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Renesas Electronics Corporation

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M16C/60 Series and M16C/20 Series

General-purpose Program for Dividing 64 Bits

1. Abstract

This program performs an unsigned division on a 64-bit dividend and a 32-bit divisor using registers.

2. Introduction

This program performs an unsigned division on a 64-bit dividend and a 32-bit divisor using registers. Set the dividend in R3, R1, R2, and R0 beginning with the most significant part, and the divisor in A1 and A0 beginning with the upper half. The quotient and the remainder are output to R3, R1, R2, and R0, and A1 and A0, respectively. The zero divide information is output to the Z flag.

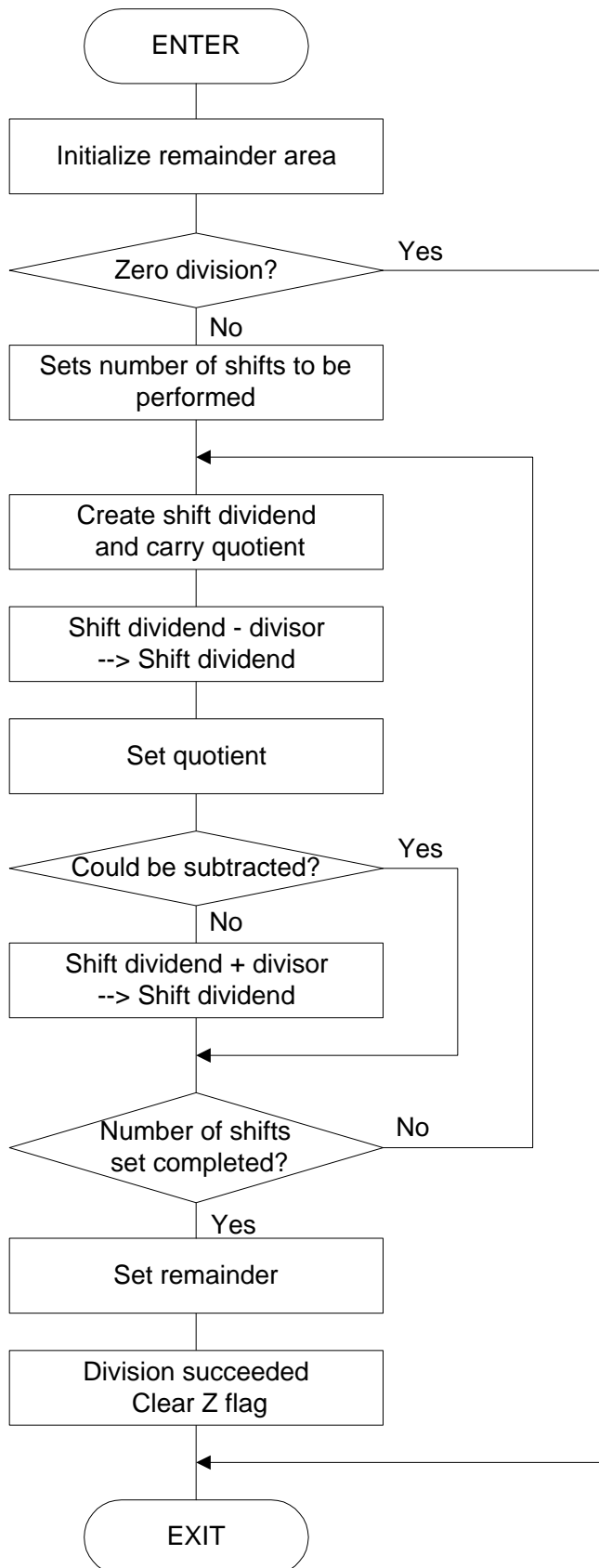
In this program, the dividend is pushed out one bit at a time beginning with the most significant bit as the program creates a dividend for calculation purposes and the divisor is subtracted from that data to get the quotient beginning with the most significant bit. The quotient and the remainder are 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 : DIVIDE64	ROM capacity : 78 bytes
Interrupt during execution : Accepted	Number of stacks used : 8 bytes

Register/memory	Input	Output	Usage condition
R0	Lower part of dividend	Lower part of quotient	←
R1	Upper part of dividend	Upper part of quotient	←
R2	Middle part of dividend	Middle part of quotient	←
R3	Most significant part of dividend	Most significant part of quotient	←
A0	Lower half of divisor	Lower half of remainder	←
A1	Upper half of divisor	Upper half of remainder	←
JYOUYO	-	Indeterminate	Shift dividend used for calculation
CNT	-	Indeterminate	Number of shifts performed
Z flag	-	Zero divide information	←
Usage precautions	CNT and JYOUYO are allocated in a stack area by configuring stack frames as temporary variable areas in the program. Therefore, the values of CNT and JYOUYO when program execution is completed are indeterminate. The dividend 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
FBcnst       .EQU    001000H      ; Assumed FB register value
;=====
; Title      : Dividing 64 bits
; Outline    : Divides 64-bit dividend by 32-bit divisor
; Input      : -----> Output:
; R0 (Lower part of dividend)      R0 (Lower part of quotient)
; R1 (Upper part of dividend)      R1 (Upper part of quotient)
; R2 (Middle part of dividend)     R2 (Middle part of quotient)
; R3 (Most significant part of dividend) R3 (Most significant part of quotient)
; A0 (Lower half of divisor)       A0 (Lower half of remainder)
; A1 (Upper half of divisor)       A1 (Upper half of remainder)
; Stack amount used: 8 bytes
; Notes      : Division by zero is returned by Z flag.
;              R3R1R2R0 ÷ A1A0 = R3R1R2R0 remainder A1A0
;=====
                .SECTION    PROGRAM, CODE
                .ORG      VromTOP      ; ROM area
                .FB      FBcnst      ; Assumes FB register value
DIVIDE64:
;----- ;
; Declaration of temporary variables ;
;----- ;
JYOUYO        .EQU    -6          ; Used for remainder calculation
CNT           .EQU    -1          ; Shift count counter
    ENTER      #6              ; Sets stack frame
    MOV.W     #0, JYOUYO[FB]    ; Initializes remainder area
    MOV.W     #0, JYOUYO+2[FB]
    MOV.B     #0, JYOUYO+4[FB]
    CMP.W     #0, A0
    JNE      DIVIDE64_10
    CMP.W     #0, A1
    JEQ      DIVIDE64exit      ; --> Division by zero
DIVIDE64_10:
    MOV.B     #64, CNT[FB]      ; Sets number of shifts performed
                                ; (64 times)
DIVIDE64_20:
    SHL.W     #1, R0           ; Pushes divided and carry quotient
    ROLC.W    R2
    ROLC.W    R1
    ROLC.W    R3
    ROLC.W    JYOUYO[FB]      ; Creates dividend
    ROLC.W    JYOUYO+2[FB]
    ROLC.B    JYOUYO+4[FB]
    SUB.W     A0, JYOUYO[FB]    ; Subtracts divisor
    SBB.W     A1, JYOUYO+2[FB]
    SBB.B     #0, JYOUYO+4[FB]
    BMC      0, R0            ; Sets quotient
    JC       DIVIDE64_30      ; --> Subtraction of divisor succeeded

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ADD.W      A0,JYOUYO[FB]          ; Restored to original data because
                                       ; subtraction of divisor failed
ADC.W      A1,JYOUYO+2[FB]        ;
ADCF.B     JYOUYO+4[FB]          ;
DIVIDE64_30:                          ;
ADJNZ.B    #-1,CNT[FB],DIVIDE64_20 ; --> Executes next digit
MOV.W      JYOUYO[FB],A0          ; Sets lower half of remainder
MOV.W      JYOUYO+2[FB],A1        ; Sets upper half of remainder
FCLR      Z                       ; Division succeeded
DIVIDE64exit:                          ;
EXITD                                           ; Clears stack frame
;                                           ;
          .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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