Addition of Variable Sections

CC-RL C Compiler for RL78 Family

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Jun 30, 2015 Rev. 1.00

R20UT3477EJ0100

Introduction

- This document describes how to change the section names to be generated by default and add new sections when using the CC-RL C compiler for the RL78 family.

- This document uses the following tools and versions for description.
  - CC-RL C compiler for the RL78 family V.1.01.00
  - e^2 studio integrated development environment V.4.0.0.26
  - CS+ integrated development environment V.3.01.00

- How to Change Variable Sections
- Adding Section Settings to the C Source
- Adding Settings in the Linker
- Adding Initialization Processing
  - Creating the Initialization Routine (C Language)
  - Modifying the Startup Routine (cstrat.asm)

How to Change Variable Sections

- Adding section settings to the C source
  - Change the names of the variable sections with #pragma section.
- Adding settings in the linker
  - Specify the section for initialized variables as the section mapped from ROM to RAM.
- Adding initialization processing
  - As the startup routine has only the processing for the default sections, either of the following processes should be added.
  - Creating the initialization routine (C language)
    - Create initialization tables and an initialization function and call the created function.
  - Modifying the startup routine (cstrat.asm)
    - As this routine has only the processing for the default sections, the following should be added.
      - Add the processing for initializing the uninitialized variable area to 0.
      - Add the processing for copying initial values to the initialized variable area.

Adding Section Settings to the C Source

- Using #pragma section
  - Change the section names to be output by default.
  - Specification format:
    - #pragma section [*section type*] [*new section name*]
    - Section type:
      - text, const, data, bss
  - Example:

```
#pragma section data Mydata
__near unsigned char a0 = 0, a1 = 1, a2 = 2;

#pragma section bss Mybss
__near unsigned char b0, b1, b2;

#pragma section
```

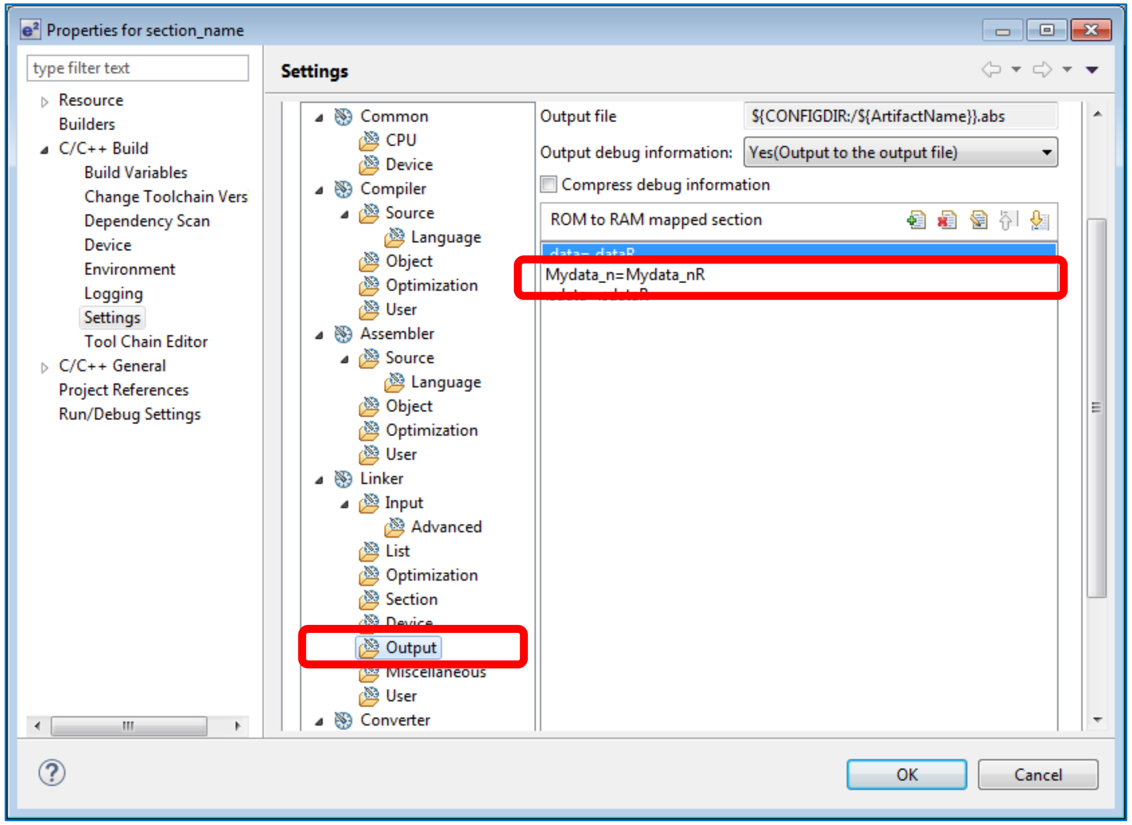
Change to a user-specified section name

Change to a user-specified section name.

Restore the default section names.

Adding Settings in the Linker (1/2)

- Specifying the section for initialized variables as the section mapped from ROM to RAM.
  - Specify the target section with the linker option -rom.
  - Example: e^2 studio



Output file: ${CONFIGDIR:/${ArtifactName}}.abs

Output debug information: Yes(Output to the output file)

☐ Compress debug information

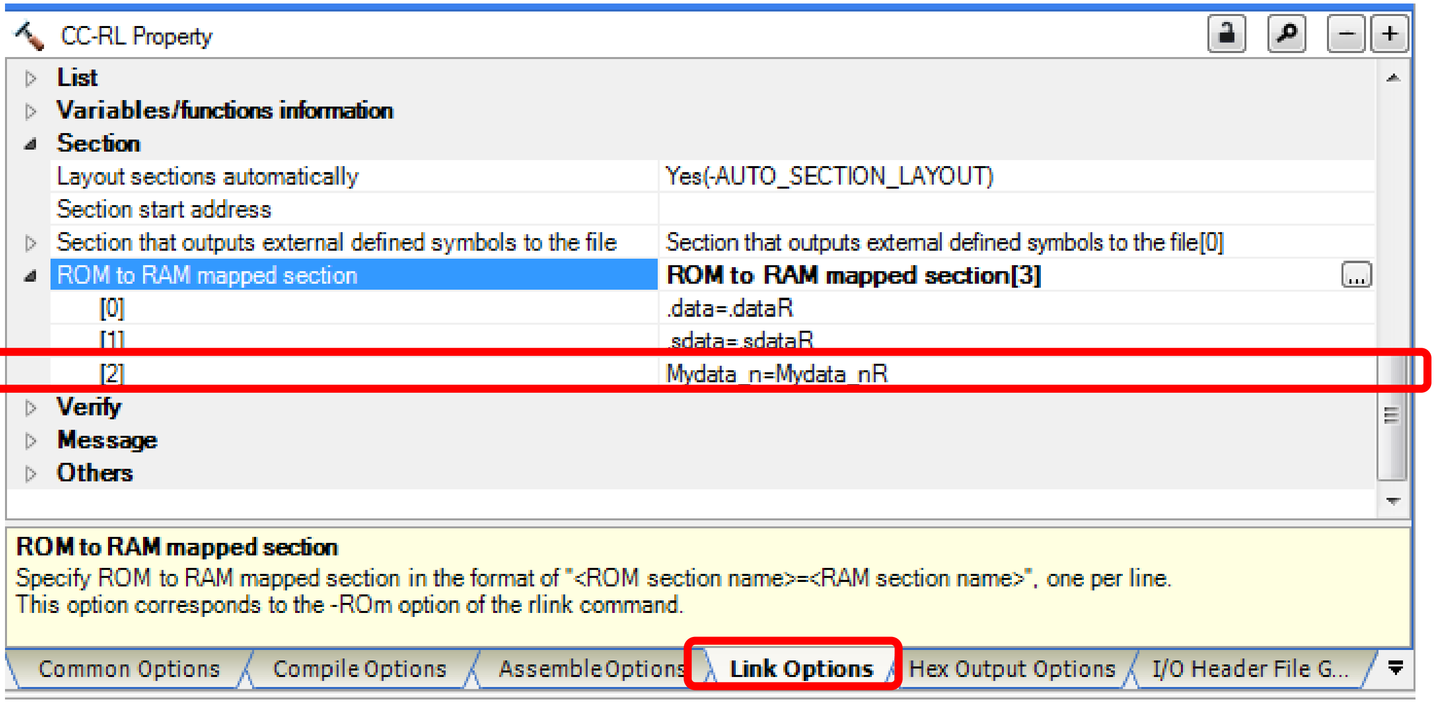
ROM to RAM mapped section

data=_dataR

Mydata_n=Mydata_nR

Adding Settings in the Linker (2/2)

- Example: CS+



CC-RL Property

- List
- Variables/functions information
- Section

Layout sections automatically	Yes(-AUTO_SECTION_LAYOUT)
Section start address	
Section that outputs external defined symbols to the file	Section that outputs external defined symbols to the file[0]
ROM to RAM mapped section	ROM to RAM mapped section[3]
[0]	.data=.dataR
[1]	.sdata=.sdataR
[2]	Mydata_n=Mydata_nR

- Verify
- Message
- Others

ROM to RAM mapped section
Specify ROM to RAM mapped section in the format of "<ROM section name>=<RAM section name>", one per line.
This option corresponds to the -ROm option of the rlink command.

Creating the Initialization Routine (C Language) (1/4)

- Defining an initialization table (for uninitialized variables)
  - Define the section addresses and size to be used by the initialization function.
  - Remark:
    - The examples in this section (Creating the Initialization Routine (C Language)) use structures that enable multiple sections to be handled.
  - Example: initsct.c
    Add the following processing with the name **in blue** changed to the section name output with the #pragma section specification.

```
#define BSEC_MAX 1                      /* Number of BSS sections to be initialized to 0 */

const struct bsec_t {
  char __near *ram_sectop;              /* Section start address */
  char __near *ram_secend;              /* Section end address + 1 */
} bsec_table[BSEC_MAX] = {
  {(char __near *)__sectop("Mybss_n"),
   (char __near *)__secend("Mybss_n")}};
```

Creating the Initialization Routine (C Language) (2/4)

- Defining an initialization table (for initialized variables)
  - Define the section addresses and size to be used by the initialization function.
  - Example: initsct.c
    Add the following processing with the **name in blue** changed to the section name output with the #pragma section specification and the **name in purple** changed to the section name specified with the -rom option.

```
#define DSEC_MAX 1                    /* Number of DATA sections to be copied */

const struct dsec_t {
  char __far *rom_sectop; /* Start address of copy source section */
  char __far *rom_secend; /* End address of copy source section + 1 */
  char __near *ram_sectop; /* Start address of copy destination section */
} dsec_table[DSEC_MAX] = {
  {__sectop("Mydata_n"),
   __secend("Mydata_n"),
   (char __near *)__sectop("Mydata_nR")}};
```

Creating the Initialization Routine (C Language) (3/4)

- Creating an initialization function
  - Create a function for clearing the uninitialized variables to 0 and copying the initial values to the initialized variables by using the initialization tables.
  - Call this function from the main function, etc.

Creating the Initialization Routine (C Language) (4/4)

- Example: initsct.c

```
#define BSEC_MAX 1    /*Number of BSS sections to be initialized to 0*/
#define DSEC_MAX 1    /* Number of DATA sections to be copied*/

void INITSCT_RL(void)
{
  unsigned int i;
  char __far *rom_p;
  char __near *ram_p;
  for (i = 0; i < BSEC_MAX; i++) {
    ram_p = bsec_table[i].ram_sectop;
    for ( ; ram_p != bsec_table[i].ram_secend; ram_p++) {
      *ram_p = 0;
    }
  }
  for (i = 0; i < DSEC_MAX; i++) {
    rom_p = dsec_table[i].rom_sectop;
    ram_p = dsec_table[i].ram_sectop;
    for ( ; rom_p != dsec_table[i].rom_secend; rom_p++, ram_p++) {
      *ram_p = *rom_p;
    }
  }
}
```

Initialize to 0.

Copy the initial values.

Modifying the Startup Routine (cstrat.asm) (1/2)

- Adding the processing for initializing the uninitialized variable area to 0
  - Add the processing for clearing the target section area to 0 by using the section name.
  - Example
    Add the following processing with the **name in blue** changed to the section name output with the #pragma section specification.

Section start address

```
          ; clear external variables which doesn't have initial value (Mybss_n)
          MOVW      HL,#LOWW(STARTOF(Mybss_n))
          MOVW      AX,#LOWW(STARTOF(Mybss_n) + SIZEOF(Mybss_n))
          BR        $.L2_Mybss_n
.L1_Mybss_n:
          MOV       [HL+0],#0
          INCW      HL
.L2_Mybss_n:
          CMPW      AX,HL
          BNZ       $.L1_Mybss_n
```

Section size

Initialize to 0.

Modifying the Startup Routine (cstrat.asm) (2/2)

- Adding the processing for copying the initial values to the initialized variable area.
  - Add the processing for copying the initial values by using the section name.
  - Example
    Add the following processing with the **name in blue** changed to the section name output with the #pragma section specification and the **name in purple** changed to the section name specified with the -rom option.

Section start address (in ROM)

```
            ; copy external variables having [illegible]l value (Mydata_n)
            MOV         ES,#HIGHW(STARTOF(Mydata_n))
            MOVW        BC,#LOWW(SIZEOF(Mydata_n))
            BR          $.L2_Mydata_n
.L1_Mydata_n:
            DECW        BC
            MOV         A,ES:LOWW(STARTOF(Mydata_n))[BC]
            MOV         LOWW(STARTOF(Mydata_nR))[BC],A
.L2_Mydata_n:
            CLRW        AX
            CMPW        AX,BC
            BNZ         $.L1_Mydata_n
```

Section size

Copy the initial values.

Section start address (in RAM)

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