
AT12616: Getting Started with ATSAMD10D14A

SMART ARM-Based Microcontrollers

Objective

- Get started with the ATSAMD10D14A (Atmel® | SMART ARM® Cortex®-M0+ based SAM D10 series).
- Find the ATSAMD10D14A device related links in Atmel website (like documents, tools etc).
- Get started with Atmel Studio 6.2 (project creation and demo program (GPIO input / output configuration) development on a step by step basis). All these steps are also described in Atmel Studio help system.

Pre-requisites

- ATSAM D10 Xplained Mini Kit
- Atmel Studio 6.2 or later

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1 Getting Started with ATSAMD10D14A

1.1 Introduction

The Atmel | SMART SAM D portfolio is architected beyond the core, using over two decades of Atmel microcontroller (MCU) experience to create unique, connected peripherals that work flawlessly with the ARM® Cortex®-M0+ CPU. These MCUs are easy-to-use and provide scalability and performance.

The SAM D10 and SAM D11 are the smallest ARM Cortex-M0+ devices available from Atmel, expanding our product offering down to 8kB of Flash, 4kB of SRAM and 14-pin packages. All packages use only 2 pins for power, and the reset pin can be configured to as a GPIO, maximizing the functionality available. To help simplify the design process and reduce the Bill of Materials, these new Atmel families also integrate additional functionality, including Full Speed crystal-less USB(in SAMD11), peripheral touch controller that requires no external components, Event System, ADC with gain stage, DMA, timers/counters for control applications, and several other new features. From the SAM D10 to the SAM D21, these devices are code- and pin-compatible making it easy for designers to migrate up and down the family.

SAMD10 and SAMD11 Device Details

Flash / SRAM	
16KB / 4KB	SAM D10C 2x SERCOM 5-ch ADC 12 GPIO SAM D11C USB device 2x SERCOM 5-ch ADC 12 GPIO SAM D10D 3x SERCOM 8-ch ADC 18/22 GPIO SAM D11D USB device 3x SERCOM 8-ch ADC 18/22 GPIO
8KB / 4KB	
Package	14-pin SOIC20-pin SOIC 24-pin QFN

Main Features and Functions in all devices:

ARM Cortex-M0+ CPU at 48 MHz, 1.62-3.6V operation*, -40°C – 85°C,
12-bit 350 kps ADC, 1-ch 10-bit 350kps DAC and analog comparators, 2x AC
Peripheral Touch Controller*, 32-bit RTC with calendar mode, 2x 16-bit TC and 1x 24-bit TCC
6-ch Event system and 6-ch DMA controller with SleepWalking
SERCOM supports USART/UART with autobaud, SPI, I²C up to 3.4MHz*, PMBus, SMBus, IrDA
96 MHz Fractional PLL, 1 Timer/Counter optimized for Control applications (TCC)

1.2 ATSAM10D14A Device Features

- 2.14 CoreMark / MHz
- 45 DMIPS (0.9375 DMIPS per MHz)
- Flexible Clock System (8 clock sources)
- $\pm 2\%$ Calibrated Internal RC oscillator
- Digital Frequency Locked Loop (DFLL48M)
- Capacitor less internal regulator
- Sleep Walking Peripherals (Asynchronous wakeup with event system)
- High Speed bus matrix for concurrent (bus) accesses
- Dedicated flash area for EEPROM emulation
- Peripheral Touch Controller (PTC) - Hardware Touch Acquisition
- Atmel® QTouch® library support

Note: For detailed information (like flash size, number of peripheral channels, module description etc) refer to the SAMD10 datasheet.

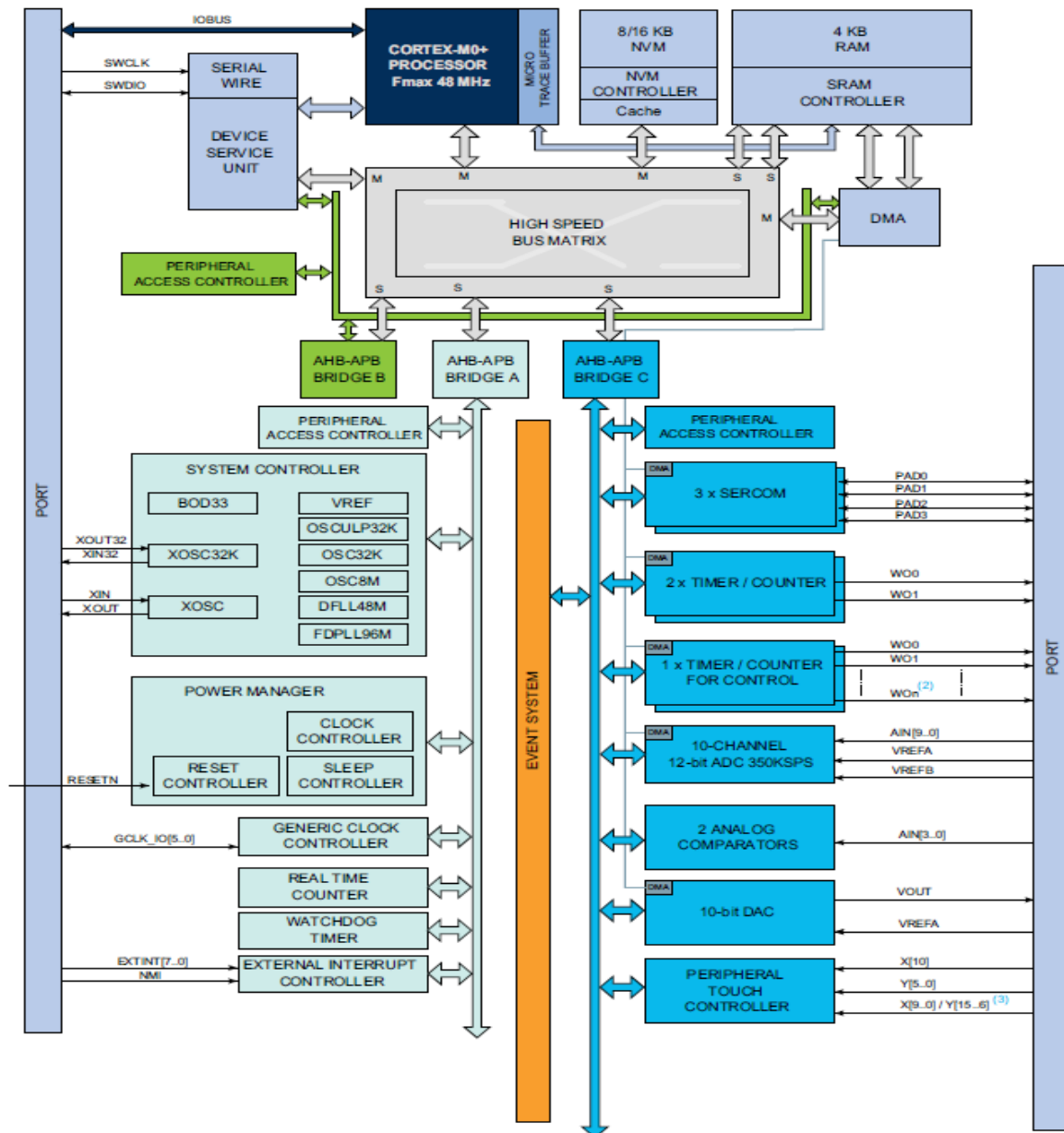
1.3 Cortex M0+ Core Features

- Von Neumann Architecture
- 2 Stage Pipelining
- Micro trace buffer (Instruction trace buffer for fast debug)
- Completely programmable in 'C' (even start-up code)
- Simple memory map (Linear Addressing)
- CMSIS (Cortex-M Software Interface Standard) - Portable Code

1.4 Cortex M0+ Configuration for SAM D10 series devices

- Single I/O Access
- Little endian
- SysTick Timer
- Single Cycle 32 *32 Multiplier (Fast)
- 32 - bit Instruction Width
- Vector Table Offset Register
- Halting Debug

1.5 ATSAM10D14A Block Diagram



Note: For detailed information (like module description) refer to the SAMD10 datasheet.

1.6 ATSAMD10D14A Device Related Website Links

The ATSAMD10D14A product overview webpage (as shown below) is available at the following link
<http://www.atmel.com/devices/ATSAMD10D14A.aspx>

Home > Products > Microcontrollers > SMART ARM-based MCUs > SAM D MCUs

ATSAMD10D14A

Overview Parameters Tools Documents Applications

Get Started

We'll tell you all you need to know to start evaluating and working with this product.

- » **Start Now**
- » **Contact Sales**
- » **Request Samples**
- » **Sign-up for News**

Datasheet

PDF Software Description

SAM D10 Preliminary Summary
(file size: 0.9MB, 18 pages, revision A, updated: 01/2015)

SAM D10 Preliminary
(file size: 11.8MB, 847 pages, revision A, updated: 01/2015)

[More Documents...](#)

Related Items

- » Third Party Support
- » University Program
- » Atmel SMART Knowledge Base
- » Technical Support
- » What's Changed
- » Mature Devices

A low-power, high-performance ARM® Cortex®-M0+ based flash microcontroller, the Atmel® | SMART ATSAMD10D14A is ideal for a wide range of home automation, consumer, metering and industrial applications. It features:

- 16KB of flash memory and 4KB of SRAM
- Up to 48MHz operating frequency
- Three serial communication modules (SERCOM) configurable as UART/USART, SPI or I²C, two 16-bit timer/counters, 32-bit Real-Time Clock and calendar, 12 PWM channels, one 8- or 10-channel 12-bit ADC, one 10-bit DAC
- Supports 7/12 self-capacitance touch channels in low/high pincount devices
- Supports 72 mutual-capacitance touch channels
- 1.62V to 3.63V power supply
- Easy pin migration to SAMD10C devices
- Supported by Atmel Studio, the Atmel Software Framework, and the SAM D10 Xplained Mini kit

In 'Parameters' tab, we can find the configuration parameter details (like flash size, number of peripheral channels etc) for this device.

<http://www.atmel.com/devices/ATSAMD10D14A.aspx?tab=parameters>

In 'Documents' tab, we can find all the related documents (like datasheet, application notes) for this device

<http://www.atmel.com/devices/ATSAMD10D14A.aspx?tab=documents>

In the above link under 'datasheet' section there are two documents

- **Complete** version (includes all peripheral descriptions and electrical characteristics)
- **Summary** version (includes Ordering Information, pin out, and Packaging Information)

The device related application notes (like getting started with SAMD10) and its associated firmware (if any) is also available in the above specified link.

In 'Applications' tab, we can find the recommended application areas for (not limited to) for this device

<http://www.atmel.com/devices/ATSAMD10D14A.aspx?tab=applications>

In 'Tools' tab, we can find all the related tools (like IDE, debugger, evaluation kit) for this device

<http://www.atmel.com/devices/ATSAMD10D14A.aspx?tab=tools>

If we click 'SAMD10 Xplained Mini' from the above link then we can view the SAMD10 Xplained Mini kit's overview webpage (as shown below)

<http://www.atmel.com/tools/ATSAMD10-XMINI.aspx>

1.7 SAMD10 Xplained Mini Kit

Home > Products > Microcontrollers > SMART ARM-based MCUs > SAM D MCUs

SAM D10 Xplained Mini

Overview

DevicesDocumentsApplicationsRelated Tools



Get Started
We'll tell you all you need to know to start evaluating and working with this product.
» **Start Now**
» **Contact Sales**
» **Request Samples**
» **Sign-up for News**

The Atmel ATSAMD10 Xplained Mini evaluation kit is a hardware platform for evaluating the Atmel ATSAMD10 microcontroller. The evaluation kit comes with a fully integrated debugger that provides seamless integration with Atmel Studio 6.2 or later. The kit provides access to the features of the ATSAMD10 enabling easy integration of the device in a custom design.

Key Features

- On-board debugger with full source-level debugging support in Atmel Studio
- Auto-ID for board identification in Atmel Studio 6.2
- Access to all signals on target MCU
- One green status LED
- One yellow user LED
- One mechanical user push button
- One touch button
- Virtual COM port (CDC)
- 8MHz external target clk
- USB powered
- Arduino shield compatible footprints
- Target SWD bus header footprint
- Xplained Pro extension headers can easily be strapped in

Related Items

- » Third Party Support
- » University Program
- » Atmel SMART Knowledge Base
- » Technical Support
- » What's Changed
- » Mature Devices



Ordering code: ATSAMD10-XMINI

Buy Tool

If we click on 'Buy Tool' from the above link then we can purchase the same kit from our Atmel Store

<http://store.atmel.com/PartDetail.aspx?q=p:10500413>

In 'documents' tab from the above link we can find the kit related documents like (schematic, user guide).

<http://www.atmel.com/tools/ATSAMD10-XMINI.aspx?tab=documents>

Note: For detailed information like header and connections refer to the ATSAMD10 Xplained Mini User Guide which is available at the above specified link.

1.8 Atmel Studio

1.8.1 Atmel Studio Webpage

The Atmel Studio installer (free IDP) is available at the following (as shown below) link

<http://www.atmel.com/tools/ATMELSTUDIO.aspx>

1.8.2 Atmel Studio Microsite

To learn more about Atmel Studio refer to the following micro site link

http://www.atmel.com/microsite/atmel_studio6/

Overview Software Library QTouch Tools C/C++ Compiler/Editor Debugging/Simulation Videos

Version 6.2
Released for Production

ATMEL
STUDIO
6

One Collaborative Studio
With Integrated App Store and
Shared Workspace

DOWNLOAD NOW

Atmel Studio 6 - The Studio to Design All Embedded Systems

What's New in Atmel Studio 6.2

Atmel introduces the latest xplained Mini development kit, an easy-to-use development board with extensive examples.

Develop and Debug Atmel applications in a single, integrated environment with Atmel-ICE

Studio 6.2 support for the new Atmel-ICE probe provides advanced programming and debugs connectivity for Atmel ARM- and AVR-based MCUs, including the ability to capture data trace information

Accelerate Your Time to Market with Percepio Trace™

Gain insight into the run-time of embedded software with trace visualization. Percepio Trace for Atmel Studio features

- Control-flow trace (tasks and interrupts)
- Custom data plots
- Application debug output
- Statistical code profiling
- Support for viewing MCU event counters
- Real-time operating system (RTOS) awareness

Atmel Gallery Overview: Introduction of the Gallery

Atmel Studio 6 Read the White Paper

ASF Design (1 of 5): Starting with a board, XMEGA-A3BU Xplained

Atmel Studio ring

In 'Software Library' tab, we can find the details about Atmel Software Framework (software drivers and libraries)
http://www.atmel.com/microsite/atmel_studio6/software.aspx

In 'Videos' tab we can find the getting started videos (like editor, creating a new C (gcc) project, debugging AVR applications, debugging ARM applications etc)

http://www.atmel.com/microsite/atmel_studio6/videos.aspx

1.9 Connecting the ATSAMD10 Xplained Mini kit

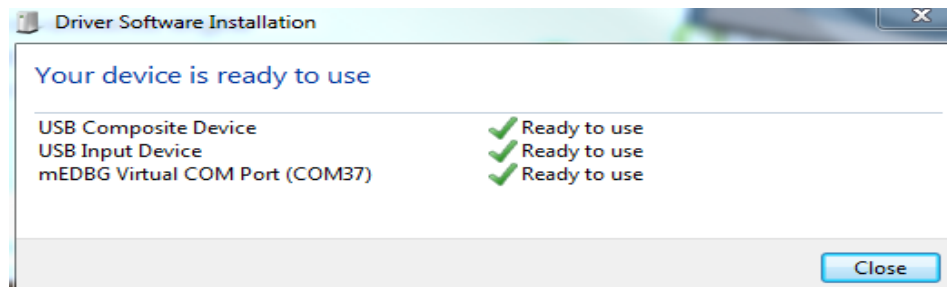
This section helps user to connect the ATSAMD10 Xplained Mini with Atmel Studio 6.2

1. Download and install Atmel Studio version 6.2 or later.
2. Launch Atmel Studio.
3. Connect the ATSAMD10 Xplained Mini to the USB port and it will be visible in Atmel Studio.

1.9.1 Auto board identification of ATSAMD10 Xplained Mini Kit

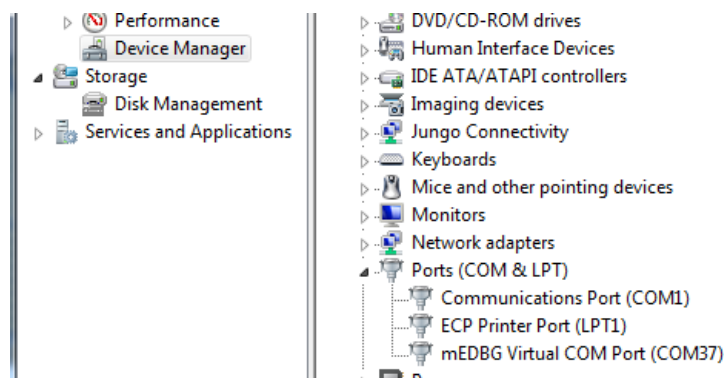
1. Once the ATSAMD10 Xplained Mini kit is connected to the PC, the Windows® Task bar will pop-up a message as shown in figure.

Figure: ATSAMD10 Xplained Mini Driver Installation



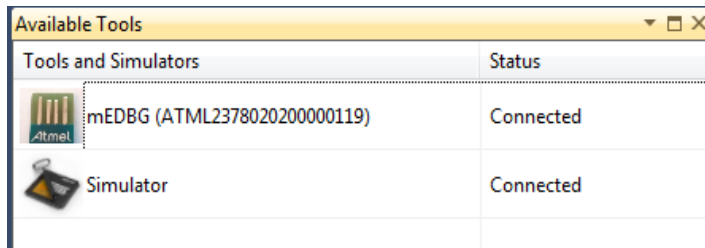
2. If the driver installation is proper, EDBG will be listed in the Device Manager as shown in figure.

Figure: Successful mEDBG Driver Installation



3. Open Atmel Studio 6.2, Go to 'View' -> 'Available Atmel Tools'. The EDBG should get listed in the tools as "EDBG" and the tool status should display as "Connected". This indicates that the tool is communicating properly with Atmel Studio.

Figure: mEDBG under Available Atmel Tools



1.9.2 Connect the ATSAMD10 Xplained Mini UART to the mEDBG COM Port

1. Connect the mEDBG USB to the PC.
2. Use the Device Manager to find the COM port number.
3. Default COM port settings are 9600 baud N 8 1. The COM port settings can be changed using the Device Manager.

1.10 Programming and Debugging

This section helps to program and debug the ATSAMD10 Xplained Mini kit using mEDBG.

1.10.1 Programming the ATSAMD10 Xplained Mini using mEDBG

1. Connect the mEDBG USB to the PC.
2. Go to Atmel Studio: Click Tools, select Device Programming, and select the connected mEDBG as Tool with Device = ATSAMD10D14AM and Interface = SWD, click Apply.
3. Select "Memories" and locate the source hex or elf file and then click Program.

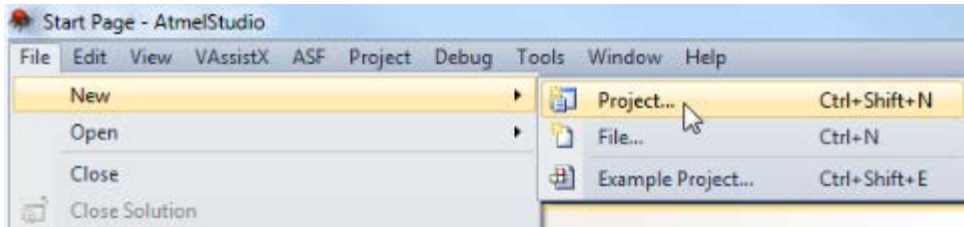
1.10.2 Debugging the ATSAMD10 Xplained Mini using mEDBG

1. Start Atmel Studio.
2. Connect the mEDBG USB to the PC.
3. Open your project.
4. In the Project menu select the project properties page, select the Tools tab and select mEDBG as debugger and SWD as interface.
5. In the Debug menu click Start Debugging and Break.
6. A debug session is started with a break in main, debugging can start.

2 Creating an Example Application in Atmel Studio

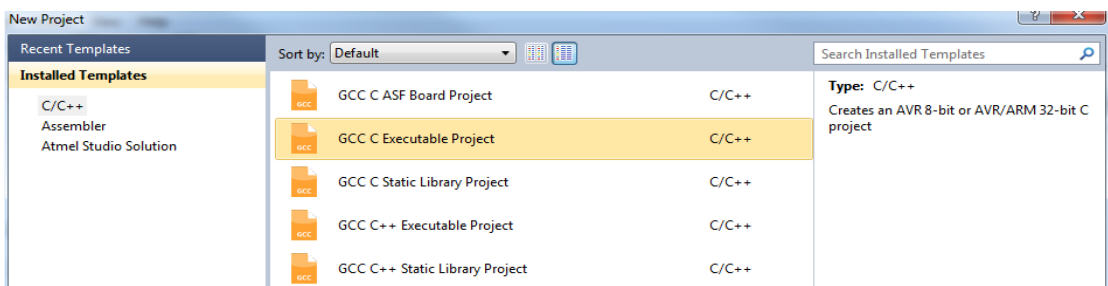
1. After connecting the board, to create a new project in Atmel Studio go to 'File' -> 'New' and click on 'Project...' (as shown in figure 2-1)

Figure 2-1: Creating New Project in Atmel Studio



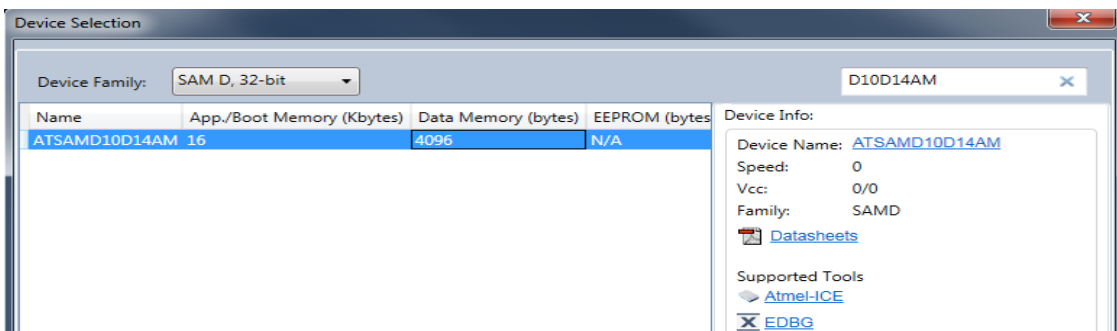
2. The New Project wizard will display as shown in figure 2-2 and select "GCC C executable Project" template and name the project as appropriately and click "OK" to get the device selection wizard.

Figure 2-2: New Project Wizard



3. The Device Selection wizard will display as shown in figure 2-3 and select the ATSAM D device family then click OK.

Figure 2-3 Device Selection Wizard



4. The new project and .c file will be created as shown in figure 2-4.

Add the following code snippet (LED Control using push button) in .c file.

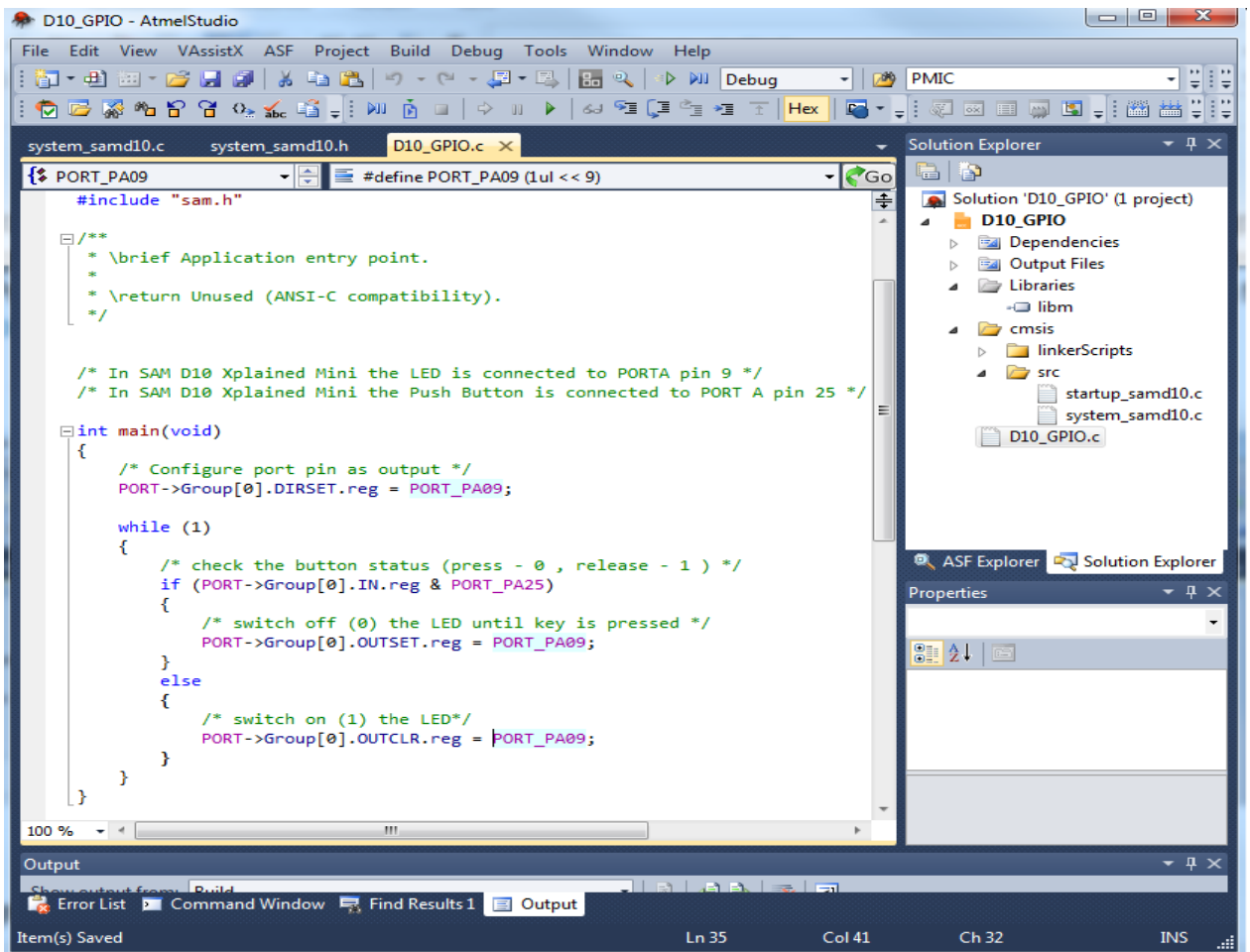
```
int main(void)
{
    PORT->Group[0].DIRSET.reg = PORT_PA09;

    while (1)
    {
        if (PORT->Group[0].IN.reg & PORT_PA25)
        {
            PORT->Group[0].OUTSET.reg = PORT_PA09;
        }
        else
        {
            PORT->Group[0].OUTCLR.reg = PORT_PA09;
        }
    }
}
```

5. Code Explanation:

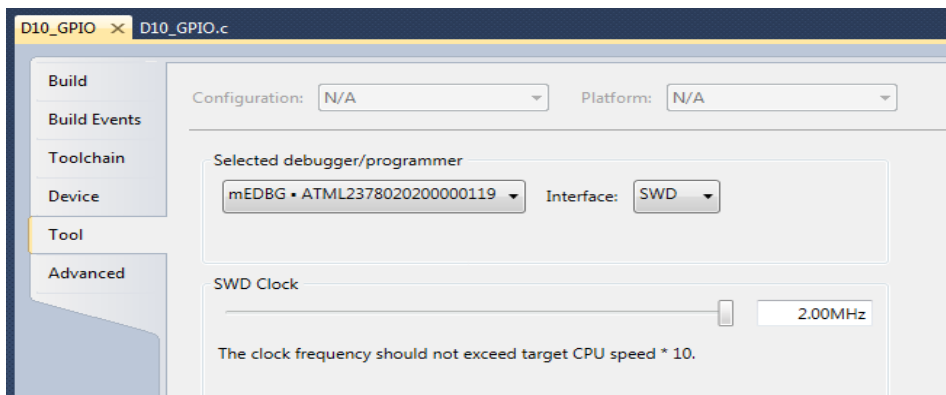
- DIRSET register is used to set the port pin as output .
- IN register is used to read the port pin status.
- OUTSET register is used to drive the output pin as high
- OUTCLR register is used to drive the output pin as low
- In the above example code we use PA25 (Button) as input and PA09 (LED) as output.
- We are controlling the LED based on the push button status.
- As long the button is in pressed state (1) then the LED will not glow (1).
- If we release the button (0) then the LED will glow (0 - default).

Figure 2-4: Project Window



6. In order to debug this project, configure the Tool and Interface in the Project properties. To open the project properties, go to 'Project' menu -> 'Properties'. In the project properties, go to "Tool" tab -> Under the Selected Debugger/Programmer, select the tool as "mEDBG" and interface as "SWD" as shown in figure 2-5 Tool and Interface Settings.

Figure 2-5: Tool and Interface Settings



7. To program and execute the application, we have two options.
 - a. We can start a debug session on the board, where we will be able to break the code execution and follow the application flow.
 - b. We can program the generated hex file into the controller and execute the application. In this case we will program the code with no debugging, so we select the green arrow for "Start without Debugging".

Both these options can be done on ATSAMD10 Xplained Mini as shown in figure 2-6 and figure 2-7.

Figure 2-6: Start without Debugging

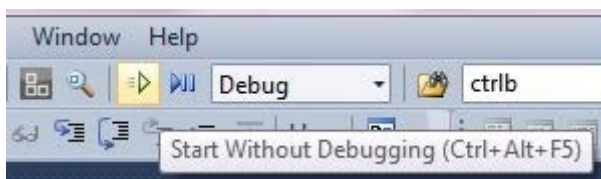
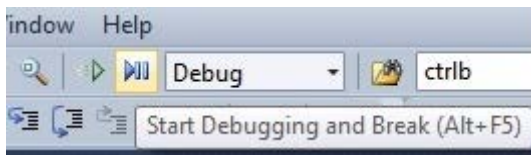


Figure 2-7: Start Debugging and Break



3 What's Next?

- Atmel Studio videos
http://www.atmel.com/microsite/atmel_studio6/videos.aspx
- Atmel Studio online help
<http://www.atmel.com/webdoc/atmelstudio/>
- Atmel Studio offline help (After installing Atmel Studio)

In Atmel Studio
Help -> View Help (Ctrl+F1) -> Atmel Studio
- ASF (Atmel Software framework) Getting Started and ASF Reference manual
<http://www.atmel.com/tools/AVRSOFTWAREFRAMEWORK.aspx?tab=documents>
- ASF online documentation
<http://asf.atmel.com/docs/latest/>
- Technical documentation for various products
<http://www.atmel.com/webdoc/>
- Atmel Gallery
<https://gallery.atmel.com/>
- Production Selection Guide
Atmel MCU Selector on <http://www.atmel.com/>
- Ordering Samples
https://secure.atmel.com/forms/secure/verifylogin.aspx?target_url=samplestore
- Buying evaluation board & kits
<http://store.atmel.com/>
- Technical Documentation
<http://www.atmel.com/design-support/documentation/default.aspx>
- Knowledge Base and Technical Support/Design Support
<http://www.atmel.com/design-support/>
- Collaborative workspace
<http://spaces.atmel.com>
- AT91 SAM community
[http://www.at91.com /](http://www.at91.com/)

4 Revision History

Doc. Rev.	Date	Comments
42421A	03/2015	Initial document release



Atmel Corporation 1600 Technology Drive, San Jose, CA 95110 USA T: (+1)(408) 441.0311 F: (+1)(408) 436.4200 | www.atmel.com

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