Renesas Electronics America Inc - DF71251AD50FPV Datasheet

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	SH-2
Core Size	32-Bit Single-Core
Speed	50MHz
Connectivity	SCI
Peripherals	POR, PWM, WDT
Number of I/O	37
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	4V ~ 5.5V
Data Converters	A/D 8x10b
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LFQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/df71251ad50fpv

The clock pulse generator blocks function as follows:

PLL Circuit: The PLL circuit multiples the clock frequency input from the crystal oscillator or the EXTAL pin by 8. The multiplication ratio is fixed at ×8.

Crystal Oscillator: The crystal oscillator is an oscillator circuit when a crystal resonator is connected to the XTAL and EXTAL pins.

Divider: The divider generates clocks with the frequencies to be used by the internal clock (Iϕ), bus clock (Bϕ), peripheral clock (Pϕ), and MTU2 clock (MPϕ).

The frequencies can be selected from 1/2, 1/4 (initial value), and 1/8 times the frequency output from the PLL circuit. The division ratio should be specified in the frequency control register (FRQCR).

Oscillation Stop Detection Circuit: This circuit detects an abnormal condition in the crystal oscillator.

Clock Frequency Control Circuit: The clock frequency control circuit controls the clock frequency according to the setting in the frequency control register (FRQCR).

Standby Control Circuit: The standby control circuit controls the state of the on-chip oscillator circuit and other modules in sleep or standby mode.

Frequency Control Register (FRQCR): The frequency control register (FRQCR) has control bits for the frequency division ratios of the internal clock (Iϕ), bus clock (Bϕ), peripheral clock (Pϕ), and MTU2 clock (MPϕ).

Oscillation Stop Detection Control Register (OSCCR): The oscillation stop detection control register (OSCCR) has an oscillation stop detection flag and a bit for selecting flag status output through an external pin.

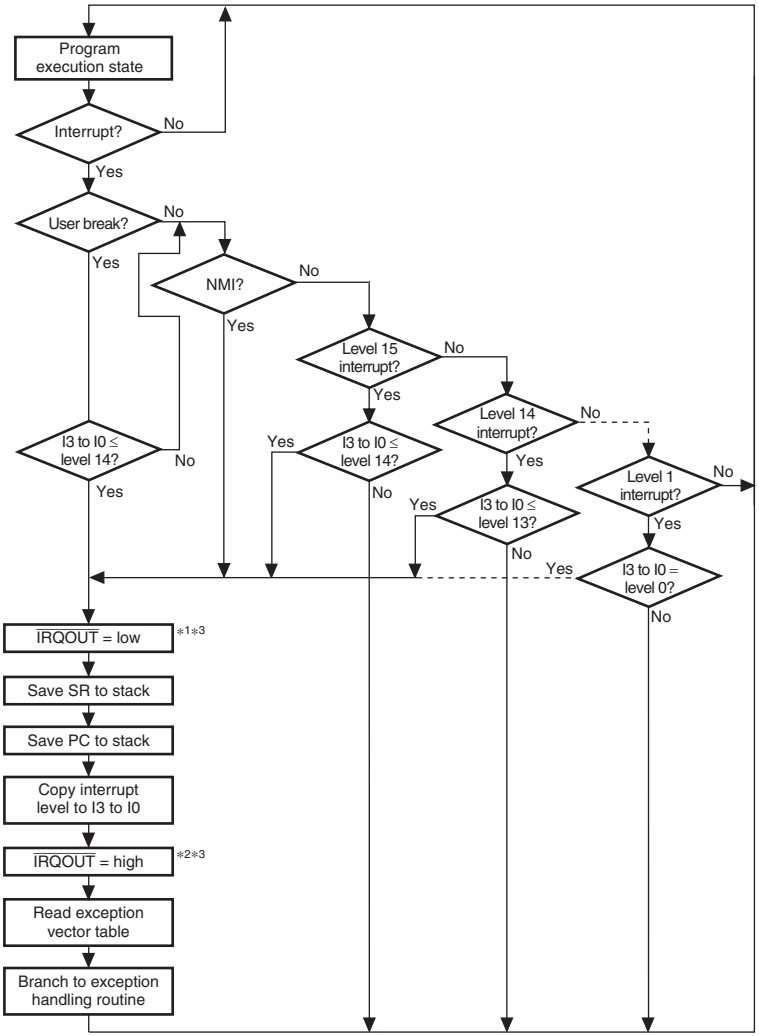
Standby Control Registers 1 to 6 (STBCR1 to STBCR6): The standby control register (STBCR) has bits for controlling the power-down modes. For details, see section 19, Power-Down Modes.

6.5 Interrupt Exception Handling Vector Table

Table 6.3 lists interrupt sources, their vector numbers, vector table address offsets, and interrupt priorities.

Individual interrupt sources are allocated to different vector numbers and vector table address offsets. Vector table addresses are calculated from the vector numbers and vector table address offsets. For interrupt exception handling, the start address of the exception handling routine is fetched from the vector table address in the vector table. For the details on calculation of vector table addresses, see table 5.4 in section 5, Exception Handling.

IRQ interrupts and on-chip peripheral module interrupt priorities can be set freely between 0 and 15 for each pin or module by setting interrupt priority registers A to F and H to M (IPRA to IPRF and IPRH to IPRM). However, when interrupt sources whose priority levels are allocated with the same IPR are requested, the interrupt of the smaller vector number has priority. This priority cannot be changed. Priority levels of IRQ interrupts and on-chip peripheral module interrupts are initialized to level 0 at a power-on reset. If the same priority level is allocated to two or more interrupt sources and interrupts from those sources occur simultaneously, they are processed by the default priority order shown in table 6.3.



Notes: I3 to I0 are interrupt mask bits in the status register (SR) of the CPU

1. $\overline{\text{IRQOUT}}$ is the same signal as the interrupt request signal to the CPU (see figure 6.1). Therefore, $\overline{\text{IRQOUT}}$ is output when the request priority level is higher than the level in bits I3–I0 of SR.
2. When the accepted interrupt is sensed by edge, a high level is output from the $\overline{\text{IRQOUT}}$ pin at the moment when the CPU starts interrupt exception processing instead of instruction execution (namely, before saving SR to stack). However, if the interrupt controller accepts an interrupt with a higher priority than the interrupt just to be accepted and has output an interrupt request to the CPU, the $\overline{\text{IRQOUT}}$ pin holds low level.
3. The $\overline{\text{IRQOUT}}$ pin change timing depends on a frequency dividing ratio between the internal ($I\phi$) and bus ($B\phi$) clocks. This flowchart shows that the frequency dividing ratios of the internal ($I\phi$) and bus ($B\phi$) clocks are the same.

Figure 6.3 Interrupt Sequence Flowchart

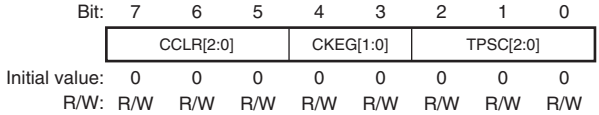
Bit	Bit Name	Initial Value	R/W	Description
18	—	0	R	Reserved This bit is always read as 0. The write value should always be 0.
17	UBIDA	0	R/W	User Break Disable A Enables or disables the user break interrupt request when the channel A break conditions are satisfied. 0: User break interrupt request is enabled when break conditions are satisfied 1: User break interrupt request is disabled when break conditions are satisfied
16	—	0	R	Reserved This bit is always read as 0. The write value should always be 0.
15	SCMFCA	0	R/W	L Bus Cycle Condition Match Flag A When the L bus cycle condition in the break conditions set for channel A is satisfied, this flag is set to 1. In order to clear this flag, write 0 into this bit. 0: The L bus cycle condition for channel A does not match 1: The L bus cycle condition for channel A matches
14	SCMFCB	0	R/W	L Bus Cycle Condition Match Flag B When the L bus cycle condition in the break conditions set for channel B is satisfied, this flag is set to 1. In order to clear this flag, write 0 into this bit. 0: The L bus cycle condition for channel B does not match 1: The L bus cycle condition for channel B matches
13	SCMFDA	0	R/W	I Bus Cycle Condition Match Flag A When the I bus cycle condition in the break conditions set for channel A is satisfied, this flag is set to 1. In order to clear this flag, write 0 into this bit. 0: The I bus cycle condition for channel A does not match 1: The I bus cycle condition for channel A matches

Table 9.1 MTU2 Functions

Item		Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
Count clock		MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64 TCLKA TCLKB TCLKC TCLKD	MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64 MPϕ/256 TCLKA TCLKB	MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64 MPϕ/1024 TCLKA TCLKB TCLKC	MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64 MPϕ/256 MPϕ/1024 TCLKA TCLKB	MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64 MPϕ/256 MPϕ/1024 TCLKA TCLKB	MPϕ/1 MPϕ/4 MPϕ/16 MPϕ/64
General registers		TGRA_0 TGRB_0 TGRE_0	TGRA_1 TGRB_1	TGRA_2 TGRB_2	TGRA_3 TGRB_3	TGRA_4 TGRB_4	TGRU_5 TGRV_5 TGRW_5
General registers/ buffer registers		TGRC_0 TGRD_0 TGRF_0	—	—	TGRC_3 TGRD_3	TGRC_4 TGRD_4	—
I/O pins		TIOC0A TIOC0B TIOC0C TIOC0D	TIOC1A*[1] TIOC1B*[1]	TIOC2A*[1] TIOC2B*[1]	TIOC3A TIOC3B TIOC3C TIOC3D	TIOC4A TIOC4B TIOC4C TIOC4D	Input pins TIC5U TIC5V TIC5W
Counter clear function		TGR compare match or input capture	TGR compare match or input capture	TGR compare match or input capture	TGR compare match or input capture	TGR compare match or input capture	TGR compare match or input capture
Compare match output	0 output	√	√	√	√	√	—
	1 output	√	√	√	√	√	—
	Toggle output	√	√	√	√	√	—
Input capture function		√	√	√	√	√	√
Synchronous operation		√	√	√	√	√	—
PWM mode 1		√	√	√	√	√	—
PWM mode 2		√	√	√	—	—	—
Complementary PWM mode		—	—	—	√	√	—
Reset PWM mode		—	—	—	√	√	—
AC synchronous motor drive mode		√	—	—	√	√	—

9.3.1 Timer Control Register (TCR)

The TCR registers are 8-bit readable/writable registers that control the TCNT operation for each channel. The MTU2 has a total of eight TCR registers, one each for channels 0 to 4 and three (TCRU_5, TCRV_5, and TCRW_5) for channel 5. TCR register settings should be conducted only when TCNT operation is stopped.



Bit	Bit Name	Initial Value	R/W	Description
7 to 5	CCLR[2:0]	000	R/W	Counter Clear 0 to 2 These bits select the TCNT counter clearing source. See tables 9.4 and 9.5 for details.
4, 3	CKEG[1:0]	00	R/W	Clock Edge 0 and 1 These bits select the input clock edge. When the input clock is counted using both edges, the input clock period is halved (e.g. MPϕ/4 both edges = MPϕ/2 rising edge). If phase counting mode is used on channels 1 and 2, this setting is ignored and the phase counting mode setting has priority. Internal clock edge selection is valid when the input clock is MPϕ/4 or slower. When MPϕ/1, or the overflow/underflow of another channel is selected for the input clock, although values can be written, counter operation compiles with the initial value. 00: Count at rising edge 01: Count at falling edge 1x: Count at both edges
2 to 0	TPSC[2:0]	000	R/W	Time Prescaler 0 to 2 These bits select the TCNT counter clock. The clock source can be selected independently for each channel. See tables 9.6 to 9.10 for details.

[Legend]
x: Don't care

Table 9.10 TPSC1 and TPSC0 (Channel 5)

Channel	Bit 1 TPSC1	Bit 0 TPSC0	Description
5	0	0	Internal clock: counts on MPϕ/1
		1	Internal clock: counts on MPϕ/4
	1	0	Internal clock: counts on MPϕ/16
		1	Internal clock: counts on MPϕ/64

Note: Bits 7 to 2 are reserved in channel 5. These bits are always read as 0. The write value should always be 0.

9.3.2 Timer Mode Register (TMDR)

The TMDR registers are 8-bit readable/writable registers that are used to set the operating mode of each channel. The MTU2 has five TMDR registers, one each for channels 0 to 4. TMDR register settings should be changed only when TCNT operation is stopped.

Bit:	7	6	5	4	3	2	1	0
	-	BFE	BFB	BFA	MD[3:0]			
Initial value:	0	0	0	0	0	0	0	0
R/W:	-	R/W	R/W	R/W	R/W	R/W	R/W	R/W

Bit	Bit Name	Initial Value	R/W	Description
7	—	0	—	Reserved This bit is always read as 0. The write value should always be 0.
6	BFE	0	R/W	Buffer Operation E Specifies whether TGRE_0 and TGRF_0 are to operate in the normal way or to be used together for buffer operation. When TGRF is used as a buffer register, TGRF compare match is generated. In channels 1 to 4, this bit is reserved. It is always read as 0 and the write value should always be 0. 0: TGRE_0 and TGRF_0 operate normally 1: TGRE_0 and TGRF_0 used together for buffer operation

Bit	Bit Name	Initial Value	R/W	Description
2	I2AE	0	R/W	Input Capture Enable Specifies whether to include the TIOC2A pin in the TGRA_1 input capture conditions. 0: Does not include the TIOC2A pin in the TGRA_1 input capture conditions 1: Includes the TIOC2A pin in the TGRA_1 input capture conditions
1	I1BE	0	R/W	Input Capture Enable Specifies whether to include the TIOC1B pin in the TGRB_2 input capture conditions. 0: Does not include the TIOC1B pin in the TGRB_2 input capture conditions 1: Includes the TIOC1B pin in the TGRB_2 input capture conditions
0	I1AE	0	R/W	Input Capture Enable Specifies whether to include the TIOC1A pin in the TGRA_2 input capture conditions. 0: Does not include the TIOC1A pin in the TGRA_2 input capture conditions 1: Includes the TIOC1A pin in the TGRA_2 input capture conditions

Note: This function is supported only by the SH7125. In the SH7124, write value should always be H'00.

Table 9.45 shows the TICCR setting and input capture input pins.

Table 9.45 TICCR Setting and Input Capture Input Pins

Target Input Capture	TICCR Setting	Input Capture Input Pins
Input capture from TCNT_1 to TGRA_1	I2AE bit = 0 (initial value)	TIOC1A
	I2AE bit = 1	TIOC1A, TIOC2A
Input capture from TCNT_1 to TGRB_1	I2BE bit = 0 (initial value)	TIOC1B
	I2BE bit = 1	TIOC1B, TIOC2B
Input capture from TCNT_2 to TGRA_2	I1AE bit = 0 (initial value)	TIOC2A
	I1AE bit = 1	TIOC2A, TIOC1A
Input capture from TCNT_2 to TGRB_2	I1BE bit = 0 (initial value)	TIOC2B
	I1BE bit = 1	TIOC2B, TIOC1B

Example of Cascaded Operation Setting Procedure: Figure 9.20 shows an example of the setting procedure for cascaded operation.

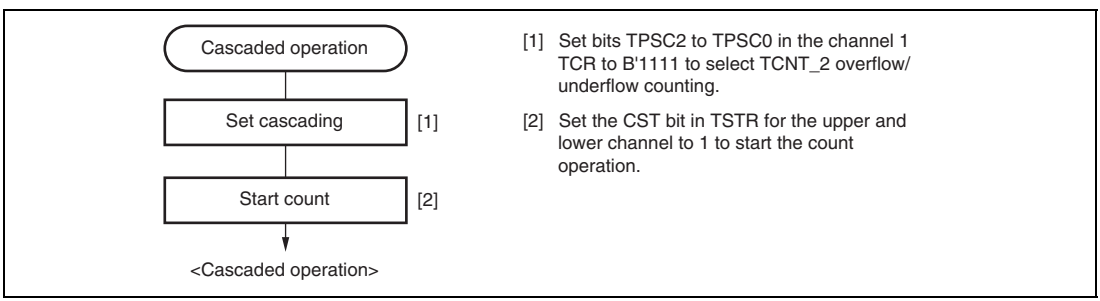


Figure 9.20 Cascaded Operation Setting Procedure

Cascaded Operation Example (a): Figure 9.21 illustrates the operation when TCNT_2 overflow/underflow counting has been set for TCNT_1 and phase counting mode has been designated for channel 2.

TCNT_1 is incremented by TCNT_2 overflow and decremented by TCNT_2 underflow.

Phase Counting Mode Application Example: Figure 9.34 shows an example in which channel 1 is in phase counting mode, and channel 1 is coupled with channel 0 to input servo motor 2-phase encoder pulses in order to detect position or speed.

Channel 1 is set to phase counting mode 1, and the encoder pulse A-phase and B-phase are input to TCLKA and TCLKB.

Channel 0 operates with TCNT counter clearing by TGRC_0 compare match; TGRA_0 and TGRC_0 are used for the compare match function and are set with the speed control period and position control period. TGRB_0 is used for input capture, with TGRB_0 and TGRD_0 operating in buffer mode. The channel 1 counter input clock is designated as the TGRB_0 input capture source, and the pulse widths of 2-phase encoder 4-multiplication pulses are detected.

TGRA_1 and TGRB_1 for channel 1 are designated for input capture, and channel 0 TGRA_0 and TGRC_0 compare matches are selected as the input capture source and store the up/down-counter values for the control periods.

This procedure enables the accurate detection of position and speed.

9.6 Operation Timing

9.6.1 Input/Output Timing

TCNT Count Timing: Figures 9.83 and 9.84 show TCNT count timing in internal clock operation, and figure 9.85 shows TCNT count timing in external clock operation (normal mode), and figure 9.86 shows TCNT count timing in external clock operation (phase counting mode).

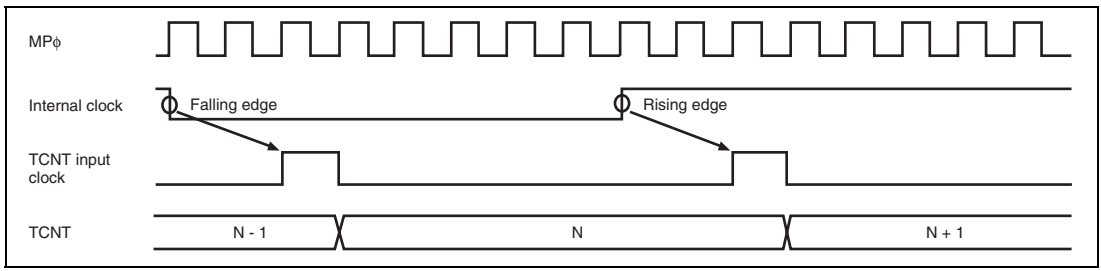


Figure 9.83 Count Timing in Internal Clock Operation (Channels 0 to 4)

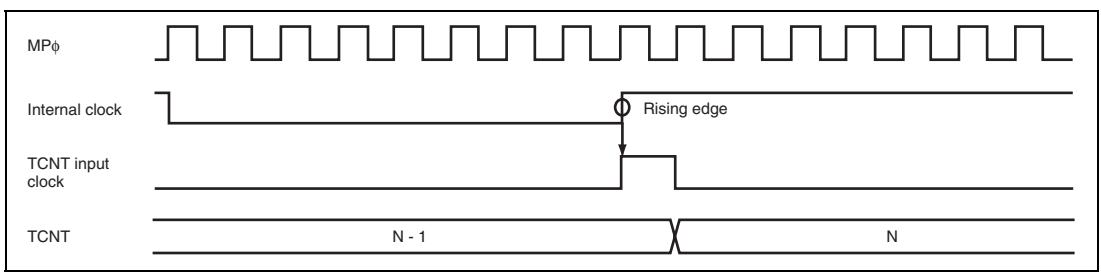


Figure 9.84 Count Timing in Internal Clock Operation (Channel 5)

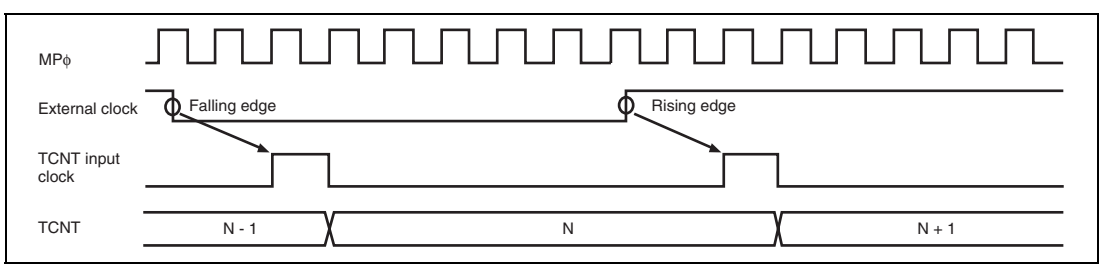


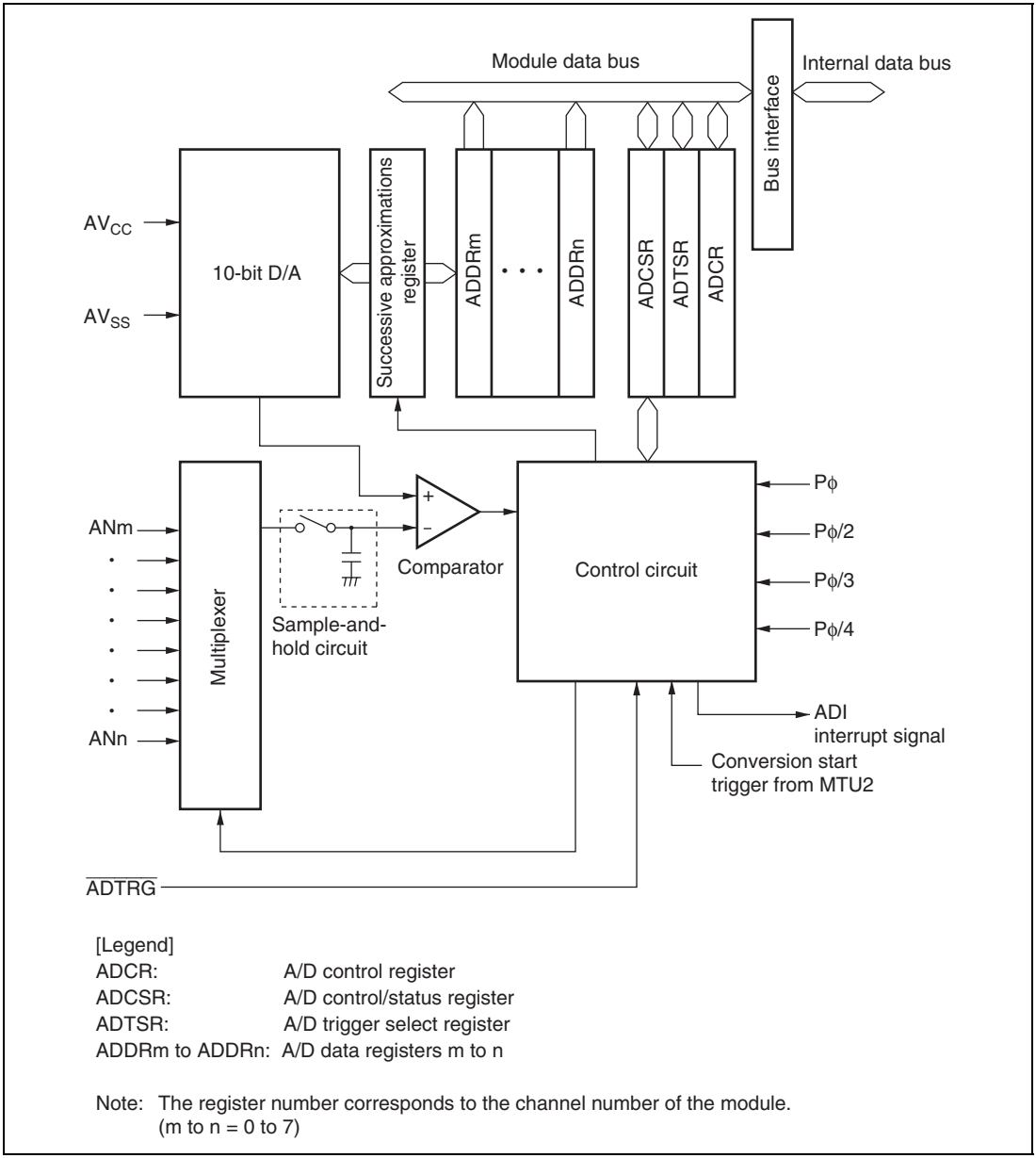
Figure 9.85 Count Timing in External Clock Operation (Channels 0 to 4)

Bit	Bit Name	Initial value	R/W	Description
13	POE1F	0	R/(W)*[1]	POE1 Flag This flag indicates that a high impedance request has been input to the $\overline{\text{POE1}}$ pin. [Clearing conditions] • By writing 0 to POE1F after reading POE1F = 1 (when the falling edge is selected by bits 3 and 2 in ICSR1) • By writing 0 to POE1F after reading POE1F = 1 after a high level input to POE1 is sampled at Pϕ/8, Pϕ/16, or Pϕ/128 clock (when low-level sampling is selected by bits 3 and 2 in ICSR1) [Setting condition] • When the input set by ICSR1 bits 3 and 2 occurs at the $\overline{\text{POE1}}$ pin
12	POE0F	0	R/(W)*[1]	POE0 Flag This flag indicates that a high impedance request has been input to the $\overline{\text{POE0}}$ pin. [Clearing conditions] • By writing 0 to POE0F after reading POE0F = 1 (when the falling edge is selected by bits 1 and 0 in ICSR1) • By writing 0 to POE0F after reading POE0F = 1 after a high level input to POE0 is sampled at Pϕ/8, Pϕ/16, or Pϕ/128 clock (when low-level sampling is selected by bits 1 and 0 in ICSR1) [Setting condition] • When the input set by ICSR1 bits 1 and 0 occurs at the $\overline{\text{POE0}}$ pin
11 to 9	—	All 0	R	Reserved These bits are always read as 0. The write value should always be 0.

Table 12.7 Bit Rates and SCBRR Settings in Clock Synchronous Mode (1)

Bit Rate (bits/s)	Pϕ (MHz)											
	10		12		14		16		18		20	
	n	N	n	N	n	N	n	N	n	N	n	N
250	3	155	3	187	3	218	3	249				
500	3	77	3	93	3	108	3	124	3	140	3	155
1000	2	155	2	187	2	218	2	249	3	69	3	77
2500	1	249	2	74	2	87	2	99	2	112	2	124
5000	1	124	1	149	1	174	1	199	1	224	1	249
10000	0	249	1	74	1	87	1	99	1	112	1	124
25000	0	99	0	119	0	139	0	159	0	179	0	199
50000	0	49	0	59	0	69	0	79	0	89	0	99
100000	0	24	0	29	0	34	0	39	0	44	0	49
250000	0	9	0	11	0	13	0	15	0	17	0	19
500000	0	4	0	5	0	6	0	7	0	8	0	9
1000000	—	—	0	2	—	—	0	3	—	—	0	4
2500000	0	0*	—	—	—	—	—	—	—	—	0	1
5000000			—	—	—	—	—	—	—	—	0	0*

Figure 13.1 shows a block diagram of the A/D converter.



[Legend]
ADCR: A/D control register
ADCSR: A/D control/status register
ADTSR: A/D trigger select register
ADDRm to ADDRn: A/D data registers m to n

Note: The register number corresponds to the channel number of the module.
(m to n = 0 to 7)

Figure 13.1 Block Diagram of A/D Converter (for One Module)

14.5.3 Conflict between Word-Write and Count-Up Processes of CMCNT

Even when the count-up occurs in the T2 cycle while writing to CMCNT in words, the writing has priority over the count-up. In this case, the count-up is not performed. Figure 14.6 shows the timing to write to CMCNT in words.

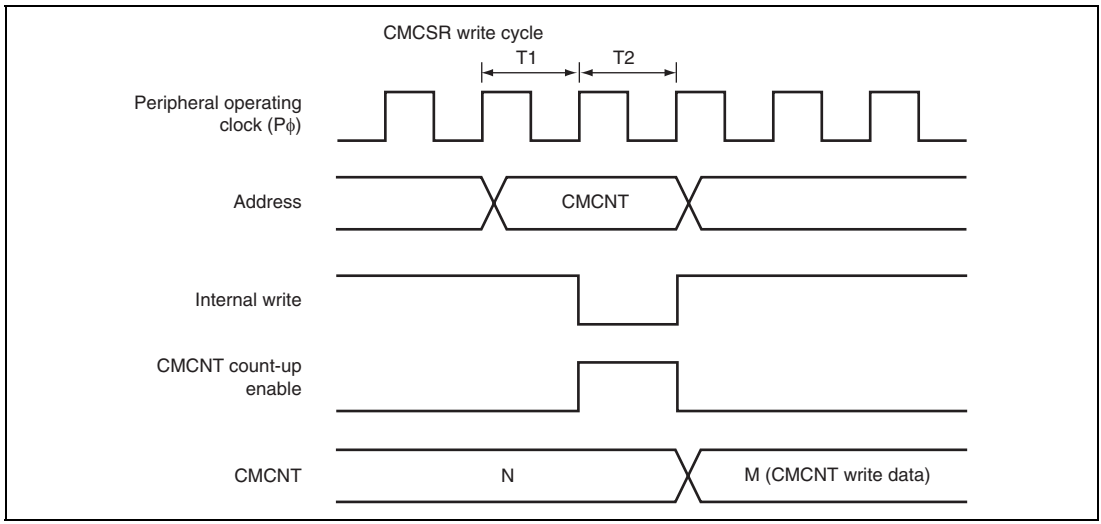


Figure 14.6 Conflict between Word-Write and Count-Up Processes of CMCNT

15.1.1 Port A I/O Register L (PAIORL)

PAIORL is a 16-bit readable/writable register that is used to set the pins on port A as inputs or outputs. Bits PA15IOR to PA0IOR correspond to pins PA15 to PA0 (names of multiplexed pins are here given as port names and pin numbers alone). PAIORL is enabled when the port A pins are functioning as general-purpose inputs/outputs (PA15 to PA0). In other states, PAIORL is disabled.

A given pin on port A will be an output pin if the corresponding bit in PAIORL is set to 1, and an input pin if the bit is cleared to 0.

However, bits 15 to 10, 5, and 2 of PAIORL are disabled in SH7124.

The initial value of PAIORL is H'0000.

Bit:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	PA15 IOR	PA14 IOR	PA13 IOR	PA12 IOR	PA11 IOR	PA10 IOR	PA9 IOR	PA8 IOR	PA7 IOR	PA6 IOR	PA5 IOR	PA4 IOR	PA3 IOR	PA2 IOR	PA1 IOR	PA0 IOR
Initial value:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R/W:	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W

15.1.2 Port A Control Registers L1 to L4 (PACRL1 to PACRL4)

PACRL1 to PACRL4 are 16-bit readable/writable registers that are used to select the functions of the multiplexed pins on port A.

SH7125:

- Port A Control Register L4 (PACRL4)

Bit:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	-	PA15 MD2	PA15 MD1	PA15 MD0	-	PA14 MD2	PA14 MD1	PA14 MD0	-	PA13 MD2	PA13 MD1	PA13 MD0	-	PA12 MD2	PA12 MD1	PA12 MD0
Initial value:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R/W:	R	R/W	R/W	R/W	R	R/W	R/W	R/W	R	R/W	R/W	R/W	R	R/W	R/W	R/W

Bit	Bit Name	Initial Value	R/W	Description
15	—	0	R	Reserved This bit is always read as 0. The write value should always be 0.

15.2 Usage Notes

1. In this LSI, the same function is available as a multiplexed function on multiple pins. This approach is intended to increase the number of selectable pin functions and to allow the easier design of boards. If two or more pins are specified for one function, however, there are two cautions shown below.
   — When the pin function is input

     Signals input to several pins are formed as one signal through OR or AND logic and the signal is transmitted into the LSI. Therefore, a signal that differs from the input signals may be transmitted to the LSI depending on the input signals in other pins that have the same functions. Table 15.6 shows the transmit forms of input functions allocated to several pins. When using one of the functions shown below in multiple pins, use it with care of signal polarity considering the transmit forms.

Table 15.6 Transmit Forms of Input Functions Allocated to Multiple Pins

OR Type	AND Type
SCK0 to SCK2, RXD0 to RXD2, $\overline{\text{POE0}}$, $\overline{\text{POE1}}$, $\overline{\text{POE3}}$*, $\overline{\text{POE8}}$	IRQ0* to IRQ3

Note: * This pin is supported only by the SH7125.

     OR type: Signals input to several pins are formed as one signal through OR logic and the signal is transmitted into the LSI.

     AND type: Signals input to several pins are formed as one signal through AND logic and the signal is transmitted into the LSI.

   — When the pin function is output

     Each selected pin can output the same function.
2. When the port input is switched from a low level to the IRQ edge for the pins that are multiplexed with input/output and IRQ, the corresponding edge is detected.
3. Do not set functions other than those specified in tables 15.3 and 15.4. Otherwise, correct operation cannot be guaranteed.

Table 17.4 (1) Register Configuration

Register Name	Abbreviation*3	R/W	Initial Value	Address	Access Size
Flash code control and status register	FCCS	R, W*1	H'00*2 H'80*2	H'FFFFCC00	8
Flash program code select register	FPCS	R/W	H'00	H'FFFFCC01	8
Flash erase code select register	FECS	R/W	H'00	H'FFFFCC02	8
Flash key code register	FKEY	R/W	H'00	H'FFFFCC04	8
Flash transfer destination address register	FTDAR	R/W	H'00	H'FFFFCC06	8

Notes: 1. The bits except the SCO bit are read-only bits. The SCO bit is a programming-only bit. (The value, which can be read is always 0.)
2. The initial value of the FWE bit is 0 when the FWE pin goes low. The initial value of the FWE bit is 1 when the FWE pin goes high.
3. All registers can be accessed only in bytes.

Table 17.4 (2) Parameter Configuration

Name	Abbreviation	R/W	Initial Value	Address	Access Size
Download pass/fail result	DPFR	R/W	Undefined	On-chip RAM*	8, 16, 32
Flash pass/fail result	FPFR	R/W	Undefined	R0 of CPU	8, 16, 32
Flash multipurpose address area	FMPAR	R/W	Undefined	R5 of CPU	8, 16, 32
Flash multipurpose data destination area	FMPDR	R/W	Undefined	R4 of CPU	8, 16, 32
Flash erase block select	FEBS	R/W	Undefined	R4 of CPU	8, 16, 32
Flash program and erase frequency control	FPEFEQ	R/W	Undefined	R4 of CPU	8, 16, 32
Flash user branch address set parameter	FUBRA	R/W	Undefined	R5 of CPU	8, 16, 32

Note: * One byte of the start address in the on-chip RAM area specified by FTDAR is valid.

21.2 DC Characteristics

Tables 21.2 and 21.3 list DC characteristics.

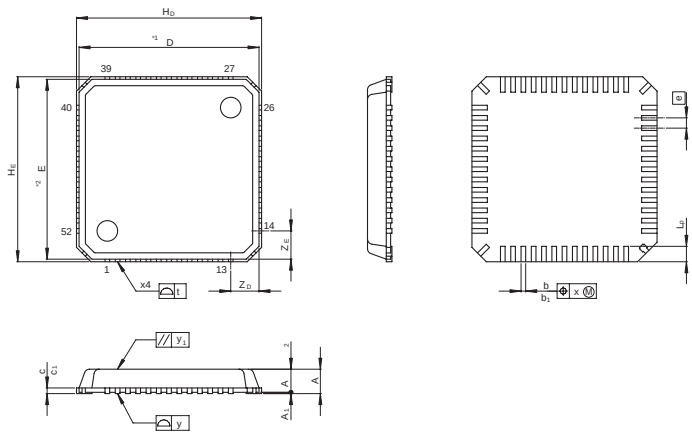
Table 21.2 DC Characteristics

Conditions: V_{CC} = AV_{CC} = 4.0 V to 5.5 V, V_{SS} = $PLLV_{SS}$ = AV_{SS} = 0 V,
T_a = –20 to +85°C (consumer specifications),
T_a = –40 to +85°C (industrial specifications)

Item		Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Input high-level voltage (other than Schmitt trigger input voltage)	$\overline{RES}$, $\overline{MRES}$, NMI, FWE, MD1, $\overline{ASEMD0}$, EXTAL	V_{IH}	V_{CC} – 0.7	—	V_{CC} + 0.3	V	
	Analog ports		2.2	—	AV_{CC} + 0.3	V	
	Other input pins		2.2	—	V_{CC} + 0.3	V	
Input low-level voltage (other than Schmitt trigger input voltage)	$\overline{RES}$, $\overline{MRES}$, NMI, FWE, MD1, $\overline{ASEMD0}$, EXTAL	V_{IL}	–0.3	—	0.5	V	
	Other input pins		–0.3	—	0.8	V	
Schmitt trigger input voltage	IRQ3 to IRQ0, $\overline{POE8}$, $\overline{POE3}$, $\overline{POE1}$, $\overline{POE0}$, TCLKA to TCLKD, TIOC0A to TIOC0D, TIOC1A, TIOC1B, TIOC2A, TIOC2B, TIOC3A to TIOC3D, TIOC4A to TIOC4D, TIC5U, TIC5V, TIC5WS, SCK0 to SCK3, RXD0 to RXD3	V_{T+}	V_{CC} – 0.5	—	—	V	
		V_{T-}	—	—	1.0	V	
		V_{T+}–V_{T-}	0.4	—	—	V	V_{CC} = 4.5 V to 5.5 V
Input leak current	All input pins (except $\overline{ASEMD0}$)	$\lvert I_{in} \rvert$	—	—	1.0	µA	
Input pull-up MOS current	$\overline{ASEMD0}$, $\overline{POE3}$	$-I_{pu}$	—	—	800	µA	V_{in} = 0 V
Tri-state leakage current (OFF state)	Ports A, B, E	$\lvert I_{tsi} \rvert$	—	—	1.0	µA	

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-VQFN52-7x7-0.40	PVQN0052LE-A	-	0.095g

NOTE)
1. DIMENSIONS"*1"AND"*2"
DO NOT INCLUDE MOLD FLASH.



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	7.0	—
E	—	7.0	—
A_2	—	0.89	—
A	—	—	0.95
A_1	0.005	0.02	0.04
b	0.13	0.18	0.23
b_1	—	0.16	—
e	—	0.4	—
L_p	0.50	0.60	0.70
x	—	—	0.05
y	—	—	0.05
y_1	—	—	0.20
t	—	—	0.20
H_D	—	7.2	—
H_E	—	7.2	—
Z_D	—	1.1	—
Z_E	—	1.1	—
c	0.17	0.22	0.25
c_1	—	0.20	—

Figure C.5 VQFN-52