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.

SH7000 Series

Multi-Bit Shift of 32-Bit Data (Logical Right Shift)

Label: SHLRN

Functions Used: SHLR2 Instruction
SHLR8 Instruction
SHLR16 Instruction

Contents

1. Function

Performs a multi-bit (0–31) logical right shift of 32-bit data.

2. Arguments

Description		Storage Location	Data Length (Bytes)
Input	Number of shift bits (0–31)	R0	4
	32-bit data before shift	R1	4
Output	32-bit data after shift	R1	4

3. Internal Register Changes and Flag Changes

	(Before Execution) → (After Execution)
R0	Number of shift bits → No change
R1	32-bit data before shift → 32-bit data after shift
R2	Work
R3	Work
R4	
R5	
R6	
R7	
R8	
R9	
R10	
R11	
R12	
R13	
R14	
R15	(SP)

T bit [*]
— : No change
* : Change
0 : Fixed 0
1 : Fixed 1

4. Programming Specifications

Program memory (bytes)
36
Data memory (bytes)
0
Stack (bytes)
0
Number of states
19
Reentrant
Yes
Relocation
Yes
Intermediate interrupt
Yes

5. Notes

The number of states indicated in the programming specifications is the value when a 31-bit shift is performed.

6. Description

(1) Function

Details of the arguments are as follows.

R0: As the input argument, set the number of shift bits (0–31).
R1: Set the 32-bit data before the shift as the input argument.
Holds the 32-bit data after the shift as the output argument.

Figure 1 shows a software SHLRN execution example.

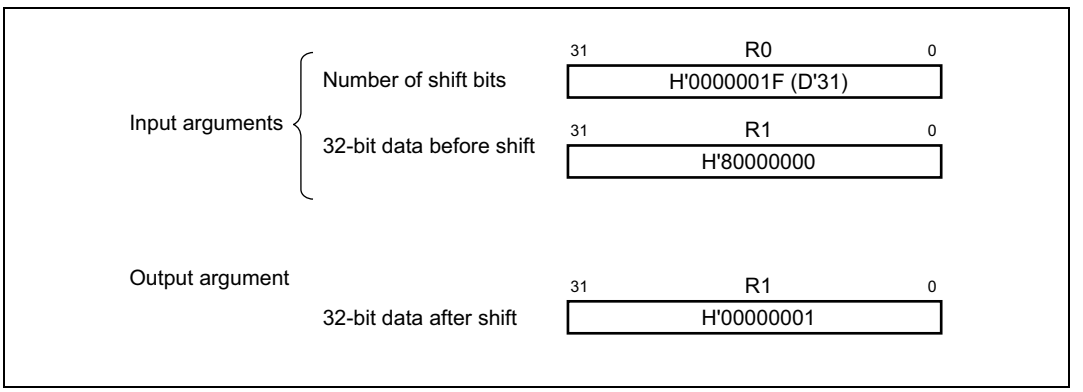


Figure 1 Software SHLRN Execution Example

(2) Usage Notes

The contents of R1, which holds the 32-bit data before the shift, are destroyed after the shift when the 32-bit data after the shift is stored there. If the value for the 32-bit data before the shift will be needed after the software SHLRN instruction is executed, it should be saved beforehand.

(3) RAM Used

No RAM is used by the software SHLRN instruction.

(4) Usage Example

After the number of shift bits and the 32-bit data before the shift have been set in the input arguments, the software SHLRN instruction is executed by a subroutine call.

```
        MOV     #H'05,R0        ....Sets number of shift bits in input argument (R0)
        BSR     SHARN           ....Subroutine call to software SHLRN
        MOV.L   DATA,R1         ....Sets 32-bit data before shift in input argument (R1)
                .
                .
                .
                .
      .align    4
DATA  .data.l   H'80000000
```

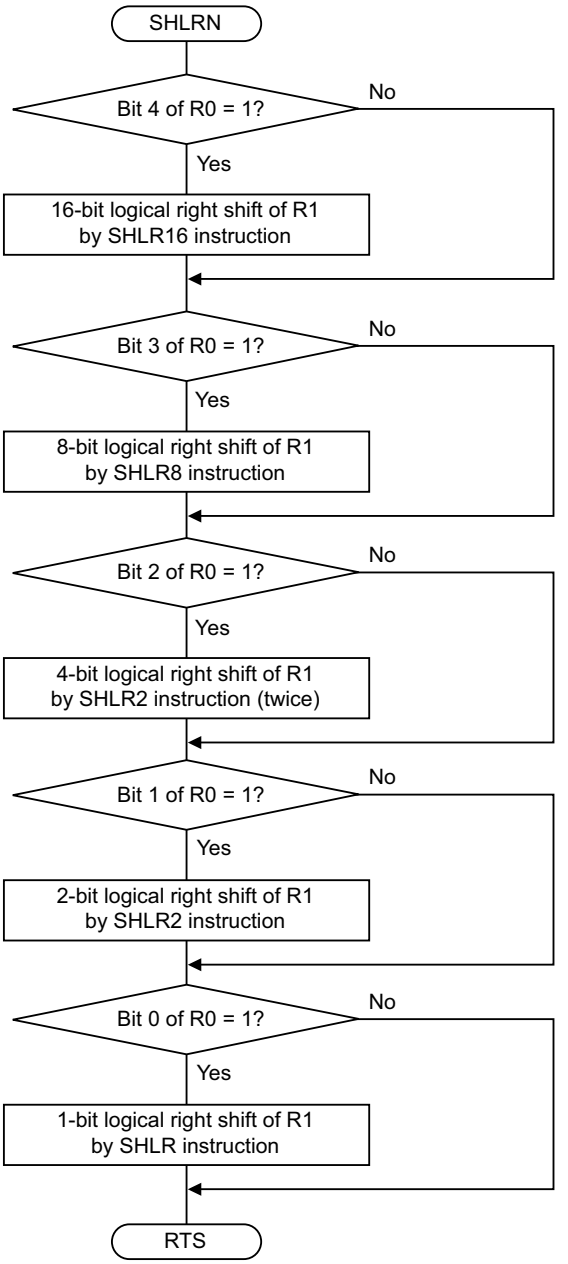
(5) Operating Principle

Bits 4 to 0 in R0, which is set to the number of shift bits, are tested. If any of them have a value of 1, a shift corresponding to the weighting of the bits in question is performed using the 16-bit logical right shift command (SHLR16), the 8-bit logical right shift command (SHLR8), the 2-bit logical right shift command (SHLR2), and the 1-bit logical right shift command (SHLR).

Table 1 Number of Shift Bits and Instructions Used for Each Bit

Bit Number	Weighting	Instruction
Bit 4	$2^4 = 16$	SHLR16
Bit 3	$2^3 = 8$	SHLR8
Bit 2	$2^2 = 4$	SHLR2 (twice)
Bit 1	$2^1 = 2$	SHLR2
Bit 0	$2^0 = 1$	SHLR

7. Flowchart


SHLRN
Bit 4 of R0 = 1?
No
Yes
16-bit logical right shift of R1
by SHLR16 instruction
Bit 3 of R0 = 1?
No
Yes
8-bit logical right shift of R1
by SHLR8 instruction
Bit 2 of R0 = 1?
No
Yes
4-bit logical right shift of R1
by SHLR2 instruction (twice)
Bit 1 of R0 = 1?
No
Yes
2-bit logical right shift of R1
by SHLR2 instruction
Bit 0 of R0 = 1?
No
Yes
1-bit logical right shift of R1
by SHLR instruction
RTS

8. Program Listing

```
  1                       1   ;*************************************************************
  2                       2   ;*                                                           *
  3                       3   ;*       NAME ; n BITS SHIFT LOGICAL RIGHT (SHLRN)            *
  4                       4   ;*                                                           *
  5                       5   ;*************************************************************
  6                       6   ;*                                                           *
  7                       7   ;*      ENTRY : R0   (NUMBER OF BIT SHIFTED)                 *
  8                       8   ;*              R1   (32 BIT DATA)                           *
  9                       9   ;*    RETURNS : R1   (SHIFT RESULT)                          *
 10                      10   ;*                                                           *
 11                      11   ;*************************************************************
 12 00001000              12           .SECTION A,CODE,LOCATE=H'1000
 13          00001000     13   SHLRN   .EQU    $               ; Entry point
 14 00001000              14   SHLRN1                          ;
 15 00001000 C810         15           TST     #B'00010000,R0  ; Bit 4 = 1?
 16 00001002 8900         16           BT      SHLRN2          ; No
 17 00001004 4129         17           SHLR16  R1              ; 16 bit shift logical right
 18 00001006              18   SHLRN2                          ;
 19 00001000 C808         19           TST     #B'00001000,R0  ; Bit 3 = 1?
 20 00001008 8900         20           BT      SHLRN3          ; No
 21 0000100A 4119         21           SHLR8   R1              ; 8 bit shift logical right
 22 0000100C              22   SHLRN3                          ;
 23 0000100C C804         23           TST     #B'00000100,R0  ; Bit 2 = 1?
 24 0000100E 8901         24           BT      SHLRN4          ; No
 25 00001010 4109         25           SHLR2   R1              ; 4 bit shift logical right
 26 00001012 4109         26           SHLR2   R1              ;
 27 00001014              27   SHLRN4                          ;
 28 00001014 C802         28           TST     #B'00000010,R0  ; Bit 1 = 1?
 29 00001016 8900         29           BT      SHLRN5          ; No
 30 00001018 4109         30           SHLR2   R1              ; 2 bit shift logical right
 31 0000101A              31   SHLRN5                          ;
 32 0000101A C801         32           TST     #B'00000001,R0  ; Bit 0 = 1?
 33 0000101C 8900         33           BT      SHLRN_END       ; No
 34 0000101E 4101         34           SHLR    R1              ; 1 bit shift logical right
 35 00001020              35   SHLRN_END                       ;
 36 00001020 000B         36           RTS                     ;
 37 00001022 0009         37           NOP                     ;
 38                       38           .END                    ;
*****TOTAL ERRORS    0
*****TOTAL WARNINGS  0
```

Keep safety first in your circuit designs!

1. Renesas Technology Corp. 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 Corp. 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 Corp. or a third party.
2. Renesas Technology Corp. 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 Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. 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 Corp. 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 Corp. by various means, including the Renesas Technology Corp. 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 Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. 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 Corp. or an authorized Renesas Technology Corp. 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 Corp. 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 Corp. for further details on these materials or the products contained therein.