



AT06467: Getting started with SAM D09/D10/D11

APPLICATION NOTE

Features

- Getting started with Atmel® | SMART SAM D09/D10/D11 microcontrollers and tools
- Getting started with SAM D11 Xplained PRO, SAM D10 Xplained Mini, and Atmel Studio 6.2

Description

This application note helps the readers to get started with the Atmel SAM D09/D10/D11 ARM® Cortex®-M0+ based microcontroller.

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1. Getting the Device Datasheet

Web page:

<http://www.atmel.com/products/microcontrollers/arm/sam-d.aspx?tab=overview>

- **Document:** Atmel SAM D11 Datasheet (summary, complete) (.pdf)
- **Document:** Atmel SAM D10 Datasheet (summary, complete) (.pdf)
- **Document:** Atmel SAM D09 Datasheet (summary, complete) (.pdf)
- Select the required device (e.g. ATSAMD11D14A) and get the latest datasheet (.pdf file)
- Two versions of the datasheet are available:
 - Complete version (includes all peripheral descriptions and electrical characteristics)
 - Summary version (includes ordering information, pinout, and packaging information)

2. SAM D Evaluation Platform

The following development boards are available for evaluation of SAM D11/D10 devices:

1. SAM D11 Xplained Pro.
2. SAM D10 Xplained Mini.

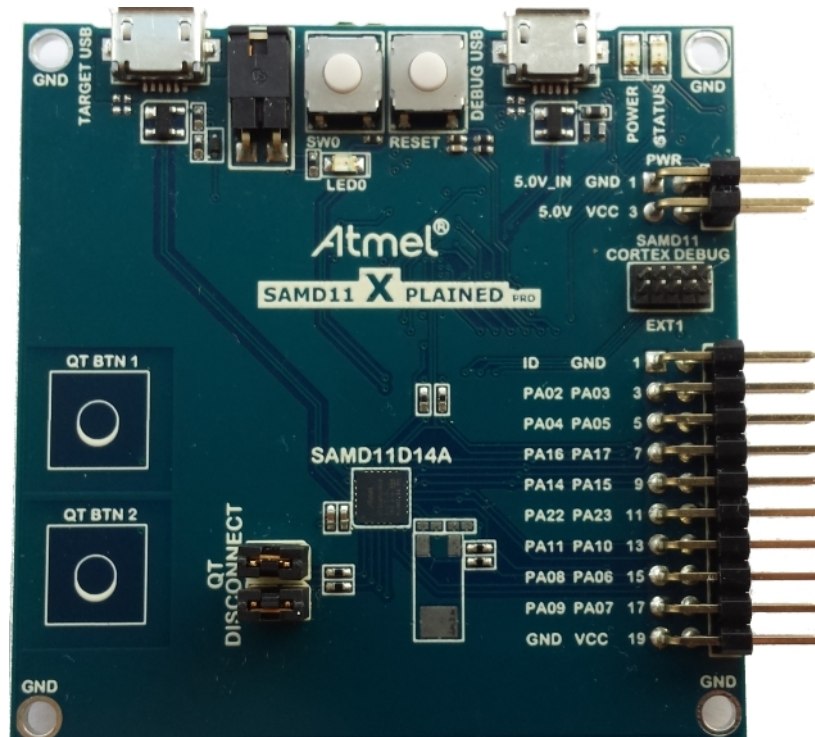
2.1. SAM D11 Xplained Pro

The Atmel SAM D11 Xplained Pro evaluation kit is a hardware platform to evaluate the ATSAM D11D14A MCU. Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATSAM D11D14A and explains the steps to integrate the device in a custom design.

The Xplained Pro MCU series evaluation kits include an on-board Embedded Debugger. No external tools are required to program or debug the ATSAM D11D14A.

The Xplained Pro extension kits offers additional peripherals to extend the features of the board and ease the development of custom designs.

Figure 2-1 SAMD11 Xplained Pro



Web page:

<http://www.atmel.com/products/microcontrollers/arm/sam-d.aspx?tab=tools>

Get the kit:

<http://www.atmel.com/buy/>

Document/file:

- Atmel-42349-SAMD11-Xplained-Pro_User-Guide.pdf

Key features:

- SAMD11D14A microcontroller
- One mechanical reset button
- One mechanical programmable button (SW0)
- One yellow user LED (LED0)
- USB device interface function
- Two QTouch buttons
- 32.768kHz crystal
- Standard Cortex Debug connector
- One Xplained Pro extension headers (EXT1)
- USB powered
- Supported with application examples in Atmel Software Framework
- Embedded Debugger
 - Auto ID for board identification in Atmel Studio 6.2 or later
 - One yellow status LED
 - One green board power LED
 - Symbolic debug of complex data types including scope information
 - Programming
 - Data Gateway Interface: USART, TWI, four GPIOs
 - Virtual COM port (CDC)

The SAM D11 Xplained Pro User Guide application note covers the instructions to power the kit, the detailed information of the on board components, extension interface and the hardware guide.

2.2. SAM D10 Xplained Mini

The ATSAMD10 Xplained Mini evaluation kit is a hardware platform to evaluate the Atmel ATSAMD10 MCU. 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.

<http://www.atmel.com/products/microcontrollers/arm/sam-d.aspx?tab=tools>

<http://www.atmel.com/buy/>

- Atmel-42387-ATSAMD10-Xplain-Mini User-Guide.pdf

- ATSAM10D14AM microcontroller
- One mechanical programmable button
- One QTouch button
- One yellow user LED
- The external 8MHz clock to ATSAM10 (Target)
- Standard Cortex Debug connector
- One Xplained Mini extension headers (EXT1)
- USB powered
- Supported with application examples in Atmel Software Framework
- Embedded Debugger
 - Auto ID for board identification in Atmel Studio 6.2 or later
 - One green status LED
 - Symbolic debug of complex data types including scope information
 - Programming
 - Data Gateway Interface: USART, TWI, four GPIOs

- Virtual COM port (CDC)

The SAM D10 Xplained Mini User Guide application note covers the steps to power the kit, the detailed information of the on board components, extension interface, and the hardware guide.

2.3. SAM D09 On-board

Evaluation of SAM D09 can be performed using the SAM D10 Xplained Mini board and testing can be performed on custom hardware. Steps start with evaluation of SAM D09 using a custom board is explained in later part of this document.

3. Get the Tools

Atmel Studio 6.2 is the preferred IDE to get started with the SAM D09/D10/D11 devices and GCC compiler. Atmel Software Framework (ASF) provides SAM D09/D10/D11 peripheral drivers. Example projects are available in ASF for easy evaluation SAM D10/D11 MCU families. IAR™ compiler is supported as well.

3.1. Get Atmel Studio 6.2

Web page:

www.atmel.com/atmelstudio

Document/file: Atmel Studio 6.2 installer (.exe)

Atmel Studio 6.2 is the IDE for developing and debugging firmware for the SAM D09/D10/D11 Microcontroller.

3.2. Get IAR Embedded Workbench for ARM

Web page:

<http://www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/>

Document/file:

IAR installer for ARM.

Get SAM D11 Xplained Pro Embedded Debugger Software (Segger J-Link):

Web page:

<http://www.segger.com/jlink-software.html>

Document/file:

J-Link software.

This software is required to use the SAM D11 Xplained Pro embedded debugger with IAR IDE.

3.3. Get Atmel Software Framework (ASF)

Web page:

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

Document/file:

- ASF update for Atmel Studio (.vsix) from ASF web page
- ASF update through Atmel Gallery <https://gallery.atmel.com/>
- ASF update through **Tools > Extension Manager** from Atmel Studio
- ASF standalone package for GCC makefile and IAR users
- Atmel AVR4029: Atmel Software Framework - User Guide
- Atmel AVR4030: Atmel Software Framework - Reference Manual

The ASF online documentation for the API and example usage are available at <http://asf.atmel.com>.

4. Atmel Studio 6.2 Users Getting Started

4.1. Getting Started with SAM D11 Xplained Pro

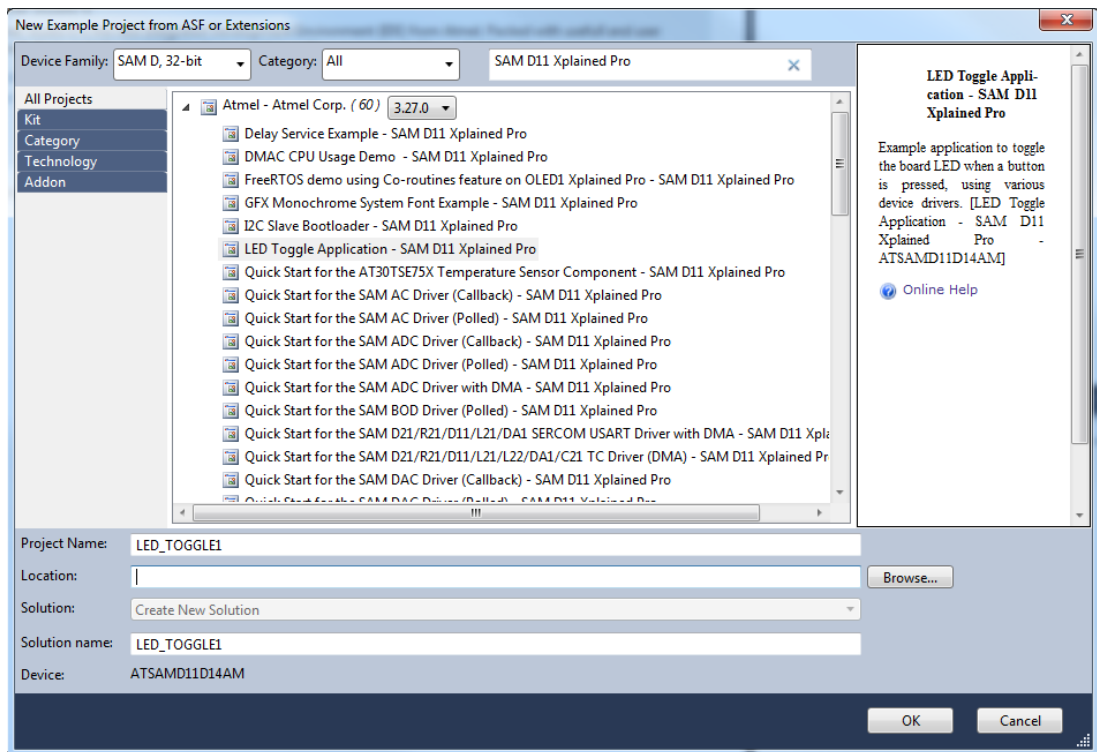
Requirements:

- Atmel Studio 6.2 or later
- ASF version 3.27 or later
- SAM D11 Xplained Pro board connected to Atmel Studio 6.2 through the embedded debugger USB connector. The kit is powered by the USB.

Getting started

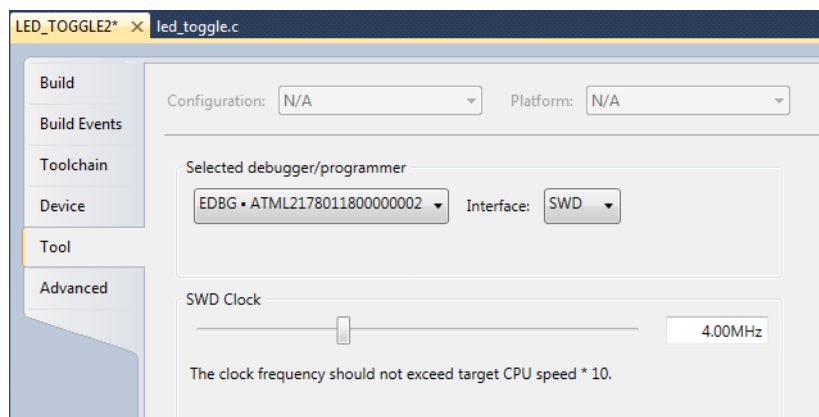
1. Launch Atmel Studio 6.2.
2. Connect the SAM D11 Xplained Pro board to the PC using a USB cable.
3. A page on SAM D11 Xplained Pro description will open in Atmel Studio.
4. This page contains external link to Device Technical Documentation, Datasheet, Kit user guide, and Kit specific details, serial number, target name, etc. Also, there will be an option to open ASF example projects.
5. Go to **File > New Example Project >** select the device family and filter it to relevant examples.
6. Select the project **LED Toggle Application**, press **OK**, and accept the license agreement.

Figure 4-1 SAM D11 New ASF Example Project Window



7. Open project properties (**Project > Properties** or shortcut **Alt+f7**).
8. In Tool view (**Tools > Device Programming**), set the configurations – Tool (**EDBG**), and Interface (**SWD**).

Figure 4-2 SAM D11 Tool Selection Window



9. Build the project: **Build > Build solution or shortcut F7**.
10. To load the code in the SAM D11 Xplained Pro and debug, select **Debug > Start debugging and break (shortcut Alt + F5)**.
11. The application is programmed and the debugger breaks in main.
12. To run the code, select **Debug > Continue (shortcut F5)**.

4.2. Getting Started with SAM D10 Xplained Mini

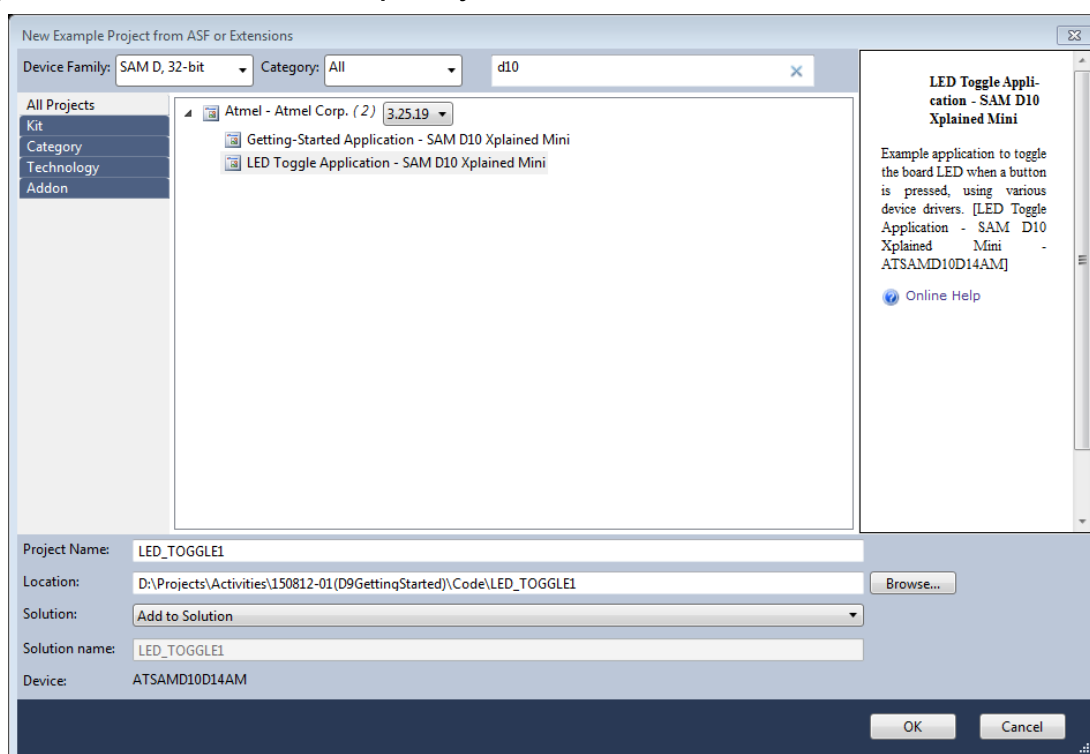
Web page:

- Atmel Studio 6.2 or later
- ASF version 3.27 or later
- SAM D10 Xplained Mini board connected to Atmel Studio 6.2 through the embedded debugger USB connector. The kit will be powered by the USB.

Getting started

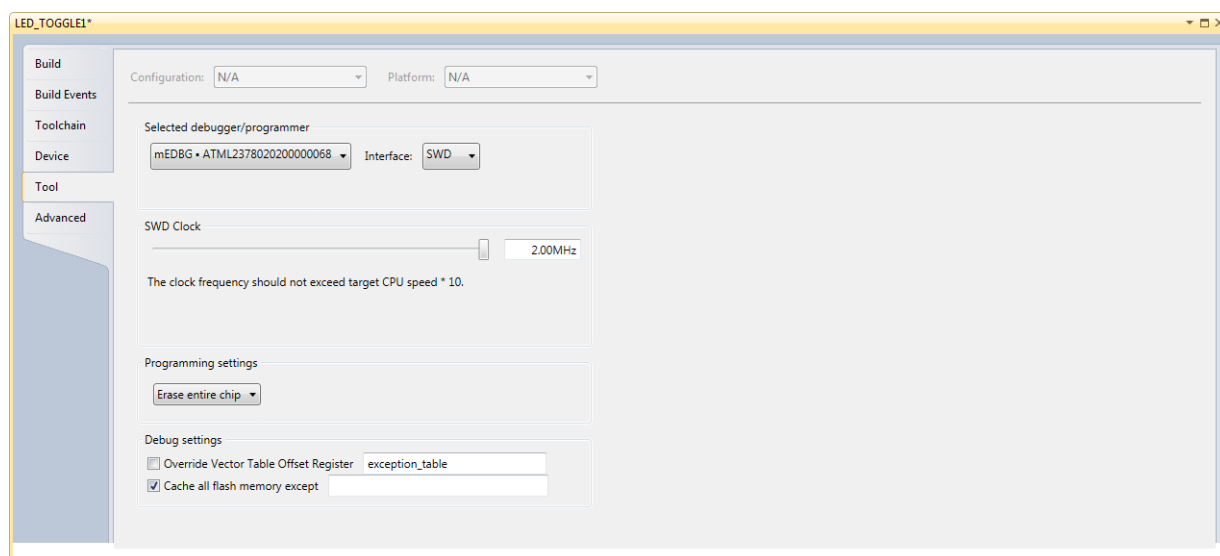
1. Launch Atmel Studio 6.2 application.
2. Connect the SAM D10 Xplained Mini board to the PC using a USB cable.
3. A page on SAM D10 Xplained Mini description will open in Atmel Studio.
4. This page contains external link to Device Technical Documentation, Datasheet, Kit user guide, and Kit specific details, serial number, target name, etc. There is an option to open ASF example projects.
5. Go to, **File > New Example Project >** select the device family and filter it to relevant examples.
6. Select the project “**LED Toggle Application**”, press **OK** and accept the license agreement. The project will be created and opened.

Figure 4-3 SAM D10 New ASF Example Project Window



7. Open project properties (**Project > Properties** or shortcut **Alt+f7**).
8. In Tool view (**Tools > Device Programming**), set the configurations – Tool (**mEDBG**), and Interface (**SWD**).

Figure 4-4 SAM D10 Tool Selection Window



9. Build the project: **Build > Build solution** or shortcut **F7**.
10. To load the code in the SAM D10 Xplained Mini and debug, select **Debug > Start debugging and break** (shortcut **Alt + F5**).
11. The application is programmed and the debugger breaks in main.
12. To run the code, select **Debug > Continue** (shortcut **F5**).

4.3. Getting Started with SAM D09

Due to the functional compatibility of the architecture and peripherals, SAM D10 firmware can be used for SAM D09 with limited or no change.

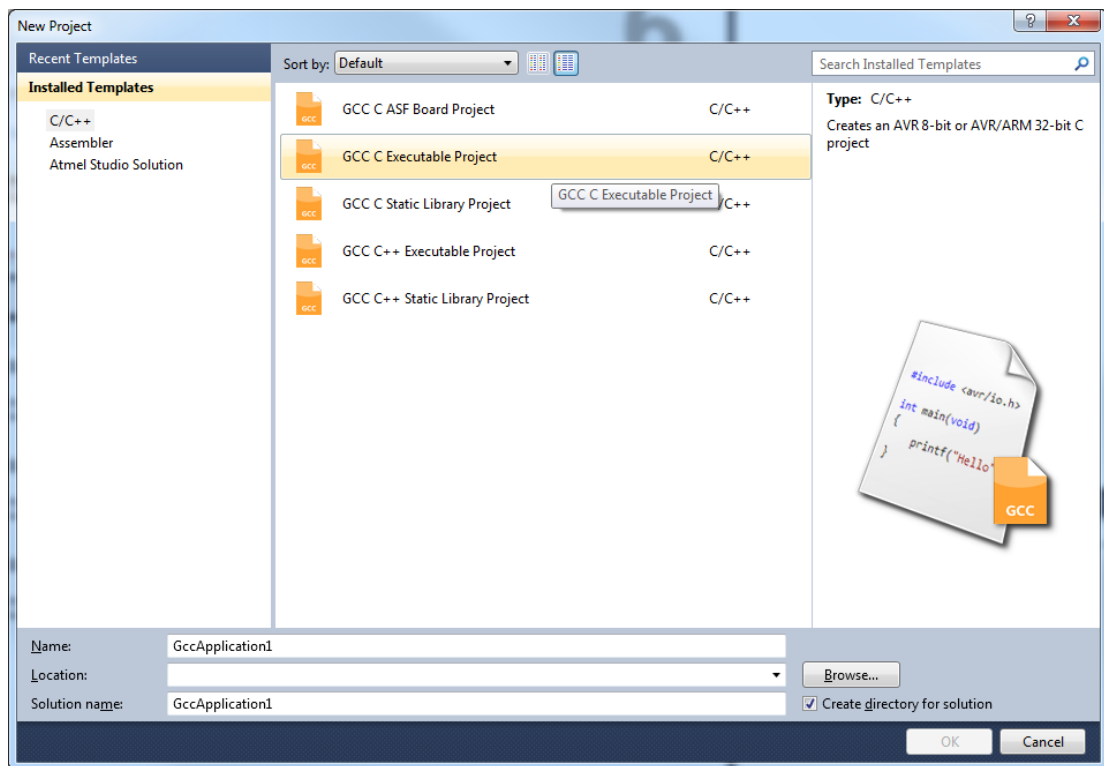
Requirements

- Custom board with SAM D09 device mounted. Refer Device datasheet for more details on “Schematics and Programming ports”.
- Atmel Studio 6.2 or later
- ASF version 3.27 or later
- Atmel ICE Debugger to program/debug the device

Getting Started

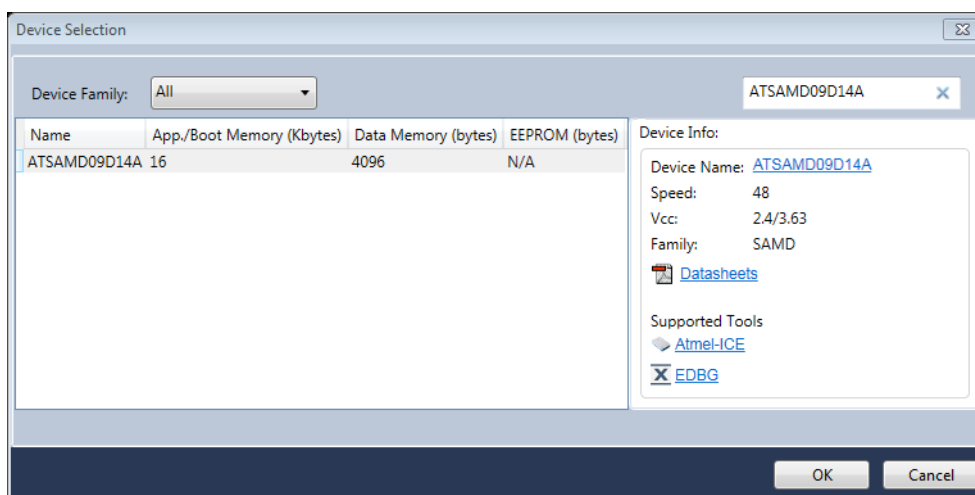
1. Launch Atmel Studio 6.2. Go to **File > New Project > GCC C Executable Project**.

Figure 4-5 SAM D09 New Project Window



2. Select the device as **ATSAMD09D14A** from **Device Selection** window.

Figure 4-6 SAM D09 Device Selection Window



3. Go to **Solution Explorer > main.c** file and add the below code snippet to the **main()** function.

```
int main(void)
{
    SystemInit();

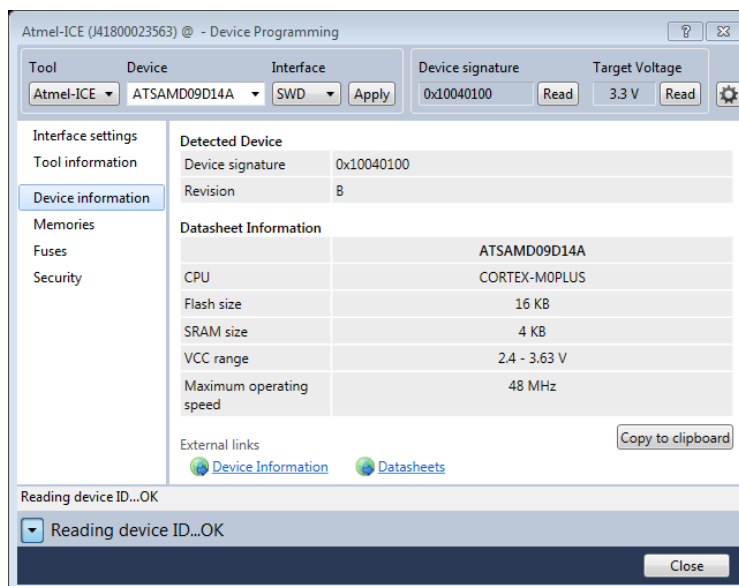
    PM->APBBMASK.reg |= PM_APBBMASK_PORT;

    PORT->Group[0].OUTSET.reg = PORT_PA09;
    PORT->Group[0].DIRSET.reg = PORT_PA09;

    while (1)
    {
        PORT->Group[0].OUTTGL.reg = PORT_PA09;
    }
}
```

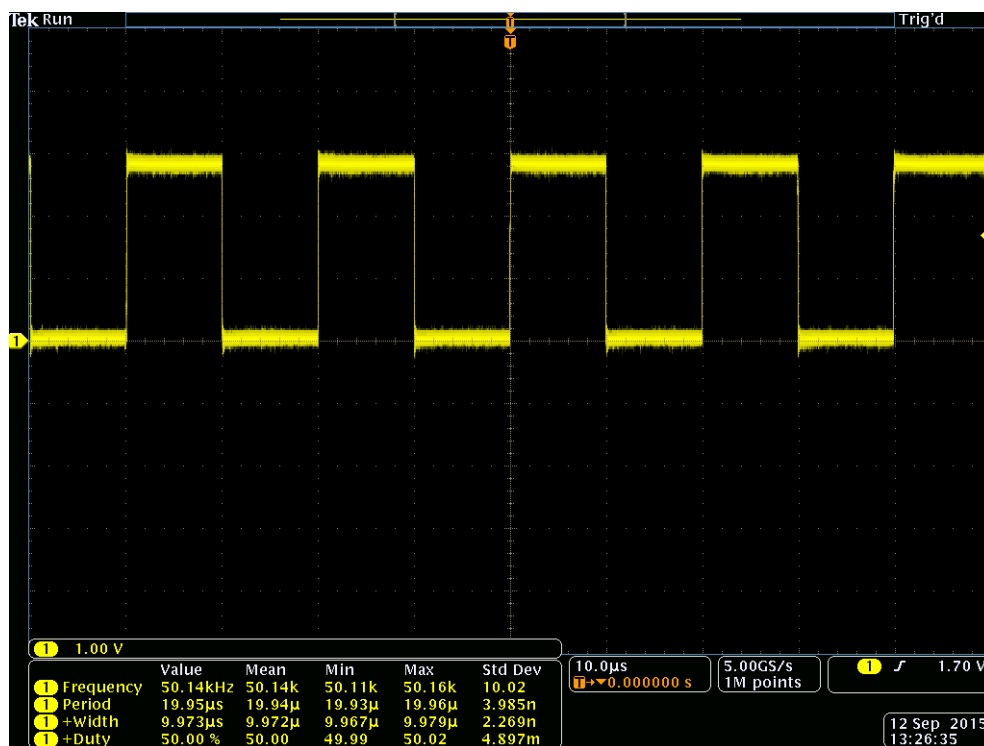
4. Connect Atmel ICE debugger to **ATSAMD09D14A** available on the target board through SWG interface. Refer the **User Guide of Atmel ICE** for more details on debugging a target board.
5. In Tool view (**Tools > Device Programming**), set the configurations – Tool (**Atmel-ICE**), and Interface (**SWD**).
6. Build the project: **Build > Build solution or shortcut F7**.
7. To load the code and debug, select **Debug > Start debugging and break (shortcut Alt + F5)**.
8. The application is programmed and the debugger breaks in **main()**. To run the code, select **Debug > Continue (shortcut F5)**.

Figure 4-7 SAM D09 Device Programming Window



9. The code snippet is supposed to toggle PortA pin 9 (**PA09**) at approximately 50kHz. This can be verified by probing the pin using an oscilloscope.
10. The snapshot of waveform captured through oscilloscope is as follows:

Figure 4-8 Pin Toggle Output Waveform



5. What's next?

- Atmel Studio videos: www.atmel.com/atmelstudio
- Atmel Studio help: **Help > View Help (Ctrl+F1)**
- ASF Getting Started: www.atmel.com/asf
- ASF online documentation: asf.atmel.com
- ASF Reference manual: asf.atmel.com
- Technical Documentation for various products: www.atmel.com/webdoc/

6. Revision History

Doc Rev.	Date	Comments
42362B	11/2015	Updated for SAM D09 device
42362A	8/2014	Initial document release



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