To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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RENESAS TECHNICAL UPDATE

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Product Category	MPU&MCU		Document No.	TN-16C-A157A/E	Rev.	1.00
Title	M16C/70 Series, M16C80 Series, M32C/80 Series, M32C/90 Series: Usage Precaution for String Instruction, Product-Sum Operation Instruction		Information Category	Technical Notification		
Applicable Product	M16C/70, M16C/80,M32C/80, M32C/81, M32C/82, M32C/83, M32C/84, M32C/85, M32C/86, M32C/87, M32C/88, M32C/95 Groups	Lot No.	Reference Document			

1. Precaution

The string instructions and the product sum operation instruction listed in **1.1 Subject Instructions** will be aborted under the condtions listed in **1.2 Problem Conditions**.

1.1 Subject Instructions

String instructions: SCMPU, SIN, SMOVB, SMOVF, SMOVU, SOUT, SSTR
Product sum operation instruction: RMPA

1.2 Problem Conditions

When DMAC is not used:

1) (a) The interrupt A is requested when bits ILVL2 to ILVL0 in the interrupt control registers are set to other than 000b (level 0, interrupt disabled). However, the interrupt request is not acknowledged because the I flag is set to 0 (interrupt disabled) or the requested interrupt has smaller priority level than IPL (IPL interrupt priority level < 001b) while the interrupt is requested.
   (b) After (a), set the IR bit in the interrupt control register for the interrupt A to 0 (no interrupt request) by program or set the interrupt priority level smaller than the last set level.
   (c) After (b), execute the subject instruction, SCMPU, SIN, SMOVB, SMOVF, SMOVU, SOUT, SSTR, or RMPA, immediately after setting the I flag to 1 or IPL to smaller priority than the interrupt priority level, which is set when an interrupt request is generated, to enable the requested interrupt.

When DMAC is used,

2) (a) The interrupt A is requested when bits ILVL2 to ILVL0 are set to other than 000b. However, the interrupt request is not acknowledged because the I flag is set to 0 or the requested interrupt has smaller priority level than IPL (IPL interrupt priority level < 001b) while the interrupt is requested.
   (b) After (a), set the IR bit for the interrupt A to 0 by program or set the interrupt priority level smaller than the last set level.
   (c) After (b), execute the subject instruction within next three instructions after setting the I flag to 1 or IPL to smaller priority than the interrupt priority level, which is set when an interrupt request is generated, to enable the requested interrupt.

3) (a) Interrupts are generated immediately before or in the middle of executing the subject instruction. The interrupt A request is generated when bits ILVL2 to ILVL0 are set to other than 000b (level 0, interrupt disabled) in the interrupt routine. However, the interrupt request is not acknowledged because I flag is set to 0 or because IPL is equal to or greater than the interrupt priority level even if I flag is set to 1 (multipul interrupts enabled).
   (b) After (a), set the IR bit for the interrupt A to 0 by program or set the interrupt priority level smaller than the last set level.
   (c) After (b), execute the subject instructions after the interrupts are completed with the REIT instruction or FREIT instruction.

If DMA transfer occurs in conditions 2)-(c) or 3)-(c), the subject instruction is aborted.
The patterns for the above conditions 1) through 3) are illustrated in **Figure 1**.

2. Operation Check

Use the flow chart in **Figure 2** to determine whether the countermeasure programs are needed. When the countermeasure is needed, refer to **3. Countermeasure Program**.

3. Countermeasure Program

To execute the subject instruction, interrupts need to be disabled. If interrupts cannot be disabled, use the countermeasure program in **Figure 3**.

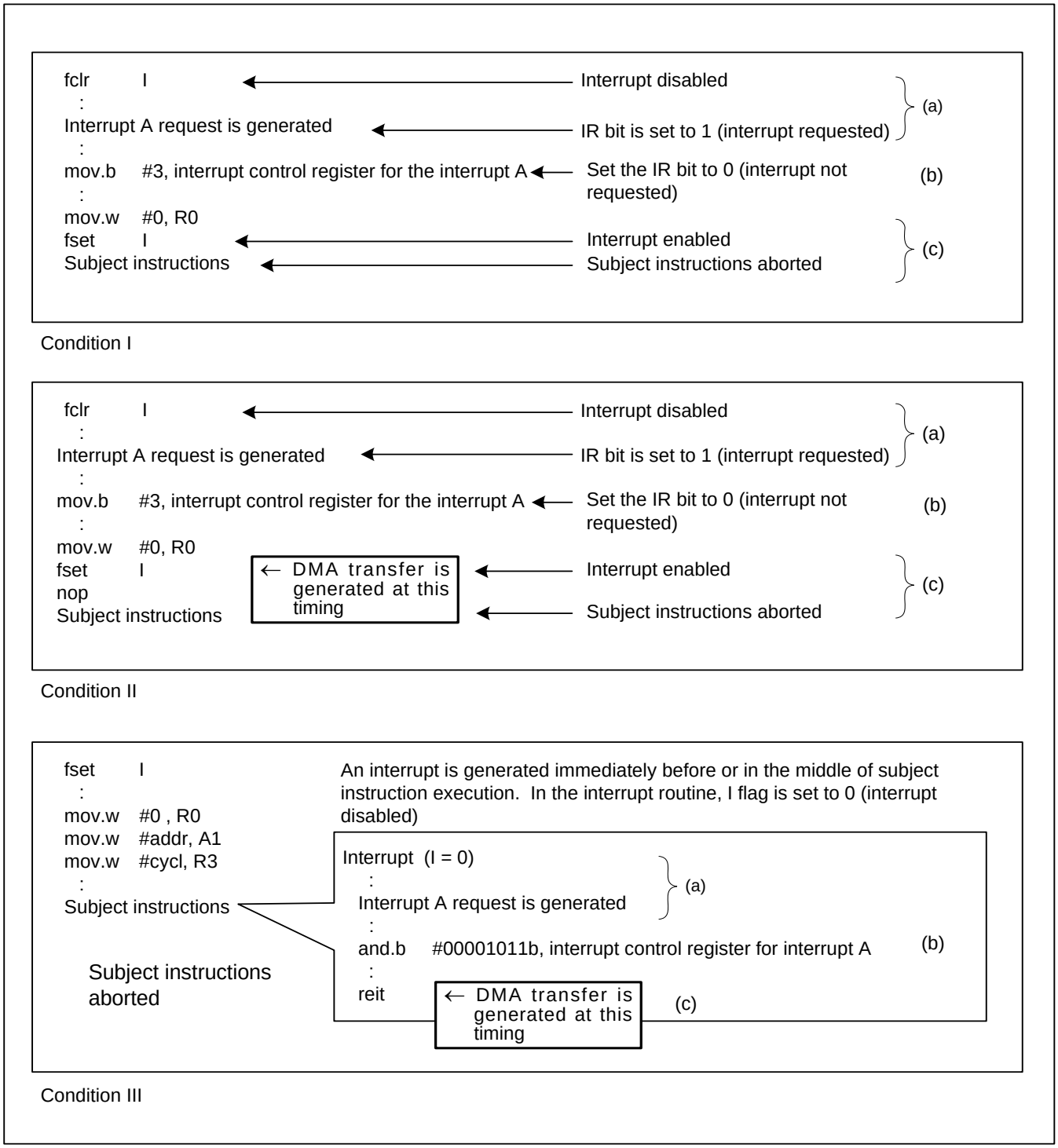

Figure 1. Problem Conditions

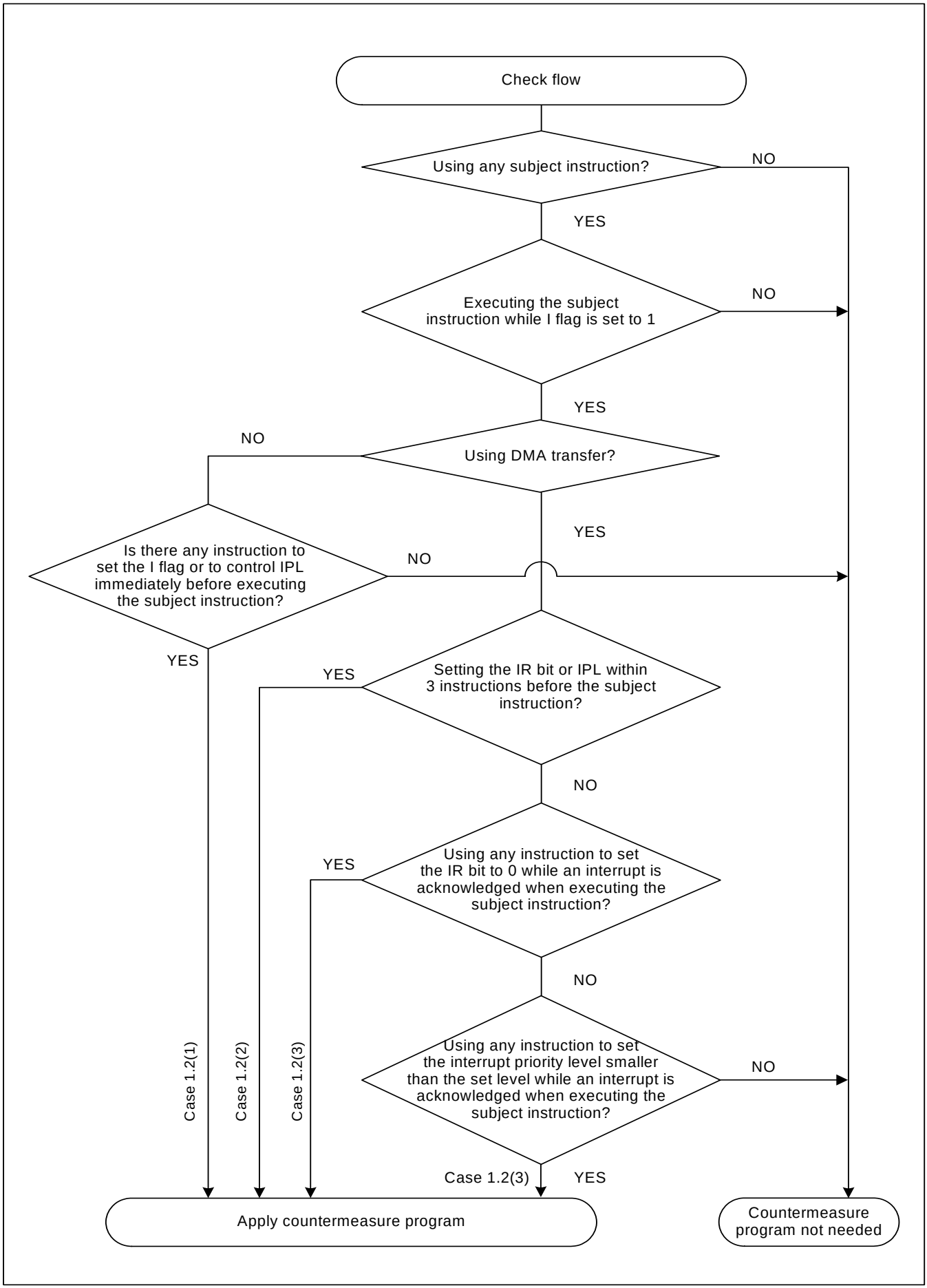

Figure 2. Operation Check Flow

• Instructions SIN, SMOVB, SMOVF, SOUT, and SSTR

```
Loop:
    String instruction
    cmp.w   #0, R3
    jnz     Loop
```

•SMOVU Instruction

When the size specifier is ".B,"

```
Loop:
    smovu.b
    sub.l   #1, A0
    sub.l   #1, A1
    cmp.b   #0, [A0]
    jnz     Loop
```

When the size specifier is ".W,"

```
Loop:
    smovu.w
    sub.l   #1, A0
    sub.l   #1, A1
    cmp.b   #0, [A0]
    jz      Next
    sub.l   #1, A0
    sub.l   #1, A1
    cmp.b   #0, [A0]
    jnz     Loop
Nex:
```

•RMPA Instruction

```
Loop:
    rmpa.b (rmpa.w)
    pushc   FLG
    jz      Next
    popc    FLG
    jmp     Loop
Next:
    popc    FLG
```

•SCMPU Instruction

When the size specifier is ".B,"

```
Loop:
        scmpu.b
        pushc   FLG
        jnz     Next
        sub.l   #1, A0
        sub.l   #1, A1
        cmp.b   #0, [A0]
        jz      Next
        popc    FLG
        jmp     Loop
Next:
        popc    FLG
```

When the size specifier is ".W,"

```
Loop:
        scmpu.w
        pushc   FLG
        jnz     Next
        sub.l   #1, A0
        sub.l   #1, A1
        cmp.b   #0, [A0]
        jz      Next
        sub.l   #1, A0
        sub.l   #1, A1
        cmp.b   #0, [A0]
        jz      Next
        popc    FLG
        jmp     Loop
Next:
        popc    FLG
```

Figure 3. Countermeasuer Programs