To our customers,

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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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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 "1", the program outputs a "0". In either case, the result is output to R3 and R1.

<table>
<thead>
<tr>
<th>R3, R1</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>7FFFFFFFH</td>
<td>Magnitude of a single-precision, floating-point number is equal to or greater than (2^{31}) (sign +)</td>
</tr>
<tr>
<td>80000000H</td>
<td>Magnitude of a single-precision, floating-point number is equal to or greater than (2^{31}) (sign -)</td>
</tr>
<tr>
<td>00000000H</td>
<td>Magnitude of a single-precision, floating-point number is less than &quot;1&quot;</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Register/memory</th>
<th>Input</th>
<th>Output</th>
<th>Usage condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>R0</td>
<td>Mid and lower parts of mantissa</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>R1</td>
<td>-</td>
<td>Lower half of signed binary</td>
<td>←</td>
</tr>
<tr>
<td>R2</td>
<td>Exponent, upper part of mantissa</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>R3</td>
<td>-</td>
<td>Upper half of signed binary</td>
<td>←</td>
</tr>
<tr>
<td>A0</td>
<td>-</td>
<td>Indeterminate</td>
<td>Used to save sign bit</td>
</tr>
<tr>
<td>A1</td>
<td>-</td>
<td>-</td>
<td>Unused</td>
</tr>
</tbody>
</table>

Usage precautions

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 "1", the program outputs a "0". The floating-point data is destroyed as a result of program execution.
3. Flowchart

```
ENTER

Initialize binary area

Save sign bit

0?

Yes

No

Create exponent and mantissa data

Less than 1?

Yes

No

Within range of binary numbers represented with 31 bits?

Yes

No

Shift mantissa data 1 bit left

Load binary data into register

Number of times equal to exponent + 1 finished?

Yes

No

Positive number?

Yes

No

Set 2's complement

Set maximum value of the same sign

EXIT
```
4. The example of a reference program

```asm
.include apl.inc ; special page include file

R8C Program Collection No. 22
CPU : R8C/Tiny

;******************************************************************************

VromTOP .EQU 00D000H ; 12Kbyte Flash version

; 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
ROL.C.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:
```

Notes:
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
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

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Dec 24, 2003</td>
<td>First edition issued</td>
</tr>
</tbody>
</table>

Summary

Page
Keep safety first in your circuit designs!

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