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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# M16C/60 Series and M16C/20 Series

## General-purpose Program for Subtracting 32 Bits

### 1. Abstract

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

This program performs a 32-bit unsigned subtraction between memory locations.

### 2. Introduction

This program performs a 32-bit unsigned subtraction using registers. Set the minuend in R2 and R0 and the subtrahend in R3 and R1 beginning with the upper half, respectively. The subtraction result is output to R2 and R0 beginning with the upper half and borrow information to the C flag, respectively.

This program performs a 32-bit unsigned subtraction between memory locations. Set the least significant memory address of the minuend and that of the subtrahend in the address registers. The subtraction result is output to the minuend's memory location and borrow information to the C flag, respectively.

C	Meaning
0	With borrow
1	Without borrow

#### (1) 32-bit subtraction (register)

Subroutine name : SUBTRACT32	ROM capacity : 5 bytes
Interrupt during execution : Accepted	Number of stacks used : None

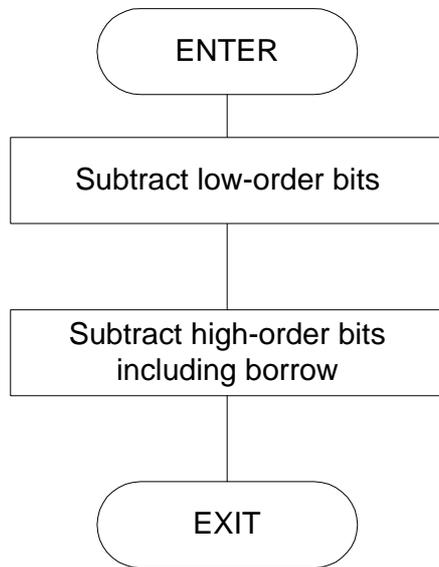
Register/memory	Input	Output	Usage condition
R0	Lower half of minuend	Lower half of subtraction result	←
R1	Lower half of subtrahend	Does not change	←
R2	Upper half of minuend	Upper half of subtraction result	←
R3	Upper half of subtrahend	Does not change	←
A0	-	-	Unused
A1	-	-	Unused
C flag	-	Borrow information	←
Usage precautions	The minuend is destroyed as a result of program execution.		

**(2) 32-bit subtraction (memory)**

Subroutine name : SUBTRACTmemory32	ROM capacity : 7 bytes
Interrupt during execution : Accepted	Number of stacks used : None

Register/memory	Input	Output	Usage condition
R0	-	-	Unused
R1	-	-	Unused
R2	-	-	Unused
R3	-	-	Unused
A0	Minuend address	Does not change	←
A1	Subtrahend address	Does not change	←
Memory indicated by A0	Minuend	Subtraction result	←
Memory indicated by A1	Subtrahend	Does not change	←
C flag	-	Borrow information	←
Usage precautions	The minuend is destroyed as a result of program execution.		

**3. Flowchart**



#### 4. The example of a reference program

```

;*****
;
; M16C Program Collection No. 10
; CPU      : M16C/60 Series, M16C/20 Series
; Version  : 1.00 ( 2002-7-08 ) Initial
;           : 2.00 ( 2005-11-17 ) SUBTRUCT32 ->SUBTRACT32
;           SUB.W R3,R2 ->SBB.W R3,R2
;           SUB.W 2[A1],2[A0] ->SBB.W 2[A1],2[A0]
; Copyright(C) 2005. Renesas Technology Corp., All rights reserved.
;*****
VromTOP      .EQU      0F0000H      ; Declares start address of ROM
;
;=====
; Title: Subtracting 32 bits
; Outline: Subtracts 32-bit data using registers.
; Input:  -----> Output:
; R0 (Lower half of minuend)      R0 (Lower half of subtraction result)
; R1 (Lower half of subtrahend)   R1 (Does not change)
; R2 (Upper half of minuend)      R2 (Upper half of addition result)
; R3 (Upper half of subtrahend)   R3 (Does not change)
; A0 ( )                          A0 (Unused)
; A1 ( )                          A1 (Unused)
; Stack amount used: None
; Notes: Borrow information in C flag
;       R2R0 - R3R1
;=====
        .SECTION    PROGRAM,CODE    ;
        .ORG        VromTOP        ; ROM area
SUBTRACT32:
        SUB.W      R1,R0            ; Subtracts low-order bits
        SBB.W      R3,R2            ; Subtracts high-order bits
        RTS
;
;=====
; Title: Subtracting 32 bits
; Outline: Subtracts 32-bit data between memory locations
; Input:  -----> Output:
; R0 ( )                          R0 (Unused)
; R1 ( )                          R1 (Unused)
; R2 ( )                          R2 (Unused)
; R3 ( )                          R3 (Unused)
; A0 (Minuend address)            A0 (Does not change)
; A1 (Subtrahend address)        A1 (Does not change)
; Stack amount used: None
; Notes: Borrow information in C flag
;       (A0) - (A1)
;=====
SUBTRACTmemory32:
        SUB.W      [A1],[A0]        ; Subtracts low-order bits
        SBB.W      2[A1],2[A0]      ; Subtracts high-order bits
        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/en/m16c>

Contact for Renesas technical support

Mail to : [csc@renesas.com](mailto:csc@renesas.com)

## REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.00	Jul 08, 2002	-	First edition issued
2.00	Nov 17, 2005	3	SUBTRUCT32 ->SUBTRACT32 SUB.W R3,R2 ->SBB.W R3,R2 SUB.W 2[A1],2[A0] ->SBB.W 2[A1],2[A0]

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