HT32 MCU Touch Key Library User's Guide

D/N: AN0608EN

Introduction

The HT32 touch key library developed by Best Solution is a library that integrates all of the touch key underlying driver library files. The library has pre-configured the touch-related MCU hardware, and provides intuitive and flexible touch key sensitivity settings, while integrating common functions such as key detection and power-saving sleep modes.

Using the HT32 touch key library simplifies the use of the MCU touch functions, allowing users to get started quickly and reducing the development period. This document will describe in detail the environmental configuration and library usage.

Environmental Configuration

Obtain HT32 Touch Key Library

Contact Best Solution's FAE or refer to its website: http://www.bestsolution.com.tw/EN/

Or download the library from the Holtek website: https://www.holtek.com

Obtain HT32 Firmware Library

Refer to the following link to quickly obtain the Holtek HT32 firmware library:

https://www.holtek.com/productdetail/-/vg/HT32F54231_41_43_53

Open the link, select the Documents option as shown in Figure 1, where the red box 1 indicates the location of the HT32 firmware library compressed files and the red box 2 indicates the location of the touch key library download guide.

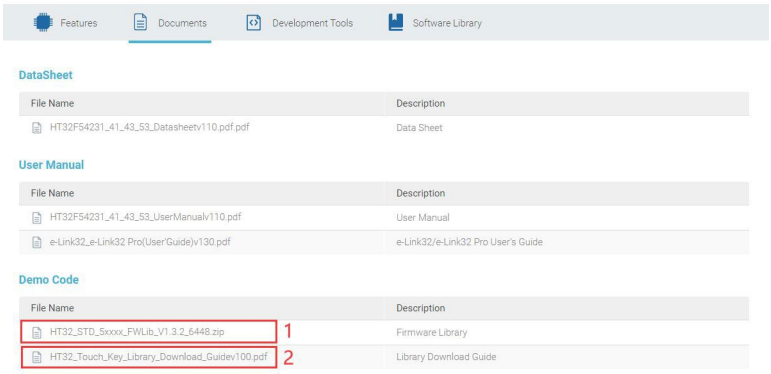


Figure 1

Keil Project Configuration

1. The user's PC needs to have the Keil development tool installed.
2. Unzip and open the HT32 firmware library. The files are listed as shown in Figure 2. Click on Holtek.HT32_DFP.latest to install it, after which the installation completion screen, as shown in Figure 3, will appear.

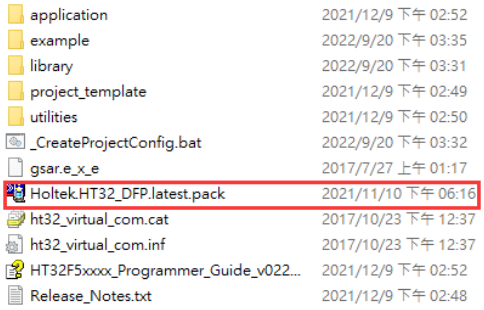


Figure 2. HT32 Firmware Library File List

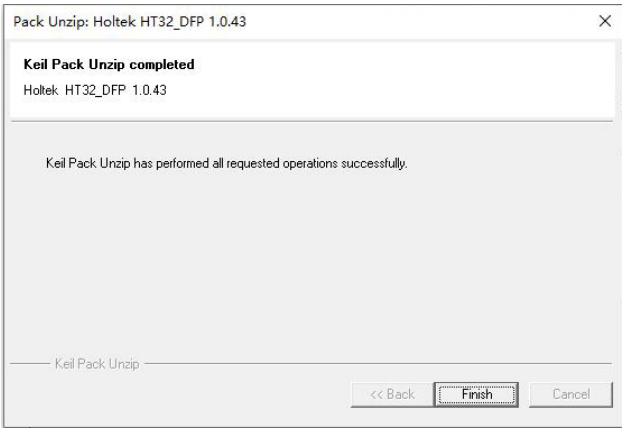


Figure 3. HT32 Pack Installation Finished

3. Unzip the HT32 touch key library which includes two folders, example and library.

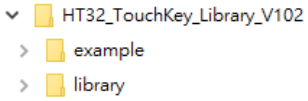


Figure 4. HT32 Touch Key Library

4. Copy the example and library folders to the HT32_STD_xxxxx_FWLib_Vm.n.r_XXXX folder.
5. Execute ..\example\TouchKey\TouchKey_LIB_CreateProject.bat (Figure 6).

Figure 5

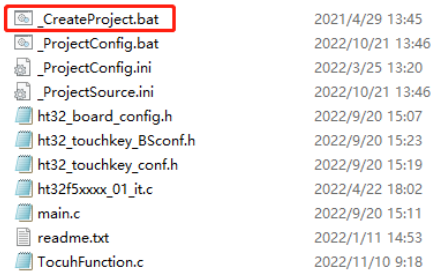


Figure 6

6. An interface, as shown in Figure 7, will appear. Input the number corresponding to the user's IDE, after which a "*" sign will appear, as shown in Figure 8. Input "N" to go to next step.

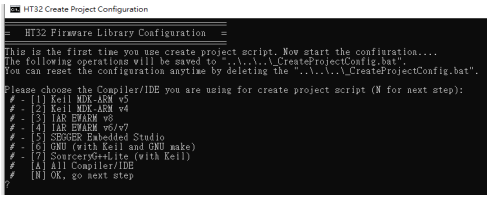


Figure 7

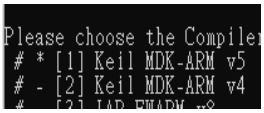


Figure 8

7. As shown in Figure 9, input "*" to create projects for all IC types or input the IC name to create a project for the selected IC.

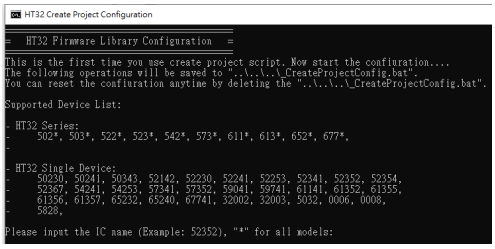


Figure 9

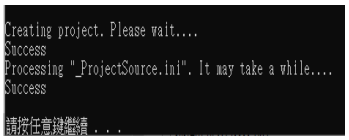


Figure 10

8. After finishing steps 1~7, as shown in Figure 11, select the desired IC project such as Project_54xxx.uvprojx from the ..\example\TouchKey\TouchKey_LIB\MDK_ARMv5\ path.

   *Note that only the MCU with the largest resources in each series is used to create the project. For example, to use the HT32F54231 users must select the HT32F54241 project.

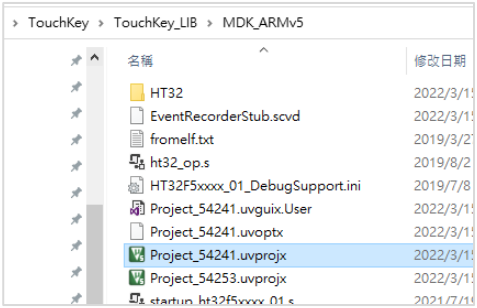


Figure 11

Considerations

As the touch key program may enter the sleep state, it is required to set the project to power on reset, otherwise it will not be available for programming. The setting steps are as follows.

- Step 1: Click the button in the Keil5 tool menu, as shown below.

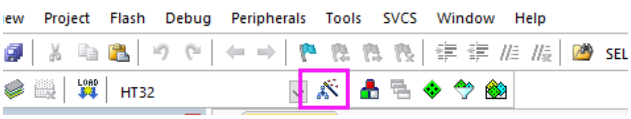


Figure 12

- Step 2: Select Debug→Settings.

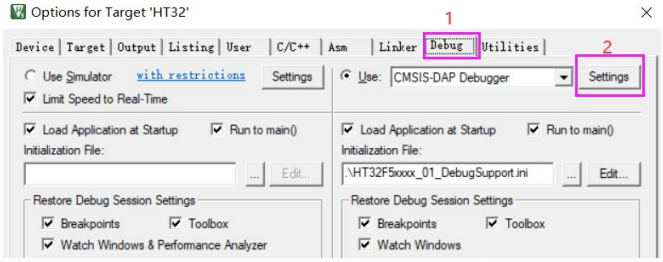


Figure 13

- Step 3: Select "under Reset" in the Connect field.

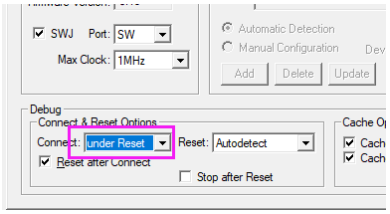


Figure 14

IAR EWARM Project Configuration

1. The user's PC needs to have the IAR EWARM development tool installed.
2. After the IAR EWARM has been installed, it needs to install the HT32 support package for IAR. This support package includes the microcontroller data libraries, Flash programming algorithms, and all other files required for HT32 series microcontroller program development.

   The following are the installation steps of installing the support package to IAR EWARM.

   - Step 1: Download the latest version of the HT32 IAR Support Package from the Holtek website. The file name is "HT32_ IAR_Package_vnnn.exe", where "nnn" stands for version number. The latest version of the HT32 IAR Support Package can be quickly found by searching HT32_ IAR_Package in the search bar.
   - Step 2: Double-click the "HT32_IAR_Package_vnnn.exe" to execute the support package wizard. When the following interface appears, press the "Finish" button.

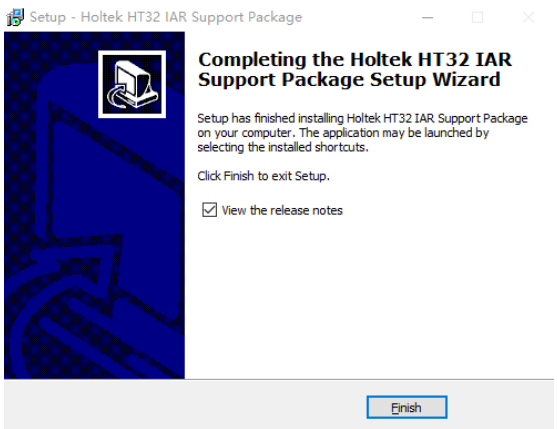


Figure 15. HT32 IAR Pack Finished Installing

3. Unzip and open the Holtek HT32 Firmware Library, the files are listed as shown in Figure 16.

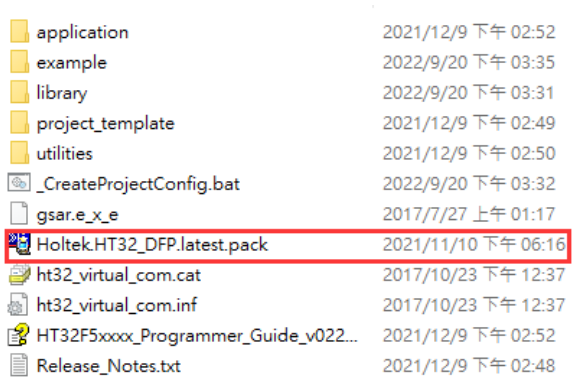


Figure 16. HT32 Firmware Library File List

4. Unzip the touch key library which includes two folders, example and library, as shown below.

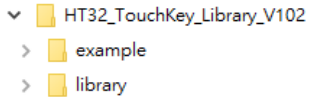


Figure 17. Touch Key Library

5. Copy the example and library folders mentioned in the step 4 to the HT32_STD_5xxxx_FWLib_Vm.n.r_XXXX folder.

6. Execute..\example\TouchKey\TouchKey_LIB_CreateProject.bat (Figure 19).

Figure 18

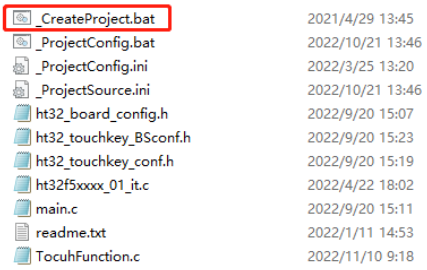


Figure 19

7. An interface, as shown in Figure 20, will appear. Input the number corresponding to the user's IDE, after which a "*" sign will appear, as shown in Figure 21. Input "N" to go to next step.

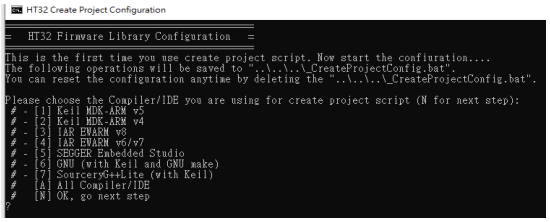


Figure 20

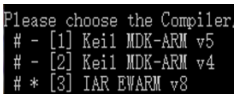
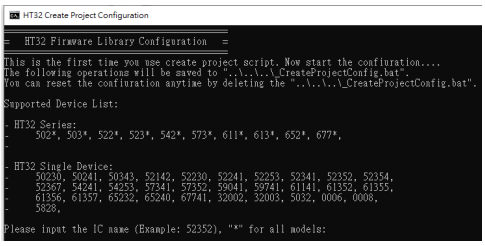


Figure 21

8. As shown in Figure 22, input "*" to create projects for all IC types or input the IC name to create a project for the selected IC.



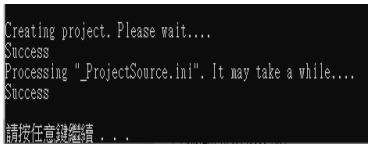


Figure 22 **Figure 23**

9. After finishing steps 1~8, as shown in Figure 24, select the desired IC project such as Project_54253.eww from the ..\example\TouchKey\TouchKey_LIB\EWARM\ path.

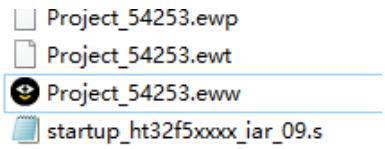


Figure 24

10. After opening the Project_54253.eww, connect to the e-Link32 Pro and click the compile and emulate buttons (Figure 25) to implement emulation.

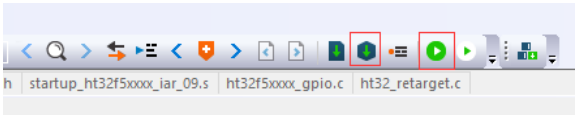


Figure 25

Library Files Description

Library Used Resources

Keil Project	Usable IC	ROM/RAM Resources	Used IP	Max. Number of Keys
HT32F54241	HT32F54241 HT32F54231	7148B / 2256B	Touch key BFTM0 RTC	24
HT32F54253	HT32F54243 HT32F54253	7140B / 2528B	Touch key BFTM0 RTC	28

Note: 1. The RTC is used to wake up MCU from the sleep state and used as time base for sleep state processing.

2. When the program is loaded into the IC, the Keil will determine whether the ROM or RAM size has been exceeded.

3. For the specific use of resources, refer to the actual library version.

Environment and File Description

The HT32 touch key library is located in the following path.

..\example\TouchKey\TouchKey_LIB\MDK_ARMv5\Project_542xx.uvprojx project (Figure 26).

IAR files are in..\example\TouchKey\TouchKey_LIB\EWARM\Project_54253.eww (Figure 27).

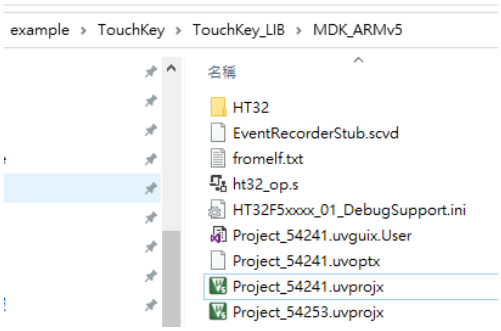


Figure 26

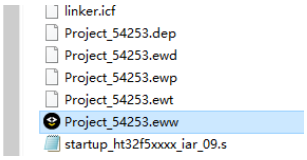


Figure 27

After the HT32 touch key library project is opened by using the Keil tool, the main screen is shown as Figure 28.

After the HT32 touch key library project is opened by using the IAR tool, the main screen is shown as Figure 29.

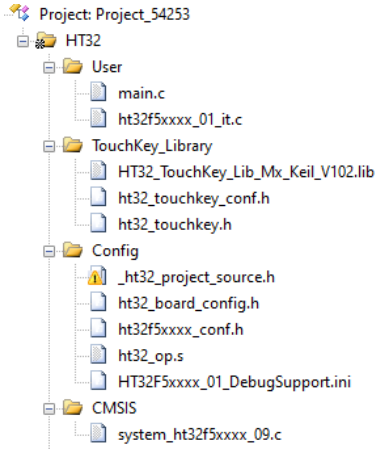


Figure 28

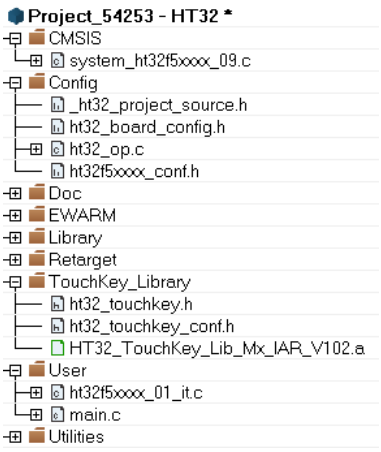


Figure 29

The relevant files are described as follows, among which are the ht32_TouchKey_conf.h and system_ht32f5xxxx_09.c files, including a Configuration Wizard interface, as shown in Figure 30. It should be noted that there is no Configuration Wizard interface within the IAR EWARM software.

File Name	Description
main.c	Project main program file
ht32f5xxxx_01_it.c	Interrupt main program file
ht32_TouchKey_Lib_Mx_Keil.lib	Touch control library file
*ht32_TouchKey_conf.h	Touch control parameter file
ht32_TouchKey.h	External declaration definition file
ht32_TouchKey_BSconf.h	Underlying main parameter file (not recommended to modify)
ht32_board_config.h	Hardware definition file (not recommended to modify)
*system_ht32f5xxxx_09.c	Clock source and system clock parameter file

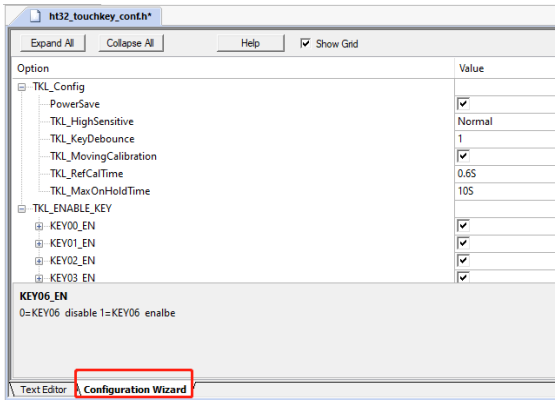


Figure 30

Configuration Wizard Parameters

It should be noted that there is no Configuration Wizard interface in the IAR tool, and the Configuration Wizard interface is unique to the KEIL MDK.

1. ht32_TouchKey_conf.h Configuration Wizard parameters:

Name	Function
PowerSave	Activate the default sleep procedure defined in main.c
TKL_HighSensitive	Touch sensitivity setting: high or low sensitivity; default to high sensitivity after being enabled
TKL_keyDebounce	Key debounce time setting
TKL_RefCalTime	Calibration time. The shorter the time, the more effective it will be in resisting environmental interference, however it will result in lower key sensitivities.
TKL_MaxOnHoldTime	The maximum time that the key is pressed. The key is automatically released after being pressed for n seconds.
KEYn_EN	Enable or disable KEYn
KeynThreshold	KEYn threshold value. The smaller the value, the more sensitive the key will be.

2. system_ht32f5xxxx_09.c Configuration Wizard parameters:

Name	Function
Enable High Speed External Crystal Oscillator - HSE	Enable or disable HSE (external high speed oscillator)
Enable Low Speed External Crystal Oscillator - LSE	Enable or disable LSE (external low speed oscillator)
Enable PLL	Enable or disable PLL
PLL Clock Source	Select clock source for PLL
SystemCoreClockConfiguration (CK_AHB)	Select clock source for system CK_AHB

Description of Touch Key Lib Interface Functions

Description of Get Functions

Item	Description
Function Name	TKL_Get_Standby
Input Parameter	—
Return Value	Counting value (500~60000)
Description	Used to obtain the count-down counter value

Item	Description
Function Name	TKL_Get_KeyRCCValue
Input Parameter	Key value (0 ~ max. key value), frequency (0, 1)
Return Value	Capacitance value (0~1023)
Description	Used to obtain the capacitance value of the specified key

Item	Description
Function Name	TKL_GetKeyRef
Input Parameter	Key value (0 ~ max. key value)
Return Value	Reference value (0~65535)
Description	Used to obtain the reference value of the specified key

Item	Description
Function Name	TKL_GetKeyThreshold
Input Parameter	Key value (0 ~ max. key value)
Return Value	Threshold value (0~255)
Description	Used to obtain the threshold value of the specified key

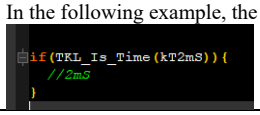
Item	Description
Function Name	TKL_Get_AllKeyState
Input Parameter	—
Return Value	Key state (32-bit) BITn stands for KEYn state Bit0 = 1 means that KEY0 is pressed, Bit0 = 0 means that KEY0 is not pressed
Description	Used to obtain all key states

Description of Set Functions

Item	Description
Function Name	TKL_Set_KeyThreshold
Input Parameter	Key value (0 ~ max. key value), threshold value (10~127)
Return Value	—
Description	Used to set the threshold value of the specified key

Item	Description
Function Name	TKL_Set_Standby
Input Parameter	Sleep time (500~60000)
Return Value	—
Description	Used to set the count-down counter (not recommended to use this function)

Description of State and Command Functions

Item	Description
Function Name	TKL_Is_Time
Input Parameter	Preset constant (kT2mS, kT4mS…kT2048mS)
Return Value	—
Description	Time flag for user reference. In the following example, the program enters the function every 2ms. 

```
if(TKL_Is_Time(kT2mS)){
  //2mS
}
```

Item	Description
Function Name	TKL_Is_AnyKeyPress
Input Parameter	—
Return Value	1 = one or more key has been triggered; 0 = no key has been triggered
Description	Used to obtain the key press flag

Item	Description
Function Name	TKL_Is_KeyPress
Input Parameter	Key value (0 ~ max. key value)
Return Value	1 = key has been triggered; 0 = key has not been triggered
Description	Used to obtain the state flag of the specified key

Item	Description
Function Name	TKL_Is_Active
Input Parameter	—
Return Value	1 = LIB initialisation has finished; 0 = LIB initialisation has not finished
Description	Used to obtain the LIB initialisation state flag

Item	Description
Function Name	TKL_Is_Standby
Input Parameter	—
Return Value	1 = allowed to enter sleep state; 0 = not allowed to enter sleep state
Description	Used to obtain the sleep state flag. *When a value of 0 is returned, then entering the sleep state may result in an unexpected state.

Item	Description
Function Name	TKL_Is_KeyScanCycle
Input Parameter	—
Return Value	1 = scan has finished; 0 = presently scanning
Description	Used to obtain the scan flag

Item	Description
Function Name	TKL_Reset
Input Parameter	—
Return Value	—
Description	Used to compel LIB to execute a reset action. *Flags used by LIB and RAM will be initialised. *Parameters and AFIO are excluded.

Description of Touch Key Lib Initialisation Functions

These functions are located in main.c. It is not recommended to modify their contents.

Name	Function
GPIO_Configuration()	I/O port configurations
RTC_Configuration()	Touch keys are woken up by the RTC
BFTM_Configuration()	Touch key library time bases are implemented by BFTM
TKL_Configuration()	Touch key configurations

Key State Query

As shown below, the main program includes a touch key example which will not be activated by default. To activate this function, modify (0) after #if to (1).

```
117   if(gIsEnterLowPowerMode == TKL_NOT_SLEEP) //Touch Key Working
118   {
119     //Touch Main Loop
120     Touch_Key_Main_Function();
121     #if (0) //use touch key example
122     if(TKL_Is_KeyScanCycle()){
123       u32 KeyData;
124       /********** KEY 0  ***************/
125       if(TKL_Is_KeyPress(0)){   //KEY 0 PRESS
126
127       }
128       else{                     //KEY 0 RELEASE
129
130       }
131
132       /********** ANY KEY ***************/
133       if(TKL_Is_AnyKeyPress()){ //AND KEY PRESS
134
135       }
136       else{                     //ALL KEY RELEASE
137
138       }
```

Figure 31

Sleep Mode Description

1. In ht32_TouchKey_conf.h, set the PowerSave to "1" to enable the sleep modes. The KEIL tool can check the PowerSave to enable sleep modes directly in the Configuration Wizard interface in ht32_TouchKey_conf.h (Figure 32).

Figure 32

2. After the sleep modes have been enabled, the touch keys will enter the sleep state if the keys have not experienced any touch conditions for a certain period of time.
3. A standby time count function is used for down-counting, the current time is obtained using TKL_Get_Standby and the time parameter is set using TKL_Set_Standby.
4. There are three sleep mode options.

Mode	Description
USE_SLEEP_MODE	Enter Sleep Mode
USE_DEEP_SLEEP1_MODE	Enter Deep Sleep1 Mode
USE_DEEP_SLEEP2_MODE	Enter Deep Sleep2 Mode

5. As shown below, set the required sleep mode using "#define" in the main file.

```
51  /************************SLEEP MODE DEFINE************************/
52  #define USE_SLEEP_MODE          0
53  #define USE_DEEP_SLEEP1_MODE    1
54  #define USE_DEEP_SLEEP2_MODE    2
55  /***********************Select sleep mode*************************/
56  #define SEL_SLEEP_MODE          USE_DEEP_SLEEP2_MODE
57  /*****************************************************************/
```

Figure 33

Conclusion

This document has provided instructions for setting up the entire HT32 touch key development environment, assisting users to get started quickly. In addition, the resources used by the library, as well as various functions and parameters, have been explained in detail, allowing for an easier development process.

Reference Material

For more details, refer to the Holtek website: www.holtek.com

or consult the Best Solution website: http://www.bestsolution.com.tw/EN/

Versions and Modification Information

Date	Author	Release	Description
2022.10.24	謝東霖、梁德浩、陳少雄	V1.10	New add IAR EWARM project configuration description
2022.03.16	謝東霖、梁德浩	V1.00	First version

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