R8C/38C Group

Timer RD (PWM Mode)

1. Abstract

This document describes a setting method and an application example for timer RD in PWM mode in the R8C/38C Group.

2. Introduction

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

- MCU: R8C/38C Group
- XIN clock frequency: 20 MHz

This application note can be used with other R8C 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. Application Example

3.1 Program Outline

Three PWM waveforms with 100 µs periods are output. The PWM period is generated at a compare match of the timer RD counter 0 (TRD0) and general register A0 (TRDGRA0). PWM change points for each are generated at the compare match of the TRD0 register and general registers TRDGRB0, TRDGRC0, and TRDGRD0. An interrupt is generated at the compare match of registers TRD0 and TRDGRA0. Output signals are as follows:

TRDIOB0 pin: Inactive low level 25 µs = 1/20 MHz × (TRDGRB0 + 1) = 50 ns × 500

         Active high level 75 µs = 1/20 MHz × ((TRDGRA0 + 1) − (TRDGRB0 + 1))

             = 50 ns × (2000 − 500) = 50 ns × 1500

TRDIOC0 pin: Inactive low level 50 µs = 1/20 MHz × (TRDGRC0 + 1) = 50 ns × 1000

         Active high level 50 µs = 1/20 MHz × ((TRDGRA0 + 1) − (TRDGRC0 + 1))

             = 50 ns × (2000 − 1000) = 50 ns × 1000

TRDIOD0 pin: Inactive low level 75 µs = 1/20 MHz × (TRDGRD0 + 1) = 50 ns × 1500

         Active high level 25 µs = 1/20 MHz × ((TRDGRA0 + 1) − (TRDGRD0 + 1))

             = 50 ns × (2000 − 1500) = 50 ns × 500

The 100 µs PWM period is set to the TRDGRA0 register.

100 µs = 1/20 MHz × (TRDGRA0 + 1)

        = 50 ns × 2000

Settings

- Use f1 (XIN clock: 20 MHz) as the count source.
- Clear the TRD0 register at the compare match of the TRDGRA0 register.
- Select the TRDGRB0 pin output level as active high and the initial output level as inactive low.
- Select the TRDGRC0 pin output level as active high and the initial output level as inactive low.
- Select the TRDGRD0 pin output level as active high and the initial output level as inactive low.
- Output an active high level from the TRDIOB0 output pin at the compare match of registers TRD0 and TRDGRB0.
- Output an active high level from the TRDIOC0 output pin at the compare match of registers TRD0 and TRDGRC0.
- Output an active high level from the TRDIOD0 output pin at the compare match of registers TRD0 and TRDGRD0.
- Output an inactive low level from output pins TRDIOB0, TRDIOC0, and TRDIOD0 at the compare match of registers TRD0 and TRDGRA0.
- Do not use the pulse output forced cutoff input function.
- Do not use A/D triggers.
- Use the timer RD0 interrupt.

Figure 3.1 shows a Block Diagram and Figure 3.2 shows a Timing Diagram. Table 3.1 lists the pins used and their functions.
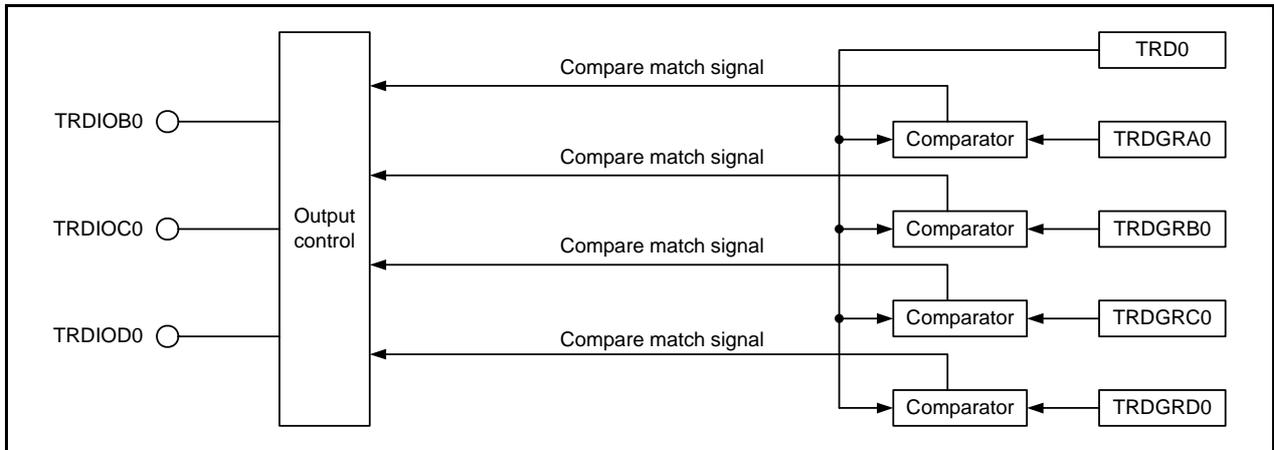
Figure 3.1   Block Diagram
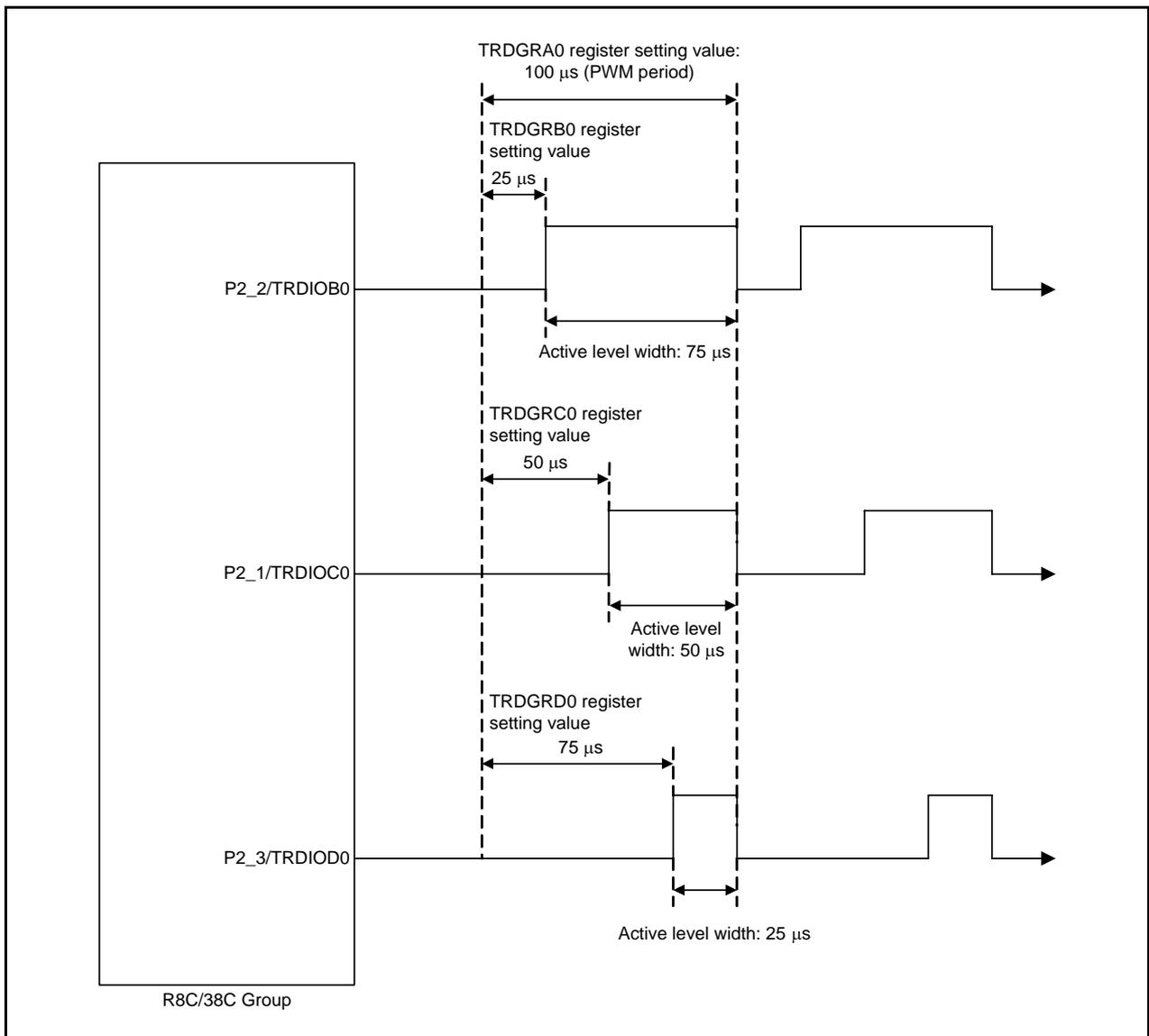
Figure 3.2   Timing Diagram

Table 3.1   Pins and Their Functions

Pin Name	I/O	Function
P2_2/TRDIOB0	Output	PWM output
P2_1/TRDIOC0	Output	PWM output
P2_3/TRDIOD0	Output	PWM output

3.2   Memory

Table 3.2   Memory

Memory	Size	Remarks
ROM	200 bytes	In the r01an0086_src.c module
RAM	0 bytes	In the r01an0086_src.c module
Maximum user stack	10 bytes	
Maximum interrupt stack	18 bytes	

Memory size varies depending on the C compiler version and compile options.

The above applies to the following conditions:

C compiler: M16C Series, R8C Family C Compiler V.5.45 Release 01

Compile option: -c -finfo -dir "$(CONFIGDIR)" -R8C

4. Software

This section shows the initial setting procedures and values to set the example described in section **3. Application Example**. Refer to the latest **R8C/38C Group** hardware user's manual for details on individual registers.

The × in the register's Setting Value represents bits not used in this application, blank spaces represent bits that do not change, and the dash represents reserved bits or bits that have nothing assigned.

4.1 Function Tables

Declaration	void mcu_init(void)		
Outline	System clock setting		
Argument	Argument name		Meaning
	None		—
Variable (global)	Variable name		Contents
	None		—
Returned value	Type	Value	Meaning
	None	—	—
Function	Set the system clock (XIN clock).		

Declaration	void timer_rd_init(void)		
Outline	Initial setting of timer RD associated SFRs		
Argument	Argument name		Meaning
	None		—
Variable (global)	Variable name		Contents
	None		—
Returned value	Type	Value	Meaning
	None	—	—
Function	Initialize timer RD associated SFRs to use timer RD in PWM mode.		

Declaration	void _timer_rd_ch0(void)		
Outline	Timer RD0 interrupt handling		
Argument	Argument name		Meaning
	None		—
Variable (global)	Variable name		Contents
	None		—
Returned value	Type	Value	Meaning
	None	—	—
Function	Perform timer RD0 interrupt handling.		

4.2   Main Function

• Flowchart

Flowchart	Description
main()	
asm("FCLR I")	Disable interrupts.
System clock setting / mcu_init()	System clock setting (XIN clock set)
Initial setting of timer RD associated SFRs / timer_rd_init()	Initial setting of timer RD associated SFRs (PWM mode set)
asm("FSET I")	Enable interrupts.
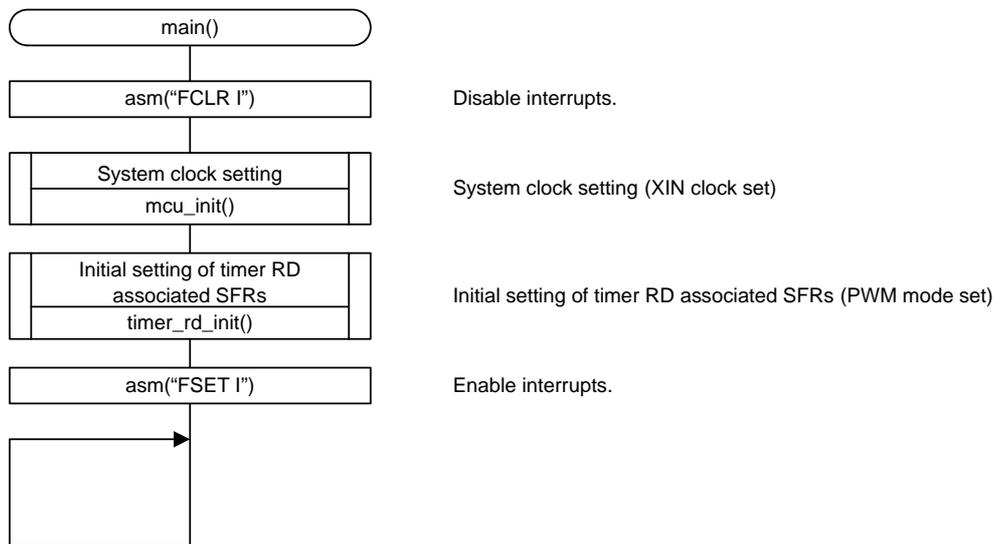
4.3   System Clock Setting

● Flowchart

	mcu_init()	
(1)	prc0 ← 1	Disable system control register protect.
(2)	cm14 ← 0	Start low-speed on-chip oscillator.
(3)	cm13 ← 1	Select pins XIN-XOUT.
(4)	cm05 ← 0	Oscillate XIN clock.
(5)	Repeat (i <= 2040)	
	i++	Wait until oscillation stabilizes.
(6)	cm07 ← 0	Select XIN clock.
(7)	ocd2 ← 0	Select XIN clock as the system clock.
(8)	cm1 ← cm1 & 0x3f	Select CPU clock no division.
(9)	cm06 ← 0	Enable bits CM16 and CM17.
(10)	prc0 ← 0	Set system control register protect.
	return	

• Register settings

(1) Enable writing to registers CM0, CM1, CM3, OCD, FRA0, FRA1, FRA2, and FRA3.

Protect Register (PRCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x	x	x	1

Bit	Symbol	Bit Name	Function	R/W
b0	PRC0	Protect bit 0	Enables writing to registers CM0, CM1, CM3, OCD, FRA0, FRA1, FRA2, and FRA3. 1: Write enabled	R/W

(2) Start the low-speed on-chip oscillator.

System Clock Control Register 1 (CM1)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value			—	0		x	x	x

Bit	Symbol	Bit Name	Function	R/W
b4	CM14	Low-speed on-chip oscillator stop bit	0: Low-speed on-chip oscillator on	R/W

(3) Set system clock control register 1.

System Clock Control Register 1 (CM1)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value			—		1	x	x	x

Bit	Symbol	Bit Name	Function	R/W
b3	CM13	Port/XIN-XOUT switch bit	1: XIN-XOUT pin	R/W

(4) Set system clock control register 0.

System Clock Control Register 0 (CM0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value			0	x	x	x	—	—

Bit	Symbol	Bit Name	Function	R/W
b5	CM05	XIN clock (XIN-XOUT) stop bit	0: XIN clock oscillates	R/W

(5) Wait until oscillation stabilizes.

(6) Select the XIN clock.

System Clock Control Register 0 (CM0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	0			x	x	x	—	—

Bit	Symbol	Bit Name	Function	R/W
b7	CM07	XIN, XCIN clock select bit	0: XIN clock	R/W

(7) Select the XIN clock as the system clock.

Oscillation Stop Detection Register (OCD)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x	0	x	x

Bit	Symbol	Bit Name	Function	R/W
b2	OCD2	System clock select bit	0: XIN clock selected	R/W

(8) Set system clock control register 1.

System Clock Control Register 1 (CM1)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	0	0	—			x	x	x

Bit	Symbol	Bit Name	Function	R/W
b6	CM16	CPU clock division select bit 1	b7 b6 0 0: No division mode	R/W
b7	CM17			R/W

(9) Set system clock control register 0.

System Clock Control Register 0 (CM0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value		0		x	x	x	—	—

Bit	Symbol	Bit Name	Function	R/W
b6	CM06	CPU clock division select bit 0	0: Bits CM16 and CM17 in CM1 register enabled	R/W

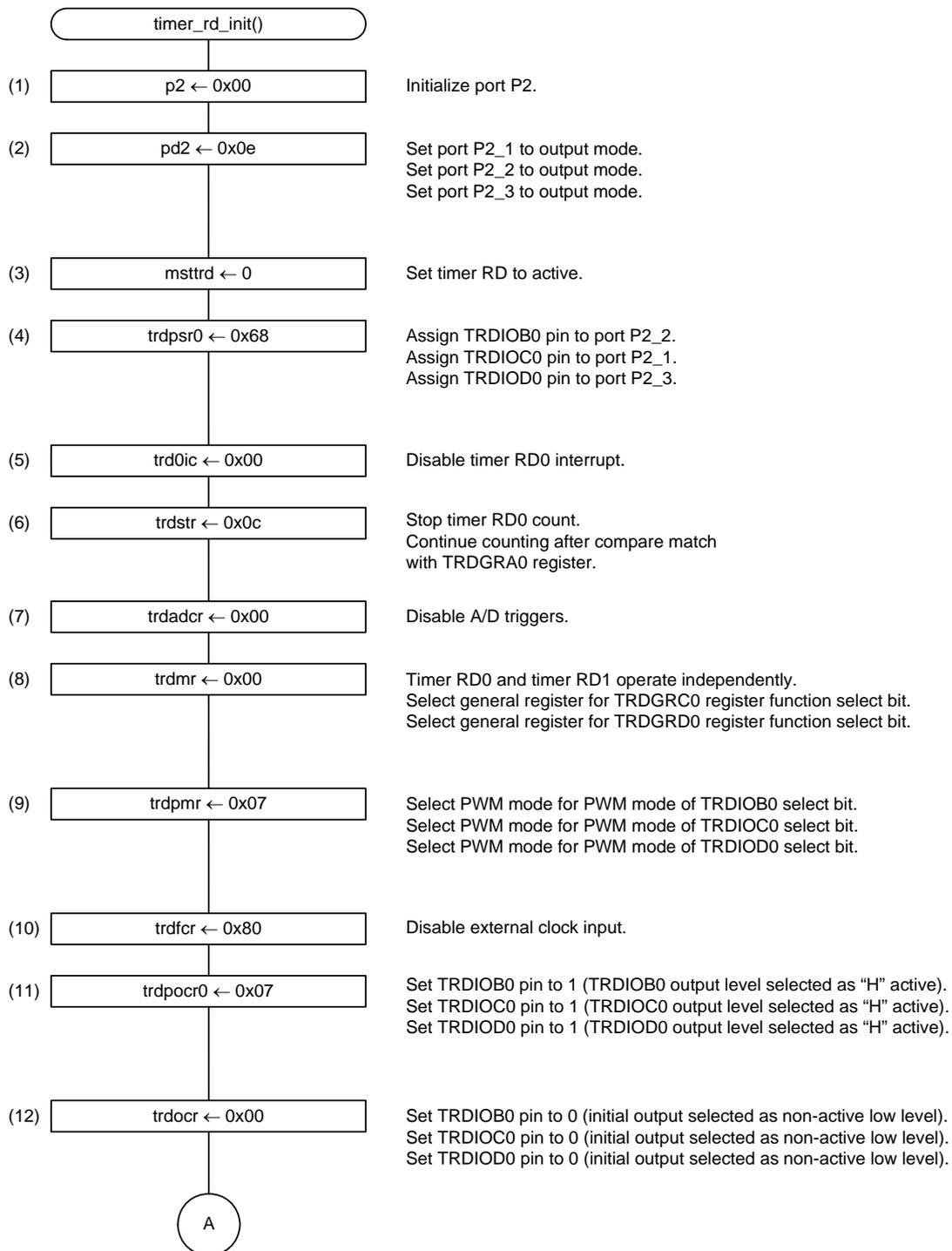(10) Disable writing to registers CM0, CM1, CM3, OCD, FRA0, FRA1, FRA2, and FRA3.
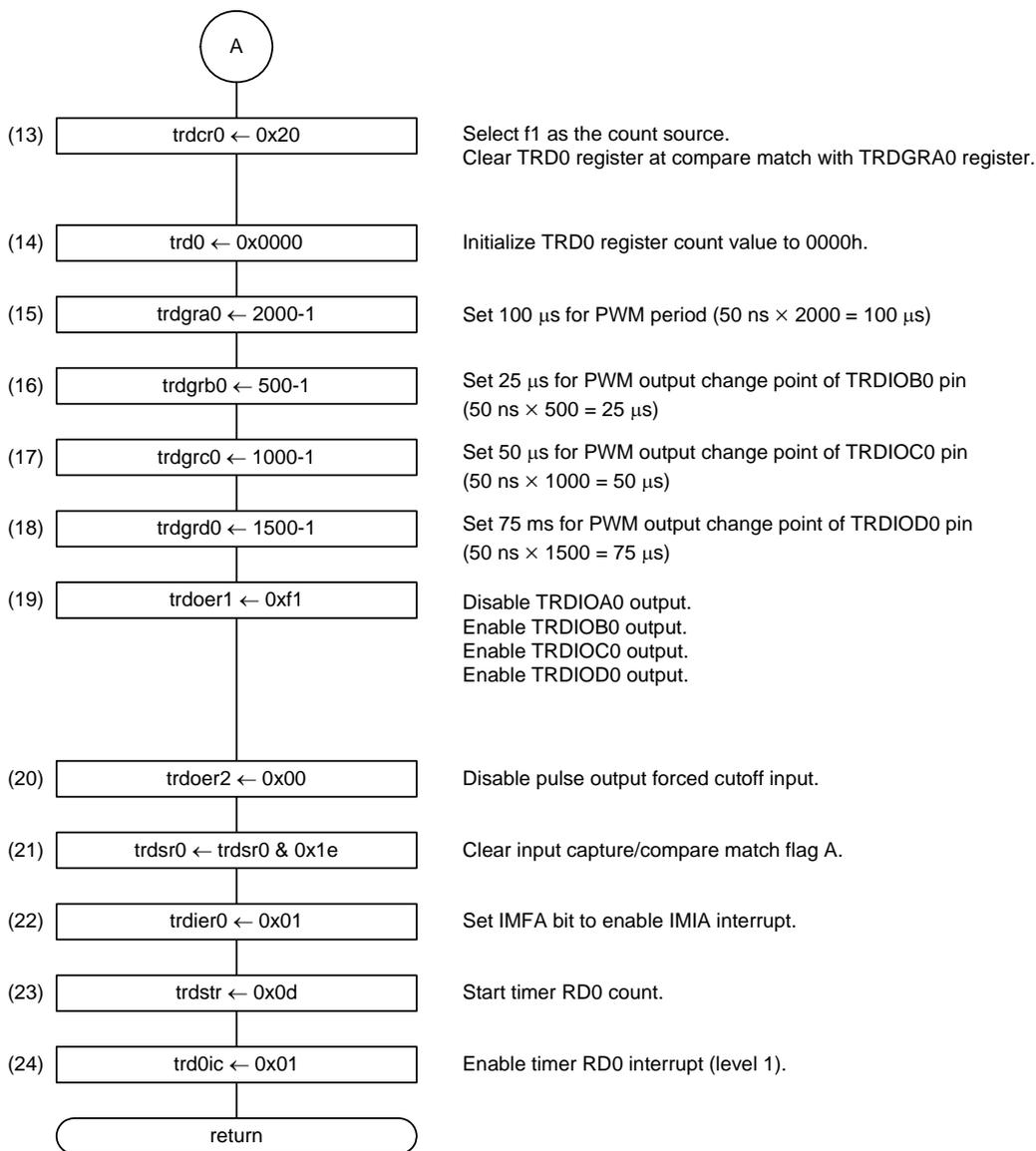
Protect Register (PRCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x	x	x	0

Bit	Symbol	Bit Name	Function	R/W
b0	PRC0	Protect bit 0	Enables writing to registers CM0, CM1, CM3, OCD, FRA0, FRA1, FRA2, and FRA3. 0: Write disabled	R/W

4.4　Initial Setting of Timer RD Associated SFRs

• Flowchart

	timer_rd_init()	
(1)	p2 ← 0x00	Initialize port P2.
(2)	pd2 ← 0x0e	Set port P2_1 to output mode. Set port P2_2 to output mode. Set port P2_3 to output mode.
(3)	msttrd ← 0	Set timer RD to active.
(4)	trdpsr0 ← 0x68	Assign TRDIOB0 pin to port P2_2. Assign TRDIOC0 pin to port P2_1. Assign TRDIOD0 pin to port P2_3.
(5)	trd0ic ← 0x00	Disable timer RD0 interrupt.
(6)	trdstr ← 0x0c	Stop timer RD0 count. Continue counting after compare match with TRDGRA0 register.
(7)	trdadcr ← 0x00	Disable A/D triggers.
(8)	trdmr ← 0x00	Timer RD0 and timer RD1 operate independently. Select general register for TRDGRC0 register function select bit. Select general register for TRDGRD0 register function select bit.
(9)	trdpmr ← 0x07	Select PWM mode for PWM mode of TRDIOB0 select bit. Select PWM mode for PWM mode of TRDIOC0 select bit. Select PWM mode for PWM mode of TRDIOD0 select bit.
(10)	trdfcr ← 0x80	Disable external clock input.
(11)	trdpocr0 ← 0x07	Set TRDIOB0 pin to 1 (TRDIOB0 output level selected as "H" active). Set TRDIOC0 pin to 1 (TRDIOC0 output level selected as "H" active). Set TRDIOD0 pin to 1 (TRDIOD0 output level selected as "H" active).
(12)	trdocr ← 0x00	Set TRDIOB0 pin to 0 (initial output selected as non-active low level). Set TRDIOC0 pin to 0 (initial output selected as non-active low level). Set TRDIOD0 pin to 0 (initial output selected as non-active low level).
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                              ( A )
                                │
(13)  ┌─────────────────────────────────┐      Select f1 as the count source.
      │        trdcr0 ← 0x20             │      Clear TRD0 register at compare match with TRDGRA0 register.
      └─────────────────────────────────┘
                                │
(14)  ┌─────────────────────────────────┐      Initialize TRD0 register count value to 0000h.
      │        trd0 ← 0x0000             │
      └─────────────────────────────────┘
                                │
(15)  ┌─────────────────────────────────┐      Set 100 μs for PWM period (50 ns × 2000 = 100 μs)
      │       trdgra0 ← 2000-1           │
      └─────────────────────────────────┘
                                │
(16)  ┌─────────────────────────────────┐      Set 25 μs for PWM output change point of TRDIOB0 pin
      │       trdgrb0 ← 500-1            │      (50 ns × 500 = 25 μs)
      └─────────────────────────────────┘
                                │
(17)  ┌─────────────────────────────────┐      Set 50 μs for PWM output change point of TRDIOC0 pin
      │       trdgrc0 ← 1000-1           │      (50 ns × 1000 = 50 μs)
      └─────────────────────────────────┘
                                │
(18)  ┌─────────────────────────────────┐      Set 75 ms for PWM output change point of TRDIOD0 pin
      │       trdgrd0 ← 1500-1           │      (50 ns × 1500 = 75 μs)
      └─────────────────────────────────┘
                                │
(19)  ┌─────────────────────────────────┐      Disable TRDIOA0 output.
      │       trdoer1 ← 0xf1             │      Enable TRDIOB0 output.
      └─────────────────────────────────┘      Enable TRDIOC0 output.
                                │              Enable TRDIOD0 output.
                                │
(20)  ┌─────────────────────────────────┐      Disable pulse output forced cutoff input.
      │       trdoer2 ← 0x00             │
      └─────────────────────────────────┘
                                │
(21)  ┌─────────────────────────────────┐      Clear input capture/compare match flag A.
      │     trdsr0 ← trdsr0 & 0x1e       │
      └─────────────────────────────────┘
                                │
(22)  ┌─────────────────────────────────┐      Set IMFA bit to enable IMIA interrupt.
      │       trdier0 ← 0x01             │
      └─────────────────────────────────┘
                                │
(23)  ┌─────────────────────────────────┐      Start timer RD0 count.
      │        trdstr ← 0x0d             │
      └─────────────────────────────────┘
                                │
(24)  ┌─────────────────────────────────┐      Enable timer RD0 interrupt (level 1).
      │       trd0ic ← 0x01             │
      └─────────────────────────────────┘
                                │
                 (        return        )
```

● Register settings

(1) Initialize port P2.

Port P2 Register (P2)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	x	x	0	0	0	x

Bit	Symbol	Bit Name	Function	R/W
b1	P2_1	Port P2_1 bit		R/W
b2	P2_2	Port P2_2 bit	0: "L" level	R/W
b3	P2_3	Port P2_3 bit		R/W

(2) Set ports P2_1, P2_2, and P2_3 to output mode.

Port P2 Direction Register (PD2)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	x	x	1	1	1	x

Bit	Symbol	Bit Name	Function	R/W
b1	PD2_1	Port P2_1 direction bit		R/W
b2	PD2_2	Port P2_2 direction bit	1: Output mode (functions as an output port)	R/W
b3	PD2_3	Port P2_3 direction bit		R/W

(3) Set timer RD to active.

Module Standby Control Register (MSTCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	x	x	0	x	—	—	—

Bit	Symbol	Bit Name	Function	R/W
b4	MSTTRD	Timer RD standby bit	0: Active	R/W

(4) Set timer RD pin select register 0.

Timer RD Pin Select Register 0 (TRDPSR0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	1	1	0	1	0	—	x

Bit	Symbol	Bit Name	Function	R/W
b2	TRDIOB0SEL0	TRDIOB0 pin select bit	b3 b2 1 0: P2_2 assigned	R/W
b3	TRDIOB0SEL1			R/W
b4	TRDIOC0SEL0	TRDIOC0 pin select bit	b5 b4 1 0: P2_1 assigned	R/W
b5	TRDIOC0SEL1			R/W
b6	TRDIOD0SEL0	TRDIOD0 pin select bit	1: P2_3 assigned	R/W

(5) Disable the timer RD0 interrupt.

Interrupt Control Register (TRD0IC)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—		0	0	0

Bit	Symbol	Bit Name	Function	R/W
b0	ILVL0	Interrupt priority level select bit	b2 b1 b0 0 0 0: Level 0 (interrupt disabled)	R/W
b1	ILVL1			R/W
b2	ILVL2			R/W
b3	IR	Interrupt request bit	0: No interrupt requested 1: Interrupt requested	R

(6) Stop the timer RD0 count and set the timer RD0 count operation.

Timer RD Start Register (TRDSTR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x	1	x	0

Bit	Symbol	Bit Name	Function	R/W
b0	TSTART0	TRD0 count start flag	0: Count stops	R/W
b2	CSEL0	TRD0 count operation select bit	1: Count continues after the compare match with the TRDGRA0 register	R/W

(7) Set to A/D trigger disabled.

Timer RD Trigger Control Register (TRDADCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	x	x	0	0	0	0

Bit	Symbol	Bit Name	Function	R/W
b0	ADTRGA0E	A/D trigger A0 enable bit	0: A/D trigger disabled	R/W
b1	ADTRGB0E	A/D trigger B0 enable bit	0: A/D trigger disabled	R/W
b2	ADTRGC0E	A/D trigger C0 enable bit	0: A/D trigger disabled	R/W
b3	ADTRGD0E	A/D trigger D0 enable bit	0: A/D trigger disabled	R/W

(8) Set the timer RD mode register.

Timer RD Mode Register (TRDMR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	0	0	—	—	—	0

Bit	Symbol	Bit Name	Function	R/W
b0	SYNC	Timer RD synchronous bit	Registers TRD0 and TRD1 operate independently	R/W
b4	BFC0	TRDGRC0 register function select bit	0: General register	R/W
b5	BFD0	TRDGRD0 register function select bit	0: General register	R/W

(9) Set the timer RD PWM mode register.

Timer RD PWM Mode Register (TRDPMR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	x	x	x	—	1	1	1

Bit	Symbol	Bit Name	Function	R/W
b0	PWMB0	PWM mode of TRDIOB0 select bit		R/W
b1	PWMC0	PWM mode of TRDIOC0 select bit	1: PWM mode	R/W
b2	PWMD0	PWM mode of TRDIOD0 select bit		R/W

(10) Set the timer RD function control register.

Timer RD Function Control Register (TRDFCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	1	0	x	x	x	x	0	0

Bit	Symbol	Bit Name	Function	R/W
b0	CMD0	Combination mode select bit	Set to 00b (timer mode, PWM mode, or PWM3 mode) in PWM mode.	R/W
b1	CMD1			R/W
b6	STCLK	External clock input select bit	0: External clock input disabled	R/W
b7	PWM3	PWM3 mode select bit	Set this bit to 1 (other than PWM3 mode) in PWM mode.	R/W

(11) Set timer RD PWM mode output level control register 0.

Timer RD PWM Mode Output Level Control Register 0 (TRDPOCR0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	—	1	1	1

Bit	Symbol	Bit Name	Function	R/W
b0	POLB	PWM mode output level control bit B	1: "H" active TRDIOB0 output level is selected	R/W
b1	POLC	PWM mode output level control bit C	1: "H" active TRDIOC0 output level is selected	R/W
b2	POLD	PWM mode output level control bit D	1: "H" active TRDIOD0 output level is selected	R/W

(12) Set the timer RD output control register.

Timer RD Output Control Register (TRDOCR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	x	0	0	0	0	0

Bit	Symbol	Bit Name	Function	R/W
b0	TOA0	TRDIOA0 output level select bit	Set this bit to 0 in PWM mode.	R/W
b1	TOB0	TRDIOB0 output level select bit		R/W
b2	TOC0	TRDIOC0 initial output level select bit	0: Initial output is inactive level	R/W
b3	TOD0	TRDIOD0 initial output level select bit		R/W
b4	TOA1	TRDIOA1 initial output level select bit	Set this bit to 0 in PWM mode.	R/W

(13) Set timer RD control register 0.

Timer RD Control Register 0 (TRDCR0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	0	0	1	x	x	0	0	0

Bit	Symbol	Bit Name	Function	R/W
b0	TCK0			R/W
b1	TCK1	Count source select bit	b2 b1 b0 0 0 0: f1	R/W
b2	TCK2			R/W
b5	CCLR0		Set to 001b (the TRD0 register cleared at	R/W
b6	CCLR1	TRD0 counter clear select bit	compare match with TRDGRA0 register) in PWM	R/W
b7	CCLR2		mode.	R/W

(14) Initialize timer RD counter 0 to 0000h.

Timer RD Counter 0 (TRD0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	0	0	0	0	0	0	0	0

Bit	b15	b14	b13	b12	b11	b10	b9	b8
Setting Value	0	0	0	0	0	0	0	0

Bit	Function	Setting Range	R/W
b15-b0	Count a count source. Count operation is incremented. When an overflow occurs, the OVF bit in the TRDSR0 register is set to 1.	0000h to FFFFh	R/W

(15) Set compare value 2000 - 1 (7CFh) with timer RD counter 0 to timer RD general register A0.

Timer RD General Register A0 (TRDGRA0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	1	1	0	0	1	1	1	1

Bit	b15	b14	b13	b12	b11	b10	b9	b8
Setting Value	0	0	0	0	0	1	1	1

Bit	Function	R/W
b15-b0	General register. Set the PWM period.	R/W

(16) Set compare value 500 - 1 (1F3h) with timer RD counter 0 to timer RD general register B0.

Timer RD General Register B0 (TRDGRB0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	1	1	1	1	0	0	1	1

Bit	b15	b14	b13	b12	b11	b10	b9	b8
Setting Value	0	0	0	0	0	0	0	1

Bit	Function	R/W
b15-b0	General register. Set the PWM output change point.	R/W

(17) Set compare value 1000 - 1 (3E7h) with timer RD counter 0 to timer RD general register C0.

Timer RD General Register C0 (TRDGRC0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	1	1	1	0	0	1	1	1

Bit	b15	b14	b13	b12	b11	b10	b9	b8
Setting Value	0	0	0	0	0	0	1	1

Bit	Function	R/W
b15-b0	General register. Set the PWM output change point.	R/W

(18) Set compare value 1500 - 1 (5DBh) with the timer RD counter 0 to timer RD general register D0.

Timer RD General Register D0 (TRDGRD0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	1	1	0	1	1	0	1	1

Bit	b15	b14	b13	b12	b11	b10	b9	b8
Setting Value	0	0	0	0	0	1	0	1

Bit	Function	R/W
b15-b0	General register. Set the PWM output change point.	R/W

(19) Set timer RD output master enable register 1.

Timer RD Output Master Enable Register 1 (TRDOER1)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	x	x	x	x	0	0	0	1

Bit	Symbol	Bit Name	Function	R/W
b0	EA0	TRDIOA0 output disable bit	Set this bit to 1 (the TRDIOA0 pin is used as a programmable I/O port) in PWM mode.	R/W
b1	EB0	TRDIOB0 output disable bit	0: Enable output	R/W
b2	EC0	TRDIOC0 output disable bit	0: Enable output	R/W
b3	ED0	TRDIOD0 output disable bit	0: Enable output	R/W

(20) Set to pulse output forced cutoff input disabled.

Timer RD Output Master Enable Register 2 (TRDOER2)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	0	—	—	—	—	—	—	—

Bit	Symbol	Bit Name	Function	R/W
b7	PTO	$\overline{\text{INT0}}$ of pulse output forced cutoff signal input enabled bit	0: Pulse output forced cutoff input disabled	R/W

(21) Initialize input capture/compare match flag A.

Timer RD Status Register 0 (TRDSR0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	x	x	x	x	0

Bit	Symbol	Bit Name	Function	R/W
b0	IMFA	Input capture/compare match flag A	[Source for setting this bit to 0] Write 0 after read.	R/W

(22) Set the IMFA bit to enable the IMIA interrupt.

Timer RD Interrupt Enable Register 0 (TRDIER0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x	x	x	1

Bit	Symbol	Bit Name	Function	R/W
b0	IMIEA	Input capture/compare match interrupt enable bit A	1: Enable interrupt (IMIA) by the IMFA bit	R/W

(23) Start the timer RD0 count.

Timer RD Start Register (TRDSTR)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—	x		x	1

Bit	Symbol	Bit Name	Function	R/W
b0	TSTART0	TRD0 count start flag	1: Count starts	R/W

(24) Enable the timer RD0 interrupt (level 1).

Interrupt Control Register (TRD0IC)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	—		0	0	1

Bit	Symbol	Bit Name	Function	R/W
b0	ILVL0			R/W
b1	ILVL1	Interrupt priority level select bit	b2 b1 b0 0 0 1: Level 1	R/W
b2	ILVL2			R/W
b3	IR	Interrupt request bit	0: No interrupt requested 1: Interrupt requested	R

4.5 Timer RD Interrupt Handling

• Flowchart

```
        _timer_rd0_int

(1)    trdsr0 ← trdsr0 & 0x1e        Clear input capture/compare match flag A.

           return
```
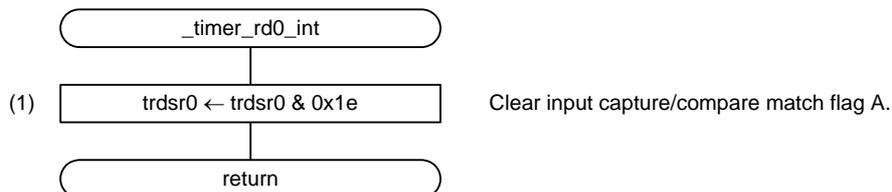
• Register setting

(1) Initialize input capture/compare match flag A.

Timer RD Status Register 0 (TRDSR0)

Bit	b7	b6	b5	b4	b3	b2	b1	b0
Setting Value	—	—	—	x	x	x	x	0

Bit	Symbol	Bit Name	Function	R/W
b0	IMFA	Input capture/compare match flag A	[Source for setting this bit to 0] Write 0 after read.	R/W

5.   Sample Program

A sample program can be downloaded from the Renesas Electronics website.
To download, click "Application Notes" in the left-hand side menu of the R8C Family page.

6.   Reference Documents

R8C/38C Group User's Manual: Hardware   Rev.1.00
The latest version can be downloaded from the Renesas Electronics website.

Technical Update/Technical News
The latest information can be downloaded from the Renesas Electronics website.

Website and Support

Renesas Electronics website
http://www.renesas.com/

Inquiries
http://www.renesas.com/inquiry

Revision History		R8C/38C Group Timer RD (PWM Mode)	

Rev.	Date	Description	
		Page	Summary
1.00	Aug. 31, 2010	—	First edition issued

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General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.

   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.

   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to one with a different part number, confirm that the change will not lead to problems.

   — The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

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Renesas Electronics Corporation

http://www.renesas.com

SALES OFFICES

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
7F, No. 363 Fu Shing North Road Taipei, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141