the pulse output function select bit to “Pulse output”. P7_0 changes into TA0OUT pin and outputs 2kHz pulses.

(3) The MCU stops outputting pulses by setting the pulse output function select bit to “No pulse output”. P7_0 goes to an input pin, and the output from the pin becomes high-impedance.

Figure 1 shows the operation timing of buzzer output.

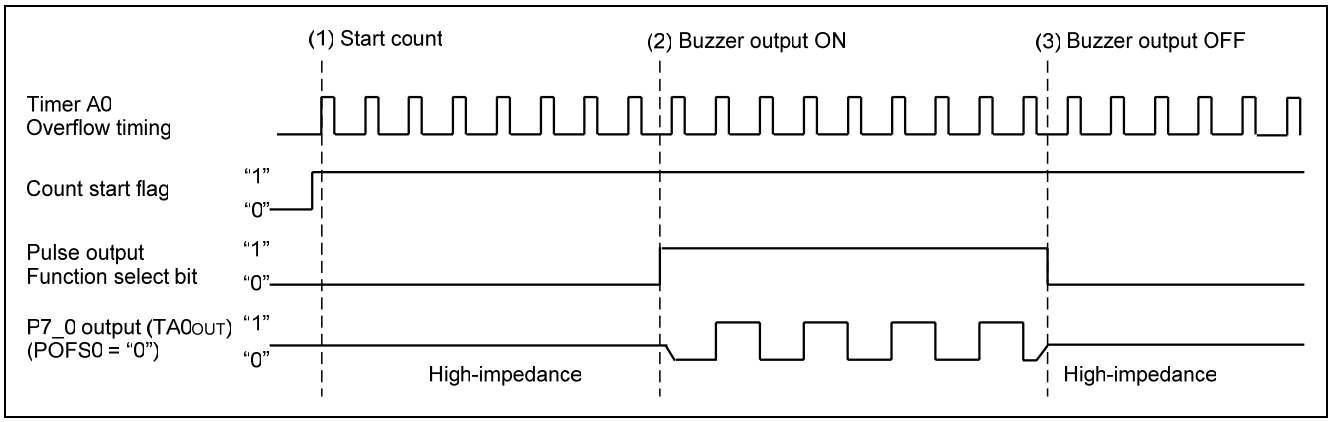


Figure 1. Operation timing of buzzer output

5. Set-up procedure

Table 1 shows Timer A count source, Figure 2 shows block diagram of Timer A count source in timer mode.

Table 1. Count Source Selection of Timer A

TCKDIVC0 register (Note 1)	TACSj register (Note 2)				TAiMR register		Count source	Count source period
TCDIV00	TCS3/ TCS7	TCS2/ TCS6	TCS1/ TCS5	TCS0/ TCS4	TCK1	TCK0		f(XIN):20MHz f(XCIN):32.768kHz f(oco-F):about 20MHz f(oco-s):about 125kHz
0	0	-	-	-	0	0	f1TIMAB/ f2TIMAB (Note 3)	50ns/100ns
0	0	-	-	-	0	1	f8TIMAB	400ns
0	0	-	-	-	1	0	f32TIMAB	1600ns
0	0	-	-	-	1	1	fc32	976.56µs
0	1	0	0	0	-	-	f1TIMAB/ f2TIMAB (Note 3)	50ns/100ns
0	1	0	0	1	-	-	f8TIMAB	400ns
0	1	0	1	0	-	-	f32TIMAB	1600ns
0	1	0	1	1	-	-	f64TIMAB	3200ns
0	1	1	0	0	-	-	foco-F	about 50ns
0	1	1	0	1	-	-	foco-s	about 8µs
0	1	1	1	0	-	-	fc32	976.56µs
1	1	0	0	0	-	-	f1TIMAB/ f2TIMAB (Note 3)	about 50ns/100ns
1	1	0	0	1	-	-	f8TIMAB	about 400ns
1	1	0	1	0	-	-	f32TIMAB	about 1600ns
1	1	0	1	1	-	-	f64TIMAB	about 3200ns

Note 1: TCDIV00 bit is clock select prior to timer AB division bit. Set the TCDIV00 bit before setting other registers associated with timer A. After changing the TCDIV00 bit, set other registers associated with timer A again.

Note 2: TCS3~TCS0 bits of TACS0 register correspond to Timer A0 count source selection, TCS7~TCS4 bits of TACS0 register correspond to Timer A1 count source selection, TCS3~TCS0 bits of TACS1 register correspond to Timer A2 count source selection, TCS7~TCS4 bits of TACS1 register correspond to Timer A3 count source selection, and TCS3~TCS0 bits of TACS2 register correspond to Timer A4 count source selection.

Note 3: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f1TIMAB. When the PCLK0 bit is "0", the selected clock source is f2TIMAB.

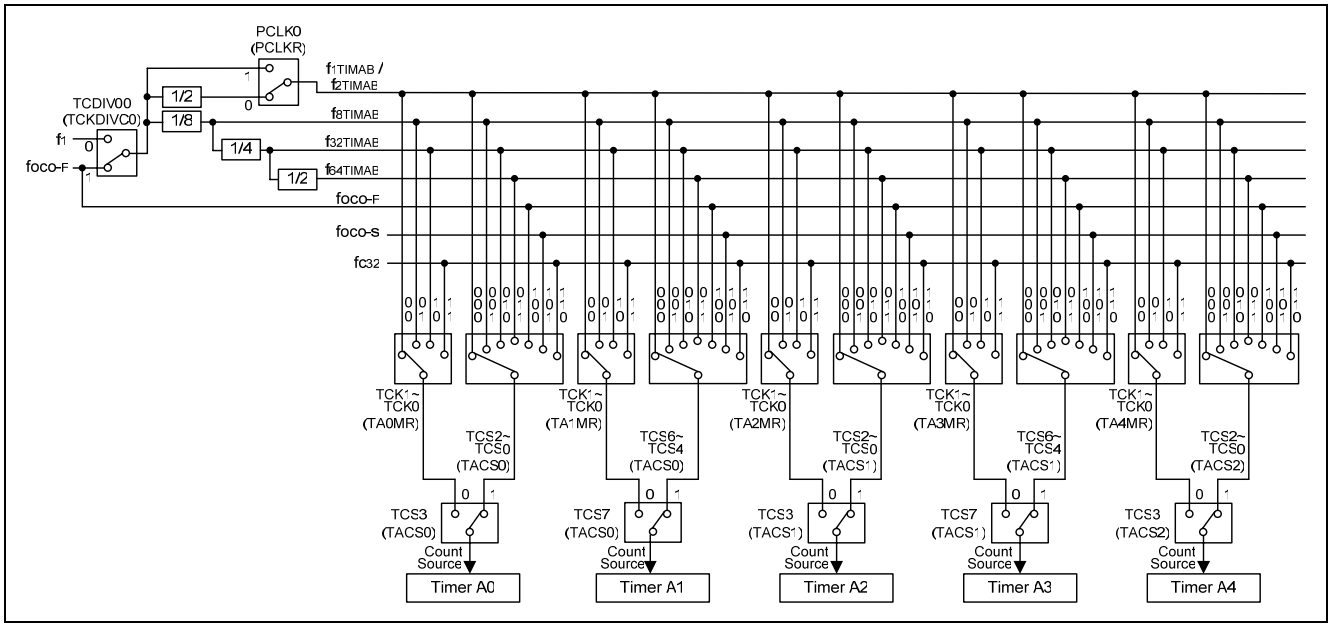


Figure 2. Count source of Timer A

Selecting a clock used prior to timer AB frequency dividing

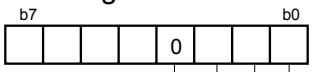
(Set the TCDIV00 bit before setting other registers associated with timer A. After changing the TCDIV00 bit, set other registers associated with timer A again.)

Timer AB Division Control Register 0 [Address 01CBh] TCKDIVC0

b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	X	0	0	0

- b0: Clock select prior to timer AB division bit
  0 : f_1
- b1, b2: Reserved bits
  Set to 0
- b3: No register bits. If necessary, set to 0. Read as undefined value.
- b4 to b7: Reserved bits
  Set to 0

Selecting timer count source



Timer A count source select register 0 [Address 01D0h] TACS0

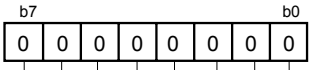
TA0 count source select bit (Note1)

b2 b1 b0
0 0 0 : f_{1TIMAB} or f_{2TIMAB} (Note2)
0 0 1 : f_{8TIMAB}
0 1 0 : $f_{32TIMAB}$
0 1 1 : $f_{64TIMSB}$
1 0 0 : foco-F
1 0 1 : foco-s
1 1 0 : fc_{32}
1 1 1 : Do not set

TA0 count source option specified bit (Note1)
0 : TCK0, TCK1 enabled, TCS0 to TCS2 disabled

Note 1: About the count source period, please refer to Table 1.
Note 2: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f_{1TIMAB}. When the PCLK0 bit is "0", the selected clock source is f_{2TIMAB}.

Initialization of timer A0



Timer A0 mode register [Address 0336h]
TA0MR

Selection of timer mode

Pulse output function select bit
0 : Pulse is not output (TA0OUT pin is a normal port pin)

Gate function select bit

b4 b3
0 0 :
0 1 : } Gate function not available (TA0IN pin is a normal port pin)

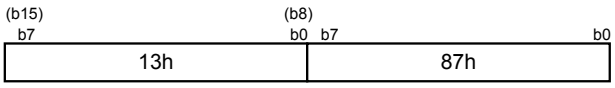
0 (Must always be "0" in timer mode)

Count source select bit (Note1)

b7 b6
0 0 : f_{1TIMAB} or f_{2TIMAB} (Note2)
0 1 : f_{8TIMAB}
1 0 : $f_{32TIMAB}$
1 1 : fc_{32}

Note 1: Valid when the TCS3 bit or TCS7 bit in registers TACS0 to TACS2 is set to 0 (TCK0, TCK1 enabled). About the count source period, please refer to Table 1.
Note 2: When the PCLK0 bit in the PCLKR register is "1", the selected clock source is f_{1TIMAB}. When the PCLK0 bit is "0", the selected clock source is f_{2TIMAB}.

Setting counter value



Timer A0 register [Address 0327h, 0326h]
TA0

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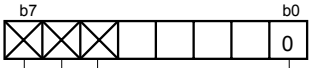
Selecting waveform output function



Timer A waveform output function select register [Address 01D5h]
TAPOFS

TA0OUT output polar control bit
0 : Output waveform "H" active

No register bits. If necessary, set to 0. Read as undefined value

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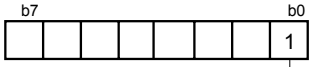
Setting count start flag



Count start flag [Address 0320h]
TABSR

Timer A0 count start flag
1 : Start counting

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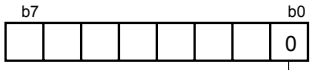
Initialization of port P7 direction register



Port P7 direction register [Address 03EFh]
PD7

Port P7_0 direction register
0 : Input mode

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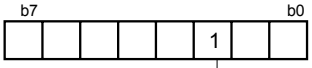
Buzzer ON



Timer A0 mode register [Address 0336h]
TA0MR

Pulse output function select bit
1 : Pulse is output (Port P7_0 is TA0OUT output pin)

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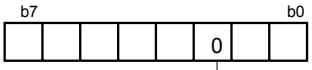
Buzzer OFF



Timer A0 mode register [Address 0336h]
TA0MR

Pulse output function select bit
0 : Pulse is not output

6. Reference

Hardware manual

M16C/65 Group Hardware Manual
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