

Application note

GCC development environment based on Windows Application Note

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1. Overview

Taking N32H785 series MCU as an example, this paper introduces the methods of setting up development environment, compiling, firmware downloading and code debugging based on VScode editor, GCC compilation tool chain and GDB debugging tool under Windows environment.

2. Development tools

2.1 software

- 1) Editor Visual Studio Code 1.5x.x or above
- 2) Compile toolchain arm-none-eabi-gcc 6.3.1 or above
- 3) Make for Windows
- 4) Download and debugging tool JLink_v6.40(need to be no higher than the hardware support version) or above

2.2 hardware

- 1) Development board N32 H785xIx7-STB V1.0
- 2) JLink Downloader V9.2(need to be no lower than the software support version) or above

3. Development environment setup

3.1 Installing VScode

- **Download the software:** <https://code.visualstudio.com/>

VScode is used for code viewing and editing, and it also provides powershell and bash terminals for command-line operations, which will be used throughout our development process.

3.2 Installing the GCC Compilation tool chain

- **Download address:**
<https://launchpad.net/gcc-arm-embedded/+announcement/28093>
example version: [10-2020-q4-major](#)

Check whether the installation is successful: Open the DOS command line window, type `arm-none-eabi-gcc -v`,

The installation is successful if:

```
C:\Users\tan.dengwang>arm-none-eabi-gcc --version
arm-none-eabi-gcc (GNU Arm Embedded Toolchain 10-2020-q4-major) 10.2.1 20201103
(release)
Copyright (C) 2020 Free Software Foundation, Inc.
```

If you don't succeed

1. Check whether environment variables are properly added
2. Go to “*C:\Program Files (x86)\GNU Arm Embedded Toolchain\10-2020-q4-major\bin*” and check whether the `arm-none-eabi-gcc.exe` file name is correct

3.3 Installing Make for Windows

This tool is used to parse Makefile scripts and can be installed with either of the following software.

- **Install the cmake.exe tool**
Download address: <http://www.equation.com/servlet/equation.cmd?fa=make>
- **Install MinGW software and use its own make tool.**

Check whether the installation is successful: Open the DOS command line window and enter `make -v` as follows:

```
C:\Users\tan.dengwang>make -v
GNU Make 3.82.90
Built for i686-pc-mingw32
Copyright (C) 1988-2012 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
```

If you don't succeed

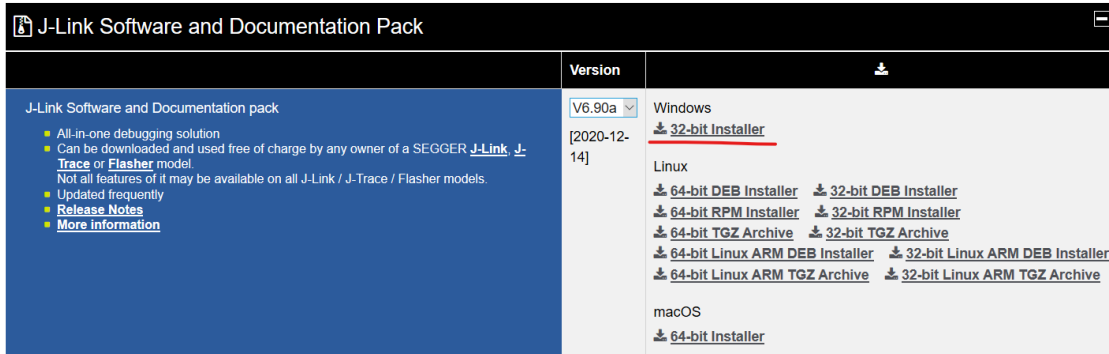
- 1, Check that the environment variables are properly added
- 2, Go to the bin folder of the corresponding `make` installation directory to check whether the

make.exe file is correctly named

3.4 Installing the JLink Tool

- Download the JLINK installation package, V6.90a or others version

<https://www.segger.com/downloads/jlink/#-LinkSoftwareAndDocumentationPack>



3.5 Adding Chip Support

After installing JLink, we need to add our company's chip patch package to JLink, so that we can get the download algorithm correctly during downloading and debugging.

For details, see <jlink Tool Adding Nations Chip.7z>.

3.6 JLink download test

- Test the JLink environment installation

- 1, Connect the PC and j-Link debugger, connect the development board, and power on;
- 2, Open cmd.exe command line tool, go to JLink installation directory C:\Program Files (x86)\SEGGER\JLink_V640, type jlink.exe.

```
Microsoft Windows [版本 10.0.19045.5247]
(c) Microsoft Corporation。保留所有权利。

C:\Program Files (x86)\SEGGER\JLink_V640>JLink.exe
SEGGER J-Link Commander V6.40 (Compiled Oct 26 2018 15:06:29)
DLL version V6.40, compiled Oct 26 2018 15:06:02

Connecting to J-Link via USB...O.K.
Firmware: J-Link V9 compiled May 7 2021 16:26:12
Hardware version: V9.40
S/N: 59417452
License(s): RDI, GDB, FlashDL, FlashBP, JFlash
VTref=3.304V

Type "connect" to establish a target connection, '?' for help
J-Link>
```

The image above shows that the PC successfully connected to the JLink debugger.

- 3, Then according to the prompt input: “connect”, “N32H785XIX7:CM4”, “SWD”, “4000”, if the previous operation is successful, you will see the following output information, JLink download debugging environment can be used normally.

```
Type "connect" to establish a target connection, '?' for help
J-Link>connect
Please specify device / core. <Default>: N32H785XIX7:CM4
Type '?' for selection dialog
Device>
Please specify target interface:
  J) JTAG (Default)
  S) SWD
  T) cJTAG
TIF>S
Specify target interface speed [kHz]. <Default>: 4000 kHz
Speed>
Device "N32H785XIX7:CM4" selected.

Connecting to target via SWD
Executing J-Link script file function: InitTarget()
*****
J-Link script: NationsTech Cortex-M4 J-Link script
*****
Found SW-DP with ID 0x2BA01477
AP map detection skipped. Manually configured AP map found.
AP[0]: AHB-AP (IDR: Not set)
AP[1]: AHB-AP (IDR: Not set)
AP[2]: AHB-AP (IDR: Not set)
AP[2]: Core found
AP[2]: AHB-AP ROM base: 0xE00FF000
CPUID register: 0x410FC241. Implementer code: 0x41 (ARM)
Found Cortex-M4 r0p1, Little endian.
FPUnit: 6 code (BP) slots and 2 literal slots
CoreSight components:
ROMTbl[0] @ E00FF000
ROMTbl[0][0]: E000E000, CID: B105E00D, PID: 000BB00C SCS-M7
ROMTbl[0][1]: E0001000, CID: B105E00D, PID: 003BB002 DWT
ROMTbl[0][2]: E0002000, CID: B105E00D, PID: 002BB003 FPB
ROMTbl[0][3]: E0000000, CID: B105E00D, PID: 003BB001 ITM
ROMTbl[0][4]: E0040000, CID: B105900D, PID: 000BB9A1 TPIU
ROMTbl[0][5]: E0041000, CID: B105900D, PID: 000BB925 ETM
Cortex-M4 identified.
J-Link>
```

4.SDK Contens

SDK follows the issued SDK version, currently using V1.2.0, on this basis to make the following modifications to adapt to GCC development environment.

4.1 Makefile

In the "GCC" folder of the H78x_GCD_In_Slash routine directory in the SDK package:

Nations.N32H7xx_Library.1.2.0 > projects > n32h7xx_EVAL > applications > H78x_GCC_In_Flash > GCC			▼	🔍
名称	修改日期	类型		
Makefile	2026/1/16 14:13	文件		

The "Makefile" file is the GCC compilation script file.

4.2 .s file

In the SDK package "*Nations.N32H7xx_Library.1.2.0\firmware\CMSIS\device\startup*" there are GCC compiler .S files "*startup_n32h78x_cm4_gcc.s*" and "*startup_n32h78x_cm7_gcc.s*" in the corresponding path.

Nations.N32H7xx_Library.1.2.0 > firmware > CMSIS > device > startup				在 startup 中搜索
名称	修改日期	类型		
startup_n32h73x_76x.s	2026/1/12 11:27	S 文件		
startup_n32h73x_76x_EWARM.s	2026/1/12 11:27	S 文件		
startup_n32h73x_76x_gcc.s	2026/1/19 9:19	S 文件		
startup_n32h76x_ITCM_gcc.s	2026/1/16 17:39	S 文件		
startup_n32h78x_cm4.s	2026/1/12 11:27	S 文件		
startup_n32h78x_cm4_EWARM.s	2026/1/12 11:27	S 文件		
<u>startup_n32h78x_cm4_gcc.s</u>	2025/4/25 12:04	S 文件		
startup_n32h78x_cm7.s	2026/1/12 11:27	S 文件		
startup_n32h78x_cm7_EWARM.s	2026/1/12 11:27	S 文件		
<u>startup_n32h78x_cm7_gcc.s</u>	2025/4/25 11:25	S 文件		

4.3 .ld file

In the SDK package, "*Nations.N32H7xx_Library.1.2.0\firmware\CMSIS\device*" there are .ld files "*n32h78x_cm4_flash.ld*" and "*n32h78x_cm7_flash.ld*" in the corresponding path.

Nations.N32H7xx_Library.1.2.0 > firmware > CMSIS > device			在 devi
名称	修改日期		
startup	2026/1/19 9:19		
n32h7xx.h	2026/1/12 11:27		
n32h73x_76x_flash.ld	2026/1/16 11:32		
n32h76x_ITCM_flash.ld	2026/1/16 17:31		
<u>n32h78x_cm4_flash.ld</u>	2025/4/24 17:25		
<u>n32h78x_cm7_flash.ld</u>	2025/4/24 17:24		
system_n32h7xx.c	2026/1/12 11:27		
system_n32h7xx.h	2026/1/12 11:27		

4.4 Printing remapping

The "*print_remap.c*" file is added in the "*bsp/src*" directory of the SDK package for serial port printing remapping.

× Nations.N32H7xx_Library.1.2.0 > projects > n32h7xx_EVAL > bsp > src			在 src 中搜索
名称		修改日期	
bsp_sdram.c		2026/1/12 11:27	
delay.c		2026/1/12 11:27	
log.c		2026/1/14 10:02	
print_remap.c		2026/1/16 11:30	

4.5 J-Link script

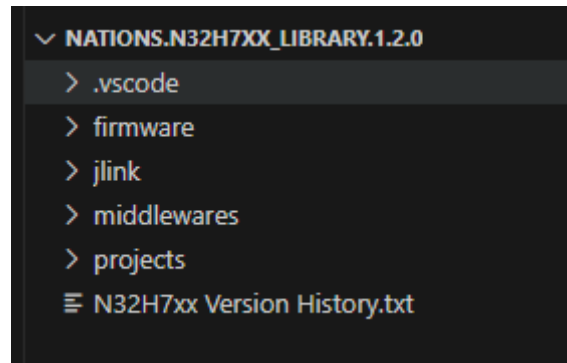
Added the jlink folder in the SDK home directory, which contains a Jlink download script for downloading firmware using the J-Link tool.

开发套件 > SDK > Nations.N32H7xx_Library.1.2.0 > jlink			在 jlink
名称		修改日期	
flash.jlink		2023/1/4 16:28	
flash_CM4.jlink		2025/4/25 14:04	
flash_CM7.jlink		2025/4/25 14:04	

5. Compile and download

5.1 Workspace

Open the SDK folder in VScode and save it as a workspace. At this point, the ".vscode" folder will be generated under the SDK folder to place the workspace configuration file.



5.2 Working Directory

Take the GPIO routine LedBlink as an example to enter the project directory:

"Nations.N32H7xx_Library.1.2.0\projects\n32h7xx_EVAL\applications\H78x_GCC_In_Flash"

GCC project "GCC"

Project source file "CMx/src /xxx.c"

Project header file "CMx/inc/XXX.h"

Makefile file "GCC/Makefile"

5.3 Code Compilation

In the terminal of the VScode editor, switch to the "GCC" folder directory and type "make" to start CM7 compiling

```
PS D:\desktop\GCC\Nations.N32H78x_Library.0.2.0\projects\n32h78x_EVAL\examples\GPIO\LedBlink\GCC> make
```

And CM7's .elf, .bin and .hex files are generated when compiled error-free

```
-m7 -mthumb -Wl,--gc-sections --specs=nosys.specs -Xlinker -Map=build_CM7/output_CM7.map -T../../../../../../../../firmware/OSIS/device/n32h78x_flash_cm7.ld -o build_CM7/output_CM7.elf
arm-none-eabi-size build_CM7/output_CM7.elf
text data bss dec hex filename
11840 2128 12396 26364 66fc build_CM7/output_CM7.elf
arm-none-eabi-objcopy -O ihex -S build_CM7/output_CM7.elf build_CM7/output_CM7.hex
arm-none-eabi-objcopy -O binary -S build_CM7/output_CM7.elf build_CM7/output_CM7.bin
```

In this case, the "build_CM7" folder is created under the "GCC" folder. The compiled firmware and intermediate files are stored in this folder.

type "make DCORE=CM4" to start CM4 compiling

```
PS D:\desktop\GCC\Nations.N32H78x_Library.0.2.0\projects\n32h78x_EVAL\examples\GPIO\LedBlink\GCC> make DCORE=CM4
```

And CM4's .elf, .bin and .hex files are generated when compiled error-free

```
-m4 -mthumb -hl,--gc-sections --specs=nosys.specs -Xlinker -Map=build_CM4/output_CM4.map -T../.../.../firmware/CHSIS/device/n32h76x_78x_flash_cm4.ld -o build_CM4/output_CM4.elf
arm-none-eabi-size build_CM4/output_CM4.elf
text      data      bss      dec      hex filename
3496      1888      12324    16900    4204 build_CM4/output_CM4.elf
arm-none-eabi-objcopy -O ihex -S build_CM4/output_CM4.elf build_CM4/output_CM4.hex
arm-none-eabi-objcopy -O binary -S build_CM4/output_CM4.elf build_CM4/output_CM4.bin
```

In this case, the “**build_CM4**” folder is created under the “**GCC**” folder. The compiled firmware and intermediate files are stored in this folder.

5.4 Downloading Firmware

1. Connect PC->JLink->development board
2. On the terminal, type “**make download**” to download the code for CM7

```
PS E:\workspace_linqi\3605\GCC\Nations.N32G430_Library.1.0.0\projects\n32g430_EVAL\examples\GPIO\LedBlink\GCC> make download
```

Some information will be printed in the process...Finally, the download is complete

```
Writing target memory failed.
J-Link>r
Reset delay: 0 ms
Reset type NORMAL: Resets core & peripherals via SYSRESETREQ & VECTRESET bit.
Reset: Halt core after reset via DEMCR.VC_CORERESSET.
Reset: Reset device via AIRCR.SYSRESETREQ.
J-Link>g
J-Link>qc

Script processing completed.

"Download Completed!"
```

3. Enter "make download DCORE=CM4" on the terminal to download the code for CM4, and the result is the same as CM7

```
PS D:\desktop\GCC\Nations.N32H78x_Library.0.2.0\projects\n32h78x_EVAL\examples\GPIO\LedBlink\GCC> make download DCORE=CM4
```

4. After downloading, CM7&CM4 system will automatically reset and start running
5. If the download fails, check the JLink configuration

5.5 Clearing Intermediate Files

Type "**make clean**" on the terminal to clear the intermediate files generated by the compilation.

6.Code debugging

6.1 VSCode set

There is a ".vscode" folder in the SDK working path, which contains "launch.json" workspace configuration files that need to be configured for code debugging:

« Natio... > .vscode

在 .vscode 中搜索

名称

launch.json

settings.json

tasks.json

修改日期

2022/4/6 14:51

2021/11/12 16:42

2022/4/6 14:49

类型

JSON 文件

JSON 文件

JSON 文件

launch.json:

```

vscode > {} launch.json > Launch Targets > {} gdb-arm
1
2 {
3   "version": "1.0.0",
4   "configurations": [
5     {
6       "name": "gdb-arm",
7       "type": "cppdbg",
8       "request": "launch",
9       "targetArchitecture": "arm",
10      "program": "output",
11      "args": [],
12      "stopAtEntry": true,
13      "cwd": "${workspaceFolder}",
14      "environment": [],
15      "externalConsole": false,
16      "MIMode": "gdb",
17      "miDebuggerPath": "C:\\Program Files (x86)\\GNU Arm Embedded Toolchain\\10 2020-q4-major\\bin\\arm-none-eabi-gdb.exe",
18      "miDebuggerServerAddress": "localhost:2331",
19      "setupCommands": [
20        {
21          "description": "Enable pretty-printing for gdb",
22          "text": "-enable-pretty-printing",
23          "ignoreFailures": false
24        }
25      ],
26      "customLaunchSetupCommands": [
27        {
28          "text": "target remote :2331",
29          "description": "connect to server",
30          "ignoreFailures": false
31        },
32        {
33          "text": "file 'D:/desktop/GCC/Nations.N32H78x_Library.0.2.0/projects/n32h78x_EVAL/examples/GPIO/LedBlink/GCC/build_CM4/output_CM4.elf'",
34          "description": "load file to gdb",
35          "ignoreFailures": false
36        },
37        {
38          "text": "load",
39          "description": "download file to MCU",
40          "ignoreFailures": false
41        },
42        {
43          "text": "monitor reset",
44          "description": "reset MCU",
45          "ignoreFailures": false
46        },
47        {
48          "text": "b main",
49          "description": "set breakpoints at main",
50          "ignoreFailures": true
51        }
52      ],
53      "launchCompleteCommand": "None",
54      // "preLaunchTask": "build"
55    }
56  ]
57 }
```

This is the vscode debugger configuration file, and the following changes should be made according

to your project path:

1, specify the path to the **GDB** debugger :(absolute path)

```
"miDebuggerPath": "C:\\Program Files (x86)\\GNU Arm Embedded Toolchain\\10-2020-q4-major\\bin\\arm-none-eabi-gdb.exe",
```

The version of the **GDB** tool must match the version of the compiler tool. Otherwise, errors will be reported or some functions will be unavailable. The **arm-none-eabi-gdb.exe** tool is usually in the same directory as the **arm-none-eabi-gcc.exe** tool.

2, specify debug code **xxx.elf** file path: (Note: path cannot be too long)

```
"text": "file 'D:/desktop/GCC/Nations.N32H78x_Library.0.2.0/projects/n32h78x_EVAL/examples/GPIO/LedBlink/GCC/build_CM4/output_CM4.elf'",
```

The file paths generated by CM4 and CM7 are different, so they need to be modified here during debugging in different kernels.

6.2 Makefile Settings

Open the routine "**GCC/Makefile**" file:

```
download:
ifeq ($(DCORE), CM4)
    @$(JK_DPATH)JLink.exe -device $(CHIP_TYPE) -if SWD -speed 4000 -autoconnect 1 -CommanderScript $(JKS_DIR)/flash_CM4.jlink
else
    @$(JK_DPATH)JLink.exe -device $(CHIP_TYPE) -if SWD -speed 4000 -autoconnect 1 -CommanderScript $(JKS_DIR)/flash_CM7.jlink
endif
@echo "Download Completed!"

debug:
    @$(JK_DPATH)JLinkGDBServer.exe -select USB -device $(CHIP_TYPE) -if SWD -speed auto -noir -LocalhostOnly

# *** EOF ***
```

1, you can see that there is a debug startup configuration pointing to the JLinkGDBserver server in the JLink installation directory.

2. The **make** command is in debug mode by default, with some debugging information. If you want to compile CM4, compile the code with the following command: **make DCORE=CM4**. If you want to switch to the release version, compile the code with the following command: **make Release=y**.

6.3 Debugging Examples

Using the GPIO LedBlink project as an example, see how to start code debugging:

1. Open SDK project in vscode, switch to **LedLink/GCC** directory in terminal, and type **make** to compile CM7 code

```
PS D:\desktop\GCC\Nations.N32H78x_Library.0.2.0\projects\n32h78x_EVAL\examples\GPIO\LedBlink\GCC> make
```

```
-m7 -mthumb -Wl,--gc-sections --specs-nosys.specs -Xlinker -Map=build_CM7/output_CM7.map -T./../../../../../../../../Firmware/QMSIS/device/n32h76x_78x_flash_cm7.ld -o build_CM7/output_CM7.elf
arm-none-eabi-size build_CM7/output_CM7.elf
text      data      bss      dec      hex filename
11840     2128     12396     26364     66fc build_CM7/output_CM7.elf
arm-none-eabi-objcopy -O ihex -S build_CM7/output_CM7.elf build_CM7/output_CM7.hex
arm-none-eabi-objcopy -O binary -S build_CM7/output_CM7.elf build_CM7/output_CM7.bin
```

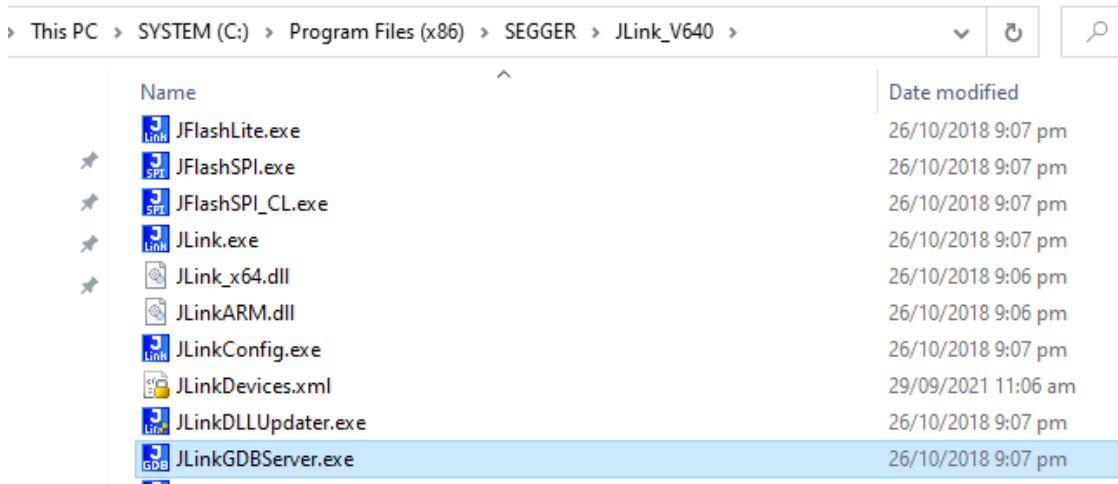
output_CM7.elf, output_CM7.bin, output_CM7.hex files are generated in **GCC/build_CM7** folder.

If compiling CM4 code, refer to section 5.3 as above.

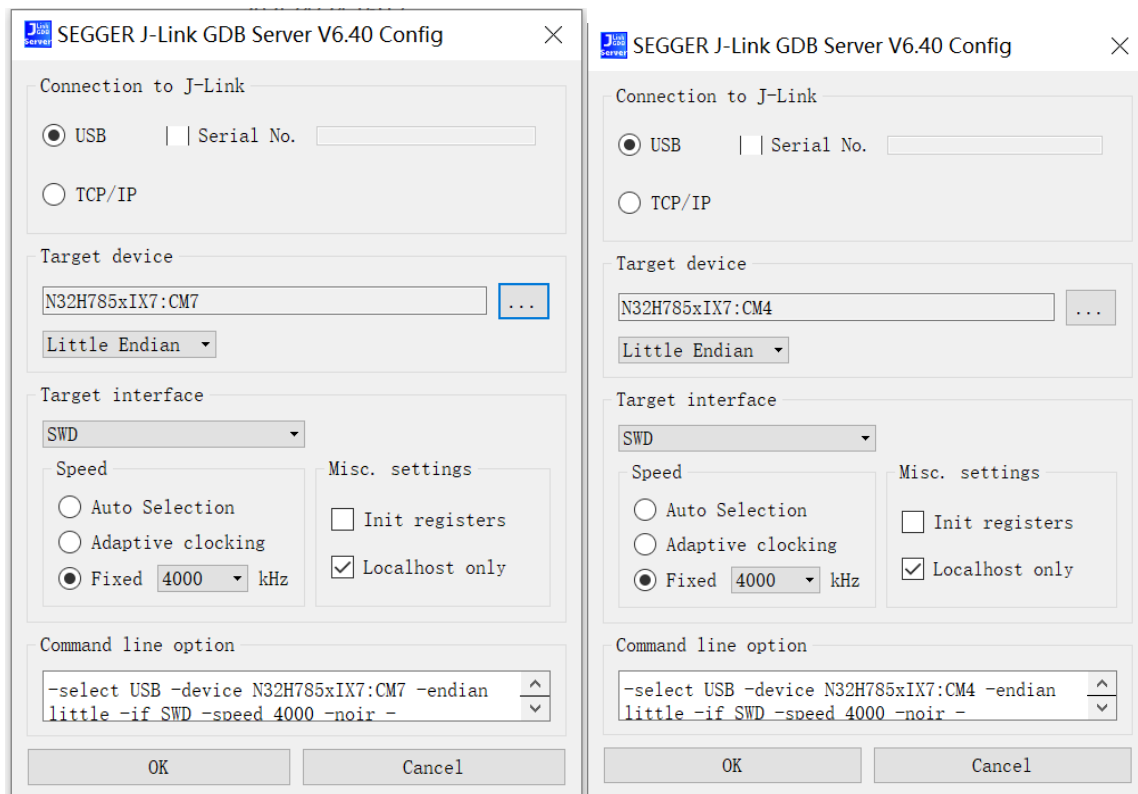
2. Refer to 6.1 and 6.2 section to configure the path in the launch.json files.

3, connect the JLink debugger to the development board, power on and prepare.

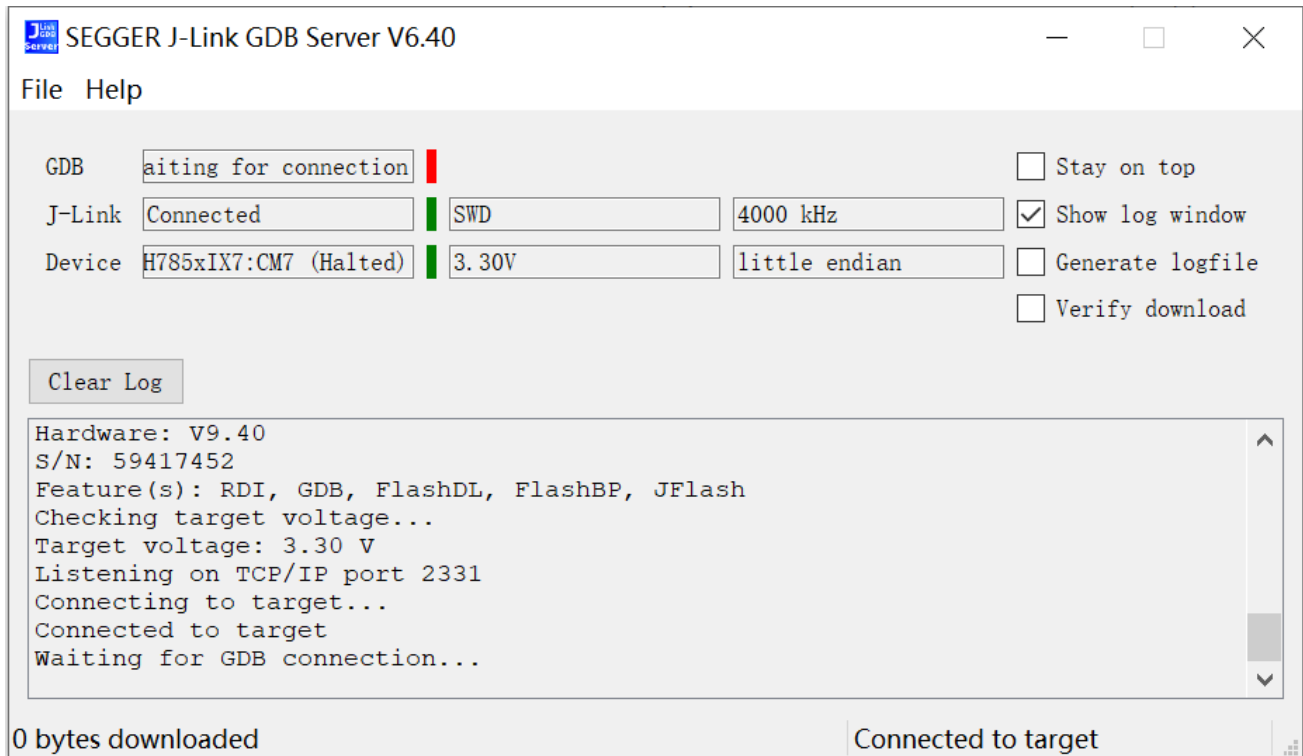
4, Go to your JLink installation directory and double-click [JlinkGDBServer.exe](#)



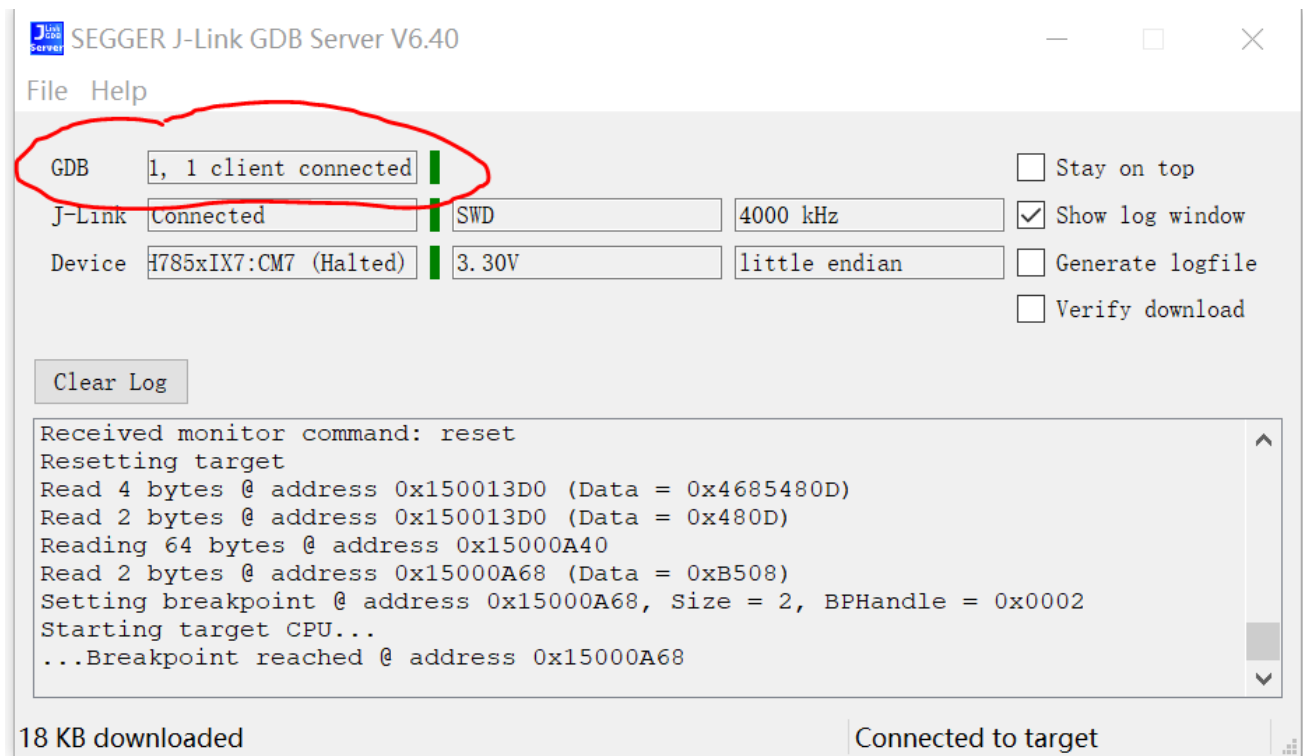
To configure ports, protocols, and chip models, when debugging CM7, choose CM7, and when debugging CM4, choose CM4, click [OK](#)



If the JLink debugger is successfully connected to the chip:



5. Under vscode working environment, press "F5" or click "Run" -> "Start debugging". At this time, it can be seen that the label below turns green, indicating that gdb tool successfully connects to JLinkGDBserver.



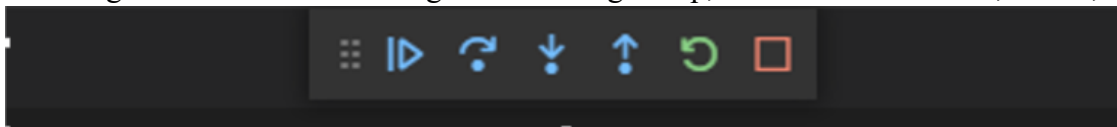
6, vscode automatically switches to the debug window

```

projects > n32h78x_EVAL > examples > GPIO > LedBlink > CM7 > src > C main.c > main(void)
62
63 /**
64  * \name    main.
65  * \fun     Main program.
66  * \param   none
67  * \return  none
68  */
69 int main(void)
70 {
71     /* Initialize system clock */
72     RCC_SetSysClkToMode0();
73     /* Enable Cortex-M4 boot*/
74     RCC_EnableCM4(0x15080000);
75     /* Add Cortex-M7 user application code here */
76
77     /* RCC configuration -----*/
78     RCC_Configuration();
79     /* LOG configuration -----*/
80     log_init();
81     /* GPIO configuration -----*/
82     GPIO_Configuration();
83
84     log_info("This is led blink demo\r\n");
85
86     while (1)
87     {
88         GPIO_SetBits(LED1_PORT, LED1_PIN);
89         systick_delay_ms(500);
90         GPIO_ResetBits(LED1_PORT, LED1_PIN);
91         systick_delay_ms(500);
92     }
93 }
94

```

7. Debug buttons above the debug window: single step, continuous execution, restart, stop, etc



8. Now you can step and run at full speed

```

8  */
9  int main(void)
10 {
11     /* Initialize system clock */
12     RCC_SetSysClkToMode0();
13     /* Enable Cortex-M4 boot*/
14     RCC_EnableCM4(0x15080000);
15     /* Add Cortex-M7 user application code here */
16
17     /* RCC configuration -----*/
18     RCC_Configuration();
19     /* LOG configuration -----*/
20     log_init();
21     /* GPIO configuration -----*/
22     GPIO_Configuration();
23
24     log_info("This is led blink demo\r\n");
25
26     while (1)
27     {
28         GPIO_SetBits(LED1_PORT, LED1_PIN);
29         systick_delay_ms(500);
30         GPIO_ResetBits(LED1_PORT, LED1_PIN);
31         systick_delay_ms(500);
32     }
33 }

```

7. Configuration changes

7.1 Chip Models

If you are using chips other than the N32H785 family, you need to modify the variables "TARGET_PLATFORM" and "DEFS" in the makefile.

```
#####
# chip platform info
#####
TARGET_PLATFORM := n32h7xx
ifeq ($(DCORE), CM4)
TARGET_STARTUP := n32h78x_cm4
DEFS += -DCORE_CM4
else
TARGET_STARTUP := n32h78x_cm7
DEFS += -DCORE_CM7
endif
DEFS += -DN32H78x
DEFS += -DUSE_STDPERIPH_DRIVER
```

7.2 Firmware Download Algorithm

You need to type the full chip model so that JLink can properly match the download algorithm.

```
241 #Chip type
242 ifeq ($(DCORE), CM4)
243 CHIP_TYPE = N32H785xIx7:CM4
244 else
245 CHIP_TYPE = N32H785xIx7:CM7
246 endif
```

Configure the path to download the tool: configure it according to your installation directory

```
#####
# download .hex/.bin by jlink
#####
#Your JLink installation directory
PATH_WINPC = 'C:/Program Files (x86)/SEGGER/JLink_V640/'
#PATH_LINUX = /opt/SEGGER/JLink_V640b/JLinkExe
JK_DPATH = $(PATH_WINPC)
```

7.3 Using the SDK algorithm library

By default, the library is not used. Please modify the variable `USELIB = 1` to use the library.


```
40 #####
41 # Algo libs
42 #####
43 USELIB = 0
```

7.4 DEBUG configuration

The default "make" compilation is with "-g" debugging information. If you want to build a release version, use "make release=y".

7.5 Optimization Grade

The default optimization level is ' -O0 ', and optimization is not enabled.

8. Version history

Date	Version	Modify
2025/04/27	V1.0	The initial release
2025/08/21	V1.1	1. Replace nsing's log in the header
2026/01/19	V1.2	1. Move the example project to the path of "Nations. N32H7xx_Library. 1.2.0 \ projects \ n32H7xx_EVAL \ applications \ H7x_GC_inFlash" 2. Update header/footer/notice

9. Notice

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