TN00036

USBD Library for LPC1100 series MCUs

1.0 — 13 March 2018 **Technical note**

Document information

Info	Content
Keywords	USBD library source code, LPC, USB stack.
Abstract	This technical note describes the history of USBD ROM device driver stack and releases the latest USBD library source with bug fixes and new features. The latest USBD library supports most of the LPC family MCUs including LPC1100 series, LPC1500 series, and LPC54000 series. USBD device driver stack for LPC1800 and LPC4300 series is not included here and will be provided as a separate package.

Revision history

Rev	Date	Description
1.0	20180314	Initial version.

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1. Introduction

ROM-based USBD driver is provided as part of the boot ROM since LPC1100 series USB based MCUs are widely implemented.

The ROM contains flexible USB device stack to simplify the USB application development. The USBD ROM stack has built-in support for Communication Device Class (CDC), the Human Interface Device (HID), the Mass Storage Class (MSC), and the Device Firmware Upgrade (DFU) class. It also supports composite device model consisting of multiple interfaces of these supported classes.

However, there are limitations in the earlier version of the USBD driver and few known issues identified over time by both NXP and end users. NXP is unable to provide instant ROM update for every USBD driver issue found, therefore, errata sheets with work-arounds are offered where possible. On the other hand, hardware features, such as Link Power Management (LPM) were not supported in the earlier version of the USBD ROM, therefore no work-around is available.

The ROM based USBD driver simplifies the USB application development, however, it makes debugging of complex USB class driver more difficult. In addition, some USBD ROM work-arounds require more RAM resources.

On MCUs with larger flash memory size, linking the USBD library components directly speed up development and make debugging easier. All these work-arounds can then be removed.

NXP now publishes two versions of the USBD driver stack source code: one residing in the MCU ROM as the reference and the updated version, also known as the USBD library, with bug fixes on all known issues and additional new features. Some of the key new features of the USBD library include:

- Link Power Management (LPM) Support.
- Root 2 test support.
- Enhancement to DFU class to support multiple alternate interfaces.
- String descriptor callback. New stack has callback to provide customer string descriptors not present in descriptor array for random indexed strings.

This technical note gives an overview of how to use the USBD library to build a USB application.

At an early stage of the USB controller integration, Keil and NXP collaborated to provide USB driver software support solution. Later, NXP added more low-level drivers to support different USB IPs, new features such as Link Power Management (LPM) support, more USB class, such as DFU class driver support, improved memory management and included callbacks to make the USBD stack more user friendly with regular bug fixes.

The following is the original Copyright statement of USB driver examples from Keil:

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NXP Semiconductors recognizes the original USB driver software work from Keil. This USBD library software is supplied "AS IS" without any warranties. For details of the copyright disclaimer, please refer to header of the included source files.

2. Description

Error! Reference source not found. Fig 1 shows the architectural block diagram of the USBD device ROM stack. The stack consists of three main layers:

1. The Class Layer
2. The USB Core Layer
3. The Device Controller Driver Layer

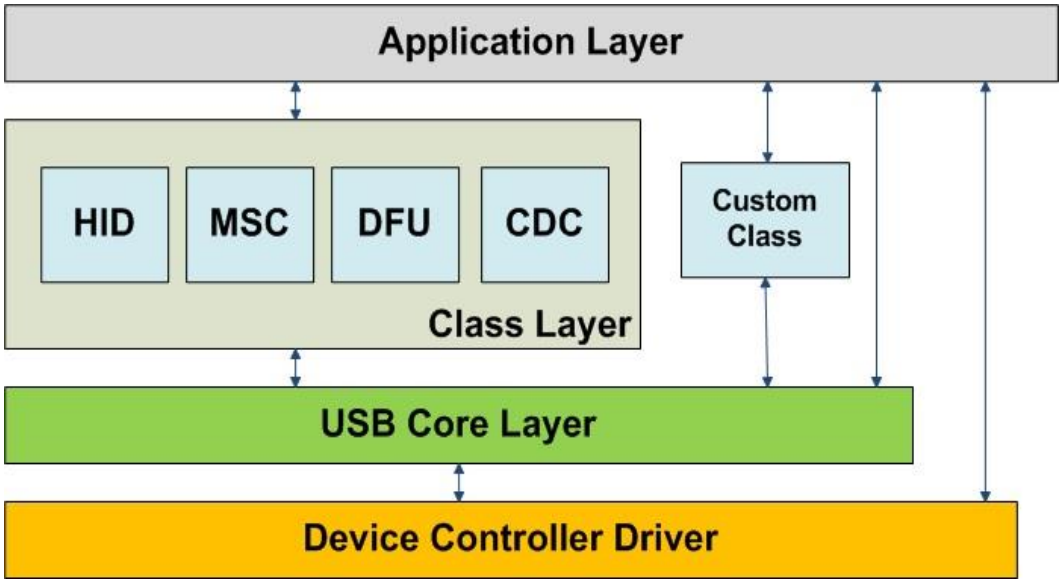

Fig 1. USBD device ROM stack block diagram

The source files of the updated USBD library are built and tested on Keil, IAR, and MCUXpresso IDEs.

The LPCXpresso Development Board for LPC11U68 MCUs is used in this technical note. For details of the board, see:

https://www.nxp.com/support/developer-resources/hardware-development-tools/lpcxpresso-boards/lpcxpresso-board-for-lpc11u68:OM13058

The attached USBD library package is based on LPCOpen (version 3) for LPC11U68:

“usbd_rom_lpc11u68” directory contains the source of original USBD stack residing in the ROM. **Since it is unmodified from the LPC11U6x ROM, it contains all the known issues of the USBD ROM device driver stack listed in the LPC11U68 Errata and should be used as reference only.**

Note: For the ROM release, the source files of the USBD ROM driver were built on the Keil MDK only. Some of the directives and keywords in the source are for Keil compiler only and may not work on other compilers.

“usbd_lib_lpc11u68” directory contains the latest USBD stack library with fixes of all known issues from USBD ROM. It also contains the LPCOpen.USB examples using USBD library API calls.

Under “usbd_lib_lpc11u68” directory, “LPC_USBD_Lib” contains the latest USBD stack library and USB examples utilizing the USBD library. Identical LPCOpen (version 3) directory structure is applied to these USB examples.

The example is available in three tool chains:

- IAR embedded Workbench
- Keil MDK
- MCUXpresso

The USBD library can be found under:

\usbd_lib_lpc11u6x\prj_lpc_usbd_lib

The USB class examples can be found under:

\usbd_lib_lpc11u6x\prj_xpresso11u68

The USBD library documentation (revision 2.0) in HTML format is under:

\usbd_lib_lpc11u6x\LPC_USBD_Lib\docs\html

Click **\usbd_lib_lpc11u6x\LPC_USBD_Lib\docs\html\index.html** to start.

If using Internet Explorer, click “Allow block Content” to allow page to run script and active X control.

It is important to note that there are differences between the library documentation and the Section “USB ROM API” of the User Manual. The key difference is related to USBD_API_INIT_PARAM data structure defined in “chip_11u6x\usbd_lib” directory where all the new features have been added.

Under ”\LPC_USBD_Lib\mw_usbd” directory, mw_usbd_rom.c has the version identifier of the latest USBD library stack.

Following the “LPCOpen Quick Start Guide for all platforms”, build chip and board libraries first under “lib_chip_lpcxxx” and “lib_board_lpcxxx”, then, build USBD library under “LPC_USBD_Lib”, finally, build the USB class application under “prj_xpresso11u68” directory.

Now, the USB class application links the USBD library APIs instead of the USBD ROM APIs and is ready to run.

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4. Contents

1. Introduction 3
2. Description 4
3. Legal information 7
3.1 Definitions 7
3.2 Disclaimers 7
3.3 Trademarks 7
4. Contents 8

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