UM1680
User manual

Getting started with STM32F429 Discovery software development tools

Introduction

This document describes the software environment and development recommendations required to build an application around the STM32F429 Discovery (32F429IDISCOVERY).

It provides guidelines to novice users on how to build and run a sample application and to create and build their own application.

This document is structured as follows:

- *Chapter 1* describes where to find the ST-LINK/V2 driver that should be installed before starting coding on any Integrated Development Environment
- *Chapter 2* describes step by step how to execute and debug an existing project with one of the following toolchains:
  - IAR Embedded Workbench® for ARM (EWARM) by IAR Systems
  - Microcontroller Development Kit for ARM (MDK-ARM) by Keil™
  - TrueSTUDIO® by Atollic
- *Chapter 3* describes advanced debugging features
- *Chapter 4* provides links to detailed information on the previously mentioned toolchains

Although this manual cannot cover all the topics relevant to software development environments; it demonstrates the first basic steps necessary to get started with the compilers/debuggers and provides links to the documents needed to fully understand every single step.

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1 System requirements

Before running your application, you should:

1. Install your preferred Integrated Development Environment (IDE).
2. Install the ST-LINK V2 driver from the ST web site.
3. Download the STM32F429I-Discovery firmware from the ST web site.
4. Establish the connection with the STM32F429 Discovery board as shown in *Figure 1*.

Figure 1. Hardware environment

To run and develop any firmware applications on your STM32F429 Discovery board, the minimum requirements are as follows:

- Windows PC (2000, XP, Vista, 7)
- 'USB type A to Mini-B' cable, to power the board (through USB connector CN1) from the host PC and connect to the embedded ST-LINK/V2 for debugging and programming.

1.1 IDEs supporting STM32 family

STMicroelectronics' STM32 family of 32-bit ARM Cortex-M core-based microcontrollers are supported by a complete range of software tools, encompassing traditional IDEs with C/C++ compilers and debuggers from major 3rd-parties (free versions up to 64KB of code, depending on partner), and completed with innovative tools from STMicroelectronics. *Table 1* regroups general information about some IDE versions that officially support the STM32F429I product.

Table 1. Supported Toolchain versions

Toolchain	Company	Compiler	Version	Download link (*)
EWARM	IAR Systems®	IAR C/C++	6.60 and later	www.iar.com/en/Products/IAR-Embedded-Workbench/ARM – 30-day evaluation edition – KickStart edition(32 KB Limitation for Cortex M3/M4) – KickStart edition(16 KB Limitation for Cortex M0)
MDK-ARM	Keil™	ARMCC	4.72 and later	www.keil.com/demo/eval/arm.htm MDK-Lite (32 KB Code size limitation)
TrueSTUDIO	© Atollic	GNUC	4.1 and later	www.atollic.com/index.php/request-eval-license(1) – 32 KB Limitation (8 KB on Cortex-M0 and Cortex-M1) – 30 day Professional version (Trial)

1. Registration is required before download

1.2 ST-LINK/V2 installation and development

The STM32F429 Discovery board includes an ST-LINK/V2 embedded debug tool interface which requires a dedicated USB driver. This driver is available on the www.st.com ST-LINK V2 page and is supported by these common software toolchains, and others:

- IAR™ Embedded Workbench for ARM (EWARM)
  - The toolchain is installed by default on the PC's local hard disk in the C:\Program Files\IAR Systems\Embedded Workbench x.x directory.
  - After installing EWARM, install the ST-LINK/V2 driver by running ST-Link_V2_USB.exe from [IAR_install_directory]\embedded Workbench x.x \arm\drivers\ST-Link\ST-Link_V2_USBdriver.exe
- RealView Microcontroller Development Kit (MDK-ARM) toolchain
  - The toolchain is installed by default on the PC's local hard disk in the C:\Keil directory; the installer creates a start menu shortcut for µVision4.
  - When connecting the ST-LINK/V2 tool, the PC detects new hardware and asks to install the ST-LINK_V2_USB driver. The "Found New Hardware wizard" guides you through the steps needed to install the driver from the recommended location.
- Atollic TrueSTUDIO® STM32
  - The toolchain is installed by default on the PC's local hard disk in the C:\Program Files\Atollic directory.
  - The ST-Link_V2_USB.exe is installed automatically with the software toolchain.

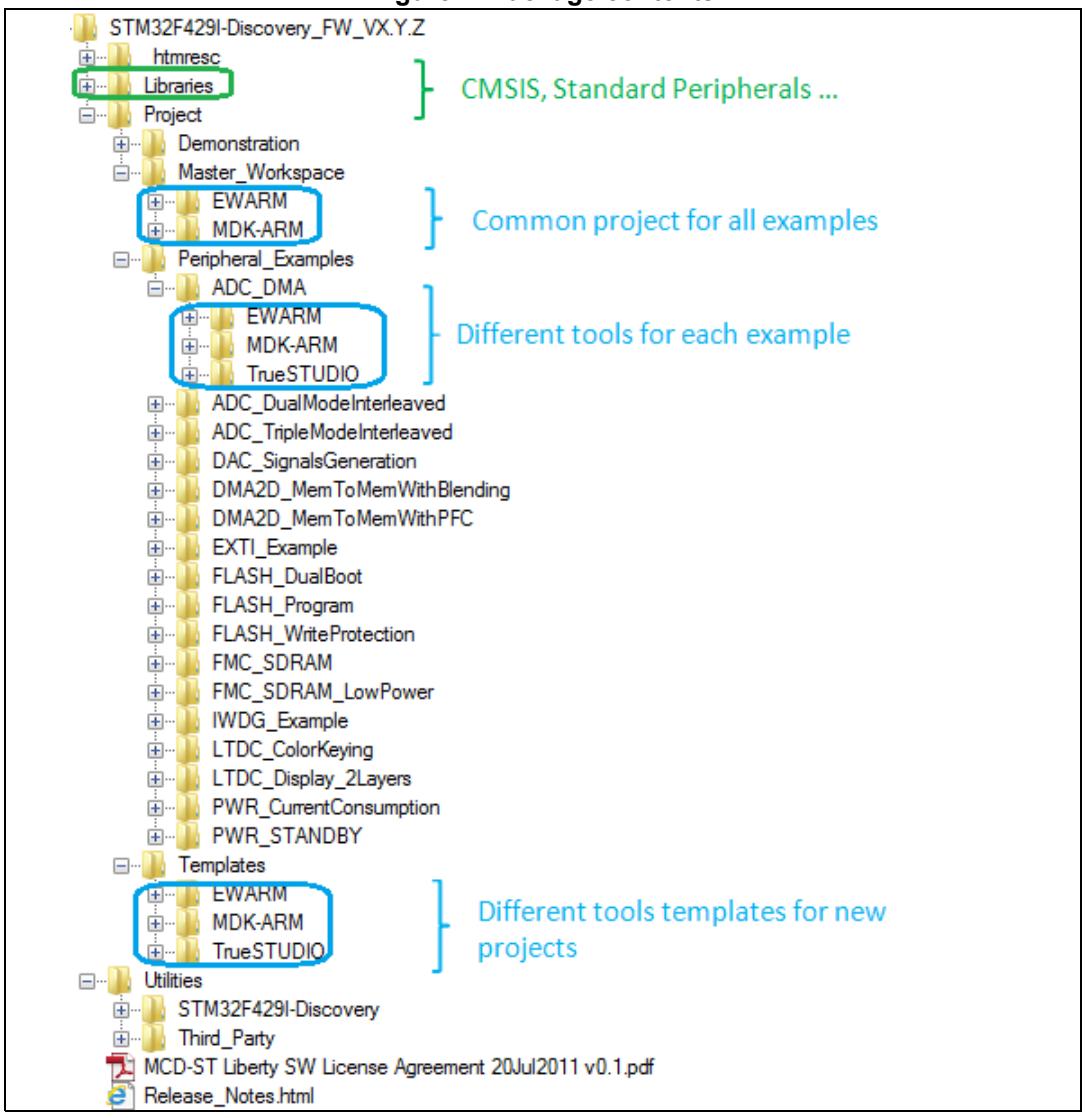
Complementary information on the firmware package and the STM32F429 Discovery requirements are available from the Getting started with STM32 Firmware document.

Note: The embedded ST-LINK/V2 supports only SWD interface for STM32 devices.

1.3 Firmware package

The STM32F429I-Discovery firmware applications, demonstration and IP examples are provided in one package in one zip file. Extracting the zip file generates one folder, STM32F429I-Discovery_FW_VX.Y.Z, which contains the following subfolders:

Figure 2. Package contents



Template project: Pre-configured project with empty main function to be customized by you. This is helpful to start creating your own application based on the peripherals drivers.

Master workspace: Assembly of all projects available within this firmware package.

Peripheral examples: Set of examples for each peripheral ready to be run.

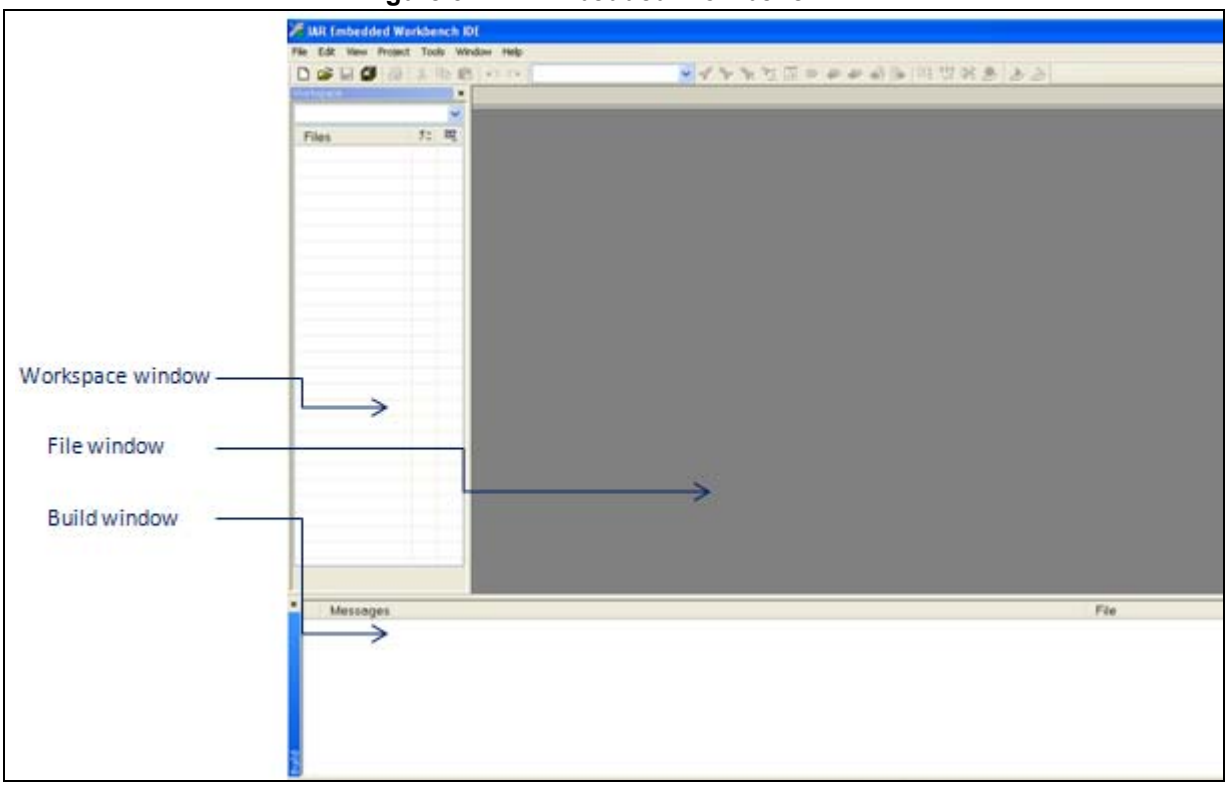
2 Executing / debugging firmware using software toolchains

2.1 EWARM toolchain

The following procedure compiles, links and executes an existing EWARM project.
The steps below can be applied to an existing example, demonstration or template project for STM32F429I-Discovery_FW_VX.Y.Z firmware available at www.st.com.

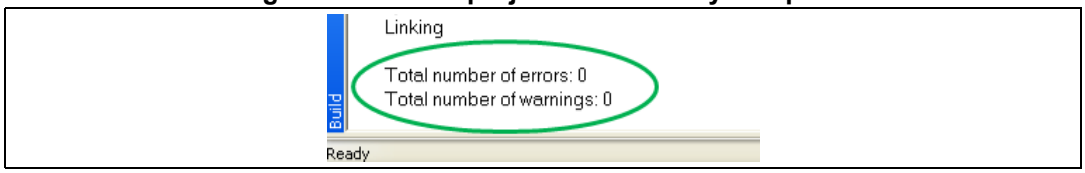
1. Read the firmware readme.txt file which contains the firmware description and hardware/software requirements, then start the EWARM toolchain. *Figure 3* shows the basic names of the windows referred to in this document.

Figure 3. IAR Embedded Workbench IDE



2. Select **File** > **Open** > **Workspace**. Browse to select either an example, demonstration or template workspace file and click **Open** to launch it in the Project window.
3. Select **Project** > **Rebuild All** to compile your project. If your project is successfully compiled, the following window is displayed.

Figure 4. EWARM project successfully compiled



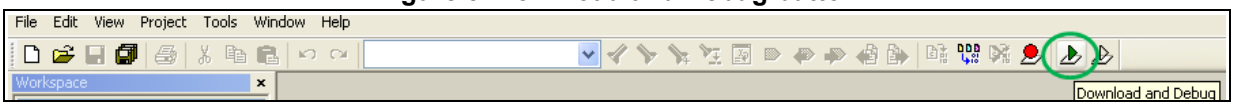
If you need to change project settings (Include and preprocessor defines), just go through project options:

– For Include directories: **Project>Options…>C/C++ compiler>**

– For pre-processor defines: **Project>Options…C/C++ compiler>pre-processor>**

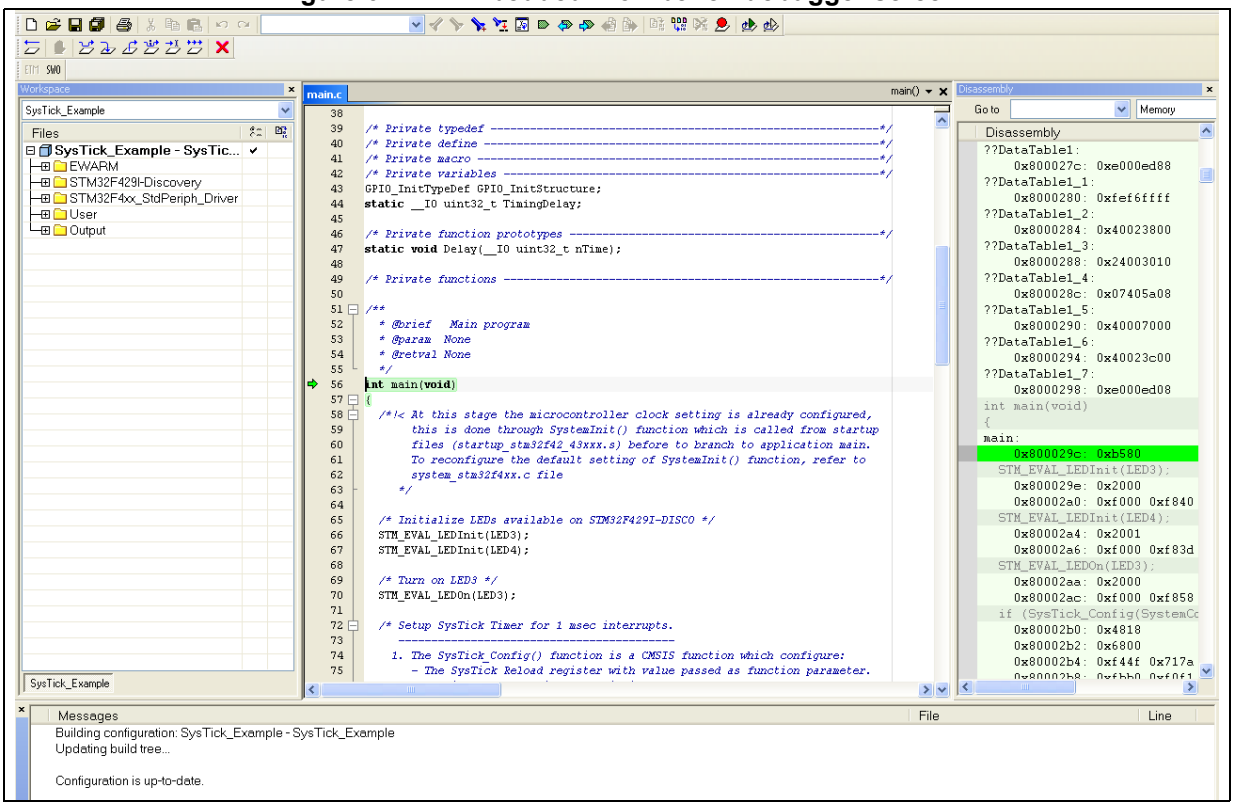
4. Select **Project** > **Download and Debug** or, alternatively, click the **Download and Debug** button the in toolbar, to program the Flash memory and begin debugging.

Figure 5. Download and Debug button



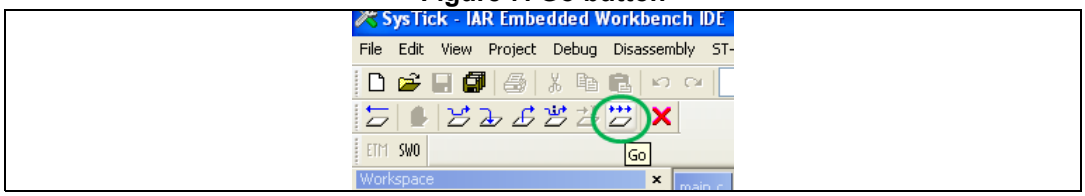
5. The debugger in the IAR Embedded Workbench can debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during code execution.

Figure 6. IAR Embedded Workbench debugger screen



6. Select **Debug** > **Go** to run your application, or click the **Go** button in the toolbar.

Figure 7. Go button

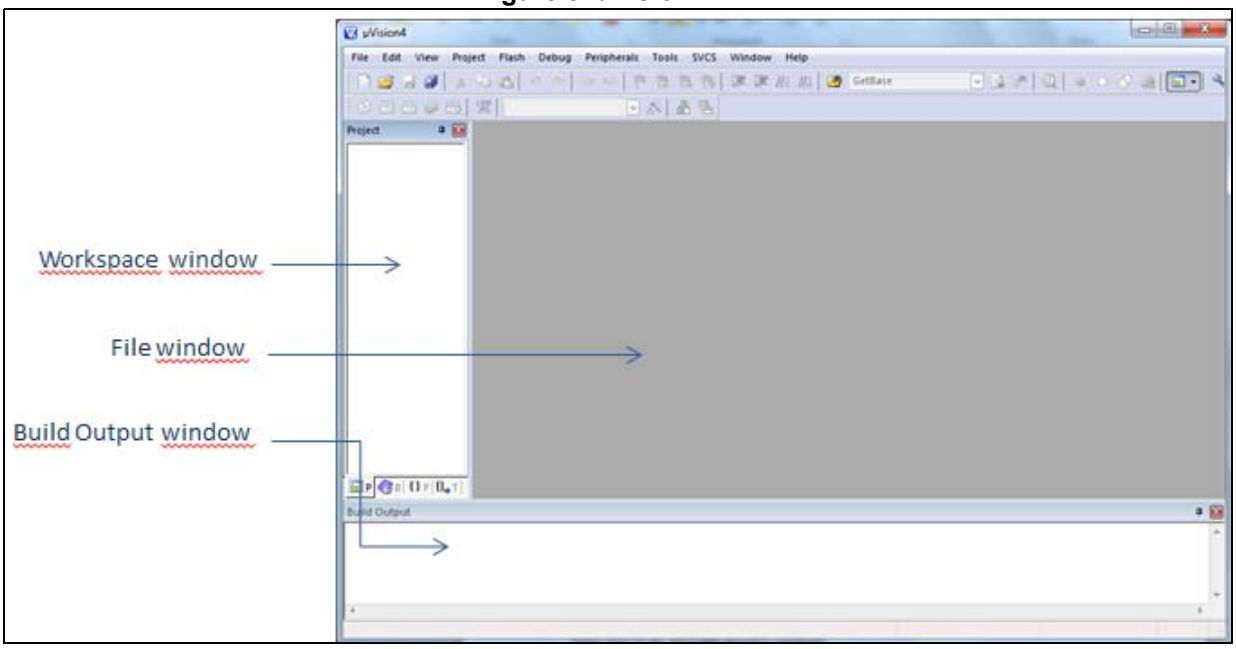


2.2 MDK-ARM toolchain

The following procedure compiles, links and executes an existing MDK-ARM project. The steps below can be applied to an existing example, demonstration or template project for STM32F429I-Discovery_FW_VX.Y.Z firmware available at www.st.com.

1. Open Keil MDK-ARM Microcontroller Kit. *Figure 8* shows the basic names of the "Keil uVision4"windows referred to in this document.

Figure 8. uVision4 IDE



2. Select **Project** > **Open Project... Browse** to select either an example, demonstration or template project file and click **Open** to launch it in the Project window.
3. Select **Project** > **Rebuild All target files** to compile your project. If your project is successfully compiled, the following window is displayed.

Figure 9. MDK-ARM project successfully compiled

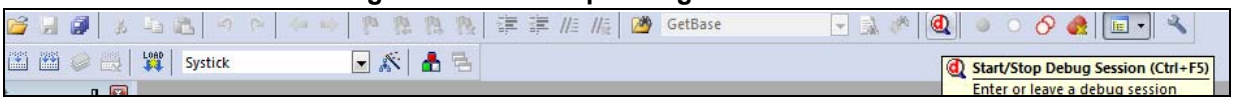
```
Build Output
Build target 'SysTick'
linking...
Program Size: Code=852 RO-data=460 RW-data=44 ZI-data=1028
".\SysTick\SysTick.axf" - 0 Error(s), 0 Warning(s).
```

You can change your project settings (Include and preprocessor defines), through the project options:

- For Include directories: **Project>Options for Target > C/C++ > Include Paths**
- For pre-processor defines: **Project>Options for Target > C/C++ > Preprocessor symbols > Define**

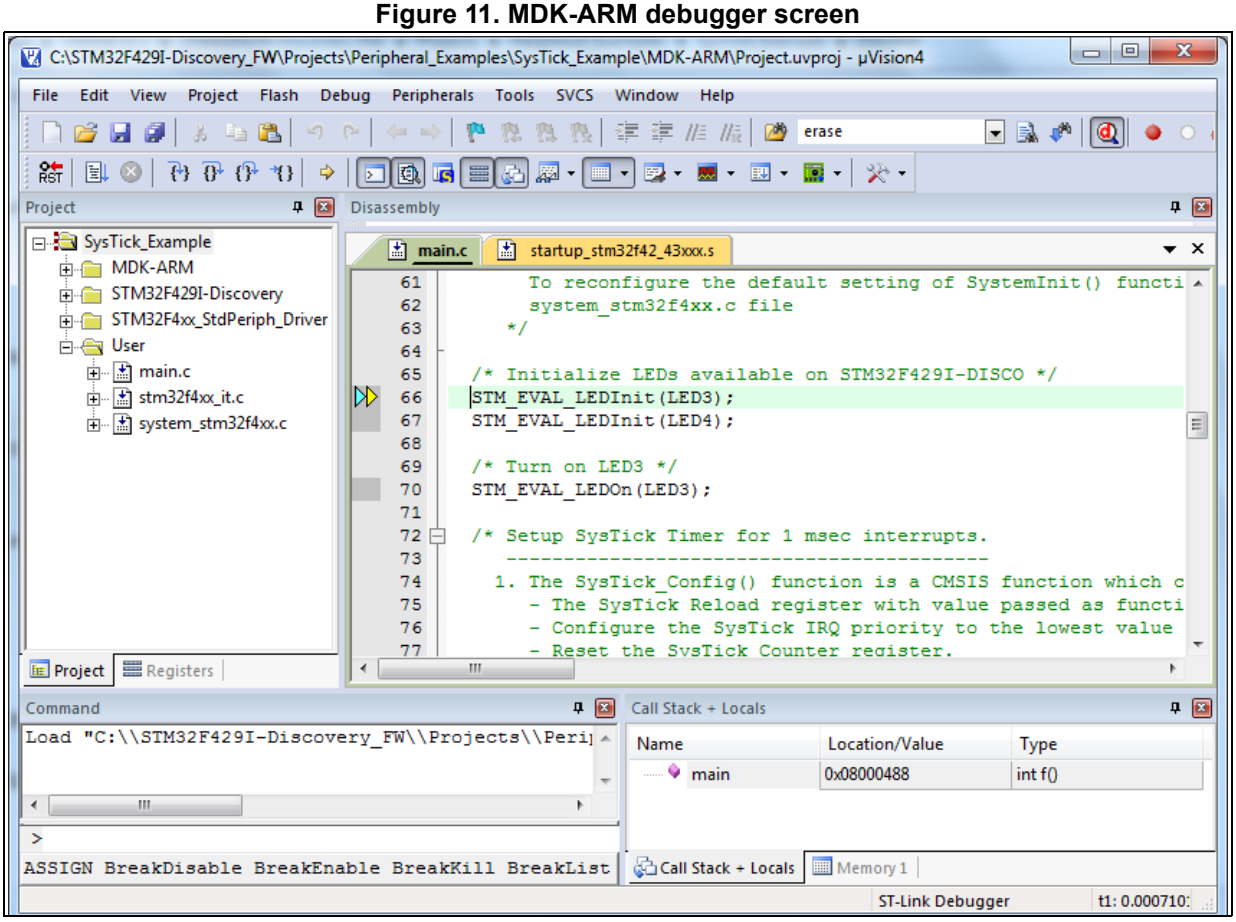
4. Select **Debug** > **Start/Stop Debug Session** or, click the **Start/Stop Debug Session** button in the toolbar, to program the Flash memory and begin debugging.

Figure 10. Start/Stop Debug Session button



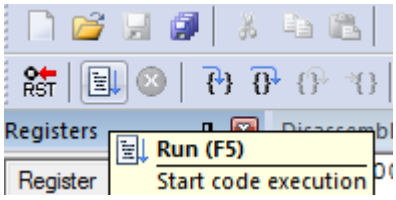
5. The MDK-ARM debugger can debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during code execution.

Figure 11. MDK-ARM debugger screen



6. Select **Debug** > **Run** to run your application, or click the **Run** button in the toolbar.

Figure 12. Run button

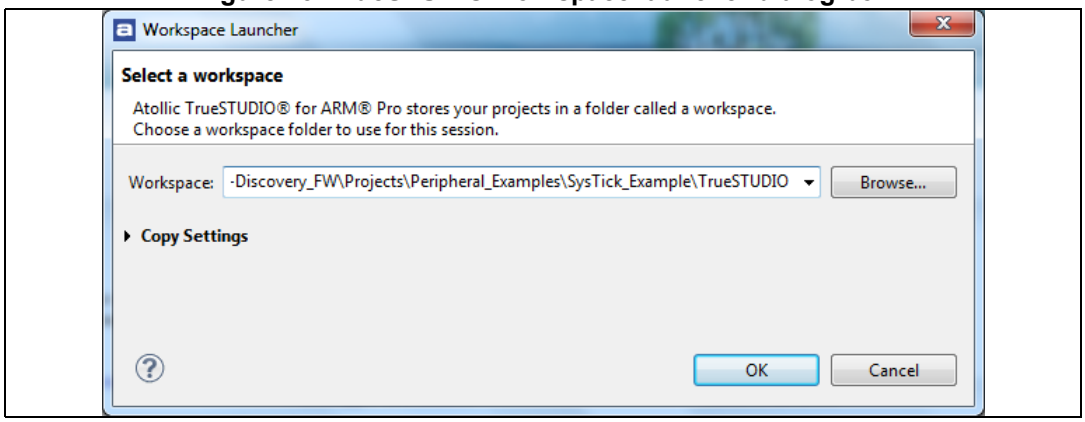


2.3 TrueSTUDIO toolchain

The following procedure compiles, links and executes an existing TrueSTUDIO project. The steps below can be applied to an existing example, demonstration or template project for STM32F429I-Discovery_FW_VX.Y.Z firmware available at www.st.com.

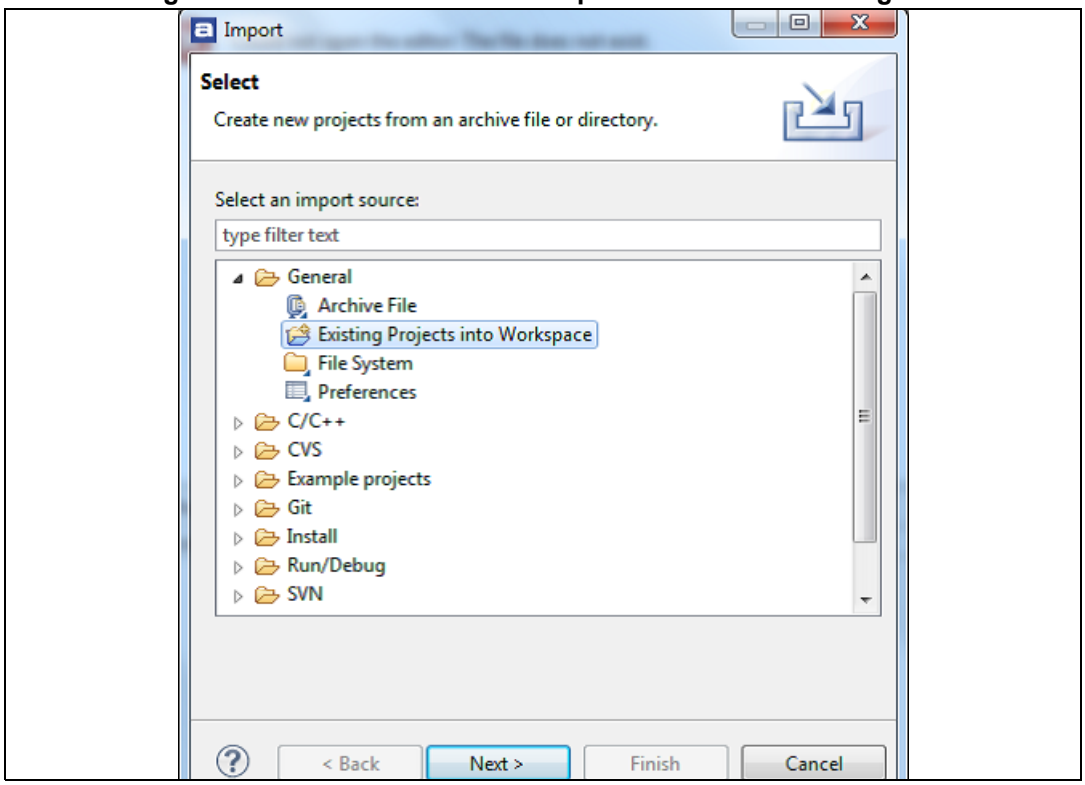
1. Open Atollic TrueSTUDIO for ARM. The program launches and asks for a **Workspace** location.

Figure 13. TrueSTUDIO workspace launcher dialog box



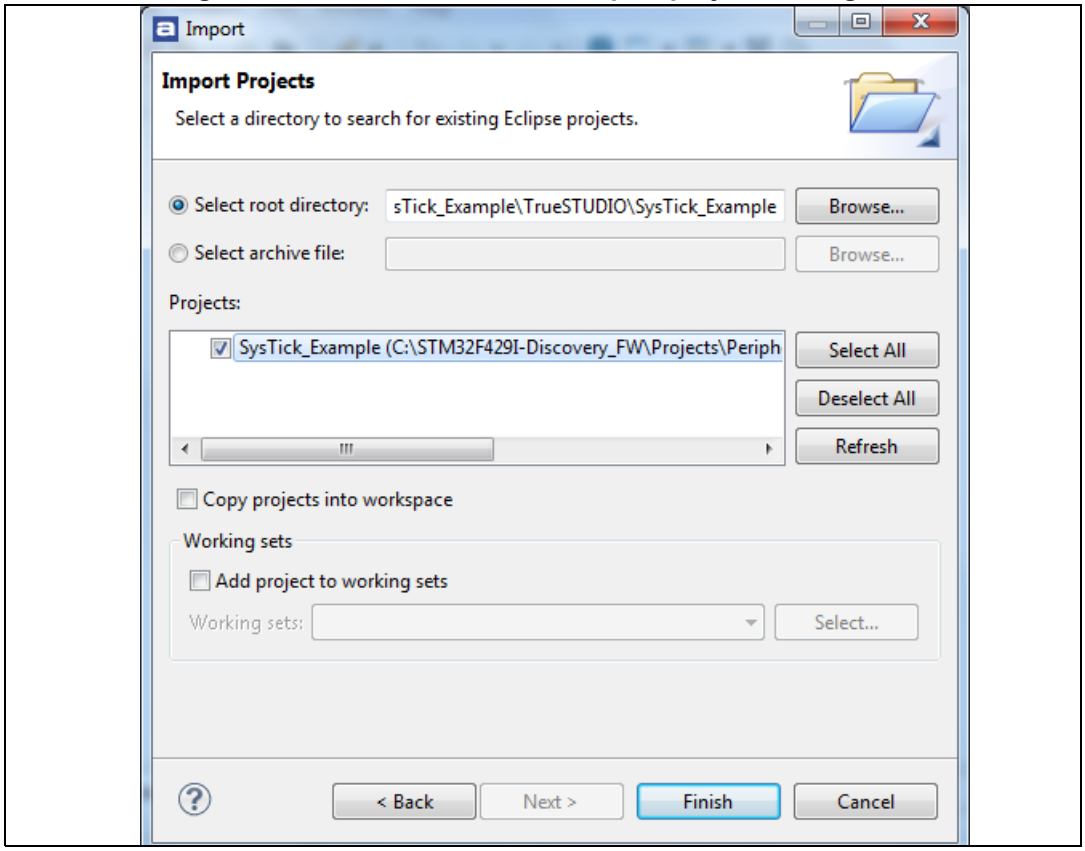
2. Browse to select a TrueSTUDIO workspace of either an example, demonstration or template workspace file and click **OK** to load it.
3. To load an existing project in the selected workspace, select **File > Import**, then **General** > **Existing Projects into Workspace** and click **Next**.

Figure 14. Atollic TrueSTUDIO® import source select dialog box



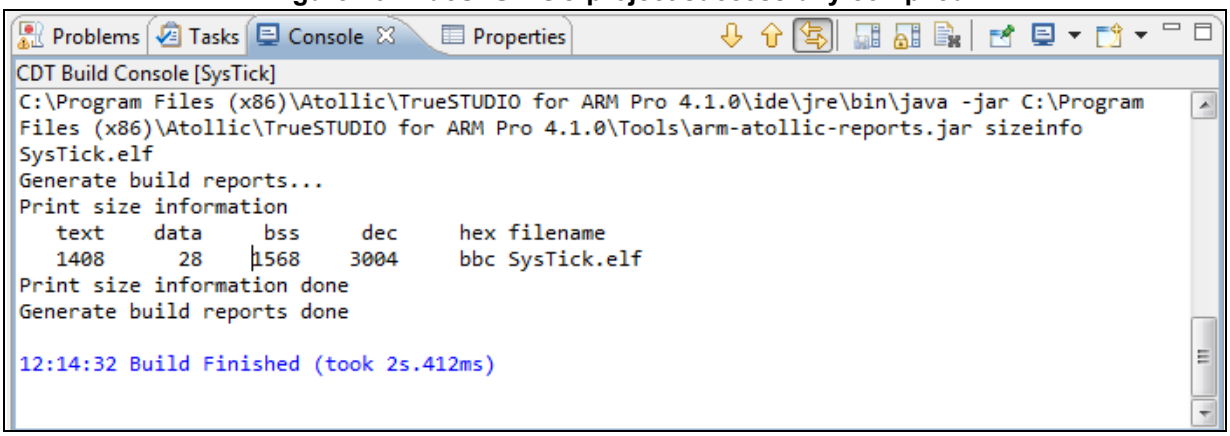
4. Click **Select root directory** and browse to **TrueSTUDIO workspace folder**.

Figure 15. Atollic TrueSTUDIO® import projects dialog box



5. In the **Projects** panel, select the project and click **Finish**.
6. In the **Project Explorer**, select the project, open **Project** menu, and click **Build Project**.
7. If your project is successfully compiled, the following messages will be displayed on the Console window.

Figure 16. TrueSTUDIO® project successfully compiled



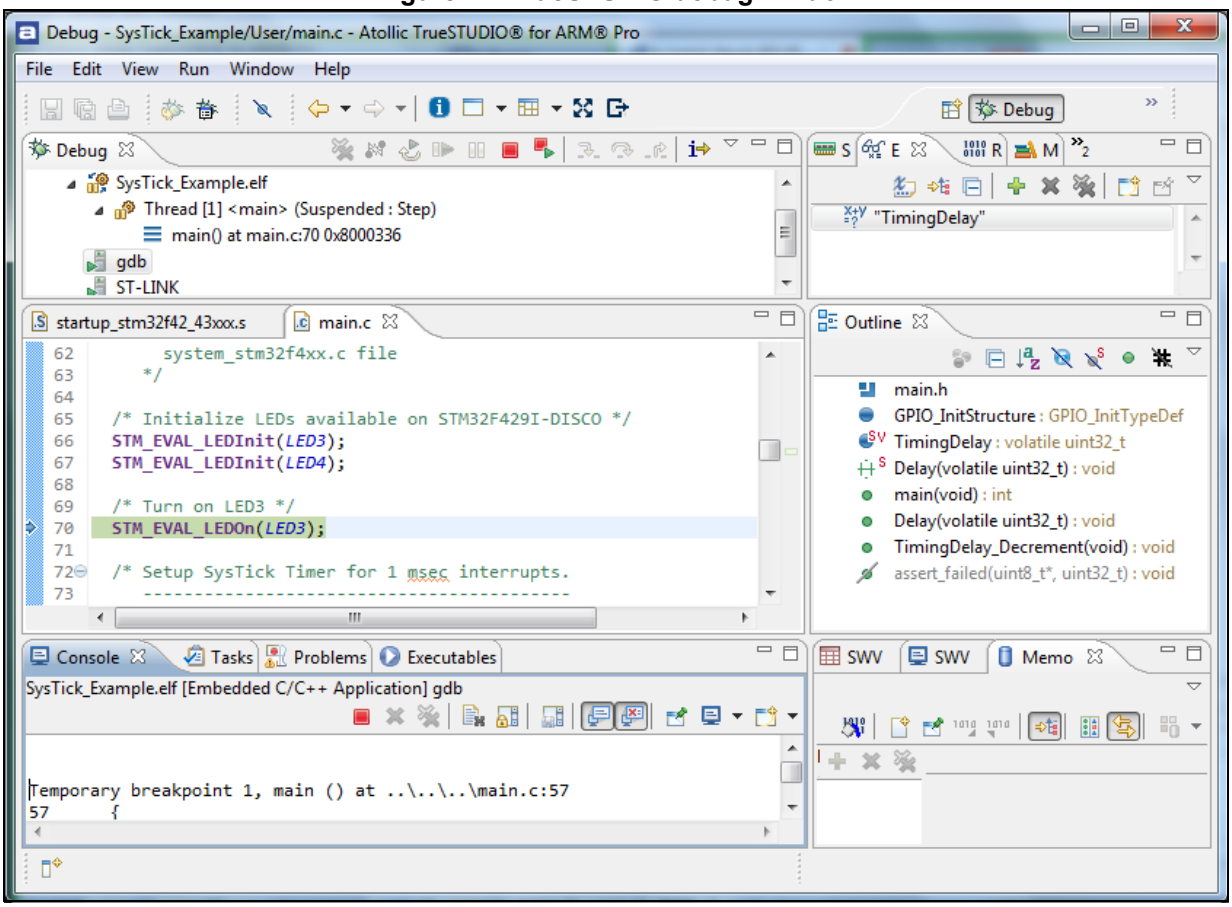
To change the project settings (Include directories and preprocessor defines), just go through **Project**>**Properties**, select **C/C++ Build>Settings** from the left panel:

– For Include directories: **C Compiler>Directories>Include path**

– For pre-processor defines: **C Compiler>Symbols> Defined symbols**

8. To debug and run the application, select the project in the **Project Explorer** and press **F11** to start a debug session (see *Figure 17*).

Figure 17. TrueSTUDIO debug window



9. The debugger in the Atollic TrueSTUDIO can debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during code execution.

10. Select **Run** > **Resume** to run your application, or alternatively click the **Resume** button in the toolbar.

3 STM32F429 advanced debugging

The STM32 family using the Cortex-M4 processor has many interrupts and it can be difficult to determine when they are being activated and how often.

Serial Wire Viewer (SWV) on the STM32F429 family makes this task easy. In fact, SWV displays PC Samples, Exceptions (including interrupts), data reads and writes, ITM (printf), CPU counters and a timestamp. This information comes from the ARM CoreSight™ debug module integrated into STM32F429 CPU.

SWV does not steal any CPU cycles and is non-intrusive (except for ITM Debug printf Viewer).

You have already configured Serial Wire Viewer (SWV) on the template project. This allows:

1. Retargeting **printf** to ITM stimulus port(0). This allows debug messages to display easily. How to use it:
   EWARM : View > terminal IO
   MDK-ARM : View > Serial Windows Debug (printf) Viewer
   TrueSTUDIO: View > SWV Console
2. **Exception trace**:
   Entry: when the exception enters.
   Exit: When it exits or returns.
   Return: When all the exceptions have returned to the main
   EWARM : ST-LINK > Interrupt log
   MDK-ARM : View > Trace > Exceptions
   TrueSTUDIO: View > SWV Exception Trace Log
3. **Function profiler**: Shows timing information for the functions in an application
   EWARM : ST-LINK > Function Profiler
   MDK-ARM : View > Analysis Window > Code Coverage
   TrueSTUDIO: View > SWV Statistical Profiling
4. **Data Trace Timeline**: Shows a graphical representation of the data
   EWARM : ST-LINK > Timeline (Data log)
   MDK-ARM : View > Analysis Window > Logic Analyzer
   TrueSTUDIO: View > SWV Data Trace Timeline

4 SW Toolchains helpful references and links

The following table regroups useful references about the integrated development environments described in this document:

Table 2. IDE references

Toolchain	Download link
EWARM	www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/ EWARM_UserGuide
MDK-ARM	www.keil.com/demo/eval/arm.htm www.keil.com/arm/mdk.asp
TrueSTUDIO	www.atollic.com/index.php/request-eval-license

5 Revision history

Table 3. Document revision history

Date	Revision	Changes
26-Oct-2013	1	Initial release.

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