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RENESAS

Preliminary Application Note

V850E/IF3, V850E/IG3

32-bit Single-Chip Microcontrollers

Sample Programs for Timer M

V850E/IF3:
- μPD70F3451
- μPD70F3452

V850E/IG3:
- μPD70F3453
- μPD70F3454

Document No. U18728EJ1V0AN00 (1st edition)
Date Published September 2007 N

[MEMO]

NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (MAX) and V_{IH} (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (MAX) and V_{IH} (MIN).

② HANDLING OF UNUSED INPUT PINS

Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD

A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION

Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

⑤ POWER ON/OFF SEQUENCE

In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current.

The correct power on/off sequence must be judged separately for each device and according to related specifications governing the device.

⑥ INPUT OF SIGNAL DURING POWER OFF STATE

Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements.

Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

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M5 02. 11-1

INTRODUCTION

Cautions 1. This Application Note explains a case where the V850E/IG3 is used as a representative microcontroller. Use this Application Note for your reference when using the V850E/IF3.

2. Download the program used in this manual from the page of Programming Examples (http://www.necel.com/micro/en/designsupports/sampleprogram/index.html) in the NEC Electronics Website (http://www.necel.com/).

3. The sample programs are provided for reference purposes only and operations are therefore not subject to guarantee by NEC Electronics Corporation. When using sample programs, customers are advised to sufficiently evaluate this product based on their systems, before use.

4. When using sample programs, reference the following startup routine and link directive file and adjust them if necessary.

- **Startup routine: ig3_start.s**
- **Link directive file: ig3_link.dir**

Target Readers

This Application Note is intended for users who understand the functions of the V850E/IF3 (μPD70F3451, 70F3452), and V850E/IG3 (μPD70F3453, 70F3454), and who design application systems that use these microcontrollers.

Purpose

This manual is intended to give users an understanding of the basic functions of the V850E/IF3 and V850E/IG3, using the application programs.

How to Use This Manual

It is assumed that the reader of this Application Note has general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

For details of hardware functions (especially register functions, setting methods, etc.) and electrical specifications

→ See the **V850E/IF3, V850E/IG3 Hardware User's Manual**.

For details of instruction functions

→ See the **V850E1 Architecture User's Manual**.

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Active low representation:	$\overline{xxx}$ (overscore over pin or signal name)
Memory map address:	Higher addresses on the top and lower addresses on the bottom
Note:	Footnote for item marked with **Note** in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeric representation:	Binary ... xxxx or xxxxB
	Decimal ... xxxx
	Hexadecimal ... xxxxH
Prefix indicating the power of 2 (address space, memory capacity):	K (kilo): $2^{10} = 1,024$
	M (mega): $2^{20} = 1,024^2$
	G (giga): $2^{30} = 1,024^3$

The function lists are structured as follows.

Theme

[Function]	Function description
[Function name]	Name of sample function
[Argument(s)]	Type and overview of argument(s)
[Processing content]	Processing content of sample function
[SFR(s) used]	Register name and setting content
[call function(s)]	Name and function of call function(s)
[Variable(s)]	Type, name, and overview of variable(s) used in sample function
[Interrupt(s)]	Name of function
[Interrupt source(s)]	Name
[File name]	Name of corresponding sample program file
[Caution(s)]	Caution(s) upon function usage

Interrupt function

[Function name]	Name of interrupt function
[Overview]	Servicing content
[Source(s)]	Name of interrupt and conditions for occurrence
[call function(s)]	None
[Variable(s)]	Name of variable, function
[File name]	Name of corresponding sample program file
[Caution(s)]	None

Related Documents

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents related to V850E/IF3 and V850E/IG3

Document Name	Document No.
V850E1 Architecture User's Manual	U14559E
V850E/IF3, V850E/IG3 Hardware User's Manual	U18279E
V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (UARTA) Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (UARTB) Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (CSIB) Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (I^2C) Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for DMA Function Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Timer M Application Note	This manual
V850E/IF3, V850E/IG3 Sample Programs for Watchdog Timer Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Timer AA Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Timer AB Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Timer T Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Port Function Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Clock Generator Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Standby Function Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Interrupt Function Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for A/D Converters 0 and 1 Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for A/D Converter 2 Application Note	To be prepared
V850E/IF3, V850E/IG3 Sample Programs for Low-Voltage Detector (LVI) Function Application Note	To be prepared
V850E/IF3, V850E/IG3 6-Phase PWM Output Control by Timer AB, Timer Q Option, Timer AA, A/D Converters 0 and 1 Application Note	U18717E

CONTENTS

[Function]	Starts 16-bit counter operation by setting the TM0CTL0.TM0CE bit to 1. Outputs an interrupt request signal (INTTM0EQ0) at an interval set by the TM0CMP0 register.
[Function name]	main
[Argument]	None
[Processing content]	Generates an interrupt upon the count subsequent to the count (1 ms) whose value matches the value of the TM0CMP0 register, and clears the 16-bit counter.
[SFR used]	None
[call function]	timerm_interval_ini, timerm_interval_st
[Variable]	None
[Interrupt]	timerm_interval_int
[Interrupt source]	INTTM0EQ0
[File name]	timerm_interval\MAIN.C
[Caution]	None

The set time can be calculated by the following formula (in clock through mode (8 MHz)).

Synchronous clock: 8 MHz = 1/8 $\rightarrow$ 0.125 μs
Count clock cycle (fxx/32): 0.125 μs $\times$ 32 $\rightarrow$ 4 μs
Compare register value when an interrupt occurs in 1 ms: 1000 μs/4 μs $\rightarrow$ 250 $-$ 1 = 249

The interval can be calculated by the following formula.

Interval = (Set value of TM0CMP0 register + 1) $\times$ Count clock cycle

[Function name]	timerm_interval_ini
[Argument]	None
[Processing content]	Sets operation of TMM0 and interrupts.
[SFRs used]	TM0CTL0.TM0CE: 0 (Disables TMM0 operation.) IMR5.TM0EQMK0: 0 (Enables INTTM0EQ0 interrupt.)
[call function]	timerm_interval
[Variable]	None
[File name]	timerm_interval\timerm_1.c
[Caution]	None

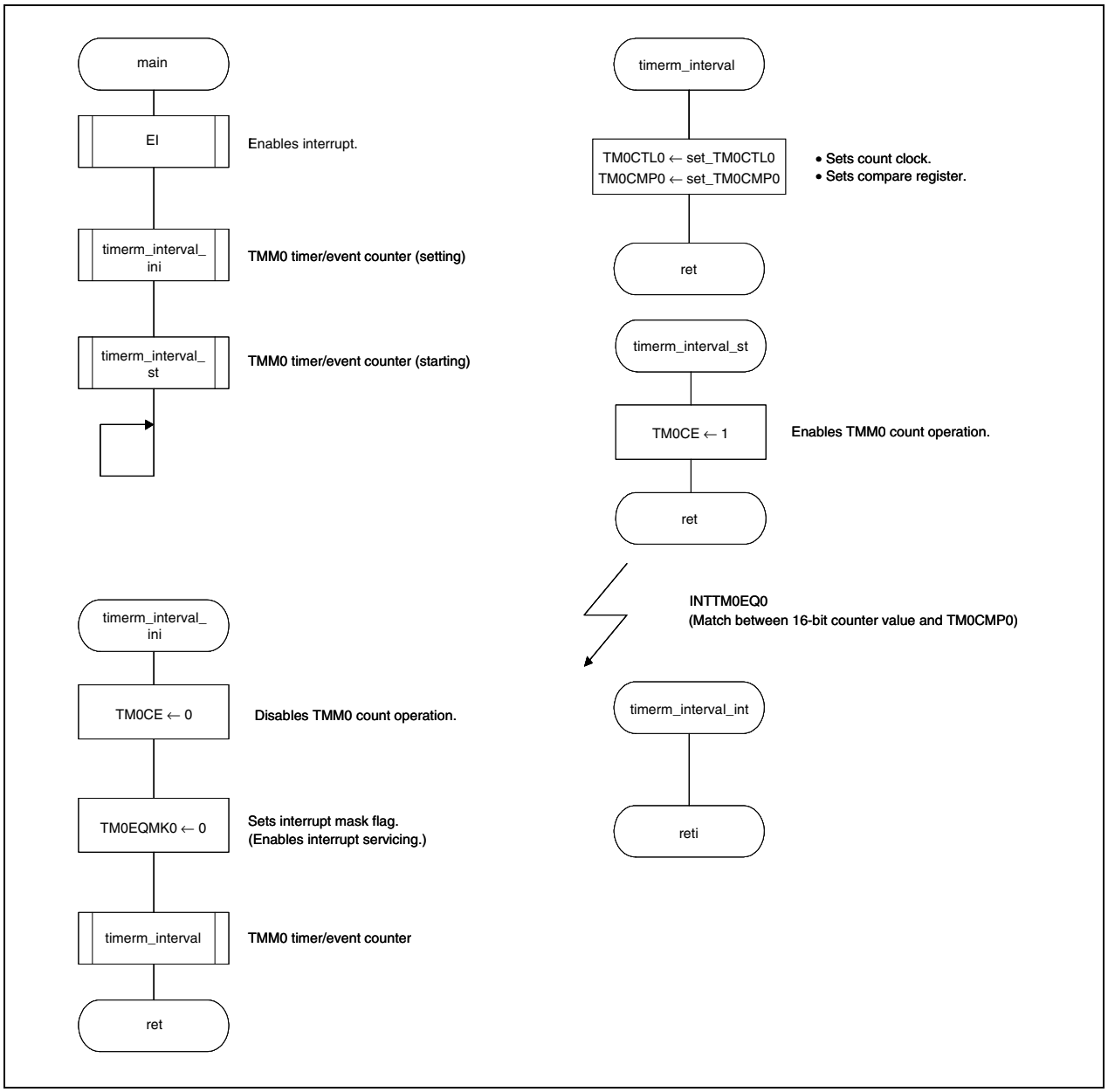
[Function name]	timerm_interval
[Arguments]	unsigned char set_TM0CTL0 Sets count clock. unsigned short set_TM0CMP0 Sets compare register.
[Processing content]	Sets TMM0 control register.
[SFRs used]	TM0CTL0: 0x04 (Sets count clock to fxx/64.) TM0CMP0: 249 (Compare register of 16-bit counter)
[call function]	None
[Variable]	None
[File name]	timerm_interval\timerm_1.c
[Cautions]	• Call this function when the 16-bit counter is stopped. • Operate in clock through mode (8 MHz). • Set the TM0CTL0 (count clock setting) register when TMM0 is stopped. • Be sure to set bits 3 to 6 of the TM0CTL0 register to 0. • Rewriting the TM0CMP0 (compare register) is prohibited during TMM0 operation.

[Function name]	timerm_interval_st
[Argument]	None
[Processing content]	Starting function of timerm_interval.
[Starting method]	Call this function after the timerm_interval function.
[SFR used]	TM0CTL0.TM0CE: 1 (Enables TMM0 operation.)
[call function]	None
[Variable]	None
[File name]	timerm_interval\timerm_1.c
[Caution]	None

Interrupt function

[Function name]	timerm_interval_int	
[Overview]	Defined by the user.	
[Source]	INTTM0EQ0	Match between the count value of the 16-bit counter and the TM0CMP0 register value
[call function]	None	
[Variable]	None	
[File name]	timerm_interval\timerm_1.c	
[Caution]	None	

Figure 1-1. Startup



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