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R8C/2D Group

Timer RF in Output Compare Mode

1. Abstract

This document describes a program for timer RF in output compare mode.

2. Introduction

The application example described in this document applies to the following MCU and parameter(s):

- MCU : R8C/2D Group

This program can be used with other R8C/Tiny Series MCUs which have the same special function registers (SFRs) as the R8C/2D Group. Check the manual for any additions and modifications to functions. Careful evaluation is recommended before using this application note.

3. Application Example Description

In output compare mode, when the TRF register value matches the TRFM0 register value (compare 0 match), or the TRFM1 register value (compare 1 match), a given level is output from the output-compare pin.

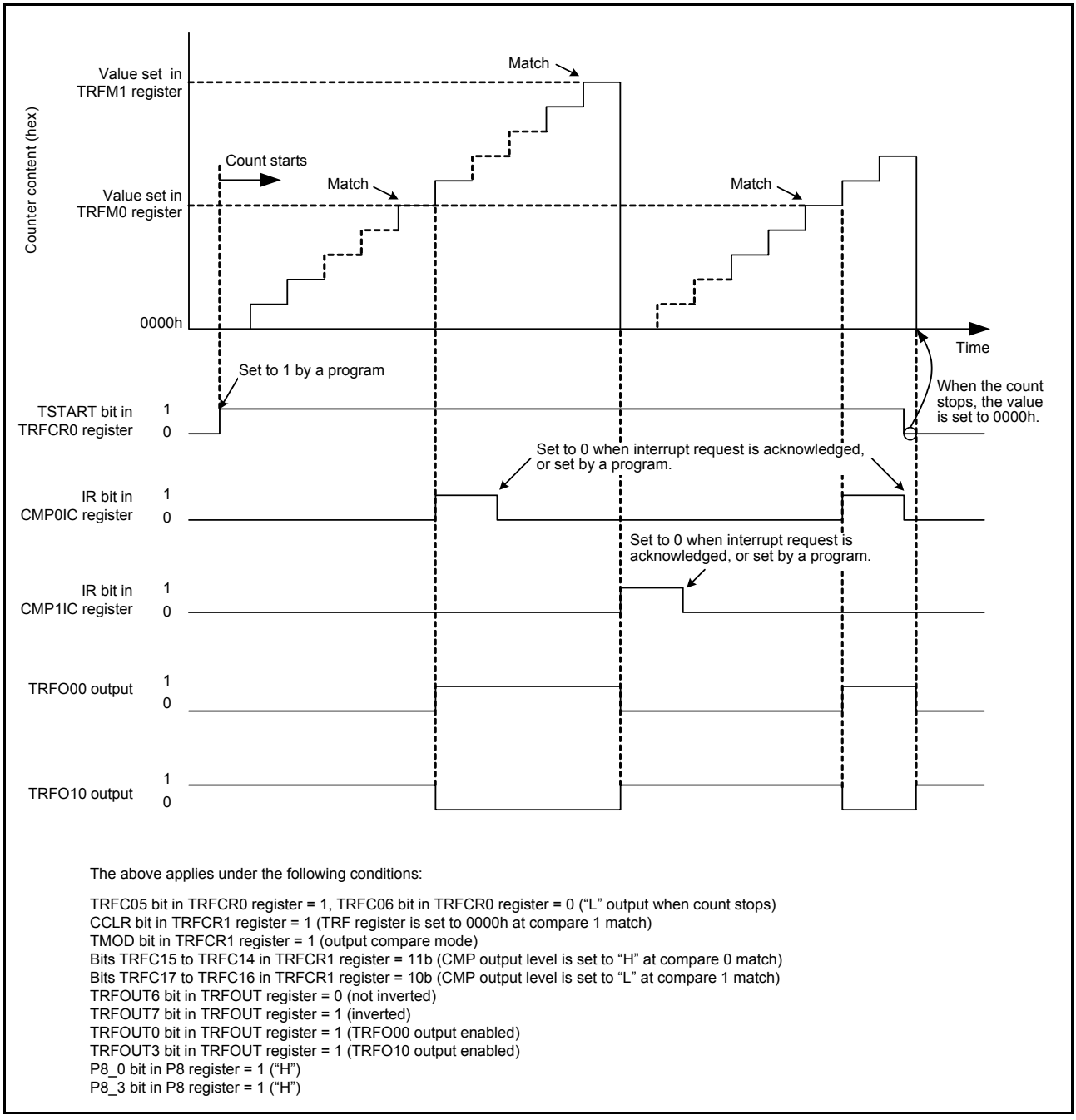
This section shows how to output the level from the TRFO00 pin in output compare mode. 25 µs is used to compare/match registers TRF and TRFM0, and 50 µs is used to compare/match registers TRF and TRFM1.

Compare 0 match : 40 MHz(fOCO) × f2(FRA2) × f1 × (trfm0 + 1) = 50 ns × 1 × 500 = 25 µs
Compare 1 match : 40 MHz(fOCO) × f2(FRA2) × f1 × (trfm1 + 1) = 50 ns × 1 × 1000 = 50 µs

The setting conditions of this program are as follows:

- Timer RF count source : f1
- CMP output when count stops : Output before count stops is held
- TRF register count operation : TRF register is set to 0000h at compare 1 match
- CMP output at compare 0 match : Inverted
- CMP output at compare 1 match : Inverted

Figure 3.1 shows the Operating Example in Output Compare Mode.



The above applies under the following conditions:

TRFC05 bit in TRFCR0 register = 1, TRFC06 bit in TRFCR0 register = 0 (“L” output when count stops)
CCLR bit in TRFCR1 register = 1 (TRF register is set to 0000h at compare 1 match)
TMOD bit in TRFCR1 register = 1 (output compare mode)
Bits TRFC15 to TRFC14 in TRFCR1 register = 11b (CMP output level is set to “H” at compare 0 match)
Bits TRFC17 to TRFC16 in TRFCR1 register = 10b (CMP output level is set to “L” at compare 1 match)
TRFOUT6 bit in TRFOUT register = 0 (not inverted)
TRFOUT7 bit in TRFOUT register = 1 (inverted)
TRFOUT0 bit in TRFOUT register = 1 (TRFO00 output enabled)
TRFOUT3 bit in TRFOUT register = 1 (TRFO10 output enabled)
P8_0 bit in P8 register = 1 (“H”)
P8_3 bit in P8 register = 1 (“H”)

Figure 3.1 Operating Example in Output Compare Mode

This sample program may include operations of unused bit functions for the SFR bit layout. Set these values according to the operating conditions of the user system.

3.1 Pin Usage

Table 3.1 Pin Usage and Function

Pin	I/O	Function
P8_0/TRFO00	Output	Output compare output pin 00

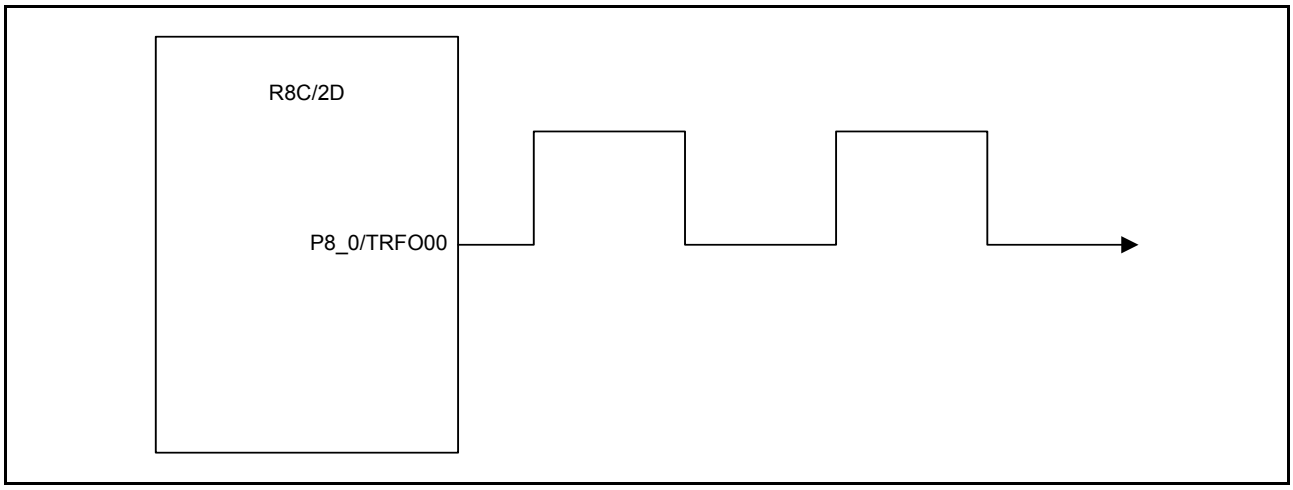


Figure 3.2 Output Compare Output

3.2 Memory Usage

Table 3.2 Memory Usage

Memory Usage	Size	Remark
ROM	149 bytes	In main.c module
RAM	0 bytes	In main.c module
Maximum user stack usage	10 bytes	main function: 7 bytes timer_rf_init function: 3 bytes
Maximum interrupt stack usage	0 bytes	Unused

Memory usage varies depending on the C compiler version and the compile option.
The above applies under the following conditions:

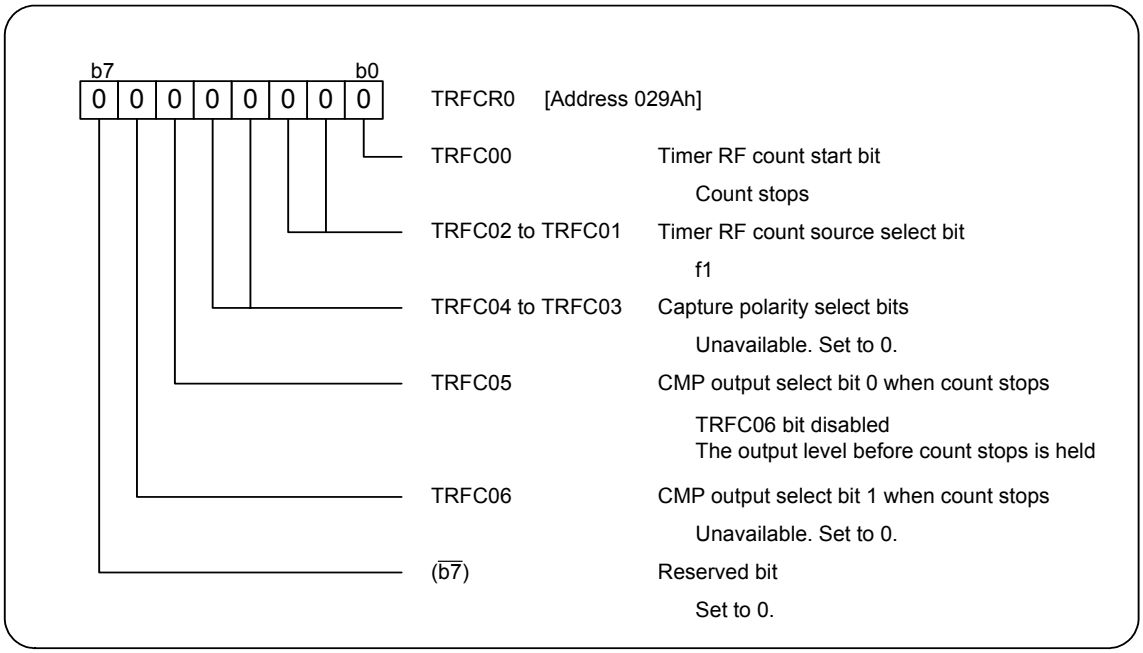
- C compiler: M16C/60, 30, 20, 10, Tiny, R8C/Tiny Series Compiler V.5.40 Release 00
- Compile option: -c -finfo; NOTE: -dir “$(CONFIGDIR)” -R8C

NOTE: Unavailable in the R8C/Tiny-exclusive free version.

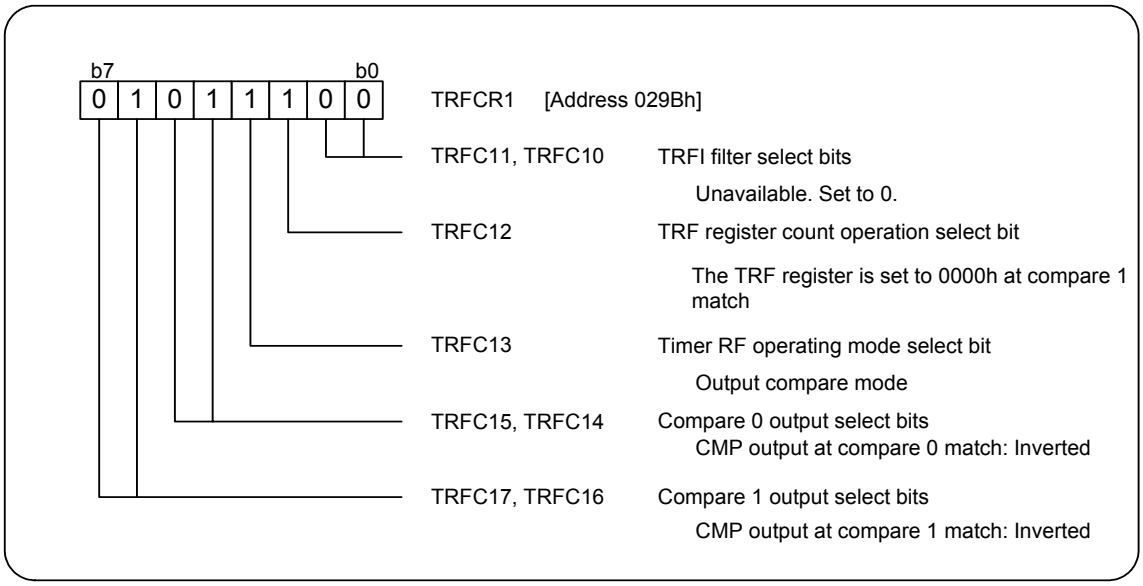
4. Setup

This section shows the initial setting procedures and values to perform the example described in **3. Application Example Description**. Refer to the **R8C/2D Group Hardware Manual** for details on individual registers.

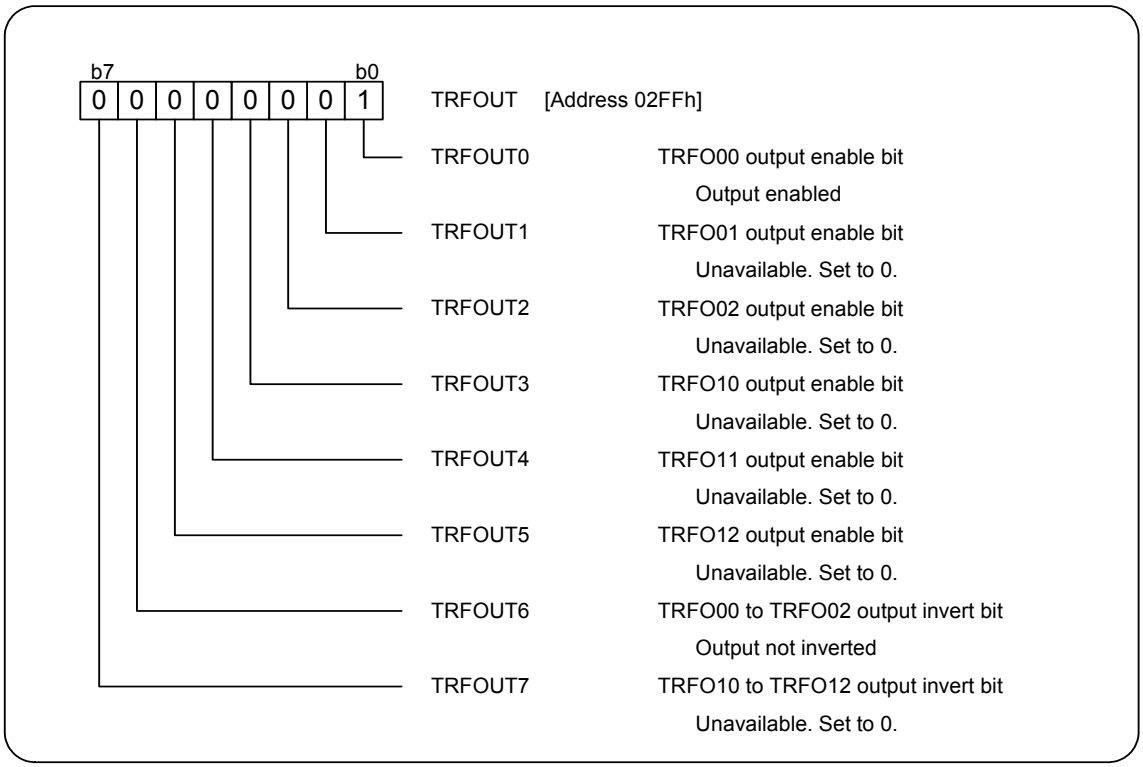
(1) Set timer RF control register 0



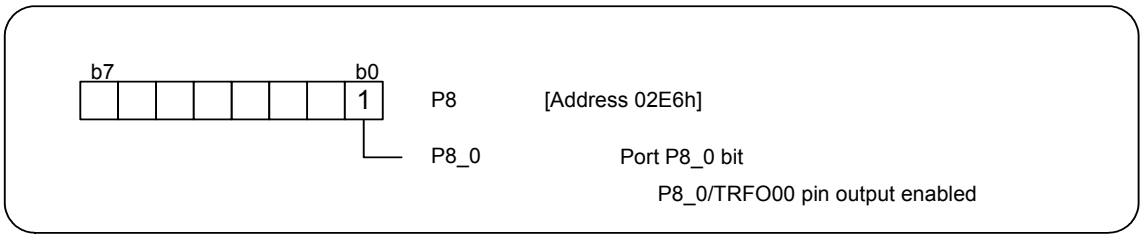
(2) Set timer RF control register 1



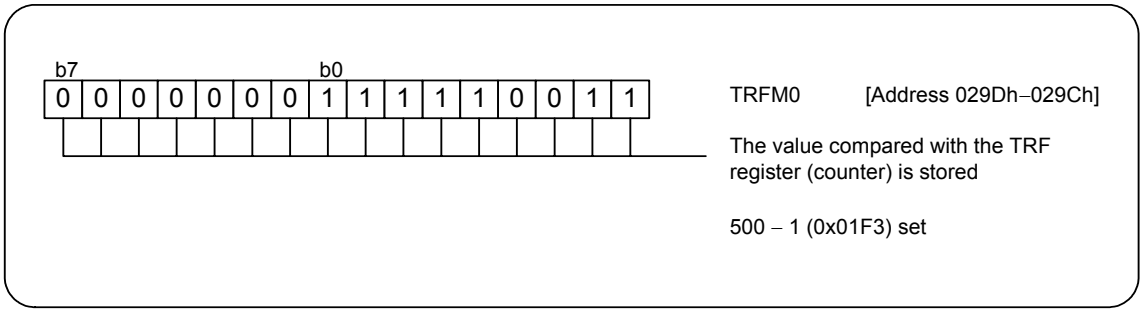
(3) Set the timer RF output control register



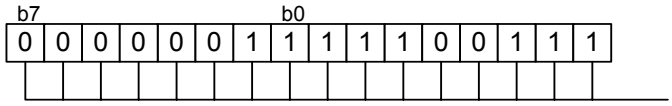
(4) Set the port P8 register



(5) Set the compare 0 register



(6) Set the compare 1 register

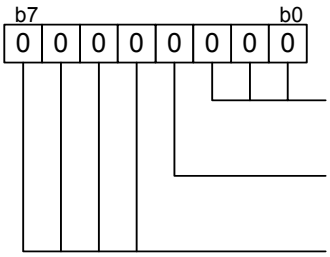


TRFM1 [Address 029Fh–029Eh]

The value compared with the TRF register (counter) is stored

1000 – 1 (0x03E7) set

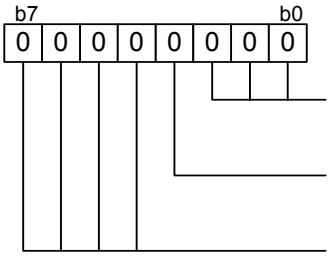
(7) Set the compare 0 interrupt control register



CMP0IC [Address 005Ch]

ILVL2 to ILVL0	Interrupt priority level select bits 2 to 0
	Level 0 (interrupt disabled)
IR	Interrupt request bit
	No interrupt request
($\overline{b7}$-$\overline{b4}$)	Nothing is assigned
	Set to 0.

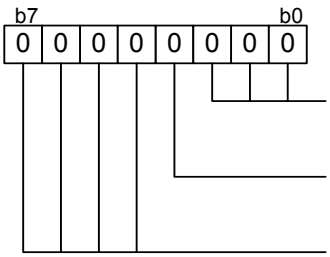
(8) Set the compare 1 interrupt control register



CMP1IC [Address 0050h]

ILVL2 to ILVL0	Interrupt priority level select bits 2 to 0
	Level 0 (interrupt disabled)
IR	Interrupt request bit
	No interrupt request
($\overline{b7}$-$\overline{b4}$)	Nothing is assigned
	Set to 0.

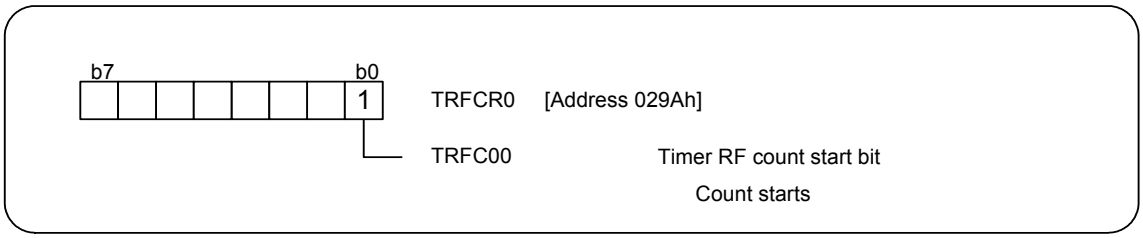
(9) Set the timer RF interrupt control register



TRFIC [Address 005Bh]

ILVL2 to ILVL0	Interrupt priority level select bits 2 to 0
	Level 0 (interrupt disabled)
IR	Interrupt request bit
	No interrupt request
($\overline{b7}$-$\overline{b4}$)	Nothing is assigned
	Set to 0.

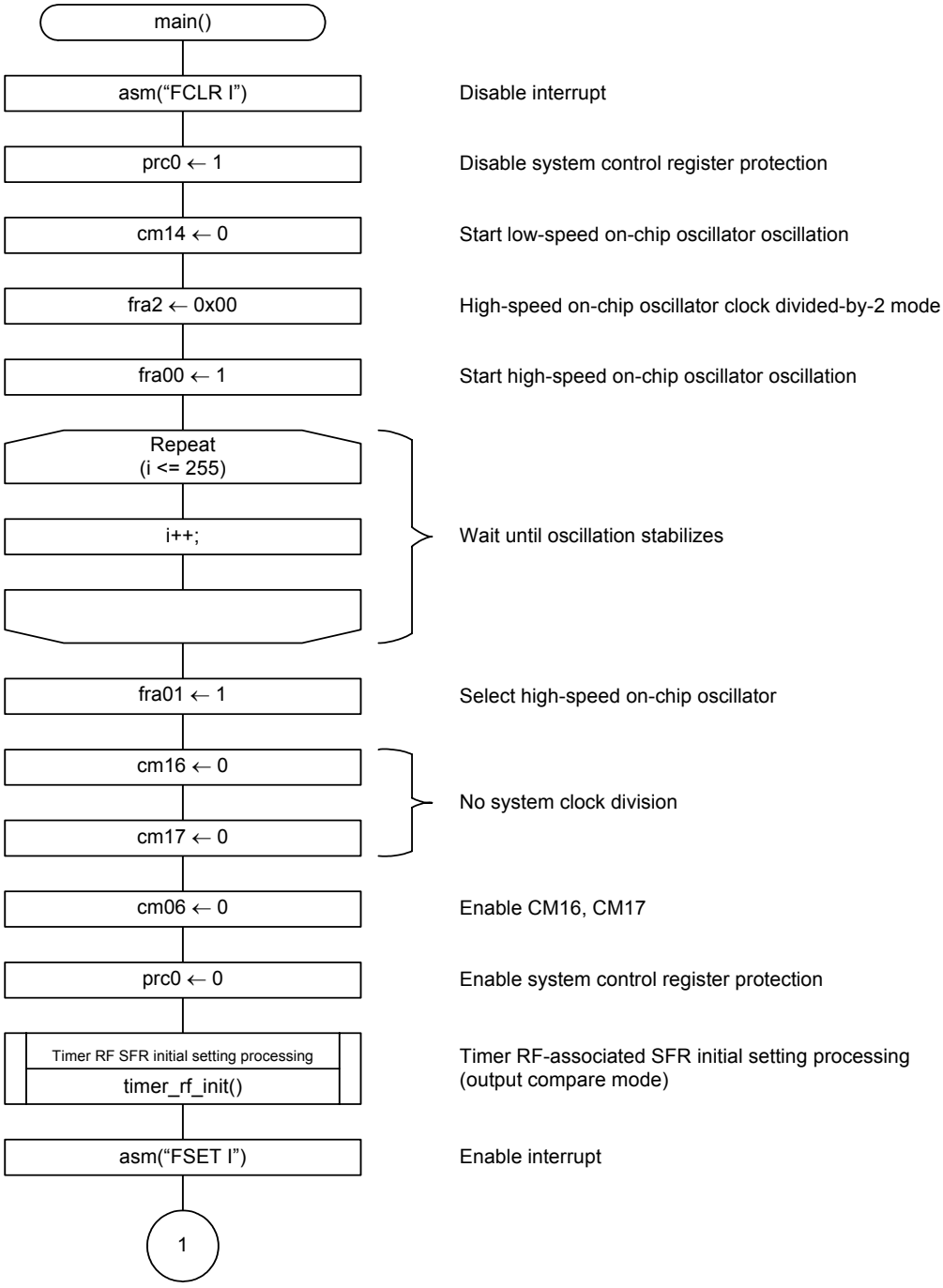
(10) Set the timer RF count start bit



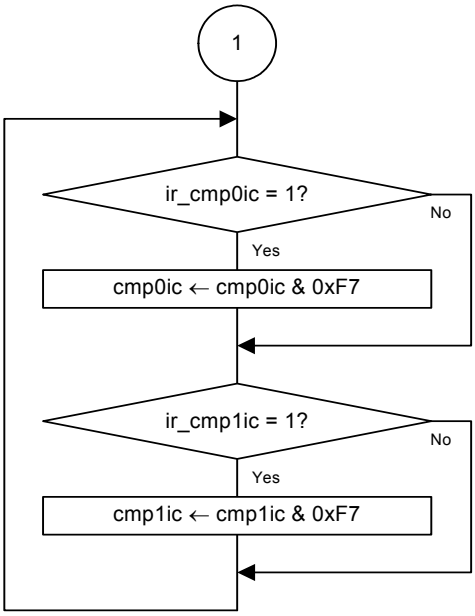
5. Flowchart

5.1 Main Function

5.1.1 Main Function 1



5.1.2 Main Function 2



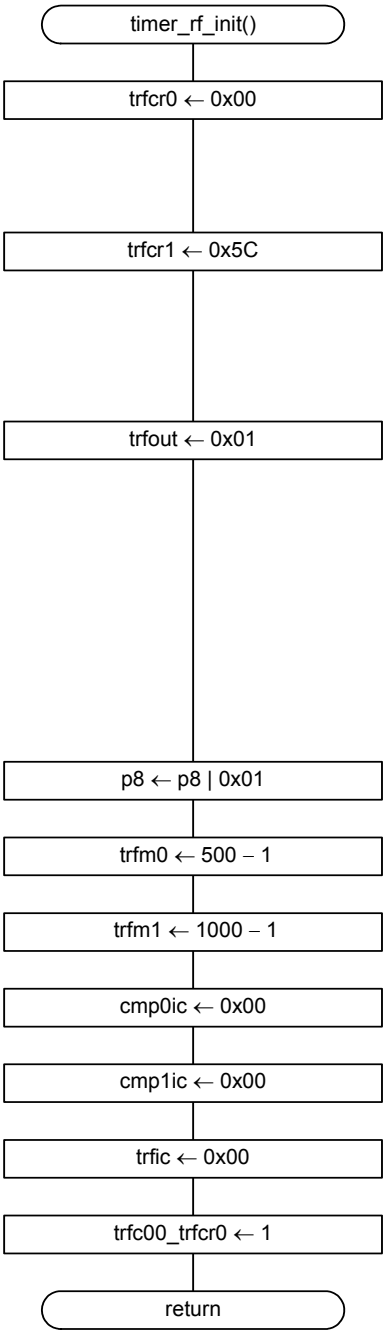
Generate compare 0 interrupt request

Clear compare 0 interrupt request flag

Generate compare 1 interrupt request

Clear compare 1 interrupt request flag

5.2 Timer RF-Associated SFR Initial Setting Processing



Stop timer RF counting

Timer RF count source: f1
CMP output when count stops:
Hold output before count stops

Set TRF register to 0000h at compare 1 match

Select output compare mode

CMP output at compare 0 match: Invert

CMP output at compare 1 match: Invert

TRFO00: Enable output

TRFO01: Disable output

TRFO02: Disable output

TRFO10: Disable output

TRFO11: Disable output

TRFO12: Disable output

TRFO00 to TRFO02: Do not invert output

TRFO10 to TRFO12: Do not invert output

P8_0/TRFO00: Enable output

Count period: Set to 25 μs (50 ns × 1 × 500 = 25 μs)

Count period: Set to 50 μs (50 ns × 1 × 1000 = 50 μs)

Disable compare 0 interrupt

Disable compare 1 interrupt

Disable timer RF interrupt

Start timer RF counting

6. Sample Programming Code

A sample program can be downloaded from the Renesas Technology website.
To download, click “Application Notes” in the left-hand side menu of the R8C/Tiny Series page.

7. Reference Documents

Hardware Manual
R8C/2D Group Hardware Manual
The latest version can be downloaded from the Renesas Technology website.

Technical Update/Technical News
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		Page	Summary
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