

User Guide

N32WB03x SDK User Guide

Introduction

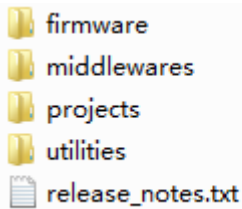
This document is to help users to quickly familiarize with the development kit for N32WB03x series Bluetooth SOC and Keil MDK-ARM settings.

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1 Directory Structure Of SDK/ Development Firmware Files

Under the SDK directory, it is a file named after the firmware library version, which contains five subfolders:



1.1 Firmware

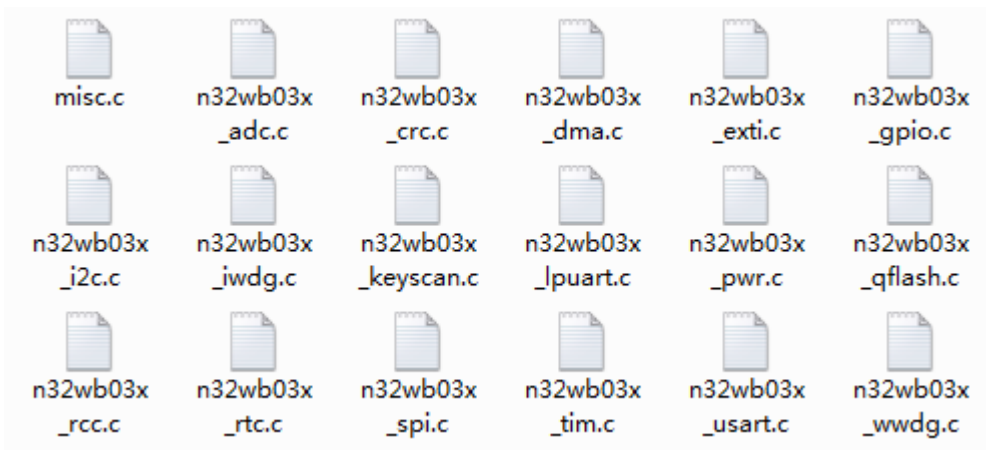
- CMSIS:

Cortex Microcontroller Software Interface Standard (CMSIS) is a vendor-independent hardware abstraction layer of Cortex-M processor series. CMSIS provides a general interface between core and peripherals, real-time operating system and intermediate devices.

- It contains the name definition, address definition and configuration functions of the register used to access the core. The interface includes the definition of debug channel.
- It provides the definition of all peripherals on the chip, including all peripheral register header files, startup files and system initialization template files.

- n32wb03x_std_periph_driver:

Standard driver functions of chip peripherals, including source files of .c and header files of .h. Users can transplant to the project and quickly complete the use of a peripheral module.



1.2 Middleware

The middleware mainly includes the following two directories:

- Third_Party
 - FreeRTOS: FreeRTOS related library
- NSINGtech
 - ble_library: BLE related library
 - ns_ble_stack: Ble Bluetooth protocol stack header file
 - ns_ble_profile: Ble profile library source code
 - ns_library: Other library source code of ble program, including log, sleep and timer, etc.

1.3 Utilities

Utility software directory, which mainly includes:

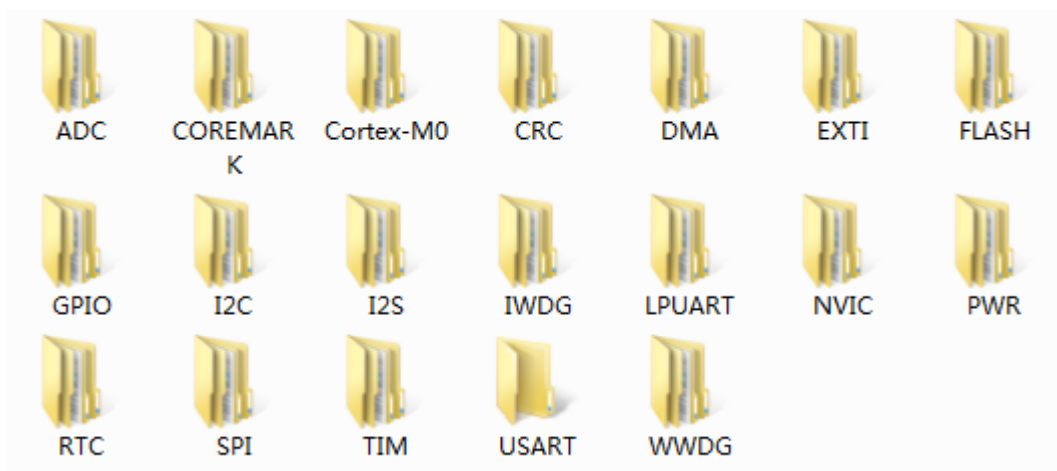
- dfu
 - Software directory of dfu firmware upgrade related tools and bat scripts for calling these tools
 - Image: bin file generated by bat script and bin file used for DFU demo.
 - JLink: burning tool
 - Keys: keys used to generate dfu upgrade bin
 - NSAndroidUtil: DFU test APK
 - NSUtil: serial port upgrade utility software and source code

1.4 Projects

Projects directory contains a development board directory, which includes:

- Bsp: log function with printing by debugging serial port, which is used for peripheral demo to respond to various debugging information during debugging.
- Application: application demo, a comprehensive demo that uses a variety of peripherals or functional requirements.
 - peripheral_alone: Integrated peripheral demo, including serial communication, PWM output of TIM, ADC reading and voltage conversion, IO output, IO input interrupt response and RTC sleep wake-up.
 - FreeRTOS: Freetos related demo
- Ble: BLE slave demo, to understand the basic method to develop BLE program through the BLE demo of specific profiles
 - dis: device service demo
 - hid_mouse: BLE mouse demo
 - rdtss: BLE data transmission slave demo (128bit UUID), including DFU OTA upgrade project options.
 - rdtss_16bit: BLE data transmission slave demo (16bit UUID), including DFU OTA upgrade project options.
 - rdtss_3s: BLE data transmission slave demo which can connect 3 master devices.

- heart_rate: BLE heart rate service demo
- blood_pressure: BLE blood pressure service demo.
- Ble_central: BLE host demo
 - Central_rdtsc: BLE data transmission master demo. It can be used with the rdtss demo.
 - Central_rdtsc_c&s: BLE data transmission demo with master and slave mode switching . It can be used with rdtss or central_rdtsc demo.
 - Central_rdtsc_3m: BLE data transmission master demo which can connect 3 slave devices.
 - Central_relay_1m1s: BLE data transmission relay demo, that is, one master and one slave work at the same time. It can be used with the rdtss demo.
- Dfu: Device firmware upgrade demo
 - common: Dfu common library directory
 - App_ota: BLE over-the-air upgrade demo
 - Image_update: in single bank mode, the source code of image_update demo
 - App_usart: serial port upgrade demo (jump to masterboot)
 - Masterboot: firmware upgrade boot, including serial port upgrade, firmware checksum jump.
- Prod_test: product test demo
 - DTM_Test: support standard HCI DTM command via USART1(PB6, PB7), it need connect with Bluetooth tester running the test.
 - RF_Test: support BLE TX, RX, and constant carrier TX mode via UART commands, the UART command can send by pc software.
- Peripheral: It contains demo items of each peripheral function module, and realizes the basic function application development of each peripheral module. Users can quickly understand the use of chip peripherals through these demo items.



2 Project Configuration And Burning

2.1 Compilation Environment Installation

Please install KEIL MDK-ARM development environment, which requires a version V5.00 or above, and V5.24.2.0 is recommended.

2.2 Firmware Support Package Installation

Double-click N32WB03x_DFP.1.1.0.pack to install the Keil chip support package.

2.3 Build Environment Configuration

Note: All demo have been configured as follows, so there is no need to reconfigure the build environment to run demo.

- The FLASH and RAM configuration of Target page

- It does not contain ble function items.

- Target page containing ble function items

- For items with DFU function, please refer to the firmware upgrade user guide.pdf.

- Linker page

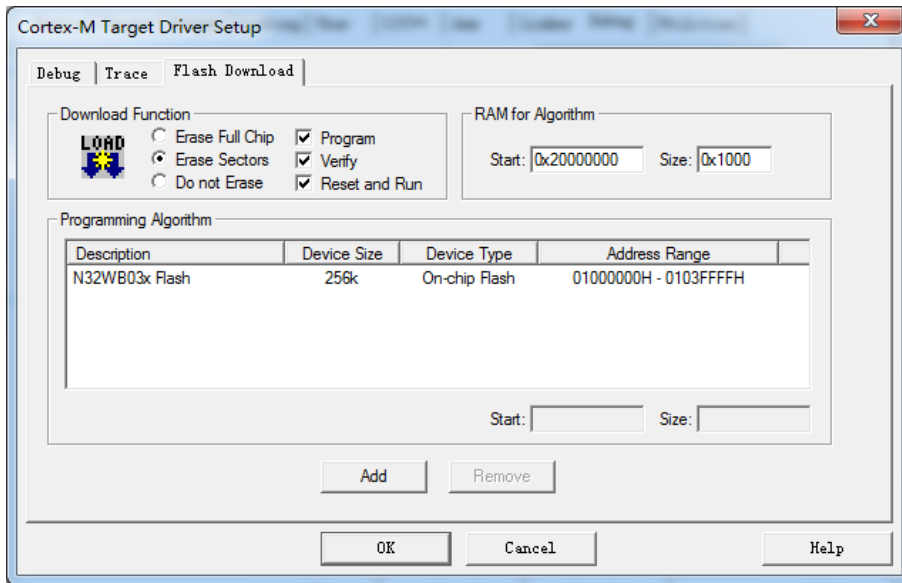
- Check the memory configuration of the Target page.

- For items with ble, add middlewares\NSINGtech\ble_library\ns_ble_stack\symdef\symbol_g15.obj to Misc control. Note that the obj file used by the program with Bluetooth host function is symbol_g15_central.obj.

- Debug Page

- Select the debugger CMSIS-DAP as the NS-Link on the development board.

- The setting page is as follows



2.4 Build And Download

- Build: click the build button on the menu.
- Download: Click the Download button on the menu.
- Debug: Click the start/stop debug session button on the menu.

Note: After downloading the program, you can't continue to download it.

- Possibility 1: SWDIO/SWDCLK in the code is used for other purposes, resulting in the failure of the simulation interface. Generally, it is not recommended to use simulation pins for other functional design.
- Possibility 2: When the chip enters the low-power sleep mode, the simulation interface fails, it needs to be downloaded in the wake-up state.

2.5 Structure Of BLE Project Directory

Take rdtss project as an example

- Project Target
 - N32WB03x: BLE project, without DFU configuration. Generally, a ble project only has this target.
 - OTA_IMG_1: OTA project with bluetooth, configured as Bank1 address.
 - OTA_IMG_2: OTA project with bluetooth, configured as Bank2 address.

Note: Must rebuild all the files after switch project target. The OTA_IMG_1 and OTA_IMG_2 target will copy the bin to \utilities\dfu\Image folder, user can run the bat script to download or create OTA package(zip format).

- The directory structure is as follows
 - STARTUP: chip startup file

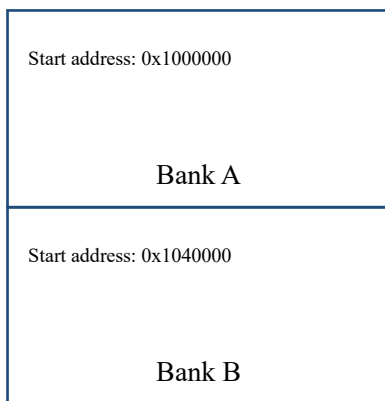
- CMSIS: chip core configuration
- FWLB: Chip peripheral driver library
- BLE_STACK: BLE protocol stack
- BLE_PROFILE: BLE profile
- NS_DUF (optional): BLE OTA firmware upgrade related library
- Crypto (optional): Encryption-related library for BLE OTA firmware upgrade
- NS_LIB: BLE application related library
- BLE_APP: BLE application code
- USER: User application code
- CONFIG: configuration file
- DOC: Descriptive document

3 Memory Allocation

3.1 Flash allocation

The FLASH address range of chip N32WB031 is 0x01000000 - 0x0107FFFF, with a total space of 512K bytes. It is divided into two banks, BankA and BankB, with the space size of 256K bytes respectively. The address range of BankA is 0x01000000 - 0x0103FFFF, and the address range of BankB is 0x01040000 - 0x0107FFFF. The user code can only run in one of the banks, and BankA is used by default. Note that the FLASH space of N32WB031KC series is 256K, that is, only the BankA area.

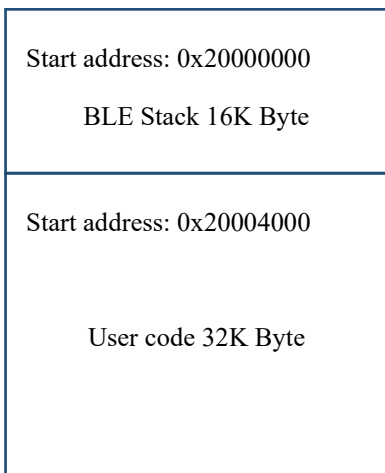
To use the firmware upgrade function, please refer to the FLASH memory distribution chapter of the firmware upgrade user guide.pdf.



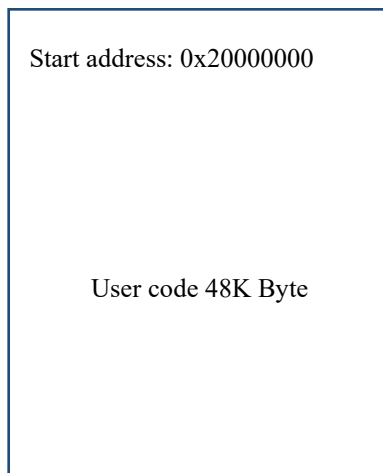
3.2 RAM

The RAM address range of chip N32WB031 is 0x20000000 - 0x2000BFFF, with an available space of 48K bytes.

- If the BLE function is enabled, the BLE protocol stack will occupy 0x20000000 - 0x20003FFF, with a total of 16K bytes of RAM, and the user code can use 0x20004000 - 0x2000BFFF, with a total of 32K bytes of RAM.
- If the BLE function is disabled, the user code can use all 48K bytes of RAM.



BLE protocol stack is used



Not use the BLE protocol

4 System Clock

4.1 Application Without BLE Protocol Stack

The system clock source can be HSE or HSI, and all peripheral demo use HSI 64M as the system clock source by default. The low-speed clock source can be selected from the external crystal LSE 32.768K or the internal LSI 32K clock source.

4.2 BLE Application

All BLE demo use HSI 64M as the system clock source by default, LSI as the low-speed clock source, and an external 32M crystal must be used as the dedicated clock source for BLE RF. It is not recommended to change the system clock source. The low-speed clock source can be external crystal LSE 32.768K or internal LSI 32K, but LSI or LSE can be configured only in the initialization function of BLE protocol stack and the low-speed clock source can be initialized. User code cannot switch to the low-speed clock source later, otherwise the function of BLE protocol stack will be affected.

5 Version History

Version	Date	Changes
V1.3	2022.12.29	Initial release

6 Disclaimer

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