

To our customers,

---

## Old Company Name in Catalogs and Other Documents

---

On April 1<sup>st</sup>, 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 1<sup>st</sup>, 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.

---

# H8SX Series

## W/L Size Immediate Abbreviation

---

### Introduction

As well as having an architecture that is upward-compatible with each CPU of the H8/300, H8/300H, and H8S series, so as to inherit a full complement of peripheral functions, the H8SX microcomputer series has a maximum operating frequency of 50 MHz and uses a 32-bit H8SX core CPU as well as an on-chip multiplier/divider to improve performance.

This H8SX series Application Note provides information you may need during software and hardware design. This is a basic edition that provides operation examples that each use a single H8SX series on-chip peripheral function.

Although the operation of each program, circuit, and other aspects covered by this application note has been checked, make sure that you conduct your own operation checks before actually using the H8SX series.

### Contents

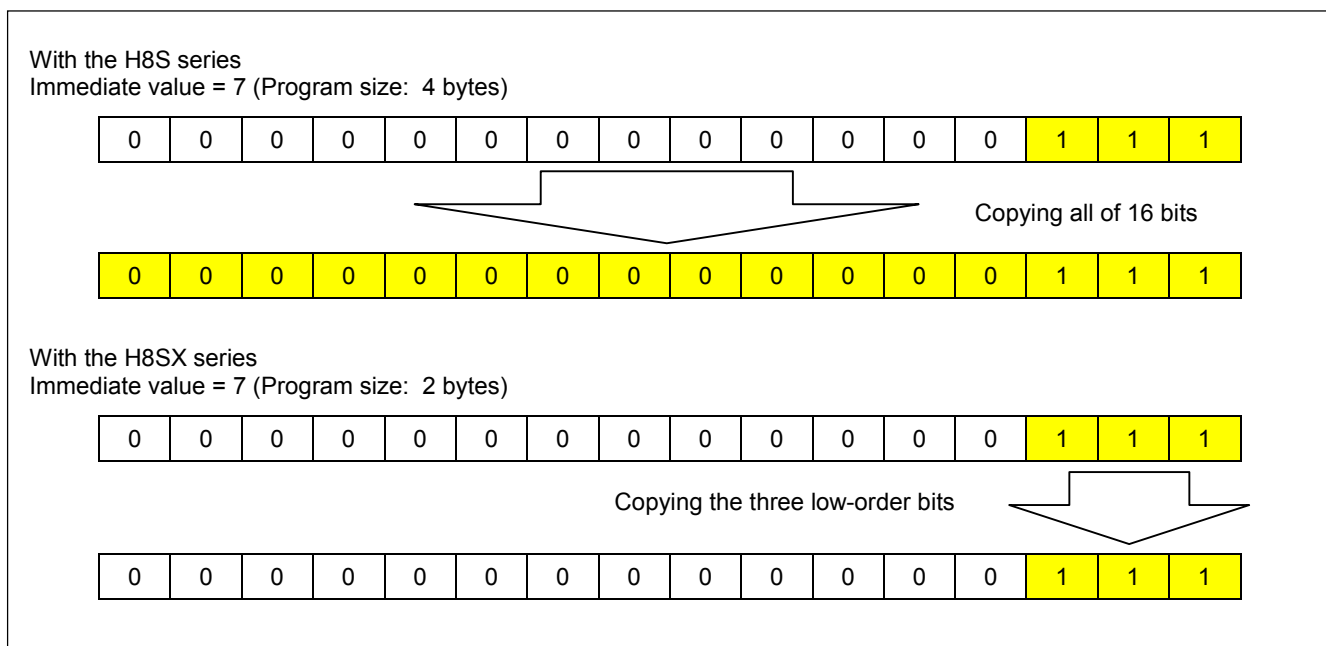
1. Overview .....	2
2. Configuration.....	2
3. Sample Program .....	3

### 1. Overview

The H8SX series has an architecture that is upward-compatible with each CPU of the H8/300, H8/300H, and H8S series. Furthermore, in addition its instruction set has been enhanced to improve CPU performance. This enhancement of the instruction set has greatly improved coding efficiency compared to the conventional series. This coding efficiency leads to benefits such as a reduction in the amount of ROM required for storing programs as well as the shortening of each instruction fetch cycle. This application note describes "W/L size immediate abbreviation", which is an enhanced instruction set item.

### 2. Configuration

"W/L size immediate abbreviation" is described below. The conventional H8/300, H8/300H, and H8S series support :8, :16, and :32 as their size immediate abbreviations. For the H8SX series, :3 and :4 are also supported. For example, to set immediate values 0 to 7 in the short variable with the conventional H8S series, :16 is used; with the H8SX series, :3 is used. With the H8SX series, there is no need to allocate a 16-bit area in the program code, which reduces the size of the program. An example is shown in Figure 1.



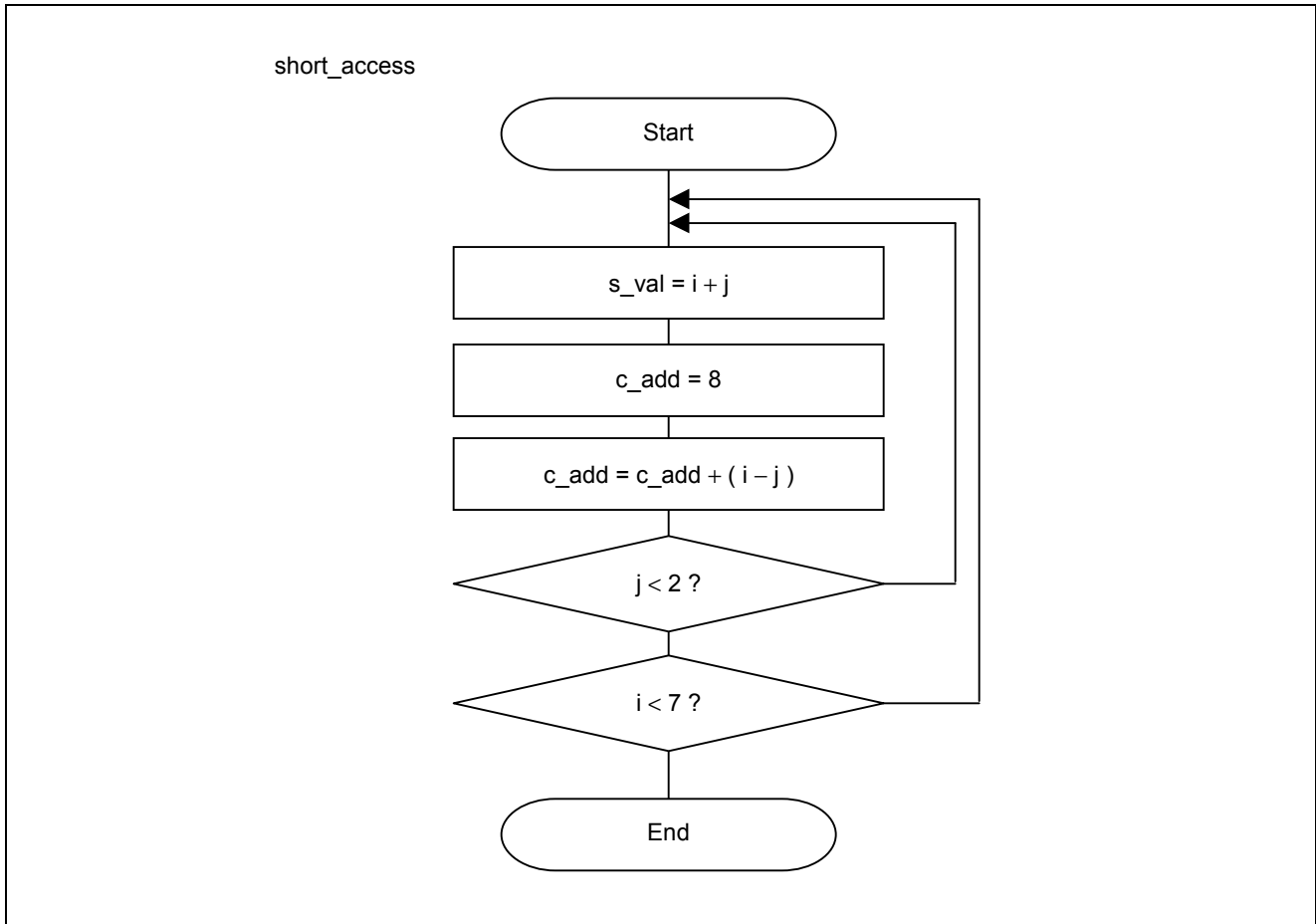
**Figure 1 Immediate Abbreviations**

### 3. Sample Program

#### 3.1 Flowchart

The sample program shown below is very simple, and will allow you to understand the description of "W/L size immediate abbreviation", an enhanced instruction set item.

As a comparison with the H8S series, the results of compilation are shown. This example is for reference only because the instruction code length generated in the compilation of an application-level program greatly depends on the source program and compiling conditions.



### 3.2 Program Listing

```

/*****
/* Include File
/*****
#include <machine.h>

void short_access(void);

/*****
/* RAM allocation
/*****
short s_val;           // Short Data
volatile char c_add;   // char Data
/*****
/* Function Definition(Main Program)
/*****
void short_access(void)
{
    unsigned short i,j;           // Loop Counter
    for( i=0; i<7; i++ )         // i Loop
    {
        for( j=0; j<2; j++)      // j Loop
        {
            s_val = i + j;       // i + j
            c_add = 8;           // c_add Initialize
            c_add +=(i-j);
        }
    }
}

```

### 3.3 Comparison of the H8S Series with the H8SX Series

The result of compilation (assembly code) with the H8S series is shown below.

```

P                                     ; section
00000000 _short_access:                ; function: short_access
00000000     STM.L      (ER4-ER5),@-SP
00000004     MOV.L     #_s_val,ER5
0000000A     SUB.W     E4,E4
0000000C     MOV.L     #_c_add,ER1
00000012 L70:
00000012     SUB.W     E0,E0
00000014 L71:
00000014     MOV.W     E4,R0
00000016     ADD.W     E0,R0
00000018     MOV.W     R0,@ER5
0000001A     MOV.B     #8,R0L
0000001C     MOV.B     R0L,@_c_add:32
00000022     MOV.W     E4,R0
00000024     SUB.W     E0,R0
00000026     MOV.B     @ER1,R0H
00000028     ADD.B     R0L,R0H
0000002A     MOV.B     R0H,@ER1
0000002C     INC.W     #1,E0
0000002E     CMP.W     #2,E0
00000032     BLO      L71:8
00000034     INC.W     #1,E4
00000036     CMP.W     #7,E4
0000003A     BLO      L70:8
0000003C     LDM.L     @SP+, (ER4-ER5)
00000040     RTS

B                                     ; section
00000000 _s_val:                        ; static: s_val
00000000     .RES.W    1
00000002 _c_add:                        ; static: c_add
00000002     .RES.B    1

```

The result of compilation (assembly code) with the H8SX series is shown below.

```

P                                     ; section
00000000 _short_access:                ; function: short_access
00000000     PUSH.W    R3
00000002     SUB.W     R1,R1
00000004 L8:
00000004     SUB.W     E0,E0
00000006     MOV.B     R1L,R0L
00000008 L10:
00000008     MOV.W     E0,R0
0000000A     ADD.W     R1,R0
0000000C     MOV.W     R0,E1
0000000E     MOV.B     #8:4,@_c_add:32
00000014     MOV.B     R1L,R0L
00000016     MOV.W     E0,R3
00000018     MOV.B     R3L,R0H

```

```

0000001A    SUB.B    R3L,R0L
0000001C    ADD.B    R0L,@_c_add:32
00000024    INC.W    #1,E0
00000026    CMP.W    #2:3,E0
00000028    BLO     L10:8
0000002A    INC.W    #1,R1
0000002C    CMP.W    #7:3,R1
0000002E    BLO     L8:8
00000030    MOV.W    E1,@_s_val:32
00000036    POP.W    R3
00000038    RTS

```

```

B                                     ; section
00000000  _s_val:                               ; static: s_val
00000000    .RES.W    1
00000002  _c_add:                               ; static: c_add
00000002    .RES.B    1

```

Table 1 lists the results of compilation with the H8S series, while Table 2 lists the result with the H8SX series.

**Table 1 Results of Compilation (H8S Series)**

H8S series	Instruction length		Execution state count	
	In bytes	Total	State count	Total
CMP.W #2,E0	4	4	2	2

**Table 2 Results of Compilation (H8SX Series)**

H8SX series	Instruction length		Execution state count	
	In bytes	Total	State count	Total
CMP.W #2:3,E0	1	1	1	1



### Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Sept.19.03	—	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.