TN00041

USBD Library for LPC4300/LPC1800 series MCUs

1.0 — 9 July 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, the differences between LPC4300/LPC1800 series and the rest of the MCUs with USB controller, releases of 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, LPC4300/LPC1800 series, and LPC54000 series. This package works with LPC4300 and LPC1800 series only.

Revision history

Rev	Date	Description
1.0	20180709	Initial version.

Contact information

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1. Introduction

The ROM-based USBD driver is provided as part of the boot ROM since LPC4300 and LPC1800 series MCUs are widely adopted by many users.

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 Device Firmware Upgrade (DFU) class. It also supports a composite device model consisting of multiple interfaces of these supported classes. However, there are limitations in the earlier version of the USBD driver and some known issues have been identified by both NXP and end users over time. Work-arounds are offered wherever possible and described in the errata sheets because NXP cannot provide instant ROM update for every USBD driver issue found. Hardware features, such as Link Power Management (LPM) were not supported in the earlier version of the USBD ROM, therefore, no work-around is provided.

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

MCUs with larger flash memory size links the USBD library components directly, speeding up development time and enabling easier debugging. This removes any required work-around. NXP publishes two versions of the USBD driver stack source code:

- Original version residing in the MCU ROM as references.
- Updated version, also called USBD library, with bug fixes on all known issues and new features.

Some of the key new features of the USBD library include:

- Link Power Management (LPM) Support (not applicable to LPC4300 and LPC1800 MCUs)
- MSC class enhancement allowing access to larger memory media greater than 4GB.
- Device Core stack update including Root 2 test (Microsoft XBOX compliance) support.
- Enhancement to DFU class to support multiple alternate interfaces.
- String descriptor callback. To provide customer string descriptors not present in descriptor array for random indexed strings.

Two packages of the USBD libraries are published. Although the stack level of the device driver shares the same source code, the low-level drivers for LPC4300/LPC1800 series and LPC1100/LPC1500 series are different. See Table xx

Table 1. USB IPs used in LPC family MCUs

MCUs\Feature	Speed	Maximum number of EPs	Link Power Management (LPM)	USB IP name
LPC1100/LPC1500 series	FS only	5	Yes	IP351x
LPC54100 series	FS only	5	Yes	IP351x
LPC54100 series	FS only	5	Yes	IP351x
LPC54600 series	Both HS (port 1) and FS (port 0). The HS controller cannot be forced to FS in the device driver	HS: 6 FS: 5	Yes	IP351x

The following section gives an overview of the USBD library and how to use the USBD library to build a USB application for LPC4300/LPC1800 series MCUs.

2. Description

During the early stages of the USB controller integration, Keil and NXP worked together towards the USB driver software support solution. Since then, NXP has added more low-level drivers to support different USB IPs. In addition, several new features, such as, Link Power Management (LPM) support, DFU class support, improved memory management, callbacks to make the USBD stack more user friendly, and bug fixes, are now included.

The following figure 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

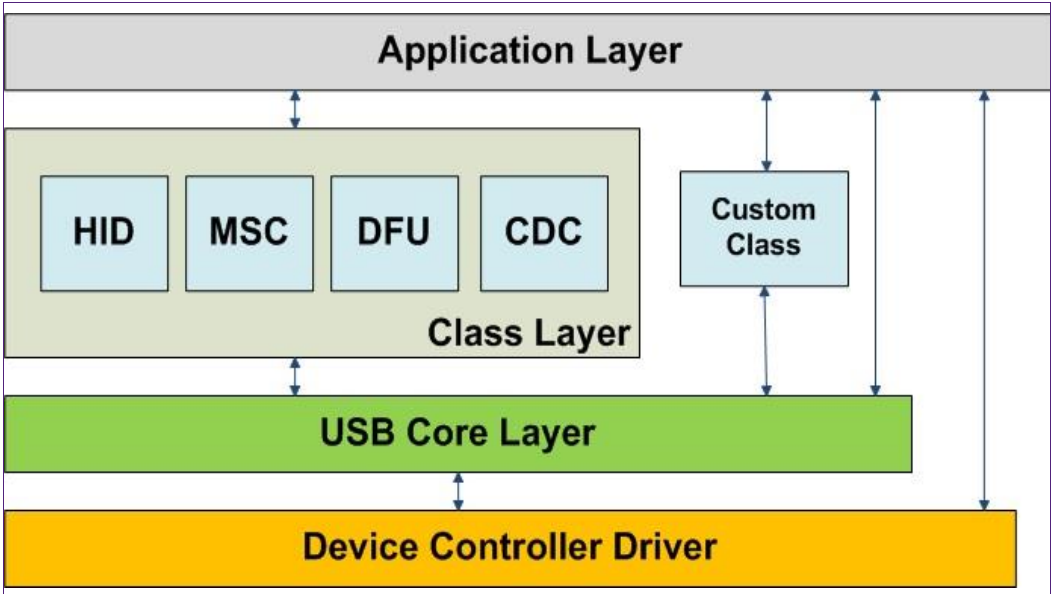

Fig 1. USBD device ROM stack block diagram

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

For the User Manual of LPCXpresso Development Board for LPC4300 MCUs, see:

https://www.nxp.com/support/developer-resources/hardware-development-tools/lpcxpresso-boards/lpcxpresso4367-development-board:OM13088

The USBD library package provided with this technical note is based on the LPCOpen (version 3) for LPC4300:

https://www.nxp.com/products/processors-and-microcontrollers/arm-based-processors-and-mcus/lpc-cortex-m-mcus/lpc4300-cortex-m4-m0/lpcopen-software-development-platform-lpc43xx:LPCOPEN-SOFTWARE-FOR-LPC43XX?fsrch=1&sr=3&pageNum=1

“usbd_rom_lpc43xx” directory contains the source of the original USBD stack residing in the ROM. **Since it is unmodified from the LPC43xx/LPC18xx ROM, it contains all the known issues of the USBD ROM device driver stack listed in the LPC43xx/LPC18xx Errata and must be used as reference only.**

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

“usbd_lib_lpc43xx” directory contains the latest USBD stack library with the known issues from USBD ROM fixed. It also contains the LPCOpen.USB class examples using USBD library API calls.

In the “usbd_lib_lpc43xx” directory, “LPC_USBD_Lib” contains the latest USBD stack library and the rest are the USB class examples making use of the USBD library. An identical LPCOpen (version 3) directory structure is applied to these USB class examples.

The USB examples are available in three tool chains:

- IAR embedded Workbench
- Keil MDK
- MCUXpresso

The USBD library can be found under:

\usbd_lib_lpc43xx\prj_lpc_usbd_lib

The USB class examples can be found under:

\usbd_lib_lpc43xx\prj_xpresso4337

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

\usbd_lib_lpc43xx\LPC_USBD_Lib\docs\html

Click **\usbd_lib_lpc43xx\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_43xx_l8xx\usbd_lib” directory where all the new features are added.

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

Follow the “LPCOpen Quick Start Guide for all platforms” to build chip and board libraries first under “lib_chip_lpcxxx” and “lib_board_lpcxxx”. Then, build the USBD library under “LPC_USBD_Lib”. Finally, build your USB class application under “prj_xpresso4337” directory.

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

3. Legal information

3.1 Definitions

3.2 Disclaimers

3.3 Trademarks

4. Contents

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