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## Getting Started with the SAM L10/L11 Xplained Pro

## Abstract

This application note aims at getting started with the Atmel<sup>®</sup> SAM L10 and SAM L11 ARM<sup>®</sup>Cortex<sup>®</sup>-M23 based microcontrollers using their respective Xplained Pro evaluation kits.

The Atmel SAM L10 and SAM L11 Xplained Pro evaluation kits are hardware platforms used to evaluate the ATSAML10E16A and ATSAML11E16A microcontrollers.

Each kit is supported by the Atmel Studio Integrated development Platform, and provides an easy access to the features of the microcontroller.

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## 1. Device Documentation

## Data Sheet

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

**Document:** SAM L10/L11 Family Data Sheet, which provides peripheral descriptions and electrical characteristics.

## Silicon Errata

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

**Document:** SAM L10/L11 Family Silicon Errata and Data Sheet Clarification.

## 2. Obtain the SAM L10/SAM L11 Xplained Pro Evaluation Kit



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

#### To order the kit, accessMicrochip Direct

#### **Documents:**

- SAM L10/L11 Xplained Pro User Guide (.pdf)
- SAML10-Xplained-Pro\_Design-Documentation (.zip)
- SAML11-Xplained-Pro\_Design-Documentation (.zip)

#### **Key Features:**

- ATSAML10E16A-AU or ATSAML11E16A-AU microcontrollers
- One mechanical reset button
- One mechanical programmable button
- One QTouch<sup>®</sup> button
- One user LED (yellow)
- 32.768 kHz crystal

- ATECC508A Crypto Authentication IC
- Two Xplained Pro extension headers
- One X32 header
- One mikroBUS header
- Embedded Debugger
  - Auto-ID for board identification in Atmel Studio
  - One status LED (yellow)
  - One board power LED (green)
  - Symbolic debug of complex data types including scope information
  - Programming and debugging, including power measurements
  - Data Gateway Interface: SPI, I<sup>2</sup>C, four GPIOs
  - Virtual COM-port (CDC)
- Embedded current measurement circuitry with Atmel Data Visualizer support for data visualization
- USB powered



**Tip:** The SAM L10/SAM L11 Xplained Pro User's Guide describes how to power the kit, and it also describes the detailed information on board components, extension interface and the hardware guide.

## 3. Obtain the Tools

Atmel Studio 7, which uses a GCC compiler, is the preferred IDE to get started with SAM L10/SAM L11 MCUs. Atmel START is the preferred user interface to generate the initial project. Any Atmel START project can be used in Atmel Studio 7, IAR or KEIL IDEs.

## Atmel Studio 7

Web page: Atmel Studio
 Document: Atmel Studio 7.0 web installer(.exe)

Atmel Studio 7 is the preferred IDE for developing and debugging firmware for SAM L10/SAM L11.

## Atmel Start

• Web page: Atmel Start

**Document:** Atmel Start User's guide: Also, use the help menu from the interface.



Atmel Start enables users to select and configure software components and tailor embedded applications in a usable and optimized manner.

## 4. Getting Started With SAM L10/SAM L11 Using Atmel Studio 7 and START

**Note:** The following steps are described using the SAM L10 Xplained Pro as reference; however, the same sequence can be performed using the SAM L11 Xplained Pro.

## 4.1 Instructional Guide

Follow these steps to start exploring the Atmel Xplained Pro platform:

- 1. Download Atmel Studio.
- 2. Install Atmel Studio.
- 3. Launch Atmel Studio.



4. Connect the kit to the PC using a micro-USB cable (Standard-A to Micro-AB). When the Xplained Pro MCU kit is connected to the computer for the first time, the operating system will install the software driver. The driver file supports both 32-bit and 64-bit versions of Microsoft<sup>®</sup> Windows<sup>®</sup>XP, Windows Vista<sup>®</sup>, Windows 7, Windows 8 and Windows 10.



When the Xplained Pro MCU board is powered, the power LED (green) will glow and Atmel Studio will auto-detect the specific Xplained Pro MCU and extension boards that might be connected. Atmel Studio will provide links to relevant information, such as data sheets and kit documentation.

**Note:** The ATSAML10E16A and ATSAML11E16A devices are programmed and debugged by the on-board embedded debugger, hence no external programmer or debugger tool is required.

SAM L10 Xplained Pro - 000	2 🕫 🗙
MCU board	SAMI 10 Valained Dre
SAM L10 Xplained Pro	SAM LTO Xplained Pro
Extension	
	platform to evaluate the ultra low power Microchip ATSAML10E16A microcontroller. Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features o the Microchip SAM L10 and explains how to integrate the device in a customer design.
	Launch Data Visualizer
	External Links:
	😹 Xplained Home Page (find other kits and extensions)

Figure 4-1. Atmel Studio SAM L10/SAM L11 Xplained Pro Introduction

5. Launch Atmel Start from Atmel Studio: *File > New > Atmel Start Example Project*, and then open Atmel Start directly into Atmel studio.

	New	٠	13	Project	Ctrl+Shift+N
	Open	٠	*0	File	Ctrl+N
	Close		₽	Example Project	Ctrl+Shift+E
23	Close Solution		As	Atmel Start Project	
	Import	٠	As	Atmel Start Example Project	
ia)	Save Selected Items	Ctrl+S	-		
	Save Selected Items As		200		
2	Save All	Ctrl+Shift+S	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	Export Template		ann.	6	
D	Page Setup		1		
8	Print	Ctrl+P	7		
	Recent Files	٠			
	Recent Projects and Solutions				

## Figure 4-2. Opening Atmel Start Example Project in Atmel Studio

Atmel Start will load the existing example list.

6. Choose the example "LED Flasher" in the list, and then click **Open Selected Example. Figure 4-3. Atmel start SAM L1x Available Example List** 

hinne	Catagories	Description	Reard(c) supported	Lleas quida
Name	categories	Description	board(s) supported	user guide
Calendar demo	💂 I/O 🛗	This example shows the use of the Calendar driver and alarms to blink LED every 10 seconds.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
EDBG UART	<b>1</b> 0	This demo uses the UART usage example function to write data to the EDBG Virtual COM Port. Echo back input characters and toggle LED.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
LED flasher	I/O	This example periodically toggles an on-board LED.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
LED switcher	I/O	This example toggles an on-board LED every time when an on-board switch is pressed.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
Low power for SAML1X	<b>[</b> +]	This example demonstrates the different low power modes of the SAM L10/L11 which are DLE, STANDBY and OFF modes.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
PWM Example	$\odot$ $\odot$ $\sim$	This demo read light sensor on IO Xplained over ADC, and then output PWM on LED to reflect the current measured light level.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
		This second a design of a design data second for the	CAMI 10 Valaised Bre	Provide State

7. Choose either the SAM L10 or SAM L11 Xplained Pro Board, and then click Select board.

## Figure 4-4. Board Selection

SELECT BOARD	×
The example <i>LED flasher</i> is supported by n Select which one to use:	nore than one board.
Board	Device
SAM L10 Xplained Pro	ATSAML10E16A
SAM L11 Xplained Pro	ATSAML11E16A
	Select board Cancel

8. Click **GENERATE PROJECT** to generate the project from Atmel Start. My "Software Components Window" will be displayed.

	E COMPONENTS				?
<ul> <li>Application</li> <li>Middleware</li> <li>Driver</li> </ul>		+ Add softw	are component		Show system drivers ① Show hardware ①
		LED FU	ASHER 🔅		
SELECTED BO	ARD: SAM L10 XPLAI	NED PRO			
Selected board	The Atmel®   SMART <sup>™</sup> SAM microcontroller. Supported b SAM L10 and explains how to	L10 Xplained Pro evaluation kit is a h y the Atmel Studio integrated develo integrate the device in a customer d	ardware platform to evaluat oment platform, the kit prov esign.	e the ultra low power Atmel ATS ides easy access to the features	AML10E16A of the Atmel®   SMART™
SELECTED DEV	VICE: ATSAML10E16A	BOAR	D DETAILS		
SELECTED DEN GENERAL Name	ATSAML10E16A	SUPPORTED PERIPHERAL	D DETAILS .S	OPAMP	1 🔺
SELECTED DEN GENERAL Name CPU	ATSAML10E16A ATSAML10E16A CORTEX-M23	SUPPORTED PERIPHERAL	D DETAILS .S 1	OPAMP     OSC32KCTRL	1 A
SELECTED DEV GENERAL Name CPU Flash	VICE: ATSAML10E16A ATSAML10E16A CORTEX-M23 66 KB	SUPPORTED PERIPHERAL AC ADC CCL	D DETAILS	OPAMP OSC32KCTRL OSCCTRL	1 1 1
SELECTED DEV GENERAL Name CPU Flash SRAM	VICE: ATSAML10E16A ATSAML10E16A CORTEX-M23 66 KB 16 KB	SUPPORTED PERIPHERAL AC ADC CCL DAC	D DETAILS	OPAMP     OSCITEL     OSCITEL     PAC	1 1 1 1
SELECTED DEV GENERAL Name CPU Flash SRAM Package	VICE: ATSAML10E16A ATSAML10E16A CORTEX-M23 66 KB 16 KB TQFP32	SUPPORTED PERIPHERAN AC ADC CCL DAC DMAC	D DETAILS	OPAMP OSC32KCTRL OSCCTRL PAC RTC	1 1 1 1 1 1
SELECTED DEV GENERAL Name CPU Flash SRAM Package Change package	VICE: ATSAML10E16A ATSAML10E16A CORTEX-M23 66 KB 16 KB TQFP32	SUPPORTED PERIPHERAN AC ADC CCL DMAC DSU DSU	D DETAILS	OPAMP OSC32KCTRL OSCCTRL PAC RTC SERCOM	1 1 1 1 1 3
SELECTED DE GENERAL Name CPU Flash SRAM Package Change package	VICE: ATSAML10E16A ATSAML10E16A CORTEX-M23 66 KB 16 KB TQFP32	SUPPORTED PERIPHERAL AC ADC CCL DAC DAC DSU SU SU	D DETAILS	OPAMP OSC32KCTRL OSCCTRL PAC RTC SERCOM SERCOM	1 × 1 1 1 1 1 3 1 2

Figure 4-5. Atmel Start Project Generation

 The following window will be displayed: Enter Project Name, Solution, Solution Name, and then browse and choose a location for the project. Click OK to open the project in Atmel Studio.
 Figure 4-6. Atmel Studio New Atmel Start Project Importation

lew Atmel Sta	rt Project		
Project Name:	LED flasher		
Location:	C:\SAML10_Example_Folder		Browse
Solution:	Create New Solution	*	
Solution Name:	LED flasher		
Tiew Project Summary	5/		

The Atmel Studio will create the project.

- 10. Configure the Debugger/Programmer Interface by following these steps:
  - Open the project properties: *Project > Properties* or <ALT+F7>.
  - Click Tool.
  - For the Selected debugger/programmer, choose "EDBG ATMLxxx".
  - For the Interface, choose "SWD".

#### Figure 4-7. Programming Tool Selection

SAM L10 Xplained Pro -	)163 LED flasher 보 🗙 ASF Wizard Atmel   START SAM L11 Xplained Pro - 0125	
Build Build Events	Configuration: N/A * Platform: N/A *	
Toolchain Device Tool Packs	Selected debugger/programmer EDBG • ATML00000000000163 • Interface: SWD •	
Advanced		
	SWD Clock 2 MHz Reset to default clock The clock frequency should not exceed target CPU speed * 10.	
	Programming settings           Erase entire chip         Reset strategy	
	Debug settings	
	Override Vector Table Offset Register exception_table	
	Cache all flash memory except	

- 11. Compile and run the LED Flasher application.
  - Build the project: *Build > Build Solution* or <F7>.
  - Load the code into the SAM L10 Xplained Pro and start debugging: Debug > Start debugging and break or <ALT+F5>.
  - The application is programmed and the debugger breaks in main.
  - Run the code: Debug > Continue or <F5>.
  - The example runs out of the Xplained Pro target.

## 5. Getting Started With SAM L11 Secure Solution Using Atmel Studio 7 and Start

## 5.1 SAM L11 Security Concept Overview

Using the ATSAM L11 requires to be familiar with different security features and concepts that involve a TrustZone<sup>®</sup> for ARMv8-M devices.

The TrustZone technology is a System-on-Chip (SoC) and MCU system-wide approach to security that enables Secure and Non-Secure code to run on a MCU. It enables creating multiple software security domains that restrict access to selected memory, peripherals, and I/O to trusted software without compromising the system performances. The user can consider the following deployment approaches:

- Single-developer approach (Customer A)
- Dual-developer approach (Customer A+ Customer B)

The Single developer approach involves a unique developer (Customer A), which is in charge of the following:

- Developing, deploying, and protecting the Secure code
- Developing and deploying the Non-Secure code

In the Dual-Developer approach, the first developer (Customer A) is in charge of developing the Secure application and its associated Non-Secure callable library. The Secure Application must be loaded in the SAM L11 NVM and protected.

A different developer (Customer B) will then start Non-Secured application development on a preprogrammed SAM L11 with limited access to Secure resources (call to Non-Secure API only).





This document describes how to debug a solution composed of the following two projects:

- Secure Project
- Non-Secure Project

**Note:** Refer to the "SAM L11 Security Reference Guide" application note, which describes the security features available in the Microchip SAM L11 microcontroller that fulfill the security requirement of most embedded systems.

## 5.2 Instructional Guide

Follow these steps to explore the Atmel Xplained Pro platform:

- 1. Download Atmel Studio.
- 2. Install Atmel Studio.
- 3. Launch Atmel Studio.



4. Connect the DEBUG USB port on the kit to the PC using a micro-USB cable (Standard-A to Micro-AB). When the Xplained Pro MCU kit is connected to the computer for the first time, the operating system will install the software driver. The driver file supports 32-bit and 64-bit versions of Microsoft<sup>®</sup> Windows<sup>®</sup>XP, Windows Vista<sup>®</sup>, Windows 7, Windows 8 and Windows10.



When the Xplained Pro MCU board is powered, the power LED (green) will glow. Atmel Studio will auto-detect the specific Xplained Pro MCU and extension boards that are connected. Atmel Studio will present relevant information, such as data sheets and kit documentation.

The ATSAML11E16A device is programmed and debugged by the on-board embedded debugger, hence no external programmer or debugger tool is required.



#### Figure 5-2. Atmel Studio SAM L11 Xplained Pro Introduction

5. Launch Atmel Start from Atmel Studio to Open the Secure Application Project: *File > New > Atmel Start Example Project* and then open Atmel Start into Atmel studio 7.

Figure 5-3. Open a New Atmel Start Example Project in Atmel Studio

File	Edit View VAssistX ASF	Project Deb	ug	Tools Window Help	
	New	•	韵	Project	Ctrl+Shift+N
	Open	•	*0	File	Ctrl+N
	Close		₫	Example Project	Ctrl+Shift+E
EB	Close Solution		As	Atmel Start Project	
	Import	٠	As	Atmel Start Example Project	
14	Save Selected Items	Ctrl+S	-		
	Save Selected Items As		200	~	
<b>.</b> "	Save All	Ctrl+Shift+S	1000		
	Export Template		and the second		
	Page Setup		đ		
蓹	Print	Ctrl+P	1		
	Recent Files	÷.			
	Recent Projects and Solutions				

Note: After few seconds the example llist will be displayed.

6. Select the "TrustZone Getting Started Example" for the Secure Project (TZ-GetStart-S) from the examples list, and then click **OPEN SELECTED EXAMPLE**.

Figure 5-4. TrustZone Getting started SAM L11 Secure Project Example Selection

earch: Filter		Category: All ~	Board:	All
Name	Categories	Description	Board(s) supported	User guide
	9	ATECC508A CryptoAuthenticationTM device to demonstrate secure node provisioning and node authentication using PKI methodology. Specific details include internal key generation, creation of signer and device certificates, and certificate chain verification from device to the certificate root.	SAM L10 Xplained Pro	- oser Baae
PWM Example	$\odot$	This demo read light sensor on IO Xplained over ADC, and then output PWM on LED to reflect the current measured light level.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
Smart Card Example	I/O <b>_</b> ]	This example does a read and write data example for smart card.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
TZ-GetStart-NS	ම	Getting started example of using TrustZone for Cortex-M device. This is non-secure project, please use it together with secure project.	SAM L11 Xplained Pro	User guide
TZ-GetStart-S	6	Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.	SAM L11 Xplained Pro	User guide
TZ-MixSecureEIC-NS	6	This example illustrates the use of TrustZone for Cortex-M device of mix secure peripheral EIC. This is non-secure project, please use it together with secure project.	SAM L11 Xplained Pro	User guide
TZ-MixSecureEIC-S	ම	This example illustrates the use of TrustZone for Cortex-M device of mix secure peripheral EIC. This is secure project, please use it together with non-secure project.	SAM L11 Xplained Pro	User guide
TZ-SecureDriver-NS	ම	This example illustrates the use of TrustZone for Cortex-M device by isolating temperature sensor driver source code	SAM L11 Xplained Pro	User guide

7. Generate the project from Atmel Start to open it in Atmel Studio. Once the project is open, click **GENERATE PROJECT.** 

Image: Solution in the solution of the solution	Image: Second Structure Control Contents       Image: Second Structure Contents       Show system driver: Image: Show system driver: Image: Show hardware Contents         Image: System driver       Image: Show system driver: Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show system driver: Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: System driver       Image: Show hardware Contents       Image: Show hardware Contents         Image: Show hardware Contents       Image: Show hardware Contents       Image: Show hardware Contents         Image: Show hardware Contents       Image: Show hardware Contents       Image: Show hardware Contents <tr< th=""><th>MIT SUPPORT       Add software component       Show system divers         Middleware       Driver       Show system divers         System diver       ITELESTARTS       Image: Complex Component         Image: Complex Complex Component       Image: Complex Com</th></tr<>	MIT SUPPORT       Add software component       Show system divers         Middleware       Driver       Show system divers         System diver       ITELESTARTS       Image: Complex Component         Image: Complex Complex Component       Image: Complex Com
Application       Add software component       Show system drivers         Driver       System driver       Show hardware         System driver       TZ-GETSTARTS       Image: Component         Image: Component       Image: Component       Show system drivers         Image: Component       Image: Component       Show system drivers         Image: Component       Image: Component       Image: Component	Show system driver  Add software component  Show system driver  Show hardware C  Show hard	Application Show system drivers   Driver Driver   Driver System drivers     TZ-GETSTART-S Image: Complex transformed in the system drivers   GCLK MCLK   OSC3ZKCTRL OSCCTRL   MAAC     TZ-GETSTART-S   Image: Complex transformed in the system drivers     State of the system drivers     TZ-GETSTART-S   Image: Complex transformed in the system drivers     State of t
Image: Solution of the second project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure project place use it together with non-secure project.         Image: Solution of the secure place use use it together with non-secure project.         Image: Solution of the secure place use use use it together with non-secure project.         Image: Solution of the secure place use use use use use use use use use us	TZ-GETSTART-S       Image: Constraint of the	Image: Difference of the second problem of the second p
GCLK       MCLK       OSC32KCTRL       OSC32KCTRL       OSC32KCTRL       DMAC         TZ-GETSTART-S         Cetting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.         GENERAL         Ink         Image: Secure project.         Control of Cortex-M device. This is secure project, please use it together with non-secure project.	GCLK       MCLK       OSC32KCTRL       OSCCTRL       DMAC       OMAC       OMAC </td <td>GCLK MCLK OSC32KCTRL OSCCTRL DMAC   TZ-GETSTART-S   Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.   GENERAL   I User guide   © Link   IDE: Atmel Studio   IDE:   Atmel Studio   UNKER CONFIGURATION</td>	GCLK MCLK OSC32KCTRL OSCCTRL DMAC   TZ-GETSTART-S   Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.   GENERAL   I User guide   © Link   IDE: Atmel Studio   IDE:   Atmel Studio   UNKER CONFIGURATION
TZ-GETSTART-S Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.  GENERAL  User guide  Chink C	T2-GETSTART-S         Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.         GENERAL         Ink         Image: Component         TOOLCHAIN SETTINGS         IDE:       Atmel Studio         COMPILER CONFIGURATION         LINKER CONFIGURATION	TZ-GETSTART-S         Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.         GENERAL         Inik         Image: Im
Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.  GENERAL  GENERAL  C Unk  Rename component	Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.  GENERAL  Complex Component  Complex Configuration  LINKER CONFIGURATION	Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.         GENERAL         i       User guide         Image: Secure project.         Image: Secure project.         i       User guide         Image: Secure project.         Image: Secure project.         Image: Secure project.         Image: Secure project.         Secure project.         Image: Secure project.     <
GENERAL  User guide  Suink  Rename component	GERERAL	GENERAL
User guide     So Link     Rename component		i User guide  Compiler configuration  i User guide  i Use
Eink     Rename component	Sename component       TOOLCHAIN SETTINGS       IDE:     Atmel Studio       COMPILER CONFIGURATION       LINKER CONFIGURATION	Sename component       TOOLCHAIN SETTINGS       IDE:     Atmel Studio       COMPILER CONFIGURATION     LINKER CONFIGURATION
Rename component	Rename component         TOOLCHAIN SETTINGS         IDE:       Atmel Studio         COMPILER CONFIGURATION         LINKER CONFIGURATION	Rename component         TOOLCHAIN SETTINGS         IDE:       Atmel Studio         COMPILER CONFIGURATION       LINKER CONFIGURATION
	TOOLCHAIN SETTINGS	TOOLCHAIN SETTINGS       IDE:     Atmel Studio       COMPILER CONFIGURATION     LINKER CONFIGURATION
TOULCHAIN SETTINGS	IDE: Atmel Studio	IDE: Atmel Studio
IDE: Atmel Studio	COMPILER CONFIGURATION LINKER CONFIGURATION	COMPILER CONFIGURATION LINKER CONFIGURATION
COMPILER CONFIGURATION LINKER CONFIGURATION	Miscellaneous Other Flags: 🛛 std=gnu99 -mcmse Miscellaneous Linker Flags: 🖓 -Wi,out-implib=libsecure_gateway_veneer.lit	Miscellaneous Other Flags: 0 -std=gnu99 -mcmse Miscellaneous Linker Flags: 0 -Wi,out-implib=libsecure_gateway_venee

### Figure 5-5. Atmel Start Secure Project Overview and Generation

8. The following "New Atmel Start Project" window will be displayed. Figure 5-6. Secure Project Importation View

Atmel Start Importer			×
New Atmel Sta	rt Project		
Project Name:	TZ-GetStart-S		
Location:	C:\Users\M43422\Documents\Atmel Studio\7.0		Browse
Solution:	Create New Solution	~	
Solution Name:	TZ-GetStart-S		
View Project Summary			
		ОК	Cancel

- 9. Modify the following project information:
  - Enter a new Project Name.
  - Click **Browse** to choose a location.
  - For Solution: Create New Solution.
  - For Solution Name, enter *TrustZoneGettingStarted*.
  - Cick **OK** to open the project in Atmel Studio.

#### Figure 5-7. Modifying the Project Information

Atmel Start Importer			×
New Atmel Star	rt Project		
Project Name:	SecureProject		
Location:	C:\SAML11_GettingStarted_TZ_Example_Folder		Browse
Solution:	Create New Solution	×.	
Solution Name: <u>View Project Summary</u>	TrustZoneGettingStarted		
		ОК	Cancel

10. To see the project in the Atmel Studio Solution Explorer: *View > Solution Explorer* or <CTRL+ALT +L>.

## Figure 5-8. Atmel Studio Solution Explorer Showing Secure Project

Solution Explorer	• 4 ×
G O 🔂 To - 7 🗊 🖋 🗕 🚳 D	
Search Solution Explorer (Ctrl+\$)	- م
Solution 'TrustZoneGettingStarted' (1 project)	
🔺 📙 SecureProject	
📴 Dependencies	
📴 Output Files	
Libraries	
▷ D Config	
Device_Startup	
Examples	
P i hai	
V i npi	
c atmel start c	
b) atmel_start.b	
atmel start pins.h	
c driver_init.c	
b driver_init.h	
c main.c	
VA View VA Outline Solution Explorer	

Currently, the TrustZoneGettingStarted solution is only composed of the SecureProject.

11. To compile the "TrustZoneGettingStarted " Secure application, build the project: *Build* > *Build* Solution or <F7 >..

The current building of the project is important as it enables the generation of the Secure library gateway used in the future Non-Secure application.

#### Figure 5-9. Secure Project Building Output Window

Output
Show output from: Build 🔹 🚽 🖆 🖆
<pre>make: Nothing to be done for 'all'. Done executing task "RunCompilerTask". Task "RunOutputFileVerifyTask". Task "RunOutputFileVerifyTask". Done executing task "RunOutputFileVerifyTask". Done building target "CoreBuild" in project "SecureProject.cproj". Target "PostBuildEvent" skipped, due to false condition; ('\$(PostBuildEvent)' != '') was evaluated as ('' != ''). Target "Build" in file "C:\Porgram files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\SAML11_GettingStarted_TZ_Examp Done building target "Build" in project "SecureProject.cproj". Build succeeded. =================================</pre>
Output
Build succeeded

The Secure Application is built, and the Secure library gateway has been generated in the *SecureProject /Debug* folder:

ed_TZ	_Example_Folder > TrustZoneGetting	Started > SecureProject >	Debug	~ ē	Search Debug	م
Na	me	Date modified	Туре	Size		
	Config	5/25/2018 10:32 AM	File folder			
	Device_Startup	5/25/2018 10:56 AM	File folder			
	examples	5/25/2018 10:56 AM	File folder			
	hal	5/25/2018 10:32 AM	File folder			
	hpl	5/25/2018 10:32 AM	File folder			
	hri	5/25/2018 10:32 AM	File folder			
	trustzone	5/25/2018 10:56 AM	File folder			
	atmel start.d	5/25/2018 10:56 AM	D File		19 KB	
17	atmel start.o	5/25/2018 10:56 AM	O File	1	728 KB	
1	driver init.d	5/25/2018 10:56 AM	D File		18 KB	
-	driver init.o	5/25/2018 10:56 AM	O File		712 KB	
8	libsecure_gateway_veneer.lib	5/25/2018 10:56 AM	Altium Library		1 KB	
	main.d	5/25/2018 10:56 AM	D File		19 KB	
1	main.o	5/25/2018 10:56 AM	O File	2	725 KB	
	makedep.mk	5/25/2018 10:32 AM	MK File		1 KB	
	Makefile	5/25/2018 10:56 AM	File		31 KB	
	SecureProject.bin	5/25/2018 10:56 AM	BIN File	8,2	209 KB	
1	SecureProject.eep	5/25/2018 10:56 AM	EEP File		0 KB	
[	SecureProject.elf	5/25/2018 10:56 AM	ELF File		333 KB	
1	SecureProject.hex	5/25/2018 10:56 AM	HEX File		4 KB	
	SecureProject.lss	5/25/2018 10:56 AM	LSS File		24 KB	
-	SecureProject.map	5/25/2018 10:56 AM	MAP File	84	432 KB	
	SecureProject.srec	5/25/2018 10:56 AM	SREC File		4 KB	

## Figure 5-10. Compilation Resulting Secure Library File

- 12. Close the Atmel Start window from Atmel Studio.
- 13. Reopen a new Atmel Start Example Project to create the Non-Secure application:
  - File > New > Atmel Start Example Project.
  - Open Atmel START directly into Atmel Studio 7. \_

#### Figure 5-11. Open a New Atmel Start Example Project in Atmel Studio

	New	•	韵	Project	Ctrl+Shift+N
	Open	•	*	File	Ctrl+N
	Close		₫	Example Project	Ctrl+Shift+E
3	Close Solution		As	Atmel Start Project	
	Import	٠	As	Atmel Start Example Project	
il.	Save Selected Items	Ctrl+S	-		
	Save Selected Items As		200	(D)	
٩	Save All	Ctrl+Shift+S	11/2		
	Export Template				
	Page Setup		đ		
5	Print	Ctrl+P	1		
	Recent Files	۲			
	D D				

14. Choose the "TrustZone Getting Started Example" for the Non-Secure Project (TZ-GetStart-NS) from the existing examples list, and then click **OPEN SELECTED EXAMPLE**. Figure 5-12. TrustZone Getting started SAM L11 Non-Secure Project Example Selection

earch: Filter		Category: All ~	Board: All	8
Name	Categories	Description	Board(s) supported	User guide
PWM Example		This demo read light sensor on IO Xplained over ADC, and then output PWM on LED to reflect the current measured light level.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
Smart Card Example	I/O 🗖 🗌	This example does a read and write data example for smart card.	SAM L10 Xplained Pro SAM L11 Xplained Pro	User guide
TZ-GetStart-NS	ම	Getting started example of using TrustZone for Cortex-M device. This is non-secure project, please use it together with secure project.	SAM L11 Xplained Pro	User guide
TZ-GetStart-S	6	Getting started example of using TrustZone for Cortex-M device. This is secure project, please use it together with non-secure project.	SAM L11 Xplained Pro	User guide
TZ-MixSecureEIC-NS	6	This example illustrates the use of TrustZone for Cortex-M device of mix secure peripheral EIC. This is non-secure project, please use it together with secure project.	SAM L11 Xplained Pro	User guide
TZ-MixSecureEIC-S	6	This example illustrates the use of TrustZone for Cortex-M device of mix secure peripheral EIC. This is secure project, please use it together with non-secure project.	SAM L11 Xplained Pro	User guide
TZ-SecureDriver-NS	ම	This example illustrates the use of TrustZone for Cortex-M device by isolating temperature sensor driver source code from non-secure world. This is non-secure project, please use it together with secure project.	SAM L11 Xplained Pro	User guide
TZ-SecureDriver-S	ම	This example illustrates the use of TrustZone for Cortex-M device by isolating temperature sensor driver source code from non-secure world. This is secure project, please use it together with non-secure project.	SAM L11 Xplained Pro	User guide

15. Generate the project from Atmel Start to open it in Atmel Studio, and once it is loaded, click **GENERATE PROJECT.** 

	NENTS	
Application Middleware	+ Add software component	Show system driver Show hardward
System driver	Click "Add software components" to add drivers and middleware to your project.	
<u>⊗</u> •	TZ-GETSTART-NS	
	OSC32KCTRL 🔅 MCLK 🔅 OSCCTRL	DMAC 🔅
	TZ-GETSTART-NS	
Getting start	ted example of using TrustZone for Cortex-M device. This is non-secure project, please use it toget	her with secure project.
GENERAL		
Gen Link		
Rename component		
Pename component		
Rename component	L11 XPLAINED PRO	
Rename component	L11 XPLAINED PRO	Ilcrochip ATSAML11E16A microcontroller.
Rename component	L11 XPLAINED PRO hip® SAM L11 Xplained Pro evaluation kit is a hardware platform to evaluate the ultra low power N by the Atmel Studio integrated development platform, the kit provides easy access to the features grate the device in a customer design.	licrochip ATSAML11E16A microcontroller. of the Microchip® SAM L11 and explains
Rename component	hip® SAM L11 XPLAINED PRO hip® SAM L11 Xplained Pro evaluation kit is a hardware platform to evaluate the ultra low power M by the Atmel Studio integrated development platform, the kit provides easy access to the features grate the device in a customer design. BOARD DETAILS	licrochip ATSAML11E16A microcontroller. of the Microchip® SAM L11 and explains

Figure 5-13. Atmel Start Non-Secure Project Overview and Generation

16. The following "New Atmel Start Project " window will be displayed. Figure 5-14. Non-Secure Project Importation Window

tmel Start Importer			
New Atmel Start	Project		
Project Name:	TZ-GetStart-NS		
Location:	C:\SAML11_GettingStarted_TZ_Example_Folder\TrustZoneGettingStarter	d	Browse
Solution:	Add To Solution	~	
Solution Name:	TrustZoneGettingStarted		
Non-secure SAML11 project	t is detected,Please select below files and proceed		
ecure Project Veneer Header	File: Add	As Link 👻	Browse
ecure Project Export Library:	Add	As Link 🗡	Browse
on-Secure Project Linker Sc	ipt: Add	As Link \vee	Browse
		ок	Cancel