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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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M16C/60 Series and M16C/20 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.

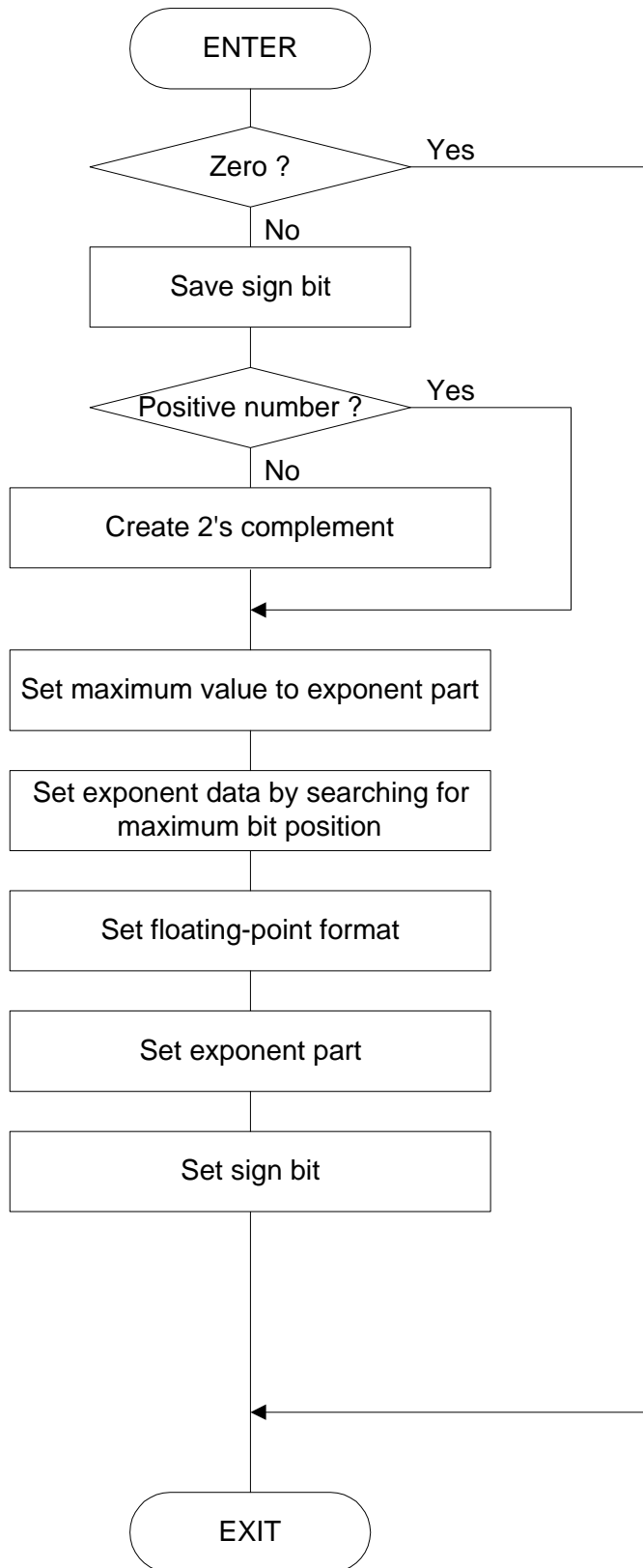
In this program, after confirming whether the input data is "0" and adjusting the data by the sign, a maximum value is set to the exponent part that can be represented by a 32-bit signed binary number. Next, the input data is shifted left while calculating (subtracting) the exponent part to create mantissa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

```

;*****
; *
; M16C General-purpose Programs *
; CPU : M16C *
; *
;*****
VromTOP    .EQU    0F0000H    ; Declares start address of ROM
;
;=====
; 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
BINTtoFLOATING:
    XCHG.W      R2,R0    ; Changes data
    CMP.W       #0,R2    ;
    JNE        BINTtoFLOATING_10    ;
    CMP.W       #0,R0    ;
    JEQ        BINTtoFLOATING_EXIT    ; --> ZERO
BINTtoFLOATING_10:
    MOV.W       R0,R3    ; Saves sign bit
    BTST       15,R0    ; Checks sign
    JEQ        BINTtoFLOATING_20    ; --> Positive number
    NOT.W       R2    ; Takes 2's complement
    NOT.W       R0    ;
    ADD.W       #1,R2    ;
    ADCF.W      R0    ;
BINTtoFLOATING_20:
    MOV.B       #9DH+1,R1L    ; Sets maximum value to exponent part
BINTtoFLOATING_30:
    BTST       15,R0    ; Search of maximum bit position
    JNE        BINTtoFLOATING_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        BINTtoFLOATING_30    ;
BINTtoFLOATING_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

M16C/60 M16C/20 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	Jul 08, 2002	-	First edition issued

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