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

April 1st, 2010
Renesas Electronics Corporation

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

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R8C/Tiny Series

General-purpose Program for Converting from Binary Number to Floating-point Number

1. Abstract

This program converts a 32-bit signed binary number into a single-precision, floating-point number.

2. Introduction

This program converts a 32-bit signed binary number into a single-precision, floating-point number. Set the 32-bit signed binary number in R2 and R0 beginning with the upper half. A single-precision, floating-point number is output to R2 and R0.

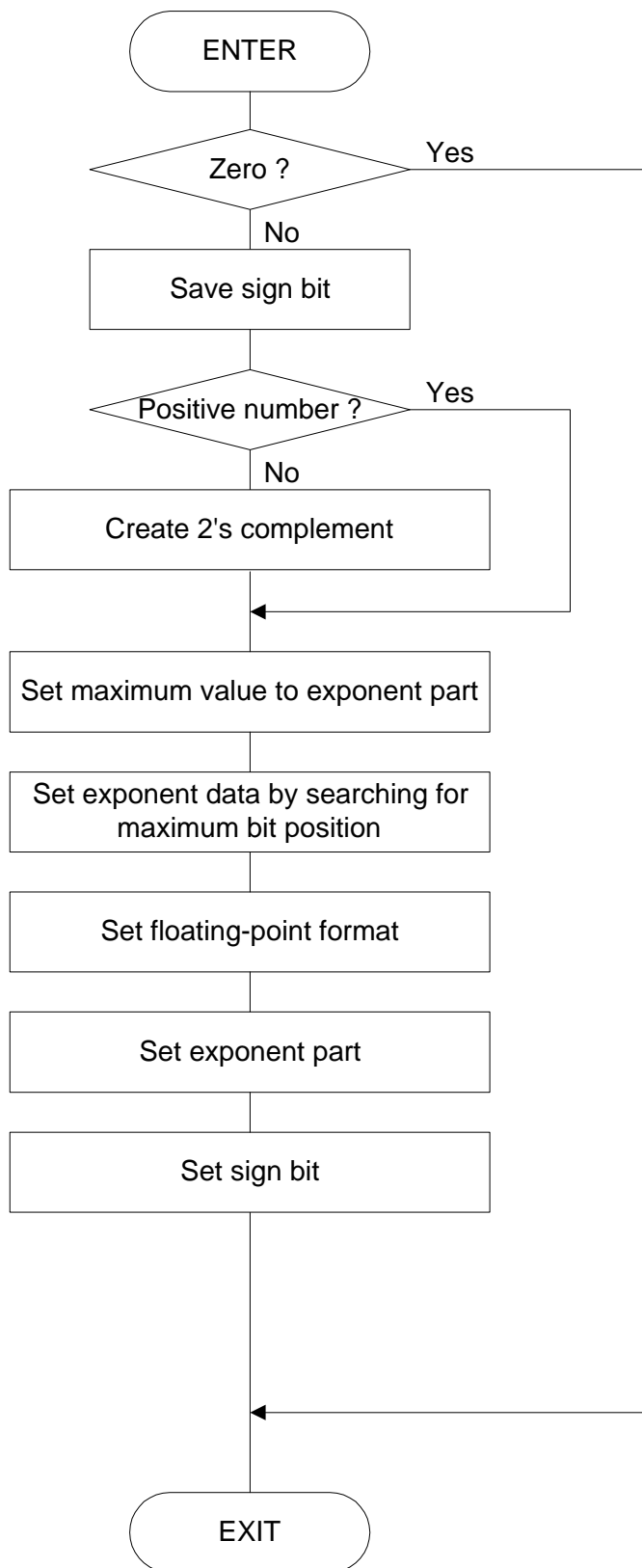
In this program, after confirming whether the input data is "0" and adjusting the data by the sign, a maximum value is set to the exponent part that can be represented by a 32-bit signed binary number. Next, the input data is shifted left while calculating (subtracting) the exponent part to create mantissa data. Finally, the resulting data is adjusted to suit the format of single-precision, floating-point numbers.

R3, R1	Meaning
7FFFFFFFH	Magnitude of a single-precision, floating-point number is equal to or greater than "2 ³¹ " (sign +)
80000000H	Magnitude of a single-precision, floating-point number is equal to or greater than "2 ³¹ " (sign -)
00000000H	Magnitude of a single-precision, floating-point number is less than "1"

Subroutine name : BINtoFLOATING	ROM capacity : 67 bytes
Interrupt during execution : Accepted	Number of stacks used : None

Register/memory	Input	Output	Usage condition
R0	Lower half of signed binary	Mid and lower parts of mantissa	←
R1	-	Indeterminate	Used for format conversion
R2	Upper half of signed binary	Exponent, upper part of mantissa	←
R3	-	Indeterminate	Used to save sign bit
A0	-	-	Unused
A1	-	-	Unused
Usage precautions			

3. Flowchart



4. The example of a reference program

```

        .include apl.inc                ; special page include file
;*****
;
;
;   R8C Program Collection No. 23      *
;   CPU       : R8C/Tiny              *
;
;*****
VromTOP   .EQU    00D000H              ; 12Kbyte Flash version
;
;=====
;   Title: Converting from binary number to single-precision, floating-point number
;   Outline: Converts 32-bit signed binary number into single-precision, floating-point number
;   Input:  -----> Output:
;   R0 (Lower half of signed binary)   R0 (Mid and lower parts of mantissa)
;   R1 ( )                             R1 (Indeterminate)
;   R2 (Upper half of signed binary)   R2 (Exponent, upper part of mantissa)
;   R3 ( )                             R3 (Indeterminate)
;   A0 ( )                             A0 (Unused)
;   A1 ( )                             A1 (Unused)
;   Stack amount used: None
;   Notes:
;=====
        .SECTION PROGRAM,CODE          ;
        .ORG      VromTOP              ; ROM area
BINtoFLOATING:
        XCHG.W    R2,R0                ; Changes data
        CMP.W     #0,R2                ;
        JNE      BINtoFLOATING_10     ;
        CMP.W     #0,R0                ;
        JEQ      BINtoFLOATING_EXIT   ; --> ZERO
BINtoFLOATING_10:
        MOV.W    R0,R3                ; Saves sign bit
        BTST    15,R0                ; Checks sign
        JEQ     BINtoFLOATING_20     ; --> Positive number
        NOT.W   R2                    ; Takes 2's complement
        NOT.W   R0                    ;
        ADD.W   #1,R2                 ;
        ADCF.W  R0                    ;
BINtoFLOATING_20:
        MOV.B   #9DH+1,R1L           ; Sets maximum value to exponent part
BINtoFLOATING_30:
        BTST    15,R0                ; Search of maximum bit position
        JNE     BINtoFLOATING_40     ; --> Finds maximum bit
        SHL.W   #1,R2                 ; Pushes for search of maximum bit position
        ROLC.W  R0                    ;
        SUB.B   #1,R1L                ; Counts down exponent
        JMP     BINtoFLOATING_30     ;
BINtoFLOATING_40:
;=====

```

```

MOV.B    #7,R1H                ; Number of shifts to adjust mantissa position
BINtoFLOATING_50:              ;
SHL.W    #-1,R0                ; Adjusts mantissa position
RORC.W    R2                    ;
ADJNZ.B   #-1,R1H,BINtoFLOATING_50 ; --> Adjustment not completed
MOV.B    R1L,R0H              ; Sets exponent
SHL.W    #-1,R0                ; Adjusts format
RORC.W    R2                    ;
BTST     15,R3                ; Sets sign bit
BMC      15,R0                ;
BINtoFLOATING_EXIT:           ;
XCHG.W   R2,R0                ; Changes data
RTS                                             ;
;                                             ;
        .END                    ;

```

5. Reference

SOFTWARE MANUAL

R8C/Tiny Series SOFTWARE MANUAL

(Acquire the most current version from Renesas web-site)

6. Web-site and contact for support

Renesas Web-site

<http://www.renesas.com>

Contact for Renesas technical support

Mail to : support_apl@renesas.com

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.00	Dec 24, 2003	-	First edition issued

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