

Contents

Chapter 1	User's Manuals	2
Chapter 2	Changes	3
2.1	Changes to CC-RL	3
2.1.1	Enhanced optimization	3
2.1.2	Improvements to the feature for checking source code against MISRA-C:2012 rules [Professional edition]	6
2.1.3	Improvement to the method of authenticating licenses	7
2.1.4	Change to the output of the initial values for array type variables	7
2.1.5	Specification of the type of end record of Motorola S-type files	7
2.1.6	Change to the specification of link map files	8
2.1.7	Change to the messages for linkage errors	8
2.1.8	Addition of an option for inserting a local label and nop instruction	8
2.1.9	Extension of the functionality of the -vfinfo option	8
2.1.10	Extension of the functionality of the -binary option	8
2.1.11	Addition of #pragma near/far	8
2.1.12	Addition of #pragma pack/unpack	8
2.1.13	Extension of the functionality of #pragma address	9
2.1.14	Acceptance of duplicated #pragma directives when the function to support porting is specified	9
2.1.15	Addition of numbers to messages when using the evaluation version	9
2.1.16	Rectified points for caution	9
2.1.17	Other changes and improvements	9
Chapter 3	Points for Caution	10

Chapter 1 User's Manuals

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

Manual Name	Document Number
CC-RL Compiler	R20UT3123EJ0105

Chapter 2 Changes

This chapter describes changes to V1.05.00 of the CC-RL compiler.

2.1 Changes to CC-RL

This section describes changes to CC-RL from V1.04.00 to V1.05.00.

The features of the latter can only be used if the compiler is registered under the professional license.

They are indicated by **[Professional edition]** from here on.

2.1.1 Enhanced optimization

For V1.05.00, optimization has been further enhanced on points (1) to (2), listed and described below.

(1) Handling of switch statements

<Example of source code>

```
void sub(int);  
void func(int key) {  
    switch(key & 0x3){  
        case 0:  
            sub(0);  
            break;  
        case 1:  
            sub(1);  
            break;  
        case 2:  
            sub(2);  
            break;  
        case 3:  
            sub(3);  
            break;  
        default:  
            sub(4);  
            break;  
    }  
}
```

Since the result of (key & 0x3) at the third line will be 0, 1, 2, or 3, optimization in V1.05.00 takes the fact that the condition for the block default will never be satisfied into account.

```
<Code generated by V1.04.00>
    mov a, x
    and a, #0x03
    bz $.BB@LABEL@1_5
.BB@LABEL@1_1:      ; entry
    dec a
    bz $.BB@LABEL@1_6
.BB@LABEL@1_2:      ; entry
    dec a
    bz $.BB@LABEL@1_7
.BB@LABEL@1_3:      ; entry
    dec a
    bz $.BB@LABEL@1_8
.BB@LABEL@1_4:      ; bb5
    movw ax, #0x0004
    br !!_sub
.BB@LABEL@1_5:      ; bb
    clrw ax
    br !!_sub
.BB@LABEL@1_6:      ; bb2
    onew ax
    br !!_sub
.BB@LABEL@1_7:      ; bb3
    onew ax
    incw ax
    br !!_sub
.BB@LABEL@1_8:      ; bb4
    movw ax, #0x0003
    br !!_sub
```

```
<Code generated by V1.05.00>
    mov a, x
    and a, #0x03
    bz $.BB@LABEL@1_4
.BB@LABEL@1_1:      ; entry
    dec a
    bz $.BB@LABEL@1_5
.BB@LABEL@1_2:      ; entry
    dec a
    bnz $.BB@LABEL@1_6
.BB@LABEL@1_3:      ; bb3
    onew ax
    incw ax
    br !!_sub
.BB@LABEL@1_4:      ; bb
    clrw ax
    br !!_sub
.BB@LABEL@1_5:      ; bb2
    onew ax
    br !!_sub
.BB@LABEL@1_6:      ; bb4
    movw ax, #0x0003
    br !!_sub
```

(2) Alias analysis

<Example of source code>

```
struct tag1 {
    char member1;
    int  member2;
    long long member3;
} StructArray[2];

struct tag2 {
    short index0;
    short index1;
    short index2;
};

void func(struct tag2 *p) {
    StructArray[p->index1].member1 = 1;
    StructArray[p->index1].member2 = 2;
    StructArray[p->index1].member3 = 3;
}
```

Although the address of StructArray[p->index1] would be calculated three times in V1.04.00, it is only calculated once in V1.05.00.

<Code generated by V1.04.00>

```
movw de, ax
movw bc, #0x000C
movw ax, [de+0x02]
mulh
movw bc, ax
mov LOWW(_StructArray)[bc], #0x01
movw ax, [de+0x02]
movw bc, #0x000C
mulh
addw ax, #LOWW(_StructArray+0x00002)
movw hl, ax
onew ax
incw ax
movw [hl], ax
movw ax, [de+0x02]
movw bc, #0x000C
mulh
addw ax, #LOWW(_StructArray+0x00004)
movw de, ax
clrw ax
movw [de+0x06], ax
movw [de+0x04], ax
movw [de+0x02], ax
movw ax, #0x0003
movw [de], ax
ret
```

<Code generated by V1.05.00>

```

push hl
movw de, ax
movw bc, #0x000C
movw ax, [de+0x02]
mulh
addw ax, #LOWW(_StructArray)
movw [sp+0x00], ax
movw de, ax
movw ax, de
mov [de+0x00], #0x01
incw ax
incw ax
movw de, ax
new ax
incw ax
movw [de], ax
movw ax, [sp+0x00]
addw ax, #0x0004
movw de, ax
clrw ax
movw [de+0x06], ax
movw [de+0x04], ax
movw [de+0x02], ax
movw ax, #0x0003
movw [de], ax
pop hl
ret

```

2.1.2 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 -misra2012 option, which selects checking by the compiler of source code against the specified MISRA-C:2012 rules.

The V1.05.00 compiler supports Amendment 1 of MISRA-C:2012.

[Mandatory rules] **12.5, 21.13**

[Required rules] **13.2, 13.5, 21.15, 21.16**

[Advisory rules] **17.5, 17.8**

The following are the numbers of MISRA-C:2012 rules against which each revision of compilers can check source code for compliance.

<i>Rule classification (number of rules in the standard)</i>	<i>V1.02.00</i>	<i>V1.03.00</i>	<i>V1.04.00</i>	<i>V1.05.00</i>
Mandatory rules (16)	3	3	4	6
Required rules (108)	31	58	76	80

Advisory rules (32)	7	21	23	25
Total number of rules (156)	41	82	103	111

2.1.3 Improvement to the method of authenticating licenses

The way licenses are authenticated was improved to reduce build times.

With this improvement, when a license for the professional edition has not been registered and the code includes `#pragma` extended language directives for the professional edition, the compiler operates as follows.

- Versions earlier than V1.05.00

The compiler outputs a warning and ignores the option.

- V1.05.00 and later versions

When the syntax of the `#pragma` extended language directive is correct, the compiler outputs a warning but still ignores the option.

When the syntax of the `#pragma` extended language directive is not correct, the compiler outputs an error message.

2.1.4 Change to the output of the initial values for array type variables

The output of the initial values for array type variables in assembly source code has been changed so that the values are collectively output on one line. This change reduces the load of analytical processing during building and so can reduce build times.

<Example of source code>

```
float flt[4] = {1,2,3,4};
```

<Code generated by V1.04.00>

```
_flt:
    .DB4 0x3F800000 ; float value: 1
    .DB4 0x40000000 ; float value: 2
    .DB4 0x40400000 ; float value: 3
    .DB4 0x40800000 ; float value: 4
```

<Code generated by V1.05.00>

```
_flt:
    .DB4 0x3F800000,0x40000000,0x40400000,0x40800000 ; float 1,2,3,4
```

2.1.5 Specification of the type of end record of Motorola S-type files

A linker option `-end_record` for specifying the types of end records of Motorola S-type files has been added. In versions earlier than V1.05.00, the end record was output to suit the address of the entry point. In V1.05.00, Motorola S-type files can be generated with specified types of end record.

```
-end_record=record
```

For the argument “record”, **S7**, **S8**, or **S9** can be specified.

2.1.6 Change to the specification of link map files

The ATTRIBUTE column which is the relocation attribute was added to “Mapping List” of the link map file.

When **-show=relocation_attribute** is specified, the relocation attribute corresponding to the section is output. For details on the attributes, refer to the CC-RL Compiler User’s Manual.

2.1.7 Change to the messages for linkage errors

The file name is output in messages for the linkage error “F0563102”.

- Versions earlier than V1.05.00

F0563102:Section contents overlap in absolute section <section name>.

- V1.05.00 and later versions

When F0563102:Section contents overlap in absolute section <section name> in <file name>.

2.1.8 Addition of an option for inserting a local label and nop instruction

The **-insert_nop_with_label** option, which is used in the solution for measuring current drawn by CS+ or the e² studio, was added.

This option is for use with CS+ or the e² studio.

2.1.9 Extension of the functionality of the -vfinfo option

The output attribute *attribute* was added to the -vfinfo option.

In V1.05.00, specifying near functions as well as callt functions is now possible. In addition, information on functions in sections specified for the ROM option or the far area is not output.

2.1.10 Extension of the functionality of the -binary option

For the -binary option, items that are specifiable for the section attribute *attribute* have been extended.

- Versions earlier than V1.05.00

CODE,DATA

- V1.05.00 and later versions

CALLT0, CODE, TEXT, TEXTF, TEXTF_UNIT64KP, CONST, CONSTF,
SDATA, DATA, DATAF, OPT_BYTE, and SECUR_ID

2.1.11 Addition of #pragma near/far

The #pragma directives can specify the near or far attribute of functions.

The near or far attribute can be specified at the same time for multiple functions.

2.1.12 Addition of #pragma pack/unpack

The #pragma directives can specify whether a structure is to be packed or not.

Packing can be specified for parts of C source files.

2.1.13 Extension of the functionality of #pragma address

#pragma address can specify an address for the allocation of const variables.

2.1.14 Acceptance of duplicated #pragma directives when the function to support porting is specified

When the function to support porting is specified, the duplication of #pragma directives such as #pragma nop in code will not lead to an error.

2.1.15 Addition of numbers to messages when using the evaluation version

Numbers W0561016 and W0561017 were added to the messages that may be output during building by using the evaluation version. This enables control by using -change_message such that the message is handled as an error when the evaluation version is in use.

W0561016:The evaluation version is valid for the remaining *** days

W0561017:The evaluation period has expired

2.1.16 Rectified point for caution

The point for caution on the following item no longer applies. For details, refer to Tool News.

-Assembly Statements Not in Accord with the Specification (CCRL#001)

2.1.17 Other changes and improvements

Other major changes and improvements are described below.

(a) Improved runtime library for arithmetic operations on the float type

Performance of the runtime library functions for the addition, subtraction, multiplication, and division of float type variables has been improved.

(b) Correction of a compiler

The generation of compiler error code "F0530800" in response to specification of the -merge_files option has been corrected.

(c) Improved prevention of internal errors

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

Chapter 3 Points for Caution

Please refer to the user's manual for caution regarding V1.05.00 of the CC-RL compiler.

All trademarks and registered trademarks are the property of their respective owners.

Revision History

Rev.	Date	Description	
		Page	Summary
Rev.1.00	Jun 20,2017		First Edition issued
Rev.1.01	Jan 16,2021	9	The error in rectified point for caution is corrected.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.