



# USB Device Low Level Driver for Atmel SAM4 User Guide

Version 1.10

For use with USB Device Low Level Driver for Atmel® SAM4 versions 1.01 and above

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# 1 System Overview

This chapter contains the fundamental information for this module.

The component sections are as follows:

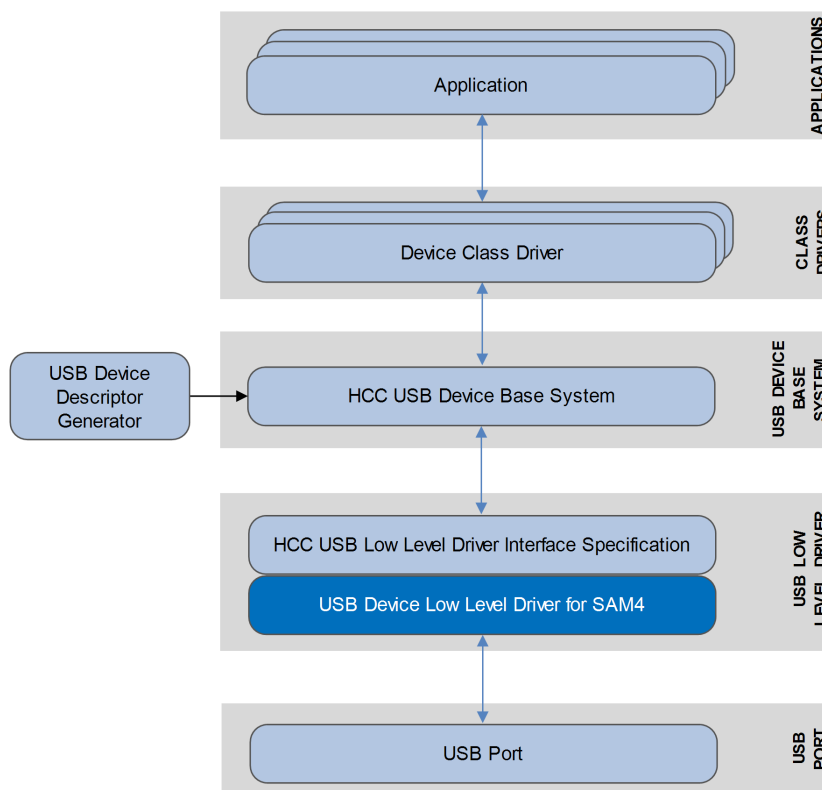
- [Introduction](#) – describes the main elements of the module.
- [Feature Check](#) – summarizes the main features of the module as bullet points.
- [Packages and Documents](#) – the *Packages* section lists the packages that you need in order to use this module. The *Documents* section lists the relevant user guides.
- [Change History](#) – lists the earlier versions of this manual, giving the software version that each manual describes.

## 1.1 Introduction

This guide is for those who want to configure and use the HCC Embedded Low Level Driver for Atmel® SAM4 module with HCC's USB device stack. This module provides a USB device driver for Atmel® SAM4 micro-controllers that have a USB device core (Atmel® ATSAM4C, ATSAM4E, ATSAM4L, ATSAM4N, and ATSAM4S micro-controllers).

The driver can handle all USB transfer types and, in conjunction with the USB device stack, can be used with any USB device class driver.

This package provides a low level driver for a USB stack, as shown below.



The low level driver is always started automatically by the USB device stack. The driver is linked to the stack at compile time because each low level driver uses the same function names. This also means that only one driver can run in a system.

## 1.2 Feature Check

The main features of the low level driver are the following:

- Conforms to the HCC Advanced Embedded Framework.
- Designed for integration with both RTOS and non-RTOS based systems.
- Conforms to HCC's USB Device Low Level Driver Specification.
- Integrated with the HCC USB device stack and all its class drivers.
- Supports all Atmel<sup>®</sup> ATSAM4C, ATSAM4E, ATSAM4L, ATSAM4N, and ATSAM4S micro-controllers that have a Full Speed USB controller.
- Supports all USB transfer types: control, bulk, interrupt, and isochronous.

## 1.3 Packages and Documents

### Packages

This table lists the packages that you need in order to use this module:

Package	Description
<b>hcc_base_doc</b>	This contains the two guides that will help you get started.
<b>usbd_base</b>	The USB device base package. Its source code includes the USB Driver device core.
<b>usbd_drv_atmel_usbcd</b>	The Atmel® SAM4 low level driver package described by this document.
<b>util_hcc_mem</b>	The HCC memory management utility.

### Documents

For an overview of HCC's embedded USB stacks, see [Product Information](#) on the main HCC website.

Readers should note the points in the [HCC Documentation Guidelines](#) on the HCC documentation website.

#### **HCC Firmware Quick Start Guide**

This document describes how to install packages provided by HCC in the target development environment. Also follow the *Quick Start Guide* when HCC provides package updates.

#### **HCC Source Tree Guide**

This document describes the HCC source tree. It gives an overview of the system to make clear the logic behind its organization.

#### **HCC Embedded USB Device Base System User Guide**

This document defines the USB device base system upon which the complete USB stack is built.

#### **USB Device Low Level Driver for Atmel® SAM4 User Guide**

This is this document.

## 1.4 Change History

To view or download manuals, see [USB Device PDFs](#).

For the history of changes made to the package code itself, see [History: usbd\\_drv\\_atmel\\_usbc](#).

The current version of this manual is 1.10. The previous versions are as follows:

Manual version	Date	Software version	Reason for change
1.10	2018-10-19	1.01	Improved <i>PSP Porting</i> section: added two functions.
1.00	2018-05-24	1.01	First online release.

## 2 Source File List

This section describes all the source code files included in the system. These files follow the HCC Embedded standard source tree system, described in the [HCC Source Tree Guide](#). All references to file pathnames refer to locations within this standard source tree, not within the package you initially receive.

**Note:** Do not modify any of these files except the configuration file and the PSP files.

### 2.1 Configuration File

The file `src/config/config_usbd_atmel_usbc.h` contains all the configurable parameters. Configure these as required. For details of these options, see [Configuration Options](#).

### 2.2 Source Code Files

These source code files are in the directory `src/usb-device/usb-drivers`. **These files should only be modified by HCC.**

File	Description
<code>usbd_dev.h</code>	USB driver-specific header file.
<code>usbd_atmel_usbc.c</code>	Source code.
<code>usbd_atmel_usbc_regs.h</code>	Register definitions.

### 2.3 Version File

The file `src/version/ver_usbd_atmel_usbc.h` contains the version number of this module. This version number is checked by all modules that use this module to ensure system consistency over upgrades.



## 2.4 Platform Support Package (PSP) Files

There is one set of files, in the directory **psp\_sam4l\_ek**. These files are in the directory **src/psp/target/usbd\_atmel\_usbc**. They provide functions and elements the core code may need to use, depending on the hardware.

**Note:**

- These are PSP implementations for the specific microcontroller and development board; you may need to modify these to work with a different microcontroller and/or board. See [PSP Porting](#) for details.
- In the package these files are offset to avoid overwriting an existing implementation. Copy them to the root **hcc** directory for use.

File	Description
<b>psp_usbd_atmel_usbc.c</b>	Functions source code.
<b>psp_usbd_atmel_usbc.h</b>	This sets the base address of USBC registers.

The PSP also has a version file, **src/version/ver\_psp\_usbd\_atmel\_usbc.h**.

## 3 Configuration Options

Set the following system configuration options in the file `src/config/config_usbd_atmel_usbc.h`. This section lists the available options and their default values.

### **NO\_OF\_HW\_EP**

The number of hardware endpoints; the maximum is 8. The default is 5.

### **EPO\_BANK\_SIZE**

The size of the memory area that endpoint 0 will use. The default is 64.

### **USB\_MEM\_HANDLE**

The memory handle. The default is `HCC_MEM_DEFAULT`.

### **ATMEL\_DEVICE\_ISR**

The device interrupt. The default is 18.

### **ATMEL\_DEVICE\_INT\_PRIO**

The interrupt priority. The default is 1.

## 4 Integration

This section specifies the elements of this package that need porting, depending on the target environment.

### 4.1 OS Abstraction Layer

All HCC modules use the OS Abstraction Layer (OAL) that allows the module to run seamlessly with a wide variety of RTOSes, or without an RTOS.

This module requires the following OAL elements:

OAL Resource	Number Required
Tasks	0
Mutexes	0
Events	0
ISRs	1

## 4.2 PSP Porting

The Platform Support Package (PSP) is designed to hold all platform-specific functionality, either because it relies on specific features of a target system, or because this provides the most efficient or flexible solution for the developer. For full details of its functions and macros, see the *HCC Base Platform Support Package User Guide*.

The module makes use of the following standard PSP functions:

Function	Package	Element	Description
<b>psp_memcpy()</b>	psp_base	psp_string	Copies a block of memory. The result is a binary copy of the data.
<b>psp_memset()</b>	psp_base	psp_string	Sets the specified area of memory to the defined value.

The module makes use of the following standard PSP macro:

Macro	Package	Element	Description
PSP_RD_LE16	psp_base	psp_endianness	Reads a 16 bit value stored as little-endian from a memory location.

The module makes use of the following PSP functions, provided by the PSP to perform particular tasks. Their design makes it easy for you to port them to work with your hardware solution. The package includes samples in the **psp\_usbd\_atmel\_usbc.c** file.

Function	Description
<b>usbd_hw_init()</b>	Initializes the device.
<b>usbd_hw_delete()</b>	Deletes the device, releasing the associated resources.

These are described in the sections which follow.

## usbd\_hw\_init

This function is provided by the PSP to initialize the device.

**Note:** Call this function first.

### Format

```
int usbd_hw_init ( void )
```

### Arguments

None.

### Return Values

Return value	Description
USB_SUCCESS	Successful execution.
USB_ERROR	Operation failed.

## usbd\_hw\_delete

This function is provided by the PSP to delete the device, releasing the associated resources.

### Format

```
int usbd_hw_delete( void )
```

### Arguments

None.

### Return Values

Return value	Description
USB_SUCCESS	Successful execution.
USB_ERROR	Operation failed.