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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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1. Abstract

This program converts 4-byte HEX code into 5-byte BCD code.

2. Introduction

This program converts 4-byte HEX code into 5-byte BCD code. Set the HEX code in R3 and R1 beginning with the upper half. The BCD code is output to A1, R2, and R0 beginning with the most significant part.

In this program, the HEX code is doubled by decimal calculation sequentially beginning with the most significant bit and the results are added. This operation is repeated by a specified number of bits as the HEX code is converted into BCD code.

<table>
<thead>
<tr>
<th>Subroutine name</th>
<th>ROM capacity</th>
<th>Interrupt during execution</th>
<th>Number of stacks used</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEXtoBCD_4byte</td>
<td>38 bytes</td>
<td>Accepted</td>
<td>2 bytes</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>-</td>
<td>Lower part of BCD code</td>
<td>←</td>
</tr>
<tr>
<td>R1</td>
<td>Lower half of HEX code</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>R2</td>
<td>-</td>
<td>Middle part of BCD code</td>
<td>←</td>
</tr>
<tr>
<td>R3</td>
<td>Upper half of HEX code</td>
<td>Indeterminate</td>
<td>←</td>
</tr>
<tr>
<td>A0</td>
<td>-</td>
<td>0000_{16}</td>
<td>Number of digits counter</td>
</tr>
<tr>
<td>A1</td>
<td>-</td>
<td>Upper part of BCD code</td>
<td>←</td>
</tr>
</tbody>
</table>

Usage precautions

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

ENTER

Initialize BCD area

Set loop count

Shift most significant bit to C flag

Save register

BCD area x 2 + C flag --> BCD area

Restore register

Loop count finished?

Yes

EXIT

No
4. The example of a reference program

```assembly
;****************************************************************************
;* M16C General-purpose Programs *
;CPU : M16C *
;*
;****************************************************************************
VromTOP .EQU 0F0000H ; Declares start address of ROM
;
;==============================================================================
; Title : Converting from HEX code to BCD code
; Outline : Converts 4-byte HEX code into 5-byte BCD code
; Input : ------------------------------> Output:
; R0 ( ) : R0 (Lower part of BCD)
; R1 (Lower half of HEX code) : R1 (Indeterminate)
; R2 ( ) : R2 (Middle part of BCD)
; R3 (Upper half of HEX code) : R3 (Indeterminate)
; A0 ( ) : A0 (Indeterminate)
; A1 ( ) : A1 (Upper part of BCD)
; Stack amount used: 2bytes
; Notes:
;==============================================================================

.SECTION PROGRAM,CODE
.ORG VromTOP ; ROM area
HEXtoBCD_4byte:
;
MOV.W #0,R0 ; Initializes BCD area
MOV.W #0,R2 ;
MOV.W #0,A1 ;
MOV.B #32,A0 ; Sets loop count
HEXtoBCD_4byte_10:
;
SHL.L #1,R3R1 ; Shifts most significant bit to C flag
PUSH.W R1 ; Saves register
MOV.W R0,R1 ;
DADC.W R1,R0 ; Doubled by decimal calculation ; + C flag
XCHG.W R2,R0 ;
MOV.W R0,R1 ;
DADC.W R1,R0 ; Doubled by decimal calculation ; + carry
XCHG.W R0,A1 ;
MOV.W R0,R1 ;
DADC.W R1,R0 ; Doubled by decimal calculation ; + carry
XCHG.W R0,A1 ;
XCHG.W R2,R0 ;
PPOP.W R1 ; Restores register
ADJNZ.W #-1,A0, HEXtoBCD_4byte_10 ; --> Executes next digit
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

Contact for Renesas technical support

Mail to: support_apl@renesas.com
## REVISION HISTORY

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