

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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## R8C/Tiny Series

### General-purpose Program for Dividing 32 Bits

#### 1. Abstract

This program performs a 32-bit unsigned division using registers.

#### 2. Introduction

This program performs a 32-bit unsigned division using registers. Set the dividend in R2 and R0 and the divisor in R3 and R1 beginning with the upper half, respectively. The quotient and the remainder are output to R2 and R3, and to A1 and A0 beginning with the upper half, respectively. The zero divide information is output to the Z flag.

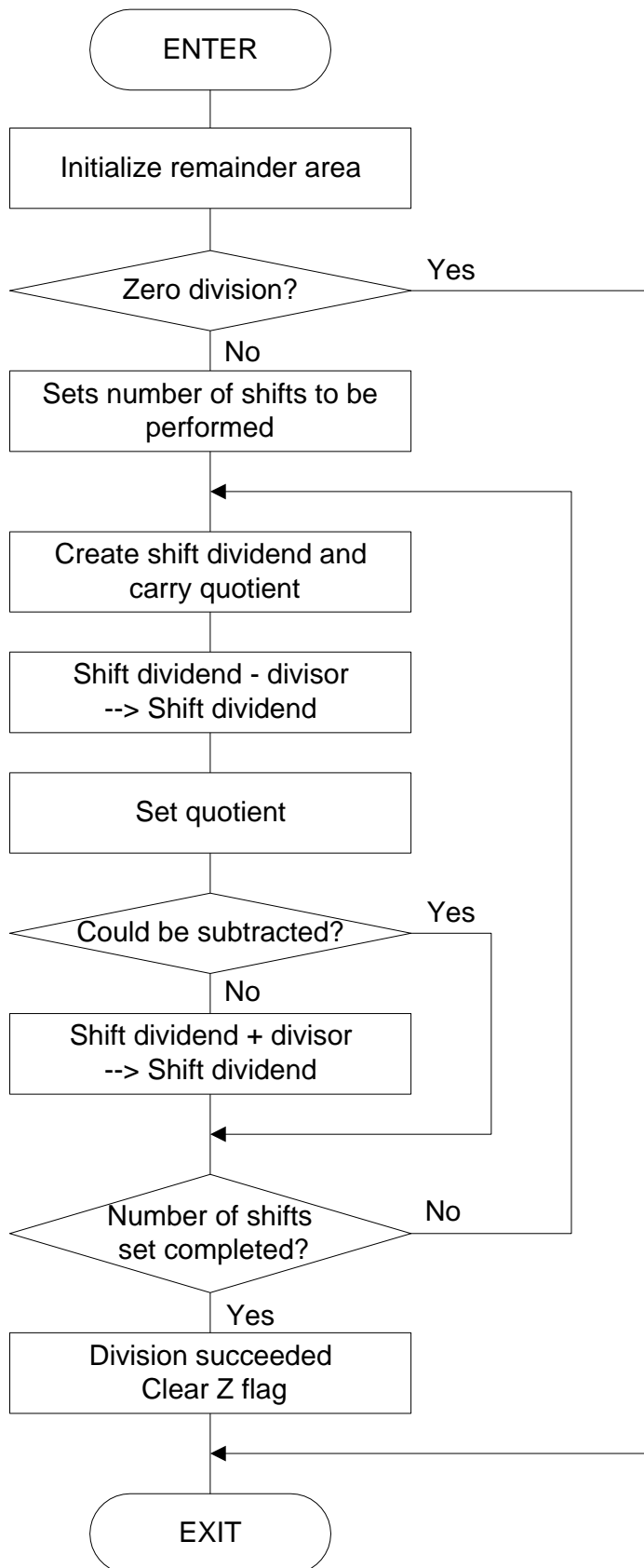
In this program, the dividend is pushed out one bit at a time beginning with the most significant bit as the program creates a dividend for calculation purposes and the divisor is subtracted from that data to get the quotient beginning with the most significant bit. The quotient and the remainder are obtained by repeating this operation as many times as the number of bits in the dividend.

Z	Meaning
0	Quotient and remainder are valid.
1	Quotient and remainder are invalid because division by zero is attempted.

Subroutine name : DIVIDE32	ROM capacity : 48 bytes
Interrupt during execution : Accepted	Number of stacks used : 3 bytes

Register/memory	Input	Output	Usage condition
R0	Lower half of dividend	Lower half of quotient	←
R1	Lower half of divisor	Does not change	←
R2	Upper half of dividend	Upper half of quotient	←
R3	Upper half of divisor	Does not change	←
A0	-	Lower half of remainder	←
A1	-	Upper half of remainder	←
CNT	-	Indeterminate	Number of shifts performed
Z flag	-	Zero divide information	←
Usage precautions	CNT is allocated in a stack area by configuring a stack frame as a temporary variable area in the program. Therefore, the value of CNT when program execution is completed is indeterminate.  The dividend is destroyed as a result of program execution.		

3. Flowchart



## 4. The example of a reference program

```

        .include apl.inc                ; special page include file
;*****
;
;
;   R8C Program Collection No. 12      *
;   CPU      : R8C/Tiny                *
;
;*****
VromTOP   .EQU    00D000H                ; 12Kbyte Flash version
FBcnst    .EQU    0006FFH                ; Assumed FB register value
;=====
;   Title: Dividing 32 bits
;   Outline: Divides 32-bit data together using registers
;   Input:  -----> Output:
;   R0 (Lower half of dividend)      R0 (Lower half of quotient)
;   R1 (Lower half of divisor)       R1 (Lower half of divisor)
;   R2 (Upper half of dividend)      R2 (Upper half of quotient)
;   R3 (Upper half of divisor)       R3 (Upper half of divisor)
;   A0 ( )                            A0 (Lower half of remainder)
;   A1 ( )                            A1 (Upper half of remainder)
;   Stack amount used: 3 bytes
;   Notes: R2R0 / R3R1
;
;       Division by zero is returned by Z flag.
;=====
        .SECTION PROGRAM,CODE           ;
        .ORG      VromTOP                ; ROM area
        .FB       FBcnst                 ; Assumes FB register value
DIVIDE32:
;-----;
;   Declaration of temporary variable   ;
;-----;
CNT      .EQU    -1                      ; Shift count counter
ENTER #1                               ; Sets stack frame
MOV.B #0,A0                             ; Initializes remainder area
MOV.B #0,A1                               ;
CMP.W #0,R1                              ;
JNE     DIVIDE32_10                       ;
CMP.W #0,R3                              ;
JEQ     DIVIDE32exit                       ; --> Division by zero
DIVIDE32_10:
        MOV.B #32,CNT[FB]                ; Sets number of shifts performed (32 times)
DIVIDE32_20:
        SHL.W #1,R0                       ; Pushes dividend and carry quotient
        ROLC.W R2                          ;
        ROLC.W A0                          ; Creates dividend
        ROLC.W A1                          ;
        SUB.W R1,A0                        ; Subtracts divisor
        SBB.W R3,A1                        ;
        BMC     0,R0                       ; Sets quotient

```

```

JC      DIVIDE32_30                ; --> Subtraction of divisor succeeded
ADD.W  R1,A0                      ; Restored to original data because subtraction of divisor failed
ADC.W  R3,A1                      ;
DIVIDE32_30:                       ;
ADJNZ.B #-1,CNT[FB],DIVIDE32_20   ; --> Executes next digit
FCLR   Z                          ; Division succeeded
DIVIDE32exit:                      ;
EXITD  ; Clears stack frame
;                                     ;
      .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>

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## REVISION HISTORY

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



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