To our customers,

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April 1\textsuperscript{st}, 2010
Renesas Electronics Corporation

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M16C/60 Series and M16C/20 Series

General-purpose Program for Converting from 4-byte BCD Code to HEX Code

1. Abstract

This program converts 4-byte BCD code into 4-byte HEX code.

2. Introduction

This program converts 4-byte BCD code into 4-byte HEX code. Set the BCD code in R2 and R0 beginning with the upper half. The HEX code is output to R3 and R1 beginning with the upper half.

In this program, the BCD code is divided by 2 (shifted right) and the remainder is loaded into the register as HEX code. If a significant bit is transferred from the BCD’s high-order digit to the low-order digit, numeric correction is applied.

<table>
<thead>
<tr>
<th>Subroutine name : BCDtoHEX_4byte</th>
<th>ROM capacity : 42 bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interrupt during execution : Accepted</td>
<td>Number of stacks used : None</td>
</tr>
</tbody>
</table>

<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>Lower half of BCD code</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>R1</td>
<td>-</td>
<td>Lower part of HEX code</td>
<td>←</td>
</tr>
<tr>
<td>R2</td>
<td>Upper half of BCD code</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>R3</td>
<td>-</td>
<td>Upper part of HEX code</td>
<td>←</td>
</tr>
<tr>
<td>A0</td>
<td>-</td>
<td>(0000_{16})</td>
<td>Loop count</td>
</tr>
<tr>
<td>A1</td>
<td>-</td>
<td>(0000_{16})</td>
<td>Number of digits counter</td>
</tr>
</tbody>
</table>

Usage precautions

The BCD code is destroyed as a result of program execution.
3. Flowchart

ENTER

Initialize HEX area

Set loop count (bit)

Set remainder of BCD code vid. 2 to MSB of HEX data

Set loop count (digit)

Change upper and lower halves for each other

Execute 1-digit correction processing

Change digits

4th digit finished?

Yes

Change upper and lower halves for each other

No

All digits finished?

Yes

Conversion of all digits finished?

No

Yes

EXIT
4. The example of a reference program

```
;************************************************************************
; *                      M16C General-purpose Programs                     *
; *                      CPU : M16C                                    *
; *                     ************************************************************************
VromTOP .EQU 0F0000H ; Declares start address of ROM

;************************************************************************
; Title : Converting from BCD code to HEX code
; Outline : Converts 4-byte BCD code into 4-byte HEX code
; Input : ------------------------------> Output:
; R0 (Lower half of BCD code) R0 (Indeterminate)
; R1 ( ) R1 (Lower part of HEX)
; R2 (Upper half of BCD code) R2 (Indeterminate)
; R3 ( ) R3 (Upper part of HEX)
; A0 ( ) A0 (Indeterminate)
; A1 ( ) A1 (Indeterminate)
; Stack amount used: None
; Notes:
;************************************************************************

.SECTION PROGRAM,CODE
.ORG VromTOP ; ROM area

BCDtoHEX_1byte:
; MOV.W #0,R1 ; Initializes HEX area
MOV.W #0,R3
MOV.B #32,A0 ; Sets loop count
BCDtoHEX_1byte_10:
; SHL.W #-1,R2 ; Shifts most significant bit
RORC.W R0
RORC.W R3
RORC.W R1
MOV.B #8,A1 ; Sets loop count
XCHG.W R2,R0 ; Changes upper/lower halves for each other

BCDtoHEX_1byte_20:
; BTST 3,R0
JEQ BCDtoHEX_1byte_30 ; --> Correction not required
SUB.W #3,R0 ; Executes correction

BCDtoHEX_1byte_30:
; ROT.W #-4,R0 ; Changes digits
CMP.B #5,A1 ; Determines whether high-order correction is completed
JNE BCDtoHEX_1byte_40 ; --> Change of upper/lower halves not required
XCHG.W R2,R0 ; Changes upper/lower halves for each other

BCDtoHEX_1byte_40:
; ADJNZ.W #-1,A1,BCDtoHEX_1byte_20 ; --> Processes next digit correction
ADJNZ.W #-1,A0,BCDtoHEX_1byte_10 ; --> Executes next digit
RTS
```

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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

<table>
<thead>
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<th>Rev.</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td>1.00</td>
<td>Jul 08, 2002</td>
<td>First edition issued</td>
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</table>
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