To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

M16C/62P Group

Real Time Clock Function

1. Abstract

This application note describes the real-time clock programming with timer function.

2. Introduction

This application note is applied under the following condition:
Applicable MCU: M16C/62P Group

The program on this application note can also be used when operating other MCUs within the M16C Family, provided they have the same SFRs (Special Function Registers) as the M16C/62P Group. However, some functions may have been modified. Refer to each device's hardware manual for details. Use functions covered in this application note only after careful evaluation.

3. Operation Description

A) Set bits TMOD1 and TMOD0 in the TA0MR register to 00b (timer mode), bits TCK1 and TCK0 to 11b (fc32). Moreover, set the timer value to (400-1)h to generate a timer interrupt every one second.
Xcin = 32.768 kHz
B) Set the TA0S bit in the TABSR register to 1 (starts counting) so that timer A0 decrements a counter value.
C) The IR bit in the TA0IC register is set to 1 (interrupt requested) when the timer A0 counter underflows.
D) While one second is incremented every time the IR bit is set to 1, data for date and time are stored into RAM in hexadecimal.
E) Counting starts from January 01, 0001, Sunday, 00:00:00 immediately after the timer starts counting.

4. Software Description

4.1 Function Description

Table 1 lists the functions used in the sample program.

Table 1 Function Description

Function Name	Label Name	Function
Main	main	Register setting, RAM initialization, interrupt enabled, and time setting process function call
Time Setting	time_set	Data setting for “second”, “minute”, “hour”, “date”, “a day of a week”, and “week”; date setting process function call
Date Setting	date_set	Data setting for “day”, “month”, and “year”; leap year checking process function call
Leap Year Check	leap_year_check	Leap year check

4.2 Register Description

Table 2 lists the registers used in the sample program.

Table 2. Register Description

Register Name		Address	Setting Value	Function
PRCR	Protect register	000Ah	01h 00h	Enables writing to registers CM0, CM1, CM2, PLC0, and PCLKR. PRC0 bit: 0 (write protected) PRC1 bit: 1 (write enabled) *The PRC2 bit is set to 0 by writing into a desired address after the PRC2 bit is set to 1. Bits PRC0, PRC1, and PRC3 are not automatically set to 0. Set them to 0 by program.
CM0	System clock control register0	0006h	18h 10h	-Main clock -Divide-by-1 (no division) mode -Main clock oscillation -Xcin-Xcout oscillation function -Xcin-Xcout drive High/Low -Peripheral function clock is not stopped -Clock output function: P5_7 * Refer to technical update (TN-16C-119A)
TABSR	Count start flag	0380h	00h 01h	-Timer A0 stops counting -Timer A0 starts counting
TA0MR	Timer A0 mode register	0396h	C0h	Count source of fc32 selected, gate function disabled, no pulse output, timer mode
TA0	Timer A0 register	0386h	03FFh	Set the timer to (400-1)h to generate a timer A0 interrupt request every one second
TA0IC	Timer A0 interrupt control register	0055h	00h	Interrupt level 0, interrupt request bit setting

4.3 RAM Description

Table 3 lists RAM memories and their specifications.

Table 3. RAM Memory

RAM Code	Specifications	Data Length	Functions
sec_cnt	"Second" data is stored in hexadecimal	1 byte	main, time_set
min_cnt	"Minute" data is stored in hexadecimal	1 byte	main, time_set
hour_cnt	"Hour" data is stored in hexadecimal	1 byte	main, time_set
day_cnt	"Date" data is stored in hexadecimal	1 byte	main, time_set, date_set, leap_year_check
week_cnt	"Week" data is stored in hexadecimal 0x00: Sunday 0x01: Monday 0x02: Tuesday 0x03: Wednesday 0x04: Thursday 0x05: Friday 0x06: Saturday	1 byte	main, time_set
month_cnt	"Month" data is stored in hexadecimal	1 byte	main, date_set, leap_year_check
year_cnt	"Year" data is stored in hexadecimal	2 bytes	main, date_set, leap_year_check

4.4 ROM Description

Table 4 lists ROM memories and their specifications.

Table 4. ROM Memory

ROM Code	Specifications	Data Length	Functions
day_max_tbl[12]	"Maximum monthly days" data is stored in hexadecimal. [0] (January)… 0x1F (31days) [1] (February)… 0x1C (28 days) [2] (March)… 0x1F (31 days) [3] (April)… 0x1E (30 days) [4] (May)… 0x1F (31 days) [5] (June)… 0x1E (30 days) [6] (July)… 0x1F (31 days) [7] (August)… 0x1F (31 days) [8] (September)… 0x1E (30 days) [9] (October)… 0x1F (31 days) [10] (November)… 0x1E (30 days) [11] (December)… 0x1F (31 days)	12 bytes	leap_year_check

5. Set-up procedure

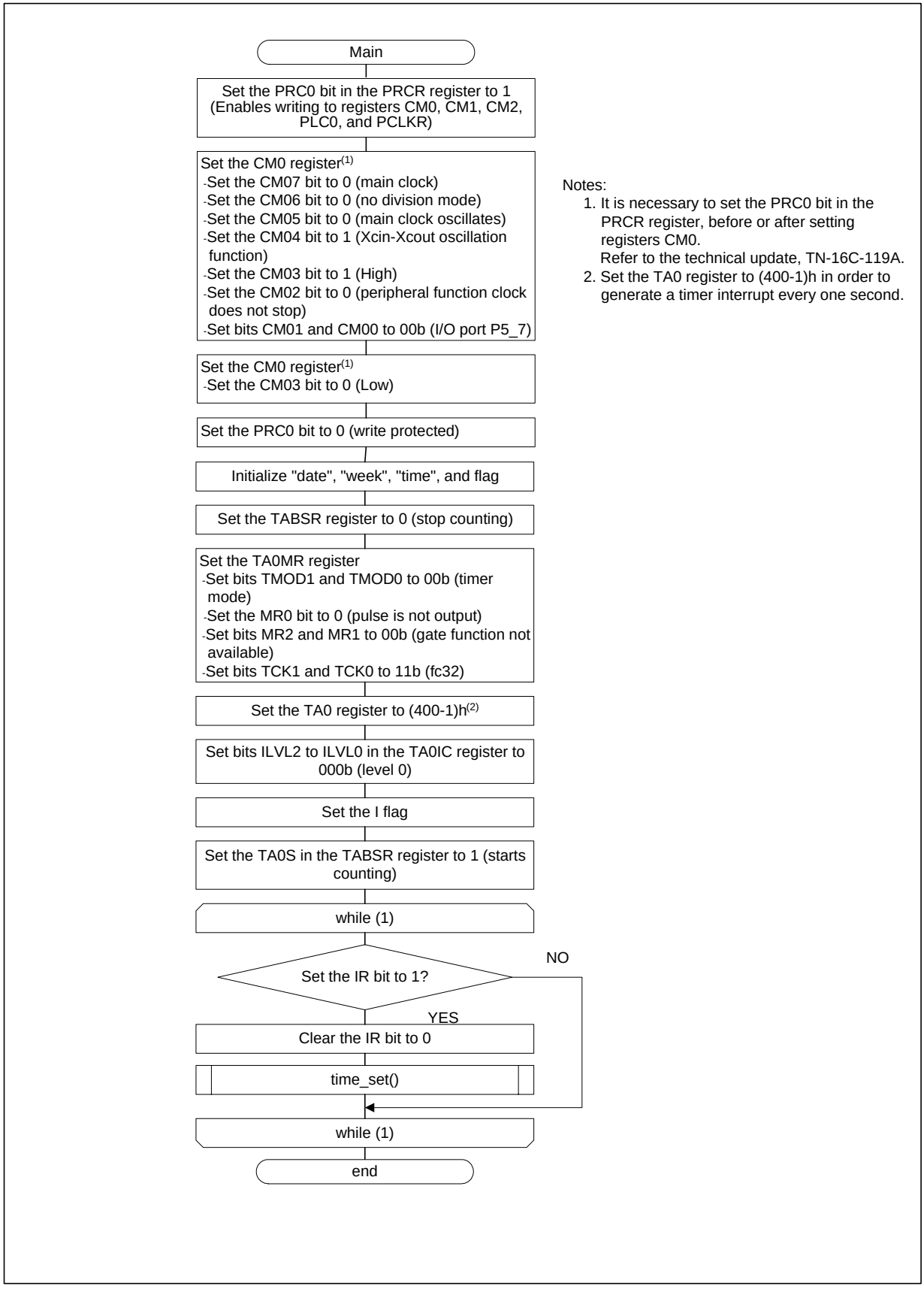

Figure 1. Flowchart (Main)

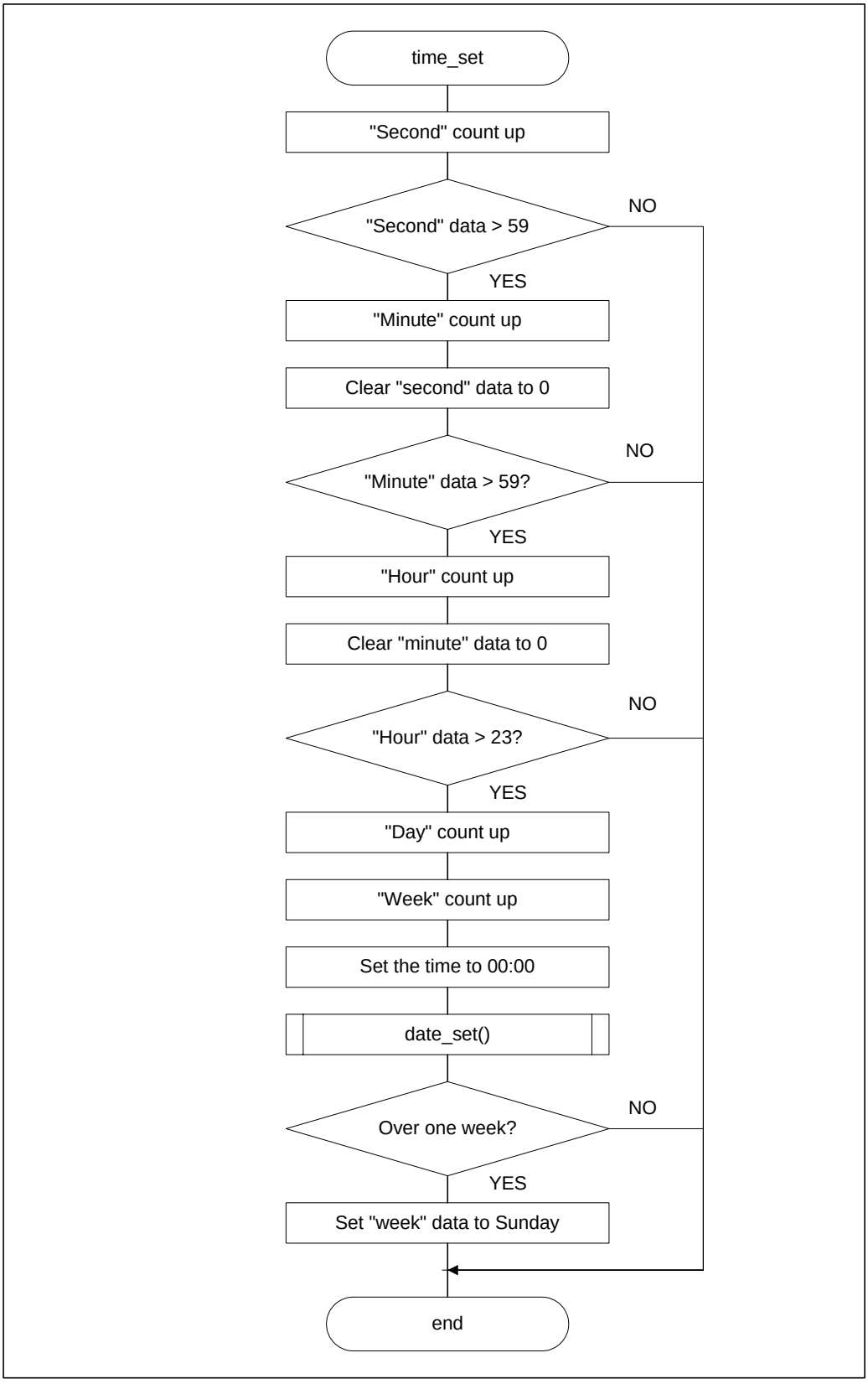

Figure 2. Flowchart (time_set)

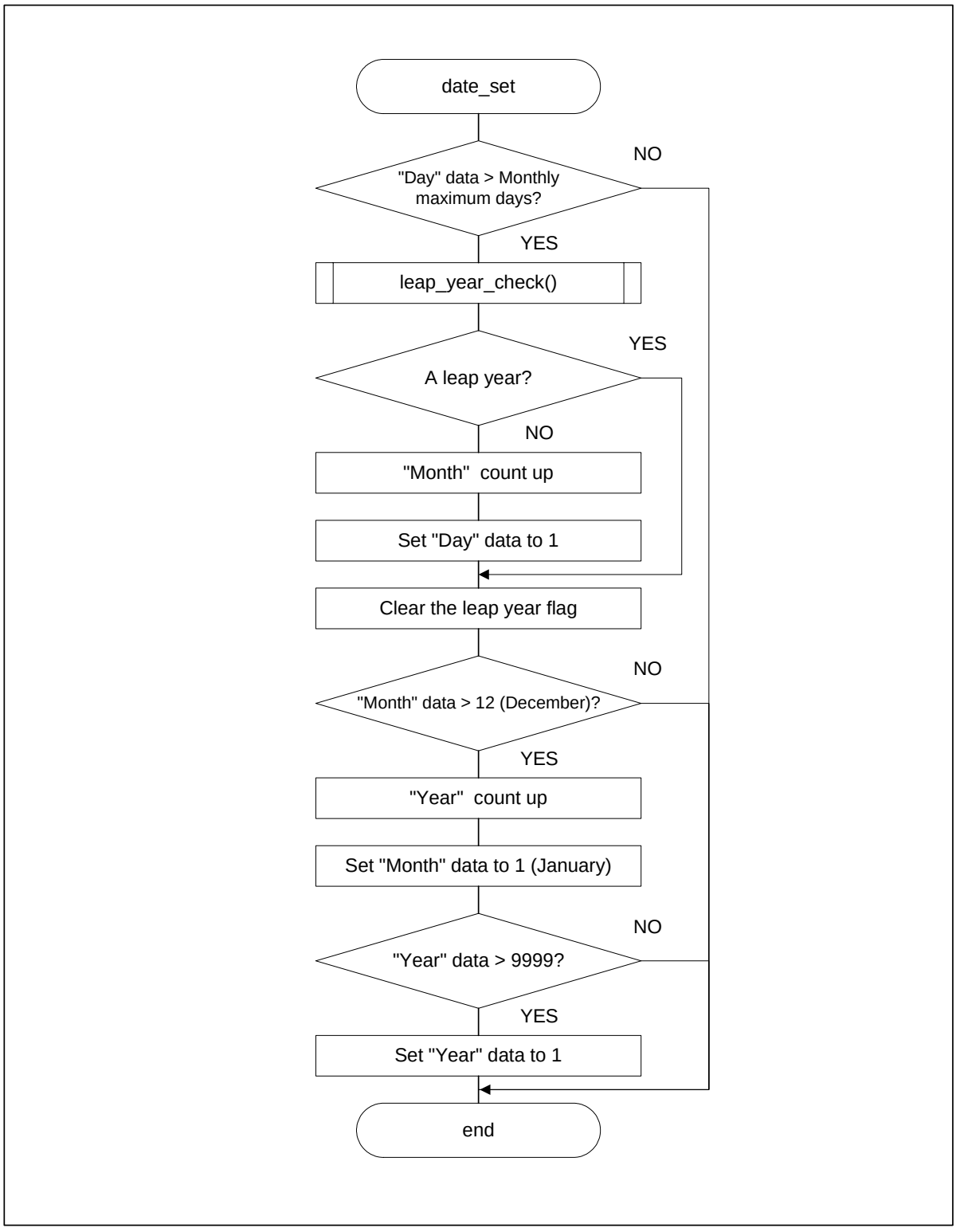

Figure 3. Flowchart (date_set)

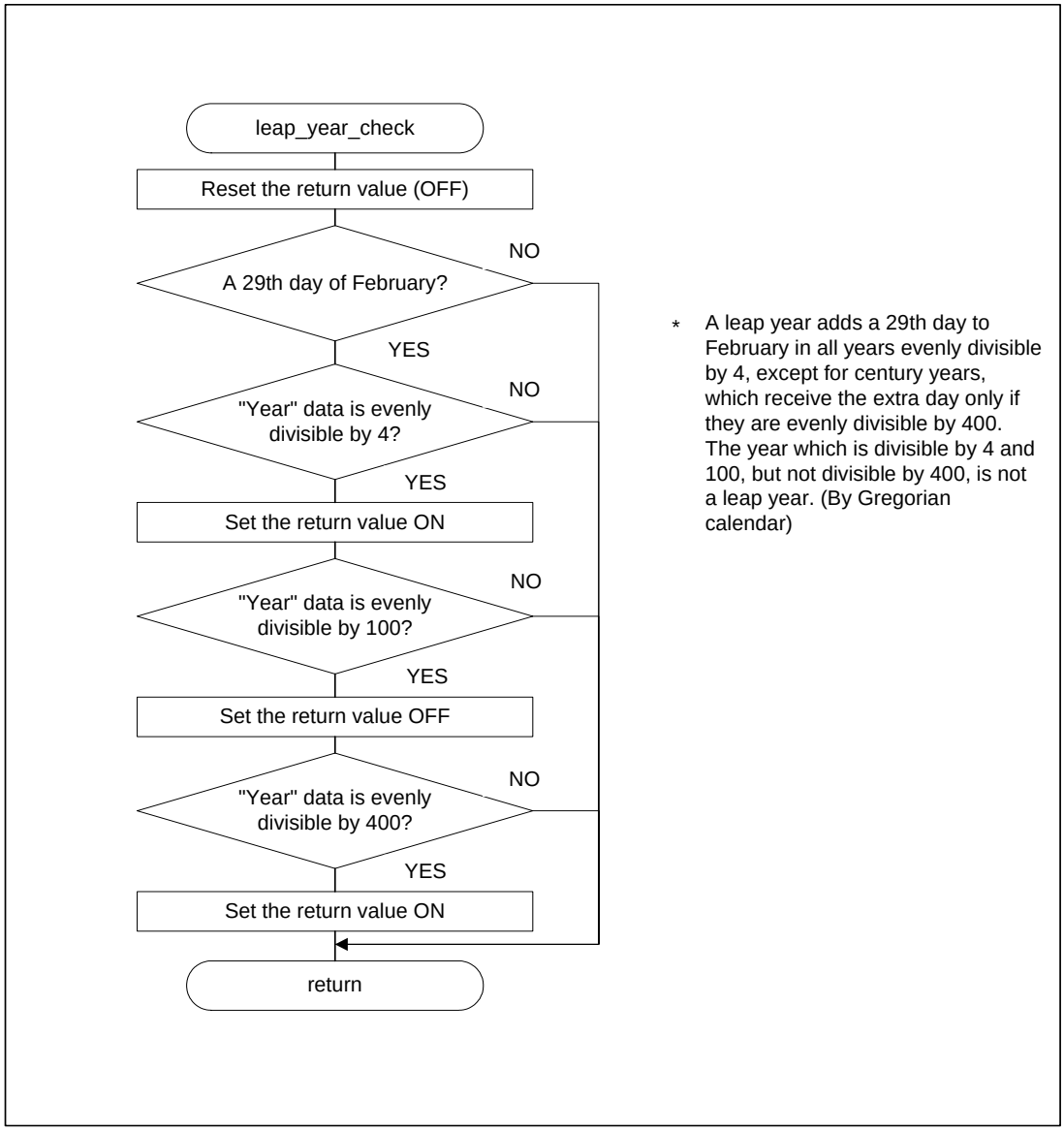

Figure 4. Flowchart (leap_year_check)

6. Reference Program

Please find the reference program from the Renesas Technology Web site.
Click Application Note in the left menu of the M16C/60 Series top page.
The M16C/62P Group is used for the sample program.

7. Reference Documents

Hardware manual
M16C/62P Group Hardware Manuals
(Use the most recent version of the document on the Renesas Technology Web site.)

Technical news/Technical update
(Use the most recent version of the document on the Renesas Technology Web site.)

Renesas Technology Web site
http://www.renesas.com/

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

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.00	2006.06.01	-	First edition issued

Keep safety first in your circuit designs!

1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corporation or a third party.
2. Renesas Technology Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.