

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics Corporation

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## M16C/60 Series and M16C/20 Series

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

#### 1. Abstract

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

#### 2. Introduction

This program converts a single-precision, floating-point number into a 32-bit signed binary number. Set the single-precision, floating-point number in R2 and R0. A signed binary number is output to R3 and R1 beginning with the upper half.

In this program, after confirming that the single-precision, floating-point number is convertible, the data is loaded into the registers while shifting the mantissa data left, and this operation is repeated as many times as dictated by the exponent to create a binary number. Finally, the resulting data is adjusted to make it matched to the sign bit of the input data.

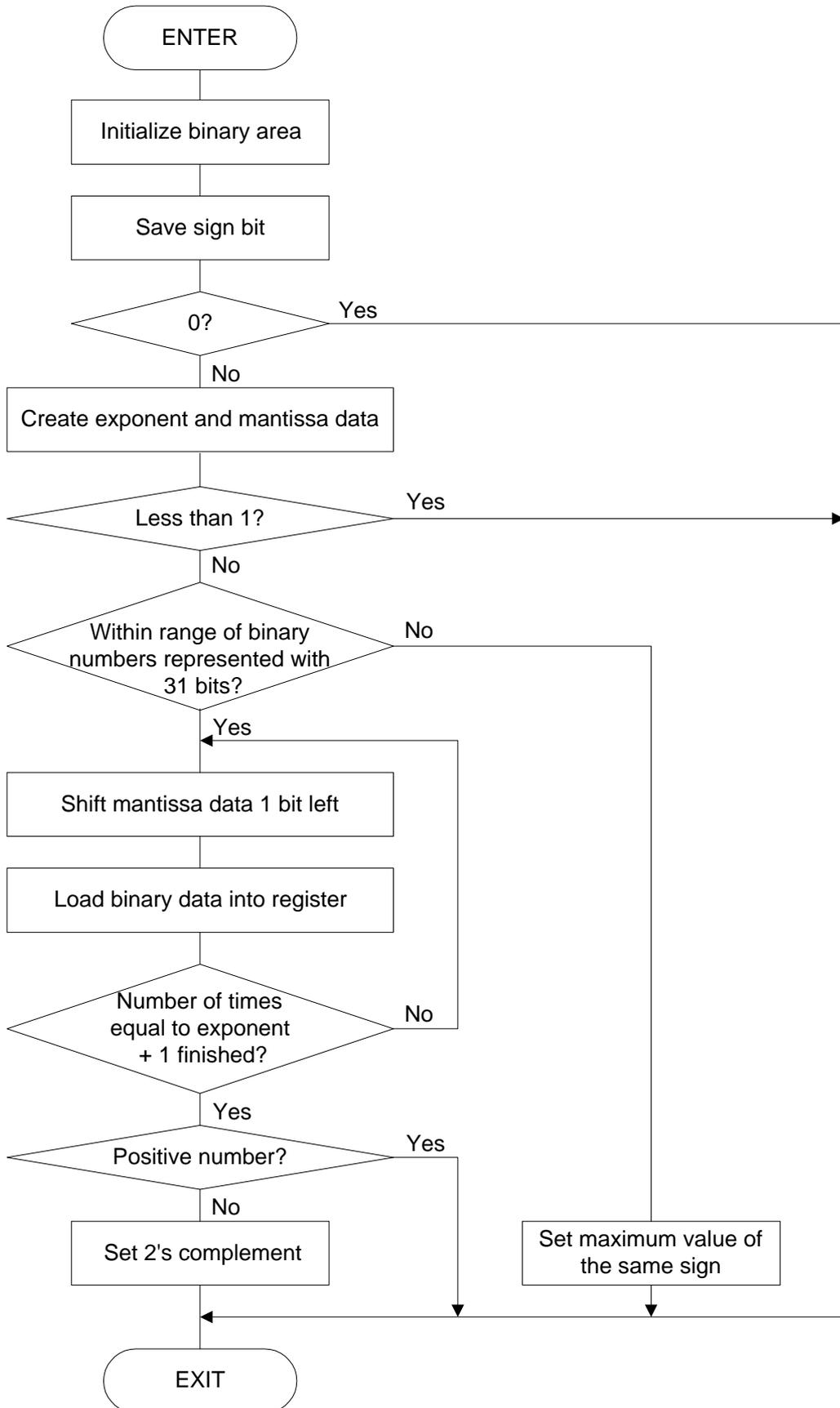
If the magnitude of a single-precision, floating-point number is equal to or greater than  $2^{31}$ , the program outputs the maximum value of the same sign; if less than  $2^{31}$ , the program outputs a "0". In either case, the result is output to R3 and R1.

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 $2^{31}$

Subroutine name : FLOATINGtoBIN	ROM capacity : 72 bytes
Interrupt during execution : Accepted	Number of stacks used : None

Register/memory	Input	Output	Usage condition
R0	Mid and lower parts of mantissa	Indeterminate	←
R1	-	Lower half of signed binary	←
R2	Exponent, upper part of mantissa	Indeterminate	←
R3	-	Upper half of signed binary	←
A0	-	Indeterminate	Used to save sign bit
A1	-	-	Unused
Usage precautions	If the magnitude of a single-precision, floating-point number is equal to or greater than "2 <sup>31</sup> ", the program outputs the maximum value of the same sign; if less than "1", the program outputs a "0". The floating-point data is destroyed as a result of program execution.		

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 single-precision, floating-point number to binary number
; Outline  :Converts single-precision, floating-point number into 32-bit signed
;          binary number
; Input    : -----> Output:
; R0 (Mid and lower parts of mantissa)    R0 (Indeterminate)
; R1 ( )                                  R1 (Lower half of signed binary)
; R2 (Exponent, upper part of mantissa)   R2 (Indeterminate)
; R3 ( )                                  R3 (Upper half of signed binary)
; A0 ( )                                  A0 (Indeterminate)
; A1 ( )                                  A1 (Unused)
; Stack amount used: None
; Notes:
;=====
                .SECTION    PROGRAM, CODE
                .ORG      VromTOP        ; ROM area
FLOATINGtoBIN:
    XCHG.W     R0,R2        ; Changes registers
    MOV.W      #0,R1        ; Initializes binary area
    MOV.W      #0,R3        ;
    MOV.W      R0,A0        ; Saves sign bit
    BCLR      15,R0        ; Clears sign
    CMP.W      #0,R0        ;
    JNE       FLOATINGtoBIN_10 ;
    CMP.W      #0,R2        ;
    JEQ       FLOATINGtoBIN_EXIT ; --> Zero
FLOATINGtoBIN_10:
    BTSTS     7,R0        ; Sets LSB of exponent to C flag
                    ; and adds 1.0 to mantissa
    ROLC.B    R0H        ; Creates exponent
    SUB.B     #7FH,R0H    ; Determines whether magnitude is
                    ; less than 1
    JNC      FLOATINGtoBIN_EXIT ; --> Sets 0 because magnitude is
                    ; less than 1
    CMP.B     #31,R0H    ; Determines whether number is within
                    ; representation range
    JLTU     FLOATINGtoBIN_20 ; --> Number is within binary
                    ; representation range
    BSET     15,R3        ; Initial sets maximum value of the
                    ; same sign
    BTST     15,A0        ; Checks sign bit
    JNE     FLOATINGtoBIN_EXIT ; --> Negative number (80000000)
    NOT.W    R1          ; Positive number (7FFFFFFF)
    NOT.W    R3          ;
    JMP.B    FLOATINGtoBIN_EXIT ;

```

```
FLOATINGtoBIN_20:                ;
    INC.B      R0H                ; Adjusts loop count
FLOATINGtoBIN_30:                ;
    SHL.W      #1,R2              ; Pushes mantissa data
    ROLC.B     R0L                ;
    ROLC.W     R1                 ; Loads result into register
    ROLC.W     R3                 ;
    ADJNZ.B    #-1,R0H,FLOATINGtoBIN_30 ; --> Conversion loop
    BTST      15,A0               ; Checks sign bit
    JEQ       FLOATINGtoBIN_EXIT  ; --> Positive number
    NOT.W     R1                  ; Takes 2's complement
    NOT.W     R3                  ;
    ADD.W     #1,R1               ;
    ADCF.W    R3                  ;
FLOATINGtoBIN_EXIT:              ;
    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>

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Mail to : [support\\_apl@renesas.com](mailto:support_apl@renesas.com)

### REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.00	Jul 08, 2002	-	First edition issued

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