Freescale Semiconductor
User's Guide

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Freescale MQX USB Stack for TWR-K24F120M GA User's Guide

1 Read Me First

This document describes how to compile the USB stack and examples, download a binary image, and run the examples. This document also provides the board-specific information related to TWR-K24F120M.

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2 Requirements for Building USB Examples

2.1 Hardware

- TWR-K24F120M board
- J-Link debugger
- USB cables

2.2 Software

- Freescale MQX™ RTOS for the TWR-K24F120M release package
- IAR Embedded Workbench for ARM Version 6.70.1, available for Kinetis devices
- Keil µVision5 Integrated Development Environment Version 5.0.5.15, available for Kinetis ARM® CortexM4 devices
- Keil.Kinetis_K20_DFP.1.0.2.pack for TWR-K24F120M which is available in <install_dir>/tools/keil_extensions/uVision4 in this release package
- GNU Tools for ARM Embedded Processors 4.7 2013Q3
- MinGW v3.82.90 with **mingw32-base** and **msys-base** packages installed
- Segger J-Link driver V4.88 or later

2.3 Board jumper settings

This document focuses on the USB-related jumper settings on the board. For the other jumper settings, refer to the board-related user guide.

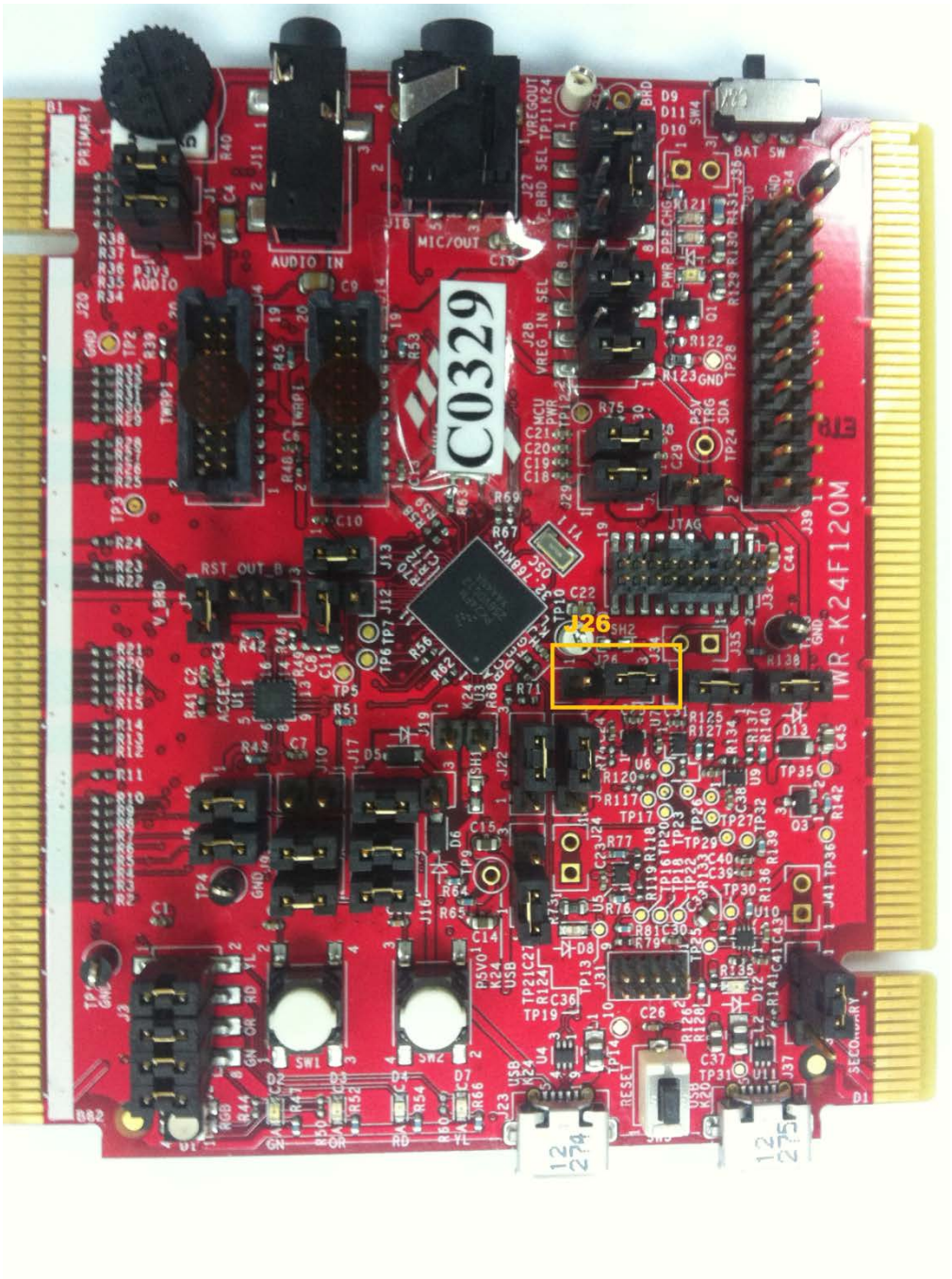


Figure-1 Board jumper settings

- J26 1-2: enables 5V VBUS

3 USB Code Structure

The USB stack is located in the `usb_v2` subfolder of the MQX RTOS root folder. There are five subfolders in it:

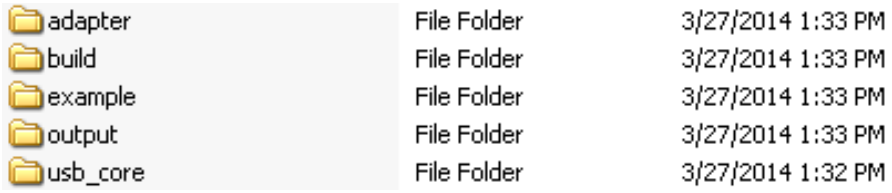


Figure-2 usb_v2 folder structure

- adapter

  Includes the adapter files that allow the USB stack to run on different RTOSs with the same USB core code.

- build

  Includes the GCC make files.

- example

  Includes all the source code and project files of the USB examples.

- output

  The USB library binary file is generated into this folder and all the USB-related public header files are copied to this folder. The examples need to include one folder as the including path in the example project settings.

- usb_core

  Includes the USB source files, such as HAL, controller driver, and class drivers. It also includes the USB library projects.

4 Compiling or Running the USB Stack and Examples

4.1 Step by step guide for IAR

This section takes IAR as an example to show how to build examples. The other tool chains have similar steps.

1. Open IAR as follows.

Figure-3 IAR

2. Add MQX RTOS bsp and psp projects by clicking **Project → Add Existing Project**.
   You can find the corresponding IAR project files in the following paths:
   - bsp
     <install_dir>/mqx/build/iar/bsp_twrk24f120m
   - psp
     <install_dir>/mqx/build/iar/psp_twrk24f120m

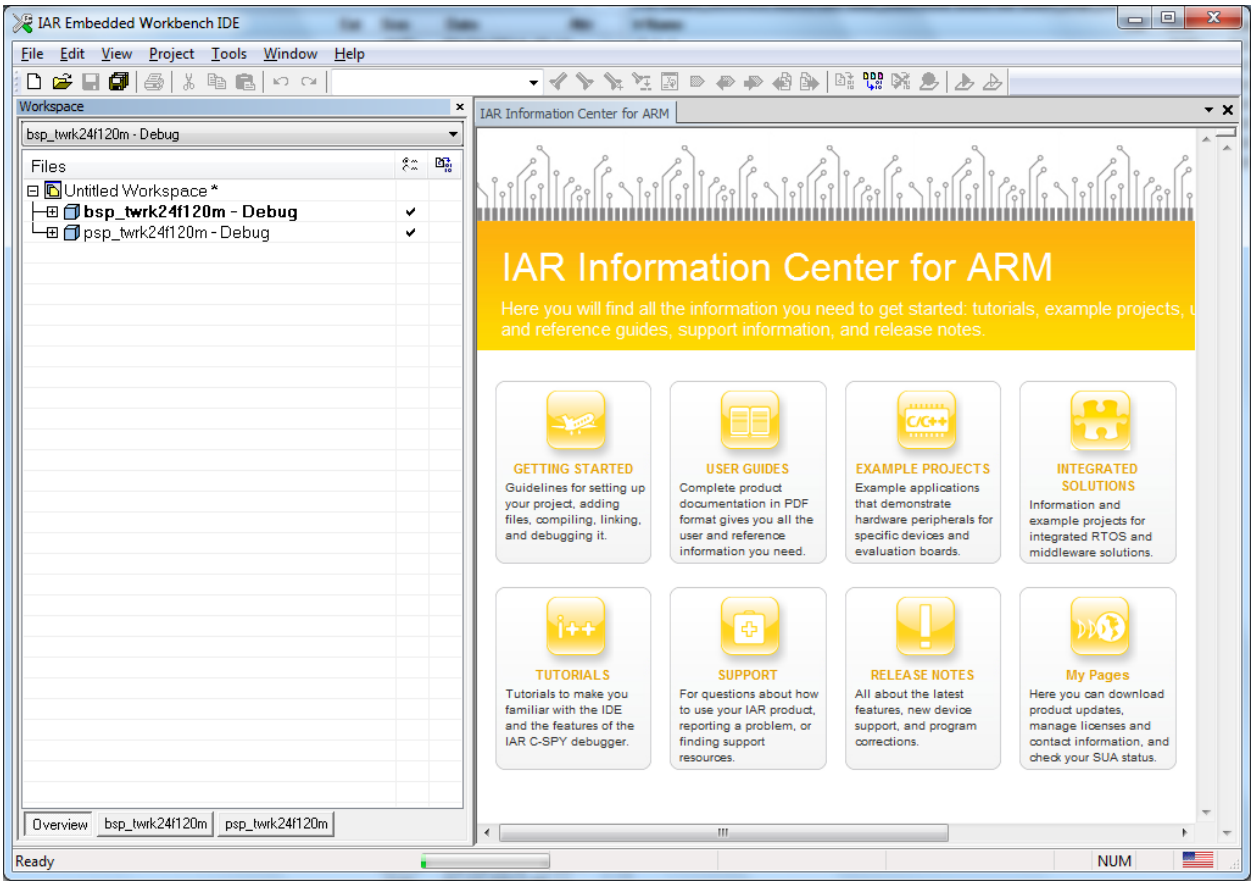


Figure-4 bsp and psp projects

3. Add a USB stack library project in the following paths:
   - USB Device Stack

     <install_dir>/usb_v2/usb_core/device/build/iar/usbd_mqx_twrk24f120m
   - USB Host Stack

     <install_dir>/usb_v2/usb_core/host/build/iar/usbh_mqx_twrk24f120m
   - USB OTG Stack

     <install_dir>/usb_v2/usb_core/otg/build/iar/usbotg_mqx_twrk24f120m

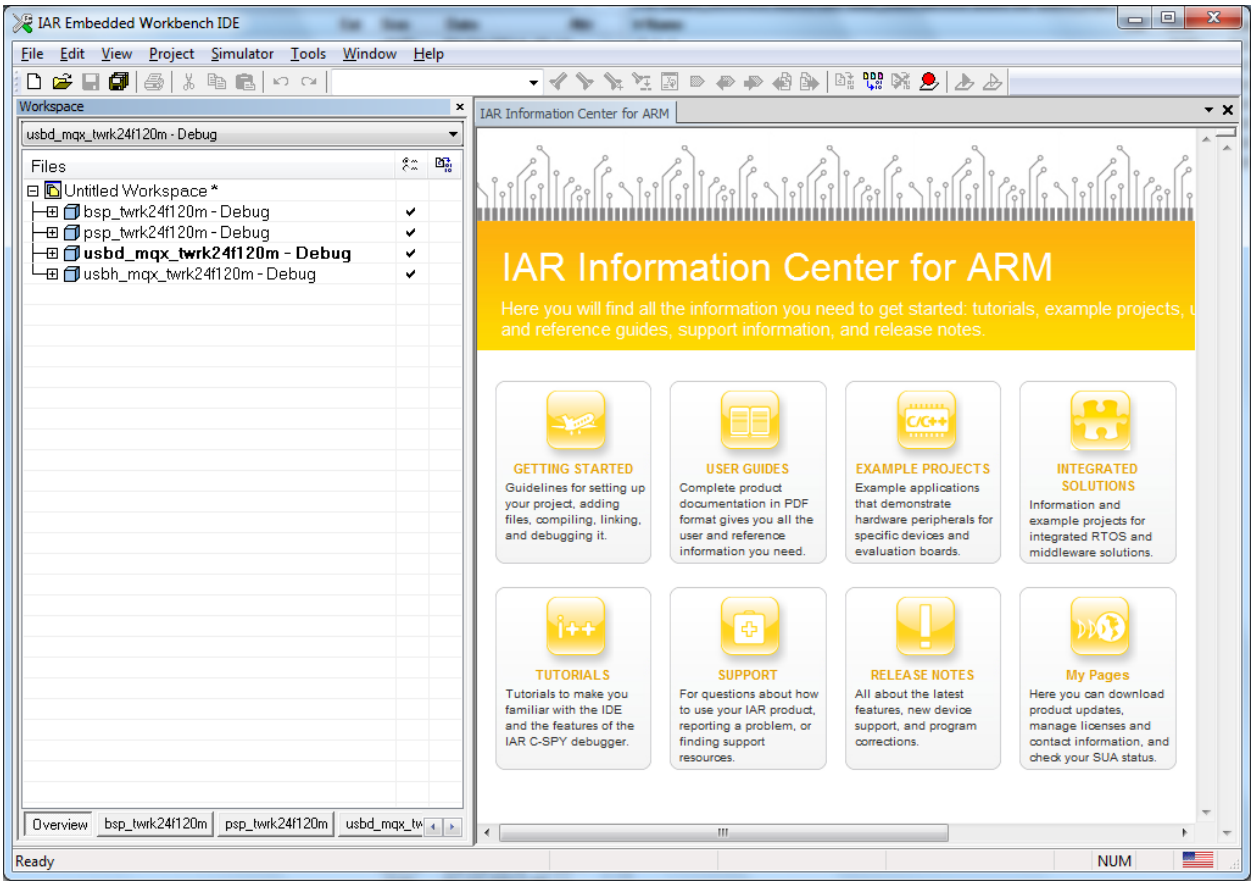


Figure-5 Folder name of USB device stack

4. Add a USB example project.

All the USB examples are located in the `example` folder. The folder structure is as follows.

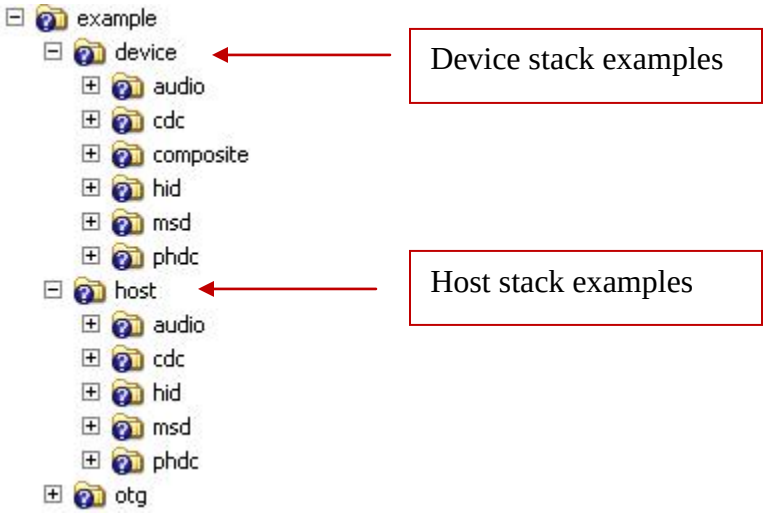


Figure-6 Example Folder Structure

This guide adds the USB HID mouse device example.

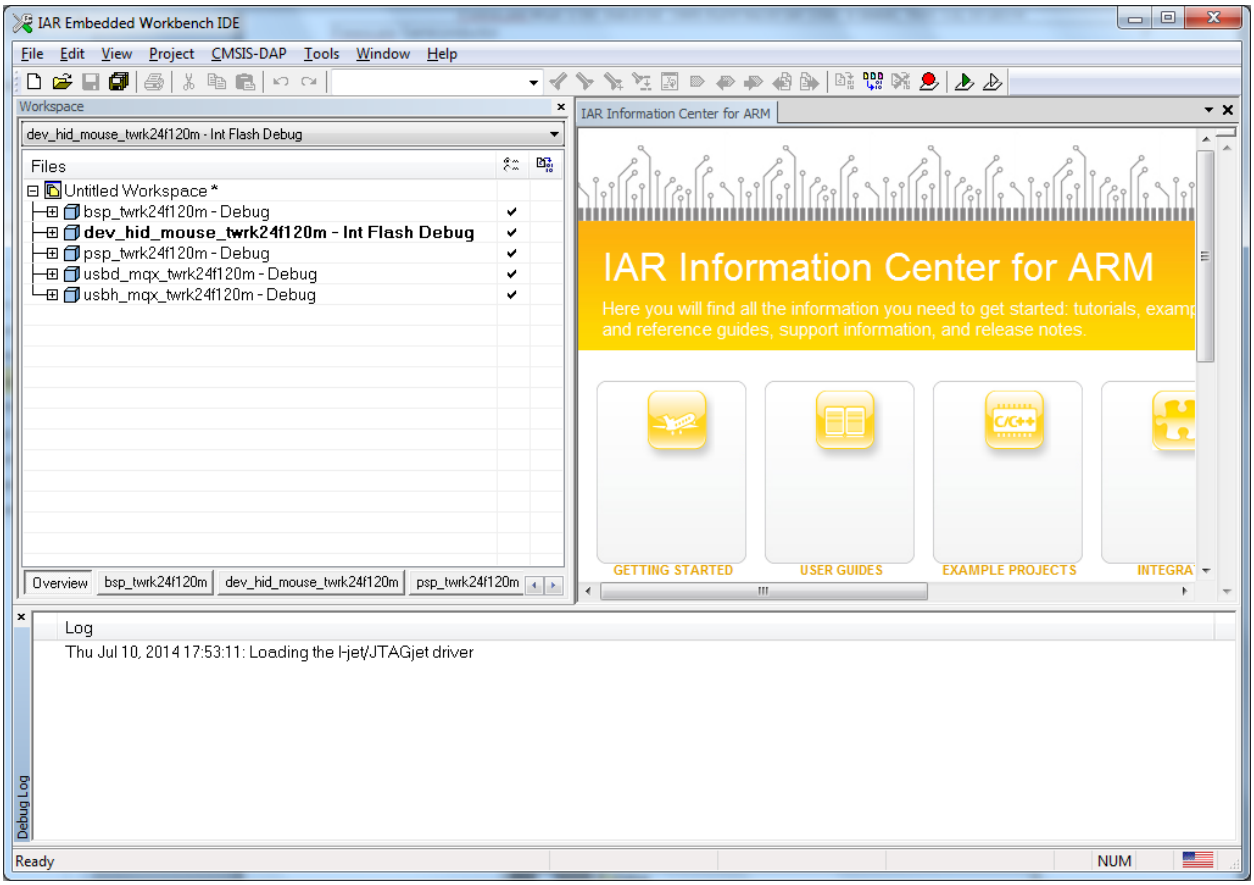


Figure-7 Adding a USB example project

5. Build the bsp and psp libraries.

   Save the workspace in the resulting dialog box and proceed with the builds.

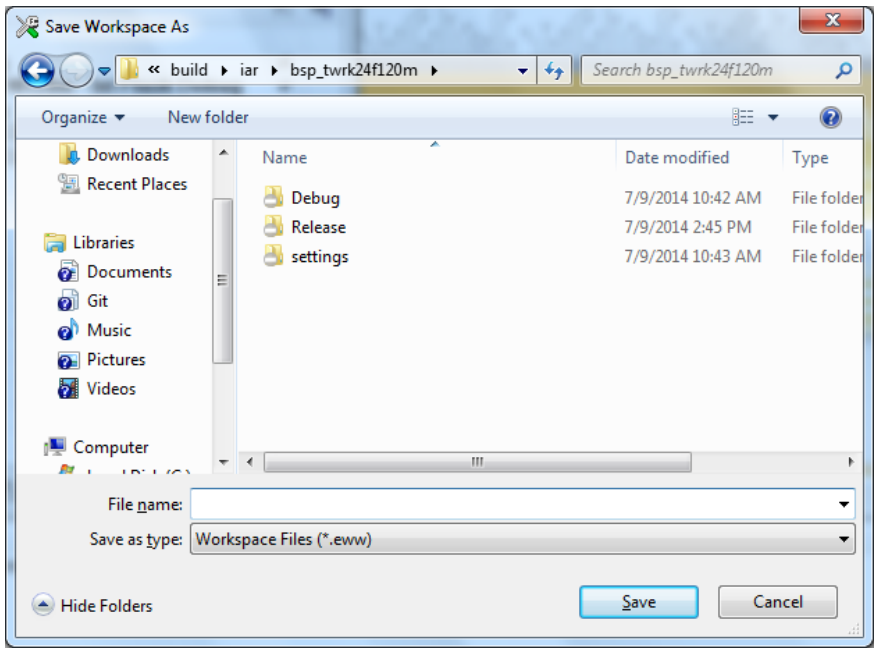
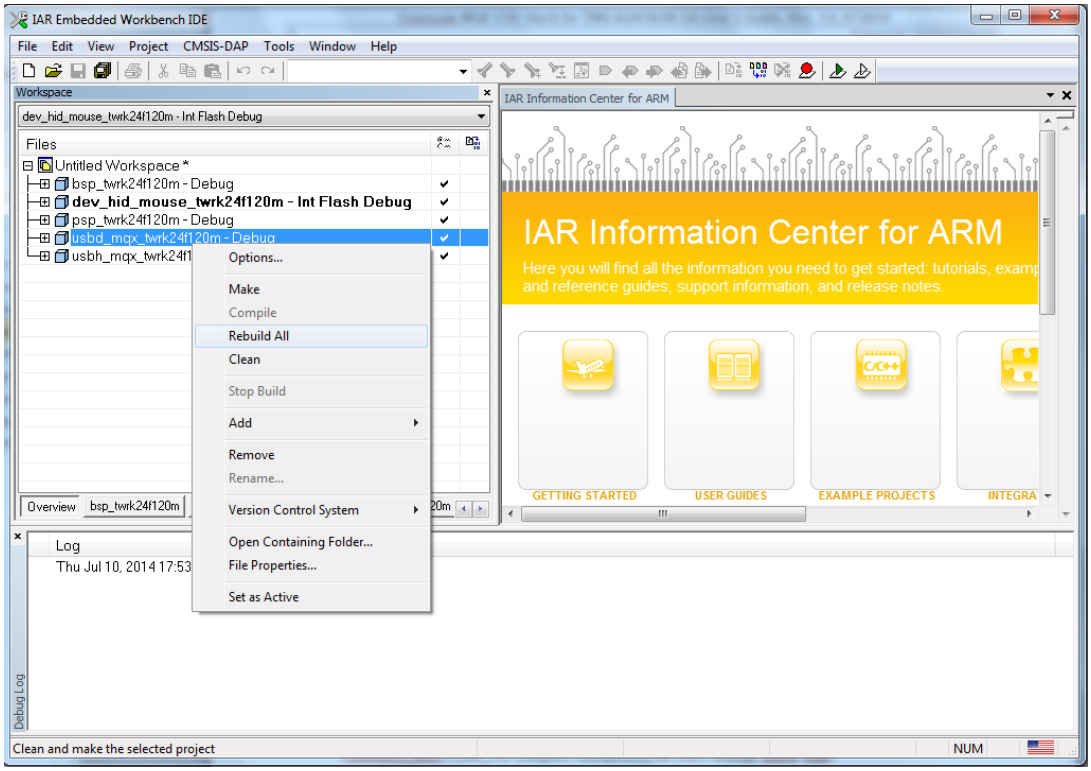


Figure-8 Save Workspace As dialog box

6. Build a USB stack library.



7. Check the USB library build result.

   - After the USB library is built, you can find the generated library binary file (usbd.a) under <install_dir>/usb_v2/output/twrk24f120m.iar/debug/usbd/mqx/
   - In addition, all the USB-related public header files are copied to this folder.

8. Build the USB device HID mouse example. The USB library must compile successfully. Otherwise, the build for the example project may fail.

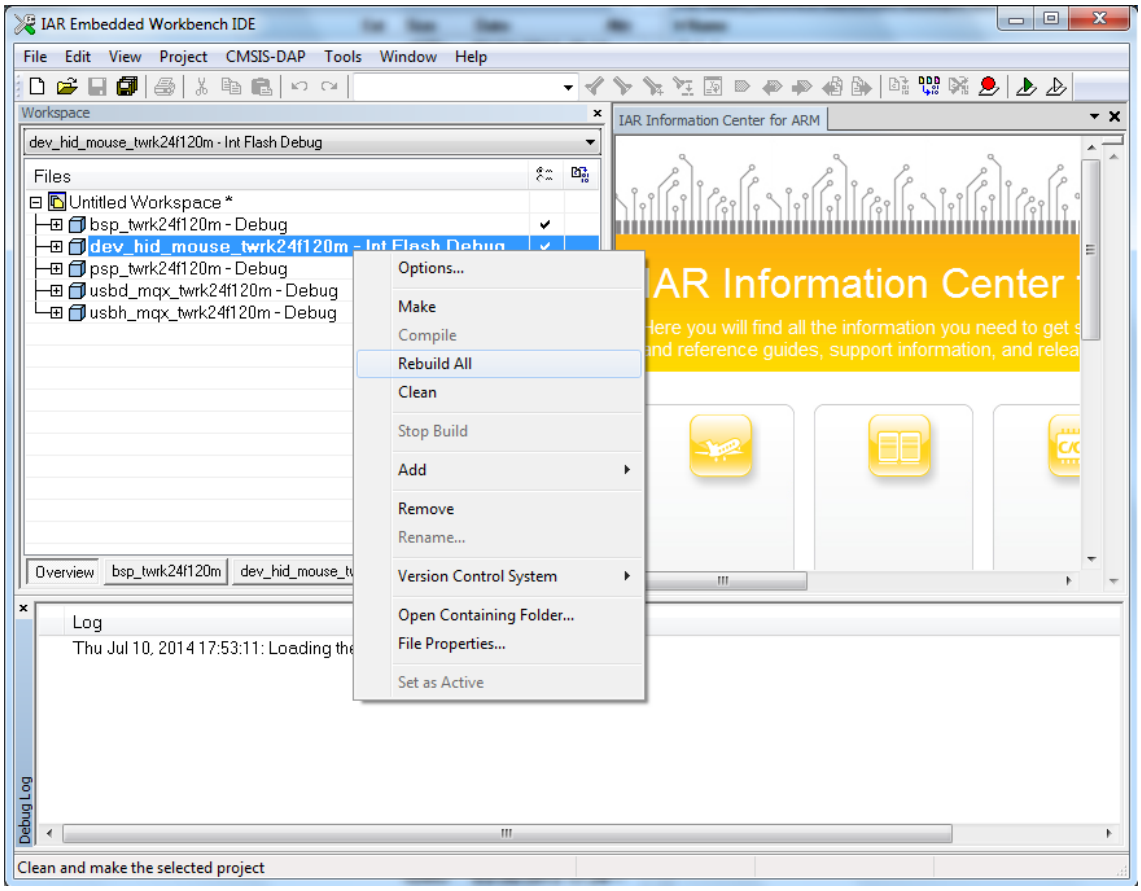


Figure-9 Building the USB device HID mouse example

9. Connect the J-Link to the JTAG port (J32) on TWR-K24F120M.
10. Connect the micro USB cable from a computer to J37 of TWR-K24F120M to power on the board.
11. Click **Download and Debug**. Wait for the downloading to finish.
12. Click **Go** to run the example.
13. Connect the micro USB cable from a computer to the J23 port of TRW-K24F120M to enable the USB mouse device to work on the computer.

    After the mouse device is enumerated by the computer, the mouse will be active, and the mouse pointer draws a rectangle on the computer.

4.2 Additional actions for Keil

The compilation process for Keil is similar to that for IAR. This section focuses on the parts of the Keil downloading process that are different from IAR.

Before we can download the binary to the target board with Keil, we need to set a programming algorithm as follows.

1. Access the options for the target project by right-clicking the target project.

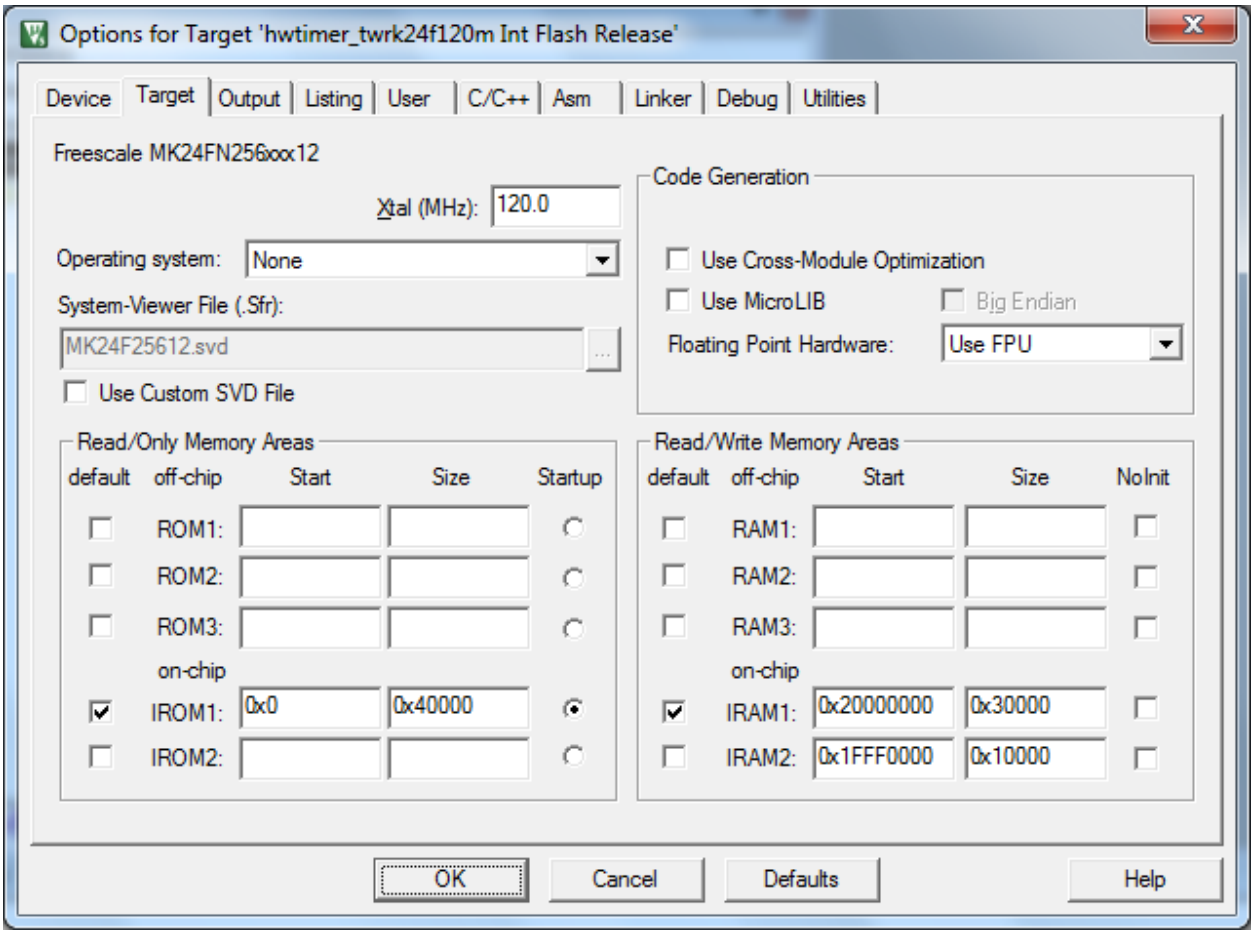


Figure-10 Options for the target project

2. Click the **Debug** tab.

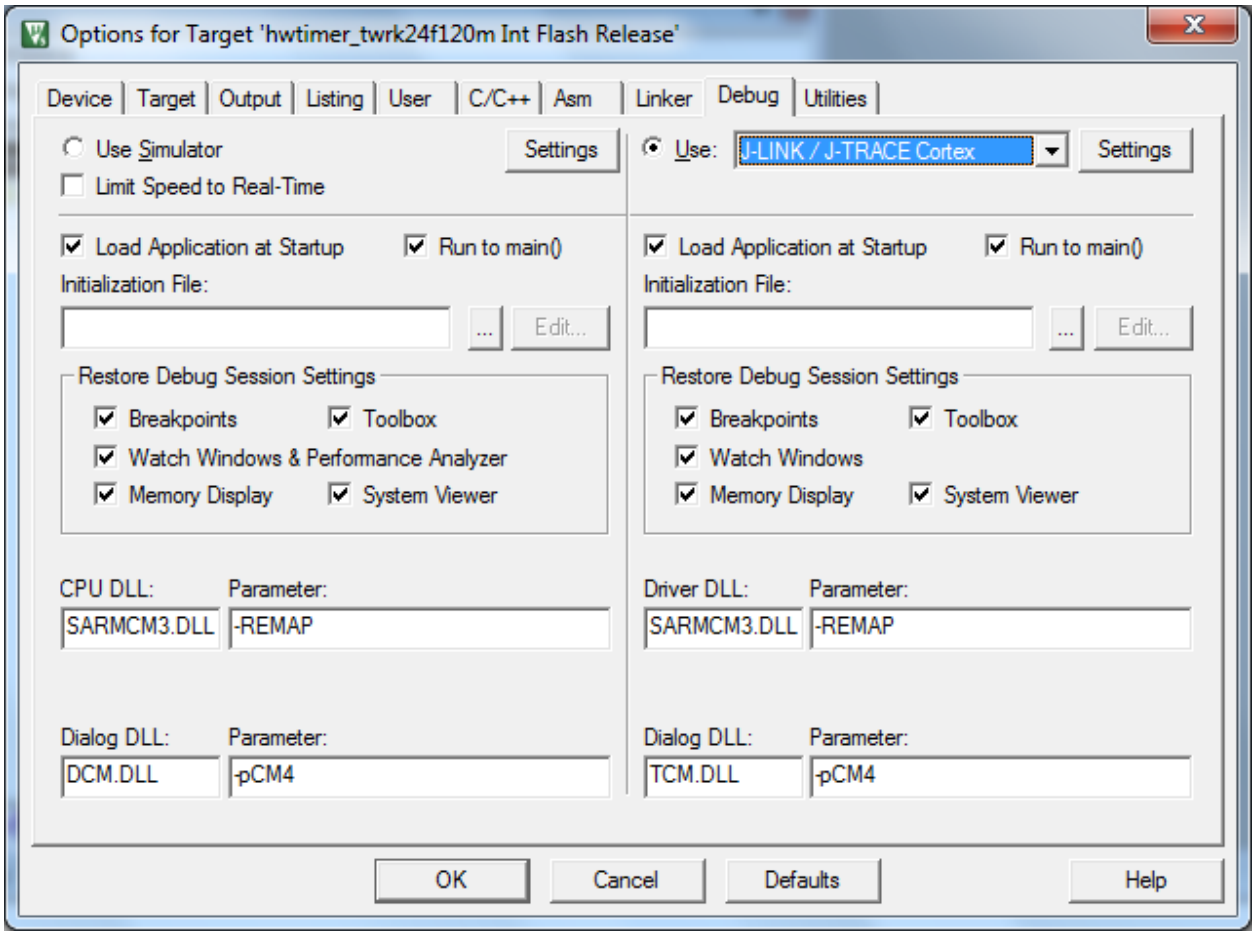


Figure-11 Debug tab

3. Click **Setting** next to the **Use: J-Link/J-Trace Cortex** option. The **Cortex JLink/JTrace Target Driver Setup** dialog box appears.

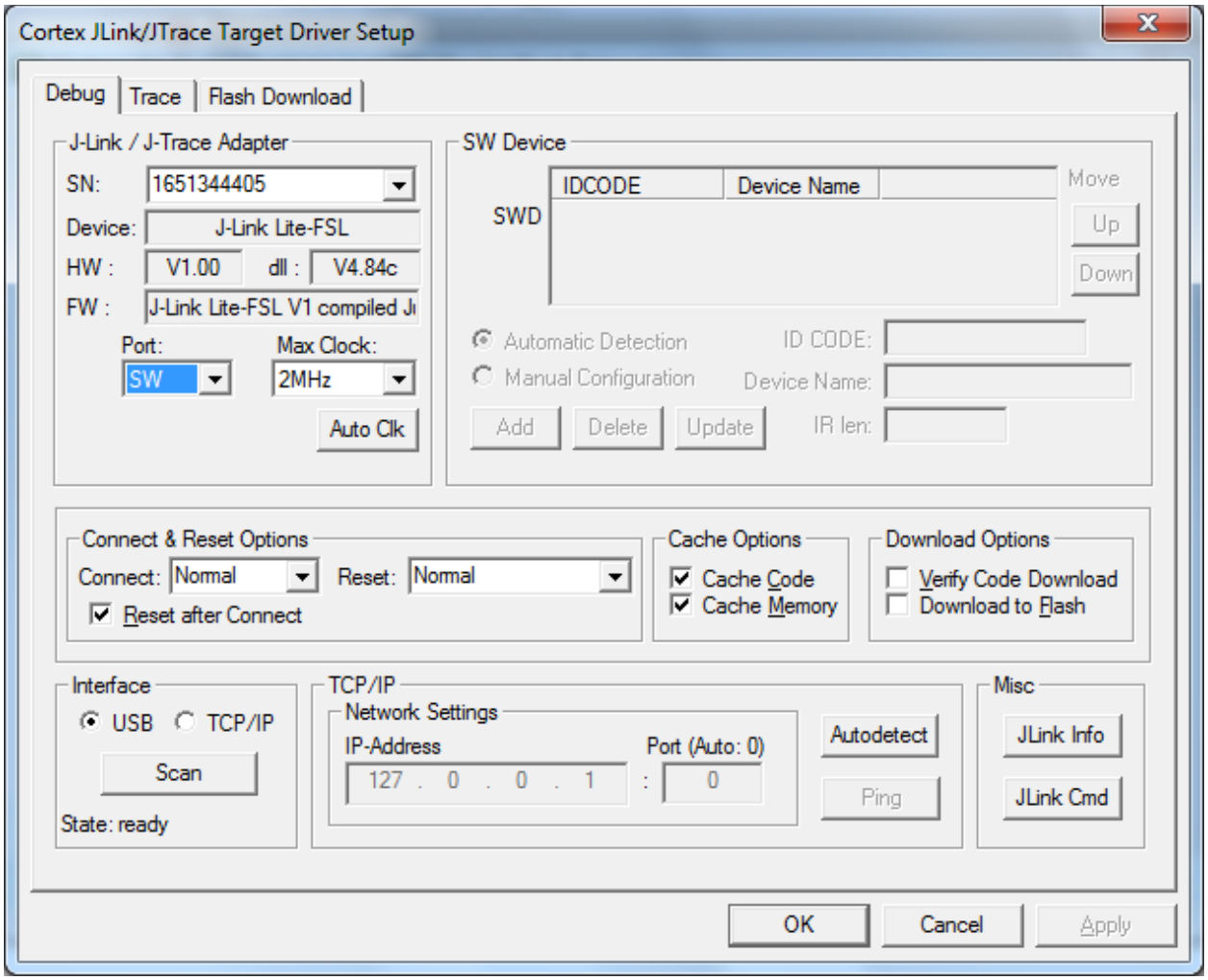


Figure-12 Cortex JLink/JTrace Target Driver Setup dialog box

4. Click the **Flash Download** tab.

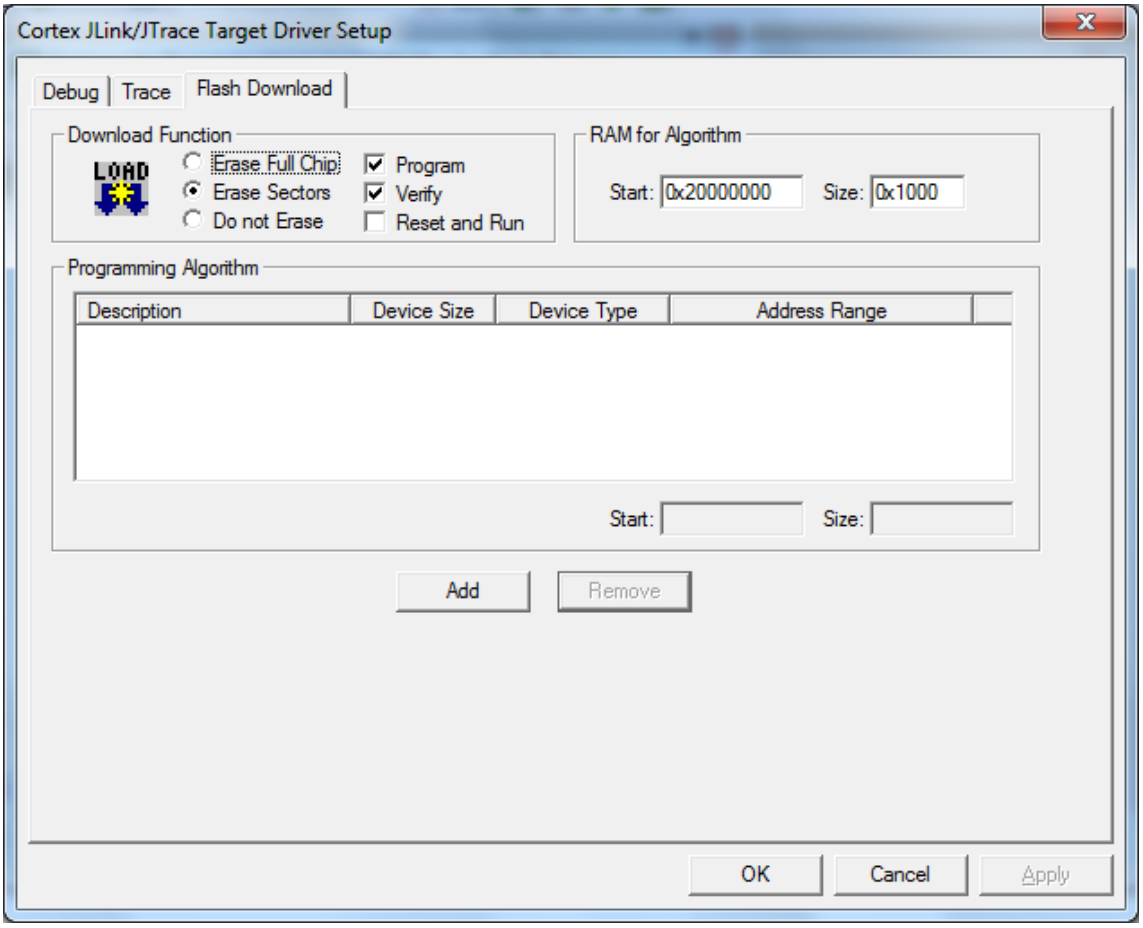


Figure-13 Cortex JLink/JTrace Target Driver Setup dialog box - Flash Download tab

5. Click **Add** and select **MKXX 256kB PFlash SEC(4KB)**.

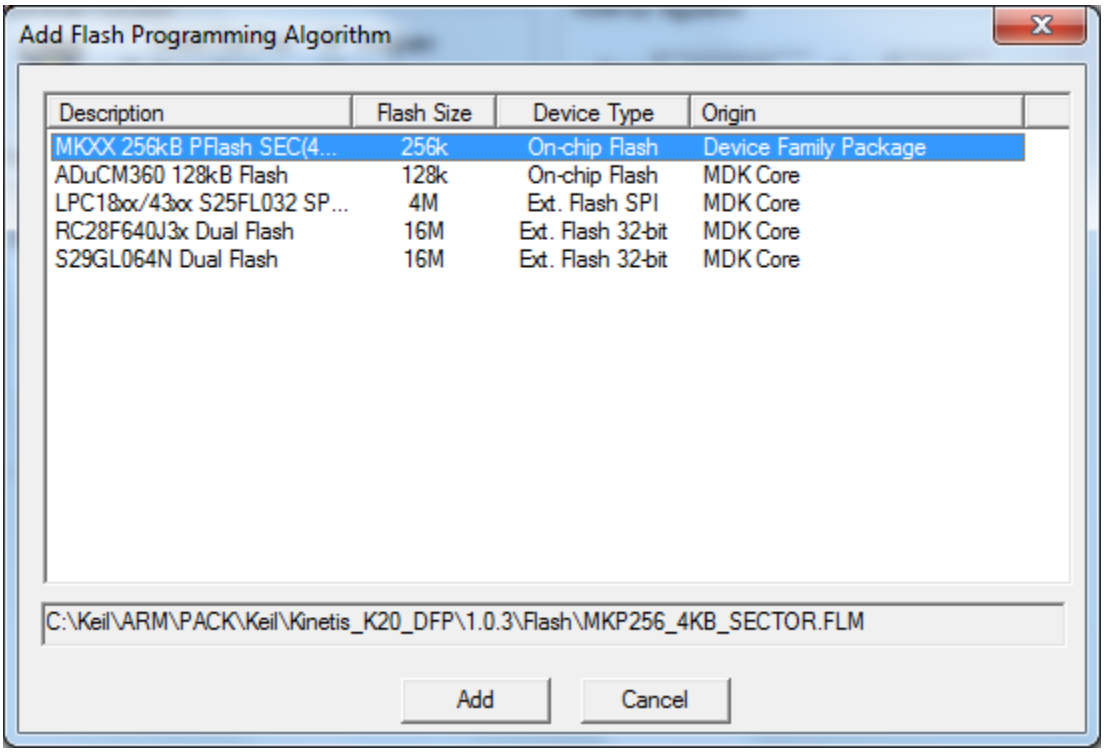


Figure-14 Selecting MKxxN 256kB programming flash

4.3 Downloading GNU tools ARM embedded 4.7

The compilation process of GNU Tools ARM Embedded is similar to that of IAR and Keil. You need to access the corresponding folder and run `mingw32-make` to compile the project from the command line or just run the corresponding batch file build_gcc_arm.bat for each example.

Note: The makefile provided by the USB stack supposes that the GCC tool chain is installed in C:/PROGRA~1/GNUTOO~1/43F2B~1.720 (the default installation path). If the GCC tool chain is installed in another folder in your system, you need to change **GCC_TOOLCHAIN_DIR** in `build\common\make\global.mak` to the correct path manually. Otherwise, the compilation process will fail. In addition, the path should be in the short file name format. You can get the short file name by using the following command:

```
for %A in ("C:\Program Files\GNU Tools ARM Embedded\4.7 2013q3") do @echo %~sA
```

The string `C:\Program Files\GNU Tools ARM Embedded\4.7 2013q3` in the command above should be replaced by the correct target long file name.

Some strange issues may occur when the default installation path of the GCC Tool Chain is changed, hence it is recommended not to change it. In addition, make sure that the **mingw32-base** and **msys-base** packages are installed in your system and the corresponding path has been added into the system path (MINGW\bin), and MINGW\msys\1.0\bin is not added to the system path.

The downloading steps are as follows:

1. Run **J-Link GDB Server**.

   This application is installed along with the J-Link. Select MK24FN256xxx12 as the target device and click **OK**.

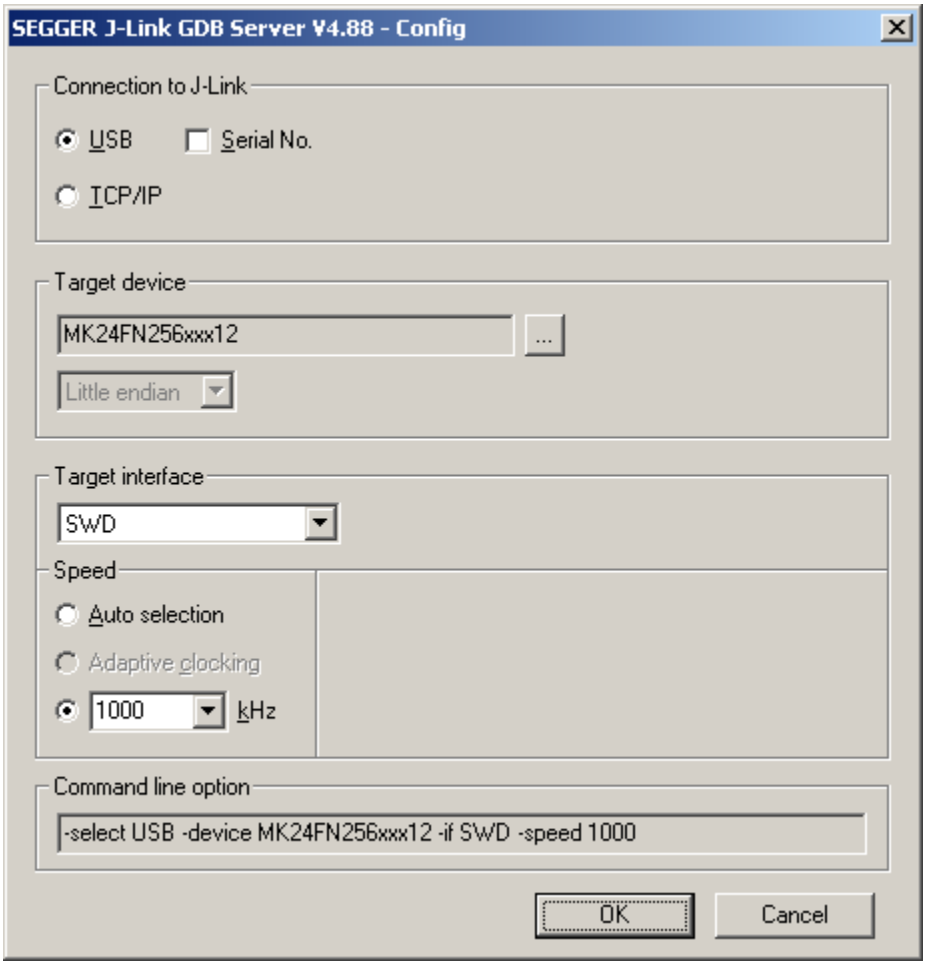


Figure-15 J-Link GDB Server Configuration dialog box

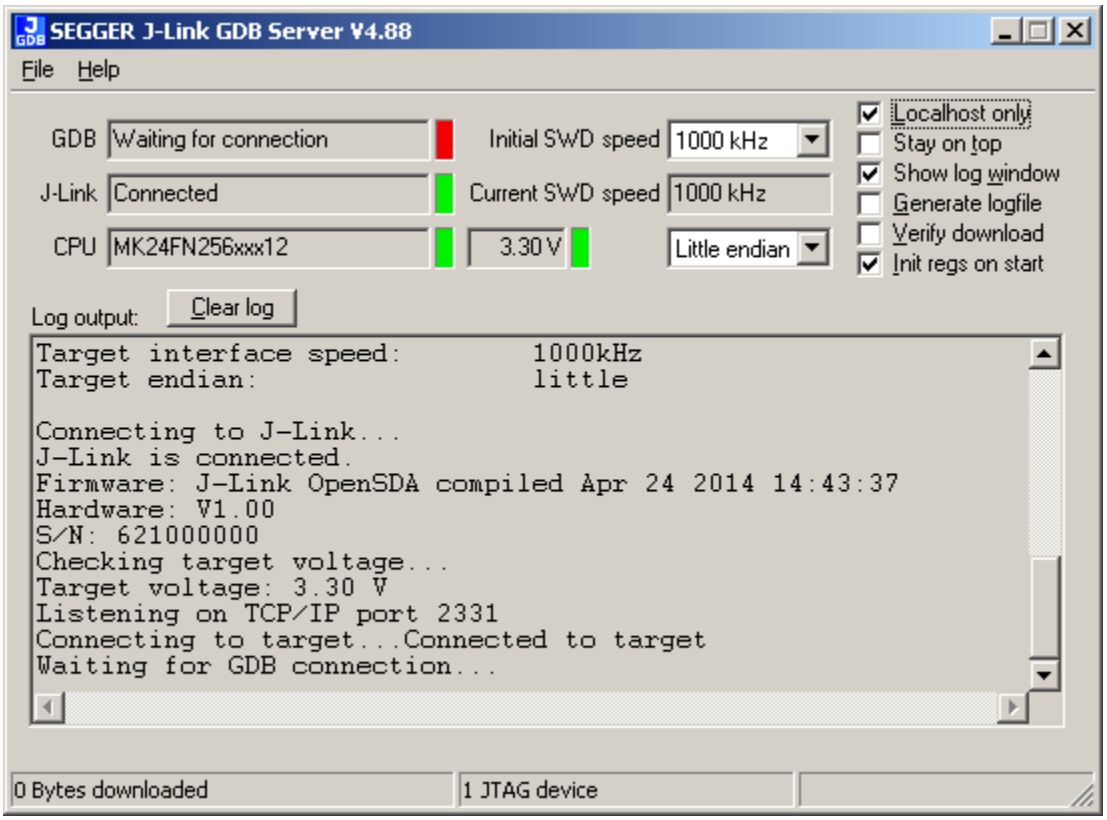


Figure-16 J-Link GDB server configuration result

2. Run **arm-none-eabi-gdb** under the folder where the target binary is located.

   In the example, this folder is under the following path: <install_dir>/usb_v2/example/device/hid/hid_mouse/mqx/make/dev_hid_mouse_twrk24f120m/gcc_arm/intflash_release

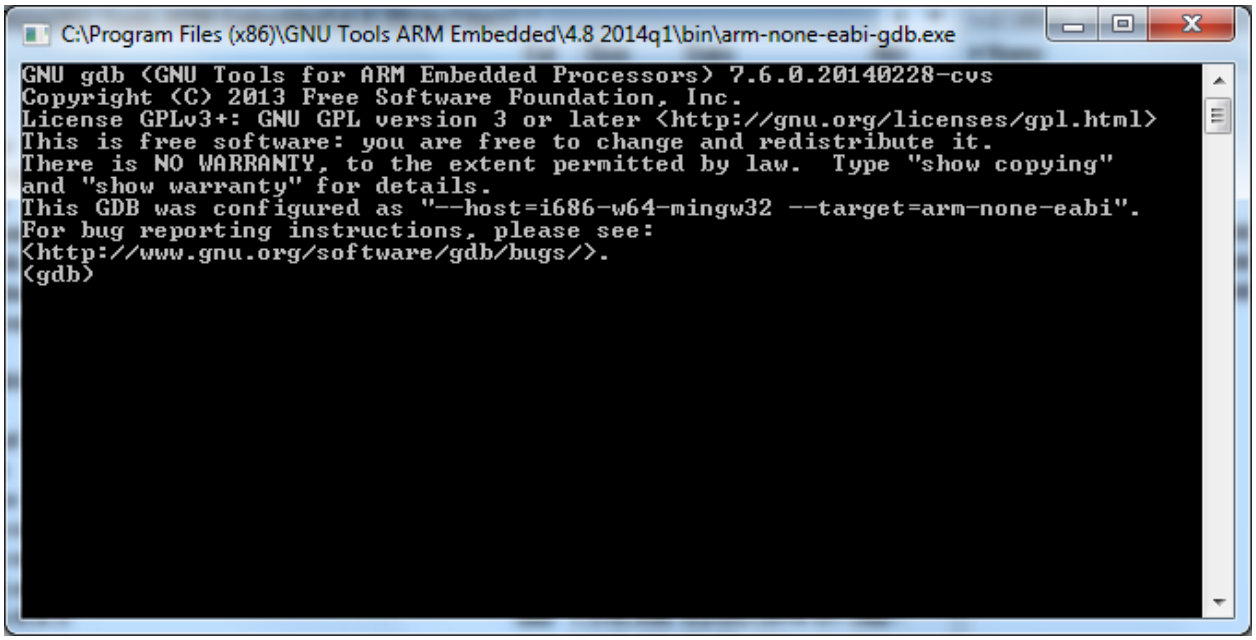


Figure-17 arm-none-eabi-gdb folder

3. On the gdb client, run the following commands:

```
target remote localhost:2331
monitor reset
monitor flash device = MK24FN256xxx12
load dev_hid_mouse_twrk24f120m.elf
monitor reg pc = (0x00000004)
monitor reg sp = (0x00000000)
monitor go
```

   The mouse becomes active on the computer.

5 USB Stack Configuration

5.1 Device configuration

All the device configurations are listed in the following file:

<install_dir>/usb_v2/usb_core/device/include/twrk24f120m/usb_device_config.h

We can enable or disable the USB class driver through this file, and we can configure the object number to decrease the memory usage or increase the object number to meet some specific requirements.

If you change the configuration of the device stack, both the USB library project and the example project need to be rebuilt.

Notes

The composite device examples can work only with:

```
USBCFG_DEV_COMPOSITE            1
```

All other non-composite device examples can work only with:

```
USBCFG_DEV_COMPOSITE            0
```

If incorrect settings are configured, a build error will occur and will need to be modified.

5.2 Host configuration

All the host configurations are listed in the following file:

<install_dir>/usb_v2/usb_core/host/include/twrk24f120m/usb_host_config.h

We can enable or disable the USB class driver through this file, and we can configure the object number to decrease the memory usage or increase the object number to meet some specific requirements.

If you change the configuration of the host stack, both the USB library project and the example project need to be rebuilt.

5.3 OTG configuration

All the OTG configurations are listed in the following files:

- <install_dir>/usb_v2/usb_core/host/include/twrk24f120m/usb_device_config.h
- <install_dir>/usb_v2/usb_core/host/include/twrk24f120m/usb_host_config.h

You can enable or disable the USB class driver through these files, and configure the object number to decrease the memory usage or increase the object number to meet specific requirements.

If you change the configuration of the OTG stack, both the USB library project and the example project need to be re-built.

NOTE

The OTG example requests to use the mini receptacle on the TWR-SER board. The jumper settings should be:

- J4 1 – 2
- J27 1 – 2
- For the jumper settings on the TWR-SER board, see the TWR-SER user's guide.

Additional configuration is needed for the host mode:

USBCFG_HOST_PORT_NATIVE 0

Additional configuration is needed for the device mode:

USBCFG_DEV_COMPOSITE 0

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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331