UM1660
User manual

Getting started with the STM32F401 Discovery kit

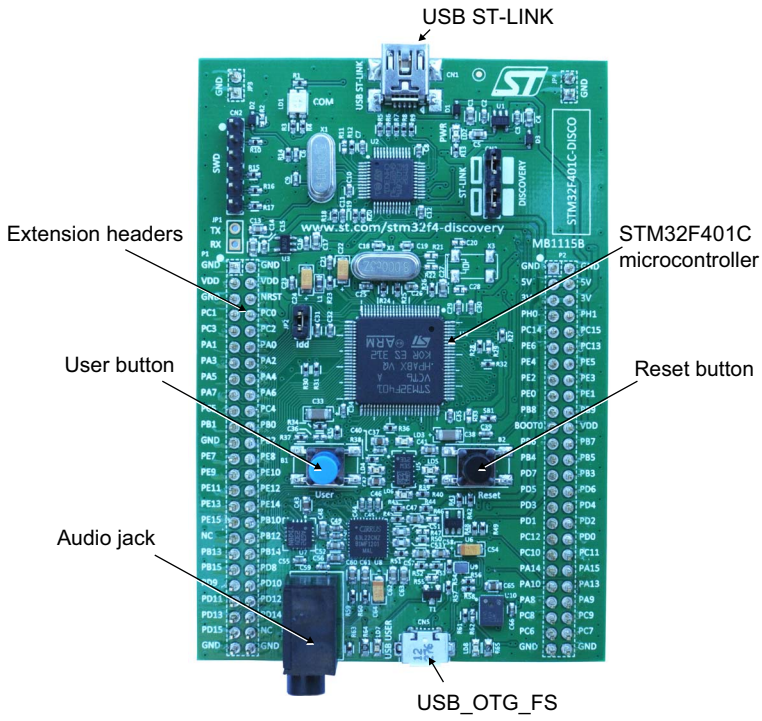
Introduction

This document describes the software, firmware environment and development recommendations required to build an application around the STM32F401 Discovery kit (32F401CDISCOVERY) with demonstration firmware (STSW-STM32136).

The STM32F401 Discovery kit is a low-cost and easy-to-use development kit to quickly evaluate and start applications with an STM32F4 series ARM® 32-bit Cortex™-M4 high-performance microcontroller. Before installing and using the product, please accept the Evaluation Product License Agreement from *www.st.com/stm32f4-discovery*.

For more information on the STM32F401 Discovery kit, visit *www.st.com/stm32f4-discovery*. To order the STM32F401 Discovery kit, use the STM32F401C-DISCO order code.

Figure 1. STM32F401 Discovery board: STM32F401C-DISCO



References

- STM32F401xB STM32F401xC datasheet
- STM32F40xxx advanced ARM®-based 32-bit MCUs reference manual (RM0344)
- Discovery kit for STM32F401 line (UM1669)
- Getting started with STM32F401 Discovery software development tools (UM1671)
- Forum: user question/discussion

Contents

List of figures

1 Hardware configuration and layout

1.1 Features

The STM32F401 Discovery offers the following features:

- STM32F401VCT6 microcontroller featuring 256 KB of Flash memory, 64 KB of RAM in an LQFP100 package
- On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)
- Board power supply: through USB bus or from an external 5 V supply voltage
- External application power supply: 3 V and 5 V
- L3GD20, ST MEMS motion sensor, 3-axis digital output gyroscope.
- LSM303DLHC, ST MEMS system-in-package featuring a 3D digital linear acceleration sensor and a 3D digital magnetic sensor.
- MP45DT02, ST MEMS audio sensor, omnidirectional digital microphone
- CS43L22, audio DAC with integrated class D speaker driver
- Eight LEDs:
  - LD1 (red/green) for USB communication
  - LD2 (red) for 3.3 V power on
  - Four user LEDs:
    LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)
  - Two USB OTG LEDs:
    LD7 (green) VBus and LD8 (red) over-current
- Two pushbuttons (user and reset)
- USB OTG with micro-AB connector
- Extension header for LQFP100 I/Os for a quick connection to the prototyping board and an easy probing

1.2 STM32F401x microcontroller

The STM32F401x device is based on the high-performance ARM® 32-bit Cortex™-M4 RISC core operating at a frequency of up to 84 MHz. The Cortex-M4 core features a floating point unit (FPU) single precision which supports all ARM single-precision data-processing instructions and data types. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances application security.

The STM32F401x device incorporates high-speed embedded memories (Flash memory up to 256 Kbytes, up to 64 Kbytes of SRAM), up to 4 Kbytes of backup SRAM, and an extensive range of enhanced I/Os and peripherals connected to two APB buses, two AHB buses and a 32-bit multi-AHB bus matrix.

1.3 System requirements

- Windows PC (XP, Vista, 7)
- USB type A to Mini-B cable
- ST-LINK/V2
- Supported IDE are EWARM (IAR Embedded Workbench®), MDK-ARM™ and Atollic TrueSTUDIO®

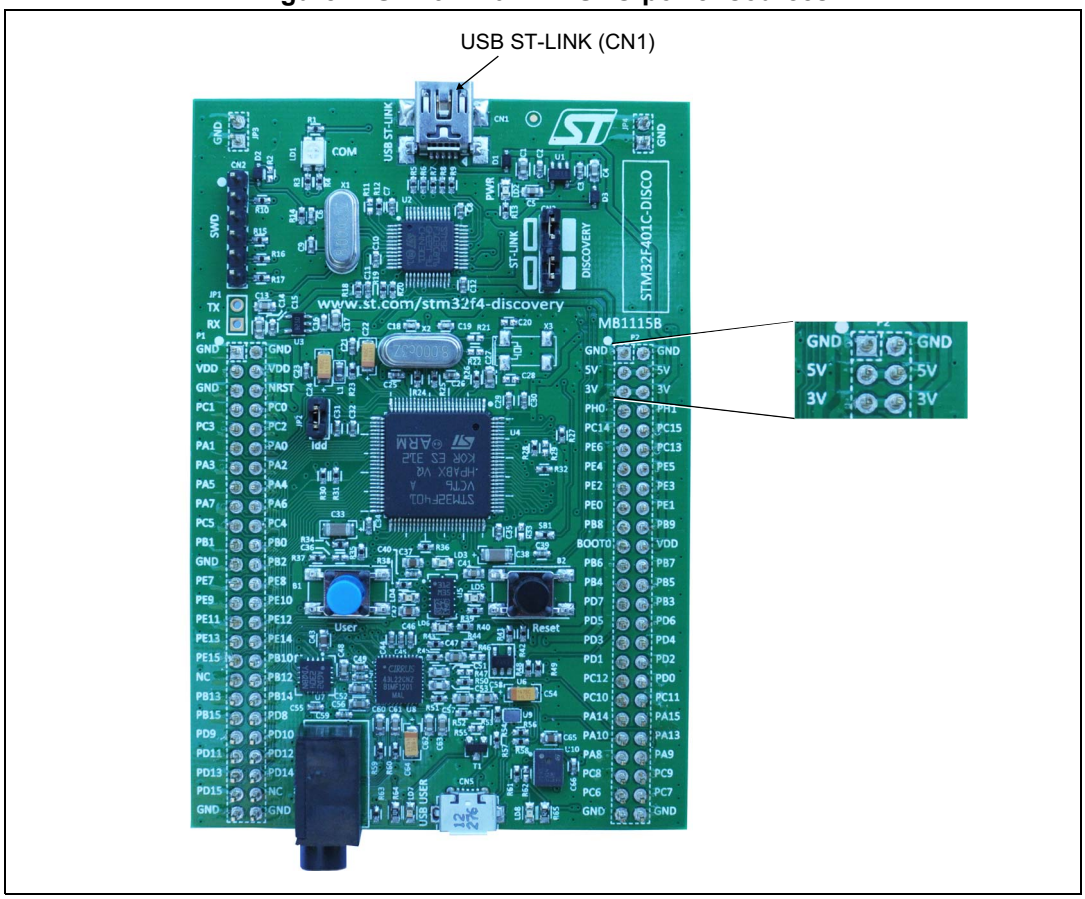
Note: Required information to download and install desired IDE and ST-LINK/V2 are detailed in ***Getting started with STM32F401 Discovery software development tools (UM1671)****.*

1.4 Powering up the board

The STM32F401C-DISCO board can be powered up from three sources.

- USB ST-LINK: To power the board from the USB connector CN1, use the 'USB type A to Micro-B' cable and connect it between the host and the board USB connector CN1.
- Two external sources: DC power supply can be inserted in the GND and 3 V (or 5 V) pin.

Figure 2. STM32F401C-DISCO power sources



1.5 Reset the board

There are three ways to reset the board:

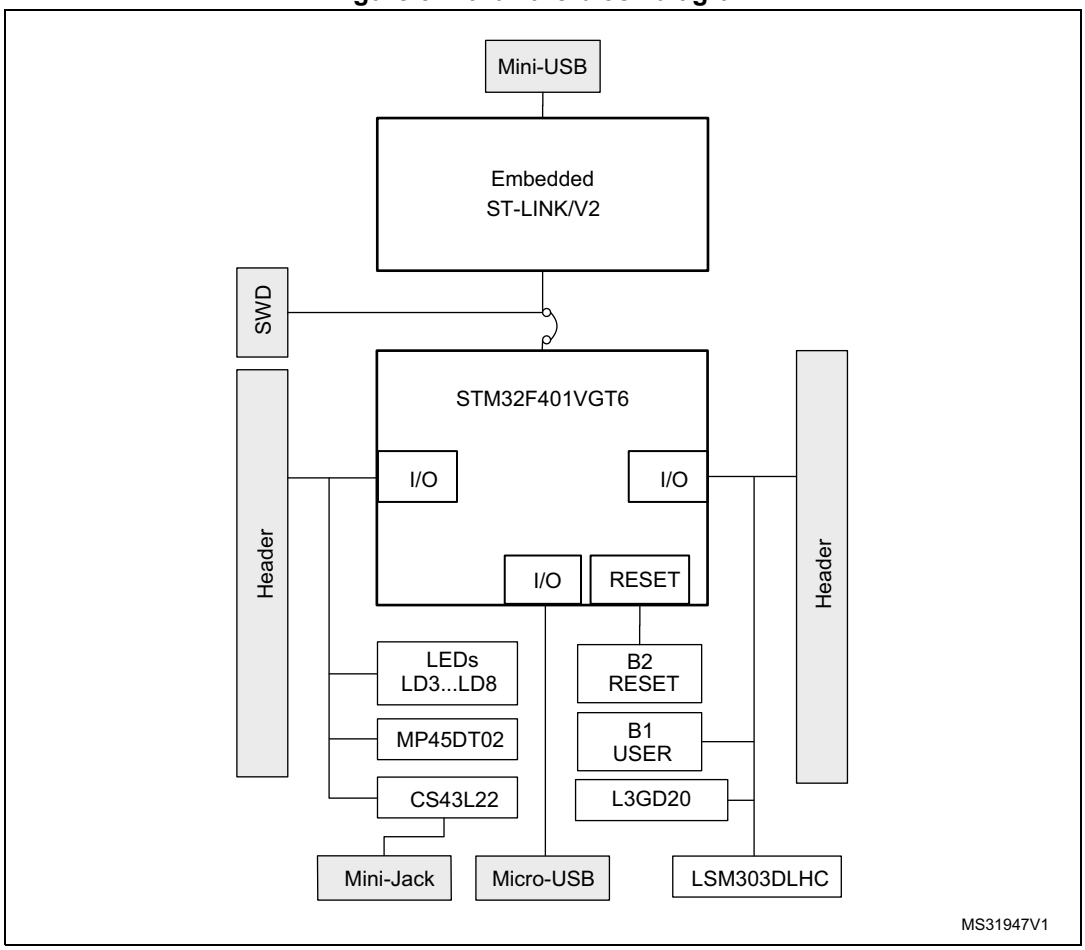
- Push the reset button mounted on the STM32F401C-DISCO.
- Remove and reinsert the USB cable.
- The MCU can also be reset by debuggers.

1.6 Hardware block diagram

The STM32F401C-DISCO is designed around the STM32F401xC microcontroller in a 100-pin LQFP package. *Figure 3* illustrates the connections between the STM32F401xC and its peripherals (STLINK/V2, pushbutton, LED, USB and connectors).

Please refer to *Schematic Pack* on www.st.com/stm32f4-discovery for more details.

Figure 3. Hardware block diagram



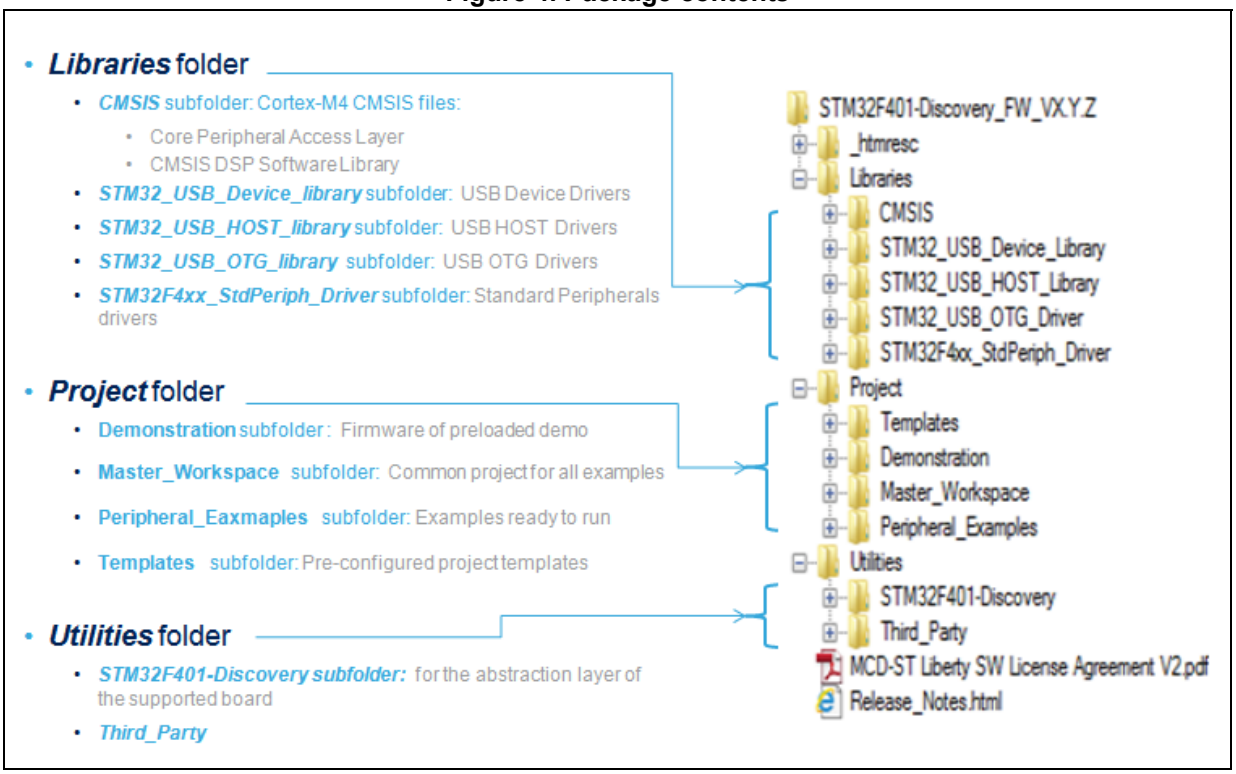
2 Firmware package

To get started with the STM32F401 Discovery kit, a firmware package that contains a set of IPs examples and demonstrations of some features are available on www.st.com/stm32f4-discovery.

2.1 Package description

The STM32F401 Discovery firmware applications and related documentation are provided in one single package and supplied in one single ZIP file. The extraction of the ZIP file generates one folder, *STM32F401-Discovery_FW_VX.Y.Z*, which contains the following subfolders:

Figure 4. Package contents



You can run examples provided within this package. A set of examples for each peripheral are ready to be run.

2.2 Programming firmware application

To start programming, user must:

- Install the preferred Integrated Development Environment (IDE).
- Install the ST-LINK/V2 driver from the ST web site.

2.2.1 Programming application

To program application (demonstration or example), follow the sequence below:

1. Open the application folder
2. Choose the desired IDE project
3. Double click on the project file (ex. STM32F401-Discovery_Demo.eww for EWARM)
4. Rebuild all files: Project->Rebuild all
5. Load project image: Project->Debug
6. Run program: Debug->Go

Please refer to **Getting started with STM32F401 Discovery software development tools (UM1671)** for more details.

2.2.2 Run pre-loaded demo

To run and develop any firmware applications on your STM32F401 Discovery board, the minimum requirements are as follows:

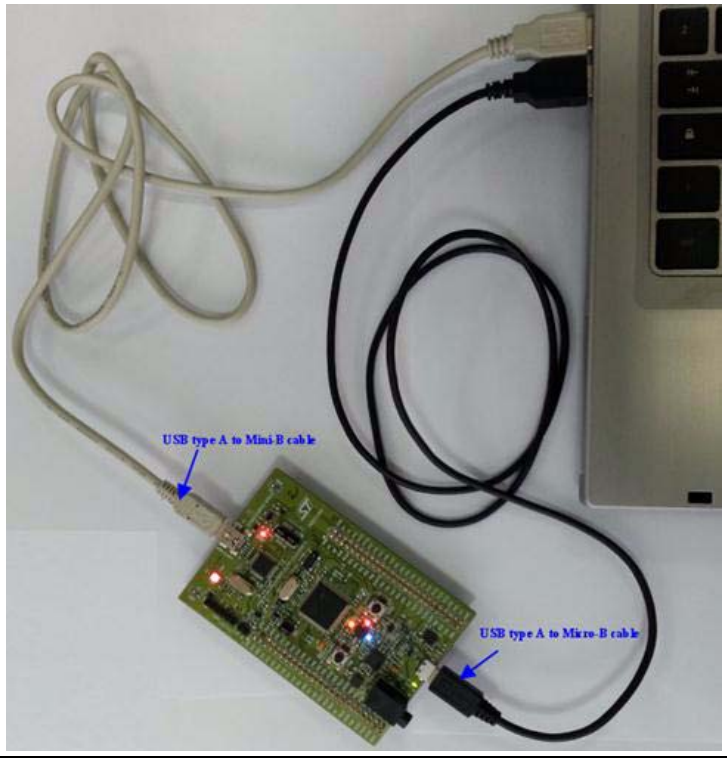
- Windows PC (XP, Vista, 7)
- 'USB type A to Mini-B' cable, used to power the board (through USB connector CN1) from host PC and connect to the embedded ST-LINK/V2 for debugging and programming.

Additional hardware accessories will be needed to run some applications:

- 'USB type A to Micro-B' cable, used to connect the board (through USB connector CN5) as USB Device to host PC.

Establish the connection with the STM32F401 Discovery board as shown in *Figure 5*.

Figure 5. Hardware environement



The demonstration software is already preloaded in the Flash memory on the board. The latest versions of the demonstration source code and associated documentation can be downloaded from www.st.com/stm32f4-discovery.

Follow the sequence below to configure the STM32F401 Discovery board and launch the DISCOVER application:

1. Ensure that the jumpers JP2 and CN3 are set to "on" (Discovery mode).
2. Connect the STM32F401 Discovery board to a PC using a USB cable type A/mini-B through the USB ST-LINK connector CN1, to power the board. The LED LD2 (PWR) will light up and the four LEDs between the buttons B1 and B2 start blinking.
3. Press the user button B1 to enable the MEMS sensor. The four LEDs will indicate the board motion direction and speed. When connected to a PC with a second USB type A/micro-B cable through CN5, the board will be recognized as a standard mouse.
4. The demo software, as well as other software examples that allow you to discover the STM32 F4 series features, are available on *www.st.com/stm32f4-discovery*.
5. Develop your own applications starting from the examples.

3 Revision history

Table 1. Document revision history

Date	Revision	Changes
11-Sep-2013	1	Initial release.

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