AN2712

Getting Started with tinyAVR® 0-series

Introduction

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This application note outlines how to get started with the tinyAVR® 0-series devices.

Refer to the data sheet for further information on the differences between the tinyAVR® 0-series devices.

Features

- Getting Started with tinyAVR® 0-series Microcontrollers and Tools
- Getting Started with STK600 and Atmel Studio 7.0

Table of Contents

1. Relevant Devices

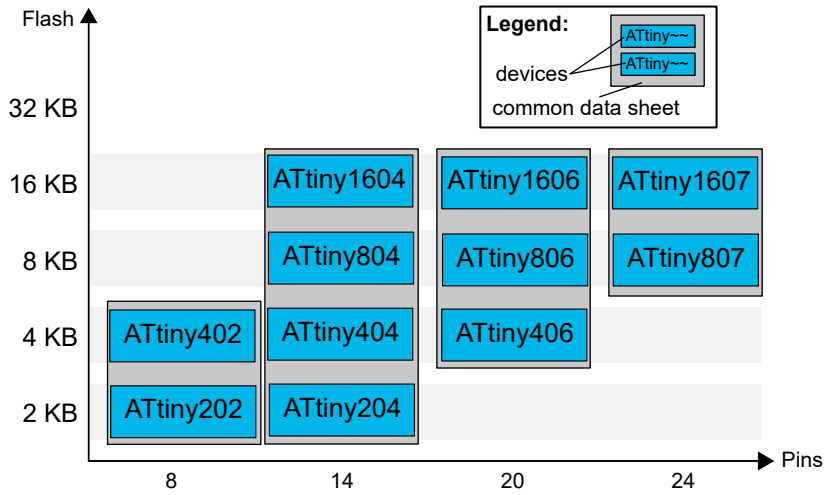
This chapter lists the relevant devices for this document.

1.1 tinyAVR 0-series

The figure below shows the tinyAVR 0-series, laying out pin count variants and memory sizes:

- Vertical migration is possible without code modification, as these devices are fully pin- and feature compatible.
- Horizontal migration to the left reduces the pin count and, therefore, the available features.

Figure 1-1. tinyAVR® 0-series Overview



Devices with different Flash memory size typically also have different SRAM and EEPROM.

2. Get the Device Data Sheet

Web pages

- http://www.microchip.com/wwwproducts/en/ATtiny202
- http://www.microchip.com/wwwproducts/en/ATtiny204
- http://www.microchip.com/wwwproducts/en/ATtiny402
- http://www.microchip.com/wwwproducts/en/ATtiny404
- http://www.microchip.com/wwwproducts/en/ATtiny406
- http://www.microchip.com/wwwproducts/en/ATtiny804
- http://www.microchip.com/wwwproducts/en/ATtiny806
- http://www.microchip.com/wwwproducts/en/ATtiny807
- http://www.microchip.com/wwwproducts/en/ATtiny1604
- http://www.microchip.com/wwwproducts/en/ATtiny1606
- http://www.microchip.com/wwwproducts/en/ATtiny1607

Documents/files

- ATtiny202/402 Data Sheet (summary, complete)(.pdf)
- ATtiny204/404 Data Sheet (summary, complete)(.pdf)
- ATtiny406 Data Sheet (summary, complete)(.pdf)
- ATtiny804/1604 Data Sheet (summary, complete)(.pdf)
- ATtiny806/1606 Data Sheet (summary, complete)(.pdf)
- ATtiny807/1607 Data Sheet (summary, complete)(.pdf)

The documentation for the tinyAVR® 0-series is split into three document types:

- Manual (includes all device independent descriptions of the device)
- Data sheet[1] (includes all device dependent descriptions of the device, number of peripherals, pinout and electrical characteristics)
- Errata (includes all known erratas for the device)

[1] For devices that are future products, the product brief is available instead of the data sheet.

3. Get the Tools

Atmel Studio 7.0, which uses GCC compiler, is the preferred IDE to get started with tinyAVR® 0-series.

3.1 Get the STK600 Starter Kit

Figure 3-1. STK600 Starter Kit

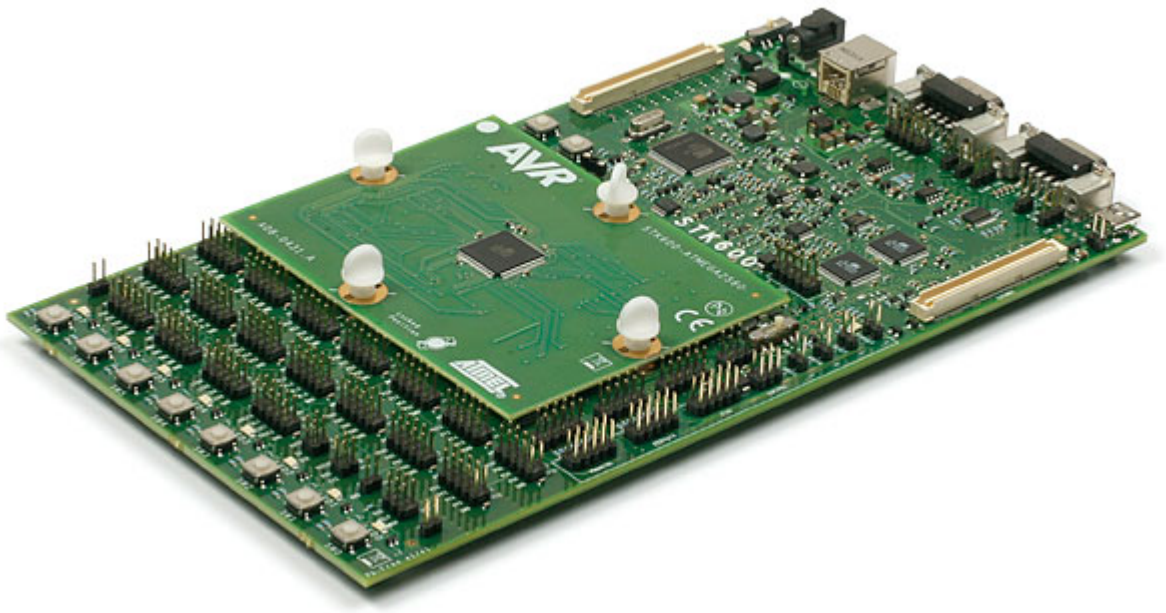


Table 3-1. STK600 Device Support for tinyAVR® 0-series

Device	Routing Card	Socket Card
ATtiny204	STK600-RC020T-104	STK600-SOIC
ATtiny404	STK600-RC020T-104	STK600-SOIC
ATtiny406	STK600-RC020T-104	STK600-SOIC
ATtiny804	STK600-RC020T-104	STK600-SOIC
ATtiny806	STK600-RC020T-104	STK600-SOIC
ATtiny807	STK600-RC024T-103	STK600-QFN24
ATtiny1604	STK600-RC020T-104	STK600-SOIC
ATtiny1606	STK600-RC020T-104	STK600-SOIC
ATtiny1607	STK600-RC024T-103	STK600-QFN24

For device support for other devices, refer to: http://www.microchip.com/STK600_Starter_Kit-Users_Guide

Web page: http://www.microchip.com/ATSTK600

Get the kit: https://www.microchipdirect.com/product/ATSTK600

Document/file:

- STK600 User Guide (.pdf)

Key features

- AVR® Studio 4/AVR32 Studio/AVR Studio 5/Atmel Studio Compatible
- USB Interface to PC for Programming and Control
- Powered from USB Bus or from an External 10-15V DC Power Supply
- Adjustable Target V_{CC} (0-5.5V)
- Two Adjustable Reference Voltages with High Accuracy (0-5.0V, 10 mV res.)
- Clock Oscillator, Adjustable On-The-Fly from Atmel Studio (0-50 MHz, 0.1% res.)
- Serial In-System Programming (ISP) of tinyAVR and megaAVR® Devices
- PDI Programming of AVR XMEGA® Devices
- JTAG Programming of megaAVR, AVR XMEGA, and AVR UC3 Devices
- aWire Programming of AVR UC3 Devices
- ISP and JTAG Programming of AVR Devices in External Target Systems
- Flexible Routing and Socket Card System for Easy Mounting of all Supported Devices
- Eight Push Buttons for General Use
- Eight LEDs for General Use
- All AVR I/O Ports are Easily Accessible through Pin Header Connectors
- Expansion Connectors for Plug-In Modules and Prototyping Area
- On-Board 4 Mb DataFlash for Nonvolatile Data
- USB mini-AB (On-The-Go) Connector for AVR Devices with USB
- PHY and DSUB-9 Connector for RS-232 Interface
- PHY and DSUB-9 Connector for CAN Bus
- PHY and Header for LIN Bus
- Device Board with an ATmega2560 AVR Microcontroller Included

The STK600 User Guide describes how to power the kit and includes detailed information about board components, extension interface, and the hardware description.

3.2 Get Source Code from Atmel | START

The example code is available through Atmel | START, which is a web-based tool that enables configuration of application code through a Graphical User Interface (GUI). The code can be downloaded for both Atmel Studio and IAR Embedded Workbench® via the direct example code-link below or the *Browse examples* button on the Atmel | START front page.

Atmel | START web page: http://microchip.com/start

Example Code

Finding example code for devices in the tinyAVR 0-series can be done by searching for the device name, e.g. ATtiny406, in the Atmel | START example browser.

Click *User guide* in Atmel | START for details and information about example projects. The *User guide* button can be found in the example browser, and by clicking the project name in the dashboard view within the Atmel | START project configurator.

Atmel Studio

Download the code as an `.atzip` file for Atmel Studio from the example browser in Atmel | START, by clicking *Download selected example*. To download the file from within Atmel | START, click *Export project* followed by *Download pack*.

Double click the downloaded `.atzip` file and the project will be imported to Atmel Studio 7.0.

IAR Embedded Workbench

For information on how to import the project in IAR Embedded Workbench, open the Atmel | START User Guide, select *Using Atmel Start Output in External Tools*, and *IAR Embedded Workbench*. A link to the Atmel | START User Guide can be found by clicking *Help* from the Atmel | START front page or *Help And Support* within the project configurator, both located in the upper right corner of the page.

3.3 Get Atmel Studio 7.0

Web page: http://www.microchip.com/development-tools/atmel-studio-7

Document/file:

- Atmel Studio 7.0 (build 1645) Installer (.exe)

Atmel Studio 7.0 or later is the preferred IDE for developing and debugging firmware for the tinyAVR® 0-series.

For device support, refer to 3.5 Get Device Support.

3.4 Get IAR Embedded Workbench for AVR

Web page: https://www.iar.com/iar-embedded-workbench/#!?architecture=AVR

Document/file: IAR Embedded Workbench installer for AVR.

3.5 Get Device Support

Atmel Studio: Support for new devices in Atmel Studio can be added by using the *Device Pack Manager*, which is found under *Tools → Device Pack Manager*.

For tinyAVR® 0-series, update to the latest version by performing the following steps:

1. Click *Check for Updates*.
2. For tinyAVR® 0-series, select the latest available version of *ATtiny_DFP*.
3. Click *Install*.

For offline installers, go to http://packs.download.atmel.com/. To install a package, double click on the installer file and follow the instructions. Any open Atmel Studio windows will have to be closed for the installation to take effect.

IAR: Support for new devices in IAR Embedded Workbench can be added by installing the latest service package. The service package is available at *My Pages* on https://iar.com.

4. Atmel Studio Users Getting Started

4.1 Atmel Studio with STK600

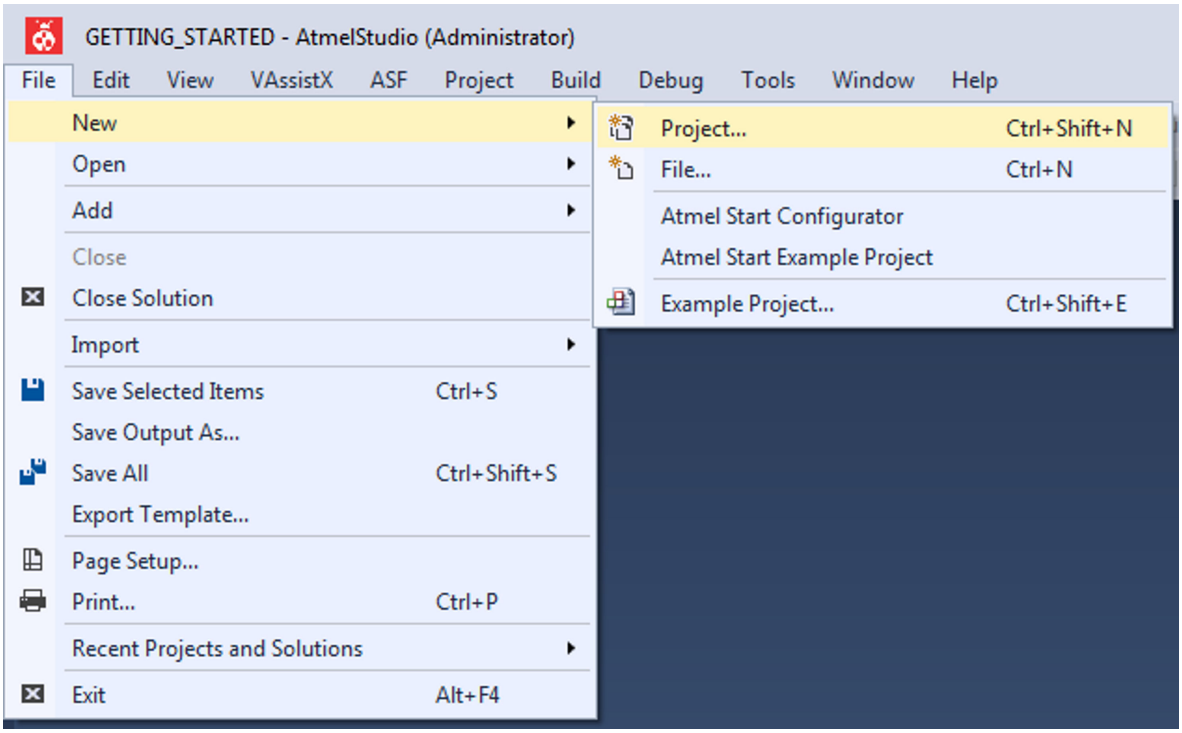
Prerequisites

- Atmel Studio 7.0 1645 or above installed
- The STK600 board connected to Atmel Studio 7.0 via the on-board USB connector.

Workflow

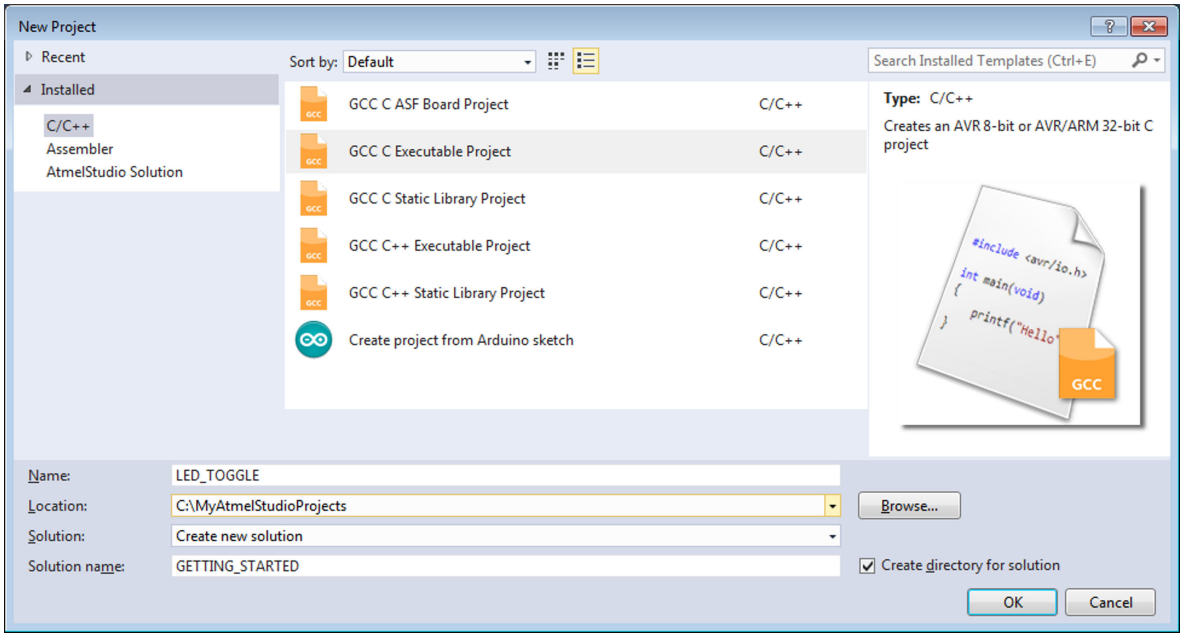
1. Launch Atmel Studio 7.0.
2. Start creating a new project by clicking *New → Project...* or by using the shortcut *Ctrl+Shift+N*, as shown in the figure below.

Figure 4-1. Create New Project in Atmel Studio



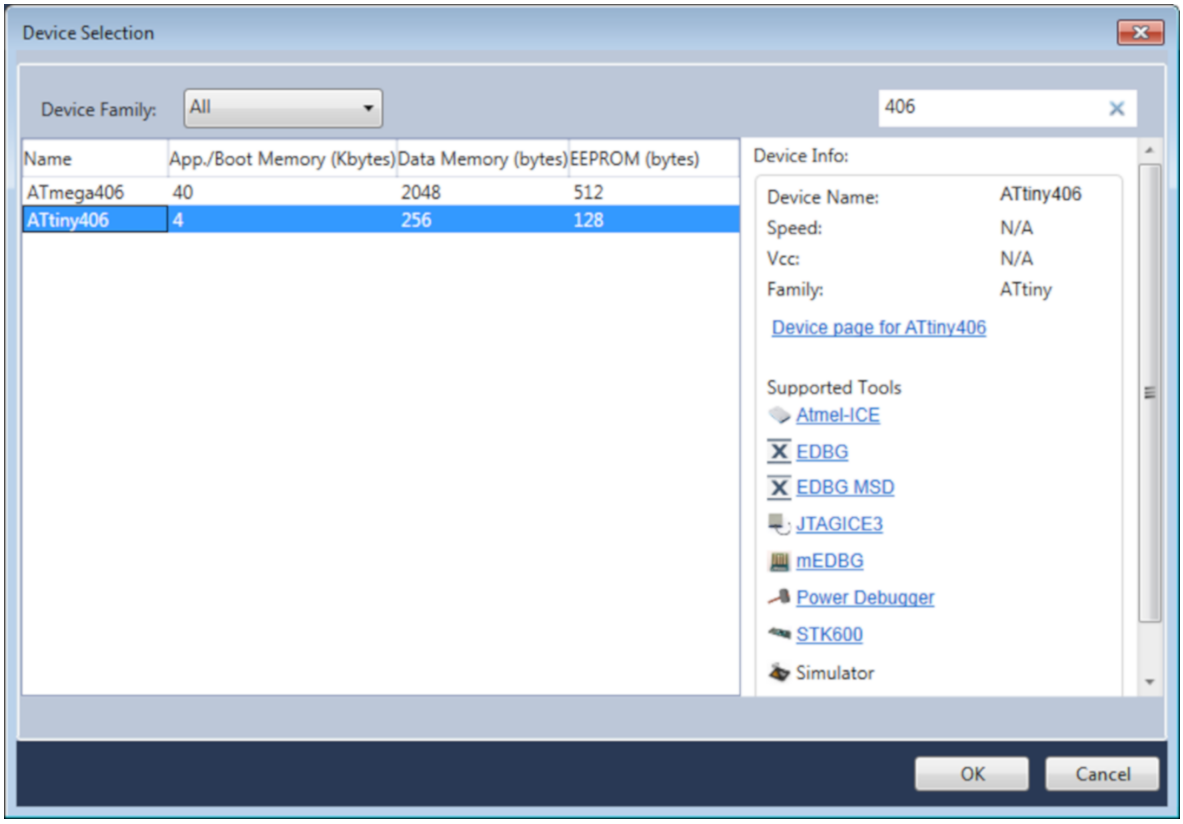
3. Select the *GCC C Executable Project* template from the new project wizard shown in the following figure, type in the name of the solution and project (e.g. *GETTING_STARTED* and *LED_TOGGLE*), and click **OK**.

Figure 4-2. New Project Wizard



4. Select ATtiny406 from the device selection wizard as shown in the figure below, and click **OK**.

Figure 4-3. Device Selection Wizard



A new project with a `main.c` file associated with it will be generated in Atmel Studio.

5. Replace the '`main`' function in the `main.c` file with the following code snippet:

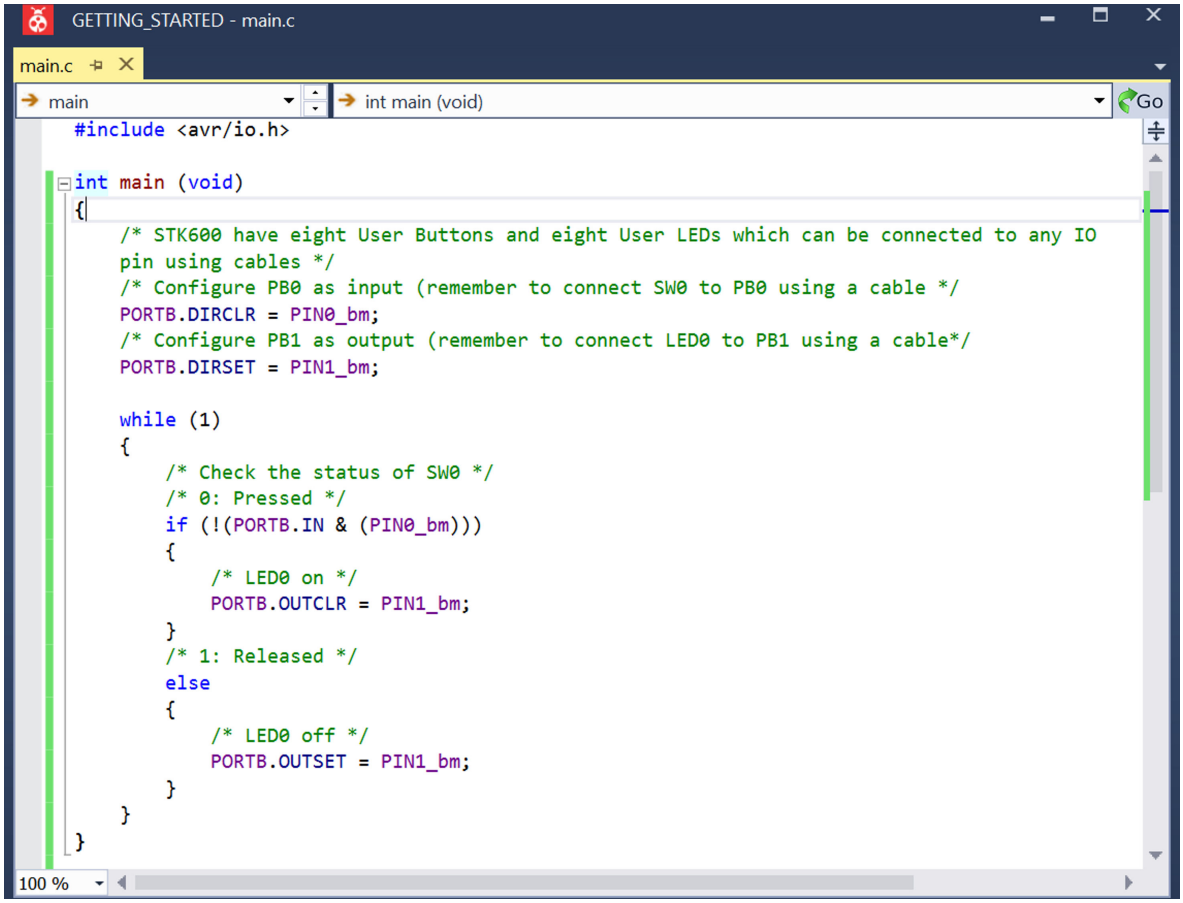
```
int main (void)
{
  /* STK600 have eight User Buttons and eight User LEDs which can be connected to any IO
pin using cables */
  /* Configure PB0 as input (remember to connect SW0 to PB0 using a cable */
  PORTB.DIRCLR = PIN0_bm;

  /* Configure PB1 as output (remember to connect LED0 to PB1 using a cable*/
  PORTB.DIRSET = PIN1_bm;

  while (1)
  {
    /* Check the status of SW0 */
    /* 0: Pressed */
    if (!(PORTB.IN & (PIN0_bm)))
    {
      /* LED0 on */
      PORTB.OUTCLR = PIN1_bm;
    }
    /* 1: Released */
    else
    {
      /* LED0 off */
      PORTB.OUTSET = PIN1_bm;
    }
  }
}
```

In the code editor, the code may appear as shown in the figure below.

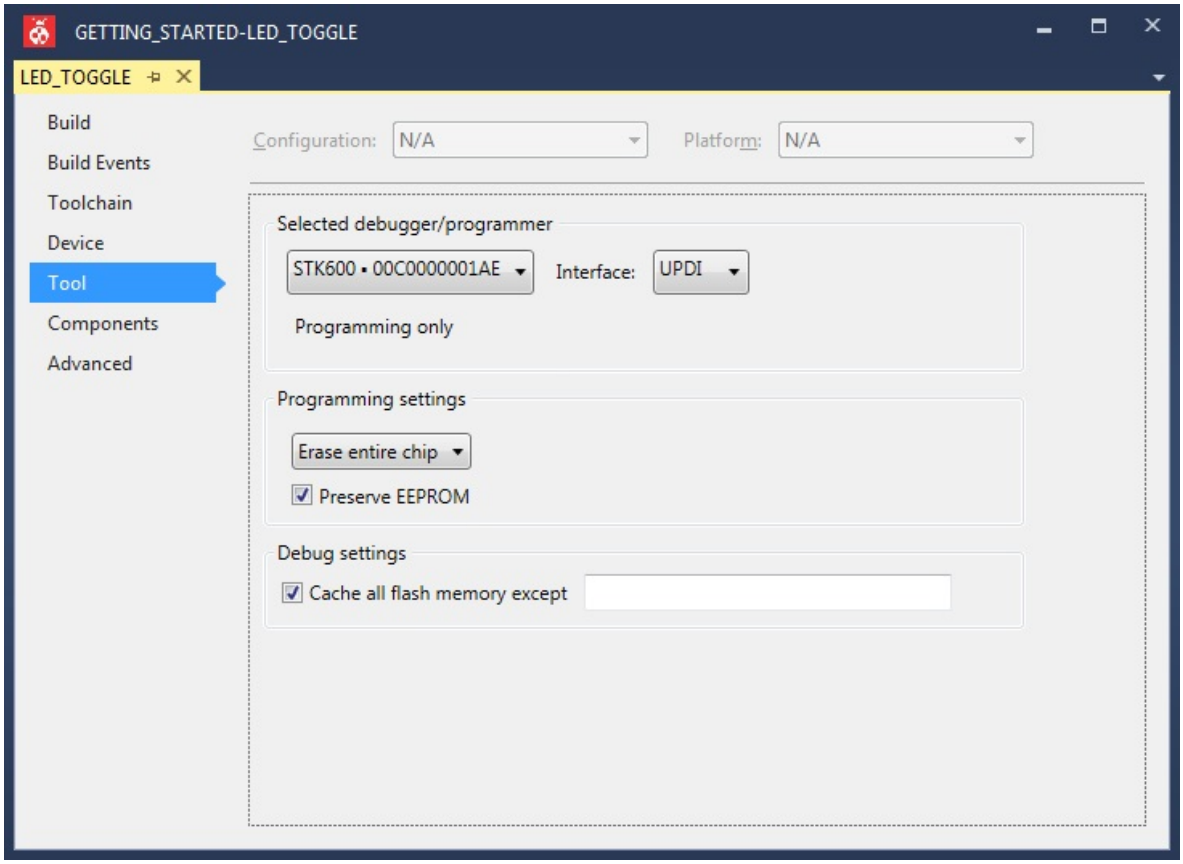
Figure 4-4. Code Editor Window



6. Open project properties by clicking *Project → Properties* or by using the shortcut *ALT+F7*.

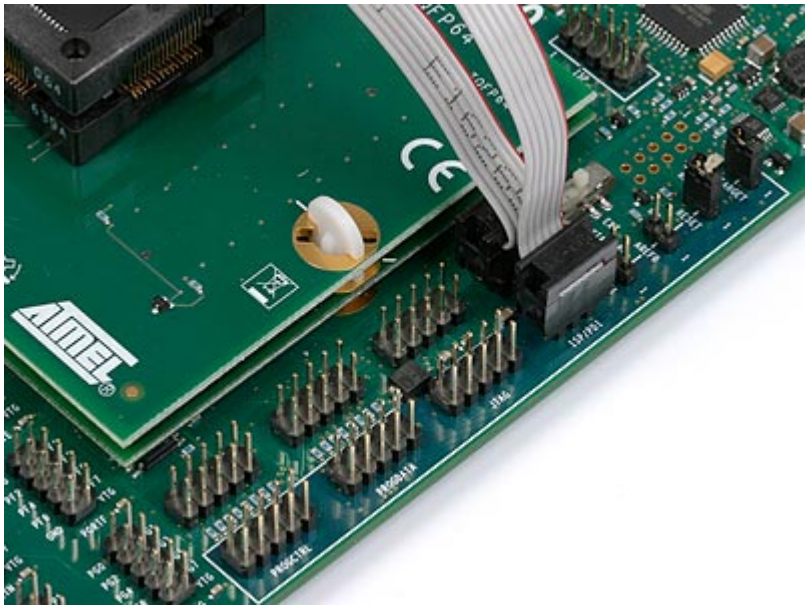
7. In *Tool* view (figure below), set *Selected debugger/programmer* to STK600 and *Interface* to UPDI.

Figure 4-5. Debugger and Interface for ATtiny406



8. Build the project by clicking *Build → Build Solution* or using the shortcut *F7*.
9. Connect the embedded debugger on STK600 to ATtiny406 by connecting a cable between the ISP/PDI headers, as shown in the figure below.

Figure 4-6. UPDI Connection on STK600



10. Connect PB0 to SW0, and PB1 to LED0 by using cables.
11. Load the code onto the STK600 and start debugging by clicking *Debug → Start debugging and break* or by using the shortcut *ALT+F5*. The application is programmed onto the device and the program execution should break in main.
12. Run the code by clicking *Debug → Continue* or by using the shortcut *F5*.
13. Verify that LED0 is lit when SW0 is pushed on STK600.

5. What's Next

For further information on related AVR products and IDE, refer to the links below:

Software:

- Atmel Studio: http://www.microchip.com/avr-support/atmel-studio-7
- Atmel Studio help: *Help → View Help* (shortcut *CTRL+F1*)
- Atmel Gallery: https://gallery.microchip.com/

Firmware:

- Atmel START documentation: http://start.atmel.com/#
- Atmel START examples: http://microchip.com/start/#examples

Hardware:

- AVR042: AVR Hardware Design Considerations: http://www.microchip.com/AVR042:AVR_Hardware_Design_Considerations
- AVR IBIS files: http://www.microchip.com/doclisting/TechDoc.aspx?type=IBIS
- AVR BDSL files: http://www.microchip.com/doclisting/TechDoc.aspx?type=BSDL

Recommended programming/debugging tools:

- Atmel-ICE:
  - Documentation: http://www.microchip.com/Atmel-ICE_Debugger_User_Guide
  - Buy: https://www.microchip.com/Development-Tools/atatmel-ice
- Power debugger:
  - Documentation: http://www.microchip.com/42696D_Power_Debugger_User_Guide
  - Buy: https://www.microchip.com/Development-Tools/atpowerdebugger

Other:

- AVR Freaks®: http://www.avrfreaks.net/
- Application notes: http://www.microchip.com/paramChartSearch/chart.aspx?branchID=30047, find the preferred device and go to the product page. All relevant application notes can be found under the documentation tab.
- AVR product selector: http://www.microchip.com/paramChartSearch/chart.aspx?branchID=30047
- More technical documentation concerning various products: https://www.microchip.com/webdoc
- Microchip Technical Support: http://www.microchip.com/support/hottopics.aspx

6. Revision History

Doc Rev.	Date	Comments
B	10/2018	Fixed grammar and punctuation.
A	05/2018	Initial document release.

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- Technical Support

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- Microchip is willing to work with the customer who is concerned about the integrity of their code.

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ISO/TS 16949

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