GigaDevice Semiconductor Inc.

Arm® Cortex®-M3/4/23/33 32-bit MCU

Application Note
AN038

AN038
Method for adding CRC check batch processing of IEC60730
Flash self-check in keil environment

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1.   Introduction

In the IEC60730 self-inspection test, self-inspection is required for the on-chip flash of the mcu. In order to realize the automatic calculation and addition of the CRC value, it is necessary to add a CRC check batch process step in the IDE. For this reason, this application note describes how to add CRC check batch processing method in the Keil environment, the process is described as follows.

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2.　　　Addition of CRC check batch

There is no function to directly calculate the CRC value in the Keil environment. Therefore, it is necessary to calculate the CRC value with the help of open source tools and automatically add it to the end of the .hex file during the compilation process to facilitate the normal operation of the flash self-check program.

2.1.　　　Addition of files required for CRC value

1. First download the Srecord tool, create a new 'bin' folder in the project directory, and copy srec_cat.exe, srec_cmp.exe and srec_info.exe to this folder.

2. Add the gen_crc.bat, IEC_TEST_BOOT_FLASH.sct and CRC_LOAD.ini files in the project directory. The gen_crc.bat file is used to call the Srecord tool to calculate the CRC value, and store the value at the end of the .hex file to facilitate the self-test of the entire flash, and print the CRC value calculated by the Srecord tool in the build window. The command code of the file is as follows:

```
SET MAP_FILE=Listings\Project.map

::-----------------get CRC address information line
SET TMP_FILE=crc_temp.txt
FINDSTR /R /C:"^   *CHECKSUM" %MAP_FILE%>%TMP_FILE%
SET /p crc_search=<%TMP_FILE%
DEL %TMP_FILE%
::----------------CRC address
for /f "tokens=1 delims=(" %%a in ("%crc_search%") do set crc_search=%%a
SET crc_search=%crc_search:CHECKSUM=%
for /f "tokens=1 delims= " %%a in ("%crc_search%") do set CRC_ADDR=%%a


SET /a CRC_ADDR_END=%CRC_ADDR%+4
::-----------------choose CRC32 or CRC16
FINDSTR  /R  /C:"^     *crc_block_data_calculate"  %MAP_FILE%  >  nul  &&
call :OK||call :NO


goto :eof
:OK
::--------------------CRC32
bin\srec_cat.exe Objects\Project.hex -intel -crop 0x08000000 %CRC_ADDR%  -fill
0xff   0x08000000   %CRC_ADDR%      -stm32-l-e   %CRC_ADDR%      -o
Objects\Project_checked.hex -intel
```

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```
bin\srec_cat.exe  Objects\Project.hex  -intel  -crop  0x08000000  %CRC_ADDR%
Objects\Project_checked.hex -intel  -crop %CRC_ADDR% %CRC_ADDR_END%  -o
Objects\Project.hex -intel
bin\srec_cat.exe          Objects\Project.hex          -intel          -
crop %CRC_ADDR% %CRC_ADDR_END%      -o  -hex-dump
goto :eof


:NO
::--------------------CRC16
bin\srec_cat.exe Objects\Project.hex -intel -crop 0x08000000 %CRC_ADDR%  -fill
0xff 0x08000000 %CRC_ADDR%  -crc16-l-e %CRC_ADDR% -POLYnomial ccitt -
XMODEM  -o  Objects\Project_checked.hex -intel
bin\srec_cat.exe  Objects\Project.hex  -intel    -crop  0x08000000  %CRC_ADDR%
Objects\Project_checked.hex -intel  -crop %CRC_ADDR% %CRC_ADDR_END%  -o
Objects\Project.hex -intel
bin\srec_cat.exe          Objects\Project.hex          -intel          -
crop %CRC_ADDR% %CRC_ADDR_END%      -o  -hex-dump
goto :eof


exit
```

IEC_TEST_BOOT_FLASH.sct is a scatter loading file, which defines the loading address of each program segment and variable. The CRC value (CHECKSUM) is fixed at the end of the FLASH space through the code shown below.

```
; ************************************************************
;
; *** Scatter-Loading Description File generated by uVision ***
; ************************************************************
;

LR_IROM1 0x08000000 0x0001FFF8 {
    ER_IROM1 0x08000000 0x0001FFF8 {
        *.o (RESET, +First)
        *(InRoot$$Sections)
        .ANY (+RO)
    }

    ; RAM test during run time
    RAM_BUF 0x20000004
    {
        gd32e10x_test_prerun.o (RAM_RUN_BUF)
    }

    ; RAM pointer during run time
    RAM_PTR 0x20000030
```

```
    {
        gd32e10x_test_prerun.o (RAM_RUN_PTR)
    }


    ; variables of IEC test
    IEC_TEST_VAR 0x20000040 UNINIT 0x0000070
    {
        gd32e10x_test_prerun.o (IEC_TEST_RAM)
    }


    ; RW data
    RW_IRAM1 0x200000B0 UNINIT 0x00005000
    {
        .ANY (+RW +ZI)
    }


    ; stack overflow test
    STACK_IRAM2 0x200050B0 UNINIT 0x00002F40
    {
        gd32e10x_test_prerun.o (STACK_OV_TEST)
        startup_gd32e10x.o (STACK, +Last)
    }
}


LR_IROM2 0x0801FFFC 0x0000004 {
    ER_IROM2 0x0801FFFC 0x0000004
    {
        *.o (CHECKSUM, +Last)
    }
}
```

The CRC_LOAD.ini file is used to download the .hex file with the CRC value added to the
MCU under test, so that the CRC value is automatically added to the self-check program
without manual addition. The code is as follows:

```
LOAD "Objects\\Project.hex"
```

2.2.   Configure batch processing

1. After adding the above three files in the project directory, open the project and select the
gen_crc.bat file in Options for Target->user->After Build/Rebuild, as shown in ***Figure 2-1.
Select the gen_crc.bat file*** as shown.

Figure 2-1. Select the gen_crc.bat file

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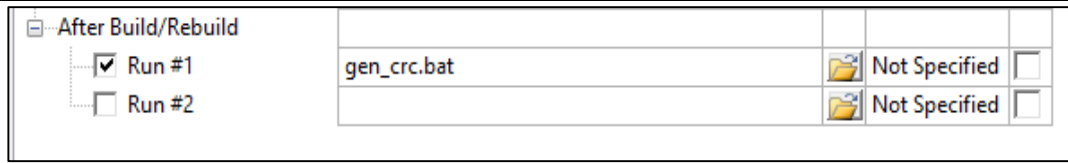
2. Select the IEC_TEST_BOOT_FLASH.sct file in the Scatter File option of Options for Targe->Linker, as shown in **_Figure 2-2. Select the IEC_TEST_BOOT_FLASH.sct file_** as shown.

Figure 2-2. Select the IEC_TEST_BOOT_FLASH.sct file

3. Select the CRC_LOAD.ini file in the Init File option of Options for Targe->Utilities, as shown in **_Figure 2-3.Select the CRC_LOAD.ini file_**.

Figure 2-3.Select the CRC_LOAD.ini file

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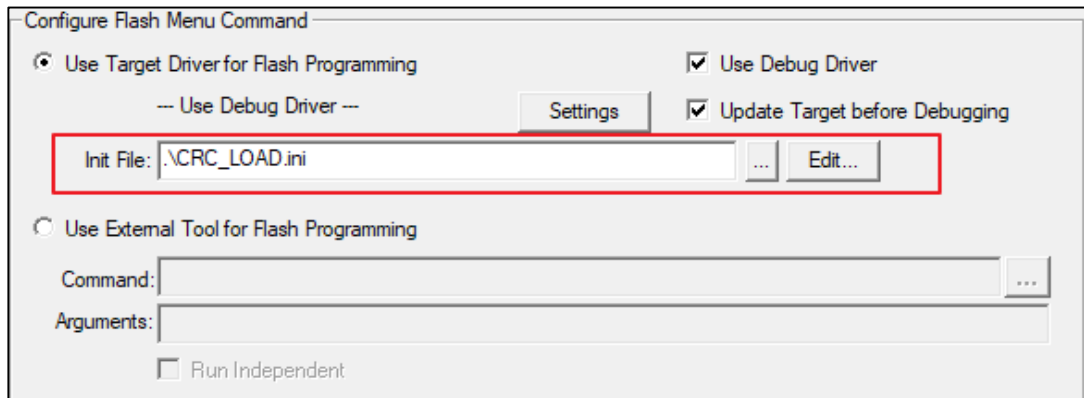
3.   Results

After the configuration is completed, click Compile, and you can observe the build information in the Build Output window, as shown in *Figure 3-1. Build information*, showing that the CRC value has been stored in the location after 0x0801FFF0; click Debug, and query the address of 0x0801FFF0 in the memory observation window, as shown in *Figure 3-2. 0x0801FFF0 address*, it can be seen that the value in the memory is consistent with the CRC value displayed in the Build Output window, and the CRC value calculation batch has been added successfully.

Figure 3-1. Build information

Figure 3-2. 0x0801FFF0 address

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4. Revision history

Table 4-1. Revision history

Revision No	Description	Date
1.0	Initial Release	Oct.19,2021

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