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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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M16C/80 Series

Multiplying BCD

1.0 Abstract

This program multiplies 4-digit BCD using registers.

2.0 Introduction

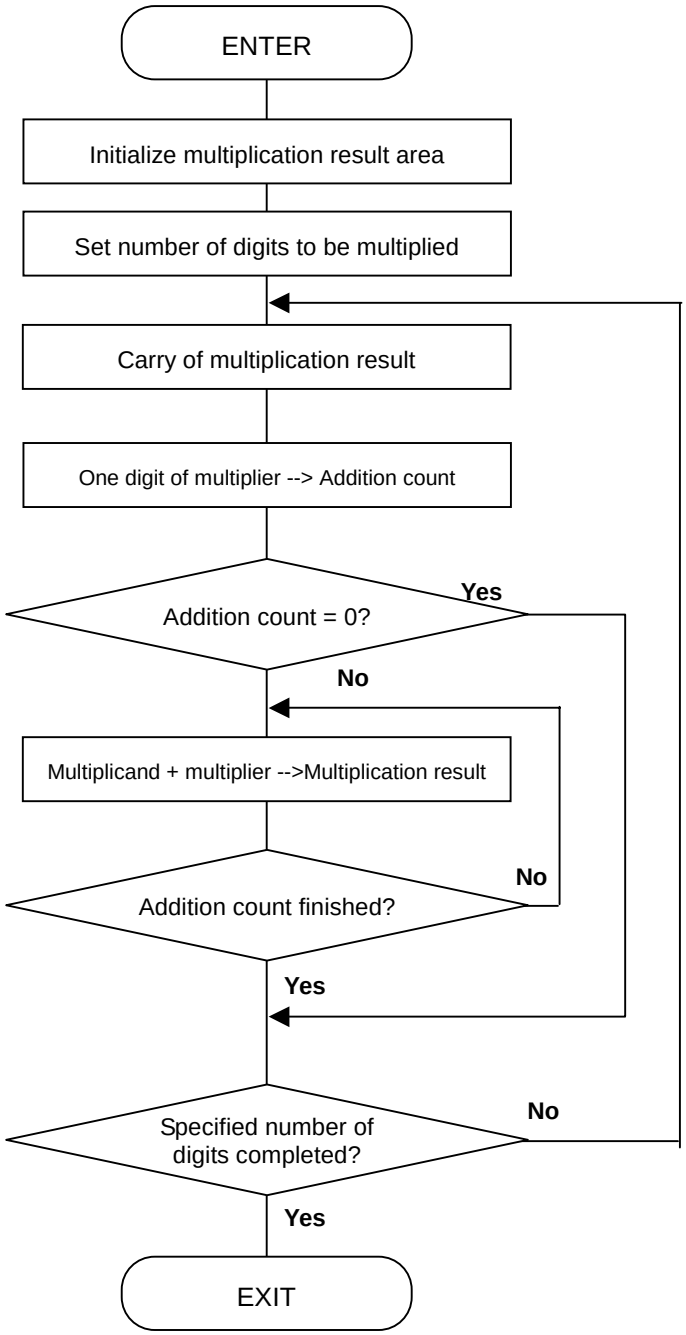
This program multiplies 4-digit BCD together by using registers. Set the multiplicand in R1 and the multiplier in R3, respectively. The multiplication result is output to R2 and R0 beginning with the upper half.

In this program, data for BCD calculation is loaded from the multiplier 4 high-order bits at a time to set an addition count and the multiplicand is added to the multiplication result. The carry deriving from multiplication is shifted in units of 4 bits to the next high-order digit.

Subroutine name : BCD_MULTIPLE4	ROM capacity : 38byte
Interrupt during execution:Accepted	Number of stacks used : None

Register/memory	Input	Output	Usage condition
R0	-	Lower part of multiplication result	←
R1	Multiplicand	Does not change	←
R2	-	Upper part of multiplication result	←
R3	Multiplier	Indeterminate	←
A0	-	" 0000_{16} "	Number of digits counter
A1	-	" 0000_{16} "	Addition count
Usage precautions	The multiplier is destroyed as a result of program execution.		

3.0 Flowchart



4.0 Programming Code

```
;*****************************************************************
; *
;       M16C Program Collection
;       CPU : M16C/80 series
; *
;*****************************************************************
VromTOP     .EQU            0FE0000H                ; Declares start address of ROM
;=======================================================================
;   Title: Multiplying 4-digit BCD
;   Outline: Multiplies 4-digit BCD using registers.
;   Input:      ------------------------------>     Output:
;   R0()                                        R0(Lower half of multiplication result)
;   R1(Multiplicand)                            R1(Does not change)
;   R2()                                        R2(Upper half of multiplication result)
;   R3(Multiplier)                              R3(Indeterminate)
;   A0()                                        A0(Indeterminate)
;   A1()                                        A1(Indeterminate)
;   Stack amount used: None
;   Notes:
;=======================================================================
            .SECTION    PROGRAM,CODE
            .ORG        VromTOP                 ; ROM area
BCD_MULTIPLE4:                                  ;
;                                               ;
  MOV.L     #0,R2R0                             ; Clears multiplication result area
  MOV.B     #4,A0                               ; Sets number of digits to be multiplied
BCD_MULTIPLE4_10:                               ;
  SHL.L     #4,R2R0                             ; Carry processing
  MOV.W     #0001000000000000B,A1               ; Specifies for 4 bits to be loaded
BCD_MULTIPLE4_20:                               ;
  SHL.W     #1,R3                               ; Loads 4 bits
  ROLC.W    A1                                  ; Loads addition count
  JNC       BCD_MULTIPLE4_20                    ; --> Taking 4 bits    not completed
  JEQ       BCD_MULTIPLE4_40                    ; --> Zero (no addition)
BCD_MULTIPLE4_30:                               ;
  DADD.W    R1,R0                               ;
  XCHG.W    R2,R0                               ; Moves high-order data
  DADC.W    #0,R0                               ; Adds C flag to next high-order digit for carry
  XCHG.W    R2,R0                               ; Moves high-order data
  ADJNZ.W   #-1,A1,BCD_MULTIPLE4_30             ; --> Specified addition count not completed
BCD_MULTIPLE4_40:                               ;
  ADJNZ.W   #-1,A0,BCD_MULTIPLE4_10             ; --> Specified digit count to be multiplied not completed
  RTS                                           ;
  ;                                             ;
            .END ;
```

5.0 Reference

MCU Technical Information Homepage

http://www.infomicom.maec.co.jp/indexe.htm
(or http://www.mdece.com/ , http://www.mitsubishichips.com/products/mcu/index.html or your local Web Site.)

Technical Support

E-mail: support@apl.maec.co.jp
(or your local support E-mail address. A private e-mail address should NOT be used.)

Data Sheet

M16C/80 group
(Use the latest version on the Homepage: http://www.infomicom.maec.co.jp/indexe.htm)

User's Manual

M16C/80 group
(Use the latest version on the Homepage: http://www.infomicom.maec.co.jp/indexe.htm)

RENESAS
Renesas Technology Corp.

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