CS+ RH850 Compiler CC-RH V1.04.00 Release Note

R20UT3808EJ0100
Rev.1.00
June 30, 2016

Thank you for using the CS+ integrated development environment.

This document describes the restrictions and points for caution. Read this document before using the product.

Contents

Chapter 1. Target Devices

The target devices supported by the CC-RH compiler are listed on the Website.

Please see the URL below.

CS+ Product Page:

http://www.renesas.com/cs+

Chapter 2. User's Manuals

Please read the following user's manuals along with this document.

Manual Name	Document Number
CC-RH Compiler User's Manual	R20UT3516EJ0101
CS+ Integrated Development Environment User's Manual: CC-RH Build Tool Operation	R20UT3283EJ0102

Chapter 3. Keywords When Uninstalling the Product

There are two ways to uninstall this product.

- Use the integrated uninstaller from Renesas (uninstalls all CS+ components)
- Use the Windows uninstaller (only uninstalls this product)

To use the Windows uninstaller, select “CS+ CC-RH V1.04.00” from “Programs and Features” of the control panel.

Chapter 4. Changes

This chapter describes changes to the CC-RH compiler.

4.1 Changes to the CC-RH compiler

This section describes changes to the CC-RH compiler from V1.03.00 to V1.04.00. Note that the features which are only available to users holding a registered license for the Professional edition are indicated as [Professional edition].

4.1.1 Enhanced optimization

For V1.04.00, optimization has been further enhanced on points (a) to (d), listed and described below.

a. Merging of stack areas allocated for auto arrays in different local scopes (reducing the stack size)

The compiler merges stack areas allocated for auto arrays that belong to different blocks ({}) whose lifetimes do not overlap.

```
<Example of source code>
int *g;
void func01(void)
{
    {
        int array01[10];
        g = array01;
         foo();
    }
    {
        int array02[10]; // Lifetimes of array01[10] and array02[10] do not overlap.
        g = array02;
    }
}
```

```
<Code generated by V1.03.00>
_func01:
        .stack _func01 = 88         ; Size of allocated
                                    ; stack = 88bytes
        prepare 0x00000041, 0x00000050
        movhi HIGHW1(#_g), r0, r20
        mov r3, r2
        st.w r2, LOWW(#_g)[r20]
        jarl _foo, r31
        movea 0x00000028, r3, r2
        st.w r2, LOWW(#_g)[r20]
        dispose 0x00000050, 0x00000041, [r31]
```

```
<Code generated by V1.04.00>
_func01:
        .stack _func01 = 52         ; Size of allocated
                                    ; stack = 52 bytes
        prepare 0x00000061, 0x00000028
        movhi HIGHW1(#_g), r0, r20
        mov r3, r21
        st.w r21, LOWW(#_g)[r20]
        jarl _foo, r31
        st.w r21, LOWW(#_g)[r20]
        dispose 0x00000028, 0x00000061, [r31]
```

b. Optimization of constant propagation

Obviously recognizable calculations of constants within loops are omitted.

<Example of source code>

```
int func02(int xtra, int n4, int e1[]) {
  int i,ix,j,k,l;
  j = 1;
  k = 2;
  l = 3;

  for (ix=0; ix<xtra; ix++) {
    for (i=0; i<n4; i++) {
      j = j*(k-j)*(l-k); // j is always 1
      k = l*k-(l-j)*k;   // k is always 2
      l = (l-k)*(k+j);   // l is always 3
      e1[l-2] = j+k+l; // l-2 is always 1, j+k+l is always 6
      e1[k-2] = j*k*l; // k-2 is always 0, j+k*l is always 6
    }
  }
  return e1[0]+e1[1];
}
```

<Code generated by V1.03.00>

```
.BB.LABEL.2_3:    ; bb47
          cmp r7, r11
          bge9 .BB.LABEL.2_5
.BB.LABEL.2_4:    ; bb1
          mov r9, r12
          sub r5, r12
          ; j*(k-j)*(l-k) and
          ; l*k-(l-j)*k, (l-k)*(k+j) are calculated each time.
          mov r5, r13
          sub r2, r13
          mul r12, r2, r0
          mul r13, r2, r0
          mov r9, r12
          sub r2, r12
          mul r5, r12, r0
          mul r9, r5, r0
          sub r12, r5
          sub r5, r9
          mov r5, r12
          add r2, r12
          mul r12, r9, r0
          add r9, r12
          mov r9, r13
          shl 0x00000002, r13
          add r8, r13
          st.w r12, 0xFFFFFFF8[r13]
          mov r5, r12
          mul r2, r12, r0
          mul r9, r12, r0
          mov r5, r13
          shl 0x00000002, r13
          add r8, r13
          st.w r12, 0xFFFFFFF8[r13]
          add 0x00000001, r11
          br9 .BB.LABEL.2_3
```

<Code generated by V1.04.00>

```
          mov 0x00000006, r5
          :
.BB.LABEL.2_3:    ; bb46
          cmp r7, r9
          bge9 .BB.LABEL.2_5
.BB.LABEL.2_4:    ; bb1
          st.w r5, 0x00000004[r8]
          ; 6 is always assigned to e1[1].
          st.w r5, 0x00000000[r8]
          ; 6 is always assigned to e1[0].
          add 0x00000001, r9
          br9 .BB.LABEL.2_3
```

c. Optimization of induction variables

The compiler does not generate code for redundantly updating loop induction variables.

```
<Example of source code>
void callee(unsigned i);
void caller(void){
  unsigned i;
  for(i=128; i != 0; --i){
    callee(i);
  }
}
```

```
<Code generated by V1.03.00>
_caller:
        .stack _func03 = 12
        prepare 0x00000061, 0x00000000
        movea 0x00000080, r0, r20
        mov r20, r21                ; Loop induction variable
                                    ; is redundantly initialized.
.BB.LABEL.3_1:   ; bb
        mov r21, r6
        jarl _callee, r31
        add 0xFFFFFFFF, r21         ; Loop induction variable
                                    ; is redundantly updated.
        loop r20, .BB.LABEL.3_1
.BB.LABEL.3_2:   ; return
        dispose 0x00000000, 0x00000061, [r31]
```

```
<Code generated by V1.04.00>
_caller:
        .stack _func03 = 8
        prepare 0x00000041, 0x00000000
        movea 0x00000080, r0, r20
.BB.LABEL.3_1:   ; bb
        mov r20, r6
        jarl _callee, r31
        loop r20, .BB.LABEL.3_1
.BB.LABEL.3_2:   ; return
        dispose 0x00000000, 0x00000041, [r31]
```

d. Deleting unused code

The ability to delete unused code has been further enhanced.

```
<Example of source code>
unsigned long test(unsigned long long variable, int var){
  if (var){
    variable &= 0x012345678abcdefULL;
  }
  return (variable >> 32);
}
```

```
<Code generated by V1.03.00>
_test:
        .stack _test = 0
        cmp 0x00000000, r8
        bz9 .BB.LABEL.5_2
.BB.LABEL.5_1: ; if_then_bb
        mov 0x78ABCDEF, r2
        and r2, r6                  ; r6 is not referenced
                                    ; in the subsequent lines.
        mov 0x00123456, r2
        and r2, r7
.BB.LABEL.5_2: ; if_break_bb
        mov r7, r10
        jmp [r31]
```

```
<Code generated by V1.04.00>
_test:
        .stack _test = 0
        cmp 0x00000000, r8
        bz9 .BB.LABEL.5_2
.BB.LABEL.5_1:   ; if_then_bb
        mov 0x00123456, r2
        and r2, r7
.BB.LABEL.5_2:   ; if_break_bb
        mov r7, r10
        jmp [r31]
```

4.1.2 Improvements to the feature for checking source code against MISRA-C:2012 rules [Professional edition]

The following rule numbers have been added to those which can be designated as arguments of the -Xmisra2012 option, which selects checking by the compiler of source code against the specified MISRA-C:2012 rules.

2.6 2.7
9.2 9.3
12.1 12.3 12.4
14.4
15.1 15.2 15.3 15.4 15.5 15.6 15.7
16.1 16.2 16.3 16.4 16.5 16.6 16.7
17.1 17.7
18.4 18.5
19.2
20.1 20.2 20.3 20.4 20.5 20.6 20.7 20.8 20.9 20.10 20.11 20.12 20.13 20.14

The following are the numbers of MISRA-C:2012 rules against which the V1.03.00 and V1.04.00 compilers can check source code for compliance.

Rule classification (number of rules in the standard)	*V1.03.00*	*V1.04.00*
Mandatory rules (10)	3	3
Required rules (101)	31	**58**
Advisory rules (32)	7	**21**
Total number of rules (143)	41	**82**

4.1.3 Enhancing the security of dynamic memory management [Professional edition]

A feature has been added for the detection of illicit operations in the releasing of heap space. This feature can be used by linking a dedicated standard library (lib¥v850e3v5¥secure¥libmalloc.lib) of secure functions related to dynamic memory allocation.

An error with code E0562310 will occur if the compiler is not registered for a license to the Professional edition.

Run the dedicated standard library as follows.

1. As well as the actual areas allocated for users in the heap space by the calloc, malloc, and realloc functions, four extra bytes are added before and after each area for the detection of illicit operations.

2. When called, the free and realloc functions determine if any of (a) to (c) applies.

   (a) The argument is not a pointer to an actual area allocated by calloc, malloc, or realloc.

   (b) The four-byte area for detecting illicit operations has been overwritten.

   (c) The pointer is to an area that has already been released.

3. In the event of any of the above, an illicit operation is assumed to have proceeded, and _heap_chk_fail will be called.

The __heap_chk_fail function needs to be defined by the user. Write the processing which should be executed when any illicit operation has been detected in the heap space. For example, if “ABCDEF” is copied from str to the buffer for four letters in the 6th line in the following program, the heap space will be corrupted since the buffer will overflow due to “EF” and the null character (‘¥0’). In this case, _heap_chk_fail will be executed when the related heap space is released by the 8th line.

```
1: #include <string.h>
2: #include <stdlib.h>
3: void func(char *str) {
4:    char *buf;
5:    buf = malloc(4);
6:    strcpy(buf, str);      // Copy ”ABCDEF” from str
7:    …
8:    free(buf);
9: }
```

By using this feature, you can easily counter security problems through measures against the dual release of memory and against buffers overflowing.

4.1.4 Addition of checking for exclusive control

The -Xcheck_exclusion_control option has been added to select checking for exclusive control by CS+.

When this option is designated, the exclusive control check settings file which is generated by CS+ is read, and DBTAG instructions are generated in response to the calling of functions or access to variables designated in the file.

This function assumes usage of the file through CS+, and it should not be directly used by the user.

4.1.5 Rectified points for caution

Points for caution on the following three items no longer apply.

- External labels defined after conditional assembly control instructions (No. 7)
- Designating a member of a packed structure or union in an initializing declaration (No. 8)
- Scope of optimization (No. 10)

4.1.6 Other changes and improvements

Other major changes and improvements are described below.

(a) Improved debugging information

A problem with C and assembly source code not being displayed properly during debugging has been corrected.

(b) Improved prevention of internal errors

A problem with an internal error during building has been corrected.

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