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Renesas Electronics Corporation

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740 Family

C-ASM Mixture Program

1. Abstract

The following document describes examples how to write a C-ASM mixture program in ICC740.

2. Introduction

- Interface between functions.
 - Rules for passing parameters.
 - Rules for passing return values.
 - Interface keywords.
- Calling assembly language program from C language program.
- Describe the memory assign about parameters and return values according to actual C-ASM mixture programs.

3. Content

3.1 Interface between function

Assembly language subroutines can be called from a C language program. Use this interface to call assembly language from C language.

This section describes interfacing between functions in ICC740.

3.1.1 Rules for passing parameters

The ICC740 uses different places in which to store parameters depending on the data types of parameters. The following Table 1 shows how parameters are passed to a function.

Table 1 Parameter passing table

Type of parameter	Passed via
Char type	Accumulator (Note 1)
Other types	C_ARGN or C_ARGZ(Note 2)

Notes: 1. For first parameter only.

2. C_ARGN: stores Auto variables and parameters to functions in N page.

C_ARGZ: stores Auto variables and parameters to functions in Z page.

3.1.2 Rules for passing return values

The ICC740 uses different places in which to store return values depending on the data types of return values. The following Table 2 shows how return values are passed to a function.

Table 2 Return values table

Type of parameter	Passed via
Char type	Accumulator
Other types	EXPR_STACK (Note 1)

Notes: 1. EXPR_STACK: expression stack(whose size is specified in link740.xcl, manipulated by register X).

3.1.3 Interface keywords

To declare the functions in an assembly language program to be called from a C language program, use the assembler interface keyword “DEFFN”. For the functions in an assembly language program, you need to declare the names of those functions with “PUBLIC.” Then, in the C language program, declare those functions names as “EXTERN”.

Figure 1 is shown to use the assembler interface key word “DEFFN”.

Parameters of “a”, “b” can be decided by the user assemble language subroutine. Otherwise parameters of “x”, “y” are decided by the parameter type of C program .

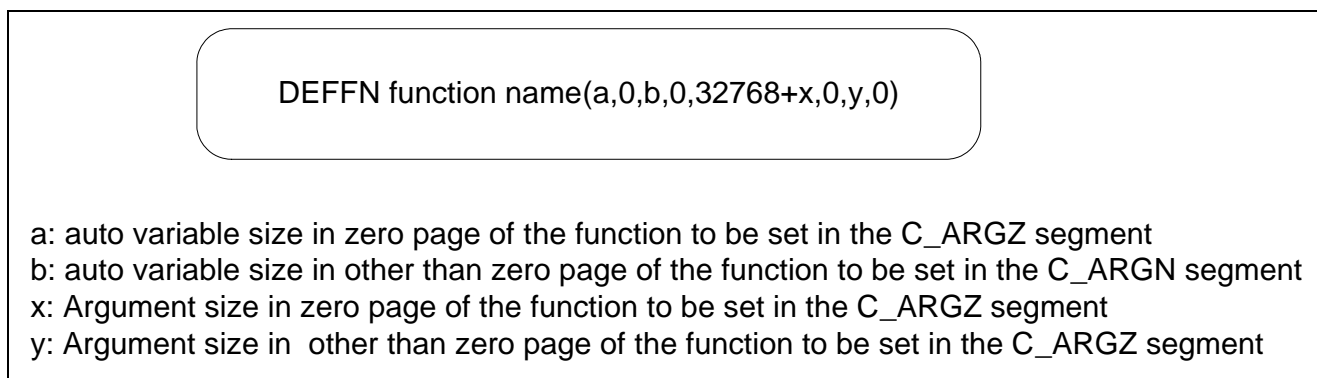


Figure 1 Setting Of Interface Keyword DEFFN

An example of how to set the “DEFFN” in C-ASM mixture program is shown in figure 2.

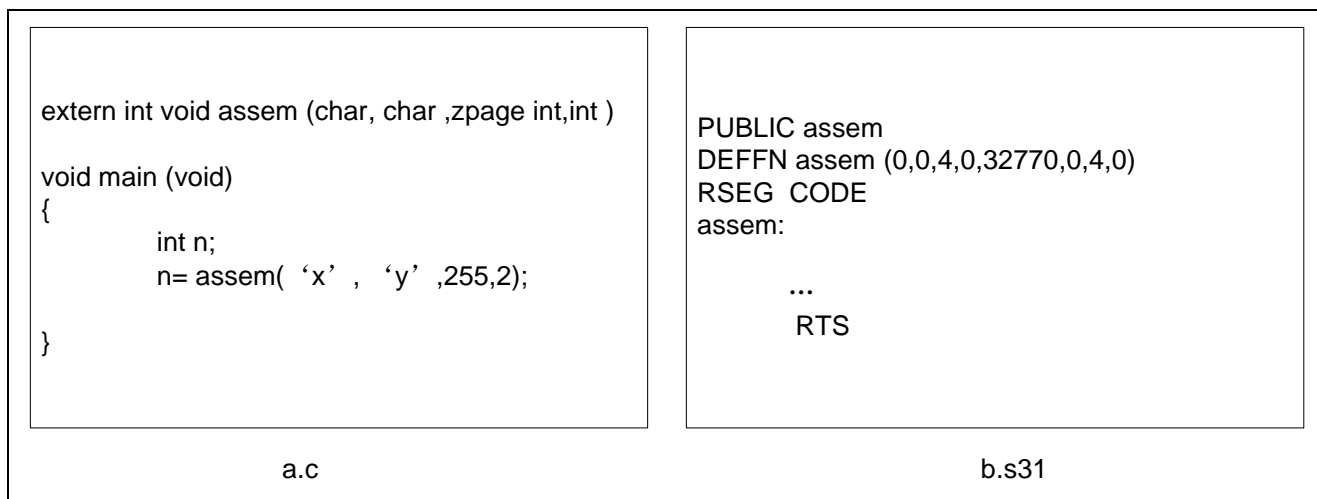


Figure 2 Example Of Setting DEFFN

In C program ,the subroutine “assem” has one parameter whose type is “int” in “ZPAGE”. So the x value in (32768+x) is “2(byte)”. The other parameters are all in “NPAGE”, the size of npage parameters are “4(bytes)”, so the value of “y” in “DEFFN” is “4”. In “assem” assemble language program need 4 byte auto variable size which can be decided by user in “NPAGE”, so the value of “b” is 4.

3.2 Calling assembly language subroutine

To call assembly language subroutines (assembly language functions) from a C language program, follow the rules described below.

- Write the subroutine in a separate file from the C language program.
- For the subroutine name, follow the symbol conversion rules.
- In the C language program from which to call, declare the prototype of the subroutine(assembly language function). At this time, use the storage-class specifier “extern”.
- In the subroutine(assembly language function), do not normally alter the X register and flag values that are used exclusively by the ICC740. If the X register or flag value needs to be altered, save the value on entry to the function and restore it from the stack on exit from the function. Figure 3 shows how to call the assembly language subroutine.

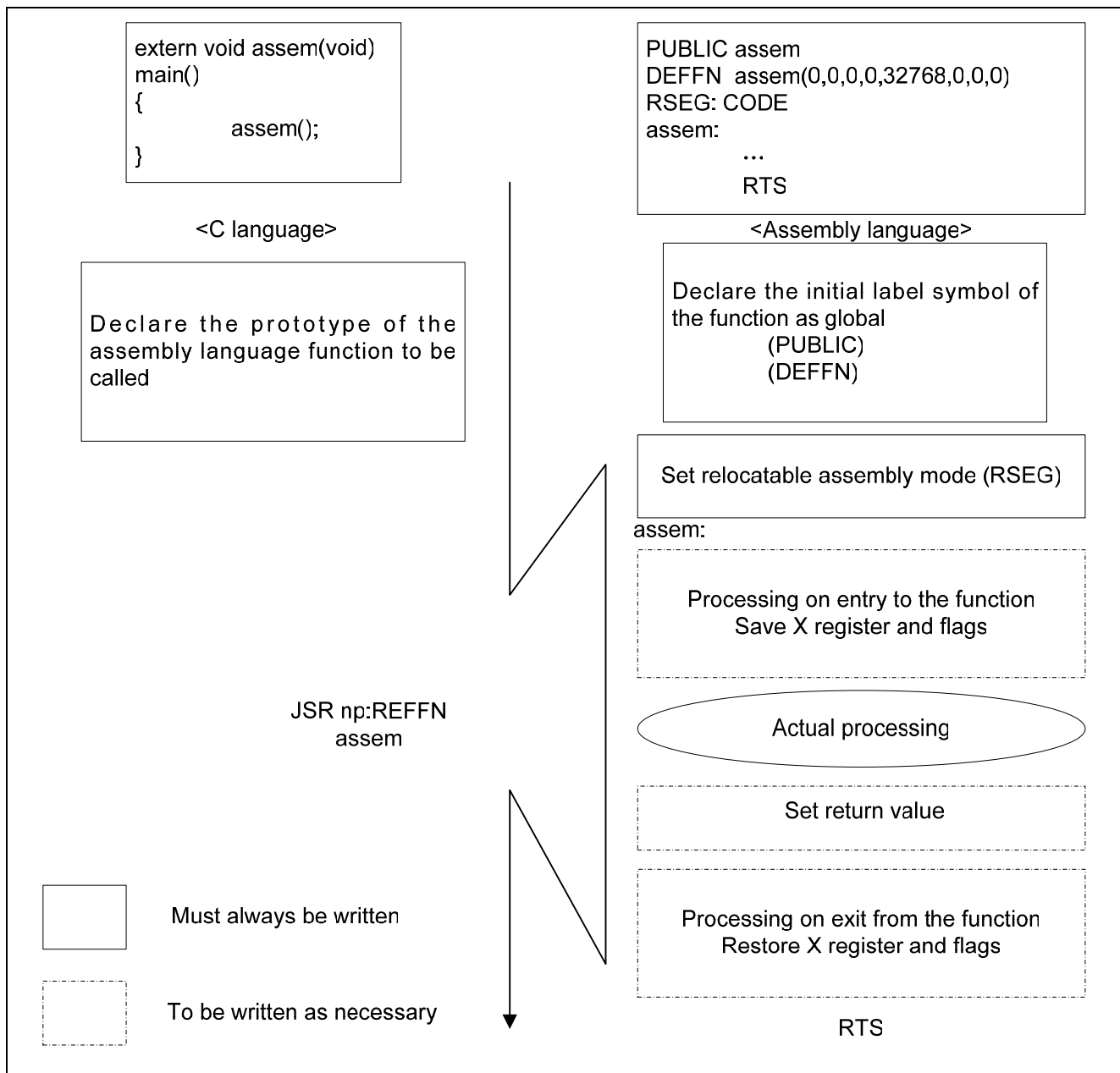


Figure 2 Call The Assembly Language Subroutine

3.3 Parameter passing and memory assign

This section will describe how the parameters and return values are passed according to the different types in the actual C-ASM mixture program and how the memory is assigned. Figure 3 and Figure 4 will show the the passing with “char” type . Figure 5 and Figure 6 will show the passing other than “char ”type. For passing the parameters correctly, it is important to know where the parameters are placed both in C and assembly program.

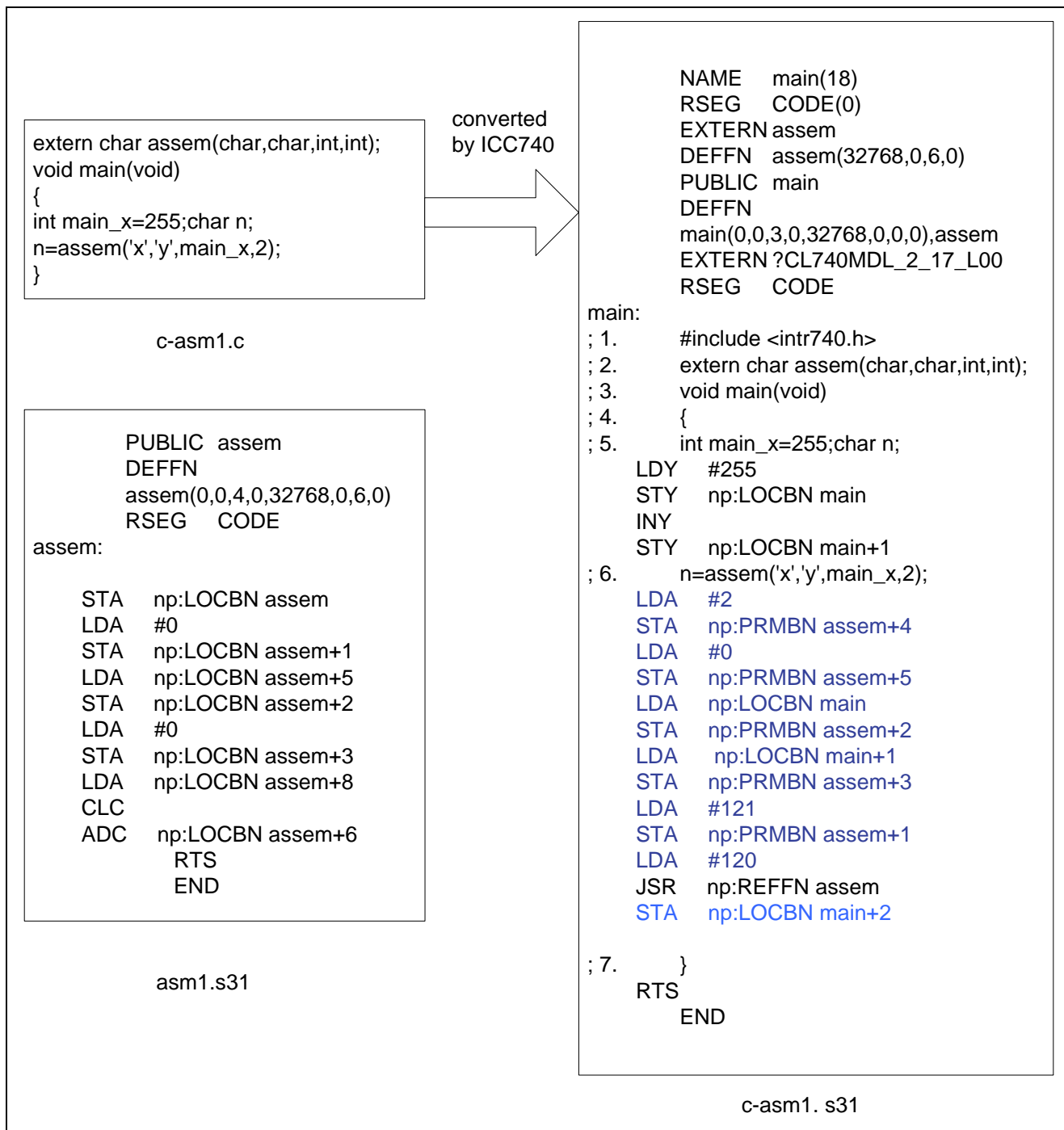


Figure 3 C Program And ASM Program (1)

Program c-asm1.s31 is the assembly language program which is created by compiler ICC740. From c-asm1.s31, we can know how the compiler deal with the parameter and return value. The red part in c-asm1.s31 is the disposal of parameter before calling assembly language subroutine. The blue part in c-asm1.s31 is the disposal of return value after returned from assembly language subroutine. Because the first parameter of “assem” subroutine is “char”, so the character ‘x’ will be put to the register A. And the return value is also the character, so the return value is put to the register A likewise. The memory assign is shown in Figure 4.

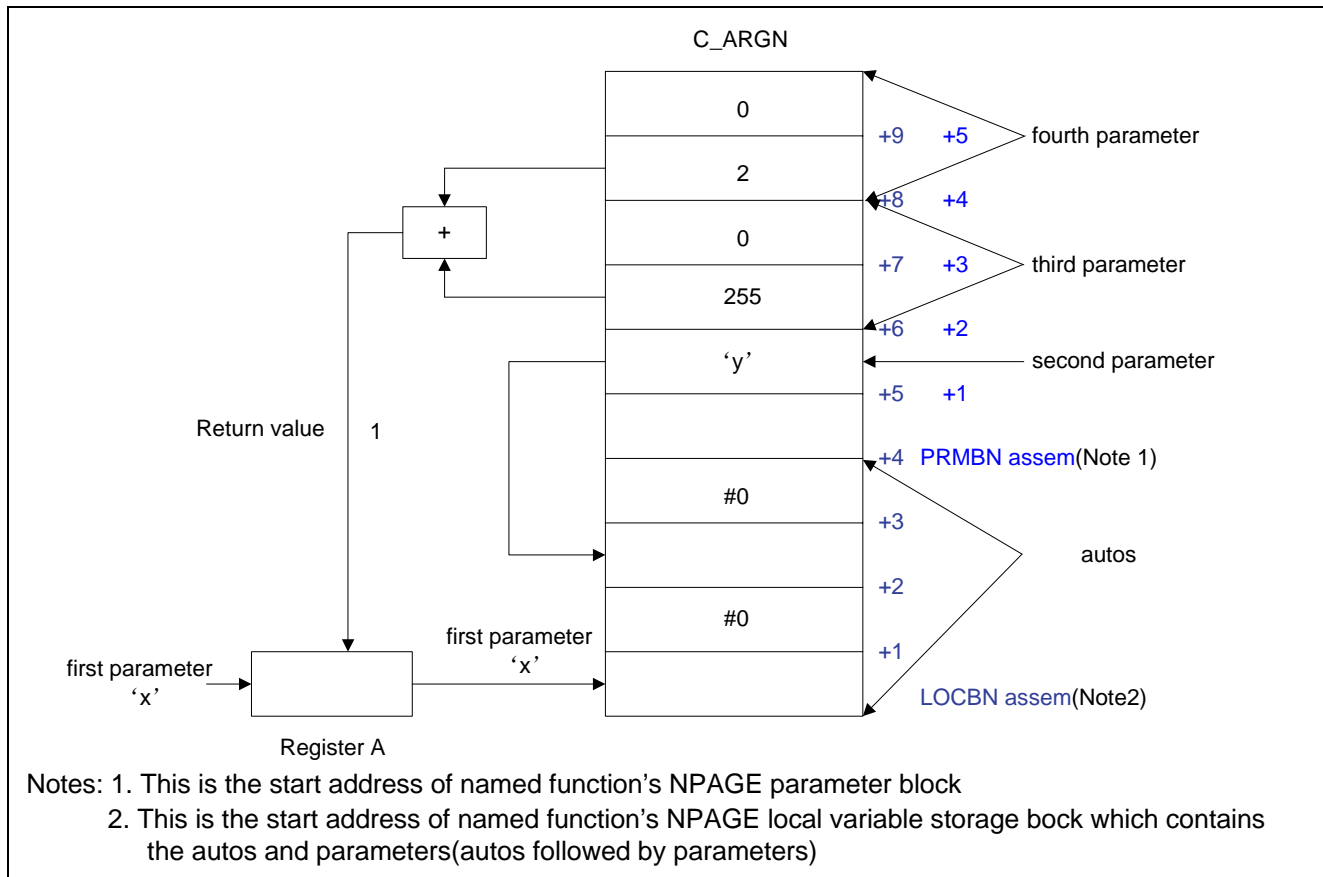


Figure 4 Memory Assign (1)

From Figure 4, we can know that addresses , which are (PRMBN assem),(PRMBN assem+1)... (PRMBN assem+5), are used to store the parameters. Though the first parameter is put to register A ,in C_ARGN segment there still reserved the places for the first parameter. Autos in assembly language subroutine are stored following the address of parameters.

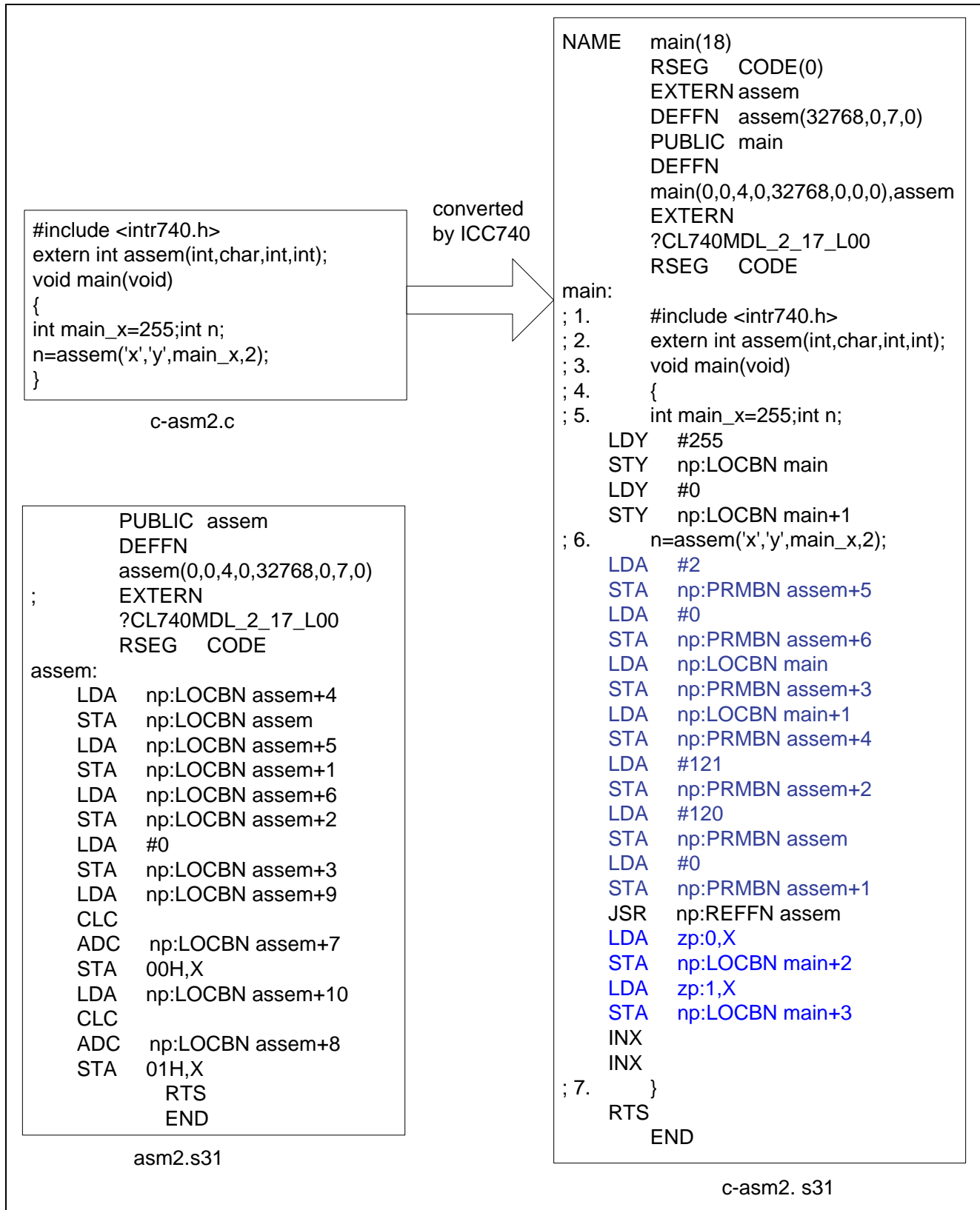


Figure 5 C Program And ASM Program (2)

Because the first parameter of “assem” subroutine is “int”, so the integer character ‘a’ will be put to the C_ARGN segment. And the return value is also the integer, so the return value should be put to the EXPR_STACK. The memory assign is shown in Figure 6.

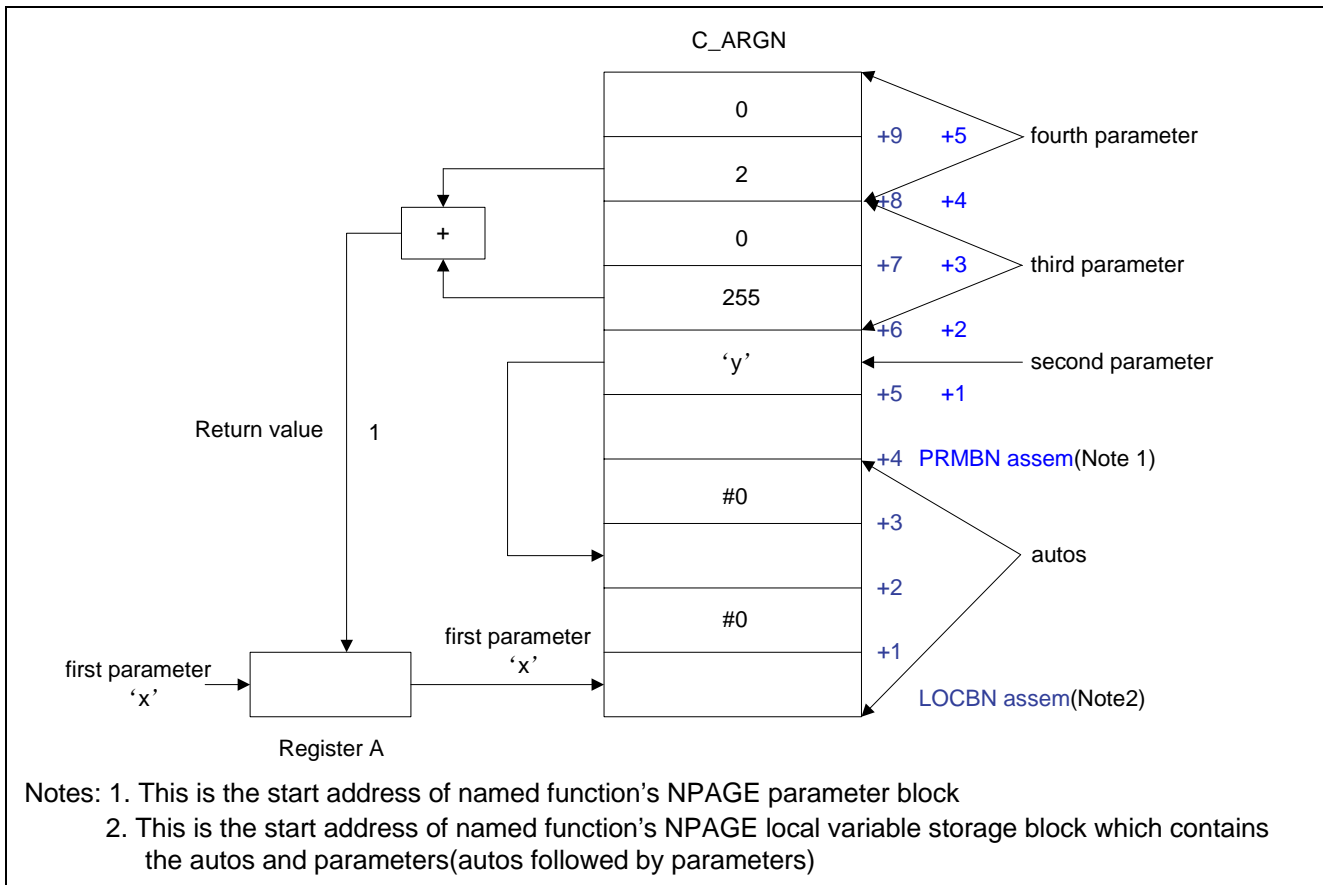


Figure 6 Memory Assign (2)

4. Sample program

```

/*****
* File Name      : main.c
* Contents       : Demo program for C-ASM mixture
* Copyright      : Renesas Technology Corp.,
* Version        : 1.00 ( 2005-12-28 ) Initial
*
*****/
#include <intr740.h>
extern int assem(int,char,int,int)      ;Declare assem as "EXTERN"
void main(void)
{
    int main_x=255
    int n;
    n=assem('x','y',main_x,2)           ;Calling assembly subroutine and
                                        return integer value
}

/*****
* File Name      : asm.s31
* Contents       : Demo program for C-ASM mixture
* Copyright      : Renesas Technology Corp.,
* Version        : 1.00 ( 2005-12-28 ) Initial
*
*****/
PUBLIC  assem
DEFFN   assem(0,0,4,0,32768,0,7,0)      ;Declare the initial label symbol of
                                        the function as global
        RSEG   CODE                    ;Set relocatable assembly mode
assem:
LDA     np:LOCBN assem+4
STA     np:LOCBN assem
LDA     np:LOCBN assem+5
STA     np:LOCBN assem+1                ;Move the value in memory
LDA     np:LOCBN assem+6
STA     np:LOCBN assem+2
LDA     #0
STA     np:LOCBN assem+3                ;Move the value in memory
LDA     np:LOCBN assem+9
CLC
ADC     np:LOCBN assem+7
STA     00H,X
LDA     np:LOCBN assem+10
CLC
ADC     np:LOCBN assem+8
STA     01H,X                            ;take the integer sum to EXPR stack
RTS
END

```

5. Reference

Renesas web-site

<http://www.renesas.com/>

Contact for Renesas technical support

E-mail: csc@renesas.com

Software manual

740 family programming guidelines Rev.1.00

740 C complier programming guide Rev.1.00

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Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Dec.28.05	—	First edition issued

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