USB Device Low Level Driver for VUSB User Guide

Version 1.30

For use with USBD Low Level Driver for VUSB versions 1.23 and above

Date: 05-Apr-2018 10:12

Table of Contents

1 System Overview

This chapter contains the fundamental information for this module.

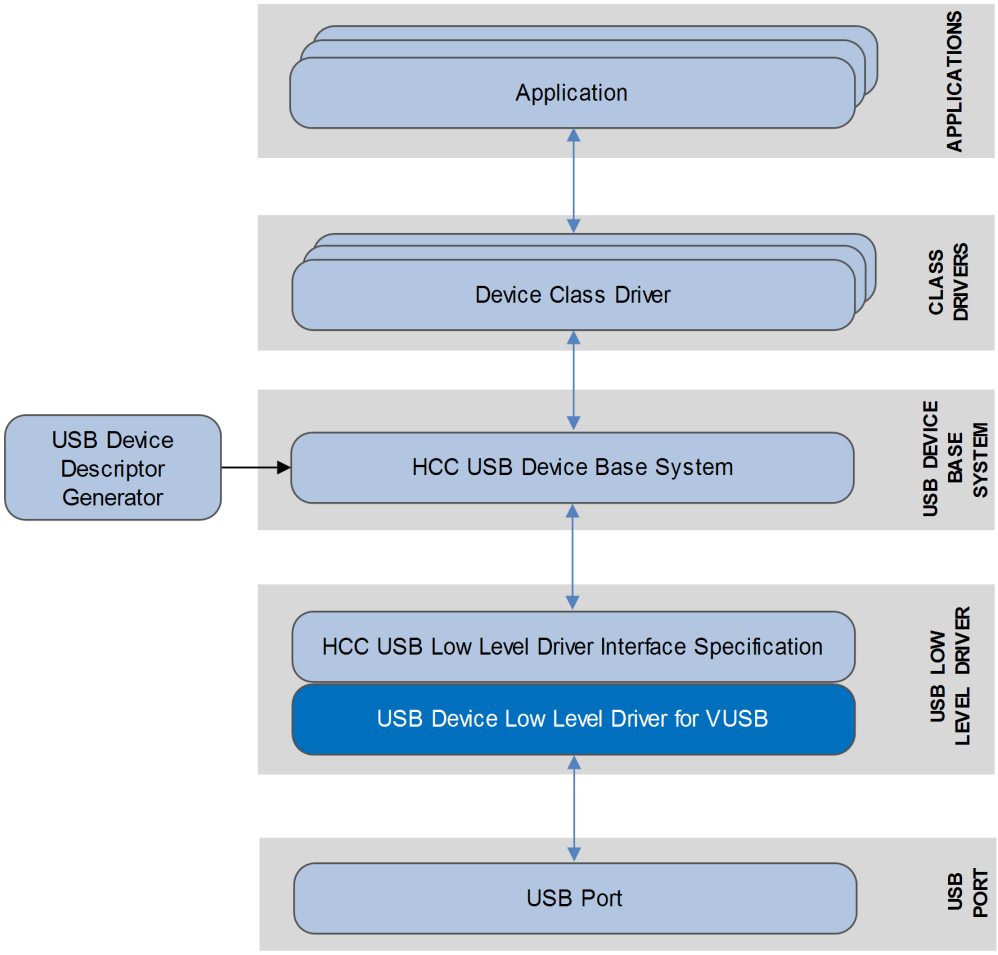
The component sections are as follows:

- 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 VUSB module with HCC's USB device stack. This module provides a USB device driver for VUSB core microcontrollers (including PIC24/32, Freescale™ Kinetis FS, and the Freescale™ JM series). 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 many VUSB core controllers.
- Supports all USB transfer types: control, bulk, interrupt, and isochronous.

1.3 Packages and Documents

Packages

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

Package	Description
hcc_base_doc	This contains the two guides that will help you get started.
usbd_base	The USB device base package. Its source code includes the USB Driver device core.
usbd_drv_vusb	The VUSB low level driver package described in this document.
util_hcc_mem	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 VUSB User Guide

This is this document.

1.4 Change History

This section describes past changes to this manual.

- To view or download manuals, see USB Device PDFs.
- For the history of changes made to the package code itself, see History: usbd_drv_vusb.

The current version of this manual is 1.30. The full list of versions is as follows:

Manual version	Date	Software version	Reason for change
1.30	2018-04-05	1.23	Corrected *OS Abstraction Layer* table: removed event.
1.20	2017-08-29	1.23	Corrected *Packages* list, new *Change History* format.
1.10	2017-03-14	1.20	Various small changes.
1.00	2015-04-22	1.13	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 PSP files.

2.1 Configuration File

The file **src/config/config_usbd_vusb.h** contains all the configurable parameters. Configure these as required. For details of these options, see Configuration Options.

2.2 Source Code

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

File	Description
usbd_dev.h	USB driver-specific header file.
usbd_vusb.c	Source code.
usbd_vusb.h	USB driver-specific content.
usbd_vusb_reg.h	VUSB register definitions.

2.3 Version File

The file **src/version/ver_usbd_vusb.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

These files are in the directory **src/psp/target**. 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.

File	Description
include/hcc_k20d72_reg.h	Register definitions.
usbd-device-vusb/usbd_vusb_hw.c	Functions source code.
usbd-device-vusb/usbd_vusb_hw.h	Functions header file.
usbd-device-vusb/usbd_vusb_hw_reg.h	Compatibility checks.

3 Configuration Options

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

NUM_OF_HW_EP

The number of hardware endpoints. Currently only EP0 can be TX and RX. The default is (MAX_NO_OF_EP + 1).

HCC_VUSB_RENDIAN

The reverse endianness between VUSB and the system. The default is 0.

HCC_VUSB_BASE_16

The VUSB base. Specify 0 for 32 bit or 1 for 16 bit. The default is 0.

HCC_VUSB_COPY_BUF

Set this to 1 to copy buffer content from ROM to RAM. The default is 1.

USBD_VUSB_BDT_SIZE

The size of one Buffer Descriptor Table (BDT) table in bytes. The default is 8.

> **Note:** The following BDT BIT options define the position of these bits within the Buffer Descriptor Table.

BDT_CTL_STALL_BIT

The BDT stall bit. If HCC_VUSB_RENDIAN is 0 the default is 2, otherwise it is 26.

BDT_CTL_DTS_BIT

The BDT DTS bit. If HCC_VUSB_RENDIAN is 0 the default is 3, otherwise it is 27.

BDT_CTL_DATA_BIT

The BDT Control bit. If HCC_VUSB_RENDIAN is 0 the default is 6, otherwise it is 30.

BDT_CTL_OWN_BIT

The BDT Own bit. If HCC_VUSB_RENDIAN is 0 the default is 7, otherwise it is 31.

BDT_CTL_PID_BIT

The BDT Product ID bit. The default is 2.

BDT_BYTE_COUNT_POS_BIT

The BDT count position bit. The default is 16.

USBD_VUSB_INT_ID

The Interrupt ID. The default is ISR_ID(USB_ISR, USB_DEVICE_ISR).

USBD_VUSB_INT_PRIO

The Interrupt priority. The default is 3.

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
psp_memcpy()	psp_base	psp_string	Copies a block of memory. The result is a binary copy of the data.
psp_memset()	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 various tasks. These are designed for a specific microcontroller and development board. Their design makes it easy for you to port them to work with your hardware solution. The package includes samples in the PSP file **src/psp/target/usbd-device-vusb/usbd_vusb_hw.c**.

Function	Description
psp_usbd_vusb_init()	Initializes the hardware to operate in Device mode.
psp_usbd_vusb_start()	Starts the device.
psp_usbd_vusb_stop()	Stops the device.
psp_usbd_vusb_delete()	Deletes the device, releasing the associated resources.
psp_usbd_vusb_pup_on_off()	Enables or disables the pull-up resistor.

These are described in the sections which follow.

psp_usbd_vusb_init

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

> **Note:** Call this function first.

Format

```
int psp_usbd_vusb_init ( void )
```

Arguments

None.

Return Values

Return value	Description
USBD_SUCCESS	Successful execution.
USBD_ERROR	Operation failed.

psp_usbd_vusb_start

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

> **Note:** Call **psp_usbd_vusb_init()** before this.

Format

```
int psp_usbd_vusb_start ( void )
```

Arguments

None.

Return Values

Return value	Description
USBD_SUCCESS	Successful execution.
USBD_ERROR	Operation failed.

psp_usbd_vusb_stop

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

Format

```
int psp_usbd_vusb_stop( void )
```

Arguments

None.

Return Values

Return value	Description
USBD_SUCCESS	Successful execution.
USBD_ERROR	Operation failed.

psp_usbd_vusb_delete

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

Format

```
int psp_usbd_vusb_delete( void )
```

Arguments

None.

Return Values

Return value	Description
USBD_SUCCESS	Successful execution.
USBD_ERROR	Operation failed.

psp_usbd_vusb_pup_on_off

This function is provided by the PSP to enable or disable USB pull-up.

Format

```
int psp_usbd_vusb_pup_on_off ( int on )
```

Arguments

Parameter	Description	Type
on	The pull-up state flag. Set this to 1 to enable pull-up, 0 to disable it.	int

Return Values

Return value	Description
USBD_SUCCESS	Successful execution.
USBD_ERROR	Operation failed.